



Designation: D975 – 22a

## Standard Specification for Diesel Fuel<sup>1</sup>

This standard is issued under the fixed designation D975; 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.

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

### 1. Scope\*

1.1 This specification covers seven grades of diesel fuel suitable for various types of diesel engines. These grades are described as follows:

1.1.1 *Grade No. 1-D S15*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 15 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S15 fuel.<sup>2</sup>

1.1.2 *Grade No. 1-D S500*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 500 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S500 fuel.<sup>2</sup>

1.1.3 *Grade No. 1-D S5000*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 5000 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S5000 fuels.

1.1.4 *Grade No. 2-D S15*—A general purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 15 ppm sulfur (maximum). It is especially suitable for use in applications with conditions of varying speed and load.<sup>2</sup>

1.1.5 *Grade No. 2-D S500*—A general-purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 500 ppm sulfur (maximum). It is especially suitable for use in applications with conditions of varying speed and load.<sup>2</sup>

1.1.6 *Grade No. 2-D S5000*—A general-purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 5000 ppm sulfur (maximum), especially in conditions of varying speed and load.

<sup>1</sup> 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.E0 on Burner, Diesel and Non-Aviation Gas Turbine Fuels.

Current edition approved Nov. 1, 2022. Published December 2022. Originally approved in 1948. Last previous edition approved in 2022 as D975 – 22. DOI: 10.1520/D0975-22A.

<sup>2</sup> This fuel complies with 40 CFR Part 80—Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engines and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements: Final Rule. Regulation of Fuels and Fuel Additives: Fuel Quality Regulations for Highway Diesel Fuel Sold in 1993 and Later Calendar Years.

1.1.7 *Grade No. 4-D*—A heavy distillate fuel, or a blend of distillate and residual oil, for use in low- and medium-speed diesel engines in applications involving predominantly constant speed and load.

NOTE 1—A more detailed description of the grades of diesel fuels is given in X1.2.

NOTE 2—The Sxxx designation has been adopted to distinguish grades by sulfur rather than using words such as “Low Sulfur” as previously because the number of sulfur grades is growing and the word descriptions were thought to be not precise. S5000 grades correspond to the so-called “regular” sulfur grades, the previous No. 1-D and No. 2-D. S500 grades correspond to the previous “Low Sulfur” grades. S15 grades were not in the previous grade system and are commonly referred to as “Ultra-Low Sulfur” grades or ULSD.

1.2 This specification, unless otherwise provided by agreement between the purchaser and the supplier, prescribes the required properties of diesel fuels at the time and place of delivery.

1.2.1 Nothing in this specification shall preclude observance of federal, state, or local regulations which can be more restrictive.

NOTE 3—The generation and dissipation of static electricity can create problems in the handling of distillate diesel fuels. For more information on the subject, see Guide D4865.

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*:<sup>3</sup>  
D56 Test Method for Flash Point by Tag Closed Cup Tester  
D86 Test Method for Distillation of Petroleum Products and

<sup>3</sup> 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.

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

- Liquid Fuels at Atmospheric Pressure
- D93** Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
- D129** Test Method for Sulfur in Petroleum Products (General High Pressure Decomposition Device Method)
- D130** Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- D445** Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D482** Test Method for Ash from Petroleum Products
- D524** Test Method for Ramsbottom Carbon Residue of Petroleum Products
- D613** Test Method for Cetane Number of Diesel Fuel Oil
- D1266** Test Method for Sulfur in Petroleum Products (Lamp Method)
- D1319** Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
- D1552** Test Method for Sulfur in Petroleum Products by High Temperature Combustion and Infrared (IR) Detection or Thermal Conductivity Detection (TCD)
- D1796** Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)
- D2274** Test Method for Oxidation Stability of Distillate Fuel Oil (Accelerated Method)
- D2500** Test Method for Cloud Point of Petroleum Products and Liquid 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
- D2709** Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge
- D2880** Specification for Gas Turbine Fuel Oils
- 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
- D3828** Test Methods for Flash Point by Small Scale Closed Cup Tester
- D4057** Practice for Manual Sampling of Petroleum and Petroleum Products
- D4176** Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
- D4177** Practice for Automatic Sampling of Petroleum and Petroleum Products
- D4294** Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry
- D4306** Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination
- D4308** Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter
- D4539** Test Method for Filterability of Diesel Fuels by Low-Temperature Flow Test (LTFT)
- D4737** Test Method for Calculated Cetane Index by Four Variable Equation
- D4865** Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems
- D5304** Test Method for Assessing Middle Distillate Fuel Storage Stability by Oxygen Overpressure
- D5453** Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
- D5771** Test Method for Cloud Point of Petroleum Products and Liquid Fuels (Optical Detection Stepped Cooling Method)
- D5772** Test Method for Cloud Point of Petroleum Products and Liquid Fuels (Linear Cooling Rate Method)
- D5773** Test Method for Cloud Point of Petroleum Products and Liquid Fuels (Constant Cooling Rate Method)
- D5842** Practice for Sampling and Handling of Fuels for Volatility Measurement
- D5854** Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
- D6078** Test Method for Evaluating Lubricity of Diesel Fuels by the Scuffing Load Ball-on-Cylinder Lubricity Evaluator (SLBOCLE) (Withdrawn 2021)<sup>4</sup>
- D6079** Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR)
- D6217** Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration
- D6304** Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
- D6371** Test Method for Cold Filter Plugging Point of Diesel and Heating Fuels
- D6468** Test Method for High Temperature Stability of Middle Distillate Fuels
- D6469** Guide for Microbial Contamination in Fuels and Fuel Systems
- D6751** Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels
- D6890** Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber
- D6898** Test Method for Evaluating Diesel Fuel Lubricity by an Injection Pump Rig (Withdrawn 2021)<sup>4</sup>
- D7039** 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
- D7042** Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- D7094** Test Method for Flash Point by Modified Continuously Closed Cup (MCCCFP) Tester
- D7220** Test Method for Sulfur in Automotive, Heating, and Jet Fuels by Monochromatic Energy Dispersive X-ray Fluorescence Spectrometry
- D7344** Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (Mini Method)

<sup>4</sup>The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

- D7345** Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (Micro Distillation Method)
- D7371** Test Method for Determination of Biodiesel (Fatty Acid Methyl Esters) Content in Diesel Fuel Oil Using Mid Infrared Spectroscopy (FTIR-ATR-PLS Method)
- D7467** Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20)
- D7545** Test Method for Oxidation Stability of Middle Distillate Fuels—Rapid Small Scale Oxidation Test (RSSOT)
- D7619** Test Method for Sizing and Counting Particles in Light and Middle Distillate Fuels, by Automatic Particle Counter
- D7668** Test Method for Determination of Derived Cetane Number (DCN) of Diesel Fuel Oils—Ignition Delay and Combustion Delay Using a Constant Volume Combustion Chamber Method
- D7683** Test Method for Cloud Point of Petroleum Products and Liquid Fuels (Small Test Jar Method)
- D7688** Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR) by Visual Observation
- D7689** Test Method for Cloud Point of Petroleum Products and Liquid Fuels (Mini Method)
- D7861** Test Method for Determination of Fatty Acid Methyl Esters (FAME) in Diesel Fuel by Linear Variable Filter (LVF) Array Based Mid-Infrared Spectroscopy
- D7945** Test Method for Determination of Dynamic Viscosity and Derived Kinematic Viscosity of Liquids by Constant Pressure Viscometer
- D8183** Test Method for Determination of Indicated Cetane Number (ICN) of Diesel Fuel Oils using a Constant Volume Combustion Chamber—Reference Fuels Calibration Method
- D8148** Test Method for Spectroscopic Determination of Haze in Fuels
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E1064** Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration
- 2.2 Other Documents:**
- 26 CFR Part 48** Manufacturers and Realtors Excise Taxes<sup>5</sup>
- 40 CFR Part 80** Regulation of Fuels and Fuel Additives<sup>5</sup>
- API RP 2003** Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents<sup>6</sup>
- EN 14078** Liquid petroleum products—Determination of fatty acid methyl esters (FAME) in middle distillates—Infrared spectroscopy method<sup>7</sup>
- EN 15751** Automotive fuels—Fatty acid methyl ester (FAME) fuel and blends with diesel fuel—Determination of oxidation stability by accelerated oxidation method<sup>7</sup>
- IP 156** Determination of hydrocarbon types in petroleum

- products—Fluorescent indicator adsorption method<sup>8</sup>
- ISO 4406** Hydraulic fluid power—Fluids—Method for coding the level of contamination by solid particles<sup>6</sup>
- ISO 16889** Hydraulic fluid power—Filters—Multi-pass method for evaluating filtration performance of a filter element<sup>6</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *additive, n—in diesel fuels*, a substance added to diesel fuel at a blend level not greater than 1 % by volume of the finished fuel.

3.1.1.1 *Discussion*—Additives are generally included in finished diesel fuel to enhance performance properties (for example, cetane number, lubricity, cold flow, etc.).

3.1.1.2 *Discussion*—Additives that contain hydrocarbon oil blended with other substances may exclude the hydrocarbon oil portion for determination of the volume percent of the additive in the finished fuel.

3.1.1.3 *Discussion*—Triglycerides (for example, vegetable oils, animal fats, greases, and so forth) have been found to cause fouling of fuel oil burning equipment. Similar fouling is expected in diesel engine applications and triglycerides are therefore not allowed as additives or components of additives.

3.1.2 *alternative blendstock, n—in diesel fuels and fuel oils*, a non-hydrocarbon oil substance added to diesel fuel and fuel oil at blend levels greater than 1 % by volume of the finished fuel.

3.1.2.1 *Discussion*—An alternative blendstock should normally have an industry consensus standard or an annex in this specification that defines its physical and chemical properties.

3.1.2.2 *Discussion*—See **Appendix X7** for guidance regarding new materials for #1-D and #2-D grades of diesel fuels.

3.1.3 *biodiesel, n*—fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100.

3.1.4 *biodiesel blend (BXX), n*—a homogeneous mixture of hydrocarbon oils and mono-alkyl esters of long chain fatty acids.

3.1.4.1 *Discussion*—In the abbreviation, BXX, the XX represents the volume percentage of biodiesel in the blend.

3.1.5 *diesel fuel, n*—liquid specifically designed for injection into a compression-ignition engine to provide energy.

3.1.5.1 *Discussion*—The liquid is frequently a mixture consisting primarily of hydrocarbons. For D975 compliant diesel fuels, see the section on Alternative Blendstocks for allowed non-hydrocarbon blendstocks.

3.1.5.2 *Discussion*—A compression-ignition engine is frequently called a diesel engine. In this type of engine, the combustion reactions are initiated when the injected fuel mixes with the hot compressed gases in the combustion zone. There is no spark. The properties of the fuel must support the requirements for compression-ignition engines.

<sup>5</sup> Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

<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 the National CEN members listed on the CEN website ([www.cenorm.be](http://www.cenorm.be)) or from the CEN/TC 19 Secretariat ([astm.@nen.nl](mailto:astm.@nen.nl)).

<sup>8</sup> Available from Energy Institute, 61 New Cavendish St., London, W1G 7AR, U.K., <http://www.energyinst.org>.