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. 272-1 12% CHROMIUM STEEL

LABORATORY MEANS (4 Values)
mass content in %

Line No	C	Si	Mn	P	S	Cr	Mo	Ni	Al (Tot)	As	B
1	0.2774	0.4040	0.5877	0.0134	0.0185	11.8440	0.0021	0.2322	—	—	0.0012
2	0.2790	0.4043	0.5886	0.0141	0.0186	11.8625	0.0021	0.2368	0.0039	0.0107	0.0013
3	0.2790	0.4061	0.5900	—	0.0186	11.8700	0.0025	0.2371	0.0039	0.0109	0.0015
4	0.2790	0.4120	0.5925	0.0150	0.0189	11.8723	0.0026	0.2374	0.0040	0.0109	0.0015
5	0.2796	0.4122	0.5941	0.0151	0.0192	11.8729	0.0026	0.2376	0.0041	0.0110	0.0017
6	0.2800	0.4173	0.5946	0.0152	0.0193	11.8829	0.0027	0.2386	0.0042	0.0111	0.0017
7	0.2805	0.4184	0.5955	0.0153	0.0195	11.8857	0.0028	0.2390	0.0042	0.0112	0.0018
8	0.2807	0.4200	0.5969	0.0153	0.0195	11.9086	0.0028	0.2437	0.0045	0.0112	0.0018
9	0.2809	0.4203	0.5969	0.0153	0.0196	11.9277	0.0028	0.2438	0.0047	0.0115	0.0018
10	0.2810	0.4208	0.5985	0.0154	0.0197	11.9300	0.0029	0.2441	0.0048	0.0116	0.0018
11	0.2814	0.4208	0.6003	0.0154	0.0197	11.9305	0.0030	0.2451	—	0.0116	0.0019
12	0.2815	0.4209	0.6024	0.0155	0.0198	11.9432	0.0030	0.2461	0.0050	0.0117	0.0019
13	0.2815	0.4219	0.6028	0.0155	0.0199	11.9450	0.0031	0.2473	0.0050	0.0119	0.0020
14	0.2818	0.4238	0.6031	0.0157	0.0200	11.9553	0.0032	0.2476	0.0051	0.0119	0.0020
15	0.2827	0.4244	0.6033	0.0159	0.0201	11.9591	0.0034	0.2476	0.0054	0.0132	0.0020
16	0.2829	0.4244	0.6035	0.0159	0.0201	11.9648	0.0034	0.2486	0.0055	0.0133	0.0022
17	0.2840	0.4250	0.6046	0.0168	0.0202	11.9755	0.0035	0.2495	—	—	0.0023
18	0.2847	0.4260	0.6053	0.0168	0.0205	11.9768	0.0035	0.2509			
19	0.2856	0.4265	0.6131	0.0169	0.0206	11.9817	0.0036	0.2515			
20	0.2864	0.4291	0.6140	0.0173	0.0207	11.9866	0.0041	0.2518			
21		0.4306	0.6156			11.9950		0.2528			
22		0.4365				—					
M_M	**0.2815**	**0.4202**	**0.6002**	**0.0156**	**0.0197**	**11.9271**	**0.0030**	**0.2442**	**0.0046**	**0.0116**	**0.0018**
s_M	0.0024	0.0084	0.0080	0.0010	0.0007	0.0470	0.0006	0.0060	0.0006	0.0008	0.0003
s_W	0.0012	0.0042	0.0037	0.0003	0.0004	0.0385	0.0003	0.0028	0.0003	0.0003	0.0002

Line No	Co	Cu	N	Nb	Ti	V	Ca	Sb	Zn	*Mg*
1	0.0129	0.0177	0.0492	0.0024	0.00070	0.0155	0.00050	0.00053	0.0024	*<0.0001*
2	0.0131	0.0181	0.0493	0.0024	0.00075	0.0157	0.00060	0.00055	0.0025	*0.0001*
3	0.0135	0.0184	0.0499	0.0025	0.00082	0.0159	0.00070	0.00060	0.0025	*0.0001*
4	0.0140	0.0184	0.0500	0.0025	0.00085	0.0161	0.00085	0.00060	0.0026	*0.0002*
5	0.0141	0.0185	0.0502	0.0026	0.00085	0.0161	0.00085	0.00065	0.0027	*0.0002*
6	0.0142	0.0186	0.0504	0.0027	0.00090	0.0163	0.00088	0.00068	0.0029	*0.0003*
7	0.0143	0.0188	0.0505	0.0027	0.00090	0.0163	0.00088	0.00069	0.0030	*0.0003*
8	0.0143	0.0188	0.0506	0.0028	0.00092	0.0163	0.00088	0.00070	0.0031	*0.0005*
9	0.0144	0.0189	0.0506	0.0028	0.00093	0.0164	0.00090	0.00070	0.0031	
10	0.0145	0.0190	0.0507	0.0029	0.00093	0.0164	0.00090	0.00070	0.0033	
11	0.0145	0.0192	0.0508	0.0029	0.00095	0.0165	—	0.00071	0.0033	
12	0.0146	0.0193	0.0510	0.0030	0.00098	0.0166	0.00101	0.00078	0.0036	
13	0.0147	0.0193	0.0512	0.0031	0.00100	0.0166	0.00103	0.00080	0.0037	
14	0.0148	0.0193	0.0512	0.0032	0.00105	0.0166	0.00110	0.00090	0.0039	
15	0.0148	0.0196	0.0513	0.0033	0.00120	0.0171	0.00115	0.00093	0.0044	
16	0.0150	0.0197	0.0513	0.0036	0.00123	0.0175	0.00123	—		
17	0.0150	0.0197	0.0513	—	0.00135	0.0177	—			
18	0.0154	0.0200	0.0514		—	0.0177				
19	0.0155	0.0201	0.0516			0.0185				
20	0.0155	0.0202	0.0525			0.0190				
21	—	0.0206								
M_M	**0.0145**	**0.0192**	**0.0508**	**0.0028**	**0.00096**	**0.0167**	**0.00090**	**0.00070**	**0.0031**	
s_M	0.0008	0.0008	0.0008	0.0004	0.00017	0.0010	0.00020	0.00012	0.0006	
s_W	0.0003	0.0004	0.0005	0.0003	0.00008	0.0004	0.00010	0.00005	0.0002	

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, $s_b = \sqrt{s_M^2 - (s_W^2 \div 4)}$

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 eliminated by either the Cochran or Grubbs Test.

Values in small italic type are for information only.

Additional Information from one laboratory: Pb: 0.0004%, W: 0.0005%, Sn: 0.0008%, Bi: 0.000012%. A second laboratory also determined Sn and found 0.0008%

CERTIFIED VALUES
Mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	Al (Tot)	As
M_M	**0.2815**	**0.420**	**0.600**	**0.0156**	**0.0197**	**11.927**	**0.0030**	**0.244**	**0.0046**	**0.0116**
C(95%)	0.0011	0.004	0.004	0.0005	0.0004	0.022	0.0003	0.003	0.0004	0.0005

	B	Co	Cu	N	Nb	Ti	V	Ca	Sb	Zn
M_M	**0.0018**	**0.0145**	**0.0192**	**0.0508**	**0.0028**	**0.00096**	**0.0167**	**0.00090**	**0.00070**	**0.0031**
C(95%)	0.0002	0.0004	0.0004	0.0004	0.0002	0.00009	0.0005	0.00011	0.00007	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 35:1989 section 4

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

METHODS USED
EURONORM – CRM No. 272-1

Element	Line Number	Methods
C	1	Combustion, coulometric titration
	2-3-4-5-6-7-8-9-10-11-12-13-14-16-17-18-19-20	Combustion, infrared absorption
	15	Combustion, non-aqueous titration
Si	1-3-5-7-9-10-13-17-19	Gravimetric, dehydration with perchloric acid
	2	Photometric, as molybdenum blue, without extraction
	4-6-8-12-14-15-16-18-20-21-22	Inductively coupled plasma-optical emission spectrometry
	11	Photometric, as silicovanadomolybdate, with extraction
Mn	1-4-9-11-15-21	Photometric, periodate oxidation
	2-3-5-6-7-8-10-12-13-16-17-18-19-20	Inductively coupled plasma-optical emission spectrometry
	14	Flame atomic absorption spectrometry
P	1-5-8-11-16	Photometric, as phosphovanadomolybdate, with extraction
	2-9-12-20	Photometric, as molybdenum blue, without extraction
	4-6-10-13-14-15-17-18	Inductively coupled plasma-optical emission spectrometry
	7-19	Photometric, as molybdenum blue, with extraction
S	1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19	Combustion, infrared absorption
	20	Gravimetric, as barium sulphate, after chromatographic separation on alumina
Cr	1-2-4-10-13-14-15-17	Inductively coupled plasma-optical emission spectrometry
	3-5-7-8-9-11-12-16-18-21	Titration with Fe (II), oxidation with persulphate
	6-20	Titration with Fe (II), oxidation with perchloric acid
	19	Titration with Fe (II), oxidation with peroxide
Mo	1-2-3-4-5-6-9-12-14-15-16-18-19-20	Inductively coupled plasma-optical emission spectrometry
	7-8	Inductively coupled plasma-mass spectrometry
	11	Flame atomic absorption spectrometry
	13	Photon activation analysis
	10-17	Photometric, with thiocyanate in presence of $SnCl_2$, with extraction
Ni	1	Photometric, with dimethylglyoxime, iron separation
	2	Gravimetric, with dimethylglyoxime
	3-5-6-7-9-10-11-12-13-14-15-16-18-19-20-21	Inductively coupled plasma-optical emission spectrometry
	4-8	Flame atomic absorption spectrometry
	17	Titrimetric, with dichromate, separation with dimethylglyoxime
Al (Tot)	2-3-5-12-13-14-16-17	Inductively coupled plasma-optical emission spectrometry
	4-9	Electrothermal atomic absorption spectrometry
	6-7-8-10-15	Flame atomic absorption spectrometry
As	2-4-10-15-16	Electrothermal atomic absorption spectrometry
	3-14	Inductively coupled plasma-optical emission spectrometry
	5	Flame atomic absorption spectrometry, evolution as arsine
	6-11	Inductively coupled plasma-mass spectrometry
	7	Inductively coupled plasma-optical emission spectrometry, evolution as arsine
	8	Photometric, as molybdenum blue, halide extraction
	9	Neutron activation analysis
	12	Photometric, with diethyldithiocarbamate, separation as arsine
	13	Photon activation analysis
B	1-2-3-8-9-16-17	Inductively coupled optical emission spectroscopy
	4	Photometric, with 1-1 dianthrimide, with distillation
	5-10-14	Inductively coupled plasma-mass spectrometry
	6-7-11-13-15	Photometric, with curcumin
	12	Photometric, with 1-1 dianthrimide, without distillation
Co	1-2-3-5-6-8-9-10-11-12-13-14-15-16	Inductively coupled plasma-optical emission spectrometry
	4	Neutron activation analysis
	7-18-20	Flame atomic absorption spectrometry
	17	Inductively coupled plasma-mass spectrometry
	19	Photometric, with nitroso-R-salt

METHODS USED
EURONORM – CRM No. 272-1
(Continued)

Element	Line Number	Methods
Cu	1-3-4-5-8-9-10-11-12-13-14-15-16-18-20	Inductively coupled plasma-optical emission spectrometry
	2-6-19-21	Flame atomic absorption spectrometry
	7	Photometric, with diethyldithiocarbamate and extraction
	17	Inductively coupled plasma-mass spectrometry
N	1	Photometric, indophenol blue with distillation
	2	Acidimetric titration after distillation, visual end point
	3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20	Thermal conductivity, decomposition in graphite crucible
Nb	1-2-3-4-8-9-10-11-12-13-14-16	Inductively coupled plasma-optical emission spectrometry
	5-6-7	Inductively coupled plasma-mass spectrometry
	15	Photometric, with 4-(2-pyridylazo)resorcinol
Ti	1-2-4-5-9-10-11-12-13-14-15-16	Inductively coupled plasma-optical emission spectrometry
	3-6-7-8	Inductively coupled plasma-mass spectrometry
	17	Photometric, with diantipyrylmethane
V	1-2-3-4-5-6-7-8-9-11-12-13-15-18-19-20	Inductively coupled plasma-optical emission spectrometry
	10-14	Inductively coupled plasma-mass spectrometry
	16-17	Flame atomic absorption spectrometry
Ca	1-4-9-10-12-13-14-15	Flame atomic absorption spectrometry
	2-3-5-6-7-8-16	Inductively coupled plasma-optical emission spectrometry
Sb	1-2-7-9-10-13-14-15	Electrothermal atomic absorption spectrometry
	3-4-8	Inductively coupled plasma-mass spectrometry
	5	Flame atomic absorption, hydride generation
	6	Neutron activation analysis
	11	Photon activation analysis
	12	Flame atomic absorption spectrometry, extraction with TOPO/KI/MIBK
Zn	1-2-7-12-14-15	Inductively coupled plasma-optical emission spectrometry
	3-4-5-6-8-9-11	Flame atomic absorption spectrometry
	/10-13	Inductively coupled plasma-mass spectrometry
Mg	*1*	*Inductively coupled plasma-mass spectrometry*
	2-6-8	*Inductively coupled plasma-optical emission spectrometry*
	3-4-5-7	*Flame atomic absorption spectrometry*

PARTICIPATING LABORATORIES

AB Sandvik Materials Technology, Sandviken, Sweden
Acerinox SA, Algerciras, Spain
ALLVAC, Sheffield, UK
Aubert & Duval, Les Ancizes, France
Bodycote Materials Testing Teesside, Middlesbrough, UK
Böhler Edelstahl GmbH & Co KG, Kapfenberg, Austria
Bundesanstalt für Materialforschung und –prüfung (BAM), Berlin, Germany
Carsid SA, Couillet, Belgium
Centro Nacional de Investigaciones Metalurgicas (CENIM), Madrid, Spain
CORUS Engineering Steels, Stocksbridge, UK
Corrosion and Metals Research Institute, Stockholm, Sweden
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Luxcontrol SA, Esch-sur-Alzette, Luxembourg
Outokumpu Stainless AB, Avesta, Sweden
Ovako Steel AB, Hofors, Sweden
Ridsdale & Co Ltd, Middlesbrough, UK
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Ugine & ALZ Groupe Arcelor, Isbergues, France
USI Ugine Groupe Arcelor, Ugine, France
voestalpine Stahl GmbH, Linz, Austria

DESCRIPTION OF THE SAMPLE

The sample is available in the form of chips passing a 1700 µm aperture from which the fines passing a 250 µm aperture sieve have been removed. It is supplied in bottles containing 100 g…ref ECRM 272-1(C). It is also supplied in the form of 38 mm dia. discs…ref ECRM 272-1(D).

INTENDED USE & STABILITY

The chip sample, ECRM 272-1(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 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 (eg oxidised) by atmospheric contamination they should be discarded.
The disc sample, ECRM 272-1(D), is intended for establishing and checking the calibration of Optical Emission and X-Ray Spectrometers for the analysis of similar materials. The “as received” working surface of the sample should be linished before use to remove any protective coating. It will remain stable provided that it is not subject to excessive heat (e.g., during preparation of the working surface).

NB An area 6mm in diameter in the centre of the disc should be avoided for optical emission spectrometry.

TRACEABILITY

The traceability of this ECRM is ensured by the use of either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric 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 CEN Report CR 10317 and ECISS Information Circular No. 5, both of which are available from the national standards body in your country or from CEN in Brussels. (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 le Rapport CEN CR 10317 et dans la circulaire d’information No. 5 (ECISS). On peut se procurer ces deux documents auprès des organismes nationaux de normalisation ou auprès du CEN, Bruxelles. (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 im CEN-Report CR 10317 und in der Mitteilung Nr. 5 (ECISS), beide zu beziehen durch die nationalen Normenorganisationen oder direkt von CEN, Brüssel. (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 statistisk information, som angivits i detta certifikat, refereras till CEN rapport CR 10317 och till informationscirkulär Nr. 5 (ECISS) från den nationella standardiseringsorganisationen eller från CEN, Bruxelles. (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, på Island är det STRI, Holtagardar, IS-104 Reykjavik).

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