

## **NEW OILS LAST LONGER, SEPARATE FROM WATER RAPIDLY AND IMPROVE EQUIPMENT LIFE**

In the past, improvements in oil refining techniques and in oil additive chemistry had enabled conventional mineral oils to adequately fulfill the lubrication needs of most equipment. But today's newer and faster machinery place progressively higher demands on lubricants.

As worldwide competition forces plants to become more efficient and reduce costs, the bottom line question becomes: Do higher priced, high performance lubricants produce adequate savings that justify their higher purchase price?

It is inevitable that a business will want to lower the procurement cost of lubricants. Although this approach may sound like a good idea, it is the wrong thing to do. To really save money, a plant should first make every effort to improve the quality of its lubricants and lubrication practices. The reason is simple.

## **QUALITY COMES FIRST**

The cost of lubricants in any rotating equipment maintenance budget is an insignificantly small fraction of the total budget (less than 0.1%). Yet the quality of those lubricants directly influence the ultimate cost of large budget items, such as energy consumption, parts purchases, equipment reliability, downtime and the cost of simply maintaining the lubricant itself. Significant savings cannot be attained by holding down the procurement cost of lubricants, but the savings can be captured by using better lubricants and implementing improved lubrication practices.

Premium lubricants often save far more than their higher incremental purchase prices. For example, an energy plant in Southeast U.S. recently replaced its conventional mineral-based turbine oil with a high performance synthetic turbine oil and achieved cost savings.

Water contamination was a continuing problem at the plant, even with the continuous use of a large oil-water centrifugal separator. Bacteria formation originating in the oil-water separator contaminated the entire system.

Preheat temperatures due to water contamination became hard to regulate resulting in increased journal bearing temperatures. Additionally, water contamination was accelerating the oxidation process of the turbine oil resulting in significant varnishing of servo valves and controls.

The contamination significantly increased the cost of scheduled shutdowns that were necessary to keep the oil within minimum cleanliness standards (16 / 15 / 13 ISO code). For example, each shutdown required oil system filtration and vacuum dehydration that cost \$115,000 per shutdown. This prompted plant management to research alternatives including upgrading to one of the purported high performance synthetic turbine oils. After the change, no oil-water emulsions were seen. The water separator was valved-off and not used. Free water was periodically drained from the low point of the main sump.

With the oil-water separator no longer necessary and without the formation of oil-water emulsions, no microorganisms were forming in the lube system. Preheat temperatures remained constant and bearing temperatures dropped and remained constant even in summer.

Oil analysis showed cleanliness levels remaining in the 14 / 13 / 11 range even after 10,000 hours of operation<sup>1</sup>. Filtration and dehydration treatments were no longer necessary at each shutdown. Savings in the lube oil system exceeded the cost difference between the old mineral oil and high performance synthetic oil in the first three years after the change. The oil will remain in service for over 20 years, adding to the savings.

Because of the tremendous potential for savings, it might seem that decision makers would concentrate on upgrading oil. Unfortunately, few do.

One reason lubricant upgrades aren't researched as a potential cost saver is that there are no measurable differences among the lower cost mineral oil products that are traditionally used. Additionally, there are no recognized tests for predetermining the savings from lubricant upgrades.

The key to predicting the results of lubricant upgrades is simply to test one's choice of the upgraded product on a representative sample of plant equipment. Any lubricant company with products worthy of real world testing will be happy to work with plant staff to coordinate a test. The negligible amount of time needed to coordinate a predictive test will pay for itself either through cost savings from the product, or it will pay for itself through cost avoidance if it is determined that the premium product does not perform as promised.

## INCREASING BEARING LIFE

Water in oil is death to bearings. In conventional oils, even 0.002% of water in oil can shorten bearing life by half, and just 3% water can form a milky oil-water emulsion. When discovered, emulsified oil must be drained and replaced with new oil.

Today's premium oils separate rapidly from water and can save costs associated with labor, new oil purchase, and emulsified oil disposal (see Figure below). Some special formulations form a bond with metal surfaces that displaces moisture. One U.S. Gulf Coast chemical company that used such oil conducted a year long test in several pumps that ran flawlessly after the oil was mixed 50 / 50 with water.

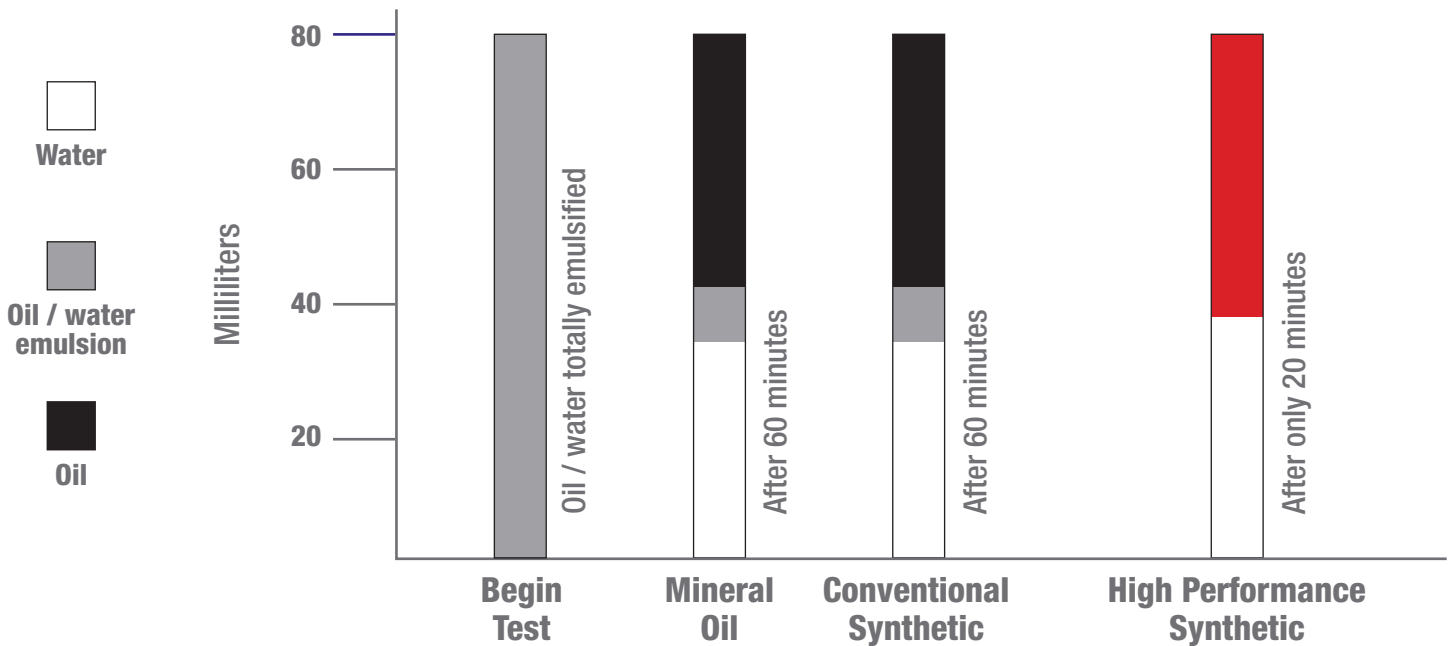


Figure: New synthetic lubricants separate quickly from water

The first line of defense in protecting a bearing is oil film thickness. The thicker the oil film, relative to the surface roughness of the bearing and race, the greater the bearing life. In actual operation, it is estimated that fewer than 10% of bearings ever reach their design life in service. An estimated 40% fail prematurely because of water or dirt in the oil.

Many other bearings fail because of surface initiated fatigue caused by mechanical stresses (caused by equipment imbalance, bearing misalignment and so on) that overwhelm the oil film. Under such conditions, a premium lubricant that has a high film strength provides a margin of protection unattainable in any other way.

Some of these oils can offer film strengths exceeding 300,000 psi, as against conventional industrial oils whose film strengths are typically 6,000 psi. High film strength prolongs service life. Additionally, a premium high film strength oil formulated with polar additives can effectively increase oil film thickness without increasing fluid friction. In fact, the chemical film formed on the bearing surfaces can sometimes exceed the film thickness of the oil itself, contributing significantly to improved equipment reliability.

# LUBRICANT UPGRADES DO PAY

Lubricating oils are changed either because they become contaminated (dirt, water and process fluids) or because they oxidize (chemically react with oxygen). When an oil oxidizes, it becomes more viscous and forms deposits such as sludge, varnish and lacquer in equipment. The greater the heat, the more rapidly the oil will oxidize. In fact, the rate of chemical oxidation doubles with each 18° F rise in temperature. Plants that do not have continuous oil analysis programs for determining when to change the oil for specific pieces of equipment can have their used oil analyzed to establish oil change intervals.

In the absence of contamination, oxidation is the sole measure of oil life. Premium lubricants using superior base oils and additives can last many times longer than conventional oils, saving on new oil cost and disposal cost of used oil. Disposal costs are often many times greater than the original cost of the oil. Additionally, longer drain intervals save labor, which is particularly welcomed if a company has downsized.

Once the decision has been made to explore upgrading lubricants, it's critical to remember that laboratory bench tests of products don't matter, but real world results do. A lubricant manufacturer with a quality product will be able to provide you documentation of real world results.

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<sup>1</sup> While specifying oil cleanliness, the number of particles equal to or greater than 2, 5 and 15 microns in the oil is measured. The corresponding cleanliness numbers are read off from the oil cleanliness chart in ISO 4406.

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