



Standard Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry¹

This standard is issued under the fixed designation E1251; 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 describes the analysis of aluminum and its alloys by atomic emission spectrometry. The aluminum specimen to be analyzed may be in the form of a chill cast disk, casting, foil, sheet, plate, extrusion or some other wrought form or shape. The elements covered in the scope of this method are listed in the table below.

Element	Tested Concentration Range (Wt %)
Antimony	0.001 to 0.003
Arsenic	0.001 to 0.006
Beryllium	0.0004 to 0.24
Bismuth	0.03 to 0.6
Boron	0.0006 to 0.009
Calcium	0.0002 to –
Chromium	0.001 to 0.23
Cobalt	0.4 to –
Copper	0.001 to 5.5
Gallium	0.02 to –
Iron	0.2 to 0.5
Lead	0.04 to 0.6
Lithium	0.0003 to 2.1
Magnesium	0.03 to 5.4
Manganese	0.001 to 1.2
Nickel	0.005 to 2.6
Phosphorus	0.003 to –
Silicon	0.07 to 16
Sodium	0.003 to 0.02
Strontium	0.03 to –
Tin	0.03 to –
Titanium	0.001 to 0.12
Vanadium	0.002 to 0.022
Zinc	0.002 to 5.7
Zirconium	0.001 to 0.12

NOTE 1—The concentration ranges given in the above scope were established through cooperative testing (ILS) of selected reference materials. The range shown for each element does not demonstrate the actual usable analytical range for that element. The usable analytical range may be extended higher or lower based on individual instrument capability, spectral characteristics of the specific element wavelength being used and the availability of appropriate reference materials.

¹ This test method is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.04 on Aluminum and Magnesium.

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NOTE 2—Mercury (Hg) is intentionally not included in the scope. Analysis of Hg in aluminum by spark atomic emission spectrometry (Spark-AES) is not recommended. Accurate analysis of Hg using this technique is compromised by the presence of an intense iron interference. Inaccurate reporting of Hg due to these interference effects can jeopardize the current designation of aluminum production as a mercury free process. To demonstrate compliance with legislated Hg content limits, use of an alternate method capable of analysis with a minimum reporting limit of 0.0001% or lower is recommended. Suitable techniques include but are not limited to glow discharge mass spectrometry, XRF, and cold vapor AA.

1.2 This test method is suitable primarily for the analysis of chill cast disks as defined in Practices E716. Other forms may be analyzed, provided that: (1) they are sufficiently massive to prevent undue heating, (2) they allow machining to provide a clean, flat surface, which creates a seal between the specimen and the spark stand, and (3) reference materials of a similar metallurgical condition and chemical composition are available.

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 safety and health statements are given in Section 10.

2. Referenced Documents

2.1 ASTM Standards:²

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

E158 Practice for Fundamental Calculations to Convert Intensities into Concentrations in Optical Emission Spectrochemical Analysis (Withdrawn 2004)³

E172 Practice for Describing and Specifying the Excitation Source in Emission Spectrochemical Analysis (Withdrawn 2001)³

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.

³ The last approved version of this historical standard is referenced on www.astm.org.