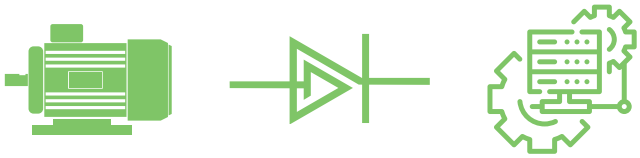
# VEM MARINE


# VEM SOLUTIONS

MOTOR - GENERATOR - VFD - IOT



## SOLUTIONS FOR SHIPBUILDING

VEM MARINE SOLUTIONS CATALOG

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## MOTOR - GENERATOR - VFD - IOT



# ABOUT VEM

VEM in Asia has been established in 2003 incorporated in Singapore. A small and smart Team leading new sales and after sales services for whole APEC and Oceania areas. A stock in Singapore ensure availability for Marine and flameproof motor within a few minutes.

VEM is an innovative, internationally-active and reliable manufacturer of technically sophisticated system and drive solutions, custom drives and single components. The output capacity ranges from 0.06 kilowatts to 60 megawatts / 90 megavolt ampere. Continuity and reliability, including in the future, this is what the production and service at VEM stands for. The engineering and quality of the products with the VEM logo are trendsetters within the market.

# Introduction

## Solutions for shipbuilding

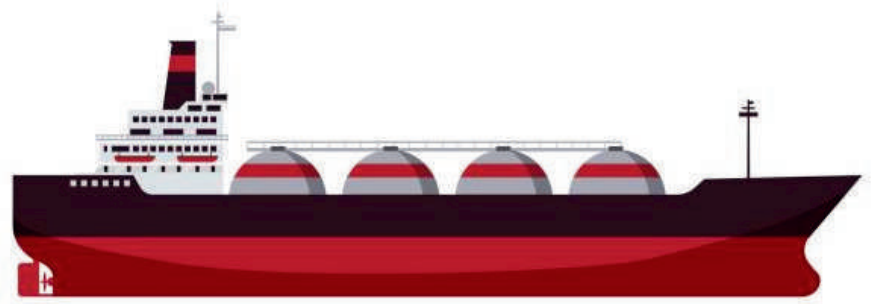
With a wealth of experience spanning many years, VEM is a trusted authority in the construction of ship motors, backed by licenses from all major ship classification companies. Our expertise extends to building and supplying motors and generators for a diverse range of ship models, from large-scale machinery weighing up to 300 tonnes to a wide array of accessory drives.

Our comprehensive scope of delivery encompasses shaft, diesel, and on-board electrical system generators, propeller drives, Azimuth and bow thrusters, transverse rudder drives, pump drives, and auxiliary equipment drives.

Our shaft and diesel generators provide vital energy to power grids on major luxury liners and container ships, while propeller motors serve as efficient alternatives to large diesel engines, distributed strategically throughout the ship according to the electrical shaft principle.

Transverse rudder drives facilitate precise manoeuvring in ports, with careful consideration given to engineering the machines to accommodate the often confined installation spaces and unique ventilation requirements on board.

Our robust grey cast iron motors, designed with protective seawater specifications, ensure reliable operation of auxiliary equipment in the low-voltage range. From fans and pumps to capstans and hoisting gears, these motors are tailored to withstand the specific climatic and mechanical stresses encountered at sea, underscoring VEM's commitment to delivering durable and high-performance marine solutions.



# Range of Vessels

## Exploring diverse vessel categories: our range of specialized solutions

Research and special purpose vessels

Supply vessels

Ferries

Cruise liners

Mega-yachts

Container ships

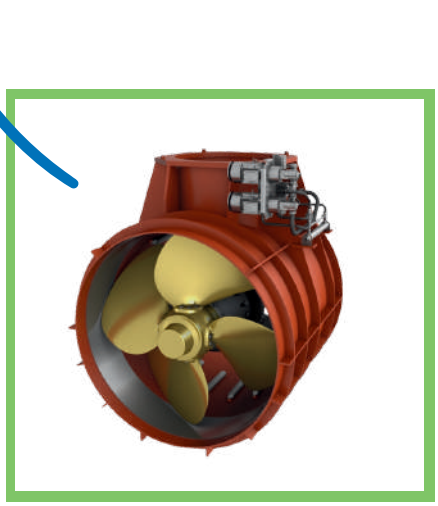
LPG/LNG carrier

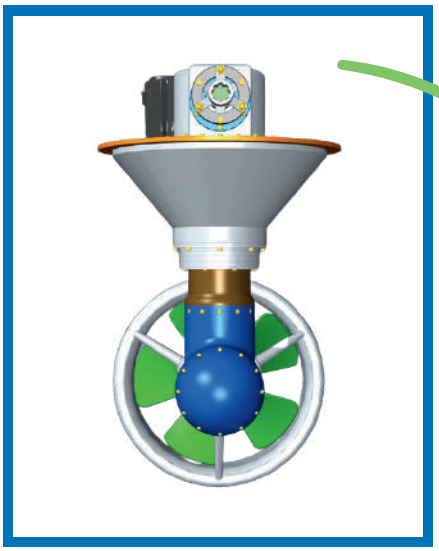
Navy vessels

# Marine Applications

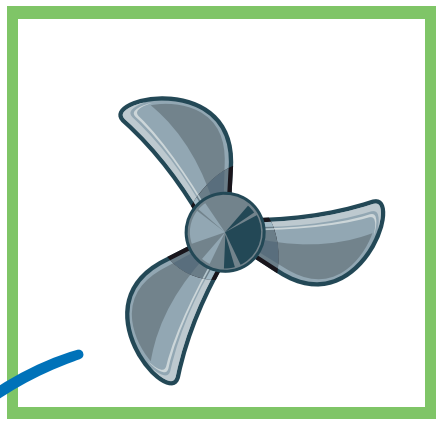
## Powering your vessel's performance

Bow thruster





Azimuth thruster

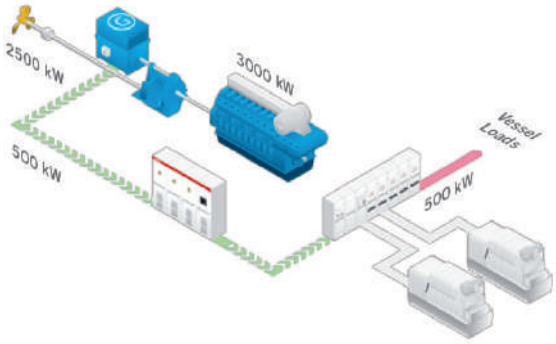


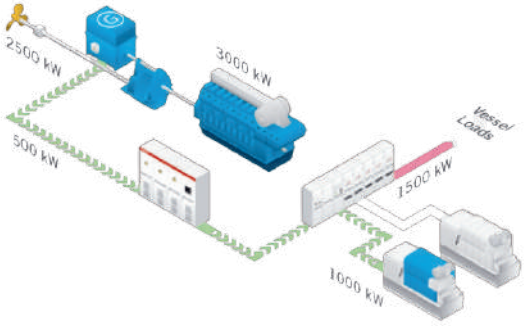
Vessel propeller

# Operation Modes

## PTO Mode

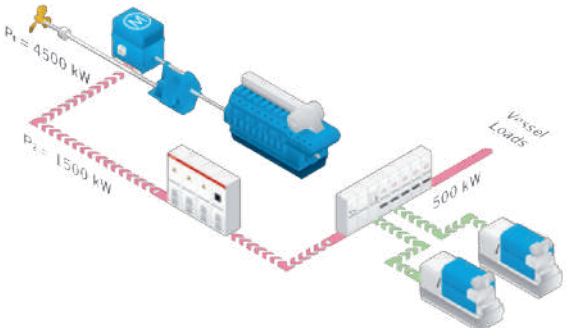
The main diesel engine supplies the power needed for the propulsion as well as for the ship's consumers. Therefore, the gensets are off or one of them is on. This mode provides a significant reduction in the consumption of fuel and emissions during sailing.



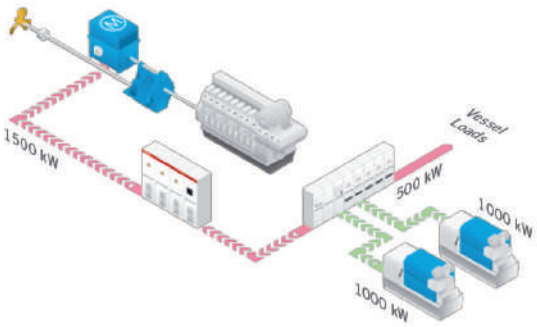

## PTI Mode

Mode selected for maximum speed. The shaft generator functions as an auxiliary motor (P2), and works concurrently to the main diesel engine (P1). Hence, the main propeller receives a power of P total = P1+P2. The gensets supply electrical power for both the propulsion (P2) and for the ship's consumers.

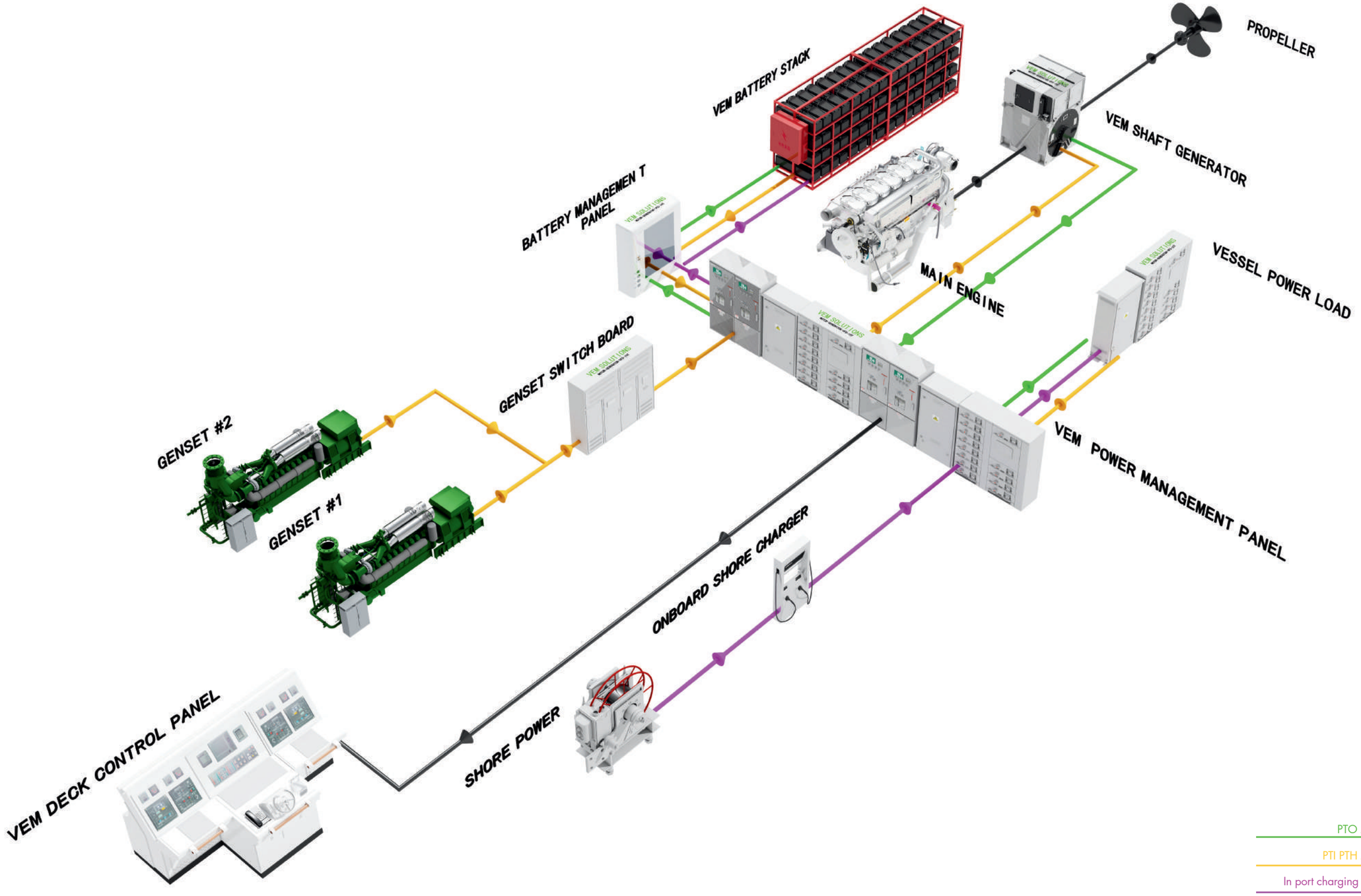



## PTH Mode

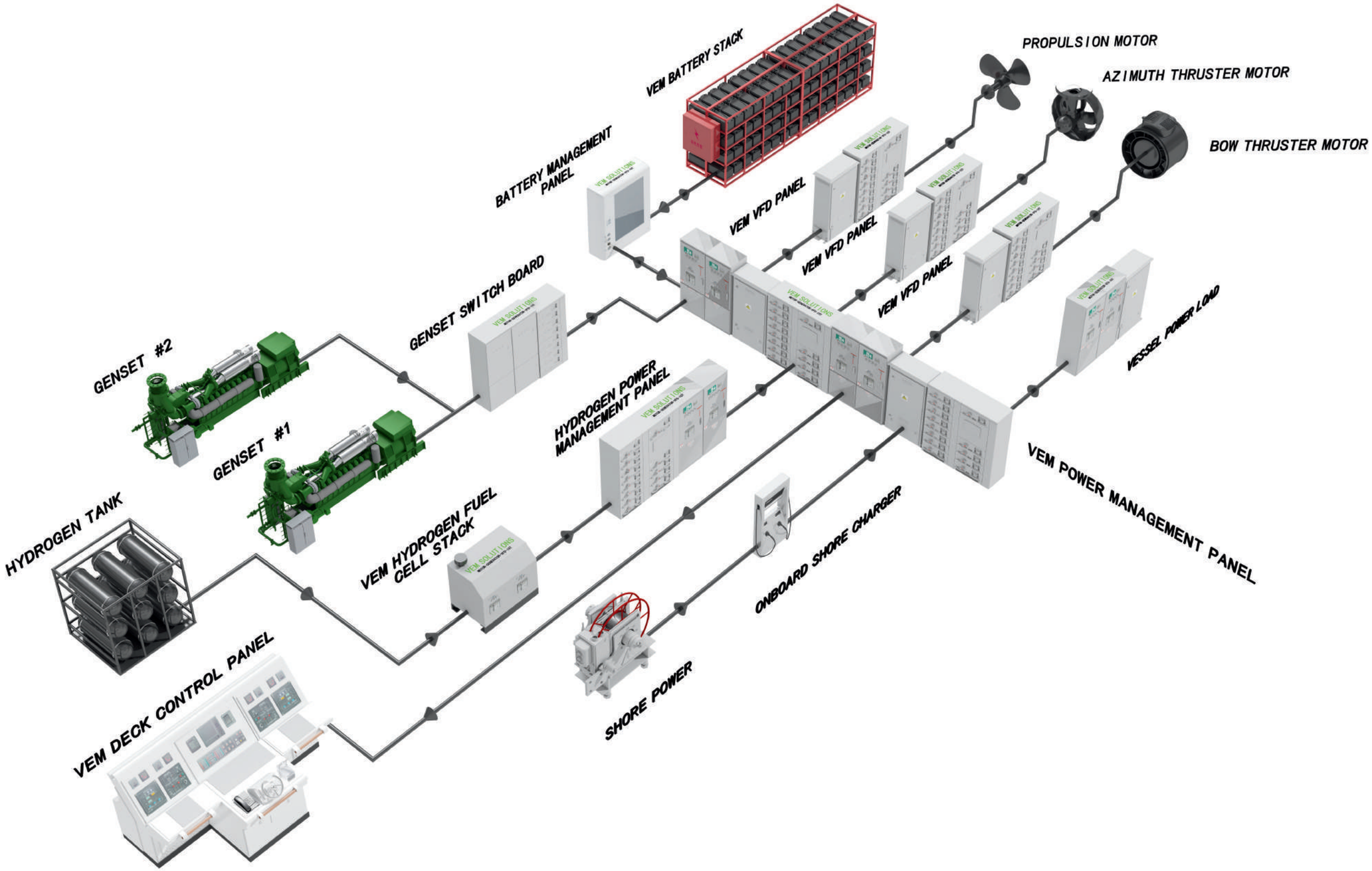
This mode is used at low speeds and does not need the main diesel engine, reducing the need for maintenance. The gensets are functioning and feed the ship's loads as well as the main propulsion. The shaft generator functions in this case as a motor. It is a mode that can also start operating in the event of a failure in the main diesel engine ("Power Take Home", PTH functionality) and which makes it possible for the vessel to return home safely to be repaired.



# Shaft Generator Solution



# Hybrid Solution



# Propulsion Motor

Synchronous motors can be considered the standard drives for electric vessel propulsion systems, especially where high torques apply. They are often designed with two separate winding systems and configured for operation on medium voltage synchronous converters. VEM machines are to be found as drives on cruise liners, for example, where quiet operation is absolutely essential. They are similarly an ideal choice for mega-yachts. Another characteristic of our synchronous propulsion motors is their extremely high availability, a factor which is a top priority for installations on board navy vessels.

Slow-running synchronous propulsion motors with separate base frames and additional custom vibration damping play a special role within our product portfolio. The variable concept for welded housing constructions enables us to adapt the machine design to the particular installation requirements on board.

## Technical Data

**Output range**
1000 - 30000 kW

**Voltage range**
690 – 10 000 V for converter-fed operation

**Frequency range**
5 – 120Hz

**Speed range**
120 – 200 rpm (1200 rpm)

**Number of poles**
6 to 24

**Type of cooling**
IC8A6W7

**Type of protection**
IP 55

# Shaft Generator

The VEM product portfolio also includes high-power shaft generators with IP 54 protection and air water heat exchangers. In modern shipbuilding, the use of such generators reduces fuel consumption significantly compared to conventional configurations with a separate diesel unit. They are mounted directly on the main shaft between the diesel engine and the propeller, and are able to generate all the energy required on board. On container ships, for example, where electricity demand is especially high to maintain the cooling for refrigerated containers, our shaft generators are greatly superior to fast-running diesel generators in terms of energy efficiency. We design generators both for combination with passive rectifiers and for converter-fed operation.

In addition, they can function as either boosters or "power take home" systems. The latter operating mode enables the crew to compensate any failure of the main engine. The shaft generator acts as a drive motor to bring the vessel safely to the nearest port. In booster mode, on the other hand, additional drive power can be transferred onto the propeller shaft in certain navigation situations. The stators of shaft generators are delivered to the shipyard, where our service technicians can also mount the salient poles directly onto the main shaft of the vessel, if required. This generator series is designed with IP 54 protection and equipped with an air-water heat exchanger.

## Technical Data

**Output range**
up to 12.000 kVA

**Voltage range**
400 – 10.000 V

**Frequency range**
5-30Hz

**Speed range**
30 – 200 rpm

**Number of poles**
16 & 28

**Type of cooling**
IC8A6W7

**Type of protection**
IP 54

# Azimuth Thruster Motor

Electric motors are used as drives for thrusters and pump jets on almost all types of vessel. These systems are in the meantime standard features for larger vessels, and they also play an important role for the exact positioning of pipe layers, cable layers and floating cranes. The bow and stern thruster drives for such special-purpose vessels deliver output up to 5 MW. Our motors are offered in IM 3011 and IM 1001 designs with a built-on air-water heat exchanger for type of protection IP 54 or with open circuit ventilation for type of protection IP 23. In addition to the VEM standard series with grey cast iron housing, custom-welded housings can also be supplied upon request. The machines are intended for operation either as direct drives (DOL) in S1 or S2 mode or in conjunction with a frequency converter. A variable-speed controller is imperative for positioning drives.

## Technical Data

**Output range**
200 – 5000 kW

**Voltage range**
400 – 11000 V

**Frequency range**
Variable

**Speed range**
200 – 3000 rpm

**Number of poles**
4,6,8 and 10

**Type of cooling**
IC 01,
IC71W
IC8A1W7

**Type of protection**
IP 54, IP 23

Source: www.schottel.de

# Bow Thruster Motor

A lateral thruster is installed in an athwartships tunnel near the bow to enhance maneuverability, particularly in coastal waters, narrow channels, and during port entries and exits. This effect is most pronounced at speeds between four to six knots, but it can be mitigated by incorporating an anti-suction tunnel to relieve the vacuum on the hull.

Optimal placement of the bow thruster involves positioning it as far forward as possible, with parallel side walls exerting a favorable influence. The recommended tunnel length typically ranges from 2 to 3 times the diameter (2-3D). Efforts should be made to locate the propeller in the midship plane. In shorter tunnels, the propeller is intentionally placed eccentrically on the port side to enhance thruster performance when maneuvering to starboard. The average power of bow thrusters in ferries ranges from 0.54 kW/m2 to 0.96 kW/m2, with a prevailing trend towards 0.6-0.8 kW/m2. In contrast, stern thrusters are typically dimensioned at 0.2-0.25 kW/m2.

## Technical Data

**Output range**
200 – 7000 kW

**Voltage range**
400 – 11000 V

**Frequency range**
Variable

**Speed range**
200 – 3000 rpm

**Number of poles**
4,6,8 and 10

**Type of cooling**
IC 01,
IC71W
IC8A1W7

**Type of protection**
IP 54, IP 23

Source: www.schottel.de

# PM Motor

Permanent magnet excited synchronous machines (PMSM) differ from induction machines only by the rotor design. Often there is simply an isotropic rotor with a smooth surface on which permanent magnets are mounted. This type of machines achieves the highest efficiency levels because there is no extra current necessary to produce a rotor field component, as it is with induction and synchronous reluctance machines. However, while this advantage is even higher in the partial load area it is reduced in the overload and field weakening range. Especially in the latter the power output and efficiency reduce strongly because current is needed to weaken the permanent magnet excitation.

Thanks to these properties PMSM can be built one frame size step smaller at the same rated output power and are therefore extraordinarily compact. They need an inverter too, however and are not capable of starting while directly connected to the grid.

## Technical Data

**Output range**
15 – 7000 kW

**Voltage range**
400 – 11000 V

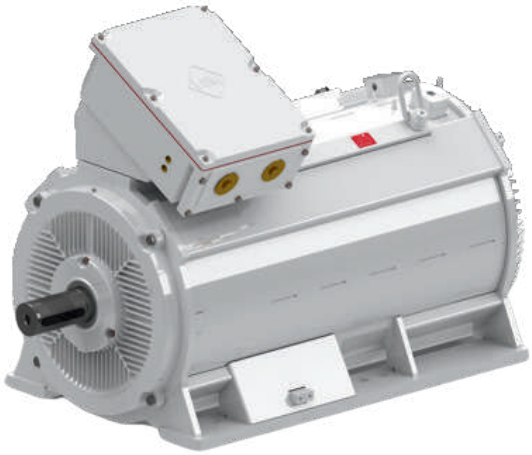
**Frequency range**
Variable

**Speed range**
100 - 5000 rpm

**Number of poles**
4,6 and 8

**Type of cooling**
IC 411,416,
IC71W

**Type of protection**
IP55/56
65 and 66



# VFD

A Variable Frequency Drive (VFD) is a motor controller that adjusts the frequency and voltage supplied to an electric motor, thereby controlling its speed. It is also known as a variable speed drive, adjustable speed drive, or inverter. The frequency of the power supplied to the motor determines its speed, with higher frequencies resulting in faster RPMs. By using a VFD, the motor's speed can be precisely controlled to match the requirements of the application, allowing for energy savings and optimized performance.

Variable Frequency Drives (VFDs) offer several significant benefits in industrial applications. Firstly, they reduce energy consumption and costs by allowing precise control of motor speed to match load requirements, potentially cutting energy usage by up to 70%. This optimization also enhances product quality and lowers production costs. Secondly, VFDs increase production efficiency through tighter process control, minimizing errors and maximizing throughput. Additionally, they extend equipment lifespan and reduce maintenance needs by smoothly controlling motor frequency and voltage, thereby offering better protection against various issues such as overloads and voltage fluctuations. Overall, VFDs provide comprehensive solutions for energy efficiency, production optimization, and equipment longevity in industrial settings.

## Technical Data

**Power**
0.75kW - 25 MW

**Voltage**
220 - 11.000 V

**Cooling**
Air and Water cooled

**Enclosure**
up to IP65

# Main Switchboard

The Main Switchboard (MSB) panel, a critical component of a ship's electrical system, stands as the primary switchboard directly supplied by the main source of electrical power. For traditional electrical propulsion it serves to control and distribute power from the ship's generators to various electrical loads. In the era of hybrid propulsion, it is critical for managing all power sources include generators, shaft generator power, battery pack, hydrogen fuel cell, shore power and distributing them. Ensuring proper servicing and troubleshooting of the MSB is essential to maintain the reliable operation of the ship's electrical system.

## Technical Data

**Voltage range**
220 - 11000 V

**Sub-Bus**
100 - 2000 A

**Protection**
Up to IP54

**Built-in**
Controller

# Battery

Batteries are increasingly integrated onboard ships to reduce greenhouse gas emissions and comply with shipping sustainability regulations. They are particularly useful in environmentally sensitive areas or near populated regions with strict restrictions.

On ships, batteries serve multiple purposes, including energy storage for hybrid marine power systems, emergency backup power, and starting motors for lifeboats and rescue boats. They often act as backup power to maintain vessel operations and support Dynamic Positioning systems, and can function as the sole source of electricity for short periods, enabling zero-emission operation.

Additionally, batteries are crucial for providing power during blackout and emergency situations, supporting low-voltage DC systems for essential equipment like navigational instruments and emergency lighting. Arrangements for recharging batteries onboard are vital to ensure their continued availability and optimal performance.

## Technical Data

| Capacity | Ambient Temperature | Cycle life | Output voltage |
|---|---|---|---|
| Up to 1600 kWh | -20 - + 55 °C | > 3600 | 690 - 840 VDC |

# Hydrogen Fuel Cell

Hydrogen fuel cells represent cutting-edge energy generation technology, operating electrochemically to convert hydrogen's chemical energy directly into electricity and heat. Unlike traditional combustion engines, fuel cells produce power without combustion, emitting only clean water. Proton Exchange Membrane Fuel Cells (PEMFC) stand out for their application in zero-emission scenarios, utilizing hydrogen as a fuel source to generate electricity and heat sustainably.

In the maritime sector, hydrogen fuel cells offer promising solutions for decarbonizing shipping operations. They serve as both alternative fuels and sources of clean electricity, powering ship systems without emitting greenhouse gases. When hydrogen is the fuel, fuel cells provide a zero-emission solution that aligns with environmental regulations and shipowners' sustainability goals.

Fuel cells offer numerous advantages in maritime operations, including extended running hours in zero-emission mode, integration with batteries and shore charging systems, and high recyclability, enhancing vessel sustainability, flexibility, and reliability. However, to facilitate broader adoption, clear guidelines governing the design, construction, installation, and operation of fuel cells in maritime applications are crucial.

As fuel cell technology evolves, access to updated safety frameworks becomes essential for shipyards and vessel operators. Comprehensive guidance is needed to navigate evolving fuel profiles and technological developments safely. By establishing robust safety protocols and staying informed about advancements in fuel cell technology, the maritime industry can maximize the potential of hydrogen fuel cells in its pursuit of sustainability and environmental stewardship.

## Technical Data

| Output Power | Hydrogen pressure | Output Voltage | Weight |
|---|---|---|---|
| up to 80kW | 0.8+ - 0.1 Mpa | 400 - 700 VDC | 300 - 500 kg |

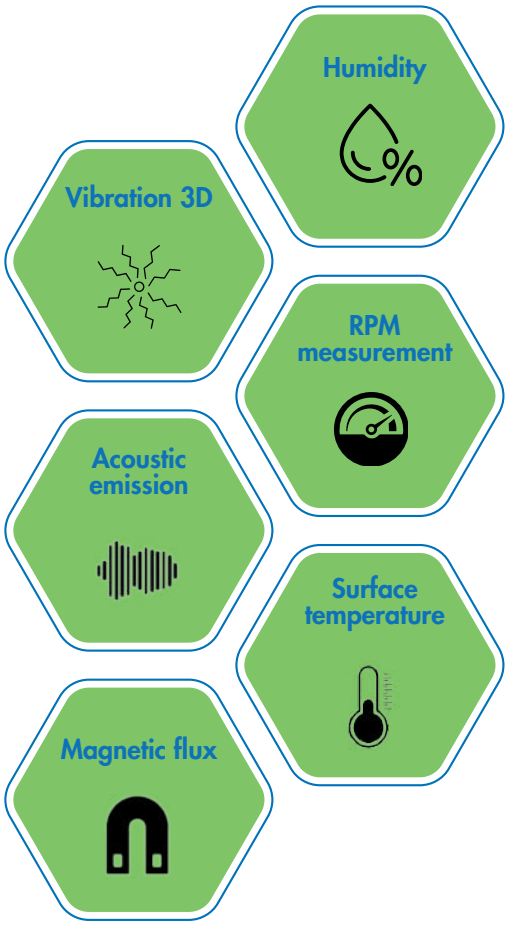
**VEM Hydrogen fuel cell stack**


**Hydrogen tank**

# Automated Predictive Analytic System

In the dynamic maritime sector, Automated Predictive Analytic Systems (APAS) leveraging IoT technology have emerged as indispensable tools for enhancing vessel performance and minimizing downtime. By employing predictive analytics, APAS enables early detection of machinery faults, empowering maintenance teams to shift from reactive to proactive maintenance strategies. Real-time monitoring provides invaluable insights into machine health, aiding decision-making for optimized maintenance schedules and resource allocation. Instant notifications ensure swift response to anomalies, preventing costly breakdowns and operational disruptions. APAS revolutionizes maintenance practices, enabling maritime professionals to achieve sustainable operational excellence.

Additionally, IoT solutions bring unparalleled value to maritime operations by prioritizing uptime and equipment effectiveness. With innovative 6-in-1 sensor hardware and wireless deployment, IoT enables seamless data collection and predictive maintenance capabilities. This comprehensive approach empowers maritime stakeholders to make informed decisions, reducing labor and inventory costs while driving sustainable operational excellence.

# VEM Marine References List

| Type | Power | Customer / Bestseller project driven equipment | Country |
|---|---|---|---|
| DGMUZ 1653-16WS | 4.968,0 kW / 5.157,0 kVA<br>4.100 V<br>64,0 min-1 | Wärtsilä Deutschland GmbH<br>WG HHI 2499 - SAM<br>Shaft Generator | South Korea |
| DGMUZ 1653-16WS | 4.968,0 kW / 5.157,0 kVA<br>4.100 V<br>64,0 min-1 | Wärtsilä Deutschland GmbH<br>WG HHI 2500 - SAM<br>Shaft Generator | South Korea |
| DGMUW 1145-16U | 2.240,0 kVA<br>690 V<br>72,0 min-1 | Wärtsilä Deutschland GmbH<br>JGNSY Petretec H2735-40 - Wärt<br>Shaft Generator | China |
| DPMUW 1140-28U | 1.925,0 kW / 2.094,0 kVA<br>556 V<br>54,0 min-1 | Wärtsilä Deutschland GmbH<br>PMSG HSHI Korea H8105 - Wärts<br>Shaft Generator | Russia |

| Customer<br>Kunde | Ship yards<br>Werft | Ship project<br>Schiffsprojekt | Driven equipment<br>Arbeitsmaschiene | Type<br>Typ | | Power<br>Leistung | Classif. |
|---|---|---|---|---|---|---|---|
| Wärtsilä SAM Electronics | Fincantieri Italy | ODIN 5 | Diesel generator / Dieselgenerator | DRKSX 1032-10WS | Synchronous generator | 8400 kVA | LR |
| Wärtsilä SAM Electronics | Fincantieri Italy | ODIN 5 | Diesel generator / Dieselgenerator | DRKSX 9032-10WS | Synchronous generator | 6300 kVA | LR |
| SAM Electronics | Fincantieri Italy | Princess Cruises | Propeller motor / Propellermotor | DTMSZ 3466-6YS | Synchronous generator | 18000 kW | LR |
| SAM Electronics | Fincantieri Italy | Princess Cruises | Diesel generator / Dieselgenerator | DRKSY 2536-12WSA | Synchronous generator | 21000 kVA | LR |
| Siemens | Meyer-Werft Papenburg Germany | AIDA | Thruster motor / Thrustermotor | DKKJT 7124-8WF | Asynchronous motor, squirrel-cage rotor (mit Käfigläufer) | 2300 kW | GL |
| Siemens | Meyer-Werft Papenburg Germany | AIDA | Thruster motor / Thrustermotor | DKKJT 5621-6WF | Asynchronous motor, squirrel-cage rotor (mit Käfigläufer) | 1500 kW | GL |

| Customer<br>Kunde | Ship yards<br>Werft | Ship project<br>Schiffsprojekt | Driven equipment<br>Arbeitsmaschiene | Type<br>Typ | | Power<br>Leistung |
|---|---|---|---|---|---|---|
| SAM Electronics | | Cutter suction dredger BA33 | Thruster motor / Thrustermotor | DKMAF 5023-6V | Asynchronous motor, squirrel-cage rotor (mit Käfigläufer) | 1250 kW |
| SAM Electronics | Lithuania | Heavy Lift crane Vessel | Propeller motor / Propellermotor | DKMJB 5018-6U | Asynchronous motor, squirrel-cage rotor (mit Käfigläufer) | 1100 kW |

# VEM SOLUTIONS

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# Why choose VEM?

## Your Comprehensive Partner for Marine Solutions and Beyond

- Product range from single motors to complete drive systems
- Own design engineers develop tailored solutions
- Flexibility thanks to a high proportion of in-house manufacturing
- Quick response
- Worldwide service availability
- 24hr delivery service for stock motors (online warehouse)
- Design - Made in Germany
- Durable and robust under extreme conditions
- Environment-friendly and energy-efficient
- Low life-cycle cost
- Machine lifetime 25 years

# VEM SOLUTIONS

MOTOR - GENERATOR - VFD - IOT

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