



Designation: E 1473 – 94a (Reapproved 1998)

Standard Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys¹

This standard is issued under the fixed designation E 1473; 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 describe the chemical analysis of nickel, cobalt, and high-temperature alloys having chemical compositions within the following limits:

Element	Concentration Range, %
Aluminum	0.005 to 7.00
Beryllium	0.001 to 0.05
Boron	0.001 to 1.00
Calcium	0.002 to 0.05
Carbon	0.001 to 1.10
Chromium	0.10 to 33.00
Cobalt	0.10 to 75.00
Copper	0.01 to 35.00
Iron	0.01 to 50.00
Lead	0.001 to 0.01
Magnesium	0.001 to 0.05
Manganese	0.01 to 3.0
Molybdenum	0.01 to 30.0
Niobium (Columbium)	0.01 to 6.0
Nickel	0.10 to 98.0
Nitrogen	0.001 to 0.20
Phosphorus	0.002 to 0.08
Sulfur	0.002 to 0.10
Silicon	0.01 to 5.00
Tantalum	0.005 to 1.00
Tin	0.002 to 0.10
Titanium	0.01 to 5.00
Tungsten	0.01 to 18.00
Vanadium	0.01 to 3.25
Zinc	0.001 to 0.01
Zirconium	0.01 to 2.50

1.2 The test methods in this standard are contained in the sections indicated as follows:

	Sections
Aluminum, Total by the 8-Quinolinol Gravimetric Method (0.20 to 7.00 %) ²	62 to 69
Chromium by the Atomic Absorption Method (0.018 to 1.00 %) ²	100 to 109
Chromium by the Peroxydisulfate Oxidation—Titration Method (0.10 to 33.00 %) ²	110 to 118
Cobalt by the Ion-Exchange-Potentiometric Titration Method (2 to 75 %) ²	34 to 41
Cobalt by the Nitroso-R-Salt Photometric Method (0.10 to 5.0 %) ²	42 to 51
Copper by Neocuproine Photometric Method (0.010 to 10.00 %) ²	52 to 61
Iron by the Silver Reduction Titrimetric Method (1.0 to 50.0 %) ²	127 to 134

Manganese by the Metaperiodate Photometric Method (0.05 to 2.00 %) ²	8 to 17
Molybdenum by the Ion Exchange—8-Hydroxyquinoline Gravimetric Method (1.5 to 30 %) ²	119 to 126
Molybdenum by the Photometric Method (0.01 to 1.50 %) ²	88 to 99
Nickel by the Dimethylglyoxime Gravimetric Method (0.1 to 84.0 %) ²	70 to 77
Niobium by the Ion Exchange—Cupferron Gravimetric Method (0.5 to 6.0 %)	135 to 142
Silicon by the Gravimetric Method (0.05 to 5.00 %) ²	27 to 33
Sulfur by the Combustion-Iodate Titration Method (0.006 to 0.1 %) ²	18 to 26
Tantalum by the Ion Exchange—Pyrogallol Spectrophotometric Method (0.03 to 1.0 %)	143 to 151
Tin by the Solvent Extraction-Atomic Absorption Method (0.002 to 0.10 %) ²	78 to 87

1.3 Methods for the determination of several elements not included in these test methods can be found in Test Methods E 30, E 76, and E 1019.

1.4 Some of the concentration ranges given in 1.1 are too broad to be covered by a single method, and therefore, these test methods contain multiple methods for some elements. The user must select the proper test method by matching the information given in the scope and interference sections of each test method with the composition of the alloy to be analyzed.

1.5 The values stated in SI units are to be regarded as standard. In some cases, exceptions allowed in Practice E 380 are also used.

1.6 *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 hazard statements are given in Section 7 and in special caution and warning paragraphs throughout these test methods.

2. Referenced Documents

2.1 ASTM Standards:

- D 1193 Specification for Reagent Water³
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁴
- E 30 Test Methods for Chemical Analysis of Steel, Cast

¹ These test methods are under the jurisdiction of ASTM Committee E-1 on Analytical Chemistry for Metals, Ores, and Related Material and are the direct responsibility of Subcommittee E01.08 on Ni and Co and High-Temperature Alloys.

Current edition approved July 15, 1994. Published September 1994. Originally published as E 1473 – 92. Last previous edition E 1473 – 94.

² These test methods were extracted from Test Methods E 354 and the references to Test Methods E 350, E 351, E 352, and E 353 contained therein.

³ *Annual Book of ASTM Standards*, Vol 11.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.