



Designation: D 2170 – 01a



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Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)¹

This standard is issued under the fixed designation D 2170; 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 Department of Defense.

1. Scope

1.1 This test method covers procedures for the determination of kinematic viscosity of liquid asphalts (bitumens), road oils and distillation residues of liquid asphalts (bitumens) all at 60°C (140°F) and of asphalt cements at 135°C (275°F) (Note 1) in the range from 6 to 100 000 mm²/s (cSt).

1.2 Results of this test method can be used to calculate viscosity when the density of the test material at the test temperature is known or can be determined. See Annex A1 for the method of calculation.

NOTE 1—This test method is suitable for use at other temperatures and at lower kinematic viscosities, but the precision is based on determinations on liquid asphalts and road oils at 60°C (140°F) and on asphalt cements at 135°C (275°F) only in the viscosity range from 30 to 6000 mm²/s (cSt).

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:

- C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials²
- D 92 Test Method for Flash and Fire Points by Cleveland Open Cup³
- D 341 Viscosity-Temperature Charts for Liquid Petroleum Products³
- D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)³
- D 446 Specifications and Operating Instructions for Glass Capillary Kinematic Viscometers³

D 2162 Test Method for Basic Calibration of Master Viscometers and Viscosity Oil Standards³

D 2493 Viscosity-Temperature Chart for Asphalts⁴

E 1 Specification for ASTM Thermometers⁵

E 77 Test Method for Inspection and Verification of Thermometers⁵

3. Terminology

3.1 Definitions:

3.1.1 *density*—the mass per unit volume of liquid and the cgs unit of density is 1 g/cm³. The SI unit of density is 1 kg/m³.

3.1.2 *kinematic viscosity*—the ratio of the viscosity to the density of a liquid. It is a measure of the resistance to flow of a liquid under gravity. The SI unit of kinematic viscosity is m²/s; for practical use, a submultiple (mm²/s) is more convenient. The cgs unit of kinematic viscosity is 1 cm²/s and is called a stokes (symbol St). The centistokes (1 cSt = 10⁻² St) is 1 mm²/s and is often used.

3.1.3 *Newtonian liquid*—a liquid in which the rate of shear is proportional to the shearing stress. The constant ratio of the shearing stress to the rate of shear is the viscosity of the liquid. If the ratio is not constant, the liquid is non-Newtonian.

3.1.4 *viscosity*—the ratio between the applied shear stress and rate of shear is called the coefficient of viscosity. This coefficient is a measure of the resistance to flow of a liquid. It is commonly called the viscosity of the liquid. The cgs unit of viscosity is 1 g/cm·s (1 dyne·s/cm²) and is called a poise (P). The SI unit of viscosity is 1 Pa·s (1 N·s/m²) and is equivalent to 10 P.

4. Summary of Test Method

4.1 The time is measured for a fixed volume of the liquid to flow through the capillary of a calibrated glass capillary viscometer under an accurately reproducible head and at a closely controlled temperature. The kinematic viscosity is then calculated by multiplying the efflux time in seconds by the viscometer calibration factor.

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.44 on Rheological Tests. In the IP this test method is under the jurisdiction of the Standardization Committee.

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² Annual Book of ASTM Standards, Vol 04.02.

³ Annual Book of ASTM Standards, Vol 05.01.

⁴ Annual Book of ASTM Standards, Vol 04.03.

⁵ Annual Book of ASTM Standards, Vol 14.03.