

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. 690-1 Haematite Iron Ore

LABORATORY MEANS (4 Values)
 mass content in %

Line No	Fe	Si	Ca	Mg	Al	Ti	Mn	P	Na	K	V
1	66.507	0.8462	0.2546	0.7796	0.1857	0.2184	0.0300	0.0078	0.0242	—	0.1372
2	66.510	0.8537	0.2547	0.7941	0.1893	0.2209	0.0300	0.0078	0.0268	—	0.1374
3	66.526	0.8572	0.2573	0.7952	0.1898	0.2236	0.0304	0.0080	0.0269	0.0131	0.1376
4	66.543	0.8670	0.2574	0.7960	0.1917	0.2242	0.0314	0.0084	0.0291	0.0132	0.1382
5	66.588	0.8683	0.2590	0.7970	0.1919	0.2250	0.0317	0.0084	0.0296	0.0143	0.1387
6	66.618	0.8698	0.2591	0.7976	0.1926	0.2255	0.0327	0.0085	0.0300	0.0150	0.1388
7	66.630	0.8716	0.2662	0.8000	0.1928	0.2258	0.0331	0.0085	0.0300	0.0153	0.1391
8	66.634	0.8781	0.2673	0.8060	0.1946	0.2264	0.0337	0.0086	0.0301	0.0153	0.1397
9	66.683	0.8787	0.2700	0.8076	0.1961	0.2265	0.0338	0.0087	0.0302	0.0159	0.1402
10	66.726	0.8825	0.2716	0.8133	0.1964	0.2272	0.0340	0.0087	0.0307	0.0160	0.1405
11	66.732	0.8863	0.2723	0.8137	0.1995	0.2277	0.0340	0.0088	0.0312	0.0161	0.1410
12	66.742	0.8881	0.2745	0.8207	0.2004	0.2277	0.0346	0.0088	0.0312	0.0162	0.1424
13	66.763	0.8894	0.2751	0.8210	0.2007	0.2284	0.0350	0.0090	0.0312	0.0164	0.1424
14	66.769	0.8926	0.2753	0.8225	0.2017	0.2308	0.0351	0.0090	0.0318	0.0165	0.1427
15	66.790	0.8982	0.2754	0.8267	0.2017	0.2321	0.0352	0.0090	0.0320	0.0167	0.1433
16	66.818	0.9062	0.2764	0.8293	0.2025	0.2325	0.0353	—	0.0325	0.0168	0.1434
17	66.825	0.9091	—	0.8350	0.2050	0.2351	0.0355	—	0.0325	0.0170	0.1438
18	66.825	0.9119	0.2785	0.8440	0.2066	0.2356	0.0356	—	0.0347	0.0172	0.1453
19	66.867	—	0.2789	0.8516	—	0.2358	0.0357	—	0.0353	0.0173	0.1458
20	66.888	—	0.2824	0.8517	0.2125	0.2540	0.0370	—	0.0362	0.0171	0.1471
21	—	—	—	—	0.2131	—	—	—	0.0385	—	0.1507
M_M	66.699	0.8808	0.2687	0.8151	0.1982	0.2292	0.0337	0.0085	0.0312	0.0158	0.1417
<i>S_M</i>	0.123	0.0190	0.0091	0.0203	0.0075	0.0075	0.0021	0.0005	0.0033	0.0013	0.0036
<i>S_W</i>	0.070	0.0088	0.0037	0.0088	0.0053	0.0032	0.0006	0.0005	0.0015	0.0009	0.0018

Line No	Cr	Ni	Co	Cu	Pb	S	Zn	Cl	Sn
1	—	—	0.0077	0.0004	<0.0001	<0.0003	<0.0006	0.0007	0.0003
2	0.0093	0.0191	0.0080	0.0004	0.0001	0.0005	0.0011	0.0008	0.0003
3	0.0098	0.0191	0.0081	0.0005	0.0001	0.0005	0.0011	<0.001	<0.0004
4	0.0100	0.0193	0.0085	0.0005	0.0002	0.0007	0.0012	0.0010	0.0004
5	0.0102	0.0194	0.0087	0.0006	0.0002	0.0009	0.0013	0.0014	0.0004
6	0.0104	0.0196	0.0087	0.0006	0.0002	0.0011	0.0014	0.0015	0.0007
7	0.0110	0.0197	0.0088	0.0006	0.0002	0.0012	0.0014	0.0029	0.0007
8	0.0113	0.0198	0.0088	0.0006	0.0004	0.0014	0.0015	—	0.0008
9	0.0113	0.0198	0.0089	0.0007	<0.0005	0.0034	0.0015	—	0.0009
10	0.0114	0.0198	0.0090	0.0007	<0.0005	0.0039	0.0018	—	0.0010
11	0.0114	0.0199	0.0090	0.0008	0.0014	—	0.0018	—	0.0010
12	0.0117	0.0200	0.0091	0.0008	<0.002	—	0.0021	—	0.0014
13	0.0118	0.0201	0.0092	—	0.0023	—	0.0025	—	<0.005
14	0.0120	0.0201	0.0093	—	—	—	0.0027	—	—
15	0.0120	0.0203	0.0094	—	—	—	0.0027	—	—
16	0.0120	0.0204	0.0095	—	—	—	0.0030	—	—
17	0.0124	0.0205	0.0099	—	—	—	0.0033	—	—
18	0.0133	0.0209	—	—	—	—	—	—	—
19	—	0.0210	—	—	—	—	—	—	—
20	—	0.0213	—	—	—	—	—	—	—
M_M	0.0113	0.0200	0.0089	0.0006					
<i>S_M</i>	0.0011	0.0007	0.0006	0.0002					
<i>S_W</i>	0.0005	0.0005	0.0002	0.0001					

Additional information: As: <0.0009%, Ba: 0.0045%, C: 0.0040%, Fe (II): 0.45%, Mo: 0.0003%; Moisture (H₂O): <0.012%;
 LOI has not been given for information as, although 15 laboratories reported results the values varied from a gain of 0.07% to a loss of 0.1%.

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 given in italics are for information only.

CERTIFIED VALUES
 Mass content in %

	Fe	Si	Ca	Mg	Al	Ti	Mn	P
M_M	66.70	0.881	0.269	0.815	0.198	0.229	0.0337	0.0085
C(95%)	0.06	0.010	0.005	0.010	0.004	0.004	0.0010	0.0003

	Na	K	V	Cr	Ni	Co	Cu
M_M	0.0312	0.0158	0.1417	0.0113	0.0200	0.0089	0.0006
C(95%)	0.0015	0.0007	0.0017	0.0006	0.0003	0.0003	0.0001

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:**

BUREAU OF ANALYSED SAMPLES LIMITED

Newham Hall, Middlesbrough, England TS8 9EA

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 organizations. (France – IRSID/CTIF, Germany – Iron and Steel CRM Working Group: Stahlinstitut VDEH, BAM Bundesanstalt für Materialforschung und prüfung & MPI für Eisenforschung, Nordic Countries – Nordic CRM Working Group, UK – BAS Ltd.)



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**EURONORM – CRM No. 690-1
METHODS USED**

Element	Line Number	Methods
Fe	1-5-7-8-11-12	X-Ray Fluorescence Spectrometry
	2-3-4-6-9-10-13-14-15-16-18-20	Titration with Cr (VI) after reduction with Sn (II)
	17	Titration with Cr (VI) after reduction with Ti (III)
	19	Titration with Mn (VII) after reduction with Sn (II)
Si	1-3	Gravimetry, dehydration with sulphuric acid
	2-4-6-17	Inductively Coupled Plasma-Optical Emission Spectrometry
	5	Inductively Coupled Plasma-Mass Spectrometry
	7-9-12	Gravimetry, dehydration with perchloric acid
	8-11-13-15-16-18	X-Ray Fluorescence Spectrometry
	10 14	Flame Atomic Absorption Spectrometry Spectrophotometry, molybdenum blue, without extraction
Ca	1-2-3-4-5-7-10-14-18-19	Inductively Coupled Plasma-Optical Emission Spectrometry
	6-20	Inductively Coupled Plasma-Mass Spectrometry
	8-11-12-13-15-16	X-Ray Fluorescence Spectrometry
	9	Flame Atomic Absorption Spectrometry
Mg	1-9-13-18-19-20	X-Ray Fluorescence Spectrometry
	2-4	Inductively Coupled Plasma-Mass Spectrometry
	3-5-6-7-8-10-11-12-15-16	Inductively Coupled Plasma-Optical Emission Spectrometry
	14	Flame Atomic Absorption Spectrometry
	17	Complexometric titration, visual end point
Al	1-4-9-10-12-15	X-Ray Fluorescence Spectrometry
	2-17-20	Flame Atomic Absorption Spectrometry
	3-5-6-7-11-13-16-18-21	Inductively Coupled Plasma-Optical Emission Spectrometry
	8-14	Inductively Coupled Plasma-Mass Spectrometry
Ti	1-2-4-6-7-14-15-17-18-19-20	Inductively Coupled Plasma-Optical Emission Spectrometry
	3-9-10-11-13-16	X-Ray Fluorescence Spectrometry
	5-8	Flame Atomic Absorption Spectrometry
	12	Inductively Coupled Plasma-Mass Spectrometry
Mn	1-7-11-12-15-17	X-Ray Fluorescence Spectrometry
	2-10-18	Flame Atomic Absorption Spectrometry
	3-14	Inductively Coupled Plasma-Mass Spectrometry
	4-5-6-8-9-13-16-19-20	Inductively Coupled Plasma-Optical Emission Spectrometry
P	1-3-8-9-12-13	Inductively Coupled Plasma-Optical Emission Spectrometry
	2-5-7-11-15	X-Ray Fluorescence Spectrometry
	4	Spectrophotometry, molybdenum blue, extraction
	6-14 10	Spectrophotometry, phosphovanadomolybdate, extraction Inductively Coupled Plasma-Mass Spectrometry
Na	1-4-6-7-8-12-13-18-21	Inductively Coupled Plasma-Optical Emission Spectrometry
	2-3	X-Ray Fluorescence Spectrometry
	5-9-10-14-15-16-19-20	Flame Atomic Absorption Spectrometry
	11-17	Inductively Coupled Plasma-Mass Spectrometry
K	3-11-14-16-18-19	Inductively Coupled Plasma-Optical Emission Spectrometry
	4-5-12-17	X-Ray Fluorescence Spectrometry
	6-15	Inductively Coupled Plasma-Mass Spectrometry
	7-8-9-10-13	Flame Atomic Absorption Spectrometry
V	1-3-4-5-6-8-9-11-13-15-19-21	Inductively Coupled Plasma-Optical Emission Spectrometry
	2-16-17-18-20	X-Ray Fluorescence Spectrometry
	7	Flame Atomic Absorption Spectrometry
	10-12-14	Inductively Coupled Plasma-Mass Spectrometry
Cr	2-3-4-5-8-12-13-15-16-17	Inductively Coupled Plasma-Optical Emission Spectrometry
	6-7-9-14	X-Ray Fluorescence Spectrometry
	10-11-18	Inductively Coupled Plasma-Mass Spectrometry
Ni	2-4-5-6-10-13-15-16-17-18-20	Inductively Coupled Plasma-Optical Emission Spectrometry
	3-8-14-19	X-Ray Fluorescence Spectrometry
	7-9-11	Inductively Coupled Plasma-Mass Spectrometry
	12	Flame Atomic Absorption Spectrometry

**EURONORM – CRM No. 690-1
METHODS USED**

Element	Line Number	Methods
Co	1-2-5-6-8-9-14-15-16-17	Inductively Coupled Plasma-Optical Emission Spectrometry
	3-7-10-11	Inductively Coupled Plasma-Mass Spectrometry
	4-13	X-Ray Fluorescence Spectrometry
	12	Flame Atomic Absorption Spectrometry
Cu	1-8-9-10	Inductively Coupled Plasma-Optical Emission Spectrometry
	2-5-11-12	Flame Atomic Absorption Spectrometry
	3-4-6-7	Inductively Coupled Plasma-Mass Spectrometry
Pb	1-3-4-5	<i>Inductively Coupled Plasma-Mass Spectrometry</i>
	2-6	<i>Electrothermal Atomic Absorption Spectrometry</i>
	7-8-13	<i>Inductively Coupled Plasma-Optical Emission Spectrometry</i>
	9-11	<i>Flame Atomic Absorption Spectrometry</i>
	10-12	<i>X-Ray Fluorescence Spectrometry</i>
S	1-2-3-6-7-8-9	<i>Combustion, Infrared absorption</i>
	4	<i>Gravimetry as BaSO₄ without separation</i>
	5-10	<i>X-Ray Fluorescence Spectrometry</i>
Zn	1-9-14	<i>X-Ray Fluorescence Spectrometry</i>
	2-3-7-15-17	<i>Inductively Coupled Plasma-Optical Emission Spectrometry</i>
	4-8-11	<i>Inductively Coupled Plasma-Mass Spectrometry</i>
	5-6-10-12-13-16	<i>Flame Atomic Absorption Spectrometry</i>
Cl	1-2	<i>Ion Chromatography</i>
	3	<i>X-Ray Fluorescence Spectrometry</i>
	4-5	<i>Titration with Ag⁺, potentiometric end point</i>
	6	<i>Coulometric titration</i>
	7	<i>Spectrophotometry, ferrithiocyanate</i>
Sn	1-2-4-5	<i>Inductively Coupled Plasma-Mass Spectrometry</i>
	3-7-8-10-11-12	<i>Inductively Coupled Plasma-Optical Emission Spectrometry</i>
	6-13	<i>X-Ray Fluorescence Spectrometry</i>
	9	<i>Electrothermal Atomic Absorption Spectrometry</i>

PARTICIPATING LABORATORIES

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 ArcelorMittal Florange, Florange, France
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 Tata Steel, Scunthorpe, UK
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DESCRIPTION OF THE SAMPLE

The sample is available in the form of a powder passing a nominal 150 µm aperture. It is supplied in bottles containing 100 g.

INTENDED USE & STABILITY

ECRM 690-1 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 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 contents should become discoloured (e.g. oxidised) by atmospheric contamination they should be discarded.

TRACEABILITY

The traceability of ECRM 690-1 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.

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 10317:2009 and CEN/TR 10350:2009, 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).

Further information and advice on this or other Certified Reference Materials or Reference Materials produced by Bureau of Analysed Samples Ltd. may be obtained from the address below.

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