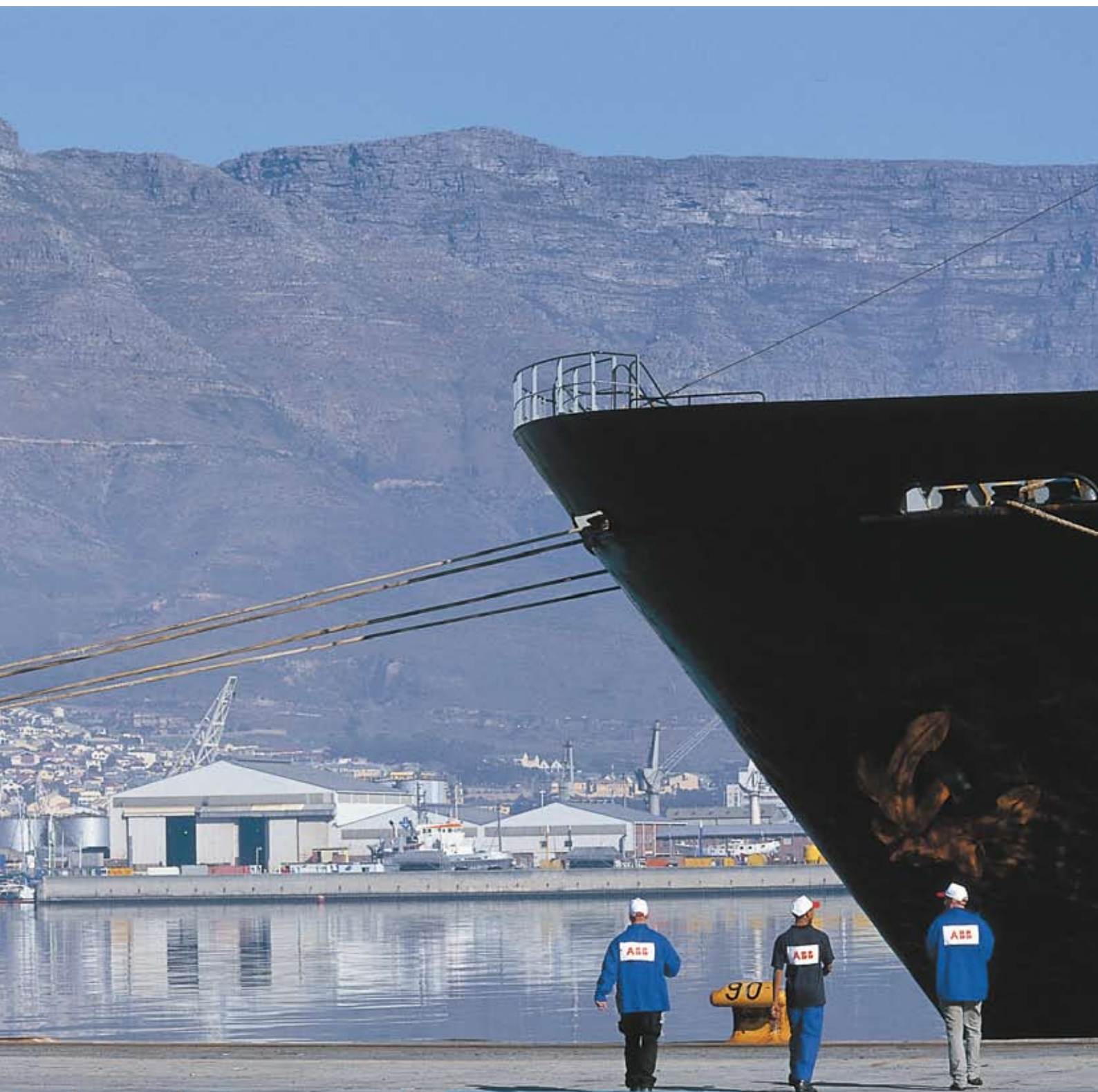


ABB drives for marine

Medium voltage drives for reliable and efficient operations at sea





Picture front page, source: Kværner Masa-Yards

2 – ABB drives for marine

ABB

ABB - the world's leading supplier of variable speed drives for the marine industry

Reliability is crucial for all operations at sea and innovative technological solutions must be based on extensive experience.

Leading-edge drive technology

A pioneer in AC drives technology, ABB started research in the 1960s and industrial production started in the 1970s. Today, ABB is the world's leading supplier of AC drive systems.

ABB's unrivalled experience in AC drive technology, combined with its long experience in the marine industry, results in innovative drive solutions with unsurpassed performance and reliability.

ABB supplies drive products for use in propulsion and auxiliary applications for ships and floating structures:

- Cable and pipe layers
- Chemical and product tankers
- Cruise vessels
- Double-acting tankers
- Dredgers
- Drill ships and semi-submersible rigs
- FPSO tankers
- Icebreakers
- Offshore support vessels
- Research and survey vessels
- RoRo and RoPax ferries
- Shuttle tankers



Applications and references

ABB has equipped over 500 vessels and floating structures with medium voltage variable speed drives. This is equivalent to a total rated power in excess of 6'500 MW.



Source: Kvaerner Masa-Yards

Navigator of the Seas, Cruise Liner
3 x 14 MW Propulsion Drives (ACS 6000c)



TyCom Reliance, Cable Layer
2 x 3.1 MW Propulsion Drives
2 x 3.1 MW Thruster Drives



Source: Kvaerner Masa-Yards

Tempera and Mastera, Double-Acting Tankers
16 MW Propulsion Drive (ACS 6000c)



Deepwater Millennium, Drilling Vessel
6 x 4 MW Propulsion Drives



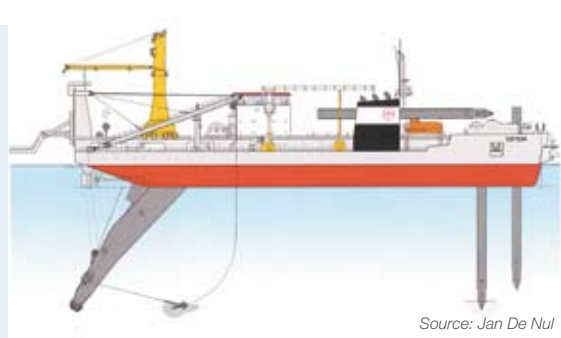
Thialf, Crane Ship
6 x 5.5 MW Thruster Drives (ACS 6000)



Shin-Nihonkai, Ferries
17.6 MW Redundant Propulsion Drive (ACS 6000)



Ras Laffan, Shuttle Tanker
2 MW Thruster Drive (ACS 6000)

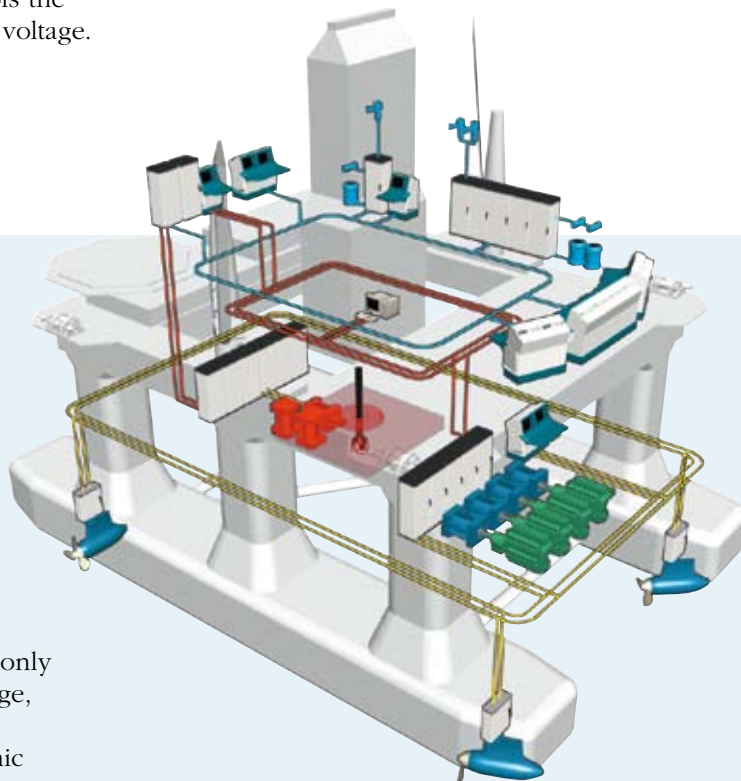


Jan De Nul, Self-Propelled Cutter Suction Dredger
2 x 6 MW Cutter and Propulsion Drives (ACS 6000)
2 x 6 MW Inboard Pumps (ACS 6000)
2 x 4 MW Submerged Pumps (ACS 6000)

Electric propulsion

Due to its flexibility, energy efficiency and superior performance, electric propulsion is widely used in today's marine technology.

A variable speed propulsion drive system consists of a supply transformer, a frequency converter and a propulsion motor. Propulsion drive power is controlled by the frequency converter, which controls the speed by varying motor frequency and voltage.



The single-motor-drive design

Single-motor configurations are commonly used in applications which require large, independent and decentralized drives. For example thruster drives for dynamic positioning of drilling vessels and floating production vessels or main propulsion drives for shuttle tankers, cruise liners and ferries.

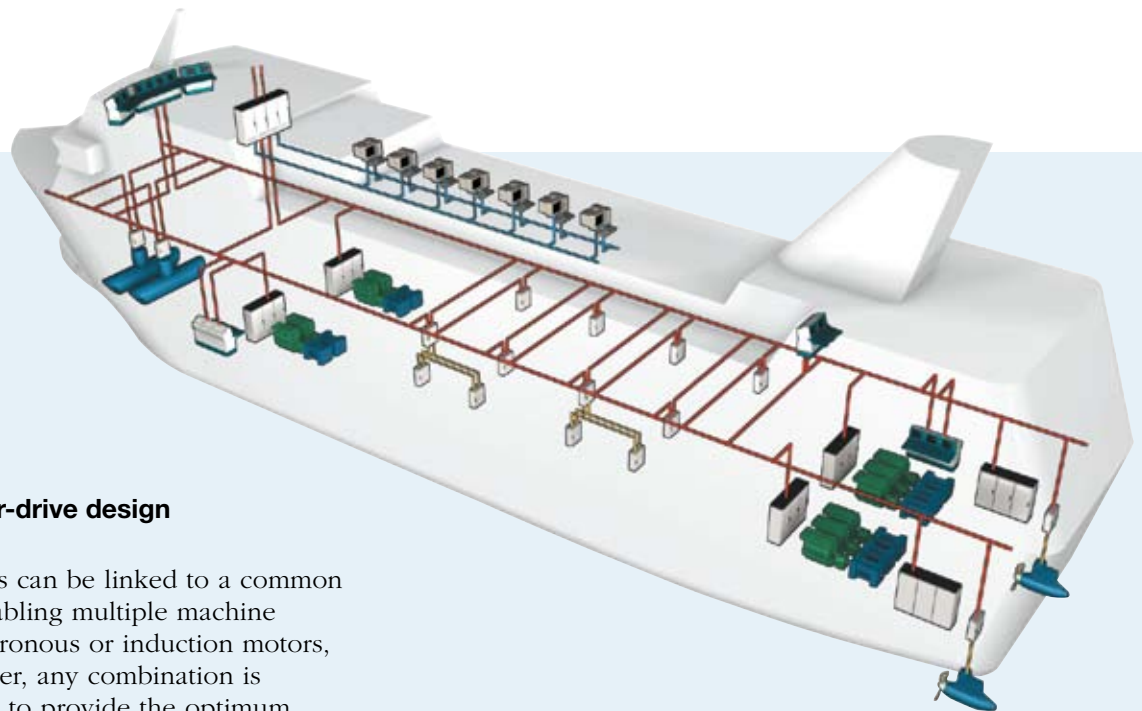
The transformerless solution

Direct generation of the appropriate converter input voltage allows the creation of solutions without converter transformers. Reactors integrated in the converter provide the necessary decoupling.

The consequent reduction in total weight and size of the whole system results in a greater layout flexibility, making more space available for other needs. Fewer components with auxiliary equipment combined with additional monitoring devices increase reliability and availability.

Benefits of medium voltage drives in marine applications

- Safety and redundancy
- Reliability
- Low operating costs
- Reduced maintenance
- Low exhaust emissions
- Layout flexibility
- Cost-effective construction
- High performance



The multi-motor-drive design

Up to five motors can be linked to a common DC bus, thus enabling multiple machine operation. Synchronous or induction motors, high or low power, any combination is possible in order to provide the optimum configuration.

In applications with different operation cycles (e.g. thrusters and main propulsion) the ratings of rectifier modules, main circuit breaker and transformer can be reduced substantially.

The redundant drive design

Single drives can be configured to allow various schemes for redundancy offering greater availability of the drive system.

ACS 6000 (3 – 28 MVA)

The ACS 6000 medium voltage drive with its modular concept is the perfect answer to the requirements of modern propulsion schemes for floating production facilities, dynamically positioned drilling vessels, shuttle tankers, service ships and large passenger vessels.

ACS 6000 technology highlights

Efficiency and reliability with IGCT power semiconductors

The ACS 6000 uses a revolutionary power semiconductor switching device known as IGCT (Integrated Gate Commutated Thyristor) researched and designed by ABB. The use of IGCTs results in an intrinsically less complex, more efficient and reliable high-power medium voltage converter.

The inherently low losses of the IGCT require less cooling capacity and smaller cooling equipment. The fast switching enables the implementation of unique control algorithms.

The converter design with IGCTs allows the use of a fuseless main circuitry. This increases the availability of the drive since the protective functions are actively controlled by the converter control, and the recovery from a fault can be accelerated.

Compact and robust marine design

During the design and development phase special care was taken to meet marine and offshore requirements resulting in a small footprint, flexibility and lightweight design.

The ACS 6000 meets the requirements of marine certifications, such as Lloyd's, DNV and ABS.

High performance with Direct Torque Control (DTC)



The motor control platform is based on ABB's award winning Direct Torque Control (DTC), resulting in the highest torque and speed performance ever achieved in medium voltage drives. As a result, control of the drive is immediate and smooth under all conditions.

With DTC, speed encoders are no longer needed, thereby reducing maintenance costs and ensuring high availability. Fast DTC also guarantees minimum torque ripple and results in minimum machine wear. The high switching frequency also reduces the noise considerably.

DriveWare, the tools to increase availability

The ACS 6000 incorporates the same set of user-friendly tools as other drives of the ACS product family.

DriveWindow

ABB's DriveWindow is an advanced, easy-to-use tool for commissioning and maintenance of ABB drive systems in different industries.

DriveOPC

DriveOPC is a software package which allows communication between Windows applications and ABB drives.

Key features and benefits:

- High power and outstanding reliability increases the safety of the ship and decreases maintenance costs
- Smooth torque over the entire speed range reduces noise and vibration levels, which minimizes mechanical stress and increases comfort
- Compact and lightweight design are the base for cost-effective construction
- Redundant main propulsion drives provide adequate power for the ship to operate safely if a malfunction should occur
- Minimized energy and fuel consumption as drives allow the engines to operate at their optimum efficiency, particularly at partial loads
- High immunity to varying climatic conditions and vibrations increases availability

ACS 6000 single drive (9 MVA)



Configuration concepts

The design of the ACS 6000 is characterized by its modular structure and the common DC bus concept: Depending on the individual drive requirements and the power demands different configurations can be realized.

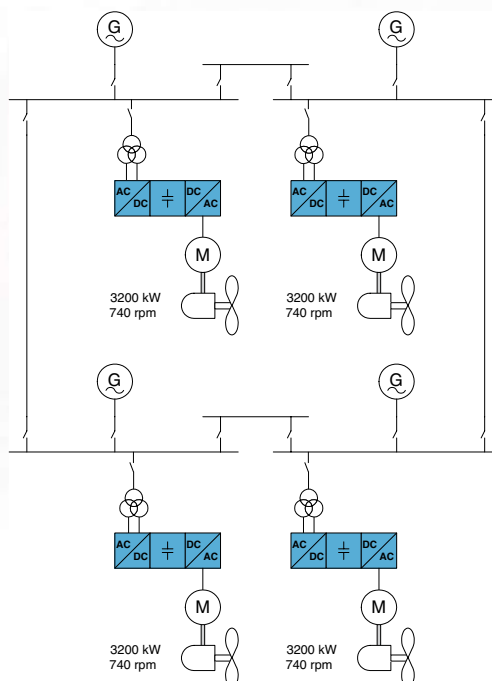
As a result, the system is optimized to best fit your application. In addition, installation and commissioning time is reduced due to standardized procedures and documentation.

Configuration examples

Examples illustrate how the modular concept of the ACS 6000 is applied to provide the optimum converter configuration for high power marine and offshore applications.

Dynamic positioning of floating vessels: Distributed concept

This dynamically positioned offshore drilling rig is equipped with four ACS 6000 single drives. Power generation and propulsion can be separated and distributed to the most convenient locations resulting in cost-effective construction.



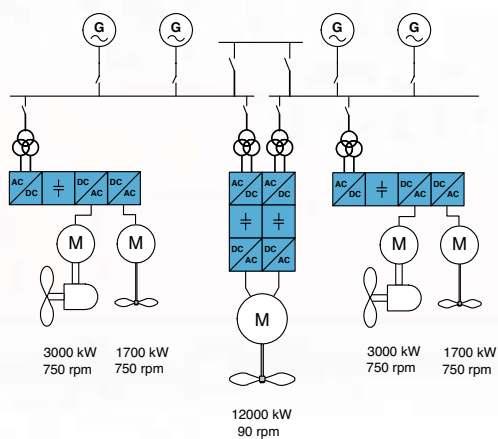
Other fields of marine applications:

- Dredge pumps and cutter motors
- Cargo pumps
- Compressor drives
- Heavy load crane drives
- Shaft generators
(with Active Rectifier Unit)

Propulsion and thruster for shuttle and service vessels: Redundant concept

In a redundant main propulsion configuration the power system can be split. Thus operation at reduced power is maintained in case of partial failure of the converter.

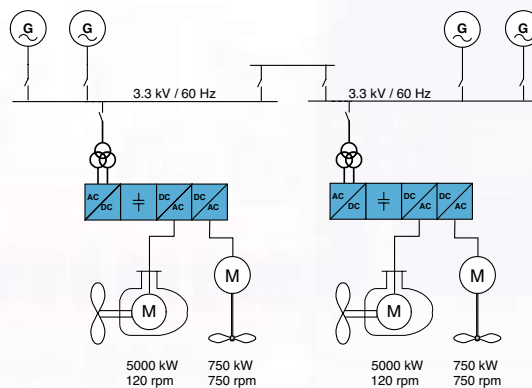
The main propeller (Azimuth or conventional installation with shaft) is driven by a variable speed drive tandem motor which is fed by a redundant ACS 6000 converter. For positioning and manoeuvring, 2x2 thrusters on a common DC bus (Azimuth and propeller units) are provided.



Main propulsion with thrusters: Transformerless multi-motor-drive concept

This service vessel with two main propulsion Azimuth thrusters is assisted by two smaller (tunnel) thrusters. This type of configuration is used for smaller power requirements.

The most economic solution is an arrangement with two ACS 6000 multidrives and line reactances instead of transformers.



Service

**Global network, local presence.
Wherever you are, ABB is there
for you.**

After sales service is an integral part of the process of providing the customer with a reliable and efficient drive system.

The ABB Group of companies operates in more than 100 countries and has a worldwide network of service operations.



Services for ABB's medium voltage drives

- Installation
- Commissioning
- Training
- On-board diagnostics
- Remote diagnostics
- Customized service programs
- Local technical support
- Local service support
- Spare parts and logistics network
- Worldwide service network
- 24 x 365 support line



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