



# Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons<sup>1</sup>

This standard is issued under the fixed designation D7566; 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 ( $\epsilon$ ) 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 specification covers the manufacture of aviation turbine fuel that consists of conventional and synthetic blending components.

1.2 This specification applies only at the point of batch origination. Aviation turbine fuel manufactured, certified and released to all the requirements of this specification, meets the requirements of Specification D1655 and shall be regarded as Specification D1655 turbine fuel. Once released to this specification (D7566) the requirements of this specification are no longer applicable: any recertification shall be done to D1655. Field blending of synthesized paraffinic kerosine (SPK) with D1655 fuel (which may on the whole or in part have originated as D7566 fuel) shall be considered batch origination in which case all of the requirements of this specification (D7566) apply, however the fuel shall be regarded as D1655 turbine fuel after certification and release.

1.3 This specification defines specific types of aviation turbine fuel that contain synthesized hydrocarbons for civil use in the operation and certification of aircraft and describes fuels found satisfactory for the operation of aircraft and engines. The specification is intended to be used as a standard in describing the quality of aviation turbine fuels and synthetic blending components at the place of manufacture but can be used to describe the quality of aviation turbine fuels for contractual transfer at all points in the distribution system.

1.4 This specification does not include all fuels satisfactory for aviation turbine engines. Certain equipment or conditions of use may permit a wider, or require a narrower, range of characteristics than is shown by this specification.

1.5 While aviation turbine fuels defined by this specification can be used in applications other than aviation turbine engines, requirements for such other applications have not been considered in the development of this specification.

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

1.7 *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:<sup>2</sup>

- D56 Test Method for Flash Point by Tag Closed Cup Tester
- D86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure
- D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D129 Test Method for Sulfur in Petroleum Products (General Bomb Method)
- D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- D156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
- D240 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter
- D323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
- D381 Test Method for Gum Content in Fuels by Jet Evaporation
- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D1094 Test Method for Water Reaction of Aviation Fuels
- D1266 Test Method for Sulfur in Petroleum Products (Lamp Method)
- D1298 Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.J0.06 on Emerging Turbine Fuels.

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<sup>2</sup> 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.

- Petroleum Products by Hydrometer Method
- D1319** Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
- D1322** Test Method for Smoke Point of Kerosine and Aviation Turbine Fuel
- D1405** Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
- D1655** Specification for Aviation Turbine Fuels
- D1740** Test Method for Luminometer Numbers of Aviation Turbine Fuels<sup>3</sup>
- D1840** Test Method for Naphthalene Hydrocarbons in Aviation Turbine Fuels by Ultraviolet Spectrophotometry
- D2276** Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling
- D2386** Test Method for Freezing Point of Aviation Fuels
- D2425** Test Method for Hydrocarbon Types in Middle Distillates by Mass Spectrometry
- D2622** Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
- D2624** Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
- D2887** Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography
- D3227** Test Method for (Thiol Mercaptan) Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)
- D3240** Test Method for Undissolved Water In Aviation Turbine Fuels
- D3241** Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure)
- D3242** Test Method for Acidity in Aviation Turbine Fuel
- D3338** Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
- D3343** Test Method for Estimation of Hydrogen Content of Aviation Fuels
- D3701** Test Method for Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry
- D3828** Test Methods for Flash Point by Small Scale Closed Cup Tester
- D3948** Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer
- D4052** Test Method for Density and Relative Density of Liquids by Digital Density Meter
- D4057** Practice for Manual Sampling of Petroleum and Petroleum Products
- D4171** Specification for Fuel System Icing Inhibitors
- D4176** Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
- D4294** Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry
- D4305** Test Method for Filter Flow of Aviation Fuels at Low Temperatures
- D4306** Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination
- D4529** Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
- D4629** Test Method for Trace Nitrogen in Liquid Petroleum Hydrocarbons by Syringe/Inlet Oxidative Combustion and Chemiluminescence Detection
- D4809** Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)
- D4865** Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems
- D4952** Test Method for Qualitative Analysis for Active Sulfur Species in Fuels and Solvents (Doctor Test)
- D4953** Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)
- D5001** Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator (BOCLE)
- D5006** Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels
- D5190** Test Method for Vapor Pressure of Petroleum Products (Automatic Method)
- D5191** Test Method for Vapor Pressure of Petroleum Products (Mini Method)
- D5291** Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants
- D5452** Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration
- D5453** Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
- D5901** Test Method for Freezing Point of Aviation Fuels (Automated Optical Method)
- D5972** Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)
- D6045** Test Method for Color of Petroleum Products by the Automatic Tristimulus Method
- D6304** Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
- D6379** Test Method for Determination of Aromatic Hydrocarbon Types in Aviation Fuels and Petroleum Distillates—High Performance Liquid Chromatography Method with Refractive Index Detection
- D6469** Guide for Microbial Contamination in Fuels and Fuel Systems
- D7153** Test Method for Freezing Point of Aviation Fuels (Automatic Laser Method)
- D7154** Test Method for Freezing Point of Aviation Fuels (Automatic Fiber Optical Method)
- D7359** Test Method for Total Fluorine, Chlorine and Sulfur

<sup>3</sup> Withdrawn. The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

in *Aromatic Hydrocarbons and Their Mixtures by Oxidative Pyrohydrolytic Combustion followed by Ion Chromatography Detection (Combustion Ion Chromatography-CIC)*

**E29** *Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*

2.2 *Energy Institute Standards*:<sup>4</sup>

**IP 225** *Copper Content of Aviation Turbine Fuel*

**IP 227** *Silver Corrosion of Aviation Turbine Fuel*

**IP 540** *Determination of the Existent Gum Content of Aviation Turbine Fuel—Jet Evaporation Method*

2.3 *ANSI Standard*:<sup>5</sup>

**ANSI 863** *Report of Test Results*

2.4 *Other Standard*:<sup>6</sup>

**Defence Standard 91-91** *Turbine Fuel, Aviation Kerosine Type, Jet A-1*

2.5 *UOP Test Methods*:<sup>7</sup>

**UOP 389** *Trace Metals in Oils by Wet Ash/ICP-AES*

2.6 *U.S. Department of Defense Specifications*:<sup>8</sup>

**MIL-PRF-25017** *Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble*

**QDS-25017** *Qualified Data Set for MIL-PRF-25017 (Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble)*

### 3. General

3.1 This specification, unless otherwise provided, prescribes the required properties of aviation turbine fuel at the time and place of delivery.

### 4. Terminology

#### 4.1 Definitions:

4.1.1 *conventional hydrocarbons, n*—hydrocarbons derived from the following conventional sources: crude oil, natural gas liquid condensates, heavy oil, shale oil, and oil sands.

#### 4.2 Definitions of Terms Specific to This Standard:

4.2.1 *conventional blending component, n*—blending streams derived from conventional hydrocarbons.

4.2.2 *synthesized hydrocarbons, n*—hydrocarbons derived from alternative sources such as coal, natural gas, biomass, and hydrogenated fats and oils by processes such as gasification, Fischer-Tropsch synthesis, and hydroprocessing.

4.2.3 *synthetic blending component, n*—synthesized hydrocarbons that meet the requirements of **Annex A1**.

### 5. Classification

5.1 Two types of aviation turbine fuels are provided, as follows:

5.1.1 *Jet A and Jet A-1*—Relatively high flash point distillates of the kerosine type.

5.2 Jet A and Jet A-1 represent two grades of kerosine fuel that differ in freezing point. Other grades would be suitably identified.

### 6. Materials and Manufacture

6.1 Aviation turbine fuel, except as otherwise defined in this specification, shall consist of the following blends of components or fuels:

6.1.1 Conventional blending components or Jet A or Jet A-1 fuel certified to Specification **D1655**; with up to 50 % by volume of the synthetic blending component defined in **Annex A1**.

6.2 Fuels used in certified engines and aircraft are ultimately approved by the certifying authority subsequent to formal submission of evidence to the authority as part of the type certification program for that aircraft and engine model. Additives to be used as supplements to an approved fuel must also be similarly approved on an individual basis (see **X1.2.4**).

6.3 *Additives*—May be added to each type of aviation turbine fuel in the amount and of the composition specified in **Table 2** or the following list of approved material:<sup>9</sup>

6.3.1 Other additives are permitted under **6.2** and **8.1**. These include fuel system icing inhibitor, other antioxidants, inhibitors, and special purpose additives. The quantities and types shall be declared by the fuel supplier and agreed to by the purchaser. Only additives approved by the aircraft certifying authority are permitted in the fuel on which an aircraft is operated.

6.3.1.1 Biocidal additives are available for controlled usage. Where such an additive is used in the fuel, the approval status of the additive and associated conditions shall be checked for the specific aircraft and engines to be operated.

#### 6.3.1.2 Fuel System Icing Inhibitor:

(1) *Diethylene Glycol Monomethyl Ether (DiEGME)*, conforming to the requirements of Specification **D4171**, Type III, may be used in concentrations of 0.10 to 0.15 volume %.

(2) Test Method **D5006** may be used to determine the concentration of DiEGME in aviation fuels.

6.4 Guidance material is presented in **Appendix X2** concerning the need to control processing additives in jet fuel production.

### 7. Detailed Requirements

7.1 The aviation turbine fuel shall conform to the requirements prescribed in **Table 1** Part 1 and **Table 1** Part 2 unless otherwise noted in **Annex A1**.

7.2 The additional requirements of Part 2 of **Table 1** apply only for each batch of fuel intentionally containing a synthetic blending component. The additional requirements of Part 2 of **Table 1** are not mandated if conventionally-derived jet fuel is mixed with the residue of a D7566 semi-synthetic aviation turbine fuel in refinery equipment from a previous batch of certified final blended product, for example in a tank heel.

7.3 Test results shall not exceed the maximum or be less than the minimum values specified in **Table 1**, **Table A1.1**, and

<sup>4</sup> Available from Energy Institute, 61 New Cavendish St., London, WIG 7AR, U.K., <http://www.energyinst.org.uk>.

<sup>5</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>6</sup> Available from Defence Equipment and Support, UK Defence Standardization, Kentigern House, 65 Brown Street, Glasgow, G2 8EX (<http://www.dstan.mod.uk>).

<sup>7</sup> Available from ASTM International, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org).

<sup>8</sup> Available from the Standardization Document Order Desk, 700 Robbins, Avenue, Building 4D, Philadelphia PA 19111-5094 (<http://assist.daps.dla.mil>).

<sup>9</sup> Supporting data (Guidelines for Approval or Disapproval of Additives) have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1125.

**TABLE 1 Detailed Requirements of Aviation Turbine Fuels Containing Synthesized Hydrocarbons<sup>A</sup>**

## Part 1—Basic Requirements

Property		Jet A or Jet A-1	ASTM Test Method <sup>B</sup>
<b>COMPOSITION</b>			
Acidity, total mg KOH/g	Max	0.10	D3242
Aromatics: One of the following requirements shall be met:			
1. Aromatics, vol %	Max	25	D1319
2. Aromatics, vol %	Max	26.5	D6379
Sulfur, mercaptan, <sup>C</sup> mass %	Max	0.003	D3227
Sulfur, total mass %	Max	0.30	D1266, D2622, D4294, or D5453
<b>VOLATILITY</b>			
Distillation			D2887 <sup>D</sup> or D86 <sup>E</sup>
Distillation temperature, °C:			
10 % recovered, temperature (T10)	Max	205	
50 % recovered, temperature (T50)		report	
90 % recovered, temperature (T90)		report	
Final boiling point, temperature	Max	300	
Distillation residue, %	Max	1.5	
Distillation loss, %	Max	1.5	
Flash point, °C	Min	38 <sup>F</sup>	D56 or D3828 <sup>G</sup>
Density at 15°C, kg/m <sup>3</sup>		775 to 840	D1298 or D4052
<b>FLUIDITY</b>			
Freezing point, °C	Max	−40 Jet A <sup>H</sup> −47 Jet A-1 <sup>H</sup>	D5972, D7153, D7154, or D2386
Viscosity −20°C, mm <sup>2</sup> /s <sup>I</sup>	Max	8.0	D445
<b>COMBUSTION</b>			
Net heat of combustion, MJ/kg	Min	42.8 <sup>J</sup>	D4529, D3338, or D4809
One of the following requirements shall be met:			
(1) Smoke point, mm, or	Min	25	D1322
(2) Smoke point, mm, and	Min	18	D1322
Naphthalenes, vol, %	Max	3.0	D1840
<b>CORROSION</b>			
Copper strip, 2 h at 100°C	Max	No. 1	D130
<b>THERMAL STABILITY</b>			
JFTOT (2.5 h at control temperature)			
Temperature, °C	Min	260	D3241
Filter pressure drop, mm Hg	Max	25 <sup>K</sup>	
Tube deposits less than		3 <sup>L</sup>	
		No peacock or abnormal color deposits	
<b>CONTAMINANTS</b>			
Existent gum, mg/100 mL	Max	7	D381, IP 540 D3948
Microseparator, <sup>M</sup> Rating			
Without electrical conductivity additive	Min	85	
With electrical conductivity additive	Min	70	
<b>ADDITIVES</b>			
Electrical conductivity, pS/m		See 6.3 <sup>N</sup>	D2624

<sup>A</sup> For compliance of test results against the requirements of Table 1, see 7.3.

<sup>B</sup> The test methods indicated in this table are referred to in Section 11.

<sup>C</sup> The mercaptan sulfur determination may be waived if the fuel is considered sweet by the doctor test described in Test Method D4952.

<sup>D</sup> Distillation property criteria are specified in D86 scale units. D2887 results shall be converted to estimated D86 results by application of the correlation in Appendix X5 of D2887 for comparison with the specified property criteria. Distillation residue and loss limits provide control of the distillation process during the D86 test method and do not apply to D2887. Distillation residue and loss shall be reported as "not applicable" (N/A) when reporting D2887 results.

<sup>E</sup> D86 distillation of jet fuel is run at Group 4 conditions, except Group 3 condenser temperature is used.

<sup>F</sup> A higher minimum flash point specification may be agreed upon between purchaser and supplier.

<sup>G</sup> Results obtained by Test Methods D3828 can be up to 2°C lower than those obtained by Test Method D56, which is the preferred method. In case of dispute, Test Method D56 will apply.

<sup>H</sup> Other freezing points may be agreed upon between supplier and purchaser.

<sup>I</sup> 1 mm<sup>2</sup>/s = 1 cSt.

<sup>J</sup> For all grades use either Eq 1 or Table 1 in Test Method D4529 or Eq 2 in Test Method D3338. Test Method D4809 may be used as an alternative. In case of dispute, Test Method D4809 shall be used.

<sup>K</sup> Preferred SI units are 3.3 kPa, max.

<sup>L</sup> Tube deposit ratings shall always be reported by the Visual Method.

<sup>M</sup> At point of manufacture.

<sup>N</sup> If electrical conductivity additive is used, the conductivity shall not exceed 600 pS/m at the point of use of the fuel. When electrical conductivity additive is specified by the purchaser, the conductivity shall be 50 to 600 pS/m under the conditions at point of delivery. (1 pS/m = 1 × 10<sup>-12</sup> Ω<sup>-1</sup>m<sup>-1</sup>)



**TABLE 1 Detailed Requirements of Aviation Turbine Fuels Containing Synthesized Hydrocarbons<sup>A</sup> (continued)**

Part 2—Extended Requirements			
Property		Jet A or Jet A-1	ASTM Test Method <sup>B</sup>
<b>COMPOSITION</b>			
Aromatics: One of the following requirements shall be met:			
1. Aromatics, vol %	Min <sup>O,Q</sup>	8	D1319
2. Aromatics, vol %	Min <sup>O,Q</sup>	8.4	D6379
Distillation			D2887 <sup>D</sup> or D86 <sup>E</sup>
T50-T10, °C	Min <sup>P,Q</sup>	15	
T90-T10, °C	Min <sup>P,Q</sup>	40	
Lubricity, <sup>M</sup> mm	Max	0.85	D5001

<sup>O</sup> Minimum aromatics contents are based on current experience with the approved synthetic fuels and those levels were established from what is typical for refined jet fuel. Research is ongoing on the actual need for aromatics.

<sup>P</sup> These distillation slope limits are based on current experience with the approved synthetic fuels and these values were established from what is typical for refined jet fuel. Research is ongoing on the actual requirements for distillation slope.

<sup>Q</sup> The minimum aromatics and distillation slope criteria only apply to aviation turbine fuels containing synthesized hydrocarbons produced to this specification and are not applicable to conventional aviation turbine fuels produced to Specification D1655. Some batches of aviation turbine fuels produced to Specification D1655 may not meet the minimum aromatics and distillation slope criteria specified in Table 1 of this specification.

**TABLE 2 Detailed Requirements for Additives in Aviation Turbine Fuels**

Additive	Dosage
<b>Fuel Performance Enhancing Additives</b>	
Antioxidants <sup>A,B</sup> One of the following: 2,6 ditertiary-butyl phenol 2,6 ditertiary-butyl-4-methyl phenol 2,4 dimethyl-6-tertiary-butyl-phenol 75 % minimum, 2,6 ditertiary-butyl phenol plus 25 % maximum mixed tertiary and tritertiary butyl-phenols 55 % minimum 2,4 dimethyl-6-tertiary-butyl phenol plus 15 % minimum 2,6 ditertiary-butyl-4-methyl phenol, remainder as monomethyl and dimethyl tertiary-butyl phenols 72 % minimum 2,4 dimethyl-6-tertiary-butyl phenol plus 28 % maximum monomethyl and dimethyl-tertiary-butyl-phenols	24.0 mg/L max <sup>C</sup>
Metal Deactivator <sup>A</sup> N,N-disalicylidene-1,2-propane diamine On initial blending After field rebinding cumulative concentration	2.0 mg/L max <sup>C,D</sup> 5.7 mg/L max
Fuel System Icing Inhibitor <sup>E</sup> Diethylene Glycol Monomethyl Ether (see Specification D4171)	0.10 vol % min 0.15 vol % max
<b>Fuel Handling and Maintenance Additives</b>	
Electrical Conductivity Improver <sup>F</sup> Stadis 450 <sup>G</sup> On initial blending After field rebinding, cumulative concentration If the additive concentration is unknown at time of retreatment, additional concentration is restricted to 2 mg/L max	3 mg/L max 5 mg/L max
Leak Detection Additive Tracer A (LDTA-A) <sup>H</sup>	1 mg/kg max
Biocidal Additives <sup>E,I</sup> Corrosion Inhibitor/Lubricity Improvers <sup>J</sup> One of the following: Apollo PRI-19 HiTEC 580 Octel DCI-4A Nalco 5403	23 mg/L max 23 mg/L max 23 mg/L max 23 mg/L max

<sup>A</sup> The active ingredient of the additive must meet the composition specified.

<sup>B</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02:1125.

<sup>C</sup> Active ingredient (not including weight of solvent).

<sup>D</sup> If copper contamination is suspected, initial treatment may exceed 2.0 mg/L but cumulative total must be below 5.7 mg/L.

<sup>E</sup> quantity must be declared by the fuel supplier and agreed to by the purchaser.

<sup>F</sup> If electrical conductivity improver is used, the conductivity shall not exceed 600 pS/m at the point of use of the fuel. When electrical conductivity additive is specified by the purchaser, the conductivity shall be 50 to 600 pS/m under the conditions at point of delivery. (1 pS/m =  $1 \times 10^{-12} \Omega^{-1}m^{-1}$ )

<sup>G</sup> Stadis 450 is a registered trademark marketed by Innospec Inc., Innospec Manufacturing Park, Oil Sites Road, Ellesmere Port, Cheshire, CH65 4EY, UK.

<sup>H</sup> Tracer A (LDTA-A) is a registered trademark of Tracer Research Corp., 3755 N. Business Center Dr., Tucson, AZ 85705.

<sup>I</sup> Biocidal additives are available for controlled usage. Where such an additive is used in the fuel, the approval status of the additive and associated conditions must be checked for the specific aircraft and engines to be operated.

<sup>J</sup> More information concerning minimum treat rates of corrosion inhibitor/lubricity improver additives is contained in X1.10.2.

**Table A1.2.** No allowance shall be made for the precision of the test methods. To determine conformance to the specification requirement, a test result may be rounded to the same number of significant figures as in **Table 1**, **Table A1.1**, and **Table A1.2** using Practice **E29**. Where multiple determinations are made, the average result, rounded in accordance with Practice **E29**, shall be used.

## 8. Workmanship, Finish and Appearance

8.1 The aviation turbine fuel specified in this specification shall be visually free of undissolved water, sediment, and suspended matter. The odor of the fuel shall not be nauseating or irritating. No substance of known dangerous toxicity under usual conditions of handling and use shall be present, except as permitted in this specification.

## 9. Sampling

9.1 Because of the importance of proper sampling procedures in establishing fuel quality, use the appropriate procedures in Practice **D4057** to obtain a representative sample from the batch of fuel for specification compliance testing. This requirement is met by producing fuel as a discrete batch then testing it for specification compliance. This requirement is not satisfied by averaging online analysis results.

9.2 A number of jet fuel properties, including thermal stability, water separation, electrical conductivity, and others, are very sensitive to trace contamination, which can originate from sample containers. For recommended sample containers, refer to Practice **D4306**.

## 10. Report

10.1 The type and number of reports to ensure conformance with the requirements of this specification shall be mutually agreed upon by the seller and the purchaser of the aviation turbine fuel.

10.2 A suggested form for reporting inspection data on aviation turbine fuels is given in **Appendix X3**.

## 11. Test Methods

11.1 Determine the requirements enumerated in this specification in accordance with the following ASTM test methods.

11.1.1 *Density*—Test Method **D1298** or **D4052**.

11.1.2 *Distillation*—Test Method **D86**. For Jet A and Jet A-1, Test Method **D2887** may be used as an alternate. Results from Test Method **D2887** shall be reported as estimated **D86** results by application of the correlation in **Appendix X5** of

**D2887**. In case of dispute, Test Method **D86** shall be the referee method (see **X1.6.1.1**).

11.1.3 *Flash Point*—Test Method **D56** or **D3828**.

11.1.4 *Freezing Point*—Test Method **D5972**, **D7153**, **D7154**, or **D2386**. Any of these test methods may be used to certify and recertify jet fuel. However, Test Method **D2386** is the referee method. An interlaboratory study (RR: D02-1572<sup>10</sup>) that evaluated the ability of freezing point methods to detect jet fuel contamination by diesel fuel determined that Test Methods **D5972** and **D7153** provided significantly more consistent detection of freeze point changes caused by contamination than Test Methods **D2386** and **D7154**. It is recommended to certify and recertify jet fuel using either Test Method **D5972** or Test Method **D7153**, or both, on the basis of the reproducibility and cross-contamination detection reported in D02-1572.<sup>10</sup> The cause of freezing point results outside specification limits by automated methods should be investigated, but such results do not disqualify the fuel from aviation use if the results from the referee method (Test Method **D2386**) are within the specification limit.

11.1.5 *Viscosity*—Test Method **D445**.

11.1.6 *Net Heat of Combustion*—Test Method **D4529**, **D3338**, or **D4809**.

11.1.7 *Corrosion (Copper Strip)*—Test Method **D130**.

11.1.8 *Total Acidity*—Test Method **D3242**.

11.1.9 *Sulfur*—Test Method **D1266**, **D2622**, **D4294**, or **D5453**.

11.1.10 *Mercaptan Sulfur*—Test Method **D3227**.

11.1.11 *Microseparator*—Test Method **D3948**.

11.1.12 *Existent Gum*—Test Method **D381** or **IP 540**. Test Method **D381**, using steam jet operating conditions, shall be the referee test method.

11.1.13 *Thermal Stability*—Test Method **D3241**.

11.1.14 *Aromatics*—Test Method **D1319** or **D6379**. Test Method **D1319** shall be the referee test method.

11.1.15 *Smoke Point*—Test Method **D1322**.

11.1.16 *Naphthalene Content*—Test Method **D1840**.

11.1.17 *Electrical Conductivity*—Test Method **D2624**.

## 12. Keywords

12.1 aviation turbine fuel; avtur; Jet A; Jet A-1; jet fuel; synthesized hydrocarbons; synthesized paraffinic kerosene; synthetic blending component; turbine fuel

<sup>10</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1572.