

O T T A W A

August 4th, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1277.

Examination of K1130 Tubes
Manufactured by Page-Hersey Tubes Limited.

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



CANADA

DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

O T T A W A

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Examination of X4130 Tubes
Manufactured by Page-Hersey Tubes Limited.

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Source of Material and Object of Investigation:

On July 22nd, 1942, Group Captain A. L. Johnson, for Chief of the Air Staff, submitted for examination nine sample specimens of SAE X4130 seam welded tubes, made by Page-Hersey Tubes Limited.

The samples were approximately 8 inches long x 1 inch O.D. x 0.048 inches thick and were stated to have received the following treatments:

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

- (1) 3 pieces in the "as welded" condition.
- (2) 3 " normalized after welding.
- (3) 3 " normalized and drawn after welding.

It was requested that the welds of the tubes be X-rayed and tested in accordance (but not necessarily in compliance) with tests called for in Specification D.T.D. 167. Hydraulic and drifting tests to Specification T26 and a survey of the hardness of the parent and weld metals were also requested.

Macro Examination:

The tubes in the "as welded" condition had a glossy finish and were free from scale, while the other heat-treated tubes had a dull grey colour and the surface was oxidized.

Hardness Tests:

Location of Reading	AS WELDED		NORMALIZED		NORMALIZED AND DRAWN	
	Vickers	Brinell	Vickers	Brinell	Vickers	Brinell
	by	by	by	by	by	by
	conversion	conversion	conversion	conversion	conversion	conversion
	:	:	:	:	:	:
Weld metal	490	454	235	235	217	217
1/16 in from weld metal	493	455	224	224	186	186
1/4 in. from weld metal	167	167	204	204	183	183
1/8 " " " "	145	145	203	203	182	182

The above hardness values were determined by the Vickers method using a 30-kilogram load.

Physical Properties:

Condition of tubing	Size, in inches	Maximum stress, p.s.i.	0.2 per cent proof stress, p.s.i.	Per cent elongation in 2 inches
Spec. D.T.D. 167	-	101,000	89,500 [⊙]	-
As welded	1.008 x .049	87,500	73,800	7.5
Normalized	1.007 x .050	102,100	56,500	22.0
Normalized and drawn	1.009 x .049	91,900	71,900	20.5
Drifting test	-	Failed	Failed	Failed
Flattening Test	-	Passed	Passed	Passed
Crushing test	-	Failed	Passed	Passed
Hydraulic test, p.s.i.	-	10,000	10,000	10,000

[⊙] Yield point.

X-Ray Examination:

The X-ray work on the welds of these tubes was carried out by Mr. L. Ball of the National Research Council. All welds on the nine samples X-rayed were found to be free from blow-holes and cavities.

Microscopic Examination:

Figures 1 and 2 show at X100 and X1000 magnification, respectively, the etched structure of the parent metal and Figures 3 and 4 show at X100 and X1000 magnification the etched structure of the weld metal of the tubing in the "as welded" condition. No decarburization of steel was observed in this condition.

Figures 5 and 6 show at X100 and X1000 magnification, respectively, the etched structure of the parent metal and Figures 7 and 8 show at X100 and X1000 magnification the etched structure of the weld metal of the tubing in the "normalizing and drawn" condition.

Figure 9 shows, at X100 magnification, an outer layer of iron oxide on the surface of the tube in the normal-

(Microscopic Examination, cont'd) -

ized and drawn condition. The decarbed area of the heat-treated tube (Figure 5) is approximately 0.008 inches.

Discussion of Results:

The welds of all the tubes were found to be satisfactory. There was some scale on the tubes in heat-treated condition. This is readily explained as it was stated that the tubes had been heat-treated in an oil furnace without atmosphere control. This condition also accounts for the decarburization observed in the parent metal (Figure 5) after normalizing and drawing.

The physical tensile properties of the normalized and drawn tubing were slightly under those given in Specification D.T.D. 167. However, the tubing passed the hydraulic flattening and crushing tests but failed to pass the drifting test. The hard spots in the welds of the tubes in the "as welded" condition were eliminated in the heat treatment.

Conclusions:

The welding technique used in the manufacture of these tubes can be considered as satisfactory.

The tubes failed to meet the tensile properties given in the specification.

A close control of the furnace atmosphere should be maintained in order to eliminate decarburization.

It is recommended that good pyrometric equipment be used in order to obtain the proper heat treatment.

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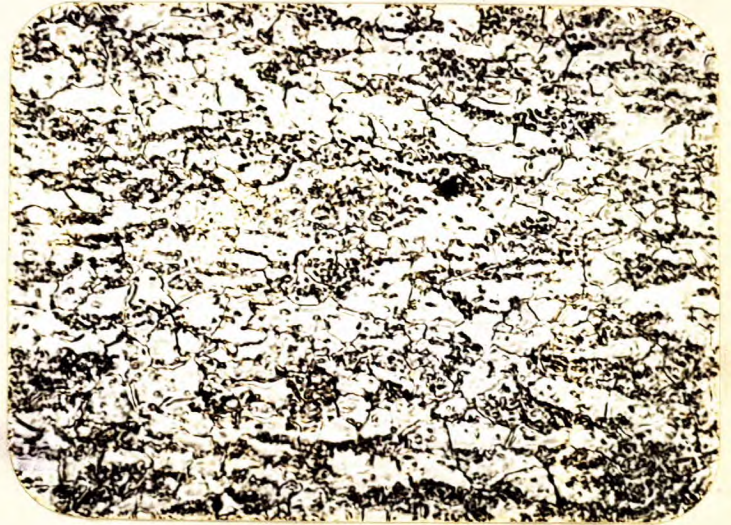
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Figure 1.

Figure 2.



X100

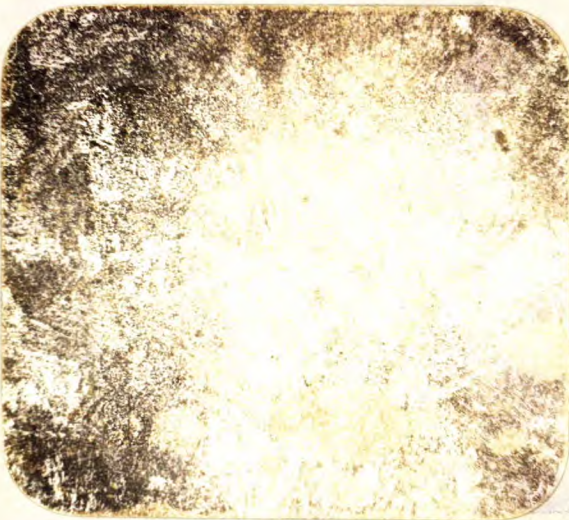


X1000

X4130 Steel Tube No. 1, showing
structure of parent metal in the
"as welded" condition.

Figure 3.

Figure 4.



X100



X1000

X4130 Steel Tube No. 1, showing
structure of weld metal in the
"as welded" condition.

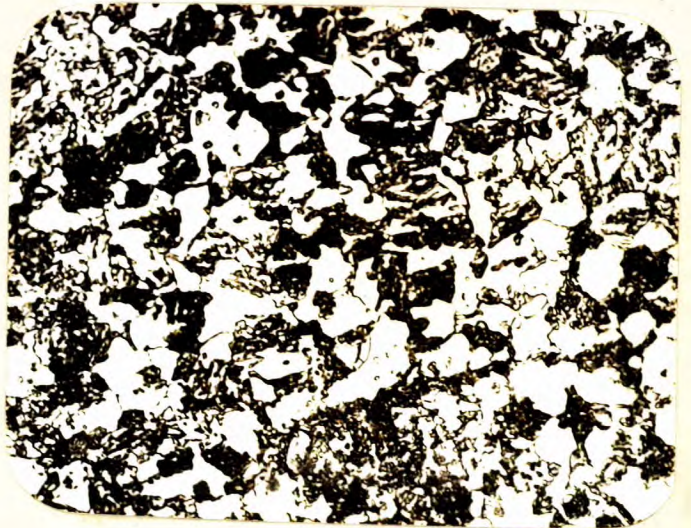
Etchant: Solution of 2 per cent
nitric acid in alcohol.

Figure 5.



X100

Figure 6.



X1000

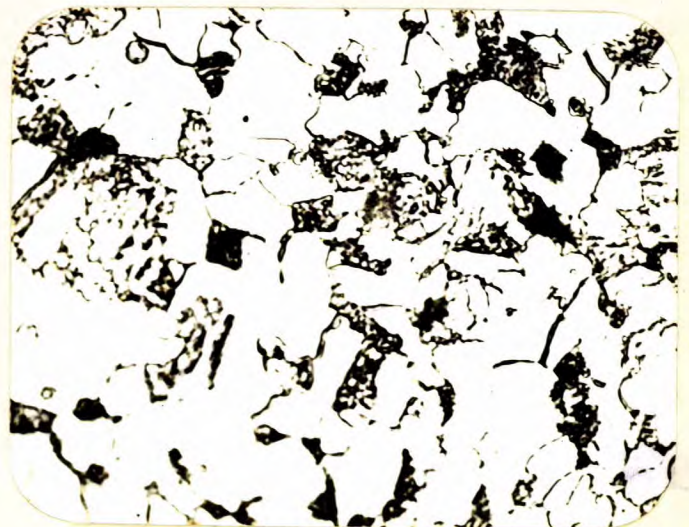
X4130 Steel Tube No. 3, showing
structure of parent metal after
"normalizing and drawn."

Figure 7.



X100

Figure 8.



X1000

X4130 Steel Tube No. 3, showing
structure of weld metal after
"normalizing and drawn."

Etchant: Solution of 2 per cent
 nitric acid in alcohol.

Figure 9.



X100

X4130 Tube No. 3, showing scale
after normalizing and drawing.

Unetched.

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NBB:GHB.