



Standard Test Method for Viscosity of Cellulose Derivatives by Ball-Drop Method¹

This standard is issued under the fixed designation D1343; 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 test method describes the apparatus and general procedure for making ball-drop viscosity measurements on solutions of various cellulose derivatives. Instructions for sample preparation, solution concentration, and other details are discussed in the ASTM methods for the respective cellulose derivatives.

1.2 This test method is applicable to solutions of various cellulose derivatives having viscosities greater than 10 P, by using balls of various diameters and densities. Viscosity results are expressed preferably in poises.

1.3 In commercial practice, viscosities are often expressed in seconds using 2.38-mm ($\frac{3}{32}$ -in.) stainless steel balls.² When the viscosity is outside the practical range for these balls (75 to 300 P), the measurement can be made using a calibrated pipet viscometer or a different ball and calculating the observed viscosity to the corresponding time for a 2.38-mm ($\frac{3}{32}$ -in.) ball, even though it is a small fraction of a second.

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

1.5 *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:³

D301 Test Methods for Soluble Cellulose Nitrate (Withdrawn 2011)⁴

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D817 Test Methods of Testing Cellulose Acetate Propionate and Cellulose Acetate Butyrate

D871 Test Methods of Testing Cellulose Acetate

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Summary of Test Method

3.1 A solution of the cellulose derivative is made in a suitable solvent and allowed to equilibrate at a chosen temperature. A stainless steel or aluminum ball is dropped into the solution, and the time required for it to cover a measured distance in its fall is recorded. The viscosity of the solution can then be calculated in poise or recorded in seconds.

NOTE 1—The choice of solvent has significant influence on viscosity.

4. Significance and Use

4.1 This test provides an easy method of determining the viscosity of cellulose derivatives in a given solvent. The answers are in units commonly used in industrial practice. Such information is needed for cellulose derivatives that are to be extruded, molded, sprayed, or brushed as is or in solution.

5. Apparatus

5.1 Constant-Temperature Water Bath, glass-walled.

5.1.1 For routine testing, an aquarium viscometer is recommended. This viscometer is a rectangular glass enclosure with front and rear walls that have etched horizontal parallel lines 50.8 mm (2.00 ± 0.02 in.) apart. The bottles containing the

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² When a $\frac{3}{32}$ -in. stainless steel ball is used, the viscosities in seconds should be practically the same as those obtained using the apparatus described in Section 11 of Test Methods D871 – 48, and in Section 10 of Test Methods D301 – 50, which last appeared in the 1952 *Annual Book of ASTM Standards*, Part 4.

³ 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.

⁴ The last approved version of this historical standard is referenced on www.astm.org.