



Designation: E1835 – 25

Standard Test Method for Analysis of Nickel Alloys by Flame Atomic Absorption Spectrometry¹

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1. Scope

1.1 This test method covers analysis of nickel alloys by flame atomic absorption spectrometry (FAAS) for the following elements:

Element	Composition Range, %
Aluminum	0.2 to 4.0
Chromium	0.01 to 4.0
Cobalt	0.01 to 4.0
Copper	0.01 to 4.0
Iron	0.1 to 4.0
Manganese	0.1 to 4.0
Silicon	0.2 to 1.0
Vanadium	0.05 to 1.0

1.2 The composition ranges of these elements can be expanded using appropriate reference materials.

1.3 The values stated in SI units are regarded as standard. No other units of measurement are included in this standard.

1.4 *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.* For specific hazards associated with the use of this test method, see Practices E50 and the warning statements included in this test method.

1.5 *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.*

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 E01.08 on Ni and Co and High Temperature Alloys.

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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

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

E882 Guide for Accountability and Quality Control in the Chemical Analysis Laboratory (Withdrawn 2025)³

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

E1812 Practice for Optimization of Flame Atomic Absorption Spectrometric Equipment (Withdrawn 2004)³

2.2 ISO Standards:⁴

ISO 5725:1986 Precision of Test Methods—Determination of Repeatability and Reproducibility for a Standard Test Method by Inter-laboratory Tests

ISO 7530 Parts 1 through 9—Nickel Alloys—Flame Atomic Absorption Spectrometric Analysis

3. Terminology

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

4. Summary of Test Method

4.1 The sample is dissolved in a mixture of HCl and HNO₃. The solution is aspirated into an appropriate flame of an atomic absorption spectrometer. The absorbance of the resonant line

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, <http://www.ansi.org>.

TABLE 1 Nominal Compositions of Test Samples, %

Test Material	Al	Co	Cr	Cu	Fe	Mn	Mo	Nb	Ni	Si	Ti	V	Zr
825	0.2	0.07	21	1.6	30	0.7	...	...	Bal	0.4	1.1	...	...
902	0.4	0.05	5	0.04	48	0.4	...	...	Bal	0.35	2.5	...	...
3920	0.15	2	19	0.1	3	0.3	...	...	Bal	0.6	2.3	...	...
3927	0.1	1	20	0.05	44	0.4	...	...	Bal	0.8	0.6	...	...
7013	1.5	17	20	0.2	0.2	0.05	...	...	Bal	0.7	2.4	...	...
7049	1	0.01	15	0.15	7	0.8	...	...	Bal	0.3	2.3	...	...
925	0.3	0.2	21	...	27	...	3	0.4	Bal	...	2	0.05	0.05
NPK31	0.5	14	20	...	1	...	4.5	5	Bal	...	2	0.3	...
IN100	5.5	15	10	...	<0.5	...	3	...	Bal	...	5	1	...

energy from the spectrum of the analyte is measured and compared with that of calibration solutions.

5. Significance and Use

5.1 This test method is used for the analysis of nickel alloy samples by FAAS to check for compliance with compositional specifications. It is assumed that all who use the procedure will be trained analysts capable of performing common laboratory procedures skillfully and safely. It is expected that the work will be performed in a properly equipped laboratory and that proper waste disposal procedures will be followed. Appropriate quality control practices must be followed such as those described in Guide E882.

5.2 *Interlaboratory Studies (ILS)*^{5,6}—ILS's were conducted by ISO/TC 155/SC4, Analysis of Nickel Alloys. Results were evaluated in accordance with ISO 5725:1986 and restated to conform to Practice E1601. The method was published as ISO 7530, Parts 1 through 9. The published ISO statistics are summarized separately for each analyte to correspond with Practice E1601.

5.3 In this test method, some matrix modifiers are specified. However, other additives are now commonly used since the original publication of this test method. These may be equally or more effective but have not been tested. It is the responsibility of the user to validate the use of such additives or the use of different dilutions, or both.

6. Apparatus

6.1 *Flame Atomic Absorption Spectrometer*, equipped with an appropriate background corrector, a signal output device such as a video display screen (VDS), a digital computer, a printer or strip chart recorder, and an optional autosampler.

6.2 *Radiation Source*—Hollow cathode lamp or electrodeless discharge lamp for the analyte(s).

7. Reagents

7.1 *Purity of Reagents*—Refer to Practices E50, 5.2, for the purity of reagent provision. The reagents should be free of or contain minimal amounts (<0.1 µg/g) of the analyte of interest.

7.2 *Purity of Water*—Refer to Practices E50, 5.1, for the purity of water provision.

7.3 *Calibration Solutions*—Prepared for the individual analytes.

7.4 *Matrix Modifiers and Ionization Buffers*—Prepared for the individual analytes, where required.

8. Sampling and Sample Preparation

8.1 Sampling and sample preparation shall be performed by procedures agreed upon between the parties, or, in the event of a dispute, in accordance with the relevant standard if one is available.

8.2 The sampling procedure shall not involve any steps or procedures that can result in the loss of any analyte in the sample.

8.2.1 Arc or induction melting of the sample under vacuum can result in significant loss of several elements that have a low vapor pressure. Arc melting of the sample should be performed only after careful consideration of all elements to be determined on the melted sample. Induction melting should only be performed in a complete or partial inert atmosphere.

8.3 The laboratory sample is normally in the form of turnings, millings, or drillings and no further mechanical preparation is necessary.

8.4 If it is suspected that the laboratory sample is contaminated with oil or grease from the milling or drilling operation, it shall be cleaned by rinsing with high purity acetone, or other appropriate solvent, and dried in air.

8.5 If brazed alloy tools have been used in the preparation of the sample, it shall be further cleaned by pickling in dilute HNO₃ for a few minutes. The sample shall then be rinsed several times with water followed by several rinses with high purity acetone, or other appropriate solvent, and dried in air.

9. General Procedure

9.1 Sample Dissolution:

9.1.1 Transfer a 1.0-g sample, weighed to the nearest 1 mg, to a 600-mL beaker. If sample inhomogeneity is suspected, a larger mass of sample (10 g to 50 g) may be taken for analysis. However, an aliquot portion corresponding to a 1-g sample shall be taken from the solution and processed in accordance with the procedure given. Add 15 mL HCl and 5 mL HNO₃. Apply sufficient heat to initiate and maintain the reaction until the dissolution is complete. If the sample contains over 0.5 % silicon, a few drops of HF will accelerate the dissolution considerably. (**Warning**—This operation will emit corrosive,

⁵ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report : RR:E01-1018.

⁶ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report : RR:E01-1019.