MECHANICAL

To flush or not to flush

Lubricating oil is the lifeblood of virtually all rotating equipment found in a power plant. Keep it clean and the lube system is relatively low-maintenance. However, cycling operation and restarts after a temporary or long-term shutdown can create a whole new class of what may be unfamiliar problems.

The fundamental question is determining when a lube oil flush is justified, and answering that question requires understanding the conditions that trigger the need for a flush. A good place to start is to consider the most common reasons a flush is required (see table).

Often, the need to flush is first observed during an inspection, by the appearance of sludge in a sight glass, on a used filter, or at the bottom of a sump. This can be confirmed by oil analysis and further inspection. Remediation entails both the removal of the sludge, varnishing, or debris as well as removal of the root cause before the system can be returned to service.

Flushing tactics

What are the risks associated with a flush? They vary considerably and depend on the flushing procedure, the machine, and the lubricating oil. If the flush procedure involves introducing foreign chemistry (solvents, detergents, and the like) into the oil or machine, this could impair the performance of the lubricant and attack seals and machine surfaces. Lab testing in advance can hedge these risks. In certain cases, flushing can also result in leaks when deposits are removed around aged seals and gaskets. In addition, problems can come from the disturbance and resuspension of settled, low-lying contaminants that are not fully carried out of the system by the flush.

Choosing the wrong lube oil flushing tactic can be not only wasteful but also risky from the standpoint of potential system upsets and negative side effects. Whenever you introduce unusual fluid chemistry, temperatures, pressures, flows, or turbulence, you risk adverse consequences to the machine, its seals, and the lubricant.

The first step in developing a tactical approach to flushing is to carefully distinguish between two closely related cleanup activities: oil reclamation and machine flushing. Unlike flushing, oil reclamation (also known as reconditioning) does not have to involve the machine and its surfaces. It is simply a process of removing health-threatening contaminants from the bulk oil. In certain cases, this may include acid scavenging. For large systems, it may be followed by bleed-and-feed or other top treatments to restore depleted additives and dilute soluble impurities.

Refine your flushing tactics

Reason for performing a flush	Risks of not flushing	Oil analyses for revealing this condition
Oil degradation. Oils degrade for a number of reasons: thermal degradation, oxidation, nitration, hydrolysis, or additive precipitation. Sludge, varnish, acids, and reactive chemicals are often the products of the degradation.	Corrosion, oil flow restriction, mechanical interference of machine movement, infection of next oil change.	FTIR (Fourier transform infrared) spectroscopy (for oxidation and nitration), blotter spot test, acid number, rotating pressure vessel oxidation test (RPVOT), ultracentrifuge, differential scanning calorimetry, dielectric properties, flash point, voltametry, coagulated insolubles.
Filter collapse/failure. When a filter fails, releasing debris into an active system, collateral damage can occur unless a flush is performed.	Accelerated wear to gears, bearings, pumps, valves, etc.	Particle count, patch test, ultracentrifuge, gravimetric analysis.
New or repaired machine. New or repaired machines are often contaminated by manufacturing and service debris (casting sand, weld slag, drill turnings, burrs, blasting sand, filings, etc.). Also, when a component fails, it will often release debris downstream to other components. This debris will remain after the failed component is replaced unless a flush is performed.	Premature filter plugging, wear and mechanical interference of machine movement. This can lead to infant mortality of new and rebuilt machines.	Particle count, patch test, ultracentrifuge, ferrographic analysis, gravimetric analysis.
After machine lay-up. After a machine has been laid-up for a long period of time, water, dirt, sludge, and other contaminants may have accumulated in components, lines, and the sump.	Accelerated wear of gears, bearings, pumps, valves, etc. due to the disturbance and mobilization of low-lying contaminants by recommissioning.	Patch test, particle count, patch test, ultracentrifuge, acid number, dielectric properties, voltametry, FTIR.
Aftercooler failure. When mixed with oil and additives, antifreeze (glycol) produces acids, sludge, deposits, and precipitants.	Oil flow restriction, plugged filters, mechanical interference of machine movement, impaired fluid properties.	Acid number, elemental analysis, FTIR, blotter spot test, gas chromatography, moisture analysis, Schiff's reagent test, viscosity test.
After mixed or wrong lubricants. Mixed lubricants can potentially result in insoluble by-products from the reaction of incompatible additives and base oils. For instance, polyglycols, when mixed with mineral oils, produce a thick, pasty sludge.	Oil flow restriction, plugged filters, mechanical interference of machine movement, impaired fluid properties.	Acid number, FTIR, blotter spot test, ultracentrifuge, elemental analysis, patch test, demulsibility, dielectric properties, flash point, voltametry, RPVOT, coagulated insolubles.
Microbial contamination. When a fluid has been invaded by water and biological contaminants, sludge, varnish, acids, and deposits often result.	Corrosion, oil flow restriction, premature filter plugging, wear, mechanical interference of machine movement, impaired fluid properties.	Blotter spot test, ultracentrifuge, moisture analysis, microbial analysis tests, acid number.

Source: Noria Corp.

The removal of harmful contaminants (both soluble and insoluble) from bulk oil can benefit the removal of preexisting sludge and varnish. It can also substantially mitigate the future formation of internal machine deposits. The result is a blurring of the boundary between oil reclamation and flushing. Ridding a machine's internal environment of deposits, sediment, and sludge will—by default—extend the usable life of oil. Similarly, scrubbing a bulk lubricant of soluble and insoluble impurities by oil reclamation will have a measurable effect on a machine's service life, cooling, and friction. In certain instances, reconditioned oil can even be an effective agent in the removal of varnish-like deposits. This explains why many of the flushing tactics mentioned in the table are also used in oil reclamation.

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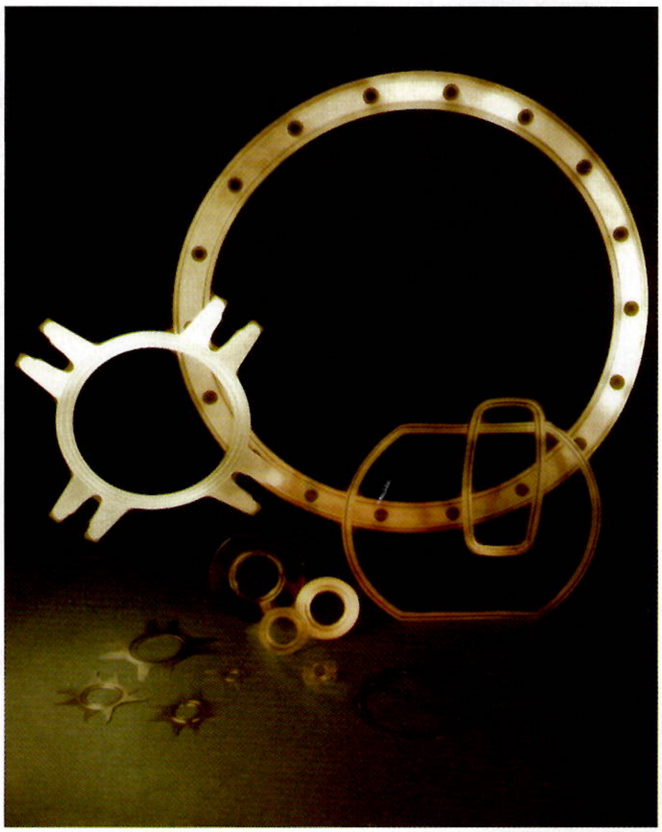
The perfect gasket

Major utility and industrial power plants, as well as valve manufacturers, are adopting blowout-proof, leak-free mechanical gaskets to improve productivity while minimizing maintenance requirements. Gasket failures give rise to a number of problems ranging from untimely shutdowns and dangerous leaks to repetitive gasket replacement and costly inventory of a wide variety of replacement gaskets.

Sealing Corp. (North Hollywood, Calif.) has developed what could be considered the perfect gasket—the Selco Seal (Figure 1).



1. Stops leaks of money, too. The leak-proof, blowout-proof Selco Seal gasket promises major cost savings to operators of high-pressure steam and water systems, such as those found in power plants. *Courtesy: Sealing Corp.*