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Engineering Dynamics CEO Christo van der Walt.

Predictive maintenance – the key to

Machines that fail while in service often cost ten times as much to repair than if the repair was anticipated and scheduled. A well thought out predictive maintenance programme has the potential to reduce the number of unexpected failures and provide a more reliable scheduling tool for routine preventative maintenance tasks. Many industries have reported a 2-10 % productivity increase, due to predictive maintenance practices.

When coupled with a comprehensive plant maintenance programme, predictive maintenance is a valuable tool. Where traditional maintenance management programmes rely on routine servicing of all machinery and fast response to unexpected failures, a predictive maintenance programme schedules specific maintenance tasks as they are actually required by plant equipment.

The premise behind predictive maintenance is that regular monitoring of the actual mechanical condition of machinery, as well as the operating efficiencies of process systems, will ensure maximum intervals between repairs; minimise the number of costly unscheduled outages created by machine failures; and improve the overall availability of operating plants.

Machine condition monitoring specialist Engineering Dynamics' chief executive officer Christo van der Walt says that by including predictive maintenance into a total plant management programme, the availability of process machinery will be optimised, while the cost of maintenance will be greatly reduced. "By making use of predictive maintenance, you can ensure that expensive equipment does not reach a state of disrepair where problems become catastrophic," he explains.

A predictive maintenance system has the ability to improve operational efficiencies in the following ways:

- Reduction in lost production: by identifying problems in their initial stages, a predictive maintenance programme gives notice of impending failure, so downtime can be scheduled for the most convenient and inexpensive time.
- Reduced likelihood of secondary damage: by identifying potential failures in advance, the severity of these failures can be substantially diminished by reducing or preventing secondary damage. For example, a bearing that is failing in a motor can be identified and replaced before the winding and shaft are also damaged.
- Reduced inventory: predictive maintenance reduces inventory costs owing to the fact that lead time is given when there is an impending failure. Parts can be ordered as required, thereby reducing expenditure for spare parts.
- Extending the life of plant items: as machine items are only dismantled when necessary, the probability of machinery handling wear and tear is reduced.
- Increased safety: by reducing the likelihood of unexpected equipment breakdown, the safety of employees is improved.

Vibration monitoring sensors.

Monitoring at Safripol

Engineering Dynamics has, over the last five years, been instrumental in assisting plastics manufacturer Safripol with a predictive equipment condition monitoring (ECM) programme. The ECM programme has replaced Safripol's original equipment manufacturer (OEM) maintenance philosophy with great success.

According to Safripol maintenance facility leader Thinus Steyn, since implementing the ECM programme, repair maintenance has become condition-based, meaning that refurbishments are only carried out on a needs-basis, regardless of running hours. "This has improved Safripol's asset management reliability (AMR) by approximately 10% over the past five years," he confirms.

Vibration monitoring cable grouping.

Van der Walt points out that in the case of a milling plant, when faced with large rotating equipment that is critical to the plant's overall work flow, a three-phase 'stepwise approach' installation programme would be recommended.

Phase 1 would begin with the installation of permanent vibration sensors on the plant's most critical machinery. During a plant walk-down, the best sensor positions would also need to be identified.

After power and conditioning are provided to the vibration sensors, 4-20 mA vibration outputs would be connected to the resident programmable logic controller (PLC) system. Additional analog cards in the PLC system would need to accommodate the 4-20 mA vibration signals.

From there, the supervisory control and data acquisition (SCADA) software can be configured to allow for the trending, alarming and storage of the vibration signals. This will allow for 24/7/365 coverage of machine condition, however, will not allow for trouble-shooting capabilities, which will enter

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operational efficiency

in Phase 2. At this point, a rising trend on the SCADA system would trigger a maintenance action.

In Phase 2, diagnostic capability would be added to enable a plant's vibration consultant to take detailed measurements from the installed sensors after their call-out was triggered by the rising trend on the SCADA system. In order to achieve this, the same sensors and cables will be used; however, the power and signal conditioning units would be replaced with XM120 measurement modules in the same panel.

Van der Walt says that the fact that these units are so close to the machines reduces the cabling costs drastically, compared to older rack-base systems that had to be in the switch room. "These XM120 modules will provide the same capabilities as in Phase 1, but will now also provide a raw output of the vibration signal. The modular XM120 system will allow for easy scalability, should you wish to expand the measurements to more machines."

An external data collection box is set up in a safe area away from the machines. This is where a plant's vibration consultant can hook up his portable data collector and capture detailed data from the installed sensors to give a detailed report on the cause of the high vibration, as seen on the SCADA system by the operators in the control room.

"In this situation, one would still need a consultant to come to site to provide a report. Phase 3 can reduce this delay for quicker action. No new sensors or modules are required in Phase 3; instead options to improve analysis/troubleshooting, communication and a possible trip signal from the XM120 vibration unit," he explains.

An XM120 vibration module has a built-in relay. Plant operation managers that are confident about their vibration levels and have set warning and alarm levels in the XM120 units may use the relay output to shut down the machine when these levels are exceeded to avoid further damage. By adding a communications device and a modem, a plant's vibration consultant will have the capability to dial into the system and use Fast Fourier Transforms (FFT) or just plain vibration spectrums, time waveforms and overlaying Fault Frequencies to pinpoint the problem.

Safripol's Sasolburg-based factory produces an annual output of 160 000 t of high-density polyethylene.

"For this, a user accessible copy of Emonitor software must reside on a plant's server for user access, firewall restrictions permitting. If the manufacturer of the plant's PLC system supports DeviceNet, then four bands of data pertinent to areas of interest such as pinion gearmesh frequency and others as single values to be trended in the SCADA system can be extracted," van der Walt adds. ❑