

Brammer Standard Company, Inc.

Certificate of Analysis

BS 2931A

Certified Reference Material for 1018 Grade Carbon Steel (UNS Number G10180)

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value	Estimate of Uncertainty ²
	Analysis listed as percent by weight			Analysis listed as percent by weight	
C	0.178	0.004	Pb	0.0008	0.0002
Mn	0.842	0.006	Sb	0.0021	0.0002
P	0.0046	0.0005	Sn	0.0094	0.0008
S	0.0262	0.0008	Ti	0.0006	0.0002
Si	0.244	0.005	V	0.0006	0.0002
Cu	0.199	0.008			
Ni	0.064	0.002			
Cr	0.086	0.003			
Mo	0.018	0.002			
Al	0.0011	0.0003	Not Certified - Informational Values ³		
As	0.005	0.001	Ga	(0.0007)	
B	0.0004	0.0001	Ge	(0.0025)	
Ca	0.0014	0.0001	Mg	(0.0002)	
Co	0.0067	0.0008	Nb	(0.0004)	
N	0.0099	0.0004	W	(0.0013)	
O	0.0050	0.0006	Zr	(0.0003)	

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

See the following pages for more information.

Certificate Number 2931A-050609p1

BS 2931A		* code for analytical method				analysis listed as percent by weight						Certificate No. 2931A-050609P2						
Analysis	*	C	*	Mn	*	P	*	S	*	Si	*	Cu	*	Ni	*	Cr	*	Mo
1	C	0.173	SA	0.833	IA	0.0035	C	0.0250	SA	0.234	IM	0.1790	IM	0.0585	IA	0.0794	IA	0.0160
2	C	0.173	SA	0.836	IA	0.0036	C	0.0251	SA	0.239	GM	0.1800	GM	0.0615	IM	0.0820	SA	0.0167
3	C	0.1736	IA	0.838	SA	0.0038	C	0.0255	SA	0.239	SA	0.192	IA	0.0623	IA	0.0848	SA	0.01700
4	C	0.17383	SA	0.838	SA	0.0042	C	0.0255	SA	0.240	IA	0.193	IA	0.0630	IA	0.0859	IA	0.0173
5	C	0.174	SA	0.83970	IM	0.0043	C	0.0257	SA	0.241	IA	0.194	SA	0.063	GM	0.0860	SA	0.0173
6	C	0.1744	SA	0.840	SA	0.0043	C	0.0257	IA	0.245	IA	0.1948	SA	0.063	SA	0.086	SA	0.0174
7	C	0.1756	IA	0.841	IA	0.0045	SA	0.0257	IA	0.2460	IA	0.198	IA	0.0640	SA	0.086	SA	0.0174
8	C	0.178	IA	0.8419	SA	0.0045	C	0.0259	IA	0.246	IA	0.200	SA	0.064	SA	0.086	SA	0.0176
9	SA	0.178	SA	0.842	SA	0.0046	SA	0.02597	IA	0.246	IA	0.201	SA	0.064	SA	0.086	IA	0.0176
10	SA	0.178	SA	0.843	SA	0.0047	C	0.0260	SA	0.24639	SA	0.203	IA	0.0643	IA	0.0866	IA	0.0178
11	C	0.178	IA	0.848	IA	0.0049	C	0.0260	SA	0.247	SA	0.203	SA	0.06475	IA	0.0868	IA	0.0179
12	C	0.179	IA	0.852	GM	0.0051	C	0.0260	IA	0.249	SA	0.203	IA	0.0648	SA	0.0869	IA	0.0179
13	SA	0.179	IA	0.855	IA	0.0052	C	0.02607	IA	0.255	SA	0.20388	SA	0.065	IA	0.0869	IA	0.0209
14	C	0.179			IA	0.0053	C	0.02609			SA	0.206	IA	0.0651	SA	0.087	IM	0.0210
15	C	0.180			IA	0.0053	C	0.0265			SA	0.207	IA	0.0652	SA	0.08783	IA	0.0216
16	SA	0.180			IA	0.0053	SA	0.0265			IA	0.2102	SA	0.0654	IA	0.0913	SA	0.0224
17	SA	0.18066			SA	0.00553	C	0.02661			IA	0.2165	IA	0.0655	IA	0.0930		
18	C	0.181					SA	0.0268										
19	C	0.181					C	0.0271										
20	SA	0.184					SA	0.0272										
21	SA	0.184					SA	0.0278										
22	C	0.1843					SA	0.0278										
23	C	0.185																
Average		0.1785		0.8421		0.00463		0.02621		0.2441		0.1991		0.0637		0.0864		0.01836
Std Dev		0.0038		0.0062		0.00062		0.00077		0.0054		0.0097		0.0018		0.0030		0.00194
Certified		0.178		0.842		0.0046		0.0262		0.244		0.199		0.064		0.086		0.018
t		2.07		2.18		2.12		2.08		2.18		2.12		2.12		2.12		2.13
C(95%)		0.0016		0.0038		0.00032		0.00034		0.0033		0.0050		0.0009		0.0015		0.00103

analysis listed as mg/kg (ppm by mass)

Analysis	*	Al	*	As	*	B	*	Ca	*	Co	*	N	*	O	*	Pb	*	Sb
1	SA	7	SA	31	GM	2.8	SA	13.0	IA	50	F	91	F	42	GF	6.3	GM	18
2	IA	7	SA	32	IA	3	IA	13	GM	59	F	94	F	44	IM	6.4	IA	18
3	IA	9	SA	33	IM	3.2	IA	13	SA	62	F	94.4	F	44	GF	6.4	IA	19
4	SA	9.4	SA	34	SA	3.2	IA	13.2	SA	62	F	94.6	F	45	GF	6.8	IA	19
5	IA	10	SA	36	SA	4	IA	13.5	SA	63	F	97	F	47	GF	7	IM	20
6	IA	10	IA	49	IA	4	IA	13.8	SA	63	F	99	F	50	GM	8.9	IA	21
7	IM	10	GM	50	IA	4	IA	14.0	SA	63	F	100.6	F	53	SA	10	IA	22
8	IA	10	IA	55	SA	4.9	SA	14.7	IM	64	F	100.6	F	53	IM	10	SA	22
9	SA	11	IA	55	SA	5	IA	14.8	IA	65	F	101	F	55	IA	10	IA	22
10	GM	11	IA	56	SA	5	SA	15.0	IA	68	F	102	F	62			IA	23
11	SA	12	IM	56	IA	5	SA	15.0	IA	70	F	102					IM	23
12	SA	13	SA	61	SA	5	GM	15	SA	74	F	103						
13	SA	15	IA	62	SA	5	SA	15.0	IA	75	F	103						
14	SA	19	SA	65.3			IA	15	IA	77								
15							SA	15.2	IA	77								
16							SA	17.0	IA	78								
17																		
Average		11.0		48.2		4.2		14.4		66.9		98.6		49.5		8.0		20.6
Std Dev		3.1		12.4		0.9		1.1		7.8		4.0		6.3		1.7		1.9
Certified		11		50		4		14		67		99		50		8		21
t		2.16		2.16		2.18		2.13		2.13		2.18		2.26		2.31		2.12
C(95%)		1.8		7.2		0.5		0.6		4.1		2.4		4.5		1.3		1.3

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

*** Method of Analysis**

F Fusion - Thermal Conductivity Method
IA AES-ICP Inductively Couples Plasma Spectrometry
SA AES- Spark-Atomic Emission Spectrometry
GM Glow Discharge Mass Spectrometry
IM AES-ICP-MS Inductively Couples Plasma with Mass Spectrometry

C Combustion
GF Graphite Furnace - Atomic Absorption Spectrometry

analysis listed as mg/kg (ppm by mass)

Analysis	*	Sn	Ti	*	V	*	Ga	*	Ge	*	Mg	*	Nb	*	W	*	*	Zr
1	SA	80	IA	1	IA	2	GM	3.8	IM	22	IM	2	GM	5.4	GM	1.5	GM	1.5
2	SA	80	IM	3	IA	3	IM	11	GM	28	IA	2	IM	6	IM	4.0	IM	4.0
3	SA	83	GM	4.2	IM	5.2					IM	1	GM	2.8	IA	7		
4	SA	86	IM	4.8	IA	6					SA	1.8	IA	3	IA	9		
5	SA	89	IA	5	IA	6					IM	1.8	IM	7.2	IA	10		
6	IM	90	IA	5	GM	6.5					IA	2	SA	7.5	IA	10		
7	SA	94	SA	5	SA	7					IA	2			IA	11		
8	IA	95	SA	5.5	IA	7					IA	2			SA	12		
9	IA	96	IA	6	IA	8					IA	2			SA	13		
10	IA	99	SA	6	IA	8									SA	13		
11	IM	100	SA	6	IA	9									IM	14		
12	IA	100	IA	6											SA	16		
13	IA	100	IA	6											SA	17		
14	IA	101	IA	6											SA	18		
15	IA	101	SA	7											IA	25		
16	SA	102.3	SA	8											IA	26		
17	GM	105	SA	9														
Average		94.2		5.5		6.2		7.4		25.0		1.6		4.1		13.3		2.8
Std Dev		8.1		1.8		2.1		5.1		4.2		0.5		2.6		6.0		1.8
Certified		94		6		6		(7)		(25)		(2)		(4)		(13)		(3)
t		2.12		2.12		2.23						2.31		2.57		2.13		
C(95%)		4.2		0.9		1.4						0.4		2.7		3.2		

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

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

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

Laboratory

Brammer Standard Company, Inc., Houston, TX
 Dirats Laboratory, Westfield, MA
 ArcelorMittal, Hamilton, Ontario, Canada
 IMZ - Instytut Metalurgii Zelaza, Gliwice, Poland
 Laboratory Testing Inc, Hatfield, PA
 Leco Technical Services Laboratory, St. Joseph, MI
 Northern Analytical Laboratory Inc., Londonderry, NH
 VHG Labs, Manchester, NH

Accredited/Registered by

A2LA - ISO 17025, ISO Guide 34
 Nadcap - 17025
 A2LA - ISO 17025
 PCA - AB 554
 Nadcap - 17025
 BSI - ISO 9001
 Nadcap - ISO 17025
 URS - ISO 17025

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, and ASTM Standard Guides E 1724 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 Standard 17025. Methods of analysis used were a combination of ASTM Standard Test Method E 1019 plus additional ICP and AA spectrometric methods.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 11h, 13g, 179, 293, 3102a, 3131a, 3128, 3137, 3162a, 3163; ECRM 085-1, 086-1, 087-1, 482-1, BAS BCS 232/2, 320, 321, 322, 345, 346, 361, 362, 365, 435, 456; IMZ 130, 139, 1.75/1; JSS GS-1d

Homogeneity: This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by spark atomic emission spectrometry using ASTM Standard Test Method E 415 and found to be compatible with the following Reference Materials: NIST SRM 1269, 1767; BAS SS 456/2; CKD 165D; BS 61D, 3941, 3942.

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: The bar stock for this CRM was purchased from Southern Tool Steel, Inc., Chattanooga, Tennessee.

Form: This CRM is machined in the form of a disc, approximately 41 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 2931A-050609-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 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
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Certified by: _____ on May 6, 2009.
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)
The scope of accreditation is listed on the website: www.brammerstandard.com

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 9001:2000 by National Quality Assurance, U.S.A.

References:

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

E 415-08 Standard Test Method for Atomic Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel

E 826 - 08 Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectrometry

E 1019 - 08 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

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

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 Guide 30:1992 Terms and definitions used in connection with reference materials

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

ISO Guide 33:2000 Uses of certified reference materials

ISO Guide 34:2000 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