

U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 135

CHROMIUM-MOLYBDENUM STEEL

ANALYST*	C	Mn		P		S		Si	COPPER H ₂ S-CuS-CrO	NICKEL Weighed as nickel dimethyl- glyoxime	Cr	Mo				
	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 final precipitation after reduction of iron)	Evolution (HCl sp gr 1.18-ZnS-Iodine theoretical sulfur titer) ^b	Combustion			Perochloric acid dehydration	FeSO ₄ -KMnO ₄ titration	VANADIUM	Gravimetric	Colorimetric	NITROGEN
1	0.092	^c 0.460		0.016	^d 0.016	0.010	0.009		^e 0.384	0.086	^f 5.16	0.010	^g 0.577		^h 0.024	
2	.093		ⁱ 0.453	.018	.018	.008	.009	0.007	^j .398	.079	^k 5.15		^l 1.563		.025	
3									^m .380		5.15		ⁿ .57	0.56		
4	.095		^o .46		^p .015	.010	^q .009		^r .377	^s 0.074	^t 0.085	^u 5.14		.59	^v .025	
	.097		.45		.018	.010		.011	.376	^w 0.09	5.18			.59		
	.097		^x .461		.019	^y .007			.375	^z 0.074	^{aa} 0.079	^{ab} 5.14		^{ac} .582	^{ad} .58	
	.088	^{ae} 0.453			.017	.013			^{af} .385	^{ag} 0.084	^{ah} 5.14		^{ai} .572		^{aj} .025	
8	.090		.468		.020		.010		^{ak} .392	^{al} 0.076	^{am} 0.083	^{an} 5.17		^{ao} .56		
9	.094		^{ap} .461		.017		^{aq} .012		^{ar} .383	^{as} 0.074	^{at} 5.15			.59	^{au} 0.023	
10	.097		.457		.017	.012			^{av} .379	^{aw} 0.088	^{ax} 5.15		^{ay} .575	.57		
Averages General Average	0.094	0.457	0.459	0.017	0.017	0.010	0.010	0.009	0.383	0.076	0.083	5.15	0.010	0.571	0.58	0.024

^a Precipitated at 40° C, washed with a 1-percent solution of HNO₃, and titrated with alkali standardized by the use of National Bureau of Standards acid potassium phthalate and the ratio 23NaOH:1P.
^b Value obtained by standardizing the titrating solution by means of sodium oxalate through KMnO₄ and Na₂S₂O₈, and use of the ratio 2I:1S.
^c Chromium removed by precipitation with ZnO.
^d Colorimetric method. See J. Research NBS 26, 405 (1941) RP1386.
^e Double dehydration.
^f Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate solution standardized with recrystallized potassium dichromate.
^g Alpha-benzoinoxime method. See BS J. Research 9, 1 (1932) RP453.
^h Determination made by M. Marie Cron, by the

vacuum-fusion method. See BS J. Research 7, 375 (1931) RP346.
ⁱ Chromium removed by precipitation with NaHCO₃.
^j Sulfuric acid dehydration.
^k Perochloric acid oxidation.
^l Weighed as lead molybdate.
^m Double dehydration in HClO₄. Residues fused with Na₂S₂O₈. Sulfuric acid added to partially cooled melt and solution fumed.
ⁿ Titrating solution standardized by the use of a standard steel.
^o Solution in HCl (1:1).
^p Copper precipitated with KCNS. Finished by KI-Na₂S₂O₃ titration.
^q Glyoxime precipitate titrated with KCN.
^r Solution-distillation method. Sample dissolved in HCl (1:1).

^s Chromium volatilized as CrO₂Cl₂.
^t Meinel method.
^u Copper precipitated with Na₂S₂O₃. Finished by electrolysis.
^v Solution-distillation method. See Ind. Eng. Chem., Anal. Ed. 11, 303 (1932).
^w Bismuthate-arsenite.
^x Copper precipitated with H₂S. Finished by KI-Na₂S₂O₃ titration.
^y H₂S-MoS₃-MoO₃.
^z Chromium removed as lead perchlorate.
^{aa} Distillation-titration. Solution and digestion in H₂SO₄ containing H₃PO₄ and selenium.
^{ab} Sulfuric-perchloric acid dehydration.
^{ac} Copper precipitated with KCNS. Finished by titration with KCN.
^{ad} Cyanate-cinchonine-thiosulfate method. See Iron Age 132 No. 2, 16 (1933).

*LIST OF ANALYSTS

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| 1. Ferrous laboratory, National Bureau of Standards. Analysis by John L. Hague and John P. Hewlett, Jr. | 0. R. H. Maurer and Harvey E. Trapp, Climax Molybdenum Co. of Michigan, Detroit, Mich. |
| 2. M. A. Frost, Vanadium-Alloys Steel Co., Latrobe, Pa. | 7. J. T. Norton, Jr., Allegheny Ludlum Steel Corp., Watervliet, N. Y. |
| 3. T. R. Cunningham, Union Carbide & Carbon Research Labs., Inc., Niagara Falls, N. Y. | 8. C. E. Nesbitt, Carnegie-Illinois Steel Corp., Edgar Thomson Works, Braddock, Pa. |
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The steel for the preparation of this standard was furnished by the Crucible Steel Company of America.