KERR PUMP AND SUPPLY

12880 Cloverdale

Oak Park, Michigan 48237

Kerr Lube Free Analysis Program

TESTING BY: CPI-FLUID ENGINEERING

EXTEND EQUIPMENT LIFE BY IDENTIFYING

MINOR PROBLEMS BEFORE A MAJOR FAILURE

WHY USE THE OIL ANALYSIS PROGRAM?

It is important to routinely use an oil analysis program for your fluids. Analysis can identify problems in the earliest stages which can keep downtime to a minimum and reduce repair costs. Our facility manufactures the fluids, providing us the most accurate and detailed analysis and lubricant evaluation. The program is geared around unique specifications from engineered formulations. Our state of the art testing laboratory is equipped with automated processes, instruments, and advanced technologies that enable us to deliver consistent and accurate test results. We apply our technical expertise to an extensive range of analytical, physical, and mechanical testing capabilities, demonstrating our commitment to help you succeed. We also provide an easy to read report giving detailed information such as: when to sample again, what parameters are abnormal and possible steps you need to amend any abnormality with your fluid system. Our dedicated lab technicians can provide you with expert knowledge of our lubricants.

TURN-AROUND TIME

Our goal is 48-72 hours turn-around time with proper information completed on the sample bottle kit. If the label has insufficient information the processing time will be delayed. If you have any questions regarding proper completion of the label please contact us at

KERR PUMP AND SUPPLY
1-800-482-8259

TYPES OF TESTING

The Karl Fischer method is used for many substances as a reference method. It is a chemical analysis procedure which is based on the oxidation of sulfur dioxide by iodine in a methanolic hydroxide solution. In principle, the following chemical reaction takes place: H2O + I2 + SO2 + CH3OH + 3RN -> [RNH] SO4CH3 + 2[RNH] I
The titration can be performed volumetrically or coulometrically. In the volumetric method, a Karl Fischer solution containing iodine is added until the first trace of excess iodine is present. The amount of iodine converted is determined from the burette volume of the iodine-containing Karl Fischer solution. In the coulometric procedure, the iodine participating in the reaction is generated directly in the titration cell by electrochemical oxidation of iodide until again a trace of unreacted iodine is detected. Faraday's law can be used to calculate the amount of iodine generated from the quantity of electricity required. The Karl Fischer test is important because it informs the user how much dissolved water is in their system? High water can cause coalescing filter and bearing damage. It also causes corrosion in the compressor. Results are reported in ppm.

PARTICLE COUNT

The particle count instrument uses a laser diode as the illumination source and a photodiode as the detector. The particles pass through a sensor. When particles are present within the sensor's micro cell, the particles block the laser beam from the photodiode detector. The loss of laser light generates an electronic pulse for each particle. These pulses are proportional in amplitude to the light intensity or light extinction, which is a measure of the particle size. The particle counter identifies the quantity and the height of the pulses by sorting the pulses into bins with predefined pulse amplitude ranges. The data is transferred to digital numbers and printed. The test breaks the size ranges down from 4-70 microns. The results formulate the ISO (International Standards Organization) code fraction. The ISO code (i.e. 3/2/1) represents the ratio between particles present at levels, greater than 4 (the denominator (1)) versus the particles present at levels greater than 6 microns (the middle number (2)) versus the particles present at levels greater than 14 microns (the numerator (3)). The importance of particle count analysis includes: identification of solid material, identifying abnormal wear conditions, monitoring the effects of filtration, and measuring overall system cleanliness.

KINEMATIC VISCOSITY

The term viscosity is defined as the internal resistance of a liquid to flow over a certain amount of time with larger numbers relating to thicker fluids. Kinematic Viscosity is the measure of the resistive flow of a fluid under the influence of gravity. The S.I. unit for the measurement of viscosity is the centistoke (cSt). A fixed volume of liquid flows under gravity through a calibrated viscometer capillary, by a reproducible driving head and at

a closely controlled and known temperature, 40º C. If the oil increases in viscosity, it means that the oil is becoming thicker. The most common cause of increased viscosity is oxidation. Oxidation is a normal process of a lubricant and is the reason for most oil changes. The viscosity test is considered the most imperative property of lubricating oils, and an active indicator of the oils' functionality. The viscosity can be used to indicate high operating temperatures, contamination of another fluid, overloading, and water/coolant contamination conditions. An increase or decrease in viscosity can lead to overheating, increased friction, and ultimately catastrophic failure.

INDUCTIVELY COUPLED PLASMA (ICP)

Inductively Coupled Plasma (ICP) is an analytical technique used for the detection of trace metals in samples. The primary goal of ICP is to get elements to emit characteristic wavelength specific light which can then be measured. Metals analysis is performed to determine the parts per million (ppm) of metals that are either present or not present. Al, Ag, Ba, Ca, Cr, Cu, Fe, Mg, Mo, Na, Ni, P, Pb, Si, Sn, Ti, V, and Zn are the significant metals being tested.

TOTAL ACID NUMBER

The total acid number (TAN) is the number expressed in milligrams (mg) of potassium hydroxide needed to neutralize the acid in one gram of oil. The test is used to indicate the amount of oxidation that the fluid has undergone. The acid number increases as the fluid begins to oxidize. The TAN test is used to condemn nearly all fluid types, thus a precise and accurate analysis is crucial. The TAN signifies the basic condition of the fluid by giving a value that signifies the amount of oxidation that the fluid has undergone. The TAN can also indicate if a compressor is running too hot, or if the compressor is ingesting a foreign chemical that is harmful to the lubricant and or the compressor.

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC)

HPLC is a method of separating mixtures into their individual components for isolation, identification, or quantification. A sample, dissolved in a liquid, is carried by a flowing liquid (the mobile phase) through a tube (the column) tightly packed with a finely divided solid material (stationary phase). During the passage through the column, the components move at different rates by virtue of differences in chemical or physical interaction with the stationary phase and thus exit the column separately. The high separating power is achieved by the column, which uses very small particles of large surface area, which are densely packed in the column. A pump is used to allocate the proper liquid flow rate through the column. A design of the optic assembly is attached. The HPLC analysis is important because it measures the approximate amount of antioxidant present in used and new oil (QC) samples. Depending on the hours on the fluid the antioxidant is deemed normal or below normal. It also gives the percentage of antioxidant for Quality Control purposes.

OIL SAMPLING EXAMPLE

OIL SERVICES LABORATORIES
www.oil-services-lab.com

Attention to: John Doe

Custome: ABC Company

Location: 123 street city, state zip code

Laboratory Analysis Report

No Action Required

Report Date	8/29/2017
Report Number	2034817
Serial Number	C-2044 #175
Fluid Type	KV-9003-100
Sample Date	8/25/2017
Receive Date	8/29/2017
Model Number	RAO630.B007.1001
Machine Manufacturer	Busch
Hours on Fluid	854
Hours on Machine	8

Test Results

	2034817	2024268	2010285	2002249	1311287
Sample Dates	8/25/2017	7/11/2017	5/10/2017	4/8/2017	1/4/2017
Received Dates	8/29/2017	7/14/2017	5/12/2017	4/11/2017	1/9/2017
Hours On Fluid	854	365			
Total Acid Number	0.144	0.059	0.138	0.077	0.064
Viscosity (40 cSt)	108.40	107.30	108.00	107.6	107.4
iso_code	21/20/15	21/20/15	22/21/15	22/20/15	21/20/15
Aluminum (ppm)	0	0	0	0	0
Barium (ppm)	0	0	0	0	0
Calcium (ppm)	0	0	0	0	0
Chromium (ppm)	0	0	0	0	0
Copper (ppm)	0	0	0	0	0
Iron (ppm)	1	0	0	0	0
Lead (ppm)	0	0	0	0	0
Magnesium (ppm)	0	0	0	0	0
Molybdenum (ppm)	0	0	0	0	0
Nickel (ppm)	0	0	0	0	0
Phosphorus (ppm)	1	2	0	0	0
Silicon (ppm)	39	65	66	13	15
Silver (ppm)	0	0	0	0	0

The fluid is in good condition. Sample again in 3 months.

OIL SAMPLE LABELING AND SHIPPING PROCEDURE

- We request that customers provide all information as to hazards related to the sample. If a hazard exists, this information should be clearly marked in the comment area on the label or on a separate of paper.
- Fill the plastic sample bottle with as much oil as it will hold. It takes a minimum of 4 ounces (120 milliliters) of oil to perform a complete analysis.
- Fill out the information label completely (see example below). This information is required to log the sample into our system and to ensure a complete and accurate analysis.

- CUSTOMER NAME: ABC COMPANY INC
- ADDRESS: 1234 ANY STREET, CITY, STATE, COUNTRY
- SERIAL NO.: L123456. SAMPLE DATE: MO/DA/YR
- MACHINE MFG.: ANY MFG. HOURS ON OIL: 500
- OIL TYPE: KV 9003. MACHINE HOURS 500
- MODEL NO: ANY MODEL NUMBER. CONTACT NAME. NAME OF CONTACT
- EMAIL: ANYNAME@ANYCOMPANY.COM
- DISTRIBUTOR: KERR PUMP AND SUPPLY
- COMMENTS:
- CPI 2200 James Savage Rd. Midland, MI 48642

- Attach the information label directly to the plastic sample bottle.
- Place the plastic sample bottle, which contains the sample and the completed information label, into to cardboard mailer.
- Record the sender's address in the address label (see example below)

FROM	ABC COMPANY INC 1234 ANY STREET CITY, STATE, COUNTRY
TO	CPI Oil Services Lab 2200 James Savage Road Midland, MI 48642

- Place the completed address label around the cardboard mailer

- Ship the sample to our address on the address label

Note: *the address label only needs to be attached to the cardboard mailer if shipping the sample in the cardboard canister. If additional packaging is added the address label does not need to go on the cardboard canister*

SAMPLE TAKING GUIDELINES

The appropriate sampling procedure is important because it will help to ensure that the lubricant analysis data that you receive is the best representation of the lubricant within your system. Utilizing proper sampling techniques will allow for better data consistency and accuracy when determining the condition of your lubricant. Inconsistent sampling will cause the trend analysis, which is used to determine the condition of the fluid, to be inaccurate. There are several tools that can be utilized to help the sample taking process. These procedures or tools will not be discussed, but the focus will be on the appropriate locations and timing of taking the actual lubricant sample.

- All samples should be taken by trained individuals utilizing all appropriate safety practices required.
- Use clean sample bottle kits and sampling tools.
- Obtaining a lubricant sample while equipment is running would be ideal. If this is not possible then shut the unit down and allow cooling for 5-10 minutes.
- The best location to take samples is past the lubricant filter. We are interested in the fluid that will actually be lubricating the equipment.
- If the equipment does not have lubricant filters or taking samples after the lubricant filters are not possible then take the sample from the sump. Be sure to drain off all water and debris before taking the actual sample that will be sent to the laboratory. Condensation is common as the equipment cools so it is very important that all liquids are drained.
- Taking a sample from an actual lubricant filter is the least optimal location or the last choice.
- All samples for a specific machine should be taken from the same sampling location and the procedure of taking the sample shall be consistent. This will allow for better trend analysis.
- The sampling label should be filled out before sending the sample to the laboratory. All customer, distributor, lubricant, and equipment information needs to be entered onto the sample label to process the sample. Include on the sample label if there was a lubricant or filter change during sampling. It is imperative that the sample label be applied directly to the plastic sample bottle, not the cardboard canister. The mailing label can be applied to the cardboard mailing canister or if using a box to send in more than one sample, it can be attached to the outside of the box and therefore, does not need to be applied to the canister**. Missing information from the sample label can result in a longer turnaround time as the laboratory will need to request the information before the sample can be processed. All the information on the information label is required for an accurate analysis.**
- Prompt delivery of the sample to the laboratory is important. Oil analysis attempts to evaluate the current condition of the oil and the equipment, so it is crucial to get the sample to the laboratory for analysis quickly after the sample is taken.
- Follow your OEM sampling frequencies and the sampling guidelines noted on the lubricant analysis reports to determine when the next sample should be taken and sent in for analysis.