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Azipod® Propulsion

Azipod® XO
The new generation Azipod®
takes podded propulsion to a new level

Azipod® XO

An introduction to the new generation Azipod®

For over two decades the Azipod® propulsion concept has provided the shipping industry with unique benefits in ship design, construction and operations. Now ABB takes podded propulsion to the next level with the Azipod® XO, the new generation Azipod® in the 4.5 - 25 MW power range.

Azipod® is an azimuthing electric podded propulsion system providing both vessel propulsion and steering in a single unit. Originally introduced in the late 1980's, Azipod® created a revolution in ship propulsion technology. Azipod® quickly established a new propulsion standard for icegoing vessels and has become the market leader in the cruise ship segment. With the milestone of 5 million operational hours surpassed in 2009, Azipod® today provides reliable, cost-efficient service to a wide array of vessels and vessel types.

Part of the Azipod® family

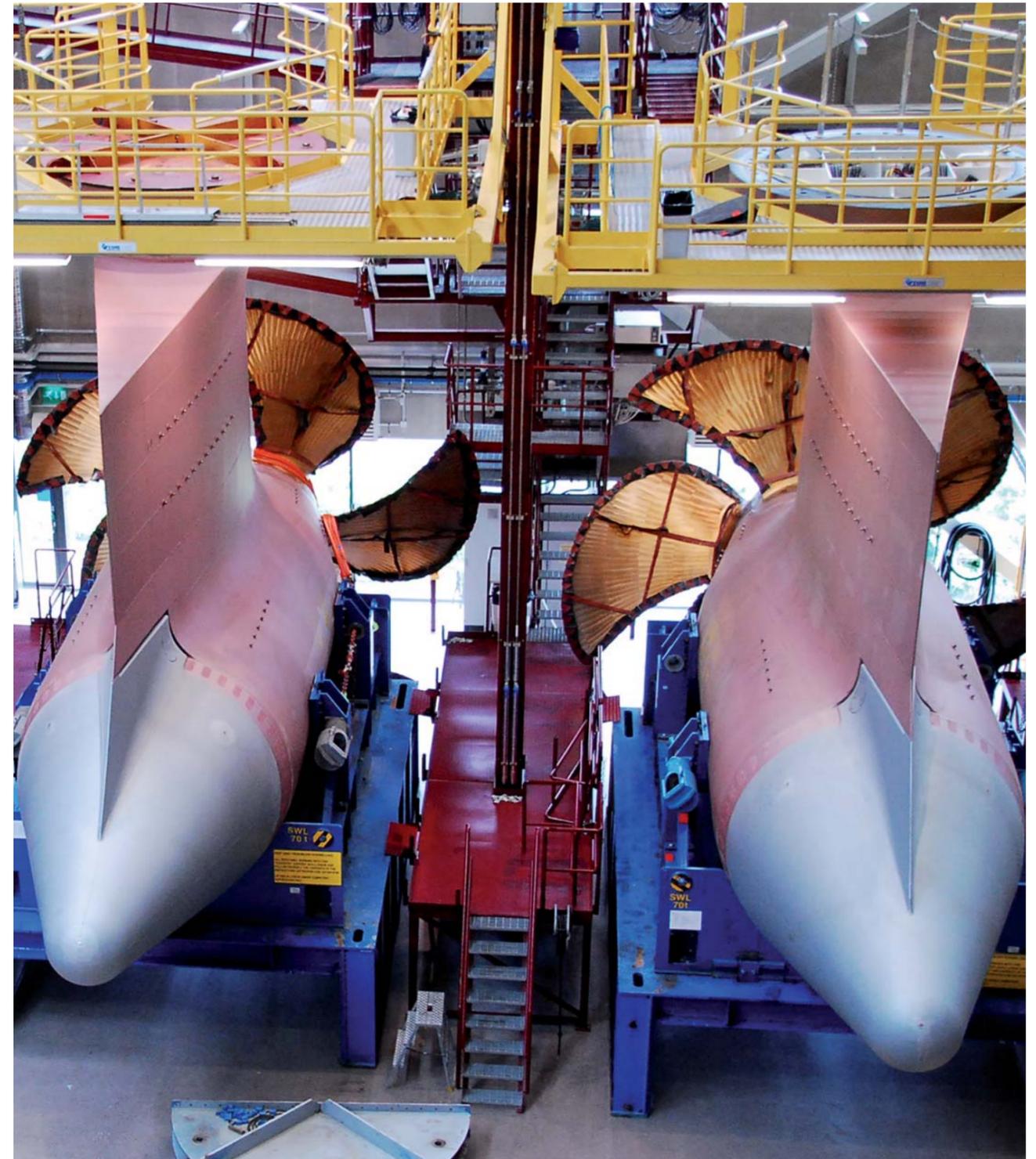
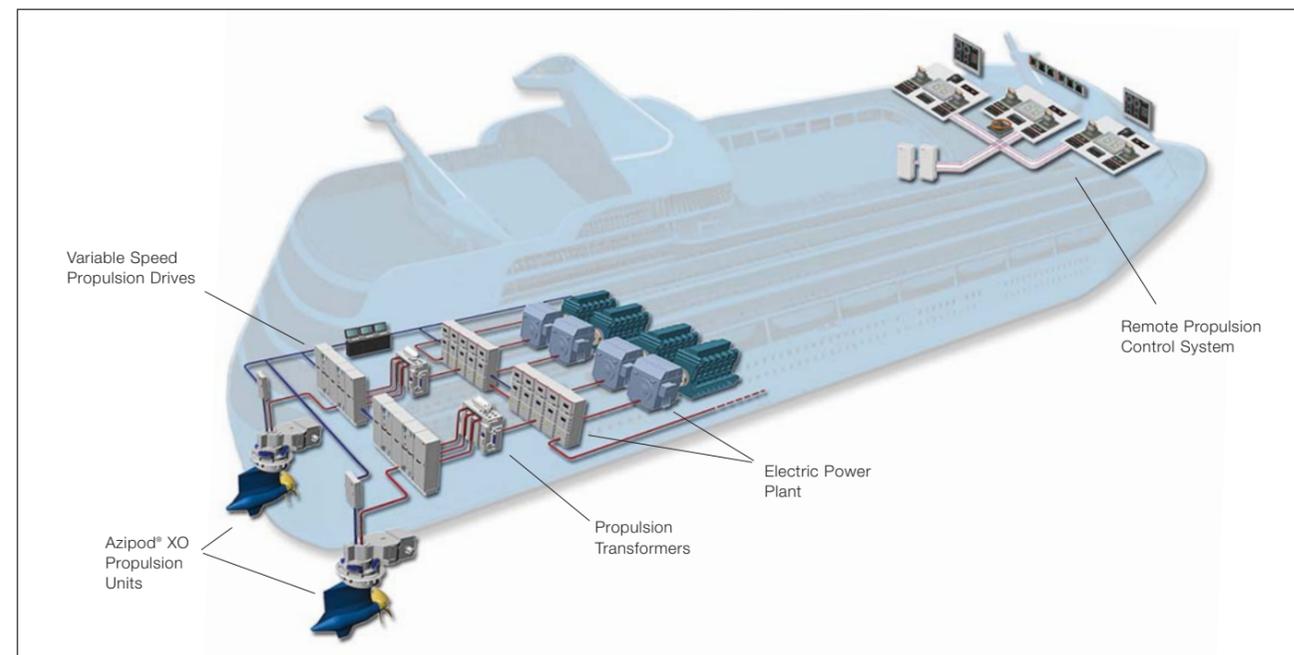
Azipod® XO is the successor to the Azipod® VO series and is the newest member of the Azipod® family. X represents the new Azipod® series in the 4.5 to 25 MW power range and O identifies the Open water design. Azipod® is also available in an ice version and in a contra-rotating version. A compact Azipod® C series is available for the power range up to 4.5 MW.

Azipod® XO - a new level of performance

Azipod® XO is the result of an extensive R&D project that started in 2006 to develop the next generation Azipod®. An important aspect of the development was to involve customers and users in identifying areas for product optimization and improvement. In this way innovative new ideas were generated and development could be focused on features essential to customers.

On the surface Azipod® XO is not dramatically different than the previous model, but strategic design changes have further improved hydrodynamics and fuel consumption. Inside the new pod changes are more apparent, giving improved operational performance, enhanced reliability, better maintainability and higher environmental protection. The combined results of these improvements can provide up to a 50% reduction in lifecycle costs.

ABB offers complete Azipod® XO ship solutions including Propulsion Drives and Transformers, Electric Power Plant and Propulsion Control System.



The photo above is from the new highly modern ABB Azipod® factory located just outside of Helsinki, Finland.

All aspects of the new Azipod® XO are designed to reduce ship lifecycle costs and increase ship profitability.

Benefits in ship design, construction and operations Safer, more environmental and profitable ships



Oasis of the Seas was built at STX Europe, Turku shipyard, with a triple Azipod® propulsion solution.

The numerous benefits of Azipod® propulsion are each important in their own right, but the full impact of Azipod® to a ship is best realized when considering the complete vessel lifecycle. From flexibility in ship design to simplified construction and cost-effective operations, the overall contribution made by Azipod® is significant and decisive.

Inspiring modern ship design

Azipod® has inspired naval architects to develop new ship designs and concepts that transform unique Azipod® advantages into safer, more environmental and profitable ships. Externally, Azipod® simplifies the hull and improves hydrodynamics. Internally, Azipod® creates the freedom to optimize the ship interior and maximize payload.

Low fuel consumption, low emissions and the opportunity to use almost any current or future energy source - diesel-electric, gas-electric or fuel cell technology, for example - make Azipod® propulsion ideal for developing and realizing green ship concepts.

Azipod® XO frees up valuable onboard space by locating the propulsion motors in submerged pods and eliminating long shaftlines, thruster systems and other onboard equipment. In addition, the modular electric power plant can be ideally located to allow for maximum cargo space. As a result, the Azipod® concept can increase payload by up to 10%.

Simplifying the construction process

For the yard, Azipod® XO means simpler hull design form and structure, and far easier machinery installation. Fewer sub-suppliers, less parts and large savings in weight and space are all elements that have significant effect on construction time and costs. To optimize logistics and economy, the pod itself can be quickly installed late in the construction process.

Peak operational performance

Following efficient design and construction, the true pleasure of Azipod® is experienced at sea. High maneuverability, quick response, fast cruising speeds and smooth, quiet operations are all hallmarks of Azipod® propulsion.



When launched in 2009, Royal Caribbean International's Oasis of the Seas was around 50% bigger than the world's next largest cruise ship.

Outstanding maneuverability

Compared to ships with shaftline propellers, rudders and tunnel thrusters, ships with Azipod® provide far better maneuverability. The ability to direct the powerful main propellers and produce thrust in all directions substantially enhances maneuverability. Features such as extremely short crash-stop distance, tight turning circle and excellent course-keeping capabilities make Azipod® attractive to a wide range of vessels.

Comfort for passengers and crew

Passenger comfort is an important factor behind the success of Azipod® propulsion in the cruise ship segment. In other ship segments creating a good working environment for the crew is increasingly important. Azipod® contributes greatly to onboard comfort through extremely low noise and vibration, which is due to reduced pressure pulses to the hull, no noise or vibration from mechanical transmissions and the underwater location of the podded propulsion motor.

Savings in fuel and emissions

Ships with Azipod® propulsion feature significantly better hydrodynamic efficiency compared to ships with traditional shaftline propulsion, resulting in high fuel savings and low emissions. The main reasons for improved hydrodynamic efficiency are:

- Reduced hull resistance by eliminating long shaftlines, brackets and stern thrusters and simplifying hull design
- The pulling Azipod® propeller works in an optimum environment where the inflow to the propeller is undisturbed due to the absence of any shaft support appendages in front of the propeller.
- The flexibility of the Azipod® units means that they can be freely and precisely located on the vessel hull to achieve maximum hydrodynamic efficiency.

Extensive operational experience and testing show that the propulsion efficiency of a twin Azipod® solution is typically 10-20% higher compared to electric shaftline propulsion.

Innovative new Azipod® XO

Smart solutions give lifetime payback

When Azipod® XO was launched in the autumn of 2009 it was based on 20 years of experience and almost 5,000,000 operating hours from the first generation Azipod®. The new Azipod® XO is easier to produce, easier to implement in different vessel types and, not least, easier to use and maintain. This means that our customers will experience higher performance with lower operational costs.

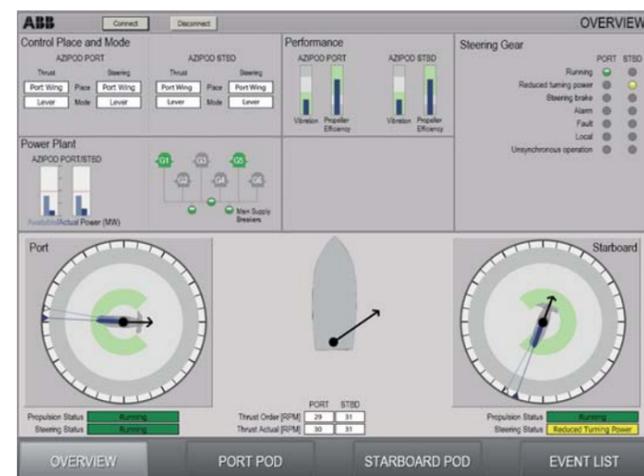
Optimized hydrodynamics

A comprehensive design project has resulted in a new Azipod® XO hull. A reduced propeller hub, smaller hull diameter and modified strut shape allow for increased hydrodynamic efficiency of around 2% compared to the previous Azipod® - which already offers a 10-15% efficiency gain over conventional electric shaftline systems.

The vertical turning axis of the pod has also been changed, reducing steering torque by 20%, which gives smaller steering system dimensioning, energy savings and less wear on steering mechanics.

Interspace shaft seal system

ABB has developed an innovative new shaft seal solution that greatly increases the integrity of the pod and reliability of operations. Known as the interspace concept (patent pending), this feature makes it possible to service the seals from inside the pod. The water and oil seal packages are divided so that there is no chance of leakage of seawater



The Azipod® XO intelligent bridge control interface improves usability and performance of the complete propulsion system.

into the pod unit or seepage of oil from the bearings into the sea. In addition, the interspace concept provides an active seal system with extensive seal environment control and condition monitoring capabilities.

Introducing the hybrid thrust bearing

In Azipod® XO a new hybrid thrust bearing technology (patent pending) replaces the previous thrust bearing. The innovative hybrid thrust bearing combines both slide- and roller-type bearings, utilizing proven roller bearings for radial support of the shaftline and slide-type bearings to bear all propeller thrust loads. The hybrid thrust bearing is serviceable and can be renovated from inside the pod without the need for drydocking - which is a major lifecycle benefit.

Safe and easy access inside the pod

Special attention has been given to human safety during installation and maintenance routines that require moving inside the pod. For added personnel safety, the new pod design includes permanent ladders, safety rails and internal lighting.

Advanced condition monitoring

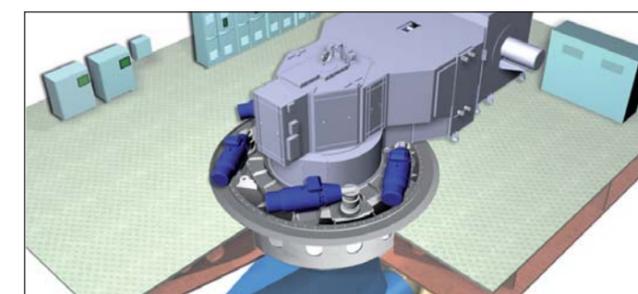
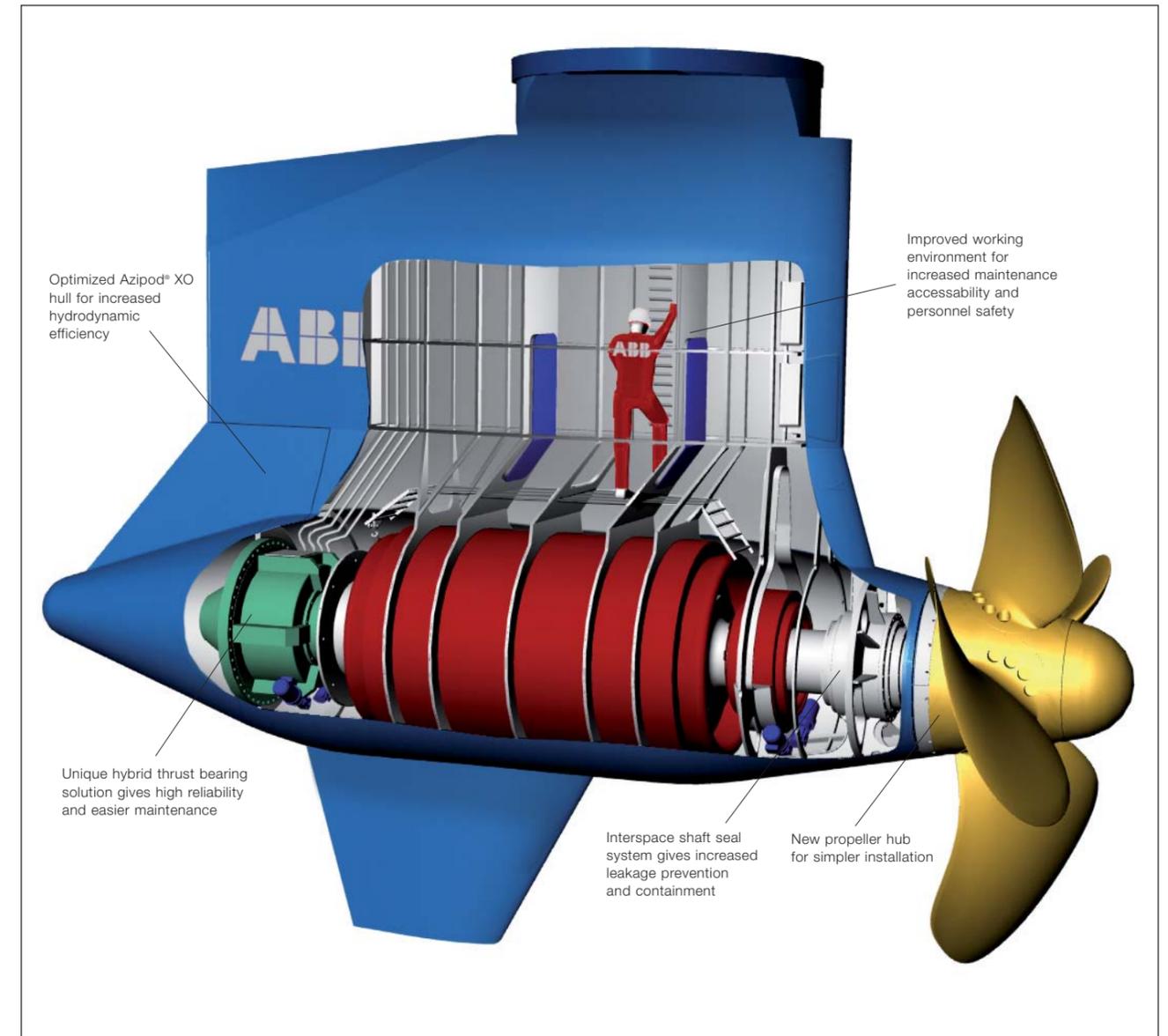
Azipod® XO includes an advanced Propulsion Condition Monitoring System (PCMS) that monitors most vital parts of the propulsion system, gathers data and presents it in easily understandable graphical formats. The PCMS provides remote and local monitoring and diagnostics, and new opportunities for preventative maintenance.

Fully electric steering system

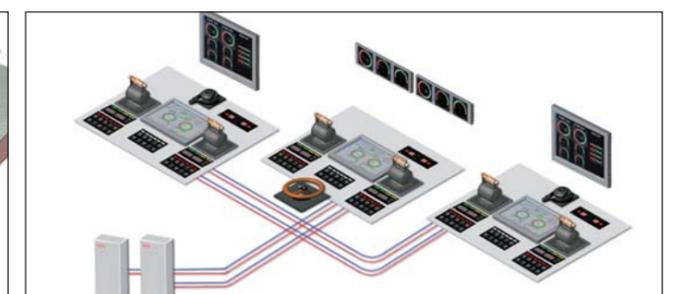
Azipod® XO has replaced hydraulic steering with a fully electric steering system. Each of the four electric motors has a dedicated steering drive, adding a new level of system redundancy. Other benefits include easier installation, improved efficiency, reduced maintenance and less noise. The new steering module is designed so that maintenance of seals can be performed with the ship afloat, depending on ship water line.

Intelligent bridge control interface

A new bridge control interface provides a full overview of all information required to steer the ship optimally. By presenting Azipod® performance related to vibration and propeller efficiency in real-time and recommending steering angles, the use of power and fuel can be optimized continually and stresses on mechanical components can be reduced.



Azipod® XO features fully electrical steering.

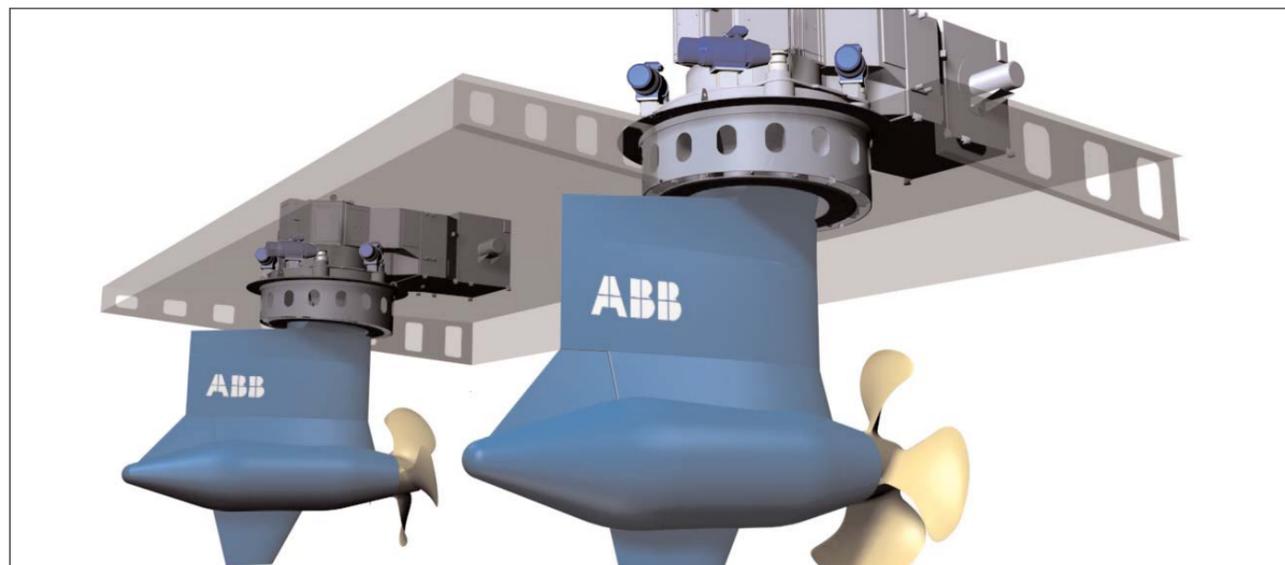


The Azipod® XO intelligent bridge control has fieldbus-based modular system architecture.

The new Azipod® XO is a truly user-based propulsion system, designed with our customers, for our customers.

Azipod® XO - a modular product family

Adaptable to a wide range of vessel types



Flexible Azipod® XO steering propulsors shown in a twin configuration.

A main goal for the development of Azipod® XO was to make it easier to implement in a wide range of ship types. To achieve this, modularity and standardization have been core product strategies throughout the development process. Previously, customer- and vessel-specific requirements often involved product adaptation and specialized solutions, but with Azipod® XO these are now addressed through a highly refined and comprehensive module program.

5 sizes from 350 modules

The Azipod® XO series encompasses five model sizes that cover the power range from 4.5 to 25 MW per unit. The complete product series is built up from 300 standard modules and 50 optional modules. This extensive product and module portfolio ensures fast, reliable response to different customer needs and requirements.

The complete Azipod® XO series is launched successively starting with model size 2100 in 2009, with the other sizes to follow in 2010/2011.

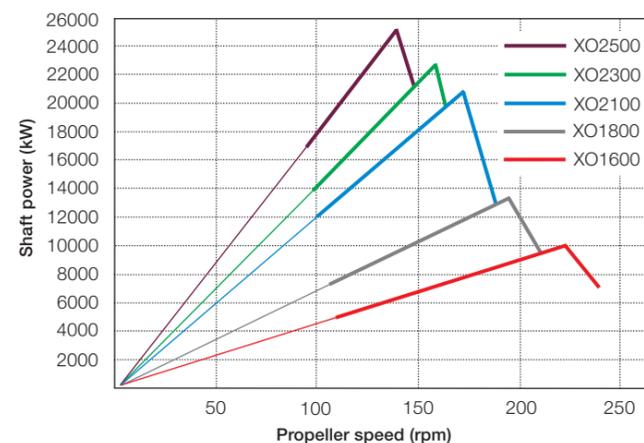
More attractive to new vessel types

Modularity and standardization are important in making Azipod® more attractive to new markets and ship types by enabling benefits such as:

- Flexible, controlled and cost-efficient adaptation to individual vessels
- Shorter engineering lead times and project specific design time
- Reduced manufacturing lead time and cost
- Easier assembly and quicker onboard assembly time
- Improved quality and shorter total delivery time

In addition to providing benefits in the construction phase, modularity and standardization also provide simplified maintenance and spare parts management in the operational phase.

Model sizes in Azipod® XO product series



Shown above is an Azipod® unit used in a contra-rotating propulsion (CRP) solution.

Configurable solutions

Azipod® is an inherently flexible propulsion system that can be applied in several different configurations and adapted to a broad spectrum of vessel types. In combination with the electric power plant concept, Azipod® offers unique possibilities to achieve the optimal combination of fuel efficiency, redundancy and reliability.

Azipod® applications include:

- Single Azipod® solutions are used for vessels such as tankers and cargo ships. A high degree of redundancy is achieved with a double-wound motor.
- Twin Azipod® provides greater maneuverability and full redundancy from power generation to propeller. Twin Azipod® is the most common propulsion for cruise ships.
- Triple Azipod® is an attractive solution for large ships with high power and redundancy requirements.
- Azipod® XC is a unique contra-rotating propulsion (CRP) system designed specifically for high-speed, high-power vessels such as ultra-large container ships, LNG carriers and RoPax ferries. With extremely high hydrodynamic efficiency, Azipod® XC is an innovative and exciting development in ship propulsion technology.



Working with our customers Azipod® services for the life of the ship

From the project phase and throughout the life of the ship, ABB works closely with our customers to ensure efficient vessel design, construction and operations. A central element of our strategy of achieving low lifecycle costs with Azipod® propulsion is to keep the Azipod® units in peak working condition in order to maintain high ship performance and avoid off-hire.

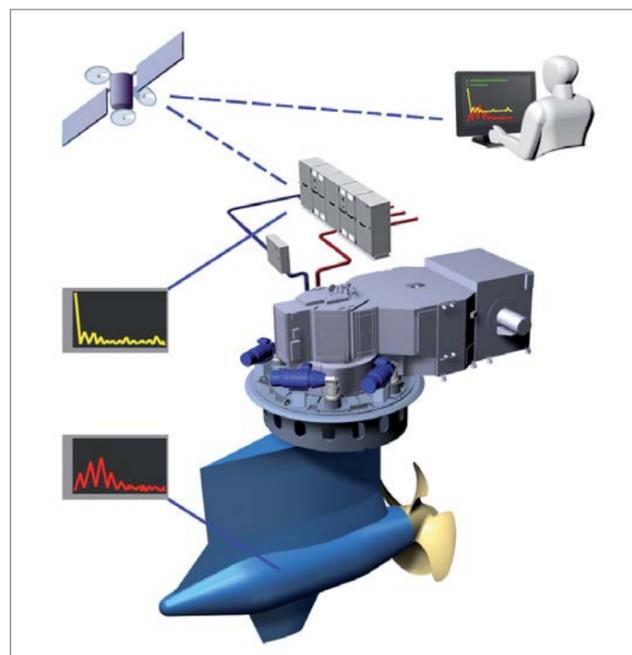
Initial Life Cycle Cost evaluation

To help customers determine if Azipod®XO is the best overall propulsion alternative for their new vessel, ABB has developed an advanced Life Cycle Cost (LCC) tool. The LCC tool compares and assesses the life cycle economics of different propulsion concepts based on the unique operational parameters of the vessel. Customers are invited to contact ABB for a thorough LCC evaluation.

Contributing to successful project execution

From a very early design phase ABB helps our customers develop and optimize the total vessel concept, contributing specialized competence and extensive experience to the project. Areas of special focus include the ship aft body and critical hydrodynamic aspects, as well as general machinery arrangement including the complete electric power plant and Azipod® propulsion solution.

Remote condition monitoring allows service personnel to monitor system status and optimize operation and maintenance of Azipod® XO.



During the transition from design to construction and throughout the construction phase, ABB provides a broad range of supervisory services and all necessary drawings and instructional material to ensure a smooth delivery, installation and commissioning of the Azipod® system.

Worldwide Marine Service Centers

To meet the support and maintenance demands of our customers, ABB has established a worldwide network of Marine Services Centers that provide specialized after-sales services. ABB Marine Services include Preventive Maintenance Planning, Planned Repair and Drydocking, On-call Services, Commissioning, Spare Parts Management and Modernizations. Onboard, classroom and on-line training is available through the ABB Marine Academy.

Azipod® Service Centers

To further strengthen our Azipod® service and support capabilities, ABB provides a network of dedicated Azipod® Regional Service Centers located in Helsinki, Houston, Murmansk and Shanghai. The Azipod® Regional Service Centers provide dedicated Azipod® service personnel, workshops and tooling. Each Regional Center is capable of leading large Azipod® service projects as well as providing service support to ABB Marine Services Centers. These locations provide specialized Azipod® services, spare parts and local contacts for Azipod® customers in the area.

Azipod® XO operational support

Normal maintenance support by Azipod® Services includes enhanced continuous operational support to our customers. By monitoring and analysing the actual condition of the Azipod® system, our customers get improved confidence and guidance of the systems' performance and condition, allowing improved operational planning and optimal long-term maintenance scheduling.

As part of the enhanced operational support to our customers, ABB has developed the Propulsion Condition Monitoring System (PCMS). The new PCMS is a fully scalable and flexible monitoring tool that allows our Azipod® service specialists and engineers to locally and remotely monitor and diagnose critical components of the Azipod® propulsion system and provide operational support and guidance for onboard crew and ship management.



Today a wide range of vessels take advantage of the benefits of Azipod® propulsion, and the new Azipod® XO promises to bring these benefits to an even larger spectrum of vessel types.