Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 13B

Chill-cast Low Alloy Steel

Certified Elements			Uncertified Elements	
	Certified Value[1]	Estimate of Uncertainty[2]	Information values	
	Analysis listed as percent by weight			
C	**0.211**	0.005	B	0.00002
Mn	**0.316**	0.005	Bi	<0.0001
P	**0.018**	0.001	Ca	<0.0001
S	**0.005**	0.001	Ce	<0.0005
Si	**0.015**	0.003	Hg	<0.00001
Cu	**0.023**	0.002	La	<0.0005
Ni	**0.43**	0.01	Mg	0.00005
Cr	**0.081**	0.002	O	0.02
Mo	**0.050**	0.004	Te	<0.00005
Al	**0.016**	0.002	Zr	0.01
As	**0.050**	0.003		
Co	**0.19**	0.01		
N	**0.0099**	0.0004		
Nb	**0.003**	0.001		
Pb	**0.0009**	0.0002		
Sb	**0.027**	0.005		
Se	**0.023**	0.002		
Sn	**0.061**	0.003		
Ta	**0.005**	0.001		
Ti	**0.004**	0.001		
V	**0.010**	0.001		
W	**0.04**	0.01		
Zn	**0.0003**	0.0001		

[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.

See reverse side for more information. Certificate Number 13B-091192

Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895
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BS 13B analysis listed as percent by weight Certificate 13B-091192

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	As
1	0.206	0.311	0.017	0.003	0.012	0.021	0.415	0.0786	0.046	0.0137	0.0466
2	0.209	0.312	0.0175	0.004	0.0128	0.022	0.428	0.079	0.048	0.0144	0.0481
3	0.2092	0.317	0.018	0.0046	0.014	0.022	0.429	0.080	0.049	0.015	0.0484
4	0.210	0.318	0.0189	0.0046	0.014	0.0229	0.434	0.080	0.050	0.016	0.0492
5	0.211	0.319	0.019	0.0047	0.015	0.023	0.438	0.0808	0.0504	0.016	0.0504
6	0.212	0.321	0.0199	0.0049	0.017	0.024	0.440	0.082	0.051	0.017	0.052
7	0.212			0.006	0.019	0.024	0.445	0.082	0.0511	0.017	0.052
8	0.217			0.006	0.0192	0.024		0.0831	0.056	0.017	
Average	0.2108	0.3163	0.0184	0.0047	0.0154	0.0229	0.4327	0.0807	0.0502	0.0158	0.0500
Std Dev	0.0032	0.0040	0.0011	0.0010	0.0027	0.0011	0.0099	0.0016	0.0029	0.0013	0.0020
Certified	0.211	0.316	0.018	0.005	0.015	0.023	0.43	0.081	0.050	0.016	0.050

Analysis	Co	N	Nb	Pb	Sb	Se	Sn	Ta	Ti	V	W	Zn
1	0.183	0.0094	0.0017	0.0006	0.021	0.022	0.0572	0.004	0.0024	0.009	0.037	0.0002
2	0.185	0.0095	0.002	0.0008	0.022	0.023	0.0576	0.0042	0.003	0.0095	0.039	0.00025
3	0.188	0.0097	0.0030	0.00086	0.0241	0.0245	0.061	0.0045	0.0031	0.0098	0.041	0.00028
4	0.192	0.0101	0.003	0.00087	0.027		0.061	0.005	0.0036	0.0100	0.043	0.0003
5	0.193	0.0101	0.003	0.0009	0.0282		0.0611	0.006	0.0037	0.0100	0.0470	0.0005
6	0.200	0.01014	0.0032	0.00097	0.0285		0.062	0.0069	0.0037	0.0100	0.048	
7	0.204	0.0102	0.0034	0.0010	0.0292		0.062		0.0040	0.010	0.0508	
8			0.004	0.0010	0.030		0.0643		0.004	0.010	0.052	
9				0.00108	0.0304				0.0042	0.0105		
10				0.0011						0.0111		
Average	0.1921	0.00988	0.0029	0.00092	0.0267	0.0232	0.0608	0.0051	0.0035	0.0100	0.0447	0.00031
Std Dev	0.0077	0.00034	0.0007	0.00015	0.0035	0.0013	0.0023	0.0011	0.0006	0.0006	0.0055	0.00011
Certified	0.19	0.0099	0.003	0.0009	0.027	0.023	0.061	0.005	0.004	0.010	0.04	0.0003

Analysis	B	Bi	Ca	Ce	Hg	La	Mg	O	Te	Zr
1	0.000015	0.000005	0.00001	0.0002	<0.000003	0.00006	0.00001	0.014	0.00001	0.002
2	0.00002	0.00005	0.00001	0.00029	<0.00001	0.0003	0.00003	0.0154	<0.00001	0.006
3		<0.00004	0.00004	<0.0002		0.00034	0.00004	0.023		0.0112
4		<0.0001	0.00008	<0.0005		<0.0005	0.0001			0.012
5		<0.0001					0.0001			0.0167
6							0.0001			0.018
7										0.022
8										0.025
Best Estimate	0.00002	<0.0001	<0.0001	<0.0005	<0.00001	<0.0005	0.00005	0.02	<0.00005	0.01

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs. 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 and Glow-Discharge Mass Spectrometers. 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

Co-operating Laboratories: Some of the co-operating laboratories were:

Analytical Associates Inc., Detroit, Michigan
Analytika Co., Ltd., Prague, Czechoslovakia
Brammer Standard Co., Inc., Houston, Texas
Crucible Specialty Metals, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
Hoesch Stahl AG, Dortmund, Germany
Northern Analytical Laboratory, Inc., Merrimack, New Hampshire
Shiva Technologies, Inc., Cicero, New York
VHG Laboratories, Inc., Manchester, New Hampshire

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 melted and cast by American Centrifugal, Birmingham, Alabama, using an electric arc furnace. It was chill-cast into a water-cooled sample mold producing 648 discs simultaneously.

Description and Use: This Reference Material is in the form of a disc, approximately 32 mm in diameter and 17 mm thick. It is intended for use in optical emission and x-ray spectrometric methods of analysis.

Certified Area: The area certified of each disc is the portion extending upward 10 mm from the larger diameter surface.

Note: Shrinkage cavities may appear in the top portion of some discs. These cavities are normal and will not affect the certified portion of the disc.

Preparation: Use the same method for preparing the analytical surface on all reference materials and specimens for best results. Avoid overheating the disc during surface preparation.

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 11, 1992.
G. R. Brammer