Designation: D 6615 – 05a

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 with other fuels described in Specification D 1655. This fuel is intended for use in aircraft that are certified to use such 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:* [2]

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

D 130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

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

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

D 1094 Test Method for Water Reaction of Aviation Fuels

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

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

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

D 1322 Test Method for Smoke Point of Kerosine and Aviation Turbine Fuel

D 1655 Specification for Aviation Turbine Fuels

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

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

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

D 2386 Test Method for Freezing Point of Aviation Fuels

D 2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry

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

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

D 3240 Test Method for Undissolved Water in Aviation Turbine Fuels

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

D 3338 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels

D 3948 Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer

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

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D 4171 Specification for Fuel System Icing Inhibitors

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

D 4294 Test Method for Sulfur in Petroleum and Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectrometry

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

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

D 4529 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels

[1] This specification 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.

Current edition approved Nov. 1, 2005. Published November 2005. Originally approved in 2000. Last previous edition approved in 2005 as D 6615–05.

[2] 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.

[3] Withdrawn.

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

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

2.2 *IP Standards:*[4]

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

2.3 *Other Standard:*[5]

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:*[6]

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 in this specification, 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:[7]

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 % minimum 2,6-ditertiary-butyl phenol, plus 25 % maximum mixed tertiary and tritertiary-butyl phenols.

5.2.1.5 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.

5.2.1.6 72 % minimum 2,4-dimethyl-6-tertiary-butyl phenol, 28 % maximum 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[8] 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[9] 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*:

(1) 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 %.

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

[4] Available from Directorate of Standardization, Stan 1, Room 5131, Kentigern House, 65 Brown St., Glasgow, G2 8EX, United Kingdom.

[5] Available from the Canadian General Standards Board (CGSB), Ottawa, Canada K1A 1G6.

[6] Available from Dept. of Defense Single Stock Point, Bldg 4D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

[7] 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.

[8] Stadis 450 is a registered trademark marketed by Octel America, 200 Executive Dr., Newark, DE 19702.

[9] Tracer A (LDTA-A) is a registered trademark of Tracer Research Corp., 3755 N. Business Center Dr., Tucson, AZ 85705.

5.3 Guidance material is presented in Appendix X3 concerning the need to control processing additives in jet fuel production.

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 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.

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

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	0.30	D 1266, D 2622, D 4294, or D 5453
Distillation temperature, °C:			
20 % recovered, temperature	min	90	D 86
20 % recovered, temperature	max	145	
50 % recovered, temperature	min	110	
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		14 to 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
ADDITIVES		See 5.2	
Electrical conductivity, pS/m		[K]	D 2624
Microseparometer Rating[L]			D 3948
Without electrical conductivity additive	min	85	
With electrical conductivity additive	min	70	

[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.

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

[L] At point of manufacture.

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 X4 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 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 with 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

APPENDIXES

(Nonmandatory Information)

X1. PERFORMANCE CHARACTERISTICS OF AVIATION TURBINE FUELS

X1.1 Introduction

X1.1.1 This appendix describes the performance characteristics of aviation turbine fuels. A more detailed discussion of the individual test methods and their significance is found in ASTM Manual No. 1.[10]

X1.2 Significance and Use

X1.2.1 Specification D 6615 defines one type of jet fuel for civil use. Limiting values for the two types of fuel covered are placed on fuel properties believed to be related to the performance of the aircraft and engines in which they are most commonly used.

X1.2.2 The safe and economical operation of aircraft requires fuel that is essentially clean and dry and free of any contamination prior to use. It is possible to measure a number of jet fuel characteristics related to quality.

X1.2.3 The significance of standard tests for fuel properties may be summarized for convenience in terms of the technical relationships with performance characteristics as shown in Table X1.1.

X1.2.4 The acceptability of additives for use must ultimately be determined by the engine and aircraft type certificate holder and must be approved by his certifying authority. In the United States of America, the certifying authority is the Federal Aviation Administration.

X1.3 Thermal Stability

X1.3.1 Stability to oxidation and polymerization at the operating temperatures encountered in certain jet aircraft is an important performance requirement. The "thermal stability" measurements are related to the amount of deposits formed in the engine fuel system on heating the fuel in a jet aircraft. Commercial jet fuels should be thermally stable at fuel temperature as high as 149°C (300°F). Such fuels have been demonstrated to have inherent storage stability.

X1.3.2 Originally, thermal stability was measured by Test Method D 1660, known as the ASTM Coker. When this test was replaced by Test Method D 3241, the JFTOT, a correlation study was conducted between the two methods. (CRC Report 450, dated 1969 and revised in 1972. See also Bert and Painter's SAE paper 730385.[11]) It was concluded that, on average, a Test Method D 3241 test at 245°C was equivalent to the original Test Method D 1660 requirement of 300°F/400°F/5 lbs/h (149°C/204.5°C/2.27 kg/h). However, the data scatter about the best fit line was such that users insisted on the initial test of 260°C as a safety margin but permitted a retest at 245°C.

[10] ASTM MNL 1, *Manual on Significance of Tests for Petroleum Products*, ASTM International, W. Conshohocken, 1993.

[11] Bert, J. A., and Painter, L., "A New Fuel Thermal Stability Test (A Summary of Coordinating Research Council Activity)," SAE Paper 730385, Society of Automotive Engineers, Warrendale, PA, 1973.