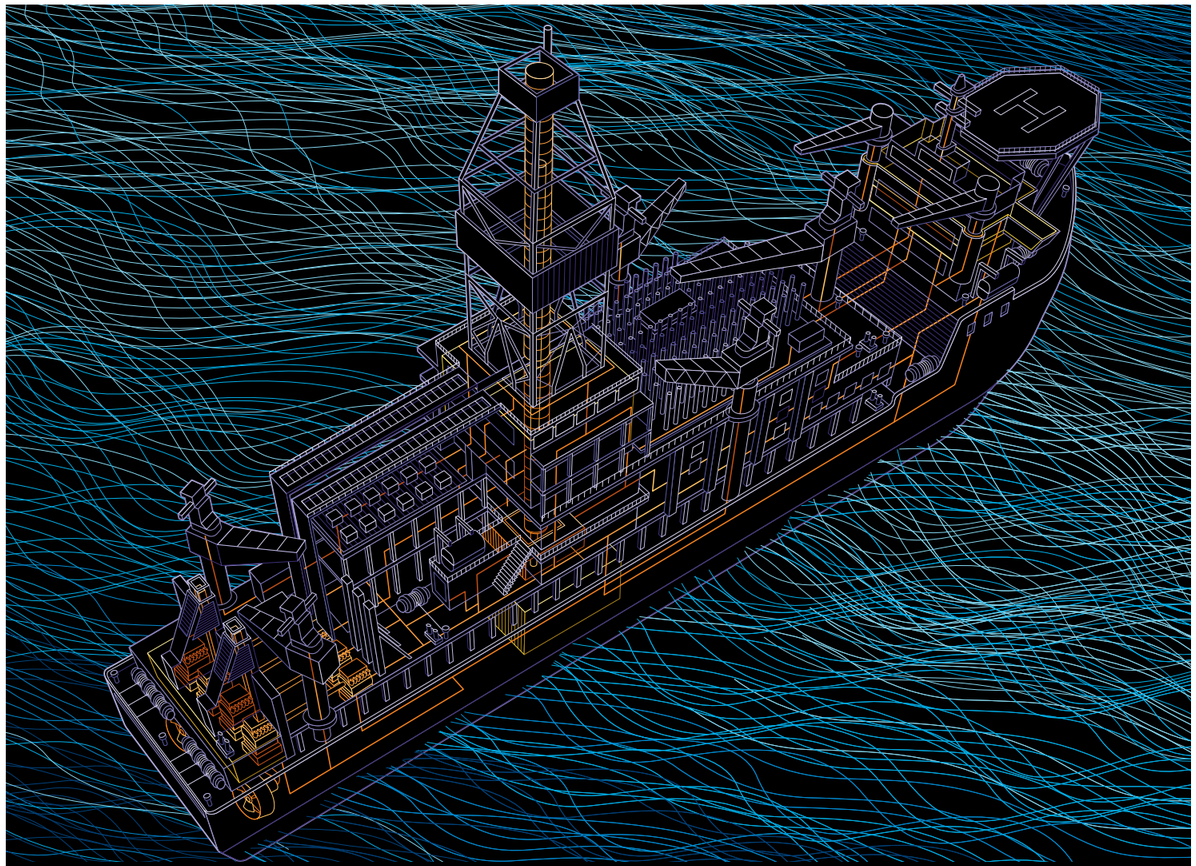
# Contact us

**ABB AS**
**Marine**
Bergerveien 12
P.O. Box 94
NO-1375 Billingstad
Norway
Phone: +47 03 500
Fax: +47 22 35 36 80

**ABB Oy**
**Marine**
Merenkulkijankatu 1
P.O. Box 185
FI-00981 Helsinki
Finland
Phone: +358 10 2211
Fax: +358 10 222 2350

**www.abb.com/marine**



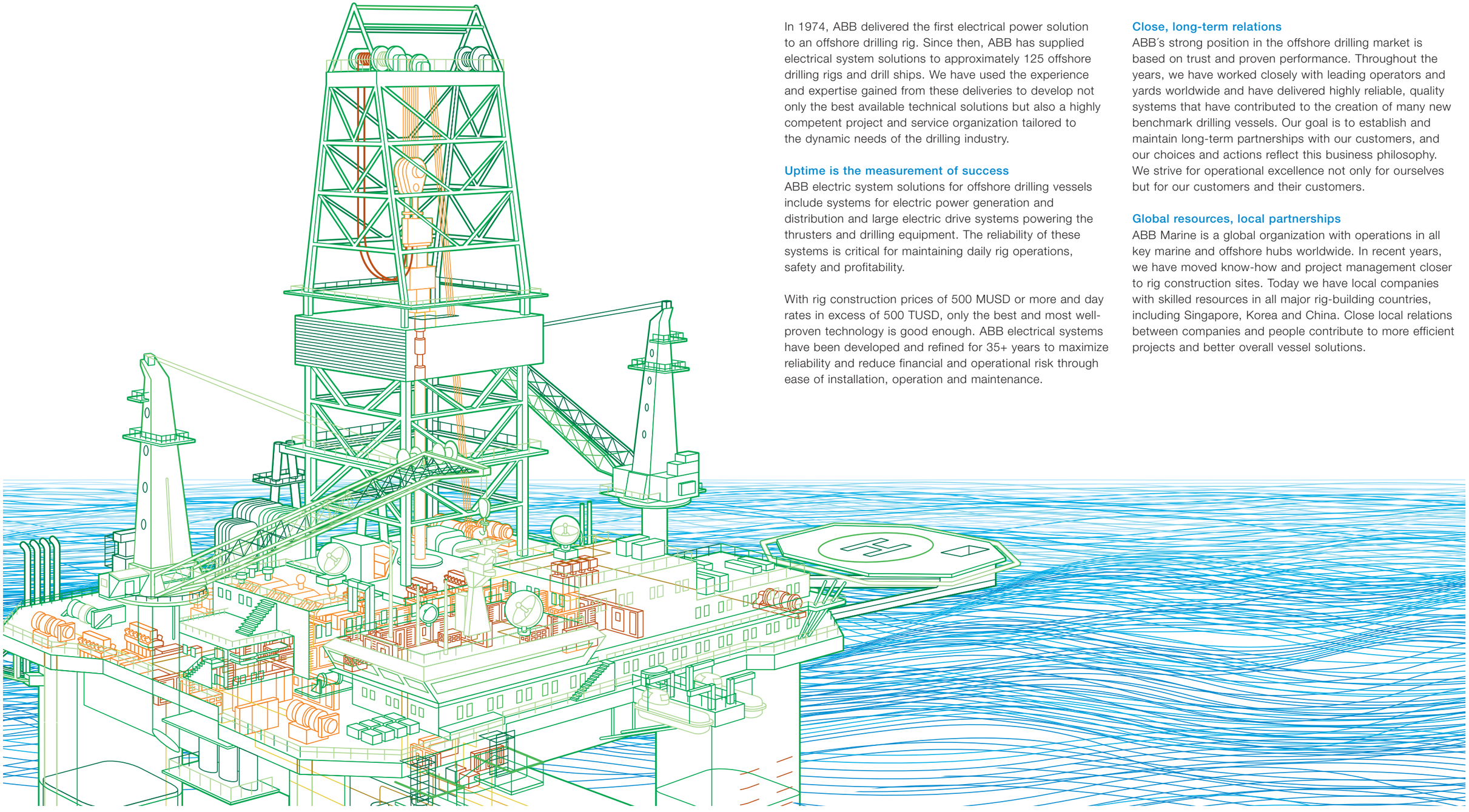


# Offshore Drilling Vessels
## Total electrical systems for safe, efficient and environmental drilling operations

Power and productivity
for a better world™

Power and productivity
for a better world™

# A trusted technology partner serving the offshore drilling market for over 35 years



## Modern offshore drilling operations are performed at depths once thought to be insurmountable and at locations once thought to be inaccessible. To meet these challenges, much of the world's deepwater drilling fleet relies on electrical power and drives solutions from ABB.

In 1974, ABB delivered the first electrical power solution to an offshore drilling rig. Since then, ABB has supplied electrical system solutions to approximately 125 offshore drilling rigs and drill ships. We have used the experience and expertise gained from these deliveries to develop not only the best available technical solutions but also a highly competent project and service organization tailored to the dynamic needs of the drilling industry.

### Uptime is the measurement of success

ABB electric system solutions for offshore drilling vessels include systems for electric power generation and distribution and large electric drive systems powering the thrusters and drilling equipment. The reliability of these systems is critical for maintaining daily rig operations, safety and profitability.

With rig construction prices of 500 MUSD or more and day rates in excess of 500 TUSD, only the best and most well-proven technology is good enough. ABB electrical systems have been developed and refined for 35+ years to maximize reliability and reduce financial and operational risk through ease of installation, operation and maintenance.

### Close, long-term relations

ABB´s strong position in the offshore drilling market is based on trust and proven performance. Throughout the years, we have worked closely with leading operators and yards worldwide and have delivered highly reliable, quality systems that have contributed to the creation of many new benchmark drilling vessels. Our goal is to establish and maintain long-term partnerships with our customers, and our choices and actions reflect this business philosophy. We strive for operational excellence not only for ourselves but for our customers and their customers.

### Global resources, local partnerships

ABB Marine is a global organization with operations in all key marine and offshore hubs worldwide. In recent years, we have moved know-how and project management closer to rig construction sites. Today we have local companies with skilled resources in all major rig-building countries, including Singapore, Korea and China. Close local relations between companies and people contribute to more efficient projects and better overall vessel solutions.

# New generation deepwater drilling vessels with total ABB electrical solutions

## Dhirubhai Deepwater KG1


*Dhirubhai Deepwater KG1* was delivered to Transocean in 2009 from Samsung Heavy Industries. This advanced deepwater drill ship is equipped with Power Generation and Distribution Systems, Thruster Drive Systems and Drilling Drive Systems from ABB.

For decades, ABB has been the technology innovator within electrical power technology for the offshore drilling market…

## West Sirius


*West Sirius* was delivered to Seadrill in 2008 from Jurong Shipyard. This 6th generation semi-submersible drilling rig is equipped with Power Generation and Distribution Systems, Thruster Drive Systems and Drilling Drive Systems from ABB.

…and since 2005 ABB has delivered electrical solutions to around 50% of all new deepwater drilling rigs and drill ships.

# Total electric power and drive solutions
## A core strategy of simplicity

For drilling vessels, ABB delivers total electric solutions designed for maximum reliability and performance. We keep it simple by adapting industry-standard ABB products and systems rather than engineering complex special solutions.

**Total solutions, total responsibility**

ABB's scope of supply to the offshore drilling market includes the following systems:

- Electric power generation and distribution systems - medium and low voltage
- Drilling drives and drilling drives control - low voltage
- Thruster drives with control systems - medium and low voltage
- Azipod® CZ azimuthing electric podded thrusters

ABB is a total system integrator, and an important element of our scope of supply is the portfolio of services we provide throughout the vessel life cycle. These services include:

- Project management including overall responsibility for the delivery
- Project engineering, documentation and studies needed for vessel construction, installation and commissioning and also for the classification society for certification of the electrical plant and equipment
- Site support, depending on customer´s preference - typically commissioning and sea trials but also site management, installation supervision and engineering support
- Warranty and after-sales services

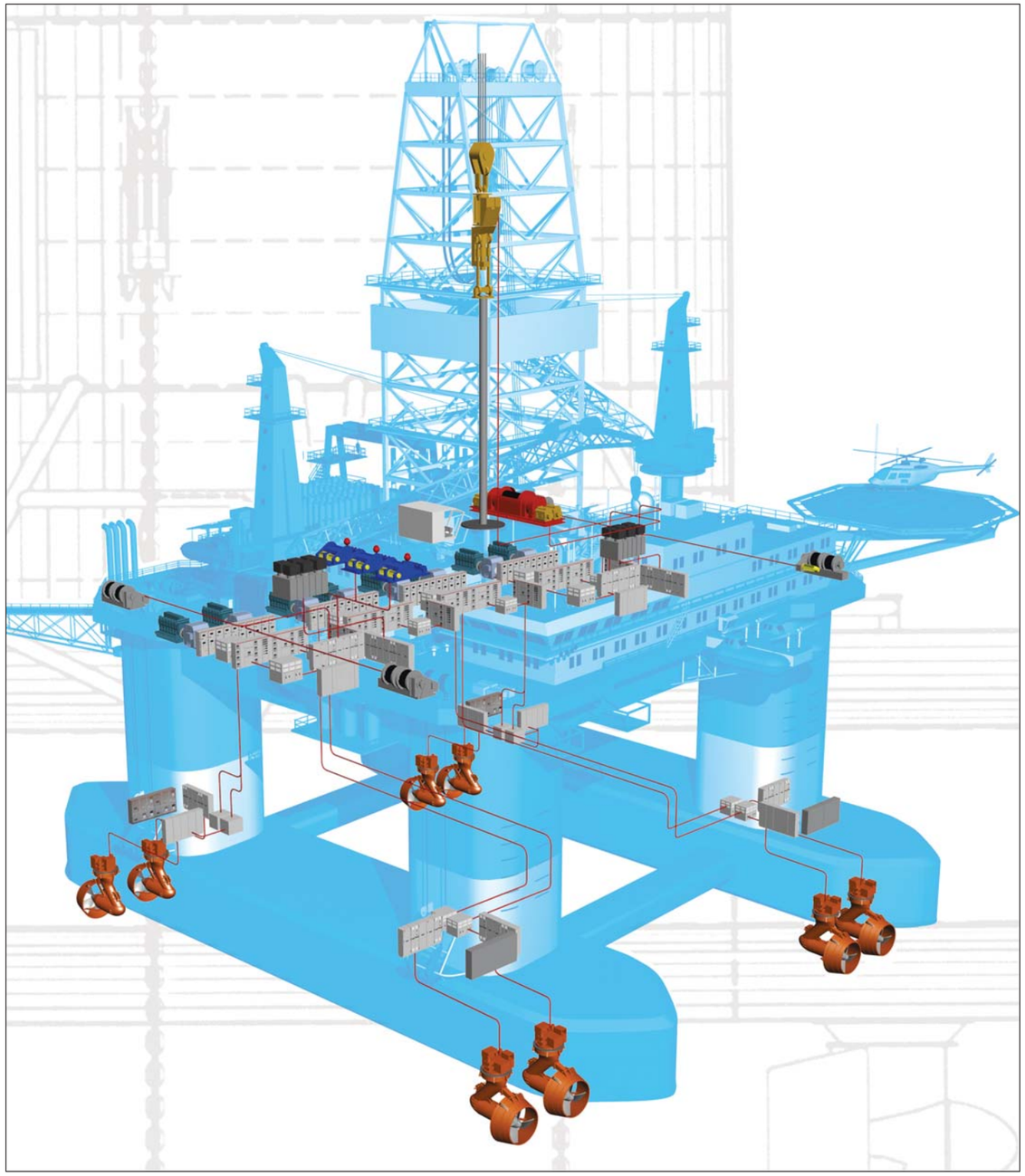
By choosing a total solution from ABB, customers gain a thoroughly proven functional solution based on unified technology. This eliminates problematic interfaces, and single-point supply clearly defines responsibility throughout the project and operations phase.

**Simplicity through technology...**

Simplicity is a core strategy behind ABB systems for offshore drilling vessels. This means that our systems are based on industry-standard ABB products that are adapted to and certified for maritime operations. ABB electrical products represent the pinnacle of modern, energy-efficient power technology, and as building blocks for a total solution they are unmatched in functional and physical integration capabilities, functionality, reliability and user interface. We believe that compared to complex, custom engineered systems, a standard and simplified system approach also provides clear benefits in areas such as blackout prevention, fuel consumption and, not least, ease of understanding, operating and maintaining the system.

**...simplicity through design**

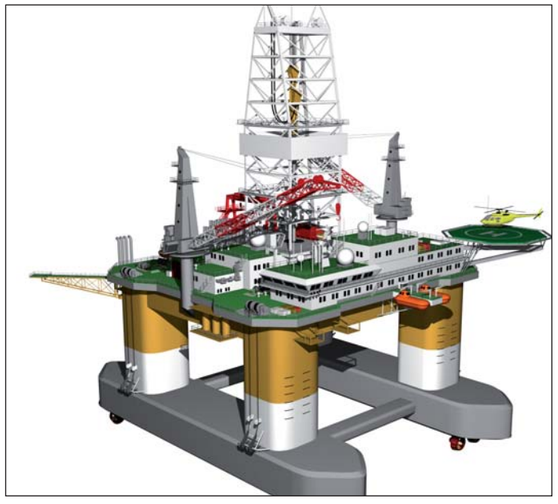
Segregation and redundancy are key factors in design of the electric systems for a drilling vessel. Our goal is to achieve the simplest possible segregation with clear system split and top-to-bottom solutions in each split - from the generators to the thruster motors, drilling systems and auxiliary systems. Typically, four-split solutions are applied to DP semi-submersible rigs while three-split solutions are used in DP drill ships. These configurations ensure that the vessel has sufficient power to continue safe operations in case of a complete failure of a single system. The clean split design also eases the installation process for the shipyard and provides the operators a solution that is easier to understand and support in fault-finding situations.

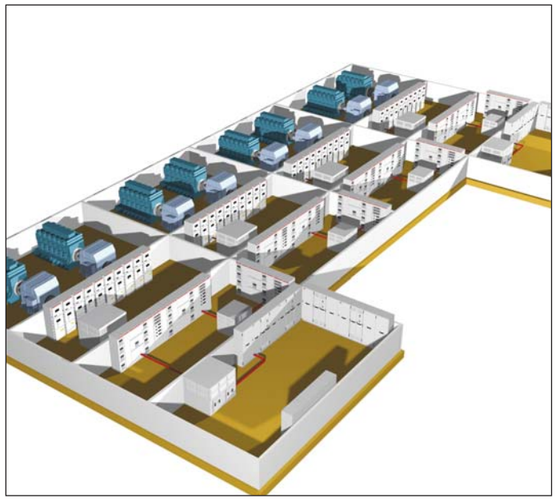


**A total ABB electrical solution includes the Power Generation and Distribution System, Thruster Drive System and Drilling Drives System.**

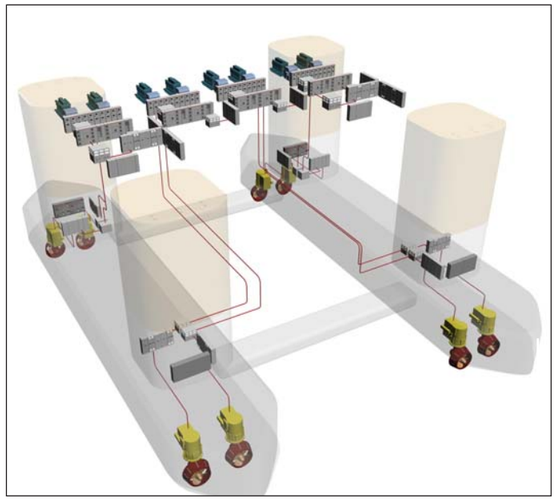
A total electrical power and drives solution from ABB cuts costs and improves overall vessel standards.

# Three main systems
## The Power Generation and Distribution System, the Thruster Drive System and the Drilling Drive System

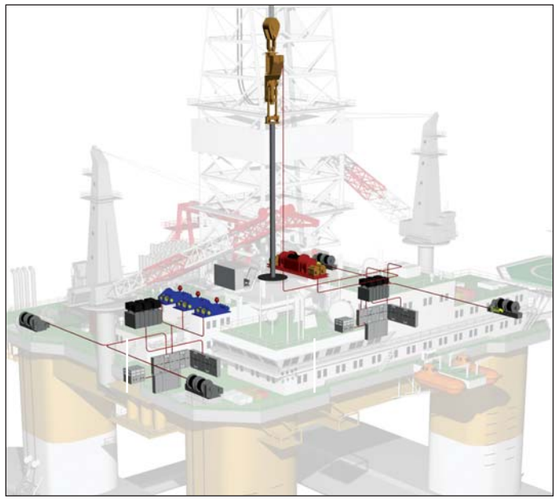




Typical 4-split power system for DP semi-sub drilling rig



Thruster Drive System configured for 8 thrusters



Complete AC Drilling Drive System

The total electric solution for a DP offshore drilling vessel consists of three main systems; the Power Generation and Distribution System, the Thruster Drive System and the Drilling Drive System.

### Electric Power Generation and Distribution System

New DP-based drilling vessels typically have a total electric power requirement in the range of 40 to 50 MW. For the production of electric power, DP2, DP2+, DP3 and Posmoor notation drilling vessels utilize 6 to 8 generator sets with power ratings between 4.8 and 7.4 MW.

The figure above shows a typical 4-split electrical configuration for semi-submersible drilling rigs featuring segregation and redundancy throughout the system. Failure in one segregated part should have minimal or no consequence for the parallel paths of the power flow to redundant installed equipment.

In some cases, changeover connections for diesel generators and thrusters may need to be installed. These changeover circuits must be held to a minimum, and all necessary measures must be taken to uphold the fault tolerance of the system. An example of this type of measure developed by ABB is the Diesel Generator Monitoring System (DGMS) that proactively monitors and protects the diesel generators against problems that can result in a black-out situation.

### Thruster Drive System

To stay accurately positioned over the well under all conditions, modern DP drilling vessels are equipped with 6 to 8 thrusters with power ratings from 2.5 to 5.5 MW each. The system – from the generator to the propeller - is configured so that a maximum of two out of three thrusters of the total of six to eight may be lost in the event of a major failure. The system is designed so that the remaining thrusters keep the vessel in position when a single major fault occurs.

ABB's Thruster Drive System provides the latest in electric marine propulsion technology and has proven system interfaces towards leading thruster units and DP- and automation systems. In addition to our range of thruster motors, ABB offers a complete podded thruster solution, the Azipod® CZ, which provides unique advantages in building and operating a drilling vessel. Additional information on Azipod® CZ and ABB drive solutions can be found on page 13.

### Drilling Drive System

ABB has been a leading technology developer within AC Drilling Drive Systems for many years, and in 1993 we delivered the first AC Drilling Drive System to an offshore platform. Our solutions within this area – drives, motors, control systems and user interfaces – are highly optimized and our experienced engineers ensure that each delivery meets our customers` requirements and specifications.

A Drilling Drive System from ABB typically includes:
- Air- or liquid-cooled frequency drives for single- and multimotor solutions
- Integrated control system with applications for topdrives, drawworks, mud pumps and cement pumps
- Drilling motors
- Assignment, Maintenance and Operation panels
- Braking resistors
- Supply transformers (12 or quasi-24 pulse)
- Drilling switchboards and motor control centers

Electrical supply capacity to the Drilling Drives Systems is typically between two times 7500 kVA to four times 4000 kVA, and the systems are located in two or more separate fireproof rooms to get the appropriate redundancy to secure continuous drilling operation.

# ABB scope of supply
## Semi-submersible drilling rigs, drill ships and jack-up rigs

Based on our standard products and technology platform, our drilling vessel solutions are engineered to meet the specific rig design requirements and the unique demands of each customer.

ABB has delivered electrical system solutions to all types of drilling vessels and is the market leader in suppling systems and solutions for DP drilling vessels. With the competence we have gained from these deliveries, we do not need to “reinvent the wheel” with each new project, but rather reuse solutions provided to previous successful jobs and tailor them to the individual requirements of new projects.

By reusing proven solutions from past projects, we are able to significantly enhance the overall effectiveness of a project by reducing engineering time, cost and risk. Fast-track projects are made possible through the use of proven “best practice” solutions, interfaces, documentation and, not least, experienced project personnel.

Shown to the right are typical ABB electrical package solutions for different types of drilling vessels. The exact scope varies from project to project depending on the requirements from yards and owners.

If an even larger turnkey supply is preferred by the customer, ABB can also take responsibility for extended package solution. Through established alliances, ABB can offer solutions that included, for example, the diesel engines and Dynamic Positioning (DP), automation and safety systems.

Seadrill´s *West Aquarius* DP3 semi-sub drillling rig was built by Daewoo and utilizes a complete ABB electrical solution.

### Semi-submersible drilling rigs - type DP3

A typical ABB scope of delivery to this type of drilling vessel includes:

**Power Generation**
- 8 x Generators
  AMG@3600 - 5200kW@900 - 720rpm

**Power Distribution System**
- 4 x 11kV/60Hz Switchboards
- 690/460V Main Switchboards & MCC
- 50 to 3500kVA Transformers

**Thruster Drive System**
- 8 x drives
  ACS600/800wc 3300 - 3800kW@720 rpm

**Thrusters**
- 8 x Azipod® CZ 3300kW

**Drilling Drive System**
- ACS600/800wc 2/4 x 4000 - 7500kVA

**Services**
- Calculation, Analysis
- Interface engineering
- Commissioning

Seadrill´s *West Capella* DP drill ship was delivered by Samsung in 2008 and is equipped with a complete ABB electrical solution.

### Drill ships - type DP3

A typical ABB scope of delivery includes:

**Power Generation**
- 6/8 x Generators
  AMG@5000 - 7400kW@720rpm

**Power Distribution System**
- 2/3/4 x 11kV/60Hz Switchboards
- 690/460V Main Switchboards & MCC
- 40 to 4000kVA Transformers

**Thruster Drive System**
- 6/8 x ACS600wc 4000 - 5500kW@720 rpm
  or 6/8 x ACS800wc 4000 - 4800kW@720 rpm

**Thrusters**
- 8 x Azipod® CZ 3300 - 4500kW

**Drilling Drive System**
- ACS600/800wc 2/4 x 4000 - 7500kVA

**Services**
- Calculation, Analysis
- Interface engineering
- Commissioning

The *COSLCraft* jack-up drilling rig was delivered from Keppel FELS in 2007 and utilizes a complete ABB electrical solution.

### Jack-up drilling rigs

A typical ABB scope of delivery includes:

**Power System**
- 600V – 6.6 kV Main Switchboard
- Power Management System
- 480/220V Power Distribution and MCCs
- Passive harmonics filter

**Drilling Drive System**
- Air-cooled ACS800
  - Top drive (1 x 1 motor)
  - Drawworks (1 x 3 motors)
  - Mud pumps (3 x 2 motors)
- AC800M Drilling Drive Control System
- Air-cooled braking resistors
- Mud pump panels

**Services**
- Calculation, Analysis
- Interface engineering
- Commissioning

# Solutions based on standard, well-proven products
## All developed and manufactured by ABB

All main products in our drilling vessel solutions are produced in-house, which enables us to control and secure complete deliveries and simplifies life-time maintenance and service.

ABB´s product platform for marine and offshore applications are characterized by light weight and small footprint, low noise and vibration, and high efficiency. Straightforward construction gives high reliability with less maintenance. Certification by leading classification societies ensures compliance with all major international standards.

### Generators and electric motors
Our factories have produced generators and motors for more than 80 years. High efficiency and robust construction make our machines ideal for offshore applications, providing considerable savings over the vessel lifetime. Our AMI and AMA motors are utilized for azimuthing thrusters and drilling applications and are produced for the power range up to 5.5 MW. They are delivered in both low and high voltage versions.

### Switchboards
Our robust 11 kV (MV) Unigear switchboards and Unimotor control switchboards are used for HV distribution networks. The metal clad, arc-proof switchboard housing provides high-level safety and protection for personnel. The switchboards are equipped with state-of-the-art protection relays, measuring functions, PLC control logic, conditioning monitoring and diagnostics. A full range of flexible and compact MNS switchboards are delivered for low voltage distribution.

### Transformers
For the distribution, thruster and drilling systems we use our RESIBLOC® transformer, and epoxy resin insulated, dry type transformer that is designed to fulfil the most exacting specification requirements. These non-flammable, environmentally safe tansformers are known to successfully withstand stress from high voltage peaks that can occur in marine networks. ABB has produced RESIBLOC® transformers for over 30 years.

Synchronous AMG generator

Medium Voltage Unigear switchboard

RESIBLOC® dry type transformer

### Variable Speed Drives
Based on ABB's unique Direct Torque Control (DTC) motor control technology, our drives for thruster and drilling applications offer the most accurate and smooth speed and torque control available.

For flexible system configuration, both water-cooled and air-cooled single- and multi-drive solutions are available. Depending on customer requirements, ABB drives can be configured for 6-pulse, 12-pulse or quasi 24-pulse solutions. High efficiency and close to unity power factor across the whole load and speed range offers considerable energy savings. The common DC bus principle of the converter system results in major savings in space requirements and cabling costs. The integrated control system has advanced built-in diagnostic tools and flexible interface for drilling and thruster control systems.

Our DTC drives are voltage source converters that provide significant advantages in regards to total harmonic distortion (THD). This type of converter enables us to keep the THD level under required limits without using additional filtering.

### Azipod® CZ electric podded thrusters
Azipod® CZ is a unique all-in-one thruster solution that stands out from other thrusters due to its built-in electric motor. A fixed propeller is mounted directly to the motor shaft, eliminating mechanics such as gears, shaft lines and bearings, which makes the thruster unit extremely resilient to mechanical stress and wear.

Azipod® CZ offers better internal and hydrodynamic efficiency than other thruster solutions. The difference in internal efficiency is due to the high-efficiency permanent magnet motor and the electric power transmission that eliminates mechanical gearing between motor and propeller. High hydrodynamic efficiency and low thrust loss are achieved by a tilted shaft to the propeller, which enables less hull resistance and interference with other thrusters.

Water-cooled ACS800WC variable speed drive

AC drilling motor - AMA423M6 Drilling

Azipod® CZ electric podded thruster unit

# Single-point responsibility
## For the life of the drilling vessel

From the early design phase and throughout the life of the rig, ABB works closely with our customers to contribute to efficient vessel design, construction and operations.

### Always one responsible

Drilling rig projects are complex, requiring a high level of cooperation and communication between the owner, yard, designers and main equipment and system suppliers. To streamline this cumbersome process, ABB takes the overall responsibility for the complete electrical system solution and serves as a single point of contact for all aspects of project management and execution. To the yard and owner this means:

- One contract with uniform Terms & Conditions
- One project manager, uniform scheduling and reporting
- One technical integration responsible
- One uniform logistics
- One uniform document control
- One site and commissioning coordinator
- One point of contact for warranty and service

### Contributing to successful project execution

From a very early design phase, ABB helps our customers develop and optimize the total vessel concept, contributing conceptual electrical design solutions and lifecycle cost analysis to the project. Throughout the building phase, ABB offers a full scope of services including system design, project management, system engineering, calculation and analysis, equipment delivery, installation/installation supervision, commissioning and site management.

For each drilling vessel project, ABB assigns a project manager that is dedicated to the project and is located close to or in the shipyard. We also offer local engineering support for the yard, which is especially important in the initial period. For some projects ABB prefers to have a fixed team present on site.

Two areas are of critical importance to the overall success of the project. The first area is related to interfaces and integration of the systems – both functionally and physically. It is important to be proactive with collection and verification of interfaces and, not least, to utilize established and proven solutions that are developed for drilling vessels. The second area of critical importance is engineering studies and responsibilities related to Fault Tolerance. For these tasks, a high degree of expertise and experience is necessary, and the utmost caution must be taken.

### Worldwide Service and Support

To adequately support our drilling customers in their global operations, ABB provides a global network of specialized Marine Services Centers. ABB Marine Services provides a full range of after-sales services including Preventive Maintenance, Planned Repair and Drydocking, 24/7 On-call Services, Commissioning, Spare Parts Management and modernization. Onboard classroom and on-line training is available through the ABB Academy.

We continually strive to tailor our service offerings towards specific vessel segments. An example of this is found in our Marine Sevices Center in Houston, Texas. These new facilities have fast and direct access to the Houston ship channel and the workshop in specially equipped to meet the service needs of offshore drilling rigs and vessels operating in the Gulf of Mexico.

Another example is our Marine Academy in Singapore that opened in 2007. With drilling rig construction activities growing steadily in Asia and an increasing number of new crew members coming from this region, ABB identified the need to set up a new training academy in this area. Training is also offered at ABB training facilities in other key regions. The ABB Marine Academy provides heightened system proficiency and familiarization by utilizing the same equipment for simulation as is used at sea.

**ABB provides on-site services where you need us the most - any time, any place.**

ABB offers a full package of specialized after-sales services to provide our customers the resources they need to ensure optimal ongoing vessel performance and profitability.