condition monitoring — Oa — oil analysis

Integrated Oil Analysis

the Key to Early Detection

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When it comes to oil analysis, there are a number of options, from simple inspections to onsite instruments, and from basic test packages to full blown "forensic" lab analysis. But which one's the best? Which one will provide the earliest detection and the most information to successfully diagnose a failure? The answer is all of them!

Those running world-class oil analysis programs don't rely on a single level of diagnostic measurement, but rather use a variety of strategies to ensure that lubrication related failures aren't missed. Just like a car mechanic has a variety of tools at his or her disposal depending on the issue at hand, the oil analysis toolkit needs an integrated series of options that work together to achieve the desired result.

In Figure 1, we show an integrated oil analysis scheme for a gearbox that combines four different levels of diagnosis: basic inspections, onsite oil analysis, lab analysis, and expert diagnostic testing. Used in conjunction with other predictive maintenance technologies such as vibration analysis, thermography, and ultrasonic measurements, this scheme provides maximum coverage with the lowest total cost. Here's how it works:

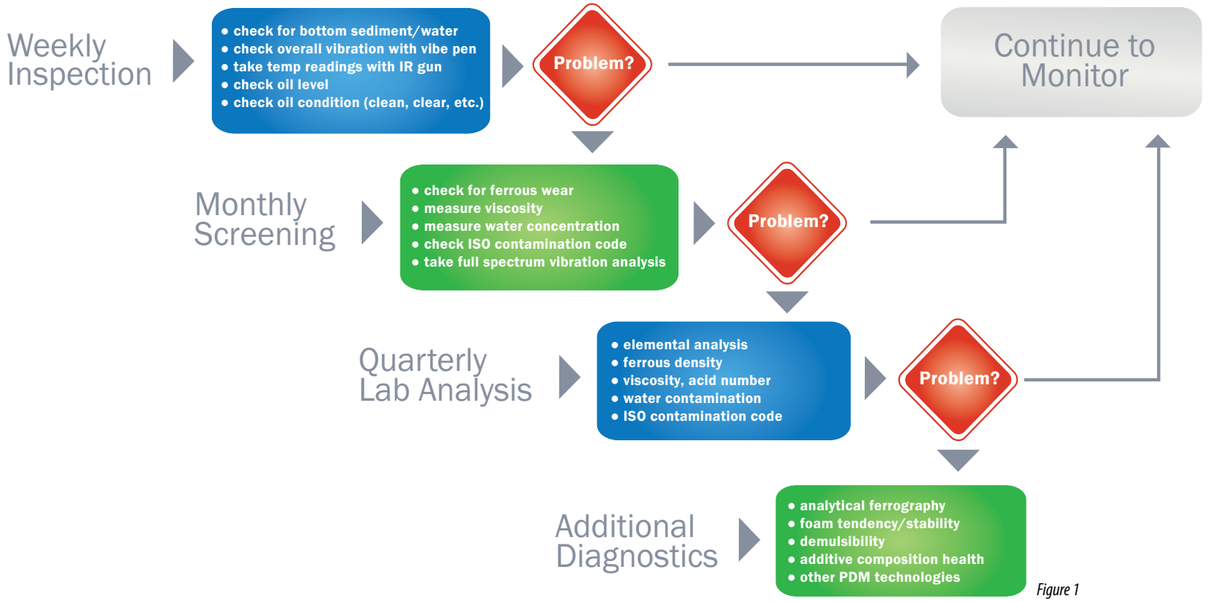

Figure 1

Basic Inspections

It's been estimated that 80-90% of emergent maintenance problems can be identified through basic mechanical integrity inspections. When it comes to lubrication, checks should include looking for evidence of water or sediment on the bottom of the sump, checking oil level, or inspecting the oil in the site glass to look for changes in the oil's color or clarity. In addition, other checks, such as taking temperature readings using an infra-red temperature gun, or taking an overall vibration reading with a vibration pen can, all help to highlight an emergent problem. Lubrication problems identified through basic inspections should prompt immediate further diagnosis using the other "tools" in our oil analysis toolkit.

Onsite Oil Analysis

Periodically, all critical oil-lubricated assets should be tested more rigorously. For plants that are large enough to justify the time and costs involved, onsite instruments capable of evaluating the condition of the lubricant, the level of contamination in the machine, and any active machine wear are an excellent way to isolate problems. Done on a periodic basis or in response to problems observed through basic inspections, onsite oil analysis is an important piece of the puzzle. For plants that are too small or are unable or unwilling to spend the money on onsite instrumentation, onsite analysis can be replaced with offsite lab analysis, but the frequency of sampling must be increased to make up for the "loss" of onsite oil analysis data.

Additional Diagnostic Testing

Good oil analysis labs offer a range of oil analysis tests from basic tests, such as viscosity and elemental analysis, to high-end testing, such as analytical ferrography, x-ray fluorescence, or other ASTM tests that take a detailed looked at lubricant health. Any problem that is identified through inspections, onsite or lab-based analysis, or any other PdM inspection should be fully investigated. With several hundred relevant tests that can be run on lubricating oils, there is always a way to dig deeper using oil analysis.

Integrated Model

Using an integrated approach to oil analysis requires careful pre-planning. It's not good enough to simply buy a box of oil sample kits from your preferred lab and expect them to tell you what's failing, how long until the problem becomes terminal, and what corrective action to take. Oil analysis is an integrated effort requiring input from difference sources.

The key to oil analysis is to sample from the right place and at the right interval. Depending on the machine, failures can go from incipient to catastrophic in just a few days in the case of high-speed turbo machinery to several months for slower equipment such as industrial gear reducers. While the scheme and measurement frequencies shown in Figure 1 are appropriate for a gearbox, for other equipment such as compressors or hydraulics the periodicity should be shortened perhaps to daily inspections, bi-weekly onsite testing, and monthly lab analysis. But the same concepts apply: use simple techniques onsite, integrated with quality offsite analysis, to truly reap the benefits that oil analysis can provide.

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Full Lab Analysis

Even those plants that have great inspection routes and great onsite capabilities need to do offsite oil analysis with a commercial lab. Short of investing the same amount of money it takes to set-up a fully functioning commercial oil analysis lab, onsite analysis cannot and does not provide the same amount of diagnostic horsepower that a well-equipped commercial lab possesses. Lab analysis should include checking for evidence of wear, looking at the overall health of the base oil and additives, and trending particle and moisture contamination to ensure the oil is fit for continued use. Any problem identified with routine lab analysis where the route cause is not immediately obvious should prompt an expanded set of oil analysis tests to try to pinpoint the root cause of the problem.

Mark Barnes, CMRP, recently joined Des-Case Corporation as Vice President of the newly formed Equipment Reliability Services team. Mark has been an active consultant and educator in the maintenance and reliability field for over 17 years. Mark holds a PhD in Analytical Chemistry. www.descase.com