Brammer Standard Company, Inc.

Certificate of Analysis

BS 4620

AISI Grade 4620 Low Alloy Steel

	Certified Elements		Uncertified Elements	
	Certified Value[1]	Estimate of Uncertainty[2]	Information values	
	Analysis listed as percent by weight		Analysis listed as µg/g (ppm by weight)	
C	**0.189**	0.005	As	84
Mn	**0.57**	0.01	B	0.6
P	**0.006**	0.001	Ca	1
S	**0.018**	0.001	Hg	<0.1
Si	**0.25**	0.01	Mg	1
Cu	**0.216**	0.005	Nb	1
Ni	**1.75**	0.03	Pb	2
Cr	**0.072**	0.005	Sb	24
Mo	**0.24**	0.01	Ti	26
Al	**0.032**	0.002	V	8
Co	**0.012**	0.001	W	9
Sn	**0.013**	0.001	Zn	2
N	**0.0078**	0.0003		
O	**0.0009**	0.0002		

[1] The certified value listed is the present best estimate of the true value.

[2] The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values.

Some of the co-operating laboratories were:

Brammer Standard Co., Inc., Houston, Texas
Crucible Specialty Metals, Syracuse, New York
Hoesch Stahl AG, Dortmund, Germany
J. Dirats and Co., Inc., Westfield, Massachusetts
Northern Analytical Laboratory, Inc., Merrimach, New Hampshire
Shiva Technologies, Inc., Cicero, New York
VHG Laboratories, Inc., Manchester, New Hampshire

See reverse side for more information.

Certificate Number REC4620-081092

THIS CERTIFICATE OF ANALYSIS HAS BEEN RECREATED FOR POSTING ON THE WEB.

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Brammer Standard Company, Inc.

Supplemental Information Sheet
for
B.S. 4620

AISI Grade 4620
Low Alloy Steel

The data presented is these tables are supplied for general information.

Samples of the BS 4620 material were used as unknown specimens in the first quarter of 1992, Brammer Standard Company's Proficiency Testing Program (PTP). Samples were sent to 33 laboratories and tested by optical emission spectrometers, x-ray fluorescence spectrometers, a direct current plasma spectrometer and combustion instruments. The participants included very large, medium and small steel companies, foundries, fabricators and independent testing laboratories.

Each laboratory participating in the PTP was asked to analyze the sample as an unknown by using their routine methods and normal number of analyses.

The PTP was designed to show how one laboratory's routine analyses compares with that of other laboratories. Table 1 shows the number of laboratories within 1s (1 standard deviation) of the average of the PTP data. This information may be useful if you analyze this material by your routine methods as an unknown. If the values you obtain are within 1s of the averages shown in Table 2, then your values are as good as the majority of the laboratories participating in the PTP.

Element	Rounded Average, %	1s	Nr. of labs reporting	Nr. of labs within 1s	% Labs within 1s
Carbon, OES	0.195	0.007	21	15	71
Carbon, Comb.	0.192	0.004	19	16	84
Manganese	0.566	0.011	31	19	61
Phosphorus	0.006	0.002	32	28	88
Sulfur, OES	0.017	0.002	22	15	68
Sulfur, Comb.	0.018	0.001	17	13	76
Silicon	0.25	0.01	33	29	88
Copper	0.22	0.01	33	27	82
Nickel	1.76	0.04	31	27	87
Chromium	0.071	0.005	32	27	84
Molybdenum	0.239	0.007	32	24	75
Aluminum	0.033	0.003	28	25	89
Tin	0.013	0.001	18	18	100

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Notes on presentation of data in Table 2 –

- The mean averages from each lab are presented in the table.
- Most labs reported data to at least 3 decimal places.
- Data in brackets were treated as outlying data and not included in the statistical calculation or the range of values.

Table 2

BS 4620 (Results of Proficiency Test Program, First Quarter 1992, Sample Number 1922) **Certificate Number REC4620-081092**

Lab Code	C OES	C Comb	Mn	P	S OES	S Comb	Si	Cu	Ni	Cr	Mo	Al	Sn
A	----	0.1946	0.5488	0.0070	----	0.0203	0.2535	0.2425	1.7925	0.0723	0.2415	0.0363	----
B	----	0.1947	0.5557	0.0072	----	0.0186	0.2637	0.2283	1.7720	0.0690	0.2427	0.0358	----
C	----	0.1920	0.5720	0.0061	----	0.0187	0.2400	0.2180	1.7540	0.0690	0.2410	0.0345	0.0140
D	0.1883	0.1940	0.5767	0.0051	0.0221	0.0208	0.2580	0.2217	1.7343	0.0723	0.2413	0.0330	0.0119
E	----	0.1890	0.5630	0.0039	0.0181	0.0188	0.2600	0.2160	1.7200	0.0722	0.2450	0.0313	----
F	0.200	0.1957	0.575	0.0070	0.0193	0.0170	0.258	0.225	1.762	0.070	0.2365	0.0298	0.0120
G	0.185	0.200	0.580	0.0078	0.0140	[0.0070]	0.242	0.212	1.735	0.070	0.235	0.0360	0.0130
H	0.1988	----	[0.5930]	0.0051	0.0149	----	0.2394	0.2469	1.8023	0.0896	0.2428	0.0354	----
I	0.1957	----	0.5755	0.0069	0.0197	----	0.2625	0.2290	1.7875	0.0694	0.2351	0.0331	0.0128
J	----	0.1903	0.5625	0.0045	----	0.0190	0.2275	0.2230	1.7280	0.0660	0.2215	0.0275	----
K	0.1950	0.1940	0.5545	0.0056	0.0182	0.0155	0.2505	0.2307	1.7882	0.0752	0.2375	0.0308	0.0123
L	0.2098	----	0.5645	0.0077	0.0170	----	0.2598	0.2053	1.7508	0.0635	0.2455	----	----
M	0.2073	----	0.5713	0.0072	0.0170	----	0.2407	0.1989	[1.9868]	0.0795	[0.2687]	[0.0716]	0.0139
N	----	0.1925	0.5790	0.0080	----	0.0190	0.2620	0.2200	1.7480	0.0745	0.2520	0.0320	----
O	0.1933	----	0.5440	0.0043	0.0165		0.2490	0.2157	1.740	0.0660	0.2383	0.0327	0.0120
P	----	0.1913	0.5733	0.0063	----	0.0173	0.2613	0.233	1.753	0.0687	0.2383	0.0340	----
R	----	0.1933	0.562	0.0065	----	0.0190	0.258	0.230	1.745	0.070	0.248	0.0330	0.0120
S	0.2000	0.1865	0.580	0.0050	0.0165	0.0176	0.260	0.230	1.775	0.080	0.240	0.0320	0.0125
T	0.1955	0.1945	0.5830	0.0020	0.0167	----	0.2460	0.2275	1.6850	0.0715	0.2310	0.0315	0.0130
U	0.2010	0.1900	0.5825	0.0090	0.0195	----	0.2245	0.2160	1.7900	0.0695	0.2450	0.0350	----
V	0.1870	0.1940	0.5565	0.0062	0.0154	----	0.2435	0.2430	1.7665	0.0705	0.2390	0.0341	0.0132
W	----	0.1945	0.560	0.0105	----	0.0179	0.235	0.220	1.822	0.070	0.250	[0.0435]	0.0135
X	----	----	0.5550	0.0070	----	0.0167	0.2460	0.2130	1.7400	0.0700	0.2370	0.0250	----
Y	0.1957	----	[0.5385]	0.0077	0.0182	0.0182	0.2465	0.2275	1.7760	0.0773	0.2263	0.0298	----
Z	0.1895	----	0.5651	[0.0160]	0.0107	----	0.2664	0.2201	1.6899	0.0660	0.2334	0.0367	----
2	0.1996	0.1790	0.5825	0.0073	0.0198	0.0160	0.2525	0.2361	1.7773	0.0712	0.2218	0.0298	0.0138
4	0.1853	----	0.5648	0.0046	0.0191	----	0.2553	0.2253	1.7960	0.0728	0.2378	0.0337	----
5	0.1860	----	0.5510	0.0060	0.0130	----	0.2570	0.1990	[1.620]	0.0670	0.2300	0.0340	----
6	0.1950	----	0.5725	0.0105	0.0195	----	0.2613	0.2250	1.8688	[0.1075]	0.2450	0.0325	----
8	0.1875	0.1880	0.5540	0.0051	0.0189	0.0178	0.2545	0.2160	1.7350	0.0755	0.2365	0.0352	0.0138
9	0.2005	----	0.5650	0.0070	0.0185	----	0.2445	0.2125	1.7565	0.0670	0.2385	0.0315	0.0120
9A	----	----	0.5500	0.0070	----	----	0.2605	0.2200	1.7675	0.0690	0.2460	----	0.0120
9B	----	----	0.5635	0.0040	----	----	0.2195	0.2240	1.7400	0.0660	0.2400	----	0.0120
Average	**0.1950**	**0.1919**	**0.5659**	**0.0064**	**0.0174**	**0.0181**	**0.2502**	**0.2228**	**1.7613**	**0.0713**	**0.2387**	**0.0327**	**0.0128**
Std Dev	0.0069	0.0044	0.0110	0.0018	0.0025	0.0014	0.0117	0.0110	0.0360	0.0050	0.0071	0.0027	0.0008
Range of values													
Low	0.1850	0.1790	0.5440	0.0020	0.0107	0.0155	0.2195	0.1989	1.6850	0.0635	0.2215	0.0250	0.0119
high	0.2098	0.200	0.5830	0.0105	0.0221	0.0208	0.2664	0.2469	1.8688	0.0896	0.2520	0.0367	0.0140

"C Comb" and "S Comb" indicates analysis performed with a combustion instrument.

Instruments used: Labs C, J, N, R, W, X, 8, 9A, 9B used XRF, Lab E used DCP; all others used OES

BS 4620 analysis listed as percent by weight Certificate REC4620-081092

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	Co	Sn	N	O
1	0.185	0.563	0.0056	0.017	0.245	0.212	1.72	0.067	0.232	0.030	0.011	0.0107	0.0072	0.0008
2	0.188	0.565	0.0056	0.017	0.247	0.213	1.74	0.070	0.232	0.0313	0.0112	0.0119	0.0078	0.0008
3	0.189	0.565	0.006	0.017	0.253	0.215	1.748	0.072	0.242	0.0313	0.0116	0.012	0.0080	0.00095
4	0.189	0.565	0.0063	0.0172	0.254	0.216	1.75	0.0722	0.245	0.0318	0.012	0.013	0.0081	
5	0.192	0.573		0.0181	0.255	0.216	1.752	0.074	0.246	0.032	0.012	0.0145		
6	0.192	0.573		0.019	0.259	0.218	1.759	0.075	0.247	0.033	0.0123	0.015		
7		0.579			0.260	0.218	1.78	0.077	0.251	0.033				
8					0.262	0.223			0.252					
Average	0.1892	0.5690	0.0059	0.0176	0.2544	0.2164	1.750	0.0725	0.2434	0.0318	0.0117	0.0129	0.0078	0.0009
Std Dev	0.0026	0.0060	0.0003	0.0008	0.0060	0.0034	0.018	0.0033	0.0077	0.0011	0.0005	0.0017	0.0004	0.0001
Certified	0.189	0.57	0.006	0.018	0.25	0.216	1.75	0.072	0.24	0.032	0.012	0.013	0.0078	0.0009

Information values on uncertified elements analysis listed as µg/g (ppm by weight)

Analysis	As	B	Ca	Hg	Mg	Nb	Pb	Sb	Ti	V	W	Zn	Instrument Used
1	66	0.6		<0.1	1.4	1	1.6	26	23	3.8	17	3.3	Glow Discharge - Mass Spectrometer
2	40	0.5	1	<0.03	0.8	1	1	20	25	3	7	2	Glow Discharge - Mass Spectrometer
3	84				1		3	28		13	2	2	ICP Spectrometer
4	94												ICP Spectrometer
5	110				0.7				30	11	10		Optical Emission Spectrometer
6	110		0.9				1.3	24		7		2.6	Graphite Furnace AA Spectrometer
Best Estimate	84	0.6	1	<0.1	1	1	2	24	26	8	9	2	

Analysis: Chemical analyses were made on chips prepared by a lathe from cross-sections of the bars. The individual values listed above are the average of each analyst's results. Methods of analysis used were a combination of ASTM Standard Methods E 350, E 415, E 1019, plus additional ICP, and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 32e, 125b, 361 to 365; BAM 039-2, 044-1; BCS 455/1, 456/1, 458/1; ECRM 085-1, 088-1, 096-1, 184-1, 481-1; GBW 01402; IMZ 1.22, 1.74

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 the following NIST Certified Reference Materials: SRM 1222, 1224, 1225, 1261A to 1265A, 1761 to 1767

Source: This material was produced by The Timken Company, Canton, Ohio, by electric arc furnace, vacuum degassing, and casting into ingots. The bar stock material was produced by hot-rolling.

Description and Use: This Reference Material is in the form of a disc, approximately 40 mm (1-1/2") in diameter and 19 mm (3/4") thick. It is intended for the use in optical emission and x-ray spectrometric methods of analysis. The entire depth of the disc may be used.

Caution: As with any bar material processed from an ingot, avoid optical emission spectrometric burns in the center of the disc (5 mm radius) as some segregation may be present.

Preparation: Use the same method for preparing the analytical surface on all reference materials and specimens for best results.

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
14603 Benfer Road
Houston, Texas 77069-2895 USA Fax: (281) 440-4432

Certified by: _____ on August 10, 1992.
G. R. Brammer

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