FAST™ lubricant analysis services

maintain and protect crucial equipment onboard
and increase the efficiency of your vessel
The marine industry has experienced great change over recent years and with even more change on the horizon with global sulphur limit legislation, it’s more important than ever to protect and ensure optimal operation of your vessels equipment.

In recent years the global marine industry has seen tremendous changes triggered by:

- demand for more efficient engines
- increased environmental awareness and legislation
- global upward pressures on fuel and lubricant prices
- changes in residual fuel oil quality

protecting your assets in a changing world

the range of FAST™ lubricant analysis services:

1. FAST Service ....................................................... page 3
2. FAST OnBoard ................................................... page 7
3. DOT.FAST® Service ........................................... page 8
4. Sweeptest ......................................................... page 14
5. XLC/XLI Refractometers ............................ page 15
Predictive measures and analysis play a vital role in the maintenance of equipment on board your vessels, and Chevron's FAST™ service can help you identify contamination and wear — **before** it results in costly downtime.

**What is FAST?**

FAST is a comprehensive fluid analysis service performed in our ISO 17025 certified labs. FAST helps protect your vessels, with online access to a readily accessible database of fluid analysis reports and expert commentary.
The advantages of using FAST™ for managing and monitoring the condition of all lubricated equipment on board are numerous:

✔ Accurate results on diverse test packages and flexibility for specialized testing procedures
✔ Reliable interpretations of test results and actionable recommendations based on the data
✔ Reports which have been optimized for readability
✔ Expert advice on reports via helpdesk: CMLfast@chevron.com
✔ Samples are tested at our dedicated ISO certified laboratories in Belgium and China
✔ Cost-effective standard and specialty tests
✔ Online access to complete historical records (downloadable through Excel® 5.0 or higher)
ISO 17025 certified laboratories

Chevron’s laboratories are some of the best equipped in the marine industry. With facilities in China and Belgium we deliver reliable, expert support wherever you are in the world.

Our global marine team is on call to accurately diagnose the condition of your equipment — FAST!

what you can expect from implementing this program

FAST™ enables you to track the performance of equipment that your business depends on to get your cargo to points around the globe on time and without incident.

By analyzing operating fluid on a regular basis, you can optimize equipment life and oil replacement intervals — and identify issues before they result in damage — through follow up on the trends of the different parameters.

This knowledge helps in the precise scheduling of maintenance work that can help reduce downtime and minimize the risk of equipment failure.

complete fluid analysis for improved marine reliability

The FAST program provides comprehensive analyses for all vessel equipment that requires lubricating oil, greases or coolants. Our stern tube advanced testing, for example, complies with the requirements of the major shipping classification societies.

A FAST report with satisfactory results on the analysis of the stern tube lubricant is a valuable tool when considering the extension of the period between dry-dockings for classification surveys.

A FAST report with satisfactory results on the analysis of the stern tube lubricant is a valuable tool when considering the extension of the period between dry-dockings for classification surveys.

what you can expect from implementing this program

FAST™ enables you to track the performance of equipment that your business depends on to get your cargo to points around the globe on time and without incident.

By analyzing operating fluid on a regular basis, you can optimize equipment life and oil replacement intervals — and identify issues before they result in damage — through follow up on the trends of the different parameters.

This knowledge helps in the precise scheduling of maintenance work that can help reduce downtime and minimize the risk of equipment failure.

complete fluid analysis for improved marine reliability

The FAST program provides comprehensive analyses for all vessel equipment that requires lubricating oil, greases or coolants. Our stern tube advanced testing, for example, complies with the requirements of the major shipping classification societies.

A FAST report with satisfactory results on the analysis of the stern tube lubricant is a valuable tool when considering the extension of the period between dry-dockings for classification surveys.

what you can expect from implementing this program

FAST™ enables you to track the performance of equipment that your business depends on to get your cargo to points around the globe on time and without incident.

By analyzing operating fluid on a regular basis, you can optimize equipment life and oil replacement intervals — and identify issues before they result in damage — through follow up on the trends of the different parameters.

This knowledge helps in the precise scheduling of maintenance work that can help reduce downtime and minimize the risk of equipment failure.

complete fluid analysis for improved marine reliability

The FAST program provides comprehensive analyses for all vessel equipment that requires lubricating oil, greases or coolants. Our stern tube advanced testing, for example, complies with the requirements of the major shipping classification societies.

A FAST report with satisfactory results on the analysis of the stern tube lubricant is a valuable tool when considering the extension of the period between dry-dockings for classification surveys.

FAST™ enables you to track the performance of equipment that your business depends on to get your cargo to points around the globe on time and without incident.

By analyzing operating fluid on a regular basis, you can optimize equipment life and oil replacement intervals — and identify issues before they result in damage — through follow up on the trends of the different parameters.

This knowledge helps in the precise scheduling of maintenance work that can help reduce downtime and minimize the risk of equipment failure.

what you can expect from implementing this program

FAST™ enables you to track the performance of equipment that your business depends on to get your cargo to points around the globe on time and without incident.

By analyzing operating fluid on a regular basis, you can optimize equipment life and oil replacement intervals — and identify issues before they result in damage — through follow up on the trends of the different parameters.

This knowledge helps in the precise scheduling of maintenance work that can help reduce downtime and minimize the risk of equipment failure.

complete fluid analysis for improved marine reliability

The FAST program provides comprehensive analyses for all vessel equipment that requires lubricating oil, greases or coolants. Our stern tube advanced testing, for example, complies with the requirements of the major shipping classification societies.

A FAST report with satisfactory results on the analysis of the stern tube lubricant is a valuable tool when considering the extension of the period between dry-dockings for classification surveys.

what you can expect from implementing this program

FAST™ enables you to track the performance of equipment that your business depends on to get your cargo to points around the globe on time and without incident.

By analyzing operating fluid on a regular basis, you can optimize equipment life and oil replacement intervals — and identify issues before they result in damage — through follow up on the trends of the different parameters.

This knowledge helps in the precise scheduling of maintenance work that can help reduce downtime and minimize the risk of equipment failure.

complete fluid analysis for improved marine reliability

The FAST program provides comprehensive analyses for all vessel equipment that requires lubricating oil, greases or coolants. Our stern tube advanced testing, for example, complies with the requirements of the major shipping classification societies.

A FAST report with satisfactory results on the analysis of the stern tube lubricant is a valuable tool when considering the extension of the period between dry-dockings for classification surveys.

what you can expect from implementing this program

FAST™ enables you to track the performance of equipment that your business depends on to get your cargo to points around the globe on time and without incident.

By analyzing operating fluid on a regular basis, you can optimize equipment life and oil replacement intervals — and identify issues before they result in damage — through follow up on the trends of the different parameters.

This knowledge helps in the precise scheduling of maintenance work that can help reduce downtime and minimize the risk of equipment failure.

complete fluid analysis for improved marine reliability

The FAST program provides comprehensive analyses for all vessel equipment that requires lubricating oil, greases or coolants. Our stern tube advanced testing, for example, complies with the requirements of the major shipping classification societies.

A FAST report with satisfactory results on the analysis of the stern tube lubricant is a valuable tool when considering the extension of the period between dry-dockings for classification surveys.
the FAST™ process

Submitting samples for FAST™ analysis is as easy as 1–2–3.

1. Prepare sample and complete the information on Label 3.
2. Add Label 2 to the bottle, keeping Part 1 for your records.
3. Send the sample bottle along with Label 3 in the sample bag provided.

Customers calling at China mainland ports can send samples to our FAST Chinese laboratory. All other samples should be mailed to our laboratory in Belgium. Most sample analysis will be completed within 24–48 hours of receipt, and your reports are conveniently delivered by email. Address labels can also be downloaded from the Chevron Marine Lubricants website.

standard test packages

FAST simplifies the process of testing with a list of standard tests for frequent, typical applications. Samples are analyzed according to a particular test schedule, depending on the type of lubricant and the application. Examples of typical analysis are indicated to the right.

<table>
<thead>
<tr>
<th>Engine Oils</th>
<th>Non-Engine Oils</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Appearance</td>
<td>• Appearance</td>
</tr>
<tr>
<td>• Water</td>
<td>• Water</td>
</tr>
<tr>
<td>• Viscosity@40°C</td>
<td>• Viscosity@40°C</td>
</tr>
<tr>
<td>• Base Number</td>
<td>• Base Number</td>
</tr>
<tr>
<td>• Soot Load, %wt</td>
<td>• Wear elements</td>
</tr>
<tr>
<td>• Flash point</td>
<td>• Additive elements</td>
</tr>
<tr>
<td>• Wear elements</td>
<td>• Total Acid Number</td>
</tr>
<tr>
<td>• (Nature of water*)</td>
<td>• (Nature of water)</td>
</tr>
</tbody>
</table>

For more information on standard test packages, visit www.chevronmarineproducts.com

the FAST report

As soon as the lab has completed testing your samples, our in-house experts review the data and provide comprehensive comments and recommendations. Each report includes a traffic light icon, indicating whether the condition of the sample is normal or if further action needs to be taken. The reports also contain historical data for follow up on the trends of the different parameters, providing operators with a full overview of the condition of their equipment.
The FAST OnBoard test kit from Chevron Marine Lubricants offers ship engineers a compact, portable and easy-to-use array of tests to quickly and accurately assess the performance of oils used aboard their vessels.

Benefits of FAST OnBoard
- Portable, lightweight, robust kit
- Fast and easy to use
- Suitable for lubricants, hydraulic, gear, compressor and fuel oils
- Immediate test results, no ‘lab lag’
- Continuity in sampling and testing regime
- Key oil parameters monitored
- Non-hazardous reagents
- Supplied with full instruction manual
- Allows the user to monitor trends
- Greater optimization when used alongside DOT.FAST®

Multi-parameter test features
- **Water** — The supplied water test cell, with its easy-to-read digital display, provides instructions and results at various concentrations from 200–10,000 ppm, 0–10%.
- **Base Number** — Utilizing the same reaction cell used for water, the FAST OnBoard Kit reports the used BN value for oils up to 150 BN.
- **Insolubles** — Chromatography papers easily display soot/carbon accumulation in the lubricating oil. High insoluble content in engine oils can be caused by poor combustion, poor filtration/separation, or keeping the oil in service for too long. High soot content can lead to increased viscosity and filter blocking.
- **Viscosity Comparator** — Recognized as one of the most important oil characteristics, the Viscostick provides a direct comparison of a used oil viscosity against a sample of the new oil, helping to identify fuel dilution, oxidation, emulsification issues.
- **Salt Water Determination** — A simple colour change pad easily indicates Sodium Chloride contamination from seawater.

Why should you use FAST OnBoard?
- Identifies earliest onset of change in the condition of your asset
- Allows engineers to take immediate action based on results
- Enables identification and use of correct grades and types of oil
- Encourages a monitoring culture on-board vessels
- Regular testing of critical operating equipment saves costs

### FAST OnBoard features by application

<table>
<thead>
<tr>
<th>Application</th>
<th>Water</th>
<th>Base Number</th>
<th>Insolubles</th>
<th>Viscosity</th>
<th>Salt Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>New diesel engine oil</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Used diesel engine oil</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Cylinder/Scrapedown oil</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic oil</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gear oil</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Greases</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Compressor oil</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Turbine oil</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Heavy fuel oil (HFO)</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Marine gas oil (MGO)</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Diesel fuel</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>
“Continuous monitoring of drain oil samples is a good way to optimize the cylinder oil feed rate and consumption and to safeguard the engine against excessive wear. The fastest way to evaluate the corrosive behavior of an engine and optimize the feed rate is to do a stress test, a so-called sweep test. It can also be used in the ACC familiarization period to find the suitable lube oil feed rate for your particular engine, operating pattern and lube oil used.”

MAN Energy Solutions SE

“Measuring the total iron content of piston underside drain oil with Chevron’s DOT.FAST® Service provides very valuable feedback of the piston running conditions in each cylinder, and allows operators to optimize cylinder oil feed rates for a specific set of operating conditions.”

Wärtsilä Switzerland
why should your fleet use drip oil analysis?

With IMO 2020 bringing the greatest change to the marine industry in many years, it’s critical to ensure optimized engine operation as you navigate change. Whatever your 2020 compliance option, DOT.FAST will help you reduce wear and corrosion, ensure the correct feed-rate and increase engine efficiency.

For this reason, it is now more important than ever to better understand and balance conditions in your engine.

Drip oil analysis can give you the answers and is recommended by the major slow speed 2-stroke engine OEMs (MAN Energy Solutions SE & Winterthur Gas & Diesel Ltd.). Analysis of unburned cylinder lubricant which has passed the piston and rings to the main engine stuffing box is an effective way to monitor engine wear using DOT.FAST.

“It is MAN’s experience that, in addition to regular scavenge port inspections, drip oil analysis can be a very useful tool to monitor combustion and cylinder conditions. Drip oil analysis can detect changes in cylinder liner wear and help to optimize the cylinder oil feed rate. “Chevron’s DOT.FAST® Service makes it possible to monitor, both onboard and onshore, the total amount of adhesive, abrasive and corrosive wear.”

MAN Energy Solutions SE
the DOT.FAST® service provides your fleet with accurate and comprehensive onboard and onshore analysis of drip oil, and takes the total iron wear into account

Everything you need to get started is supplied with your first order, where we then make sure that with every DOT.FAST onboard analyzer at least one DispoRack is included.

onboard analysis

The benefits you may receive from onboard analysis include:

• Reliable OnBoard wear measurement with laboratory accuracy
• Immediate feedback on cylinder running conditions
• Optimized cylinder lubrication at different engine operating modes
• Early indication of elevated engine wear of any type
• Minimized build-up of abrasive deposits and engine fouling
• Reduced risk of scuffing
• Minimized cylinder oil consumption by optimizing cylinder oil feed rate
• Combined with on board testing of the Base Number, it is possible to determine if the wear is of corrosive nature.
• Easy compliance with engine builders’ recommendations
• Better engine protection while fuels of varying quality and catfines content are in use
• Increased time between overhauls
• Predictive maintenance and less downtime, i.e., Condition Based Monitoring (CBM)
• Monitoring of running-in of new units
• A valuable complement to regular engine inspections

onshore analysis

The additional benefits of onshore analysis may include:

• Testing of drip oil samples via highest industry standards in two quality certified laboratories
• Comprehensive reporting with to-the-point commenting considering the full picture
• Monitoring effectiveness of fuel purification through measurement of CAT Fines
• Identifying excessive system oil leakage (for example, through stuffing box glands)
• Monitoring of piston ring groove wear
• Indication of blow-by

Recommended sampling frequency for Onboard Drip Oil Analysis (or each time the vessel switches to a new batch of HFO). Recommended sampling frequency for Onshore Drip Oil Analysis.
The DOT.FAST® Service was evaluated in cooperation with operators and equipment builders in the marine and power generation industries.

In field tests onboard Wallenius Marine’s M/V Undine and Suisse Atlantique’s M/V Général Guisan, lubrication engineers and crew members found the DOT.FAST Drip Oil Analyzer to be both effective and easy to operate.
the sulphur/base balance

High sulphur fuel oil burns to produce oxides of sulphur (SOx) during combustion. In the presence of water, these SOx form sulphuric acid which causes corrosion in the engine; different levels of sulphur in the fuel oil contribute to varying levels of acidity.

One task for the cylinder oil is to protect the engine from acidic corrosion. This is achieved by the alkalinity of the cylinder oil, defined by its base number (BN) and its feed rate. Too much alkalinity however, will result in the formation of excessive abrasive deposits on the piston crown top lands, ultimately leading to increased liner wear and scuffing.

It is important to maintain the correct sulphur/base balance. This balance can be achieved by changing to a cylinder oil with an appropriate BN, by adjusting the cylinder oil feed rate or a combination of the two. Chevron Marine Lubricants offers cylinder oils with a very wide BN range, going from 20 BN to 140 BN (Taro Ultra 20, Taro Ultra 40, Taro Ultra 70, Taro Ultra 100, and Taro Ultra 140).

The total iron content measured by DOT.FAST® indicates the total wear taking place in the engine, including corrosive wear, enabling you to make any necessary adjustments.

This graph is based on real time data and will vary from engine to engine.
**onboard analysis**

The DOT.FAST® Drip Oil Analyzer is unique and innovative in the industry and delivers onboard test results with laboratory accuracy. The DOT.FAST Drip Oil Analyzer comes with everything you need to prepare and test samples, including a custom-designed DispoRack and software to record, process and interpret results.

Using the Drip Oil Analyzer once every two weeks ensures effective management of your engine's lubrication. It can also be beneficial to do onboard drip oil analysis after changing to a new batch of fuel oil or to monitor the running-in process of new overhauled units.

**onshore analysis**

Samples sent to Chevron's laboratory are fully analyzed (base number, iron and all other elements). The results are tabulated and reviewed by technical experts.

Recommendations are reported back to the ship. Historical data is maintained and can be accessed via a password-protected Internet site.

Subscribers to the DOT.FAST Service may send a full set of samples for analysis once every two months.

*Always confirm that the product selected is consistent with the original equipment manufacturer’s recommendation for the equipment operating conditions and customer’s maintenance practices.*

---

**Correlation Between Onboard and Onshore Analysis**

![Graph showing correlation between onboard and onshore analysis of iron (ppm) using ICP-AES and DOT.FAST Drip Oil Analyzer results.](image)
sweeptest sample analysis

Performing a sweeptest is the shortest way to determine the optimal oil feed rate factor, bringing valuable cost saving efficiencies to your operation, and is recommended by major OEMs such as MAN Energy Solutions AS.

Analysis of sweeptest oil samples is conducted on-shore at our ISO certified laboratories, and customers receive feedback in a fully reviewed FAST™ report within 24–48 hours of receipt of the final sample. These reports indicate what the optimum oil feed rate factor (g/kWh * S%wt) is with the given cylinder oil in use. FAST sample kits contain everything you need to conduct the tests, including standard sized sample bottles, labels and pre-addressed envelopes for our laboratories.

sweeptest sample delivery

To be included with each batch of samples:

- **Completed DOT.FAST® engine data sheet**
  - Download a copy from the DOT.FAST CD-ROM or from the CML website:
    - chevronmarineproducts.com/en_UK/lubricants-services/dotfast-drip-oil-analysis-service.html
  - Batches received without this sheet will not be analyzed.

- **One main engine system oil used sample**
  - Required in order to calculate the amount of system oil dilution in the drip oil samples.

- **Fully completed FAST sample labels for each bottle**
  - These tests will be handled separately in the laboratory.

Testing guidelines:

1. **For the cylinder oil to be evaluated, collect drip oil samples at different cylinder oil feed rates.** A typical approach is to start at 1.4 g/kWh and lower in steps of 0.2 g/kWh to the OEM minimum recommended. For every step, collect the samples after 24 running hours from every cylinder at the same time (complete batch of samples).

2. **Use FAST labels** and indicate the corresponding cylinder number on the label. Fully complete a FAST label for any system oil sump tank sample included.

3. **Always include a completed DOT.FAST engine data sheet with every batch of samples.**

4. **Send completed sweeptests to our global FAST laboratories.** Please do not send FAST samples to the personal attention of any of our staff as this will delay processing (use addresses located on back).
Refractometer testing
This method is easy to perform with Chevron’s portable refractometers for Delo XLI or XLC cooling water treatment respectively, and does not require extensive sample handling or expensive equipment.

Comprehensive FAST™ reports
Chevron’s FAST service provides in-depth onshore analysis of your cooling water samples at advanced global laboratories. We report on several parameters and elements in your cooling water samples, as part of our comprehensive equipment monitoring program.

Chloride and pH monitoring is easy
Delo XLI’s Organic Acid Inhibitor Technology (OAT) corrosion inhibitor system is designed to protect cast iron, copper and other system metals at lower pH levels than conventional coolants. Acid and base indicator strips are used to easily measure pH balance. High chloride levels can significantly increase the risk of corrosion, and are also evidence of seawater contamination in the system.

For onboard testing, test strips can be used for quickly and conveniently measuring rough chloride levels in cooling water. Chevron recommends testing the Delo inhibitor cooling water treatment’s concentration, pH value and chloride levels once a week.

Below, left to right: Chevron’s Portable XLI Refractometer designed to measure % Brix, pH and chloride test strips.
all samples from any of the lubricant analysis services mentioned in this brochure are to be sent to the following addresses:

Inform the courier company that the receiver is ‘Warehouse Assistant’.

Chevron Marine Lubricants — FAST Program
Chevron Technology Ghent
Technologiepark — Zwijnaarde 88
B-9052 Ghent/Zwijnaarde
Belgium
Tel: +32 9 2937141

Samples landed in mainland China can be sent to our laboratory in Shanghai:

Chevron Marine Lubricants — FAST Program
SGS-CSTC Standards Technical Services Co., Ltd
No.88 Pugong Road, Fengxian District
Shanghai Chemical Industrial Park,
Shanghai, 201507, China
上海市奉贤区化学工业区普工路88号（201507）
Tel: +86 021 6027 6372

Search our YouTube channel for Chevron Marine Lubricants training videos on how to conduct safe, reliable tests and visit our website chevronmarineproducts.com for more FAST resources.

www.chevronmarineproducts.com