Machinery Diagnostics Institute

Case Study: Inner Race Bearing Defect

Introduction

Inner race bearing defects can be a significant problem in many industrial applications. The inner race is part of the bearing that rotates against the shaft. Defects in the inner race can lead to increased vibration, noise, and decreased performance of the machine. In severe cases, the bearing can fail completely, which can lead to the machine breaking down or even catastrophic failure. In this case study, we will illustrate what inner race bearing defects look like as part of the vibration spectrum collected during routine data collection.

Analysis

MDI was commissioned to perform routine data analysis at a Pulverized Coal Mill. Inner race defects were found on two machines:

- Motor on a PF Mill
- Motor on an Auxiliary Water Pump

MDI utilized the following hardware for this analysis:

- CTC's AC294 Compact Size, Side Exit, 100 mV/g Accelerometer
- CTC's MH214-3A Magnetic Mounting Base
- CTC's CB104-C555-006-K2C-SF Cable and Connectors Assembly
- CSI 2130 Data Collector

Utilizing a cable with a breakaway safety feature for portable data collection (as shown here) is extremely important for analyst safety while collecting data on large operating machinery

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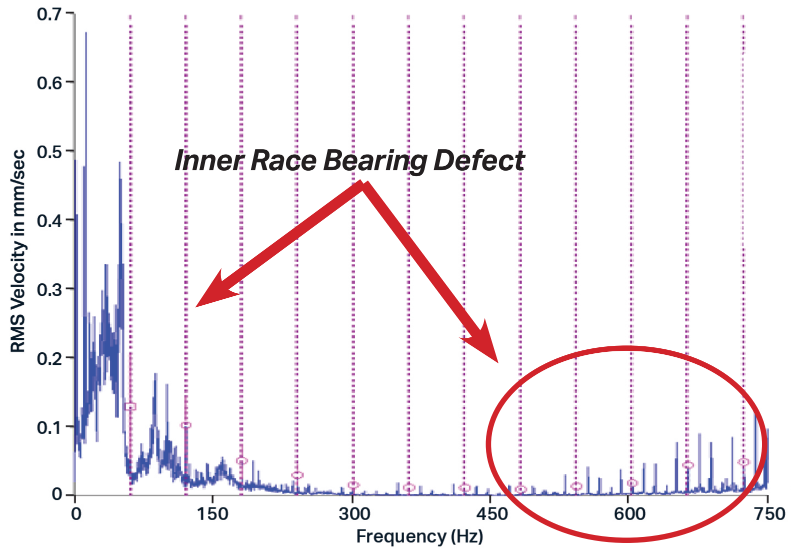
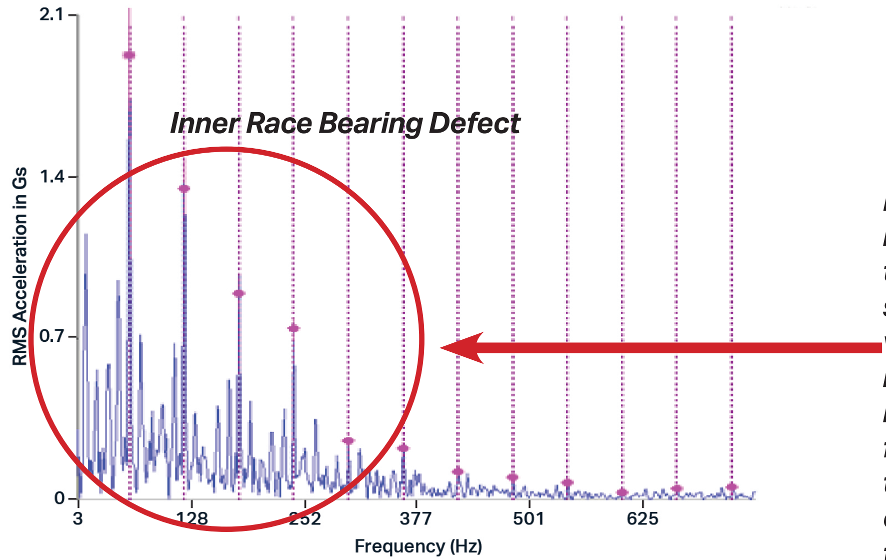
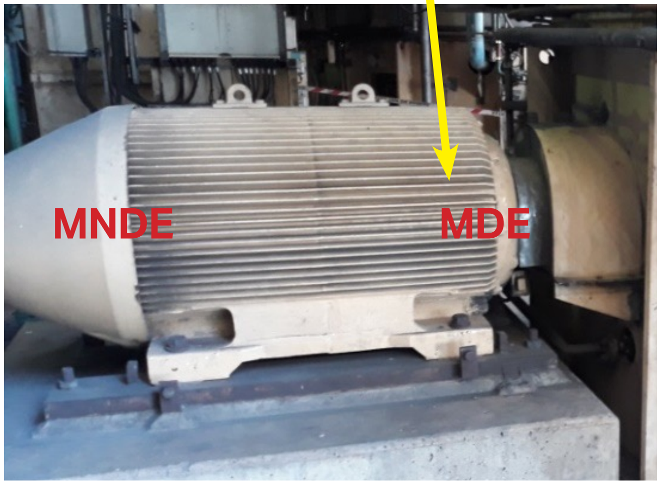




Motor drive end bearing. Velocity and the Peakvue spectrum showed elevated vibration at the inner race defect frequency initiative of bearing fault, the Peakvue trend showed increase on vibration levels up to 2.1 g's



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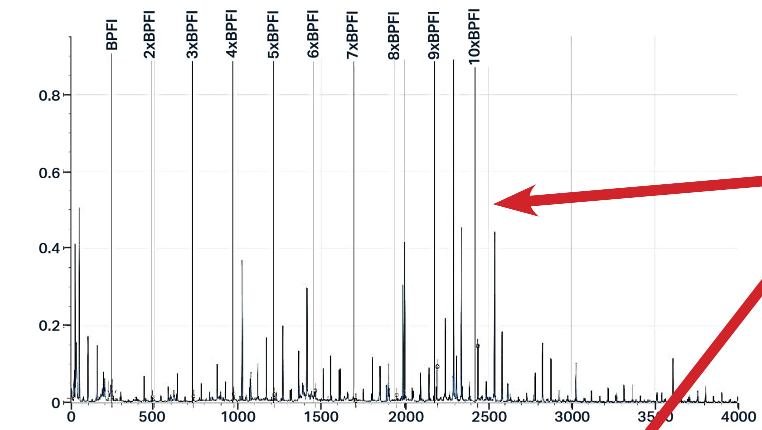
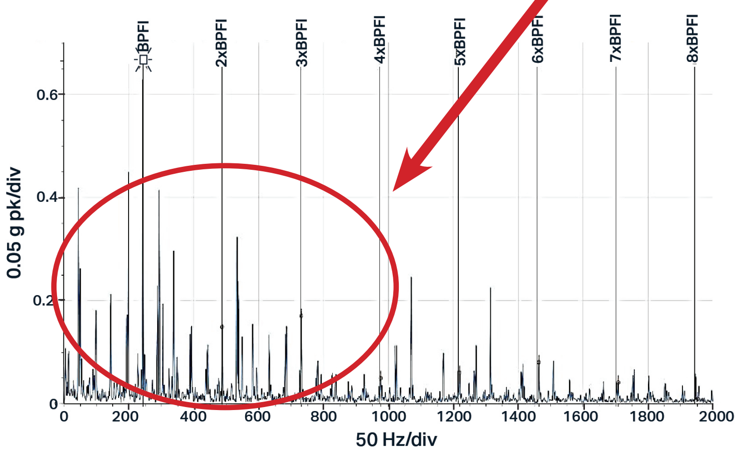
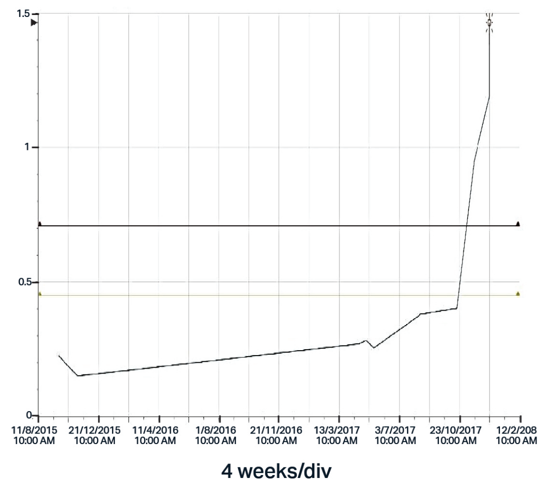


The motor non-drive end bearing velocity spectrum and demodulation showing elevated vibration at the inner race bearing defect.





Conclusion

The characteristic frequencies associated with inner race defects can vary depending on the bearing's size and speed of rotation. For example, in a typical 6206 ball bearing with a rotational speed of 3000 RPM, the characteristic frequency associated with inner race defects is around 150,000 RPM. However, in larger bearings the characteristic frequencies can be lower, while in smaller bearings the characteristic frequencies can be higher.

It's essential to note that the frequency range for detecting inner race defects is not fixed and can vary depending on the specific application and the condition of the bearing. In both cases above, it was recommended to replace the bearings showing inner race defects. It was determined that the root cause of the inner race defect in the auxiliary water pump was due to false brinelling.

False brinelling is caused by vibrations acting on the bearing while stationary. Since lubricant is not redistributed inside the bearing without rotational movement, lubricant can be pushed out of the loaded region in stationary bearings, resulting in wear and potential oxidation.

Related CTC Products

In addition to the CTC products used by MDI, CTC also offers a variety of vibration analysis hardware solutions that are ideal for use in applications like those explored in this case study. In general, any CTC 100 mV/g accelerometer (top or side exit) should be sufficient for standard route-based analysis and detecting faults between 0.5 to 15000 Hz. A popular alternative is CTC's TREA Series premium triaxial accelerometers, which feature a low-profile case and a wide frequency response range (0.5 to 15000 Hz ±3 dB). Additionally, CTC offers the widest variety of customized cable solutions on the market, with specialty connectors compatible with all major data collection systems.

TREA Series Triaxial Accelerometer mounted on a MH117-3T multipurpose magnetic mounting base

CB117-J4C-006-C560-SFT Cable and Connector Assembly