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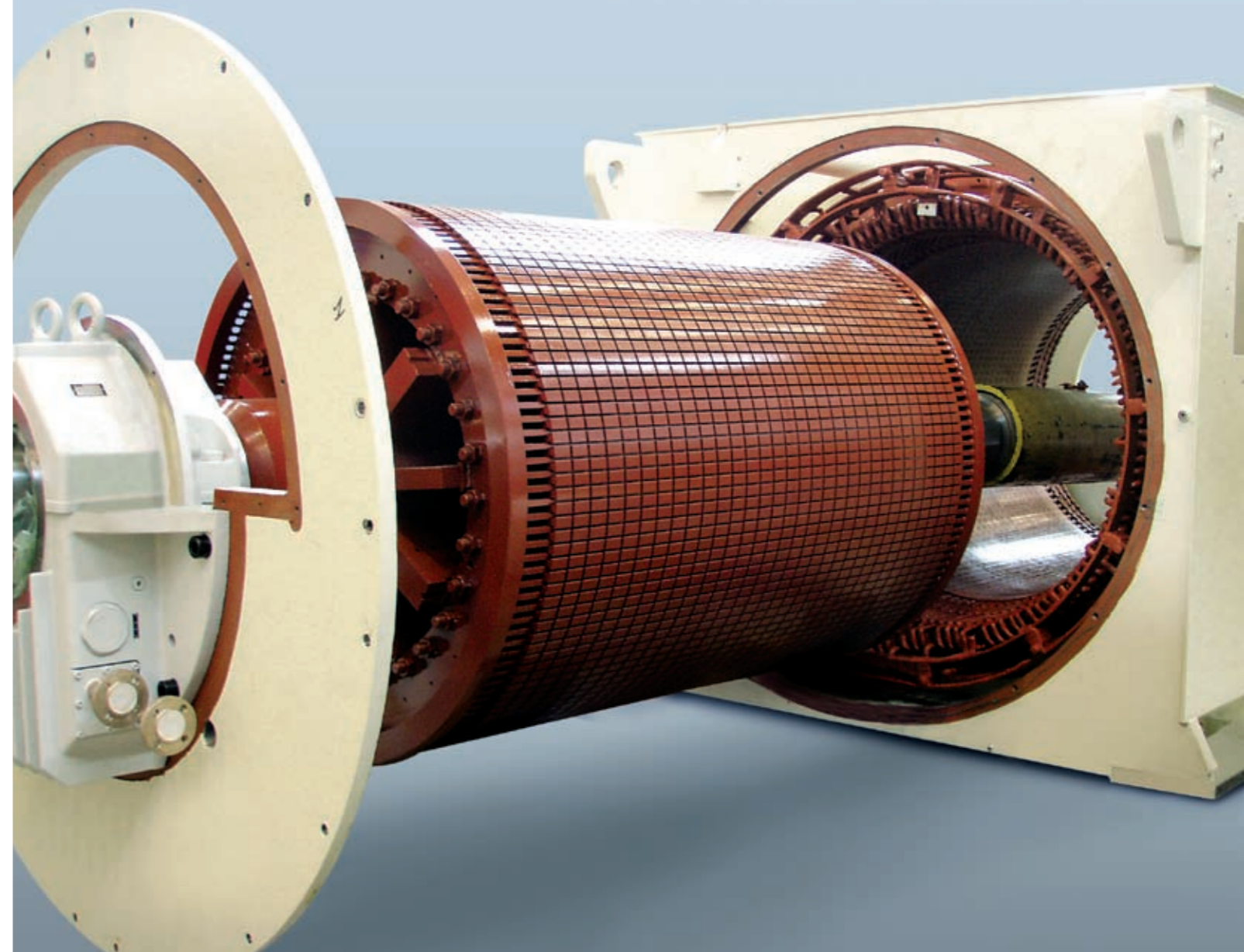
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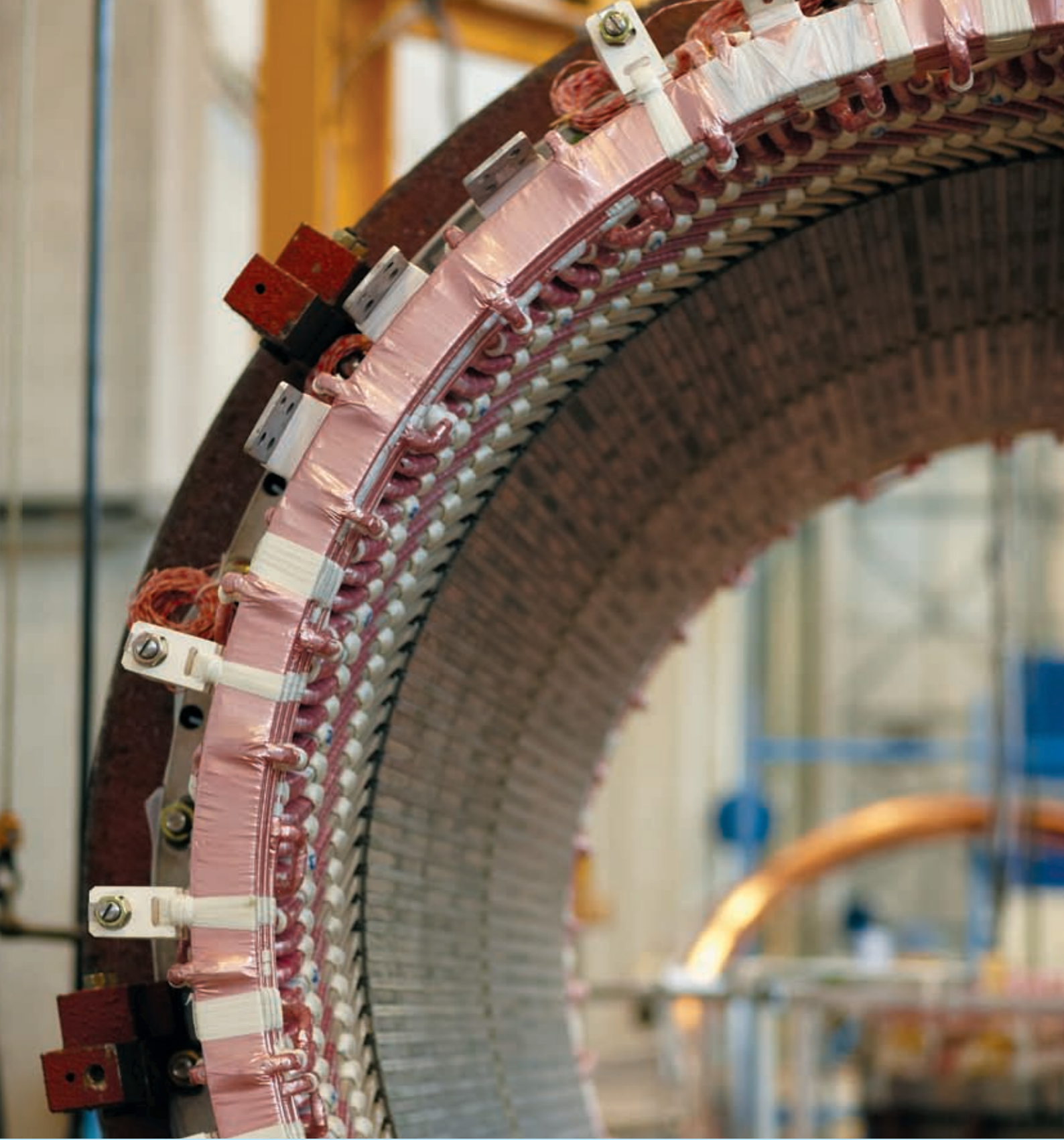
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Motors and Generators
A complete range of high performance
electrical machines



Worldwide Leader in Supplying Electrical Machines for all Market Applications

Converteam has more than 100 years of combined experience in the design, manufacture, testing and support of electrical machines supplied from our factories.

We are located in 14 countries and have supplied in excess of 20 000 motors and generators to more than 115 countries worldwide. As a result, Converteam is one of the world's leading international suppliers of electrical machines.

Our extensive product range includes leading edge technology based around both induction and synchronous machines.

Our broad offering ranges from standalone machines to turnkey systems focusing on the following applications:

Oil & Gas

Electrical machines are used in both onshore and offshore industry for driving pumps and compressors and generating power. They can be used for fixed or variable speed applications. Converteam is able to supply fully customized electrical system solutions all along the value chain from extraction (including subsea compression) to pipelines and storage, refineries, petrochemical and Liquefied Natural Gas (LNG) plants. We also supply electrical propulsion and automation for offshore vessels, including Floating Production, Storage and Offloading Vessels (FPSO's) and semi-submersibles.

Marine

Converteam supplies high performance propulsion systems for merchant, naval and research vessels including cruise ships, LNG carriers and tankers. Our systems include generators, power distribution, inboard and outboard electric propulsion systems and vessel control. Our extensive track record and well-established brand name result from our leading position in the marine market over many years.

Power Generation

Converteam provides generators up to 100 MW, motors and drives for auxiliary systems in gas, steam, hydro, geothermal, biomass, nuclear and diesel power generation plants.

Industry

Converteam supplies complete power conversion solutions including motors, drives and automation for different types of industries such as: air separation, cement, material handling, metals, mining, test benches and others (glass, pulp and paper, water treatment).

Renewable Energy

Converteam provides complete electrical systems: generators, converters, including direct-drive and hybrid Permanent Magnet Generator (PMG) solutions and automation systems. These technologies are well suited to environments requiring low maintenance and are used in offshore and onshore wind turbines, wave and tidal technologies.

Converteam — a world leading company in electrical solutions

Converteam is an engineering company providing customized solutions and systems converting electrical energy into productive performance. These solutions are built around three core components: rotating machines, variable speed drives, automation and process control.

Our scope covers consulting, design, manufacturing, system integration, installation, commissioning and a broad range of services. Our worldwide workforce remains fully committed to one overriding goal: to bring you the best in technology, backing this up with truly effective service in all markets. Our expertise covers marine applications, industry, oil & gas and offshore, renewable sources of energy, and more.



10 MW - 85 rpm propulsion motor for marine application

Cutting-Edge Innovations to Meet Customers' Needs

Induction Motors, a Reliable Choice for almost all Applications

At Converteam, we provide the most advanced technologies to deliver clear competitive advantages to our customers. Research and Development (R&D) plays a key strategic role at Converteam. Our R&D programs focus on the technologies that enable Converteam to offer new solutions to meet customers' needs. The major innovations featuring Converteam's main developments are:

High-speed technology

Our high-speed direct-drive induction motor technology is a good example of Converteam's capability to develop innovative concepts. This cutting-edge technology was first developed 15 years ago and now Converteam is the world leader and most experienced supplier of high-speed solutions.

Our designs provide the following:

- Light weight - most compact
- High torque density
- Low noise and vibration signature
- High efficiency
- Reliability
- Safety
- Return on investment

POD solutions

The electrical solutions for outboard propulsion were developed by Converteam at the end of the 90's, and are used for merchant, offshore and naval applications.

More recently, we have developed a new compact and more efficient propulsion system (pump-jet POD), featuring innovative high torque density induction motors fed by Pulse Width Modulated (PWM) converters.

Advanced Induction Motor (AIM)

The Advanced Induction Motor is a multi-phase, shock hardened, high torque density induction motor. The AIM was specially designed for converter starting which allows for more flexibility in operation and optimization of the electromagnetic design. This, in turn, enables improved efficiency and power factor whilst allowing a larger air gap to be used to provide a good shock withstand capability.

High Torque Density (HTD) induction motors

In 2005, Converteam successfully delivered, for a research vessel, the first High Torque Density induction propulsion motor in the world.

Since then, we have developed, manufactured and commissioned HTD motors for merchant marine applications, with powers up to 24 MW and speeds of 130 rpm.

Direct-drive Permanent Magnet Generators (PMG)

Converteam has developed innovative solutions for wind applications, with first installations of semi-geared generators back in 2004. In 2008, our first direct-drive PMG was delivered and successfully tested on customer site.

Active Stator technology

The next generation of propulsion motor, the APM (Advanced Propulsion Motor) is based on Active Stator technology in which the machine is an «inside out» brushless DC machine with a solid-state commutator.

By replacing the conventional mechanical commutator with an electronic commutator, the Active Stator is able to achieve significant improvements in noise levels and reliability.

One of the principal objectives of Active Stator and APM development was to maximize the power density using approximately 50% less volume than an equivalent AIM and designed specifically for use in confined areas for small surface and subsurface vessels.

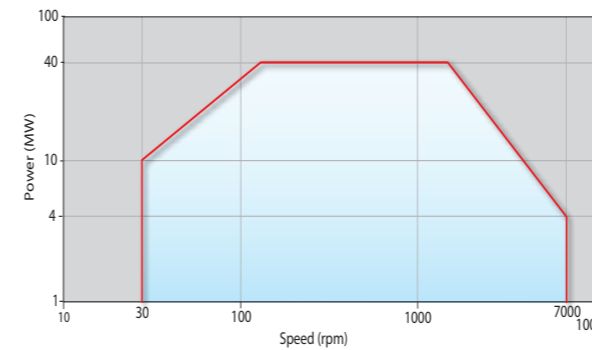
High-Temperature Superconducting (HTS) motors and generators

The HTS technology is now well known. When applied to a motor or a generator, it features the following benefits:

- Reduced size and weight (by 3 to 4 times)
- Improved efficiency with almost zero losses
- Significantly reduced noise and vibration levels
- Maintenance free.

Converteam has successfully designed, manufactured and tested a 250 kW, 1500 rpm prototype machine using HTS conductors.

The ruggedness and simplicity of induction motors makes them a reliable choice. Converteam is a leader in the design and manufacture of high power induction motors (up to 40 MW) and of low starting current motors.



Output Range	Up to 40 MW / 44 200 HP
Speed	30 – 7 000 rpm
Frequency	50 Hz / 60 Hz and variable frequency
Voltage	690 to 14 000 V
Construction	Horizontal or vertical
Standards	All major international standards
Cooling	Air or water-cooled

The main advantages of an induction motor are the robust mechanical construction of the rotor and the reduction in the number of parts required compared to a synchronous motor. The induction motor offers lower weight and inertia, higher efficiency, higher overload capacity and is more cost-effective to manufacture than the equivalent synchronous machine.

These features also mean that the induction motor is nearly maintenance free while providing dependable performance.

With the recent advances of Converteam's high powered, variable frequency drives, induction motors can now be used in almost all applications where high reliability and robust performance is required.



2.4 MW - 1 200 rpm induction motor

Features of Converteam solution:

- High torque density
- Low noise and vibration level
- Direct-drive solution (gearless)
- Robustness
- Suitable for hazardous area
- Possibility of low starting current for direct-on-line motors

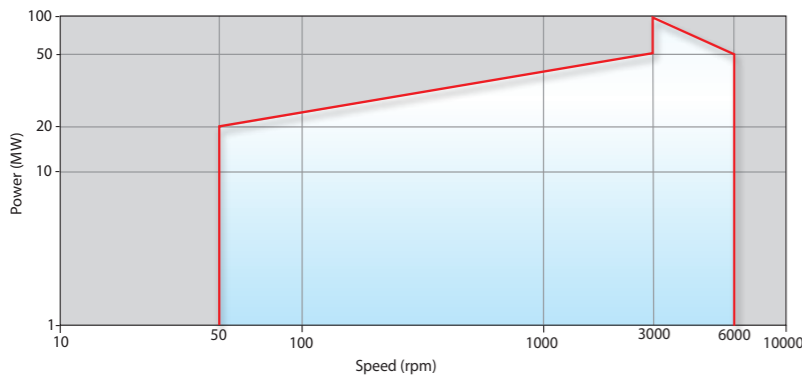
Value for customers:

- Compactness
- Environmental benefits
- High efficiency
- Reliability
- ATEX compliance
- Smooth start-up

Synchronous Motors for High Efficiency and Reliability

Unique Expertise in High-Speed Direct-Drive Solutions

Converteam offers a full range of horizontal and vertical synchronous motors, ranging from direct-drive high torque density motors (at speeds as low as 20 rpm) to turbo-type motors for compressor applications.



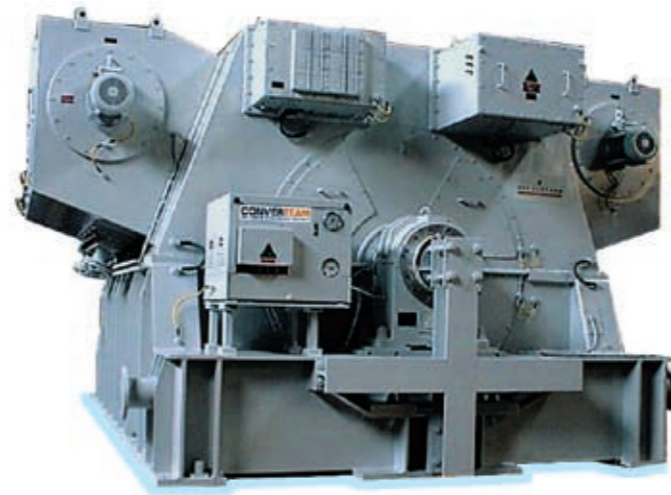
Output Range	Up to 100 MW / 135 000 HP
Speed Range	20 – 7 000 rpm
Frequency	50 Hz / 60 Hz or variable frequency
Voltage	690 to 15 000 V
Excitation	Brushless or static with collector rings
Construction	Horizontal or vertical
Standards	All major international standards
Cooling	Air or water-cooled

Synchronous motor rotor platforms:

- Salient pole rotors (both laminated and solid pole versions available - dependent upon starting requirements or duty cycle)
- Cylindrical rotor-concentric field winding
- 2 pole turbo rotor.

We can rapidly adapt our standard product platforms to cater for many applications or any proposed starting methods, including but not limited to:

- Fixed-speed started by asynchronous means, e.g. direct-on-line, series reactor, capacitor, reactor/capacitor, auto-transformer (single or multi-stage)
- Fixed-speed started by pony motor, electronic soft starter or mechanical gear system (i.e. variable speed planetary gear)
- Variable speed drive system controlled.



7 MW - 170 rpm synchronous motor

Features of Converteam solution:

- Low starting current machines available (starting and pull-in torque based on electrical system limitation and load requirements)
- Brushless excitation system (slip ring solutions are available for special applications)
- Robustness (in particular brushless components)
- Optimized design
- System improvements (power factor correction capabilities)

Value for customers:

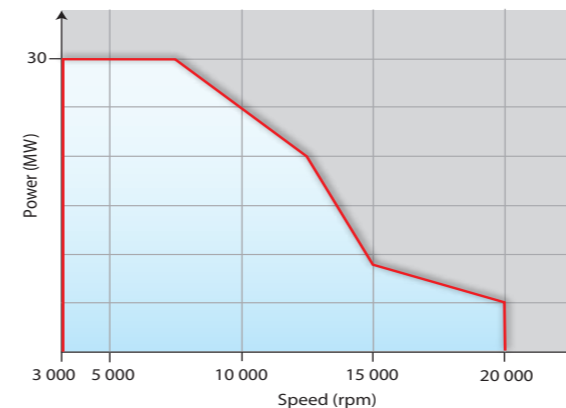
- Smooth start-up
- Reduced maintenance
- High reliability
- High efficiency
- Improved performance (reactive power and reduced OPEX)

Converteam is the leader and the pioneer in high-speed direct-drive solutions. The direct coupling, without using a gearbox, makes the system more efficient and reliable and allows a totally emission free solution to be offered.

High-speed induction motor technology

Our high-speed solution is based on an induction motor technology (called MGV) with a squirrel cage and laminated rotor.

Speed	Up to 20 000 rpm
Power	Up to 30 MW



Integrated compressor units (1 to 17 MW)

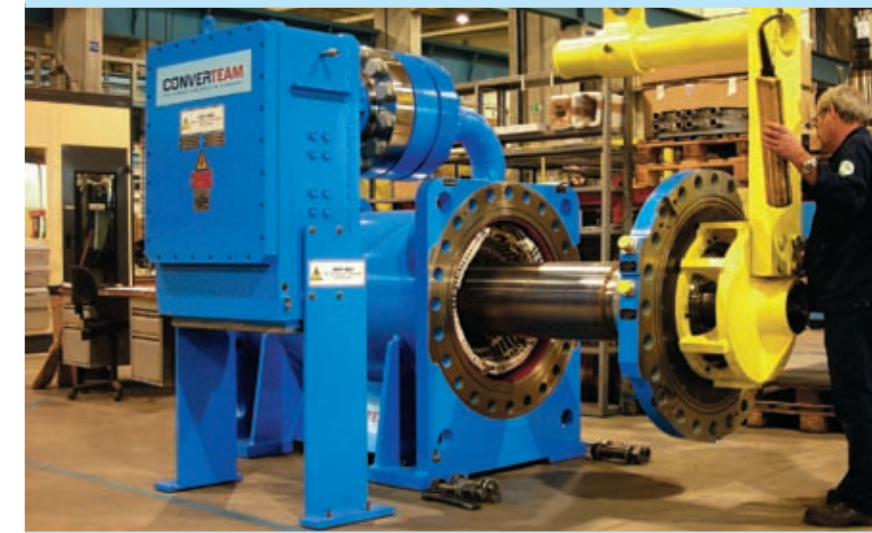
In this application the high-speed induction motor and the compressor are installed inside the same pressurized casing. This design is suitable for subsea projects.

Cooling	By the processed gas
Bearings	Magnetic bearings

Standalone motors (1 to 30 MW)

Standalone high-speed motors can be used to drive any kind of rotating equipment. Their small size, weight and footprint mean that they can readily be accommodated within existing structures when used to replace older drive equipment.

Cooling	Air-to-air or air-to-water
Bearings	Oil-lubricated or magnetic bearings

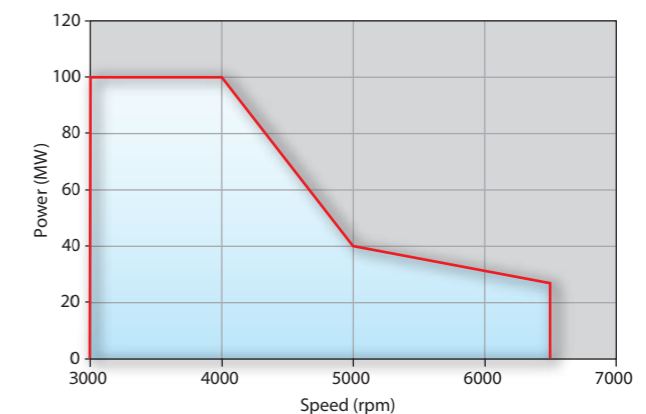


6.8 MW - 11 700 rpm high-speed MGV motor

High-speed synchronous motor technology (2 pole turbo)

Through very careful design and control during manufacturing, the 2 pole turbo offers excellent performance, efficiency and flexibility as well as high reliability.

Speed	Up to 7 000 rpm
Power	10 MW to 100 MW
Cooling	Air or water-cooled



Main benefits of Converteam solution:

- Direct-drive
- Reduced footprint
- High efficiency
- High availability and reliability
- Very low maintenance and operating costs

A Complete Range of Large Industrial Generators...

...Suitable for Many Different Market Applications

Converteam has an extensive product range of synchronous generators (including excitation control schemes) suitable for many market applications, including power generation, marine (naval, merchant, etc), industry (including test benches) and oil & gas applications.

4 pole generators for gas and steam turbine applications

Our range of 4 pole generators provides a reliable, power dense product which is based on a modular construction concept, utilizing the latest design and manufacturing techniques, including Vacuum Pressure Impregnation (VPI) insulation systems (for both the stator and rotor components) and the Converteam unique cooling technology.

Rating	5 000 kVA to 75 000 kVA
Voltage	400 to 15 000 V
Frequency	50 Hz / 60 Hz
Cooling	Air or water-cooled



21 000 kVA - 1 800 rpm 4 pole generator for gas and steam turbine application

2 pole generators for power generation

Converteam's range of 2 pole turbo-generators provides a robust design coupled with state-of-the-art rated speed dynamic balancing which ensures the lowest levels of vibration resulting in smoother operation and longer life.

Rating	7 500 kVA to 150 000 kVA
Voltage	3 300 to 15 000 V
Frequency	50 Hz / 60 Hz
Cooling	Air or water-cooled

Hydro generators for conventional and pump storage applications

Converteam has an extensive history in the hydro market having supplied some of the world's largest hydro power plants with generators and generators/motors for pumped storage applications. We are in a quite unique position of being able to offer some of the world's largest integrated VPI stator units in these applications. These stators can be delivered to site in one piece, hence significantly reducing the on-site installation time and risk.

Rating	2 500 kVA to 100 000 kVA
Voltage	3 300 to 15 000 V
Frequency	50 Hz / 60 Hz or variable speed (HTS)
Cooling	Air or water-cooled
Construction	Horizontal or vertical
Excitation	Static or brushless

Diesel & gas engine-driven generators

Our range of multi-pole generators is specifically designed for medium speed diesel applications. The machines are designed to operate within the specified temperature rises and to withstand all normal operating conditions, including suddenly applied loads, switching surges and short circuits occurring externally to the generator as well as the high levels of vibrations associated with this type of prime mover.

Rating	2 500 kVA to 45 000 kVA
Voltage	400 to 15 000 V
Pole N°.	6 to 22
Frequency	50 Hz / 60 Hz
Cooling	Air or water-cooled



11 MW - 514 rpm diesel & gas engine-driven generator

Wind generators

Permanent Magnet Generators (PMG)

Converteam provides direct-drive and semi-geared (one-stage gearbox) and two-stage high-speed Permanent Magnet Generators.

Rating	2 500 kVA to 12 500 kVA
Voltage	690 to 14 400 V
Cooling	Air or water-cooled
Construction	Horizontal or vertical



3.7 MW - 14 rpm Permanent Magnet Generator

Doubly Fed Induction Generators (DFIG)

Converteam has all the competencies and references to supply Doubly Fed Induction Generators, which are used in many installations.

Rating	2 500 kVA to 10 000 kVA
Voltage	690 to 15 000 V
Cooling	Air or water-cooled
Construction	Horizontal or vertical

Fully Dedicated Services for Electrical Machines of all Types

Converteam provides 24/7 support from initial design studies, manufacturing and commissioning to after-sales and service through a network of regional business centers. Thanks to our experience with equipment of all types and generations our highly qualified teams provide a complete lifecycle support to your equipment.

At Converteam we are committed to a proactive management of your systems. Our scope of services includes:

- Installation, commissioning and start-up
- Maintenance and field support
- Spares / replacement parts
- Rebuilds and rewinds
- Refurbishment / replacement
- Technical support.

Refurbishment

All motors and generators are subject to aging. Factors such as network harmonics, tough starting conditions, corrosive atmospheres, short circuits, poor maintenance all have a negative impact on electrical machines.

Motors or generators need to be refurbished to secure safe operation and reduce breakdown risk. Converteam removes, refurbishes, re-commissions and services your installed equipment, offering you a cost-effective solution.



Replacement

Converteam has a large and well documented installed base around the world. If your motor or generator was manufactured by CGE, GEC, AEG, Westinghouse, Cegelec, ALSTOM or Electric Machinery, or by any other company whose products have been included in the Converteam electrical machines range by merger or acquisition, the drawings will be available in our archives.

In many cases, a new identical motor can be manufactured, irrespective of the age of the installed equipment.

Our capability is not limited to products of our own manufacture. As far as possible, we ensure that interfaces like the foundation and electrical / mechanical connections are arranged to minimize site-work. These factors make Converteam the optimum partner for equipment owners planning replacement of motors and generators.



Technical support

Converteam can replace older motors and generators with completely new designs. A unit with the same power as the existing equipment can today be fitted in a smaller frame size, leaving space for an intermediate base.

In this way the existing foundations can be retained. Interfaces such as the main terminal box and auxiliary boxes are designed so as to enable the existing installation to be reused as much as possible.

Electrical Machines Manufacturing Plants

Converteam Group operates in four strategically located electrical machines plants to better serve our customers worldwide.

Rugby, United Kingdom
Site area: 26 500 sq.m. - Established in 1889



Nancy, France
Site area: 25 000 sq.m. - Established in 1898,
new factory in 2002



Minneapolis, USA
Site area: 42 000 sq.m. - Established in 1897



Yantai, PR China
Site area: 20 000 sq.m. - Established in 2008