

Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 464A

Copper Alloy 464

Copper	60.6	Silicon	<0.01
Tin	0.62	Manganese	0.0002
Lead	0.056	Phosphorus	0.012
Zinc	38.73	Arsenic	<0.002
Iron	0.013	Antimony	(0.001)
Nickel	0.004	Carbon	(0.0006)
Aluminum	(0.001)	Sulfur	0.001

(analysis listed as percent by weight)

Some of the co-operating laboratories were:

Brammer Standard Co., Inc., Houston, Texas
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. 464A-060591

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

Analysis	Cu	Sn	Pb	Zn	Fe	Ni	Al	Si
1	60.25	0.60	0.055	38.69	0.012	0.0037	0.0007	0.00029
2	60.535	0.60	0.055	38.70	0.012	0.0038	0.001	0.0011
3	60.59	0.60	0.055	38.70	0.013	0.0039	0.0018	0.008
4	60.68	0.62	0.0567	38.71	0.013	0.004		<0.01
5	60.83	0.628	0.057	38.78	0.015	0.004		
6		0.64	0.057	38.80				
7		0.647						
Average	60.577	0.619	0.0560	38.730	0.0130	0.0039	0.0012	
Std Dev	0.214	0.020	0.0010	0.047	0.0012	0.0001	0.0006	
Certified	60.6	0.62	0.056	38.73	0.013	0.004	(0.001)	<0.01

Analysis	Mn	P	As	Sb	Ag	C	S
1	0.0001	0.010	0.0006	0.00065	0.0018	0.0005	0.0009
2	0.0001	0.011	0.00068	0.0009		0.0007	0.001
3	0.0002	0.011	0.0012				0.001
4	0.0003	0.0139	<0.001				
5	0.0004	0.015					
Average	0.0002	0.0122		0.0008	0.0018	0.0006	0.0010
Std Dev	0.0001	0.0021		0.0002		0.0001	0.0001
Certified	0.0002	0.012	<0.002	(0.001)		(0.0006)	0.001

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

Chemical analyses were made on millings from cross-sections of the bars. The individual values listed above are the average of each analysts' results.

Methods of analysis used were a combination of ASTM Standard Methods E 54-86a, 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 37e, 158a, 393, 394, 400, 454; BAM 222, 223, 224, 227, 228, 361; IPT 10a, 15; BCS 183/3.

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 1103, 1104, 1107, C1110, C1111, C1115, C1119.

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 USA

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

Certified by _____ on June 5, 1991.
G. R. Brammer