



Designation: D3142/D3142M – 11

Standard Test Method for Specific Gravity, API Gravity, or Density of Cutback Asphalts by Hydrometer Method¹

This standard is issued under the fixed designation D3142/D3142M; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This test method covers the laboratory determination, using a glass hydrometer, of the density, specific gravity, or API gravity of cutback asphalts as defined in Specifications D2026, D2027, and D2028 (Note 1). Values are measured on a hydrometer at convenient temperatures, readings of density, specific gravity, and API gravity being reduced to 15°C or 60°F by means of international standard tables. By means of these same tables, values determined in one of the three systems of measurement are convertible to equivalent values in either system so that measurements may be made in the units of local convenience.

NOTE 1—This test method is applicable to cutback asphalts and in general follows, but provides more explicit routines than, the procedure outlined in Test Method D1298.

1.2 *Units*—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 and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 7.

2. Referenced Documents

2.1 *ASTM Standards:*²

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.47 on Miscellaneous Asphalt Tests.

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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.

- D140 Practice for Sampling Bituminous Materials
- D1250 Guide for Use of the Petroleum Measurement Tables
- D1298 Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D2026 Specification for Cutback Asphalt (Slow-Curing Type)
- D2027 Specification for Cutback Asphalt (Medium-Curing Type)
- D2028 Specification for Cutback Asphalt (Rapid-Curing Type)
- E1 Specification for ASTM Liquid-in-Glass Thermometers
- E100 Specification for ASTM Hydrometers
- E220 Test Method for Calibration of Thermocouples By Comparison Techniques

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *API gravity*—a function of specific gravity 15/15°C [60/60°F], represented by the equation:

$$^{\circ}\text{API} = [141.5/\text{SG } 15/15^{\circ}\text{C}] - 131.5 \text{ or}$$

$$^{\circ}\text{API} = [141.5/\text{SG } 60/60^{\circ}\text{F}] - 131.5$$

No statement of reference temperature is required since 15°C [60°F] is included in the definition.

3.1.2 *density*—The mass of material per unit volume. When reporting results, explicitly state the density in units of mass (kilograms) and volume (litres), together with the standard reference temperature.

3.1.3 *observed values*—values observed at temperatures other than the standard reference temperature. Values observed at other temperatures are only hydrometer readings, and not density, relative density (specific gravity), or API gravity.

3.1.4 *specific gravity*—The ratio of mass of a given volume of a material at a specified temperature to the mass of an equal volume of pure water measured at the reference temperature. When reporting results, the standard reference temperature must be stated.

4. Summary of Test Method

4.1 The sample is brought to the testing temperature and transferred to a hydrometer cylinder at approximately the same temperature. The cylinder and its contents are placed in a

constant-temperature bath to avoid excessive temperature variation during the test. The appropriate hydrometer is lowered into the sample and allowed to settle. After temperature equilibrium, the hydrometer is read and the temperature of the sample is noted.

4.2 The hydrometer reading is corrected to either 15°C or 60°F by referring to standard tables.

5. Significance and Use

5.1 Accurate determination of the density, specific gravity, or API gravity of cutback asphalts is necessary for the conversion of measured volumes to volumes at the standard temperature of 15°C or 60°F.

5.2 Similarly, accurate determination is necessary for converting volumes to mass as required in other ASTM tests on cutback asphalts.

5.3 Values corrected to 15°C and 60°F will be different because the two temperatures are not equal.

6. Apparatus

6.1 *Hydrometers*, glass, graduated in units of specific gravity, API gravity, or density as required, as listed in **Table 1** and in accordance with Specification **E100**.

6.2 *Thermometers*—A calibrated ASTM Gravity Thermometer, having a range of –20 to 102°C or –5 to 215°F and conforming to the requirements for Thermometer 12°C or 12°F, respectively, as prescribed in Specification **E1**, or an equivalent thermometric device that has been calibrated in accordance with Test Method **E220**. If a thermohydrometer is used, the temperature scale shall have a range from 20 to 65°C or 60 to 220°F (Designation H).

6.3 *Hydrometer Cylinder*, clear glass, plastic (**Note 2**), or metal. For convenience in pouring, the cylinder may have a lip on the rim. The inside diameter of the cylinder shall be at least 20 mm [$\frac{3}{4}$ in.] greater than the outside diameter of the hydrometer used in it. The height of the cylinder shall be such that the hydrometer floats in the sample with at least 25 mm [1 in.] clearance between the bottom of the hydrometer and the bottom of the cylinder.

NOTE 2—Hydrometer cylinders constructed of plastic materials should be resistant to discoloration or attack by oil samples and must not become opaque by prolonged exposure to sunlight and oil samples.

TABLE 1 Recommended Hydrometers

| Hydrometer Designation | Measurement | Range | Total Length, mm | Body Diameter, mm |
|------------------------|-----------------------------------|----------------------------|------------------|-------------------|
| 1H to 4H | API Gravity | –1 to 41°API | 325-335 | 23-27 |
| 21H to 28H | API Gravity | 0 to 41°API | 158-168 | 12-15 |
| 85H to 90H | Relative Density (SG) 15.6/15.6°C | 0.8 to 1.1 | 325-335 | 23-27 |
| 105H to 108H | Relative Density (SG) 15.6/15.6°C | 0.8 to 1.0 | 250-270 | 20-24 |
| 315H to 320H | Density at 15°C | 800-1100 kg/m ³ | 325-335 | 21-27 |

6.4 *Constant-Temperature Bath*, capable of maintaining the testing temperature to $\pm 0.5^\circ\text{C}$ [1.0°F] and of such dimensions that the level of the liquid is approximately the same as that of the sample in the hydrometer cylinder.

6.5 *Oven*, for preheating the sample, and capable of maintaining the selected testing temperature to within $\pm 3^\circ\text{C}$ [5°F].

7. Hazards

7.1 Materials tested using this procedure may contain volatile and flammable hydrocarbons. Heat the sample in a covered container to minimize loss of volatile components. Carry out the test in a well ventilated area, and avoid breathing any vapors which may be generated. Keep sources of ignition away from materials being tested.

7.2 **Warning:** Mercury has been designated by the United States Environmental Protection Agency (EPA) and many state agencies as a hazardous material that can cause central nervous system, kidney and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website—www.epa.gov/mercury/faq.htm—for additional information. Users should be aware that selling mercury, mercury containing products, or both, into your state may be prohibited by state law.

8. Sampling

8.1 Take samples in accordance with Practice **D140**. The sample shall be free of foreign substances.

8.2 Thoroughly mix the sample before removing a representative portion for testing.

9. Temperature of Test

9.1 Because of differences in viscosity between various grades of cutback asphalts, the temperature of the test must be adjusted so that it will provide sufficient fluidity to conduct the test over a reasonable period of time. The recommended testing temperatures for the various grades shown in **Table 2** are based on a viscosity of approximately 200 to 500 mm²/s (cSt).

9.2 When the hydrometer value is to be used to select multipliers for correcting volumes to standard temperatures, the hydrometer reading should be made preferably at a temperature within $\pm 3^\circ\text{C}$ [5°F] of the temperature at which the bulk volume of the oil was measured (**Note 3**). However, in cases when appreciable amounts of light fractions may be lost during determination at the bulk asphalt temperature, the temperatures given in **Table 2** should not be exceeded.

TABLE 2 Recommended Testing Temperatures for Various Grades of Cutback Asphalts

| Grade | Testing Temperature, °F | Testing Temperature, °C |
|---------------------------|-------------------------|-------------------------|
| MC-30 | Room | Room |
| SC-70, MC-70, RC-70 | 104 | 40 |
| SC-250, MC-250, RC-250 | 140 | 60 |
| SC-800, MC-800, RC-800 | 176 | 80 |
| SC-3000, MC-3000, RC-3000 | 212 | 100 |