A V TECHNOLOGY LIMITED

Machines Talk,
And It Pays to
LISTEN.

Case History No.6

COOLING TOWER FAN BALANCE CORRECTION

Overall vibration data collected from the fan motors of a 4 cell cooling tower had, for some time, exhibited erratic levels particularly in the axial direction, (up to 7 mm/s rms at the fan rotational frequency). It was also noticed that the cooling tower itself was swaying in a east/west direction. Vibration data collected from the fan stack also indicated the fan rotational component to be dominant. The vibration increased or decreased depending which fans were in service at any one time. Because the four fans are of the same design and speed, then vibration generated from one machine could be transferred to one or all the others to some degree, the amount of transferred vibration would depend on several factors, for example each units structural stiffness, transmissibility, distance between units.

Before correcting this problem we needed to ascertain the forcing unit responsible for setting up the vibration in the tower, (assuming it is only one). To do this, a test sequence was devised to enable two fans to be run at any one time. Operational requirements would not allow the fans to be run independently.

The results of these sequences can be seen in Figure 1 below.

2 fan sequence

Fans	*Amplitude (mm/s rms)*
A + **B**	4.8 + **7**
C + D	0.1 + 0.5
A + C	0.1 + 0.2
B + D	**7.5** + 7.7
A + D	0.7 + 0.5
B + C	**8.1** + 4.4

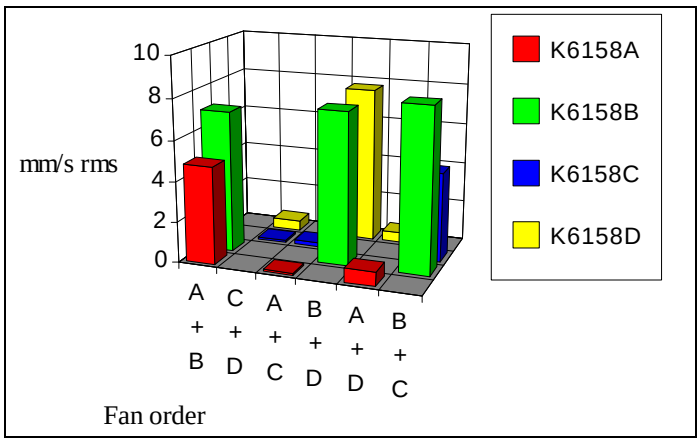

Figure 1 - Results from the 2 fan sequence tests.

It was recommended that an in-situ balance be performed on the 'B' machine fan to reduce the vibration levels and allow continued operation of the cooling tower fans throughout the summer months ahead when demand on the tower would be high.

A phase reference optical sensor and accelerometer were fitted to the gearbox output shaft and cabled out to a safe location. During this operation it was noticed that a large steel block had at some time been fitted to the fan hub, also, the fan tip drain holes were found to be blocked, these were subsequently cleared. With this weight still in place the fan was brought on line and phase and vibration data collected. The results of this 1st run indicated a running speed peak of 6.6 mm/s rms. The fan was then isolated and the mass on the hub measured at 10kg. Inspection inside the stack revealed water around its circumference at blade tip height and it is assumed this came out of the fan blades as a result of clearing the drain holes. The fan was run up a second time without the mass and again the phase and amplitude measured. The amplitude of the fan rotational frequency peak had reduced to less than 0.5 mm/s rms, clearly the problem was the 10kg mass, no further action was needed as the imbalance had been located and corrected. Figures 2 and 3 below give the before and after condition.

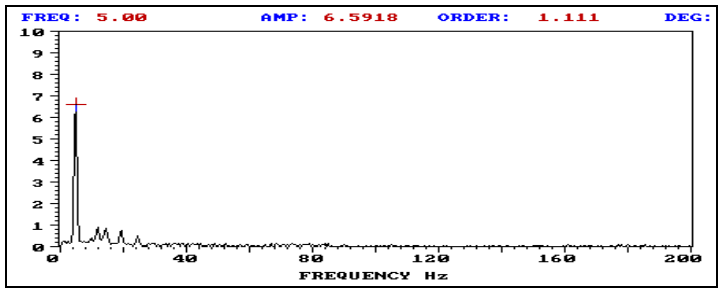

Figure 2 - Before balance correction.

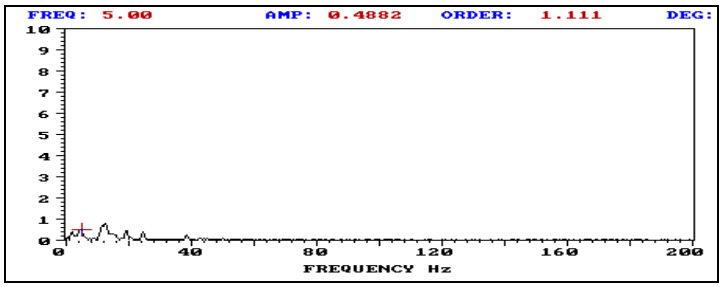

Figure 3 - After balance correction.

It is possible that this weight was used to balance out the effect of the water in the blades, although this is not conclusive.

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