Brammer Standard Company, Inc.

Certificate of Analysis

BS 6255

Certified Reference Material for Austenitic Nickel - UNS Number N06255

Certified Values[3]

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
B	**0.0026**	0.0004	**Nb**	**0.094**	0.006
Cr	**24.6**	0.1	**Ni**	**50.5**	0.4
Cu	**0.75**	0.02	**O**	**0.0015**	0.0004
Fe	**16.0**	0.1	**P**	**0.0125**	0.0008
Mn	**0.17**	0.01	**S**	**0.0005**	0.0002
Mo	**6.8**	0.2	**Sn**	**0.0010**	0.0003
N	**0.014**	0.001	**Ti**	**0.35**	0.02

Reference Values[4]

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
Co	**0.075**	0.007	**V**	**0.034**	0.005
Si	**0.27**	0.02			

Informational Values[3,5]

Al (0.082)	As (0.004)	C (0.0124)	Ca (0.001)	Mg (0.001)
Pb (0.0002)	Sb (0.0003)	Ta (0.003)	W (0.03)	Zr (0.002)

[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 Bi, Ga, Ge, Ir, Os, Re, U, and Zn 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 6255 * Code for method Certified values listed as weight percent

Analysis	*	B	*	Cr	*	Cu	*	Fe	*	Mn	*	Mo	*	N	*	Nb	*	Ni	*	O
1	4	0.0018	4	24.163333	3	0.7276667	4	15.733333	11	0.155	4	6.580	2	0.012	4	0.0834	16	49.82	2	0.0008
2	4	0.002	4	24.4	4	0.7327333	3	15.826667	5	0.156	3	6.59	2	0.012233	10	0.088	16	50.1	2	0.0012667
3	14	0.002367	17	24.46	4	0.733	4	15.97	4	0.1645	4	6.5996	8	0.013033	10	0.0895	10	50.126667	2	0.00131
4	5	0.0024	4	24.486	3	0.74	4	15.970333	4	0.165667	14	6.653333	2	0.0138	3	0.089567	3	50.163333	2	0.0013333
5	3	0.0024	10	24.51	4	0.741	4	15.982967	10	0.166873	17	6.71	2	0.013833	4	0.09	14	50.236667	2	0.0015333
6	4	0.002567	4	24.51	4	0.7446667	10	15.98878	4	0.171	4	6.711	2	0.013967	4	0.0914	16	50.3	2	0.0015667
7	11	0.0026	17	24.539433	4	0.7483333	4	15.993333	4	0.172667	11	6.72	2	0.014033	4	0.0929	10	50.32	2	0.0016
8	12	0.002767	13	24.595667	4	0.75	4	16.0	4	0.1736	4	6.723333	2	0.0143	10	0.093427	17	50.5	2	0.0017267
9	4	0.0028	4	24.597333	10	0.75	10	16	10	0.175667	10	6.745283	2	0.014467	11	0.0945	16	50.60034	2	0.002
10	3	0.0028	11	24.6	8	0.7536667	10	16.03	10	0.178167	4	6.77	2	0.015	4	0.099533	4	50.6161		
11	4	0.0028	10	24.60438	10	0.7537633	13	16.127	3	0.18	3	6.85			4	0.100167	16	50.716667		
12	7	0.002857	14	24.633333	10	0.756	4	16.317333	4	0.18	10	6.86			14	0.100333	13	50.753		
13	5	0.0031	4	24.670667	11	0.759	14	16.50	4	0.180167	4	6.869667			4	0.100367	6	50.796		
14			3	24.73	4	0.7600333			14	0.180667	4	6.8889			3	0.103	10	50.818733		
15			10	24.745067	10	0.762133			3	0.181	10	6.902497					4	51.156667		
16			10	24.953333	4	0.7646667			3	0.183	10	6.92					4	51.2		
17			3	25.193333	8	0.77					4	6.940967								
18											3	6.943333								
Average		0.002558		24.611287		0.749804		16.029		0.1711		6.776551		0.01367		0.094007		50.514011		0.00147
Std Dev		0.000088		0.000077		0.000077		0.056		0.0035		0.000075		0.00010		0.000085		0.000079		0.00015
H		0.00061		0.076		0.0092		0.057		0.0042		0.033		0.0012		0.0031		0.12		0.00049
U_1		0.00062		0.076		0.0092		0.080		0.0055		0.033		0.0012		0.0031		0.12		0.00052
t-statistic		2.18		2.12		2.12		2.18		2.13		2.11		2.26		2.16		2.13		2.31
U_2		0.0013		0.16		0.020		0.17		0.012		0.070		0.0028		0.0067		0.26		0.0012
U_3		0.00037		0.039		0.0047		0.048		0.0029		0.017		0.00089		0.0018		0.065		0.00040
Certified		**0.0026**		**24.6**		**0.75**		**16.0**		**0.17**		**6.8**		**0.014**		**0.094**		**50.5**		**0.0015**
Uncertainty		0.0004		0.1		0.02		0.1		0.01		0.2		0.001		0.006		0.4		0.0004
Tolerance		0.0013		0.3		0.06		0.3		0.03		0.6		0.003		0.018		1.2		0.0012

Analysis	*	P	*	S	*	Sn	*	Ti
1	10	0.011137	1	0.0002	12	0.00063	3	0.3286667
2	4	0.0113	11	0.0004	5	0.0006667	11	0.335
3	3	0.012	3	0.0005	9	0.0007	4	0.34
4	3	0.012	1	0.0006	5	0.0007	4	0.3422333
5	14	0.012667	1	0.0006	3	0.0008	4	0.3463333
6	12	0.012667	1	0.0006	5	0.0008	4	0.348
7	4	0.012767	1	0.0006667	5	0.0008767	3	0.35
8	4	0.012767	1	0.0006833	4	0.0010	4	0.3505667
9	4	0.0128	1	0.0007	11	0.0016	4	0.353
10	10	0.013	1	0.0007333	5	0.0016667	4	0.3536667
11	4	0.013033	12	0.00087	4	0.0019333	14	0.3576667
12	11	0.0138					4	0.3600333
13	4	0.0144					3	0.361
14							10	0.363567
15							10	0.36969
16							10	0.37
17							10	0.3756667
Average		0.01245		0.000494		0.000951		0.353241
Std Dev		0.00060		0.000043		0.000030		0.000077
H		0.0012		0.00033		0.00042		0.0061
U_1		0.0013		0.00033		0.00042		0.0061
t-statistic		2.18		2.23		2.23		2.12
U_2		0.0029		0.00074		0.00093		0.013
U_3		0.00081		0.00022		0.00028		0.0031
Certified		**0.0125**		**0.0005**		**0.0010**		**0.35**
Uncertainty		0.0008		0.0002		0.0003		0.02
Tolerance		0.0029		0.0005		0.0009		0.06

BS 6255 * Code for method Reference values listed as weight percent

Analysis	*	Co	*	Si	*	V
1	4	0.056433	5	0.228	3	0.0273667
2	12	0.059333	3	0.25	5	0.0274
3	10	0.060633	10	0.2543	12	0.028
4	5	0.0684	10	0.2566667	4	0.0293333
5	4	0.0741	4	0.257	4	0.0316667
6	4	0.0745	6	0.2700333	10	0.0325
7	14	0.075267	14	0.2703333	4	0.0325667
8	10	0.075947	11	0.273	4	0.0349667
9	4	0.076967	4	0.2798667	11	0.0357
10	3	0.0774	10	0.28	10	0.036
11	4	0.0802	6	0.2813333	10	0.0363017
12	3	0.088	4	0.2823333	4	0.0365
13	3	0.089033	4	0.284	14	0.0376
14	10	0.093	3	0.284	3	0.039
15			10	0.285983	3	0.0399
16			4	0.29	4	0.0400333
17			4	0.3083		
Average		0.074944		0.2731		0.034052
Std Dev		0.000085		0.0042		0.000079
H		0.0028		0.0053		0.0019
U_1		0.0028		0.0068		0.0019
t-statistic		2.16		2.12		2.13
U_2		0.0060		0.014		0.0040
U_3		0.0016		0.0035		0.0010
Reference		**0.075**		**0.27**		**0.034**
Uncertainty		0.007		0.02		0.005
Tolerance		0.021		0.06		0.015

BS 6255 * Code for method Informational values listed as weight percent

Analysis	*	Al	*	As	*	C	*	Ca	*	Mg	*	Pb	*	Sb	*	Ta	*	W	*	Zr
1	12	0.060667	5	0.003	1	0.0069333	12	0.0000503	8	0.0002	12	0.000147	5	0.0003	5	0.0016	12	0.0040667	12	0.000098
2	5	0.062833	12	0.0045667	1	0.0107	14	0.0012667	8	0.0002	5	0.0002	12	0.000323	14	0.0026	10	0.0052933	3	0.0019
3	11	0.0726			1	0.0112157	11	0.0017	5	0.0003					3	0.0044	5	0.0088	10	0.0039
4	4	0.076			11	0.0117	4	0.0017333	12	0.00034					10	0.004573	5	0.0123		
5	10	0.0774			1	0.012			4	0.000367							4	0.0123333		
6	4	0.0783			1	0.0121333			4	0.00045							14	0.0130333		
7	8	0.086			1	0.0121667			14	0.0007							4	0.0131333		
8	4	0.0872			3	0.0124			2	0.0027							4	0.0174333		
9	10	0.088			1	0.0129			4	0.003033							3	0.063		
10	4	0.0884			1	0.0130			11	0.004							11	0.124		
11	3	0.0894			3	0.013														
12	14	0.090067			1	0.0130667														
13	4	0.090067			1	0.0133333														
14	3	0.0903			1	0.0135333														
15	10	0.093183			1	0.0145														
16	4	0.094733																		
Average		0.0823		0.004		0.01238		0.0012		0.0012		0.00017		0.00031		0.00316		0.03		0.002
Std Dev		0.0021		0.045		0.00049		0.0050		0.0033		0.00014		0.00053		0.00027		0.20		0.013
H		0.0029		0.001		0.0012		0.0005		0.0005		0.00023		0.00028		0.00067		0.002		0.001
U_1		0.0036		0.045		0.0013		0.0050		0.0034		0.00027		0.00060		0.00072		0.20		0.013
t-statistic		2.13		12.71		2.14		3.18		2.26		12.71		12.71		3.18		2.26		4.30
U_2		0.0076		0.57		0.0028		0.016		0.0076		0.0034		0.0076		0.0023		0.46		0.058
U_3		0.0019		0.40		0.00071		0.0080		0.0024		0.0024		0.0053		0.0011		0.14		0.034
Informational		(0.082)		(0.004)		(0.0124)		(0.001)		(0.001)		(0.0002)		(0.0003)		(0.003)		(0.03)		(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 6255 * Code for analytical method Trace analysis listed as mg/kg (ppm)

Analysis	*	Bi	*	Ga	*	Ge	*	Ir	*	Os	*	Re	*	U	*	Zn
1	12	0.11	5	13	12	0.90	12	0.08	12	0.08	12	2.2	12	0.003	5	19
2	12	0.13	5	13	12	0.94	12	0.09	12	0.09	12	2.7	12	0.004	5	19
3	12	0.13	12	14	12	0.99	12	0.10	12	0.11	12	2.9	12	0.004	5	21
4			12	15											12	30
5			12	15											12	30
6			5	15											12	30

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
17 Wet

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
Eurofins EAG Materials Science, LLC	Liverpool, NY	A2LA	17025
Dirats Laboratories	Westfield,MA	ANAB	17025
NSL Analytical	Cleveland, OH	ANAB	17025
Element Materials Technology	Glendale Heights, IL	A2LA	17025
Instytut Metalurgii Zelaza	Gliwice, Poland	PCA	17025
Vitkovice	Hulvaky, ostrava	ILAC	17025
TUV Rheinland Pvt Ltd	Bangalore, India	NABL	17025
National Analysis Center For Iron And Steel	Beijing, China	CNAS	17025
Carpenter Technology Corporation	Reading, PA	A2LA	17025
Luvak Inc.	Boylston, MA	PRI	17025
Chicago Spectro	Chicago, IL	A2LA	17025
Laboratory Testing, Inc.	Hatfield, PA	PRI	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: 28X6253, 28X62510, 28X62520, 28X71820, 215X10276, 219X8825A; AR 654, 657, 668, 673, 882, 892, 952, 1650, 1651, 1652, 1653; BAS 387; BS H2D, H3A, H3B, H3C, H6B, H8, 197B, 199B, 200-4, 510B, 625E, 630B, 630C, 690, 690A, 718C, 718D, 825, 825F, 903E, 925, 929, 937C; IARM 54B, 56C, 56H, 59A, 59B, 67B, 67C, 69D; LECO 501-320, 501-644, 502-348, 502-411, 502-712, 502-863; SRM 8F, 8J, 124D, 349, 459, 865, 866, 867, 3109A.

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 H3A, H3B, H8, 197B, 690, 690A; DSZU CA01A, CA012, CA013; IARM 67C, 189A, 338A; SRM 867, 882.

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 6255 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 Ellwood National Steel; Irvine, PA.

Form: This CRM is machined in the form of a disc, approximately 63 mm in diameter and 19 mm 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 6255-052220. 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) 440-9396Web: 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 35:2006 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 May 22, 2020.

Beau R. Brammer

President