GOOD Oil Analysis Starts With GOOD Sampling Practices

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Proper sampling methods are an essential part of an effective oil analysis program. In many cases, the quality of oil analysis results and the subsequent decisions that are made are no better than the quality of sampling practices. Poor sampling methods can lead to incorrect diagnoses which can initiate unnecessary corrective actions, or, they may prevent abnormal conditions from being observed.

When it comes to taking samples for used oil analysis the primary objectives are data validity and data repeatability. To accomplish these objectives several things have to happen. To have repeatable data, the samples must come from the same location via the same pathway, and with a consistent procedure every time.

To have valid data that actually represents the condition in the machine, oil samples must be taken from the correct location for a given machine type, and the integrity of that sample must be protected from the ambient environment. It is quite possible to have suitably clean oil in a machine, yet have the oil analysis results indicate an abnormal condition due to poor sample handling or extraction practices. Likewise, it is not uncommon to get oil analysis results that look good while in fact, multiple problems exist with the oil or machine.

As previously stated, the primary objectives for oil sampling are validity and repeatability. In order for an oil sample to offer valid data it must come from a correct location. That location is typically one that provides information about the oil that is actually lubricating the lubricated components in the machine.

In a gearbox, the oil sitting at the bottom of the case is not really representative of the oil between the gears. The oil just above the drain port may contain many years' worth of wear debris making the samples collected from this location indicate excessive wear when that is not the case. When a sample is collected immediately after a high-performance filter in a hydraulic system, the resulting particle count will likely be quite good, but the oil lubricating the pump could be very dirty, so sampling downstream of oil filters is a poor practice for hydraulics.

To get repeatable data, we must simply follow the same sampling procedure each time. The best way to ensure consistent sampling is to rigorously document the procedures.

Which sampling method is best?

That really depends on the system being sampled. For gearboxes and other bath lubricated systems, a minimess-type sampling valve with a pitot tube is the usually the best option. This apparatus uses a fixed tube which can be cut to length and positioned in a desirable location in the sump. This is similar to the "drop tube" method but it eliminates the most common problems associated with drop tube sampling which are inconsistent placement of the sampling tubing, the excessive sampling pathway volume, and overall difficulty or time requirement to collect the sample. The use of a minimess and pitot tube minimizes the sampling pathway and ensures a consistent extraction point.

Using fixed hardware for sampling bath lubricated components ensures proper extraction location and minimizes the time required to complete the task.

Drop tube sampling refers to the use of a flexible tube which is inserted into the sump by hand. This method may produce valid results, but to do so you must be very careful and you must be aware of the potential problems. While the minimess is certainly the preferred method, drop tube sampling is an acceptable alternative. Most other sampling methods, such as drain port sampling, will not yield useful results and should be eliminated from your sampling program.

For hydraulic systems the primary sample point should be on a pressurized portion of the system upstream of system filters. All pressurized systems offer easy, consistent sampling if they are properly fitted with sampling hardware. The same type of minimess sampling port can be utilized although no pitot is required, and if the sample bottle cap is vented there is no need for a vacuum pump.

To address safety concerns, it is desirable to use a low pressure portion of the system such as the pump case drain or a bypass circuit. These locations offer easy sampling, safe pressures, and consistent data about the pumps and the fluid cleanliness.

For other circulating systems it is reasonable to sample from the pressurized portion of the system (after the pump and before the filter), but it may be better to sample from return lines. By sampling from the return line, you can get highly concentrated wear debris information making the oil analysis a very sensitive predictive condition monitoring tool.

What is the proper procedure for each method?

For drop tube sampling there are quite a few common mistakes, but a well thought out and documented procedure will ensure the best results. Always use a new piece of sample tubing. In any sampling procedure, always begin by flushing the sampling pathway with approximately 5 to 10 times the volume of the pathway.

Proper placement of the sample tubing is easier with a "one-handed" vacuum pump.

Technicians often choose to use a dedicated waste oil bottle for flushing that is larger than the sample collection containers so they can typically complete a sampling route without having to empty the waste bottle. The proper length of tubing should be predetermined so that you can effectively insert the tube end in the middle of the reservoir without touching anything. In general, the tube end should be at least two inches from the bottom of the sump, two inches from the sides, two inches below the oil level and at least two inches from any moving parts. This can be difficult to accomplish without three hands, but if you use a "one-handed" pump it is easier.

For sampling from pressurized systems, the extraction is simpler because a vacuum pump is not required, and if tubing is necessary, only a short length need be used. If the sample is to be obtained from a high pressure location in the system, additional steps such as the use of a pressure regulator may be required for safety.

As with the drop tube method, begin by flushing the sample valve and tubing with 5 to 10 times the pathway volume to a waste oil container before collecting the sample to be analyzed. Another hardware requirement for pressurized sampling is a vented sample bottle cap. If such a cap is not available, you can attach the sample bottle to a standard vacuum pump to allow the bottle to vent.

While there are several acceptable sampling methods for each machine, there is usually one best way. The best sampling methods will typically require some work up front in that you will usually have to install sampling hardware, but the end result will be well worth it. Using fixed hardware installed in the correct location, will provide consistent, valid data with which you can make good decisions about machine and lubricant condition. With the sample location selected and the proper hardware installed, all that is left is to document a detailed, step-wise procedure that will ensure the sample will be taken correctly no matter who takes it.

Vented bottle caps like the one shown here are necessary for collecting pressurized samples. Otherwise, a vacuum pump maybe used but with the risk of contaminating the pump.

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