



Standard Test Method for Nitrogen in Petroleum and Petroleum Products by Boat-Inlet Chemiluminescence¹

This standard is issued under the fixed designation D5762; 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 nitrogen in liquid hydrocarbons, including petroleum process streams and lubricating oils in the concentration range from 40 to 10 000 $\mu\text{g/g}$ nitrogen. For light hydrocarbons containing less than 100 $\mu\text{g/g}$ nitrogen, Test Method D4629 can be more appropriate.

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 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.* Specific warning statements are given in Section 6, 7.1, 8.2, and 8.2.2.

2. Referenced Documents

2.1 ASTM Standards:²

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D4629 Test Method for Trace Nitrogen in Liquid Petroleum Hydrocarbons by Syringe/Inlet Oxidative Combustion and Chemiluminescence Detection

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

3. Summary of Test Method

3.1 A hydrocarbon sample is placed on a sample boat at room temperature. The sample and boat are advanced into a

high-temperature combustion tube where the nitrogen is oxidized to nitric oxide (NO) in an oxygen atmosphere. The NO contacts ozone and is converted to excited nitrogen dioxide (NO_2^*). The light emitted as the excited NO_2^* decays is detected by a photomultiplier tube, and the resulting signal is a measure of the nitrogen contained in the sample.

4. Significance and Use

4.1 Many nitrogen compounds can contaminate refinery catalysts. They tend to be the most difficult class of compounds to hydrogenate, so the nitrogen content remaining in the product of a hydrotreater is a measure of the effectiveness of the hydrotreating process. In lubricating oils the concentration of nitrogen is a measure of the presence of nitrogen containing additives. This test method is intended for use in plant control and in research.

5. Apparatus

5.1 *Boat Inlet System*, capable of being sealed to the inlet of the combustion tube and swept with inert gas. The boats are fabricated from platinum or quartz. To aid quantitative liquid injection, it is recommended to add a small piece of quartz wool or suitable equivalent (see 6.8) to the boat. The boat drive mechanism should be able to fully insert the boat into the furnace tube inlet section. A drive mechanism that advances and withdraws the sample boat into and out of the furnace at a controlled and repeatable rate is required.

5.2 *Chemiluminescence Detector*, capable of measuring light emitted from the reaction between nitric oxide and ozone, and containing a variable attenuation amplifier, integrator, and readout.

NOTE 1—Detectors designed to maintain the chemiluminescence reaction cell at reduced pressure are acceptable for use and were included in the instruments used to determine the precision of this test method.

5.3 *Combustion Tube*, fabricated from quartz. The inlet end of the tube shall be large enough to accept the sample boat and to have side arms for introduction of oxygen and inert gas. The construction is such that the carrier gases sweep the inlet zone transporting all of the volatilized sample into a high-temperature oxidation zone. The oxidation section should be large enough to ensure complete oxidation of the sample.

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.