

**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. 096-2 LOW S, Ca TREATED STEEL**

Similar to BS EN 10025 S355/DIN 52-3/AFNOR NF A 35-501

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

Line No.	C	Si	Mn	P	S	Cr	Mo	Ni	Al (Total)	Cu	Nb	Ca
1	0.1013	0.2547	1.2983	0.0116	—	0.0222	0.0014	—	0.0436	0.0158	—	0.0017
2	0.1018	0.2562	1.2984	0.0117	0.0012	0.0226	0.0017	0.0243	0.0445	0.0159	0.0234	0.0018
3	0.1030	0.2564	1.3075	0.0117	0.0013	0.0228	0.0017	0.0243	0.0446	0.0164	0.0240	0.0018
4	0.1031	0.2574	1.3090	0.0121	0.0013	0.0236	0.0018	0.0245	0.0448	—	0.0242	0.0018
5	0.1036	0.2582	1.3127	0.0122	0.0014	0.0236	0.0018	0.0245	0.0451	0.0166	0.0245	0.0018
6	0.1043	0.2585	1.3143	0.0123	0.0014	0.0239	0.0018	0.0247	0.0453	0.0167	0.0246	0.0018
7	0.1044	0.2590	1.3150	0.0124	0.0014	0.0241	0.0019	0.0247	0.0454	0.0168	0.0247	0.0018
8	0.1051	0.2593	1.3161	0.0125	0.0014	0.0241	0.0019	0.0247	0.0455	0.0169	0.0247	0.0019
9	0.1051	0.2595	—	0.0126	0.0014	0.0241	0.0019	0.0247	0.0456	0.0169	0.0248	0.0019
10	0.1052	0.2602	1.3173	0.0126	0.0014	0.0243	0.0019	0.0248	0.0457	0.0169	0.0248	0.0019
11	0.1053	0.2605	1.3178	0.0126	0.0015	0.0243	0.0020	0.0251	0.0459	0.0170	0.0249	0.0020
12	0.1053	0.2608	1.3187	0.0128	0.0016	0.0244	0.0021	0.0252	0.0459	0.0170	0.0252	0.0020
13	0.1054	0.2610	1.3201	0.0129	0.0017	0.0244	0.0021	0.0252	0.0460	0.0170	0.0253	0.0021
14	0.1055	0.2620	1.3214	0.0129	0.0017	0.0244	0.0021	0.0252	0.0460	0.0171	0.0254	0.0021
15	0.1056	0.2636	1.3218	0.0132	0.0017	0.0246	0.0022	0.0255	0.0464	0.0171	0.0257	0.0021
16	0.1059	0.2638	1.3236	0.0133	0.0018	0.0248	0.0022	0.0256	0.0466	0.0171	0.0258	0.0022
17	0.1059	0.2641	1.3260	0.0133	0.0018	0.0248	0.0022	0.0259	0.0469	0.0171	0.0260	0.0022
18	0.1063	—	1.3280	0.0135	0.0019	0.0248	0.0023	0.0260	0.0469	0.0173	0.0260	0.0022
19	0.1068	0.2641	1.3280	0.0137	0.0019	0.0249	0.0024	0.0261	0.0472	0.0173	0.0268	0.0023
20	0.1068	0.2660	1.3285	0.0137	0.0020	0.0251	0.0024	0.0262	0.0475	0.0175	0.0274	0.0023
21	0.1069	0.2670	1.3335	0.0138	—	0.0252	—	0.0264	0.0475	0.0175	—	—
22	0.1070	0.2689	1.3416	0.0139	—	0.0253	—	0.0267	0.0475	0.0176	—	—
23	—	0.2708	1.3425	—	—	0.0257	—	0.0270	0.0479	0.0176	—	—
M <sub>M</sub>	0.1050	0.2615	1.3200	0.0128	0.0016	0.0243	0.0020	0.0253	0.0460	0.0170	0.0252	0.0020
s <sub>M</sub>	0.0016	0.0042	0.0115	0.0007	0.0002	0.0009	0.0003	0.0008	0.0011	0.0005	0.0010	0.0002
s <sub>w</sub>	0.0010	0.0024	0.0051	0.0003	0.0002	0.0003	0.0001	0.0003	0.0004	0.0002	0.0004	0.0001

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 outlying values. Where a “—” appears in the table it indicates that an outlying value has been omitted by either the Cochran or Grubbs Test.

One laboratory also determined Al (Acid sol.) and found approximately 0.044%.

**CERTIFIED VALUES**  
mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	Al (Total)	Cu	Nb	Ca
M <sub>M</sub>	0.1050	0.262	1.320	0.0128	0.0016	0.0243	0.0020	0.0253	0.0460	0.0170	0.0252	0.0020
C(95%)	0.0007	0.002	0.005	0.0003	0.0001	0.0004	0.0002	0.0004	0.0005	0.0002	0.0005	0.0001

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. Q3993

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/CTIF,

Germany—Iron and Steel CRM Working Group: VDEh, BAM & MPI für

Eisenforschung, Nordic Countries-Nordic CRM Working Group, UK—BAS Ltd.)

MARCH 1999

# PARTICIPATING LABORATORIES

AB Sandvik Steel, Sandviken (Sweden)  
 Acerinox S.A., Algeciras (Spain)  
 Böhler Edelstahl GmbH, Kapfenberg (Austria)  
 British Steel Sections, Plates and Commercial Steels, Scunthorpe (UK)  
 British Steel Strip Products, Llanwern (UK)  
 Bundesanstalt für Materialforschung und-prüfung (BAM), Berlin (Germany)  
 Centro Nacional de Investigaciones Metalurgicas (CENIM), Madrid (Spain)  
 Cockerill Sambre S.A., Couillet (Belgium)  
 Force Institutet, Copenhagen (Denmark)  
 Hoogovens Staal BV, IJmuiden (Netherlands)  
 Institutet för Metallforskning, Stockholm (Sweden)  
 Luxcontrol S.A., Esch-sur-Alzette (Luxembourg)

Max Planck Institut für Eisenforschung GmbH, Düsseldorf (Germany)  
 NILAB, Avesta (Sweden)  
 Preussag Stahl AG, Salzgitter (Germany)  
 Rautaruukki Oy, Raahel (Finland)  
 Ridsdale & Co. Ltd., Middlesbrough (UK)  
 SOLLAC-Dunkerque, Dunkerque (France)  
 SOLLAC-Florange, Florange (France)  
 SOLLAC-Fos-sur-Mer, Fos-sur-Mer (France)  
 Thyssen Krupp Stahl AG, Duisburg (Germany)  
 Unimetal Creas Gandrange, Amneville (France)  
 Voest-Alpine Stahl Linz GmbH, Linz (Austria)

## DESCRIPTION OF THE SAMPLE

This sample is available in the form of chips passing a 1700µm aperture sieve from which the fines passing a 250µm aperture sieve have been removed. It is supplied in bottles containing 100g. It is also supplied in the form of 38mm dia discs ECRM 096-2(D).

## INTENDED USE & STABILITY

The chip sample, ECRM 096-2(C), is intended for the verification of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments in cases where the calibration with primary substances (pure stoichiometric metals or compounds) is not possible and for establishing values for secondary reference materials.

It will remain stable provided that the bottle remains sealed and is stored in a cool, dry atmosphere. When the bottle has been opened the lid should be secured immediately after use. If the contents should become discoloured (eg oxidised) due to atmospheric contamination they should be discarded.

The solid (disc) sample, ECRM 096-2(D), is intended for establishing and checking the calibration of Optical Emission and X-Ray Spectrometers for the analysis of samples of similar materials. The "as received" working surface of the sample should be finished before use to remove any protective coating. It will remain stable provided that it is not subjected to excessive heat (eg, during preparation of the working surface).

## TRACEABILITY

The traceability of this ECRM is ensured by the use of either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds.

## METHODS USED

### EURONORM – CRM No. 096-2

Element	Line Number	Methods
<b>C</b>	1-2-3-7-8-11-12-13-14-15-16-17-18-20-21-22	Combustion, infrared absorption
	4-6-10	Combustion, non-aqueous titration
	5-9	Combustion, coulometric titration
	19	Combustion, conductimetry
<b>Si</b>	1-4-5-6-7-8-9-10-12-15-20	ICP-OES
	2-19-22	Photometric as molybdenum blue, without extraction
	3-14-17-21-23	Gravimetric, dehydration with perchloric acid
	11	IGravimetric, dehydration with hydrochloric acid in presence of gelatin
<b>Mn</b>	13-16	Photometric as silicomolybdate without extraction
	1-2-5-6-7-11-12-16-18-19-20-22	ICP-OES
	3-10-15-21	FAAS
	4-8-13-14-17-23	Photometric, persulphate oxidation
<b>P</b>	1-2-3-6-11-12-18-21	Photometric as phosphovanadomolybdate, extraction
	4-7-9-10-13-15-16-17-19-20-22	ICP-OES
	5-8-14	Photometric as phosphovanadomolybdate, without extraction
	2-3-4-5-6-7-8-9-10-11-12-13-14-15-17-19-20	Combustion, infrared absorption
<b>S</b>	16	Gravimetric as BaSO <sub>4</sub> after chromatographic separation on alumina
	18	Combustion, conductimetry
<b>Cr</b>	1-2-4-5-6-7-10-12-16-17-18-19-21-23	ICP-OES
	3-8-9-11-13-14-15-20-22	FAAS
<b>Mo</b>	1-2-3-5-6-7-8-10-11-12-13-15-18	ICP-OES
	4-14	ICP-MS
	9	FAAS
	16-19-20	Photometric with thiocyanate in presence of Sn(II), extraction
<b>Ni</b>	17	Photometric with thiocyanate in presence of ascorbic acid, extraction
	2-3-4-5-7-11-12-13-15-17-19-20-23	ICP-OES
	6-8-9-10-14-16-18-21-22	FAAS
	1-2-7-8-9-10-11-13-17-19-20-21-23	ICP-OES
<b>Al (Total)</b>	3-4-5-12-14-15-16-18-22	FAAS
	6	ICP-MS
	1-6-7-8-9-11-12-13-15-18-20-22	ICP-OES
	2-3-5-10-14-16-17-19-21-23	FAAS
<b>Cu</b>	2-3-5-6-7-8-9-10-11-12-13-16-17-18	ICP-OES
	4	ICP-MS
	14-15-20	Photometric with PAR
	19	Photometric with PAN, extraction
<b>Nb</b>	1-2-3-4-8-11-12-13-15-16-20	ICP-OES
	5-6-7-9-10-14-17-18-19	FAAS
<b>Ca</b>		

## Abbreviations:-

FAAS: Flame Atomic Absorption Spectrometry  
 ICP-MS: Inductively Coupled Plasma-Mass Spectrometry  
 PAR: 4-(2-pyridylazo)-resorcinol

ICP-OES: Inductively Coupled Plasma-Optical Emission Spectrometry  
 PAN: 1-(2-pyridylazo)-2-naphthol

## 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 Europäischen Zertifizierten Referenzmaterialien (EURONORM-ZRM) sowie über die Anwendungen 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).