

A Case Study for Improving Maintenance Planning of Centrifugal Pumps Using Condition-Based Maintenance

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(Received 25 February 2019; Revised 30 July 2019; Accepted 27 September 2019)

Abstract: Centrifugal Pumps (CPs) are one of the most widely used industrial assets globally. Condition-based maintenance (CBM) is one of the maintenance strategies applied for monitoring the operational conditions of CPs. Use of CBM has resulted in improvements in CP performance. However, CBM practice for maintenance planning is suboptimal. This work presents a case study which utilises a CBM approach for monitoring CPs as part of a safety critical Fire Water System aboard an Offshore Production Platform. A CBM approach for CP maintenance was researched, and the best practice identified. This was compared to the practices of the offshore company, and the deficiencies in application and data collection observed. A test programme was simulated which would represent the company's operations. Subsequently, data was collected to assess the ability of CBM to identify various failures for CPs. Vibration data for the CPs was utilised to develop the P-F curve for pump failure as a result of faulty bearings. The results were then used for establishing potential inspection activities. In cases where a single fault was studied, a classification accuracy of 100% was attained from the test programme. In cases where multiple faults were studied, a classification accuracy of 67% was attained. An overall classification accuracy of 76.5% was attained. Furthermore, a P-F interval of five months was obtained, implying that inspections should be performed every two or three months for the bearings compared with the current schedule of one month. The tests demonstrated the possibility for improved fault classification and data driven maintenance planning when a CBM best practice approach is implemented effectively. Future work will investigate the ability of enhanced Artificial Intelligent (AI) techniques to improve the classification accuracies in the face of more complex operational conditions.

Keywords: Condition Based Maintenance, Centrifugal Pumps, Vibration Analysis, Failure Modes, Effects and Criticality Analysis, PF Curve