



Standard Test Method for Determination of Trace Elements in Middle Distillate Fuels by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)¹

This standard is issued under the fixed designation D7111; 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 selected elements in middle distillate fuels by inductively coupled plasma atomic emission spectrometry (ICP-AES). The specific elements are listed in [Table 1](#). The concentration range of this test method is approximately 0.1 mg/kg to 2.0 mg/kg. The test method may be used for concentrations outside of this range; however, the precision statements may not be applicable. Middle distillate fuels covered in this test method have all distillation fractions contained within the boiling range of 150 °C to 390 °C. This includes, but is not limited to, diesel fuels and aviation turbine fuels.

1.2 This test method is not intended to analyze insoluble particulates. However, very small particulate matter (smaller than a micrometre) will be carried into the plasma and be included in the quantitative analysis.

1.3 This test method may give a result that is higher than the true value if an analyte is present in the sample in a form which is sufficiently volatile. For example, hexamethyldisiloxane will generate a biased high result for silicon.

1.4 The values stated in SI units are to be regarded as standard.

1.5 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

[D2880 Specification for Gas Turbine Fuel Oils](#)

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

Current edition approved Dec. 1, 2016. Published December 2016. Originally approved in 2005. Last previous edition approved in 2015 as D7111 – 15a. DOI: 10.1520/D7111-16.

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.

[D3605 Test Method for Trace Metals in Gas Turbine Fuels by Atomic Absorption and Flame Emission Spectroscopy](#)
[D4057 Practice for Manual Sampling of Petroleum and Petroleum Products](#)
[D4306 Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination](#)
[D5185 Test Method for Multielement Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry \(ICP-AES\)](#)
[D6299 Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance](#)
[D6792 Practice for Quality System in Petroleum Products and Lubricants Testing Laboratories](#)
[D7260 Practice for Optimization, Calibration, and Validation of Inductively Coupled Plasma-Atomic Emission Spectrometry \(ICP-AES\) for Elemental Analysis of Petroleum Products and Lubricants](#)

2.2 Military Standard:

[MIL-DTL-16884 Fuel, Naval Distillate](#)³

3. Terminology

3.1 Definitions:

3.1.1 *calibration, n*—the determination of the values of the significant parameters by comparison with values indicated by a set of reference standards.

3.1.2 *calibration curve, n*—the graphical or mathematical representation of a relationship between the assigned (known) values of standards and the measured responses from the measurement system.

3.1.3 *calibration standard, n*—a standard having an accepted value (reference value) for use in calibrating a measurement instrument or system.

3.1.4 *detection limit, n*—a stated limiting value that designates the lowest concentration that can be determined with confidence and that is specific to the analytical procedure used.

³ Available online at <http://quicksearch.dla.mil> or <http://assistdocs.com>

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