

LUBRICANT SELECTION MAY HELP LOWER OPERATING COST

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ROYAL PURPLE LUBRICANTS HELP BALANCE THE COST OF LUBRICANT UPGRADES

Nearly every business is under increasing pressure to lower operating costs and increase efficiency. This often means doing more with fewer people and using older equipment. This challenge has prompted increased attention to lubrication and its role in equipment reliability and expense. As a result, industry is focusing more on lubricant management and selection.

LUBRICATION MANAGEMENT

Lubrication management encompasses all of the lubrication practices and procedures for properly storing, applying, monitoring and taking care of the selected lubricant(s). It includes making sure the right oil gets into the right equipment in the right place in the right amount at the right time. It also encompasses used oil analysis programs, visual inspections and maintenance of fluid levels, timely oil changes and attention to contamination control from water, etc. Good fluid management, though far too extensive to address in one article, is essential to achieving quality lubrication. It is important to note that good lubrication practices are not a substitute for selecting lubricants with the performance properties necessary for optimum performance in equipment. Good lubrication practices simply cannot make a poor lubricant become a high performance lubricant. Good lubrication practices can only help preserve the original lubricating properties of the selected oil.

LUBRICANT SELECTION

Lubricant selection is often nothing more than selecting the appropriate type and viscosity of lubricant for each piece of equipment requiring lubrication. If all lubricants performed equally well, lubrication selection would end with selecting the appropriate type and the correct viscosity. Recent advances in lubricant technology provide users with a broad range of quality options, and a number of lubricants that significantly improve machinery efficiency and reliability.

A lubricant's performance characteristics are determined by each lubricant manufacturer's unique blend of additive chemistry and base oil(s). The conventional wisdom is that synthetic lubricants are better than mineral-oil-based lubricants. This isn't necessarily true. A mineral-based lubricant with a superior additive package can outperform a synthetic lubricant with a lesser additive package. Testing lubricants against each other in a real-world situation is the only way to determine which works best.

High performance lubricants can cost more and opting to use one almost always involves overcoming the additional hurdle of "price justification." This becomes somewhat of a "Catch 22" situation, wherein the cost justification required for purchase approval cannot be documented until after the lubricant has been purchased and put to use. Thus a commitment to lubricant upgrades often requires a leap-of-faith.

LUBRICANT UPGRADES

When is the appropriate time to upgrade lubricant quality?

Lubricants should be upgraded whenever the upgraded lubricant produces benefits or savings that exceed the additional cost of the oil.

What is a lubricant upgrade and who defines it?

Some attempts to make lubricant upgrade decisions are based solely on comparative ASTM test results on various oil candidates. While ASTM tests can be indicators of how oil may perform, there is only one final arbiter for performance — the equipment being lubricated. Observed changes in oil and bearing temperatures, bearing vibration levels, energy demand, oil life and re-lubrication intervals, equipment cleanliness, how the oil handles water and other contaminants, and machine repair frequency and costs are all indicators of lubricant performance. There simply is no substitute for running the candidate oil upgrade in the equipment. When considering a lubricant upgrade, a competent lubricant supplier should be able to provide you with real-world case histories that will indicate whether the candidate lubricant is likely to deliver the targeted results.

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RETURN ON INVESTMENT

Too often the cost of the oil becomes the main focus in purchasing decisions. In the absence of empirical evidence to the contrary, cost per gallon becomes the defining measure of value. Though unintentional, this leads to the most myopic view of lubricants possible, for it's not the cost per gallon of the oil that is ultimately important. The only meaningful measure of value is the applied cost of the lubricant in the equipment it lubricates, which encompasses the lubricant's contribution to increasing or decreasing each of the following:

- Machine efficiency as represented by energy use
- Oil service life as represented by oil drain frequency
- Downtime and lost production
- The cost of labor and replacement parts
- The cost of used oil disposal
- Purchase price

WHERE TO BEGIN

It's common for 80 percent of a plant's maintenance efforts to be expended on the worst performing 20 percent of its equipment. These machines are the most likely candidates that can benefit from lubricant upgrades. Other candidates for a lubricant upgrade are the machines in which the reliability benefits of the upgrade will be most quickly observed. While the need for improved equipment reliability may be the primary motivation for manufacturers to upgrade lubricant quality, the cost reductions attainable through energy savings can be significant and are the most easily documented.

MAINTENANCE SAVINGS

Repairs and unscheduled down time can drive costs up considerably. The following case illustrates how upgrading lubricants can dramatically reduce maintenance costs.

A Southeastern U.S. energy producer using inexpensive mineral-based oil experienced a failed cooling water pump on a turbine. Cooling water was lost due to the pump failure. This caused the turbine bearing's temperatures to exceed 180°. This increase caused massive amounts of material in the oil system to break loose and overcome the oil filter; consequently, a 250-gpm-filter skid had to be placed in service and staffed around the clock for a week to clean the oil to acceptable standards.

Detailed investigation of the oil revealed that ammonia from the steam cycle was being pulled into the bearing oil returns. The company's lab verified that ammonia was mixing with the additives in the lubricant and creating alkenylsuccinic acid compounds (metallic soap). The soap-like material was plugging the control oil orifices and caused at least one unit shutdown. The degraded mineral-based lubricant created a heavy varnish layer inside the main tank and all of the oil lines.

The maintenance costs associated with using the inexpensive mineral-based oil prompted the company to investigate upgrading lubricants. The company decided to flush the turbine with an upgraded synthetic solvent and then refill it with high performance synthetic oil from the same company.

Once the varnished system had been cleaned, synthetic oil was used to replace the inexpensive mineral-based oil. The synthetic oil did not varnish the way the mineral oil did. Additionally, the demulsibility of the synthetic oil enabled maintenance staff to drain the water off of the bottom of the main tank and stop using a coalesce filter altogether.

The company compiled a detailed cost / benefit analysis. The prevention of one unit shutdown due to lubrication problems will save an estimated \$120,000 over and above the total cost to upgrade lubricants. The initial analysis did not include the potential for bearing failure due to material in the oil system. A bearing failure on a large steam turbine would result in millions of dollars of lost revenue. (The company asked that the details of the cost / benefit analysis not be shared in this article.)

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ENERGY SAVINGS

Energy costs for rotating equipment are many times larger than maintenance costs. Even a small percentage energy savings can quickly exceed the total cost of lubricant purchases. Here is a case that illustrates this:

A large, Midwestern, coal-powered energy producer tested a boiler feed pump to see if upgrading from a mineral-based lubricant to a purported high performance synthetic would reduce energy consumption. Data on the voltage and draw of the motor powering the pump was collected using MotorSTATUS™ monitoring equipment to determine energy consumption.

It was necessary to know the following to determine any reductions in energy consumption:

- The average full load heat rate as a measure of how efficiently the coal was converted to electricity
- The actual power that the unit generates
- The cost of coal

Benchmark readings were measured over the course of seven days using the mineral oil. At the end of the seven days, the lubricant was changed to the high performance synthetic. The equipment then ran, and was monitored, for another seven days. With the mineral oil, the motor ran at an average of 455.33 amps. With the high performance synthetic, the motor ran an average of 425 amps.

THE FOLLOWING CALCULATIONS WERE USED TO DETERMINE ENERGY CONSUMPTION:

$(30.33 \text{ A change in amps} * 4000 \text{ volt motor}) / 1,000,000 \text{ watts} = .12132 \text{ MW additional power generated}$

$9581 \text{ BTU per kilowatt hour mineral oil heat rate} * 238,000 \text{ kilowatts produced} = 2,280,278,000 \text{ BTU per hour coal utilization}$

$2,280,278,000 \text{ BTU per hour coal utilization} / (238,000 \text{ kilowatts produced using mineral oil} + 121.32 \text{ kilowatts additional power generated using synthetic lubricant}) = 9576.13 \text{ BTU per kilowatt hour synthetic oil heat rate}$

$(9581 \text{ BTU} / \text{kWhr original heat rate}) - (9576.13 \text{ BTU} / \text{kWhr new heat rate}) = 4.87 \text{ BTU change in heat rate}$

$4.87 \text{ BTU change in heat rate} * 238,000 \text{ kW power generated} * (\$1.26 / \text{MBTU cost of coal}) * (1 \text{ MBTU} / (1 * 106 \text{ BTU} * 4760 \text{ hours of operation per year})) = \$6,959.53 \text{ in energy savings from one boiler feed pump}$

The additional cost for upgrading lubricants worked out to less than \$260 per year. The internal rate of return on the investment was dramatic with a payback rate of less than one month. The potential energy savings to a plant with numerous pumps could be dramatic as well.

SUMMARY

Companies can make significant improvements to their bottom line by simply upgrading the quality of the lubricants they select and use. To stay competitive, companies must shift their mindset from seeking the lowest cost lubricant to seeking out the lubricant that is most likely to help them improve plant reliability and reduce maintenance costs.

Seeking the best performing lubricant will require some research and the return on investment is well worth the minimal time and effort involved. The first step is to contact your lubricant supplier and / or research high performance lubricant manufacturers to request performance data specific to equipment used in the power generation industry. The next step is simply to choose a lubricant (or lubricants) based on the available documentation, determine performance criteria, and begin testing on a few pieces of equipment. Few changes, if any, can reduce maintenance expenses so dramatically, quickly, and easily as upgrading your lubricants.