Brammer Standard Company, Inc.

Certificate of Analysis

BS 750C

Certified Reference Material for Inconel X750 - UNS Number N07750

Certified Values[3]

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
Al	**0.91**	0.02	**Sn**	**0.0012**	0.0003
B	**0.0028**	0.0003	**Ti**	**2.61**	0.02
C	**0.041**	0.002	**V**	**0.132**	0.007
Co	**0.036**	0.003	**Zr**	**0.022**	0.002
Cr	**15.92**	0.04			
Cu	**0.012**	0.002			
Fe	**8.36**	0.07			
Mg	**0.0022**	0.0006			
Mn	**0.056**	0.002			
Mo	**0.070**	0.003			
N	**0.0031**	0.0006			
Nb	**0.83**	0.01			
Ni	**71.0**	0.2			
P	**0.0059**	0.0004			
Si	**0.071**	0.002			

Informational Values[3,4]

As (0.0009)	Ca (0.0006)	O (0.0014)	Pb (0.0001)	S (0.0004)
Sb (0.00007)	Ta (0.006)	W (0.0028)		

[1] For each element, the certified value listed is the present best estimate of the true value based on the mean of the weighted results of an interlaboratory testing program. See page 5 for more information on its calculation.

[2] For each element, the uncertainty listed is based on a statistical evaluation of the contributions of homogeneity and the interlaboratory testing program. See page 5 for more information on its calculation.

[3] Values are given in weight percent. Values in brackets are reported by difference.

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

Trace element information values for Ag, Bi, Cl, Ga, Ge, Hf, K, Na, Ru, Sc, Th, U, and Zn are shown on page 5.

The requirements of ISO Guides 31, 34, and 35 were followed for the preparation of this Certified Reference Material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

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BS 750C * Code for method Certified values listed as weight percent

Analysis	*	Al	*	B	*	C	*	Co	*	Cr	*	Cu	*	Fe	*	Mg
1	17	0.8465	5	0.001533	1	0.028267	12	0.0255	4	15.70333	12	0.0080	4	8.163333	3	0.0008
2	4	0.862333	2	0.002	1	0.038867	4	0.03	10	15.77	5	0.0081	4	8.24	5	0.0012
3	4	0.86575	10	0.002	3	0.0396	5	0.0310	13	15.785	8	0.008237	10	8.26	14	0.001533
4	3	0.8705	3	0.0020	1	0.03988	3	0.0315	10	15.79	5	0.0087	18	8.264	4	0.001567
5	4	0.888867	5	0.002523	18	0.040	4	0.031667	13	15.829	4	0.009	10	8.264	4	0.0016
6	4	0.89	4	0.002533	3	0.040	8	0.031833	3	15.85333	3	0.0097	4	8.29	5	0.001833
7	4	0.890333	7	0.002557	1	0.040333	17	0.03225	13	15.855	10	0.01	10	8.29	17	0.00195
8	3	0.8905	5	0.002633	1	0.040333	10	0.0327	4	15.87	4	0.01	4	8.2937	4	0.00204
9	4	0.894	14	0.0027	1	0.040633	4	0.033	13	15.88	5	0.010167	4	8.2975	12	0.0021
10	4	0.894	5	0.002767	1	0.0407	4	0.033133	10	15.88	17	0.01115	4	8.30	5	0.002733
11	14	0.899667	12	0.0028	1	0.0411	3	0.0336	14	15.88	10	0.012	4	8.321333	5	0.002767
12	4	0.902	3	0.0028	1	0.041467	4	0.034033	4	15.88667	4	0.0122	4	8.336667	3	0.004
13	3	0.902	3	0.00282	1	0.042067	4	0.034333	10	15.901	4	0.012333	13	8.37	3	0.004275
14	4	0.902	4	0.002833	3	0.0422	5	0.035867	18	15.93657	4	0.013867	13	8.377		
15	4	0.903767	4	0.002867	1	0.042433	10	0.0365	4	15.943	4	0.0139	4	8.39		
16	10	0.905	3	0.002975	1	0.042533	5	0.0365	18	15.94433	14	0.014133	4	8.430		
17	3	0.914	4	0.003	1	0.043428	4	0.0372	3	15.95	3	0.01415	3	8.45		
18	4	0.919667	3	0.003	3	0.0443	4	0.037467	13	15.95333	4	0.015	3	8.453333		
19	4	0.925	3	0.003065	1	0.045	14	0.038033	3	15.958	3	0.015	4	8.471067		
20	10	0.935	4	0.003067	3	0.0487	3	0.039	18	15.965	4	0.015067	3	8.475		
21	3	0.9475	4	0.0033			10	0.04	3	15.98	3	0.0173	14	8.493333		
22	3	0.968667	4	0.00335			3	0.0409	4	15.99			4	8.53		
23	10	0.978667	7	0.0034			4	0.041	4	16.00			3	8.63		
24	4	0.996	4	0.003767			3	0.045	4	16.0						
25							7	0.0456	4	16.025						
26							10	0.048	3	16.045						
27									3	16.06						
28									4	16.13333						
Average		0.9080		0.00276		0.04109		0.0360		15.92025		0.01181		8.36479		0.00218
Std dev		0.0020		0.00065		0.00071		0.0020		0.00060		0.00069		0.00066		0.00088
H		0.009453		0.000435		0.001411		0.001318		0.093141		0.000775		0.053297		0.000401
U_1		0.0097		0.00078		0.0016		0.0024		0.093		0.0010		0.053		0.00096
t-statistic		2.07		2.07		2.09		2.06		2.05		2.09		2.07		2.18
U_2		0.020		0.0016		0.0033		0.0049		0.19		0.0022		0.11		0.0021
U_3		0.0041		0.00033		0.00074		0.00095		0.036		0.00047		0.023		0.00058
Certified		**0.91**		**0.0028**		**0.041**		**0.036**		**15.92**		**0.012**		**8.36**		**0.0022**
Uncertainty		**0.02**		**0.0003**		**0.002**		**0.003**		**0.04**		**0.002**		**0.07**		**0.0006**
Tolerance		0.06		0.0016		0.006		0.009		0.19		0.006		0.21		0.0021

BS 750C * Code for method Certified values listed as weight percent

Analysis	*	Mn	*	Mo	*	N	*	Nb	*	Ni	*	P	*	Si	*	Sn
1	4	0.05	3	0.060833	2	0.002302	6	0.76	16	[70.425]	3	0.003	5	0.050667	9	0.0005
2	3	0.051	3	0.0635	2	0.0024	5	0.7900	16	[70.475]	5	0.003133	10	0.0612	5	0.0008
3	4	0.0521	4	0.064	2	0.00254	3	0.791	18	70.53	10	0.0035	3	0.0643	5	0.000877
4	10	0.052567	12	0.0650	2	0.0028	4	0.813333	16	[70.58]	3	0.0043	10	0.066	12	0.00090
5	4	0.053667	4	0.065467	2	0.00292	4	0.815	16	[70.7146]	3	0.004667	17	0.067	5	0.0009
6	4	0.054	7	0.0665	2	0.003107	4	0.816	17	70.73833	4	0.005067	3	0.067433	5	0.0009
7	8	0.054133	4	0.067	2	0.003133	4	0.816667	3	70.744	4	0.005433	4	0.068133	5	0.000943
8	4	0.054167	10	0.067	2	0.0032	3	0.823	6	70.78	3	0.0055	3	0.069	5	0.001033
9	4	0.0552	7	0.067533	2	0.0032	4	0.827067	4	70.816	7	0.005567	4	0.069133	17	0.0011
10	17	0.0553	4	0.068	2	0.003333	14	0.829667	14	70.83333	4	0.005867	4	0.069833	4	0.002
11	14	0.055633	4	0.068667	2	0.003367	10	0.83	10	70.849	4	0.0059	4	0.07	3	0.00285
12	5	0.056667	4	0.069	2	0.003493	10	0.83	3	70.94333	3	0.006	4	0.071		
13	3	0.056767	14	0.069533	2	0.0035	4	0.83025	16	[71.00]	4	0.006	6	0.071		
14	3	0.0573	3	0.0696	18	0.004	4	0.831333	10	71.00	10	0.006	14	0.0711		
15	12	0.0575	10	0.0700			6	0.835	13	71.003	14	0.006067	18	0.072		
16	4	0.05815	4	0.07			10	0.837333	16	[71.02333]	12	0.0061	5	0.072167		
17	3	0.0585	17	0.0715			3	0.838	4	71.04	5	0.0061	4	0.072367		
18	5	0.058567	5	0.071567			4	0.840	6	71.11033	3	0.0063	12	0.0725		
19	4	0.059	4	0.071733			10	0.841	3	71.12	10	0.0066	4	0.072933		
20	4	0.060	4	0.071967			4	0.843667	4	71.125	18	0.007	4	0.075		
21	10	0.06	4	0.0720			3	0.844	18	71.16	3	0.00705	3	0.075		
22	7	0.06	5	0.073667			4	0.847333	10	71.23	4	0.007287	3	0.08215		
23	4	0.060133	3	0.079			4	0.85	4	71.23333	7	0.00735	7	0.082567		
24	5	0.061133	3	0.079			3	0.851	4	71.36667	7	0.00786	3	0.09475		
25			10	0.080			3	0.852	10	71.42333	4	0.009				
26			10	0.08			4	0.8525	4	71.5						
27			3	0.082			7	0.868333								
Average		0.05631		0.07052		0.00309		0.82976		70.95245		0.00587		0.07113		0.00116
Std dev		0.00065		0.00061		0.00085		0.00061		0.00062		0.00063		0.00065		0.00030
H		0.01666		0.001884		0.000453		0.008869		0.375837		0.000578		0.001893		0.000328
U_1		0.0018		0.0020		0.00096		0.0089		0.38		0.00086		0.0020		0.00045
t-statistic		2.07		2.06		2.16		2.06		2.06		2.06		2.07		2.23
U_2		0.0037		0.0041		0.0021		0.018		0.77		0.0018		0.0041		0.00099
U_3		0.00075		0.00078		0.00055		0.0035		0.15		0.00035		0.00084		0.00030
Certified		**0.056**		**0.070**		**0.0031**		**0.83**		**71.0**		**0.0059**		**0.071**		**0.0012**
Uncertainty		**0.002**		**0.003**		**0.0006**		**0.01**		**0.2**		**0.0004**		**0.002**		**0.0003**
Tolerance		0.006		0.009		0.0021		0.03		0.8		0.0018		0.006		0.0010

BS 750C * Code for method Certified values listed as weight percent

Analysis	*	Ti	*	V	*	Zr
1	10	2.486667	17	0.104	3	0.01865
2	4	2.516667	4	0.117767	10	0.02
3	3	2.533333	3	0.118	3	0.020033
4	4	2.55	4	0.12	4	0.0212
5	7	2.550	4	0.120167	5	0.021333
6	4	2.57	14	0.122333	5	0.0216
7	10	2.58	4	0.122567	10	0.0216
8	3	2.59	12	0.1250	3	0.0219
9	4	2.59	5	0.126667	4	0.0224
10	4	2.597333	3	0.1308	4	0.022767
11	3	2.605	10	0.131	4	0.0233
12	7	2.605	4	0.1325	4	0.024
13	14	2.613333	4	0.133	3	0.02405
14	18	2.614	4	0.133667	5	0.024467
15	4	2.617	5	0.135667	4	0.024933
16	4	2.619	3	0.136	3	0.025
17	4	2.6245	4	0.137	14	0.025033
18	4	2.62900	7	0.137333	4	0.0258
19	10	2.63	10	0.138667	10	0.0264
20	3	2.635	3	0.139	12	0.0270
21	4	2.642	10	0.14	3	0.027
22	4	2.645	10	0.144		
23	10	2.650	4	0.145		
24	4	2.65	3	0.145333		
25	4	2.675	5	0.1488		
26	3	2.70	4	0.159		
	3	2.704				
Average		2.60822		0.13243		0.02220
Std dev		0.00061		0.00062		0.00067
H		0.020701		0.002701		0.001037
U_1		0.021		0.0028		0.0012
t-statistic		2.06		2.06		2.09
U_2		0.043		0.0057		0.0026
U_3		0.0082		0.0011		0.00056
Certified		**2.61**		**0.132**		**0.022**
Uncertainty		**0.02**		**0.007**		**0.002**
Tolerance		0.06		0.021		0.006

BS 750C * Code for method Informational values listed as weight percent

Analysis	*	As	*	Ca	*	O	*	Pb	*	S	*	Sb	*	Ta	*	W
1	5	0.0004	12	0.00017	2	0.0011	5	0.0000267	1	0.0001	12	0.000072	5	0.000267	5	0.001867
2	12	0.00050	4	0.000333	2	0.00112	14	0.00004	12	0.00018	5	0.0000773	12	0.00045	12	0.0021
3	15	0.000613	4	0.000423	2	0.001167	17	0.000092	3	0.0002			5	0.000813	3	0.0027
4	5	0.000633	3	0.000435	2	0.001173	5	0.00010	1	0.00032			4	0.01	5	0.00334
5	4	0.000833	4	0.000467	2	0.0012	5	0.0001	1	0.000333			3	0.019	3	0.0034
6	5	0.00093	4	0.00063	2	0.001227	12	0.00012	1	0.0005					5	0.003567
7	4	0.001	3	0.000775	2	0.0013	9	0.0001467	10	0.0005					5	0.0037
8	3	0.001085	4	0.0012	2	0.00132	4	0.000355	1	0.0005					5	0.004433
9	3	0.00115	17	0.00125	2	0.00134			1	0.000503					4	0.006333
10	9	0.0013			2	0.001467			1	0.000667					4	0.008
11	4	0.001433			2	0.002284			3	0.00075						
12					18	0.0055										
Average		0.00090		0.0006		0.00144		0.0001		0.00035		0.0001		0.0061		0.00282
Std dev		0.00095		0.0011		0.00085		0.0011		0.00088		0.0022		0.0014		0.00085
H		0.000305		0.000273		0.000351		0.00019		0.00024		0.00019		0.000587		0.000439
U_1		0.0010		0.0011		0.00092		0.0011		0.00091		0.0022		0.0015		0.00095
t-statistic		2.23		2.31		2.20		2.36		2.23		12.71		2.78		2.26
U_2		0.0022		0.0025		0.0020		0.0027		0.0020		0.029		0.0043		0.0022
U_3		0.00067		0.00084		0.00058		0.00095		0.00061		0.020		0.0019		0.00068
(Informational)		**(0.0009)**		**(0.0006)**		**(0.0014)**		**(0.0001)**		**(0.0004)**		**(0.00007)**		**(0.006)**		**(0.0028)**

For each element, in accordance with the requirements of ISO Guides 34 and 35, an effort must be made to account for the effects on the certified value of the uncertainty estimate from homogeneity testing (H) and the uncertainties of the contributing laboratories. The average (A) is calculated using a weighted mean where the reciprocal of the square of each laboratory's combined uncertainty (C_L), calculated from its standard deviation (S_L) and its uncertainty estimate (U_L), is used as the weight (W_L) for it's mean (M_L). The standard deviation (S) is calculated as the square root of the reciprocal of the sum of the weights. U_1 is the combined uncertainty from homogeneity and labs. U_2 is U_1 multiplied by the coverage factor (95 % t-statistic). U_3 is U_2 divided by the square root of the number of determinations (n). Thus:

$$C_L = \sqrt{S_L^2 + U_L^2} \qquad W_L = \frac{1}{C_L^2} \qquad A = \frac{\sum_{i=1}^{n} W_L M_L}{\sum_{i=1}^{n} W_L} \qquad S = \frac{1}{\sqrt{\sum_{i=1}^{n} W_L}} \qquad U_1 = \sqrt{H^2 + S^2} \qquad U_2 = t \times U_1 \qquad U_3 = \frac{U_2}{\sqrt{n}}$$

*All but the final reported values are taken to two significant figures as determined by each quantity's uncertainty estimate. The final reported Uncertainty is U_3 rounded to one significant figure and represents the half width of the 95 % confidence interval for the **Certified** value. The final reported **Certified** value is A rounded to the same decimal place as the Uncertainty. The Uncertainty is a measure of the quality of the **Certified** value.*

The Tolerance is a measure of the expected performance of an analysis. This involves further expanding the sample uncertainty to include instrument and operator uncertainty, for those without access to such calculations.

For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 section 6.

BS 750C * Code for analytical method Trace analysis listed as mg/kg (ppm)

Analysis	*	Ag	*	Bi	*	Cl	*	Ga	*	Ge	*	Hf	*	K	*	Na	*	Ru	*	Sc
1	5	2	12	0.13	12	0.11	12	9.0	12	1.9	12	0.21	12	0.23	12	0.30	5	1	5	3
2	5	2					5	10	5	4	5	0.34					5	2	5	5
3	5	2					5	10	5	4	5	0.38					5	2		
4							5	10	5	4	5	0.38								
5							5	12												
6							5	12												
7							5	12												

Analysis	*	Th	*	U	*	Zn
1	12	0.047	12	0.030	12	5.5
2	5	0.15			5	60
3	5	0.15			5	61
4	5	0.16			5	63

Analytical Method Codes:

1	Combustion (ASTM E1019)	7	Photometric	13	Titrimetric
2	Fusion (ASTM E1019)	8	Flame Atomic Absorption	14	DCP Atomic Emission
3	Spark Atomic Emission	9	GF Atomic Absorption	15	HG Atomic Fluorescence
4	ICP Atomic Emission	10	X-Ray Fluorescence	16	Difference
5	ICP Mass Spectrometry	11	GD Atomic Emission	17	Atomic Absorbtion Spectormetry
6	Gravimetric	12	GD Mass Spectrometry	18	Wet

ICP = Inductively Coupled Plasma GF = Graphite Furnace GD = Glow Discharge
DCP = Direct Current Plasma HG = Hydride Generation

Laboratory	Location	Registrar	Accreditation
Brammer Standard Company, Inc.	Houston, TX	A2LA	17025, Guide 34
LECO Corporation	St. Joseph, MI		
Dirats Laboratories	Westfield, MA	ANAB	17025
Crucible Specialty Metals	Syracuse, NY		
Laboratory Testing, Inc.	Dublin, PA	PRI/Nadcap	
VHG Labs, Inc.	Manchester, NH		
IncoTest	Huntington, WV	Nadcap	
Shiva Analyticals (India) Ltd.	Bangalore, India		
Evans Analytical Group	Liverpool, NY	A2LA	17025
NSL Analytical	Cleveland, OH	ANAB	17025
Laboratory Testing, Inc.	Hatfield, PA	PRI/Nadcap	17025
Instytut Metalurgii Zelaza	Gliwice, Poland	PCA	AB 554
Anderson Laboratories	Greendale, WI	A2LA	17025
National Analysis Center for Iron and Steel	Beijing, China	CNAS	17025
Luvak, Inc.	Boylston, MA	A2LA	17025
Exova	Glendale heights, IL	A2LA	17025
TUV Rheinland Limited	Karnatake, India	NABL	17025
Northern Analytical Laboratory, Inc.	Lodonderry, NH	PRI/Nadcap	17025

A2LA = American Association for Laboratory Accreditation
ANAB = ANSI-ASQ National Accreditation Board
CNAS = China National Accreditation Service
NABL = National Accreditation Board for Testing and Calibration Laboratories
Nadcap = National Aerospace and Defense Contractors Accreditation Program
PCA = Polish Center For Accreditation
PRI =Performance Review Institute

Analysis: Chemical analyses were made on solid pieces and chips prepared by an end mill from representative samples for the certified portion of the lot in accordance with ASTM Standard Practice E1806. The laboratories participating in the testing followed the requirements of ISO Standard 17025.

Traceability: The following Certified Reference Materials were used to validate the analytical data: 11XC4, 11XC8, 12X357; 501-257, 501-320, 501-501, 501-503, 501-504, 501-644, 501-646, 501-674, 501-675, 501-676, 501-992, 501-993, 502-348, 502-416, 502-873; AR 511, 645, 657, 659, 670, 875, 892, 1649, 1653, 1656; BAS 54, 310/1, 342, 345, 349A, 351, 387, 434; BS CSN-2D, HON-T, H3B, H3C, 56H, 61G, 66L, 75G, 199, 199B, 200-2, 200-4, 600-2, 600-5, 600B, 600C, 718B, 750, 750A, 2931A; CKD 162A; ECRM 088-1, 096-1, 85, 86, 87, 184-1, 284-1, 481-1; IARM 54B, 56C, 56D, 56G, 57A, 57B, 57C, 57D, 62E, 68C, 100B, 190A; IMZ 1.22, 63/1, 74, 112, 114, 119, 187, 202; NCS NS11028; SRM 15F, 33D, 73C, 101G, 125B, 325, 345, 348A, 349, 349A, 362, 364, 690, 864, 865, 866, 867, 868, 882, 898, 1188, 1208, 1243, 1244, 1249, 1264, 1765, 1766, 2166, 3109A, 3165.

Homogeneity: This Certified Reference Material (CRM) was tested for homogeneity using ASTM Standard Method E826 and found acceptable. It was also examined by spark atomic emission spectrometry and found to be compatible with the following Reference Materials — 501-676; BAS 351; BS HON-T, HT8209X, HT8211X, 199, 199B, 600-2, 600-5, 600B, 600C, 750, 750A; MQ CA01a; NCS NS11028; SRM 864, 866, 1244.

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. The certification of BS 750C is valid indefinitely. The certification is nullified if this CRM is damaged, contaminated, or otherwise modified.

Source: The bar stock for this CRM was produced by Carpenter Technology Corporation; Reading, PA.

Form: This CRM is machined in the form of a disc approximately 41 mm in diameter and 19 mm thick by Brammer Standard Company, Inc.

Use: This CRM is intended for use in spark atomic emission, glow discharge, and x-ray spectrometric methods of analysis. Refer to ISO Guide 33 for information about the use of Certified Reference Materials.

Certified Area: The entire depth of the CRM may be used.

Caution: As with any bar material, avoid spark atomic emission spectrometric burns in the center of the CRM (5 mm radius), as some segregation may be present.

Sample Preparation: For best analytical results, use the same method for preparing the analytical surface on all reference materials as used for production specimens. Avoid overheating the sample during surface preparation.

Certificate Number: The unique identification number for this certificate of analysis is 750C-072916. You may obtain information on revisions of certificates from the internet at **www.brammerstandard.com**.

Safety Notice: A Safety Data Sheet (SDS) 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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Brammer Standard Company, Inc., is accredited by the American Association For Laboratory Accreditation (A2LA) to ISO Guide 34 as a Reference Material Producer for the production of Certified Reference Materials and Reference Materials (Certificate Number 656.02)

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

By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9001:2008 by National Quality Assurance (NQA), U.S.A.

The scopes of accreditation are listed on the website: www.brammerstandard.com

References:

Versions used were those available at the time of testing and characterization

E826 Standard Practice for Testing Homogeneity of a Metal Lot or Batch in Solid Form by Spark Atomic Emission Spectrometry

E1019 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

E1806 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

ISO Standard 17025:2005 General requirements for the competence of testing and calibration laboratories

ISO Standard 9001:2008 Quality Management Systems - Requirements

ISO Guide 30:1992 Terms and definitions used in connection with reference materials + 2008 amendment

ISO Guide 31:2000 Reference materials - Contents of certificates and labels

ISO Guide 33:2000 Uses of certified reference materials

ISO Guide 34:2009 General requirements for the competence of reference material producers

ISO Guide 35:2006 Reference Materials - General and statistical principles for certification

ASTM documents available from ASTM, 100 Barr Harbor Dr., West Conshohocken, Pa 19428.

*ISO Guides and Standards available from Global Engineering - **www.global.ihs.com***

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

Certified by: _____ on July 29, 2016.

Beau R. Brammer