Step Up Your Oil Sampling Program

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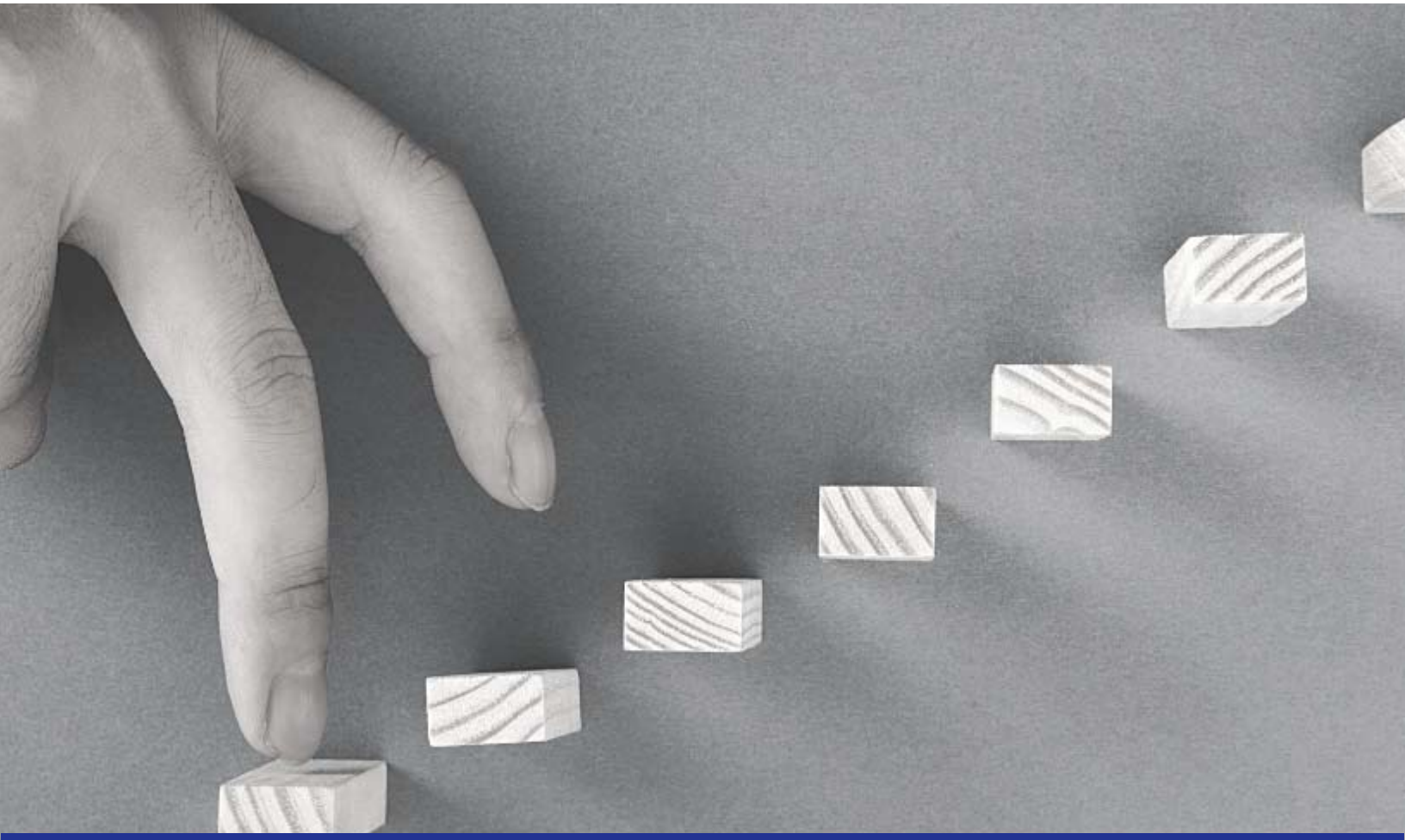

The Impact Oil Sampling Can Make

Oil analysis is one of the earliest predictors of pending machine failure on the P-F Curve. The P-F Curve represents the behaviour of an asset or asset component before functional failure has occurred. When used effectively it can provide a significant amount of time between the latest inspection and impending failure in order to remedy the situation. When oil analysis is performed properly it is a highly effective method of determining the health of your equipment's lubricant and machine.

A successful oil analysis program depends on a highly representative fluid sample. That very small 3 oz (70 mL) sample represents all the oil in your system at the time that sample was taken. That sample must represent the actual condition of the all oil in the machine. Therefore entire oil sampling process should be focused on ensuring the oil entering the bottle contains complete information

The method and care in taking the sample is fundamental and important but, some companies are still engaging in less than ideal sampling methods.

Comparing Sampling Methods

There are three common methods to get your oil sample

- Drop-tube sampling
- Drain Sampling
- Dedicated oil sampling valves

These 3 methods each have their advantages for instance you don't need any hardware to draw drain sample, and you only need a vacuum pump and tubing to draw from the fill port. But while there are advantages to the methods there are certainly disadvantages

Remember: The entire oil sampling process should be focused on ensuring the oil entering the bottle contains complete information - It should represent the active fluid that is doing the work. This means:

1. **Get an active sample while the equipment is running, while the lubricant is thoroughly mixed**
2. Take future samples from the same location each time
3. Limit the chance for outside contamination

Digging Deep Into Drop Tube Sampling

Let's look at what's you could be missing by only using a vacuum pump and plastic tubing to draw your oil sample. To start, the entire process is time consuming. In order to get the sample safely, you're locating clean sampling supplies, and shutting down the machine, opening up the fill port, drawing your sampling, closing the fill port, and then restarting the machine. **From studies, and customer accounts we have seen it can take on average approximately 20 minutes to get a sample.** Due to the nature of shutting down the machine to sample, you're also sampling at set time. An oil sample is a snap shot at your equipment at any time; if it's indicated that a sample is needed you should be able to take it at any time.

Second, you're opening up the system to external contamination. Sampling from a closed system greatly reduces the chances of fluid contamination in dirty and outdoor environments. Also, if improper sampling procedures are used, the oil sample can become contaminated due to residuals left over from the previous sample. **In fact, a Checkfluid Customer Survey found that 80% of respondents had contaminated samples from drop-tube sampling.**

Third, you're getting inconsistent sample data. A study done with Western University demonstrated the inability of drop tube sampling to produce repeatable results. Three sampling methods were used to draw oil samples from the same piece of machinery, daily for one week:

- Method A (Pushbutton sampling valve)
- Method B (Sampling valve with tube)
- Method C (Drop tube and vacuum pump)

It was found that Method C has high variability in measurements. In addition Method C gave a wide result of particle counts when resampled. Without reliable sample data, maintenance decisions can result in unnecessary maintenance repairs or equipment problems worsening.

This variability can be from particles settling due to lack or circulation or from the placement of the tube when it is drop into the machine. Unless caution is used, it is difficult to predict where the end of the plastic tube will land when inserted in the machine, it could be too close to the sides, top or bottom of the sump. In any case, it is difficult to produce sample trending with drop tube sampling.

"It was hard to keep fresh tubing on hand. The hand vacuum pump was often left with residual oil or coolant in it causing the new sample to be compromised."

Drain Sampling - Lost Value

Like drop tube sampling, drain sampling also share some common problems. The equipment must be shutdown in order to get your sample. It is also difficult to get a trend line established to compare sample reports. Sample results from drain sampling tend to be even less representative and repeatable than drop tube sampling. This is because bottom sediment, debris and particles (including water) enter the bottle in concentrations that are not representative of what is experienced near or around the area where the oil lubricates the machine components. The sump or reservoir is full of historic data that could have been building up for weeks or months. You're also sampling at a set time, most likely when you are changing out your oil.

The biggest drain sampling draw back is you loose out on the ability to accurately extend or optimize oil life. When drain sampling is typically performed when the oil is being replaced with new oil. You're not capturing how the oil is performing under normal operating conditions to see if it needs to be replaced. You're capturing oil you are already replacing.

	Drop Tube Sampling	Drain Sampling
Can sample while the equipment is running, while the lubricant is thoroughly mixed	Not recommended	Not recommended
Can sample from the same location each time	Difficult to achieve	Yes
The chance for outside or cross-contamination is reduced	System is open to contamination	System is open to contamination

How You Should Be Sampling

Dedicated oil sampling valves allow you to:

- **Sample while the equipment is running, while the lubricant is thoroughly mixed**
- **From the same location each time**
- **While reducing the chance for outside or cross-contamination**

Sampling valves make it easier, and faster to get those much needed samples, saving you valuable maintenance time and resources. No shutdowns or special conditions are needed to get that oil sample. In some cases you can just simply walk up to the valve and push.

What You'll Get In Return

With dedicated sampling valves you'll get more sampling compliance, better oil analysis results and increased program savings through:

- Less time spent sampling
- Reduced spending on unnecessary maintenance
- Reduced lubricant changes
- Longer Equipment Life

Less Time Spent Sampling

The most commented benefit we get from customers who have switched to sampling valves is a reduction in sampling time. For example, **a company was taking 4.5 hours to sample their 9 compressors** (approx. 15 - 30 minutes per compressor) to draw sample via drop tube. They wanted reduce that sampling time. The solution was a simple KP Pushbutton sampling valve. **After installing the valve they were able to sample all 9 of their compressors in 30 minutes.**

The time savings converted to cost-benefit was significant after the 1st year. But what people forget to see is how that significant cost-benefit continues year after year, typically until the equipment is retired.

This compressor company isn't alone, another company with **refrigerant compressors found that the KP Pushbutton valves saved them 20 minutes sampling per compressor.**

One time cost of sampling valves	$270
Savings from quicker sampling time & only needing one person to sample	$3,060
First year savings	**$2,790**

Remember: Oil analysis is more than just the one sample, in order to achieve program success, new samples should be compared to previous samples and results are to be trended over-time.

Reduced Spending On Unnecessary Maintenance

Companies can't afford to spend unnecessary time trying to fix problems that don't need fixing. This is where sampling valves providing a true representative sample will avoid pulling apart a piece of equipment that's just fine. Oil samples submitted that includes bottom sludge or something that's not representative of the fluid will come back with an alert. A pulp and paper company with a set of HPU pumps that they were sampling via drop-tube sampling through the reservoir found just that. Frequently their sampling reports would come back showing elevated wear particles on the pump set. Since the sample was only coming from the shared reservoir, they did not know which pump needed to be replaced out of the set. So, they would just replace the set - an $8000 cost.

After replacing the set, the next oil sample came back again with evaluated wear particles. What did they do? They decided to see if their sampling method was the culprit. They installed sample valves separately on each pump so they could tell which pump might be failing. They also began to use filtration so that high particle counts did not contribute to further deterioration or replacement of the pump. The result, a filtration run and better samples lead to multiple reports indicating nothing needed to be replaced.

So here as before a low-cost investment in sampling valves reduced the waste of a complete replacement; the time to purchase and ship, the time to store the pumps, the time to install, the lost time while the equipment was out of commission.

One time cost of sampling valves	$99.20
Savings from not having to replace the pump set	$8,000
First year savings	**$7,900.80**

Reduced Lubricant Changes

A plastic's manufacture wanted to be able to sample and filter without shutting down and impacting production. By installing breather and drain mounts, they were able achieve their goal. They also discovered that with improved sampling reports and filtering they learned they could extend out their drain intervals; saving them thousands on oil disposal costs.

	2012	2017	2018
Pieces of Equipment	12	28	25
Gallons of Oil Disposed	988	563	160
Disposal Costs	**$7,410**	**$4,222.50**	**$1,200**

See, prior to 2012 this company's preventative maintenance strategy consisted only of two semi-annual oil changes, where all the oil would be disposed of. By the time their sampling and filtering program was set up in 2017 they had 28 pieces of vital equipment being maintained. By filtering through 1856 gallons of oil, they were able to retain 1293 gallons in the machines and only had to change out 563 gallons. In 2018 the number of equipment drop to 25 pieces being maintained. They filtered through 1510 gallons of oil, retaining 1350 gallons, and changing out 160 gallons. This optimization has saved they thousands in oil disposal costs over the years.

Longer Equipment Life

Instead of sampling the easiest way, the reliability engineer took the time to research and test different sampling methods and hardware. The original plan was to optimize the drain intervals out beyond the established 1-year mark. To do this they needed a way to cleanly sample his oil at least once every three months. By installing condition monitoring mounts they were able to sample and filter but they also discovered that they could prolong a gearbox's life.

"We had a gearbox that came back trending with higher iron levels. This is due to the gearbox being operated outside its original design envelope. This allowed us to order a replacement gearbox and make adjustments to prolong the remaining life to bridge the replacement lead time. Most of all it provided the necessary justification to order two more robust gearbox/mixer units for next year".

How To Get Better Sampling?

The easiest way to get better sampling is to install oil sampling valves. But before we get to that we want to challenge you to look at your program as a whole to ensure everyone understands the value of oil samples and oil analysis.

You should consider reviewing your entire program. While reviewing, look at following the guidelines set out in asset management standard ISO 55001. In the standard the requirements have been broken down into approximately several different groupings that often overlap one another when taking a step-by-step approach. There are a number of papers and supporting articles that can help with this approach such as the ASTM paper D 8112, as it relates to oil sampling and analysis.

To upgrade your oil sampling and analysis program look at reviewing the following elements:

1. Set your lubrication targets
2. Set equipment groupings and assess criticality
3. Determine the best sampling hardware and time allocations by asset
4. Assess equipment and oil condition through baseline sampling
5. Develop daily and monthly procedures for best practice sampling
6. Choose leaders and train personnel
7. Review compliance and success ratios

Establish Targets

To maximize your investment in an oil analysis program, you must understand what you are trying to accomplish, be able to interpret the results you are given and be able to act on those results. So what are you trying to achieve with your oil analysis program? Are you looking to:

- Eliminate root cause failures by establishing thresholds to monitor?
- Reduce equipment downtime and increase reliability?
- Warranty protection?
- Optimize drain intervals?
- Extend equipment life?

Define or redefine what you are trying to achieve, then establish program goals that will drive the proper testing. For example, consider extended oil drain intervals on a fleet. A test package that monitors contamination and wear wouldn't necessarily include the base number and oxidation/nitration tests necessary to extend oil drain intervals.

An effective oil analysis program is a long-term approach. Sometimes people over analyze the data when they first start with a program. Get a trend and baseline started before you start making decisions. Unless you see samples with extreme contamination from dirt or coolant, use caution until you get a good trend line of your wear metals. If you receive a "critical" result on a sample, resample to ensure that the initial oil sample was correct. Do not use one oil analysis instead of trending to make a large decision, i.e., prematurely overhauling equipment or shutting down a vital piece of equipment for inspection with a false negative lab result.

Review Assets & Access Criticality

Install sampling valves on the equipment you're currently sampling. If you're not currently sampling your equipment but would like to know which ones to, we have a simple suggestion. The 80/20 rule.

- **Sample the 20% of the units that are going to occupy 80% of your time i**mportant especially when you short-staffed. This may include small but critical equipment
- **Sample the 20% of your most valuable asset**s the workhorses that can't be easily replaced
- **Sample the 20% of the equipment that is old** and will need replacing sooner than later, and preferably later if capital budgets are tight

Your company's position or policies will dictate which equipment should be focused on. Good solid oil analysis information on all your assets, not just critical assets, makes for a much smoother and safer running operation

Select Sampling Valves

Sometimes it can be hard to know which sampling valve will work best for your equipment. We have recommended sampling valves for different types of equipment or sampling situations.

Engines	KP Pushbutton or KST Series
Transmissions	KP Pushbutton or KST Series
Coolants	LP Pushbutton or KST Series
Hydraulic Return Lines	Inline Connector with KP Pushbutton
Hydraulic Reservoirs	LT/LTJ Series or CORE Solution
Gearboxes	LT/LTJ Series or CORE Solution
Compressors	KP Pushbutton or KST Series
Turbines	LP Pushbutton or KST Series
Drums & Totes	Drum/Tote Adapter
Circulating Lube Lines	LP Pushbutton

Incorporate Condition Monitoring

incorporating condition based monitoring tools in with your oil sampling valves will only help you increase savings. Condition based monitoring versus time based monitoring enables a company to complete necessary maintenance when it is needed rather than when it is scheduled.

The easiest way to incorporate additional condition monitoring tools along side your sampling valves is through introducing visual oil inspections. Visual oil inspections can be done by the operator at the equipment with little to no training. Adding visual oil analysis along with sampling to your current program can allow you to detect problems even before your scheduled oil sample. Visual oil analysis tools such as sight glasses, and level gauges play an important role in early detection of contamination and other oil problems. They provide continuous fluid monitoring of the clarity, colour, sediment, and water contamination of the oil. For example, a bottom sediment and water bowl can be used to find the presence of water before it impacts your machine and before your next scheduled sampling time.

Desiccant breathers offer front line defence against particle detection. As air is drawn into the equipment, the desiccant filter elements remove particles while the beads stop harmful moisture.

The AB and AD adapters join together as the CORE to condition monitor oil levels, free water and sediment levels, changes in coloration, and desiccant breather performance. The CORE is ready to provide a clean hook-up to fast off-line filtration to a level needed to extend equipment life and optimize performance. The condition monitoring process is not complete without precision Checkfluid sampling providing the representative repeatable fluid sample data you need to make those important management decisions, quickly and confidently.

Take A Baseline Sample

In order to conduct accurate lubricant condition monitoring, a baseline sample should be taken. This will allow subsequent tests to be compared to the baseline test when the lubricant was new.

Baseline can extend beyond the oil sample. Get a baseline of, equipment failures and reliability within the plant, which is needed to measure progress. It is likely that at some point, management will want to know how effective the program is. Therefore, the leader responsible for the program must know the condition of the equipment, failure rates and costs before the program is initiated. Creating a good baseline, it may take some time, but it will be worth it when you can demonstrate just how far your program has come.

Develop Procedures

Sampling and other oil analysis program procedures add important structure necessary to assure continuity and consistency of an oil analysis program, institutionalizing it within the organization. It's important to note that sampling procedures will vary in form from organization to organization.

At a minimum, your sampling procedure should include the following elements:

1. Sampling Location
2. Sampling Frequency/Scheduling
3. Sampling Method
4. Material Requirements
5. Safety Considerations

Data will only help if you have an actionable plan in place. Once you receive sample data, you need to identify trends that pinpoint small problems before they become catastrophic failures, and use the laboratory's recommendations to effect change in your maintenance practices.

Make sure the analysis program gets the emphasis it deserves by sending in samples as soon as possible after they are collected. You don't want machines that are close to failure operating any longer than necessary

Choose Leaders & Train Personnel

Review with your maintenance team the proper way to pull oil samples and how to understand oil analysis reports. Make sure your team members know what to do when they get a report back from the lab. Your data will only help if you have an actionable plan in place. Once you receive sample data, you need to identify trends that pinpoint small problems before they become catastrophic failures, and use the laboratory's recommendations to effect change in your maintenance practices.

Make sure the analysis program gets the emphasis it deserves by sending in samples as soon as possible after they are collected. You don't want machines that are close to failure operating any longer than necessary.

Ensure that the organization fully supports the changes needed to achieve asset management excellence. This means the top management team must understand and support the lubrication excellence journey as part of ISO 55001 certification. For the lubrication excellence initiatives, the LET team should include all levels of the organization at senior and the most junior positions if short-term and long-term success is to be achieved.

Take Action

Prioritize work orders. Get the team to communicate. Make the changes needed quickly and effectively.

Review Compliance & Success

The program needs to be monitored to ensure the benefits which were originally targeted are achieved. This could take the form of tracking and plotting the contamination control data from the lab and comparing these values to the contamination targets set for each piece of equipment. Eventually, plant management will want to see an evaluation of the cost of the oil analysis program relative to the benefits received This is where the baseline of plant performance, generated at the beginning of the program, will be beneficial.

Want To Upgrade?

Improving your oil analysis program starts with improving your oil samples. Start getting the reliable oil samples you need to get great returns on your oil analysis program. **Start small, contact Checkfluid to get sampling on your smaller gearboxes and compressors.**

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