



Designation: ~~D70-09~~^{e1} D70-17

Standard Test Method for Density of Semi-Solid Bituminous Materials (Pycnometer Method)¹

This standard is issued under the fixed designation D70; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

~~^{e1} NOTE—Values in Table 1 were editorially corrected in July 2009.~~

1. Scope*

1.1 This test method covers the determination of the relative density and density of semi-solid bituminous materials, ~~asphalt cements, asphalt, and soft tar pitches~~ by use of a pycnometer.

NOTE 1—An alternate method for determining the density of semi-solid and solid bituminous materials is Test Method ~~D3142~~ D3289. For materials which are too fluid for use of this test method, use Test Method ~~D3142/D3142M~~.

1.2 The values stated in SI units are to be regarded as the standard. ~~The values given in parentheses are for information only. No other units of measurement are included in this standard, with the exception of temperature measurements, which are stated in degrees Celsius with temperature. Units provided in Fahrenheit are for reference purposes only. Temperatures given in degrees Celsius are to be considered standard.~~

1.3 **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 the EPA's website (www.epa.gov/mercury/faq.htm) for additional information. Users should be aware that selling mercury, mercury-containing products, or both, in your state may be prohibited by state law.

1.4 *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~~ safety, health, and ~~health~~ environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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

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

~~D140~~ D140M Practice for Sampling Bituminous Asphalt Materials

~~D3142~~ D3142/D3142M Test Method for Specific Gravity, API Gravity, or Density of Cutback Asphalts by Hydrometer Method

D3289 Test Method for Density of Semi-Solid and Solid Asphalt Materials (Nickel Crucible Method)

~~D431~~ D431M Practice for Determining Asphalt Volume Correction to a Base Temperature

E1 Specification for ASTM Liquid-in-Glass Thermometers

E77 Test Method for Inspection and Verification of Thermometers

E563 Practice for Preparation and Use of an Ice-Point Bath as a Reference Temperature

E644 Test Methods for Testing Industrial Resistance Thermometers

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.

Current edition approved July 1, 2009 Dec. 15, 2017. Published June 2009 December 2017. Originally approved in 1920. Last previous edition approved in 2008 2009 as ~~D70-08~~ D70-09^{e1}. DOI: ~~10.1520/D0070-09E01~~ 10.1520/D0070-17.

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.

*A Summary of Changes section appears at the end of this standard

E1137/E1137M Specification for Industrial Platinum Resistance Thermometers

2.2 Other:

CRC Handbook of Chemistry and Physics

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *density*—the mass per unit volume of a material.

3.1.2 *relative density*—the ratio of the mass of a given volume of a material to the mass of the same volume of water at the same temperature (see **Note 2**).

NOTE 2—Relative density is also described as specific gravity.

4. Summary of Test Method

4.1 The sample is placed in a calibrated standardized pycnometer. The pycnometer and sample are weighed, then the remaining volume is filled with water. The filled pycnometer is brought to the test temperature, temperature and weighed. The density of the sample is calculated from its mass and the mass of water displaced by the sample in the filled pycnometer.

5. Significance and Use

5.1 Values of density are used for converting volumes to units of mass, and for correcting measured volumes from the temperature of measurement to a standard temperature using Practice D4311/D4311M.

6. Apparatus

6.1 *Pycnometer*, glass, consisting of a cylindrical or conical vessel carefully ground to receive an accurately fitting glass stopper 22 to 26 mm in diameter. The stopper shall be provided with a hole 1.0 to 2.0 mm in diameter, centrally located in reference to the vertical axis. The top surface of the stopper shall be substantially plane and have no chips, and the lower surface shall be concave to allow all air to escape through the bore. The height of the concave section shall be 4.0 to 18.0 mm at the center. The stoppered pycnometer shall have a capacity of 24 to 30 mL and shall weigh not more than 40 g. Suitable pycnometers are illustrated in **Fig. 1**.

6.2 *Water Bath*, constant-temperature, capable of maintaining the temperature within 0.1°C (0.2°F) 0.1 °C (0.2 °F) of the test temperature. The water bath shall be equipped with a thermometer as described in **6.3**.

6.3 *Thermometric device, Thermometer*—calibrated liquid in glass, total immersion type, of suitable range with graduations at least every 0.1°C (0.2°F) and a maximum scale error of 0.1°C (0.2°F) as prescribed in Specification The thermometer shall be one of the following: E1. Thermometer commonly used is ASTM 63°C (63F). Any other thermometric device of equal accuracy may be used.

6.3.1 A liquid-in-glass partial immersion thermometer of suitable range with subdivisions and maximum scale error of 0.1 °C (0.2 °F) which conforms to the requirements of Specification E1. Calibrate the thermometer in accordance with one of the methods in Test Method E77 or verify its original calibration at the ice point (**Notes 3 and 4**). Thermometer commonly used is ASTM 63C.

NOTE 3—Practice E563 provides instructions on the preparation and use of an ice-point bath as a reference temperature.

NOTE 4—If the thermometer does not read 0.0 ± 0.1 °C (32.0 ± 0.1 °F) at the ice point then the thermometer should be recalibrated.

6.3.2 A platinum resistance thermometer (PRT) with a probe which conforms to the requirements of Specification E1137/E1137M. The PRT shall have a 3- or 4-wire connection configuration and the overall sheath length shall be at least 50 mm greater than the immersion depth. Calibrate the PRT system (probe and readout) in accordance with Test Methods E644 or verify its original calibration at the ice point (**Notes 3 and 4**). Corrections shall be applied to ensure accurate measurements within 0.1 °C.

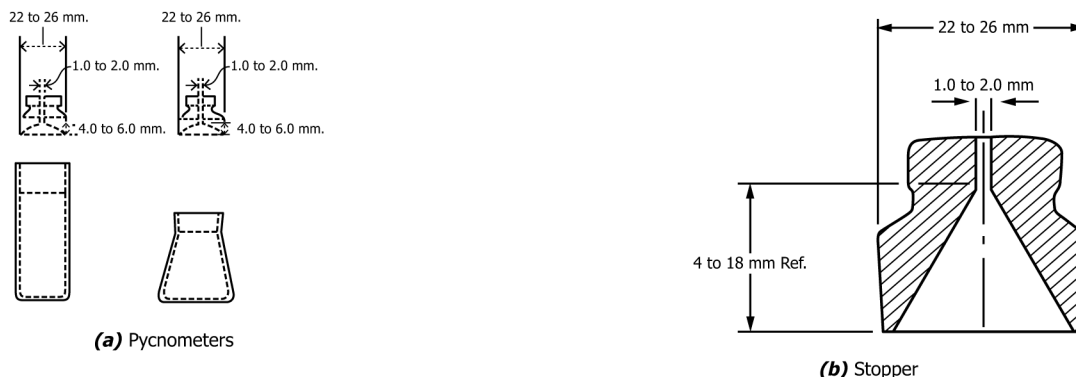


FIG. 1 Suitable Pycnometers and Stopper