

# British Chemical Standards

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## Certificate of Analyses

### B.C.S.\* / S.S.† No. 466

# AUSTENITIC STAINLESS STEEL

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

The standard bar was specially prepared by Edgar Allen, Balfour Ltd., Sheffield.

### ANALYSES

Analyst No.	C %	Si %	Mn %	P %	S %	Cr %	Mo %	Ni %	As %	Nb %	Pb %	Sn %	Ta %
1	0.074	0.50	0.66	0.018	0.021	17.61	2.20	8.70	0.010	0.052	0.0013	0.006	0.0002
2	0.076	0.50	0.65	0.020	0.022	17.66	2.19	8.72	0.011	0.043	0.0014	0.006	0.0003
3	...	0.50	...	...	0.021	...	...	8.68	0.010	...	0.0014	...	...
4	...	...	0.64	...	...	17.56	...	8.61	...	...	...	...	...
5	0.072	0.49	...	0.020	0.022	...	2.20	...	...	0.04-	...	...	0.0008
6	0.072	...	...	...	0.019	...	...	...	...	...	...	...	...
7	0.073	0.51	0.66	0.019	0.023	17.57	2.24	8.72	0.011	0.050	0.0013	0.006	0.0008
8	0.075	0.50	...	...	...	...	2.21	...	...	...	...	0.006	...
9	...	0.50	...	0.021	0.020	...	2.20	...	0.012	...	...	...	...
10	0.073	0.49	0.67	0.019	0.023	17.64	2.25	8.68	0.010	0.046	0.0015	0.006	0.0007
11	...	...	0.67	0.021	0.021	...	...	...	...	0.049	...	...	...
12	...	...	0.66	0.021	...	17.63	...	8.64	...	0.058	...	...	...
13	...	...	...	...	...	...	...	...	...	0.050	0.0013	...	0.0004
14	0.076	...	...	...	...	17.62	2.22	...	...	...	0.0015	0.007	...
15	...	...	0.67	...	0.019	17.69	...	...	...	...	...	...	...
Average	0.074	0.50	0.66	0.020	0.021	17.6 <sub>0</sub>	2.21	8.68	0.010	0.05-	0.0014	0.006	<0.001

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

\*British Chemical Standard – chips for chemical analysis.

†Spectroscopic Standard – disc sample for spectroscopic analysis.

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## AUSTENITIC STAINLESS STEEL

### 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 0.072% and 0.075% 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. 7 also used the British Standard Silicon Method 4\* and found 0.51%. Analyst No. 9 also used the British Standard Silicon Method 1\* and found 0.51%.

#### 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 11 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\*.

#### MOLYBDENUM

All analysts except No. 8 determined molybdenum photometrically as oxythiocyanate. No. 1 used the Analoid Method No. 42 and the remaining analysts used the British Standard Molybdenum Method 1\* which involves extraction of the coloured complex into butyl acetate. Analyst No. 8 used atomic absorption spectrometry.

#### NICKEL

All analysts except No. 12 determined nickel by titration after separation with dimethylglyoxime. 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.

#### ARSENIC

Analysts Nos. 1, 3 and 10 determined arsenic photometrically as molybdenum blue. Nos. 1 and 10 extracted the arsenic as iodine into chloroform (Fogg et al, Analyst, 1972, **97**, 657) and No. 3 separated by extraction of the chloride into chloroform (Nall, Analyst, 1971, **96**, 398). Nos. 2 and 7 separated arsenic as arsine by reduction with zinc and completed photometrically after absorption in a chloroform solution of silver diethyldithiocarbamate. Analyst No. 9 precipitated the arsenic with hypophosphite and completed iodimetrically according to the British Standard Arsenic Method 1\*.

## NIوبيUM

Analysts Nos. 1, 7, 10 and 13 determined niobium photometrically with PAR after separation with phenylarsonic acid. A version of this method is currently being investigated by the ECSC WG20 Group. No. 2 extracted niobium as thiocyanate into acetone and completed photometrically. No. 5 separated niobium with phenylarsonic acid and completed photometrically with PAN (Schoffman, Arch. Eisenhüttenwesen, 1972, 43, 45). Analyst No. 11 used a photometric method with N-benzyl-N-phenyl hydroxylamine (Villarreal and Barker, Anal. Chem., 1969, 41, 611). No. 12 precipitated niobium and completed gravimetrically.

## LEAD

Analysts Nos. 1, 13 and 14 determined lead photometrically with dithizone according to the British Standard Lead Method 3\*. Nos. 2, 7 and 10 used atomic absorption spectrometry. Analyst No. 3 extracted lead as the iodide into 4-methylpentan-2-one and completed by square wave polarography.

Analyst No. 10 also used the British Standard Lead Method 3\* and found 0.0015%.

## TIN

Analysts Nos. 1, 7, 10 and 14 determined tin titrimetrically with iodate after separation as sulphide according to the British Standard Tin Method 1\*. No. 2 used a photometric method with catechol violet and cetyl trimethyl ammonium bromide (Ashton et al, Analyst, 1973, 98, 202). No. 8 used atomic absorption spectrometry.

## TANTALUM

All analysts except No. 10 determined tantalum photometrically with pyrogallol according to the British Standard Tantalum Method 1\*. No. 10 used a phenylfluorone photometric 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.

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