



Designation: D 5452 – 00

An American National Standard



Designation: 423/97

Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration¹

This standard is issued under the fixed designation D 5452; 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 Department of Defense.

1. Scope

1.1 This test method covers the gravimetric determination by filtration of particulate contaminant in a sample of aviation turbine fuel delivered to a laboratory.

1.1.1 The sample is filtered through a test membrane and a control membrane using vacuum. The mass change difference identifies the contaminant level per unit volume.

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

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see 4.2, 7.3, 7.5, 11.3, and X1.7.2. Before using this standard, refer to supplier's safety labels, material safety data sheets, and technical literature.

2. Referenced Documents

2.1 ASTM Standards:

- D 56 Test Method for Flash Point by Tag Closed Tester²
- D 93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester²
- D 1193 Specification for Reagent Water³
- D 1535 Practice for Specifying Color by the Munsell System⁴
- D 1655 Specification for Aviation Turbine Fuels²
- D 2244 Test Method for Calculation of Color Differences

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.J0 on Aviation Fuels.

Current edition approved June 10, 2000. Published August 2000. This document was previously published as ES 19. Last previous edition D 5452–99.

This standard has been separated from D 2276 and has been modified primarily to establish improved safety measures. Last previous edition was D 2276–89.

² Annual Book of ASTM Standards, Vol 05.01.

³ Annual Book of ASTM Standards, Vol 11.01.

⁴ Annual Book of ASTM Standards, Vol 06.01.

from Instrumentally Measured Color Coordinates⁴

D 2276 Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling²

D 3828 Test Methods for Flash Point by Small Scale Closed Tester⁵

D 4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination⁵

D 4865 Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems⁵

3. Terminology

3.1 Definitions:

3.1.1 *bond*, *v*—to connect two parts of a system electrically by means of a bonding wire to eliminate voltage differences.

3.1.2 *ground*, *vt*—to connect electrically with ground (earth).

3.1.3 *membrane filter*, *n*—a porous article of closely controlled pore size through which a liquid is passed to separate matter in suspension.

3.1.3.1 *Discussion*—RR:D02–1012 contains information on membrane filters that meet the requirements therein.

3.1.4 *particulate*, *adj*—of or relating to minute separate particles.

3.1.4.1 *Discussion*—Solids generally composed of oxides, silicates, and fuel insoluble salts.

3.1.5 *volatile fuels*—relatively wide boiling range volatile distillate.

3.1.5.1 *Discussion*—These are identified as Jet B in Specification D 1655 or the military grade known as JP-4. Any fuel or mixture having a flash point less than 38°C must be considered volatile.

4. Summary of Test Method

4.1 A known volume of fuel is filtered through a pre-weighed test membrane filter and the increase in membrane filter mass is weight determined after washing and drying. The change in weight of a control membrane located immediately

⁵ Annual Book of ASTM Standards, Vol 05.02.

below the test membrane filter is also determined. The particulate contaminant is determined from the increase in mass of the test membrane relative to the control membrane filter.

4.2 In order to ensure safety in handling, the test method requires that volatile fuels be transferred from the sample container to the funnel without pouring. Fuels having a verified flash point greater than 38°C (refer to Test Method D 56 or Test Methods D 93 or D 3828) may be transferred by pouring the sample from the sample container directly into the funnel. Bonding the sample container to the funnel is required. (**Warning**—Volatile fuels such as JP-4 and Jet B or mixtures having flash points below 38°C have been ignited by electrostatic discharges when poured through membrane filters.)

4.3 Appendix X1 describes safety precautions to avoid static discharge in filtering fuel through membranes.

5. Significance and Use

5.1 This test method provides a gravimetric measurement of the particulate matter present in a sample of aviation turbine fuels delivered to a laboratory for evaluation. The objective is to minimize these contaminants to avoid filter plugging and other operational problems. Although tolerable levels of particulate contaminants have not yet been established for all points in fuel distribution systems, the total contaminant measurement is normally of most interest.

6. Apparatus

6.1 *Analytical Balance*, single- or double-pan, the precision standard deviation of which must be 0.07 mg or better.

6.2 *Oven*, of the static type (without fan-assisted air circulation), controlling to $90 \pm 5^\circ\text{C}$.

6.3 *Petri Dishes*, approximately 125 mm in diameter with removable glass supports for membrane filters.

6.4 *Forceps*, flat-bladed with unserrated, non-pointed tips.

6.5 *Vacuum System*.

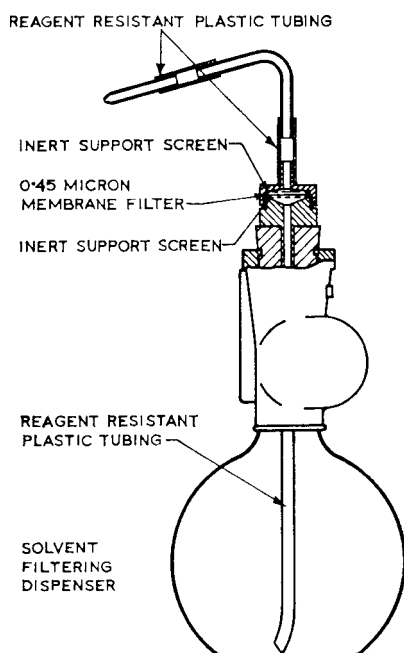


FIG. 1 Apparatus for Filtering and Dispensing Flushing Fluid

6.6 *Test Membrane Filters*,^{6,7} plain, 47-mm diameter, nominal pore size 0.8 μm (see Note 1).

6.7 *Control Membrane Filters*,^{6,7} 47-mm diameter, nominal pore size 0.8 μm . (Gridded control membrane filters may be used for purpose of identification.)

NOTE 1—Matched weight membrane filters,⁶ 47-mm diameter, nominal pore size 0.8 μm , may be used as test and control membrane filters if so desired. Use of matched-weight membrane filters precludes the necessity for carrying out subsequently the procedures detailed in Section 10.

6.8 *Dispenser for Flushing Fluid*, 0.45- μm membrane filters to be provided in the delivery line (see Fig. 1).

6.9 *Air Ionizer*, for the balance case. See Note 2 and Note 3.

NOTE 2—When using a solid-pan balance, the air ionizer may be omitted provided that, when weighing a membrane filter, it is placed on the pan so that no part protrudes over the edge of the pan.

NOTE 3—Air ionizers should be replaced within 1 year of manufacture.

6.10 *Filtration Apparatus*, of the type shown in Fig. 2. It consists of a funnel and a funnel base with a filter support such that a membrane filter can be gripped between the sealing surface and the base by means of a locking ring. Use a metal funnel with at least a 70-mm diameter at the top.

6.11 *Support Apparatus*, as shown in Fig. X3.1, having adjustable height, integral spill collection pan at the base, and an edge on the can shelf to prevent the can from slipping off. The shelf is slotted. Refer to Appendix X2 for fabrication details.

6.12 *Dispensing Cap or Plug*, with approximately 9.5-mm inside diameter hose barb 32-mm long on which a 75 to 100-mm long piece of fuel resistant, flexible, plastic tubing is installed (see Fig. 2). The closure gasket shall be made of a fuel resistant material. A paper composition material is not acceptable.

6.13 *Feed Container*, shall be a 3.8 to 5-L (1-gal) epoxy lined sample can, preferably the same container in which the sample was collected.

6.14 *Receiving Flask*, shall be glass or metal. A graduated glass flask is preferred so that the space remaining for fuel can be observed. The filtration apparatus is fitted to the top of the flask. The flask shall be fitted with a side arm to connect the vacuum system. The flask should be large enough to contain the sample and flushing fluids.

6.15 *Safety Flask*, shall be glass containing a sidearm attached to the receiving flask with a fuel and solvent resistant rubber hose and shall be connected to the vacuum system.

6.16 *Ground/Bond Wire*, #10 thru #19 (0.912–2.59 mm) bare stranded flexible, stainless steel or copper installed in the flasks and grounded as shown in Fig. 2. If a metallic flask(s) is used instead of glass, the flask(s) must be grounded.

6.17 *Plastic Film*, polyethylene or any other clear film not adversely affected by flushing fluids.

⁶ All available membrane filters are not suitable for this application. Apparatus considered for this application shall be checked by the user for suitability in accordance with the requirements of RR:D02-1012, 1994 revision.

⁷ A list of suppliers who have provided data indicating their membranes, field monitors, and field monitor castings are in accordance with the requirements of RR:D02-1012 is available from ASTM Headquarters. To obtain the research report, data, and list of suppliers request RR:D02-1012, 1994 revision.

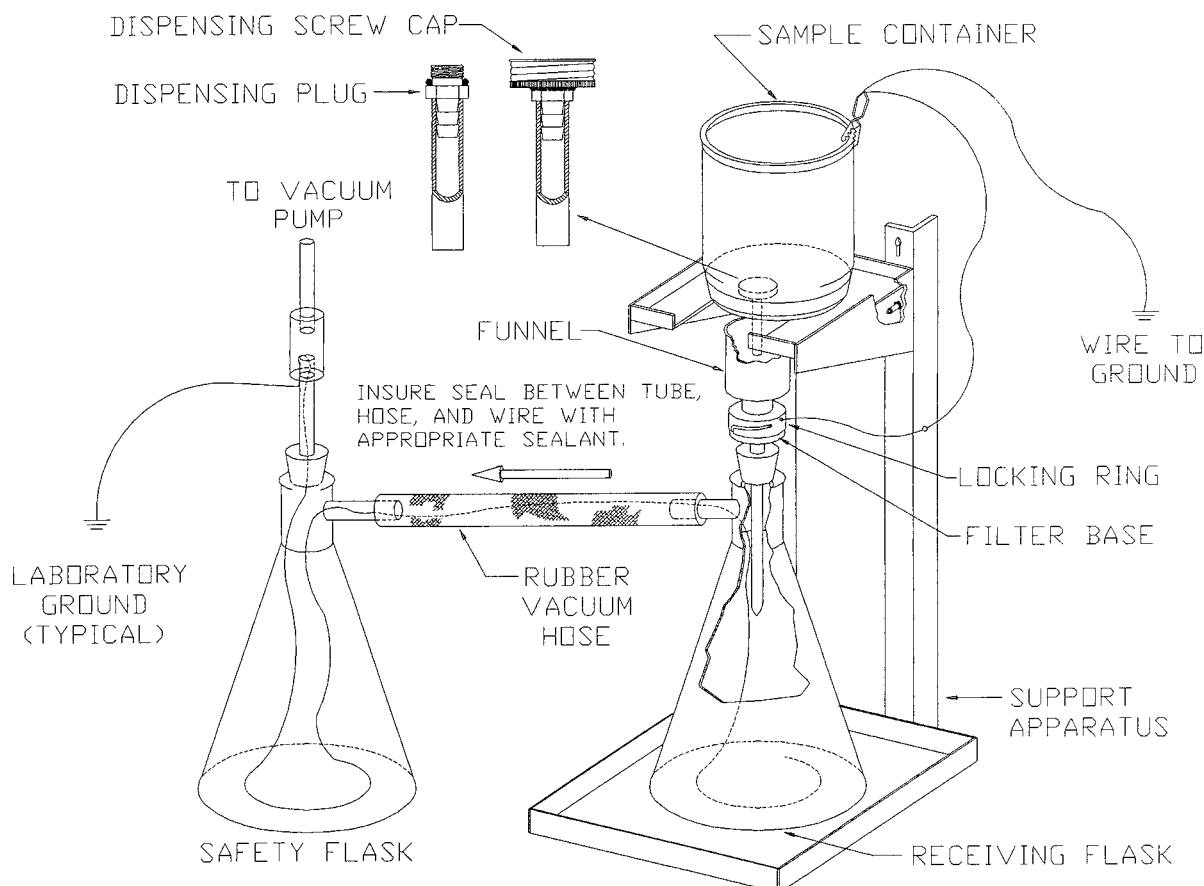


FIG. 2 Apparatus for Determining Total Contaminant

6.18 *Multimeter/VOM*, used for determining whether electrical continuity is 10 ohms or less between 2 points.

7. Reagents

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.⁸ 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 *Purity of Water*—Unless otherwise indicated references to water shall be understood to mean reagent water as defined by Type III of Specification D 1193.

7.3 *Isopropyl Alcohol*, (**Warning**—Flammable.)

7.4 *Liquid Detergent*, water-soluble.

7.5 *Flushing Fluids*—Petroleum spirit (also known as petroleum ether or IP Petroleum Spirit 40/60) (**Warning**—Extremely flammable. Harmful if inhaled. Vapors are easily

ignited by electrostatic discharges, causing flash fire.), having boiling range from 35 to 60°C.

7.6 *Filtered Fluids*—Filtered fluids are fluids filtered through a nominal 0.45- μ m membrane filter. Filtered fluids are most conveniently obtained by means of the solvent filtering dispenser described in Fig. 1.

8. Sampling

8.1 All containers and their closures, sampling lines, and other equipment used in obtaining the sample for analysis must be thoroughly cleaned as described in Section 9. Containers used must conform to the criteria set forth in Practice D 4306.

8.2 To obtain a representative sample from a fuel stream and to avoid external contamination, the sample may be drawn from the flushing line of a field sampling kit. Ensure that the line is first flushed with the fuel to be sampled and that the line is externally clean.

8.3 Whether or not a sampling kit is available, suitable precautions must be taken to avoid sample contamination by the use of a suitable sampling point in accordance with Test Method D 2276. If the quick-disconnect sampling connection is not used, a stainless steel ball or plug type valve should be selected as its internal design avoids the possibility of trapping or generating solid contaminant. Samples that are collected for general laboratory or chemical analysis are not necessarily suitable for this test method because insufficient care may have been taken to avoid particulate contamination.

⁸ *Reagent Chemicals, American Chemical Society Specifications*, 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.