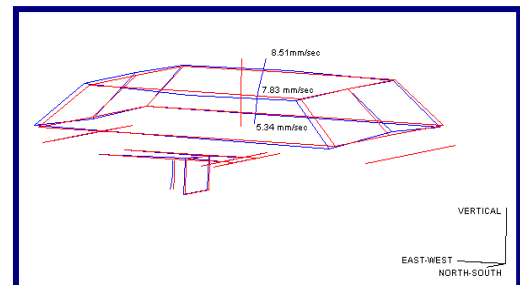
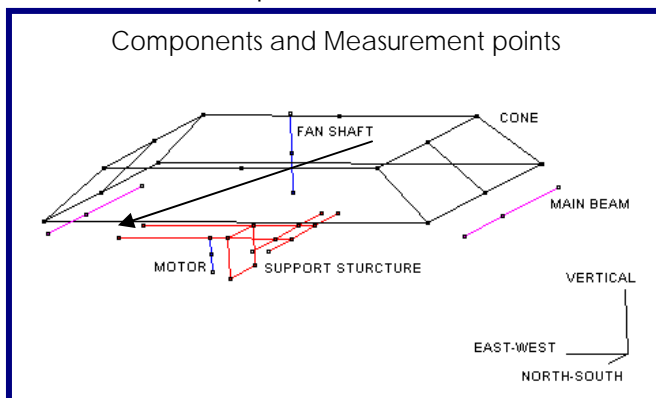


An Investigation on Air Fin Fan Blade Failure on ID Fan, 2000

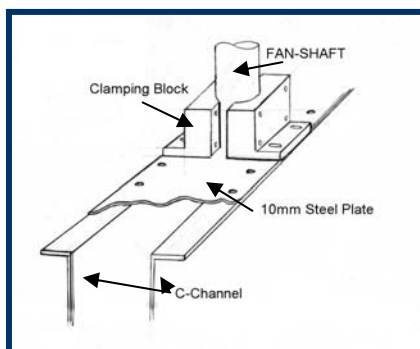
Repeated failure of the Air Fin Fan Cooler Blade for the Induced Draft Fan is investigated. Analysis techniques include Operating Deflection Shape Analysis, Modal Analysis, and visual inspection on the damaged components and machine maintenance history.

It is concluded that the root cause of the repeated failure of the Air Fin Fan Cooler Blade was due to the weaknesses of the supporting structure inducing harmonics of the fan-shaft running speed of 2.9 Hz (174 rpm). Operating Deflection Shape (ODS) analysis showed that dominating frequency at the fan-shaft was found to be a combination of the 4th and 5th harmonics (11.75Hz/705rpm) and 14.75 Hz/885 rpm respectively. This has excited the 12Hz fan blade-bending mode that creates a cyclic bending stress on the holding bolts. Simulation of the actual movement while in operation shows that the fan-shaft is vibrating at 8.51mm/sec peak in East-West direction (elliptical shape) which is perpendicular to the supporting C-channel. These had resulted in a relative angular velocity of 11.9Hz in the fan-shaft movement that imposed a cyclic bending stress on the holding bolts. The C-channel is vibrating in a bending mode at 11.75Hz (4th harmonics of the running speed).

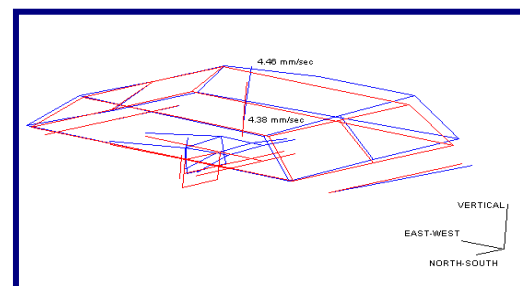
It is recommended that the two C-channels supporting the whole fan-shaft, motor and pulley should be stiffen with a 10-mm thick steel plate bolted to the top and bottom of the channels. Additional to the bearing assembly, which is the only thing that holds the entire fan, it is recommended to fabricate another clamping device as to holds it at two points.



Operating Deflection Shape at 14.75 Hz showing shaft movement mainly in East-West direction



Sketch of the recommended modification on the C-channel



Operating Deflection Shape at 11.75 Hz showing fan-shaft and C-channel bending in vertical direction.