Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 110A

High Purity Copper

Copper	99.97	Silicon	0.001
Tin	0.002	Manganese	<0.0003
Lead	0.003	Phosphorus	0.001
Zinc	(0.001)	Arsenic	(0.001)
Iron	0.003	Antimony	0.0004
Nickel	0.002	Sulfur	0.0008
Aluminum	0.002	Carbon	0.0018

(analysis listed as percent by weight)

Some of the co-operating laboratories were:

Brammer Standard Co., Inc., Houston, Texas
Brush Wellman Inc., 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

See data on reverse side.

Certificate No. 110A-112690

Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069
Telephone (281) 440-9396 Fax (281) 440-4432

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Analysis	Cu	Sn	Pb	Zn	Fe	Ni	Al
1	99.97	0.001	0.002	0.0009	0.002	0.001	0.0012
2	99.97	0.0017	0.0024	0.001	0.002	0.0015	0.0015
3	99.97	0.0018	0.0025	0.001	0.002	0.002	0.0016
4	99.98	0.002	0.003	0.0012	0.0038	0.002	0.002
5	99.98	0.003	0.0033	<0.01	0.0039	0.0027	
6		0.003	0.004	<0.01	0.004	0.003	
Average	99.974	0.0021	0.0029		0.0030	0.0020	0.0016
Std. Dev.	0.006	0.0008	0.0007		0.0010	0.0007	0.0003
Certified	99.97	0.002	0.003	(0.001)	0.003	0.002	0.002

Analysis	Si	Mn	P	As	Sb	C	S
1	0.001	0.000073	0.0008	0.00017	0.0003	0.0014	0.0008
2	0.001	0.0001	0.0009	0.0009	0.00032	0.0016	0.0008
3	0.0013	0.0002	0.0009	0.001	0.0004	0.00184	0.00089
4	0.0014	<0.0001	0.001	0.0013	0.00054	0.0023	
5	0.002	<0.0002	0.001	0.0017			
Average	0.0013		0.0009	0.00101	0.00039	0.0018	0.00083
Std. Dev.	0.0004		0.0001	0.00057	0.00011	0.0004	0.00005
Certified	0.001	<0.0003	0.001	(0.001)	0.0004	0.0018	0.0008

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

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

Methods of analysis used were a combination of ASTM Standard Methods E 53-86a, E 62-89, E 478-89a, plus additional ICP, and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 393, 394, 395, 396, 398, 399, 400, 454; BAM 361; IPT 64.

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 NIST Certified Reference Materials SRM 494, 495, 496, 457, 498, 499, 500, C1251, C1252, and C1253.

Inquiries concerning this Reference Material should be directed to:

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

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

Certified by: G. R. Brammer _____
on November 26, 1990