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O T T A W A September 11th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1494.

Examination of Corroded Aluminium Alloy Sheets.

(Copy No. 10.)

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 Problem:

In a letter dated July 2nd, 1943, Mr. V. J. Hatton, Chief Inspector, Aircraft Division, Canadian Car and Foundry Company Limited, Fort William, Ontario, requested the examination of some aluminium alloy sheet samples, being forwarded, which showed surface defects caused probably by corrosion.

It was stated that the sheets were made from 24ST aluminium alloy and had been received in the fully heat-treated condition. The material, prior to forming, is heated in a salt bath at a temperature of 920° F. (493° C.), then immediately quenched in water at 65° F. (18° C.), and rinsed.

The material is apparently in perfect condition up to the time of forming, but within approximately 24 hours after heat treatment corrosion becomes evident.

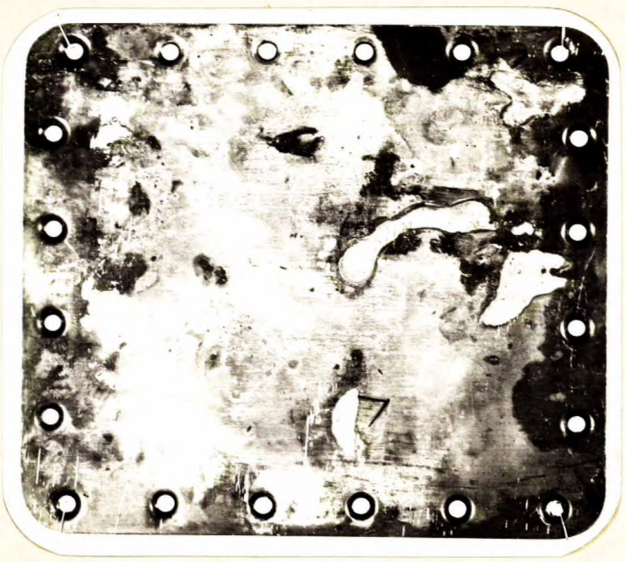
It was requested that the cause of these surface defects be determined, if possible, and suggestions made to help in overcoming this condition.

Description of Samples:

Three samples of sheet metal were received on July 6th, 1943.

Figure 1 shows one of the samples as received.

Figure 1.



SHEET SAMPLE AS RECEIVED.
(Approximately ½ size).

The surfaces of these samples show areas of discolouration and regions of apparent corrosion.

Mechanical Properties:

Tensile test specimens of normal size were taken from different locations, representative of "sound," slightly discoloured, and heavily stained surface areas. All three specimens were cut parallel to the rolling direction.

The tests gave the following results (none of them different, for all practical purposes):

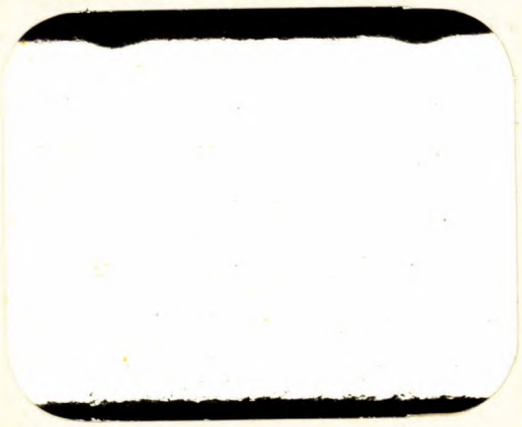
	Sample 1	Sample 2	Sample 3
	Sound	Discoloured	Corroded
0.1 per cent proof stress, p.s.i.	44,000	41,200	42,200
Ultimate tensile strength, p.s.i.	66,850	64,200	65,400
Elongation, per cent in 2 inches	15	10.5	12
Elongation, per cent in 1 inch	19	14	15

Microscopic Examination:

Figure 2 shows the cross-section of an apparently corroded spot, and reveals only minor pits on the surface.

Figure 3 shows the generally sound structure of the material.

Figure 2.



X100, unetched.

Figure 3.

X100, Keller's etch.

CROSS-SECTION OF "CORRODED" SPOT.

Discussion of Results:

Mechanical tests revealed practically no differences in the properties of the three representative specimens examined.

Microscopic examination showed only minor pitting on the surface of the stained and apparently corroded locations on the sheet specimens.

Some years before the present war, the writer of this report made a thorough investigation on a similar problem. This included a study of the effect of various surface defects of duralumin-type aluminium alloy sheets upon their corrosion resistance. The type of surface condition encountered in the present investigation was included in that previous work.

The results of this previous study* revealed that

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* Publications of the Institute of Testing Materials of the University at Lwów, Poland. No. 32 (1935), pp. 1-7. Also published in Czasopismo Techniczne, Lwów, Poland. Vol. 53, No. 11 (June 10, 1935), pp. 217-223. (Both in Polish).

(Discussion of Results, cont'd) -

such defects were not very serious, especially when the surface is covered with a protective coating. Long storage of the exposed material, however, may result in more serious corrosion.

It was found that this type of surface defect is caused by improper handling of the sheet surfaces before or during the heat treatment (greasy fingermarks, contact between plates in the heat-treating operation, carburization of oil spots during subsequent heat treatment, etc.). All these surface effects become visible only during the ageing process, that is, some time after quenching and storing at room temperature.

CONCLUSION:

The surface defect in question, which is caused by improper handling in manufacturing operations or by lack of proper protection of surface, is not regarded as being serious, particularly should the material be used without a long period of storage. Storage, however, is liable to aggravate the condition.

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