Brammer Standard Company, Inc.

Certificate of Analysis

BS D-6B

Certified Reference Material for Tool Steel Grade D6 - UNS Number K24728

	Certified Value[1]	Estimate of Uncertainty[2]	**Certified Values[3]**		Certified Value[1]	Estimate of Uncertainty[2]
Al	**0.058**	0.003		**N**	**0.0021**	0.0003
As	**0.0053**	0.0007		**Ni**	**0.48**	0.02
C	**0.46**	0.03		**O**	**0.0007**	0.0003
Co	**0.0103**	0.0009		**P**	**0.006**	0.002
Cr	**1.01**	0.03		**S**	**0.0003**	0.0002
Cu	**0.156**	0.009		**Si**	**0.220**	0.009
Fe	**95.8**	0.1		**Sn**	**0.0070**	0.0007
H	**0.00010**	0.00005		**Ti**	**00027**	0.0007
Mn	**0.73**	0.03		**V**	**0.101**	0.009
Mo	**0.91**	0.02		**W**	**0.0024**	0.0006

	Reference Value[1]	Estimate of Uncertainty[2]	**Reference Values[3,4]**		Reference Value[1]	Estimate of Uncertainty[2]
Nb	**<0.05**			**Zr**	**<0.05**	

[1] For each element, the certified value listed is the present best estimate of the true value based on the mean of the weighted results of an interlaboratory testing program. See page 3 for more information on its calculation.

[2] For each element, the uncertainty listed is based on a statistical evaluation of the contributions of homogeneity and the interlaboratory testing program. See page 3 for more information on its calculation.

[3] Values are given in weight percent. Values in brackets are reported by difference.

[4] Reference values are not certified and are provided for information only.

Trace element information values for B, Ca, Ga, Ge, Mg, Re, Sb, Ta, U, and Zn are shown on page 4.

The requirements of ISO Guides 30, and Standards 33401 and 33405 were followed for the preparation of this Certified Reference Material and certificate of analysis.

BS D-6B * Code for method Certified values listed as weight percent

Analysis	*	Al	*	As	*	C	*	Co	*	Cr	*	Cu	*	Fe	*	H	*	Mn	*	Mo
1	5	0.053367	4	0.0046667	1	0.4363	5	0.0093	11	0.985	4	0.145333	4	95.68	2	0.00005	10	0.70	11	0.895
2	5	0.053367	3	0.0048	3	0.441	4	0.0097	4	0.988	5	0.145333	16	95.7568	2	0.000083	4	0.71433333	4	0.896
3	3	0.0538	10	0.005	1	0.4465	11	0.0098	4	0.991	5	0.145333	16	95.79	2	0.000083	4	0.720	4	0.897267
4	12	0.054333	5	0.0050667	3	0.454	5	0.009867	4	0.991	3	0.15	16	95.80023	2	0.000096	4	0.722	14	0.897333
5	10	0.0549	4	0.0052	1	0.454667	5	0.009867	3	0.994	3	0.152	14	95.81333	2	0.000098	4	0.722	4	0.899667
6	3	0.058	12	0.0052333	1	0.4575	4	0.0099	3	0.997	3	0.1522	16	95.83	2	0.000101	4	0.723	4	0.908333
7	4	0.058267	5	0.0052333	3	0.46	4	0.009967	13	0.9973333	3	0.153	10	95.84333	2	0.0001267	4	0.7230	4	0.909
8	11	0.0585	5	0.0052667	1	0.460333	3	0.010	4	0.9976667	4	0.154333	16	95.84367	2	0.0002033	4	0.72413333	3	0.909
9	4	0.058667	5	0.0052667	4	0.461333	3	0.010	4	0.9991	10	0.155333	3	95.85333	2	0.00027	4	0.7244	3	0.91
10	4	0.058667	4	0.0053	1	0.461667	14	0.010133	8	1.00	4	0.156333	4	95.87			3	0.726	7	0.91
11	14	0.058733	4	0.0054333	1	0.461667	4	0.010133	12	1.003	14	0.156667	16	95.87667			4	0.72766667	10	0.91
12	4	0.0589	5	0.00560	1	0.464667	4	0.010133	3	1.003	3	0.157	16	95.89067			4	0.73033333	10	0.913
13	3	0.059	4	0.0058	1	0.467	4	0.0102	3	1.0046667	10	0.157	16	95.9			4	0.73133333	4	0.914
14	3	0.059	3	0.006	1	0.467333	4	0.0108	4	1.0086667	4	0.158	16	95.9			14	0.732	3	0.914
15	4	0.059033	3	0.006	1	0.468	10	0.011	3	1.01	11	0.158					3	0.732	4	0.915667
16	4	0.0591			1	0.468333	12	0.011	10	1.01	4	0.159333					10	0.737	4	0.915667
17	4	0.0593			1	0.469	3	0.011167	4	1.0123333	10	0.16					3	0.737	4	0.918
18	3	0.0601			1	0.469667	3	0.0113	4	1.0140	8	0.16					3	0.74	4	0.921
19	4	0.060633			1	0.4704	4	0.012	4	1.0158	4	0.1602					8	0.74	4	0.921533
20	4	0.0607			1	0.470667			14	1.0233333	4	0.1602					10	0.74033333	4	0.923667
21					1	0.471			10	1.024	4	0.1605					7	0.743667	10	0.9925
22					1	0.4755			4	1.027	4	0.161333					3	0.747	3	0.94
23					11	0.486			10	1.036667	4	0.161367					11	0.754	3	0.949
24					1	0.488333											4	0.755667		
Average		0.0584		0.00532		0.464		0.01033		1.006		0.1556		95.824		0.0000848		0.731		0.914
Std Dev		0.0015		0.00039		0.012		0.00068		0.013		0.0055		0.017		0.0000094		0.013		0.013
H		0.0024		0.00083		0.0071		0.0011		0.011		0.0040		0.19		0.00018		0.0091		0.010
U_1		0.0028		0.00083		0.0071		0.0011		0.011		0.0040		0.19		0.00018		0.0091		0.010
t-statistic		2.09		2.14		2.07		2.10		2.07		2.07		2.16		2.31		2.07		2.07
U_2		0.0059		0.0018		0.015		0.0023		0.022		0.0082		0.41		0.00043		0.019		0.021
U_3		0.0013		0.00046		0.0030		0.00053		0.0047		0.0017		0.11		0.00014		0.0038		0.0044
Certified		**0.058**		**0.0053**		**0.46**		**0.0103**		**1.01**		**0.156**		**95.8**		**0.00010**		**0.73**		**0.91**
Uncertainty		0.003		0.0007		0.03		0.0009		0.03		0.009		0.1		0.00005		0.03		0.02
Tolerance		0.009		0.0021		0.09		0.0027		0.09		0.027		0.4		0.00009		0.09		0.06

Analysis	*	N	*	Ni	*	O	*	P	*	S	*	Si	*	Sn	*	Ti	*	V	*	W
1	2	0.001833	3	0.445	2	0.00045	5	0.002367	1	0.0001033	5	0.207	4	0.0063	5	0.0019867	12	0.08466667	3	0.0018
2	2	0.00185	4	0.4496667	2	0.000467	5	0.003567	1	0.0001173	5	0.207	5	0.006467	11	0.0021	4	0.09233333	12	0.001833
3	2	0.0020	4	0.4496667	2	0.000633	5	0.0046	1	0.000119	3	0.211	5	0.006467	5	0.0021333	5	0.09523333	4	0.002187
4	2	0.002	10	0.4496667	2	0.000643	4	0.00467	1	0.0002	10	0.215333	3	0.0066	5	0.0021333	5	0.09523333	4	0.0022
5	2	0.002	4	0.456	2	0.000733	10	0.0051	4	0.0002333	4	0.218333	11	0.0067	14	0.0024	10	0.09583333	11	0.0022
6	2	0.002067	4	0.4626667	2	0.000827	3	0.0054	1	0.0003	4	0.219	4	0.0068	5	0.0024667	3	0.0973	4	0.002333
7	2	0.002067	3	0.463	2	0.000867	10	0.005533	1	0.0003467	4	0.219	3	0.0068	4	0.0025	3	0.098	4	0.0024
8	2	0.0021	4	0.4643333	2	0.000943	12	0.0057	1	0.00035	11	0.219	9	0.0069	3	0.0026	3	0.099	1	0.0024
9	2	0.0021	10	0.465	2	0.000947	3	0.006	1	0.00041	3	0.219333	5	0.006933	4	0.0028333	11	0.099	4	0.0025
10	2	0.002133	4	0.466			4	0.006067	1	0.00043	3	0.22	12	0.006967	4	0.0029	4	0.09933333	5	0.0025
11	2	0.002133	7	0.47			3	0.0061			10	0.22	4	0.006967	4	0.0029667	4	0.09936667	5	0.0025
12	2	0.0022	4	0.4736			14	0.006233			6	0.22	3	0.007	4	0.0029667	3	0.10	5	0.002593
13	2	0.0023	4	0.4742667			6	0.006233			3	0.22	3	0.007	4	0.0030	10	0.10	5	0.002667
14	2	0.00235	4	0.477			4	0.0063			4	0.220333	4	0.0072	3	0.0032	4	0.10056667	4	0.0040
15			11	0.477			11	0.0063			14	0.220333	4	0.007233	4	0.0034	10	0.101		
16			4	0.4776667			3	0.006333			4	0.2205	4	0.00741	12	0.0034333	4	0.10103333		
17			14	0.4833333			4	0.0064			4	0.2210	5	0.007413			4	0.102		
18			4	0.4896667			4	0.006533			4	0.2216	4	0.007467			4	0.10266667		
19			3	0.49			4	0.007367			3	0.222	10	0.008			3	0.103		
20			3	0.4986667			4	0.0076			6	0.223833	4	0.008267			14	0.10766667		
21			3	0.499			3	0.010			4	0.228					4	0.108		
22			8	0.50							4	0.229					4	0.1087		
23			10	0.50							10	0.23					8	0.11		
24			4	0.500333													4	0.1104		
25			4	0.502033													4	0.110467		
Average		0.002117		0.475		0.000726		0.00594		0.00026		0.2196		0.00704		0.00269		0.1008		0.00244
Std Dev		0.000069		0.018		0.000069		0.00021		0.00012		0.0057		0.00049		0.00047		0.0061		0.00052
H		0.00057		0.0072		0.00038		0.00087		0.00026		0.0048		0.00093		0.00062		0.0032		0.00060
U_1		0.00057		0.0072		0.00038		0.00089		0.00028		0.0048		0.00093		0.00063		0.0032		0.00061
t-statistic		2.16		2.06		2.31		2.09		2.26		2.07		2.09		2.13		2.06		2.16
U_2		0.0012		0.015		0.00089		0.0019		0.00064		0.010		0.0020		0.0013		0.0066		0.0013
U_3		0.00033		0.0030		0.00030		0.00041		0.00020		0.0021		0.00044		0.00034		0.0013		0.00035
Certified		**0.0021**		**0.48**		**0.0007**		**0.006**		**0.0003**		**0.220**		**0.0070**		**0.0027**		**0.101**		**0.0024**
Uncertainty		0.0003		0.02		0.0003		0.002		0.0002		0.009		0.0007		0.0007		0.009		0.0006
Tolerance		0.0012		0.06		0.0006		0.005		0.0002		0.027		0.0021		0.0021		0.027		0.0018

BS D-6B * Code for method Reference values listed as weight percent

Analysis	*	Nb	*	Zr
1	5	0.0003	12	0.0001767
2	12	0.000327	5	0.0002
3	5	0.000423	5	0.00022
4	5	0.000493	5	0.0002233
5	5	0.00061	3	0.001
6	3	0.0015	3	0.0012
7	11	0.0016	4	0.0015
8	4	0.0020	11	0.0018
9	4	0.002133	4	0.0018233
10	4	0.0022	4	0.002
11	4	0.0023	4	0.0021
12	4	0.002467	4	0.0021
13	4	0.0025		
14	3	0.0029		
15	10	0.0030		
Average		0.00165		0.00120
Std Dev		0.00098		0.00080
H		0.00052		0.00060
U_1		0.00052		0.00061
t-statistic		2.14		2.20
U_2		0.0011		0.0013
U_3		0.00029		0.00039
Reference		**<0.05**		**<0.05**
Uncertainty				
Tolerance				

For each element, in accordance with the requirements of ISO 17034 and 33405, an effort must be made to account for the effects on the certified value of the uncertainty estimate from homogeneity testing (H) and the uncertainties of the contributing laboratories. The average (A) is calculated using a weighted mean where the reciprocal of the square of each laboratory's combined uncertainty (C_L), calculated from its standard deviation (S_L) and its uncertainty estimate (U_L), is used as the weight (W_L) for its mean (M_L). The standard deviation (S) is calculated as the square root of the reciprocal of the sum of the weights. U_1 is the combined uncertainty from homogeneity and labs. U_2 is U_1 multiplied by the coverage factor (95 % t-statistic). U_3 is U_2 divided by the square root of the number of determinations (n). Thus:

$$C_L = \sqrt{S_L^2 + U_L^2} \qquad W_L = \frac{1}{C_L^2} \qquad A = \frac{\sum_{i=1}^{n} W_L M_L}{\sum_{i=1}^{n} W_L} \qquad S = \frac{1}{\sqrt{\sum_{i=1}^{n} W_L}} \qquad U_1 = \sqrt{H^2 + S^2} \qquad U_2 = t \times U_1 \qquad U_3 = \frac{U_2}{\sqrt{n}}$$

*All but the final reported values are taken to two significant figures as determined by each quantity's uncertainty estimate. The final reported Uncertainty is U_3 rounded to one significant figure and represents the half width of the 95 % confidence interval for the **Certified** value. The final reported **Certified** value is A rounded to the same decimal place as the Uncertainty. The Uncertainty is a measure of the quality of the **Certified** value.*

The Tolerance is a measure of the expected performance of an analysis. This involves further expanding the sample uncertainty to include instrument and operator uncertainty, for those without access to such calculations.

For further information regarding the confidence interval for the certified value see ISO Standard 33405:2024 section 10.

BS D-6B * Code for analytical method Trace analysis listed as mg/kg (ppm)

Analysis	*	B	*	Ca	*	Ga	*	Ge	*	Mg	*	Re	*	Sb	*	Ta	*	U	*	Zn
1	12	0.59	12	0.39	12	8.1	12	18	12	0.70	12	0.11	12	12	4	72	12	0.01	12	0.23
2	12	0.69	12	0.39	12	8.2	12	18	12	0.75	12	0.11	12	13			12	0.01	12	0.24
3	12	0.72	12	0.45	12	8.7	12	18	12	0.77	12	0.12	12	13			12	0.02	12	0.25

Analytical Method Codes:

1 Combustion (ASTM E1019)
2 Fusion (ASTM E1019)
3 Spark Atomic Emission
4 ICP Atomic Emission
5 ICP Mass Spectrometry
6 Gravimetric
7 Photometric
8 Flame Atomic Absorption
9 GF Atomic Absorption
10 X-Ray Fluorescence
11 GD Atomic Emission
12 GD Mass Spectrometry
13 Titrimetric
14 DCP Atomic Emission
15 HG Atomic Fluorescence
16 Difference

ICP = Inductively Coupled Plasma GF = Graphite Furnace GD = Glow Discharge
DCP = Direct Current Plasma HG = Hydride Generation

Lab Name	Location	Registrar	Accreditation
Brammer Standard Company, Inc.	Houston, TX	A2LA	17025, 17034
NSL Analytical	Cleveland, OH	ANAB	17025
Element Materials Technology	Glendale Heights, IL	A2LA	17025
Dirats Laboratories	Westfield,MA	ANAB	17025
Vitkovice Testing Center	Hulvaky, Ostrava	Czech Accreditation Institute	17025
National Analysis Center For Iron And Steel	Beijing, China	CNAS	17025
Elemental Analysis, Inc.	Lexington, KY	A2LA	17025
Anderson Laboratories, Inc.	Greendale, WI	A2LA	17025
TUV Rheinland Pvt Ltd	Bangalore, India	NABL	17025
Shiva Analyticals Private Limited	Hoskote, Bangalore	NABL	17025
Raghavendra Spectro Metallurgical Laboratory	Karnataka, India	NABL	17025
Luvak Inc.	Boylston, MA	PRI	17025
Eurofins EAG Materials Science, LLC	Liverpool, NY	A2LA	17025
Laboratory Testing, Inc.	Hatfield, PA	A2LA	17025
Instytut Metalurgii Zelaza	Gliwice, Poland	PCA	17025

A2LA = American Association for Laboratory Accreditation
ANAB = ANSI-ASQ National Accreditation Board
CNAS = China National Accreditation Service
NABL = National Accreditation Board for Testing and Calibration Laboratories
PCA = Polish Center For Accreditation
PRI =Performance Review Institute

Analysis: Chemical analyses were made on solid pieces and chips prepared by an end mill from representative samples for the certified portion of the lot in accordance with ASTM Standard Practice E1806. The laboratories participating in the testing followed the requirements of ISO Standard 17025.

Traceability: The following Certified Reference Materials were used to validate the analytical data: 12X353F; AR 546, 555, 556, 629, 644, 647, 654, 655, 660, 668, 670, 673, 675, 867, 869, 870, 873, 878, 882, 889, 893, 89, 945, 946, 954, 102F, 1120N, 1650, 1652, 1653; BAS 8/1, 258/1, 325, 410, 422, 433, 464/1; BS CSN-4, D-6A, LAS 7, LF2B, 5H, 11, 17A, 30D, 33F, 36C, 40B, 45B, 50G, 54H, 54J, 59C, 73S, 74F, 189A, 192, 300A, 355, 1018, 1020, 1026, 1030A, 1101, 2023, 3952, 4031, 8620E; CKD 169D, 185A; CMSI 2074, 2075; DSZU CA01A, CA031; ECRM 184-1; IARM 30C, 30F, 31C, 35J, 36C, 47B, 199C, 259A, 299A; IMZ 55/1a, 117; IPT 12A, 17A, 21-1; JSS 003-3; KMS LCSON-001E; SRM 9C, 13G, 14D, 132A, 155, 160B, 343A, 346A, 361, 362, 363, 364, 368, 1763, 1764, 3113; USS CCB; VS F19.

Homogeneity: This Certified Reference Material (CRM) was tested for homogeneity using ASTM Standard Method E826 and found acceptable. It was also examined by spark atomic emission spectrometry and found to be compatible with the following Reference Materials: BS 11, 40B, 1101, 3952, 4031, 4942; CKD 169D; CMSI 2074; USS CCB.

Validity statement: ISO Standard 33401 states that the certification should contain an expiration date for all materials where instability has been demonstrated or is considered possible, after which the certified value is no longer guaranteed by the certifying body. The certification of BS D-6B is valid indefinitely. The certification is nullified if this CRM is damaged, contaminated, or otherwise modified.

Storage: This CRM must be stored in a cool, dry, non-corrosive environment.

Source: The bar stock for this CRM was produced by Next Generation Metals, Inc.; Boca Raton, Fl.

Form: This CRM is machined in the form of a disc, approximately 38mm in diameter and 19mm thick by Brammer Standard Company, Inc.

Use: This CRM is intended for use in spark atomic emission, glow discharge, and x-ray spectrometric methods of analysis. Refer to ISO Standard 33403 for information about the use of Certified Reference Materials.

Certified Area: The entire depth of the CRM may be used.

> Caution: As with any bar material, avoid spark atomic emission spectrometric burns in the center of the CRM (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 used for production specimens. Avoid overheating the sample during surface preparation.

> Caution: CRM contains significant insoluble soft metal inclusions. Surface smearing may occur. Spark atomic emission spectrometers may require extended preburns to compensate.

Certificate Number: The unique identification number for this certificate of analysis is D-6B-010826. You may obtain information on revisions of certificates from the internet at **www.brammerstandard.com**.

Safety Notice: A Safety Data Sheet (SDS) 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

Web: www.brammerstandard.com
Email: contact@brammerstandard.com

Brammer Standard Company, Inc., is accredited by the American Association for Laboratory Accreditation (A2LA) to ISO Standard 17034:2016 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials (our current Certificate Number 656.02 expires 01/31/2027)

Brammer Standard Company's Chemical Laboratory is accredited by A2LA to ISO Standard 17025:2017. (Our current Certificate Number 656.01 expires 01/31/2027)

By current Certificate Number 10539 expiring 01/01/2027, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001:2015 by National Quality Assurance (NQA), U.S.A.

The scopes of accreditation are listed on the website: www.brammerstandard.com

References:

Versions used were those available at the time of testing and characterization

E826 Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectrometry

E1019 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

E1806 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

ISO Standard 17025:2017 General requirements for the competence of testing and calibration laboratories

ISO Standard 9001:2015 Quality Management Systems - Requirements

ISO Guide 30:2015 Terms and definitions used in connection with reference materials + 2008 amendment

ISO Standard 33401:2024 Reference materials - Contents of certificates, labels and accompanying documentation

ISO Standard 33403:2024 Reference materials – Requirements and recommendations for use

ISO Standard 17034:2016 General requirements for the competence of reference material producers

ISO Standard 33405:2024 Reference Materials – Approaches for characterization and assessment of homogeneity and stability

ASTM documents available from ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428.

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

Other useful documents available from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.

NIST Special Publication 260-100, Handbook for SRM Users

NIST Special Publication 829, Use of NIST Standard Reference Materials for Decisions on Performance of Analytical Chemical Methods and Laboratories

Certified by: _____ on January 8, 2026.

Beau R. Brammer

President