MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD.

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS
BCS*/SS§-CRM No. 435/2
PLAIN CARBON STEEL

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

The steel for this CRM was specially cast by Sanderson Kayser Ltd., Sheffield

CO-OPERATING ANALYSTS AND FIRMS

INDEPENDENT ANALYSTS

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7. FOX, G., British Steel, Engineering Steels, Stocksbridge.
8. JOWITT, R. British Steel Technical, Teesside Laboratories, Middlesbrough.
9. PARSONS, D.W., British Steel Strip Products, Llanwern Works, Newport.

ANALYSES

Mean of 4 values - mass content in %.

Analyst No.	C	Si	Mn	P	S	Cr	Ni	Co	Nb	*Mo*
1	0.4884	0.3203	0.3891	0.0377	0.0419	0.1866	0.1339	0.0122	0.1298	...
2	0.4840	...	0.3953	...	0.0425	0.1810	0.1338	0.0110	...	...
3	0.4900	0.3262	0.3933	0.0365	0.0412	0.1877	0.1337	0.0113	0.1380	*0.019*
4	...	...	0.4043	0.0365	...	0.1698	0.1253	0.0107	...	...
5	...	0.3285	0.3787	...	...	0.1917	0.1348	0.0130	...	*0.017*
6	...	0.3303	0.3848	0.0387	...	...	...	...	0.1344	...
7	...	...	0.3950	0.0377	...	0.1883	0.1373	0.0128	0.1364	...
8	0.4905	...	0.3873	...	0.0420	0.1853	0.1340	0.0096	...	...
9	0.4924	0.3355	0.3828	0.0366	0.0444	0.1798	0.1320	0.0124	0.1307	...
M_M	**0.4891**	**0.3282**	**0.3901**	**0.0373**	**0.0424**	**0.1838**	**0.1331**	**0.0116**	**0.1339**	...
s_M	0.0032	0.0056	0.0078	0.0009	0.0012	0.0068	0.0035	0.0012	0.0035	...
s_W	0.0031	0.0026	0.0036	0.0008	0.0007	0.0014	0.0017	0.0003	0.0014	...

M_M: Mean of the intralaboratory means. s_M: Standard deviation of the intralaboratory means. s_W: Intralaboratory standard deviation.

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

The following additional information was supplied by Analyst No. 3: Cu 0.05%, V 0.005%, W 0.015%

CERTIFIED VALUES

mass content in %

	C	Si	Mn	P	S	Cr	Ni	Co	Nb
M_M	**0.489**	**0.328**	**0.390**	**0.0373**	**0.0424**	**0.184**	**0.133**	**0.0116**	**0.134**
C(95%)	0.004	0.007	0.007	0.0010	0.0015	0.006	0.003	0.0010	0.004

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.

*British Chemical Standard - chips graded 1700-250 µm (10-60 mesh) for chemical analysis.

§Spectroscopic Standard - discs 38mm dia. x 19mm thick for spectroscopic analysis.

N.B. Due to slight segregation of certain elements an area 6mm in diameter in the centre of the disc sample should be avoided for emission spectrometry.

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NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 2, 8 & 9 determined total carbon by high frequency combustion and infrared absorption, No. 3 by non-aqueous titration according to BS 6200:3.8.2:1991.

SILICON

Analysts Nos. 1 and 5 determined silicon using the reduced molybdosilicate spectrophotometric method, BS EN 24829-1:1990. Nos 3, 6 and 9 determined silicon gravimetrically after dehydration with perchloric acid..

MANGANESE

Analysts Nos. 1, 3, 6 and 8 determined manganese photometrically after oxidation with potassium periodate according to BS 6200:3.18.2:1985. Nos. 2, 4, 5 and 9 used FAAS and No. 7 used ICP-OES.

PHOSPHORUS

Analysts Nos. 1, 3 and 6 determined phosphorus photometrically as the phosphovanadomolybdate complex, No. 3 according to BS EN 10184:1992. No. 4 determined phosphorus by titration after precipitation as phosphomolybdate. Nos. 7 and 9 used ICP-OES.

SULPHUR

Analysts Nos. 1, 2, 8 and 9 determined sulphur by high frequency combustion and infrared absorption. No. 3 determined sulphur gravimetrically as barium sulphate.

CHROMIUM

Analysts Nos. 1, 2, 4, 5 and 8 determined chromium using FAAS. No. 3 determined chromium titrimetrically according to BS EN 29437 and Nos. 7 and 9 used ICP-OES.

NICKEL

Analysts Nos. 1, 2, 3, 4, 5 and 8 determined nickel using FAAS according to BS EN 10136:1991. Nos. 7 and 9 used ICP-OES.

COBALT

Analysts Nos. 1, 2, 3, 4, 5 and 8 determined cobalt using FAAS. Nos. 7 and 9 used ICP-OES.

NIOBIUM

Analysts Nos. 1 and 3 determined niobium photometrically using PAR, No. 1 after separation by ion exchange. No. 3 used the procedure according to BS EN 10178:1989. Nos. 6, 7 and 9 used ICP-OES.

MOLYBDENUM

Analyst No. 3 determined molybdenum photometrically according to BS 6200:3.19.1:1985. No. 5 used FAAS.

Abbreviations:

FAAS: Flame Atomic Absorption Spectrometry.
ICP-OES: Inductively Coupled Plasma-Optical Emission Spectrometry.
PAR: 4-(2-pyridylazo) resorcinol.

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

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