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An American National Standard

Standard Specification for Jet B Wide-Cut Aviation Turbine Fuel[1]

This standard is issued under the fixed designation D 6615; 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 specification covers the use of purchasing agencies in formulating specifications for purchases of aviation turbine fuel under contract.

1.2 This specification defines one specific type of aviation turbine fuel for civil use. This fuel has advantages for operations in very low temperature environments compared to fuels described in Specification D 1655. This fuel is intended for use in aircraft which are certified to use such fuel and operators should refer to their operating manuals for any limitations regarding the use of this fuel.

NOTE 1—The technical requirements of this product, at the time of the first publication of this specification, are substantially identical to the requirements of Jet B in Specification D 1655.

2. Referenced Documents

2.1 *ASTM Standards:*

D 86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure[2]

D 130 Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test[2]

D 156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)[2]

D 323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)[2]

D 381 Test Method for Gum Content in Fuels by Jet Evaporation[2]

D 1094 Test Method for Water Reaction of Aviation Fuels[2]

D 1266 Test Method for Sulfur in Petroleum Products (Lamp Method)[2]

D 1298 Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method[2]

D 1319 Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption[2]

D 1322 Test Method for Smoke Point of Aviation Turbine Fuels[2]

D 1552 Test Method for Sulfur in Petroleum Products (High-Temperature Method)[2]

D 1660 Test Method for Thermal Stability of Aviation Turbine Fuels[3]

D 1655 Specification for Aviation Turbine Fuels[2]

D 1840 Test Method for Naphthalene Hydrocarbons in Aviation Turbine Fuels by Ultraviolet Spectrophotometry[2]

D 2276 Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling[2]

D 2386 Test Method for Freezing Point of Aviation Fuels[2]

D 2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-Ray Fluorescence Spectrometry[4]

D 2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels[4]

D 3227 Test Method for Mercaptan Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)[4]

D 3240 Test Method for Undissolved Water in Aviation Turbine Fuels[4]

D 3241 Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure)[4]

D 3338 Test Method for Estimation of Heat of Combustion of Aviation Fuels[4]

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

D 4052 Test Method for Density and Relative Density of Liquids by Digital Density Meter[4]

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

D 4171 Specification for Fuel System Icing Inhibitors[4]

D 4176 Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)[4]

D 4294 Test Method for Sulfur in Petroleum and Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectroscopy[4]

D 4305 Test Method for Filter Flow of Aviation Fuels at Low Temperatures[4]

D 4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination[4]

[1] This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.J on Aviation Fuels.

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

[3] Discontinued—Replaced by D 3241—See *1993 Annual Book of ASTM Standards*, Vol 05.02.

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

D 4529 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels[4]
D 4809 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Intermediate Precision Method)[4]
D 4865 Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems[4]
D 4952 Test Method for Qualitative Analysis for Active Sulfur Species in Fuels and Solvents (Doctor Test)[5]
D 5001 Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-On-Cylinder Lubricity Evaluator (BOCLE)[5]
D 5006 Test Method for Determination of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels[5]
D 5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)[5]
D 5452 Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration[5]
D 5453 Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence[5]
D 5901 Test Method for Freezing Point of Aviation Fuels (Automated Optical Method)[5]
D 5972 Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)[5]
E 29 Practice for Using Significant Digits In Test Data to Determine Conformance with Specifications[6]

2.2 *IP Standards:*[7]

225 Copper Content of Aviation Turbine Fuel
227 Silver Corrosion of Aviation Turbine Fuel

2.3 *Other Standard:*[8]

CAN/CGSB 3.22-97 "Aviation Turbine Fuel, Wide Cut Type" includes grade Jet B and NATO grade F-40 fuel

2.4 *Military Standard:*[9]

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

3. General

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

4. Classification

4.1 One type of aviation turbine fuel is provided, as follows:

4.1.1 *Jet B*—A relatively wide boiling range volatile distillate.

5. Materials and Manufacture

5.1 Aviation turbine fuel, except as otherwise specified herein, shall consist of blends of refined hydrocarbons derived from crude petroleum, natural gasoline, or blends thereof with synthetic hydrocarbons.

5.1.1 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 and X1.11.1).

5.2 *Additives*—May be added to each type of aviation turbine fuel in the amount and of the composition specified in the following list of approved material:[10]

5.2.1 *Antioxidants*—In amounts not to exceed 24.0 mg/L active ingredients (not including weight of solvent):

5.2.1.1 2,6-ditertiary-butyl phenol.

5.2.1.2 2,6-ditertiary-butyl-4-methyl phenol.

5.2.1.3 2,4-dimethyl-6-tertiary-butyl phenol.

5.2.1.4 75 % min. 2,6-ditertiary-butyl phenol, plus 25 % max. mixed tertiary and tritertiary-butyl phenols.

5.2.1.5 55 % min. 2,4-dimethyl-6-tertiary-butyl phenol, plus 15 % min. 2,6-ditertiary-butyl-4-methyl phenol, remainder as monomethyl and dimethyl tertiary-butyl phenols.

5.2.1.6 72 % min. 2,4-dimethyl-6tertiary-butyl phenol, 28 % max. monomethyl and dimethyl-tertiary-butyl phenols.

5.2.2 *Metal Deactivator*, in amount not to exceed 5.7 mg/L (not including weight of solvent):

5.2.2.1 *N,N* -disalicylidene-1,2-propane diamine.

5.2.3 *Electrical Conductivity Additive*—Stadis 450[11] not to exceed 3 mg/L.

5.2.3.1 When loss of fuel conductivity necessitates retreatment with electrical conductivity additive, the following concentration limits apply:

At Manufacture:	
Stadis 450	3 mg/L, max
Retreatment	
Stadis 450	cumulative total 5 mg/L, max

5.2.4 *Leak Detection Additive*—Tracer A[12] may be added to the fuel in amounts not to exceed 1 mg/kg.

5.2.5 Other additives are permitted under 5.1 and Section 7. These include fuel system icing inhibitor, other anti-oxidants, inhibitors, and special purpose additives. The quantities and types must 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.

5.2.5.1 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 must be checked for the specific aircraft and engines to be operated.

5.2.5.2 *Fuel System Icing Inhibitor*:

(a) Diethylene Glycol Monomethyl Ether (DIEGME), conforming to the requirements of Specification D 4171, Type III, may be used in concentrations of 0.10 to 0.15 volume %.

[5] *Annual Book of ASTM Standards*, Vol 05.03.
[6] *Annual Book of ASTM Standards*, Vol 14.02.
[7] Available from Directorate of Standardization, Stan 1, Room 5131, Kentigern House, 65 Brown St., Glasgow, G2 8EX, United Kingdom.
[8] Canadian General Standards Board (CGSB) specifications are available from the Canadian General Standards Board, Ottawa, Canada K1A 1G6.
[9] Available from Dept. of Defense Single Stock Point, Bldg 4D, 700 Robbins Ave., Philadelphia, PA 19111-5098.
[10] Guidelines for Approval or Disapproval of Additives are available from ASTM, Headquarters. Request RR: D02-1125.
[11] Stadis 450 is a registered trademark marketed by Octel America, 200 Executive Dr., Newark, DE 19702.
[12] Tracer A (LDTA-A) is a registered trademark of Tracer Research Corp., 3755 N. Business Center Dr., Tucson, AZ 85705.

(b) Test Method D 5006 may be used to determine the concentration of DIEGME in aviation fuels.

6. Detailed Requirements

6.1 The aviation turbine fuel shall conform to the requirements prescribed in Table 1.

6.2 Test results shall not exceed the maximum or be less than the minimum values specified in Table 1. 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 using Practice E 29. Where multiple determinations are made, the average result, rounded in accordance with Practice E 29, shall be used.

7. Workmanship, Finish, and Appearance

7.1 The aviation turbine fuel herein specified 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 herein.

8. Sampling

8.1 Because of the importance of proper sampling procedures in establishing fuel quality, use the appropriate procedures in Practice D 4057.

8.2 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 D 4306.

9. Report

9.1 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.

9.2 A suggested form for reporting inspection data on aviation turbine fuels is given in Appendix X3 of Specification D 1655.

10. Test Methods

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

10.1.1 *Density*—Test Methods D 1298 or D 4052.

10.1.2 *Distillation*—Test Method D 86.

10.1.3 *Vapor Pressure*—Test Methods D 323 or D 5191. Test Method D 5191 shall be the referee test method.

10.1.4 *Freezing Point*—Test Methods D 2386, D 4305, D 5901, or D 5972. Test Method D 2386 shall be the referee test method.

10.1.5 *Net Heat of Combustion*—Test Methods D 4529, D 3338, or D 4809.

10.1.6 *Corrosion (Copper Strip)*—Test Method D 130.

10.1.7 *Sulfur*—Test Methods D 1266, D 1552, D 2622, D 4294, or D 5453.

10.1.8 *Mercaptan Sulfur*—Test Method D 3227.

10.1.9 *Water Reaction*—Test Method D 1094.

10.1.10 *Existent Gum*—Test Method D 381.

10.1.11 *Thermal Stability*—Test Method D 3241.

NOTE 2—Table 1 requires the measurement of thermal stability at a tube temperature of 260°C, but permits a retest at 245°C if the first test fails. This two tier system was developed to resolve a dispute over the equivalence of results by Test Method D 3241 compared to Test Method D 1660, the original thermal stability method. A more detailed discussion of test conditions is found in X1.3.2.

10.1.12 *Aromatics*—Test Method D 1319.

10.1.13 *Smoke Point*—Test Method D 1322.

10.1.14 *Naphthalene Content*—Test Method D 1840.

10.1.15 *Electrical Conductivity*—Test Method D 2624.

11. Keywords

11.1 aviation turbine fuel; avtag; Jet B; jet fuel; turbine fuel; wide-cut

TABLE 1 Detailed Requirements of Aviation Turbine Fuels[A]

Property		Jet B	ASTM Test Method[B]
Aromatics, vol %	max	25	D 1319
Sulfur, mercaptan,[C] mass %	max	0.003	D 3227
Sulfur, total mass %	max	0.3	D 1266, D 1552, D 2622, D 4294, or D 5453
Distillation temperature, °C:			
20 % recovered, temperature	max	145	D 86
50 % recovered, temperature	max	190	
90 % recovered, temperature	max	245	
Distillation residue, %	max	1.5	
Distillation loss, %	max	1.5	
Density at 15°C, kg/m^3		751 to 802	D 1298 or D 4052
Vapor pressure, 38°C, kPa	max	21	D 323 or D 5191[D]
Freezing point, °C	max	−50[E]	D 2386, D 4305[F], D 5901, or D 5972[G]
Net heat of combustion, MJ/kg	min	42.8[H]	D 4529, D 3338, or D 4809
One of the following requirements shall be met:			
(*1*) Smoke point, mm, or	min	25	D 1322
(*2*) Smoke point, mm, and	min	18	D 1322
Naphthalenes, vol, %	max	3.0	D 1840
Copper strip, 2 h at 100°C		No. 1	D 130
Thermal Stability:			
Filter pressure drop, mm Hg	max	25[I]	D 3241[J]
Tube deposits less than		Code 3	
Existent gum, mg/100 mL	max	7	D 381
Water reaction:			
Interface rating	max	1b	D 1094
ADDITIVES		See 5.2	
Electrical conductivity, pS/m		[K]	D 2624

[A] For compliance of test results against the requirements of Table 1, see 6.2.

[B] The test methods indicated in this table are referred to in Section 10.

[C] The mercaptan sulfur determination may be waived if the fuel is considered sweet by the doctor test described in Test Method D 4952.

[D] Cyclohexane and toluene, as cited in 7.2 and 7.7 of Test Method D 5191, shall be used as calibrating reagents. Test Method D 5191 shall be the referee method.

[E] Other freezing points may be agreed upon between supplier and purchaser.

[F] When using Test Method D 4305, use Procedure A only, do not use Procedure B. Test Method D 4305 shall not be used on samples with viscosities greater than 5.0 mm^2/s at -20°C. If the viscosity of the sample is not known and cannot be obtained by means of the batch certificate(s), then it shall be measured. The viscosity shall be reported when reporting the Test Method D 4305 results. In case of dispute, Test Method D 2386 shall be the referee method.

[G] Test Method D 5972 may produce a higher (warmer) result than that from Test Method D 2386 on wide-cut fuels such as Jet B or JP-4. In case of dispute, Test Method D 2386 shall be the referee method.

[H] Use either Eq 1 or Table 1 in Test Method D 4529 or Eq 2 in Test Method D 3338. Test Method D 4809 may be used as an alternative. In case of dispute, Test Method D 4809 shall be used.

[I] Preferred SI units are 3.3 kPa, max.

[J] Thermal stability test (JFTOT) shall be conducted for 2.5 h at a control temperature of 260°C, but if the requirements of Table 1 are not met, the test may be conducted at 245°C. Results at both temperatures shall be reported in this case. Tube deposits shall always be reported by the Visual Method; a rating by the Tube Deposit Rating (TDR) optical density method is desirable but not mandatory.

[K] If electrical conductivity additive is used, the conductivity shall not exceed 450 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 450 pS/m under the conditions at point of delivery.

$$1 \text{ pS/m} = 1 \times 10^{-12} \Omega^{-1} m^{-1} \quad (1)$$