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Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration[1,2]

This standard is issued under the fixed designation D5452; 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 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see 4.2, 7.3, 7.5, 11.2, and X1.7.2. Before using this standard, refer to supplier's safety labels, material safety data sheets, and technical literature.

1.4 *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:*[3]

D56 Test Method for Flash Point by Tag Closed Cup Tester

D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

D1193 Specification for Reagent Water

D1535 Practice for Specifying Color by the Munsell System

D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

D2276 Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling

D3828 Test Methods for Flash Point by Small Scale Closed Cup Tester

D4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination

D4865 Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems

D6615 Specification for Jet B Wide-Cut Aviation Turbine Fuel

D8194 Practice for Evaluation of Suitability of 37 mm Filter Monitors and 47 mm Filters Used to Determine Particulate Contaminant in Aviation Turbine Fuels

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.

[1] This test method is under the jurisdiction of ASTM International Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of ASTM Subcommittee D02.J0.05 on Fuel Cleanliness. The technically equivalent standard as referenced is under the jurisdiction of the Energy Institute Subcommittee SC-B-11.

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This test method has been separated from D2276 and has been modified primarily to establish improved safety measures.

[2] This test method has been developed through the cooperative effort between ASTM and the Energy Institute, London. ASTM and IP standards were approved by ASTM and EI technical committees as being technically equivalent but that does not imply both standards are identical.

[3] 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**

3.1.3.1 *Discussion*—Research Report RR:D02-1012[4] contains information on membrane filters that have historically met the requirements of the method and are still considered suitable. Practice D8194 contains the test methods and acceptance criteria for suitable membrane filters.

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, n*—relatively wide boiling range volatile distillate.

3.1.5.1 *Discussion*—These are identified as Jet B in Specification D6615 or the military grade known as JP-4. Any fuel or mixture having a flash point less than 38 °C is considered to be volatile.

4. Summary of Test Method

4.1 A known volume of fuel is filtered through a preweighed 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 below the test membrane filter is also determined. The objective of using a control membrane is to assess whether the fuel itself influences the weight of a membrane. 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 using a support stand shown in Fig. 1. Fuels having a verified flash point greater than

[4] Supporting data (including a list of suppliers who have provided data indicating their membranes, field monitors, and field monitor castings) have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1012. Contact ASTM Customer Service at service@astm.org.

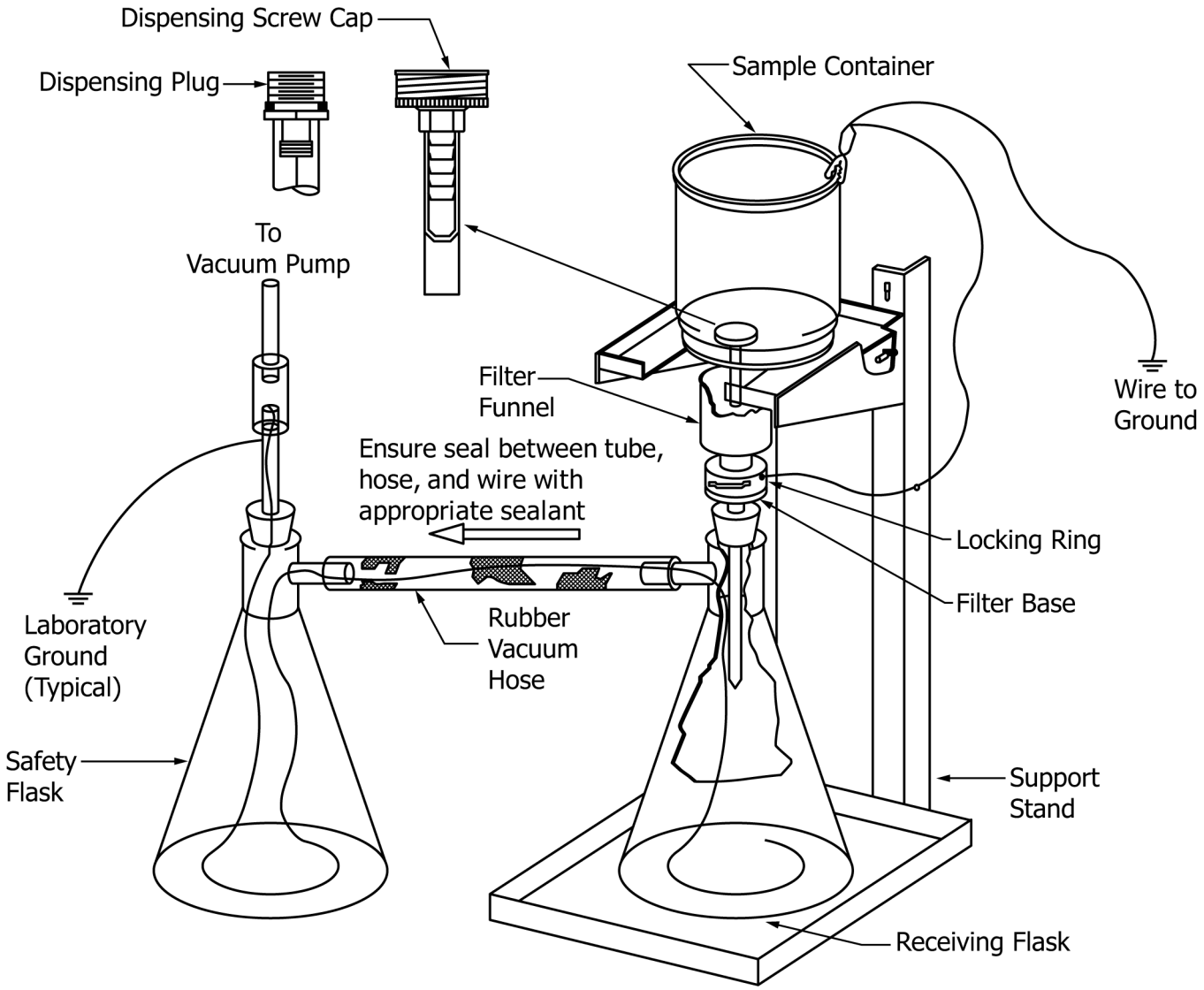

FIG. 1 Apparatus for Determining Total Contaminant

38 °C (refer to Test Method D56 or Test Methods D93 or D3828) may be transferred by pouring the sample from the sample container directly into the funnel. Bonding of a metallic 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 X2 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 fuel 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 °C ± 5 °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.*

6.6 *Test Membrane Filters,* [4,5] plain, 47 mm diameter, nominal pore size 0.8 µm (see Note 1).

6.7 *Control Membrane Filters,* [4,5] 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,[5] 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 Filtered Flushing Fluid,* 0.45 µm membrane filters to be provided in the delivery line (see Fig. 2). Alternatively, flushing fluid that has been pre-filtered through a 0.45 µm membrane before delivery to the dispenser flask is acceptable.

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. 1. It consists of a filter 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.

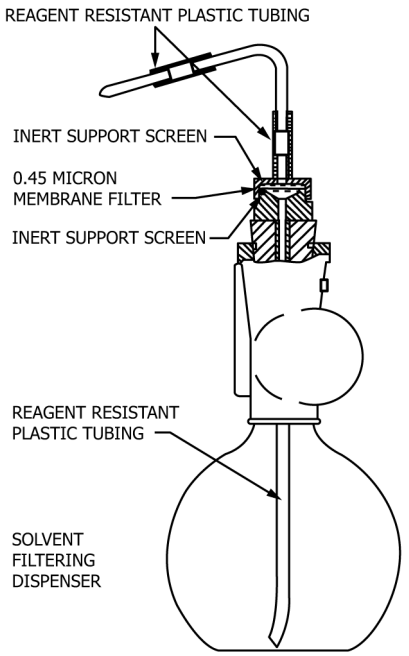

FIG. 2 Apparatus for Filtering and Dispensing Flushing Fluid

6.11 *Support Stand,* (required when the sample flash point is lower than 38 °C) 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 Fig. X3.1 for fabrication details.

6.12 *Dispensing Cap or Plug,* (required when the sample flash point is lower than 38 °C) with approximately 9.5 mm inside diameter hose barb 32 mm long on which a 75 mm to 100 mm long piece of fuel resistant, flexible, plastic tubing is installed (see Fig. 1). The plug is for sample containers having ¾ in. (19 mm) female pipe threads while the cap is for containers having 1.75 in. (44 mm) diameter sheet metal threads. Dispensing spouts for other containers must be fabricated. The closure gasket shall be made of a fuel resistant material. A paper composition material is not acceptable.

6.13 *Sample Container,* should be a 3.8 L to 5 L (1 gal) epoxy lined sample can, preferably the same container in which the sample was collected and should conform to the criteria set forth in Practice D4306. When samples are collected in a smaller container than recommended here, select a container that does not trap particles when the contents are poured out.

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.

[5] 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.