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

National Bureau of Standards Certificate of Analyses

Standard Sample 106B
Chromium-Molybdenum-Aluminum Steel

ANALYST	C	Mn	P		S			Si	Cu	Ni	Cr	V	Mo	Al
	Direct combustion	Persulfate-Arsenite	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		Photometric	
1	0.328	[c] 0.504	0.006	[d] 0.008	0.015	[e] 0.016	0.016	[f] 0.278	[g] 0.114	0.216	[h] 1.18	[i] 0.002	0.198	[j] 1.08
2	.32	[k] .50, .507		[l] .009, .008	.017	.017		.27	[m] .11	.222	[n] 1.21	[o] .002	[p] .21	[q] 1.07
3	.326	[r] .511	[s] .008	[t] .008	.017		.017	.277	[u] .119	[l] .215	[h] 1.18	.002	.196	[v] 1.06
4	.329	[w] .509		[l] .012, .010		[w] .018		.269	[u] .126	.219	[x] 1.18		.199	[y] 1.09
5	.326	[w] .502	.007	.007	.013	[w] .015		[z,f] .277	[a'] .116	.223	[b'] 1.16	[o'] .002	.188	[d',w] 1.07
6	.323	[w] .510		.008	.018	.017		[z,f] .274	[a'] .121	.213	[b'] 1.19		[e'] .204, .197	
7	.329	[f'] .509	.009	.009		[w] .018		[f] .275	[u] .116	[l] .213	[n] 1.16	[f',g'] .005	.20	[f',h'] 1.07
8	.328	[i'] .501	.008	.008	.016	.017		[f] .275	[u] .114	[j'] .217	[n] 1.17	[i] .003	.20	[k'] 1.07
Average	0.326	0.506	0.008	0.009	0.016	0.017	0.016	0.274	0.117	0.217	1.18	0.003	0.199	1.07
General average	0.326	0.506	0.008		0.016			0.274	0.117	0.217	1.18	0.003	0.199	1.07

[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 the use of 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 1,425 °C, and sulfur dioxide absorbed in starch-iodide solution. Iodine liberated from iodide by titration, during 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] Persulfate oxidation, potentiometric titration with ferrous ammonium sulfate.
[i] Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.
[j] $NaHCO_3$-NaOH–Al_2O_3 method.
[k] Bismuthate method.
[l] Photometric method.
[m] H_2S–α–benzoinoxime–CuO.
[n] Perchloric acid oxidation.
[o] Mercury cathode–$FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$ method.
[p] H_2S–MoS_3–MoO_3.
[q] Iron removed with mercury cathode. Aluminum precipitated with 8-hydroxyquinoline and the precipitate ignited to Al_2O_3.
[r] KIO_4 photometric method.
[s] Weighed as ammonium phosphomolybdate.
[t] Molybdenum-blue photometric method.
[u] Electrolytic method.
[v] Mercury cathode–NH_4OH–Al_2O_3.
[w] Titrating solution standardized by the use of a standard steel.
[x] Perchloric acid oxidation, titration with $FeSO_4$–$K_2Cr_2O_7$ using diphenylamine sulfonate indicator.
[y] $NaNH_4HPO_4$–NaOH–NH_4OH–$AlPO_4$.
[z] Sulfuric acid dehydration.
[a'] H_2S–CuS–CuO.
[b'] Persulfate oxidation.
[c'] Cupferron–$FeSO_4$–$(NH_4)_2S_2O_8$–$KMnO_4$ method.
[d'] $NaHCO_3$–NaOH–8-hydroxyquinoline precipitation and titrated with bromate.
[e'] Alpha-benzoinoxime method.
[f'] Chromium removed as $PbCrO_4$.
[g'] $FeSO_4$–$KMnO_4$ method.
[h'] Aluminum precipitated with 8-hydroxyquinoline and titrated with bromate.
[i'] Chromium removed as CrO_2Cl_2.
[j'] Finished by electrolysis.
[k'] Mercury cathode–NH_4OH–$AlPO_4$.

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. E. R. Vance, The Timken Roller Bearing Co., Canton, Ohio.
3. D. I. Walter, Naval Research Laboratory, Washington, D.C.
4. J. A. Novak, Industrial Chemical and Metallurgical Analysis, Inc., Cleveland, Ohio.
5. R. H. Rouse, Bethlehem Steel Corp., Steelton, Pa.
6. E. W. Polley, The Youngstown Sheet and Tube Co., Youngstown, Ohio.
7. P. P. Eismont, United States Steel Corp., Duquesne Works, Duquesne, Pa.
8. H. A. Patterson, United States Steel Corp., South Works, Chicago, Ill.

The steel for the preparation of this standard was furnished by The Timken Roller Bearing Co., Canton, Ohio.

WASHINGTON, D.C., March 24, 1961. A. V. ASTIN, *Director.*

U.S. GOVERNMENT PRINTING OFFICE 16—76522-1