

Building Your Ultrasound Toolbox for Pharmaceutical Manufacturing

Created by: **ue**
SYSTEMS INC

**LEAK
DETECTION**

**STEAM TRAP &
VALVE LEAKAGE
INSPECTION**

**PRECISION
LUBRICATION**

**BEARING
CONDITION
MONITORING**



The pharmaceutical industry is known for having the highest cost of downtime among all industries with a single hour of downtime potentially costing millions of dollars in lost productivity and quality issues. From a survey in Pharma Manufacturing, 60% of pharmaceutical manufacturing downtime is caused by equipment failure. For the industry to meet increasing demand and maintain global supply chain needs, plants must shift from a reactive maintenance state to a preventive maintenance state.

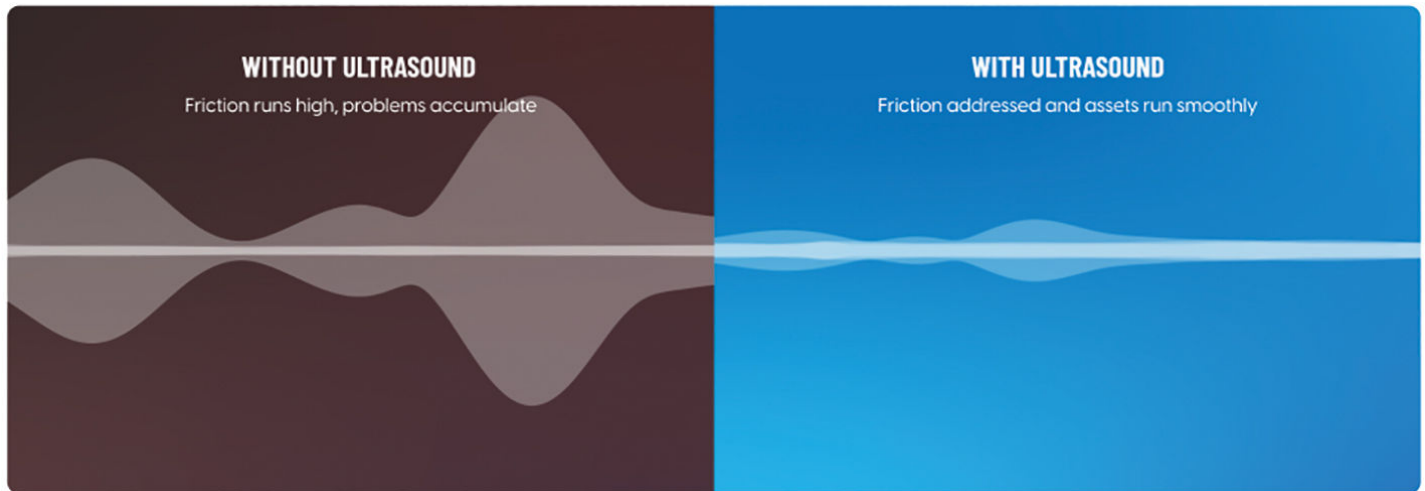
The adoption of modern technologies, such as ultrasound monitoring, has facilitated this shift, leading to less downtime and tremendous cost savings. Ultrasound technology provides direct feedback to the technician, or “listener,” through automated systems and probes. To adopt this technology, it is as simple as just point and listen to know how every bearing, valve and asset is running. Ultrasound technology stops problems before they stop production.

Challenges in Pharmaceutical Manufacturing

There are several challenges that pharmaceutical manufacturers must contend with. Pharmaceutical manufacturing is one of the highest regulated industries, meaning rules are in place to govern the design, commissioning, operations, and even the maintenance of the equipment. Unlike other industries, adding a new piece of equipment can take years of planning and preparation. That’s why it’s important to protect the machinery that you do have by practicing proper lubrication and investing in the overall continued health of your current machines.

With pharmaceutical manufacturing, there is also an extremely low margin of error that is acceptable. This means that even a small functional failure can be enough to disrupt production deadlines. When we talk about function failure, it does not mean that the equipment no longer works. Instead, it means that it can no longer serve its desired function. Even a small leak in a critical specialty gas line or a pump falling a few gallons short of its gallons-per-minute quota is considered a function failure, which can have a considerable impact on both the quality and production yield. Production demand for pharmaceutical manufacturing is high, governed by various regulatory bodies, and a loss of production, even by a single batch, can cause a ripple effect felt all around the world. This is why maintenance and reliability leaders need a simple yet effective way to monitor the health of their assets.

GET YOUR FIRST LINE OF DEFENSE SOONER. ULTRASOUND TECHNOLOGY DETECTS FAULTS AT THE EARLIEST STAGES.



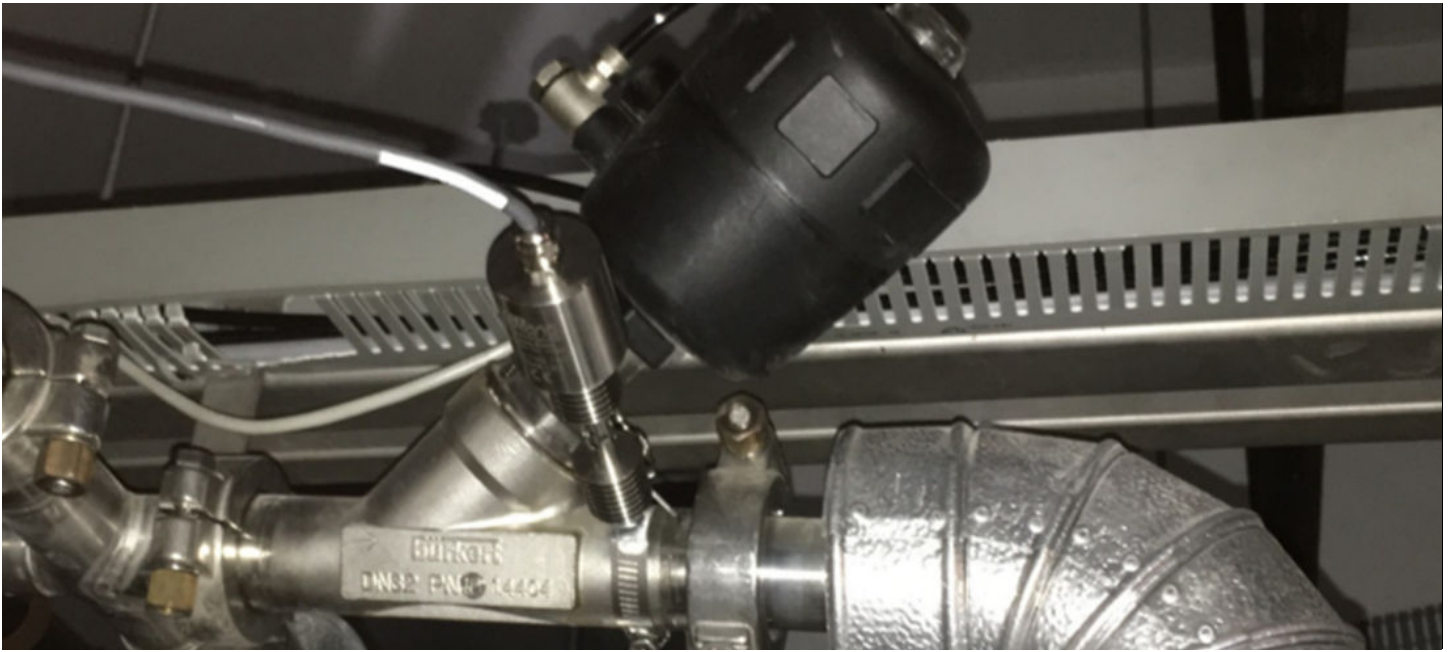
How Ultrasound Works

All equipment makes noises that are indicative of its health and needs, especially if the machine or component is experiencing symptoms of failure. Often, by the time the failure symptoms can be heard with the naked ear, it is too late – the asset is already in late-stage failure. But by using ultrasound technology, experts can get an accurate read on what is happening inside the machines long before failure sets in and production is affected.

In essence, ultrasound technology lets you hear the inner workings of your critical equipment, measuring aspects such as friction, impact and turbulence, even in the loudest of industrial environments. In fact, according to NASA research, “Ultrasonic monitoring of bearings provides the earliest warning of bearing failure.” With up to 80 percent of premature bearing failures being caused by poor lubrication, having a tool on your side that can accurately read friction levels makes it perfectly designed for bearing lubrication by removing all of the guesswork. With the first signs of bearing failure resulting in an increase in friction, ultrasound can detect even the smallest change in friction and has been well documented as being able to detect the onset of bearing failures long before other technologies.

Not only will the ultrasound technology alert you to when a critical mode has been triggered, but it also:

- **Minimizes the Workload** – It frees up precious manpower to be more targeted in other areas.
- **Creates a strategic and consistent maintenance process** – Because the actions are controlled using a single element, the variance between application styles from different people and different equipment is practically eliminated. This extends the life of the equipment and allows for you to plan your maintenance more strategically.
- **Is Readily Available** – Waiting for downtime or shutting down machines for maintenance is no longer a requirement with ultrasound technology. It also significantly reduces work hazards, creating a safer environment for your entire team.



Equipment Condition Monitoring Made Easy with Ultrasound

Detecting a pending failure is only part of the process. If you are not actively preventing failures, then you are missing a large part of the equation. That's why it helps to have an industry leader, such as UE Systems and their remote bearing monitoring system and leak detection tools. This technology makes it easy to monitor the health of production equipment by detecting faults early, pinpointing leaks, and detecting when bearings need lubrication.

Predictive maintenance with ultrasound is the easiest and most effective way to protect your equipment and prevent unplanned downtime. While there are a plethora of benefits to making the switch, there are four main reasons why ultrasound technology is different from other monitoring systems.

- **Ease of Use** – Ultrasound technology is designed to be intuitive - simply point and listen. Most people who are being trained to use this ultrasound technology only spend a couple of hours with hands-on training before they feel confident enough to start detecting leaks, identifying bad bearings, and determining when grease is required.
- **Versatility** – Predictive maintenance with ultrasound lets you instantly pinpoint leaks, assess bearings, and detect faults early. The types of applications in which ultrasound technology can be used are nearly limitless, lending to its mass appeal. You can even safely use ultrasound technology to monitor electrical systems at all voltage levels.
- **Early Notification** – Often times, ultrasound provides the earliest notification alerting to a potential early failure symptom.
- **Implementation Costs** – Purchasing a new predictive technology typically is accompanied by a planned payback justification, which is usually based on cost avoidance. With ultrasound technology, there is nearly a 15:1 return on investment ratio. Payback can come from many avenues, such as reduced grease consumption, reduction of equipment failure, and even energy savings that can start on day one of using ultrasound technology.

Applications with Ultrasound

As one principal reliability engineer put it, “pound for pound, the ultrasound provides the biggest value for the cost, because of its ease of use and versatility.” While there are an almost endless number of possibilities for ultrasound technology, four of the most popular applications include bearing condition monitoring, precision lubrication, steam trap and valve leakage inspections, and compressed air and gas leak detection.

Remote Bearing Monitoring and Lubrication

50% of critical equipment failures can be traced back to improper lubrication. With ultrasonic monitoring with the OnTrak, you can measure the amount of friction being produced in your bearings, taking the guesswork out of lubricating critical equipment, such as chilled water pumps, air handler units, and purified water pumps. Once a need for grease is detected, the system notifies the operator through UE Insights, a cloud-based platform. From there, with a push of a button, the operator can grease the bearing remotely by giving the system permission.

While traditional regreasing methods are relatively cheap to implement, it almost always results in over or under lubrication, leading to suboptimal bearing function. Having the OnTrak System in place can play a large role in preventing machine failure by eliminating guesswork—the M-UE Single-Point Lubricator not only applies the lubricant with unmatched precision, but also keeps the lubricant enclosed, preventing contamination often associated with manual application methods.



Figure 1 OnTrak system installed monitoring the real-time lubrication needs and health of the bearing on an air handler motor.

Steam Trap Inspection

If ignored, defective steam traps can pose serious threats to plant profitability, efficiency, and safety. UE Systems’ Ultraprobe series helps an inspector identify potential failures in the trap operation in various environments, even in low pressure steam applications like clean steam systems for autoclaves. Inspectors can choose from simple analog instruments to sophisticated digital instruments with on-board non-contact infrared thermometers, sound analysis and data logging features. UE Systems’ frequency tuning feature enables users to literally tune into the trap sound and clearly identify leaking or blowing traps.



Figure 2 Inspector performing steam trap inspection on plant steam system using the UE Systems Ultraprobe.

The inspection method you will use depends on the type of steam trap. Therefore, the primary rule is to know the details of your system. Ultrasonic steam trap inspection is considered a “positive” test in that an operator can instantly identify sound quality and intensity differentials and determine operating condition accurately.

Leak Detectability

When it comes to critical machines, any undetected leaks can cause extensive damage to your equipment and break the bank to fix. With ultrasound leak detection, you can instantly pinpoint the source of any leak, whether air or gas, including specialty traceable pharmaceutical grade gasses used to produce pharmaceuticals and active pharmaceutical ingredients.

The important thing to remember is that leaks can occur in nearly any machine in a plant. The main cause of leaks can be linked to a specific occurrence – when fluids move from a high-pressure area to a low-pressure area. When the fluid enters the low-pressure point, turbulent flow is created. Turbulence produces white noise by disturbing the air molecules, which contains low and high frequencies. The Ultraprobe is able to tune in by looking for high-frequency areas. By ignoring the lower frequencies, ultrasound technology can accurately locate and identify a leak, even in a noisy plant environment.



Figure 3 Inspector performing leak detection on critical facility equipment using the UE Systems Ultraprobe.



Figure 4 Small scratches in the seat of the valve detected by ultrasound.

Not only will the ultrasound technology alert you to when a critical mode has been triggered, but it also:

- **Turbulence** – There are two types of lubricant flow – turbulent and laminar. Laminar flows travel in a smooth or regular path while turbulent flow varies erratically both in the amount of flow and the direction. Most leaks will produce a turbulent flow, and ultrasound technology can detect this flow while ignoring the laminar flow, allowing for the proper identification of the leak.
- **Fluid Viscosity** – Viscosity can be described as a fluid’s resistance to flow. The factors that influence the flow of a leak are the viscosity of the fluid, the length of the leak’s path, and the pressure. These key factors are essential when trying to determine the location of a leak.
- **Orifice Shape** – The shape and size of an orifice can have a huge impact on the turbulence. If the orifice is smooth, it will only produce a minimal amount of turbulence, but if the orifice is jagged, it will produce a significant amount of turbulence, which can then be detected by the ultrasound technology.



A final factor to consider is the accessibility of the leak. While making sure that it is safe to do so, the closer an inspector can get to the leak, the greater likelihood they are able to detect and identify a leak. The more factors that come in between the inspector and the leak, the more likely the results will be skewed as the ultrasonic waves bounce off multiple surfaces. By getting close to the leak source and removing as many interfering objects as possible, a clearer picture of the condition of the leak can be achieved.

Conclusion

Pharmaceutical manufacturing has the highest cost of downtime with the most severe consequences of any manufacturing industry. Luckily, with the use of ultrasonic monitoring technology, operators and inspectors can readily determine the condition of their equipment and stop failure in its tracks. The resulting improvements in machine reliability play a significant role in helping plants keep up with increasing demand and meet quality control standards.

About UE Systems & the OnTrak

UE Systems is the world leader in ultrasonic instruments & training solutions for predictive maintenance, reliability, condition monitoring and energy saving program. The OnTrak by UE Systems uses the power of remote prescriptive monitoring to give lubrication experts a powerful, accurate and easy-to-use software application to monitor bearing friction and remotely lubricate from anywhere, anytime, on any supported device. To learn more about UE Systems and OnTrak, please visit UESystems.com/ontrak or UESystems.com.

