MAIN EDITION

BUREAU OF ANALYSED SAMPLES LTD

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS
BCS-CRM No. 207/2
GUNMETAL

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.	Cu	Sn	Zn	Pb	Ni	Fe	Al	Sb	As	Si	Bi	*P*
1	87.38	9.72	1.59	0.69	0.30	0.028	0.013	0.093	0.065	0.016	0.040	*0.018*
2	87.41	9.70	1.60	0.68	0.28	0.035	0.010	0.11	0.065	...	0.04	...
3	87.29	9.73	1.59	0.72	0.28	0.030	0.013	0.105	0.065	0.014	0.039	...
4	87.33	9.74	1.61	0.71	0.28	0.028	0.014	0.095	0.063	0.018	0.048	...
5	87.30	9.77	1.58	0.68	0.28	0.028	0.012	0.11	0.069	0.015	0.040	...
6	87.39	9.79	1.63	0.73	0.28	0.027	0.014	0.110	0.069	0.017	0.042	...
M_M	**87.35**	**9.74**	**1.60**	**0.70**	**0.28**	**0.029**	**0.013**	**0.10**	**0.066**	**0.016**	**0.04**	...
s_M	0.06	0.04	0.02	0.03	0.01	0.003	0.002	0.01	0.003	0.002	0.01	...

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 %

	Cu	Sn	Zn	Pb	Ni	Fe	Al	Sb	As	Si	Bi
Cv	**87.35**	**9.74**	**1.60**	**0.70**	**0.28**	**0.029**	**0.013**	**0.10**	**0.066**	**0.016**	**0.04**
C(95%)	0.06	0.04	0.02	0.03	0.01	0.004	0.002	0.01	0.003	0.002	0.01

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

COPPER

Analysts Nos. 1, 2 and 3 determined copper electrolytically from a nitric acid solution after removing tin by evaporation with bromine/hydrobromic acid according to the Standard Method B.S. 1748: Part 1: 1961. Nos. 4 and 6 electrolysed from a nitric/fluoroboric acid solution. No. 5 electrolysed initially from a nitric/fluoroboric acid solution, dissolved the deposit and removed impurities using ferric hydroxide as a collector; the copper was then redeposited from a nitric/sulphuric acid solution.

TIN

All Analysts determined tin by titration. Nos. 1, 2, 3 and 5 used the Standard Method B.S. 1748: Part 6: 1960 in which the tin is separated by co-precipitation with iron and reduced with a nickel coil. Nos. 4 and 6 reduced with hyphophosphite.

ZINC

Analysts Nos. 1, 2, 4 and 5 determined zinc by atomic-absorption spectroscopy. No. 3 titrated with EDTA in a buffered solution after first separating tin, copper, lead and nickel. No. 6 titrated with EDTA after separation of zinc by ion-exchange.

Analyst No. 3 also used atomic-absorption spectroscopy and found 1.56%. No. 6 also found 1.63% by titration with EDTA after separation of zinc as sulphide.

LEAD

Analysts No. 1, 2, 4 and 5 determined lead by atomic-absorption spectroscopy. No. 3 determined it gravimetrically as the sulphate. No. 6 separated the lead electrolytically as PbO_2, converted to lead molybdate and completed gravimetrically.

NICKEL

Analysts Nos. 1, 2, 3 and 6 determined nickel photometrically with dimethylglyoxime; Nos. 3 and 6 used the Standard Method B.S. 1748: Part 5: 1961. Nos. 4 and 5 determined nickel by atomic-absorption spectroscopy.

Analyst No. 2 also used atomic-absorption spectroscopy and found 0.28%.

IRON

Analysts Nos. 1, 3, 4 and 6 determined iron by photometric methods. Nos. 1, 3 and 6 used 1, 10-phenanthroline after preliminary separation of tin and copper. No. 4 used ammonium thioglycollate without making any preliminary separations. Nos. 2 and 5 determined iron by atomic-absorption spectroscopy.

Analyst No. 4 also used atomic-absorption spectroscopy and found 0.026%.

ALUMINIUM

All Analysts determined aluminium photometrically using portions of the copper-free electrolyte. No. 1 used eriochrome cyanine, No. 2 used chrome azurol S, Nos. 3, 4, 5 and 6 used aluminon (B.S. 1748: Part 4 1961).

ANTIMONY

Analysts No. 1, 4, 5 and 6 separated copper as insoluble cuprous iodide and determined antimony photometrically as the iodoantimonite complex. Nos. 2 and 3 determined antimony by atomic-absorption spectroscopy.

ARSENIC

Analysts Nos. 1, 2 and 5 determined arsenic spectrophotometrically after precipitation in colloidal form with hypophosphite. No. 3 used atomic-absorption spectroscopy. Nos. 4 and 6 extracted the arsenic into chloroform and determined it photometrically as molybdenum-blue.

SILICON

All Analysts determined silicon photometrically as molybdenum-blue according to the Standard Method B.S. 1748: Part 7: 1960.

BISMUTH

All Analysts except No. 2 determined bismuth photometrically as the iodide after separation of copper as cuprous iodide. No. 2 used atomic-absorption spectroscopy.

PHOSPHORUS

B.S. 1748: Part 8: 1960.

DESCRIPTION OF SAMPLE

Bottles of 100g powder 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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Managing Director

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