Brammer Standard Company, Inc.

Certificate of Analysis

BS 67C

Certified Reference Material[1] for Grade 8740 Alloy Steel

(UNS Number G87400)

	Certified Value[2]	Estimate of Uncertainty[3]		Certified Value[2]	Estimate of Ucertainty[3]
		Analysis listed as percent by weight			
C	**0.404**	0.005	**N**	**0.0075**	0.0006
Mn	**0.91**	0.02	**Sn**	**0.010**	0.002
P	**0.015**	0.002	**V**	**0.0022**	0.0004
S	**0.009**	0.001	**Co**	**0.010**	0.002
Si	**0.239**	0.015			
Cu	**0.173**	0.004			
Ni	**0.61**	0.01	**Information Values[4]**		
Cr	**0.511**	0.010	O	0.0014	
Mo	**0.221**	0.005	Ti	0.002	
Al	**0.024**	0.002			

[1] Brammer Standard Company, Inc., is accredited to ISO Guide 34 as a Reference Material Producer to produce Certified Reference Materials by A2LA (Certificate Number 656.02)

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

[3] 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.

[4] Information values are not certified and are provided for information only.

See the following pages for more information.

Certificate Number 67C-031408p1

Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895
Telephone (281) 440-9396 Fax (281) 440-4432 brammerstandard.com

BS 67C **Data listed as mass fraction expressed as percent.** **67C-031408p2**

Analysis	*	C	*	Mn	*	P	*	S	*	Si	*	Cu	*	Ni	*	Cr	*	Mo
1	C	0.397	ICPA	0.89	ICPA	0.0136	C	0.008	ICPA	0.2229	ICPA	0.169	ICPA	0.593	ICPA	0.5000	XRF	0.216
2	C	0.4000	AES	0.908	ICPA	0.014	C	0.0081	ICPA	0.234	ICPA	0.174	ICPA	0.606	ICPA	0.506	ICPA	0.218
3	C	0.4021	K	0.908	ICPA	0.014	C	0.0084	AES	0.235	BCO	0.1735	AES	0.609	ICPA	0.5070	TP	0.219
4	C	0.4032	ICPA	0.910	ICPA	0.0145	C	0.0084	ICPA	0.2360	XRF	0.174	D	0.609	T	0.510	ICPA.	0.222
5	C	0.4040	ICPA	0.911	ICPA	0.0152	C	0.00851	ICPA	0.237	AES	0.175	ICPA	0.6110	ICPA	0.512	AES	0.222
6	C	0.405	ICPA	0.9160	AES	0.0156	C	0.00888	XRF	0.243	ICPA	0.1756	ICPA.	0.6130	AES	0.512	ICPA.	0.2220
7	C	0.4053	XRF	0.921	B	0.0157	C	0.00954	G	0.250			XRF	0.62	XRF	0.516	ICPA	0.2245
8	C	0.4088	ICPA	0.94	AES	0.0174	C	0.00975	ICPA	0.254			ICPA	0.62	ICPA	0.527	ICPA	0.226
9	C	0.410			XRF	0.0176	C	0.00986										
Average		0.4039		0.9130		0.0153		0.0088		0.2390		0.1734		0.6101		0.5113		0.2212
Std Dev		0.0040		0.0141		0.0015		0.0007		0.0098		0.0023		0.0086		0.0080		0.0033
Certified		0.404		0.91		0.015		0.009		0.239		0.173		0.61		0.511		0.221
# Labs		9		8		9		9		8		6		8		8		8
t		2.306		2.3646		2.306		2.306		2.3646		2.5706		2.3646		2.3646		2.3646
C(95%)		0.0031		0.0118		0.0011		0.0006		0.0082		0.0024		0.0072		0.0067		0.0028

* indicates method of analysis

Analysis	*	Al	*	N	*	Sn	*	V	*	Co	*	O	*	Ti
1	ICPA	0.0232	F	0.0069	ICPA	0.0074	XRF	0.002	ICPA	0.008	F	0.00088	ICPA	0.0002
2	AES	0.0235	F	0.0074	ICPM	0.0082	ICPA	0.002	ICPA	0.0100	F	0.0011	ICPA	0.001
3	ICPM	0.0236	F	0.0078	ICPA	0.0097	ICPA	0.0022	ICPA	0.0102	F	0.0014	XRF	0.0013
4	ICPA	0.0239	F	0.00775	AES	0.0100	AES	0.0024	AES	0.0104	F	0.00224	ICPA	0.0014
5	ICPA	0.024	F	0.0068	AES	0.010	ICPA	0.0026	XRF	0.011			AES	0.0022
6	ICPA	0.024	F	0.00843	ICPA	0.011			ICPA	0.0115			ICPA	0.0074
7					ICPA	0.012								
Average		0.0237		0.00752		0.0098		0.00224		0.01018		0.0014		0.0023
Std Dev		0.0003		0.00061		0.0016		0.00026		0.00120		0.0006		0.0026
Certified		0.024		0.0075		0.010		0.0022		0.010		(0.0014)		(0.002)
# Labs		6		6		7		5		6		4		6
t		2.5706		2.57060		2.4469		2.7764		2.5706		3.1824		2.5706
C(95%)		0.0003		0.00064		0.0014		0.00032		0.00126		0.0009		0.0027

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.

Methods of Analysis

Code Method

AES	AES - Spark Source Optical Emission Spectrometry
B	Bismuth-phosphorus-molybdenum blue photometric method
BCO	BCO photometric method
D	Dimethylglyoxime photometric method
ICPA	AES - ICP -Inductively Coupled Plasma Spectrometry
ICPM	AES ICP - MS Mass Spectrometry
C	Combustion-Infrared Absorption (ASTM E 1019) traceable to CRMs
F	Inert gas Fusion Method (ASTM E 1019) traceable to CRMs
G	Gravimetry with perchloric acid
K	Potassium periodate photometric method
T	Ammonium persulfate oxidation-ferrous titrimetric method
TP	Thiocyanate photometric emthod
XRF	X-Ray Fluorescence spectrometry

AES = Atomic Emission Spectrometry

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

Laboratory	Contact person
Allvac, Lockport, New York	Thomas Herdlein
Brammer Standard Co., Inc., Houston, Texas	Richard P. Beaumont
China National Analysis Center for Iron and Steel, Beijing, China	Prof. Wang Haizhou
Crucible Specialty Steel, Syracuse, New York	William Mastroe
J. Dirats and Co., Inc., Westfield, Massachusetts	Eric E. Dirats
Laboratory Testing Inc., Hatfield, Pennsylvania	Rick Heist
LECO Corporation, St. Joseph, Michigan	Dennis Lawrenz
Stork Herron, Cleveland, Ohio	Charles Belle (retired)
VHG Laboratories, Inc., Manchester, New Hampshire	Julie M. McIntosh

Additional analytical data: This material was used as an unknown test specimen number 3041 in a nationally recognized Proficiency Testing Program (PTP) for carbon and low-alloy steel. Most of the participating laboratories used one or more of the ASTM Standard Test Methods E 415, E 1019, and E 1085. The PTP data was not used in calculating the certified values listed on pages 1 and 2. The data shown below are the results from the PTP.

Combustion Instrument Analysis using ASTM Standard Test Method E 1019

	C	S	N	O
Number of Labs	26	41	22	15
Grand Average	0.4046	0.0098	0.0074	0.0013
Standard Deviation	0.0044	0.0013	0.0003	0.0004

Optical Emission Spectrometric Analysis using ASTM Standard Test Method E 415

	C	Mn	P	S	Si	Cu	Ni
Number of Labs	41	47	12	41	47	43	44
Grand Average	0.4090	0.9118	0.0155	0.0098	0.2339	0.1762	0.6111
Standard Deviation	0.0092	0.0148	0.0008	0.0013	0.0056	0.0046	0.0084

	Cr	Mo	Al	Sn	V	Co
Number of Labs	44	45	41	35	37	28
Grand Average	0.5127	0.2241	0.0259	0.0096	0.0031	0.0108
Standard Deviation	0.0078	0.0053	0.0014	0.0007	0.0012	0.0007

X-ray Emission Spectrometric Analysis using ASTM Standard Test Method E 1085

	Mn	P	Si	Cu	Ni	Cr	Mo
Number of Labs	9	7	7	8	9	9	9
Grand Average	0.9232	0.0161	0.2382	0.1760	0.6072	0.5145	0.2253
Standard Deviation	0.0153	0.0011	0.0100	0.0089	0.0088	0.0110	0.0041

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, and ASTM Standard Guides E 1724 and E 1831 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 Guide 25 and/or ISO Standard 17025. Individual values listed on page 2 are the average of each analyst's results. Methods of analysis are listed on page 3.

Outliers: Some outlying data was excluded from the data listed on page 2 due to technical assessment of the cooperating laboratories and statistical evaluation.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 293, 361, 362, 363, 364, 2172, 3113, 3161a, 3162a, ; ECRM 184-1, JSS 502-5; LECO 501-502, 501-503, 501-504, 501-550, 501-644, 501-679, 502-197; BS CSN2-1, CSN 4;

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Homogeneity: This Certified Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by optical emission spectrometry using ASTM Standard Test Method E 415 and found to be compatible with the following Reference Materials: NIST SRM 1222, 1269; BSC BS XEEH, 61D, 3941, 3942, 4942.

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: This material was produced by Copperweld Steel Company in 1999.

Form: This Certified Reference Material is in the form of a disc, approximately 38 mm (1.50 inches) diameter and 19 mm (0.75 inches) thick.

Use: This Certified Reference Material is intended for use in optical 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 optical 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 67C-031408-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 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:

Brammer Standard Co., Inc.
14603 Benfer Road
Houston, Texas 77069-2895 USA

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

web brammerstandard.com
e-mail contact@brammerstandard.com

Certified by: _____ on March 14, 2008.
Beau R. Brammer

Certificate Number 67C-031408p4

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

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.

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

References:

ASTM documents available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959,
Telephone: 610-832-9500 Fax: 610-832-9555 e-mail: service@astm.org Website: www.astm.org

E 415-99a(2005) Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel

E 826 - 85 (Withdrawn 2005) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019 - 2003 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

E 1085-95(2004) Standard Test Method for X-Ray Emission Spectrometric Analysis of Low-Alloy Steels

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

E 1831 - 96 (Withdrawn 2005) Standard Guide for Preparing Certificates for Reference Materials Relating to Chemical Composition of Metals, Ores, and Related Materials.

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

ISO Standard 17025 (Second edition, 2005), General requirements for the competence of calibration and testing laboratories.

ISO Guide 30 (Second edition, 1992), Terms and definitions used in connection with reference materials.

ISO Guide 31 (Second edition, 2000), Reference materials -Contents of certificates and labels.

ISO Guide 33 (Second edition, 2000), Uses of certified reference materials.

ISO Guide 34 (Second edition, 2000), General requirements for the competence of reference material producers.

ISO Guide 35 (Third edition, 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