



Standard Test Method for Phosphorus in Gasoline¹

This standard is issued under the fixed designation D3231; 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 standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This test method covers the determination of phosphorus generally present as pentavalent phosphate esters or salts, or both, in gasoline. This test method is applicable for the determination of phosphorus in the range from 0.2 to 40 mg P/litre or 0.0008 to 0.15 g P/U.S. gal.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

1.3 *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 warning statements, see Section 6 and 9.5.

2. Referenced Documents

2.1 ASTM Standards:²

D1193 Specification for Reagent Water

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D6299 Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance

E832 Specification for Laboratory Filter Papers

3. Summary of Test Method

3.1 Organic matter in the sample is decomposed by ignition in the presence of zinc oxide. The residue is dissolved in sulfuric acid and reacted with ammonium molybdate and hydrazine sulfate. The absorbance of the Molybdenum Blue

complex is proportional to the phosphorus concentration in the sample and is read at approximately 820 nm in a 5-cm cell.

4. Significance and Use

4.1 Phosphorus in gasoline will damage catalytic convertors used in automotive emission control systems, and its level therefore is kept low.

5. Apparatus

5.1 *Buret*, 10-mL capacity, 0.05-mL subdivisions.

5.2 *Constant-Temperature Bath*, equipped to hold several 100-mL volumetric flasks submerged to the mark. Bath must have a large enough reservoir or heat capacity to keep the temperature at 82.2 to 87.8°C (180 to 190°F) during the entire period of sample heating.

NOTE 1—If the temperature of the hot water bath drops below 82.2°C (180°F), the color development cannot be complete.

5.3 *Cooling Bath*, equipped to hold several 100-mL volumetric flasks submerged to the mark in ice water.

5.4 *Filter Paper*, for quantitative analysis, Class G for fine precipitates as defined in Specification E832.

5.5 *Ignition Dish*—Coors porcelain evaporating dish, glazed inside and outside, with pourout (Size No. 00A, diameter 75 mm, capacity 70 mL).

5.6 *Spectrophotometer*, equipped with a tungsten lamp, a red-sensitive phototube capable of operating at 830 nm and with absorption cells that have a 5-cm light path.

5.7 *Thermometer*, ASTM 34C or 34F, range from 25 to 105°C (77 to 221°F).

NOTE 2—Other temperature measuring devices, such as thermocouples or resistance thermometers, may be used when the temperature readings obtained by these devices are determined to produce the same results that are obtained when mercury-in-glass thermometers are used. The precision and bias given in Section 12 may or may not apply in such cases since the published precision is based on an interlaboratory study where only mercury-in-glass thermometers were used. No information on the effect on precision when using alternative temperature measuring devices is available.

5.8 *Volumetric Flask*, 100-mL with ground-glass stopper.

5.9 *Volumetric Flask*, 1000-mL with ground-glass stopper.

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

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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.