U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

Standard Sample 32D

Nickel-Chromium Steel

ANALYST	C	Mn		P		S			Si	Cu	Ni	Cr	V	Mo	N	
	Direct combustion	Bismuthate ($FeSO_4$–$KMnO_4$)	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Alkali-Molybdate [d]	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion	Evolution with HCl (1–1) ZnS–Iodine (theoretical sulphur titre) [h]	Perchloric acid dehydration	H_2S–CuS–CuO	Weighed as nickel dimethylglyoxime	$FeSO_4$–$KMnO_4$ titration	Colorimetric			
1	0.396	[c] 0.787	0.793	0.010	[d] 0.012	0.026	[e] 0.028	0.027	[f,g] 0.306	0.096	1.18	[h] 0.710	[i] 0.003	0.035	[j] 0.010	
2	.397	[k,l] .798	[l] .801	.010	[l] .011	.027	[l,m] .027		[n,g] .297	[o] .104	[p] 1.19	.707	[q] .003	.042		
3	.402		[l] .795		.014	.027	[l] .029	[r] .028	.308	[s] .092	1.20	.714	[t] .003	.039		
4	.392		[l] .800	[u] .014	.013				.294		1.22	.703		.038		
5	.391	.785	.79	.012	.012	.026	[v] .027		.303	[w] .093	1.19	.709	[x] .003	.037		
6	.399	[y] .800		.012	.014	.029	[z] .026		[f,g] .302	[z] .093	1.20	[h] .708	[z] .004	.037		
7	.392	.799	[y] .798		[l] .012		[aa] .027	[r] .027	[g] .301	[z] .098	1.17	[ab] .720	[ac] .002	.036		
Average	0.396	0.794	0.796	0.012	0.013	0.027	0.027	0.027	0.301	0.096	1.19	0.710	0.003	0.038	0.010	
General average	0.396	0.795		0.012		0.027			0.301	0.096	1.19	0.710	0.003	0.038		

[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 $Na_2S_2O_3$ and use of the ratio 21:1S.

[c] Chromium removed by hydrolytic precipitation with $NaHCO_3$ or ZnO.

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

[e] 1-g sample burned in oxygen at 1,400° C, and sulfur dioxide absorbed in starch-iodine solution. The iodine was liberated from iodide by titration, during the combustion, with standard KIO_3, based on 93 percent of the theoretical factor.

[f] Sulfuric acid dehydration.

[g] Double dehydration with intervening filtration.

[h] Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.

[i] Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.

[j] Semimicro distillation-titration method. 1.0 g sample digested 4 hours with H_2SO_4. See J. Research NBS 43, (1949).

[k] Bismuthate-arsenite method.

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

[m] As in (e), except burned at 2,200° F with tin accelerator.

[n] Nitric-sulfuric acid dehydration.

[o] H_2S-α-benzoinoxime-CuO method.

[p] Dimethylglyoxime-NiO method.

[q] Ammonium phosphomolybdate precipitation, reduced by fuming with H_2SO_4–H_2O_2, and titrated with $KMnO_4$.

[r] Absorbed in ammoniacal cadmium chloride.

[s] Finished by electrolysis.

[t] Nitric acid oxidation, ferrous sulfate titration with o-phenanthroline.

[u] Weighed as ammonium phosphomolybdate.

[v] As in (e), except 0.5 g sample.

[w] CuCNS–KI–$Na_2S_2O_3$ method.

[x] $NaHCO_3$ concentration, $KMnO_4$ titration method.

[y] ZnO separation.

[z] Mercury cathode–H_2O_2 photometric method.

[aa] Gases absorbed in NaOH–H_2O_2 solution and excess NaOH titrated with H_2SO_4.

[ab] $HClO_4$ oxidation, ferrous ammonium sulfate titration with o-phenanthroline indicator.

[ac] Ammonium phosphomolybdate precipitation, strychnine colorimetric method.

List of Analysts

1. Ferrous Laboratory, National Bureau of Standards, John L. Hague in charge. Analysis by J. I. Shultz, C. Litsey and J. Baldwin.
2. R. F. Lab and A. C. Hale, Copperweld Steel Co., Warren, Ohio.
3. W. A. Richardson, Iron and Steel Division, Kaiser Co., Fontana, Calif.
4. W. F. Schniepp, Alan Wood Steel Co., Conshohocken, Pa.
5. O. Perkins, Allis-Chalmers Manufacturing Co., West Allis, Wisconsin.
6. F. W. Dillon, A. L. Sloan and R. P. Mogel, The Carpenter Steel Co., Reading, Pa.
7. Chemical Laboratory, Norfolk Naval Shipyard, Portsmouth, Va.

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E. U. Condon, *Director*.

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