



Designation: D7826 – 23

# Standard Guide for Evaluation of New Aviation Gasolines and New Aviation Gasoline Additives<sup>1</sup>

This standard is issued under the fixed designation D7826; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This guide provides procedures to develop data for use in research reports for new aviation gasolines or new aviation gasoline additives.

1.2 This data is intended to be used by the ASTM subcommittee to make a determination of the suitability of the fuel for use as an aviation fuel in either a fleet-wide or limited capacity, and to make a determination that the proposed properties and criteria in the associated standard specification provide the necessary controls to ensure this fuel maintains this suitability during high-volume production.

1.3 These research reports are intended to support the development and issuance of new specifications or specification revisions for these products. Guidance to develop ASTM International standard specifications for aviation gasoline is provided in Subcommittee J on Aviation Fuels Operating Procedures, Annex A6, “Guidelines for the Development and Acceptance of a New Aviation Fuel Specification for Spark-Ignition Reciprocating Engines.”

1.4 The procedures, tests, selection of materials, engines, and aircraft detailed in this guide are based on industry expertise to give appropriate data for review. Because of the diversity of aviation hardware and potential variation in fuel/additive formulations, not every aspect may be encompassed and further work may be required. Therefore, additional data beyond that described in this guide may be requested by the ASTM task force, Subcommittee J, or Committee D02 upon review of the specific composition, performance, or other characteristics of the candidate fuel or additive.

1.5 While it is beyond the scope of this guide, investigation of the future health and environmental impacts of the new aviation gasoline or new aviation gasoline additive and the requirements of environmental agencies is recommended.

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

<sup>1</sup> This guide 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.

Current edition approved May 1, 2023. Published June 2023. Originally approved in 2013. Last previous edition approved in 2022 as D7826 – 22. DOI: 10.1520/D7826-23.

1.6.1 *Exception*—Some industry standard methodologies utilize imperial units as their primary system (permeability; Table A2.2).

1.7 *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.*

1.8 *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:<sup>2</sup>

- D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- D97 Test Method for Pour Point of Petroleum Products
- D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- D156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
- D323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
- D381 Test Method for Gum Content in Fuels by Jet Evaporation
- D395 Test Methods for Rubber Property—Compression Set
- D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D471 Test Method for Rubber Property—Effect of Liquids
- D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

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

- D873** Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method)
- D892** Test Method for Foaming Characteristics of Lubricating Oils
- D909** Test Method for Supercharge Rating of Spark-Ignition Aviation Gasoline
- D910** Specification for Leaded Aviation Gasolines
- D924** Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids
- D943** Test Method for Oxidation Characteristics of Inhibited Mineral Oils
- D1002** Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
- D1056** Specification for Flexible Cellular Materials—Sponge or Expanded Rubber
- D1094** Test Method for Water Reaction of Aviation Fuels
- D1298** Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D1331** Test Methods for Surface and Interfacial Tension of Solutions of Paints, Solvents, Solutions of Surface-Active Agents, and Related Materials
- D1414** Test Methods for Rubber O-Rings
- D1500** Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)
- D1621** Test Method for Compressive Properties of Rigid Cellular Plastics
- D2240** Test Method for Rubber Property—Durometer Hardness
- D2344/D2344M** Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
- D2386** Test Method for Freezing Point of Aviation Fuels
- D2500** Test Method for Cloud Point of Petroleum Products and Liquid Fuels
- D2583** Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor (Withdrawn 2022)<sup>3</sup>
- 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
- D2700** Test Method for Motor Octane Number of Spark-Ignition Engine Fuel
- D2717** Test Method for Thermal Conductivity of Liquids (Withdrawn 2018)<sup>3</sup>
- D2896** Test Method for Base Number of Petroleum Products by Potentiometric Perchloric Acid Titration
- D3339** Test Method for Acid Number of Petroleum Products by Semi-Micro Color Indicator Titration
- D3359** Test Methods for Rating Adhesion by Tape Test
- D3525** Test Method for Gasoline Fuel Dilution in Used Gasoline Engine Oils by Wide-Bore Capillary Gas Chromatography
- D3652** Test Method for Thickness of Pressure-Sensitive Tapes
- D3762** Test Method for Adhesive-Bonded Surface Durability of Aluminum (Wedge Test) (Withdrawn 2019)<sup>3</sup>
- 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
- D4294** Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry
- D4308** Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter
- 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
- D5188** Test Method for Vapor-Liquid Ratio Temperature Determination of Fuels (Evacuated Chamber and Piston Based Method)
- D5191** Test Method for Vapor Pressure of Petroleum Products and Liquid Fuels (Mini Method)
- D5453** Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
- D5762** Test Method for Nitrogen in Liquid Hydrocarbons, Petroleum and Petroleum Products by Boat-Inlet Chemiluminescence
- D5972** Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)
- D6053** Test Method for Determination of Volatile Organic Compound (VOC) Content of Electrical Insulating Varnishes
- D6227** Specification for Unleaded Aviation Gasoline Containing a Non-hydrocarbon Component
- D6304** Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
- D6424** Practice for Octane Rating Naturally Aspirated Spark Ignition Aircraft Engines
- D6469** Guide for Microbial Contamination in Fuels and Fuel Systems
- D6812** Practice for Ground-Based Octane Rating Procedures for Turbocharged/Supercharged Spark Ignition Aircraft Engines
- D7042** Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- D7096** Test Method for Determination of the Boiling Range Distribution of Gasoline by Wide-Bore Capillary Gas Chromatography
- D7220** Test Method for Sulfur in Automotive, Heating, and Jet Fuels by Monochromatic Energy Dispersive X-ray Fluorescence Spectrometry
- D7547** Specification for Hydrocarbon Unleaded Aviation Gasoline
- D7719** Specification for High Aromatic Content Unleaded Hydrocarbon Aviation Gasoline Test Fuel

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

**E659** Test Method for Autoignition Temperature of Chemicals

**E1259** Practice for Evaluation of Antimicrobials in Liquid Fuels Boiling Below 390 °C

2.2 *EI Standards:*<sup>4</sup>

**EI 1529** Aviation fuelling hose and hose assemblies

**EI 1581** Specification and qualification procedures for aviation jet fuel filter/separators

**EI 1583** Laboratory tests and minimum performance levels for aviation fuel filter monitors

**EI 1590** Specifications and qualification procedures for aviation fuel microfilters

2.3 *MODUK Standard:*<sup>5</sup>

**MODUK DEF STAN 80-97** Paint System, for the Interior of Bulk Fuel Tank and Fittings, Multi-Pack

2.4 *ISO Standards:*<sup>6</sup>

**ISO 1825** Rubber hoses and hose assemblies for aircraft ground fuelling and defuelling—Specification

**ISO 20823** Determination of the flammability characteristics of fluids in contact with hot surfaces—Manifold ignition test

2.5 *UL Standard:*<sup>7</sup>

**UL 94** Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing

2.6 *Federal Standards:*<sup>8</sup>

**DOT/FAA/AR-03/21** Characterization of In-Plane, Shear-Loaded Adhesive Lap Joints: Experiments and Analysis

**DOT/FAA/AR-06/10** Guidelines and Recommended Criteria for the Development of a Material Specification for Carbon Fiber/Epoxy Fabric Prepregs

**14 CFR Part 33:49** Block Tests; Reciprocating Aircraft Engines—Endurance Test

**Fed-Std-791** Testing Method of Lubricants, Liquid Fuels, and Related Products

**MIL-S-8802** Sealing Compound, Temperature-Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High-Adhesion

**MIL-DTL-6000** Hose, Rubber, Aircraft, Fuel, Oil, Coolant, Water, and Alcohol

**Federal Aviation Administration, TSO-C80** Flexible and Oil Cell Material<sup>9</sup>

2.7 *SAE Standards:*<sup>10</sup>

**SAE AMS 3276** Sealing Compound, Integral Fuel Tanks and General Purpose, Intermittent Use to 360 °F (182 °C)

**SAE AMS 3277** Sealing Compound, Polythioether Rubber Fast Curing for Integral Fuel Tanks and General Purpose, Intermittent Use to 360 °F (182 °C)

**SAE AMS 3281** Sealing Compound, Polysulfide (T) Synthetic Rubber for Integral Fuel Tank and Fuel Cell Cavities Low Density for Intermittent Use to 360 °F (182 °C)

**SAE AS4842** Fittings and Bosses, Pipe Threaded, Fluid Connection

**SAE AS5127** Aerospace Standard Test Methods for Aerospace Sealants Two-Component Synthetic Rubber Compounds

**SAE AMS-P-5315** Acrylonitrile-butadiene (NBR) Rubber For Fuel-Resistant Seals 60 to 70

**SAE AMS-C-6183** Cork and Rubber Composition Sheet; for Aromatic Fuel and Oil Resistant Gaskets

**SAE AMS 7276** Rubber: Fluorocarbon (FKM) High-Temperature-Fluid Resistant Low Compression Set for Seals in Fuel Systems and Specific Engine Oil Systems

**SAE AMS-S-8802** Sealing Compound, Fuel Resistant, Integral Fuel Tanks and Fuel Cell Cavities

2.8 *IP Standards:*<sup>11</sup>

**IP 12** Determination of Specific Energy

**IP 15** Determination of Pour Point

**IP 16** Determination of Freezing Point of Aviation fuels—Manual Method

**IP 69** Determination of Vapour Pressure—Reid Method

**IP 71** Transparent and Opaque Liquids—Determination of Kinematic Viscosity and Calculation of Dynamic Viscosity

**IP 119** Knock Characteristics of Aviation Gasolines by the Supercharged Method

**IP 123** Determination of Distillation Characteristics at Atmospheric Pressure

**IP 138** Determination of Oxidation Stability of Aviation Fuel Potential Residue Method

**IP 160** Crude Petroleum and Liquid Petroleum Products—Laboratory Determination of Density—Hydrometer Method

**IP 196** Determination of Colour (ASTM scale)

**IP 219** Determination of Cloud Point

**IP 236** Determination of Knock Characteristics of Motor and Aviation Fuels—Motor Method

**IP 274** Determination of Electrical Conductivity of Aviation and Distillate Fuels

**IP 365** Crude Petroleum and Petroleum Products—Determination of Density—Oscillating U-tube Method

**IP 394** Liquid Petroleum Products—Vapour Pressure—Part 1: Determination of Air Saturated Vapour Pressure (ASVP) and Calculated Dry Vapour Pressure Equivalent (DVPE)

**IP 435** Determination of the Freezing Point of Aviation Turbine Fuels by the Automatic Phase Transition Method

### 3. Terminology

#### 3.1 Definitions:

<sup>11</sup> Available from Energy Institute, 61 New Cavendish St., London, W1G 7AR, U.K., <http://www.energyinst.org>.

<sup>4</sup> Available from Publications Team, Energy Institute, 61 New Cavendish St., London W1G 7AR, UK, <http://www.energyinst.org>.

<sup>5</sup> Available from UK Defence Standardization, Kentigern House, Rm. 1138, 65 Brown St., Glasgow G2 8EX.

<sup>6</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>7</sup> Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

<sup>8</sup> Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

<sup>9</sup> Available from Federal Aviation Administration (FAA), 800 Independence Ave., SW, Washington, DC 20591, <http://www.faa.gov>.

<sup>10</sup> Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.