

Brammer Standard Company, Inc.

Certificate of Analysis

BS H-19

Certified Reference Material¹ for Grade H-19 Tool Steel
(UNS Number T20819)

	Certified Value ²	Estimate of Uncertainty ³		Certified Value ²	Estimate of Uncertainty ³
Analysis listed as percent by weight					
C	0.404	0.005	N	0.0190	0.0008
Mn	0.318	0.008	O	0.0071	0.0008
P	0.014	0.002	Sn	0.0056	0.0008
S	0.011	0.001	V	2.05	0.05
Si	0.29	0.01	W	4.02	0.05
Cu	0.055	0.006	Nb	0.008	0.003
Ni	0.114	0.008			
Cr	4.27	0.05			
Mo	0.356	0.010	Information Values⁴		
Co	4.17	0.08	Al	<0.001	
As	0.0056	0.0008	Ti	(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 values are not certified and are provided for information only.

See the following pages for more information.

Certificate Number H-19-032008p1

Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895
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Data	* C	* Mn	* P	* S	* Si	* Cu	* Ni	* Cr	* Mo	* Co
1	1 0.3960	4 0.31	3 0.0112	1 0.0104	3 0.2727	11 0.048	11 0.105	11 4.209	11 0.341	3 4.116
2	1 0.3986	11 0.311	11 0.0121	1 0.0104	4 0.281	11 0.048	11 0.107	12 4.238	11 0.344	3 4.14
3	1 0.3992	11 0.314	3 0.0127	1 0.0105	8 0.285	4 0.053	14 0.111	11 4.246	11 0.349	3 4.140
4	1 0.400	3 0.315	10 0.0136	1 0.0105	3 0.288	3 0.0540	3 0.1112	12 4.251	3 0.352	11 4.14
5	1 0.401	3 0.3180	10 0.0139	1 0.0106	8 0.2883	11 0.054	3 0.115	11 4.256	3 0.356	3 4.140
6	1 0.405	9 0.320	3 0.014	1 0.0108	8 0.289	3 0.0546	6 0.115	4 4.26	9 0.357	12 4.192
7	1 0.406	3 0.322	4 0.0143	1 0.0115	4 0.291	3 0.0549	11 0.116	12 4.269	3 0.3596	12 4.195
8	1 0.4062	9 0.322	3 0.0146	1 0.0115	8 0.292	6 0.0578	3 0.116	12 4.273	4 0.361	3 4.2266
9	1 0.4063	3 0.3227	3 0.0147	1 0.0118	8 0.294	6 0.0580	3 0.116	3 4.34	3 0.3630	12 4.195
10	1 0.4068	3 0.326		1 0.0119	11 0.301	3 0.0592	6 0.118	12 4.3428	9 0.366	3 4.2266
11	1 0.407			1 0.0119	11 0.302	3 0.063	3 0.1234		3 0.369	
12	1 0.408			1 0.0119						
13	1 0.409			4 0.0119						
14	1 0.409			1 0.012						
15				1 0.0133						
Average	0.4042	0.3181	0.0135	0.0114	0.2895	0.0550	0.1140	4.2685	0.3561	4.1711
Std Dev	0.0043	0.0054	0.0012	0.0008	0.0083	0.0045	0.0051	0.0424	0.0089	0.0403
Certified	0.404	0.318	0.014	0.011	0.29	0.055	0.114	4.27	0.356	4.17
# Labs	14	10	9	15	11	11	11	10	11	10
t	2.1604	2.2622	2.306	2.1448	2.2281	2.2281	2.2281	2.2622	2.2281	2.2622
C (95%)	0.0025	0.0038	0.0009	0.0005	0.0056	0.0030	0.0035	0.0303	0.0060	0.0289

* indicates method of analysis - listed below

Data	* As	* N	* O	* Sn	* W	* V	* Nb	* Al	* Ti
1	8 0.0049	2 0.0181	2 0.0064	7 0.0049	11 3.97	4 1.99	4 0.0056	4 0.0006	7 0.0001
2	3 0.0049	2 0.0183	2 0.0065	3 0.0052	9 3.997	3 1.993	3 0.0056	3 0.0006	3 0.0004
3	4 0.0051	2 0.0185	2 0.0065	4 0.0052	4 4.01	3 2.0049	7 0.0072	7 0.0007	4 0.0015
4	6 0.0059	2 0.0186	2 0.0069	3 0.0054	3 4.031	11 2.055	4 0.009	7 <0.001	11 0.0024
5	6 0.0059	2 0.0189	2 0.0070	3 0.0054	3 4.0406	3 2.064	7 0.0091	11 <0.001	4 0.0027
6	6 0.0062	2 0.0191	2 0.00746	3 0.0057	3 4.044	3 2.069	7 0.0091	11 <0.001	3 0.0035
7	6 0.0063	2 0.0192	2 0.0075	7 0.0057	9 4.045	3 2.07	3 0.0113	7 <0.001	3 0.0035
8		2 0.0193	2 0.00751	7 0.0060	3 4.056	12 2.072			
9		2 0.0194	2 0.0077	4 0.0068		12 2.090			
10		2 0.0196							
11		2 0.0197							
Average	0.00560	0.01897	0.007052	0.00559	4.024	2.0453	0.0081		0.0020
Std Dev	0.00061	0.00053	0.00051	0.00056	0.029	0.0383	0.0021		0.0014
Certified	0.0056	0.0190	0.0071	0.0056	4.02	2.05	0.008	<0.001	(0.002)
# Labs	7	11	9	9	8	9	7		7
t	2.4469	2.2281	2.306	2.306	2.3646	2.306	2.4469		2.4469
C (95%)	0.00057	0.00036	0.00039	0.00043	0.025	0.0295	0.0019		0.0013

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

Code	Method
1	Combustion - Inferred Absorption Method
2	Fusion - Thermal Conductivity Method
3	AES-ICP Inductively Coupled Plasma Spectrometry
4	AES- Spark Optical Emission Spectrometry
5	Gravimetric method
6	Flame Atomic Absorption Spectrometry
7	AES-ICP-MS Inductively Coupled Plasma with Mass Spectrometry
8	Graphite Furnace - Atomic Absorption Spectrometry
9	Colorimetric method
10	Spectrophotometric method
11	X-Ray Fluorescence spectrometry
12	Titration method

AES = Atomic Emission Spectrometry

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

ATI Allvac - Lockport, Lockport, New York
 Brammer Standard Co., Inc., Houston, Texas
 China National Analysis Center for Iron and Steel, Beijing, China
 J. Dirats and Co., Inc., Westfield, Massachusetts
 Laboratory Testing Inc., Hatfield, Pennsylvania
 LECO Corporation, St. Joseph, Michigan
 VHG Laboratories, Inc., Manchester, New Hampshire

Contact person

Thomas Herdlein
 Richard P. Beaumont
 Prof. Wang Haizhou
 Eric E. Dirats
 Rick Heist
 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 Standard 17025. Individual values listed on page 2 are the average of each analyst's results. Methods of analysis are listed on page 2.

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 12h, 15h, 129c, 132b, 337a, 346a, 368, 1766, 1262a, 2611, 3101a, 3103a, 3109a, 3112a, 3113, 3114, 3128, 3132, 3134, 3136, 3137, 3139a, 3150, 3161a, 3162a, 3163, 3165; ECRM 096-1, 283-1; JSS 607-8, 609-8; BAS SS 487-1; LECO 501-024, 501-504, 501-506, 501-644, 501-645,

Homogeneity: This Certified Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by optical emission spectrometry using and found to be compatible with the following Reference Materials: NIST SRM 1222, 1269; BS XEEH, 61D, 3941, 3942, 4942.

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 produced by Crucible Specialty Metals, Syracuse, New York.

Form: This Certified Reference Material is in the form of a disc, approximately 38 mm (1.50 inches) diameter and 12 mm (0.50 inches) thick.

Use: This Certified Reference Material is intended for use in optical 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 optical 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 H-19-032008-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 March 20, 2008.

Beau R. Brammer

Certificate Number H-19-032008p3

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

**Brammer Standard Company's Chemical Laboratory is accredited to ISO Standard 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 826 - 85 (Withdrawn 2005) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019 - 2003 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

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

E 1831 - 96 (Withdrawn 2005) Standard Guide for Preparing Certificates for Reference Materials Relating to Chemical Composition of Metals, Ores, and Related Materials.

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

ISO Standard 17025 (Second edition, 2005), General requirements for the competence of calibration and testing laboratories.

ISO Guide 30 (Second edition, 1992), 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 (Third edition, 2006), 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 H-19-032008p4