How?
Water kills bearings

Out of all contaminants known to affect bearing life, water arguably does the most harm. It only takes a small amount to lessen the oil's ability to properly do its job, creating friction, oxidation and more. Recognizing water-related failure modes can help you determine the optimum lubricants, seals and bearings to protect your equipment's oil.

Where Is It Coming from?

In a circulating oil system, water can enter in a variety of places. For instance, the reservoir headspace typically breathes into the environment. If a proper breather arrangement is not implemented or there are other breathing locations, humid air will condense in the headspace and water will drain into the oil. Pipe junctions and flanges can also allow ingression of water and other contaminants. Internal and external seals should be considered as well. These may include nearby steam joint leaks, leakage past seals and gland seams, heat exchangers, seal water zones, seals being washed down by high-pressure hoses, etc.

Water-Related Failure Modes

Knowing what each failure mode looks like and its cause can help you prolong bearing life by identifying a means of defence.

Corrosion

Bearings corrode when met with oxygen and water. Once corrosion occurs, the bearings begin to flake and crack over time. This can lead to pitting, a more irreversible form of damage that can cause machine failure.

Oxidation

When high temperatures meet metal particles and water, the antioxidants in the lubricant can be consumed at rapid rates. Oil oxidation comes with an array of negative consequences including varnish, sludge corrosion, and impaired oil flow.

Hydrogen-Induced Fractures

In theory, water is drawn to microscopic cracks in the surface of the bearing by capillary forces. The contact between the water and metal allows hydrogen particles to break free and cause an even deeper fracture. Furthermore, the sulphur found in additives, mineral oils, and environmental hydrogen sulphide can accelerate this process.

Aeration and Foam

Water impacts oil's ability to handle air. This means when water and oil meet, oil films are weakened, causing excess heat, induced oxidation, cavitation, and restricted oil flow—all of which can cause serious harm to the bearing. The worst part is it doesn't take much. Amounts as small as 1,000 ppm of water are enough to create air bubbles that prevent oil slingers, ring oilers, and collar oilers from operating efficiently.

Oil Flow Restrictions

Due to its polarity, water attracts impurities such as particles, dead additives, carbon fines and resin. This attraction results in the formation of sludge and emulsions, which can enter oil ways meant to provide lubrication to bearings. The blockage then causes bearing starvation, and as we know, a starved bearing rarely lives a long life.

Additive Depletion

There's no sense in using quality additives if water contamination is going to rid them of all their benefits. Depending on the type (AW, EP, rust inhibitors, detergents, dispersants, etc.), water can either hydrolyse, agglomerate, or wash additives out of the oil and onto sump floors. If you

use sulphur-phosphorous EP additives, water can even increase an oil's acid number (AN) by breaking the substance into sulfuric and phosphorous acids.

Preventing Contamination

Undoubtedly, the best way to avoid these moisture-related problems is to prevent the contamination from occurring. Effort expended in this area can have significant effects on reliability and availability.

Steam joints: Leaking steam joints are a major source of water contamination. Typically, escaping steam is blown against bearing housings on the back side of dryer sections. The resulting condensate contaminates the oil system.

Seals: Most bearing housings are fitted with a labyrinth-type seal that allows water to pass through into the bearing housing. Flingers or stationary add-on shields improve the protection afforded to the bearing.

Inspections: Check lubrication drainage systems for holes or openings that allow water or water vapor to get into the system. Such problems are commonly found in vents. Consistently check piping for holes.

Oil/water heat exchangers: The purpose of these units is to cool the oil as it returns to the reservoir. The design of modern systems is usually such that the oil pressure is higher than the pressure of the cooling water so that any leaks should result in oil contaminating the water, rather than the other way around. Severe leaks of this kind can be a serious problem, but it's usually of a different kind (e.g., environmental).

Monitoring for water contamination using Ultrasound technology

Measuring and preventing water contamination requires an investment in time and resources, but in the long run, it is imperative to maintaining bearing health.

In the meanwhile, what you can do to avoid bearing failures is monitoring them. And ultrasound is just the perfect technology: because water contamination will increase the bearings' friction levels, and friction generates high frequency sound, an ultrasonic instrument will be able to indicate what's going on with the bearing.

Either by measuring dB levels and comparing them to a dB baseline, or by simply assessing the sound quality coming from the bearing, an ultrasonic instrument will inform the inspector about the condition of the bearing. This is particularly useful for facilities with water contamination issues – you can then easily monitor your bearings, observing which ones are above their dB baseline. Instruments such as the Ultraprobe 10000 or Ultraprobe 15000 from UE Systems are recommended for this application.

Solutions to monitor your bearings remotely are also available, via ultrasonic sensors connected to data processing devices. This can be a big time saver, allowing maintenance teams to focus their efforts on tackling the water contamination issue. The OnTrak SmartLube, for example, is effective in reducing the time spent lubricating bearings – in many cases by 95%. It will provide alerts as soon as friction is detected, giving inspectors the opportunity to regrease remotely with the touch of a button.

Having this technology in place allows you more time and energy to focus on addressing pesky water contamination and other areas in need of improvement in your plant.