

# Prescription for Better Lubricant Health & Life

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## ABSTRACT:

Just as maintaining a healthy lifestyle can result in a longer and higher quality of life for human beings, so it goes for industrial equipment lubrication. Recently introduced products that protect lubrication should be considered as a part of maintenance programs designed to keep equipment "healthy".

Although predictive maintenance programs are widely in use, most are based on either the condition monitoring of elements that detect impending failure of components and equipment or scheduled maintenance based on historical data. While these programs can be valuable in the attempt to minimize or eliminate "surprise" equipment failures, they may not be as effective in preventing the failures caused by poor lubrication.

Recently introduced products that monitor critical lubricant conditions can be used as an integral part of a proactive maintenance program designed to maintain peak equipment performance. Essential lubricant properties can be cost effectively monitored as a "front line" part of an oil maintenance program on all types of equipment - not just on expensive, or critical, equipment.

## Plant Maintenance Budget

\$3,500,000 - Non-critical equipment

Process Pumps

Centrifugal Pumps

Generators

\$1,000,00 - Critical

Turbo Machinery

Compressors

\$500,000 - Other

Non-lubricating Items

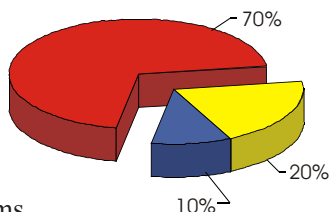


Figure - 1

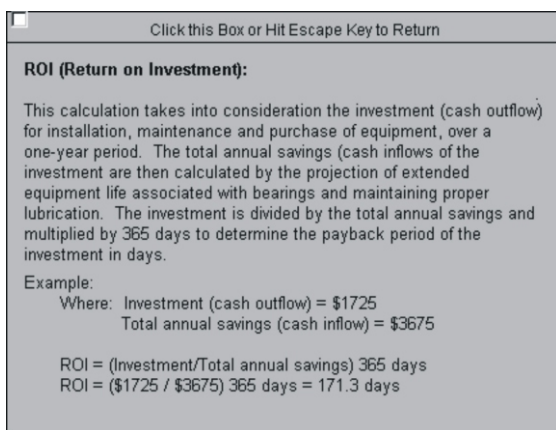


Figure - 2

Although condition monitoring has been a significant component of preventative maintenance programs for many years, the focus of this effort has been directed toward critical equipment including turbines and larger pumps. Concentrating on eliminating "surprise" equipment failures and extending mean time between repairs has successfully resulted in significant savings in many industrial facilities. Although for many years it has been cost effective to monitor "critical" equipment, it was difficult to justify the expense of installing monitoring devices on non-critical equipment including process pumps, compressors, and blowers - even though the overall maintenance cost was higher on "non-critical" equipment as shown in *figure 1*. For example, in one independent study, over 70% of the maintenance budget of a chemical processing plant was spent on non-critical equipment maintenance such as oil changes, oil sampling, and scheduled repairs.

It was not statistically evident what percentage of costs were associated with lubrication, but literally all of the professionals involved in the research agreed that lubrication was a factor in many component and pump failures. Much of this expense can be eliminated through the use of low-cost products that help maintain "healthy" lubrication - while eliminating the guesswork of when to sample or change the lubricant. By using the Trico Product and Financial Advisor software, it is now possible to effectively cost justify the proactive monitoring and maintenance of non-critical equipment. After entering information into the easy-to-use program, savings projection calculations such as

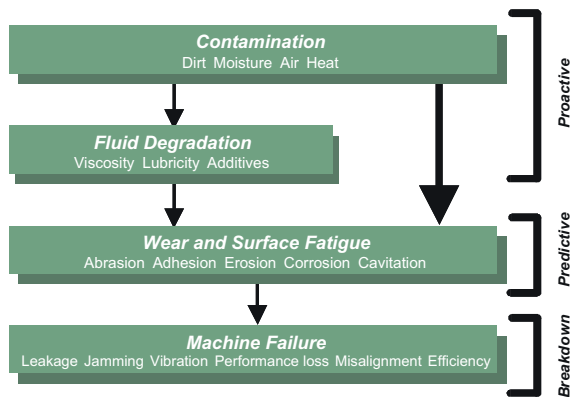


Figure - 3

Security System, an on-line oil monitoring system, real time assurance that the lubricant has not degraded to potentially ineffective levels is now possible. Used as a part of an oil maintenance program. The OSS automatically measures viscosity, moisture, and temperature without the need for manual sampling or equipment shutdown. The unit measures the kinematic viscosity and compares it to the ISO performance specifications of the oil, as shown in *figure 4*. When used in conjunction with oil analysis laboratories, specific conditions can be detected - leading to prevention and cure. For example, as shown in *figure 5*, change in the acidity of the oil closely resembles the corresponding change of the viscosity. The OSS would detect this viscosity change, while also monitoring heat and moisture content, and this information (along with a sample) would be provided to an oil analysis lab. The lab could then run pertinent tests to confirm the total acid number (TAN) while eliminating the need for unnecessary tests - a cost savings.

Although the Trico Oil Security System can monitor

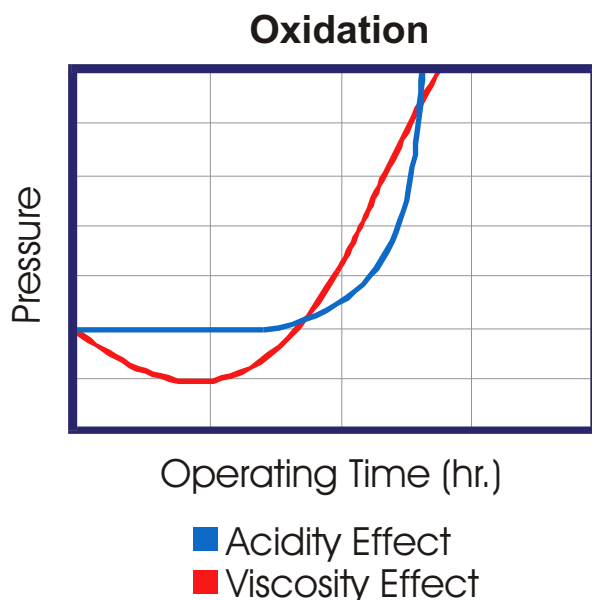


Figure - 5

Return on Investment (ROI), Net Present Value (NPV), and Internal Rate of Return (IRR) are provided. Easy-to-read summaries and explanations, as show in *figure 2*, make it possible for employees to determine what products and procedures make financial sense. The measurement of viscosity, the single most important factor in effective equipment lubrication, can be used as an excellent indication of the "health" of the oil. By taking a more proactive approach to monitoring viscosity, along with factors that have an effect on it, damage to equipment due to poor lubrication can be avoided. As shown in *figure 3*, moisture, dirt, air, and heat each have an effect on both the degradation of oil and equipment failure due to wear and surface fatigue. By using the Oil

## Safe Operating Range for ISO 68

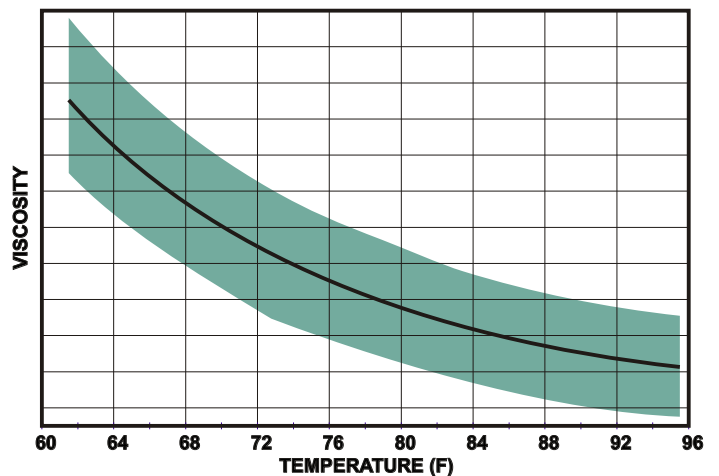


Figure - 4

many critical lubricant elements with respect to oil degradation, advanced bearing housing and bearing isolator designs available today reduce many problems associated with the ingress of contamination. Trico Mfg. Corp. has developed products that in many cases, when used in conjunction with these design advances, can all but eliminate oil contamination.

The Hydrolert® is a low cost device designed to detect water in oil. Although there are many ways of detecting water in oil, most of these require that a sample be taken from the piece of equipment. Research has shown that over 85% of all oil sampling or oil changes were done either unnecessarily or after damage has already occurred. As shown in *figure 6*, it is virtually impossible to "see" when it is time to either change or sample the oil when dealing with water contamination. Additionally, most on-line water sensing begins between 300 and 600 parts per million (PPM), where an already potentially damaging

## Water Absorption of Mineral Oil

		Effect	Detection
Parts Per Million	1300	Extremely damaging to steel element bearings	Visibly cloudy oil
	1000		
	600	Damaging to bearings	Being sensed at damaging levels. Karl Fischer and centrifugal detection are typically done in laboratories.
	200		
100	Very safe, non-damaging	Water sensing detects levels online	
	New oil levels		

Figure - 6

## Comparison of PPM to %SRH

	Oil 1	Oil 2	Oil 3	Oil 4
100	300 ppm	400 ppm	700 ppm	900 ppm
90	261 ppm	360 ppm	630 ppm	810 ppm
80	232 ppm	320 ppm	560 ppm	720 ppm
70	203 ppm	280 ppm	490 ppm	630 ppm
60	<b>Safe operating range</b>			
50				
40				
30				
20				
10				

Figure - 7

condition exists. The unit is calibrated to indicate 70% Saturated Relative Humidity (SRH), which has been determined to be the maximum safe concentration level of water in oil used with steel rolling element bearings. As shown in *figure 7*, the common measurement of moisture contamination has been in PPM, when what is most critical is the level of SRH. As the SRH increases, the damage potential increases. Factors such as whether the oil is mineral or synthetic, and what type of additive package is present can change an oil's ability to absorb moisture. In elastohydrodynamic (EHD) lubrication, increased water levels in oil reduce the lubricant's ability to provide a protective barrier between the ball and the race in a rolling element bearing. Additionally, the conditions are "ripe" for hydrogen embrittlement to occur where steel bearings or gears are in use.

The Hydrolert is self contained, powered by a lithium battery, and is designed for use in harsh environments. Installation is simple, and battery life is estimated between 3 and 5 years. It is even simpler to use than to install - when the light begins to flash there is 70% SRH of water in oil. The Hydrolert is the only water detection device available that measures water contamination BEFORE it reaches damaging levels, for less than \$425.

Two of the most innovative, yet low priced, products designed to prevent and control oil contamination are the

Watchdog® lubricator, and the Watchdog desiccant oil dryer. The Watchdog lubricator is a high temperature thermoplastic design (for corrosion resistance), ultrasonically welded during assembly to eliminate the need for gaskets (potential leakage), that is internally vented to eliminate ingress into the bearing housing through the device. The unit replaces the 1" NPT level sight commonly installed on ANSI designed centrifugal pumps. The Watchdog allows for level viewing, proper oil filling (the common method through the fill plug at the top of the bearing housing is not accurate due to shaft interference), and constant level maintenance of oil quantity without external venting as is common in traditional oilers. Since the Watchdog is mounted "on the level", and is non-adjustable, improper level settings are also eliminated.

Used in wet sump lubricated equipment with labyrinth type bearing isolators, this Watchdog Oil Dryer has been effective in reducing the moisture levels in the oil. In one performance test conducted in a paper processing plant, by simply installing a Watchdog Oil Dryer on a pump, the moisture level was reduced from over 700 PPM to less than 75 PPM. This reduction has resulted in fewer required oil changes while extending bearing and seal life. This

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lower level of moisture has been effectively maintained with continued use of the Watchdog Oil Dryer. With facilities such as oil refineries, chemical processing plants, and pulp and paper facilities operating with fewer maintenance personnel, there is an increased emphasis on equipment efficiency and reliability. Both the Hydrolert and Oil Security System provide on-line, easy to understand indication of lubrication condition without the need for sampling, decreasing the workload of maintenance personnel. The Watchdog Oiler and Oil Dryer can reduce both contamination and need for oil changes.

Guesswork, predictive maintenance, and historical trend analysis all become outdated methods of ensuring effective lubrication. Equipment and devices that can provide immediate, concise, and accurate indication of well-being are desired, and will become part of the "prescription for healthy equipment".