

U. S. DEPARTMENT OF COMMERCE

National Bureau of Standards

Certificate of Analyses

OF

STANDARD SAMPLE 156 CHROMIUM-NICKEL-MOLYBDENUM STEEL (N.E. 9450)

| ANALYST* | C | Mn | | P | S | | | Si | Ni | Cr | Mo | | | |
|-------------------|--------------------|--|---------------------|---|-------------------------------|--|---|---------------------|---------------------|---------------------------|---------------------|--|---------------------|---------------|
| | 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 (HCl sp gr 1.18-ZnS-iodine - theoretical sulfur titer) ^b | Combustion | | Sulfuric acid dehydration | | FeSO ₄ -KMnO ₄ titration | | |
| 1..... | 0. 513 | 1. 40 | 1. 39 | 0. 033 | ^c 0. 032 | 0. 017 | 0. 018 | ^d 0. 226 | 0. 050 | 0. 474 | ^e 0. 427 | ^f 0. 002 | ^g 0. 137 | 0. 138 |
| 2..... | . 510 | | 1. 40 | . 031 | | . 017 | ^h 0. 017 | ⁱ . 218 | ^j . 051 | . 481 | . 432 | | ^k . 134 | . 136 |
| 3..... | . 515 | ^l 1. 41 | | . 031 | | . 017 | . 017 | . 229 | ^m 0. 056 | . 472 | . 434 | | ⁿ . 143 | . 144 |
| 4..... | . 526 | | 1. 40 | ^o 0. 032 | | . 032 | . 016 | ^p . 016 | ^q . 22 | ^r . 48 | ^e . 43 | | ^s . 135 | |
| 5..... | ^e . 517 | | 1. 42 | ^t 0. 031 | | . 018 | | ^u . 019 | ^v . 225 | . 051 | . 470 | . 422 | ^s . 137 | . 134 |
| | . 516 | | ^t 1. 42 | ^v 0. 032 | | ^t 0. 031 | ^t 0. 019 | ⁱ . 231 | ^m 0. 056 | . 467 | . 421 | | | . 132 |
| | . 519 | ^l 1. 41 | 1. 41 | . 029 | | . 018 | . 017 | ⁱ d. 224 | ^m 0. 053 | . 464 | . 422 | | ^s . 139 | . 140 |
| | . 518 | | ^t 1. 40 | ^t 0. 033 | | . 017 | . 016 | ^d . 224 | . 054 | . 480 | . 429 | | ^p . 142 | |
| 9..... | . 519 | | 1. 41 | ^t 0. 032 | | . 018 | . 018 | ^h 0. 018 | ^q d. 219 | . 049 | ^e . 437 | | ^p . 139 | . 138 |
| 10..... | . 507 | 1. 38 | ^t 1. 40 | . 031 | | . 031 | ^w 0. 018 | ^d . 231 | ^j . 053 | ^x . 476 | . 428 | | | . 137 |
| 11..... | . 508 | ^v 1. 38 | 1. 39 | . 032 | | | | ⁱ d. 228 | ^s . 051 | . 481 | . 435 | | | . 138 |
| 12..... | . 515 | | ^z 1. 39 | . 031 | | . 030 | | ^d . 234 | ^m 0. 055 | ^r . 474 | . 432 | | ⁿ . 138 | . 140 |
| Averages.. | 0. 515 | 1. 40 | 1. 40 | 0. 032 | 0. 031 | 0. 017 | 0. 017 | 0. 018 | 0. 053 | 0. 475 | 0. 429 | 0. 002 | 0. 138 | 0. 138 |
| General average.. | 0. 515 | 1. 40 | | 0. 032 | | | 0. 017 | 0. 226 | 0. 053 | 0. 475 | 0. 429 | 0. 002 | 0. 138 | |

^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 2I:1S.

^c Molybdenum-blue photometric 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 α-Benzoinoxime method. See BS J. Research 9, 1 (1932) RP453.

^h Sulfur dioxide absorbed in starch-iodine solution. Titration with KIO₃ solution.

ⁱ Nitric-sulfuric acid dehydration.

^j KI-Na₂S₂O₃ titration.

^k NaOH separation, molybdenum precipitated and weighed as PbMoO₄.

^l Titration with arsenite solution.

^m Finished by electrolysis.

ⁿ H₂S-MoO₃ method.

^o Weighed as ammonium phosphomolybdate.

^p Sulfur evolved as H₂S by passing H₂+HCl over drillings at 950° to 1,000° C.

^q Perchloric acid dehydration.

^r Glyoxime-cyanide titration method.

^s Differential-gasometric after sodium hydroxide treatment of exit gases.

^t Titrating solution standardized by use of a standard steel.

^u Sulfur gases absorbed in NaOH-H₂O₂ solution. Titrated with H₂SO₄ solution.

^v Yellow precipitate ignited and weighed as P₂O₅-24MoO₃.

^w Evolution with diluted HCl (1+1).

^x Glyoxime precipitate ignited and weighed as NiO.

^y Chromium removed as PbCrO₄.

^z Copper precipitated as CuCNS and titrated with standard KIO₃ and Na₂S₂O₃.

^{aa} Chromium volatilized as CrO₂Cl₂.

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E. U. CONDON, Director.