

Brammer Standard Company, Inc.

Certificate of Analysis

BS CC-30

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	3.06	0.03	Mg	0.042	0.003
Mn	0.275	0.004	N	0.0074	0.0008
P	0.021	0.001	Nb	<0.002	
S	0.011	0.0015	Sn	0.005	0.001
Si	0.88	0.015	Ti	0.0022	0.0005
Cu	0.070	0.002	V	0.008	0.0005
Ni	0.045	0.002	W	<0.003	
Cr	0.073	0.004	Zr	<0.002	
Mo	0.016	0.002			
Al	0.009	0.002			
Ca	0.0014	0.0002	Information Value⁴		
Te	0.010	0.002	As	0.002	
Co	0.016	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	3.02	AIC 0.272	AIC 0.020	C 0.0093	AIC 0.867	AIC 0.0665	AIC 0.044	AIC 0.068	AIC 0.014
2	C	3.02	AIC 0.274	AIC 0.0206	C 0.0098	AIC 0.868	AES 0.0682	AIC 0.044	AIC 0.072	AIC 0.015
3	C	3.04	AIC 0.274	AIC 0.0207	C 0.010	AIC 0.88	AIC 0.0688	AIC 0.044	AIC 0.072	AIC 0.0155
4	C	3.04	AES 0.275	AES 0.021	C 0.010	AIC 0.88	AIC 0.070	AIC 0.0443	AES 0.073	AIC 0.0156
5	C	3.04	AIC 0.276	AIC 0.021	C 0.0110	AIC 0.89	AIC 0.071	AIC 0.0445	AIC 0.0743	AIC 0.0160
6	C	3.04	AIC 0.278	AIC 0.022	C 0.0112	AES 0.892	AIC 0.071	AIC 0.046	AIC 0.076	AIC 0.0161
7	C	3.05	AIC 0.279	AIC 0.022	C 0.0113		AIC 0.071	AES 0.048	AIC 0.076	AIC 0.017
8	C	3.065			C 0.0114					AES 0.0173
9	C	3.077			C 0.0114					
10	C	3.08			C 0.0114					
11	C	3.107			C 0.0122					
12	C	3.11								
13	C	3.118								
Average		3.062	0.2754	0.0210	0.0108	0.880	0.0695	0.0450	0.0730	0.0158
Std Dev		0.0337	0.0024	0.0007	0.0009	0.011	0.0017	0.0015	0.0028	0.0011
Certified		3.06	0.275	0.021	0.011	0.88	0.070	0.045	0.073	0.016
t		2.1788	2.4469	2.4469	2.2281	2.5706	2.4469	2.4469	2.4469	2.3646
C (95%)		0.0204	0.0023	0.0007	0.0006	0.0111	0.0016	0.0014	0.0026	0.0009

Analysis	*	Al	* Ca	* Te	* Co	* Mg	* N	* Sn	* Ti
1	AIC	0.007	AIC 0.0013	AIC 0.0090	AIC 0.013	AES 0.0383	FU 0.0059	AIC 0.003	AES 0.0019
2	AIC	0.0078	AIC 0.0013	AAE 0.0095	AIC 0.014	AIC 0.039	FU 0.0068	AIC 0.0045	AIC 0.0021
3	AIC	0.0087	AIC 0.0014	AAE 0.0095	AIC 0.0147	AIC 0.0425	FU 0.0074	AIC 0.0046	AIC 0.0022
4	AES	0.009	AES 0.0014	AIC 0.0106	AIC 0.0155	AIC 0.0436	FU 0.0077	AIC 0.0050	AIC 0.0022
5	AIC	0.009	AIC 0.0014	AIC 0.0110	AIC 0.0156	AIC 0.0436	FU 0.0078	AIC 0.005	AIC 0.0022
6	AIC	0.0099	AIC 0.0015	AIC 0.012	AIC 0.0166	AIC 0.044	FU 0.0079	AIC 0.0053	AIC 0.0029
7	AIC	0.0100	AIC 0.0015		AIC 0.017	AIC 0.044	FU 0.0080		
8					AES 0.0175				
Average		0.0088	0.00140	0.0103	0.0155	0.0421	0.00736	0.0046	0.00225
Std Dev		0.0011	0.00008	0.0011	0.0015	0.0024	0.00076	0.0008	0.00034
Certified		0.009	0.0014	0.010	0.016	0.042	0.0074	0.005	0.002
t		2.4469	2.4469	2.5706	2.3646	2.4469	2.4469	2.5706	2.5706
C (95%)		0.0010	0.00008	0.0012	0.0013	0.0023	0.00070	0.0009	0.00036

Analysis	*	V	* W	* Zr	* Nb	* As
1	AIC	0.0076	AIC <0.002	AIC <0.0006	AIC <0.002	AIC 0.0013
2	AIC	0.0076	AIC <0.002	AIC <0.0006	AIC <0.002	AES 0.0016
3	AES	0.0077	AIC 0.0015	AIC <0.0010	AIC <0.002	AIC 0.0020
4	AIC	0.0077	AIC 0.0015	AIC 0.0004	AIC 0.0004	AIC 0.0021
5	AIC	0.0078	AIC 0.0019	AIC 0.0011	AIC 0.001	AIC 0.0022
6	AIC	0.008	AIC 0.0019	AIC 0.0018	AIC 0.001	AAH 0.0035
7	AIC	0.008	AES 0.0025		AIC 0.0012	AAH 0.0035
8					AES 0.0014	
Average		0.0078				0.0023
Std Dev		0.0002				0.0008
Certified		0.008	<0.003	<0.002	<0.002	(0.002)
t		2.4469				2.4469
C (95%)		0.0002				0.0007

* 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.

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	Laboratory contact
AK Steel Research, Middletown, Ohio	Howard Vail
Allegheny Ludlum, Technical Center, Brackenridge, Pennsylvania	Shawn Cooper
Allvac, Lockport, New York	Thomas Herdlein
Brammer Standard Co., Inc., Houston, Texas	Richard P. Beaumont
Crucible Specialty Steel, Syracuse, New York	William Mastroe
J. Dirats and Co., Inc., Westfield, Massachusetts	Eric E. Dirats
LECO Corporation, St. Joseph, Michigan	Dennis Lawrenz
VHG Laboratories, Inc., Manchester, New Hampshire	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 are 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. (Note added April 6, 2006)

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-CC30-040606-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: (281) 440-9396

Fax: (281) 440-4432

Certified by: _____ on April 6, 2006.
G. R. Brammer

Certificate Number REV-CC30-040606p4

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

Certificate Number REV-CC30-040606p5