

**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. 086-1 0.3% CARBON STEEL**

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

Line No.	C	Si	Mn	P	S	Cr	Ni	As	Cu	Sn
1	0.2872	0.1982	–	0.0220	–	–	–	–	0.3048	0.0225
2	0.2908	0.1990	0.8625	0.0231	0.0346	0.1385	0.1625	0.0198	0.3088	0.0238
3	0.2910	0.2000	0.8642	0.0232	0.0348	0.1410	0.1640	0.0201	0.3120	0.0239
4	0.2925	0.2010	0.8685	0.0234	0.0362	0.1422	0.1650	0.0206	0.3120	0.0244
5	0.2928	0.2012	0.8700	0.0235	0.0363	0.1450	0.1655	0.0212	0.3152	0.0245
6	0.2928	0.2015	0.8702	0.0235	0.0363	0.1458	0.1660	0.0212	0.3184	0.0252
7	0.2936	0.2030	0.8725	0.0236	0.0365	0.1470	0.1664	0.0216	0.3185	0.0253
8	0.2956	0.2040	0.8760	0.0237	0.0369	0.1485	0.1668	0.0222	0.3200	0.0254
9	0.2975	0.2041	0.8768	0.0238	0.0370	0.1490	0.1668	0.0226	0.3200	0.0255
10	0.2975	0.2045	0.8800	0.0238	0.0371	0.1500	0.1685	0.0228	0.3205	0.0256
11	0.2980	0.2062	0.8800	0.0238	0.0372	0.1502	0.1688	0.0235	0.3215	0.0258
12	0.2988	0.2065	0.8800	0.0240	0.0372	0.1508	0.1690	0.0235	0.3220	0.0265
13	0.2990	0.2072	0.8818	0.0240	0.0376	0.1512	0.1690	0.0240	0.3233	0.0266
14	0.3005	0.2074	0.8820	0.0242	0.0380	0.1515	0.1700	0.0240	0.3252	0.0280
15	0.3015	0.2078	0.8825	0.0245	0.0382	0.1515	0.1700	0.0242	0.3252	0.0285
16	0.3025	0.2138	0.8825	0.0248	0.0382	0.1521	0.1702	0.0248	0.3253	0.0290
17	0.3028	0.2145	0.8832	0.0248	0.0382	0.1552	0.1708	0.0250	0.3262	0.0295
18	0.3035	0.2185	0.8862	0.0250	0.0384	0.1565	0.1710	0.0252	0.3275	0.0298
19	0.3050	0.2200	0.8912	–	0.0391	0.1592	0.1720	0.0253	0.3305	0.0306
20	0.3055	–	0.9025	–	–	0.1600	0.1750	0.0262	0.3308	–
<b>M<sub>M</sub></b>	<b>0.2974</b>	<b>0.2062</b>	<b>0.8786</b>	<b>0.0238</b>	<b>0.0371</b>	<b>0.1497</b>	<b>0.1683</b>	<b>0.0230</b>	<b>0.3204</b>	<b>0.0263</b>
<b>s<sub>M</sub></b>	0.0053	0.0064	0.0095	0.0007	0.0012	0.0058	0.0031	0.0019	0.0070	0.0023
<b>s<sub>w</sub></b>	0.0027	0.0031	0.0046	0.0007	0.0007	0.0023	0.0017	0.0009	0.0025	0.0010

M<sub>M</sub>: Mean of the intralaboratory means s<sub>M</sub>: Standard deviation of the intralaboratory means  $s_M = \sqrt{s_D^2 + s_W^2/4}$   
 s<sub>w</sub>: Intralaboratory standard deviation s<sub>b</sub>: Interlaboratory standard deviation

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.

**CERTIFIED VALUES**  
 mass content in %

	C	Si	Mn	P	S	Cr	Ni	As	Cu	Sn
<b>M<sub>M</sub></b>	<b>0.297</b>	<b>0.206</b>	<b>0.879</b>	<b>0.0238</b>	<b>0.0371</b>	<b>0.150</b>	<b>0.168</b>	<b>0.0230</b>	<b>0.320</b>	<b>0.0263</b>
<b>C(95%)</b>	0.003	0.003	0.005	0.0004	0.0006	0.003	0.002	0.0009	0.004	0.0011

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 is available in the form of chips passing a 710µm aperture sieve from which the fines passing a 180µm aperture sieve have been removed. It is supplied in bottles containing 100g.....ref ECRM 086-1(C). It is also supplied in the form of 38mm dia discs.....ref ECRM 086-1(D).



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.)

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 (first published in February 1978  
 without uncertainty values for the  
 certified elements)

**PARTICIPATING LABORATORIES**

Arbed, Division de Differdange (Luxembourg)  
 Arbed, Division d'Esch-Belval, Esch-sur-Alzette (Luxembourg)  
 British Steel Corporation, Bilston, Wolverhampton and Birchley Works (UK)  
 British Steel Corporation, Rotherham Works (UK)  
 Bundesanstalt für Materialprüfung (BAM), Berlin-Dahlem (Germany)  
 Bureau Veritas, Levallois Perret (France)  
 Centro Sperimentale Metallurgico (CSM), Rome (Italy)  
 Cockerill, Seraing (Belgium)  
 Dunford-Hadfields Ltd., Sheffield (UK)  
 Eisenwerk-Gesellschaft Maximilianshütte mbH, Sulzbach-Rosenberg (Germany)  
 Hoogovens-ESTEL, IJmuiden (Holland)

Institut de Recherches de la Sidérurgie Française (IRSID)  
 St. Germain en Laye (France)  
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 Klöckner-Werke AG, Bremen (Germany)  
 Laboratoires d'Analyses Pourquery, Paris (France)  
 NV Staalgieterwerk-SMDK, Utrecht (Holland)  
 Round Oak Steelworks, Brierley Hill (UK)  
 Solmer, Fos-sur-Mer (France)  
 Stahlwerke Peine-Salzgitter AG, Peine (Germany)  
 Usinor, Usine de Longwy, Longwy (France)

**INTENDED USE & STABILITY**

The chip sample, ECRM 086-1(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 metals or stoichiometric 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 086-1(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. 086-1**

Element	Line Number	Methods
<b>C</b>	1-5-9-15	Non aqueous titration
	2	Manometry after freezing out CO <sub>2</sub>
	3-6-7-8	Coulometric
	4-18-19-20	Thermal conductivity
	10-12	Conductimetric
<b>Si</b>	11-13-14-16-17	Infrared absorption
	1	Colorimetric as silicomolybdovanadate
	2-3-4-6-7-9-14-15-18	Colorimetric as molybdenum blue
	5-8-10-11-13-16-19	Gravimetric, dehydration with perchloric acid
<b>Mn</b>	12-17	Atomic absorption spectroscopy
	2-4-6-7-8-9-13-17-18-19	Colorimetric after oxidation with periodate
	3-5-12-16	Atomic absorption spectroscopy
	10	Titration with arsenite after oxidation with persulphate/silver nitrate
<b>P</b>	11-14-15-20	Colorimetric after oxidation with persulphate/silver nitrate
	1-6-7-9-10-11-12-15-16-17-18	Colorimetric as molybdenum blue
	2-4-5-8-13-14	Colorimetric as phosphovanadomolybdate with extraction
<b>S</b>	3	Titrimetric as phosphomolybdate
	2-4	Combustion, coulometric
	3-5-10-11-15-19	Combustion, oxidation/reduction titration
	6	Combustion, acidimetric titration
	7	Gravimetric as barium sulphate after separation on alumina
	8	Gravimetric as barium sulphate
	9-12-13-16-18	Combustion, infrared absorption
<b>Cr</b>	14-17	Combustion, conductimetric
	2-3-5-9-10-17-18	Colorimetric with diphenylcarbazide
	4-6-7-8-11-12-13-14-16-19	Atomic absorption spectroscopy
	15-20	Potentiometric titration with ammonium ferrous sulphate
<b>Ni</b>	2-7-10-11-12-14-18-19-20	Colorimetric with dimethylglyoxime
	3-4-5-6-8-9-13-15-16-17	Atomic absorption spectroscopy
<b>As</b>	3-8-10-11-12-14-16-17-18	Colorimetric as molybdenum blue
	4-15	Distillation, titration with bromate
	5-6-19	Colorimetric as silver diethyldithiocarbamate
	7-20	Atomic absorption spectroscopy
	9-13	Hypophosphite reduction, titration with iodine
<b>Cu</b>	1-5-6	Colorimetric with diethyldithiocarbamate
	2-8-18	Colorimetric with biscyclohexanone oxalyldihydrazone
	3-11-14-19	Colorimetric with 2,2' diquinolyl
	4-7-10-12-13-15-16-17-20	Atomic absorption spectroscopy
	9	Colorimetric as cupro ammine complex
<b>Sn</b>	1-4-7-8-9-12-18-19	Atomic absorption spectroscopy
	2-11-17	Colorimetric with 3-pyridyl fluorone
	3	Iodate titration, separation as sulphide
	5-6-16	Colorimetric with phenylfluorone
	10-13-14-15	Iodate titration, reduction with aluminium

**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).