



Designation: D7807 – 20

Standard Test Method for Determination of Boiling Range Distribution of Hydrocarbon and Sulfur Components of Petroleum Distillates by Gas Chromatography and Chemiluminescence Detection¹

This standard is issued under the fixed designation D7807; 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 boiling range distribution of petroleum products. The test method is applicable to petroleum products and fractions having a final boiling point of 538 °C (1000 °F) or lower at atmospheric pressure as measured by this test method. This test method is limited to samples having a boiling range greater than 55 °C (100 °F), and having a vapor pressure sufficiently low to permit sampling at ambient temperature.

1.1.1 The applicable sulfur concentration range will vary to some extent depending on the boiling point distribution of the sample and the instrumentation used; however, in most cases, the test method is applicable to samples containing levels of sulfur above 10 mg/kg.

1.2 This test method requires the use of both FID and SCD for detection. The hydrocarbon simulated distillation data obtained from the FID signal should be performed according to Test Method [D2887](#) Procedure B.

1.3 The test method is not applicable for analysis of petroleum distillates containing low molecular weight components (for example, naphthas, reformates, gasolines, crude oils). Materials containing heterogeneous components (for example, alcohols, ethers, acids, or esters) or residue are not to be analyzed by this test method. See Test Methods [D3710](#), [D7096](#), [D5307](#), [D7169](#), or [D7500](#).

1.4 This test method does not purport to identify all sulfur species in a sample. The detector response to sulfur is equimolar for all sulfur compounds within the scope (1.1) of this test method. Thus, unidentified sulfur compounds are determined with equal precision to that of identified substances. Total sulfur content is determined from the total area of the sulfur detector.

1.4.1 This test method uses the principles of simulated distillation methodology.

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

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

[D86](#) Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure

[D1160](#) Test Method for Distillation of Petroleum Products at Reduced Pressure

[D2622](#) Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry

[D2887](#) Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography

[D2892](#) Test Method for Distillation of Crude Petroleum (15-Theoretical Plate Column)

[D3120](#) Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry

[D3710](#) Test Method for Boiling Range Distribution of Gasoline and Gasoline Fractions by Gas Chromatography (Withdrawn 2014)³

[D4626](#) Practice for Calculation of Gas Chromatographic Response Factors

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 [D02.04.0H](#) on Chromatographic Distribution Methods.

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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.

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

- D5307** Test Method for Determination of Boiling Range Distribution of Crude Petroleum by Gas Chromatography (Withdrawn 2011)³
- D5504** Test Method for Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence
- D5623** Test Method for Sulfur Compounds in Light Petroleum Liquids by Gas Chromatography and Sulfur Selective Detection
- 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
- D6352** Test Method for Boiling Range Distribution of Petroleum Distillates in Boiling Range from 174 °C to 700 °C by Gas Chromatography
- D7096** Test Method for Determination of the Boiling Range Distribution of Gasoline by Wide-Bore Capillary Gas Chromatography
- D7169** Test Method for Boiling Point Distribution of Samples with Residues Such as Crude Oils and Atmospheric and Vacuum Residues by High Temperature Gas Chromatography
- D7500** Test Method for Determination of Boiling Range Distribution of Distillates and Lubricating Base Oils—in Boiling Range from 100 °C to 735 °C by Gas Chromatography
- E178** Practice for Dealing With Outlying Observations
- E355** Practice for Gas Chromatography Terms and Relationships
- E594** Practice for Testing Flame Ionization Detectors Used in Gas or Supercritical Fluid Chromatography
- E1510** Practice for Installing Fused Silica Open Tubular Capillary Columns in Gas Chromatographs

3. Terminology

3.1 *Definitions*—This test method makes reference to many common gas chromatographic procedures, terms, and relationships. Detailed definitions of these can be found in Practices **E355**, **E594**, and **E1510**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *area slice, n*—the area, resulting from the integration of the chromatographic detector signal, within a specified retention time interval. Peak detection parameters are bypassed and the detector signal integral is recorded as area slices of consecutive, fixed duration time intervals.

3.2.2 *corrected area slice, n*—an area slice corrected for baseline offset, by subtraction of the exactly corresponding area slice in a previously recorded blank (non-sample) analysis.

3.2.3 *cumulative corrected area, n*—the accumulated sum of corrected area slices from the beginning of the analysis through a given retention time, ignoring any non-sample area (for example, solvent).

3.2.4 *final boiling point (FBP), n*—the temperature (corresponding to the retention time) at which a cumulative corrected

area count equal to 99.5 % of the total sample area under the chromatogram is obtained.

3.2.5 *initial boiling point (IBP), n*—the temperature (corresponding to the retention time) at which a cumulative corrected area equal to 0.5 % of the total sample area under the chromatogram is obtained.

3.2.6 *response factor (RF), n*—the factor used in order to calculate the mg/kg sulfur recovery of the sample.

3.2.7 *slice rate, n*—the time interval used to integrate the continuous (analog) chromatographic detector response during an analysis. The slice rate is expressed in Hz (for example, integrations or slices per second).

3.2.8 *slice time, n*—the cumulative slice rate (analysis time) associated with each area slice throughout the chromatographic analysis. The slice rate is the time at the end of each contiguous area slice.

3.2.9 *total sample area, n*—the cumulative corrected area from the initial point to the final area point.

3.3 *Abbreviations*—A common abbreviation of hydrocarbon compounds is to designate the number of carbon atoms in the compound. A prefix is used to indicate the carbon chain form, while a subscripted suffix denotes the number of carbon atoms (for example, normal decane n-C10, iso-tetradecane = i-C14).

4. Summary of Test Method

4.1 The boiling range distribution determination by distillation is simulated by the use of gas chromatography. A nonpolar open tubular (capillary) gas chromatographic column is used to elute the hydrocarbon components of the sample in order of increasing boiling point. The column temperature is raised at a reproducible linear rate and the area under the chromatogram is recorded throughout the analysis. Boiling points are assigned to the time axis from a calibration curve obtained under the same chromatographic conditions by analyzing a known mixture of hydrocarbons covering the boiling range expected in the sample. A quantitative standard is used to determine the SCD detector response factor. Finally, the sample solution is injected and with the use of the response factor, the amount of sample recovered is calculated. After converting the retention times of the sample slices to temperature, the boiling point distribution can be calculated up to the recovered amount. From these data, the boiling range distribution can be obtained.

4.1.1 By splitting the column effluent to FID and Sulfur Chemiluminescence Detector, simultaneous detection for hydrocarbon (FID) and sulfur (SCD) components boiling range distribution is obtained. The hydrocarbon simulated distillation data should be calculated according to Test Method **D2887**.

4.1.2 Alternatively, the FID may be used with the SCD detector superimposed over the FID and thus avoiding splitting the sample through the column exit. This type of arrangement will lower the sensitivity of the detector in the sulfur mode.

4.2 A sample aliquot is introduced into the chromatographic system. Sample vaporization is provided by separate heating of the point of injection or in conjunction with column oven heating.