



Designation: D7094 – 23

Standard Test Method for Flash Point by Modified Continuously Closed Cup (MCCCFP) Tester¹

This standard is issued under the fixed designation D7094; 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 the flash point of fuels including diesel/biodiesel blends, lube oils, solvents, and other liquids by a continuously closed cup tester utilizing a specimen size of 2 mL, cup size of 7 mL, with a heating rate of 2.5 °C per minute.

1.1.1 Apparatus requiring a specimen size of 1 mL, cup size of 4 mL, and a heating rate of 5.5 °C per minute must be run according to Test Method [D6450](#).

1.2 This flash point test method is a dynamic method and depends on definite rates of temperature increase. It is one of the many flash point test methods available and every flash point test method, including this one, is an empirical method.

NOTE 1—Flash point values are not a constant physical chemical property of materials tested. They 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 where different test apparatus is specified.

1.3 This test method utilizes a closed but unsealed cup with air injected into the test chamber.

1.4 The precision of this test method is applicable for testing samples with a flash point from 22.5 °C to 235.5 °C. Determinations below and above this range may be performed; however, the precision has not been established.

1.5 If the user's specification requires a defined flash point method other than this method, neither this method nor any other test method should be substituted for the prescribed test method without obtaining comparative data and an agreement from the specifier.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. Temperatures are in degrees Celsius, pressure in kilo-Pascals.

1.7 *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 [7.2](#) and [8.5](#).*

1.8 *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

- [D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester](#)
- [D4057 Practice for Manual Sampling of Petroleum and Petroleum Products](#)
- [D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants](#)
- [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, Liquid Fuels, and Lubricants](#)
- [D6450 Test Method for Flash Point by Continuously Closed Cup \(CCCFP\) Tester](#)

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.

Current edition approved Dec. 1, 2023. Published January 2024. Originally approved in 2004. Last previous edition approved in 2017 as D7094 – 17a. DOI: 10.1520/D7094-23.

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.

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

D6708 Practice for Statistical Assessment and Improvement of Expected Agreement Between Two Test Methods that Purport to Measure the Same Property of a Material

E300 Practice for Sampling Industrial Chemicals

2.2 ISO Standards;³

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 For definitions of terms used in this test method, refer to Terminology D4175.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *dynamic, adj*—the condition where the vapor above the test specimen and the test specimen are not in temperature equilibrium at the time at which the ignition source is applied.

3.2.2 *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.

3.2.2.1 *Discussion*—For the purpose of this test method, the test specimen is deemed to have flashed when the hot flame of the ignited vapor causes an instantaneous pressure increase of at least 20 kPa inside the closed measuring chamber.

4. Summary of Test Method

4.1 The lid of the test chamber is regulated to a temperature at least 18 °C below the expected flash point. A 2 mL ± 0.2 mL test specimen of a sample is introduced into the sample cup. Both specimen and cup are at a temperature at least 18 °C below the expected flash point; cooled if necessary. The cup is then raised and pressed onto the lid of specified dimensions to form the continuously closed but unsealed test chamber with an overall volume of 7.0 mL ± 0.3 mL.

4.2 After closing the test chamber, the temperatures of the test specimen and the regulated lid are allowed to equilibrate to within 1 °C. Then the lid is heated at a prescribed, constant rate. For the flash tests, a high voltage arc of defined energy is discharged inside the test chamber at regular intervals. After each ignition, a variable amount of air (see Table 1) is introduced into the test chamber to provide the necessary oxygen for the next flash test. The pressure inside the continu-

ously closed but unsealed test chamber remains at ambient barometric pressure except for the short time during the air introduction and at a flash point.

4.3 After each arc application, the instantaneous pressure increase above the ambient barometric pressure inside the test chamber is monitored. When the pressure increase exceeds 20 kPa, the temperature at that point is recorded as the uncorrected flash point, which is then corrected to barometric pressure.

5. Significance and Use

5.1 The flash point temperature is one measure of the tendency of the test specimen to form a flammable mixture with air under controlled laboratory conditions. It is only one of a number of properties which must be considered in assessing the overall flammability hazard of a material.

5.2 Flash point is used in shipping and safety regulations to define *flammable* and *combustible* materials and for classification purposes. This definition may vary from regulation to regulation. Consult the particular regulation involved for precise definitions of these classifications.

5.3 This test method can be used to measure and describe the properties of materials in response to heat and an ignition source under controlled laboratory conditions and shall not be used to describe or appraise the fire hazard or fire risk of materials under actual fire conditions. However, results of this test method 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.

5.4 Flash point can also indicate the possible presence of highly volatile and flammable materials in a relatively non-volatile or nonflammable material, such as the contamination of lubricating oils by small amounts of diesel fuel or gasoline. This test method was designed to be more sensitive to potential contamination than Test Method D6450.

6. Apparatus

6.1 *Flash Point Apparatus, Continuously Closed Cup Operation*—The type of apparatus suitable for use in this test method employs a lid of solid brass, the temperature of which is controlled electrically. Two temperature sensors for the specimen and the lid temperatures, respectively, two arc pins for a high voltage arc, and a connecting tube for the pressure monitoring and the air introduction are incorporated in the lid. Associated equipment for electrically controlling the chamber temperature is used, and a digital readout of the specimen temperature is provided. The apparatus and its critical elements are shown in Figs. A1.1 and A1.2.

6.1.1 *Test Chamber*—The test chamber is formed by the sample cup and the temperature-controlled lid, and shall have an overall volume of 7 mL ± 0.3 mL. A metal-to-metal contact between the lid and the sample cup shall provide good heat contact but allow ambient barometric pressure to be maintained inside the test chamber during the test. Critical dimensions are shown in Fig. A1.2. The pressure inside the measuring chamber during the temperature increase is monitored. A seal that is too tight results in a pressure increase above ambient due to the

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

TABLE 1 Volume of Introduced Air as a Function of Sample Temperature

Sample Temperature Range (°C)	Introduced Volume of Air (mL)
below 80	0
80 to below 150	0.5 ± 0.15
150 to below 200	1 ± 0.2
200 to below 300	1.5 ± 0.3
300 and above	2 ± 0.4