Predictive maintenance

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Thanks to the early identification of a damaged bearing at a Cemex plant in Egypt, the company was able to keep the cement mill running and save more than US$500,000 in unplanned downtime.

Modern predictive maintenance techniques and the use of a patented method of viewing vibration measurements were combined to identify a potentially crippling bearing fault on Cement Mill 7 at the Cemex plant in Egypt, avoiding unplanned downtime that could have cost as much as US$510,000. If the faulty bearing had not been discovered in time, it might have seized up, causing an emergency shutdown of the mill. A two-day stoppage for repairs would have resulted in a product loss of 4600t at an average price of US$100/t, plus US$50,000 for repair parts. The cost could have been much greater if a sudden bearing failure resulted in pinion gear and shaft damage as well.

Fortunately, Emerson's AMS Suite: Machinery Health™ Manager software was routinely used in this mill for analysis of vibration data obtained during bi-weekly monitoring of the most important rotating machinery. Data gathered on 4 April 2010 revealed a condition involving a spherical roller bearing that warranted closer evaluation. A multiple-spectra view of the axial vibration at the inboard bearing of the left pinion gear failed to show anything unusual. Then, additional PeakVue measurements made on April 20 revealed a big change. The five very apparent spikes in Figure 1 were the earliest indication of a serious problem.

This is the story of using Emerson's PeakVue technology to make predictions of the bearing's expected run-life, which led to an order to stop the mill for repairs. In this case, the downtime was limited to about 12 hours to replace the faulty bearing.

Figure 1: an additional PeakVue measurements indicate a serious problem

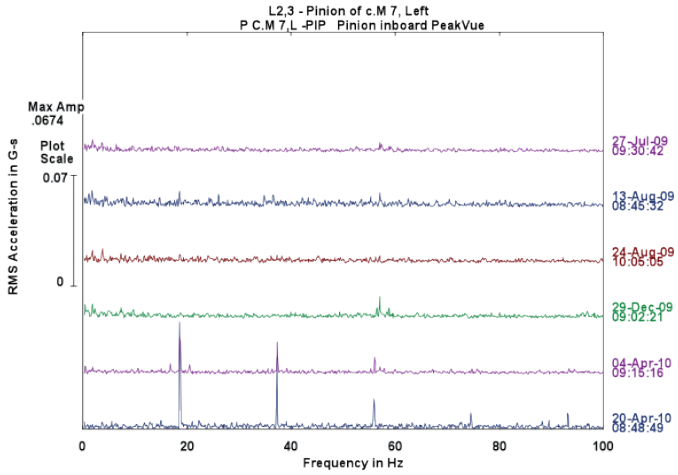
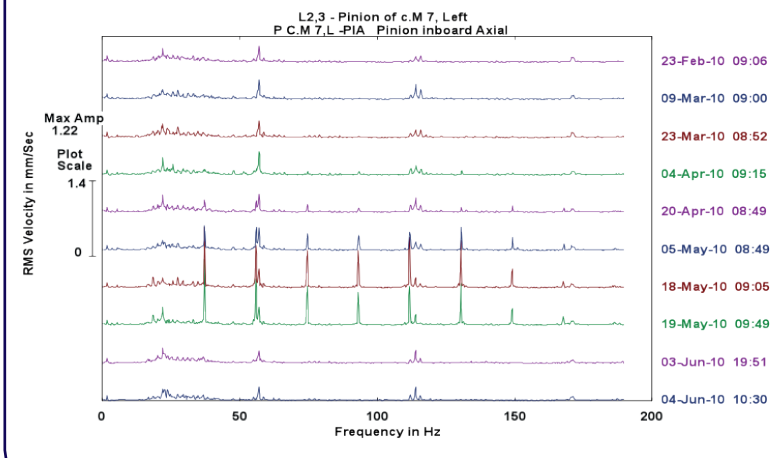


Figure 2: confirmation appears on subsequent axial views of the inboard pinion bearing

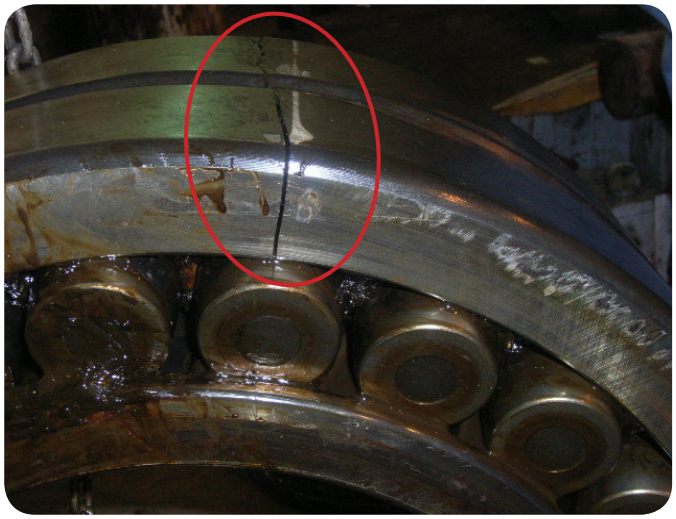


Predictive maintenance programmes

Today's predictive maintenance programmes rely largely on intelligence produced by advanced monitoring technologies. Such systems are capable of raising alarms if field assets suddenly develop symptoms of impending failure.

Accurate diagnostic data enables maintenance supervisors to effectively determine which repairs must be done immediately and which ones can be delayed until a scheduled shutdown or other appropriate time. Actions based on such predictions increase equipment reliability, whereas costly unplanned interruptions are significantly reduced.

The operating condition of rotating machinery is monitored periodically by following pre-established routes to gather vibration data using CSI 2130 handheld instruments. Critical machinery can also be monitored online using permanently installed sensors that transmit vibration information continuously. In both cases, the diagnostic data provides vibration analysts with a vivid picture of the operating condition of essential rotating machinery. The ability to overlay frequencies and match fault frequencies



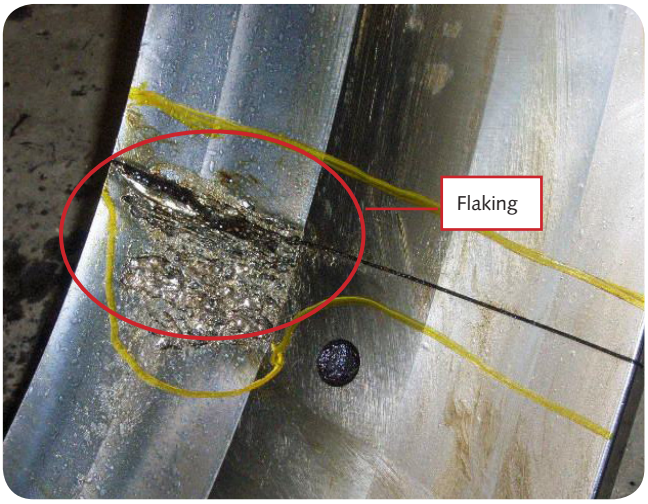
to peaks enables the analyst to efficiently determine the condition of a specific piece of machinery.

The PeakVue technology, which is embedded in the AMS Machinery manager software, provides early and accurate detection of roller bearing and gearbox anomalies in a way that is unmatched by any other machinery health tools. The patented PeakVue method of processing preserves the peak amplitude of the stress wave emitted by a defective bearing or gearbox. This information is trendable and can be presented in multi-spectra views, helping analysts follow and evaluate the development of a fault.

Analysis

Once it was established on 20 April that a bearing fault existed, the location had to be found and the severity of the problem determined. By checking the fault frequencies, the outer race of bearing 23168B was pinpointed. Confirmation appeared in subsequent axial views of the inboard pinion bearing from readings taken on 5, 18, and 19 May (Figure 2).

Analysis proved to be correct when the bearing was removed and inspected. The outer race was cracked, and flaking had begun



This identification using conventional vibration data occurred considerably later than the initial revelation of the problem by PeakVue. Note that the vibrations returned to normal on 3 June after the repair completed on 1 June.

Multiple waveform views (Figure 3) confirmed the significance of the problem on 5, 18 and 19 May – also returning to normal on June 3.

Based on the accumulated information indicating the apparent severity of the problem, a decision was made to stop the mill for repairs, precluding a sudden failure while running that might have caused pinion shaft damage.

The analysis proved to be correct when the bearing was removed and inspected. The outer race was cracked, and flaking had begun, as shown in the pictures above. It was only a matter to time before this part failed due to high stress during normal operation of the mill.

This event also proved the value of predictive maintenance based on the PeakVue technology as the best way to keep rotating equipment available, reliable, and profitable.

Figure 3: multiple waveform views confirm significance of problem