

# REVISED Certificate of Analysis

## B.S. 718A

Reference Material for 718 Nickel Alloy

	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					
C	0.036	0.004	Ti	1.02	0.04
Mn	0.078 <sup>5</sup>	0.005	Fe	19.21	0.12
S	0.0010	0.0003	B	0.0046	0.0005
P	0.013 <sup>5</sup>	0.002	Al	0.57 <sup>5</sup>	0.03
Si	0.12	0.006			
Cu	0.06	0.01	Informational Values <sup>3</sup>		
Cr	18.21 <sup>4</sup>	0.08	Sn	(0.004)	
Mo	3.06	0.04	W	(0.08)	
Co	0.32	0.02	V	(0.03)	
Ni	52.05 <sup>5</sup>	0.15	Mg	(0.001)	
Nb	5.19 <sup>5</sup>	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.

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

<sup>4</sup> Value revised on May 21, 1997.

<sup>5</sup> Value revised on May 13, 1998.

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 REV2-718A-051398-p1

Analysis	C	Mn	P	S	Si	Cu	Cr	Mo	Co	Ni	Ni**
1	0.032	0.070	0.0128	0.0008*	0.11	0.046	18.16	3.01	0.29	51.88	Nickel by diff.
2	0.034	0.075	0.0128*	0.0010	0.11*	0.05*	18.17	3.03	0.31	51.96*	
3	0.035	0.077	0.013*	0.0010	0.12	0.05	18.18	3.03*	0.31*	51.96	
4	0.0352*	0.08*	0.014*	0.0011	0.12	0.06	18.18	3.04	0.31*	52.02	
5	0.037	0.080	0.014*	0.0011	0.12	0.06	18.19	3.06*	0.31	52.04	
6	0.037	0.080		0.0012	0.12	0.06	18.20	3.07	0.32	52.10	
7	0.040	0.084			0.12	0.068	18.21*	3.084*	0.33	52.11*	
8					0.123		18.22	3.09	0.33	52.118*	
9							18.26*	3.09	0.34	52.25	
10							18.292*	3.09			
Average	0.0357	0.0780	0.0132	0.0010	0.118	0.056	18.206	3.059	0.317	52.049	51.99
Std Dev	0.0026	0.0045	0.0009	0.0001	0.005	0.008	0.042	0.030	0.015	0.110	
Certified	0.036	0.078	0.013	0.0010	0.12	0.06	18.21	3.06	0.32	52.05	
t	2.4469	2.4469	2.7764	2.5706	2.3646	2.4469	2.2622	2.2622	2.306	2.306	
C(95%)	0.002	0.0042	0.0011	0.0001	0.004	0.007	0.030	0.021	0.012	0.085	

continued from above

Analysis	Nb	Ti	Fe	B	Al	Sn	W	V	Mg
1	5.09	0.99	19.10	0.0040	0.53	0.0031	0.040	0.017	0.0008
2	5.14	1.00	19.10	0.0045	0.55	0.0033	0.06*	0.022	0.0010
3	5.158*	1.002	19.17	0.0047	0.55	0.0053	0.060	0.03*	0.0017
4	5.16*	1.01*	19.21*	0.0047*	0.57*		0.066	0.03	
5	5.18	1.01*	19.23*	0.0048	0.57		0.070	0.034	
6	5.2	1.02	19.246*	0.0050	0.59		0.11	0.040	
7	5.2	1.03	19.25		0.60		0.13	0.042	
8	5.20*	1.05*	19.3						
9	5.25	1.06	19.31						
10	5.28								
Average	5.186	1.019	19.213	0.00462	0.566	0.0039	0.0766	0.0307	0.0012
Std Dev	0.054	0.023	0.077	0.00034	0.024	0.0012	0.0317	0.0090	0.0005
Certified	5.19	1.02	19.21	0.0046	0.57	(0.004)	(0.08)	(0.03)	(0.001)
t	2.2622	2.306	2.306	2.5706	2.4469				
C(95%)	0.038	0.018	0.059	0.00036	0.023				

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

$C(95\%) = (t \times sd) / \sqrt{n}$  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 35:1989 section 4.

\* New values obtained in 1997 and 1998.

\*\* Nickel calculated by difference.

**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. Methods of analysis used were a combination of ASTM Standard methods for classical wet chemistry, ICP and AA spectrometric methods, and combustion instrument procedures for carbon and sulfur. The values listed above are the average of each analyst's results.

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

Allegheny Ludlum Steel Corp., Brackenridge, Pennsylvania  
 Allegheny Ludlum Steel Corp., Lockport, New York  
 ALLVAC, Monroe, North Carolina  
 Brammer Standard Co., Inc., Houston, Texas  
 Crucible Specialty Metals, Syracuse, New York  
 Crucible Research, Pittsburgh, Pennsylvania  
 IncoTest, Huntington, West Virginia  
 Jessop Steel, Washington, Pennsylvania  
 Turret Alloys Ltd., Analytical Services, Sheffield, England  
 Vac Air Alloys, Frewsburg, New York

**REVISION:** The original certificate of analysis for BS 718A was produced on October 5, 1988. This certificate of analysis is revised due to additional testing. A table on page 4 lists the original and revised values.

**Homogeneity:** This Reference Material was tested for homogeneity using ASTM Standard Practice E 826 and found acceptable.

**Source:** This material was produced by Cytemp Specialty Steel Division of Cyclops Corporation, Titusville, Pennsylvania. This material has been heat treated at 1750 °F for one hour and water cooled.

**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.

**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 May 13, 1998.  
G. R. Brammer

## Referenced Documents

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

E 826 - 85 Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

*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 35 (Second edition, 1989), Certification of reference materials - General and statistical principles.

Original and Revised Values

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Element	Original 10-05-88	Revised 05-21-97	Revised 05-13-98
Mn	0.08		0.078
P	0.007	(0.01)	0.013
Cr	18.19	18.21	
Ni	52.0	52.04	52.05
Nb	5.19	5.18	5.19
Al	0.57	0.56	0.57