

Bureau of Standards

Certificate of Analyses

Hand
1st 3 Bars

OF

STANDARD SAMPLE No. 30c

CHROME-VANADIUM STEEL

ANALYST*	C	Mn	P	S	Si	COPPER H ₂ S-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	Cr		V		MOLYBDENUM	ARSENIC			
	CARBON (Direct combustion)	MANGANESE 1. Bismuthate (FeSO ₄ -KMnO ₄ titration, after removing Cr and V.) 2. Persulphate arsenite	PHOSPHORUS 1. Alkali-molybdate (vanadium reduced by molybdate precipitation) 2. Gravimetric (weighed as Mg ₂ P ₂ O ₇ after elimination of arsenic)	SULPHUR 1. Sulphuric acid oxidation and final precipitation in reduced solution 2. Sulphur evolution, ZnS-Iodine (theoretical sulphur titre)	SILICON Sulphuric acid dehydration			CHROMIUM 1. Potassium oxidation (FeSO ₄ -KMnO ₄ titration) 2. Other methods	VANADIUM 1. HNO ₃ oxidation potentiometric titration 2. Other methods							
1.....	0.493	0.708	0.705 ^o	0.019	0.019	0.014	0.012	0.237	0.094 ^d	0.079	0.972 ^e	0.238	.233 ^e	0.015 ^f		
2.....	.481 ^g		.707 ^h	.019 ⁱ			.015	.233	.099 ^j	.077 ^j	.975		.229 ^k	Trace		
3.....	.495	.708 ^m	.706	.016 ⁿ		.011 ^o	.011 ^p	.234 ^q	.105	.081	.987	.972 ^r	.238 ^s			
4.....	.491		.704 ^t	.021 ^u	.022	.013	.013	.241 ^q	.095 ^v	.062		.966 ^w		.246		
5.....	.481		.702 ^t	.020 ^u			.014 ^p	.238	.086 ^v	.080		.981 ^w		.234 ^x		
6.....	.503	.70		.017		.013	.009	.237	.106	.073	.98	.98 ^w		.230 ^k		
	.487		.718 ^o	.020		.014	.012 ^p	.237 ^s	.103 ^d	.086	.981 ^e		.232			
8.....	.480	.710 ^{a1}	.703	.017		.014	.015 ^p	.237		.08	.976 ^e	.990 ^w	.225	.008 ^y		
9.....	.484		.71	.017			.016	.230	.095 ^d	.10 ^{a2}	.973		.24			
10.....	.490	.700		.020		.015		.243	.105	.086	.984 ^w		.240	.013		
11.....	.491	.709 ^e	.709 ^t	.019			.014 ^p	.242	.107 ^d	.082	.967 ^e		.235 ^{a3}			
12.....	.486	.705 ^t		.020		.015	.012	.233	.092 ^v	.070	.977 ^e		.237			
Averages.....	.489	.706	.707	.019	.020	.014	.013	.237	.099	.080	.977	.978	.235	.235	.010	.016
General Averages..	.489	.707	.019	.014	.013	.237	.099	.080	.977	.235	.010	.016				

^a Precipitated at 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 Value obtained by standardization of titrating solution against sodium oxalate through KMnO₄ and Na₂S₂O₃.
^c Potentiometric titration.
^d Finished by electrolysis.
^e Modification of J. R. Cain's method, Reprint 161 from Bulletin of the Bureau of Standards, 7, No. 3, and J. Ind. Eng. Chem., 3, p. 476; 1911.
^f Sulphide converted to arsenate, precipitated as Ag₃AsO₄, dissolved in HNO₃ and titrated with KCNS.
^g Covered with 0.75 g red lead.
^h Oxidized with lead peroxide after ZnO separation and titrated with sodium arsenite.
ⁱ Precipitated with faintly ammoniacal molybdate solution. Alkali-acid solutions standardized against a standard steel.
^j Precipitated with K₂Fe(CN)₆. "The Chemical Analysis of Special Steels, Steel Making Alloys and Graphite," C. M. Johnson.
^k Ferrous sulphate-persulphate method.

^l As Cl₂ distilled into ammonia water solution containing CO₂, distillate acidified with H₂SO₄ and arsenic titrated with KMnO₄.
^m Ford-Williams method.
ⁿ Alkali-acid solutions standardized against oxalic acid.
^o Dissolved in a solution of copper potassium chloride.
^p Absorbed in CaCl₂.
^q HNO₃-H₂SO₄ solution.
^r Barba's KMnO₄ oxidation.
^s Extension method.
^t Chromium and vanadium separated by ZnO.
^u Alkali-acid solutions standardized against a standard steel.
^v Na₂S₂O₃-CuS-CuO.
^w KMnO₄ oxidation.
^x Titrated with ferrous ammonium sulphate using potassium ferricyanide indicator.
^y Colorimetric by developing color with KCNS and SnCl₂.
^z HCl dehydration.
^{a1} Volhard's method.
^{a2} Dimethylglyoxime precipitation, KCN titration.
^{a3} Potassium bromate oxidation, potentiometric titration.

*INDEX TO ANALYSTS

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| 1. Ferrous Laboratory, Bureau of Standards, H. A. Bright in charge; analysis by R. M. Fowler and C. P. Larrabee. | 7. J. A. Wiley, The Midvale Co., Nicetown, Philadelphia, Pa. |
| 2. C. M. Johnson, The Crucible Steel Co. of America, Pittsburgh, Pa. | 8. Fletcher Logan, The Timken Steel & Tube Co., Canton, Ohio. |
| 3. W. P. Putnam, The Detroit Testing Laboratory, Detroit, Mich. | 9. F. M. Portz, Central Alloy Steel Co., Massillon, Ohio. |
| 4. A. D. Beers, Illinois Steel Co., Gary, Ind. | 10. W. T. Hartley, Atlas Steel Division, Ludlum Steel Co., Dunkirk, N. Y. |
| 5. O. L. Van Valkenburgh, Holcomb Steel Co., Syracuse, N. Y. | 11. W. G. Rinehart and R. J. Flanigan, American Chain Co., Bridgeport, Conn. |
| 6. H. E. Campbell, Carnegie Steel Co., Clairton, Pa. | 12. Paul L. Tyson, The Carpenter Steel Co., Reading, Pa. |

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

Washington, D. C.
November 5, 1929.

George K. Burgess
Director.