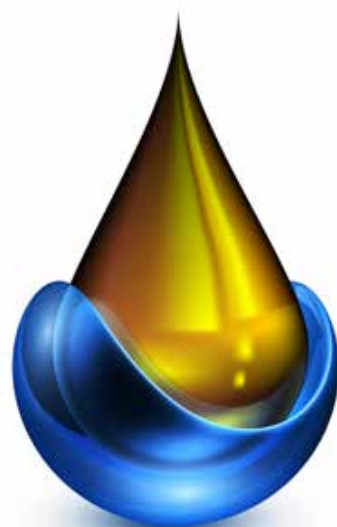


# FLUID ANALYSIS | USER GUIDE

Keep It Clean



**yacht**samples



# What Can Yacht Samples Fluid Analysis Do For You?

The diesel engines, gear systems and hydraulics required to power today's marine industry are expected to operate for long periods of time at full load capacity under extreme, often uncontrollable, conditions. When you monitor the condition of both the unit and fluid using Yacht Samples Fluid Analysis Program, you can identify wear-causing contaminants in virtually any application.

Marine units are constantly exposed to the damaging effects of either fresh water or saltwater, which are also used by some to cool the very systems that keep them up and running. Where contamination and wear are eminent, maximizing asset reliability becomes priority. And, when you make Fluid Analysis an integral part of your preventive maintenance program, you will be able to:

- **Identify opportunities for optimize equipment performance**
- **Safely extend oil drain intervals**
- **Extend equipment life**
- **Minimize downtime by identifying minor problems before they become major failures**



## High Quality Testing

With Fluid Analysis, you can be confident you're testing with a laboratory that knows your equipment better than anyone and all our independent laboratories are ISO 17025 A2LA accredited. 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 and that your fluid analysis program is supported by a documented quality system you can depend on to deliver superior testing and customer service.

## Innovative Data Management Capabilities

HORIZON®, will show you how to get the most from your testing results and analysis. Results are FREE and available online almost immediately after sample processing is complete. You can easily set or change application preferences and filters to organize the critical information you need to stay focused on your goals.

HORIZON Management Reports help you:

- Keep sampling schedule on track
- Identify bottlenecks in turnaround time
- Influence future purchasing decisions

Equipment Management and Sample Submission allow you to:

- Add new sample points
- Update missing unit information
- Submit sample information to the laboratory - just apply the barcode to the sample, no paperwork required





### Taking Samples

Routine fluid analysis is critical to managing asset reliability in any marine application. Yacht Samples Fluid Analysis program 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, increase company profits.

Samples should be taken while equipment is at operating temperature so that wear metals and contaminants don't have an opportunity to settle. Along with the Original Equipment Manufacturer's (OEM) recommended sampling intervals, how critical a piece of equipment is should be a major consideration for determining sampling frequency, as are environmental factors.

EQUIPMENT TYPE	SUGGESTED SAMPING FREQUENCY	SAMPING LOCATION
Diesel Engines	Monthly, 500 hours	Through Dipstick Retaining Tube or Sampling Valve Installed in Filter Return
Gears Systems	Bi-monthly	Through Sample Valve Installed Upstream of the Filter on the Return Line or Out of the System Reservoir
Hydraulics	Bi-monthly	Through Sample Valve Installed Upstream of the Filter on the Return Line or Out of the System Reservoir



## Fluid Analysis Test Packages

Yacht Samples Fluid Analysis kits provide advanced diagnostic and preventive maintenance testing designed to evaluate fluid condition, component wear and contamination in diesel engines, hydraulic systems, and gear systems.

ADVANCED MARINE   OIL			
Tests	Standard Test Method	Engines	Non-Engines
Elemental Metals by ICP	mod. ASTM D5185	▲	▲
Water % by Crackle	In-house Method	▲	▲
Viscosity @ 40 °C or 100 °C	mod. ASTM D445	▲	▲
Fuel Dilution %	Gas Chromatography	▲	
Soot %	ASTM E2412, FTIR	▲	
Total Acid Number	mod. ASTM D664		▲
Total Base Number	mod. ASTM D4739	▲	
Oxidation/Nitration	ASTM E2412, FTIR	▲	▲ *
Particle Quantifier (Ferrous Density)	Manufacturer		▲ *
Particle Count (Calibration 11171)	mod. ISO 11500		▲ *


BASIC & ADVANCED   DIESEL FUEL			
Tests	Standard Test Method	Basic	Advanced
Elemental Metals by ICP	mod. ASTM D5185	▲	▲
Particle Count	mod. ISO 11500	▲	▲
Sulfur	ASTM D7220	▲	▲
Water by Karl Fischer, ppm	mod. ASTM D1744	▲	▲
API Gravity	ASTM D287	▲	▲
Flash Point - Pensky-Martens (Closed Cup)	ASTM D93	▲	▲
Bacteria, Fungi, Mold	Manufacturer	▲	▲
Water & Sediment	ASTM D2709		▲
Ash	ASTM D482/IP4		▲
Cetane Index	ASTM D976		▲
Pour Point	ASTM D97		▲
Distillation	ASTM D86		▲

LEVEL 3   COOLANT	
Tests	Standard Test Method
Elemental Metals by ICP	ASTM D6130
Antifreeze% (Ethylene or Propylene Glycol)	In-House Method
Freeze Point	mod. ASTM D3321
Nitrates	In-House Method (Test Strip)
SCA Number	Calculation
Total Hardness	Calculation
pH	ASTM D1287
Boil Point	In-House Method
Specific Conductance	Meter Measurement
HPLC (Benzotriazole, Tolytriazole, Mercaptoben-zothiazole, Benzoic Acid, Sebacic Acid, 2-Ethyl-hexanoic Acid, Octonooic Acid, P-Toluic Acid)	In-House Method
Visuals (color, oil, fuel, foam, magnetic precipi-tate, non-magnetic precipitate, odor & foam)	In-House Method

\* Component type determines testing.



## How to Read Your Fluid Analysis Report



## Lubricant Analysis Report

Europe: +44 (0) 759 533 4592  
USA: +1 954 218 7015

0	1	2	3	4
NORMAL	ABNORMAL	CRITICAL		

Overall report severity based on comments.

Account Information	Component Information	Sample Information
Account Number: Company Name: Contact: Address:  Phone Number:	Component ID: ABC-STB-OIL E Code/Serial#: PROPULSION STARBOARD Component Type: DIESEL ENGINE Manufacturer: MAN Model: MAD2842LE404 Application: PLEASURE CRAFT Sump Capacity: 0 gal	Tracking Number: Lab Number: Z-001234 Lab Location: Poznan Data Analyst: RNF Sampled: 20-May-2014 Received: 26-May-2014 Completed: 27-May-2014
Filter Information	Miscellaneous Information	Product Information
Filter Type: <span style="color: red;">Missing Information</span> Micron Rating: 0		Product Manufacturer: CAT Product Name: DEO Viscosity Grade: SAE 15W40
<b>Comments</b> Flagged data does not indicate an immediate need for maintenance action. Continue to observe the trend and monitor equipment and fluid conditions. Copper is at a MODERATE LEVEL; COPPER is most likely LEACHING into the oil via the OIL COOLER core tubing. This typically DOES NOT REQUIRE MAINTENANCE ACTION unless there is evidence of COOLANT in the oil; FUEL DILUTION is at a MINOR LEVEL; Iron is at a MINOR LEVEL; IRON SOURCE in engines can be cylinder liners, iron pistons, hardened steel camshafts, crankshafts, gears, hardened rocker arms, valve bridges, alloyed steel cam follower rollers, etc.; Unit and/or lube TIME missing:		

Sample #	Wear Metals (ppm)										Contaminant Metals (ppm)		Multi-Source Metals (ppm)					Additive Metals (ppm)						
	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	78	3	0	7	74	6	1	0	0	0	7	4	7	0	2	0	1	0	45	247	3282	0	1245	1516

Sample Information								Contaminants			Fluid Properties					
Sample #	Date Sampled	Date Received	Lube Time	Unit Time	Lube Change	Lube Added	Filter Change	Fuel Dilution	Soot	Water	Viscosity 40°C	Viscosity 100 °C	Acid Number	Base Number	Oxidation	Nitration
1	20-May-2014	26-May-2014	0	0	Unk	0	Unk	3.4 - GC	0.3 - FTIR	< 1 - FTIR	cSt	cSt	mg KOH/g	mg KOH/g	abs/cm	abs/0.1 mm

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	//										

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.

Page 1 of 1

Accurate, thorough, and complete fluid and equipment information allows for more in-depth analysis and can eliminate confusion when interpreting results.



## 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. **Properly document your equipment and share this knowledge with your laboratory.** Implement a sampling process for every piece of equipment in your Fluid Analysis program that can be followed consistently each time the unit is sampled. **Accurate, thorough and complete fluid and equipment information allows for more in-depth analysis and can eliminate confusion when interpreting results.**

Account Information		Component Information		Sample Information	
Account Number: Company Name: Contact: Address: Phone Number:		Component ID: ABC-STB-OIL E Code/Serial#: PROPULSION STARBOARD Component Type: DIESEL ENGINE Manufacturer: MAN Model: MAD2842LE404 Application: PLEASURE CRAFT Sump Capacity: 0 gal		Tracking Number: Lab Number: Z-001234 Lab Location: Poznan Data Analyst: RNF Sampled: 20-May-2014 Received: 26-May-2014 Completed: 27-May-2014	
Filter Information		Miscellaneous Information		Product Information	
Filter Type: <b>Missing Information</b> Micron Rating: 0				Product Manufacturer: CAT Product Name: DEO Viscosity Grade: SAE 15W40	
Comments		Flagged data does not indicate an immediate need for maintenance action. Continue to observe the trend and monitor equipment and fluid conditions. Copper is at a MODERATE LEVEL; COPPER is most likely LEACHING into the oil via the OIL COOLER core tubing. This typically DOES NOT REQUIRE MAINTENANCE ACTION unless there is evidence of COOLANT in the oil; FUEL DILUTION is at a MINOR LEVEL; IRON is at a MINOR LEVEL; IRON SOURCE is unknown; see customer for details.			

### Component Information

- Component ID** is each customer's opportunity to uniquely identify components being tested and their location.
- Component 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.
- Manufacturer** and **Model** can also identify metallurgies involved as well as the OEM's standard maintenance guidelines and possible wear patterns to expect.
- Application** identifies in what type of environment the equipment operates and is useful in determining exposure to possible contaminants.
- Sump Capacity** identifies the total volume of oil (gallons, liters or quarts) in which wear metals are suspended and is critical to trending wear metal concentrations.

### Filter Information

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

### Product Information

- Product Manufacturer, Name** and **Grade** identify a lube's properties and its viscosity and is critical in determining if the right lube is being used.


### Sample Information

- Severity Status Levels:**
  - 0** - Normal.
  - 1** - At least 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 is not performed.
- The laboratory at which testing was completed. The following Lab # 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.
- 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 shipping or shipping service problems. Also noted is testing **Date Completed**.



## Recommendations

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 first in order of severity. Justifications for recommending those actions immediately follow.



### Lubricant Analysis Report

Europe: +44 (0) 759 533 4592  
USA: +1 954 218 7015

0	1	2	3	4
NORMAL		ABNORMAL		CRITICAL

Overall report severity based on comments.

Account Information	Component Information	Sample Information
Account Number: Company Name: Contact: Address:  Phone Number:	Component ID: ABC-STB-OIL E Code/Serial#: PROPULSION STARBOARD Component Type: DIESEL ENGINE Manufacturer: MAN Model: MAD2842LE404 Application: PLEASURE CRAFT Sump Capacity: 0 gal	Tracking Number: Lab Number: Z-001234 Lab Location: Poznan Data Analyst: RNF Sampled: 20-May-2014 Received: 26-May-2014 Completed: 27-May-2014
Filter Information	Miscellaneous Information	Product Information
Filter Type: <span style="color: red;">Missing Information</span> Micron Rating: 0		Product Manufacturer: CAT Product Name: DEO Viscosity Grade: SAE 15W40
Comments	Flagged data does not indicate an immediate need for maintenance action. Continue to observe the trend and monitor equipment and fluid conditions. Copper is at a MODERATE LEVEL; COPPER is most likely LEACHING into the oil via the OIL COOLER core tubing. This typically DOES NOT REQUIRE MAINTENANCE ACTION unless there is evidence of COOLANT in the oil; FUEL DILUTION is at a MINOR LEVEL; Iron is at a MINOR LEVEL; IRON SOURCE in engines can be cylinder liners, iron pistons, hardened steel camshafts, crankshafts, gears, hardened rocker arms, valve bridges, alloyed steel cam follower rollers, etc.; Unit and/or lube TIME missing;	
	Wear Metals (ppm)	Contaminant Metals (ppm)
		Multi-Source Metals (ppm)
		Additive Metals (ppm)

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





## 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).

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	78	3	0	7	74	6	1	0	0	0	7	4	7	0	2	0	1	0	45	247	3282	0	1245	1516

Sample Information										Contaminants					Fluid Properties				
#	Sampled	Received	Lube Time	Unit Time	Change	Lube Added	Change	Fuel Dilution	Soot	Water	Viscosity @ 40 °C	Viscosity @ 100 °C	Acid Number	Base Number	Oxidation	Corrosion			

- 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** 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).

## 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.

Sample #	Sample Information							Contaminants			Fluid Properties					
	Date Sampled	Date Received	Lube Time	Unit Time	Lube Change	Lube Added	Filter Change	Fuel Dilution	Soot	Water	Viscosity 40 °C	Viscosity 100 °C	Acid Number	Base Number	Oxidation	Nitration
			h	h		gal		% Vol	% Vol	% Vol	cSt	cSt	mg KOH/g	mg KOH/g	abs/cm	abs/0.1 mm
1	20-May-2014	26-May-2014	0	0	Unk	0	Unk	3.4 - GC	0.3 - FTIR	<.1 - FTIR		12.9		8.18	11	8
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	//															

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.

- 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 it's most important physical property. Depending on lube grade, it is tested at 40 and/or 100 degrees Centigrade and reported in Centistokes.
- 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.
- Particle Count** is a cumulative range between 4 and 100 microns. This test is valuable in determining large particle wear in filtered systems.
- Fuel** and **Soot** are reported in % of volume. High fuel dilution decreases unit load capacity. Excessive soot is a sign of reduced combustion efficiency. (only on engine oil samples)
- 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. These results appear in the Special Testing section of your report.



For your first sample submission, complete the Required Sample Information section of your fluid analysis form for every fluid submitted to the laboratory. Be sure to fill out the form completely and accurately to ensure proper testing and accurate analysis. After your first submission, you may submit your samples online. See below for details.

## Things to Remember

- Include all component and fluid information requested including component ID, type of component and position, time on both the fluid and the component and whether or not the fluid and/or filter has been changed.
- Attach one barcode sticker label to sample jar
- Keep one barcode sticker label for your record



**1** Apply barcode to bottle

**2** Submit sample online via **ILC BIZON**  
OR complete this form

**3** Place form in smaller container and ship sample

Receive report

### SAMPLE INFORMATION

Act # **YACHTS**

Customer \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Sample Point \_\_\_\_\_

☐ Engine    ☐ Gear Box    ☐ Hydraulic    ☐ Transom  
☐ Propulsion    ☐ Generator    ☐ Transom  
☐ Other \_\_\_\_\_

☐ Engine    ☐ Cooling    ☐ Fuel    ☐ Water  
☐ Hydraulic    ☐ Gear Box    ☐ Transom  
☐ Other \_\_\_\_\_

☐ Propulsion    ☐ Gear Box    ☐ Hydraulic    ☐ Transom  
☐ Other \_\_\_\_\_

☐ Engine    ☐ Gear Box    ☐ Hydraulic    ☐ Transom  
☐ Other \_\_\_\_\_

### SAMPLE INFORMATION

Act # **YACHTS**

Customer \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Sample Point \_\_\_\_\_

☐ Engine    ☐ Gear Box    ☐ Hydraulic    ☐ Transom  
☐ Propulsion    ☐ Generator    ☐ Transom  
☐ Other \_\_\_\_\_

☐ Engine    ☐ Cooling    ☐ Fuel    ☐ Water  
☐ Hydraulic    ☐ Gear Box    ☐ Transom  
☐ Other \_\_\_\_\_

☐ Propulsion    ☐ Gear Box    ☐ Hydraulic    ☐ Transom  
☐ Other \_\_\_\_\_

☐ Engine    ☐ Gear Box    ☐ Hydraulic    ☐ Transom  
☐ Other \_\_\_\_\_

### COMPLEMENT REGISTRATION

Complement Type (Check One)

☐ Captain    ☐ Skipper    ☐ Crew    ☐ Passenger  
☐ Other \_\_\_\_\_

☐ Captain    ☐ Skipper    ☐ Crew    ☐ Passenger  
☐ Other \_\_\_\_\_

☐ Captain    ☐ Skipper    ☐ Crew    ☐ Passenger  
☐ Other \_\_\_\_\_

☐ Captain    ☐ Skipper    ☐ Crew    ☐ Passenger  
☐ Other \_\_\_\_\_

**YACHT SAMPLES LABORATORY**  
1660 CALIFORNIA AVE, SUITE B  
P.O. BOX 5082  
SALT LAKE CITY, UT 84104

**YACHT SAMPLES LABORATORY**  
1660 EVERGREEN BLVD, SUITE 400  
DULUTH, GA 30096

**YACHT SAMPLES LABORATORY**  
UL. RUBEŻ 46 H129  
81-412  
POZNAN, POLAND



2

## Shipping Samples

Attach the return address label for the laboratory location nearest you to the black mailer.

- Include sample jar and sample information form, if applicable, in black mailer
- Ship by trackable delivery service such as UPS, Fedex or DHL

3

## Sample Reports & Online Data Management

To submit subsequent sample reports online, visit [www.eoilreports.com](http://www.eoilreports.com). On this site, you'll use our **HORIZON®** data management tool to:

- Add or update component information online
- Submit samples
- Receive immediate test results after processing is complete
- Place critical components on asset watch and receive email alerts on high severities
- Document maintenance action taken
- Estimate cumulative savings to bring visibility to program value







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