

Brammer Standard Company, Inc.
Certificate of Analysis

B.S. 825E

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	0.010	0.002	Al	0.080	0.004
Mn	0.51	0.01	B	0.0025	0.0004
P	0.015	0.002	Co	0.26	0.01
S	0.0010	0.0002	N	0.0105	0.0009
Si	0.24	0.01	Nb	0.19	0.01
Cu	1.72	0.03	Ti	0.82	0.01
Ni	39.92	0.08	V	0.049	0.004
Cr	21.87	0.08	W	0.166	0.007
Mo	2.74	0.03	Informational values ³		
Fe	31.45	0.15	Ca	(0.0004)	
			O	(0.004)	

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.

³ Values in parentheses are not certified and are provided for information only

Trace element information values for Ag, As, Bi, Cd, Ga, Ge, Hf, Hg, K, Mg, Na, 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 825E-101210p1/4

BS 825E	* code for analytical method		analysis listed as percent by weight									Certificate Number 825E-101210p2/4								
Analysis *	C	* Mn	* P	* S	* Si	* Cu	* Ni	* Cr	* Mo	* Fe										
1	1	0.006	6	0.4967	6	0.013	12	0.21	7	1.667	6	39.747	15	21.78	12	2.704	6	31.216		
2	11	0.00625	4	0.4998	13	0.0135	1	0.0006	6	0.226	7	1.667	6	39.888	3	21.78	6	2.704	6	31.23
3	1	0.0068	4	0.50	4	0.01365	1	0.0007	4	0.226	3	1.670	15	39.91	6	21.798	6	2.705	6	31.235
4	1	0.0068	6	0.50	16	0.0139	1	0.000854	6	0.226	6	1.685	6	39.92	15	21.80	6	2.707	4	31.268
5	3	0.007	6	0.507	6	0.0141	1	0.0009	11	0.2278	6	1.69	10	39.927	6	21.81	4	2.71	4	31.36
6	1	0.00768	4	0.509	4	0.0145	1	0.0009	6	0.228	11	1.700	15	39.98	3	21.85	6	2.736	4	31.38
7	1	0.009	6	0.511	14	0.0155	1	0.0010	13	0.233	6	1.705	6	39.983	4	21.855	6	2.7369	3	31.468
8	1	0.009	4	0.514	6	0.0159	1	0.0010	4	0.2344	3	1.708	4	40.01	3	21.868	4	2.74	6	31.474
9	1	0.0100	12	0.515	6	0.016	1	0.0010	4	0.24	6	1.713	6	21.88	14	2.758	6	31.49		
10	1	0.0113	3	0.516	4	0.0162	1	0.0010	6	0.242	4	1.731	6	21.88	4	2.759	4	31.54		
11	1	0.0118	4	0.518	3	0.0163	13	0.0010	4	0.244	4	1.735	15	21.900	14	2.759	4	31.54		
12	1	0.012	14	0.525	4	0.0165	1	0.0011	6	0.245	6	1.7422	4	21.93	4	2.768	4	31.547		
13	1	0.0129	14	0.525	4	0.017	1	0.0012	12	0.247	4	1.751	15	22.00	4	2.773	3	31.55		
14	1	0.013	4	0.5258	14	0.0174	1	0.0013	9	0.248	12	1.754	6	22.008			15	31.56		
15	1	0.0139	11	0.5268	3	0.0174		9	0.249	4	1.76						15	31.61		
16									4	1.782							4	31.68		
Average		0.0096		0.5128		0.0154		0.00097		0.2351		1.716		39.921		21.868		2.735		31.447
Std Dev		0.0027		0.0102		0.0015		0.00019		0.0111		0.036		0.082		0.074		0.027		0.147
Certified		0.010		0.51		0.015		0.0010		0.24		1.72		39.92		21.87		2.74		31.45
t		2.14		2.14		2.14		2.18		2.14		2.13		2.36		2.16		2.18		2.13
(95%)		0.0015		0.0056		0.0008		0.00011		0.0062		0.019		0.068		0.043		0.016		0.078

continued from above

Analysis *	Al	* B	* Co	* N	* Nb	* Ti	* V	* W	* Ca	* O											
1	3	0.0735	3	0.0019	4	0.249	2	0.0089	4	0.174	6	0.799	4	0.044	3	0.158	13	0.000027	2	0.0027	
2	6	0.075	4	0.002	3	0.25	2	0.0094	3	0.1748	4	0.80	3	0.045	4	0.159	4	0.0002	2	0.0028	
3	6	0.0754	13	0.00213	4	0.250	2	0.0098	6	0.1755	4	0.806	4	0.0470	11	0.16	4	0.0002	2	0.00300	
4	3	0.0764	14	0.00213	3	0.251	2	0.0100	3	0.183	6	0.809	16	0.0475	6	0.161	3	0.00022	2	0.0034	
5	4	0.079	13	0.00219	6	0.258	2	0.0100	4	0.184	11	0.81	4	0.0478	6	0.163	3	0.0005	2	0.0040	
6	6	0.081	14	0.00226	4	0.2584	2	0.0103	4	0.184	4	0.810	4	0.0485	4	0.166	4	0.0007	2	0.00439	
7	4	0.082	4	0.0023	4	0.259	2	0.0104	4	0.1844	3	0.811	4	0.0486	6	0.1675	4	0.00103	2	0.0050	
8	12	0.0827	4	0.00238	7	0.260	2	0.0104	12	0.187	3	0.8133	6	0.051	4	0.168			2	0.0067	
9	5	0.0829	3	0.00244	4	0.2603	2	0.0105	14	0.190	6	0.815	4	0.05165	6	0.1694			2	0.0068	
10	5	0.0829	4	0.0025	7	0.265	2	0.0106	11	0.1955	4	0.8188	4	0.052	4	0.1720			2	0.0081	
11	5	0.0833	4	0.0027	12	0.267	2	0.0110	6	0.196	6	0.821	6	0.0531	4	0.1765					
12	5	0.0833	11	0.00280	11	0.2703	2	0.0111	14	0.196	14	0.822	6	0.057	12	0.178					
13	3	0.00280	6	0.273	2	0.0114	6	0.200	6	0.8251											
14	5	0.0029	6	0.273	2	0.0117	6	0.2015	14	0.828											
15	3	0.003	6	0.2745	2	0.0118	3	0.203	4	0.843											
16			16	0.0031	6	0.276		4	0.207	12	0.846										
Average		0.0798		0.00247		0.2622		0.01049		0.1897		0.8173		0.0494		0.1665		0.00041		0.00431	
Std Dev		0.0037		0.00037		0.0094		0.00082		0.0105		0.0134		0.0037		0.0067		0.00035		0.00191	
Certified		0.080		0.0025		0.26		0.0105		0.19		0.82		0.049		0.166		(0.0004)		(0.004)	
t		2.20		2.13		2.13		2.14		2.13		2.13		2.20		2.20					
C(95%)		0.0024		0.00020		0.0050		0.00045		0.0056		0.0071		0.0023		0.0060					

$C(95\%) = (t \times sd) / \sqrt{n}$ 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	*	Mg	
1	5	0.4	3	1	13	0.011	5	<0.1	13	17	5	0.5	4	<0.1	13	<05	13	0.14	13	0.72	
2	5	0.449	13	22	4	0.05	13	<0.2	5	29	13	9.7	13	<0.1						4	1
3	13	<0.5	5	26	5	<0.1														4	3

Analysis	*	Na	*	Pb	*	Sb	*	Se	*	Sn	*	Ta	*	Te	*	Tl	*	Zn	*	Zr
1	13	0.095	13	0.061	13	3.9	5	<0.1	3	18	3	15	5	0.4	13	<0.05	13	0.73	6	12
2			5	0.09	4	5.2	13	<0.5	13	22	4	37	13	<0.1	5	<0.1	5	17	3	16
3			5	0.2	5	5.5			5	31	6	40							6	20
4									5	32.1	6	71							3	24
5									6	42									13	33
6									8	48										

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 825E-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