



Designation: E353 – 25

Standard Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys¹

This standard is issued under the fixed designation E353; 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 chemical analysis of stainless, heat-resisting, maraging, and other similar chromium-nickel-iron alloys having chemical compositions within the following limits:

Element	Composition Range, %
Aluminum	0.002 to 5.50
Boron	0.001 to 0.20
Carbon	0.01 to 1.50
Chromium	0.01 to 35.00
Cobalt	0.01 to 15.00
Niobium	0.01 to 4.00
Copper	0.01 to 5.00
Lead	0.001 to 0.50
Manganese	0.01 to 20.00
Molybdenum	0.01 to 7.00
Nickel	0.01 to 48.00
Nitrogen	0.001 to 0.50
Phosphorus	0.002 to 0.35
Selenium	0.01 to 0.50
Silicon	0.01 to 4.00
Sulfur	0.002 to 0.50
Tantalum	0.01 to 0.80
Tin	0.001 to 0.05
Titanium	0.01 to 4.50
Tungsten	0.01 to 4.50
Vanadium	0.005 to 1.00
Zirconium	0.001 to 0.20

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

	Sections
Aluminum, Total, by the 8-Quinolinol Gravimetric Method (0.20 % to 7.00 %)	119–126
Aluminum, Total, by the 8-Quinolinol Spectrophotometric Method (0.003 % to 0.20 %)	71–81
Carbon, Total, by the Combustion–Thermal Conductivity Method– <i>Discontinued 1986</i>	153–163
Carbon, Total, by the Combustion Gravimetric Method (0.05 % to 1.50 %)— <i>Discontinued 2013</i>	98–108
Chromium by the Atomic Absorption Spectrometry Method (0.006 % to 1.00 %)	202–211

Chromium by the Peroxydisulfate Oxidation–Titration Method (0.10 % to 35.00 %)	212–220
Chromium by the Peroxydisulfate–Oxidation Titrimetric Method– <i>Discontinued 1980</i>	145–152
Cobalt by the Ion-Exchange–Potentiometric Titration Method (2 % to 15 %)	53–60
Cobalt by the Nitroso-R-Salt Spectrophotometric Method (0.01 % to 5.0 %)	61–70
Copper by the Neocuproine Spectrophotometric Method (0.01 % to 5.00 %)	109–118
Copper by the Sulfide Precipitation–Electrodeposition Gravimetric Method (0.01 % to 5.00 %)	82–89
Lead by the Ion-Exchange–Atomic Absorption Spectrometry Method (0.001 % to 0.50 %)	127–136
Manganese by the Periodate Spectrophotometric Method (0.01 % to 5.00 %)	9–18
Molybdenum by the Ion Exchange–8-Hydroxyquinoline Gravimetric Method	242–249
Molybdenum by the Thiocyanate Spectrophotometric Method (0.01 % to 1.50 %)	190–201
Nickel by the Dimethylglyoxime Gravimetric Method (0.1 % to 48.0 %)	172–179
Phosphorus by the Alkalimetric Method (0.02 % to 0.35 %)	164–171
Phosphorus by the Molybdenum Blue Spectrophotometric Method (0.002 % to 0.35 %)	19–30
Silicon by the Gravimetric Method (0.05 % to 4.00 %)	46–52
Sulfur by the Gravimetric Method– <i>Discontinued 1988</i>	30–36
Sulfur by the Combustion–Iodate Titration Method (0.005 % to 0.5 %)— <i>Discontinued 2014</i>	37–45
Sulfur by the Chromatographic Gravimetric Method– <i>Discontinued 1980</i>	137–144
Tin by the Solvent Extraction–Atomic Absorption Spectrometry Method (0.002 % to 0.10 %)	180–189
Tin by the Sulfide Precipitation–Iodometric Titration Method (0.01 % to 0.05 %)	90–97
Titanium by the Diantiprylmethane Spectrophotometric Method (0.01 % to 0.35 %)	231–241
Vanadium by the Atomic Absorption Spectrometry Method (0.006 % to 0.15 %)	221–230

1.3 Test methods for the determination of carbon and sulfur not included in this standard can be found in Test Methods **E1019**.

1.4 Some of the composition ranges given in 1.1 are too broad to be covered by a single test method and therefore this standard contains multiple test 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 method with the composition of the alloy to be analyzed.

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 E01.01 on Iron, Steel, and Ferroalloys.

Current edition approved May 15, 2025. Published May 2025. Originally approved in 1968. Last previous edition approved in 2019 as E353 – 19^{ε1}. DOI: 10.1520/E0353-25.

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific hazards statements are given in Section 6 and in special “Warning” paragraphs throughout these test methods.

1.7 *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 Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

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

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

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

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 (Withdrawn 1997)³

E350 Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

E351 Test Methods for Chemical Analysis of Cast Iron—All Types

E352 Test Methods for Chemical Analysis of Tool Steels and Other Similar Medium- and High-Alloy Steels

E354 Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

E882 Guide for Accountability and Quality Control in the Chemical Analysis Laboratory

E1019 Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Combustion and Inert Gas Fusion Techniques

E1024 Guide for Chemical Analysis of Metals and Metal Bearing Ores by Flame Atomic Absorption Spectrophotometry (Withdrawn 2004)³

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

E1806 Practice for Sampling Steel and Iron for Determination of Chemical Composition

2.2 Other Document:

ISO 5725 Precision of Test Methods—Determination of Repeatability and Reproducibility for Inter-Laboratory Tests⁴

3. Terminology

3.1 For definitions of terms used in these test methods, refer to Terminology **E135**.

4. Significance and Use

4.1 These test methods for the chemical analysis of metals and alloys are primarily intended as referee methods to test such materials for compliance with compositional specifications, particularly those under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys. 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 under appropriate quality control practices such as those described in Guide **E882**.

5. Apparatus, Reagents, and Instrumental Practices

5.1 *Apparatus*—Specialized apparatus requirements are listed in the “Apparatus” Section in each method.

5.1.1 In the methods specifying spectrophotometric testing, the cells utilized to contain the reference material solutions and the sample solutions in spectrophotometers are referred to as “absorption cells.” Please note that the radiant energy passed through the cells can be measured as absorbance or transmittance. These methods refer to absorbance measurements. Refer to Practices **E60** for details.

5.2 Reagents:

5.2.1 *Purity of Reagents*—Refer to Practice **E50**, Section 5.2, for the purity of reagents provision.

5.2.2 *Purity of Water*—Refer to Practice **E50**, Section 5.1, for the purity of water provision.

5.3 *Spectrophotometric Practice*—Spectrophotometric practice prescribed in these test methods shall conform to Practice **E60**.

6. Hazards

6.1 For precautions to be observed in the use of certain reagents and equipment in these methods, refer to Practices **E50**.

7. Sampling

7.1 For procedures to sample the material, refer to Practice **E1806**.

8. Interlaboratory Studies and Rounding Calculated Values

8.1 These test methods have been evaluated as directed in Practice **E173** (withdrawn 1997) or ISO 5725. Practice **E173**

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. 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.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, www.ansi.org.