

ECISS
EUROPEAN COMMITTEE FOR IRON AND STEEL STANDARDISATION
COMITÉ EUROPÉEN DE NORMALISATION DU FER ET DE L'ACIER
EUROPÄISCHES KOMITEE FÜR EISEN-UND STAHLNORMUNG
EUROPEAN CERTIFIED REFERENCE MATERIAL (EURONORM – CRM)

CERTIFICATE OF CHEMICAL ANALYSIS
EURONORM – CRM No. 689-1 Iron ore

LABORATORY MEANS (4 values) - Mass content in %

Line No	Fe	Ca	Mg	Al	Ti	Mn	P	Na	K	V	Ni	Zn	Co	Cu
1	56.844	----	0.9420	1.1150	0.3199	----	----	0.5994	0.4308	0.0983	----	0.0029	0.0090	0.0055
2	56.845	----	0.9424	1.1197	0.3201	0.1126	----	0.6023	0.4384	0.0998	----	0.0030	0.0096	0.0062
3	56.914	1.1074	0.9555	1.1405	0.3216	0.1143	0.0682	0.6058	0.4418	0.1002	----	0.0033	0.0096	0.0062
4	56.957	----	0.9610	1.1581	0.3219	0.1170	0.0687	0.6160	0.4430	0.1008	0.0185	0.0034	0.0097	0.0063
5	----	1.1502	0.9628	1.1646	0.3241	0.1182	0.0690	0.6187	0.4450	0.1008	0.0186	0.0037	0.0098	0.0063
6	57.000	1.1506	0.9675	1.1732	0.3250	0.1183	0.0691	0.6189	0.4455	0.1010	0.0188	0.0038	0.0099	0.0063
7	57.023	1.1615	0.9675	1.1740	0.3263	0.1189	0.0700	0.6222	0.4489	0.1017	0.0188	0.0040	0.0101	0.0064
8	57.036	1.1730	0.9695	1.1784	0.3265	0.1195	0.0703	0.6384	0.4520	0.1019	0.0192	0.0041	0.0101	0.0065
9	57.040	1.1765	0.9756	----	0.3273	0.1195	0.0705	0.6410	0.4547	0.1022	0.0193	0.0042	0.0101	0.0067
10	57.058	1.1785	0.9831	1.1805	0.3278	0.1198	0.0707	0.6433	0.4550	0.1024	0.0194	0.0043	0.0103	0.0068
11	57.087	1.1830	0.9858	1.1819	0.3281	0.1200	0.0713	0.6525	0.4591	0.1024	0.0195	0.0047	0.0103	0.0068
12	57.094	1.1880	0.9886	1.1887	0.3285	0.1201	0.0715	0.6575	0.4593	0.1025	0.0195	0.0050	0.0103	0.0068
13	57.113	1.1924	0.9890	1.1979	0.3296	0.1203	0.0719	0.6575	0.4626	0.1028	0.0197	0.0051	0.0103	0.0069
14	57.138	1.1954	0.9919	1.2110	0.3310	0.1205	0.0720	0.6609	0.4660	0.1031	0.0197	0.0052	0.0105	0.0072
15	57.155	1.1970	0.9950	1.2208	0.3311	0.1210	0.0724	0.6637	0.4733	0.1032	0.0200	0.0053	0.0105	0.0075
16	57.225	1.1988	0.9998	1.2292	0.3338	0.1237	0.0725	0.6698	0.4734	0.1032	0.0201	0.0059	0.0113	0.0075
17	57.279	1.1996	1.0004	1.2317	----	0.1246	----	0.6715	0.4750	0.1035	0.0202	----	0.0115	0.0077
18	----	1.2100	1.0125	1.2325	----	0.1247	----	----	0.4856	0.1035	0.0206	----	0.0119	0.0080
19	----	1.2193	1.0280	1.2328	----	----	----	----	0.4858	0.1040	0.0207	----	----	----
20	----	1.2324	----	----	----	----	----	----	0.4967	----	----	----	----	----
21	----	----	----	----	----	----	----	----	0.5014	----	----	----	----	----
22	----	----	----	----	----	----	----	----	----	----	----	----	----	----
M_M	57.051	1.1832	0.9799	1.1850	0.3264	0.1196	0.0706	0.6376	0.4616	0.1020	0.0195	0.0042	0.0103	0.0068
s_M	0.123	0.0296	0.0228	0.0372	0.0041	0.0032	0.0015	0.0245	0.0195	0.0015	0.0007	0.0009	0.0008	0.0007
s_w	0.084	0.0126	0.0099	0.0155	0.0040	0.0017	0.0015	0.0096	0.0055	0.0013	0.0005	0.0003	0.0003	0.0005

Line No	Si	S	F	Cr	C	Sn	Cl	Gol
1	5.21	----	----	0.0010	0.2343	0.00029	0.0083	----
2	5.22	0.0495	----	<0.0014	0.2367	0.00029	0.0099	1.2766
3	5.22	0.0502	0.0684	0.0031	0.2400	0.00030	0.0128	1.2900
4	5.29	0.0525	0.0691	0.0038	0.2413	0.00031	0.0136	1.3500
5	5.30	0.0552	0.0699	----	0.2428	0.00034	0.0158	1.3552
6	5.32	0.0553	0.0708	----	0.2429	0.00035	0.0184	1.4800
7	5.32	0.0569	----	----	0.2439	0.00038	0.0215	1.4803
8	5.33	0.0575	----	----	0.2500	<0.0004	----	1.4825
9	5.37	0.0577	----	----	0.2535	----	----	1.5054
10	5.39	0.0607	----	----	0.2669	----	----	1.5064
11	5.45	0.0618	----	----	0.2681	----	----	1.5075
12	5.45	0.0634	----	----	----	----	----	1.5536
13	5.49	0.0644	----	----	----	----	----	1.5550
14	5.50	0.0653	----	----	----	----	----	1.5800
15	5.58	----	----	----	----	----	----	1.5975
16	5.60	----	----	----	----	----	----	1.6655
17	5.64	----	----	----	----	----	----	----
18	5.71	----	----	----	----	----	----	----

M_M: Mean of the intralaboratory means

s_M: Standard deviation of the intralaboratory means

s_w: Intralaboratory standard deviation

The laboratory mean values have been examined statistically to eliminate outlying values. Where a "----" appears in the table it indicates that an outlying value has been eliminated by either the Cochran or Grubbs Test. Values reported as "less than" by the participating laboratories have not been taken into account in the statistical calculations.

Values given in italics are for information only.

Additional values from laboratories, for information (in µg/g):

As: 1, B: 2, Be: 2, Cd <0.1, Ce: 32, Ga: 20, Gd: 3, Hf: 1, Hg: <0.01, La: 19, Nb: 2, Nd: 12, Pb: 5, Pr: 4, Rb: 12, Sc: 8, Sm: 2, Sr: 11, Th: 21, Y: 10, Yb: 1, Zr: 22

CERTIFIED VALUES - Mass content in %

	Fe	Ca	Mg	Al	Ti	Mn	P
M_M	57.05	1.183	0.980	1.185	0.3264	0.1196	0.0706
C(95 %)	0.07	0.016	0.011	0.019	0.0022	0.0017	0.0009

	Na	K	V	Ni	Zn	Co	Cu
M_M	0.638	0.462	0.1020	0.0195	0.0042	0.0103	0.0068
C(95 %)	0.013	0.009	0.0008	0.0004	0.0005	0.0004	0.0004

The half-width confidence interval C(95%) = $\frac{t \times s_M}{\sqrt{n}}$ where "t" is the appropriate Student's t value and "n" is the number of acceptable mean values

For further information regarding the confidence interval for the certified value see ISO Guide 35:2006 sections 6.1 and 10.5.2

This certified reference material was prepared in accordance with the recommendations set out in ISO Guides 30 – 35 and issued by:

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Isafjordsgatan 28A, SE 164 40, Kista, Sweden

On behalf of: The Iron and Steel Nomenclature Co-ordinating Committee (COCOR) of the ECISS,
after approval by all the participating laboratories and all the producing organisations.

(France-IRSID/CTIF; Germany-Iron and Steel CRM Working Group: Stahlinstitut VDEh,

BAM Bundesanstalt für Materialforschung und -prüfung & MPI für Eisenforschung;

UK-BAS Ltd; Nordic Countries-Nordic CRM Working Group)



SEPTEMBER 2013

EURONORM – CRM No. 689-1
METHODS USED

Element	Line number	Methods
Fe	1	Titration with Cr (VI) after reduction with Ti (III)
	2.3.4.6.10.14.15.16	Titration with Cr (VI) after reduction with Sn (II)
	7.8.11.12.13.17	XRF
	9	Titration with Mn (VII) after reduction with Sn (II)
Ca	3.5.9.12.16.19.20	ICP-OES
	6.18	FAAS
	7.8	ICP-MS
	10.11.13.14.15.17	XRF
Mg	1.19	ICP-MS
	2.4.10.13.17	XRF
	3.5.8.11.12.14.15.16.18	ICP-OES
	6.7	FAAS
9	Complexometric titration, visual end point	
Al	1.11.18	FAAS, without separation
	2.3.4.5.6.7.13.14	ICP-OES
	8.12.15.16.17.19	XRF
	10	ICP-MS
Ti	1.2.3.4.7.13.14.16	ICP-OES
	5.8.9.10.11.12	XRF
	6	Spectrophotometry, chromotropic acid, without separation
15	ICP-MS	
Mn	2.5.11.14	FAAS
	3.6.8.9.16.17	ICP-OES
	4.7.10.12.15	XRF
	13.18	ICP-MS
P	3	ICP-MS
	4.6.8.9.10.11	XRF
	5.7.12.16	ICP-OES
	13	Spectrophotometry, molybdenum blue, extraction
14.15	Spectrophotometry, phosphovanadomolybdate, extraction	
Na	1.2.3.5.13.15.17	FAAS
	4.6.9.10.11.12.14	ICP-OES
	7	XRF
	8.16	ICP-MS
K	1.3.8.10.11.12.13.16.20	ICP-OES
	2.4.5.15.17.18	FAAS
	6.7	ICP-MS
	9.14.19.21	XRF
V	1.6.7	ICP-MS
	2.3.5.8.9.12.15.17.19	ICP-OES
	4.11	FAAS
	10.13.14.16.18	XRF
Ni	4.5.6.8.10.14.15.16.17	ICP-OES
	7.18.19	XRF
	9.11.13	ICP-MS
	12	FAAS
Zn	1.4.11.12	FAAS
	2.5.6.7.8.9.16	ICP-OES
	3.13	XRF
	10.14.15	ICP-MS
Co	1.5.6.9.11.12.13.14.15.16	ICP-OES
	2.3.4.7	ICP-MS
	8.17.18	XRF
	10	FAAS
Cu	1.4.9.12	ICP-MS
	2.5.6.7.10.11.15.17	ICP-OES
	3.8.14.16	FAAS
	13.18	XRF
Si	1	ICP-MS
	2.7.15	ICP-OES
	3.4.5.13.18	Gravimetry, dehydration with perchloric acid
	6	Gravimetry, dehydration with hydrochloric acid
	8.11.14.16.17	XRF
	9	Gravimetry, dehydration with sulphuric acid
10	FAAS	
12	Spectrophotometry, molybdenum blue, without extraction	
S	2	ICP-MS
	3.5.8.9.11.12.13	Combustion, infrared absorption
	4	Combustion, oxidation reduction titration
	6.10	XRF
7.14	Gravimetry as BaSO ₄ without separation	
F	3.6	Ion chromatography
	4	Spectrophotometry, alizarin, pyrohydrolysis
	5	Titration with La (III), Th (IV) or Ca (II), specific ion electrode end point, without separation

EURONORM – CRM No. 689-1
METHODS USED

Element	Line number	Methods
<i>Cr</i>	1	<i>Electrothermal Atomic Absorption Spectrometry</i>
	2.3.4	<i>X-ray Fluorescence Spectrometry</i>
<i>C</i>	1.3.4.5.6.7.8.9	<i>Combustion, infrared absorption</i>
	2.10	<i>Combustion, gravimetry</i>
	11	<i>Combustion, non-aqueous titration after absorption in organic solvent</i>
<i>Sn</i>	1.2.3.6	<i>ICP-MS</i>
	4.7.8	<i>ICP-OES</i>
	5	<i>ETAAS</i>
<i>Cl</i>	1.6.7	<i>Ion chromatography</i>
	2.3.4	<i>Titration with Ag⁺, potentiometric end point</i>
	5	<i>Titration with Ag⁺, visual end point</i>
<i>Gol</i>	2.3.4.5.6.7.8.9.10.11.12.13.14.15.16	<i>Gravimetry</i>

Abbreviations:

ETAAS	Electrothermal Atomic Absorption Spectrometry
FAAS	Flame Atomic Absorption Spectrometry
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometry
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
XRF	X-ray Fluorescence Spectrometry
Gol	Gain on Ignition

DESCRIPTION OF THE SAMPLE

ECRM 689-1 is available in the form of a powder passing a 250 µm aperture sieve and is supplied in bottles containing 100 g.

INTENDED USE & STABILITY

ECRM 689-1 is intended for the verification of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments in cases where the calibration with primary substances (pure metals or stoichiometric compounds) is not possible and for establishing values for secondary reference materials.

It will remain stable provided that the bottle remains sealed and is stored in a cool, dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the content should become discoloured (e.g. oxidised) due to atmospheric contamination it should be discarded.

TRACEABILITY

The traceability of ECRM 689-1 has been established in accordance with principles of ISO Guides 30 – 35 and the International vocabulary of basic and general terms in metrology.

The characterisation of this material has been achieved by inter-laboratory study, each laboratory using the method of their choice, details of which are given above. These methods are either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds. Most methods used were either international or national standard methods or methods which are technically equivalent.

PARTICIPATING LABORATORIES

AG der Dillinger Hüttenwerke, Dillingen/Saar (Germany)
 ALS Scandinavia AB, Luleå (Sweden)
 ArcelorMittal, Dunkerque (France)
 ArcelorMittal, Florange (France)
 ArcelorMittal Research, Maizières-lès-Metz (France)
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 Corporation Scientifique Claisse, Quebec (Canada)
 CRPG, Vandoeuvre-Les-Nancy (France)
 CSIRO, Urrbrae (Australia)
 Höganäs Sweden AB, Höganäs (Sweden)
 ISD Dunafer, Dunaújváros (Hungary)
 LKAB, Malmberget (Sweden)
 Luxcontrol, Esch sur Alzette (Luxembourg)
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FURTHER INFORMATION

For information regarding the preparation, certification and supply of these European Certified Reference Materials (EURONORM-CRMs) and the use of the statistical information given on this certificate, please refer either to the producer of this Certified Reference Material or to Technical Reports CEN/TR 10317:2013 and CEN/TR 10350:2013, both of which are available from the national standards body in your country. (In the UK this is the BSI, 389 Chiswick High Road, London W4 4AL).

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