

National Bureau of Standards Certificate of Analyses

Standard Sample 139A Chromium-Nickel-Molybdenum Steel (A.I.S.I. 8640)

ANALYST	C	Mn	P		S			Si	Cu	Ni	Cr	V	Mo	N
	Direct combustion	Persulfate-Arsenite	Gravimetric (weighed as Mg ₂ P ₂ O ₇ after removal of arsenic)	Alkali-Molybdate ^a	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Iodate titration	Evolution with HCL (1+1) ZnS-Iodine (theoretical sulfur titer) ^b	Perchloric acid dehydration		Weighed as nickel dimethylglyoxime	FeSO ₄ -KMnO ₄ titration		Photometric	Distillation-Photometric
1.....	0.402	0.784	0.012	0.012	0.018	0.018	0.019	0.236	0.099	0.513	0.486	0.005	{ 0.184 } { 0.183 }	0.007
2.....	.409	.787	.012	.012	.019	.020	.020	m. 247	n. 098	.517	0.487	p. 004	{ .182 } { .178 }	.008
.....	.405	0.781	0.013	0.013	.022	.....	.021	.238	0.098	0.50	0.490	v. 002	.184	w. 008
4.....	.402	0.781	.....	0.013	.017	1.020	.....	m. f. 245	0.090	.506	0.481	.....	{ .186 } { .183 }	.....
5.....	.405	.772	.....	0.014	.....	1.019	.....	.232	.....	.517	0.486	v. 002	.183	.....
6.....	.402	0.773	.....	.014	.020	.020	.....	.246	0.096	0.51	.487	b'. 003	c'. 187	.008
Average.....	0.404	0.780	0.012	0.013	0.019	0.019	0.020	0.241	0.096	0.510	0.486	0.003	0.183	0.008
General Average.....	0.404	0.780	0.013		0.019			0.241	0.096	0.510	0.486	0.003	0.183	0.008

^a Precipitated at 40° C, washed with a 1-percent solution of KNO₃ 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 KMnO₄ and Na₂S₂O₈ and the use of the ratio 21:1S.
^c Potentiometric titration.
^d Molybdenum-blue photometric method. See J. Research NBS 28, 405 (1941) RP 1386.
^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 KIO₃ 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) RP 2265.

^h Chromium separated from the bulk of the iron in a 10-g sample by hydrolytic precipitation with NaHCO₃, oxidized with persulfate, and titrated potentiometrically with ferrous ammonium sulfate.
ⁱ Vanadium separated as in (h), oxidized with HNO₃ and titrated potentiometrically with ferrous ammonium sulfate.
^j α-Benzoinoxime method. See BS J. Research 9, 1 (1932) RP 453.
^k Sulfuric acid digestion for 4 hr of 0.25-g sample. See J. Research NBS 48, 201 (1949) RP 2021.
^l Titrating solution standardized with a standard steel.
^m Sulfuric acid dehydration.
ⁿ H₂S-electrolytic method.
^o Persulfate oxidation.
^p Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.
^q KIO₃ photometric method.

^r Weighed as ammonium phosphomolybdate.
^s Photometric method.
^t Copper precipitated with Na₂S₂O₄ and determined by electrolysis.
^u Chromium oxidized with HClO₄, potentiometric titration with ferrous ammonium sulfate.
^v Vanadium separated with cupferron and determined photometrically with H₂O₂.
^w Distillation-titration.
^x Bismuthate-arsenite method.
^y FeSO₄-(NH₄)₂S₂O₈-KMnO₄ method.
^z H₂S-CuS-CuO.
^{aa} Dimethylglyoxime precipitate ignited to NiO.
^{ab} Mercury cathode-FeSO₄-(NH₄)₂S₂O₈-KMnO₄ method.
^{ac} H₂S-MoS₂-MoO₄.

List of Analysts

1. Ferrous Laboratory, National Bureau of Standards, J. I. Shultz, in charge. Analysis by E. June Maienthal, T. W. Freeman, and E. R. Deardorff.
H. V. Reddinger, Bethlehem Steel Co., Johnstown Plant, Johnstown, Pa.

3. Ove Mylting, United States Naval Research Laboratory, Washington, D.C.
4. R. H. Maurer, Climax Molybdenum Co. of Michigan, Detroit, Mich.
5. J. Gurski, Ford Motor Co., Dearborn, Mich.
6. E. R. Vance, Timken Roller Bearing Co., Canton, Ohio.