CONSIDERING AN AT SPEED BALANCE

By Tony Rubino, PE

Any rotating body, such as a rotor, has inherent residual unbalance that acts as a forcing function upon that body's support system. The support system includes the structural stiffness of the rotor itself, bearings, housings, casings, pedestals, baseplate, and foundation. When the frequency of the forcing function is sufficiently close to one of the natural frequencies (or even possibly an integral multiple) of the support system, resonance can occur. There are occasions when the geometric constraints of a design prevent obtaining adequate frequency separation between the forcing function and the system's natural frequency by changing stiffness or mass distribution. These occasions are addressed by maximizing damping in the bearings and minimizing the forcing function potential through an at speed balance.

RMS recently completed a rotor overhaul where the as found unbalance was beyond the API allowable of 4W/N. The rotor did not satisfy the rule of thumb for considering an at speed balance: rotor normal operating speed was less than 8,000 rpm and the ratio of length between journal centerlines to rotor body diameter was less than 8. Rotors operating at greater than 8,000 rpm and an L/D of 10 usually receive further scrutiny regarding whether an at speed balance should be considered.

The rotor in question experienced elevated vibration (between 0.002" and 0.003") during operation even though the low speed balance residual was less than 4W/N. After an at speed balance, vibration was below 0.001". Review of the startup vibration trend indicated the rotor system had a second critical speed very close to operating speed. In the final analysis, the determination of whether to at speed balance a rotor should include a review of the machine's rotor dynamics analysis. If an analysis is not available, the vibration trend from a start up should be reviewed to verify whether the rotor is operating near a critical.

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