

Certificate of Analysis

B.S. 4C Chill-cast Iron

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ²
Analysis listed as percent by weight					
C	3.82	0.03	Ca	0.0013	0.0002
Mn	0.21	0.01	Ce	0.010	0.002
P	0.003	0.001	Co	0.014	0.002
S	0.001	0.0005	La	0.002	0.0005
Si	0.52	0.02	Mg	0.0002	0.0001
Cu	0.014	0.002	N	0.008	0.001
Ni	0.068	0.002	Sb	0.0012	0.0005
Cr	0.111	0.005	Te	0.0011	0.0004
Mo	0.105	0.005	Ti	0.002	0.0005
Al	0.003	0.0006	V	0.0005	0.0001
As	0.007	0.002	Zr	0.010	0.002
B	0.0002	0.00005			

Informational Values

Bi	<0.00001	Pb	0.0004
Cd	<0.00005	Se	<0.00005
Hg	<0.00002	Sn	0.0004
Nb	0.0005	W	0.006
O	0.004	Zn	<0.0003

¹ The certified value listed is the present best estimate of the true value.

² The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values.

See reverse side for more information.

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BS 4C

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Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al
1	3.79	0.18	0.0020	0.0003	0.503	0.012	0.0646	0.106	0.097	0.0030
2	3.80	0.204	0.0022	0.0007	0.519	0.0125	0.067	0.108	0.101	0.003
3	3.817	0.205	0.0023	0.001	0.519	0.013	0.067	0.109	0.103	0.0030
4	3.82	0.205	0.0029	0.0010	0.528	0.013	0.068	0.113	0.105	0.003
5	3.823	0.206	0.003	0.001	0.532	0.0146	0.0685	0.115	0.107	0.003
6	3.829	0.208	0.004	0.0011		0.015	0.069	0.116	0.107	0.003
7	3.83	0.210		0.0012		0.015	0.069		0.108	0.0036
8	3.84	0.21		0.0015		0.015	0.069		0.109	0.0038
9	3.855	0.22								
10		0.22								
Average	3.823	0.207	0.0027	0.0010	0.520	0.0138	0.0678	0.1112	0.1046	0.0032
Std Dev	0.020	0.011	0.0007	0.0004	0.011	0.0013	0.0015	0.0041	0.0041	0.0003
Certified	3.82	0.21	0.003	0.001	0.52	0.014	0.068	0.111	0.105	0.003

Analysis	As	B	Ca	Ce	Co	La	Mg	N	Nb	O
1	0.0046	0.0001	0.0009	0.007	0.012	0.0013	0.0001	0.0073	0.0002	0.0022
2	0.005	0.00011	0.0012	0.0078	0.012	0.0013	0.0001	0.0074	0.0004	0.0042
3	0.0055	0.00016	0.0012	0.010	0.012	0.0020	0.00015	0.0077	0.0005	0.0045
4	0.006	0.0002	0.0013	0.010	0.013	0.0021	0.0002	0.0079	0.0005	
5	0.007	0.0002	0.00135	0.0105	0.013	0.0022	0.0002	0.0081	0.0007	
6	0.0070		0.0014	0.0122	0.0137	0.0025	0.00024	0.0088		
7	0.0077		0.0015	0.0128	0.0144		0.0003	0.0095		
8	0.0078		0.0015		0.0145		0.0003	0.0097		
9	0.0078		0.0015		0.0155		0.0004			
10	0.0081				0.016					
11					0.0162					
Average	0.0067	0.00015	0.00132	0.0100	0.0138	0.0019	0.00022	0.0083	0.0005	0.0036
Std Dev	0.0013	0.00005	0.00020	0.0021	0.0016	0.0005	0.00010	0.0009	0.0002	0.0013
Certified	0.007	0.0002	0.0013	0.010	0.014	0.002	0.0002	0.008	(0.0005)	(0.004)

Analysis	Pb	Sb	Sn	Te	Ti	V	W	Zn	Zr
1	0.00016	0.0006	0.00005	0.0006	0.001	0.0003	0.003	<0.0001	0.0075
2	0.0003	0.0006	0.0002	0.0008	0.001	0.0005	0.0040	0.00015	0.0100
3	0.0003	0.0006	0.00029	0.0009	0.0011	0.0005	0.005	0.0002	0.010
4	0.00035	0.0012	0.0003	0.0011	0.0018	0.0005	0.0060		0.0110
5	0.0005	0.0012	0.0004	0.0014	0.0018	0.0006	0.0082		0.0112
6	0.0007	0.0013	0.0005	0.0014	0.002	0.0006	0.0088		
7		0.0014	0.0007	0.0015	0.0020		0.009		
8		0.0014	0.0009		0.0021				
9		0.0018							
10		0.0021							
Average	0.00039	0.00122	0.00042	0.00110	0.0016	0.00050	0.0063		0.0099
Std Dev	0.00019	0.00051	0.00028	0.00035	0.0005	0.00011	0.0024		0.0015
Certified	(0.0004)	0.0012	(0.0004)	0.0011	0.002	0.0005	(0.006)	(<0.0003)	0.010

Analysis produced by glow-discharge mass spectrometers

Lab	Bi	Cd	Hg	Se
1	---	0.00009	<0.00001	<0.00005
2	<0.000001	<0.000005	<0.00001	---
3	<0.00001	<0.00005	<0.00002	---

Methods of analysis - Certified Reference Materials used for validation of the results for BS 4C.

Al BY GFAAS- ECRM 184-1 BY AAS- 476-2, 481-1
BY ICP- NIST SRM 125B, 361 - 363, ECRM 096-1, 184-1, 481-1

As BY GFAAS- NIST SRM 364; ECRM 481-1 BY HYDRIDE AAS- 476-2
BY ICP- NIST SRM 361 - 364; ECRM 184-1, 481-1;

B BY ICP- NIST SRM 361 - 365
BY DISTILLATION AND PHOTOMETRY- NIST SRM 361, 362, 364

C BY COMBUSTION- NIST SRM 5L, 122g, 333, 342a, 890, 891; ECRM 481-1, 486-1, 487-1
BY COMBUSTION- Barium carbonate

Ca BY AAS- ECRM 088-1, 096-1
BY ICP- NIST SRM 361 - 364; ECRM 096-1

Ce BY ICP- JSS 190-1 through 191-5; CMSI 1551
BY ICP- NIST SRM 361 - 364

Co BY AAS- ECRM 088-1, 481-1, ASMW 23/6
BY ICP- NIST SRM 361 - 365, 1270; ECRM 085-1, 184-1; CMSI 1551

Cr BY AAS- NIST SRM 363, 364, 476-2, 481-1
BY SPECTROPHOTOMETRY- ECRM 476-2, 481-1
BY ICP- NIST SRM 125B, 361 - 365, 1270; ECRM 088-1, 096-1, 184-1, 481-1; CMSI 1551

Cu BY AAS- NIST SRM 363; ECRM 096-1, ECRM 476-2, 481-1; ASMW 23/6
BY SPECTROPHOTOMETRY - DIETHYLTHIURAMDISULPHIDE- ECRM 476-2, 481-1
BY ICP- NIST SRM 125B, 361 - 365, 1270; ECRM 085-1, 096-1, 184-1, 481-1; CMSI 1551

Mg BY AAS- NIST SRM 362, 363
BY ICP- NIST SRM 361 - 364; ECRM 481-1; CMSI 1551

Mn BY AAS- NIST SRM 363, 364; ECRM 476-2, 481-1
BY SPECTROPHOTOMETRY - PERIODATE- ECRM 476-1, 481-1
BY ICP- NIST SRM 125B, 361 - 365; ECRM 085-1, 088-1, 096-1, 184-1, 481-1; CMSI 1551

Mo BY AAS- NIST SRM 362; ECRM 184-1
BY ICP- NIST SRM 125B, 361 - 365, 1270; ECRM481-1; CMSI 1551
BY SPECTROPHOTOMETRY - THIOCYANATE EXTRACTED TO BUTYLACETATE- 476-2, 481-1; ASMW 23/6

N BY THERMO-EVOLUTION-HELIUM CARRIER- ECRM 476-2

Nb BY ICP- NIST SRM 361 - 364; ECRM 096-1
BY SPECTROPHOTOMETRY SULPHOCHLOROPHENOLE-S-EXTRACTION- ASMW 23/6

Ni BY GRAVIMETRIC DMG- ECRM 476-2, 481-1
BY AAS- NIST SRM 361, BAM 044-1; ECRM 476-2, 481-1; ASMW 23/6
BY ICP- NIST SRM 125B, 361 - 365, 1270; ECRM 088-1, 096-1, 184-1, 481-1; CMSI 1551

P BY SPECTROPHOTOMETRY, PVM EXTRACTED TO MIBK- ECRM 476-2, 481-1
BY ICP- NIST SRM 125B, 361 - 365, 1270; ECRM 085-1, 088-1, 096-1, 184-1, 481-1; CMSI 1551

Pb BY GF AAS- BCS 456/1, 458/1; BY AAS AFTER TOPO EXTRACTION TO MIBK- ASMW 23/6
BY GFAAS- NIST SRM 362; BCS 455/1
BY ICP- NIST SRM 361 - 365; ECRM 085-1

S BY COMBUSTION- NIST SRM 5L, 122g, 333, 342a, 890, 891; ECRM 476-2, 481-1, 486-1, 487-1

Sb BY AAS- ECRM 184-1; BCS 458-1 BY AAS AFTER TOPO EXTRACTION TO MIBK- ASMW 23/6
BY ICP- NIST SRM 361 - 364; ECRM 085-1

Si GRAVIMETRIC- NIST SRM 5L; ECRM 476-2, 481-1; ASMW 23/6
BY AAS- ECRM 481-1, 458/1
BY ICP- NIST SRM 125B, 361 - 365, 1270; ECRM 085-1, 088-1, 096-1, 184-1, 481-1; CMSI 1551

Sn BY GFAAS- NIST SRM 363; BAM 039-2; BY AAS AFTER TOPO EXTRACTION TO MIBK- ASMW 23/6
BY ICP- NIST SRM 125B, 361 - 364; ECRM 184-1

Te BY GFAAS- NIST SRM 361
BY ICP- JSS 190-1 through 191-5; CMSI 1551

Ti BY GFAAS- NIST SRM 361
BY SPECTROPHOTOMETRY WITH DIANTIPYRYLMETHANE- ECRM 476-2
BY ICP- NIST SRM 361 - 364; CMSI 1551

V BY GFAAS- NBS SRM 362, 364, 365; ECRM 085-1
BY SPECTROPHOTOMETRY AND N-BENZOYL N-PHENYL HYDROXILAMINE EXTRACTION- ECRM 476-2; ASMW 23/6
BY ICP- NIST SRM 361 - 365, 1270; ECRM 085-1, 088-1, 096-1, 184-1; CMSI 1551

W BY ICP- NIST SRM 361 - 364

Zn BY ICP- NIST SRM 362; ECRM 085-1

Zr BY ICP- NIST SRM 125B, 361 - 365; ECRM 085-1, 088-1, 096-1, 184-1, 481-1; CMSI 1551
BY SPECTROPHOTOMETRY WITH ARSENAZO III AFTER TOPO EXTRACTION- Pure metal