



Standard Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys¹

This standard is issued under the fixed designation E34; 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 These test methods cover the chemical analysis of aluminum and aluminum-base alloys having compositions within the following limits:

Beryllium, ppm	0.3	to 100
Bismuth, %	0.02	to 1.0
Boron, %	0.005	to 0.060
Cadmium, %	0.001	to 0.50
Chromium, %	0.01	to 1.0
Copper, %	0.01	to 20.0
Gallium, %	0.001	to 0.05
Iron, %	0.01	to 3.0
Lead, %	0.01	to 1.0
Lithium, %	0.001	to 4.0
Magnesium, %	0.002	to 12.0
Manganese, %	0.005	to 2.0
Nickel, %	0.01	to 4.0
Silicon, %	0.05	to 20.0
Tin, %	0.03	to 1.0
Titanium, %	0.002	to 0.30
Vanadium, %	0.002	to 0.16
Zinc, %	0.003	to 12.0
Zirconium, %	0.01	to 0.30

1.2 The analytical procedures appear in the following sections:

Procedure	Sections
Beryllium:	
Beryllium by Argon Plasma Optical Emission Spectroscopy	283 to 292
Beryllium by the Morin (Fluorometric) Test Method	^{1e}
Bismuth:	
Bismuth by the Thiourea (Photometric) Method	^{1a}
Bismuth and Lead by the Atomic Absorption Test Method	188 to 198
Boron:	

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

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^{1a} Discontinued as of Feb. 25, 1983.

^{1b} Discontinued as of May 29, 1981.

^{1c} Discontinued as of Oct. 25, 1985.

^{1d} Discontinued as of March 25, 1983. DOI: 10.1520/E0034-11.

^{1e} Discontinued as of July 1, 2011. DOI: 10.1520/E0034-11.

Procedure	Sections
Boron by the Carmine (Photometric) Test Method	^{1e}
Cadmium:	
Cadmium by the Atomic Absorption Test Method	167 to 177
Chromium:	
Chromium by the Diphenylcarbazide (Photometric) Test Method	^{1e}
Chromium by the Persulfate Oxidation (Titrimetric) Test Method	^{1b}
Chromium by the Atomic Absorption Test Method	199 to 209
Copper:	
Copper and Lead by the Electrolytic (Gravimetric) Test Method	^{1c}
Copper and Zinc by the Atomic Absorption Spectrometry Test Method	210 to 220
Copper by the Electrolytic (Gravimetric) Test Method	303 to 311
Copper by the Neocuproine (Photometric) Test Method	^{1a}
Gallium:	
Gallium by the Ion Exchange-Atomic Absorption Test Method	312 to 323
Iron:	
Iron by the 1,10-Phenanthroline (Photometric) Method	73 to 81
Iron and Manganese by the Atomic Absorption Spectrometry Method	221 to 231
Lead:	
Copper and Lead by the Electrolytic (Gravimetric) Test Method	^{1c}
Bismuth and Lead by the Atomic Absorption Spectrometry Test Method	188 to 198
Lithium:	
Lithium by the Atomic Absorption Test Method	324 to 334
Magnesium:	
Magnesium by the Pyrophosphate (Gravimetric) Method	^{1b}
Magnesium by the Ethylenediamine Tetraacetate (Titrimetric) Test Method	^{1e}
Magnesium by the Atomic Absorption Spectrometry Test Method	232 to 242
Manganese:	
Iron and Manganese by the Atomic Absorption Spectrometry Test Method	221 to 231
Manganese by the Periodate (Photometric) Test Method	293 to 302
Nickel:	
Nickel by the Dimethylglyoxime (Photometric) Test Method	^{1a}
Nickel by the Dimethylglyoxime (Gravimetric) Test Method	^{1b}
Nickel by the Atomic Absorption Spectrometry Test Method	243 to 253
Silicon:	

E1601 Practice for Conducting an Interlaboratory Study to Evaluate the Performance of an Analytical Method

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology E135.

4. Significance and Use

4.1 These test methods for the chemical analysis of metals and alloys are primarily intended to test such materials for compliance with compositional specifications. It is assumed that all who use these test methods will be trained analysts capable of performing common laboratory procedures skillfully and safely. It is expected that work will be performed in a properly equipped laboratory.

5. Apparatus, Reagents, and Photometric Practice

5.1 Apparatus and reagents required for each determination are listed in separate sections preceding the procedure.

5.2 Photometric practice prescribed in these test methods shall conform to Practice E60.

5.3 Calculated values shall be rounded to the desired number of places in accordance with the rounding method of Practice E29.

Silicon by the Molybdisilicic Acid (Photometric) Test Method	1 ^e
Silicon by the Sodium Hydroxide-Perchloric Acid (Gravimetric) Method	1 ^e
Tin:	
Tin by the Iodate (Titrimetric) Test Method	1 ^e
Titanium:	
Titanium by the Chromotropic Acid (Photometric) Test Method	141 to 150
Titanium by the Diantiprylmethane Photometric Test Method	254 to 263
Vanadium:	
Vanadium by an Extraction-Photometric Test Method using <i>N</i> -Benzoyl- <i>N</i> -Phenylhydroxylamine	264 to 273
Zinc:	
Zinc by the Ammonium Mercuric Thiocyanate or the Zinc Oxide (Gravimetric) Test Method	1 ^b
Zinc by the Ethylenediamine Tetraacetate (Titrimetric) Test Method	1 ^d
Copper and Zinc by the Atomic Absorption Spectrometry Test Method	210 to 220
Zinc by the Ion Exchange-EDTA Titrimetric Test Method	274 to 282
Zirconium:	
Zirconium by the Arsenazo III (Photometric) Method	178 to 187

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

1.4 *This standard does not purport to address all of the safety problems, 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 hazard statements are given throughout these test methods.

2. Referenced Documents

2.1 *ASTM Standards:*²

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications³

E50 Practices for Apparatus, Reagents, and Safety Considerations for Chemical Analysis of Metals, Ores, and Related Materials³

E55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition³

E60 Practice for Analysis of Metals, Ores, and Related Materials by Spectrophotometry³

E88 Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition

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

E173 Practice for Conducting Interlaboratory Studies of Methods for Chemical Analysis of Metals^{3 4}

E716 Practices for Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spectrochemical Analysis⁴

E1024 Guide for Chemical Analysis of Metals and Metal Bearing Ores by Flame Atomic Absorption Spectrophotometry⁵

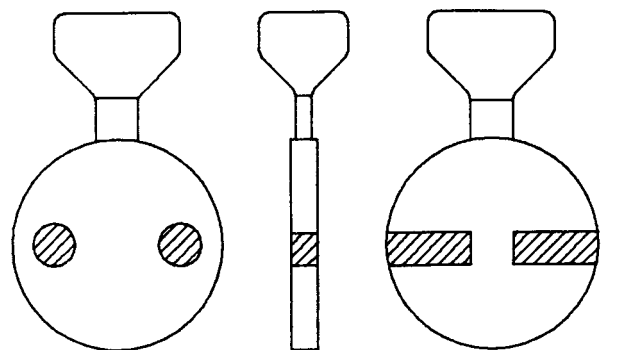
E1479 Practice for Describing and Specifying Inductively-Coupled Plasma Atomic Emission Spectrometers

² Annual Book of ASTM Standards, Vol 14.02.

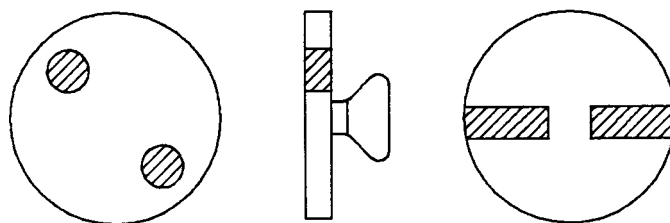
³ Annual Book of ASTM Standards, Vol 03.05.

⁴ Annual Book of ASTM Standards, Vol 03.06.

⁵ Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.



Type A Mold



Type B Mold

NOTE 1—Shaded areas are suitable for sampling.

FIG. 1 Type A and Type B Disks

6. Precautions

6.1 For precautions to be observed in the use of certain reagents in these test methods, reference shall be made to Practices E50.

7. Sampling

7.1 Wrought products shall be sampled in accordance with Practice E55. Cast products shall be sampled in accordance with Practice E88.

7.2 Chill cast disks produced for analysis by spectrochemical methods (see Practices E716) shall be sampled by drilling or milling through the entire thickness. Drill bits or milling cutters should be carbide to avoid iron contamination.

NOTE 1—The use of a machined disk may result in the exclusion of an element-rich portion of the sample. This practice should be avoided wherever possible, especially for analyses affecting product acceptance.

7.2.1 If samples are produced by drilling, use a minimum of two positions approximately opposite each other and combine the drillings.

7.2.2 The outer edges of the holes shall be approximately 0.48 cm ($\frac{3}{16}$ in.) from the edge of the disk. Drill bits shall be not less than 0.95 cm ($\frac{3}{8}$ in.) in diameter and not larger than 1.27 cm ($\frac{1}{2}$ in.) in diameter.⁶

7.2.3 If samples are produced by milling, mill disks at similar points to a distance of 40 % of the sample diameter or other methods that provide a representative sample such as quarter of half milling. A 0.95-cm ($\frac{3}{8}$ in.) milling cutter has been shown to provide acceptable chips.⁶

7.2.4 Center pour (Type B, Practices E716) and vacuum cast disks may be sampled around the entire circumference. Fig. 1 illustrates the areas suitable for sampling Type B disks. Vacuum cast disks are sampled in the same manner as Type B disks.⁶

7.2.5 Drilling or milling techniques ideally should produce uniformly small chips. Break large continuous pieces into smaller pieces 0.64 cm ($\frac{1}{4}$ in.) to 0.95 cm ($\frac{3}{8}$ in.) long. Drilling or milling techniques should minimize production of fine, dust-like material.⁶

BERYLLIUM BY THE MORIN (FLUOROMETRIC) TEST METHOD

(This test method, which consisted of Sections 8 through 19 of this standard, was discontinued in 2008.)

BISMUTH BY THE THIOUREA (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 20 through 29 of this standard, was discontinued in 1983.)

BORON BY THE CARMINE (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 30 through 38 of this standard, was discontinued in 2008.)

CHROMIUM BY THE DIPHENYLCARBAZIDE (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 39 through 47 of this standard, was discontinued in 2008.)

CHROMIUM BY THE PERSULFATE OXIDATION (TITRIMETRIC) TEST METHOD

(This test method, which consisted of Sections 48 through 53 of this standard, was discontinued in 1981.)

COPPER BY THE NEOCUPROINE (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 54 through 63 of this standard, was discontinued in 1983.)

COPPER AND LEAD BY THE ELECTROLYTIC (GRAVIMETRIC) TEST METHOD

(This test method, which consisted of Sections 64 through 72 of this standard, was discontinued in 1985.)

IRON BY THE 1,10-PHENANTHROLINE (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 73 through 81 of this standard, was discontinued in 2008.)

MAGNESIUM BY THE PYROPHOSPHATE (GRAVIMETRIC) TEST METHOD

(This test method, which consisted of Sections 82 through 87 of this standard, was discontinued in 1981.)

MAGNESIUM BY THE ETHYLENEDIAMINE TETRAACETATE (TITRIMETRIC) TEST METHOD

(This test method, which consisted of Sections 88 through 93 of this standard, was discontinued in 2008.)

MANGANESE BY THE PERIODATE (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 94 through 102 of this standard, was replaced in 1984 by Sections 293 through 302.)

NICKEL BY THE DIMETHYLGLYOXIME (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 103 through 111 of this standard, was discontinued in 1983.)

NICKEL BY THE DIMETHYLGLYOXIME (GRAVIMETRIC) TEST METHOD

(This test method, which consisted of Sections 112 through 117 of this standard, was discontinued in 1981.)

SILICON BY THE MOLYBDISILICIC ACID (PHOTOMETRIC) TEST METHOD

(This test method, which consisted of Sections 118 through 127 of this standard, was discontinued in 2008.)

⁶ Olson, H. A., and Macy, D. W., "Metallurgical Approach to Evaluating Chemical Sample Disks," *Light Metals*, Vol 2, 1978, pp. 301–311.