

National Bureau of Standards

Certificate of Analyses

OF
STANDARD SAMPLE 155
CHROMIUM—TUNGSTEN STEEL

ANALYST*	C	Mn		P		S		Si	COPPER HS-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	Cr	VANADIUM	MOLYBDENUM Colorimetric	W	
	Direct combustion	Bismuthate (FeSO ₄ -KMnO ₄)	Persulfate-Arsenite	Gravimetric (weighed as Mg ₃ P ₂ O ₇ after removal of arsenic)	Alkali-Molybdate ^a	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion	Perochloric acid dehydration			FeSO ₄ -KMnO ₄ titration			Gravimetric	Colorimetric
1.....	0. 901	^b 1. 23	1. 25	0. 015	^c 0. 013	0. 010	^d 0. 008	^e 0. 318	0. 083	0. 098	^f 0. 479	^g 0. 014	0. 039	^h 0. 525	
2.....	. 908		ⁱ 1. 24	. 015	^j 0. 015	. 010	^k 0. 010	. 326	^l 0. 078	^m 1. 102	ⁿ 0. 488	. 015	. 038	^o 0. 517	^p 0. 518
3.....	. 906		^q 1. 23		^r 0. 015	. 010	^s 0. 011	. 325	^t 0. 082	^u 1. 101	^v 0. 490	^w 0. 013	. 039	^x 0. 521	
4.....	. 904		1. 25		. 016		. 012	. 323	^y 0. 087	^z 1. 099	. 489	. 011	^{aa} 0. 043	^{ab} 0. 514	
5.....	. 905		1. 24		. 016		^{ac} 0. 011	. 323	^{ad} 0. 091	^{ae} 1. 098	^{af} 0. 48		^{ag} 0. 040	^{ah} 0. 526	^{ai} 0. 52
6.....	. 902	1. 25	1. 25		. 015	. 008	^{aj} 0. 008	. 331	^{ak} 0. 08	^{al} 1. 105	^{am} 0. 484	^{an} 0. 017	^{ao} 0. 041	^{ap} 0. 509	
7.....	. 906		1. 24		^{aq} 0. 018	. 012	^{ar} 0. 012	^{as} 0. 321	^{at} 0. 073	^{au} 0. 087	^{av} 0. 493	^{aw} 0. 010	. 035	^{ax} 0. 519	
8.....	. 91		^{ay} 1. 22	^{az} 0. 018	^{ba} 0. 016		^{bb} 0. 012	. 313	^{bc} 0. 079	. 105	^{bd} 0. 473	^{be} 0. 022	. 042	^{bf} 0. 508	
9.....	. 904	^{ca} 1. 26		. 014	. 013	. 009	^{cb} 0. 012	^{cc} 0. 319	^{cd} 0. 095	. 103	^{ce} 0. 492	^{cf} 0. 013	. 038	^{cg} 0. 515	
Averages.	0. 905	1. 25	1. 24	0. 016	0. 015	0. 010	0. 011	0. 322	0. 083	0. 100	0. 485	0. 014	0. 039	0. 517	0. 519
General average.	0. 905	1. 24		0. 015		0. 010		0. 322	0. 083	0. 100		0. 014	0. 039	0. 517	

^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 bicarbonate hydrolysis.
^c Molybdenum-blue photometric method. See J. Research NBS 26, 405 (1941) RP1386.
^d 1-g sample burned in oxygen at 1,400° C, and sulfur dioxide absorbed in acidified starch-iodine solution. The iodine was liberated from iodide by titration, during the combustion, with standard KIO₃ solution based on 93 percent of the theoretical factor.
^e Double dehydration with intervening filtration.
^f Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.
^g Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.
^h Single precipitation with HCl-HNO₃ and cinchonine. Ignited precipitate corrected for R₂O₃, SiO₂, and MoO₃.

Unprecipitated tungsten in filtrate determined by α -benzoinoxime-hydroquinone colorimetric method.
ⁱ Periodate photometric method.
^j Sulfur gases absorbed in NaOH-H₂O₂ and excess NaOH titrated with H₂SO₄.
^k Diethyldithiocarbamate photometric method.
^l Glyoxime-cyanide titration method
^m Perochloric acid oxidation.
ⁿ Hydroquinone photometric method.
^o Red lead oxidation.
^p Titrating solution standardized by use of a standard steel.
^q CuCNS precipitation, iodide titration method.
^r α -Benzoinoxime method.

^s Combustion at 2,220° to 2,400° F with tin, titration as in (4) with iodate standardized on standard steels.
^t CuCNS precipitation, KCN titration.
^u Mercury cathode-KMnO₄ titration method.
^v As in (h), except recovery made by second evaporation and precipitation with cinchonine.
^w Nitric-hydrochloric acid dehydration.
^x Glyoxime precipitate ignited to NiO.
^y FeSO₄-(NH₄)₂S₂O₈-KMnO₄ titration method.
^z Chromium volatilized as CrO₂Cl₂.
^{aa} Weighed as (NH₄)₂PO₄·12MoO₃.
^{ab} Chromium removed by ZnO precipitation.
^{ac} Finished by electrolysis.
^{ad} As in (h), except α -benzoinoxime precipitate added to main precipitate.

*LIST OF ANALYSTS

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| <p>1. Ferrous Laboratory, National Bureau of Standards, John L. Hague in charge. Analysis by John L. Hague, J. I. Shultz, Florence Yenchius, and Jewel Doran.</p> <p>2. O. L. Van Valkenburgh, Crucible Steel Company of America, Halcomb Works, Syracuse 1, N. Y.</p> <p>3. R. H. Van Tyne, Crucible Steel Company of America, Atha Works, Harrison, N. J.</p> <p>4. F. J. Cloran, Crucible Steel Company of America, Pittsburgh Crucible Division, Midland, Pa.</p> | <p>5. C. M. Johnson, Crucible Steel Company of America, Park Works, Pittsburgh, Pa.</p> <p>6. E. R. Vance, The Timken Roller Bearing Co., Steel and Tube Division, Canton, Ohio.</p> <p>7. R. F. Lab and Z. Oakley, Copperweld Steel Co., Warren, Ohio.</p> <p>8. D. P. Bartell, Allegheny Ludlum Steel Corporation, Brackenridge, Pa.</p> <p>9. F. W. Dillon and A. L. Sloan, The Carpenter Steel Co., Reading, Pa.</p> |
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The steel for the preparation of this standard was furnished by The Halcomb Works of The Crucible Steel Company of America.

WASHINGTON, October 1, 1946.

E. U. CONDON, *Director*.