



BEARING FAILURE ANALYSIS

**Example Type B Report**

**Cylindrical Roller Electric Motor Bearing Failure**

1. INTRODUCTION

A single rhombic ball bearing unit (BBU) plus casting and bearing was supplied to us for inspection and report. We have no information on intended or fitted application. On removal of the outer packaging, the casting and BBU were found. A single hair line crack was seen running through the casting at a point approximately 90 degrees from the centre-line of the bolt holes, (See Fig 1).



Fig 1

2. INSPECTION

The ball bearing was carefully removed from the casting and cleaned. Excess new lubricant found on the outer surfaces of the bearing and on the self-aligning inner surface of the casting was wiped away.

2.1 Ball Bearing

The bearing was turned by hand and found to feel and rotate normally. The inner ring showed clear fitting marks identified by scratch lines across the ring bore metal.

## 2.2 Rhombic Casting

On close inspection of the back face and around the bolt holes it was clear that the casting had been fitted to a framework of some type. Small indentations were seen on the back face and there was evidence of wearing of the "painted" surface in a circumference round the bolt holes.

The machined self-aligning surface was then inspected. Points along the centre-line of bolt holes appeared normal and undamaged (Fig 2). However, evidence that a unit had been installed could again be seen.



Fig 2

The casting was viewed at 90 degrees to the crack and a deep raised lip was noted (Fig 3).



Fig 3

The lip was inspected using a macro viewer and seen to correspond to the form and shape of the outer edge of the BBU outer ring. The marking clearly indicated that a grossly misaligned bearing had been present in the casting and that a large amount of thrust force, possibly from the tightening of the casting bolts, had been applied.

The casting was turned through 180 degrees and the area around the crack inspected (Fig 4).



Fig 4

Once again a raised lip was seen, confirming misalignment and the application of an unnaturally heavy thrust force. At the thinnest point of the casting and correspondingly the deepest point of the lip, the crack was seen to run (Fig 4).

### 3. DISCUSSIONS AND CONCLUSIONS

Cast iron housings are prone to cracking if excess or unnatural forces are applied to them at an angle or through an unintended plane of loading.

On this occasion a thrust load appears to have been applied to the casting as a result of the outer angle of the ball bearing outer ring being pressed into the casting under a condition of misalignment.

One possible scenario that could cause such a chain of events is that the BBU was placed into the shaft and the shaft locking grub screws tightened, this would produce marks similar to the fitting lines seen in the bearing inner ring bore.

If the casting locating bolts are then fully tightened (with no attempt made to align the bearing within the casting during the tightening process) it is highly likely that the corner of the misaligned outer bearing ring will induce a stress raiser that will transmit heavy forces into the casting. This will almost inevitably result in cracking of the type seen on this occasion.

No bearing manufacture defects were found during the investigation and therefore the reason for this complaint appears to be fitting damage.