

Brammer Standard Company, Inc.
Certificate of Analysis

B.S. 825D

Certified Reference Material for Nickel Alloy 825

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ²
Analysis listed as percent by weight					
C	0.015	0.002	Al	0.082	0.004
Mn	0.46	0.02	B	0.0019	0.0003
P	0.019	0.002	Ca	0.0012	0.0002
S	0.0007	0.0001	Co	0.29	0.01
Si	0.132	0.006	Mg	0.0009	0.0002
Cu	1.73	0.03	N	0.0076	0.0009
Ni	45.19	0.08	Nb	0.136	0.008
Cr	21.53	0.08	Ti	1.08	0.01
Mo	3.15	0.02	V	0.043	0.004
Fe	25.92	0.09	W	0.205	0.009

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 the 95% confidence interval. The half-width confidence interval C(95%) is shown on page 2.

Trace element information values for Ag, As, Bi, Cd, Ga, Ge, Hf, Hg, K, Na, O, Pb, Sb, Se, Sn, Ta, Te, Tl, Zn, and Zr are shown on page 3.

The requirements of ISO Guide 31 and ISO Guide 35 were generally followed for the preparation of this certified reference material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

Certificate Number 825D-101210p1/4

BS 825D	* code for analytical method		analysis listed as percent by weight										Certificate Number 825D-101210p2/4							
Analysis *	C	* Mn	* P	* S	* Si	* Cu	* Ni	* Cr	* Mo	* Fe										
1	3	0.013	3	0.4385	4	0.01635	13	0.00061	4	0.121	3	1.71	6	45.06	15	21.44	6	3.129	4	25.77
2	1	0.0133	6	0.4445	11	0.017	1	0.000617	6	0.123	6	1.715	6	45.065	3	21.45	4	3.131	6	25.811
3	1	0.0133	12	0.446	4	0.017	1	0.0007	6	0.124	6	1.715	6	45.135	6	21.46	14	3.133	3	25.83
4	1	0.0134	4	0.4464	4	0.017	1	0.0007	4	0.127	3	1.72	6	45.162	4	21.463	6	3.138	15	25.83
5	1	0.0141	6	0.4503	6	0.0181	1	0.0008	6	0.131	6	1.72	4	45.171	6	21.525	14	3.143	6	25.834
6	1	0.0146	4	0.452	6	0.0185	1	0.0008	4	0.1328	7	1.728	15	45.21	6	21.529	4	3.144	4	25.87
7	1	0.015	6	0.455	14	0.0188	1	0.0008	9	0.133	7	1.728	10	45.219	4	21.543	4	3.146	6	25.89
8	1	0.015	6	0.456	16	0.0189	1	0.0008	11	0.1335	4	1.731	6	45.22	4	21.55	6	3.15	4	25.89
	1	0.0151	4	0.464	4	0.0189	1	0.00083	6	0.134	4	1.734	4	45.235	15	21.571	12	3.153	11	25.9
10	1	0.0154	6	0.465	6	0.0206			9	0.135	11	1.745	3	45.25	6	21.578	11	3.155	3	25.923
11	1	0.016	14	0.476	4	0.0214			12	0.136	4	1.746	15	45.27	6	21.65	6	3.163	4	25.963
12	1	0.01643	11	0.4778	3	0.0215			4	0.1375	6	1.7462	4	45.27	6	21.65	6	3.1696	6	25.98
13	11	0.01718	4	0.481	14	0.0217			4	0.138	4	1.761					4	3.206	6	25.983
14	1	0.0174	4	0.4848	4	0.0219			4	0.138	4	1.77							4	25.99
15	1	0.018	4	0.487															15	26.03
16			14	0.492															4	26.04
17																			15	26.06
Average		0.0151		0.4635		0.0191		0.00074		0.1317		1.734		45.189		21.534		3.1508		25.917
Std Dev		0.0016		0.0173		0.0020		0.00008		0.0057		0.018		0.072		0.072		0.0205		0.088
Certified		0.015		0.46		0.019		0.0007		0.132		1.73		45.19		21.53		3.15		25.92
t		2.14		2.13		2.16		2.31		2.16		2.16		2.20		2.20		2.18		2.12
(95%)		0.0009		0.0092		0.0011		0.00007		0.0033		0.010		0.046		0.046		0.0124		0.045

continued from above

Analysis *	Al	* B	* Ca	* Co	* Mg	* N	* Nb	* Ti	* V	* W										
1	6	0.077	3	0.0015	4	0.00103	4	0.268	3	0.0007	2	0.00603	6	0.1205	12	1.067	11	0.037	3	0.19
2	6	0.0778	3	0.0015	7	0.0012	4	0.278	3	0.00071	2	0.0061	12	0.126	11	1.073	4	0.038	4	0.195
3	6	0.079	13	0.0015	4	0.0012	3	0.281	13	0.0008	2	0.0066	4	0.126	4	1.073	6	0.0395	6	0.196
4	12	0.0796	4	0.0016	4	0.0012	4	0.282	4	0.0010	2	0.0073	4	0.127	6	1.075	4	0.0408	6	0.196
5	5	0.0796	14	0.00179	13	0.0012	4	0.282	8	0.0010	2	0.0074	4	0.1279	3	1.078	3	0.041	4	0.2024
6	5	0.0807	13	0.00184	4	0.0014	12	0.290	4	0.0011	2	0.0074	3	0.132	4	1.08	4	0.0411	6	0.203
7	4	0.083	13	0.00186			4	0.2907			2	0.0080	6	0.138	6	1.081	4	0.0419	4	0.205
8	11	0.0833	14	0.00193			6	0.292			2	0.0081	14	0.138	4	1.081	4	0.0422	12	0.207
9	3	0.0846	4	0.002			4	0.2955			2	0.0083	14	0.138	4	1.082	4	0.0422	11	0.21
10	4	0.085	4	0.002			6	0.298			2	0.0089	6	0.1405	14	1.089	4	0.045	6	0.2155
11	4	0.08533	4	0.00203			7	0.298			2	0.0093	6	0.144	6	1.0904	4	0.04573	4	0.213
12	3	0.086	3	0.00205			3	0.303				11	0.1445	14	1.098	6	0.047	4	0.216	
13	4	0.0867	4	0.0021			6	0.307				3	0.147			6	0.0470	6	0.216	
14			5	0.0021			7	0.307				3	0.1483			6	0.052			
15			16	0.0023			6	0.307				4	0.1495							
16			3	0.0023			11	0.3078												
17			11	0.00246			6	0.3091												
Average		0.0821		0.00193		0.00121		0.2939		0.00089		0.00758		0.1365		1.0806		0.0429		0.2047
Std Dev		0.0033		0.00029		0.00012		0.0124		0.00017		0.00107		0.0093		0.0086		0.0040		0.0085
Certified		0.082		0.0019		0.0012		0.29		0.0009		0.0076		0.136		1.08		0.043		0.205
t		2.18		2.12		2.57		2.12		2.57		2.23		2.14		2.20		2.16		2.18
C(95%)		0.0020		0.00015		0.00012		0.0064		0.00018		0.00072		0.0052		0.0055		0.0023		0.0051

$C(95\%) = (t \times sd) / \sqrt{n}$ The half-width confidence interval, where t is the appropriate Student's t value, sd is the interlaboratory standard deviation, and n is the number of acceptable mean values. For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 section 6.

Code for analytical method

1	Combustion (ASTM E1019)	5	ICP-MS	ICP Mass Spectrometry	9	Gravimetric	13	GD-MS (Glow Discharge)
2	Fusion (ASTM E 1019)	6	XRF		10	Average of titration & gravimetric	14	Spectro-photometric
3	Spark AES	7	AAS - Atomic Absorption		11	GD AES (Glow Discharge)	15	Titration
4	ICP-AES	8	GFAAS	Graphite Furnace AAS	12	Average of ICP & DCP AES	16	DCP-AES

AES = Atomic Emission Spectrometry

Data listed below are not certified and provided for information only

analysis listed as mg/kg (ppm by mass)

* see page 2 for code for analytical method

Analysis	*	Ag	*	As	*	Bi	*	Cd	*	Ga	*	Ge	*	Hf	*	Hg	*	K	*	Na
1	13	<0.5	13	9.1	13	0.026	5	<0.1	13	23	13	<0.1	4	<0.1	13	<05	13	0.35	13	0.33
2	6	0.29	5	21	5	0.1	13	<0.2	5	31.6	5	4.4								
3	5	0.3	5	26.7	5	0.10														

Analysis	*	O	*	Pb	*	Sb	*	Se	*	Sn	*	Ta	*	Te	*	Tl	*	Zn	*	Zr
1	2	8	13	0.28	13	1.3	5	<0.1	13	7.2	4	4	13	<0.1	5	<0.05	13	1.1	3	10
2	2	8.5	5	0.7	5	3.39	13	<0.3	5	11.4	6	<10	5	0.1	13	<0.1	5	24.5	6	15
3	2	9	4	0.73	5	3.4			5	11.8	3	52							6	20
4	2	10.2							8	18									13	30
5	2	11.8							6	29										
6	2	18																		

Co-operating Laboratories: The co-operating laboratories were:

Laboratory	Accredited/Registered by
Anderson Laboratories, Inc., Greendale, WI	A2LA - 17025
ATI Allvac, Lockport, NY	PRI/Nadcap - 17025
ATI Allvac, Monroe, NC	PRI/Nadcap - 17025
ATI, Technical Center, Brackenridge, PA	PRI/Nadcap - 17025
Brammer Standard Company, Inc., Houston, TX	A2LA - ISO 17025, ISO Guide 34
Carpenter Technology Company, Reading, PA	PRI/Nadcap - 17025
Dirats Laboratory, Westfield, MA	Nadcap - 17025
IMZ - Instytut Metalurgii Zelaza, Gliwice, Poland	PCA - AB 554
Inco Test, Huntington, WV	Nadcap - 17025
Laboratory Testing Inc, Hatfield, PA	Nadcap - 17025
Leco Technical Services Laboratory, St. Joseph, MI	BSI - ISO 9001
National Analysis Center for Iron and Steel, Beijing, China	CNAS - 17025
Northern Analytical Laboratory Inc., Londonderry, NH	Nadcap - ISO 17025
VHG Labs, Manchester, NH	URS - ISO 17025

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, were followed for the preparation of this reference material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs in accordance with ASTM Standard Practice E 1806. The laboratories participating in the testing normally followed the requirements of ISO Standard 17025. Methods of analysis used were a combination of ASTM Standard Test Method E 1019 plus additional ICP and AA spectrometric methods and other methods listed on page 2.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM; 12h, 15h, 73c, 101f, 101g, 136e, 348a, 867, 882, 1078, 1098, 2166, 6102a, 3101a, 3106, 3107, 3109a, 3112a, 3113, 3114, 3126a, 3128, 3131a, 3132a, 3134, 3136, 3137, 3139a, 3150, 3151, 3161a, 3162a, 3163, 3165; BAS BCS 345, 351, 867; IMZ 184; JSS 003-3

Homogeneity: This Certified Reference Material (CRM) was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by spark atomic emission spectrometry and found to be compatible with the following Reference Materials: NIST SRM 1247, C1288; JK 37; BS 187, 187A, 187C, 187C, 825, 825B

Validity statement: ISO Guide 31 states that the certification should contain an expiration date for all materials where instability has been demonstrated or is considered possible, after which the certified value is no longer guaranteed by the certifying body. Whereas this material is in a solid form and stable, no expiration date is specified.

Source: The bar stock for this CRM was produced by Huntington Alloys/Special Metals, Huntington, WV.

Form: This CRM is machined in the form of a disc, approximately 38 mm in diameter and 19 mm thick by Brammer Standard Company, Inc.

Use: This CRM is intended for use in spark atomic emission and x-ray spectrometric methods of analysis. Refer to ISO Guide 33 for information about the use of Reference Materials.

Certified area: The entire depth of the disc may be used.

Caution: As with any bar material, avoid spark atomic emission spectrometric burns in the center of the disc (5 mm radius), as some segregation may be present.

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 disc during surface preparation.

Certificate Number: The unique identification number for this certificate of analysis is 825D-101210. You may obtain information on revisions of certificates from the internet at www.brammerstandard.com.

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. Phone: (281) 440-9396 web: www.brammerstandard.com
14603 Benfer Road
Houston, Texas 77069-2895 USA Fax: (281) 440-4432 e-mail: contact@brammerstandard.com

Certified by: _____ on October 12, 2010.
 Beau R. Brammer

**Brammer Standard Company, Inc., is accredited to ISO Guide 34 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials by A2LA (Certificate Number 656.02)
The scope of accreditation is listed on the website: www.brammerstandard.com**

**Brammer Standard Company's Chemical Laboratory is accredited to ISO Standard 17025 by A2LA.
(Certificate Number 656.01)**

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001:2008 by National Quality Assurance, U.S.A.

References:

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

Versions used were those available at the time of interlaboratory testing

- E 826 Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectrometry
- E 1019 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques
- E 1806 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

ISO Guides and Standards available from Global Engineering - www.global.ihs.com

- ISO Standard 17025:2005 General requirements for the competence of testing and calibration laboratories
- ISO Standard 9001:2008 Quality Management Systems - Requirements
- ISO Guide 30:1992 Terms and definitions used in connection with reference materials + 2008 amendment
- ISO Guide 31:2000 Reference materials -Contents of certificates and labels
- ISO Guide 33:2000 Uses of certified reference materials
- ISO Guide 34:2009 General requirements for the competence of reference material producers
- ISO Guide 35:2006 Reference Materials - General and statistical principles for certification

Other useful documents available from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.

NIST 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