MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCS-CRM No. 332

AUSTENITIC STAINLESS STEEL

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

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ANALYSES

Mean of 4 values - mass content in %.

Analyst No.	C	Si	Mn	P	S	Cr	Ni	*Co*	*Cu*	*V*
1	0.065	...	...	0.017	0.019	...	...	...	...	...
2	0.063	0.44	0.80	0.014	0.020	12.74	12.48	*0.037*	*0.10*	*0.02*
3	0.066	...	0.78	...	...	...	12.58	...	...	...
4	0.063	...	0.80	...	...	...	12.42	...	...	...
5	0.061	0.44	0.80	0.016	0.018	12.75	12.45	...	...	...
6	...	0.43	0.80	...	...	...	12.45	...	...	...
7	...	...	...	...	...	12.80	12.43	...	...	...
8		0.44	0.79	0.014	...	...	...	...	...	...
9	0.062	0.43	0.81	0.016	0.021	12.82	12.41	...	...	...
10	...	0.44	0.79	...	...	...	...	...	...	...
11	...	0.44	...	...	...	...	12.54	...	...	...
12	0.064	...	0.80	0.015	...	12.79	...	...	...	*0.03*
13	...	0.43	...	...	0.020	...	...	...	...	...
14	0.061	...	...	0.015	0.020	12.76	...	...	...	...
15	0.062	...	...	0.016	0.022	12.77	...	...	...	...
16	...	...	...	...	0.019	12.80	...	...	...	...
M_M	**0.063**	**0.44**	**0.80**	**0.015**	**0.020**	**12.78**	**12.47**	...	...	...
s_M	0.002	0.01	0.01	0.002	0.002	0.03	0.07	...	...	...

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.

CERTIFIED VALUES (Cv)

mass content in %

	C	Si	Mn	P	S	Cr	Ni
Cv	**0.063**	**0.44**	**0.80**	**0.015**	**0.020**	**12.78**	**12.47**
C(95%)	0.002	0.01	0.01	0.001	0.002	0.03	0.06

The half width confidence interval **C**(95%) = $\frac{t \times s_M}{\sqrt{n}}$ where "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.

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NOTES ON METHODS USED

CARBON

Analysts Nos. 1, 2, 4 and 12 determined carbon by conductimetric methods. Nos. 1 and 12 used a balanced two-cell circuit, No. 2 used the G.E.C. method (Still, Dauncey and Chirnside, Analyst, 1954, **79**, 4) and No. 4 used a semi-micro method (Nall and Scholey, Metallurgia, 1961, **64**, 97). Nos. 3 and 9 used the Standard gravimetric method, B.S. 1121: Part 11: 1948, Nos. 5, 14 and 15 used a low-pressure method (Cook and Speight, Analyst, 1956, **81**, 144).

SILICON

All Analysts determined silicon gravimetrically by dehydration with perchloric acid according to the Standard method B.S. 1121: Part 10: 1948.

MANGANESE

Analysts Nos. 2, 4, 5, 6, 8, 9, 10 and 12 determined manganese photometrically; Nos. 2, 4, 5, 8, 9 and 12 oxidized with periodate according to the Standard photometric method B.S. 1121: Part 23: 1951, Nos. 6 and 10 oxidized with persulphate. No. 3 used the Standard titrimetric method B.S. 1121: Part 16: 1951 which includes a zinc oxide separation.

Analyst No. 2 also used the British Standard titrimetric method and found 0.79%. No. 3 also obtained a value of 0.79% by a photometric method.

PHOSPHORUS

All Analysts except Nos. 9 and 15 determined phosphorus photometrically. No. 1 used a molybdenum-blue method in conjunction with an automatic analyser. Nos. 2, 5, 8, 12 and 14 used a phosphovanadomolybdate method; Nos. 2, 5, 12 and 14 extracted the coloured complex with *iso*-butyl methyl ketone according to the then Draft B.S. 1121: Part 45, No. 8 extracted with amyl alcohol. Nos. 9 and 15 used the Standard gravimetric method B.S. 1121: Part 9: 1948 in which the phosphorus is precipitated as ammonium phosphomolybdate and converted to lead molybdate.

Analyst No. 1 also used a phosphovanadomolybdate method and found 0.016%.

SULPHUR

Analysts Nos. 1, 14 and 15 determined sulphur by combustion. Nos. 1 and 14 used IRSID type combustion equipment (Pontet and Boulin, Chim. Anal., 1954, **38**, 98). No. 1 completed conductimetrically, Nos. 14 and 15 completed titrimetrically. Nos. 2, 5, 9 and 16 determined sulphur gravimetrically; Nos. 2, 9 and 16 used the Standard method B.S. 1121: Part 1: 1966 in which the barium sulphate is precipitated in presence of the iron while No. 5 first separated sulphuric acid chromatographically on an alumina column (Nydahl, Anal. Chem., 1954, **26**, 580). No. 13 used both the Standard gravimetric method and a combustion method and reported the average of the results obtained.

Analyst No. 5 also used a combustion method and found 0.022%.

CHROMIUM

All Analysts determined chromium titrimetrically. No. 2 used the Analoid method No. 37 in which the hexavalent chromium is titrated directly with ammonium ferrous sulphate solution. No. 12 used a similar method but added excess ferrous solution and back-titrated with potassium dichromate. The other Analysts used the Standard method B.S. 1121: Part 13: 1954 in which the final titration is carried out with ammonium ferrous sulphate/permanganate.

NICKEL

All Analysts determined nickel titrimetrically after precipitation with dimethylglyoxime. No. 2 dissolved the precipitate in dilute sulphuric acid and boiled with excess ferric sulphate; the ferrous salt thus formed was titrated with dichromate (Analoid Method, No. 62). Nos. 3, 4, 5, 6 and 11 titrated cyanometrically according to the Standard method B.S. 1121: Part 37: 1961. Nos. 7 and 9 titrated with EDTA.

Analyst No. 4 also used an EDTA method and found 12.36%. No. 11 also used a gravimetric method (Claassen and Bastings, Z. anal. Chem., 1959, **165**, 354) and found 12.55%.

COBALT

Standard method B.S. 1121: Part 42: 1961.

COPPER

Photometric method using bis-cyclohexanone oxalyldihydrazone (Analoid method No. 65).

VANADIUM

Analyst No. 2 separated the vanadium by precipitation with cupferron and determined it titrimetrically. No. 12 separated iron and chromium by mercury cathode electrolysis and determined vanadium photometrically by a phosphovanadotungstate method.

DESCRIPTION OF SAMPLE

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

INTENDED USE & STABILITY

The 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.

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For BUREAU OF ANALYSED SAMPLES LTD

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