



Designation: D 4402 – 02

Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer¹

This standard is issued under the fixed designation D 4402; 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 outlines a procedure for measuring the apparent viscosity of asphalt from 38 to 260°C (100 to 500°F) using a rotational viscometer and a temperature-controlled thermal chamber for maintaining the test temperature.

1.2 The values stated in SI units are to be regarded as the standard. The values given in centimetre gram second (cgs) units and inch-pound units 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.* See 10.6 for specific precautionary information.

2. Referenced Documents

2.1 ASTM Standards:

E 220 Method for Calibration of Thermocouples by Comparison Techniques²

3. Terminology

3.1 Definitions:

3.1.1 *apparent viscosity, n* —the ratio of shear stress to shear rate for a Newtonian or non-Newtonian liquid.

3.1.2 *filled asphalt, n* —an asphalt blend that contains finely dispersed insoluble mineral matter.

3.1.3 *Newtonian liquid, n* —a liquid for 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. The viscosity of a Newtonian liquid is therefore not dependent on its shear rate. If the ratio is not constant, the

liquid is non-Newtonian. Many liquids exhibit both Newtonian and non-Newtonian behavior, depending on the shear rate or temperature, or both.

3.1.4 *shear rate, n* —the measure of the speed at which the intermediate layers of the liquid move with respect to each other. Its unit of measure is the reciprocal second (sec^{-1}).

3.1.5 *shear stress, n* —the force per unit area required to produce the shearing action. Its SI unit of measurement is the pascal, and its cgs unit of measurement is dynes/cm².

3.1.6 *viscosity, n* —the ratio between the applied shear stress and the rate of shear is called the coefficient of viscosity. This coefficient is a measure of the resistance to flow of the liquid. The SI unit of viscosity is the pascal second (Pa·s). The centimetre gram second (cgs) unit of viscosity is the poise (dyne·s/cm²) and is equivalent to 0.1 Pa·s. Frequently, centipoise (cP)—equal to one millipascal second (mPa·s)—is used as the viscosity unit.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *apparatus-measuring geometry, n* —the part of the equipment that is immersed in the asphalt sample, the dimensions of which are used, in conjunction with the rotational resisting torque, to calculate the apparent viscosity. This geometry may be referred to by the equipment manufacturer as a spindle, bob, inner concentric cylinder, vane, and so forth.

4. Summary of Test Method

4.1 A rotational viscometer, as described in this test method, is used to measure the apparent viscosity of asphalt at elevated temperatures. The torque on the apparatus-measuring geometry, rotating in a thermostatically controlled sample holder containing a sample of asphalt, is used to measure the relative resistance to rotation. The torque and speed are used to determine the viscosity of the asphalt in pascal seconds, millipascal seconds, or centipoise.

5. Significance and Use

5.1 This test method is used to measure the apparent viscosity of asphalts at handling, mixing, or application temperatures.

¹ This test method is under the jurisdiction of ASTM Committee D08 on Roofing, Waterproofing, and Bituminous Materials and is the direct responsibility of Subcommittee D08.03 on Surfacing and Bituminous Materials for Membrane Waterproofing and Builtup Roofing.

Current edition approved June 10, 2002. Published July 2002. Originally published as D 4402 – 84. Last previous edition D 4402 – 87 (2000)¹.

² *Annual Book of ASTM Standards*, Vol 14.03.