Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 180A

Reference Material for High Manganese Stainless Steel (Nitronic® 50)

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
		Analysis listed as percent by weight			
C	**0.018**	0.004	**Al**	**0.012**	0.002
Mn	**5.05**	0.05	**Co**	**0.039**	0.005
P	**0.012**	0.001	**O**	**0.003**	0.001
S	**0.001**	0.0004	**W**	**0.02**	0.005
Si	**0.32**	0.01			
Cu	**0.067**	0.002	Informational values[3]		
Ni	**13.19**	0.05	As	(0.002)	
Cr	**21.09**	0.10	B	(0.0023)	
Mo	**2.04**	0.04	Ca	(0.0004)	
N	**0.334**	0.006	Sn	(0.002)	
Nb	**0.20**	0.015	Ta	(0.002)	
V	**0.20**	0.01	Ti	(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] Data in parentheses are not certified and are provided for information only.

Nitronic® is a registered trademark of Armco Steel Company.

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 180A-020195

Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895
Telephone (281) 440-9396 Fax (281) 440-4432

BS 180A Certificate Number 180A-020195

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	N	Nb	V
1	0.0147	4.99	0.011	0.00044	0.31	0.064	13.12	21.03	2.01	0.3298	0.180	0.19
2	0.015	4.99	0.012	0.0006	0.311	0.065	13.14	21.04	2.018	0.330	0.188	0.198
3	0.015	5.00	0.0122	0.001	0.312	0.0679	13.15	21.066	2.02	0.3300	0.19	0.20
4	0.0152	5.03	0.013	0.0010	0.313	0.068	13.17	21.07	2.023	0.3380	0.20	0.202
5	0.016	5.04	0.013	0.0011	0.315	0.068	13.18	21.07	2.03	0.3409	0.20	0.205
6	0.016	5.05	0.014	0.0012	0.316	0.069	13.20	21.07	2.03		0.204	0.21
7	0.017	5.05			0.32	0.069	13.21	21.10	2.05		0.205	0.21
8	0.017	5.07			0.322		13.215	21.10	2.07		0.21	0.220
9	0.019	5.07			0.323		13.22	21.14	2.09		0.216	
10	0.019	5.08			0.33		13.24	21.15	2.11		0.22	
11	0.022	5.112					13.24	21.18				
12	0.024	5.12										
Average	0.0175	5.050	0.0125	0.0009	0.317	0.0673	13.190	21.092	2.045	0.3337	0.201	0.204
Std Dev	0.0030	0.043	0.0010	0.0003	0.006	0.0020	0.041	0.047	0.034	0.0053	0.013	0.009
Certified	0.018	5.05	0.012	0.001	0.32	0.067	13.19	21.09	2.04	0.334	0.20	0.20

Analysis	Al	B	Co	O	W	As	Ca	Sn	Ta	Ti
1	0.010	0.0019	0.035	0.0019	0.012	0.001	0.0002	0.0015	0.0016	0.001
2	0.011	0.0020	0.0356	0.0028	0.014	0.0028	0.0002	0.0019	0.002	0.0018
3	0.011	0.0021	0.038	0.0033	0.016	0.003	0.0004	0.0019	0.002	0.002
4	0.0126	0.0023	0.041	0.0035	0.0188		0.0007	0.0025		0.002
5	0.0138	0.00239	0.0457	0.0037	0.019			0.003		0.0023
6	0.0138	0.0025			0.0245					
7	0.014	0.0027								
8	0.014	0.0029								
Average	0.0125	0.0023	0.0391	0.0030	0.0174	0.0023	0.0004	0.0022	0.0019	0.0018
Std Dev	0.0016	0.0003	0.0044	0.0007	0.0044	0.0011	0.0002	0.0006	0.0002	0.0005
Certified	0.012	0.0023	0.039	0.003	0.02	(0.002)	(0.0004)	(0.002)	(0.002)	(0.002)

Data in parentheses are not certified but 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.

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

Allegheny Ludlum Steel Corp., Lockport, New York
Analytical Associates, Inc., Detroit, Michigan
ANAREM, Prague, Czech Republic
Brammer Standard Co., Inc., Houston, Texas
China Research Institute, Beijing, China
Coleman Testing Laboratories, Riverside, New Jersey
Crucible Specialty Steel, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
LECO Corporation, St. Joseph, Michigan
Ledoux & Company, Teaneck, New Jersey
Andrew S. McCreath & Son, Inc., Harrisburg, Pennsylvania
Shiva Technologies, Inc., Cicero, New York
Spectrochemical Laboratories, Inc., Pittsburgh, Pennsylvania
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 C1151, C1152, C1153, C1154; BAS SS 466/1. The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 73c, 101g, 121d, 123c, 125b, 131c, 133b, 160a, 160b, 344, 345, 346, 346a, 348a, 361, 864, 865, 866, 868; ECRM 284-1, 286-1; BCS 342, 351, 466/1, 467/1, 475; JK 37; IMZ 1.27/3; BAM 230-1; CMSI 1356.

Source: This material was produced by Carpenter Technology Corporation, Reading, 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 in the form of a disc, approximately 37 mm (1.50") in diameter and 12 mm (0.50") thick. It is also available in a special set of 7 mm thick discs.

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 manganese, nickel, chromium, and molybdenum, 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.

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 February 1, 1995.
G. R. Brammer

Certificate Number 180A-020195

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 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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