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November 23, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES

Investigation No. 1968.

Metallurgical Examination and Corrosion  
Resistance Tests on Zinc Die Cast and  
Cast Iron Motor End Heads.

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Origin of Material and Object of Investigation:

On June 13, 1945, two motor end heads (see Figure 1), one made of cast iron and the other fabricated as a zinc die casting, were submitted to these Laboratories by Mr. G. F. Bush, Chief Metallurgist, The McKinnon Industries Limited, St. Catharines, Ontario, via Mr. J. H. Parkin, Director, Division of Mechanical Engineering, National Research Council, Ottawa, Ontario.

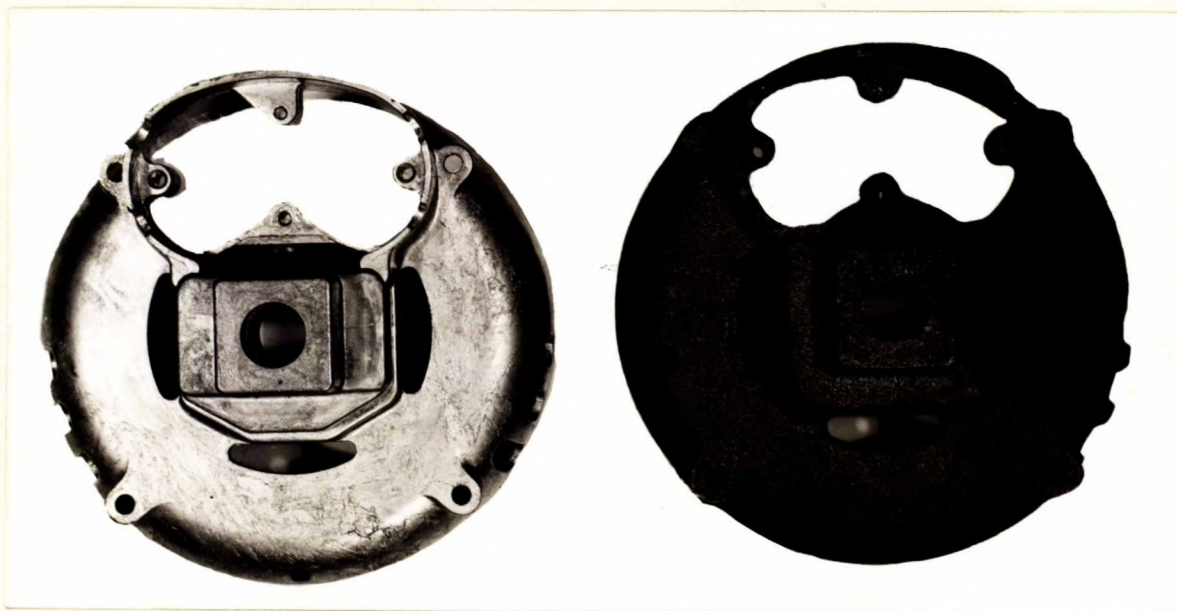
The covering letter, dated May 30, 1945, stated that it was proposed to substitute zinc base alloy No. A.S.T.M. XXIII for grey cast iron, to be used on washing machines and electric

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

refrigerators. It was requested that an opinion be given as to the "relative merits of the two heads for long time, trouble-free service."

As a result of correspondence received from Mr. Bush, dated August 13 and August 23, 1945, it was decided to investigate the corrosion resistance properties of the zinc die cast motor end head, in order to determine its suitability for the desired application.

Figure 1.



MOTOR END HEADS.

Zinc die casting (left).  
Grey cast iron (right).

(Approximately 4/9 actual size).

#### PROCEDURE

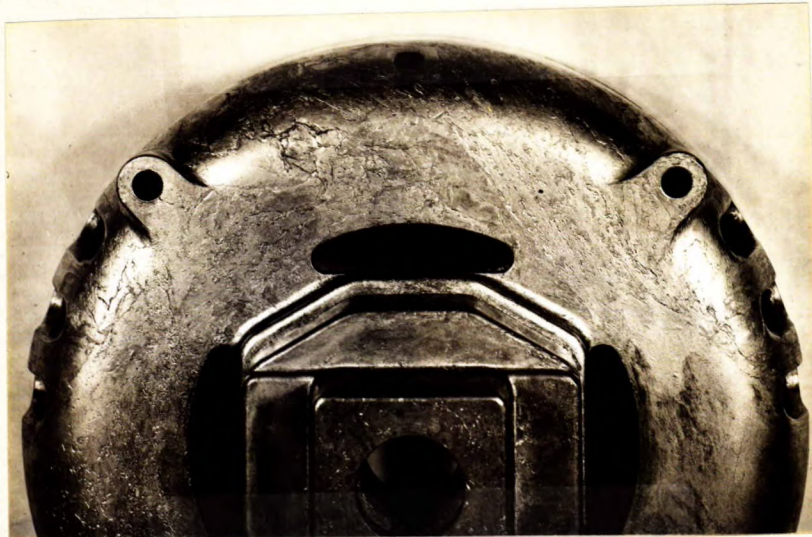
##### 1. VISUAL EXAMINATION.

Visual examination of the zinc die cast motor end head indicated surface defects (see Figure 2) which may have been caused by the low temperature of the die casting machine during the initial operation.

(Continued on next page)

(Procedure, Visual Examination, cont'd) -

Figure 2.



ZINC DIE CAST END HEAD.

Showing surface defects.

2. RADIOGRAPHY.

Radiographs made of the castings submitted showed minor casting defects in both the zinc and the cast iron components.

3. CORROSION TESTS.

A. Steam Cabinet Test -

A section of the zinc die casting motor end head was placed in a steam cabinet for 262 hours. The cabinet temperature was controlled at  $204^{\circ} \pm 1^{\circ}$  F. throughout the tests and had a relative humidity of approximately 100 per cent.

At the termination of the test it was noted that the sample was covered with a white corrosion product. The sample was then sectioned and examined under a microscope. Some intercrystalline corrosion was found near the surface of the sample (see Figure 3).

The Steam Cabinet Test is a standard test performed on zinc die castings in order to determine the presence of flux inclusions or other imperfections. Nothing of this

(Procedure, Corrosion Tests, cont'd) -

nature was found; the white intercrystalline corrosion product was expected under these conditions.

Figure 3.



X200, unetched.

SPECIMEN SUBJECTED TO STEAM CABINET TEST.

Showing normal intercrystalline corrosion at surface of specimen.

B. Accelerated Indoor Corrosion Test -

A second sample of the zinc die casting was placed, for a period of 262 hours, in a cabinet under an atmosphere resembling severe indoor conditions. The temperature was controlled at  $120 \pm 2^\circ$  F. throughout the test and had a relative humidity of approximately 100 per cent. On removal the sample showed very little evidence of corrosion on the surface. This sample was also sectioned and examined under a microscope. No evidence of intercrystalline corrosion could be found.

C. Accelerated Outdoor Corrosion Test -

A third sample of the zinc die casting motor end head was subjected to an accelerated outdoor corrosion test for a period of 1,186 hours, the conditions of the test having been designed so as to simulate severe outdoor, non-industrial service conditions.

Throughout the test the samples were kept at a

(Procedure, Corrosion Tests, cont'd) -

temperature of  $130^{\circ} \pm 2^{\circ}$  F., and were exposed to rays (resembling that of the sun) emitted from an arc lamp. The specimens were alternately soaked by a direct water spray for 3 minutes and dried by the heat from the arc lamp for 17 minutes. On removal, the sample showed very little evidence of corrosion on the surface. This sample was also sectioned and examined under a microscope. No evidence of intercrystalline corrosion could be found.

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Conclusions:

The results of the above tests indicate that zinc die castings similar to the one submitted would have a sufficient corrosion resistance to render them entirely satisfactory for motor end heads on small commercial motors, used on washing machines and refrigerators.

Corrosion was found to occur only in Test A, under conditions much more severe than would be encountered under ordinary service conditions.

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AF:GV:LB.