

U. S. DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Certificate of Analyses

Standard Sample 7E

Cast Iron

(High-Phosphorus)

ANALYST	C		Mn	P		S			Si	Cu	Ni	Cr	V	Mo	Ti	As
	Total	Graphitic	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Alkali-Molybdate ^a	Gravimetric (direct oxidation and final precipitation after reduction of iron)	Evolution (HCl, sp. gr. 1.18, ZnS-iodine ^b theoretical sulfur titer ^c)	Combustion	Sulfuric acid dehydration	$H_2S-CuS-CuO$	Weighed as nickel dimethylglyoxime	$FeSO_4-KMnO_4$ titration		Colorimetric	Colorimetric	
1	2.90	2.55	^d 0.449	0.881		0.080	0.079	^e 0.077	^f 1.90	0.021	0.009	^g 0.014	^h 0.048	0.003	ⁱ 0.059	^j 0.086
2	2.96	2.56	.441		.884	.082	^k 0.082	^l 0.079	^m 1.88	.024	.014	.018	ⁿ 0.040	.003	.064	.088
3	2.93	2.53	.439		.878	.078	^k 0.078		ⁿ 1.87	.023	^o 0.013	^p 0.015	^q 0.044		.065	
4	2.88	2.52	^r 0.454	.872	.874	.078		^o 0.077	^f 1.88	.023	.011	^p 0.018	^q 0.043		ⁱ 0.058	
5	2.96	2.54	^r 0.446		^r 0.883	.081	^k 0.082		ⁿ 1.88	^s 0.020	^t 0.013	^u 0.016			.063	
6	2.94	2.50	^r 0.454	.870	^r 0.868	.076	^k 0.075		ⁿ 1.89	^v 0.022	.010	.010	^w 0.050	.003	.060	
7	2.88	2.55	.45		.88		.077	^l 0.081	^f 1.87	^x 0.019	^t 0.010	^u 0.018	^h 0.043		.058	.089
8	2.89	2.52	.449	.885	.888	.079	.078		^f 1.90	.023	^t 0.009	^p 0.014	^q 0.050		ⁱ 0.060	
Average	2.92	2.53	0.448	0.877	0.879	0.079	0.079	0.079	1.88	0.022	0.011	0.015	0.045	0.003	0.061	0.088
General average	2.92	2.53	0.448	0.878		0.079			1.88	0.022	0.011	0.015	0.045	0.003	0.061	0.088

^a Precipitated at 40° C, washed with a 1-percent solution of KNO_3 and titrated with alkali standardized by the use of acid potassium phthalate and the ratio 23NaOH:1P.

^b Sample annealed by covering with a layer of graphite, and heating for 20 minutes at 685° C.

^c Value obtained by standardizing the titrating solution by means of sodium oxalate through $KMnO_4$ and $Na_2S_2O_8$, and use of the ratio 2L:1S.

^d Potentiometric titration.

^e 1-g sample burned in oxygen at 1,425° C, and sulfur dioxide absorbed in starch-iodine solution. The iodine was liberated from iodide by titration, during the combustion, with standard KIO_3 solution based on 93 percent of the theoretical factor.

^f Double dehydration with intervening filtration.

^g Chromium separated from the bulk of iron in a 10-g sample by hydrolytic precipitation with $NaHCO_3$. Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.

^h Vanadium separated as in (g). Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.

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

^j Molybdenum-blue photometric method. See J. Research NBS 24, 7 (1940) RP1267.

^k Solution in diluted HCl (1+1).

^l Titrating solutions standardized against standard irons or steels.

^m Gases absorbed in $NaOH-H_2O_2$ solution, and excess NaOH titrated with H_2SO_4 .

ⁿ Perchloric acid dehydration.

^o Glyoxime precipitate ignited to nickel oxide.

^p As in (g), except $FeSO_4-KMnO_4$ titration.

^q Bicarbonate hydrolysis of a 10-g sample and vanadium determined by $FeSO_4-(NH_4)_2S_2O_8-KMnO_4$ titration.

^r Phospho-vanado-molybdate photometric method.

^s Diethylthiocarbamate photometric method.

^t Dimethylglyoxime photometric method.

^u Diphenylcarbazide photometric method.

^v Precipitated and weighed as $CuONS$.

^w $FeSO_4-(NH_4)_2S_2O_8-KMnO_4$ titration.

^x Copper-ammonia-complex photometric method.

List of Analysts

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|---|---|
| <ol style="list-style-type: none"> 1. Ferrous Laboratory, National Bureau of Standards, John L. Hague in charge. Analysis by J. I. Shultz, C. Litsey and J. Baldwin. 2. Roy E. Deas, American Cast Iron Pipe Co., Birmingham, Ala. 3. A. E. McBee, Republic Steel Corp., Birmingham, Ala. H. Rouse, Bethlehem Steel Corp., Steelton, Pa. K. Aites, Westinghouse Air Brake Co., Wilmerding, Pa. | <ol style="list-style-type: none"> 6. R. E. DeHart and J. L. Graham, Lynchburg Foundry Co., Radford, Va. 7. Jones and Laughlin Steel Corp., C. F. Allison, director of chemical laboratories. Analysis by Pittsburgh Works, C. A. Trathowen, Chief Chemist. 8. Jones and Laughlin Steel Corp., C. F. Allison, director of chemical laboratories. Analysis by Aliquippa Works, D. J. Hallisey, Chief Chemist. |
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The cast iron for the preparation of this standard was furnished by the American Cast Iron Pipe Co.

WASHINGTON, D. C., November 8, 1951.

A. V. ASTIN, *Acting Director.*