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Azipod® Propulsion

Azipod® CZ for drilling vessels

High-efficiency thruster solution for modern deepwater drill ships and rigs

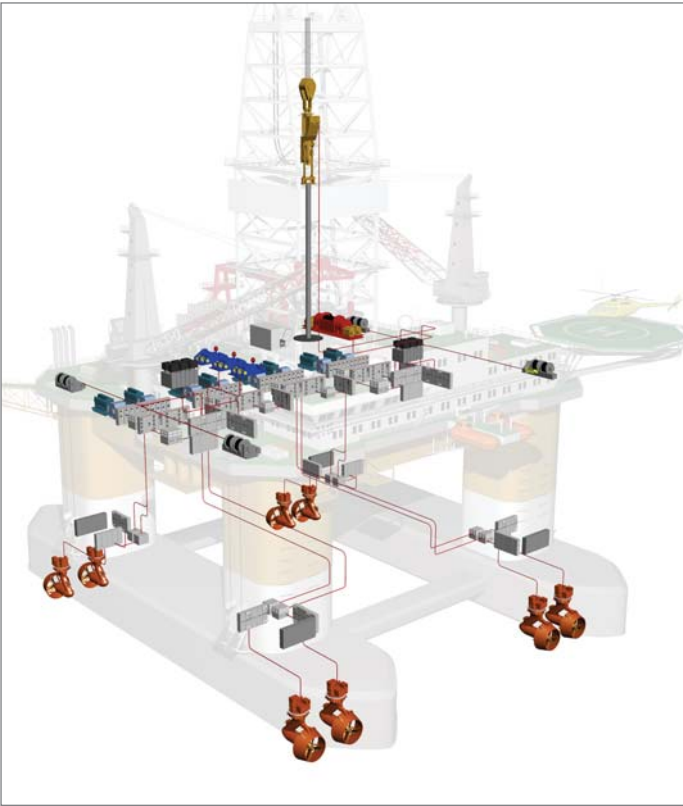
New generation thruster technology for deepwater drilling vessels

Azipod® CZ presents a significant advancement in thruster technology for drilling vessels with station keeping capabilities. A highly simplified structural design with few moving parts combined with high efficiency and minimal thrust loss enables Azipod® CZ to provide great operational and economical advantages to the vessel throughout its lifecycle.

Azipod® CZ is a unique underwater (de)mountable thruster solution that stands out from other thrusters due to its built-in high-efficiency electric motor. A fixed pitch propeller is mounted directly to the motor shaft, thus eliminating unnecessary mechanics such as gears, shaft lines and bearings, which makes the thruster unit extremely resilient to mechanical stress and wear. The thruster motor is cooled directly by the surrounding seawater, so no other cooling is needed.

Propulsion speed is controlled by a low voltage frequency converter and the Azipod® CZ is connected externally by cabling only – no shafts are necessary. This ensures a simple, cost-effective installation at the yard and easy accessibility for ongoing maintenance.

The Azipod® CZ thruster system complements ABB's total solutions for semisubmersible drilling rigs.



Designed for demanding service

The design concept for Azipod® CZ originated in the 1990's, when the Azipod® propulsion system was first introduced to the shipping industry. Due to its simplified construction concept and high durability, Azipod® was originally intended for heavy duty icebreaking operations. Capitalizing on its proven performance in this market, Azipod® has grown steadily in several vessel segments and is today the leading edge propulsion technology. The system is especially suited for segments where high maneuverability, reliability and robustness are critical.

Based on the success of Azipod® propulsion, Azipod® CZ was launched in the early 2000's to cover the market in the under 5 MW class. Azipod® CZ is now available in two versions/applications; a main propulsion version for ships and a thruster version for drilling vessels.

Main Azipod® CZ advantages

- Azipod® CZ is a unique thruster system with unique benefits, such as:
- Modern technology can provide long operational life and low maintenance requirements due to simple mechanics and an “all in one” system approach
 - Higher efficiency and less thrust loss means lower power demand, less fuel consumption and a more environmental drilling vessel
 - Simplified vessel construction due to easy-to-mount, modular thruster design with podded motor

A single source provider

ABB is the leading supplier of total solutions to deepwater drilling vessels and over half of the world's drilling fleet is equipped with an ABB electric power solution. A total ABB solution typically encompasses systems for electric power generation and distribution, and drilling and thruster drive systems. With Azipod® CZ, ABB's scope of supply for the drilling market is expanded and our position as a single source provider is further strengthened.



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Azipod® CZ

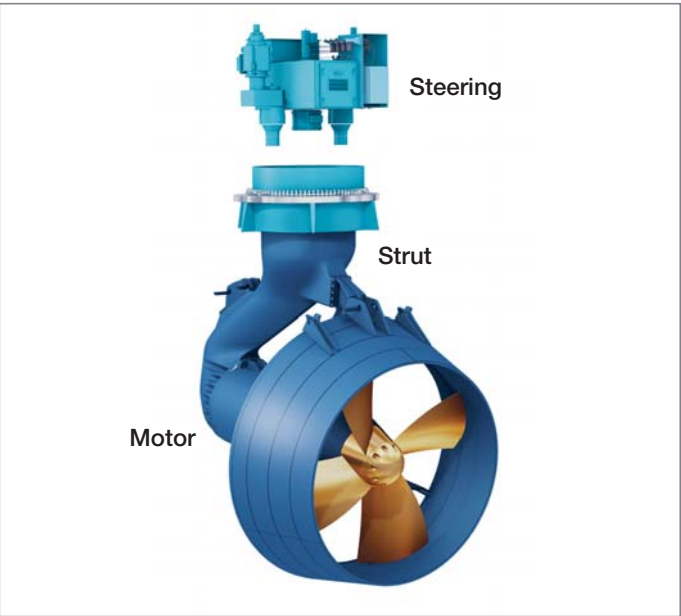
- construction principles

Azipod® CZ is highly standardized and modular, comprised of plug-and-play modules for fast and simple installation.

The Propulsion Module consists of the motor, the strut and the propeller with nozzle. The Propulsion Module is attached to the steering mechanics at the factory prior to delivery. At the shipyard, the Propulsion Module with steering mechanics is attached to the mounting block by bolted connections.

The Propulsion Module incorporates a high-efficiency permanent-magnet synchronous motor, enabling many unique benefits. The design allows the motor to be cooled directly by the surrounding seawater without the need for additional cooling media. The outer diameter of the motor can thus be decreased for obtaining improved hydrodynamic efficiency. The over-pressure in the motor prevents seawater from seeping into the motor.

The strut is the connective element in the Azipod® CZ structure. Control cables, piping and power supply cables for the propulsion motors are located inside the single piece cast strut.



Shown above is the Azipod® CZ Propulsion Module with the Steering System. The Steering System and Steering Converters are the only components inside the vessel, ensuring simple and fast installation.

The table below shows typical Mechanical and Operational characteristics of Traditional Mechanical Thrusters vs. Azipod® CZ.

	Traditional Mechanical Thruster	Azipod® CZ
Mechanical	6 shaft bearing units	2 shaft bearing units
	gear wheels	no gear wheels
	oil filters, pumps and cooling circulation units	no oil filters, no pumps and no cooling circuits
	approximately 4,000 - 6,000 liters of lube oil	approximately 100 liters of lube oil
	hydraulic steering (requires oil circuit, filters, etc.)	electrical steering (low noise, clean, etc.)
	precise shaft alignment required	no shaft alignment required
	single shaft sealing system (oil lubricated)	double shaft sealing system (water + grease)
Operational	3 rotating shafts	1 rotating shaft
	gear loss (around 3%)	no gear loss
	electric motor losses to be cooled inside vessel	electric motor losses directly to sea water
	limited reverse torque	full reverse torque
	sequence start-up	immediate full power
	hydraulic steering efficiency (around 60-70%)	electrical steering efficiency (around 80-90%)
	main electrical motor efficiency (around 95-96%)	main electrical motor efficiency (around 97-98%)

High efficiency

- minimum thrust loss

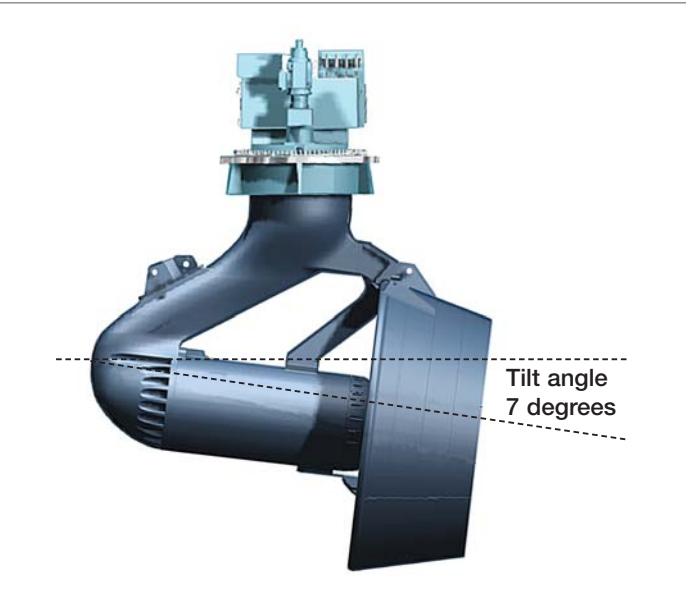
A 3.3 MW Azipod® CZ thruster unit is comparable in performance to a 3.8 MW mechanical thruster. The reason for this is that Azipod® CZ has far better internal and hydrodynamic efficiency.

The difference in internal efficiency is due to the high-efficiency permanent-magnet synchronous motor and the power transmission. Azipod® CZ has an electric power transmission and no mechanical gearing between motor and propeller. The difference in thrust loss lies in the unique possibility Azipod® CZ provides for tilting and thrust optimization.

Tilting and thrust optimization

- A semisubmersible drilling rig has several sources of thrust loss, including:
- Friction between propeller slipstream and pontoon bottom
 - Coanda effect
 - Thruster-to-thruster interaction

It is possible to reduce these losses significantly by directing the jet from the thrusters downward. In traditional mechanical thrusters this can be accomplished by tilting the propeller nozzle. However, tilting the propeller nozzle provides only limited effect as the propeller/nozzle efficiency is reduced and the tilting angle is limited.



The Azipod® CZ motor with nozzle and propeller is tilted relative to the horizontal position to obtain optimal thrust.

With Azipod® CZ it is possible to optimize the thrust because the complete motor with nozzle and propeller is tilted. By locating the optimized tilt angle large gains are achieved and water jet interactions with the hull/pontoon are practically eliminated. Compared with traditional thrusters without tilting, a gain of around 20-30% can be achieved. A gain of 4 – 6% is achieved in comparison to traditional thrusters with tilted nozzles.

Less installed power

Considering the combined value of both efficiency rewards and thrust loss, Azipod® CZ requires up to 13% less installed power than a mechanical thruster with tilted nozzle. When compared to a mechanical thruster without tilted nozzle, installed power can be reduced by 20-30%. For the drilling rig this means smaller engines and electrical equipment - cost savings, more space and less weight.

Due to far better internal and hydrodynamic efficiency, the performance of a 3.3 MW Azipod® CZ is comparable to a 3.8 MW traditional mechanical thruster.

Comprehensive services and support for the life of the vessel

ABB offers project management, design and installation support as well as a full range of specialized after-sales services to provide our customers the resources they need to ensure optimal performance from their Azipod® CZ thruster systems.

ABB works closely with our customers throughout all project phases. From an early design phase we can contribute with expertise in critical hydrodynamic areas. Our professional project management services and highly developed project execution models help assure that all specifications and requirements are implemented accurately, economically and in a timely manner.

Testing and installation

For simple, safe installation and start-up at the yard, Azipod® CZ is delivered as a complete, fully tested unit. Before leaving the factory the motor is heat run tested in a water tank.

The Azipod® CZ is a self-contained unit that requires far less work to install than mechanical thrusters. With Azipod® CZ, much installation work is eliminated, such as installation and connection of equipment for cooling, hydraulics and lubrication oil, construction of the motor foundation and precise mechanical alignment and adjustment.

The structural interface for the Azipod® CZ thruster is the mounting block. The mounting block is supplied by the shipyard and ABB specifies the interfaces to the Azipod® equipment. The structure is straightforward, allowing fast mounting of the Azipod® CZ unit with no further adjustments required. A thorough procedure has been developed for easy underwater thruster installation and de-mounting.



The photo above shows the grand opening in December 2008 of the new ABB Marine Service Center in Houston, which provides specialized Azipod® CZ competence and equipment for our customers operating in the Gulf of Mexico.

Lifetime support

Lifecycle services are an integral part of each delivery and we offer a full range of after-sales services including 24/7 On-call, Planned Repairs, Preventive Maintenance, Training and Spare Parts Management programs to thoroughly address the individual requirements of each vessel.

We continually strive to tailor our service offerings towards specific vessel segments. A good example of this is found in our newly opened Marine Service Center in Houston, Texas. These new facilities have fast and direct access to the Houston ship channel to effectively support our customers. The new workshop is also specially equipped to meet the service needs of offshore rigs and vessels operating in the Gulf of Mexico.



Development Driller I (shown above) and Development Driller II from Transocean (originally built for Global Santa Fe) are both equipped with Azipod® CZ thruster systems.