Simple Structural Modification Solves Vibration Problem

State-of-the-Art Vibration Analysis Techniques

The Challenge: An East Coast sugar refiner engaged Flowserve Services and Solutions to restore a boiler feed pump (BFP) to original OEM condition and performance. Upon installing the reconditioned unit, however, the BFP experienced very high vibration in the horizontal plane. Flowserve technicians re-balanced the rotating assembly, but the vibration problem persisted. As a result, the plant operator shut down the BFP for safety concerns despite the cost related to downtime and maintenance. Flowserve was directed to identify and rectify the cause of excessive vibration.

The Solution: Flowserve service technicians thoroughly inspected and monitored the BFP installation, applying sophisticated analysis techniques to identify the source and extent of the vibration problem. This resulted in the relatively simple and inexpensive solution of reinforcing the BFP base supports. This modification increased the structural natural frequency by 50 percent and eliminated the high vibration problem along with the safety concerns related to mechanical seal and bearing reliability.

A BFP in a sugar refinery was repaired to OEM specification. Upon start-up, however, it experienced unacceptably high vibration levels. This caused the plant operator to shut down the unit, regardless of the lost production cost, for fear of potential high temperature water hazard to employees and equipment. The refiner turned to Flowserve technicians to solve the vibration problem. They re-balanced the rotating assembly, but the vibration continued.

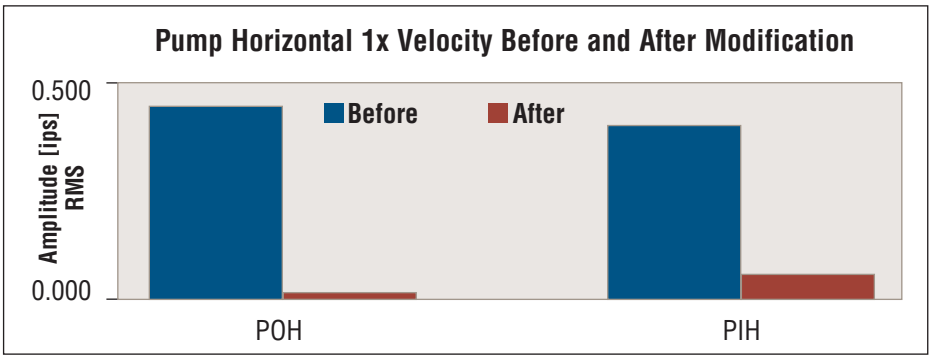
Engineering and technical services personnel inspected the BFP installation and conducted analyses to verify rotor-structure and pump-foundation structural dynamics. Logging equipment was installed to map a spectrogram of the pump-motor vibration characteristics. Employing state-of-the-art vibration analysis techniques, Flowserve technicians analyzed operating deflection shapes (ODS) to impact deflection shapes (IDS) through model analysis and identified a structural natural frequency at the operating speed. It was determined that the BFP had excessively high vibration in the pump's inboard and outboard horizontal planes: a Pump-Outboard Horizontal (POH) 1x horizontal velocity of 0.342 in/sec RMS and only slightly less severe in Pump-Inboard Horizontal (PIH).

Recommendations

Based upon the ODS and IDS findings, Flowserve technicians recommended the addition of gussets to fortify the pump baseplate. This simple, low cost fabrication solution increased the structural natural frequency by more than 50 percent and eliminated the high vibration. The POH 1x horizontal velocity was reduced to 0.050 in/sec RMS or less; the PIH 1x horizontal velocity was similarly affected. Safety and reliability concerns due to premature seal and bearing failures were satisfactorily addressed.

Before

After



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