TORSIONAL VIBRATION PROBLEMS IN RECIPROCATING MACHINERY

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Torsional vibration can be broadly described as the angular vibration of any object as a result of applied torque. Torsional vibration involves the twisting of shafts while the machinery is rotating.

Reciprocating machines produce torsional excitation at multiples of running speed (orders or harmonics). When operated over a wide speed range, it is likely that one or more of these torque harmonics will excite a torsional natural frequency (TNF) of the system. The amplitude of vibrations can increase significantly if the system speed is close to the natural frequencies of the system. Excessive strain at speeds near the natural frequencies causes excessive stress which causes component failures. It can also lead to premature fatigue failures.

Excessive torsional vibration and resonance leads to very expensive failures such as damaged shafting, couplings, dampers, gears, auxiliary equipment, and more. Repair costs to such equipment can easily exceed $1,000,000 in parts, labor, and downtime.

There are numerous books and technical papers written on torsional vibration, so the phenomenon is generally thought to be well understood and controlled. However, torsional vibration problems continue to occur in reciprocating and rotating machinery. One reason for this is the mating of equipment traditionally used in nonreciprocating applications (such as variable speed motors) with reciprocating compressors. Other causes include poor performance monitoring of engine and compressors, as well as improper application and maintenance of viscous dampers and couplings.

Machinery systems continue to increase in speed and horsepower leading to higher torsional excitation. Preventing failures caused by this requires adequate analysis over the equipment’s intended range of operating conditions.

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