

# BRAMMER STANDARD COMPANY, INC.

## Certificate of Analysis

### BS 929

Certified Reference Material for CDA 929 - UNS Number C92900

	Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>	Certified Values <sup>3</sup>
<b>As</b>	<b>0.0017</b>	0.0003	
<b>Co</b>	<b>0.0031</b>	0.0003	
<b>Cu</b>	<b>85.3</b>	0.6	
<b>Fe</b>	<b>0.0030</b>	0.0003	
<b>Ni</b>	<b>3.37</b>	0.02	
<b>O</b>	<b>0.0031</b>	0.0005	
<b>P</b>	<b>0.119</b>	0.003	
<b>Pb</b>	<b>1.98</b>	0.02	
<b>S</b>	<b>0.0026</b>	0.0003	
<b>Sb</b>	<b>0.0146</b>	0.0007	
<b>Sn</b>	<b>9.07</b>	0.07	
<b>Zn</b>	<b>0.0055</b>	0.0004	

### Informational Values<sup>3,4</sup>

Ag (<0.005)	Al (<0.00005)	Bi (<0.005)	C (<0.005)	Ca (<0.0005)
Cr (<0.005)	Mn (<0.00005)	N (<0.0001)	Si (<0.001)	

<sup>1</sup> For each element, the certified value listed is the present best estimate of the true value based on the mean of the weighted results of an interlaboratory testing program. See page 3 for more information on its calculation.

<sup>2</sup> For each element, the uncertainty listed is based on a statistical evaluation of the contributions of homogeneity and the interlaboratory testing program. See page 3 for more information on its calculation.

<sup>3</sup> Values are given in weight percent.

<sup>4</sup> Values in parentheses are not certified and are provided for information only.

Trace element information values for Ag, B, Ba, Be, Br, Cd, Ce, Cl, Cs, Dy, Er, Eu, F, Ga, Gd, Ge, Hf, Hg, Ho, I, In, Ir, K, La, Li, Lu, Mg, Mo, Na, Nb, Nd, Os, Pd, Pr, Pt, Rb, Re, Rh, Ru, Sc, Se, Sm, Sr, Ta, Tb, Te, Th, Ti, Tl, Tm, U, V, W, Y, Yb, and Zr are shown on page 4.

The requirements of ISO Guides 31, 34, and 35 were 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.

**Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895**  
**Telephone: (281) 440-9396 Fax: (281) 440-4432 Website: [www.brammerstandard.com](http://www.brammerstandard.com)**  
Certificate Number 929-021413 Page 1/6

Analysis	*	As	*	Co	*	Cu	*	Fe	*	Ni	*	O	*	P
1	4	0.0014	8	0.0023	4	85.1	8	0.0023	10	3.30	2	0.0027	7	0.110
2	5	0.0015	4	0.0025	13	85.3	3	0.0025	4	3.31	2	0.0028	4	0.110
3	3	0.0015	5	0.0028	5	85.5	5	0.0028	5	3.33	2	0.0029	5	0.118
4	5	0.0015	5	0.0030	5	85.5	5	0.0031	3	3.34	2	0.0034	5	0.118
5	5	0.0015	5	0.0032	4	85.5	12	0.0032	5	3.35	2	0.0037	3	0.121
6	5	0.0018	5	0.0032	4	86.2	4	0.0033	14	3.35			3	0.123
7	9	0.0019	4	0.0032	3	86.2	14	0.0034	4	3.36			4	0.128
8	4	0.0019	5	0.0033			9	0.0034	4	3.37				
9	14	0.0023	14	0.0034					4	3.37				
10			3	0.0034					5	3.38				
11									8	3.41				
12									4	3.42				
13									4	3.43				
Average		0.00171		0.00311		85.33		0.00303		3.366		0.00305		0.1192
Std dev		0.00015		0.00023		0.12		0.00025		0.017		0.00027		0.0024
H		0.00026		0.00032		0.64		0.00032		0.026		0.00032		0.0021
U <sub>1</sub>		0.00030		0.00039		0.65		0.00040		0.031		0.00042		0.0032
t-statistic		2.31		2.26		2.45		2.36		2.18		2.78		2.45
U <sub>2</sub>		0.00069		0.00089		1.58		0.0010		0.068		0.0012		0.0078
U <sub>3</sub>		0.00023		0.00028		0.60		0.00034		0.019		0.00052		0.0029
<b>Certified</b>		<b>0.0017</b>		<b>0.0031</b>		<b>85.3</b>		<b>0.0030</b>		<b>3.37</b>		<b>0.0031</b>		<b>0.119</b>
		<b>0.0003</b>		<b>0.0003</b>		<b>0.6</b>		<b>0.0003</b>		<b>0.02</b>		<b>0.0005</b>		<b>0.003</b>
Tolerance		0.0007		0.0009		1.6		0.0010		0.07		0.0012		0.008

Analysis	*	Pb	*	S	*	Sb	*	Sn	*	Zn
1	4	1.94	1	0.0018	5	0.0127	5	8.99	5	0.0044
2	4	1.95	1	0.0023	9	0.0137	4	9.01	4	0.0050
3	5	1.95	1	0.0023	4	0.0140	3	9.04	12	0.0051
4	4	1.96	1	0.0025	14	0.0151	4	9.04	9	0.0051
5	4	2.00	3	0.0025	5	0.0155	5	9.06	14	0.0051
6	14	2.03	1	0.0025	12	0.0168	10	9.07	5	0.0060
7	10	2.09	1	0.0027	3	0.0168	4	9.15	5	0.0064
8			1	0.0032	5	0.0170	14	9.23	5	0.0064
9			1	0.0032					4	0.0065
10			12	0.0032						
Average		1.979		0.00264		0.01465		9.072		0.00546
Std dev		0.018		0.00022		0.00062		0.048		0.00032
H		0.017		0.00030		0.00063		0.064		0.00040
U <sub>1</sub>		0.024		0.00037		0.00089		0.080		0.00051
t-statistic		2.45		2.26		2.36		2.36		2.31
U <sub>2</sub>		0.060		0.00085		0.0021		0.19		0.0012
U <sub>3</sub>		0.023		0.00027		0.00074		0.067		0.00040
<b>Certified</b>		<b>1.98</b>		<b>0.0026</b>		<b>0.0146</b>		<b>9.07</b>		<b>0.0055</b>
		<b>0.02</b>		<b>0.0003</b>		<b>0.0007</b>		<b>0.07</b>		<b>0.0004</b>
Tolerance		0.06		0.0008		0.0021		0.19		0.0012

Analysis	* Ag	* Al	* Bi	* C	* Ca	* Cr	* Mn	* N	* Si
1	5 0.0037	12 0.000022	5 0.0018	1 0.0025	4 0.00005	5 0.0015	5 0.000020	2 0.00005	4 0.0005
2	5 0.0048	5 0.000025	12 0.0021	1 0.0027	5 0.00005	5 0.0021	5 0.000025	2 0.00010	4 0.0006
3	12 0.0051	3 0.000050	5 0.0022	1 0.0032	4 0.00020	3 0.0025	1 0.000038		5 0.0007
4	5 0.0063	4 0.000050	5 0.0029	1 0.0037	5 0.00025	4 0.0025	4 0.000050		5 0.0010
5		4 0.000100		1 0.0046	14 0.00025		8 0.000050		
6				1 0.0047			5 0.000050		
7							3 0.000150		
Average	0.00483	0.000045	0.00218	0.00363	0.000156	0.00199	0.000047	0.000075	0.00066
Std dev	0.00047	0.000029	0.00025	0.00034	0.000054	0.00031	0.000025	0.000057	0.00016
H	0.00038	0.00012	0.00028	0.00034	0.00014	0.00027	0.00012	0.00012	0.00019
U <sub>1</sub>	0.00060	0.00012	0.00038	0.00048	0.00015	0.00041	0.00012	0.00014	0.00025
t-statistic	3.18	2.78	3.18	2.57	2.78	3.18	2.45	12.71	3.18
U <sub>2</sub>	0.0019	0.00034	0.0012	0.0012	0.00041	0.0013	0.00030	0.0017	0.00080
U <sub>3</sub>	0.0010	0.00015	0.00060	0.00050	0.00019	0.00065	0.00011	0.0012	0.00040
(Informational)	(<0.005)	(<0.00005)	(<0.005)	(<0.005)	(<0.0005)	(<0.005)	(<0.00005)	(<0.0001)	(<0.001)

For each element, in accordance with the requirements of ISO Guides 34 and 35, an effort must be made to account for the effects on the certified value of the uncertainty estimate from homogeneity testing (H) and the uncertainties of the contributing laboratories. The average (A) is calculated using a weighted mean where the reciprocal of the square of each laboratory's combined uncertainty (C<sub>L</sub>), calculated from its standard deviation (S<sub>L</sub>) and its uncertainty estimate (U<sub>L</sub>), is used as the weight (W<sub>L</sub>) for its mean (M<sub>L</sub>). The standard deviation (S) is calculated as the square root of the reciprocal of the sum of the weights. U<sub>1</sub> is the combined uncertainty from homogeneity and labs. U<sub>2</sub> is U<sub>1</sub> times the coverage factor (95 % t-statistic). U<sub>3</sub> is U<sub>2</sub> divided by the square root of the number of determinations (n). Thus:

$$C_L = \sqrt{S_L^2 + U_L^2} \quad W_L = \frac{1}{C_L^2} \quad A = \frac{\sum_{i=1}^n W_L M_L}{\sum_{i=1}^n W_L} \quad S = \frac{1}{\sqrt{\sum_{i=1}^n W_L}} \quad U_1 = \sqrt{H^2 + S^2} \quad U_2 = t \times U_1 \quad U_3 = \frac{U_2}{\sqrt{n}}$$

All but the final reported values are taken to two significant figures as determined by each quantity's uncertainty estimate. The final reported Uncertainty is U<sub>3</sub> rounded to one significant figure and represents the half width of the 95 % confidence interval for the **Certified** value. The final reported **Certified** value is A rounded to the same decimal place as the Uncertainty. The Tolerance is the half width of the 95 % confidence interval for measurements rounded to the same decimal place as the Uncertainty. The Uncertainty is a measure of the quality of the **Certified** value. The Tolerance is a measure of the expected performance of an analysis.

For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 section 6.

Analysis	* Au	* B	* Ba	* Be	* Br	* Cd	* Ce	* Cl	* Cs	* Dy
1	12 0.25	12 0.018	12 0.05	12 0.05	12 0.25	5 7.0e-09	12 0.05	12 0.11	12 0.05	12 0.025
2						10 1.0e-06				
3						12 0.1				
Analysis	* Er	* Eu	* F	* Ga	* Gd	* Ge	* Hf	* Hg	* Ho	* I
1	12 0.025	12 0.025	12 0.05	12 0.05	12 0.025	12 0.05	12 0.05	12 0.25	12 0.025	12 0.05
Analysis	* In	* Ir	* K	* La	* Li	* Lu	* Mg	* Mo	* Na	* Nb
1	12 0.25	12 0.05	5 2.9e-07	12 0.05	12 0.05	12 0.025	10 1.0e-06	10 1.0e-06	12 0.006	10 1.0e-06
2			12 0.016				12 0.056	12 0.025		12 0.025
Analysis	* Nd	* Os	* Pd	* Pr	* Pt	* Rb	* Re	* Rh	* Ru	* Sc
1	12 0.025	12 0.05	12 0.25	12 0.025	12 0.05	12 0.05	12 0.05	12 2.5	12 0.05	12 0.05
Analysis	* Se	* Sm	* Sr	* Ta	* Tb	* Te	* Th	* Ti	* Tl	* Tm
1	5 1.0e-08	12 0.025	12 0.05	12 0.05	12 0.025	12 0.61	12 0.005	10 0.0000	12 0.025	12 0.025
2	10 1.0e-06					5 1		12 0.0025		
3	12 8.6									
Analysis	* U	* V	* W	* Y	* Yb	* Zr				
1	12 0.005	10 1E-06	10 0	12 0.05	12 0.025	12 0.025				
2		12 0.0005	12 0.05							

**Analytical Method Codes:**

1	Combustion (ASTM E1019)	7	Photometric	13	Titrimetric
2	Fusion (ASTM E 1019)	8	Flame Atomic Absorption	14	DCP Atomic Emission
3	Spark Atomic Emission	9	GF Atomic Absorption	15	HG Atomic Fluorescence
4	ICP Atomic Emission	10	X-Ray Fluorescence		
5	ICP Mass Spectrometry	11	GD Atomic Emission		
6	Gravimetric	12	GD Mass Spectrometry		

ICP = Inductively Coupled Plasma      GF = Graphite Furnace      GD = Glow Discharge  
DCP = Direct Current Plasma      HG = Hydride Generation

**Laboratory**

Anderson Laboratories, Inc.  
Brammer Standard Company, Inc.  
Dirats Laboratories  
Elemental Analysis, Inc.  
Shiva Technologies  
Laboratory Testing, Inc.  
LECO Corporation  
Luvak Inc.  
National Analysis Center For Iron And Steel  
NSL Analytical  
Northern Analytical Laboratory, Inc.

**Location**

Greendale, WI  
Houston, TX  
Westfield, MA  
Lexington, KY  
Syracuse, NY  
Hatfield, PA  
St. Joseph, MI  
Boylston, MA  
Beijing, China  
Cleveland, OH  
Londonderry, NH

**Registrar**

A2LA  
A2LA  
ACCLASS  
A2LA  
PRI/Nadcap  
PRI/Nadcap  
BSI  
PRI/Nadcap  
CNAS  
ACCLASS  
PRI/Nadcap

**Accreditation**

17025  
17025, Guide 34  
17025  
17025  
17025  
17025  
9001  
17025  
17025  
17025  
17025

A2LA = American Association for Laboratory Accreditation  
ACCLASS = ANSI-ASQ National Accreditation Board  
BSI = British Standards Institution  
CNAS = China National Accreditation Service  
Nadcap = National Aerospace and Defense Contractors Accreditation Program  
PRI = Performance Review Institute

**Analysis:** Chemical analyses were made on solid pieces and chips prepared by a lathe from representative samples of the certified portion of the lot in accordance with ASTM Standard Practice E 1806. The laboratories participating in the testing followed the requirements of ISO Standard 17025. Methods of analysis used were a those listed on pages 2-4.

**Traceability:** The following Certified Reference Materials were used to validate the analytical data listed on pages 2-4 — 33XGM75; 501-073, 501-550, 501-644, 501-646, 501-673, 501-679, 501-929, 501-991, 502-402, 502-403, 502-952; AR 673, 892, 893; BAM 361; BAS 180/1; BS CSN 4, CSN 2-1, CC937, 642A, 706A, 954M, 955B; CKD 937; CTIF UE30, UE50, UE54; IARM 74B, 77B, 78B, 89B, 90B, 267A; SRM 37B, 55D, 63B, 164A, 872, 885, 1253A, 3101A, 3103A, 3109A, 3112A, 3113, 3132, 3150, C1100.

**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 — CKD 321; CTIF UE30, UE50, UE54; BS CC937, 937, 954M, 955B.

**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. The certification of BS 929 is valid indefinitely. The certification is nullified if this CRM is damaged, contaminated, or otherwise modified.

**Source:** The bar stock for this CRM was produced by National Bronze & Metals, Inc. Lorain, Ohio

**Form:** This CRM is machined in the form of a disc, approximately 51 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 Certified Reference Materials.

**Certified Area:** The entire depth of the CRM may be used.

Caution: As with any bar material, avoid spark atomic emission spectrometric burns in the center of the CRM (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 sample during surface preparation.

**Certificate Number:** The unique identification number for this certificate of analysis is 929-021413. You may obtain information on revisions of certificates from the internet at [www.brammerstandard.com](http://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.**  
14603 Benfer Road  
Houston, Texas 77069-2895 USA

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

**Web: [www.brammerstandard.com](http://www.brammerstandard.com)**  
**Email: [contact@brammerstandard.com](mailto:contact@brammerstandard.com)**

**Brammer Standard Company, Inc., is accredited by the American Association For Laboratory Accreditation (A2LA) to ISO Guide 34 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials (Certificate Number 656.02)**

**Brammer Standard Company's Chemical Laboratory is accredited by A2LA to ISO Standard 17025. (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 (NQA), U.S.A.**

**The scopes of accreditation are listed on the website: [www.brammerstandard.com](http://www.brammerstandard.com)**

## **References:**

**Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895**  
**Telephone: (281) 440-9396 Fax: (281) 440-4432 Website: [www.brammerstandard.com](http://www.brammerstandard.com)**  
Certificate Number 929-021413 Page 5/6

Versions used were those available at the time of testing and characterization

- 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 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

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

*ISO Guides and Standards available from Global Engineering - [www.global.ihs.com](http://www.global.ihs.com)*

*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

Certified by: \_\_\_\_\_ on February 14, 2013.

Beau R. Brammer