UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards
Certificate of Analyses
Standard Sample 5K
Cast Iron

ANALYST	C		Mn	P		S			Si	Cu	Ni	Cr	V	Mo	Ti	As	N
	Total	Graphitic	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Alkali-Molybdate [a]	Gravimetric (direct oxidation and final precipitation after reduction of iron)	Combustion Iodate titration	Evolution (HCl, sp. gr. 1.18, ZnS-iodine [b] theoretical sulfur titer [c])	Sulfuric acid dehydration	H_2S–CuS–CuO	Weighed as nickel dimethylglyoxime	$FeSO_4$–$KMnO_4$ titration		Photometric	H_2O_2 photometric		Distillation-titration
1	2.68	1.96	[d]0.543	0.261	[e]0.260	0.100	[f]0.099	0.098	[g]2.09	[h]1.52	0.047	[i]0.109	[j]0.011	0.008	[k]0.026	[e]0.025	[l]0.008
2	2.77	1.99	.542		.278	.098	[m].099		[n,g]2.12	1.50	.052	[o].104	[p].015	.005	[q].030	[r].026	.009
3	2.69	2.01	.535		.277	.094		.091	2.02	[s]1.49	.057	.106	.014	.005	.03		
	2.68	1.99	.53	.258	.259	.104		[t,u].100	[g]2.10	[v]1.50	[w].049	.113	[x].016	.008	[q].029	[r].026	[y].008
	2.72	1.96	[z].534	.259	.260	.100	[aa].099		[n,g]2.08	[v]1.48	.050	[bb].110	[cc].014	.009	[q].028	[dd].028	.009
6	2.72	2.02	[z].534 [ee].537	.259	[z].258	.101	[z].102		[g]2.07 [ff]2.08	1.51 [g]1.50	.049	.111 [hh].112	[ii].014 [jj].013	.009	[k].028	.028	.009
Average	2.71	1.99	0.536	0.259	0.265	0.100	0.100	0.096	2.08	1.50	0.051	0.109	0.014	0.007	0.028	0.027	0.009
General average	2.71	1.99	0.536	0.263		0.099			2.08	1.50	0.051	0.109	0.014	0.007	0.028	0.027	0.009

[a] Precipitated 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 23 NaOH:1P.

[b] Sample annealed by covering with a layer of graphite, and heating for 20 minutes at 685° C.

[c] 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.

[d] Potentiometric titration.

[e] Molybdenum-blue photometric method.

[f] 1-g sample burned in oxygen at 1,425° 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.

[g] Double dehydration with intervening filtration.

[h] Diethyldithiocarbamate photometric method. See J. Research NBS **47**, 380 (1951) RP2265.

[i] 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.

[j] Vanadium separated as in (i), oxidized with HNO_3, and titrated potentiometrically with ferrous ammonium sulfate.

[k] Cupferron separation after solution of the sample in diluted HCl (1+2). Vanadium separated by treatment with NaOH.

[l] Sulfuric acid digestion for 3 hours of a 1-g sample. See J. Research NBS **43**, 201 (1949) RP2021.

[m] Combustion gases absorbed in NaOH-H_2O_2 and excess NaOH titrated with H_2SO_4.

[n] Perchloric acid dehydration.

[o] Bicarbonate hydrolysis-perchloric acid oxidation.

[p] Vanadium separated as in (j), oxidized with $HClO_4$ and determined by $FeSO_4$-$(NH_4)_2S_2O_8$-$KMnO_4$ titration.

[q] Vanadium separated by Na_2CO_3 fusion.

[r] Distillation-H_2S-As_2S_3.

[s] Copper precipitated with $Na_2S_2O_3$.

[t] Solution in diluted HCl (1+1).

[u] Absorbed in ammoniacal cadmium chloride.

[v] Finished by electrolysis.

[w] Dimethylglyoxime precipitate titrated with cyanide.

[x] Ether-cupferron separation on a 10-g sample. Vanadium titrated with $KMnO_4$.

[y] Finished photometrically with Nessler's reagent.

[z] Titrating solution standardized by the use of a standard iron.

[aa] Sulfur gases absorbed in H_2O_2, and H_2SO_4 titrated with standard NaOH using brom-cresol-green indicator.

[bb] As in (i), except $FeSO_4$-$KMnO_4$ titration.

[cc] Vanadium separated as in (j) and titrated by the $FeSO_4$-$(NH_4)_2S_2O_8$-$KMnO_4$ method.

[dd] Distillation-titration with standard $KBrO_3$.

[ee] Bismuthate-$FeSO_4$-$KMnO_4$.

[ff] Silico-molybdate photometric method. See Anal. Chem. **24**, 805 (1952).

[gg] KI-$Na_2S_2O_3$ titration.

[hh] Diphenylcarbazide photometric method.

[ii] $NaHCO_3$ hydrolysis-mercury cathode-SO_2 reduction-$KMnO_4$ titration.

[jj] $NaHCO_3$ hydrolysis, extraction with 8-hydroxyquinoline and chloroform. Vanadium determined by the phosphotungstovanadate photometric method.

List of Analysts

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The iron for the preparation of this standard was furnished by the American Cast Iron Pipe Co.

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