

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. 035-2 (1,3 % Carbon Steel)

LABORATORY MEANS (4 values)
mass content in %

No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Al (acid sol.)	As	Cu	N	Ti
1	1,2622	0,2015	0,2973	0,0029	0,0097	0,0093	0,0050	0,0176	0,0182	0,0169	0,0012	0,0077	0,0219	0,0027
2	1,2625	0,2077	0,3002	0,0029	0,0100	0,0096	0,0052	0,0179	0,0182	0,0169	0,0014	0,0080	0,0221	0,0027
3	1,2673	0,2101	0,3008	0,0032	0,0106	0,0100	0,0053	0,0181	0,0184	0,0170	0,0015	0,0080	0,0222	0,0028
4	1,2678	0,2103	0,3010	0,0033	0,0107	0,0103	0,0054	0,0183	0,0186	0,0172	0,0015	0,0080	0,0226	0,0028
5	1,2681	0,2108	0,3023	0,0033	0,0109	0,0103	0,0055	0,0186	0,0186	0,0172	0,0015	0,0082	0,0226	0,0028
6	1,2738	0,2127	0,3026	0,0034	0,0109	0,0103	0,0055	0,0187	0,0187	0,0172	0,0016	0,0082	0,0228	0,0029
7	1,2742	0,2130	0,3035	0,0038	0,0109	0,0104	0,0055	0,0188	0,0188	0,0172	0,0016	0,0083	0,0230	0,0029
8	1,2742	0,2131	0,3035	0,0038	0,0110	0,0104	0,0056	0,0188	0,0192	0,0173	0,0016	0,0083	0,0232	0,0029
9	1,2763	0,2155	0,3035	0,0039	0,0111	0,0105	0,0056	0,0188	0,0193	0,0173	0,0017	0,0083	0,0234	0,0030
10	1,2774	0,2163	0,3041	0,0040	0,0112	0,0105	0,0056	0,0188	0,0193	0,0173	0,0017	0,0083	0,0236	0,0030
11	1,2789	0,2194	0,3043	0,0040	0,0114	0,0106	0,0057	0,0190	0,0195	0,0174	0,0017	0,0084	0,0236	0,0030
12	1,2795	0,2196	0,3046	0,0041	0,0114	0,0107	0,0060	0,0190	0,0196	0,0179	0,0017	0,0085	0,0236	0,0030
13	1,2828	0,2196	0,3064	0,0043	0,0116	0,0108	0,0061	0,0193	0,0199	0,0180	0,0020	0,0087	0,0236	0,0031
14	1,2836	0,2202	0,3065	0,0043	0,0117	0,0108	-----	0,0198	0,0200	0,0182	0,0021	0,0087	0,0237	0,0032
15	1,2841	0,2205	0,3066	0,0044	0,0117	0,0109	0,0064	0,0199	0,0203	0,0183	0,0021	0,0088	-----	0,0032
16	1,2844	0,2213	0,3070	0,0047	0,0119	0,0110	0,0064	0,0201	-----	0,0190		0,0089		0,0034
17	1,2845	0,2259	0,3087	0,0049	0,0121	0,0112		0,0203	0,0203	0,0192		0,0090		0,0036
18	1,2966	0,2289	0,3102			-----		0,0204	0,0216	0,0194		0,0092		
19			0,3118									0,0098		
20			0,3160									-----		
M_M	1,2766	0,2159	0,3050	0,0038	0,0111	0,0104	0,0056	0,0190	0,0193	0,0177	0,0017	0,0085	0,0230	0,0030
S_M	0,0089	0,0067	0,0043	0,0006	0,0006	0,0005	0,0004	0,0008	0,0009	0,0008	0,0003	0,0005	0,0006	0,0002
S_b														
S_w	0,0073	0,0023	0,0021	0,0002	0,0002	0,0002	0,0001	0,0004	0,0004	0,0003	0,0001	0,0001	0,0002	0,0001

M_M : Mean of the laboratory means
S_M : Standard deviation of the laboratory means
S_b : Interlaboratory standard deviation
S_w : Intralaboratory standard deviation

$$S_M = \sqrt{S_b^2 + \frac{S_w^2}{4}}$$

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 omitted by either the Cochran or Grubbs test.

CERTIFIED VALUES

mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	Al	Al (acid sol.)	As	Cu	N	Ti
M_M	1,277	0,216	0,305	0,0038	0,0111	0,0104	0,0056	0,0190	0,0193	0,0177	0,0017	0,0085	0,0230	0,0030
C(95%)	0,005	0,004	0,002	0,0003	0,0003	0,0003	0,0002	0,0004	0,0005	0,0004	0,0001	0,0002	0,0004	0,0001

C(95%) is the half-width confidence interval where t is the appropriate Student's t value and n is the number of acceptable laboratory means. For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.

$$C(95\%) = \frac{t \cdot s_M}{\sqrt{n}}$$

Düsseldorf, April 1998
(Engl. version June 2001)

DESCRIPTION OF THE SAMPLE

The particle size of the sample material is < 0,400 mm. The material is supplied in glass bottles containing 100 g. It is also supplied in the form of 38 mm dia discs (20 mm thick).

This reference material was prepared and issued by the German Iron and Steel CRM Working Group on behalf of the Iron and Steel Nomenclature Co-ordinating Committee (COCOR) of the European Committee for Iron and Steel Standardization (ECISS).

The German Iron and Steel CRM Working Group is composed of

Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin,
Max-Planck-Institut für Eisenforschung GmbH (MPI), Düsseldorf,
Verein Deutscher Eisenhüttenleute VDEh (Committee of Chemists), Düsseldorf (management)

The certification was carried out by the association of European Certified Reference Material Producers (EURONORM-CRM) after approval of its members: Institut de Recherches de la Sidérurgie Française (IRSID), Centre Technique des Industries de la Fonderie (CTIF), France, Bureau of Analysed Samples Ltd. (BAS), UK and the above mentioned German Iron and Steel CRM Working Group and all participating laboratories.

Sale of the reference material: Bundesanstalt für Materialforschung und -prüfung (BAM), Unter den Eichen 87, 12205 Berlin.

INTENDED USE & STABILITY

The chip sample ECRM 035-2 (C) 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 stoichiometric metals or 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 and dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the contents should become discoloured (eg. oxidised) due to atmospheric contamination they should be discarded.

The disc sample ECRM 035-2 (D) is intended for establishing and checking the calibration of Optical Emission and X-Ray Spectrometers for the analysis of samples of similar materials.

The "as received" working surface of the sample should be finished before use to remove any protective coating.

It will remain stable provided that it is not subjected to excessive heat (eg, during preparation of the working surface).

TRACEABILITY

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

PARTICIPATING LABORATORIES

AG der Dillinger Hüttenwerke, Dillingen/Saar (Germany)
Ascometal, Usine des Fos, Fos-sur-Mer (France)
Böhler Edelstahl GmbH, Kapfenberg (Austria)
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany)
CTIF, Centre Technique des Industries de la Fonderie, Sèvres (France)
CRM, Centre de Recherches Métallurgiques, Liège (Belgium)
Hoogovens Staal BV, IJmuiden (Netherlands)
Inspectorate Griffith Ltd., Witham (UK)
Institut für Gießereitechnik GmbH, Düsseldorf (Germany)
Luxcontrol S.A., Esch-sur-Alzette (Luxembourg)
Materialprüfungsamt Nordrhein-Westfalen (MPA NRW), Dortmund (Germany)
Max-Planck Institut für Eisenforschung GmbH, Düsseldorf (Germany)
Preussag Stahl AG, Salzgitter (Germany)
Ridsdale & Co. Ltd., Middlesbrough (UK)
Sollac, Florange (France)
Sollac, Fos-sur-Mer (France)
Sollac, Usine de Dunkerque, Dunkerque (France)
Thyssen Krupp Stahl AG, Dortmund (Germany)
Thyssen Krupp Stahl AG, Duisburg (Germany)
Voest Alpine Stahl Linz GmbH, Linz (Austria)

METHODS USED

Element	Line number	Methods
C	1, 2, 5, 7, 8, 9, 11, 12, 13, 14, 16, 17, 18 3, 10 4 6, 15	Combustion, infrared absorption Combustion, conductimetry Combustion, coulometric titration Titration, acidimetric after absorption in organic solution
Si	1, 3, 5, 7, 10 2, 8, 11, 14, 15, 16, 17, 18 4, 12, 13 6 9	Gravimetric, dehydration with perchloric acid ICP-OES Photometric as molybdenum blue, without extraction FAAS Photometric as silicovanadomolybdate, without extraction
Mn	1, 4, 6, 20 2, 3, 5, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17 11, 18, 19	Photometric, periodate oxidation ICP-OES FAAS
P	1, 2, 3, 4, 5, 6, 7, 8, 14, 16 9, 12, 13, 15 10, 11, 17	ICP-OES Photometric as phosphovanadomolybdate, extraction Photometric as molybdenum blue, without extraction
S	1 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17 5, 10	Gravimetric as BaSO ₄ , after chromatographic separation on alumina Combustion, infrared absorption Combustion, conductimetry
Cr	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 16 2, 14, 15 10 17	ICP-OES FAAS ICP-MS ETAAS
Mo	1, 2, 3, 4, 5, 6, 8, 9, 11, 13, 15 7 10 12, 16	ICP-OES ICP-MS FAAS Photometric with thiocyanate in presence of Sn(II), extraction
Ni	1, 2, 4, 5, 6 7, 9, 13, 14, 16, 17 3 8, 11, 12, 15, 18 10	ICP-OES Photometric with diacetyldioxime, extraction FAAS ICP-MS
Al	1, 3, 5, 7, 9 10, 14, 15 2 4, 6, 8, 11, 12 13, 17, 18	ICP-OES ET AAS FAAS, without separation
Al (acid sol.)	1, 3, 5, 7, 8 10, 12, 14, 15 2, 4, 6, 9, 11, 16, 17, 18 13	ICP-OES FAAS, without separation ET AAS
As	1, 3, 4, 9, 10, 11, 14, 15 2 5, 8, 12 6 7 13	ICP-OES Photometric with DDC, separation as AsH ₃ ET AAS ICP-MS Photometric as molybdenum blue, extraction as halide AAS, separation as AsH ₃

Element	Line number	Methods
Cu	1, 3, 4, 5, 6,	ICP-OES
	8, 11, 12, 14, 19	
	2, 7, 9, 13, 15,	FAAS
	17, 18	
	10	ICP-MS
N	16	ETAAS
	1, 2, 3, 4, 5,	Measurement of heat conductivity, melting in a graphite crucible
	6, 8, 9, 10, 11,	
	12, 13, 14	
	7	Titration, acidimetric after distillation, visual detection
Ti	1, 2, 3, 4, 5,	ICP-OES
	6, 7, 8, 9, 11, 12,	
	14, 15, 16	
	9, 10	Photometric with diantipyrylmethane
	13	ICP-MS
	17	Photometric with chromotropic acid, without separation

Abbreviations:

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

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 de normalisation (pour la France: AFNOR, Tour Europe, Cedex 7, 92080 Paris La Défense).

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 Mitteilungen 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 distribuering av dessa europeiska certifierade referensmaterial (EURONORM-CRM) och för användning av statistik information, som angivits i detta certifikat, refereras till informationscirkulär Nr 1 (ECISS) och Nr 5 (ECSC) från de nationella standardiseringsorganisationerna. (I Sverige är det SIS, Box 6455, SE-113 82 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, på Island är det STRI, Holtagardar, IS-104 Reykjavik).