O T T A W A August 10th, 1944.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1699.

Investigation of Generator Base Failures.

(Copy No. 10.)

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Origin of Request and Object of Investigation:

On July 22nd, 1944, a request was received from Lieut. F. H. Iliffe, of the Directorate of Electrical and Communications Design, Department of National Defence (Army), Ottawa, Ontario, for an investigation into the failure of grey iron generator base castings. The request was accompanied by one of the broken castings.

Macro-Examination:

The casting had a normal grey iron fracture. Shrinkage cavities were observed at the thicker sections of the fracture. The surface of the casting was clean and sound. The casting was $\frac{1}{4}$-inch thick at the point of fracture, with four cross-ribs giving additional support.

Chemical Analysis:

The casting was found to have the following analysis:

		Per cent
Total carbon	-	3.39
Graphitic carbon	-	2.99
Silicon	-	2.38
Manganese	-	0.70
Phosphorus	-	0.106
Sulphur	-	0.068
Nickel	-	Trace.
Chromium	-	Nil.

Physical Tests:

The Brinell hardness (average of four readings) was found to be 135.

The tensile strength of a specimen cut from the casting was found to be 18,000 p.s.i.

Microstructure:

Figure 1 is a photomicrograph of the unetched structure.

Figure 2 is a photomicrograph of the structure after etching in hydrochloric and picric acids (Vilella's etch).

Discussion:

The low hardness and tensile strength indicate that this is an A.S.T.M. Spec. A48-36, Class 20 grey iron. The sizes and arrangement of the graphite particles are typical of this grade of iron.

The castings were free of surface defects. The shrinkage cavities observed are not an abnormal condition. They

(Discussion, cont'd) -

occur on the central axis of any stresses applied, and in this case are not particularly harmful.

The casting failed because service conditions required greater strength than the metal possesses. The remedy is to specify the use of a better grade of iron, or to lower the stresses by increasing the amount of metal in the casting.

Conclusions:

1. The castings are probably made of A.S.T.M. Specification A48-36, Class 20 grey iron.

2. Service conditions are too severe for this grade of metal.

Recommendations:

1. Continue the use of a Class 20 grey iron and increase the thickness of the casting, or increase the number of reinforcing ribs to lower the stress on the metal.

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2. Specify the use of an A.S.T.M. Spec. A48-36, Class 30 (or higher) grey iron. Have the manufacturer cast standard A.S.T.M. test bars to ensure that this grade is being used.

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3. Specify the use of malleable iron.

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AEM:GHB.

Figure 1.

X100, unetched.

Figure 2.

X100, etched in picric
and hydrochloric acids.

MICROSTRUCTURE OF CASTING RECEIVED.

Typical A.S.T.M. Specification A48-36,
Class 20 grey iron.

AEM:GHB.