



Designation: D4625 – 21

Standard Test Method for Middle Distillate Fuel Storage Stability at 43 °C (110 °F)¹

This standard is issued under the fixed designation D4625; 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 a method for evaluating the inherent storage stability of distillate fuels having flash points above 38 °C (100 °F), by Test Methods **D93**, and 90 % distilled points below 340 °C (644 °F), by Test Method **D86**.

NOTE 1—ASTM specification fuels falling within the scope of this test method are Specification **D396**, Grade Nos. 1 and 2; Specification **D975**, Grades 1-D and 2-D; and Specification **D2880**, Grades 1-GT and 2-GT.

1.2 This test method is not suitable for quality control testing but, rather it is intended for research use to shorten storage time relative to that required at ambient storage temperatures.

1.3 **Appendix X1** presents additional information about storage stability and the correlation of Test Method D4625 results with sediment formation in actual field storage.

1.4 The values given in SI units are to be regarded as the standard.

1.4.1 *Exception*—The values in parentheses are for information only.

1.5 *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.*

1.6 *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.*

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 **D02.14** on Stability, Cleanliness and Compatibility of Liquid Fuels.

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2. Referenced Documents

2.1 ASTM Standards:²

- D86** Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- D93** Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D381** Test Method for Gum Content in Fuels by Jet Evaporation
- D396** Specification for Fuel Oils
- D975** Specification for Diesel Fuel
- D1193** Specification for Reagent Water
- D2880** Specification for Gas Turbine Fuel Oils
- 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

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 *adherent insolubles, n*—gums formed during storage that remain tightly attached to the walls of the vessel after fuel has been flushed from the container.

3.2.2 *filterable insolubles, n*—solids formed during storage that can be removed from the fuel by filtration.

3.2.3 *inherent storage stability, n*—of middle distillate fuel—the resistance of the fuel to change during storage in contact with air, but in the absence of other environmental factors such as water, or reactive metals and dirt.

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

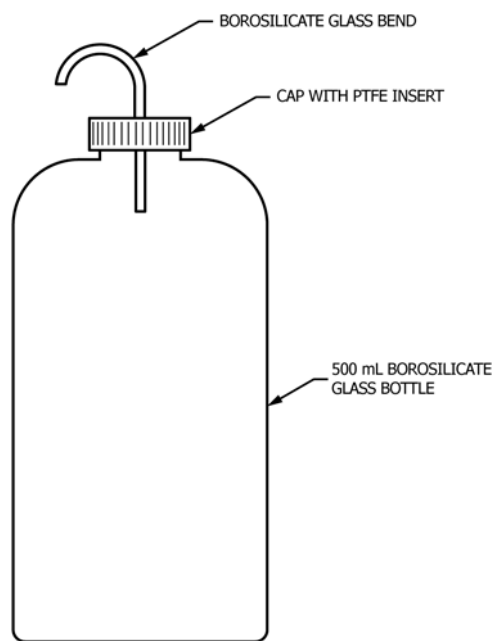


FIG. 1 Sample Storage Container

3.2.4 *total insolubles, n*—the arithmetic sum of the filterable insolubles plus the adherent insolubles.

4. Summary of Test Method

4.1 Four-hundred (400) mL volumes of filtered fuel are aged by storage in borosilicate glass containers at 43 °C (110 °F) for periods of 4, 8, 12, 18, and 24 weeks. If desired, perform zero-week analyses on the same day as the other samples are placed in storage. Zero-week data are used to provide base data and ensure satisfactory technique. After aging for a selected time period, a sample is removed from storage, cooled to room temperature, and analyzed for filterable insolubles and for adherent insolubles.

5. Significance and Use

5.1 Fuel oxidation and other degradative reactions leading to formation of sediment (and color) are mildly accelerated by the test conditions compared with typical storage conditions. Test results have been shown to predict storage stability more reliably than other more accelerated tests. See [Appendix X1](#) for information on the correlation of test results with actual field storage.

5.2 Because the storage periods are long (4 weeks to 24 weeks), the test method is not suitable for quality control testing, but does provide a tool for research on storage properties of fuels.

5.3 Because environmental effects and the materials and nature of tank construction affect storage stability, the results obtained by this test are not necessarily the same as those obtained during storage in a specific field storage situation.

6. Apparatus

6.1 *Sample Containers*, borosilicate glass bottles, nominal capacity 500 mL ([Fig. 1](#)). The containers shall have a cap, lid,

or cover, preferably with a polytetrafluoroethylene (PTFE) insert and a hole for a borosilicate glass vent.

6.2 *Storage Oven*, large enough to contain all of the sample bottles. The oven shall be thermostatically controlled to maintain a temperature of 43 °C ± 1 °C (110 °F ± 2 °F). It shall be as dark as possible to prevent degradation due to photolytic reactions and shall also be *explosion proof*.

6.3 *Filter Drying Oven*, shall be capable of safely evaporating the solvent at 90 °C ± 5 °C for the drying of filters.

6.4 *Filtration System*—Arrange the following components as shown in [Fig. 2](#).

6.4.1 *Funnel and Funnel Base*, with filter support for a 47 mm diameter membrane and a locking ring or spring action clip.

6.4.2 *Ground/Bond Wire*, 0.912 mm to 2.59 mm (No. 10 to No. 19) bare-stranded, flexible stainless steel or copper installed in the flasks and grounded as shown in [Fig. 2](#).

6.4.3 *Receiving Flask*, 1.5 L, or larger, borosilicate glass vacuum filter flask, into which the filtration apparatus fits, equipped with a sidearm to connect to the safety flask.

6.4.4 *Safety Flask*, 1.5 L, or larger, borosilicate glass vacuum filter flask equipped with a sidearm to connect the vacuum system. A fuel and solvent resistant rubber hose, through which the grounding wire passes, shall connect the sidearm of the receiving flask to the tube passing through the rubber stopper in the top of the safety flask.

6.4.5 *Vacuum System*, either a water-aspirated, or a mechanical, vacuum pump may be used if capable of producing a vacuum of 80 kPa to 100 kPa below atmospheric pressure when measured at the receiving flask.

7. Reagents and Materials

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.³ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Nylon Test and Control Membrane Filters*—plain, 47 mm diameter, nominal pore size 0.8 µm. (Membrane filters with a grid imprinted on their surface may be used as control membrane filters for identification.)

7.3 *Hydrocarbon Solvent*, 2,2,4-trimethylpentane (*isooctane*)—ASTM knock test reference fuel grade or equivalent, prefiltered through two glass-fiber or nylon membrane filters, nominal pore size 0.8 µm. (**Warning**—Extremely flammable. Harmful if inhaled. Vapors may cause flash fire.)

³ *ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.