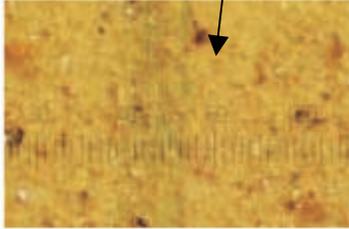


Photomicrograph

A photomicrograph representing the contamination in the sample is provided. The photo is taken at 100X magnification and can be consulted for particle identification or for comparison to previous samples or a reference database. The contamination level is expressed as an ISO 4406 code.



COMMENTS Filter change suggested if not done at sampling time (as applicable); Chrome is at a **SIGNIFICANT LEVEL**; **CHROMIUM** in hydraulic systems could possibly be pistons/rods (if piston), gears or bearings (if gear pump); Iron is at a **MODERATE LEVEL**; **IRON** in hydraulic systems could possibly be pistons/rods (if piston pump), gears or bearings (if gear pump), or fluid conductors such as piping, tubing or steel fittings; Copper is at a **MINOR LEVEL**; Lead is at a **MINOR LEVEL**; Viscosity is **SLIGHTLY HIGH**.

ISO CODE: 23 22 20
Volume: 25mL
Magnification: 100 X
Scale: 10 micrometers per division

Comments and Recommendations

A data analyst's job is to explain and, if necessary, recommend actions for rectifying significant changes in a unit's condition. Reviewing comments before looking at the actual test results will provide a roadmap to the report's most important information. Any actions that need to be taken are listed first in order of severity. Justifications for recommending those actions immediately follow.

Elemental Analysis

Elemental Analysis, or Spectroscopy, identifies the type and amount of wear particles, contamination and oil additives. Determining metal content can alert you to the type and severity of wear occurring in the unit. Measurements are expressed in parts per million (ppm).

Combinations of these **Wear Metals** can identify components within the machine that are wearing. Knowing what metals a unit is made of can greatly influence an analyst's recommendations and determine the value of elemental analysis.

Knowledge of the environmental conditions under which a unit operates can explain varying levels of **Contaminant Metals**. Excessive levels of dust and dirt can be abrasive and accelerate wear.

Additive and **Multi-Source Metals** may turn up in test results for a variety of reasons. Molybdenum, antimony and boron are additives in some oils. Magnesium, calcium and barium are often used in detergent/dispersant additives. Phosphorous is used as an extreme pressure additive in gear oils. Phosphorous, along with zinc, are used in anti-wear additives (ZDP).

VALUES EXPRESSED IN PARTS PER MILLION (PPM) BY WEIGHT

WEAR METALS											CONTAMINANT METALS			MULTI-SOURCE METALS					ADDITIVE METALS				
Fe	Cr	Ni	Al	Cu	Pb	Sn	Cd	Ag	Ti	V	Si	Na	K	Mo	Sb	Mn	Li	B	Mg	Ca	Ba	P	Zn
3	2	0	2	4	3	0	0	0	0	0	2	2	88	5	0	0	0	1	27	249	1	430	482
2	1	0	3	5	2	0	0	0	0	0	3	2	1	4	0	0	0	1	20	268	0	412	466
7	4	0	8	14	9	0	0	0	0	0	2	2	0	5	0	0	0	2	24	267	0	442	486
▲	▲		▲▲	▲▲	▲																		
14	23	0	20	51	40	0	0	0	0	0	2	1	0	6	0	0	0	2	26	257	1	409	422
▲▲▲	▲▲▲		▲▲▲	▲▲▲	▲▲▲																		

Test Data

Test results are listed according to age of the sample—oldest to most recent, top to bottom—so that trends are apparent. Significant changes are flagged and printed in the shaded areas of the report.

Samples are listed by **Date Received** in the lab—oldest first. They are also assigned a **Lab Number** for easy internal tracking. Important to also note is whether or not the **Lube** has been **Changed** since the last sample was taken.

Water in oil decreases lubricity, prevents additives from working and furthers oxidation.

For free water (water content above 100% saturation), the water content is determined by Karl Fischer and is reported as ppm.

For water content below saturation (dissolved water), we report the content using a Pall water sensor as percent of saturation. 100% represents the maximum amount of water a lubricant can hold prior to becoming free water (free water will generally appear cloudy).

TEST DATA SAMPLED RECEIVED	LUBE UNIT	L C U H B A E N G E D	W A T E R P P M	W A T E R % S A T	V I S 40C cSt	T A N Total Acid No.	I S O C O D E	4 M I C R O N	6 M I C R O N	10 M I C R O N	14 M I C R O N	21 M I C R O N	38 M I C R O N	70 M I C R O N	100 M I C R O N
09/03/2004		N		43	36.8	0.52	19 18 15	3224	1295	292	163	82	8	1	0
09/07/2004															
10/06/2004		N		78	35.8	0.55	18 17 15	2080	907	386	220	63	14	2	0
10/08/2004															
11/04/2004		N		68	37.5	0.57	20 19 16	6529	3402	1109	543	149	32	9	0
11/11/2004							▲	▲	▲	▲	▲				
12/13/2004		N		54	35.7	0.73	23 22 20	63130	24845	12605	6605	2231	417	22	2
12/17/2004							▲▲▲	▲▲▲	▲▲▲	▲▲▲	▲▲▲	▲▲▲	▲▲▲		

Viscosity measures a lubricant's resistance to flow at temperature and is considered its most important physical property. Depending on lube grade, it is tested at 40 and/or 100 degrees Centigrade and reported in centistokes.

Total Acid Number is the amount of acid present in the lubricant. Numbers higher than that of new lube indicate oxidation or some type of contamination.

The **ISO 4406 Code** represents a range of particles greater than a size, i.e. 4, 6, 14 $\mu\text{m}(c)$. Each class designates a range of measured particles per mL of sample. The actual particle counts per mL are also shown for 8 particle sizes.

Summary

Make a habit of reading your analysis reports regularly. Know your equipment and share as much information with your laboratory as possible. Understanding your reports and being able to utilize analysis results to schedule downtime and productively manage your reliability programming, is a vital part of successful predictive and preventative maintenance.