An Investigation of Condensate Transfer Pump Problem at Onshore Gas Terminal (OGT), Kerteh, 2004

High temperature problem of the stuffing box and mechanical seal of Condensate Transfer Pump at On-Shore Gas Terminal, Kerteh were investigated. Analysis techniques include Operating Deflection Shape (ODS) Analysis, Modal Analysis and Finite Element Analysis (FEA).

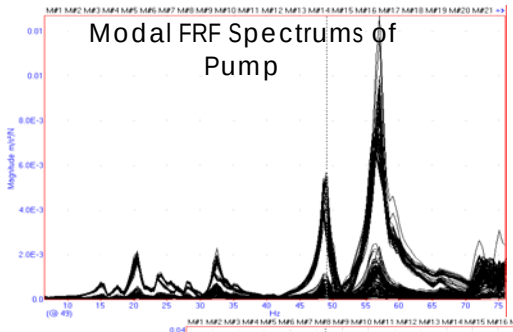
The investigation includes the Pump, its Motor and their support. It is concluded that the root cause of the failure was due to the dynamic weaknesses of the support structures, which lead to the Pump and Motor 1st bending mode resonance. Modal analysis on the Pump and Motor; revealed resonance (natural) frequencies 48.8Hz and 53.7Hz, respectively. The natural frequency of 48.8Hz is 'spot-on' the running frequency of the Pump and motor, hence a "Resonance phenomena". The lateral bending mode of the pump and pitching mode of the motor had caused a relatively large shaft movement in the stuffing box region.

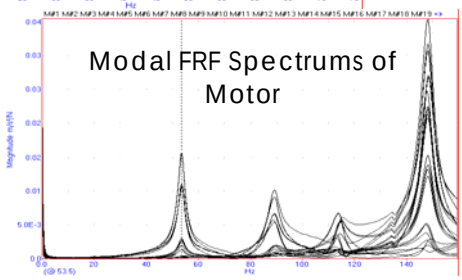
Operation Deflection Shape (ODS) analysis showed that the dominating frequencies were at 49.5Hz which were the Pump and Motor running frequency. Pump suffered more due to the fact that both the lateral and pitching mode natural frequencies were closer to the running speed.

These findings had been confirmed with FEA results that determined two natural frequencies and its mode shapes of interest, namely the 48.8Hz and 53.7Hz. The 1st bending mode of the pump was at 49.1Hz. The 1st bending mode of the motor at 54.1Hz correlates with the mode obtained from Modal FRF at 48.8Hz and Motor natural frequency at 53.7Hz. Hence, the correlation between FEA and Modal Analysis results being established thus verifying the Finite Element model.

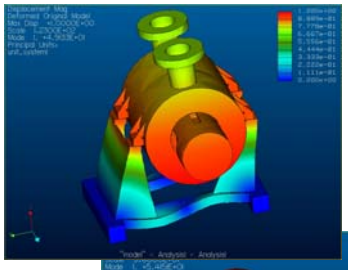
The static analyses on the stuffing box and mechanical seal results in deflection of about 0.13mm in axial direction while in radial direction was only 3.4µm. Simulating the effect of closing the gap with the same loading condition have reduced the amount of the stuffing box deflection in both directions by a factor of 10.

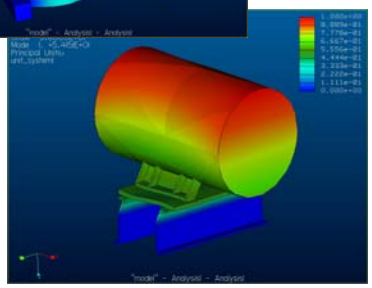
A dynamic design criterion was established that would shift the 1st bending mode of Pump and Motor away from the operating speed. The structural dynamic modifications have successfully shifted the 1st bending mode of the Pump to 82.9Hz, while the 1st bending mode of the Motor to 78.4Hz.





FEA results of Pump@49.1Hz





FEA result of Motor@54.2Hz

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