Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 35D

Reference Material for O-1 Tool Steel

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
Carbon	**0.879**	0.006	**Molybdenum**	**0.035**	0.003
Manganese	**1.13**	0.02	**Cobalt**	**0.012**	0.003
Phosphorus	**0.021**	0.002	**Tin**	**0.006**	0.002
Sulfur	**0.024**	0.002	**Tungsten**	**0.46**	0.02
Silicon	**0.22**	0.01	**Vanadium**	**0.181**	0.007
Copper	**0.141**	0.004	**Aluminum**	(0.005)[3]	
Nickel	**0.132**	0.006	**Niobium**	(0.001)	
Chromium	**0.495**	0.006	**Titanium**	(0.003)	

(analysis listed as percent by weight)

[1] The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

[2] The uncertainties listed are based on value judgments of the material inhomogeneity and the 95% confidence interval. The half-width confidence interval C(95%) is shown on page 2.

[3] Data in parentheses are not certified and are provided for information only.

Some of the co-operating laboratories were:

Alpha Research Laboratories, Stevensville, MI
Allegheny Ludlum Steel Corporation, Brackenridge, PA
Allegheny Ludlum Steel Corporation, Lockport, NY
Brammer Standard Company, Inc, Houston, TX
Crucible Inc./Specialty Metals, Syracuse, NY
Jessop Steel Company, Washington, PA

This Reference Material was produced by hot-rolling and annealing. This Reference Material should be used and compared with material of similar metallurgical history as it may not plot well with chill cast materials on some instruments.

See the following page for more information.

Original Certificate Number 35D-121489
New Certificate Number REV-35D-120409

New Certificate Number REV-35D-120409 Revised to show uncertainty values on December 4, 2009

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

BS 35D Certificate Number REV35D-120409p2

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
1	0.87	1.09	0.019	0.021	0.205	0.138	0.126	0.49	0.030
2	0.877	1.12	0.02	0.023	0.21	0.139	0.13	0.49	0.035
3	0.879	1.13	0.022	0.024	0.22	0.14	0.13	0.49	0.036
4	0.88	1.13	0.022	0.024	0.22	0.14	0.13	0.495	0.037
5	0.88	1.14	0.022	0.025	0.23	0.143	0.136	0.50	0.038
6	0.88	1.15	0.022	0.0251	0.231	0.144	0.14	0.503	0.038
7	0.884								
Average	0.879	1.127	0.0212	0.0237	0.219	0.1407	0.132	0.495	0.0357
Std Dev	0.004	0.021	0.0013	0.0015	0.010	0.0023	0.005	0.006	0.003
Certified	0.879	1.13	0.021	0.024	0.22	0.141	0.132	0.495	0.036
t	2.45	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57
C(95%)	0.004	0.022	0.0014	0.0016	0.011	0.0025	0.005	0.006	0.0032

Analysis	Co	Sn	W	V	Al	Nb	Ti
1	0.010	0.0050	0.44	0.178	0.003	0.0002	0.001
2	0.012	0.0066	0.45	0.179	0.005	0.001	0.002
3	0.012	0.007	0.46	0.18	0.005	0.001	0.003
4	0.012	0.007	0.47	0.18	0.006	0.002	0.004
5	0.016		0.49	0.19	0.007		
Average	0.0124	0.0064	0.462	0.1814	0.0052	0.0011	0.0025
Std Dev	0.0022	0.001	0.019	0.0049	0.0015	0.0007	0.0013
Certified	0.012	0.006	0.46	0.181	(0.005)	(0.001)	(0.003)
t	2.78	3.18	2.78	2.78	2.78	3.18	3.18
C(95%)	0.0027	0.0015	0.024	0.0061	0.0018	0.0012	0.0021

Analysis listed as percent by weight

C(95%) = (t x sd)/√n The half-width confidence interval, where t is the appropriate Student's t value, sd is the interlaboratory standard deviation, and n is the number of acceptable mean values. For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 section 6.

ISO Guides and Standards available from Global Engineering - www.global.ihs.com

ISO Guide 35 Reference Materials - General and statistical principles for certification

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

Analysis: Chemical analyses were performed on chips taken from cross-sections of the discs. The individual values listed above are the average of each analyst's results.

Form: This Reference Material is machined in the form of a disc, approximately 38 mm diameter and 12 mm thick by Brammer Standard Company. The bar stock used for this material was produced by hot-rolling billets and annealing.

Certificate Number: The unique identification number for this certificate of analysis is REV-35D-120409. This BS 35D Certificate of Analysis was revised to show the estimate of uncertainty for the certified values. Also, an additional decimal place was certified for copper, nickel, and vanadium.

Refer to the “Certificates” section of the Brammer Standard Company website for any revision to this or other Brammer Standard Company’s Certificates of Analysis.

Use: This Reference Material is intended for use in spark atomic emission and x-ray spectrometric methods of analysis.

Certified area: The entire depth of the disc may be used.

Caution: As with any bar material, avoid spark atomic emission spectrometric burns in the center of the disc (5 mm radius), as some segregation may be present.

Sample 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 web: brammerstandard.com
14603 Benfer Road
Houston, Texas 77069 USA Fax: (281) 440-4432 email: contact@brammerstandard.com

Revision Certified by: _____ on December 4, 2009.
Beau R. Brammer

Brammer Standard Company, Inc., is accredited to ISO Guide 34 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials by A2LA (Certificate Number 656.02)
The scope of accreditation is listed on the website: www.brammerstandard.com

Brammer Standard Company's Chemical Laboratory is accredited to ISO Standard 17025 by A2LA. (Certificate Number 656.01)

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001:2000 by National Quality Assurance, U.S.A.

Certificate Number REV-35D-120409p3