

Brammer Standard Company, Inc.
Certificate of Analysis

B.S. 93E

Grade 440C Stainless Steel

Replaces certificate number 93E-050988

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ²
Analysis listed as percent by weight					
C	1.02	0.02	Al	0.009	0.001
Mn	0.52	0.02	Co	0.048	0.003
P	0.022	0.002	N	0.0359	0.0005
S	0.0010	0.0003	Nb	0.005	0.001
Si	0.90	0.02	O	0.0040	0.0005
Cu	0.12	0.01	Sn	0.003	0.0015
Ni	0.35	0.02	Ti	0.007	0.001
Cr	17.33	0.05	V	0.24	0.015
Mo	0.50	0.02	W	0.11	0.01

¹ The certified value listed is the present best estimate of the true value.

² The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values.

See reverse side for more information.

Certificate Number 93EREV-102293

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

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
1	0.99	0.50	0.0198	0.0007	0.87	0.11	0.33	17.26	0.47
2	1.007	0.50	0.020	0.0008	0.883	0.11	0.35	17.28	0.474
3	1.012	0.52	0.021	0.0009	0.885	0.11	0.35	17.29	0.483
4	1.015	0.522	0.021	0.0011	0.90	0.112	0.35	17.30	0.49
5	1.015	0.523	0.0213	0.0011	0.90	0.113	0.352	17.31	0.494
6	1.017	0.53	0.022	0.0013	0.90	0.114	0.355	17.32	0.502
7	1.02	0.532	0.023		0.91	0.115	0.356	17.35	0.51
8	1.02	0.533	0.023		0.92	0.116	0.356	17.38	0.516
9	1.023	0.54	0.024		0.92	0.12	0.357	17.38	0.518
10	1.033	0.542	0.025		0.929	0.12	0.36	17.38	0.518
11						0.12	0.373		0.52
12									0.52
Average	1.015	0.524	0.0220	0.0010	0.902	0.115	0.354	17.332	0.501
Std Dev	0.011	0.015	0.0017	0.0002	0.019	0.004	0.010	0.041	0.019
Certified	1.02	0.52	0.022	0.0010	0.90	0.12	0.35	17.33	0.50

Analysis	Al	Co	N	Nb	O	Sn	Ti	V	W
1	0.008	0.0444	0.0355	0.004	0.0036	0.0012	0.0051	0.22	0.103
2	0.009	0.045	0.0356	0.004	0.00374	0.0021	0.006	0.225	0.103
3	0.0091	0.046	0.0357	0.0049	0.0040	0.003	0.007	0.227	0.104
4	0.010	0.048	0.0358	0.006	0.0041	0.0036	0.0070	0.230	0.107
5	0.0105	0.048	0.0363	0.0063	0.0042	0.004	0.007	0.24	0.11
6		0.049	0.0364	0.0063	0.0042	0.005	0.0077	0.245	0.11
7		0.050				0.005		0.25	0.11
8		0.050						0.250	0.13
Average	0.0093	0.0476	0.0359	0.0053	0.0040	0.0034	0.0066	0.236	0.110
Std Dev	0.0010	0.0022	0.0004	0.0011	0.0003	0.0014	0.0009	0.012	0.009
Certified	0.009	0.048	0.0359	0.005	0.0040	0.003	0.007	0.24	0.11

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs. 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 353, E 572, E 1086, 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 73c, 101g, 121d, 131, 160b, 345, 348a, 365; BCS 466/1, 467/1, 475; ECRM 284-1, 286-1, 292-1; IMZ 1.27/3.

Co-operating Laboratories: Some of the co-operating laboratories were:
 Allegheny Ludlum Corporation, Brackenridge, Pennsylvania
 Allegheny Ludlum Corporation, Lockport, New York
 Analytical Process Labs, Milwaukee, Wisconsin
 Brammer Standard Co., Inc., Houston, Texas
 Chicago Spectro Service Labs, Chicago, Illinois
 Crucible Specialty Metals, Syracuse, New York
 Hoesch Stahl AG, Dortmund, Germany
 J & L Steel Corporation, Warren, Michigan
 J. Dirats and Co., Inc., Westfield, Massachusetts
 Spectrochemical Laboratories, Pittsburgh, Pennsylvania
 VHG Laboratories, Inc., Manchester, New Hampshire

Homogeneity: This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by optical emission spectrometry and found to be compatible with the following Certified Reference Materials -
NIST: SRM 1219, 1223, 1267
European CRMs: BAS SS 469 through 473.

Source: This material was produced in 1980 by the Crucible Specialty Metals Division of Colt Industries, Syracuse, New York.

Available form: This Reference Material is available only in the form of a disc, approximately 41 mm (1.62") 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 chromium, care must be taken in its application. Make certain that corrections are made for possible element interference and dilution effects.

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 October 22, 1993.
G. R. Brammer

This is a revision of the original analysis that was certified on May 9, 1988. The original certificate number is 93E-050988.

Certificate Number 93EREV-102293