Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 50F

Certified Reference Material for Commercially Pure Iron

	Certified Value[1]	Estimate of Uncertainty[2]		Not Certified Informational Values[3]
	Analysis listed as percent by weight			Analysis listed as mg/kg (ppm by weight)
C	**0.0064**	0.0006	B	(<2)
Mn	**0.082**	0.004	Ca	(1)
P	**0.0066**	0.0007	Mg	(<1)
S	**0.0031**	0.0003	Nb	(<2)
Si	**0.016**	0.003	O	(26)
Cu	**0.0088**	0.0006	Pb	(<3)
Ni	**0.016**	0.002	Sb	(<10)
Cr	**0.022**	0.003	V	(3)
Mo	**0.0017**	0.0003	W	(<50)
Al	**0.003**	0.001	Zn	(14)
As	**0.0013**	0.0003	Zr	(<5)
Co	**0.0023**	0.0004		
N	**0.0042**	0.0003		
Sn	**0.0010**	0.0002		
Ti	**0.0004**	0.0001		

[1] The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

[2] The uncertainties listed are based on value judgments of the material inhomogeneity and the 95% confidence interval. The half-width confidence interval C(95%) is shown on page 2.

[3] Data in parentheses are not certified and are provided for information only.

See the following pages for more information.

Certificate Number 50F-010709p1

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BS 50F * code for analytical method Certificate No. 50F-010709

Analysis	*	C	*	Mn	*	P	*	S	*	Si	*	Cu	*	Ni	*	Cr	*	Mo	*	Al
1	10	0.0058	2	0.074	2	0.0058	3	0.0028	5	0.0115	3	0.00811	5	0.0107	2	0.017	2	0.0014	2	0.0016
2	3	0.0059	5	0.0750	2	0.0060	4	0.0029	5	0.013	5	0.0082	2	0.013	5	0.0172	2	0.0015	2	0.0024
3	10	0.0059	2	0.079	8	0.00629	10	0.0029	4	0.0135	4	0.0082	4	0.0148	2	0.0222	5	0.0015	5	0.0024
4	10	0.0061	2	0.0806	3	0.00630	10	0.00297	3	0.0141	5	0.0084	5	0.0155	2	0.0223	2	0.0015	5	0.0028
5	10	0.0061	2	0.081	8	0.00638	10	0.0030	3	0.01532	2	0.0088	2	0.016	2	0.0230	5	0.0015	5	0.0029
6	3	0.0062	2	0.0818	4	0.0066	10	0.0030	2	0.0178	2	0.0089	2	0.0167	2	0.0230	3	0.00160	5	0.0030
7	10	0.0063	3	0.08189	2	0.0068	10	0.00306	2	0.018	2	0.0090	2	0.0169	5	0.023	4	0.0016	5	0.0030
8	10	0.0066	2	0.0823	2	0.0074	3	0.00307	2	0.0180	6	0.0090	5	0.017	2	0.0232	2	0.0019	5	0.0030
9	10	0.0074	3	0.0835	3	0.0078	10	0.00309	8	0.0185	6	0.0091	2	0.0178	3	0.02366	2	0.0019	4	0.0040
10	10	0.0077	5	0.084			10	0.0031	8	0.0190	3	0.0093	3	0.0178	2	0.024	3	0.0022	3	0.0041
11			8	0.0849			10	0.00310	2	0.020	2	0.0100	6	0.0179	3	0.0246			2	0.0043
12			8	0.0851			10	0.00311					6	0.0180	4	0.0255			3	0.00488
13			4	0.0870			10	0.0033					3	0.01868						
14							10	0.0040												
Average		0.00640		0.0815		0.00660		0.00310		0.0162		0.00882		0.0162		0.0224		0.00166		0.00320
Std Dev		0.00065		0.0038		0.00065		0.00029		0.0029		0.00057		0.0023		0.0026		0.00025		0.00094
Certified		0.0064		0.082		0.0066		0.0031		0.016		0.0088		0.016		0.022		0.0017		0.003
# Labs		10		13		9		14		11		11		13		12		10		12
t		2.2622		2.1788		2.306		2.1604		2.2281		2.2281		2.1788		2.201		2.2622		2.201
C(95%)		0.00046		0.0023		0.0005		0.00016		0.0019		0.00038		0.0014		0.0017		0.00018		0.00060

Analysis listed as mg/kg (ppm by weight)

Analysis	*	As	*	Co	*	N	*	Sn	*	Ti
1	4	8.1	2	15	1	38	5	8	5	3
2	7	9	5	19	1	38.8	5	8.2	2	4
3	2	11	4	20	1	39	5	8.5	4	4.0
4	5	12	3	21	1	39	5	9	2	4
5	3	12.5	5	21	1	40	4	11	2	4
6	7	14.5	2	23	1	40.3	8	11	5	4.6
7	7	15.3	5	23	1	40.4	3	11	2	5
8	3	16	2	27	1	40.9	3	11.4	2	5
9	7	16.6	2	29	1	41	8	12	2	5
10	7	17.0	5	30	1	43	5	12	3	5.1
11					1	44				
12					1	44.7				
13					1	46				
14					3	50.3				
Average		13.2		22.8		41.8		10.2		4.4
Std Dev		3.2		4.7		3.4		1.6		0.7
Certified		13		23		42		10		4
# Labs		10		10		14		10		10
t		2.2622		2.2622		2.1604		2.2622		2.2622
C(95%)		2.3		3.4		2.0		1.1		0.5

Analysis listed as mg/kg (ppm by weight)

Analysis	*	B	*	Ca	*	O	*	Mg	*	Nb	*	Pb	*	Sb	*	V	*	W	*	Zn	*	Zr
1	4	0.26	4	0.48	1	15	4	0.054	3	0.1	4	0.074	3	1.8	5	1	4	0.24	4	12	4	0.24
2	3	0.7	2	0.7	1	15.2	2	0.42	4	1.5	5	0.1	4	4.5	4	1.5	3	1.9	5	16	3	4.5
3	5	1.5	2	0.7	1	17	3	0.5	3	<1	3	0.1	5	6.1	5	1.8	2	18			3	<1
4	3	<0.1	2	0.8	1	17.5					2	2	3	7	3	2	3	<1				
5			2	1	1	18					5	<0.5			3	2.5	5	<1				
6			2	1.0	1	21					5	<1			2	3	2	<10				
7			2	1	1	23.8					5	<1			2	3	2	<50				
8			2	2	1	27.7					5	<1			2	4	2	<50				
9			3	2.1	1	36					5	<1			2	5	2	<50				
10					1	36					5	<1			2	7	2	<50				
11					1	40					3	<1					2	<50				
12					1	44																
Average				1.1		25.9		0.325								3.1				14.0		
Std Dev				0.6		10.5		0.238								1.8				2.8		
Information (<0.2)				(1)		(26)		(<1)		(<2)		(<3)		(<10)		(3)		(<50)		(14)		(<5)

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

C(95%) = (t x sd)/√n The half-width confidence interval, where t is the appropriate Student's t value, sd is the interlaboratory standard deviation, and n is the number of acceptable mean values. For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.

*** Method of Analysis**

1	**Fusion - Thermal Conductivity Method**	**6**	**Flame Atomic Absorption Spectrometry**
2	**AES-ICP Inductively Couples Plasma Spectrometry**	**7**	**Graphite Furnace - Atomic Absorption Spectrometry**
3	**AES- Spark-Atomic Emission Spectrometry**	**8**	**Spectrophotometric method**
4	**Glow Discharge Mass Spectrometry**	**9**	**Titration method**
5	**AES-ICP-MS Inductively Couples Plasma with Mass Spectrometry**	**10**	**Combustion**

Co-operating Laboratories: The co-operating laboratories were:

Laboratory	Accredited/Registered by
Brammer Standard Company, Inc., Houston, TX	A2LA - ISO 17025, ISO Guide 34
Dirats Laboratory, Westfield, MA	Nadcap - 17025
ArcelorMittal, Hamilton, Ontario, Canada	A2LA - ISO 17025
Laboratory Testing Inc, Hatfield, PA	Nadcap - 17025
Leco Technical Services Laboratory, St. Joseph, MI	BSI - ISO 9001
Andrew S. McCreath & Son, Inc., Harrisburg, PA	A2LA - ISO 17025
National Analysis Center Iron and Steel, Beijing, China	Nadcap PNAS 17025
Northern Analytical Laboratory Inc., Londonderry, NH	Nadcap - ISO 17025
NSL Analytical, Cleveland, OH	Nadcap - ISO 17025
Tensile Testing Metallurgical Laboratory, Cleveland, OH	A2LA - ISO 17025
VHG Labs, Manchester, NH	URS - ISO 17025

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, and ASTM Standard Guides E 1724 were followed for the preparation of this reference material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs in accordance with ASTM Standard Practice E 1806. The laboratories participating in the testing normally followed the requirements of ISO Standard 17025. Methods of analysis used were a combination of ASTM Standard Test Method E 1019 plus additional ICP and AA spectrometric methods.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 293, 348a, 361, 2165, 2168, 3128, 3163; BS CSN 2-1, CSN 4, CE 013); BCS 345.

Homogeneity: This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by spark atomic emission spectrometry using ASTM Standard Test Method E 415 and found to be compatible with the following Reference Materials: NIST SRM 1265a, 1767, 1768; BS 50D, 50E.

Validity statement: ISO Guide 31 states that the certification should contain an expiration date for all materials where instability has been demonstrated or is considered possible, after which the certified value is no longer guaranteed by the certifying body. Whereas this material is in a solid form and stable, no expiration date is specified.

Source: The bar stock for this CRM was purchased from The Wagner Companies, Butler, Wisconsin.

Form: This CRM is machined in the form of a disc, approximately 35 mm in diameter and 19 mm thick by Brammer Standard Company, Inc..

Use: This CRM is intended for use in spark atomic emission and x-ray spectrometric methods of analysis. Refer to ISO Guide 33 for information about the use of Reference Materials.

Certified area: The entire depth of the disc may be used.

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

Sample Preparation: For best analytical results, use the same method for preparing the analytical surface on all reference materials as you use for production specimens. Avoid overheating the disc during surface preparation.

Certificate Number: The unique identification number for this certificate of analysis is 50F-010709-px, where x indicates the page number. Refer to future Brammer Standard Company catalogs for information on any revisions to this or other Brammer Standard reference materials. You may also obtain information on revisions of certificates from the internet at www.brammerstandard.com.

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:

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Houston, Texas 77069-2895 USA

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

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e-mail contact@brammerstandard.com

Certified by: _____ on January 7, 2009.
Beau R. Brammer

Brammer Standard Company, Inc., is accredited to ISO Guide 34 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials by A2LA (Certificate Number 656.02)
The scope of accreditation is listed on the website: www.brammerstandard.com

Brammer Standard Company's Chemical Laboratory is accredited to ISO Standard 17025 by A2LA.
(Certificate Number 656.01)

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001:2000 by National Quality Assurance, U.S.A.

References:

ASTM documents available from ASTM, 1916 Race Street, Philadelphia, PA, 19103.

E 415-08 Standard Test Method for Atomic Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel

E 826 - 08 Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectrometry

E 1019 - 2008 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

E 1724 - 95 (Reapproved 2001) Standard Guide for Testing and Certification of Metal and Metal-Related Reference Materials

E 1806-96(2006) Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

ISO Guides and Standards available from Global Engineering - www.global.ihs.com

ISO Standard 17025:2005 General requirements for the competence of calibration and testing laboratories.

ISO Guide 30:1992/Amd 1:2008 Terms and definitions used in connection with reference materials.

ISO Guide 31:2000 Reference materials -Contents of certificates and labels.

ISO Guide 33:2000 Uses of certified reference materials.

ISO Guide 34:2000 General requirements for the competence of reference material producers.

ISO Guide 35:2006 Certification of reference materials - General and statistical principles.

Other useful documents available from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.

NIST Special Publication 260-100, Handbook for SRM Users

NIST Special Publication 829, Use of NIST Standard Reference Materials for Decisions on Performance of Analytical Chemical Methods and Laboratories