Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 4340M

AISI Grade 4340 modified
Low Alloy Steel

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
		Analysis listed as percent by weight			
C	**0.414**	0.005	**Al**	**0.076**	0.003
Mn	**0.74**	0.02	**As**	**0.007**	0.001
P	**0.004**	0.002	**Co**	**0.013**	0.002
S	**<0.001**		**N**	**0.0020**	0.0004
Si	**1.65**	0.03	O	(0.001)	
Cu	**0.134**	0.005	**Sn**	**0.009**	0.001
Ni	**1.78**	0.02	**Ti**	**0.004**	0.001
Cr	**0.78**	0.01	**V**	**0.056**	0.004
Mo	**0.35**	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.

Data in parentheses is not certified but provided for information only.

See reverse side for more information. Certificate Number 4340M-102293

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

BS 4340M analysis listed as percent by weight Certificate 4340M-102293

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
1	0.409	0.721	0.0018	0.0001	1.61	0.130	1.76	0.767	0.332
2	0.409	0.73	0.002	0.0002	1.64	0.130	1.77	0.777	0.337
3	0.414	0.744	0.003	0.0006	1.649	0.131	1.77	0.78	0.338
4	0.414	0.75	0.0046	0.0008	1.65	0.134	1.77	0.782	0.348
5	0.414	0.757	0.0046	0.0008	1.65	0.1355	1.775	0.784	0.35
6	0.417	0.762	0.005		1.66	0.136	1.778	0.79	0.355
7	0.4172		0.0056		1.69	0.137	1.78	0.792	0.357
8						0.138	1.80		0.359
9									0.361
Average	0.4135	0.744	0.0038	0.0005	1.650	0.1339	1.775	0.782	0.349
Std Dev	0.0033	0.016	0.0015	0.0003	0.024	0.0032	0.012	0.008	0.011
Certified	0.414	0.74	0.004	<0.001	1.65	0.134	1.78	0.78	0.35

Analysis	Al	As	Co	N	O	Sn	Ti	V
1	0.073	0.006	0.010	0.0016	0.00051	0.0070	0.0025	0.053
2	0.074	0.0070	0.013	0.0020	0.0006	0.0083	0.0036	0.055
3	0.075	0.0072	0.013	0.0020	0.0007	0.0087	0.004	0.055
4	0.076	0.0072	0.0133	0.0020	0.0015	0.0087	0.004	0.0550
5	0.0771	0.00755	0.0134	0.0023	0.0017	0.009		0.056
6	0.0794	0.0083	0.0134	0.0023		0.0094		0.0576
7	0.0795		0.0135			0.00945		0.060
8			0.0141					0.0603
Average	0.0763	0.0072	0.0130	0.0020	0.0010	0.0087	0.0035	0.0565
Std Dev	0.0025	0.0007	0.0012	0.0003	0.0006	0.0008	0.0007	0.0026
Certified	0.076	0.007	0.013	0.0020	(0.001)	0.009	0.004	0.056

Data in parentheses is not certified but provided for information only.

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

Allegheny Ludlum Corporation, Brackenridge, Pennsylvania
Allegheny Ludlum Corporation, Lockport, New York
Brammer Standard Co., Inc., Houston, Texas
Crucible Specialty Metals, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
Hoesch Stahl AG, Dortmund, Germany
VHG Laboratories, Inc., Manchester, New Hampshire

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 Test 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 30f, 30e, 125b, 348a, 361 to 365; BAM 038-1, 039-2, 044-1; BCS 405/1, 455/1, 456/1, 458/1; ECRM 085-1, 088-1, 096-1, 184-1, 481-1; GBW 01402; IMZ 1.22, 1.74; IPT 43.

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 NIST Certified Reference Materials: SRM 1261A through 1265A

Source: This material was produced in 1988 by LTV Steel, Special Metals, Canton, Ohio. The material was made by consumable electrode vacuum melting and cast into ingots. The bar stock material was produced by hot rolling. The bar stock was given a normalizing and tempering heat treatment.

Available Form: This Reference Material is available only in the form of a disc, approximately 37 mm (1.50") in diameter and 19 mm (0.75") 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.

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

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 October 22, 1993.
G. R. Brammer

Certificate number 4340M-102293