

# Clean hydraulics, oils and lubricants. Three ways to big savings & lean maintenance reliability

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## Six Sigma Root Cause Analysis

The first article in this series detailed how, with the use of Six Sigma's formula  $Y = f(x)$  and five years of maintenance log data, the root cause of most automated and computer controlled equipment's unscheduled downtime (and a large percentage of rework and scrap (low yield)) can be traced to seven chronic stresses. Within hydraulic systems the root cause stress is contamination. Contaminations of dirt, metal particles, water, acids, varnishes, asphaltants, etc.. The problem is that oil filters are only effective at removing dirt and metal particles but not very effective at removing water, acids and varnishes.

## Improve on Cost and Quality

This article will show how you can reap large savings, year after year, on oil costs and PM labor, while greatly improving uptime, reliability and the life of machines that rely on hydraulic oil, compressor oil, lubrication oil, etc.. Several case studies will be shown, as they apply to:

- Power Plant Turbine Lube Oil
- Compressed Air & Gas Lube Oil
- CNC Machines Hydraulic Oil
- Break Presses Hydraulic Oil
- Plastic Injection Mold Machines
- Gear Lube Oil
- Way Lube Oil
- Ball Screw Lube Oil, etc.

## The Goal

Most manufacturing, power plants and process plants have these or similar systems. As you consider implementing these cost saving improvements, keep in mind the first goal is to maximize equipment uptime, reliability, accuracy, repeatability, availability and profits. Just cutting back on oil quality or frequency of oil changes would save money for a few months, but would be counter productive to this goal. Yet, admit it, that's what most companies have done gradually, over the past fifteen years, to save short term. The second goal, I suppose, is to justify one's job. Do something that makes you look good before your next annual review. Normally, with over \$100,000 savings in medium size

companies, this ought to do it. The savings will cover your wage and that possibly of a few other key people.

### **The Problem**

Like in your car, oil in any hydraulic system needs to be changed. What will happen to your new \$62,000 BMW Coupe if you drive out of the show room and off into the sunset, never worrying to change the oil again? After all, you shouldn't have to, this a quality and sturdy BMW, right? Wrong! If you paid \$62,000 for any luxury car, you're going to have the oil changed quarterly, religiously. Yet, how many of these same managers, responsible for multiple \$150,000 - \$600,000 machine tools and other hydraulic systems, have repeatedly cut the maintenance budget until maintenance cannot provide the oil or the man power to do an oil change? The other part of this problem is, as oil has become more expensive and as environmental concerns prevent us from "dumping," we now spend almost as much to dispose of the oil as it costs to purchase. So, as costs go up, we keep cutting back. Soon we wonder, "Why all the oil leaks, malfunctioning gears, solenoids and increased machine downtime (a forbidden state in lean manufacturing)? What to do?"

### **Three Part Solutions**

Recent technology has provided three synergistic tools, one great solution:

1. Rolling Oil Purification Karts that reclaim oil rather than disposing of oil.
2. Affordable and portable oil analysis equipment to monitor oil quality.
3. Improved oils and lubricants that truly prolong equipment life and last longer between changes.

### **Oil Purifier Karts**

When properly applied these technologies will allow further cost cuts by 80% - 90%, by increasing the time between oil changes. In many cases you can eliminate 9 out of 10 oil changes and still maintain perfectly clean oil for more reliable operation and prolonged equipment life. Rather than changing hydraulic oil once a year, always a time consuming and expensive undertaking (or worse, failing to make the change once a year). How about simply plugging in a roving purifier, quarterly. Leave the purifier in place for 3 days, while the machine tool or air compressor continues its operation, then plug the purifier into the next machine (using hydraulic hose quick connect fittings) and leave it there for another three days. By this method, 25 machines or hydraulic reservoirs can be cleaned and reclaimed quarterly. By reclaiming rather than changing, you bring the oil, quarterly, to a "cleaner than new oil" state, yet your oil and labor cost remain near zero. Walla!

There are various technologies used in oil purifiers.

Centrifugal,  
Barrier Purifier,  
Vacuum,  
Heavy Filters,  
Heat & Gas Treat,

or a combination of these technologies are used by oil purifier manufacturers. Some work better than others for various applications. The overall goal is to remove the water, acids, varnishes, etc., along with the dirt and metal particles, to reclaim the oil with additives in tact. Result: clean oil that will meet lab analysis as better than new. New oil, shipped in 55 gallon drums is not so clean. From the sides of the barrel, container and hoses can come dirt and particles we hope system filters will take out.

You can do in-house research or use an outside consultant to select the best system for your application(s), but your investment in making the change should simplify and reduce your PM process and labor and give you ROI of less than one year, thus increasing company profits year after year.

### **In-house or Oil Lab Analysis**

Small and fairly inexpensive oil analyzers are now available for \$1,000 - \$1,500 that monitor your oil's electrical impedance, capacitance and conductivity. If any oil properties change, or contamination levels go up, these electrical characteristics will change, letting you know it is time to change oil or do more extensive oil analysis. Oil samples can be sent, overnight, to professional oil analysis labs where they can further check and report the state of the oil, the contaminants and the additives. If testing the oil shows clean oil and no change, why change it. A oil CBM (condition based monitoring) program can help further reduce oil change labor costs and insure clean oil for prolonged equipment life.

### **Improved Oils and Lubricants**

As the short case study's below indicate, improved lubricants and oils are now available for almost every application that will last longer and reduce wear. Here again, if you don't have the time or manpower, use outside expertise to evaluate and select oils and lubricants that will give your equipment the best lubrication, lowest wear factor on equipment gears, valves, solenoids, ways, bearings and other parts and that will last longer before needing changed or purified and reclaimed. You can easily afford these improved lubricants because you will not be throwing them away, as usual. You will be purifying and reclaiming them, as needed. Again equipment life will be extended, operation and performance enhanced, leakage eliminated, while PM labor costs and oil change costs greatly reduced. Even though you will pay a bit more for some of these new lubricants, with a roving purifier to reclaim, you will still be paying just a small fraction of what you now spend annually.

## **Case Studies Showing Seven Ways to Save**

### **Power Plant Steam Turbine**

Last year Ibaraki-Ken installed a ThermoJet® on a 24" square opening on their steam turbine, on the turbine's lube oil system. All suction and discharge piping is through the machine base directly into oil reservoir. The ThermoJet from Lubrication



Systems Company provides heating of oil for cold start up and continuous purification of the oil, removing water to below 100ppm. Oil is maintained in like new condition resulting in reduced MTBF, improved machinery reliability and oil replacement costs are virtually eliminated.

### Compressor Lube Oil Systems

In 1996 Southeast Texas Chemical Plant saw their oil viscosity dropping due to contamination in 3 lube oil systems on Ethylene Compressor Units. Existing centrifuge and vacuum dehydrators were unreliable and operators had no confidence in them. Oil analysis reports were showing a need for improved oil purification. They installed the ThermoJet® as a permanently mounted system in 1996 and manifold it to 3 major machine reservoirs the largest being 3600 gallons. The system is switched each Monday from one reservoir to the next.

Results: Since the installation, they have not experienced any viscosity or contaminated lubrication issues on these major machine systems. They also invested in a portable ThermoJet® for their smaller lube oil systems (200 to 300 gallon). ThermoJet® is mounted on a trailer and is

moved around as their oil-sampling program indicates the need. Customer estimates a savings on approximately 6000 gallons of lubricant per year!



### CNC Machines, Robotics, Injection Molding, Break Presses, Shop Air, etc.

Rexnord, a gear, bearing and industrial chain manufacture purchased multiple portable Sy-Klone oil purifiers in **2003** and **2004** in multiple plants to purify and save on hydraulic oil costs. One Sy-Klone Barrier Purifier Cart unit shown here, can circulate on ½ week intervals to treat hydraulic oil in 25 machines or reservoirs per quarter. Eliminating 9 out of 10 annual oil changes and all associated oil change costs while improving oil cleanliness, quality and machine tool life.

Results: One oil type FR-2 cost \$9.73/gal. X 1,250 gallon per year usage from 32 machine reservoirs = \$12,162.50



annually savings on oil cost alone, plus labor and improved machine uptime. Estimated ROI is six months.

A similar Sy-Klone Barrier Purifier model FS-87E-P purifier was dedicated to a single LeRoy air compressor where 10 gallons of \$66.00/gal. oil was being replaced monthly: 10 gal. X 12 months = 120 gallons X \$66.00 = \$7,920.00 annual savings, yielded an ROI in less than 1 year. Another Sy-Klone Barrier Purifier rotating between three shop air compressors where \$23.63 per gallon oil had to be changed monthly. Annual oil savings: 360 gallons X \$23.63 = \$8,506.80 annual savings plus extended compressor life. Again estimated ROI is less than 1 year.

### **Plastic Injection Mold Machines – Upgrade Oil Type**

Molded Designs Technology, a manufacturer of plastic battery boxes for the marine and boat industry has 8 injection molding machines. These include Cincinnati Milacron Sentry 120 ton, TMC 90 ton, and Van Dorn 110 ton. Even with commercial grade hydraulic oil, the maintenance department found the machines were experiencing high operating temperatures, leaks and they were having to change the oil at 12 month intervals.

Solution: Upgrading to Lubrication Engineer's 4933 & 4934 All Purpose Hydraulic Oil, made from 100% paraffinic base stock to provide high oxidation resistance, special anti-wear and excellent rust protection.

Result: Molded Designs have been able to extend drain intervals 2½ times longer and temperatures are staying down, between 95-115°F. Maintenance personnel are very pleased with equipment performance and savings.

### **Way Lube Oil, Ball Screw Lube Oil, Push-Rod Lube Grease**

Nibco, a plastic product manufacturer with ten plants, noticed their commercial grade grease was piling up under strain rods on injection mold machines. This was creating a housekeeping problem. If the grease was slinging off of the strain-rods, then it was not protecting. Thus, maintenance personnel had to grease the strain rods twice a week.

Solution: They upgraded to LE's 3752 ALMAGARD Vari-Purpose Lubricant, a very tacky grease that will stay in place. Nibco was able to extend lube intervals to every two weeks and reduce labor costs by more than 75%, as the area remains clean. Also LE's 8800 MONOLEC ULTRA Engine Oil is being used in forklifts. It has extended oil drain intervals from 200 hours with a commercial grade engine oil to 800 hours. LEAP (Lubrication Engineers' Oil Analysis Program) is used to monitor the life of the engine oil. LE's 607 ALMASOL Vari-Purpose Gear Lubricant is used on toggle pins.

### **Gear Lube**

Nibco (above) is now using one-fourth as much of LE's 607 as they were their previous gear lubricant. LE's 4025 QUINPLEX (white) Food Machinery Lubricant is being used on bin conveyor chains. The competitive grease was leaving stains on the finished product. This has been eliminated with LE's 4025, thus saving additional labor costs to clean the fittings before shipment to their customers.

**About the author**

*Howard Cooper is a 20-year veteran consultant and founder of Amemco ([www.amemco.net](http://www.amemco.net)). He helps manufacturers, hospitals, telecom and data centers, semiconductor, nanotech, oil companies, etc. to achieve improved equipment uptime, availability and maintenance reliability by hardening their systems (protecting equipment) from basic (root cause) chronic stresses. Clients often eliminate 70% - 92% of their unscheduled downtime in 30-60 days. He holds a bachelor's degree in electronic technology from SUU with a minor in mathematics and worked toward a master's degree in industrial and technical training at BYU. Questions & Comments can be e-mailed to [hcooper@amemco.net](mailto:hcooper@amemco.net)*