



Designation: D1319 – 20a

Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption¹

This standard is issued under the fixed designation D1319; 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 of hydrocarbon types of total aromatics, total olefins, and total saturates in petroleum fractions that distill below 315 °C. Samples containing dark-colored components that interfere in reading the chromatographic bands cannot be analyzed.

NOTE 1—For the determination of olefins below 0.3 % by volume, other test methods are available, such as Test Method [D2710](#).

1.2 This test method is intended for use with full boiling range products. Cooperative data have established that the precision statement does not apply to narrow boiling petroleum fractions near the 315 °C limit. Such samples are not eluted properly, and results are erratic.

1.3 This test method is also applicable to automotive spark-ignition engine fuels which are gasolines with and without blended oxygenates, such as alcohols and ethers (for example MTBE, ethanol) and where gasoline is the primary component by volume in the blend.

1.4 The applicability of this test method to products derived from fossil fuels other than petroleum, such as coal, shale, or tar sands, has not been determined, and the precision statement may or may not apply to such products.

1.5 This test method has two precision statements depicted in Table 3 and Table 4.

1.5.1 Table 3 is applicable to fuels that do not contain oxygenated blending components over the test method concentration working ranges from 5 % to 99 % by volume aromatics, 1 % to 55 % by volume olefins, and 1 % to 95 % by volume saturates in petroleum fractions and with a final boiling point of <315 °C. It may or may not apply to automotive gasolines containing lead antiknock mixtures.

1.5.2 Table 4 precision was derived from an ILS containing only blended oxygenated (for example, MTBE, ethanol) and

non-oxygenated automotive spark-ignition engine fuels (gasolines) and is applicable only in the test method concentration working range of 13 % to 40 % by volume aromatics, 4 % to 33 % by volume olefins, and 45 % to 68 % by volume saturates.

1.5.3 Non-oxygenated automotive spark-ignition engine fuels (gasolines) outside the inclusive valid test result reporting concentration ranges of Table 4 may use the precision in Table 3 and its applicable concentration ranges.

1.6 The oxygenated blending components, methanol, ethanol, methyl-*tert*-butylether (MTBE), *tert*-amylmethylether (TAME), and ethyl-*tert*-butylether (ETBE), do not interfere with the determination of hydrocarbon types at concentrations normally found in commercial blends. These oxygenated components are not detected since they elute with the alcohol desorbent. Other oxygenated compounds shall be individually verified. When samples containing oxygenated blending components are analyzed, correct the results to a total-sample basis.

1.7 This test method includes a relative bias section based on Practice [D6708](#) accuracy assessment between Test Method D1319 and Test Method [D5769](#) for total aromatics in spark-ignition engine fuels as a possible Test Method D1319 alternative to Test Method [D5769](#) for U.S. EPA spark-ignition engine fuel regulations reporting. The Practice [D6708](#) derived correlation equation is only applicable for fuels in the total aromatic concentration range from 3.3 % to 34.4 % by volume as measured by Test Method D1319 and the distillation temperature T_{95} , at which 95 % of the sample has evaporated, ranges from 149.1 °C to 196.6 °C (300.3 °F to 385.8 °F) when tested according to Test Method [D86](#).

1.7.1 The applicable Test Method [D5769](#) range for total aromatics is 3.7 % to 29.4 % by volume as reported by Test Method [D5769](#) and the distillation temperature T_{95} values, at which 95 % of the sample has evaporated, when tested according to Test Method [D86](#) is from 149.1 °C to 196.6 °C (300.3 °F to 385.8 °F).

1.7.2 Regulations may change over time and the user is advised to verify current regulatory requirements.

1.8 **WARNING**—Mercury has been designated by many regulatory agencies as a hazardous substance that can cause

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 [D02.04.0C](#) on Liquid Chromatography.

Current edition approved Aug. 1, 2020. Published September 2020. Originally approved in 1954. Last previous edition approved in 2020 as D1319 – 20. DOI: 10.1520/D1319-20A.

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

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.

1.9 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.10 *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 Section 7, 8.1, and 10.5.

1.11 *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
- D1655** Specification for Aviation Turbine Fuels
- D2710** Test Method for Bromine Index of Petroleum Hydrocarbons by Electrometric Titration
- D3663** Test Method for Surface Area of Catalysts and Catalyst Carriers
- D4057** Practice for Manual Sampling of Petroleum and Petroleum Products
- D4815** Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C₁ to C₄ Alcohols in Gasoline by Gas Chromatography
- D5599** Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection
- D5769** Test Method for Determination of Benzene, Toluene, and Total Aromatics in Finished Gasolines by Gas Chromatography/Mass Spectrometry
- D6300** Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants
- D6708** Practice for Statistical Assessment and Improvement of Expected Agreement Between Two Test Methods that Purport to Measure the Same Property of a Material
- E11** Specification for Woven Wire Test Sieve Cloth and Test Sieves

2.2 Other Standards:

BS 410–1:2000 Test sieves. Technical requirements and testing. Test sieves of metal wire cloth³

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *aromatics, n*—the volume percent of monocyclic and polycyclic aromatics, plus aromatic olefins, some dienes, compounds containing sulfur and nitrogen, or higher boiling oxygenated compounds (excluding those listed in 1.6).

3.1.2 *gasoline, n*—a volatile mixture of liquid hydrocarbons, generally containing small amounts of additives, suitable for use as a fuel in spark-ignition, internal combustion engines.

3.1.3 *olefins, n*—the volume percent of alkenes, plus cycloalkenes, and some dienes.

3.1.4 *saturates, n*—the volume percent of alkanes, plus cycloalkanes.

4. Summary of Test Method

4.1 Approximately 0.75 mL of sample is introduced into a special glass adsorption column packed with activated silica gel. A small layer of the silica gel contains a mixture of fluorescent dyes. When all the sample has been adsorbed on the gel, alcohol is added to desorb the sample down the column. The hydrocarbons are separated in accordance with their adsorption affinities into aromatics, olefins, and saturates. The fluorescent dyes are also separated selectively, with the hydrocarbon types, and make the boundaries of the aromatic, olefin, and saturate zones visible under ultraviolet light. The volume percentage of each hydrocarbon type is calculated from the length of each zone in the column.

5. Significance and Use

5.1 The determination of the total volume percent of saturates, olefins, and aromatics in petroleum fractions is important in characterizing the quality of petroleum fractions as gasoline blending components and as feeds to catalytic reforming processes. This information is also important in characterizing petroleum fractions and products from catalytic reforming and from thermal and catalytic cracking as blending components for motor and aviation fuels. This information is also important as a measure of the quality of fuels, such as specified in Specification **D1655**.

6. Apparatus

6.1 *Adsorption Columns*, with precision bore (“true bore” IP designation) tubing, as shown on the right in Fig. 1, made of glass and consisting of a charger section with a capillary neck, a separator section, and an analyzer section; or with standard wall tubing, as shown on the left in Fig. 1. Refer to Table 1 for column tolerance limits.

6.1.1 The inner diameter of the analyzer section for the precision bore tubing shall be 1.60 mm to 1.65 mm. In addition

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 Available from British Standards Institution (BSI), 389 Chiswick High Rd., London W4 4AL, U.K., <http://www.bsigroup.com>.

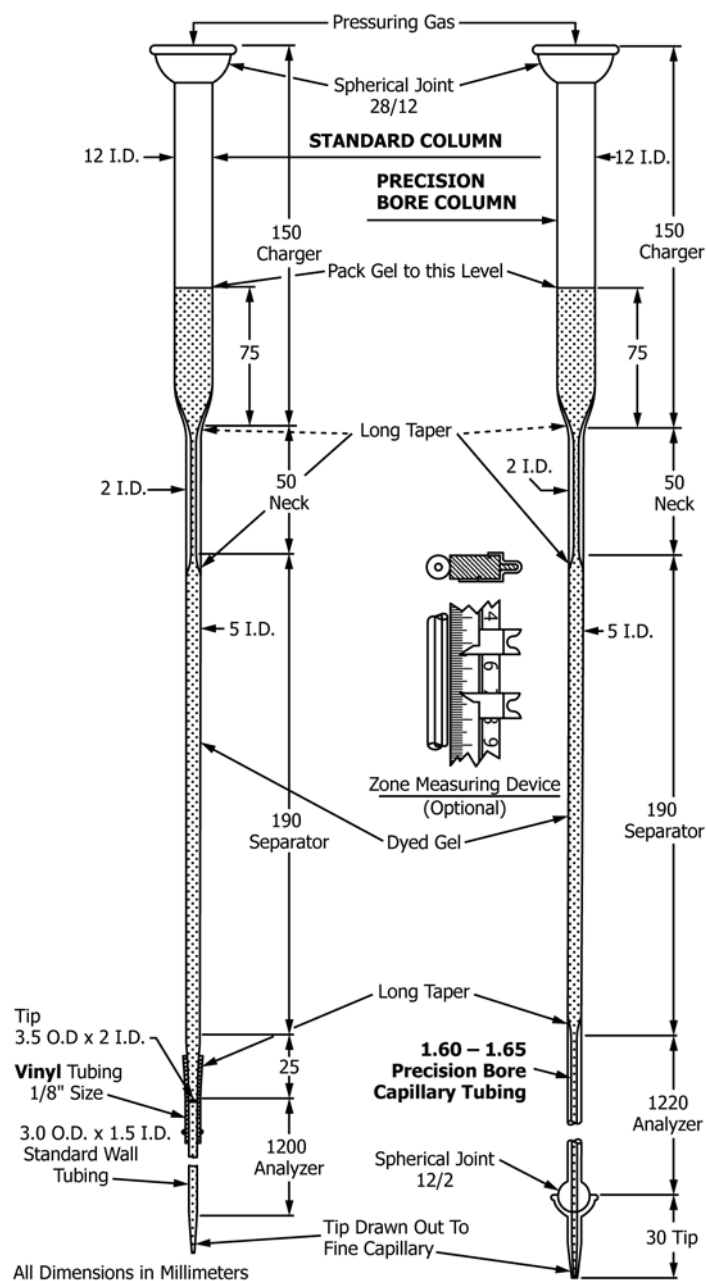


FIG. 1 Adsorption Columns with Standard Wall (left) and Precision Bore (right) Tubing in Analyzer Section

the length of an approximately 100 mm thread of mercury shall not vary by more than 0.3 mm in any part of the analyzer section. In glass-sealing the various sections to each other, long-taper connections shall be made instead of shouldered connections. Support the silica gel with a small piece of glass wool located between the ball and socket of the 12/2 spherical joint and covering the analyzer outlet. The column tip attached to the 12/2 socket shall have a 2 mm internal diameter. Clamp the ball and socket together and ensure that the tip does not tend to slide from a position in a direct line with the analyzer section during the packing and subsequent use of the column. Commercial compression-type connectors may be used to couple the bottom of the separator section (which has been cut square), to the disposable 3 mm analyzer section, provided that

the internal geometry is essentially similar to the aforementioned procedure and provides for a smooth physical transition from the inner diameters of the two glass column sections. Similar commercial compression-type connectors may be employed at the terminal end of the 3 mm analyzer section, having an integral porous support to retain the silica gel.

6.1.2 For convenience, adsorption columns with standard wall tubing, as shown on the left in Fig. 1, can be used. When using standard wall tubing for the analyzer section, it is necessary to select tubing of uniform bore and to provide a leakproof connection between the separator and the analyzer sections. Calibrations of standard wall tubing would be impractical; however, any variations of 0.5 mm or greater, as measured by ordinary calipers, in the outside diameter along