ECSC - CECA - EGKS

EUROPEAN COAL AND STEEL COMMUNITY
COMMUNAUTÉ EUROPÉENNE DU CHARBON ET DE L'ACIER
EUROPÄISCHE GEMEINSCHAFT FÜR KOHLE UND STAHL
CERTIFIED REFERENCE MATERIAL

EURO-CRM (formerly EURO-STANDARD) No. **281-1** HIGHLY ALLOYED STEEL

CERTIFICATE OF ANALYSES

Laboratory Means (4 values)

Line No.	%C	%Si	%Mn	%P	%S	%Cr	%Ni	%Al (Total)	%B
1	0.0441	0.9158	—	0.0106	—	—	—	0.0140	0.0010
2	0.0450	0.9175	0.7745	0.0107	0.0135	18.08	9.295	0.0142	0.0010
3	0.0460	0.9178	0.7750	0.0110	0.0148	18.09	9.295	0.0142	0.0010
4	0.0460	0.9228	0.7781	0.0112	0.0150	18.11	9.325	0.0145	0.0010
5	0.0466	0.9234	0.7790	0.0112	0.0152	18.13	9.331	0.0148	0.0011
6	0.0470	0.9250	0.7800	0.0112	0.0152	18.14	9.335	0.0151	0.0011
7	0.0475	0.9265	0.7825	0.0115	0.0153	18.16	9.340	0.0152	0.0011
8	0.0475	0.9272	0.7825	0.0115	0.0155	18.16	9.340	0.0154	0.0011
9	0.0476	0.9274	0.7838	0.0115	0.0156	18.18	9.348	0.0155	0.0011
10	0.0478	0.9275	0.7850	0.0117	0.0157	18.18	9.350	0.0156	0.0012
11	0.0478	0.9300	0.7865	0.0121	0.0158	18.18	9.372	0.0159	0.0012
12	0.0480	0.9300	0.7875	0.0122	0.0161	18.19	9.385	0.0160	0.0012
13	0.0485	0.9325	0.7875	0.0122	0.0164	18.19	9.394	0.0163	0.0012
14	0.0486	0.9338	0.7875	0.0124	0.0165	18.19	9.404	0.0172	0.0012
15	0.0490	0.9365	0.7900	0.0125	0.0166	18.20	9.425	0.0176	0.0013
16	0.0502	0.9372	0.7902	0.0127	0.0166	18.20	9.428		0.0017
17	0.0502	0.9395	0.7918	0.0127	0.0170	18.22	9.428		—
18	0.0510	0.9412	0.7952	0.0128	0.0174	18.25	9.438		
19	0.0511	0.9475	0.8000	0.0130	0.0175	18.26	9.484		
20	0.0512	—	0.8000	0.0134	0.0182	—	—		
21				0.0138					
M_M	**0.0480**	**0.9294**	**0.7861**	**0.0120**	**0.0160**	**18.17**	**9.373**	**0.0154**	**0.0012**
s_M	0.0020	0.0085	0.0074	0.0009	0.0011	0.05	0.053	0.0011	0.0002

Line No.	%Co	%Cu	%N	%Pb	%Sn	%Ti
1	0.0200	0.0702	0.0212	0.0004	0.0082	0.2038
2	0.0206	0.0725	0.0217	0.0004	0.0084	0.2045
3	0.0211	0.0728	0.0218	0.0004	0.0090	0.2050
4	0.0212	0.0732	0.0220	0.0004	0.0092	0.2078
5	0.0214	0.0740	0.0224	0.0004	0.0094	0.2095
6	0.0215	0.0742	0.0226	0.0004	0.0094	0.2150
7	0.0216	0.0745	0.0226	0.0005	0.0095	0.2152
8	0.0216	0.0752	0.0227	0.0005	0.0095	0.2162
9	0.0218	0.0760	0.0228	0.0005	0.0095	0.2162
10	0.0229	0.0762	0.0228	0.0005	0.0096	0.2162
11	0.0232	0.0763	0.0230	0.0005	0.0097	0.2165
12	0.0250	0.0766	0.0230	0.0006	0.0098	0.2185
13	0.0250	0.0768	0.0231	0.0006	0.0100	0.2185
14	0.0250	0.0768	0.0232	0.0007	0.0100	0.2205
15	0.0260	0.0778	0.0234		0.0102	0.2220
16	0.0260	0.0780	0.0234			0.2225
17		0.0797	0.0239			0.2250
18		0.0805	0.0241			0.2260
19		0.0820				0.2260
20		—				
M_M	**0.0227**	**0.0760**	**0.0228**	**0.0005**	**0.0094**	**0.2160**
s_M	0.0020	0.0029	0.0008	0.0001	0.0006	0.0071

%As
0.0108
0.0112
0.0127
0.0128
0.0128
0.0134
0.0145
0.0147
0.0148
0.0155
0.0157
0.0158
0.0158
0.0172
0.0172
0.0174
0.0182
0.0182
0.0194
0.015

M_M: Mean of the intralaboratory means. s_M: Standard deviation of the intralaboratory means.

CERTIFIED VALUES

	%C	%Si	%Mn	%P	%S	%Cr	%Ni	%Al (Total)	%B	%Co	%Cu	%N	%Pb	%Sn	%Ti
M_M	**0.048**	**0.929**	**0.786**	**0.012**	**0.016**	**18.17**	**9.37**	**0.015**	**0.0012**	**0.023**	**0.076**	**0.023**	**0.0005**	**0.009**	**0.216**
s_M	0.002	0.008	0.007	0.001	0.001	0.05	0.05	0.001	0.0002	0.002	0.003	0.001	0.0001	0.001	0.007

BUREAU OF ANALYSED SAMPLES LIMITED

Newham Hall, Middlesbrough, England. Revised DECEMBER, 1982

(First issued in July 1980 without certified values for B and Pb)

Laboratories which have participated in the standardization of Euro-CRM 281-1

Acieries de Champagnole, Champagnole (France)
Arbed, Division d'Esch Belval, Esch-sur-Alzette (Luxembourg)
Automobiles Peugeot, Voujeaucourt (France)
British Steel Corporation, Rotherham Works (UK)
British Steel Corporation, Stocksbridge and Tinsley Park Works (UK)
Brown Firth Research Laboratories, Sheffield (UK)
Bundesanstalt für Materialprüfung (BAM), Berlin-Dahlem (Germany)
Centro Sperimentale Metallurgico (CSM), Rome (Italy)
Cockerill, Seraing (Belgium)
Hoogovens-ESTEL, IJmuiden (Holland)
Institut de Recherches de la Sidérurgie Francaise (IRSID), Saint Germain-en-Laye (France)
Ridsdale and Co. Ltd., Middlesbrough (UK)
Societa Terni, Terni (Italy)
Société Metallurgique Hainaut Sambre, Couillet (Belgium)
Société Nouvelle Acieries de Pompey, Pompey (France)
Staatliches Materialprüfungsamt Nordrhein-Westfalen, Dortmund 41 (Germany)
Stahlwerke Röchling-Burbach GmbH, Völklingen-Saar 1 (Germany)
Thyssen Edelstahlwerke AG, Witten (Germany)
Ugine Aciers, Ugine (France)
Usinor, Longwy (France)
Wiggin Steel and Alloys, Birmingham (UK)

For the Commission of Co-ordination of the Nomenclature of Metallurgical Products—Commission of European Communities.

For information regarding Euro-CRMs, please refer to the ECSC Information Circular No. 1 available from the Institution responsible for standardization in your country

Pour tous renseignements sur les Euro-MRC, se reporter à la Circulaire d'information No. 1 de la CECA, diffusée par les organismes nationaux de normalisation.

Wegen Erläuterungen über Euro-ZRM siehe Mitteilung Nr. 1 der EGKS, zu beziehen durch die nationalen Normenorganisationen.

METHODS USED
ECRM 281-1

Element	Line No.	Method
C	1-8	Combustion, conductimetric
	2	Combustion, thermal conductivity
	3-6	Combustion, low pressure
	4-15	Conbustion, non aqueous titration
	5-7-9-10-11-12-13-14-16-18-19-20	Combustion, infrared absorption
	17	Combustion, coulometric
Si	1-3-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19	Gravimetric, dehydration with perchloric acid
	2	Gravimetric, dehydration with hydrochloric acid
	4	Photometric as molybdenum blue
Mn	2-3-4-5-6-9-11-12-13-16-17-19	Photometric, oxidation with periodate
	7	Photometric, oxidation with persulphate/silver nitrate
	8-10-15-18	Atomic absorption spectrometry
	14	Titrimetric with ammonium ferrous sulphate, oxidation with persulphate/silver nitrate
	20	Titrimetric with arsenite, oxidation with persulphate/silver nitrate
P	1-8-9-10-11-13-16-19-20	Photometric as molybdenum blue
	2-3-4-6-7-15-17-18-21	Photometric as phosphovanadomolybdate with extraction
	5-12-14	Photometric as molybdenum blue with extraction
S	2-5-6-8-10-11-13-14-16-17-18-19-20	Combustion, infrared absorption
	3-4-9	Combustion, acidimetric titration
	7	Combustion, coulometric
	12	Combustion, conductimetric
	15	Combustion, oxidation/reduction titration
Cr	2	Titrimetric with ammonium ferrous sulphate, oxidation with perchloric acid, potentiometric end point
	3-13-14-15-16	Titrimetric with ammonium ferrous sulphate, oxidation with persulphate/silver nitrate, potentiometric end point
	4-5	Titrimetric with ammonium ferrous sulphate, oxidation with perchloric acid, visual end point
	6-7-9-10-11-12-17-18-19	Titrimetric with ammonium ferrous sulphate, oxidation with persulphate/silver nitrate, visual end point
	8	Atomic absorption spectrometry

METHODS USED
ECRM 281-1

Element	Line No.	Method
Ni	2-7-9-11-12-13-16-19	Dimethylglyoxime precipitation, gravimetric
	3-4-6	Dimethylglyoxime precipitation, titration with cyanide
	5	Dimethylglyoxime precipitation, titration with EDTA
	8	Photometric with dimethylglyoxime
	10-15-18	Atomic absorption spectrometry
	14	Dimethylglyoxime precipitation, titration with dichromate
	17	Photometric with dimethylglyoxime with extraction
Al (Total)	1-3-4-5-7-8-9-11-12-13-14	Atomic absorption spectrometry
	2-6-15	Photometric with eriochrome cyanine, mercury cathode separation
	10	Photometric with chrome azurol S
B	1	Photometric with dianthrimide
	2-5-6-9-10-13-14-16	Photometric with curcumin
	3-7	Photometric with curcumin, separation by distillation
	4	Plasma emission spectrometry
	8	Photometric with carmine, separation by distillation
	11-12	Photometric with methylene blue, separation by extraction
	15	Photometric with dianthrimide after mercury cathode and ion exchange separations
Co	1-2-6-8-9-11-13-14-15-16	Atomic absorption spectrometry
	3-12	Photometric with nitroso-R-salt
	4-5-7-10	Photometric with nitroso-R-salt, separation with 1-nitroso-2-naphthol
Cu	1-3-4-5-6-12-16-17-18	Atomic absorption spectrometry
	2-8-10-14-15	Photometric with 2,2′ diquinolyl with extraction
	7-9-19	Photometric with 2,2′ diquinolyl
	11	Photometric with diethyldithiocarbamate with extraction
	13	Photometric with diethyldithiocarbamate
N	1	Vacuum fusion, pressure measurement
	2-9-12-17	Titrimetric with hydrochloric acid, separation by distillation
	3	Photometric with indophenol blue, separation by distillation
	4-5-6-7-8-10-11-13-14-15-16-18	Carrier gas fusion, thermal conductivity
Pb	1-6-8-13-14	Photometric with dithizone with extraction
	2-3-4-5-7-9-10-11-12	Atomic absorption spectrometry
Sn	1-3-6-10-12-14	Atomic absorption spectrometry
	2	Photometric as 3-pyridyl complex with extraction
	5-8-11	Photometric with phenylfluorone
	4-7-9	Titrimetric with iodate, reduction with aluminium, sulphide separation
	13-15	Photometric with catechol violet with extraction
Ti	1-7-9-17-18-19	Photometric with chromotropic acid
	2-8	Photometric with hydrogen peroxide, cupferron separation
	3-15-16	Photometric with hydrogen peroxide
	4-11-13-14	Atomic absorption spectrometry
	5-6-12	Photometric with diantipyryimethane
	10	X-ray fluorescence spectrometry
As	1-9-12-13-17-18-19	Photometric as molybdenum blue with extraction
	2	Atomic absorption spectrometry
	3-7-8-11-16	Photometric with silver diethyldithiocarbamate
	4-15	Titrimetric with bromate, separation by distillation potentiometric end point
	5	Titrimetric with iodine, hypophosphite reduction
	6	Titrimetric with iodine, separation as sulphide
	10	Photometric as molybdenum blue, separation as arsine
	14	X-ray fluorescence spectrometry