



BUREAU OF ANALYSED SAMPLES LTD

Directors:-

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Certificate No. GB94/Q3993

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS BCS-CRM No. 161/4 0.8% CARBON STEEL

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

CO-OPERATING ANALYSTS

INDEPENDENT ANALYSTS

- | | | |
|---|--------------------------------------|---|
| 1 | CROCKER, F., | Pattinson and Stead (2005) Ltd., Middlesbrough. |
| 2 | JONES, S.J., <i>BSc, CChem, MRSC</i> | Ridsdale & Co. Ltd., Middlesbrough. |

ANALYSTS representing MANUFACTURERS and USERS

- | | | |
|---|------------------------------------|--|
| 3 | CROOK, D. G., <i>MRSC, TIFireE</i> | Corus Strip Products, Llanwern, Newport. |
| 4 | FOX, G., | Corus Testing Solutions, Stocksbridge. |
| 5 | DE WEERDT, MISS J.A & TEN BRAS, P. | Corus Strip Products, IJmuiden, Holland. |
| 6 | RAW, M., | Corus Testing Solutions, Redcar. |
| 7 | SNOWDEN, MISS Y. A., | Corus Testing Solutions, Scunthorpe. |
| 8 | WILSON, J., | Allvac Ltd., Sheffield. |

ANALYSES

Mean of 4 values - mass content in %.

Analyst No.	C	Si	Mn	P	S
1	0.8156	0.2021	0.5070	0.0108	0.0099
2	0.8149	0.1991	0.4999	0.0103	0.0095
3	0.8204	0.2102	0.5110	0.0117	0.0097
4	0.8163	0.2026	0.5057	0.0099	0.0094
5	0.8195	0.2043	0.5047	0.0104	0.0098
6	0.8185	0.0097
7	0.8153	0.1955	0.4928	0.0101	0.0090
8	0.8143	0.2018	0.5069	0.0105	0.0097
M_M	0.8169	0.2022	0.5040	0.0105	0.0096
s _M	0.0023	0.0046	0.0060	0.0006	0.0003
s _w	0.0031	0.0029	0.0033	0.0003	0.0003

M_M: Mean of the intralaboratory means. **s_M**: standard deviation of the intralaboratory means. **s_w**: intralaboratory standard deviation.

CERTIFIED VALUES (C_v)

mass content in %

	C	Si	Mn	P	S
C_v	0.817	0.202	0.504	0.0105	0.0096
C(95%)	0.002	0.005	0.006	0.0006	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 uncertainty for the certified value see ISO Guide 35:2006 section 10

DESCRIPTION OF SAMPLE

This 0.8% carbon steel was manufactured in the United Kingdom, cast as 120mm square billets and forged and rolled to 44mm diameter black rolled bar from which turnings were prepared by Bureau of Analysed Samples Ltd. It is supplied in bottles of 100g turnings to a nominal grading of 1700 – 250µm (10 – 60 mesh).

BCS – CRM 161/4

0.8% CARBON STEEL

NOTES ON METHODS USED

CARBON

Analysts Nos. 1 and 2 used the non-aqueous titration method described in BS 6200:3.8.2:1991, No. 1 standardised with benzoic acid and No. 2 with calcium carbonate. Analysts Nos. 3, 4, 5 and 8 used infrared absorption methods following combustion, Nos. 3 and 5 according to ISO 9556:2001. Analyst No. 3 calibrated with sucrose and No. 5 with sodium carbonate. Analysts Nos. 6 and 7 determined carbon by thermal conductivity after combustion, No. 6 calibrating with barium carbonate and No. 7 with calcium carbonate.

SILICON

Analysts Nos. 1, 2, 3 and 8 determined silicon gravimetrically after dehydration with perchloric acid. Analysts Nos. 4 and 7 used Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES), calibrating with pure silicon solution. Analyst No. 5 determined silicon photometrically as molybdenum blue without extraction, calibrating with silica.

MANGANESE

Analyst No. 1 determined manganese by Flame Atomic Absorption Spectrometry (FAAS), calibrating with pure manganese. Analysts Nos. 2 and 8 determined manganese photometrically as Mn (VII) after oxidation with periodate, No. 2 calibrating with pure manganese. Analysts Nos. 3, 4, 5 and 7 used ICP-OES, No. 5 according to ISO 10278 and calibrating with potassium permanganate. Analyst No. 3 calibrated with manganese and Nos. 4 and 7 calibrated with a pure manganese solution.

PHOSPHORUS

Analysts Nos. 1, 2 and 8 determined phosphorus photometrically as phosphovanadomolybdate after extraction. Analysts Nos. 1 and 2 calibrated with potassium dihydrogen orthophosphate. Analysts Nos. 3, 4 and 5 used ICP-OES, Nos. 3 and 4 calibrating with a pure phosphorus solution and No. 5 calibrating with potassium hydrogen phosphate. No. 7 calibrated with dihydrogen ammonium phosphate.

SULPHUR

Analyst No. 1 determined sulphur by acidimetric titration after combustion, calibrating with potassium sulphate. Analyst No. 2 determined sulphur gravimetrically as barium sulphate and the remaining analysts used infrared absorption after combustion, No. 3 according to BS 6200:3.28.1:1985 (ISO 4935-1980), calibrating with potassium sulphate. Analysts Nos. 5, 6, and 7 calibrated with potassium sulphate.

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.

It can be demonstrated statistically that there is no significant contribution to the uncertainty of this material from any longitudinal changes of composition.

TRACEABILITY

The traceability of BCS-CRM 161/4 has been established to SI units in accordance with principles of ISO Guides 30 – 35 and the International vocabulary of basic and general terms in metrology.

Six of the participating laboratories held accreditation to ISO/IEC 17025 for the analysis of all of the certified constituents at the time of analysis. The remaining laboratories used either stoichiometric analytical techniques or methods which were calibrated against pure metals or stoichiometric compounds.

It has been established statistically that there is no difference between the results of the accredited laboratories and those of the non-accredited laboratories for all of the elements reported.

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.

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,
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For BUREAU OF ANALYSED SAMPLES LTD.

P.D. RIDSDALE,
Chairman

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