U. S. DEPARTMENT OF COMMERCE

# National Bureau of Standards

## Certificate of Analyses

## Standard Sample 13E

## Basic Open-Hearth Steel, 0.6% Carbon

| ANALYST | C | Mn | | P | | S | | | Si | Cu | Ni | Cr | V | Mo | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Direct combustion | Bismuthate ($FeSO_4$-$KMnO_4$) | Persulfate-Arsenite | Gravimetric (weighed as $Mg_2P_2O_7$ after removal of arsenic) | Alkali-Molybdate [a] | Gravimetric (direct oxidation and precipitation after reduction of iron) | Combustion | Evolution with HCl (1-1) ZnS-Iodine (theoretical sulfur titre) [b] | Sulfuric acid dehydration | $H_2S$-CuS-CuO | Weighed as nickel dimethylglyoxime | $FeSO_4$-$KMnO_4$ titration | Colorimetric | | |
| 1 | 0.636 | | [c] 0.894 | 0.020 | [d] 0.020 | 0.015 | [e] 0.015 | 0.014 | [f] 0.244 | 0.101 | 0.114 | [g] 0.131 | [h] 0.002 | 0.032 | |
| 2 | .638 | | [i] .885 | | [i] .022 | .017 | [i,j] .016 | | [k] .235 | [l] .108 | [m] .115 | [i,n] .130 | | .030 | |
| | .638 | | [i] .887 | | [d] .021 | | [i,o] .017 | [i,p] .016 | [q] .240 | [r] .092 | .107 | [i,n] .122 | [s] .004 | .032 | |
| 4 | .634 | 0.885 | [i] .889 | .019 | .020 | .017 | [i,j] .017 | [p] .017 | [q] .240 | [t] .106 | [u] .107 | [n] .128 | [s] .004 | .033 | |
| 5 | .632 | [i,v] .884 | [i] .894 | | [i] .022 | .015 | [e] .015 | .014 | [f,q] .237 | [l] .112 | .102 | [i,n] .120 | [w] .003 | [x] .030 | |
| 6 | .639 | .897 | .898 | .021 | .020 | .016 | .017 | .017 | .240 | [y] .102 | .118 | [n] .135 | [z] .001 | .033 | |
| Average | **0.636** | **0.889** | **0.891** | **0.020** | **0.021** | **0.016** | **0.016** | **0.015** | **0.239** | **0.103** | **0.110** | **0.128** | **0.003** | **0.032** | |
| General average | **0.636** | **0.890** | | **0.021** | | **0.016** | | | **0.239** | **0.103** | **0.110** | **0.128** | **0.003** | **0.032** | |

[a] 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.

[b] Value obtained by standardizing the titrating solution by means of sodium oxalate through $KMnO_4$ and $Na_2S_2O_3$ and use of the ratio 2I:1S.

[c] Potentiometric titration.

[d] Molybdenum-blue photometric method. See J. Research NBS 26, 405 (1941) RP1386.

[e] 1-g sample burned in oxygen at 1,400° C, and sulfur dioxide absorbed in starch-iodine solution. Iodine liberated from iodide by titration, during the combustion, with standard $KIO_3$ solution based on 93 percent of the theoretical factor.

[f] Double dehydration with intervening filtration.

[g] Chromium separated from the bulk of the iron in a 10-g sample by $NaHCO_3$ hydrolysis, oxidized with persulfate, and titrated potentiometrically with ferrous ammonium sulfate.

[h] Vanadium separated as in (g), oxidized with nitric acid, and titrated potentiometrically with ferrous ammonium sulfate.

[i] Titrating solution standardized by use of a standard steel.

[j] Burned at 2,400 to 2,450° F with tin.

[k] Sulfuric-nitric acid dehydration.

[l] $Na_2S_2O_3$ precipitation, finished by electrolysis.

[m] Dimethylglyoxime precipitation—KCN titration.

[n] $HClO_4$ oxidation.

[o] 0.5-g sample burned at 2,580° F.

[p] Evolution with HCl (sp gr 1.18). Value omitted from the average.

[q] $HClO_4$ dehydration.

[r] $H_2S$ precipitation-diethyldithiocarbamate photometric method.

[s] $FeSO_4$-$(NH_4)_2S_2O_8$-$KMnO_4$-titration procedure.

[t] Copper-ammonia complex photometric method.

[u] Dimethylglyoxime photometric method.

[v] Bismuthate-arsenite method.

[w] Cupferron precipitation, nitric acid oxidation, potentiometric titration.

[x] $H_2S$-α-benzoinoxime-$MoO_3$ method.

[y] Finished by electrolysis.

[z] $NaHCO_3$ precipitation, photometric method.

## List of Analysts

1. Ferrous Laboratory, National Bureau of Standards, John L. Hague in charge, Analysis by James I. Shultz, J. R. Baldwin and H. J. Litsch.
2. W. F. Lantz, Bethlehem Steel Co., Bethlehem, Pa.
3. J. F. O'Mara, Great Lakes Steel Corp., Ecorse, Detroit, Mich.
4. G. W. Madsen and C. V. Rooney, Geneva Steel Co., Geneva, Utah.
5. U. S. Navy Metals Laboratory, Munhall, Pa.
6. Chemical Laboratory, Donora Steel and Wire Works, American Steel and Wire Co., R. J. Ruff in charge, Donora, Pa.

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E. U. CONDON, *Director.*

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