



Standard Test Method for Viscosity Determinations of Unfilled Asphalts Using the Brookfield Thermosel Apparatus¹

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.

^{ε1} NOTE—Editorial changes were made throughout in January 2000.

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 the Brookfield Thermosel apparatus.

1.2 *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 7.6 for specific precautionary information.

2. Referenced Documents

2.1 ASTM Standards:

D 92 Test Method for Flash and Fire Points by Cleveland Open Cup²

3. Terminology

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

3.2 *Newtonian liquid*—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. 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.

3.3 *viscosity*—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. It is commonly called the viscosity. The SI unit of viscosity is the pascal second (Pa·s). The centimetre gram second (cgs) unit of viscosity is the poise (dynes/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.

¹ This test method is under the jurisdiction of ASTM Committee D-8 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 Feb. 10, 1987. Published April 1987. Originally published as D 4402 – 84. Last previous edition D 4402 – 84.

² *Annual Book of ASTM Standards*, Vol 05.01.

4. Summary of Test Method

4.1 The Brookfield Thermosel Viscometer described in this procedure can be used to measure the viscosity of asphalt at elevated temperatures. The torque on a spindle rotating in a special thermostatically controlled sample holder containing a small sample of asphalt is used to measure the relative resistance to rotation. A factor is applied to the torque dial reading to yield the viscosity of the asphalt in millipascal seconds.

5. Significance and Use

5.1 This test method can be used to measure the apparent viscosity of asphalts at application temperatures.

5.2 Some asphalts may exhibit non-Newtonian behavior under the conditions of this test, or at temperatures within the range of this method. Since non-Newtonian viscosity values are not unique material properties but reflect the behavior of the fluid and the measurement system, it should be recognized that measurements made by this method may not always predict performance under the conditions of use.

5.3 Comparisons between non-Newtonian viscosity values should be made only for measurements made with similar viscometers under similar conditions of shearing stress and shear history.

6. Apparatus

6.1 *Brookfield Thermosel High Temperature Viscosity Measurement System Using a Standard Brookfield Synchro-Lectric Viscometer*—Depending on viscosity range Model LV, RV, HA, or HB series may be used.³

6.2 *Spindles for Brookfield Thermosel Viscometer.*

6.3 *Thermosel System:*

6.3.1 *Thermo Container and Sample Chamber.*

6.3.2 *SCR Controller and Probe.*

6.3.3 *Graph Plotting Equipment.*

7. Procedure for the Brookfield Thermosel

7.1 Read and understand the information in the instrument manufacturer's operating instructions before proceeding.

7.2 Turn on Thermosel power.

³ Available from Brookfield Engineering Laboratories, Stoughton, MA 02072