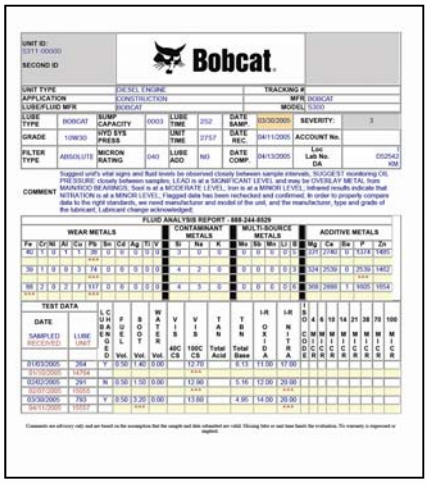
TECHNICAL
Bulletin

How to Read the Bobcat Oil Analysis Report

Reading an oil analysis report can be an overwhelming and sometimes seemingly impossible task without an understanding of the basic fundamentals for interpreting laboratory results and recommendations. Referring to the report descriptions and explanations below will help you better understand your results and, ultimately, better manage a productive, cost-saving oil analysis program.



Customer, Equipment and Sample Information

The information submitted with a sample is as important to who is reading the report as it is to the analyst interpreting the test results and making recommendations. **Know your equipment and share this information with your laboratory.** Accurate, thorough and complete lube and equipment information not only allows for in-depth analysis, but can eliminate confusion and the difficulties that can occur when interpreting results.

Unit Type should give as much detail as possible. What kind of compressor, gearbox, engine, etc. influences flagging parameters and depth of analysis. Different metallurgies require different lubrication and have great impact on how results are interpreted.

Second ID is each customer's opportunity to uniquely identify units being tested and their location.

Application identifies in what type of environment the equipment operates and is useful in determining exposure to possible contaminants.

Severity Status Levels:
0—Normal
1—At lease one or more items have violated initial flagging points yet are still considered minor.
2—A trend is developing.
3—Simple maintenance and/or diagnostics are recommended.
4—Failure is eminent if maintenance not performed. Occasionally, a test result can violate the S4 excursion level. But, if there is no supporting data or a clear indicator of what is actually happening within the unit, maintenance action may not be recommended. Customer may be asked to investigate all possible contamination sources, shorten sampling intervals, or simply monitor the situation very closely.

Manufacturer and Model can also identify metallurgies involved as well as the OEM's standard maintenance guidelines and possible wear patterns to expect.

UNIT ID: 5311 00000 SECOND ID		Bobcat							
UNIT TYPE	DIESEL ENGINE					TRACKING #			
APPLICATION	CONSTRUCTION					MFR	BOBCAT		
LUBE/FLUID MFR	BOBCAT					MODEL	S300		
LUBE TYPE	BOBCAT	SUMP CAPACITY	0003	LUBE TIME	252	DATE SAMP.	03/30/2005	SEVERITY:	3
GRADE	10W30	HYD SYS PRESS		UNIT TIME	2757	DATE REC.	04/11/2005	ACCOUNT No.	
FILTER TYPE	ABSOLUTE	MICRON RATING	040	LUBE ADD	NO	DATE COMP.	04/13/2005	Loc Lab No. DA	I D52542 KM

Customer Account Number

Lube Manufacturer, Type and Grade identifies a lube's properties and its viscosity and is critical in determining if the right lube is being used.

Filter Types and their **Micron Ratings** are important in analyzing particle count—the higher the micron rating, the higher the particle count results.

Sump Capacity identifies the total volume of oil (in gallons) in which wear metals are suspended and is critical to trending wear metal concentrations.

Lube Time is how long the oil has been used. **Unit Time** is the age of the equipment and **Lube Added** is how much oil has been added since the last sample was taken.

Make note of the difference between the **Date Sampled** and the **Date Received** by the lab. Turnaround issues may point to storing samples too long before mailing or mail service problems.

Data Analyst Initials

The laboratory at which testing was completed is denoted by an I for **Indianapolis** and an H for **Houston**. The following **Lab #** is assigned to the sample upon entry for processing and should be the reference number used when notifying the lab with questions or concerns.

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.

COMMENT Suggest unit's vital signs and fluid levels be observed closely between sample intervals; SUGGEST monitoring OIL PRESSURE closely between samples; LEAD is at a SIGNIFICANT LEVEL and may be OVERLAY METAL from MAIN/ROD BEARINGS; Soot is at a MODERATE LEVEL; Iron is at a MINOR LEVEL; Infrared results indicate that NITRATION is at a MINOR LEVEL; Flagged data has been rechecked and confirmed; In order to properly compare data to the right standards, we need manufacturer and model of the unit, and the manufacturer, type and grade of the lubricant; Lubricant change acknowledged;

152
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Numbers with "carets" printed below them denote test results the analyst has flagged because they exceed pre-set warning parameters and warrant closer examination or require action.

FLUID ANALYSIS REPORT - 888-244-8529

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
40	1	0	1	1	38	0	0	0	0	0	3	0	0	0	0	0	0	5	331	2740	0	1374	1485
					^^^																		
39	1	0	0	3	74	0	0	0	0	0	4	2	0	0	0	0	0	3	324	2539	0	2539	1462
					^^^																	^^^	
88	2	0	2	7	117	0	0	0	0	0	4	3	0	0	0	0	0	6	368	2888	1	1605	1654
^^^					^^^																		

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 (ZDDP).

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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 gray 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.

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.

Oxidation measures the breakdown of a lubricant due to age and operating conditions. Oxidation prevents additives from working and therefore promotes increased acid content, as well as increased viscosity. **Nitration** is an indication of excessive "blow-by" from cylinder walls and/or compression rings and indicates the presence of nitric acid, which speeds up oxidation. Too much disparity between oxidation and nitration can indicate air to fuel ratio problems. As Oxidation/Nitration increases, TAN will also increase and TBN will begin to decrease.

Providing your lab with a New Lube sample allows the analyst to verify product integrity and establishes a guideline for analyzing subsequent used oil samples. It will appear first on all reports for the unit.

TEST DATA																				
DATE SAMPLED	DATE RECEIVED	LUBE UNIT	LUBE CHANGED	FUEL Vol.	SOOT Vol.	WATER Vol.	VIS 40C CS	VIS 100C CS	TAN Total Acid	TBN Total Base	I-R OXIDA	I-R NITRA	ISO CODE	4 MICR	6 MICR	10 MICR	14 MICR	21 MICR	38 MICR	70 MICR	100 MICR
01/03/2005	264	Y	0.50	1.40	0.00		12.70		6.13	11.00	17.00									
01/10/2005	14764						^^^													
02/02/2005	291	N	0.50	1.50	0.00		12.90		5.16	12.00	20.00									
02/07/2005	15055						^^^				^^^									
03/30/2005	793	Y	0.50	3.20	0.00		13.60		4.95	14.00	20.00									
04/11/2005	15557			^^^							^^^									

Fuel and **Soot** results are all reported in % of volume. High fuel dilution decreases unit load capacity. Excessive soot is a sign of reduced combustion efficiency.

Water in oil decreases lubricity, prevents additives from working and furthers oxidation. Its presence can be determined by crackle or FTIR and is reported in % of volume. Water by Karl Fischer determines the **amount** of water present. These results appear in the Special Testing section of your report.

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. Total Base Number measures the lube's alkalinity, or ability to neutralize acid. When TAN and TBN approach the same number, the lube should be changed or "sweetened," meaning more lube could be added.

The **ISO Code** is an index number that represents a range of particles within a specific micron range, i.e. 4, 6, 14. Each class designates a range of measured particles per one ml of sample. The particle count is a cumulative range between 4 and 6 microns. This test is valuable in determining large particle wear in filtered systems.

Summary

The Bobcat Oil Analysis Program places a wealth of information at your disposal. It provides timely, accurate reporting through HORIZON. 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.