Brammer Standard Company, Inc.

Certificate of Analysis

BS 285BF

Certified Reference Material for Chill Cast Iron

Certified Values[3]

	Certified Value[1]	Estimate of Uncertainty[2]		Certified Value[1]	Estimate of Uncertainty[2]
Al	**0.0164**	0.0004	**Nb**	**0.0039**	0.0002
As	**0.0009**	0.0003	**Ni**	**1.386**	0.009
B	**0.0084**	0.0003	**P**	**0.0472**	0.0007
C	**3.43**	0.03	**Pb**	**0.0008**	0.0002
Ca	**0.0010**	0.0001	**S**	**0.0127**	0.0009
Co	**0.0033**	0.0006	**Si**	**1.93**	0.01
Cr	**1.047**	0.007	**Sn**	**0.0018**	0.0005
Cu	**0.320**	0.002	**Ti**	**0.0424**	0.0006
Fe	**90.54**	0.08	**V**	**0.122**	0.001
Mg	**0.050**	0.001	**W**	**0.0608**	0.0008
Mn	**0.732**	0.003	**Zr**	**0.0054**	0.0003
Mo	**0.238**	0.002			

Informational Values[3,4]

Sb (0.2)

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.

The requirements of ISO Guides 30, 31, and 35 were followed for the preparation of this Certified Reference Material and certificate of analysis.

BS 285BF * Code for method Certified values listed as weight percent

Analysis	*	Al	*	As	*	B	*	C	*	Ca	*	Co	*	Cr	*	Cu	*	Fe	*	Mg
1	4	0.015767	3	0.0001	4	0.00753	3	3.36	4	0.0006	3	0.0005	3	1.03	4	0.31167	3	90.46	3	0.04953
2	3	0.0159	3	0.0001	3	0.00803	3	3.36	4	0.0006	3	0.0007	4	1.0327	4	0.3130	3	90.47	3	0.04962
3	3	0.0159	3	0.0001	3	0.00804	1	3.386667	3	0.00083	3	0.0008	3	1.04	10	0.313	3	90.48	3	0.04964
4	3	0.016	3	0.0003	14	0.0081	3	3.39	3	0.00085	3	0.0012	3	1.04	3	0.315	3	90.48	3	0.04965
5	3	0.016	3	0.0003	3	0.0082	3	3.39	3	0.00086	3	0.0016	3	1.04	3	0.315	3	90.49	3	0.04972
6	3	0.016	3	0.0004	3	0.00823	3	3.39	3	0.00088	3	0.0021	3	1.04	3	0.316	3	90.49	3	0.04989
7	3	0.0161	3	0.0004	3	0.00823	3	3.4	3	0.00089	3	0.0022	3	1.04	3	0.317	3	90.49	3	0.04992
8	3	0.0161	3	0.0004	3	0.00824	3	3.4	3	0.0009	3	0.0027	3	1.04	3	0.317	3	90.49	3	0.04994
9	4	0.0161	3	0.0004	3	0.00824	3	3.4	3	0.00091	3	0.0029	3	1.04	3	0.318	3	90.50	3	0.04997
10	3	0.0161	3	0.0006	3	0.00828	1	3.408733	3	0.00092	3	0.0029	3	1.04	3	0.318	3	90.51	3	0.04997
11	3	0.0162	3	0.0006	3	0.0083	3	3.41	3	0.00092	3	0.003	3	1.04	3	0.318	3	90.52	3	0.04998
12	3	0.0162	3	0.0006	3	0.0083	3	3.41	3	0.00093	3	0.0031	3	1.04	3	0.318	3	90.53	3	0.04998
13	3	0.0162	3	0.0007	3	0.00832	3	3.42	3	0.00093	3	0.0031	3	1.04	3	0.319	3	90.53	3	0.05005
14	3	0.0162	3	0.0007	3	0.00833	3	3.42	3	0.00094	3	0.0031	3	1.04	3	0.319	3	90.53	3	0.05013
15	3	0.0163	3	0.0008	3	0.00834	3	3.42	3	0.00094	10	0.0032	10	1.04	3	0.319	16	90.53	3	0.05016
16	3	0.0163	3	0.0008	3	0.00834	3	3.42	3	0.00095	3	0.0033	3	1.04	3	0.319	16	90.54	3	0.05021
17	3	0.0163	3	0.0009	3	0.00835	3	3.42	3	0.00096	3	0.0033	3	1.04	3	0.319	3	90.54	3	0.05027
18	14	0.0164	3	0.001	3	0.00836	3	3.42	3	0.00097	3	0.0033	3	1.04667	3	0.319	3	90.54	3	0.05027
19	3	0.0164	3	0.001	3	0.00836	1	3.426667	3	0.00097	3	0.003367	3	1.05	3	0.319	3	90.54	3	0.05028
20	3	0.0164	3	0.001	3	0.00836	3	3.43	3	0.00099	4	0.003433	3	1.05	3	0.32	3	90.54	3	0.0503
21	3	0.0165	3	0.001	3	0.00837	3	3.43	3	0.001	3	0.0035	14	1.05	3	0.32	3	90.54	3	0.05032
22	3	0.0165	3	0.0011	3	0.00837	3	3.43	3	0.00103	3	0.0035	3	1.05	3	0.32	3	90.55	3	0.05033
23	3	0.0165	3	0.0012	3	0.00838	3	3.44	3	0.00104	3	0.0035	3	1.05	3	0.32	3	90.55	3	0.05034
24	3	0.0166	5	0.001233	3	0.0084	3	3.45	14	0.001067	3	0.0036	3	1.05	3	0.32	3	90.55	3	0.05034
25	3	0.0166	3	0.0014	3	0.0084	3	3.45	3	0.00108	3	0.0036	3	1.05	3	0.32	3	90.55	3	0.05035
26	3	0.0166	3	0.0014	3	0.00841	3	3.45	3	0.00109	3	0.0038	3	1.05	3	0.321	3	90.56	3	0.05036
27	3	0.0166	3	0.0015	3	0.00842	3	3.45	3	0.0011	14	0.0039	3	1.05	3	0.321	3	90.56	3	0.05038
28	3	0.0167	3	0.0016	3	0.00843	3	3.45	3	0.0011	3	0.0043	3	1.05	3	0.321	3	90.56	3	0.05038
29	3	0.0167	3	0.0017	3	0.00843	3	3.46	3	0.00114	3	0.0043	3	1.05	14	0.32133	3	90.57	3	0.05041
30	3	0.0167	5	0.001767	3	0.00845	3	3.46	3	0.00116	3	0.0043	3	1.05	3	0.322	3	90.57	3	0.05041
31	3	0.0168	3	0.0018	3	0.00846	3	3.46	3	0.00118	3	0.0044	3	1.05	3	0.322	3	90.58	3	0.05044
32	3	0.0168			3	0.00847	3	3.46	3	0.00122	3	0.0044	3	1.05	3	0.322	3	90.58	3	0.05046
33	3	0.0169			3	0.00851	3	3.46	3	0.00123	5	0.004667	3	1.05	3	0.322	3	90.58	3	0.05048
34	3	0.0169			3	0.00859	1	3.466533	3	0.00123	3	0.0047	3	1.05	3	0.323	3	90.59	3	0.05048
35	3	0.017			5	0.00862	3	3.47	3	0.00141	3	0.0047	3	1.05	3	0.323	3	90.59		
36	3	0.017			3	0.00867	3	3.48	3	0.00158	3	0.0049	3	1.05	3	0.323	14	90.60		
37					3	0.00874	3	3.49	3	0.00176	3	0.0055	3	1.05	3	0.324	4	90.61		
38					4	0.01043	3	3.506667			5	0.0055	3	1.05	3	0.325	3	90.61		
39							3	3.51					4	1.06433	3	0.326				
40													4	1.07333						
Average		0.01642		0.000868		0.00836		3.432186		0.000970		0.003339		1.047		0.3202		90.544		0.05014
Std Dev		0.00029		0.000057		0.00020		0.000051		0.000069		0.000051		0.012		0.0047		0.033		0.00086
H		0.0012		0.00037		0.00089		0.022		0.00039		0.00061		0.011		0.0054		0.23		0.0020
U_1		0.0012		0.00038		0.00091		0.022		0.00039		0.00062		0.016		0.0071		0.23		0.0022
t-statistic		2.03		2.04		2.03		2.02		2.03		2.03		2.02		2.02		2.03		2.03
U_2		0.0025		0.00077		0.0019		0.045		0.00080		0.0012		0.033		0.014		0.46		0.0045
U_3		0.00042		0.00014		0.00030		0.0073		0.00013		0.00020		0.0051		0.0023		0.075		0.00077
Certified		**0.0164**		**0.0009**		**0.0084**		**3.43**		**0.0010**		**0.0033**		**1.047**		**0.320**		**90.54**		**0.050**
Uncertainty		0.0004		0.0003		0.0003		0.03		0.0001		0.0006		0.007		0.002		0.08		0.001
Tolerance		0.0025		0.0009		0.0019		0.09		0.0008		0.0018		0.002		0.014		0.46		0.003

BS 285BF * Code for method Certified values listed as weight percent

Analysis	*	Mn	*	Mo	*	Nb	*	Ni	*	P	*	Pb	*	S	*	Si	*	Sn	*	Ti
1	14	0.722333	5	0.230	3	0.0024	4	1.312333	5	0.038633	5	0.0002	1	0.00943	4	1.850	3	0.001	3	0.0315
2	3	0.723	4	0.231233	3	0.0036	10	1.32	10	0.044	9	0.0002	3	0.011	3	1.91	5	0.001	4	0.04083
3	3	0.725	10	0.235	3	0.0037	3	1.34	3	0.0459	3	0.0004	1	0.01103	3	1.92	5	0.001033	5	0.04157
4	3	0.726	3	0.236	3	0.0037	4	1.346433	3	0.0463	3	0.0006	3	0.0117	3	1.92	3	0.0011	3	0.0422
5	3	0.728	3	0.236	3	0.0037	4	1.353333	3	0.0463	3	0.0006	3	0.0117	3	1.92	3	0.0011	3	0.0423
6	3	0.728	3	0.237	3	0.0038	3	1.359667	3	0.0463	3	0.0007	3	0.0118	3	1.92	10	0.0012	3	0.0424
7	3	0.728	3	0.237	3	0.0038	3	1.36	3	0.0464	3	0.0007	3	0.012	3	1.92	3	0.0013	3	0.0424
8	3	0.729	3	0.237	3	0.0038	3	1.37	3	0.0464	3	0.0008	3	0.012	3	1.92	3	0.0013	10	0.0425
9	3	0.729	3	0.237	3	0.0038	3	1.37	3	0.0467	3	0.0008	3	0.012	3	1.92	3	0.0013	3	0.0425
10	3	0.729	3	0.237	3	0.0038	3	1.37	3	0.0467	3	0.0008	3	0.0121	3	1.92	3	0.0014	3	0.0426
11	3	0.729	3	0.237	3	0.0038	3	1.38	3	0.0469	3	0.0008	3	0.0122	3	1.92	3	0.0014	3	0.0426
12	3	0.73	3	0.237	4	0.00387	3	1.38	3	0.047	3	0.0008	3	0.0122	14	1.92667	3	0.0015	3	0.0426
13	3	0.73	3	0.237	14	0.00387	3	1.38	3	0.047	3	0.0008	3	0.0122	3	1.93	3	0.0015	3	0.0426
14	3	0.73	3	0.237	3	0.0039	3	1.38	3	0.047	3	0.0008	3	0.0122	3	1.93	3	0.0015	3	0.0426
15	3	0.731	3	0.237	3	0.0039	3	1.38	3	0.047	10	0.0008	3	0.0123	3	1.93	3	0.0015	3	0.0426
16	3	0.731	3	0.237	3	0.0039	3	1.38	3	0.0471	3	0.0008	3	0.0124	3	1.93	3	0.0016	14	0.04263
17	3	0.731	3	0.238	3	0.0039	3	1.38	3	0.0471	3	0.0008	3	0.0124	3	1.93	3	0.0016	3	0.0427
18	3	0.731	14	0.238	3	0.0039	14	1.386667	3	0.0471	3	0.0009	3	0.0125	3	1.93	3	0.0016	3	0.0427
19	3	0.731	3	0.238	3	0.0039	3	1.39	3	0.0471	3	0.0009	3	0.0126	3	1.93	9	0.001667	3	0.0427
20	3	0.731	3	0.238	3	0.0039	3	1.39	3	0.0472	3	0.0009	1	0.0126	3	1.93	3	0.0017	3	0.0427
21	3	0.731	3	0.238	3	0.0039	3	1.39	3	0.0472	3	0.0009	3	0.0126	3	1.93	3	0.0017	3	0.0427
22	10	0.732	3	0.238	3	0.004	3	1.39	14	0.0472	3	0.0009	3	0.0126	3	1.93	3	0.0017	4	0.04273
23	3	0.732	3	0.238	3	0.004	3	1.39	3	0.0473	3	0.0009	1	0.01267	3	1.93	3	0.0018	3	0.0428
24	3	0.732	3	0.238	3	0.004	3	1.39	3	0.0473	3	0.0009	3	0.0127	3	1.93	3	0.0019	3	0.0428
25	3	0.733	3	0.238	3	0.004	3	1.39	3	0.0473	3	0.0009	3	0.0128	3	1.93	3	0.0019	3	0.0428
26	3	0.733	3	0.238	3	0.004	3	1.39	3	0.0473	3	0.001	3	0.0128	3	1.93	3	0.0019	3	0.0428
27	3	0.733	3	0.238667	3	0.004	3	1.4	3	0.0473	3	0.001	10	0.013	3	1.93	3	0.002	3	0.0428
28	3	0.733	3	0.239	3	0.004	3	1.4	3	0.0474	3	0.001	3	0.013	3	1.93	3	0.0021	3	0.0429
29	3	0.734	3	0.239	3	0.004	3	1.4	3	0.0476	3	0.001	3	0.0131	3	1.93	3	0.0021	3	0.0429
30	3	0.734	3	0.239	3	0.004	3	1.4	3	0.0478	3	0.001	3	0.0131	3	1.93	3	0.0022	3	0.0429
31	4	0.734667	3	0.239	3	0.0041	3	1.4	3	0.0482	3	0.001	3	0.0131	3	1.93	3	0.0023	3	0.043
32	3	0.735	4	0.239	3	0.0041	3	1.4	3	0.0484	3	0.0011	3	0.0131	3	1.93	3	0.0023	3	0.043
33	3	0.735	3	0.239	3	0.0041	3	1.41	3	0.0487	3	0.0011	3	0.0132	3	1.94	5	0.002467	3	0.0431
34	3	0.735	3	0.24	3	0.0042	3	1.41	3	0.0488	3	0.0011	3	0.0133	3	1.94	3	0.0025	3	0.0432
35	3	0.735	3	0.24	3	0.0042	3	1.41	3	0.0489	3	0.0011	3	0.0133	3	1.94	3	0.0028	3	0.0432
36	3	0.737	3	0.24	3	0.0042	3	1.41	3	0.049	3	0.0012	3	0.0133	3	1.94	3	0.0029	3	0.0432
37	3	0.739	3	0.24			3	1.42	3	0.0491	3	0.0012	3	0.0135	17	1.94883	3	0.0031	3	0.0433
38	3	0.739	3	0.24			3	1.43	4	0.049367			3	0.0135			3	0.0032	3	0.0433
39	4	0.743467	3	0.24			3	1.45	3	0.0501			3	0.0145					3	0.0435
40			3	0.241			3	1.45	4	0.051033			3	0.0192					3	0.0435
Average		0.731602		0.2379		0.00386		1.386461		0.04721		0.000849		0.01266		1.926		0.001794		0.04245
Std Dev		0.000051		0.0035		0.00013		0.000050		0.00078		0.000052		0.00022		0.025		0.000051		0.00070
H		0.0084		0.0046		0.00065		0.013		0.001969		0.00037		0.0011		0.016		0.00048		0.00187
U_1		0.0086		0.0057		0.00066		0.013		0.0021		0.00037		0.0011		0.029		0.00049		0.0020
t-statistic		2.02		2.02		2.03		2.02		2.02		2.03		2.02		2.03		2.03		2.02
U_2		0.017		0.012		0.0013		0.026		0.0043		0.00076		0.0022		0.060		0.0010		0.0040
U_3		0.0027		0.0018		0.00022		0.0041		0.00068		0.00013		0.00035		0.010		0.00016		0.00064
Certified		**0.732**		**0.238**		**0.0039**		**1.386**		**0.0472**		**0.0008**		**0.0127**		**1.93**		**0.0018**		**0.0424**
Uncertainty		0.003		0.002		0.0002		0.009		0.0007		0.0002		0.0009		0.01		0.0005		0.0006
Tolerance		0.009		0.012		0.0013		0.027		0.0043		0.0006		0.0027		0.06		0.0015		0.0040

BS 285BF * Code for method Certified values listed as weight percent

Analysis	*	V	*	W	*	Zr
1	3	0.115	3	0.059	14	0.00293
2	5	0.118667	3	0.0593	5	0.0036
3	10	0.12	3	0.0595	3	0.005
4	3	0.12	3	0.0597	3	0.0052
5	3	0.121	3	0.0598	3	0.0053
6	3	0.121	3	0.0599	3	0.0053
7	3	0.121	10	0.06	3	0.0053
8	3	0.121	3	0.0602	3	0.0054
9	3	0.121	3	0.0602	3	0.0054
10	3	0.121	3	0.0602	3	0.0054
11	3	0.121	3	0.0602	3	0.0054
12	3	0.122	3	0.0603	3	0.0054
13	3	0.122	3	0.0603	3	0.0054
14	3	0.122	3	0.0603	3	0.0054
15	3	0.122	3	0.0604	3	0.0054
16	3	0.122	3	0.0604	3	0.0054
17	3	0.122	3	0.0606	3	0.0054
18	3	0.122	3	0.0607	3	0.0055
19	3	0.122	3	0.0607	3	0.0055
20	3	0.122	3	0.0607	3	0.0055
21	3	0.122	4	0.0608	3	0.0055
22	3	0.122	3	0.0608	3	0.0055
23	3	0.122	14	0.0608	3	0.0055
24	3	0.122	3	0.0608	3	0.0055
25	3	0.122	3	0.0609	3	0.0056
26	3	0.122	3	0.0609	3	0.0056
27	3	0.122	3	0.061	3	0.0056
28	3	0.122	3	0.061	3	0.0056
29	3	0.122	3	0.0611	3	0.0056
30	3	0.122	3	0.0612	3	0.0057
31	3	0.122	3	0.0613	3	0.0057
32	4	0.1223	3	0.0614	3	0.0057
33	3	0.123	3	0.0614	3	0.0057
34	3	0.123	3	0.0615	3	0.0057
35	3	0.123	3	0.0616	3	0.0059
36	3	0.123	3	0.0619	3	0.006
37	14	0.123	4	0.063		
38	3	0.123	3	0.063333		
39	3	0.123	5	0.063933		
40	4	0.127333				
Average		0.1215		0.0608		0.00543
Std Dev		0.0019		0.0010		0.00014
H		0.0032		0.0022		0.00075
U_1		0.0037		0.0024		0.00076
t-statistic		2.02		2.02		2.03
U_2		0.0075		0.0049		0.0015
U_3		0.0012		0.00079		0.00026
Certified		**0.122**		**0.0608**		**0.0054**
Uncertainty		0.001		0.0008		0.0003
Tolerance		0.008		0.0049		0.0015

BS 285BF * Code for method Informational values listed as weight percent

Analysis	*	Sb
1	10	0.2
Average		0.20
Std Dev		2.18
H		0.004
U_1		2.18
t-statistic		12.71
U_2		27.77
U_3		27.77
Informational		(0.2)

For each element, in accordance with the requirements of ISO 17034 and Guide 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.

Analytical Method Codes:

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

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

Lab Name	Location	Registrar	Accreditation
Dirats Laboratories	Westfield,MA	ANAB	17025
NSL Analytical	Cleveland, OH	ANAB	17025
Laboratory Testing, Inc.	Hatfield, PA	PRI	17025
Instytut Metalurgii Zelaza	Gliwice, Poland	PCA	17025
Luvak Inc.	Boylston, MA	PRI	17025
Brammer Standard Company, Inc.	Houston, TX	A2LA	17025, 17034

A2LA = American Association for Laboratory Accreditation
ANAB = ANSI-ASQ National Accreditation Board
PCA = Polish Center For Accreditation
PRI =Performance Review Institute

Analysis: Chemical analyses were made on solid pieces 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: 11XC1N, 11XC2R, 11XC6U, 11XSG1A; AR 303, 306, 510, 892, 4007; BS 5, 27, 45B, 188B, 199B, 285, 285AA, 286AE, 291, 291DJ, 410C, 416, 9325A; CKD 235, 236, 238, 239; SPL 2A, 6A, 15A; SRM 16F, 55D, 82, 361, 362, 363, 2159, 3113.

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 — BS 5, 27, 285, 285AA, 286AE, 291, 291DJ.

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 285BF is valid indefinitely. The certification is nullified if this CRM is damaged, contaminated, or otherwise modified.

Storage: This CRM must be stored in a cool, dry, non-corrosive environment.

Source: The cast stock for this CRM was produced by Shijiazhuang Trump Scientific Co, LTD.

Form: This CRM is machined in the form of a disc, approximately 35 mm in diameter and 30 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 certified area of each disc is the portion extending upward 25 mm from the analytical surface.

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 285BF-052218. 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:

Brammer Standard Co., Inc.
14603 Benfer Road
Houston, Texas 77069-2895 USA
Phone: (281) 440-9396 **Web: www.brammerstandard.com**
Fax: (281) 440-4432 **Email: contact@brammerstandard.com**

Brammer Standard Company, Inc., is accredited by the American Association For Laboratory Accreditation (A2LA) to ISO Standard 17034 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 by National Quality Assurance (NQA), U.S.A.

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

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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 9001:2015 Quality Management Systems - Requirements

ISO Guide 30:2015 Terms and definitions used in connection with reference materials + 2008 amendment

ISO Guide 31:2015 Reference materials - Contents of certificates and labels

ISO Guide 33:2015 Uses of certified reference materials

ISO Standard 17034:2016 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 May 22, 2018.

Beau R. Brammer

President