



# Standard Test Method for Flash Point of Cutback Asphalt with Tag Open-Cup Apparatus<sup>1</sup>

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 ( $\epsilon$ ) 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 of cutback asphalts having flash points of less than 93°C [200°F].

NOTE 1—Specifications commonly designate the Cleveland Open Cup (Test Method D92–IP 36) Method for asphalt cements and cutback asphalts having flash points above 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].

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 **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 products. See the applicable Material Safety Data Sheet (MSDS) for details and EPA's website (<http://www.epa.gov/mercury/index.htm>) for additional information. Users should be aware that selling mercury and/or mercury containing products into 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 and health practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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.*

## 2. Referenced Documents

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

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

D140 Practice for Sampling Bituminous Materials

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

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:

IP 36 Test for Flash and Fire Points by Cleveland Open Cup<sup>3</sup>

<sup>1</sup> 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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<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.

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

### 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.

### 5. Apparatus

5.1 *Flash Tester*—Tag Open-Cup Tester (manual) (Fig. A1.1) as described in detail in Annex A1.

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] 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- or 4-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].

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

6.2 *Cleaning Solvents*—Use 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 D140, D4057, D4177, or E300.

7.2 Transfer sample to the test cup when the sample is at least 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.

### 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 [77 ± 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 3—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] 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 should be approximately 3 mm [0.13 in.] below the rim of the cup).

NOTE 4—The test sample should be at least 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 5—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 ± 6 s.

NOTE 6—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 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 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] 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] 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 7—Each pass must be made in one direction only and the taper should be kept in the “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:

- (1) Corrected flash point =  $C + 0.25 (101.3 - p)$
- (2) Corrected flash point =  $F + 0.06 (760 - P)$
- (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.

10.2 The barometric pressure used in this calculation shall be the ambient pressure for the laboratory at the time of test. Many aneroid barometers such as those used at weather stations and airports, are pre-corrected to give sea level readings; these shall not be used.

## 11. Report

11.1 Report the corrected flash point to the nearest 0.5C [1°F].

## 12. Precision and Bias

12.1 *Precision*—The single-operator standard deviation has been found to be 3.7°C [7°F]. Therefore, results of two properly conducted tests by the same operator on the same asphalt should not differ by more than 10°C [18°F].

12.1.1 The multilaboratory standard deviation has been found to be 5.4°C [10°F]. Therefore, results of two properly conducted tests from two different samples of the same asphalt should not differ by more than 15°C [27°F].

12.2 *Bias*—The procedure in Test Method D3143 for measuring flash point has no bias since the tag flash point can be defined only in terms of this test method.

## 13. Keywords

13.1 cutback asphalt; flash point; open cup; tag

# ANNEX

## (Mandatory Information)

### A1. APPARATUS

A1.1 The manual Tag Open-Cup Tester is shown in Fig. A1.1. It consists of the following parts, which must conform to the dimensions shown, and have the additional characteristics as noted:

A1.1.1 *Copper Bath*, preferably equipped with a constant level overflow so placed as to maintain the bath liquid level 3 mm [0.13 in.] below the rim of the glass cup.

A1.1.2 *Thermometer Holder*, supplied with the tester as shown in Fig. A1.1. It shall support the thermometer firmly in a vertical position.

A1.1.3 *Glass Test Cup* (Fig. A1.2), of molded clear glass, annealed, heat-resistant, and free from surface defects.

A1.1.4 *Leveling Device*, or gage, for proper adjustment of the liquid level in the cup (Fig. A1.3). This shall be made of approximate metal with two projections for adjusting the liquid level in the glass cup to exactly 3 mm [0.13 in.] below the top rim of the cup. This leveling device may also be used to adjust the size of the test flame and for gaging the height of the taper above the edge of the cup.

A1.1.5 *“Micro” of Small Gas Burner*, of suitable dimensions for heating the bath. A screw clamp may be used to help regulate the gas. A small electric heater controlled by a variable power transformer may be used.

A1.1.6 *Ignition Taper*, which is a small, straight, blow-pipe type gas burner. The tip of the taper should be approximately 1.6 mm [0.06 in.] in diameter and the orifice should be 0.8 mm [0.03 in.] in diameter. The ignition taper should be maintained in a fixed horizontal plane above the test cup by means of a swivel device so that the test flame passes on the circumference of a circle having a radius of at least 152 mm [6.0 in.]. A comparison bead 4 mm [0.16 in.] in diameter may be mounted in a convenient spot. If mounted near the end of the ignition taper, a portion of the tip of the taper 1.6 mm [0.06 in.] in diameter shall extend at least 3 mm [0.13 in.] beyond the bead.

A1.1.7 *Draft Shield*, consisting of two rectangular sheets of noncombustible material, 610 by 710 mm [24 by 28 in.], fastened together along the 710-mm [28-in.] side, preferably by hinges. A triangular sheet, 610 by 610 by 860 mm [24 by 24 by 34 in.] is fastened by hinges to one of the lateral sheets (to form a top when shield is open). The interior of the draft shield shall

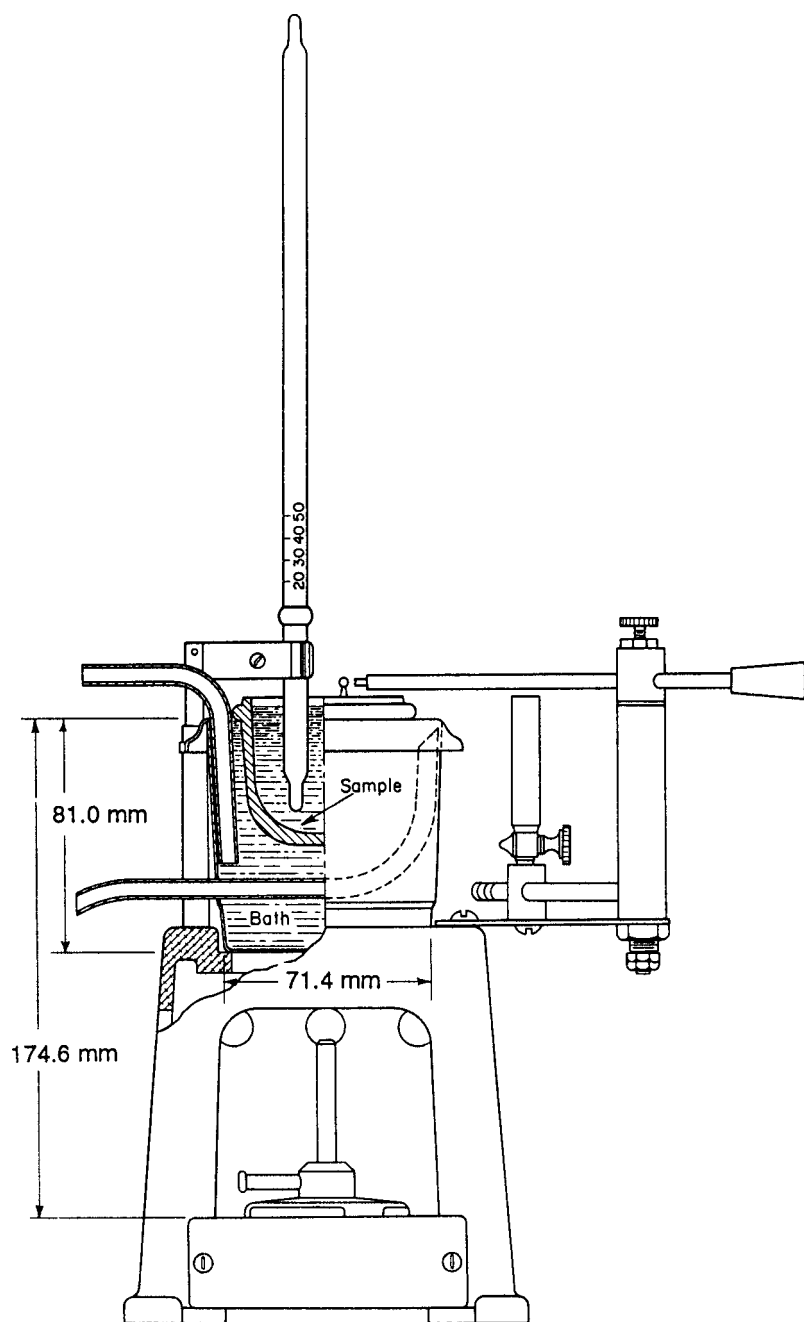
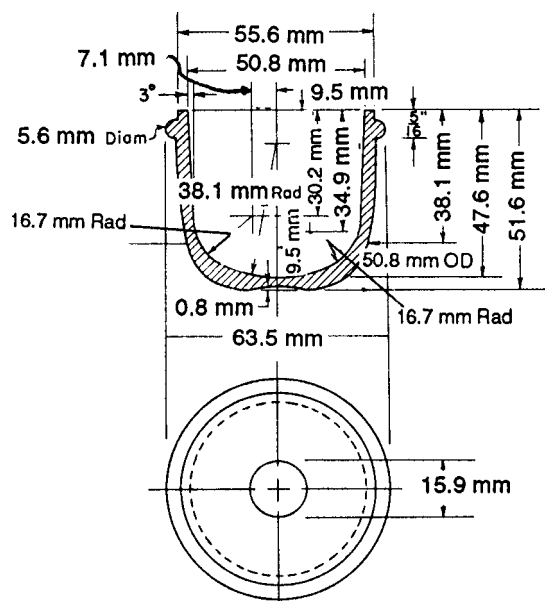


FIG. A1.1 Tag Open-Cup Flash Tester

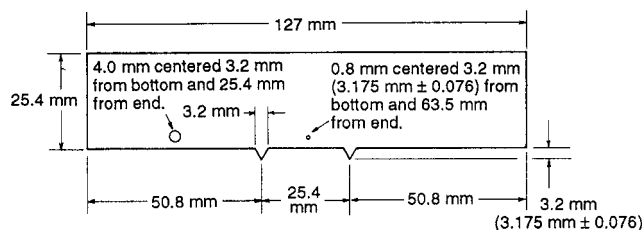
be painted a flat black if used for the manual device. A draft-free fume hood may be used. The draft shield may not be

required if the apparatus is placed in a draft free environment.



Inch-pound Equivalents			
mm	in.	mm	in.
0.8	0.03	38.1	1.50
5.6	0.22	47.6	1.88
7.1	0.28	50.8	2.00
7.9	0.31	51.6	2.03
9.5	0.38	55.6	2.19
15.9	0.63	63.5	2.50
16.7	0.66	71.4	2.81
30.2	1.19	81.0	3.19
34.9	1.38	174.6	6.87

FIG. A1.2 Glass Test Cup



Inch-pound Equivalents			
mm	in.	mm	in.
0.8	0.03	25.4	1.00
3.2	0.13	50.8	2.00
0.07	0.003	63.5	2.50
4.0	0.16	127.0	5.00

FIG. A1.3 Leveling Device for Adjusting Liquid Level in Test Cup, Height of Taper Above Cup, and Size of Test Flame

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