Designation: ~~D5983 – 18~~ D5983 – 21

Standard Specification for Methyl Tertiary-Butyl Ether (MTBE) for Blending With Gasolines for Use as Automotive Spark-Ignition Engine Fuel[1]

This standard is issued under the fixed designation D5983; 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 requirements for fuel grade methyl *tertiary*-butyl ether utilized in blending with gasolines at 1 % to 15 % by volume (equivalent to 2.7 % by weight oxygen) for use as automotive spark-ignition engine fuel covered by Specification D4814 as well as other automotive fuel applications involving MTBE. Other MTBE grades may be available for blending that are not covered by this specification.

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

1.3 *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]

D156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
D381 Test Method for Gum Content in Fuels by Jet Evaporation
D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
D4045 Test Method for Sulfur in Petroleum Products by Hydrogenolysis and Rateometric Colorimetry
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
D5441 Test Method for Analysis of Methyl Tert-Butyl Ether (MTBE) by Gas Chromatography
D5854 Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
D7757 Test Method for Silicon in Gasoline and Related Products by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry
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

[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.

Current edition approved ~~Dec. 1, 2018~~July 1, 2021. Published ~~January 2019~~July 2021. Originally approved in 1996. Last previous edition approved in ~~2017~~2018 as ~~D5983 – 17.~~D5983 – 18. DOI: ~~10.1520/D5983-18.~~10.1520/D5983-21.

[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**

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

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 *methanol, n*—methyl alcohol, the chemical compound CH_3OH. **D5797**

3.2.2 *methyl tertiary-butyl ether (MTBE), n*—the chemical compound $CH_3OC(CH_3)_3$.

3.2.2.1 *Discussion*—
MTBE is also known as 2-methoxy-2-methylpropane.

3.2.3 *oxygenate, n*—~~an oxygen-containing ashless, organic compound, such as an alcohol or ether, which may be used as a fuel or fuel supplement.~~a molecule composed solely of carbon, hydrogen, and oxygen. **D4814**

3.2.3.1 *Discussion*—
In this standard, the oxygenate of interest is MTBE.

4. Performance Requirements

4.1 Methyl *tertiary*-butyl ether utilized with fuels for ground vehicles equipped with spark-ignition engines shall conform to the requirements of Table 1.

4.2 *Other Properties*—Limits more restrictive than those specified in Table 1, or the specification of additional properties, may be agreed upon between the supplier and the purchaser.

4.3 For purposes of determining conformance with these specification limits, an observed value or a calculated value shall be rounded "to the nearest unit" in the right-most significant digit used in expressing the specification limit, in accordance with the rounding method of Practice E29. All digits expressed in the specification limits are to be considered significant digits.

5. Workmanship

5.1 At the point of custody transfer, the MTBE shall be visually free of undissolved water, sediment, suspended or undissolved matter. It shall be clear and bright at the fuel temperature at the point of custody transfer or at a lower temperature agreed upon by the purchaser and seller.

5.1.1 Ethers, such as MTBE, are visually clear and bright under normal conditions when free of contamination.

TABLE 1 Performance Requirements

Property	Limits	Method
MTBE, % by mass, min	95.0	D5441
Methanol, % by mass, max	0.5	D5441
Water, % by mass, max	0.10	D7923, E203, or E1064
Sulfur, mg/kg, max	30[A]	D2622 or D4045
Solvent-washed gum content, mg/100 mL, max	5[B]	D381

[A] Individual applications may require a more restrictive sulfur limit. These requirements are to be negotiated between buyer and seller.
[B] MTBE does not typically contain any measurable solvent-washed gum content. The limit is included to ensure that finished blends of gasoline do not contain excess solvent-washed gum and handling contamination is minimized.

5.2 The specification defines only a basic purity for this product. The product shall be free of any adulterant or contaminant that can render the material unacceptable for its commonly used applications.

5.2.1 If the product appears discolored, contamination of the product may have occurred and testing for contamination may be warranted. Test Method D156 may be helpful in assessing the degree of color of the product.

5.3 Manufacturers and importers of MTBE shall avoid contamination by silicon-containing materials. Silicon contamination of gasoline-oxygenate blends has led to fouled vehicle components (for example, spark plugs, exhaust oxygen sensors, catalytic converters) requiring parts replacement and repairs. Test Method D7757 is a procedure for determining silicon that might be applicable to MTBE. Additional studies will be needed to include MTBE into the scope of Test Method D7757. No specification limits have been established for silicon.

5.4 Manufacturers and importers of MTBE shall avoid contamination by chlorine or chloride-containing materials such as saltwater or halogenated hydrocarbons. Low concentrations of chloride ions are corrosive to many metals.

5.5 Manufacturers and importers of MTBE shall avoid contamination by sulfur-containing materials that may cause an increase in the fuel sulfur content.

5.6 In case of dispute or cargo contamination and to test for suitability for the intended use, corrosion test values shall not exceed those of automotive spark-ignition engine fuel specifications.

6. Sampling, Containers, and Sample Handling

6.1 The user is strongly advised to review all intended test methods prior to sampling in order to understand the importance and effects of sampling technique, proper containers, and special handling required for each test method.

6.2 Correct sampling procedures are critical to obtain a sample representative of the lot intended to be tested. Use appropriate procedures in Practice D4057 or Practice E300 for manual method sampling and in Practice D4177 for automatic method sampling as applicable.

6.3 The correct sample volume and appropriate container selection are important decisions that can impact test results. Refer to Practice D4306 for aviation fuel container selection for tests sensitive to trace contamination. Refer to Practice D5854 for procedures on container selection and sample mixing and handling. Where practical, MTBE should be sampled in glass containers. If samples must be collected in metal containers, do not use soldered metal containers. This is because the soldering flux in the containers and the lead in the solder can contaminate the samples. Plastic containers should be avoided.

6.4 *Sample Size*—A minimum of about 0.5 L is recommended.

6.5 *Lot Size*—A lot shall normally consist of the amount contained in a tanker compartment or other bulk container in which it is delivered. If this definition does not apply, the definition of a lot must be agreed upon between the supplier and purchaser.

NOTE 2—See Sections 5, 6, and 7 on Significance, Safety, and Statistical Considerations, respectively, of Practice E300 for a detailed discussion of the statistics of sampling.

7. Test Methods

7.1 The scope of some of the test methods specified below do not include MTBE. The precision of those test methods may differ from the reported precisions when testing MTBE.

7.2 *MTBE, % by Mass*—Test Method D5441.

7.3 *Methanol, % by Mass*—Test Method D5441.

7.4 *Water Content*—Test Method D7923, E203, or E1064.

7.5 *Sulfur*—Test Method D2622 or D4045.

7.6 *Solvent-Washed Gum Content*—Test Method D381, air-jet apparatus.

8. Keywords

8.1 automotive spark-ignition engine fuel; blending; chloride; corrosion; impurities; methanol; methyl *tertiary*-butyl ether; oxygenate; sulfur; water content

APPENDIX

(Nonmandatory Information)

X1. SIGNIFICANCE OF ASTM SPECIFICATION FOR MTBE FOR BLENDING WITH GASOLINE FOR USE IN AUTOMOTIVE SPARK-IGNITION ENGINE FUEL

X1.1 General

X1.1.1 Methyl *tertiary*-butyl ether may be used as a blending component for automotive spark-ignition engine fuel to meet the oxygenate content requirements or improve the antiknock quality, or both, of certain types of fuels. MTBE purchased under this specification will assist terminal or downstream blenders in the use of MTBE as a blending component.

X1.1.2 The composition of unleaded fuel is subject to the rules, regulations, and Clean Air Act waivers of the U.S. Environmental Protection Agency (EPA). The use of oxygenates in blends with unleaded gasoline is described under Section 211(f) (1) of the Clean Air Act. The performance requirements of this specification were established to help ensure that the addition (in appropriate amounts) of MTBE as described in this specification would not be detrimental to the properties of the fuel blend.

X1.1.3 The user is advised to check with the national authorities where MTBE is used. Some states in the U.S. limit the sale of gasoline containing MTBE in their retail distribution and retail gasoline markets. Other countries, states, or jurisdictions may allow or require other limits.

X1.2 Appearance

X1.2.1 Methyl *tertiary*-butyl ether as covered by this specification is a relatively pure material. Suspended materials, sediments, or contaminants in the MTBE which cause a cloudy or colored appearance may adversely affect the performance of the finished fuel blend in automotive spark-ignition engines. Also, a cloudy or colored appearance may indicate excessive water or contamination by materials not directly measured under this specification.

X1.2.1.1 Fuel components can encounter conditions in the bulk distribution system that could cause the material to fail a workmanship visual evaluation. Some fuel components can contain water, dirt, or rust particles during distribution. Terminals or bulk plants can address these issues with proper operating procedures, for example, by allowing sufficient time for the free water, dirt, or particles to settle in a tank, by filtration or by other means.

X1.2.1.2 Turbidity, phase separation, or evidence of precipitation normally indicate contamination.