



Designation: D910 – 24

Standard Specification for Leaded Aviation Gasolines¹

This standard is issued under the fixed designation D910; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification covers formulating specifications for purchases of aviation gasoline under contract and is intended primarily for use by purchasing agencies.

1.2 This specification defines specific types of aviation gasolines for civil use. It does not include all gasolines satisfactory for reciprocating aviation engines. Certain equipment or conditions of use may permit a wider, or require a narrower, range of characteristics than is shown by this specification.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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
- 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
- D323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
- D357 Method of Test for Knock Characteristics of Motor Fuels Below 100 Octane Number by the Motor Method;

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.

- Replaced by D 2700 (Withdrawn 1969)³
- D381 Test Method for Gum Content in Fuels by Jet Evaporation
- D614 Method of Test for Knock Characteristics of Aviation Fuels by the Aviation Method; Replaced by D 2700 (Withdrawn 1970)³
- D873 Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method)
- D909 Test Method for Supercharge Rating of Spark-Ignition Aviation Gasoline
- 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
- D1948 Method of Test for Knock Characteristics of Motor Fuels Above 100 Octane Number by the Motor Method; Replaced by D 2700 (Withdrawn 1968)³
- 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
- D2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
- D2700 Test Method for Motor Octane Number of Spark-Ignition Engine Fuel
- 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
- D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
- 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

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

- 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
- D5006** Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels
- 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
- D6469** Guide for Microbial Contamination in Fuels and Fuel Systems
- D7547** Specification for Hydrocarbon Unleaded Aviation Gasoline
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- 2.2 *EI Standards*:⁴
- IP 270** Determination of Lead Content of Gasoline – Iodine Monochloride Method

3. Terminology

3.1 Definitions:

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

3.1.1.1 *Discussion*—Principal properties include volatility limits, stability, detonation-free performance in the engine for which it is intended, and suitability for low temperature performance.

3.2 Abbreviations:

3.2.1 *LL*—low lead

3.2.2 *VLL*—very low lead

4. General

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

5. Classification

5.1 Three grades of leaded aviation gasoline are provided, known as:

- Grade 100
- Grade 100LL
- Grade 100VLL

NOTE 1—The above grade names are based on their octane/performance numbers as measured by the now obsolete Test Method **D614** (Discontinued 1970). A table for converting octane/performance numbers obtained by Test Method **D2700** motor method into aviation ratings was last published in Specification D910–94 in the 1995 *Annual Book of ASTM Standards*, Vol 05.01.

5.2 Grades 100, 100LL, and 100VLL represent aviation gasolines identical in minimum antiknock quality but differing in maximum lead content and color. The color identifies the difference for engines that have a low tolerance to lead.

NOTE 2—Listing of, and requirements for, Avgas Grades 91/98, 108/135, and 115/145 appeared in the 1967 version of this specification. U.S. Military Specification MIL-G-5572F, dated January 24, 1978 (withdrawn March 22, 1988), also covers grade 115/145 aviation gasoline, and is available as a research report.⁵ Listing of, and requirements for, Avgas Grades 80 and 91 appeared in the 2016 and 2017 versions of this specification respectively. Provision for unleaded Grade 91, with an optional supercharge **D909** test, has been made in Specification **D7547**.

5.3 Although the grade designations show only a single octane rating for each grade, they shall meet a minimum lean mixture motor rating and a minimum rich mixture supercharge rating (see **X1.2.2**).

6. Materials and Manufacture

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 synthetic hydrocarbons or aromatic hydrocarbons, or both.

6.2 *Additives—Mandatory*, shall be added to each grade of aviation gasoline in the amount and of the composition specified in the following list of approved materials.

6.2.1 *Tetraethyl Lead*, shall be added in the form of an antiknock mixture containing not less than 61 % by mass of tetraethyl lead and sufficient ethylene dibromide to provide two bromine atoms per atom of lead. The balance shall contain no added ingredients other than kerosene, an approved oxidation inhibitor, and blue dye, as specified herein. The maximum concentration limit for each grade of gasoline is specified in **Table 1**.

6.2.1.1 If mutually agreed upon by the fuel producer and additive vendor, tetraethyl lead antiknock mixture may be diluted with 20 % by mass of a mixed aromatic solvent having a minimum flash point of 60 °C according to Test Methods **D93** when the product is to be handled in cold climates. The TEL content of the dilute product is reduced to 49 % by mass, so that the amount of antiknock additive must be adjusted to achieve the necessary lead level. The dilute product still delivers two bromine atoms per atom of lead.

6.2.2 *Dyes*—The maximum concentration limits in each grade of gasoline are specified in **Table 1**.

6.2.2.1 The only blue dye that shall be present in the finished gasoline shall be essentially 1,4-dialkylaminoanthraquinone.

6.2.2.2 The only yellow dyes that shall be present in the finished gasoline shall be essentially p-diethylaminoazobenzene (Color Index No. 11021) or 1,3-benzenediol 2,4-bis [(alkylphenyl)azo-].

6.3 *Additives*—These may be added to each grade of aviation gasoline in the amount and of the composition specified in

⁴ Available from Energy Institute, 61 New Cavendish St., London, W1G 7AR, U.K., <http://www.energyinst.org>

⁵ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1255. Contact ASTM Customer Service at service@astm.org.