



# Standard Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method)<sup>1</sup>

This standard is issued under the fixed designation D71; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope

1.1 This test method covers the determination of relative density by water displacement of hard pitches and asphalts with softening points above 70°C.

1.2 The relative density of hard pitch and asphalt shall be determined, whenever possible, on homogeneous natural fragments free of cracks. The use of cast cubes is not recommended due to the difficulty of avoiding incorporation of air bubbles.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

**D61** Test Method for Softening Point of Pitches (Cube-in-Water Method)

**D140** Practice for Sampling Bituminous Materials

**D4296** Practice for Sampling Pitch

## 3. Terminology

3.1 *Definitions:*

3.1.1 *relative density*—the ratio of a given volume of material at 25°C to the weight of an equal volume of water at the same temperature (specific gravity).

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.05 on Properties of Fuels, Petroleum Coke and Carbon Material.

Current edition approved Oct. 1, 2009. Published November 2009. Originally approved in 1920. Last previous edition approved in 2004 as D71–94(2004). DOI: 10.1520/D0071-94R09.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

## 4. Summary of Test Method

4.1 The sample is suspended from a thin wire and weighed, first in air, then submerged in water at 25.0°C. The relative density is calculated from these weights.

## 5. Significance and Use

5.1 This test method is useful in characterizing pitches and asphalts as one element in establishing uniformity of shipments and sources of supply.

## 6. Apparatus

6.1 *Pan Straddle*, suitable for use with an analytical balance.

6.2 *Analytical Balance*, equipped with a hook above the pan and capable of weighing a 20-g specimen to 1 mg.

6.3 *Water Bath*, maintained at  $25.0 \pm 0.2^\circ\text{C}$  and provided with mechanical stirring/circulation.

6.4 *Thermometer*, capable of measuring water temperature of  $25.0 \pm 0.2^\circ\text{C}$  (or other suitable temperature measuring instrument).

6.5 *Nichrome Wire*, 0.127-mm (5-mL) diameter or monofilament nylon fishing line of about the same diameter for attaching specimen to the balance pan hook.

## 7. Bulk Sampling

7.1 Samples from shipments shall be taken in accordance with Practice D140 or Practice D4296, and shall be free of foreign substances. Thoroughly mix the sample before removing a representative portion for the determination.

## 8. Test Specimens

8.1 Select two fragments of the bulk sample weighing between 5 and 20 g each. Inspect the fragments carefully to ensure the use of specimens free of cracks and other surface defects.

8.2 If the nature of the material is such that specimens can be cast without incorporation of air bubbles, follow the preparation and casting directions in Test Method D61. Cube molds measuring a minimum of 12.7 mm (1/2 in.) per side or

larger can be used. Assemble the cube molds so that solid cubes with no perforations can be cast. A softening point cube mold base plate can be inverted to provide the required flat surface on which to assemble the cube mold before pouring.

## 9. Procedure

9.1 Tare the balance with a piece of 0.127-mm (5-mL) Nichrome wire or monofilament nylon line sufficiently long to reach from the hook on the pan support to the straddle when the latter is in position across the pan. Attach the test specimen to the wire or line so that it is suspended 20 to 30 mm above the straddle when the other end of the wire is attached to the hook.

9.2 Weigh the suspended specimen to the nearest 1 mg and record this weight as  $a$ . Fill a 400 or 600-mL beaker two-thirds full with freshly boiled distilled water containing a small amount of detergent (**Note 1**). Adjust the temperature of the water to  $25.0 \pm 0.2^\circ\text{C}$ , and maintain this temperature during the remainder of the test. Place the beaker with water on the straddle with the specimen, still suspended, fully submerged. When positioned correctly the beaker should not interfere with the movement of the balance. Remove any air bubbles adhering to the specimen or wire by means of a thin wire, then weigh the immersed specimen to the nearest 1 mg. Record this weight as  $b$ .

**NOTE 1**—About 100 mg of Alconox<sup>3</sup> to 200 mL of water has been found satisfactory.

<sup>3</sup> The sole source of supply of the apparatus known to the committee at this time is Alconox, Inc, 30 Glenn St., Suite 309, White Plains, NY 10603. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

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9.3 Repeat the determination with the second test specimen.

## 10. Calculation

10.1 Calculate the relative density of the material under test as follows:

$$\text{Relative Density at } 25^\circ\text{C} = a/(a - b) \quad (1)$$

where:

$a$  = weight of the specimen in air, mg, and

$b$  = weight of the specimen in water at  $25.0^\circ\text{C}$ , mg.

## 11. Report

11.1 Report the average of the two determinations to the third decimal place, unless the individual values differ by more than 0.005. In this case, repeat the determinations with two newly selected fragments or cast specimens. Discard the lowest of the four values and report the average of the others to the third decimal place as relative density  $25^\circ\text{C}/25^\circ\text{C}$ .

## 12. Precision

12.1 The following criteria shall be used for the acceptability of results (95 % probability):

12.1.1 *Repeatability*—Duplicate values by the same operator shall not be considered suspect unless they differ by more than 0.005.

12.1.2 *Reproducibility*—The values reported by each of two laboratories, representing the arithmetic average of duplicate determinations, shall not be considered suspect unless the reported values differ by more than 0.007.

## 13. Keywords

13.1 asphalt; density; pitch; specific gravity; water displacement