Case History No.8

VIBRATION ANALYSIS TO DETECT GEAR DAMAGE

Gearmesh vibration frequencies are typically easy to recognise, but not easy to interpret. This is due to two reasons:

1) It is not normally possible to place the transducer close to the problem gears.

2) The number of vibration sources in a multi-gear drive unit result in a complex array of gear mesh, modulation and running speed frequencies.

For the analysis of suspected gear problems a high resolution spectrum analyser is required to enable a high frequency range spectrum to be taken without loss of sideband data. Sidebands are very important and in most cases enable the analyst to determine which of the two meshing gears is at fault.
The following case history shows how spectral analysis proved invaluable in helping identify a problem gear in a cooling tower fan gearbox.

Vibration data is collected from the electric motor by means of a vibration spectrum analyser and a magnetically mounted accelerometer. Due to the inaccessibility of the fan gearbox, permanently mounted accelerometers are fitted to the input and output shaft bearing housings and cabled out to a safe location. Figure 1 below shows the spectrum collected from the gearbox output shaft.

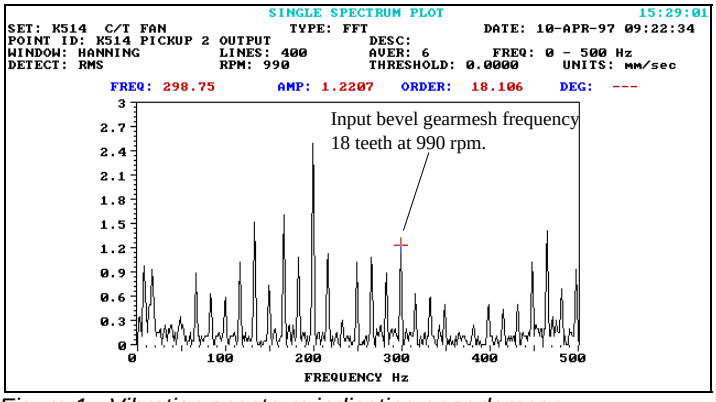

Figure 1 - Vibration spectrum indicating gear damage

From the above spectrum, and knowing the fan was running at low speed, we could identify the input bevel gear meshing frequency. Harmonic activities at the input shaft frequency of 16.5 Hz are evident at either side of the input gear mesh frequency. From this information, and technical data from the gearbox (Figure 2) it was concluded that the input bevel gear had sustained some degree of gear tooth damage.

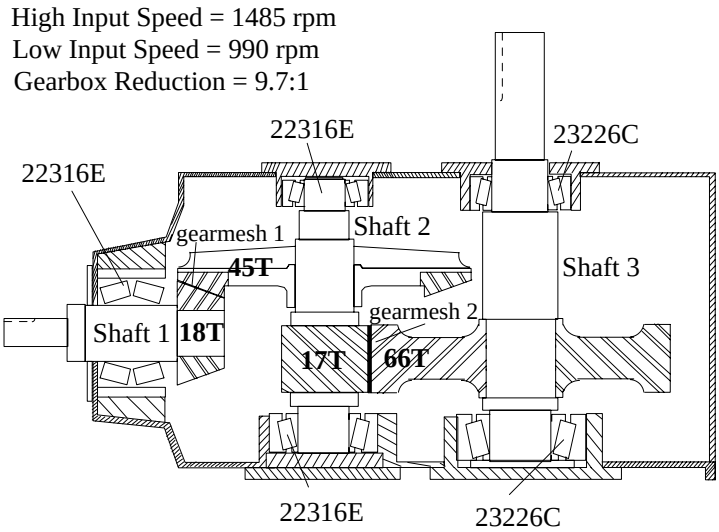

Figure 2 - Layout of gearbox internals

Examination of the gearbox proved the analysis to be accurate, with damage to several of the bevel gear teeth evident. Figure 3 below is photographic evidence of the damaged gear teeth.

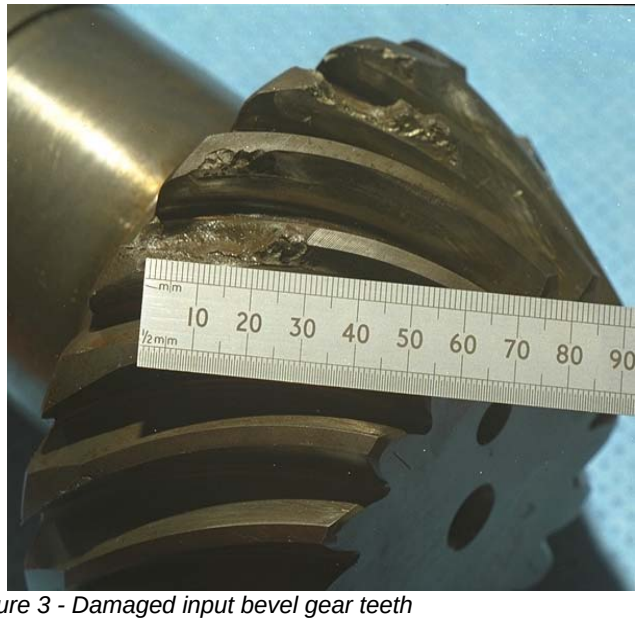

Figure 3 - Damaged input bevel gear teeth

It is estimated that a saving of **£4,500** was made due to early fault detection, however, had this unit catastrophically failed then secondary damage could have run into *many THOUSANDS* of pounds more as the potential for damage to blades and structure is high.

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