MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCS-CRM No. 463

AUSTENITIC STAINLESS STEEL

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

CO-OPERATING ANALYSTS

INDEPENDENT ANALYST

1 PICKERING, J. L., *CChem*, *MRSC*, Ridsdale and Co. Ltd., Middlesbrough.

GOVERNMENT DEPARTMENT

2 NICHOLLS, H. A., *CChem*, *FRSC*, Materials Quality Assurance Directorate, Bragg Laboratory, Sheffield.

ANALYSTS representing MANUFACTURERS and USERS

3 BALFOUR, B. E., *AMet*, *MIM*, Henry Wiggin and Company Ltd., Hereford.
4 BOOTH, G. M., Catton and Company Ltd., Leeds.
5 DOUGHTY, A., APV Paramount Ltd., Crawley.
6 DYSON, R., BSC Corporate Laboratories, Sheffield.

ANALYSTS representing MANUFACTURERS and USERS (CONT.)

7 KIDMAN, L., *AMet*, *MIM*, BSC Rotherham Works, Rotherham.
8 LAYCOCK, C., *AMet*, *MIM*, Round Oak Steelworks, Brierley Hill.
9 MATHIESON, V., BSC Craigneuk Works, Motherwell.
10 PEMBERTON, R., *AMet*, Brown-Firth Research Laboratories, Sheffield.
11 REID, R. B., Cameron Iron Works, Livingston, West Lothian.
12 SAXBY, A. *AMet*, O-H Steel Founders and Engineers Ltd., Sheffield.
13 SHIREBY, D., *CChem*, *FRSC*, *FI Ceram*, *MRSH*, BSC Sheffield Laboratories, Rotherham.
14 STATHAM, R. F., *AMet*, *MIM*, BSC Stocksbridge and Tinsley Park Works, Stocksbridge.
15 WISE, R. A. Langley Alloys Ltd., Slough.

ANALYSES

Mean of 4 values - mass content in %.

Analyst No.	C	Si	Mn	P	S	Cr	Ni	*B*
1	0.088	0.51	0.77	0.015	0.016	18.36	9.71	*<0.0005*
2	0.090	0.51	0.77	0.014	0.018	18.29	9.66	*0.0003*
3	...	0.51	...	...	...	...	9.63	...
4	...	...	0.76	...	...	18.28	9.59	...
5	0.087	0.52	...	0.015	...	...	...	...
6	0.085	...	...	...	0.014	...	...	...
7	0.090	0.51	0.78	0.014	0.018	18.24	9.70	*0.0002*
8	0.088	0.51	...	...	...	...	...	...
9	...	0.52	...	0.015	0.017	...	...	...
10	0.087	0.50	0.78	0.014	0.016	18.32	9.63	*0.0006*
11	...	...	0.79	0.015	0.019	...	...	...
12	...	...	0.76	0.016	...	18.22	9.61	...
13	...	...	...	...	...	...	...	...
14	0.089	...	...	...	...	18.32	...	...
15	...	...	0.76	...	0.016	18.25	...	...
M_M	**0.088**	**0.51**	**0.77**	**0.015**	**0.017**	**18.29**	**9.65**	...
s_M	0.002	0.01	0.02	0.001	0.002	0.05	0.05	...

The above figures are those which each Analyst has decided upon after careful verification.
Figures in bold type certified, figures in small italic type only approximate.

M_M: Mean of the laboratory mean values. s_M: standard deviation of the laboratory mean values.

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	Mn	P	S	Cr	Ni
Cv	**0.088**	**0.51**	**0.77**	**0.015**	**0.017**	**18.29**	**9.65**
C(95%)	0.002	0.01	0.01	0.001	0.002	0.04	0.05

The half width confidence interval **C**(95%) is an expression of the uncertainty of the certified value, where **C**(95%) = $\frac{t \times s_M}{\sqrt{n}}$ and "t" is the appropriate two sided Student's t value at the 95% confidence level for "n" 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: Although widely accepted within the industry "mass content in %" is neither an SI nor an IUPAC supported quantity.
Multiplication of the certified value (Cv) by 10^4 will yield the value in µg/g.

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BCS-CRM 463

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NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 5 and 10 determined carbon by non-aqueous titration according to the British Standard Carbon Method 4*. Nos. 2 and 8 used high frequency combustion/infrared absorption. No. 6 used an automatic coulometric apparatus and No. 7 a low pressure method. Analyst No. 14 determined carbon gravimetrically according to the British Standard Carbon Method 1*.

Analysts Nos..10 and 14 also used high frequency combustion/infrared absorption and found 0.087% and 0.089% respectively.

SILICON

Analysts Nos. 1, 2, 3, 7, 8 and 10 determined silicon gravimetrically after double dehydration with perchloric acid according to the British Standard Silicon Method 1*. Nos. 5 and 9 used the British Standard Silicon Method 4* which involves the formation and photometric measurement of the molybdenum blue complex.

Analyst No. 9 also used the British Standard Silicon Method 1* and found 0.53%.

MANGANESE

All Analysts except No. 15 determined manganese photometrically after oxidation with periodate according to the British Standard Manganese Method 2*. No. 15 used the British Standard Manganese Method 1* in which manganese is determined titrimetrically with ammonium ferrous sulphate after a zinc oxide separation and oxidation with persulphate/silver nitrate.

PHOSPHORUS

All Analysts except No. 9 determined phosphorus photometrically as phosphovanadomolybdate according to the British Standard Phosphorus Method 2*. No. 9 used a titrimetric method after separation as phosphomolybdate.

SULPHUR

Analyst No. 1 determined sulphur gravimetrically after chromatographic separation on an alumina column (Nydahl, Anal. Chem., 1954, **26**, 580). The remaining Analysts used combustion methods. Nos. 2 and 15 absorbed in hydrogen peroxide solution and titrated with borate. No. 6 used an automatic coulometric apparatus. Nos. 7 and 10 used high frequency combustion/infrared absorption. Nos. 9 and l 1 absorbed in water and dilute hydrochloric acid respectively and titrated with iodate.

CHROMIUM

All Analysts determined chromium by titration with ammonium ferrous sulphate after oxidation with persulphate/silver nitrate. No. 1 followed the procedure of the Analoid Method No. 37 and Nos. 4, 7, 10, 12 and 14 used the British Standard Chromium Method 1*.

NICKEL

All Analysts except No. 12 determined nickel by titration after separation with demethylglyoxime. No. 1 dissolved the precipitate in dilute sulphuric acid, boiled with excess of ferric sulphate and titrated with dichromate (Analoid Method No. 62). Nos. 2 and 4 dissolved and titrated with EDTA and Nos. 3, 7 and 10 completed cyanometrically according to the British Standard Nickel Method 1*. Analyst No. 12 used a dimethylglyoxime photometric method.

BORON

All Analysts determined boron by photometric methods. Nos. 1, 2 and 7 separated boron by distillation as methyl borate and completed with carmine (No. 1) or curcumin (Nos. 2 and 7). Nos. 2 and 7 followed the procedure of the British Standard Boron Method 1. Analyst No. 10 used a direct dianthrimide method.*

*Methods for Sampling and Analysis of Iron, Steel and Other Ferrous Metals, B.S. Handbook No. 19, first published 1970 by the British Standards Institution, 2 Park Street, London, W1A 2BS.

DESCRIPTION OF SAMPLE

British Chemical Standard, BCS-CRM 463, is sold in bottles containing 100g chips graded 2000 - 150µm (10 - 100 mesh) for chemical analysis.

The preparation of representative samples for chemical analysis and certification by co-operative analysis was undertaken by Bureau of Analysed Samples Ltd.

INTENDED USE

BCS-CRM 463 is intended for uses such as the verification of the accuracy and repeatability of analytical methods, such as those used by the participating laboratories, for the calibration of analytical instruments, for establishing values for secondary reference materials and for training purposes. In order to ensure that a fully representative sample is taken users should take a minimum sub-sample size of 1.0g. Users of this material should be aware that the use of a smaller sub-sample size will invalidate the certified values and the associated 95% confidence limits. The sample should be mixed thoroughly before each use.

STABILITY

BCS-CRM 463 will remain stable provided that the bottle remains sealed and is stored in a dry atmosphere. When the bottle has been opened the lid should be secured immediately after use.

TRACEABILITY

The characterisation of BCS-CRM 463 has been achieved by chemical analysis involving inter-laboratory study, each laboratory using the method of their choice, details of which are given above. Most of the analytical methods used in the characterisation of this CRM were either international or national standard methods or methods which are technically equivalent. All laboratories used either stoichiometric analytical techniques or methods which were calibrated predominantly against pure metals or stoichiometric compounds, ensuring traceability of the individual results to the SI.

MEASUREMENT UNCERTAINTY

The uncertainty of each of the certified values of BCS-CRM 463 has been established by multiplying the standard error arising from the chemical analysis by the appropriate two sided Student's t value at the 95% confidence level for the number of results. The stability of this CRM and its transportation also make negligible contributions to the overall uncertainty of the certified values.

COMMUTABILITY

BCS-CRM 463 is intended to be used in the same physical form as that used by the participating Analysts and therefore commutability is not of relevance in respect of this CRM.

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.

NEWHAM HALL, NEWBY,
MIDDLESBROUGH, ENGLAND, TS8 9EA
Email: enquiries@basrid.co.uk
Website: www.basrid.co.uk

For BUREAU OF ANALYSED SAMPLES LTD

R.P. MEERES,
Managing Director

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