Analysis of Sullube

Routine Test items for Sullube:

pH

New Sullube = 8.0 pH
Caution = 5.0 pH
Change Point 4.5 pH

A pH less than 5 when all other indicators are normal often indicates contamination of the **Sullube** lubricant by intake of air containing acid gases. A low pH can be a warning sign of corrosive wear of the bearings. When the pH is less than 4.5, the fluid should be changed due to loss of corrosion protection, to prevent shortening the air end life.

Total Acid Number (TAN)

This test gives an indication of the remaining useful life of the fluid
New Sullube = 0.10 TAN
Change Point = 1.0 TAN
Change and Flush 2.0 TAN

High TAN may be caused by several factors including high operating temperature or intake of air containing acidic gases. It may also occur in an initial charge as **Sullube** dissolves varnish and sludge left by previous fluids.

Viscosity (VIS)

Viscosity is the measurement of the resistance of a fluid to flow.
Viscosity of new Sullube = 39 cSt @ 40°C (184 SSU)

The viscosity of Sullube normally ranges up to 43-47 cSt , or 200-220 SSU during the course of 8000 hours. It is rare to need to change Sullube due to viscosity, unless it is contaminated.

✓ *Methanol Insolubles (MI)*

This test determines the amount of hydrocarbon or diester fluid present as contamination in **Sullube.** Generally, 10% or less is acceptable, but may shorten the life of the **Sullube**. If it is more than 10%, it is advisable to drain and refill with fresh **Sullube** lubricant. Excessive amounts of contamination may cause filter or separator plugging, as well as shorten the life of the fluid.

Optional Analysis of Sullube

These tests are available when needed

✓ *DR Ferrography – (see next page)*

Count and size primarily metallic particulate in fluid.

✓ *Particle Counting*

Counts both ferrous and non-ferrous particulate.

✓ *Analytical Ferrography*

Is used when DR Ferrography indicates a problem, and further explanation of the problem is needed. A photograph is taken of a microscope slide of the particles in the fluid, to identify origin and type.

✓ *Chlorides*

Chlorides are a major air contamination concern. The usual sources are hydrochloric acid, bleach, chlorine, etc. This test determines how much is present. (See Technote on Chlorides pages 70 &71)

✓ *EDX*

Sometimes called "metals" analysis, it does much more. About 80 elements are identified and measures. This is used to identify an unknown problem, primarily contaminants ingested with the air.

✓ *Water*

Water levels in compressors operating at proper temperature are usually not a concern. In water cooled machines, cooler leaks can be a problem. Water analysis verifies the presence of water when lubricant appears milky.

✓ *Condensate TOG (Total Oil & Grease)*

Waste water treatment plants occasionally require analysis of a condensate sample from a compressor, before allowing discharge of condensate. We can do that!

✓ *Condensate acidity*

Inlet air contamination problems don't just accumulate in the Sullube, but also go on downstream with the condensate. When they do, they can corrode dryers, coolers, and piping. We can check condensate acidity for these bad actors.

Sullube - We want to solve your problems – and assure compressor reliability!

DR Ferrography -- A Valuable Tool

Spot impending air end failures before they occur
Save money on turnable exchange air ends!
Plan for needed maintenance

- Avoid unexpected failures!

What is DR Ferrography?

The DR Ferrography instrument counts ferrous (wear metal) particles in lubricant. This test is now available to users of Sullube as an optional part of our analytical service. Ferrography has nothing to do with the condition of the Sullube. It relates only to the condition of the machine!

Why would we need it?

The DR test is useful as confirmation when other indications (noise, vibration, or amp draw) point to the need for an air end exchange. It can also be used to verify that severe wear is not occurring in a machine.

How and when do we use it?

If for any reason (high amp draw, noisy air end, high discharge temperature, etc.) you suspect that an air end may be nearing overhaul, note on your sample analysis request sheet "DR requested", or "suspect air end failure". We will then include the DR with the regular analysis of the sample.

What do the results mean?

High count of "Large" particles indicates severe rapid wear and is an indication of impending unit failure.
High levels of both "Large" and "Small" particles usually indicates a dirty or rusty system, and is less severe.

The test counts any ferrous particles whether they result from wear or corrosion. With each DR test, we will offer explanations and interpretations of the data.

IMPORTANT: For accurate results, it is very important that samples for DR Ferrography be taken using good sampling technique. The fluid should be taken from a location which is not stagnant (not from the bottom of the sump, unless a good amount is drained off first). Do not pour samples for DR out of an oil filter when it has been changed. Fluid from a bearing line is an example of a good sample point.

Water in Lubricants

Where does it come from?

In a rotary compressor, there are two sources of water. It is normal for water vapor to be ingested with the air, and some will condense in the fluid. The other possibility is an exchanger leak in a water-cooled machine. This usually occurs when the machine is not running for an extended period.

Why is it higher in some machines?

Several things affect how much water will be in rotary compressor fluid at any given time:

1. Heat and Humidity
2. Percent loading of machine
3. Discharge temperature

What is normal?

If you have an analysis, the water will normally be 1000 ppm to 3000 ppm in a rotary compressor. (0.1-0.3%) That is not a concern. Also, if you take a sample from the bottom of the sump, a small amount of water will sometimes collect there. Again, this is normal.

How much water is too much?

Visually, the fluid in the compressor should always be amber or brown, but with no cloudy appearance (like coffee without cream). A milky appearance, like coffee with cream, often indicates a large amount of water in the fluid. Milky oil is a cause for alarm, and should be analyzed or changed immediately. If two layers appear, the bottom layer will normally be water.

What to do about it?

If there is only a small amount of water, or haze in the oil, then consider whether the compressor duty cycle is loaded enough. Especially with water cooled machines, consider if the discharge temperature should be increased. If the fluid is grossly contaminated, it should be changed to prevent bearing damage.

Fix it!

Changing the fluid alone is not enough. Either a leak or improper operation caused the high water contamination. The cause must be remedied, or the problem will return quickly!

Metals Analysis

What can "metals" analysis tell you about the condition of lubricant and the compressor?

Traditional spectrometric analysis is useful only in identifying particles smaller than 10μ - not the large ones which are really a concern! It is useful in screening for wear or contamination in circulating lubricants from the crankcase or gearbox of reciprocating equipment. Rotary compressors do not necessarily generate an abnormal amount of these small size particles in anticipation of a failure. Hence, it is not a reliable indicator of rotary compressor condition. Nevertheless, lubricant analysis labs often run this test, and compressor owners then want an explanation of what the various metals and other elements mean. In a rotary compressor, we would offer these explanations:

Iron (Fe) - Wear or corrosion of castings, bearings, rotors, etc. Some iron will always be present. It may indicate a machine problem, but is also likely to be corrosion from water in the system. Verify by DR Ferrography.

Chromium (Cr) and **Molybdenum (Mo)** - Worry about these if large amounts are present. They are alloy metals for the steel used in bearings.

Aluminum (Al) and **Copper (Cu)** - Lubricant coolers are usually constructed from one of these. Large amounts may indicate cooler corrosion. For guidance, look at the TAN of the lubricant. If the TAN is more than 1.0, the metals are probably from corrosion.

Lead (Pb), Tin (Sn), and **Silver (Ag)** - Babbit bearings usually contain Tin, Copper and Antimony. Lead may also be present, and silver is sometimes used as a lining of bearings. All this is nice, but rotary compressors use non-friction roller and/or ball bearings, so when these elements show on a report they indicate either contamination from the environment, or a mistaken analysis.

Gold (Au) or Platinum (Pt) – It's your lucky day.

Silicon (Si) - Up to 10 parts per million may be in most new lubricants, except for 24KT, which is about 30% Silicon. If more than 30 ppm is present in regular lubricants, it indicates dirt, sand, or other contaminants are being ingested past the air filter. Is it anything to be concerned about? This test won't tell you, because it can't determine the size of the particles. Run a particle count on the sample.

Metals Analysis (page 2)

Sodium (Na), Potassium, (K), and **Boron (B)** - More contaminants. None of these are measured in unused Sullube. How much is too much? Less is always better, but the main concern is that the particles should not be large enough to cause abrasive wear. This test won't identify particle size. Sodium can also indicate ingestion of salt from the air when very close to the sea coast.

Sodium (Na), and **Calcium (Ca) Together** - Contamination, may indicate a water leak across a cooling water exchanger.

Magnesium (Mg) and **Phosphorus (P)** - Not used in Sullube, but is an additive in some lubricants. If it shows up in an analysis of Sullube, it is a contaminant.

Calcium (Ca) and **Barium (Ba)** - Common lubricant additives, used as corrosion inhibitors. The amounts will typically range around 100-300 ppm, but more or less should not be a concern.

Zinc (Zn) - In a rotary compressor, Zinc may come from corrosion of the galvanized parts of the air-oil separator. To see if this is a problem, check the TAN. If the TAN is over 1.0, that is likely to be the source. If the TAN is normal, the Zinc may be present as an additive in the lubricant. Sullube lubricant does <u>not</u> contain Zinc additives, because they are not necessary in rotary compressors, and tend to contribute to the formation of sludge and deposits.

Summary: Spectrometric analysis gives a lot of information, but for rotary compressors not all is useful. Metals which <u>may</u> indicate corrosion are verified by simply checking the pH and TAN. The single item which is most useful is the level of iron, but serious machine wear may be occurring, even with normal levels of iron.

For reciprocating compressors, some of these numbers are more meaningful. Especially of interest are bearing metals used in that particular compressor.

Analysis Request

Required fields

Date:_____
*Customer:_____
Location:
City_____State_____

*Compressor Hourmeter: _____ (estimate OK)
*Hours since fluid change: _____ (estimate OK)
Compressor S/N:_____
*Compressor Model:*_____
*Sample is: Sullube ❒ or other type_____
Reason for Analysis or comments :_____
_____

Report Results To:
*Attention of: _____
*Company: _____
*Address: _____
*City, State, ZIP:_____
*FAX: _____
e-mail: _____

Send Lubricant Samples To:

The Dow Chemical Company
Lubricant Technology Center
Building B-1605
Freeport, TX 77541

Please enclose the sample in a plastic bag to prevent leakage, and tape this form to the outside of the bag.
THANK YOU