

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

**B.S. 66B**

**Certified Reference Material for AISI Grade 1141 Resulfurized Steel**

	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>0.418</b>	0.006	<b>Co</b>	<b>0.005</b>	0.001
<b>Mn</b>	<b>1.56</b>	0.02	<b>N</b>	<b>0.0056</b>	0.0003
<b>P</b>	<b>0.018</b>	0.002	<b>Sn</b>	<b>0.0016</b>	0.0004
<b>S</b>	<b>0.112</b>	0.004	<b>V</b>	<b>0.0014</b>	0.0002
<b>Si</b>	<b>0.017</b>	0.005			
<b>Cu</b>	<b>0.028</b>	0.002			
<b>Ni</b>	<b>0.032</b>	0.002	Information Values <sup>3</sup>		
<b>Cr</b>	<b>0.093</b>	0.005	Al	(0.001)	
<b>Mo</b>	<b>0.019</b>	0.002	Ti	(0.001)	
<b>B</b>	<b>0.0003</b>	0.0001			

<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.

See the following pages for more information.

Replaces Certificate Number REV66B-121793  
New Certificate Number REV2-66B-042710

New Certificate Number REV2-66B-042710 was Revised on April 27, 2010

**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
1	1	0.402	4 1.53	3 0.016	1 0.107	4 0.0119	4 0.025	4 0.031	3 0.088	4 0.0174
2	1	0.415	4 1.544	4 0.017	1 0.1098	5 0.0125	4 0.027	4 0.031	4 0.0882	4 0.0175
3	1	0.416	4 1.556	4 0.018	1 0.110	4 0.014	4 0.0272	4 0.031	4 0.093	4 0.018
4	1	0.417	4 1.56	4 0.0185	1 0.111	3 0.015	4 0.0279	4 0.0313	4 0.0935	3 0.018
5	1	0.4171	4 1.561	3 0.0188	1 0.112	4 0.0177	4 0.028	5 0.0315	4 0.0941	5 0.0182
6	1	0.418	3 1.58	4 0.019	1 0.113	9 0.020	5 0.0289	4 0.032	4 0.096	4 0.019
7	1	0.420	4 1.58	4 0.019	1 0.114	4 0.021	3 0.029	4 0.0329	4 0.096	4 0.021
8	1	0.420		5 0.0206	1 0.114	4 0.025	4 0.030	3 0.034	4 0.098	4 0.023
9	1	0.42			1 0.122					
10	1	0.4206								
11	1	0.422								
12	1	0.43								
Average		0.4181	1.559	0.0184	0.1125	0.0171	0.0279	0.0318	0.0934	0.0190
Std Dev		0.0064	0.018	0.0014	0.0042	0.0046	0.0015	0.0011	0.0036	0.0020
Certified		0.418	1.56	0.018	0.112	0.017	0.028	0.032	0.093	0.019
t		2.20	2.45	2.36	2.31	2.36	2.36	2.36	2.36	2.36
C(95%)		0.0041	0.017	0.0012	0.0032	0.0039	0.0013	0.0009	0.0030	0.0017

continued from above

\* Methods of analysis listed below

Analysis	*	B	* Co	* N	* Sn	* V	* Al	* Ti
1	4	0.0003	4 0.004	2 0.0053	8 0.0008	4 0.0011	5 0.0007	4 0.0004
2	3	0.0003	4 0.0042	2 0.0053	3 0.0013	4 0.0012	4 0.0008	3 0.001
3	6	0.00031	4 0.0044	2 0.0053	4 0.0015	4 0.0012	4 0.001	4 0.0015
4	4	0.00036	5 0.0047	2 0.0056	4 0.0016	3 0.0014	4 0.001	7 0.0016
5	4	0.0004	3 0.005	2 0.0057	5 0.0016	4 0.0015	4 0.001	4 0.002
6			4 0.005	2 0.0057	6 0.0017	4 0.0016	7 0.0018	
7			4 0.006	2 0.00575	5 0.0020	5 0.0016	3 0.002	
8			7 0.006	2 0.0058	4 0.0020	7 0.0018	4 0.002	
9				2 0.0058				
10				2 0.0061				
Average		0.00033	0.0049	0.00564	0.00156	0.00143	0.0013	0.0013
Std Dev		0.00004	0.0008	0.00026	0.00039	0.00024	0.0005	0.0006
Certified		0.0003	0.005	0.0056	0.0016	0.0014	(0.001)	(0.001)
t		2.78	2.36	2.26	2.36	2.36	2.36	2.78
C(95%)		0.00006	0.0006	0.00019	0.00033	0.00020	0.0005	0.0008

$C(95\%) = (t \times sd) / \sqrt{n}$  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 35:2006 section 6.

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

## \* Methods of Analysis

1	Combustion	5	ICP-MS	9	Gravimetry
2	Fusion	6	Wet chemistry		
3	Spark AES	7	Flame AAS		
4	ICP AES	8	Flameless AAS		

AES = Atomic Emission Spectrometry

Some of the co-operating laboratories were:

Anderson Laboratories, Inc., Greendale, WI  
 Bowser-Morner, Dayton, OH  
 Brammer Standard Co., Inc., Houston, TX  
 Chicago Spectro Service Labs, Chicago, IL  
 J. Dirats and Co., Inc., Westfield, MA  
 LECO Technical Services, St. Joseph, MI  
 Laboratory Testing Inc., Hatfield, PA  
 NSL Analytical Services Inc., Cleveland, OH  
 VHG Laboratories, Inc., Manchester, NH

Accredited to:

ISO 17025  
 ISO 17025  
 ISO 17025  
 ISO 17025  
 ISO 17025  
 ISO 9001  
 ISO 17025  
 ISO 17025  
 ISO 17025  
 ISO 17025

**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. Each individual value listed on page 2 is the average of each analyst's results. The laboratories participating in the testing normally followed the requirements of ISO Standard 17025.

**Analytical Methods:** Methods of analysis used were a combination of ASTM Standard Methods E 350, E 415, E 1019, plus additional ICP, and AA spectrometric methods.

**Certification Process:** The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, were followed for the preparation of this reference material and certificate of analysis. This material was upgraded to a Certified Reference Material as defined by ISO Guide 30 after retesting conforming to ISO Guide 34.

**Traceability:** The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 12h, 15h, 50c, 129c, 361, 362, 363, 365, 368, 1270, 2160, 3101a, 2112a, 3107, 3114, 3132, 3136, 3139a, 3150, 3162a, 3165; BCS 456/1, 458/1; ECRM 097-1; CKD CZ 20-06A; IPT 43

**Homogeneity:** This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by spark atomic emission spectrometry and found to be compatible with the following NIST Certified Reference Materials: SRM 1222, 1224, 1225, 1261A to 1265A, 1761 to 1767

**Form:** This Reference Material is machined in the form of a disc, approximately 41 mm diameter and 19 mm thick by Brammer Standard Company. The bar stock used for this material was produced by hot-rolling billets and annealing.

**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.

**Use:** This CRM is intended for use in spark atomic 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 spark atomic emission spectrometric burns in the center of the disc (5 mm radius), as some segregation may be present. An extender preburn may be required.

**Note:** The presence of high sulfur concentrations may produce erroneous higher readings for manganese, boron, and other elements when analyzed by spark atomic emission spectrometry.

**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 REV2-66B-042710. This BS 66B Certificate of Analysis was revised to show the estimate of uncertainty for the certified values. After reviewing the analytical data from a new inter-laboratory study, the certified values were slightly changed for manganese, sulfur, silicon, copper, nickel, chromium, tin, and vanadium. The boron and nitrogen value were changed to certified and the aluminum and titanium values were changed to conform to current versions of ISO Guides.

The first Certificate of Analysis for BS 66B was certified in 1981. The first revision (Rev66B-121793) was produced after being retested by additional laboratories.

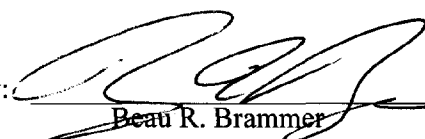
Refer to the "Certificates" section of the Brammer Standard Company website for any revision to this or other Brammer Standard Company's Certificates of Analysis.

**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:

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Fax: (281) 440-4432

website: [brammerstandard.com](http://brammerstandard.com)  
email: [contact@brammerstandard.com](mailto:contact@brammerstandard.com)

Certified by:  on April 27, 2010.  
Beau R. Brammer

**Certificate Number REV2-66B-042710**

**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](http://www.brammerstandard.com)

**Brammer Standard Company's Chemical Laboratory is accredited to ISO Standard 17025 by A2LA.**  
(Certificate Number 656.01)

**By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001:2000 by National Quality Assurance, U.S.A.**

## **Referenced Documents**

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

Versions used were those available at the time of interlaboratory testing

- E 350 Standard Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron
- E 415 Standard Test Method for the Atomic Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel
- E 826 Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectrometry
- E 1019 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques.
- E 1806 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

*ISO Guides and Standards available from Global Engineering - [www.global.ihs.com](http://www.global.ihs.com)*

- ISO Standard 17025:2005 General requirements for the competence of testing and calibration laboratories
- ISO Guide 30:1992 (with 2008 amendment) Terms and definitions used in connection with reference materials
- ISO Guide 31:2000 Reference materials -Contents of certificates and labels
- ISO Guide 33:2000 Uses of certified reference materials
- ISO Guide 34:2000 General requirements for the competence of reference material producers
- ISO Guide 35:2006 Reference Materials - General and statistical principles for certification

*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