

Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 60E

AISI Grade 4340 Low Alloy Steel

Certified Elements			Uncertified Elements	
	Certified Value ¹	Estimate of Uncertainty ²	Information values	
C	0.408	0.01	O	0.001
Mn	0.70	0.015	Ti	0.004
P	0.012	0.0015		
S	0.024	0.002		
Si	0.26	0.01		
Cu	0.153	0.01		
Ni	1.73	0.025		
Cr	0.86	0.01		
Mo	0.249	0.008		
Al	0.024	0.002		
As	0.007	0.0015		
Ca	0.0010	0.0002		
Co	0.009	0.002		
N	0.0087	0.0005		
Sn	0.009	0.002		
V	0.004	0.001		

Analysis listed as percent by weight

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.

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Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
1	0.401	0.686	0.010	0.022	0.242	0.145	1.696	0.851	0.242
2	0.402	0.689	0.011	0.0229	0.252	0.146	1.70	0.854	0.242
3	0.404	0.692	0.011	0.023	0.254	0.148	1.71	0.854	0.243
4	0.407	0.693	0.0112	0.0233	0.254	0.149	1.71	0.858	0.247
5	0.408	0.696	0.012	0.0236	0.255	0.150	1.719	0.86	0.248
6	0.409	0.696	0.0120	0.0238	0.255	0.153	1.723	0.860	0.250
7	0.410	0.703	0.012	0.0239	0.256	0.154	1.725	0.864	0.251
8	0.411	0.708	0.012	0.0251	0.256	0.155	1.735	0.87	0.252
9	0.4125	0.716	0.012	0.027	0.260	0.155	1.746	0.873	0.252
10	0.4128	0.718	0.012	0.027	0.262	0.156	1.746	0.874	0.253
11		0.72	0.012	0.027	0.267	0.162	1.75	0.880	0.253
12		0.722	0.0144		0.274	0.168	1.75		0.254
Average	0.4077	0.703	0.0118	0.0244	0.2573	0.1534	1.726	0.864	0.2489
Std Dev	0.0042	0.013	0.0010	0.0018	0.0080	0.0066	0.020	0.010	0.0045
Certified	0.408	0.70	0.012	0.024	0.26	0.153	1.73	0.86	0.249

Analysis	Al	As	Ca	Co	N	O	Sn	Ti	V
1	0.021	0.0052	0.00075	0.007	0.00845	0.0008	0.008	0.0020	0.0019
2	0.022	0.0058	0.0008	0.007	0.0085	0.00090	0.0082	0.0025	0.003
3	0.023	0.007	0.0009	0.0090	0.0087	0.0010	0.0082	0.0033	0.0035
4	0.0230	0.0072	0.00099	0.0090	0.0090		0.0090	0.005	0.0036
5	0.0240	0.0072	0.0010	0.0094			0.009	0.005	0.0037
6	0.024	0.0075	0.0010	0.0094			0.0090		0.004
7	0.025		0.0011	0.010			0.0094		0.0043
8	0.025		0.0012	0.0101			0.0099		0.0043
9	0.026		0.0012	0.0105			0.010		0.0045
10			0.0013	0.0105			0.011		0.0047
11				0.0118			0.0117		0.0049
Average	0.0237	0.0067	0.00102	0.0094	0.0087	0.0009	0.0094	0.0036	0.0039
Std Dev	0.0016	0.0009	0.00018	0.0014	0.0002	0.0001	0.0012	0.0014	0.0009
Certified	0.024	0.007	0.0010	0.009	0.0087	(0.001)	0.009	(0.004)	0.004

Data in parentheses are not certified but provided for information.

Analysis: Chemical analyses were made on chips prepared by a lathe from cross-sections of the bars. 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 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 361 to 364; BAM 039-2, 044-1; BCS 455/1, ECRM 085-1, 088-1, 096-1, 184-1, 284-1

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

- Brammer Standard Co., Inc., Houston, Texas
- J. Dirats and Co., Inc., Westfield, Massachusetts
- Crucible Specialty Metals, Syracuse, New York
- The Timken Company, Canton, Ohio
- Hoesch Stahl AG, Dortmund, Germany
- 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 C1173, 1261A to 1265A, 1761 to 1767

Europe: ECRM 186-1, 191-1, SS 457/1, 458/1

Japan: JSS 169-4, 170-6, 171-4

Source: This material was produced by North Star Steel, Monroe, Michigan. The material was made by an electric arc furnace and continuous casting. The bar stock was given a normalizing and tempering heat treatment.

Description and Use: This Reference Material is in the form of a disc, approximately 43 mm (1.75") in diameter and 19 mm (0.75") thick. It 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.

Preparation: Use the same method for preparing the analytical surface on all reference materials and specimens for best results.

Data from routine analysis: The data presented on the last page of this certificate is the result of this material being tested as an unknown specimen by routine analysis. This material was used as an unknown specimen in one of Brammer Standard Company's Proficiency Testing Programs (PTP). The PTP was designed to show how one laboratory's routine analysis compares with that of other laboratories. Each laboratory participating in the PTP was asked to analyze the sample using its routine methods and normal number of analyses. This information may be useful if you analyze this material as an unknown by your routine methods. When using non-CRMs as unknown specimens in a PTP, the general criteria for acceptable analysis is that a laboratory's analysis should be within two standard deviation of the grand mean (average of the laboratories' averages). A laboratory's analysis is considered more acceptable if it is within one standard deviation of the grand mean. Any laboratory with an analysis showing a difference of greater than two standard deviations from the grand mean would be advised to investigate its analytical procedures.

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 March 22, 1993
G. R. Brammer

Certificate Number 60E-032293