



WHAT SUCCESS SOUNDS LIKE:

Customer Success Stories of Predictive
Wins with Ultrasound Technology

- ◆ Leak detection of compressed air and other gases
- ◆ OnTrak Wireless: Bearing condition monitoring and condition-based lubrication looks off balance
- ◆ Partial discharge detection
- ◆ Steam trap & valve inspection



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Ultrasound and Vibration Analysis:

Two key elements of predictive maintenance

Vibration analysis has been for many years the technology of choice for maintenance professionals to monitor the condition of rotating assets. However, in the last years ultrasound has also emerged as a very popular technology for condition monitoring.

The question that many are now asking themselves is: which one is best? Ultrasound or vibration?

Why Vibration Analysis?

Vibration analysis is an incredible tool: it detects and measures small vibrations and what is causing them, thus allowing maintenance professionals to detect early failures on rotating equipment. Furthermore, vibration analysis gives us a very deep diagnostic and allows us to identify the failure's root cause, and thus correct it to avoid further issues in the future. Plus, there is a great number of vibration sensors and solutions in the market to choose for, so maintenance teams can find a solution that is suitable for their needs.

Why Ultrasound?

Ultrasound is considered by many the first line of defense when it comes to bearing failures, since it can give a very early warning of a potential problem, even with lubrication issues. The way ultrasound does that is by monitoring the friction levels on rotating equipment. The concept is simple: as a bearing starts to fail or is not lubricated properly (under or over lubricated), the friction levels rise. Friction creates ultrasound emissions that can be picked up by an ultrasonic handheld device or sensor and translated to low frequency sounds that the inspector can hear. Ultrasound equipment will also provide a decibel level – and the higher the decibel, the higher the friction.

Ultrasound or Vibration?

There is no easy answer to this question, but one thing is for sure: if a maintenance team wants to reach excellence, both technologies should be used. Ultrasound will provide the earliest warning of failure and is also very easy to use, since it relies on simply trending decibel levels. Vibration analysis is extremely complete and will give maintenance professionals a deep overview of the issue and the root cause of such issue. Almost as if ultrasound is the doctor who detects the problem, and vibration is the health specialist that will diagnose it properly. We will now talk about a few situations where, in general, ultrasound can be used instead of vibration analysis.

Slow Speed Bearings

Slow speed bearings are difficult to monitor. Since they rotate very slowly, it's difficult for vibration sensors to pick up significant changes in vibration. Even with an ultrasound instrument it may be difficult to pick up failures if we rely only on decibel levels, since in extreme slow speed bearing applications (usually less than 25rpm), the bearing will produce little to no ultrasonic noise. However, high-end ultrasonic devices will allow for sound recording: by recording the sound of the bearing and checking it in a spectrum analysis software, we can easily find peaks in the sound spectrum amplitude which indicates a fault in the bearing.

First Line of Defense, Easy to Use

For a maintenance professional to properly work with vibration analysis, significant training and experience are needed. On the other side, ultrasound has a much quicker learning curve. And this is because of how the technology works: since it is monitoring friction levels and translating them to dB values, we can easily check for potential problems with our rotating equipment. Once we setup a dB baseline for a bearing, we just need to trend the dB value overtime. So, if the baseline for a bearing is 20dB, but the ultrasonic instrument reads 32db, we already know there is a problem simply by comparing values.

Lubrication

Again, because ultrasound is based on the friction levels, it is perfectly adequate for bearing lubrication. Is the bearing lacking lubrication? Then the friction levels will increase, and we can hear that through the ultrasonic instrument and see it in the dB levels. If we start lubricating the bearing, most likely we will see a decrease in the sound intensity and the dB levels. Did the bearing receive too much lubricant? Then again, friction levels will increase, and we will know that using the ultrasonic instrument. Thus, ultrasound is perfect to avoid under- and over-lubrication issues.

Versatility

While vibration analysis is an extremely powerful tool, its uses are limited to mechanical equipment. On the other hand, ultrasound has a wide range of applications which makes it a very versatile technology. One of the most popular applications of ultrasound, besides condition monitoring, is energy savings. Since turbulence also creates ultrasound emissions, the ultrasonic instruments can be easily used for leak detection (compressed air and other gases), steam traps inspection and even for electrical inspections, to detect issues such as corona, tracking and arcing.

Conclusion

We believe, as many other maintenance professionals nowadays, that using multiple technologies that complement each other is the way to go. Therefore, the question is not ultrasound vs vibration, but instead ultrasound and vibration and when we should be using one or the other. Both are very powerful condition monitoring technologies and, when used properly together, can really take any maintenance and reliability program to the excellence level.

Ultrasound: Achieving Energy Savings by Detecting Compressed Air Leaks

With energy prices at an all-time high, it's now more important than ever for maintenance teams to focus on detecting compressed air leaks at their industrial facilities. As electricity prices keep going up, generating compressed air becomes more and more expensive – detecting and fixing leaks becomes now a priority.

It is estimated that more than 50% of all compressed air systems have energy efficiency problems, and losses from such systems can be very costly. About 30% of all industrial compressed air is lost due to leaks, generating a huge economical and energetic waste. Just think that a leak of just 3mm can cost up to 574 GBP per year if it is not detected (on a 5 bar pressure system). Thus, detecting and repairing compressed air leaks may lead to huge energy savings.

Leak Detection Methods

There are a few methods used to detect compressed air leaks. One of the most traditional methods, still widely used, is detecting leaks with a soap and water solution. This method has a few disadvantages: it takes a very long time, creates additional work and may also constitute a safety hazard.

A much more effective, quick and safe method is using ultrasonic inspections instruments. These can be listen-only instruments or the more recent ultrasound leak detection cameras, which make the job even easier.

Why Use Ultrasound for Leak Detection

Using the characteristics of Ultrasound, locating leaks is fast and easy to do so because of:

- ◆ Directionality of sound waves makes locating the source easy
- ◆ Intensity of signal: the closer you get, the more sound you detect
- ◆ Fixed frequency, making it effective to locate even in a loud factory environment

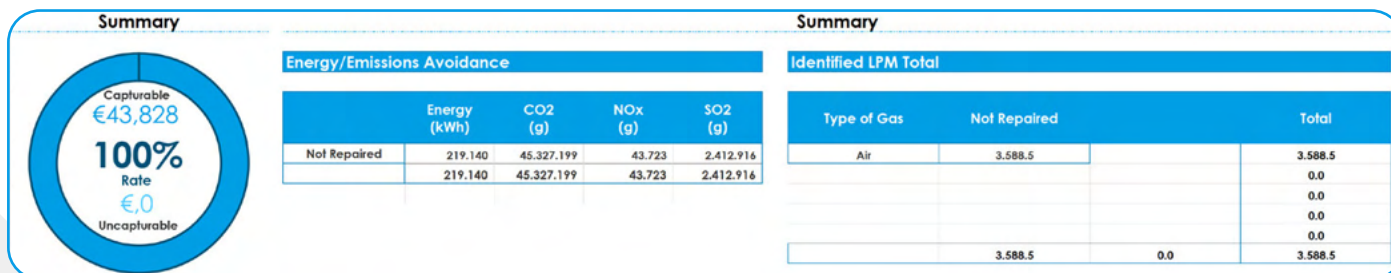
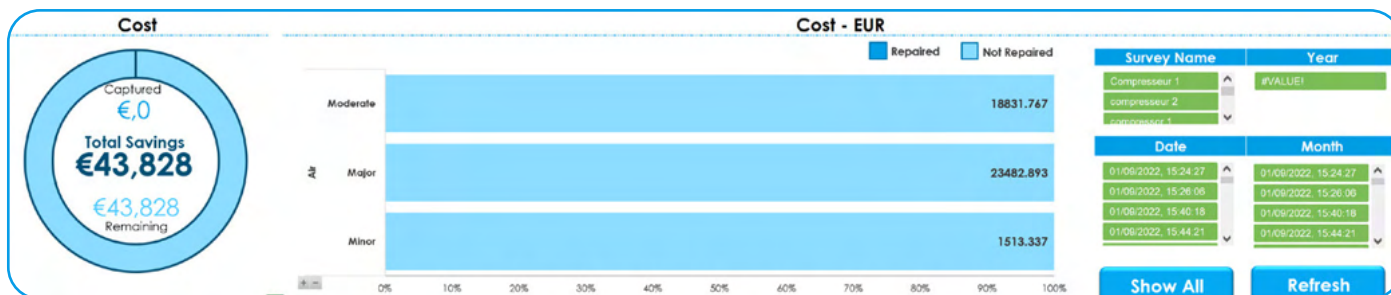
As any gas (air, oxygen, nitrogen, etc.) passes through a leak orifice, it generates a turbulent flow with detectable high frequency components.

By scanning the test area with an ultrasound instrument, a leak can be heard through the headset as a rushing sound or noted on the display/meter. The closer the instrument is to the leak, the louder the rushing sound and the higher the reading.

Should ambient noise be a problem, a rubber focusing probe may be used to narrow the instrument's reception field and to shield it from conflicting ultrasounds.

In addition, frequency tuning (available in most models) dramatically reduces background noise interference to provide ease of ultrasonic leak detection as never before experienced.





Compressed Air Leak Surveys – evaluating the cost of leaks.

One of the more popular applications for ultrasound is the creation of compressed air leak surveys.

Utilizing a software for compressed air leaks, users are able to locate and report on cost estimation per leak while also demonstrating the reduction of the carbon footprint.

- ◆ Locate the leak site fast & easy
- ◆ Tag the leak site & record values with digital ultrasound inspection instruments
- ◆ Report potential cost avoidance & produce repair reports

This can be done using software such as UE Systems DMS or even a mobile app like the Leak Survey Sidekick app.

This app lets the user create a compressed air leak survey report. Once leaks are identified and information is entered, the data can be used to generate a comprehensive Excel report that includes estimated LMP (liter-per-minute) loss, up-to-date cost avoidance, leak location photos (taken with your smartphone or tablet), and greenhouse gas reductions.

Survey quality assurance is optimized by identifying leaks that have been repaired and leaks that have not been repaired. Also works with specialty gases like Argon, Helium etc.

Ultrasonic Cameras for Compressed Air Leak Detection

Traditional ultrasonic inspection instruments are effective, but work only with sound. The user detects leaks by following the leak sound coming through the headphones connected to the instrument, scanning in all directions and following the sound source until it's possible to pinpoint the exact leak location. This is called the gross-to-fine method.

However, with the most recent developments in ultrasound technology for leak detection, there are ultrasonic cameras available which allow the user to see the leak on a screen, in real-time.

Maintenance professionals can easily find compressed air leaks (or any other compressed gas) by simply switching on the camera and watch how the leak locations show up on the screen. This way, it is possible to quickly cover a large area and find a significant amount of leaks, even at a safe distance. Thus, finding leaks with this ultrasound camera is much more efficient when compared to traditional leak detection methods.



How to Conduct a Steam Trap Inspection Survey



High energy prices and global competition dictate a need to reduce energy waste and improve system efficiencies whenever possible. Steam, aside from being one of the costliest utilities in plants, is an essential component of product quality in many processing industries. Christopher Hallum, UE Systems Regional Manager UK & Ireland explains.

A major contributor to waste and inefficiency is leaks: both to atmosphere and through valves and steam traps. Improvements to the steam system may include insulating steam and condensate return lines, stopping any steam leaks, and maintaining steam traps. Experts have also said that as much as 20% of the steam generated at the central boiler is lost to leaking or failed steam traps.

The purpose of a successful steam trap inspection programme should be to repair any faulty steam traps and steam leaks that can affect safety, to reduce energy waste and promote sustainability as well as product quality.

Using Ultrasound Technology

Ultrasound technology is used by maintenance and reliability professionals around the world and is considered to be the most versatile of any predictive maintenance technology. Typical applications for ultrasound include compressed air and gas leak detection, inspection of bearings, motors, gearboxes and valves, electrical inspection of energised electrical equipment, hydraulic applications, and inspection of steam traps.

Planning for Success

Before beginning your inspection, it will be helpful to think a few things through that will help to make the steam trap survey successful. First, walk the area to identify and tag every steam trap. The tag should include a number, and information should be noted such as the manufacturer of the steam trap, its type, the orifice size inside the trap, and the purpose of the trap.



Testing Steam Traps with Ultrasound

When the inspector is at the steam trap, before testing with ultrasound it is recommended to take temperature readings with a simple spot radiometer first. Not only will the temperature let the inspector know if steam is coming to the trap or not, it can also be used to estimate the steam pressure. If the steam trap is cold, the inspector should check to make sure that the valves are open or if the trap has been taken out of service. If the steam trap is warm or hot, the inspector can note the inlet and outlet temperatures and proceed to test with ultrasound.

When it comes to actually testing the steam traps with ultrasound, the most important item that the inspector will need to know is what type of trap is being inspected. This will determine what the steam trap should sound like once contact has been made between the trap and the ultrasound instrument. Steam traps will have one of the following sound characteristics: on/off or continuous flow.

It is recommended that you listen to a number of traps prior to starting the inspection to determine a "normal" sound characteristic for how the steam trap is operating under the operating conditions of your particular steam system.

Physical contact between the steam trap and the ultrasound instrument is necessary in order to be able to "hear" how the steam trap is performing. If using an ultrasound instrument that has frequency tuning, adjust the frequency to the recommended frequency setting of 25kHz.

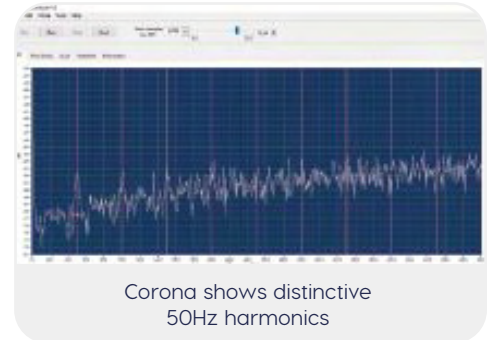
Regardless of the type of trap, the contact probe will always be placed at the discharge orifice of the trap, since turbulence is created on the outlet side of the steam trap when the steam trap releases condensate.

Once contact has been made, adjust the sensitivity/volume on the instrument until the sound of the trap can be heard.

When inspecting steam traps with ultrasound, it is important to exercise patience. Make contact at the discharge orifice of the trap and wait for it to cycle. If the temperatures have been checked, and the trap has not cycled for approximately one minute, move on to the next trap. If the steam trap has not cycled within one minute's time, it may be difficult to know when the trap may cycle again, but if the temperatures are OK and there's no indication of a plugged condition, proceed to the next trap to be tested.

Ultrasound Spectrum Analysis for Mechanical and Electrical Faults

Ultrasound technology has become one of the essential tools in predictive maintenance, condition monitoring and reliability, due to its quick learning curve, ease of use and flexibility. Leak detection has been one of the most common applications for ultrasound, but we now see the technology more and more being used together with sound analysis software to diagnose specific mechanical and electrical faults. Christopher Hallum, UE Systems Regional Manager UK & Ireland explains.



Ultrasound Spectrum Analysis

Ultrasound technology can be used in different applications such as leak detection, steam traps and valves inspection, bearings condition monitoring and electrical inspections.

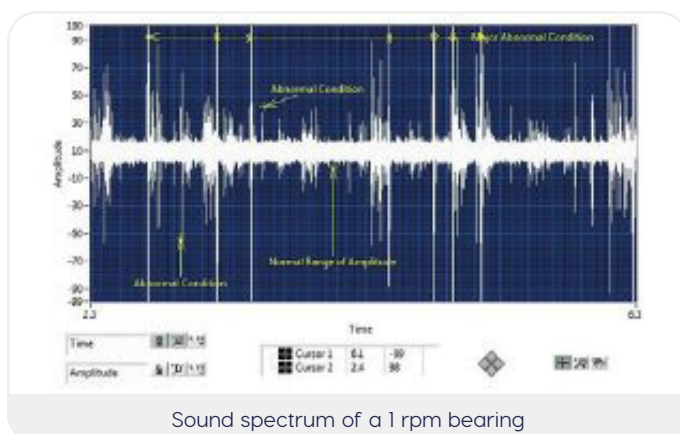
In some cases, for example when trying to evaluate the condition of mechanical or electrical assets, it may be necessary to use an instrument with sound recording capabilities. This allows the inspector to load the recording into a sound analysis software to more accurately diagnose the type of fault.

Diagnosing Mechanical Faults

Mechanical inspections with ultrasound include diagnostics such as bearing faults, pump cavitation, and valves condition. When it comes to bearings, users usually monitor their condition by relying on what they hear through the headset or by trending decibel levels.

This is a simple and effective method. However, in some cases, maintenance professionals will need to dig deeper and record the sound from the asset for further analysis on the software. This practice is especially useful in two situations: inspecting slow speed bearings and pinpointing where the failure is. When it comes to inspecting slow speed bearings, in many cases there is not enough 'noise' to trend the condition using decibel levels. In this case it is necessary to look at the sound spectrum.

In the diagram (bottom left), we can see the sound spectrum from a 1 rpm bearing on a furnace application. Note all of the anomalies that appear in the Time Wave Form from the 'crackling and popping' sounds that were produced by bearing fatigue. This issue could only be properly diagnosed by using a sound spectrum analysis software.



We can also use this type of software to identify where the fault is, if there is an integrated bearing fault calculator. By entering in the speed (rpm) and the number of balls (bearings), an outer race, inner race, ball pass, and cage frequency will be calculated.

In one example, the speed was 1708rpm and the number of balls was 8. The fault frequency calculated by the spectrum analysis software that was of interest was an outer race fault at 91Hz.

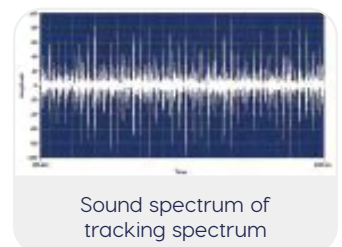
Diagnosing Electrical Faults

Ultrasound can be used to listen for electrical conditions such as corona, tracking, and arcing. Each anomaly has a distinct sound and can easily be identified and confirmed through the use of ultrasound spectrum analysis.

Corona, the ionization of air surrounding an electrical connection above 1000 volts, is heard using the ultrasound instrument as a steady, uniform, static sound. When looking at the recorded ultrasound of corona in spectrum analysis software, very distinct and evenly spaced peaks or harmonics can be seen, as demonstrated in the diagram above.

The harmonics appear every 50Hz. You can also see frequency content, peaks within the peaks, between the 50Hz harmonics. These are signature features to look for when analysing recorded ultrasounds of corona. Being able to detect corona with ultrasound is particularly helpful because corona typically does not produce significant heat to be detected with infrared.

With electrical inspection, the well defined 50Hz harmonics will diminish as the condition becomes more severe. This can be seen in a sound of tracking, which typically has a more distinct continuous frying and popping sound (pictured above). Also, increased amplitudes indicate a more intense sound versus the amplitudes of corona.



The analysis of arcing is even more evident of the loss of the uniform 50Hz or 60Hz harmonics. With arcing, the electrical discharge becomes more erratic and has sudden starts and stops of the discharge.

Case Study: Slow-Speed Bearing On Oven Motor - Failure Detection Using Ultrasound

Monitoring the condition of slow speed bearings is quite important, since in most cases these are critical assets. When slow speed bearings fail, the consequences usually involve long unplanned downtime and costly repairs. Maintenance professionals know how challenging it can be to properly monitor the condition of slow speed bearings - in this case study we show how ultrasound technology might be the perfect tool for such a challenge.



Slow speed bearing from an oven motor, after being removed for replacement

Slow Speed Bearing Inspection with Ultrasound

Vibration analysis has long been the instrument of choice to use for bearings and other rotating equipment. More commonly, ultrasound is being used in conjunction with vibration analysis to help technicians confirm the condition of mechanical assets.

Because of the versatility of ultrasound, if a facility does not have a robust vibration analysis program in place, ultrasound can be implemented to detect early stage bearing failures, as well as other issues. If the vibration analysis is performed by an outside service provider on a quarterly or monthly basis, ultrasound can be used during the interim. This will help the facility to know the condition of some of the more critical assets prior to the service provider entering the facility; therefore, the service provider's time can be used more efficiently because the plant knows if there are any prominent problems with the assets that are being monitored by ultrasound. The service provider can then prioritise based off the ultrasound findings.

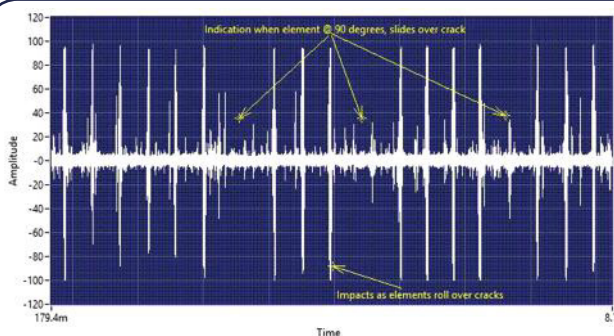
Another scenario in which ultrasound may be used first over vibration analysis is with the monitoring of slow speed bearings. Slow speed bearing monitoring with ultrasound is easier than you might think. Because most high-end ultrasound instruments have a wide sensitivity range and frequency tuning, it is possible to listen to the acoustic quality of the bearing, especially at slower speeds.

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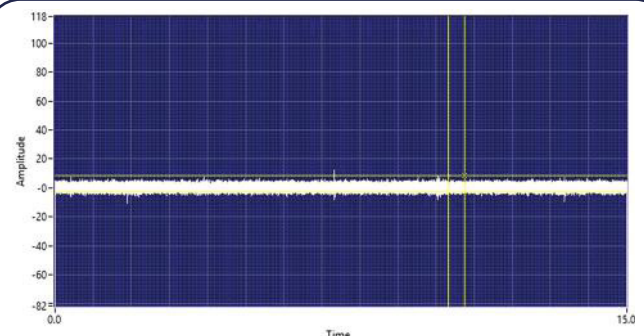
If a facility does not have a robust vibration analysis program in place, ultrasound can be implemented to detect early stage bearing failures.

In extreme slow speed bearing applications (usually less than 25rpm), the bearing will produce little to no ultrasonic noise.

In that case, it is important to not only listen to the sound of the bearing, but more importantly to analyse the recorded ultrasound sound file in a spectrum analysis software, focusing on the time wave form to see if there are any anomalies present. If “crackling” or “popping” sounds are present, then there is some indication of a deformity occurring. In bearing speeds above 25rpm, it is possible to set a baseline decibel level and trend the associated decibel level readings over time.



Sound Spectrum of the damaged bearing, where the peaks in amplitude give the inspector a clear sign of damage.



Sound Spectrum of a 'good' bearing. Very uniform and no changes in amplitude.



The damage to the bearing was very noticeable and consistent with the sound file pattern



Ultrasound instrument with sound recording is the perfect tool to monitor the condition of slow speed bearings.

Using Ultrasound to Identify Oven Motor Bearing Failure

An inspection with an ultrasound instrument was carried out on a site with a newly installed oven dryer. This was a large drum oven, about 20 meters long by 5 meters wide. It was rotated by 4 large motors, each of them having two large sets of bearings. These motors rotate the oven and are rotating at a speed of around 7-10 rpm. Meaning we are talking about a case of extreme slow speed bearings, which is usually a challenge to inspect.

An ultrasonic instrument was used to inspect all bearings – almost all of them presented a nice and smooth sound and a 0dB reading, except for one. On one of the bearings from this set, the ultrasonic instrument was displaying 2dB instead of 0. Also, the sound heard from the headphones was different: it was not smooth as in the other bearings and it presented a repetitive “knocking” sound. This gave the inspector an indication that something might have been wrong with this specific bearing.

After the results from the ultrasonic inspection, a grease sample was taken to confirm if there was any damage on the bearing – in which case the grease sample would show metal contamination. The results from the grease analysis showed indeed the presence of metal particles, confirming the damage as indicated by the ultrasound instrument.

The next step was naturally scheduling an outage to replace the bearing, which was in a very bad condition as it can be seen in the images. Part of the outer race came away as it was opened. It was also noticeable that one of the rollers had moved 90 degrees. The cage had been totally damaged too. (See figure 1, 2 & 3).

Ultrasound and Slow Speed Bearings - the Method

As we can see, ultrasound technology is very useful when trying to monitor the condition of slow speed bearings, and an ultrasonic instrument/sensor is able to provide maintenance personnel with a warning of failure, even in extreme slow speeds like in this case.

With bearings rotating at normal speeds, ultrasonic inspection can be performed by comparing changes in dB values, establishing that a bearing with a certain value above a decibel baseline will need lubrication or be already in a failure state, depending on how much decibels it is above the baseline.

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This find has saved the company a significant amount of money, as it was necessary to get cranes in to replace such a big bearing, a job that took up to 6 hours.

However, with slow speed bearings, comparing dB levels and establishing alarms is not enough: in many situations the difference in the dB levels will not be significant or even non-existent, in which case the inspector might think there is nothing wrong with it.

For slow speed bearings, one must rely on the sound quality and the sound pattern. For this, it is necessary to use an ultrasonic instrument with sound recording capabilities, like the Ultraprobe 15000, and then analyse the sound file on a sound spectrum analysis software like the Spectralyzer from UE Systems. Then, maintenance professionals can simply record the sound produced by a slow-speed bearing, load the file in Spectralyzer and analyse it in the Time Series view.

The spectrum analysis of this oven motor bearing shows clearly where the roller at 90 degrees hits the crack as the knock stops briefly. Thus, the sound pattern indicates already an existing problem, being the most reliable source of information when determining the condition of a slow- speed bearing using ultrasound.

On the other hand, the spectrum of a recorded sound from one of the “good” bearings shows a very different picture: a very uniform spectrum with almost no changes in the amplitude.

This find has saved the company a significant amount of money, as it was necessary to get cranes in to replace such a big bearing, a job that took up to 6 hours. Luckily this was done during a planned outage, avoiding the costs of unplanned downtime.

Harnessing the Power of Ultrasound:

Ontrak wireless detects bearing faults earlier than vibration monitoring in recirculation fans

MONITORING A RECIRCULATION FAN'S NDE BEARING WITH THE ONTRAK WIRELESS

This case study focuses on a Recirculation Fan's Non-Drive End (NDE) bearing, a 4-15/16" pillow block bearing. To ensure the bearing's ongoing performance, the OnTrak Wireless System was installed to continuously monitor both the bearing's lubrication needs and its mechanical health. By tracking both lubrication levels and mechanical condition, the OnTrak Wireless system aids in the early detection of potential issues, ultimately helping to prevent downtime and prolong its operational life.

EARLY INDICATION OF BEARING ISSUES: ULTRASOUND VS. VIBRATION MONITORING

From the start of operations, ultrasound data indicated that friction levels on this bearing were consistently higher than those of similar bearings. Over time, friction levels gradually increased, eventually reaching the second alarm level despite multiple lubrication attempts. The OnTrak Wireless system's ultrasound monitoring detected a clear, upward trends in friction levels, but lubrication efforts did not return friction levels back to baseline, suggesting a deeper underlying issue.

To compare the early detection capabilities of ultrasound and vibration monitoring, the team tested when traditional vibration sensors would detect the issue initially flagged by ultrasound.

Despite rising friction levels, the vibration data remained stable. **It wasn't until one full month later** that vibration acceleration began to increase, finally triggering a vibration alarm and indicating a developing mechanical fault.

By the time vibration sensors detected the issue, significant damage could already have occurred, compromising the bearing's structural integrity and efficiency. As a result, reducing the friction levels back to baseline could now require more intensive maintenance efforts and time.

ONTRAK WIRELESS SYSTEM SOLUTION

The OnTrak Wireless System's continuous ultrasound monitoring provided early detection of rising friction, giving maintenance teams one full month's advance notice before vibration alarms indicated an issue. Ultrasound, with its high sensitivity to changes in both friction and lubrication, identified the problem well before vibration sensors could detect any mechanical faults. This allowed the team to plan a controlled shutdown and address the issue, avoiding a potentially catastrophic failure.

RESULTS

This case study highlights the clear advantage of ultrasound monitoring in detecting bearing issues earlier than traditional vibration monitoring. The OnTrak Wireless system provided a critical early warning by detecting rising friction levels in early July, giving the team time to investigate and address the issue before a mechanical fault developed, which vibration acceleration only indicated one full month later.

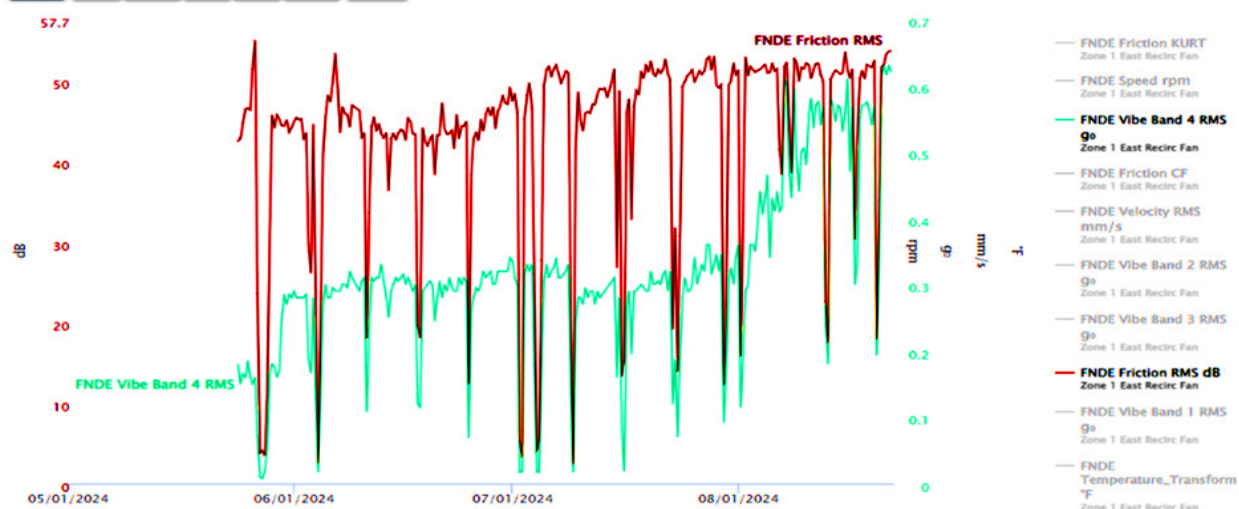
This case study also illustrates the effectiveness of ultrasound technology for early fault detection in industrial bearings, demonstrating how the OnTrak Wireless enables proactive monitoring to identify issues well before they are detected by vibration sensors, ultimately reducing the risk of unexpected equipment failures.

KEY TAKEAWAYS

- ◆ **Ultrasound monitoring detected rising friction one full month earlier** than vibration, providing crucial early insight into bearing health.
- ◆ Despite regular lubrication, friction levels remained elevated, signaling the need for further investigation beyond lubrication alone.
- ◆ The OnTrak Wireless tracks both friction (via ultrasound) and vibration trends, ensuring comprehensive monitoring of bearing conditions.
- ◆ Early detection through ultrasound provided valuable time to react and prevent a minor issue from escalating into a severe mechanical fault.

All Variable Trend

1H 12H 1D 5D 30D LIVE



Ultrasound Technology for Predictive Maintenance and Energy Savings



CONDITION-BASED LUBRICATION

- ◆ 80% of premature bearing failure is caused by poor lubrication practice
- ◆ Know exactly when to lubricate your bearings and how much grease to apply
- ◆ Remove the guesswork and reduce bearing failures



BEARING CONDITION MONITORING

- ◆ Ultrasound provides the earliest warning of bearing failure
- ◆ Detect bearing failure on all speeds, including as low as 1 RPM
- ◆ Remote and online monitoring solutions available



ULTRASONIC LEAK DETECTION

- ◆ 30% of all compressed air produced is wasted due to leaks
- ◆ Easily locate and quantify air leaks that are wasting energy
- ◆ Report on the cost of every leak and potential energy savings



STEAM TRAP & VALVE INSPECTION

- ◆ Defective steam traps and valves will waste energy and create safety hazards
- ◆ Detect operating conditions while steam traps are online
- ◆ Report steam losses and potential savings



PARTIAL DISCHARGE DETECTION

- ◆ Ultrasound can detect corona, tracking, arcing, and mechanical vibrations
- ◆ Scan enclosed gear before opening for further inspection
- ◆ Easily diagnose type and severity of partial discharge



YOUR PARTNER IN ULTRASOUND



INSTRUMENTS

- ◆ Condition-Based Lubrication
- ◆ Bearing Condition Monitoring
- ◆ Ultrasonic Leak Detection
- ◆ Steam Trap & Valve Inspection
- ◆ Partial Discharge Detection



TRAINING

- ◆ Level I and Level II Ultrasound Training
- ◆ Onsite Implementation Training
- ◆ Application Specific Training



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