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An American National Standard

Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings[1]

This standard is issued under the fixed designation D2235; 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 solvent cement for joining acrylonitrile-butadiene styrene (ABS) plastic pipe and fittings for pressure and nonpressure systems.

1.2 Recommendation for using solvent cement for joining acrylonitrile-butadiene-styrene (ABS) plastic pipe and fittings is given in Appendix X1. Satisfactory joining of pipe and fittings cannot be made in the presence of water, as water destroys the bonding ability of solvent cement; therefore, all materials must be dry for satisfactory joining.

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 standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 The following safety hazards caveat pertains only to the test methods portion, Section 7, 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]

D329 Specification for Acetone
D618 Practice for Conditioning Plastics for Testing
D740 Specification for Methyl Ethyl Ketone
D883 Terminology Relating to Plastics
D1084 Test Methods for Viscosity of Adhesives
D1527 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80 (Withdrawn 2013)[3]
D2282 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (Withdrawn 2006)[3]
D2465 Specification for Threaded Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 80 (Withdrawn 1985)[3]
D2468 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40 (Withdrawn 2003)[3]
D2469 Specification for Socket-Type Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 80 (Withdrawn 1985)[3]
D2661 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
D2680 Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
D2750 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastics Utilities Conduit and Fittings (Withdrawn 1997)[3]
D2751 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings (Withdrawn 2014)[3]
D1600 Terminology for Abbreviated Terms Relating to Plastics
D3965 Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings
F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
F409 Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular 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 F17.20 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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

F628 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core

2.2 *Federal Standard:*

Fed. Std. 123 Marking for Shipment (Civil Agencies)[4]

2.3 *Military Standard:*

MIL STD-129 Marking for Shipment and Storage[4]

2.4 *National Sanitation Foundation Standards:*

Standard No. 14 Plastic Piping Components and Related Materials[5]

Standard No. 61 for Drinking Water Systems Components—Health Effects[5]

3. Terminology

3.1 Definitions are in accordance with Terminologies D883 and F412. Abbreviations are in accordance with Terminology D1600 unless otherwise indicated. The abbreviation for Acrylonitrile-Butadiene-Styrene plastic is ABS.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *solvent cement*—adhesive made by dissolving a plastic resin or compound in a suitable solvent or mixture of solvents. The solvent cement dissolves the surfaces of the pipe and fittings to form a bond between the mating surfaces provided the proper cement is used for the particular materials and proper techniques are followed.

4. Classification

4.1 Solvent Cement shall be acrylonitrile-butadiene-styrene plastic resin dissolved in either of the following solvents:

(1) methyl ethyl ketone,

(2) a blend of methyl ethyl ketone and acetone, with acetone constituting no more than 25 % of the solvent blend by weight.

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

5. Materials

5.1 *Material Specification*—Virgin ABS material shall conform to the requirements prescribed in Specification D3965 with a minimum cell classification of 1-1-2-2-2 or equivalent to the cell classification for the material being joined.

5.2 *Acrylonitrile-Butadiene-Styrene (ABS) Plastic*—Plastic containing polymers in which the minimum butadiene content is 6 %, the minimum acrylonitrile content is 15 %, the minimum styrene or substituted styrene content, or both, is 15 %, and the maximum content of all other monomers is not more than 5 %.

5.3 *Rework Material*—Only clean regrind material conforming to the requirements of this specification may be used.

5.4 *Methyl Ethyl-Ketone*— Commercial or industrial grade of MEK shall be used which complies with Specification D740.

5.5 *Acetone*—Commercial or industrial grade of acetone shall be used which complies with Specification D329.

6. Requirements

6.1 *Resin Content*—The ABS resin content shall be 15 % minimum when tested in accordance with 7.3.

6.2 *Dissolution*—The cement shall be capable of dissolving 10 % by weight of the plastic compound used in the pipe or fitting, and still be free flowing and not contain lumps or undissolved resin particles.

6.3 The cement shall be free flowing and shall not contain lumps, undissolved particles, or foreign matter. It shall show no gelation or separation that cannot be removed by stirring.

6.4 *Viscosity*—The minimum viscosity shall be 100 cP (100 mPa·s) when tested in accordance with 7.2.2.

6.5 *Lap Shear Strength*—The minimum average lap shear strength shall be 800 psi (5.5 MPa) when tested in accordance with 7.4.

NOTE 2—The specified shear strength value is used to evaluate the cement and should not be used for designing pipe joints.

7. Test Methods

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

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

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

7.2 *Viscosity:*

7.2.1 The samples for test shall be representative of the material under consideration. One sample for every batch shall be tested in accordance with 7.2.2.

7.2.2 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 are used for qualification purposes.

7.3 *Total Solids:*

7.3.1 *Apparatus:*

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

7.3.1.2 *Vacuum Oven.* [6]

7.3.1.3 *Desiccator*

7.3.1.4 *Analytical Balance.*

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

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

[6] Labline Duo-Vac vacuum oven, or equivalent, has been found satisfactory for this purpose.

7.3.2 *Procedure*—Stir the sample thoroughly with a spatula before weighing. Weigh 3.0 ± 0.5 g of the sample into a tared ointment tin. Place tin into the vacuum oven and heat at 248°F (120°C) for 45 min. Vacuum must be continually in operation to draw off flammable solvents and should be maintained at 0.6 in. Hg (15 mm Hg) minimum. 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 0.015 grains (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 volatization.

7.3.3 The use of a vacuum oven is mandatory for drying the specimen because it 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.

7.3.4 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.

7.3.5 *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.

7.3.6 *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.

7.4 Lap Shear Strength (Qualification Tests):

7.4.1 *Number of Specimens*—A minimum of seven specimens shall be tested for the requirement specified in 6.5.

7.4.2 Cut sections 1 by 1 in. (25 by 25 mm) and 1 by 2 in. (25 by 50 mm) from 0.25-in. (6-mm) thick ABS sheets. One section of each size is required for each specimen (Fig. 1).

7.4.3 Clean the surfaces to be adhered with a cloth dampened with methyl ethyl ketone (MEK).

NOTE 4—The cleaning of the surface with an abusive amount of MEK may affect the performance of the test. Tests should be conducted to determine if this is significant.

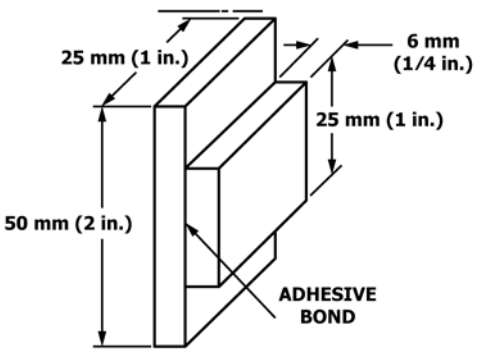

FIG. 1 Compression Shear Specimen

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

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

7.4.6 Place the assembled test specimen on a clean, level surface, by using the 1 by 2-in. (25 by 50-mm) section as a base. After 30 s, place a 4.4-lb (2-kg) weight on the test specimen for a period of 3 min, then remove.

7.4.7 Store the assembled test specimens at 73.4 ± 3.6°F (23 ± 2°C) for 48 to 50 h and test them in a holding fixture similar to that shown in Fig. 2.

7.4.8 Place the specimen in the holding fixture and adjust the screws to bring the sample to a vertical position with the face of the 2-in. (50-mm) specimen in contact with the test jig as shown in Fig. 2 (Note 5). Back off the screw in contact with the 2-in. specimen slightly, and insert a 0.001-in. (0.02-mm) shim between the screw plate and the specimen. Then bring the bearing plate of the test machine into contact with the top of the 2-in. specimen, using care to ensure that the plate is on a horizontal plane.

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

NOTE 5—Alternative jigs may be used if they can be shown to be equivalent.

7.4.10 Disregard the lowest and highest value for the calculation of the average lap shear strength.

8. Retest and Rejection

8.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) shall be conducted again only by agreement between the purchaser and the seller. Under such agreement, minimum requirements shall not be lowered, nor tests omitted, substituted, 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.

9. Report

9.1 A report of the test results shall include the following:
9.1.1 Name of cement manufacturer,
9.1.2 Lot number, if given,
9.1.3 Total solids, in percent,
9.1.4 Dissolution, pass or fail,
9.1.5 Viscosity, and

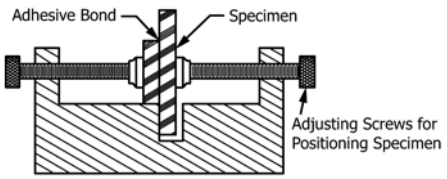

FIG. 2 Typical Specimen-Holding Device