



Standard Test Method for Manganese In Gasoline By Atomic Absorption Spectroscopy¹

This standard is issued under the fixed designation D 3831; 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 test method covers the determination of the total manganese content, present as methylcyclopentadienyl manganese tricarbonyl (MMT)², of gasoline within the concentration range from 0.25 to 0.30 mg of manganese/L (0.001 to 0.120 g/U.S. gal).

1.2 This test method is not applicable to gasoline containing highly cracked materials (greater than 20 Bromine Numbers).

1.3 This test method has been developed and tested specifically for the determination of MMT in gasoline over the recommended concentration range. Application of the method to other concentration ranges, to the determination of MMT in other materials, or to the determination of other manganese compounds in gasoline have not been tested

1.4 *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 and health practices and determine the applicability of regulatory limitations prior to use. For specific precautionary statements, see Section 7.*

1.5 The values stated in SI units are to be regarded as the standard. For reporting purposes, the values stated in grams per U.S. gallon are the preferred units in the United States.

2. Referenced Documents

2.1 ASTM Standards:

D 1159 Test Method for Bromine Number of Petroleum Distillates and Commercial Aliphatic Olefins by Electro-metric Titration³

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products⁴

D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products⁴

3. Summary Test of Method

3.1 The gasoline sample is treated with bromine and diluted

with methyl isobutyl ketone. The manganese content of the sample is determined by atomic absorption spectrometry using an air-acetylene flame at 279.5 nm and standards prepared from an organo-manganese standard material.

4. Significance and Use

4.1 Certain organo-manganese compounds act as antiknock agents when added to gasoline. This test method provides a means for determining the concentration of such a material in a gasoline sample.

5. Apparatus

5.1 *Atomic Absorption Spectrometer*, capable of scale expansion and equipped with a manganese hollow-cathode lamp for monitoring manganese absorption at 279.5 nm, a premix slot-type burner with rotatable burner head, and an adjustable nebulizer.

5.2 *Glass Vials*, 40-mL size with polyethylene-lined screw caps.

5.3 *Pipet, Delivery*, 1-mL size.

5.4 *Micropipet*, 100- μ L size, Eppendorf type or equivalent.

5.5 *Automatic Pipet*, capable of delivering 9.0-mL quantities.⁵

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.⁶ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

6.2 *Bromine Solution*—Add reagent grade bromine to an equal volume of carbon tetrachloride.

NOTE 1—**Warning:** In addition to other precautions, bromine can cause

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² MMT is a registered trademark of Ethyl Corp.

³ *Annual Book of ASTM Standards*, Vol 05.01.

⁴ *Annual Book of ASTM Standards*, Vol 05.02.

⁵ The standard repipet with 950-mL round amber bottle and 10-mL dispenser capacity, available from Fisher Scientific Co. 1600 Park View Dr., Pittsburgh, PA 15205, has been found satisfactory.

⁶ *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopoeia and National Formulary*, U.S. Pharmacopoeial Convention, Inc. (USPC), Rockville, MD.