

U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 21D

ACID OPEN-HEARTH STEEL, 0.6% CARBON

ANALYST*	C	Mn		P		S			Si	COPPER H ₂ S-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	CHROMIUM FeSO ₄ -KMnO ₄ titration	VANADIUM	MOLYBDENUM Colorimetric	TIN	ARSENIC
	Direct combustion	Bismuthate (FeSO ₄ -KMnO ₄)	Persulfate-Arsenite	Gravimetric (weighed as Mg ₂ P ₂ O ₇ after removal of arsenic)	Alkali-Molybdate ^a	Gravimetric (direct oxidation and precipitation after reduction of iron)	Evolution with HCl (1-1) ZnS-Iodine (theoretical sulfur titre) ^b	Combustion	Sulfuric acid dehydration							
1	0.651	1.04	1.04	0.038	0.040	0.044	0.040	^d 0.042	^e 0.334	0.104	0.189	^f 0.101	^g 0.005	0.035	^h 0.077	^e 0.010
2	.657	ⁱ 1.02			.041	.042	.043	^d 0.044	ⁱ 0.331	^k 0.107	^l 0.193	^f 0.111			.074	
3	.649		^m 1.05		^m 0.038		.043	.042	.330	ⁿ 0.116	.190	.099			^h 0.076	
4	.653	1.04	^m 1.04	.043	^m 0.043	.045	.039	^o 0.044	^e 0.333	.107	.186	.097			^h 0.076	
	.642	1.03	^m 1.03	.042	.041	.043	.044		^e 0.338	^p 0.104	^q 0.192	.095		.034	^r 0.083	
	.651		^m 1.04		.043		.042		^e 0.324	^s 0.103	^t 0.187	^u 0.097		.035	^h 0.076	
Averages	0.651	1.03	1.04	0.041	0.041	0.044	0.042	0.043	0.332	0.107	0.190	0.100	0.005	0.035	0.077	0.010
General averages	0.651	1.03		0.041		0.043						0.100		0.035	0.077	

^a Precipitated at 40° C, washed with a 1-percent solution of KNO₃ and titrated with alkali standardized by the use of acid potassium phthalate and the ratio 23NaOH:1P.

^b Value obtained by standardizing the titrating solution by means of sodium oxalate through KMnO₄ and Na₂S₂O₃ and use of the ratio 21:1S.

^c Molybdenum-blue photometric method.

^d 1-g sample burned in oxygen at 1,400° C, and sulfur gases absorbed in acidified starch-iodine solution. Iodine liberated from iodide by titration, during the combustion, with KIO₃ solution based on 93 percent of the theoretical factor.

^e Double dehydration with intervening filtration.
^f Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.

^g Vanadium separated from the bulk of iron in a 10-gram sample by selective precipitation with sodium bicarbonate, then oxidized with HNO₃ and titrated potentiometrically with ferrous ammonium sulfate.

^h Sulfide-iodine method. See BS J. Research 8, 309 (1932) RP415.

ⁱ Potentiometric titration with mercurous nitrate.

^j Hydrochloric acid dehydration.

^k Thiosulfate-electrolytic method.

^l Glyoxime-cyanide titration method.

^m Titrating solution standardized by use of a standard steel.

ⁿ Finished by electrolysis.

^o As in (d), except burned at 1,300° C, and iodate solution standardized on standard steels.

^p KI-Na₂S₂O₃ titration method.

^q Weighed as nickel oxide.

^r Stannous-iodate titration method.

^s Ammonia-copper complex photometric method.

^t Dimethylglyoxime photometric method.

^u Diphenylcarbazide photometric method.

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The steel for the preparation of this standard was furnished by The Midvale Co.

WASHINGTON, March 1, 1948.

E. U. CONDON, *Director.*