Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 50D

Pure Iron

Analysis listed as µg/g (ppm by weight)

	Certified Elements		Informational Values for Uncertified Elements	
	Certified Value	Estimate of Uncertainty		
C	20	4	Ag	0.1
Mn	8	3	Al	40
P	14	2	As	1
S	2.4	1	Ca	<0.5
Si	18	3	Cd	<0.1
Cu	4	1	Ga	0.1
Ni	12	3	Ge	0.8
Cr	3	1.5	Hg	<0.5
Sn	<1		Mo	0.4
Co	26	4	Sb	0.2
N	24	4	Sr	0.1
O	220	12	Te	2
B	0.4	0.15	W	2
Mg	0.5	0.15	Zn	0.7
Nb	2	1	Zr	<2
Pb	0.5	0.15		
Ti	1	0.4		
V	4	1.5		

Some of the co-operating laboratories were:

Armco Research & Technology, Middletown, Ohio
Brammer Standard Co., Inc., Houston, Texas
Crucible Specialty Metals, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
LTV Steel Company, E. Chicago, Illinois
Northern Analytical Laboratory, Inc., Merrimach, New Hampshire
Shiva Technologies, Inc., Cicero, New York
Sumitomo Metal Mining Co., Ltd., Analytical Center, Ehime, Japan
VHG Laboratories, Inc., Manchester, New Hampshire

See reverse side for more information.

Certificate Number 50D-070892

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

BS 50D Certificate 50D-070892

Number	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	Co	N	O
1	18.6	6	13	1.6	15	3.8	9	1.6	0.2	0.05	21.1	21	20	208
2	19	6	13	2	16	4	9.5	2	0.2	0.31	31	25	20.5	214
3	19	6.6	13	2.5	17	4	11	2.6	0.9	0.8	33	25.3	23	219
4	20	7	13.5	2.7	18.2	4.2	11	3.1		<0.1	40	25.4	24	220
5	20	7.4	15	3	19	4.2	12	3.4		<1	41	26	24	230
6	20	8.5	17		20	5	13	6		<1	45	28	25	232
7	21.5	9					13				50	28	26	
8		9.1					14				56	30	26	
9		10					15						26.5	
Average	19.7	7.7	14.1	2.4	17.5	4.2	11.9	3.1	0.4		39.6	26.1	23.9	220.5
Std. Dev.	1.	1.5	1.6	0.6	1.9	0.4	2.0	1.6	0.4		11.1	2.7	2.4	9.2
Certified	20	8	14	2.4	18	4	12	3	(0.4)	<1	(40)	26	24	220

Number	Ag	As	B	Ca	Cd	Ga	Ge	Hg	Mg
1 GD-MS	0.13	0.52	0.34	<0.1	<0.1	0.09	0.80	<0.01	0.4
2 GD-MS	0.08	1.3	0.35	<0.01	<0.01	0.1	0.8	<0.5	0.43
3			0.45	<0.5					0.5
4			0.5						0.6
5									0.6
Average	0.11	0.91	0.41			0.10	0.80		0.51
Std. Dev.	0.04	0.55	0.08			0.01	0.00		0.09
Certified	(0.1)	(1)	0.4	<0.5	(<0.1)	(0.1)	(0.8)	(<0.5)	0.5

GD-MS indicates that analysis was performed by a Glow Discharge Mass Spectrometer

Number	Nb	Pb	Sb	Sr	Te	Ti	V	W	Zn	Zr
1 GD-MS	1.3	0.62	0.10	0.07	1.2	0.91	3	1.1	0.70	0.16
2 GD-MS	3	0.5	0.2	0.07	1.8	1.9	6.2	2.5	0.6	0.1
3	1.7	0.31				1	3.1	3		1
4	3	0.5				1.2	4			<0.7
5		0.54					5			
Average	2.25	0.49	0.15	0.07	1.50	1.25	4.3	2.20	0.65	
Std. Dev.	0.88	0.11	0.07	0.00	0.42	0.45	1.4	0.98	0.07	
Certified	2	0.5	(0.2)	(0.1)	(2)	1	4	(2)	(0.7)	<2

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 analyst's results.

Methods of analysis used were a combination of ASTM Standard Methods E 350, E 415, E 1019, plus additional ICP, AA, and Glow Discharge Mass 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; CMSI 1001, 1010A; ECRM 085-1, 088-1, 096-1, 097-1C

This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable for all elements except aluminum. It was also examined by optical emission spectrometry and found to be compatible with the following NIST Certified Reference Materials: SRM 1261A to 1265A, 1761 to 1767

The bar stock used for this material was produced by hot-rolling billets and annealing. The entire depth of the disc may be used.

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 G. R. Brammer _____ on July 8, 1992.