

Brammer Standard Company, Inc.
Certified Reference Material¹

BS CCS-2

	Certified Value ²	Estimate of Uncertainty ³		Certified Value ²	Estimate of Uncertainty ³
Analysis listed as percent by weight					
C	0.200	0.004	Nb	0.049	0.003
Mn	0.885	0.007	Pb	0.0032	0.0009
P	0.046	0.002	Sb	0.024	0.003
S	0.040	0.0015	Sn	0.017	0.001
Si	0.310	0.005	Ta	0.020	0.003
Cu	0.096	0.003	Ti	0.037	0.003
Ni	0.314	0.005	V	0.080	0.002
Cr	0.269	0.006	W	0.042	0.004
Mo	0.100	0.003	Zr	0.002	0.0004
Al	0.038	0.002	Information Values⁴		
As	0.016	0.002	Ca	(0.0001)	
B	0.0037	0.0003	N	(0.0006)	
Co	0.055	0.003	O	(0.0010)	

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 homogeneity and the 95% confidence interval. The half-width confidence interval C(95%) is shown on pages 2 and 3.

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

See the following pages for more information.

Certificate Number **CCS2-111202p1**

BS CCS-2

Certificate Number CCS2-111202p2

Analysis	*	C	eu	*	Mn	eu	*	P	eu	*	S	eu	*	Si	eu	*	Cu	eu	*	Ni	eu
1	C	0.196	NS	AIC	0.877	0.054	AIC	0.043	0.001	C	0.0379	0.0014	GSI	0.306	0.006	AIC	0.093	0.007	AES	0.308	0.001
2	C	0.196	0.002	AIC	0.877	0.009	AIC	0.0439	0.0006	C	0.0381	0.0005	AES	0.308	0.003	AES	0.0949	0.0011	MND	0.310	0.009
3	C	0.197	0.002	MnP	0.883	0.009	AIC	0.045	0.003	C	0.040	0.001	AIC	0.3097	0.0016	AIC	0.0954	0.0020	AIC	0.3118	0.0020
4	C	0.198	0.002	AIC	0.8860	0.0020	AIC	0.0457	0.0016	C	0.0404	NS	AIC	0.310	0.014	MCB	0.0959	0.0043	AIC	0.315	0.005
5	C	0.2001	0.0010	AES	0.887	0.005	AES	0.0459	0.0008	C	0.041	0.001	AIC	0.313	0.005	AIC	0.096	0.002	AIC	0.316	0.006
6	C	0.202	0.002	AIC	0.89	0.01	MBT	0.0466	0.0016	C	0.0413	0.0025	AIC	0.316	0.005	AIC	0.0962	0.0035	AIC	0.320	0.029
7	C	0.205	0.002	AIC	0.894	0.010	AIC	0.049	0.002	C	0.0414	0.0025				AIC	0.099	0.002	AIC	0.321	0.005
Average		0.1992			0.8849			0.0456			0.0400			0.3105			0.0958			0.3145	
Std Dev		0.0034			0.0064			0.0019			0.0015			0.0036			0.0018			0.0049	
Certified		0.200			0.885			0.046			0.040			0.310			0.096			0.314	
t		2.4469			2.4469			2.4469			2.4469			2.5706			2.4469			2.4469	
C(95%)		0.0031			0.0059			0.0018			0.0014			0.0038			0.0017			0.0045	

Analysis	*	Cr	eu	*	Mo	eu	*	Al	eu	*	As	eu	*	B	eu	*	Co	eu	*	Nb	eu
1	AIC	0.262	0.014	AIC	0.097	0.005	AIC	0.036	0.005	AIC	0.015	0.002	AIC	0.0034	0.0009	AIC	0.052	0.006	AIC	0.045	0.006
2	AES	0.263	<0.001	AES	0.0982	0.0006	AES	0.0382	0.0005	AES	0.0158	0.0004	AIC	0.0036	0.0003	AIC	0.0531	0.0008	AES	0.0464	0.0010
3	AIC	0.2650	0.0030	AIC	0.099	0.002	AIC	0.0383	0.0010	AIC	0.016	0.001	MBD	0.0036	0.0003	AIC	0.054	0.002	AIC	0.0486	0.0012
4	TCr	0.270	0.006	AIC	0.0990	0.0020	AIC	0.0384	0.0014	AIC	0.0162	0.0020	MBD	0.0037	0.0003	AIC	0.0546	0.0019	AIC	0.050	0.002
5	AIC	0.270	0.005	AIC	0.100	0.005	MAC	0.0389	0.0028	AIC	0.0162	0.0009	AES	0.00373	0.00007	M5	0.0548	0.0030	AIC	0.050	0.002
6	AIC	0.274	0.005	AIC	0.101	0.002	AIC	0.039	0.001	MA _s	0.0162	0.0009	AIC	0.0039	0.0006	AES	0.0561	0.0004	AIC	0.0516	0.0019
7	AIC	0.277	0.003	MM _o	0.103	0.004	AIC	0.040	0.002	AA	0.017	0.001	AIB	0.0041	0.0002	AIC	0.058	0.002	MN _b	0.0524	0.0021
Average		0.2687			0.0996			0.0384			0.0161			0.00372			0.0547			0.0491	
Std Dev		0.0056			0.0020			0.0012			0.0006			0.00023			0.0020			0.0027	
Certified		0.269			0.100			0.038			0.016			0.0037			0.055			0.049	
t		2.4469			2.4469			2.4469			2.4469			2.4469			2.4469			2.4469	
C(95%)		0.0052			0.0018			0.0011			0.0006			0.00021			0.0018			0.0025	

NS = Not supplied

* Methods of analysis listed on page 4.

eu = estimate of uncertainty supplied by participating laboratory

$C(95\%) = (t \times sd) / n$ 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.

BS CCS-2 (continued)

Certificate Number CCS2-111202p3

Analysis *	Pb	eu	*	Sb	eu	*	Sn	eu	*	Ta	eu	*	Ti	eu	*	V	eu	*	W	eu	
1	AIC	0.0022	0.0005	AIC	0.020	0.004	AIM	0.0164	0.0014	AES	0.0173	0.0026	AIC	0.033	0.007	AIC	0.0776	0.0014	AIC	0.037	0.010
2	AES	0.0027	0.0002	AA	0.0224	0.0014	AES	0.0168	0.0003	AIC	0.0194	0.0012	AES	0.036	0.0006	AIC	0.0788	0.0012	AIC	0.040	0.002
3	SWP	0.0034	0.0005	AIC	0.023	0.002	AIC	0.0172	0.0005	AIC	0.0196	0.0021	AIC	0.036	0.002	AES	0.0789	0.0003	AIC	0.0421	0.0013
4	AIC	0.0037	0.0002	AIC	0.0232	0.0004	MSn	0.0172	0.0006	AIC	0.020	0.001	AIC	0.0378	0.0029	MVE	0.0793	0.0042	AIC	0.0428	0.0016
5	AIM	0.0038	0.0004	AIM	0.0232	0.0014	AIC	0.0174	0.0003	AIC	0.0204	0.0021	AIC	0.0383	0.0008	AIC	0.080	0.001	MWC	0.0429	0.0024
6				AES	0.026	0.0007	AIC	0.018	0.002	AIC	0.023	0.010	MTD	0.0388	0.0022	AIC	0.081	0.004	AIC	0.043	0.002
7				AIC	0.027	0.002				AIC	0.023	0.002	AIC	0.039	0.001	AIC	0.081	0.002	AES	0.0433	0.0007
Average		0.00316			0.0235			0.0172			0.0204			0.0370			0.0795			0.0416	
Std Dev		0.00069			0.0023			0.0005			0.0020			0.0021			0.0012			0.0023	
Certified		0.0032			0.024			0.017			0.020			0.037			0.080			0.042	
t		2.7764			2.4469			2.5706			2.4469			2.4469			2.4469			2.4469	
C(95%)		0.00085			0.0021			0.0006			0.0019			0.0020			0.0011			0.0021	

Analysis *	Zr	eu	*	Ca	eu	*	N	eu	*	O	eu	
1	AIC	0.0015	0.0003	AIC	0.00005	0.00003	FU	0.0004	0.0002	FU	0.0008	NS
2	AIC	0.0018	0.0004	AES	0.00008	0.00002	FU	0.0007	0.0002	FU	0.0010	0.0003
3	AIC	0.0019	0.0007	AIC	0.00014	0.0005	FU	0.0008	NS	FU	0.0010	0.0003
4	AIC	0.002	0.001							FU	0.0012	0.0002
5	PZ	0.0020	0.0004									
6	AIC	0.0021	0.0004									
Average		0.0019			0.00009			0.00063			0.00100	
Std Dev		0.0002			0.00005			0.00021			0.00016	
Certified		0.002			(0.0001)			(0.0006)			(0.0010)	
t		2.5706			4.3027			4.3027			3.1824	
C(95%)		0.0002			0.00011			0.00052			0.00026	

NS = Not supplied

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

* Methods of analysis listed on page 4.

eu = estimate of uncertainty supplied by participating laboratory

$C(95\%) = (t \times sd) / n$ 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.

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

Laboratory

AK Steel Research
 Brammer Standard Co., Inc., Houston, Texas
 China National Analysis Center for Iron and Steel, Beijing, China
 J. Dirats and Co., Inc., Westfield, Massachusetts
 LECO Corporation, St. Joseph, Michigan
 Shiva Technologies, Inc.
 VHG Laboratories, Inc., Manchester, New Hampshire

Laboratory contact

Howard Vail
 Richard P. Beaumont
 Prof. Wang Haizhou
 Eric E. Dirats
 Dennis Lawrenz
 Richard Balamut
 Julie M. McIntosh

Methods of Analysis

AA		Flame Atomic Absorption Spectrometry
AES		AES - Spark Source Optical Emission Spectrometry
AIB	B	AES - Extraction with 2-ethyl-1,3-hexanediol and back-extraction into dilute NaOH prior to ICP determination
AIC		AES - ICP - Inductively Coupled Plasma Spectrometry
AIM		AES - ICP Mass Spectrometry addition method
C	C, S	Combustion-Infrared Absorption (ASTM E 1019) traceable to CRMs
FU	N, O	Inert gas Fusion Method (ASTM E 1019) traceable to CRMs
GSI	Si	Gravimetry with perchloric acid (ASTM 350)
M5	Co	MAS - 5-Cl-PADAB spectrophotometric
MAC	Al	MAS - Chromazol S photometric
MAs	As	MAS - Molybdate test photometric method
MBD	B	MAS - Distillation separation-curcumin photometric
MBT	P	MAS - Trichloromethane extraction molybdenum blue photometric
MCB	Cu	MAS - Bicyclohexane oxalyldihydrazone photometric
MMo	Mo	MAS - Thiocyanate photometric
MNb	Nb	MAS - Sulphochlorophenol S photometric
MND	Ni	MAS - Dimethylglyoxime photometric
MnP	Mn	MAS - Periodate oxidation
MSn	Sn	MAS - Phenylfluorone photometric
MTD	Ti	MAS - Diantipylmethane photometric
MVE	V	MAS - n-benzoyl phenylhydroxylamine extraction photometric
MWC	W	MAS - Chlorpromazine hydrochloride sodium thiocyanate - tri-chloromethane extraction
PZ	Zr	MAS - Arsenazo III photometric
SWP	Pb	Square wave polarographic
TCr	Cr	Persulfate oxidation, ferrous sulfate titrimetric

AES = Atomic Emission Spectrometry

MAS = Molecular Absorption Spectrometry (photometric, spectrophotometric methods)

Homogeneity: This Certified Reference Material (CRM) 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: SRM 1222, 1225, 1262A, 1264A, 1269, 1763; CKD 165D; BS 3842.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on pages 2 and 3: NIST SRM 11f, 13g, 19g, 20d, 15h, 337a, 361, 362, 363, 364, 1761, 1762, 1764; ECRM 086-1; IMZ 1.74; CKD CZ 2004A.

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 blocks 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 pages 2 and 3 are the average of each analyst's results. Methods of analysis used are listed on this page.

Outliers: Some outlying data was excluded from the data listed on pages 2 and 3 due to technical assessment of the cooperating laboratories and statistical evaluation.

Source: This CRM was by an electric arc furnace, poured into an ingot, aluminum killed, hot rolled, and annealed.

Form: This CRM is in the form of a block, approximately 38 mm x 38 mm and 30 mm thick.

Use: This CRM is intended for use in optical emission and x-ray spectrometric methods of analysis.

Analytical area: The entire depth of the block may be used.

Caution: As with any bar material, avoid optical emission spectrometric burns in the center of the block (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 bar during surface preparation.

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.

Certificate Number: The unique identification number for this certificate of analysis is CCS2-111202-px, where x indicates the page number. You may also obtain information on revisions to this or other Brammer Standard materials 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 CRM should be directed to:

Brammer Standard Co., Inc.	Phone: (281) 440-9396	web	brammerstandard.com
14603 Benfer Road			
Houston, Texas 77069-2895 USA	Fax: (281) 440-4432	e-mail	bramstan@netropolis.net

Prepared by: _____ on November 12, 2002.
G. 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

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 415 - 85 (Reapproved 1999) Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel

E 826 - 85 (Reapproved 1996) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

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.

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

ISO Standard 17025 (First edition, 1999), General requirements for the competence of calibration and testing laboratories.

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 (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 (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