



GE VERNOVA

ROTATING MACHINE SERVICES

Essential solutions from 125+ years old industry expert for your RM assets



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RM PRODUCT PORTFOLIO

Customized products for customer needs



	Oil & Gas	Marine	Mining	Metals	Power generation	Power quality & supply	Hydro	Research & test systems	Water	Wind
ROTATING STABILIZERS										
DIESEL, GAS & STEAM DRIVEN GENERATORS										
ICL (INTEGRATED COMPRESSOR LINE)										
PODS (PODDED PROPULSION UNITS)										
ADVANCED INDUCTION MOTORS										
VERTICAL INDUCTION MOTORS										
HORIZONTAL INDUCTION MOTORS										
PERMANENT MAGNET MOTORS										
HIGH SPEED MOTORS										
SYNCHRONOUS MOTORS										
OTHER GENERATORS										

Available

CORE PRODUCTS

Motors

- Induction & synchronous motors
- Speed : up to 18,000rpm
- Power : up to 100MW
- Voltage : up to 15kV
(up to 22kV on request)

Generators

- Speed : up to 18,000rpm
(fixed or variable)
- Power : up to 80,000kVA
- Voltage : up to 15kV
(up to 22kV on request)

RM FACTORIES

Centers of Excellence (CoE) for your product & services

PRODUCT PORTFOLIO

- 4 Pole synchronous generator
- Multi pole synchronous generator
- Permanent magnet generators (PMG)
- Excitation & control systems
- Advanced induction motor
- Compact induction motor
- Vertical induction motor
- Mine winders
- Low speed motors
- High speed synchronous motors
- High speed induction motors
- Two pole turbo motos
- Podded propulsion motor
- Steam turbine replacement solution
- High power induction motors
- High power synchronous motors



RUGBY, ENGLAND



NANCY, FRANCE

CoE for generator design & manufacturing

CoE for large induction & synchronous motors

MANUFACTURING & REPAIR CAPABILITIES

- Machine & press shop
- Stator & rotor build
- Coil shop & stator winding
- Vacuum pressure impregnation (216" dia)
- Assembly, test & packaging
- Rotating machines repair shop
- 25 moving bridges
- Rotor machining tools
- Rotor balancer
- High speed balancing bench
- Vacuum pressure impregnation (157" dia)
- 9 test areas
- Engineering capabilities



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RM FACTORIES

Centers of Excellence (CoE) for your product & services

PRODUCT PORTFOLIO

- Medium AC induction motors
- Synchronous motors
- High speed generators
- Small hydro generators
- Large DC motors

Service support for

- Synchronous motors
- Induction motors
- DC Motors
- Synchronous generator



CoE for induction motors and DC motors

CoE for synchronous motors and generators

MANUFACTURING & REPAIR CAPABILITIES

- Machine & press shop
- Stator & rotor Build
- Coil shop & stator winding
- Load tests capabilities for AC & DC motors
- Repair shop (DC & AC motor)
- Vacuum pressure impregnation (157" dia)
- Cranes for 150 Ton

- Vertically integrated manufacturing
- Coil manufacturing facility
- Large VPI (Vacuum Pressure Impregnation) capability (192" dia.)
- In-house excitation panel design & built
- Rotor Design
- Engineering studies & trainings



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SERVICES OFFERED

An overview



VARIOUS RM SERVICES FOR ALL THE INDUSTRIES

- Health monitoring/TIMSA
- Maintenance & repair support
- RM spare parts support
- DC motor services
- RM controller services and AVR replacements
- RM Replacements & upgrades (DC/AC)
- RM stator winding in-situ
- Engineering services to increase efficiency or output
- Digital solutions
- Training programs
- Legacy brands & support

HEALTH MONITORING SERVICES

Pro-active way to keep your assets up and running

Rotating machines health checks

To help you reduce unplanned outages and optimize your maintenance costs, our service health check program assists you with fleet knowledge-based maintenance strategy, specific to your equipment.

Features of service health-check program:



Live non-invasive inspection to integrate data to understand the historic maintenance, environmental constraints and much more.



Field service expertise is available for GE equipment and a wide range of other equipment types.



Safety critical issues detection, prioritized dispatch of parts and implementation of solution by our experts if required.



Operational critical issues detection - deterioration in performance or critical items affecting reliability.



Comprehensive report, including preventive maintenance plan, list of critical spare parts and upgrade packages.

TIMSA

Test and Inspection for Machine Status Assessment (TIMSA) is an advanced, non-invasive inspection protocol to mitigate the risk of failures on MV/HV rotating machines.

It includes:

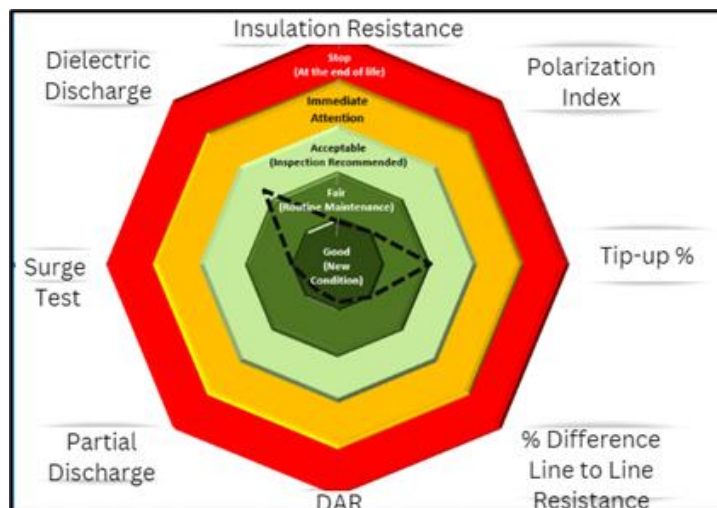
- Dedicated electrical and mechanical tests and analysis of test results
- Action plan to fix any issues proactively.

The full TIMSA electric protocol can be complemented with several optional mechanical tests.

HIGHLIGHTS OF TIMSA

- Applicable to all induction, synchronous & DC units.
- At every major outage (or dry dock, for marine units).
- 1-2 Field Service Engineer (FSE) day/machine for electrical tests at your site
- 2-4 extra days for mechanical checks, based on unit size and tests included.

TIMSA Diamond : An analytic model





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MAINTENANCE & REPAIR SUPPORT

Customized plans to monitor and maintain your assets

Are you in need of scheduled maintenance assistance?

Then choose your plan from our standard maintenance programs. A comprehensive set of inspections will be followed. The findings of these inspections will be used to inform planned maintenance recommendations, which will help you understand what preventive measures may best support your spare parts management and repair operations.

Standard maintenance programs from GE Vernova Power Conversion & Storage

1. Minor maintenance every 1-2 years (1-3 days)

- Electrical disconnection + borescopes / insp. Plates.
- RM controls should get a minor inspection and functional check.

2. Major maintenance every 4-6 years (3-7 days)

- Minor inspection disconnection + end shields out and bearings out.
- RM control & protection should get full secondary injection to check all systems.

3. Rotor out maintenance every 10-12 years (8-15 days)

- Major inspection disconnection + rotor is unthreaded.
- It would be ideal to consider RM controls refurbishments.

SPECIALIZED RM SERVICES

- RM terminal cubicle instrumentation checks (CT, PT...)
- RM control panel testing
- Onsite vibration analysis and dynamic balancing
- Heat exchanger extensive activities
- Stator wedge mapping
- Stator core magnetization
- PMG inspections and re-greasing
- Online harmonic component analysis
- HV testing
- Resonant surge oscillography
- Frame vibration frequency analysis
- Lube oil sampling
- Noise level monitoring
- Horsepower upgrades and frame modifications
- Basic overhauls, rebuilds & repairs
- Emergency response
- Motor starting study
- Impact load study
- Load flow study
- Power factor study

And customized service support upon request.

RM SPARE PARTS SUPPORT

Genuine spare parts from OEM to plan your inventory

Keeping essential spares on site is critical to ensure continuity of your operations. Our spare parts management consultancy services can help you identify the spares' criticality for your installation.

Spare parts classification

RM Spare parts can be classified into three - based on criticality, profile behavior and the propensity to fail.

1. Highly critical spares, resulting in probable downtime, are:

- Large bespoke parts including stator, rotor, exciter, PMG, AVR, main & neutral terminal box bushes
- Diode, pressurization unit, LP oil lube unit, slip ring brush.

2. Medium critical spares, resulting in lower performance, are:

- Production CT/VT, bearing, seal, cooler battery, fan motor.

3. Low critical spares are:

- Space heater, probe, leakage detector



Special packages from Power Conversion & Storage

- Health check for your inventory
- Standard or express refurbishments
- Buy back and exchange program options*
- Disposal and recycling
- Long time storage packaging SEI-4DC standard to protect against corrosion and vibration

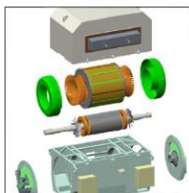
WHY GEV SPARE PARTS?



Guaranteed source of high-quality, durable replacement parts ensuring plant safety, integrity and continuity by extending equipment lifetime.



Optimal utilization of your operational budget as we help you stock only what is critical for your equipment and application needs.



Where appropriate, re-engineering of your equipment to incorporate current technology.

To simplify your spare part order, you can request a preventive maintenance kit for the upcoming service.

*subject to terms and conditions.



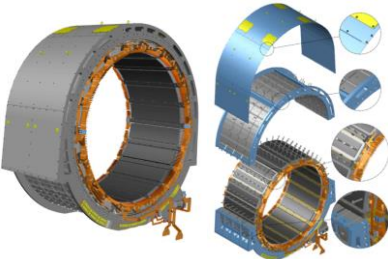
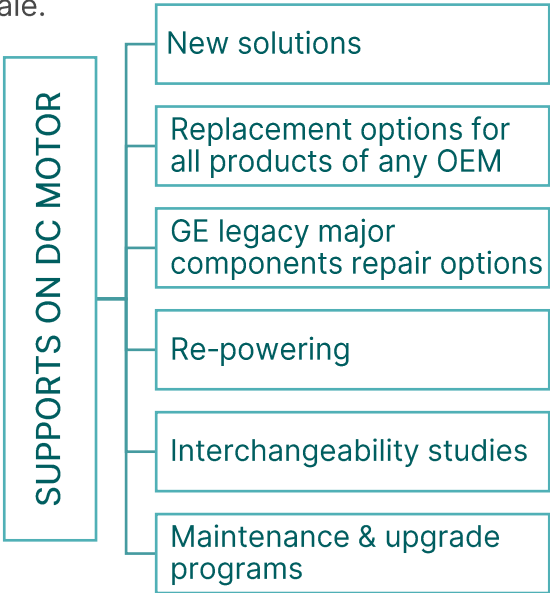
DC MOTOR SERVICES

On time & customized support

Would you like your DC motors to last longer?

As DC motor experts, Power Conversion & Storage is best suited to overhaul your asset and renew its lifespan.

Advancements in recent times have made it possible for DC motors to become more robust and consistent while maintaining the same level of dependability and operating efficiency. The industry has successfully implemented these upgrades on a large scale.



Complete Mag Frame for DC Motor GE 8000HP 850V 35/90RPM



New Universal motor designed and supplied to an amusement park in the USA.

Upgrade your DC motors

- To ensure continuous availability & increased reliability of your assets
- To minimize production downtime
- To minimize the impact to the existing infrastructure

Upgrade options for DC motors from Power Conversion & Storage

Assembly	Options	Benefits
Armature	Banded Stack with Modern insulation using class H materials	Better level of insulation and improved commutation
Main Poles	Robust Insulation with V.P.I impregnation	Keep satisfactory insulation levels avoiding drops due to environment and operation
Interpoles	Class H Insulation materials	Extended life
Frame	Retain the footprints	Avoid unnecessary retrofit costs
Bearing	Sleeve	Increase reliability



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RM CONTROL SERVICES & AVR REPLACEMENTS

Ensuring increased efficiency and output

Rotating machine controls and Power Conversion & Storage services

Power Conversion & Storage offers various services to its RM control products such as,

Inspection programs

We will provide you all the information you need to know about the condition of your AVR system and the optimum ways to prolong its life.

Replacements & upgrades of core products

For the rotating machine to operate at its peak output and response levels, we advise modernizing, retrofitting, or replacing aged controls with cutting-edge technology.

Obsolete & postproduction support products

We will update you about the lifecycle status and suggest appropriate, optimal solutions for your workflows.

Legacy regulators service support

We support in servicing rotating machines that has legacy controls made by us and our closest partners.

POWER CONVERSION & STORAGE ADVANTAGES

Being a 125+ year old industry expert, we serve our customers with our unique features

- Flexible architecture, modern networks and versatile software suites, to simplify operations and integration with plant level controls
- Advanced algorithms and the latest control technology designed to improve performance
- Built-in HMI, powerful diagnostics and control simulators to support rapid installation, tuning of settings and staff training
- Industry leading digital technology that will maximize unit performance and support in lowering operational costs
- Fast installation and start up due to customized setup
- Product life cycle support with the ability to perform conversions, modernization & upgrades
- Turnkey rotating machine controls servicing and lifecycle management programs, which can be easily fulfilled during your rotating machines outages, reducing costs

We can also extend such values to 3rd party controls with suitable equivalent for the same application to support our customers.

RM CONTROL SERVICES & AVR REPLACEMENTS

To increase efficiency or output

Power Conversion & Storage's RM control products

CORE PRODUCTS

- DECS-250 (Basler Electric – partnership June/2022)
- ESP1 motor controls
- ACBEX
- Stat-X-Ator
- Quad-control
- Protection relay builds
- Special application AVR



ESP1

LEGACY PRODUCTS

- B12/75
- C10/120
- XCOM-20
- DX21
- RVD
- Microstat
- DECS-200 & DECS 200N (Basler Electric partnership June/2022)



DX21

AUXILIARY LEGACY C10 & DX21 MODULES

- FV223 diode failure module
- FV200 excitation fault detector module
- MC15 manual control module
- LC110 excitation limiter module
- FYP54 auto synchronizer module
- FF100 VT fuse failure detector module
- FYC42 check synch module
- HC15 manual control module
- HC12 manual control module
- FV211 manual control module
- ST130 static voltage trimmer
- FX45 automatic power factor control unit

RM REPLACEMENTS & UPGRADES

Options to refresh your induction & synchronous machines

Are your outdated motors in need of more efficiency?

Then, consider Power Conversion & Storage upgrades or replacements for the following reasons.

- More efficiency, more output for your process needs, or different starting requirements.
- More reactive power to accommodate demand.
- Improved reliability and reduced operating costs.
- Regulatory Standards compliance on existing equipment.
- Or a mix of the above and more, tailored to your needs.

What next?

Planning equipment upgrades, and modifications to meet productivity targets is made easier when you are aware of the state of your equipment. Connect with us to understand your unit's capacity to operate at peak efficiency as it will be thoroughly examined through our equipment performance audit.

Assembly	Options	Benefits
Stator	Proven & robust insulation system for replacement stators and rewinds	Extended life improved, reliability, low partial discharge
Rotor	Salient solid pole, laminated rotor strip or wire wound	Inherently robust, high-power density, high efficiency
Field excitation	Rotating or static, based on customer needs	Extended life & reliability
Frame	Retain the footprints	Avoid unnecessary retrofit costs
Bearing	Sleeve	Increase reliability
Heat exchangers	Air cooled, water cooled, or liquid cooled	Increased heat dissipation
Accessories	Temp. & vibration, detectors/ system, monitor partial discharge	Trend monitoring helps prevent failures and downtime

Power Conversion & Storage can provide a turn-key stator rewind or a complete stator assembly, to fit your refurbishment or upgrade needs and thus accelerate your return on investment.

Rotor replacement is a more straightforward option. Replacement of a rotor can be completed quickly at a planned outage. The bearings can also be renewed or upgraded at that time.

Additionally, we are able to support products that are not Power Conversion & Storage. Complete assistance to ensure customer satisfaction.

Stator upgrade



Rotor upgrade



3rd Party upgrade



RM STATOR REWINDING IN SITU

VPI stator to resin rich coil

Is stator rewinding in situ possible?

With Power Conversion & Storage the answer is always “Yes”.

To reduce the impact of failed or aged stator winding repairs, Power Conversion & Storage is introducing the VPI (Vacuum Pressure Impregnated) stator to resin rich coil rewind in situ, a pre-engineered solution, with this the motor stator can be repaired in place, still within the vessel.

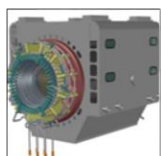
FACTS ABOUT RESIN RICH COIL



High quality epoxy resin insulation is applied and consolidated during the coil manufacturing process, making the coil robust and resistant to moisture and dirt.



The individual coils and the fully assembled winding are fully tested, thus ensuring the individual dielectric integrity of each coil.

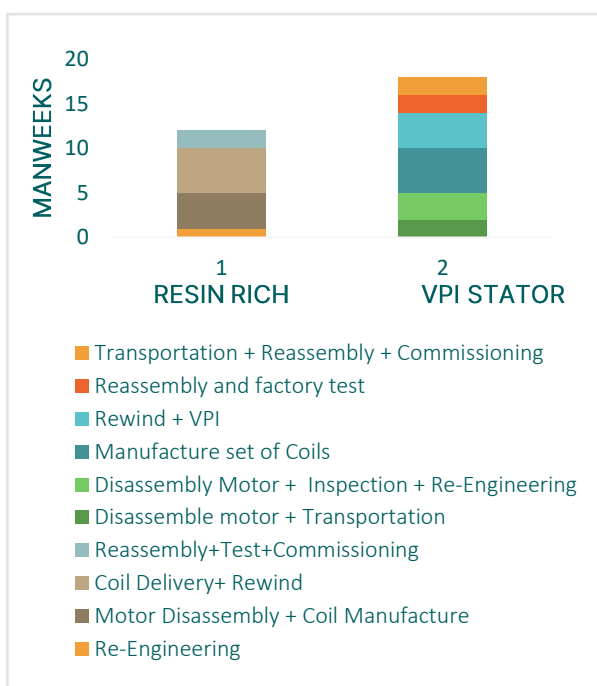


The resin rich coils are more reliable than VPI and are tested at high voltage to meet or exceed all Power Conversion & Storage standards for quality.

Applicability

- The VPI stator to resin rich rewind is suitable for all rotating machines with frame size 630 and above - typically used in LNG carriers, drill ships, cruise vessels and naval vessels.

Resin rich Vs VPI stator rewind*



*Example repair calendar comparison based on past projects (it might vary)

Benefits of resin rich coil

- Helps to reduce turnaround time and other related difficulties.
- Helps to reduce various logistic and operational challenges, like disassembly, removal, reassembly and transportation of the bulky VPI rotating machine to and from the repair yard.
- Helps to avoid the various challenges effectively translates into considerable savings in both cost and time.

Our global services teams are well-equipped and have extensive experience performing rewinds inside vessels, including 3rd party rotating machines.



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ENGINEERING SERVICES

To define the appropriate solution to your assets

Dedicated engineering services

Root cause analysis (RCA)

Would you like to understand the reason behind the failure of your asset to avoid repeating?

RCA is one of the best ways to understand the failure reasons. Warranty failures will be analyzed by Power Conversion Storage's global QMS expert team according to 5 WHY principle.

Appropriate action plans will be suggested as a report.

Feasibility study

Are you considering commissioning difficulties when you plan replace, upgrade or create a new solution for a RM asset?

Power Conversion & Storage's feasibility study helps in designing appropriate solution based on real time applicability.

Our dedicated team will visit your site and perform the study using our checklist and present their results as a report.

Turbine replacement study

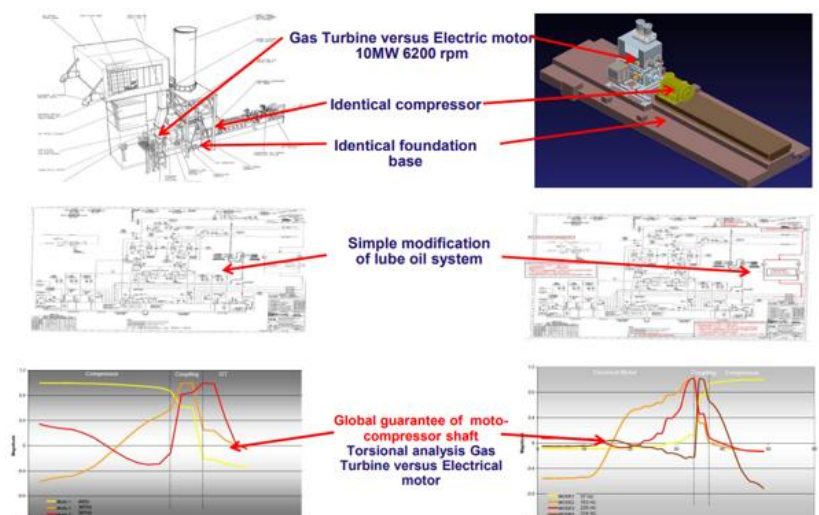
Are you keen on CO2 reduction?

Then think about gas or steam turbines replacement.

It also improves system efficiency, reduces the operation and maintenance costs.

Our expert team will do the site study and necessary parameters such as critical speed, maximum short circuit torque, torsional vibration, etc will be considered.

Possibilities of implementing the solution will be advised.



Typical turbine replacement study

All the dedicated engineering services will be performed upon request at additional cost.

DIGITAL SOLUTIONS

Smart software application helps to reduce unplanned downtime

Power Conversion & Storage's three easy-to-navigate modules focuses on a key area of improvement. All the solutions are available on-prem and cloud-based.

Services+ It's about tapping into our expertise at the point you need it, and includes our remote engineering solution for remote monitoring, diagnostics and support.

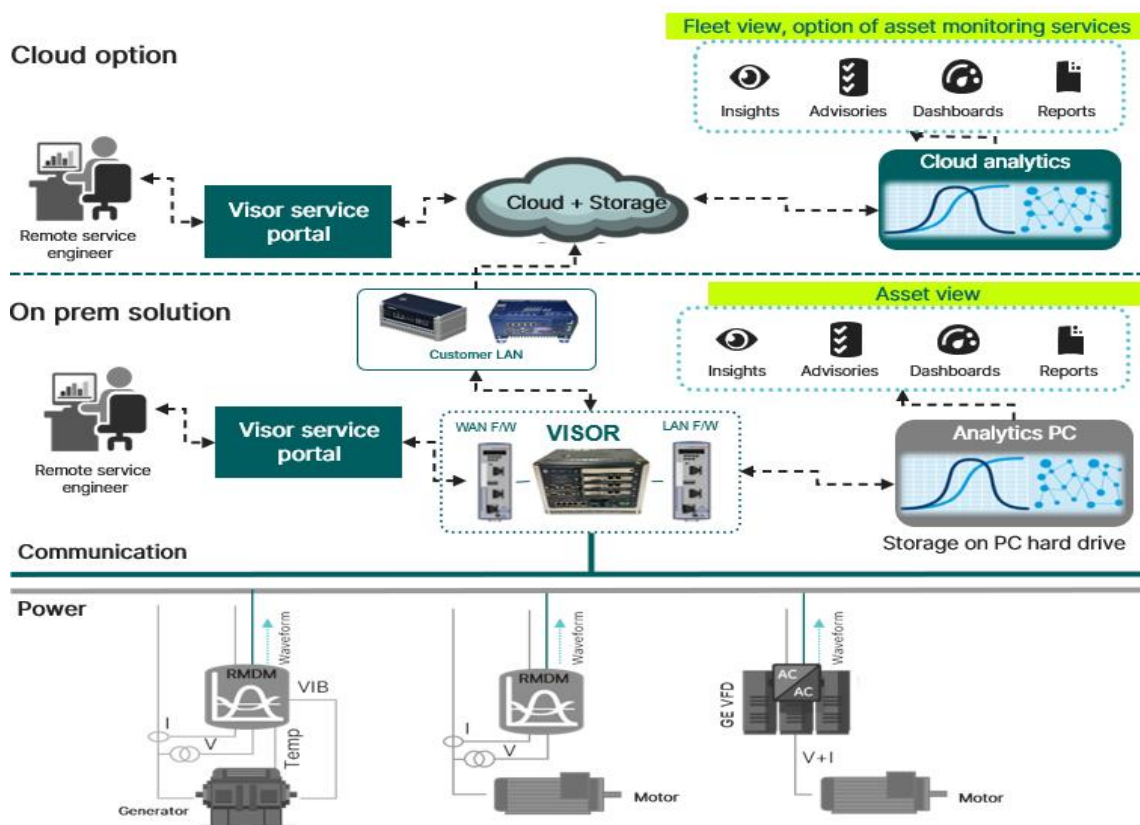
Maintenance+ It provides a view on the health of your critical assets with early warnings of developing issues to help you take timely, corrective actions.

Operations+ solution includes performance, process and energy optimization.

Asset Performance Management (APM) solution

As a part of Maintenance+, APM eases predictive maintenance through Electrical Signature Analysis (ESA)/ Motor Current Signature Analysis (MCSA). It allows early detection of electrical and mechanical degradations such as,

- Bearing (inner/outer race defect, ball defect)
- Insulation (shorted turns)
- Rotor bar (broken rotor bar)
- Electrical (voltage/current THD, sequence voltage/current harmonics, energy usage)
- Temperature (bearing/stator temperature)





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TRAINING PROGRAMS

Way to handle your assets as an expert

Do you want to become an expert with your RM assets?

Power Conversion & Storage provides training programs in order to facilitate this. Every training course has a unique schedule, intended audience, length, and any necessary prerequisites. You can choose from a variety of options, including:

Installation & commissioning for all motors and generators

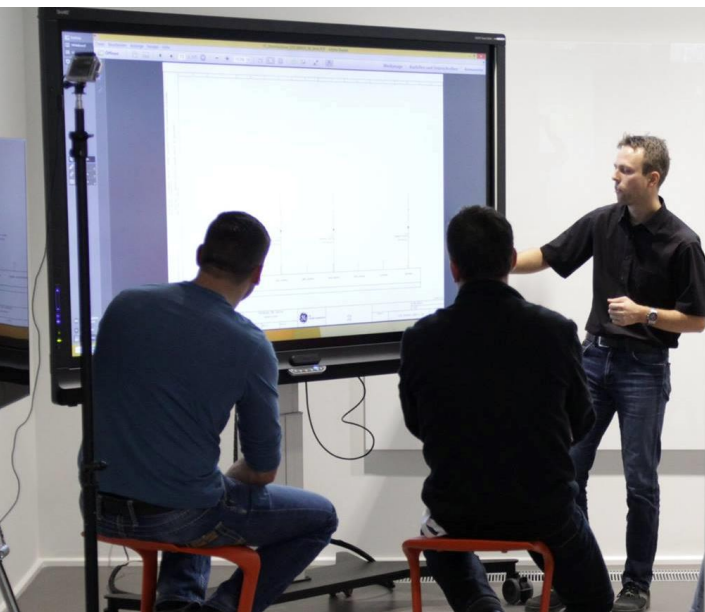
Course : Power Conversion's recommendations when installing an electrical motor on skid or grouting
– 1.5 days

Participants : Engineers, technicians for maintenance & operations

Operation, maintenance & trouble shooting for motors and generators

Course : Operation modes, maintenance practice, troubleshooting methodology
– 3 days

Participants : Operation, commissioning and maintenance engineers



SIGNIFICANCE OF TRAININGS

- These training programs help to enhance the asset knowledge
- Equip your team to handle the machines with more confidence
- Less dependency for inconsequential supports.
- Available in both inhouse and classroom options.

Customized trainings are also available upon request

LEGACY BRANDS & SUPPORT

End to end support for legacy brands

Looking for service assistance for a legacy brand?

Check out this page with us.

GE Vernova has walked long path on rotating machines evolution. We support service on all our legacy brands, including, predictive, preventive & corrective services, as well as like-for-like replacements and technology upgrades. Find many of our legacy brands here below:



New DC armature spare



Turbo generator insulation repair



Winding repair in-situ



New double armature spare

SUCCESS STORIES OF LEGACY SUPPORT

- Legacy Alstom DC Motor of 5800KW**
 New DC Armature was re-designed, built in Brazil and supplied as a spare to LATAM customer
- Legacy Converteam Induction motor of 12MW, 4Pole, 13.8KV**
 Inspection and partial stator winding repair was done onsite for an offshore application in Brazil
- Legacy Alstom Turbo generator 41.6MVA, 2Pole, 13.8KV**
 Rotor inspection and insulation repair was done
- Legacy GE Schenectady and Peterborough DC machines**
 Supported many customers with repairs, equivalent replacements and spare parts.
- Legacy GEC Alsthom AVR**
 AVR & protection upgrade in a wood processing plant in Europe.
- Legacy GEC large machines, Rugby synchronous motor**
 Machine health status (TIMSA) assessment on a wind tunnel motor of a leading aerospace company.
- Legacy Converteam Generator**
 Upgrading generators including installation of new sensor systems in New Zealand.
- Legacy Converteam Generator**
 Service Shop work in Rugby on two generators taken from a marine vessel and finally design and manufacturing of new interchangeable rotors.



OBSOLESCENCE & LIFE CYCLE MANAGEMENT PROCESS

Standard process for continuous improvement

Product lifecycle management policy

Power Conversion & Storage categorizes its products in one of the five lifecycle stages as mentioned in the model.

Product leadership commits to supporting products in line with the defined lifecycle through funding the development of alternate parts or supporting a last time buy.

Product lifecycle model & summary table

Customer can understand the support for the products based on their lifecycle stage from the summary table.

Goals of product lifecycle management

- To provide transparency to the customers regarding what level of support can be expected when a product faces obsolescence issues
- To provide clarity to the customers regarding which products are nearing end of life and jointly develop a migration strategy to the next generation product
- To provide a consistent approach to making obsolescence decisions across the product portfolio

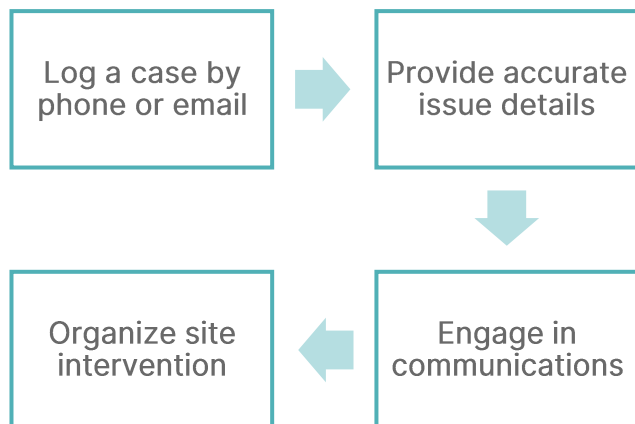
		Complete Life cycle Services		Limited Life cycle services		End of Life	
Restricted		Active		Limited		Post-production	
Obsolete*							
Lifecycle Phase	Feature Enhancement	Component Obsolescence	Bug Fix	Spare Parts	Migration or New Product Available	Lifecycle Announcement	
Restricted	Case by Case	✓	✓	✓			
Active	✓	✓	✓	✓	Roadmap	Active to Limited Transition	
Limited	Case by Case	✓	✓	✓	Under Development		
Post-Production		Case by Case	Critical only	✓	✓	Post-Production to Obsolete Transition	
Obsolete			Case by Case	Subject to Availability	✓		

CONTACT US FOR YOUR NEEDS

We are at your service, worldwide

- Are you having problem at your site and are unsure of who to contact?
- Do you need a business proposal for one of our products or services but lack a business contact?
- Are you looking for an engineering study where Power Conversion & Storage has the expertise?

Then follow the procedure.



Contact centers

Region	Local number	Language
France, South Europe and Middle East Africa/Turkey	+33 177312323	FR - EN
Germany, Central Europe and CIS	+49 6966125588	DE - EN
UK and North Europe	+44 1788563800	EN
Asia Pacific	+61 1300193189	EN
China and Mongolia	+86 4000215605	ZH
India, Bangladesh & Sri Lanka	+91 44 49680008	EN
North America	+1 844 437 4474	EN

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Contact us : services.powerconversion@ge.com

**OUR GE VERNOVA COMMUNITY SUPPORTS YOU
24X7 , USE IT TO YOUR ADVANTAGE.**