A V TECHNOLOGY LIMITED

Machines Talk,
And It Pays to
LISTEN.

Case History No.15

# COOLING TOWER WATER PUMP BEARING FAILURE

P502D pump forms part of a team of 4 identical units responsible for supplying the production unit with cooling water. Depending on the time of year and thus the amount of cooling water required by the production unit, determines how many of the 4 pumps will be in service at any one time.

Overall and spectral vibration data collected from the electric motor and pump bearings on P502D over the last 4 years had been consistently low and acceptable, with levels typically being around 1.5 to 2.5 mm/s rms.
This particular pump had been out of service for inspection purposes and had not been tested for several weeks. During the routine vibration survey on the 21st January 1998 it was noticed that the overall vibration levels recorded at the pump drive end had exhibited a marked increase see, Figure 1.

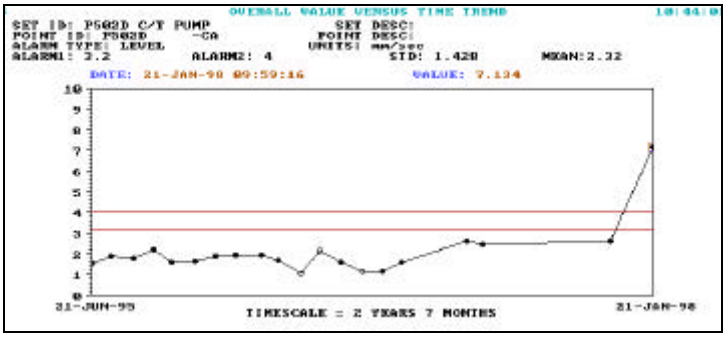


Figure 1 - Pump drive end bearing trend

Examination of the vibration spectrum exhibited frequency components which matched the calculated defect frequencies for an RHP 318 C3 roller bearing with a inner race speed of 740 rpm, this defect frequency was calculated to be 192.5 Hz see Figure 2.

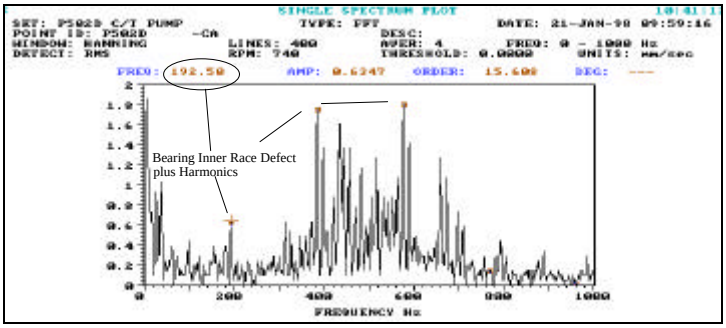


Figure 2 - Vibration spectrum indicating bearing inner race defect.

On further examination of this vibration spectrum, not only were the bearing inner race defect frequency components evident, but also across the frequency bandwidth was a large degree of sub synchronous vibration, possibly caused by the rolling elements passing over the tiny particles of metal from the original fault that had been impregnated into the surface of the inner and outer races.
A recommendation was made to replace the pump bearing and pass it to our office for inspection. Figure 3 below is photographic evidence of this inspection and indicates a crack all the way across and through the inner race leaving one part protruding slightly higher than the other. This slight protrusion would undoubtedly be the mechanism for generating the inner race spectral frequency component as the rolling elements passed over it.

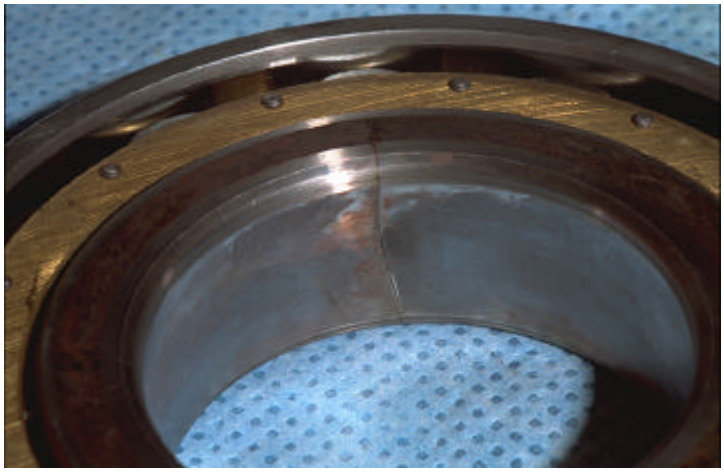

Figure 3 - Photograph showing crack through the inner race.

Further examination of the rollers and bearing races indicated surface irregularities in the form of indentations caused by tiny fragments of bearing material being forced into the raceways by the action of the rolling elements passing over them and it is these irregularities which would be responsible for the sub-synchronous vibration which was observed in the spectrum.

Fortunately the bearing inner ring did not spin on the pump shaft and therefore secondary damage was minimised allowing bearing replacement to be carried out in situ.
The pump was subsequently brought back into service with minimal disruption to the process, baseline vibration recorded at the pump bearings indicated levels had returned to previous values. The estimated mechanical cost saving for this machine was in the region of **£12,000**.

David Stevens