

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. **379-1** High alloy steel

Similar to EN 1.4563
 LABORATORY MEANS (4 values) - Mass content in %

Line No	C	Si	Mn	P	S	Cr	Mo	Ni	B	Co	Cu	N	Sn	V
1	0.0112	-----	-----	0.0149	0.0005	26.590	3.2199	30.702	0.00173	0.0354	0.9645	0.0522	0.0015	0.0616
2	0.0114	0.3813	1.7898	0.0152	0.0005	26.624	3.2602	30.705	0.00177	0.0354	0.9688	0.0539	0.0017	0.0624
3	0.0115	0.3827	1.7927	0.0157	0.0005	26.657	3.2705	30.716	0.00180	-----	0.9732	0.0544	0.0017	0.0642
4	0.0118	0.3850	1.7940	0.0157	0.0006	26.703	3.2775	30.728	0.00182	0.0375	0.9757	0.0546	0.0018	0.0651
5	0.0119	0.3858	1.7945	0.0160	0.0006	26.710	3.2792	30.750	0.00183	0.0376	0.9761	0.0546	0.0019	0.0653
6	0.0119	0.3864	1.7948	0.0164	0.0006	26.713	3.2810	30.768	0.00183	0.0377	0.9778	0.0546	0.0021	0.0654
7	0.0120	0.3870	-----	0.0166	0.0007	26.733	3.2815	30.780	0.00183	0.0382	0.9787	0.0548	0.0022	0.0657
8	0.0121	0.3890	1.7968	0.0167	0.0007	26.753	3.2873	30.863	0.00185	0.0385	0.9791	0.0549	0.0023	0.0663
9	0.0121	0.3900	1.8005	0.0167	0.0007	26.765	3.2968	30.885	0.00188	0.0388	0.9805	0.0551	0.0023	0.0667
10	0.0122	0.3926	1.8030	0.0168	-----	26.765	3.3047	30.901	0.00188	0.0392	0.9823	0.0555	0.0023	0.0668
11	0.0123	0.3932	1.8030	0.0174	0.0007	26.780	3.3083	30.903	0.00192	0.0393	-----	0.0555	0.0024	0.0675
12	0.0124	0.3953	1.8036	0.0177	0.0009	26.819	3.3087	30.905	0.00203	0.0397	0.9907	-----	0.0024	0.0676
13	0.0128	0.3965	1.8098	0.0178	-----	26.837	3.3153	30.927	0.00208	0.0398	0.9940	0.0565	0.0024	0.0680
14	-----	0.3988	1.8151	0.0181	-----	26.844	3.3153	30.950	0.00210	0.0402	0.9984	0.0565	0.0025	0.0683
15	0.0135	0.4010	1.8188	-----	-----	26.844	3.3208	30.968	0.00218	0.0410	0.9995	0.0570	-----	0.0697
16	-----	0.4034	1.8212	-----	-----	26.888	3.3467	-----	-----	0.0410	1.0008	-----	-----	0.0699
17	-----	0.4056	1.8216	-----	-----	26.966	-----	-----	-----	0.0412	1.0035	-----	-----	-----
18	-----	0.4098	-----	-----	-----	26.975	-----	-----	-----	0.0425	-----	-----	-----	-----
19	-----	-----	-----	-----	-----	26.988	-----	-----	-----	-----	-----	-----	-----	-----
20	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
M_M	0.0121	0.3931	1.8039	0.0166	0.0006	26.787	3.2902	30.830	0.00190	0.0390	0.9840	0.0550	0.0021	0.0663
S_M	0.0006	0.0084	0.0109	0.0010	0.0002	0.114	0.0294	0.097	0.00014	0.0020	0.0122	0.0013	0.0004	0.0024
S_w	0.0003	0.0042	0.0078	0.0003	0.0001	0.046	0.0164	0.059	0.00012	0.0005	0.0041	0.0005	0.0002	0.0006

Line No	Ca	Sb	Al	As	Bi	Fe	O	Nb	Pb	Ti
1	0.0025	0.00048	0.0204	0.0018	0.000002	-----	0.0017	0.0012	0.000015	0.0008
2	0.0025	0.00053	0.0210	0.0026	0.000004	35.194	0.0018	0.0015	0.000021	0.0008
3	0.0027	0.00053	0.0222	0.0026	0.000005	35.417	0.0022	0.0017	-----	0.0010
4	0.0029	0.00054	0.0228	0.0030	0.000010	35.463	0.0023	0.0019	0.000025	0.0010
5	0.0029	0.00058	0.0229	0.0033	< 0.00002	35.557	0.0025	0.0020	0.000030	0.0011
6	0.0031	0.00058	0.0242	-----	≤ 0.00002	35.646	0.0028	0.0020	0.000100	0.0013
7	0.0032	0.00061	0.0250	-----	-----	35.705	0.0030	0.0039	-----	0.0022
8	0.0033	0.00062	0.0250	-----	-----	35.710	0.0034	0.0040	-----	0.0022
9	0.0033	0.00062	0.0267	-----	-----	35.765	0.0036	0.0041	-----	0.0026
10	0.0034	0.00064	0.0270	-----	-----	35.972	0.0041	0.0053	-----	-----
11	0.0036	-----	0.0273	-----	-----	-----	-----	-----	-----	-----
12	0.0037	-----	0.0277	-----	-----	-----	-----	-----	-----	-----
13	0.0042	-----	0.0281	-----	-----	-----	-----	-----	-----	-----
14	0.0045	-----	-----	-----	-----	-----	-----	-----	-----	-----
M_M	0.0033	0.00057	-----	-----	-----	-----	-----	-----	-----	-----
S_M	0.0006	0.00006	-----	-----	-----	-----	-----	-----	-----	-----
S_w	0.0002	0.00003	-----	-----	-----	-----	-----	-----	-----	-----

M_M: Mean of the intralaboratory means
 S_M: Standard deviation of the intralaboratory means
 S_w: Intralaboratory standard deviation
 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 given in italics are for information only.

Additional values from laboratories, for information (in µg/g):

Ag: 0.7, Ce: 0.1, Cs: 0.01, Ga: 17 and 29, Ir: 0.1, Mg: 6, Nd: 0.6, Os: 0.07, Pr: 0.2, Pt: 0.04, Rb: 4.3, Re: 2.4, Rh: 0.4, Ru: 1.4, Sm: 0.6, Ta: 0.04, W: 82, 92 and 100, Y: 0.1, Zr: 2.5 and 4.0

CERTIFIED VALUES - Mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni
M_M	0.0121	0.393	1.804	0.0166	0.0006	26.79	3.290	30.83
C (95 %)	0.0004	0.005	0.007	0.0006	0.0001	0.06	0.016	0.06

	B	Co	Cu	N	Sn	V	Ca	Sb
M_M	0.00190	0.0390	0.984	0.0550	0.0021	0.0663	0.0033	0.00057
C (95 %)	0.00008	0.0010	0.007	0.0007	0.0002	0.0013	0.0004	0.00004

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 35:2006 sections 6.1 and 10.5.2

This reference material was prepared in accordance with the recommendations set out in ISO Guides 30 – 35 and issued by:

swerea | KIMAB

Drottning Kristinas väg 48, SE 114 28, Stockholm, Sweden

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 organisations.

(France-IRSID/CTIF; Germany-Iron and Steel CRM Working Group: Stahlinstitut VDEh, BAM Bundesanstalt für Materialforschung und -prüfung & MPI für Eisenforschung; UK-BAS Ltd; Nordic Countries-Nordic CRM Working Group)



SEPTEMBER 2010

EURONORM – CRM No. 379-1
METHODS USED

Element	Line number	Analytical methods
C	1.2.3.4.5.6.7.8.9.10.11.12.13 15	Combustion - infrared absorption Combustion - non-aqueous titration after absorption in organic solvent
Si	2.5.6.7.8.9.10.12.17 3.4.11.13.14.15.16.18	Gravimetry, dehydration with perchloric acid ICP-OES
Mn	2.8.9.17 3.5.6.10.11.13.15.16 4 12 14	Spectrophotometry, periodate oxidation ICP-OES PAA FAAS XRF
P	1.2.6.8.11.14 3.4.5.9.12.13 7.10	ICP-OES Spectrophotometry, phosphovanadomolybdate, extraction Spectrophotometry, molybdenum blue, extraction
S	1.2.3.4.5.6.7.8.9.11.12	Combustion - Infrared absorption
Cr	1.2.3.5.7.8.9.11.13.14.15.16 4.12 6.17.18.19 10	Titration with Fe (II), oxidation with persulphate Titration with Fe (II), oxidation with peroxide ICP-OES XRF
Mo	1 2.4.5.6.8.9.11.12.13.14 3.16 7 10	Spectrophotometry, thiocyanate in presence of Sn (II), without extraction ICP-OES Spectrophotometry, thiocyanate in presence of Sn (II), extraction XRF Gravimetry with 8-hydroxyquinoline, after anion-exchange
Ni	1.4.6.8.9.11.12.15 2 3.5.7.14 10 13	Gravimetry, dimethylglyoxime Titration with dichromate, separation with dimethylglyoxime ICP-OES Cyanometric titration Complexometric titration, visual end point
B	1.3.5.8.11 2.10 4.6.7.9.12.13.14.15	Spectrophotometry, curcumin ICP-MS ICP-OES
Co	1.4.6.7.8.9.11.12.15.17.18 2.5.10 13.14 16	ICP-OES FAAS NAA ETAAS
Cu	1.5.6.7.8.9.10.15.16.17 2.4.12.13.14 3	ICP-OES FAAS Spectrophotometry, diethyldithiocarbamate, extraction
N	1.2.3.4.5.6.7.8.9.10.11.14.15 12 13	Thermal conductivity, decomposition in graphite crucible Acidimetric titration after distillation, visual end point Spectrophotometry, indophenol blue, distillation
Sn	1.2.4.5.10.12 3.7.8.11.13.14 6 9	ICP-OES ETAAS FAAS, extraction with TOPO/KI/MIBK ICP-MS
V	1.3.4.6.8.9.11.12.13.14.15.16 2.5 7 10	ICP-OES FAAS NAA ETAAS
Ca	1.2.5.8.11.13 3.4.6.7.9.10.12.14	FAAS ICP-OES
Sb	1.2.3.9.10 4.6.7.8 5	ETAAS ICP-MS NAA

Abbreviations:

ETAAS	Electrothermal Atomic Absorption Spectrometry
FAAS	Flame Atomic Absorption Spectrometry
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometry
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
NAA	Neutron Activation Analysis
PAA	Photon Activation Analysis
XRF	X-ray Fluorescence Spectrometry

<i>Element</i>	<i>Line number</i>	<i>Analytical methods</i>
<i>Al</i>	1.2.3.5.6.7.10.13 4.8.9.11.12	ICP-OES FAAS
<i>As</i>	1 2.5 3 4	ICP-MS ETAAS FAAS NAA
<i>Bi</i>	1.2.4.5.6 3	ETAAS AAS, hydride
<i>Fe</i>	2 3.4.5.7.9 6 8 10	Titration with Cr (VI) after reduction with Sn (II) ICP-OES Titration with Mn (VII) after reduction with Ti (III) Titration with Mn (VII) after reduction with Sn (II) XRF
<i>O</i>	1 2.3.4.5.6.7.8.9.10	Thermal conductivity, reduction fusion under helium Infrared absorption measurement, reduction fusion under helium
<i>Nb</i>	1.2.3.4.5.6.7.8.9.10	ICP-OES
<i>Pb</i>	1.2.4.5.6	ETAAS
<i>Ti</i>	1.2.3.4.5.6.7.9 8	ICP-OES ETAAS

Abbreviations:

ETAAS	Electrothermal Atomic Absorption Spectrometry
FAAS	Flame Atomic Absorption Spectrometry
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometry
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry
NAA	Neutron Activation Analysis
XRF	X-ray Fluorescence Spectrometry

DESCRIPTION OF THE SAMPLE

ECRM 379-1 is available in the form of milling chips in bottles containing 100 g. It is also available as 38 mm diameter discs 25 mm thick. The chips were passed through a 2000 µm aperture sieve and further sieving was carried out to exclude chips passing through a 250 µm aperture sieve.

INTENDED USE & STABILITY

The chip sample, ECRM 379-1(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 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.

The solid (disc) sample, ECRM 379-1(D), is intended for establishing and checking the calibration of instruments, such as Optical Emission Spectrometers 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 in order 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 ECRM 379-1 has been established in accordance with principles of ISO Guides 30 – 35 and the International vocabulary of basic and general terms in metrology.

The characterisation of this material has been achieved by inter-laboratory study, each laboratory using the method of their choice, details of which are given above. These methods are either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds. Most methods used were either international or national standard methods or methods which are technically equivalent.

PARTICIPATING LABORATORIES

AB Sandvik Materials Technology, Sandviken (Sweden)
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AG der Dillinger Hüttenwerke, Dillingen (Germany)
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ArcelorMittal Isbergues Stainless, Isbergues (France)
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EURONORM – CRM No. 379-1

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 either to the producer of this Certified Reference Material or to Technical Reports CEN/TR 10317:2009 and CEN/TR 10350:2009, 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).

Further information and advice on this or other Certified Reference Materials or Reference Materials produced by Swerea KIMAB AB, may be obtained from the address below.

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