Designation: ~~D6824 – 13 (Reapproved 2018)~~ D6824 – 23

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

This standard is issued under the fixed designation D6824; 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 ($\varepsilon$) indicates an editorial change since the last revision or reapproval.

## 1. ~~Scope~~ Scope*

1.1 This test method covers a procedure for determining the filterability of aviation turbine fuels (for other middle distillate fuels, see Test Method D6426).

NOTE 1—ASTM specification fuels falling within the scope of this test method are Specifications D1655 and D6615 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 standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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:*[2]
D1655 Specification for Aviation Turbine Fuels
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
D4176 Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
D4860 Test Method for Free Water and Particulate Contamination in Middle Distillate Fuels (Clear and Bright Numerical Rating)
D5452 Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration
D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants
D6426 Test Method for Determining Filterability of Middle Distillate Fuel Oils

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

D6615 Specification for Jet B Wide-Cut Aviation Turbine Fuel
2.2 *Military Standards:*[3]
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:*

3.1.1 For definitions of terms used in this test method, refer to Terminology D4175.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *filterability, n*—a measure of the rapidity with which a standard filter medium is plugged by insoluble matter in fuel and may be described as a function of pressure or volume:

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

3.2.1.2 *filterability (by volume), n*—the volume of fuel passed when a pressure of 104 kPa (15 psig) is reached.

3.2.1.3 *Discussion*—
Filterability by volume is used when less than 300 mL passes the filter at a pressure up to 104 kPa (15 psig).

3.2.1.4 *filterability quality factor (F-QF), n*—a value that defines the filter plugging tendency of a fuel caused by particulates.

3.2.1.5 *Discussion*—
The F-QF value is calculated using the volume and pressure attained at the end of the test cycle, according to one of two equations, depending on the outcome of the test. (See Section 10, Calculations.)

## 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 psig) 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 psig) 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.

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[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.
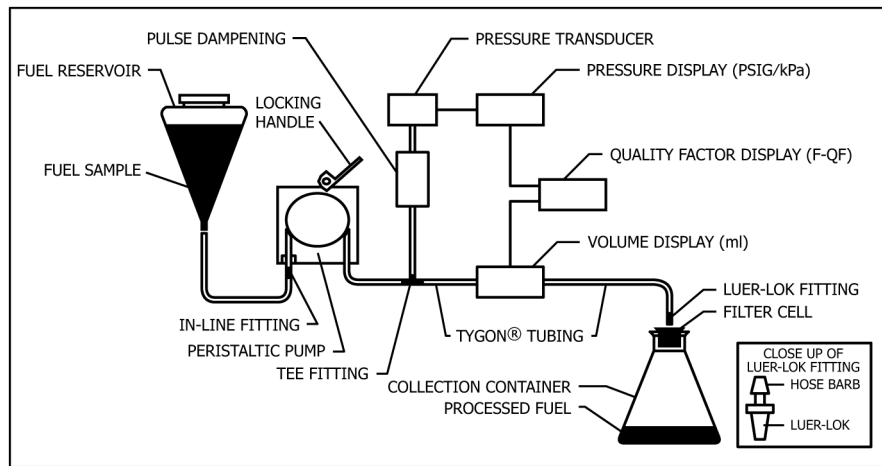
NOTE 1—Fuel flow from reservoir through pump to container.
**FIG. 1 Schematic Diagram of Filterability Apparatus**

## 6. Apparatus

6.1 *Micro-Filter Analyzer*[4]—The apparatus is shown as a diagram 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 mL∕min ± 1 mL∕min, and incorporating a pulse dampening mechanism to produce a smooth flow.

6.1.2 *Pressure Transducer,* capable of measuring gauge pressure in the range from 0 kPa to 104 kPa, in 1.0 kPa increments (0 psig to 15 psig, in 0.1 psig 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 kPa to 104 kPa in 1.0 kPa increments (0 psig to 15 psig in 0.1 sig increments), one for volume readout with display range from 0 mL 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 psig 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 *Flexible, Inert Tubing,*[5] fuel compatible, nominal 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 flexible, inert tubing (see 6.1.7).

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

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[4] 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 34285. 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.

[5] Tygon (trademarked) 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.
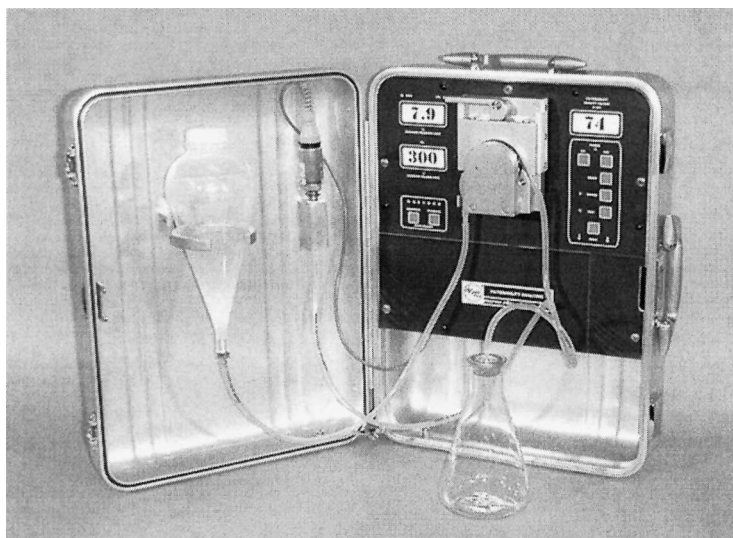
**FIG. 2 Micro-Filter Analyzer**

6.1.10 *Plastic Coupler,* fuel compatible, one end capable of being inserted into, and making a seal in flexible, inert tubing (see 6.1.7) and the other end into the filter unit (see 6.2). Luer-Lok (trademarked) couplers have been used successfully.

6.2 *FCell (trademarked)[6]Filter Unit,* disposable, precalibrated assembly consisting of a shell and plug containing a 25 mm diameter nylon membrane filter of nominal 0.65 μm pore size, nominal 60 % porosity, with a 158.9 mm$^2$ effective filtering area. Unit is labeled in green background with black lettering:

D6824, FCell, JET (0.65)

6.3 *Accessories for Apparatus Verification Test:*

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

6.3.2 *Pressure Gauge,* 350 kPa (50 psig) capability, graduations 0.5 kPa (0.1 psig).

6.3.3 *Temperature Measuring Device,* general purpose type, having a range that includes 0 °C to 60 °C and an accuracy of 0.5 °C. Liquid-in-glass thermometers, thermocouples, or platinum resistance thermometers that provide the desired accuracy and precision may be used.

## 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 D4057 or D4177, and report (see 11.1.1) how and from where it was obtained. The maximum sample size is dictated by the quantity that can be mixed thoroughly (see 9.2). If any undissolved water is visually apparent (as determined by Test Methods D4176 or D4860, or both), discard and replace with a fresh sample.

7.2 After thoroughly mixing, if the original sample container is too large to easily handle, use an epoxy lined can or dark glass bottle as a transfer container to store an aliquot of the test sample. Prior to drawing the aliquot, rinse the transfer container three times with the product to be tested. Draw a representative 1 L to 2 L aliquot from the sample container into a transfer container. (**Warning**—Because the situations under which samples are taken vary from laboratory to laboratory and from situation to
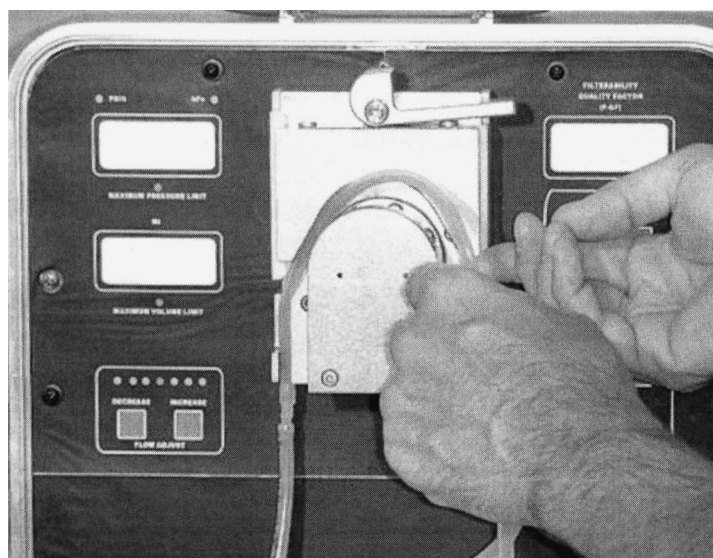
FIG. 3 Threading the Tubing in the Pump

situation, no firm recommendation for sampling can be given. It is the responsibility of the user of this test method to ensure the aliquot used in the test is representative of the lot of fuel.)

**8. Preparation of Apparatus**

8.1  Locate the apparatus on a level surface in an area where the temperature is between 15 °C and 25 °C (59 °F and 77 °F).

8.2  Open the case, and assemble the apparatus as shown in Fig. 2. If the flexible, inert tubing (see 6.1.7) is not attached, as shown, carry out 8.2.1 to 8.2.2.

8.2.1  Attach one end of the flexible, inert tubing to the fuel reservoir container (6.1.5) and insert the plastic in-line splice coupler (6.1.8) into the other end.

8.2.2  Insert the plastic in-line coupler into another piece of flexible, inert tubing, thread the tubing in the peristaltic pump (see 6.1.1), as shown in Fig. 3, and clamp it in place by moving the lever arm counterclockwise.

Note 3—The splice fitting prevents the tubing from being pulled into the pump during operation. This also allows easy replacement of the portion of the tubing that is depressed by the pump rollers. To extend the life of the flexible, inert tubing, when not in use, leave the clamp open or remove the tubing from the pump.

8.2.3  Insert one end of the horizontal section of the plastic tee coupler (6.1.9) into the tubing that is clamped in the pump, and attach two other sections of tubing to the other parts of the tee.

8.2.4  Connect the tubing that is connected to the perpendicular part of the tee to the pressure transducer. Insert the hose barbered portion of the plastic coupler (6.1.10) into the other section of tubing that is connected to the in-line part of the tee.

8.3  Attach the power pack to the connector on the top of the case, and connect the power pack to an ac power source. Turn the instrument on by depressing the ON switch, causing both the POWER and MODE A lights to illuminate.

8.4  Have a labeled FCell filter (see 6.2) ready for use.

8.5  *Verification of Apparatus*—As required in accordance with 4.3, verify apparatus performance by checking that the flow rate and the pressure transducer are within tolerance.

8.5.1  Check the flow rate by performing a purge cycle to eliminate any air from the system. Subsequently, perform a test using