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Standard Test Method for Flash Point of Cutback Asphalt with Tag Open-Cup Apparatus[1]

This standard is issued under the fixed designation D3143/D3143M; 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 determination of flash points by the Tag ~~Open-Cup Apparatus~~open-cup apparatus of cutback asphalts having flash points of less than ~~93°C [200°F].~~93 °C [200 °F].

NOTE 1—Specifications commonly designate the Cleveland ~~Open Cup~~open cup (Test Method D92~~–IP 36) Method~~ , IP 36) method for asphalt cements and cutback asphalts having flash points above ~~79°C [175°F].~~79 °C [175 °F].

NOTE 2—This procedure follows in general the procedure outlined in Test Method D1310, but is restricted to cutback asphalt having flash points of less than ~~93°C [200°F].~~93 °C [200 °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 non-conformance with the standard.

1.3 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 **Warning—**Mercury has been designated by the United States Environmental Protection Agency 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~~ mercury-containing products. See the applicable Safety Data Sheet (SDS) or Material Safety Data Sheet (MSDS) for details and the EPA's website (http://www.epa.gov/mercury/index.htm) for additional information. Users should be aware that selling mercury and/or ~~mercury containing~~ mercury-containing products ~~into~~in your state may be prohibited by state law.

1.5 *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.*

1.6 *This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.*

1.7 *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]

D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester

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

D1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving 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.

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
~~D6299 Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance~~
~~D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products and Lubricants~~
E1 Specification for ASTM Liquid-in-Glass Thermometers
E77 Test Method for Inspection and Verification of Thermometers
E300 Practice for Sampling Industrial Chemicals
E644 Test Methods for Testing Industrial Resistance Thermometers
E1137/E1137M Specification for Industrial Platinum Resistance Thermometers

2.2 *IP Standard:*[3]
IP 36 Test for Flash and Fire Points by Cleveland Open Cup

3. Summary of Test Method

3.1 The sample is placed in the cup of the tester and heated at a slow but constant rate. A small test flame is passed at a uniform rate in a level plane across the cup at specified intervals. The flash point is the lowest temperature at which application of the test flame causes the vapor at the surface of the liquid to flash.

4. Significance and Use

4.1 This test method is useful in determining that an asphalt cutback has been prepared with solvents that meet the desired range of flammability, and that the product has not been contaminated with lower flash point solvents.

NOTE 3—The quality of results produced by this standard is dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of Specification D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Specification D3666 alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of Specification D3666 or some similar acceptable guidance provides a means of evaluating and controlling some of those factors.

5. Apparatus

5.1 *Flash Tester*—Tag ~~Open-Cup Tester~~open-cup tester (manual) (Fig. A1.1) as described in detail in Annex A1. Automatic Tag open-cup tester is allowed in place of the manual. The machine must be performed in accordance with Section 9.

5.2 *Shield,* as described in detail in Annex A1.

5.3 *Thermometer*—A thermometer for measuring the temperature of the sample. The thermometer shall be one of the following:

5.3.1 An ASTM 9C [9F] liquid-in-glass thermometer with subdivisions and maximum scale error of ~~0.5°C [1°F]~~0.5 °C [1 °F] which conforms to the requirements of Specification E1. The thermometer shall be standardized in accordance with one of the methods in Test Method E77.

5.3.2 A platinum resistance thermometer (PRT) with a probe which conforms to the requirements of Specification E1137/E1137M. The PRT shall have a ~~3-~~three- or ~~4-wire~~four-wire configuration and the overall sheath length shall be at least 50 mm [2 in.] greater than the immersion depth. Calibrate the PRT system (probe and readout) in accordance with Test Methods E644.

6. Reagents and Materials

6.1 *Bath Media:*

6.1.1 *Water,* for flash points to ~~79°C [175°F].~~79 °C [175 °F].

6.1.2 *Water-Glycol Solution,* (1 + 1), for flash points above ~~79°C [175°F].~~79 °C [175 °F].

6.2 *Cleaning Solvents*—Use ~~technical grade~~ technical-grade solvent capable of cleaning out the test specimen from the test cup and drying the test cup.

7. Sampling

7.1 Obtain a sample in accordance with the instructions given in ~~Practices~~Practice ~~D140~~D140/D140M, D4057, D4177, or E300.

7.2 Transfer sample to the test cup when the sample is at least ~~10°C [18°F]~~10 °C [18 °F] below the expected flash point. Erroneously high flash points may be obtained if precautions are not taken to avoid loss of volatile material. Do not open containers unnecessarily; this will prevent the loss of volatile material and possible introduction of moisture. When possible, the flash point should be the first test performed on a sample.

[3] Available from Energy Institute, 61 New Cavendish St., London, WIG 7AR, U.K., http://www.energyinst.org.uk.

8. Assembly and Preparation of Apparatus

8.1 Place the tester in a level position on a solid vibration-free table in a location free of draft. Shield the top of the tester from strong light so that the flash may be easily seen. Maintain a room temperature of 25 ± ~~5°C~~5 °C [77 ± ~~10°F~~]10 °F] throughout the test.

8.2 Adjust the horizontal and vertical positions of the ignition taper so that the jet passes on the circumference of a circle having a radius of 152 mm [6.0 in.] and in a level plane 3 mm [0.13 in.] above the upper edge of the cup as measured from the center of the orifice. The jet should pass across the center of the cup at right angles to the thermometer. These adjustments should be made only when required as usually the apparatus is used continuously for a series of tests.

NOTE 4—The leveling device is used as a gage to adjust the height of the taper.

8.3 Set the draft shield around the tester so that the sides form right angles with each other and the tester is well toward the back of the shield. If the apparatus is in a draft-free hood or flash room, the shield is not required.

9. Procedure

9.1 *Manual Apparatus:*

9.1.1 Place the glass test cup in the metal bath and adjust the thermometer holder so that the thermometer is supported firmly in a vertical position halfway between the center and edge of the cup and on a line passing through the center of the cup and the pivot of the taper. Place the thermometer so that the bottom of the device is 6 mm [0.25 in.] above the inner bottom of the cup.

9.1.2 Fill the metal bath with water or water-glycol solution having a temperature at least ~~10°C [18°F]~~10 °C [18 °F] below the probable flash point of the material to be tested. Cool tap water is satisfactory in most instances when water is used, and may be introduced into the chamber between the bath and sample cups until a slight overflow is noted at the overflow spout. The bath solution should be up to the overflow tube when the test cup is in place.

9.1.3 Rest the metal leveling device on the rim of the cup and fill the cup with material to be tested until the level just touches the pointer of the leveling ~~device (this~~device. (This should be approximately 3 mm [0.13 in.] below the rim of the ~~cup).~~cup.)

NOTE 5—The test sample should be at least ~~10°C [18°F]~~10 °C [18 °F] below the anticipated flash point.

9.1.4 Light the ignition taper and adjust the test flame to a diameter approximately the same size as the comparison bead on the apparatus, but in no case greater than 4 mm [0.16 in.].

NOTE 6—Some instruments have a 4-mm [0.16-in.] hole in the apparatus for comparison instead of the bead.

9.1.5 Apply heat to the bath so that the temperature of the sample rises at the rate of ~~1°C [2°F]/min~~1 °C [2 °F]/min ± 6 s.

NOTE 7—When determining the flash point or fire point, or both, of viscous liquids and those liquids that tend to form a surface film, the following procedure is suggested: ~~About~~about 15 s before the taper is passed over the surface, insert the end of a stirring rod to a depth of about 13 mm [0.5 in.] in approximately a vertical position. Move the rod from ~~side-to-side~~ side to side of the cup for three or four complete passes following approximately the path of the taper, remove, and continue the testing procedure.

9.1.6 Beginning at a point ~~10°C [18°F]~~10 °C [18 °F] below the anticipated flash point, make final adjustment of the sample level in the test cup. (A syringe or medicine dropper provides a convenient means of adding or removing the sample from the cup.) At successive ~~1°C [2°F]~~1 °C [2 °F] intervals, pass the ignition taper across the sample in a continuous motion, such that the time consumed for each pass is 1 s. The first pass should be made immediately after the final adjustment of the sample level.

NOTE 8—Each pass must be made in one direction only and the taper should be kept in the ~~"off"~~OFF position at one or the other end of the swing, except when the flame is applied to the sample.

9.1.7 Record, as the flash point, the temperature read on the thermometer at the time the test flame application causes a distinct flash in the interior of the test cup.

10. Calculations

10.1 Correct for barometric pressure. Observe and record the barometric pressure at the time and place of the test. When the pressure differs from 101.3 kPa [760 mm Hg], correct the flash as follows:

$$\text{(1) Corrected flash point} = C + 0.25\,(101.3 - p)$$
$$\text{(2) Corrected flash point} = F + 0.06\,(760 - P)$$
$$\text{(3) Corrected flash point} = C + 0.033\,(760 - P)$$

where:

C = observed flash point, °C,
F = observed flash point, °F,
p = ambient barometric pressure, kPa, and
P = ambient barometric pressure, mm Hg.