VARNISH POTENTIAL MPC

Lubricating oil in hydraulic and gas turbine systems is subject to the effects of varnish. Varnish can be described as thin, oil-insoluble contaminant that is present in the oil and may deposit or plate-out on internal components. Varnish consists of the by-products of oil degradation including oxidation and nitration.

The presence of these deposits can result in loss of operating clearance and may lead to sticking, seizing or other malfunctions of close clearance moving parts. Varnish may also lead to increased thermal insulation. The ability to measure a lubricant's potential to form these harmful deposits is a useful took to prevent failure and lengthen component life.

ROOT CAUSES

Varnish is comprised of small particles that are the result of the degradation of oil molecules. The mechanisms causing this molecular breakdown fall into three categories:

Mechanical: Shearing of oil molecules between moving surfaces.

Chemical: Oxidation may lead to the formation of decomposition products that include varnish precursors.

Thermal: Oxidation, nitration, and varnish formation rates increase as temperature increases.

NEGATIVE EFFECTS OF VARNISH IN A LUBRICATION SYSTEM

- **Reduced clearance zones diminish the effectiveness of hydrodynamic lubrication.** Lubrication efficiency is impeded resulting in increase wear rates of gears, bearings and other internal components.
- **Increased friction points.** This friction results in greater expenditure and can cause valves to stick or clog.
- **Increase operating temperatures.** Varnish can become an insulator reducing the ability of the lubricant to cool internal surfaces.
- **Constriction and reduction of oil flow.** Varnish can result in the clogging of valves and filters.
- **Component abrasion and internal wear.** Varnish captures contaminants, creating a hard grit surface that accelerate wear. When magnified, varnish has the appearance of sandpaper.
- **More downtime and higher maintenance costs.** The results of the effects of varnish are unpredictable and costly.

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VARNISH POTENTIAL MPC

WHY IS VARNISH A MORE COMMON MAINTENANCE PROBLEM THAN EVER?

- End uses and service technicians attempt to maximize oil drain intervals and decrease maintenance frequency.
- Increase operating temperatures have placed higher demands on lubricants.
- Changes in oil base stock technologies may contribute to varnish formation, especially if base stocks are combined to create hybrids.
- Service technicians and reliability experts are performing more "post-mortem" analysis on failed components discovering varnish as the root cause of the breakdown.
- Manufacturer specifications on equipment tolerances continue to be tightened resulting in reduced lubrication clearance zones.

DIAGNOSIS

Identifying the precursors or "potential" for varnish formation has proven to be very challenging for service technicians and maintenance experts. Traditional methods of oil analysis have proven ineffective in detecting soft contaminants that will ultimately lead to varnish deposits. Until recently, it has not been practical to incorporate anti-varnish testing into a maintenance regime.

Industries that run equipment with a greater likelihood of developing varnish should add varnish potential testing to their overall maintenance program. For example, measuring the Varnish Potential of a lubricating oil is important for many kinds of rotating equipment, including gas turbines.

When testing oil, varnish indicators may not be identified with standard test methods such as particle counts, acid numbers, etc. The Varnish Potential MPC test can be used to determine the potential of the system to form varnish. Insoluble varnish particles are extracted from an oil sample and deposited on a membrane filter patch. A spectrophotometer is then used to analyze the color of the patch and the result is reported as a change of energy on a scale 0 to 100.

MAINTENANCE SOLUTIONS

Knowing the varnish potential of a lubricant, the maintenance technician can take a course of action, such as:

- Adjusting or optimizing oil change intervals.
- Modifying their maintenance schedule to reduce the chance of varnish formation based on the run time of the specific component.
- Use a side-stream filtration system for use in components that use the same oil for long periods of time. (e.g. large hydraulic systems and turbines)