

# Brammer Standard Company, Inc.

## Certificate of Analysis

### BS 4130A

Certified Reference Material for AISI 4130 - UNS Number G41300

	Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>	Certified Values <sup>3</sup>	Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>
<b>Al</b>	<b>0.025</b>	0.002	<b>Nb</b>	<b>0.0014</b>	0.0006
<b>B</b>	<b>0.0002</b>	0.0001	<b>Ni</b>	<b>0.152</b>	0.007
<b>C</b>	<b>0.318</b>	0.004	<b>O</b>	<b>0.0017</b>	0.0006
<b>Ca</b>	<b>0.0010</b>	0.0003	<b>P</b>	<b>0.016</b>	0.002
<b>Co</b>	<b>0.0068</b>	0.0008	<b>S</b>	<b>0.0183</b>	0.007
<b>Cr</b>	<b>0.97</b>	0.01	<b>Sb</b>	<b>0.0018</b>	0.0004
<b>Cu</b>	<b>0.249</b>	0.009	<b>Si</b>	<b>0.270</b>	0.007
<b>Fe</b>	<b>97.2</b>	0.1	<b>Sn</b>	<b>0.0093</b>	0.0009
<b>Mn</b>	<b>0.56</b>	0.04	<b>Ti</b>	<b>0.0009</b>	0.0004
<b>Mo</b>	<b>0.206</b>	0.009	<b>V</b>	<b>0.0029</b>	0.0004
<b>N</b>	<b>0.0060</b>	0.0006	<b>W</b>	<b>0.0025</b>	0.0006
	Reference Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>	Reference Values <sup>3,4</sup>	Reference Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>
<b>As</b>	<b>0.005</b>	0.002	<b>Ta</b>	<b>0.006</b>	0.004
<b>Mg</b>	<b>&lt;0.005</b>		<b>Zr</b>	<b>0.0012</b>	0.0009
<b>Pb</b>	<b>0.00002</b>	0.00001			

<sup>1</sup> 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.

<sup>2</sup> 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.

<sup>3</sup> Values are given in weight percent. Values in brackets are reported by difference.

<sup>4</sup> Reference values are not certified and are provided for information only.

Trace element information values for Ag, Ga, Ge, H, Na, Re, 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.

Analysis	*	Al	*	C	*	Ca	*	Co	*	Cr	*	Cu	*	Fe	*	Mn	*	Mo	*	N
1	5	0.022767	1	0.31226	12	0.000643	10	0.006	4	0.9395	4	0.23925	16	[97.086334]	7	0.507	5	0.192667	2	0.00564
2	3	0.0232	1	0.315333	14	0.0007	3	0.006	4	0.942667	10	0.24	16	[97.11]	4	0.523	4	0.194333	2	0.005667
3	4	0.023433	1	0.3170	3	0.0009	8	0.006116667	4	0.957667	7	0.242333	16	[97.1128667]	8	0.5243333	4	0.199	2	0.00578
4	11	0.0237	11	0.317	4	0.00095	12	0.0062	10	0.96	4	0.244	4	97.1133333	4	0.529	3	0.202667	2	0.005933
5	3	0.024333	1	0.317	4	0.000967	4	0.006356667	3	0.966	14	0.245667	10	97.12	10	0.55	4	0.203667	2	0.005933
6	4	0.024367	1	0.317667	4	0.001033	5	0.006733333	4	0.967333	3	0.246	4	97.1294	11	0.551	4	0.2054	2	0.005967
7	4	0.024633	1	0.318	11	0.0011	14	0.0068	3	0.968	3	0.247333	3	97.1366667	3	0.552	10	0.206	2	0.006033
8	14	0.024667	1	0.318667	4	0.001133	4	0.006833333	4	0.969867	4	0.249667	16	[97.18]	4	0.5525	3	0.207	2	0.006083
9	4	0.024933	1	0.318767	4	0.001167	4	0.0069	3	0.97	3	0.25	16	[97.1868667]	14	0.5536667	14	0.207333	2	0.006225
10	4	0.025	1	0.32	4	0.0014	5	0.006966667	4	0.9700	4	0.250267	16	[97.19]	3	0.555	11	0.209	2	0.00635
11	4	0.0250	3	0.32			4	0.007033333	14	0.972	11	0.251	14	97.2	4	0.5583333	4	0.209	2	0.0064
12	4	0.025667	3	0.321			5	0.007126667	4	0.972	10	0.251667	16	[97.2]	3	0.56	10	0.21		
13	3	0.0259	1	0.324733			4	0.007133333	4	0.972267	4	0.252233			3	0.5623333	3	0.21		
14	3	0.026	1	0.325			4	0.0072	11	0.973	4	0.252333			10	0.5643333	4	0.210033		
15	4	0.026733					3	0.0073	4	0.976167	4	0.252333			4	0.5723333	4	0.2103		
16							4	0.007333333	10	0.984	4	0.2525			4	0.5876667	4	0.210333		
17							11	0.0074	3	0.989333	5	0.253667			4	0.5926667	3	0.210667		
18							3	0.007433333	4	1.003	8	0.254333			4	0.5991333				
19											3	0.255			4	0.5995667				
20											4	0.260			4	0.6000				
Average		0.024689		0.3181		0.001048		0.006826		0.969600		0.2490		97.152		0.559693		0.2064		0.00597
Std Dev		0.000082		0.0036		0.000034		0.000075		0.000075		0.0030		0.032		0.000071		0.0032		0.00021
H		0.0016		0.0058		0.00043		0.00092		0.011		0.0051		0.19		0.0078		0.0046		0.00087
U <sub>1</sub>		0.0016		0.0068		0.00043		0.00092		0.011		0.0059		0.19		0.0078		0.0056		0.00089
t-statistic		2.14		2.16		2.26		2.11		2.11		2.09		2.20		2.09		2.12		2.23
U <sub>2</sub>		0.0035		0.015		0.0010		0.0019		0.022		0.012		0.42		0.016		0.012		0.0020
U <sub>3</sub>		0.00090		0.0039		0.00031		0.00046		0.0053		0.0028		0.12		0.0037		0.0029		0.00060
Certified		<b>0.025</b>		<b>0.318</b>		<b>0.0010</b>		<b>0.0068</b>		<b>0.97</b>		<b>0.249</b>		<b>97.2</b>		<b>0.56</b>		<b>0.206</b>		<b>0.0060</b>
Uncertainty		0.002		0.004		0.0003		0.0008		0.01		0.009		0.1		0.04		0.009		0.0006
Tolerance		0.006		0.012		0.0009		0.0024		0.03		0.027		0.4		0.12		0.027		0.0020

Analysis	*	N	*	Nb	*	Ni	*	O	*	P	*	S	*	Sb	*	Si	*	Sn	*	Ti
1	2	0.00564	12	0.000083	4	0.14466667	2	0.0010	12	0.0120	12	0.014	9	0.0015	3	0.2566667	12	0.007867	12	0.00029
2	2	0.005667	5	0.000133	14	0.14866667	2	0.00113	4	0.013767	1	0.01575	11	0.0016	4	0.263	5	0.008267	5	0.00039
3	2	0.00578	11	0.0011	5	0.14966667	2	0.001325	3	0.0148	1	0.017533	4	0.00166667	11	0.263	4	0.008367	5	0.000543
4	2	0.005933	4	0.0012	4	0.14966667	2	0.001333333	5	0.014833	3	0.018	12	0.0017	3	0.264	5	0.008863	3	0.0008
5	2	0.005933	3	0.0015	4	0.14975	2	0.001443333	3	0.015	1	0.0181	5	0.0017	14	0.266	5	0.0092	4	0.000867
6	2	0.005967	4	0.0019	10	0.15	2	0.001663333	4	0.0153	1	0.018133	5	0.00173333	7	0.2692333	3	0.0094	3	0.0010
7	2	0.006033	4	0.001967	3	0.15	2	0.001933333	14	0.015633	1	0.018167	5	0.00179667	4	0.2696667	4	0.0095	4	0.001
8	2	0.006083	10	0.002	4	0.15003333	2	0.00215	6	0.015733	1	0.018333	5	0.0018	10	0.27	4	0.0097	14	0.0011
9	2	0.006225	3	0.002	3	0.151	2	0.0022	11	0.0159	1	0.018343	4	0.00183333	3	0.2700	9	0.0098	4	0.001167
10	2	0.00635	3	0.002033	4	0.15116667	2	0.0022	10	0.016	3	0.0186	4	0.002	4	0.27	5	0.0099	3	0.0012
11	2	0.0064			4	0.15133333	2	0.0027	4	0.016033	1	0.018867	10	0.002	4	0.2712667	4	0.009967	11	0.0012
12					4	0.15166667			4	0.016133	11	0.0189			4	0.2723333	3	0.010	4	0.0013
13					3	0.152			3	0.016233	1	0.018933			10	0.274	3	0.010		
14					4	0.15223333			10	0.0163	1	0.0190			4	0.2743333				
15					3	0.155			4	0.0170	10	0.019			3	0.2773333				
16					8	0.15533333			3	0.017667	1	0.019967			4	0.29				
17					10	0.15566667			4	0.0202	1	0.021667								
18					11	0.158			4	0.023										
19					4	0.15866667														
Average		0.00597		0.00139		0.1520		0.00168		0.016196		0.018311		0.001757		0.2705		0.009295		0.000905
Std Dev		0.00021		0.00010		0.0026		0.00010		0.000075		0.000077		0.000095		0.0035		0.000088		0.000091
H		0.00087		0.00048		0.0039		0.00052		0.0013		0.0014		0.00053		0.0053		0.0010		0.00041
U <sub>1</sub>		0.00089		0.00049		0.0047		0.00053		0.0013		0.0014		0.00054		0.0064		0.0011		0.00042
t-statistic		2.23		2.26		2.10		2.23		2.11		2.12		2.23		2.13		2.18		2.20
U <sub>2</sub>		0.0020		0.0011		0.010		0.0012		0.0028		0.0030		0.0012		0.014		0.0023		0.00093
U <sub>3</sub>		0.00060		0.00035		0.0023		0.00036		0.00067		0.00073		0.00036		0.0034		0.00064		0.00027
Certified		<b>0.0060</b>		<b>0.0014</b>		<b>0.152</b>		<b>0.0017</b>		<b>0.016</b>		<b>0.0183</b>		<b>0.0018</b>		<b>0.270</b>		<b>0.0093</b>		<b>0.0009</b>
Uncertainty		0.0006		0.0006		0.007		0.0006		0.002		0.0007		0.0004		0.007		0.0009		0.0004
Tolerance		0.0020		0.0013		0.021		0.0016		0.006		0.0021		0.0012		0.021		0.0027		0.0008

**BS 4130A**

\* Code for method

Certified values listed as weight percent

Analysis	*	V	*	W
1	12	0.0018	11	0.0018
2	5	0.002333	4	0.001967
3	4	0.0025	4	0.001967
4	4	0.002667	5	0.002167
5	3	0.002833	12	0.0022
6	5	0.002833	3	0.0022
7	14	0.002867	5	0.0027
8	4	0.0029	4	0.003067
9	3	0.003	3	0.0031
10	4	0.003033	5	0.0038
11	3	0.0031		
12	4	0.003233		
13	4	0.0033		
14	11	0.0034		
15	10	0.004		
<b>Average</b>		0.002931		0.00250
<b>Std Dev</b>		0.000099		0.00010
<b>H</b>		0.00065		0.00061
<b>U<sub>1</sub></b>		0.00065		0.00061
<b>t-statistic</b>		2.14		2.26
<b>U<sub>2</sub></b>		0.0014		0.0014
<b>U<sub>3</sub></b>		0.00036		0.00044
<b>Certified</b>		<b>0.0029</b>		<b>0.0025</b>
<b>Uncertainty</b>		0.0004		0.0006
<b>Tolerance</b>		0.0014		0.0018

**BS 4130A**

\* Code for method

Reference values listed as weight percent

Analysis	*	As	*	Mg	*	Pb	*	Ta	*	Zr
1	3	0.0026	3	0.000049	12	0.000019	5	0.000323333	4	0.000833
2	12	0.003833	12	0.000074	5	0.000021	3	0.0037	11	0.0015
3	15	0.004003	11	0.0002			4	0.004633333	3	0.0015
4	5	0.00411	4	0.000427			4	0.006	10	0.0017
5	5	0.004367	4	0.0006			4	0.0097	4	0.001867
6	10	0.004433							3	0.0019
7	9	0.004733							4	0.002
8	4	0.0049								
9	10	0.005								
10	5	0.0052								
11	4	0.0057								
12	4	0.005767								
13	5	0.005933								
14	4	0.006033								
15	11	0.0087								
<b>Average</b>		0.00502		0.00027		0.00001980		0.00487		0.00116
<b>Std Dev</b>		0.00018		0.00024		0.00000060		0.00014		0.00010
<b>H</b>		0.00081		0.00027		0.00012		0.00080		0.00045
<b>U<sub>1</sub></b>		0.00083		0.00036		0.00012		0.00081		0.00046
<b>t-statistic</b>		2.14		2.78		12.71		2.78		2.26
<b>U<sub>2</sub></b>		0.0018		0.0010		0.0015		0.0022		0.0010
<b>U<sub>3</sub></b>		0.00046		0.00045		0.0011		0.0010		0.00033
<b>Reference</b>		<b>0.005</b>		<b>&lt;0.005</b>		<b>0.00002</b>		<b>0.006</b>		<b>0.0012</b>
<b>Uncertainty</b>		0.002				0.00001		0.004		0.0009
<b>Tolerance</b>		0.004				0.00001		0.005		0.0011



Lab Name	Location	Registrar	Accreditation
Brammer Standard Company, Inc.	Houston, TX	A2LA	17025, 17034
Dirats Laboratories	Westfield, MA	ANAB	17025
NSL Analytical	Cleveland, OH	ANAB	17025
Elemental Analysis, Inc.	Lexington, KY	A2LA	17025
Element Materials Technology	Glendale Heights, IL	A2LA	17025
Eurofins EAG Materials Science, LLC	Liverpool, NY	A2LA	17025
Laboratory Testing, Inc.	Hatfield, PA	A2LA	17025
National Analysis Center For Iron And Steel	Beijing, China	CNAS	17025
Shiva Analyticals Private Limited	Hoskote, Bangalore	NABL	17025
Luvak Inc.	Boylston, MA	PRI	17025
APL, Inc	Milwaukee, WI	A2LA	17025
Instytut Metalurgii Zelaza	Gliwice, Poland	PCA	17025
TUV Rheinland Pvt Ltd	Bangalore, India	NABL	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 a lathe 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: 12X24065A; AR 148, 614A, 631, 644, 645, 647, 657, 659, 660, 668, 870, 878, 881, 884, 892, 960, 1120, 1647, 1653, 8620; BAS 340, 434, 464/1; BS 11B, 45B, 55G, 56H, 59A, 61G, 70C, 71A, 230, 1018, 1020, 1045, 1762, 2931, 2931A, 3001, 4130, 4140B, 4140C, 4142SE, 4330MOD, 4340A, 4820A, 8620E, 8630; CKD 244C, 249C; DSZU Ca01a; ECRM 085-1, 086-1, 087-1, 285-2; IARM Fe1020-18, 20A, 30J, 9310; IMZ 55/1, 55/1A, 112, 113, 115; KMS LCSON-001E; LECO 501-502, 501-503, 502-712, 502-856, 502-903, 502-916; NCS NS20035b; SRM 100B, 131E, 160B, 361, 363, 1762, 3109A; Y TSN013.

**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: AR 8620; BS 59A, 71A, 230, 3001, 3932, 4130, 4140B, 4140C, 4142SE.

**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 4130A 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 Gerdau Monroe; Monroe, MI.

**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 4130A-011023. You may obtain information on revisions of certificates from the internet at [www.brammerstandard.com](http://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

Web: [www.brammerstandard.com](http://www.brammerstandard.com)

Fax: (281) 440-4432

Email: [contact@brammerstandard.com](mailto: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](http://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](http://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 9, 2023.

Beau R. Brammer

President