

Certificate of Analysis

BS 192A

Certified Reference Material¹ for 17-7PH Stainless Steel Alloy
(UNS Number S17700)

	Certified Value ²	Estimate of Uncertainty ³	Certified Value ²	Estimate of Ucertainty ³
Analysis listed as percent by weight				
C	0.066	0.002	Sn	0.008 0.001
Mn	0.768	0.010	Ti	0.083 0.005
P	0.021	0.001	V	0.077 0.003
S	<0.002		W	0.048 0.003
Si	0.300	0.010		
Cu	0.334	0.007		
Ni	7.01	0.04		
Cr	16.44	0.05		
Mo	0.28	0.01	Information Values⁴	
Al	0.98	0.015	As	0.0035
Co	0.114	0.004	B	0.0003
N	0.029	0.001	Ca	0.0006
Nb	0.208	0.007	O	0.0006

¹ Brammer Standard Company, Inc., is accredited to ISO Guide 34 as a Reference Material Producer to produce Certified Reference Materials by A2LA (Certificate Number 656.02)

² The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

³ 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.

⁴ Information values are not certified and are provided for information only.

See the following pages for more information.

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Data listed as mass fraction expressed as percent.

192A-032901p2

Analysis	*	C	* Mn	* P	* S	* Si	* Cu	* Ni	* Cr	* Mo
1	C	0.065	XRF 0.749	AES 0.0187	C 0.0001	XRF 0.282	XRF 0.326	GNi 6.9402	TCr 16.39	AES 0.258
2	C	0.0658	AA 0.757	MPH 0.0197	C 0.0002	AGA 0.293	AIC 0.328	XRF 6.961	AES 16.40	GMO 0.263
3	C	0.066	AGX 0.762	AIC 0.020	C 0.00028	XRF 0.294	AGX 0.331	AES 6.98	TCr 16.40	AES 0.270
4	C	0.066	AIC 0.765	AIC 0.0205	C 0.0003	GSI 0.295	AIC 0.331	XRF 6.99	XRF 16.412	XRF 0.276
5	C	0.0663	MnP 0.766	AIC 0.0207	C 0.0008	AIC 0.295	MCB 0.332	AGA 6.99	AIC 16.43	AIC 0.277
6	C	0.0678	AES 0.766	AES 0.021		GSI 0.29995	MCT 0.334	XRF 7.005	AGX 16.44	AGX 0.280
7	C	0.068	AES 0.768	XRF 0.021		GSI 0.301	XRF 0.334	GNI 7.02	XRF 16.44	XRF 0.282
8			XRF 0.770	AGA 0.0215		AES 0.307	AES 0.335	AES 7.02	XRF 16.484	AIC 0.282
9			MnP 0.7731	AIC 0.0215		AIC 0.307	AA 0.335	AIC 7.03	TCr 16.50	AIC 0.286
10			AIC 0.775	AIC 0.0219		AES 0.31	XRF 0.337	TNI 7.04	AIC 16.52	XRF 0.286
11			AIC 0.782	AES 0.022		GSI 0.314	AES 0.34	TNI 7.05		AIC 0.292
12			MnP 0.782	MPN 0.0225			AIC 0.340	AIC 7.06		AIC 0.296
13							ECS 0.342	AIC 7.070		MMT 0.298
Average		0.0664	0.7679	0.0209	0.00034	0.2998	0.3342	7.012	16.442	0.2805
Std Dev		0.0011	0.0096	0.0011	0.00027	0.0092	0.0047	0.039	0.045	0.0119
Certified		0.066	0.768	0.021	<0.002	0.300	0.334	7.01	16.44	0.28
t		2.4469	2.201	2.201	2.7764	2.2281	2.1788	2.1788	2.2622	2.1788
C (95%)		0.0010	0.0061	0.0007	0.00034	0.0062	0.0029	0.023	0.032	0.0072

Analysis	*	Al	* Co	* N	* Nb	* Sn	* Ti	* V	* W
1	AES	0.957	AAA 0.109	FU 0.0281	MNA 0.1922	AAG 0.0060	AIC 0.0753	XRF 0.072	XRF 0.043
2	AES	0.960	AA 0.112	FU 0.0285	AIC 0.200	AIM 0.0067	AIC 0.076	AIC 0.0735	XRF 0.045
3	AAA	0.96	M5 0.112	FU 0.0286	MNR 0.202	AGA 0.007	XRF 0.078	XRF 0.076	AIC 0.0458
4	AIC	0.966	AIC 0.112	FU 0.0290	AIC 0.204	AIH 0.0072	MTD 0.0792	AIC 0.0762	AIC 0.047
5	TAL	0.970	XRF 0.114	FU 0.02928	AIC 0.207	AES 0.0080	AIC 0.0821	AIC 0.0771	MWC 0.0470
6	AGX	0.98	AES 0.115	FU 0.0296	XRF 0.208	AIC 0.008	AAA 0.085	AAA 0.079	AIM 0.047
7	XRF	0.984	AIC 0.116	TN 0.0300	AES 0.209	AIM 0.0081	AIC 0.085	AES 0.079	AIC 0.048
8	AIC	0.989	AES 0.116	FU 0.032	AGX 0.210	AIC 0.0084	AGX 0.085	MVE 0.0790	AES 0.0507
9	AIC	0.991	AGX 0.116		AIC 0.212	AES 0.0085	AES 0.086	AGX 0.079	AIC 0.0509
10	AIC	1.00	AIC 0.118		AES 0.213	AES 0.0086	AES 0.088	AIC 0.0793	AGA 0.053
11	XRF	1.003	XRF 0.1185		XRF 0.216	AIC 0.0086	AIC 0.088	AES 0.0812	
12	AIC	1.007			AIC 0.219	MSn 0.0086			
Average		0.981	0.1144	0.02939	0.2077	0.0078	0.0825	0.0774	0.0477
Std Dev		0.018	0.0029	0.00122	0.0074	0.0009	0.0047	0.0028	0.0030
Certified		0.98	0.114	0.029	0.208	0.008	0.083	0.077	0.048
t		2.201	2.2281	2.3646	2.201	2.201	2.2281	2.2281	2.2622
C (95%)		0.011	0.0020	0.00102	0.0047	0.0006	0.0031	0.0019	0.0022

Analysis	*	As	* B	* Ca	* O
1	AAG	0.0035	AES 0.0002	AIC 0.0001	FU 0.0003
2	AES	0.0036	AES 0.0003	AGA 0.0003	FU 0.00044
3			AES 0.00034	AIC 0.0004	FU 0.0008
4				AIM 0.00042	FU 0.0010
5				AIC 0.0005	
6				AES 0.00066	
7				AIC 0.0007	
8				AIC 0.0009	
9				AIC 0.0010	
Average		0.00355	0.00028	0.00055	0.00064
Std Dev		0.00007	0.00007	0.00029	0.00032
Information		(0.0035)	(0.0003)	(0.0006)	(0.0006)

* Methods of analysis listed on page 3

Data in parentheses are not certified but are provided for information only.

$C(95\%) = (t \times sd) / n$ 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 35:1989 section 4.

Methods of Analysis

Code	Element	Method
AA		Flame Atomic Absorption Spectrometry
AAA		Flame Atomic Absorption - standard addition method
AAG		Electro-thermal atomization (graphite furnace) Atomic Absorption Spectrometry
AES		AES - Spark Source Optical Emission Spectrometry
AGA		AES - Spark Source and Glow Discharge Spectrometry average
AGX		Glow Discharge and X-Ray Fluorescence Spectrometry average
AIC		AES - ICP -Inductively Coupled Plasma Spectrometry
AIH		AES - ICP -Inductively Coupled Plasma Spectrometry after hydride generation
AIM		AES - ICP Mass Spectrometry addition method
C	C, S	Combustion-Infrared Absorption (ASTM E 1019) traceable to CRMs
ECS	Cu	Sulphide precipitation, electro- deposition, gravimetric
FU	N, O	Inert gas Fusion Method (ASTM E 1019) traceable to CRMs
GMo	Mo	Gravimetry, Benzionoxime
GNi	Ni	Dimethylglyoxime gravimetric
GSi	Si	Gravimetry with perchloric acid
M5	Co	MAS - 5-Cl-PADAB spectrophotometric
MCB	Cu	MAS - Bicyclohexane oxalyldihydrazone photometric
MCT	Cu	MAS - Tetraethylthiuram disulphide
MMT	Mo	MAS - Thiocyanate photometric
MNA	Nb	MAS - Absorptionmetric determination method with 4-(2-pyridylazo)-Resorcinol
MnP	Mn	MAS - Periodate oxidation
MNR	Nb	MAS - PAR photometric
MPH	P	MAS - Heteropoly molybdenum blue photometric
MPN	P	MAS - n-butyric alcohol-trichloromethane extraction photometric
MSn	Sn	MAS - Phenylfluorone photometric
MTD	Ti	MAS - Diantipyrylmethane photometric
MVE	V	MAS - n-benzoyl phenylhydroxylamine extraction photometric
TAI	Al	EDTA titration method after separation with cupferron
TCr	Cr	Persulfate oxidation, ferrous sulfate titrimetric
TN	N	Neutralization titrimetric after distillation separation
TNi	Ni	EDTA titration
XRF		X-Ray Fluorescence spectrometry

AES = Atomic Emission Spectrometry

MAS = Molecular Absorption Spectrometry (photometric, spectrophotometric methods)

Co-operating Laboratories: The co-operating laboratories were:

Laboratory

Allvac, Lockport, New York
 Allvac, Monroe, North Carolina
 ANAREM, Prague, Czech Republic
 Brammer Standard Co., Inc., Houston, Texas
 China National Analysis Center for Iron and Steel, Beijing, China
 Crucible Specialty Steel, Syracuse, New York
 J. Dirats and Co., Inc., Westfield, Massachusetts
 IncoTest, Huntington, West Virginia
 LECO Corporation, St. Joseph, Michigan
 Shiva Analyticals (India) Ltd., Hoskote, Bangalore, India
 VHG Laboratories, Inc., Manchester, New Hampshire

Laboratory contact

Thomas Herdlein
 Patrick M. Cole
 Karel Bišovsk
 Richard P. Beaumont
 Prof. Wang Haizhou
 William Mastroe
 Eric E. Dirats
 Melissa G. Staley
 Dennis Lawrenz
 Dr. T. V. Ramakrishna
 Julie M. McIntosh

Additional analytical data: This material was used as an unknown test specimen number 0011 in a nationally recognized Proficiency Testing Program (PTP) for stainless steel. Most of the participating laboratories used one or more of the ASTM Standard Test Methods E 572, E 1019, and E 1086. The PTP data was not used in calculating the certified values listed on pages 1 and 2. The data shown below are the results from the PTP.

Combustion Instrument Analysis using ASTM Standard Test Method E 1019

	C	S	N	O
Number of Labs	20	15	16	12
Grand Average	0.0673	0.0004	0.0293	0.0010
Standard Deviation	0.0030	0.0003	0.0013	0.0005

Optical Emission Spectrometric Analysis using ASTM Standard Test Method E 1086

	C	Mn	P	S	Si	Cu	Ni	N*
Number of Labs	9	13	13	10	12	12	11	4
Grand Average	0.0680	0.7578	0.0208	0.0018	0.2943	0.3317	6.9982	0.0325
Standard Deviation	0.0035	0.0141	0.0018	0.0014	0.0158	0.0100	0.0594	0.0034
	Cr	Mo	Co*	V*	Nb*	Sn*	Ti*	Al*
Number of Labs	12	13	8	8	8	6	8	6
Grand Average	16.4841	0.2953	0.1164	0.0770	0.2131	0.0087	0.0792	1.0706
Standard Deviation	0.1184	0.0184	0.0036	0.0083	0.0104	0.0014	0.0065	0.0625

X-ray Emission Spectrometric Analysis using ASTM Standard Test Method E 572

	Mn	P*	Si*	Cu	Ni	Cr	Mo
Number of Labs	14	9	8	13	12	13	12
Grand Average	0.7611	0.0210	0.2938	0.3314	7.0088	16.4315	0.2843
Standard Deviation	0.0192	0.0012	0.0109	0.0079	0.0344	0.0632	0.0036
	V*	Co	Nb	Sn*	Ti*	Al*	
Number of Labs	9	13	7	7	5	6	
Grand Average	0.0756	0.1168	0.2054	0.0087	0.0815	1.0237	
Standard Deviation	0.0040	0.0064	0.0059	0.0018	0.0057	0.0735	

* The elements are not listed in the Scope of the ASTM Standard Test Method but are reported for information.

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, and ASTM Standard Guides E 1724 and E 1831 were followed for the preparation of this reference material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs in accordance with ASTM Standard Practice E 1806. The laboratories participating in the testing normally followed the requirements of ISO Guide 25 and/or ISO Standard 17025. Individual values listed on page 2 are the average of each analyst's results. Methods of analysis are listed on page 3.

Outliers: Some outlying data was excluded from the data listed on page 2 due to technical assessment of the cooperating laboratories and statistical evaluation.

Traceability: The following Certified Reference Materials were used to validate the analytical data listed on page 2: SRM 15h, 32b, 101g, 121d, 123c, 126c, 133b, 160b, 343a, 344, 345, 346a, 348a, 361, 864, 865, 868, 2171; ECRM 096-1, 284-1, 286-1, 289-1, 295-1; BCS 342, 351, 466/1, 467/1, 475; BAM 230-1.

Homogeneity: This Certified Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by optical emission spectrometry using ASTM Standard Test Method E 1086 and found to be compatible with the following Reference Materials: SRM C1151, C1152, C1153; BS CA304-2, 81G, 85D, 184, 184A.

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. Whereas this material is in a solid form and stable, no expiration date is specified.

Source: This material was produced by AL Tech Specialty Steel Corporation, Dunkirk, New York. It was melted by an electric arc furnace, bottom poured in to ingots, hot rolled, and finished with a normalized heat treatment .

Form: This Certified Reference Material is in the form of a disc, approximately 38 mm in diameter and 12 mm thick.

Use: This Certified Reference Material is intended for use in optical emission and x-ray spectrometric methods of analysis. Refer to ISO Guide 33 for information about the use of Reference Materials.

Certified area: The entire depth of the disc may be used.

Caution: As with any bar material, avoid optical emission spectrometric burns in the center of the disc (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 you use for production specimens. Avoid overheating the disc during surface preparation.

Certificate Number: The unique identification number for this certificate of analysis is 192A-032901-px, where x indicates the page number. Refer to future Brammer Standard Company catalogs for information on any revisions to this or other Brammer Standard reference materials. You may also obtain information on revisions of certificates from the internet at brammerstandard.com.

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 77069-2895 USA	Fax: (281) 440-4432	e-mail	bramstan@netropolis.net

Certified by: _____ on March 29, 2001.
G. R. Brammer

Brammer Standard Company, Inc., is accredited to ISO Guide 34 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials by A2LA (Certificate Number 656.02) The scope of accreditation is listed on the website: www.brammerstandard.com

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9002:1994 by National Quality Assurance, U.S.A.

Brammer Standard Company's Chemical Laboratory is accredited to ISO Guide 25 by A2LA. (Certificate Number 656.01)

References:

ASTM documents available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Telephone: 610-832-9500 Fax: 610-832-9555 e-mail: service@astm.org Website: www.astm.org

E 572 - 94 Standard Test Method for X-Ray Emission Spectrometric Analysis of Stainless Steel

E 826 - 85 (Reapproved 1996) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019 - 2000 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

E 1086 - 94 Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Stainless Steel by the Point-to-Plane Excitation Technique

E 1724 - 95 Standard Guide for Testing and Certification of Metal and Metal-Related Reference Materials

E 1806 - 96 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

E 1831 - 96 Standard Guide for Preparing Certificates for Reference Materials Relating to Chemical Composition of Metals, Ores, and Related Materials.

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

ISO Standard 17025 (First edition, 1999), General requirements for the competence of calibration and testing laboratories.

ISO Guide 25 (Third edition, 1990), General requirements for the competence of calibration and testing laboratories.

ISO Guide 30 (Second edition, 1991), Terms and definitions used in connection with reference materials.

ISO Guide 31 (Second edition, 2000), Reference materials -Contents of certificates and labels.

ISO Guide 33 (Second edition, 2000), Uses of certified reference materials.

ISO Guide 34 (Second edition, 2000), General requirements for the competence of reference material producers.

ISO Guide 35 (Second edition, 1989), Certification of reference materials - General and statistical principles.

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

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