Oil Analyzers INC.

Fluid Analysis Program

0	1	2	3	4
NORMAL		ABNORMAL		CRITICAL

www.oaitesting.com

About Fluid Analysis

Fluid analysis is a preventive maintenance tool that provides diagnostic testing designed to evaluate lubricant condition, component wear and contamination in mobile and industrial applications. Routine fluid analysis can detect lubricant or equipment issues before major problems develop.

Fluid Analysis Helps You Save Money

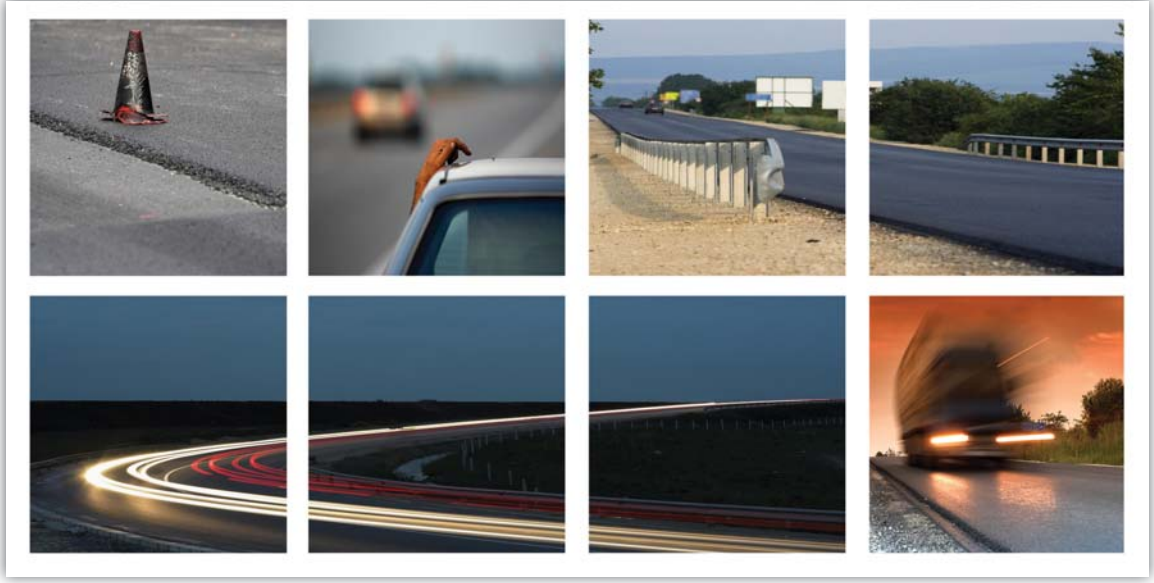
Because fluid analysis provides a comprehensive look at the condition of lubricants and internal component wear, tracking sample results over a period of time can help save money.

- **Maximize oil drain intervals.** Monitoring the condition of the oil allows you to optimize drain intervals so that you capitalize on the fluid's full service life. Performing fewer oil changes minimizes maintenance costs and maximizes uptime.
- **Extend equipment life.** Monitoring system cleanliness and filtration efficiency can help you keep your equipment longer and significantly reduce replacement costs.
- **Prevent major problems.** State-of-the-art fluid analysis identifies dirt, wear particles, fuel dilution, coolant and other contaminants that can cause catastrophic failure or significantly shorten equipment life.
- **Maximize asset reliability.** Testing and analysis ensure that equipment is up, running and making money.
- **Increase resale value.** Analysis results provide valuable sampling history documentation that justifies higher equipment resale values.

Oil Analyzers Fluid Analysis

The Oil Analyzers Fluid Analysis Program protects valuable equipment by providing solutions for lubrication concerns through accurate and easy-to-understand fluid analysis, timely reporting and an unparalleled commitment to personal, friendly customer service. Oil Analyzers works with fully equipped laboratories staffed by highly trained analysts and offers a complete line of oil analysis services to help you get the most from your lubricants and extend the life of your equipment.

- **Personalized Service.** Oil Analyzers provides personalized customer service. Reports are easy to understand and recommendations are included so you know exactly what you should do to provide the best care for your equipment. In addition, Oil Analyzers customer service representatives are available by phone and email to answer questions.
- **High-Quality Testing.** Oil Analyzers Fluid Analysis is performed at independent ISO 17025 A2LA accredited testing laboratories. This is the highest level of quality attainable by a testing laboratory backed by the most stringent accrediting body in the industry. You can be confident that the results you receive are accurate, repeatable and traceable to a standard.
- **Innovative Information Technology Solutions.** Oil Analyzers online reporting software, HORIZON®, delivers your results almost immediately after sample processing is complete. The software's management reports take your fluid-analysis program to the next level by helping you manage your data and your program efficiently and effectively.



Sampling and Trend Analysis

The first step in any fluid analysis program is obtaining a sample. Regular sampling and trend analysis – monitoring test data over an extended period of time – provides the information you need to continually maximize asset reliability and increase profits. Comparing a component's most recent samples to its historical data is instrumental in identifying trends that can indicate potential problems or possible failure.

Best Practices

Fluid analysis is most effective when samples are representative of typical operating conditions. Dirt, system debris, water and light fuels tend to separate from lubricants and coolants when system temperatures cool. For optimum results:

- Take samples while systems are operating under normal conditions or immediately after shutdown while they are still at operating temperature.
- Take samples at regularly scheduled intervals.
- Take samples from the same sampling point each time.

Suggested Sampling Intervals and Methods

Although an equipment manufacturer's recommendations provide a good starting point for developing preventative maintenance practices, sampling intervals can easily vary. A piece of equipment's importance to production is a major consideration for determining sampling frequency, as are environmental factors such as hot, dirty operating conditions, short trips with heavy loads and excessive idle times. See the chart below for suggested sampling intervals and methods.*

COMPONENT	INTERVAL	SUGGESTED METHOD & LOCATION
MOTOR VEHICLE		
Gas Engines	125 Hours/7,500 miles	By vacuum pump through dipstick retaining tube or sampling valve installed in filter return
Diesel Engines	250 Hours/15,000 miles	
Gears, Differentials & Final Drives	250 hours	By vacuum pump through oil level plug or dipstick retaining tube
Planetaries	250 hours	By vacuum pump through oil fill port of system reservoir at mid-level
Cooling Systems	1000 hours	By vacuum pump through radiator cap or fill port of system reservoir at mid-level
INDUSTRIAL EQUIPMENT		
Hydraulics	250-500 hours	By vacuum pump through oil fill port of system reservoir at mid-level
Gas Turbines	Monthly or every 500 hours	Through sample valve installed upstream of the filter on the return line or out of the system reservoir
Steam Turbines	Bi-monthly or monthly/quarterly	Through sample valve installed upstream of the filter on the return line or out of the system reservoir
Gas/Air Compressors	Monthly or at 500 hours/quarterly	Through sample valve installed upstream of the filter on the return line or out of the system reservoir

*The suggested sampling intervals in the chart above are for conventional (non-synthetic) oils only. When using synthetic motor oil, the lubricant manufacturer's recommended interval should be followed. To extend the service of synthetic motor oil beyond the lubricant manufacturer's recommendation, oil analysis should be conducted.

Obtaining an Oil Sample

Obtaining fluid samples is relatively simple, regardless of the application. Sampling methods may vary according to the type of equipment from which the sample is taken. Mobile vehicles typically require a vacuum pump while common industrial applications may give direct access through a sample valve or system reservoir. Some industrial equipment may require a vacuum pump.

To ensure accurate fluid analysis and reporting, appropriate procedures must be observed. All kits and materials necessary for obtaining an oil sample are outlined on pages 14 and 15.

Sampling with a Vacuum Pump

A vacuum pump is used to take samples from a dipstick or non-pressurized system.

To use a vacuum pump, securely attach a sample bottle to the pump. Attach a clean tube to the top of the pump and tighten the lock ring. Place the free end of the tube into the dipstick retaining tube or oil fill port, making sure not to allow contact between tubing and bottom of reservoir. Pump the plunger until oil flow is consistent and then pump only as needed to maintain consistent flow. The sample bottle should be filled about 3/4 full or to its shoulder. Remove the sample bottle from the vacuum pump and tighten the lid securely.

Sampling through a Sample Valve

Some industrial applications have a sampling port through which a sample can be obtained. This sampling method requires the equipment be in operation. Open the sampling valve and allow a small amount of oil to flush contaminants from the valve. Place the sampling bottle under the valve and obtain the sample. The sample bottle should be filled about 3/4 full or to its shoulder. Ensure the sampling valve is securely closed once the sampling process is complete.

Sampling from a System Reservoir

If collecting a sample through a sample valve is not possible, the equipment's system reservoir can be used.

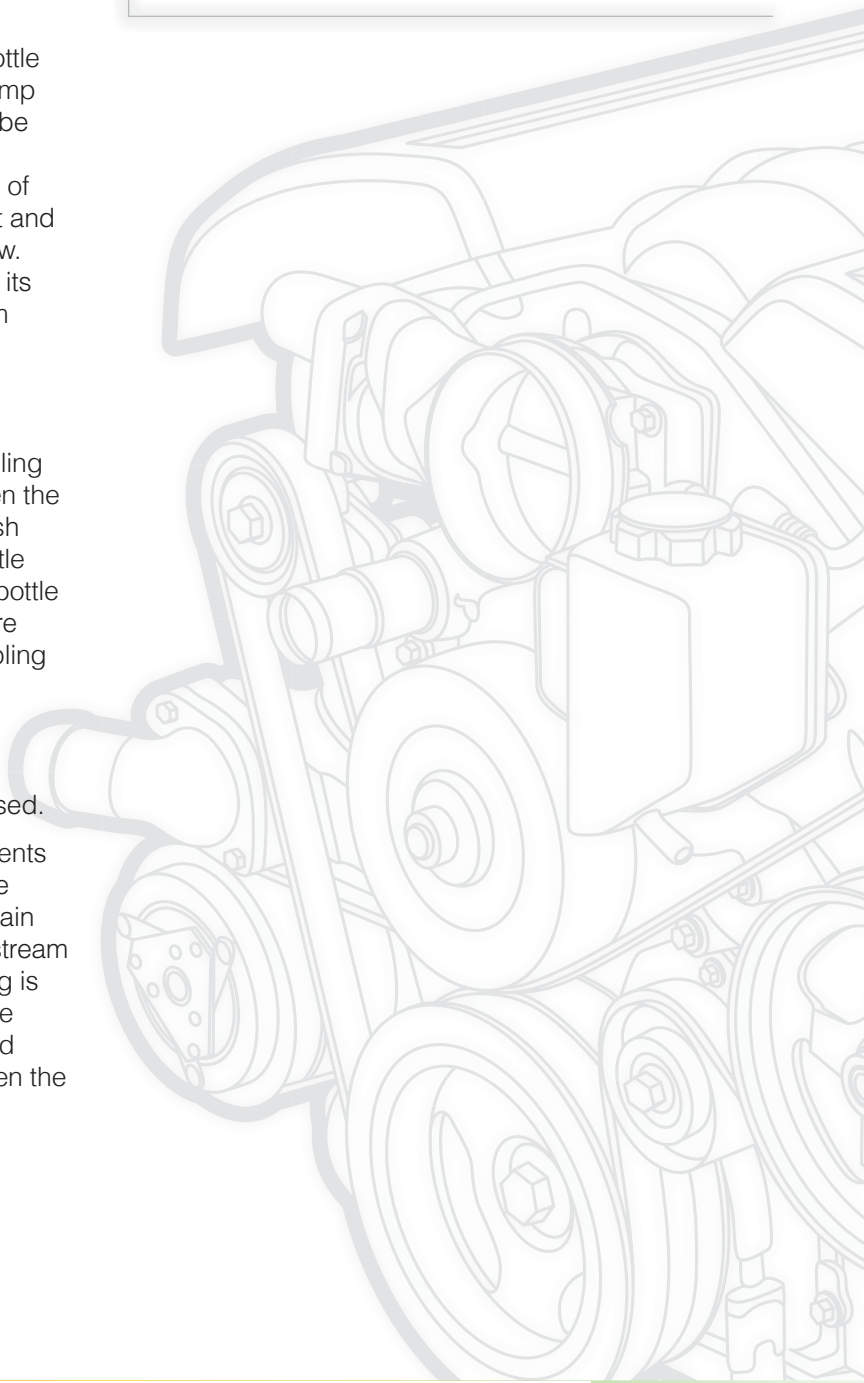
The oil must be drained from the plug for a few moments before the sample is taken so contaminants that have settled around the drain are flushed out. Once the drain has been flushed, place the sample bottle in the oil stream and collect the sample. Using the reservoir drain plug is the least desirable method for obtaining an oil sample because the bottom of the reservoir contains elevated amounts of contaminants. It should be used only when the other options are unavailable.

Mobile Sampling Locations

Appropriate sampling locations for automobiles; light-duty, heavy-duty and over-the-road trucks include the oil dipstick tube, the reservoir drain plug or petcock valve if one has been installed.

Industrial Sampling Locations

Common sampling locations include the oil reservoir, oil filter, sampling port and filtration mount. If excess wear is detected in industrial applications, samples can be taken immediately before or after particular components, such as pumps or valves, to help isolate which component is producing excess wear elements.



Submitting an Oil Sample

Accurately filling out a registration form, affixing a barcode label to the sample bottle and sending the oil sample to the appropriate lab for analysis are the final steps in submitting an oil sample.

Component Registration Form

Accurate, thorough and complete lube and equipment information not only allows for in-depth analysis, but can eliminate confusion and difficulties that can occur when interpreting results.

A component registration form is included with every sample kit. Always complete the Sample Information section of the form. Fill out the Component Registration section of the form when sampling a component for the first time or to notify the laboratory of a change for a previously registered component or fluid. The Component Registration section of the form does not need to be completed if a previous sample has been analyzed for that specific Component ID and no information has changed. The laboratory will request additional information if the registration form is incomplete and there is no information on record from the last sample that was analyzed.

Barcode Label

The Component Registration Form includes a barcode that corresponds to the sample information you recorded on the form. Identical barcode labels are included on the bottom of the Component Registration Form.

- The barcode labeled “APPLY TO SAMPLE JAR” should be applied vertically to the oil sample bottle.
- The barcode labeled “FOR YOUR RECORDS” should be maintained for your files.

Oil Analyzers INC.

ADVANCED OIL

00000A00000

Kit Questions or Additional Testing: 715-395-0222
Test Results or Equipment Changes: 877-458-3315
www.oaitesting.com

1. Apply barcode to bottle vertically
2. Complete this form or submit sample info online at www.oaitesting.com
3. Place form in mailer (unless sample info is submitted online) and ship sample
4. Receive report by email, fax or mail
5. View sample progress through the lab using Track My Sample

HORIZON

SAMPLE INFORMATION *(Oil Samples Only)*

Acct # OILANA | Receive your report by: ❑ Email ❑ Fax or ❑ Mail | INTERNAL USE ONLY
Company | Contact Name
Address | City - State/Province - Postal Code - Country
Phone | Fax | Email Address
Sample Point | Component ID | Secondary ID
❑ Engine ❑ Gear ❑ Bearing ❑ Differential ❑ Final Drive ❑ Hydraulic ❑ Planetary ❑ Transmission ❑ Other
Position *(If Applicable)* ❑ Chassis ❑ Left ❑ Right ❑ Front ❑ Rear ❑ Center
New Lube Sample ❑ | Date Sampled
Lube Time ❑ Mi ❑ Km ❑ Hr ❑ Day ❑ Mo ❑ Yr
Component Time ❑ Mi ❑ Km ❑ Hr ❑ Day ❑ Mo ❑ Yr
Lube Added ❑ Qt ❑ Gal ❑ Ltr | Lube Changed ❑ Yes ❑ No
Misc | Filter Changed ❑ Yes ❑ No
Comments

COMPONENT REGISTRATION *(Required **ONLY** for registering new components or to request changes.)*

Engine Options (check only one)
Fuel Type: ❑ Diesel (AA) ❑ LP Gas (BALPG) ❑ Gasoline (ABUNL) ❑ Methane Gas (BAMGE) ❑ Natural Gas (BANGE) ❑ Dual Fuel (AA2F) ❑ Other

Non-Engine Options (check only one)
Transmission: ❑ Manual (BBMNT) ❑ Auto/Powershift (BBAPT) ❑ Torque Converter (BBTRQ) ❑ Hydrostatic (BHHYD) ❑ Other
Mobile Gear/Bearing: ❑ Differential (BBDIF) ❑ Final Drive (BBFDR) ❑ Planetary (BBPLT) ❑ Other
Industrial Gear/Bearing: ❑ Gearbox/System (BB) ❑ Worm (BBWRM) ❑ Sleeve (BGSLV) ❑ Rolling Element (BGRLL) ❑ Other
Hydraulic: ❑ Piston Pump (BHPIP) ❑ Gear Pump (BHGP) ❑ Vane Pump (BHVAN) ❑ Other

Engine Manufacturer | Non-Engine Manufacturer
Engine Model (Model # if diesel or natural gas, displacement if gasoline) | Non-Engine Model
Application ❑ Automotive - 700 ❑ Transportation - 100 ❑ Plant/Industrial - 400 ❑ 0-T-R Trucking - 110 ❑ Off-Highway - 200 ❑ Agricultural - 280 ❑ Railroad 800 ❑ Waste Hndling/Landfill - 230 ❑ Quarry - !88 ❑ Construction - 220 ❑ Mining - 600 ❑ Marine - 500 ❑ Utility - 490 ❑ Gas/Oil Field - 300 ❑ Other
Lube Manufacturer | Product Code | Grade ❑ SAE ❑ ISO
Filter ❑ Full-Flow - 10 ❑ By-Pass - 11 ❑ Kidney Loop - 16 ❑ None ❑ Other | Sump Capacity ❑ Qt ❑ Gal ❑ Ltr

APPLY TO SAMPLE JAR
Component ID
Sample Date
Tracking 00000A00000

FOR YOUR RECORDS
00000A00000
Component ID

OIL ANALYZERS LABORATORY
7451 WINTON DRIVE
P.O. BOX 68983
INDIANAPOLIS, IN 46268

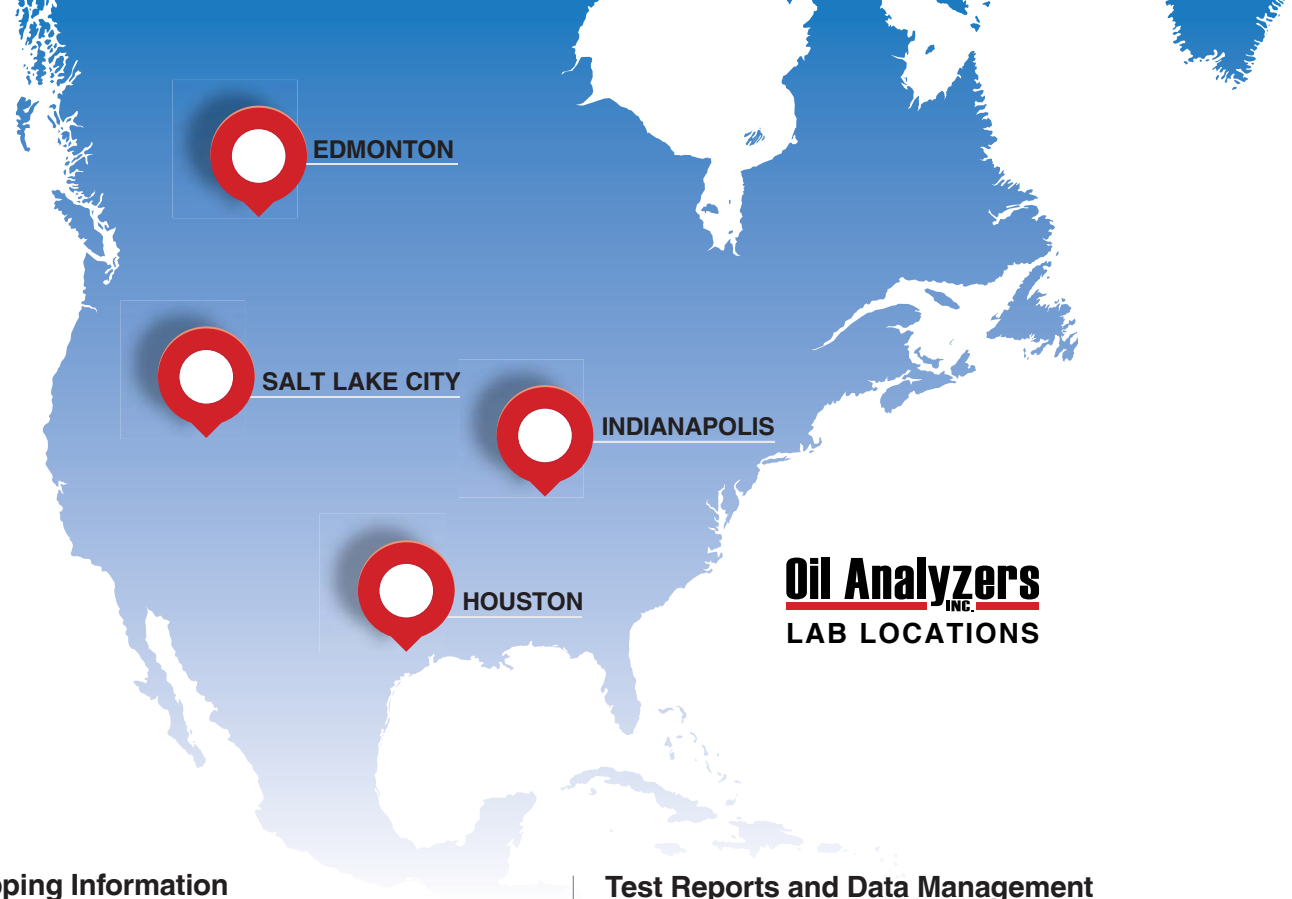
OIL ANALYZERS LABORATORY
10910 W. SAM HOUSTON PKWY N.
SUITE 700
HOUSTON, TX 77064-9903

OIL ANALYZERS LABORATORY
P.O. BOX 30820
3060 CALIFORNIA AVE, SUITE B
SALT LAKE CITY, UT 84104

SMALL RETURN ADDRESS LABELS ARE FOR NON-POSTAGE PAID KITS ONLY

00000A00000
Component ID

Note: Prepaid shipping labels are already addressed. Do not alter shipping labels.



Shipping Information

Small return-address labels are provided on the Component Registration Form for non-postage-paid kits. Choose the label for the laboratory nearest you.

- Adhere the correct return-address label located on the Component Registration Form to the provided mailer.
- Place the Component Registration Form in the clear pocket on the front of the mailer.
- Place the oil sample bottle inside the mailer and seal.
- Apply the appropriate postage. Use a trackable shipping service such as FedEx, UPS or the USPS for mailing samples.

Test Reports and Data Management

Oil Analyzers Inc. and HORIZON® provide your test results almost immediately after processing your oil sample.

Analysis reports are available via fax, email or online. To view your oil analysis test results online, go to www.eoilreports.com and click Test Results.

Fast access to oil analysis reports allows you to affect positive changes in your daily maintenance practices.

- Keep sampling schedules on track.
- Identify bottlenecks in turnaround time that are costing you money.
- Summarize unit problems that could influence future purchasing decisions.

Oil Analyzers INC.

Lubricant Analysis Report

North America: 1-877-458-3315

0	1	2	3	4
NORMAL		ABNORMAL		CRITICAL

Overall report severity based on comments.

Account Information	Component Information	Sample Information
Account Number: OILANA-1234-5678 Company Name: Contact: JOHN Q. CUSTOMER Address: 1234 MAIN STREET ANYTOWN, WI 54555 US Phone Number: 715-555-5555	Component ID: John's Truck Secondary ID: 2014 Suburban Component Type: Unleaded Gasoline Engine Manufacturer: Chevrolet Model: 5.3L Application: Transportation Sump Capacity: 7 qts	Tracking Number: 12345A67890 Lab Number: I-123456 Lab Location: Indianapolis Data Analyst: AKB Sampled: 04-Jul-2015 Received: 07-Jul-2015 Completed: 09-Jul-2015
Filter Information	**Miscellaneous Information**	**Product Information**
Filter Type: Full-Flow Micron Rating: 20		Product Manufacturer: AMSOIL Product Name: ASL SIG SIGNATURE SERIES Viscosity Grade: SAE 5W30
Comments	NEW LUBE REFERENCE - Data used for baseline reference only;	

	Wear Metals (ppm)	Contaminant Metals (ppm)	Multi-Source Metals (ppm)	Additive Metals (ppm)

Reading the Oil Analyzers Fluid Analysis Report

Once the oil sample is processed, Oil Analyzers provides a complete fluid analysis report detailing customer and equipment information, recommendations, elemental analysis, sample information, contaminants and fluid properties. This information is critical in determining the integrity of both the lubricant and the equipment.

Oil Analyzers INC.

Lubricant Analysis Report

North America: 1-877-458-3315

0	1	2	3	4
NORMAL		ABNORMAL		CRITICAL

Overall report severity based on comments.

Account Information		Component Information		Sample Information	
Account Number:	OILANA-1234-5678	Component ID:	John's Truck	Tracking Number:	12345A67890
Company Name:		Secondary ID:	2014 Suburban	Lab Number:	I-123456
Contact:	JOHN Q. CUSTOMER	Component Type:	Unleaded Gasoline Engine	Lab Location:	Indianapolis
Address:	1234 MAIN STREET	Manufacturer:	Chevrolet	Data Analyst:	AKB
	ANYTOWN, WI 54555 US	Model:	5.3L	Sampled:	04-Jul-2015
Phone Number:	715-555-5555	Application:	Transportation	Received:	07-Jul-2015
		Sump Capacity:	7 qts	Completed:	09-Jul-2015

Filter Information		Miscellaneous Information	Product Information	
Filter Type:	Full-Flow		Product Manufacturer:	AMSOIL
Micron Rating:	20		Product Name:	ASL SIG SIGNATURE SERIES
			Viscosity Grade:	SAE 5W30

Comments	NEW LUBE REFERENCE - Data used for baseline reference only;

	Wear Metals (ppm)										Contaminant Metals (ppm)			Multi-Source Metals (ppm)						Additive Metals (ppm)				
Sample #	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorous	Zinc
1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	9	3043	1	999	1066
2	1	0	0	1	0	0	0	0	0	0	3	2	1	0	0	0	0	0	1	7	3649	2	1174	1268

	Sample Information							Contaminants			Fluid Properties					
Sample #	Date Sampled	Date Received	Lube Time h	Unit Time h	Lube Change	Lube Added gal	Filter Change	Fuel Dilution % Vol	Soot % Vol	Water % Vol	Viscosity 40°C cSt	Viscosity 100 °C cSt	Acid Number mg KOH/g	Base Number mg KOH/g	Oxidation abs/cm	Nitration abs/cm
1	01-Nov-2012	09-Nov-2012	10,000	13,000	Yes		Yes			<.1 - FTIR		14.2		10.7	39	9
2	15-Feb-2014	21-Feb-2014	10,000	23,000	Yes		Yes			<.1 - FTIR		14.3		10.9	52	8

Particle Count (particles/mL) | Additional Testing

Customer and Equipment Information

This section of the report includes the severity status of the sample and information regarding the account, component and sample, as well as information regarding the filter and product. It also includes a miscellaneous information section for any additional information recorded by the lab.

Account Information: Specifies the account number (assigned by the lab) and contact information of the company or individual who submitted the sample for analysis.

Component Information: Specifies the component ID and secondary ID (provided by the customer) for equipment identification. Also specifies component type, manufacturer, model, application and sump capacity.

Sample Information: Identifies the location of the analysis; the data analyst's initials; and the dates the sample was taken, received and completed. Turnaround issues may be indicative of storing samples too long before shipping or shipping service problems.

Severity Status Levels: Indicates the status of severity of the submitted oil sample*.

Severity 0 (Normal) = Oil is suitable for continued use.

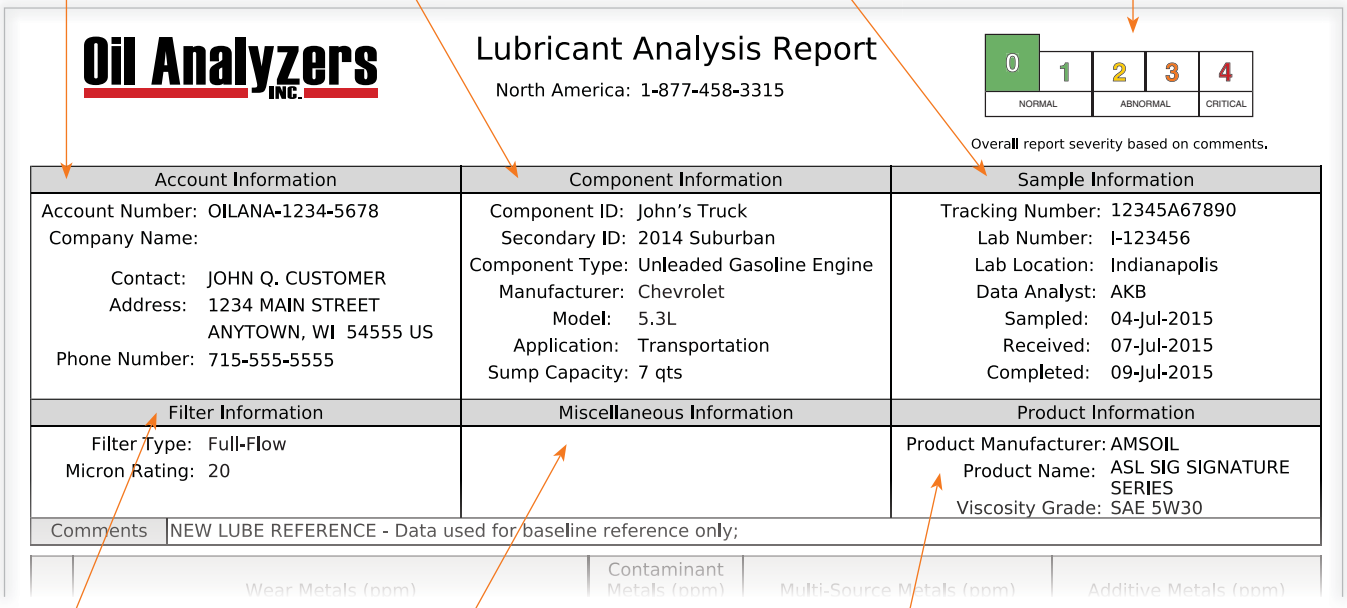
Severity 1 (Normal) = Oil is suitable for continued use. Observe for trends in future tests.

Severity 2 (Abnormal) = Oil is suitable for continued use. Resample at half the normal interval.

Severity 3 (Abnormal) = Replace oil filter and top off system with fresh oil. Resample at half the normal interval or change oil.

Severity 4 (Critical) = Change oil and filter if not done when sample was taken.

*These particular statuses are specific to engine oil samples, but often reflect the lab's recommendations for other fluids.



Oil Analyzers INC.

Lubricant Analysis Report

North America: 1-877-458-3315

0 | 1 | 2 | 3 | 4

NORMAL | ABNORMAL | CRITICAL

Overall report severity based on comments.

Account Information		Component Information		Sample Information	
Account Number:	OILANA-1234-5678	Component ID:	John's Truck	Tracking Number:	12345A67890
Company Name:		Secondary ID:	2014 Suburban	Lab Number:	I-123456
Contact:	JOHN Q. CUSTOMER	Component Type:	Unleaded Gasoline Engine	Lab Location:	Indianapolis
Address:	1234 MAIN STREET	Manufacturer:	Chevrolet	Data Analyst:	AKB
	ANYTOWN, WI 54555 US	Model:	5.3L	Sampled:	04-Jul-2015
Phone Number:	715-555-5555	Application:	Transportation	Received:	07-Jul-2015
		Sump Capacity:	7 qts	Completed:	09-Jul-2015

Filter Information		Miscellaneous Information	Product Information	
Filter Type:	Full-Flow		Product Manufacturer:	AMSOIL
Micron Rating:	20		Product Name:	ASL SIG SIGNATURE SERIES
			Viscosity Grade:	SAE 5W30

Comments	NEW LUBE REFERENCE - Data used for baseline reference only;

Wear Metals (ppm) | Contaminant Metals (ppm) | Multi-Source Metals (ppm) | Additive Metals (ppm)

Filter Information: Identifies the filter used and its micron rating.

Miscellaneous Information: Details additional miscellaneous information.

Product Information: Identifies the sample lubricant and its properties.

Note: Missing or incomplete information is printed in red.

Comments

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

Comments	NEW LUBE REFERENCE - Data used for baseline reference only;

	Wear Metals (ppm)										Contaminant Metals (ppm)			Multi-Source Metals (ppm)						Additive Metals (ppm)				
Sample #	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorous	Zinc
1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	9	3043	1	999	1066
2	1	0	0	1	0	0	0	0	0	0	3	2	1	0	0	0	0	0	1	7	3649	2	1174	1268

	Sample Information							Contaminants			Fluid Properties					
Sample #	Date Sampled	Date Received	Lube Time h	Unit Time h	Lube Change	Lube Added gal	Filter Change	Fuel Dilution % Vol	Soot % Vol	Water % Vol	Viscosity 40°C cSt	Viscosity 100 °C cSt	Acid Number mg KOH/g	Base Number mg KOH/g	Oxidation abs/cm	Nitration abs/cm
1	01-Nov-2012	09-Nov-2012	10,000	13,000	Yes		Yes			<.1 - FTIR		14.2		10.7	39	9
2	15-Feb-2014	21-Feb-2014	10,000	23,000	Yes		Yes			<.1 - FTIR		14.3		10.9	52	8

Particle Count (particles/mL)	Additional Testing

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 metal 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 Metals 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. Phosphorus is used as an extreme-pressure additive in gear oils. Phosphorus and zinc are used in anti-wear additives (ZDDP).

	Wear Metals (ppm)										Contaminant Metals (ppm)			Multi-Source Metals (ppm)						Additive Metals (ppm)				
Sample #	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorous	Zinc
1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	9	3043	1	999	1066
2	1	0	0	1	0	0	0	0	0	0	3	2	1	0	0	0	0	0	1	7	3649	2	1174	1268
	Sample Information										Contaminants									Fluid Properties				

Sample Information, Contaminants and Fluid Properties

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. For lubricant lower and upper limitations, see pages 12 and 13.

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

Fuel and **Soot** (only on engine oil samples) are 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 ASTM D1744 determines the **amount** of water present.

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

	Sample Information							Contaminants			Fluid Properties					
Sample #	Date Sampled	Date Received	Lube Time h	Unit Time h	Lube Change	Lube Added gal	Filter Change	Fuel Dilution % Vol	Soot % Vol	Water % Vol	Viscosity 40°C cSt	Viscosity 100 °C cSt	Acid Number mg KOH/g	Base Number mg KOH/g	Oxidation abs/cm	Nitration abs/cm
1	01-Nov-2012	09-Nov-2012	10,000	13,000	Yes		Yes			<.1 - FTIR		14.2		10.7	39	9
2	15-Feb-2014	21-Feb-2014	10,000	23,000	Yes		Yes			<.1 - FTIR		14.3		10.9	52	8

The **ISO Code** is an index number that represents a range of particles within a specific micron range, (e.g. 4, 6, 14). Each class designates a range of measured particles per one ml of sample. This test is valuable in determining large particle wear in filtered systems. This section is only used when a particle count is specified.

	Particle Count (particles/mL)										Additional Testing
Sample #	ISO Code Based On 4/6/14	> 4 µm	> 6 µm	> 10 µm	> 14 µm	> 21 µm	> 38 µm	> 70 µm	> 100 µm	Test Method	
1	//										
2	//										

Comments are advisory only and are based on the assumption that the sample and data submitted are valid. Missing fluid or component information limits the evaluation. No warranty is expressed or implied.

Historical | 1 | NEW LUBE REFERENCE - Data indicates no abnormal findings. Resample at normal interval

Acid and **Base Numbers** are measured to determine if the lubricant is becoming acidic. A lubricant that becomes too acidic can cause corrosion to internal engine components. Note that acid and base numbers do not begin at zero.

Oxidation measures the breakdown of the lubricant due to age and operating conditions. **Nitration** occurs when nitrogen oxides react with the lubricant, causing deposit formation and an increase in viscosity. Note that oxidation and nitration readings do not begin at zero.

Typical Lubricant Guidelines

The charts below describe the properties typical of various lubricants. Consulting these charts while reading the fluid analysis report may help you understand the indicated severity level and recommendations.

Diesel & Gasoline Engine Oil Guidelines (for physical properties, contaminants & degradation)				
	Normal	**Elevated**	**Abnormal**	**Critical**
Water	0.10%	0.30%	0.40%	0.50%
Fuel Dilution (Gasoline)	<2.4%	2.5% - 3.4%	3.5% - 4.9%	>5.0%
Fuel Dilution (Diesel)	<3.4%	3.5% - 4.9%	5.0% - 6.9%	>7.0%
Viscosity	In grade	+/- one SAE/ISO viscosity grade change	+/- one SAE/ISO viscosity grade change	+/- two SAE/ISO viscosity grade changes
Soot (Diesel Only)	<3.4%	3.5% - 4.9%	5.0% - 6.9%	>7.0%
Oxidation	Baseline + 17	Baseline + 20	Baseline + 23	Baseline + 27
Nitration	Baseline + 17	Baseline + 20	Baseline + 23	Baseline + 27
Base Number TBN	50% depletion	57% depletion	65% depletion	80% depletion
Acid Number TBN	1 x new-oil baseline	2 x new-oil baseline	3 x new-oil baseline	4 x new-oil baseline

SAE Engine & Gear Oil Viscosity Grade @ 100°C (Automotive Fluids)		
SAE Engine Oil Grade @ 100°	**Min cST.**	**Max cST.**
16	6.1	<8.2
20	6.9	<9.3
30	9.3	<12.5
40	12.5	<16.3
50	16.3	<21.9
60	21.9	<26
SAE Gear Oil	**Min cST.**	**Max cST.**
90	13.5	<24.0
140	24.0	<41.0
250	41.0	No Reg.

ISO Viscosity Grade @ 40°C (Industrial Fluids)		
ISO Viscosity Grade @ 40°C	**Min cST.**	**Max cST.**
2	1.98	2.42
3	2.88	3.52
5	4.14	5.06
7	6.12	7.48
10	9.00	11.0
15	13.5	16.5
22	19.8	24.2
32	28.8	35.2
46 (AGMA 1)	41.4	50.6
68 (AGMA 2)	61.2	74.8
100 (AGMA 3)	90.0	110
150 (AGMA 4)	135	165
220 (AGMA 5)	198	242
320 (AGMA 6)	288	352
460 (AGMA 7)	414	506
680 (AGMA 8)	612	748
1000 (AGMA 8A)	900	1100
1500	1350	1650

Oil Analyzers Fluid Analysis Test Packages

Oil Analyzers fluid analysis provides diagnostic testing designed to evaluate lubricant condition, component wear and contamination in mobile and industrial applications with a test report provided by an independent laboratory for each sample submitted. Refer to the chart below to determine which combination of tests each component will receive.

To order **Oil Analyzers** fluid analysis kits, visit www.oaitesting.com or call Oil Analyzers at **800-777-7094**. If you have questions regarding the Oil Analyzers Fluid Analysis Program or need help understanding your test reports, call **877-458-3315**.

Full-Service Kits (KIT01, KIT02, KIT06)			Value Kit (KIT14)	
Applications	**Engines**	**Non-Engines**	**Engines**	**Non-Engines**
Purpose	Monitors wear & contamination			
24 Metals by ICP	•	•	•	•
% Fuel Dilution	•			
% Soot	•			
Water % by Crackle	•	•		
Viscosity @ 40°C		• (if ISO grade fluid)	•	• (if ISO grade fluid)
Viscosity @ 100°C	•	• (if ISO grade fluid)	•	• (if ISO grade fluid)
Oxidation/Nitration By FTIR	•	•		
Total Base Number	•		•	
Total Acid Number		•		•

KIT01	Oil Analyzers Test Kit, US Postal Service Pre-Paid
KIT02	Oil Analyzers Test Kit, UPS Pre-Paid
KIT06	Oil Analyzers Test Kit, Non Postage Paid
KIT14	Oil Analyzers Sample Value Kit, Non Postage Paid (do not use for first oil sample)

Note: Oil analysis kits cannot be used for coolant or diesel fuel samples. See page 15 for additional sampling kits.

Coolant Kit (KIT09)
17 Metals by ICP
pH
Glycol % (Ethylene or Propylene Glycol)
Freeze Point
Boil Point
Nitrite
SCA Number
Total Dissolved Solids
Specific Conductance
Total Hardness
Visuals (color, oil, fuel, magnetic precipitate, non-magnetic precipitate, odor & foam)

Basic Fuel Kit – Fuel Contamination (KIT10)
Water & Sediments
Aerobic Bacteria

Basic Fuel Kit (KIT11)
24 Metals by ICP
Viscosity @ 40°C
Calculated Cetane Index
Distillation
API Gravity

Basic Winter Fuel Kit (KIT12)
Cloud Point
Pour Point

Premium Winter Kit (KIT13)
Cloud Point
Pour Point
Cold-Filter-Plugging Point

* Cold-Filter-Plugging Point can be added to any fuel test package.

Sampling Equipment and Supplies
Oil Analysis Pump (G1206)
Replacement Hose, 25’ ft. (G1571)

To order **OIL ANALYZERS Fluid Analysis** kits, visit **www.oaitesting.com** or call **800-777-7094**.

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