

Brammer Standard Company, Inc.

# Certificate of Analysis

**B.S. 3942**

**Reference Material for AISI Carbon Steel Grade 1045**

	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>0.47</b>	0.008	<b>Co</b>	<b>0.010</b>	0.002
<b>Mn</b>	<b>0.72</b>	0.01	<b>Nb</b>	<b>0.019</b>	0.003
<b>P</b>	<b>0.023</b>	0.001	<b>Pb</b>	<b>0.0003</b>	0.0001
<b>S</b>	<b>0.032</b>	0.0015	<b>Sb</b>	<b>0.003</b>	0.001
<b>Si</b>	<b>0.26</b>	0.006	<b>Sn</b>	<b>0.012</b>	0.001
<b>Cu</b>	<b>0.281</b>	0.004	<b>Ti</b>	<b>0.003</b>	0.001
<b>Ni</b>	<b>0.14</b>	0.008	<b>V</b>	<b>0.0019</b>	0.0003
<b>Cr</b>	<b>0.165</b>	0.005	<b>W</b>	<b>0.003</b>	0.001
<b>Mo</b>	<b>0.037</b>	0.003	Informational Values <sup>3</sup>		
<b>Al</b>	<b>0.004</b>	0.001	<b>Mg</b>	(0.0002)	
<b>As</b>	<b>0.009</b>	0.001	<b>N</b>	(0.0088)	
<b>Ca</b>	<b>0.0012</b>	0.0003	<b>O</b>	(0.0041)	

<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.

<sup>3</sup> Values in parentheses are not certified and are provided for information only.

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 3942-053195

**Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895**  
**Telephone (281) 440-9396 Fax (281) 440-4432**

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	As	Ca
1	0.458	0.714	0.022	0.0306	0.252	0.277	0.128	0.1627	0.0352	0.0028	0.0084	0.00090
2	0.46	0.718	0.0225	0.0308	0.256	0.281	0.137	0.164	0.036	0.00293	0.0085	0.00092
3	0.465	0.720	0.023	0.031	0.260	0.282	0.14	0.165	0.0366	0.0040	0.0095	0.0010
4	0.469	0.721	0.0239	0.031	0.260	0.2826	0.141	0.168	0.0378	0.004	0.010	0.0013
5	0.470	0.726	0.024	0.032	0.263	0.283	0.142	0.170	0.040	0.005	0.0100	0.0014
6	0.471	0.73		0.0329			0.146				0.0102	0.0015
7	0.473			0.033								0.0016
8				0.033								
Average	0.467	0.722	0.0231	0.0318	0.258	0.2811	0.1390	0.1659	0.0371	0.0037	0.0094	0.0012
Std Dev	0.006	0.006	0.0009	0.0011	0.004	0.0024	0.0061	0.0030	0.0019	0.0009	0.0008	0.0003
Certified	0.47	0.72	0.023	0.032	0.26	0.281	0.14	0.165	0.037	0.004	0.009	0.0012

Analysis	Co	Nb	Pb	Sb	Sn	Ti	V	W	Mg	N	O
1	0.009	0.0165	0.0002	0.0014	0.0114	0.0016	0.0017	0.002	0.0001	0.0087	0.0041
2	0.00947	0.017	0.00024	0.0033	0.0117	0.0019	0.0017	0.0032	0.00018	0.0089	
3	0.0095	0.019	0.00025	0.0035	0.0120	0.0029	0.0018	0.0039	0.00020	0.00895	
4	0.0096	0.019	0.00029	0.0035	0.0126	0.004	0.0021	0.0040	0.00022		
5	0.010	0.0195	0.00031	0.004	0.013	0.004	0.0023		0.00023		
6	0.0101	0.020	0.00031			0.0041					
7	0.012	0.0232				0.0042					
Average	0.0100	0.0192	0.00027	0.0031	0.0121	0.0032	0.00192	0.0033	0.00019	0.00885	0.0041
Std Dev	0.0010	0.0022	0.00004	0.0010	0.0007	0.0011	0.00027	0.0009	0.00005	0.00013	
Certified	0.010	0.019	0.0003	0.003	0.012	0.003	0.0019	0.003	(0.0002)	(0.0088)	(0.0041)

Values in parentheses are not certified and are provided for information only.

**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 322, E 350, E 415, 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  
 Crucible Specialty Metals, Syracuse, New York  
 J. Dirats and Co., Inc., Westfield, Massachusetts  
 Leco Corporation, St. Joseph, Michigan  
 Northern Analytical Laboratory, Inc., Merrimack, New Hampshire  
 Shiva Technologies, Inc., Cicero, New York  
 VHG Laboratories, Inc., Manchester, New Hampshire

**Source:** This material was produced by Southwest Steel Co., Inc., Catoosa, Oklahoma.

**Available Form:** This Reference Material is available only in the form of a disc, approximately 42 mm (1.68") in diameter and 19 mm (0.75") thick.

**Additional analytical data:** This material was used as an unknown test specimen in a nationally recognized Proficiency Testing Program (PTP) for low-alloy steel. Most of the participating laboratories used ASTM Standard Test Methods E 322, E 415, and E 1019. The data shown below are the results from the PTP.

Instrument analysis using ASTM Standard Test Method E 1019

	C	S	N	O
Number of Labs	28	26	26	21
Grand Average	0.4725	0.0319	0.0094	0.0048
Standard Deviation	0.0077	0.0021	0.0003	0.0020

Optical Emission Spectrometric Analysis using ASTM Standard Test Method E 415

	C	Mn	P	S	Si	Cu	Ni
Number of Labs	32	38	38	32	38	38	39
Grand Average	0.4646	0.7236	0.0223	0.0319	0.2557	0.2739	0.1380
Standard Deviation	0.0118	0.0115	0.0021	0.0033	0.0079	0.0126	0.0063

	Cr	Mo	Sn	Nb
Number of Labs	38	38	35	37
Grand Average	0.1626	0.0390	0.0106	0.0209
Standard Deviation	0.0060	0.0044	0.0016	0.0021

X-ray Emission Spectrometric Analysis using ASTM Standard Test Method E 322

	Mn	Cu	Ni	Cr	Mo
Number of Labs	7	7	8	8	8
Grand Average	0.7257	0.2827	0.1418	0.1689	0.0379
Standard Deviation	0.0088	0.0077	0.0075	0.0052	0.0008

**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, 1261a - 1265a, 1761 - 1767; ECRM 186-1, 191-1; SS 457/1, 458/1; JSS 169-4, 170-6, 171-4.

The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 30f, 125b, 291, 345, 346, 361 - 365, 898, 1270; ECRM 085-1, 088-1, 096-1, 097-1, 184-1, 481-1; BAM 039-2, 044-1; BCS 405/1, 455/1, 456/1, 458/1; IPT 43; IMZ 1.22, 1.74/3.

**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.

**Certificate Number 3942-053195**

**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 May 31, 1995.  
G. R. Brammer

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## Referenced Documents

*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 1989) 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 at no cost from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.*

NBS 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