



Designation: D6751 – 20a

Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels¹

This standard is issued under the fixed designation D6751; 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*

1.1 This specification covers four grades of biodiesel (B100) for use as a blend component with middle distillate fuels. These grades are described as follows:

1.1.1 *Grade No. 1-B S15*—A special purpose biodiesel blendstock intended for use in middle distillate fuel applications which can be sensitive to the presence of partially reacted glycerides, including those applications requiring good low temperature operability, and also requiring a fuel blend component with 15 ppm sulfur (maximum).

1.1.2 *Grade No. 1-B S500*—A special purpose biodiesel blendstock intended for use in middle distillate fuel applications which can be sensitive to the presence of partially reacted glycerides, including those applications requiring good low temperature operability, and also requiring a fuel blend component with 500 ppm sulfur (maximum).

1.1.3 *Grade No. 2-B S15*—A general purpose biodiesel blendstock intended for use in middle distillate fuel applications that require a fuel blend component with 15 ppm sulfur (maximum).

1.1.4 *Grade No. 2-B S500*—A general purpose biodiesel blendstock intended for use in middle distillate fuel applications that require a fuel blend component with 500 ppm sulfur (maximum).

1.2 This specification prescribes the required properties of diesel fuels at the time and place of delivery. The specification requirements may be applied at other points in the production and distribution system when provided by agreement between the purchaser and the supplier.

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

NOTE 1—The generation and dissipation of static electricity can create problems in the handling of distillate fuel oils with which biodiesel may be blended. For more information on the subject, see Guide D4865.

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.E0 on Burner, Diesel and Non-Aviation Gas Turbine Fuels.

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

- 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
- D189 Test Method for Conradson Carbon Residue of Petroleum Products
- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D524 Test Method for Ramsbottom Carbon Residue of Petroleum Products
- D613 Test Method for Cetane Number of Diesel Fuel Oil
- D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration
- D874 Test Method for Sulfated Ash from Lubricating Oils and Additives
- D974 Test Method for Acid and Base Number by Color-Indicator Titration
- D975 Specification for Diesel Fuel
- D976 Test Method for Calculated Cetane Index of Distillate Fuels
- D1160 Test Method for Distillation of Petroleum Products at Reduced Pressure
- D1266 Test Method for Sulfur in Petroleum Products (Lamp 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.

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

- 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
- D2709** Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge
- D2880** Specification for Gas Turbine Fuel Oils
- D3120** Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry
- D3242** Test Method for Acidity in Aviation Turbine Fuel
- D3828** Test Methods for Flash Point by Small Scale Closed Cup Tester
- D4057** Practice for Manual Sampling of Petroleum and Petroleum Products
- 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
- D4530** Test Method for Determination of Carbon Residue (Micro Method)
- D4737** Test Method for Calculated Cetane Index by Four Variable Equation
- D4865** Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems
- D4951** Test Method for Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry
- 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)
- D6217** Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration
- D6450** Test Method for Flash Point by Continuously Closed Cup (CCCFP) Tester
- D6469** Guide for Microbial Contamination in Fuels and Fuel Systems
- D6584** Test Method for Determination of Total Monoglycerides, Total Diglycerides, Total Triglycerides, and Free and Total Glycerin in B-100 Biodiesel Methyl Esters by Gas Chromatography
- D6890** Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber
- 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)
- D7344** Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (Mini Method)
- D7345** Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (Micro Distillation Method)
- D7397** Test Method for Cloud Point of Petroleum Products and Liquid Fuels (Miniaturized Optical Method)
- D7501** Test Method for Determination of Fuel Filter Blocking Potential of Biodiesel (B100) Blend Stock by Cold Soak Filtration Test (CSFT)
- 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
- D7689** Test Method for Cloud Point of Petroleum Products and Liquid Fuels (Mini Method)
- 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
- 2.2 Government Standard:**
- 40 CFR Part 79** Registration of Fuels and Fuel Additives Section 211(b) Clean Air Act³
- 2.3 Other Documents:**
- AOCS Standard Procedure Ck 2-09**⁴ Determination of Various Properties of Biodiesel by the QTA System Method⁵
- UOP 389** Trace Metals in Oils by Wet Ashing and ICP-OES⁶
- UOP 391–91** Trace Metals in Petroleum Products or Organics by AAS⁶
- EN 14105** Fat and Oil Derivatives—Fatty Acid Methyl Esters (FAME)—Determination of Free and Total Glycerol and Mono-, Di-, Triglyceride Contents (Reference Method)⁷
- EN 14110** Fat and Oil Derivatives—Fatty Acid Methyl Esters (FAME)—Determination of Methanol Content⁷
- EN 14112** Fat and Oil Derivatives—Fatty Acid Methyl Esters (FAME)—Determination of Oxidation Stability (Accelerated Oxidation Test)⁷
- EN 14538** Fat and Oil Derivatives—Fatty Acid Methyl Esters (FAME)—Determination of Ca, K, Mg and Na

³ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

⁴ Available from AOCS Headquarters, 2710 S. Boulder, Urbana, IL 61802-6996. Download Product Code: MC-CK209 from www.aocs.org.

⁵ QTA is a registered trademark of the Cognis Corporation, 5051 Estecreek Drive, Cincinnati, OH 45232-1446.

⁶ Available from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA. Visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org.

⁷ Available from the National CEN Members listed on the CEN website (www.cenorm.be) or from the CEN/TC19 secretariat (astm@nen.nl).

Content by Optical Emission Spectral Analysis with Inductively Coupled Plasma (ICP OES)⁷
EN 15751 Automotive Fuels—Fatty Acid Methyl Ester (FAME) Fuel and Blends with Diesel Fuel—Determination of Oxidation Stability by Accelerated Oxidation Method⁷

3. Terminology

3.1 Definitions:

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

3.1.1.1 *Discussion—biodiesel*, as defined above, is registered with the U.S. EPA as a fuel and a fuel additive under Section 211(b) of the Clean Air Act (40 CFR Part 79). There is, however, other usage of the term biodiesel in the marketplace. Due to its EPA registration and the widespread commercial use of the term biodiesel in the U.S. marketplace, the term biodiesel will be maintained for this specification.

3.1.1.2 *Discussion—Biodiesel* is typically produced by a reaction of a vegetable oil or animal fat with an alcohol such as methanol or ethanol in the presence of a catalyst to yield mono-alkyl esters and glycerin, which is removed. The finished biodiesel derives approximately 10 % of its mass from the reacted alcohol. The alcohol used in the reaction may or may not come from renewable resources.

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

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

3.1.2.2 *Discussion—*The mono-alkyl esters of long chain fatty acids (that is, biodiesel) used in the mixture shall meet the requirements of Specification D6751.

3.1.2.3 *Discussion—*Diesel fuel, fuel oil, and non-aviation gas turbine oil are examples of hydrocarbon oils.

3.1.3 *biodiesel fuel*, *n*—synonym for *biodiesel*.

3.1.4 *free glycerin*, *n*—a measure of the amount of glycerin remaining in the fuel.

3.1.5 *Grade S15 B100*, *n*—a grade of biodiesel meeting ASTM Specification D6751 and having a sulfur specification of 15 ppm maximum.

3.1.6 *Grade S500 B100*, *n*—a grade of biodiesel meeting ASTM Specification D6751 and having a sulfur specification of 500 ppm maximum.

3.1.7 *middle distillate fuel*, *n*—kerosines and gas oils boiling between approximately 150 °C and 400 °C at normal atmospheric pressure and having a closed-cup flash point above 38 °C.

3.1.8 *monoglyceride*, *n*—a partially reacted fat or oil molecule with one long chain alkyl ester group on a glycerin backbone.

3.1.9 *total glycerin*, *n*—the sum of the free glycerin and the glycerin portion of any unreacted or partially reacted oil or fat.

4. Requirements

4.1 The biodiesel specified shall be mono-alkyl esters of long chain fatty acids derived from vegetable oils and animal fats.

4.2 Unless otherwise specified, samples for analysis shall be taken by the procedure described in Practices D4057 or D4177.

4.3 The biodiesel specified shall conform to the detailed requirements shown in Table 1.

NOTE 2—A considerable amount of experience exists in the U.S. with a 20 % blend of biodiesel, primarily produced from soybean oil, with 80 % diesel fuel (B20). Experience with biodiesel produced from animal fat and other oils is similar. Experience with B20 and lower blends in other applications is not as prevalent. Although biodiesel (B100) can be used, blends of over 20 % biodiesel with diesel fuel (B20) should be evaluated on a case by case basis until further experience is available.

NOTE 3—The user should consult the equipment manufacturer or owner's manual regarding the suitability of using biodiesel or biodiesel blends in a particular engine or application.

5. Test Methods

5.1 The requirements enumerated in this specification shall be determined in accordance with the following methods.

5.1.1 *Flash Point*—Test Methods D93, except where other methods are prescribed by law. Test Methods D3828 or D6450 can also be used. The precision and bias of Test Methods D3828 and D6450 with biodiesel is not known and is currently under investigation. Test Methods D93 shall be the referee method.

5.1.2 *Water and Sediment*—Test Method D2709. Test Method D1796 may also be used. Test Method D2709 shall be the referee method. The precision and bias of these test methods with biodiesel is not known and is currently under investigation.

5.1.3 *Viscosity*—Test Methods D445, D7042, or D7945 may be used with the same limits. Bias-corrected results from Test Method D7042 shall be reported as “Predicted D445.” Use bias correction for biodiesel fuel according the Precision and Bias section of Test Method D7042. In case of dispute, Test Method D445 shall be used as the referee test method.

5.1.4 *Monoglycerides*—Test Method D6584, Test Method EN 14105, and AOCs Standard Procedure Ck 2-09 may be used. Test Method D6584 shall be the referee test method.

5.1.5 *Sulfated Ash*—Test Method D874.

5.1.6 *Oxidation Stability*—Test Method EN 15751. Test Method EN 14112 may also be used. See X1.19.1 for further information. Test Method EN 15751 shall be the referee test method.

5.1.7 *Sulfur*—Test Method D5453. Test Method D7039 may also be used. Other test methods may also be suitable for determining up to 0.05 % (500 ppm) sulfur in biodiesel fuels such as Test Methods D1266, D2622, D3120 and D4294 but may provide falsely high results (see X1.5) although their precision and bias with biodiesel is unknown. Test Method D5453 shall be the referee test method.

5.1.8 *Corrosion*—Test Method D130, 3 h test at 50 °C.

5.1.9 *Cetane Number*—Test Method D613. Test Method D6890, D7668 (see Note 4), or D8183 (Note 5) may also be used. In case of dispute, Test Method D613 shall be the referee method.