

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON 25, D.C.

National Bureau of Standards

Certificate of Analyses

Standard Sample 101E 18 Chromium-9 Nickel Steel

ANALYST	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	Co	Sn	N	W	Nb	
	Direct combustion	Persulfate-Arsenite	Alkali-Molybdate	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Iodate titration	Perchloric acid dehydration	Weighed as nickel dimethylglyoxime	FeSO ₄ -KMnO ₄ titration		Photometric	Zinc oxide-Alpha nitroso-beta naphthol		Distillation-titration			
1.....	0.053	^a 1.78	$\left\{ \begin{array}{l} \text{b} 0.025 \\ \text{c} 0.024 \end{array} \right\}$	0.010	^d 0.008	^e 0.43	^f 0.356	9.48	^g 17.97	^h 0.043	$\left\{ \begin{array}{l} \text{i} 0.422 \\ \text{j} 0.423 \end{array} \right\}$	^k 0.18	^l 0.020	^m 0.040	ⁿ 0.056	^o 0.013
2.....	.054	^{a,p} 1.78	$\left\{ \begin{array}{l} \text{b} .026 \\ \text{c,p} .028 \end{array} \right\}$		.013	.44	^q .360	9.48	^{r,p} 18.03	^{h,p} .045	.43	ⁱ .19	^k .020	.040		
3.....	$\left\{ \begin{array}{l} .058 \\ \text{a} .053 \end{array} \right\}$	^t 1.77	^u .024	.010	.010	.42	^v .36	^w 9.48	^r 17.96	^x .043	.428	ⁱ .18	^y .020	.038		
4.....	^a .054	^t 1.75	^u .023	.010	^a .009	.42	^v .36	^w 9.47	^{r,p} 18.00	^h .042	.42	ⁱ .18	^y .019	.036		
5.....	^a .053	^t 1.80	$\left\{ \begin{array}{l} \text{b} .024 \\ \text{u} .025 \end{array} \right\}$	.012	^p .012	^e .43	^v .353	^{w,p} 9.52	^{r,p} 17.97	^{a',p} .038	^{b'} .434	ⁱ .17	^{k,p} .023	ⁿ .043		
6.....	.054	^{e'} 1.76	.027		.011	^e .44	^{d'} .359	9.46	17.93		^{b'} .429	.17		.041		
7.....	.052	^{e',e'} 1.76	^e .023		.008	.42	^{f'} .358	^w 9.49	^{g'} 17.97	.045	.423	^{h'} .18	^k .019	.041		
8.....	.052	^{i'} 1.76	$\left\{ \begin{array}{l} \text{b} .024 \\ .025 \end{array} \right\}$	.010	.010	^e .43	$\left\{ \begin{array}{l} \text{i}' .366 \\ \text{q} .360 \end{array} \right\}$	$\left\{ \begin{array}{l} \text{9} .47 \\ \text{k}' 9.50 \end{array} \right\}$	17.99	^{i'} .043	^{m'} .428	.17	^{n'} .021	^{o'} .036		
Average..	0.054	1.77	0.025	0.010	0.010	0.43	0.359	9.48	17.98	0.043	0.426	0.18	0.020	0.039	0.056	0.013
General average..	0.054	1.77	0.025	0.010	0.010	0.43	0.359	9.48	17.98	0.043	0.426	0.18	0.020	0.039		

^a Chromium removed by precipitation with NaHCO₃.
^b Gravimetric method (weighed as Mg₂P₂O₇ after removal of arsenic).

^c Molybdenum-blue photometric method. See J. Research NBS 26, 405 (1941) RP1386.

^d 1-g sample burned in oxygen at 1,425° C and sulfur dioxide absorbed in starch-iodide solution. Iodine liberated from iodide by titration, during the combustion, with standard KIO₃ solution. Titer based on 93 percent of the theoretical factor.

^e Double dehydration with intervening filtration.

^f Diethyldithiocarbamate photometric method. See J. Research NBS 47, 380 (1951) RP2265.

^g Persulfate oxidation, potentiometric titration with ferrous ammonium sulfate.

^h Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.

ⁱ Alpha-benzoinoxime gravimetric method. See BS J. Research 9, 1 (1932) RP453.

^j Nitroso-R photometric method.

^k Sulfide-iodine method. See BS J. Research 8, 309 (1932) RP415.

^l Sulfuric acid digestion for 4 hr of a 0.5-g sample. See J. Research NBS 43, 201 (1949) RP2021.

^m Dithiol photometric method. See J. Research NBS 59, 6 (1957) RP2812.

ⁿ Hydroquinone photometric method. See J. Research NBS 62, 1 (1959) RP2923.

^o Chromium separated with ZnO.

^p Titrating solution standardized by the use of a standard steel.

^q Neocuproine photometric method.

^r Perchloric acid oxidation.

^s Conductometric method.

^t KIO₃ photometric method.

^u Molybdenum-blue photometric method.

^v Diethyldithiocarbamate photometric method.

^w Dimethylglyoxime precipitate titrated with cyanide.

^x Chromium volatilized as chromyl chloride and vanadium determined by FeSO₄-KMnO₄ titration method.

^y Stannous-iodate titration method.

^z Combustion gases absorbed in NaOH-H₂O₂. Solution titrated with H₂SO₄.

^{aa'} FeSO₄-(NH₄)₂S₂O₈-KMnO₄ method.

^{bb'} H₂S-MoS₃-PbMoO₄.

^{cc'} Chromium volatilized as CrO₃Cl₂.

^{dd'} H₂S precipitation—KI-Na₂S₂O₃ titration.

^{ee'} Titration with arsenite-nitrite solution.

^{ff'} CuCNS precipitation, CuCl₂ photometric method.

^{gg'} Persulfate oxidation, titration with FeSO₄-K₂Cr₂O₇ using ortho-phenanthroline indicator.

^{hh'} ZnO-CuCNS photometric method.

^{ii'} Chromium removed as in (a), bismuthate method.

^{jj'} H₂S-electrolytic method.

^{kk'} Finished by electrolysis.

^{ll'} Ether-cupferron separation on a 10-g sample. Vanadium titrated by the FeSO₄-(NH₄)₂S₂O₈-KMnO₄ method.

^{mm'} Molybdenum separated by H₂S in presence of tartaric acid and determined by α benzoinoxime method.

^{nn'} Tin separated as sulfide, reduced with antimony and titrated with iodine.

^{oo'} Distillation-photometric method.

List of Analysts

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The steel for the preparation of this standard was furnished by the Allegheny Ludlum Steel Corp., Brackenridge, Pa.
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