

Brammer Standard Company, Inc.
Certificate of Analysis

B.S. SS 4951

Reference Material for 420 Grade Stainless Steel

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ²
Analysis listed as percent by weight					
C	0.333	0.005	As	0.002	0.001
Mn	0.58	0.015	N	0.0127	0.0006
P	0.016	0.001	O	0.0055	0.0008
S	0.0012	0.0003	Nb	0.006	0.002
Si	0.62	0.01	Sn	0.003	0.001
Cu	0.033	0.003	Ti	0.002	0.001
Ni	0.15	0.005			
Cr	13.55	0.08			
Mo	0.009	0.002	Informational values ³		
Co	0.013	0.003	B	(0.0002)	
V	0.032	0.003	Ca	(0.0004)	
Al	0.002	0.001	W	(0.003)	

¹ The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

² 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.

³ Data in parentheses are not certified and are provided for information only.

See reverse side for more information.

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Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Co	V
1	0.3255	0.565	0.014	0.0009	0.595	0.030	0.14	13.38	0.007	0.0096	0.027
2	0.329	0.566	0.0155	0.0010	0.61	0.031	0.145	13.38	0.007	0.0100	0.0298
3	0.331	0.570	0.0156	0.0010	0.62	0.032	0.146	13.49	0.0076	0.0113	0.0308
4	0.332	0.571	0.016	0.0012	0.62	0.0329	0.146	13.51	0.008	0.013	0.031
5	0.333	0.578	0.016	0.00126	0.621	0.033	0.146	13.535	0.0093	0.013	0.032
6	0.333	0.579	0.016	0.0013	0.622	0.033	0.147	13.54	0.0095	0.014	0.032
7	0.334	0.58	0.016	0.0013	0.626	0.033	0.148	13.58	0.010	0.0150	0.0325
8	0.335	0.58	0.0160	0.0015	0.627	0.033	0.15	13.60	0.011	0.015	0.034
9	0.3376	0.583	0.0166		0.628	0.0349	0.15	13.63	0.011	0.016	0.036
10	0.34	0.59	0.017		0.63	0.0351	0.15	13.638		0.016	0.037
11		0.60	0.018		0.64	0.036	0.153	13.64			
12		0.60			0.654	0.037	0.16	13.645			
13		0.601					0.16				
Average	0.3330	0.582	0.0161	0.00118	0.624	0.0334	0.149	13.547	0.0089	0.0133	0.0322
Std Dev	0.0041	0.013	0.0010	0.00020	0.014	0.0020	0.006	0.094	0.0016	0.0023	0.0029
Certified	0.333	0.58	0.016	0.0012	0.62	0.033	0.15	13.55	0.009	0.013	0.032
C(95%)	0.0029	0.008	0.0007	0.0002	0.009	0.0013	0.003	0.060	0.0012	0.0017	0.0021

continued from above

Analysis	Al	As	N	O	Nb	Sn	Ti	B	Ca	W
1	0.0008	0.0010	0.0119	0.0049	0.0026	0.0015	0.001	0.00007	0.0002	0.0006
2	0.002	0.002	0.01215	0.0054	0.005	0.0018	0.001	0.0001	0.00038	0.0010
3	0.002	0.0022	0.0126	0.00559	0.0054	0.002	0.0012	0.00013	0.00046	0.002
4	0.002	0.0026	0.0127	0.00585	0.0075	0.0024	0.0012	0.0002	0.0005	0.002
5	0.0021		0.0128	0.0060	0.0077	0.0032	0.0013	0.0003	0.0005	0.002
6	0.0022		0.013		0.008	0.0037	0.002		0.00059	0.007
7	0.0025		0.0136		0.008	0.004	0.002			0.0075
8	0.005					0.004	0.0028			
Average	0.0023	0.0020	0.01268	0.00555	0.0063	0.0028	0.0016	0.00016	0.00044	0.0032
Std Dev	0.0012	0.0007	0.00056	0.00043	0.0021	0.0010	0.0006	0.00009	0.00014	0.0029
Certified	0.002	0.002	0.0127	0.0055	0.006	0.003	0.002	(0.0002)	(0.0004)	(0.003)
C(95%)	0.0010	0.0011	0.00051	0.00053	0.0019	0.0009	0.0005			

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

$C(95\%) = (t \times sd) / \sqrt{n}$ 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.

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, and ASTM Standard Guide E 1724 were generally followed for the preparation of this reference material and certificate of analysis. This is a 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 bars in accordance with ASTM Standard Practice E 59. The laboratories participating in the testing normally followed the requirements of ISO Guide 25. The individual values listed above are the average of each analyst's results. Methods of analysis used were a combination of ASTM Standard Methods E 350, E 353, E 572, E 1019, E 1086, plus additional ICP and AA spectrometric methods.

Co-operating Laboratories: Some of the co-operating laboratories were:

Allegheny Ludlum Steel Corp., Brackenridge, Pennsylvania
 Allegheny Ludlum Steel Corp., Lockport, New York
 ANAREM, Prague, Czech Republic
 Brammer Standard Co., Inc., Houston, Texas
 Climax Research Services, Farmington Hills, Michigan
 Crucible Specialty Steel, Syracuse, New York
 J. Dirats and Co., Inc., Westfield, Massachusetts
 LECO Corporation, St. Joseph, Michigan
 Spectrochemical Laboratories, Inc., Pittsburgh, Pennsylvania
 VHG Laboratories, Inc., Manchester, New Hampshire

Additional analytical data: This material was used as an unknown test specimen in the ASTM Stainless Steel Proficiency Testing Program (PTP). The participating laboratories used a combination of combustion instruments, XRF spectrometers, and optical emission spectrometers.

	C	Mn	P	S	Si	Cu	Ni
Number of data sets	31	30	25	25	28	30	28
Grand Average	0.3339	0.580	0.0163	0.0016	0.614	0.0327	0.147
Standard Deviation	0.0079	0.012	0.0010	0.0006	0.033	0.0046	0.008

	Cr	Mo	Co	N	O	V
Number of data sets	33	26	15	11	10	10
Grand Average	13.640	0.0139	0.0136	0.0127	0.0058	0.0300
Standard Deviation	0.192	0.0072	0.0034	0.0004	0.0009	0.0063

Homogeneity: This Reference Material was tested for homogeneity using ASTM Standard Practice E 826 and found acceptable.

Traceability: This Reference Material was also examined by optical emission spectrometry and found to be compatible with the following Certified Reference Materials: NIST SRM 1219 and 1295; SS 470; JSS 650-8. The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 15h, 16f, 73c, 101g, 121d, 125b, 160b, 133b, 337a, 344, 345, 346a, 348a, 361, 362, 363, 364, 365, 882, 1270; ECRM 096-1, 088-1, 184-1, 284-1, 286-1, 291-1, 292; BCS 341, 342, 456/1, 455/1, 466/1, 467/1, 475; BAM 044-1; JK 37; INZ 1.74.

Source: This material was produced by the Slater Steels Corporation. The material was made in an electric arc furnace and cast into ingots. The bar stock was hot rolled and annealed.

Available Form: This Reference Material is available in the form of a disc, approximately 42 mm (1.65") in diameter and 12 mm (0.50") thick.

Use: This Reference Material is intended for use in optical emission and x-ray spectrometric methods of analysis. 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.

Because this Reference Material contains a high percent of chromium, care must be taken in its application. Make certain that corrections are made for possible element interference and dilution effects.

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.

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
14603 Benfer Road
Houston, Texas 77069-2895 USA Fax: (281) 440-4432

Certified by: _____ on June 26, 1996.
G. R. Brammer

Certificate Number SS4951-062696p3

By Certificate Number R-021, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9002 by the American Association for Laboratory Accreditation (A2LA).

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

References:

ASTM documents available from ASTM, 1916 Race Street, Philadelphia, PA, 19103.

E 59 - 93 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

E 350-90 Standard Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

E 353 - 93 Standard Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

E 572 - 88 Standard Test Method for X-Ray Emission Spectrometric Analysis of Stainless Steel

E 826 - 85 (Reapproved 1990) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019-93 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

E 1086 - 85 Standard 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

ISO Guides available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

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 (First edition, 1981), Contents of certificates of reference materials.

ISO Guide 33 (First edition, 1989), Uses of certified reference materials.

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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