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This month:

Using shock pulse for bearing

Rolling element bearings provide an important function by supporting rotating shafts while minimizing friction. But bearings do have a calculated life expectancy and will eventually fail. Metal fatigue, high temperatures, lack of lubrication and contamination also contribute to early failure.

Condition monitoring is an essential manufacturing practice to determine the status of the bearing's condition while in operation. This process is critical to ensure that bearing life can be maximized and to determine as soon as possible when replacement might be necessary.

Premature bearing replacement can be costly because not completing the bearing's useful life expectancy is poor management of the investment, which leads to additional unnecessary labor and time spent, needlessly adding to the overall cost. Waiting for the bearing to fail can lead to even greater costs due to lost production and collateral damage to the machine and associated metal parts.

Patrick Parvin, sales/service technician for SPM Instrument Inc., headquartered in Strängnäs, Sweden, says, "Each bearing operates at a specific frequency. During rotation, rolling element bearings become shock pulse generators. The impact of the rolling elements in the raceway creates a compression (shock) wave that increases in amplitude as the bearing lubrication film thickness decreases and/or as surface damage starts to occur."

For example, a shock wave can be formed when a steel ball is dropped onto a metal plate. The initial contact between the steel ball and the metal plate generates a compression (shock) wave that propagates ultrasonically in all directions through the plate. The intensity of the impact (shock) is a direct derivative of the velocity of the ball.

Using normal vibration analysis in this example does not provide an indication of the intensity of the impact between the steel ball and the metal plate. Rather, this technique measures the result of the impact, which would be a deflection of the plate measured in velocity, displacement and acceleration.

Measuring shock pulses in rolling element bearings can provide important data to determine the condition of the lubrication film thickness between the rolling elements and the raceways and the condition of the bearing itself. More important, a technique that can evaluate changes in these shock pulses will be of value in assessing the condition of a bearing in use.

Shock pulse method©

A portable, handheld instrument has been developed by SPM Instrument to evaluate shock pulse measurements. The instrument, known as the Bearing Checker, measures shock pulses on bearings and instantly provides a color-coded evaluation showing whether damage is developing and its severity.

Parvin says, "This instrument will read the shocks generated by bearings by touching the bearing housing with the built-in probe for about four seconds. The intensity and amplitude of the shocks are then analyzed to let the user know the status of the bearing. The instant evaluation is the result of an empirical database combined with a calculation of the shaft size and the speed of the bearing. The evaluation also will differentiate whether it is a lubrication film thickness problem or a bearing damage problem."

The instrument also measures surface temperature with infrared light. Temperature changes usually occur after the magnitude of shock pulses

(Courtesy of SPM Instrument, Inc)

Figure 1.

The Bearing Checker has a built-in probe that when placed on the bearing housing will collect shocks generated by the bearing in approximately four seconds.

increase in bearings, according to Parvin.

With headphones, the instrument can be used as an electric stethoscope for listening to machine sounds. Use of the instrument on an actual bearing is shown in Figure 1.

Parvin says, "The instrument is designed for use just on rolling element bearings. Sleeve bearings and plane bearings (bushings) provide a sliding motion rather than a rolling motion, so they do not produced shocks."

Case study

Parvin discussed one application in which the instrument determined that the wrong type of grease was being used in a specific application. He says, "In a steel mill, 15 fans are set to provide ventilation in a paint room. Grease is required to lubricate the motor bearings and the fan shaft bearings. The pillar block bearings of these fans run at temperatures between 70 C and 83 C. A high-temperature lithium grease is used, and no problems have been observed for most of the fans."

The instrument confirms with a green rating that the bearings are operated without any problem for most of the fans. But Parvin indicated that a problem was seen with one specific fan, which was given a yellow rating by the instrument indicating a lubrication film thickness problem.

Parvin explains, "We found using the temperature sensor that the problematic bearing actually was running at a considerably lower temperature (32 C) than the other fans. The reason for the lower temperature is that a fan along the wall is blowing air on the bearing."

The data obtained from the instrument showed that there was, in fact, a lubrication problem, which led the steel mill to switch to a standard NLGI EP 2 grease. As a result, the standard lubricant increased film thickness which extended the operating life of the bearing.

Parvin indicates that the instrument is very durable and will work for years. He recommends that all instruments be recalibrated once a year to ensure they are compliant under ISO.

Further information can be found at **www.bearingchecker.com** or by contacting Parvin at **patrickparvin@spminstrument.com**.

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