

**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. 296-1 JETHETE STEEL**

**LABORATORY MEANS (4 Values)**  
 mass content in %

Line No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	Co	Cu	N	Pb	Sn	V	B
1	0.1141	0.2345	0.6584	0.0163	0.0023	11.7247	—	2.7535	0.0238	0.0111	0.0197	0.1444	0.0198	0.00010	0.0121	0.3413	0.0001
2	0.1145	0.2348	0.6605	0.0171	0.0024	11.7315	1.6696	2.7603	0.0240	0.0129	0.0200	0.1447	0.0201	0.00010	0.0122	0.3492	0.0001
3	0.1150	0.2364	0.6688	0.0171	0.0025	11.7450	1.6711	2.7633	0.0259	0.0131	0.0204	0.1480	0.0204	0.00010	0.0126	0.3528	0.0002
4	0.1151	0.2391	0.6688	0.0172	0.0025	11.7656	1.6760	2.7775	0.0264	0.0131	0.0208	0.1483	0.0204	0.00010	0.0126	0.3529	0.0002
5	0.1154	0.2395	0.6706	0.0173	0.0026	11.7688	1.6813	2.7786	0.0265	0.0132	0.0210	0.1483	0.0205	0.00010	0.0129	0.3560	0.0003
6	0.1155	0.2400	0.6708	0.0173	0.0026	11.7730	1.6827	2.7793	0.0266	0.0133	0.0212	0.1490	0.0210	0.00012	0.0129	0.3579	0.0004
7	0.1156	0.2405	0.6717	0.0176	0.0026	11.7897	1.6868	2.7864	0.0272	0.0135	0.0213	0.1490	0.0211	0.00012	0.0130	0.3607	0.0005
8	0.1160	0.2428	0.6727	0.0176	0.0026	11.7900	1.6918	2.7872	0.0274	0.0136	0.0213	0.1491	0.0212	0.00013	—	0.3616	—
9	0.1161	0.2430	0.6728	0.0177	0.0026	11.7975	1.7044	2.7893	0.0274	0.0138	0.0215	0.1496	0.0213	0.00015	0.0132	0.3626	—
10	0.1171	0.2434	0.6753	0.0177	0.0027	11.8000	1.7045	2.7951	0.0274	0.0139	0.0216	0.1501	0.0214	0.00020	0.0133	0.3640	—
11	0.1173	0.2434	0.6762	0.0178	0.0027	11.8177	1.7056	2.7969	0.0275	0.0143	0.0217	0.1502	0.0216	0.00020	0.0133	0.3665	—
12	0.1173	0.2435	0.6782	0.0178	0.0027	11.8373	1.7072	2.7971	0.0279	0.0145	0.0220	0.1503	0.0217	0.00025	0.0133	0.3669	—
13	0.1173	0.2437	0.6783	0.0179	0.0027	11.8469	1.7094	2.7984	—	0.0148	0.0221	0.1506	0.0222	0.00025	0.0136	0.3677	—
14	0.1180	0.2445	0.6795	0.0179	0.0027	11.8500	1.7103	2.8033	0.0287	0.0148	0.0223	0.1509	0.0223	0.00030	0.0136	0.3703	—
15	0.1180	0.2446	0.6810	0.0180	0.0027	11.8784	1.7131	2.8043	0.0287	0.0148	0.0225	0.1510	0.0224	—	0.0136	—	—
16	0.1180	0.2447	0.6824	0.0187	0.0028	11.8800	1.7179	2.8048	0.0291	0.0152	0.0227	0.1517	0.0228	—	0.0140	0.3714	—
17	0.1186	0.2455	0.6856	0.0187	0.0029	11.8939	1.7213	2.8063	0.0296	0.0166	0.0232	0.1522	0.0234	—	—	0.3743	—
18	0.1196	0.2499	0.6882	0.0187	0.0029	11.9459	1.7239	2.8086	0.0298	—	0.0235	0.1533	—	—	—	0.3755	—
19	0.2538	0.6959	0.0195	—	—	11.9898	1.7248	2.8097	0.0309	—	0.0248	0.1561	—	—	—	0.3823	—
<b>M<sub>M</sub></b>	<b>0.1166</b>	<b>0.2425</b>	<b>0.6756</b>	<b>0.0178</b>	<b>0.0026</b>	<b>11.8224</b>	<b>1.7001</b>	<b>2.7895</b>	<b>0.0275</b>	<b>0.0139</b>	<b>0.0218</b>	<b>0.1498</b>	<b>0.0214</b>	<b>0.00016</b>	<b>0.0131</b>	<b>0.3630</b>	<b>0.0003</b>
<b>s<sub>M</sub></b>	0.0015	0.0047	0.0090	0.0007	0.0002	0.0715	0.0183	0.0169	0.0019	0.0012	0.0027	0.0010	0.00007	0.0005	0.0102	—	—
<b>s<sub>w</sub></b>	0.0008	0.0035	0.0043	0.0004	0.0001	0.0293	0.0103	0.0074	0.0006	0.0004	0.0006	0.0010	0.0004	0.00003	0.0003	0.0030	—

**M<sub>M</sub>**: Mean of the laboratory means **s<sub>M</sub>**: Standard deviation of the laboratory means  
**s<sub>w</sub>**: Intralaboratory standard deviation **s<sub>b</sub>**: Interlaboratory standard deviation

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

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	Al	As	Co	Cu	N	Pb	Sn	V
<b>M<sub>M</sub></b>	<b>0.1166</b>	<b>0.242</b>	<b>0.676</b>	<b>0.0178</b>	<b>0.0026</b>	<b>11.82</b>	<b>1.700</b>	<b>2.790</b>	<b>0.0275</b>	<b>0.0139</b>	<b>0.0218</b>	<b>0.1498</b>	<b>0.0214</b>	<b>0.00016</b>	<b>0.0131</b>	<b>0.363</b>
<b>C(95%)</b>	0.0008	0.003	0.005	0.0004	0.0001	0.04	0.009	0.008	0.0009	0.0006	0.0006	0.0013	0.0005	0.00004	0.0003	0.005

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.



Certificate No. 94/3993

This reference material was prepared and issued by:

**BUREAU OF ANALYSED SAMPLES LIMITED**

Newham Hall, Middlesbrough, England

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 Germany-Iron and Steel CRM Working Group, UK-BAS Ltd.)

MARCH 1997

## PARTICIPATING LABORATORIES

Acerinox S.A., Algeciras (Spain) Aubert & Duval, Les Ancizes (France) British Steel Engineering Steels, Sheffield (UK) Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany) Böhler Edelstahl GmbH, Kapfenberg (Austria) Centro Nacional de Investigaciones Metalúrgicas (CENIM), Madrid (Spain) Cockerill Sambre S.A., Couillet (Belgium) Creusot Loire Industrie, Le Creusot (France) Defence Research Agency, Ministry of Defence, Farnborough (UK) EWK Edelstahl Witten-Krefeld GmbH, Witten (Germany) Hoogovens Groep BV, IJmuiden (Netherlands)	Institutet för Metallforskning, Stockholm (Sweden) Keighley Laboratories Ltd., Keighley (UK) Krupp Edelstahlprofile GmbH, Siegen (Germany) Luxcontrol S.A., (Luxembourg) Materialprüfungsamt Nordrhein-Westfalen (MPA-NRW), Dortmund (Germany) Ridsdale & Co. Ltd., Middlesbrough (UK) Special Melted Products Ltd., Sheffield (UK) Ugine Savoie, Ugine (France) Voest Alpine Stahl Linz GmbH., Linz (Austria)
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## DESCRIPTION OF THE SAMPLE

This sample is available in the form of chips passing a 1700µm aperture sieve from which the dust passing a 250µm aperture sieve has been removed. It is supplied in bottles containing 100g ...ref 296-1(C). It is also supplied in the form of 38mm dia discs ...ref 296-1(D).

## METHODS USED EURONORM – CRM No. 296-1

Element	Line Number	Methods
<b>C</b>	1-2-3-4-5-6-8-9-10-12-14-15-16-17-18	Combustion, infrared absorption
		7 Combustion, non-aqueous titration
		11 Combustion, conductimetry
		13 Combustion, coulometric titration
<b>Si</b>	1-4-5-6-7-8-9-10-12-13-15-16-19 2-3-17-18 11-14	Gravimetric, dehydration with perchloric acid
		Photometric as molybdenum blue, without extraction
		PES
<b>Mn</b>	1-2-7-11 3-5-6-10-12-15-18 4-8-13-14-16-17-19	FAAS
		Photometric, periodate oxidation
		PES
		9 Photometric, persulphate oxidation
<b>P</b>	1-2-3-7-10 4-5-8-12-13-14-16-17-18 6-9-15-19	Photometric as molybdenum blue, without extraction
		Photometric as phosphovanadomolybdate, extraction
		PES
		11 Photometric as molybdenum blue, extraction
<b>S</b>	1-2-3-5-6-7-8-9-10-11-13-14-15-16-17-18	Combustion, infrared absorption
		4 Gravimetric as BaSO <sub>4</sub> after chromatographic separation on alumina
		12 Combustion, conductimetry
		13
<b>Cr</b>	1-4-5-6-7-8-10-11-13-17-18-19 2-12-15 3-9-14-16	Titration with Fe(II), oxidation with persulphate
		Titration with Fe(II), oxidation with perchloric acid
		PES
<b>Mo</b>	2-11-14 3-9-13 4-5-7-8-10-16-17-19 6 12-15-18	Photometric with thiocyanate in presence of Sn(II), extraction
		FAAS
		PES
		6 Photometric with thiocyanate in presence of ascorbic acid, extraction
<b>Ni</b>	1-5-10 2-3-6-9-11-12 4-7-14-15-16 8-19 13 17 18	FAAS
		Gravimetric, dimethylglyoxime
		PES
		8-19 Complexometric titration
		13 Cyanometric titration
		17 Photometric, dimethylglyoxime, without extraction
18 Titration with dichromate after separation with dimethylglyoxime		
<b>Al</b>	1-2-6-11-14-19 3 4-5-7-8-9-10-12-16-17 15 18	PES
		GF-AAS
		FAAS
		15 Photometric with eriochrome cyanine, NaOH separation of iron
<b>As</b>	1-2-3-7-16-17 4-14 5-6-9-10-13 8-11 12 15	PES
		FAAS, evolution as arsine
		GF-AAS
		8-11 Photometric as molybdenum blue, halide extraction
		12 Photometric with silver diethyldithiocarbamate, separation as arsine
<b>Co</b>	1-6-8-10-11 2-4-5-7-9-12-13-14-15-16-17-18-19 3	PES
		FAAS
		3 Photometric with nitroso-R-salt
<b>Cu</b>	1-2-3-5-6-8-9-10-11-14-18-19 4-7-12-13-15-16-17	FAAS
		PES
<b>N</b>	1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17	Thermal conductivity, decomposition in graphite crucible

**METHODS USED**  
**EURONORM – CRM No. 296-1**

Element	Line Number	Methods
<b>Pb</b>	1-2-3-4-5-7-8-12	GFAAS
	6-14	ICP-MS
	9-10-11-13	FAAS
<b>Sn</b>	1-4-5-6	FAAS
	2	FAAS after separation with TOPO
	3-9-11-13-14	GF-AAS
	7-12-15-16	PES
	10	ICP-MS
<b>V</b>	1-2-4-5-8-10-12	FAAS
	3-6-7-11-13-14-16-17-19	PES
	9	Titration with Fe(II), oxidation with Mn(VIII)
	18	Photometric with dimethylnaphthidine
<b>B</b>	1-3-6-7	Photometric with curcumin
	2	Photometric with 1-1 dianthrimide, separation
	4-5	PES

**Abbreviations:**

FAAS: Flame Atomic Absorption Spectrometry  
 GF-AAS: Graphite-Furnace Atomic Absorption Spectrometry  
 ICP-MS: Inductively Coupled Plasma - Mass Spectrometry  
 PES: Plasma Emission Spectrometry  
 TOPO: Tri-octylphosphine oxide

**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, 389 Chiswick High Road, London W4 4AL).

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, 10787 Berlin 30).