

Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 66B

AISI Grade 1141 Resulfurized Steel

Carbon	0.418	Molybdenum	0.019
Manganese	1.57	Aluminum	0.002
Phosphorus	0.018	Cobalt	0.005
Sulfur	0.110	Nitrogen	(0.006)
Silicon	0.02	Tin	0.001
Copper	0.031	Titanium	<0.002
Nickel	0.033	Vanadium	0.002
Chromium	0.094	Boron	(0.0003)

(analysis listed as percent by weight)

Some of the co-operating laboratories were:

Alpha Research Laboratories, Stevensville, Michigan
Analytical Consulting Services, Houston, Texas
Analytical Process Labs, Milwaukee, Wisconsin
Brammer Standard Co., Inc., Houston, Texas
Chicago Spectro Service Labs, Chicago, Illinois
Crucible Specialty Metals, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
Midstates Analytical Labs, Tulsa, Oklahoma
VHG Laboratories, Inc., Manchester, New Hampshire

Note: This is a revision of the original certificate of analysis. The material was retested by additional laboratories in 1991 and 1992. Additional elements are now certified. Also, as a result of the retesting, the certified analysis has been revised slightly for C, Si, Ni, Cr, Mo, and Sn.

See reverse side for more information.

Certificate No. Rev66B-121793

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

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
1	0.413	1.53	0.016	0.1062	0.011	0.0292	0.030	0.090	0.017
2	0.416	1.54	0.018	0.107	0.017	0.030	0.031	0.0909	0.017
3	0.416	1.56	0.018	0.107	0.0185	0.030	0.031	0.092	0.0187
4	0.417	1.57	0.0185	0.110	0.020	0.030	0.0329	0.094	0.019
5	0.4174	1.57	0.019	0.1102		0.031	0.034	0.098	0.0196
6	0.4189	1.57	0.020	0.1106		0.032	0.0341	0.0987	0.020
7	0.4203	1.60		0.113		0.032	0.035		
8	0.425	1.60		0.114					
Average	0.4180	1.568	0.0183	0.1098	0.017	0.0306	0.0326	0.0939	0.0186
Std Dev	0.0036	0.025	0.0013	0.0029	0.004	0.0011	0.0019	0.0037	0.0013
Certified	0.418	1.57	0.018	0.110	0.02	0.031	0.033	0.094	0.019

Analysis	Al	Co	N	Sn	Ti	V	B
1	0.0018	0.0046	0.0063	0.0008	0.0003	0.0012	0.00031
2	0.0020	0.005	0.0062	0.0013	0.0015	0.0016	0.00036
3	0.0021	0.005		0.0014	0.0016	0.0018	
4		0.006		0.0017	<0.002		
5				0.002			
Average	0.0020	0.0052	0.0063	0.0014		0.00153	0.00034
Std Dev	0.0002	0.0006	0.0001	0.0005		0.00031	0.00004
Certified	0.002	0.005	(0.006)	0.001	<0.002	0.002	(0.0003)

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

Chemical analyses were made on millings 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 106b, 293, 361 to 365; BAM 039-2, 044-1; BCS 455/1, 456/1, 458/1; ECRM 085-1, 088-1, 096-1, 184-1, 481-1; GBW 01402; IMZ 1.22, 1.74

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 1222, 1224, 1225, 1261A to 1265A, 1761 to 1767

NOTE: The presence of high sulfur concentrations may produce erroneously higher readings for manganese, boron, and other elements when analyzed by optical emission spectrometry.

The bar stock used for this material was produced by hot-rolling billets and annealing. The entire depth of the disc may be used. Avoid sparking the center of the disc on optical emission spectrometers.

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 December 17, 1993.
G. R. Brammer