Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 33E

Reference Material for S-1 Tool Steel

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
Carbon	**0.49**	0.01	**Molybdenum**	**0.045**	0.003
Manganese	**0.29**	0.01	**Cobalt**	**0.006**	0.002
Phosphorus	**0.022**	0.003	**Vanadium**	**0.19**	0.01
Sulfur	**0.005**	0.001	**Tungsten**	**2.75**	0.05
Silicon	**0.20**	0.01			
Copper	**0.038**	0.006			
Nickel	**0.08**	0.01			
Chromium	**1.25**	0.03	Titanium	(0.002)[3]	

(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] The value in parentheses is shown for information only and is not certified.

Some of the co-operating laboratories were:

Allegheny Ludlum Steel Corporation, Brackenridge, PA
Allegheny Ludlum Steel Corporation, Lockport, NY
Brammer Standard Company, Inc, Houston, TX
Crucible Inc./Specialty Metals, Syracuse, NU
Midstates Analytical Laboratories, Inc., Tulsa, OK

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.

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

See the following page for more information.

Original Certificate Number 33E-112988
New Certificate Number REV-33E-120909

New Certificate Number REV-33E-120909 Revised to show uncertainty values on December 9, 2009

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

BS 33E Certificate Number REV-33E-120909

Analysis Number	C	Mn	P	S	Si	Cu	Ni	Cr
1	0.481	0.280	0.019	0.0048	0.179	0.030	0.070	1.22
2	0.485	0.281	0.021	0.0050	0.190	0.039	0.073	1.23
3	0.490	0.282	0.023	0.0050	0.192	0.040	0.075	1.24
4	0.494	0.290	0.023	0.0050	0.200	0.040	0.080	1.26
5	0.500	0.292	0.024		0.210	0.042	0.080	1.28
6		0.300			0.210		0.090	1.28
Average	0.4900	0.2875	0.0220	0.0050	0.1968	0.0382	0.0780	1.252
Std.Dev.	0.0074	0.0079	0.0020	0.0001	0.0122	0.0047	0.0071	0.026
Certified	0.49	0.29	0.022	0.005	0.20	0.038	0.08	1.25
t	2.78	2.57	2.78	3.18	2.57	2.78	2.57	2.57
C(95%)	0.0093	0.0083	0.0025	0.0002	0.013	0.0059	0.0074	0.027

continued Analysis listed as percent by weight

Analysis Number	V	Mo	W	Co	Ti	Sn	Al	Nb
1	0.183	0.040	2.68	0.0050	0.002	0.011	0.008	0.002
2	0.189	0.042	2.70	0.0050	0.002			
3	0.190	0.044	2.75	0.0058				
4	0.190	0.045	2.78	0.0070				
5	0.190	0.046	2.79					
6	0.200	0.050	2.80					
Average	0.1903	0.0445	2.750	0.0057	0.002			
Std.Dev.	0.0055	0.0034	0.050	0.0009				
Certified	0.19	0.045	2.75	0.006	(0.002)			
t	2.57	2.57	2.57	3.18				
C(95%)	0.0054	0.0036	0.052	0.0015				

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

Certificate Number: The unique identification number for this certificate of analysis is REV-33E-112309. This BS 33E Certificate of Analysis is revised to show the estimate of uncertainty for the certified values. With this revision, a third decimal place was added to the certified copper value.

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.

Form: This Reference Material is machined in the form of a disc, approximately 38 mm diameter and 12 mm thick by Brammer Standard Company

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 9, 2009.
Beau R. Brammer