

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards
Certificate of Analyses

Standard Sample 133 A
Chromium-Molybdenum 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 ₂ P ₂ O ₇ after removal of arsenic)	Alkali-Molybdate ^a	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Locate titration	Perchloric acid dehydration	H ₂ S-CuS-CuO	Weighed as nickel dimethylglyoxime	Persulfate oxidation (FeSO ₄ -KMnO ₄ titration)	HNO ₃ oxidation, potentiometric titration	Photometric	Distillation-titration
1.....	0.117		^{b,c} 1.04	0.024	^d 0.026	0.323	^e 0.329	^f 0.413	^g 0.119	0.240	^h 12.91	ⁱ 0.026	0.290	^j 0.032
2.....	.122	^{b,k} 1.02			1.025	.317		^f .420	.120	.237	12.86	^m 1.034	.288	
3.....	.128		ⁿ 1.04		.026		1.320	.41	^o .115	^p .24	^q 12.87	^r .023	^s .29	.033
	.118		1.03		.025		.324	.416	.126	.247	12.93	.028	.296	.033
	^t .119		ⁿ 1.01		.029		^u .328	^v .400				^w .022		
6.....	.118		^x 1.02		1.026	^y .337	1.34	^f .412	^z .119	^{aa} 1.237	12.86	.022	.298	.032
7.....	.120		^{ab} 1.04		.027		1.340	^f .41	^{ac} .110	^{ad} 1.245	^{ae} 12.94	^{af} 0.024	.30	.030
Average.....	0.120	1.02	1.03	0.024	0.026	0.326	0.330	0.412	0.118	0.241	12.89	0.026	0.294	0.032
General average.....	0.120	1.03		0.026		0.329		0.412	0.118	0.241	12.89	0.026	0.294	0.032

^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 23NaOH:1P.
^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 1,425° C, and sulfur dioxide absorbed in starch-iodide solution. Iodine liberated from iodide by titration, during the combustion, with standard KIO₃ solution. Titer based on 93 percent of the theoretical factor.
^f Double dehydration with intervening filtration.
^g Diethylthiocarbamate photometric method. See J. Research NBS 47, 380 (1951) RP2265.

^h Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.
ⁱ Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.
^j Sulfuric acid digestion for 3 hours of a 0.5-g sample. See J. Research NBS 43, 201 (1949) RP2021.
^k Arsenite titration.
^l Titrating solution standardized by use of a standard steel.
^m FeSO₄-(NH₄)₂S₂O₈-KMnO₄ method.
ⁿ Chromium removed by precipitation with ZnO.
^o H₂S-α benzoinoxime-CuO.
^p Dimethylglyoxime precipitate ignited to NiO.
^q Perchloric acid oxidation.
^r Mercury cathode-FeSO₄-(NH₄)₂S₂O₈-KMnO₄ method.

^s H₂S-MoS₃-MoO₃.
^t Differential gasometric method.
^u Combustion gases absorbed in neutral H₂O₂ and titrated with NaOH.
^v Sulfuric acid dehydration.
^w Vanadium separated with cupferron and determined by the FeSO₄-(NH₄)₂S₂O₈-KMnO₄ method.
^x Chromium volatilized as CrO₂Cl₂.
^y Chromium volatilized before precipitation of BaSO₄.
^z Finished by electrolysis.
^{aa} Dimethylglyoxime precipitate titrated with cyanide.
^{ab} Chromium removed as PbCrO₄.
^{ac} CuCNS-KI-Na₂S₂O₃ method.
^{ad} Chromium separated as PbCrO₄, vanadium titrated with KMnO₄ after addition of K₂HPO₄.

List of Analysts

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| <p>1. Ferrous Laboratory, National Bureau of Standards. Analysis by J. I. Shultz, R. E. McIntyre, E. June Maienthal, and L. A. Machlan.</p> <p>2. R. F. Lab and D. R. Burrier, Copperweld Steel Co., Warren, Ohio.</p> <p>3. E. R. Vance, The Timken Roller Bearing Co., Canton, Ohio.
E. O. Waltz, Republic Steel Corp., Canton Steel Division, Canton, Ohio.</p> | <p>5. C. Ferguson, Materials Division, Research and Test Department, U. S. Naval Ordnance Plant, Indianapolis, Ind.</p> <p>6. H. A. Patterson, United States Steel Corp., South Works, Chicago, Ill.</p> <p>7. R. H. Colin, United States Steel Corp., Duquesne Works, Duquesne, Pa.</p> |
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The steel for the preparation of this standard was furnished by the Republic Steel Corp.

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