Designation: ~~D6615 – 14~~ D6615 – 14a

An American National Standard

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

This standard is issued under the fixed designation D6615; 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 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 D1655. 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 D1655.

1.3 This specification does not define the quality assurance testing and procedures necessary to ensure that fuel in the distribution system continues to comply with this specification after batch certification. Such procedures are defined elsewhere, for example in ICAO 9977, EI/JIG Standard 1530, JIG 1, JIG 2, API 1543, API 1595, and ATA-103.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure
D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
D323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
D381 Test Method for Gum Content in Fuels by Jet Evaporation
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, or API Gravity of Crude Petroleum and Liquid 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
D1655 Specification for Aviation Turbine Fuels
D1660 Method of Test for Thermal Stability of Aviation Turbine Fuels (Withdrawn 1992)[3]
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
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
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
D3338 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
D3948 Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer

[1] This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.J0.01 on Jet Fuel Specifications.

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[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] The last approved version of this historical standard is referenced on www.astm.org.

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

D4052 Test Method for Density, Relative Density, and API Gravity 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
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
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)
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
D5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)
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
D5972 Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)
D6379 Test Method for Determination of Aromatic Hydrocarbon Types in Aviation Fuels and Petroleum Distillates—High Performance Liquid Chromatography Method with Refractive Index Detection
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *IP Standard:*[4]

EI/JIG 1530 Quality Assurance Requirements for the Manufacture, Storage and Distribution of Aviation Fuels to Airports
IP 225 Copper Content of Aviation Turbine Fuel

2.3 *API Standards:*[5]

API 1543 Documentation, Monitoring and Laboratory Testing of Aviation Fuel During Shipment from Refinery to Airport
API 1595 Design, Construction, Operation, Maintenance, and Inspection of Aviation Pre-Airfield Storage Terminals[5]

2.4 *Joint Inspection Group Standards:*[6]

JIG 1 Aviation Fuel Quality Control & Operating Standards for Into-Plane Fuelling Services
JIG 2 Aviation Fuel Quality Control & Operating Standards for Airport Depots & Hydrants[6]

2.5 *Military Standard:*[7]

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

2.6 *Other Standards and Guidance Material:*

ATA-103 Standard for Jet Fuel Quality Control at Airports[8]
CAN/CGSB 3.22-97 "Aviation Turbine Fuel, Wide Cut Type" includes grade Jet B and NATO grade F-40 fuel[9]
ICAO 9977 Manual on Civil Aviation Jet Fuel Supply[10]

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 (see Note 2) derived from conventional sources, including crude oil, natural gas liquid condensates, heavy oil, shale oil, and oil sands. The use of jet fuel blends, containing components from other sources, is permitted only on a specific individual basis.

[4] Available from Energy Institute, 61 New Cavendish St., London, WIG 7AR, U.K., http://www.energyinst.org.uk.
[5] Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, http://www.api.org.
[6] Available from Joint Inspection Group (JIG), http://www.jigonline.com.
[7] Available from Dept. of Defense Single Stock Point, Bldg 4D, 700 Robbins Ave., Philadelphia, PA 19111-5098.
[8] Available from Air Transport Association of America, Inc. (ATA) d/b/a Airlines for America, 1301 Pennsylvania Ave. NW, Suite 1100, Washington, D.C. 20004, http://www.airlines.org.
[9] Available from the Canadian General Standards Board (CGSB), Ottawa, Canada K1A 1G6.
[10] Available from International Civil Aviation Organization (ICAO), 999 University St., Montreal, Quebec H3C 5H7, Canada, http://www.icao.int.

TABLE 1 Detailed Requirements of Aviation Turbine Fuels[A]

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Property		Jet B	ASTM Test Method[B]
1. Aromatics, vol %	max	25	D1319
2. Aromatics, vol %	max	26.5	D6379
Sulfur, mercaptan,[C] mass %	max	0.003	D3227
Sulfur, total mass %	max	0.30	D1266, D2622, D4294, or D5453
Distillation temperature, °C:			
20 % recovered, temperature	min	90	D86
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	D1298 or D4052
Vapor pressure, 38°C, kPa		14 to 21	D323 or D5191[D]
Freezing point, °C	max	–50[E]	D2386 or D5972[F]
Net heat of combustion, MJ/kg	min	42.8[G]	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
Copper strip, 2 h at 100°C		No. 1	D130
Thermal Stability:			
(2.5 h at control temperature of 260°C min):			
Filter pressure drop, mm Hg	max	25	D3241[H]
Tube deposits less than		3	
		No *Peacock* or *Abnormal* Color Deposits	
Existent gum, mg/100 mL	max	7	D381
ADDITIVES		See 5.2	
Electrical conductivity, pS/m		[I]	D2624
Microseparometer Rating[J]			D3948
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 D4952.
[D] Cyclohexane and toluene, as cited in 7.2 and 7.7 of Test Method D5191, shall be used as calibrating reagents. Test Method D5191 shall be the referee method.
[E] Other freezing points may be agreed upon between supplier and purchaser.
[F] Test Method D5972 may produce a higher (warmer) result than that from Test Method D2386 on wide-cut fuels such as Jet B or JP-4. In case of dispute, Test Method D2386 shall be the referee method.
[G] 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.
[H] Tube deposits shall always be reported by the Visual Method.
[I] 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.

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

[J] At point of manufacture.

NOTE 2—Conventionally refined jet fuel contains trace levels of materials which are not hydrocarbons including oxygenates, organosulfur, and nitrogeneous compounds.

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 X1.12.1).

5.2 *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:[11]

~~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.~~

[11] 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 2 Detailed Requirements for Additives in Aviation Turbine Fuels

Additive	Dosage
Fuel Performance Enhancing Additives	
Antioxidants[A,B]	24.0 mg/L
max[C]	
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	
Metal Deactivator[A]	
N,N-disalicylidene-1,2-propane diamine	
On initial blending	2.0 mg/L max[C,D]
After field reblending, cumulative concentration	5.7 mg/L max
Fuel System Icing Inhibitor[E]	0.10 vol % min
Diethylene Glycol Monomethyl Ether (see Specification D4171)	0.15 vol %
max	
Fuel Handling and Maintenance Additives	
Electrical Conductivity Improver	
Stadis 450[G]	
On initial blending	3 mg/L max
After field reblending, cumulative concentration	5 mg/L max
If the additive concentration is unknown at time of retreatment	
Additional concentration is restricted to 2 mg/L max	
Leak Detection Additive	1 mg/kg max
Tracer A (LDTA-A)[H]	
Biocidal Additives[E,I,K]	
Biobore JF	
Kathon FP1.5	
Corrosion Inhibitor/Lubricity Improvers[J]	
One of the following:	
HiTEC 580	23 mg/L max
Octel DCI-4A	23 mg/L max
Nalco 5403	23 mg/L max

[A] The active ingredient of the additive must meet the composition specified.
[B] Supporting data have been filed at ASTM Internation Headquarters and may be obtained by requesting Research Report RR:D02-1125.
[C] Active ingredient (not including weight of solvent).
[D] If copper contamination is suspected, initial treatment may exceed 2.0 mg/L but cumulative total must be below 5.7 mg/L.
[E] The quantity must be declared by the fuel supplier and agreed to by the purchaser.
[F] 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.

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

[G] Stadis 450 is a registered trademark marketed by Innospec Inc., Innospec Manufacturing Park, Oil Sites Road, Ellesmere Port, Cheshire, CH65 4EH, UK.
[H] Tracer A (LDTA-A) is a registered trademark of Tracer Research Corp., 3755 N. Business Center Dr., Tucson, AZ 85705.
[I] 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.
[J] More information concerning minimum treat rates of corrosion inhibitor/lubricity improver additives is contained in X1.11.
[K] Refer to the Aircraft Maintenance Manual (AMM) to determine if either biocide is approved for use and for their appropriate use and dosage.

~~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[12] 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[13] may be added to the fuel in amounts not to exceed 1 mg/kg.~~

5.2.1 Other additives are permitted under 5.1 and Section ~~7~~7.1. These include fuel ~~system icing inhibitor, other anti-oxidants, inhibitors, and special purpose additives.~~ performance enhancing additives and fuel handling and maintenance additives as found in Table 2. 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.

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

5.2.1.2 *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.

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 E29. Where multiple determinations are made, the average result, rounded in accordance with Practice E29, 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 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.

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 D4306.

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 D1655.

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 D1298 or D4052.

10.1.2 *Distillation*—Test Method D86.

10.1.3 *Vapor Pressure*—Test Methods D323 or D5191. Test Method D5191 shall be the referee test method.

10.1.4 *Freezing Point*—Test Methods D2386 or D5972. Test Method D2386 shall be the referee test method.

10.1.5 *Net Heat of Combustion*—Test Methods D4529, D3338, or D4809.

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

10.1.7 *Sulfur*—Test Methods D1266, D2622, D4294, or D5453.

10.1.8 *Mercaptan Sulfur*—Test Method D3227.

10.1.9 *Water Reaction*—Test Method D1094.

10.1.10 *Existent Gum*—Test Method D381.

10.1.11 *Thermal Stability*—Test Method D3241.

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

10.1.13 *Smoke Point*—Test Method D1322.
10.1.14 *Naphthalene Content*—Test Method D1840.
10.1.15 *Electrical Conductivity*—Test Method D2624.

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.[12]

X1.2 Significance and Use

X1.2.1 Specification D6615 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.

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

TABLE X1.1 Performance Characteristics of Aviation Turbine Fuels

Performance Characteristics	Test Method	Sections
Engine fuel system deposits and coke	Thermal stability	X1.3
Combustion properties	Smoke point	X1.4.2.1
	Aromatics	X1.4.2.2
	Percent naphthalenes	X1.4.2.3
Fuel metering and aircraft range	Density	X1.5.1
	Net heat of combustion	X1.5.2
Fuel atomization	Distillation	X1.6.1
	Vapor pressure	X1.6.2
Fluidity at low temperature	Freezing point	X1.7.1
Compatibility with elastomer and the metals in the fuel system and turbine	Mercaptan sulfur	X1.8.1
	Sulfur	X1.8.2
	Copper strip corrosion	X1.8.3
Fuel storage stability	Existent gum	X1.9.1
Fuel cleanliness, handling	Water reaction	X1.10.1
	Water separation characteristics	X1.10.2
	Free water and particulate contamination	X1.10.3
	Particulate matter	X1.10.4
	Membrane color ratings	X1.10.5
	Undissolved water	X1.10.6
Static electricity	Conductivity	X1.10.7
Fuel lubricating ability (lubricity)	Fuel lubricity	X1.11
Miscellaneous	Additives	X1.12.1
	Sample containers	X1.12.2
	Leak detection additive	X1.12.3
	Color	X1.12.4