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MARINE

# **Decrease fuel consumption and emissions with shaft generators and drives**





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# Your investment is safe with ABB

ABB provides you with the highest-quality shaft generator (SG/M) and drive (SGD) solutions. We can provide you with products perfectly suited for your vessel's design, both for new builds and existing vessels. You get prompt equipment deliveries and the shortest possible payback time. Your investment is safe with ABB.

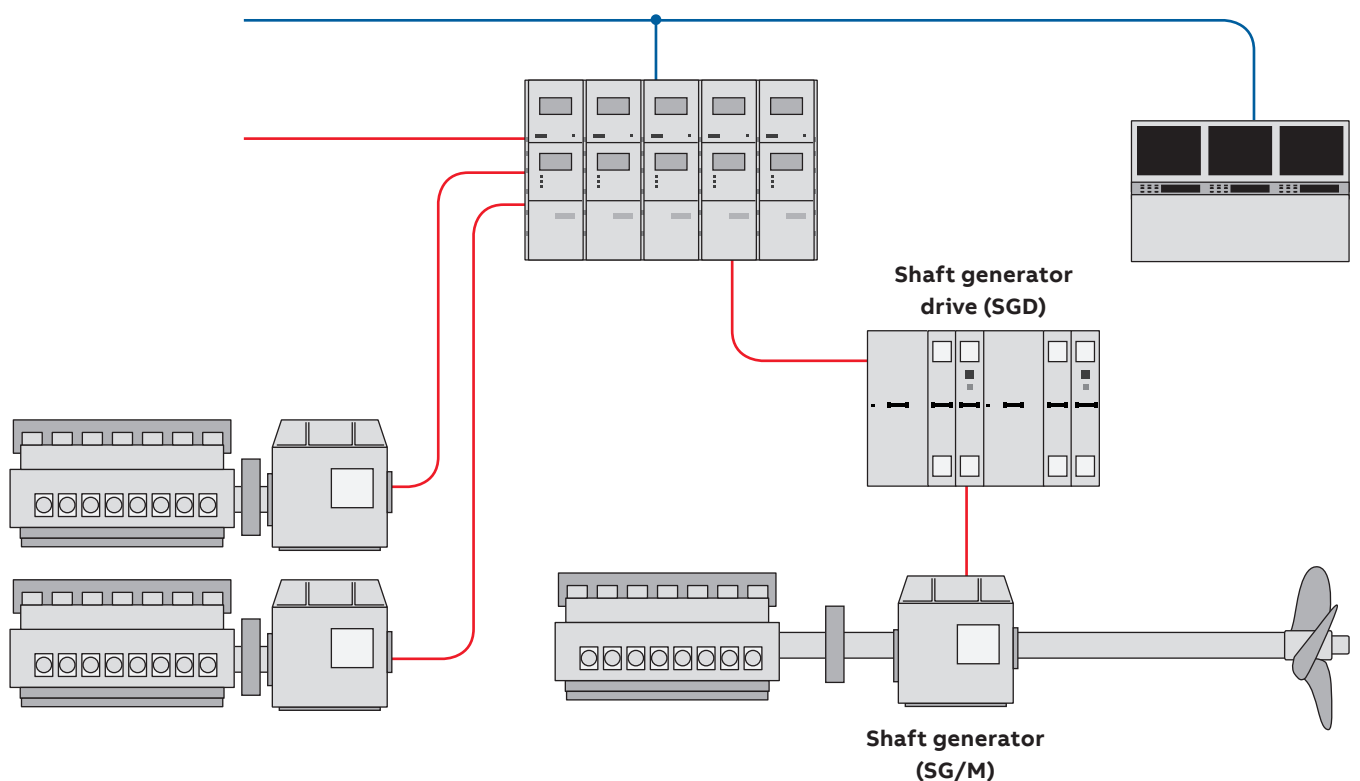
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01 Typical shaft  
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02 Shaft generator and  
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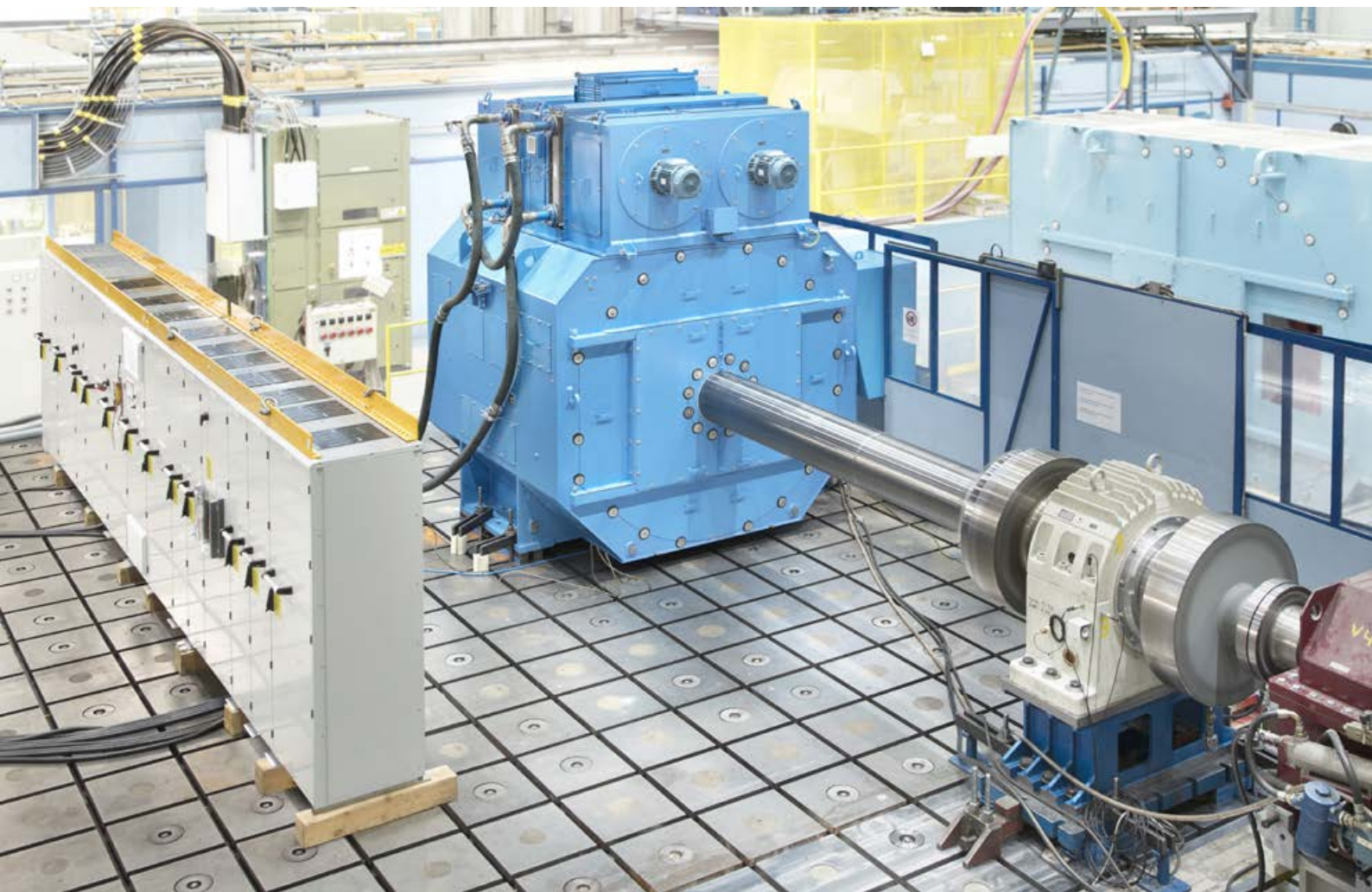
ABB is the world's largest producer of variable speed drives, motors and generators. With our extensive experience of marine equipment deliveries, we offer the optimal marine certified shaft generators and drives tailored exactly according to your needs. All our products are designed, manufactured and tested according to our strict quality assurance procedures, and we follow international standards and classification society requirements. The highest on-time-delivery rate on the market helps you get the systems running exactly when needed. ABB's top-quality technical support makes sure the shaft generator and the drive are seamlessly compatible with the vessel's propulsion system. Our range of after-sales services helps you keep the shaft generator running reliably throughout its entire lifetime.

## Why partner with ABB?

- We make sure that the shaft generator and the drive match exactly the vessel's design, in both new build and modernization projects.
- Strong support from our organization during pre-sales and throughout the equipment's lifetime.
- Our shaft generator and drive have the highest efficiency, lowest cost of ownership and highest availability on the market.
- We serve you with the highest on-time-delivery rate on the market.
- Our shaft generators and drives meet marine and offshore requirements, and their design and operation comply with regulations from all major marine classification societies.





**ABB's shaft generator and drive helps:**

- Reduce fuel consumption and emissions, making it easier to conform to the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP)
- Improve the operations and safety of your vessel.

# Helping to decrease fuel consumption and emissions

Today, fuel costs account for up to 60 percent of a vessel's operating costs. Energy efficiency has become critical in lowering the operating costs of, and emissions from, vessels, as well as for better compliance with environmental regulations. A shaft generator and drive help shipowners and operators hit their profitability targets while helping to keep the seas cleaner.



## **Main engine speed can always be optimized**

Traditionally, when the shaft generator is directly connected to the vessel's network, the main engine drives both the propeller and the shaft generator. The goal is for the shaft generator to supply power to the vessel's network at constant voltage and frequency. Any change in engine speed has a direct impact on network frequency, so ship speed can only be controlled by the pitch of the propeller. Adding a shaft generator drive helps maintain a stable voltage and frequency in the ship's network, regardless of the main engine speed. With an SGD, propeller pitch and main engine speed can always be optimized for any desired sailing speed, leading to lower fuel consumption and NO<sub>x</sub>/CO<sub>2</sub> emissions.

## **More efficient power generation**

An SGD allows the shaft generator to generate electrical power for the vessel's network in parallel with the auxiliary generator sets. This can lead to large savings on fuel as the vessel's main engine operates with far better efficiency than the auxiliary engines. The main engine is typically operated with heavy fuel oil (HFO) instead of the more expensive marine diesel oil (MDO) that the auxiliary engines use, making the cost difference even greater. The running hours of auxiliary gen sets can also be reduced, extending their lifetime and maintenance intervals.



# Improving the operations and safety of vessels

When a vessel is equipped with a combination of a shaft generator and a drive, the generator machine can also work as a propulsion motor. This increases the operational flexibility of the vessel and improves crew safety.



## **Assisting the main propulsion engine**

Adding an SGD between the shaft generator and switchboard allows the generator's power take-off (PTO) mode to be extended to a combined PTO/PTI (power take-in) mode. The shaft generator machine can now operate either as a generator or a motor.

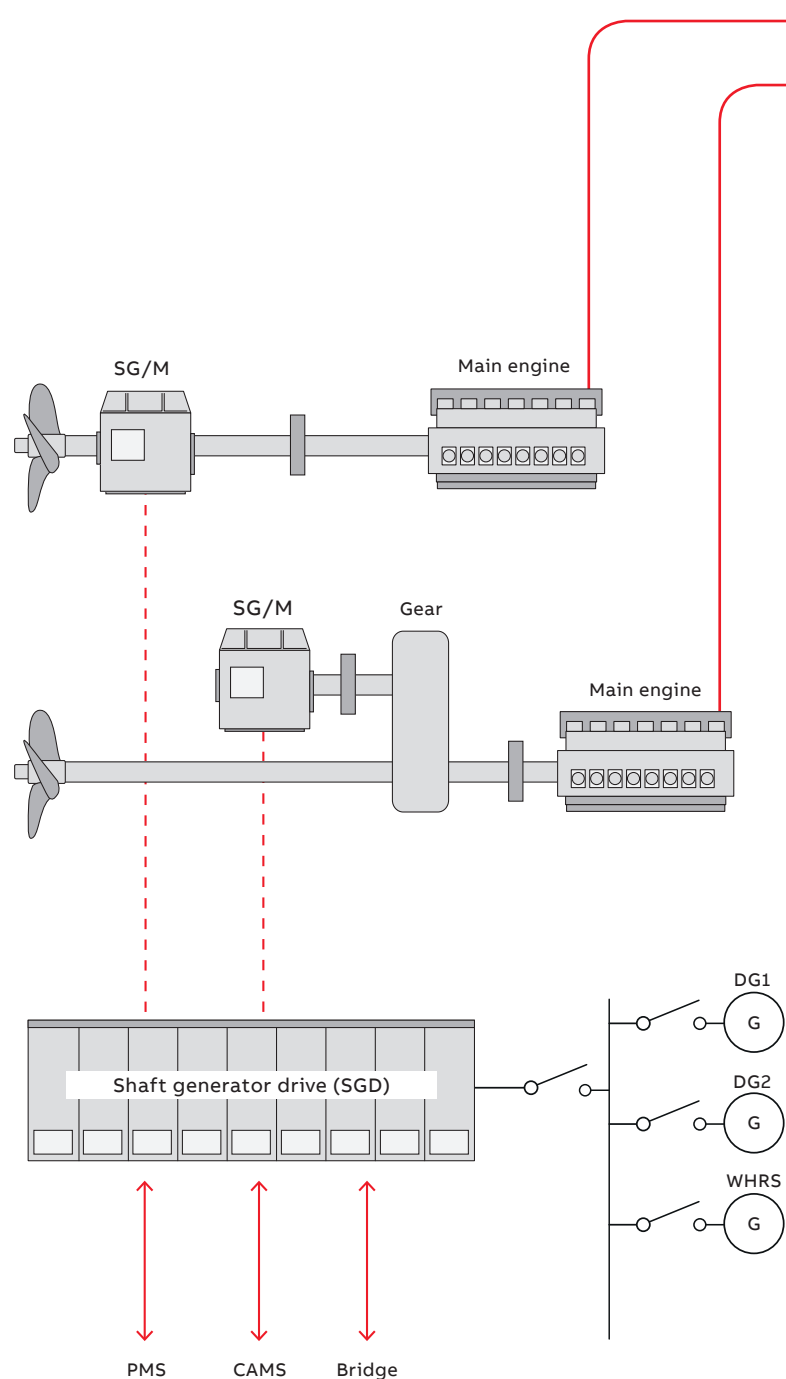
In PTI mode, the shaft generator operates as a motor to boost the main propulsion engine power. Power take-home (PTH) solutions are also possible with the shaft generator operating as an alternative propulsion motor. The vessel can still be maneuvered even if the main engine is not functioning, making it possible to reach port or to anchor safely. This adds redundancy and a higher level of safety to propulsion. An alternative means of propulsion is also helpful when the vessel needs to move through narrow straits, areas with high traffic and close to ports, or during engine maintenance.

## **Connect your vessel to any port network**

Depending on the port, there are different voltage levels available for ship connection. The shaft generator drive can be utilized for shore-to-ship connection. This drive is capable of connecting any port network to the ship's grid. This addition gives the ship the possibility to shut down all the auxiliary generators, leading to huge decreases in emissions and helping to meet ports' regulations.

# Shaft generator configurations

01 Typical shaft generator installation configurations.



## Shaft generator installation alternatives

A shaft generator can be installed in different configurations on the shaft line, as shown in picture on the left.

### 1 Directly to the propeller shaft

### 2 With gearbox to the propeller shaft

## Modernization of existing shaft generators

Existing fixed-speed shaft generators can be upgraded with a shaft generator drive. This enables the optimization of the main engine speed for any sailing speed. At the same time, the SGD guarantees the stability of the ship's network.

## Integration with automation and power management systems

A shaft generator drive can be connected to the ship's automation systems, including the power management system.

It is controllable directly from the bridge or automatically using a PMS/CAMS.

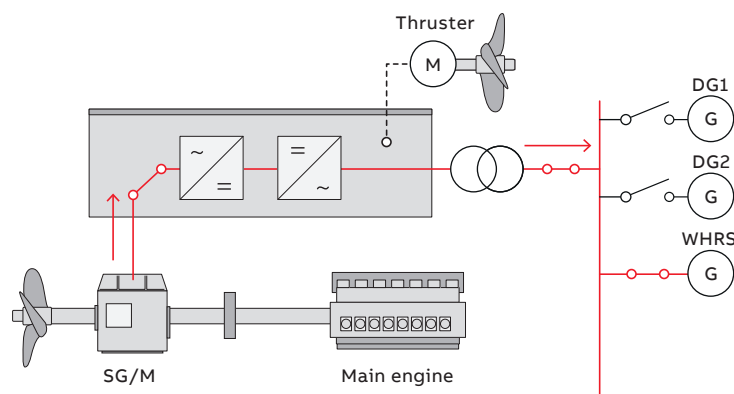
## Compatible generator types

SGDs support all common machine types, e.g. synchronous, induction and permanent magnet machines.



# Multiple operating modes in one drive

**PTO mode: energy flow from shaft generator to ship's grid**



## PTO (island, parallel and maneuvering modes)

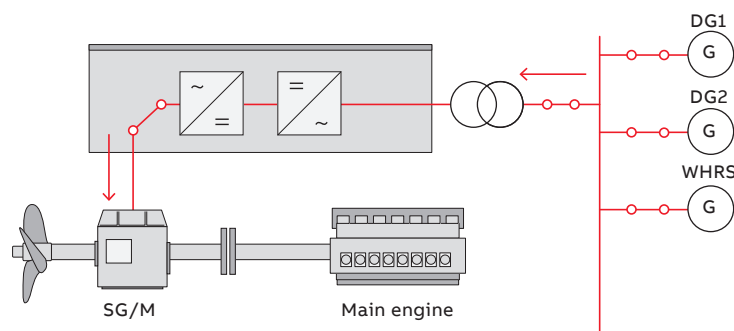
In power take-off (PTO) operation, the shaft generator operates as a generator. The shaft generator drive can operate in island mode (single generator), in parallel mode together with other power sources, or in maneuvering mode to supply power to the thrusters.

The SGD uses droop control to adjust voltage and frequency when operating in parallel with other generators.

The SGD can also compensate for unbalanced loads in the grid and provide reactive power compensation.

In maneuvering mode, the grid converter power unit is used as a frequency converter and connected to a thruster motor.

**PTI mode: energy flow from auxiliary generators to shaft generator**



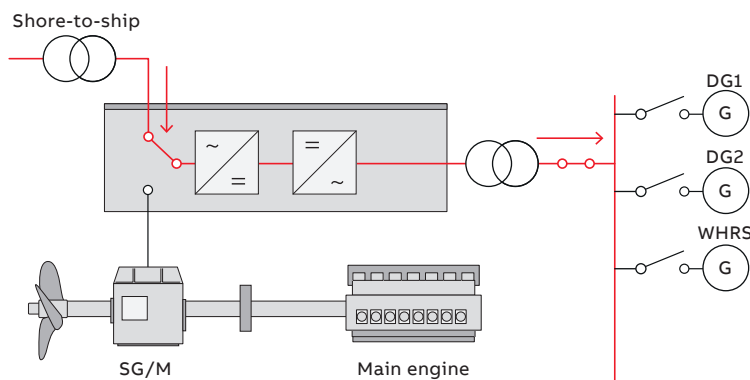
## PTI (boost and power take-home modes)

In power take-in (PTI) operating mode, the shaft generator functions as a motor. Power is taken from the auxiliary generators, and the SGD operates the motor.

In power take-home (PTH) mode, the shaft generator can be used as an alternative propulsion motor to the main engine if the main engine can be unclutched from the shaft line.

The motoring power of the shaft generator can be used to boost main engine power. The SGD can drive the shaft generator/motor in synchronization with the main engine.

**Shore-to-ship: energy flow from shore supply to ship's grid**



## Shore-to-ship

A shaft generator drive offers a flexible solution for onshore grid connection. It can be connected to 50 Hz or 60 Hz grids, and various voltage levels are supported.

The change between auxiliary generators and shore supply connection is seamless. Auxiliary generators can be left running while joining the shore connection to the shaft generator drive. After the shaft generator drive is synchronized with the auxiliary generators, they can be stopped and the SGD will provide the needed energy from the shore.

# Global support throughout the product lifetime

We make sure that our shaft generators and drives are properly tested before shipping, as well as installed and commissioned efficiently. Our global support network and wide range of services help keep your equipment performing optimally throughout its lifetime. Wherever you are, ABB is always near.

Over

**900**

ABB field service engineers

## Testing

ABB is committed to ensuring the reliability of every shaft generator and drive it delivers. To verify that quality standards and your requirements are fully met, we subject each component of every product to thorough testing in our modern test facilities.

Routine tests and functional tests form an integral part of the scope of supply of ABB's shaft generators and drives. They are performed in accordance with international standards and ABB quality assurance procedures.

## Installation and commissioning

You will have all the support you need to correctly install and run the shaft generator and drive efficiently. Proper installation and commissioning of the system carried out by qualified and ABB-certified engineers reduces startup time, increases safety and reliability, and decreases operational costs.

## Training

ABB provides extensive training in the use of its shaft generators and drives. We offer a range of training programs, from basic tutorials to programs tailored to your specific needs.



**Technical support**


Just contact us when you need to, via phone or email. For whatever technical questions you have, or advanced product and application support, all our expertise is available through our local ABB contact centers.

**ABB Ability™ Remote Assistance for drives**

If you detect a fault, we can use remotely stored data about your drive for rapid support. Where possible, we strive to respond within two hours from your inquiry, to find a quick resolution and minimize downtime.

**ABB Ability™ Condition Monitoring for drives**

Accurate, real-time information about drive events and data-based analytics help you make the right decisions about your assets, operations and maintenance at the right time.



Service centers  
in more than

**60**  
countries



More than

**500**  
service partners





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