

**Brammer Standard Company, Inc.**  
**Certificate of Analysis**

**B.S. 6418**

**AISI Steel Grade 6418 Reference Material (UNS Number K32550)**

	Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>		Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>
Analysis listed as percent by weight					
<b>C</b>	<b>0.255</b>	0.006	<b>As</b>	<b>0.0044</b>	0.0004
<b>Mn</b>	<b>1.42</b>	0.02	<b>Co</b>	<b>0.010</b>	0.001
<b>P</b>	<b>0.010</b>	0.001	<b>N</b>	<b>0.0066</b>	0.0004
<b>S</b>	<b>0.004</b>	0.0008	<b>O</b>	<b>0.0012</b>	0.0003
<b>Si</b>	<b>1.54</b>	0.02	<b>Sn</b>	<b>0.006</b>	0.001
<b>Cu</b>	<b>0.11</b>	0.005	<b>Ti</b>	<b>0.003</b>	0.001
<b>Ni</b>	<b>1.74</b>	0.02	<b>V</b>	<b>0.003</b>	0.001
<b>Cr</b>	<b>0.34</b>	0.01			
<b>Mo</b>	<b>0.42</b>	0.015			
<b>Al</b>	<b>0.027</b>	0.002			

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

<sup>2</sup> The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values. No attempt is made to derive exact statistical measurements of imprecision because several methods were used in the determination of most constituents.

The requirements of ISO Guide 31 and ISO Guide 35 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.

See reverse side for more information.

Certificate Number 6418-020195

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al
1	0.248	1.39	0.0099	0.0030	1.51	0.104	1.71	0.33	0.4084	0.0248
2	0.250	1.392	0.010	0.003	1.51	0.108	1.72	0.33	0.41	0.0258
3	0.251	1.40	0.010	0.0031	1.52	0.108	1.725	0.334	0.414	0.026
4	0.252	1.41	0.010	0.0035	1.53	0.108	1.727	0.338	0.419	0.027
5	0.254	1.42	0.010	0.004	1.53	0.110	1.73	0.34	0.42	0.027
6	0.254	1.42	0.0103	0.004	1.54	0.11	1.73	0.34	0.424	0.0271
7	0.254	1.43	0.012	0.004	1.54	0.11	1.730	0.342	0.425	0.028
8	0.258	1.45		0.004	1.548	0.11	1.74	0.346	0.43	0.029
9	0.258	1.458		0.004	1.55	0.115	1.74	0.35	0.44	0.032
10	0.264			0.0043	1.556	0.12	1.76	0.35	0.44	
11	0.265				1.557		1.77	0.35	0.442	
13					1.56					
Average	0.2553	1.419	0.0103	0.0037	1.538	0.110	1.735	0.341	0.425	0.0274
Std Dev	0.0055	0.024	0.0008	0.0005	0.018	0.004	0.017	0.008	0.012	0.0021
Certified	0.255	1.42	0.010	0.004	1.54	0.11	1.74	0.34	0.42	0.027

Analysis	As	Co	N	O	Sn	Ti	V
1	0.0042	0.0088	0.0060	0.0010	0.005	0.002	0.0016
2	0.0042	0.009	0.0063	0.0010	0.006	0.002	0.002
3	0.0044	0.009	0.0065	0.0010	0.0060	0.003	0.0022
4	0.0046	0.0092	0.0067	0.0012	0.0060	0.0034	0.0025
5		0.011	0.0067	0.0012	0.0066	0.0034	0.003
6		0.011	0.0068	0.0012	0.0066	0.0036	0.004
7			0.0069	0.0015	0.0068	0.004	
8			0.0069		0.007	0.002	
9			0.0070		0.007	0.005	
10					0.008		
Average	0.0044	0.0097	0.0066	0.0012	0.0065	0.0032	0.0026
Std Dev	0.0002	0.0010	0.0003	0.0002	0.0008	0.0010	0.0009
Certified	0.0044	0.010	0.0066	0.0012	0.006	0.003	0.003

**Analysis:** Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs. 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 415, and E 1019, plus additional ICP and AA spectrometric methods.

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

Analytical Associates, Inc., Detroit, Michigan  
 Brammer Standard Co., Inc., Houston, Texas  
 Coleman Testing Laboratories, Riverside, New Jersey  
 Copperweld Steel Company, Warren, Ohio  
 Crucible Specialty Steel, Syracuse, New York  
 J. Dirats and Co., Inc., Westfield, Massachusetts  
 Laboratory Testing Inc., Dublin, Pennsylvania  
 LECO Corporation, St. Joseph, Michigan  
 Ledoux & Company, Teaneck, New Jersey  
 Andrew S. McCreath & Son, Inc., Harrisburg, Pennsylvania  
 Shiva Technologies, Inc., Cicero, New York  
 Spectrochemical Laboratories, Inc., Pittsburgh, Pennsylvania  
 The Timken Company, Canton, Ohio  
 VHG Laboratories, Inc., Manchester, New Hampshire

**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 C1173, 1224, 1225, 1261A to 1265A, 1761 to 1767. The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 13g, 30f, 32e, 125b, 361 to 365; BAM 039-2, 044-1; BCS 455/1, 456/1, 458/1; ECRM 085-1, 088-1, 096-1, 097-1, 184-1; GBW 01402; IMZ 1.22/3.

**Source:** This material was produced by Copperweld Steel Company, Warren, Ohio. 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 57 mm (2.25") in diameter and 19 mm (0.75") 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.

**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 February 1, 1995.  
G. R. Brammer

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## References:

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

E 322 - 67 (Reapproved 1990) Standard Method for X-Ray Emission Spectrometric Analysis of Low-Alloy Steels and Cast Irons

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

E 415 - 85 (Reapproved 1995) Standard Test Method for Optical Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy 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

*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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