



ULTRASONIC UPTIME

Using ultrasound instruments for predictive maintenance tasks

by Alan S. Bandes

Whether you call proactive inspections “predictive maintenance” or “condition monitoring,” your goal is the same. You want to note a deviation from a normal or baseline condition so you can determine whether to take corrective action in a planned, orderly manner and prevent an unplanned incident. That action might include more frequent monitoring, detailed analysis of the condition, adjusting, repairing or replacing a component.

Ultrasound inspection is a unique technology used to speed up the inspection/analysis process. Many inspectors use ultrasound instruments as their basic screening tool to identify anomalies and determine follow-up actions such as additional testing with other technologies or corrective procedures.

Ultrasound technology?

Ultrasound is composed of high-frequency sound waves above the range of human hearing. Predictive maintenance uses airborne/structure-borne ultrasound technology. Instruments based on this technology sense frequencies ranging from 20 to 100 kilohertz, which are electronically translated down into the audible range.

Operators hear the sound

through headphones and view it as intensity increments on a meter or display panel.

They come in analog and digital versions, and are used for a variety of applications ranging from leak detection to electrical inspection and mechanical analysis. The digital versions often include software for data collection and management. Some have features such as frequency tuning to enable users to filter out extraneous noises while focusing on the sound of interest; others have on-board data logging and on-board sound recording to enhance the diagnostic process.

As a short-wave, high-frequency sound wave, ultrasound provides some advantages in typical plant inspections. It’s a relatively directional signal that can be deflected easily, which means these sound waves can be located in relatively noisy environments and monitored with little interference from competing sound sources.

Mechanical inspection

Mechanical equipment produces a “normal” sound signature when operating effectively. As components begin to fail, a change in the original sonic signature occurs. This change can be noted as a shift in intensity or as a qualitative sound change heard through headphones

and recorded for further analysis.

For bearing condition inspections, ultrasound instruments offer the ability to simultaneously observe intensity levels while listening to the sound quality to note any deviations from a baseline. Some instruments have the ability to display both current and baseline information to enhance the procedure. Bearing information can then be logged for trending purposes or recorded for spectral analysis.

In addition to noting bearing failure conditions, ultrasound instruments can be used for condition-based lubrication programs. Instead of lubricating bearings on a routine, “time-based” schedule, inspectors can routinely test bearings and identify those that need lubrication, leaving the others alone. In this manner, lubrication technicians learn how to effectively apply just enough lubricant to prevent overlubrication.

Spectral analysis software

Since it’s possible to record sound samples, spectral analysis software is another tool used for detailed condition analysis. FFT diagnosis can be performed on standard personal computers as long as the PC has a sound card. These programs provide the

spectral and time series views of sound, but also enable users to hear sound samples simultaneously as they view them on the PC monitor.

Electrical emissions

Ultrasound electrical inspection can be performed on all voltages: low, medium and high, in open or enclosed equipment. The advantage of being able to hear while scanning enables inspectors to quickly identify electrical anomalies such as arcing, tracking and corona. The diagnosis will depend on the voltage since corona will not be present below 1 kilovolt.

Ultrasound testing of enclosed electrical cabinets can help prevent exposing an inspector to the potential of an arc flash incident. By scanning the door seams and air vents, an inspector can detect

the presence of arcing, tracking or corona, which could contribute to arc flash should the cabinet be opened incorrectly.

Leak detection

The category of leak detection covers a wide area. Some plants include it as part of an energy conservation program while others refer to it as fugitive emissions. No matter what, leaks can cost money, affect product quality and wreak havoc with the environment.

Leakage can occur in liquid or gas systems. The greatest advantage of ultrasonic detection is that it can be used in a variety of leak situations since it is sound sensitive and not "gas" specific. The intensity of the ultrasonic signal falls off rapidly from the source. For this reason, operators can locate the

exact spot of a leak. This can apply to pressure leaks and negative pressure (vacuum) leaks, leaks in valves and in steam traps.

Conclusion

Airborne ultrasound instruments are becoming an important part of predictive maintenance programs. Their versatility, ease of use and portability help inspectors effectively plan and implement inspection procedures. By locating leaks, detecting high-voltage electrical emissions and sensing early warning of mechanical failure, these instruments contribute to cost reductions, improved system efficiencies and reduced downtime. ▲

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