

Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 68D

Certified Reference Material for Nitriding 135G, Modified AMS 6470 Grade Steel

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ²
Analysis listed as percent by weight					
C	0.388	0.008	Sn	0.008	0.001
Mn	0.602	0.004	V	0.006	0.001
P	0.018	0.001			
S	0.0067	0.0007			
Si	0.31	0.01			
Cu	0.178	0.004			
Ni	0.166	0.003			
Cr	1.77	0.02	Informational Values ³		
Mo	0.35	0.01	As	(0.004)	
Al	1.04	0.03	B	(0.0004)	
Co	0.009	0.002	Ca	(0.0002)	
N	0.0044	0.0005	O	(0.001)	

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 Guide 31 and ISO Guide 35 were generally 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.

See reverse side for more information.

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Analysis	*	C	* Mn	* P	* S	* Si	* Cu	* Ni	* Cr	* Mo
1	1	0.373	4 0.599	4 0.017	1 0.0061	7 0.299	3 0.174	4 0.163	5 1.75	3 0.340
2	1	0.384	7 0.599	3 0.0172	1 0.0062	3 0.303	4 0.175	7 0.164	7 1.75	3 0.342
3	1	0.387	3 0.600	3 0.018	1 0.0065	3 0.305	4 0.175	3 0.166	5 1.75	3 0.3462
4	1	0.388	3 0.602	3 0.018	1 0.0065	4 0.308	3 0.178	3 0.167	3 1.76	3 0.3478
5	1	0.390	3 0.602	3 0.0182	1 0.0073	3 0.312	3 0.182	3 0.169	5 1.77	4 0.348
6	1	0.397	3 0.607	3 0.0188	1 0.0076	3 0.326	3 0.182	3 0.170	3 1.78	3 0.362
7	1	0.3979							1 1.78	3 0.363
8									5 1.79	3 0.366
Average		0.3881	0.6015	0.0179	0.00670	0.3088	0.1777	0.1665	1.766	0.3519
Std Dev		0.0084	0.0030	0.0007	0.00061	0.0095	0.0036	0.0027	0.016	0.0102
Certified		0.388	0.602	0.018	0.0067	0.31	0.178	0.166	1.77	0.35
t		2.45	2.57	2.57	2.57	2.57	2.57	2.57	2.36	2.36
C(95%)		0.0078	0.0032	0.0007	0.00064	0.0100	0.0038	0.0029	0.013	0.0085

continued from above

Analysis	*	Al	* Co	* N	* Sn	* V	* As	* B	* Ca	* O
1	3	1.01	3 0.0078	2 0.0038	7 0.0077	3 0.0052	4 0.002	3 0.00033	3 0.00012	2 0.0004
2	3	1.03	3 0.0080	2 0.0041	4 0.008	3 0.0052	7 0.0026	4 0.0004	7 0.00012	2 0.0004
3	3	1.05	3 0.0082	2 0.0041	3 0.0084	3 0.0053	3 0.0040		4 0.0003	2 0.0004
4	3	1.06	3 0.0101	2 0.0043	3 0.0085	4 0.0062	3 0.0055			2 0.0008
5	7	1.074	3 0.0109	2 0.0045	7 0.0089	3 0.0063	6 0.0061			2 0.0008
6				2 0.0046	3 0.009	3 0.0075				2 0.0012
7				2 0.0048		3 0.0080				2 0.0029
8				2 0.0050						
Average		1.045	0.00900	0.00440	0.00842	0.00624	0.0040	0.00037	0.00018	0.00099
Std Dev		0.025	0.00141	0.00040	0.00050	0.00114	0.0018	0.00005	0.00010	0.00090
Certified		1.04	0.009	0.0044	0.008	0.006	(0.004)	(0.0004)	(0.0002)	(0.001)
t		2.78	2.78	2.36	2.57	2.45	2.78	12.71	4.30	2.45
C(95%)		0.031	0.00174	0.00033	0.00053	0.00105	0.0022	0.00044	0.00026	0.00083

$C(95\%) = (t \times sd) / \sqrt{n}$ 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 35:2006 section 6.

*** Key to Analytical Methods used:**

- 1 combustion
- 2 fusion
- 3 ICP-AES
- 4 Spark-AES
- 5 titrimetric
- 6 GF-AAS
- 7 Flame-AAS

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

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, were generally 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.

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs. The laboratories participating in the testing normally followed the requirements of ISO Guide 17025. The individual values listed above are the average of each analyst's results.

Methods of Analysis: Methods of analysis used were a combination of ASTM Standard Methods E 322, E 350, E 415, E 1019, plus additional ICP and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 30f, 101f, 348a, 361 - 365; JSS 003; ECRM 085-1, 088-1, 096-1, 097-1, 184-1, 481-1; BCS 405/1, 455/1, 458/1; BAM 038-1; IPT 43.

Co-operating Laboratories: Some of the co-operating laboratories were:

Analytical Associates Inc., Detroit, Michigan
Andrew S. McCreath & Son, Inc., Harrisburg, Pennsylvania
Brammer Standard Co., Inc., Houston, Texas
Coleman Testing Laboratories, Riverside, New Jersey
Crucible Specialty Metals, Syracuse, New York
Hoesch Stahl AG, Dortmund, Germany
J. Dirats and Co., Inc., Westfield, Massachusetts
Shiva Technologies, Inc., Cicero, New York
VHG Laboratories, Inc., Manchester, New Hampshire

Homogeneity: This Certified Reference Material was tested for homogeneity using ASTM Standard Practice E 826 and found acceptable.

Traceability: This Certified Reference Material was also examined by spark atomic emission spectrometry and found to be compatible with the following Certified Reference Materials: NIST SRM C1173, 1261a - 1265a, 1761 - 1767; ECRM 186-1, 191-1; SS 457/1, 458/1.

Source: This material was produced by Crucible Specialty Metals Division, Colt Industries, Syracuse, New York. The material was made in an electric arc furnace, cast into ingots, and rolled into billets. The billets were hot rolled down to 1.50 inch diameter round bars.

Available Form: This Certified Reference Material is available only in the form of a disc, approximately 37 mm (1.50") in diameter and 19 mm (0.75") thick.

Use: This Certified Reference Material is intended for use in spark atomic emission and x-ray spectrometric methods of analysis. 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 68D-121109.

Refer to the "Certificates" section of the Brammer Standard Company website for any revision to this or other Brammer Standard Company's Certificates of Analysis

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.

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.	Phone: (281) 440-9396	web: brammerstandard.com
14603 Benfer Road		
Houston, Texas 77069-2895 USA	Fax: (281) 440-4432	email: contact@brammerstandard.com

Certified by: Beau R. Brammer on December 11, 2009.

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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 - 09 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 plus amendment of 2008
- 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

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