



BUREAU OF ANALYSED SAMPLES LTD.

Directors: -

P.D.RIDSDALE, *BSc, FRSC, CEng, MIM*, (Chairman)R. P. MEERES, *BA, (Oxon), MRSC* (Managing)G. C. FLINTOFT, *ACMA*

Certificate No. Q3993

SPECTROSCOPIC STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCS-CRM No. 112 LOW ALLOY STEEL

Prepared under rigorous laboratory conditions and, AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN,
issued by the Bureau of Analysed Samples Ltd.

CO-OPERATING ANALYSTS

ANALYSTS representing MANUFACTURERS and USERS

1. CROOK, D. and SYMONDS, J., Corus Strip Products, Llanwern.
2. O'SULLIVAN, P., Corus Strip Products Port Talbot
3. RAW, M. and SNOWDEN, Miss Y.A.,
Corus Construction and Industrial, Scunthorpe.
4. FOX, G., Corus Engineering Steels, Stocksbridge.

5. RAW, M and RICHMOND, Mrs H.,
Corus Construction and Industrial, Teesside.

INDEPENDENT ANALYST

6. PAGE-GIBSON, J.E. *BSc, CChem, MRSC*,
Ridsdale & Co. Ltd., Middlesbrough.

ANALYSES

Mean of 4 values – mass content in %

Lab. No	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	B	Co	Cu	N	Nb	Sn	Ti	V	Ca
1	0.3940	0.3010	0.4385	0.0045	0.0030	1.2445	0.1960	...	0.0167	0.0021	0.0005	0.0176	0.1535	0.0025	0.0065	...	0.0100	0.0092	<0.0005
2	0.3943	0.2873	0.4315	0.0041	0.0023	1.2318	0.1840	1.4583	0.0165	0.0026	...	0.0176	0.1508	0.0022	0.0077	0.0087	0.0102	0.0093	...
3	0.3971	0.2908	0.4340	0.0044	0.1893	...	0.0145	...	0.0007	0.0174	0.1450	...	0.0065	0.0083	...	0.0084	0.0002
4	0.3896	0.2790	0.4371	0.0044	0.0031	1.2302	0.1909	1.4449	0.0138	0.0022	0.0008	0.0168	0.1471	0.0026	0.0062	0.0085	0.0096	0.0087	0.0001
5	0.3903	0.2897	0.4372	0.0043	0.0024	1.2500	0.1818	1.4681	0.0137	0.0015	...	0.0177	0.1498	0.0023	0.0070	0.0092	0.0104	0.0087	...
6	0.3970	0.2863	0.4398	0.0041	0.0023	1.2256	0.1976	1.4706	0.0134	0.0022	0.0009	0.0176	0.1472	0.0026	0.0051	0.0084	0.0100	0.0087	0.0002
M_M	0.3937	0.2890	0.4364	0.0043	0.0026	1.2364	0.1899	1.4605	0.0148	0.0021	0.0007	0.0175	0.1489	0.0024	0.0065	0.0086	0.0100	0.0088	
<i>s_M</i>	0.0032	0.0072	0.0031	0.0002	0.0004	0.0102	0.0063	0.0117	0.0015	0.0004	0.0002	0.0003	0.0031	0.0002	0.0009	0.0004	0.0003	0.0003	
<i>s_w</i>	0.0010	0.0023	0.0016	0.0003	0.0002	0.0040	0.0008	0.0059	0.0009	0.0001	0.0001	0.0004	0.0012	0.0002	0.0006	0.0002	0.0005	0.0002	

The above figures are those which each analyst has decided upon after careful verification.

M_M: Mean of the intralaboratory means; s_M: Standard deviation of the intralaboratory means, s_w Intralaboratory standard deviation

Values given above in small italic type are for information only.

Additional information: The elements Pb, Zr and Sb were determined by one or more Analysts and found to be present at contents of <10µg/g

CERTIFIED VALUES

mass content in %

	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	B	Co	Cu	N	Nb	Sn	Ti	V
M_M	0.394	0.289	0.436	0.0043	0.0026	1.236	0.190	1.461	0.0148	0.0021	0.0007	0.0175	0.149	0.0024	0.0065	0.0086	0.0100	0.0088
C(95%)	0.004	0.008	0.004	0.0002	0.0005	0.013	0.007	0.019	0.0016	0.0005	0.0003	0.0003	0.004	0.0003	0.0010	0.0005	0.0004	0.0003

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 SAMPLE

Bottles of 100g chips graded 1700 – 250µm (10 – 60 mesh) for chemical analysis.

This material is also available in disc form as SS-CRM 112

BCS-CRM 112

LOW ALLOY STEEL

NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 2, 4 and 5 determined carbon by high frequency combustion and infrared absorption. Analysts Nos. 3 and 6 determined carbon using non-aqueous titration according to BS 6200: 3.8.2: 1991

SILICON

Analyst No. 1 determined silicon photometrically as silicophosphomolybdate without extraction. Nos. 2, 3 and 6 determined silicon gravimetrically after dehydration with perchloric acid according to BS 6200: 3.26.1: 1995. Nos.4 and 5 used Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES.)

MANGANESE

Analysts Nos. 1, 2, 4 and 5 used ICP-OES. Nos. 3 and 6 determined manganese photometrically after oxidation with potassium periodate according to BS 6200: 3.18.2: 1995.

PHOSPHORUS

Analysts Nos. 1, 2, 4 and 5 used ICP-OES. Nos. 3 and 6 determined phosphorus photometrically as phosphovanadomolybdate according to BS EN 10184:1992

SULPHUR

Analysts Nos. 1, 2, 4 and 5 determined sulphur using high frequency combustion and infrared absorption. Analyst No. 6 determined sulphur using oxidation/reduction titration after combustion.

CHROMIUM

Analysts Nos. 1, 2, 4 and 5 determined chromium using ICP-OES. Analyst No. 6 determined chromium titrimetrically after oxidation with persulphate according to BS EN 24937:1991

MOLYBDENUM

Analysts Nos. 1, 2, 4 and 5 determined molybdenum using ICP-OES. Analyst No.6 determined Molybdenum photometrically as oxythiocyanate according to BS 6200:3.19.1:1985.

NICKEL

Analysts Nos. 2, 4 and 5 determined nickel using ICP-OES. Analyst No. 6 determined nickel titrimetrically after separation with dimethylglyoxime (Analoid Method No. 62).

ALUMINIUM

Analysts Nos. 1, 2, 3, 4 and 5 determined aluminium using ICP-OES. Analyst No. 6 used Flame Atomic Absorption Spectrometry (FAAS) according to BS 6200: 3.1.4:1990.

ARSENIC

Analysts Nos. 1, 2, 4 and 5 determined arsenic using ICP-OES. Analyst No. 6 determined arsenic photometrically with silver diethyldithiocarbamate after separation as arsine.

COBALT

All Analysts determined cobalt by ICP-OES.

COPPER

Analysts Nos. 1, 2, 3, 4 and 5 determined copper using ICP-OES. Analyst No. 6 used FAAS according to BS EN 24943:1990

NITROGEN

Analysts Nos. 1, 2, 3, 4 and 5 determined nitrogen using thermal conductivity. Analyst No. 6 determined nitrogen titrimetrically after distillation as ammonia.

NIObIUM

All analysts determined niobium using ICP-OES.

TIN

All Analysts determined tin using ICP-OES.

TITANIUM

All Analysts determined titanium using ICP-OES.

VANADIUM

All Analysts determined vanadium using ICP-OES.

CALCIUM

Analyst No. 1 and 3 determined calcium using ICP-OES. Analysts Nos. 4 and 6 used FAAS

INTENDED USE & STABILITY

This sample 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.

TRACEABILITY

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

This Certified Reference Material has been prepared in accordance with the recommendations specified in ISO Guides 30 to 35, available from the International Standards Organisation in Geneva.

NEWHAM HALL
NEWBY
MIDDLESBROUGH
ENGLAND
TS8 9EA

For BUREAU OF ANALYSED SAMPLES LTD.
P.D. RIDSDALE,
Chairman

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