
Standard Method of Test for Viscosity Determination of Asphalt Binder Using Rotational Viscometer

AASHTO Designation: T 316-22¹

Technically Revised: 2022

Technical Subcommittee: 2b, Liquid Asphalt



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This test method outlines the procedure for measuring the viscosity of asphalt binders at elevated temperature from 60 to over 200°C using a Rotational Viscometer apparatus as specified by M 320 and R 29.
- 1.2. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the application of regulatory limitations prior to use.*
- 1.3. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*
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2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 320, Performance-Graded Asphalt Binder
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - R 29, Grading or Verifying the Performance Grade (PG) of an Asphalt Binder
 - R 66, Sampling Asphalt Materials
- 2.2. *ASTM Standards:*
- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
 - E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
 - E1137/E1137M, Standard Specification for Industrial Platinum Resistance Thermometers
- 2.3. *International Electrotechnical Commission Standard:*
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- IEC 60751: 2008 Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors

2.4. *ISO/IEC Standard:*

- ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories

3. TERMINOLOGY

3.1. *Definition:*

- 3.1.1. *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).

4. SUMMARY OF METHOD

- 4.1. This test method can be used to measure the viscosity of asphalt at application temperatures. The torque required to maintain a constant rotational speed of a cylindrical spindle while submerged in an asphalt binder sample at a constant temperature is used to measure the relative resistance to rotation. The torque and speed are used to determine the viscosity of the binder in Pascal seconds.

5. SIGNIFICANCE AND USE

- 5.1. This test method can be used to measure the apparent viscosity of asphalt binder at application temperatures.
- 5.2. The measured viscosity at elevated temperatures can be used to determine whether the asphalt binder can be handled and pumped at the refinery, terminal, or hot mix plant facility. Measured viscosity from this procedure can be used to develop temperature viscosity charts for estimating mixing and compaction temperatures for use in asphalt mixture design.

6. APPARATUS

- 6.1. *Oven*—An oven capable of maintaining any desired temperature setting from room temperature to 260°C to within $\pm 3^\circ\text{C}$. Oven(s) shall be capable of operation at the temperatures required, as corrected, if necessary, by standardization. More than one oven may be used, provided each is used within its proper operating temperature range. The thermometer for measuring the temperature of materials shall meet the requirements of M 339M/M 339 with a temperature range of at least 25 to 265°C and an accuracy of $\pm 0.75^\circ\text{C}$ (see Note 1).

Note 1—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E1137/E1137M Pt-100 RTD platinum resistance thermometer, special order; or IEC 60751: 2008 Pt-100 RTD platinum resistance thermometer, special order.

- 6.2. *Thermometers*—The thermometer for measuring the temperature of material in the test chamber shall meet the requirements of M 339M/M 339 with a temperature range of at least 60 to 200°C with an accuracy of $\pm 0.25^\circ\text{C}$ that is traceable to the International System of Units (SI) by an entity accredited to ISO/IEC 17025 such as NIST (see Note 2).

Note 2—Thermometer types suitable for use include ASTM E1137/E1137M Pt-100 RTD platinum resistance thermometer, special order sealed ultra-small, paired with a compatible meter;