



Designation: D5291 – 21

Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants¹

This standard is issued under the fixed designation D5291; 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 These test methods cover the instrumental determination of carbon, hydrogen, and nitrogen in laboratory samples of petroleum products and lubricants. Values obtained represent the total carbon, the total hydrogen, and the total nitrogen.

1.2 These test methods are applicable to samples such as crude oils, fuel oils, additives, and residues for carbon and hydrogen and nitrogen analysis. These test methods were tested in the concentration range of at least 75 % to 87 % by mass for carbon, at least 9 % to 16 % by mass for hydrogen, and <0.1 % to 2 % by mass for nitrogen.

1.3 The nitrogen test method is not applicable to light materials or those containing <0.75 % by mass nitrogen, or both, such as gasoline, jet fuel, naphtha, diesel fuel, or chemical solvents.

1.3.1 However, using Test Method D levels of 0.1 % by mass nitrogen in lubricants could be determined.

1.4 These test methods are not recommended for the analysis of volatile materials such as gasoline, gasoline-oxygenate blends, or gasoline type aviation turbine fuels.

1.5 The results of these tests can be expressed as mass % carbon, hydrogen or nitrogen.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 *ASTM Standards:*²

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

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

3. Terminology

3.1 For definitions of terms used in these test methods, refer to Terminology **D4175**.

4. Summary of Test Methods

4.1 In these test methods, carbon, hydrogen, and nitrogen are determined concurrently in a single instrumental procedure. With some systems, the procedure consists of simply weighing a portion of the sample, placing the portion in the instrument, and initiating the (subsequently automatic) analytical process. In other systems, the analytical process, to some degree, is manually controlled.

4.2 The actual process can vary substantially from instrument to instrument, since a variety of means can be utilized to effect the primary requirements of the test methods. All satisfactory processes provide for the following:

4.2.1 The conversion of the subject materials (in their entirety) to carbon dioxide, water vapor, and elemental nitrogen, respectively, and

4.2.2 The subsequent, quantitative determination of these gases in an appropriate gas stream.

¹ These test methods are under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and are the direct responsibility of Subcommittee D02.03 on Elemental Analysis.

Current edition approved Nov. 1, 2021. Published December 2021. Originally approved in 1992. Last previous edition approved in 2016 as D5291 – 16. DOI: 10.1520/D5291-21.

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.

*A Summary of Changes section appears at the end of this standard