



# Power and Propulsion Solutions

## Hybrid Electric Propulsion Systems

### Electric Azimuthing Permanent Magnet Propulsion Drives



**With variable rpm Gen-Sets for optimal Fuel Savings**

**AC-DC Grid System Solutions**

**Power Management**

**Reliable & Efficient with Maximum Fuel and Emission Reductions**

**Complete Propulsion and Drive Systems – ONE SOLUTION SOURCE**

Marine Propulsion Solutions Group is recognized as one of the world's leading Electric Podded Thruster and Propulsion Systems Manufacturer and introduces its unique Electric (Permanent Magnet) Podded Rotatable Propulsion Units for all types of Marine vessels.

**Owner/Operator benefits:**

- Propeller speed is independent of engine speed leading to better maneuverability
- Increased propulsion system efficiency – Up to **20% fuel savings** & maximum reduced emissions.
- Increased propulsion system redundancy and power availability
- Reduced total installed power generation
- Reduced noise & vibration levels



# PT. Marine Propulsion Solutions

## Design:

Marine Propulsion Solutions Electric Podded Drives are engineered products of European design based on the latest marine propulsion technologies, ANSYS Finite Element Analysis and the most modern manufacturing technologies available. They are of very heavy duty design and incorporate many unique features to optimize reliability, longevity and easy maintenance.

## Integrated Propulsion Packages:

- Dual Azimuthing Propulsion Drives
- Variable Speed - Drives & Diesel Generator Sets
- Power Management Systems
- Integrated Bridge Controls with full system monitoring.
- Fully Classed Systems (ABS, B.V., Lloyds and other available)

## A Complete Drive Package

## Customer Benefits:

- The output voltage of the variable rpm generator is not dependent on the RPM (revolutions per minute) of the generator. The generator RPM can be fixed to a position offering the optimal balance between RPM & Load, output power, audible noise and vibration.
- The PM alternator utilizes the same cooling circuit as the main engine making the installation much simpler.
- The output voltage / power of the PM can be used for various purposes including integration into DC systems. For example with our DC-Grid concept or as an inverter based variable speed generator.

## System features of both variants:

- Audible noise inside a boat will be greatly reduced
- Automatic start stop based on energy balance
- Clean running of engine at the right load
- Global shore power access

### Electric Propulsion Permanent Magnet Systems



Electric Propulsion Drives designed with the electric permanent magnet motor as an integral part of the thruster pod and eliminating reduction gears producing Simplicity with Reliability in a **"SILENT DRIVE"**. Available as a fixed, steerable or full Azimuthing drive for maximum maneuverability and available from 125 to 2500Kw.



### Bow/Stern Thrusters



Electric Bow/Stern Thrusters designed with permanent magnet integrated motors and rated from 25 up to 1500Kw complete with motor inverter/controller and full bridge controls.

- Compact Installation with no air cooling required
- Silent and Reliable Bow & Stern Thruster Systems



# PT. Marine Propulsion Solutions

The development of variable speed power generation is becoming a game changer. By attaching an AC (PM) generator to a variable speed marine propulsion engine and converting the output of that generator into a useful form of power (in this case DC power), the best efficiency point of the diesel can be continuously matched to the load demand at any given time. Therefore the diesel engine can run at whatever speed that achieves the best specific fuel consumption for a given load, and the power electronics converts whatever volts/hertz to DC volts for power distribution.



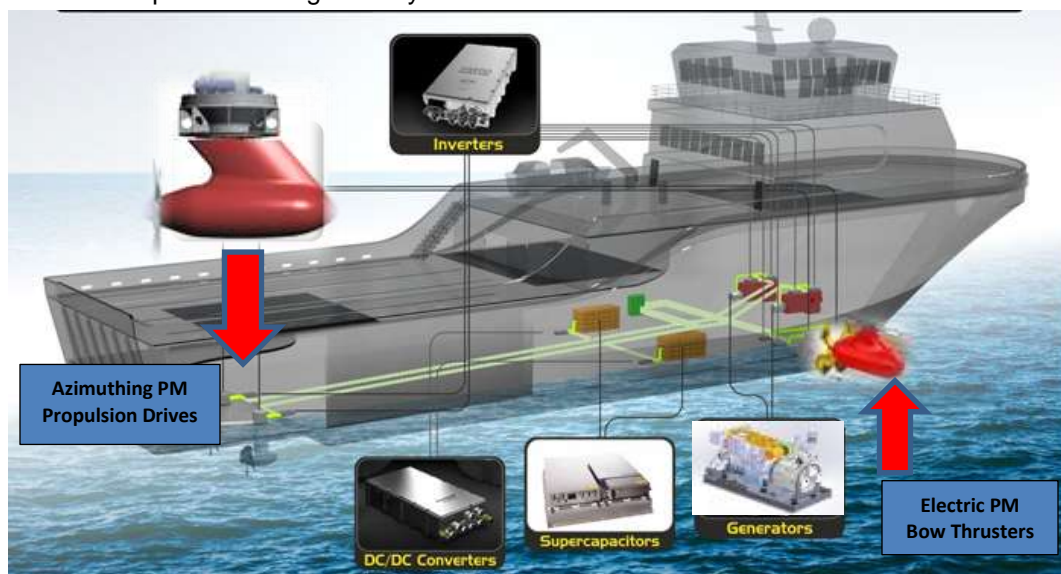
- Combined potential for 20% in fuel savings, 15% from power management and 5% from Energy Storage.
- Improved life cycle cost by reduced fuel consumption and maintenance intervals.
- Improved reliability and reduction of single point failures within the system.
- Better quality power by producing less harmful harmonics and better power factor control.
- Improved efficiency of energy due to optimization of loading of the prime movers in conjunction with energy storage and by utilization of an integrated power management system.
- Less space and weight intensive packaging of the power and control systems offering more flexibility within the machinery arrangements and allow more cargo carrying capacity for the same sized ship.
- Less propulsion machinery noise and less vibration due to fewer machines being on line, running at lower speed, and utilization of energy storage system.

## AC/DC GRID-DISTRIBUTION:

The MPS AC/DC-distribution system allows variable speed generators with constant dc grid output, which increases fuel efficiency and allows for higher exhaust temperatures. Reduced running speeds, for the diesel engines, allows for increased service intervals and reduced on-board noise whilst operating on low power output. The AC/DC Grid concept eliminates **HARMONICS** which can often interfere with DP Systems.

## ENVIRONMENT IMPACT:

NOx emission requirements and penalties have already been introduced into the marine industry. Tougher regulations usually require more expensive solutions. The DC Ring-Net Solution is different and suitable for submarine operation in a good way!





# PT. Marine Propulsion Solutions

## Inverter Technology



The **MPS Inverter/Controller** is built with components that can handle double the number of load cycles compared to components used in standard industrial inverters. The standard lifespan of MPS products is up to 20 years. The high-performance vector control of MPS drives the motors accurately and smoothly. It can control induction motors (IM) and permanent magnet (PM) motors and MPS reluctance-assisted permanent magnet (SRPM) motors with or without sensors.

**GENERAL** The MPS Inverter/Controller is a heavy-duty inverter series designed especially for electric or hybrid electric drive trains for marine vessels. Typical applications are:

- Controlling the speed and torque of electrical traction motors
- Converting alternating current (AC) from electrical generator to direct current (DC) for energy storage
- Active Front End for connecting to AC grid with regenerative power and low harmonic

## Variable Frequency Grid-Drives



The VFD controller is a solid-state power electronics conversion system consisting of three distinct sub-systems: a rectifier bridge converter, a direct current (DC) link, and an inverter. Voltage-source inverter (VSI) drives are by far the most common type of drives. Most drives are AC-AC drives in that they convert AC line input to AC inverter output. However, in some applications such as common DC bus, drives are configured as DC-AC drives. The most basic rectifier converter for the VSI drive is configured as a three-phase, six-pulse, full-wave diode bridge. In a VSI drive, the DC link consists of a capacitor which smooths out the converter's DC output ripple and provides a stiff input to the inverter. This filtered DC voltage is converted to quasi-sinusoidal AC voltage output using the inverter's active switching elements. VSI drives provide higher power factor and lower harmonic distortion than phase-controlled current-source inverter (CSI) and load-commutated inverter .

## DC BATTERY SYSTEMS

As an option, PT. Marine Propulsion Solutions can also offer a battery pack whereby it is possible to shut down all the engines during station keeping, maneuvering and free sailing at low speeds, making the vessel even more environmentally friendly. Battery packs can be provided, which allow the vessel to sail up at lower speeds. A battery system allows the vessel (varies on vessel type) to be alongside the quay for hours and still sail and can represent a further 10 to 15% fuel saving. Batteries make it much more comfortable for the crew because when they are asleep, energy is coming from the batteries so there is no noise or emissions

## SHORE POWER

A shore-connection can be challenging in terms of the correct capacity, voltage and frequency available from on-shore. A converter stage in combination with a transformer can adapt to any voltage and frequency. By combining the shore power with batteries, the peak available power can be increased, yielding full operational functionality to the vessel, even when the shore capacity is less than the vessel's requirements. This allows cheaper energy is to be used and running hours for the diesel engines can be avoided when in harbor.

***“One Source Solution”***