

An Investigation of 2 units of Gas Lift Reciprocating Compressor High Vibration Problem at South Angsi Platform, Off-shore Kerteh Terengganu, 2008

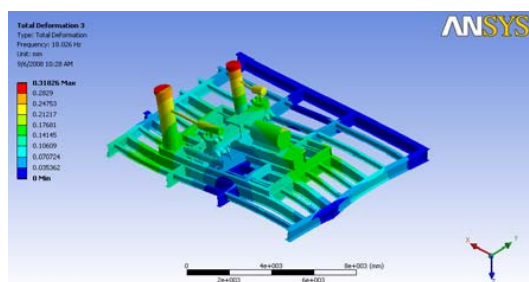
Two units of Gas Lift Compressor namely, Train 1 and Train 2 are investigated with the objective of identifying the root cause of the high vibration problem leading to the repeated crack incidence especially at the 1st stage suction scrubbers.

In ODS analysis, it was observed that the movement was dominated by the running frequency, 16.5Hz. Harmonics of the compressor speed were present with less significant contribution to the ODS spectral. Maximum amplitude recorded on the 1st stage scrubbers was about 30mm/sec or 300µm for Train 1 and 55mm/sec or 550µm for Train 2. ODS animation showed a global bending deflection of the main skid along the shaft axis and related high vibration of the cylinders, bottles and scrubbers.

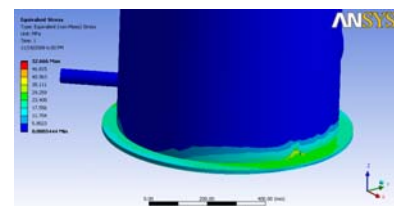
In FRF modal analysis, it is found that the significant modes are in the region of 14Hz (1st bending mode about the axis of shaft) and 18Hz (2nd bending mode about axis perpendicular to the shaft line). The 18Hz mode is very close to the running speed of the compressor (16.7Hz). The ODS of compressor at 16.7Hz confirmed the motion to be very close to the mode shape of the compressor at 18Hz. This problem is classified as structural dynamic weakness or resonance.

Finite Element Analysis (FEA); Modal analysis and stress analysis was performed and correlation was established between both measurement and computational techniques. From the analyses, structural dynamic modifications were performed by introducing additional beams and plate below the skid for both the train. The aim is to shift the 18Hz mode to a higher value while maintaining the frequency of the 14Hz mode not to allow it to creep into the running speed of the compressors. Performing these modifications would shift the 18Hz mode to about 20Hz and 14Hz to about 15Hz. However, due to its high mass, large amount of stiffening is required to shift the natural frequencies.

For short term solution, performing stress analysis focusing at the 1st stage suction scrubber, revealed a high stress concentration pinpoint to the reported crack location; classified as fatigue-induced crack. Modification was done to reduce as well as re-distribute the high stresses by improving the welding procedures and additional ribs installed to the suction scrubber base.



FE Modal Results for Reciprocating Compressor



Stress Analysis Results on suction scrubber