

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. 451-2 AUSTENITIC CAST IRON

LABORATORY MEANS (4 Values)
mass content in %

Line No.	C	Si	Mn	P	S	Cr	Ni	Cu
1	2.0288	2.0713	1.0567	0.0553	—	1.0543	—	6.1714
2	2.0348	2.0761	1.0574	0.0565	0.0292	1.0671	13.8623	6.2147
3	2.0352	2.0798	1.0579	0.0565	0.0298	1.0737	13.8850	6.2200
4	2.0405	2.0800	1.0630	0.0568	0.0299	1.0785	13.9125	6.2248
5	2.0479	2.0807	1.0636	0.0573	0.0299	1.0803	13.9365	6.2310
6	2.0500	2.0808	1.0650	0.0580	0.0301	1.0888	13.9440	6.2341
7	2.0510	2.0825	1.0693	0.0580	0.0302	1.0901	13.9746	6.2353
8	2.0525	2.0831	1.0720	0.0582	0.0303	1.0911	13.9800	6.2375
9	2.0531	2.0856	1.0725	0.0582	0.0304	1.0960	13.9905	6.2487
10	2.0545	2.0863	1.0729	0.0587	0.0307	1.0968	14.0099	6.2625
11	2.0610	2.0880	1.0734	0.0587	0.0310	1.0978	14.0328	6.2708
12	2.0664	2.0890	1.0748	0.0587	0.0315	1.0978	14.0364	6.2712
13	2.0666	2.0910	1.0803	0.0591	0.0318	—	14.0457	6.2758
14	2.0678	2.0944	1.0816	0.0599	0.0322	1.0999	14.0470	6.2825
15	2.0685	2.0954	1.0840	0.0600	0.0327	1.1053	14.0475	6.2969
16	2.0695	2.1000	1.0882	0.0606	0.0327	1.1164	14.0675	6.3105
17	2.0735	2.1022	1.0892	0.0611	0.0328	1.1170	14.0700	6.3218
18	2.0761	2.1038	1.0915	0.0627	0.0338	1.1173	14.0774	6.3268
19	2.0775	2.1084	1.0997	0.0633	0.0346	1.1179	14.0854	6.3275
20	2.0790	—	1.1040	0.0635	0.0351	1.1186	14.0988	—
21	2.0855	2.1202	1.1050	0.0646	—	1.1375	14.1573	—
22	—	2.1244	1.1168	—	—	—	—	—
M_M	2.0590	2.0916	1.0790	0.0593	0.0315	1.0971	14.0131	6.2613
s_M	0.0160	0.0140	0.0168	0.0025	0.0017	0.0203	0.0764	0.0430
s_W	0.0068	0.0106	0.0070	0.0010	0.0007	0.0095	0.0395	0.0243

M_M : Mean of the laboratory means s_M : Standard deviation of the laboratory means

s_W : Intralaboratory standard deviation s_b : Interlaboratory standard deviation

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

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	Ni	Cu
M_M	2.059	2.092	1.079	0.0593	0.0315	1.097	14.01	6.26
C(95%)	0.007	0.007	0.008	0.0011	0.0008	0.010	0.04	0.02

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.



Certificate No. Q3993

This reference material was prepared and issued by:

BUREAU OF ANALYSED SAMPLES LIMITED

Newham Hall, Middlesbrough, England

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.)

JANUARY 1999

PARTICIPATING LABORATORIES

AB Sandvik Steel, Sandviken (Sweden)	Force Institutet, Copenhagen (Denmark)
Acerinox S.A., Algeciras (Spain)	Hoogovens Staal BV, IJmuiden (Netherlands)
AG der Dillinger Hüttenwerke, Dillingen-Saar (Germany)	Institutet för Metallforskning, Stockholm (Sweden)
Aubert et Duval, Les Ancizes (France)	Luxcontrol S.A., Esch-sur-Alzette (Luxembourg)
Böhler Edelstahl GmbH, Kapfenberg (Austria)	Materialprüfungsamt Nordrhein-Westfalen (MPA-NRW), Dortmund (Germany)
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany)	Max Planck Institut für Eisenforschung GmbH, Dusseldorf (Germany)
Castings Development Centre, Birmingham (UK)	Ridsdale & Co. Ltd., Middlesbrough (UK)
Centro Nacional de Investigaciones Metalúrgicas (CENIM), Madrid (Spain)	Stahlwerke Bremen GmbH, Bremen (Germany)
Centre de Recherches de Madières - DDPP, Pont-à-Mousson (France)	Weir Pumps Ltd., Glasgow (UK)
Cockerill Sambre, Couillet (Belgium)	Voest-Alpine Stahl Linz GmbH, Linz (Austria)
Centre Technique des Industries de la Fonderie (CTIF), Charleville (France)	
Centre Technique des Industries de la Fonderie (CTIF), Sèvres (France)	

DESCRIPTION OF THE SAMPLE

This sample is available in the form of chips passing a 710µm aperture sieve from which the fines passing a 180µm aperture sieve have been removed. It is supplied in bottles containing 100g. N.B. a significant proportion of the carbon content is in the graphitic form.

INTENDED USE & STABILITY

This ECRM 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, 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.

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.

METHODS USED EURONORM – CRM No. 451-2

Element	Line Number	Methods
C	1-2-3-4-6-8-10-12-14-15-16-17-18-19-20-21	Combustion, infrared absorption
	5	Coulometric titration
	7-9	Combustion, conductimetry
	11-13	Combustion, non-aqueous titration
Si	1-2-3-5-6-7-9-10-13-16-18-19-21	Gravimetric, dehydration with perchloric acid
	4-8-11	Photometric as molybdenum blue, without extraction
	12	Gravimetric, dehydration with hydrochloric acid in presence of gelatine
	14-15-17	Inductively Coupled Plasma-Optical Emission Spectrometry
	22	Gravimetric, dehydration with hydrochloric acid
Mn	1-3-4-6-15-19	Photometric, periodate oxidation
	2-5-7-13-16-21-22	Inductively Coupled Plasma-Optical Emission Spectrometry
	8-9-10-11-12-14-17-18	Flame Atomic Absorption Spectrometry
	20	Photometric, persulphate oxidation
P	1-5-10-12-14-15-17	Photometric as phosphovanadomolybdate, with extraction
	2-4-16-18	Photometric as molybdenum blue, without extraction
	3-6-9-13-19-21	Inductively Coupled Plasma-Optical Emission Spectrometry
	7	Acidimetric titration of ammonium phosphomolybdate
	8-11	Photometric as molybdenum blue, with extraction
S	20	Inductively Coupled Plasma-Mass Spectrometry
	2-3-4-5-7-8-9-10-11-12-13-15-16-20	Combustion, infrared absorption
	6	Photometric as methylene blue, separation as hydrogen sulphide
	14	Inductively Coupled Plasma-Optical Emission Spectrometry
	17	Combustion, oxidation reduction titration
Cr	18	Gravimetric as barium sulphate, without separation
	19	Combustion, conductimetry
	1-2-8-16-17	Flame Atomic Absorption Spectrometry
	3-5-7-9-11-15-19-20-21	Inductively Coupled Plasma-Optical Emission Spectrometry
	4-6-12-14-18	Titration with Fe(II), oxidation with persulphate
Ni	10	Titration with Fe(II), oxidation with perchloric acid
	2-3-6-7-9-14-16-17-19	Gravimetric, dimethylglyoxime
	4-5-10-12-20	Inductively Coupled Plasma-Optical Emission Spectrometry
	8-21	Photometric, dimethylglyoxime, without extraction
	11-15	Complexometric titration
Cu	13	Photometric, dimethylglyoxime, with extraction
	18	Titration with dichromate, separation with dimethylglyoxime
	1-3-11-12-13-15-19	Inductively Coupled Plasma-Optical Emission Spectrometry
	2-6-7-8-9-10-14-16-17	Flame Atomic Absorption Spectrometry
	4	Photometric with oxalyldihydrazide
	5	Electrogravimetry
	18	Photometric, dibenzoyldithiocarbamate

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 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).