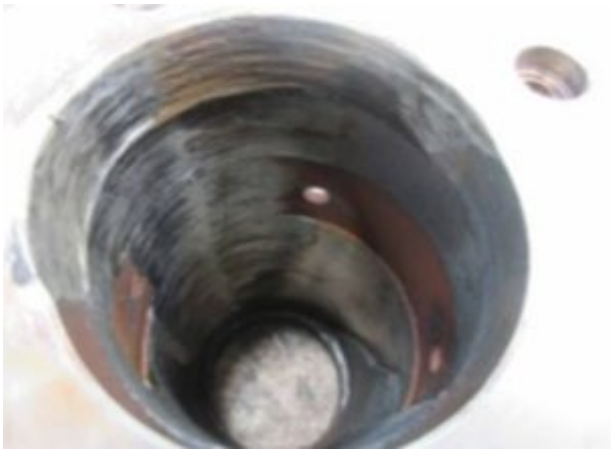
Fertilizer Focus: Resolving Design Flaws in UAN Solution Pump



A newly commissioned US fertilizer plant was experiencing recurring vibration problems with their vertical UAN Solution pump. The VSF vertically suspended pump was removed from service and sent to Hydro for a full inspection and investigation of the vibration source. When the pump was disassembled, it was evident that there were significant problems at the motor bearing and guide bushing locations. These design flaws that were affecting reliable operation of the pump.

Inspection of the motor thrust bearing revealed that the ball bearing cage had become unseated and was damaged. During Hydro's analysis, it was determined that the motor thrust bearing was unsuitable for the service. The OEM chose a single row, angular contact bearing that could only handle thrust in one direction. During start-up, when the pump experienced an upthrust, the bearing became unseated. The unseated bearing was unable to function properly, even when the pump reached its normal operating thrust. This unrestrained upward motion of the shaft also caused damage to the mechanical seal faces.

Another problem detected during the DCI was elliptical wear of the bearing bores. In this pump, the lineshaft couplings were located under the guide bushings, which is very atypical. Lineshaft couplings are areas where the greatest runout often occurs, resulting in a greater probability of contact and wear in this area. This problematic design was coupled with excessive tolerances on the columns, spiders, sole plate, and motor flange that affected centerline compatibility of the components.

The pump was upgraded to a new design that included a relocation of the lineshaft couplings, a new thrust bearing that could handle load in both directions, and an improvement of all component tolerances to minimize the possibility of component misalignment. Almost 70% of the pump was redesigned; this work was completed on an emergency schedule of only 2-3 weeks. Since reinstallation, the pump has operated successfully with reduced vibration.