

Brammer Standard Company, Inc.

Certificate of Analysis

BS 285BG

Certified Reference Material for Chill Cast Iron

	Certified Value ¹	Estimate of Uncertainty ²	Certified Values³	Certified Value ¹	Estimate of Uncertainty ²
Al	0.0165	0.0004		Nb	0.0002
As	0.0008	0.0003		Ni	0.03
B	0.0084	0.0003		P	0.0006
C	3.44	0.03		Pb	0.0002
Ca	0.0010	0.0001		S	0.0005
Co	0.0038	0.0006		Si	0.01
Cr	1.05	0.01		Sn	0.0004
Cu	0.321	0.002		Ti	0.0006
Fe	90.54	0.07		V	0.001
Mg	0.051	0.001		W	0.0009
Mn	0.731	0.003		Zr	0.0002
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.

Analysis	*	Al	*	As	*	B	*	C	*	Ca	*	Co	*	Cr	*	Cu	*	Fe	*	Mg
1	3	0.013	3	0.0001	4	0.00753	3	3.37	4	0.0006	3	0.0011	3	1.03	4	0.31167	3	90.44	3	0.05064
2	5	0.013967	3	0.0001	3	0.0081	1	3.386667	4	0.0006	3	0.0014	4	1.0327	10	0.313	3	90.45	3	0.05067
3	3	0.014067	3	0.0001	14	0.0081	3	3.39	3	0.00092	3	0.002	3	1.04	4	0.313	3	90.48	3	0.05069
4	4	0.015767	3	0.0002	3	0.00823	3	3.39	3	0.00093	3	0.0021	3	1.04	3	0.317	3	90.48	3	0.0507
5	3	0.0158	3	0.0003	3	0.00823	3	3.4	3	0.00093	3	0.0026	3	1.04	3	0.317	3	90.49	3	0.0507
6	3	0.016	3	0.0003	3	0.00825	3	3.4	3	0.00094	3	0.0028	3	1.04	3	0.317	3	90.49	3	0.05072
7	3	0.016	3	0.0003	3	0.00826	3	3.4	3	0.00095	3	0.0028	3	1.04	3	0.317	3	90.5	3	0.05073
8	3	0.016	3	0.0004	3	0.00826	1	3.408733	3	0.00095	3	0.0029	3	1.04	3	0.317	3	90.5	3	0.05073
9	4	0.0161	3	0.0004	3	0.00827	3	3.41	3	0.00095	3	0.0029	3	1.04	3	0.318	3	90.5	3	0.05074
10	3	0.0161	3	0.0005	3	0.00829	3	3.41	3	0.00096	3	0.0032	3	1.04	3	0.318	3	90.51	3	0.05075
11	3	0.0161	3	0.0005	3	0.00829	3	3.41	3	0.00097	10	0.0032	3	1.04	3	0.319	3	90.51	3	0.05075
12	3	0.0161	3	0.0006	3	0.0083	3	3.41	3	0.00097	3	0.0033	3	1.04	3	0.319	3	90.52	3	0.05075
13	3	0.0163	3	0.0006	3	0.0083	3	3.42	3	0.00098	3	0.0033	3	1.04	3	0.319	3	90.52	3	0.05076
14	3	0.0163	3	0.0006	3	0.00831	3	3.42	3	0.00099	3	0.0033	3	1.04	3	0.319	3	90.52	3	0.05076
15	3	0.0164	3	0.0007	3	0.00831	3	3.42	3	0.00099	3	0.003367	10	1.04	3	0.319	3	90.52	3	0.05079
16	14	0.0164	3	0.0007	3	0.00832	3	3.42	3	0.001	4	0.003433	3	1.04	3	0.319	3	90.52	3	0.05079
17	3	0.0164	3	0.0008	3	0.00832	1	3.426667	3	0.001	3	0.0035	3	1.04	3	0.319	3	90.53	3	0.05083
18	3	0.0164	3	0.0009	3	0.00833	3	3.43	3	0.001	3	0.0036	3	1.04	3	0.319	3	90.53	3	0.05083
19	3	0.0165	3	0.0009	3	0.00833	3	3.43	3	0.001	3	0.0036	3	1.04	3	0.319	3	90.53	3	0.05086
20	3	0.0165	3	0.0009	3	0.00833	3	3.43	3	0.00101	3	0.0037	3	1.04	3	0.32	3	90.53	3	0.05091
21	3	0.0165	3	0.001	3	0.00833	3	3.43	3	0.00101	3	0.0037	3	1.04	3	0.32	3	90.53	3	0.05093
22	3	0.0165	3	0.001	3	0.00834	3	3.43	3	0.00101	3	0.0038	3	1.04667	3	0.32	16	90.53333	3	0.05093
23	3	0.0166	3	0.0011	3	0.00834	3	3.43	3	0.00101	14	0.0039	3	1.05	3	0.32	16	90.5392	3	0.05093
24	3	0.0166	3	0.0011	3	0.00834	3	3.43	3	0.00102	3	0.004	3	1.05	3	0.32	3	90.54	3	0.05096
25	3	0.0167	3	0.0012	3	0.00837	3	3.44	3	0.00103	3	0.0041	3	1.05	3	0.321	3	90.54	3	0.05098
26	3	0.0167	3	0.0012	3	0.00837	3	3.44	3	0.00104	3	0.0042	3	1.05	3	0.321	3	90.54	3	0.05099
27	3	0.0167	5	0.001233	3	0.00838	3	3.44	3	0.00105	3	0.0042	14	1.05	14	0.32133	3	90.54	3	0.051
28	3	0.0168	3	0.0013	3	0.00838	3	3.44	3	0.00106	3	0.0042	3	1.05	3	0.322	3	90.55	3	0.0511
29	3	0.0168	3	0.0013	3	0.00841	3	3.45	14	0.001067	3	0.0043	3	1.05	3	0.322	3	90.55	3	0.05119
30	3	0.0168	3	0.0014	3	0.00841	3	3.45	3	0.00107	3	0.0045	3	1.05	3	0.322	3	90.55	3	0.05119
31	3	0.0169	3	0.0015	3	0.00843	3	3.45	3	0.00107	3	0.0045	3	1.05	3	0.322	3	90.55	3	0.05121
32	3	0.0169	3	0.0017	3	0.00843	3	3.45	3	0.00108	3	0.0045	3	1.05	3	0.322	3	90.56	3	0.05124
33	3	0.0169	5	0.001767	3	0.00844	3	3.46	3	0.00109	3	0.0045	3	1.05	3	0.323	3	90.56	3	0.05125
34	3	0.0169			3	0.00845	3	3.46	3	0.00111	3	0.0046	3	1.05	3	0.324	3	90.56	3	0.05135
35	3	0.017			3	0.00849	3	3.46	3	0.00111	5	0.004667	3	1.05	3	0.324	3	90.57	3	0.05135
36	3	0.017			3	0.00856	1	3.466533	3	0.00125	3	0.0048	3	1.05	3	0.324	3	90.57	3	0.05136
37	3	0.0171			3	0.00857	3	3.47	3	0.00126	3	0.0053	3	1.05	3	0.325	3	90.57	3	0.0514
38	3	0.0171			3	0.00861	3	3.47	3	0.00135	3	0.0053	3	1.05	3	0.325	3	90.58	3	0.05146
39	3	0.0171			5	0.00862	3	3.47	3	0.00143	5	0.0055	3	1.05	3	0.326	3	90.59		
40	3	0.0172			3	0.00874	3	3.49	3	0.00156	3	0.0059	3	1.05	3	0.326	14	90.6		
41	3	0.0173			3	0.00884	3	3.506667	3	0.0017	3	0.0065	3	1.06	3	0.326	4	90.60667		
42	3	0.0173			4	0.01043	3	3.51					3	1.06	3	0.329	3	90.61		
43	3	0.0176					3	3.52000					4	1.06433	3	0.329				
44													4	1.07333						
Average		0.01648		0.000809		0.00837		3.435936		0.000998		0.003782		1.047		0.3211		90.538		0.05094
Std Dev		0.00027		0.000055		0.00019		0.000048		0.000066		0.000049		0.012		0.0045		0.031		0.00083
H		0.0012		0.00036		0.00089		0.022		0.00039		0.00064		0.011		0.0054		0.23		0.0020
U ₁		0.0012		0.00037		0.00091		0.022		0.00040		0.00065		0.016		0.0070		0.23		0.0022
t-statistic		2.02		2.04		2.02		2.02		2.02		2.02		2.02		2.02		2.02		2.03
U ₂		0.0025		0.00075		0.0018		0.045		0.00080		0.0013		0.032		0.014		0.46		0.0045
U ₃		0.00038		0.00013		0.00028		0.0069		0.00013		0.00020		0.0048		0.0020		0.071		0.00072
Certified		0.0165		0.0008		0.0084		3.44		0.0010		0.0038		1.05		0.321		90.54		0.051
Uncertainty		0.0004		0.0003		0.0003		0.03		0.0001		0.0006		0.01		0.002		0.07		0.001
Tolerance		0.0025		0.0007		0.0018		0.09		0.0008		0.0018		0.03		0.014		0.46		0.003

Analysis	*	Mn	*	Mo	*	Nb	*	Ni	*	P	*	Pb	*	S	*	Si	*	Sn	*	Ti
1	14	0.722333	5	0.230	3	0.0028	4	1.312333	5	0.038633	9	0.0002	3	0.011	3	1.92	3	0.0004	4	0.04083
2	3	0.723	4	0.231	3	0.0038	10	1.32	10	0.044	5	0.0002	1	0.01103	3	1.92	3	0.0009	5	0.04157
3	3	0.725	10	0.235	3	0.0038	4	1.346433	3	0.0448	3	0.0006	3	0.0117	3	1.92	3	0.001	3	0.0422
4	3	0.725	3	0.236	3	0.0038	3	1.35	3	0.0457	3	0.0007	3	0.0118	3	1.92	5	0.001	3	0.0423
5	3	0.725	3	0.236	3	0.0038	3	1.35	3	0.0461	3	0.0007	3	0.0119	3	1.92	5	0.001033	3	0.0423
6	3	0.726	3	0.236	3	0.0038	4	1.353333	3	0.0464	3	0.0007	3	0.0119	3	1.92	3	0.0011	3	0.0423
7	3	0.726	3	0.236	14	0.00387	3	1.359667	3	0.0464	3	0.0007	3	0.012	3	1.92	3	0.0011	3	0.0424
8	3	0.727	3	0.236	4	0.00387	3	1.36	3	0.0464	3	0.0007	3	0.0121	3	1.92	3	0.0011	3	0.0424
9	3	0.728	3	0.236	3	0.0039	3	1.36	3	0.0464	3	0.0007	3	0.0122	3	1.92	10	0.0012	3	0.0424
10	3	0.728	3	0.237	3	0.0039	3	1.36	3	0.0465	3	0.0007	3	0.0122	3	1.92	3	0.0013	10	0.0425
11	3	0.728	3	0.237	3	0.0039	3	1.37	3	0.0465	3	0.0007	3	0.0122	3	1.92	3	0.0013	3	0.0426
12	3	0.728	3	0.237	3	0.0039	3	1.37	3	0.0466	3	0.0008	3	0.0122	14	1.92667	3	0.0014	3	0.0426
13	3	0.729	3	0.237	3	0.0039	3	1.37	3	0.0466	3	0.0008	3	0.0123	3	1.93	3	0.0014	3	0.0426
14	3	0.729	3	0.237	3	0.0039	3	1.38	3	0.0466	3	0.0008	3	0.0123	3	1.93	3	0.0014	3	0.0426
15	3	0.73	3	0.237	3	0.0039	3	1.38	3	0.0466	10	0.0008	3	0.0123	3	1.93	3	0.0014	14	0.04263
16	3	0.73	14	0.238	3	0.0039	14	1.386667	3	0.0467	3	0.0008	3	0.0123	3	1.93	3	0.0014	3	0.0427
17	3	0.731	3	0.238	3	0.0039	3	1.39	3	0.0467	3	0.0008	3	0.0124	3	1.93	3	0.0015	3	0.0427
18	3	0.731	3	0.238	3	0.004	3	1.39	3	0.0468	3	0.0008	3	0.0124	3	1.93	3	0.0015	3	0.0427
19	3	0.731	3	0.238	3	0.004	3	1.39	3	0.0468	3	0.0008	3	0.0124	3	1.93	3	0.0015	3	0.0427
20	3	0.731	3	0.238	3	0.004	3	1.39	3	0.0469	3	0.0009	3	0.0125	3	1.93	3	0.0016	3	0.0427
21	3	0.731	3	0.238	3	0.004	3	1.39	3	0.047	3	0.0009	3	0.0126	3	1.93	9	0.001667	3	0.0427
22	10	0.732	3	0.238	3	0.004	3	1.39	3	0.047	3	0.0009	3	0.0126	3	1.93	3	0.0017	3	0.0427
23	3	0.732	3	0.238	3	0.004	3	1.39	3	0.0471	3	0.0009	3	0.0126	3	1.93	3	0.0017	4	0.04273
24	3	0.732	3	0.238	3	0.004	3	1.39	3	0.0471	3	0.0009	3	0.0126	3	1.93	3	0.0017	3	0.0428
25	3	0.733	3	0.238	3	0.004	3	1.39	3	0.0471	3	0.0009	3	0.0126	3	1.93	3	0.0017	3	0.0428
26	3	0.733	3	0.238	3	0.004	3	1.39	3	0.0472	3	0.0009	1	0.0126	3	1.93	3	0.0018	3	0.0428
27	3	0.733	3	0.238	3	0.004	3	1.39	3	0.0472	3	0.001	1	0.01267	3	1.93	3	0.0018	3	0.0428
28	3	0.733	3	0.238	3	0.004	3	1.39	14	0.0472	3	0.001	3	0.0127	3	1.93	3	0.0018	3	0.0428
29	3	0.733	3	0.238	3	0.004	3	1.39	3	0.0472	3	0.001	3	0.0127	3	1.93	3	0.0018	3	0.0428
30	3	0.734	3	0.238	3	0.004	3	1.4	3	0.0473	3	0.001	3	0.0127	3	1.93	3	0.0019	3	0.0429
31	3	0.734	3	0.238	3	0.0041	3	1.4	3	0.0473	3	0.001	3	0.0128	3	1.93	3	0.002	3	0.0429
32	3	0.734	3	0.238	3	0.0041	3	1.4	3	0.0474	3	0.001	10	0.013	3	1.94	3	0.002	3	0.0429
33	3	0.734	3	0.238	3	0.0041	3	1.4	3	0.0474	3	0.0011	3	0.013	3	1.94	3	0.0021	3	0.0429
34	3	0.734	3	0.239	3	0.0041	3	1.41	3	0.0475	3	0.0011	3	0.013	3	1.94	3	0.0021	3	0.0429
35	3	0.734	3	0.239	3	0.0041	3	1.41	3	0.0476	3	0.0011	3	0.0131	3	1.94	3	0.0021	3	0.043
36	4	0.734667	3	0.239	3	0.0041	3	1.41	3	0.0476	3	0.0012	3	0.0131	3	1.94	3	0.0021	3	0.043
37	3	0.735	3	0.239	3	0.0041	3	1.41	3	0.0479	3	0.0012	3	0.0132	3	1.94	3	0.0022	3	0.043
38	3	0.735	3	0.239	3	0.0041	3	1.41	3	0.0479	3	0.0013	3	0.0133	3	1.94	3	0.0023	3	0.043
39	3	0.735	3	0.239	3	0.0042	3	1.42	3	0.048	3	0.0014	3	0.0134	3	1.94	3	0.0024	3	0.0431
40	3	0.735	4	0.239	3	0.0042	3	1.42	3	0.048	3	0.0014	3	0.0135	17	1.94883	5	0.002467	3	0.0431
41	3	0.737	3	0.239			3	1.43	3	0.0481	3	0.0015	3	0.0135			3	0.0028	3	0.0431
42	3	0.738	3	0.24			3	1.43	3	0.0489			3	0.0136			3	0.0031	3	0.0433
43			3	0.24			3	1.43	4	0.049367			3	0.0137			3	0.0035	3	0.0438
44			3	0.24			3	1.45	4	0.051033										
Average		0.730929		0.2377		0.00393		1.387010		0.04687		0.000893		0.01257		1.929		0.001704		0.04275
Std Dev		0.000049		0.0033		0.00013		0.000048		0.00073		0.000049		0.00021		0.024		0.000048		0.00068
H		0.0086		0.0046		0.00065		0.013		0.001962		0.00038		0.0011		0.016		0.00047		0.00188
U ₁		0.0086		0.0057		0.00067		0.013		0.0021		0.00038		0.0011		0.029		0.00048		0.0020
t-statistic		2.02		2.02		2.02		2.02		2.02		2.02		2.02		2.02		2.02		2.02
U ₂		0.017		0.011		0.0013		0.026		0.0042		0.00077		0.0022		0.059		0.0010		0.0040
U ₃		0.0027		0.0017		0.00021		0.0039		0.00064		0.00012		0.00033		0.0093		0.00015		0.00061
Certified		0.731		0.238		0.0039		1.39		0.0469		0.0009		0.0126		1.93		0.0017		0.0427
Uncertainty		0.003		0.002		0.0002		0.03		0.0006		0.0002		0.0005		0.01		0.0004		0.0006
Tolerance		0.009		0.011		0.0013		0.09		0.0042		0.0006		0.0015		0.03		0.0012		0.0040

BS 285BG

* Code for method

Certified values listed as weight percent

Analysis	*	V	*	W	*	Zr
1	3	0.115	3	0.0587	14	0.00293
2	5	0.118667	3	0.059	5	0.0036
3	10	0.12	3	0.0593	3	0.0052
4	3	0.12	3	0.0593	3	0.0053
5	3	0.121	3	0.0594	3	0.0053
6	3	0.121	3	0.0594	3	0.0053
7	3	0.121	3	0.0599	3	0.0054
8	3	0.121	10	0.06	3	0.0054
9	3	0.121	3	0.0601	3	0.0054
10	3	0.121	3	0.0601	3	0.0054
11	3	0.121	3	0.0602	3	0.0054
12	3	0.121	3	0.0605	3	0.0054
13	3	0.122	3	0.0605	3	0.0054
14	3	0.122	3	0.0606	3	0.0055
15	3	0.122	3	0.0606	3	0.0055
16	3	0.122	3	0.0607	3	0.0055
17	3	0.122	3	0.0607	3	0.0055
18	3	0.122	14	0.0608	3	0.0055
19	3	0.122	4	0.0608	3	0.0055
20	3	0.122	3	0.0608	3	0.0055
21	3	0.122	3	0.0609	3	0.0055
22	3	0.122	3	0.061	3	0.0055
23	3	0.122	3	0.0611	3	0.0055
24	3	0.122	3	0.0611	3	0.0055
25	3	0.122	3	0.0612	3	0.0055
26	3	0.122	3	0.0612	3	0.0056
27	3	0.122	3	0.0612	3	0.0056
28	3	0.122	3	0.0613	3	0.0056
29	3	0.122	3	0.0614	3	0.0056
30	3	0.122	3	0.0615	3	0.0056
31	3	0.122	3	0.0617	3	0.0056
32	3	0.122	3	0.0618	3	0.0056
33	3	0.122	3	0.062	3	0.0057
34	3	0.122	3	0.062	3	0.0057
35	3	0.122	3	0.0621	3	0.0057
36	3	0.122	3	0.0624	3	0.0057
37	4	0.1223	3	0.0626	3	0.0057
38	3	0.123	4	0.063	3	0.0058
39	3	0.123	3	0.063	3	0.0059
40	3	0.123	3	0.0632	3	0.006
41	3	0.123	3	0.063333		
42	14	0.123	3	0.0638		
43	3	0.124	5	0.063933		
44	4	0.127333				
Average		0.1215		0.0611		0.00547
Std Dev		0.0018		0.0010		0.00013
H		0.0032		0.0022		0.00075
U ₁		0.0037		0.0024		0.00076
t-statistic		2.02		2.02		2.02
U ₂		0.0074		0.0049		0.0015
U ₃		0.0011		0.00075		0.00024
Certified		0.122		0.0611		0.0055
Uncertainty		0.001		0.0009		0.0002
Tolerance		0.007		0.0027		0.0015

BS 285BG

* Code for method

Informational values listed as weight percent

Analysis	*	Sb
1	10	0.2
Average		0.20
Std Dev		2.18
H		0.00
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 its mean (M_L). The standard deviation (S) is calculated as the square root of the reciprocal of the sum of the weights. U₁ is the combined uncertainty from homogeneity and labs. U₂ is U₁ multiplied by the coverage factor (95 % t-statistic). U₃ is U₂ divided by the square root of the number of determinations (n). Thus:

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

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 U₃ 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) | 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 WET |
| 6 Gravimetric | 12 GD Mass Spectrometry | |

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 285BG 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 285BG-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

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