Pump Baseplate Resonance
Responsible for Large Piping
Vibration and Component Failures

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Problem Statement

- Two overhang Centrifugal Pumps working in parallel
- Pumps driven by 75 hp motors, 3600 rpm
- Over 15 years of operation, experienced repeat failures on piping system, valves, couplings, impellers and housings
- Routine vibration measurement for trending do not show any discernable pattern
Problem Statement (cont)

- Maintenance Personnel observed high vibration on the piping system where many of the failures occurred.
- Initial thought was that piping resonance was excited and that shook the pump.
- It had been a practice to tighten the pipe hanging supports to reduce vibration temporarily.
Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

Period of 8.1 sec
Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

Typical collection window for vibration routes

60000 CPM, 800 Lines, 4 Averages, 50% overlap
Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

FFT on 5 minutes worth of data.
153600 lines, 0.00333 Hz resolution
Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

Zoom around Pump running speed.
0.00333 Hz resolution
Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

- South Pump Only
- North Pump Only
- Both Pumps
Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

South Pump. North Pump is Off
Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

North Pump. South Pump is Off
ODS of the pumps

North Pump
ODS of the pumps

South Pump

[Graphs and diagrams showing vibrations and data points]
Vibration Analyses

• All Vibration at running speed (1X)
• Previous attempts at balancing did not yield any significant improvements
• Maintenance Personnel thought the problem was a piping resonance
Impact Testing

• Impact testing on the Inlet and discharge piping did not show any resonance in the vicinity of running speed

• Based on the evidence from the ODS, the baseplate was impacted in several directions. We found a natural frequency on the baseplate of the south pump at the running speed of that pump.
South Pump Baseplate resonance
Repairs

• Repaired the pump pad that had some cracks
• Changed the in-house baseplate for a fabricated baseplate that could be grouted in
• Corrected the local practice of tightening the pipe hangers to control vibration
• The pumps have been in operation for 5 years without major issues
Current Look of the Pump Installation