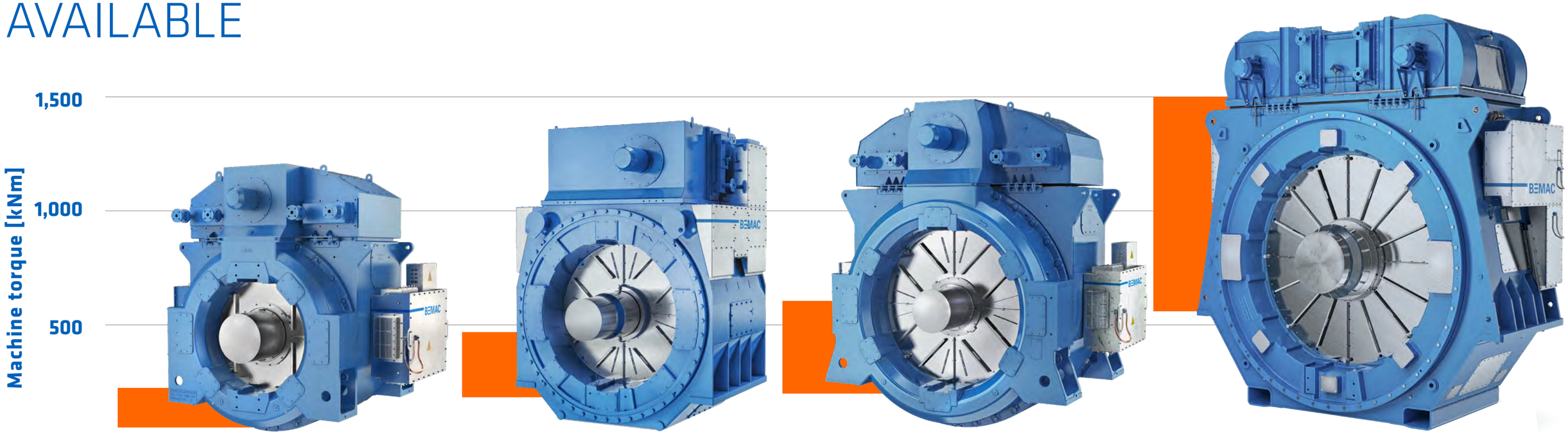
THE SWITCH
A BEMAC GROUP COMPANY

THE SWITCH PERMANENT MAGNET MACHINES FOR MARINE

BEMAC

WIDEST RANGE OF PERMANENT MAGNET (PM) MARINE MACHINES AVAILABLE

Our wide range of PM machines improves overall efficiency for propulsion and on-board electricity generation, reducing CO_2 emissions and operating expenses.



PMM1000M
73–230 kNm, 0–250 rpm
Typically used in 1–2 MW direct-drive systems

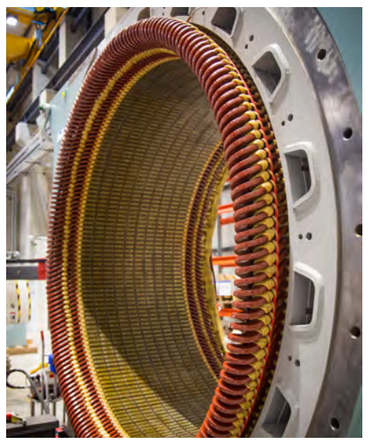
PMM1200M
200–450 kNm, 0–250 rpm
Typically used in 1–3 MW direct-drive systems

PMM1500M
220–630 kNm, 0–220 rpm
Typically used in 2–4 MW direct-drive systems

PMM2000M
580–1,500 kNm, 0–130 rpm
Typically used in 4–12 MW direct-drive systems

Permanent magnet technology

- **Magnetic field created by strong Neodymium magnets**
- **Lossless excitation, ensuring maximum efficiency. This results in reduced fuel costs and lower emissions**
- **Extremely simple mechanical construction, resulting in high reliability and minimal maintenance need**
- **Form-wound stator with vacuum pressure impregnation (VPI)**
- **High power density, resulting in a compact design**
- **Based on over 2 decades of The Switch experience from MW-class PM machines for wind and marine applications**
- **Tailored to the customer's application**
- **Several million cumulative operating hours from marine**
- **Unlike electrically excited synchronous generators (EESGs), PM machines are type-tested at full power before delivery**
- **Testing with third-party drives is also possible**
- **No need to replace magnets during the entire lifetime**



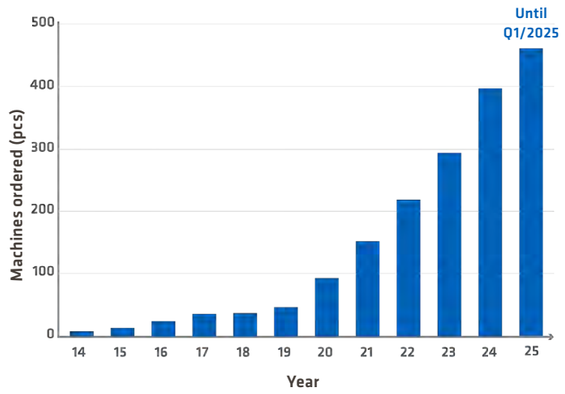
INLINE SHAFT GENERATORS

We were the first to deliver a megawatt-class PM shaft generator in 2015. Since then, over 450 of these machines have been sold, with cumulative operating hours exceeding several million. Today, PM shaft generators have become a standard solution in large ocean-going vessels, simplifying their compliance with IMO regulations.

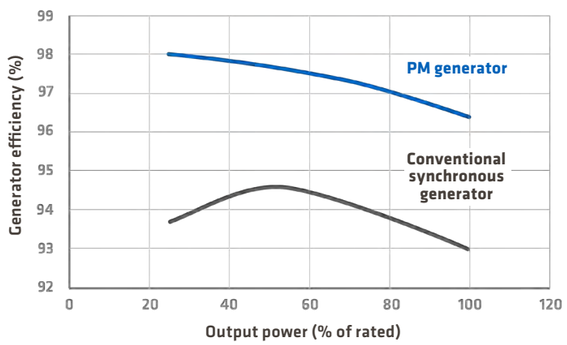
Why choose The Switch PM shaft generator

- Significant fuel savings when electric power is produced by utilizing the vessel's 2-stroke main engine
- Permanent magnet technology further reduces emissions and fuel costs
- Minimal need for maintenance as gensets can stay shut down most of the time
- Possibility for PTI and PTH functions, allowing boost mode or emission-free maneuvering in port areas using batteries
- More space for cargo due to a more compact machine
- Reduced EU carbon tax due to lower emissions
- Minimized project risk with full-power testing of the machine at our factory
- Proven technology with several million cumulative operating hours
- Our machine is always tailored to the customer's system, with flexibility for design changes

Cumulative marine machine orders



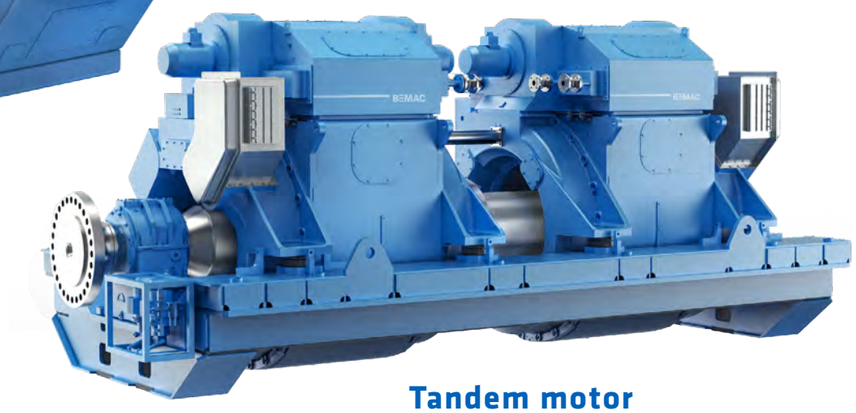
Efficiency comparison



DIRECT-DRIVE PROPULSION

Our direct-drive propulsion motor technology has the same basic elements as our field-proven shaft generators. Bearings and the shaft are always designed in close cooperation with the ship designer to optimize the functionality and efficiency of the entire propulsion line.

Single motor with bearings



Tandem motor with bearings

Compact tandem motor

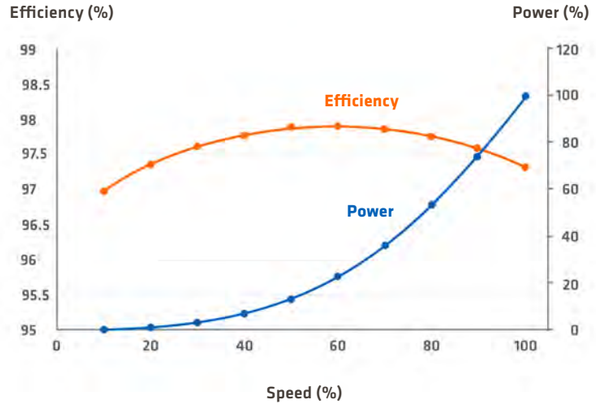
Single motor with the shaft and bearings provided by the yard or system integrator

Why choose The Switch PM propulsion motor

- Three different concepts depending on the customer's propulsion line design and redundancy requirements
- The tandem concept for single-screw vessels allows operation with over 50% power in case of motor failure, significantly increasing the system's redundancy
- The motors can also be used in silent applications, such as DNV Silent classes
- Bearings and the shaft are designed together with the ship designer to ensure compatibility, avoid resonances and more
- Extensive product portfolio ranging from below 1 MW to over 12 MW

M/S Nukumi with two The Switch PMM1500M propulsion motors

Typical efficiency of a 5 MW direct-drive PM propulsion motor



UNMATCHED TESTING CAPABILITIES

Our Large Drive Test Center (LDTC) provides full-load testing capabilities for electric machines and drives up to 18 MW. String testing with the customer's frequency converters is also possible on request.

Lappeenranta Large Drive Test Center – Finland
Full-load testing capability for electric machines and drives up to 18 MW

Vaasa test center – Finland
Electric machine full-power testing over 10 MW. DC-Hub testing, including applications such as active front end (AFE), motor inverter and DC/DC. Full-power testing of drives over 3 MW

Heiane test center – Norway
Member of the Energy House. System integration testing for DC-Hubs with batteries, fuel cells and more

All tests fulfill international standards and class requirements.

THE SWITCH DC-HUB AND SINGLE DRIVE

The Switch DC-Hub is the world's smartest technology for a multimegawatt DC power system. It ensures stable and secure operation for chosen consumers and enables a vessel to be future-flexible for new fuel sources.

THE SWITCH LOCATIONS

Finland
Helsinki, office
Lappeenranta, factory
Vaasa, factory

Norway
Stord, factory
Trondheim, office

China
Beijing, branch office
Lu'an, workshop
Nanjing, branch office and partner factory

Japan
Imabari, BEMAC head office

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www.theswitch.com

The Switch is part of the BEMAC Group whose products are unified under the BEMAC brand.

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