

**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	—	—	—	—	—	—	—	—	—
<b>M<sub>M</sub></b>	<b>0.2815</b>	<b>0.4202</b>	<b>0.6002</b>	<b>0.0156</b>	<b>0.0197</b>	<b>11.9271</b>	<b>0.0030</b>	<b>0.2442</b>	<b>0.0046</b>	<b>0.0116</b>	<b>0.0018</b>
<b>S<sub>M</sub></b>	0.0024	0.0084	0.0080	0.0010	0.0007	0.0470	0.0006	0.0060	0.0006	0.0008	0.0003
<b>S<sub>W</sub></b>	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	—	—	—	—	—	—	—	—
<b>M<sub>M</sub></b>	<b>0.0145</b>	<b>0.0192</b>	<b>0.0508</b>	<b>0.0028</b>	<b>0.00096</b>	<b>0.0167</b>	<b>0.00090</b>	<b>0.00070</b>	<b>0.0031</b>	—
<b>S<sub>M</sub></b>	0.0008	0.0008	0.0008	0.0004	0.00017	0.0010	0.00020	0.00012	0.0006	—
<b>S<sub>W</sub></b>	0.0003	0.0004	0.0005	0.0003	0.00008	0.0004	0.00010	0.00005	0.0002	—

M<sub>M</sub>: Mean of the intralaboratory means, S<sub>M</sub>: Standard Deviation of the intralaboratory means.

S<sub>W</sub>: Intralaboratory standard deviation, S<sub>B</sub>: 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
<b>M<sub>M</sub></b>	<b>0.2815</b>	<b>0.420</b>	<b>0.600</b>	<b>0.0156</b>	<b>0.0197</b>	<b>11.927</b>	<b>0.0030</b>	<b>0.244</b>	<b>0.0046</b>	<b>0.0116</b>
<b>C(95%)</b>	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
<b>M<sub>M</sub></b>	<b>0.0018</b>	<b>0.0145</b>	<b>0.0192</b>	<b>0.0508</b>	<b>0.0028</b>	<b>0.00096</b>	<b>0.0167</b>	<b>0.00090</b>	<b>0.00070</b>	<b>0.0031</b>
<b>C(95%)</b>	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**

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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.)



Certificate No: Q3993

**METHODS USED**  
**EURONORM – CRM No. 272-1**

Element	Line Number	Methods
<b>C</b>	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
<b>Si</b>	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
<b>Mn</b>	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
<b>P</b>	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
<b>S</b>	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
<b>Cr</b>	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
<b>Mo</b>	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 <sub>2</sub> , with extraction
<b>Ni</b>	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
<b>Al (Tot)</b>	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
<b>As</b>	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>B</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
<b>Co</b>	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
<b>Cu</b>	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
<b>N</b>	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
<b>Nb</b>	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
<b>Ti</b>	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
<b>V</b>	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
<b>Ca</b>	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
<b>Sb</b>	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
<b>Zn</b>	12	Flame atomic absorption spectrometry, extraction with TOPO/KI/MIBK
	1-2-7-12-14-15	Inductively coupled plasma-optical emission spectrometry
	3-4-5-6-8-9-11 /10-13	Flame atomic absorption spectrometry Inductively coupled plasma-mass spectrometry
<i>Mg</i>	1	<i>Inductively coupled plasma-mass spectrometry</i>
	2-6-8	<i>Inductively coupled plasma-optical emission spectrometry</i>
	3-4-5-7	<i>Flame atomic absorption spectrometry</i>

## PARTICIPATING LABORATORIES

AB Sandvik Materials Technology, Sandviken, Sweden  
Acerinox SA, Algerciras, Spain  
ALLVAC, Sheffield, UK  
Aubert & Duval, Les Ancizes, France  
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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 finished 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).

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