

U. S. DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Certificate of Analyses

Standard Sample 164

Manganese — Aluminum Bronze

ANALYST	COPPER Electrolytic	ZINC ZnS-ZnO	ALUMINUM Weighed as Al ₂ O ₃	MANGANESE Persulfate-arsenite	IRON	TIN	LEAD Weighed as PbO ₂	NICKEL Weighed as nickel dimethylglyoxime	SILICON
1	^a 63.77	21.89	^b 6.23	^c 4.67	^d 2.52	^e 0.64	^f 0.22	^g 0.047	^h 0.036
2	ⁱ 63.77	21.93	^j 6.22	^k 4.65	^l 2.52	^m .64	.21	.044	ⁿ .036
3	ⁱ 63.76	21.92	^o 6.20	^p 4.68 ^q 4.70	^d 2.51	^r .64	^r .21	.047	^s .040
4	ⁱ 63.75	21.94	^j 6.20	^t 4.66 ^u 4.72	^l 2.49	^v .60	^r .20	.045	^s .030
5	^w 63.74			^k 4.65		.63			
6	^x 63.77	21.85	^b 6.22	^{p, v} 4.70	^z 2.52	^m .64	.22	.046	^y .034 ^z .049
7	^x 63.77	21.85	^j 6.22	^p 4.67	^d 2.53	^z .62	^z .23	.045	^z .046
8	^x 63.75	21.86	^b 6.18	4.72	^d 2.54	^r .64	^r .22	.05	^s .03
Average	63.76	21.89	6.21	4.68	2.52	0.63	0.22	0.046	0.038

^a Five-gram sample dissolved in 110 ml of HNO₃ (1+4). Solution digested on a steam bath overnight, filtered, and the precipitate washed with hot HNO₃ (1+99). Filtrate diluted to 350 ml, 2 drops of 0.1 N HCl added, and the solution electrolyzed overnight, using a current density of 0.5 amp/dm². Metastannic acid precipitate and paper treated with HNO₃-H₂SO₄. Tin volatilized with HCl, and residual copper determined by electrolysis.
^b Mercury cathode -H₂S in 0.01 N acid solution -Al₂O₃ method using a 1-g sample.
^c Potentiometric titration of a 0.1-g sample.
^d SnCl₂-K₂Cr₂O₇ method.
^e Tin separated by distillation from a 5-g sample, precipitated with cupferron, and ignited to SnO₂. See J. Research NBS 33: 307 (1944) RP1610.
^f Anode deposit (footnote a) dissolved in nitric acid and a little alcohol. Solution treated with H₂S, filtered, and lead determined by electrolysis.

^z Dimethylglyoxime-photometric method.
^h HCl dehydration.
ⁱ Copper deposited from a H₂SO₄-HNO₃ solution. See ASTM method E 36-45. (Methods for Chemical Analysis of Metals, p. 260. American Society for Testing Materials, Philadelphia, Pa. (1950)).
^j Mercury cathode-NH₄OH-Al₂O₃ method.
^k Bismuthate method. See ASTM method E 54-49.
^l Iron reduced in a Jones reductor and titrated with K₂MnO₄ standardized with sodium oxalate.
^m Tin reduced with aluminum in presence of added antimony and titrated with iodine. See ASTM method E 54-49.
ⁿ HClO₄ dehydration.
^o Mercury cathode-8-hydroxyquinoline method.
^p Bromate method. See ASTM method E 54-49.
^q Tin reduced with nickel and titrated with KIO₃. See ASTM method E 36-45.
^r Weighed as PbSO₄. See ASTM method E 54-49.

^s H₂SO₄ dehydration. See ASTM method E 54-49.
^t Bismuthate-Fe(NH₄)₂(SO₄)₂-KMnO₄ method.
^u Bismuthate oxidation and titration with arsenite solution standardized with NBS standard 62b.
^v Tin reduced with iron and titrated with iodine.
^w Copper deposited from a HNO₃-HF solution.
^x Copper deposited after removal of tin. See ASTM method E 54-49.
^y Same value by the KIO₃-photometric method. See ASTM method E 62-50T.
^z Titrated with standard TiCl₃ solution.
¹ Molybdisilicic acid-photometric method. See Ind. Eng. Chem. Anal. Ed. 16, 300 (1944).
² Tin reduced with aluminum and titrated with KIO₃. See ASTM method E 54-49.
³ PbO₂ deposited from a HNO₃-HF solution and corrected for manganese. See ASTM method E 54-49.

List of Analysts

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A. V. ASTIN, *Acting Director.*