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Standard Specification for Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings[1]

This standard is issued under the fixed designation D3122; 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~~ Scope*

1.1 This specification provides general requirements for styrene-rubber solvent cements to be used in joining styrene-rubber (SR) plastic pipe and fittings.

1.2 A recommended procedure for joining styrene-rubber pipe and fittings is given in the appendix.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 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]

D618 Practice for Conditioning Plastics for Testing
D1084 Test Methods for Viscosity of Adhesives
D1600 Terminology for Abbreviated Terms Relating to Plastics
D2852 Specification for Styrene-Rubber (SR) Plastic Drain Pipe and Fittings
E1953 Practice for Description of Thermal Analysis and Rheology Apparatus
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

3. Terminology

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

4. General Requirements

4.1 The solvent cement shall be a solution of styrene-rubber (SR) plastic compound or resin meeting the following requirements.

4.1.1 The SR plastic compounds or resin shall contain at least 50 % styrene plastics, combined with rubbers to a minimum rubber content of 5 %, and compounding materials such as antioxidants and lubricants, and may contain up to 15 % acrylonitrile combined in the styrene plastics or rubbers, or both. The rubbers shall be of the polybutadiene or butadiene-styrene type, or both, with a maximum styrene content of 25 % or nitrile type or both. The combined styrene plastics and rubber content shall be not less than 90 %. No filler may be used. (See Specification D2852.)

4.2 Either virgin or clean rework material may be used provided that the rework material is generated from the solvent cement manufacturer's own production, is compatible with virgin material, and will produce a cement that meets the requirements of this specification.

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[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.
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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**

4.3 The cement shall be free-flowing and shall not contain lumps, macroscopic undissolved particles, 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 gelatin. It shall show no stratification or separation that cannot be removed by stirring.

4.5 The cement shall be a solution of styrene-rubber (SR) plastic compound or resin meeting the requirements of 4.1.1 dissolved in one of the following solvents:

4.5.1 Methyl ethyl ketone.

4.5.2 Toluene.

NOTE 1—It is recommended that solvent cements made to this specification *not* be orange since that color is being recommended for use with CPVC solvent cement under Specification F493.

5. Detail Requirements

5.1 *Resin Content*—The SR resin compound shall be 20 % minimum by mass with methyl ethyl ketone as the solvent or shall be 15 % minimum by mass with toluene as the solvent, when tested in accordance with 6.3.

5.2 *Dissolution*—The cement shall be capable of dissolving an additional 10 % by mass of styrene-rubber (SR) resin or compound meeting the requirements of 4.1.1 at 23 ± 2°C (73.4 ± 3.6°F) without evidence of gelation.

5.3 *Viscosity*—The minimum viscosity at 23 ± 2°C (73.4 ± 3.6°F) shall be 90 mPa·s (90 cP) when tested in accordance with 6.2.

NOTE 2—Cements approaching the minimum viscosity of this specification generally are not recommended for noninterference-type fit (where gap exists between the pipe and fitting socket).

5.4 *Lap Shear Strength:*

5.4.1 The minimum lap shear strength of a cement made with methyl ethyl ketone as the solvent when tested in accordance with 6.4 shall be 3.5 MPa (500 psi) after a 16-h curing time and 6.0 MPa (900 psi) after a 48-h curing time.

5.4.2 The minimum lap shear strength of a cement made with toluene as the solvent when tested in accordance with 6.4 shall be 1.6 MPa (230 psi) after a 16-h curing time and 2.4 MPa (350 psi) after a 48-h curing time.

NOTE 3—These values should not be used for designing pipe joints.

6. Test Methods

6.1 The properties enumerated in this specification shall be determined in accordance with the following methods:

6.1.1 *Conditioning*—Condition the test specimens at 23 ± 2°C (73.4 ± 3.6°F) for not less than 40 h prior to test in accordance with Procedure A of Practice D618, for those tests where conditioning is required.

6.1.2 *Test Conditions*—Conduct tests at 23 ± 2°C (73.4 ± 3.6°F), unless otherwise specified in the test methods or in this specification.

6.2 *Viscosity:*

6.2.1 The samples for test shall be representative of the material under consideration. One sample for every batch shall be tested in accordance with 6.2.2 unless otherwise agreed upon by the supplier and the purchaser.

6.2.2 Measure the viscosity in accordance with Method B of Test Methods D1084, except that conditioning to temperature equilibrium only is required. Use ~~a Model RVF viscometer,~~rotational viscometer with a full scale torque reading of 0.7 mN-m (see E1953), 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.

6.3 *Total Solids:*

6.3.1 *Apparatus:*

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

6.3.1.2 *Vacuum Oven.*

6.3.1.3 *Desiccator.*

6.3.1.4 *Analytical Balance.*

6.3.2 *Procedure*—Stir the sample thoroughly with a spatula before weighing (Note 4). Weigh 3.0 ± 0.5 g of the sample to the nearest 1 mg into a tared ointment tin. Place tin into the vacuum oven (Note 5) and heat at 120°C for 45 min (Note 6). Vacuum must be continually in operation to draw off flammable solvents and should be maintained at 15 mm Hg maximum. 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 1 mg.

NOTE 4—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 volatilization.

NOTE 5—The use of a vacuum oven is mandatory for drying the specimen because this oven has no exposed heating surface nor an open flame, thus avoiding the danger of flashing. The oven also provides an open vacuum to exhaust solvent fumes.

NOTE 6—The specimen shall be left in the oven for 45 min and no longer. Specimens left in for 1 h or more show a definite increase in weight.

6.3.3 *Calculation*—Calculate the percentage total solids, TS, as follows:

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

where:

A = weight of ointment tin,
B = weight of tin and specimen after drying, and
C = weight of tin and specimen before drying.

6.3.4 *Precision*—Duplicate samples shall be tested for best results. Duplicate results obtained by the same analyst, on the same material, on the same day, in the same laboratory are suspect if they differ by more than 0.52 % absolute. This procedure has a standard deviation of 0.13.

6.4 *Lap Shear Strength:*

6.4.1 *Number of Specimens*—A minimum of five specimens shall be tested for the requirement specified in 5.4.

6.4.2 Cut 25 by 25-mm (1 by 1-in.) and 25 by 50-mm (1 by 2-in.) sections from a 6-mm (¼-in.) thick rigid styrene-rubber plastic (SR) sheet. One section of each size is required for each test specimen (Fig. 1).

6.4.3 Clean the surfaces to be adhered with a cloth dampened with the solvent (see 4.5) used to make the solvent cement.

6.4.4 Using a 25-mm (1-in.) natural bristle brush, apply two layers of cement in immediate succession to the complete surface of a 25 by 25-mm (1 by 1-in.) sheet section and to the center of a 25 by 50-mm (1 by 2-in.) sheet section.

6.4.5 Assemble these sections immediately and rotate the 25 by 25-mm (1 by 1-in.) section 180° on the 25 by 50-mm (1 by 2-in.) section within 5 s using light hand pressure (approximately 2 N (½ lbf)).

6.4.6 Place the assembled test specimen on a clean, level surface, by using the 25 by 50-mm (1 by 2-in.) section as a base. After 30 s, place a 2-kg weight on the test specimen for a period of 3 min, and then remove.

6.4.7 Store the assembled test specimens at 23 ± 2°C (73.4 ± 3.6°F) for 16-h or 48-h and test them in a holding fixture similar to that shown in Fig. 2.

6.4.8 Place the specimen in the holding fixture and adjust the screws to bring the sample to a vertical position with the face of the 50-mm (2-in.) specimen in contact with the test jig as shown in Fig. 2 (Note 7). Back off the screw in contact with the 50-mm (2-in.) specimen until a 0.02-mm (0.001-in.) shim can be inserted between the screw plate and the specimen. Then bring the bearing plate of the test machine into contact with the top of the 50-mm (2-in.) specimen, using care to ensure that the plate is on a horizontal plane.

6.4.9 Apply the compressive shear at a speed of 1.25 mm (0.05 in.)/min. Express the results in megapascals (or pounds-force per square inch).

NOTE 7—Alternative jigs may be used if they can be shown to be equivalent.

7. Retest and Rejection

7.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) may be conducted again in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be met, and the test methods designated in the specification shall be followed. If, upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

8. Report

8.1 Report the following information:

8.1.1 Name of cement manufacturer,

8.1.2 Lot number, if given,

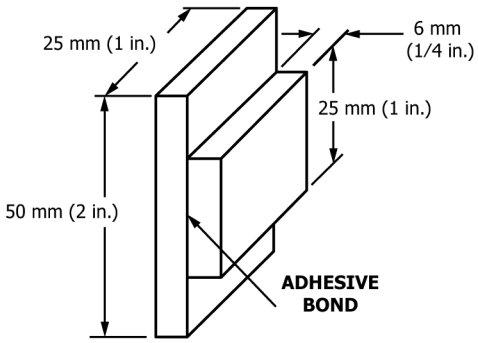

FIG. 1 Compressive Shear Specimen