



TEXACO

SERVICES & SOLUTIONS // **VARTECH**

Defeat destructive varnish to help optimise turbine performance



enduring
performance

Turbines are at the heart of your operation. If they're attacked by varnish, your production could halt.

Industrial operators have long been aware of the tremendous damage that varnish can do to their operations. Many of them know that varnish can lead to a range of equipment problems, from poor performance to catastrophic failures. They typically consider varnish, and the difficulties that come with it, as inevitable to doing business – something that's beyond their control.

You don't have to accept this.



Varnish attacks turbines from the inside, destroys performance and threatens operations. But to defeat varnish, you must first understand it...

The culprit

Varnish is a coating that adheres to internal surfaces, wears out equipment components, restricts performance and can ultimately cause failures. It is composed primarily of organic residue mixed with metals, inorganic salts and other contaminants. Varnish can take different forms, from a sticky coating to a hard lacquer, and ranges in colour from grey to brown to amber. Varnish is very destructive and hard to remove.

The causes

Varnish is formed when high operating temperatures deplete protective additives, causing the lubricant to oxidise and break down. Water, chemicals, particles, gasses and other contaminants also act to degrade the oil. Elements of this degradation, known as varnish precursors, precipitate out of the oil and attach themselves to internal surfaces. The tacky nature of these deposits attracts more and more precursors, and varnish builds up layer-by-layer.

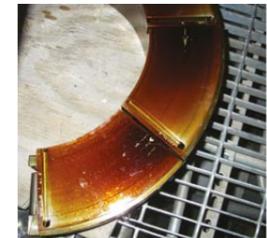
The cycle of failure

As varnish worsens, a vicious cycle is often set in motion. The coating insulates metal surfaces which prevents efficient oil cooling and raises the temperature. This causes more degradation and less effective lubrication. More precursors are created, more varnish layers are formed and the problem spirals toward equipment failure.

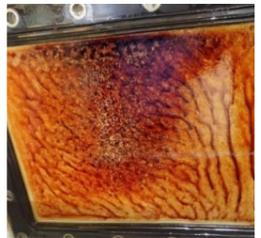
The consequences

Even the smallest amount of varnish can result in poor system performance and equipment failures. Valves stick, bearings overheat, components wear out, oil inlets and filters clog, and the internal mechanics of your turbine begin to malfunction. These issues tend to worsen over time as more varnish builds up, leading to shortened oil life, poor equipment performance and premature shut-downs.

It's time to fight back...



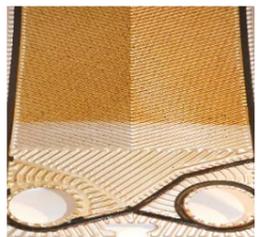
Thrust bearing tilt pad



Reservoir hatch cover



Reservoir floor



Heat exchanger cooling plate

The VARTECH Solution

Designed to protect equipment from varnish and help ensure peak productivity in your operation, the experts at Texaco® Lubricants have developed the VARTECH Solution.

Using VARTECH Technology, this two-step solution helps both clean and control varnish deposits in turbines.

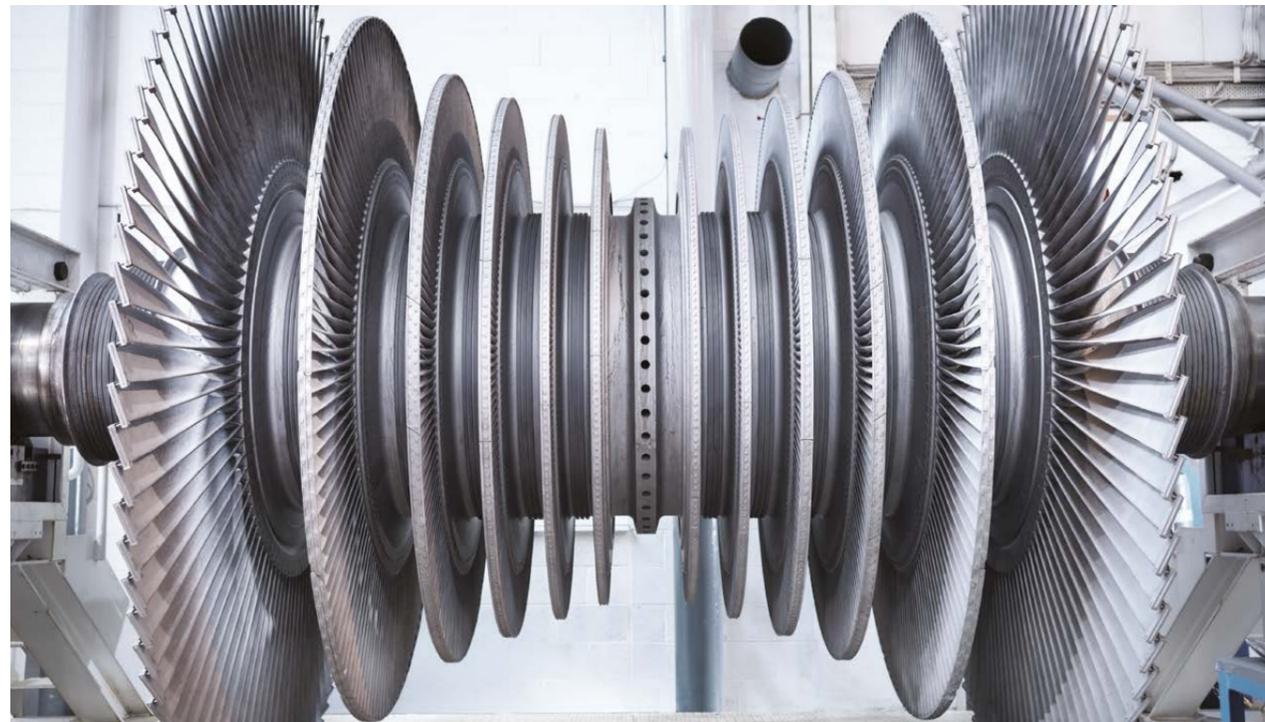


STEP 1: CLEAN

Designed to eradicate varnish that has infiltrated your turbine system with **VARTECH Industrial System Cleaner**

STEP 2: CONTROL

Helps prevent the formation of new varnish through **lubricants formulated with VARTECH Technology**



STEP 1: CLEAN

VARTECH® Industrial System Cleaner (ISC) utilises proprietary technology to do an efficient cleaning job without creating operational constraints.

VARTECH Industrial System Cleaner

Triple action technology formulated to:

Cut through the hard varnish layers and remove them as micro-sized particles.

Capture and stabilise these varnish particles in a protective barrier so they can be removed from your system without re-depositing in other parts of the equipment.

Be **Compatible** with the in-service oil for optimum operational flexibility while maintaining performance during the cleaning cycle that prepares the system for change out to fresh oil.

VARTECH ISC helps prepare your equipment for fresh oil. A Texaco® lubrication specialist can work with you to recommend an optimised cleaning cycle time to help remove sludge and stubborn, baked-on varnish from your system.

However, if unexpected delays are encountered, you can feel confident knowing that the cleaner can temporarily remain in your system without damaging internal components.



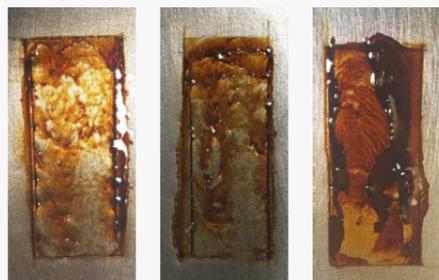
VARTECH Industrial System Cleaner (ISC) ...helps clean without compromise

Cleaning with COMPETITIVE CLEANERS	Cleaning with VARTECH ISC
> Shut-down sometimes required	> Turbines remain online and productive
> Large pieces of varnish can break loose and settle in other areas of the system	> Varnish micro-particles are gradually removed to avoid overwhelming filters
> Some contain harsh chemicals that can damage seals and cause leaks	> Compatible with most internal equipment components, including seals
> Has the potential to lower lubricant flash point causing higher fire and explosion risk	> Demonstrated compatibility with most turbine and compressor oils
> May accelerate oil degradation, shorten oil life and cause system corrosion	> Minimally impacts performance of new oil
> Shorter cleaning cycle may not effectively clean	> Compatibility with most in-service oil can allow longer residence time (if needed) for better removal of stubborn, baked-on varnish
> Can lead to repeated filter plugging and shorter filter life	> Can temporarily remain in the system without causing operational constraints
> Can lead to shorter equipment life and higher maintenance costs	> Efficient cleaning process saves time and money

BEFORE CLEANING:



AFTER CLEANING with competitive cleaners:

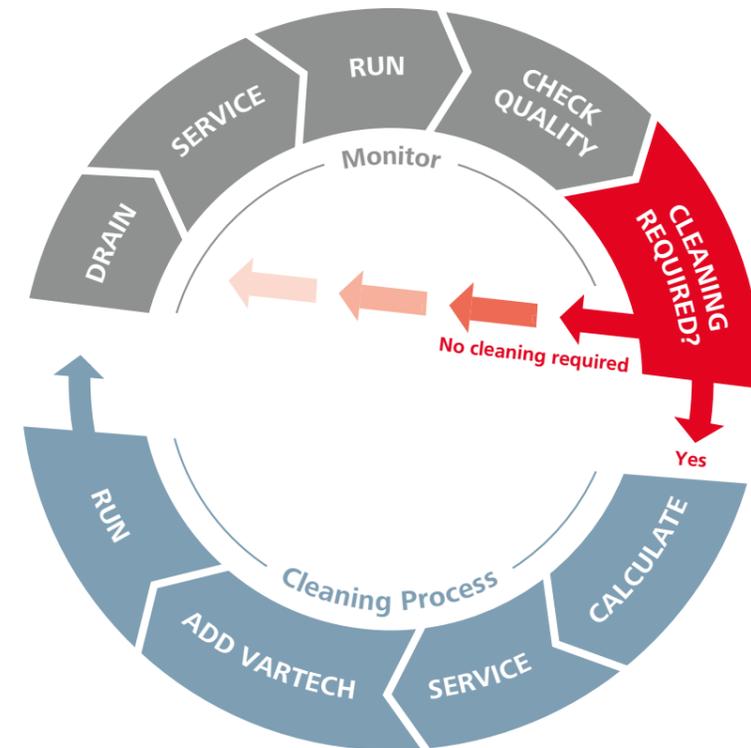


AFTER CLEANING with VARTECH ISC:



...and helps maximise operational efficiency

The VARTECH® Industrial System Cleaner (ISC) cleaning process is simple, streamlined and economic. Many conventional system cleaning processes are more complex and require additional steps, external filtration and multiple rinses and compatibility tests.



MONITOR:

- DRAIN** – Drain and rinse
- SERVICE** – Replace filters and add fresh oil
- RUN** – Run system normally
- CHECK QUALITY** – Monitor oil quality and schedule oil change as needed
- CLEANING REQUIRED?** – Determine whether to clean this cycle

CLEANING PROCESS:

- CALCULATE** – Determine % of cleaner to be added and duration of cleaning cycle
- SERVICE** – Replace system filters
- ADD VARTECH** – Add VARTECH ISC to running system
- RUN** – Run system normally for cleaning period

Cleaning with VARTECH Industrial System Cleaner helped save up to \$81,200 in annual maintenance costs.*

**Spar Floating Platform, Tahiti Field, Gulf of Mexico:
Turbine operation temperatures kept below alarm levels**

The equipment

Two Solar Titan 130 gas turbines are configured in generator sets that deliver 15,000 kW of electricity to the platform. Power loss would halt production.

The problem

Varnish in the oil coolers was causing the unit to run hot, triggering high-temperature alarms. The operator tried a conventional cleaner which created operational challenges during the cleaning process and only temporarily lowered the temperatures. The operation had to resort to costly mitigation measures, sending the coolers on-shore every four months to clean the varnish, costing the operation \$80,000+ per year.*

The solution

VARTECH Industrial System Cleaner (ISC) was added to the in-service oil, and temperatures quickly dropped below alarm levels. There were no filter clogging problems.

Steel plates from oil cooler



**BEFORE
CLEANING:**
Varnish film



**AFTER CLEANING
with VARTECH ISC:**
Varnish film cleaned

* Results may vary depending on equipment type, operating conditions and utility costs.

STEP 2: CONTROL

A range of Texaco® lubricants with VARTECH Technology, formulated to prevent the formation of new varnish.



Lubricants formulated with VARTECH Technology

After existing varnish has been cleaned from your system, it is important to refill your equipment with a lubricant that helps prevent the formation of new varnish. Texaco has developed advanced lubrication chemistry which is designed to inhibit the precursors that can form in your oil stream, deposit on internal surfaces and eventually become varnish.

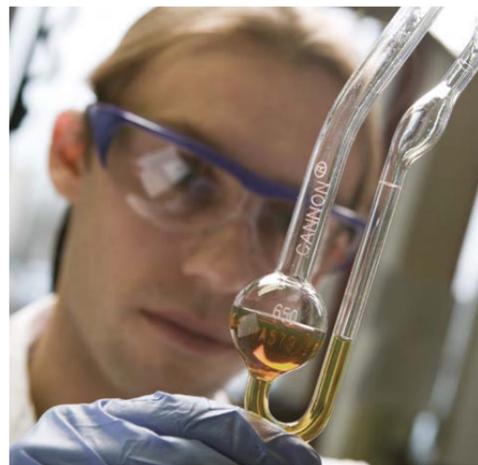
Texaco lubrication experts have formulated a range of lubricants with VARTECH Technology to help protect operations across a number of industries. Our GST Advantage™ and GST EliteSyn™ turbine oils are developed to control the formation of varnish and help:

- > improve oxidation stability
- > reduce oil degradation
- > extend oil life.

The VARTECH Solution for varnish control aids trouble-free operation of equipment, to help you achieve peak performance, reliability and productivity.

MONITORING & PREVENTION

The best way to prevent varnish from attacking your equipment is to detect it early and take decisive action...



Fluid monitoring and LubeWatch® oil analysis are excellent methods to help track the health of your lubricating system, but while they can detect varnish precursors in your oil stream, they can't usually detect varnish that has already formed.

Regularly check for signs of varnish and monitor for changes:

In addition to regular health checks, look for the following signs during your routine maintenance:

- > changes in oil colour
- > spiking temperatures
- > visible varnish deposits.

A number of other tests can be run to monitor the health of your lubricating system:

- > Membrane Patch Colorimetry (MPC), RPVOT and particle count testing can help you measure oil degradation and determine lubricant condemning limits
- > RULER-voltammetry testing can measure oxidation trends in your oil.



Best in Class tools and services to help Run Better Longer:

For further support, Texaco® Lubricants has developed advanced expertise, premium lubricants and targeted programmes for a broad array of industries, to help our customers' equipment and operations Run Better Longer. The RBL Programme is our commitment of business support and reliability.

To find precisely the right lubrication programme to help protect equipment performance, contact your Texaco Representative, your Authorised Texaco Lubricants Distributor or visit texacolubricants.com/VARTECH

Cleaning with VARTECH Industrial System Cleaner helped achieve \$350,000 in annual revenue gain.*

**San Joaquin Valley Business Unit, California:
Turbine operation maintained at full design capacity**

The equipment

Solar Taurus 60 gas turbine is used in a steam/electricity co-generation configuration. The steam facilitates oil recovery and the electricity is sold to a power utility.

The problem

Varnish in the oil coolers was causing the gas turbine bearings to run too hot for the turbine to operate at full design capacity and the operation was losing \$350,000 annually from lost electricity sales.

The solution

After adding VARTECH Industrial System Cleaner (ISC) to the in-service oil, it was apparent that something had radically changed. The operating temperature of the bearings quickly dropped and the turbine returned to full design capacity, recapturing the lost \$350,000.*

SJV was able to operate the gas turbine at full capacity with no temperature alarms

	BEFORE VARTECH ISC:	AFTER VARTECH ISC:	IMPACT OF VARTECH ISC:
Header temp.	71°C	68°C	-3°C
Bearing temp.	97°C	90°C	-7°C
Unit output	3.3 MW	5.5 MW	+2.2 MW

*Results may vary depending on equipment type, operating conditions and utility costs.



Advanced technology Texaco® Services & Solutions.
Whatever the requirement – private and commercial vehicles through
to industrial plant and machinery operating in some of the world's
most challenging environments – customers trust Texaco.



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