

Brammer Standard Company, Inc.

# Certificate of Analysis

B.S. 15A

Reference Material for Chill-cast Low Alloy Steel

	Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>		Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>
Analysis listed as percent by weight					
<b>C</b>	<b>0.142</b>	0.004	<b>Nb</b>	<b>0.041</b>	0.002
<b>Mn</b>	<b>1.12</b>	0.02	<b>Sn</b>	<b>0.002</b>	0.001
<b>P</b>	<b>0.016</b>	0.002	<b>Ti</b>	<b>0.008</b>	0.001
<b>S</b>	<b>0.008</b>	0.001	<b>V</b>	<b>0.012</b>	0.002
<b>Si</b>	<b>0.058</b>	0.006	<b>Zr</b>	<b>0.022</b>	0.002
<b>Cu</b>	<b>0.030</b>	0.003	Information values <sup>3</sup>		
<b>Ni</b>	<b>0.029</b>	0.003	<b>B</b>	(0.0002)	
<b>Cr</b>	<b>0.044</b>	0.002	<b>Ca</b>	(0.0005)	
<b>Mo</b>	<b>0.008</b>	0.002	<b>Ce</b>	(0.003)	
<b>Al</b>	<b>0.041</b>	0.002	<b>Pb</b>	(0.0003)	
<b>As</b>	<b>0.003</b>	0.001	<b>Sb</b>	(0.003)	
<b>Co</b>	<b>0.005</b>	0.001	<b>W</b>	(0.004)	

<sup>1</sup> The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

<sup>2</sup> The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values. No attempt is made to derive exact statistical measurements of imprecision because several methods were used in the determination of most constituents.

<sup>3</sup> 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 reference material and certificate of analysis. This is a reference material as defined by ISO Guide 30.

See reverse side for more information.

Certificate Number 15A-010695

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Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	As	Co
1	0.138	1.096	0.014	0.0076	0.049	0.0245	0.0255	0.0426	0.0063	0.038	0.0012	0.0036
2	0.140	1.10	0.015	0.008	0.0498	0.025	0.0265	0.043	0.007	0.0402	0.002	0.0046
3	0.140	1.102	0.0154	0.008	0.057	0.031	0.0285	0.044	0.0072	0.0403	0.0025	0.0047
4	0.141	1.11	0.0158	0.0083	0.059	0.0312	0.029	0.044	0.0078	0.041	0.0027	0.0058
5	0.141	1.112	0.0167	0.0085	0.0594	0.0312	0.029	0.045	0.0090	0.041	0.0027	0.0059
6	0.142	1.120	0.017	0.0085	0.060	0.032	0.029	0.045	0.0092	0.042	0.0028	
7	0.1442	1.12	0.0171	0.0086	0.060	0.0321	0.0300	0.045	0.010	0.043	0.0033	
8	0.145	1.13	0.0173	0.0087	0.060	0.0324	0.0325	0.0457	0.011	0.044	0.004	
9	0.146	1.14	0.018	0.009	0.061	0.033	0.035					
10		1.14	0.0183	0.0090	0.064							
Average	0.1419	1.117	0.0165	0.0084	0.0579	0.0303	0.0294	0.0443	0.0084	0.0412	0.0027	0.0049
Std Dev	0.0026	0.016	0.0014	0.0005	0.0048	0.0032	0.0029	0.0011	0.0016	0.0018	0.0008	0.0010
Certified	0.142	1.12	0.016	0.008	0.058	0.030	0.029	0.044	0.008	0.041	0.003	0.005

Analysis	Nb	Sn	Ti	V	Zr	B	Ca	Ce	Pb	Sb	W
1	0.039	0.0016	0.007	0.010	0.020	0.00009	0.0001	0.0015	0.00015	0.003	0.003
2	0.0402	0.0020	0.0076	0.0106	0.020	0.0001	0.0001	0.002	0.00023	0.0032	0.0034
3	0.0405	0.0020	0.0076	0.0115	0.021	0.0002	0.0002	0.0027	0.00025	0.004	0.0040
4	0.041	0.0021	0.0079	0.0119	0.0218	0.0004	0.0006	0.0030	0.0003		0.004
5	0.0420	0.003	0.008	0.012	0.022	0.0004	0.0009	0.0048	0.0004		0.0043
6	0.042	0.0031	0.008	0.013	0.022		0.00107	0.0054			0.0078
7	0.042	0.0033	0.0095	0.014	0.022						
8			0.010		0.023						
9					0.0240						
10					0.024						
Average	0.0410	0.0024	0.0082	0.0119	0.0220	0.0002	0.0005	0.0032	0.0003	0.0034	0.0044
Std Dev	0.0011	0.0007	0.0010	0.0014	0.0014	0.0002	0.0004	0.0016	0.0001	0.0005	0.0017
Certified	0.041	0.002	0.008	0.012	0.022	(0.0002)	(0.0005)	(0.003)	(0.0003)	(0.003)	(0.004)

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

**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 25. The individual values listed above are the average of each analyst's results. 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 14f, 16f, 111b, 125b, 337a, 346a, 361 - 365, 898; ECRM 085-1, 088-1, 096-1, 179-1, 283-1, 480-1, 481-1; BCS 401/1, 455, 455/1, 456/1, 458/1; BAM 039-2, 044-1; IMZ 1.21/1, 1.74.

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

American Centrifugal, Birmingham, Alabama  
Analytical Associates Inc., Detroit, Michigan  
Anarem, Praha, Czech Republic  
Andrew S. McCreath & Son, Inc., Harrisburg, Pennsylvania  
Brammer Standard Co., Inc., Houston, Texas  
China Research Laboratory, Beijing, China  
Coleman Testing Laboratories, Riverside, New Jersey  
Crucible Specialty Metals, Syracuse, New York  
J. Dirats and Co., Inc., Westfield, Massachusetts  
Ledoux & Company, Teaneck, New Jersey  
Shiva Technology, Inc., Cicero, New York  
Northern Analytical Laboratory, Inc., Merrimack, New Hampshire  
Jeffrey A. Nunes Laboratories, Inc., Washington, Pennsylvania  
VHG Laboratories, Inc., Manchester, New Hampshire

**Homogeneity:** This Reference Material was tested for homogeneity using ASTM Standard Practice E 826 and found acceptable for all elements except calcium. The zirconium homogeneity was found to be of minimal acceptance.

**Traceability:** This Reference Material was also examined by optical 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; JSS 169-4, 170-6, 171-4.

**Source:** This material was melted and cast by American Centrifugal, Birmingham, Alabama, using an electric arc furnace. It was chill-cast into a water-cooled sample mold producing 648 discs simultaneously.

**Description:** This Reference Material is in the form of a disc, approximately 32 mm in diameter and 17 mm thick.

**Certified Area:** The area certified of each disc is the portion extending upward 10 mm from the larger diameter surface.

**Note:** Shrinkage cavities may appear in the top portion of some discs. These cavities are normal and will not affect the certified portion of the disc.

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

**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.

**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  
14603 Benfer Road  
Houston, Texas 77069-2895 USA Fax: (281) 440-4432

Certified by: \_\_\_\_\_ on January 6, 1995.  
G. R. Brammer

**Certificate Number 15A-010695**

## Referenced Documents

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

E 322 - 67 (Reapproved 1990) Standard Method for X-Ray Emission Spectrometric Analysis of Low-Alloy Steels and Cast Irons

E 350 - 90 Standard Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

E 415 - 85 (Reapproved 1989) Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel

E 826 - 85 (Reapproved 1990) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019-93 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

*ISO Guides available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.*

ISO Guide 25 (Third edition, 1990), 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 (First edition, 1981), Contents of certificates of reference materials.

ISO Guide 33 (First edition, 1989), Uses of certified reference materials.

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.*

NBS 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