U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 20E

ACID OPEN-HEARTH STEEL, 0.4% CARBON

ANALYST*	C	Mn		P		S			Si								
	Direct combustion	Bismuthate ($FeSO_4$-$KMnO_4$)	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Alkali-Molybdate [a]	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion	Evolution with HCl (1-1) ZnS-Iodine (theoretical sulfur titre) [b]	Sulfuric acid dehydration	COPPER H_2S-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	CHROMIUM $FeSO_4$-$KMnO_4$ titration	VANADIUM	MOLYBDENUM Colorimetric	TIN	
1	0. 342	0. 821	0. 814	0. 054	[c] 0. 054	0. 080	[d] 0. 078	0. 073	[e] 0. 258	0. 108	0. 093	[f] 0. 330	[g] 0. 006	0. 017	[h] 0. 014	
2	. 344		. 827		[i] . 052		. 082	[j] . 080	. 254	[k] . 117	. 092	. 338			[h] . 014	
	. 353	[l] . 808			. 057	. 076	[d] . 078	[m] . 078	[n] . 263	[o] . 104	[p] . 097	[f] . 330			. 011	
4	. 347	. 823	. 816	. 056	[i] . 056	. 078	[q] . 077	. 074	[e] . 253	. 114	. 096	[r i] . 327			[h] . 013	
5	. 338	. 818	. 813	. 053	. 054	. 076		. 075	[e] . 260	[s] . 111	[t] . 092	. 326		. 017	[u] . 012	
6	. 349		. 804		. 056			. 079	[e] . 255	[v] . 109	[w] . 093	[x] . 332		. 018	[h] . 014	
Averages	**0. 346**	**0. 818**	**0. 815**	**0. 054**	**0. 055**	**0. 078**	**0. 079**	[y] **0. 076**	**0. 257**	**0. 111**	**0. 094**	**0. 331**	**0. 006**	**0. 017**	**0. 013**	
General average	**0. 346**	**0. 816**		**0. 055**		**0. 078**			**0. 257**	**0. 111**	**0. 094**	**0. 331**		**0. 017**	**0. 013**	

ppt

[a] ~~Titrated~~ at 40° C, washed with a 1-percent solution of KNO_3 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 $KMnO_4$ and $Na_2S_2O_3$ and use of the ratio 2I : 1S.

[c] Molybdenum-blue photometric method. See J. Research NBS 26, 405 (1941) RP1386.

[d] 1-g sample burned in oxygen at 1400° C, and sulfur dioxide absorbed in starch-iodine solution. Iodine liberated from iodide by titration, during the combustion, with standard KIO_3 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-g sample by selective precipitation with sodium bicarbonate, then oxidized with HNO_3 and titrated potentiometrically with ferrous ammonium sulfate.

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

[i] Titrating solution standardized by use of a standard steel.

[j] Evolution with HCl (2:1). Value omitted from average.

[k] Finished by electrolysis.

[l] Potentiometric titration with $HgNO_3$.

[m] Absorbed in ammoniacal cadmium chloride.

[n] Hydrochloric acid dehydration.

[o] Thiosulfate precipitation, electrolytic method.

[p] Dimethylglyoxime precipitation, cyanide titration method.

[q] As in (d), except combustion at 1300° C, and iodate solution standardized by use of standard steels.

[r] Perchloric acid oxidation.

[s] KI-$Na_2S_2O_3$ titration method.

[t] Weighed as nickel oxide.

[u] Stanreduce-iodate titration method.

[v] Copper-ammonia complex photometric method.

[w] Dimethylglyoxime photometric method.

[x] Diphenylcarbazide photometric method.

[y] Experience with this type of steel indicates that, for the evolution method, the amount of sulfur evolved decreases slowly under ordinary conditions of storage.

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The steel for the preparation of this standard was furnished by the Bethlehem Steel Company.

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