



Designation: D 1725 – 62 (Reapproved 1996)^{ε1}

Standard Test Method for Viscosity of Resin Solutions¹

This standard is issued under the fixed designation D 1725; 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.

ε¹ NOTE—Editorial changes were made throughout in November 1996.

1. Scope

1.1 This test method covers the measurement of the viscosity of resin solutions.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *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 154 Guide for Testing Varnishes²

D 1545 Test Method for Viscosity of Transparent Liquids by Bubble Time Method³

3. Summary of Test Method

3.1 Solid resins are dissolved in organic solvents by cold-cut or hot-cut methods in the laboratory. The viscosity of such prepared solutions, or of commercial solutions of resins is then determined by the bubble time method (Test Method D 1545). The bubble seconds are approximately equal to stokes.

4. Apparatus

4.1 *Bath*, constant-temperature, consisting of a cylindrical glass jar of about 5-gal capacity, or an aquarium tank with controls capable of maintaining the temperature at $25 \pm 0.1^\circ\text{C}$ with water as the bath medium.

4.2 *Bottles*, 8-oz (225-mL), wide-mouth, screw cap.

4.3 *Cellophane*, sheet, cut into 4 or 5-in. (102 or 127-mm) squares.

4.4 *Corks*, No. 2 short taper, to fit viscosity tubes.

4.5 *Holder for Viscosity Tubes*, preferably a mechanical holder with rack and pinion for inverting the tubes. The holder should be checked with a small level and T-square to make certain it holds the tubes in an exact vertical position after being placed in the constant-temperature bath.

4.6 *Bottle Shaker*, preferably one which will give end-over-end agitation.

4.7 *Timing Device*, such as a stopwatch or electric stop clock capable of being read to a precision of 0.1 s.

4.8 *Viscosity Tubes*, of clear glass and flat bottoms, having 10.65 ± 0.025 -mm inside diameter and 114 ± 1 -mm outside length. Plainly legible lines shall be located on the tubes as follows:

27 ± 0.5 mm
 100 ± 0.5 mm
 108 ± 0.5 mm

All distances shall be measured from the bottom outside of the tube. The distance between the first and second lines shall be 73 ± 0.5 mm.

5. Solvent

5.1 The solvent used should be mutually agreed upon between the purchaser and the manufacturer. Toluene, xylene, mineral spirits, alcohols, etc., are used for the preparation of solutions of resins. For a given resin, the viscosity obtained will depend on the solvent used. In case of dispute, both laboratories should use portions of the same batch of solvent.

6. Preparation of Resin Solutions

6.1 The procedure employed for dissolving solid resins will be dependent upon the chemical nature of the resin under test. Some resins will dissolve readily in cold solvent with moderate agitation, while others must be hot-cut in order to effect solution. The method of solution shall be agreed upon mutually between the purchaser and the seller since there may be differences in solubility or viscosity between solutions prepared with and without heat. The solvent concentration may vary from 30 to 90 % and is generally selected to give a solution having a viscosity between 5 and 300 s. With hard

¹ This test method is under the jurisdiction of ASTM Committee D-1 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.33 on Polymers and Resins.

Current edition accepted Sept. 28, 1962. Originally issued 1960. Replaces D 1725 – 60 T.

² *Annual Book of ASTM Standards*, Vol 06.03.

³ A suitable mechanical holder is available from the Gardner Laboratory, Inc., 5521 Landy Lane, Washington, DC, Item 660.

resin use only material taken from freshly broken lumps. Do not use crushed or powdered material from the resin sample container.

6.2 Cold-Cut Solutions—Because it is not easy to tell when solution of the resin is complete, proceed exactly in accordance with the following directions, unless experience has shown that short cuts can be safely taken:

6.2.1 Prepare 100 g of solution as follows: Weigh an 8-oz (225-mL), screw-cap bottle, cap, and cellophane sheet to the nearest 0.05 g. Weigh into the bottle to the nearest 0.05 g the appropriate amount of solvent (40 g for a 60 % solution).

6.2.2 Weigh into a beaker to the nearest 0.05 g the correct amount (60 g for a 60 % solution) of the freshly crushed resin, passing a No. 10 (2000- μ m) sieve.

6.2.3 Pour the resin slowly into the bottle containing the solvent, swirling gently so as to wet the resin as thoroughly as possible as it is added. Place the cellophane sheet over the mouth of the bottle and screw on the cap tightly.

6.2.4 Immediately shake vigorously by hand and place on a shaker to give end-over-end agitation for an overnight period.

6.2.5 Check the weight of the bottle and solution to make certain that none was lost during the mixing. If appreciable loss has occurred, discard the solution and prepare a fresh one.

6.3 Hot-Cut Solutions:

6.3.1 Prepare 100 g of solution as follows: Weigh a 250-mL Erlenmeyer flask with a ground joint to the nearest 0.05 g. Weigh into the flask to the nearest 0.05 g the appropriate amount of solvent (40 g for a 60 % solution).

6.3.2 Weigh into the flask to the nearest 0.05 g the correct amount (60 g for a 60 % solution) of the freshly crushed resin passing a No. 10 (2000- μ m) sieve. Connect the flask to a suitable air or water condenser and warm gently on a hot plate with swirling as necessary to prevent any charring or scorching of the resin. Usually, the solution will be complete in 15 or 20 min.

6.3.3 When the solution is complete, cool the flask, disconnect, and weigh. If over 0.1 g of solvent has been lost, add the necessary amount and swirl to mix.

6.3.4 If any air bubbles are present, allow the solution to stand until they disappear.

6.4 Resins Supplied in Solution—These resins ordinarily can be tested for viscosity as received. However, if modification is necessary, such as a reduction to a specified solids content, use a solvent or solvent combination suitable for use with resin under test, as agreed upon between the manufacturer and the purchaser.

7. Procedure

7.1 Determine the viscosity of the resin solution in accordance with Test Method D 1545, repeating the timing determination until three readings are obtained that agree within 10 s or 3 % relative, whichever is larger.

7.2 For viscosities of solutions which have a timed bubble travel of 5 s or less, more precise results can be obtained by comparison against reference standards having predetermined viscosity (Test Method D 154) or timed bubble travel (Guide D 1545).

8. Report

8.1 Report the following information:

8.1.1 The mean bubble travel time, in seconds, as the viscosity at 25°C, including:

8.1.1.1 Solution concentration,

8.1.1.2 Solvent used, and

8.1.1.3 Whether cold- or hot-cut solutions were used.

9. Precision

9.1 Repeatability and Reproducibility—Two results, each the mean of three readings, should be considered suspect if they differ by more than 7 % relative (95 % confidence level).

NOTE 1—This estimate of precision is based on an interlaboratory study.⁴ Because the data showed no significant difference for between laboratory and within laboratory variances, the precision estimates for repeatability and reproducibility were pooled and a single value reported.

10. Keywords

10.1 bubble time; resin solutions; viscosity

⁴ For the results of the interlaboratory study, see Report of Committee D-1, *Proceedings*, ASTM, Vol 60, 1960.

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