

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

**B.S. 37D**

**Reference Material for AISI Grade D-2 Tool Steel**  
UNS Number T30402

	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>1.54</b>	0.01	<b>Mo</b>	<b>1.09</b>	0.0015
<b>Mn</b>	<b>0.28</b>	0.015	<b>Co</b>	<b>0.07</b>	0.01
<b>P</b>	<b>0.021</b>	0.002	<b>N</b>	<b>0.016</b>	0.001
<b>S</b>	<b>0.015</b>	0.001	<b>O</b>	<b>0.0031</b>	0.0005
<b>Si</b>	<b>0.29</b>	0.01	<b>Sn</b>	<b>0.004</b>	0.001
<b>Cu</b>	<b>0.063</b>	0.003	<b>V</b>	<b>0.80</b>	0.02
<b>Ni</b>	<b>0.21</b>	0.01	<b>W</b>	<b>0.16</b>	0.02
<b>Cr</b>	<b>11.07</b>	0.06			

<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 37D-101794

**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	1.53	0.265	0.019	0.0143	0.278	0.061	0.206	10.99	1.07
2	1.53	0.266	0.0204	0.0150	0.2805	0.0616	0.210	11.02	1.072
3	1.530	0.275	0.0210	0.0154	0.285	0.063	0.213	11.05	1.08
4	1.535	0.28	0.023	0.0155	0.29	0.063	0.214	11.05	1.091
5	1.54	0.282	0.0232	0.016	0.299	0.065		11.08	1.095
6	1.543	0.283		0.016				11.09	1.13
7	1.544							11.09	
8	1.546							11.10	
9	1.551							11.14	
Average	1.539	0.275	0.0213	0.0154	0.287	0.0627	0.2108	11.068	1.090
Std Dev	0.008	0.008	0.0018	0.0006	0.008	0.0015	0.0036	0.045	0.022
Certified	1.54	0.28	0.021	0.015	0.29	0.063	0.21	11.07	1.09

Analysis	Co	N	O	Sn	V	W
1	0.063	0.0149	0.0028	0.0031	0.77	0.148
2	0.069	0.0156	0.0028	0.0031	0.77	0.149
3	0.072	0.0159	0.0033	0.0038	0.78	0.154
4	0.077	0.0160	0.0034	0.004	0.799	0.168
5		0.0165	0.0034		0.801	0.174
6		0.0165			0.803	0.175
7					0.809	0.18
8					0.816	
9					0.822	
Average	0.0703	0.0159	0.0031	0.0035	0.797	0.164
Std Dev	0.0059	0.0006	0.0003	0.0005	0.019	0.013
Certified	0.07	0.016	0.0031	0.004	0.80	0.16

**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 353, E 572, E 1019, plus additional ICP and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 125b, 133a, 133b, 361 - 365, 1270; JSS 003; ECRM 085-1, 088-1, 096-1, 097-1, 184-1, 283-1, 291-1; 481-1; BCS 345, 346.

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

Analytical Associates Inc., Detroit, Michigan  
 Anarem, Praha, Czech Republic  
 Brammer Standard Co., Inc., Houston, Texas  
 Coleman Testing Laboratories, Riverside, New Jersey  
 Crucible Specialty Metals, Syracuse, New York  
 J. Dirats and Co., Inc., Westfield, Massachusetts  
 Beijing Iron and Steel Research Center, Beijing, China  
 Ledoux & Company, Teaneck, New Jersey  
 Andrew S. McCreath & Son, Inc., Harrisburg, Pennsylvania  
 Shiva Technologies, Inc., Cicero, New York  
 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 1219, C1289; ECRM 288-1, 292-1D; CMSI 2165 - 2168.

**Source:** This material was produced by the Earle M. Jorgensen Company. The material was made in an electric arc furnace and cast into ingots. Billets were formed by hot rolling the ingots. The billets were hot rolled down to 1.50 inch diameter round bars and annealed.

**Available Form:** This Reference Material is available in the form of a disc, approximately 37 mm (1.50") in diameter and 12 mm (0.50") thick. It is also available in a special set of 7 mm thick discs.

**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 carbon and 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.  
14603 Benfer Road  
Houston, Texas 77069-2895 USA

Phone: (281) 440-9396  
Fax: (281) 440-4432

Certified by: \_\_\_\_\_ on October 17, 1994.  
G. R. Brammer

**Certificate Number 37D-101794**

## Referenced Documents

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

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

*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.*

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