

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

B.S. 98

**AISI Stainless Steel Grade 420**

	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>0.309</b>	0.005	<b>Nb</b>	<b>0.003</b>	0.001
<b>Mn</b>	<b>0.48</b>	0.015	<b>O</b>	<b>0.0038</b>	0.0005
<b>P</b>	<b>0.019</b>	0.003	<b>Sn</b>	<b>0.006</b>	0.001
<b>S</b>	<b>0.0014</b>	0.0004	<b>Ti</b>	<b>0.002</b>	0.001
<b>Si</b>	<b>0.72</b>	0.03	<b>V</b>	<b>0.075</b>	0.005
<b>Cu</b>	<b>0.098</b>	0.005	<b>W</b>	<b>0.009</b>	0.002
<b>Ni</b>	<b>0.21</b>	0.01			
<b>Cr</b>	<b>13.35</b>	0.08			
<b>Mo</b>	<b>0.034</b>	0.004	Informational values		
<b>Al</b>	<b>0.003</b>	0.0015	As	(0.003)	
<b>Co</b>	<b>0.020</b>	0.003	B	(0.0002)	
<b>N</b>	<b>0.0181</b>	0.0010	Ca	(0.0005)	

<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.

Data 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 REV-98-010594

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	Co
1	0.306	0.473	0.018	0.0011	0.69	0.095	0.20	13.29	0.030	0.002	0.017
2	0.306	0.476	0.018	0.0012	0.70	0.097	0.209	13.32	0.031	0.002	0.0184
3	0.308	0.48	0.018	0.0013	0.71	0.098	0.21	13.32	0.031	0.0022	0.020
4	0.310	0.481	0.018	0.0016	0.729	0.098	0.21	13.35	0.034	0.0024	0.020
5	0.311	0.489	0.0198	0.0017	0.73	0.098	0.211	13.40	0.034	0.003	0.020
6	0.313	0.49	0.020		0.735	0.100	0.211	13.42	0.036	0.004	0.021
7		0.493	0.022		0.743	0.10	0.219		0.036	0.005	0.022
8							0.22		0.0365		0.023
Average	0.3090	0.483	0.0191	0.0014	0.720	0.098	0.211	13.350	0.0336	0.0029	0.0201
Std Dev	0.0028	0.008	0.0016	0.0003	0.020	0.002	0.006	0.051	0.0026	0.0012	0.0019
Certified	0.309	0.48	0.019	0.0014	0.72	0.098	0.21	13.35	0.034	0.003	0.020

Analysis	N	Nb	O	Sn	Ti	V	W	As	B	Ca
1	0.017	0.002	0.0035	0.005	0.002	0.070	0.0076	0.002	0.0002	0.0004
2	0.0175	0.002	0.0036	0.0057	0.002	0.070	0.008	0.0021	0.00022	0.0006
3	0.01775	0.0026	0.00374	0.006	0.002	0.072	0.010	0.0037		
4	0.0178	0.003	0.0038	0.0064	0.0022	0.073	0.010			
5	0.0179	0.003	0.0041	0.007	0.0023	0.076	0.010			
6	0.0180	0.003	0.0043	0.007	0.003	0.078				
7	0.0180	0.004		0.007	0.004	0.078				
8	0.0183					0.080				
9	0.0184									
10	0.0185									
11	0.0188									
12	0.0193									
Average	0.01810	0.0028	0.00384	0.0063	0.0025	0.0746	0.0091	0.0026	0.00021	0.0005
Std Dev	0.00061	0.0007	0.00030	0.0008	0.0008	0.0039	0.0012	0.0010	0.00001	0.00014
Certified	0.0181	0.003	0.0038	0.006	0.002	0.075	0.009	(0.003)	(0.0002)	(0.0005)

Data 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 350, E 353, E 572, E 1019, E 1086, plus additional ICP and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 73c, 101g, 121d, 160b, 344, 345, 348a; ECRM 284-1, 286-1; BCS 466/1, 467/1, 475; JK 37.

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

Allegheny Ludlum Steel Corp., Brackenridge, Pennsylvania  
 Allegheny Ludlum Steel Corp., Lockport, New York  
 Analytical Associates, Inc., Detroit, Michigan  
 Brammer Standard Co., Inc., Houston, Texas  
 Crucible Specialty Steel, Syracuse, New York  
 J. Dirats and Co., Inc., Westfield, Massachusetts  
 Hoesch Stahl AG, Dortmund, Germany  
 Charles C. Kawin Company, Broadview, Illinois  
 Republic Engineered Steels, Inc., Canton, Ohio  
 Shiva Technologies, Inc., Cicero, New York  
 VHG Laboratories, Inc., Manchester, New Hampshire



## References:

*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

E 1086 - 85 Standard Method for Optical Emission Vacuum Spectrometric Analysis of Stainless Steel by the Point-to-Plane Excitation Technique

*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

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