OUTSIDE-SOURCE REFERENCE MATERIALS

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INTRODUCTION

For over eighty years Bureau of Analysed Samples Ltd (BAS) has been preparing British Chemical Samples, now known as BCS Certified Reference Materials (CRMs) for the metallurgical industries. Full particulars of all BAS-produced materials are given in a separate catalogue.

When the UK joined the EEC in 1973 BAS was invited to co-operate with BAM in Germany and IRSID in France in the production of CRMs for the iron and steel industry on a European basis and this European Producers Group has been augmented by the inclusion of the Nordic CRM Working Group: this work was under the auspices of the European Committee for Iron and Steel Standardization (ECISS). These EURONORM Certified Reference Materials (ECRMs) are normally analysed by approximately twenty laboratories from countries in the European Economic Area (EEA) and are issued with a Certificate of Analysis approved by the participating laboratories and the producing organizations. These ECRMs are indicated by an asterisk in this list. Although BAS is no longer a part of the ECRM Producers Group, all ECRMs (prepared by BAM, IRSID (now ARCELORMITTAL), CTIF and Jernkontoret) are available from BAS. Data regarding the BAS-produced ECRMs are given in the BAS Certified Reference Materials Catalogue, whilst the data re BAM, ARCELORMITTAL, CTIF and Jernkontoret -produced ECRMs are given in this catalogue.

Further details of ECRMs, including their method of preparation, certification and supply and the use of the statistical information given on ECRM certificates are given in Technical Reports CEN/TR 10317:2014 and CEN/TR 10350:2013 which are available in the UK from the BSI, 389 Chiswick High Road, London W4 4AL.

In September 1992, the BNF – Fulmer organisation was closed down. BAS purchased their Reference Materials business, including the considerable stock of BNF samples, and is continuing the business as before. Thus, BAS is now the primary source of BNF copper, nickel and lead base Reference Materials. Replacement samples are being produced by BAS in order to maintain continuity of supply of these samples: (see the latest BAS Catalogue for details of such samples already produced by BAS).

In order to assist our customers to obtain complementary Reference Materials from other reputable producers, BAS is now holding a stock, and many of the Reference Materials detailed in this catalogue are immediately available, with delivery of non-stock items usually achieved within two to three weeks.

In this catalogue Reference Materials which are supplied with a Certificate of Analysis giving the information specified in ISO Guide 31 "Contents of Certificates of Reference Materials" are referred to as "Certified Reference Materials" and the remainder as "Reference Materials", in accordance with the definitions given in ISO Guide 30 "Terms and definitions used in connection with Reference Materials". (ISO Guides are available from Case Postale 56, CH-1211 Geneva 20, Switzerland).

The Certificate accompanying each CRM, or Analysis Report/Information Sheet accompanying each RM, should be consulted to obtain the accurate analysis of each sample, since in some cases the figures shown in this catalogue may differ slightly from those given on the Certificate or Analysis Report/Information Sheet. Please note that the disc/block sizes stated in this catalogue are approximate and may vary from sample to sample.

GENERAL INFORMATION

Our website, at www.basrid.co.uk, is continuously being improved and now includes a page of downloadable certificates for all currently available BAS products.

QUALITY ASSURANCE

Bureau of Analysed Samples Ltd, is very pleased to advise customers that in November 1994 its Quality System was formally approved and recognised by the award of a Certificate of Registration to the Quality Standard BS EN ISO 9002:1994 for the production and supply of CRMs, RMs and SUS. This certificate has now been revalidated to the new standard BS EN ISO 9001:2015. Furthermore, BAS was accredited, in June 2006, to the International Guide, ISO Guide 34 (General Requirements for the Competence of Reference Material Producers) and the accreditation has since been updated to the Standard ISO 17034.

Please note that, whilst BAS is accredited to ISO 17034, only three of the Producers detailed in this catalogue (Brammer Standard Company, Inc., Bundesanstalt für Materialforschung und -prüfung and Community Bureau of Reference / Institute for Reference Materials and Measurements) are so accredited. The CRM/RMs prepared by the other producers in this catalogue will not have been produced under ISO 17034 accreditation.

Australian Coal Industry Reference Samples (ACIRS), Australia

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only

Coal Reference Materials (Finely divided material – unit weights as shown in table)

ACIRS No.	Description	Unit Weight	Ash	Volatile Matter	Total C	H	N	P	C as CO	Cl	F	Hg	Cd	As	Se	Total S	Hardgrove Grindability Index	Gross Calorific Value MJ/kg	Relative Density
S1A-2011	Coal	250g	…	…	…	…	…	…	…	…	…	…	…	…	…	0.42	…	…	…
S1C-2011	Coal	250g	…	…	…	…	…	…	…	…	…	…	…	…	…	1.46	…	…	…
G8-2019	Coal	120g	10.14	20.23	79.44	4.40	1.79	0.027	…	0.052	0.0085	0.000002	…	…	…	0.590	…	32.357	1.382
H7-2019	Coal	4 x 1kg	…	…	…	…	…	…	…	…	…	…	…	…	…	…	30, 46, 63 & 86	…	…
M1-2014 (Lot#2)	Coal	125g	18.68	(32.8)	(67.4)	(4.73)	(1.34)	0.098	(0.04)	0.014	0.0160	0.0000122	0.000018	0.00039	0.00015	2.39	…	(28.36)	1.417
M2-2018	Coal	50g	9.32	…	…	…	…	…	…	…	0.0176	0.0000041	0.000002	0.00003	(0.00003)	…	…	…	…

Coal Fly Ash Reference Material (Units of 80g)

ACIRS No.	Description	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	P_2O_5	TiO_2	Mn_3O_4	BaO	SrO	SO_3	Co	Cr	Cu	Ni	Pb	V	Zn
A1-2016	Coal Fly Ash	44.1	28.9	14.6	6.05	1.25	0.43	0.46	1.26	1.56	0.22	0.183	0.16	0.32	(0.0043)	(0.0058)	(0.0099)	(0.0047)	(0.0047)	(0.0176)	(0.0090)

Values are also given for Ash Fusibility Reducing Temperatures:- Deformation 1257 °C; Sperical 1287 °C; Hemispherical 1309 °C; Flow 1367 °C
Ash Fusibility Oxidising Temperatures:- Deformation 1349 °C; Sperical 1383 °C; Hemispherical 1398 °C; Flow 1429 °C

ALPHA RESOURCES Inc. (AR), USA

CHEMICAL COMPOSITION (nominal mass content in %)

Oxygen & Nitrogen in Steel Reference Materials (units as shown)

AR No.	Units	Oxygen	Nitrogen
644	100 x 1g pins	0.0003	0.0140
645	"	0.0035	0.0088
646	"	0.0035	0.0738
654	100 x 0.5g pins	0.0044	0.0536
655	"	0.0037	0.392
659	"	0.0110	0.0056
661	"	0.0008	0.0091
668	"	0.0010	0.0024
1647	100 x 1g pins	0.0031	0.140
1650	"	0.0100	0.0102
1651	"	0.0031	0.0202
1652	"	0.0034	0.0530
1653	"	0.0007	0.0030
1657	"	0.0034	0.0319

Hydrogen in Steel Reference Materials (units as shown)

AR No.	Units	Hydrogen
546	100 x 1g pins	0.000095
555	"	0.00023
556	"	0.00045
558	"	0.00067

Hydrogen, Oxygen & Nitrogen in Titanium Reference Materials (units as shown)

AR No.	Units	Hydrogen	Oxygen	Nitrogen
637	100 x 0.1g pins	0.0015	0.152	0.008
641	"	0.0041	0.1958	0.0309
650	"	0.0068	0.089	0.0087
651	"	0.0029	0.1262	0.0065

The above figures are target levels and may vary between batches.
The above only constitutes a selection of Alpha Resource samples. Additional samples are available and information on these will be provided on request.

ARCELORMITTAL MAIZIÈRES RESEARCH SA (formerly IRSID), France

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate.

Unalloyed Steel Certified Reference Materials (Finely divided material – units of 100g)

AMMZ/IRSID No.	C	Si	Mn	P	S	Cr	Ni	Al Total	Co	Cu	Pb	Sn
ECRM 012-1	**0.082**	…	…	**0.083**	**0.255**	…	…	…	…	…	…	…
ECRM 021-1	**0.243**	**0.271**	**1.288**	**0.0121**	**0.0087**	**0.125**	**0.255**	…	…	**0.167**	…	…
ECRM 022-1	**0.115**	…	**0.797**	**0.057**	**0.296**	…	…	…	…	…	…	…
ECRM 023-1	**0.331**	**0.264**	**0.667**	**0.021**	**0.0156**	…	…	…	…	…	**0.280**	…
ECRM 024-1	**0.104**	**0.139**	**0.726**	**0.0155**	**0.235**	…	…	…	…	…	**0.287**	…
*ECRM 081-1	**0.099**	**0.105**	**0.605**	**0.0129**	**0.014**	…	**0.042**	**0.023**	**0.017**	**0.026**	…	*0.0039*

Alloy Steel Certified Reference Materials (Finely divided material – units of 100g; 190-1 also available as 35mm x 35mm x 30mm blocks)

AMMZ/IRSID No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Co	Cu	N	V	W
ECRM 106-2	**0.153**	**0.238**	**0.727**	…	…	**1.030**	**0.054**	**1.430**	…	…	**0.078**	…	…	…
ECRM 107-1	**0.407**	**0.286**	**0.611**	…	…	**1.443**	**0.323**	**0.191**	**0.345**	…	**0.108**	…	…	…
ECRM 108-1	**0.384**	**0.340**	**0.690**	**0.0176**	**0.017**	**2.92**	**0.538**	**0.215**	…	…	**0.118**	…	…	…
ECRM 112-1	**0.348**	**1.00**	**0.191**	…	…	**4.78**	**1.21**	**0.234**	…	…	**0.115**	…	**0.604**	**1.78**
ECRM 113-1	**0.680**	**0.249**	**0.586**	*0.013*	*0.006*	**0.816**	**0.413**	**1.744**	…	…	**0.146**	…	…	…
*ECRM 188-1	**1.094**	…	…	…	**0.0113**	**1.538**	…	…	…	…	…	…	…	…
*ECRM 190-1	**0.395**	**0.278**	**1.28**	**0.0112**	**0.0044**	**2.18**	**0.410**	**0.934**	…	**0.034**	…	**0.0096**	…	…

Alloy Steel Certified Reference Materials (continued)

AMMZ/IRSID No.	Bi	Cd	Ga	Hg	Nb	Pb	Sb	Se	Te	Tl	Zn
*ECRM 188-1	**<0.00002**	**<0.00005**	**0.00251**	*<0.00001*	**0.00013**	**<0.0001**	**0.00048**	*<0.0002*	**<0.0002**	*<0.00002*	*<0.0003*

Highly Alloyed Steel Certified Reference Materials (Finely divided material – units of 100g; ECRM 269-1 also available as 35mm diameter x 25mm discs)

AMMZ/IRSID No.	C	Si	Mn	P	S	Cr	Mo	Ni	As	Co	Cu	N	Nb	Sn	Ti	V	W	Ca	Zn
ECRM 201-1	**0.291**	**0.843**	**0.363**	…	…	**12.33**	**0.050**	**0.202**	…	…	**0.099**	…	…	**0.0193**	…	*0.020*	…	**0.0018**	**0.0005**
*ECRM 269-1	**0.0499**	**0.441**	**1.262**	**0.0313**	**0.0010**	**18.150**	**0.397**	**8.044**	**0.0061**	**0.1116**	**0.366**	**0.0460**	**0.0242**	**0.0099**	**0.0006**	**0.0991**	**0.0306**	…	…
*ECRM 279-2	**0.0885**	**0.5160**	**0.2584**	…	…	**15.642**	…	**1.603**	…	…	**0.1067**	…	…	…	…	…	…	…	…
*ECRM 282-1	**0.086**	**0.734**	**1.64**	**0.019**	**0.0042**	**16.72**	**2.19**	**10.86**	…	…	**0.109**	…	…	…	**0.488**	*0.031*	…	…	…

* Denotes Full EURONORM-Certified Reference Material

ARCELORMITTAL MAIZIÈRES RESEARCH SA (formerly IRSID), France

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate.

Ferro-Alloy Certified Reference Materials (Finely divided material – units of 100g)

AMMZ/IRSID No.	Description	C	Si	Mn	P	S	Cr	Al	N	Ti
ECRM 503-1	Ferro-Manganese	0.700	0.865	80.8	0.069	*0.009*	…	…	…	…
ECRM 507-1	Ferro-Chromium	5.43	1.20	0.270	0.018	…	70.27	…	0.050	…
ECRM 509-1	Ferro-Chromium	0.013	0.229	…	0.018	…	72.85	…	0.026	…
ECRM 510-1	Ferro-Titanium	0.058	4.65	…	*0.035*	…	…	*4.9*	*0.014*	26.95

Mineral, Concentrate and Ore Certified Reference Materials (Finely divided material – units of 100g)

AMMZ/IRSID No.	Description	Fe	Si	Ca	Mg	Al	Ti	Mn	P	S	Na	K	V	Cr	Ni	Co	C(T)	Zn	Fe (II)	Others
ECRM 601-1	Iron Ore	36.76	8.95	4.05	1.21	2.33	0.114	0.370	0.590	0.065	…	…	…	…	…	…	…	…	*8.8*	…
ECRM 603-1	Iron Ore	53.65	1.28	*0.91*	*0.2*	4.20	0.137	0.440	0.084	0.097	…	…	…	…	…	…	…	…	*0.3*	…
ECRM 604-1	Iron Ore	65.69	1.27	0.107	0.049	0.93	0.060	0.092	0.053	0.015	…	…	…	…	…	…	…	…	*0.5*	…
ECRM 606-1	Iron Ore	59.66	1.04	1.04	0.32	0.34	0.019	2.59	0.026	0.033	…	…	…	…	…	…	…	…	*0.1*	…
ECRM 607-1	Iron Ore	30.89	3.07	13.74	0.77	2.48	0.123	0.254	0.529	0.050	…	…	…	…	…	…	…	…	*5.95*	…
ECRM 608-1	Ferriferrous Marl	4.00	28.23	6.22	0.81	5.26	0.428	0.044	0.053	0.455	…	…	…	…	…	…	…	…	*1.85*	…
ECRM 611-1	Iron Ore Sinter	62.22	2.07	2.85	0.32	0.69	0.035	1.97	0.030	*0.008*	…	…	…	…	…	…	…	…	*13.84*	…
ECRM 612-1	Iron Ore Sinter	42.43	5.94	12.06	1.20	3.00	0.151	0.363	0.885	0.053	…	…	…	…	…	…	…	…	*9.19*	…
*ECRM 677-1	Iron Ore	51.54	11.78	0.038	0.012	0.32	0.013	0.016	0.0170	*0.005*	0.007	0.008	…	*0.002*	*0.0015*	*0.0006*	…	*0.002*	…	0.43 H_2O+
*ECRM 685-1	Pre-reduced Iron Ore	91.10	0.795	0.140	0.239	0.320	0.220	0.042	0.017	0.0031	0.077	0.042	0.144	…	0.018	0.013	1.49	…	*7.72*	80.80 Fe_m
*ECRM 691-1	Iron Ore	64.39	0.556	0.999	2.022	0.475	0.966	0.1734	0.0877	0.0632	0.0164	0.0504	0.0603	0.0095	0.0299	*(0.0216)*	0.307	0.0195	20.71	0.0768 Cu 0.0008 Pb

Refractory Certified Reference Materials (Finely divided material – units of 100g)

AMMZ/IRSID No.	Description	Fe	Si	Ca	Mg	Al	Ti	Cr	Mn	B	N	P	S	C(T)	H_2O	LOI
ECRM 702-1	Dolomite	0.440	1.04	21.48	12.37	0.21	0.013	*<0.002*	0.098	…	…	0.024	*0.027*	*12.3*	0.5	45.6
*ECRM 778-1	High Carbon Magnesia	0.67	0.489	0.883	48.87	0.297	*0.008*	0.102	0.011	0.0012	…	*0.004*	…	14.00	…	15.38
*ECRM 780-1	Silicon Carbide	1.30	63.5	0.84	0.051	1.86	…	…	0.029	…	0.32	…	…	26.38	…	…

Slag and Dust Certified Reference Materials (Finely divided material – units of 100g)

AMMZ/IRSID No.	Description	Fe	Si	Ca	Mg	Al	Ti	Mn	P	S	Na	K	F	V	Cr	Ni	Zn	Cu	As	Pb	C(T)	Cl	Others
ECRM 802-1	Blast Furnace Slag	0.576	15.16	30.62	2.87	8.53	0.366	0.460	0.109	0.714	0.236	0.491	0.243	0.028	0.0053	…	0.0025	…	…	…	…	…	0.0245 B
ECRM 803-1	Blast Furnace Slag	0.613	17.01	30.93	2.44	6.98	0.301	0.552	0.118	0.767	…	…	…	…	…	…	…	…	…	…	…	…	…
ECRM 804-1	Basic Slag	11.92	2.59	36.88	0.88	0.407	0.152	1.48	7.67	0.127	…	…	…	0.460	…	…	…	…	…	…	…	…	…
ECRM 805-1	Basic Slag	14.87	3.10	34.96	1.12	0.326	0.205	1.59	7.07	0.092	…	…	…	0.514	…	…	…	…	…	…	…	…	…
ECRM 806-1	Basic Slag	17.89	5.48	32.97	1.82	0.477	0.302	4.60	0.982	0.110	…	…	…	0.288	…	…	…	…	…	…	…	…	…
*ECRM 876-1	Electric Furnace Dust	24.85	1.72	3.43	1.31	0.34	0.048	2.84	0.128	0.87	1.98	1.63	0.24	…	0.17	0.034	23.29	0.42	0.023	7.82	0.26	3.63	0.13 Cd 0.094 Sn
*ECRM 880-1	Blast Furnace Dust	31.0	3.34	3.15	0.714	1.28	0.081	0.218	0.038	0.425	0.041	0.108	0.034	…	0.027	0.014	0.064	0.005	…	0.017	*37.77*	0.086	…

* Denotes Full EURONORM Certified Reference Materials

BUNDESANSTALT FÜR MATERIALFORSCHUNG UND -PRÜFUNG (BAM), Germany

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate.

Unalloyed Steel Certified Reference Materials

(All finely divided materials - units of 100g, except 026-1, 026-2, 027-1, 028-1, and 029-1 which are 10mm dia. x 90mm rods and 098-1 which is in solid disc form 36-39mm dia. x 26mm: ECRM 035-2 also available as 38mm dia. x 20mm discs and ECRM 083-2 also available as 39mm dia. x 28mm discs)

BAM No.	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Al (Acid Sol.)	Al (Total)	As	Co	Cu	N	Pb	Sn	Ti	V	Others
ECRM 026-1	1969	*0.44*	…	…	…	…	…	…	…	…	…	…	…	…	0.0053	…	…	…	…	0.0031 O
ECRM 026-2	1973	…	…	…	…	…	…	…	…	…	…	…	…	…	0.0042	…	…	…	…	0.0025 O
ECRM 027-1	1970	*0.05*	*0.003*	*0.4*	*0.03*	*0.03*	…	…	…	…	*0.001*	…	…	…	0.0157	…	…	…	…	0.0084 O
ECRM 028-1	1970	*0.1*	*0.002*	*0.3*	*0.06*	*0.03*	…	…	…	…	*0.001*	…	…	…	0.0029	…	…	…	…	0.0113 O
ECRM 029-1	1970	*0.05*	*0.003*	*0.3*	*0.03*	*0.03*	…	…	…	…	*0.001*	…	…	…	0.0083	…	…	…	…	0.0312 O
ECRM 030-4	1973	0.456	0.318	0.603	0.018	0.021	0.117	…	0.042	…	0.042	0.012	…	0.061	0.0051	…	0.0055	…	…	…
ECRM 031-3	1972	0.055	0.037	0.329	0.014	0.021	…	…	…	…	0.054	0.013	…	0.020	0.0050	…	…	…	…	…
ECRM 032-2	1968	0.271	0.282	0.556	0.0129	0.0254	*0.088*	…	*0.040*	…	…	0.020	…	0.085	0.0044	…	…	…	…	…
*ECRM 035-2	1998	1.277	0.216	0.305	0.0038	0.0111	0.0104	0.0056	0.0190	0.0177	0.0193	0.0017	…	0.0085	0.0230	…	…	0.0030	…	…
ECRM 036-1	1968	0.858	0.194	0.327	0.0074	0.0095	*0.091*	…	*0.058*	…	*0.015*	0.0233	…	0.065	0.0100	…	*0.006*	…	*0.019*	…
ECRM 042-1	1972	0.108	0.037	0.666	0.0057	0.024	0.016	…	0.029	…	0.010	…	…	0.041	0.0078	…	…	…	…	0.0054 Nb
*ECRM 077-3	2017	0.1650	…	…	…	0.01623	…	…	…	…	…	…	…	…	0.00852	…	…	…	…	…
*ECRM 079-2	1989	0.596	0.247	0.743	0.0234	0.192	0.0382	…	0.022	…	0.021	0.004	…	0.046	0.0074	…	0.0037	…	…	…
*ECRM 082-1	1976	0.415	0.235	0.769	0.013	0.030	0.018	…	0.027	…	0.032	*0.029*	…	0.025	*0.0047*	0.149	…	…	…	0.030 Te
*ECRM 083-1	2009	0.0262	…	0.289	0.0076	0.0100	*0.013*	…	0.014	…	*0.004*	*0.004*	…	0.016	0.00189	…	…	…	…	…
*ECRM 083-2	2017	0.0315	0.00747	0.2160	0.0106	0.00561	0.0219	…	0.0116	…	0.0784	0.00177	0.00236	0.0127	0.00157	*(0.0002)*	…	*(0.0003)*	*(0.0005)*	0.00439 Zn
*ECRM 098-1	1993	0.00051	0.00048	0.00008	*0.00006*	0.00031	0.00571	0.00085	…	…	…	…	…	…	0.00024	…	…	…	…	

Alloy Steel Certified Reference Materials

(Finely divided material - units of 100g; 129-3, 179-2, 187-2, 192-1, 193-1 and 194-2 also available as 37-40mm dia. x 25-35mm discs)

BAM No.	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Al (Total)	As	B	Co	Cu	N	Sn	Ti	V	Others
ECRM 126-1	1963	0.841	*0.24*	1.817	0.009	0.005	0.317	…	*0.038*	…	…	…	…	*0.098*	…	…	…	0.143	…
ECRM 128-1	1972	0.085	0.949	0.839	0.007	0.007	0.108	…	0.046	0.286	…	…	…	0.055	*0.0024*	…	0.890	*0.008*	…
*ECRM 129-3	2008	0.3684	0.2087	0.371	0.0110	0.0165	1.702	0.206	1.022	1.016	0.0049	*0.00014*	0.0148	0.0804	0.0046	0.0067	0.030	*0.0045*	0.00059 Sb
ECRM 130-1	1968	0.546	0.313	1.593	0.0209	0.0158	*0.032*	…	*0.031*	0.0037	0.0167	…	…	0.072	0.0093	…	…	*0.003*	0.0019 Al (Acid Sol.)
*ECRM 179-2	1990	0.598	0.579	0.539	0.0267	*0.0006*	1.08	0.070	0.078	…	…	…	*0.0153*	0.111	0.0068	…	*0.0014*	0.188	1.87 W, <0.00003 Bi, <0.00003 Cd, 0.00129 Ga, 0.00144 Nb, 0.00013 Pb, 0.00175 Sb, <0.0002 Te, 0.00023 Zn
*ECRM 180-1	1973	0.197	0.362	1.286	0.0174	0.0249	1.250	…	0.096	…	0.030	…	…	0.115	0.0068	…	…	…	…
*ECRM 181-1	1973	0.590	1.054	1.047	0.018	0.035	0.126	…	0.070	0.022	*0.026*	…	…	0.174	0.0068	*0.015*	…	…	…
*ECRM 182-1	1993	0.790	0.368	0.389	0.009	0.011	0.591	…	0.152	0.020	…	…	…	0.141	0.0102	…	…	0.177	0.0039 Pb, 0.0042 Sb, 0.0015 Zn
*ECRM 183-1	1973	0.083	0.421	0.354	0.089	0.031	0.670	…	0.073	0.027	…	…	…	0.445	0.0064	…	…	…	…
*ECRM 187-1	1986	0.195	0.026	1.354	0.014	0.025	1.186	0.035	0.096	0.046	0.018	0.0004	0.014	0.161	0.014	0.011	…	…	…
*ECRM 187-2	2011	0.2038	0.2111	1.257	0.0066	0.0300	1.132	*0.0623*	0.1755	0.0223	0.0057	0.00048	0.0112	0.1288	0.0105	0.0237	…	0.0122	*0.0018* Sb
*ECRM 191-2	2006	0.0043	3.267	0.1334	0.0087	0.0029	0.0314	0.0020	0.0224	0.985	0.0018	…	…	0.0165	0.00105	0.0050	0.0024	…	…
*ECRM 192-1	1995	0.188	0.219	1.377	0.0029	0.0010	0.072	0.482	0.755	0.0308	*0.003*	*0.0002*	0.0055	0.045	0.0118	*0.003*	*0.001*	*0.003*	0.029 Al (Acid Sol.)
*ECRM 193-1	1990	0.139	0.404	0.972	0.0063	0.0086	0.182	0.347	1.178	0.0257	0.0062	*0.0002*	0.0073	0.598	0.0108	…	*0.0013*	*0.0019*	0.0232 Nb
*ECRM 194-1	2015	0.1532	0.431	1.188	0.0097	0.00059	0.733	0.2857	0.3417	0.0837	0.0042	0.0020	…	0.0751	0.0115	…	…	0.0243	0.0026 Ca
*ECRM 194-2	2015	0.1694	0.2974	1.282	0.0137	0.00049	0.760	0.402	0.3316	0.0669	0.00208	0.00155	0.00328	0.0313	0.00319	*0.0004*	0.00322	0.00161	0.0290 Nb, *0.0003* Sb

* Denotes Full EURONORM-Certified Reference Materials

BUNDESANSTALT FÜR MATERIALFORSCHUNG UND -PRÜFUNG (BAM), Germany

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate.

Highly Alloyed Steel Certified Reference Materials

(Finely divided material – units of 100g; 284-3, 288-1, 289-1, 290-1 and 291-1 also available as 36-40mm dia. x 25-35mm discs; 271-1 as a 37mm dia. x 25mm disc, 294-1 as a 40mm dia. x 20mm disc and both 297-1 and 299-1 as a 36mm dia. x 25mm disc)

BAM No.	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	B	Co	Cu	N	Sn	Ti	V	W	Others
ECRM 226-1	1967	0.416	0.514	0.434	0.0207	0.0094	13.67	0.024	0.139	…	*0.026*	…	*0.025*	…	0.0362	…	…	0.022	…	…
ECRM 227-1	1994	0.950	0.272	0.236	0.016	0.022	4.25	2.64	0.114	…	…	…	…	0.124	0.040	0.0251	…	2.44	3.03	0.0035 Sb
*ECRM 231-2	2002	0.0140	0.368	1.263	0.0179	0.0250	18.07	0.301	10.105	0.0032	0.0048	0.0020	0.0402	0.0941	0.0444	0.0043	0.0007	0.0708	0.0141	0.00074 Ca 0.0011 Sb
ECRM 235-1	1972	0.912	0.094	12.73	0.045	0.0072	0.354	0.032	…	…	…	…	…	0.073	0.020	…	…	…	…	…
ECRM 237-1	1973	0.068	0.482	1.443	0.032	0.012	17.24	0.306	10.32	…	…	…	0.221	0.123	0.035	…	…	0.057	…	0.660 Nb
*ECRM 271-1	2007	0.3698	0.923	0.437	0.0120	0.00045	5.002	1.247	0.1552	0.0234	0.0057	…	0.0139	0.1371	0.0137	0.0084	0.0020	0.850	0.0054	0.0009 Ca 0.0020 O
*ECRM 278-1	1973	0.903	0.336	0.405	0.0154	0.0052	18.11	1.040	0.236	…	…	…	…	0.077	…	…	…	0.077	…	…
*ECRM 283-1	1985	1.219	0.345	0.217	0.022	0.029	4.15	3.41	…	0.010	…	0.0003	10.27	…	0.033	…	…	3.28	9.66	…
*ECRM 284-2	2000	0.0201	0.537	1.745	0.0258	0.0237	16.811	2.111	10.72	0.0027	0.0063	0.0026	0.0525	0.1831	0.0151	0.0047	0.191	0.0425	…	0.0099 O
*ECRM 284-3	2016	0.0025	0.0442	0.0615	0.0049	0.0066	17.37	2.236	12.09	*0.002*	0.00131	0.00020	0.0366	0.0105	0.0418	0.00074	0.0050	*0.005*	0.0039	…
*ECRM 286-1	1985	0.100	…	1.92	0.026	0.280	18.13	0.329	8.54	*0.0023*	…	*0.0003*	0.150	…	0.043	0.0084	…	…	…	0.0014 Sb
*ECRM 288-1	1986	2.08	0.260	0.292	0.024	*0.0012*	12.00	0.103	0.298	0.012	*0.006*	…	0.018	0.060	0.0151	*0.0043*	0.020	0.055	*0.68*	…
*ECRM 289-1	1990	0.0489	0.531	1.016	0.0114	0.0027	14.63	1.102	24.68	0.199	*0.006*	0.0044	0.065	…	…	0.111	2.01	0.260	…	…
*ECRM 290-1	1990	0.911	0.072	0.244	0.0160	0.0160	4.18	4.83	0.329	…	…	…	5.12	0.081	0.0325	…	…	1.91	6.27	…
*ECRM 291-1	1990	0.903	0.907	0.808	0.0168	0.0087	17.10	2.10	0.563	0.0030	…	…	0.0233	0.0711	0.1142	…	…	0.388	…	…
*ECRM 294-1	2005	0.0657	0.283	18.68	0.0271	0.00031	17.98	0.0861	0.429	*0.001*	0.0037	*<0.0005*	0.0288	0.0242	0.566	*0.001*	*<0.002*	0.0694	*<0.004*	…
*ECRM 297-1	2005	0.0223	0.344	0.897	0.0135	0.0101	18.37	0.290	12.33	0.0195	0.0040	1.146	0.0413	0.204	0.0152	…	0.0072	0.535	*0.006*	…
*ECRM 299-1	2009	0.0154	0.299	0.2678	0.0152	0.00022	22.32	0.0186	0.172	5.33	0.0054	0.0002	0.0187	0.0382	0.0198	*0.008*	0.1289	0.0329	*0.0002*	0.1775 Zr

Also available: **BAM Steel-H1**, highly alloyed steel, with a certified hydrogen content of **0.97** mg/kg (100 x 1g pins)

Special Alloy Certified Reference Materials

(Finely divided material – units of 100g)

BAM No.	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Co	Cu	N	Nb	V	W	Zr	Ta	Fe
ECRM 326-1	1972	0.092	1.46	0.406	0.0093	0.0028	16.37	*0.025*	61.16	*0.79*	0.223	*0.027*	*0.036*	…	*0.024*	…	0.129	…	…
ECRM 327-2	1972	0.152	2.052	1.289	0.0228	0.0046	24.35	0.174	19.72	0.070	0.159	0.060	0.059	…	0.044	…	…	…	…
ECRM 328-1	1973	0.390	0.629	1.395	0.005	0.003	20.54	4.41	20.38	0.070	41.65	0.013	0.027	3.61	…	4.16	…	0.18	2.40

Cast Iron Certified Reference Materials

(Finely divided material – units of 100g)

BAM No.	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	Cu	N	Ti	V	Mg
*ECRM 428-2	1998	2.747	1.752	0.750	0.0691	0.1105	0.0366	*0.0014*	0.0358	…	0.0156	0.0996	…	0.0311	0.0120	…
*ECRM 476-3	1996	3.390	1.813	0.987	0.0908	0.0493	0.0648	…	0.0549	…	0.0145	0.2445	0.0038	0.0222	0.0115	…
*ECRM 478-2	1996	4.003	2.411	0.321	0.202	0.0460	0.251	…	0.151	…	*0.0018*	0.1276	0.0023	0.0328	0.0113	…
*ECRM 479-1	1978	2.86	2.02	0.136	0.076	0.089	1.00	0.196	1.012	0.014	…	…	…	…	…	…
*ECRM 480-1	1988	3.03	2.41	0.151	0.0021	0.0086	…	…	0.483	0.016	…	…	…	…	…	0.017

* Denotes Full EURONORM Certified Reference Materials

BUNDESANSTALT FÜR MATERIALFORSCHUNG UND -PRÜFUNG (BAM), Germany

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate.

Ferro-Alloy Certified Reference Materials (Finely divided material – units of 100g)

BAM No.	Cert. Date	C	Si	Mn	P	S	Cr	Ni	Al	B	Cu	Pb	N	Ti	Ca	Mg	Fe
*ECRM 502-2	2004	6.94	*0.10*	77.87	0.148	*0.002*	0.0265	0.0384	…	*0.0003*	0.0370	0.0179	*0.02*	0.0034	…	…	*14.6*
ECRM 529-1	1975	0.10	91.11	0.04	0.013	…	…	…	0.86	…	…	…	…	0.09	0.46	0.04	6.15

* Denotes Full EURONORM-Certified Reference Materials

Ore Certified Reference Materials (Finely divided material – units of 100g)

BAM No.	Cert. Date	Description	Fe	SiO_2	Al_2O_3	TiO_2	CaO	MgO	Mn	P	S	Na_2O	K_2O	As	Ba	CO_2	H_2O
ECRM 630-1	1969	Bomi-Hill Concentrate	65.63	5.88	0.88	0.066	0.10	0.47	0.060	0.043	0.032	…	…	…	…	…	…
ECRM 631-1	1969	Venezuela Iron Ore	61.09	3.20	1.06	0.109	0.75	0.54	0.044	0.114	0.033	*0.04*	*0.04*	…	…	…	…
ECRM 633-1	1967	Manganese Ore	1.64	10.39	1.64	0.079	2.02	0.58	47.85	0.170	0.227	…	…	*0.0040*	1.13	*3.48*	*7.11*

Iron Ore Certified Reference Materials (Finely divided material – units of 100g; 686-1 supplied as 2 x 50g)

BAM No.	Cert. Date	Description	Fe	Si	Al	Ti	Ca	Mg	Mn	P	S	Na	K	Zn	Cl	Co	Cr	Cu	Ni	Others
*ECRM 680-1	1977	Purple Ore	59.98	4.20	0.66	0.045	0.45	0.14	0.025	0.018	0.544	0.128	0.078	0.165	…	0.013	0.005	0.063	0.007	0.317 Pb, 0.057 As
*ECRM 686-1	2002	Iron Oxide	69.44	0.0083	0.0407	0.0014	0.0097	0.0027	0.231	0.0078	…	0.0058	0.0024	0.0004	0.095	0.0019	0.0182	0.0003	0.0004	0.0007 Mo, 0.0002 Sn
*ECRM 687-1	2009	Iron Oxide	69.66	0.0157	0.0356	0.0303	0.0113	0.0018	0.1658	0.0120	…	0.0030	0.0011	0.0051	0.0173	*(0.002)*	0.0227	0.0030	0.0122	0.0020 Mo, 0.0006 Sn

Ceramic Certified Reference Materials (Finely divided material – units of 100g; 777-1 supplied as 2 x 50g)

BAM No.	Cert. Date	Description	Si	Ca	Mg	Al	Ti	Mn	P	Fe	Na	K	B	Cr
*ECRM 777-1	1984	Silica Brick	44.44	2.02	0.043	0.42	0.27	…	…	0.23	*0.02*	0.13	…	…
*ECRM 779-1	1991	Magnesite	0.182	1.691	*54.6*	0.105	0.0081	0.503	0.0267	3.73	*0.006*	*0.002*	0.0116	*0.003*

Molybdenum Oxide Certified Reference Material (Finely divided material – units of 100g)

BAM No.	Cert. Date	Ca	Mg	Ti	P	Bi	Cu	Fe	Pb	K	Al	As	Mo	Si	S	Na	C	W	Ba	V
*ECRM 784-1	2018	0.888	0.0883	0.0223	0.0113	0.00326	0.390	1.870	0.0215	0.164	0.468	0.0126	*57.85*	*2.651*	*0.0083*	*0.0396*	*0.0103*	*0.0145*	*(0.006)*	*(0.127)*

Slag Certified Reference Materials (Finely divided material – units of 100g)

BAM No.	Cert. Date	Description	SiO_2	CaO	P_2O_5 (Citric Acid Sol.)	P_2O_5 (Total)	Cr	Al	V	K	Na	Mo	Ni	B	Cu	Pb	F
ECRM 826-1	1994	Phosphate Slag	8.96	46.48	10.73	14.65	0.182	0.696	0.503	0.0278	0.375	*0.001*	*0.002*	*0.003*	*0.002*	*0.005*	*0.37*
ECRM 827-1	1991	Thomas Phosphate	6.21	47.38	18.79	20.70	…	…	…	…	…	…	…	…	…	…	…

* Denotes Full EURONORM-Certified Reference Materials

BUNDESANSTALT FÜR MATERIALFORSCHUNG UND - PRÜFUNG (BAM), Germany

CHEMICAL COMPOSITION (nominal mass content) – Figures in bold type certified, figures in small italic type only approximate and figures in brackets are for information only.

Copper and Copper Alloy Certified Reference Materials (223-229 finely divided material – units of 100g; all others are 40mm dia. x 30mm discs)

Mass fraction in %

BAM No.	Cu	Sn	Zn	Pb	Fe	Ni	Al	Mn	Bi	As	Sb	Si	P	S	Cd	Ag	Mg	Others
223	58.74	0.089	38.82	2.13	0.091	0.0214	*<0.002*	*<0.001*	0.0018	0.0084	0.0040	*<0.003*	0.0003	0.0011	…	…	…	*<0.0001* Se
224	57.40	0.066	39.40	1.13	0.136	0.038	0.0012	1.70	0.0006	0.0025	0.0026	*(0.002)*	0.0112	0.0004	…	…	…	…
227	85.57	6.01	3.46	4.12	0.129	0.284	*<0.0001*	…	0.0088	0.081	0.160	*<0.01*	*0.0002*	0.122	…	…	…	0.0028 Se, 0.0012 Te
228	85.34	9.76	3.32	1.24	0.036	0.109	*0.0001*	*<0.001*	0.0086	0.024	0.078	…	0.019	0.036	…	…	…	0.0012 Se
229	63.334	0.00485	36.63	0.0192	0.01061	0.01114	…	…	…	0.00217	0.00072	…	*0.0011*	…	…	…	…	0.0034 Se
368	77.05	0.0147	Bal.	0.0131	0.0193	0.0258	1.972	0.0203	…	0.0246	…	*0.013*	0.0090	*0.0019*	…	…	0.0062	0.00129 Ti
369	…	…	0.0022	…	…	…	…	…	0.00097	…	…	…	…	…	…	…	0.00036	0.001042 Co, 0.000921 Cr
370	…	0.00168	…	0.00158	…	…	0.00126	…	…	…	0.00156	0.00187	0.00117	…	…	…	…	…
371	…	…	…	…	0.00183	…	…	…	…	…	…	…	…	0.00121	0.00016	…	…	0.00144 Te
372	…	…	…	…	…	0.00117	…	0.00114	…	0.00103	…	…	…	…	…	0.00090	…	0.00084 Se
ERM-EB374	92.22	7.60	0.00404	0.00083	0.0040	0.00327	*<0.0001*	0.00043	0.00022	0.00043	0.00063	*<0.001*	0.1697	0.0013	*<0.0001*	0.00121	*<0.0001*	*<0.0002* Se, *<0.0001* Te
ERM-EB375	58.32	0.209	38.02	2.90	0.207	0.1053	0.0270	0.0222	0.00686	0.0231	0.0122	0.0211	*0.00086*	…	0.00859	0.0166	…	0.00538 Te
M376a	Bal.	0.0247	0.0217	0.0236	0.0235	0.0209	*0.0182*	0.0206	0.0200	0.0200	0.0202	…	0.0203	*0.0133*	0.0186	0.0163	*0.0124*	0.0210 Se, 0.0215 Te 0.00422 Zr
ERM-EB377	94.04	5.92	0.01006	0.00449	0.01042	0.01074	0.00451	0.00921	0.00422	*<0.001*	0.0013	*<0.0134*	*<0.001*	0.00068	*<0.0001*	0.00644	*<0.0001*	0.0055 Se, *<0.0001* Te
ERM-EB378	94.13	5.74	*0.00073*	*0.00042*	0.00182	0.00183	*<0.0001*	*0.000074*	*<0.0001*	0.00995	0.00861	*<0.0010*	0.0602	*0.00091*	0.01007	0.00266	0.00287	*<0.0002* Se, 0.00850 Te 0.0089 Co, 0.0311 Cr
ERM-EB387	75.18	0.00301	19.57	0.00108	0.0617	5.020	…	0.0796	…	…	…	…	…	…	…	…	…	…
ERM-EB388	89.27	0.857	4.81	0.000969	0.0303	0.00736	4.972	0.0512	…	…	…	…	…	…	…	…	…	…
ERM-EB389	74.3	0.0262	0.1125	0.0098	0.107	24.7	*0.0123*	0.415	0.0044	…	0.0046	*0.0349*	0.0093	*0.0308*	0.0016	…	0.067	0.0770 Co, 0.0153 Cr 0.0660 Ti, 0.098 Zr
ERM-EB393a	75.8	39.0	*(20.8)*	0.0104	0.0143	0.00297	0.00021	0.00185	*0.000019*	0.000134	*0.000093*	3.35	0.0454	…	0.000061	…	…	*0.000047* Se, 0.0000156 Cr
M394	57.70	0.232	…	1.93	0.1191	0.0399	*0.00010*	0.00141	0.00081	0.01001	0.00238	*0.00053*	0.00157	…	0.00070	…	…	*<0.0002* Cr
M394a	57.64	0.174	…	1.92	0.1323	0.0386	*0.00079*	0.00125	0.00083	0.00959	0.00241	*0.00058*	0.00172	…	0.00073	…	…	0.00013 Cr
M396	65.49	0.0367	…	0.592	0.0235	0.0143	0.223	0.00445	0.00032	0.0590	0.00061	0.187	0.00089	…	0.00022	…	…	0.00012 Co, 0.00079 Cr
M397	…	3.99	1.96	0.229	…	0.336	…	…	…	*0.00029*	0.097	…	…	0.459	…	…	…	*<0.0001* Se, *<0.0001* Te
M397a		3.98	1.87	0.227		0.337				*0.00020*	0.097			0.45				*<0.0001* Se, *<0.0001* Te

Pure Copper Certified Reference Materials (M365a finely divided material – units of 100g; all others are 40mm dia. x 30mm discs, except M383b - M385a which are 38mm dia. x 30mm discs)

Mass fraction in µg/g, except where marked

BAM No.	Cu	Sn	Zn	Pb	Fe	Ni	Al	Mn	Bi	As	Sb	Si	P	S	Cd	Co	Cr	Ag	Se	Te	Mg	Ti	Zr
M365a*	99.73%	*(29)*	30	141	6.1	235	…	…	30.0	40.4	12.1	…	…	…	…	2.13	…	159	179	1.27	…	…	…
M381	Bal.	3.86	5.3	0.59	3.3	0.7	*<1*	0.22	<0.3	<0.5	<1	*<3*	…	*3.2*	<0.4	<0.3	<0.4	<1	*<1*	<0.3	<0.6	<0.3	<6
M383b	Bal.	0.8	9.3	1.01	3.6	1.43	*<1.2*	0.18	1.85	2.8	1.69	*<2*	*<1*	*3.6*	0.93	1.02	*<1*	10.6	1.17	5.7	*<1*	*<1*	*<1*
M384a	Bal.	2.6	5.3	11.7	2.7	6.1	*<1.5*	0.22	6.16	5.4	5.4	*<2.5*	*<1.5*	*4.6*	4.1	3.64	*<0.2*	10.7	5.8	9.3	*<0.2*	*<1*	*0.1*
M384b	Bal.	2.1	2.6	1.6	*5.1*	4.7	*2.9*	8.1	6.81	6.6	5.8	*<2.5*	*<2*	*3.8*	4.0	10.4	*2.3*	11.3	*2.9*	7.2	3.3	2.9	1.3
M385a	Bal.	16.0	9.2	10.8	44.5	10.8	13.3	9.9	5.62	9.3	14.9	7.2	10.0	35.4	2.73	7.5	10.4	24.9	5.2	8.1	*(32)*	6.7	*(18)*
M390	Bal.	*<0.1*	…	…	0.79	…	…	…	…	…	…	…	1.3	…	…	…	…	…	…	…	…	…	…
M391	Bal.	*<0.1*	…	…	0.90	…	…	…	…	…	…	…	3.3	…	…	…	…	…	…	…	…	…	…
M392	Bal.	*<0.1*	…	…	0.80	…	…	…	…	…	…	…	7.0	…	…	…	…	…	…	…	…	…	…

*O=(*1712*) µg/g

Also available: **379/1**, **379/2** and **379/3** which are certified for oxygen at **38** µg/g, **212** µg/g and **378** µg/g respectively (40mm dia. x 30mm discs).

BUNDESANSTALT FÜR MATERIALFORSCHUNG UND - PRÜFUNG (BAM), Germany

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate.

Aluminium Alloy Certified Reference Materials

(201-301 and M319 finely divided material – units of 100g; ERM-EB307a, EB312a, EB315a, M318, M320 and M321 – approx. 65mm dia. x 30mm discs; M308a – approx. 60mm dia. x 30mm discs; 310 and 311 – approx. 60mm dia. x 25mm discs; ERM-EB316 and EB317 – approx. 50mm dia. x 30mm discs)

BAM No.	Si	Mn	Fe	Cu	Ti	Zn	Mg	Pb	Al	Cr	Ni	V	Be	Bi	Ca	Cd	Li	Na	Sn	Zr	Ga	Sc
201	13.20	0.38	0.18	0.009	0.011	0.038	0.0024	…	Bal.	…	…	…	…	…	…	…	…	…	…	…	…	…
300	0.14	0.018	0.203	0.046	0.011	0.128	2.67	0.016	Bal.	0.23	…	…	…	…	…	…	…	…	*<0.0005*	…	…	…
301	0.061	0.001	0.054	0.0016	0.005	0.033	0.0008	…	Bal.	…	…	0.0018	…	…	…	…	…	…	*<0.0005*	…	…	…
ERM-EB307a	0.152	0.811	0.345	0.0939	0.0595	0.0690	4.80	0.0084	Bal.	0.1536	0.0097	0.0119	0.000537	…	0.00192	0.00326	0.00081	*0.00084*	0.0075	0.00319	0.0124	…
M308a	0.072	0.0343	0.164	1.36	0.0257	5.61	2.28	0.00436	Bal.	0.192	0.0147	…	0.00018	…	*0.00108*	…	…	0.00158	…	0.00873	…	…
310	0.080	0.003	0.070	0.0017	0.003	0.009	0.994	0.0035	Bal.	0.0009	0.002	0.0044	0.00013	…	0.00073	0.0024	0.00037	*0.0003*	0.0024	0.0014	0.0115	…
311	0.204	0.694	0.310	4.653	0.056	0.200	1.567	0.0504	Bal.	0.104	0.052	0.0240	0.00052	0.0500	0.00056	0.0013	0.00053	*0.0018*	0.0127	0.140	0.0159	…
ERM-EB312a	0.403	0.0488	0.198	0.0509	0.0291	0.0297	0.379	0.00497	Bal.	0.0320	0.00407	0.00673	…	0.00180	*0.00169*	0.00167	0.00060	*0.00040*	…	0.00085	0.0129	…
ERM-EB315a	9.88	0.311	0.621	2.46	0.142	0.801	0.446	0.077	Bal.	0.0274	0.0955	0.00470	0.000433	0.0036	…	0.00079	…	…	0.0764	0.00310	0.0089	…
ERM-EB316	11.98	0.204	0.1054	0.2970	0.0790	0.0611	0.045	0.0087	Bal.	0.00593	0.0235	0.0098	0.000295	0.0140	*0.00113*	0.00208	…	…	*0.0106*	0.00328	0.0105	…
ERM-EB317	0.0271	0.0912	0.112	1.77	0.0952	6.93	2.39	0.00481	Bal.	0.141	0.0359	0.0105	0.00101	0.0041	*0.00060*	…	…	…	0.0237	0.130	0.0183	…
M318	1.210	0.0908	0.246	0.0986	0.0238	0.0486	0.356	0.0056	Bal.	0.0208	0.00500	0.0104	0.00047	…	0.00091	0.00096	0.00060	0.00037	0.00206	0.00329	0.0189	…
M319	0.1043	0.371	0.291	0.0015	0.0030	0.0073	4.96	*<0.001*	…	*0.060*	*0.037*	*0.0093*	…	*<0.001*	…	*<0.0002*	…	…	*<0.001*	0.324	*0.015*	0.847
M320	0.197	0.699	0.206	0.147	0.102	0.252	3.98	0.00448	…	0.1044	0.00209	0.00759	0.00224	…	0.00119	0.00152	0.00091	0.0064	0.00456	0.102	0.0208	0.282
M321	0.0496	0.812	0.0495	4.38	0.0436	0.147	1.51	0.0099	…	0.0558	0.0504	0.0105	0.00049	0.0323	0.00052	0.0030	0.00058	0.00029	0.0286	0.1554	0.00880	0.0502

ERM-EB307a also certified for Co: **0.00051**% and Sb: **0.0046**%, M308a for Ag: **0.00065**%, ERM-EB312a for Sr: **0.00111**%, ERM-EB315a for Sb: **0.0051**%, ERM-EB316 for Sr: **0.0260**%, ERM-EB317 for Ag: **0.0073**% and In: **0.0162**%.

Lead Alloy Certified Reference Materials

(Disc samples – dimensions as below)

BAM No.	Description	Disc Dimensions	Ca	Sb	As	Sn	Se	Bi	Ag	Al	Cu	Tl	Ni	Cd	Hg	Pt	S	Te	Zn
ERM-EB101a	PbCaSnAl	40mm dia. x 40mm	0.136	*<0.00012*	*<0.0002*	0.294	…	0.0165	0.00290	0.0227	0.00243	0.00102	*<0.00006*	*(0.0002)*	…	…	*(<0.0003)*	*<0.0003*	0.00010
ERM-EB102a	PbCaSn	40mm dia. x 40mm	0.0635	*0.0004*	*<0.0002*	1.01	…	0.00737	0.0170	0.0124	0.00013	0.00302	…	…	…	…	*(<0.0003)*	*<0.00011*	*<0.00005*
ERM-EB103	PbSb1.6	40mm dia. x 30mm	…	1.64	0.097	0.183	0.0180	0.0158	0.0066	…	0.00097	0.00152	0.000302	0.000020	…	…	*0.00054*	*0.00019*	…
ERM-EB104	PbCaSn	40mm dia. x 40mm	0.0530	…	…	1.27	…	*0.0126*	*0.00293*	…	…	…	…	…	…	…	…	…	…
ERM-EB105	PbCaSn	40mm dia. x 40mm	0.0595	…	…	1.43	…	0.0133	0.00321	…	…	…	…	…	…	…	…	…	…
ERM-EB106	PbCaSn	40mm dia. x 40mm	0.0782	…	…	1.72	…	*(0.0135)*	*(0.00323)*	…	…	…	…	…	…	…	…	…	…
ERM-EB107	Pure Lead	40mm dia. x 40mm	…	…	…	…	…	…	…	…	…	…	…	0.00261	0.00113	…	…	…	…
ERM-EB108	Pure Lead	40mm dia. x 40mm	…	…	…	…	…	…	…	…	…	…	…	0.00260	0.00083	…	…	…	…
M109	Refined Lead	40mm dia. x 28mm	…	0.0098	0.0113	0.115	…	0.0193	0.00451	*<0.00021*	0.00196	0.00030	0.00035	0.00353	…	…	…	0.00306	0.00318
M110	PbSb3	40mm dia. x 28mm	*<0.0002*	3.08	0.107	0.131	0.0106	0.0126	0.00226	…	0.00064	…	…	*<0.0001*	…	…	…	0.00038	*<0.0001*
M112	Pure Lead	38mm dia. x 38mm	…	…	…	…	0.00052	…	…	…	0.00082	…	0.00053	…	…	0.00054	…	0.00053	…

Gold Alloy Certified Reference Materials

(15.8mm dia. x 0.25mm discs)

BAM No.	Description	Au	Ag	Cu	Ni	Zn
ERM-EB506	Rose Gold	58.56	3.90	35.65	…	1.891
ERM-EB507	White Gold	75.10	3.02	14.69	4.99	2.107
ERM-EB508	Yellow Gold	75.12	24.90	…	…	…

Iron in Float Glass Certified Reference Materials

(100mm x 50mm x 3.5mm plates)

BAM No.	Fe (total)	Fe(II)	Fe(II) as Fe_2O_3	Fe(III)
S050	0.0084	0.0026	0.0037	0.0058
S051	0.0481	0.0155	0.0326	0.0326
S052	0.597	0.160	0.229	0.437

BUNDESANSTALT FÜR MATERIALFORSCHUNG UND - PRÜFUNG (BAM), Germany

CHEMICAL COMPOSITION (nominal mass content) – Figures in bold type certified, figures in small italic type only approximate.

High Purity Substances Certified Reference Materials (Finely divided material - units of 100g) Mass fraction in µg/g

BAM No.	Description	Cert. Date	CO_2	H_2O	Ag	Al	As	B	Ba	Be	Bi	C	Ca	Cd	Ce	Cl
RS 1	SiO_2 (>99.99%)	1991	…	…	…	8.7	<0.1	…	…	…	…	…	0.42	<0.05	…	…
RS 2	Al_2O_3 (99.76%)	1994	…	2280	…	…	*<0.5*	*<5*	*<0.5*	*<0.2*	…	…	3.1	*<0.2*	*<0.1*	*<10*
RS 3	$CaCO_3$ (99.79%)	1994	43970	1320	…	*<5*	…	*<1*	45.3	…	…	…	…	*<0.5*	…	…
RS 4	Ni (99.995%)	1996	…	…	<1	<1	<0.5	*<2*	…	…	*<2*	9.4	<1	<0.2	…	…
RS 5	NiO (Ni: 79.3%)	1996	…	150	<1	6	<0.2	…	<1	…	*<1*	14	2.2	<0.2	…	…
RS 6A	MgO (Mg: 60.19%)	1997	…	110	…	46	…	…	*<10*	…	…	*<50*	994	…	…	…
RS 6B	MgO (Mg: 60.17%)	1997	…	283	…	49	…	…	*<20*	…	…	*<210*	956	…	…	…

BAM No.	Co	Cr	Cu	Fe	Ga	Ge	Hg	In	K	La	Li	Mg	Mn	Mo	N	Na
RS 1 (continued)	…	0.062	<0.1	0.62	…	<1	<0.05	…	0.48	…	0.25	<0.5	<0.2	…	…	<2
RS 2 (continued)	<1	<1.5	<2.5	3.3	*<2*	…	…	*<0.5*	*<5*	*<0.3*	*<1*	<3	<1.5	*<1*	…	<15
RS 3 (continued)	*<1*	<1	<1	<5	*<1.5*	…	…	…	*<20*	*<0.5*	…	183	3.0	…	…	47.5
RS 4 (continued)	<1	<0.5	<2	4.2	<0.2	…	*<1*	*<0.2*	…	…	…	<0.8	<0.5	*<0.2*	2.5	*<1*
RS 5 (continued)	<2	10	1.53	27	<0.5	…	…	*<1*	<2	…	*<2*	<1	<1	<5	…	<2
RS 6A (continued)	*<5*	9.2	*<6*	82	…	…	…	…	…	…	…	601900	5.4	*<10*	…	…
RS 6B (continued)	*<5*	8.1	*<6*	80	…	…	…	…	…	…	…	601700	5.2	*<10*	…	…

BAM No.	Ni	O	Pb	S	Sb	Se	Si	Sn	Sr	Te	Ti	Tl	V	W	Zn	Zr
RS 1 (continued)	<0.2	…	<0.15	…	…	…	…	…	…	…	1.3	…	…	…	<1.3	<0.1
RS 2 (continued)	<10	…	…	…	…	…	<20	*<1*	…	…	<2	…	*<1*	…	<2	3.2
RS 3 (continued)	*<3*	…	*<0.1*	…	…	…	*<20*	*<1*	173	…	*<0.5*	…	…	…	<2	*<0.2*
RS 4 (continued)	999950	*29*	<1	*<2*	<0.2	<1	*<2*	0.3	…	*<0.2*	…	<0.2	*<0.2*	*<0.1*	<4	…
RS 5 (continued)	793000	207000	<2	*<4*	*<0.1*	<1	*<5*	*<1*	*<1*	*<0.2*	*<2*	<0.5	<1	*<1*	3.4	*<1*
RS 6A (continued)	3.9	…	*<5*	…	…	…	…	…	2.0	…	1.3	…	8.4	…	*<6*	*<20*
RS 6B (continued)	3.3	…	*<5*	…	…	…	…	…	2.1	…	1.2	…	7.8	…	*<6*	*<160*

Platinum Group Elements in Used Automobile Catalyst Certified Reference Material (Finely divided material - units of 200g) Mass fraction in µg/g

BAM No.	Pt	Pd	Rh
ERM-EB504a	1414	1596	210.0

Electronic Scrap Certified Reference Material (Finely divided material - units of 200g) Mass fraction in µg/g

BAM No.	Cu	Ni	Ag	Pb	Cr	Sn	Au	Pd	Pt	As	Be	Cd	In	Hg
M505a	167600	6940	633	11300	9800	4680	52.4	48.0	5.7	372	6.8	16.4	*43*	*<5*

Silicon Nitride Powder Certified Reference Material (Finely divided material - units of 50g) Mass fraction in µg/g

BAM No.	Al	Ca	Co	Fe	Mg	Na	W	C	N	O	β-phase
ERM-ED101	469	14.1	43.5	79.5	4.3	7.59	41.3	1620	381000	*19100*	74300

Tungsten Metal Powder Certified Reference Material (Finely divided material - units of 100g) Mass fraction in µg/g

BAM No.	Al	Ca	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Si	Sn
S002	29.4	46	45	47.0	28.4	53	40.0	38.8	16.7	59	41	29	*7.2*	106	42

Glass Certified Reference Materials (S004 finely divided material - units of 50g; S005c – approx. 38mm dia. x 4mm discs) Mass fraction in %

BAM No.	Description	SiO_2	Na_2O	CaO	Al_2O_3	BaO	MgO	ZnO	SO_3	K_2O	Cr_2O_3	Fe_2O_3	CuO	Cr Hexavalent	Cr Total
S004	Containing Hexavalent Chromium	*70.9*	*14.5*	*9.4*	*2.15*	*1.2*	*0.90*	*0.33*	*0.17*	*0.16*	*0.07*	*0.06*	*0.04*	0.0094	0.0471
S005c	Multielement	70.8	13.92	10.39	1.109	0.0114	2.28	0.0196	…	0.717	0.00158	0.0422	0.0107	…	0.00108

BNF - FULMER (BNF), UK

CHEMICAL COMPOSITION (nominal mass content in %)

Following the closure of the BNF-Fulmer organization in October 1992, BAS purchased their entire stock of non-ferrous spectroscopic reference materials and will continue to supply these until exhausted. Replacement samples are being produced by BAS in order to maintain continuity of these samples (see BAS Catalogue for details of such samples which are designated as CURMs).

Copper Base Reference Materials (Approx. 50mm dia x 10mm discs)

BNF No.	Description	Cu	Sn	Pb	Zn	Ni	P	Fe	Si	Mn	As	Sb	Bi	Al	Mg	S
C11.01-1	Copper Tin Binary Bronze	Bal.	*3.4*	*0.01*	*<0.005*	*0.006*	*0.009*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.0005*	*<0.005*	*<0.001*	*<0.001*
C11.02	〃	Bal.	*5.5*	*0.02*	*<0.005*	*0.006*	*0.02*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.0005*	*<0.005*	*<0.001*	*<0.001*
C11.03	〃	Bal.	*7.4*	*0.01*	*<0.005*	*<0.005*	*0.04*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.0005*	*<0.005*	*<0.001*	*<0.001*
C11.04	〃	Bal.	*9.6*	*0.01*	*<0.005*	*<0.005*	*0.05*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.0005*	*<0.005*	*<0.001*	*<0.001*
C30.01-2	Main Elements in Brass	*51.48*	*<0.01*	*<0.01*	Bal.	*<0.005*	...	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*0.005*	*<0.002*	...	...
C30.02-1	〃	*55.6*	*<0.01*	*<0.01*	Bal.	*<0.005*	...	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.002*	...	...
C30.03-2	〃	*60.6*	*<0.01*	*<0.01*	*39.3*	*<0.01*	...	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.002*	...	...
C30.06-1	〃	*74.8*	*<0.01*	*<0.01*	Bal.	*<0.01*	...	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.002*	*<0.002*	...	...
C30.07-1	〃	*82.0*	*<0.01*	*<0.01*	Bal.	*<0.01*	...	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.002*	*<0.002*	...	...
C30.10-2	〃	*93.8*	*<0.01*	*<0.01*	*6.1*	*<0.01*	...	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.002*	*<0.002*	...	...
C30.12-2	〃	*60.85*	*<0.01*	*<0.01*	Bal.	*0.52*	...	*<0.005*	*<0.005*	*0.90*	*<0.005*	*<0.005*	*<0.002*	*<0.005*	...	...
C30.13-1	〃	*60.6*	*<0.01*	*<0.01*	Bal.	*<0.01*	...	*<0.005*	*<0.005*	*1.9*	*<0.005*	*<0.005*	*<0.002*	*<0.002*	...	...
C30.14-2	〃	*60.5*	*<0.005*	*<0.01*	Bal.	*1.0*	...	*<0.01*	*<0.005*	*2.4*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	...	...
C30.15-1	〃	*60.6*	*<0.01*	*<0.01*	Bal.	*<0.01*	...	*0.55*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.002*	*<0.002*	...	...
C30.16-1	〃	*61.2*	*<0.01*	*<0.01*	Bal.	*<0.01*	...	*0.90*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.002*	*<0.002*	...	...
C30.17-2	〃	*61.6*	*<0.01*	*0.01*	Bal.	*0.01*	...	*1.4*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	...	...
C30.18-1	〃	*64.36*	*0.65*	*<0.01*	Bal.	*<0.005*	...	*<0.005*	*0.10*	*<0.005*	*<0.005*	*<0.005*	*<0.003*	*2.91*	...	...
C30.19-1	〃	*69.9*	*1.07*	*<0.01*	Bal.	*<0.01*	...	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.01*	*<0.002*	*4.65*	...	...
C30.21-1	〃	*56.0*	*1.96*	*<0.005*	Bal.	*<0.005*	...	*<0.005*	*0.18*	*<0.005*	*<0.005*	*<0.01*	...	*1.44*	...	...
C30.22-2	〃	*58.28*	*0.009*	*1.05*	Bal.	*<0.01*	...	*0.006*	*<0.005*	*<0.005*	*0.011*	*<0.012*	*<0.005*	*<0.003*	...	...
C38.01-1	Impurities in Brass	*61*	*0.20*	*0.20*	Bal.	*0.01*	...	*0.01*	*<0.0005*	*0.009*	*0.03*	*0.02*	*<0.0005*	*0.003*	...	...
C38.02-1	〃	*61*	*0.10*	*0.10*	Bal.	*0.03*	...	*0.09*	*0.01*	*0.14*	*0.06*	*0.06*	*0.005*	*0.004*	...	...
C38.03-1	〃	*61*	*0.05*	*0.06*	Bal.	*0.13*	...	*0.05*	*0.07*	*0.07*	*0.08*	*0.08*	*0.008*	*0.07*	...	...
C38.04-1	〃	*61*	*0.02*	*0.03*	Bal.	*0.06*	...	*0.04*	*0.12*	*0.22*	*0.04*	*0.12*	*0.008*	*0.02*	...	...
C38.05-1	〃	*61*	*0.01*	*0.02*	Bal.	*0.19*	...	*0.008*	*0.14*	*0.02*	*0.01*	*0.01*	*0.01*	*0.12*	...	...
C38.06-1	〃	*61*	*<0.005*	*0.002*	Bal.	*<0.005*	...	*<0.005*	*<0.0005*	*<0.001*	*<0.001*	*<0.002*	*<0.0005*	*<0.001*	...	...

BNF – FULMER (BNF), UK

CHEMICAL COMPOSITION (nominal mass content in %)

Copper Base Reference Materials (Approx. 50mm dia x 10mm discs)

BNF No.	Description	Cu	Sn	Pb	Zn	Ni	P	Fe	Si	Mn	As	Sb	Bi	Al	Mg	Co	S	Cr	Ag	Cd
C42.21-1	Admiralty and Naval Brass	*66.1*	*0.54*	*0.23*	*Bal.*	*0.096*	*0.081*	*0.06*	*0.081*	*<0.005*	*<0.005*	*0.19*	*0.012*	*0.005*	...	...	*0.007*	...	...	...
C42.25	″	*58.5*	*2.2*	*<0.01*	*Bal.*	*<0.005*	*0.06*	*<0.005*	*<0.002*	*0.13*	*0.10*	*<0.005*	*<0.002*	*0.02*	...	...	*0.001*	...	...	...
C43.03-1	Aluminium Brass	*80.0*	*<0.01*	*0.11*	*Bal.*	*<0.003*	...	*0.044*	*<0.005*	*<0.002*	*<0.005*	*<0.01*	*<0.005*	*1.41*	...	...	...	...	...	...
C48.03-1	Cartridge Brass	*70.45*	*0.047*	*0.054*	*Bal.*	*0.030*	*<0.001*	*<0.001*	*<0.002*	*0.040*	*0.079*	*0.097*	*0.029*	*0.007*	*0.001*	...	*0.004*	*0.0005*	...	*0.013*
C48.06	″	*71.6*	*0.03*	*0.02*	*Bal.*	*0.11*	*0.002*	*0.02*	*0.006*	*0.006*	*0.008*	*0.006*	*0.004*	*0.002*	*0.001*	...	*0.006*	*0.0006*	...	*0.008*
C51.12-2	Aluminium Bronze	Bal.	*0.18*	*0.25*	*0.42*	*0.11*	*<0.005*	*2.90*	*<0.01*	*1.25*	*0.11*	...	...	*6.06*	...	...	...	...	...	...
C51.13-2	″	Bal.	*0.19*	*0.12*	*0.30*	*0.053*	*0.021*	*2.05*	*0.16*	*0.77*	*0.21*	...	...	*6.93*	...	...	...	...	...	...
C52.51-3	Aluminium Bronze	Bal.	*<0.01*	*<0.01*	*0.02*	*5.1*	...	*4.3*	*<0.01*	*<0.01*	...	...	...	*10.0*	*<0.01*	...	...	*<0.01*	...	...
C52.55-3	″	Bal.	*0.03*	*0.14*	*0.10*	*4.6*	...	*4.9*	*0.03*	*1.1*	...	...	...	*9.3*	*0.13*	...	...	*0.05*	...	...
C52.56-3	″	Bal.	*0.11*	*0.17*	*0.28*	*5.6*	...	*4.6*	*0.15*	*0.74*	...	...	...	*8.9*	*0.09*	...	...	*0.14*	...	...
C54.01-3	Phosphor Bronze	Bal.	*3.2*	*0.29*	*0.31*	*0.26*	*0.05*	*0.01*	*0.006*	*0.13*	*0.04*	*0.08*	...	*0.009*	*<0.001*	...	*0.03*	...	...	...
C62.11-2	Cupro-Nickel	Bal.	*0.04*	*<0.005*	*0.097*	*29.8*	...	*0.60*	*0.36*	*0.52*	...	...	...	...	*0.03*	*<0.005*	*<0.005*	...	...	...
C62.14-2	″	Bal.	*0.12*	*0.01*	*0.12*	*20.2*	...	*1.49*	*0.022*	*0.24*	...	...	...	...	*0.002*	*0.03*	*0.083*	...	...	...
C62.15-2	″	Bal.	*0.03*	*0.016*	*0.04*	*25.9*	...	*2.36*	*0.014*	*0.23*	...	...	...	...	*0.004*	*0.042*	*0.023*	...	...	...
C65.27-1	Nickel Silver	*57.0*	*0.01*	*0.04*	*28.7*	*13.9*	*0.02*	*0.26*	*<0.002*	*0.13*	...	...	...	...	*<0.01*	...	*0.03*	...	...	...
C65.28-1	″	*56.9*	*0.15*	*0.06*	*26.7*	*15.3*	*0.07*	*0.13*	*0.01*	*0.57*	...	...	...	...	*0.01*	...	*0.03*	...	...	...
C65.29-1	″	*58.9*	*0.08*	*0.11*	*23.4*	*16.8*	*0.07*	*0.39*	*0.02*	*0.17*	...	...	...	...	*0.01*	...	*0.07*	...	...	...

BNF - FULMER (BNF), UK

CHEMICAL COMPOSITION (nominal mass content in %)

Nickel Base Alloy Reference Materials (Approx. 28.6mm dia. x 25mm discs)

BNF No.	Description	C	Si	Cu	Fe	Mn	Cr	Ti	Al	Co	Mo	Mg	Ni
B6998	MONEL Alloy 400	*0.09*	*0.04*	*31.3**	*2.30*	*0.29*	*0.02*	*0.11*	*0.008*	*0.025*	…	*0.079*	Bal.
B7000	"	*0.05*	*0.11*	*31.5**	*0.64*	*0.87*	*0.035*	*0.03*	*0.028*	*0.50*	…	*0.026*	Bal.
B7001	"	*0.01*	*0.28*	*31.4**	*0.32*	*1.66*	*0.05*	*0.025*	*0.040*	*0.25*	…	*0.010*	Bal.
B7002	"	*0.015*	*0.15*	*31.7**	*0.13*	*2.65*	*0.10*	*0.015*	*0.060*	*0.10*	…	*0.007*	Bal.
E3918	NIMONIC Alloy 75	*0.05*	*1.14*	*0.005*	*1.57*	*0.85*	*19.4**	*0.72*	*0.25*	*0.22*	*0.49*	*0.058*	Bal.
E3919	"	*0.07*	*0.89*	*0.055*	*2.62*	*0.47*	*19.6**	*0.40*	*0.15*	*1.00*	*0.25*	*0.040*	Bal.
E3920	"	*0.07*	*0.57*	*0.11*	*3.02*	*0.28*	*19.2**	*0.35*	*0.13*	*2.02*	*0.095*	*0.020*	Bal.
E3921	"	*0.11*	*0.34*	*0.27*	*3.50*	*0.14*	*19.4**	*0.20*	*0.045*	*0.53*	*0.05*	…	Bal.
E3922	"	*0.14*	*0.16*	*0.50*	*3.98*	*0.10*	*19.2**	*0.08*	*0.035*	*0.115*	*0.03*	*0.014*	Bal.
B7004	NIMONIC Alloy 80A	*0.01*	*0.17*	*0.14*	*0.97*	*0.08*	*19.6**	*2.63*	*1.64*	*0.06*	*0.06*	*0.002*	Bal.
B7005	"	*0.035*	*0.23*	*0.045*	*0.32*	*0.16*	*19.6**	*2.52*	*1.55*	*1.04*	*0.10*	*0.005*	Bal.
B7006	"	*0.08*	*1.03*	*0.075*	*0.61*	*0.25*	*19.6**	*2.14*	*1.19*	*0.35*	*0.20*	*0.008*	Bal.
B7007	"	*0.14*	*0.66*	*0.22*	*0.22*	*0.53*	*19.4**	*2.31*	*1.36*	*0.15*	*0.39*	*0.019*	Bal.
B7008	"	*0.21*	*0.36*	*0.025*	*0.19*	*0.02*	*19.3**	*2.33*	*1.46*	*2.00*	*<0.01*	*0.030*	Bal.
B7010	NIMONIC Alloy 90	*0.05*	*0.22*	*0.04*	*0.62*	*0.24*	*19.7**	*2.48*	*1.61*	*16.9**	*0.10*	*0.004*	Bal.
B7011	"	*0.095*	*1.02*	*0.065*	*0.34*	*0.16*	*19.7**	*2.05*	*1.20*	*17.0**	*0.20*	*0.010*	Bal.
B7012	"	*0.16*	*0.39*	*0.11*	*0.25*	*0.53*	*19.6**	*2.28*	*1.25*	*17.0**	*0.39*	*0.018*	Bal.
B7013	"	*0.22*	*0.65*	*0.20*	*0.22*	*0.06*	*19.6**	*2.39*	*1.46*	*17.0**	*<0.01*	*0.030*	Bal.

***** These values are not designed for calibration purposes and are quoted for reference only (MONEL, NIMONIC and INCOLOY are all trade marks of Special Metals Corporation)

BNF - FULMER (BNF), UK

CHEMICAL COMPOSITION (nominal mass content in %)

Nickel Base Alloy Reference Materials (Approx. 28.6mm dia. x 25mm discs)

BNF No.	Description	C	Si	Cu	Fe	Mn	Cr	Ti	Al	Co	Mg	Mo	Nb	Ni
E3923	NIMONIC Alloy 800	*0.01*	*0.17*	*0.54*	*Bal.*	*1.00*	*20.6**	*0.29*	*0.57*	*0.06*	...	*0.51*	...	*32.0**
E3924	"	*0.03*	*0.30*	*0.29*	*Bal.*	*0.85*	*20.6**	*0.30*	*0.28*	*0.13*	...	*0.26*	...	*32.3**
E3925	"	*0.08*	*0.41*	*0.14*	*Bal.*	*0.68*	*20.8**	*0.28*	*0.24*	*0.28*	...	*0.10*	...	*32.2**
E3926	"	*0.06*	*0.60*	*0.085*	*Bal.*	*0.50*	*20.2**	*0.39*	*0.08*	*0.54*	...	*0.05*	...	*32.0**
E3927	"	*0.08*	*0.75*	*0.055*	*Bal.*	*0.40*	*20.4**	*0.58*	*0.10*	*1.02*	...	*0.025*	...	*32.1**
E3928	INCOLOY Alloy DS	*0.10*	*1.77*	*0.05*	*Bal.*	*1.44*	*18.2**	*0.24*	*0.115*	*1.01*	...	*0.025*	...	*36.5**
E3929	"	*0.085*	*1.80*	*0.085*	*Bal.*	*1.30*	*17.9**	*0.14*	*0.07*	*0.52*	...	*0.055*	...	*36.3**
E3930	"	*0.08*	*2.09*	*0.135*	*Bal.*	*1.18*	*18.6**	*0.065*	*0.03*	*0.26*	...	*0.105*	...	*36.2**
E3931	"	*0.05*	*2.32*	*0.28*	*Bal.*	*1.06*	*18.5**	*0.035*	*0.015*	*0.12*	...	*0.25*	...	*36.4**
E3932	"	*0.04*	*2.50*	*0.55*	*Bal.*	*0.93*	*18.5**	*0.025*	*0.01*	*0.07*	...	*0.49*	...	*36.4**
B5789	INCONEL Alloy 600	...	*0.61*	*0.24*	*6.10*	*0.39*	*16.5**	*0.52*	*0.09*	*0.60*	*0.017*	...	...	Bal.
B5871	"	...	*0.88*	*0.02*	*6.34*	*0.57*	*16.0**	*0.27*	*0.18*	*1.09*	*0.013*	...	...	Bal.
B5967	"	...	*0.45*	*0.41*	*7.18*	*0.23*	*16.0**	*0.28*	*0.09*	*0.31*	*0.038*	...	...	Bal.
B5968	"	...	*0.22*	*0.80*	*8.05*	*0.12*	*16.0**	*0.11*	*0.03*	*0.18*	*0.059*	...	...	Bal.
B7047	INCONEL Alloy X-750	*0.035*	*0.17*	*0.49*	*5.51*	*1.29*	*15.0**	*2.71*	*0.49*	...	...	*0.58*	*1.36* Ṫ	Bal.
B7048	"	*0.075*	*0.23*	*0.30*	*6.09*	*1.00*	*15.1**	*2.52*	*0.71*	...	...	*0.30*	*1.18* Ṫ	Bal.
B7049	"	*0.09*	*0.33*	*0.155*	*7.08*	*0.81*	*15.0**	*2.30*	*0.91*	...	...	*0.20*	*0.97* Ṫ	Bal.
B7050	"	*0.125*	*0.44*	*0.075*	*8.09*	*0.61*	*15.0**	*2.27*	*1.01*	...	...	*0.10*	*0.77* Ṫ	Bal.

(INCONEL is a trade mark of Special Metals Corporation)

Ṫ Samples contain less than 0.01% Ta

***** The Cr and Ni values are not designed for calibration purposes and are quoted for reference only

Lead Base Alloy Reference Material (Approx. 50mm square x 20mm blocks)

BNF No.	Description	Cu	Sn	Pb	Zn	Ni	Cd	Sb	Bi	Ca	Ag
L21.02-1	Battery Alloy	*0.0013*	*0.27*	Bal.	*0.0016*	*≤0.0002*	*≤0.0002*	*0.0003*	*0.01*	*0.03*	*0.008*

BRAMMER STANDARD COMPANY, Inc. (BS), USA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

C, S, N, H & O in Steel Reference Materials
(CSN 2-1 and CSN 2-2 are 500 x 1g pins; CSN 2C and CSN A are 100g of finely divided material; HON U is 100 x 1g balls)

BRAMMER No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	H	V	O	Ca	Sn	Ti	Co	N
BS CSN 2-1	*0.476*	*(0.03)*	*(0.4)*	*(0.004)*	*0.034*	*(16.8)*	*(0.5)*	*(0.2)*	...	...	...	...	...	...	...	...	...	*0.064*
BS CSN 2-2	*0.548*	*(0.03)*	*(0.4)*	*(0.004)*	*0.028*	*(16.8)*	*(0.5)*	*(0.2)*	...	...	...	...	...	...	...	...	...	*0.076*
BS CSN 2C	*0.469*	*0.17*	*0.60*	*0.012*	*0.0305*	*0.072*	*(0.006)*	*0.071*	*0.046*	*0.073*	...	*0.004*	...	*0.0033*	*(0.006)*	*0.002*	*(0.006)*	*0.0173*
BS CSN A	*0.068*	*(0.05)*	*(1.0)*	*(0.14)*	*0.305*	*(0.06)*	...	*(0.05)*	...	*(0.06)*	...	...	...	...	...	...	...	*0.0081*
BS HON U	*0.0500*	...	...	...	*0.0018*	...	...	...	...	...	*0.00010*	...	*0.0023*	...	...	...	...	*0.0254*

Calcium Treated Carbon Steel Reference Materials
(38-41mm dia. x 19-30mm discs)

BRAMMER No.	C	Si	Mn	P	S	Cr	Ni	Mo	Al	As	B	Ca	Co	Cu
BS 56H	*0.457*	*0.210*	*0.772*	*0.0096*	*0.0234*	*0.098*	*0.154*	*0.0419*	*0.0009*	*0.0056*	*0.0002*	*0.0012*	*0.0078*	*0.299*
BS 1018	*0.195*	*0.237*	*0.79*	*0.012*	*0.024*	*0.177*	*0.104*	*0.044*	*0.029*	*0.0041*	*(0.0002)*	*(0.0004)*	*0.0058*	*0.130*
BS 3941	*0.407*	*0.257*	*0.802*	*0.016*	*0.023*	*0.069*	*0.018*	*0.0061*	*0.0019*	*0.0036*	*(0.0001)*	*0.0011*	*0.0042*	*0.053*
BS 9325A	*0.203*	*0.612*	*0.969*	*0.0079*	*0.0045*	*1.50*	*3.29*	*0.358*	*0.0056*	*0.0024*	*(0.0001)*	*0.0039*	*0.0093*	*0.163*
BS HiCal-1	*0.271*	*1.29*	*1.00*	*(0.007)*	*0.0007*	*1.55*	*3.28*	*0.379*	*0.070*	*0.0022*	*(0.0001)*	*0.0140*	*0.0024*	*0.152*

BRAMMER No.		Fe	Mg	Nb	N	O	Pb	Sb	Sn	Ta	Ti	V	W	Zr
BS 56H	(continued)	*(97.8)* #	*0.0002*	*0.0009*	*0.0106*	*0.0025*	*0.0004*	*0.0025*	*0.0124*	*0.0011*	*0.0009*	*0.0295*	*0.0007*	*0.0007*
BS 1018	(continued)	*98.2*	*(0.0003)*	*(0.0006)*	*0.0079*	*0.0014*	*(0.0006)*	*(0.001)*	*0.0099*	...	*0.0009*	*0.0009*	*0.0014*	*(0.001)*
BS 3941	(continued)	*(98.3)* #	*(0.0002)*	*0.033*	*0.0069*	*0.0055*	*0.0010*	*0.0005*	*0.0019*	*(0.0004)*	*0.0017*	*0.0025*	*(0.0004)*	*(0.0003)*
BS 9325A	(continued)	*92.8*	*(0.0002)*	*0.0017*	*0.0076*	...	*(0.0003)*	...	*(0.0003)*	*(0.010)*	*0.0030*	*0.0024*	*0.024*	*(0.001)*
BS HiCal-1	(continued)	*91.9*	*(0.0003)*	*(0.002)*	...	...	*(0.0005)*	...	*(0.0002)*	...	*0.0037*	*0.0027*	*(0.0009)*	*(0.0008)*

Calculated by difference

High Manganese Steel Reference Materials
(32mm dia. x 17mm discs)

BRAMMER No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu	N	Nb	Sn	Ti	V
BS 17A	*0.588*	*0.22*	*19.38*	*0.043*	*0.005*	*1.37*	*0.52*	*0.060*	*0.052*	*(0.0001)*	*0.013*	*0.135*	*0.038*	*0.06*	*0.012*	*(0.002)*	*0.016*
BS 19A	*1.57*	*1.46*	*8.76*	*0.092*	*0.009*	*3.75*	*1.97*	*1.48*	*0.057*	*(0.0005)*	*0.014*	*0.51*	*0.039*	*0.040*	*0.037*	*(0.007)*	*0.10*

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Stainless and High Temperature Steel Reference Materials (37-44mm dia. x 10-19mm discs)

BRAMMER No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Ca	Co	Cu	N	O	Nb	Sn	Ti	V	W	Others
BS 17-4PHA	0.018	0.40	0.85	0.023	0.022	15.40	0.34	4.69	0.004	0.0016	0.0009	0.072	3.30	0.022	0.006	0.204	0.007	(0.002)	0.043	0.04	(0.002) **Ta**
BS 17-4PHB	0.042	0.42	0.56	0.021	0.024	15.60	0.11	4.53	0.035	0.0036	(0.0003)	0.040	3.35	0.046	(0.0021)	0.31	0.012	0.005	0.059	(0.01)	(0.002) **Ta**
BS 82E	0.062	0.58	1.61	0.027	0.001	22.38	0.31	12.49	0.006	0.0024	0.0014	0.12	0.26	0.072	...	0.062	0.006	0.003	0.064	0.041	...
BS 83G	0.073	0.56	1.66	0.024	0.004	24.50	0.085	19.15	(0.004)	(0.0001)	...	0.153	0.114	0.026	0.0064	0.061	0.003	(0.003)	0.077	0.007	...
BS 85D	0.048	0.54	1.69	0.024	0.024	17.09	0.59	9.98	0.13	(0.001)	0.0004	0.97	0.45	(0.02)	(0.002)	0.062	0.0062	0.48	0.132	(0.07)	(0.01) **As** (0.001) **Sb**
BS 86F	0.054	1.22	1.30	0.021	0.0011	18.74	0.24	34.99	(0.007)	0.0026	(0.001)	0.098	0.23	0.035	...	0.19	0.004	(0.006)	0.061	(0.03)	(0.003) **As** (0.001) **Pb**
BS 87F	0.055	0.67	1.64	0.024	0.025	17.30	0.29	10.12	0.004	(0.0006)	0.0007	0.17	0.28	0.037	0.005	0.57	0.004	0.004	0.13	0.050	0.005 **As**
BS 90F	0.085	0.58	0.53	0.023	0.328	13.01	0.14	0.30	(0.006)	...	...	0.021	0.12	0.037	0.011	0.011	0.005	(0.002)	0.076	0.032	...
BS 94C	0.057	0.62	0.45	0.024	0.002	25.90	0.20	0.43	0.004	(0.0005)	0.0008	0.042	0.056	0.065	0.0061	0.032	0.006	...	0.12	(0.03)	...
BS 180B	0.022	0.46	4.65	0.017	0.0008	21.5	2.20	11.9	(0.007)	0.0011	0.0009	0.111	0.201	0.315	0.0043	0.131	0.0040	(0.005)	0.149	0.050	58.5 **Fe**
BS 181B	0.070	3.94	8.07	0.021	0.0009	16.17	0.173	8.18	0.0119	(0.0008)	(0.001)	0.044	0.206	0.158	0.0010	0.026	(0.004)	0.0051	0.044	0.016	62.8 **Fe**
BS 183A	0.172	0.37	0.35	0.016	0.0040	12.14	0.12	1.85	0.002	(<0.0005)	0.0020	0.036	0.093	0.0256	0.0065	0.006	0.003	0.002	0.090	2.60	(0.002) **As**
BS 184A	0.035	0.080	0.06	0.007	0.001	12.66	2.20	8.34	1.00	(0.0004)	(0.0003)	0.036	0.041	0.0045	(0.0003)	(0.006)	(0.002)	0.051	0.014	0.032	(0.002) **Ta**
BS 185A	0.033	0.38	0.49	0.022	0.002	14.46	0.30	4.43	0.002	0.0017	(0.0002)	0.026	3.41	0.027	(0.0021)	0.32	0.007	(0.001)	0.048	(0.014)	(0.002) **Ta**
BS 186A	0.040	0.19	0.72	0.008	0.0053	0.16	0.0032	35.86	(0.001)	...	...	0.028	0.016	0.0026	...	(<0.002)	(0.002)	(<0.003)	0.0012	(0.01)	0.229 **Se**
BS 187D	0.0337	0.669	0.938	0.0155	0.0021	19.91	2.17	32.3	0.0164	0.0026	0.0063	0.089	3.52	0.046	0.0026	0.621	0.0085	0.0027	0.073	0.086	0.0019 **Pb** 0.0008 **Ta**
BS 188B	0.046	0.266	0.247	0.016	(0.0007)	14.32	1.30	24.81	0.168	0.0047	(0.00003)	0.274	0.120	0.0021	0.0006	0.099	0.0051	2.20	0.264	0.043	0.0045 **As** 55.8 **Fe**
BS 189A	0.0147	0.30	0.639	0.019	(0.001)	20.4	6.04	23.8	0.0129	(0.0002)	(0.0004)	0.100	0.184	0.198	0.0024	0.13	0.0035	0.0065	0.054	0.037	0.0039 **As** (0.001) **Zr**
BS 316F	0.015	0.55	1.46	0.029	0.026	16.79	2.10	10.09	(0.002)	0.0019	0.0018	0.126	0.437	0.061	0.0055	0.011	0.0092	0.011	0.062	0.045	0.0067 **As** 68.1 **Fe**
BS 430	0.061	0.37	0.71	0.024	0.002	16.5	0.052	0.22	<0.05	<0.005	<0.005	<0.5	0.12	0.06	(0.006)	0.01	0.009	<0.05	0.057	<0.05	0.0045 **As** 81.7 **Fe**
BS 2205	0.0199	0.564	1.029	0.0227	0.0005	22.92	3.26	5.27	0.0080	0.0016	0.0014	0.041	0.196	0.169	0.0034	0.0052	0.0050	0.0019	0.0560	0.0309	0.0059 **As** 0.0010 **Sb**
BS 9841	0.067	0.54	1.69	0.024	0.024	24.30	0.57	19.55	(<0.006)	0.0026	(0.0002)	0.116	0.356	0.064	(0.011)	0.070	0.006	(0.002)	0.070	0.06	(0.006) **Sb**
BS 9842	0.059	0.99	1.50	0.025	0.0016	24.19	0.111	20.02	0.014	0.0025	0.0010	0.237	0.147	0.037	(0.0044)	0.026	0.005	0.003	0.075	0.011	(0.002) **As**
BS 9941	0.021	0.33	1.78	0.027	0.024	18.48	3.24	13.68	0.004	0.0025	(0.0003)	0.178	0.424	0.036	(0.0058)	0.015	0.007	(0.002)	0.062	0.068	(0.010) **As**
BS 9942	0.021	0.49	1.84	0.025	0.006	18.21	3.30	13.55	0.004	0.0014	0.0014	0.086	0.305	0.071	(0.0023)	0.005	0.006	(0.002)	0.072	0.032	(0.004) **As**
BS SS 3951	0.014	0.61	1.56	0.023	0.031	18.71	0.303	9.18	0.002	(0.0006)	0.0005	0.16	0.22	0.077	0.0074	0.085	0.007	(0.002)	0.067	0.040	(0.003) **As**

BRAMMER STANDARD COMPANY, Inc. (BS), USA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Nickel Base Alloy Reference Materials (Disc samples – dimensions as below)

Brammer No.	Description	Disc Dimensions mm	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu	Nb	Pb	Sn	Ti	V	W	Fe	Mg	Others
BS 200A	Nickel 200	38 dia. x 19	0.078	0.0051	0.151	0.0007	0.0037	0.0006	0.0004	99.54	0.0281	0.0044	0.0564	0.0038	0.0004	(0.00005)	(0.00002)	0.0427	0.0006	0.0005	0.074	0.0131	0.0013 **O**
BS 200-1	"	38 dia. x 15	0.0413	0.037	0.111	0.0009	0.0011	0.0011	0.0004	99.60	0.0048	0.0033	0.089	0.0077	0.0004	0.0010	(0.0001)	0.0209	0.0008	0.00016	0.046	0.0307	0.0015 **O**
BS 200-2	"	"	0.050	0.060	0.244	0.0020	0.0068	0.0094	0.0005	99.31	0.0041	0.0031	0.104	0.053	0.0009	0.0006	(0.0002)	0.0197	0.0014	(0.0003)	0.115	0.0368	0.0025 **O**
BS 200-3	"	"	0.0145	0.0110	0.157	0.0015	0.0032	0.0091	0.0004	99.4	0.0068	0.0037	0.103	0.108	0.0004	0.0008	0.0003	0.0235	0.0009	(0.0004)	0.138	0.0240	0.0026 **O**
BS 200-4	"	"	0.107	0.101	0.310	0.0023	0.0076	0.132	0.0013	98.9	0.0057	0.0037	0.0911	0.0482	0.0010	0.00087	0.00020	0.0191	0.0024	0.00095	0.297	0.0312	0.0015 **O**
BS 600-2	Nickel 600 Alloy	38 dia. x 20	0.071	0.23	0.31	0.006	0.004	16.36	0.007	75.34	0.16	0.0098	0.10	0.089	(0.02)	(<0.002)	(0.002)	0.37	0.028	…	6.80	0.012	0.030 **N**
BS 600-3	"	"	0.020	0.19	0.28	0.008	0.005	14.77	0.007	75.05	0.09	0.0082	0.10	0.24	(0.02)	(0.001)	(0.002)	0.20	0.020	…	8.88	0.012	0.0081 **N**
BS 600-4	"	"	0.034	0.22	0.20	0.007	0.004	14.72	(0.002)	75.88	0.06	0.0060	0.09	0.08	(0.015)	(<0.001)	(0.002)	0.20	0.023	…	8.40	0.020	0.021 **N**
BS 600-5	"	38 dia. x 19	0.047	0.26	0.21	0.005	<0.002	15.59	0.049	74.83	0.19	0.0018	0.029	0.10	(0.03)	(<0.001)	(<0.003)	0.23	0.054	…	8.36	0.004	0.011 **N**
BS 600-6	"	"	0.083	0.31	0.21	0.007	0.001	14.86	0.12	76.00	0.278	0.0028	0.066	0.24	0.14	(<0.001)	(<0.003)	0.24	0.030	…	7.33	0.022	0.0078 **N** 0.0012 **O**
BS 625E	"	"	0.049	0.065	0.050	0.004	0.0005	22.44	8.77	60.7	0.214	0.0022	0.031	0.024	3.56	(0.00005)	(0.0006)	0.27	0.020	0.016	3.81	0.0021	(0.003) **As** 0.0074 **N** 0.0015 **O**
BS 800A	Cr/Fe Nickel Alloy	38 dia. x 19	0.075	0.361	0.883	0.013	(0.0007)	21.09	0.117	33.3	0.362	0.0018	0.069	0.244	0.021	(0.001)	0.0041	0.526	0.058	(0.030)	42.7	0.0022	0.0126 **N** 0.0014 **O**
BS 197A	Ra 333 Alloy	38 dia. x 19	0.050	0.96	1.56	0.021	(<0.001)	25.11	2.99	44.44	0.185	0.0019	3.06	0.119	0.20	(0.0002)	…	0.017	0.051	2.80	18.07	(0.0030)	(0.052) **N**
BS 718D	In 718 Alloy	"	0.037	0.072	0.100	0.0083	0.0004	18.32	3.00	52.5	0.631	0.0041	0.368	0.071	5.16	(0.00006)	0.0020	0.93	0.038	0.049	18.51	0.0038	0.0011 **As** 0.0084 **N** 0.0015 **O**
BS 825F	Nickel Alloy 825	"	0.012	0.59	0.521	0.018	(0.005)	23.2	3.19	38.9	0.081	0.0023	0.064	1.78	(0.02)	(0.0008)	0.0036	0.91	0.086	0.015	30.7	0.0013	0.0085 **N** 0.0009 **O**
BS 400D	Monel Alloy	"	0.130	0.146	0.993	(0.0010)	0.0006	0.0057	0.0024	63.4	0.0231	0.0009	0.032	33.0	(0.0001)	0.0004	0.00012	0.064	(0.0002)	0.0004	2.00	0.0217	0.00017 **N** 0.0008 **O** 0.0003 **Zr**
BS 400-1	"	38 dia. x ~18	0.109	0.16	1.07	0.022	0.008	0.033	0.001	66.0	0.004	(0.0005)	0.37	30.97	0.0003	0.0020	0.0010	0.007	(0.001)	…	1.27	0.048	0.004 **As**
BS 400-2	"	"	0.170	0.17	1.17	0.027	0.008	0.091	0.0012	65.9	0.006	(0.0006)	0.46	30.75	0.0004	(0.001)	0.0012	0.011	(0.003)	…	1.42	0.033	0.004 **As**
BS 400-3	"	"	0.153	0.063	0.85	0.026	0.006	0.21	0.003	65.4	0.001	(0.0002)	0.46	31.25	(0.0004)	(0.0015)	0.0014	0.004	0.003	…	1.60	0.012	0.004 **As**
BS 500E	"	38 dia. x 19	0.134	0.148	0.605	0.0022	0.0006	0.0174	0.0044	64.7	2.94	0.0017	0.017	29.9	(0.002)	(0.0008)	(0.0008)	0.607	(0.001)	(0.002)	0.722	0.0058	0.0005 **O** 0.0133 **Zr**
BS H1C	Hastelloy (B-2)	"	0.0022	(0.01)	0.51	0.0049	(0.0004)	0.70	27.2	69.8	0.15	(0.001)	(0.01)	(0.002)	(0.009)	(0.00002)	(0.002)	(0.008)	(0.02)	(0.009)	1.29	(0.0012)	(0.001) **As** (0.009) **Ta**
BS H2E	" (C-276)	32 dia. x 19	0.0030	0.030	0.55	0.005	0.00045	15.85	15.98	58.3	0.35	0.0028	0.032	0.0070	(0.009)	(0.002)	(0.001)	0.007	0.15	3.28	5.41	0.0019	0.0119 **N** 0.0005 **O**
BS H3C	" (x)	38 dia. x 19	0.087	0.36	0.492	0.0150	(0.0003)	21.50	8.82	46.6	0.149	0.0020	1.37	0.106	0.095	…	0.0019	(0.0064)	0.047	0.623	19.54	0.0020	0.0266 **N** 0.0013 **O**
BS H6B	" (C-22)	"	(0.008)	(0.035)	0.226	0.0054	0.0005	22.3	14.05	55.9	0.23	0.0016	0.079	0.035	(0.1)	…	(0.0007)	0.050	0.0063	3.20	3.45	0.0010	0.0118 **N** 0.0007 **O**

BS 200A to 200-4 also certified for As and Ca, plus some for N, Sb and Ta

BRAMMER STANDARD COMPANY, Inc. (BS), USA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Copper Base Alloy Reference Materials (38-41mm dia. x 12-19mm discs)

BRAMMER No.	Cu	Pb	Sn	Zn	Mn	Al	Fe	Ni	P	As	Si	Sb	C	S	Others
BS 172 Be-1 (Wrought)	97.68	(0.002)	0.033	0.007	0.001	(0.02)	0.052	0.039	...	...	0.055	...	...	...	1.89 Be, 0.21 Co
BS 464A (Wrought)	60.6	0.056	0.62	38.73	0.0002	(0.001)	0.013	0.004	0.012	<0.002	<0.01	(0.001)	(0.0006)	(0.001)	...
BS 482A (Wrought)	60.0	0.50	0.65	38.8	<0.002	(0.003)	0.020	(0.007)	<0.003	<0.002	(0.002)	0.0012	(0.0015)	<0.002	...
BS 510B (Wrought)	95.0	0.0112	4.6	0.251	0.0004	(0.006)	0.009	0.0211	0.074	0.0010	(0.003)	(0.002)	0.0010	0.007	(0.0001) N, 0.0009 O
BS 544B (Wrought)	88.2	3.9	4.06	3.51	(0.0009)	(0.0009)	0.087	0.068	0.0258	0.0043	0.0042	0.0244	0.0031	0.0249	0.0173 Ag, 0.0005 O
BS 623A (Wrought)	88.13	0.001	0.002	0.008	0.273	9.12	2.19	0.146	<0.002	(0.006)	0.014	<0.002	(0.002)	(<0.0005)	...
BS 630C (Wrought)	80.7	0.0093	0.0152	0.234	0.325	9.90	3.82	4.82	0.0043	0.0007	0.064	0.0003	0.0060	(<0.0005)	0.0019 Co, 0.0030 Cr 0.0011 Mg
BS 655A (Wrought)	95.74	0.008	0.07	0.02	0.91	(0.002)	0.075	0.008	(0.004)	<0.002	3.14	<0.002	(0.0006)	(0.0003)	...
BS 675A (Wrought)	58.5	0.074	0.80	39.1	0.32	<0.002	1.12	0.019	0.010	0.003	(0.005)	0.0011	(0.0007)	(0.0005)	...
BS 706B (Wrought)	87.00	0.006	0.006	0.054	0.61	<0.003	1.56	10.9	0.009	<0.0005	<0.002	<0.002	(0.004)	0.009	0.005 Co
BS 715A (Wrought)	68.0	(0.007)	0.008	0.10	0.82	(0.01)	0.61	30.22	0.006	(0.0014)	0.10	(0.003)	0.03	0.001	...
BS 836A-4 (Cast)	84.7	5.31	4.58	4.64	(0.001)	0.0013	0.026	0.46	0.086	0.008	0.0019	0.068	(0.002)	0.041	0.023 Ag
BS 857B-1 (Cast)	61.3	1.22	1.14	34.91	0.003	0.35	0.30	0.61	0.004	(0.001)	0.004	(0.002)	...	...	(0.002) Ag
BS 903E (Cast)	87.0	0.100	8.63	4.11	...	(0.001)	0.0072	0.293	0.056	(0.002)	(0.0018)	0.010	(0.002)	0.0092	(0.007) O
BS 905A-1 (Cast)	87.3	0.030	10.25	2.27	(<0.0003)	(<0.003)	0.015	0.018	0.055	(0.001)	(<0.004)	0.004	...	...	(0.002) Ag
BS 932F (Cast)	82.1	7.32	6.30	3.39	(0.0002)	(0.0008)	0.057	0.388	0.0105	0.0091	0.0011	0.199	(0.0053)	0.0368	(0.0003) N, 0.0025 O
BS 938-1 (Cast)	77.1	14.8	7.16	0.26	(0.001)	(<0.002)	(0.015)	0.49	(0.059)	(0.004)	(<0.004)	0.033	...	0.009	0.0048 Ag
BS 954B (Cast)	83.9	0.047	0.07	0.10	0.27	10.20	3.90	1.38	0.012	(0.005)	0.07	(0.001)	(0.005)	(<0.0005)	0.003 Ag
BS 955C (Cast)	80.6	0.003	0.003	0.15	0.06	10.68	4.04	4.31	0.012	(<0.002)	0.025	(<0.002)	...	...	0.014 Ag

Cobalt Base Reference Materials (38mm dia. X 19mm discs)

BRAMMER No.	Description	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu	N	Nb	Ti	V	W	Fe	O	La
BS 171B	L605	0.087	0.29	1.90	0.008	<0.001	20.5	0.65	10.68	0.08	(0.0025)	Bal.	0.035	...	0.046	...	(0.02)	15.1	1.82	...	...
BS 171C	Stellite 25	0.119	(0.1)	1.47	(0.008)	(0.0008)	20.3	(0.08)	10.1	(0.04)	(0.004)	51.2	(0.02)	0.0045	(0.006)	(0.07)	(0.009)	15.3	1.07	(0.002)	(0.030)
BS 171D	Stellite 25	0.120	(0.1)	1.47	(0.01)	(0.0009)	20.2	(0.08)	10.1	(0.05)	(0.004)	51.2	(0.02)	0.0046	(0.006)	(0.05)	(0.01)	15.3	1.07	(0.0008)	(0.02)
BS 172B	Stellite 188	0.055	0.33	0.97	(0.008)	(0.0009)	22.8	0.28	22.5	0.21	(0.004)	34.8	(0.02)	0.033	0.042	0.079	0.0081	15.2	2.46	0.0011	0.059

CANADA CENTRE FOR MINERAL AND ENERGY TECHNOLOGY (CANMET), Canada

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Base Metal Ore Certified Reference Materials (Finely divided material – units of 200g)

CANMET No.	Description	Si	Al	S	Fe	K	Na	Ca	As	Mg	C	Cd	Pb	Cu	Ti	W
BH-1	Tungsten Ore	*38.0*	*3.5*	*0.8*	*3.2*	*0.7*	*0.1*	*0.5*	…	*0.4*	*0.1*	…	…	…	*0.4*	**0.422**
CD-1	Antimony Ore	*32.9*	*5.5*	*3.1*	*2.8*	*1.8*	*0.1*	*1.4*	**0.66**	*0.6*	*0.21*	…	*0.02*	*<0.01*	…	…
CT-1	Tungsten Ore	*17.2*	*2.9*	*8.2*	*17.5*	*0.7*	*0.2*	*12.2*	…	*2.0*	*1.7*	…	…	…	*0.2*	**1.04**
HV-2a	Copper-Molybdenum Ore	**31.34**	**7.96**	**0.344**	**2.044**	**2.31**	**2.335**	**1.891**	**0.00121**	**0.329**	*(0.4)*	*(0.2)*	**0.00069**	**0.3808**	**0.0000128**	*0.000789*
MP-1b	Zinc-Tin-Copper-Lead Ore	**16.79**	*3.46*	**13.79**	**8.19**	*(0.2)*	…	**2.47**	**2.30**	**0.024**	*(0.028)*	**0.0527**	**2.091**	**3.069**	*0.075*	*(0.11)*
MP-2a	Tungsten-Molybdenum Ore	**31.2**	**5.99**	**0.716**	**5.00**	*1.226*	*(0.03)*	**3.22**	*0.558*	**0.0923**	…	**0.00145**	**0.277**	**0.0459**	**0.0268**	**0.338**
OKA-1	Niobium Ore	*2.4*	*0.9*	*0.6*	*2.8*	*0.3*	*0.2*	*31.3*	…	*1.3*	…	…	…	…	…	…
TAN-1	Tantalum Ore	*33.42*	*8.2*	…	*0.2*	*1.5*	*4.6*	*0.5*	…	*0.02*	…	…	…	…	…	…
TLG-1	Tungsten Ore	*21.5*	*3.0*	…	*8.6*	*0.4*	*0.2*	*16.6*	…	*2.7*	*1.4*	…	…	…	*0.1*	**0.083**

(Continued from above)

CANMET No.		Bi	Cr	Mn	Mo	P	Zn	Zr	Sr	In	Nb	Ta	Sn	Sb	Ag	H_2O (105°C)	LOI
BH-1	(continued)	…	…	*0.2*	*0.02*	…	…	…	…	…	…	…	…	…	…	…	…
CD-1	(continued)	…	…	…	…	…	…	…	…	…	…	…	…	**3.57**	…	*0.2*	*4.0*
CT-1	(continued)	…	…	*0.7*	*0.03*	…	…	…	…	…	…	…	…	…	…	…	…
HV-2a	(continued)	**0.000158**	**0.0100**	**0.0545**	**0.01254**	**0.0427**	**0.00565**	*0.00658*	**0.00123**	…	*(0.0002)*	*(0.00002)*	*(0.00012)*	**0.000689**	**0.0001448**	*(0.3)*	*3.01*
MP-1b	(continued)	**0.0954**	…	*(0.048)*	**0.0285**	*(0.02)*	**16.67**	…	…	*0.056*	…	…	**1.61**	*0.0054*	**0.00470**	…	…
MP-2a	(continued)	**0.0989**	**0.0150**	**0.1018**	**0.1586**	…	**0.566**	**0.0134**	**0.00123**	*0.001209*	**0.0097**	**0.0016**	**0.0537**	*0.00078*	**0.000482**	…	*(4)*
OKA-1	(continued)	…	…	*1.1*	…	*1.1*	*0.05*	…	*1.0*	…	**0.37**	…	…	…	…	…	*31.9*
TAN-1	(continued)	…	…	*0.02*	…	…	…	…	…	…	*0.02*	**0.236**	*0.01*	…	…	…	…
TLG-1	(continued)	…	…	*1.3*	*<0.01*	…	…	…	…	…	…	…	…	…	…	*1.6*	…

HV-2a also certified for Ba: **869** µg/g, Ce: **19.1** µg/g, Co: **3.40** µg/g, Cs: **2.70** µg/g, Dy: **1.126** µg/g, Er: **0.646** µg/g, Gd: **1.40** µg/g, La: **9.1** µg/g, Nd: **8.77** µg/g, Ni: **6.47** µg/g, Rb: **48.3** µg/g, Sm: **1.69** µg/g, Th: **1.28** µg/g and U: **1.08** µg/g.
MP-2a also certified for Ba: **12.3** µg/g, Ce: **357** µg/g, Co: **5.50** µg/g, Cs: **5.78** µg/g, Dy: **32.5** µg/g, Gd: **24.8** µg/g, Hf: **9.40** µg/g, La: **157** µg/g, Li: **81** µg/g, Lu: **4.36** µg/g, Nd: **117.9** µg/g, Rb: **229** µg/g, Sc: **4.87** µg/g, Sm: **26.7** µg/g, Tb: **4.82** µg/g, Th: **61.3** µg/g, Tm: **4.10** µg/g, U: **37** µg/g and Yb: **28.8** µg/g.

Noble Metal Ore, Concentrate and Matte Certified Reference Materials (Finely divided material – CH-4, MA-1b, MA-3a, PTC-1b and SU-1b in units of 200g, GTS-2a in units of 350g, DS-1, MA-2c, PTA-1 and UMT-1 in units of 400g)

CANMET No.	Description	Si	SiO_2	Fe	Al	Ca	K	Na	S	Mg	Ni	Cu	Co	Pb	Ag	As	Pd	Pt	Au	Rh	C	Zn	H_2O	LOI
CH-4	Gold Ore	…	**62.75**	**5.32**	**7.73**	**1.96**	**1.80**	**3.18**	**0.65**	**1.40**	*0.0051*	**0.20**	**0.0026**	*(0.0014)*	**0.00021**	**0.00082**	…	…	**0.000088**	…	*0.12*	**0.020**	…	*(0.9)*
DS-1	Gold Ore	*25.68*	…	*(3.0)*	**4.48**	*6.248*	*1.1*	…	*2.85*	**2.76**	**0.00487**	**0.00271**	**0.00095**	**0.00138**	**0.000047**	**0.6960**	…	…	**0.003259**	…	…	**0.0206**	…	*13*
GTS-2a	Gold Ore Mill Tailings	**23.65**	…	**7.56**	**6.96**	**4.01**	**2.021**	**0.617**	**0.348**	**2.412**	**0.00771**	**0.00886**	**0.00221**	*0.00179*	*(0.000064)*	**0.0124**	*(0.002)*	…	**0.0000272**	…	**2.011**	**0.0208**	…	*9.87*
MA-1b	Gold Ore	*24.5*	…	*4.62*	*6.11*	*4.6*	*4.45*	*1.49*	*1.17*	*2.6*	…	…	…	…	*0.0004*	…	…	…	**0.00170**	…	*2.44*	…	*0.1*	*7.9*
MA-2c	Gold Ore	*24.40*	…	*5.39*	*6.70*	*4.76*	*3.20*	*2.23*	*0.23*	*2.91*	*0.0064*	*0.0095*	*0.0029*	*0.0029*	*0.000051*	*0.0009*	…	…	**0.000302**	…	*1.78*	*0.0093*	…	*7.55*
MA-3a	Gold Ore	*21*	…	*5*	*6*	*5.5*	*4*	*1.5*	*1*	*3*	*0.007*	*0.01*	*0.003*	*0.002*	*0.00024*	*0.0008*	…	…	**0.000856**	…	*2.5*	*0.008*	…	*10*
PTA-1	Platiniferous Black Sand	…	*3.6*	*63.0*	*2.9*	*1.2*	…	…	…	*0.6*	…	…	…	…	…	…	…	**0.000305**	…	…	…	…	…	…
PTC-1b	Nickel-Copper Sulphide	**2.468**	…	**36.78**	*0.752*	*0.571*	*0.15*	*(0.17)*	**29.95**	**0.441**	**11.256**	**7.919**	**0.3253**	**0.0795**	**0.00531**	**0.0222**	**0.000946**	**0.000647**	**0.000199**	*(0.00005)*	…	**0.2083**	**0.81**	*13.44*
SU-1b	Nickel Copper Cobalt Ore	**15.23**	…	**25.54**	**4.30**	**2.21**	*(0.6)*	*(1.6)*	**14.14**	**1.790**	**1.953**	**1.185**	**0.0672**	**0.0058**	**0.00639**	**0.000249**	**0.0000791**	**0.0000491**	*(0.00002)*	…	*0.04*	**0.0235**	*(0.6)*	*(8)*
UMT-1	Ultramafic Ore Tailings	…	…	…	…	…	…	…	…	…	*0.1396*	*0.0743*	*0.0077*	…	…	…	**0.0000106**	**0.0000129**	**0.0000048**	**0.000001**	…	…	…	…

DS-1 also certified for Ba: **0.0221**%, Hg: **0.0082**%, Mn: **0.0437**%, P: **0.034**% and Tl: **0.0020**%. **GTS-2a** also certified for Ba: **0.0186**%, Mn: **0.1510**%, P: **0.0892**%, Sr: **98.2** µg/g and Th: **1.244** µg/g. **SU-1b** is also certified for Mn: **0.0703**% and has provisional constituent values for Bi, Se and V %. **UMT-1** also has provisional constituent values for Ir and Ru.

CANADA CENTRE FOR MINERAL AND ENERGY TECHNOLOGY (CANMET), Canada

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Ore Concentrate Certified Reference Materials (Finely divided material – units of 200g)

CANMET No.	Description	SiO_2	Al	Mg	Ca	Cu	Zn	Pb	Ag	Hg	Au	S	Fe	Sb
CCU-1e	Copper Concentrate	**3.134**	**0.1385**	**0.706**	**0.129**	**23.07**	**3.02**	**0.703**	**0.02052**	**0.00104**	**0.002027**	**35.28**	**30.7**	**0.0104**
CZN-4	Zinc Concentrate	**0.295 Si**	**0.0715**	*0.0352*	*0.0419*	**0.403**	**55.24**	**0.1861**	**0.00514**	**0.000454**	*(0.000004)*	**33.07**	*9.086*	*(0.001)*

CANMET No.	As	Bi	C	Cd	Co	Mn	Mo	Se	Te	Tl	H_2O	LOI
CCU-1e (continued)	**0.101**	*(0.0003)*	**0.100**	**0.00742**	**0.0301**	**0.0096**	**0.00181**	**0.0244**	**0.00618**	**0.000269**	*0.150*	*17.14*
CZN-4 (continued)	**0.0356**	*(0.0010)*	*(0.09)*	**0.2604**	**0.00935**	*(0.009)*	...	**0.00867**	...	...	*0.149*	...

Sulphide Ore Mill Tailings and Concentrate/Tailings Certified Reference Materials (Finely divided material – RTS-3a and RTS-5 in units of 100g, TPO-1 in units of 25g)

CANMET No.	Description	Al	As	Ca	Co	Cu	Fe	Mg	Ni	Pb	Si	SiO_2	S (Sulphate)	S (Total)	Zn
RTS-3a	Sulphide Ore Mill Tailings	**5.12**	**0.00182**	**2.14**	**0.0143**	**0.2353**	**20.49**	**2.483**	**0.00613**	**0.0209**	**18.28**	...	*(1.1)*	**9.59**	**0.2890**
RTS-5	Nickel-Copper-Gold Tailings	**6.25**	**0.1286**	**3.86**	**0.00769**	**0.0647**	**11.9**	**3.59**	**0.1104**	**0.00663**	**19.20**	...	*1.23*	**1.924**	**0.0105**
TPO-1	Iron Sulphide Conc./Tailings	*3.51*	...	*2.17*	**0.021**	**0.118**	**34.85**	*1.66*	**0.617**	...	...	**25.52**	...	**18.03**	*0.02*

CANMET No.	Ag	Au	Ba	Bi	C	Cd	CO_2	Cr	H_2O	K	Mn
RTS-3a (continued)	**0.00111**	*0.0000561*	**0.0106**	**0.00313**	*(0.04)*	**0.00092**	*(0.04)*	*0.0176*	...	**0.460**	**0.1585**
RTS-5 (continued)	**0.000150**	**0.0000408**	**0.0252**	*0.000205*	*1.617*	...	...	**0.0261**	*(1.4)*	**0.850**	**0.1092**
TPO-1 (continued)	...	...	...	...	...	...	...	*0.03*	...	*0.56*	*0.08*

CANMET No.	Na	Pd	Pt	P	Se	Sr	S (Elemental)	S (Sulphide)	Ti	Zr	LOI
RTS-3a (continued)	**0.684**	*(0.0000004)*	...	*0.0446*	*0.00448*	**0.00447**	*(1.2)*	*(8)*	*0.351*	*0.0078*	*(10.6)*
RTS-5 (continued)	**1.285**	*(0.000014)*	*(0.00002)*	**0.0369**	*0.000803*	**0.01306**	*(0.3)*	...	**0.3132**	*(0.0075)*	*9.90*
TPO-1 (continued)	*0.85*	*0.02*	...	*0.03*	...	...	...	...	*0.35*	...	...

CANADA CENTRE FOR ENERGY AND MINERAL TECHNOLOGY (CANMET), Canada

CHEMICAL COMPOSITION (nominal mass content) - Figures in bold type certified, figures in small italic type only approximate and figures in brackets for information only.

Geochemical Soil and Till Reference Materials (Finely divided material – units of 100g)

CANMET No.	Description	Mass content	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	MnO	TiO_2	P_2O_5	S	LOI (500°C)	LOI (1000°C)
TILL-2	Till	%	*60.8*	*16.0*	*5.39*	*1.83*	*1.27*	*2.19*	*3.07*	*0.10*	*0.88*	*0.17*	*<0.05*	*6.8*	*8.1*
TILL-3	Soil	%	*69.1*	*12.2*	*3.92*	*1.71*	*2.63*	*2.64*	*2.42*	*0.06*	*0.49*	*0.11*	*<0.05*	*3.6*	*4.6*

CANMET No.	Mass content	As	Au	Ba	Be	Bi	Br	Ce	Co	Cr	Cs	Cu	Eu	Er	Hf	La	Li	Lu	Mn	Mo	Nb
TILL-2 (continued)	µg/g	*26*	*0.002*	*540*	*4.0*	*<5*	*12.2*	*98*	*15*	*74*	*12*	*150*	*1.0*	*3.7*	*11*	*44*	*47*	*0.6*	*780*	*14*	*20*
TILL-3 (continued)	µg/g	*87*	*0.006*	*489*	*2.0*	*<5*	*4.5*	*42*	*15*	*123*	*1.7*	*22*	*<1*	*1.4*	*8*	*21*	*21*	*0.2*	*520*	*2*	*7*

CANMET No.	Mass content	Nd	Ni	P	Pb	Rb	Sb	Sc	Sm	Sr	Ta	Tb	Th	Ti	U	V	W	Y	Yb	Zn	Zr
TILL-2 (continued)	µg/g	*36*	*32*	*750*	*31*	*143*	*0.8*	*12*	*7.4*	*144*	*1.9*	*1.2*	*18.4*	*5300*	*5.7*	*77*	*5*	*40*	*3.7*	*130*	*390*
TILL-3 (continued)	µg/g	*16*	*39*	*490*	*26*	*55*	*0.9*	*10*	*3.3*	*300*	*<0.5*	*<0.5*	*4.6*	*2910*	*2.1*	*62*	*<1*	*17*	*1.5*	*56*	*230*

Information is also given on the certificate of analysis re several partial extraction elements using HNO_3/HCl.

Rock and Mineral Certified Reference Materials (Finely divided material – units of 400g, except WMG-1a - 350g and WMS-1a - 200g) Nominal mass content in %

CANMET No.	Description	SiO_2	Al_2O_3	Fe_2O_3	Fe	TiO_2	CaO	MgO	K_2O	Na_2O	MnO	P_2O_5	Cu	$Cr_{(total)}$	Ni	S	LOI
TDB-1	Diabase Rock	*50.2*	*13.6*	*14.4*	**10.4**	*2.3*	*9.6*	*5.9*	*0.89*	*2.2*	*0.20*	*0.23*	**0.0323**	**0.0251**	**0.0092**	*0.03*	*0.3*
WGB-1	Gabbro Rock	*49.1*	*11.15*	**6.71**	…	*0.84*	*15.78*	**9.40**	**0.94**	*2.15*	*0.143*	*0.099*	*0.0106*	**0.0291**	*0.0076*	*0.02*	*4*
WMG-1a	Mineralized Gabbro	**18.27 Si**	**4.75 Al**	…	**12.71**	**0.419 Ti**	**10.06 Ca**	**7.41 Mg**	**0.1021 K**	**0.1119 Na**	*0.1141* **Mn**	**0.0731 P**	**0.7120**	**0.0804**	**0.2480**	**3.43**	*4.31*
WMS-1a	Massive Sulphide	*(4.7)* **Si**	**1.350 Al**	…	**45.4**	*0.084* **Ti**	**3.09 Ca**	*0.331* **Mg**	*0.0991* **K**	**0.0329 Na**	*0.060* **Mn**	*(0.018)* **P**	**1.396**	*0.0068*	**3.02**	**28.17**	…
WPR-1a	Altered Peridotite	**17.62 Si**	**2.621 Al**	…	**11.34**	**0.3527 Ti**	**2.528 Ca**	*15.22* **Mg**	**0.156 K**	*0.050* **Na**	**0.138 Mn**	**0.0303 P**	**0.299**	*0.322*	**0.439**	**1.764**	*8.42*

Nominal mass content in ng/g

CANMET No.	As	Au	Pt	Pd	Rh	Ru	Ir	Os	Ba	Ce	Ag	Co	Sb	Th	V	Zn
TDB-1 (continued)	…	**6.3**	**5.8**	**22.4**	*0.7*	*0.3*	*0.15*	…	**241000**	**41000**	*(500)*	*47000*	*1000*	**2700**	*471000*	**155000**
WGB-1 (continued)	…	**2.9**	**6.1**	**13.9**	*0.32*	*0.3*	*0.33*	…	*851000*	*(<20000)*	*(<1000)*	*29800*	*2000*	*(<1600)*	*222000*	*31500*
WMG-1a (continued)	**5990**	*617*	**899**	**484**	*(15)*	*(20)*	*(27)*	…	***216***	*17180*	**3030**	**191**	*1550*	**1070**	**158000**	**112**
WMS-1a (continued)	**30900**	**300**	**1910**	**1450**	**222**	*145*	*322*	*(150)*	*(70000)*	*(7900)*	*3700*	*1450000*	*6920*	*(1200)*	*140000*	*130000*
WPR-1a (continued)	**9300**	*50*	**452**	**614**	…	…	*20*	…	***70600***	**9690**	**1020**	**213000**	**3130**	*640*	**135000**	**160000**

WPR-1a also certified for Bi, Cd, Cs, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Li, Lu, Nd, Pb, Pd, Rb, Sc, Sm, Sr, Tb, Tm, Y and Yb.

Rock Certified Reference Material (Finely divided material – units of 100g)

CANMET No.	Description	SiO_2	TiO_2	Al_2O_3	FeO	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	CO_2	P_2O_5	Sr	LOI
SY-4	Diorite Gneiss	**49.9**	**0.287**	**20.69**	**2.86**	**6.21**	**0.108**	**0.54**	**8.05**	**7.10**	**1.66**	**3.5**	**0.131**	**0.1191**	**4.56**

Also shows values for trace levels of many elements, including Ba, Be, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Li, Lu, Nb, Nd, Ni, Pb, Pr, Rb, Sc, Sm, Ta, Tb, Th, Tm, U, V, Y, Yb, Zn, Zr.

CANADA CENTRE FOR ENERGY AND MINERAL TECHNOLOGY (CANMET), Canada

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Rare Earth Elements with Zirconium and Niobium Certified Reference Materials (Finely divided material – units of 100g)

CANMET No.	Description	Al	As	Ba	Be	Ca	Ce	Co	Cr	Cs	Cu	Dy	Er	Eu	Fe	Gd	Hf
REE-1	Rare Earth Elements	**3.59**	**0.0124**	**0.01001**	*0.0590*	**2.30**	**0.3960**	**0.000158**	**0.0277**	**0.000107**	**0.00797**	**0.0847**	**0.0701**	**0.00235**	*4.16*	**0.0433**	**0.0479**
REE-2	Rare Earth Elements	**0.761**	…	**5.02**	*0.00331*	**13.68**	**0.9610**	**0.000771**	*0.00327*	*(0.000009)*	**0.000555**	**0.00692**	**0.00140**	**0.00966**	**12.14**	*0.0219*	*0.000095*
REE-3	Rare Earth Elements	**4.372**	…	**0.00691**	**0.00823**	**1.644**	**0.4540**	*0.000092*	**0.0082**	**0.0001118**	**0.00163**	**0.03303**	**0.01872**	**0.002085**	**8.28**	**0.0346**	**0.0448**

CANMET No.	Ho	K	La	La(Total)	Li	Lu	Mg(Total)	Mn(Total)	Mo	Na	Nb	Nd	Ni	P	Pb	Pr	Rb	S(Total)
REE-1 (continued)	**0.0208**	**3.09**	**0.1661**	…	*0.0205*	*0.00924*	*0.895*	*0.155*	**0.00366**	**1.445**	**0.4050**	**0.1456**	**0.00247**	**0.0261**	**0.1137**	**0.0435**	**0.1047**	*(0.03)*
REE-2 (continued)	**0.000787**	*0.0172*	*(0.46)*	**0.5130**	**0.000961**	*0.000092*	**6.26**	**1.316**	*0.0154*	*0.120*	*0.1060*	**0.3660**	*0.000899*	**0.461**	*0.00408*	**0.1075**	**0.000122**	**1.745**
REE-3 (continued)	**0.00650**	**3.76**	**0.2121**	…	*(0.0060)*	**0.2153**	**0.0594**	*0.313*	**0.00597**	*2.328*	**0.1073**	**0.2083**	**0.001083**	**0.0201**	**0.0534**	**0.0550**	**0.0887**	*(0.04)*

CANMET No.	Sc	Si	Si(Total)	Sm	Sn	Sr	Ta	Tb	Th	Ti	Tm	U	W	Y	Yb	Zn	Zr	L.O.I
REE-1 (continued)	*(0.0008)*	**31.36**	…	**0.0381**	**0.0498**	**0.0129**	*0.0231*	**0.01062**	**0.0719**	*0.384*	**0.01060**	**0.0137**	*(0.001)*	**0.548**	**0.0678**	*0.187*	**1.91**	*(2)*
REE-2 (continued)	**0.00575**	…	**1.377**	**0.0410**	**0.00241**	**0.2300**	**0.000117**	**0.00203**	**0.0737**	**0.1969**	**0.0001383**	**0.000373**	**0.00099**	**0.0176**	*0.00072*	*0.042*	*0.00322*	**31.38**
REE-3 (continued)	*(0.0003)*	**29.66**	…	**0.0398**	**0.01211**	**0.01337**	**0.00607**	**0.00552**	**0.01355**	**0.3202**	**0.002580**	*0.00299*	*(0.0001)*	**0.1725**	**0.01594**	**0.1499**	**1.866**	**0.346**

Copper Anode Certified Reference Materials (finely divided material – units of 425g)

CANMET No.	Description	Ag	As	Au	Bi	Cu	Fe	Ni	Pb	Sb	Se	Sn	Te	Zn
CUAR-1	Copper Anode	**0.0294**	**0.0145**	**0.00023**	*0.0083*	*(98.6)*	**0.0076**	*0.4109*	**0.0864**	*0.0798*	*0.0026*	**0.0113**	**0.0033**	*(0.0032)*
CUPD-1	Copper Anode	**0.0216**	**0.0306**	**0.00039**	**0.0062**	*(99.5)*	**0.0040**	**0.0147**	**0.0069**	**0.0147**	**0.0237**	**0.0005**	*0.0056*	*(0.0011)*

Zinc-Aluminium Foundry Alloy Certified Reference Materials (50mm dia. x 12mm discs; also as finely divided material – units of 80g)

CANMET No.	Description	Al	Cu	Mg	Fe	Sn	Pb	Cd
NZA-1	Zinc-Aluminium Foundry Alloy	**28.70**	**1.51**	**0.020**	**0.046**	**0.0069**	**0.0030**	**0.00098**
NZA-2	Zinc-Aluminium Foundry Alloy	**23.81**	**3.00**	**0.029**	**0.021**	**0.0045**	**0.0076**	**0.0047**
NZA-3	Zinc-Aluminium Foundry Alloy	**25.99**	**2.00**	**0.0049**	**0.066**	**0.0034**	**0.0045**	**0.0064**
NZA-4	Zinc-Aluminium Foundry Alloy	**26.65**	**2.45**	**0.0106**	**0.027**	**0.0087**	**0.0101**	**0.0029**
NZA-5	Zinc-Aluminium Foundry Alloy	**10.85**	**1.04**	**0.021**	**0.016**	**0.0017**	**0.0012**	**0.0095**
NZA-6	Zinc-Aluminium Foundry Alloy	**7.54**	**3.17**	**0.00037**	**0.0105**	**0.0051**	**0.0809**	**0.0147**
NZA-7	Zinc-Aluminium Foundry Alloy	**13.17**	**0.212**	**0.052**	**0.016**	**0.0116**	**0.0136**	**0.00020**

CENTRE TECHNIQUE DES INDUSTRIES DE LA FONDERIE (CTIF), France

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Highly Alloyed Steel Certified Reference Material (Finely divided material units of 100g or a 40mm dia x 20mm disc)

CTIF No.	Description	C	Si	Mn	P	S	Cr	Mo	Ni	As	Co	Cu	N	Nb	Sn	V	$Al_{Sol.}$	$Al_{Tot.}$	Ga
*ECRM 273-1	Highly Alloyed Steel	**0.0336**	**0.378**	**0.785**	**0.0131**	**0.00037**	**14.747**	**0.246**	**4.852**	**0.0030**	**0.0391**	**3.047**	**0.0444**	**0.221**	**0.0021**	**0.0512**	*0.0032*	*0.0062*	*0.0023*

Special Alloy Certified Reference Materials (40mm dia. x 20mm discs: ECRM 378-1 is also available in the finely divided form in units of 100g.)

CTIF No.	Description	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu	Nb	Ti	W	Fe
*ECRM 377-1	Nickel Alloy IN 625	**0.0202**	**0.077**	**0.0225**	**0.0036**	**0.0006**	**21.72**	**8.94**	**61.45**	**0.216**	*0.0006*	**0.0348**	**0.0110**	**3.50**	**0.255**	...	**3.77**
*ECRM 377-2	Nickel Alloy IN 625	**0.0202**	**0.077**	**0.0225**	**0.0036**	**0.0006**	**21.72**	**8.94**	**61.45**	**0.232**	*0.0006*	**0.0348**	**0.0104**	**3.50**	**0.264**	...	**3.77**
*ECRM 378-1	Cobalt Alloy, Stellite grade 6	**1.181**	**1.172**	**0.0579**	*0.0023*	**0.0055**	**28.22**	**0.0503**	**0.617**	...	...	**63.52**	...	...	...	**4.43**	**0.606**

Cast Iron Certified Reference Materials (Finely divided material units of 100g)

CTIF No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	Co	Cu	N	Sn	Te	Ti	V	Zn
*ECRM 485-3	**3.514**	...	...	...	**0.1488**	...	...	...	...	...	...	...	**0.0081**	...	...	...	...	...
*ECRM 487-2	**3.573**	**0.0899**	**0.0491**	**0.0066**	**0.0031**	**0.0249**	**0.0034**	**0.0219**	**0.079**	**0.0064**	**0.0151**	**0.0136**	**0.0044**	**0.0045**	**0.0064**	**0.0021**	**0.0117**	**0.0012**
*ECRM 488-2	**3.956**	**0.374**	**0.201**	**0.0111**	**0.1173**	**0.303**	*0.0008*	**0.1247**	...	...	...	**0.0256**	**0.0052**	**0.0013**	*0.0089*	**0.0636**	**0.0545**	*0.0006*
*ECRM 490-1	**4.813**	*0.03*	**10.83**	**0.0267**	**0.0040**	**0.0183**	...	*0.02*	...	...	...	**0.0088**	**0.0030**	...	...	**0.0035**	**0.0152**	...
*ECRM 491-1	**3.616**	...	...	...	**0.0866**	...	...	...	...	...	...	...	...	...	...	...	...	...
*ECRM 492-1	**3.258**	...	...	...	**0.0854**	...	...	...	...	...	...	...	**0.0048**	...	...	...	...	...

* Denotes Full EURONORM Certified Reference Materials

Low Alloy Iron Reference Materials (43mm dia. x 5mm chill cast discs) Supplied as a pair of discs of the same material.

CTIF No.	C	Si	Mn	P	S	Cr	Mo	Ni	Co	Cu	Sn	Ti	V	Others
FL 1-1	*2.1*	*3.2*	*0.80*	*0.118*	*0.0765*	*0.06*	*0.038*	*0.245*	...	*0.0195*	*0.305*	*0.020*	*0.015*	...
FL 3-1	*2.3*	*2.1*	*0.27*	*0.729*	*(0.013)*	*0.107*	*0.106*	*0.553*	*(0.022)*	*0.102*	*0.111*	*0.054*	*0.049*	*0.008* **N**
FL 7-1	*3.1*	*2.55*	*0.1*	*1.34*	*0.048*	*0.043*	*0.335*	*0.232*	...	*0.351*	*0.0291*	*0.05*	*0.0796*	*0.0266* **As**, *0.004* **N**
FO 4-3	*2.81*	*1.51*	*0.64*	*0.58*	*0.009*	*0.17*	*0.095*	*0.32*	...	*0.32*	*0.013*	*0.075*	*0.049*	...
FO 5-4	*3.2*	*0.7*	*0.2*	*1.30*	*0.027*	*0.23*	*0.41*	*0.172*	*(0.019)*	*0.12*	*0.109*	*0.04*	*0.14*	*(0.003)* **As**
FO 6-4	*3.5*	*0.55*	*0.7*	*0.87*	*0.106*	*0.45*	*0.202*	*0.128*	...	*0.12*	*0.039*	*0.09*	*0.11*	...
FO 7-2	*2.45*	*0.675*	*0.70*	*0.84*	*0.085*	*0.455*	*0.26*	*0.15*	...	*0.125*	...	*0.065*	*0.13*	*0.0113* **N**
FO 8-2	*3.6*	*1.04*	*0.37*	*0.107*	*0.019*	*0.30*	*0.0086*	*0.30*	...	*0.215*	*0.051*	*0.05*	*0.010*	*0.0095* **As**, *0.0067* **N**
FO 9-2	*2.7*	*1.5*	*0.7*	*0.02*	*0.015*	*0.18*	*0.13*	*0.355*	...	*0.31*	*0.144*	*0.017*	*0.022*	...
FO 10-3	*3.5*	*0.65*	*1.05*	*0.196*	*0.101*	*0.379*	*0.202*	*0.117*	*0.0275*	*0.116*	*(0.002)*	*0.1*	*0.085*	*0.0012* **As**
FO 12-1	*3.7*	*1.86*	*0.44*	*0.038*	*0.004*	...	...	...	...	*0.77*	*0.011*	...	...	...
FO 17-1	*3.0*	*2.48*	*0.47*	*0.470*	*0.168*	*(0.016)*	...	*0.021*	*0.032*	*(0.006)*	*0.024*	*0.032*	*0.018*	...
FO 18-2	*3.4*	*1.2*	*0.60*	*1.34*	*0.136*	*0.170*	*0.179*	*0.140*	...	*0.049*	*0.046*	*0.055*	*0.102*	*0.004* **N**
FO 19-2	*4.04*	*1.05*	*1.05*	*0.030*	*0.057*	*0.0420*	...	*(0.075)*	*0.0392*	*0.0298*	*0.0012*	*0.029*	*0.0419*	*0.0005* **Te**, *0.0070* **N**
FPA-1-3	*3.10*	*0.029*	*0.105*	*0.002*	*0.0009*	*0.073*	*0.0109*	*0.045*	*0.0097*	*0.062*	...	*0.0010*	*0.0010*	*0.0109* **As**, *0.012* **N**
FT 1-3	*2.9*	*2.25*	*0.7*	*0.118*	*(0.006)*	*0.07*	...	*0.134*	...	*0.018*	...	*0.04*	*0.7*	...
FT 2-1	*3.4*	*1.4*	*0.78*	*0.045*	*0.095*	*0.03*	...	*0.07*	...	*0.01*	...	*0.10*	*0.405*	...
FT 3-1	*3.2*	*1.55*	*0.345*	*0.063*	*0.051*	*0.685*	...	*0.092*	...	*0.015*	...	*0.2*	*0.016*	...

CENTRE TECHNIQUE DES INDUSTRIES DE LA FONDERIE (CTIF), France

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Cu, Ni, Cr, Mo Iron Reference Materials (43mm dia. x 5mm chill cast discs) Supplied as a pair of discs of the same material

CTIF No.	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
NH 1-2	*3.00*	*1.35*	*0.90*	*0.060*	*0.105*	*0.83*	*1.45*	*1.38*	*1.99*
NH 2-3	*2.45*	*1.80*	*1.05*	*0.043*	*0.065*	*1.26*	*1.00*	*1.82*	*1.00*
NH 3-2	*3.45*	*0.85*	*0.175*	*0.36*	*0.024*	*1.76*	*0.73*	*2.53*	*0.031*
NH 4-2	*2.85*	*0.49*	*0.28*	*0.12*	*0.022*	*2.46*	*0.30*	*3.60*	*0.09*
NH 5-2	*2.30*	*0.31*	*0.24*	*0.115*	*0.04*	*2.85*	*0.017*	*4.90*	*0.035*
NH 6-1	*2.70*	*2.28*	*0.355*	*0.066*	*0.036*	*6.60*	*0.11*	*7.06*	*0.115*
NH 7-1	*3.43*	*0.95*	*0.63*	*0.035*	*0.022*	*9.02*	…	*5.53*	*0.105*
NH 7-2	*3.20*	*1.20*	*0.91*	*0.034*	*0.0120*	*8.87*	…	*5.53*	*0.108*
NH 8-1	*3.00*	*0.80*	*0.57*	*0.052*	*0.076*	*5.03*	*0.125*	*8.16*	*0.065*
NH 9-1	*3.15*	*1.24*	*0.65*	*0.087*	*0.029*	*11.70*	*0.059*	*4.11*	*0.203*

Austenitic (Ni-resist) Iron Reference Materials (43mm dia. x 5mm chill cast discs) Supplied as a pair of discs of the same material

CTIF No.	C	Si	Mn	P	S	Cr	Ni	Cu	N	Nb	Mg
NR CU 1-1B	*3.1*	*1.0*	*1.465*	*0.172*	*0.09*	*0.994*	*18.02*	*4.95*	…	…	…
NR CU 2	*2.52*	*2.07*	*1.07*	*0.115*	*0.049*	*2.05*	*15.9*	*6.50*	…	…	…
NR CU 3	*1.94*	*3.12*	*0.597*	*0.047*	*0.017*	*3.49*	*13.30*	*8.07*	*(0.008)*	…	…
NR 1-2L	*2.50*	*2.99*	*1.34*	*0.125*	*0.10*	*1.74*	*25.87*	*0.49*	…	…	…
NR 3-2L	*2.99*	*3.04*	*0.72*	*0.088*	*0.052*	*2.97*	*21.58*	*0.26*	…	…	…
NR 5-2L	*1.77*	*2.99*	*1.207*	*0.037*	*0.083*	*0.27*	*33.89*	*0.48*	…	…	…
NR 6-2L	*1.76*	*2.07*	*0.70*	*0.031*	*0.063*	*3.49*	*30.37*	*0.020*	…	…	…
NR 8-2L	*2.89*	*1.74*	*5.19*	*0.054*	*0.025*	*0.165*	*13.33*	*0.075*	…	…	…
NR 1-2S	*2.58*	*3.02*	*1.54*	*0.19*	…	*2.00*	*20.60*	*0.11*	…	…	^
NR 2-2S	*2.32*	*1.43*	*0.53*	*0.062*	…	*0.51*	*36.3*	*0.21*	…	…	variable
NR 3-2S	*2.92*	*2.91*	*0.77*	*0.024*	…	*3.05*	*24.63*	*0.33*	…	…	between
NR 4-2S	*2.47*	*4.87*	*1.71*	*0.145*	…	*1.50*	*18.30*	*0.63*	…	…	0.003%
NR 6-2S	*1.815*	*2.44*	*0.99*	*0.019*	…	*1.06*	*30.75*	*0.03*	…	…	and
NR 8-2S	*3.05*	*1.41*	*4.39*	*0.124*	…	*0.191*	*14.20*	*0.071*	…	…	0.25%
NR 2-1G	*2.2*	*1.5*	*0.4*	*0.05*	*<0.01*	*0.40*	*36.3*	*0.23*	…	*0.25*	
NR 4-1G	*2.3*	*5.6*	*1.72*	*0.11*	…	*1.40*	*21.30*	*0.64*	…	…	v

Chromium Iron Reference Materials (43mm dia. x 5mm chill cast discs) Supplied as a pair of discs of the same material

CTIF No.	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	N
FCR 1-3	*2.46*	*0.48*	*0.63*	*0.019*	*0.007*	*18.71*	*1.41*	*1.30*	*0.031*	…
FCR 2-4	*2.8*	*1.07*	*0.74*	*0.137*	*0.055*	*11.8*	*3.88*	*1.87*	*0.135*	…
FCR 3-1	*2.03*	*0.255*	*0.99*	*0.034*	*0.035*	*14.85*	*0.91*	*0.652*	*0.0490*	…
FCR 4-1	*2.45*	*1.40*	*2.05*	*0.097*	*0.066*	*24.2*	*2.16*	*0.57*	*1.32*	…
FCR 5-1	*3.43*	*0.30*	*0.55*	*0.052*	*0.0175*	*28.5*	*3.27*	*2.69*	*1.02*	…
FCR 6-1	*1.3*	*0.75*	*1.4*	*0.201*	*0.086*	*30.84*	*0.455*	*0.188*	*0.480*	…
FCR 7-1	*3.3*	*1.07*	*0.365*	*0.099*	*0.0427*	*33.65*	*2.62*	*0.947*	*0.704*	…
FCR NI 1	*1.27*	*1.63*	*0.71*	*0.41*	*0.06*	*26.20*	…	*16.50*	*0.02*	…
FCR NI 2	*2.0*	*1.51*	*0.60*	*0.185*	*0.024*	*29.07*	…	*13.11*	…	*0.1*
FCR NI 3	*2.74*	*0.67*	*0.46*	*0.036*	*0.011*	*31.65*	…	*11.05*	…	…

CENTRE TECHNIQUE DES INDUSTRIES DE LA FONDERIE (CTIF), France

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Brass Reference Materials (60mm dia. x 5-6 mm mushrooms)

CTIF No.	Cu	Sn	Pb	Zn	Fe	Ni	Mn	Al	Si	Sb	P	Others
L 1-1	*58.7*	*0.046*	*0.06*	*39.7*	*0.017*	*0.106*	...	*0.01*	*0.36*	...	*0.08*	...
L 2	*61.55*	*0.48*	*0.408*	*35.55*	*0.216*	*0.71*	*0.350*	*0.485*	*0.202*	...	...	...
L 3-1	*58.5*	*1.62*	*1.32*	*35.5*	*0.357*	*0.993*	*0.214*	*1.22*	*0.0256*	*0.032*	*0.0306*	*0.073* **As**
L 4-1	*61.70*	*0.693*	*2.017*	*34.60*	*0.466*	*0.227*	*0.109*	*0.104*	*0.12*	...	...	...
L 5-1	*61.0*	*0.88*	*2.99*	*31.5*	*(1.0)*	*0.494*	*0.50*	*0.64*	*(0.50)*	*0.174*	*(0.15)*	*0.13* **As**
L 6	*65.95*	*0.193*	*0.159*	*30.70*	*0.108*	*1.30*	*0.029*	*0.130*	*1.28*	*0.060*	*0.040*	*0.102* **As**
L 7	*55.60*	*0.038*	*0.71*	*42.45*	*0.031*	*0.020*	*0.62*	*0.308*	*0.13*	...	...	...
L 20-1	*85.2*	*0.49*	*0.274*	*13.3*	*0.039*	*0.223*	*0.130*	*(0.06)*	*0.106*	...	*0.026*	*0.099* **As**
L 21	*82.50*	*1.50*	*0.209*	*15.40*	*0.086*	*0.156*	*0.004*	...	*0.036*	...	...	*0.103* **As**
L 22	*83.0*	*1.05*	*0.123*	*15.0*	*0.15*	*0.105*	*<0.001*	...	*0.05*	*0.088*	*0.06*	*<0.05* **Mg**
L 23	*81.20*	*0.20*	*0.058*	*17.90*	*0.246*	*0.033*	...	...	*0.280*	...	...	*0.051* **As**
LH 1-1	*64.9*	*(0.007)*	*0.022*	*16.9*	*4.48*	*0.0944*	*5.18*	*7.99*	*0.205*	*0.081*	*0.079*	...
LH 2-1	*61.2*	*0.051*	*0.103*	*22.4*	*3.15*	*3.27*	*3.19*	*6.50*	*0.057*	...	...	...
LH 5-1	*66.0*	*0.141*	*0.110*	*25.72*	*1.26*	*1.57*	*1.37*	*3.65*	*0.114*	...	...	...
LH 6-1	*63.18*	*0.257*	*0.25*	*19.04*	*3.13*	*3.19*	*4.54*	*6.09*	*0.20*	...	...	...
LH 7-1A	*63.40*	*0.227*	*0.327*	*(26.85)*	*(2.35)*	*0.70*	*2.96*	*3.16*	*0.055*	...	...	...
LH 10	*59.05*	*0.203*	*1.76*	*28.90*	*(1.0)*	*1.49*	*3.57*	*2.66*	*1.30*	...	...	...
LH 11	*66.80*	*0.44*	*1.26*	*26.20*	*0.36*	*2.91*	*0.71*	*0.46*	*0.88*	...	...	...
LH 12	*62.75*	*0.83*	*0.21*	*33.15*	*(1.2)*	*0.505*	*0.125*	*1.13*	*(0.06)*	...	...	...
LH 13	*55.75*	*1.19*	*0.67*	*31.8*	*(2.00)*	*3.22*	*3.14*	*2.00*	*0.21*	...	...	...
LS 1	*77.7*	*0.243*	*0.213*	*16.3*	*0.448*	*0.55*	*0.039*	*(0.02)*	*4.35*	...	*0.128*	...
LS 3-1	*76.05*	*0.154*	*0.576*	*18.95*	*0.101*	*0.113*	*0.151*	*0.426*	*3.32*	*0.107*	*0.0110*	...
UZ 52-3	*81.18*	*1.06*	*0.11*	*16.90*	*0.32*	*0.084*	*0.002*	...	*0.12*	*0.08*	*0.068*	*0.040* **Mg**, *0.014* **Be**
UZ 53	*82.60*	*0.205*	*0.025*	*16.67*	*0.255*	*0.025*	*≤0.001*	...	*0.145*	...	*0.055*	*0.01* **As**

CENTRE TECHNIQUE DES INDUSTRIES DE LA FONDERIE (CTIF), France

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Bronze Reference Materials (60mm dia. x 6 mm mushrooms)

CTIF No.	Cu	Sn	Pb	Zn	Fe	Ni	Mn	Si	S	P	Al	Sb	As
B 1	*83.0*	*15.10*	*0.202*	*0.88*	*0.085*	*0.063*	...	*0.053*	*0.030*	*0.034*	*0.061*	*0.444*	...
B 2	*85.90*	*13.55*	*0.02*	*0.11*	*0.051*	*(0.004)*	...	*0.17*	*0.048*	*0.17*	*(0.003)*	*(≤0.002)*	...
B 3	*80.2*	*12.8*	*1.6*	*2.2*	*0.2*	*1.5*	*0.20*	*0.07*	*0.04*	*0.45*	*0.1*	*0.2*	...
B 4	*83.75*	*11.10*	*2.53*	*1.34*	*0.021*	*0.57*	...	*0.015*	*0.019*	*0.52*	...	*0.10*	...
B 5	*85.95*	*9.90*	*0.48*	*0.42*	*0.18*	*2.28*	*0.082*	*0.049*	*0.067*	*0.041*	*0.039*	*0.47*	...
B 10	*83.90*	*6.60*	*4.03*	*2.55*	*0.17*	*0.97*	*<0.01*	*<0.01*	*0.05*	*0.015*	*0.17*	*1.09*	*0.009*
B 11-1	*84.5*	*8.3*	*2.0*	*2.0*	*0.2*	*2.06*	*0.02*	*0.2*	*0.098*	*0.07*	...	*0.73*	...
B 12	*85.65*	*9.57*	*0.201*	*0.6*	*0.162*	*2.63*	*0.235*	*0.050*	*0.013*	*0.520*	*0.120*	*0.117*	*0.111*
B 13	*86.35*	*10.05*	*0.99*	*1.09*	*0.250*	*0.50*	*0.046*	*0.085*	*0.070*	*0.210*	*0.016*	*0.243*	*0.065*
B 14	*87.00*	*10.75*	*0.50*	*0.15*	*0.11*	*0.30*	*0.02*	*0.075*	*0.02*	*0.64*	*<0.01*	*0.08*	*0.04*
B 20-1	*83.35*	*6.35*	*5.10*	*3.77*	*0.165*	*0.51*	...	*0.055*	*0.115*	*0.072*	*0.040*	*0.520*	...
B 21	*83.0*	*5.13*	*3.79*	*6.22*	*0.285*	*1.21*	...	*0.135*	*0.047*	*(0.004)*	...	*0.18*	...
B 22-1	*83.0*	*3.5*	*6.0*	*4.0*	*<0.10*	*2.5*	...	*<0.1*	*0.03*	...	...	*0.05*	...
B 23-1	*83.45*	*7.18*	*7.20*	*1.46*	*(0.040)*	*0.086*	...	*0.025*	*0.019*	*0.070*	*0.020*	*0.384*	...
B 30-1	*76.5*	*11.1*	*9.6*	*1.0*	*0.07*	*1.19*	*0.1*	*(<0.06)*	*0.075*	*0.05*	*(<0.05)*	*0.214*	*0.0088*
B31	*78.65*	*7.65*	*11.79*	*0.79*	*(0.015)*	*0.489*	...	*(0.047)*	*0.028*	...	*(0.031)*	*0.475*	...
B 32	*74.65*	*5.96*	*16.10*	*1.21*	*0.11*	*1.49*	...	*0.075*	*0.027*	*0.041*	*0.085*	*0.13*	*0.0056*

Cupro-Beryllium Cobalt and Cupro-Nickel Reference Materials (60mm dia. x 6mm mushrooms)

CTIF No.	Cu	Sn	Pb	Zn	Fe	Ni	Mn	Si	S	Al	Be	Co	Ag	C	Nb	Others
4583	*96.35*	*0.25*	*0.084*	*0.094*	*(0.15)*	*2.02*	*0.064*	*0.08*	...	*0.029*	*0.84*	*(0.002)*	...	...	...	...
4584	*97.05*	*0.022*	*(0.002)*	*0.022*	*0.120*	*0.015*	*(0.002)*	*0.166*	...	*0.033*	*2.53*	*0.04*	...	...	...	...
4766	*96.83*	*0.100*	*0.053*	*0.070*	*0.160*	*0.203*	*0.008*	*0.110*	...	*0.027*	*1.58*	*0.64*	...	...	...	*(0.2)* **Cr**
4872	*97.00*	*0.044*	*0.019*	*0.119*	*0.104*	*0.103*	*<0.008*	*0.16*	...	*0.059*	*1.93*	*0.400*	...	...	...	*(0.04)* **Cr**
4873	*98.40*	*(0.007)*	*(0.003)*	*(0.003)*	*0.078*	*0.049*	*(0.002)*	*0.088*	...	*0.094*	*0.17*	*0.98*	...	...	...	*0.105* **Cr**
CuBeCo6	*93.09*	*0.0135*	*0.0397*	*0.0330*	*0.12*	*(1.45)*	*0.0173*	*0.26*	...	*0.135*	*1.5*	*(1.90)*	*1.37*	...	...	*0.0576* **Cr**
CN 1	*85.0*	*(0.005)*	*0.085*	*0.2*	*1.1*	*12.3*	*0.8*	*(0.05)*	*0.046*	*(0.003)*	...	...	...	*(0.002)*	*(0.1)*	...
CN 2	*88.5*	*(0.005)*	*0.055*	*0.5*	*1.6*	*7.8*	*1.1*	*0.24*	*0.028*	*(0.005)*	...	...	...	*(0.005)*	*(0.005)*	...
CN 4	*84.0*	*0.058*	*0.006*	*0.07*	*1.8*	*11.2*	*1.5*	*(0.01)*	*(0.001)*	*(0.02)*	...	...	...	*(0.001)*	*0.7*	...
CN 33	*67.1*	*(0.003)*	*0.053*	*0.37*	*1.6*	*29.75*	*0.45*	*0.47*	*0.013*	*(0.01)*	...	...	...	*0.02*	*0.06*	*0.02* **P**, *0.0212* **Bi** *0.006* **Cd**, *<0.06* **Mg** *0.0224* **Te**
UN 3S	*92.65*	*0.215*	*0.20*	*1.62*	*0.30*	*3.45*	*0.07*	*1.24*	...	*0.11*	...	...	...	...	...	...

DEGERFORS LABORATORIUM AB (D-LAB), Sweden

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in small italic type only approximate.

Ferro-Alloy Certified Reference Materials from Degerfors Laboratorium AB (D-LAB), Sweden (Finely divided material – units of 50g)

D-LAB No.	Description	C	Si	P	S	Cr	N	O	H
DFS 1	Ferro-chromium - Low Carbon	**0.0549**	*0.87*	*0.027*	*0.0017*	**69.8**	**0.0973**	*0.56*	*0.0024*
DFS 2	Ferro-chromium - High Carbon	**9.03**	*0.2*	*0.021*	*0.0174*	**69.6**	*0.0178*	*0.2*	...
DFS 3	Ferro-chromium - High Nitrogen	*0.068*	*0.54*	*0.023*	*0.016*	**64.2**	**9.71**	*3*	...

Nordisk Industrilaboratorium AB (NILAB), Sweden

CHEMICAL COMPOSITION (nominal mass content in %)

Alloy Steel Certified Reference Materials (500 HA and 501 HA available in finely divided form and all available in disc form – see table)

NILAB No.	Description	Unit sizes	C	Si	Mn	P	S	Cr	Mo	Ni
100 LA	Bearing Steel	34mm dia. x 20mm disc	**1.002**	**0.283**	**0.333**	**0.012**	**0.018**	**1.517**	**0.012**	**0.027**
500 HA	Stainless Steel	150g powder 38mm dia. x 20mm disc	**0.041**	**0.720**	**1.541**	**0.024**	**0.012**	**16.93**	**2.73**	**11.00**
501 HA	Highly Alloyed Steel	150g powder 38mm dia. x 20mm disc	**0.014**	**0.676**	**0.858**	**0.020**	**0.003**	**19.79**	**6.14**	**17.69**

Alloy Steel Certified Reference Materials (continued)

NILAB No.	Al	As	Co	Cu	N	Nb	Ti	V
100 LA (cont.)	**0.005**	**0.004**	**0.007**	**0.019**	**0.0046**	...	**0.0007**	**0.004**
500 HA (cont.)	...	...	**0.139**	**0.182**	**0.1154**	**0.023**	...	**0.074**
501 HA (cont.)	**0.003**	...	**0.159**	**0.761**	**0.223**	**0.007**	...	**0.044**

DILLINGER LABORATORY (DL), Germany

CHEMICAL COMPOSITION (nominal mass content in %)

Ferro-Alloy, Calcium-Silicon, Silico-Chromium, Silico-Manganese and Electrolytic Manganese Reference Materials (Finely divided material - units of 50g)

Dillinger No.	Description	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	N
DL SL01-07	Silico – Manganese	1.65	17.36	77.82	0.135	...	...	...	0.021	...	...	0.030	...
DL SL04-06	Calcium – Silicon	0.61	60.79	0.056	0.031	0.022	<0.009	<0.021	<0.007	0.333	...	...	...
DL SL12-07	Ferro – Manganese	1.630	1.113	88.00	0.081	...	0.060	...	0.022	...	...	0.039	...
DL SL17-05	Ferro – Boron	0.62	1.011	0.416	0.061	...	0.925	0.023	0.097	0.085	20.23	0.025	...
DL SL20-10	Ferro – Molybdenum	0.026	0.161	0.010	0.015	0.092	0.035	78.09	0.112	0.008	...	0.020	...
DL SL23-10	Ferro – Silicon	0.11	75.94	0.139	0.021	...	0.019	...	0.006	2.041	...	...	...
DL SL25-10	Ferro – Vanadium	0.120	0.894	1.154	0.051	0.016	0.201	0.029	0.009	0.783	...	0.008	...
DL SL28-15	Ferro – Niobium	0.043	1.580	0.842	0.065	0.056	0.028	0.020	0.019	4.82	...	...	...
DL SL29-02	Fe-Si-Ti	0.284	59.25	1.64	0.010	0.005	0.059	0.126	0.043	0.613	...	...	...
DL SL30-01	Fe-Si-Zr	0.338	51.14	0.210	0.033	0.002	0.004	...	0.013	0.852	...	...	0.027
DL SL54-03	Silico – Chromium	0.034	40.46	0.41	0.022	...	36.93	...	0.190	0.579	...	...	...
DL SL77-01	Electrolytic Manganese	0.120	1.09	95.85	0.056	0.016	0.411	...	0.0068	0.0015	...	0.0012	...

Dillinger No.	Cu	Nb	Pb	Ti	V	W	Zr	Ba	Ca	Mg	Ta	Zn	Fe
DL SL01-07 (cont.)	0.012	...	...	0.122	0.015	...	...	...	...	...	...	...	2.64
DL SL04-06 (cont.)	<0.010	...	...	0.055	...	...	...	...	30.48	0.010	...	...	5.17
DL SL12-07 (cont.)	0.016	...	...	...	0.026	...	...	...	...	...	...	0.009	8.78
DL SL17-05 (cont.)	0.072	...	...	0.025	0.006	0.127	...	...	...	...	...	...	75.71
DL SL20-10 (cont.)	0.464	...	...	...	...	...	...	...	...	...	...	...	20.66
DL SL23-10 (cont.)	0.011	...	...	0.093	...	...	...	0.042	1.019	0.029	...	...	19.42
DL SL25-10 (cont.)	0.038	0.013	...	0.071	80.85	0.025	...	...	...	0.010	...	...	14.25
DL SL28-15 (cont.)	0.209	60.15	0.140	0.185	0.013	...	0.105	...	...	...	0.856	...	28.77
DL SL29-02 (cont.)	0.022	...	...	11.21	0.154	...	0.046	...	0.220	0.234	...	...	24.80
DL SL30-01 (cont.)	...	...	...	0.073	...	...	36.06	...	0.157	...	...	...	8.87
DL SL54-03 (cont.)	0.020	...	...	0.124	0.074	...	...	...	...	...	...	...	20.93
DL SL77-01 (cont.)	0.007	...	...	...	...	...	...	...	...	...	...	0.0011	2.07

The above represents a selection of samples prepared by Dillinger Laboratory in which the reference values have been obtained after a preliminary multi-element analysis by a complete reconstitution of the test sample using pure and ultrapure compounds as primary references. Sets of Dillinger samples are available to provide ranges of values for most categories of materials stated, and details can be provided on request.

The Dillinger certified values are based on the SI unit's kg and mole and are obtained by means of absolute calibration.

DILLINGER LABORATORY (DL), Germany

CHEMICAL COMPOSITION (nominal mass content in %)

Dust and Slag Reference Materials (Finely divided material - all units of 100g except DL SX62-05 - units of 20g)

Dillinger No.	Description	CaO	SiO_2	Fe	Fe_2O_3	Mn_3O_4	P_2O_5	S	SO_3	CuO	Al_2O_3	MgO	NiO	Cr_2O_3
DL SX62-05	Cupola Dust	4.91	34.52	...	9.49	2.57	0.147	...	2.70	0.163	1.30	1.85	0.005	0.041
DL SX66-04	Tundish Slag	1.609	24.75	...	4.62	0.098	0.084	...	0.026	...	1.884	64.65	0.165	0.255
DL SX74-02	Zinc Slag	0.405	11.01	0.207	...	0.113	14.03	0.114	...	7.02	5.99	0.118	...	0.086

Dillinger No.	SnO_2	V_2O_5	MoO_3	TiO_2	PbO	SnO_2	ZnO	Cl	F	Na_2O	K_2O	CO_2	C(tot)	H_2O (900°C)
DL SX62-05 (cont.)	0.018	0.019	0.030	0.060	2.43	...	21.01	2.88	0.096	2.26	3.68	3.84	6.80	0.107
DL SX66-04 (cont.)	...	...	...	0.141	...	...	...	...	...	0.516	0.089	0.35	0.471	1.02
DL SX74-02 (cont.)	...	...	...	0.274	...	0.386	45.16	...	...	0.13	0.164	...	11.92	0.077

Dunite, Refractory, Magnesite and Uncover Compound Reference Materials (Finely divided material - units of 100g)

Dillinger No.	Description	CaO	SiO_2	Fe	FeO	Fe_2O_3	Mn_3O_4	P_2O_5	S	SO_3	Al_2O_3
DL SX10-02	Dunite	4.36	41.87	5.40	0.623	...	0.061	0.922	...	...	8.87
DL SX26-12	Refractory	1.80	40.80	...	...	3.10	0.135	0.279	...	...	36.45
DL SX42-03	Magnesite	1.293	15.94	...	...	2.75	0.090	0.059	...	0.070	1.27
DL SX59-03	Uncover Compound	61.81	21.41	...	...	1.36	0.046	0.151	0.194	...	3.70

Dillinger No.	MgO	NiO	TiO_2	Cr_2O_3	V_2O_5	ZrO_2	Na_2O	K_2O	F	C (tot)	CO_2	H_2O (900°C)
DL SX10-02 (cont.)	23.79	0.022	0.929	0.037	...	...	0.068	4.80	...	0.332	0.767	5.95
DL SX26-12 (cont.)	13.13	0.032	1.25	0.385	0.027	0.163	0.242	0.759	...	0.437	0.54	0.75
DL SX42-03 (cont.)	76.81	...	0.054	0.119	...	...	0.375	0.019	...	0.396	0.104	1.01
DL SX59-03 (cont.)	10.07	...	0.183	...	...	...	0.174	0.599	0.046	...	0.016	0.023

The above represents a selection of samples prepared by Dillinger Laboratory in which the reference values have been obtained after a preliminary multi-element analysis by a complete reconstitution of the test sample using pure and ultrapure compounds as primary references. Sets of Dillinger samples are available to provide ranges of values for most categories of materials stated, and details can be provided on request.

The Dillinger certified values are based on the SI unit's kg and mole and are obtained by means of absolute calibration.

DILLINGER LABORATORY (DL), Germany

CHEMICAL COMPOSITION (nominal mass content in %)

Fluorspar, Continuous Casting Powder, Limestone and Gravel Reference Materials (Finely divided material - all units of 100g)

Dillinger No.	Description	Ca	CaO	SiO_2	Fe	Fe_2O_3	MnO	Mn_3O_4	P_2O_5
DL SX27-12	Fluorspar	*44.18*	...	*8.91*	...	*0.373*	*0.237*	...	...
DL SX30-13	Continuous Casting Powder	*30.73*	...	*37.70*	...	*0.437*	*0.045*	...	*0.047*
DL SX35-15	Limestone	...	*48.91*	*8.75*	*1.293*	*1.293*	*0.028*	...	*0.036*
DL SX36-09	Gravel	...	*0.047*	*96.35*	*0.706*	*0.706*	...	*0.20*	*0.019*

Dillinger No.	S	SO_4	Al_2O_3	MgO	TiO_2	Na_2O	K_2O	V_2O_5	Cr_2O_3	F
DL SX27-12 (cont.)	...	*0.103*	*1.01*	*0.739*	*0.069*	...	*0.125*	...	*0.106*	*40.6*
DL SX30-13 (cont.)	*0.077*	...	*5.95*	*1.93*	*0.064*	*6.43*	*0.288*	...	...	*5.72*
DL SX35-15 (cont.)	*0.025*	...	*0.787*	*0.379*	*0.048*	*0.032*	*0.187*	...	...	...
DL SX36-09 (cont.)	...	...	*1.46*	*0.104*	*0.086*	*0.045*	*0.334*	*<0.006*	*0.029*	...

Dillinger No.	BaO	Co_3O_4	NiO	CuO	ZnO	SnO_2	PbO	SrO	CO_2	H_2O (900°C)
DL SX27-12 (cont.)	...	...	*0.153*	*0.199*	*0.103*	*0.054*	*0.102*	...	*2.11*	*0.370*
DL SX30-13 (cont.)	*0.121*	...	...	...	...	...	...	*0.034*	...	...
DL SX35-15 (cont.)	...	...	...	...	...	...	...	*0.050*	...	...
DL SX36-09 (cont.)	...	*0.005*	...	...	...	...	...	...	*<0.025*	*0.043*

Cover Powder and Rutile Reference Materials (Finely divided material - DL SX57-04 - units of 20g, DL SX58-05 - units of 100g)

Dillinger No.	Description	CaO	SiO_2	Fe_2O_3	Mn_3O_4	P_2O_5	S	Al_2O_3	MgO
DL SX57-04	Cover Powder	*0.302*	*92.49*	*0.090*	*0.067*	*0.273*	*0.071*	*0.198*	*0.362*
DL SX58-05	Rutile	*0.035*	*0.297*	*3.53*	*0.124*	*0.147*	*0.027*	*0.500*	*0.032*

Dillinger No.	Cr_2O_3	TiO_2	Na_2O	K_2O	V_2O_5	Nb_2O_5	ZrO_2	C	CO_2	H_2O (900°C)
DL SX57-04 (cont.)	...	...	*0.070*	*0.97*	...	...	...	*3.60*	*0.008*	*1.38*
DL SX58-05 (cont.)	*0.117*	*93.35*	...	...	*0.243*	*0.532*	*0.198*	*0.23*	...	...

The above represents a selection of samples prepared by Dillinger Laboratory in which the reference values have been obtained after a preliminary multi-element analysis by a complete reconstitution of the test sample using pure and ultrapure compounds as primary references. Sets of Dillinger samples are available to provide ranges of values for most categories of materials stated, and details can be provided on request.

The Dillinger certified values are based on the SI unit's kg and mole and are obtained by means of absolute calibration.

DILLINGER LABORATORY (DL), Germany

CHEMICAL COMPOSITION (nominal mass content in %)

Iron Ore and Sinter Reference Materials (Finely divided material – units of 100g)

Dillinger No.	CaO	SiO_2	Fe	FeO	Mn	P_2O_5	S	Al_2O_3	MgO	TiO_2	Na_2O	K_2O	V_2O_5	Cr_2O_3	ZnO	C(tot)	CO_2	H_2O (900°C)
DL SX11-13	*0.030*	*1.80*	*66.33*	*0.04*	*0.432*	*0.084*	*0.002*	*1.11*	*0.040*	*0.046*	*<0.003*	*0.010*	*0.007*	*0.010*	…	*0.035*	…	*1.24*
DL SX11-14	*0.421*	*7.47*	*65.55*	*27.20*	*0.029*	*0.028*	*0.019*	*0.271*	*0.565*	*0.060*	*0.078*	*0.061*	*0.002*	*0.006*	…	*0.125*	…	…
DL SX11-15	*0.494*	*5.79*	*63.17*	…	*0.074*	*0.101*	…	*2.68*	*0.244*	*0.128*	*0.020*	*0.008*	*0.010*	*0.005*	…	…	…	…
DL SX11-16*	*1.149*	*4.67*	*64.69*	…	*0.198*	*0.058*	…	*0.722*	*0.400*	*0.078*	*0.016*	*0.023*	*0.009*	*0.038*	*0.0010*	*0.016*	*0.026*	*0.059*
DL SX11-18	*0.052*	*1.56*	*64.72*	…	*0.713*	*0.141*	*0.009*	*1.785*	*0.057*	*0.075*	*0.014*	*0.020*	*0.017*	…	*0.005*	*0.085*	*0.033*	*2.51*
DL SX11-23	*0.034*	*2.67*	*64.80*	*0.133*	*0.049*	*0.123*	*0.011*	*1.619*	*0.037*	*0.047*	*0.006*	*0.008*	*0.005*	…	*0.0009*	*0.058*	…	…
DL SX11-35	*0.011*	*0.696*	*64.69*	*0.06*	*1.520*	*0.140*	*0.006*	*1.49*	*0.033*	*0.052*	…	*0.016*	…	…	…	*0.069*	*0.007*	*2.31*
DL SX11-36	*0.370*	*3.35*	*65.74*	…	*1.21*	*0.017*	*0.002*	*0.345*	*0.083*	*0.023*	*0.025*	*0.033*	*0.006*	*0.025*	…	*0.016*	*0.030*	*0.057*
DL SX11-37	*1.930*	*2.365*	*66.15*	*0.32*	*0.038*	*0.113*	*0.003*	*0.442*	*0.164*	*0.032*	*0.020*	*0.011*	…	*0.017*	…	*0.101*	*0.089*	*0.080*
DL SX56-29	*9.38*	*4.80*	*57.78*	*7.12*	*0.426*	*0.129*	*0.011*	*1.453*	*0.919*	*0.108*	*0.026*	*0.050*	…	*0.040*	*0.089*	…	…	…
DL SX56-35	*6.11*	*4.81*	*59.22*	*5.27*	*0.368*	*0.120*	*0.013*	*1.392*	*0.882*	*0.224*	*0.047*	*0.066*	…	*0.031*	*0.010*	…	…	*1.27*

*** DL SX11-16** has the following additional constituent value: NiO *0.011%.*

Cement Reference Materials (Finely divided material – units of 100g)

Dillinger No.	Ca	CaO	SiO_2	Fe_2O_3	Mn_3O_4	P_2O_5	S	Al_2O_3	MgO	TiO_2	SrO	K_2O	Na_2O	BaO	V_2O_5
DL SX02-09	*48.78*	…	*21.95*	*0.204*	*0.025*	*0.043*	*1.19*	*4.63*	*0.717*	*0.095*	*0.051*	*1.01*	*0.078*	*0.028*	…
DL SX02-10	*33.39*	*46.72*	*30.30*	*1.66*	*0.327*	*0.066*	*1.77*	*9.99*	*4.96*	*0.421*	*0.077*	*0.541*	*0.236*	*0.071*	*0.011*
DL SX02-11	*40.63*	…	*25.04*	*2.98*	*0.172*	*0.137*	*1.48*	*6.86*	*2.79*	*0.319*	*0.083*	*0.524*	*0.156*	*0.041*	*0.014*
DL SX02-12	*46.48*	…	*21.16*	*3.94*	*0.062*	*0.191*	*1.18*	*4.41*	*0.945*	*0.242*	*0.086*	*0.495*	*0.084*	…	…

The above represents a selection of samples prepared by Dillinger Laboratory in which the reference values have been obtained after a preliminary multi-element analysis by a complete reconstitution of the test sample using pure and ultrapure compounds as primary references. Sets of Dillinger samples are available to provide ranges of values for most categories of materials stated, and details can be provided on request.

The Dillinger certified values are based on the SI unit's kg and mole and are obtained by means of absolute calibration.

FLUXANA GMBH & CO. KG REFERENCE MATERIALS (FLX), GERMANY

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Cement Reference Materials (Finely divided material – unit weights as shown)

FLX No.	Unit Weight	Al_2O_3	CaO	Cl	Cr_2O_3	Fe_2O_3	K_2O	MgO	Mn_2O_3	Na_2O	P_2O_5	S	SiO_2	SO_3	SO_4 as SO_3	SrO	TiO_2	ZnO	LOI
FLX-CRM 100	50g	*5.54*	*64.51*	*(0.09)*	*0.009*	*2.62*	*0.82*	*1.47*	*0.066*	*0.23*	*0.166*	*(0.06)*	*20.89*	*2.97*	...	*0.286*	*0.283*	*0.051*	*2.37*
FLX-CRM 101	50g	*8.86*	*48.43*	...	*0.011*	*3.54*	*2.1*	*1.72*	*0.116*	*0.657*	*0.189*	...	*30.29*	*3.12*	...	*0.248*	*0.463*	*0.046*	*5.13*
FLX-CRM 103	50g	*7.75*	*54.9*	...	*0.007*	*1.78*	*0.77*	*4.44*	*0.17*	*0.33*	*0.09*	...	*26.95*	*2.73*	...	*0.07*	*0.372*	*0.014*	...
FLX-CRM 105	30g	*4.27*	*65.24*	*0.049*	*0.008*	*2.5*	*1.24*	*1.57*	*0.04*	*0.21*	*0.0053*	...	*20.84*	*3.37*	...	*0.146*	*0.179*	*0.054*	*(2.61)*
FLX-CRM 106	30g	*5.7*	*66.05*	*0.055*	*0.008*	*1.98*	*0.86*	*0.96*	*0.161*	*0.12*	*0.111*	...	*20.29*	*3.01*	...	*0.206*	*0.271*	*0.012*	*(2.06)*
FLX-CRM 107	30g	*4.23*	*67.19*	*0.043*	*0.006*	*1.29*	*0.7*	*0.7*	*0.04*	*0.18*	*0.16*	...	*21.81*	*3.13*	...	*0.151*	*0.194*	*0.013*	*(6.59)*
FLX-CRM 108	30g	*4.66*	*65.15*	*0.042*	*0.007*	*2.97*	*0.74*	*2.15*	*0.219*	*0.09*	*0.169*	...	*20.06*	*3.31*	...	*0.083*	*0.186*	*0.036*	*(2.68)*
FLX-CRM 109	30g	*4.25*	*66.45*	*0.049*	*0.008*	*2.32*	*1.06*	*1.59*	*0.051*	*0.18*	*0.052*	...	*20.39*	*3.11*	...	*0.144*	*0.0203*	*0.042*	*(5.96)*
FLX-CRM 110	30g	*4.7*	*68.13*	*0.008*	*0.004*	*0.18*	*0.94*	*0.65*	*0.029*	*0.05*	*0.037*	...	*22.01*	*2.88*	...	*0.041*	*0.17*	*0.003*	*(3.46)*
FLX-CRM 130	30g	*11.62*	*56.6*	...	*0.021*	*2.88*	*0.682*	*1.84*	*0.062*	*0.277*	*0.067*	...	*14.35*	*10.91*	*(10.18)*	*0.052*	*0.563*	*0.018*	*(5.12)*
FLX-CRM 131	30g	*23.1*	*42.89*	...	*0.038*	*3.24*	*0.287*	*1.62*	*0.029*	*0.466*	*0.06*	...	*8.73*	*18.19*	*(17.85)*	*0.067*	*1.15*	*0.006*	*(2.03)*
FLX-CRM 137	30g	*4.99*	*64.77*	...	*(0.007)*	*3.07*	*0.769*	*1.64*	*0.266*	*(0.107)*	*0.171*	...	*20.78*	*3.17*	...	*0.076*	*0.221*	*0.029*	*(2.66)*
FLX-CRM 138	30g	*4.39*	*68.6*	...	*(0.005)*	*1.78*	*0.77*	*1.09*	*0.095*	*0.15*	*0.114*	...	*19.0*	*3.44*	...	*0.189*	*0.220*	*0.017*	*(9.5)*

Glass Reference Materials (Discs - dimensions as shown)

FLX No.	Description	Dimensions	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	CaO	MgO	Na_2O	K_2O	SO_3	BaO	Cr_2O_3	PbO	ZnO	ZrO_2
FLX-DGG1	Soda-lime Glass	40mm dia. x 10mm	*71.72*	*1.23*	*0.137*	*0.191*	...	*6.73*	*4.18*	*14.95*	*0.338*	*0.436*	...	...	...	...	...
FLX-DGG2	Float Glass	40mm dia. x 5mm	*72.26*	*0.1*	*0.033*	*0.021*	...	*10.05*	*3.4*	*13.78*	...	*0.27*	...	...	...	...	...
FLX-Q0	Quartz Glass	40mm dia. x ~5mm	...	*<0.1*	*0.0103*	*0.0103*	*<0.0002*	*<0.0002*	*<0.1*	*<0.1*	*<0.0003*	*<0.01*	*<0.025*	*<0.0002*	*<0.0007*	*<0.0003*	*<0.02*

FLX No.	As_2O_3	CdO	CeO_2	Co_3O_4	CuO	Gd_2O_3	La_2O_3	NiO	Sb_2O_3	SeO_2	SnO_2	SrO	TeO_2	Y_2O_3
FLX-Q0 (continued)	*<0016*	*<0.0009*	*<0.05*	*<0.0002*	*<0.000*	*<0.3*	*<0.0005*	*<0.0003*	*<0.0014*	*<0.0004*	*<0.0013*	*<0.8*	*<0.0018*	*<0.3*

XRF Monitor Glass (40mm dia. x approx. ~3mm disc)

FLX No.	Description	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	CaO	MgO	Na_2O	K_2O	SO_3	P_2O_5	B_2O_3	SrO	Cl	F
FLX-Z1	XRF Monitor Glass	*14.01*	*0.62*	*0.09*	*0.09*	*0.04*	*30.22*	*0.44*	*5.80*	*0.09*	*2.97*	*0.23*	*bal.*	*0.01*	*0.84*	*3.23*

INSTITUTE OF CERTIFIED REFERENCE MATERIALS (ICRM), RUSSIA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified and figures in brackets are for information only.

High Alloy Steel Certified Reference Materials

(LG57-LG64 38-42mm dia. x 25-35mm discs; LG66-LG68 38-40mm dia. x 15-23mm discs; LG69 48-52mm dia x 24-28mm dia. discs; LG73-LG78 40-50mm dia. x 25-32mm discs)

ICRM No.	Description	C	Si	Mn	Cr	P	S	Mo	Ni	Al	Co	Cu	N	Ti	Nb	V	W
LG57	High Alloy Steel	**0.016**	**0.56**	**0.52**	**13.70**	**0.011**	**0.0023**	**0.401**	**25.2**	**0.151**	...	**0.080**	...	**1.81**	*(0.008)*	**0.65**	**4.24**
LG58	Stainless Steel	**0.48**	**0.292**	**0.99**	**23.4**	**0.0135**	**0.0280**	**2.41**	**4.26**	*(0.006)*	...	**0.388**	...	**0.039**	**0.214**	**0.264**	**0.21**
LG59	High Alloy Steel	**0.073**	**0.63**	**1.15**	**15.81**	**0.011**	**0.0083**	**0.094**	**35.1**	**0.079**	...	**0.083**	...	**1.12**	**0.106**	**0.273**	**3.08**
LG60	High Alloy Steel	**0.020**	**0.289**	**2.31**	**21.8**	**0.028**	**0.0205**	**3.62**	**19.86**	**0.040**	...	**0.027**	...	**0.265**	**0.83**	**0.229**	**0.115**
LG63	High Alloy Steel	**0.068**	**0.285**	**0.356**	**10.13**	**0.010**	**0.0050**	**1.65**	**22.15**	**0.45**	...	**0.024**	...	**2.98**	**0.113**	**0.086**	**0.43**
LG64	High Alloy Steel	**0.049**	**0.76**	**0.75**	**24.7**	**0.017**	**0.0032**	**2.89**	**28.3**	**0.189**	...	**2.88**	...	**0.64**	**0.048**	**0.094**	**0.013**
LG66	High Mn Steel	**0.44**	**0.41**	**16.1**	**0.30**	**0.031**	**0.010**	...	**0.059**	**2.6**	...	**0.104**	...	...	...	...	...
LG68	High Mn Steel	**0.89**	...	**28.8**	**0.13**	*(0.02)*	**0.003**	**0.46**	**0.20**	**8.6**	...	**0.11**	...	...	**0.46**	...	...
LG69	Mn Alloy Steel	**0.45**	**0.50**	**18.6**	**0.428**	**0.033**	**0.0048**	**0.020**	**0.178**	**2.78**	...	**0.088**	**0.011**	...	...	...	...
LG73	Stainless Steel	**0.098**	**0.570**	**1.26**	**22.60**	**0.019**	**0.0073**	**0.061**	**17.74**	...	**0.247**	**0.140**	**0.0319**	**0.0022**	...	...	**0.018**
LG74	Stainless Steel	**0.373**	**2.49**	**0.962**	**18.30**	**0.024**	**0.0049**	**0.104**	**23.66**	**0.035**	**0.031**	**0.093**	**0.030**	**0.030**	...	...	**0.052**
LG75	Stainless Steel	**0.027**	**0.298**	**0.728**	**14.80**	**0.0046**	**0.0026**	**0.052**	**24.5**	**0.113**	**0.019**	**0.029**	**0.0044**	**1.76**	...	...	**4.14**
LG76	Stainless Steel	**0.445**	**0.455**	**0.342**	**13.77**	**0.021**	**0.0076**	**0.263**	**13.39**	**0.034**	...	**0.098**	**0.031**	**0.020**	...	**0.041**	**2.38**
LG78	Stainless Steel	**0.074**	**0.58**	**1.60**	**14.71**	**0.017**	**0.0017**	**0.061**	**35.4**	**0.15**	...	**0.053**	**0.0062**	**1.31**	**0.004**	**0.020**	**3.16**

Slag, Flux and Refractory Certified Reference Materials

(Finely divided material – unit weights as shown)

ICRM No.	Description	Unit Weight	Fe	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	MnO	P	S	TiO_2	K_2O	Na_2O	CaF_2	C	FeO	V_2O_5	Cr_2O_3	$CaCO_3$
SH6/2	Flux	125g	...	**1.30**	**39.2**	**12.72**	**1.60**	**3.00**	**38.5**	**0.069**	**0.0092**	...	...	...	**7.71**	...	...	...	...	...
SH7/3	Flux	100g	...	...	**23.4**	**24.0**	**11.4**	**29.8**	**0.40**	**0.011**	**0.031**	...	**0.94**	**1.41**	**28.5**	...	**0.56**	...	...	...
SH8/4	Flux	100g	**0.147**	...	**1.77**	*(52.7)*	...	**26.5**	...	**0.013**	**0.013**	...	...	...	**68.6**	**0.039**	...	...	...	...
SH9/3	Vanadium Slag	150g	**28.9**	...	**16.63**	**1.61**	**3.53**	**1.76**	**9.73**	**0.015**	**0.015**	**7.39**	...	...	...	...	...	**22.2**	**3.32**	...
SH12/3	Alumina, Semi-conc.	75g	**0.66**	...	**0.76**	**18.8**	**2.15**	**73.6**	...	...	...	...	...	...	...	...	...	...	**0.46**	...
SH13	Fluorite Concentrate	100g	**0.353**	...	...	...	...	...	...	**0.012**	**0.103**	...	...	...	**84.7**	...	...	...	...	**0.51**
K10/3	Corundum	125g	...	**1.82**	*(0.2)*	*(0.03)*	...	**97.0**	...	...	...	**0.35**	*(0.03)*	*(0.5)*	...	*(0.05)*	...	...	...	...

INSTITUTE OF CERTIFIED REFERENCE MATERIALS (ICRM), RUSSIA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified and figures in brackets are for information only.

Ferro-Alloy Certified Reference Materials (Finely divided material – units of 100g)

ICRM No.	Description	C	Si	Mn	Cr	S	P	Al	Cu	Ti	Fe	V	Zn	N	As	Sn	Pb	Mo	Others
F5/3	Manganese, Metallic	0.079	1.25	95.9	...	0.0095	0.062	...	0.0055	...	2.73	...	...	...	...	...	...	...	...
F7/5	Ferro-Manganese	6.79	0.366	77.2	...	0.0039	0.123	...	...	...	15.65	...	...	...	...	...	...	...	...
F17/4	Ferro-Molybdenum	0.081	0.54	...	...	0.066	0.032	...	0.52	...	...	...	0.0064	...	0.0111	0.0023	0.0029	59.2	0.022 W, 0.0039 Sb, 0.00056 Bi
F19/3	Ferro-Vanadium	0.418	1.47	3.30	1.21	0.0102	0.059	*(0.005)*	0.204	...	...	42.6	...	...	0.0009	...	...	...	...
F20/3	Ferro-Niobium	0.136	0.67	...	...	0.0091	0.039	0.35	...	0.292	33.3	...	...	0.067	...	0.0014	...	...	63.5 Nb+Ta, 0.0056 Co
F21/2	Ferro-Boron	0.047	0.73	...	...	...	0.0119	1.546	0.0120	...	...	...	0.0055	...	...	...	...	...	20.91 B
F22/3	Ferro-Boron	0.161	7.82	...	...	0.018	0.021	7.78	3.43	...	...	...	...	...	...	...	...	...	8.95 B
F24/2	Ferrosilicochromium	0.019	49.9	...	29.18	0.0015	0.027	0.87	...	...	...	...	...	...	...	...	...	...	...
F25/3	Ferro-Calcium	...	51.5	...	...	0.0056	0.011	0.67	...	...	23.06	...	...	...	...	...	...	...	21.3 Ca
F26/2	Ferro-Calcium	...	59.5	...	...	0.030	0.024	1.52	...	0.156	6.29	...	...	...	*(<0.001)*	...	...	...	29.9 Ca
F27/2	Ferrosilicozirconium	0.111	26.1	...	...	*(0.001)*	0.044	7.48	1.47	0.215	*(12)*	...	...	...	...	...	...	...	51.5 Zr
F28/2	Ferro-Phosphorus	...	1.11	1.20	...	0.021	16.05	...	...	...	...	...	...	...	...	...	...	...	...
F29/3	Manganese, Metallic	0.146	...	87.5	...	0.031	0.055	...	...	...	2.26	...	...	4.63	...	...	...	...	...
F30/4	Ferro-Titanium	0.154	0.163	0.189	0.154	0.0054	0.0030	3.83	0.065	70.3	21.51	2.29	...	0.38	...	0.077	...	0.60	0.053 Ni, 0.231 Zr
F32/3	Ferro-Vanadium, Nitrated	*(0.4)*	*(1.2)*	3.14	...	*(0.008)*	*(0.05)*	*(<0.05)*	*(0.2)*	...	...	40.2	...	7.51	*(<0.001)*	...	...	...	...
F35/2	Ferro-Chromium	0.79	0.181	...	68.9	0.0022	0.027	...	...	...	28.16	...	...	0.185	...	...	...	...	...
F40	Ferro-Vanadium	0.096	1.31	1.49	0.185	0.014	0.022	2.12	0.081	...	...	80.1	...	...	...	...	...	...	...
F41	Ferro-Nickel - low Fe	0.0124	...	...	...	0.132	...	...	0.47	...	5.68	...	...	...	0.058	...	...	...	91.4 Ni, 2.04 Co
F42	Ferro-Titanium	0.55	6.74	1.10	2.22	0.023	0.050	11.41	1.32	27.15	...	0.249	0.129	*(0.15)*	...	0.033	...	0.106	*(0.44)* Zr
F43	Ferro-Titanium	0.098	2.50	1.22	0.354	0.0058	0.038	11.11	0.336	31.9	...	0.152	0.032	0.085	...	0.013	...	0.0036	0.059 Zr
F44	Silico-calcium with Mg	0.166	49.7	...	...	0.0066	0.014	1.68	...	...	19.91	*(2.5)*	...	...	...	...	...	...	12.6 Ca, 9.6 Mg
F45	Ferro-Chromium	0.071	1.10	...	69.0	0.0024	0.027	0.041	...	...	...	...	...	0.082	...	...	...	...	...
F46	Ferro-Chromium	5.47	1.05	...	68.8	0.015	0.030	...	...	...	...	...	...	0.055	...	...	...	...	...
F47	Ferro-Chromium	8.80	0.103	...	69.8	0.036	0.025	...	...	...	...	...	...	0.020	...	...	...	...	...
F48	Ferro-Tungsten	0.074	0.47	0.695	...	0.211	0.035	0.64	0.096	...	...	...	...	...	0.037	0.031	0.0048	0.047	71.0 W, 0.014 Sb
F50	Ferro-Chromium	0.079	1.29	...	64.3	0.0058	0.0048	0.168	...	...	...	...	...	11.2	...	...	...	...	...

INSTITUTE OF GEOLOGICAL SCIENCES/BRITISH GEOLOGICAL SURVEY (IGS), U.K.

CHEMICAL COMPOSITION (nominal mass content in %)

Ore and Concentrate Reference Materials (Finely divided material - approximate unit weights as shown)

IGS No.	Description	Unit Weight	Ba	Cu	F	Fe	MnO_2	Nb	Sr	Ti	W	SiO_2	Others
27	Molybdenum-Tungsten Ore	65g	...	2.11	...	1.76	...	...	...	...	0.036	...	0.276 Mo
29	Pyrolusite	40g	0.59	0.185	...	...	93.38	...	...	...	...	2.21	...
30	Chromite	55g	...	...	...	11.20	...	...	...	0.14	...	2.76	23.95 Cr, 16.63 MgO 29.12 Al_2O_3
32	Rutile	45g	...	...	...	...	...	0.26	...	57.19	...	...	...
35	Zircon	50g	...	...	...	...	...	...	...	0.16	...	...	1.20 Hf, 48.96 Zr
39	Fluorite	55g	0.44	...	46.85	...	...	...	0.014	...	...	...	...

SOCIETY OF GLASS TECHNOLOGY (SGT), U.K.

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Glass Certified Reference Materials (Broken pieces - units of 25g) (G4, G7, G10 and G11 are also available as 40mm dia. glass discs)

SGT No.	Description	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	BaO	Na_2O	K_2O	PbO	As_2O_3	B_2O_3	TiO_2	Cr_2O_3	ZnO	ZrO_2	Mn_3O_4	F	SO_3	LOI (550°C)
G4	Fluoride Opal Glass	69.49	3.02	0.099	4.24	<0.05	...	15.45	0.57	...	...	0.19	0.041	...	3.28	...	...	4.96	<0.05*	0.22
G6	Soda-Lime-Silica Glass	73.06	1.70	0.034*	9.97	<0.1	...	14.65	<0.1	...	...	...	0.02	...	...	...	...	...	0.20*	...
G7	Soda-Lime-Silica Glass	72.64	1.50	0.044*	11.03	0.14	...	13.90	0.43	...	...	...	0.042	...	...	...	...	...	0.19*	0.07
G8	Lead Oxide-Potassium Oxide-Silica Glass	56.34	0.05	0.010*	<0.02	<0.02	...	0.23	11.85	30.59	0.32*	0.36	0.02	...	...	...	...	...	...	0.21
G10	Amber Soda-Lime-Silica Container Glass	72.7	1.62	0.325	10.7	1.81	0.02	12.2	0.35	...	...	...	0.097	0.020	...	(0.024)	(0.038)	...	0.05	...
G11	Green Soda-Lime-Silica Container Glass	70.7	1.83	0.342	10.3	2.14	0.03	13.6	0.69	...	...	...	0.068	0.205	...	(0.015)	(0.034)	...	0.06	...

* Total iron as iron (III) oxide Fe_2O_3 * Total arsenic as As_2O_3 * Total sulphur as SO_3

HEALTH AND SAFETY LABORATORY (HSL), UK

CHEMICAL COMPOSITION (nominal mass content in %)

Welding Fume Reference Materials (Finely divided material – units of 1g)

HSL No.	Descrption	Fe	Mn	Ni	Cr	Zn
MSWF-1	Elements in Mild Steel Welding Fume	*42.8*	*1.48*	…	…	*21.7*
SSWF-1	Elements in Stainless Steel Welding Fume	*29.8*	*22.9*	*3.7*	*8.4*	…

Respirable α-Quartz Reference Material (Finely divided material – units of 5g)

HSL No.	Description	% Crystallinity
A9950	Respirable α-Quartz Powder	89.3

IMI WOLVERHAMPTON METAL (IMI), U.K.

CHEMICAL COMPOSITION (nominal mass content in %)

Aluminium Alloy Reference Materials (Mushroom samples, approx. 58mm dia. x 7mm thick)

IMI Ref No.	Description	Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb	Sn	Ti	Cr
IMI 2WM1	**BS 1490: LM 2**	*1.69*	*0.005*	*8.90*	*0.26*	*0.60*	*0.39*	*2.42*	*0.21*	*0.20*	*0.20*	*<0.005*
IMI 2WM3		*0.41*	*0.19*	*8.33*	*1.19*	*0.35*	*0.21*	*0.70*	*0.10*	*0.10*	*0.11*	*0.09*
IMI 4P1	**BS 1490: LM 4**	*1.80*	*0.25*	*5.92*	*0.25*	*0.63*	*0.40*	*0.01*	*0.19*	*0.19*	*0.21*	*<0.005*
IMI 4P4		*3.69*	*0.045*	*4.55*	*0.84*	*0.30*	*0.11*	*0.46*	*0.05*	*0.055*	*0.05*	*0.15*
IMI 4P5		*4.25*	*<0.005*	*3.94*	*1.03*	*0.14*	*<0.005*	*0.61*	*<0.005*	*<0.005*	*<0.005*	*0.19*
IMI 620WM5	**BS 1490: LM 6/9/20**	*<0.005*	*0.005*	*12.85*	*0.15*	*0.84*	*<0.005*	*0.005*	*<0.005*	*<0.005*	*0.005*	*0.14*
IMI 24WM6	**BS 1490: LM 24**	*1.85*	*0.20*	*6.55*	*1.02*	*0.63*	*0.45*	*0.56*	*0.26*	*0.10*	*0.23*	*0.19*
IMI 25WM1	**BS 1490: LM 25**	*<0.005*	*0.87*	*5.92*	*0.59*	*0.24*	*0.19*	*0.20*	*<0.005*	*0.12*	*0.19*	*<0.005*
IMI 25WM5		*0.075*	*0.19*	*8.36*	*0.42*	*0.15*	*<0.005*	*0.015*	*0.07*	*<0.005*	*<0.005*	*0.10*
IMI 27WM2	**BS 1490: LM 27**	*1.52*	*0.12*	*7.79*	*0.35*	*0.57*	*0.30*	*0.63*	*0.14*	*0.045*	*0.16*	*0.12*
IMI 27WM3		*1.98*	*0.18*	*7.50*	*0.55*	*0.40*	*0.20*	*0.80*	*0.10*	*0.085*	*0.11*	*0.075*
IMI 27WM5		*2.79*	*0.36*	*5.60*	*0.91*	*0.10*	*0.005*	*1.13*	*<0.005*	*0.15*	*0.005*	*<0.005*

Note that all the IMI RMs have a dimple, approx 15mm diameter, in the surface and hence are unsuitable for XRF analysis.

INDUSTRIAL ANALYTICAL (PTY) LTD. (IA), SOUTH AFRICA

CHEMICAL COMPOSITION (nominal mass content) – Figures in brackets are for information only.

Concentrate/Tailing Reference Materials (Finely divided material – unit of 120g) (nominal mass content in %)

IA No.	Description	SiO_2	Al_2O_3	CaO	MgO	Pb	Cu	Zn	Fe	C	S	Mn	As	Sn	Cd	Ni	Ag
RPZ-PC	Lead Concentrate	*1.26*	*0.22*	*4.06*	*2.30*	*52.13*	*0.66*	*7.05*	*5.03*	*3.45*	*16.76*	*0.39*	*0.059*	*0.012*	*0.015*	*0.00052*	*0.0660*
RPZ-PF	Lead Feed Stock	*14.32*	*1.66*	*14.12*	*8.48*	*3.85*	*0.29*	*12.85*	*5.16*	*5.77*	*1.57*	*1.35*	*0.023*	*0.018*	*0.026*	*0.00071*	*0.0070*
RPZ-ZC	Zinc Concentrate	*0.53*	*0.14*	*1.80*	*0.89*	*3.53*	*0.65*	*55.26*	*4.02*	*0.89*	*31.75*	*0.77*	*0.023*	*0.012*	*0.11*	*0.00032*	*0.0310*

Concentrate/Tailing Reference Materials (Finely divided material – units of 120g) (nominal mass content in µg/g)

IA No.	Description	Co	Cu	Ni	Au	Pt	Pd	Rh	Ru	Ir	Ag
HGC	High Grade Sulphide Concentrate	*1600*	*69500*	*61500*	*9.7*	*81.5*	*47.5*	*4.79*	*4.44*	*2.42*	*(14.7)*
HGT	High Grade Tail	*97*	*230*	*78*	*0.13*	*0.40*	*0.32*	*0.05*	*0.051*	*0.016*	*(0.27)*
LGC	Low Grade Sulphide Concentrate	*1000*	*29100*	*34900*	*5.39*	*38.5*	*27.0*	*2.89*	*2.74*	*1.44*	*(0.98)*
LGT	Low Grade Tail	*97*	*220*	*700*	*0.097*	*0.37*	*0.28*	*0.05*	*0.053*	*0.023*	*(0.18)*
MGC-A	Medium Grade Sulphide Concentrate A	*1030*	*31900*	*35700*	*5.56*	*40.4*	*29.1*	*3.28*	*3.02*	*1.55*	*(1.17)*
MIM C2	PGM bearing Pyroxenite Concentrate	*1230*	*33100*	*42800*	*4.90*	*44.5*	*33.4*	*4.01*	*3.76*	*2.18*	*(5.5)*
MIM T2	PGM bearing Pyroxenite Tailing	*70*	*180*	*840*	*0.13*	*0.358*	*0.384*	*0.048*	*0.055*	*(<0.5)*	*(0.15)*

Nickel Ore/Concentrate/Tailing Reference Materials (Finely divided material – unit of 130g) (nominal mass content in %)

IA No.	Description	Ni	Co	Cu	Si	Fe	Ca	Mg	Al	S	Ti
TN-O 01	Tati Nickel Ore	*0.40*	*0.014*	*0.31*	*22.52*	*7.07*	*6.41*	*5.48*	*9.32*	*1.94*	…
TN-T 01	Tati Nickel Tailing	*0.083*	*0.0047*	*0.047*	…	…	…	…	…	*0.22*	*0.20*

Nickel Ore/Concentrate/Tailing RMs (continued) (nominal mass content in µg/g)

IA No.	Au	Pt	Pd	Rh	Ag	Sn	Se	Te	Zn	Pb	Cd	Cr	As	Mn	Bi	V
TN-O 01 (cont.)	*0.04*	*0.15*	*0.65*	*(<0.01)*	*0.60*	*0.73*	*11.50*	*0.82*	*46.5*	*10.80*	*22.10*	*547*	*12.0*	*771*	*0.75*	*101*
TN-T 01 (cont.)	…	…	…	…	…	…	…	…	…	…	…	*490*	…	*860*	…	…

Ferro-Alloy Slag Reference Materials (Finely divided material – units of 120g) (nominal mass content in %)

IA No.	Description	SiO_2	Al_2O_3	FeO	Fe_2O_3	MnO	MgO	CaO	B_2O_3	Cr_2O_3
XS-FCS	Ferro-Chrome Slag	*24.34*	*23.72*	*10.82*	…	…	*15.39*	*3.91*	…	*22.45*
SAM-FMS1	Ferro-Manganese Slag	*30.21*	*4.95*	…	*0.065*	…	*7.38*	*30.26*	*0.59*	…
SAM-SMS1	Silico-Manganese Slag	*43.28*	*8.96*	…	*0.178*	*16.81*	*5.16*	*19.47*	*0.26*	…

INSTITUTO DE PESQUISAS TECNOLOGICAS (IPT), BRAZIL

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified and figures in italic type only approximate.

Cast Iron Certified Reference Materials (Finely divided material – units of 80g)

IPT No.	Description	C (Total)	C (Graphitic)	Si	Mn	P	S	Cr	Mo	Ni	Cu	Ti	V
49	White Iron	2.11	...	0.78	0.272	0.012	0.019	0.020	...	0.021	0.040	...	...
69	Cast Iron	3.34	2.50	2.07	0.715	0.267	0.018	0.353	0.004	0.272	0.473	0.019	...
75A	Ni-Cr-Mo-Cu Iron	3.4	2.7	1.98	0.722	0.250	0.033	0.487	0.439	0.425	0.433	0.022	0.030

Copper Base Alloy Certified Reference Materials (Finely divided material – unit weights as shown)

IPT No.	Description	Unit Weight	Cu	Sn	Pb	Zn	Ni	P	Fe	As	Sb	Bi	Al	S	Ag	Cd	Se	Te
10B	Bronze	80g	85.2	4.61	4.74	4.73	0.33	0.003	0.211	0.019	0.114	...	...	0.068	...	...	...	...
40	Brass	100g	58.10	0.18	2.45	39.1	0.001	...	0.007	...	0.023	...	0.010	...	0.0015	0.049	...	...
64	Pure Copper	50g	99.98	*<0.0005*	0.00006	*0.001*	0.00018	...	0.00045	*0.0002*	*0.0002*	*<0.0001*	*<0.0006*	...	0.0010	...	*<0.0002*	*<0.0001*
74	Bronze	60g	80.41	2.84	6.24	9.88	0.15	0.002	0.315	0.002	0.016	...	...	0.056	...	0.013	...	...

Silicon Metal Certified Reference Materials (Finely divided material – units of 60g)

IPT No.	Fe	Ca	Al	C	S	Mn	Ti	Mg	P	Cu	Cr	Ni	V	Pb
134	0.29	0.102	0.085	0.025	0.002	0.0113	0.0097	0.0048	0.0033	0.0014	0.0011	0.0006	0.0004	*0.0002*
135	0.125	0.011	0.045	0.018	0.002	0.0070	0.0113	0.0012	0.0027	0.0008	0.0006	0.0005	0.0003	*0.0002*

Clay, Refractory, Feldspar, Glass Sand, Limestone and Bauxite Certified Reference Materials (Finely divided material – unit weights as shown)

IPT No.	Description	Unit Weight	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	ZrO_2	SrO	CaO	MgO	MnO	Li_2O	Na_2O	K_2O	P_2O_5	LOI
32	Plastic Clay	50g	51.8	28.5	3.46	1.49	...	...	0.17	0.39	...	...	0.16	0.80	0.13	12.6
42	Clay	50g	51.9	32.2	1.09	0.96	...	...	0.05	0.19	...	...	0.02	0.47	0.07	12.9
51	Burnt Refractory	80g	55.0	40.3	1.19	2.19	0.070	...	0.06	0.20	...	0.018	0.09	0.69	0.09	0.16
53	Potash Feldspar	80g	65.8	18.3	0.13	0.013	...	...	0.27	0.05	...	...	2.5	12.1	0.072	0.51
57	Burnt Refractory	80g	24.3	71.5	1.25	1.19	0.20	0.009	0.05	0.13	...	0.008	0.35	0.83	0.054	0.20
63	Silica Refractory	80g	96.28	0.48	0.52	0.030	*0.002*	...	2.21	0.18	0.008	*0.0005*	0.013	0.043	0.013	0.17
72	Soda Feldspar	80g	66.2	20.26	0.09	0.005	...	...	0.18	*0.022*	...	...	10.0	1.47	1.03	0.66
122	Dolomitic Limestone	80g	4.3	1.24	0.65	0.06	...	0.018	32.0	17.5	0.042	...	0.019	0.43	0.048	43.3
131	Bauxite	70g	0.78	54.1	11.5	1.77	0.35	...	...	...	0.31	...	...	0.022	0.15	30.0

JERNKONTORET / NAREMA (JK), Sweden

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Alloy Steel and Special Alloy Certified Reference Materials (Finely divided material – units of 100g; also available as discs of 38mm dia. x 25mm depth)

JK No.	Description	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	B	Co	Cu	N	Pb
*ECRM 196-2	Silicon Steel	**0.0060**	**1.808**	**0.364**	**0.00369**	**0.00065**	**0.0282**	**0.0142**	**0.0401**	**0.2167**	**0.00033**	**0.00014**	**0.0138**	**0.0057**	**0.00178**	…
*ECRM 197-1	Low Alloy Steel	**0.219**	**0.275**	**0.792**	**0.0073**	**0.0232**	**0.451**	**0.402**	**0.148**	**0.0313**	**0.0083**	…	**0.0135**	**0.152**	**0.0114**	*0.0003*
*ECRM 268-1	Tool Steel	**1.134**	**0.373**	**0.293**	**0.0209**	**0.0154**	**4.578**	**3.208**	**0.1437**	*(0.00005)*	**0.0062**	**0.0009**	**0.0290**	**0.1232**	**2.030**	*(0.00016)*
*ECRM 270-1	Stainless Steel	**0.0742**	**1.517**	**0.540**	**0.0196**	**0.0007**	**20.88**	**0.2099**	**10.86**	*0.0023*	*0.0034*	…	**0.0685**	**0.1076**	**0.1417**	…
*ECRM 274-1	Vanadium Steel	**1.563**	**1.057**	**0.397**	**0.0148**	**0.0096**	**8.036**	**1.4551**	**0.077**	*0.0025*	*0.0013*	*0.0005*	*0.023*	**0.0281**	**0.0769**	*0.000064*
*ECRM 298-1	Duplex Steel	**0.0146**	**0.262**	**0.398**	**0.0198**	**0.0006**	**24.72**	**3.799**	**7.056**	**0.0285**	*0.003*	**0.0021**	**0.055**	**0.201**	**0.263**	**0.00008**
*ECRM 379-1	Stainless Steel	**0.0121**	**0.393**	**1.804**	**0.0166**	**0.0006**	**26.79**	**3.290**	**30.83**	*0.0246*	*0.0028*	**0.00190**	**0.0390**	**0.984**	**0.0550**	*0.000038*

Alloy Steel and Special Alloy Certified Reference Materials (continued)

JK No.	Sn	Ti	V	W	Bi	Ca	Ce	Ga	Ir	La	Mg	Nb	Pr	Sb	Zn	Fe	O
*ECRM 196-2 (cont.)	**0.00047**	**0.00253**	**0.00368**	…	…	**0.00071**	…	…	…	…	**0.00075**	…	…	…	**0.00019**	…	…
*ECRM 197-1 (cont.)	**0.0097**	**0.0005**	*0.005*	…	…	…	…	…	…	…	…	…	…	*0.002*	…	…	…
*ECRM 268-1 (cont.)	**0.0078**	*<0.0012*	**8.478**	**3.707**	*(0.00002)*	*(0.0004)*	…	*(0.0019)*	…	…	…	*<0.0019*	…	**0.0017**	*(0.0010)*	…	…
*ECRM 270-1 (cont.)	*0.0035*	*0.0019*	**0.0256**	*0.0244*	…	…	**0.0487**	*0.0021*	*0.0002*	**0.0154**	*0.0009*	…	*0.00295*	*0.0007*	*0.00074*	…	…
*ECRM 274-1 (cont.)	*0.001*	*0.0011*	**4.010**	**0.0087**	…	…	…	…	…	…	…	…	…	*0.0002*	…	…	*0.0026*
*ECRM 298-1 (cont.)	*0.004*	**0.0014**	**0.0607**	*0.02*	*0.000006*	*0.002*	*0.00004*	*0.0023*	*0.00002*	…	*0.0008*	*0.004*	…	*0.0007*	…	**63.38**	*0.0036*
*ECRM 379-1 (cont.)	**0.0021**	*0.0014*	**0.0663**	*0.0091*	*0.00001*	**0.0033**	*0.00001*	*0.0023*	*0.00001*	…	*0.0006*	*0.0028*	*0.00002*	**0.00057**	…	*35.6*	*0.0027*

* Denotes Full EURONORM-Certified Reference Materials

Alloy Steel and Special Alloy Certified Reference Materials (Finely divided or disc material – as shown in table) (Note: discs of JK 27B are 38mm dia. x 25mm

JK No.	Description	Unit	C	Si	Mn	P	S	Cr	Mo	Ni	Al_{Tot}	Co	Cu	N	Pb	Sn	V	W	Ce
JK 3B	Unalloyed Steel	150g	**0.742**	**0.251**	**0.803**	**0.0101**	**0.0071**	**0.0529**	**0.0051**	**0.0591**	**0.0036**	**0.0048**	**0.0175**	**0.0054**	*0.0002*	**0.0044**	*0.002*	…	…
JK 7B	Low Alloy Steel	150g	**0.342**	**0.267**	**0.697**	**0.0057**	**0.0064**	**1.34**	**0.182**	**1.34**	**0.014**	…	**0.021**	**0.0050**	…	…	**0.004**	…	…
JK 12A	Tool Steel	150g	**0.886**	**0.30**	**0.312**	**0.020**	**0.023**	**4.04**	**4.85**	**0.191**	…	**0.189**	**0.062**	**0.0259**	**0.0004**	**0.007**	**1.94**	**6.42**	…
JK 20A	Tool Steel	150g	**1.263**	…	…	…	**0.0094**	…	…	…	…	…	…	**0.0027**	**0.160**	…	**0.161**	**1.75**	…
JK 21	Low Alloy Steel	150g	**0.1741**	**0.36**	**1.46**	**0.0148**	**0.011**	**0.024**	**0.004**	**0.035**	…	**0.008**	**0.045**	**0.008**	*0.0010*	**0.006**	**0.002**	*0.0006*	…
JK 25	Stainless Steel	150g	…	…	*1.7*	…	…	*22.3*	*0.1*	*11.3*	…	…	…	…	…	…	…	…	**0.096**
JK 27B	Austenitic Stainless Steel	150g/disc	**0.0089**	**0.401**	**1.510**	**0.0298**	**0.0207**	**17.36**	**2.510**	**12.56**	*0.0021*	**0.142**	**0.265**	**0.0630**	*0.000097*	**0.0068**	**0.057**	**0.031**	…

Alloy Steel and Special Alloy Certified Reference Materials (continued)

JK No.	Al Acid Sol.	Al Non-Acid	As	B	Nb	Sb	Ta	Ti	Zr	Ca	O	Mg	Ag	Bi	Zn	Cd
JK 3B (cont.)	…	…	*0.002*	…	…	*0.0007*	…	*0.0020*	…	*0.0005*	*0.018*	*0.0001*	*0.00002*	*0.0001*	…	…
JK 21 (cont.)	**0.032**	**0.005**	*0.0100*	…	**0.0175**	*0.0010*	*0.0010*	**0.0008**	*0.0010*	…	…	…	…	…	*0.0007*	*0.0001*
JK 27B (cont.)	…	…	*(0.006)*	**0.00072**	…	*(0.0014)*	…	*0.0002*	…	**0.0022**	*0.008*	…	…	…	*0.00017*	…

JERNKONTORET / NAREMA (JK), Sweden

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate and figures in brackets for information only.

C, S, N & O in Steel Certified Reference Materials (Finely divided or rod material – as shown in table)

JK No.	Description	Unit	C	Si	Mn	S	Cr	Ni	Al Tot.	Al Sol.	N	O
JK 31	Alloy Steel	8mm dia. x 500mm rod	*1.03*	*0.32*	*0.36*	…	…	…	*0.021*	*0.020*	…	**0.0015**
JK 32	Alloy Steel	10mm dia. x 500mm rod	*1.02*	*0.32*	*0.30*	…	*1.38*	…	*0.011*	*0.008*	…	**0.0028**
JK 34	Alloy Steel	8mm dia. x 500mm rod	*0.13*	*0.31*	*1.40*	…	…	…	*0.051*	*0.047*	…	**0.0068**
JK 36	Stainless Steel	150g	**0.0125**	…	…	**0.0126**	…	…	…	…	**0.0337**	…

Iron Powder Certified Reference Material (Finely divided material – unit weight of 35g)

JK No.	Description	O	N	C	S
JK 47A	Iron Powder	**0.69**	**0.0062**	**0.370**	*0.0090*

Ferro-Alloy Certified Reference Material (Finely divided material – unit weight of 50g)

JK No.	Description	C	Si	Mn	P	Cr	Ni	Al	Ca	Co	Cu	Fe	Ti	V
JK 39	Ferro-Silicon	**0.105**	**75.9**	**0.165**	**0.018**	*0.01*	*0.008*	**1.45**	**0.24**	*0.002*	**0.013**	**21.6**	**0.116**	*0.007*

Iron Ore Certified Reference Material (Finely divided material – ECRMs 688-1 and 689-1 in units of 100g, JK 28 in units of 150g, JK 29A and JK 42A in units of 100g)

JK No.	Description	Fe_2O_3	FeO	Fe	SiO_2	CaO	MgO	Al_2O_3	TiO_2	MnO	P_2O_5	P	S
***ECRM 688-1**	Iron Ore	…	…	**61.38**	**3.383 Si**	**1.449 Ca**	**1.061 Mg**	**0.679 Al**	**0.408 Ti**	**0.0457 Mn**	…	**0.337**	*0.047*
***ECRM 689-1**	Iron Ore	…	…	**57.05**	*5.4* **Si**	**1.183 Ca**	**0.980 Mg**	**1.185 Al**	**0.3264 Ti**	**0.1196 Mn**	…	**0.0706**	*0.058*
JK 28	Iron Ore	**91.5**	**2.4**	**65.86**	**4.20**	**0.30**	**0.30**	**0.60**	**0.20**	**0.059**	**0.102**	**0.045**	**0.004**
JK 29A	Magnetite	…	…	**71.36**	**0.33**	**0.082**	**0.223**	**0.232**	**0.292**	**0.0632**	…	**0.0059**	**0.0059**
JK 42A	Magnetite	…	…	**70.66**	**0.800**	**0.199**	**0.382**	**0.278**	**0.385**	**0.0506**	…	**0.0247**	**0.0082**

Iron Ore Certified Reference Materials (continued)

JK No.	Na_2O	K_2O	V_2O_5	Cr	Ni	Co	Cu	Sn	Pb	Zn
***ECRM 688-1** (cont.)	**0.333 Na**	**0.180 K**	**0.135 V**	*0.002*	**0.0136**	**0.0096**	**0.0023**	*0.0003*	**0.00025**	**0.0015**
***ECRM 689-1** (cont.)	**0.638 Na**	**0.462 K**	**0.1020 V**	*<0.002*	**0.0195**	**0.0103**	**0.0068**	*<0.0004*	*(0.0005)*	**0.0042**
JK 28 (cont.)	**0.11**	**0.12**	**0.21**	…	…	…	**0.002**	…	…	…
JK 29A (cont.)	**0.015**	**0.0087**	**0.266**	**0.0057**	**0.0167**	**0.0106**	**0.0007**	*0.0002*	*<0.001*	**0.0016**
JK 42A (cont.)	**0.043**	**0.0157**	**0.251**	**0.0010**	**0.0129**	**0.0105**	**0.0007**	*0.0003*	*<0.001*	**0.0015**

* Denotes Full EURONORM-Certified Reference Materials

JERNKONTORET / NAREMA (JK), Sweden

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate and figures in brackets for information only.

Slag and Fluorspar Reference Materials (Finely divided material – unit weights as shown in table)

JK No.	Description	Unit	SiO_2	Al_2O_3	TiO_2	FeO	Fe_2O_3	Ca	CaO	CaF_2	MgO	MnO	P	S	C	F	P_2O_5	V_2O_5	Cr_2O_3	Pb
JK S10	Electro Slag Refining	100g	**7.8**	**0.54**	**0.05**	**0.10**	…	**50.8**	**20.3**	**70.7**	**0.30**	**0.03**	**0.002**	…	**0.022**	**34.4**	…	*<0.01*	…	…
JK S11	AOD Slag	100g	**26.8**	**2.85**	**0.95**	**0.2**	…	…	**60.0**	…	**4.7**	**0.12**	…	**0.30**	…	**7.9**	*<0.005*	*<0.01*	**0.17**	…
JK D	Fluorspar	100g	*1.5*	**0.04**	…	…	**0.20**	…	…	**97.07**	…	…	**0.035**	**0.004**	…	**47.24**	…	…	…	*<0.001*

Blast Furnace Slag Certified Reference Material (Finely divided material – unit of 100g)

JK No.	Description	Fe	Si	Ca	Mg	Al	Ti	Mn	P	S	Na	K	V	Cr	Ni	Mo	Ba	Sr	Zr
*ECRM 883-1	Blast Furnace Slag	**0.9820**	**16.67**	**21.32**	**8.86**	**6.55**	**1.3331**	**0.546**	**0.0033**	**1.0885**	**0.316**	**0.393**	**0.122**	**0.0130**	**0.00053**	**≤0.001**	**0.0436**	**0.0380**	**0.0276**

Industrial Fly Ash Certified Reference Materials (Finely divided material – unit weights as shown in table)

JK No.	Description	Unit	Fe	Ca	Al	Na	K	Zn	Pb	Cd	Cr	Ni	Cu	V	As	Bi	Sb	Hg	Sn
*ECRM 882-1	Industrial Fly Ash	100g	**22.20**	**10.11**	**0.375**	**0.697**	**0.960**	**28.49**	**1.324**	**0.0183**	**0.490**	**0.0263**	**0.218**	**0.0090**	**0.0054**	**0.0026**	**0.0116**	**0.000075**	*0.021*
JK 43	Industrial Fly Ash	15g	*20*	*12*	*0.2*	*0.5*	*0.3*	**4.96**	**0.21**	**0.0023**	*8*	*2*	*0.2*	*0.02*	…	…	…	**0.00039**	…
JK 44	Industrial Fly Ash	25g	*27*	*5*	*0.2*	*1*	*1.3*	**27.3**	**2.74**	**0.0469**	*0.2*	*0.02*	*0.2*	*0.02*	…	…	…	**0.00028**	…
JK 45	Industrial Fly Ash	15g	*40*	*7*	*0.1*	*7*	*0.4*	**1.53**	**0.11**	**0.0047**	*0.3*	*0.05*	*0.01*	*0.1*	…	…	…	**0.000025**	…

* Denotes Full EURONORM-Certified Reference Materials

Ceramic (high oxygen) Setting-up Sample (Disc – 25mm dia. x 8mm)

JK No.	Description	O	Al	C_{Total}	Ti	Fe	W	
CE 650A	Ceramic (high oxygen)	*30*	*34*	*6*	*21*	*2.1*	*0.8*	

Depth Profile Setting-up Sample (Plate – 102mm x 68mm x 0.5mm)

JK No.	Description	P	Al	Ni	Layer thickness
JK SUS NiP-1	Steel plate with a layer of electroplated nickel (NiP alloy)	*5.8 ± 0.02*	*0.26 ± 0.02*	*bal.*	*8.7 ± 0.5 µm*

LUCIDEON (formerly CERAM Research) (LUCIDEON), UK

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Siliceous, Zircon Bearing and Basic Reference Materials (Finely divided material – units of 100g)

LUCIDEON No.	Description	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	Li_2O	P_2O_5	Cr_2O_3	Mn_3O_4	B_2O_3	BaO	CuO	PbO	ZnO	SrO	ZrO_2	HfO_2	LOI
AN25	Alumina	<0.01	<0.01	99.39	0.03	0.03	<0.01	0.01	0.53	...	<0.01	...	...	...	...	...	...	...	...	...	...	#(0.34)
AN26	Alumina	0.12	<0.01	99.76	0.03	0.03	<0.01	<0.01	0.02	...	...	...	...	...	...	...	...	...	...	...	...	#(0.08)
AN27	Alumina	0.08	<0.01	99.76	0.02	0.03	<0.01	<0.01	0.08	...	...	...	...	...	...	...	...	...	...	...	...	#
AN28	Lead Bisilicate Frit	32.76	<0.01	2.46	0.018	0.05	<0.01	0.05	0.05	...	...	...	...	...	...	...	64.33	...	...	...	...	0.15
AN36	Magnesite	0.48	0.01	0.42	4.66	0.94	93.30	<0.01	<0.05	...	0.008	0.004	0.11	0.09	...	...	...	...	...	...	...	...
AN37	Magnesite	1.39	0.03	1.06	1.80	1.46	94.00	<0.01	<0.05	...	0.02	0.005	0.12	0.09	...	...	...	...	...	...	...	...
AN46	Zircon Batt	45.46	0.48	30.52	0.85	0.20	5.34	1.03	0.15	0.02	...	...	...	...	...	...	...	...	...	15.41	0.32	0.08
AN100	Chrome Ore	11.1	0.21	24.7	12.88	1.16	22.38	0.01	0.04	...	...	26.60	0.13	...	...	0.02	...	0.04	...	...	...	#(5.03)
2CAS12	Sillimanite	33.9	1.31	63.8	0.31	0.25	0.12	0.13	0.15	...	...	...	...	...	...	...	...	...	...	...	...	0.13
2CAS14	Steatite	62.7	0.005	0.149	0.314	0.249	31.28	0.002	0.008	...	...	...	...	...	...	...	...	...	...	...	...	5.10
2CAS15	Zircon	33.9	0.20	0.38	0.07	0.28	0.07	0.01	0.02	...	...	...	...	...	...	...	...	...	...	63.6	1.28	0.23
CCB1*	Calcined Bone	1.28	<0.01	0.05	0.04	53.4	1.14	0.011	0.52	...	40.5	...	...	...	0.031	...	...	...	0.049	...	...	2.60
CEB1	Earthenware Body	74.0	0.34	16.2	0.48	0.52	0.16	1.75	0.71	...	0.14	...	...	...	0.05	...	...	...	0.02	...	...	5.60

* **CCB1** has the following additional constituent values: F *0.13%*, SiO_2 as quartz *(0.5%)*, SO_3 *(0.114%)* and H_2O *(0.12%)*. Hydroxyapatite is the major constituent, estimated as *99.5%* (by difference).

Results calculated on the ignited 1025°C basis (otherwise calculated on the dried basis at 110°C)

Please note that LUCIDEON (formerly CERAM Research) also provides a series of RMs for physical properties of ceramic materials. These include two thermal expansion RMs, one of alumina and the other of cordierite. Further details of how these RMs are supplied, as special cut bars or pieces, will gladly be provided on request.

LUCIDEON (formerly CERAM Research) also supplies a Dental Frit Particle Size Distribution CRM, with D50% 3.2 µm, Median diameter 3.2 µm, with 90% between 0.6 and 10.0 µm. This is available in units of 75g.

Please ask us for further details of these Alumina and Cordierite Thermal Expansion CRMs and Dental Frit Particle Size Distribution CRM.

MBH ANALYTICAL LTD. (MBH), U.K. (via Analytical Reference Materials International, USA)

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Pure Zinc (Cast) Reference Materials (Approx. 50mm dia. x 20mm discs)

MBH No.	Pb	Mg	Al	Cd	Fe	Sn	Cu	Ni	Mn	Ti	In	Tl	Bi	Sb	Si	Hg
41X Z3(M)	0.00502	(0.00034)	0.00158	0.00327	0.00605	0.00297	0.00345	0.00209	0.00524	…	0.00233	0.00210	0.00315	0.00167	…	0.00289
41X Z4(L)	0.0058	0.0033	0.0065	0.00437	0.0148	0.00221	0.00326	0.00320	0.00286	<0.0005	0.00300	0.00277	0.00310	0.00340	(0.0014)	0.0025
41X Z5(N)	0.0286	0.0107	0.0243	0.0165	0.0262	0.00632	0.0109	0.00514	0.00494	…	0.00573	0.0068	0.0056	0.0054	…	0.0050
41X Z6(A)	0.031	<0.0005	0.0096	0.0093	(0.002)	0.0038	0.0088	0.0002	0.0002	…	0.0228	0.0004	0.0122	…	…	…
41X Z11(A)	0.0077	…	0.0261	0.0155	0.0019	0.0072	0.0116	…	…	…	0.0345	(0.0010)	0.0189	0.0026	…	(0.0009)

Low Alloy Zinc (Cast) Reference Materials (Appox. 50mm dia. x 20mm discs)

MBH No.	Pb	Mg	Al	Cd	Fe	Sn	Cu	Ni	Mn	Cr	Ti
41X 2951Zn1(A)	0.0042	0.0029	0.029	0.0005	0.011	(0.0007)	0.79	0.0038	0.0013	0.083	0.278
41X 2951Zn2(A)	0.0040	0.0123	0.032	0.0037	0.019	(0.0015)	1.37	0.0027	0.0011	0.142	0.209
41X 2951Zn3(A)	0.0065	0.0164	0.078	0.0062	0.029	(0.006)	1.89	0.0010	0.0018	0.184	0.133

Zinc/Aluminium (Cast) Reference Materials (Approx. 50mm dia. x 20mm discs)

MBH No.	Pb	Mg	Al	Cd	Fe	Sn	Cu	Ni	Mn	Cr	In	Ti	Tl	Si	Sb	Ce	La
42X Z1(J)	0.0017	0.0009	4.66	0.0014	0.013	0.0007	0.0050	0.0014	0.0038	0.0004	…	…	…	(0.0018)	0.0011	0.0011	(0.0008)
42X Z2(K)	0.0029	0.0146	3.79	0.0017	0.0055	0.0011	0.0300	0.00155	0.0274	(0.0001)	…	…	…	0.0011	0.0010	0.0055	0.0026
42X Z3(J)	0.0068	0.0503	3.84	0.0065	0.0145	0.0048	0.135	0.0071	0.0090	…	…	…	…	(0.0018)	0.0006	0.0032	0.0013
42X Z4(J)	0.0133	0.0663	3.52	0.0065	0.019	0.0052	0.0752	0.0170	0.0083	(0.0002)	0.0025	…	…	0.006	…	0.0361	0.0183
42X Z5(M)	0.0030	0.0508	4.33	0.0013	(0.05)	0.0012	0.111	0.041	0.0049	(0.0002)	0.0047	…	0.0017	…	…	0.0328	0.0150
42X Z6(B)	0.0093	0.177	3.67	0.0039	0.008	0.0057	0.238	0.00030	0.0157	0.0034	0.00191	…	0.0021	(0.010)	0.0169	(0.012)	(0.011)
42X Z7(D)[#]	0.004	0.010	4.35	0.002	0.025	0.0025	0.025	0.008	0.005	…	…	…	…	0.002	…	0.060	0.025
42X Z8(A)	0.0025	0.0033	7.03	0.0003	0.013	(0.0023)	0.0215	0.0019	0.0014	(0.0002)	…	(0.0001)	…	0.013	…	0.0081	0.0079
42X Z9(A)	0.0021	0.0464	5.58	0.0054	0.032	(0.00035)	0.0070	(0.0003)	0.0006	…	…	0.020	…	(0.004)	0.011 **Zr**	0.0047	0.0044
42X Z11(A)	0.0058	0.0329	3.19	0.0020	(0.036)	0.0017	0.093	0.0241	0.0196	0.0016	0.0037	…	0.0047	…	0.0047	0.0014	(0.0009)
42X Z12(A)	0.0079	0.0488	4.72	0.0028	0.046	0.0022	0.156	0.0413	0.0483	0.00063	0.0068	…	0.0076	…	0.0070	0.0116	0.0084

[#] Supplied with a provisional certificate.

Zinc/Aluminium/Copper (Cast) Reference Materials (Approx. 50mm dia. x 20mm discs)

MBH No.	Pb	Mg	Al	Cd	Fe	Sn	Cu	Ni	Mn	Cr	Ti	Sb	Bi	Si	Be
43X Z1(L)	0.0011	0.0345	4.48	0.0004	0.0009	(0.0005)	0.720	0.0069	0.0075	…	0.0037 **Ag**	(0.0006)	(0.0008)	…	…
43X Z2(P)	0.0048	0.0614	4.07	0.0031	0.0013	0.0033	1.019	0.0100	0.0162	…	0.0098 **Ag**	0.0012	0.0038	…	…
43X Z3(M)	0.0077	0.114	3.40	0.0109	(0.042)	0.0058	1.499	0.0062	0.0013	0.0046	…	0.0029	0.0092	…	…
43X Z4(C)	0.0062	0.0480	4.79	0.0033	0.0017	0.0030	2.69	0.0258	0.0153	…	…	(0.0023)	0.0113	(0.0012)	…
43X Z5(B)	0.0029	0.0144	3.164	0.0030	0.10	(0.0004)	5.92	0.0056	0.0061	…	0.0254 **Ag**	0.065	0.0148	(0.0005) **As**	(0.0013) **Sr**
43X Z6(B)	0.004	0.0238	4.51	0.0031	0.024	0.0052	2.85	0.0027	0.0022	0.0005	…	0.0044	0.0054	…	…
43X Z7(A)	0.0058	0.062	3.68	0.00092	0.029	0.0031	3.14	0.0005	0.0025	0.0003	0.067	0.0016	(0.0009)	…	0.0194
43X Z8(A)	0.0027	0.00155	2.51	0.00090	(0.0017)	(0.0005)	0.481	0.00033	0.00021	0.00024	…	…	…	…	…
43X Z9(A)	0.0078	0.0472	3.17	0.0034	0.073	0.0020	4.82	0.0027	0.0108	0.0034	0.0012	0.0033	0.0033	…	0.0010
43X Z10(A)	0.0046	0.0403	3.99	0.0014	0.007	0.0012	2.97	0.0036	0.0050	0.00027	…	…	…	0.009	…
43X Z11(F)	0.0202	0.0357	11.12	0.0175	0.015	0.0145	0.335	0.0014	0.0032	(0.0003)	…	0.0009	0.0046	0.0013	…
43X Z12(E)	0.0041	0.0287	10.38	0.0045	0.037	0.0017	0.791	0.0033	0.0026	0.0008	0.0050	0.0032	0.0021	(0.002)	…
43X Z13(E)	0.0086	0.0198	9.01	0.0072	0.0045	0.056	1.113	0.0036	0.0025	0.0004	…	0.0020	0.0014	(0.0012)	…
43X Z14(F)	0.0019	0.0123	7.98	0.00567	0.0025	0.0005	1.238	0.0058	(0.0003)	0.0037	(0.0001)	0.0105	0.0106	(<0.001)	…
43X Z15(D)	0.0029	0.0236	8.33	0.0036	0.0056	0.0020	1.18	0.0082	0.0067	…	…	(0.0010)	0.0055	…	…

MBH ANALYTICAL LTD. (MBH), U.K. (via Analytical Reference Materials International, USA)

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Aluminium/Silicon/Copper (Cast) Reference Materials (All approx. 50mm dia. x 15mm discs, except 55X G02D7(P) approx. 65mm dia. x 30mm & G02D8(M) approx. 50mm dia. x 50mm discs)

MBH No.	Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb	Sn	Ti	Cr	Co	V	Sb	Cd	Be
55X G02D5(A)	*0.406*	*0.331*	*10.03*	*0.557*	*0.391*	*0.0652*	*0.131*	*0.067*	*0.051*	*0.0180*	*0.760*	*0.0752*	*0.0129*	*0.031*	*0.0182*	*0.0037*
55X G02D6(K)	*0.510*	*0.376*	*11.55*	*0.528*	*0.300*	*0.0511*	*0.577*	*0.0580*	*0.0355*	*0.055*	*0.366*	*0.0195*	*0.0182*	*0.0150*	*0.0115*	*0.0026*
55X G02D7(P)*	*1.489*	*0.343*	*10.24*	*1.02*	*0.493*	*0.209*	*0.908*	*0.352*	*0.171*	*0.214*	*0.0558*	*0.0378*	*0.0242*	*0.0021*	*0.0008*	*0.00008*
55X G02D8(M)*	*2.481*	*0.1517*	*9.24*	*0.776*	*0.256*	*0.406*	*1.415*	*0.201*	*0.201*	*0.1535*	*0.0756*	*0.0107*	*0.0536*	*0.0112*	*0.0029*	*0.0008*
55X G02D9(K)	*3.51*	*0.093*	*8.49*	*0.423*	*0.269*	*0.494*	*2.48*	*0.10*	*0.187*	*0.096*	*0.185*	*0.0074*	*0.0223*	*0.049*	*0.0012*	*0.0035*
55X G02D10(L)	*4.59*	*0.0206*	*7.33*	*0.975*	*0.0524*	*0.645*	*2.77*	*0.022*	*0.138*	*0.0302*	*0.128*	*0.0544*	*0.0341*	*0.0086*	*0.0012*	*0.0389*

***** Supplied as HIP material (Please note that G02D7(P) also has the following additional constituent values: B *0.0010%* and Ca *0.0070%).*

Magnesium/Aluminium/Zinc (Cast) Reference Materials (Approx. 40-50mm dia. x 15-20mm discs)

MBH No.	Al	Zn	Mn	Cu	Si	Fe	Ni	Ca	Sn	Pb	Ag	Be	Cd	Ce	La	Sr	Ti	Zr
65X MgA1(J)*	*5.45*	*1.26*	*0.060*	*0.221*	*0.20*	*0.021*	*0.021*	*0.029*	*0.072*	*0.012*	*0.012*	*0.006*	*0.013*	*0.009*	*0.007*	…	*(0.005)*	*(0.0015)*
65X MgA11(B)	*3.63*	*1.59*	*0.047*	*0.0496*	*(0.024)*	*0.0048*	*0.0134*	*(0.09)*	*0.093*	*0.0183*	*(0.0002)*	*0.0022*	*0.0014*	*(0.0005)*	*(0.0005)*	*0.006* **Hg**	…	…
65X MgA12(A)	*5.68*	*3.18*	*0.198*	*0.266*	*0.0142*	*0.0053*	*0.0148*	*0.037*	*0.0021*	*0.010*	*0.0128*	*(0.0036)*	*0.0121*	*0.0009*	*0.0007*	*(0.016)* **Hg**	…	…
65X MgA13(A)	*7.45*	*0.925*	*0.092*	*0.125*	*0.022*	*(0.008)*	*0.0039*	*0.0064*	*0.043*	*0.0085*	*0.0074*	*(0.010)*	*0.0055*	*0.0024*	*0.0021*	*(0.033)* **Hg**	…	…
65X MgA14(B)	*9.50*	*0.752*	*0.246*	*0.0181*	*0.205*	*0.0219*	*0.0069*	…	*0.014*	*0.0086*	*0.0047*	*0.0018*	*0.0015*	*0.0151*	*0.0074*	*(0.031)* **Hg**	…	…
65X MgA15(A)	*10.67*	*0.348*	*0.067*	*0.0273*	*0.034*	*0.010*	*0.0026*	*(0.0014)*	*0.0021*	*0.0051*	*0.030*	*0.0062*	*0.0034*	*0.0069*	*0.0048*	*0.011* **Hg**	…	…
65X MgA16(A)	*6.78*	*4.03*	*0.271*	*0.099*	*0.023*	*0.0073*	*0.0057*	*0.0024*	*0.028*	*0.050*	*0.0035*	*0.0011*	*0.0066*	*0.0017*	*0.0012*	*0.005* **Hg**	…	…
65X MgA17(A)	*4.20*	*0.128*	*0.203*	*0.0215*	*0.33*	*0.0069*	*0.0141*	*0.021*	*0.0050*	*0.009*	*0.0064*	…	*0.0049*	…	…	…	…	…
65X MgB2(C)	*2.67*	*0.95*	*0.333*	*0.113*	*0.069*	*0.010*	*0.0028*	*0.011*	*0.0047*	*0.0036*	*0.0099*	*0.0008*	*0.0115*	*0.0009*	*0.0007*	…	*0.0003*	*<0.001*
65X MgB3(C)	*3.38*	*0.711*	*0.277*	*0.0222*	*0.042*	*0.0028*	*0.0027*	*(0.003)*	*0.0017*	*0.0023*	*0.0028*	*0.0019*	*0.0025*	…	…	…	…	…
65X MgB4(C)	*3.86*	*0.333*	*0.031*	*0.0183*	*0.037*	*(0.009)*	*0.0003*	*0.0010*	*0.0050*	*0.0037*	*0.0046*	*0.0033*	*0.00016*	*0.0003*	*(0.0001)*	…	*(0.0008)*	*<0.001*

***** Unsuitable for use with glow-discharge systems

Tin with Impurities (Cast) Reference Materials (Approx. 40mm dia. x 15mm discs, except 71X SR1(F) which is approx. 40mm dia. x 20mm)

MBH No.	Sb	As	Bi	Pb	Cu	Fe	Co	Ni	Al	Ag	Cr	P	Tl	Cd	Zn	In	Au	Te	Se	Ga	Hg	Ge
71X SR0(D)	*0.0284*	*(0.0006)*	*(0.0007)*	*0.0380*	*0.0049*	*0.0011*	*0.0006*	*0.0009*	*0.0057*	*0.0101*	…	*0.0007*	…	*0.0020*	*0.0022*	*0.0119*	*0.0039*	*0.0019*	…	*0.0070*	*0.0083*	*(0.0005)*
71X SR1(F)	*0.0203*	*0.0032*	*0.0102*	*0.0256*	*0.0016*	*(0.002)*	*0.0016*	*0.0058*	*(0.002)*	*0.012*	…	*0.0014*	…	*0.0109*	*0.0126*	*0.0104*	*0.0022*	*0.0010*	*0.004*	…	*0.0178*	*0.011*
71X SR2(F)	*0.074*	*0.0070*	*0.0403*	*0.151*	*0.116*	*0.0133*	*0.0064*	*0.0183*	*0.0022*	*0.0212*	*0.0031*	*(0.007)*	*0.005*	*0.0351*	*0.0058*	*0.0597*	*0.0077*	*0.0246*	…	…	*0.140*	*0.009*

MBH ANALYTICAL LTD. (MBH), U.K. (via Analytical Reference Materials International, USA)

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in brackets are for information only.

Tin White Metal (Pewter, Babbit) Reference Materials (Approx. 40mm dia. x 15mm discs)

MBH No.	As	Bi	Sb	Pb	Cu	Fe	Cd	Zn	Ni	Al	Ag	Co	In	S	P
73X SC2(B)	*0.0355*	*0.602*	*3.05*	*0.0457*	*1.028*	*0.0037*	*0.0282*	*(0.0007)*	*0.0156*	...	*0.0318*	*0.0217*	*0.0099*	...	...
73X SC4(B)	*0.0268*	*0.153*	*5.94*	*0.429*	*2.63*	*0.0014*	*0.0085*	*(0.001)*	*0.0130*	*(0.0015)*	*0.0525*	*0.0020*	*0.0143*	...	*0.005*
73X SC5(A)	*0.013*	*0.43*	*7.03*	*0.136*	*0.57*	*0.004*	*0.008*	*0.001*	*0.0058*	*0.003*	*0.063*	*0.011*	*0.036*	*(0.001)*	...
73X SC7(B)	*0.059*	*0.013*	*13.86*	*0.32*	*5.71*	*(0.043)*	*0.0019*	*0.0033*	*0.016*	*(0.001)*	*0.0059*	*0.0143*	*0.0194*	*(0.0007)*	...
73X SC8(B)	*0.11*	*0.0531*	*5.52*	*0.110*	*3.78*	*0.055*	*0.098*	*0.004*	*0.0351*	*(0.0007)*	*0.0253*	*0.0267*	*0.0325*	*0.004*	...
73X SC9(B)	*0.117*	*0.0825*	*8.31*	*0.305*	*8.03*	*0.053*	*0.0506*	...	*0.0084*	*(0.0010)*	*0.0055*	*0.0051*	*0.0059*	...	...
73X SC11(C)	*0.248*	*0.554*	*12.98*	*0.0630*	*11.51*	*0.0052*	*1.72*	*0.005*	*0.110*	...	*(0.056)*	...	...	...	*0.025*
73X SC12(B)	*(0.034)*	*0.0301*	*7.50*	*0.091*	*6.03*	*0.024*	*0.758*	*0.0212*	*0.115*	*0.0015*	*0.842*	*0.0210*	...	...	...
73X SC13(A)	*0.054*	*0.0188*	*4.21*	*0.259*	*4.19*	*0.053*	*0.0021*	*0.0126*	...	*(0.01)*	...	...	...	...	*(0.02)*

Lead with Impurities Reference Materials (Approx. 40mm dia. x 15mm discs)

MBH No.	Sn	Sb	Bi	Cu	As	Ag	Fe	Zn	Cd	In	Ni	Te	Se	Au	Tl	Na	Hg	Pt	S
83X PR1(K)	*0.016*	*0.0100*	*0.0508*	*0.0465*	*0.0338*	*0.1029*	...	*(0.002)*	*0.074*	*0.0080*	*(0.0004)*	*0.0058*	*0.0008*	*0.0019*	...	...	...	...	...
83X PR2(G)	*0.0948*	*0.0499*	*0.0404*	*0.0309*	*0.0233*	*0.055*	...	*0.0005*	*0.0020*	*0.0010*	*0.0006*	*0.0100*	*0.0005*	*0.0005*	*(0.0017)*	*0.0013*	*0.003*	...	...
83X PR3(G)	*0.0417*	*0.0888*	*0.144*	*0.694*	*0.0011*	*0.0029*	...	*(0.0007)*	*0.0462*	0.0093	*0.0116*	*0.0039*	*0.0166*	*0.0036*	*0.0033*	*(0.0038)*	*0.0008*	...	...
83X PR4(H)	...	*0.0050*	*0.0150*	*0.0454*	*0.0003*	*0.0114*	...	...	*0.0081*	...	*0.0029*	*0.0229*	*(0.004)*	*0.0021*	*0.0021*	...	*0.019*	...	...
83X PR5(H)	*(0.0007)*	*0.00067*	*0.00813*	*0.00061*	*(0.0001)*	*0.00045*	...	*(0.00015)*	*0.00078*	*(0.00014)*	*0.00016*	*0.00059*	*(0.0002)*	...	*(0.0002)*	...	*(<0.0005)*	...	...
83X PR7(C)	*0.218*	*0.789*	*0.497*	*0.148*	*0.0503*	*0.287*	...	...	*0.450*	*0.550*	*0.0027*	*0.0094*	*0.0069*	...	...	...	...	*0.0047*	...
83X PR8(D)	*0.604*	*0.257*	*1.18*	*0.0448*	*0.134*	*0.497*	...	*0.0004*	*0.199*	*0.293*	*0.0008*	*0.0014*	*(0.0003)*	*0.0106*	...	...	*0.086*	...	...
83X PR11(A)	*0.119*	*0.497*	*0.0117*	*0.0551*	*0.0095*	*0.0030*	*(0.0003)*	...	*0.0008*	...	*0.0011*	...	*(0.0001)*	...	*0.0042*	...	...	...	*0.009*
83X PR12(A)	*0.0005*	*0.0011*	*0.0119*	*0.0353*	*(0.0003)*	*0.0030*	*(0.0003)*	...	*0.0011*	...	*0.0009*	...	*(0.0002)*	...	*0.0051*	...	...	...	*(0.0002)*

Please note that the batches of MBH samples denoted (A), (B, (C) etc., may change from time to time and that the compositions may therefore vary from those stated above. Please check at the time of ordering which batch is currently available.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), USA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Electrolytic Iron and Low Alloy Steel Certified Reference Materials

(SRMs 361 and 363 finely divided material, units of 150g; SRMs 1264a and 1265a 31mm dia x 19mm discs and 1761a-1767 31-34mm dia. x 19mm discs)

NIST No.	Description	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Al (Total)	As	B	Co	Cu
SRM 361	AISI 4340	**2016**	**0.383**	**0.222**	**0.66**	**0.014**	**0.0143**	**0.694**	**0.19**	**2.00**	**0.021**	**0.017**	**0.000478**	**0.032**	**0.042**
SRM 363	Cr-V (Mod)	**2012**	**0.62**	**0.74**	**1.50**	**0.029**	**0.0068**	**1.31**	**0.028**	**0.30**	**0.24**	**0.010**	**0.00131**	**0.048**	**0.10**
SRM 1264a	High Carbon (Mod)	**2019**	**0.87**	**0.067**	**0.258**	**0.010**	**0.025**	**0.066**	**0.49**	**0.142**	*0.008*	**0.052**	*0.011*	**0.15**	**0.250**
SRM 1265a	Electrolytic Iron	**2019**	**0.0067**	**0.0080**	**0.0057**	**0.0011**	**0.0055**	**0.0072**	**0.0050**	**0.041**	*0.0007*	*0.0002*	**0.00013**	**0.0070**	**0.0058**
SRM 1761a	Low Alloy Steel	**2008**	*1.05*	*0.182*	**0.679**	**0.042**	**0.037**	**0.222**	**0.103**	**1.981**	**0.055**	*0.011*	**0.0023**	*0.027*	**0.298**
SRM 1762a	Low Alloy Steel	**2015**	**0.341**	**0.351**	**1.912**	**0.0346**	**0.0295**	**0.923**	**0.353**	**1.156**	**0.0706**	**0.0173**	**0.0042**	**0.0616**	**0.1186**
SRM 1763b	Low Alloy Steel	**2019**	**0.201**	**0.6275**	**1.605**	**0.01233**	**0.0229**	**0.5039**	**0.491**	**0.5075**	**0.0422**	**0.0539**	**0.00535**	**0.09248**	**0.4170**
SRM 1764a	Low Alloy Steel	**2009**	**0.592**	**0.0595**	**1.193**	**0.0210**	**0.0118**	**1.468**	**0.2007**	**0.2006**	**0.0098**	**0.0100**	*0.0010*	*0.012*	**0.5178**
SRM 1765	Low Alloy Steel	**1993**	**0.006**	*(0.004)*	**0.144**	**0.0052**	**0.0038**	**0.051**	**0.005**	**0.154**	*(0.006)*	**0.0010**	**0.0009**	**0.0012**	**0.0013**
SRM 1766	Low Alloy Steel	**1993**	**0.015**	**0.010**	**0.067**	**0.002**	**0.0024**	**0.024**	**0.0035**	**0.021**	**0.012**	**0.0035**	**0.00012**	**0.0020**	**0.015**
SRM 1767	Low Alloy Steel	**1993**	**0.052**	**0.026**	**0.022**	**0.0031**	**0.0090**	**0.0015**	**0.020**	**0.002**	**0.004**	**0.0005**	**0.001**	**0.0050**	**0.0014**

Electrolytic Iron and Low Alloy Steel CRMs (continued)

NIST No.	N	Nb	Pb	Sn	Ta	Ti	V	W	Zr	Ag	Bi	Ca	Ce
SRM 361	*0.0037*	**0.022**	**0.000025**	**0.010**	**0.020**	**0.020**	**0.011**	**0.017**	**0.009**	**0.0004**	*0.0004*	**0.00010**	**0.0040**
SRM 363	*0.0041*	**0.049**	**0.00186**	**0.104**	*0.053*	**0.050**	**0.31**	**0.046**	**0.049**	**0.0037**	*0.0008*	**0.00022**	**0.0030**
SRM 1264a	*0.0032*	**0.157**	**0.024**	*0.008*	**0.11**	**0.24**	**0.106**	**0.102**	**0.069**	*0.00002*	*0.0009*	**0.00004**	**0.00022**
SRM 1265a	*0.0011*	…	**0.000015**	*0.0002*	*<0.0005*	*0.0001*	**0.0006**	*0.00004*	*<0.00001*	*0.000002*	*<0.00001*	*<0.00001*	*<0.000005*
SRM 1761a	*0.0042*	**0.021**	…	*0.050*	*0.050*	**0.173**	**0.054**	…	**0.012**	…	…	…	…
SRM 1762a	*(0.002)*	**0.0692**	…	**0.0479**	**0.0203**	**0.0952**	**0.2010**	…	**0.0285**	…	…	…	…
SRM 1763b	…	**0.0998**	…	**0.01098**	**0.0119**	**0.313**	**0.3075**	**0.00216**	**0.0445**	…	…	…	…
SRM 1764a	*0.0023*	**0.0416**	…	*0.024*	**0.0297**	**0.0286**	**0.1063**	*(0.0016)*	*0.0012*	…	…	…	…
SRM 1765	**0.0010**	**0.0004**	**0.0003**	**0.002**	*(0.004)*	**0.0055**	**0.0040**	…	*(0.0002)*	**0.0002**	*(<0.0001)*	…	…
SRM 1766	**0.0033**	**0.005**	**0.003**	**0.0010**	*0.006*	**0.0005**	**0.009**	*0.001*	*0.0004*	**0.0005**	*<0.0001*	…	*0.002*
SRM 1767	**0.0008**	**0.010**	*0.0001*	**0.006**	*0.002*	**0.011**	**0.033**	…	*0.004*	**0.0008**	*<0.0001*	*0.0003*	…

Electrolytic Iron and Low Alloy Steel CRMs (continued)

NIST No.	Fe	Au	Ge	H	Hf	La	Mg	Nd	O	Pr	Sb	Te	Zn
SRM 361	*95.6*	*<0.00005*	*0.006*	*<0.0005*	*0.0002*	*0.001*	**0.00026**	**0.00029**	*0.0009*	*0.0003*	**0.0042**	*0.0006*	*0.0001*
SRM 363	*94.4*	**0.0005**	*0.010*	*<0.0005*	*0.0005*	*0.002*	**0.00062**	**0.0012**	*0.00066*	*0.0004*	**0.002**	*0.0009*	*0.0004*
SRM 1264a	*96.7*	*0.0001*	*0.003*	*<0.0005*	*0.0013*	**0.00007**	**0.00015**	**0.00007**	*0.0010*	*0.00003*	**0.034**	**0.00018**	*0.001*
SRM 1265a	*99.9*	*<0.000002*	*0.0014*	*0.0001*	*<0.00002*	*<0.000005*	*<0.00002*	*<0.000005*	*0.0063*	*<0.000005*	*<0.00001*	*<0.00001*	*<0.0001*
SRM 1761a	*95.0*	…	…	…	…	…	…	…	…	…	*0.0052*	…	…
SRM 1762a	*(94.2)*	…	…	…	…	…	…	…	…	…	…	…	…
SRM 1763b	*(95.0)*	…	…	…	…	…	…	…	…	…	*0.0110*	…	…
SRM 1764a	*(95.1)*	…	…	…	…	…	…	…	…	…	…	…	…

Information on NIST samples not included in this list will be provided on request.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), USA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

High Temperature Alloy and Specialty Steel Certified Reference Materials

(Approx. 32-35mm dia x 19mm discs except SRM 126c, SRM 867 and SRM 868 which are finely divided material, units of 150g, 100g and 150g respectively)

NIST No.	Description	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	Cu	N	Nb
SRM 1158 (SRM 126c)	High Nickel Steel (36% Ni)	**2017**	**0.02540**	**0.1936**	**0.4684**	*0.00350*	*0.0050*	*0.0625*	*0.0110*	**36.054**	…	…	*0.0396*	…	…
SRM 1230	High Temperature Alloy A286	**2016**	**0.0428**	**0.411**	**0.652**	**0.0239**	**0.00095**	**14.65**	**1.15**	**24.08**	**0.249**	*(<0.005)*	**0.137**	*(0.003)*	*0.067*
SRM 1247 (SRM 867)	Ni-Fe-Cr Alloy UNS N08825	**2015**	**0.0212**	**0.3234**	**0.3806**	**0.0203**	*0.0017*	**23.375**	**2.723**	**43.47**	**0.0630**	**0.00257**	**1.767**	*0.0170*	**0.458**
SRM 1250 (SRM 868)	High Temperature Alloy Fe-Ni-Co	**1993**	**0.022**	**0.097**	**0.052**	*(<0.003)*	**0.0025**	**0.077**	**0.014**	**37.78**	**0.99**	…	**0.022**	…	**2.99**
SRM C2400	Fe-Cr-Ni Alloy UNS J92180	**2016**	**0.036**	**0.61**	**0.71**	**0.013**	**0.003**	**17.06**	**0.23**	**4.07**	*(<0.01)*	…	**2.63**	…	**0.15**

High Temperature Alloy and Specialty Steel CRMs (continued)

NIST No.	Pb	Sn	Ta	Ti	Tl	V	W	Zr	Ag	B	Bi	Co	Fe	Ga	O
SRM 1158 (SRM 126c)	…	…	…	…	…	*(0.001)*	…	…	…	…	…	*0.0080*	…	…	…
SRM 1230	*(<0.0003)*	*(<0.033)*	*(<0.001)*	**2.18**	…	**0.229**	*0.0695*	*(<0.018)*	*(0.000025)*	**0.00519**	*(<0.0001)*	**0.151**	**55.6**	…	…
SRM 1247 (SRM 867)	**0.0000340**	*(0.0030)*	*(<0.0010)*	**0.755**	**0.000000223**	**0.0478**	*0.0056*	…	*0.000025*	**0.00198**	*(<0.00005)*	**0.092**	**26.564**	*0.0112*	*0.0050*
SRM 1250 (SRM 868)	…	…	**0.003**	**1.48**	…	**0.077**	…	…	…	**0.0078**	…	**16.1**	**40.5**	…	…
SRM C2400	…	…	…	*(<0.01)*	…	**0.092**	*(0.1)*	*(<0.01)*	…	*(0.0004)*	…	**0.10**	…	…	…

Tool Steel Certified Reference Materials

(SRM 1772 approx. 34mm dia x 19mm discs, SRMs 50c, 132b and 134a are all finely divided materials, units of 150g)

NIST No.	Description	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	As	Cu	N	V	W	Pb	Sn	B	Ca	Co
SRM 50c	W-Cr-V Steel	**2011**	*0.7193*	**0.3102**	**0.3417**	**0.0222**	**0.006367**	**4.128**	**0.0821**	**0.0686**	**0.0225**	**0.0792**	**0.0117**	**1.158**	**18.445**	…	**0.0183**	…	…	*(0.035)*
SRM 132b	Tool Steel (AISI M2)	**1995**	**0.864**	**0.185**	**0.341**	**0.012**	**0.004**	**4.38**	**4.9**	**0.23**	…	**0.088**	…	**1.83**	**6.28**	…	…	…	…	**0.029**
SRM 134a	Mo-W-Cr-V Steel	**1957**	**0.808**	**0.323**	**0.218**	**0.018**	**0.007**	**3.67**	**8.35**	**0.088**	…	**0.101**	…	**1.25**	**2.00**	…	…	…	…	…
SRM 1772	Tool Steel (S-7)	**1995**	**0.477**	**0.264**	**0.61**	**0.008**	**0.0031**	**3.10**	**1.39**	**0.105**	…	**0.083**	…	**0.236**	*0.002*	*<0.001*	*0.008*	*<0.001*	*0.001*	*0.007*

White Cast and Ductile Iron Certified Reference Materials

(Approx. 32mm dia x 19mm discs except SRM 892 which is finely divided material, units of 150g)

NIST No.	Description	Cert. Date	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Ti	V
SRM 892	White Cast Iron (Ni-Hard Type IV)	**1982**	**3.33**	**1.83**	**0.76**	**0.054**	**0.015**	**10.18**	**0.20**	**5.53**	**0.270**	*(0.02)*	**0.041**
SRM C1145a	White Cast Iron	**1988**	**2.92**	**0.271**	**0.187**	**0.215**	**0.191**	**0.63**	**0.48**	**0.62**	**0.46**	**0.012**	**0.112**
SRM C1290	White Cast Iron (HC-250+V)	**1985**	**3.04**	**0.971**	**0.66**	**0.030**	**0.013**	**30.5**	*(0.041)*	**0.917**	**0.065**	…	**0.442**
SRM C1291	White Cast Iron (Ni-Hard Type I)	**1985**	**2.67**	**1.34**	**1.14**	**0.028**	**0.032**	**2.78**	**0.32**	**4.34**	**0.26**	…	**0.031**
SRM C1292	White Cast Iron (Ni-Hard Type IV)	**1985**	**3.47**	**0.59**	**0.55**	**0.049**	**0.016**	**11.4**	**0.25**	**5.04**	**0.36**	…	**0.041**
SRM C2424	Ductile Iron	**1985**	**2.68**	**3.37**	**0.268**	**0.041**	**0.024**	**0.13**	**0.019**	**0.061**	…	**0.050**	**0.083**

White Cast and Ductile Iron CRMs (continued)

NIST No.	Mg	Pb	Sb	Sn	Zr	Al	As	B	Bi	Ce	Co	La	Fe
SRM 892	…	…	*(0.0012)*	*(0.02)*	*(<0.001)*	*(0.009)*	*(0.006)*	*(0.0020)*	…	…	**0.31**	…	*(77.4)*
SRM C1145a	…	**0.0012**	*(0.04)*	*(0.10)*	*(0.002)*	*(0.04)*	*(0.03)*	*(0.02)*	*(<0.01)*	…	**0.058**	…	…
SRM C2424	**0.006**	…	…	…	…	*(<0.01)*	…	*(0.002)*	…	**0.0046**	*(0.05)*	**0.0011**	…

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), USA

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified, figures in italic type only approximate and figures in brackets are for information only.

Ore and Concentrate Certified Reference Materials (Finely divided material – unit weights as shown in table)

NIST No.	Description	Cert. Date	Unit Weight	Fe_2O_3	SiO_2	Al_2O_3	TiO_2	CaO	MgO	MnO	P_2O_5	SO_3	K_2O
SRM 25d	Manganese Ore	**2010**	60g	*3.91*	**2.54**	*5.33*	*0.136*	*(0.052)*	…	**51.78 Mn**	**0.251**	…	*0.928*
SRM 69b	Bauxite, Arkansas	**1991**	60g	**7.14**	**13.43**	**48.8**	**1.90**	**0.13**	**0.085**	**0.110**	**0.118**	**0.63**	**0.068**
SRM 277	Tungsten Concentrate	**2013**	100g	*7.47* **Fe**	*0.842* **Si**	…	*2.20* **Ti**	*0.38* **Ca**	…	*10.2* **Mn**	*0.034* **P**	*0.267* **S**	…
SRM 423	Molybdenum Oxide Conc.	**2019**	50g	*1.708* **Fe**	…	…	…	…	…	…	…	…	…
SRM 600	Bauxite, Australian	**1991**	90g	**17.0**	**20.3**	**40.0**	**1.31**	**0.22**	**0.05**	**0.013**	**0.039**	**0.19**	**0.23**
SRM 670	Rutile Ore	**1993**	90g	**0.86**	**0.51**	…	**96.16**	*(0.10)* **Ca**	…	…	…	…	…
SRM 690	Iron Ore, Canada	**1992**	100g	**66.85 Fe**	**3.71**	**0.18**	**0.022**	**0.20**	**0.18**	**0.23**	**0.011 P**	**0.003 S**	**0.0030**
SRM 691	Iron Oxide, Reduced	**1991**	100g	**90.8 Fe**	**3.7**	**1.22**	**0.27**	**0.63**	**0.52**	**0.043**	**0.006 P**	**0.008 S**	…
SRM 692	Iron Ore, Labrador	**1992**	100g	**59.58 Fe**	**10.14**	**1.41**	**0.045**	**0.023**	**0.035**	**0.46**	**0.039 P**	**0.005 S**	**0.039**
SRM 693	Iron Ore, Nimba	**1990**	100g	**65.11 Fe**	**3.87**	**1.02**	**0.035**	**0.016**	**0.013**	**0.091**	**0.056 P**	**0.005 S**	**0.0028**
SRM 694	Phosphate Rock (Western)	**1993**	90g	**0.79**	**11.2**	**1.8**	*(0.11)*	**43.6**	**0.33**	**0.0116**	**30.2**	…	**0.51**
SRM 696	Bauxite, Surinam	**1991**	60g	**8.70**	**3.79**	**54.5**	**2.64**	**0.018**	**0.012**	**0.004**	**0.050**	**0.21**	**0.009**
SRM 697	Bauxite, Dominican	**1991**	60g	**20.0**	**6.81**	**45.8**	**2.52**	**0.71**	**0.18**	**0.41**	**0.97**	**0.0769**	**0.062**
SRM 698	Bauxite, Jamaican	**1991**	60g	**19.6**	**0.69**	**48.2**	**2.38**	**0.62**	**0.058**	**0.38**	**0.37**	**0.22**	**0.010**
SRM 1835	Borate Ore	**1987**	60g	**1.141**	**18.408**	**3.47**	**0.133**	**21.622**	**3.411**	**0.0333**	…	**1.477**	**1.261**
SRM 2430	Scheelite Ore	**2016**	100g	*1.13* **Fe**	**1.74 Si**	*(0.4)* **Al**	…	**19.44**	*(0.5)* **Mg**	**0.1178 Mn**	*(0.02)* **P**	*0.25* **S**	**0.179 K**

Ore and Concentrate CRMs (continued)

NIST No.		Na_2O	Cr_2O_3	V_2O_5	WO_3	ZnO	ZrO_2	Bi	Cu	F	Mo	Pb	Others	LOI
SRM 25d	(continued)	…	…	…	…	…	…	…	…	…	…	…	*(1)* **H_2O**	…
SRM 69b	(continued)	*0.025*	**0.011**	**0.028**	…	**0.0035**	**0.29**	…	…	…	…	…	…	**25.72**
SRM 277	(continued)	…	…	…	**67.50**	…	*(<0.8)* **Zr**	*(<0.01)*	*(0.014)*	…	*0.060*	*0.068*	*(22.0)* **O_2**	…
SRM 423	(continued)	…	…	…	…	…	…	*(0.006)*	**0.0640**	…	**58.61**	*0.0433*	*7.69* **Acid-Insoluble Residue**	…
SRM 600	(continued)	**0.022**	**0.024**	**0.060**	…	**0.003**	**0.060**	…	…	…	…	…	…	…
SRM 670	(continued)	…	**0.23**	**0.66**	…	…	**0.84**	…	…	…	…	…	…	…
SRM 690	(continued)	**0.003**	…	…	…	…	…	…	…	…	…	…	…	…
SRM 691	(continued)	**0.186**	…	…	…	…	…	…	**0.032**	…	…	…	**0.030 Co**	…
SRM 692	(continued)	**0.008**	…	…	…	…	…	…	…	…	…	…	…	…
SRM 693	(continued)	**0.0028**	…	…	…	…	…	…	…	…	…	…	…	…
SRM 694	(continued)	**0.86**	*(0.10)*	**0.31**	…	*(0.19)*	…	…	…	**3.2**	…	…	**0.0141 U**	…
SRM 696	(continued)	*0.007*	**0.047**	**0.072**	…	**0.0014**	**0.14**	…	…	…	…	…	…	**29.9**
SRM 697	(continued)	*0.036*	**0.100**	**0.063**	…	**0.037**	**0.065**	…	…	…	…	…	*0.0013* **Co**	**22.1**
SRM 698	(continued)	*0.015*	**0.080**	**0.064**	…	**0.029**	**0.061**	…	…	…	…	…	…	**27.3**
SRM 1835	(continued)	**3.484**	…	…	…	…	…	…	…	**0.348**	…	…	…	…
SRM 2430	(continued)	*0.018* **Na**	…	…	**70.30**	…	…	*0.080*	*0.0086*	*(1.3)*	*0.22*	…	*0.0022* **As**	…

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CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified and figures in italic type only approximate.

Rock, Mineral and Refractory Certified Reference Materials (Finely divided material – unit weights as shown in table)

NIST No.	Description	Cert. Date	Unit Weight	SiO_2	Al_2O_3	TiO_2	FeO	Fe_2O_3	Cr_2O_3	MnO	CaO	MgO	BaO	Na_2O	K_2O	Li_2O	P_2O_5	SrO	ZrO_2	LOI
SRM 1d	Limestone, Argillaceous	2005	70g	4.080	0.526	0.07	…	0.3191	*0.0012*	…	52.85	0.301	*0.0033*	0.0109	0.1358	…	0.0413	0.0303	…	39.9
SRM 76a	Burnt Refractory (Al_2O_3-40%)	1992	75g	54.9	38.7	2.03	…	1.60	…	…	0.22	0.52	…	0.07	1.33	0.042	0.120	0.037	…	*0.34*
SRM 77a	Burnt Refractory (Al_2O_3-60%)	1992	75g	35.0	60.2	2.66	…	1.00	…	…	0.05	0.38	…	0.037	0.090	0.025	0.092	0.009	…	*0.22*
SRM 78a	Burnt Refractory (Al_2O_3-70%)	1992	75g	19.4	71.7	3.22	…	1.2	…	…	0.11	0.70	…	0.078	1.22	0.12	1.3	0.25	…	*0.42*
SRM 81a	Glass Sand	1978	75g	…	0.66	0.12	…	0.082	0.0046	…	…	…	…	…	…	…	…	…	0.034	…
SRM 165a	Glass Sand (low iron)	1992	75g	…	0.059	0.011	…	0.012	0.00011	…	…	…	…	…	…	…	…	…	0.006	…
SRM 198	Silica Brick	1960	45g	…	0.16	0.02	…	0.66	…	0.008	2.71	0.07	…	0.012	0.017	0.001	0.022	…	<0.01	0.21
SRM 199	Silica Brick	1991	45g	…	0.48	0.06	…	0.74	…	0.007	2.41	0.13	…	0.015	0.094	0.002	0.015	…	0.01	0.17
SRM 278	Obsidian Rock	1992	35g	73.05	14.15	0.245	…	2.04	…	0.052	0.983	…	…	4.84	4.16	…	0.036	…	…	…
SRM 688	Basalt Rock	1981	60g	48.4	17.36	1.17	7.64	10.35	…	0.167	…	…	…	2.15	0.187	…	0.134	…	…	…
SRM 1413	Glass Sand (high alumina)	1985	75g	82.77	9.90	0.11	…	0.24	ZnO	Mn_2O_3	0.74	0.06	0.12	1.75	3.94	…	…	…	…	…
SRM 2696	Silica Fume	2017	70g	95.61	0.2080	0.11	…	*0.055*	0.051	0.032	0.426	0.235	…	*0.129*	0.652	…	*0.0863*	…	…	*2.11*

Cement Certified Reference Materials (Finely divided material – units of 4 x 5g sealed vials, except SRM 634a units of 100g, SRM 1880b units of 5 x 5g, SRM 1884b units of 5 x 4.5g sealed vials, SRM 1885b, 1886b and 1889b units of 5 x 5g vials and SRM 1887b units of 5 x 4g vials)

NIST No.	Cert. Date	CaO	SiO_2	Al_2O_3	Fe_2O_3	MgO	SO_3	Na_2O	K_2O	TiO_2	SrO	Mn_2O_3	P_2O_5	Cl	F	ZnO	Cr_2O_3	LOI
SRM 634a	2015	65.07	20.493	5.015	3.362	1.0057	2.780	*0.0842*	0.3572	0.2463	*0.0735*	*0.0229*	0.1767	…	…	*0.0222*	*0.0114*	*1.683*
SRM 1880b	2018	64.16	20.42	5.183	3.681	1.176	2.710	0.0914	0.646	0.236	*0.0272*	0.1981	0.2443	0.01830	*0.0539*	*0.01054*	0.01927	*1.666*
SRM 1882a	2014	39.29	4.01	39.14	14.67	0.51	…	0.021	0.051	1.786	*0.024*	*0.060*	*0.070*	…	…	*0.004*	*0.113*	*0.20*
SRM 1883a	2019	29.52	0.24	70.04	0.078	0.19	…	0.30	0.014	*0.020*	*0.019*	*0.003*	*0.003*	…	…	…	*0.006*	*0.59*
SRM 1884b	2009	61.31	19.30	4.851	2.937	4.74	4.034	0.278	0.957	0.2651	0.0258	0.0750	0.0965	*0.0065*	*0.0394*	*0.0042*	0.00791	*0.597*
SRM 1885b	2013	61.87	20.05	4.70	3.044	3.86	2.832	0.293	0.497	0.2361	0.0795	0.1282	0.0737	*0.0021*	*0.0524*	0.0354	0.02709	*2.310*
SRM 1886a	2016	67.87	22.38	3.875	0.152	1.932	2.086	0.021	0.093	0.084	*0.018*	0.0073	0.022	*0.0042*	*0.02*	*0.001*	0.0024	*1.56*
SRM 1886b	2016	67.05	22.08	3.903	0.297	1.526	2.757	0.01682	0.0164	0.2054	0.0886	0.02639	0.0413	0.00399	*0.0118*	*0.00058*	0.00404	*3.344*
SRM 1887b	2013	61.15	19.59	4.911	2.471	3.624	4.599	0.288	0.961	0.2034	0.2625	0.0957	0.1540	0.01001	*0.101*	0.01560	0.01551	*2.121*
SRM 1888b	2010	63.13	20.42	4.277	3.062	3.562	2.634	0.1364	0.658	0.2316	0.1009	0.0652	0.07307	0.0143	*0.048*	*0.01253*	*0.01021*	*2.039*
SRM 1889b	2019	60.11	18.39	5.79	2.891	2.82	4.3721	0.365	1.115	0.260	0.284	0.0840	0.297	0.0101	*0.10*	0.0770	0.0083	*3.117*

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CHEMICAL COMPOSITION (nominal mass content) – Figures in bold type certified, figures in small italic type only approximate and figures in brackets for information only.

Biological Certified Reference Materials (Finely divided material – unit weights as shown in table) nominal mass content in %

NIST No.	Description	Cert. Date	Unit Weight	Ca	Cl	Mg	N	P	K	Na	S
SRM 1515	Apple Leaves	**2019**	50g	**1.525**	**0.0582**	**0.271**	**2.299**	**0.1593**	**1.608**	**0.00244**	*(0.18)*
SRM 1547	Peach Leaves	**2019**	50g	**1.559**	**0.0361**	**0.432**	**2.965**	**0.1371**	**2.433**	**0.00238**	*(0.20)*
SRM 1566b	Oyster Tissue	**2019**	25g	**0.0838**	**0.514**	**0.1085**	*7.6*	…	**0.652**	**0.3297**	**0.687**
SRM 1567b	Wheat Flour	**2014**	50g	**0.01914**	**0.05653**	**0.0398**	…	**0.1333**	**0.1325**	**0.000671**	**0.1645**
SRM 1568b	Rice Flour	**2013**	50g	**0.01184**	**0.03011**	**0.0559**	…	**0.1530**	**0.1282**	**0.000674**	**0.1200**
SRM 1570a	Spinach Leaves	**2014**	60g	**1.526**	…	*(0.9)*	*6.06*	**0.5187**	**2.900**	**1.821**	*(0.5)*
SRM 1573a	Tomato Leaves	**2018**	50g	**5.045**	*0.66*	*(1.2)*	**3.02**	**0.2161**	**2.676**	**0.01361**	*(0.96)*
SRM 1575a	Pine Needles	**2017**	50g	**0.25**	**0.0421**	*0.106*	…	**0.107**	**0.417**	*0.0063*	…

SRM 1568b also certified for Arsenic Species.

Biological CRMs (continued) nominal mass content in µg/g

NIST No.	Al	As	B	Ba	Cr	Cu	Fe	Mn	Rb	Sr	Zn
SRM 1515 (continued)	**284.5**	…	**27.6**	**48.8**	*(0.3)*	**5.69**	**82.7**	**54.1**	**10.2**	**25.1**	**12.45**
SRM 1547 (continued)	**248.9**	**0.062**	**28.73**	**123.7**	*(1)*	**3.75**	**219.8**	**97.8**	**19.65**	**53.0**	**17.97**
SRM 1566b (continued)	**197.2**	**7.65**	*4.5*	*8.6*	…	**71.6**	**205.8**	**18.5**	**3.26**	*6.8*	**1424**
SRM 1567b (continued)	*4.4*	*0.0048*	*6.45*	…	…	**2.03**	**14.11**	**9.00**	**0.671**	…	**11.61**
SRM 1568b (continued)	**4.21**	**0.285**	…	…	…	**2.35**	**7.42**	**19.2**	**6.198**	…	**19.42**
SRM 1570a (continued)	**310**	**0.068**	**37.7**	…	…	**12.22**	…	**76.0**	*12.7*	**55.54**	**82.3**
SRM 1573a (continued)	**5984**	**0.1126**	**33.13**	*(63)*	**1.988**	**4.70**	**367.2**	**246.3**	**14.83**	*(85)*	**30.94**
SRM 1575a (continued)	**580**	*0.039*	*9.6*	**6.0**	*<0.5*	**2.8**	**46**	*488*	**16.5**	…	**38**

Biological CRMs (continued) nominal mass content in ng/g

NIST No.	Cd	Co	I	Pb	Hg	Mo	Ni	Se	Ag	Th	U	V
SRM 1515 (continued)	**13.2**	*(90)*	*(300)*	**470**	**43.2**	**95**	**936**	…	…	*(30)*	*(6)*	**254**
SRM 1547 (continued)	**26.1**	*(70)*	*(300)*	**869**	**31.7**	**60.3**	**689**	**120**	…	*(50)*	*(15)*	**367**
SRM 1566b (continued)	**2480**	**371**	…	**308**	**37.1**	…	**1040**	**2060**	**666**	**36.7**	*255.0*	**577**
SRM 1567b (continued)	**25.4**	…	…	**10.4**	*(0.5)*	**464**	…	**1140**	…	…	…	*(10)*
SRM 1568b (continued)	**22.4**	*17.7*	…	*5*	**5.91**	**1451**	…	**365**	…	…	…	…
SRM 1570a (continued)	**2876**	**393**	…	*(200)*	**29.7**	…	**2142**	**115.2**	…	**48.0**	*155*	**568**
SRM 1573a (continued)	**1517**	**577.3**	*(850)*	…	**34.1**	*(460)*	**1582**	**54.3**	…	*(120)*	*(35)*	**835**
SRM 1575a (continued)	**233**	*61*	…	*167*	**39.9**	…	*1470*	*99*	…	…	…	…

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CHEMICAL COMPOSITION (nominal mass content) – Figures in bold type certified, figures in small italic type only approximate and figures in brackets for information only.

Environmental Certified Reference Materials (Finely divided materials – unit weights as shown in table) nominal mass content in %

NIST No.	Description	Cert. Date	Unit Weight	Al	Ca	Cl	C	Fe	H	K	Mg	Na	P	Pb	S	Si	Ti	Ash content	Calorific Value (Btu/lb)
SRM 1632e	Trace Elements in Coal (Bituminous)	**2018**	50g	**0.960**	**0.1714**	*0.0963*	*(76)*	**1.42**	*4.97*	**0.1248**	*0.0391*	**0.0374**	*0.150*	*(0.0005)*	**2.738**	**1.81**	**0.0519**	*(8.488)*	*(13678)*
SRM 1633c	Trace Elements in Coal Fly Ash	**2011**	75g	**13.28**	**1.365**	…	…	**10.49**	…	**1.773**	**0.498**	**0.1707**	*0.192*	**0.00952**	*0.110*	*21.30*	**0.724**	…	…
SRM 1635a	Trace Elements in Coal (Subbituminous)	**2017**	50g	*0.5437*	*1.087*	…	*(77.90)*	**0.2472**	*3.92*	…	*0.2303*	**0.1031**	*0.01874*	**0.000285**	**0.2909**	…	*0.0524*	*(6.29)*	*(11664)*
SRM 1646a	Estuarine Sediment	**2004**	70g	**2.297**	**0.519**	…	…	**2.008**	…	**0.864**	**0.388**	**0.741**	**0.027**	**0.00117**	**0.352**	**40.00**	**0.456**	…	…
SRM 1648a	Urban Particulate	**2015**	2g	**3.43**	**5.84**	**0.4543**	*(12.7)*	**3.92**	…	**1.056**	**0.813**	**0.4240**	…	**0.655**	**5.51**	*12.8*	**0.4021**	…	…
SRM 2689	Fly Ash, Low Lime	**2015**	Set (3)	**12.94**	**2.18**	…	…	**9.32**	…	**2.20**	**0.61**	**0.25**	**0.10**	*(0.0052)*	…	**24.06**	**0.75**	*(12)*	*(12000)*
SRM 2690	Fly Ash, Medium Lime	**2015**	Set (3)	**12.35**	**5.71**	…	…	**3.57**	…	**1.04**	**1.53**	**0.24**	**0.52**	*(0.0039)*	**0.15**	**25.85**	**0.52**	*(5.3)*	*(9700)*
SRM 2691	Fly Ash, High Lime	**2015**	Set (3)	**9.81**	**18.45**	…	…	**4.42**	…	**0.34**	**3.12**	**1.09**	**0.51**	*(0.0029)*	**0.83**	**16.83**	**0.90**	*(4.8)*	*(8800)*
SRM 2709a	San Jaoquin Soil	**2018**	50g	**7.37**	**1.91**	…	…	**3.36**	…	**2.11**	**1.46**	**1.22**	**0.0688**	**0.00173**	…	**30.3**	**0.336**	…	**0.0195 Zr**
SRM 2710a	Montana I Soil	**2018**	50g	**5.95**	**0.964**	…	…	**4.32**	…	**2.17**	**0.734**	**0.894**	**0.105**	**0.552**	…	**31.1**	**0.311**	…	*(0.0200)* **Zr**
SRM 2711a	Montana II Soil	**2018**	50g	**6.72**	**2.42**	…	…	**2.82**	…	**2.53**	**1.07**	**1.20**	**0.0842**	**0.140**	…	**31.4**	**0.317**	…	…

SRM 1648a also certified for PAH and PCB Congeners;

Environmental CRMs (continued) nominal mass content in µg/g

NIST No.		Ag	As	Ba	Br	Cd	Ce	Co	Cr	Cu	Hg	Mn	Ni	Rb	Sb	Se	Sr	Th	Tl	U	V	Zn
SRM 1632e	(continued)	*(0.02)*	*8.55*	*62.8*	*11.9*	*(0.1)*	*12.24*	*3.622*	*16.57*	*5.70*	**0.1351**	*18.4*	*11.08*	**8.49**	*0.428*	*1.525*	**84.1**	*(1)*	*(0.4)*	*0.636*	*29.2*	**13.0**
SRM 1633c	(continued)	…	**186.2**	**1126**	…	**0.758**	…	**42.9**	*258*	**173.7**	**1.005**	**240.2**	**132**	**117.42**	*8.56*	*13.9*	**901**	*23.0*	…	*9.25*	**286.2**	*235*
SRM 1635a	(continued)	…	**0.860**	**3578**	…	*0.282*	…	**2.004**	**3.56**	**11.42**	**0.0836**	**6.69**	**5.37**	**1.226**	**0.251**	**0.662**	**160**	**1.299**	…	**0.4792**	**13.34**	*7.3*
SRM 1646a	(continued)	*<0.3*	**6.23**	*210*	…	**0.148**	*(64)*	*5*	**40.9**	**10.01**	*0.04*	**234.5**	**22.5**	*38*	*0.3*	**0.193**	*68*	*5.8*	…	*2.0*	**44.84**	**48.9**
SRM 1648a	(continued)	*6.0*	**115.5**	…	**502**	**73.7**	**54.6**	**17.93**	**402**	**610**	**1.323**	**790**	**81.1**	**51.0**	**45.4**	*28.4*	**215**	…	…	…	**127**	**4800**
SRM 2689	(continued)	…	*(200)*	*(800)*	…	…	…	*(48)*	*(170)*	…	*(0.018)*	*(300)*	*(122)*	…	*(9)*	*(7)*	*(700)*	*(25)*	…	…	…	*(240)*
SRM 2690	(continued)	…	*(26)*	*(5800)*	…	…	…	*(19)*	*(67)*	…	*(0.0005)*	*(300)*	*(46)*	…	*(6)*	*(0.8)*	*(2000)*	*(25)*	…	…	…	*(120)*
SRM 2691	(continued)	…	*(30)*	*(5900)*	…	…	…	*(26)*	*(68)*	…	**0.0578**	*(200)*	*(53)*	…	*(3)*	*(17)*	*(2700)*	*(26)*	…	…	…	*(120)*
SRM 2709a	(continued)	…	*10.5*	**979**	…	**0.371**	*42*	**12.8**	**130**	*33.9*	*0.9*	**529**	*85*	*99*	**1.55**	*(1.5)*	**239**	*10.9*	*0.58*	*3.15*	**110**	*103*
SRM 2710a	(continued)	*(40)*	**1540**	**792**	…	**12.3**	*(60)*	**5.99**	*23*	**3420**	**9.88**	**2149**	*8*	*117*	**52.5**	*(1)*	**255**	*18.1*	*1.52*	**9.11**	*82*	**4180**
SRM 2711a	(continued)	*(6)*	**107**	**730**	…	**54.1**	*(70)*	**9.89**	**52.3**	**140**	**7.42**	**675**	**21.7**	*120*	**23.8**	*(2)*	**242**	*15*	*(3)*	**3.01**	**80.7**	**414**

Please note that other categories of NIST SRMs (Standard Reference Materials) are available from BAS if required.

SOUTH AFRICAN BUREAU OF STANDARDS (SABS), South Africa

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified and figures in small italic type only approximate.

Igneous Rock Certified Reference Materials (Finely divided material – units of 100g)

SABS No.	Description	SiO_2	Al_2O_3	Total Fe as Fe_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	MnO	TiO_2	Cr_2O_3	P_2O_5	BaO	H_2O^+	CO_2
SARM 4	NIM-N Norite	**52.64**	**16.50**	**8.97**	*0.8*	**7.47**	**7.50**	**11.50**	**2.46**	**0.25**	**0.18**	**0.20**	…	…	…	**0.33**	*0.1*
SARM 6	NIM-D Dunite	**38.96**	*0.3*	**17.00**	**0.71**	**14.63**	**43.51**	**0.28**	*0.04*	*0.01*	**0.22**	…	…	**0.26**	**0.42**	**0.30**	**0.40**

Values are also given for the following minor and trace elements:- Ba, Ce, Co, Cr, Cu, Dy, Eu, F, Ga, Gd, La, Li, Lu, Mn, Nb, Ni, P, Pb, Rb, S, Sm, Sr, Tb, Th, Ti, Tm, U, V, Y, Yb, Zn, and Zr.

Chromium Ore Certified Reference Materials (Finely divided material – units of 100g)

SABS No.	Description	Al_2O_3	CaO	Cr_2O_3	FeO	Fe_2O_3	MgO	MnO	SiO_2	TiO_2	V_2O_5
SARM 131	Chromium Ore	**14.60**	*0.24*	**41.83**	…	**30.7**	**9.15**	**0.243**	**3.13**	**0.944**	**0.414**
SARM 146	Chromium Ore	**14.54**	**0.10**	**46.91**	**25.58**	…	**10.62**	**0.22**	**0.616**	**0.57**	**0.32**

Magnetite Iron Ore Certified Reference Material (Finely divided material – units of 100g)

SABS No.	Description	Fe	Al	K	Si	As	Ca	Cd	Co	Cr	Cu	Mg	Mn	Na	Ni	P	Pb	S	Ti	Zn	V
SARM 12	Magnetite Ore	**66.63**	**0.41**	**0.0108**	**0.16**	*0.0002*	**0.78**	*0.0005*	**0.0223**	**0.0021**	**0.0502**	**1.69**	**0.17**	**0.0091**	**0.0281**	**0.0477**	**0.0025**	**0.0695**	**0.43**	**0.0142**	**0.0520**

Hematite Iron Ore Certified Reference Material (finely divided material – units of 100g)

SABS No.	Description	Fe	SiO_2	Al_2O_3	CaO	Na_2O	K_2O	MnO	TiO_2	P
SARM 132	Hematite Iron Ore	**62.2**	**7.82**	**1.84**	*0.09*	*0.03*	**0.22**	*0.020*	*0.09*	**0.054**

Zirconium Concentrate Certified Reference Material (Finely divided material – units of 100g)

SABS No.	Description	ZrO_2	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5	HfO_2	CaO	MgO	Cr
SARM 13	Zirconium Concentrate	**64.01**	**32.45**	**0.61**	**0.187**	**0.295**	**0.23**	**1.29**	*0.14*	*0.044*	*0.0023*

Fluorspar Certified Reference Materials (Finely divided material – units of 100g)

SABS No.	Description	CaF_2	$CaCO_3$	$MgCO_3$	P_2O_5	Mn	SiO_2	Fe_2O_3
SARM 14	Acid Grade, Buffalo	**97.32**	*0.3*	*0.03*	*0.18*	…	*0.57*	*0.06*
SARM 15	Acid Grade, Zeerust	**97.84**	**0.95**	**0.55**	**0.017**	**0.0213**	*0.26*	*0.23*

Manganese Ore Certified Reference Materials (Finely divided material – units of 100g)

SABS No.	Description	Mn	Fe	SiO_2	CaO	MgO	Al_2O_3	P	Na_2O	K_2O	BaO	S	CO_2	Zn
SARM 16	Manganese Ore (Wessels)	**49.17**	**11.48**	**5.04**	**4.70**	**0.76**	*0.3*	**0.033**	*0.03*	**0.02**	**0.60**	**0.17**	*1.3*	**0.0364**
SARM 17	Manganese Ore (Mamatwan)	**38.81**	**4.27**	**4.69**	*14.4*	**3.03**	**0.24**	**0.018**	**0.09**	**0.09**	*0.08*	*0.01*	**15.40**	**0.0043**
SARM 149	Manganese Ore (Kalahari)	**38.0**	**5.39**	**5.89**	**14.2**	**2.08**	**0.221**	**0.021**	**0.147**	**0.132**	**0.050**	…	…	…

The mineral content of SARM 149 is Braunite: 57.4%, Calcite: 24.6% and Ankerite: 18.0% (Quartz, Hematite and Iron Sulphate were also observed).

Coal Certified Reference Materials (Finely divided material – units of 120g)

SABS No.	Description	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	Na_2O	K_2O	P_2O_5	S	LOI
SARM 18	Witbank Coal	**6.20**	**2.57**	**0.29**	**0.114**	**0.18**	**0.11**	…	**0.145**	…	**0.56**	**90.11**
SARM 19	OFS Coal	**15.00**	**8.01**	**1.75**	**0.341**	**1.39**	**0.20**	**0.29**	**0.24**	…	**1.49**	**71.28**
SARM 20	Sasolburg Coal	**17.66**	**11.27**	**1.17**	**0.63**	**1.87**	**0.43**	**0.27**	**0.14**	**0.14**	**0.51**	**64.66**

Values are also given for the following minor and trace elements:- As, Ba, Be, Ce, Co, Cr, Cs, Cu, Ga, Ge, Hf, Hg, La, Mn, Ni, P, Pb, Rb, Sc, Se, Sm, Sr, Ta, Th, U, V, Y, Zn and Zr.

Phosphate Rock Certified Reference Material (Finely divided material – units of 100g)

SABS No.	Description	P_2O_5	CaO	F	CO_2	MgO	SrO	Fe_2O_3
SARM 32	Phosphate rock	**39.96**	**54.44**	**2.49**	**1.61**	**0.50**	**0.52**	**0.14**

SOUTH AFRICAN BUREAU OF STANDARDS (SABS), South Africa

CHEMICAL COMPOSITION (nominal mass content) – Figures in bold type certified, figures in small italic type only approximate and figures in brackets are for information only.

Andalusite Certified Reference Material (Finely divided material – units of 100g)

SABS No.	Description	Al_2O_3	SiO_2	Fe (as Fe_2O_3)	TiO_2	K_2O	Na_2O	MgO	CaO	LOI
SARM 34	Andalusite	59.15	39.04	0.75	0.168	0.238	0.093	0.131	*0.13*	0.622

Vanadium Pentoxide Certified Material (Finely divided material – units of 100g)

SABS No.	Description	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	Na_2O	P_2O_5	SiO_2	As	S	V (Total)
SARM 38	Vanadium Pentoxide	0.14	*0.019*	0.119	0.060	0.0037	0.22	*0.008*	0.11	*0.001*	*0.0045*	55.84

Rock, Mineral and Sediment Certified Reference Materials (Finely divided material – units of 100g)

SABS No.	Description	Mass content	SiO_2	Al_2O_3	Fe as Fe_2O_3	FeO	MgO	ZrO_2	CaO	Na_2O	K_2O	MnO	TiO_2	P_2O_5	Cr_2O_3	HfO_2	U_3O_8	ThO_2	S
SARM 41	Carbonaceous Shale	%	56.67	13.50	4.23	*0.3*	8.10	…	1.50	0.93	1.39	0.06	0.55	0.05	…	…	…	…	*0.15*
SARM 42	Soil	%	74.09	10.03	4.68	*4.0*	1.92	…	0.89	*0.15*	0.45	0.10	0.36	*0.04*	0.63	…	…	…	*0.02*
SARM 43	Magnesite	%	5.99	*0.06*	0.26	*0.1*	44.11	…	0.75	*0.05*	*0.04*	*0.01*	*0.01*	*0.02*	…	…	…	…	*0.04*
SARM 44	Sillimanite Schist	%	38.84	58.80	2.60	*1.0*	*0.1*	…	0.14	*0.05*	0.18	0.03	1.83	0.10	…	…	…	…	*0.03*
SARM 47	Serpentinite	%	36.30	1.09	4.14	*0.4*	42.09	…	*0.10*	*0.05*	*0.02*	0.06	*0.01*	*0.02*	0.29	…	…	…	*0.02*
SARM 48	Fluorspar Granite	%	67.11	11.24	0.58	*0.2*	0.18	…	8.90	3.22	4.26	0.02	0.10	*0.09*	…	…	…	…	…
SARM 50	Dolerite	%	51.56	15.28	11.00	8.49	7.57	…	10.80	2.30	0.61	0.17	0.86	0.15	…	…	…	…	*0.03*
SARM 52	Stream Sediment	%	57.81	9.38	19.71	*4.0*	0.60	…	0.37	*0.1*	0.25	0.27	1.30	0.09	0.19	…	…	…	*0.02*
SARM 62	Zircon (RBM)	%	32.8	0.88	0.07	…	0.04	64.2	0.11	…	…	…	0.13	0.12	…	1.31	0.0354	0.0158	…

Rock, Mineral and Sediment Certified Reference Materials (continued)

SABS No.	Mass content	Ba	Ce	Co	Cr	Cu	Ga	Mo	Nb	Ni	Pb	Rb	Sr	Th	V	Y	Zn	Zr
SARM 41 (cont.)	µg/g	820	*60*	*15*	123	53	*20*	*5*	8	122	*30*	59	54	*12*	139	17	76	146
SARM 42 (cont.)	µg/g	*250*	*30*	35	…	17	*12*	*5*	8	125	*10*	22	37	*5*	94	11	44	192
SARM 43 (cont.)	µg/g	*25*	*20*	4	*195*	*15*	…	…	…	252	…	…	8	…	…	…	*10*	…
SARM 44 (cont.)	µg/g	*50*	*220*	*8*	384	*10*	*55*	*15*	96	*15*	*30*	13	5	50	395	84	271	405
SARM 47 (cont.)	µg/g	*75*	*20*	79	…	*5*	*5*	…	…	2221	*60*	…	*3*	…	*16*	*5*	45	…
SARM 48 (cont.)	µg/g	*290*	*850*	…	23	*10*	…	*5*	202	…	135	291	*5*	113	*8*	436	53	300
SARM 50 (cont.)	µg/g	220	*30*	40	357	84	…	…	*10*	*85*	*25*	14	195	*6*	216	23	81	86
SARM 52 (cont.)	µg/g	*410*	*210*	81	…	219	*15*	…	11	182	1200	20	25	*11*	346	20	264	250

PGM and Gold Ore Certified Reference Materials (Finely divided material – units of 3kg, except SARM 186 – units of 1kg) nominal mass content in µg/g

SABS No.	Description	Au	Pt	Pd	Rh	Ru	Ir	Fe	Si	Co	Cr	Cu	Ni	S	Al	Ca	Mg	Os	3E PGMs +Au
SARM 75	Sheba Sulphide Zone	0.053	0.32	0.61	…	…	…	…	…	…	…	…	2300	…	…	…	…	…	…
SARM 107	PGM Ore	0.046	1.99	0.926	0.320	0.626	*0.14*	…	…	…	…	…	…	…	…	…	…	…	…
SARM 186	PGM Concentrate	2.58	67.1	28.1	7.63	11.4	3.01	109000	210000	1800	5900	12500	22900	*45900*	*14800*	*12900*	*135000*	*1.48*	*108*

Ferro-Alloy Certified Reference Materials (Finely divided material – units of 100g) nominal mass content in %

SABS No.	Description	C	Si	Mn	P	S	Cr	Ni	Al	Co	Mg	Ti	V	Fe
SARM 33	Ferro-silicon	1.01	15.60	0.75	0.043	…	0.43	0.28	…	…	…	…	…	80.2
SARM 144	Ferro-chromium	6.64	5.30	0.32	*0.02*	*0.04*	49.02	0.20	*0.06*	*0.06*	*(0.04)*	0.67	0.36	36.87

Ferro-Chrome Slag Certified Reference Material (Finely divided material – units of 100g) nominal mass content in %

SABS No.	Description	Cr_2O_3	SiO_2	Al_2O_3	Fe_{Total}	CaO	MgO	S
SARM 77	Ferro-Chrome Slag	12.5	26.8	27.5	5.31	3.64	22.99	*0.32*

SPL-LABMAT (SPL), Czech Republic

CHEMICAL COMPOSITION (nominal mass content in %) - Figures in bold type certified and figures in small italic type only approximate.

Cast Iron Certified Reference Materials (Approx. 40mm dia. x 18mm depth discs)

SPL No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co
CZ02033-1G	3.22	2.53	0.701	0.036	0.007	0.044	0.185	0.357	0.062	0.0034	0.010
CZ02033-2G	3.78	1.10	0.096	0.125	0.009	0.027	0.002	0.650	0.019	0.0023	0.012
CZ02033-3D	3.24	2.12	0.317	0.008	0.006	0.236	0.453	0.025	0.055	0.0071	0.014
CZ02033-4E	4.45	0.090	0.034	0.023	0.006	0.030	0.002	0.049	0.003	...	0.033
CZ02033-5C	2.30	1.40	0.704	0.027	0.091	0.085	0.104	0.188	0.103	0.0078	0.013
CZ02033-6C	3.11	3.25	1.25	0.097	0.019	1.33	0.006	0.021	0.024	0.0024	0.005
CZ02033-7C	3.55	1.73	0.389	0.028	0.026	0.542	0.966	1.26	0.040	0.0008	0.048
CZ02033-8C	3.41	1.93	0.408	0.168	0.058	0.125	0.041	0.102	0.004	...	0.030

SPL No.	Cu	Pb	Sn	Ti	V	W	Bi	Ce	Mg	Sb	Zn
CZ02033-1G (cont.)	0.027	0.016	0.028	0.054	0.019	0.015	0.005	0.023	0.050	...	0.003
CZ02033-2G (cont.)	0.88	0.008	0.015	0.029	0.017	0.004	0.006	0.013	0.036	0.029	0.020
CZ02033-3D (cont.)	0.396	0.005	0.009	0.016	0.072	...	0.002	0.006	0.016	0.007	...
CZ02033-4E (cont.)	0.005	*0.002*	0.001	0.011	0.015	...	*0.002*	...	...	...	...
CZ02033-5C (cont.)	0.013	...	0.002	0.008	0.054	...	0.007	...	...	*0.002*	...
CZ02033-6C (cont.)	0.273	0.003	0.131	0.107	0.192	0.007	...	...	...	0.044	...
CZ02033-7C (cont.)	0.016	...	0.004	0.026	0.067	0.037	*0.002*	...	...	...	...
CZ02033-8C (cont.)	0.158	0.008	0.067	0.022	0.015	...	0.009	...	...	0.014	...

Cast Iron Certified Reference Materials (Approx. 40mm dia. x 18mm depth discs)

SPL No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Zr
CZ20034-11B	2.44	3.67	0.382	0.271	0.140	1.178	1.144	0.082	0.067	0.0032	0.007	0.007
CZ20034-12B	2.92	2.96	1.047	0.484	0.077	0.638	0.117	0.174	0.077	0.047	*0.002*	*0.002*
CZ20034-13C	3.15	2.23	0.704	0.0261	0.0044	0.124	0.360	1.299	0.022	...	*0.02*	*0.02*
CZ20034-14C	3.14	2.49	0.275	0.0162	0.0081	0.045	0.646	0.030	0.007	0.0123	0.013	0.013
CZ20034-15C	3.47	1.68	0.060	0.054	0.0028	0.078	0.002	0.728	0.010	0.0057	...	...
CZ20034-16C	3.87	0.95	1.311	0.173	0.0243	0.332	0.195	0.375	0.004	0.020	*0.002*	*0.002*
CZ20034-17C	4.08	0.150	0.503	0.104	0.0033	0.178	0.030	2.32	0.002	*0.0006*	...	...

SPL No.	Cu	Pb	Sn	Ti	V	W	Bi	Ce	Mg	Sb	As	Zn
CZ20034-11B (cont.)	0.130	0.007	0.074	0.041	0.182	0.005	*0.007*	...	...	0.011	0.005	...
CZ20034-12B (cont.)	0.223	0.009	0.042	0.071	0.326	0.002	*0.006*	...	...	0.046	0.024	0.004
CZ20034-13C (cont.)	0.089	...	0.014	0.015	0.043	0.003	...	0.011	0.064	*0.002*	0.002	...
CZ20034-14C (cont.)	0.585	...	0.025	0.018	0.013	*0.003*	...	0.019	0.017	0.020	0.035	0.010
CZ20034-15C (cont.)	1.123	...	0.006	0.036	0.019	0.004	0.008	0.030	0.040	0.056	*0.003*	...
CZ20034-16C (cont.)	0.345	0.015	0.125	0.057	0.027	0.015	...	...	...	0.010	0.003	0.017
CZ20034-17C (cont.)	0.037	0.002	0.002	0.015	0.076	0.004	*0.002*	0.003	0.007	...	0.005	...

Some other SPL samples are available, and information on these will be provided on request.

SUS (SUS), Germany

CHEMICAL COMPOSITION (nominal mass content in %) – figures in small italic type only approximate and and figures in brackets are for information only.

Aluminium and Aluminium Alloy Setting-up Samples (Approx. 55mm dia. x 50mm discs)

SUS No.	Al	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Ag	B	Be	Bi	Ca	Cd	Co	Ga	Li	P	Pb	Sn	Sr	V	Zr	Na	Sb	In
SUS-RA10	*99.99*	*0.0010*	*0.0005*	*0.0002*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0002*	*<0.0003*	*<0.0001*	*<0.0001*	*<0.0002*	*<0.0001*	*<0.0003*	*<0.00001*	...	*<0.0001*	*<0.0001*	*<0.00002*	...	*<0.0003*	*<0.0003*	*<0.00003*	*<0.0002*	*<0.0001*	*<0.00001*	*<0.0003*	...
SUS-RA18	*75*	*15*	*0.2*	*7.5*	*0.3*	*0.2*	*0.0003*	*3*	*0.3*	*0.001*	*0.01*	*0.0035*	*<0.0001*	*0.001*	*0.004*	*0.0005*	*<0.001*	*0.008*	*<0.001*	*0.015*	*0.37*	*0.37*	*0.05*	*0.001*	*0.005*	*0.005*	*0.45*	...
SUS-RA19	*78*	*1.7*	*1.3*	*0.8*	*1.3*	*8*	*0.2*	*0.6*	*7*	*0.2*	*0.3*	*0.001*	*0.005*	*0.2*	*0.008*	*0.04*	*0.3*	*0.06*	*0.009*	*0.0009*	*0.01*	*0.02*	*0.009*	*0.1*	*0.2*	*0.001*	*0.007*	*0.01*
SUS-RA20	*75.8*	*13.5*	*0.7*	*5.2*	*0.3*	*1*	*0.09*	*2.7*	*0.2*	*0.05*	...	...	...	...	*0.005*	...	...	...	...	*0.02*	*0.1*	*0.06*	...	*0.1*	*0.09*	*0.008*	...	...

Cobalt and Cobalt Alloy Setting-up Samples (Approx. 40mm dia. x 20mm discs)

SUS No.	Co	C	Si	Mn	P	S	Cr	Cu	Ni	Mo	Nb	Ti	V	W	Zr	Fe	Ta	Al
SUS-RCO11	*99.9*	...	*0.01*	*<0.005*	*<0.003*	*0.0005*	*<0.005*	*<0.01*	*0.003*	*<0.0005*	*<0.0005*	*<0.3*	*0.001*	*0.01*	*<0.003*	*<0.02*	...	...
SUS-RCO14	*52*	*0.2*	*1*	*0.5*	*(0.005)*	*(0.005)*	*30*	...	*10*	...	...	...	...	*7*	...	*(0.7)*	...	...
SUS-RCO15	...	*1*	*0.2*	...	*0.02*	*0.02*	...	*1*	...	*6*	*2*	*0.1*	*0.1*	...	...	*24*	*0.5*	*0.1*
SUS-RCO16	...	*0.2*	*0.4*	...	...	...	...	*3*	...	*3*	*2*	*0.1*	*1*	...	...	*25*	*0.2*	*0.1*

Copper and Copper Alloy Setting-up Samples (Approx. 40mm dia. x 40mm discs)

SUS No.	Cu	Zn	Pb	Sn	Mn	Fe	Ni	Si	Sb	Al	C	S
SUS-RC11	*99.99*	*0.0002*	*0.0002*	*0.0004*	*0.0001*	*0.0005*	*0.0005*	*0.0001*	*0.0001*	*0.0001*	...	*0.0010*
SUS-RC32	*60*	*35*	*(0.6)*	*(0.2)*	*(0.5)*	*(0.3)*	*(1.5)*	*0.5*	...	*1.5*	...	...
SUS-RC33	*80*	*(0.02)*	*(0.01)*	...	*(0.4)*	*4.5*	*4*	...	...	*10*	...	...
SUS-RC36	*80*	*(0.4)*	*12*	*7*	...	*(0.01)*	*(1.7)*	...	*(0.3)*	...	...	...
SUS-RC38	*65*	*(0.02)*	*(0.01)*	...	*0.75*	*0.5*	*30*	...	...	...	*(0.05)*	*(0.015)*
SUS-RC40	*82*	*(0.01)*	*(0.02)*	...	*5*	*1.5*	*2*	...	...	*9*	...	...

Iron and Steel Setting-up Samples (Disc samples – approx. dimensions as below)

SUS No.	Disc Dimensions	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	B	Co	Cu	Nb	Pb	Sn	Ti	V	W
SUS-RE12	40mm dia. x 40mm	*<0.005*	*0.003*	*<0.01*	*<0.005*	*<0.002*	*<0.01*	*<0.005*	*<0.01*	*<0.005*	*<0.001*	*<0.0001*	*0.002*	*<0.01*	*0.002*	*<0.002*	*0.001*	*0.0003*	*<0.001*	*<0.01*
SUS-RG13	40mm dia. x 20mm	*3*	*2*	*1*	*0.3*	*0.05*	*1*	*0.3*	*0.6*	*0.02*	...	...	...	*0.05*	...	...	*0.2*	*0.04*	*0.3*	...
SUS-RG14	"	*3*	*2*	*0.2*	*0.02*	*0.005*	*1*	...	...	*0.02*	...	...	...	*0.05*	...	...	*0.2*	...	*0.1*	...
SUS-RH12	40mm dia. x 40mm	*0.5*	*0.6*	*17*	*(0.01)*	*(0.01)*	*4*	...	...	...	...	...	...	...	...	...	...	...	...	...
SUS-RH18	"	*1.3*	*(0.04)*	*(0.3)*	*(0.01)*	*(0.01)*	*4*	*3.5*	...	...	...	...	...	*10*	...	...	...	...	*3*	*10*
SUS-RH31	"	*0.03*	*0.3*	*1.2*	*(0.01)*	*(0.01)*	*17*	*2*	*20*	...	...	...	...	*2*	*0.3*	*2*	...	...	...	...
SUS-RN13	40mm dia. x 40mm	*1*	*(0.05)*	*1.8*	*(0.005)*	*(0.005)*	*(0.05)*	*(0.01)*	*3*	*0.4*	*(0.002)*	*(0.0005)*	*(0.01)*	*(0.01)*	*(0.005)*	*(0.001)*	*0.05*	*(0.01)*	*(0.01)*	*(0.01)*
SUS-RN14	"	*(0.05)*	*1.8*	*(0.07)*	*0.08*	*0.08*	*3*	*0.5*	*(0.01)*	*(0.01)*	*0.05*	*0.006*	*0.4*	*0.4*	*0.5*	*0.03*	*(0.0005)*	*0.1*	*0.5*	*0.4*
SUS-RN19	"	*1*	*1*	*1.5*	*0.08*	*0.07*	*3*	*1*	*1*	*0.5*	*0.05*	*0.006*	*0.8*	*0.5*	*0.5*	*(0.03)*	*0.1*	*0.1*	*0.5*	*0.5*
SUS-CFE3	40mm dia. x 30mm	*0.04*	*0.4*	*1.7*	*0.3*	*0.002*	*16.7*	*2.0*	*11*	*0.007*	...	*0.005*	*0.21*	*0.09*	*0.77*	...	...	*0.005*	*0.07*	*0.03*
SUS-CFE4	"	*1.7*	*0.4*	*0.4*	*0.01*	*0.01*	*11*	*0.8*	*0.3*	*0.008*	*0.008*	*0.002*	*0.03*	*0.06*	*0.04*	*0.005*	*0.005*	*0.003*	*1*	*0.03*
SUS-CFE5	40mm dia. x 20mm	*4*	*0.3*	*0.3*	*0.1*	*0.03*	*0.1*	*0.1*	*0.1*	*0.1*	...	...	...	*0.1*	...	...	*0.04*	...	*0.1*	...

The above figures are target levels and may vary between batches. Bracketed figures may vary more significantly.

SUS (SUS), Germany

CHEMICAL COMPOSITION (nominal mass content in %) - figures in small italic type only approximate and figures in brackets for information only.

Lead and Lead Alloy Setting-up Samples (Approx. 40mm dia. x 40mm discs)

SUS No.	Pb	Zn	Sn	Cd	As	Cu	Bi	Fe	Ti	Ni	Ag	Sb	Te	Se	S	Al	In	Ca	Cr	Co	Ge	Ba	Mn	Pt	Na	Au	Mg	Pd
SUS-RPB11	99.99	0.0005	0.0005	0.0005	0.0005	0.0002	0.0030	0.0002	0.0003	0.0002	0.0006	0.0003	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
SUS-RPB14	88	<0.003	0.015	0.002	1.2	0.06	0.005	...	0.01	0.001	0.005	10	0.01	0.01	0.01	...	...	...	...	...	...	...	...	...	...	...	...	...
SUS-RPB15	64	0.1	30	0.01	0.02	1.5	0.1	0.005	0.01	0.003	3	2	0.01	0.01	...	...	...	...	...	...	...	...	...	...	...	...	...	...
SUS-RPB16	97	0.001	0.18	...	...	...	...	...	...	...	0.003	...	...	...	...	0.02	...	0.3	...	...	0.01	0.02	...	...	0.01	...	0.0015	...
SUS-RPB17	83	0.001	3.6	...	0.3	1.5	0.1	0.007	0.002	0.001	0.3	9.9	0.003	...	...	...	...	0.01	0.0009	0.001	0.001	...	0.0002	0.001	...	0.001	...	0.0003
SUS-RPB18	90	...	0.03	0.03	7.6	0.06	0.3	...	0.02	...	0.09	1.2	0.03	0.02	...	...	0.01	...	...	...	...	...	...	...	...	...	...	...

Magnesium and Magnesium Alloy Setting-up Samples (Approx. 50mm dia. x 50mm discs)

SUS No.	Mg	Si	Fe	Cu	Mn	Ni	Al	Zn	Pb	Sn	Zr	Cd	Na	Ce	La	Y	Nd	Pr
SUS-RMG11	99.9	<0.01	<0.03	<0.002	0.01	<0.001	0.01	0.01	0.001	0.001	0.001	...	...	...	...	...	...	...
SUS-RMG13	93	0.01	0.001	0.006	0.2	0.001	5.7	0.8	0.001	0.001	0.004	0.0001	0.001	...	...	...	...	...
SUS-RMG14	88	0.8	0.003	0.3	0.4	0.04	7.9	1	0.02	0.08	0.08	<0.01	<0.01	...	...	...	...	...
SUS-RMG16	...	...	0.001	...	...	...	...	...	...	...	0.06	...	...	2.2	1	2.2	1.6	0.26

Nickel and Nickel Alloy Setting-up Samples (Approx. 40mm dia. x 40mm discs)

SUS No.	Ni	C	Si	Mn	P	S	Cr	Fe	Mo	V	Cu	Nb	Co	W	B	Ti	Al	Pb	Zn	Ag
SUS-RNI10	99.99	<0.0008	<0.0010	...	...	<0.0002	...	<0.0005	...	...	<0.0001	...	<0.0003	...	...	...	<0.0004	0.00008	0.0002	0.00003
SUS-RNI11	99.6	(0.03)	(0.1)	(0.25)	...	(0.25)	...	(0.25)	...	...	(0.03)	...	...	...	...	(0.03)	...	...	...	...
SUS-RNI12	65	(0.1)	(0.1)	(0.6)	...	(0.6)	...	(0.6)	...	...	30	...	...	...	...	0.5	2.5	...	...	...
SUS-RNI13	57	(0.02)	(0.05)	(0.5)	(0.01)	(0.5)	16	(0.5)	16	(0.2)	(0.1)	...	(1.5)	3.5	...	...	...	...	...	...
SUS-RNI14	50	0.05	(0.2)	(0.2)	...	(0.2)	20	(0.2)	6	...	(0.03)	...	20	...	(0.0005)	2	0.5	...	...	...
SUS-RNI15	51	0.05	(0.1)	(0.1)	(0.005)	(0.1)	18	(0.1)	3	...	(0.03)	5	(0.5)	...	0.005	1	0.6	...	...	...

Zinc and Zinc Alloy Setting-up Samples (Approx. 40mm dia. x 30mm discs)

SUS No.	Zn	Pb	Sn	Cd	Cu	Fe	Al	Mg	Ti	Ni	Mn	Ag	In	Sb	Tl
SUS-RZN11	99.99	0.0008	<0.0001	<0.0001	0.0003	0.0005	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	...	...	...	...
SUS-RZN13	99	0.6	0.3	0.3	0.3	0.02	0.3	<0.001	<0.001	0.05	<0.001	0.05	0.3	0.2	0.03
SUS-RZN14	85.7	0.03	0.02	0.02	4	0.05	10	0.08	0.1	0.004	0.015	0.007	<0.01	<0.01	...

The above figures are target levels and may vary between batches. Bracketed figures may vary more significantly.

VASIPARI KUTATO ES FEJLESZTO VALLALAT (VASKUT), Hungary

CHEMICAL COMPOSITION (nominal mass content in %) – Figures in bold type certified, figures in small italic type only approximate and figures in brackets for information only.

Unalloyed and Low Alloy Steel Certified Reference Materials (32-35mm dia. x 19mm discs)

VASKUT No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	B	Co	Cu	Nb	Sn	Ti	V	Sb
A11/1	**0.043**	*(1.46)*	**0.21**	**0.011**	**0.0137**	**0.02**	**1.20**	**0.04**	**0.02**	…	…	…	**0.047**	**0.16**	**0.002**	**0.17**	**0.46**	*<0.001*
A12	**0.031**	**1.19**	**0.31**	**0.014**	**0.082**	**1.25**	**0.47**	**2.43**	**0.18**	**0.007**	…	**0.012**	**0.18**	*(0.03)*	…	**0.05**	**0.042**	**0.013**
A13	**0.104**	**0.81**	**0.49**	**0.053**	**0.073**	**0.14**	**0.91**	**1.93**	**0.042**	**0.070**	*(0.002)*	**0.013**	**0.166**	…	**0.060**	**0.11**	**0.23**	**0.024**
A18	**1.16**	**0.15**	*(1.99)*	**0.014**	**0.007**	**0.90**	…	**0.125**	*(0.02)*	**0.003**	*(0.011)*	…	**0.066**	**0.035**	**0.016**	**0.011**	**0.10**	**0.005**

Unalloyed and Low Alloy Steel Certified Reference Materials (All 32-35mm dia. x 19mm discs, except K3-K9 which are 32-35mm dia. x 38mm discs)

VASKUT No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Co	Cu	Nb	Ti	V	W	Zr
B2/1	**0.067**	**0.34**	**1.34**	**0.047**	**0.046**	…	**1.09**	**1.49**	**0.082**	…	**0.24**	…	**0.22**	**0.91**	…	…
B3	**0.20**	**0.53**	**0.14**	*(0.012)*	**0.025**	**5.94**	…	…	…	…	**0.25**	…	…	**1.16**	**1.19**	…
B4	**0.55**	**1.72**	**1.07**	**0.047**	**0.043**	…	…	…	…	…	**0.49**	…	…	…	…	**0.09**
B15	**0.98**	**0.80**	**0.69**	**0.030**	**0.031**	**3.70**	**1.20**	**0.15**	**0.13**	**0.21**	**0.14**	…	**0.32**	**0.33**	…	…
B16	**0.16**	**1.95**	**2.05**	**0.068**	**0.051**	**0.26**	**0.11**	**3.74**	*(0.037)*	…	**0.09**	**0.11**	**0.075**	**0.53**	…	…
K3	**1.03**	**0.32**	**0.46**	*(0.02)*	**0.010**	**1.63**	…	**0.18**	…	…	**0.09**	…	…	…	…	…
K4	**0.52**	**0.46**	**0.84**	*(0.02)*	**0.025**	**1.24**	…	*(0.1)*	…	…	**0.28**	…	…	**0.20**	…	…
K6	**0.51**	**0.30**	**0.79**	*(0.02)*	**0.026**	**0.96**	**0.37**	**1.72**	…	…	**0.26**	…	…	…	…	…
K9	**0.096**	**0.59**	**1.53**	*(0.01)*	**0.018**	**0.64**	**0.56**	**0.97**	*(0.01)*	…	**0.73**	*(0.04)*	**0.11**	**0.27**	…	…

Austenitic Stainless Steel Certified Reference Materials (All 32-35mm dia. x 19mm discs, except K7-K10/C which are 32-35mm dia. x 38mm discs)

VASKUT No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Cu	Nb	Ti	Fe
K7	**0.063**	**0.89**	**1.44**	**0.026**	**0.012**	**17.5**	…	**10.45**	…	**0.20**	…	**0.27**	…
K8	**0.061**	**1.38**	**1.10**	**0.026**	**0.017**	**23.5**	…	…	**1.53**	*(0.18)*	…	…	…
K10/C	**0.13**	**0.88**	**1.77**	**0.022**	**0.020**	**17.5**	**2.98**	**11.2**	…	**0.16**	**0.98**	…	…
S15	**0.043**	**0.26**	**0.38**	*(0.02)*	**0.013**	**16.7**	**2.46**	**3.90**	…	**1.54**	**0.64**	…	*(74.0)*
S19	**0.26**	**2.32**	**0.32**	**0.012**	**0.021**	**7.00**	**0.11**	**12.8**	…	**0.19**	**0.81**	**0.048**	*(76.1)*
S20	**0.097**	**1.80**	**1.50**	**0.011**	**0.025**	**2.06**	**3.15**	**18.2**	…	**0.44**	**1.22**	*(0.01)*	*(71.5)*
S21	**0.37**	**1.26**	**0.19**	**0.017**	**0.021**	**3.99**	**4.12**	**22.3**	…	**0.11**	…	**0.50**	*(67.1)*
S22	**0.014**	**0.61**	**0.34**	**0.009**	**0.008**	**1.00**	**0.82**	**28.2**	…	*(0.02)*	…	**0.13**	*(68.8)*
S25	**0.067**	**1.49**	**1.90**	**0.045**	**0.015**	**15.6**	**1.77**	**13.8**	…	**0.07**	**0.07**	**0.46**	*(64.7)*
S26	**0.076**	**0.67**	**0.99**	**0.027**	**0.026**	**18.9**	**2.59**	**3.31**	…	**0.14**	**0.07**	**0.11**	*(73.1)*

PURCHASE PROCEDURE

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