

# National Bureau of Standards

## Certificate of Analyses

### Standard Sample 344 15 Chromium-7 Nickel Steel (Mo Precipitation Hardening)

ANALYST	C	Mn	P		S		Si	Cu	Ni	Cr	V	Mo	Al	Ti
	Direct combustion	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Photometric	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Iodate titration	Percbloric acid dehydration	Photometric	Weighted as nickel dimethylglyoxime	$FeSO_4$ - $KMnO_4$ titration	$HNO_3$ oxidation, potentiometric titration	Photometric		$H_2O_2$ photometric
1.....	0.070	<sup>a</sup> 0.58	0.020	<sup>b</sup> 0.018	0.020	<sup>c</sup> 0.019	<sup>d</sup> 0.394	<sup>e</sup> 0.105	7.28	<sup>f</sup> 14.94	0.038	<sup>g</sup> 2.42	<sup>h</sup> 1.15	<sup>i</sup> 0.078
2.....	.070	<sup>j</sup> 1.57		<sup>k</sup> 0.019		.020	.39	<sup>l</sup> 1.105	7.25	14.93	.039	2.38	<sup>m</sup> 1.17	.075
.....	<sup>n</sup> 0.072	<sup>j</sup> 1.56		<sup>o</sup> 0.017		.018	.392	<sup>l</sup> 1.110	<sup>p</sup> 7.23	<sup>q</sup> 14.94	.042	2.41	<sup>r</sup> 1.15	
4.....	{ <sup>n</sup> 0.067 <sup>n</sup> 0.068}	<sup>j</sup> 1.58		<sup>b</sup> 0.018		<sup>s</sup> 0.020	<sup>t,d</sup> 0.399	.100	7.31	<sup>u</sup> 14.97	.045	<sup>w</sup> 2.41	1.15	.075
5.....	.069	<sup>v,w</sup> 1.57		<sup>b</sup> 0.018		.018	.390	<sup>x</sup> 1.110	<sup>p</sup> 7.29	<sup>u</sup> 14.94	.039	2.38	<sup>y</sup> 1.16	<sup>z</sup> 0.072
6.....	.074	<sup>a',s</sup> 1.58	.016	.018		.017	.396	<sup>e</sup> 1.109	7.28	14.98	<sup>b'</sup> 0.039	2.42	1.18	.074
7.....	.067	<sup>v</sup> 1.57		<sup>o'</sup> 0.020		.022	<sup>d</sup> 0.402	<sup>d'</sup> 1.107	<sup>e'</sup> 7.27	<sup>q</sup> 14.93	.038	2.42	<sup>f'</sup> 1.15	.078
8.....	.068	<sup>a',s</sup> 1.57		<sup>b</sup> 0.020		<sup>s</sup> 0.021	<sup>d</sup> 0.397	<sup>e</sup> 1.103	7.29	{ <sup>q</sup> 14.97 <sup>q</sup> 14.93}	<sup>w'</sup> 0.040	<sup>w</sup> 2.38	<sup>f'</sup> 1.17	.077
Average.....	0.069	0.57	0.018	0.018		0.019	0.395	0.106	7.28	14.95	0.040	2.40	1.16	0.076
General average.....	0.069	0.57	0.018		0.019		0.395	0.106	7.28	14.95	0.040	2.40	1.16	0.076

<sup>a</sup> Chromium removed by precipitation with NaHCO<sub>3</sub>.  
<sup>b</sup> Molybdenum-blue photometric method. See J. Res. NBS 26, 405 (1941) RP1386.

<sup>c</sup> 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 KIO<sub>3</sub> solution. Titer based on 93 percent of the theoretical factor.

<sup>d</sup> Double dehydration with intervening filtration.  
<sup>e</sup> Diethyldithiocarbamate photometric method. See J. Res. NBS 47, 380 (1951) RP2265.

<sup>f</sup> Persulfate oxidation, potentiometric titration with ferrous ammonium sulfate.

<sup>g</sup> Alpha-benzoinoxime-MoO<sub>3</sub> method. See BS J. Res. 9, 1 (1932) RP453.

<sup>h</sup> Aluminum selectively precipitated with 8-hydroxyquinoline in an ammoniacal citrate-cyanide solution. Precipitate ignited under oxalic acid, fused with KHSO<sub>4</sub>

and dissolved in acid. NaOH separation. Aliquot treated with H<sub>2</sub>O<sub>2</sub> and aluminum precipitated with 8-hydroxyquinoline, filtered, dried and weighed. See J. Res. NBS 64A No. 2, 181 (1960).

<sup>i</sup> Cupferron separation after solution of the sample in diluted HCl (1+2). Vanadium separated by treatment with NaOH.

<sup>j</sup> KIO<sub>4</sub> photometric method.  
<sup>k</sup> Ammonium molybdate photometric method. Color complex extracted into isobutyl alcohol.

<sup>l</sup> Diethyldithiocarbamate photometric method.  
<sup>m</sup> CrO<sub>3</sub>Cl<sub>2</sub>-mercury cathode-NaOH-Al<sub>2</sub>O<sub>3</sub>.

<sup>n</sup> Conductometric method.  
<sup>o</sup> Molybdenum-blue photometric method.

<sup>p</sup> Dimethylglyoxime precipitate titrated with cyanide.  
<sup>q</sup> Percbloric acid oxidation.

<sup>r</sup> Eriochrome Cyanine-R photometric method.  
<sup>s</sup> Titrating solution standardized by use of a standard steel.

<sup>t</sup> Sulfuric acid dehydration.

<sup>u</sup> Persulfate oxidation potentiometric titration with FeSO<sub>4</sub>-K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.

<sup>v</sup> Chromium volatilized as CrO<sub>3</sub>Cl<sub>2</sub>.

<sup>w</sup> Titration with arsenite-nitrite solution.

<sup>x</sup> CuCNS precipitation-CuCl<sub>2</sub> photometric method.  
<sup>y</sup> Ether-cupferron-mercury cathode-NH<sub>4</sub>OH-Al<sub>2</sub>O<sub>3</sub>.

<sup>z</sup> Vanadium separated with NaOH.  
<sup>a'</sup> Chromium separated with ZnO.

<sup>b'</sup> Cupferron separation-HNO<sub>3</sub> oxidation, potentiometric titration with FeSO<sub>4</sub>.

<sup>c'</sup> Alkali-molybdate method.  
<sup>d'</sup> H<sub>2</sub>S-electrolytic method.

<sup>e'</sup> Dimethylglyoxime-electrolytic method.  
<sup>f'</sup> Mercury cathode-NH<sub>4</sub>OH-Al<sub>2</sub>O<sub>3</sub>.

<sup>g'</sup> Vanadium separated with cupferron and determined by the H<sub>2</sub>O<sub>2</sub>-HF photometric method.

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