

Brammer Standard Company, Inc.

Certificate of Analysis

Revision
B.S. 34D

H-13 Grade Tool Steel

Carbon	0.395	Molybdenum	1.24
Manganese	0.38	Vanadium	0.94
Phosphorus	0.017	Cobalt	0.031
Sulfur	0.005	Tin	(0.006)
Silicon	1.06	Aluminum	(0.005)
Copper (revised)*	0.048	Niobium	(0.008)
Nickel	0.10	Tungsten	0.10
Chromium	5.15	Titanium	(0.003)

(analysis listed as percent by weight)

Some of the co-operating laboratories were:

Allegheny Ludlum Steel Corp., Brackenridge, PA
Allegheny Ludlum Steel Corp., Lockport, NY
Brammer Standard Co., Houston, TX
Crucible Steel, Syracuse, NY
Midstates Analytical Laboratories, Tulsa, OK

NOTE: This reference material has been made for optical emission and X-Ray spectrochemical analyses. When establishing a working curve, care must be used in selecting the proper reference materials. The reference materials should be similar in composition. The element sought should be the only varying element among the reference materials used. If this procedure is not followed, extensive corrections for the other elements may be required. This reference material has a normal production heat metallurgical history and is compatible with most samples to be analyzed.

See data on reverse side.

Certificate No. Rev-34D-013103

* See reverse side for revision information.

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	0.390	0.37	0.016	0.0046	1.03	0.047	0.095	5.10	1.21
2	0.391	0.378	0.016	0.005	1.04	0.048	0.100	5.11	1.22
3	0.398	0.380	0.017	0.0050	1.05	0.049	0.103	5.12	1.23
4	0.40	0.38	0.018	0.0050	1.07	0.050	0.104	5.16	1.24
5		0.380	0.019		1.07		0.11	5.18	1.24
6		0.389			1.095		0.11	5.19	1.25
7		0.39						5.21	1.270
8		0.393							1.27
Average	0.3948	0.383	0.0172	0.0049	1.059	0.0485	0.104	5.153	1.241
Std Dev	0.0050	0.008	0.0013	0.0002	0.024	0.0013	0.006	0.043	0.022
Certified	0.395	0.38	0.017	0.005	1.06	0.048	0.10	5.15	1.24

Analysis	V	Co	Sn	Al	Nb	W	Ti
1	0.916	0.028	0.0023	0.0049	0.005	0.09	0.002
2	0.92	0.028	0.006	0.0050	0.008	0.093	0.005
3	0.93	0.030	0.009		0.010	0.100	
4	0.94	0.032				0.10	
5	0.95	0.036				0.11	
6	0.95						
7	0.96						
8	0.98						
Average	0.943	0.0308	0.0058	0.0050	0.0077	0.099	0.003
Std Dev	0.021	0.0033	0.0034	0.0001	0.0025	0.008	0.0021
Certified	0.94	0.031	(0.006)	(0.005)	(0.008)	0.10	(0.003)

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

Chemical analyses were made on millings from the cross-sections of the bars. The values listed above are individual laboratory analytical results.

Methods of analysis used were a combination of ASTM Standard Methods for classical wet chemistry, ICP and AA spectrometric methods, and combustion procedures for carbon and sulfur.

REVISION: Because of the misalignment of data on page 2 of the certificate number 34D-072088A, the data used for certification was reviewed and a new table was prepared on January 31, 2003. As a result of the new table, the certified Cu value was changed from 0.049% to 0.048%.

Inquiries concerning this Reference Material should be directed to:

Brammer Standard Co., Inc.
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 Houston, TX 77069

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 Fax: (281) 440-4432

Certified by: G. R. Brammer on January 31, 2003.