

U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 11E

BASIC OPEN-HEARTH STEEL, 0.2% CARBON

ANALYST*	C	Mn		P		S			Si	COPPER H ₂ S-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	CHROMIUM FeSO ₄ -KMnO ₄ titration	VANADIUM	MOLYBDENUM Colorimetric	NITROGEN <i>.004 KF</i>
	Direct combustion	Bismuthate (FeSO ₄ -KMnO ₄)	Persulfate-Arsenite	Gravimetric (weighed as Mg ₂ P ₂ O ₇ after removal of arsenic)	Alkali-Molybdate ^a	Gravimetric (direct oxidation and precipitation after reduction of iron)	Evolution with HCl (1-1)	ZnS-Iodine (theoretical sulfur titre) ^b	Combustion						
1	0.181	0.453	0.452	0.013	0.013	0.026	0.028		0.317	0.113	0.045	0.034	0.001	0.009	0.004
2	.177	.454	.454	.017	.017	.029	.029		.318	.104	.046	.031	.002	.008	
3	.180	.45	.45		.015	.027	.028	.028	.310	.10	.047	.035		.007	
	.178	.447		.018	.017	.028	.029		.318	.100	.046	.033		.006	
	.178		.458		.016		.030	.031	.308	.102	.046	.034	.001	.006	
6	.177		.449		.015		.029		.313	.107	.046	.037	.003	.008	
7	.190	.453			.014	.029	.030		.318	.104	.040	.038			
8	.181		.450	.014	.015	.028	.028	.028	.324	.107	.047	.033	.002	.008	
9	.178	.453		.017	.016	.026	.028	.028	.321	.111	.044	.045		.007	
Averages	0.180	0.451	0.452	0.016	0.015	0.028	0.029	0.029	0.316	0.105	0.045	0.036	0.002	0.007	0.004
General average	0.180	0.451		0.015		0.028			0.316	0.105	0.045	0.036	0.002	0.007	0.004

^a Precipitated at 40° C, washed with a 1-percent solution of KNO₃ and titrated with alkali standardized by the use of National Bureau of Standards acid potassium phthalate and the ratio 2:3NaOH:1P.
^b Value obtained by standardizing the titrating solution by means of sodium oxalate through KMnO₄ and Na₂S₂O₃, and use of the ratio 2:1:18.
^c Colorimetric method. See J. Research NBS 20, 405 (1941) RP1386.
^d Double dehydration.
^e Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate solution standardized with recrystallized potassium dichromate.
^f Nitric acid oxidation and potentiometric titration with

ferrous ammonium sulfate solution standardized with recrystallized potassium dichromate.
^g Determination made by M. Marie Cron, by the vacuum-fusion method. See BS J. Research 7, 375 (1931) RP346.
^h Perchloric acid oxidation.
ⁱ Ammonium persulfate-ferrous sulfate-permanganate method.
^j H₂S-MoO₃.
^k Absorbed in H₂O₂-NaOH solution. Titrated with H₂SO₄.
^l Perchloric acid dehydration.
^m Titrating solution standardized by the use of a standard steel.

ⁿ Dissolved in HCl (2:1).
^o Finished by electrolysis.
^p Colorimetric.
^q Copper precipitated with Na₂S₂O₃. Finished by KI-Na₂S₂O₃ titration.
^r Potentiometric titration with mercurous nitrate.
^s Precipitated in ferric chloride solution.
^t Absorbed in cadmium chloride solution.
^u Hydrochloric acid dehydration.
^v Sulfur dioxide absorbed in starch-iodide solution. Titration with KIO₃.
^w Arsenite titration.
^x Weighed as ammonium phosphomolybdate.
^y Nitric-sulfuric acid dehydration.

*LIST OF ANALYSTS

1. Ferrous laboratory, National Bureau of Standards, J. L. Hague in charge. Analysis by John P. Hewlett, Jr., and William Chorney.
2. W. F. Muehlberg, American Steel & Wire Co., Cleveland, Ohio.
3. Jones & Laughlin Steel Corporation. H. E. Slocum, director of chemical laboratories, Analysis by Pittsburgh Works, J. D. Ritz, chief chemist.
4. Jones & Laughlin Steel Corporation. H. E. Slocum, director of chemical laboratories. Analysis by Aliquippa Works, D. J. Hallisey, chief chemist.
5. W. E. Steiner, Bethlehem Steel Corporation, Johnstown, Pa.
6. C. G. Hummon, Sheffield Steel Corporation, Kansas City, Mo.
7. J. A. Wiley, The Midvale Co., Nicetown, Philadelphia, Pa.
8. Charles O. Geyer, Inland Steel Co., Indiana Harbor Works, East Chicago, Ind.
9. Stephen Hisch, Andrews Steel Co., Newport, Ky.

The steel for the preparation of this standard was furnished by the Inland Steel Co.

WASHINGTON, February 10, 1944.

LYMAN J. BRIGGS, Director.

*used 6/17/46
P.C. 2/1/43*