Designation: D4806 – 21a

Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel[1]

This standard is issued under the fixed designation D4806; 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 nominally anhydrous denatured fuel ethanol intended to be blended with unleaded or leaded gasolines at 1 % to 15 % by volume for use as automotive spark-ignition engine fuel covered by Specification D4814 as well as other fuel applications or specifications involving ethanol. The significance of this specification is shown in Appendix X1.

1.2 Jurisdictions may vary in their regulatory requirements for the allowable or prohibited types of denaturants, chemical composition of the denaturant or concentration of denaturant needed to denature the ethanol. The user is advised to check with the national and regional regulatory agencies where the ethanol is denatured and used.

1.2.1 Specific regulatory requirements for denatured fuel ethanol and acceptable denaturants from various jurisdictions are given in Appendixes for information.

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

1.3.1 *Exception*—Values given in parentheses are provided for information only. Non-SI units are shown in the Appendix if they are in a direct quotation from government regulations. In most cases, U.S. federal regulations specify non-SI units.

1.4 The following safety hazards caveat pertains only to the method modification in 8.7 of this specification: *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.*

1.5 *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

D381 Test Method for Gum Content in Fuels by Jet Evaporation

D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

D1613 Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products

D1688 Test Methods for Copper in Water

D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry

D3120 Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry

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

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

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination

D4814 Specification for Automotive Spark-Ignition Engine Fuel

D5453 Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence

D5501 Test Method for Determination of Ethanol and Methanol Content in Fuels Containing Greater than 20 %

[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.A0.02 on Oxygenated Fuels and Components.

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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.

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

Ethanol by Gas Chromatography
D5580 Test Method for Determination of Benzene, Toluene, Ethylbenzene, *p/m*-Xylene, *o*-Xylene, C_9 and Heavier Aromatics, and Total Aromatics in Finished Gasoline by Gas Chromatography
D5854 Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
D6423 Test Method for Determination of pHe of Denatured Fuel Ethanol and Ethanol Fuel Blends
D6550 Test Method for Determination of Olefin Content of Gasolines by Supercritical-Fluid Chromatography
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
D7318 Test Method for Existent Inorganic Sulfate in Ethanol by Potentiometric Titration
D7319 Test Method for Determination of Existent and Potential Sulfate and Inorganic Chloride in Fuel Ethanol and Butanol by Direct Injection Suppressed Ion Chromatography
D7328 Test Method for Determination of Existent and Potential Inorganic Sulfate and Total Inorganic Chloride in Fuel Ethanol by Ion Chromatography Using Aqueous Sample Injection
D7347 Test Method for Determination of Olefin Content in Denatured Ethanol by Supercritical Fluid Chromatography
D7576 Test Method for Determination of Benzene and Total Aromatics in Denatured Fuel Ethanol by Gas Chromatography
D7757 Test Method for Silicon in Gasoline and Related Products by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry
D7795 Test Method for Acidity in Ethanol and Ethanol Blends by Titration
D7923 Test Method for Water in Ethanol and Hydrocarbon Blends by Karl Fischer Titration
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E203 Test Method for Water Using Volumetric Karl Fischer Titration
E300 Practice for Sampling Industrial Chemicals
E1064 Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration

2.2 *Government Regulations:*
United States Code of Federal Regulations, Title 27, Parts 19, 20, and 21[3]
United States Code of Federal Regulations, Title 40, Parts 80 and 1090[3]
California Code of Regulations, CCR Title 13, § 2260 – § 2298[4]

[3] A printed copy of the Code of Federal Regulations may be purchased from the U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401 or the online store at http://bookstore.gpo.gov/CFR. The Code of Federal Regulations may be browsed online at https://www.govinfo.gov/app/collection/cfr/.

[4] California regulations are available online at http://government.westlaw.com.

3. Terminology

3.1 For general terminology, refer to Terminology D4175.

NOTE 1—The user is advised that the definitions used by various industries, marketers, and regulatory bodies can differ from those specific to this specification. It is the responsibility of the user to ensure that the terms used in a particular context are clearly understood.

3.2 *Definitions:*

3.2.1 *denaturants, n*—materials added to ethanol to make it unsuitable for beverage use under a formula approved by a regulatory agency to prevent the imposition of beverage alcohol tax.

3.2.1.1 *Discussion*—Denaturants are only those materials added by the denaturer to comply with the approved formula; any materials absorbed later are not denaturants.

3.2.2 *denatured fuel ethanol, n*—fuel ethanol made unfit for beverage use by the addition of denaturants under formula(s) approved by the applicable regulatory agency to prevent the imposition of beverage alcohol tax.

3.2.3 *ethanol, n*—ethyl alcohol, the chemical compound CH_3CH_2OH.

3.2.4 *fuel ethanol, n*—a grade of ethanol with other components common to its production (including water) that do not affect the use of the product as a component for automotive spark-ignition engine fuels.

3.2.4.1 *Discussion*—The common components do not include denaturant.

3.2.5 *gasoline, n*—a volatile mixture of liquid hydrocarbons, generally containing small amounts of additives, suitable for use as a fuel in spark-ignition, internal combustion engines. **D4814**

3.2.6 *gasoline blendstock, n*—a liquid hydrocarbon component suitable for use in spark-ignition engine fuels.

3.2.6.1 *Discussion*—Examples of gasoline blendstock include natural gasoline, raffinate, reformate, conventional gasoline blendstock for oxygenate blending (CBOB), and reformulated gasoline blendstock for oxygenate blending (RBOB).

3.2.7 *gasoline-ethanol blend, n*—a fuel consisting primarily of gasoline along with a substantial amount (more than 0.35 % by mass oxygen) of denatured fuel ethanol.

3.2.8 *oxygenate, n*—a molecule composed solely of carbon, hydrogen, and oxygen. **D4814**

3.2.8.1 *Discussion*—In this standard, the oxygenate of interest is ethanol.

3.2.9 *pHe, n*—a measure of hydrogen ion activity, defined by Test Method D6423. **D6423**

3.2.9.1 *Discussion*—The traditional pH measurement of hydrogen ion activity is in an aqueous system but the measurement done in Test Method D6423 is in a nearly anhydrous environment. **D6423**

3.3 *Abbreviations:*

3.3.1 *CCR*—California Code of Regulations

3.3.2 *CFR*—U.S. Code of Federal Regulations

3.3.3 *DFE*—Denatured Fuel Ethanol

3.3.4 *EPA*—The U.S. Environmental Protection Agency