

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. **590-1 FERRO-TUNGSTEN**

LABORATORY MEANS (4 values)

mass content in %

Line No.	C	Si	Mn	Mo	Cu	Sn	W	AI* (Total)
1	—	0.9600	0.1233	—	0.0450	0.0390	79.18	0.3366
2	0.0227	0.9824	0.1243	0.0929	0.0455	0.0404	79.18	—
3	0.0233	0.9923	0.1279	0.0940	0.0455	0.0431	79.21	0.3423
4	0.0234	1.0120	0.1321	0.0963	0.0462	0.0433	79.21	0.3466
5	0.0235	1.0125	0.1322	0.0965	0.0468	0.0438	79.32	0.3473
6	0.0242	1.0125	0.1330	0.0977	0.0475	0.0448	79.34	0.3500
7	0.0243	1.0225	0.1331	0.0985	0.0476	0.0450	79.34	0.3570
8	0.0243	1.0425	0.1347	0.1000	—	0.0453	79.36	0.3660
9	0.0244	1.0597	0.1380	0.1008	0.0485	0.0458	79.40	0.3735
10	0.0247	1.0659	0.1388	0.1009	0.0490	0.0460	79.41	0.3800
11	0.0248	1.0678	0.1400	0.1018	0.0499	0.0463	79.45	0.3905
12	0.0255	1.0950	0.1413	0.1019	0.0500	0.0473	79.51	0.3953
13	0.0256	1.1075	0.1420	0.1023	0.0503	0.0475	79.56	0.3975
14	0.0256	1.1080	0.1420	0.1027	0.0508	0.0478	79.63	0.4067
15	0.0258	1.1100	0.1430	0.1079	0.0514	0.0479	79.67	—
16	—	1.1178	0.1456	0.1103	0.0518	0.0540	79.71	—
17	0.0261	—	0.1485	—	—	—	79.72	—
18	0.0262	—	—	—	—	—	79.77	—
19	0.0267	—	—	—	—	—	79.78	—
20	0.0270	—	—	—	—	—	79.79	—
21	0.0274	—	—	—	—	—	79.79	—
22	—	—	—	—	—	—	79.91	—
23	—	—	—	—	—	—	79.95	—
24	—	—	—	—	—	—	80.05	—
<b>MM</b>	<b>0.0250</b>	<b>1.0480</b>	<b>0.1365</b>	<b>0.1003</b>	<b>0.0484</b>	<b>0.0454</b>	<b>79.55</b>	<b>0.37</b>
<b>sM</b>	0.0014	0.0507	0.0073	0.0047	0.0023	0.0034	0.26	—
<b>sW</b>	0.0008	0.0249	0.0041	0.0043	0.0020	0.0020	0.12	—

\*See Note under "METHODS USED" for Aluminium

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

**sW**: Mean intralaboratory standard deviation **sB**: Interlaboratory standard deviation

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

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.

**CERTIFIED VALUES**

mass content in %

	C	Si	Mn	Mo	Cu	Sn	W
<b>MM</b>	<b>0.0250</b>	<b>1.05</b>	<b>0.136</b>	<b>0.101</b>	<b>0.0484</b>	<b>0.045</b>	<b>79.55</b>
<b>C(95%)</b>	0.0007	0.03	0.004	0.003	0.0013	0.002	0.11

Approximate values for information: Fe 17.9%, O 0.6%, S 0.07%

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 laboratories

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 all passing a 150 µm aperture sieve. It is supplied only in bottles of 100g

**NOTE:** The contents of the sample bottle must be thoroughly mixed before use to avoid any possible segregation of different particle sizes.

For the determination of tungsten a minimum sample weight of 0.5g. should be used.

**PARTICIPATING LABORATORIES**

- Aciéries AUBERT & DUVAL, Les Ancizes (France)
- AG der Dillinger Hüttenwerke, Dilligen/Saar (Germany)
- Alfred H. Knight International Ltd., St. Helens (UK)
- BCIRA, Birmingham (UK)
- Böhler GmbH., Kapfenberg, (Austria)
- British Ceramic Research Ltd., Stoke-on-Trent (UK)
- British Steel Technical, Port Talbot (UK)
- Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin (Germany)
- Centre de Recherches de Maidières, Pont a Mousson (France)
- Centro Nacional de Investigaciones Metalúrgicas (CENIM), Madrid (Spain)
- Commentryenne AC Fins Vanad Alloys, Commentry (France)
- Gesellschaft für Elektrometallurgie (GFE), Nürnberg (Germany)
- GST Gesellschaft für Systemtechnik GmbH, Essen (Germany)
- Hermann C. Starck Berlin GmbH & Co. KG, Goslar (Germany)
- ILVA SpA, Terni (Italy)
- IMPHY S.A. Imphy (France)
- Inspectorate Griffith Ltd., Witham (UK)
- Krupp Stahl AG, Bochum (Germany)
- Krupp Stahl AG, Siegen (Germany)
- Laboratoires d'Analyses Pourquery, Bobigny (France)
- Laborlux, Esch-sur-Alzette (Luxembourg)
- Murex Ltd., Rainham (UK)
- Ridsdale and Co. Ltd., Middlesbrough (UK)
- Société Péchiney Electrometallurgie, Chedde (France)
- Stocksbridge Engineering Steels Ltd., Sheffield (UK)
- Thyssen Edelstahlwerke AG, Witten (Germany)

This reference material prepared and issued by:

**BUREAU OF ANALYSED SAMPLES LIMITED**

Newham Hall, Middlesbrough, England

MARCH 1991

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; German Federal Republic—Iron and Steel CRM Working Group; UK—BAS Ltd.)



## METHODS USED EURONORM-CRM 590-1

Element	Line Number	Methods
<b>C</b>	2- 4- 5- 8- 9-11-12-13-14-15-17-19-20-21	Combustion, infrared absorption
	3- 6- 7	Combustion, coulometric titration
	10	Combustion, non-aqueous titration
	18	Combustion, conductimetry
<b>Si</b>	1-15	Plasma emission spectrometry
	2-13	Gravimetry, dehydration with sulphuric acid
	3- 7- 8	Gravimetry, dehydration with perchloric acid
	4	Acidimetric titration of fluosilicate
	5-11	Gravimetry, dehydration with hydrochloric acid
	6-14-16	XRF
<b>Mn</b>	9	FAAS
	10	Photometric, molybdenum blue without extraction
	1- 6- 8-15	FAAS
	2- 4- 7-17	Photometric periodate oxidation
<b>Mo</b>	3- 5- 9-10-11-14	Plasma emission spectrometry
	12-13-16	XRF
	2- 5- 8-14-15	FAAS
<b>Cu</b>	3-16	XRF
	4- 7-11-12-13	Plasma emission spectrometry
	6- 9-10	Photometric, thiocyanate in presence of Sn(II), extraction
	1- 5- 7- 9-10-11-13-16	FAAS
<b>Sn</b>	2- 6-14-15	Plasma emission spectrometry
	3	XRF
	4	Photometric, Diethyldithiocarbamate, extraction
	12	Photometric, cuproine, without extraction
<b>W</b>	1- 4- 8- 9-16	Plasma emission spectrometry
	2- 3- 5- 7-11-12	FAAS
	6	Photometric with pyrocatechol violet
	13-14-15	AAS graphite furnace
<b>Al (Total)</b>	10	XRF
	1- 3- 4-14-15-16-19-20	Gravimetry, precipitation with cinchonine
	2-11	Gravimetry as WO <sub>3</sub> , precipitation with cinchonine and -benzoin oxime
	5	Plasma emission spectrometry
	6-12-21-22	Gravimetry as WO <sub>3</sub>
	7- 8- 9-10-13-17-18-23	XRF
<b>Al (Total)</b>	24	Gravimetry, precipitation with mercurous nitrate
	1	FAAS, extraction of iron
	3	Photometric, hydroxyquinolate, ion-exchange separation
	4- 8- 9	XRF
	5-13	Plasma emission spectrometry
	6	Photometric, hydroxyquinolate with extraction
7-10-11-12-14	FAAS, without extraction	
		<b>Note:</b> The acid insoluble aluminium compounds must be taken into solution by a stringent fusion procedure to obtain the correct aluminium content of the alloy.

Abbreviations:- FAAS - Flame Atomic Absorption Spectrometry  
XRF - X-ray Fluorescence Spectrometry - fused bead technique

### 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 Mitteilung en 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).