

**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. 482-2 LOW ALLOY CAST IRON**

LABORATORY MEANS (4 Values)  
 mass content in %

Line No.	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
1	2.5688	1.7928	0.7083	0.0925	0.0437	—	0.4342	—	—
2	2.5723	1.7945	0.7104	0.0940	0.0439	0.6548	0.4450	2.2508	1.2027
3	2.5752	1.7983	0.7132	0.0949	0.0442	0.6575	0.4478	2.2561	1.2071
4	2.5766	1.8009	0.7186	0.0949	0.0447	0.6604	0.4480	2.2637	1.2165
5	2.5770	1.8035	0.7240	0.0949	0.0469	0.6653	0.4494	2.2643	1.2213
6	2.5793	1.8046	0.7253	0.0953	0.0470	0.6662	0.4522	2.2729	1.2218
7	2.5823	1.8066	0.7264	0.0956	0.0488	0.6671	0.4525	2.2750	1.2221
8	2.5845	1.8089	0.7280	0.0960	0.0492	0.6678	0.4527	2.2755	1.2273
9	2.5871	1.8150	0.7296	0.0961	0.0495	0.6688	0.4539	2.2813	1.2280
10	2.5920	1.8163	0.7298	0.0967	0.0497	0.6773	0.4556	2.2817	1.2297
11	2.5938	1.8171	0.7334	0.0975	0.0499	0.6788	0.4558	2.2823	1.2330
12	2.6025	1.8186	0.7339	0.0982	0.0505	0.6795	0.4558	2.2839	1.2345
13	2.6152	1.8206	0.7340	0.0994	0.0513	0.6812	0.4565	2.2933	1.2365
14	2.6175	1.8268	0.7340	0.0995	0.0518	0.6825	0.4575	2.2997	1.2443
15	2.6220	1.8305	0.7342	0.1006	0.0518	0.6841	0.4605	2.3020	1.2477
16	2.6268	1.8318	0.7343	0.1010	0.0518	0.6846	0.4622	2.3028	1.2508
17	2.6329	1.8328	0.7375	0.1015	0.0519	0.6860	0.4642	2.3065	1.2515
18	2.6402	1.8340	0.7375	0.1046	0.0532	0.6899	0.4722	2.3066	1.2537
19	2.6428	1.8361	0.7398	—	0.0534	0.6922	—	2.3082	—
<b>M<sub>M</sub></b>	<b>2.5994</b>	<b>1.8151</b>	<b>0.7280</b>	<b>0.0974</b>	<b>0.0491</b>	<b>0.6747</b>	<b>0.4542</b>	<b>2.2837</b>	<b>1.2311</b>
<b>S<sub>M</sub></b>	<b>0.0247</b>	<b>0.0141</b>	<b>0.0093</b>	<b>0.0031</b>	<b>0.0032</b>	<b>0.0114</b>	<b>0.0082</b>	<b>0.0181</b>	<b>0.0152</b>
<b>S<sub>w</sub></b>	<b>0.0124</b>	<b>0.0078</b>	<b>0.0032</b>	<b>0.0012</b>	<b>0.0010</b>	<b>0.0043</b>	<b>0.0039</b>	<b>0.0102</b>	<b>0.0079</b>

$M_M$ : Mean of the intralaboratory means  $S_M$ : Standard deviation of the intralaboratory means  $S_M = \sqrt{S_b^2 + S_w^2/4}$   
 $S_w$ : Intralaboratory standard deviation  $S_b$ : interlaboratory standard deviation

The laboratory mean values have been examined statistically to eliminate outstanding values. Where a "—" appears in the table it indicates that an outlying value has been omitted by either the Cochran or Grubbs Test.

**CERTIFIED VALUES**  
 mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu
<b>M<sub>M</sub></b>	<b>2.599</b>	<b>1.815</b>	<b>0.728</b>	<b>0.0974</b>	<b>0.0491</b>	<b>0.675</b>	<b>0.454</b>	<b>2.284</b>	<b>1.231</b>
<b>C(95%)</b>	<b>0.012</b>	<b>0.007</b>	<b>0.005</b>	<b>0.0015</b>	<b>0.0015</b>	<b>0.006</b>	<b>0.004</b>	<b>0.009</b>	<b>0.008</b>

The half-width confidence interval  $C(95\%) = t \times \frac{S_M}{\sqrt{n}}$  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.

**DESCRIPTION OF THE SAMPLE**

This sample consists of specially prepared material passing a 710µm aperture sieve from which the fines passing through a 180µm aperture sieve have been removed. It is supplied only in bottles of 100g.

This reference material was prepared and issued by:

**BUREAU OF ANALYSED SAMPLES LIMITED**

Newham Hall, Middlesbrough, England

JULY 1994

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, UK-BAS Ltd.)



## PARTICIPATING LABORATORIES

Acerinox SA, Algeciras (Spain) AG der Dillinger Huttenwerke, Dillingen (Germany) Bundesanstalt für Materialforschung und-prüfung (BAM), Berlin (Germany) Cast Metals Development Ltd. (A BCIRA Group Company), Aivechurch (UK) Centre Technique des Industries de la Fonderie (CTIF), Sèvres (France) Centro Nacional de Investigaciones Metallurgicas (CENIM), Madrid (Spain) Cockerill-Sambre, Seraing (Belgium) Direction Technique de Pont-à Mousson, Pont-à Mousson (France) Hoogovens Groep BV, Ijmuiden (Netherlands)	Institut de Recherches de la Sidérurgie Française (IRSID), Maizières-les-Metz (France) Institutet för Metallforskning, Stockholm (Sweden) Midland Research Co. Ltd., Dudley (UK) Rautaruukki Oy, Raahе (Finland) Ridsdale & Co. Ltd., Middlesbrough (UK) Soillac-Florange, Florange (France) Staatliches Materialprüfungsamt, Nordrhein-Westfalen (MPA NRW), Dortmund (Germany) Stanton plc, Nottingham (UK) Triplex Williams Ltd., Cardiff (UK) Voest Alpine Stahl Linz GmbH, Linz (Austria)
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### METHODS USED EURONORM - CRM No. 482-2

Element	Line Number	Methods
C	1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 17	Combustion, infrared absorption
	15 - 18	Combustion, non-aqueous titration
Si	1 - 2 - 4 - 5 - 6 - 7 - 8 - 9 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 18 - 19	Combustion, 16 Combustion, 19 Combustion, gas volumetric
	3	Gravimetric, dehydration with perchloric acid
	10	XRF
Mn	1 - 17	Photometric, molybdenum blue, without extraction
	2 - 6 - 8 - 10 - 11 - 12 - 18	Titration with arsenite, oxidation with persulphate
	3 - 4 - 5 - 7 - 9 - 15	Photometric, periodate oxidation
	13	FAAS
P	14 - 18 - 19	XRF
	1 - 6 - 10 - 12 - 15 - 18	ICP-AES
	2 - 14 - 16 - 17	Photometric as phosphovanadomolybdate, extraction
	3 - 4 - 7 - 11	Acidimetric titration of ammonium phosphomolybdate
S	5 - 8 - 9 - 13	Photometric, molybdenum blue, without extraction
	1 - 2 - 3 - 4 - 5 - 6 - 8 - 11 - 12 - 13 - 16 - 18 - 19	ICP-AES
	7	Combustion, infrared absorption
	9	Iodimetric titration; evolution as sulphide in acid medium
Cr	10	Acidimetric titration, absorption in peroxide
	14	Combustion, conductimetry
	15 - 17	Combustion, redox titration
	2 - 5 - 7 - 9 - 12 - 15 - 19	Gravimetric as sulphate without separation
	3 - 6	FAAS
Mo	4 - 8 - 13 - 18	Titration with Fe(II), oxidation with perchloric acid
	10 - 11 - 16 - 17	Titration with Fe(II), oxidation with persulphate
	14	ICP-AES
	1 - 11 - 17	XRF
	2 - 4 - 5 - 7 - 8 - 12 - 18	FAAS
Ni	3 - 6 - 13 - 14 - 15 - 16	ICP-AES
	9	Photometric, thiocyanate with Sn(II), extraction
	10	XRF
	2 - 4 - 5 - 13 - 15	Photometric, thiocyanate with Sn(II), without extraction
	3 - 8 - 9 - 14 - 17 - 19	ICP-AES
Cu	6	FAAS
	7 - 11 - 16	Gravimetry with dimethylglyoxime
	10	Photometric with dimethylglyoxime, without extraction
	12	XRF
	18	Titration with Fe (III), separation with dimethylglyoxime
	2	Photometric with dimethylglyoxime, extraction
	3	XRF
4 - 6 - 7 - 8 - 9 - 11 - 12 - 13 - 14 - 15	Titration with iodine, separation as sulphide	
5 - 16 - 18	FAAS	
10	ICP-AES	
17	Photometric with DDTC, extraction	
		Photometric with bis(cyclohexanone-oxalyl)dihydrazone extraction

Abbreviations: ICP-AES : Inductively Coupled Plasma - Atomic Emission Spectrometry. XRF: X-Ray Fluorescence Spectrometry - fused bead technique with synthetic calibration.  
 FAAS : Flame Atomic Absorption Spectrometry

### 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 Information Circulars No. 1 (ECISS) and No. 5 (ECSC), both of which are available from the national standards body in your country (In the UK this is the BSI, 2 Park Street, London, W1A 2BS).

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 les circulaires d'information No. 1 (ECISS) et No. 5 (CECA). On peut se procurer ces deux circulaires auprès des organismes nationaux de normalisation. (Pour la France: AFNOR, Tour Europe - Cedex 7, 92080 Paris La Défense).

Angaben über Herstellung, Zertifizierung und Bezugsmöglichkeiten dieser Zertifizierten Europäischen Referenzmaterialien (EURONORM-ZRM) sowie über die Anwendung der in diesem Zertifikat enthaltenen statistischen Daten finden sich in den Mitteilungen Nr. 1 (ECISS) und Nr. 5 (EGKS), beide zu beziehen durch die nationalen Normenorganisationen. (In Deutschland bei der Vertriebsstelle des DIN: Beuth-Verlag GmbH, Burggrafenstrasse 4-10, 1000 Berlin 30).