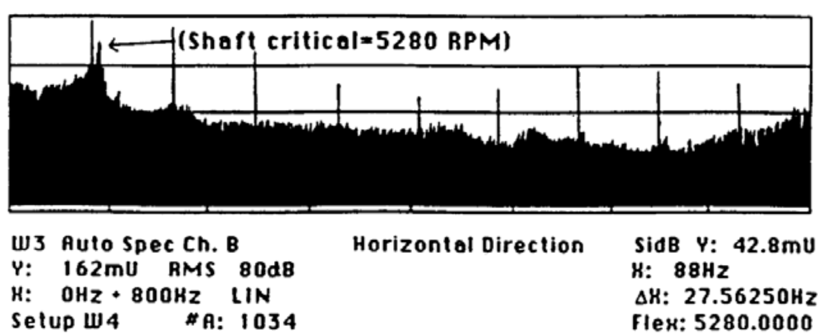
Case History: Boiler Feed Pump Reliability Problem

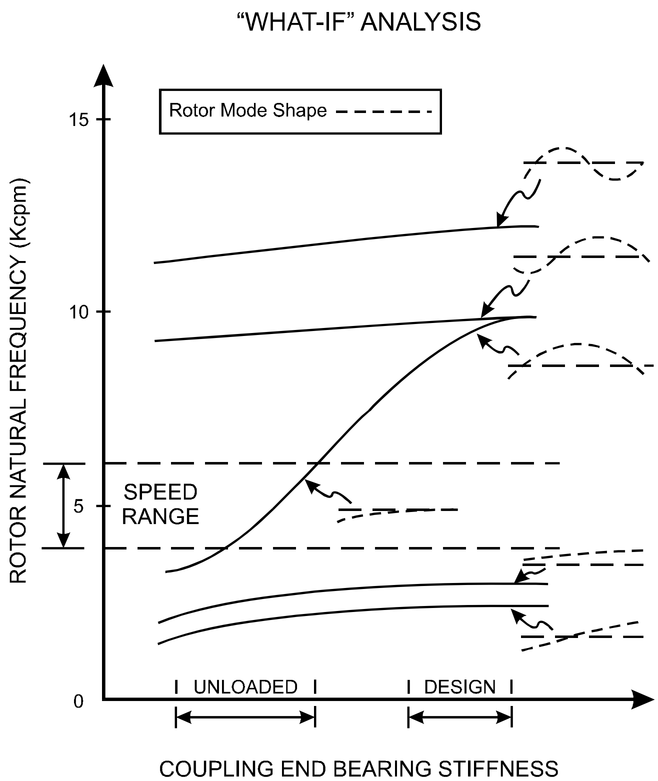
A Northeastern power plant had experienced chronic boiler feed pump failures for eight years, since the unit involved had been switched from base load to modulated load. The longest the pump had been able to log between major rotor element overhauls was 5 months. The OEM had been contracted to fix the problem under the condition that any fix would be paid for only after it was proven to work. The OEM had decided on the basis of detailed vibration signature testing and subsequent hydraulic analysis that the internals of the pump were not well enough matched to part-load operation, and proposed replacement of the rotor element with a new custom-engineered design. Although the problem showed some characteristics of a critical speed, both the OEM and the plant were sure that this could not be the problem, because carefully performed rotor dynamics analysis showed that the factor of safety between running speed and the predicted rotor critical speeds was over a factor of two. However, the financial risk associated with believing the hydraulics and rotor dynamic analyses was considerable. In terms of OEM compensation for the design, and the plant maintenance personnel and operational costs associated with new design installation, the combined financial exposure of the OEM and the plant was about $350,000. Because of this cost, MSI was called in for a "third party" opinion.

Impact vibration testing using MSI's *TAP*™ technique quickly determined that one of the rotor critical speeds was far from where it was predicted to be, had dropped into the running speed range (4900-5750 RPM), and

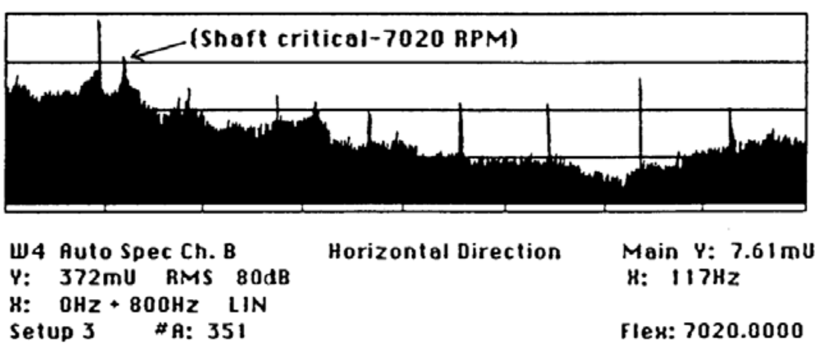


0 - 800 Hz (0 - 48000 RPM)
Operating Speed = 4900 RPM

Vibration Spectrum Before Bearing Modification



appeared to be the sole cause of the pump's reliability problems. "What-if" iterations with the OEM's rotor dynamic computer model, verified with a similar model constructed by MSI engineers using ROMAC programs, showed that the particular rotor natural frequency value and rotor mode deflection shape could best be explained by improper operation of the coupling end bearing. The bearing was removed and thoroughly inspected, and was found to have a critical clearance far from the intended value, because of a drafting mistake on the bearing's drawing, such that this mistake carried over each time the bearing was repaired or replaced. Installation of the correctly constructed bearing resulted in the problem rotor critical speed shifting to close to its expected value, well out of the operating speed range. The pump has since run for nearly three years without need for overhaul. For more information on this case, please check our web site under Tribology Component Analysis and Evaluation.



0 - 800 Hz (0 - 48000 RPM)
Operating Speed = 5750 RPM

Vibration Spectrum After Bearing Modification

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