Designation: D4306 – 20

An American National Standard

Standard Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination[1]

This standard is issued under the fixed designation D4306; 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 practice[2] covers the types of and preparation of containers found most suitable for the handling of aviation fuel samples for the determination of critical properties affected by trace contamination.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 warning statements, see 5.1, 5.2, 5.3, 5.4, and 5.6.

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]

D2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels

D3948 Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4308 Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter

D5452 Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration

2.2 *SAE Standard:*[4]

MAP1794 Aircraft Recommended Practice, Ball-On-Cylinder (Boc) Aircraft Turbine Fuel Lubricity Tester

3. Significance and Use

3.1 General descriptions for the manual sampling of petroleum products are given in Practice D4057. However, a number of aviation fuel properties are established or affected by trace levels of polar or other compounds. Measurement significance therefore requires that the sample containers not add or adsorb any materials. This practice presents types and preparations of sampling containers found satisfactory for the determination of water separation, copper corrosion, electrical conductivity, thermal stability, lubricity, and trace metal content. The choice of construction materials is an important factor, particularly in the case of aviation turbine fuel, where thermal stability can be degraded by the presence of very low concentrations of copper. The use of copper or copper based alloys shall be eliminated from aviation sampling apparatus. An approval procedure for new containers is also given.

3.2 Two properties, particulate contamination and free water content, involve materials easily removed by any sampling container. These properties should be determined by placing the sample directly into the measuring apparatus and not using containers to transport the sample to the measuring equipment.

3.3 Recommendations in this practice provide guidance for immediate use and for storage of samples. Immediate use involves sample storage for periods less than 24 h.

4. Apparatus

4.1 *Sampling Containers:*

4.1.1 *Epoxy-Coated Containers:*

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.J0.04 on Additives and Electrical Properties.

Current edition approved May 1, 2020. Published June 2020. Originally approved in 1984. Last previous edition approved 2015 as D4306 – 15. DOI: 10.1520/D4306-20.

[2] The detailed data on which this practice is based may be found in SAE Practice MAP1794 and three research reports. Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Reports RR:D02-1169, RR:D02-1142, and RR:D02-1504.

[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.

[4] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

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

4.1.1.1 While generally superior to other coatings, certain epoxy-coatings evolve plasticizers which can adversely affect critical fuel properties. Because no specification is known to describe a satisfactory epoxy-coating, 6.2 lists an approval procedure which can be used to identify a satisfactory coating.

4.1.1.2 For initial qualification of new container sources, coated cans should be examined closely to assure that the coating covers all inside surfaces. If not, the cans should be considered the same as tin-plated, exterior soldered side seam cans.

4.1.1.3 Epoxy-coated cans are generally considered satisfactory for sampling aviation gasoline.

4.1.2 *Borosilicate (Hard) Glass Bottles*—Amber colored or bottles covered with an opaque material such as aluminum foil are preferred to avoid possible reactions with sunlight.

4.1.3 *Polytetrafluoroethylene (PTFE) Bottles*—Black, carbon-filled bottles avoid possible reactions with sunlight.

4.1.4 *Polyethylene Bottles,* high-density, linear.

4.1.5 *Steel Cans,* tin-plated, exterior soldered side seam.

4.1.6 *Soda Lime (Soft) Glass Bottles.*

4.2 *Closures:*

4.2.1 Closures with a metallic inside surface are preferred. Closures with the same inside surfaces as suitable containers or PTFE are also suitable.

4.2.2 Where required by shipping regulations such as DOT 17C or 17E the closure should also include a metallic shipping seal.

NOTE 1—The use of improper or uncleaned closures or shipping seals will destroy all precautions used in selecting and preparing containers. The use of properly selected and cleaned closures or seals is essential.

5. Reagents and Materials

5.1 *Acetone,* CP Grade (**Warning—**Extremely flammable. Vapors may cause flash fire). (See Note 2.)

5.2 *Toluene,* CP Grade (**Warning—**Extremely flammable. Vapors may cause flash fire). (See Note 2.) When used to clean containers for conductivity, measure toluene conductivity according to Test Method D2624 or D4308 and use only if conductivity is less than 20 pS/m.

5.3 *Isopropanol,* CP Grade (**Warning—**Extremely flammable. Vapors may cause flash fire). (See Note 2.)

5.4 *Heptane,* CP Grade (**Warning—**Extremely flammable. Vapors may cause flash fire). (See Note 2.)

NOTE 2—Because these solvents are available at various purity levels, the use of CP grade is required to eliminates possible problems with residual impurities.

5.5 *Detergent,* heavy duty, water soluble, laboratory type.

5.6 *Jet A or Jet A-1,* used as reference fluid. (**Warning**—Combustible. Vapor harmful).

5.6.1 Reference fluid for approval testing with Jet A or Jet A-1 fuel is prepared in accordance with Test Method D3948, Appendix X1 on Preparation of Reference Fluid Base, and should have an electrical conductivity of 0.1 to 1.0 by Test Method D4308 (or give a reading of less than 1 according to Test Method D2624) and an MSEP rating of 98-100 by Test Method D3948.

5.6.2 *Compressed Air,* clean, dry, oil free and filtered, may be used to expedite air drying.

6. Preparation of Apparatus

6.1 *Introduction:*

6.1.1 Experience indicates no single container type to meets all desired requirements including size and cost. Certain container types have been found suitable for some test methods but not for others. Some containers are adequate if the samples are used immediately but are not suitable for sample storage. The procedure therefore designates the containers to be used for each test procedure and describes prior cleaning, if any. A summary of the procedures is found in Table 1. The detailed procedures follow below. However, the possibility that a fuel may contain an unusual contaminant, making a normally satisfactory container unsuitable should not be overlooked.

6.1.2 The largest sample meeting shipping rules, costs, availability, and other practical considerations should always be used to minimize surface effects.

6.1.3 It is not possible to describe some of the container materials by standard specifications or by suitable generic descriptions. Therefore, an approval procedure is outlined in 6.2.

6.1.4 Other sampling details such as sampling taps, labelling, shipping instructions, and so forth will be found in Practice D4057.

6.2 *Approval Procedure (Stored Samples):*

6.2.1 If internally coated the new container should be examined visually for coating integrity in accordance with 4.1.1.2 and closure suitability in accordance with 4.2.1.

6.2.2 Containers should be flushed three times with the container 10 % to 20 % filled with trisolvent (equal volumes of 5.1, 5.2, and 5.3), then three times with heptane. For each flush, the container should be closed and shaken for 1 min and the solvent replaced for the next flush. After the last flush is drained, the container should be air-dried.

6.2.3 Reference fuel as indicated in 5.6 should be used for testing.

6.2.4 The containers should be filled with reference Jet A, or A-1, closed, and stored for at least one month at room temperature. During this period the samples should be shaken strongly at least once a week. At the end of storage the sample should be tested for electrical conductivity and water separation. The final electrical conductivity should be no more than 2 pS⁄m greater than the original value. The water separation rating should decrease by no more than three MSEP units.

6.2.5 Supplemental testing is necessary if the fuel normally contains additives such as conductivity improvers which may be desorbed. In that case a large additive-containing sample which has been stored for a month or longer to equilibrate additive content should be used as the test fuel. Such fuel should have a conductivity above 50 pS/m if the additive is conductivity improver additive; and the MSEP value should also be determined. After similar storage for at least one month, the final electrical conductivity should not change more than the repeatability limits of Test Method D2624 or D4308,