Jason Kopschinsky

Oil Sampling: Still the Foundation for a Successful Oil Analysis Program

A decade ago, I learned the true value of an oil sample.

I was working in a steel mill, sampling roll mill gearboxes and screening them onsite for ISO particle count, ferrous density, moisture and viscosity. As you can imagine, these gearboxes get pretty beat up both inside and out, so it was not uncommon to see high particle counts and associated ferrous wear in many of the samples. On one occasion in particular, one of the gearboxes had exceeded the cleanliness target by a small margin. This too was not uncommon. Contamination control, storage and handling, and relubrication practices were all in need of improvement in this facility. What was significant was that the ferrous density for the sample from this gearbox was off the charts. Clearly, this was information that I needed to pass on immediately. To my surprise, my warnings fell on deaf ears. I wrongly assumed that when I passed along this information to the maintenance foreman that alarms would sound, maintenance staff would assemble and the problem would be dealt with. Instead, nothing happened. What eventually happened was this gearbox failed catastrophically, resulting in twenty-seven hours of lost production time and a host of associated costs and lost revenue.

Consistency in our sampling will always lead to repeatable and dependable oil analysis results.

Sampling Goals

It's clear the maintenance foreman was counting on the data being unreliable, or perhaps he simply did not understand oil analysis and that the gearbox in question would continue to chug along as usual. However, I was sure the data that I gave him was accurate and true. I knew this, in part, because I was certain that I had extracted a high-quality, data-rich oil sample and had tested it according to the procedures required for the instruments I was using. Being able to extract quality samples is the foundation of any successful oil analysis program. It is important to remember what we are trying to accomplish when we take a sample of oil from a machine or component for analysis:

1. Capture a snapshot of the condition of the component and the lubricant. Each sample taken from a machine represents that machine at that point in time. It quite literally is a snapshot of the health and condition of the machine and the lubricant at the time the sample is taken. These properties will continue to change within the machine and in-service lubricant as time passes. For this reason, expeditious delivery of the sample to the lab is critical. Each day the sample remains in the plant or in transit to the lab, the further the data gets from current condition.
2. Provide repeatable and dependable data from which to base maintenance decisions and activity. The most effective way to use oil analysis data is to base maintenance decisions and activity on the results of the analysis. However, without a history of repeatable and dependable data, no one is likely to use the data to their advantage with fear of making the wrong decision. Repeatable and dependable data is a direct result of the hardware installed on the machine to extract the sample, the accessories used to collect the sample from the hardware and the proce-

dure that's followed when the sample is being taken. Also, the test slate that is applied to the sample is very important. If we're not looking for the right things, we're going to miss the meaningful indicators.

3. Trend the rate of change of physical and chemical properties at each sampling interval. Oil sampling is all about precision. The instruments used for analysis can be very precise, but without a precision sample, the data is going to be hard to trend. We look to trends in the data to help us predict the future health of the machine or the lubricant. A powerful tool in the oil analysis arsenal is the rate of change trend. Of course, when specific parameters break limits in oil analysis, automatic and manual alarms are the typical response. However, rate of change checks are important for those occasions when specific results don't exceed set limits, but do change dramatically signaling the early stages of a potential fault.

Location, Location, Location

Routine oil analysis requires the use of specialized hardware permanently installed in the machine or component from which we can extract an oil sample. As important as the hardware used for sampling is, also extremely important is extracting the sample or installing the sample valve in an ideal location. The ideal location for extracting an oil sample from a sump or reservoir is as close to the return line, gear set, or bearing as possible. You also need to make sure there is enough room surrounding the termination point of the hardware you've chosen to use. Maintaining a distance of two inches from any static or dynamic surface within the component puts you on the right path to a quality sample. Hardware that extends too far into the machine risks contacting machine surfaces and causing damage. Hardware that terminates on or close to the surface of the machine or component risks collecting contaminants that can skew the data and result in unreliable analysis.

The preferred location for sampling circulating systems is on the return line, not the reservoir. Another rule of thumb is to sample at 50% of the oil level. Sumps and reservoirs were designed to hold a large volume of oil, to dissipate heat and to allow air to rise and contaminants to settle. Therefore, the most concentrated contamination is on the bottom of the sump or reservoir and the cleanest oil towards the top.

The Key to Success

The key to success is to be consistent. Consistency in everything oil analysis-related allows us to identify machine or lubricant problems without having to first exclude issues with how we got the sample or how we tested it. It is of the utmost importance that we have a consistent approach to:

- Sample location
- Sampling receptacle
- Sample extraction procedure
- Sampling frequency
- Sample testing methods.

Consistency in our sampling will always lead to repeatable and dependable oil analysis results. As we know, the most successful oil analysis programs have taken a long time to develop and mature into a program that truly drives maintenance decisions within an organization. Kicking off your oil analysis program with consistency will prove to be a jumpstart toward a truly rewarding maintenance initiative.

Jason Kopschinsky, CMRP, C.E.T., MCPM, joined Des-Case as the technical services manager in April of 2011. Prior to joining Des-Case, Jason spent over a decade coaching clients in asset reliability and lubrication management.
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