LUBRICANT STORAGE & HANDLING IT'S TIME TO GET Oil Safe
REVOILUTION™
Issue 9 April – June 2006

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Welcome to the REVOILUTION™

Lubricant Foaming

This customer was also foaming as we tried to figure out logical explanations for the foam problem. As I mentally ran down a list of possible causes, I realized it had been a while since someone asked me what causes lubricant foaming?...

Extending the Operating Life of your Motor

Certain components of motors degrade with time and operating stress. Electrical insulation weakens over time with exposure to voltage unbalance, over and under-voltage, voltage disturbances, and temperature...

FACTS AND STATS

- Bangladesh has small reserves of oil and coal, but potentially very large natural gas resources. Commercial energy consumption is around 69% gas, with the remainder almost entirely oil.
- Used engine oil can end up in waterways. An average oil change uses five quarts; one change can contaminate a million gallons of fresh water.
- Every year oily road runoff from a city of 5 million could contain as much oil as one large tanker spill sources the remaining 6% (less than 1% from solar and wind)

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Lubricant Foaming

Author Jack Snavely

"There must be something wrong with your gear oil," the customer said, "It's foaming."

This customer was also foaming as we tried to figure out logical explanations for the foam problem. As I mentally ran down a list of possible causes, I realized it had been a while since someone asked me what causes lubricant foaming?

Foaming can be caused by mechanical issues, overfilling of the component, or by contaminants such as water, coolant and sealants. With the flooding we've seen due to a record hurricane season in the South and near-record string of rainy days in the Pacific Northwest, your shop could see water-related foaming issues in the future. Let's review what causes foam in lubricants, and how it can be prevented.

What Is Foam?

Foam, also known as air entrainment, is simply air bubbles suspended in liquid. Be careful not to confuse the small amount of bubbles that might drain from a component during a service. Some foam is normal. If a lubricant has too much foam, however, a full film of lubricant to protect the parts is difficult to achieve. Air does not lubricate the same as oil. Therefore, excessive foaming can lead to component wear and, possibly, a component failure.

Fortunately, the reason for lubricant foaming can usually be corrected without difficulty if the equipment has not been damaged.

Why do Lubricants Foam?

Overfilling a component may cause lubricant foaming. Although a small amount of air entrainment is expected when using a lubricant, adding significantly more lubricant to a component may result in excessive foaming.

For example, in the case of overfilling the engine oil pan, parts that normally do not contact the lubricant reservoir, such as the crankshaft in an engine (which is located over the oil pan), now hit the oil, whipping it into a milkshake-like consistency. Since, foam takes up more space than liquid, the lubricant and foam follow the path of least resistance out of the component. In engines, this path might be the dipstick tube, the PCV system or the seals and gaskets. In differentials, the path of least resistance is usually the vent tube.

Similar foaming issues, and messes, can occur by installing too much lubricant in transaxles, transmissions and other components

Incorrect Lubricant Level

Many transaxles and differentials have special instructions to gauge the proper level of lubricant. Not long ago, one only needed to fill the differential until the product was level with the fill hole. This is still the case in some components. However, following this procedure today will overfill many differentials and transaxles. Chek-Chart's "Lubricant Recommendation Guide" shows many exceptions.

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Lubricant Foaming – Continued

For example, a certain transaxle built after Jul. 26, 1999 should be filled 3/8-inch below the fill hole. I found one entry that showed three types of differentials for a particular truck, each requiring a unique fill level. These different fill levels emphasize the importance of verifying the proper differential requirements to determine the correct type and amount of gear oil.

Underfilling a component can also lead to foaming. In engines, low oil levels can allow air into the pump and more rapid contamination of the fluid with moisture and other contaminants. However, other ramifications of too little lubricant, such as engine overheating, oil oxidation and lack of lubrication, are probably even more serious than lubricant foaming.

Contamination

Lubricant foaming also can occur as a result of contamination of the lubricant. Water and coolant contamination can be expected to increase foaming in engine oil. Water can enter engines as a byproduct of combustion or an internal coolant leak. Other sources of water contamination in vehicles include condensation, submerging the component in water and contamination of the lubricant prior to filling. Failure to replace contaminated lubricants in vehicles that have been operated in high levels of water could ruin a potentially salvageable component.

Storms such as Hurricanes Katrina and Rita leave many such water-damaged vehicles in their wake. Larger storms increase the probability of having a water-damaged vehicle entering your shop.

Drivers who tow boats should pay particular attention not to submerge the rear differential while they're loading or unloading a boat so as to avoid water contamination. Should the differential be submerged, changing the gear oil is imperative to remove the water and promote long component life.

Contamination of a lubricant with assembly sealants can also produce foaming issues. Several years ago, foaming issues occurred in many light-duty diesel engines produced by an engine manufacturer. Originally, certain brands of motor oil were thought to have caused the foaming. Eventually, the root cause was discovered to be the sealant used to assemble the engine.

Preventing Foam

Three items are key to reducing the likelihood of foaming in lubricated components: Select the correct lubricant, fill the component to the proper level and keep the lubricant free of contaminants by performing regular maintenance.

If foaming occurs, be sure to retain samples of the new and used lubricant. Laboratory analysis may uncover the underlying reasons for the foam.

With antifoam additives in their formulations, many lubricants are designed to minimize foam. This is because keeping foam under control is important for the optimum protection of engines, transmissions, transaxles, transfer cases and differentials. Increased foam will inhibit proper lubrication and could result in a component failure. Keeping these reservoirs at the proper level with clean, fresh lubricant will help eliminate potential foaming issues in the future.

Extending the Operating Life of your Motor

US Department of Energy

Why do motors fail?

Certain components of motors degrade with time and operating stress. Electrical insulation weakens over time with exposure to voltage unbalance, over and under-voltage, voltage disturbances, and temperature. Contact between moving surfaces causes wear. Wear is affected by dirt, moisture, and corrosive fumes and is greatly accelerated when lubricant is misapplied, becomes overheated or contaminated, or is not replaced at regular intervals. When any components are degraded beyond the point of economical repair, the motor's economic life is ended.

For the smallest and least expensive motors, the motor is put out of service when a component such as a bearing fails. Depending upon type and replacement cost, larger motors—up to 20 or 50 horsepower (hp)—may be refurbished and get new bearings, but are usually scrapped after a winding burnout. Still larger and more expensive motors may be refurbished and rewound to extend life indefinitely. An economic analysis should always be completed prior to a motor's failure to ensure that the appropriate repair/replace decision is made.

How long do motors last?

Answers vary, with some manufacturers stating 30,000 hours, others 40,000 hours, and still others saying "It depends." The useful answer is "probably a lot longer with a conscientious motor systems maintenance plan than without one.

Motor life can range from less than two years to several decades under varying circumstances. In the best circumstances, degradation still proceeds, and a failure can occur if it is not detected. Much of this progressive deteoriation can be detected by modern predictive maintenance techniques in time for life extending intervention.

Even with excellent selection and care, motors can still suffer short lifetimes in unavoidably severe environments. In some industries motors are exposed to contaminants that are severely corrosive, abrasive, and/or electrically conductive. In such cases, motor life can be extended by purchasing special motors, such as those conforming to the Institute of Electrical and Electronic Engineers (IEEE) 841 specifications, or other severe-duty or corrosion-resistant models.

The operating environment, conditions of use (or misuse), and quality of preventive maintenance determine how quickly motor parts degrade. Higher temperatures shorten motor life. For every 10°C rise in operating temperature, the insulation life is cut in half. This can mislead one to think that purchasing new motors with higher insulation temperature ratings will significantly increase motor life. This is not always true, because new motors designed with higher insulation thermal ratings may actually operate at higher internal temperatures (as permitted by the higher thermal rating). Increasing the thermal rating during rewinding for example, from Class B (130°C) to Class H (180°C), does increase the winding life.

The best safeguard against thermal damage is avoiding conditions that contribute to overheating. These include dirt, under and over-voltage, voltage unbalance, harmonics, high ambient temperature, poor ventilation, and overload operation (even within the service factor).

Extending the Operating Life of your Motor - Continued

Bearing failures account for nearly one-half of all motor failures. If not detected in time, the failing bearing can cause overheating and damage insulation, or can fail drastically and do irreparable mechanical damage to the motor. Vibration trending is a good way to detect bearing problems in time to intervene.

With bearings often implicated in motor failures, the L10h rating of a bearing may be cause for concern. The L10 rating is the number of shaft revolutions until 10% of a large batch of bearings fails under a very specific test regimen. It does not follow that simply having a large L10 rating will significantly extend motor bearing life. Wrong replacement bearings, incorrect lubricant, excessive lubricant, incorrect lubrication interval, contaminated lubricant, excessive vibration, misaligned couplings, excessive belt tension, and even power quality problems can all destroy a bearing. Always follow the manufacturer's lubrication instructions and intervals.

Make sure motors are not exposed to loading or operating conditions in excess of limitations defined in manufacturer specifications and National Electrical Manufacturers Association (NEMA) standard MG1. This NEMA standard defines limits for ambient temperature, voltage variation, voltage unbalance, and frequency of starts.

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Knowledge Issue 9 April - June 2006

Powered by Oil Safe®

Proving that Minimal Quantity Lubrication (MQL) can bring big savings in machining operations.

How Willy Vogel AG drastically cut machining times in their own production department and gained many more benefits for customers. In two years of tests with MQL, they found production times had been cut by 24% to 78%, depending on the workpiece.

Many claims have been made about the value of minimal quantity lubrication (MQL) systems, particularly in bringing about a reduction in machining times. But SKF's recently acquired subsidiary, Willy Vogel AG, knew that what potential MQL users demanded most of all was reliable records of savings in machining times when converting from wet machining to MQL. So VOGEL, a widely experienced manufacturer and supplier of MQL systems, decided to gather clear evidence by installing MQL in their own production department.

As well as the machining details given later, VOGEL showed that if their LubriLean or Vectolub MQL systems are properly installed and optimised, customers can expect to experience an impressive number of benefits such as:

- No coolant required
- No need for lubricant filters and conditioning
- No disposal costs for chips and lubricants
- No need to clean workpieces
- Higher cutting efficiency
- Life of tools extended by as much as 300%
- Parallel use of wet and dry machining is possible
- No changes in spindle design required
- Better surface finishes

The conversion from wet machining to MQL

In the first phase the production department's existing machine tools (drilling, milling, turning, broaching) were converted to pure MQL systems or combined wet/MQL setups.

After one year the following results were achieved;

- 2350 hours of production time were saved. That corresponded to an average saving of 42%
- Longer tool life of 300%. This more than compensated for the extra costs to modify the existing tool designs.
- 145 parts were made from eight different materials (eg; X10CrNiS189, AimgSi1, St73k, GG25)
- Much less coolant lubricant was needed to be purchased and disposed of.

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The second phase involved more conversions of existing equipment as well as acquiring three new machines. For the new machines - one machining centre and two turning centres - VOGEL saw the opportunity to draw up a new specification so that all three machine tools could be fully equipped with VOGEL MQL systems by the machine tool manufacturer. The overall goal now was to have all their key workplaces on the mechanical engineering side fitted with MQL.

After two years VOGEL engineers again reviewed their records. This time they found that more than 600 parts had been converted from traditional wet machining to MQL and production times had been cut by 24% to 78% depending on the workpiece. See examples below. On average this is an decrease of 40%; clear evidence that significant savings could be made by converting to MQL .

An important point to remember is that good results were obtained not only with 'normal' types of steel but also with hard to machine materials like stainless steel or aluminium with a high silicon content. A notable instance was the fabrication of an M12x1 tap hole in case- hardened steel with a multi-stage countersink. Using a tool optimised for MQL made it possible to cut the main production time by a factor of 12. (See example 1, fig 1; Housing)

An additional benefit for VOGEL, was that the company had acquired a high degree of equipment, system and advisory competence while undertaking this trial. This was reliable first-hand experience and knowledge that could be put to in further development of their LubriLean and Vectolub systems as well as advising and assisting customers wishing to install VOGEL MQL systems.

Four examples of workpieces machined in the converted production department are given below:

EXAMPLE 1

Workpiece description: Housing

Material: 16MnCr5

Machine tool: Heckert CW 400 K

Time saved: 58%

EXAMPLE 2

Workpiece description: Mounting flange

Material: X10CrNiS 18 9

Machine tool: Traub TNA 300

Time saved: 59%

EXAMPLE 3

Workpiece description: Delivery piston

Material: AlMgSi1

Machine tool: Traub TNA 300

Time saved: 24%

EXAMPLE 4

Workpiece description: Headpiece

Material: AlMgSi0,5 F22

Machine tool: Traub TNA 300

Time saved: 78%

Benefits for customers

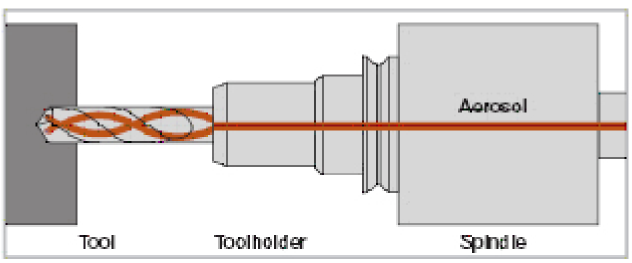
One of the first customers to benefit from VOGEL's enhanced system and advisory competence was EADS Deutschland GmbH, a military aircraft manufacturer in Augsburg. A long-time user of VOGEL MQL systems, EADS planned to purchase two large machining centres equipped with MQL.

Benefitting from what VOGEL had learned in applying MQL in their own production department, no time was spent considering whether to fit a single-duct or twin-duct system because VOGEL had found that the single-duct installation had several advantages:

- Single-duct MQL equipment requires much less maintenance than a twin-duct installation, and it is wear-free.
- Time-proven, perfected machine tool components such as spindles and rotary leadthroughs can be retained; extensive interference with a machine tool's design is not required (in contrast to twin-duct systems)
- A high aerosol quality is assured by the supply of small amounts of oil to meet the need

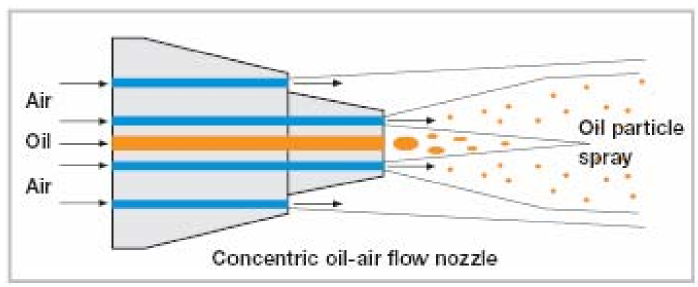
Principles of single - and twin-duct systems

Single-duct system:



The aerosol is produced in the equipment's reservoir and fed through the rotating spindle to the tool. The oil supplied is completely used up with no residue being left when the optimum setting is used.

Twin-duct system:



The lubricant and atomizing air are transported separately through coaxial lines to the spray nozzle, where the lubricating mixture (=aerosol) is formed. The concentric oil/air flow that results from this special design keeps the jet from expanding and causes the aerosol to be delivered to the process spot with pinpoint accuracy.

After discussion with the machine tool maker, DS-Technologie in Mönchengladbach, they recommended that a VOGEL LubriLean Digital MQL system with Profibus software/hardware should be fitted. This is a system that permits NC controlled adjustment of the air and oil volumes.

The system was integrated into the machine tool at DS-Technologie's plant with the support of VOGEL engineers. Preliminary tests on the machine tool showed that right from the start enough aerosol was being delivered to assure reliable cutting.

During the installation the following measures were taken to assure nearly loss-free transport of demand-based quantities of oil to the cutting site:

- The aerosol line was laid without screwed joints, constrictions or expansions
- The rotary leadthrough is axial, i.e. additional diversions were avoided
- The interfaces between the spindle, toolholder and tool were optimised.

The aerosol line was kept as short as possible because the longer the line the higher the pressure and the greater the aerosol losses. Response times grow longer as well.

In this particular application it was not possible to implement a short feed from the MQL unit to the rotary leadthrough. But, since the tool-change times were distinctly longer than the MQL equipment's response time, there was no need to take any action. After start-up the MQL parameters were adapted to the machining processes at aircraft manufacturer. From then on the focus was on achieving the full potential of the MQL system in terms of reduced machining times and extended tool lives.

The application of MQL at EADS Deutschland GmbH has significant additional benefits above those of higher production output. There is no longer any need for equipment and activities associated with coolant conditioning and disposal. This is of great importance to EADS because their factory is right next to a water reserve. The original machining technology made it necessary to handle large amounts of emulsions which had to be disposed of as hazardous waste. The MQL system delivered cost savings in this exercise and made an important contribution to their innovative eco-management programme.

These extensive trials at VOGEL and the applications at EADS and, since then, many other customers have proven the clear advantages of MQL over conventional wet machining. VOGEL's LubriLean and Vectolub MQL systems have been designed into a wide variety of machine tools (drilling, milling, turning, broaching) for well-known manufacturers such as Heckert, Gildemeister, Stama, Brother, Traub and Okuma.

The same kind of equipment, systems and installation expertise that VOGEL possesses is also available to SKF customers now that Willy Vogel AG is part of the SKF Group

An extraction of: www.skf.com / www.vogelag.com

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