

Brammer Standard Company, Inc.
Certificate of Analysis¹

B.S. LAS-10

Low Alloy Steel Setting-up Sample

Analysis listed as percent by weight

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ²
C	0.78	0.012	Nb	0.007	0.001
Mn	0.31	0.01	Sb	0.027	0.002
P	0.007	0.001	Sn	0.006	0.001
S	0.027	0.0015	Ta	0.006	0.002
Si	1.01	0.02	Ti	0.008	0.001
Cu	0.40	0.01	V	0.014	0.001
Ni	1.22	0.015	W	0.021	0.003
Cr	0.059	0.002	Zr	0.002	0.0005
Mo	0.042	0.002			
Al	0.019	0.001	Uncertified Values		
As	0.004	0.001	Ce	(<0.001)	
B	0.0006	0.0002	La	(<0.001)	
Ca	0.0024	0.0003	Mg	(0.0002)	
Co	0.023	0.002	O	(0.0009)	
N	0.0085	0.0004	Pb	(<0.001)	

¹The 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.

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Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al
1	0.759	0.303	0.005	0.024	0.986	0.39	1.197	0.056	0.039	0.018
2	0.767	0.305	0.0066	0.0258	1.00	0.394	1.20	0.058	0.040	0.018
3	0.772	0.31	0.0068	0.026	1.006	0.398	1.208	0.058	0.0416	0.018
4	0.775	0.311	0.0070	0.026	1.007	0.399	1.220	0.059	0.0422	0.0186
5	0.778	0.311	0.007	0.0271	1.008	0.40	1.22	0.060	0.043	0.019
6	0.78	0.315	0.0072	0.028	1.04	0.400	1.227	0.0600	0.043	0.019
7	0.789	0.316	0.0074	0.0283	1.04	0.401	1.23	0.060	0.043	0.019
8	0.79	0.34		0.0287		0.42	1.242	0.062	0.044	0.021
9	0.80			0.0289					0.045	
Average	0.779	0.314	0.0067	0.0270	1.012	0.400	1.218	0.0591	0.0423	0.0188
Std Dev	0.013	0.011	0.0008	0.0016	0.020	0.009	0.015	0.0018	0.0019	0.0010
Certified	0.78	0.31	0.007	0.027	1.01	0.40	1.22	0.059	0.042	0.019
t	2.306	2.3646	2.4469	2.306	2.4469	2.3646	2.3646	2.3646	2.306	2.3646
C(95%)	0.010	0.010	0.0007	0.0013	0.019	0.007	0.013	0.0015	0.0014	0.0008

Analysis	As	B	Ca	Co	N	Nb	Sb	Sn	Ta
1	0.0036	0.0002	0.00185	0.021	0.0079	0.0062	0.0249	0.0041	0.005
2	0.0038	0.0003	0.0021	0.021	0.0082	0.0065	0.026	0.0050	0.005
3	0.0040	0.0005	0.0022	0.022	0.0084	0.007	0.026	0.0052	0.0054
4	0.0043	0.0005	0.0023	0.023	0.0085	0.007	0.0267	0.006	0.006
5	0.0044	0.0007	0.0023	0.024	0.0087	0.007	0.027	0.006	0.0072
6	0.005	0.0007	0.0024	0.024	0.0087	0.0075	0.028	0.0069	0.0089
7	0.0050	0.0008	0.0026	0.024	0.0087	0.0081	0.030	0.007	
8	0.005	0.0008	0.0031	0.0243	0.0092				
9				0.025					
Average	0.0044	0.00056	0.00236	0.0231	0.00854	0.0070	0.0269	0.0057	0.0063
Std Dev	0.0006	0.00023	0.00037	0.0015	0.00039	0.0006	0.0017	0.0010	0.0015
Certified	0.004	0.0006	0.0024	0.023	0.0085	0.007	0.027	0.006	0.006
t	2.3646	2.3646	2.3646	2.306	2.3646	2.4469	2.4469	2.4469	2.5706
C(95%)	0.0005	0.00019	0.00031	0.0011	0.00033	0.0006	0.0015	0.0010	0.0016

Analysis	Ti	V	W	Zr	Ce	La	Mg	O	Pb
1	0.0067	0.012	0.019	0.001	<0.0002	<0.0003	0.0002	0.0006	<0.0001
2	0.007	0.0131	0.0199	0.0015	<0.001	<0.001		0.0008	<0.0001
3	0.0071	0.0134	0.020	0.0016	<0.001			0.0010	<0.001
4	0.0072	0.014	0.020	0.0017	0.0004			0.0011	<0.002
5	0.0079	0.014	0.020	0.002					0.0005
6	0.008	0.0144	0.020	0.002					0.0007
7	0.0083	0.0144	0.023	0.002					
8		0.0144	0.024	0.003					
Average	0.0075	0.0137	0.0207	0.0019				0.00088	
Std Dev	0.0006	0.0008	0.0018	0.0006				0.00022	
Certified	0.008	0.014	0.021	0.002	(<0.001)	(<0.001)	(0.0002)	(0.0009)	(<0.001)
t	2.4469	2.3646	2.3646	2.3646				3.1824	
C(95%)	0.0006	0.0007	0.0015	0.0005				0.0004	

Data in parentheses are 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.

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 reference material as defined by ISO Guide 30.

Analysis: Chemical analyses were made on chips prepared by a lathe from the usable portion of the discs. The laboratories participating in the testing normally followed the requirements of ISO Guide 25. The individual values listed on page 2 are the average of each analyst's results. Methods of analysis used were a combination of ASTM Standard Method E 415 and E 1019, plus additional ICP and AA spectrometric methods.

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

- Anarem, Praha, Czech Republic
- ARMCO Inc., Research & Development, Middletown, Ohio
- Bethlehem Steel Corporation, Homer Research Labs, Bethlehem, Pennsylvania
- Brammer Standard Co., Inc., Houston, Texas
- J. Dirats and Co., Inc., Westfield, Massachusetts
- Leco Technical Service Laboratory, St. Joseph, Michigan
- 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.

Traceability: This reference material sample 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; CKD 180A - 189A.

Source: This material was produced by Bethlehem Steel Corporation, Homer Research Laboratories, Bethlehem, Pennsylvania. The material was made in a vacuum induction arc furnace and cast into ingots under vacuum. The bar stock was forged from the ingots and the resulting bar stock was annealed.

Available Form: This reference material is available only in the form of a disc, approximately 38 mm (1.50") in diameter and 30 mm (1.18") thick.

Use: This reference material is intended for use in optical emission and x-ray spectrometric methods of analysis. The entire depth of the disc may be used.

Caution: As with any bar material produced from ingots, avoid optical emission spectrometric burns in the center of the discs (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.

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

Signed by: _____ on September 24, 1998.

G. R. Brammer

Referenced Documents

*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 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

E 1724 - 95 Standard Guide for Testing and Certification of Metal and Metal-Related Reference Materials

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

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 at no cost 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

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