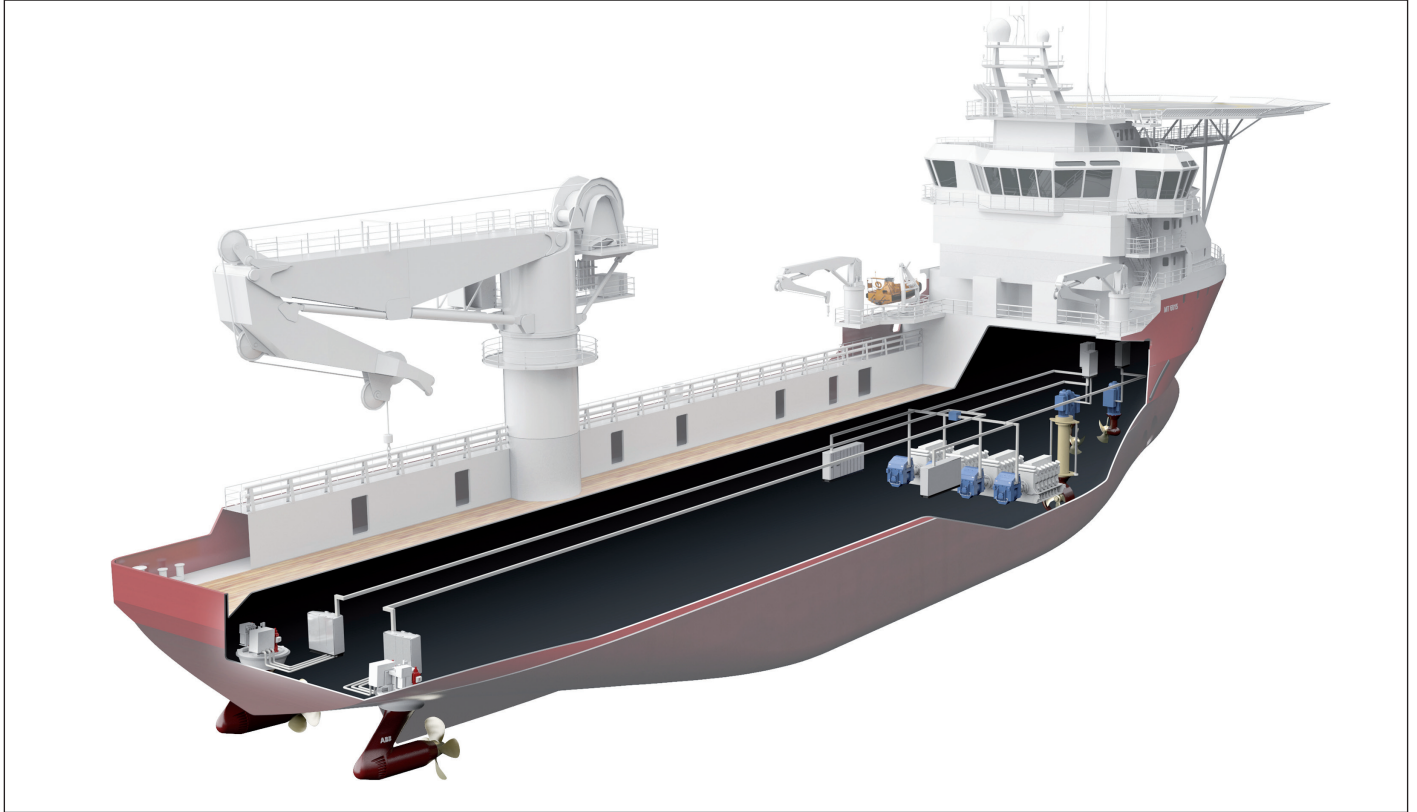


Onboard DC Grid

A significant step forward in electric propulsion increasing vessel efficiency up to 20%



Imagine a ship with an efficient and modern propulsion system. It is electric, with state-of-the-art equipment. Now, take this vessel and increase the efficiency by up to 20% and reduce the footprint of electrical equipment by up to 30%. Add to that the full freedom for integrating and combining different energy sources, including renewables, gas and diesel, and a greater flexibility in placing system components in the vessel design. This is the ABB Onboard DC Grid.

ABB, the frontrunner in electric propulsion, takes a significant step forward by launching the Onboard DC Grid. Developments in power distribution technology have made this new concept fully practical.

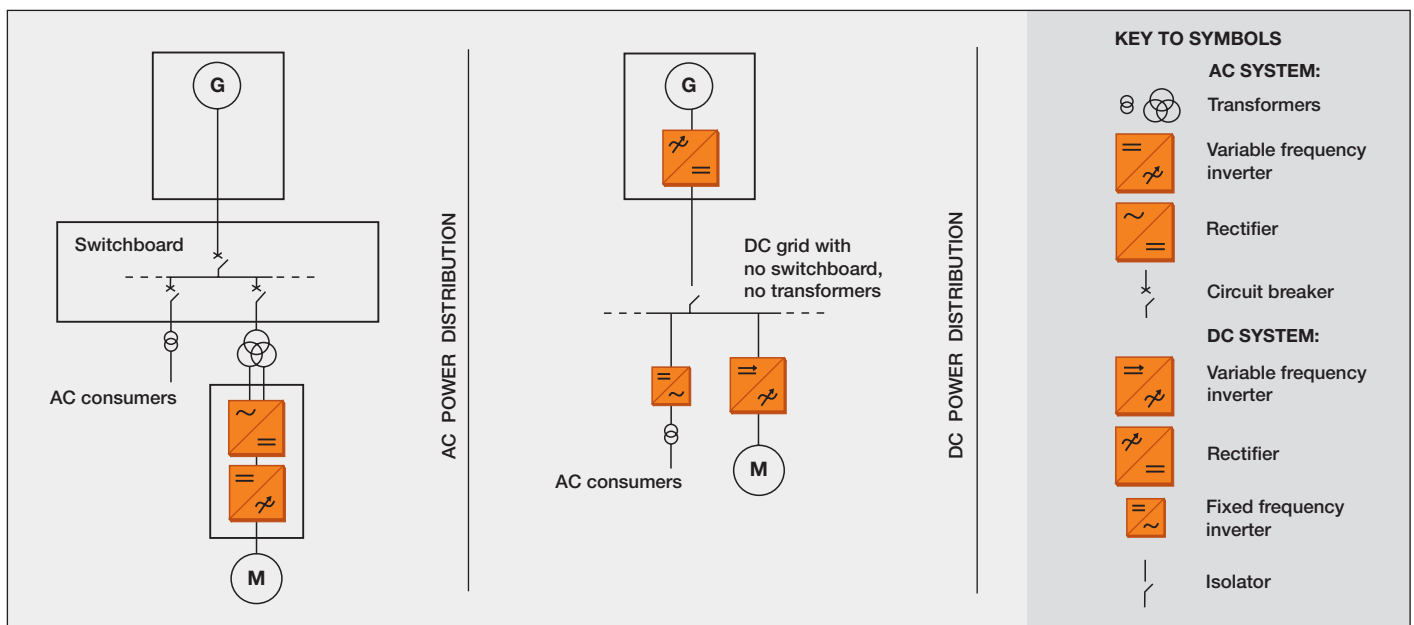
The Onboard DC Grid is a step forward in optimized propulsion and is an extension of multiple DC links that already exist in propulsion and thruster drives. Onboard DC Grid enables us to combine the advantage of AC components with a new smart DC distribution. Just as variable speed drive allows the electric propulsion motors to be run at their optimum working point, Onboard DC Grid allows the diesel engines to run at variable speed for top fuel efficiency at each load level. And, the Onboard DC Grid enables full flexibility in combining energy sources, including renewables.

To the ship owner Onboard DC Grid means:

- Up to 20% fuel savings
- Less maintenance of generator sets
- Improved dynamic response and maneuverability
- Increased space for payload
- Ready for new energy sources

To yard and designer Onboard DC Grid means:

- Fewer components to be installed
- Reduced equipment footprint and weight
- Easier cable installation
- More flexible placement of components



Comparison of onboard AC and DC power distribution

Design principles

Factors that have lead ABB's designers to adopt the alternative method of DC power distribution are:

- By far the largest proportion of the total power load on board a vessel is for propulsion and thrusters. This power must be processed as a DC input to the variable frequency inverter that performs the speed control of the motor. Actually distributing at a DC level allows the losses in a switchboard and transformer to be eliminated from this power flow.
- When diesel-electric generators run at constant r.p.m. with control of the power delivered, fuel efficiency is compromised. In a DC distribution system the generator and diesel speed can be varied to achieve the optimum fuel efficiency at every power level.

Optimization and ruggedness

Each power source and consumer on the Onboard DC Grid is an AC or DC "island" and the only connection between them is the DC bus. This yields two advantages:

- Each power source and consumer can be controlled and optimized independently.
- Complex interactions that can arise between units that share an AC connection will never occur. Consumers fed by the Onboard DC grid are designed not to interact even under fault conditions.

Energy storage

In the Onboard DC Grid solution, energy storage may be included to improve the system's dynamic performance. Diesel engines are slow to handle large, quick load changes. By using batteries or super capacitors to provide power for a short time, the ship's control capabilities can be improved. This will benefit especially vessels with Dynamic Positioning. Energy storage can also be used to absorb rapid power fluctuations seen by the diesel engines, thereby improving their fuel efficiency.

Fit for the future

The Onboard DC Grid is an open power platform which easily allows reconfiguration in number and types of power sources and consumers, power levels and other modernizations. Alternative energy sources that will become significant during a typical vessel lifetime of 20+ years will be easier to adopt in a vessel with Onboard DC Grid because they will not be bound to a AC system, nor will they require redesign of a main switchboard. To the ship owner this will mean a more flexible and competitive vessel.

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