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

National Bureau of Standards Certificate of Analyses

Standard Sample 101E
18 Chromium–9 Nickel Steel

ANALYST	C	Mn	P	S		Si	Cu	Ni	Cr	V	Mo	Co	Sn	N	W	Nb
	Direct combustion	Persulfate-Arsenite	Alkali-Molybdate	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	Zinc oxide–Alpha nitroso-beta naphthol		Distillation-titration		
1	0.053	[a] 1.78	[b] 0.025 [c] 0.024	0.010	[d] 0.008	[e] 0.43	[f] 0.356	9.48	[g] 17.97	[h] 0.043	[i] 0.422 [j] 0.423	[j] 0.18	[k] 0.020	[l] 0.040	[m] 0.056	[n] 0.013
2	.054	[o,p] 1.78	[b,p] .026 [c,p] .028		.013	.44	[q] .360	9.48	[r,p] 18.03	[h,p] .045	.43	[j] .19	[k] .020	.040		
3	[s] .058 [s] .053	[t] 1.77	[u] .024	.010	.010	.42	[v] .36	[w] 9.48	[r] 17.96	[x] .043	.428	[j] .18	[y] .020	.038		
4	[s] .054	[t] 1.75	[u] .023	.010	[z] .009	.42	[v] .36	[w] 9.47	[r,p] 18.00	[h] .042	.42	[j] .18	[y] .019	.036		
5	[s] .053	[t] 1.80	[b] .024 [u] .025	.012	[p] .012	[e] .43	[v] .353	[w,p] 9.52	[r,p] 17.97	[a′,p] .038	[b′] .434	[j] .17	[k,p] .023	[p] .043		
6	.054	[c′] 1.76	.027		.011	[e] .44	[d′] .359	9.46	17.93		[b′] .429	.17		.041		
7	.052	[c′,e′] 1.76	[c] .023		.008	.42	[f′] .358	[w] 9.49	[g′] 17.97	.045	.423	[b′] .18	[k] .019	.041		
8	.052	[i′] 1.76	[b] .024 .025	.010	.010	[e] .43	[j′] .366 [q] .360	[k′] 9.47 9.50	17.99	[l′] .043	[m′] .428	.17	[n′] .021	[o′] .036		
Average	0.054	1.77	0.025	0.010	0.010	0.43	0.359	9.48	17.98	0.043	0.426	0.18	0.020	0.039	0.056	0.013
General average	0.054	1.77	0.025	0.010		0.43	0.359	9.48	17.98	0.043	0.426	0.18	0.020	0.039		

[a] Chromium removed by precipitation with $NaHCO_3$.
[b] Gravimetric method (weighed as $Mg_2P_2O_7$ after removal of arsenic).
[c] Molybdenum-blue photometric method. See J. Research NBS **26**, 405 (1941) RP1386.
[d] 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.
[e] Double dehydration with intervening filtration.
[f] Diethyldithiocarbamate photometric method. See J. Research NBS **47**, 380 (1951) RP2265.
[g] Persulfate oxidation, potentiometric titration with ferrous ammonium sulfate.
[h] Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.
[i] Alpha-benzoinoxime gravimetric method. See BS J. Research **9**, 1 (1932) RP453.
[j] Nitroso-R photometric method.
[k] Sulfide-iodine method. See BS J. Research **8**, 309 (1932) RP415.
[l] Sulfuric acid digestion for 4 hr of a 0.5-g sample. See J. Research NBS **43**, 201 (1949) RP2021.
[m] Dithiol photometric method. See J. Research NBS **59**, 6 (1957) RP2812.
[n] Hydroquinone photometric method. See J. Research NBS **62**, 1 (1959) RP2923.
[o] Chromium separated with ZnO.
[p] Titrating solution standardized by the use of a standard steel.
[q] Neocuproine photometric method.
[r] Perchloric acid oxidation.
[s] Conductometric method.
[t] KIO_4 photometric method.
[u] Molybdenum-blue photometric method.
[v] Diethyldithiocarbamate photometric method.
[w] Dimethylglyoxime precipitate titrated with cyanide.
[x] Chromium volatilized as chromyl chloride and vanadium determined by $FeSO_4$–$KMnO_4$ titration method.
[y] Stanreduce-iodate titration method.
[z] Combustion gases absorbed in NaOH–H_2O_2. Solution titrated with H_2SO_4.
[a′] $FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$ method.
[b′] H_2S–MoS_3–$PbMoO_4$.
[c′] Chromium volatilized as CrO_2Cl_2.
[d′] H_2S precipitation—KI–$Na_2S_2O_3$ titration.
[e′] Titration with arsenite-nitrite solution.
[f′] CuCNS precipitation, $CuCl_2$ photometric method.
[g′] Persulfate oxidation, titration with $FeSO_4$–$K_2Cr_2O_7$ using ortho-phenanthroline indicator.
[h′] ZnO–CoCNS photometric method.
[i′] Chromium removed as in (a), bismuthate method.
[j′] H_2S-electrolytic method.
[k′] Finished by electrolysis.
[l′] Ether-cupferron separation on a 10-g sample. Vanadium titrated by the $FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$ method.
[m′] Molybdenum separated by H_2S in presence of tartaric acid and determined by α benzoinoxime method.
[n′] Tin separated as sulfide, reduced with antimony and titrated with iodine.
[o′] Distillation-photometric method.

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