



Netherlands ■ Russia ■ United Kingdom ■ United Arab Emirates

Gas turbine  
maintenance improvement  
GE LM1600 LM2500/+ LM6000



# VBR customer value proposition

We support GE LM users to improve reliability, availability & maintainability and to reduce total cost of ownership on their gas turbine operations.

Independent maintenance improvement experts for aero-derivative gas turbines

ISO 9001:2008, SCC Petrochemical & Achilles/FPAL certified

Specialized in GE LM1600 LM2500/+ LM6000 gas turbines & control systems



# VBR portfolio overview

## Maintenance improvement solutions

Control system retrofits

Emission reduction retrofits

Engine relocation

Hot section exchange on-site

Human error reduction

Inspection & repair

Maintenance agreements

RAPID remote maintenance support

Remote DLE mapping

Service interval & engine life extension

Spare parts management

Troubleshooting & problem solving

## Maintenance improvement services

Condition monitoring

Controls & instrumentation field service

Education & training

Mechanical field service

Overhaul consultancy

Spare parts supply

## Maintenance improvement expertise

Competence development

Consultancy

Control system commissioning

Decision support

Helpdesk

Maintenance strategies



# Authorized distributor

Cheng Cycle / Cheng Low Nox (CLN)

**CHENG** POWER  
SYSTEMS

Esterline / Weston Aerospace

**Esterline**  
Advanced Sensors

GasTOPS MetalSCAN

**MetalSCAN**  
ONLY BY GASTOPS

JADwash compressor cleaner

**JAD**  **wash**

Meggitt / Whittaker Controls

**MEGGITT**  
Valves

**MEGGITT**  
Valve overhaul

# Maintenance improvement solutions

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise



Control system retrofits

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# Control system retrofits

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

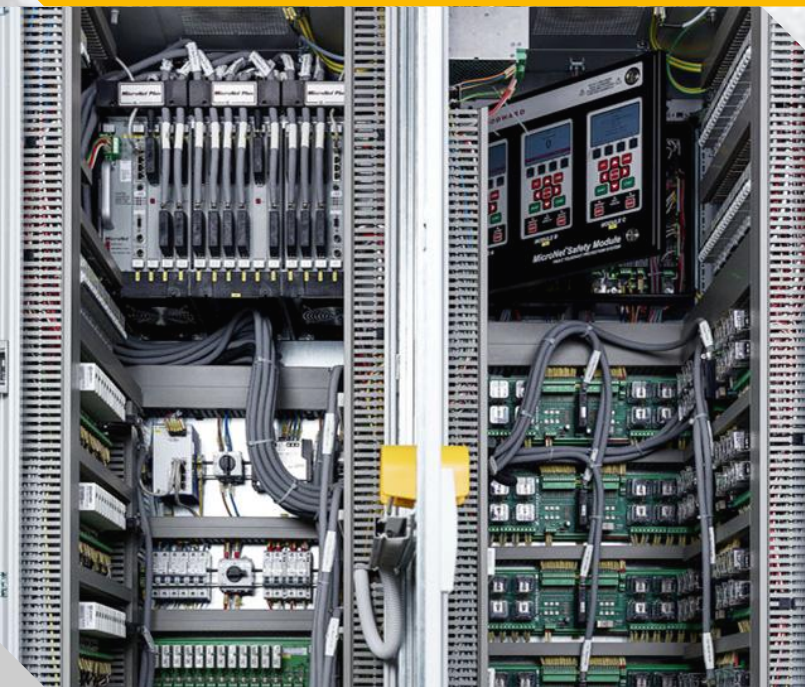
## Situation

Obsolete and mature control systems are a serious constraint for reliable gas turbine operation.

## Solution

Apply a control system retrofit to improve gas turbine reliability, availability & performance and to reduce gas turbine operation & maintenance costs.

VBR provides OEM and third party control system retrofits for obsolete & mature control systems and re-commissioning services to improve poorly commissioned new control systems.



# Emission reduction retrofits

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

European operators of older gas turbines need to apply some form of emission reduction to comply with the new NOx emission limits of the European Industrial Emissions Directive (IED).

## Solution

For European operators of older gas turbines fitted with steam injection a Cheng Low NOx (CLN) retrofit will most likely be the most cost effective way to comply with the IED.

VBR is the authorized distributor of Cheng Low NOx (CLN) emission reduction retrofits for Europe, the Middle East and Africa.



# Engine relocation

Maintenance improvement solutions

Maintenance improvement services

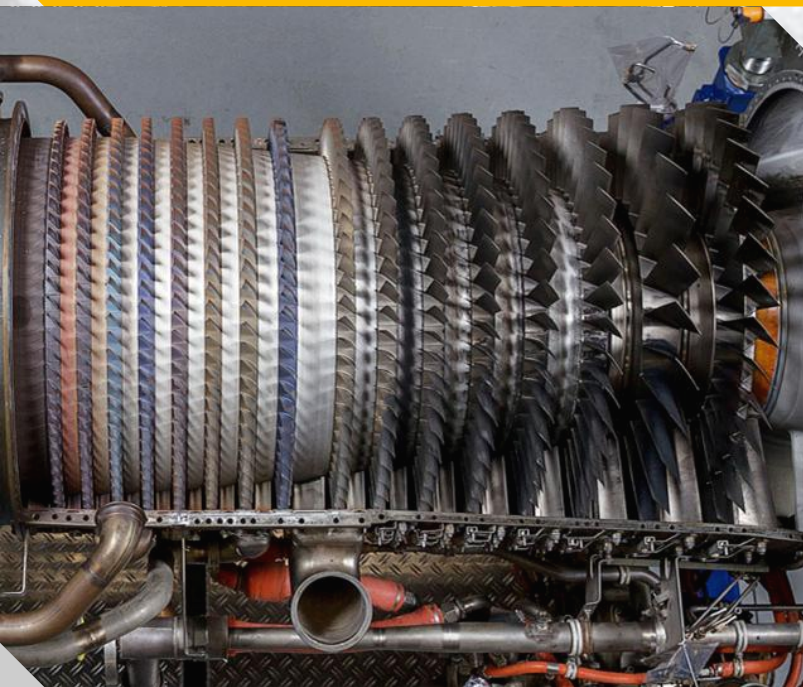
Maintenance improvement expertise

## Situation

In Europe a lot of LM power plants are closing down because it is no longer economically viable to keep them in operation due to high gas prices and low electricity prices.

## Solution

These power plant packages can be sold to parties outside of Europe that are able to operate them in a more profitable way.



VBR provides systematic decommissioning and recommissioning services for used LM power plant packages to realize effective start up and operation at their new location.



# Hot section exchange on-site

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

According to the OEM hot section exchanges and repairs need to be performed at an OEM licensed depot which is costly, requires a long turnaround time (including transport) and most likely a temporary lease engine to continue the operation.

## Solution

Perform a hot section exchange or repair on-site and put the engine back in operation immediately after the exchange or repair. This quick turnaround saves a lot of maintenance costs.



VBR engine overhaul & hot section exchange consultants are former key executives of GE and MTU BB. VBR can provide all the necessary expertise, technical capabilities and hot section tooling to perform a hot section exchange or repair on-site.

# Human error reduction

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Research shows that approx. 58% of the preventable lost production in the global process industry is primarily caused by technical error and that approx. 42% is primarily caused by human error. (Source: ARC Advisory Group)

## Solution

Reduce human error in gas turbine operation & maintenance in a sustainable way by providing predictive operation decision & maintenance action support and dedicated education & training to the gas turbine operation & maintenance staff.

VBR provides predictive operation decision & maintenance action support (based on RAPID intelligent diagnostics) and dedicated education & training to reduce human error in day-to-day gas turbine operation & maintenance in a sustainable way.



# Inspection & repair

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Every gas turbine in operation needs scheduled and unscheduled inspections. In case of an unexpected stop the cause of this stop needs to be determined and the malfunctioning parts need to be repaired or replaced.

## Solution

Develop an aligned combination of in-house maintenance expertise and external maintenance capabilities to reduce the total downtime of the engine after a scheduled or unscheduled stop.

VBR provides inspection, repair & replacement of malfunctioning parts. Our field service engineers always bring a standard set of replacement parts to site in order to reduce the total downtime of an engine.



# Maintenance agreements

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise



## Situation

Every gas turbine in operation requires scheduled and unscheduled maintenance to ensure effective operation over time.

## Solution

Maintenance agreements enable gas turbine operators to reduce the total amount of unscheduled stops and to reduce the total downtime of an engine in case of a scheduled or unscheduled stop.

VBR supports GE LM operators with maintenance agreements that are tailor made to the wants, needs and requirements of these operators.

# RAPID remote maintenance support

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Gas turbine operators face ongoing demands by their customers, managements and governments to reduce their operation costs, maintenance costs and exhaust emissions and to improve their levels of reliability, availability & maintainability.

## Solution

Optimize gas turbine operation & maintenance management by implementing intelligent diagnostic solutions to increase revenues and to reduce costs in a sustainable way.

VBR provides RAPID remote maintenance support: the ongoing gathering & analysis of all key parameters of a gas turbine to determine which operation decisions & maintenance actions are required and to predict when they are required.



# Remote DLE mapping

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

GE LM engines with DLE emission reduction require regular (re)mapping of key parameters in the DLE system to ensure performance as required.

Experienced DLE mappers are scarce and expensive.

## Solution

Realize the conditions for remote DLE mapping on your engine to enable quick, easy and cost effective access to remote DLE mapping expertise and capabilities.



VBR provides remote DLE mapping services to improve the reliability, availability & performance and to minimize the NOx, CO & CO2 emissions of a DLE LM gas turbine.

# Service interval & engine life extension

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Gas turbine operators are looking for opportunities to extend the operation of their engines between maintenance service intervals and to extend the total lifetime of their power plants.

## Solution

Move from time based maintenance strategies & approaches to condition based maintenance strategies & approaches to enable extension of maintenance service intervals and extension of the total lifetime of a gas turbine power plant.

VBR provides condition based maintenance programs for GE LM gas turbines that are based on systematic operation & maintenance improvement philosophies & strategies.



# Spare parts management

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise



## Situation

Every engine in operation needs spare parts for scheduled and unscheduled engine stops.

## Solution

Strategic spare parts planning can reduce the downtime of an engine after a scheduled or unscheduled stop and can reduce spare part purchasing & stocking costs in a sustainable way.

VBR provides strategic spare parts planning services to improve engine availability & maintainability. This avoids unnecessary spare part purchasing & stocking costs.



# Troubleshooting & problem solving

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

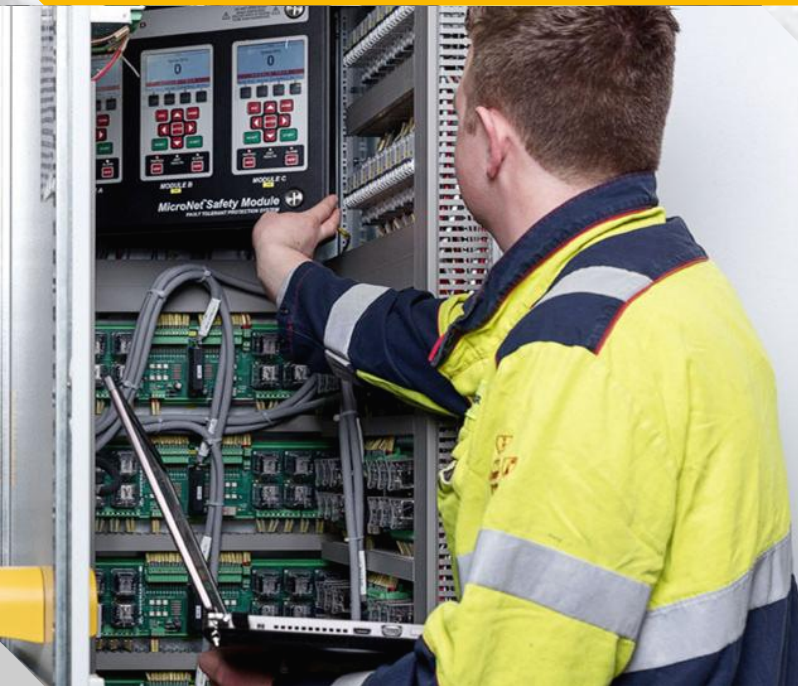
## Situation

When an engine trips or shows an uncommon series of alarms it is usually hard to determine the cause of these alarms in a short time.

## Solution

Apply condition monitoring and data logging applications which enable experienced engineers (both I&C and mechanical) to analyse all data and to determine the cause of the trips or the alarms in a quick & effective way.

VBR provides condition monitoring & data logging applications and experienced service engineers that are well trained & highly motivated to solve the gas turbine problems of our customers.



# Maintenance improvement services

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

Condition monitoring

Controls & instrumentation field service

Education & training

Mechanical field service

Overhaul consultancy

Spare parts supply



# Condition monitoring

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Many operators look for opportunities to extend the maintenance service intervals and the total lifetime of their gas turbines by shifting from (reactive) corrective maintenance to (pro-active) preventive & predictive maintenance.

## Challenge

Extending maintenance service intervals and the total lifetime of an engine requires more detailed information about the condition of the engine and its subsystems.

VBR provides GE LM condition monitoring solutions for service interval extension, life extension, revenue improvement and maintenance cost reduction.



# Controls & instrumentation field service

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

More than 80% of all unscheduled outages are caused by issues related to the control system, the instrumentation or the electrical wiring on an aero-derivative gas turbine.

## Challenge

Obsolete, mature and poorly commissioned new control systems and the associated instrumentation & wiring are a serious constraint for reliable GE LM gas turbine operation.



VBR provides inspection, calibration, re-commissioning, remote monitoring & troubleshooting, updates, upgrades and retrofits for all OEM & third party LM control system hardware & software.

# Education & training

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Experienced gas turbine operators and maintenance engineers retire and are replaced by younger operators and maintenance engineers with limited expertise & experience.

## Challenge

Reduce human error in gas turbine operation & maintenance in a sustainable way by educating & training the less experienced gas turbine operation & maintenance staff.



VBR provides gas turbine training courses from the perspective of optimizing operation & maintenance activities in order to reduce human error in day-to-day operation & maintenance.

# Mechanical field service

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Gas turbines in operation require regular inspection, troubleshooting & problem solving and repair or replacement of defective parts to ensure an ongoing effective operation over time.

## Challenge

Experienced maintenance engineers retire without sufficient opportunity to transfer their knowledge and capabilities to the younger generations of gas turbine maintenance engineers.

VBR provides well trained & very experienced mechanical field service engineers with excellent troubleshooting & problem solving capabilities to reduce engine downtime in case of a scheduled or unscheduled engine stop.



# Overhaul consultancy

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise



## Situation

The major share of a gas turbine maintenance budget is assigned to engine overhauls and hot section exchanges.

## Challenge

Consequences of possible decisions about the required scope and the associated costs of an engine overhaul are often unclear to the gas turbine owner/operator.

VBR provides independent overhaul consultancy services to support gas turbine owners & operators to realize the best possible price to performance ratio on the overhaul or a hot section exchange of their engine.

# Spare parts supply

Maintenance improvement solutions

Maintenance improvement services

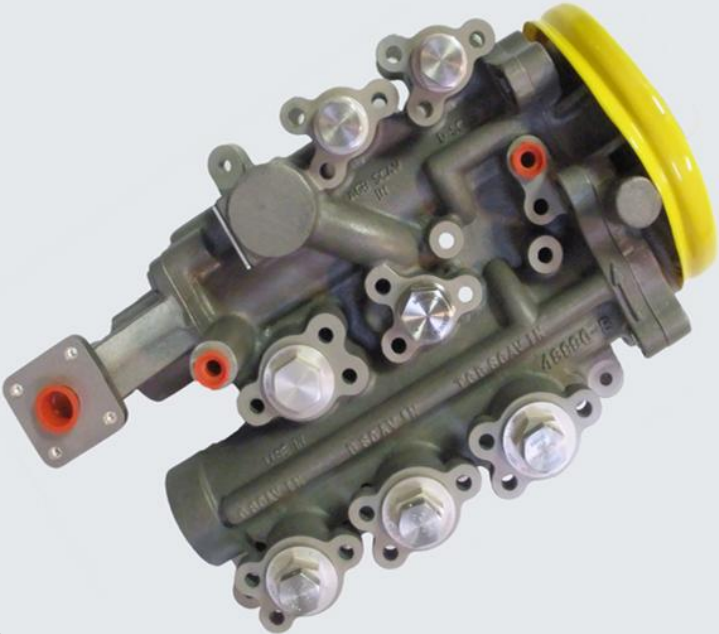
Maintenance improvement expertise

## Situation

Spare parts are required for the day-to-day maintenance of a gas turbine to ensure sustainable effective operation.

## Challenge

Since gas turbine parts can fail at unexpected moments it is required to have access to a quick, reliable and cost effective source for gas turbine spare parts, especially critical parts.



VBR keeps a permanent stock of critical spare parts and has extensive expertise & experience in supplying guaranteed quality spare parts in a cost effective way with minimal lead times.



# Maintenance improvement expertise

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

Competence development

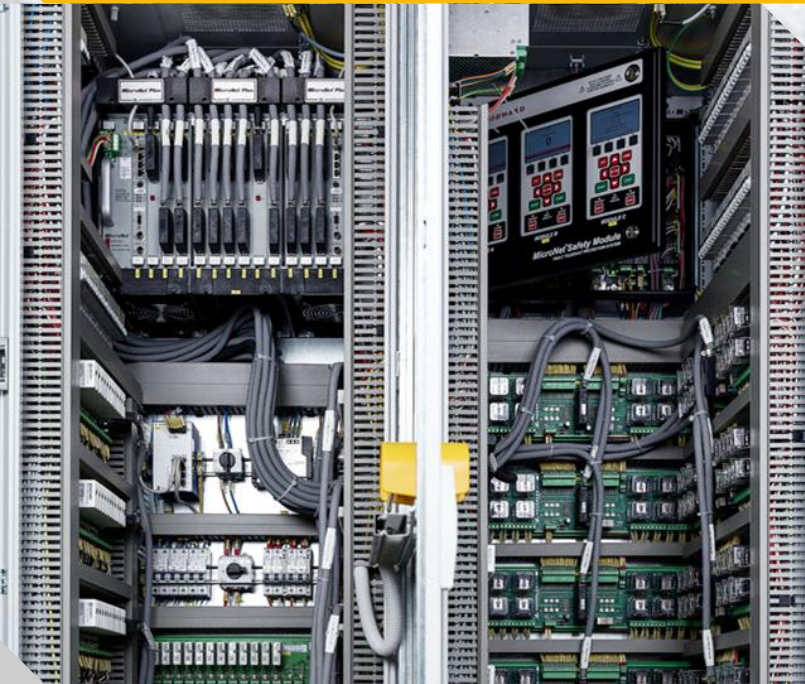
Consultancy

Control system commissioning

Decision support

Helpdesk

Maintenance strategies



# Competence development

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Experienced gas turbine operators and maintenance engineers retire and are replaced by younger operators and maintenance engineers with sometimes limited know-how & experience.

## Challenge

Reduce human error in gas turbine operation & maintenance in a sustainable way by applying a systematic competence building program for the new gas turbine operation & maintenance staff.



VBR provides gas turbine training courses from the perspective of optimizing operation & maintenance activities in order to reduce human error in day-to-day operation & maintenance.

# Consultancy

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Each and every day plant managers, procurement officers, gas turbine operators & maintenance engineers have to take many decisions that have impact on the overall profitability of their gas turbine operation.

## Challenge

Improve the profitability of a gas turbine operation by using the dedicated expertise of independent technical consultants to improve the operation & maintenance decision making process.

VBR provides independent technical consultancy services to support gas turbine owners & operators to improve performance and to reduce operation and maintenance costs in a systematic and sustainable way.



# Control system (re)commissioning

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Poorly commissioned existing and new control systems are a serious constraint for reliable gas turbine operation.

## Solution

Perform a total control system (re)commissioning to improve gas turbine reliability, availability & performance and to reduce gas turbine operation & maintenance costs.



VBR provides (re)commissioning services and retrofits for all OEM & third party LM control system hardware & software.

# Decision support

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Each and every day plant managers, procurement officers, gas turbine operators & maintenance engineers have to take many decisions that have impact on the overall profitability of their gas turbine operation.

## Challenge

Improve the quality of the operation & maintenance decision making process by applying predictive decision support system based on the actual behaviour of the engine in operation.

VBR provides RAPID remote maintenance support: the ongoing gathering & analysis of all key parameters of a gas turbine to determine which operation decisions & maintenance actions are required and to predict when they are required.



# Helpdesk

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Experienced gas turbine operators and maintenance engineers retire and are replaced by younger operators and maintenance engineers with sometimes limited know-how & experience.

## Challenge

How to provide the younger and inexperienced staff members with effective answers on their day-to-day technical questions that do not have a high priority or urgency?



VBR provides a helpdesk for contract customers to address all “lower priority or lower urgency” technical questions from gas turbine operators and maintenance engineers.

# Maintenance strategies

Maintenance improvement solutions

Maintenance improvement services

Maintenance improvement expertise

## Situation

Depending on the actual operating profile of a gas turbine some maintenance strategies are more effective & cost-effective than others.

## Challenge

To determine the most effective & cost effective maintenance strategy for a specific gas turbine operation.

VBR consultants enable gas turbine owners and operators to realize an optimal operation & maintenance price-to-performance ratio for their specific operating profile.



# Authorized distributor



Cheng Cycle / Cheng Low Nox (CLN)

**CHENG** POWER SYSTEMS

Esterline / Weston Aerospace

**Esterline**  
Advanced Sensors

GasTOPS MetalSCAN

**MetalSCAN**  
ONLY BY GASTOPS

JADwash compressor cleaner

**JAD**  **wash**

Meggitt / Whittaker Controls

**MEGGITT**  
Valves

**MEGGITT**  
Valve overhaul



# Cheng Cycle / Cheng Low Nox (CLN)

## About

Cheng Power Systems is the OEM of Cheng Cycle power output & efficiency enhancement and Cheng Low NOx (CLN) emission reduction retrofits by means of advanced steam injection.

## Why

For owners and operators of older gas turbines with steam injection a CLN retrofit is the most (cost) effective way to comply with the new European legislation about exhaust emissions.



**CHENG** POWER  
SYSTEMS

VBR is the authorized distributor of Cheng Cycle power output & efficiency enhancement and Cheng Low NOx (CLN) emission reduction retrofits in Europe, Russia, the Middle East and Africa.

# Esterline / Weston Aerospace

## About

Esterline Advanced Sensors is an approved supplier to General Electric and Rolls Royce for critical gas turbine sensors and probes (temperature, speed).

## Why

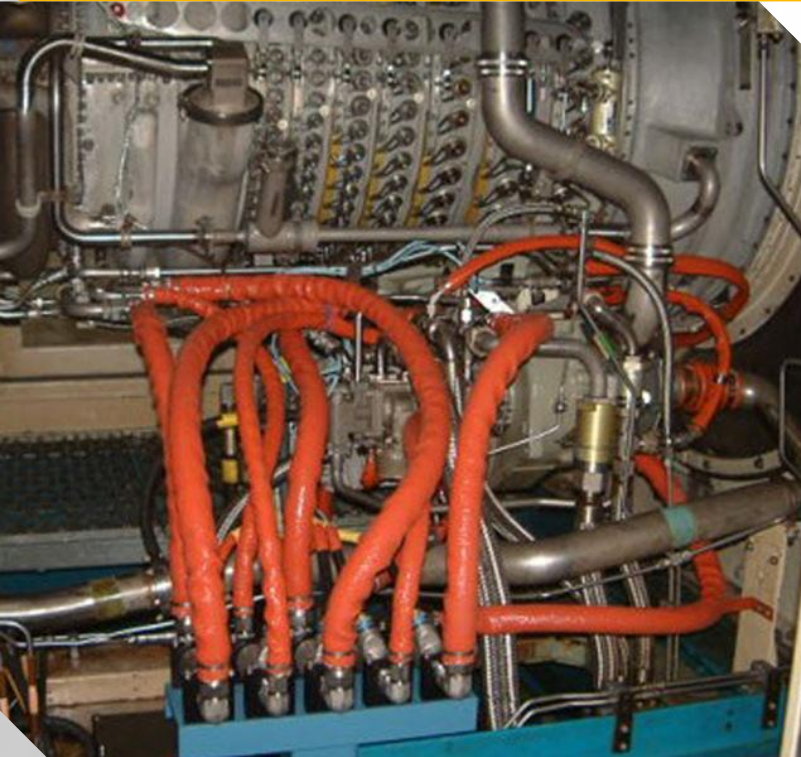
Esterline Advanced Sensors is especially known for their calibrated Weston T4.8 thermocouples that enable gas turbine operators to improve the efficiency and power output of their gas turbines.



**Esterline**  
Advanced Sensors

VBR is the authorized distributor for new Esterline sensors & probes in land based & marine GE & RR gas turbines in Europe, Russia, the Middle East & Africa.

# GasTOPS MetalSCAN



## About

GasTOPS MetalSCAN is the most effective solution for early detection of bearing damage in aero-derivative gas turbines.

## Why

In case of bearing damage MetalSCAN information allows operators to proactively plan the necessary maintenance actions and bring the engine to a scheduled stop to minimize engine downtime and to avoid secondary damage.

**MetalSCAN**  
ONLY BY GASTOPS

VBR is authorized distributor of MetalSCAN early detection of bearing damage in Europe.

# JADwash compressor cleaner

## About

JADwash green performance cleaner is a REECH compliant, very effective, environmentally friendly and entirely biodegradable gas turbine compressor cleaner.

## Why

At a competitive price JADwash delivers an improved cleaning performance with a reduced environmental impact compared to all other major gas turbine compressor cleaning products.



VBR is the authorized distributor of JADwash compressor cleaner for land based & marine gas turbines in Europe, Russia, the Middle East & Africa.

# Meggitt / Whittaker Controls

## About

Meggitt / Whittaker Controls is the OEM of many critical valves used in GE and RR aero-derivative gas turbines.

## Why

Meggitt also supplies these new valves (under the Meggitt brand and through their authorized distributor) directly to GE & RR end users at much better prices & lead times compared to the supply of these new valves through the gas turbine OEM's.



MEGGITT

VBR is the authorized distributor of new Meggitt / Whittaker Controls valves for land based & marine GE LM & RR gas turbines in Europe, Russia, the Middle East & Africa.

# Meggitt / Whittaker Controls overhaul



## About

Meggitt / Whittaker Controls is the OEM of many critical valves in GE LM and RR aero-derivative gas turbines.

Meggitt also performs OEM certified 'back to zero hour' overhauls on these valves.

## Why

Many Meggitt / Whittaker Controls valves are ATEX certified. Only the authorized Meggitt OEM valve overhaul facility can deliver the required ATEX acceptance testing and certification.

# MEGGITT

VBR is the only authorized OEM overhaul facility for Meggitt / Whittaker Controls valves in land based & marine GE & RR gas turbines in Europe, Russia, the Middle East & Africa.



# Over 250 corporate & public sector VBR customers worldwide

## Maintenance service locations

- Netherlands
- Russia
- United Kingdom
- United Arab Emirates

## Maintenance service agents

- Australia
- New Zealand

Providing **GE LM expertise, solutions, services & spare parts**

- all over the world

## Memberships

- Advisory board PGE 2017-2019
- ETN
- DGTA
- IRO
- WTUI

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