U. S. DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards
Certificate of Analyses

Standard Sample 121 B
18 Chromium-11 Nickel Steel
(Titanium-Bearing)

ANALYST	C	Mn		P		S		Si	Cu	Ni	Cr	V	Mo	Ti		N
	Direct combustion	Bismuthate ($FeSO_4$-$KMnO_4$)	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Colorimetric	Gravimetric (direct oxidation and final precipitation after reduction of iron)	Combustion Iodate titration	Perchloric acid dehydration	H_2S-CuS-CuO	Weighed as nickel dimethylglyoxime	$FeSO_4$-$KMnO_4$ titration	Nitric acid oxidation, potentiometric titration	Colorimetric	Gravimetric	Colorimetric	Distillation-titration
1	0.070		[a]1.53	0.025	[b] 0.026		[c] 0.007	[d] 0.594	[e] 0.126	11.17	[f] 17.68	0.041	0.076	[g] 0.419	0.417	[h] 0.011
2	.068		[i]1.49	.025	[j, k].026		[k].006	[d].601	.122	11.18	17.76	.042	.070	.405	.41	
3	.077	[l]1.48			[m].027		[k].008	[d].598	[n].131	11.18	[o] 17.69	[p].041	.073		.410	
4	.072		[i]		[b].026		[k].008	.598	[q].123	[r]11.13	[o] 17.68	.041	.075	[s].421	.417	
5	.074	[t]1.52			[m].028	0.007	.008	[u].599	[n].129	11.13	17.69	[v].042	.076		.410	
6	.071	[w]1.52	[x]1.50		[b].026		[k].007	.589	[q].125	11.15	17.66	.041	.072		.413	.012
7	.070		[y]1.49		[b].026		[k].005	.591	[z].122	11.14	17.65	.038	[z1].073		.413	
8	.076		1.50				[z2].009	.598		11.23	17.74	.036			.416	
9	.070	[y]1.49	[x]1.51		[b].025		[c].007	.594	[z3].12	[z4] 11.17	17.70	.045	[z1].072		.419	.012
Average	0.072	1.50	1.50	0.025	0.026		0.007	0.596	0.125	11.16	17.69	0.041	0.073	0.415	0.414	0.012
General average	0.072	1.50		0.026		0.007		0.596	0.125	11.16	17.69	0.041	0.073	0.414		0.012

[a] Chromium removed by precipitation with $NaHCO_3$.
[b] Molybdenum-blue method. See J. Research NBS **26**, 405 (1941) RP1386.
[c] 1-g sample burned in oxygen at 1,425° C, and sulfur dioxide absorbed in starch-iodine solution. Iodine liberated from iodide by titration, during the combustion, with standard KIO_3 solution based on 93 percent of the theoretical factor.
[d] Double dehydration with intervening filtration.
[e] Diethyldithiocarbamate method. See J. Research NBS **47**, 380 (1951) RP2265.
[f] Persulfate oxidation and potentiometric titration with $Fe(NH_4)_2(SO_4)_2$ standardized with $K_2Cr_2O_7$.
[g] 5-g sample dissolved in diluted H_2SO_4 and titanium precipitated with cupferron. Ignited precipitate treated with $HClO_4$-HF, reignited and fused in $Na_2S_2O_7$. Melt dissolved in tartaric-sulfuric acid solution, and the H_2S group removed. Iron removed as sulfide in ammoniacal-tartrate solution. Filtrate acidified and titanium precipitated with cupferron. Ignited precipitate corrected for V_2O_5.
[h] Sulfuric acid digestion for 4 hr of a 0.5-g sample. See J. Research NBS **43**, 201 (1949) RP2021.
[i] Chromium volatilized as CrO_2Cl_2.
[j] Alkali-molybdate method.
[k] Titrating solution standardized with a standard steel.
[l] Chromium separated as $PbCrO_4$.
[m] Alkali-molybdate method. Alkali standardized with acid potassium phthalate and the ratio 23NaOH to 1P.
[n] Finished by electrolysis.
[o] Perchloric acid oxidation.
[p] Chromium separated as $PbCrO_4$, vanadium titrated with $KMnO_4$ after addition of K_2HPO_4.
[q] KI-$Na_2S_2O_3$ titration.
[r] Glyoxime precipitate titrated with alkali cyanide.
[s] Ether-$NH_4OH(NH_4)_2S_2O_8$-H_2S-cupferron.
[t] Chromium precipitated with ZnO.
[u] Double dehydration with H_2SO_4.
[v] Initial separation of vanadium on a 10-g sample with cupferron.
[w] Periodate photometric method.
[x] Chromium volatilized as CrO_2Cl_2. Titration with arsenite-nitrite solution.
[y] Persulfate-photometric method.
[z] H_2S-copper ammonia complex-photometric method.
[z1] Alpha-benzoinoxime-thiocyanate colorimetric method.
[z2] Alkalimetric method.
[z3] CuCNS precipitation, $CuCl_2$ photometric method.
[z4] Photometric cyanide titration, corrected for copper and cobalt (0.06). See Ind. Eng. Chem. Anal. Ed. **10**, 175 (1938).

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