U. S. DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards
Certificate of Analyses

Standard Sample 55 D
Open-Hearth Iron

ANALYST	C	Mn	P		S			Si	Cu	Ni	Cr	V	Mo	Co	Sn	Al	As	N
			Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Alkali-Molybdate [a]	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Iodate titration	Evolution (HCl sp. gr. 1.18-ZnS-iodine-theoretical sulfur titer) [b]	Perchloric acid dehydration		Weighed as nickel dimethylglyoxime	$FeSO_4$–$KMnO_4$ titration		Colorimetric	Colorimetric Nitroso-R		Total		Distillation-titration
1	[c] 0.011$_3$	[d] 0.030	0.005	[e] 0.004	0.014	[f] 0.013	0.015	[g] <0.001	[h] 0.056	0.009	[i] 0.006	[j] <0.001	0.001	0.006	[k] 0.004	[l] 0.001	[m] 0.008	[n] 0.001
2	[o] .011$_2$	[p] .030		[q] .005 [q] .006		.015	.016	.001	[r] .054 [s] .056	.010	[t] .005	<.001	.002	.007	[u] .005	[v] .002	[w] .010	[x] .004
3	.010$_4$	[y] .028		.004		.015		<.001	[z] .057	.010	[t] .006	<.001	.001	[a1] .007	.005	[h1] .001		
4	[c1] .009$_9$ [d1] .010$_2$	[y] .031		.005		.013		<.001	[h] .053	.008	.005	.001	.001		.005	[e1] .003		
5	[f1] .010$_2$ [c1] .010$_8$	[y] .029		[q] .006		.012	.015	[g1] <.001	[h1] .059	[i1] .011	[j1] .005	<.001	.001	.006	[k1] .005			
	.010$_6$																	
	[f1] .011$_6$																	
8	[c1] .010$_3$																	
Averages	0.010$_6$	0.030	0.005	0.005	0.014	0.014	0.015	<0.001	0.056	0.010	0.005	<0.001	0.001	0.007	0.005	0.002	0.009	0.004
General average	0.010$_6$	0.030	0.005		0.014			<0.001	0.056	0.010	0.005	<0.001	0.001	0.007	0.005	0.002	0.009	0.004

[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 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 21:1S.

[c] Four 2.5-g samples (10 g) burned consecutively and total CO_2 from the four samples absorbed before weighing.

[d] 10-g samples extracted with ether. Persulfate-arsenite potentiometric titration method.

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

[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 H_2SO_4 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 $NaHCO_3$ hydrolysis, 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] Sulfide-iodine method. See NBS J. Research **8**, 309 (1932) RP415.

[l] $NaHCO_3$-H_2S-NaOH-Al_2O_3 method.

[m] Distillation, molybdenum-blue photometric method. See J. Research NBS **24**, 7 (1940) RP1267.

[n] Sulfuric acid digestion for 3 hours of 1-g and 2-g samples. See J. Research NBS **43**, 201 (1949) RP2021.

[o] As in (c), but three 2.73-g samples used.

[p] As in (d), but finished by photometric method.

[q] Ammonium phosphomolybdate extracted with isobutyl alcohol, reduced with $SnCl_2$, and phosphorus determined photometrically.

[r] KI-$Na_2S_2O_3$ titration.

[s] Diethyldithiocarbamate photometric method.

[t] Diphenylcarbazide photometric method.

[u] Tin separated as sulfide, reduced with antimony, and titrated with iodate.

[v] Cupferron-Eriochrome Cyanine-R photometric method. See Anal. Chem. **23**, 1806 (1951).

[w] Distillation-H_2S-As_2S_3.

[x] Finished photometrically with Nessler's reagent.

[y] Periodate photometric method.

[z] $Na_2S_2O_3$-CuS-CuO-electrolytic method.

[a1] Ether-α-nitroso-β-naphthol-Co_3O_4.

[b1] Mercury cathode-aluminon photometric method.

[c1] Conductometric method.

[d1] CO_2 absorbed in $Ba(OH)_2$ and excess $Ba(OH)_2$ titrated with standard HCl.

[e1] Mercury cathode-$AlPO_4$ method.

[f1] Low pressure combustion method.

[g1] Molybdenum-blue photometric method.

[h1] Neo-cuproine photometric method.

[i1] Dimethylglyoxime photometric method.

[j1] Chromate photometric method. See ASTM Method E30–47.

[k1] Dithiol photometric method.

List of Analysts

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