

DEPARTMENT OF COMMERCE

Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE No. 50a

CHROME—TUNGSTEN—VANADIUM STEEL

ANALYST*	C	Mn		P	S	Si	W	Cr	V		COPPER H ₂ S-CuS-CuO after removal of W	NICKEL Precipitation as nickel dimethylglyoxime after removal of W	MOLYBDENUM Colorimetric KSCN-SnCl ₂	ARSENIC	TIN
	CARBON Direct combustion	MANGANESE 1. Bismuthate (FeSO ₄ -KMnO ₄ titration after removal of Cr, V and W) 2. Persulphate-Arsenite	PHOSPHORUS 1. Alkali-molybdate (W removed and V redacted before molybdate precipitation)	SULPHUR 1. Gravimetric (direct oxidation and final precipitation in rediced solution)	SILICON	TUNGSTEN	CHROMIUM 1. Persulphate oxidation	VANADIUM 1. HNO ₃ oxidation, potentiometric titration in presence of W 2. Other methods							
1.....	0.657	0.292	0.289 ^b	0.018 ^a .019	.005 ^d .004	0.49	18.24 ^e 18.29 ^f	3.50 ^g	0.982	.979 ^h	0.046	0.040	0.006	0.032 ⁱ	0.023 ^j
2.....	.653	.286		.024	.008	.50	18.16 ^e	3.49		.967 ^h	.046		.014	.05 ^k	
3.....	.671	.275 ^l		.017	.010	.47	18.20	3.49 ^g	.969		.055 ^m	.054			
4.....	.658		.282	.017	.008	.48	18.22					.042	.012		
5.....	.656	.280		.021	.008	.47	18.27	3.55 ^g	.975	.95 ^o					
6.....	.66	.30		.020	.004	.47	18.28	3.54 ^p	.97		.042	.05	.01		
7.....	.666	.300	.303 ^q	.021	.009	.47	18.16 ^e	3.50 ^p		.96 ^o	.050 ^m				
8.....	.667	.303 ^r		.020	.010	.47	18.34	3.53 ^s	.984	.967 ^h	.036				
9.....	.649		.273 ^t	.020	.004	.46	18.16	3.53		.971 ^h	.054	.041	.005	.043 ^u	
10.....	.66	.285		.021	.009	.48	18.30	3.54 ^p		.95 ^o		.04 ^v			
11.....	.66	.275 ^w		.022	.004 ^d .005	.52	18.34	3.53 ^p		.959 ^o				.041 ^w	.026 ^x
Averages.....	.660	.290	.284	.020	.007	.48	18.25	3.52	.970	.963	.047	.045	.009	.042	.025
General Averages....	.660	.287		.020	.007	.48	18.25	3.52	.970	.963	.047	.045	.009	.042	.025

^a Precipitated 15° to 20° C., washed with a 1 per cent solution of KNO₃ and titrated with alkali standardized by use of Bureau of Standards standard acid potassium phthalate and the 23:1 ratio.
^b Method of Bright and Larrabee, E. S. Journal of Research, 3, p. 373; 1929.
^c Gravimetric. Weighed as Mg₂P₂O₇ after elimination of arsenic.
^d Sulphur volatilized as H₂S by passing H₂ + HCl over drillings at 900° - 1,050° C.
^e Solution in HCl, precipitation with HNO₃ + cinchonine, solution in NH₄OH and reprecipitation with acid and cinchonine.
^f Single precipitation by acid digestion + cinchonine, corrected for Si, Fe, Cr, and V.

^g Potentiometric titration.
^h Ferrous sulphate-persulphate method.
ⁱ Sulphide converted to arsenate, precipitated as Ag₃AsO₄, dissolved in HNO₃ and titrated with KCNS.
^j Ti₂ precipitated as sulphide, reduced with test-lead and titrated with iodine.
^k Distilled as AsCl₃, precipitated as sulphide, dissolved in HNO₃ - H₂SO₄, fumed, redistilled as AsCl₃ and titrated with I.
^l Potentiometric titration with HgNO₃, J. Ind. & Eng. Chem., 10 p. 19; 1918.
^m Finished by electrolysis.
ⁿ Dimethylglyoxime precipitation, KCN titration.
^o Titrated with ferrous sulphate, using potassium ferricyanide indicator.

^p KMnO₄ oxidation.
^q MnO₂ precipitated by HNO₃-KClO₄, dissolved, oxidized with bismuthate and titrated with arsenite.
^r Ford-Williams' method.
^s KClO₄ oxidation, FeSO₄-KMnO₄ titration.
^t Zinc oxide-sodium arsenite method.
^u Blair's method, "The Chemical Analysis of Iron," 7th ed. p. 201.
^v Dimethylglyoxime precipitate ignited to the oxide.
^w Distilled as AsCl₃, absorbed in NH₄OH solution, acidified with HCl and titrated with KMnO₄.
^x Analyst 11 reported 0.004 per cent of antimony in this sample.

* INDEX TO ANALYSTS

1. Ferrous Laboratory, Bureau of Standards, H. A. Bright in charge; analysis by R. M. Fowler and H. A. Bright.
2. R. J. Price, The Electro Metallurgical Co., New York, N. Y.
3. J. A. Wiley, The Midvale Co., Nicetown, Philadelphia, Pa.
4. J. L. Harvey, The Carnegie Steel Co., Munhall, Pa.
5. P. B. Moore, The Timken Steel & Tube Co., Canton, Ohio.
6. W. T. Hartley, Ludlum Steel Co., Dunkirk, N. Y.
7. E. J. Richards and E. Knutson, Robert W. Hunt Co., Chicago, Ill.

8. S. J. V. Emmons, The Cleveland Twist Drill Co., Cleveland, Ohio.
9. E. C. Frost, Western Electric Co., Manufacturing Department, Chicago., Ill.
10. F. M. Portz, Central Alloy Steel Corporation, Massillon, Ohio.
11. C. M. Johnson, The Crucible Steel Co. of America, Park Works, Pittsburgh, Pa.

This standard is not recommended for colorimetric carbon determinations, because of uncertainty as to the condition of the carbon.

Washington, D. C.
 July 1, 1930

George K. Burgess
 Director.