U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WASHINGTON, D. C. 20234

PROVISIONAL CERTIFICATE OF ANALYSIS
STANDARD SAMPLE 19 g
ACID OPEN-HEARTH STEEL, 0.2 PERCENT CARBON

	Percent
Carbon	0.225
Manganese	.55
Phosphorus	.046
Sulfur	.033
Silicon	.188
Copper	.093
Nickel	.066
Chromium	.37
Vanadium	.012
Molybdenum	.013
Titanium	.027
Aluminum	.030
Tin	.008
Niobium	.026

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Washington, D. C.
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National Bureau of Standards Certificate of Analyses

Standard Sample 19G
Acid Open-Hearth Steel, 0.2% Carbon

ANALYST	C	Mn	P		S		Si	Cu	Ni	Cr	V	Mo	Nb	Sn	Al	Ti	Co
	Direct combustion	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)		Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Iodate titration	Perchloric acid dehydration		Weighed as nickel dimethylglyoxime	$FeSO_4$–$KMnO_4$ titration		Photometric				H_2O_2 photometric	Photometric Nitroso-R-salt
1	0.226	[a]0.558	0.046	[b]0.049	0.032	[c]0.032	[d]0.186	[e]0.090	0.067	[f]0.377	[g]0.012	0.013	[h]0.027	[i]0.008	[j]0.027	[k]0.029	0.012
2	.225	.557	.045	[l].045	.033	.034	[d].184	[m].092 [n].093	.062 [o].064	[p].369 [f].371	[q].010	.012	[r].028	[i].009	[s].031 [t].033	[u].029 .027	[v].011
3	.221	[w].552		[l].045		.034	.189	[x].100	[o].071	[p].371 [f].370	[y].014	.011	[z].024	[a′].008	[b′].032	.028	
4	.221	[w].559	[c′].052			[w].033	[d′,d].180	[m].089	.066	[f, w].376	[e′].014	.013	[z].025		[f′].029	.024	
	.219	[w].55		[l].044		[w].035	[d′,d].189	[m].094	[o].066	.380		.015	[g′].021	.009	.032	[h′].024	
	.220			[b].046		.031	.185	[e].097	[o].06			.015					
	[i′].230	[w].550		[l].046		[w].034	[d].191	[n].091	.068	.376	[g].011	.013	[z].030	.008	[i′].031	.026	
Average	0.223	0.554	0.048	0.046	0.032	0.033	0.186	0.093	0.066	0.374	0.012	0.013	0.026	0.008	0.031	0.027	0.012
General average	0.223	0.554	0.046		0.033		0.186	0.093	0.066	0.374	0.012	0.013	[k′]0.026	0.008	0.031	0.027	0.012

[a] Potentiometric titration.
[b] Molybdenum-blue photometric method. See J. Res. NBS **26,** 405 (1941) RP1386.
[c] 1-g sample burned in oxygen at 1,450 °C, and sulfur dioxide absorbed in starch-iodide solution. Iodine liberated from iodide by titration, during the combustion, with standard KIO_3 solution. Titer based on 93 percent of the theoretical factor.
[d] Double dehydration.
[e] Diethyldithiocarbamate photometric method. See J. Res. NBS **47,** 380 (1951) RP2265.
[f] Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.
[g] Mercury cathode. Vanadium oxidized with HNO_3 and titrated potentiometrically with ferrous ammonium sulfate.
[h] Ion-exchange. Hydroquinone photometric method. See J. Res. NBS **62,** 1 (1959) RP2923.
[i] Sulfide-iodine method. See BS J. Res. **8,** 309 (1932) RP415.
[j] Mercury cathode-cupferron-aluminon photometric method. See J. Res. NBS **64a,** No. 3, 235 (1960).
[k] Cupferron separation after solution of the sample in diluted HCl (1+2). Vanadium separated by treatment with NaOH.
[l] Alkali-molybdate method.
[m] Electrolytic method.
[n] Neocuproine photometric method.
[o] Photometric method.
[p] Perchloric acid oxidation.
[q] Cupferron—$FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$.
[r] Cupferron—ion-exchange—Nb_2O_5 gravimetric method.
[s] Ether—mercury cathode—8 hydroxyquinoline—Al_2O_3.
[t] Ether—cupferron—eriochrome cyanine R photometric method.
[u] Ether—cupferron—H_2S—cupferron—TiO_2.
[v] Chromium removed with ZnO.
[w] Titrating solution standardized by use of a standard steel.
[x] Diethyldithiocarbamate photometric method.
[y] $NaHCO_3$—$FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$.
[z] Niobium hydrolyzed with $HClO_4$ and H_2SO_3. ASTM method E30–56.
[a′] Tin preferentially precipitated with ammonium hydroxide in the presence of ferrous iron, solution of the precipitate is reduced with Stanreduce and titrated with standard iodate.
[b′] CrO_2Cl_2—ether—aluminon photometric method.
[c′] Weighed as ammonium phosphomolybdate.
[d′] Sulfuric acid dehydration.
[e′] Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.
[f′] Weighed as $AlPO_4$.
[g′] H_2SO_3 hydrolysis—tannic acid—pyrogallol photometric method.
[h′] Vanadium separated with Na_2CO_3.
[i′] Differential gaseometric method.
[j′] Mercury cathode—cupferron—eriochrome cyanine R photometric method.
[k′] Values reported for niobium by analysts 3, 4, 5, and 7 include small amounts of tantalum present in the sample.

List of Analysts

1. Ferrous Laboratory, National Bureau of Standards. J. I. Shultz, in charge. Analysis by B. B. Bendigo and J. I. Shultz.
2. R. H. Rouse, Bethlehem Steel Co., Sparrows Point Plant, Sparrows Point, Md.
3. H. W. Huston, A. M. Byers Co., Ambridge, Pa.
4. A. Trathowen, Jones and Laughlin Steel Corp., Pittsburgh, Pa.
5. D. P. Robertson, Weirton Steel Co., Weirton, W. Va.
6. W. E. Walters, Pittsburgh Testing Laboratory, Pittsburgh, Pa.
7. W. F. Horscroft, Bethlehem Steel Co., Homer Research Laboratory, Bethlehem, Pa.

The steel for the preparation of this standard was furnished by the Bethlehem Steel Co., Bethlehem, Pa.

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A. V. ASTIN, *Director.*

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