Brammer Standard Company, Inc.

Certificate of Analysis

BS D-6

Certified Reference Material for Tool Steel Grade D-6

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
		Analysis listed as percent by weight			
C	**0.472**	0.004	**Sb**	**0.0012**	0.0002
Mn	**0.78**	0.01	**Sn**	**0.0104**	0.0004
P	**0.007**	0.001	**Ti**	**0.0025**	0.0005
S	**0.0008**	0.0002	**V**	**0.122**	0.003
Si	**0.228**	0.007	**W**	**0.0018**	0.0004
Cu	**0.130**	0.005			
Ni	**0.602**	0.008			
Cr	**0.99**	0.01			
Mo	**1.01**	0.01	Informational values[3]		
Al	**0.037**	0.002	B	(0.0003)	
As	**0.011**	0.001	Nb	(0.002)	
Ca	**0.0011**	0.0002	O	(0.0008)	
Co	**0.012**	0.001	Pb	(0.0003)	
Mg	**0.0002**	0.0001			
N	**0.0031**	0.0005			

[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] Values in parentheses are not certified and are provided for information only

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

Certificate Number D6-031411p1/4

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

BS D-6 * code for analytical method analysis listed as percent by weight Certificate Number D6-031411p2/4

Analysis	C		Mn		P		S		Si		Cu		Ni		Cr		Mo		Al
1	1	0.467	4	0.763	4	0.0053	1	0.0005	4	0.220	4	0.119	3	0.591	12	0.97	4	0.992	4	0.033
2	1	0.469	4	0.763	4	0.006	1	0.0005	4	0.22	5	0.121	3	0.593	10	0.985	3	0.994	4	0.034
3	1	0.470	4	0.77	5	0.0060	1	0.0006	4	0.223	4	0.128	4	0.5965	4	0.986	3	0.995	4	0.035
4	1	0.47	4	0.776	5	0.0062	1	0.00074	4	0.223	4	0.129	8	0.597	3	0.988	4	0.995	5	0.0353
5	1	0.470	8	0.778	4	0.006455	1	0.0008	4	0.2232	8	0.129	4	0.5975	3	0.988	4	0.998	4	0.0373
6	1	0.470	8	0.7805	14	0.00681	1	0.0008	3	0.224	4	0.1305	4	0.598	4	0.988	4	1.00	4	0.0380
7	1	0.4709	4	0.7810	4	0.0073	1	0.0008	11	0.2255	3	0.131	4	0.599	4	0.989	4	1.0058	5	0.03835
8	1	0.4725	4	0.784	4	0.00742	1	0.001	8	0.228	4	0.131	4	0.6027	8	0.990	4	1.01	8	0.0384
9	1	0.4738	4	0.785	4	0.0075	1	0.0008	4	0.228	4	0.1314	4	0.604	4	0.991	7	1.01	4	0.0384
10	1	0.474	4	0.801	4	0.008	1	0.0010	4	0.2305	4	0.1314	4	0.605	4	0.993	4	1.01	3	0.0385
11	1	0.474					1	0.0013	4	0.233	4	0.132	4	0.608	4	0.9939	7	1.010	3	0.039
12	1	0.475							5	0.239	8	0.132	4	0.616	4	0.9940	4	1.018	4	0.0402
13	1	0.4755							4	0.242	3	0.134	4	0.6161	4	1.00	4	1.02		
14	1	0.480									4	0.135			4	1.00	4	1.0245		
15											4	0.137			4	1.009	4	1.034		
16																	14	1.039		
Average		0.4723		0.778		0.00670		0.00080		0.2277		0.1301		0.6018		0.9910		1.010		0.0371
Std Dev		0.0034		0.011		0.00085		0.00025		0.0068		0.0047		0.0079		0.0086		0.014		0.0022
RSD%		0.71		1.45		12.66		30.84		2.99		3.63		1.31		0.87		1.42		6.03
Certified		**0.472**		**0.78**		**0.007**		**0.0008**		**0.228**		**0.130**		**0.602**		**0.99**		**1.01**		**0.037**
t		2.16		2.26		2.26		2.26		2.18		2.14		2.18		2.14		2.13		2.20
C(95%)		0.0019		0.008		0.00061		0.00018		0.0041		0.0026		0.0048		0.0048		0.008		0.0014

continued from above

Analysis	As		Ca		Co		Mg		N		Sb		Sn		Ti		V		W
1	8	0.0095	4	0.00080	4	0.0103	4	0.0001	2	0.00192	5	0.000905	5	0.0100	4	0.0018	8	0.118	3	0.0013
2	8	0.0096	4	0.0009	4	0.0106	4	0.0001	2	0.0024	9	0.000965	8	0.010	5	0.0019	3	0.119	4	0.0014
3	5	0.0106	3	0.00098	4	0.011	5	0.0001	2	0.0032	8	0.0011	4	0.010	3	0.0021	3	0.12	4	0.0015
4	1	0.0111	4	0.001025	4	0.0111	3	0.00013	2	0.00325	5	0.0012	4	0.010	4	0.0021	4	0.120	5	0.00152
5	9	0.01125	3	0.00113	4	0.012	4	0.0002	2	0.00326	5	0.0013	5	0.0101	4	0.0022	4	0.1205	5	0.0016
6	4	0.0113	4	0.0012	8	0.0121	4	0.00020	2	0.0033	5	0.0014	14	0.0104	5	0.0028	4	0.1227	4	0.0018
7	4	0.0114	4	0.0012	4	0.0123	4	0.0002	2	0.0034			5	0.0104	3	0.0028	4	0.1228	5	0.0018
8	4	0.0114	4	0.0012	5	0.0123	4	0.0005	2	0.0034			8	0.0106	4	0.00287	4	0.124	4	0.002
9	4	0.012	4	0.0013	4	0.0124			2	0.0034			3	0.0107	4	0.003	4	0.124	4	0.0028
10	3	0.0125	4	0.0015	3	0.0125			2	0.00365			3	0.0108	4	0.003	4	0.125		
11	3	0.0126			4	0.0128							4	0.0108			4	0.125		
12	8	0.013			4	0.013							4	0.0114			5	0.129		
13					8	0.01315											4	0.137		
Average		0.0114		0.00112		0.01187		0.00019		0.00312		0.00115		0.01043		0.00246		0.1225		0.00175
Std Dev		0.0011		0.00020		0.00089		0.00013		0.00053		0.00019		0.00044		0.00048		0.0031		0.00045
RSD%		9.63		18.18		7.49		69.67		17.07		16.76		4.25		19.46		2.56		25.86
Certified		**0.011**		**0.0011**		**0.012**		**0.0002**		**0.0031**		**0.0012**		**0.0104**		**0.0025**		**0.122**		**0.0018**
t		2.20		2.26		2.20		2.36		2.26		2.57		2.20		2.26		2.20		2.31
C(95%)		0.0007		0.00015		0.00056		0.00011		0.00038		0.00020		0.00028		0.00034		0.0020		0.00035

continued from above

Analysis	B		Nb		O		Pb	
1	5	0.0001	5	0.0004	2	0.0003	8	0.00004
2	14	0.00011	5	0.0004	2	0.0004	5	0.00009
3	5	0.000125	4	0.00116	2	0.00058	5	0.0003
4	3	0.00038	5	0.002325	2	0.0007	5	0.0006
5	3	0.00039	4	0.0033	2	0.00087	8	0.0006
6	4	0.00042	4	0.004	2	0.0009		
7	4	0.0006			2	0.0010		
8					2	0.0011		
9					2	0.001425		
Average		0.00030		0.0019		0.00081		0.00033
Std Dev		0.00019		0.0015		0.00035		0.00027
RSD%		63.87		78.86		43.81		82.35
Not Certified		**(0.0003)**		**(0.002)**		**(0.0008)**		**(0.0003)**
t		2.45		2.57		2.31		2.78
C(95%)		0.00018		0.0016		0.00027		0.00033

* Code for analytical methods

1 Combustion
2 Fusion
3 Spark AES
4 ICP-AES
5 ICP-MS
6 GD-MS
7 DCP-MS
8 AAS
9 Flameless AAS
11 Gravimetric
12 Titrametric
14 Spectro-photo

AES = Atomic Emission Spectroscopy
ICP = Inductively Coupled Plasma
MS = Mass Spectroscopy
GD = Glow Discharge
DCP = Directly Coupled Plasma
AAS = Atomic Absorption Spectroscopy

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 35:2006 section 6.

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

Laboratory	Accredited/Registered by
Anderson Laboratories, Inc., Greendale, WI	A2LA - ISO 17025
Brammer Standard Company, Inc., Houston, TX	A2LA - ISO 17025, ISO Guide 34
Dirats Laboratory, Westfield, MA	Nadcap - ISO 17025
IMZ - Instytyt Metalurgii Zelaza, Gliwice, Poland	PCA - AB 554
Laboratory Testing Inc, Hatfield, PA	Nadcap - ISO 17025
Leco Technical Services Laboratory, St. Joseph, MI	BSI - ISO 9001
National Analysis Center for Iron and Steel, Beijing, China	CNAS - ISO 17025
NSL Analytical, Cleveland, OH	ACLASS- ISO 017025
Northern Analytical Laboratory Inc., Londonderry, NH	Nadcap - ISO 17025
VHG Labs, Manchester, NH	URS - ISO 17025

Analysis: Chemical analyses were made on chips prepared by an end mill from the certified portion of the discs in accordance with ASTM Standard Practice E 1806. The laboratories participating in the testing followed the requirements of ISO Standard 17025. Methods of analysis used were those listed on page 2.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 13g, 32e, 131e, 106a, 293, 337a, 344, 345, 346, 346a, 361, 362, 363, 364, 1757, 1762, 1764, 1766, 3102a, 3103a, 3107, 3109a, 3110a, 3112a, 3113, 3114, 3131a, 3132, 3134, 3136, 3137, 3139a, 3150, 3161a, 3162a, 3163, 3165; BCS 219, 320, 322, 325, 327, 405/1, 455/1, 456/1, 458, 458/1; ECRM 077-2, 085-1, 086-1, 087-1, 088-1, 096-1, 184/1, 481/1; IMZ 1.75/1, 1.8/3, 112, 130, 139; JSS GS-5d.

Homogeneity: This Certified Reference Material (CRM) was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by spark atomic emission spectrometry and found to be compatible with the following Reference Materials: NIST 1162, 1262a; SS 112; BS 11, 40, 43A, 3942, CSN2D.

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. The certification of BS 68E is valid indefinitely. The certification is nullified if this CRM is damaged, contaminated, or otherwise modified.

Source: The bar stock for this CRM was produced by Atlas Steel, A Division of Rio Algom Ltd..

Form: This CRM is machined in the form of a disc, approximately 38 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 D6-031411. You may 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:

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

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

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

Certified by: _____ on March 14, 2011.
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)

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 9001:2008 by National Quality Assurance, U.S.A.

The scopes of accreditation are listed on the website: www.brammerstandard.com

References:

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

Versions used were those available at the time of interlaboratory testing

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

E 1019 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

E 1806 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 testing and calibration laboratories

ISO Standard 9001:2008 Quality Management Systems - Requirements

ISO Guide 30:1992 Terms and definitions used in connection with reference materials + 2008 amendment

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

ISO Guide 33:2000 Uses of certified reference materials

ISO Guide 34:2009 General requirements for the competence of reference material producers

ISO Guide 35:2006 Reference Materials - General and statistical principles for certification

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