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. **270-1** High alloy steel

Similar to EN 1.4835

LABORATORY MEANS (4 values) - Mass content in %

Line No	C	Si	Mn	P	S	Cr	Mo	Ni	Co	Cu	N	V	Ce	La
1	0.0718	-----	0.5285	-----	0.00043	20.763	0.1998	10.772	0.0653	0.1022	0.1380	0.0241	0.0449	0.0130
2	0.0726	1.4920	0.5287	0.0176	0.00053	20.771	0.2028	10.774	0.0659	0.1048	0.1381	0.0242	0.0450	0.0141
3	0.0732	1.4944	0.5294	0.0185	0.00055	20.825	0.2031	10.836	0.0670	0.1053	0.1391	0.0244	0.0452	0.0145
4	0.0732	1.5025	0.5308	0.0188	0.00055	20.829	0.2043	10.841	0.0671	0.1056	0.1402	0.0247	0.0456	0.0147
5	0.0732	1.5050	0.5327	0.0188	0.00060	20.835	0.2055	10.861	0.0673	0.1061	0.1402	0.0253	0.0466	0.0152
6	0.0734	1.5080	0.5345	0.0192	0.00065	20.837	0.2065	10.867	0.0676	0.1063	0.1404	0.0253	0.0471	0.0152
7	0.0735	1.5097	0.5358	0.0195	-----	20.861	0.2074	10.868	0.0677	0.1064	0.1408	0.0257	0.0489	0.0153
8	0.0737	1.5180	0.5387	0.0197	0.00069	20.868	0.2093	10.869	0.0683	0.1071	0.1411	0.0257	0.0490	0.0153
9	0.0739	1.5185	0.5407	0.0197	0.00073	20.875	0.2095	10.875	0.0689	0.1076	0.1416	0.0258	0.0492	0.0155
10	0.0743	1.5249	0.5408	0.0198	0.00073	20.886	0.2100	10.886	0.0691	0.1086	0.1417	0.0259	0.0492	0.0158
11	0.0749	1.5261	0.5428	0.0199	0.00075	20.900	0.2111	10.896	0.0691	0.1090	0.1420	0.0261	0.0493	0.0159
12	0.0750	1.5280	0.5441	0.0200	0.00075	20.932	0.2127	10.896	0.0694	0.1096	0.1434	0.0261	0.0498	0.0160
13	0.0754	1.5284	0.5443	0.0201	0.00096	20.976	0.2130	10.897	0.0698	0.1102	0.1445	0.0262	0.0503	0.0163
14	0.0769	1.5365	0.5458	0.0202		21.016	0.2139	10.911	0.0699	0.1103	0.1465	0.0269	0.0505	0.0163
15	0.0776	1.5438	0.5504	0.0203		21.017	0.2140	-----	0.0707	0.1104	0.1480	0.0277	0.0512	0.0168
16		-----	0.5517	0.0205		-----	0.2145	-----	0.0709	-----		-----	0.0513	0.0170
17			0.5550	0.0206			0.2197		-----	0.1124			0.0516	
18							0.2218		0.0711				0.0530	
M_M	**0.0742**	**1.5168**	**0.5396**	**0.0196**	**0.00066**	**20.879**	**0.2099**	**10.862**	**0.0685**	**0.1076**	**0.1417**	**0.0256**	**0.0487**	**0.0154**
s_M	0.0016	0.0155	0.0084	0.0009	0.00014	0.079	0.0059	0.044	0.0018	0.0027	0.0029	0.0010	0.0025	0.0011
s_W	0.0005	0.0098	0.0030	0.0004	0.00005	0.024	0.0014	0.030	0.0009	0.0010	0.0011	0.0004	0.0010	0.0004

Additional values from laboratories, for information (in µg/g):
Al: 23, As: 34, Ba: 1.8, Dy: 0.01 and 0.015, Er: 0.004 and 0.005, Eu: 0.002 and < 0.001, Ga: 21, Gd: < 0.2 and 1.3, Ge: 6, Hf: 0.02, Ho:< 0.002 and 0.0015, Ir: 0.2, Lu: < 0.002 and < 0.001, Mg: 9, Nd: 74, 75 and 79, Os: 0.4, Pr: 29.5 and 29.5, Pt: 0.1, Rb: 6, Re: 0.4, Rh: 0.2, Ru: 2, Sb: 7, Sc: < 0.02 and < 0.006, Sm: 0.1 and < 0.006, Sn: 35, Ta: 0.1, Tb: < 0.045 and 0.033, Th: 0.002, Ti: 19, Tl: 0.006, Tm: < 0.002, U: 0.01, W: 244, Y: 0.014 and 0.18, Yb: < 0.003 and < 0.001, Zn: 7.4, Zr: 2

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.

CERTIFIED VALUES - Mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni
M_M	**0.0742**	**1.517**	**0.540**	**0.0196**	**0.0007**	**20.88**	**0.2099**	**10.86**
C (95 %)	**0.0009**	**0.009**	**0.005**	**0.0005**	**0.0001**	**0.05**	**0.0029**	**0.03**

	Co	Cu	N	V	Ce	La
M_M	**0.0685**	**0.1076**	**0.1417**	**0.0256**	**0.0487**	**0.0154**
C (95 %)	**0.0009**	**0.0014**	**0.0016**	**0.0006**	**0.0013**	**0.0006**

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. 270-1

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
	14	Combustion - non-aqueous titration after absorption in organic solvent
Si	2.3.5.6.9.10.12.13.14.15	Gravimetry, dehydration with perchloric acid
	4	Spectrophotometry, molybdenum blue, without extraction
	7.8.11.12	ICP-OES
Mn	1.3.10.15.16	Spectrophotometry, periodate oxidation
	2.5.6.7.8.9.12.13.14.17	ICP-OES
	4.11	FAAS
P	2.9.10.11.15	ICP-OES
	3	ICP-MS
	4.16	Spectrophotometry, molybdenum blue, extraction
	5.6.14	Spectrophotometry, molybdenum blue, without extraction
	7.8.12.13.17	Spectrophotometry, phosphovanadomolybdate, extraction
S	1.2.3.4.5.7.8.9.10.11.12	Combustion - Infrared absorption
	13	Spectrophotometry, methylene blue, evolution as H_2S in hypophosphoric and formic acid medium
Cr	1.5.10.12	ICP-OES
	2.3.4.6.7.9.11.14.15	Titration with Fe (II), oxidation with persulphate
	8	Titration with Fe (II), oxidation with peroxide
	13	Titration with Fe (II), oxidation with perchloric acid
Mo	1.5.6.7.8.9.11.12.13.14.15.16.17	ICP-OES
	2	Spectrophotometry, thiocyanate in presence of ascorbic acid, extraction
	3	ICP-MS
	4	FAAS
	10	Spectrophotometry, thiocyanate in presence of Sn (II), extraction
	18	Spectrophotometry, thiocyanate in presence of Sn (II), without extraction
Ni	1.5	Titration with dichromate, separation with dimethylglyoxime
	2.8.11.13	Gravimetry, dimethylglyoxime
	3.4.7.9.10.12.14	ICP-OES
	6	Spectrophotometry, dimethylglyoxime, extraction
Co	1.3.4.6.7.8.9.11.12.13.14.15.16	ICP-OES
	2.18	ICP-MS
	5.10	FAAS
Cu	1.2.7.8.9.11.12.13.14.15.17	ICP-OES
	3	Spectrophotometry, diethyldithiocarbamate, extraction
	4.10	FAAS
	5	ICP-MS
	6	Spectrophotometry, cuproine, without extraction
N	1.2.3.4.5.6.8.9.10.11.13.14.15	Thermal conductivity, decomposition in graphite crucible
	7	Spectrophotometry, indophenol blue, distillation
	12	Acidimetric titration after distillation, visual end point
V	1.2.3.4.5.7.8.9.10.11.13.14.15	ICP-OES
	6	ICP-MS
	12	FAAS
Ce	1.2.4.5.6.7.8.10.11.12.13.14.15.18	ICP-OES
	3.9	ICP-MS
	16	Spectrophotometry, hydroxyquinoline
	17	GD-MS
La	1.2.3.4.5.6.7.8.9.11.12.13.15	ICP-OES
	10.14	ICP-MS
	16	GD-MS

Abbreviations:

FAAS	Flame Atomic Absorption Spectrometry
GD-MS	Glow discharge – Mass Spectrometry
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectrometry
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry

DESCRIPTION OF THE SAMPLE

The ECRM 270-1 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 270-1 (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 270-1 (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 linished 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 270-1 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)
Aciéries Aubert et Duval, Les Ancizes (France)
ALS Scandinavia AB, Luleå (Sweden)
ArcelorMittal Industeel, Le Creusot (France)
ArcelorMittal Imphy, Imphy (France)
ArcelorMittal Isbergues Stainless, Isbergues (France)
ArcelorMittal Maiziéres, Maizières (France)
ArcelorMittal Genk – Stainless Steel, Genk (Belgium)
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BAM Bundesanstalt für Materialforschung und -prüfung, Berlin (Germany)
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