



Designation: D6227 – 24

Standard Specification for Unleaded Aviation Gasoline Containing a Non-hydrocarbon Component¹

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1. Scope*

1.1 This specification covers Grades UL82 and UL87 unleaded aviation gasolines, which are defined by this specification and are only for use in engines and associated aircraft that are specifically approved by the engine and aircraft manufacturers, and certified by the National Certifying Agencies to use these fuels. Components containing hetero-atoms (oxygenates) may be present within the limits specified.

1.2 A fuel may be certified to meet this specification by a producer as Grade UL82 or UL87 aviation gasoline only if blended from component(s) approved for use in these grades of aviation gasoline by the refiner(s) of such components, because only the refiner(s) can attest to the component source and processing, absence of contamination, and the additives used and their concentrations. Consequently, reclassifying of any other product to Grade UL82 or Grade UL87 aviation gasoline does not meet this specification.

1.3 **Appendix X1** contains an explanation for the rationale of the specification. **Appendix X2** details the reasons for the individual specification requirements.

1.4 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.5 *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

- D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- D357 Method of Test for Knock Characteristics of Motor Fuels Below 100 Octane Number by the Motor Method; Replaced by D 2700 (Withdrawn 1969)³
- D381 Test Method for Gum Content in Fuels by Jet Evaporation
- D873 Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method)
- D909 Test Method for Supercharge Rating of Spark-Ignition Aviation Gasoline
- D910 Specification for Leaded Aviation Gasolines
- 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
- D2386 Test Method for Freezing Point of Aviation Fuels
- D2392 Test Method for Color of Dyed Aviation Gasolines
- D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
- D2699 Test Method for Research Octane Number of Spark-Ignition Engine Fuel
- D2700 Test Method for Motor Octane Number of Spark-Ignition Engine Fuel
- D3120 Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry
- D3231 Test Method for Phosphorus in Gasoline
- D3237 Test Method for Lead in Gasoline by Atomic Absorption Spectroscopy

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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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

D3338 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels

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

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

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)

D4815 Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C₁ to C₄ Alcohols in Gasoline by Gas Chromatography

D4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)

D5059 Test Methods for Lead and Manganese in Gasoline by X-Ray Fluorescence Spectroscopy

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

D5482 Test Method for Vapor Pressure of Petroleum Products and Liquid Fuels (Mini Method—Atmospheric)

D5599 Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection

D5845 Test Method for Determination of MTBE, ETBE, TAME, DIPE, Methanol, Ethanol and *tert*-Butanol in Gasoline by Infrared Spectroscopy

D5983 Specification for Methyl Tertiary-Butyl Ether (MTBE) for Blending With Gasolines for Use as Automotive Spark-Ignition Engine Fuel

D6469 Guide for Microbial Contamination in Fuels and Fuel Systems

D7220 Test Method for Sulfur in Automotive, Heating, and Jet Fuels by Monochromatic Energy Dispersive X-ray Fluorescence Spectrometry

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

2.2 *Military Standard*.⁴

MIL-PRF-25017F Performance Specification for Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble

QPL-25017 Qualified Products List of Products Qualified Under Performance Specification MIL-PRF-25017F

3. Terminology

3.1 Definitions:

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

3.1.2 *aviation gasoline, n*—gasoline possessing specific properties suitable for fueling aircraft powered by reciprocating spark ignition engines.

3.1.2.1 *Discussion*—The principal properties of aviation gasoline include volatility limits, stability, detonation-free performance in the engine for which it is intended, and suitability for low temperature performance.

3.1.3 *non-hydrocarbon, n*—compound or compounds composed of carbon, hydrogen and other elements such as O, N, S, and P.

3.1.4 *oxygenate, n*—an oxygen-containing ashless organic compound, such as an alcohol or ether, which may be used as fuel or fuel supplement.

4. Grades

4.1 The specification covers two grades of unleaded aviation gasoline designated Grade UL82 and Grade UL87.

5. General

5.1 This specification, unless otherwise provided, prescribes the required properties of unleaded aviation gasoline at the time and place of delivery.

6. Material

6.1 Aviation gasoline, except as otherwise specified in this specification, shall consist of blends of refined hydrocarbons derived from crude petroleum, natural gasoline or blends, thereof, with specific aliphatic ethers, synthetic hydrocarbons, or aromatic hydrocarbons. When applicable, methyl *tertiary*-butyl ether (MTBE) shall conform to the requirements of Specification **D5983**. Types and quantities of trace alcohols shall meet the requirements of **Table 1** and **6.2.4.2**.

6.2 Only additives approved by this specification are permitted. In addition to identification dyes, corrosion inhibitors, antioxidants, and metal deactivators, fuel system icing inhibitor additives are permitted under **6.2.4**. Permitted additives may be added to aviation gasoline in the amount and of the composition specified in the following list of approved materials. The quantities and types shall be declared by the manufacturer. Additives added after the point of manufacture shall also be declared.

6.2.1 *Antioxidants*—The following oxidation inhibitors may be added to the gasoline separately or in combination in total concentration not to exceed 12 mg of inhibitor (not including weight of solvent) per litre of fuel.

6.2.1.1 2,6-ditertiary-butyl-phenol.

6.2.1.2 2,6-ditertiary-butyl-4-methyl-phenol.

6.2.1.3 2,4-dimethyl-6-tertiary-butyl-phenol.

6.2.1.4 2,6-ditertiary-butyl-phenol, 75 % minimum.

Tertiary and tritertiary-butyl-phenols, 25 % maximum.

6.2.1.5 2,4-dimethyl-6-tertiary-butyl-phenol, 55 % minimum; 4-methyl-2,6-ditertiary-butyl phenol 15 % minimum; the remainder as a mixture of monomethyl and dimethyl-tertiary-butyl-phenols.

6.2.1.6 2,4-dimethyl-6-tertiary-butyl-phenol, 72 % minimum.

⁴ Available from Standardization Document Order Desk, 700 Robbins Ave., Bldg. 4D, Philadelphia, PA 19111-5094 Attn: NPODS.