



# Certificate of Analysis

## Standard Reference Material 10G

### Bessemer Steel, 0.2% Carbon

ANALYST	C	Mn	P	S		Si	Cu	Ni	Cr	V	Mo	N		
	Direct combustion	Persulfate-Arsenite	Gravimetric (weighed as Mg <sub>2</sub> P <sub>2</sub> O <sub>7</sub> after removal of arsenic)	Alkali-Molybdate <sup>a</sup>	Gravimetric (direct oxidation and precipitation after reduction of iron)	Combustion Iodate titration	Evolution with HCl (1 + 1) ZnS-Iodine (theoretical sulfur titer) <sup>b</sup>	Perochloric acid dehydration	Photometric	FeSO <sub>4</sub> -KMnO <sub>4</sub> titration	Photometric	Distillation-Photometric		
1.....	0.239	<sup>o</sup> 0.851	0.084	<sup>d</sup> 0.085	0.112	<sup>e</sup> 0.110	0.110	<sup>f</sup> 0.023	<sup>g</sup> 0.008	<sup>h</sup> 0.004	<sup>i</sup> 0.009	<sup>j</sup> 0.006	0.001	<sup>k</sup> 0.014
2.....	.241	<sup>l</sup> 0.846	.085	<sup>m</sup> 0.086	.105	<sup>n</sup> 0.112	.....	<sup>o</sup> 0.016	{ <sup>p</sup> 0.006 <sup>q</sup> 0.008}	.005	.009	<sup>r</sup> 0.006	.001	.015
3.....	.240	<sup>s</sup> 0.857	.....	.084	.....	<sup>t</sup> 0.109	.....	.010	<sup>u</sup> 0.009	.006	<sup>v</sup> 0.009	.....	.003	.....
4.....	.241	<sup>w</sup> 0.850	.084	.086	.112	<sup>x</sup> 0.110	.109	<sup>y</sup> 0.024	<sup>z</sup> 0.006	.004	<sup>aa</sup> 0.008	<sup>ab</sup> 0.009	.001	.015
5.....	<sup>ac</sup> 0.240	<sup>ad</sup> 0.847	.....	<sup>ae</sup> 0.089	.....	<sup>af</sup> 0.105	.....	<sup>ag</sup> 0.024	<sup>ah</sup> 0.009	.006	<sup>ai</sup> 0.006	<sup>aj</sup> 0.006	.001	.015
6.....	.245	<sup>ak</sup> 0.849	.089	.090	.....	<sup>al</sup> 0.110	.....	.018	<sup>am</sup> 0.007	.007	<sup>an</sup> 0.01	<sup>ao</sup> 0.008	.001	.014
.....	.235	.850	.....	<sup>ap</sup> 0.086	.108	<sup>aq</sup> 0.108	.....	.024	{ <sup>ar</sup> 0.008 <sup>as</sup> 0.010}	<sup>at</sup> 0.005	.007	<sup>au</sup> 0.006	.003	<sup>av</sup> 0.015
average.....	0.240	0.850	0.086	0.086	0.109	0.109	0.110	0.020	0.008	0.005	0.008	0.007	0.002	0.015
General average.....	0.240	0.850	0.086	.....	.....	0.109	.....	0.020	0.008	0.005	0.008	0.007	0.002	0.015

<sup>a</sup> Precipitated at 40 °C, washed with a 1-percent solution of KNO<sub>3</sub>, and titrated with alkali standardized by the use of acid potassium phthalate and the ratio 23 NaOH:1P.  
<sup>b</sup> Value obtained by standardizing the titrating solution by means of sodium oxalate through KMnO<sub>4</sub> and Na<sub>2</sub>S<sub>2</sub>O<sub>8</sub> and the use of the ratio 2I:1S.  
<sup>c</sup> Potentiometric titration.  
<sup>d</sup> Molybdenum-blue photometric method. See J. Research NBS 26, 405 (1941) RP1386.  
<sup>e</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>4</sub> solution. Titer based on 93 percent of the theoretical factor.  
<sup>f</sup> Double dehydration with intervening filtration.  
<sup>g</sup> Diethylthiocarbamate photometric method. See J. Research NBS 47, 380 (1951) RP2265.  
<sup>h</sup> Weighed as nickel dimethylglyoxime.  
<sup>i</sup> Chromium separated from the bulk of the iron in a 10-g sample by hydrolytic precipitation with NaHCO<sub>3</sub>,

oxidized with persulfate, and titrated potentiometrically with ferrous ammonium sulfate.  
<sup>j</sup> Vanadium separated as in (i), oxidized with HNO<sub>3</sub>, and titrated potentiometrically with ferrous ammonium sulfate.  
<sup>k</sup> Sulfuric acid digestion for 4 hr of a 1-g sample. See J. Research NBS 43, 201 (1949) RP2021.  
<sup>l</sup> Titrating solution standardized with a standard steel.  
<sup>m</sup> Sulfuric acid dehydration.  
<sup>n</sup> H<sub>2</sub>S-CuS-CuO.  
<sup>o</sup> Diethylthiocarbamate photometric method.  
<sup>p</sup> As in (j), but titrated with FeSO<sub>4</sub>-K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.  
<sup>q</sup> Iron precipitated with an excess of NH<sub>4</sub>OH in a HNO<sub>3</sub>-persulfate solution. Copper determined electrolytically in an aliquot portion of the filtrate.  
<sup>r</sup> Perochloric acid oxidation, titration with FeSO<sub>4</sub>-K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, diphenylamine sulfonate indicator.  
<sup>s</sup> Finished by electrolysis.  
<sup>t</sup> Diphenylcarbazide photometric method.  
<sup>u</sup> Photometric method.  
<sup>v</sup> Differential gasometric method.

<sup>w</sup> KIO<sub>4</sub> photometric method.  
<sup>x</sup> Molybdenum-blue photometric method. Colored complex extracted into iso-butyl alcohol and measured at 730 millimicrons.  
<sup>y</sup> Sulfur gases absorbed in H<sub>2</sub>O<sub>2</sub>, and H<sub>2</sub>SO<sub>4</sub> titrated with standard NaOH using brom-cresol-purple indicator.  
<sup>z</sup> Molybdenum-blue photometric method.  
<sup>aa</sup> Neocuproine photometric method.  
<sup>ab</sup> Chromate photometric method. See ASTM Method E30-56.  
<sup>ac</sup> NaHCO<sub>3</sub> hydrolysis followed by mercury cathode. Vanadium determined by the phosphotungstovanadate photometric method.  
<sup>ad</sup> Copper-ammonia-complex photometric method.  
<sup>ae</sup> Molybdenum-blue photometric method.  
<sup>af</sup> CuS precipitated with Na<sub>2</sub>S<sub>2</sub>O<sub>8</sub>. Precipitate ignited, dissolved, and titrated with KI-Na<sub>2</sub>S<sub>2</sub>O<sub>8</sub>.  
<sup>ag</sup> Dimethylglyoxime precipitate titrated with cyanide.  
<sup>ah</sup> Nitric acid oxidation, potentiometric titration with ferrous ammonium sulfate.  
<sup>ai</sup> Distillation-titration.

### List of Analysts

1. Ferrous laboratory, National Bureau of Standards, J. I. Shultz, in charge. Analysis by E. J. Meros, E. June Maienthal, and A. Skapars.
2. L. I. Stead, E. F. Sadewasser, J. W. Swatts and E. H. Tull. The Youngstown Sheet and Tube Co., Indiana Harbor Works, East Chicago, Ind.
3. E. J. Ineman, Industrial Chemical and Metallurgical Analysis, Inc., Cleveland, Ohio.
4. H. V. Reddinger, Bethlehem Steel Co., Johnstown Plant, Johnstown, Pa.

5. R. R. Ralston, J. W. Fulton, R. J. Londergan, J. P. Broyles, and A. M. Hunt. Distribution Transformer Department Insulation Laboratory, General Electric Co., Pittsfield, Mass.
6. W. H. Weigel, United States Steel Corp., Clairton Steel Works, Clairton, Pa.
7. E. O. Waltz, Republic Steel Corp., Steel Division, Canton, Ohio.

The steel for the preparation of this standard was furnished by the United States Steel Corporation

NGTON, D. C. 20234  
October 14, 1965

W. Wayne Meinke, Chief  
Office of Standard Reference Materials.

(This certificate supersedes certificate of 8-19-58. Editorial revision only)