

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. **489-1** WHITE CAST IRON

LABORATORY MEANS (4 values)
 mass content in %

Line No.	C	Si	P	S	Cu	Mn*	N
1	2.8060	1.4997	0.7900	0.1468	0.2598	0.4920	0.0047
2	2.8188	1.5000	0.7904	0.1476	0.2640	0.4954	0.0049
3	2.8373	1.5070	0.7915	0.1498	0.2650	0.4965	0.0050
4	2.8433	1.5070	0.7975	0.1520	—	0.5003	0.0050
5	2.8482	1.5100	0.7984	0.1521	0.2697	0.5018	0.0051
6	2.8483	1.5135	0.8044	0.1525	0.2706	0.5035	0.0053
7	2.8495	1.5136	0.8070	0.1530	0.2710	0.5044	0.0054
8	2.8513	1.5137	0.8078	0.1532	0.2720	0.5052	0.0057
9	2.8553	1.5183	0.8085	0.1533	0.2725	0.5068	0.0057
10	2.8558	1.5200	0.8094	0.1541	0.2728	0.5074	0.0057
11	2.8573	1.5205	0.8120	0.1544	0.2730	0.5093	0.0057
12	2.8576	1.5253	0.8128	0.1545	0.2733	0.5100	0.0058
13	2.8579	1.5267	0.8152	0.1546	0.2736	0.5106	0.0058
14	2.8605	1.5279	0.8155	0.1553	0.2737	0.5108	0.0059
15	2.8630	1.5283	0.8186	0.1555	0.2741	0.5115	0.0060
16	2.8641	1.5293	0.8192	0.1559	0.2745	0.5128	0.0062
17	2.8659	1.5304	0.8193	0.1572	0.2759	0.5155	0.0063
18	2.8668	1.5329	0.8272	0.1574	0.2762	0.5175	0.0063
19	2.8693	1.5350	0.8281	0.1574	0.2773	0.5181	0.0064
20	2.8768	1.5355	0.8288	—	0.2775	0.5195	—
21	2.8780	1.5367	0.8298	0.1583	0.2783	0.5203	—
22	2.8828	1.5368	0.8345	0.1585	0.2828	0.5220	—
23	2.8913	1.5403	0.8413	0.1590	0.2848	0.5313	—
24	2.8955	1.5472	0.8572	0.1622	0.2868	—	—
25	2.9037	1.5575	—	0.1641	—	—	—
M_M	2.8602	1.5245	0.8152	0.1549	0.2739	0.510	0.0056
s_M	0.0218	0.0145	0.0166	0.0040	0.0062		
s_w	0.0106	0.0094	0.0072	0.0016	0.0023		

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

s_w: Mean intralaboratory standard deviation **s_b**: Interlaboratory standard deviation

$$s_M = \sqrt{s_b^2 + s_w^2/4}$$

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 by either the Cochran or Grubbs test.

* NOTE: The manganese content has not been certified because the sample was slightly contaminated with manganese during the grinding operation.

CERTIFIED VALUES
 mass content in %

	C	Si	P	S	Cu
M_M	2.860	1.524	0.815	0.155	0.274
C(95%)	0.009	0.006	0.007	0.002	0.003

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 35:1989 section 4.

DESCRIPTION OF THE SAMPLE

This sample consists of material passing a 400 µm aperture sieve from which the fines passing a 150 µm aperture sieve have been removed. It is supplied only in bottles of 100g



This reference material prepared and issued by:

BUREAU OF ANALYSED SAMPLES LIMITED

Newham Hall, Middlesbrough, England

DECEMBER 1991

On behalf of:- The Iron and Steel Nomenclature Co-ordinating Committee (COCOR) of the ECIS, 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.)

ECISS **PROOF**
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6	2.8483	1.5135	0.8044	0.1525	0.2706	0.0053	0.5035
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22	2.8828	1.5368	0.8345	0.1585	0.2828	—	0.5220
23	2.8913	1.5403	0.8413	0.1590	0.2848	—	0.5313
24	2.8955	1.5472	0.8572	0.1622	0.2868	—	—
25	2.9037	1.5575	—	0.1641	—	—	—
MM	2.8602	1.5245	0.8152	0.1549	0.2739	0.0056	0.510
SM	0.0218	0.0145	0.0166	0.0040	0.0062	0.0005	—
SW	0.0106	0.0094	0.0072	0.0016	0.0023	0.0002	—

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

SW: Mean intralaboratory standard deviation SB: Interlaboratory standard deviation

$$SM = \sqrt{SB^2 + SW^2/4}$$

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 by either the Cochran or Grubbs test.

* NOTE: The manganese content is not certified because this has been found to vary with particle size.

CERTIFIED VALUES
 mass content in %

	C	Si	P	S	Cu	N
MM	2.860	1.524	0.815	0.155	0.274	0.0056
C(95%)	0.009	0.006	0.007	0.002	0.003	0.0002

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

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PARTICIPATING LABORATORIES

Acerinox S.A., Algeciras (Spain)	Max-Planck Institut für Eisenforschung GmbH, Düsseldorf (Germany)
BCIRA, Birmingham (UK)	Midland Rollmakers Ltd., Crewe (UK)
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany)	Nordisk Analys Service AB (NASAB), Hällefors (Sweden)
Centre de Recherches de Pontà Mousson S.A. Maizières (France)	Rautaruukki Oy, Raahé (Finland)
Centre Technique des Industries de la Fonderie (CTIF), Sevre (France)	Ridsdale and Co. Ltd., Middlesbrough (UK)
Centro Nacional de Investigaciones Metalurgicas (CENIM), Madrid (Spain)	Sollac, Florange (France)
Centro Sviluppo Materiali (CSM), Rome (Italy)	Svenskt Stål AB, Oxelösund (Sweden)
Cockerill Sambre S.A., Couillet (Belgium)	Staatliches Materialprüfungsamt Nordrhein-Westfalen (MPA-NRW), Dortmund (Germany)
Dantest, Copenhagen (Denmark)	Stanton plc, Nottingham (UK)
Hoogovens Groep BV, IJmuiden (Netherlands)	The Davy Roll Co. Ltd., Sheffield (UK)
Institutet för Metallforskning, Stockholm, (Sweden)	Thyssen Edelstahlwerke AG, Witten (Germany)
Institut de Recherches de la Sidérurgie Française (IRSID), Maizières-les-Metz (France)	Voest Alpine Stahl Linz GmbH, Linz (Austria)
Lorfonte, Uckange (France)	

METHODS USED EURONORM-CRM 489-1

Element	Line Number	Methods
C	1-13-21	Combustion, gravimetric
	2- 3- 5- 6- 7- 8- 9-10-11-12-17-18-19-20-22-23-24	Combustion, infrared absorption
	4-16	Combustion, non-aqueous titration
	14-25	Combustion, conductimetry
	15	Combustion, coulometric titration
Si	1- 4- 5- 6- 7- 8- 9-11-12-13-14-16-17-18-19-20	Gravimetric, dehydration with perchloric acid
	-21-22-23-24-25	
	2- 3-15	ICP-AES
	10	Photometric as molybdenum blue without extraction
P	1- 5- 9-10-22	Photometric as phosphovanadomolybdate after extraction
	2- 4- 8-16-18	Photometric as molybdenum blue without extraction
	3-15-20-23	Acidimetric titration of ammonium phosphomolybdate
	6-11-12-14-21-24	ICP-AES
	7	Photometric as molybdenum blue after extraction
	13	Gravimetric as lead molybdate, precipitation as ammonium phosphomolybdate
	17	Gravimetric as ammonium phosphomolybdate
S	1- 2- 3- 5- 6- 9-10-12-14-15-16-17-18-19-21-23-24	Photometric as phosphovanadomolybdate without extraction
	4	Combustion, infrared absorption
	7- 8-11-22	Combustion, acidimetric titration
	13-25	Gravimetric as BaSO ₄ without separation
		Combustion, conductimetry
Cu	1- 2- 3- 5- 6- 9-10-12-15-16-17-18-21-22	FAAS
	2- 7-19-23-24	ICP-AES
	8	Photometric with bis-cyclohexanone oxalyldihydrazone
	11	Photometric with oxalyldihydrazide
	13	Photometric with cuproine, without extraction
	14	Titration with iodine, separation sulphide
	20	Photometric with cuproine, extraction
Mn	1- 3- 4-13-19-21	FAAS
	2- 7- 8-10-11-15-16-18-20	Photometric, periodate oxidation
	5- 6- 9-14	ICP-AES
	12-17	Photometric, persulphate oxidation
	23	Titration with arsenite, oxidation with persulphate
N	1-2-3-4-5-6-7-8- 9-10-12-13-14-15-16-17-18-19	Thermal conductivity, decomposition in graphite crucible
	11	Photometric with indophenol blue after distillation

Abbreviations:- FAAS - Flame Atomic Absorption Spectrometry
ICP-AES - Inductively Coupled Plasma-Atomic Emission 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).

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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).

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