Orbital combines the concept of the Journey of the Lubricant, oil sampling data, peripheral equipment, and environmental information to provide you with the most comprehensive oil analysis program. Orbital allows you to compare, combine, analyze, and report on all data points surrounding the health of your equipment and lubricant. Welcome to the new era of oil analysis...Oil Intelligence.
Journey of the Lubricant is a Key Piece of Oil Intelligence

Oil analysis is used as an early detection of problems in equipment; however, issues tend to start well before the lubricant ever reaches the intended application. Trico's philosophy focuses on the practices that are directly impacting the equipment – from the time the lubricant arrives to the time its life is spent in the equipment. We call this Journey of the Lubricant® and believe this the best methodology when evaluating a reliability program and its practices.

The Journey of the Lubricant is broken down into 5 stages - Arrival, Storage, Transfer, Application, and Lifecycle. Adding oil analysis at these different stages, which we refer to as dimensional sampling, provides deeper, more valuable insight into the viability of your equipment lubricants and your practices.

Using these multiple data points and continuously cross-referencing and interpreting the relationships among them you can uncover answers that make a real impact on your lubricants, your equipment, and your whole operation. We call this more complete application of knowledge - Oil Intelligence. Utilizing this approach, you can look at each Journey of the Lubricant stage individually and implement incremental changes that can make a significant impact. So,

**ARRIVAL**
Provides indication of the condition and care your supplier has taken to ensure lubricant meets specifications and is contaminant free.

**STORAGE**
Storage practices begin to identify how your practices are impacting your lubricant condition.

**TRANSFER**
Provides the best baseline for your equipment test results. Any changes from storage to transfer are affected by personnel interactions.

**APPLICATION**
Improper equipment configuration can allow contaminants into your system or cause the production of wear particles. Oil analysis offers the earliest warnings of wear and helps detect detrimental contamination.

**LIFECYCLE**
The most effective maintenance programs incorporate on-going, routine oil analysis, and data trending for continuous improvements and monitoring of lubricant and equipment condition.
The Value of Oil Intelligence

FEATURES

- Dedicated lubricant advisor provides step-by-step support for results interpretation, program customization, and equipment solutions
- Detailed platform and reports with relatable data, visual tools, and recommendations by experienced analysts
- Experienced laboratory and analytical staff - ensuring high quality and timely information
- State-of-the-art laboratory instrumentation utilizing applicable ASTM and ISO standards for producing reliable test data
- High-quality supplies and hardware available for consistent, repeatable sample collection
- Service and parts support to assist in lubrication program implementation

BENEFITS:

- Downtime can be organized and planned rather than reactive
- Troubleshoot problems with more precision, less guesswork
- Minimize component wear and extend equipment life
- Ensure lubricant condition for continued use
- Monitor viscosity levels for optimum performance
- Increase equipment reliability
- Extend oil change intervals

OIL INTELLIGENCE INDICATES:

- Chemical contamination of the lubricant
- Usable life of the oil
- Normal and abnormal machine wear
- Dissolved elements and concentration of additives
- Trends that contribute to harmful performance
- Optimum oil change intervals
Harsh operating conditions, extreme loads, and the high costs of replacement parts make oil analysis necessary in increasing the longevity of equipment. Routine oil analysis identifies problems before they become failures and allows you to take the necessary corrective actions.

Our industrial oil analysis combines the Journey of the Lubricant, dimensional oil sampling, and a variety of physical and chemical tests to assess lubricant condition and its ability to perform, as required by the equipment's application. We provide a variety of test packages to determine contamination levels and the health of your lubricant so you can take the necessary actions when needed.

<table>
<thead>
<tr>
<th>Description</th>
<th>ASTM Standard</th>
</tr>
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<tbody>
<tr>
<td>Acid Number</td>
<td>ASTM D664</td>
</tr>
<tr>
<td>Concentration of Small (&lt;5 um) Wear Particles</td>
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<tr>
<td>Concentration of Large (&gt;5 um) Wear Particles</td>
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<tr>
<td>Wear Particle Concentration (WPC)</td>
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<tr>
<td>Wear Metal Concentration</td>
<td>ASTM D5185</td>
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<tr>
<td>Concentration of Contaminants</td>
<td>ASTM D5185</td>
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<tr>
<td>Additive Concentrations</td>
<td>ASTM D5185</td>
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<tr>
<td>Oxidation Testing</td>
<td>ASTM E2412</td>
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<tr>
<td>Anti-Wear Evaluation</td>
<td>ASTM E2412</td>
</tr>
<tr>
<td>Nitrating, Sulfating, and other Chemical Characteristics</td>
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<tr>
<td>Particle Count for Fluid Cleanliness (ISO 4406)</td>
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<tr>
<td>Percent Water Concentration</td>
<td>ASTM D6304</td>
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<tr>
<td>Water Confirmation by Crackle Test</td>
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<tr>
<td>Water Concentration in PPM</td>
<td>ASTM D6304</td>
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<tr>
<td>Viscosity at 40°C cSt</td>
<td>ASTM D445</td>
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<tr>
<td>Visual Inspection</td>
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<tr>
<td>Wear Particle Metallurgy for Samples with Potential Wear Conditions</td>
<td>ASTM D7690</td>
</tr>
<tr>
<td>Wear Particle Types for Samples with Potential Wear Conditions</td>
<td>ASTM D7690</td>
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</tbody>
</table>
Operating equipment such as turbine units, large hydraulic units, and large compressors are critical to operations and have major costs associated with maintenance activities or downtime. Advanced annual testing provides an additional layer of insurance, recommended by organizations like EPRI and ASTM. The added testing is aligned with common issues that these large reservoir units often encounter and is designed to provide remaining useful lifetime frames to allow planned maintenance, instead of reactive downtime.

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<tr>
<td>Color</td>
<td>ASTM D1500</td>
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<tr>
<td>Demulsibility/Water Separability</td>
<td>ASTM 1401</td>
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<td>Wear Particle Concentration</td>
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<td>Foam Sequence 3</td>
<td>ASTM D82</td>
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<td>Oxidation/Nitration</td>
<td>ASTM E2412</td>
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<tr>
<td>Elemental Analysis (wear metals, contaminants, and additives)</td>
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<tr>
<td>Karl Fischer</td>
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<tr>
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<td>MPC Varnish</td>
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<tr>
<td>Viscometer 40°C cSt</td>
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<td>Visual/Crackle</td>
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<td>Wear Particle Analysis</td>
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Other Testing Services

TRANSFORMER TESTING
Transformer lubricant analysis provides customizable testing programs to adapt to each transformer's unique needs. Transformer downtime or failures present major safety risks, high repair costs, and extended downtime. Trico's testing program utilizes a vast array of testing to identify possible problems such as contact arcing, aging insulation, and latent faults.

COOLANT TESTING
Controlling equipment temperature is necessary for optimum operating performance. Trico's coolant analysis alerts you to coolant breakdowns that may contribute to engine failures. Our trained technicians measure your coolant's freezing point, boiling point, and contamination levels in order to help you make seasonal change-out decisions.

FUEL TESTING
Fuel quality is essential to proper and cost-efficient engine operation. Long-term storage and transfer of fuels can result in water, sludge, or organic contamination. Chemical and physical properties may also deteriorate. Fuel contamination and degradation are often the cause of diesel engine failures. Trico's fuel analysis service provides information to help you maintain the highest engine performance. These tests allow you to screen out poor quality stocks and ensure that your fuel meets regional and seasonal operating requirements.
Wear Debris Analysis (Ferrography)

**BENEFITS:**

- Determine start of abnormal wear
- Assess the severity, origin, and development mechanism of particles
- Evaluate particles contaminating the lubricant sample
- Predict equipment wear condition and failure potential
- Qualitatively determine the size, shape, composition, and concentration of particles
- Identify the source of wear
- Determine lubricant life
- Particle analysis 0-300 microns

Trico is the pioneer in Wear Debris Analysis (Ferrography). Our service provides accurate insight into the condition of an equipment’s lubricated components by examining wear particles and contaminants suspended in the fluid – including grease and water-based fluids. These particles can reveal abnormal wear, components involved, and the cause. Our predictive analysis will identify wear-related conditions at an early stage, preventing catastrophic equipment failure. Trico reduces repair costs by diagnosing maintenance requirements before extensive equipment damage and unscheduled shutdown occur.

**DIRECT READING FERROGRAPHY**

Direct Reading Ferrography magnetically separates wear particles and optically measures the quantity of large and small particles present in the oil sample. Results from direct reading ferrography indicate the rate, intensity, and severity of wear. With these measurements, machine wear baselines can be established and trends in wear conditions can be monitored. If there is a significant increase in the wear trend levels, a detailed analytical ferrography should be performed.

**ANALYTICAL FERROGRAPHY**

When Direct Reading Ferrographs and/or other analysis indicate abnormal wear, Trico's Analytical Ferrography can further pinpoint its source and the specific type of wear. Our skilled analysts will extract, classify, and visually analyze wear particles and solid contaminants. Particles are examined under a powerful optical microscope to determine the size, concentration, color, shape, and particle composition. Results received from Trico's analytical ferrography provide for the application of timely, corrective maintenance, based on a machine's actual condition.
Trico Oil Analysis Lab ISO Certifications

Trico is committed to providing quality oil analysis services. To meet this high level of quality our lab is ISO 9001:2015 certified and ISO/IEC 17025:2017 accredited which means we implement a quality system that is aimed at improving our ability to consistently produce valid results for our customers. ISO/IEC 17025:2017 is an International Standard designed for the accreditation of Testing and Calibration Laboratories. It includes quality management system requirements along with technical requirements to ensure that each laboratory is equipped to perform particular tests and calibration activities.

- ISO 9001:2015
- ISO/IEC 17025:2017

**BENEFITS:**

- Demonstration of a well-established quality management system producing reliable and competent test and calibration results
- Reduction of the amount of regulatory assessments required
- Competitive advantage in the marketplace
- International recognition of test and calibration reports

**A Few Of The Industries We Service**

- Aerospace
- Automotive
- Chemical
- Construction
- Food and Beverage
- General Manufacturing
- Marine
- Metal and Fabrication
- Mining
- Oil & Gas
- Pharmaceutical
- Power Generation
- Pulp and Paper
- Waste Management Facilities
- Wastewater and Water Treatment
Orbital...where oil analysis ends, and oil intelligence begins.

Orbital allows you to compare variables across your process including environment, practices, and equipment setups to identify the factors compromising your oil's condition and equipment's performance.

Doing dimensional sampling at predefined locations across your oil's journey and paired with mobile application data input provides you variable filters within Orbital to evaluate and pinpoint where and what is having the greatest impact on your program. You’re able to evaluate sample results from equipment inside compared to outside, by equipment or lubricant type, or by sample methods and locations creating clarity about where to focus initiatives to address your greatest problems.

It's not just oil analysis anymore; it's oil intelligence.

Orbital helps you see the commonality between small and vast amounts of information.

CORRELATION
See the relationships between data using factors such as operating environment, your practices, equipment type, and lubricant type.

VISUALIZATION
The data is displayed in simple, visual formats such as charts, graphics, and tables for ease of analysis and interpretation.

ANALYSIS
Provides the capability to categorize, manipulate, and summarize data to find trends and relationships.

INTERPRETATION
Allows you to see the meaning of your data to make the necessary decisions needed for the most appropriate maintenance action.
INCREASE EQUIPMENT AVAILABILITY
Quickly see equipment that needs attention, so you can focus directly on the issue.

UNCOVER BAD ACTORS
Find trends using in-depth data correlation, enabling you to fine-tune equipment performance and identify habitual bad actors.

ANTICIPATE FAILURES
Anticipate failure risks with more data, so you can prevent problems before they occur.

TREND HISTORICAL DATA
Benchmark and track data to make real, sustainable improvements that have a profound impact on multiple areas of your reliability program.

GAIN CONTROL
Full control to easily update and add new equipment and lubricant information.

JOURNEY SCORE
Provides insight into your practices through the Journey of the Lubricant based on dimensional sampling and information provided on lubricant quality, protection practices, contamination ingress, and equipment protection.

MOBILE APP
Orbital Mobile App provides an easy method to edit sample information and submit it to the lab with no paperwork. Once the sample bottles are received by the lab you will receive notification when testing is in progress and complete.

CONDITION REPORTS
Detailed report that contains vital information about the condition of the lubricant and equipment. The report provides overall findings and recommendations from the lab.
Problems Begin Across Five Stages of Your Lubricants’ Journey

The Journey of the Lubricant Score provides insight into your practices based on dimensional oil sampling and information you provided on your Equipment Data Sheet (EDS). The scores are broken down by the 5 stages of the Journey of the Lubricant: Arrival, Storage, Transfer, Application, and Lifecycle. The scores include an Overall Score which is an average of the five Journey of the Lubricant stages. The scores are based on the following key factors:

FLUID QUALITY
Your oil analysis results are used to indicate the condition of your lubricant and its ability to perform as required by the equipment’s application.

PROTECTION PRACTICES
What types of practices you have in place to protect your lubricant from degradation.

CONTAMINATION INGRESSION
What methods you are using to protect your lubricant from water, particulate, and cross contamination.

EQUIPMENT PROTECTION
What methods do you have in place to protect your equipment from environmental conditions and the frequency you are performing oil analysis.

JOURNEY SCORE
Provides overall Journey of the Lubricant score based on your program practices and oil analysis results.

STAGE SCORE
Your results for each stage within the Journey of the Lubricant.

IMPROVE SCORE
An area to add/update answers that pertain your practices based on fluid quality, protection practices, contamination ingress, and equipment protection.

SOLICIT HELP
Email another person on your team to fill in the blanks to help you improve your score. We will email them the question(s) and copy you on their answers.

TROUBLESHOOTING GUIDANCE
Provides feedback on how to improve your score with detailed explanations.
Orbital - Condition Summary

Manage all the equipment and lubricant in your oil analysis program through Orbital.

**JOURNEY ANALYSIS**
Drill into your data using different parameters

**FILTER**
Locate just one sampling point or filter by a variety of parameters

**ALERTS**
View alerts that need immediate attention

**LABELS**
Print bar-coded bottle labels online

**SPID DETAILS**
Maintain accurate and up-to-date data points

**DATA POINTS**
Quickly and easily add new sampling points and reference oils

**CONDITION REPORT**
Provides analysis overview and access to individual reports

*Bringing you accurate, real-time lubricant and equipment condition data.*
**Orbital Mobile App**

**POWER AT YOUR FINGERTIPS**

Orbital Mobile App

Download the Orbital Mobile App to easily manage and submit your oil samples.

- No more paperwork - edit sample information prior to submitting them online
- Lab is notified when sample information has been submitted
- No internet, no problem - enter information offline, once you’re back online your information will sync
- Receive notifications when samples are received, in testing, when complete, and when report is ready to view

**HOW DOES THE APP WORK**

MOBILE APP

TRICO LAB

ORBITAL

NOTIFICATIONS

REPORTS

- Information is entered into the mobile app
- Trico is notified when sample(s) is (are) submitted
- Orbital Platform is updated with new information from mobile app
- Notifications are sent to mobile app and Orbital Platform when samples are received by Trico lab and are in processing
- Oil Analysis Condition Report is available on Orbital Platform
- Notification is sent to mobile app indicating report is ready for viewing

Orbital mobile app is coming soon to the App Store and Google Play.

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Google Play and the Google Play logo are trademarks of Google LLC.
BRINGING OIL INTELLIGENCE TO LIFE

ISO 9001:2015 Certified
ISO 17025:2017 Accredited