UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON 25, D. C.

National Bureau of Standards

Certificate of Analyses

Standard Sample 51B

Electric Steel, 1.2% Carbon

ANALYST	C	Mn	P		S			Si	Cu	Ni	Cr	V	Mo	Sn	N
	Direct combustion	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Photometric	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Iodate titration	Evolution with HCl (1–1) ZnS-Iodine (theoretical sulfur titer)[a]	Perchloric acid dehydration		Weighed as nickel dimethylglyoxime	$FeSO_4$–$KMnO_4$ titration		Photometric		Distillation-titration
1	1.21	[b] 0.575	0.012	[c] 0.013	0.013	[d] 0.013	0.013	[e] 0.252	[f] 0.072	0.053	[g] 0.454	[h] 0.002	0.014	[i] 0.007	[j] 0.011
2	1.21	.566		[k] .013		[l] .015		.245	[m] .073 [n] .067	[o] .058	.458	[p] .002	.015	[q] .011	.015
3	1.20	[r] .572	[s] .012	[t] .012	.016		[u,v] .015	.243	[w] .077	.054	[x] .467	[y] .001	.017	[z] .008	[a1] .008
	1.20	[b1] .570	[s] .013	[c] .012	[c1] .016		[v] .016	.239		[d1] .051	[x,e1] .453	[f1] .001	.016	[i] .009	[g1] .010 [g1] .009
5	1.20	[l] .577		[t] .013	.013	.017	[l] .016	[h1] .246	[w] .065	.054	.442	< [y] .005	.011	[i] .007	.010
6	1.23	[b1] .580		[i1] .014		[d] .013 [j1] .011		[e] .246 [h1] .248	[k1] .072	.050	.457	[f1] .002	.013		[a1] .011
Average	1.21	0.573	0.012	0.013	0.014	0.014	0.015	0.246	0.071	0.053	0.455	0.002	0.014	0.008	0.011
General average	1.21	0.573	0.013		0.014			0.246	0.071	0.053	0.455	0.002	0.014	0.008	0.011

[a] Value obtained by standardizing the titrating solution by means of sodium oxalate through $KMnO_4$ and $Na_2S_2O_3$ and the use of the ratio 21:18.
[b] Potentiometric titration.
[c] Molybdenum-blue photometric method. See J. Research NBS **26**, 405 (1941) RP1386.
[d] 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.
[e] Double dehydration with intervening filtration.
[f] Diethyldithiocarbamate-photometric method. See J. Research NBS **47**, 380 (1951) RP2265.
[g] Chromium separated from the bulk of the iron in a 10-g sample by hydrolytic precipitation with $NaHCO_3$, oxidized with persulfate, and titrated potentiometrically with ferrous ammonium sulfate.
[h] Vanadium separated as in (g), oxidized with HNO_3, and titrated potentiometrically with ferrous ammonium sulfate.
[i] Sulfide-iodine method. See BS J. Research **8**, 309 (1932) RP415.
[j] Sulfuric acid digestion for 3 hr of a 1-g sample. See *J. Research NBS* **43**, *201 (1949) RP2021.*
[k] Molybdenum-blue photometric method.
[l] Titrating solution standardized with a standard steel.
[m] Diethyldithiocarbamate-photometric method.
[n] CuS precipitated with $Na_2S_2O_4$. Precipitate ignited, dissolved, and titrated with KI–$Na_2S_2O_3$.
[o] Dimethylglyoxime precipitate titrated with cyanide.
[p] Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.
[q] Tin separated as sulfide, reduced with lead and antimony, and titrated with iodine.
[r] ZnO separation.
[s] Weighed as ammonium phosphomolybdate.
[t] Alkali-molybdate method.
[u] Solution in concentrated HCl.
[v] Absorbed in ammoniacal cadmium chloride.
[w] Copper precipitated with $Na_2S_2O_3$, and the determination completed electrolytically.
[x] Chromium oxidized with $HClO_4$.
[y] Vanadium separated as in (g) and determined by $FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$ method.
[z] Stanreduce-iodate titration method.
[a1] Finished photometrically with Nessler's reagent.
[b1] Periodate-photometric method.
[c1] Meineke method.
[d1] Dimethylglyoxime photometric method.
[e1] Potentiometric titration with $Fe(NH_4)_2(SO_4)_2$.
[f1] Vanadium separated with cupferron and determined photometrically with H_2O_2.
[g1] Vacuum fusion method.
[h1] Double sulfuric acid dehydration with intervening filtration.
[i1] Molybdenum-blue photometric method. Colored complex extracted into isobutyl alcohol.
[j1] Combustion iodate-photometric method.
[k1] Neocuproine-photometric method.

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