

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 33c NICKEL STEEL

ANALYST*	C	Mn	P		S		Si	Ni		CHROMIUM FeSO ₄ -KMnO ₄ titration	VANADIUM	MOLYBDENUM Colorimetric	ALUMINUM (total)	TIN	NITROGEN
	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	Sulfuric acid dehydration	COPPER H ₂ S-CuS-CuO						
1	0.370	0.733	0.016	0.017	0.030	0.030	0.282	0.029	3.27	0.053	0.002	0.031	0.034	0.003	0.003
2	.373	0.738	.018	.029	.029	.029	.283	.032	3.29	.056		.031	.030	.004	
3	.370	.734	.020	.019	.030	.030	.280	.032	3.29	.050		.030	.032	.004	
4	.372	.733	.019	.029	.029	.029	.278	.029	3.27	.050		.035			
5	.362	.731	.018	.018	.030	.031	.286	.029	3.26	.052		.032			
6	.367	.726	.019	.019	.030	.029	.283	.034	3.28	.049		.029	.032	.003	
7	.361	.735	.738	.016	.029	.029	.286	.033	3.28	.054		.033			
Averages	0.368	0.734	0.733	0.018	0.018	0.030	0.030	0.283	0.031	3.28	0.052	0.002	0.032	0.004	0.003
Recommended value	0.368	0.733		0.017		0.030	0.283	0.031	3.28	0.052	0.002	0.032	0.032	0.003	0.003

^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 23NaOH:1P.
^b Value obtained by standardizing the titrating solution by means of sodium oxalate through KMnO₄ and Na₂S₂O₈, and the use of the ratio 21:1S.
^c Molybdenum-blue colorimetric method. See J. Research NBS 26, 405 (1941) RP1386.
^d Double dehydration.
^e Persulfate oxidation and potentiometric titration with ferrous ammonium sulfate.
^f Nitric acid oxidation and potentiometric titration with ferrous ammonium sulfate.
^g Aluminum separated from the bulk of the iron (of a 10-g sample) by precipitation with NaHCO₃. Precipitate treated with HCl and insoluble residue ignited, fused

with K₂S₂O₇, melt dissolved and added to the main solution. Iron and the like precipitated with NaOH. Filtrate acidified and tin removed with H₂S. Aluminum precipitated with NH₄OH, ignited to Al₂O₃, and the latter corrected for P₂O₅ and Fe₂O₃.
^h Determination made by R. K. Bell by the sulfide-iodine method. See BS J. Research 8, 309 (1932). RP415.
ⁱ Determination made by M. Marie Cron, by the vacuum-fusion method. See BS J. Research 7, 375 (1931) RP346.
^j Combustion method. Sulfur dioxide absorbed in starch-iodine solution. Titrating solution standardized on a standard steel.
^k Perchloric acid dehydration.
^l KI-Na₂S₂O₃ titration.
^m 0.023 per cent of aluminum obtained by the bicar-

bonate-phosphate method for aluminum soluble in H₂SO₄ (1:9).
ⁿ Solution in HCl, reduction with Stanredue, and titration with KIO₃.
^o Titrating solution standardized with a standard steel.
^p Absorbed in cadmium chloride solution.
^q Bicarbonate-S-hydroxyquinolate method. Titration with KBrO₃.
^r Sulfide-iodine method.
^s Finished by electrolysis.
^t Initial zinc oxide separation.
^u Weighed as ammonium phosphomolybdate.
^v Nitric-sulfuric acid method.
^w Copper precipitated with sodium thiosulfate.
^x Hydrogen sulfide-molybdic oxide method.
^y Spectrographic determination.
^z Perchloric acid oxidation.

*LIST OF ANALYSTS

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| 1. Ferrous Laboratory, National Bureau of Standards, J. L. Hague in charge. Analysis by John P. Hewlett, Jr., and William Chorney. | 5. S. A. Feldman, Alan Wood Steel Co., Conshohocken, Pa. |
| 2. K. P. Campbell, Sheffield Steel of Texas, Houston, Texas. | 6. O. W. Baldwin, Carnegie-Illinois Steel Corporation, Gary Works, Gary, Ind. |
| 3. R. H. Rouse, Bethlehem Steel Corporation, Steelton, Pa. | 7. W. D. Brown, Carnegie-Illinois Steel Corporation, Duquesne Works, Duquesne, Pa. |
| 4. Frankford Arsenal, Philadelphia, Pa. | |

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

WASHINGTON, May 15, 1944.

LYMAN J. BRIGGS, *Director.*