

The Signs of Failure

Advanced vibration-monitoring technologies protect critical assets

Rotating equipment seldom fails without notice, so breakdowns can usually be predicted and avoided by watching for signs of failure. Vibration monitoring, followed by machine diagnostics, is an effective way to track the health of production machinery in order to adhere to best maintenance practices, extend equipment longevity and avoid unplanned downtime.

More than ever, it is important to have access to reliable information about the operating condition of critical production equipment, not just a “trip” signal that comes only after internal damage has already occurred. Machinery shutdown protection is only part of a complete monitoring strategy to guard against events with little or no apparent warning. The right monitoring equipment, trained personnel and software package are needed to sense and identify the signs of failure long before a key compressor, turbine, gearbox, pump, coupling or air induction fan fails “unexpectedly.” In any economy, timely maintenance is far better than catastrophic failure and the costly repairs that follow.

Even so, studies indicate that more than 50 percent of industrial maintenance man-hours is spent fixing equipment after a failure has occurred, whereas less than 18 percent of the time is spent determining when equipment might fail and acting accordingly. The numbers will improve only when maintenance departments establish the monitoring of machine health as a key mission.

Advanced in-the-field vibration analysis as well as online and wireless vibration monitoring can be integrated with process control systems to nurture the health of the rotating machinery that is essential to high reliability production.

Route-Based Monitoring

The traditional method of collecting vibration data from rotating machinery has not changed appreciably in more than 25 years. A technician, with a hand-held data collector that can be attached to predetermined points on a machine or connected to permanently installed sensors, follows an expeditious route through the plant to obtain detailed vibration information on different rotating assets. This data is later uploaded to a computer software package for analysis and comparison with earlier

measurements taken on the same machine.

Industry leading data collection equipment (such as Emerson’s CSI 2130 Machinery Health Analyzer) accurately identifies the earliest signs of bearing and gear wear, along with many other potential machine faults, and provides an indication of severity while the technician is still at the machine. Real-time decisions can be made on whether to collect more detailed data or move on to the next machine.

Online Monitoring

In every process plant, certain rotating machinery must perform continuously to maintain a high level of production, and some critical situations can be averted only if a stream of data regarding the real-time condition of that equipment is available. To assure a flow of information regarding the health of a whole range of gas turbines, steam turbines, generators, compressors, fans, motors, pumps and the like, recently developed online monitoring systems represent technology well beyond route-based monitors that provide only snapshots of an operation. Essential equipment can be monitored for changing vibration patterns and rising temperatures — sure signs of impending trouble.

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Data received directly from a machine are presented in a variety of plots that depict exactly what is occurring. Maintenance engineers and machine specialists are given real-time information for use in analyzing changes in the machine’s operation.

These signals enable analysts to pinpoint the location, nature and even the severity of developing problems. The information from these automated monitoring systems enables plant personnel to predict with greater accuracy when a machine will need maintenance to prevent damage, avert unscheduled downtime and avoid lost production. Machinery health management soft-



AMS Suite delivers prediction, protection and performance details to both maintenance and operations personnel.

ware categorizes the significance of each machine in a production environment, focusing greater attention on those machines that would likely shut down all or a major section of the plant if they fail. Online monitoring assures that the condition of these machines is being assessed continuously.

For example, the CSI 6500 Machinery Health Monitor is designed for process automation and protecting new installations and upgrade projects, combining prediction and protection in a single chassis. Fully compliant with API 670, this online monitor delivers real-time information needed for immediate decision-making. As well, the AMS Suite: Machinery Health Manager predictive maintenance software captures vibration data continuously from a range of plant equipment, processing it and displaying the results graphically to give machinery analysts a better understanding of what is going on inside a machine.

This combination of machine health and process status/health gives operators much greater ability to recognize and manage controllable scenarios in order to avoid problems that might otherwise lead to degraded machine health. Such controllable events represent the best opportunity for plant personnel to optimize processes and performance and make a positive contribution to return on investment.

Wireless Monitoring

One of the newest technologies to be adapted for vibration monitoring, wireless communication eliminates “blind spots”: areas that have been either technically or economically unreachable with conventional wiring. Wireless has the potential to improve communications with a wide range of assets, including field instruments, valves and safety showers. Wireless vibration monitors are also adaptable to many types of rotary equipment that are critical to the process. These devices provide convenient access to information that was formerly not available but

may be essential to the overall performance and safety of each process unit.

The IEC62591 (WirelessHART) standard is based on a self-organizing mesh network in which transmissions defy the “canyons of metal” that define most large process industry plants. With this technology, each wireless device is a transceiver, so a direct, line-of-sight connection between an instrument and the data gateway is not required. In the event one transmission path is blocked, the network automatically directs the signal to an adjacent device, which relays it to the gateway, ensuring transmission reliability and data integrity.

With a wireless vibration transmitter (such as Emerson’s CSI 9420), vibration data from essential equipment can be transmitted simultaneously to control room operators and machinery health monitoring application, assuring that the right kind of data gets to the right person at the right time. This information can be used initiate predictive maintenance to prevent an unexpected failure leading to an expensive unplanned shutdown of part or all of a facility. Many times potentially disastrous conditions can be resolved before they are even recognized as problems in the control room.

Efficiently operated plants utilize every means of monitoring to obtain early indications of failing equipment so appropriate action can be taken. A system incorporating protection monitoring, prediction monitoring, performance monitoring, and integration with process control is the most effective way to achieve a complete maintenance solution.

Tracking the health of production machinery in this way is a best practice, leading to extended equipment longevity and avoidance of downtime. ■

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