GE’s Power Conversion business: Having the right partner is as vital as having the right technology.

Rotating Machines Manufacturing Capabilities, UK

Center of Excellence for Generators

GE Energy Connections
Power Conversion

GEA32458 GEPC Rotating Machines Rugby, UK – Capability Brochure
MANUFACTURER OF ELECTRICAL EQUIPMENT & ROTATING MACHINES SINCE 1902

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About GE Power Conversion

GE’s Power Conversion business applies the science and systems of power conversion to help drive the electric transformation of the world’s energy infrastructure. Designing and delivering advanced motor, generator, drive and control technologies that evolve today’s industrial processes for a cleaner, more productive future, it serves specialized sectors such as energy, marine, industry and all related services.

Rotating Machines, UK

100+ years experience

CENTER OF EXCELLENCE

GE Power Conversion’s Rotating Machines business in UK has more than 100 years experience in the design, manufacture and test of large rotating electrical machines. GE’s Rotating Machines Rugby facility has the capability to manufacture induction and synchronous machines, the Rugby facility is GE’s Center of Excellence for generator design and manufacturing.

As a Center of Excellence, we offer an extensive product range of medium & high voltage generators from 2 - 75 MVA. To be driven by gas or steam turbines and, diesel engines including excitation control, suitable for many applications including, Marine, Offshore and Onshore Oil & Gas, Naval, Industrial, Renewable Energy and Power Generation.

All generators delivered from Rotating Machines Rugby are designed and tested in accordance with the relevant IEC, NEMA, IEEE, and ANSI codes.

Designs can be customized to match specific customer specifications.

Machines are designed to operate within the temperature rises specified in the applicable code and to withstand all normal operating conditions, including suddenly applied loads, switching surges and short circuits external to the generator.

Our generators can be designed to meet the requirements of the major marine certifying authorities including DNV, ABS, BV, Lloyds, RMRS, etc.
Rotating Machines Rugby

A Pedigree in Innovation

1902 - The Rugby Mill Road factory British Thomson Houston (BTH) opens and commences manufacture of motors and generators. The 1st machine designed in Rugby was a vertical 700kW single-phase turbo-alternator running at 1500rpm.

1914 - At the beginning of World War I BTH expands its product range into naval electrical equipment and supplies the Royal Navy with lighting, radio and signalling gear. The company’s experience of manufacturing filament lamps enables it to commence manufacture of valves for radio equipment.

1937 - Frank Whittle’s power jet company builds the world’s first prototype jet engine at the BTH works in Rugby. During World War II, manufacturing in Rugby diverts to support the war effort producing radio valves, transmitters and receivers, aircraft electronics and electric torpedoes.

1958 – British Thomson Houston and Metropolitan Vickers merge to become Associated Electrical Industries (AEI). The Rugby facility with 12,000 employees reaches its peak size with the building of a new research laboratory in 1960 on the Rugby, Boughton Road site.

1998 - GEC Alsthom and Ceglec projects are re-united as Alstom under French ownership. Further investment at the Rugby facility sees the opening of a new £3million test facility in 1999.

1967 – AEI is acquired by the General Electric Company (GEC). In the 1960’s and 1970’s there was a big drive to recruit apprentices. GEC’s highly regarded apprenticeships were exposed to production of a wide range of industrial products.

1986 - GEC in Rugby separates into GEC Alsthom and Ceglec Projects. The 2 main propulsion motors for Cunard’s cruise liner, Queen Elizabeth II are manufactured at the Rugby facility.

2006 – Alstom sells it’s Power Conversion business to private equity firm, Converteam is formed as a power conversion engineering company. Permanent Magnet Generators (PMG) are added to the Rugby facility manufacturing line.

2011 - General Electric acquires Converteam to become GE’s Power Conversion business. Rugby becomes Centre of Excellence for Generators, supplying customers across the Marine, Naval, Oil & Gas, Metals, Mining and Renewable industries.

1947 - Dennis Gabor a young Hungarian refugee, employed at BTH in Rugby since the 1930’s, conducted basic experiments in holography - at that time called ‘wave front reconstruction’. In 1971, Gabor was awarded the Nobel Prize in Physics for his invention and development of the holographic method.
Product Line Manufacturing

Motors & Generators

4 POLE SYNCHRONOUS GENERATORS
For Industrial Applications
5MW to 80MW

MULTI POLE SYNCHRONOUS GENERATORS
For Industrial Applications
5MW to 40MW

PERMANENT MAGNET GENERATORS (PMG)
For Wind Applications
2.5MW to 8MW

ADVANCED INDUCTION MOTOR
Naval applications
Typical power 20MW

COMPACT INDUCTION MOTOR
Commercial applications
Typical powers 3 to 20MW

VERTICAL INDUCTION MOTOR
Typical powers 4-5MW
600-720RPM

MINE WINDERS
Typical powers 3-5MW
40-60RPM

EXCITATION & CONTROL SYSTEMS
High technology digital control

Processes & Footprint

Unique Manufacturing Capabilities

Machine & Press Shop

Vacuum Pressure Impregnation

Stator & Rotor Build

Assembly, Test & Packaging

Footprint: 21,800 m²
Cranage: 200 tonne
Clearance: 21 metres
The site's heavy materials enter into the facility through the Machine and press shop for initial processing and machining including cold-rolled low-loss silicon steel which is then die cut into laminations.

**STATOR BUILD**
Specially designed mandrels are used to build each stator core from our Standard Product Platform (SPP):
- Ring Laminations
- Segmented Laminations

The mandrels guarantee concentricity of the bore and alignment of the coil slots. After the core build process, consolidation pressure of up to 600 tonnes is applied to the core prior to the final welding operation. Adjacent to the mandrels is the pin vent welding facility where a computer controlled machine welds spacing pins to the laminations in a predetermined pattern. Where specified these are added to the core build to provide improved module ventilation.

The stator core assembly consists of insulated laminations of low-loss silicon steel, clamped between compression plates to reduce eddy current losses. Our generators employ GE's patented Pin Vent technology. In this construction the conventional drawn beams are replaced by circular steel pins. Pin Vent technology maximises heat transfer and efficiency by increasing the number of ducts and hence core surface area.

**ROTOR BUILD**
Dependent upon the size of the machine, the rotor will be constructed from one of our standard product platforms (SPPs):
- 4 Pole Laminated Rotor
- 4 Pole Solid Pole Rotor
- Multipole Laminated Rotor
- Separate Poles
Coil Shop & Stator Winding

**COIL SHOP**

The coil shop undertakes the winding and insulating of the diamond coils ready for stator winding. This area boasts the site’s first automated robot arm, specially designed to apply insulation materials. The coils are inserted into the stator slots and are firmly held in position with epoxy glass wedges. The end windings are then securely braced before the complete wound stator undergoes a Vacuum Pressure Impregnation (VPI) process, giving a full class F insulation system.

**STATOR WINDING**

The winding facility is located in a designated clean area. All stators are wound in this environment. The manufacturing processes include operations such as coil insertion, interconnecting, bracing and high-voltage testing. The stator coils are produced in-house from annealed copper strip insulated with mica. Once loops of the correct number are formed, the coil straight portion is pressed to bond the strand together prior to being pulled to the required shape. The coil is insulated with the appropriate number of layers or mica tape followed with a finishing tape on the end winding portion which provides additional protection.

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**VACUUM PRESSURE IMPREGNATION (VPI) - CAPABILITY**

- 1 tank (5.5 metre diameter)
- 2 x tanks (4.5 metre diameter)
- VPI Oven & Horizontal VPI Tank
- VPI Computer Controls

The Vacuum Pressure Impregnation (VPI) facility consists of three vessels, one horizontal and two vertical. The larger of the vertical vessels, has a volume of 145,000 litres with a diameter of 5.5 metres and an overall height of 6 metres. Its foundations penetrate the ground by 8 metres.

The complete wound stators are Vacuum Pressure Impregnated with a GE specified resin and rotated whilst they are being cured. This rotate curing process in the GE manufacturing technique ensures uniformity of distribution and retention of resin and consolidation of the insulation and winding.

All stators are impulse and HV tested prior to and after impregnation.
Assembly, Test & Packaging

ASSEMBLY
In the assembly the generators and motors are assembled using flow-line principles and techniques.

TEST
Comprehensive and modern test facilities, offer tests for individual machines; packaging equipment with gear boxes; and for combined testing with variable speed drives and driven machinery. Eight integrated test stations provide extensive flexibility for testing both horizontal and vertical machines. The test stations are backed by automated control and online measuring.

IEC 60034 Testing
Static: Resistances, HV Test...
Mechanical Running: Vibration, Bearing Run, Rotor over speed.
Electrical Running: OC/SC Characteristics and losses, Zero pf simulated load testing...

PACKAGING
The packaging facility customises electrical machines to meet our customers' specifications. Activities include air-gap setting, gear box line-out, instrumentation wiring and assembly of the bearing housing. The packaging facility has the capability to assemble and move a complete machine weighing up to 200 tonnes.

The experience list below highlights a selection of installed base which has been provided out of the Rotating Machines Rugby facility. Further references can be provided on request; please note that project/customer name cannot be disclosed for confidentiality reasons.

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<th>Product</th>
<th>Environment</th>
<th>Location</th>
<th>No. of Units</th>
<th>KVA of Each Unit</th>
<th>Power Factor</th>
<th>No. of Poles</th>
<th>Speed RPM</th>
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<th>Enclosure</th>
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At GE, we understand that the goals of your organization are demanding, and evolving. To help you meet these goals here at GE Power Conversion we provide a service that goes beyond just waiting for your call.

We offer a range of aftermarket services including replacement units, field services, spares, in-shop repairs, service agreements, unit upgrades and technical support. Our mission is to satisfy our customer needs in the aftermarket of power generation.

INSTALLATION & COMMISSIONING
Installing with confidence. Our team of field service engineers are on hand to ensure that your assets go into active service functioning efficiently.

TRAINING PROGRAMS
Through our in-depth training modules we provide our customers with the knowledge and skills to operate and maintain equipment in the field.

INSPECTION & REPAIR
We offer a broad array of motor, generator, excitation and protection relaying inspection and repairs services, supported through our international network of GE specialists and service shops.

Our team of project management experts are available to support schedule your overhaul requirements, working with you to ensure you are provided regular project updates and work is completed to your satisfaction on time.

SERVICE CONTACT CENTERS
Our global service call center is available 24 hours a day, 7 days a week. Supporting our customers to register and assign your enquiry to the appropriate expert team within the GE Power Conversion technical network for assistance.

Contact our global service call centre* by telephone or email: escc.geem@ge.com.

France +33 177312323
Germany +49 69 66125588
India +91 44 496 80008
UAE +971 2 6994931
UK +44 1788 563800
China +86 400 021 5605
ANZ +61 1300 193 189

*Note that you may be charged different rates when calling from a mobile. Toll free numbers are toll free only in certain countries. Please check with your local provider.

ENHANCED TECHNICAL SUPPORT
We offer enhanced technical support to customers with service agreements. Our enhanced technical support agreements are designed to suit your specific needs including the availability of 24/7 on-call technical assistance, remote support and immediate mobilization to emergencies.

SPARES AND CONSUMABLES
The GE Parts team is available to advise the appropriate spares and consumable parts for you to hold in stock. For those emergencies the team will support provide the parts you need on time and at the quality you expect.

DIAGNOSTICS AND SPECIALIZED
Delivering high technology and diagnostic services our specialist field engineers will apply our in-house analysis tools to analyse the asset's performance. Working with you to resolve issues on installations in the field efficiently and reliably.

UNIT UPGRADES
To extend the life of your asset, our engineering design team will provide you with suitable upgrade options aligned to meet your technical specification and requirements to improve efficiency, production and to reduce emissions.

SERVICE FOR A LIFETIME
Our goal is to provide you with a complete product life-cycle solution, to minimize risk and help you get the most out of your asset.

We’re at work with you
Wherever you are across the globe... We’re adding people, parts and perspective to your everyday operations. Helping to keep your operations running smoothly... for the long term
HAVING THE RIGHT PARTNER IS AS VITAL AS HAVING THE RIGHT TECHNOLOGY

GE as a Partner

Contact us

HAVING THE RIGHT PARTNER IS AS VITAL AS HAVING THE RIGHT TECHNOLOGY

We innovate to provide the most advanced technologies to deliver clear competitive advantages to our customers’ processes.

Return on Investment, Reliability, Safety, Efficiency, Compact-Light Weight, High Torque Density, Low Noise and Vibration Signature

Today and into Future Generations.