

British Chemical Standards

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Certificate of Analyses

B.C.S.* / S.S.† No. 455

MILD STEEL (Residual Series)

Prepared under rigorous laboratory conditions and, AFTER STANDARDIZATION BY ANALYSTS IN GREAT BRITAIN, 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 %	Ni %	Cr %	Mo %	Cu %	W %	Ti %	As %	Sn %	Mn %
1	0.56 ₀	0.22	0.062	0.050	0.23	0.22	0.16	0.043	0.23	0.026	0.019	0.074	0.09
2	..	..	0.060	0.051	..	0.21	..	0.040	..	..	..	..	..
3	0.56 ₀	0.22	0.060	..	..	..	0.15	..	..	..	..	..	..
4	..	..	..	..	..	0.22	0.16	..	..	..	0.019	0.080	..
5	..	..	..	0.052	..	..	..	..	0.22	0.027	0.017	..	..
6	0.55 ₅	..	..	0.052	..	..	0.15	..	0.21	0.027	..	..	..
7	..	..	..	0.054	..	0.21	..	0.042	..	0.029	..	..	..
8	..	0.22	0.063	..	0.25	..	..	..	..	..	..	0.079	..
9	0.55 ₀	..	..	..	0.25	..	0.15	0.043	..	0.031	..	..	..
10	0.56 ₀	..	..	..	0.24	..	..	..	0.21	..	0.020	..	..
11	0.56 ₀	..	..	..	..	0.22	..	..	0.23	..	..	0.080	..
12	..	0.21	0.061	..	..	0.22	..	..	..	..	0.019	..	..
13	..	..	..	..	0.25	..	..	0.046	..	..	0.017	0.075	..
14	..	0.21	..	..	0.25	..	0.16	..	..	..	..	0.071	..
15	..	..	0.060	..	..	..	..	0.044	0.23	0.026	..	..	..
Average	0.56-	0.22	0.061	0.052	0.24	0.22	0.16	0.043	0.22	0.028	0.018	0.076	..

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

Figures in bold type standardized, figure in small italic type only approximate.

*Chips for Chemical Analysis.

†Disc sample for Spectroscopic Analysis.

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NOTES ON METHODS USED

CARBON

Analyst No. 1 determined carbon gravimetrically after combustion. Nos. 3, 10 and 11 used coulometric methods; No. 11 used a variation in which the titration is carried out in partially aqueous medium (Boniface and Jenkins, Analyst, 1971, 96, 37). No. 6 used a low-pressure method (Cook and Speight, Analyst, 1956, 81, 144). No. 9 determined carbon by non-aqueous titration. (Jones et al., Analyst, 1965, 90, 623; 1966, 91, 399).

Analysts Nos. 6 and 10 also determined carbon by both non-aqueous titration and infra-red absorption. Results were as follows: non-aqueous titration 0.56% in each case; infra-red absorption 0.56% in each case. No. 9 also determined carbon by coulometric titration in partially aqueous medium and found 0.56%.

SILICON

Analysts Nos. 1, 8 and 12 determined silicon gravimetrically according to the British Standard Silicon Method 1*. Nos. 3 and 14 used colorimetric methods depending on the formation of molybdenum-blue; No. 3 used an automatic analyser (Scholes and Thulbourne, Analyst, 1964, 89, 466).

Analysts Nos. 8 and 12 also determined silicon colorimetrically as molybdenum-blue and found 0.21% and 0.22% respectively. No. 14 also found 0.21% by X-ray fluorescence.

SULPHUR

Analysts Nos. 1, 8, 12 and 15 determined sulphur gravimetrically according to the British Standard Sulphur Method 1*. Nos. 2 and 3 used combustion methods. No. 2 ignited the sample in air and completed volumetrically (Green, BCIRA Journal, 1968, 16, 244). No. 3 ignited in oxygen and completed coulometrically.

Analyst No. 3 also used a combustion method in conjunction with measurement of electrical conductivity and found 0.061%. Nos. 8 and 12 also determined sulphur by combustion, completing volumetrically, and found 0.062% in each case.

PHOSPHORUS

Analysts Nos. 1, 2, 5 and 6 determined phosphorus colorimetrically as phosphovanadomolybdic acid according to the British Standard Phosphorus Method 2*. No. 7 determined phosphorus volumetrically by the Analoid Method No. 21.

Analyst No. 14 found 0.051% by X-ray fluorescence.

NICKEL

Analyst No. 1 determined nickel volumetrically after precipitation with dimethylglyoxime; the precipitate was dissolved in dilute sulphuric acid, boiled with excess of ferric sulphate and the ferrous salt thus formed titrated with dichromate solution (Analoid Method No. 62). Nos. 8, 10, 13 and 14 determined nickel colorimetrically with dimethylglyoxime according to the British Standard Nickel Method 3*; No. 10 used the method in conjunction with an automatic analyser. No. 9 determined nickel by atomic absorption spectroscopy.

Analyst No. 8 also determined nickel volumetrically according to the British Standard Nickel Method 1* and found 0.25%. No. 14 also found 0.24% by X-ray fluorescence.

CHROMIUM

Analyst No. 1 determined chromium volumetrically after oxidation with persulphate/silver nitrate using the Analoid Method No. 37. Nos. 2, 4, 7, 11 and 12 determined chromium colorimetrically with diphenylcarbazide according to the British Standard Chromium Method 2*.

Analyst No. 2 also used a volumetric method and found 0.21%.

Analyst No. 14 found 0.21% by X-ray fluorescence.

MOLYBDENUM

Analysts Nos. 1, 3, 4 and 14 determined molybdenum colorimetrically as the oxythiocyanate. No. 1 used the Analoid Method No. 42, Nos. 3, 4 and 14 used the British Standard Molybdenum Method 1*. No. 6 determined molybdenum colorimetrically with toluene-3:4-dithiol (Wells and Pemberton, Analyst, 1947, 72, 185). No. 9 used atomic absorption spectroscopy.

Analyst No. 6 also used the British Standard colorimetric method and found 0.15%. No. 14 also found 0.15% by X-ray fluorescence.

COPPER

Analysts Nos. 1, 2, 7, 13 and 15 determined copper colorimetrically. Nos. 1, 2, 13 and 15 used 2-2' diquinolyl according to the British Standard Copper Method 3*. No. 7 used *bis*-cyclohexanone oxalyldihydrazone. No. 9 used atomic absorption spectroscopy.

Analyst No. 2 also used atomic absorption spectroscopy and found 0.043%.

Analyst No. 14 found 0.045% by X-ray fluorescence.

TUNGSTEN

Analysts Nos. 1, 5, 10, 11 and 15 determined tungsten colorimetrically as the thiocyanate complex according to the British Standard Tungsten Method 2*. No. 6 used the toluene-3:4-dithiol colorimetric method (Bagshawe and Truman, Analyst, 1947, 72, 189).

Analyst No. 6 also used the British Standard colorimetric method and found 0.22%. No. 10 also used the toluene-3:4-dithiol method and found 0.20%.

TITANIUM

Analysts Nos. 1, 5, 9 and 15 determined titanium colorimetrically with hydrogen peroxide; Nos 1, 9 and 15 carried out preliminary separations with cupferron. Nos. 6 and 7 used the colorimetric diantipyrylmethane method (Corbett, Analyst, 1968, **93**, 383)

Analyst No. 5 also used the diantipyrylmethane method and found 0.027%.

Analyst No. 14 found 0.023% by X-ray fluorescence.

ARSENIC

Analysts Nos. 1, 4, 5, 12 and 13 determined arsenic volumetrically by reduction with hypophosphite, solution of the precipitated arsenic in iodine solution and titration of the excess of iodine with arsenite solution; Nos. 5, 12 and 13 followed the procedure of the British Standard Arsenic Method 1*. No. 10 extracted the arsenic into chloroform and determined it as the molybdenum-blue complex (Nall, Analyst, 1971, **96**, 398).

Analyst No. 5 also determined arsenic colorimetrically as molybdenum-blue and found 0.017%. No. 10 also used the British Standard volumetric method and found 0.020%.

TIN

All analysts determined tin volumetrically. Nos. 1, 4, 13 and 14 used the British Standard Tin Method 1* which involves a preliminary separation of the tin as sulphide. Nos. 8 and 11 used a direct method after dissolving the sample in hydrochloric acid.

Analyst No. 1 also used a direct volumetric method and found 0.082%. No. 14 also found 0.070% by X-ray fluorescence.

MANGANESE

Manganese was determined colorimetrically after oxidation with periodate (Analoid Method No. 52).

* 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.

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