Marine applications
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Our vision

To become the global market leader of electric rotating machines in all our core markets.

Our mission

Our mission is to aid the sustainable growth of our customers’ businesses. We will provide innovative solutions inspired by relentless efforts to understand our customers’ needs and their specific applications. We will leverage our extensive technical knowledge, product performance and service to increase the competitiveness, efficiency and productivity of our partners worldwide.
Marelli Motori Group of Companies

The Marelli Motori Group is one of the world’s leading designers and manufacturers of generators and electric motors. The company was founded in 1891 and nowadays enjoys worldwide brand recognition thanks to its extended sales, distribution and service networks across four continents and two manufacturing facilities, based in Italy and Malaysia, which produce technologically advanced products sold in more than 120 countries.

Our business model is based on a successful combination of four key elements that enable Marelli Motori to offer innovative and inspired solutions which create value for our customers:

- wide range of innovative products
- skilled people providing sales & support globally
- local for local approach
- continuous investment in R&D.
Core markets

Marelli Motori operates in six key markets:

**Marine**

Marelli Motori manufactures electric motors and generators for all marine applications where power is required. Our product applications include:

- propulsion, thrusters, FI-FI system, auxiliaries, dredge pumps, winch and PTO-PTI system
- shaft generators, hybrid machines, offshore, variable speed generators and emergency.

Motors up to 10,000 kW
Generators up to 11,000 kVA

**Power generation**

Marelli Motori manufactures generators for all applications where energy is required. Our product applications include:

- Prime Rated Power (PRP) and Continuous Operating Power (COP)
- stand by
- emergency
- Uninterruptible Power Supply (UPS)
- telecom.

Generators up to 12,500 kVA

**Cogeneration (CHP)**

Marelli Motori manufactures electric generators for combined heat and power applications. Our product applications include:

- internal combustion (diesel and gas) engines
- steam and gas turbines.

Generators up to 12,500 kVA
Marine applications

The company • Marine applications

Marelli Motori manufactures electric motors and generators for the oil and gas market. Our product applications include:

- power generation, auxiliary generators and emergency
- centrifugal & reciprocating compressor motors
- heat exchangers & blowers
- pumps (pipeline, water, transfer, cooling, booster)
- extruders / expanders, conveyors, systems
- mixers, mills and cranes.

Motors up to 1.600 kW
Generators up to 12.500 kVA

Oil & Gas

Hydropower

Marelli Motori manufactures electric synchronous and a-synchronous generators for hydro power plants which can be utilized in any turbine installation. Our product applications include:

- Pelton turbines
- Francis turbines
- Kaplan turbines
- Turgo turbines
- Cross-Flow turbines.

Asynchronous generators up to 2.800 kW
Synchronous generators up to 9.000 kVA

Industrial

Marelli Motori manufactures electric motors for a wide variety of industrial applications. Our product applications include:

- power
- metals
- pulp and paper
- cement
- sugar mill
- water pumping and treatments
- manufacturing processes
- mining
- chemical.

Motors up to 10.000 kW
Our commitment to quality

Quality certifications

The Marelli Motori Group uses an Integrated Management System (IMS) which monitors quality, safety, health and safety and environment standards according to ISO 9001, ISO 14001 and OHSAS 18001.

Our quality certifications guarantee the highest standards in all areas of our operations to ensure:

- outstanding product quality allied to best-in-class service performance
- market leading customer satisfaction by ensuring compliance with all customer requirements from product reliability through to durability and ease of maintenance
- a safe place to work in
- minimal environmental impact in all our operations.
Our quality strategy

The Marelli Motori commitment to quality involves all employees from the boardroom to the shopfloor. Our aim is to help our employees to:

• develop a culture of quality, heightening awareness of quality issues, skills with appropriate and information
• ensure all employees comply with relevant quality regulations and procedures for the highest product quality, health and safety, and environmental standards
• plan and organise their activities with customer-oriented logic with customer satisfaction the ultimate goal at all times
• continuous evaluation of employee proposals for the improvement of processes defining key objectives and goals for the minimisation of environmental impact and health and safety risks of the personnel involved
• develop a culture where individual behavior leads to a safer and healthier workplace
• increase the awareness and involvement of all employees in work-related safety issues
• promote the Marelli Motori commitment to health and safety amongst the entire supply base ensuring a mutually beneficial relationship, enhancing the ability of both to create value.
Inspired solutions

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No compromise on quality

Vertical manufacturing
Marelli Motori's manufacturing process is vertically integrated which ensures we retain control of our supply chain both upstream and downstream.

High quality materials
Our products are manufactured using the highest quality materials and components from internationally recognised brands which are regularly audited to maintain standards.
Our electrical machines are designed and engineered to ensure a long production life, using components, such as bearings, which have been developed for the most demanding customer requirements.

Outstanding vibration resistance
Our products are required to work in very harsh environments, whilst maintaining the highest standards of reliability and efficiency. As a result, we have developed a range of sturdier mechanical designs, able to withstand extreme vibration levels and shock, above 16 mm/sec RMS.

Special impregnation process
The durability of our electrical core components is vitally important in maintaining uptime and productivity. As a result we have developed our own VPI (Vacuum Pressure Impregnation) process in-house, which ensures that the machine windings are sealed against moisture and vibration, in turn aiding mechanical strength and reliability.

International marine certifications
Independent accreditation is important for your peace of mind. All of our motors and generators comply with all major international marine certifying societies, such as ABS, KR, BV, DNV, CCS, GL, LR, NKK, RINA, RS etc. and our testing activities can be witnessed first-hand by customers.

Highest efficiency standards
We specialise in offering marine customers the highest levels of generator and motor efficiency via the use of technologically advanced solutions.
Our motors and generators are specifically designed to reach exceptionally high performance standards at any speed and during partial load operations.
Machine arrangements are suitable for variable speed applications, offering best-in-class energy efficiency levels to keep energy costs under control with no compromise on productivity.
Marelli Motori dedicated solutions can exceed 98% efficiency.
Reliable expertise

Extensive and diverse product range

Our comprehensive range of motors and generators have been specifically designed to match the diverse requirements of our customers, offering state-of-the-art solutions backed by outstanding application expertise.

Continuous enhancement through R&D

Our R&D focus is driven by a deep customer understanding which is then converted into product development and continuous range enhancement. We often develop projects in partnership with customers, for example by optimising the integrated system vibration level to avoid critical resonances.

Design flexibility

Our flexibility even reaches final assembly, a point at which customers are still able to adapt a design to meet the requirements of their specific application. Once in the field, our products can be equipped with a range of retrofit devices enabling the continuous refinement and upgrading of machine performance.

Reliable performance

Marelli Motori products are 100% rated power in emergency mode. Non-stop operations can be undertaken during ancillaries replacement and mirror system devices for back-up are standard features. All of our products are extensively tested in our in-house laboratories, with tests including the string test type, to ensure the correct evaluation of electrical and mechanical performances in any working conditions.

Serviceability

Our motors and generators have been specifically designed for ease-of-maintenance, offering quick access to key components to facilitate MRO activities and reduce servicing costs. All of our products have a friendly user-interface which, together with a global service network available worldwide, ensures best-in-class performance and high ROI.

Sustainable approach

Safety first

All Marelli Motori manufacturing sites comply with the International Standards for Safety OH SAS ISO 18000 (Occupational Health and Safety Assessment Series).

Low carbon footprint

Marelli Motori products are designed to deliver maximum performance and high energy
efficiency to achieve the lowest carbon footprint possible. For example, the energy recovery process in place during test room activities enables us to reduce the impact on the environment and mitigate global warming.

**Social responsibility**

Marelli Motori’s approach to social responsibility is based upon minimising our impact on the environment and preserving the world’s natural resources. A key part of this approach is engage, with all of our stakeholders, including our supply chain and customers, partnering with universities for research and development and supporting local communities with charity activities.
Marine applications

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Motor applications

Propulsion

TEWAC
B4V
up to 10,000 kW

TEWC
B4J - B5J
up to 4,000 kW

Thrusters

TEWAC
B4V
up to 10,000 kW

ODP
C3M - C4M - C3W - C4W
up to 10,000 kW

TEWC
B4J - B5J
up to 4,000 kW

TEFC
B5M
up to 1,900 kW

Fi - Fi system

TEWAC
B4V
up to 10,000 kW

ODP
C3M - C4M - C3W - C4W
up to 10,000 kW

TEWC
B4J - B5J
up to 4,000 kW

TEFC
B5M
up to 1,900 kW

Auxiliaries

TEFC
A5M - B5M
up to 1,900 kW

Dredge pumps

TEWAC
B4V
up to 10,000 kW

TEWC
B4J - B5J
up to 4,000 kW
Generator applications

Propulsion generators
- TEWAC MJHRM up to 11.000 kVA
- ODP MJHM up to 11.000 kVA
- TEWAC MJRM up to 6.500 kVA
- ODP MJBM up to 6.500 kVA

Shaft generators
- TEWAC MJHRM up to 11.000 kVA
- ODP MJHM up to 11.000 kVA
- TEWAC MJRM up to 6.500 kVA
- ODP MJBM up to 6.500 kVA

Auxiliary generators
- TEWAC MJHRM up to 11.000 kVA
- ODP MJHM up to 11.000 kVA
- TEWAC MJRM up to 6.500 kVA
- ODP MJBM up to 6.500 kVA
Hybrid machines

TEWAC MJHRM up to 11.000 kVA
ODP MJHM up to 11.000 kVA
TEWAC MJRM up to 6.500 kVA
ODP MJBM up to 6.500 kVA

Offshore

TEWAC MJHRM up to 11.000 kVA
ODP MJHM up to 11.000 kVA
TEWAC MJRM up to 6.500 kVA
ODP MJBM up to 6.500 kVA
TEAAC MJVM up to 5.600 kVA

Variable speed generators

TEWAC MJHRM up to 11.000 kVA
ODP MJHM up to 11.000 kVA
TEWAC MJRM up to 6.500 kVA
ODP MJBM up to 6.500 kVA
TEAAC MJVM up to 5.600 kVA

Emergency

ODP MJBM up to 6.500 kVA
TEAAC MJVM up to 5.600 kVA

Key

TEWAC Totally Enclosed Water to Air Cooled
TEWC Totally Enclosed Water Cooled
ODP Open Drip Proof
TEFC Totally Enclosed Fan Cooled
TEAAC Totally Enclosed Air to Air Cooled
AVRs

Digital Regulators
Marelli Motori digital regulation systems provide functional and reliable solutions for the excitation control of synchronous generators. These highly integrated and robust AVRs are fully configurable and guarantee easy commissioning, monitoring and maintenance by user-friendly proprietary HMI (human-machine interface) software. A wide range of built-in control functions, protections and operating modes make Marelli Motori digital AVRs flexible and suitable for a wide range of applications, including marine, hydro and cogeneration. Our automatic voltage regulator, MEC 100 is DNV type approved.

Analogue Voltage Regulators
Marelli Motori analogue regulation systems are suitable for low and medium voltage machines. The regulators are fully insulated in order to maintain high reliability also with severe ambient conditions (high level of humidity, dust, salt atmosphere) and in case of high vibration level. The AVRs can work both for single and three phase operations.
Services

When you partner with Marelli Motori, customers not only gain access to our outstanding portfolio of motors and generators but also world class aftersales support.

Technical support
Marelli Motori prides itself on providing outstanding technical and application support for all its motors and generators. Qualified technical support personnel are always on hand to help with design, retrofitting and revamping solutions for machines and voltage/control systems.

Field Service
Our highly trained aftersales service technicians are capable of deploying, at short notice, anywhere in the world, rapidly diagnosing faults and ensuring fast and efficient maintenance and repair.

Spare parts
Genuine Marelli Motori spare parts are available at the Marelli headquarters, branch offices and service centres located all over the world.

Repairs
When a machine fails it is vital that a repair is performed quickly to ensure a swift return to operation. Marelli Motori can perform repairs of low, medium and high voltage machines either at our manufacturing facility or at the customer premises.

Commissioning
We understand that correct machine commissioning is vital in ensuring that our motors and generators work to the best of their ability from day one. Marelli Motori provides hands-on assistance during the commissioning phase, guaranteeing that start-up takes place safely and that correct functional parameters for each machine are applied.

Training
Training courses are available all year to users and maintenance people to ensure the correct operation and maintenance of our electrical machines.
Industry standards

**IP Code - Degree of protection (IEC - 60034 - 5)**

<table>
<thead>
<tr>
<th>First number</th>
<th>Second number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>Machine protected against solid objects greater than 12 mm. Dripping water shall have no harmful effect from the vertical up to an angle up to 15°.</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Machine protected against solid objects greater than 2,5 mm. Spraying water shall have no harmful effect from the vertical up to an angle up to 60°.</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Machine protected against solid objects greater than 1 mm. Splashing water from any direction shall have no harmful effect.</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Machine protected against dust. Jets of water from any direction shall have no harmful effect.</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Machine totally protected against tight dust. Jets of water from heavy seas from any direction shall have no harmful effect.</td>
</tr>
</tbody>
</table>

**Example of designation - IP 44**

- **Code IP**
- **4** First number (protection against dust)
- **4** Second number (protection against liquid)
### IC Code - Cooling (IEC - 60034 - 6)

#### Typical fluids

<table>
<thead>
<tr>
<th>Code</th>
<th>Fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Air</td>
</tr>
<tr>
<td>W</td>
<td>Water</td>
</tr>
</tbody>
</table>

#### Typical circuit arrangements

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Free circulation</td>
</tr>
<tr>
<td>4</td>
<td>Machine surface - cooled</td>
</tr>
<tr>
<td>6</td>
<td>Heat exchanger machine mounted (using the motor surrounding coolant)</td>
</tr>
<tr>
<td>7</td>
<td>Heat exchanger built in the machine (not using the motor surrounding coolant)</td>
</tr>
<tr>
<td>8</td>
<td>Heat exchanger machine mounted (not using the motor surrounding coolant)</td>
</tr>
</tbody>
</table>

#### Typical methods of circulation

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Free circulation</td>
</tr>
<tr>
<td>1</td>
<td>Self circulation</td>
</tr>
<tr>
<td>6</td>
<td>Circulation with independent device</td>
</tr>
</tbody>
</table>

#### Example of designation - IC 411

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC</td>
<td>Code IC</td>
</tr>
<tr>
<td>4</td>
<td>Circuit arrangement</td>
</tr>
<tr>
<td>A</td>
<td>Primary fluid</td>
</tr>
<tr>
<td>1</td>
<td>Method of circulation for primary fluid</td>
</tr>
<tr>
<td>A</td>
<td>Secondary fluid</td>
</tr>
<tr>
<td>1</td>
<td>Method of circulation for secondary fluid</td>
</tr>
</tbody>
</table>
Mounting

IEC - 60034 - 7

**IM B3**

Code II: IM 1001
N° of bearings: 2
Feet: With feet
Flange: -
Details: -
Mounting arrangement: Mounting by feet (Feet down)

**IM B34**

Code II: IM 2101
N° of bearings: 2
Feet: With feet
Flange: With flange
Details: End Shield spigot
Mounting arrangement: Mounting by feet (Feet down with additional mounting on D - End Side of flange)

**IM B35**

Code II: IM 2001
N° of bearings: 2
Feet: With feet
Flange: With flange
Details: End Shield spigot
Mounting arrangement: Mounting by feet (Feet down with additional mounting on D - End Side)

**IM B20**

Code II: IM 1101
N° of bearings: 2
Feet: With raised feet
Flange: -
Details: -
Mounting arrangement: Mounting by feet (Feet down)

**IM B2**

Code II: IM 2105
N° of bearings: 1
Feet: With feet
Flange: With flange
Details: -
Mounting arrangement: -
**IM V10**

- **Code II:** IM 1411
- **N° of bearings:** 2
- **Feet:** -
- **Flange:** With flange
- **Details:** Special flange on D - End.
- **Mounting arrangement:** Mounted on D - End
  Side of flange, D - End down

**B5**

- **Code II:** -
- **N° of bearings:** 2
- **Feet:** With feet
- **Flange:** -
- **Details:** Endshield flange at D - End with access to back
- **Mounting arrangement:** Mounted on D - End
  Side of flange

**V1**

- **Code II:** -
- **N° of bearings:** 2
- **Feet:** -
- **Flange:** With flange
- **Details:** Endshield flange at D - End with access to back
- **Mounting arrangement:** Mounted on D - End
  Side of flange D - End down

**IM B16**

- **Code II:** IM 1301
- **N° of bearings:** 1
- **Feet:** With raised feet
- **Flange:** -
- **Details:** Horizontal shaft - One bearing
- **Mounting arrangement:** -
Motor applications

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- TEWAC motors: B4V .................................................................................................. 28
- ODP motors: C3M - C4M - C3W - C4W ................................................................. 31
- TEWC motors: B4J - B5J ......................................................................................... 34
- TEFC motors: A5M - B5M ....................................................................................... 37
Product map

<table>
<thead>
<tr>
<th>Product</th>
<th>Propulsion</th>
<th>Thrusters</th>
<th>Fi-Fi System</th>
<th>Auxiliaries</th>
<th>Dredge Pumps</th>
<th>Winch</th>
<th>PTO - PTI system</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEWAC B4V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ODP C3M C4M C3W C4W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEWC B4JH-B5JH - B4J - B5J</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEFC A5M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEFC B5M</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Motor range

**Key**
- TEWAC - Totally Enclosed Water to Air Cooled
- ODP - Open Drip Proof
- TEWC - Totally Enclosed Water Cooled
- TEFC - Totally Enclosed Fan Cooled

**Motor model**
- B4V
- C3M - C4M - C3W - C4W
- B4JH - B5JH - B4J - B5J
- A5M - B5M
TEWAC motors: B4V

Model B4V

<table>
<thead>
<tr>
<th>Power</th>
<th>Up to 10.000 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltages</td>
<td>Up to 15.000 V</td>
</tr>
<tr>
<td>Frame</td>
<td>355 ÷ 1.000</td>
</tr>
<tr>
<td>Pole</td>
<td>4, 6, 8, 10 and 12</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 81W / IC 86W</td>
</tr>
<tr>
<td>IP</td>
<td>IP 44/ 54/ 55/ 56</td>
</tr>
</tbody>
</table>

Main applications
- Propulsion, dredge pumps, winch, hybrid machine, PTO-PTI system

Other applications
- Thrusters, Fi-Fi system, auxiliaries

<table>
<thead>
<tr>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
<th>10 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW (at 60 Hz)</td>
<td>7.000</td>
<td>10.000</td>
<td>9.000</td>
</tr>
</tbody>
</table>

Certificates and testing

Certificate
Marine Survey Certificate supplied with the machine. Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.

Test and survey
See complete list on Test room chapter.
Main components

Housing
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR). Frame is provided with side ribs to increase the strength. Marelli Motori motors for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

Shield
Made of grey cast-iron (EN 1561 – GJL 200) up to 500 frame size motors. Made of hot-rolled structural steel (EN 10025 – S235 JR) from size 560 and above.

Shaft
General data
Made in carbon steel (EN 10083 – 2 C40 – TN) up to 450 frame and hot-rolled structural steel from 500 frame (EN 10025 – S355 JR).

Shaft design
Cylindrical shaft with key.

Main terminal box
Mounted on side (right or left to be selected). Made of formable steels EN 10130.

Internal fan
Made of aluminum alloy up to 400 frame. Made of hot-rolled structural steel above (EN 10025 – S235 JR).

Heat Exchanger
Construction
- mounted on top of the machine
- double tube made of CuNi 90/10
- copper fins housing
- equipped with water leakage detector
- certified by registers of shipping in compliance with Rules for Classification of Ship
- coolant can be both fresh or sea water
- suitable to be treated with corrosion inhibitors, PH regulators and anti freeze as appropriate to site conditions.

Exchanger data
- designed pressure 6 bar
- test pressure 10 bar
- max glycol: 30%
- type of water: fresh water or marine (salt) water
- flanges: PN6 – PN10 – Special (ANSI).

Construction

Enclosure
TEWAC – Totally Enclosed Water to Air Cooled

Cooling system
IC 81W as per IEC60034-6. Primary fluid (water) is flowing by external water system. Internal air is flowing by a fan mounted on the shaft of the generator at the driven side.

Degree of protection
IP 44 as per IEC60034-5. (Available up to IP 56)

Mounting
IM B3, V1 and V10 as per IEC60034-7.
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses. The stator winding is made of flat copper or round copper wire depending on the machine size. The completely wound stator pack is thereby impregnated in an epoxy-resin VPI. The subsequent heat treatment hardens the resin.

Rotor
Squirrel cage rotor type. Depending on machine size, the rotor construction is either a solid shaft or welded ribbed shaft. The rotor winding can be either a pressure die cast aluminum or a copper bar construction.

Bearing

General data
Antifriction bearings grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and/or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours. Locating bearings are on the D end side and floating bearings on the ND end side. Both bearings are fitted with a regreasing system. The used grease is removed through a valve locked in the outer bearing cover. Sleeve bearings available as an option.

On request special bearings are designed where high radial and axial forces are applied. All configurations are designed to withstand the following marine inclination

<table>
<thead>
<tr>
<th>Static</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>List</td>
<td>±22.5°</td>
</tr>
<tr>
<td>Trim</td>
<td>±7.5°</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values.

Impregnation system
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerisation in oven.

Insulation system
Low voltage
Stator: F class insulated with a synthetic enamel. (H class insulation available on request)

Protective treatments
Marine dedicated protective enamel is applied on the winding.

Optional features
- Dual/multiple winding configuration
- flanged shaft or special shaft end on both sides
- increase protection degree up to IP 56
- encoder
- vibration sensors
- special frame design to suite the application
- special bearings (sleeve or angular contact bearings)
- reinforced winding for VFD operation
- insulated bearings design for VFD application
- shaft earth brush for VFD application
- other options available on request.
ODP motors: C3M - C4M - C3W - C4W

<table>
<thead>
<tr>
<th>Model</th>
<th>C3M - C4M - C3W - C4W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Up to 10.000 kW</td>
</tr>
<tr>
<td>Voltages</td>
<td>Up to 15.000 kV</td>
</tr>
<tr>
<td>Frame</td>
<td>315 ÷ 1000</td>
</tr>
<tr>
<td>Pole</td>
<td>4, 6, 8, 10 and 12</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 01 / IC 06</td>
</tr>
<tr>
<td>IP</td>
<td>IP 23 / IP 44</td>
</tr>
<tr>
<td>Main apps</td>
<td>Thrusters, Fi-Fi</td>
</tr>
<tr>
<td>Other apps</td>
<td>Small Propulsion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pole</th>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
<th>10 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW (at 60 Hz)</td>
<td>7.000</td>
<td>10.000</td>
<td>9.000</td>
<td>7.500</td>
</tr>
</tbody>
</table>

Certificates and testing

Certificate: Marine Survey Certificate supplied with the machine. Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.

Test and survey: See complete list on Test room chapter.
Main components

Housing
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR). Frame is provided with side ribs to increase the strength. Marelli Motori motors for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

Shield
Made of grey cast-iron (EN 1561 – GJL 200) up to 500 frame size motors. Made of hot-rolled structural steel (EN 10025 – S235 JR) from size 560 and above.

Shaft
**General data**
Made in carbon steel (EN 10083 – 2 C40 – TN) up to 450 frame and hot-rolled structural steel from 500 frame (EN 10025 – S355 JR).

**Shaft design**
Cylindrical shaft with key.

Main terminal box
Mounted on top.
Made of cold-rolled formable steels EN 10025 – S235JR.

Internal fan
Made of aluminum alloy up to 400 frame.
Made of hot-rolled structural steel above (EN 10025 – S235 JR).

Construction

Enclosure
ODP – Open Drip Proof Motors.

Cooling system
IC 01 as per IEC60034-6
Free circulation.
Internal air is flowing by a fan mounted on the shaft of the motor at the driven side.
The cooling air is taken on the ND-end, the air outlet is on the D-end.
On request for variable speed application an external ventilation unit can be supplied to get the IC 06 cooling type.

Degree of protection
IP 23 as per IEC60034-5.
The series can be supplied with air inlet filters to achieve the IP 44 rating. The motor series name will be C3W - C4W.

Mounting
IM B3, V1 and V10 as per IEC60034-7.
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses. The stator winding is made of flat copper or round copper wire depending on the machine size. The completely wound stator pack with housing is thereby impregnated in an epoxy-resin VPI. The subsequent heat treatment hardens the resin.

Rotor
Short circuit rotor type. Depending on machine size, the rotor construction is either a solid shaft or welded ribbed shaft.
The rotor winding can be either a pressure die cast aluminum or a copper bar construction.

Bearing
General data
Antifriction bearings grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours.
Locating bearings are on the D end side and floating bearings on the ND end side.
Both bearings are fitted with a regreasing system. The used grease is removed through a valve locked in the outer bearing cover. Sleeve bearings available as an option.
On request special bearings are designed where high radial and axial forces are applied. All configurations are designed to withstand the following marine inclination.

<table>
<thead>
<tr>
<th>Static</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>List</td>
<td>±22.5°</td>
</tr>
<tr>
<td>Trim</td>
<td>±7.5°</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values

Impregnation system
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerised in an oven.

Insulation system
Low voltage.
Stator: F class insulated with a synthetic enamel.
(H class insulation available on request)

Protective treatments
Marine dedicated protective enamel is applied on the winding.

Optional features
- Dual/multiple winding configuration
- flanged shaft or special shaft end on both sides
- increase protection degree up to IP 56
- encoder
- vibration sensors
- special frame design to suite the application
- special bearings (sleeve or angular contact bearings)
- reinforced winding for VFD operation
- insulated bearings design for VFD application
- shaft earth brush for VFD application
- other options available on request.
**TEWC motors: B4J - B5J**

<table>
<thead>
<tr>
<th>Model</th>
<th>B4J - B5J (LV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B4JH - B5JH (MV)</td>
</tr>
<tr>
<td>Power</td>
<td>Up to 4.000 kW</td>
</tr>
<tr>
<td>Voltages</td>
<td>B4J - B5J up to 690 V</td>
</tr>
<tr>
<td></td>
<td>B4JH - B5JH up to 6,600 V</td>
</tr>
<tr>
<td>Frame</td>
<td>355 ÷ 630</td>
</tr>
<tr>
<td>Pole</td>
<td>4, 6, 8 and 10</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 71W</td>
</tr>
<tr>
<td>IP</td>
<td>IP 55/ 56</td>
</tr>
<tr>
<td>Main applications</td>
<td>Propulsion, thruster, dredge pump, hybrid machine, PTO-PTI system</td>
</tr>
<tr>
<td>Other applications</td>
<td>Fi - Fi system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW</td>
<td>4.000</td>
<td>3.800</td>
<td>2.900</td>
</tr>
</tbody>
</table>

**Certificates and testing**

- **Certificate**: Marine Survey Certificate supplied with the machine. Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society. Motors are ABS, RRR and DNV type approved.

- **Test and survey**: See complete list on Test room chapter.
Main components

Housing
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR). Frame is provided with side ribs to increase the strength. Marelli Motori motors for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

Shield
Made of grey cast-iron (EN 1561 – GJL 200) up to 500 frame size motors. Made of hot-rolled structural steel (EN 10025 – S235 JR) from size 560 and above.

Shaft
General data
Made in carbon steel (EN 10083 – 2 C40 – TN) up to 450 frame and hot-rolled structural steel from 500 frame (EN 10025 – S355 JR).

Shaft design
Cylindrical shaft with key

Main terminal box
Mounted on top or side (with vertical mounting) and made in cast iron or cold rolled formable steels depending from size.

Internal fan
Made of aluminium alloy for 450 and 500 frame size.
Made of hot-rolled structural steel from frame size 560 and above (EN 10025 – S235 JR).

Heat Exchanger
General data
Heat exchanger is part of the housing and built on the machine. The material of the frame is carbon steel according to the standard EN 10025-S275JR. Equipped with water leakage detector as standard.

Exchanger data
Working pressure < 6 bar
Test pressure 9 bar
Max glycol : 20%
Coolant : fresh water only

Construction

Enclosure
TEWC – Totally Enclosed Water Cooled

Cooling system
IC 71W as per IEC60034-6.
7 : Heat exchanger. The primary coolant is circulated in a closed circuit which is built as integral part of the machine.
1 : Self-circulation. The coolant is moved by a fan mechanically driven by the rotor.
W : Coolant. Cooling water must be clean water.

Degree of protection
IP 55 as per IEC60034-5.

Mounting
IM B3, V1 and V10 as per IEC60034-7.
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses. The stator winding is made of flat copper or round copper wire depending on the machine size. The completely wound stator pack with housing is thereby impregnated in an epoxy-resin VPI. The subsequent heat treatment hardens the resin.

Rotor
Squirrel cage rotor type.
Depending on machine size, the rotor construction is either a solid shaft or welded ribbed shaft.
The rotor winding can be either a pressure die cast aluminum or a copper bar construction.

Bearing
General data
Antifriction bearings grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours.
Locating bearings are on the D end side and floating bearings on the ND end side.
Both bearings are fitted with a regreasing system.
The used grease is removed through a valve locked in the outer bearing cover. Sleeve bearings available as an option.
On request special bearings are designed where high radial and axial forces are applied. All configurations are designed to withstand the following marine inclination.

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<tbody>
<tr>
<td>List</td>
<td>±22.5°</td>
</tr>
<tr>
<td>Trim</td>
<td>±7.5°</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values.

Impregnation system
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerised in an oven.

Insulation system
Low voltage
Stator: F class insulated with a synthetic enamel.
(H class insulation available on request)

Protective treatments
Marine dedicated protective enamel is applied on the winding.

Optional features
- Dual/multiple winding configuration
- flanged shaft or special shaft end on both sides
- increase protection degree up to IP 56
- encoder
- vibration sensors
- special frame design to suite the application
- special bearings (sleeve or angular contact bearings)
- reinforced winding for VFD operation
- insulated bearings design for VFD application
- shaft earth brush for VFD application
- other options available on request.
TEFC motors: A5M - B5M

<table>
<thead>
<tr>
<th>Model</th>
<th>A5M - B5M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Up to 1.900 kW</td>
</tr>
<tr>
<td>Voltages</td>
<td>Up to 11.000 V</td>
</tr>
<tr>
<td>Frame</td>
<td>71 ÷ 500</td>
</tr>
<tr>
<td>Pole</td>
<td>2, 4, 6 and 8</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 411 ( or IC 416)</td>
</tr>
<tr>
<td>IP</td>
<td>IP 55/ IP 56/ IP 65</td>
</tr>
<tr>
<td>Main applications</td>
<td>Auxiliaries, Fi-Fi system</td>
</tr>
<tr>
<td>Other applications</td>
<td>Winch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2 POLES</th>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW (at 60 Hz)</td>
<td>1.000</td>
<td>1.900</td>
<td>1.500</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Certificates and testing

Certificate

Marine Survey Certificate supplied with the machine. Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.

Test and survey

See complete list on Test room chapter.
## Main components

### Housing
Motors from size 71 to 132 are made in cast iron. Motors from size 160 to 280 are made or in cast iron or in aluminium. Starting from frame 315 and up to 500 the frame is in cast iron only. (EN 1561-GJL – 200)

### Shield
Made of grey cast-iron (EN 1561 – GJL 200) up to 500 frame size motors.

### Shaft
- **General data**
  Made in carbon steel (EN 10083 – 2 C40 – TN) up to 500 frame
- **Shaft design**
  Cylindrical shaft with key.

### Main terminal box
Mounted on top and made of cold-rolled formable steels EN 10025 – S235JR or cast iron depending from size.

### Fan
Made of aluminum alloy up to 500 frame.

## Construction

### Enclosure
TEFC MOTORS – Totally Enclosed Eater Cooled

### Cooling system
- **IC 411 as per IEC60034-6**
  Totally enclosed standard motor, frame surface cooled with fan
  4: Frame surface cooled
  1: Self circulation of primary coolant
  1: Self circulation of secondary coolant

  On request for variable speed application an external ventilation unit can be supplied to get the IC 416 cooling type.

### Degree of protection
IP 55 as per IEC60034-5

### Mounting
IM B3 and V1 per IEC60034-7
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses. The stator winding is made of flat copper or round copper wire depending on the machine size. The completely wound stator pack with housing is thereby impregnated in an epoxy-resin VPI. The subsequent heat treatment hardens the resin.

Rotor
Short circuit rotor type.
Depending on machine size, the rotor construction is either a solid shaft or welded ribbed shaft.
The rotor winding can be either a pressure die cast aluminum or a copper bar construction.

Bearing
General data
Antifriction bearings grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours. Locating bearings are on the D end side and floating bearings on the ND end side. Both bearings are fitted with a regreasing system. The used grease is removed through a valve locked in the outer bearing cover. Sleeve bearings available as an option.
On request special bearings are designed where high radial and axial forces are applied.

<table>
<thead>
<tr>
<th></th>
<th>Static</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>List</td>
<td>15°</td>
<td>Rolling</td>
</tr>
<tr>
<td>Trim</td>
<td>5°</td>
<td>Pitch</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values.

Impregnation system
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerised in an oven.

Insulation system
Low voltage
Stator: F class insulated with a synthetic enamel.
(H class insulation available on request)

Protective treatments
Marine dedicated protective enamel is applied on the winding.

Optional features

- Dual/multiple winding configuration
- flanged shaft or special shaft end on both sides
- increase protection degree up to IP56
- encoder
- vibration sensors
- special frame design to suite the application
- special bearings (sleeve or angular contact bearings)
- reinforced winding for VFD operation
- insulated bearings design for VFD application
- shaft earth brush for VFD application
- other options available on request.
Generator applications

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  • ODP generators: MJHM ............................................................................... 47
  • TEWAC generators: MJRM .......................................................................... 52
  • ODP generators: MJBM ............................................................................... 57
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Product map

<table>
<thead>
<tr>
<th>Product</th>
<th>Propulsion generator</th>
<th>Shaft generator</th>
<th>Auxiliary generator</th>
<th>Hybrid machine</th>
<th>Offshore</th>
<th>Variable speed generator</th>
<th>Emergency</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEWAC MJHRM</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>ODP MJHM</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>TEWAC MJRM</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>ODP MJBM</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>TEAAC MJVM</td>
<td></td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

Generator range

Key

- TEWAC - Totally Enclosed Water to Air Cooled
- ODP - Open Drip Proof
- TEWAC - Totally Enclosed Water to Air Cooled
- ODP - Open Drip Proof
- TEAAC - Totally Enclosed Air to Air Cooled

Generator model

- MJHRM
- MJHM
- MJRM
- MJBM
- MJVM
TEWAC generators: MJHRM

<table>
<thead>
<tr>
<th>Model</th>
<th>MJHRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Up to 11,000 kVA</td>
</tr>
<tr>
<td>Voltages</td>
<td>Up to 15,000 V</td>
</tr>
<tr>
<td>Frame</td>
<td>400 ÷ 1,250</td>
</tr>
<tr>
<td>Pole</td>
<td>4, 6, 8, 10 and 12 (over contact MM)</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 81W</td>
</tr>
<tr>
<td>IP</td>
<td>IP 44. Available up to IP 56.</td>
</tr>
<tr>
<td>Main applications</td>
<td>Propulsion generator, shaft generator, hybrid machine, auxiliary generator, off-shore and variable speed generator.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pole</th>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
<th>10 POLES</th>
<th>12 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVA (at 60 Hz)</td>
<td>10,000</td>
<td>9,000</td>
<td>11,000</td>
<td>11,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

Certificates and testing

Applicable standards
Generators are designed in compliance with:
- IEC EN 60034 - 1
- BS 4999 - 5000
- VDE 0530
- NF 51 - 100
- NF 51 - 111
- OVE M - 10
- NEMA MG 1.32
Generators conform to EU rules.
UL/CSA certifications available on request.

Certificate
Marine Survey Certificate supplied with the machine.
Marelli Motori has the ABS design assessment.
Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.

Test and survey
See complete list on Test room chapter.
Main components

Housing
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR). Frame is provided with side ribs to increase the strength. Marelli Motori generators for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

Shield
Made of spheroidal graphite cast-iron (EN 1563) or grey cast-iron (EN 1561) up to 630 frame size. Made of structural steel (EN 10025 – S235 JR) above.

Shaft
General data
Made in carbon steel and obtained by lamination (EN 10083–2 C40–TN). Shaft is obtained by forging from 290 mm diameter and above. The shaft is tested at the manufacturer in order to check it is defect-free.

Shaft design
Double bearing generator: cylindrical shaft with key.

Main terminal box
Mounted on side (right or left will be selected). Made of formable steels EN 10130.

Fan
Made of aluminum alloy (EN 1706) or structural steel (EN 10025 – S235 JR) depending upon application requirements.

Heat Exchanger
Construction

Exchanger data
• Designed pressure 6 bar
• test pressure 10 bar
• power: up to 200 kW
• water flow: up to 18 m$^3$/h
• max glycol: 30%
• type of water: fresh water or marine (salt) water
• flanges: PN6 – PN10 – Special (ANSI)
• Position can be adjusted to site conditions.

Construction

Enclosure
TEWAC - Totally Enclosed Water to Air Cooled.

Cooling system
IC 81W as per IEC60034-6. Primary fluid (water) is flowing by external water system. Internal air is flowing by a fan mounted on the shaft of the generator at the driven side.

Degree of protection
IP 44 as per IEC60034-5. (Available up to IP 56)

Mounting
Horizontal - IM 1001 or IM 1101 as per IEC 60034-7
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses.

Rotor
Salient pole type.
Made by copper flat wire.
H class insulated with enamel coating.
Winding retaining by pass-through bars of high quality steel.
Rotating rectifier: Graetz diode bridge with 6 diodes.
Rotors are dynamically balanced with a half key applied to the shaft extension in accordance with IEC 60034-14 to vibration grade normal A. Special vibration level construction is available.

Bearing

General data
Single or double antifriction bearing grease lubricated (ball or roller type) or oil lubricated sleeve bearing. The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours. Locating bearings are on the D end side and floating bearings on the ND end side.

Bearing selection
Antifriction bearings up to 560 frame size included.
Sleeve bearings from 630 frame size included (available for smaller frame sizes)
Antifriction bearings can be mounted on 630/710 frame size according to site working conditions.

Regreasing system (for antifriction bearing)
Both bearings are fitted with grease nipple.

Bearing insulation
ND end bearing can be insulated to prevent any harmful circulating current from passing through the bearing surfaces.
Insulated antifriction bearings in standard configuration:
• 4, 6 poles: insulated ND end bearing from 630 frame size
• 8 poles: insulated bearing from 400 frame size
• 10 poles: insulated bearing from 500 frame size
All ND end sleeve bearings are insulated as standard.
All configurations are designed to withstand the following marine inclination.

<table>
<thead>
<tr>
<th>Static</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>List 15°</td>
<td>Rolling ±22.5°</td>
</tr>
<tr>
<td>Trim 5°</td>
<td>Pitch ±7.5°</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values.

Impregnation system
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerised in an oven.

Insulation system
Stator: F class insulated with a synthetic enamel.
Rotor: H class insulated with a synthetic enamel.

Protective treatments
Specific marine treatment.
Epoxivinilic and polyacrylic. Total minimum thickness 120 micromillimeters.
Epoxvinilic: Epoxy two component products, with vinyl change.  
Polyacrylic: Two components polyurethane product formulated with unmodified hydroxyl acrylic resin.

## Operating conditions

### Overloads

During continuous duty (S1), the following overloads are allowed:

- 10% for 1 hour
- 15% for 10 minutes
- 30% for 4 minutes
- 50% for 2 minutes

These overloads must be occasional and followed by one hour of running at normal load or less.

### Parallel operations

All generators are provided with an amply sized damper cage and are suitable for parallel operations with other generators, when equipped with the paralleling unit. A power factor regulator (to work in parallel with the main) is available on request.

### Transient ratings

All generators comply with marine rules regarding transient performance. The voltage drop due to the application of 60% of nominal load is within 15%.

### Three phase short circuit current

All generators equipped with an overboosting device ensure a three phase short circuit current (Icc) higher than three times the rated current (In): \( I_{cc} > 300\% \text{ In} \)

### Radio interference

All generators are equipped with Class B Group 1 radio interference filters as defined by EN 55011.

### THD (Total Harmonic Distortion)

The no-load voltage wave form is sinusoidal with THD content less than 2%.

### Vibrations

Vibration level is in accordance with ISO 10816. Measurement, evaluation and limits of vibration severity are in accordance with IEC 60034-14.
Auxiliary device

AVR

Automatic voltage regulator mounted on board.

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 - 450</td>
<td>MEC 20 analog/ digital</td>
</tr>
<tr>
<td>500 - 560</td>
<td>M40FA610A analog</td>
</tr>
<tr>
<td>630 - 710</td>
<td>M63FA310A analog</td>
</tr>
<tr>
<td>800 - 1.250</td>
<td>MEC 100 digital</td>
</tr>
</tbody>
</table>

Overboosting device

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium voltage All</td>
<td>CT + Overboosting device</td>
</tr>
<tr>
<td>High voltage All</td>
<td>PMG</td>
</tr>
</tbody>
</table>

Space heaters

<table>
<thead>
<tr>
<th>Size</th>
<th>Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 - 560</td>
<td>400</td>
</tr>
<tr>
<td>630 - 710</td>
<td>600</td>
</tr>
<tr>
<td>800 - 900</td>
<td>800</td>
</tr>
<tr>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>1.120</td>
<td>1.200</td>
</tr>
<tr>
<td>1.250</td>
<td>1.400</td>
</tr>
</tbody>
</table>

Heaters installed at ND end side.

RTD - PT100

RTD devices in standard configuration:
- 1+1 RTD on each phase of stator winding
- 1 RTD on each bearing

Terminals in auxiliary terminal box.

Other configurations available:
- DUPLEX type
- RTD for inlet / outlet air
- RTD for inlet / outlet water

Optional features

- Reinforced construction for high linear vibrations
- flanged shaft for direct coupling with engine flywheel (in case of single bearing solution)
- neutral point terminals in separate terminal box
- terminal box inside air duct (internal terminal box)
- cooling system IC 86W with additional forced ventilation
- cooler mounted on side
- increase protection degree up to IP 54, IP 55 or IP 56
- lifted feet to couple the generator with engine on existing baseframe
- redundant rotating rectifier with 12 diodes
- insulated bearing and earthing brush
- AVR supplied loose
- automatic power factor control (analog type)
- digital AVR MEC100 for frame 400 – 710 (supplied loose)
- digital AVR MEC100D with diode failure monitoring
- redundant AVR system
- excitation/overboosting PMG mounted on generator
- lubrication system for sleeve bearing
- other options available on request.
**ODP generators: MJHM**

<table>
<thead>
<tr>
<th>Model</th>
<th>MJHM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Up to 11,000 kVA</td>
</tr>
<tr>
<td>Voltages</td>
<td>Up to 15,000 V</td>
</tr>
<tr>
<td>Frame</td>
<td>400 ÷ 1,250</td>
</tr>
<tr>
<td>Pole</td>
<td>4, 6, 8, 10 and 12 (over contact MM)</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 01</td>
</tr>
<tr>
<td>IP</td>
<td>IP 23. Available up to IP 44 with filters</td>
</tr>
<tr>
<td>Main applications</td>
<td>Propulsion generator, shaft generator, hybrid machine, auxiliary generator, off-shore and variable speed generator.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pole</th>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
<th>10 POLES</th>
<th>12 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVA (at 60 Hz)</td>
<td>10,000</td>
<td>9,000</td>
<td>11,000</td>
<td>11,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**Certificates and testing**

**Applicable standards**
Generators are designed in compliance with:
- IEC EN 60034 - 1
- BS 4999 - 5000
- VDE 0530
- NF 51 - 100
- NF 51 - 111
- OVE M - 10
- NEMA MG 1.32
All generators conform to EU rules.
UL/CSA certifications available on request.

**Certificate**
Marine Survey Certificate supplied with the machine.
Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.

**Test and survey**
See complete list on Test Room chapter.
## Main components

### Housing
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR). Frame is provided with side ribs to increase the strength. Marelli Generators for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

### Shield
Made of spheroidal graphite cast-iron (EN 1563) or grey cast-iron (EN 1561) up to 630 frame size. Made of structural steel (EN 10025 – S235 JR) above.

### Shaft
- **General data**
  Made in carbon steel and obtained by lamination (EN 10083–2 C40–TN). Shaft is obtained by forging from 290 mm diameter and above. The shaft is tested to ensure defect-free performance.
- **Shaft design**
  Double bearing generator: cylindrical shaft with key.

### Main terminal box
Mounted on top. Made of formable steels EN 10130.

### Fan
Made of aluminum alloy (EN 1706) or structural steel (EN 10025 – S235 JR) depending upon application requirements.

## Construction

### Enclosure
ODP - Open Drip Proof

### Cooling system
IC 01 as per IEC60034-6

### Degree of protection
IP 23 as per IEC60034-5

### Mounting
Horizontal - IM 1001 or IM 1101 as per IEC 60034-7
**Technical data**

**Stator/Rotor core**
Laminated and enamel-insulated on both sides to minimise eddy-current losses

**Rotor**
Salient pole type.
Made by copper flat wire.
H class insulated with enamel coating.
Winding retaining by pass-through bars of high quality steel.
Rotating rectifier: Graetz diode bridge with 6 diodes.
Rotors are dynamically balanced with a half key applied to the shaft extension in accordance with IEC 60034-14 to vibration grade normal A. Special vibration level constructions are available.

**Bearing**

**General data**
Single or double antifriction bearing grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours.
Locating bearings are on the D end side and floating bearings on the ND end side.

**Bearing selection**
Antifriction bearings up to 560 frame size included.
Sleeve bearings from 630 frame size included (available for smaller frame sizes)
Antifriction bearings can be mounted on 630/710 frame size according to site working conditions.

**Regreasing system (for antifriction bearing)**
Both bearings are fitted with grease nipple.

**Bearing insulation**
ND end bearing can be insulated to prevent any harmful circulating current from passing through the bearing surfaces.
Insulated antifriction bearings in standard configuration:
- 4, 6 poles: insulated ND end bearing from 630 frame size
- 8 poles: insulated bearing from 400 frame size
- 10 poles: insulated bearing from 500 frame size
All ND end sleeve bearings are insulated as standard. All configurations are designed to withstand the following marine inclination.

<table>
<thead>
<tr>
<th>Static</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>List 15°</td>
<td>Rolling ±22.5°</td>
</tr>
<tr>
<td>Trim 5°</td>
<td>Pitch ±7.5°</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values.

**Impregnation system**
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerized in an oven.

**Insulation system**
Stator: F class insulated with a synthetic enamel
Rotor: H class insulated with a synthetic enamel

**Protective treatments**
Specific marine treatment.
Epoxivinilic and polyacrylic. Total minimum thickness 120 micromillimeters.
Epoxivinilic: Epoxy two component products, with vinyl change
Polyacrylic: Two components polyurethane product formulated with unmodified hydroxyl acrylic resin.
### Operating conditions

#### Overloads

During continuous duty (S1), the following overloads are allowed:
- 10% for 1 hour
- 15% for 10 minutes
- 30% for 4 minutes
- 50% for 2 minutes

These overloads must be occasional and followed by 1 hour of running at normal load or less.

#### Parallel operations

All generators are provided with an amply sized damper cage and are suitable for parallel operations with other generators, when equipped with the paralleling unit. A power factor regulator (to work in parallel with the main) is available on request.

#### Transient ratings

All generators comply with marine rules regarding transient performance. The voltage drop due to the application of 60% of nominal load is within 15%.

#### Three phase short circuit current

All generators equipped with an overboosting device ensure a three phase short circuit current (Icc) higher than 3 times the rated current (In): \( I_{cc} > 300\% \text{ In} \)

#### Radio interference

All generators are equipped with Class B Group 1 radio interference filters as defined by EN 55011.

#### THD (Total Harmonic Distortion)

The no-load voltage wave form is sinusoidal with THD content less than 2%.

#### Vibrations

Vibration level is in accordance with ISO 10816. Measurement, evaluation and limits of vibration severity are in accordance with IEC 60034-14.
Auxiliary devices

AVR
Automatic voltage regulator mounted on board.

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 - 450</td>
<td>MEC 20 analog/ digital</td>
</tr>
<tr>
<td>500 - 560</td>
<td>M40FA610A analog</td>
</tr>
<tr>
<td>630 - 710</td>
<td>M63FA310A analog</td>
</tr>
<tr>
<td>800 - 1250</td>
<td>MEC 100 digital</td>
</tr>
</tbody>
</table>

Overboosting device

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium voltage</td>
<td>CT + Overboosting device</td>
</tr>
<tr>
<td>High voltage</td>
<td>PMG</td>
</tr>
</tbody>
</table>

Space heaters
Heaters installed at ND-end side.

<table>
<thead>
<tr>
<th>Size</th>
<th>Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 - 560</td>
<td>400</td>
</tr>
<tr>
<td>630 - 710</td>
<td>600</td>
</tr>
<tr>
<td>800 - 900</td>
<td>800</td>
</tr>
<tr>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>1120</td>
<td>1200</td>
</tr>
<tr>
<td>1250</td>
<td>1400</td>
</tr>
</tbody>
</table>

RTD - PT100
RTD devices in standard configuration:
- 1+1 RTD on each phase of stator winding
- 1 RTD on each bearing
Termsinals in auxiliary terminal box.

Other configurations available:
- DUPLEX type
- RTD for inlet / outlet air

Optional features

- Reinforced construction for high linear vibrations
- flanged shaft for direct coupling with engine flywheel (in case of single bearing solution)
- neutral point terminals in separate terminal box
- increase protection degree up to IP 44 with filters
- lifted feet to couple the generator with engine on existing baseframe
- redundant rotating rectifier with 12 diodes
- insulated bearing and earthing brush
- AVR supplied loose
- automatic power factor control (analog type)
- digital AVR MEC100 for frame 400 – 710 (supplied loose)
- digital AVR MEC100D with diode failure monitoring
- redundant AVR system
- excitation/overboosting PMG mounted on generator
- lubrication system for sleeve bearing
- other options available on request.
TEWAC generators: MJRM

Model | MJRM
---|---
Power | Up to 6.500 kVA
Voltages | Up to 1.000 V
Frame | 250 ÷ 900
Pole | 4, 6, 8, 10 and 12 (over contact MM)
Cooling | IC 81W/ IC 86W
IP | IP 44. Available up to IP 56.
Main applications | Propulsion generator, shaft generator, hybrid machine, auxiliary generator, off-shore and variable speed generator.

<table>
<thead>
<tr>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
<th>10 POLES</th>
<th>12 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVA (at 60 Hz)</td>
<td>4.000</td>
<td>5.000</td>
<td>6.500</td>
<td>6.000</td>
</tr>
</tbody>
</table>

Certificates and testing

Applicable standards

Generators are designed in compliance with:
- IEC EN 60034 - 1
- BS 4999 - 5000
- VDE 0530
- NF 51 - 100
- NF 51 - 111
- OVE M - 10
- NEMA MG 1.32

All generators conform to EU rules. UL/CSA certifications available on request.

Certificate

Marine Survey Certificate supplied with the machine.
Marelli Motori is DNV type approved and has the ABS design assessment.
Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.

Test and survey

See complete list on Test room chapter.
### Main components

**Housing**
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR). Frame is provided with side ribs to increase the strength. Marelli Motori generators for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

**Shield**
Made of spheroidal graphite cast-iron (EN 1563) or grey cast-iron (EN 1561) up to 630 frame size. Made of structural steel (EN 10025 – S235 JR) above.

**Shaft**
- **General data**
  Made in carbon steel and obtained by lamination (EN 10083–2 C40–N). Shaft is obtained by forging from 290 mm diameter and above. The shaft is tested at the manufacturer in order to check it is defect-free.
- **Shaft design**
  Double bearing generator: cylindrical shaft with key.

**Main terminal box**
Mounted on side (right or left will be selected). Made of formable steels EN 10130.

**Fan**
Made of aluminum alloy (EN 1706) or structural steel (EN 10025–S235 JR) depending on application requirements.

**Heat Exchanger**
- **Construction**
- **Exchanger data**
  Designed pressure 6 bar. Test pressure 10 bar
  Power: up to 200 kW
  Water flow: up to 18 m³/h
  Max glycol: 30%
  Type of water: fresh water or marine (salt) water
  Flanges: PN6 – PN10 – Special (ANSI)
  Position can be adjusted to site conditions.

### Construction

**Enclosure**
TEWAC - Totally Enclosed Water to Air Cooled

**Cooling system**
IC81W as per IEC60034-6. Primary fluid (water) is flowing by external water system. Internal air is flowing by a fan mounted on the shaft of the generator at the driven side.

**Degree of protection**
IP 44 as per IEC60034-5. (Available up to IP 56)

**Mounting**
Horizontal - IM 1001 or IM 1101 as per IEC 60034-7
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses.

Rotor
Salient pole type.
Made by copper flat wire.
H class insulated with enamel coating.
Winding retaining by pass-through bars of high quality steel.
Rotating rectifier: Graetz diode bridge with 6 diodes.
Rotors are dynamically balanced with a half key applied to the shaft extension in accordance with IEC 60034-14 to vibration grade normal A. Special vibration level construction are available.

Bearing

General data
Single or double antifriction bearing grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50.000 hours. On request, the lifetime of bearings, L10h can be in excess of 100.000 hours.
Locating bearings are on the D end side and floating bearings on the ND end side.

Bearing selection
Antifriction bearings up to 560 frame size included.
Sleeve bearings from 630 frame size included (available for smaller frame sizes)
Antifriction bearings can be mounted on 630/710 frame size according to site working conditions.

Regreasing system (for antifriction bearing)
Both bearings are fitted with a grease nipple.

Bearing insulation
ND end bearing can be insulated to prevent any harmful circulating current from passing through the bearing surfaces.
Insulated antifriction bearings in standard configuration:
• 4, 6 poles: insulated ND end bearing from 630 frame size
• 8 poles: insulated bearing from 400 frame size
• 10 poles: insulated bearing from 500 frame size
All ND end sleeve bearings are insulated as standard. All configurations are designed to withstand the following marine inclination.


<table>
<thead>
<tr>
<th>Static</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>List</td>
<td>±22.5°</td>
</tr>
<tr>
<td>Trim</td>
<td>±7.5°</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values.

Impregnation system
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerised in an oven.

Insulation system
Stator: H class insulated with a synthetic enamel.
Rotor: H class insulated with a synthetic enamel.

Protective treatments
Specific marine treatment.
Epoxivinilic and polyacrylic. Total minimum thickness 120 micromillimeters.
Epoxivinilic: Epoxy two component products, with vinyl change.
Polyacrylic: Two components polyurethane product formulated with unmodified hydroxyl acrylic resin.
## Operating conditions

### Overloads

During continuous duty (S1), the following overloads are allowed:
- 10% for 1 hour
- 15% for 10 minutes
- 30% for 4 minutes
- 50% for 2 minutes

These overloads must be occasional and followed by one hour of running at normal load or less.

### Parallel operations

All generators are provided with a amply sized damper cage and are suitable for parallel operations with other generators, when equipped with the paralleling unit. A power factor regulator (to work in parallel with the main) is available on request.

### Transient ratings

All generators comply with marine rules regarding transient performance. The voltage drop due to the application of 60% of nominal load is within 15%.

### Three phase short circuit current

All generators equipped with overboosting device to ensure a three phase short circuit current (Icc) higher than 3 times the rated current (In): Icc > 300% In

### Radio interference

All generators are equipped with Class B Group 1 radio interference filters as defined by EN 55011.

### THD (Total Harmonic Distortion)

The no-load voltage wave form is sinusoidal with THD content less than 2%.

### Vibrations

Vibration level is in accordance with ISO 10816. Measurement, evaluation and limits of vibration severity are in accordance with IEC 60034-14.
## Auxiliary devices

**AVR**

Automatic voltage regulator mounted on board.

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>MARK V analog</td>
</tr>
<tr>
<td>315 - 450</td>
<td>MEC 20 analog/ digital</td>
</tr>
<tr>
<td>500 - 560</td>
<td>M40FA610A analog</td>
</tr>
<tr>
<td>630 - 710</td>
<td>M63FA310A analog</td>
</tr>
<tr>
<td>800 - 900</td>
<td>MEC 100 digital</td>
</tr>
</tbody>
</table>

**Overboosting device**

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 - 450 (4 poles)</td>
<td>Auxiliary winding</td>
</tr>
<tr>
<td>400 - 450 (&gt;4 poles)</td>
<td>Varicomp</td>
</tr>
<tr>
<td>500 - 710 (all polarities)</td>
<td>Varicomp</td>
</tr>
<tr>
<td>800 - 900</td>
<td>PMG</td>
</tr>
</tbody>
</table>

**Space heaters**

Heaters installed at ND-end side.

<table>
<thead>
<tr>
<th>Size</th>
<th>Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 - 560</td>
<td>400</td>
</tr>
<tr>
<td>630 - 710</td>
<td>600</td>
</tr>
<tr>
<td>800 - 900</td>
<td>800</td>
</tr>
</tbody>
</table>

**RTD - PT100**

RTD devices in standard configuration:
- 1+1 RTD on each phase of stator winding
- 1 RTD on each bearing
- Terminals in auxiliary terminal box.

Other configurations available:
- DUPLEX type
- RTD for inlet / outlet air
- RTD for inlet / outlet water

### Optional features

- Reinforced construction for high linear vibrations
- Flanged shaft for direct coupling with engine flywheel (in case of single bearing solution)
- Neutral point terminals in separate terminal box
- Terminal box inside air duct (internal terminal box)
- Cooling system IC 86W with additional forced ventilation
- Cooler mounted on side
- Increase protection degree up to IP 54, IP 55 or IP 56
- Lifted feet to couple the generator with engine on existing baseframe
- Redundant rotating rectifier with 12 diodes
- Insulated bearing and earthing brush
- AVR supplied loose
- Automatic power factor control (analog type)
- Digital AVR MEC100 for frame 400 – 710 (supplied loose)
- Digital AVR MEC100D with diode failure monitoring
- Redundant AVR system
- Excitation/overboosting PMG mounted on generator
- Lubrication system for sleeve bearing
- Other options available on request.
ODP generators: MJBM

<table>
<thead>
<tr>
<th>Model</th>
<th>MJBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Up to 6.500 kVA</td>
</tr>
<tr>
<td>Voltages</td>
<td>Up to 1.000 V</td>
</tr>
<tr>
<td>Frame</td>
<td>160 ÷ 900</td>
</tr>
<tr>
<td>Pole</td>
<td>4, 6, 8, 10 and 12 (over contact MM)</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 01</td>
</tr>
<tr>
<td>IP</td>
<td>IP 23. Available up to IP 44 with filters.</td>
</tr>
</tbody>
</table>

Other applications: Propulsion generator, shaft generator, hybrid machine, auxiliary generator, off-shore, variable speed generator and emergency

<table>
<thead>
<tr>
<th>Pole</th>
<th>4 POLES</th>
<th>6 POLES</th>
<th>8 POLES</th>
<th>10 POLES</th>
<th>12 POLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVA (at 60 Hz)</td>
<td>4.000</td>
<td>5.000</td>
<td>6.500</td>
<td>6.000</td>
<td>5.400</td>
</tr>
</tbody>
</table>

Certificates and testing

Applicable standards
Generators are designed in compliance with:
- IEC EN 60034 - 1
- BS 4999 - 5000
- VDE 0530
- NF 51 - 100
- NF 51 - 111
- OVE M - 10
- NEMA MG 1.32
Generators conform to EU rules.
UL/CSA certifications available on request.

Certificate
Marine Survey Certificate supplied with the machine.
Marelli Motori is DNV type approved and has the ABS design assessment.
Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.
SOLAS compliance declaration.

Test and survey
See complete list on Test room chapter
Main components

Housing
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR).
Frame is provided with side ribs to increase the strength. Marelli Generators for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

Shield
Made of spheroidal graphite cast-iron (EN 1563) or grey cast-iron (EN 1561) up to 630 frame size.
Made of structural steel (EN 10025 – S235 JR) above.

Shaft
General data
Made in carbon steel and obtained by lamination (EN 10083 – 2 C40 – TN).
Shaft is obtained by forging from 290 mm diameter and above. The shaft is tested at the manufacturer in order to check it is defect-free.

Shaft design
Double bearing generator: cylindrical shaft with key.

Main terminal box
Mounted on top up to 630 frame size.
Mounted on side from 710 frame size.
Made of formable steels EN 10130.

Fan
Made of aluminum alloy (EN 1706) or structural steel (EN 10025–S235 JR) depending on application requirements.

Construction

Enclosure
ODP - Open Drip Proof

Cooling system
IC 01 as per IEC60034-6

Degree of protection
IP 23 as per IEC60034-5

Mounting
Horizontal - IM 1001 or IM 1101 as per IEC 60034-7
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses

Rotor
Salient pole type.
Made by copper flat wire.
H class insulated with enamel coating.
Winding retaining by pass-through bars of high quality steel.
Rotating rectifier: Graetz diode bridge with 6 diodes.
Rotors are dynamically balanced with a half key applied to the shaft extension in accordance with IEC 60034-14 to vibration grade normal.
A. Special vibration level construction are available.

Bearing

General data
Single or double antifriction bearing grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours.
Locating bearings are on the D end side and floating bearings on the ND end side.

Bearing selection
Antifriction bearings up to 560 frame size included.
Sleeve bearings from 630 frame size included (available for smaller frame sizes).
Antifriction bearings can be mounted on 630/710 frame size according to site working conditions.

Regreasing system (for antifriction bearing)
Both bearings are fitted with a grease nipple.

Bearing insulation
ND end bearing can be insulated to prevent any harmful circulating current from passing through the bearing surfaces.
Insulated antifriction bearings in standard configuration:
- 4, 6 poles: insulated ND end bearing from 630 frame size
- 8 poles: insulated bearing from 400 frame size
- 10 poles: insulated bearing from 500 frame size
All ND end sleeve bearings are insulated as standard. All configurations are designed to withstand the following marine inclination.

<table>
<thead>
<tr>
<th>Static</th>
<th>Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>List 15°</td>
<td>Rolling ±22.5°</td>
</tr>
<tr>
<td>Trim 5°</td>
<td>Pitch ±7.5°</td>
</tr>
</tbody>
</table>

Dedicated constructions available for different values.

Impregnation system
Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerised in an oven.

Insulation system
Stator: H class insulated with a synthetic enamel.
Rotor: H class insulated with a synthetic enamel.

Protective treatments
Specific marine treatment.
Epoxivinilic and polyacrylic. Total minimum thickness 120 micromillimeters.
Epoxivinilic: Epoxy two component products, with vinyl change.
Polyacrylic: Two components polyurethane product formulated with unmodified hydroxyl acrylic resin.
### Operating conditions

**Overloads**
During continuous duty (S1), the following overloads are allowed:
- 10% for 1 hour
- 15% for 10 minutes
- 30% for 4 minutes
- 50% for 2 minutes
These overloads must be occasional and followed by one hour of running at normal load or less.

**Parallel operations**
All generators are provided with a amply sized damper cage and are suitable for parallel operations with other generators, when equipped with the paralleling unit. A power factor regulator (to work in parallel with the main) is available on request.

**Transient ratings**
All generators comply with marine rules regarding transient performance. The voltage drop due to the application of 60% of nominal load is within 15%.

**Three phase short circuit current**
All generators equipped with overboosting device ensure a three phase short circuit current (Icc) higher than 3 times the rated current (In):
\[ I_{cc} > 300\% \text{ In} \]

**Radio interference**
All generators are equipped with Class B Group 1 radio interference filters as defined by EN 55011.

**THD (Total Harmonic Distortion)**
The no-load voltage wave form is sinusoidal with THD content less than 2%.

**Vibrations**
Vibration level is in accordance with ISO 10816. Measurement, evaluation and limits of vibration severity are in accordance with IEC 60034-14.
**Auxiliary devices**

**AVR**
Automatic voltage regulator mounted on board.

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 - 250</td>
<td>MARK V analog</td>
</tr>
<tr>
<td>315 - 450</td>
<td>MEC 20 analog/ digital</td>
</tr>
<tr>
<td>500 - 560</td>
<td>M40FA610A analog</td>
</tr>
<tr>
<td>630 - 710</td>
<td>M63FA310A analog</td>
</tr>
<tr>
<td>800 - 900</td>
<td>MEC 100 digital</td>
</tr>
</tbody>
</table>

**Overboosting device**

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low voltage 160 - 450 (4 poles)</td>
<td>Auxiliary winding</td>
</tr>
<tr>
<td>160 - 450 (&gt;4 poles)</td>
<td>Varicomp</td>
</tr>
<tr>
<td>500 - 710 (all polarities)</td>
<td>Varicomp</td>
</tr>
<tr>
<td>800 - 900</td>
<td>PMG</td>
</tr>
</tbody>
</table>

**Space heaters**
Heaters installed at ND end side.

<table>
<thead>
<tr>
<th>Size</th>
<th>Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 - 560</td>
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</tr>
<tr>
<td>630 - 710</td>
<td>600</td>
</tr>
<tr>
<td>800 - 900</td>
<td>800</td>
</tr>
</tbody>
</table>

**RTD - PT100**
RTD devices in standard configuration:
- 1+1 RTD on each phase of stator winding
- 1 RTD on each bearing

Terminals in auxiliary terminal box.

Other configurations available:
- DUPLEX type
- RTD for inlet / outlet air

**Optional features**

- Reinforced construction for high linear vibrations
- Flanged shaft for direct coupling with engine flywheel (in case of single bearing solution)
- Neutral point terminals in separate terminal box
- Increase protection degree up to IP 44
- Lifted feet to couple the generator with engine on existing baseframe
- Redundant rotating rectifier with 12 diodes
- Insulated bearing and earthing brush
- AVR supplied loose
- Automatic power factor control (analog type)
- Digital AVR MEC100 for frame 400 – 710 (supplied loose)
- Digital AVR MEC100D with diode failure monitoring
- Redundant AVR system
- Excitation/overboosting PMG mounted on generator
- Lubrication system for sleeve bearing
- Other options available on request.
TEAAC generators: MJVM

<table>
<thead>
<tr>
<th>Model</th>
<th>MJVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Up to 5.500 kVA</td>
</tr>
<tr>
<td>Voltages</td>
<td>Up to 1.000 V</td>
</tr>
<tr>
<td>Frame</td>
<td>250 ÷ 900</td>
</tr>
<tr>
<td>Pole</td>
<td>4, 6, 8, 10 and 12 (over contact MM)</td>
</tr>
<tr>
<td>Cooling</td>
<td>IC 611</td>
</tr>
<tr>
<td>IP</td>
<td>IP 44. Available up to IP 56</td>
</tr>
<tr>
<td>Main applications</td>
<td>Off-shore and emergency</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Pole</th>
<th>4 POLES</th>
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<th>10 POLES</th>
<th>12 POLES</th>
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<tr>
<td>kVA</td>
<td>3.500</td>
<td>4.300</td>
<td>5.600</td>
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<td>4.600</td>
</tr>
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</table>

Certificates and testing

Applicable standards
Generators are designed in compliance with:
IEC EN 60034 - 1
BS 4999 - 5000
VDE 0530
NF 51 - 100
NF 51 - 111
OVE M - 10
NEMA MG 1.32
All generators conform to EU rules.
UL/CSA certifications available on request.

Certificate
Marine Survey Certificate supplied with the machine. Shaft, housing (propulsion) and exchanger are certified by the Marine Classification Society.

Test and survey
See complete list on pages on Test room chapter.
Main components

Housing
Rigid frame, rugged welded steel fabrication (EN 10025 - S235 JR). Frame is provided with side ribs to increase strength.
Marelli Generators for continuous duty operation are designed to meet vibration levels per IEC 60034-14, ISO 10816-1 and BS 5000-3.

Shield
Made of spheroidal graphite cast-iron (EN 1563) or grey cast-iron (EN 1561) up to 630 frame size.
Made of structural steel (EN 10025 – S235 JR) above.

Shaft
General data
Made in carbon steel and obtained by lamination (EN 10083 – 2 C40 – TN). Shaft is obtained by forging from 290 mm diameter and above. The shaft is tested by the manufacturer to ensure it is defect-free.

Shaft design
Double bearing generator: cylindrical shaft with key.

Main terminal box
Mounted on side (right or left will be selected).
Made of formable steels EN 10130.

Fan
Made of aluminum alloy (EN 1706) or structural steel (EN 10025 – S235 JR) depending on application requirements.

Internal fan
Made of structural steel (EN 10025 - 5235 JR)

Heat Exchanger
Construction
Mounted on top of alternator.
Tube made of P - AlMgSi UNI 3569
Housing: EN 10025 - 5235JR

Construction

Enclosure
TEAAC – Totally Enclosed Air to Air Cooled

Cooling system
IC 611 as per IEC60034-6. Primary fluid (air) driven by a second fan (internal fan) mounted on shaft at ND end side. Internal air is flowing by a fan mounted on the shaft of the generator at the driven side.

Degree of protection
IP 44 as per IEC60034-5

Mounting
Horizontal - IM 1001 or IM 1101 as per IEC 60034-7
Technical data

Stator/Rotor core
Laminated and enamel-insulated on both sides to minimise eddy-current losses

Rotor
Salient pole type.
Made by copper flat wire.
H class insulated with enamel coating.
Winding retaining by pass-through bars of high quality steel.
Rotating rectifier: Graetz diode bridge with 6 diodes.
Rotors are dynamically balanced with a half key applied to the shaft extension in accordance with IEC 60034-14 to vibration grade normal A. Special vibration level construction are available.

Bearing
General data
Single or double antifriction bearing grease lubricated (ball or roller type) or oil lubricated sleeve bearing.
The theoretical lifetime of bearings, L10h according to ISO 281/1 standard, of standard horizontal construction generators, without external forces (radial and / or axial) is in excess of 50,000 hours. On request, the lifetime of bearings, L10h can be in excess of 100,000 hours. Locating bearings are on the D end side and floating bearings on the ND end side.

Bearing selection
Antifriction bearings up to 560 frame size included.
Sleeve bearings from 630 frame size included (available for smaller frame sizes).
Antifriction bearings can be mounted on 630/710 frame size according to site working conditions.

Regreasing system (for antifriction bearing)
Both bearings are fitted with grease nipple.

Bearing insulation
ND end bearing can be insulated to prevent any harmful circulating current from passing through the bearing surfaces.
Insulated antifriction bearings in standard configuration:
• 4, 6 poles: insulated ND end bearing from 630 frame size
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Stator and rotor are VPI treated with an unsaturated polyester amide resin which is polymerised in an oven.

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Stator: H class insulated with a synthetic enamel
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Specific marine treatment.
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Three phase short circuit current
All generators equipped with overboosting device ensure a three phase short circuit current (Icc) higher than three times the rated current (In):

\[ I_{cc} > 300\% \text{ In} \]

Radio interference
All generators are equipped with Class B Group 1 radio interference filters as defined by EN 55011.

THD (Total Harmonic Distortion)
The no-load voltage wave form is sinusoidal with THD content less than 2%.

Vibrations
Vibration level is in accordance with ISO 10816. Measurement, evaluation and limits of vibration severity are in accordance with IEC 60034-14.
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**RTD - PT100**

RTD devices in standard configuration:
- 1+1 RTD on each phase of stator winding
- 1 RTD on each bearing

Terminals in auxiliary terminal box.

Other configurations available:
- DUPLEX type
- RTD for inlet/outlet air
- RTD into oil tank for sleeve bearing

**Optional features**

- Flanged shaft for direct coupling with engine flywheel (in case of single bearing solution)
- Neutral point terminals in separate terminal box
- Cooling system IC 616 with additional forced ventilation
- Increase protection degree up to IP 54, IP 55 or IP 56
- Lifted feet to couple the generator with engine on existing baseframe
- Redundant rotating rectifier with 12 diodes
- Insulated bearing and earthing brush
- AVR supplied loose
- Automatic power factor control (analog type)
- Digital AVR MEC100 for frame 400 – 710 (supplied loose)
- Digital AVR MEC100D with diode failure monitoring
- Redundant AVR system
- Excitation/overboosting PMG mounted generator
- Other options available on request.
Testing facilities

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Special testing ................................................................................................................................... 70
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Marine certifications .......................................................................................................................... 71
Facilities

Testing surface is 2,800 sqm. Load testing capacity up to 8 MW. Voltage range during test from 400 to 15,000 V. Test benches designed for testing machines up to 35 t in horizontal and vertical configuration.

Routine and type test

Routine test and type test are carried out in compliance with all major international standards (IEC60034, IEEE, UNI-EN-ISO, MIL-STD), marine and navy societies, ATEX rules, UL certification and customer specifications.

Test for generators

Standard test < 500 frame (factory line)

- Name plate check
- voltage balance
- phase sequence
- no-load voltage regulation
- load test at power factor 0,1
- quadrature voltage drop test (test for parallel operation)
- low speed protection
- permanent short-circuit test with AVR
- winding insulation resistance test
- high voltage test.

Standard test ≥ 500 frame (test room)

- Name plate check
- winding resistance measurement at cold
- voltage balance
- phase sequence
- no-load voltage regulation
- load test at power factor 0,1
- quadrature voltage drop test (test for parallel operation)
- low speed protection
- permanent short-circuit test with AVR
- winding insulation resistance test
- high voltage test.

Routine test (standard test included)

- No load characteristic (magnetic curve)
- short circuit characteristics
- auxiliary check.

Type test (routine test included)

- Full load heat run test at power factor 0,1
- vibration
- over speed test
- heat run test.
Marine test (type test included)

- Waveform deviation and distortion test
- Voltage response with sudden load change at power factor 0.1
- Overload / overcurrent.

Test for motors

Standard test for motors

- Name plate check
- Phase sequence
- Winding insulation resistance test
- High voltage test
- No-load run test at nominal voltage.

Routine test for motors (standard test included)

- Winding resistance measurement at cold
- Auxiliary check
- Visual and dimensional check.

Type test for motors (routine test included)

- Full load heat run test at power factor 0.1
- Vibration
- Over speed test
- Heat run test.

Special testing

Special tests for the measurement of mechanical and structural vibration and overspeed tests for high-voltage machines (dissipation factor and partial discharges).

We are able to test drive-motor systems in-house in order to ensure perfect compatibility to customer site conditions.

Special test for generators

- Determination of efficiency and losses
- Sudden short-circuit test
- Waveform deviation and distortion test
- Measurement of noise level
- Measurement of dissipation factor
- Partial discharge test
- Shaft voltage measurement
- Visual and dimensional check
- Voltage response with sudden load change at power factor 0.1
- Overload / overcurrent
- IP test.
Special test for motors

- Measurement of noise level
- Measurement of dissipation factor
- Partial discharge test
- Measurement of curve $C=f(n)$
- Shaft voltage measurement
- Visual and dimensional check.

Type approval and design assessment certificates

Type approval in accordance with the major marine certifying bodies: ABS, Bureau Veritas, Det Norske Veritas and Lloyd’s Register.
Testing can be conducted at 50/60 Hz and variable frequency as the facility is provided with a large power – high frequency AFE inverter (regenerative).

Marine certifications

Marelli Motori motors and generators are compatible with the standards requested by the International Association of Classification Societies’ members (as of May 2004):

ABS American Bureau of Shipping
KR Korean Register of Shipping
BV Bureau Veritas
DNV Det Norske Veritas
CCS China Classifications Society
GL Renewables Certifications
LR Lloyd’s Register
NKK NK Certifications
RINA Registro Italiano Navale
RS Russian Maritime Register of Shipping
RRR Russian River Register
Services

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Our Service team

Marelli Motori offers all-around support throughout the entire operational life of a product. Our service team is committed to providing a fast, efficient and reliable service that keeps your motors and generators working productively, minimising downtime and lowering whole life costs.

We work closely with our manufacturing facilities to provide the highest levels of aftersales service worldwide, including commissioning, repairs, spare parts supply, technical support, performance enhancements, training courses and maintenance contracts of electrical machines of all makes.

Our service team offers technical advice to help improve performance, reduce operating costs, improve energy efficiency, minimising downtime and improve reliability.

We operate worldwide and are fully in compliance with the international quality rules, utilising highly skilled technicians and precision instruments to keep your machines working.

Aftersales services

Field service

Marelli Motori service personnel are trained to react quickly to any situation anywhere in the world. We rapidly analyse the source of machine problems and prescribe solutions which can get you ‘up and running’ quickly, minimising downtime and production losses.

We understand that, for a plant to operate efficiently, disruption must be kept to a minimum and that, when problems do occur, corrective action must be implemented quickly and effectively.

Marelli Motori Service is the solution to electrical machine problems, offering prompt technical support and ultra-fast response no matter where in the world you are located:

- diagnostic and functional tests
- start-up of brand-new machines
- revamping of regulation systems
- on the spot repairs
- custom-made maintenance programmes
- periodical inspections.

Commissioning

The Marelli Motori Commissioning Service includes all activities required for the efficient start-up up of the machine during installation, to ensure maximum operational effectiveness from the start.

Our inspection processes during commissioning guarantee that the start-up phase takes place safely and that the correct functional parameters are applied.

The full commissioning option is available to buy with every machine purchase.

Repairs

Marelli Motori Service also offers repairs and complete refurbishing of motors and generators of any make or model.

Repairs of low, medium and high voltage machines can take place at the Marelli Motori manufacturing facility or at customer premises, delivered by our constantly expanding service network.

Our high tech facilities, which include computerised machine centres, VPI plants, 3D
measurement systems, digital and infrared diagnostics tools, along with the our long
experience in designing and manufacturing machines, offer the highest quality of repairs and
absolute reliability.
All repairs and testing take place in our modern test room that can handle machines up to 5
MW and a 13.8 kV before issuing functional test certificates and detailed repair reports.
Marelli Motori Service overhauls and tests any rotating electrical machine, including third
party machines.

The characteristics of the overhaul procedure are:

• manufacturer know-how
• guarantee on the reparation
• original parts used
• tests in the internal testing room
• reports and about the reparations.

In addition Marelli Motori keeps an available stock of machines with common configurations,
which can be supplied to customers for temporary use whilst their own machines are
overhauled.

**Spare parts**

Genuine Marelli Motori spare parts are available at the Marelli headquarters, branch offices,
and service centres located all over the world, with specific characteristics:

• original and guaranteed parts.
• branded package.
• major equipment assemblies (complete rotors, stators).
• kits of recommended spare parts.
• spare stocks on Marelli Motori branches.

This policy covers all spare parts manufactured by Marelli Motori.
In the event that a component is out-of-production, Marelli Motori Spa will source and propose
the suitable interchangeable spare parts. All spare parts are certified by Marelli Motori Spa for
the operating conditions proposed.

**Technical support**

Marelli Motori customers can access our outstanding technical support at all times to ensure
their machines are safety, reliable and productive.
Our service engineers and technicians, from headquarter or subsidiaries, are always at our
customer’s disposal to assist in solving technical issues by either phone or email.

**Training**

Training courses are available all year round to users and maintenance personnel to ensure
the correct operation and maintenance of machines.
Our customised training sections are tailor-made for:

• customers
• users
• operators for the selection operation and maintenance of electrical equipment.
Training courses

Our training courses include:
- electrical generator working principle and troubleshooting
- electric generator setting and maintenance
- digital voltage regulation with MEC100.
- ATEX directive for maintenance of hazardous area motors.

In addition to the training in this brochure, it is possible to specify customised training based on a customer’s own requirements. Training language is either in Italian or English. At the end of each course, each participant will receive a personalised certificate, based on the result of a final test.
Contacts

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