Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 188A

Reference Material for Stainless Steel Grade A286

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
		Analysis listed as percent by weight			
C	**0.050**	0.004	**Al**	**0.19**	0.01
Mn	**0.139**	0.01	**B**	**0.0065**	0.0006
P	**0.015**	0.002	**Co**	**0.18**	0.01
S	**0.0049**	0.0006	**N**	**0.0029**	0.0007
Si	**0.15**	0.01	**Nb**	**0.050**	0.006
Cu	**0.099**	0.008	**O**	**0.0012**	0.0003
Ni	**24.61**	0.10	**Pb**	**<0.001**	
Cr	**14.04**	0.12	**Sn**	**0.002**	0.0006
Mo	**1.10**	0.04	**W**	**0.055**	0.010
V	**0.24**	0.01	Informational value[1]		
Ti	**2.21**	0.005	As	(0.002)	

[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 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.

[3] The value in parentheses is not certified and is 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 188A-REV061094

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Telephone (281) 440-9396 Fax (281) 440-4432

BS 188A Certificate number 188A-REV061094

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Ti
1	0.048	0.131	0.014	0.0043	0.142	0.091	24.52	13.87	1.063	0.229	2.16
2	0.048	0.133	0.014	0.0048	0.143	0.096	24.57	13.88	1.08	0.23	2.16
3	0.0491	0.140	0.0149	0.005	0.147	0.097	24.58	14.00	1.09	0.233	2.19
4	0.051	0.140	0.0157	0.0051	0.16	0.099	24.59	14.02	1.11	0.238	2.19
5	0.052	0.140		0.0051		0.100	24.61	14.03	1.11	0.239	2.23
6		0.143				0.102	24.62	14.04	1.12	0.240	2.24
7		0.145				0.102	24.70	14.04	1.13	0.243	2.26
8						0.105	24.71	14.041	1.14		2.267
9								14.047			
10								14.09			
11								14.16			
12								14.17			
13								14.19			
Average	0.0496	0.1389	0.0147	0.0049	0.148	0.0990	24.613	14.044	1.105	0.236	2.212
Std Dev	0.0018	0.0051	0.0008	0.0003	0.008	0.0043	0.065	0.097	0.026	0.005	0.043
Certified	0.050	0.139	0.015	0.0049	0.15	0.099	24.61	14.04	1.10	0.24	2.21

Analysis	Al	B	Co	N	Nb	O	Pb	Sn	W	As
1	0.18	0.0061	0.176	0.0022	0.0456	0.0009	<0.0001	0.0019	0.0448	0.001
2	0.19	0.0063	0.176	0.00246	0.046	0.0012	<0.0005	0.002	0.052	0.001
3	0.192	0.0065	0.178	0.0026	0.046	0.0014	<0.001	0.0020	0.053	0.002
4	0.194	0.0066	0.179	0.0027	0.0491	0.00146	<0.001	0.0026	0.054	0.0025
5	0.195	0.0070	0.18	0.0027	0.051		0.00018		0.063	
6	0.195		0.185	0.0028	0.056		0.0005		0.064	
7			0.19	0.0030	0.056					
8				0.0032						
9				0.0034						
10				0.0035						
Average	0.191	0.00650	0.181	0.00286	0.0500	0.00124		0.0021	0.0551	0.0016
Std Dev	0.006	0.00034	0.005	0.00042	0.0046	0.00025		0.0003	0.0073	0.0008
Certified	0.19	0.0065	0.18	0.0029	0.050	0.0012	<0.001	0.002	0.055	(0.002)

The value in parentheses is not certified and is 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 350, E 353, E 572, E 1019, E 1086, plus additional ICP and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 73c, 101g, 121d, 160b, 344, 345, 348, 348a; ECRM 284-1, 286-1; BCS 466/1, 467/1, 475; JK 37.

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

Allegheny Ludlum Steel Corp., Brackenridge, Pennsylvania
Allegheny Ludlum Steel Corp., Lockport, New York
Analytical Associates, Inc., Detroit, Michigan
Brammer Standard Co., Inc., Houston, Texas
Coleman Testing Laboratories, Riverside, New Jersey
Crucible Specialty Steel, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
Metals Analysis, Inc., Huntington Park, California
Andrew S. McCreath & Son, Inc., Harrisburg, Pennsylvania
Midstates Analytical Laboratories, Tulsa, Oklahoma
Shiva Technologies, Inc., Cicero, New York
Taussig Associates, Inc., Skokie, Illinois
Vac Air Division, Keywell Corporation, Frewsburg, New York
VHG Laboratories, Inc., Manchester, New Hampshire

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

Traceability: This Reference Material was also examined by optical emission spectrometry and found to be compatible with the following Certified Reference Materials: NIST SRM 1230, 1246; BAS SS 464, 474.

Source: This material was produced by Cyclops Specialty Steel, Titusville, Pennsylvania. The material was made in an electric arc furnace and cast into ingots. The bar stock was hot rolled and annealed.

Available Form: This Reference Material is available only in the form of a disc, approximately 38 mm (1.50") in diameter and 12 mm (0.50") 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, avoid optical emission spectrometric burns in the center of the disc (5 mm radius), as some segregation may be present.

Because this Reference Material contains a high percent of nickel, chromium and titanium, care must be taken in its application. Make certain that corrections are made for possible element interference and dilution effects.

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 of Analysis Revisions: The original certificate for this BS 188A Reference Material was issued on February 26, 1992. A new interlaboratory testing program produced additional data that made possible the certification of more elements including nitrogen and oxygen. The addition of new data produced minor changes to some of the originally certified elements. The new certificate of analysis format now lists more details about the reference material, as outlined in ISO Guide 31.

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

Certified by: _____ on June 10, 1994.
G. R. Brammer

Certificate Number 188A-REV061094

References:

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

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

E 353 - 93 Standard Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

E 572 - 88 Standard Test Method for X-Ray Emission Spectrometric Analysis of Stainless 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 1086 - 85 Standard Method for Optical Emission Vacuum Spectrometric Analysis of Stainless Steel by the Point-to-Plane Excitation Technique

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, 1991), 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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