

Affordable oil condition monitoring

Oil condition monitoring and analysis play an important role in a Condition Based Maintenance Strategy.

Martin Williamson, lubrication consultant at KEW Engineering, argues that recent technological advances in rapid on-site oil checking should encourage companies to make more use of oil condition information and analysis.

Knowledge and expertise are key ingredients to business success, but all too often businesses fail to recognise where this knowledge is kept: locked in the heads of employees. This unspoken, unwritten and largely unshared information – called tacit knowledge – can sometimes be the knowledge that makes the wheels of a business turn, quite literally.

Faced with the increasing competition from China and the rise of other 'low-cost' manufacturing nations, firms in the UK have been forced to cut back. Over the last decade there has been a tremendous decline in the number of lubrication technicians employed in manufacturing.

Having spent years lubricating machinery and helping maintain the plant, lubrication technicians knew the foibles and idiosyncrasies of every machine. They could listen to them hum and hear a damaged bearing or see a loose belt. They could often tell when their oil should be changed just by looking at the colour.

We cannot bring back this tacit knowledge. However, lubrication monitoring is rapidly becoming a key technique in condition based maintenance and a key to plant reliability.

Forward thinking companies have rediscovered that good lubrication practices are at the heart of proactive maintenance, where the emphasis is on avoiding plant stoppages and failures, rather than downtime and repairs. Lubricant Condition Monitoring is a powerful tool towards predicting failures.

OIL'S UNTOLD SECRETS

Some failure modes are best detected using oil analysis. A small sample of a machine's lubricant takes just minutes to collect, yet it holds untold secrets about the state of your plant. All you have to do is pop your samples in to the post and send them off to a professional oil analysis laboratory. Within a few days you receive your results; the detail offers an amazing insight into the insides of your plant.

Chemical and physical analyses of your oil sample may reveal that your oil is highly oxidised, or that it has a high water content. Perhaps there is contamination or fragments of metal. You can detect oil degradation of many kinds, and, most importantly, deduce their root causes.

Knowing that your oil is no longer fit for purpose and must be changed is a good start. Knowing why your oil has degraded or become contaminated and being able to

fix the root cause (for example, replacing filters or a leaking gasket) could save your company a critical failure and major expense in spare parts, unplanned stoppages or large capital outlay for new machinery.

Oil analysis may even tell you that the 'fresh' oil you are putting into your machines is already poor quality, not because it is an inferior product, but because it has been stored in an unsuitable location with the lid off the drum, for example.

COUNTING THE COST

Of course, oil analysis is not a new idea, but many companies, especially small businesses, avoid using oil analysis laboratories, largely due to their cost. It is easier – and apparently cheaper – just to change the oil at regular intervals, they think.

However, there are many hidden costs that question this assumption: today oil is by no means cheap and the costs of lubricants can be a significant overhead for a business. Would it not make more financial sense to change oil only when it is no longer fit for purpose, rather than following the calendar?

Oil analysis will indicate quite clearly whether your oil is good. But here is the paradox: how often should you send samples to the lab? There is something slightly galling to receive back your lab report only to discover that your samples were clean. Often at over £30 per sample, that's an expensive way to get a pat on the back, especially if you are taking monthly samples from dozens of machines. In today's economic, cost cutting climate this is an expense which is hard to justify.

This is where modern technology takes over from the eponymous Lubrication Technician because there are now a variety of ways to make laboratory analysis affordable and avoid the cost of analysing perfectly good oil.

You could, for example, bring the lab to your factory. A semi-automated benchtop analysis system will work to a similar standard to traditional laboratories. However, the capital expenditure is high and only the largest sites will see much return on their investment. For most companies, it is simply easier to post samples to the experts.

The ideal alternative is to make sure you only send 'bad actor' samples to the lab for more detailed analysis. There are several options available which will help you to identify the health of an oil sample.

In the last decade technology has been developed for oil sensors to be fitted permanently to machinery for full-time trending of more critical assets such as turbine trains. The use of permanently mounted sensors can also be used to focus on specific oil qualities; some units are designed to monitor particle counts, wear debris or moisture in the oil.

The downside to permanently mounted sensors is the added cost of installation, and the requirement for multiples of the units to cover all the critical machines.

At the other extreme you find handheld oil checkers which give a quick measure of overall oil quality. SKF has been selling the TMEH 1 Oil Check monitor for a number of years, which compares the dielectric constant of an oil sample against a 'clean' calibration sample. The new portable ROC500 Rapid Oil Checker from AV Technology also measures the permittivity of an oil sample, but does not require calibration because the device compares the sample against a laboratory validated database value for



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fresh samples. With its traffic light system ROC500 instantly shows you whether your oil is good; you only need to send bad samples to the lab.

An on-site portable system like the ROC500 could typically cut down the number of samples going to a laboratory by 80% or more. And you know, even before you get the results back, which machines are functioning well and which may have problems that the lab report should reveal.

A rapid, on site oil checker will tell you if your oil is good. And if it is, you can rest easy. If it is not, no-one will begrudge the relatively small outlay for sending the sample to a lab for full analysis, which should reveal the causes behind the deterioration of the oil.

indicative of the onset of mechanical failure, excessive wear or contamination. Even without laboratory analysis, you may notice, for example, that a machine suddenly requires much more frequent oil top-ups. The use of fresh lubricant could mask problems for many months, but records would highlight the increased consumption and alert you to an underlying problem. A sample could be sent to the lab for priority analysis and you could be dealing with the root cause of the problem in 24 hours.

On-site checks for oil quality could quickly reveal whether your routine scheduled oil changes are suitable too. Many companies have followed the equipment manufacturer's maintenance schedule for 30 years; they may be changing perfectly good oil, or oil that is long past its best. Rapid oil checking with a portable device will

OPTIONS FOR OIL CHECKING TECHNOLOGY

| | Commercial laboratory analysis | Bench-top systems | Portable online instruments | Handheld oil check devices | Permanently mounted units |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ownership cost | Minimal | High (typically >£40,000) plus annual service & calibration (usually >£1,000) | Medium (typically >£12,000) plus annual service & calibration (usually >£1,000) | Low (<£2,000) | Varies from £1,000 per sensor to >£8,000 per sensor, plus installation costs |
| Cost per sample plus labour costs in sampling and analysing. | Varies from £20-50 per sample depending on machine type and lab | Varies from £2-10 depending on type of system and length of time to analyse the samples | From as little 10p per sample, with minimal additional time to analyse samples | From as little as the cost of the sample bottle each time, with minimal additional time to analyse samples | Minimal costs and no labour element |
| Ease of use | Sampling only | Sampling plus analysing results | Sampling and checking results | Sampling and checking results | Very simple once installed |
| Depth of reporting | Detailed with specific testing for each oil parameter | Not as detailed as a commercial laboratory and not all give a broad range of parameters | Usually only particle counts, but some offer viscosity and moisture | Generally indicates a change in condition but is not specific as to the cause | Some report particle, count, or moisture, or wear debris. Some types also give several properties of the oil such as viscosity and TAN |
| Interpretation skills required | Analysis of data feedback requires a skilled technician or lab support | Analysis of data feedback requires a skilled technician | Use of instrument and checking of results requires less skill | Use of instrument and checking of results requires less skill | Checking of results requires less skill, can be set to trigger operator alarms |
| Benefits | Detailed analysis leading to more focused fault-finding and root cause analysis | Less detailed analysis but possible to still assist fault-finding and root cause analysis with immediate testing on-site | One unit can cover many machines. Useful for oil quality checks on new oil deliveries | Quick, simple tests that can identify non-conforming oils and improve maintenance scheduling for many machines not typically included in an OA programme | Reduces labour costs, health and safety risks while sampling and kinder to the environment through reduced sample and reagent disposal |
| Downsides | Longer turn-around on sample testing and the ongoing per sample costs limit its full potential for many businesses | Higher initial purchase costs restrict its use to sites that have logistical problems shipping samples. Often requires the use of solvents on site | The higher prices for few reported results of the oil restrict its use to sites that have logistical problems shipping samples. Cannot be used in explosive environments | These units cannot identify specific faults within the machine or the oil | The more machines, the higher the initial costs which will restrict its use to sites that have logistical problems shipping samples. Cannot be used in explosive environments unless modified |

TREND SPOTTING

The combination of regular laboratory oil analysis with a robust on-site technology for rapid oil checking to prevent 'over analysis' makes a lot of business sense. You can prevent stoppages and defective plant machinery by optimising lubrication schedules and sophisticated lab analysis will help you to detect early any significant wear, tear or damage. Simple on-site oil checking should not only reduce the costs of laboratory oil analysis, but also help many manufacturers to reduce their oil consumption, because oil is changed just before it loses its lubrication performance, rather than prematurely to coincide with planned (or unplanned) maintenance.

By keeping records of your on-the-spot checks and the results from the low quality samples sent to the labs, you can also begin to spot trends and detect the uncharacteristic 'behaviour' of machines which is typically

soon help you to optimise the oil change schedule. You are almost certain to save money, either through lower oil consumption or improved performance and lower maintenance costs.

This is the kind of knowledge that disappeared over recent years, that intimate knowledge of machines and their 'normal' performance. However, thanks to technology, businesses can rediscover this tacit knowledge, except this time it is transparent. The data from on-site oil quality checks and laboratory reports can be shared and discussed. Even the smallest outfit can now improve their reliability based on hard evidence.

It has taken some clever technology to get back to where we were, but we are now better placed than ever to use oil sampling as the primary way to look after our plant. ✨

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