

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 22c

BESSEMER STEEL, 0.5% CARBON

ANALYST*	C	Mn		P		S			Si							
	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 final precipitation after reduction of iron)	Evolution with HCl (1:1) ZnS-Iodine (theoretical sulfur titer) ^b	Combustion	Sulfuric acid dehydration	COPPER H ₂ S-CuS-CuO	NICKEL Weighed as nickel dimethylglyoxime	CHROMIUM FeSO ₄ -KMnO ₄ titration	VANADIUM	MOLYBDENUM Colorimetric	ALUMINUM (total)	NITROGEN
1	0.482	0.745	0.745	0.083	0.082	0.080	0.076	0.081	0.099	0.013	0.005	0.008	0.007	0.001	0.113	0.010
2	.483	.740	.740	.083	.084	.080	.079	.080	.096	.010	.005	.010	.001	.001	.124	
3	.480	.750	.750	.085	.083	.079	.073	.080	.098	.009	.004	.006			.113	
4	.480	.756	.756	.083	.083	.079	.078	.080	.101	.014	.005	.010			.12	
5	.486	.744	.744	.084	.084	.080	.078	.082	.096	.012	.006	.007			.111	
	.481	.745	.745	.083	.082	.079	.076	.080	.099	.009	.005	.007			.117	
	.481	.743	.743	.081	.078	.078	.078	.080	.099	.010	.003	.006			.106	
8	.48	.744	.74	.084	.084	.080	.076	.080	.096	.012	.004	.007	.005	.002	.126	
9	.485	.75	.75	.084	.084	.079	.076	.080	.098	.014	.003	.006	.004	.002	.111	
Averages...	0.482	0.745	0.746	0.084	0.083	0.079	0.076	0.081	0.098	0.011	0.004	0.007	0.005	0.002	0.116	
Recom'd values...	0.482	0.746		0.083		0.080			0.098	0.011	0.004	0.007	0.006	0.001	0.116	0.010

^a Precipitated at 40° C, washed with a 1-percent solution of KNO₃, and titrated with alkali standardized by the use of acid potassium phthalate and the ratio 23NaOH : 1P.
^b Value obtained by standardizing the titrating solution by means of sodium oxalate through KMnO₄ and Na₂S₂O₃, and use of the ratio 21 : 15.
^c Molybdenum-blue photometric method. See J. Research NBS 26 405 (1941) RP1386.
^d Double dehydration with intervening filtration.
^e Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.
^f Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.
^g 10-g sample dissolved in HCl-HNO₃. Silica removed by dehydrating and filtering. Residue ignited, treated with H₂SO₄-HF, nonvolatile fused with Na₂S₂O₇, and the solution of the melt added to the ether-extracted filtrate. Aluminum precipitated with 8-hydroxyquinoline in an ammoniacal tartrate-cyanide solution. Precipitate fil-

tered, treated with H₂SO₄-HNO₃, and aluminum precipitated with NH₄OH. Ignited Al₂O₃ corrected for SiO₂ and examined for TiO₂ and ZrO₂.
^h Determination made by J. T. Sterling, by the vacuum-fusion method. See BS J. Research 8, 309 (1932) RP415.
ⁱ Aurintricarboxylate colorimetric method.
^j ZnO separation.
^k Weighed as ammonium phosphomolybdate.
^l Evolved gas absorbed in ammoniacal cadmium solution.
^m Nitric-sulfuric acid dehydration.
ⁿ Bicarbonate hydrolysis-NaOH separation-AlPO₄ precipitation method.
^o Titrating solution standardized by use of a standard steel.
^p Perchloric acid dehydration.
^q Copper-ammonia complex colorimetric method.
^r Dimethylglyoxime colorimetric method.

^s Spectrographic method.
^t Combustion gases absorbed in neutral peroxide solution, and titrated with NaOH standardized with a standard steel.
^u Finished by electrolysis.
^v Diphenylcarbazide colorimetric method.
^w Glyoxime precipitate titrated with cyanide.
^x Bicarbonate hydrolysis-Hg cathode electrolysis-NaOH separation-AlPO₄ precipitation method. Tin removed with H₂S.
^y Sulfur gases absorbed in starch-iodine solution, the iodine being liberated from iodide by titration, during the combustion, with KIO₃ solution standardized with a standard steel.
^z Phosphate method.
^{aa} Differential titration with KMnO₄ and o-phenanthroline indicator.
^{ab} Bicarbonate hydrolysis precipitation. Aluminum precipitated with 8-hydroxyquinoline in ammoniacal cyanide-tartrate solution, dried and weighed.

*LIST OF ANALYSTS

1. Ferrous Laboratory, National Bureau of Standards, John L. Hague in charge. Analysis by J. I. Shultz, J. P. Hewlett, Jr., Florence Yenchius, and Jewel Doran.
2. W. F. Muehlberg, American Steel & Wire Co., Cleveland, Ohio.
3. W. F. Schniepp, Alan Wood Steel Co., Conshohocken, Pa.
4. W. K. Aites, Westinghouse Air Brake Co., Wilmerding, Pa.
5. War Department, Watertown Arsenal, Watertown, Mass.
6. J. B. Armstrong, Bethlehem Steel Co., Sparrows Point Plant, Sparrows Point, Md.
7. H. W. Bennett and K. P. Campbell, Sheffield Steel of Texas, Houston, Tex.
8. Jones & Laughlin Steel Corporation, H. E. Slocum, director of chemical laboratories. Analysis by Pittsburgh Works, J. D. Ritz, chief chemist.
9. Jones & Laughlin Steel Corporation, H. E. Slocum, director of chemical laboratories. Analysis by Aliquippa Works, D. J. Hallisey, chief chemist.

The steel for the preparation of this standard was furnished by The Carnegie-Illinois Steel Corporation.

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E. U. CONDON, *Director.*