

## Filterability of oils

By R. David Whitby

**I**t has been known for many years that hydraulic oils used in either high-specification systems with precision actuation or servo-valves with fine mechanical tolerances require fine filtration. This is necessary to remove any particles that may interfere with the precision actuation or servo-valve operation. In some hydraulic systems, filtration ratings as low as 0.5 micron are becoming more common. The high-performance hydraulic oils used in these systems need to be filterable.

Filterability is a measure of the ability of a "clean" fluid to pass through a standard filter without clogging or plugging. Filterability of a hydraulic oil is significantly influenced by the additives used in the formulation and by the overall hydrolytic stability of the oil. Industry standard ISO and AFNOR tests, as well as OEM tests, can be run with either dry oil or with the addition of a specific amount of water contamination. Wet filterability tests are the most difficult to pass.

Until recently, the filterability of other types of industrial oils was not considered to be an issue.

Many manufacturers of gears used in wind turbines currently recommend offline fluid filtration to remove particles at least 5 microns in size. Some manufacturers are considering lowering this limit to 1 micron particles in order to reduce the potential for micropitting of the gears.

However, some OEMs are beginning to suspect that fine filtration may be changing the gear oil's properties by depleting the needed extreme-pressure additives. According

to at least one manufacturer, the problem goes beyond merely taking out additives to actually altering their performance. For example, the bonding agent used in some fibreglass filters seems to have a detrimental effect on the oil and its additives.

The gear industry believes a standardized gear oil filtration and performance test is needed to understand this phenomenon. Current tests address the filter performance or the gear oil's cleanliness but not

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how they interact as a system. The ISO 13357 filterability test, which is a one-pass test for hydraulic fluids using a 0.8 micron filter, is too fine for gear oils.

Gear manufacturers like Flender, SKF and Internormen, as well as filter manufacturers such as Pall and Hydac, have proprietary in-house tests.

The FVA (German Gear Manufacturers Association) has a working group on gear oil filtration that is developing a dynamic test using samples taken from the field. This will be a multipass test, circulating the gear oil in a system with repeat passes. It is proposed that the test rig will allow the addition of water at any time to the sample, so the effects of water contamination also can be evaluated. A Flender foam tester can be added so that gear oil foaming tendency can be assessed after the first pass, the second pass, the third or the hundredth pass.

However, advice from a number of technical consultants confirms that, if the gear oil is formulated without solid additives and is correctly blend-



ed so that all the additives are fully dissolved when the oil is new, the additives should not be filtered out, even by a 1 micron filter. In use, as the gear oil ages, additives may be filtered out through a number of causes, including:

- Additives decompose from abnormal use.
- Polar additives, such as anti-wear, extreme-pressure, corrosion-inhibiting and metal passivation additives, become adsorbed (attached) to solid particles, which are then filtered out.
- Additives condense (desolubilize) into solid suspensions from cold temperatures.
- Additives mix with an incompatible lubricant or other contaminant, forming solid suspensions.

When a gear oil is used correctly under normal operating conditions, is monitored regularly and particulates and wear debris are constantly removed by good full-flow or bypass filtration, the additives should not be removed and the oil should continue to function for several years. It is hoped that the new FVA test will enable the determination of the operating conditions under which gear oil performance deteriorates in use. <<

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