



an EnPro Industries company

FM Notification Report Serial Number 10-06

Fairbanks Morse Engine

10CFR 21.21 (d)(3)(ii) Notification

(i) Name and address of the individual or individuals informing the Commission.

Mr. Dominic Dedolph
Quality Assurance Manager
Fairbanks Morse Engine
701 White Avenue
Beloit, WI 53511

Telephone: 608-364-8132

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

Facility:

Utilities operating Fairbanks Morse (FM) Opposed Piston (OP) Emergency Diesel Generators (EDG) that have purchased bearings which may have linear indications are as follows:

- Exelon – Limerick Generating Station
- Exelon – Peachbottom Power Station 387
- Excel Energy – Prairie Island

Basic component which fails to comply or contains a defect:

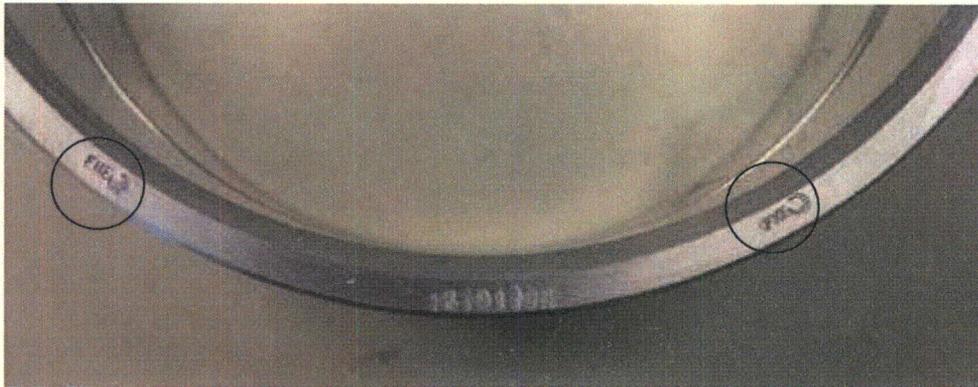
Aluminum bearings that were shipped for the OP EDG that are suspect for linear indications are as follows:

Part Number	Description	Shipped After
16701708*00	OP Connecting Rod Bearing	6/3/2008
16603841*00	OP Main Bearing, Plain	10/16/2008
16200711*00	OP Main Bearing, Lower Special	10/16/2008
16300396*00	OP Cam Bearing, Plain	3/22/2010
16300424*00	OP Cam Bearing, Control End	3/22/2010

JE19
MRR

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All bearings that are suspect for linear indications are stamped with two FM swirl logos as shown in the photo. Linear indications have only occurred on bearings machined from the latest permanent mold castings which are identified with two FM swirl logos as shown:



(iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.

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(iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

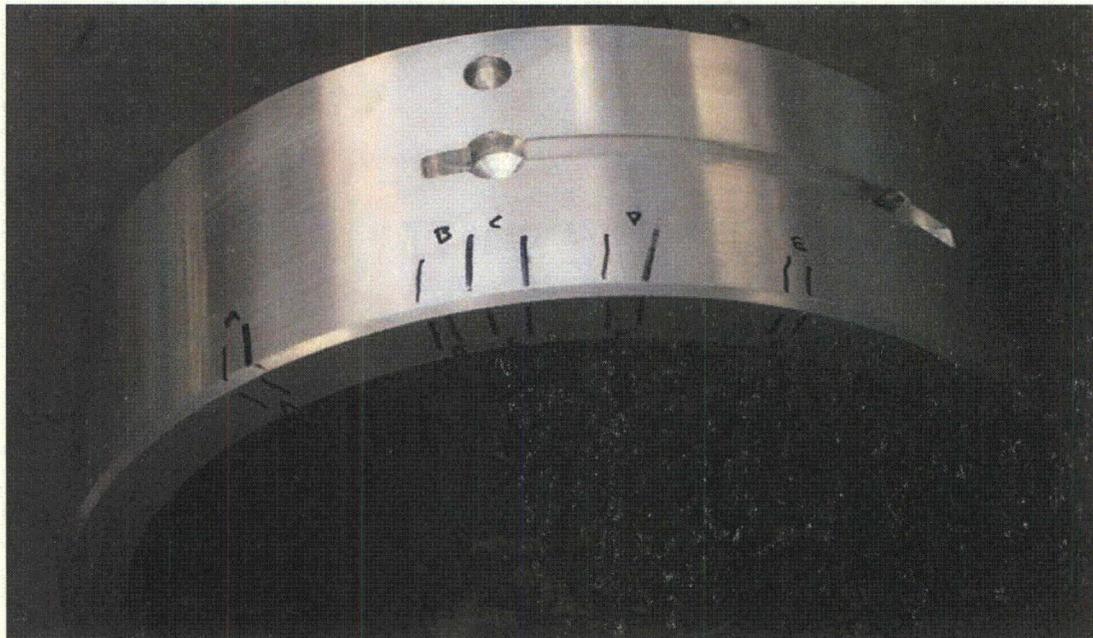
Nature of defect:

Linear indications (hot tears) were observed on one main bearing by the FM production inspector. The indications were only on one edge of the bearing. The indications went across the entire edge and extended about 1 inch deep into the bearing, being visible on the outside diameter and the inside diameter for about 1 inch. Subsequent 100% liquid penetrant inspection (PT) of all finished bearings in stock has found linear indications on 13 of 454 bearings (3% reject rate) made from permanent mold castings.

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All rejects are from permanent mold castings identified by two FM swirl logo stamps. No rejects were found on bearings stamped with a single FM swirl logo, which are made from continuous cast material.

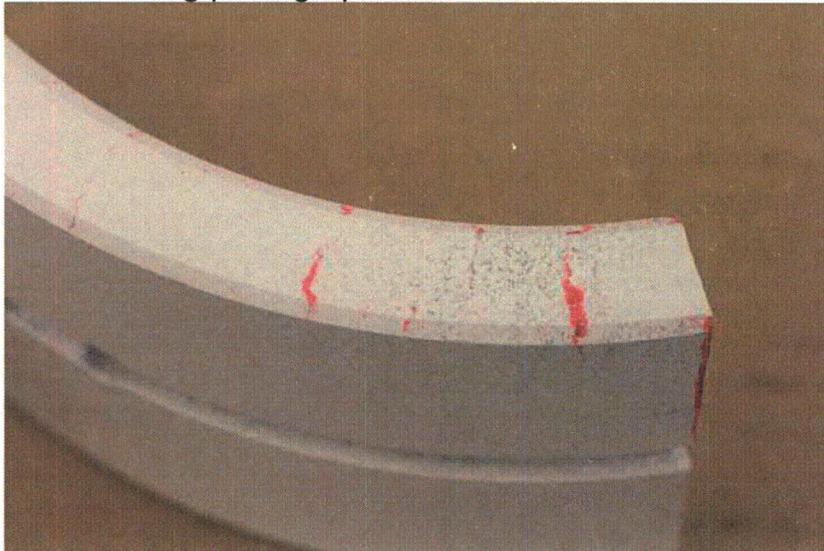
The following photo shows the location of the linear indications marked along one edge of the bearing:



The following photomicrograph at 7X magnification shows a visually apparent linear indication:



The following photograph shows linear indications observed by PT:





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Safety hazard which could be created by such defect:

No bearing failures in engines have been linked to linear indications. It is not possible by engineering analysis or any other means to provide reasonable assurance that a linear indication (hot tear) on any of the above listed bearings will not propagate, resulting in a catastrophic bearing failure. A failure of this type has potential for collateral engine damage resulting in a substantial safety hazard. A single bearing failure has the potential to cause lube oil flow and pressure changes in the lube oil system, resulting in the failure of other bearings, damage to crankshaft journals, and high lube oil filter differential pressure from bearing debris. A failure of this type will result in a loss of load carrying capability of the generator set and require shutdown of the engine, preventing the EDG from performing its safety function.

(v) The date on which the information of such defect or failure to comply was obtained.

The first linear indication defect was internally discovered by the machine operator during visual inspection of in-process machined bearing castings at FM. The first Nonconformance Report (NCR) for this defect, number 209413, was initiated on 12/3/2010.

(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of all such components in use at, supplied for, or being supplied for one or more facilities or activities subject to the regulations in this part.

Bearings purchased by nuclear utilities which may have linear indications are shown in the following table:

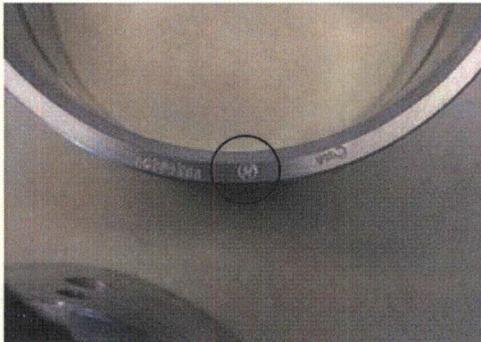
Location	Qty	Part Number	Description	Order #	Ship Date
Prairie Island	1	16200711*00	OP Main Bearing, Lower Special	00031424	3/23/10
Prairie Island	2	16603841*00	OP Main Bearing, Plain	00031511	5/6/10

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Peach-bottom	2	16300424*00	OP Cam Bearing, Control End	90 167610 REL 001016	5/19/10
Limerick	24	16701708*00	OP Connecting Rod Bearing	90 167610 REL 001023	5/12/10
Limerick	43	16603841*00	OP Main Bearing, Plain	90 167610 REL 001023	5/12/10
Limerick	7	16300396*00	OP Cam Bearing, Plain	90 167610 REL 001034	8/24/10
Limerick	4	16300424*00	OP Cam Bearing, Control End	90 167610 REL 001036	8/3/10
Limerick	6	16701708*00	OP Connecting Rod Bearing	90 167610 REL 001036	8/3/10

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.

Effective February 7, 2011, FM is performing PT inspection on all aluminum OP bearings to verify there are no linear indications. Bearings that are accepted are being stamped with an "M" inside of a circle as shown in the following photo:





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The root cause of the problem occurs during the casting of the aluminum material in the permanent mold. The linear indications occur only on one edge of the casting, which has been identified as the bottom of the casting. During the cooling and solidification of the molten material poured into the permanent mold tool, the material shrinks and must be continuously replenished with molten material from the top of the casting. If the top of the casting solidifies before the bottom, there is no additional molten material available from the top to feed the bottom as it cools and shrinks, resulting in tears (hot tears) to the material on the bottom of the casting. It is suspected these hot tears are occurring due to improper cooling of the mold tool core. Because there are no cooling passages within the solid mold tool core, the core becomes progressively hotter throughout the production run until the core reaches a temperature hot enough to cause the hot tears.

As additional permanent corrective action, the FM supplier is adding air cooling passages to the permanent mold tool cores prior to any additional castings being poured. Core cooling creates directional solidification of the casting, from the inside to the outside and from the bottom to the top. Future production runs of bearings from new castings will be stamped with an FM lot number that traces to the supplier casting heat number and allows tracking the effectiveness of the corrective actions.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

All aluminum OP bearings stamped with a double FME logo, as listed in the previous table, are suspect for having linear indications and should be returned to FME for inspection.