

# National Bureau of Standards

## Certificate of Analyses

STANDARD SAMPLE 55A

### OPEN-HEARTH IRON

ANALYST*	C	Mn	P		S		Si	Cu	NICKEL (weighed as nickel dinitritylglyoxime)	CHROMIUM	VANADIUM	MOLYBDENUM	COBALT	ARSENIC	TIN	ALUMINUM (total)	ALUMINUM OXIDE (AlO)	NITROGEN
	Direct combustion	Gravimetric (weighed as Mg <sub>2</sub> P <sub>2</sub> O <sub>7</sub> after removal of arsenic)	ALKALI-MOLYBDATE*	Gravimetric (direct oxida- tion and final precipita- tion in reduced solution)	Evolution with HCl (1:1) ZnS—iodine (theoretical sulphur titre) <sup>b</sup>	Sulphuric acid dehydra- tion	H <sub>2</sub> S—CuS—CuO											
1	0.013	{0.022 .021 <sup>d</sup> }	0.004	0.005	0.020	0.020	0.000 <sub>6</sub>	0.045	0.019	0.006	<0.0002	0.002	0.007 <sup>e</sup>	0.012	0.006 <sup>f</sup>	0.002	0.002 <sup>g</sup>	
2	.013	.020 <sup>e</sup>	.005	.006	.017		.001 <sup>h</sup>	.044	.019	.006	.000	.002						
3	.016	.022 <sup>e</sup>	.005	.004	.021	.019 <sup>i</sup>		.049 <sup>j</sup>	.019	.006	Trace	.003		.010				
4	.012	.020 <sup>e</sup>		.004	.021	.021	.001	.048	.019	.006								
5	.014	.023 <sup>k</sup>		.004 <sup>l</sup>	.018	.018 <sup>m</sup>	<.001	.042 <sup>n</sup>										
6	.013	.024 <sup>o</sup>		.005	.020	.021 <sup>p</sup>	.001	.043	.020 <sup>q</sup>	.005								
7	.015	.020 <sup>e</sup>		.004	.019	.019	<.0005	.046 <sup>m</sup>	.019	.005								
	.013	.020 <sup>k</sup>	.004	.004	.020	.021 <sup>l</sup>	.001 <sup>o</sup>	{.049 .047 <sup>m</sup> }	.019	.005	<.001	.003				.001		
9	.012	.025 <sup>e</sup>		.005	.020	.020	.001											
10	.013	.023 <sup>o</sup>		.005	.020	.021	.000 <sub>6</sub>	.046	.020	.005	.001	.002		.013	.007	.002	.004 <sup>a</sup>	
11	{.012 .014 <sup>r</sup> }	.022	.004	.005	.020	.020	.000 <sub>6</sub>	.049 <sup>m</sup>	.019	.006	<.0002		.003					
12	.015 <sup>s</sup>	.021		.006	.018	.020	.001 <sup>o</sup>	.044 <sup>t</sup>						.012				0.004 <sup>u</sup>
Averages	.014	.022	.004	.005	.020	.020	.001	.046	.019	.006	<.0005	.002	.008	.012	.007	.002 <sup>v</sup>	.003	
Recommen- ded values	.014	.022	.004		.020		<.001	.046	.019	.006	<.0005	.002	.008	.012	.007	.002	.002	.004

\* Precipitated at 40° C., washed with a 1-percent solution of KNO<sub>3</sub> and titrated with alkali standardized by the use of National Bureau of Standards acid potassium phthalate and the 23:1 ratio.

<sup>b</sup> Value obtained by standardizing 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>.  
<sup>c</sup> Bismuthate (FeSO<sub>4</sub>-KMnO<sub>4</sub>) method.  
<sup>d</sup> Persulphate-arsenite method.

<sup>e</sup> Bulk of the iron removed from a 10-g sample by extracting with ether, acid extracted-solution treated with cupferron, and cobalt precipitated in filtrate with α-nitroso β-naphthol, and ignited to Co<sub>2</sub>O<sub>3</sub>. See BS J. Research 8, 659 (1932) RP415.

<sup>f</sup> Tin precipitated as sulphide in HNO<sub>3</sub> solution, then separated from copper and molybdenum by precipitation with NH<sub>4</sub>OH, and finally reduced with lead and titrated with iodine. See BS J. Research 8, 309 (1932) RP415.

<sup>g</sup> 100-g sample treated with 1,000 ml of diluted H<sub>2</sub>SO<sub>4</sub> (1+9) and aluminum determined in the separated insoluble residue.

<sup>h</sup> Nitric-sulphuric acid method.  
<sup>i</sup> Titrating solution standardized by the use of a standard steel.

<sup>j</sup> Precipitated as sulphide, titrated with Na<sub>2</sub>S<sub>2</sub>O<sub>8</sub>.

<sup>k</sup> Bismuthate-arsenite method.

<sup>l</sup> H<sub>2</sub>S absorbed in ammoniacal CdCl<sub>2</sub> solution.

<sup>m</sup> Finished by electrolysis.

<sup>n</sup> Ignited and weighed as NiO.

<sup>o</sup> Dehydration with perchloric acid.

<sup>p</sup> Bulk of the iron removed from a 10-g sample by extracting with ether, manganese then determined by bismuthate (FeSO<sub>4</sub>-KMnO<sub>4</sub>) method.

<sup>q</sup> 59-g sample decomposed with I-KI and aluminum determined in the residue.

<sup>r</sup> Special determination by Dr. T. D. Yensen, using the vacuum-liquid-air method (Am. Electrochem. Soc. Trans. 56, 251, 1929).

<sup>s</sup> Manganese oxidized with lead peroxide, and HMnO<sub>4</sub> titrated with arsenite.

<sup>t</sup> Precipitated as thiocyanate, ignited to oxide, and titrated with KCN.

<sup>u</sup> Solution of steel in HCl, distillation from NaOH solution, and absorption of evolved ammonia in a standard solution of diluted H<sub>2</sub>SO<sub>4</sub>.

<sup>v</sup> The term "total aluminum" refers to all of the aluminum in the sample, i. e., oxide, metallic, nitride, or any other form. Analyst 1 obtained 0.0008 percent of aluminum soluble in diluted H<sub>2</sub>SO<sub>4</sub> (1+9).

#### LIST OF ANALYSTS\*

1. Ferrous Laboratory, National Bureau of Standards, H. A. Bright, in charge; analysis by R. M. Fowler and J. L. Hague.
2. Bowser-Morner Testing Laboratories, Dayton, Ohio.
3. Gulick-Henderson Co., Inc., Pittsburgh, Pa.
4. Department of Highways, Commonwealth of Pennsylvania, Harrisburg, Pa.
5. Department of Highways, State of Illinois, Springfield, Ill.
6. Eckert, A. M. Byers Co., Pittsburgh, Pa.
7. H. E. Slocum, Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
8. W. W. Braun, Department of Highways, State of Ohio, Columbus, Ohio.
9. Dr. M. E. McDonnell, The Pennsylvania Railroad, Altoona, Pa.
10. Armeo Research Chemical Laboratory—A. H. Thomas, in charge; analysis by O. B. Ellis and P. E. Ramseyer.
11. E. W. Beiter and R. H. Wynne, Research Laboratories, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.
12. C. M. Johnson, Crucible Steel Co. of America, Park Works, Pittsburgh, Pa.

LYMAN J. BRIGGS,  
Director.

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