



Designation: D5983 – 15

# Standard Specification for Methyl Tertiary-Butyl Ether (MTBE) for Downstream Blending for Use in Automotive Spark-Ignition Engine Fuel<sup>1</sup>

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 ( $\epsilon$ ) 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 commerce, terminal blending, or downstream blending with fuels for spark-ignition engines. 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.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test
- D156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
- 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
- D4045 Test Method for Sulfur in Petroleum Products by Hydrogenolysis and Rateometric Colorimetry
- 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
- 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
- D4306 Practice for Aviation Fuel Sample Containers for

### Tests Affected by Trace Contamination

- D4814 Specification for Automotive Spark-Ignition Engine Fuel
- D4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)
- 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
- 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 Definitions:

- 3.1.1 *methanol, n*—the chemical compound  $\text{CH}_3\text{OH}$ .
- 3.1.2 *methyl tertiary-butyl ether (MTBE), n*—the chemical compound  $(\text{CH}_3)_3\text{COCH}_3$  [ $\text{C}_5\text{H}_{12}\text{O}$ ].
- 3.1.3 *oxygenate, n*—an oxygen-containing ashless, organic compound, such as an alcohol or ether, which may be used as a fuel or fuel supplement.

## 4. Performance Requirements

4.1 Methyl *tertiary*-butyl ether utilized in commerce, terminal blending, or downstream blending with fuels for ground vehicles equipped with spark-ignition engines shall conform to the requirements of [Table 1](#).

NOTE 1—Individual applications may require a more restrictive sulfur limit. These requirements are to be negotiated between buyer and seller.

## 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.

NOTE 2—Fuel components should be resistant to phase separation or

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<sup>2</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

**TABLE 1 Performance Requirements**

Property	Limits
Appearance	Clear and bright
Color, Saybolt, min	+ 5
Sulfur, mg/kg, max	300
Solvent-washed gum content, mg/100 mL, max	5.0
Copper strip corrosion, max	1
MTBE, % by mass, min	95.0
Methanol, % by mass, max	0.5
Vapor pressure, kPa, max	62
Water, % by mass, max	0.10
API gravity at 15.6 °C or density at 15 °C, kg/L	Report

undissolved matter at the lowest temperatures to which it is likely to be subjected, dependent on the time and place of its intended use. See Specification **D4814**, Table X7.1 for guidance.

NOTE 3—Solubility is temperature dependent. As this fuel component cools, water and some high molecular weight additives can become insoluble.

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.

5.3 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.

## 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 2 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.

## 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 *Appearance*—Test Method **D4176**, Procedure 1.

7.3 *Sulfur*—Test Method **D4045** (see **Note 4**).

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

7.5 *MTBE, % by mass*—Test Method **D5441**.

7.6 *Methanol, % by mass*—Test Method **D5441**.

7.7 *API Gravity at 15.6 °C*—Practice **D1298**.

7.8 *Density at 15 °C*—Practice **D1298** or Test Method **D4052**.

7.9 *Copper Strip Corrosion*—Test Method **D130**, 3 h at 50 °C.

7.10 *Water Content*—Test Methods **E203** or **E1064**.

7.11 *Vapor Pressure*—Test Method **D4953**.

7.12 *Color, Saybolt*—Test Method **D156**.

NOTE 4—Test Method **D4045** may require dilution of the sample with a sulfur-free diluent.

## 8. Keywords

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