



Designation: E102/E102M – 93 (Reapproved 2021)

Standard Test Method for Saybolt Furol Viscosity of Bituminous Materials at High Temperatures¹

This standard is issued under the fixed designation E102/E102M; 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.

1. Scope

1.1 This test method covers the empirical procedures for determining the Saybolt Furol viscosities of bituminous materials at specified temperatures between 120 and 240 °C [248 and 464 °F].

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use. See 8.1.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

- 2.1 *ASTM Standards:*²
 - D88/D88M Test Method for Saybolt Viscosity
 - D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester
 - D140/D140M Practice for Sampling Asphalt Materials
 - E1 Specification for ASTM Liquid-in-Glass Thermometers
 - E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

¹ This test method is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.05 on Solvent-Bearing Bituminous Compounds for Roofing and Waterproofing.

Current edition approved May 1, 2021. Published May 2021. Originally approved in 1954. Last previous edition approved in 2016 as E102/E102M – 93 (2016). DOI: 10.1520/E0102_E0102M-93R21.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3. Terminology

3.1 *Definitions:*

3.1.1 *Furol*—an acronym of “fuel and road oils.”

3.1.2 *Saybolt Furol viscosity*—the corrected efflux time in seconds of 60 mL of sample flowing through a calibrated Furol orifice under specified conditions. The viscosity value is reported in Saybolt Furol seconds, abbreviated SFS, at a specified temperature.

4. Summary of Test Method

4.1 The efflux time in seconds of 60 mL of sample, flowing through a calibrated orifice, is measured under carefully controlled conditions. The time is corrected by an orifice factor and reported as the viscosity of the sample at that temperature.

5. Significance and Use

5.1 This test method is useful in characterizing certain bituminous materials, as one element in establishing uniformity of shipments and sources of supply.

5.2 This test method is an extension of Test Method D88/D88M.

6. Apparatus

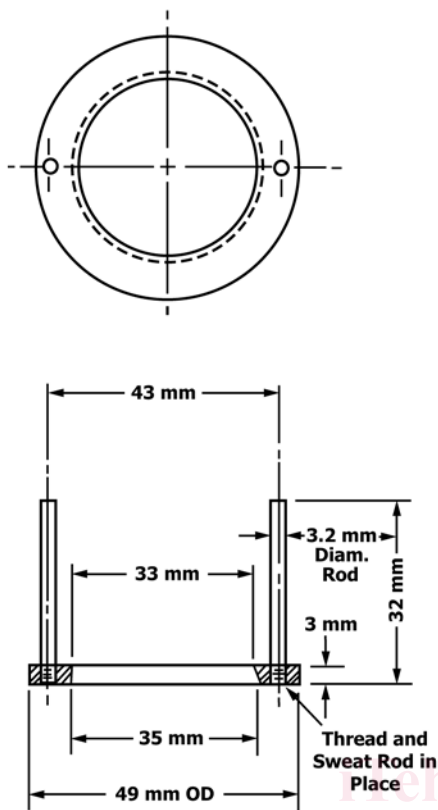
6.1 *Saybolt Furol Viscometer and Bath*, as shown and described in Test Method D88/D88M, Fig. 1 and Annex A1. An external heater may also be used, but if so, it shall be more than 51 mm [2 in.] from the viscometer. An aluminum-block, constant-temperature bath is also acceptable, and no stirring device is required with this type of bath.

6.2 *Displacement Ring*, as shown in Fig. 1, constructed of the same corrosion-resistant metal as the viscometer.

6.3 *Cover*—A metal cover for the viscometer, cylindrical with a flat top, approximately 57 mm [2¼ in.] in diameter and 7 mm [¼ in.] deep (Note 1). One hole slightly larger than the diameter of a viscosity thermometer shall be drilled in the center of the cover, and two smaller holes to permit the vertical rods of the displacement ring to pass through the cover.

NOTE 1—The cover of a 90-mL [3-oz] Gill-style ointment box fulfills these requirements.

6.4 *Thermometer Support*, as shown in Test Method D88/D88M, Fig. 3.



(Material: Corrosion-resistant metal.)

FIG. 1 Displacement Ring

6.5 *Saybolt Viscosity Thermometers*, as listed in Table 1, for reading the temperature of the sample. Each thermometer shall conform to the requirements listed in Specification E1 for that ASTM thermometer number.

6.6 *Bath Thermometers*—Saybolt Viscosity thermometers, or any other temperature-indicating means of equivalent accuracy.

6.7 *Sieve*, 850 μm [No. 20], conforming to the requirements of Specification E11.

6.8 *Receiving Flask*, as shown in Test Method D88/D88M, Fig. 5.

TABLE 1 ASTM Saybolt Viscosity Thermometers

Standard Test Temperature, °C [°F]	ASTM Thermometer Number ^A	Thermometer	
		Range, °F	Subdivisions, °F
121 [250]	77F	245 to 265	0.5
135 [275]	108F	270 to 290	0.5
149 [300]	78F	295 to 315	0.5
163 [325]	109F	320 to 340	0.5
177 [350]	79F	345 to 365	0.5
204 [400]	80F	395 to 415	0.5
232 [450]	81F	445 to 465	0.5

^A Comparable thermometers calibrated in °C are not available.

6.9 *Timer*, graduated in fifths or tenths of a second, and accurate to within 0.1 % when tested over a 60-min interval. Electric timers are acceptable if operated on a controlled frequency circuit.

6.10 *Hot Plate*, electric, approximately 200 mm [8 in.] in diameter, with a three-heat switch, rated at 1200 W at the high heat setting and 500 to 600 W at the medium heat setting.

7. Sampling

7.1 Sample the material in accordance with Practice D140/D140M.

8. Preparation of Apparatus

8.1 Clean the viscometer thoroughly with xylene, remove all solvent from the viscometer and its gallery, and dry well. Clean the displacement ring and receiving flask in the same manner. Xylene is a toxic and flammable solvent; all working areas shall be efficiently hooded and kept free of sparks and open flames. If the viscometer is hot, vaporization of xylene can be reduced by filling the tube rapidly and immediately allowing it to flow out through the orifice. A wooden toothpick may be useful in cleaning the orifice.

NOTE 2—The viscometer may be kept clean by filling with cylinder oil immediately after each test and allowing the oil to remain in the viscometer for several minutes before draining and cleaning with xylene as described above. If desired, the viscometer may be kept filled with cylinder oil between runs, draining and cleaning with xylene just before each test.

8.2 Set up the viscometer and bath in an area where they will not be exposed to drafts or rapid changes in air temperature, and dust or vapors that might contaminate a sample.

8.3 Place the receiving flask beneath the viscometer so that the graduation mark on the flask is from 100 to 130 mm [4 to 5 in.] below the bottom of the viscometer tube, and so that the stream of liquid will just touch the neck of the flask.

8.4 Fill the bath to at least 6 mm [1/4 in.] above the overflow rim of the viscometer with an appropriate bath medium for the selected test temperature:

8.4.1 Use SAE 40 grade oil for test temperatures up to 149 °C [300 °F].

8.4.2 For temperatures above 149 °C [300 °F], use a cylinder oil having a viscosity of approximately 175 to 185 SUS at 98.9 °C [210 °F], and a minimum flash point of 300 °C [572 °F] when tested in accordance with Test Method D92.

8.4.3 Change the bath medium periodically, and clean the outside walls of the tubes to remove any carbon deposits.

8.5 Provide adequate stirring and thermal control for the bath so that the temperature of a test sample in the viscometer will not vary more than 0.3 °C [0.5 °F] after reaching the selected test temperature.

9. Calibration and Standardization

9.1 Calibrate the Saybolt Furol viscometer at periodic intervals in accordance with Test Method D88/D88M, Section 9, and calculate the correction factor for the viscometer.