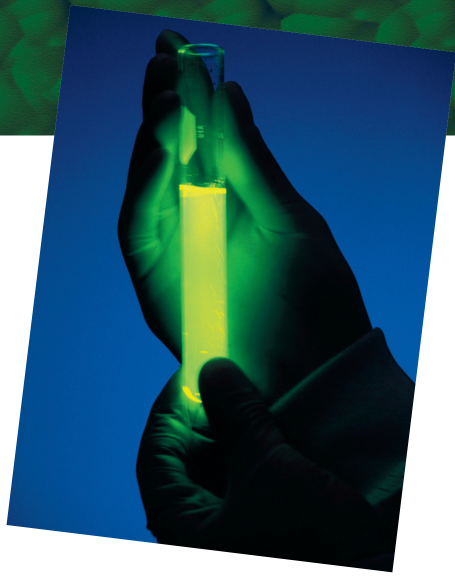

Putting the tests to use

By Jack Poley

In May TLT we presented a table suggesting preferred groups or suites of tests for routine monitoring of various components. While there are other plausible combinations, let's delve into the justification and reasoning for the combinations offered, looking at some individual component types in specific applications:

Gearsets — Industrial Applications

TEST SET	Primary Objective(s)	Reasoning and Evaluation	Added Points / Caveats
Spectro Metals SMA	1. Identify standard wear events. 2. Check for abrasives.	SMA is ALWAYS a pertinent test, augmenting the ferrous evaluation, and inspecting for some non-ferrous metal events as well. It is also wise to have SMA available for the chance possibility of abrasives contamination in the form of silicon dioxide or similar.	Rotary equipment offers the most difficulty for SMA to contribute its full value because a lot of the wear situations involve large particles not detectable with this test.
Ferrous Debris DRF/PQ,RPD *OR Preferably* **Micro-Patch Particle Debris Analysis**	Identify ferrous gear 'chunks' from possible overload and fatigue issues.	Gear boxes tend to generate particles within and without a Spectro Metals test's detection size. What is most important, however, is that most gear boxes are unfiltered, therefore the large particles generated are available to be detected, and should be investigated. There is too much potential information that might be entirely missed if SMA is the only metals inspection.	Ferrous debris analysis should be somewhat *de rigueur* for unfiltered components, however, general debris analysis using a filter patch is even more effective since all metals and other solids will be trapped for observation. If affordable, this is the particle test of choice for a gearset.
Viscosity VIS	1. Verify proper film strength. 2. Oxidation correlation.	Even for used lubes, VIS is probably the second most important test available to the evaluator, but care must be taken not to mis-infer its meaning. It is possible for the VIS to be 'normal' with two opposing problems, such as a mis-fill with low viscosity product, along with a major oxidation problem from excessive heat, brought about by the resulting inadequate film strength from the addition of a product too low in viscosity.	VIS should ALWAYS be a part of an oil analysis test package, simply for negative (*i.e., non-problem*) inferences that it tends to offer when the value is as expected.
Infrared Spectro FTIR	1. Oxidation.* 2. Process contamination.	The bread and butter of FTIR is the ability to detect oxidation in mineral oils, and this is its primary function with gearsets. Nevertheless, a significant shift in absorption characteristics may indicate process contamination or unwanted lube mixing.	****Note:*** FTIR will be ineffective in detecting oxidation when certain synthetics are employed, where the oxidation band overlaps significantly with the lube's chemistry.
Acid Number AN	1. Process contamination. 2. Oxidation correlation.	If strong acids are used in the plant process, a pH test included with the AN may isolate incidents where the gearset is contaminated, possibly from breather breaching. The former is a contamination issue; the latter a degradation event.	Oxidation often causes AN increases, but not always. FTIR and VIS are more dependable oxidation indicators much of the time.
Water (Cursory)	1. Process contamination. 2. Poor sampling.	In some plant environments it is impossible to prevent a small amount of water from residing in a gearset sump. A cursory check ensures that a significant amount of water does not go undetected. Poor sampling must always be considered when water is detected.	Very little attention is paid to the fact that the detection of water contamination is very undependable, particular in terms of quantification. Water is not usually miscible with lubes and is, therefore, not evenly proportioned throughout the sump.

Postscript

Gearsets, in particular, present added challenges in the oil analysis process. More than most systems, gearsets tend to produce relatively large (> 5 micrometers) wear particles, and there are usually significant amounts of such particles present since most gearsets have no fine filtration in their lube circuits. Such particles, of course, are mostly undetectable using SMA, but other methods, described throughout this series of articles, can and should be applied.

Nonetheless, SMA still provides a lot of primary value because many small particles are generated as well. Tests like DRF, therefore, may work particularly well for gearset fluid screening of ferrous material, since a ratio of L & S particles is generated, but PQ testing, coupled with SMA, accomplishes the same thing with a wealth of ancillary information thrown in.

The lack of a fine filtration system in gearsets is a double-edged sword in the analytical process. There is a maximum amount of debris in circulation, but large debris does not circulate homogeneously, diminishing an accurate representation of the particular sample drawn. Sampling techniques need to be more rigid.

For example, if using a draw tube, one should attempt to insert the tube within, say, one to two inches of the sump bottom in order to maximize the prospects for gathering large particles. The obvious corollary is to be prompt in securing a sample once a unit has been shut down, minimizing gravitational loss. As always, consistency is paramount in the sampling process. <<

Jack Poley is president of Jack Poley International, LLC, Miami, consultants in fluid analysis. You can reach him at **poleyj@bellsouth.net**.