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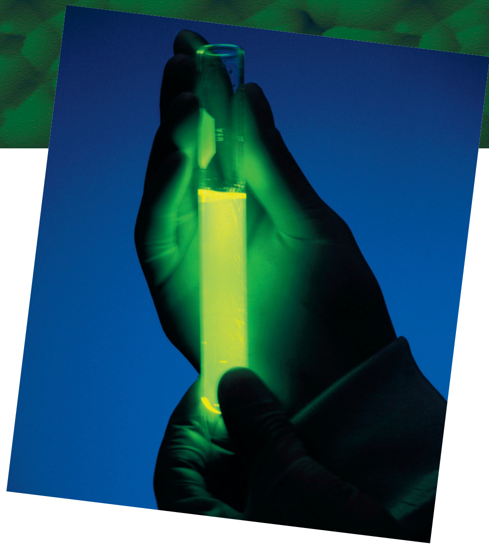

Assessing particle-counting issues

by Jack Poley

We previously discussed the limits of Spectrometric Metals Analysis (SMA), citing the application of particle counting or PQA (Particle Quantifier Analyzer) or DRF (Direct Reading Ferrography) as more probative for some types of sumps such as hydraulics and gears. But what about the diesel engine or, for that matter, reciprocating equipmentngines of any ilk, as well as reciprocating compressors?

Note: *Some hybrid type systems such as axial-radial hydraulic piston pumps include sliding wear metal debris from normal operation; however, such systems tend to exhibit wear and contamination traits more like rotary, rather than reciprocating systems, i.e., the rotary component of the unit dominates the observed wear behavior in the oil sample data.*

RECIPROCATING SYSTEMS

Diesel Engines. The diesel engine was the first component type to be analyzed for wear metals in program fashion (recall this was first explored by the U.S. railroad industry, circa 1948). Because most of the wear particles generated from sliding wear are small, all reciprocating systems readily respond to SMA. The exceptions to this rule of thumb are some slow-to-medium speed two-cycle diesel engines, where the combustion or compression chamber, lubricated via direct injection, is totally separated from the primary lube sump (e.g., a crosshead assembly), thereby offering no evidence to the oil sample.

Even when there is a common sump configuration, a slow speed diesel engine may not provide much sliding wear evidence in the oil sample. Large, slower-speed engine, instead, typically provide a greater ratio of large to small particles (per PQA or DRF). Perhaps the reason for this is the shear power generated by such components, developing forces able to cause chunks of metal to break off from compression rings and other high stress points within the engine.

It is good practice to consider performing a large particle analysis on slow speed reciprocating equipment in order to intercept the formation of such particles as early as possible. Even analytical ferrography should not be ruled out as a *routine* test for very large (and, therefore, expensive) reciprocating engine or compressor installations.

Diesels especially present issues for particle counting due to significant soot loads that preclude accurate counts, at least by optical counters, which dominate the testing industry presently. Further, diesels tend not to generate large particles at significant levels, and when they do there is almost always a co-generation of small, SMA-detectable particles in corresponding quantities. As such, the application of PQA or DRF can be useful if supported by SMA.

Compressors. Reciprocating compressors* behave very similarly to diesel engines with respect to oil analysis test data, except they don't experience soot contamination and, of course, there is no issue with fuel contamination/dilution. It is easy to perform particle counting on reciprocating compressors. Even more interesting is a micropatch analysis which, absent of soot contamination, allows a "clean" viewing for all particles collected.

**Four-cycle natural gas engines/compressors provide us with yet another exception, in that they will typically develop significant amounts of fuel soot, precluding a particle count test.*

SUMMARY (PARTICULATE INSPECTION)

SMA is virtually *always* applicable for any component and should not be omitted from the routine testing process (because other sophisticated inspection methods are in place). It is false economy to preclude this extremely valuable tool from the assessment process.

Particle Counting has two primary beneficial functions:

1. Basic contamination control, wherein specific limits can be set and monitored.
2. PC is an excellent screening device of some sophistication in that it "sorts" the particles and offers a good numerical approach toward determining the need for more specific tests, such as Analytical Ferrography.

PQA and DRF are strictly screening tools, most effective for components like gearboxes where filtration is usually non-existent. These techniques are clearly useful, but no decision process should be made without additional testing or on-site input from the equipment operator. **<<**

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