O T T A W A March 26th, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1192.

Investigation of Atomic Hydrogen Welding Test Specimens.

(Copy No. 8.)

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
ORE DRESSING AND
METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Origin of Material and Object of Investigation:

On March 15th, 1942, the Department of National Defence (Air Services), Ottawa, Ontario, submitted for examination six test specimens of atomic hydrogen welding. These specimens consisted of strips of S.A.E. X4130 steel welded with commercial X4130 filler rod (see Figures 1 and 2). It was stated that the specimens were preheated to approximately 800° F. and welded from one side only.

These samples were accompanied by Group Captain A. L. Johnson's letter of March 14th, file No. 902-38-1 (AMAE DAI). It was requested by Flight Lieutenant A. J.

(Origin of Material and Object of Investigation, cont'd) -

Smith, who delivered these specimens, that the welds be subjected to tensile testing and to microscopic examination.

Description of Test Pieces:

The two types of test pieces submitted are shown in Figures 1 and 2. Three had the welds machined off to the thickness of the plate, as in Figure 1, and the other three remained as welded. It was stated that the specimens were welded from one side only.

Physical Tests:

Table No. I is a summary of the tensile test results obtained.

Table No. I. - Tensile Test Results.

No.	Size	Maximum load, pounds	Ultimate strength, p. s. i.	Elongation, per cent in 2 in.
1	1.008" x .191"	20,600	106,700	18.0
2	1.007" x .196"	20,600	104,600	20.0
3	1.006" x .194"	20,600	105,900	26.0
4	1.009" x .256"	14,500	Broke in weld	2.0
5	1.010" x .269"	16,350	" " "	2.0
6	1.007" x .261"	20,700	" " "	2.0

Test Specimens Nos. 1, 2 and 3 broke in the parent metal (see Figure 1).

Test Specimens Nos. 4, 5 and 6 broke in the weld metal (see Figure 2).

Macroscopic Examination:

Sections of each type of weld were mounted for microscopic examination. However, subsequent examination revealed that a study of the macrostructure of the weld metal

(Macroscopic Examination, cont'd) -

was all that was necessary to show the difference between the two welds. The macrostructure was developed by etching in a 10 per cent aqueous solution of ammonium persulphate.

Figure 3 is a photograph, enlarged to twice actual size, of the macrostructure of the weld in Specimens Nos. 1, 2, and 3.

Figure 4 is a photograph, enlarged to twice actual size, of the macrostructure of the weld in Specimens Nos. 4, 5, and 6.

Conclusion:

From a study of the macrostructure of the weld metal in both groups of bars it is apparent that, while the welds in Bars 1, 2, and 3 were undoubtedly made from one side only, Bars 4, 5, and 6 were very probably welded from both sides.

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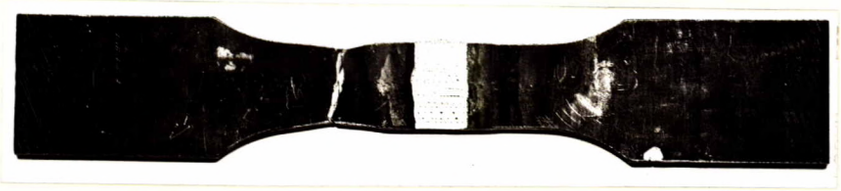
HVK:PES.

Figure 1.

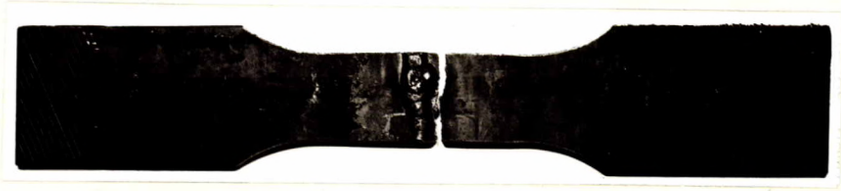


WELD TEST SPECIMEN.

Weld machined down flush. Note fracture in parent metal.

(1/3 actual size).

Figure 2.



WELD TEST SPECIMEN.

Weld not machined. Note fracture at weld.

(1/3 actual size).

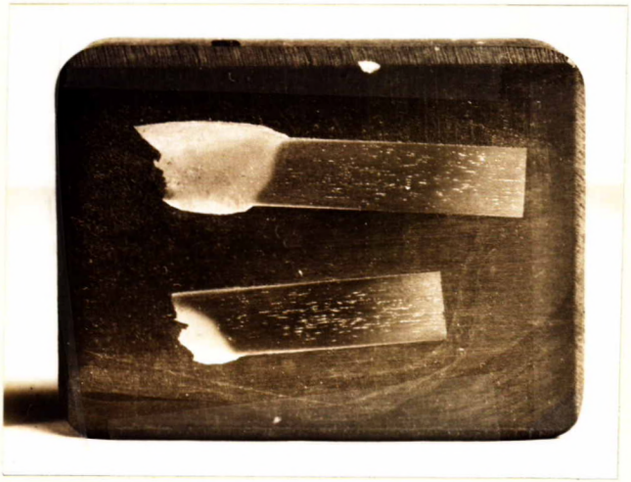
Figure 3.

Macrostructure characteristic of
Bars 1, 2, and 3.

Apparently welded from only
one side.

(Approximately 1½ times actual size).

Figure 4.



Macrostructure characteristic
of Bars 4, 5, and 6.

Apparently welded from both sides.

(Approximately 1½ times actual size).

HVK:GHB.