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Standard Test Method for Lead in Gasoline by X-Ray Spectrometry¹

This standard is issued under the fixed designation D 2599; 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. This is also a standard of the Institute of Petroleum issued under the fixed designation IP 228/72. The final number indicates the year of last revision. These methods were issued as a joint ASTM-IP tentative in 1968.

1. Scope

1.1 These test methods cover the determination of the total lead content of a gasoline within the following concentration ranges:

0.10 to 5.00 g Pb/US gal
0.12 to 6.00 g Pb/UK gal
0.026 to 1.32 g Pb/L

These test methods compensate for normal variation in gasoline composition and are independent of lead alkyl type.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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 hazard statements, see 5.1, 6.3, 6.5, 10.1, 11.1, and 12.2.

1.3 The values stated in g Pb/US gal are the preferred units in the United States. Note that in other countries, other units may be preferred.

2. Referenced Documents

2.1 ASTM Standards:

D 3341 Test Method for Lead in Gasoline-Iodine Monochloride Method²

3. Summary of Test Methods

3.1 There are two alternative methods, as follows.

3.1.1 *Test Method A (Bismuth Internal Standard Method)*—One volume of sample is mixed thoroughly with an equal volume of bismuth internal standard solution. The mixture is placed in the X-ray beam and the intensities of the lead $L\alpha_1$ radiation at 1.175 Å and the bismuth $L\alpha_1$ radiation at 1.144 Å are determined. The lead concentration of the sample is measured by comparing the ratio of gross counting rate at 1.175 Å with the gross counting rate at 1.144 Å to a previous prepared calibration curve of concentration versus the same ratios.

3.1.2 *Test Method B (Scattered Tungsten Radiation Method)*—The ratio of the net X-ray intensity of the lead $L\alpha_1$ radiation to the net intensity of the incoherently scattered tungsten $L\alpha_1$ radiation is obtained on a portion of the sample. The lead content is determined by multiplying this ratio by a calibration factor obtained with a standard lead solution of tetraethyllead in isooctane.

4. Significance and Use

4.1 These methods determine the concentration of lead (from alkyl addition) in gasoline. These alkyl additives improve the antiknock properties.

TEST METHOD A (BISMUTH INTERNAL STANDARD)

5. Apparatus

5.1 X-ray Spectrometer, capable of measuring radiations mentioned in 3.1.1 and of being operated under the following instrumental conditions or other giving equivalent results:

Tube voltage	50 kV
Tube current	20 to 45 mA
Analyzing crystal	lithium fluoride (LiF)
Optical path	air, helium
Detector	proportional or scintillation

5.1.1 **Caution**—The X-ray spectrometer and manner of use should comply with the regulations governing the use of ionizing radiation or recommendations of the International Commission of Radiological Protection, or both.

6. Reagents and Materials

6.1 Bismuth 2-Ethylhexoate.

6.2 *Bismuth 2-Ethylhexoate Internal Standard Solution*—Dilute the bismuth 2-ethylhexoate with heavy, odorless solvent or similar material to obtain a solution containing the following:

3.00 g Bi/US gal at 15.5°C (60°F)
3.60 g Bi/UK gal at 15.5°C (60°F)
0.793 g Bi/L at 15°C

6.3 Isooctane

NOTE 1: **Warning**—Extremely flammable.

6.4 *Solvent*—A heavy, odorless solvent of an essentially paraffinic stock boiling from 380 to 460°F (193 to 238°C).

6.5 *Tetraethyllead (TEL)* (Warning—see Note 2), *Standard Solution* (Note 3), in isooctane, toluene, or a mixture of

¹ This test method is under the jurisdiction of Committee D-2 on Petroleum and Petroleum Products and is the direct responsibility of Subcommittee D02.03 on Elemental Analysis.

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² Annual Book of ASTM Standards, Vol 05.02.