ECISS

EUROPEAN COMMITTEE FOR IRON AND STEEL STANDARDIZATION
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. 088-2 HIGH PURITY IRON

LABORATORY MEANS (4 Values)

mass content in %

Line No.	C*	Si	Mn	P	S	Cr	Ni	Co	Cu	V	Ca	*N*	*Al*	*Mo*
1	0.00026	0.0039	—	0.0040	0.0059	—	—	0.0056	0.0147	0.00015	0.00040	*0.0006*	*0.0002*	*0.0024*
2	0.00032	0.0039	0.0734	0.0042	0.0059	0.0204	0.0245	0.0057	—	0.00015	0.00045	*0.0007*	*0.0002*	*0.0026*
3	0.00032	0.0043	0.0750	0.0043	0.0061	0.0221	0.0254	0.0057	0.0153	0.00020	0.00052	*0.0007*	*0.0003*	*0.0026*
4	0.00035	0.0046	0.0756	0.0044	0.0061	0.0228	0.0261	0.0057	0.0155	0.00028	0.00060	*0.0008*	*0.0003*	*0.0026*
5	0.00040	0.0047	0.0762	0.0044	0.0063	0.0231	0.0262	0.0058	0.0156	0.00028	0.00060	*0.0008*	*0.0003*	
6	0.00043	0.0050	0.0767	0.0044	0.0067	0.0231	0.0265	0.0058	0.0158	0.00030	0.00062	*0.0009*	*0.0003*	
7	0.00052	0.0050	0.0783	0.0045	0.0067	0.0234	0.0267	0.0060	0.0160	0.00030	0.00065	*0.0009*	*0.0004*	
8	0.00068	0.0051	0.0783	0.0045	0.0069	0.0235	0.0270	0.0060	0.0163	0.00030	0.00068	*0.0010*	*0.0004*	
9	0.00075	0.0051	0.0803	0.0045	0.0070	0.0236	0.0271	0.0061	0.0164	0.00030	0.00068	*0.0010*	*0.0005*	
10	0.00075	0.0055	0.0806	0.0045	0.0071	0.0237	0.0271	0.0061	0.0164	0.00030	0.00072	*0.0010*	*0.0005*	
11	0.00076	0.0056	0.0811	0.0047	0.0071	0.0239	0.0274	0.0061	0.0165	0.00031	0.00075	*0.0010*	*0.0009*	
12	0.00077	0.0060	0.0815	0.0047	0.0072	0.0240	0.0275	0.0061	0.0165	0.00032	0.00078	*0.0011*	*0.0009*	
13	0.00085	0.0061	0.0821	0.0047	0.0074	0.0240	0.0276	0.0061	0.0165	0.00040	0.00080	*0.0011*	*0.0009*	
14	0.00102	0.0066	0.0825	0.0047	0.0075	0.0248	0.0277	0.0062	0.0165	0.00045	0.00080	*0.0011*	*0.0011*	
15	—	0.0069	0.0827	0.0048	0.0076	0.0253	0.0280	0.0062	0.0165		0.00080	*0.0011*	*0.0011*	
16	0.00103		0.0829	0.0048	0.0076	0.0256	0.0280	0.0062	0.0166		0.00088	*0.0011*		
17	—		0.0832	0.0049	0.0076	0.0256	0.0280	0.0062	0.0166		0.00090	*0.0012*		
18			0.0834	0.0050	0.0076	0.0262	—	0.0063	0.0166		0.00090	*0.0014*		
19			0.0843	0.0051	0.0077	0.0269	0.0285	0.0063	0.0167		0.00090	*0.0014*		
20			0.0843	0.0053	0.0081	0.0269	0.0294	0.0063	0.0167		0.00095	*0.0016*		
21			0.0852	0.0055		0.0269	0.0296	0.0064	0.0168		—			
22			0.0854	0.0056		0.0272	0.0296	0.0064	0.0170		—			
23			0.0861	0.0059			0.0297	0.0064	0.0178					
M_M	**0.00062**	**0.0052**	**0.0809**	**0.0048**	**0.0070**	**0.0244**	**0.0276**	**0.0061**	**0.0163**	**0.00029**	**0.00072**			
s_M	0.00026	0.0009	0.0037	0.0005	0.0007	0.0018	0.0014	0.0003	0.0007	0.00008	0.00016			
s_W	0.00011	0.0003	0.0006	0.0002	0.0002	0.0005	0.0004	0.0001	0.0003	0.00004	0.00007			

M_M: Mean of the intralaboratory means, s_M: Standard deviation of the intralaboratory means
s_W: Intralaboratory standard deviation, s_b: Interlaboratory standard deviation,

The laboratory mean values have been examined statistically to eliminate outlying values. Where a "—" appears in the it indicates that an outlying value has been omitted by either the Cochran or Grubbs Test.

$$s_M = \sqrt{{s_b}^2 + {s_w}^2/4}$$

Values given above in italic type are for information only

CERTIFIED VALUES
mass content in %

	C*	Si	Mn	P	S	Cr	Ni	Co	Cu	V	Ca
M_M	**0.0006**	**0.0052**	**0.0809**	**0.0048**	**0.0070**	**0.0244**	**0.0275**	**0.0061**	**0.0163**	**0.00029**	**0.00072**
C(95%)	0.0002	0.0005	0.0017	0.0002	0.0004	0.0008	0.0007	0.0002	0.0003	0.00005	0.00008

IMPORTANT NOTE

*The ECRM Producers are aware that the determination of low carbon contents should preferably be carried out on compact samples (after pre-treatment). In this special case, the powdered sample ECRM 088-2, satisfactory carbon values have been obtained after pre-heating at 420°C ± 10°C in air for 5-10 minutes in accordance with ISO 15349-2. Determination of low carbon in unalloyed steels by HF/IR. See further information under "Methods Used" for carbon.

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 35:1989 section 4

This reference material was prepared 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: VDEh, BAM & MPI für Eisenforschung, Nordic Countries – Nordic CRM Working Group, UK – BAS Ltd.)

NOVEMBER 2024

Revised from January 2001 Version, with corrected value for s_M for vanadium

METHODS USED
EURONORM – CRM NO. 088-2

Element	Line Number	Methods
C	1-2-3-4-5-6-7-8-9-10-11-12-13-16	High Frequency combustion infrared absorption
	14	Combustion, non-aqueous titration

NOTE: Extensive work has shown that this finely divided material adsorbs carbon on the surface but this can be removed by pre-heating in air immediately before combustion. (This may be carried out in a muffle furnace with thermostatic temperature control.). It is therefore vitally important to carry out this pre-treatment of the sample.

Si	1-2-3-4-5-6-7-9-11	ICP-OES
	8-10	Photometric as molybdenum blue with extraction
	12-13	Photometric as molybdenum blue without extraction
	14	Gravimetric, dehydration with perchloric acid
	15	FAAS
Mn	2-6-8-10-11-12-13-14-15-17-20-21-22-23	ICP-OES
	3-4-5-7-16-18	FAAS
	9-19	Photometric, oxidation with periodate
P	1-11-12-19-20	Photometric as phosphovanadomolybdate with extraction
	2-3-10-13-15-22-23	Photometric as molybdenum blue without extraction
	4-5-6-7-8-14-16-17-18-21	ICP-OES
	9	ICP-MS
S	1	Gravimetric as $BaSO_4$, after chromatographic separation on alumina
	2-3-4-5-6-7-9-10-11-12-13-14-15-16-17-18-19-20	High frequency combustion, infrared absorption
	8	Coulometric titration
Cr	2-3-7-13-14-19-20-21-22	FAAS
	4-5-6-8-9-10-11-12-15-16-17-18	ICP-OES
Ni	2-3-4-9-13-14-21	FAAS
	5-6-7-8-11-12-15-16-17-19-20-22-23	ICP-OES
	10	Photometric with dimethylglyoxime with extraction
Co	1-2-3-6-7-8-9-10-12-13-14-15-16-20	ICP-OES
	4-11-19-21-22-23	FAAS
	5-17-18	ICP-MS
Cu	1-4-5-7-10-18-19-21	FAAS
	3-6-8-9-13-14-15-16-17-20-22-23	ICP-OES
	11	ICP-MS
	12	Photometric with diethyldithiocarbamate with extraction
V	1-2-3-5-6-7-8-11-12-14	ICP-OES
	4	FAAS
	9-10-13	ICP-MS
Ca	1-3-4-5-6-7-14-15-16	FAAS
	2-8-9-10-11-12-13-17-18-19-20	ICP-OES
N	*1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-17-18-19-20*	*Thermal conductivity, decomposition in graphite crucible*
	16	*Photometric with indophenol blue after distillation*
Al	*1-4-5-6-9-10-11-12-15*	*ICP-OES*
	2-3-13-14	*FAAS*
	7	*ICP-MS*
	8	*Photometric with chrome azural S, ion exchange separation*
Mo	*1-2*	*ICP-OES*
	3	*ICP-MS*
	4	*FAAS*

Abbreviations:

FAAS:	Flame Atomic Absorption Spectrometry
ICP-MS:	Inductively Coupled Plasma-Mass Spectrometry
ICP-OES:	Inductively Coupled Plasma-Optical Emission Spectrometry

EURONORM – CRM No. 088-2

PARTICIPATING LABORATORIES

AB Sandvik Steel, Sandviken (Sweden)
Acerinox S.A. Algeciras (Spain)
Ascometal Usine de Fos, Fos-sur Mer (France)
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Böhler Edelstahl GmbH & Co. KG, Kapfenberg (Austria)
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IRSID, Maizières-lès-Metz (France)
Keighley Laboratories Ltd., Keighley (UK)
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Ridsdale & Co Ltd., Middlesbrough (UK)
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SOLLAC, Florange, (France)
SOLLAC, Fos-sur-Mer (France)
Swedish Institute for Metals Research (SIMR), Stockholm (Sweden)
Thyssen Krupp Stahl AG, Dortmund (Germany)
Voest-Alpine Stahl GmbH, Linz (Austria)

DESCRIPTION OF SAMPLE

This sample is available in the form of a powder passing a 180µm aperture sieve from which the dust passing a 53µm aperture sieve has been removed. It is supplied in bottles containing 100g.

INTENDED USE & STABILITY

The sample 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 contents should become discoloured (e.g. oxidised) by atmospheric contamination they should be discarded.

TRACEABILITY

The traceability of this ECRM is ensured by the use of either stoichiometric analytical techniques or methods which are calibrated against pure stoichiometric metals or compounds.

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 to Information Circulars No. 1 (ECISS) and No. 5 (ECSC), 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).

Des informations complémentaires sur la fabrication, la certification et la distribution des Matériaux de Référence Certifiés Européens (EURONORM-MRC) ainsi que sur l'utilisation des informations statistiques données sur le certificat se trouvent dans les circulaires d'information No. 1 (ECISS) et No. 5 (CECA). On peut se procurer ces deux circulaires auprès des organismes nationaux de normalisations. (Pour la France: AFNOR, 11 Avenue Francis de Pressensé, 93571 – St Denis la Plaine Cedex).

Angaben über Herstellung, Zertifizierung und Bezugsmöglichkeiten dieser Europäischen Zertifizierten Referenzmaterialien (EURONORM-ZRM) sowie über die Anwendungen der in diesem Zertifikat enthaltenen statistischen Daten finden sich in den Mittellungen Nr, 1 (ECISS) und Nr. 5 (EGKS), beide zu beziehen durch die nationalen Normenorganisationen. (In Deutschland bei der Vertriebsstelle des DIN: Beuth-Verlag GmbH, Burggrafenstrasse 4-10, 10787 Berlin).

För information angående tillverkning, certifiering och anskaffning av dessa europeiska certifierade referensmaterial (EURONORM CRM) och för användning av statistisk information, som angivits i detta certifikat, refereras till informationscirkulär Nr. 1 (ECISS) och Nr 5 (ECSC) från den nationella standardiseringsorganisationen. (I Sverige är det SIS, S:t Paulsgatan 6, SE-118 80 Stockholm, i Finland är det SFS, PL. 116, FIN-002 41, Helsinki, i Danmark är det DS, Kollegievej 6, DK-Charlottenlund 2920, i Norge är det NSF, Drammensveien, 145 A, Postboks 353 Skøyen, NO-0213 Oslo, pä Island är det STRI, Holtagardar, IS-104 Reykjavik).