

ECSC - CECA - EGKS

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

EUROPEAN CERTIFIED REFERENCE MATERIAL (EURONORM — CRM)

**CERTIFICATE OF CHEMICAL ANALYSIS**

**EURONORM — CRM No. 587-1 FERRO — BORON**

LABORATORY MEANS (4 values)  
 mass content in %

Line No.	B	C	Mn	Al (Total)
1	18.28	0.7127	—	0.0435
2	18.30	0.7180	0.2515	0.0440
3	18.32	0.7202	0.2634	0.0444
4	18.44	0.7230	0.2670	0.0445
5	18.46	0.7265	0.2673	0.0448
6	18.59	0.7295	0.2680	0.0462
7	18.60	0.7305	0.2700	0.0468
8	18.64	0.7313	0.2702	0.0470
9	18.66	0.7370	0.2712	0.0472
10	18.78	0.7376	0.2715	0.0476
11	18.79	0.7390	0.2738	0.0488
12	18.83	0.7456	0.2747	0.0492
13	18.88	0.7505	0.2750	0.0492
14	18.92	0.7526	0.2782	0.0504
15	18.93	0.7540	0.2789	0.0510
16	18.94	0.7594	0.2790	—
17	18.95	0.7600	0.2818	—
18	—	0.7638	0.2825	—
19	—	—	—	—
<b>MM</b>	<b>18.67</b>	<b>0.7384</b>	<b>0.2720</b>	<b>0.0470</b>
<b>SM</b>	<b>0.24</b>	<b>0.0157</b>	<b>0.0076</b>	<b>0.0024</b>

Si	P	S	Cr	Mo	Co	Ti	V	Ca
0.0902	0.0123	0.0006	0.0708	0.0045	0.0069	0.0270	0.0035	0.0357
0.1000	0.0140	0.0006	0.0775	0.0046	0.0080	0.0305	0.0038	0.0400
0.1060	0.0150	0.0009	0.0860	0.0049	0.0084	0.0325	0.0040	0.0428
0.1108	0.0185	0.0010	0.1007	0.0050	0.0090	0.0348	0.0044	0.0435
0.1120	0.0187	0.0011	0.1018	0.0050	0.0093	0.0350	0.0050	0.0445
0.1145	0.0197	0.0014	0.1030	0.0050	0.0100	0.0352	0.0050	0.0471
0.1155	0.0198	0.0015	0.1052	0.0053	0.0100	0.0362	0.0052	0.0476
0.1210	0.0204	—	0.1082	0.0068	0.0100	0.0383	—	0.0486
0.1235	0.0205	—	0.1140	0.0081	0.0104	0.0400	—	0.0486
0.1318	0.0211	—	0.1150	—	0.0105	0.0408	—	0.0496
0.1406	0.0219	—	0.1152	—	0.0105	0.0414	—	0.0496
0.2056	0.0222	—	0.1200	—	0.0108	0.0423	—	0.0505
0.2100	0.0228	—	0.1200	—	0.0108	0.0428	—	0.0505
—	0.0229	—	0.1230	—	0.0110	0.0435	—	0.0508
—	0.0230	—	—	—	0.0110	0.0438	—	0.0520
—	0.0231	—	—	—	0.0120	0.0438	—	0.0528
—	0.0244	—	—	—	—	0.0447	—	0.0600
—	—	—	—	—	—	0.0505	—	—
0.129	0.020	0.0010	0.104	0.005	0.010	0.039	0.004	0.048

**MM:** Mean of the intralaboratory means **SM:** Standard deviation of the intralaboratory means

The laboratory mean values have been examined statistically to eliminate any outlying values. Where a "—" appears in the table it indicates that an outlying value has been omitted.

**CERTIFIED VALUES**

mass content in %

	B	C	Mn	Al (Total)
<b>MM</b>	<b>18.7</b>	<b>0.738</b>	<b>0.272</b>	<b>0.047</b>
<b>SM</b>	<b>0.3</b>	<b>0.016</b>	<b>0.008</b>	<b>0.003</b>

**Note:** The acid insoluble residue from this sample contains a high proportion of some of the elements present. The residue must therefore be totally decomposed by fusion, dissolved and added to the bulk solution in order to obtain the correct values.

**DESCRIPTION OF THE SAMPLE**

This sample consists of material passing a 150 µm aperture sieve from which the fines passing a 53 µm aperture sieve have been removed. It is supplied only in bottles of 100g.

**PARTICIPATING LABORATORIES**

Arbed, Division d'Esch Belval, Esch-sur-Alzette, (Luxembourg)  
 British Steel Corporation, Stocksbridge & Tinsley Park Works, Sheffield (U.K.)  
 Bundesanstalt für Materialprüfung (BAM), Berlin (Germany)  
 Central-Sperimentale Metallurgico s.p.a. (CSM), Rome, (Italy)  
 Cockerill—Sambre S.A., Couillet (Belgium)  
 Cockerill—Sambre S.A., Seraing (Belgium)  
 DANTEST, Copenhagen (Denmark)  
 Gesellschaft für Electrometallurgie mbh (GFE), Nürnberg (Germany)  
 Hoogovens Groep BV, IJmuiden (Netherlands)

Institut de Recherches de la Sidérurgie Française (IRSID), St. Germain-en-Laye, (France)  
 Krupp Stahl AG, Bochum (Germany)  
 London & Scandinavian Metallurgical Co. Ltd., Rotherham (UK)  
 Pattinson and Stead, Middlesbrough (UK)  
 Pechiney Electrometallurgie, Le Fayet (France)  
 Rautaruukki Oy, Oulu (Finland)  
 Ridsdale and Co., Ltd., Middlesbrough (UK)  
 SOLLAC, Florange (France)  
 Thyssen Edelstahlwerke AG, Witten (Germany)  
 Treibacher Chemische Werke AG, Treibach (Austria)



This reference material prepared and issued by:

**BUREAU OF ANALYSED SAMPLES LIMITED**

Newham Hall, Middlesbrough, England

MAY 1986

On behalf of: The Iron and Steel Nomenclature Co-ordinating Committee (COCOR) of the ECSC, after approval by all the participating laboratories and all the producing organizations. (France—IRSID; German Federal Republic—Iron and Steel CRM Working Group; UK—BAS Ltd.)

**METHODS USED**  
**EURONORM-CRM 587-1**

Element	Line Number	Methods
<b>B</b>	1 - 5 - 11 - 12 - 16	Titration of boric acid in presence of mannitol, hydroxide precipitation.
	2 - 4 - 8 - 13 - 14 - 15	Titration of boric acid in presence of mannitol, ion-exchange separation of interfering element.
	3 - 7 - 17	AAS
	6	Photometric as methylene blue fluoroborate, extraction, separation of boron by ion-exchange
	9	ICP-AES
<b>C</b>	10	Neutron transmission
	1 - 2 - 3 - 4 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 17 - 18	Combustion, infra-red absorption
	5 - 7 - 16	Combustion, non-aqueous titration
	6 - 8	Combustion, coulometric titration
	2 - 6 - 18	ICP-AES
<b>Mn</b>	3 - 9 - 11 - 13 - 15 - 17	AAS
	4	Photometric, persulphate oxidation
	5 - 7 - 12 - 14 - 16	Photometric, periodate oxidation
	8	Spectral emission analysis, synthetic calibration with pure materials
	10	Photometric, bismuthate oxidation
<b>Al (Total)</b>	1 - 2 - 5 - 11 - 12 - 13 - 15	AAS, without separation
	3	Photometric as hydroxyquinolate, ion-exchange separation
	4 - 7 - 9	ICP-AES
	6	XRF
	8	Spectral emission analysis, synthetic calibration with pure materials
<b>Si</b>	10	Photometric as hydroxyquinolate, with extraction
	14	AAS, extraction of iron
	1 - 11	AAS
	2 - 8	Photometric as molybdenum blue without extraction
	3 - 5	Gravimetric, dehydration with sulphuric acid
<b>P</b>	4 - 7 - 10 - 12 - 13	Gravimetric, dehydration with perchloric acid
	6 - 9	ICP-AES
	1 - 15	Photometric as molybdenum blue with extraction
	2 - 4 - 9	ICP-AES
	3 - 5 - 6 - 7 - 14 - 16	Photometric as phosphovanadomolybdate, with extraction
<b>S</b>	8 - 10 - 11 - 13 - 17	Photometric as molybdenum blue, without extraction
	12	XRF
	1 - 2 - 4 - 6 - 7	Combustion, infra-red absorption
	3	Combustion, oxidation-reduction titration
	5	Gravimetric as BaSO <sub>4</sub> after chromatographic separation on alumina
<b>Cr</b>	1 - 3 - 5 - 8 - 11 - 12	ICP-AES
	2	Spectral emission analysis - synthetic calibration with pure materials
	4 - 7 - 10 - 13 - 14	AAS
	6	Photometric with diphenylcarbazide, separation of iron
	9	XRF
<b>Mo</b>	1 - 2 - 3 - 8	AAS
	4	Spectral emission analysis - synthetic calibration with pure materials
	5 - 6 - 9	ICP-AES
	7	Photometric, thiocyanate in presence of Sn (II) with extraction
	1 - 4 - 7	ICP-AES
<b>Co</b>	2 - 3 - 6 - 8 - 9 - 11 - 12 - 13 - 14	AAS
	5 - 10	Photometric with nitroso-R-salt
	15	Photometric with PADAB
	16	Spectral emission analysis, synthetic calibration with pure materials
	1 - 5 - 6 - 7 - 17	ICP-AES
<b>Ti</b>	2 - 3 - 12 - 13 - 16	AAS
	4	Photometric with chromotropic acid, without separation
	8 - 11 - 14 - 18	Photometric with diantipyrylmethane
	9	Spectral emission analysis, synthetic calibration with pure materials
	10	Photometric with hydrogen peroxide
<b>V</b>	15	XRF
	1	Photometric with N benzoylphenylhydroxylamine, with extraction
	2 - 4 - 5	ICP-AES
	3	AAS
	6	Spectral emission analysis-synthetic calibration with pure materials
<b>Ca</b>	7	Photometric with dimethylnaphthidine
	1 - 4 - 11	ICP-AES
	2	Spectral emission analysis, synthetic calibration with pure materials
	3 - 5 - 6 - 7 - 8 - 9 - 10 - 12 - 13 - 14 - 15 - 17	AAS
	16	XRF

Abbreviations:-

AAS : Atomic Absorption Spectrometry

ICP-AES: Inductively Coupled Plasma-Atomic Emission Spectrometry

PADAB : 4 - [5-Chloropyridyl-2-azo] - m - phenylenediamine

XRF : X-ray Fluorescence Spectrometry, fused bead technique, synthetic calibration

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### FURTHER INFORMATION

For information regarding the preparation and certification of these European Certified Reference Materials (EURONORM-CRMs) and sources of supply please refer to ECSC Information Circular No. 1 available from the national standardization institution in your country. (In the UK this is the BSI, 2 Park Street, London W1A 2BS).

Des informations complémentaires sur la fabrication et la certification des Matériaux de Référence Certifiés Européens (EURONORM — MRC) ainsi que sur les possibilités d'approvisionnement se trouvent dans la circulaire d'information No. 1 de la CECA. On peut se procurer cette circulaire auprès des organismes nationaux de normalisation. (Pour la France: AFNOR, Tour-Europe - Cedex 7, 92080 Paris La Défense).

Weitere Angaben über die Herstellung und Zertifizierung dieser Europäischen Zertifizierten Referenzmaterialien (EURONORM-ZRM) sowie die Bezugsmöglichkeiten finden sich in der Mitteilung Nr. 1 der EGKS, zu beziehen durch die nationalen Normenorganisationen. (In Deutschland bei der Beuth-Verlag GmbH, Burggrafenstrasse 4-10, Berlin 30).