

# NATIONAL BUREAU OF STANDARDS REPORT

10 026

## EXAMINATION OF STEEL TRANSFER PLATE SAMPLE NO. 604

To  
Electrolytic Section  
Bureau of Engraving and Printing



U.S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS

## NATIONAL BUREAU OF STANDARDS

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The Bureau comprises the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, and the Center for Radiation Research.

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<sup>1</sup> Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D. C. 20234.

<sup>2</sup> Located at Boulder, Colorado 80302.

<sup>3</sup> Located at 5285 Port Royal Road, Springfield, Virginia 22151.

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NBS PROJECT

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NBS REPORT

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## EXAMINATION OF STEEL TRANSFER PLATE SAMPLE NO. 604

By

I. J. Feinberg  
Engineering Metallurgy Section  
Metallurgy Division

To

Electrolytic Section  
Bureau of Engraving and Printing

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U.S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS



## Examination of Steel Transfer Plate Sample No. 604

Reference: Specification for Steel Engraving Plates, Bureau of Engraving and Printing, January 19, 1961.

Material: One 0.183 in. x 2.0 in. x 4.0 in. x 4.0 in. steel plate sample, identified as No. 604 and representative of material procured for transfer plates, was examined to determine whether the material complied with specifications. The sample examined was in the hot rolled condition and was polished on one face and ground on the other.

Chemical Analysis: A conventional chemical analysis was conducted on the sample. A copy of the report is included as addendum 1. The composition of the sample, except for a slightly higher than specified manganese content, complied with the composition detailed for AISI C1031 in the referenced specification. It is noteworthy that the carbon content of the sample, 0.33 percent, is close to the upper limit of the 0.28 - 0.34 percent carbon range permitted.

Hardness: The average hardness of 72 Rockwell B obtained on the polished surface of the sample complies with that specified in the Bureau of Engraving and Printing Specification.

Metallographic Examination: A section of the sample was examined to determine the inclusion content. Uniformly distributed thin inclusions, probably manganese sulfide were found. These are shown in Figure 1. The inclusion rating using ASTM Designation E-45 as a reference is A-2.

No evidence of ferrite banding was observed in the examination of a longitudinal section, Figure 2a. Figure 2b shows no decarburization adjacent to the front (polished) surface of this material. No decarburization was found adjacent to the back surface. The microstructure of the sample is composed essentially of partially spheroidized carbides in a ferrite matrix, Figure 3.

Discussion and Conclusions: The plate sample complied with composition requirements except for a manganese content that is slightly higher than that specified. However, the composition is considered to be acceptable for the intended material use.

The carbon and manganese contents of the sample approximate the upper limits of acceptability. Therefore, this plate material may exhibit greater hardenability than that experienced with previously procured material with a lower carbon and/or manganese content. The 72 Rockwell B hardness obtained on the polished surface of this hot rolled sample complies with that specified in the Bureau of Engraving and Printing specification. Inclusion contents were low and no detrimental banding was found in examination of the hot rolled structure. This structure consisting essentially of partially spheroidized carbides in a ferrite matrix is acceptable for the intended material application.



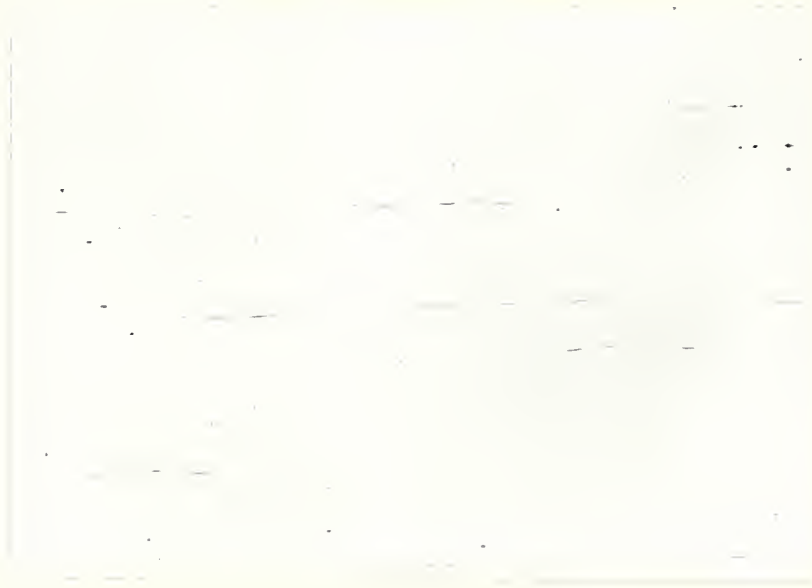
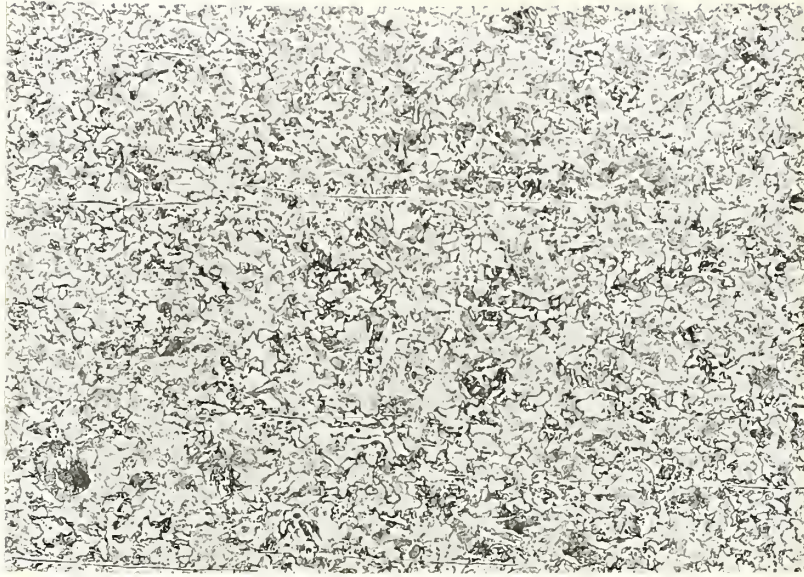


Figure 1. Thin inclusions, probably manganese sulfide, found in longitudinal section of plate sample No. 604. Unetched. X 100.

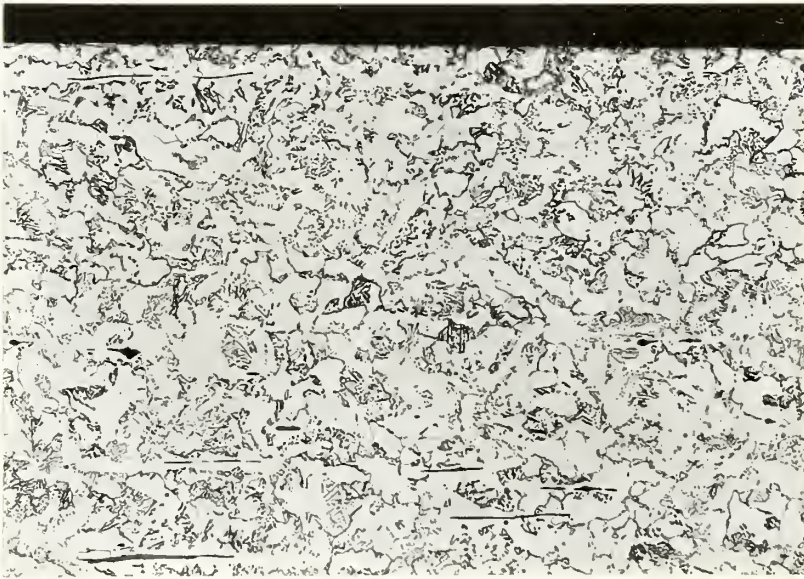






a

Polished  
surface →



b

Figure 2. Microstructures of hot rolled plate sample No. 604.

- a. Shows no evidence of ferrite banding in longitudinal section. Etched with 2% picral. X 100.
- b. Shows no decarburization adjacent to front (polished) surface. Etched with 2% picral. X 200.



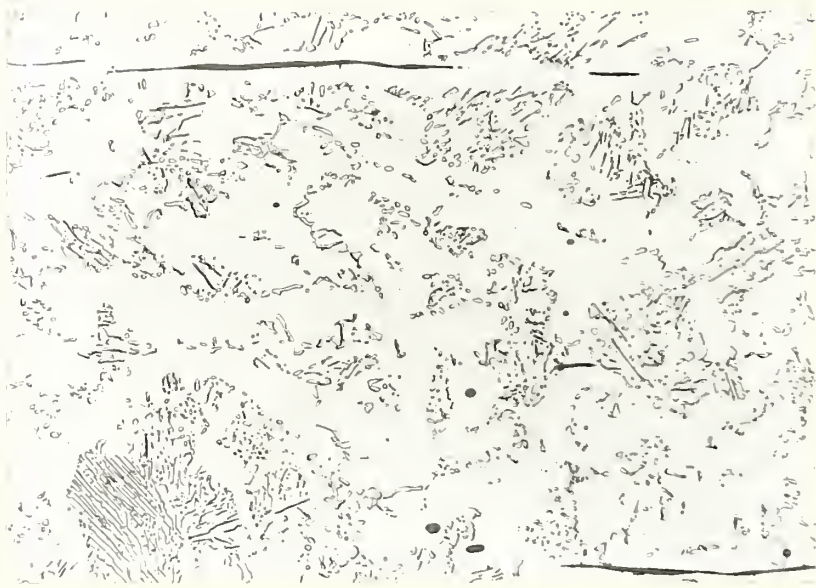


Figure 3. Microstructure observed in hot rolled plate sample No. 604. Ferrite (white) and partially spheroidized carbides. Etched with 2% picral. X 500.



VALUE ENGINEERING COMPANY  
 Materials Evaluation Laboratory  
 2316 Jefferson Davis Highway  
 Alexandria, Virginia 22301

CERTIFICATE OF TEST RESULTS

Material .. Steel Sample "604" ..... No. of Samples .. 1 ..  
 Submitted By .. National Bureau of Standards ..... Date Submitted 3/14/69 ..  
 Tests Performed .. Chemical Analysis .....

CHEMICAL ANALYSIS

Al .....	Mg .....	Pb .....	Zn .....
C .. <u>0.33</u> .....	Mn .. <u>0.65</u> .....	S .. <u>0.018</u> .....	_____
Cr .....	Mo .....	Si .. <u>0.20</u> .....	_____
Cu .....	Ni .....	Sn .....	_____
Fe .....	P .. <u>0.011</u> .....	Ti .....	_____

Analysis Performed By ..... In accordance with .....

TENSILE TEST

Sample No.	Yield Strength, psi	Tensile Strength, psi	Per Cent Elongation in... Inches	Per Cent Reduction In Area

Test Conducted By ..... In accordance with .....

HARDNESS

Sample or Position No.	Hardness .....	Sample or Position No.	Hardness .....

Test Conducted By ..... In accordance with .....

Comments .....

Approved By .. *H. P. Weinberg*  
 H. P. Weinberg  
 Laboratory Director

Date ... March 25, 1969 .....



