

**An Investigation of Reciprocating Compressor High Vibration Problem at PPMSB, Sungai Udang, Melaka, 2008**

Two units of Net Gas Compressor were investigated with the objective of identifying the root cause of the high vibration problem and the crack foundation problem. Analysis techniques used in the investigation included visual inspection of the cracks on the grouting, machine maintenance history and trending and operation deflection shape analysis, modal analysis and finite element analysis (dynamic and stress analysis).

FEA modal analysis has shown that the first natural frequency is much higher than the running speed up to a number of orders. This implies it is a stiffness-controlled situation instead of resonance problem.

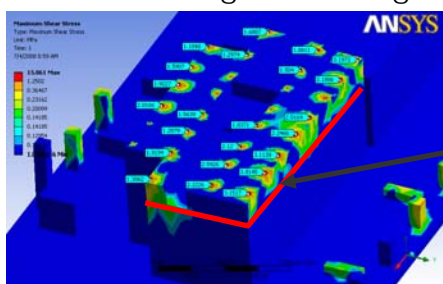
Based on ODS analysis, vibration amplitude at the top compressor crankshaft casing NDE, Unit-A gives a displacement of 91µm while Unit-B gives a displacement of 135µm. FEA analysis results was 68µm. The response obtained from FEA Stress Deformation Analysis is lower than on-site measurement was due to the FEA model assumptions that the foundation were in good condition.

From ODS analyses also revealed that for unit-A, the crankcase moved together with the foundation while there was a relative movement between the crankcase and the concrete foundation for unit-B at the NDE side. The relative movement probably caused by the ineffectiveness of bolts and crack length.

Further simulation to simulate the effect of ineffective bolts as well as the crack length using FEA Stress Deformation Analysis indicated that 1st crack line most probably originates from the sharp corners of the foundation where the foundation experiencing shear stress due to the “pull & push” movement of the compressor. Combined dynamics movement of the compressor and its gravitational load result in tensile stress occurring in the region where 2nd crack line.

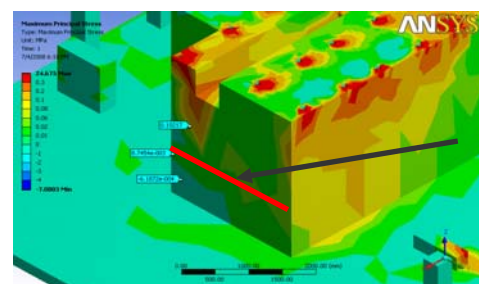
Based on analyses results, the depth (crack length) of the 1st crack line has more effect on the compressor displacement as compared to 2nd crack line. Unit-B has almost 6 ineffective bolts as compared to about 3 bolts for unit-A.

Therefore, for long term counter-measure, it was recommended to the vibration monitoring unit to include vibration monitoring at this location (in displacement) and perform amplitude trending as part of their foundation inspection procedure. As for the “loose-bolts” for unit-B, it was to be rectified during the next planned shutdown, while monitoring the crack growth of unit-A.



1st crack line

Maximum stress contour in FEA



2nd crack line