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PM AND SCHEDULED OR CONDITION-BASED ACOUSTIC LUBRICATION

Jim Hall

When implementing an acoustic lubrication program…you need to establish a baseline to account for increases in readings and decibels.

Acoustic lubrication has taken off with afterburners lit (old aviation phrase). During the 2017 RELIABILITY Conference ™ hosted by Reliabilityweb.com®, several representatives from various organizations remarked at how well their acoustic lubrication program had made such a difference. As an example, the cost savings by way of reduced man-hours using time-based lubrication and the amount of grease not purchased are two reasons.

Over the last several years, others have commented on the implementation of time-based versus condition-based acoustic lubrication. Implementing a condition-based acoustic lubrication program instead of a time-based one for some motors makes good sense. For example, one company implementing a condition-based acoustic lubrication program sends its technicians out to take ultrasonic trending data. If the reading is 8-10 dBs over the previous baseline, grease may be warranted. Now, technicians are taking ultrasound trending data and, in some cases, also performing the acoustic lubrication procedure.

Whether it be 30-, 60-, or 90-day inspection intervals, the company's technicians may encounter readings that suggest a bearing needs lubrication. In some cases, after acoustic lubrication is performed and the decibel has not returned to previous or near previous baselines, the next step, depending on criticality of the asset, may be to request vibration data on the motor. Many times, this proved to be an early warning of a failure occurring, possibly a category 1, 2, 3, or 4 failure.

With an ultrasound program within its condition-based maintenance program, the company performs 37 percent less motor maintenance since implementing acoustic lubrication.

During The RELIABILITY Conference, several attendees were asked about their acoustic lubrication program. The question posed was: "How are your PMs worded when told to grease a motor?" One participant responded that it "only tells us to grease motor bearings" and gives no particular amount. For technicians, this might mean two, three, or more pumps of grease for each PM without knowing, in many cases, whether they are over or under lubricating

Figure 1: Use ultrasound as a preventative maintenance tool to trend, record and use as a condition-based lubrication tool *(Photo courtesy of The Ultrasound Institute)*

Figure 2: An ultrasonic lubrication delivery system being used *(Photo courtesy of UE Systems)*

I first practiced the procedure of acoustic lubrication in 1993 in downtown Atlanta, GA. It was while listening to the bearing with an analog ultrasound instrument that I first heard what sounded like a "dry" bearing. It sounded exactly like what a bearing assembly with no grease, held up to your ear and spun would sound like…dry.

An analog ultrasound instrument is pure noise, unlike many of today's digitized instruments. But, if you're going to data-log, record sound, etc., then you need a digital instrument.

With seven years' experience in the use of my analog instrument, I felt very comfortable being able to diagnose bearing issues. A bearing with the correct amount of grease or lubricant that was properly installed and aligned properly may sound very fluidic or like a rushing sound. A bearing under-lubricated will sound the same, but with a higher degree of noise due to friction. When using an ultrasonic translator or receiver, high and low frequency components are present. But, the ultrasound instrument detects the high frequency components (above 20,000 hertz or 20 kHz) which would be friction and "not vibratory displacements of rolling elements," such as those that the vibration meter would recognize. As friction increases so does the amplitude or decibels.

I know that some of you are simply using both infrared and vibration as your sole predictive technologies. When using an infrared imager to check motor bearings, "caution" is warranted and must be taken in your diagnoses. High temperature readings may be the result of an incorrectly aligned shaft, improperly installed bearing and either/or, over- or under-lubrication. This is an example where ultrasound may complement your infrared technology. If you have an indication of high temperature, simply use the acoustic lubrication method and apply a half-stroke of the grease gun. If the decibels increase immediately and after 10-15 seconds do not return to the level prior to the half-stroke, this is an indication of a bearing that has enough grease and there must be some other reason for the high temperature.

What is the decibel reading? How does this relate to previous readings?

because they aren't using ultrasound as a condition-based technology, and a PM is normally performed with motors offline.

With this logic, it's easy to understand how a motor bearing can be over greased, especially if the motor is not in full-time (i.e., 24/7) operational status.

Another attendee responded that his PMs may tell them two to three pumps of grease. So, no matter what, technicians would always put two to three pumps of grease and, in some cases, they would report seeing grease coming from the seal of a bearing or from the motor casing.

But, what if the grease never shows itself externally? Perhaps the excess grease has made its way to the armature, coating the windings of the motor. This can insulate the wires and not allow heat to dissipate, leading to a shorter motor life or possibly shorting out the motor.

When implementing an acoustic lubrication program, as with vibration or any ultrasonic trending program, you need to establish a baseline to account for increases in readings and decibels.

With an estimated 95 percent of all ultrasound instruments purchased today being digital, the emphasis should be placed on the rise in decibels and not what you can discern from listening with the instrument.

With ultrasound, standard trending data is accomplished by taking either a magnetic base sensor or a sensor with a rod screwed onto the end of the ultrasonic sensor that acts as a waveguide directing the sound to the sensor. You make contact, and after five seconds, store the reading into your data logger (you just saved five minutes or more of man-hours not taking multiple vibration points) and you then continue on to the next motor bearing.

With some instruments, you can record the bearing's sound and replay it through spectral analysis, possibly rendering useful data that could help diagnose the bearing's condition.

Now, imagine implementing an acoustic lubrication program. Besides man-hour savings from lubricating fewer motors and cost savings from purchasing less lubricants, you are using technicians to take data readings and not utilizing the vibration technicians as much for non-critical motors. As such, you are freeing up the vibration technicians to analyze and concentrate on critical assets instead. And let's not forget the other savings, such as motor maintenance, motor failures and man-hours due to downtime.

There are now instruments specifically made for the acoustic lubrication procedure. However, you should keep it simple. You can get so caught up in technology that the people you are trying to convince to use the technology simply don't want another high-tech instrument that requires too much thinking. It's lubrication, it's greasing a doggone bearing for crying out loud. On the other hand, depending where your lubrication program is, these specialty products may be advantageous to your particular reliability program.

Perhaps rewriting your PM may be an alternative solution preventing motor failure due to over or under lubrication. Or, perhaps rewriting your PM to actually tell the technicians to remove a lock and start the motor to temperature so that you can perform acoustic lubrication. Why put grease into a motor if it does not require it? In "The Fundamentals: How to Write an Effective PM Procedure" (a recommended read), author Ray Atkins provides some key elements for writing a preventive maintenance procedure.

1. **Assessment** – Start with a motor that already requires greasing or lubrication. Assess whether acoustic lubrication is practical. Perhaps this motor is fully operational 24/7. Surround yourself with experts that have a vested interest in a successful PM writing.
2. **Documentation and Analysis** – Utilizing maintenance and production personnel, review formal documentation of prior reliability issues, if available, research certain anecdotal evidence, or rely on employees' memories. Perhaps there's documentation of evidence of over lubrication or motor failure due to a lack of lubrication. Don't forget failure mode and effects analysis (FMEA), perhaps the most crucial part of the PM process.
3. **Writing Your Procedures** – Review the owner's manual of the motor and other supporting documents. Regardless of the computerized maintenance management system that you have, remember these points when writing your PM procedure:

How much money are you leaving on the table because you are not utilizing ultrasound technology?

- Keep it simple and short.
- Keep it safe.
- Keep it logical.
- Solicit input.
- Build accountability into the document.

Vibration, infrared and ultrasound are complementary technologies. Can you see it? How much money are you leaving on the table because you are **not** utilizing ultrasound technology? Ultrasound is not your father's, mother's, or grandparents leak detector for air and steam leaks. It's that and much more.

There is value in implementing a condition-based acoustic lubrication program, but training is key. Save time, money, the environment and possibly injuries or life by investing in ultrasound instrumentation and training.

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***Jim Hall**, CRL, is the Executive Director of The Ultrasound Institute (TUI). Jim has been in the ultrasonic market for over 25 years and has trained many Fortune 500 companies in the use of airborne ultrasound, including the electrical power and generation, pulp and paper, automotive and aviation industries. Jim has been a contributing writer for Uptime® Magazine's (ultrasound segment) since the magazine's inception. www.theultrasoundinstitute.com*

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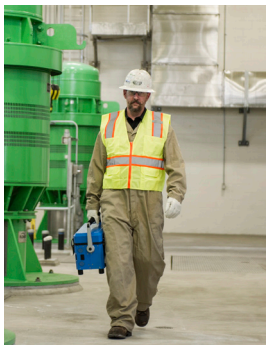

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