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Reaffirmed September 2022

Supersedes CAN/CGSB-3.22-2002
and Reaffirmation September 2017

Wide-cut type aviation turbine fuel (Grade JET B)

Canadian General Standards Board CGSB

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Preface

This National Standard of Canada has been reaffirmed by the CGSB Committee on aviation fuels.

The following definitions apply in understanding how to implement this National Standard of Canada:

- "shall" indicates a **requirement**;
- "should" indicates a **recommendation**;
- "may" is used to indicate that something is **permitted**;
- "can" is used to indicate that something is **possible**, for example, that an organization is able to do something.

Notes accompanying clauses do not include requirements or alternative requirements. The purpose of a note accompanying a clause is to separate explanatory or informative material from the text. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

Contents

Page

Wide-cut type aviation turbine fuel (Grade JET B)

1 Scope

1.1 This National Standard of Canada applies to JET B wide-cut type aviation turbine fuel, consisting of hydrocarbons, and naturally occurring non-hydrocarbons derived from petroleum, and additives as specified herein. Wide-cut type aviation fuels are low flash, volatile naphtha and kerosene blends, having a wide boiling range and a low-freezing point.

Note: Volatility is not controlled by flash point but rather by a maximum vapour pressure limit.

1.2 Grade JET B fuel is normally used in civil aviation operations in aircraft that have been approved to use this fuel.

1.3 Limitations for use

Aircraft operators should consult their aircraft manuals for the type of fuel, fuel additives and other limitations.

1.4 The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

1.5 Units of measurement – Quantities and dimensions used in this standard are provided in units from the International System of Units (SI units). This standard expresses the industry standard nominal measurements in North America of “% by mass” and “% by volume”. The SI equivalent expressions for these units are % (m/m) and % (V/V) respectively.

2 Referenced publications

2.1 The following publications are referenced in this standard:

2.1.1 ASTM International

Annual Book of ASTM Standards (Appendix A)

2.1.2 U.S. Department of Defense

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

QPL-25017 — *Qualified Products List of Products Qualified Under Performance Specification MIL-PRF-25017 Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble*

2.2 A dated reference in this standard is to the issue specified. An undated reference in this standard is to the latest issue, unless otherwise specified by the authority applying this standard. The sources are given in the Notes section.

3 General requirements

3.1 Hydrocarbons shall include products derived from crude oil, including crude from oil sands.

3.2 The fuel shall be visually clear and free from undissolved water and particulate matter.

3.3 The odour of the fuel should not be nauseating or irritating.

4 Detailed requirements

4.1 The detailed requirements shall apply to the fuel unless otherwise specified herein.

4.2 The fuel shall comply with the detailed requirements specified in par. 4.4 to 4.13 using the test methods indicated. The specified limiting values shall not be changed. This precludes any allowances for the test method precision and adding or subtracting digits.

4.3 To determine conformance with the specified limiting values, an observed value or a calculated value shall be "rounded off to the nearest unit" in the last right-hand digit used in expressing the specified limiting value, in accordance with the rounding-off method of ASTM E29.

4.3.1 Where test values differ between two parties, a resolution shall be in accordance with ASTM D3244 in order to determine conformance with the specified limiting values, with the criticality of the limits set at $P = 0.5$.

Specified limiting values

	Property	JET B		Test Method
		Min.	Max.	ASTM
4.4	**Composition**			
4.4.1	Acidity, total, mg KOH/g	—	0.10	D3242
4.4.2	Aromatics, % by volume	—	25	D1319[1] or
		—	26.5	D6379
4.4.3	Sulphur, total, % by mass	—	0.30	D4294[1], D5453 or D7039 (par. 4.14)
4.4.4	Sulphur[2], mercaptan, % by mass	—	0.003	D3227
4.5	**Volatility**			
4.5.1	Distillation temperature, °C			D86[3]
	a. Initial boiling point	Report		
	b. 10% recovered	Report		
	c. 20% recovered	90	145	
	d. 50% recovered	110	190	
	e. 90% recovered	Report		
	f. Final boiling point	—	270	
4.5.2	Residue, % by volume	—	1.5	D86
4.5.3	Loss, % by volume	—	1.5	D86
4.5.4	Vapour pressure, kPa	—	21	D5191

	Property	JET B		Test Method
		Min.	Max.	ASTM
4.6	**Fluidity**			
4.6.1	Freezing point, °C	—	-50	D2386 or D5972[1, 4]
4.7	**Combustion**			
4.7.1	Smoke point, mm or	25	—	D1322
4.7.2	Smoke point, mm and	18	—	D1322
	Naphthalene, % by volume	—	3.0	D1840
4.7.3	Net heat of combustion, lower heating value, MJ/kg	42.8	—	D4529, D3338 or D48091
4.8	**Corrosion**			
4.8.1	Copper strip, 2 h at 100 °C	—	No. 1	D130
4.9	Thermal stability			
4.9.1	Filter pressure drop, 260 ºC minimum heater-tube-controlled temperature, mm Hg	—	25 [5]	D3241
4.9.2	**Tube deposit**	Less than 3		D3241
4.9.3	Visual examination, on the heater tube, darkest deposits	No peacock (rainbow) or abnormal colour deposits		D3241
4.10	**Contaminants** (par. 7.7)			
4.10.1	Particulate matter at time of delivery to			D2276 or D5452[6]
	a. Purchaser's storage, mg/L	—	2.2	
	b. Aircraft and refuellers, mg/L	—	0.44	
4.10.2	Micro-separometer,[7] rating (par. 7.5)			D3948
	a. Without static dissipator additive, or	85	—	
	b. With static dissipator additive	70	—	
4.11	**Conductivity**			
4.11.1	Electrical conductivity, at point, time and temperature of delivery (par. 5.2), pS/m	50	600	D2624

	Property	JET B		Test Method
		Min.	Max.	ASTM
4.12	**Additives** (par. 7.6)			
4.12.1	Static dissipator additive (par. 5.2), mg/L			
	a. Original addition	—	3	
	b. Cumulative	—	5	
4.12.2	**Antioxidant** (par. 5.3), mg/L	Optional		
		—	24	
4.12.3	Metal deactivator (par. 5.4), mg/L	Optional		
	a. Original addition	—	2.0	
	b. Cumulative	—	5.7	
4.12.4	Fuel system icing inhibitor (par. 5.5), % by volume	Optional		D5006
		0.10	0.15	
4.12.5	Corrosion inhibitor/ lubricity improver (par. 5.6)	Optional		
4.12.6	Leak detection additive (par. 5.7), mg/kg	Optional		
		—	1	
4.13	**Density**			
4.13.1	Density at 15 °C, kg/m^3	751	802	D1298[1] or D4052

[1] In the event of a dispute, this method shall be the referee method.

[2] The mercaptan sulphur determination may be waived if the fuel is considered “sweet”, and receives a negative result by the doctor test described in ASTM D4952.

[3] The test values shall be reported to the nearest 0.5 °C.

[4] ASTM D5972 may produce a higher (warmer) result than D2386 on wide-cut fuels such as JET B.

[5] The SI unit equivalent for the pressure differential maximum is approximately 3.3 kPa, however, the exact maximum is given in mm Hg for compatibility with the instrumentation specified in ASTM D3241.

[6] ASTM D2276 and D5452 refer to different sampling procedures. In some situations it may not be practical to sample according to D2276; however, when results are obtained by both methods, D2276 shall be considered the referee method.

[7] The minimum micro-separometer (MSEP) rating applies up to the point immediately before the fuel enters dedicated transportation to airport storage. When the fuel enters dedicated transportation to airport storage, or when the fuel is already in airport storage, the MSEP rating requirement shall not apply. When a fuel system icing inhibitor (par. 5.5) or a corrosion inhibitor/lubricity improver (par. 5.6) is added, the MSEP limits apply before its addition.

4.14 Sulphur

The precision and bias of sulphur determinations using ASTM D7039 on diluted samples have not been determined. The accuracy of this method for jet fuel beyond 2000 mg/kg sulphur has not been validated by an interlaboratory study. Users are cautioned to conduct their own validation when using this test method for fuel containing more than 2000 mg/kg sulphur.

5 Additive requirements

5.1 Only the additives listed in par. 5.2 to 5.7 may be added to the fuel. Refer to par. 4.12 for specified limiting values and test method for each property. When additives are added to the fuel, the supplier shall record the amount and names of the additive.

5.1.1 The amount of each additive used in the fuel shall be determined by the test method (par. 4.12) or by volume reconciliation. Procedures for volume reconciliation should include recording the volume of additive introduced to the fuel and the volume of fuel additized, in appropriate units.

5.2 Static dissipator additive (SDA)

Static dissipator additive Stadis® 450[1] shall be added to the fuel to meet the electrical conductivity requirements specified in par. 4.11.1. The original concentration of the SDA shall not exceed 3 mg/L.

5.2.1 When additive depletion is evident by a conductivity loss, further addition of the SDA is permitted as follows:

a) if the original concentration of the SDA is not known, an original addition of 3 mg/L is assumed and further addition of SDA shall not exceed 2 mg/L;

b) the cumulative concentration of the SDA shall not exceed 5 mg/L.

5.2.2 Electrical conductivity varies with temperature. A typical relationship follows:

$$\log k_t = a(t - t_1) + \log k_{t_1}$$

where:

k_t = electrical conductivity at temperature t, °C;

k_{t_1} = electrical conductivity at temperature t_1, °C;

a = a factor that depends on fuel composition but normally within the range 0.013 to 0.018 for wide-cut type aviation turbine fuels.

5.2.2.1 The temperature-conductivity factor, *a*, increases at or below an approximate temperature of -10 °C. For conductivity at very low temperatures, it is recommended that a separate factor be determined based on actual measurements at the lowest temperatures likely to be encountered. For more information on how low temperature affects conductivity, see ASTM D2624.

[1] Stadis® 450, a registered trademark of Innospec Fuel Specialties LLC, is distributed globally by Innospec Fuel Specialties LLC.

5.3 Antioxidants

Only the following antioxidants may be added separately or in combination to the fuel. The total concentration (not including mass of solvent) shall not exceed 24 mg/L.

a) 2,6-di-*tert*-butylphenol;

b) 2,6-di-*tert*-butyl-4-methylphenol;

c) 2-*tert*-butyl-4,6-dimethylphenol (2,4-dimethyl-6-tertiary butylphenol);

d) 75% minimum, 2,6-di-*tert*-butylphenol,
25% maximum mixture of *tert*- and tri-*tert*-butylphenols;

e) 55% minimum, 2-*tert*-butyl-4,6-dimethylphenol (2,4-dimethyl-6-tertiary butylphenol),
15% minimum, 2,6-di-*tert*-butyl-4-methylphenol,
Remainder as methyl and dimethyl *tert*-butylphenols;

f) 72% minimum, 2-*tert*-butyl-4,6-dimethylphenol (2,4-dimethyl-6-tertiary butylphenol),
28% maximum, methyl and dimethyl *tert*-butylphenols.

Note: The names of the antioxidants conform to the International Union of Pure and Applied Chemistry (IUPAC) naming convention. In some cases, the common name of the antioxidant has been included in brackets after the IUPAC name.

5.4 Metal deactivator

Only N,N'-disalicylidene-1,2-propane-diamine may be added as a metal deactivator at a concentration not exceeding 2.0 mg/L (not including mass of solvent) on the initial fuel manufactured at the refinery. Higher concentrations are permitted in circumstances where copper contamination is suspected to have occurred during distribution. Cumulative concentration of metal deactivator when re-treating the fuel shall not exceed 5.7 mg/L (par. 7.3).

5.5 Fuel system icing inhibitor

When specified by the purchaser (par. 7.1) and agreed by the supplier and the purchaser, a fuel system icing inhibitor conforming to ASTM D4171 (Type III [DIEGME]) shall be added to the fuel (par. 4.12.4).

5.6 Corrosion inhibitors/Lubricity improvers

When specified by the purchaser (par. 7.1) and agreed by the supplier and the purchaser, a corrosion inhibitor/lubricity improver shall be added to the fuel (par. 7.2).

5.6.1 Only a corrosion inhibitor/lubricity improver qualified to U.S. Military Specification MIL-PRF-25017 and listed in the associated Qualified Product List (QPL) 25017 shall be added to the fuel. The concentration of the additive in the fuel shall be as specified in the QPL, and its introduction into the fuel shall be separate from the addition of other additives.

5.7 Leak detection additive[2]

Only tracer A (LDTA-A®)[3] may be added as a leak detection additive. The maximum concentration is 1 mg/kg.

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[2] The Tracer Tight methodology to detect and locate leaks in ground-based fuel storage, delivery and dispensing systems does not form part of this standard. Refer to the additive supplier for this information. Praxair Services, Inc. can be contacted at 3755 N. Business Center Drive, Tucson, AZ 85705, U.S.A., telephone: 1-800-989-9929, Web site: www.praxair.com.

[3] Tracer A (LDTA-A®) is a registered trademark of Praxair Services, Inc.

6 Inspection

6.1 Sampling

Samples for testing shall be obtained in accordance with ASTM D4057. For automatic sampling ASTM D4177 shall be used. Sampling for volatility measurement shall be done in accordance with ASTM D5842.

7 Notes

7.1 Options

The following options may be specified in the application of this standard:

a) fuel system icing inhibitor (par. 5.5);

b) corrosion inhibitor/lubricity (par. 5.6).

7.2 Lubricity information statement

7.2.1 Lubricity, which is the ability of jet fuel to act as a lubricant for certain aircraft fuel-wetted components, can vary considerably. It depends on the design, materials used and the intrinsic lubricity of the fuel. There have been a few isolated cases of engine hardware failures directly attributed to low-lubricity fuel.

7.2.2 ASTM D5001 may be used to identify low-lubricity fuel since this standard does not address the measurement of fuel lubricity. Hydrogen-processing[4] usually produces fuels with lower lubricity. Blending or commingling with non-hydrogen-processed fuels will improve lubricity, and the use of lubricity-improver additives (corrosion inhibitors) may offer a solution.

7.2.3 Problems are more likely to occur when aircraft operations are confined to a single refinery source where fuel is severely hydrogen-processed[5] and where there is no commingling with fuels from other sources during distribution between refinery and the aircraft.

7.3 Copper information statement

7.3.1 The contamination of jet fuel can occur during manufacture or during the distribution in marine vessels with copper coils, and from the copper-alloy components and fittings in sampling points.

7.3.2 Trace levels of copper, in the parts per billion range, can be sufficient to degrade the ASTM D3241 Jet Fuel Thermal Oxidation Tester test result. Where the possibility of copper pickup is suspected, an approved metal deactivator as specified in par. 5.4 may be added to preserve or restore the thermal stability of the fuel, or both. Note that ASTM D6732 can be used to measure the concentration of copper in jet fuel.

7.4 Colour information statement

While this standard does not have a colour requirement, colour can be a useful indicator of fuel quality or contamination. Normally fuel colour ranges from water white (colourless) to a pale straw yellow. Other fuel colours can be the result of crude oil characteristics or refining processes. Darkening of fuel or a change in fuel colour can be the result of product contamination and can indicate that the fuel is off-specification, which could render it unfit and not acceptable for aircraft or engine use, or both. Fuel having various shades of colour, that is, pink, red, green,

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[4] Hydrogen-processing is any petroleum refining process that uses hydrogen in the presence of a catalyst such as hydrotreating, hydrofining or hydrocracking.

[5] Severely hydrogen-processed fuels are those that have been subjected to a hydrogen partial pressure of greater than 7 MPa (70 bar or 1015 psi) during manufacture.

blue, or a change in colour from the supply source should be investigated to determine the cause of the colour change to ensure suitability for aircraft or engine use, or both.

7.5 Water separation characteristic information statement

The ease of coalescence of water from fuels as influenced by surface-active agents (surfactants) may be assessed by ASTM D3948. A high water separation characteristic rating suggests a fuel free of surfactants, whereas a low rating indicates the presence of surfactants. Surfactants can disarm coalescers, thus allowing water to pass through coalescer-filters and remain in the fuel. Surfactants can be introduced into the fuel downstream from a refinery distribution system, in storage facilities or deliberately introduced through the addition of specific approved additives. In light of the factors that can degrade water separation characteristics, options such as supplying higher water separation characteristics than the minimum specification should be considered at the point of origin depending upon the means of distribution.

7.6 Refinery processing additive information statement

Additives used in refinery processes, such as corrosion inhibitors, can be carried over in trace quantities into aviation fuel. In a few isolated cases this has resulted in operational problems in aircraft fuel systems. Moreover, the tests and requirements specified in this standard may not be sufficient for detecting trace levels of refinery processing additives. It is therefore recommended that adequate quality assurance and management of change procedures, such as formal risk assessments, be in place to ensure that any relevant refinery processing additive use is well defined and controlled in order to maintain the quality of the finished product.

7.7 Biodiesel esters information statement

Biodiesel Esters (Fatty Acid Methyl Esters – FAME) materials are not acceptable components in aviation turbine fuels. Increasing use of FAME has raised concerns about fuel contamination, particularly in non-dedicated distribution systems. Therefore producers, distributors and users need to take appropriate precautions to avoid contamination. Contact Transport Canada for the latest information regarding FAME contamination. Relevant Transport Canada Service Difficulty Advisories and Service Difficulty Alerts should be consulted. These can be accessed via the Transport Canada Web site at http://www.tc.gc.ca/civilaviation/certification/continuing/menu.htm, and enquiries can be sent to Transport Canada at cawwebfeedback@tc.gc.ca.

7.8 Related publications

7.8.1 ASTM International

ASTM D5001 — *Standard Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator (BOCLE)*

ASTM D6732 — *Standard Test Method for Determination of Copper in Jet Fuels by Graphite Furnace Atomic Absorption Spectrometry*

7.9 Sources of referenced publications

Note: The following addresses were valid at the date of publication.

7.9.1 The publications referred to in par. 2.1.1 and 7.8.1 may be obtained from ASTM International. Telephone: 610-832-9585. Fax: 610-832-9555. Web site: www.astm.org, or from IHS Canada. Telephone: 613-237-4250 or 1-800-267-8220. Fax: 613-237-4251. Email: gic@ihscanada.ca. Web site: www.ihs.com.

7.9.2 The publications referred to in par. 2.1.2 may be obtained from the Document Automation and Production Service. Fax: 215-697-1462. Web site: https://assist.daps.dla.mil/quicksearch.

Annex A
(normative)

Referenced ASTM publications (par. 2.1.1)

A.1 Annual Book of ASTM Standards

ASTM D86 – Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure

ASTM D130 – Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

ASTM D1298 – Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

ASTM D1319 – Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption

ASTM D1322 – Standard Test Method for Smoke Point of Kerosene and Aviation Turbine Fuel

ASTM D1840 – Standard Test Method for Naphthalene Hydrocarbons in Aviation Turbine Fuels by Ultraviolet Spectrophotometry

ASTM D2276 – Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling

ASTM D2386 – Standard Test Method for Freezing Point of Aviation Fuels

ASTM D2624 – Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels

ASTM D3227 – Standard Test Method for (Thiol Mercaptan) Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)

ASTM D3241 – Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels

ASTM D3242 – Standard Test Method for Acidity in Aviation Turbine Fuel

ASTM D3244 – Standard Practice for Utilization of Test Data to Determine Conformance with Specifications

ASTM D3338 – Standard Test Method for Estimation of Net Heat of Combustion of Aviation Fuels

ASTM D3948 – Standard Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer

ASTM D4052 – Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter

ASTM D4057 – Standard Practice for Manual Sampling of Petroleum and Petroleum Products

ASTM D4171 – Standard Specification for Fuel System Icing Inhibitors

ASTM D4177 – Standard Practice for Automatic Sampling of Petroleum and Petroleum Products

ASTM D4294 – Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-Ray Fluorescence Spectrometry

ASTM D4529 – Standard Test Method for Estimation of Net Heat of Combustion of Aviation Fuels

ASTM D4809 – Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)

ASTM D4952 – Standard Test Method for Qualitative Analysis for Active Sulfur Species in Fuels and Solvents (Doctor Test)

ASTM D5006 – Standard Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels

ASTM D5191 – Standard Test Method for Vapor Pressure of Petroleum Products and Liquid Fuels (Mini Method)

ASTM D5452 – Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration

ASTM D5453 – Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence

ASTM D5842 – Standard Practice for Sampling and Handling of Fuels for Volatility Measurement

ASTM D5972 – Standard Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)

ASTM D6379 – Standard Test Method for Determination of Aromatic Hydrocarbon Types in Aviation Fuels and Petroleum Distillates — High Performance Liquid Chromatography Method with Refractive Index Detection

ASTM D7039 – Standard Test Method for Sulfur in Gasoline, Diesel Fuel, Jet Fuel, Kerosine, Biodiesel, Biodiesel Blends, and Gasoline-Ethanol Blends by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry

ASTM E29 – Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications