



Designation: D1310 – 14 (Reapproved 2021)

Standard Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus¹

This standard is issued under the fixed designation D1310; 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.

1. Scope

1.1 This test method covers the determination by Tag Open-Cup Apparatus of the flash point and fire point of liquids having flash points between -18 and 165°C (0 and 325°F) and fire points up to 325°F .

1.2 This test method, when applied to paints and resin solutions that tend to skin over or that are very viscous, gives less reproducible results than when applied to solvents.

NOTE 1—In order to conserve time and sample, the fire point of a material may be determined by the Tag Open-Cup Method by continuing the heating of the specimen to its fire point. Fire points may also be determined by Test Method D92, which should be used for fire points beyond the scope of this test method.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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 pertinent to an assessment of the fire hazard of a particular end use.*

1.5 **Warning**—Mercury has been designated by many regulatory 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 Safety Data Sheet (SDS) for details and EPA's website, <http://www.epa.gov/mercury/faq.htm>, for additional information. Users should be

aware that selling mercury and/or mercury containing products into your state or country may be prohibited by law.

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to 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

D850 Test Method for Distillation of Industrial Aromatic Hydrocarbons and Related Materials

D1015 Test Method for Freezing Points of High-Purity Hydrocarbons (Withdrawn 2019)³

D1016 Test Method for Purity of Hydrocarbons from Freezing Points (Withdrawn 2019)³

D1078 Test Method for Distillation Range of Volatile Organic Liquids

D1364 Test Method for Water in Volatile Solvents (Karl Fischer Reagent Titration Method) (Withdrawn 2021)³

D2268 Test Method for Analysis of High-Purity *n*-Heptane and Isooctane by Capillary Gas Chromatography

D2699 Test Method for Research Octane Number of Spark-Ignition Engine Fuel

D2700 Test Method for Motor Octane Number of Spark-Ignition Engine Fuel

E1 Specification for ASTM Liquid-in-Glass Thermometers

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.21 on Chemical Analysis of Paints and Paint Materials.

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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.

³ The last approved version of this historical standard is referenced on www.astm.org.

E1137 Specification for Industrial Platinum Resistance Thermometers

E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

E2877 Guide for Digital Contact Thermometers

3. Terminology

3.1 Definitions:

3.1.1 *flash point, n*—the lowest temperature, corrected to a pressure of 760 mm Hg (101.3 kPa, 1013 mbar), at which application of an ignition source causes the vapor of the specimen to ignite by the procedure described.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *fire point, n*—the lowest temperature at which a specimen sustains burning for a minimum of 5 s by the procedure described.

4. Summary of Method

4.1 The specimen is placed in the cup of a Tag Open-Cup Apparatus and heated at a slow, but constant rate. A small test flame is passed at a uniform rate across the cup at specified intervals until a flash occurs. To determine the fire point, the test is continued until the application of the test flame causes the specimen to ignite and burn for at least 5 s.

5. Significance and Use

5.1 Flash point and fire point of a liquid are physical properties that may be used to define their flammability hazards. The flash point may be used to classify materials in government regulations.

6. Apparatus

6.1 *Flash Tester*—Tag Open-Cup Apparatus (Fig. 1), as described in detail in **Annex A1**.

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

6.3 *Thermometers*, conforming to Specification **E1**, as listed in **Table 1** Alternative temperature measuring devices are permitted providing they have a similar response time and meet the respective performance and immersion depth specifications of thermometers listed in Specification **E1**. See Specifications **E1137** and **E2251**, and Guide **E2877** when selecting alternative temperature measuring devices.

6.4 *Flasks*, 500-mL, two, with rubber stoppers.

7. Materials

7.1 *Water-Glycol Solution* (1 + 1), for flash points from -18 to 93°C (0 to 200°F).

7.2 *Solid Carbon Dioxide-Acetone or other Coolant*.

7.3 *Silicone Fluid*, inert, high boiling, having a flash point exceeding the test temperatures by at least 60°C (110°F) for flash and fire points from 93 to 165°C (200 to 325°F).

7.4 *n-Heptane*,⁴ for determination of flash points from -18 to 16°C (0 to 60°F). See **Annex A2** for specifications.

⁴ Satisfactory *n*-heptane and *p*-xylene can be obtained from Special Products Division, Chemical Department, Phillips Petroleum Company, Drawer O, Borger, TX 79607.

7.5 *p-Xylene*,⁴ for determination of flash points from 16 to 93°C (60 to 200°F). See **Annex A2** for specifications.

7.6 *Isopropanol (isopropyl alcohol)*,⁵ for determination of flash points from 16 to 93°C (60 to 200°F). See **Annex A2** for specifications.

7.7 *Diethylene Glycol*,⁶ for determination of flash points from 93 to 165°C (200 to 325°F). See **Annex A2** for specifications.

8. Assembly and Preparation of Apparatus

8.1 Place the tester in a level position on a solid table free of vibration, in a location free of perceptible draft, and in a dim light. Maintain a room temperature of $24 \pm 3^{\circ}\text{C}$ ($75 \pm 5^{\circ}\text{F}$) throughout the test. Other room temperatures may be specified on agreement between buyer and seller.

NOTE 2—For materials with vapors or products of pyrolysis that are objectionable, it is permissible to place the apparatus with shield in a fume hood with the ventilation turned off. The ventilation can then be turned on at completion of the test, or when and if fumes become objectionable.

8.2 Adjust the horizontal and vertical positions of the taper so that the jet passes on the circumference of a circle having a radius of at least 6 in. (150 mm). The jet should pass across the center of the cup at right angles to a diameter passing through the thermometer and in a plane $\frac{1}{8}$ in. (3.2 mm) above the upper edge of the cup as measured from the center of the orifice.

8.3 Using the leveling device as a gage, adjust the height of the taper so that the center of the orifice is exactly $\frac{1}{8}$ in. (3.2 mm) above the top edge of the glass cup when it is in place. It is imperative that this adjustment be made as accurately as possible. Raising or lowering the taper can be achieved by bending it slightly or preferably by adding and removing thin metal shims as required from between the taper and the vertical supporting member of the swivel holder.

8.4 With the glass cup in place in the bath, 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 bulb is $\frac{1}{4}$ in. (6.4 mm) from the inner bottom of the cup.

8.5 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.

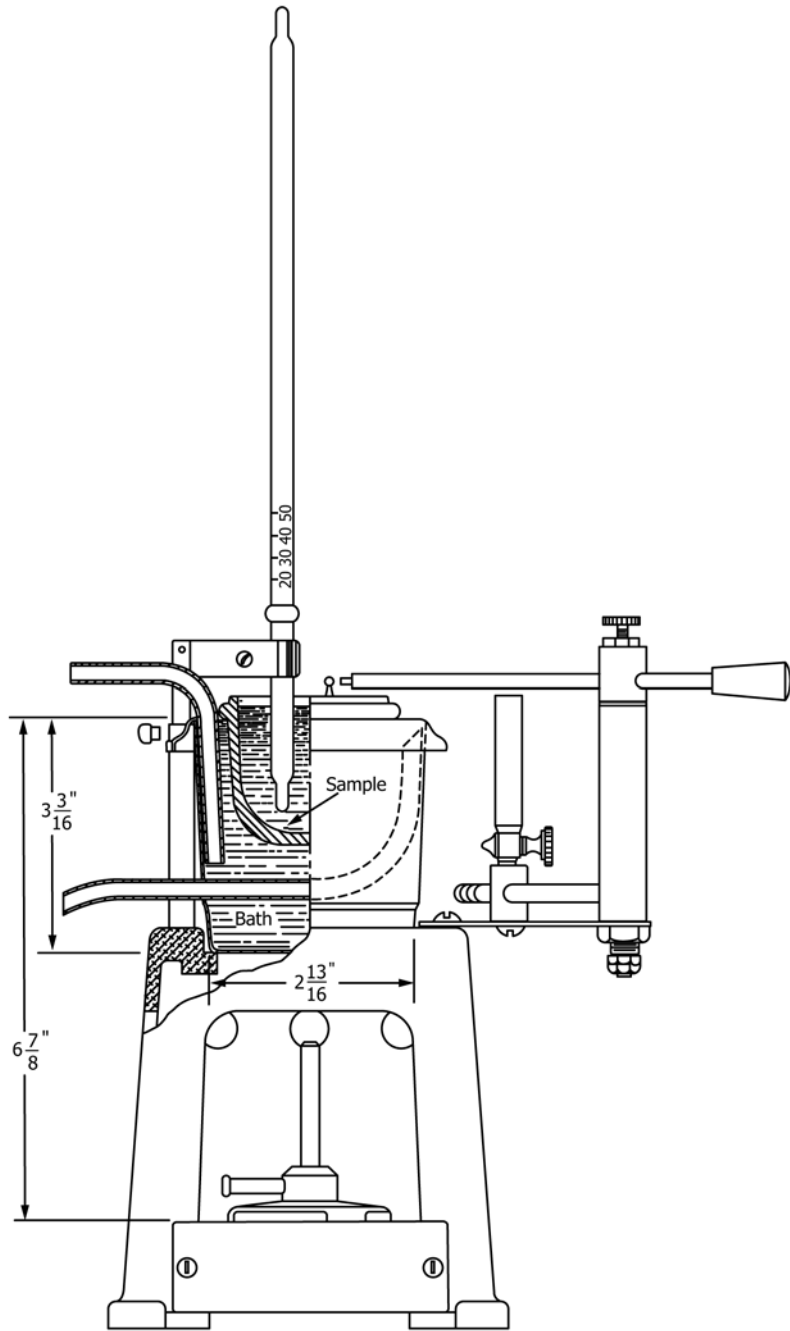
9. Procedure

9.1 *Flash Points from -18 to 16°C (0 to 60°F)* (**Warning**—Meticulous attention to all details relating to the taper, size of taper flame, rate of temperature increase, and rate of passing the taper over the sample is necessary for good results.)

9.1.1 Equip two 500-mL flasks with rubber stoppers through which are inserted ASTM 33C (33F) thermometers. Cool a quantity of 1 + 1 water-glycol solution in one stoppered

⁵ Satisfactory isopropanol may be obtained from Exxon Chemical, Americus P. O. Box 3272, Houston, TX 77001, Shell Chemical Co., One Shell Plaza, Houston, TX 77002, or Union Carbide Co., P. O. Box 8361, South Charleston, WV 25303.

⁶ Satisfactory diethylene glycol may be obtained from Union Carbide Co., S. Charleston, WV.



Metric Equivalents

in.	mm
2 ¹³ / ₁₆	71.4
3 ³ / ₁₆	81
6 ⁷ / ₈	174.5

FIG. 1 Tag Open-Cup Apparatus