

Brammer Standard Company, Inc.

Certificate of Analysis

BS CC-31

Certified Reference Material¹ for Chill-cast Iron

	Certified Value ²	Estimate of Uncertainty ³		Certified Value ²	Estimate of Uncertainty ³
	Analysis listed as percent by weight				
C	3.70	0.04	Mg	0.030	0.002
Mn	0.386	0.004	N	0.0061	0.0006
P	0.015	0.001	Nb	<0.002	
S	0.014	0.002	Sn	0.005	0.001
Si	1.23	0.03	Ti	0.003	0.0005
Cu	0.107	0.005	V	0.010	0.001
Ni	0.080	0.002	W	0.012	0.002
Cr	1.91	0.03	Zr	<0.001	
Mo	0.023	0.002			
Al	0.007	0.002			
Ca	0.0011	0.0002	Information Value⁴		
Te	0.006	0.001	As	0.003	
Co	0.012	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 value is not certified and is provided for information only.

See the following pages for more information.

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Analysis	*	C	* Mn	* P	* S	* Si	* Cu	* Ni	* Cr	* Mo
1	C	3.66	AIC 0.385	AIC 0.0149	C 0.0105	AIC 1.20	AIC 0.099	AIC 0.080	AIC 1.87	AIC 0.0215
2	C	3.67	AES 0.385	AIC 0.015	C 0.011	AIC 1.21	AES 0.107	AIC 0.080	AIC 1.90	AIC 0.0220
3	C	3.67	AIC 0.386	AIC 0.015	C 0.012	AES 1.24	AIC 0.107	AIC 0.080	AIC 1.91	AIC 0.0220
4	C	3.68	AIC 0.387	AES 0.0159	C 0.013	AIC 1.25	AIC 0.109	AES 0.0805	AES 1.92	AIC 0.023
5	C	3.69	AIC 0.387	AIC 0.016	C 0.0135		AIC 0.109	AIC 0.0810	AIC 1.930	AES 0.024
6	C	3.69			C 0.0147		AIC 0.110			
7	C	3.72			C 0.0150					
8	C	3.726			C 0.0156					
9	C	3.73			C 0.0156					
10	C	3.74			C 0.0160					
11					C 0.0160					
12					C 0.016					
Average		3.698	0.3860	0.0154	0.0141	1.225	0.1068	0.0803	1.906	0.0225
Std Dev		0.029	0.0010	0.0005	0.0020	0.024	0.0040	0.0004	0.023	0.0010
Certified		3.70	0.386	0.015	0.014	1.23	0.107	0.080	1.91	0.023
t		2.2622	2.7764	2.7764	2.201	3.1824	2.5706	2.7764	2.7764	2.7764
C(95%)		0.021	0.0012	0.0007	0.0013	0.0379	0.0042	0.0006	0.029	0.0012

Analysis	*	Al	* Ca	* Te	* Co	* Mg	* N	* Nb	* Sn
1		AIC 0.006	AIC 0.0010	AAE 0.0051	AIC 0.010	AIC 0.028	FU 0.0056	AIC <0.002	AIC 0.004
2		AIC 0.007	AIC 0.0010	AAE 0.0053	AIC 0.0110	AES 0.02809	FU 0.0057	AIC <0.002	AIC 0.0051
3		AES 0.0071	AES 0.00105	AIC 0.0059	AIC 0.0110	AIC 0.0297	FU 0.0061	AES 0.0007	AIC 0.0051
4		AIC 0.0075	AIC 0.0012	AAH 0.0064	AIC 0.0126	AIC 0.030	FU 0.0062	AIC 0.001	AIC 0.0057
5		AIC 0.0084	AIC 0.0012	AAH 0.0074	AES 0.0131	AIC 0.031	FU 0.0068	AIC 0.001	AES 0.0065
6		AIC 0.0085				AIC 0.031		AIC 0.0011	
Average		0.0074	0.00109	0.0060	0.0115	0.0296	0.0061		0.0053
Std Dev		0.0009	0.00010	0.0009	0.0013	0.0013	0.0005		0.0009
Certified		0.007	0.0011	0.006	0.012	0.030	0.0061	<0.002	0.005
t		2.5706	2.7764	2.7764	2.7764	2.5706	2.7764		2.7764
C(95%)		0.0010	0.00013	0.0011	0.0016	0.0014	0.0006		0.0011

Analysis	*	Ti	* V	* W	* Zr	* As
1		AES 0.0022	AES 0.0093	AES 0.0102	AIC <0.0006	AIC 0.0018
2		AIC 0.0027	AIC 0.0096	AIC 0.012	AIC <0.0006	AES 0.0029
3		AIC 0.0027	AIC 0.0096	AIC 0.0126	AIC 0.0004	AIC 0.0029
4		AIC 0.0028	AIC 0.0097	AIC 0.0126	AIC 0.0009	AAH 0.0047
5		AIC 0.003	AIC 0.011	AIC 0.0128		AAH 0.0047
6						
Average		0.0027	0.0098	0.0120		0.0034
Std Dev		0.0003	0.0007	0.0011		0.0013
Certified		0.003	0.010	0.012	<0.001	(0.003)
t		2.7764	2.7764	2.7764		2.7764
C(95%)		0.0004	0.0008	0.0013		0.0016

* Methods of analysis listed on page 3.

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

Data listed as mass fraction expressed as percent.

$C(95\%) = (t \times sd) / \sqrt{n}$ 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

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Code	Method
AAE	Flame Atomic Absorption Spectrometry after extraction of antimony (III) iodide with TOPO/MIBK
AAH	Flame Atomic Absorption Spectrometry with hydride generation
AES	AES - Spark Source Optical Emission Spectrometry
AIC	AES - ICP -Inductively Coupled Plasma Spectrometry
C	Combustion-Infrared Absorption (ASTM E 1019) traceable to CRMs
FU	Inert gas Fusion Method (ASTM E 1019) traceable to CRMs

AES = Atomic Emission Spectrometry

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

Laboratory

AK Steel Research, Middletown, Ohio
Allegheny Ludlum, Technical Center, Brackenridge, Pennsylvania
Allvac, Lockport, New York
Brammer Standard Co., Inc., Houston, Texas
Crucible Specialty Steel, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
LECO Corporation, St. Joseph, Michigan
VHG Laboratories, Inc., Manchester, New Hampshire

Laboratory contact

Howard Vail
Shawn Cooper
Thomas Herdlein
Richard P. Beaumont
William Mastroe
Eric E. Dirats
Dennis Lawrenz
Julie M. McIntosh

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. The individual values listed on page 2 are the average of each analyst's results. Methods of analysis used were a combination of ASTM Standard Test Methods E 350 and E 1019 plus additional ICP and AA spectrometric methods.

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 C2424, C2425; BS 1C, 2C, 3C, 4C, 284C.

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 using ASTM Standard Test Method E 1999 and found to be compatible with the following Certified Reference Materials: NIST SRM 3, 338, 341, 363, 890, 1140, 1764, 2167, C2423 ; ECRM 478-1; BS CSN-1.

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 melted and cast by Greens Bayou Foundry, Inc., Houston, Texas, using an induction furnace. It was chill-cast into a mold on copper chill-plates producing all discs simultaneously. Both flat surfaces were chill-cast.

Description and use: This Reference Material is in the form of a disc, approximately 34 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 entire depth of the disc may be used

NOTE: Shrinkage cavities may appear in the middle portion of some discs. These cavities are normal. If a shrinkage cavity appears in the middle of the disc, the other side of the disc may be used.

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 REV-CC31-040606-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.

Editorial Revision: This certificate has been revised to add a NOTE after the above "Certified area" section on this page.

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: Fax:	(281) 440-9396 (281) 440-4432
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Certified by: _____ on April 6, 2006.
G. R. Brammer

Certificate Number REV-CC31-040606p4

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9002:1994 by National Quality Assurance, U.S.A.

Brammer Standard Company's Chemical Laboratory is accredited to ISO Guide 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 350 - 90 Standard Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

E 826 - 85 (Reapproved 1990) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019 - 93 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

E 1724 - 95 Standard Guide for Testing and Certification of Metal and Metal-Related Reference Materials

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

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

E 1999 - 99 Standard Test Method for Analysis of Cast Iron Using Optical Emission Spectrometry

ISO Guides available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

ISO Guide 25 (Third edition, 1990), General requirements for the competence of calibration and testing laboratories.

ISO Guide 30 (Second edition, 1991), Terms and definitions used in connection with reference materials.

ISO Guide 31 (First edition, 1981), Contents of certificates of reference materials.

ISO Guide 33 (First edition, 1989), Uses of certified reference materials.

ISO Guide 34 (First edition, 1996), Quality system guidelines for the production of reference materials.

ISO Guide 35 (Second edition, 1989), 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

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