MAIN EDITION

British Chemical Standards

issued by

Bureau of Analysed Samples, Ltd.

Directors (1962-71):-

P. D. RIDSDALE, *B.Sc., A.I.M.* (Managing)
B. BAGSHAWE, *A.Met., F.I.M., M.Inst.F*
C. GILDON, *F.C.A.*

Certificate of Analyses

B.C.S.*/S.S.† No. 403
LOW ALLOY STEEL

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

The standard bars were specially prepared by Edgar Allen Steels Ltd., Sheffield.

ANALYSES

Analyst No.	C %	Si %	S %	P %	Mn %	Ni %	Cr %	Mo %	V %	Cu %
1	0·72	0·088	0·034	0·064	1·70	0·25	0·43	0·078	0·24	0·15
2	0·74	0·073	0·037	0·066	1·70	0·24	0·41	0·075	0·25	0·17
3	0·73	0·080	0·036	0·064	1·69	..	..	..	..	..
4	..	..	..	..	..	0·23	0·41	0·083	0·23	0·17
5	0·72	..	..	0·065	..	0·22	0·42	0·086	..	0·16
6	..	..	..	..	..	0·24	0·41	0·081	0·24	0·17
7	0·71	0·082	0·036	0·064	1·68	..	..	..	..	..
8	0·72	0·075	0·036	0·063	1·69	..	..	..	..	..
9	..	..	..	..	..	0·26	0·41	0·076	0·24	..
10	0·72	0·080	0·036	0·064	1·71	0·23	0·40	0·077	0·24	0·17
11	0·73	0·085	0·035	0·064	1·69	..	..	..	..	..
12	..	..	..	..	..	0·24	0·43	$0{\cdot}08_5$	0·24	0·17
Average	**0·72**	**$0{\cdot}08_0$**	**0·036**	**0·064**	**1·69**	**0·24**	**0·42**	**$0{\cdot}08_0$**	**0·24**	**0·17**

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

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

[P.T.O.

CO-OPERATING ANALYSTS AND FIRMS

INDEPENDENT ANALYSTS

1. Coppins, W. C., *M.Sc., F.R.I.C.*, Ridsdale & Co., Ltd. Middlesbrough.
2. Halberstat, E., and Sirovatko, V., CKD Praha Research Institute, Prague.
3. Scholes, P. H., *A.Met., A.R.I.C., A.I.M.*, BISRA, The Corporate Laboratories of the British Steel Corporation, Sheffield.
4. Swinburn, D. G., *A.I.M.*, Steel Castings Research and Trade Association, Sheffield.

ANALYSTS representing MAKERS and USERS

5. Bagshawe, B., *A.Met., F.I.M., M.Inst.F.*, Brown-Firth Research Laboratories, Sheffield.
6. Bettelley, J., *B.Sc., A.R.I.C.*, G.K.N. Group Research Centre, Wolverhampton.
7. Booth, J., *B.Sc.*, British Steel Corporation, Park Gate Works, Rotherham.
8. Borrowdale, J., *B.Sc.*, British Steel Corporation, Redbourn Works, Scunthorpe.
9. Chambers, H. F., Ford Motor Company Ltd., Central Laboratory Services, Basildon.
10. Clements, L., *A.I.M.*, and Laycock, C., *A.Met., A.I.M.*, Round Oak Steel Works Ltd., Brierley Hill.
11. Clyde, C., British Steel Corporation, Lanarkshire Works, Motherwell.
12. Dunnill, P. B., *B.Sc.*, British Steel Corporation, Rotherham Works, Rotherham.

B.C.S./S.S. No. 403 LOW ALLOY STEEL

NOTES ON METHODS USED

CARBON

Analyst No. 1 determined carbon gravimetrically according to the Standard method B.S. 1121: Part 11: 1967. No. 2 determined carbon volumetrically using the Ströhlein apparatus. No. 3 used a conductimetric method with a balanced two-cell circuit. No. 5 used a low-pressure method (Cook and Speight, Analyst, 1956, **81**, 144). Nos. 7, 8 and 10 used infra-red absorption methods. No. 11 used a non-aqueous titration method (Jones et al., Analyst, 1965, **90**, 623; 1966, **91**, 399).

Analysts Nos. 3 and 5 also used infra-red absorption methods and found 0·74% and 0·72% respectively. No. 5 also determined carbon by non-aqueous titration and found 0·73%. No. 11 also used the British Standard gravimetric method and found 0·72%.

SILICON

Analysts Nos. 1, 2, 3, 10 and 11 determined silicon colorimetrically as molybdenum-blue. No. 1 used the Analoid method No. 43. No. 3 used an automatic method (Scholes and Thulbourne, Analyst, 1964, **89**, 466). Nos. 7 and 8 determined silicon gravimetrically by double dehydration with perchloric acid; No. 7 used the Standard method B. S. 1121: Part 10: 1967.

Analyst No. 2 also used a gravimetric method involving evaporation of a hydrochloric-nitric acid solution of the alloy and found $0{\cdot}08_0$%. Nos. 3, 10 and 11 also used the British Standard gravimetric method and found 0·08%, 0·070% and 0·080% respectively.

SULPHUR

Analysts Nos. 1, 2, 7 and 11 determined sulphur gravimetrically. Nos. 1, 7 and 11 used the Standard method B.S. 1121: Part 1: 1966. No. 2 used a method involving preliminary separation of iron by shaking the sample with cupric potassium chloride solution. Nos. 3, 8 and 10 determined sulphur by combustion in oxygen (Nos. 3 and 8) or air (No. 10); No. 3 completed conductimetrically whereas Nos. 8 and 10 completed volumetrically.

Analyst No. 11 also determined sulphur by combustion and found 0·036%.

PHOSPHORUS

Analysts Nos. 1, 3, 5, 10 and 11 determined phosphorus colorimetrically as phosphovanadomolybdic acid according to the Standard method B.S. 1121: Part 45: 1966. Nos. 2 and 8 determined phosphorus gravimetrically by precipitation as phosphomolybdate and conversion to lead molybdate; No. 8 used the Standard method B.S. 1121: Part 9: 1948. No. 7 determined phosphorus volumetrically after precipitation as phosphomolybdate.

Analyst No. 2 also determined phosphorus colorimetrically as phosphovanadomolybdate and found 0·065%. No. 11 also used the British Standard gravimetric method and found 0·064%.

MANGANESE

Analysts Nos. 1 and 7 determined manganese volumetrically. No. 1 used the direct Analoid method No. 53 whereas No. 7 used the Standard method B.S. 1121: Part 16: 1949 which includes a zinc oxide separation. The other analysts determined manganese colorimetrically after oxidation with periodate; Nos. 3, 10 and 11 used the Standard method B.S. 1121: Part 23: 1951.

Analyst No. 2 also used a direct volumetric method and found 1·71%. No. 11 also used the British Standard volumetric method and found 1·68%.

NICKEL

Analysts Nos 1, 4, 6 and 10 determined nickel colorimetrically with dimethylglyoxime. No. 1 used the Analoid method No. 44. Nos. 4, 6 and 10 used the Standard method B.S. 1121: Part 6: 1967. No. 2 determined nickel gravimetrically by precipitation with dimethylglyoxime. Nos. 5, 9 and 12 precipitated nickel with dimethylglyoxime and completed cyanometrically according to the Standard volumetric method B.S. 1121: Part 37: 1961.

Analysts Nos. 2 and 5 also determined nickel colorimetrically with dimethylglyoxime and found 0·23% in each case. No. 9 also separated nickel with dimethylglyoxime and completed by titration with EDTA; the result by this method was 0·26%.

CHROMIUM

All analysts determined chromium volumetrically after oxidation with persulphate/silver nitrate. No. 1 used the Analoid method No. 37. Nos. 4, 5, 6, 9, 10 and 12 used the Standard method B.S. 1121: Part 13: 1954.

Analyst No. 2 also determined chromium colorimetrically with diphenylcarbazide and found 0·41%.

MOLYBDENUM

All analysts except No. 5 determined molybdenum colorimetrically as oxythiocyanate. No. 1 used the Analoid method No. 42. Nos. 4, 6, 9, 10 and 12 used the Standard method B.S. 1121: Part 48: 1966. No. 5 determined molybdenum colorimetrically with toluene 3-4-dithiol (Wells and Pemberton Analyst, 1947, **72**, 185).

VANADIUM

All analysts except No. 10 determined vanadium volumetrically. Nos. 1, 4, 6, 9 and 12 used the Standard method B.S. 1121: Part 25: 1956. No. 2 titrated potentiometrically with permanganate. No. 10 determined vanadium colorimetrically as phosphovanadotungstate (Scholes, Analyst, 1957, **82**, 525).

Analysts Nos. 2 and 12 also determined vanadium colorimetrically as phosphovanadotungstate and found 0·25% and 0·24% respectively.

COPPER

All analysts except No. 9 determined copper colorimetrically. Nos. 1 and 12 used *bis*-cyclohexanone oxalyldihydrazone (Haywood and Sutcliffe, Analyst, 1956, **81**, 651). No. 2 used tetraethylthiuram disulphide. Nos. 4, 5, 6 and 10 used 2-2′ diquinolyl according to the Standard method B.S. 1121: Part 36: 1956. No. 9 determined copper volumetrically by iodometric titration using the Standard method B.S. 1121: Part 14: 1956.

Analysts Nos. 2, 4, 5 and 6 also determined copper colorimetrically with *bis*-cyclohexanone oxalyldihydrazone and found 0·18%, 0·17%, 0·17% and 0·16% respectively.

NEWHAM HALL
MIDDLESBROUGH,
ENGLAND

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

Preliminary Edition .. .. May, 1969
Main Edition .. .. April, 1971