

ECISS  
EUROPEAN COMMITTEE FOR IRON AND STEEL STANDARDISATION  
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. 087-1 0.15% CARBON STEEL**

LABORATORY MEANS (4 Values)  
mass content in %

Line No	C	Si	Mn	P	S	Cr	Mo	Ni	As	Co	Cu	Sn	Sb
1	—	0.2558	—	0.0088	0.0426	0.0729	0.0177	—	—	0.0122	—	0.0156	0.0036
2	0.1682	0.2580	0.6590	0.0093	0.0434	0.0738	0.0186	0.1105	—	0.0134	0.1640	0.0158	0.0040
3	0.1690	0.2580	0.6600	0.0093	0.0445	0.0750	0.0188	0.1138	0.0216	0.0135	0.1650	0.0159	0.0041
4	0.1690	0.2585	0.6665	0.0095	0.0448	0.0750	0.0188	0.1147	0.0220	0.0135	0.1665	0.0164	0.0043
5	0.1703	0.2602	0.6668	0.0099	0.0448	0.0758	0.0192	0.1152	0.0221	0.0135	0.1668	0.0164	0.0044
6	0.1706	0.2605	0.6675	0.0100	0.0450	0.0767	0.0194	0.1160	0.0225	0.0136	0.1672	0.0165	0.0044
7	0.1712	0.2610	0.6685	0.0101	0.0450	0.0769	0.0195	0.1170	0.0231	0.0139	0.1675	0.0167	0.0045
8	0.1716	0.2613	0.6688	0.0102	0.0452	0.0778	0.0196	0.1174	0.0232	0.0143	0.1691	0.0167	0.0045
9	0.1718	0.2628	0.6700	0.0102	0.0452	0.0778	0.0198	0.1175	0.0235	0.0144	0.1692	0.0168	0.0046
10	0.1722	0.2632	0.6700	0.0103	0.0454	0.0778	0.0199	0.1175	0.0235	0.0144	0.1695	0.0171	0.0047
11	0.1738	0.2635	0.6704	0.0104	0.0456	0.0789	0.0200	0.1176	0.0238	0.0148	0.1700	0.0172	0.0047
12	0.1740	0.2635	0.6720	0.0104	0.0460	0.0798	0.0204	0.1178	0.0242	0.0149	0.1710	0.0175	0.0048
13	0.1741	0.2648	0.6725	0.0107	0.0462	0.0798	0.0204	0.1180	0.0243	0.0151	0.1715	0.0175	0.0048
14	0.1746	0.2662	0.6728	0.0108	0.0462	0.0808	0.0206	0.1188	0.0248	0.0152	0.1718	0.0175	0.0049
15	0.1758	0.2670	0.6730	0.0109	0.0468	0.0810	0.0215	0.1190	0.0250	0.0155	0.1720	0.0176	0.0049
16	0.1762	0.2672	0.6762	0.0110	0.0472	0.0812	0.0220	0.1195	0.0252	0.0162	0.1728	0.0178	0.0050
17	0.1768	0.2680	0.6770	0.0111	0.0480	0.0823	0.0235	0.1196	0.0254	0.0165	0.1735	0.0180	0.0050
18	0.1772	0.2691	0.6782	0.0118	0.0484	0.0830	0.0235	0.1199	0.0266	0.0166	0.1764	0.0182	0.0052
19	0.1792	0.2700	0.6797	0.0118	0.0484	—	0.0236	0.1227	0.0267	0.0170	0.1802	0.0185	—
20	0.1812	—	0.6815	—	0.0492	—	0.0251	0.1238	0.0270	0.0174	0.1802	0.0192	—
21	0.1842	—	—	—	0.0498	—	—	—	0.0278	—	—	—	—
<b>M<sub>M</sub></b>	<b>0.1740</b>	<b>0.2631</b>	<b>0.6711</b>	<b>0.0103</b>	<b>0.0461</b>	<b>0.0781</b>	<b>0.0206</b>	<b>0.1177</b>	<b>0.0243</b>	<b>0.0148</b>	<b>0.1707</b>	<b>0.0171</b>	<b>0.0046</b>
<b>S<sub>M</sub></b>	0.0043	0.0041	0.0060	0.0008	0.0019	0.0030	0.0020	0.0030	0.0018	0.0014	0.0045	0.0010	0.0004
<b>S<sub>W</sub></b>	0.0017	0.0029	0.0038	0.0004	0.0011	0.0018	0.0006	0.0024	0.0007	0.0004	0.0020	0.0012	0.0003

M<sub>M</sub>: Mean of the intralaboratory means, S<sub>M</sub>: Standard Deviation of the intralaboratory means.

S<sub>W</sub>: Intralaboratory standard deviation, S<sub>b</sub>: Interlaboratory standard deviation,  $S_b = \sqrt{S_M^2 - (S_W^2 \div 4)}$

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 eliminated by either the Cochran or Grubbs Test.

**CERTIFIED VALUES**  
**Mass content in %**

	C	Si	Mn	P	S	Cr	Mo	Ni	As	Co	Cu	Sn	Sb
<b>M<sub>M</sub></b>	<b>0.1740</b>	<b>0.2631</b>	<b>0.6711</b>	<b>0.0103</b>	<b>0.0461</b>	<b>0.0781</b>	<b>0.0206</b>	<b>0.1177</b>	<b>0.0243</b>	<b>0.0148</b>	<b>0.1707</b>	<b>0.0171</b>	<b>0.0046</b>
<b>C(95%)</b>	0.0020	0.0020	0.0029	0.0004	0.0009	0.0015	0.0010	0.0015	0.0009	0.0007	0.0022	0.0005	0.0002

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 35:2006 sections 6.1 and 10.5.2.

**NB** an area 6 mm in diameter in the centre of the discs, ECRM 087-1(D) should be avoided for optical emission spectrometry.

This reference material was prepared and issued by:

**BUREAU OF ANALYSED SAMPLES LIMITED**

Newham Hall, Middlesbrough, England TS8 9EA

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.)



**METHODS USED**  
**EURONORM – CRM No. 087-1**

Element	Line Number	Methods
<b>C</b>	2-4-5-16	Combustion, non-aqueous titration
	3	Combustion, low pressure
	6-9-11-13-14-17-19-20-21	Combustion, infrared absorption
	7-12	Combustion, conductimetric
	8-15-18	Combustion, coulometric
	10	Combustion, thermal conductivity
<b>Si</b>	1-3-4-6-8-10-14-16	Photometric, as molybdenum blue
	2-11-15-17-19	Flame atomic absorption spectrometry
	5-7-9-12-13-18	Gravimetric, dehydration with perchloric acid
<b>Mn</b>	2-6-8-9-10-11-13-14-15-16-17-19-20	Photometric, oxidation with periodate
	3-4-5-7-12-18	Flame Atomic Absorption Spectrometry
<b>P</b>	1-2-4-8-9-16-17-18-19	Photometric, as molybdenum blue
	3-6-7-11-13-14-15	Photometric, as phosphovanadomolybdate with extraction
	5	Photometric, as molybdenum blue with extraction
	10-12	Titrimetric as phosphomolybdate
<b>S</b>	1-7	Combustion, acidimetric titration
	2-4-5-6-9-10-11-12-16-18-19-20-21	Combustion, infrared absorption
	3-17	Combustion, conductimetric
	8-14	Combustion, coulometric
	13	Combustion, oxidation/reduction titration
	15	Gravimetric, as barium sulphate
<b>Cr</b>	1-5-6-9-10-11-12-14-16-17-18	Flame Atomic Absorption Spectrometry
	2-3-8-13-15	Photometric, with diphenylcarbazide
	4	Titrimetric with Fe (II), persulphate/silver nitrate oxidation
	7	Photometric, as chromate
<b>Mo</b>	1-2-4-5-9-11-12-14-15-17-19-20	Flame Atomic Absorption Spectrometry
	3-7-8-10-13-16	Photometric, as thiocyanate, with extraction
	6-18	Photometric, as thiocyanate, without extraction
<b>Ni</b>	2-7-10-11-12-16-20	Photometric, with dimethylglyoxime
	3-4-5-6-8-9-13-14-15-17-18-19	Flame Atomic Absorption Spectrometry
<b>As</b>	3-11-15-19-20	Flame Atomic Absorption Spectrometry
	4-5-9-14	Photometric, as silver diethyldithiocarbamate
	6	Hypophosphite reduction, titration with iodine
	7-8-10-12-13-16-18-21	Photometric as molybdenum blue, with extraction
	17	Distillation, titration with bromate
<b>Co</b>	1-2-5-8-10-12-13-14-15-16-17-18-19-20	Flame Atomic Absorption Spectrometry
	3-9	Photometric, with nitroso-R salt after separation with 1-nitroso –2-naphthol
	4-6-7	Photometric, with nitroso-R salt
	11	Photometric, with isonitrosomalonylguanidine
<b>Cu</b>	2-4-5-6-7-10-11-12-14-16-17-18-19	Flame Atomic Absorption Spectrometry
	3	Photometric, with bis-cyclohexanone oxalyldihydrazone
	8	Photometric, with diethyldithiocarbamate
	9	Photometric, with oxalyl dihydrazide
	13-15	Photometric, with 2,2' diquinolyl
	20	Photometric, as cupramine
<b>Sn</b>	1-2-4-7-9-10-11-13-14-15-18	Flame Atomic Absorption Spectrometry
	3-12-19	Iodate titration, reduction with aluminium
	5-6-8-17-20	Photometric, with phenylfluorone
	16	Photometric with dithiol after distillation
<b>Sb</b>	1-2-3-5-7-10-11-12-13-16-17	Flame Atomic Absorption Spectrometry
	4	Photometric, with rhodamine B after distillation
	6-15	Photometric, with brilliant green
	8-9	Photometric, with rhodamine B with extraction
	14-18	Photometric, as iodide

## PARTICIPATING LABORATORIES

Arbed, Division d'Esch Belval, Esch-sur-Alzette,  
Luxembourg  
Breda Siderugica, Milan, Italy  
British Steel Corporation, Corby Works, UK  
British Steel Corporation, River Don Works, Rotherham,  
UK  
British Steel Corporation, Rotherham Works, UK  
Bundesanstalt für Materialprüfung (BAM), Berlin,  
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Cockerill, Seraing, Belgium  
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Ridsdale and Co. Ltd., Middlesbrough, UK  
Round Oak Steelworks, Brierley Hill, UK  
Sacilor, Amneville, France  
SNCF, Levallois Perret, France  
Société Metallurgique Hainaut Sambre, Couillet, Belgium  
Staatliches Materialprüfungsamt NW, Dortmund, Germany  
Usinor, Dunkerque, France

## DESCRIPTION OF THE SAMPLE

The sample is available in the form of chips passing a 1700µm aperture sieve from which the fines passing a 250µm sieve have been removed. It is supplied in bottles containing 100g...ref ECRM 087-1(C). It is also supplied in the form of 38mm dia. discs...ref ECRM 087-1(D)

## INTENDED USE & STABILITY

The chip sample, ECRM 087-1 (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 (e.g. oxidised) by atmospheric contamination they should be discarded.

The disc sample, ECRM 087-1 (D), is intended for establishing and checking the calibration of Optical Emission and X-Ray Spectrometers for the analysis of similar materials. The "as received" working surface of the sample should be finished before use to remove any protective coating. The disc will remain stable provided that it is not subject to excessive heat (e.g. during preparation of the working surface).

## TRACEABILITY

**The traceability of ECRM 087-1 has been established in accordance with the principles of ISO Guides 30 – 35 and the International Vocabulary of Basic and General Terms in Metrology (VIM).**

The characterisation of this material has been achieved by inter-laboratory study, each laboratory using the method of its choice, details of which are given above. These methods are either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds. Most methods used were either international or national standard methods or methods which are technically equivalent.

## 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 CEN Report CR 10317 and ECISS Information Circular No. 5, both of which are available from the national standards body in your country or from CEN in Brussels. (In the UK this is the BSI, 389 Chiswick High Road, London W4 4AL).

Further information and advice on this or other Certified Reference Materials or Reference Materials produced by Bureau of Analysed Samples Ltd may be obtained from the address below.

Pour disposer d'informations 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 ce certificat, se reporter soit au producteur de ce Matériau de Référence Certifié, à l'adresse figurant sur ce Certificat soit au Rapport CEN CR 10317 et à la circulaire d'information No. 5 (ECISS). On peut se procurer ces deux documents auprès des organismes nationaux de normalisation ou auprès du CEN, Bruxelles. (Pour la France: AFNOR, 11 Avenue Francis de Pressensé, 93571 – St Denis la Plaine Cedex).

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## REVISION HISTORY

First Issued	February 1980
Reprinted	March 1984
Revised with C(95%) and $s_w$ values for each certified element and improved accuracy for all elements except Sb	February 2005
Revised following the preparation of disc samples	August 2007

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