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An American National Standard

Standard Test Method for Determining Filterability of Aviation Turbine Fuel[1]

This standard is issued under the fixed designation D 6824; 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.

1. Scope

1.1 This test method covers a procedure for determining the filterability of aviation turbine fuels.

NOTE 1—ASTM specification fuels falling within the scope of this test method are Specification D 1655 and the military fuels covered in the military specifications listed in 2.2.

1.2 This test method is not applicable to fuels that contain undissolved water.

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

1.4 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1655 Specification for Aviation Turbine Fuels[2]

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products[3]

D 4176 Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)[3]

D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products[3]

D 4860 Test Method for Free Water and Particulate Contamination in Mid-Distillate Fuels (Clear and Bright Numerical Rating)[3]

D 5452 Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration[4]

D 6426 Test Method for Determining Filterability of Middle Distillate Fuel Oils[5]

D 6615 Specification for Jet B Wide-Cut Aviation Turbine Fuel[5]

E 1 Specification for ASTM Thermometers[6]

2.2 *Military Standards:*[7]

MIL-DTL-5624 Turbine Fuel, Aviation, Grades JP-4, JP-5, and JP-5/JP-8 ST

MIL-DTL-25524 Turbine Fuel, Aviation, Thermally Stable

MIL-DTL-38219 Turbine Fuels, Low Volatility, JP-7

MIL-DTL-83133 Turbine Fuels, Aviation, Kerosine Types, NATO F-34 (JP-8), NATO F-35, and JP-8+100

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *filterability*—a measure of the rapidity with which a standard filter medium is plugged by insoluble matter in fuel and can be described in the following ways:

3.1.1.1 *filterability (by pressure)*—the pressure drop across a filter medium when 300 mL of fuel is passed at a rate of 20 mL/min.

3.1.1.2 *filterability (by volume)*—the volume of fuel passed when 104 kPa (15 psi) is reached. This method of report is used when less than 300 mL passes at that pressure, 104 kPa (15 psi).

3.1.1.3 *filterability quality factor (F-QF)*—a value that defines the filter plugging tendency of a fuel caused by particulate. The value is calculated using the volume and pressure attained at the end of the test cycle. Depending on the outcome of the test, two different equations are applied.

3.1.1.4 *Discussion*—Eq 1 is applied if the total sample was discharged prior to reaching the maximum pressure or Eq 2 if the maximum pressure was reached prior to discharging the entire sample. The equations proportion the results so that a continuous range of 0 to 100 is attained. Eq 1 yields values from 50 to 100, whereas Eq 2 yields values from 0 to 50. Higher values signify less particulate that can plug a filter of a given pore size and porosity.

(1) If the total sample, 300 mL, is discharged prior to reaching the maximum pressure, 104 kPa (15 psi), the F-QF is calculated by the following equation:

$$F-QF_{(300\text{ mL at }P(F))} = [(15\text{ psi} - P_{(F)}) / 15\text{ psi}][50] + [50] \quad (1)$$

where:

[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.

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[2] *Annual Book of ASTM Standards*, Vol 05.01.

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

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

[5] *Annual Book of ASTM Standards*, Vol 05.04.

[6] *Annual Book of ASTM Standards*, Vol 14.03.

[7] Available from Standardization Document Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

$P_{(F)}$ = final pressure when the total sample, 300 mL, was discharged.

(2) If the total sample is not discharged prior to reaching the maximum pressure, 104 kPa (15 psi), the F-QF is calculated by the following equation:

$$F-QF_{(V(F)} \text{ at 15 psi} = V_{(F)} / 6 \quad (2)$$

where:

$V_{(F)}$ = final volume when the maximum pressure was reached.

3.1.1.5 *Discussion*—The final volume ($V_{(F)}$) is divided by 6, since the maximum possible volume is 300 mL. By dividing by 6, the values for that test result are proportioned to fit the range from 0 to 50.

4. Summary of Test Method

4.1 A sample is passed at a constant rate (20 mL/min) through a standard porosity filter medium. The pressure drop across the filter and the volume of filtrate are monitored. The test is concluded either when the pressure drop across the filter exceeds 104 kPa (15 psi) or when 300 mL have passed through the filter.

4.2 Results are reported as either the volume that has passed through the filter when a pressure of 104 kPa (15 psi) has been reached or the pressure drop when 300 mL have passed through the filter.

4.3 Verification of the apparatus is required when there is a doubt of a test result, or when the apparatus has not been used for three months or more. It is not necessary to verify apparatus performance prior to each test.

5. Significance and Use

5.1 This test method is intended for use in the laboratory or field in evaluating aviation turbine fuel cleanliness.

5.2 A change in filtration performance after storage, pretreatment, or commingling can be indicative of changes in fuel condition.

5.3 Relative filterability of fuels may vary, depending on filter porosity and structure, and may not always correlate with results from this test method.

5.4 Causes of poor filterability in industrial/refinery filters include fuel degradation products, contaminants picked up during storage or transfer, incompatibility of commingled fuels, or interaction of the fuel with the filter media. Any of these could correlate with orifice or filter system plugging, or both.

6. Apparatus

6.1 *Micro-Filter Analyzer*[8]—The apparatus is shown diagrammatically in Fig. 1 and photographically in Fig. 2. It is capable of measuring pressure upstream of the filtering element and the volume of sample passed through the filter at a preset pressure level. The apparatus is comprised of the following parts:

6.1.1 *Peristaltic Pump*, variable speed/flow rate, with feedback speed control, adjusted to provide fuel delivery at a constant rate of 20 ± 1 mL/min, and incorporating a pulse dampening mechanism to produce a smooth flow.

6.1.2 *Pressure Transducer*, capable of measuring gage pressure in the range from 0 to 104 kPa, in 1.0 kPa increments (0 to 15 psi, in 0.1 psi increments).

6.1.3 *Three Digital Displays*, one for pressure readout capable of interfacing with transducer (see 6.1.2) with display range from 0 to 104 kPa in 1.0 kPa increments (0 to 15 psi in 0.1 psi increments), one for volume readout with display range from 0 to 300 mL in 1 mL increments, and one for filterability quality factor (F-QF).

NOTE 2—The micro-filter analyzer can display the pressure in either kPa or psi units by changing an internal jumper wire.

6.1.4 *Speed Controller*, manual speed adjustment of the peristaltic pump to increase/decrease amount of sample delivered for a given period of time.

6.1.5 *Fuel Reservoir Container*, polytetrafluoroethylene (PTFE), funnel shaped, 500-mL capacity.

6.1.6 *Collection Container*, glass or plastic Erlenmeyer flask, 500-mL capacity.

6.1.7 *Tygon Tubing*[9], fuel compatible, 3.1-mm (0.12-in.) inner diameter.

6.1.8 *Plastic In-Line Splice Coupler*, fuel compatible, capable of being inserted into, and making a seal in Tygon tubing (see 6.1.7).

6.1.9 *Plastic Tee Coupler*, fuel compatible, capable of being inserted into, and making a seal in Tygon tubing (see 6.1.7).

6.1.10 *Plastic Luer-Loc Coupler*, fuel compatible, one end capable of being inserted into, and making a seal in Tygon tubing (see 6.1.7) and the other end into the filter unit (see 6.2).

6.2 *FCell*[10] *Filter Unit*, disposable, precalibrated assembly consisting of a shell and plug containing a 25-mm diameter nylon membrane filter of nominal 0.65-µ pore size, nominal 60 % porosity, with a 158.9-mm^2 effective filtering area.

6.3 *Accessories for Apparatus Verification Test*:

6.3.1 *Measuring Cylinder*, 500-mL capacity, with 1-mL graduations.

6.3.2 *Pressure Gage*, 350-kPa (50-psi) capability, graduations 0.5 kPa (0.1 psi).

6.3.3 *Thermometer*, general purpose type, with a range of 0 to 60°C and conforming to the requirements prescribed in Specification E 1.

7. Sampling

7.1 The fuel sample from which an aliquot is being drawn for the purposes of this test method shall be representative of the lot of fuel. Obtain the sample in accordance with the procedures of Practices D 4057 or D 4177, and report (see

[8] The sole source of supply of the apparatus (Model 1143 Micro-Filter Analyzer) known to the committee at this time is available from EMCEE Electronics, Inc., 520 Cypress Ave., Venice, FL 34292. If you are aware of alternate suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[9] Tygon tubing was used in the round robin test program to generate the precision and bias. Tygon is available from most laboratory supply houses. This is not an endorsement of Tygon.

[10] A registered trademark of EMCEE Electronics, Inc., 520 Cypress Ave., Venice, FL 34292.