

UNITED STATES DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

Standard Sample 36 A

Chromium-Molybdenum Steel

O. O. S.
Placed by 36 B
Dec. 6, 1968

ANALYST	C	Mn		P		S		Si	Cu	Ni	Cr	V	Mo		Sn
	Direct combustion	Bismuthate (FeSO ₄ -KMnO ₄)	Persulfate-Arsenite	Gravimetric (weighed as Mg ₂ P ₂ O ₇ after removal of arsenic)	Alkali-Molybdate *	Gravimetric (direct oxidation and final precipitation after reduction of iron)	Combustion	Sulfuric acid dehydration	H ₂ S-CuS-CuO	Weighed as nickel dimethylglyoxime	FeSO ₄ -KMnO ₄ titration		Gravimetric	Colorimetric	
1	0.119	^b 0.436	^c 0.430	0.014	^d 0.014	0.015	^e 0.016	^f 0.365	0.110	0.244	^g 2.40	^h 0.005	ⁱ 0.915	0.921	^j 0.011
2	.122	^k .425	^l .428		.014	.017	^m .019	ⁿ .356	^o .115	.245	2.41		^p .930	.926	
3	.121		.433	.013				^r .355	^s .116	.238	2.41		^t .915		^u .010
4	.121		^v .437		^w .013		.018	.350	^x .120	.242	2.40		^y .91		.012
5	.120		^z .426		.015		^{aa} .018	^{ab} .350	^{ac} .115	^{ad} .238	2.43		^{ae} .924		^{af} .011
6	.118		^{ag} .44		.013	.016		^{ah} .362	^{ai} .122	.240	2.39		^{aj} .913		
7	.119	^{ak} .433			^{al} .014		^{am} .019	^{an} .357	^{ao} .115	.244	2.42			.917	
8	.117		^{ap} .428	^{aq} .013	.014	.017	^{ar} .017	^{as} .353	^{at} .110	.250	2.44	^{au} .007		.925	
Average	0.120	0.431	0.432	0.013	0.014	0.016	0.018	0.356	0.114	0.243	2.41	0.006	0.918	0.922	0.011
General average	0.120	0.432		0.014		0.017		0.356	0.114	0.243	2.41	0.006	0.920		0.011

* Precipitated at 40° C, washed with a 1-percent solution of KNO₃ and titrated with alkali standardized by the use of potassium acid phthalate and the ratio 23NaOH:1F.
^b Chromium removed by precipitation with NaHCO₃.
^c Potentiometric titration.
^d Molybdenum-blue photometric method. See J. Research NBS 26, 405 (1941) RP1386.
^e 1-g sample burned in oxygen at 1,400° C, and sulfur dioxide absorbed in starch-iodine solution. Iodine liberated from iodide by titration, during the combustion, with standard KIO₃ solution based on 93 percent of the theoretical factor.
^f Double dehydration with intervening filtration.

^g Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.
^h Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.
ⁱ Alpha-benzoinoxime method. See BS J. Research 9, 1 (1932) RP453.
^j Sulfide-iodine method. See BS J. Research 8, 309 (1932) RP415.
^k Chromium removed by volatilization as CrO₂Cl₂.
^l Chromium removed by precipitation with ZnO.
^m As in footnote e, except combustion at 2,200° F.
ⁿ Titrating solution standardized by use of a standard steel.
^o Perchloric acid dehydration.

^p H₂S-α-benzoinoxime-CuO method.
^q H₂S-PbMoO₄ method.
^r Nitric-sulfuric acid dehydration.
^s Copper-ammonia complex photometric method.
^t Finished by electrolysis.
^u Alpha-benzoinoxime-PbMoO₄ method.
^v Combustion temperature 2,500° F. Tin accelerator.
^w Dimethylglyoxime-KCN titration.
^x Bismuthate-arsenite method, endpoint obtained photometrically.
^y Gases absorbed in NaOH-H₂O₂.
^z Weighed as (NH₄)₂PO₄·12MoO₃.
^{aa} CuCNS precipitation, KI-Na₂S₂O₃ titration.

List of Analysts

1. Ferrous Laboratory, National Bureau of Standards, John L. Hague in charge. Analysis by J. I. Shultz, R. A. Watson, and Florence Yenchius.
2. E. R. Vance, The Timken Roller Bearing Co., Canton, Ohio.
3. W. K. Hansen, American Steel & Wire Co., Cuyahoga Works, Cleveland, Ohio.
4. W. E. Steiner, Bethlehem Steel Co., Johnstown, Pa.
H. J. Jameson and Sydney Partington, The Detroit Testing Laboratory, Detroit, Mich.
6. K. P. Campbell, H. S. Bennett, and A. S. Meyer, Sheffield Steel Corp., Houston, Tex.
7. Chemical Laboratory, Norfolk Naval Shipyard, Portsmouth, Va., R. S. Gibbs in charge. Analysis by F. B. Clardy and J. C. Edwards.
8. D. P. Bartell, Allegheny Ludlum Steel Corp., Brackenridge, Pa.

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

WASHINGTON, D. C., September 25, 1950.

E. U. CONDON, Director.