

Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 172Be-1

Beryllium Copper Alloy

	Certified Value¹	Estimate of Uncertainty²		Information Values³
Copper	97.68	0.06	Aluminum	(0.02)
Beryllium	1.89	0.03	Arsenic	(0.001)
Cobalt	0.206	0.005	Carbon	(0.001)
Chromium	0.0032	0.0005	Sulfur	(<0.0002)
Iron	0.052	0.002	Lead	(0.002)
Manganese	0.0010	0.0004		
Nickel	0.039	0.003		
Phosphorus	0.003	0.001		
Silicon	0.055	0.003		
Tin	0.033	0.003		
Zinc	0.0070	0.0010		

(analysis listed as percent by weight)

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

See the following pages for more information.

New Certificate Number REV-172Be-1-072210

New Certificate Number REV-172Be-1-072210 was Revised on July 22, 2010 to show estimates of uncertainty

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Analysis	Cu	Be	Co	Cr	Fe	Mn	Ni	P
1	97.63	1.86	0.197	0.003	0.049	0.0006	0.034	0.002
2	97.65	1.87	0.204	0.003	0.05	0.001	0.039	0.0021
3	97.67	1.88	0.207	0.0030	0.052	0.001	0.040	0.003
4	97.69	1.893	0.207	0.0033	0.052	0.0012	0.040	0.0031
5	97.74	1.90	0.208	0.0039	0.053		0.0401	0.0038
6		1.92	0.21		0.0537		0.0418	
7								
Average	97.676	1.887	0.2055	0.0032	0.0516	0.0010	0.0392	0.0028
Std Dev	0.042	0.022	0.0046	0.0004	0.0018	0.0003	0.0027	0.0008
Certified	97.68	1.89	0.206	0.0032	0.052	0.0010	0.039	0.003
t	2.78	2.57	2.57	2.78	2.57	3.18	2.57	2.78
C(95%)	0.052	0.023	0.0048	0.0005	0.0019	0.0004	0.0028	0.0009

continued from above

Analysis	Si	Sn	Zn	Al	As	C	S	Pb
1	0.05	0.030	0.006	0.017	0.00007	0.0009	0.00019	0.001
2	0.054	0.031	0.0064	0.020	0.0008	0.0010	<0.0001	0.0012
3	0.0547	0.031	0.007	0.0212	0.001	0.0020		0.002
4	0.055	0.031	0.0077	0.027	0.001			0.002
5	0.057	0.034	0.008	0.027				
6	0.057	0.036		0.036				
7		0.0362						
Average	0.0546	0.0327	0.0070	0.0247	0.0007	0.0013		0.0016
Std Dev	0.0026	0.0026	0.0008	0.0068	0.0004	0.0006		0.0005
Certified	0.055	0.033	0.0070	(0.02)	(0.001)	(0.001)	(<0.0002)	(0.002)
t	2.57	2.45	2.78					
C(95%)	0.0027	0.0024	0.0010					

$C(95\%) = (t \times sd) / \sqrt{n}$ 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.

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

Some of the co-operating laboratories were:

- Brammer Standard Co., Inc., Houston, Texas
- Brush Wellman, Elmore, Ohio
- Colonial Metals, Columbia, Pennsylvania
- J. Dirats and Co., Inc., Westfield, Massachusetts
- Metals Analysis Inc., Huntington Park, California
- Technical Service Laboratories Inc., Mississauga, Ontario, Canada
- VHG Labs, Manchester, New Hampshire

Analysis: Chemical analyses were made on millings from cross-sections of the bars. The values listed above are individual laboratory analytical results.

Analytical Methods: Methods of analysis used were a combination of ASTM Standard Methods E 53-86a, E 106-83, E 478-89a, E 1019 plus additional ICP, and AA spectrometric methods.

Homogeneity: This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by optical emission spectrometry and found to be compatible with currently available Certified Reference Materials.

Form: This Reference Material is machined in the form of a disc, approximately 38 mm diameter and 12 mm thick by Brammer Standard Company.

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.

Use: This Reference Material 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.

Certificate Number: The unique identification number for this certificate of analysis is REV-172Be-1-072210. This BS 172Be-1 Certificate of Analysis was revised to show the estimate of uncertainty for the certified values. Additional digits were certified for Mn, Cr, and Zn.

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 website: brammerstandard.com
14603 Benfer Road
Houston, Texas 77069-2895 USA Fax: (281) 440-4432 email: contact@brammerstandard.com

Certified by: _____ on July 22, 2010.
Beau R. Brammer

Referenced Documents

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

Versions used were those available at the time of interlaboratory testing

- E 53-86a Standard Test Method for Determination of Copper in Unalloyed Copper by Gravimetry
- E 106-83 Standard Test Methods for Chemical Analysis of Copper-Beryllium Alloys
- E 478-89a Standard Test Methods for Chemical Analysis of Copper Alloys
- E 826 Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials
- E 1019 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, and in Iron, Nickel, and Cobalt Alloys

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

ISO Guide 33:2000 Uses of certified reference materials

ISO Guide 35:2006 Reference Materials - General and statistical principles for certification

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