
Standard Method of Test for

**Viscosity of Asphalts by Vacuum
Capillary Viscometer**

AASHTO Designation: T 202-22

Technically Revised: 2022

Technical Subcommittee: 2b, Liquid Asphalt

ASTM Designation: D2171/D2171M-10



**American Association of State Highway and Transportation Officials
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AASHTO T 202-22 is identical to ASTM D2171/D2171M-10 except for the following provisions:

1. Add reference in Section 2 for the AASHTO standard:
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
2. Add references in Section 2 for the ASTM standard:
 - E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
 - E879, Standard Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
 - E1137/E1137M, Standard Specification for Industrial Platinum Resistance Thermometers
3. Delete references in Section 2 for ASTM standards that no longer apply:
 - E77, Test Method for Inspection and Verification of Thermometers
4. Add the following to Section 2:
 - 2.3 *International Electrotechnical Commission Standards:*
 - IEC 60584-1: 2013 Thermocouples - Part 1: EMF Specifications and Tolerances
 - IEC 60751: 2008 Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors
5. The following reference is added:

Fed. Std. No. 29, CFR 1910.1200 OSHA Hazard Communication Standard; see also Permissible Exposure Limits—Annotated Tables, available at <https://www.osha.gov/dsg/annotated-pels/>
6. Replace all of Section 6.2 (including subsections 6.2.1 through 6.2.3 and existing Notes 5, 6, and 7) with the following:

6.2 *Thermometer*—Thermometers for monitoring and adjusting the temperature of a viscometer bath, while completing the test procedure as described in Section 8, shall meet the requirements of M 339M/M 339 with a temperature range of at least 59 to 61°C (138 to 142°F), and an accuracy of ±0.03°C (±0.06°F). Thermometers for testing at any other temperatures shall have the same tolerance range of ±0.03°C (±0.06°F) (see Note 5).

Note 5—Thermometer types suitable for use include ASTM E1 mercury thermometers 47C (47F); ASTM E879 thermistor thermometer; ASTM E1137/E1137M Pt-100 RTD platinum resistance thermometer, Special order; or IEC 60751: 2008 Pt-100 RTD platinum resistance thermometer, Special order.

7. Replace the last sentence in Section 6.3 with the following:

The efficiency of the stirring and the balance between heat loss and heat input must be such that the temperature of the bath medium does not vary by more than $\pm 0.1^{\circ}\text{C}$ ($\pm 0.2^{\circ}\text{F}$) over the length of the viscometer, or from viscometer to viscometer in the various bath positions.

8. Add new Section 6.6 for oven or bath requirements as follows:

6.6 *Ovens or baths*—The ovens or baths shall be used for heating samples, as described in Section 7.2, with operating temperatures of $135 \pm 5.5^{\circ}\text{C}$ ($275 \pm 10^{\circ}\text{F}$) and, if needed, $163 \pm 5.5^{\circ}\text{C}$ ($325 \pm 10^{\circ}\text{F}$). Ovens, when used, 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 samples shall meet the requirements of M 339M/M 339 with a temperature range of at least 50 to 150°C (122 to 302°F), and an accuracy of $\pm 0.75^{\circ}\text{C}$ ($\pm 1.35^{\circ}\text{F}$) (see Note 6).

Note 6—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E230/E230M thermocouple thermometer, Type T, Special Class; IEC 60584 thermocouple thermometer, Type T, Class 1.

9. Renumber existing Notes 8 through 10 as Notes 7 through 9 respectively.

10. Replace Section 8.1.1 with the following:

8.1.1 Maintain the bath at the test temperature within $\pm 0.1^{\circ}\text{C}$ ($\pm 0.2^{\circ}\text{F}$). Apply the necessary corrections, if any, to all thermometer readings.

11. Replace Section 11 with the following:

11. Precision and Bias

11.1 *Precision*—Criteria for judging the acceptability of viscosity results obtained by this method are given in Table 1.

11.1.1 *Single-Operator Precision (Repeatability)*—The figures in Column 2 of Table 1 are the coefficients of variation that have been found to be appropriate for the conditions of test described in Column 1. Two results obtained in the same laboratory, by the same operator using the same equipment, in the shortest practical period of time, should not be considered suspect unless the difference in the two results, expressed as a percent of their mean, exceeds the values given in Table 1, Column 3.

11.1.2 *Multilaboratory Precision (Reproducibility)*—The figures in Column 2 of Table 1 are the coefficients of variation that have been found to be appropriate for the conditions of test described in Column 1. Two results submitted by two different operators testing the same material in different laboratories shall not be considered suspect unless the difference in the two results, expressed as a percent of their mean, exceeds the values given in Table 1, Column 3.

Table 1—Precision Estimates of Viscosity of Asphalts by Vacuum Capillary Viscometer^a

Condition of Test and Test Property	Coefficient of Variation (Percent of Mean)	Acceptable Range of Two Test Results (Percent of Mean)
	1s% ^b	d2s% ^b
Single-Operator Precision:		
Original	1.5	4.2
RTFO	2.7	7.7
Multilaboratory Precision:		
Original	3.1	8.8
RTFO	6.8	19.2

^a The precision estimates given in Table 1 are based on the analysis of test results from 21 pairs of AASHTO re:source Viscosity Graded Asphalt Cement proficiency samples. The data analyzed consisted of results from 94 to 135 laboratories for each of the pairs of samples. The analysis included asphalt cements with the average viscosity by vacuum capillary in a range of 102 Pa•s to 5,930 Pa•s for the original asphalt and 403 Pa•s to 11,585 Pa•s for the RTFO residue.

^b These values represent the 1s % and d2s% limits described in ASTM C670.

11.2 *Bias*—No information can be presented on the bias of the procedure because no comparison with the material having an accepted reference value was conducted.

12. In Table X2.1, change the title to “Standard Viscometer Sizes, Capillary Radii, Approximate Calibration Factors, K, and Viscosity Ranges for Asphalt Institute Vacuum Capillary Viscometers.”