Designation: D 4306 – 97

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 D 4306; 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 practice[2] describes 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 *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 Note 2, Note 4, and 5.

2. Referenced Documents

2.1 *ASTM Standards:*

D 2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels Containing a Static Dissipator Additive[3]

D 3602 Field Test Method for Water-Separation Characteristics of Aviation Turbine Fuels[4]

D 3948 Test Methods for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer[4]

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products[4]

D 4308 Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter[4]

2.2 *SAE Standard:*

SAE MAP-1794, The Ball on Cylinder Method for Measuring Lubricity of Aviation Turbine Fuel[5,6]

3. Significance and Use

3.1 General descriptions for the manual sampling of petroleum products are given in Practice D 4057. 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. 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.

4. Apparatus

4.1 *Sampling Containers*:

4.1.1 *Epoxy-coated Containers*:

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 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, soldered side seam cans.

4.1.2 *Borosilicate (hard) Glass Bottles*.

4.1.2.1 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 Bottles*.

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

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

4.2 *Closures*:

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

4.2.2 Where required by shipping regulations such as DOT

[1] This practice is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.J0.09 on Additive-Related Properties.

Current edition approved Dec. 10, 1997. Published August 1998. Originally published as D 4306 – 84. Last previous edition D 4306 – 91(1997).

[2] The detailed data on which this Practice is based may be found in ASTM Research Report D02-1169. Practice on Sampling Aviation Fuels for Tests Affected by Trace Contamination, ASTM Research Report D02-1142 Sampling for Trace Metals in Gas Turbine and SAE Practice MAP-1794.

[3] *Annual Book of ASTM Standards*, Vol 05.02.

[4] *Annual Book of ASTM Standards*, Vol 05.03.

[5] Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

[6] Alconox made by Alconox Inc., New York, NY 10003 has been found suitable.

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 (see Note 2 and Note 3).

5.2 *Toluene*, CP Grade (see Note 2 and Note 3). When used to clean containers for conductivity, measure toluene conductivity according to Test Method D 2624 or D 4308 and use only if conductivity is less than 20 pS/m.

5.3 *Isopropanol*, CP Grade (see Note 2 and Note 3).

5.4 *Heptane*, CP Grade (see Note 2 and Note 3).

NOTE 2—**Warning:** Extremely flammable. Vapors may cause flash fire.

NOTE 3—Because these solvents are available at various purity levels, the use of CP grade is required to eliminates possible problems with residual impurities.

NOTE 4—In many cases a mixture of heptane and isopropanol may be used in place of toluene, except when soaking bottles in 6.5.3

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

5.6 *Jet A or Jet A-1*, used as reference fluid.

5.6.1 Reference fluid for approval testing with Jet A or Jet A-1 fuel is prepared in accordance with Test Method D 3948 (A1.) and should have an electrical conductivity of 0.1 to 1.0 by Test Method D 4308 (or give a reading of less than 1 according to Test Method D 2624) and an MSEP rating of 100 by Test Method D 3948.

6. Preparation of Apparatus

6.1 *Introduction*:

6.1.1 Experience indicates no single container type to meet 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 procedure will be 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 D 4057.

6.2 *Approval Procedure*:

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 Reference fuel as indicated in 5.3 should be used for testing.

6.2.3 The containers should be filled with reference Jet A, (**Warning—**Combustible. Vapor harmful.) 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 within 50 % of the original value. The water separation rating should decrease by no more than 3 MSEP or MSS units.

6.2.4 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 be expected to have a conductivity above 50 pS/m. The final electrical conductivity should not change more than the repeatability limits of Test Method D 2624 or D 4308, whichever method is used to rate the fuel.

NOTE 5—Effects due to containers are sometimes variable depending on fuel sample properties especially if additives are present. Evaluations with several fuels or fuel types are helpful to verify conclusions.

6.3 *Containers for Thermal Stability Testing*:

6.3.1 Epoxy-lined containers in accordance with 4.1.1 are preferred for immediate testing or sample storage. New containers should be flushed three times with product being sampled.

6.3.1.1 Used containers should be flushed three times with the container 10 to 20 % filled with the solvent indicated in 5.4. 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.

6.3.1.2 If the same fuel type containing the same additives is to be resampled, flushing three times with the new sample is considered adequate preparation.

6.3.2 New borosilicate glass bottles are not recommended.

6.3.3 New tin-plated cans with soldered side seams should only be used if the container is cleaned and the sample is used immediately.

6.3.3.1 *Cleaning Before Use*—Half fill the container with acetone. Alternatively, a mixture of equal volumes of acetone, toluene, and isopropanol may be used. Replace closure and shake vigorously for 1 min. Drain the solvent and air dry. Fill the container about ¼ full with heptane, replace closure and repeat shaking, draining the solvent and air drying the container.

NOTE 6—Soldered cans often contain residues of soldering flux or roll-oils on inside surfaces. These materials may have low solubility in hydrocarbons but even at trace levels will adversely affect the properties discussed in this practice. The difficulties of completely removing these contaminants make the use of epoxylined containers preferable.

6.3.4 Polytetrafluoroethylene bottles have not been evaluated but should be satisfactory after cleaning with heptane in accordance with 6.3.1.1.

6.3.5 Other plastic bottles such as high-density linear polyethylene have not been evaluated and are not recommended.

6.4 *Containers for Water Separation Testing*:

6.4.1 Epoxy-lined containers are preferred for immediate use or sample storage after flushing three times with the fluid being sampled.