



Designation: D56 – 22

Standard Test Method for Flash Point by Tag Closed Cup Tester¹

This standard is issued under the fixed designation D56; 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.

INTRODUCTION

This dynamic flash point test method employs a prescribed rate of temperature rise for the material under test. The rate of heating may not in all cases give the precision quoted in the test method because of the low thermal conductivity of certain materials. To improve the prediction of flammability, Test Method D3941, which utilizes a slower heating rate, was developed. Test Method D3941 provides conditions closer to equilibrium where the vapor above the liquid and the liquid are at about the same temperature. If a specification requires Test Method D56, do not change to Test Method D3941 or other test method without permission from the specifier.

Flash point values are a function of the apparatus design, the condition of the apparatus used, and the operational procedure carried out. Flash point can therefore only be defined in terms of a standard test method, and no general valid correlation can be guaranteed between results obtained by different test methods, or with test apparatus different from that specified.

1. Scope*

1.1 This test method covers the determination of the flash point, by Tag manual and automated closed testers, of liquids with a viscosity below 5.5 mm²/s (cSt) at 40 °C (104 °F), or below 9.5 mm²/s (cSt) at 25 °C (77 °F), and a flash point below 93 °C (200 °F).

1.1.1 Two sets of test conditions are used within this test method: low temperature (LT) test conditions for expected flash points < 60 °C, and high temperature (HT) test conditions for expected flash points of ≥ 60 °C.

1.1.2 For the closed-cup flash point of liquids with the following properties: a viscosity of 5.5 mm²/s (cSt) or more at 40 °C (104 °F); a viscosity of 9.5 mm²/s (cSt) or more at 25 °C (77 °F); a flash point of 93 °C (200 °F) or higher; a tendency to form a surface film under test conditions; or containing suspended solids, Test Method D93 can be used.

1.1.3 For cut-back asphalts refer to Test Methods D1310 and D3143.

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.08 on Volatility.

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NOTE 1—The U.S. Department of Transportation (RSTA)² and U.S. Department of Labor (OSHA) have established that liquids with a flash point under 37.8 °C (100 °F) are flammable as determined by this test method for those liquids that have a viscosity less than 5.5 mm²/s (cSt) at 40 °C (104 °F) or 9.5 mm²/s (cSt) or less at 25 °C (77 °F), or do not contain suspended solids or do not have a tendency to form a surface film while under test. Other flash point classifications have been established by these departments for liquids using this test method.

1.2 This test method can be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and cannot 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 method can be used as elements of fire risk assessment that takes into account all of the factors that are pertinent to an assessment of the fire hazard of a particular end use.

1.3 Related standards are Test Methods D93, D1310, D3828, D3278, and D3941.

² For information on United States Department of Transportation regulations, see Codes of United States Regulation 49 CFR Chapter 1 and for information on United States Department of Labor regulations, see Code of United States Regulation 29 CFR Chapter XVII. Each of these items are revised annually and may be procured from the Superintendent of Documents, Government Printing Office, Washington, DC 20402.

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

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

1.5 **WARNING**—Mercury has been designated by many regulatory agencies as a hazardous substance that can cause serious medical issues. Mercury, or its vapor, has been demonstrated to be hazardous to health and corrosive to materials. Use Caution when handling mercury and mercury-containing products. See the applicable product Safety Data Sheet (SDS) for additional information. The potential exists that selling mercury or mercury-containing products, or both, is prohibited by local or national law. Users must determine legality of sales in their location.

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.* For specific warning statements see 6.5, 7.1, 9.3, 11.1.4, and refer to Safety Data Sheets.

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:³

- D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
- D3143 Test Method for Flash Point of Cutback Asphalt with Tag Open-Cup Apparatus
- D3278 Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
- D3828 Test Methods for Flash Point by Small Scale Closed Cup Tester
- D3941 Test Method for Flash Point by the Equilibrium Method With a Closed-Cup Apparatus
- D4057 Practice for Manual 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, Liquid Fuels, and Lubricants
- E1 Specification for ASTM Liquid-in-Glass Thermometers
- E502 Test Method for Selection and Use of ASTM Standards for the Determination of Flash Point of Chemicals by Closed Cup Methods

2.2 Federal Test Method Standards:⁴

- Method 1101, Federal Test Method Standard No. 791b
- Method 4291, Federal Test Method Standard No. 141A

2.3 ISO Standards:⁵

- ISO 17034 General requirements for the competence of reference material producers
- ISO Guide 35 Reference materials—Guidance for characterization and assessment of homogeneity and stability

3. Terminology

3.1 Definitions:

3.1.1 *flash point, n*—in flash point test methods, the lowest temperature of the test specimen, adjusted to account for variations in atmospheric pressure from 101.3 kPa, at which application of an ignition source causes the vapors of the test specimen to ignite under specified conditions of test.

3.1.1.1 *Discussion*—The specimen is deemed to have flashed when a flame appears and instantaneously propagates itself over the entire surface of the fluid.

3.1.1.2 *Discussion*—When the ignition source is a test flame, the application of the test flame may cause a blue halo or an enlarged flame prior to the actual flash point. This is not a flash and should be ignored.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *dynamic (non-equilibrium)*—in this type of flash point apparatus, the condition of the vapor above the specimen and the specimen are not at the same temperature at the time that the ignition source is applied.

3.2.1.1 *Discussion*—This is primarily caused by the heating of the specimen at the constant prescribed rate with the vapor temperature lagging behind the specimen temperature. The resultant flash point temperature is generally within the reproducibility of the test method.

3.2.2 *equilibrium*—in that type of flash point apparatus or test method, the vapor above the specimen and the specimen are at the same temperature at the time the ignition source is applied.

3.2.2.1 *Discussion*—This condition may not be fully achieved in practice, since the temperature is not uniform throughout the specimen and the test cover and shutter are generally cooler.

4. Summary of Test Method

4.1 The specimen is placed in the cup of the tester and, with the lid closed, heated at a slow constant rate. An ignition source is directed into the cup at regular intervals. The flash point is taken as the lowest temperature at which application of the ignition source causes the vapor above the specimen to ignite.

5. Significance and Use

5.1 Flash point measures the tendency of the specimen to form a flammable mixture with air under controlled laboratory

³ 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.

⁴ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.