Brammer Standard Company, Inc.

Certificate of Analysis
BS MP35N

Certified Reference Material for MP35N - UNS Number R30035

Certified Values[3]

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
Al	**0.047**	0.002	**Mo**	**9.7**	0.2
B	**0.0034**	0.0005	**N**	**0.0016**	0.0004
C	**0.009**	0.001	**Nb**	**0.017**	0.002
Co	**33.2**	0.2	**Ni**	**35.6**	0.2
Cr	**20.4**	0.1	**Ta**	**0.0021**	0.0006
Fe	**0.327**	0.006	**Ti**	**0.75**	0.01
Mn	**0.008**	0.001	**V**	**0.0095**	0.0008

Reference Values[3,4]

	Reference Value[1]	Estimate of Uncertainty[2]		Reference Value[1]	Estimate of Uncertainty[2]
As	**<0.01**		**S**	**<0.01**	
Ca	**<0.01**		**Si**	**<0.05**	
Cu	**0.014**	0.004	**Sn**	**<0.01**	
Mg	**<0.01**		**W**	**<0.05**	
P	**<0.01**				

Informational Values[3,5]

O (0.0004)   Sb (0.00002)   Zr (0.002)

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[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 4 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 4 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.

[5] Values in parentheses are not certified and are provided for information only.

Trace element information values for Ga, Ir, Os, Pb, Re, Sb, and U are shown on page 4.

The requirements of ISO Guides 30, 31, and 35 were followed for the preparation of this Certified Reference Material and certificate of analysis.

BS MP35N   * Code for method   Certified values listed as weight percent

Analysis	*	Al	*	B	*	C	*	Co	*	Cr	*	Fe	*	Mn	*	Mo	*	N	*	Nb
1	4	0.0444	5	0.00273333	11	0.0061	4	32.895	4	20.2675	10	0.314	4	0.007133	4	9.54	2	0.0012	12	0.012333
2	11	0.0453	7	0.00285667	1	0.00666667	16	[32.94]	3	20.32	4	0.323333	12	0.007233	4	9.60	2	0.001267	5	0.0152
3	4	0.0459667	3	0.0029	1	0.007	16	[33.03667]	10	20.395	10	0.323333	10	0.0075	4	9.60706667	2	0.001323	4	0.015467
4	4	0.0459667	4	0.0029	1	0.00793	16	[33.06091]	4	20.40623	4	0.323667	4	0.0075	4	9.63046667	2	0.001347	4	0.015767
5	4	0.0465	4	0.00308667	1	0.00799333	13	33.095667	13	20.41833	4	0.32475	5	0.007767	10	9.64333333	2	0.001367	11	0.0158
6	4	0.0466633	4	0.0035	1	0.00806	10	33.24	17	20.42	14	0.326667	3	0.0078	4	9.66546667	2	0.001467	4	0.015867
7	5	0.0471667	4	0.0037	1	0.00916667	14	33.3	14	20.43333	4	0.329	10	0.008633	4	9.71673333	2	0.001767	4	0.016033
8	10	0.0473333	5	0.00376667	1	0.00953333	4	33.303333	4	20.45023	4	0.329313	4	0.008717	10	9.74	2	0.0018	5	0.016133
9	3	0.0475	14	0.00393333	1	0.00967333	4	33.331733	11	20.46	4	0.330267	8	0.00884	4	9.79166667	2	0.00182	10	0.0162
10	10	0.048	4	0.00413333	1	0.0102	4	33.3325	4	20.52667	4	0.3305	4	0.009133	14	9.83666667	2	0.00200	4	0.016767
11	5	0.0495333			1	0.0103	4	33.536667	4	20.54533	4	0.332167	14	0.009433	4	9.88933333	2	0.002033	3	0.0168
12	14	0.0496333			3	0.0104			4	20.54667			4	0.009667	11	9.91	2	0.002123	4	0.0177
13					1	0.011							4	0.00971	4	9.9325			4	0.018733
14					1	0.01126667													10	0.020333
15																			14	0.0209
Average		0.0466		0.00335		0.00865		33.188408		20.439		0.3272		0.008390		9.731018		0.001626		0.01678
Std Dev		0.0018		0.00010		0.00038		0.000095		0.032		0.0064		0.000088		0.000088		0.000091		0.00071
H		0.0022		0.00068		0.0010		0.092		0.067		0.0059		0.0010		0.042		0.00051		0.0014
U_1		0.0028		0.00069		0.0011		0.092		0.074		0.0086		0.0010		0.042		0.00052		0.0015
t-statistic		2.20		2.26		2.16		2.23		2.20		2.23		2.18		2.18		2.20		2.14
U_2		0.0062		0.0016		0.0023		0.21		0.16		0.019		0.0022		0.091		0.0011		0.0033
U_3		0.0018		0.00049		0.00063		0.062		0.047		0.0058		0.00061		0.025		0.00033		0.00085
Certified		**0.047**		**0.0034**		**0.009**		**33.2**		**20.4**		**0.327**		**0.008**		**9.7**		**0.0016**		**0.017**
Uncertainty		0.002		0.0005		0.001		0.2		0.1		0.006		0.001		0.2		0.0004		0.002
Tolerance		0.006		0.0016		0.003		0.6		0.3		0.019		0.003		0.6		0.0012		0.006

Analysis	*	Ni	*	Ta	*	Ti	*	V
1	16	35.4	4	0.00183333	4	0.7215	4	0.0080467
2	11	35.4	4	0.00194667	4	0.73033333	5	0.0081667
3	4	35.4175	4	0.00206667	4	0.740	3	0.0092
4	4	35.43	3	0.0021	10	0.753	14	0.0094333
5	4	35.471	14	0.00226667	3	0.754	10	0.0094667
6	17	35.5	11	0.0026	14	0.75533333	4	0.0100667
7	10	35.52			10	0.75733333	4	0.01018
8	4	35.523333			4	0.76076667	4	0.0102
9	3	35.6			4	0.7608	10	0.0102
10	6	35.629333			4	0.76266667	5	0.0104
11	4	35.684067			4	0.76325	11	0.0109
12	6	35.786667			11	0.772		
13	4	35.803333						
14	16	35.846667						
15	10	35.88						
Average		35.592793		0.00207		0.752582		0.00953
Std Dev		0.000082		0.00011		0.000091		0.00044
H		0.096		0.00056		0.0092		0.0011
U_1		0.096		0.00057		0.0092		0.0011
t-statistic		2.14		2.57		2.20		2.23
U_2		0.21		0.0015		0.020		0.0026
U_3		0.053		0.00060		0.0059		0.00077
Certified		**35.6**		**0.0021**		**0.75**		**0.0095**
Uncertainty		0.2		0.0006		0.01		0.0008
Tolerance		0.6		0.0018		0.03		0.0026

BS MP35N   * Code for method   Reference values listed as weight percent

Analysis	*	As	*	Ca	*	Cu	*	Mg	*	P	*	S	*	Si	*	Sn	*	W
1	15	0.00005	12	0.0000167	4	0.0082	3	0.0003	12	0.00030	11	0.0002	4	0.012167	12	0.0000873	12	0.006733
2	12	0.000123	3	0.0005	4	0.0102	12	0.0009733	3	0.0003	1	0.0002	11	0.013	5	0.00011	4	0.00695
3	9	0.0003	4	0.0094	11	0.0107	5	0.0011	11	0.0003	12	0.000317	4	0.0134	5	0.00014667	14	0.013667
4	3	0.0012			12	0.01233333	4	0.0012567	4	0.000677	1	0.0004	4	0.0139	3	0.0013	5	0.016667
5	5	0.0071667			4	0.0125	5	0.0013333	7	0.0008	1	0.00056	4	0.0142			4	0.0171
6					10	0.013	4	0.0015233	5	0.000833	1	0.000567	3	0.0159			4	0.017933
7					5	0.01333333	14	0.0018	10	0.002167	1	0.0006	12	0.0180			11	0.0183
8					4	0.0135	4	0.0027333	4	0.0022	1	0.000867	4	0.018323			10	0.0185
9					4	0.01363333					1	0.001013	4	0.027567			4	0.0194
10					10	0.01633333					10	0.001067	4	0.032067			4	0.019467
11					4	0.0169					1	0.001167	5	0.0323			3	0.0197
12					8	0.017					3	0.0012	14	0.033667			10	0.022333
13					5	0.01703333					1	0.0013					4	0.023043
14					14	0.0171					1	0.001514						
15											1	0.0016						
Average						0.01402												
Std Dev						0.00064												
H						0.0013												
U$_1$						0.0014												
t-statistic						2.16												
U$_2$						0.0030												
U$_3$						0.00081												
Reference		<0.01		<0.01		0.014		<0.01		<0.01		<0.01		<0.05		<0.01		<0.05
Uncertainty						0.004												
Tolerance						0.012												

BS MP35N   * Code for method   Informational values listed as weight percent

Analysis	*	O	*	Sb	*	Zr
1	2	0.0002	12	0.0000170	12	0.0000773
2	2	0.0002233			5	0.0001
3	2	0.0002333			3	0.002
4	2	0.0002333			4	0.00237333
5	2	0.0002333			4	0.003
6	2	0.0003			10	0.0033
7	2	0.0003667			14	0.00433333
8	2	0.0004267				
9	2	0.0004277				
10	2	0.00091				
11	2	0.0013333				
Average		0.00044		0.0000170		0.002
Std Dev		0.00047		0.0000006		0.010
H		0.00032		0.00012		0.001
U$_1$		0.00056		0.00012		0.010
t-statistic		2.23		12.71		2.45
U$_2$		0.0013		0.0015		0.025
U$_3$		0.00038		0.001500		0.0096
Informational		(0.0004)		(0.00002)		(0.002)

For each element, in accordance with the requirements of ISO 17034 and Guide 35, 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 it's 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 Guide 35:2006 section 6.

BS MP35N   * Code for analytical method   Trace analysis listed as mg/kg   (ppm)

Analysis	*	Ga	*	Ir	*	Os	*	Pb	*	Re	*	Sb	*	U						
1	12	11	12	0.01	12	0.01	3	1	12	0.20	12	0.16	12	0.001						
2	12	12	12	0.02	12	0.01			12	0.22	12	0.17	12	0.001						
3	12	13	12	0.02	12	0.01			12	0.22	12	0.18	12	0.002						

Analytical Method Codes:

1	Combustion (ASTM E1019)	7	Photometric	13	Titrimetric
2	Fusion (ASTM E1019)	8	Flame Atomic Absorption	14	DCP Atomic Emission
3	Spark Atomic Emission	9	GF Atomic Absorption	15	HG Atomic Fluorescence
4	ICP Atomic Emission	10	X-Ray Fluorescence	16	Difference
5	ICP Mass Spectrometry	11	GD Atomic Emission	17	Wet
6	Gravimetric	12	GD Mass Spectrometry		

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
Eurofins EAG Materials Science, LLC	Liverpool, NY	A2LA	17025
Dirats Laboratories	Westfield,MA	ANAB	17025
TUV Rheinland Pvt Ltd	Bangalore, India	NABL	17025
LECO Corporation	St. Joseph, MI	A2LA	17025
Analytical Process Laboratories	Milwaukee, WI	A2LA	17025
Vitkovice Testing Center	Ostrava, Czech	ILAC	17025
National Analysis Center For Iron And Steel	Beijing, China	CNAS	17025
TUV Rheinland Pvt Ltd	Bangalore, India	NABL	17025
Luvak Inc.	Boylston, MA	PRI	17025
Element Materials Technology	Huntington Beach, CA	A2LA	17025
Laboratory Testing, Inc.	Hatfield, PA	PRI	17025
Element Materials Technology	Glendale Heights, IL	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
ILAC = International Laboratory Accreditation Cooperation
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: 23X80030, 24X11002F, 112X14943H; AR 115C, 644, 645, 649, 654, 659, 662, 668, 673, 876, 881, 882, 891, 891, 1650, 1651, 1653; BAS 346A; BS CSN-4, 172, 172A, 172B, 173; CSZU CA01A; IARM 97B, 98B, 189A, 207A, 208B; JK 37; KMS LCSON-001; LECO 501-501, 501-503, 501-646, 501-675, 501-676, 501-991, 502-412, 502-702, 502-712, 502-856, 502-891, 502-903, 502-916, 502-918; SRM 168, 862, 882, 897, 898, 899, 1199, 1200, 1242, 3109A, 3131A, 3134, 3161A, 3163; Y TSN005.

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: 24X11002F, 112X14943H; BS CSN-4, 172, 172A, 172B, 173; CSZU CA01A; IARM 189A; KMS LCSON-001; SRM 882, 1199, 1200, 1242.

Validity statement: ISO Guide 31 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 MP35N 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 Carpenter Latrobe Specialty Metals; Latrobe, PA.

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 Guide 33 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 MP35N-020421. 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.	**Phone: (281) 440-9396** **Web: www.brammerstandard.com**
14603 Benfer Road	
Houston, Texas 77069-2895 USA	**Fax: (281) 440-4432** **Email: contact@brammerstandard.com**

Brammer Standard Company, Inc., is accredited by the American Association For Laboratory Accreditation (A2LA) to ISO Standard 17034 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials (Certificate Number 656.02)

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

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001 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 Guide 31:2015   Reference materials - Contents of certificates and labels

ISO Guide 33:2015   Uses of certified reference materials

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

ISO Guide 35:2017 Reference Materials - General and statistical principles for certification

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 February 04, 2021.

Beau R. Brammer

President

Brammer Standard Company, Inc.,   14603 Benfer Road, Houston, TX 77069-2895 USA
Telephone: (281) 440-9396   Fax (281) 440-4432   Website: www.brammerstandard.com
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