U.S. DEPARTMENT OF COMMERCE
WASHINGTON 25, D.C.

National Bureau of Standards Certificate of Analyses

Standard Sample 342

NODULAR CAST IRON

ANALYST	C		Mn	P		S			Si	Cu	Ni	Cr	V	Mo	Ti	Mg	
	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 with HCl (1–1) ZnS-Iodine (theoretical sulfur titer) [b]	Perchloric acid dehydration		Weighed as nickel dimethylglyoxime	$FeSO_4$–$KMnO_4$ titration		Photometric	H_2O_2 photometric		
1	2.45	2.14	[c] 0.364	0.018	[d] 0.019	0.015	[e] 0.013		[f] 2.84	[g] 0.14	0.024	[h] 0.034	[i] 0.004	0.008	[j] 0.017	[k] 0.052	
2	2.48	2.13	[l] .368		.020	.015	[m] .015		2.85	[n] .14	.023	[o] .034	[p] .004	.010	[q] .020	[r] .055	
3	2.43	2.12	[l] .368		.020	.011		0.012	[s] 2.84	[n] .15	.024	[h] .032	[i] .005	.009	.020	[t] .057	
	[u] 2.47		.37	.022	.021	.014	[v] .014		2.85	.14	.021	.029	[p] .004	[w] .008	.017	[x] .052	
	2.44	2.16	[l] .375	[y] .019	[l] .019	.016	[l] .015		[f] 2.86	[z] .13	[a'] .021		[b'] .006	.010	.019	[r] .054	
6																[c'] .050	
Average	2.45	2.14	0.369	0.020	0.020	0.014	0.014	0.012	2.85	0.14	0.023	0.032	0.005	0.009	0.019	0.053	
General average	2.45	2.14	0.369	0.020		0.014			2.85	0.14	0.023	0.032	0.005	0.009	0.019	0.053	

[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] Value obtained by standardizing the titrating solution by means of sodium oxalate through $KMnO_4$ and $Na_2S_2O_8$, and the ratio 2I: 1S.

[c] Potentiometric titration.

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

[e] 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.

[f] Double dehydration with intervening filtration.

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

[h] Chromium separated from the bulk of the iron by hydrolytic precipitation with $NaHCO_3$, oxidized with persulfate and titrated potentiometrically with ferrous ammonium sulfate.

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

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

[k] Ether separation on a 10-g sample. Magnesium precipitated as phosphate. $Mg_2P_2O_7$ corrected for calcium and manganese.

[l] Titrating solution standardized by the use of a standard iron or steel.

[m] Sulfur gases absorbed in NaOH–H_2O_2 solution and excess NaOH titrated with H_2SO_4.

[n] H_2S–CuS–CuO.

[o] Bicarbonate hydrolysis-perchloric acid oxidation.

[p] Bicarbonate hydrolysis-$FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$ method.

[q] Vanadium separated by Na_2CO_3 fusion.

[r] Ether separation. Magnesium precipitated as phosphate.

[s] Double dehydration with H_2SO_4.

[t] Ether separation followed by mercury cathode. Magnesium precipitated with 8-hydroxyquinoline.

[u] Volumetric method.

[v] Combustion gases absorbed in $AgNO_3$ and liberated HNO_3 titrated with NaOH.

[w] α-benzoinoxime method.

[x] Ether separation-H_2S. Magnesium precipitated as phosphate.

[y] Weighed as ammonium phosphomolybdate.

[z] Copper-ammonia complex photometric method.

[a'] Dimethylglyoxime photometric method.

[b'] Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.

[c'] Spectrochemical determination. Hydrochloric acid solution of sample and synthetic solutions compared by Rotrode technic using spark excitation and lines ratio Mg 2795.5/Fe 2774.6.

List of Analysts

1. Ferrous Laboratory, National Bureau of Standards. J. I. Shultz, in charge. Analysis by E. June Maienthal and T. W. Freeman.
2. R. H. Elder and R. E. Deas, American Cast Iron Pipe Co., Birmingham, Ala.
3. H. Jukkola and C. A. Trathowen, Jones and Laughlin Steel Corp., Pittsburgh Works, Pittsburgh, Pa.
4. W. K. Bock and S. Illés, National Malleable Steel Castings Co., Cleveland, Ohio.
5. W. A. Melchreit, Republic Steel Corp., Cleveland, Ohio.
6. B. Kilberg, Materials Engineering Department, Deere & Co., Moline, Ill.

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

WASHINGTON, D.C. January 5, 1962.

A. V. ASTIN, *Director.*

U.S. GOVERNMENT PRINTING OFFICE 620150