OIL ANALYSIS PROGRAM USER GUIDE

LUBEWATCH®

CHEVRON SERVICES CAN HELP YOU **RUN BETTER LONGER**

Serviced by POLARIS Laboratories

Quality Oil Analysis Can Help Extend Equipment Life

LubeWatch maintenance management system is a diagnostic, preventive maintenance tool that uses oil analysis to monitor and evaluate lubricant and equipment condition in all types of mobile and industrial applications.

Lubricants are the "lifeblood" of machines and equipment. Routine testing and analysis can show you how the condition of the lubricant can affect equipment performance and reliability. Imagine being able to see exactly what's happening inside an engine, a gearbox or hydraulic system. Problems can be found before they become engine failures and less unscheduled downtime means increased production and profitability.

What the LubeWatch Maintenance Manage System Can Do For You

- **Identify minor problems before they become major failures** by monitoring trends in wear and contamination to help prevent catastrophic failure
- **Extend drain intervals** by performing oil changes when the condition of the oil requires it helps reduce unnecessary labor costs
- **Extend equipment** life by monitoring system cleanliness helps reduce repair and replacement costs and helps enable you to keep equipment longer
- **Maximize asset reliability** by scheduling downtime according to your schedule helps eliminate unforeseen decreased production

LubeWatch®
Oil Analysis Program

LUBEWATCH CAN HELP YOUR EQUIPMENT RUN BETTER LONGER

Reach a new level of reliability with LubeWatch Oil Analysis Program User Guide.The combination of using LubeWatch with our targeted services, allows our Chevron specialists to design a lubrication plan that works in sync to help your equipment continue to operate under demanding conditions.

To learn more, contact your marketer.

RBL RUN BETTER LONGER

CHEVRONLUBRICANTS.COM/RBL

LubeWatch® Testing and Analysis

High Quality Testing

The LubeWatch Maintenance Management System utilizes an independent ISO 17025 accredited laboratory. This is the highest level of quality attainable by a testing laboratory which is 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 recognized industry standard and that the oil analysis program is supported by a documented quality system.

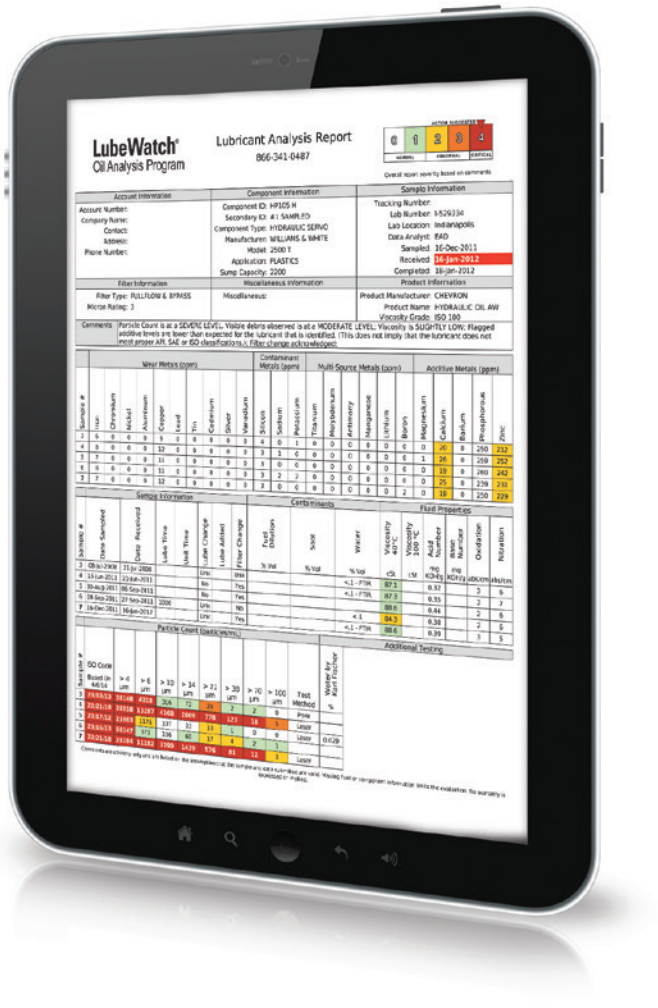
Innovative Data Management Solutions

LubeWatch test results are accessible through HORIZON®, a web-based software application serviced by POLARIS Laboratories®, that will show you how to get the most from your testing results and analysis. After the sample processing is complete, the test results are FREE and available within a 24-hour turnaround in 90 percent of cases. Management reports are available that allow you to use the data to affect positive change in your daily maintenance practices by:

- Keeping sampling schedules on track
- Identifying bottlenecks in turnaround time
- Influencing future purchasing decisions

Test Results On the Go

View test results and maintenance recommendations on the HORIZON app when you are in the field or on the maintenance floor. Alerts notify you when new results are ready. Customize alerts by fluid type and severity. Download the free app from Google Play for Android devices and the App Store for iOS devices.



Quality testing, analysis and maintenance recommendations can dramatically extend equipment life and dependability – saving you valuable time and money.

Serviced by POLARIS Laboratories

Taking Samples

The LubeWatch® Maintenance Management System shows you how regular sampling and TREND ANALYSIS – monitoring test data over an extended period of time – will provide the information you need to continually maximize asset reliability and, ultimately, help increase company profits.

Samples should be taken while equipment is operating or immediately after shutdown while the system is still at operating temperature so that wear metals and contaminants don't have an opportunity to settle. How critical a piece of equipment is to production is a major consideration for determining sampling frequency, as well as, environmental factors, such as hot, dirty operating conditions, and short trips with heavy loads and excessive idle times.

Whether you are a seasoned veteran or a first-time oil sampler, a well-designed oil analysis program helps put you on track for well-managed, cost-effective equipment maintenance program.

Implement a sampling process for every piece of equipment in your LubeWatch Oil Analysis Program that can be followed consistently each time the oil is sampled in the unit.

ON- AND OFF-HIGHWAY: AGRICULTURE, AUTOMOBILE, CONSTRUCTION, FORESTRY, MASS TRANSIT, MINING & QUARRYING, RAILROAD, TRUCKING

Equipment Type	Suggested Sampling Frequency		Sampling Location
	Hours	Miles	
Diesel Engines	250-500 hours	10,000-20,000 miles (16,000 - 32,000 km)	Through Dipstick Retaining Tube or Sampling Valve Installed in Filter Return
Gasoline Engines	-	5,000 miles (8,000 km)	Through Oil Level Checkpoint, Dipstick Retaining Tube or Oil Level Plug
Transmissions	500-1,000 hours	20,000-40,000 miles (32,000 - 64,000 km)	Through Oil Level Plug or Dipstick Retaining Tube
Gears, Differentials and Final Drives	500-1,000 hours	20,000-40,000 miles (32,000 - 64,000 km)	Through Oil Level Plug or Dipstick Retaining Tube
Hydraulics	1,000 hours	40,000 miles (64,000 km)	Through Oil Fill Port of System Reservoir at Mid-Level

Always confirm that the sampling frequency is consistent with the original equipment manufacturer's recommendation for the equipment operating conditions and customer's maintenance practices.

MANUFACTURING & PROCESSING AND INLAND MARINE: CEMENT, FOOD & BEVERAGE, MARINE EQUIPMENT, NATURAL GAS DISTRIBUTION, OIL & GAS EXPLORATION, POWER GENERATION, PULP & PAPER, SUGAR MILLS

Equipment Type	Suggested Sampling Frequency		Sampling Location
	Normal Use	Intermittent Use	
Diesel Engines	Monthly, 500 hours	Quarterly	Through Dipstick Retaining Tube or Sampling Valve Installed in Filter Return
Natural Gas Engines	Monthly, 500 hours	Quarterly	Through Oil Level Checkpoint, Dipstick Retaining Tube or Oil Level Plug
Gas Turbines	Monthly, 500 hours	Quarterly	Through Sample Valve Installed Upstream of the Filter on the Return Line or out of the System Reservoir
Steam Turbines	Bi-monthly	Quarterly	Through Sample Valve Installed Upstream of the Filter on the Return Line or out of the System Reservoir
Air, Gas Compressors	Monthly, 500 hours	Quarterly	Through Sample Valve Installed Upstream of the Filter on the Return Line or Out of the System Reservoir
Refrigeration Compressors	Bi-monthly	Quarterly	Through Sample Valve Installed Upstream of the Filter on the Return Line or Out of the System Reservoir
Gears, Bearings	Bi-monthly	Quarterly	Through Sample Valve Installed Upstream of the Filter on the Return Line or Out of the System Reservoir
Hydraulics	Bi-monthly	Quarterly	Through Oil Fill Port of System Reservoir at Mid-Level

The LubeWatch® Maintenance Management System provides advanced diagnostic, preventative maintenance testing designed to evaluate oil condition, component wear and contamination in engines, hydraulic systems, transmissions, differentials, gear boxes and turbines.

To order kits, sampling equipment or supplies, see Sample Kit Directions on page 10 for more information.

OIL ANALYSIS TEST PACKAGES

	Test Method	C1 Basic Lubrication	C2 Diesel Crankcase	C3 Basic Industrial/ Natural Gas	C4 Industrial Oils	C4PC Industrial Oils w/ Particle Count*	C5 Metal Working Fluids	C6 Turbine Oils
Elemental Metals by ICP	mod. ASTM D5185	•	•	•	•	•	•	•
% Water by Crackle**	POLARIS Method	•	•					
% Water by Karl Fischer**	mod. ASTM D6304C			•	•	•	•	•
Viscosity @ 40°C or 100°C	mod. ASTM D445	• (100°C)	• (100°C)	•	• (40°C)	• (40°C)	• (40°C)	• (40°C)
% Fuel Dilution	ASTM D7593		•					
% Fuel Soot	ASTM E2412		•					
Oxidation	ASTM E2412		•	•	•	•		•
Nitration	ASTM E2412		•	•	•	•		•
Acid Number	mod. ASTM D664			•	•	•		
Base Number	mod. ASTM D4739		•					
Particle Count w/ISO Rating*	ASTM D7647 Calibration ISO 11171					•		•
Water Separability	ASTM D1401							•
Chlorine	ASTM D5384						•	
Sulfur	ASTM D4951						•	
Fat %	ASTM E2412						•	
RPVOT	ASTM D2272							•
i-pH	mod. ASTM D7946			•				

***For all paper machine oils and any oils in which free water is detected.*
**Dark or thick samples are unable to be tested via Particle Count and will receive a Particle Quantifier test to measure the ferrous density of metals.*

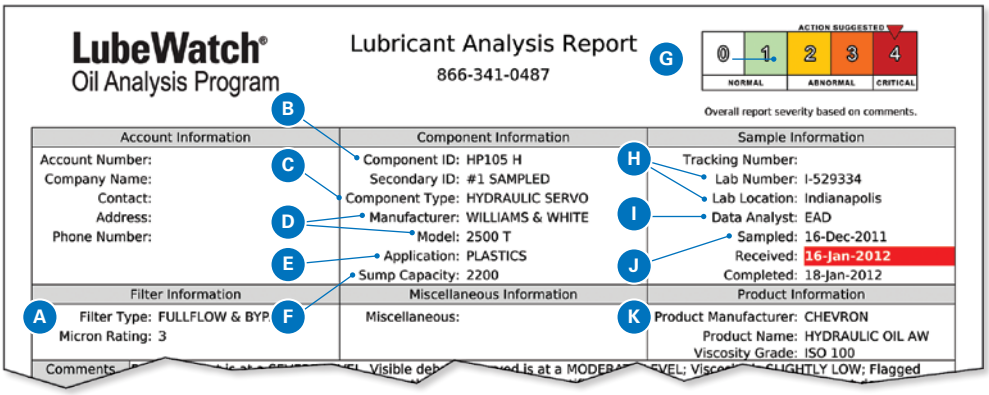
COOLANT ANALYSIS TEST PACKAGES

	Test Method	C7 Coolant Basic Conventional	C8 Coolant Basic Extended Life	C9 Coolant Advanced Extended Life
Elemental Metals by ICP	mod. ASTM D6130			•
Freeze Point	mod. ASTM D3321	•	•	•
Anti-Freeze %	POLARIS Method	•	•	•
Boiling Point	POLARIS Method	•	•	•
Nitrite	POLARIS Method	•	•	
Carboxylate Acid	Manufacturer		•	•
Anions by Chromatography	ASTM D5827			•
pH	ASTM D1287	•	•	•
Specific Conductance	Meter Measurement	•		
Visuals (color, oil, fuel, foam, magnetic precipitate, non-magnetic precipitate, odor & foam)	POLARIS Method	•	•	•

How to Read the LubeWatch® Oil Analysis Report

The information that is submitted with an oil sample is as important to who is reading the report as it is to the analyst interpreting the test results and making recommendations. **Properly document your equipment and share this knowledge with your laboratory.**

LubeWatch® Analysis Report



A **Filter Type** and its **Micron Rating** is important in analyzing the particle count — the lower the micron rating, the better the particle count results should be.

B **Component ID** is the customer's opportunity to uniquely identify units being tested and their location.

C **Component Type** should provide as much detail as possible. The type of unit (compressor, gearbox, engine, etc.) can influence flagging parameters and the depth of analysis. Different metallurgies require different lubrication and can have great impact on how the results are interpreted.

D **Manufacturer and Model** can also identify metallurgies involved, as well as, the original equipment manufacturer (OEM) standard maintenance guidelines and possible wear patterns to expect.

E **Application** identifies the type of environment in which the equipment operates. This information is useful in determining exposure to possible contaminants.

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

G **Severity Status Levels:**

0 — Normal.

1 — At least one or more items have violated initial flagging points, yet are considered minor.

2 — A trend is developing.

3 — Simple maintenance and/or diagnostics are recommended.

4 — Failure is imminent if maintenance is not performed.

H **Lab Location** indicates the laboratory at which the testing was completed. A **Lab Number** is assigned to the sample upon entry for processing and should be the reference number used when contacting the lab with questions, concerns or feedback.

I **Data Analyst's Initials**

J **Sampled, Received** and **Completed** are the dates that indicate the date the oil sample was taken, the date the sample was received by the laboratory and the date the analysis was completed. Turnaround issues may point to storing samples too long before shipping or shipping service problems.

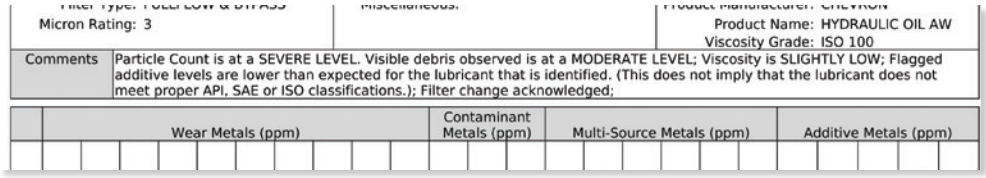
K **Product Manufacturer, Product Name and Viscosity Grade** identify a product's properties and its viscosity. This information is critical in determining if the right product is being used.

__Fluid Time__ is how long the oil has been used. __Unit Time__ is the age of the equipment and __Product Added__ is how much oil has been added since the last sample was taken.

Recommended Actions

A data analyst's job is to explain test results 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 first in order of severity. Justifications for recommending those actions immediately follow.

The laboratory will request additional unit and product information if a sample information form is incomplete.

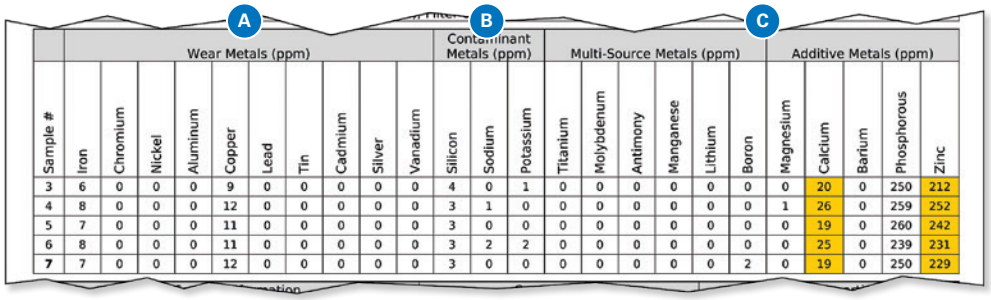


Micron Rating: 3		Product Name: HYDRAULIC OIL AW Viscosity Grade: ISO 100
Comments	Particle Count is at a SEVERE LEVEL. Visible debris observed is at a MODERATE LEVEL; Viscosity is SLIGHTLY LOW; Flagged additive levels are lower than expected for the lubricant that is identified. (This does not imply that the lubricant does not meet proper API, SAE or ISO classifications.); Filter change acknowledged;	

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

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).



		A										B			C										
		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
	3	6	0	0	0	9	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	20	0	250	212
	4	8	0	0	0	12	0	0	0	0	0	3	1	0	0	0	0	0	0	0	1	26	0	259	252
	5	7	0	0	0	11	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	19	0	260	242
	6	8	0	0	0	11	0	0	0	0	0	3	2	2	0	0	0	0	0	0	0	25	0	239	231
	7	7	0	0	0	12	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	19	0	250	229

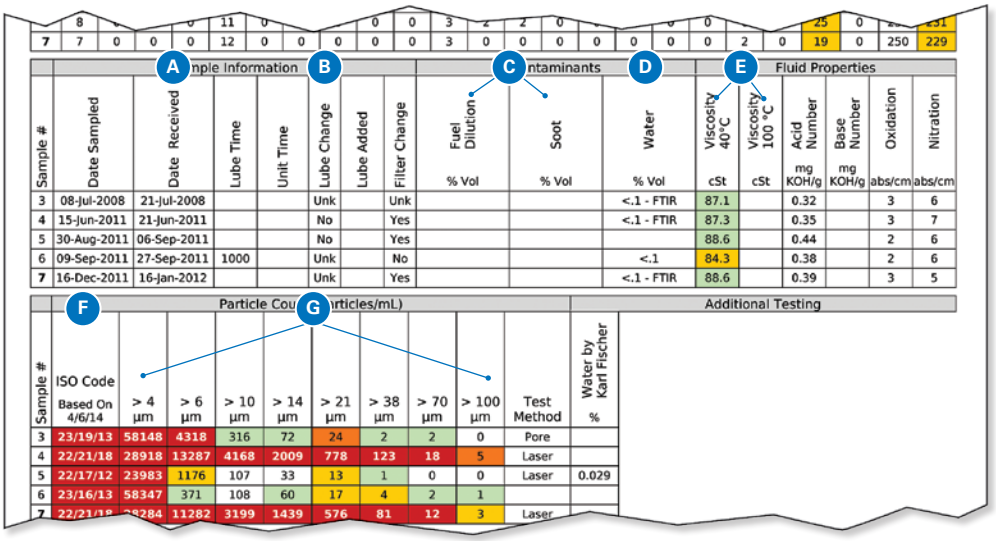
A Combinations of these **Wear Metals** can identify components within the equipment that are wearing. Knowing what metal a unit is made of can greatly influence an analyst's recommendations and determine the value of elemental analysis.

B 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.

C **Multi-Source Metals** and **Additive Metals** may appear 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).

Test Data

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



A Samples are listed by **Date Received** in the lab — oldest first. They are also assigned a **Lab Number** for easy internal tracking.

B Important to note is whether or not a **Lube Change** has occurred since the last sample was taken.

C **Fuel Dilution** and **Soot** are reported in % of volume. High fuel dilution decreases unit load capacity. Excessive soot is a sign of reduced combustion efficiency (engine samples only).

D **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 D6304C determines the amount of water present. These results appear in the Special Testing section of your report.

E **Viscosity** measures a lubricant's resistance to flow at temperature and is considered its most important physical property. Depending on product grade, it is tested at 40°C and/or 100°C and reported in Centistokes.

F 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.

G The **Particle Count** is a cumulative range between 4 and 100 microns. This test is valuable in determining large particle wear in filtered systems.

Log on at www.eoilreports.com

SAMPLE KIT DIRECTIONS

Step A

Sample Information Form

First-time users need to establish a HORIZON® account, and new components (sample point) need to be added to your account.

Next, fill out the **QR** (quick response) **code label** with the corresponding **Component ID** and **Sample Date**. Attach the label to the sample jar and retain the other label for your records.

To improve accuracy and ensure faster processing, use the **Sample Submission** feature in HORIZON to send the sample information to the laboratory. Once the information is submitted online, the QR code will be linked to the required sample information needed for processing.

00000A00000

C2 DIESEL CRANKCASE

1–866–341–0487 | www.eoilreports.com

C2P | Oil/Coolant Samples Only

ONLINE SUBMISSION INSTRUCTIONS

APPLY TO SAMPLE

00000A00000

Date Taken

Component ID

RETAIN FOR YOUR RECORDS

Date Taken

Component ID

00000A00000

Send an email to: **custserv@eoilreports.com** to establish an online account

Log into your online account to add or edit components under **Equipment Management**

Submit — Use **Sample Submission** to send sample information to the laboratory *(If online access is not available, please complete form)*

Apply **label** to sample jar

Ship sample to laboratory via trackable delivery service *(see address list below)*

Receive **results** via email or access them online

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

LUBEWATCH LABORATORY
10910 W. SAM HOUSTON PKWY N
STE 700
HOUSTON, TX 77064–9903

LUBEWATCH LABORATORY
5140 75 STREET NW
EDMONTON, AB T6E 6W2
CANADA

LUBEWATCH LABORATORY
P.O. BOX 30820
3060 CALIFORNIA AVE, STE B
SALT LAKE CITY, UT 84104

0 0 0 0 0 A 0 0 0 0 0

Chevron **LubeWatch®** Oil Analysis Program

*Complete this form **only** if online access is not available. Utilize HORIZON to provide the laboratory with more detailed component/sample information.*

ACCOUNT INFORMATION (ACCT: LUB000–0000–0000)

Distributor/Sales Rep
Company Name
Contact
Address
City / Country
Telephone
Email

SAMPLE INFORMATION New Fluid Reference ❑

Component ID
Secondary ID
Component Type *(check one)*

Engine: ❑ Diesel ❑ Natural Gas ❑ Other
Transmission: ❑ Auto ❑ Manual
❑ Differential ❑ Final Drive ❑ Hydraulic
❑ Planetary ❑ Coolant

Position: ❑ Front ❑ Rear ❑ Left ❑ Right ❑ Center ❑ Chassis
Date Taken
Fluid Time ❑ km ❑ hr ❑ mo ❑ mi ❑ day ❑ yr ❑ kt
Component Time ❑ km ❑ hr ❑ mo ❑ mi ❑ day ❑ yr ❑ kt
Fluid Changed ❑ Yes ❑ No ❑ Unknown
Filter Changed ❑ Yes ❑ No ❑ Unknown
Misc
Comments

COMPONENT INFORMATION *(For first-time samples or changes only)*

Manufacturer
Model
Product Mfr
Product & Viscosity Grade ❑ ISO ❑ SAE

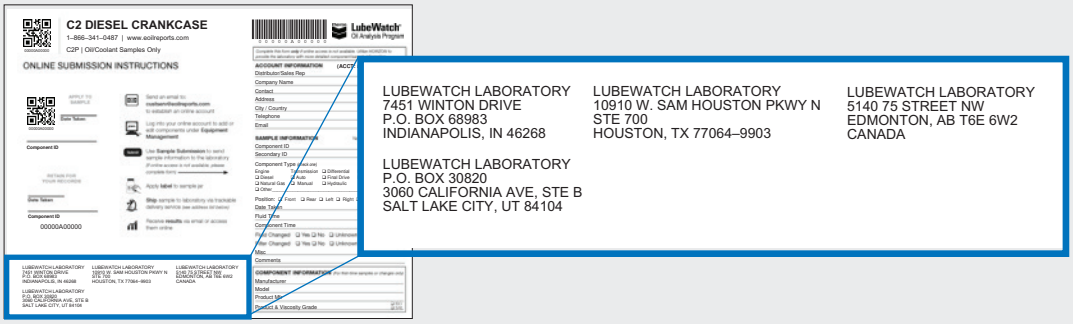
NOTE: Provide the laboratory with as much detailed equipment and fluid information as possible. More in-depth analysis is possible when the analyst knows the time on both the unit and fluid and whether the fluid and/or filter have been changed since last sampled.

To order kits, sampling equipment or supplies, contact your Chevron Lubrication Marketer.

Step B

LABORATORY LOCATIONS

A list of available **laboratory locations** is included on the form. Ship your package to the laboratory address of your choice and use a trackable shipping service, such as UPS or FedEx.



The laboratory will request additional unit and product information if sample information is incomplete.

Step C

ONLINE ACCESS

If the sample information cannot be submitted online, **complete the simple form** on the right of the label, detach the form and submit it to the laboratory with the sample.

IMPORTANT: Samples will be placed on hold if the component ID does not match an ID in your account and no component information is included on the paper form. Components can be added to your account online via HORIZON or by contacting Customer Service. Samples placed on hold for more than 30 days will be disposed.

Sample Jar

Our high density, polyethylene sample jar holds 3 oz. jar. This jar accommodates our standard vacuum pump, and has a break-resistant lid designed to prevent damage and leaking during shipment.

Faster Sample Preparation

We've simplified the sample jar label. Just fill out the date and component ID and attach it to the sample bottle. This will allow all sample information submitted to be able to be viewed in HORIZON®.

Fast Sample Turnaround Time

To ensure samples go through the laboratory faster, log the samples online. This will alleviate the need to fill out the Sample Information Form.

Soft mailer

LubeWatch® Account Set-Up Form

NOTE: **Complete and accurate** account set-up information is essential for POLARIS Laboratories to provide you with **complete and accurate** testing, data analysis and report distribution on each sample you submit for processing.

Your Lubrication Business Manager or Lubrication Marketer (please print) _____

Primary Laboratory

☐ Indianapolis ☐ Houston ☐ Mexico
☐ Salt Lake City ☐ Edmonton ☐ Guatemala

Billing Options

You must select one of the following to establish an account:

☐ Pre-Paid (Invoiced for testing when kits are ordered)
☐ Invoiced (Invoiced monthly when testing is completed)

Comments/Special Instructions _____

Test Kits

Please order in increments of 10

Place requests for additional supplies in the Comments/ Special Instructions section at left

Select what mailer you prefer

☐ Soft Mailer ☐ Hard Mailer ($0.25 per kit difference)

Kit	Quantity
C1 - Basic Lubrication	
C2 - Diesel Crankcase	
C3 - Basic Industrial/Natural Gas	
C4 - Industrial Oils	
C4PC - Industrial Oils w/Particle Count	
C5 - Metalworking Fluid	
C6 -Turbine Oils (Individual kits available. Hard mailer only)	
C7 - Coolant Basic Conventional	
C8 - Coolant Basic Extended Life	
C9 - Coolant Advanced Extended Life	

Billing Address

Company _____
Attention _____
Address _____
City _____
State _____ Zip _____
Phone _____ Fax _____
Email _____

Shipping Address ☐ Check if same as billing

Company _____
Attention _____
Address _____
City _____
State _____ Zip _____
Phone _____ Fax _____
Email _____

Report Recipient #1

Company _____
Attention _____
Address _____
City _____
State _____ Zip _____
Phone _____ Fax _____
Email _____
☐ Email all reports ☐ Email only critical reports

Report Recipient #2

Company _____
Attention _____
Address _____
City _____
State _____ Zip _____
Phone _____ Fax _____
Email _____
☐ Email all reports ☐ Email only critical reports

Report Recipient #3

Company _____
Attention _____
Address _____
City _____
State _____ Zip _____
Phone _____ Fax _____
Email _____
☐ Email all reports ☐ Email only critical reports

Delivery Options

You will receive an email to activate your HORIZON account and set a password. This allows you to view test results and submit sample information on HORIZON (www.eoilreports.com) or the HORIZON oil analysis app (free to download on Android and iOS devices). Select a default email setting to receive sample reports. You can adjust this setting in HORIZON and customize mobile alerts in the HORIZON app.*

**Email subscription settings can be adjusted in HORIZON. Customize mobile alerts in the HORIZON App.*

To set up your LubeWatch account today, print this form, complete it and email it to custserv@eoilreports.com

For questions, call **1.866.341.0487** or **1.317.808.0948**

Chevron Reliability — The RBL™ Program is our commitment of business support and reliability: Chevron's lubrication expertise combined with superior products and a tailored service program work together to help your business Run Better Longer.

A **Chevron** company product

chevronlubricants.com

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