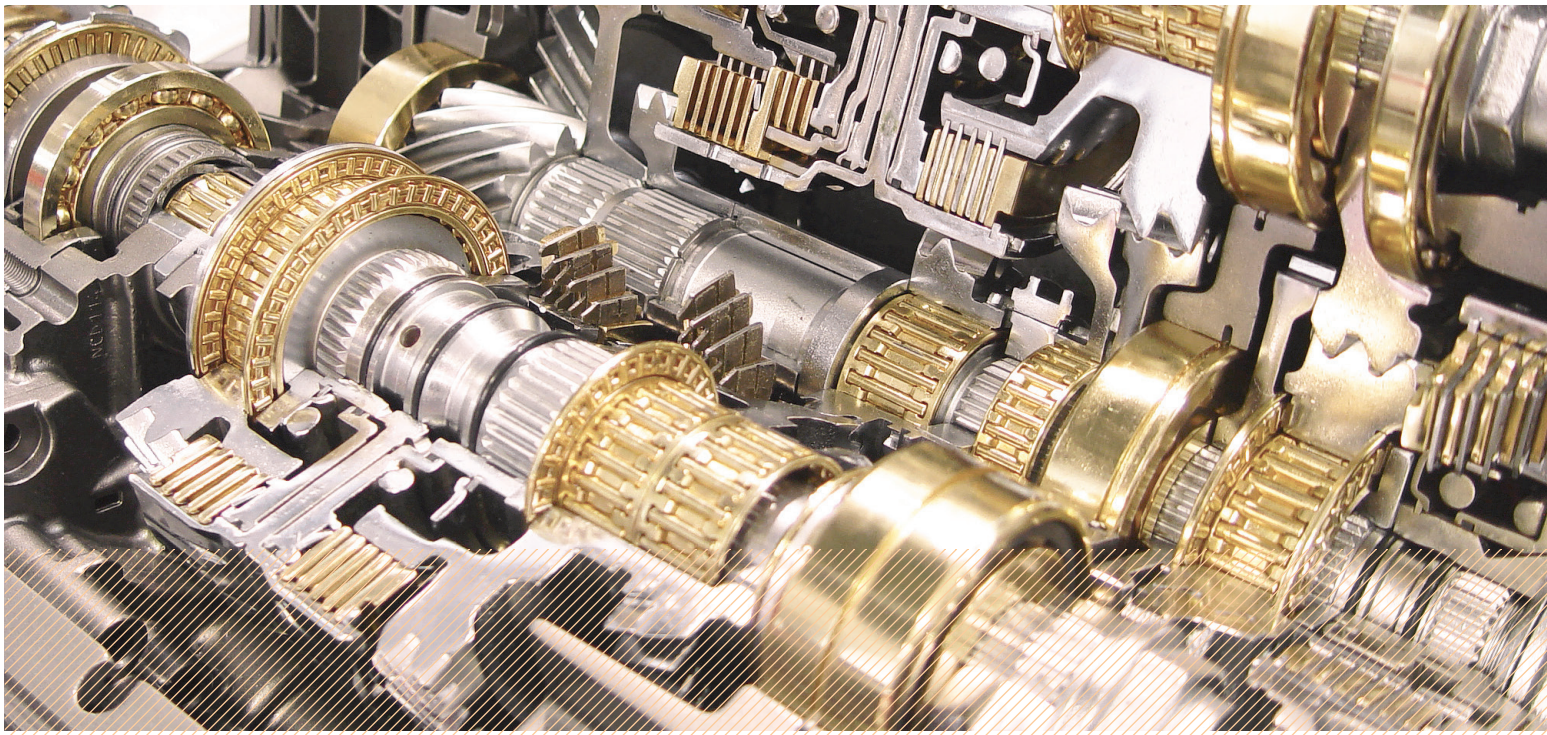
Risk Solutions



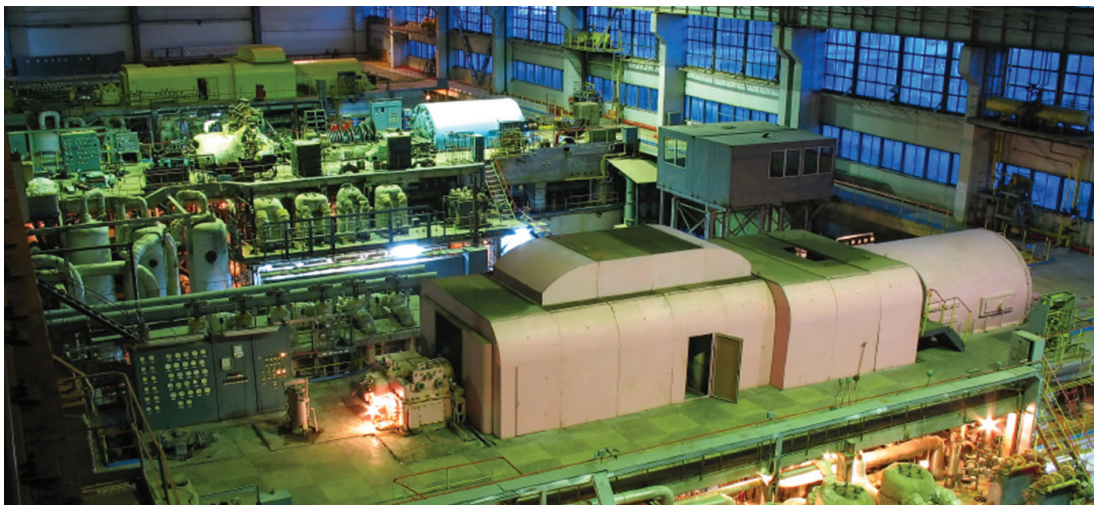
TOGA® Lube Oil, Hydraulic and Heat Transfer Fluid Analysis

Improving performance and protecting assets

Hartford Steam Boiler

Munich RE®


Munich RE
1866
Hartford Steam Boiler



Testing to protect your bottom line

Hartford Steam Boiler's (HSB) TOGA® lube oil and hydraulic fluid testing service can help prevent costly equipment breakdowns and failures. Our program offers superior technical advantages that help you get the most out of your equipment.

We add value by expanding your staff 's capabilities and improving your asset performance, without adding to your headcount.

A lot of companies offer testing, but...

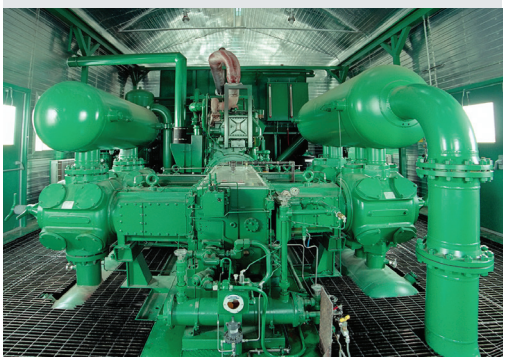
HSB's TOGA fluid testing service for lube oils, hydraulic and heat transfer fluids gives you a competitive edge. TOGA uses proven technology and engineering know-how to protect the integrity of your equipment, helping keep you on line and in business. TOGA's unique, interpretive lube oil and hydraulic fluid testing service provides you with:

- Sampling consultation
- Repeatable laboratory analysis
- Evaluation and trending of results
- Technical guidance
- Experienced, actionable intelligence

Your engine or compressor operated properly yesterday, so why shouldn't it operate tomorrow? TOGA can help answer this question.

Case study: Gearboxes and Compressors

A maintenance technician is given a work order to replace the lube oil in a critical gearbox or compressor. The technician finds a similar lube oil but not an exact match to the current lube oil. What he doesn't know is that the lube oils have specific characteristics that may not be compatible with all applications. Some fluid additives may even damage the equipment. Fluids containing an extreme pressure additive can chemically attack gearbox components containing bronze and copper bushings, seals and gears. This condition, if not found, could result in premature failure of critical components. This scenario plays out many times a day and is just one of the fluid characteristics that TOGA checks during routine fluid analysis.



A clearer picture through comprehensive testing

No single test can give a true picture of the equipment's condition. That's why Hartford Steam Boiler's TOGA program uses a number of different testing techniques to accurately identify equipment abnormalities. Our laboratories are recognized leaders in fluid analysis. TOGA recommends the most effective battery of tests for your specific equipment and equipment application.

TOGA provides spectrographic, physical properties, particle counts and fluid additive analysis for rotating equipment and hydraulic systems. Rotating equipment is critical for HVAC and power generation systems used at almost every location. This includes turbines, engines, gearboxes, compressors and motors. It even includes bio-gas testing to ensure the gas conforms to equipment specifications. Some manufacturer equipment warranties can be voided based on bio-gas quality. We use high-quality laboratories to quickly provide accurate results for analysis. Trending and equipment application are key focus points for our analysis and our service includes sample procedure consultation.

10-year HSB claims study for compressor losses (Top 8 occupancies)

Buildings and Offices	17.0%
Processing and Storage with Refrigeration	15.4%
Public Assembly	12.7%
Other	6.3%
Healthcare	6.2%
Metal Product Manufacturing	5.9%
Printing and Publishing	5.2%
Utilities	3.3%

Case study: Avoiding Loss

A food storage warehouse uses refrigeration for seasonal harvest product storage. An unexpected failure could jeopardize an entire season of fruit product valued at over $1 million. The lube oil of the 100-horsepower reciprocating compressor was recently replaced with a lower-cost alternative fluid. TOGA Lube Oil Analysis reported the fluid degraded quickly causing an elevated viscosity that increased bearing and piston wear. TOGA recommended an increased drain and replacement frequency to help prevent an unexpected compressor failure and the loss of product.

More than a report filled with numbers

TOGA gives you accurate information that you can act upon. HSB TOGA diagnoses equipment issues and identifies conditions that match failure trends and patterns. The system also notes gradual or dramatic changes in fluid condition by trending results with previous tests. We flag trouble signs and provide solutions. The data from each test is used to establish a baseline to compare against future test results. This data is also used to identify patterns and trends that can indicate a potential failure.

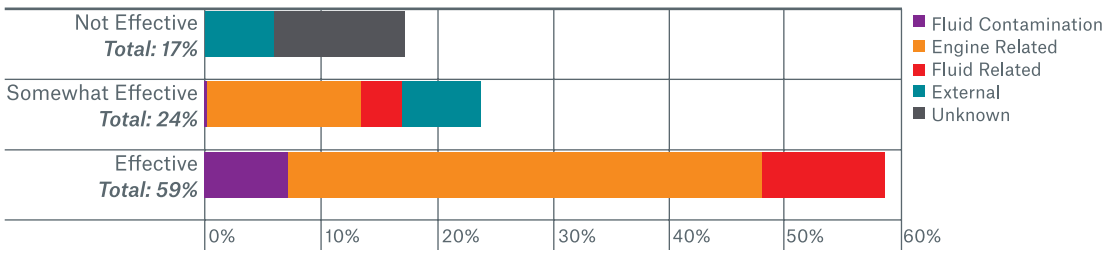
More than testing — you gain knowledge

Using the latest technology, TOGA has the technical capability, experience and the knowledge needed to enhance your equipment reliability and performance. Our technical staff specializes in fluid testing that provides you with a report that adds further insight into the equipment's condition. Our service includes an interactive web site to help you track:

- Online sample orders
- Online report review for current testing results
- Online view of historical data and trending
- Secure Internet site for your engineers and local maintenance personnel

TOGA gives you information for identifying problems with rotating equipment. This includes incorrect fluid additions, fluid contamination, coolant leakage, debris ingress, excess moisture content and abnormal wear. We help identify the problems that keep your equipment healthy and on-line.

10-year study on engine failures on lube oil analysis effectiveness



Case study: Engines

Engine lube oil spectroscopy reports elements used in additives, wear by-products and contaminates from external sources like fuel, coolant system and environment such as seawater. A bank of engines that was the sole source power supply for a power system reported elevated vanadium and sodium contamination. The primary source for vanadium and sodium is fuel oil but seawater contamination can significantly increase the sodium content. Vanadium and sodium form a metal salt at low temperatures that can foul a turbocharger and cause hot metal corrosion in the piston area. Hot metal corrosion, caused by acid formed during operation, wastes away metal surfaces. It also allows cylinder blow-by and can compromise the integrity of the cooling system. Fouled surfaces can be water washed to recover the lost efficiency. Treating the incoming fuel source to lower the sodium and selecting a different fuel source with lower vanadium and sodium concentration should be considered as a solution. The engine should also be operated within the manufacturer specifications to prevent hot metal corrosion of the valves and pistons.

TOGA screen tests

Lube & Hydraulic Fluid Screen tests include kinematic viscosity, acid number (AN) or base number (BN for engines), spectroscopy for metals, additives and contaminates, particle count, color and moisture content.

Heat transfer screen tests include kinematic viscosity at 40°C, acid number (AN), spectroscopy for metals, additives and contaminates, pentane insoluble; fluid color; cleveland open cup flash and fire point.

Typical lube oil and hydraulic fluid analysis methods

Viscosity is a measure of the internal resistance to flow or movement. It's one of the most important characteristics of a fluid. The viscosity index (VI) is a unit-less number giving the fluid relationship between viscosity and temperature. Turbine lube oil and hydraulic fluid are tested at 40°C and engine lube oil is normally tested at 100°C.

Neutralization number (AN or BN) is used to quantify the amount of acid present. Acid number (AN) is a measure of the mg of KOH per gram of fluid giving an indicate of fluid aging. Base number (BN) is a measure of excess alkalinity needed to neutralize acids from the combustion process.

FT-IR Spectroscopy detects fluid deterioration products through infrared spectrum analysis for compounds from nitration, sulfation and oxidation and contaminates like soot, glycol and water.

Atomic Emission Spectroscopy (ICP-AES) detects dissolved wear metals, additives and contaminates typically sized smaller than 2µ. ICP-AES uses the energy emitted from atoms to identify elements in parts per million (PPM). ICP-AES gives an indication of dissolved contamination from coolant sources with sodium, boron or potassium. Fluid manufacturers may also report the expect amount of additives used to provided enhanced equipment and fluid protection. Rotating disc electrode (RDE-AES) spectroscopy method identifies, in parts per million (PPM), dissolved wear metals, additives and contaminates typically for particle sizes between 2µ and 15µ sizes. The RDE method collects the sample onto a carbon disc which is consumed in a high voltage arc.

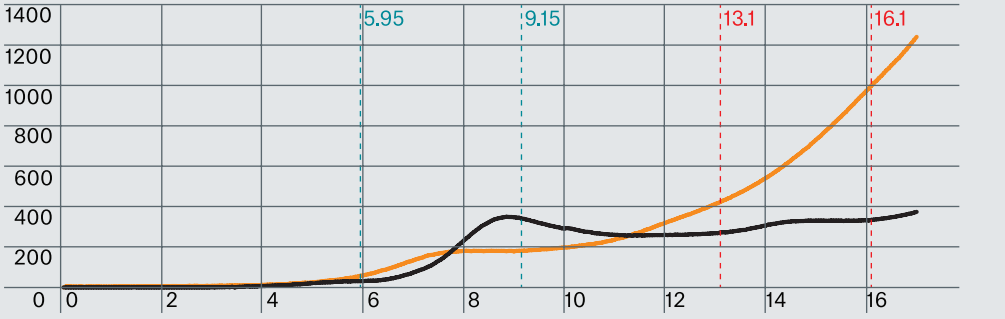
Particle count is based on the ISO 11218 Standard and related to the ISO 4406. Particles can cause wear or plug hydraulic system components. They can also be an indication of equipment deterioration. The particle counts help to identify system cleanliness issues using industry target cleanliness standards as a convenient method to trend changes in system cleanliness.

Flash Point is the lowest temperature that the gases given off by the fluid will ignite when brought in contact with an ignition source.

Fire Point is the lowest temperature that the gases given off by the fluid will sustain combustion.

Pour Point is the lowest temperature the fluid will pour.

Case study: Varnish



Linear sweep voltammetry peaks are integrated and compared to determine the remaining additive content.

The initial lube oil sample for a 400-megawatt steam turbine revealed the oil was very dark with an elevated acidity, prompting a varnish potential analysis. Varnish is a frequent problem in rotating equipment.

The varnish sticks to bearing surfaces causing elevated operating temperatures, reduced flow and premature bearing failure. The varnish potential analysis identified a significant amount of small soluble particles called varnish precursors. The linear voltammetry chart shown above compares anti-oxidation additive in new fluid (black) to the in-service fluid sample (orange). The test reported the remaining anti-oxidation additive was about 19% which will not prevent the formation of varnish.

There are several mechanisms that generate varnish including air induction, elevated temperatures, static electrification, incompatible fluid mixing; and bubble formation or foaming. Bubble formation then the adibadtic collapse generates very high temperatures. Static electrification is produced from laminer flow layers that build-up an electric charge which will arc and produce very high temperatures.

TOGA recommended a partial fluid replacement to increase the additives, and a fluid filtration system was installed to reduce the level of fluid contamination. These actions can help prevent premature bearing failure and lower the possibility of a forced outage. Severe steam turbine bearing damage can potentially drop the rotor, causing turbine blade tip and shaft seal rubs that will lower thermal efficiency and possibly cause a catastrophic failure.

Other services

TOGA® Electrical Insulating Fluid

HSB Infrared Thermography Services

Secure superior performance. Gain a competitive advantage. Add technical support to your staff without increasing headcount.

Visit our website at www.hsbtoga.com for more information.

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HSB-077 (New 03/14)

NOT IF, BUT HOW