

Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 400-1

**Reference Material for Monel® 400 Nickel Alloy
(Former Number: M2946B)**

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ²
Analysis listed as percent by weight					
Ni	66.0	0.15	As	0.004	0.001
Cu	30.97	0.10	Mo	0.001	0.0005
C	0.109	0.005	Nb	0.0003	0.0001
Mn	1.07	0.02	Ti	0.007	0.0015
P	0.022	0.002	Pb	0.0020	0.0004
S	0.008	0.001	Sn	0.0010	0.0001
Si	0.16	0.015			
Cr	0.033	0.002	Informational Values ³		
Co	0.37	0.01	B	(0.0005)	
Fe	1.27	0.04	Sb	(0.0005)	
Mg	0.048	0.004	V	(0.001)	
Al	0.004	0.001	Zn	(0.0006)	

¹ The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

² The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values. No attempt is made to derive exact statistical measurements of imprecision because several methods were used in the determination of most constituents.

³ Data in parentheses are not certified and are provided for information only.

The requirements of ISO Guide 31 and ISO Guide 35 were generally followed for the preparation of this reference material and certificate of analysis. This is a reference material as defined by ISO Guide 30. Monel is a registered trademark of Inco Alloys International Inc.

See reverse side for more information.

Certificate Number 400-1-060694

Analysis	Ni	Cu	C	Mn	P	S	Si	Cr	Co	Fe	Mg
1	65.86	30.86	0.106	1.06	0.020	0.007	0.147	0.031	0.365	1.235	0.045
2	65.96	30.95	0.107	1.06	0.0205	0.008	0.15	0.031	0.37	1.24	0.0454
3	65.97	30.98	0.107	1.07	0.0205	0.008	0.155	0.032	0.37	1.26	0.0462
4	65.97	30.98	0.107	1.07	0.021	0.008	0.156	0.0321	0.371	1.26	0.0462
5	66.00	30.98	0.1072	1.07	0.022	0.0084	0.162	0.034	0.371	1.28	0.0466
6	66.18	30.99	0.10895	1.07	0.022	0.0086	0.17	0.034	0.374	1.28	0.048
7		31.00	0.109	1.07	0.022	0.009	0.175	0.034	0.379	1.28	0.0485
8		31.02	0.110	1.08	0.0230	0.0100	0.175	0.0347		1.29	0.0494
9			0.1128	1.085	0.023					1.29	0.0505
10			0.119							1.31	0.0506
Average	65.990	30.970	0.1094	1.071	0.0216	0.0084	0.161	0.0329	0.371	1.273	0.0476
Std Dev	0.105	0.049	0.0039	0.008	0.0011	0.0009	0.011	0.0015	0.004	0.023	0.0021
Certified	66.0	30.97	0.109	1.07	0.022	0.008	0.16	0.033	0.37	1.27	0.048

Analysis	Al	As	Mo	Nb	Ti	Pb	Sn	B	Sb	V	Zn
1	0.003	0.0025	0.0005	0.0002	0.0050	0.0015	0.0009	0.00001	0.00031	0.0008	0.0004
2	0.003	0.0039	0.001	0.00029	0.006	0.0018	0.00095	0.0005	0.00034	0.0008	0.0004
3	0.0033	0.0044	0.0010	0.0003	0.0067	0.0019	0.0010	0.0005	0.00054	0.001	0.0005
4	0.00385	0.0045	0.0010	0.0003	0.007	0.00195	0.0010	0.0007	0.0006	0.00105	0.0006
5	0.0040	0.0048	0.001	0.0005	0.007	0.0021	0.0010	0.0010	0.0006	0.0015	0.0006
6	0.004	0.0048	0.0010		0.0070	0.0025	0.0010		0.0007	0.002	0.0010
7	0.004		0.0011		0.0075		0.0011		0.0007	0.0021	
8	0.0050		0.0015		0.008						
9					0.008						
10					0.008						
11					0.0082						
12					0.0084						
Average	0.0038	0.0042	0.0010	0.0003	0.0072	0.00196	0.00099	0.00054	0.0005	0.0013	0.0006
Std Dev	0.0007	0.0009	0.0003	0.0001	0.0010	0.00033	0.00006	0.00036	0.0002	0.0006	0.0002
Certified	0.004	0.004	0.001	0.0003	0.007	0.0020	0.0010	(0.0005)	(0.0005)	(0.001)	(0.0006)

Data in parentheses are not certified and are provided for information only.

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs. The laboratories participating in the testing normally followed the requirements of ISO Guide 25. The individual values listed above are the average of each analyst's results. Methods of analysis used were a combination of ASTM Standard Methods E 76, E 1473, and E 1019, plus additional ICP, and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 162, 162A, 882, C1248; BCS 346, 351, 363/1.

Co-operating Laboratories: Some of the co-operating laboratories were:

Allegheny Ludlum Steel Corp., Brackenridge, Pennsylvania
 Allegheny Ludlum Steel Corp., Lockport, New York
 Brammer Standard Co., Inc., Houston, Texas
 Coleman Testing Laboratories, Riverside, New Jersey
 Crucible Specialty Metals, Syracuse, New York
 J. Dirats and Co., Inc., Westfield, Massachusetts
 Ledoux & Company, Teaneck, New Jersey
 Andrew S. McCreath & Son, Inc., Harrisburg, Pennsylvania
 Northern Analytical Laboratory, Inc., Merrimack, New Hampshire
 Shiva Technologies, Inc., Cicero, New York
 VHG Laboratories, Inc., Manchester, New Hampshire

Additional analytical data: Three laboratories analyzed this material for nitrogen and two laboratories analyzed for oxygen. The resulting uncertified averages yield values for nitrogen of (0.0005%) and oxygen of (0.0026%).

Homogeneity: This Reference Material was tested for homogeneity using ASTM Standard Practice E 826 and found acceptable.

Traceability: This Reference Material was also examined by optical emission spectrometry and found to be compatible with the following Certified Reference Materials: NIST SRM 1248; SS 363/1; CSB 1761 - 1768.

Source: This material was produced in 1972 by Huntington Alloys, Inc., Huntington, West Virginia. The material was made in an electric arc furnace and cast into ingots. The resulting billets were hot rolled down to 1.00 inch (25 mm) diameter round rods.

Available Form: This Reference Material is available in two forms.

- Rod: 25 mm (1.0") diameter and 50 mm (2.0") long
- Disc: 38 mm (1.45") diameter and 20 mm (0.8") thick
Made from a hot pressed rod.

Use: This Reference Material is intended for use in optical emission and x-ray spectrometric methods of analysis. The entire depth of the rod and disc may be used.

Sample Preparation: For best analytical results, use the same method for preparing the analytical surface on all reference materials as you use for production specimens. Avoid overheating the rod or disc during surface preparation.

Safety Notice: A Material Safety Data Sheet (MSDS) is not required for this material. This material will not release or otherwise result in exposure to a hazardous chemical, under normal conditions of use. Inquiries concerning this Reference Material should be directed to:

Brammer Standard Co., Inc.
14603 Benfer Road
Houston, Texas 77069-2895 USA

Phone: (281) 440-9396
Fax: (281) 440-4432

Certified by: _____ on June 6, 1994.
G. R. Brammer

Certificate Number 400-1-060694

Referenced Documents

ASTM documents available from ASTM, 1916 Race Street, Philadelphia, PA, 19103.

E 76-88 (Reapproved 1993) Standard Test Methods for Chemical Analysis of Nickel-Copper Alloys

E 1473-92 Standard Test Methods for Chemical Analysis of Nickel, Cobalt, and High-Temperature Alloys

E 826 - 85 (Reapproved 1990) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019-93 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

ISO Guides available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

ISO Guide 25 (Third edition, 1990), General requirements for the competence of calibration and testing laboratories.

ISO Guide 30 (Second edition, 1991), Terms and definitions used in connection with reference materials.

ISO Guide 31 (First edition, 1981), Contents of certificates of reference materials.

ISO Guide 33 (First edition, 1989), Uses of certified reference materials.

ISO Guide 35 (Second edition, 1989), Certification of reference materials - General and statistical principles.

Other useful documents available at no cost from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.

NBS Special Publication 260-100, Handbook for SRM Users

NIST Special Publication 829, Use of NIST Standard Reference Materials for Decisions on Performance of Analytical Chemical Methods and Laboratories

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