

Department of Commerce

Bureau of Standards

Certificate of Analysis

OF

STANDARD SAMPLE No. 30b

CHROME-VANADIUM STEEL

MATERIAL FURNISHED BY BETHLEHEM STEEL COMPANY, SOUTH BETHLEHEM, PA.

ANALYST*	C	Mn		P		S		Si	COPPER H ₂ S-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	Cr		V		MOLYBDENUM	COBALT	ARSENIC
	CARBON (Direct combustion)	MANGANESE 1. Bismuthate (FeSO ₄ -KMnO ₄ titration, after removing Cr and V). 2. Other methods	PHOSPHORUS 1. Alkali-molybdate (vanadium reduced before molybdate precipitation). 2. Gravimetric (weighed as Mg ₃ P ₂ O ₈ after elimination of arsenic)	SULPHUR Gravimetric (direct oxidation and final precipitation in reduced solution) 2. SULPHUR Evolution ZnS-Iodine (theoretical sulphur titre)	SILICON Sulphuric acid dehydration	CHROMIUM 1. Perchlorate oxidation (FeSO ₄ -KMnO ₄ titration) 2. Other methods	VANADIUM 1. FeSO ₄ -(NH ₄) ₂ S ₂ O ₈ -KMnO ₄ after chromium determined ^b 2. Other methods										
1.....	0.293	0.500	0.502 ^c	0.024	0.024	0.032	0.030	0.215	{ 0.134 .131 ^d }	0.286	1.03	1.03 ^e	0.207	0.212 ^f	0.018	0.024	{ 0.021 ^g .018 ^h }
2.....	.298	.504	.505 ⁱ	.024	.024	{ .032 ^j .033 ^k }	.031	.208	.141	.299	1.04	1.02 ^l	.205	.218 ⁱ	.013	.....	.....
3.....	.291	.....	.488 ^c	.024	.....	.032	.027	.215	.144	.27 ^l	1.02	.....	.....	.22 ^m	.....	.....	.....
4.....	.299	.501	.511 ⁿ	.023	.....	.033	.028	.211	{ .139 .129 ^d }	.291	1.03	.....	.206	{ .199 ^f .202 ^o }	.012	.....	.....
5.....	.288	.505	.51 ^p	.024	.....	.033	.032	{ .204 ^q .207 .214 ^t }	.125	{ .291 .293 ^r }	1.01	.....	.20	.....	.012	.....	.....
6.....	.30	.50	{ .49 ^p .49 ^s} }	.....	.....	.032	.....	{ .213 .206 }	.126 ^d	{ .29 ^u .29 ^r }	1.01	1.02 ^v	.....	.....	.015	.....	.....
7.....	.301	.496	{ .496 ⁿ .404 ^p }	.026	.....	.032	.030	{ .205 ^q .206 }	.12	.....	1.03	.....	.....	.20 ^w	.....	.....	.....
.....	.285	.51	.....	.026	.026	.032	.028	.215	.124	.29	1.04	.....	.....	{ .206 ^{a1} .210 ^f .210 ^e .201 ^o} }	.....	.....	.....
9.....	.286	.501	.....	.022	.....	{ .032 .033 ^j} }	.....	{ .219 ^q .215 }	.133 ^d	.256	1.05	1.05 ^x	.....	.....	.....	.....	.....
10.....	.288	.496	.....	.024	.....	.030	.029	.220	{ .111 ^d .122 }	.28 ^u .269	1.01 ^y	.198	.200 ^z	.....	.....	.....	.....
11.....	.294	.494	.....	.023	.....	{ .030 ^j .031 }	.....	.218	.146	.....	1.01 ⁱ	.....	.218 ⁱ	.....	.....	.....	.....
12.....	.285	.....	.50 ^p	.022	.....	.032	.030	.21	.....	.25 .288 ^r	1.02	.....	.217	.218 ^{a1}	.....	.....	.026
13.....	.290	.....	.492 ^z	.023	.....	.033 ^j	.....	.217	{ .133 ^{a2} .127 ^z }	.291 ^z	1.01 ^z	.....	.218 ^{a3}	.....	.....	.....	.....
AVERAGES.....	.292	.501	.498	.024	.025	.032	.029	.212	.130	.282	1.03	1.02	.206	.209	.014	.024	.022
General Averages ..	.292	.499	.....	.024	.....	.032†	.029	.212	.130	.282	1.03	.....	.208†	.....	.014	.024	.022

NOTE.—By the use of methods employing empirical titres for evolution sulphur, an average of 0.032% was obtained by six analysts.

† Recommended values: 0.215% vanadium; .032% sulphur.

^a Value obtained by standardization of titrating solution against sodium oxalate through KMnO₄ and Na₂S₂O₃.

^b Described in "Methods of the U. S. Steel Corporation for the Sampling and Analysis of Alloy Steels," 1921, page 47, and in A. S. T. M., "Proposed Tentative Methods of Chemical Analysis of Alloy Steels," serial designation A55-22T.

^c Bismuthate-arsenite.

^d Finished by electrolysis.

^e Peroxide fusion method.

^f Modification of J. R. Cain's method. Reprint 161 from Bulletin of the Bureau of Standards, vol. 7, No. 3, and J. Ind. & Eng. Chem. 3, 476 (1911).

^g Weighed as As₂S₃.

^h Converted the sulphide to arsenate, precipitated as Ag₃AsO₄, dissolved in HNO₃ and titrated with KCNS.

ⁱ Electrometric titration.

^j Precipitated in FeCl₃ solution.

^k Same result obtained by Meineke's method.

^l Weighed as NiO.

^m Garratt's method. J. Ind. & Eng. Chem. 4 (1912), 256. Same result obtained by Blair's method. Blair, "The Chemical Analysis of Iron," 7th edition, p. 209.

ⁿ Ford Williams' method.

^o Cain & Hostetter's method.

^p Persulphate-arsenite.

^q Solution in HNO₃ and H₂SO₄.

^r Dissolved the glyoxime precipitate and titrated with KCN.

^s ZnO separation-persulphate arsenite.

^t Solution in HCl and HClO₄.

^u Direct KCN titration.

^v HNO₃-NaClO₃.

^w HCl reduction.

^x Barba's method.

^y Bismuthate oxidation—KMnO₄ titration.

^z Johnson's method. Johnson, "Chemical Analysis of Special Steels, etc.," 3d edition.

^{a1} Color method.

^{a2} KCN titration.

^{a3} Johnson's method after removal of copper.

*INDEX TO ANALYSTS

- James I. Hoffman, Bureau of Standards.
- Routine Laboratory, Bureau of Standards, H. A. Bright in charge.
- A. S. Townsend, The Cleveland Twist Drill Co., Cleveland, Ohio.
- G. H. Corey and L. R. Shropshire, Ledoux & Co., New York City.
- W. D. Brown, Carnegie Steel Co., Duquesne, Pa.
- John L. Harvey, Carnegie Steel Co., Munhall, Pa.

- H. A. Hosmer, Cambria Steel Co., Johnstown, Pa.
- William Brady, Illinois Steel Co., South Chicago, Ill.
- M. E. McDonnell, The Pennsylvania System, Altoona, Pa.
- H. Morrison and A. S. Anderson, Dodge Bros., Detroit, Mich.
- E. A. Loos, Carpenter Steel Co., Reading, Pa.
- J. H. Campbell, Robert W. Hunt & Co., Chicago, Ill.
- C. M. Johnson, The Crucible Steel Co. of America, Pittsburgh, Pa.

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