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Certificate of Analyses

B.C.S.*/S.S.† No. 363
MONEL ALLOY 400

(B.S. 3072: NA13)

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

The standard billets, specially selected for their homogeneity, were supplied by Henry Wiggin and Co. Ltd., Hereford.

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ANALYSES

Analyst No.	C %	Si %	S %	Cu %	Fe %	Mn %	Al %	Co %	Ni %
1	0·108	$0{\cdot}05_0$	0·009	32·97	1·71	1·02	0·005	0·19	63·8
2	0·11–	0·052	0·011	32·88	1·68	1·02	0·004	0·18	63·8
3	0·109	0·054	0·010	32·92	1·72	1·05	0·004	0·19	63·6
4	0·107	0·055	0·010	32·88	1·70	1·05	0·005	0·19	63·8
5	0·105	0·056	0·010	32·99	1·70	1·03	0·006	0·18	63·8
6	0·11–	$0{\cdot}05_5$	0·009	32·88	1·69	1·03	0·004	0·20	63·9
7	0·106	0·057	0·010	32·96	1·72	1·03	0·004	0·19	63·8
Average	**0·11–**	**$0{\cdot}05_5$**	**0·010**	**32·93**	**1·70**	**1·03**	**0·005**	**0·19**	**63·8**

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

The following additional information was supplied by Analyst No. 3:- Cr 0·02%, Mg 0·03%, P 0·02%, Ti 0·01%.

*Chips for chemical analysis. †Disc sample for spectroscopic analysis.

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NOTES ON METHODS USED

CARBON

Analyst No. 1 determined carbon by non-aqueous titration (Jones et al., Analyst, 1965, **90**, 623; 1966, **91**, 399). No. 2 used the Standard gravimetric method for iron and steel B. S. 1121: Part 11: 1967. Nos. 3, 4, 5 and 7 used infra-red absorption methods. No. 6 used a low-pressure method (Elwell and Wood, "Analysis of the New Metals", 1967 p. 27)

SILICON

Analysts Nos. 1, 2, 4, 6 and 7 determined silicon colorimetrically as molybdenum-blue. Nos. 1, 2 and 6 used the Standard method for silicon in copper alloys B.S. 1748: Part 7: 1960 whereas No. 7 used the Standard method for silicon in nickel B.S. 3727: Part 11; 1965. Nos. 3 and 5 determined silicon gravimetrically after dehydration with perchloric acid.

SULPHUR

Analysts Nos. 1 and 4 determined sulphur gravimetrically. No. 1 used a method involving a preliminary chromatographic separation of the sulphur, as sulphuric acid, on an alumina column (Nydahl, Anal. Chem., 1954, **26**, 580). The remaining analysts determined sulphur by combustion, Nos. 2 and 6 completing volumetrically and Nos. 3, 5 and 7 by infra-red absorption.

Analysts Nos. 3 and 4 also used combustion methods with volumetric completion and found 0·011% and 0·009% respectively.

COPPER

All analysts determined copper electrolytically. No. 1 stripped the initial deposit in nitric acid and re-electrolysed to ensure complete separation from nickel.

IRON

All analysts except Nos. 5 and 6 determined iron volumetrically. Nos. 1, 2, 3 and 4 separated the iron as hydroxide by precipitation with ammonia, dissolved the precipitate, reduced with hydrogen sulphide or stannous chloride and titrated with dichromate solution. No. 7 separated the iron in the same way but titrated the reduced solution with ceric sulphate. No. 5 first separated iron with cupferron, dissolved the precipitate and then re-precipitated iron as sulphide from an ammoniacal tartrate solution; the sulphide was dissolved in hydrochloric acid and then iron was determined gravimetrically by precipitation as the oxinate. No. 6 separated the iron by ammonia precipitation and completed colorimetrically with thioglycollic acid.

MANGANESE

Analysts Nos. 1, 3 and 5 determined manganese volumetrically after oxidation with persulphate/silver nitrate. The remaining analysts determined manganese colorimetrically with potassium periodate.

ALUMINIUM

Analysts Nos. 1, 2, 4, 5 and 6 separated aluminium from the bulk of the alloying constituents by mercury-cathode electrolysis, then carried out a sodium hydroxide separation and completed colorimetrically with eriochromecyanine. No. 3 carried out a mercury-cathode electrolysis, precipitated aluminium as the oxinate and completed volumetrically. No. 7 separated copper by electrolysis and determined aluminium colorimetrically after extraction of the oxinate into chloroform.

COBALT

Analysts Nos. 1 and 5 determined cobalt colorimetrically with nitroso-R-salt. No. 1 used the Standard method for cobalt in iron and steel B.S. 1121: Part 42: 1961 but with a reduced sample weight. No. 5 separated copper as the sulphide and then separated cobalt with 1-nitroso-2-naphthol before carrying out the colorimetric determination. No. 2 separated cobalt from copper, iron etc. by means of a zinc oxide separation and then determined cobalt gravimetrically by precipitation with 1-nitroso-2-naphthol and ignition to the oxide. No. 3, 4 and 7 separated copper by electrolysis and then determined cobalt colorimetrically after extraction of the 2-nitroso-1-naphthol complex into chloroform. No. 6 used an atomic-absorption method (Elwell and Gidley, "Atomic-Absorption Spectrophotometry" Second Edition, 1966, p. 89).

Analyst No. 4 also used an atomic-absorption method and found 0·19%.

NICKEL

In all cases the copper was separated by electrolysis and nickel precipitated with dimethylgloxime. Analyst No. 1 dissolved the precipitate in dilute sulphuric acid, boiled with excess of ferric sulphate and titrated the ferrous salt thus formed with dichromate (Analoid method No. 62). Nos. 3 and 7 completed volumetically by cyanide titration. Nos. 2. 4. 5 and 6 completed volumetrically by titration with EDTA.

CHROMIUM

Spectrographic method.

MAGNESIUM

Spectrographic method.

PHOSPHORUS

Volumetric method.

TITANIUM

Cupferron separation followed by colorimetric determination with hydrogen peroxide.

NEWHAM HALL,
MIDDLESBROUGH,
ENGLAND

For BUREAU OF ANALYSED SAMPLES LTD.
P. D. RIDSDALE,
Managing Director

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