

UNITED STATES DEPARTMENT OF COMMERCE  
WASHINGTON

National Bureau of Standards  
Certificate of Analyses  
Standard Sample 5J  
Cast Iron

ANALYST	C		Mn	P		S			Si	Cu	Ni	Cr	V	Mo	Ti	As	N
	Total	Graphitic	Persulfate-Arsenite	Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic)	Alkali-Molybdate <sup>a</sup>	Gravimetric (direct oxidation and final precipitation after reduction of iron)	Evolution (HCl, sp. gr. 1.18, ZnS-iodine <sup>b</sup> theoretical sulfur titer <sup>c</sup> )	Combustion	Sulfuric acid dehydration	$H_2S-CuS-CuO$	Weighed as nickel dimethylglyoxime	$FeSO_4-KMnO_4$ titration	Photometric	$H_2O_2$ photometric	Distillation-titration		
1	2.37	1.91	<sup>d</sup> 0.71	0.244	<sup>e</sup> 0.236	0.102	0.100	<sup>f</sup> 0.101	<sup>g</sup> 2.45	<sup>h</sup> 1.00	0.019	<sup>i</sup> 0.021	<sup>j</sup> 0.012	0.005	<sup>k</sup> 0.043	<sup>l</sup> 0.023	<sup>m</sup> 0.008
2	2.38	1.92	.69	.244	.244	.100	.099	<sup>n</sup> 1.00	<sup>o</sup> 2.45	.99	.016	<sup>p</sup> 0.021	<sup>q</sup> 0.011	.003	<sup>r</sup> 0.044		
3	2.41	1.87	.71	.241	.243	.100		<sup>s</sup> 1.01	<sup>t</sup> 2.43	1.00	.019	<sup>u</sup> 0.025	<sup>v</sup> 0.011	.004	<sup>w</sup> 0.045		
	2.36	1.89	<sup>x</sup> 0.70	.241	.243			<sup>y</sup> 0.98	<sup>z</sup> 2.42	<sup>aa</sup> 1.00	.016	<sup>ab</sup> 0.022	<sup>ac</sup> 0.016	.004	.044		
	2.38	1.91	.69	.242	.242	.100	<sup>ad</sup> 0.098		<sup>ae</sup> 2.43	<sup>af</sup> 0.99	.017	<sup>ag</sup> 0.020	<sup>ah</sup> 0.012		<sup>ai</sup> 0.045		
	2.34	1.96	<sup>aj</sup> 0.70	.233	.239	.100	<sup>ak</sup> 0.097		<sup>al</sup> 2.42	<sup>am</sup> 0.99	.019	<sup>an</sup> 0.019	<sup>ao</sup> 0.012	.005	<sup>ap</sup> 0.044	<sup>aq</sup> 0.029	
	2.38	1.89	<sup>ar</sup> 0.69	.244	<sup>as</sup> 0.242	.101	<sup>at</sup> 0.095		<sup>au</sup> 2.45	.98	<sup>av</sup> 0.017	<sup>aw</sup> 0.021	<sup>ax</sup> 0.013	<sup>ay</sup> 0.006	<sup>az</sup> 0.043		
8	2.33	1.91	<sup>ba</sup> 0.70	.240	.240	.101		<sup>bb</sup> 1.01	<sup>bc</sup> 2.44	<sup>bd</sup> 0.98	.017	<sup>be</sup> 0.021	<sup>bf</sup> 0.012	.005	.045		
Average	2.37	1.91	0.70	0.241	0.241	0.101	0.098	0.100	2.44	0.99	0.018	0.021	0.012	0.005	0.044	0.026	
General average	2.37	1.91	0.70	0.241			0.100		2.44	0.99	0.018	0.021	0.012	0.005	0.044	0.026	

<sup>a</sup> 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 23 NaOH:1P.

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

<sup>c</sup> 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 2I:1S.

<sup>d</sup> Potentiometric titration.

<sup>e</sup> Molybdenum-blue photometric method.

<sup>f</sup> 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.

<sup>g</sup> Double dehydration with intervening filtration.

<sup>h</sup> Diethylidithiocarbamate photometric method. See J. Research NBS 47, 380 (1951) RP2265.

<sup>i</sup> 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.

<sup>j</sup> Vanadium separated as in (i). Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.

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

<sup>l</sup> Sulfuric acid digestion for 4 hours of 0.5-g sample. See J. Research NBS 43, 201 (1949) RP2021.

<sup>m</sup> Combustion gases absorbed in NaOH- $H_2O_2$ , and excess NaOH titrated with  $H_2SO_4$ .

<sup>n</sup> Perchloric acid dehydration.

<sup>o</sup> Perchloric acid oxidation.

<sup>p</sup> Vanadium separated by  $Na_2CO_3$  fusion.

<sup>q</sup> As in (i), except  $FeSO_4-KMnO_4$  titration.

<sup>r</sup> Ferrous sulfate-persulfate- $KMnO_4$  titration.

<sup>s</sup> Titrating solution standardized by use of standard steels or irons.

<sup>t</sup> Copper-ammonia complex photometric method.

<sup>u</sup> Solution in diluted HCl (1+1).

<sup>v</sup> KI- $Na_2S_2O_8$  titration.

<sup>w</sup> Nitric-sulfuric acid dehydration.

<sup>x</sup> Distillation- $H_2S-As_2S_3$ .

<sup>y</sup> Bismuthate- $FeSO_4-KMnO_4$ .

<sup>z</sup> Spectrographic.

<sup>aa</sup> As in (f), except burned at 2,500° F, and 79-percent factor.

<sup>ab</sup> Diphenylcarbazide photometric method.

List of Analysts

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2. R. H. Elder and R. E. Deas, American Cast Iron Pipe Co., Birmingham, Ala.
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4. Spittle, Ford Motor Company, Dearborn, Mich.
5. Wood and Max Powell, Republic Steel Corp., Birmingham, Ala.

6. Charles McKimmon, H. S. Leach, and C. Dillon, Tennessee Coal and Iron Division, United States Steel Co., Fairfield, Ala.
7. R. E. James, United States Steel Co., Ohio Works, Youngstown, Ohio.
8. W. R. Sayre, United States Steel Co., Edgar Thomson Works, Braddock, Pa.

The iron for the preparation of this standard was furnished by the American Cast Iron Pipe Co.

WASHINGTON, D. C., January 21, 1953.

A. V. ASTIN, Director.