Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 600C

Reference Material for Inconel® Alloy 600

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
		Analysis listed as percent by weight			
C	**0.072**	0.003	**Mg**	**0.0020**	0.0006
Mn	**0.50**	0.01	**Mo**	**0.027**	0.004
P	**0.008**	0.001	**N**	**0.0074**	0.0005
S	**<0.002**		**Sn**	**0.002**	0.001
Si	**0.39**	0.01	**V**	**0.022**	0.004
Cu	**0.040**	0.006			
Ni	**73.59**	0.15	Informational values[3]		
Cr	**15.62**	0.05	Ca	(0.0010)	
Fe	**9.30**	0.05	Nb	(0.014)	
Al	**0.20**	0.008	O	(0.0012)	
Co	**0.04**	0.01	Pb	(0.002)	
Ti	**0.21**	0.01	Ta	(0.003)	
B	**0.0012**	0.0002	W	(0.003)	

[1] The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

[2] The uncertainties listed are based on value judgments of the material inhomogeneity and the 95% confidence interval. The half-width confidence interval C(95%) is shown on page 2.

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

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See reverse side for more information.

Certificate Number REV600C-110111p1

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

BS 600C Certificate Number REV600C-110111p2

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Fe	Al	Co	Ti	
1	0.068	0.486	0.007	0.0001	0.38	0.030	73.46	15.55	9.23	0.193	0.028	0.200	
2	0.069	0.49	0.0073	0.0003	0.380	0.0378	73.49	15.58	9.26	0.20	0.03	0.203	
3	0.070	0.499	0.0074	0.0009	0.38	0.039	73.51	15.59	9.28	0.200	0.030	0.204	
4	0.071	0.500	0.0076	0.0010	0.383	0.040	73.53	15.599	9.28	0.20	0.031	0.204	
5	0.0716	0.50	0.008	0.001	0.386	0.04	73.56	15.60	9.281	0.20	0.031	0.21	
6	0.072	0.50	0.008	0.0010	0.387	0.040	73.63	15.60	9.29	0.201	0.0334	0.21	
7	0.073	0.500	0.008	0.001	0.387	0.044	73.67	15.60	9.299	0.203	0.0340	0.22	
8	0.074	0.501			0.389	0.0485	73.70	15.62	9.30	0.209	0.034	0.22	
9	0.074	0.51			0.39		73.72	15.62	9.30	0.21	0.0354	0.22	
10	0.075	0.51			0.39			15.64	9.32	0.21	0.037	0.23	
11		0.52			0.393			15.65	9.32	0.21	0.050		
12					0.40			15.66	9.35	0.222	0.055		
13					0.406			15.71	9.36				
14					0.41				9.38				Ni by Difference
Average	0.0718	0.501	0.0076	0.0008	0.390	0.0399	73.586	15.617	9.304	0.205	0.036	0.212	73.53
Std Dev	0.0023	0.009	0.0004	0.0004	0.009	0.0053	0.097	0.041	0.040	0.008	0.008	0.010	
Certified	0.072	0.50	0.008	<0.002	0.39	0.040	73.59	15.62	9.30	0.20	0.04	0.21	
C(95%)	0.0017	0.006	0.0004	0.0004	0.0054	0.0044	0.074	0.025	0.023	0.005	0.005	0.007	

continued from above

Analysis	B	Mg	Mo	N	Sn	V	Ca	Nb	O	Pb	Ta	W
1	0.0010	0.0013	0.021	0.0070	0.001	0.017	0.0006	0.004	0.00100	0.00005	0.0018	0.0018
2	0.0010	0.0015	0.022	0.0073	0.0014	0.018	0.00079	0.005	0.0013	0.0004	0.002	0.002
3	0.0010	0.0016	0.025	0.0074	0.0017	0.019	0.00082	0.0061		0.001	0.004	0.004
4	0.0012	0.00222	0.027	0.0074	0.0019	0.0206	0.0013	0.010		0.0024		0.005
5	0.0012	0.0023	0.0280	0.0076	0.002	0.021	0.0015	0.010		0.006		
6	0.0012	0.0026	0.028	0.0079	0.003	0.0226		0.018				
7	0.0012	0.0027	0.0294		0.0038	0.026		0.020				
8	0.0012		0.0297			0.030		0.0206				
9	0.0012		0.030					0.021				
10	0.0014		0.030					0.021				
Average	0.00116	0.00203	0.0270	0.00743	0.0021	0.0218	0.00100	0.0136	0.0012	0.0020	0.0026	0.0032
Std Dev	0.00013	0.00056	0.0033	0.00030	0.0010	0.0044	0.00038	0.0072	0.0002	0.0024	0.0012	0.0016
Certified	0.0012	0.0020	0.027	0.0074	0.002	0.022	(0.0010)	(0.014)	(0.0012)	(0.002)	(0.003)	(0.003)
C(95%)	0.00009	0.00052	0.0024	0.00032	0.0009	0.0036						

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

C(95%) = (t x sd)/√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.

Revised Certificate: This material was originally certified for 14 elements on October 14, 1988. Results from a new interlaboratory testing program have provided additional data for the certification of more elements such as B, Mg, and N. Informational values were added for Ca, O, Pb, Ta, and W. The original size was noted as 44mm (1.75") in diameter and 12mm (0.50") thick, the actual size is 38mm (1.50") in diameter and 12mm (0.50") thick.

Certification Process: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, and ASTM Standard Guide E 1724 were followed for the preparation of this reference material and certificate of analysis. This is a reference material as defined by ISO Guide 30.

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the bars in accordance with ASTM Standard Practice E 59. 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 353, 354, E 1019, plus additional ICP and AA spectrometric methods.

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

Allegheny Ludlum Steel Corporation, Brackenridge, Pennsylvania
Allegheny Ludlum Steel Croporation, Lockport, New York
ANAREM, Prague, Czech Republic
Brammer Standard Co., Inc., Houston, Texas
Crucible Specialty Steel, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
Inco Alloys International, Huntington, West Virginia
LECO Corporation, St. Joseph, Michigan
Slater Steel Corporation, Ft. Wayne, Indiana
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 1243, 1244, 1245, 1247 and SS 363/1. The following Certified Reference Materials were used to validate the analytical data listed on page 2: NIST SRM 15h, 123c, 126c, 131e, 136e, 291, 349a, 864, 865, 866, 867, 868; BCS 310/1, 351, 451; ECRM 328-1.

Source: This material was produced by Inco Alloys International, Huntington, West Virginia. The material was made in an electric arc furnace and cast into ingots.

Available Form: This Reference Material is available in the form of a disc, approximately 38 mm (1.50") in diameter and 12 mm (0.50") thick.

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 nickel, chromium, and iron, 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 November 01, 2011.
Beau R. Brammer

Certificate Number REV600C-110111p3

By Certificate Number R-021, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9002 by th American Association for Laboratory Accreditation (A2LA).

Brammer Standard Company's Chemical Laboratory is accredited to ISO Guide 25 by A2LA. (Certificate Number 656

References:

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

E 59 - 93 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

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 354 - 93 Standard Test Methods for Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

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 1724 - 95 Standard Guide for Testing and Certification of Metal and Metal-Related 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 33 (First edition, 1989), Uses of certified reference materials.

ISO Guide 34 (First edition, 1996), Quality system guidelines for the production of 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.

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

Certificate Number REV600C-110111p4