Case History No.34

G441 Utility Shaft Pressurisation Fan Bearing Failures

G441 Utility shaft pressurisation fan is one of two fans used to provide cooling air for six Sea Water Lift Pumps, situated on the 86m level in the Platforms Utility shaft. A drawing of the fan can be seen in figure 1.

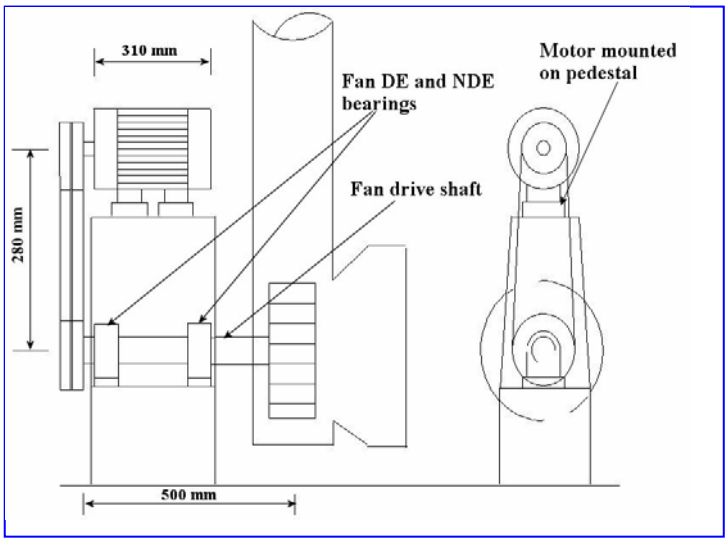

Figure 1 - Fan and motor layout

Over a period of four years the mean time between failures was relatively short for G441, as can be seen in figure 1, whereas for G442 the failure rate was a lot less (figure 3).

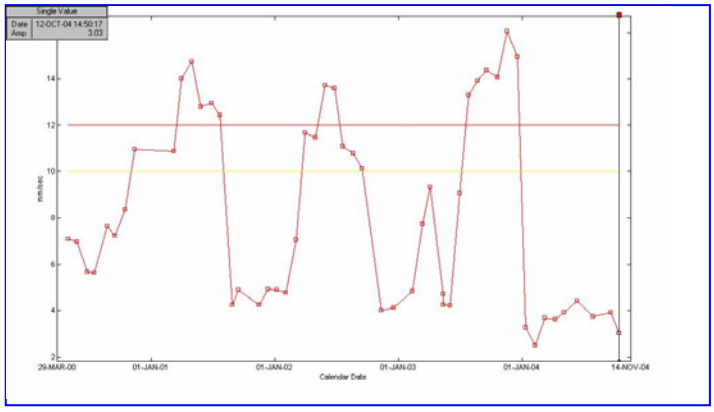

Figure 2 – Overall vibration at Fan DE H

Each time the overall vibration increased to an 'alarm level', the fan bearings and pulleys were replaced, reducing the overall level to within ISO 10816-1 recommendations. Within six months however the amplitudes would increase to outside the acceptable recommended levels.

It was decided to investigate the root cause of failure for this fan, since there had been only one bearing failure on G442, in the same period of time.

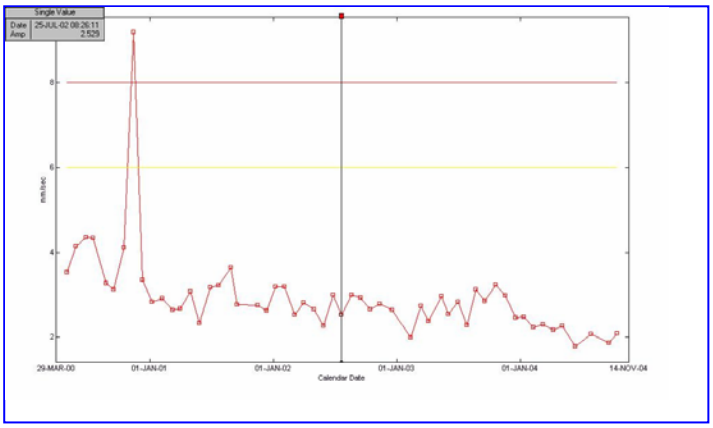

Figure 3 – Overall vibration at Fan DE H for G442

Inspection of the vibration spectra on G441, identified the dominant component to be 1 x fan rpm, which was 57.5 Hz, as can be seen in fig. 4

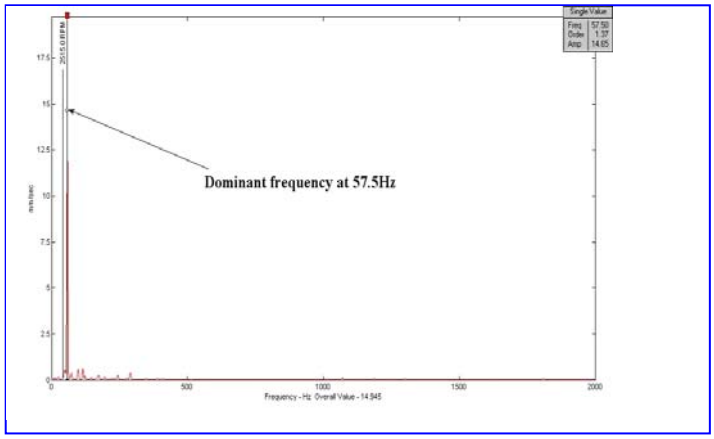

Figure 4 – Vibration Spectra of G441 at Fan DE Horizontal

Spectra taken on the same bearing on G442 showed the dominant component to be 1 x fan rpm, however the frequency on this fan was 43Hz, as shown in figure 5.

AV TECHNOLOGY LIMITED
Head Office: Avtech House, Birdhall Lane, Cheadle Heath, Stockport SK3 OXX T: 0161 491 2222 F: 0161 428 0127
Regional Offices: Aberdeen & Grangemouth
E: enquiries@avtechnology.co.uk W: www.avtechnology.co.uk

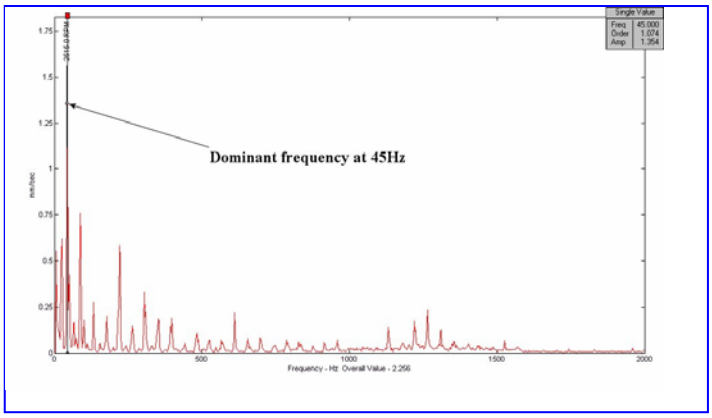

Figure 5 - Vibration Spectra of G442 at Fan DE Horizontal

A bump (resonance) test was carried out on the fan drive shaft bearings of G441, in order to identify the resonant frequencies. Results from the bump test can be seen in figure 6.

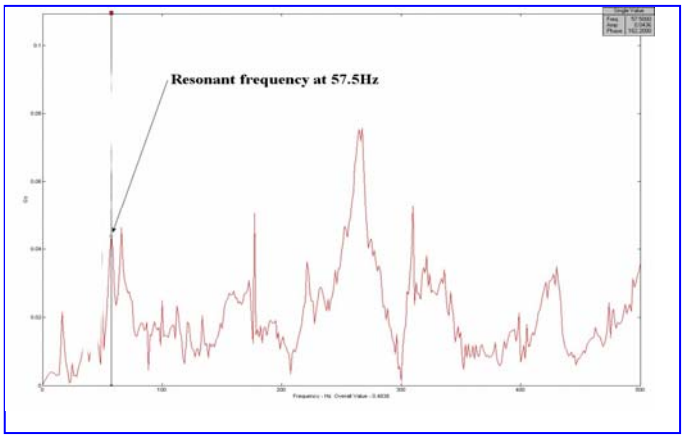

Figure 6 – Spectra from bump test on G441 Fan DE bearing

The results showed that the fan bearings had a resonant frequency of 57.5 Hz, which was the running speed of G441's fan. An investigation into what should have been the correct fan speed showed that it was 45 Hz.

The outside diameters of the pulley sheaves on both G441 and G442 were measured and compared. It was found that during maintenance on G441, the pulley sheaves had been reassembled the wrong way round, i.e. the motor pulley put on the fan and vice versa.

Driver pulley diameter – 123mm
Driven pulley diameter – 142mm
Motor speed – 2925 rpm
Fan speed – 2533 rpm

The 1 x fan rpm component equates to 43Hz, which is outside the fan bearing resonant frequencies.

If the driver pulley diameter was 142mm and driven pulley diameter 123mm as it was, then the 1 x fan rpm component equates to 57Hz, which coincides with the resonant frequency.

After the pulley sheaves were assembled correctly, vibration data was taken on the Fan DE bearing and the results can be seen in figure 7.

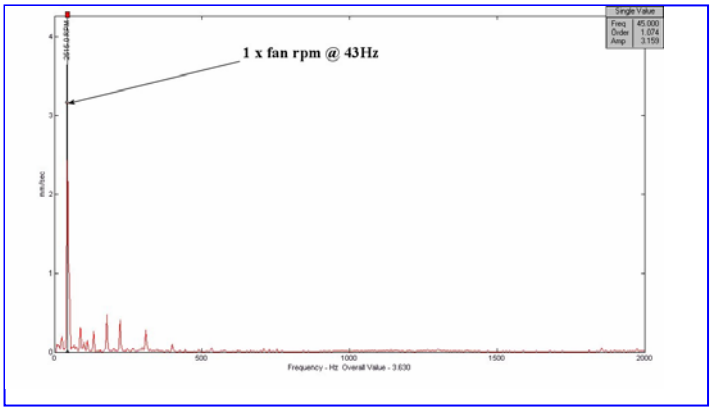

Figure 7 – Vibration Spectra of G441 at Fan DE Horizontal after reassembly

The vibration levels on G441 are now within ISO 10816-1 guidelines. Had it not been identified, the fan bearings for G441 would have continued to fail. Although the cost of replacing the bearings is relatively low, the first indication of a failure of these fans is when the Sea Water Lift Pumps begin to overheat. At this stage these pumps require shutting down, until both fans are available and there temperatures have reduced.

The Sea Water Lift Pumps provide the cooling for the heat exchangers on the Process Plant and water for sea water injection, consequently as their capacity is reduced production will become adversely affected.

Conclusion

These fans are not directly critical to production, however should one of them fail, then there is a possibility of the Sea Water Lift Pump motors overheating.

A reduction in Sea Water Injection capability will reduce the amount of barrels of oil per day that can be produced. This can be in the region of up to £10 000 per hour of differed losses.

The reliability of the cooling fans has now increased from one failure every 6 months to them now having run for over two years, without any increase in the vibration.