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Standard Specification for Special-Purpose Test Fuels for Aviation Compression- Ignition Engines¹

This standard is issued under the fixed designation D8147; 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~~ Scope*

1.1 This specification is intended to support purchasing agencies when formulating specifications for purchases of aviation distillate fuel under contract.

1.2 This specification defines specialized property requirements to produce special-purpose aviation distillate test fuels that are intended only for engineering and certification testing of aircraft, engines, and aircraft equipment. Use of this specification for engineering and certification testing of aircraft is not mandatory. Its use is at the discretion of the aircraft manufacturer, engine manufacturer, or certification authorities when determining criteria for validation of aircraft equipment design.

1.3 This specification defines special-purpose test fuels that may be used to evaluate the operability, performance and durability of aviation compression-ignition engines when operating with fuels of marginal performance. The aviation distillate test fuels defined in this specification are not intended for general purpose use in aircraft. This specification also lists acceptable additives for aviation distillate special-purpose test fuels.

1.4 Specification D8147 is directed at civil applications, and maintained as such, but may be adopted for military, government, or other specialized uses.

1.5 This specification can be used as a standard in describing the quality of aviation distillate fuel from production to the aircraft. However, this specification does not define the quality assurance testing and procedures necessary to ensure that fuel continues to comply with this specification after batch certification.

1.6 This specification does not include all fuels satisfactory for aviation compression-ignition (CI) engines.

1.7 The values stated in SI units are to be regarded as standard.

1.7.1 *Exception*—Other units of measurement are included in this standard.

1.8 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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.J0.02 on Aviation Piston Engine Fuels.

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

1.9 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

- D56 Test Method for Flash Point by Tag Closed Cup Tester
- D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- 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)
- 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 Kerosene and Aviation Turbine Fuel
- D1655 Specification for Aviation Turbine Fuels
- 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
- D2887 Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography
- D3120 Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry
- D3227 Test Method for (Thiol Mercaptan) Sulfur in Gasoline, Kerosene, 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
- D3242 Test Method for Acidity in Aviation Turbine Fuel
- D3338 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
- 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, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4171 Specification for Fuel System Icing Inhibitors
- D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
- 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
- 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)
- D4952 Test Method for Qualitative Analysis for Active Sulfur Species in Fuels and Solvents (Doctor Test)
- D5006 Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels
- 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)
- D6079 Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR)
- D6379 Test Method for Determination of Aromatic Hydrocarbon Types in Aviation Fuels and Petroleum Distillates—High Performance Liquid Chromatography Method with Refractive Index Detection
- D6890 Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber
- D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- 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)

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.

D7345 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (Micro Distillation Method)

D7524 Test Method for Determination of Static Dissipater Additives (SDA) in Aviation Turbine Fuel and Middle Distillate Fuels—High Performance Liquid Chromatograph (HPLC) Method

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

2.2 *IP Standards:*³

IP 12 Determination of specific energy

IP 16 Determination of freezing point of aviation fuels—Manual method

IP 71 **Section 1** Petroleum products—Transparent and opaque liquids—Determination of kinematic viscosity and calculation of dynamic viscosity

IP 123 Petroleum products—Determination of distillation characteristics at atmospheric pressure

IP 154 Petroleum products—Corrosiveness to copper—Copper strip test

IP 156 Petroleum products and related materials—Determination of hydrocarbon types—Fluorescent indicator adsorption method

IP 160 Crude petroleum and liquid petroleum products—Laboratory determination of density—Hydrometer method

IP 170 Determination of flash point—Abel closed-cup method

IP 274 Determination of electrical conductivity of aviation and distillate fuels

IP 323 Determination of thermal oxidation stability of gas turbine fuels

IP 336 Petroleum products—Determination of sulfur content—Energy-dispersive X-ray fluorescence spectrometry

IP 342 Petroleum products—Determination of thiol (mercaptan) sulfur in light and middle distillate fuels—Potentiometric method

IP 354 Determination of the acid number of aviation fuels-colour-indicator titration method

IP 365 Crude petroleum and petroleum products—Determination of density—Oscillating U-tube method

IP 406 Petroleum products—Determination of boiling range distribution by gas chromatography

IP 435 Determination of the freezing point of aviation turbine fuels by the automatic phase transition method

IP 436 Determination of aromatic hydrocarbon types in aviation fuels and petroleum distillates— High performance liquid chromatography method with refractive index detection

IP 498 Determination of ignition delay and derived cetane number (DCN) of middle distillate fuels by combustion in a constant volume chamber

IP 523 Determination of flash point—Rapid equilibrium closed cup method

IP 528 Determination for the freezing point of aviation turbine fuels—Automatic fibre optic method

IP 529 Determination of the freezing point of aviation turbine fuels—Automatic laser method

IP 540 Determination of the existent gum content of aviation turbine fuel—Jet evaporation method

IP 598 Petroleum products—Determination of the smoke point of kerosine, manual and automated method

2.3 *ANSI Standard:*³ <http://www.ansi.org/catalog/standards/astm/79c8da19-f756-4af9-b8bc-0a764e40fdfa/astm-d8147-24>

ANSI 863 Report of Test Results

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this specification, refer to Terminology D4175.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *identified incidental materials, n*—chemicals and compositions that have defined upper content limits in an aviation fuel specification but are not approved additives.

4. General

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

5. Materials and Manufacture

5.1 Aviation distillate fuel is a complex mixture predominantly composed of hydrocarbons and varies depending on crude source and manufacturing process. Consequently, it is impossible to define the exact composition of aviation distillate fuels. Therefore,

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

this specification is primarily a performance specification rather than a compositional specification. The specification limits aviation distillate fuels to those made from conventional sources or by specifically approved processes.

5.1.1 Aviation distillate fuel, except as otherwise specified in this specification, shall consist predominantly of refined hydrocarbons (see **Note 1**) derived from conventional sources including crude oil, natural gas liquid condensates, heavy oil, shale oil, and oil sands. The use of middle distillate fuel blends containing components from other sources is permitted.

NOTE 1—Conventionally refined aviation distillate fuel contains trace levels of materials that are not hydrocarbons, including oxygenates, organosulfur, and nitrogenous compounds.

5.2 *Additives*—Additives approved for use in **D1655** jet fuel are approved for aviation distillate fuels and are shown in **Table 2**. They may be used within the concentration limits shown in the table subject to any restrictions described in the table footnotes.

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