GE Power Conversion

Polar Research Vessel for DEA (South Africa)

GE’s Power Conversion business has been awarded an order by STX Finland Oy for South Africa’s Department of Environmental Affairs (DEA) to equip a Polar Supply and Research Vessel with an integrated package including electric power & propulsion system, dynamic positioning (DP) and vessel automation.

A multi-purpose vessel
The vessel will function as a multi-purpose vessel, serving, among other things, as a supply vessel, research vessel, icebreaker, expedition vessel, as well as a passenger ship.

The ship will carry scientists and research equipment for the South African National Antarctic Program in the sea area between South Africa, the Antarctic islands and the Antarctica.

The ice-strengthened vessel will be approximately 134 meters long and it will have accommodation for a crew of 45 and some 100 researchers or passengers.

An integrated package
Power Conversion will supply a transformerless solution including two induction propulsion motors, each 4.5 MW – 140rpm supplied by PWM MV7000 converters. The propulsion converters also supply the side thrusters motors.

This technology allows an increase in efficiency and availability of the propulsive chain, space and weight savings/reduced footprint (no more propulsion transformer) and lower maintenance time and costs.

Power Conversion’s scope also includes the C-Series Vessel Control System comprising the Power Management System (PMS), the centralized power plant and alarms management, the ship, machinery and auxiliary systems and a dynamic position (DP) control system.

Designing a direct-drive, slow speed induction propulsion motor
The induction motor is a simple, robust and reliable rotating machine. Power Conversion has designed a dedicated marine high torque density induction motor range with optimized cooling, a large air gap and low copper and iron losses. This motor offers a high efficiency.

<table>
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<th>Integrated package</th>
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<td>Slow speed induction motors: robust, reliable, efficient and high availability</td>
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<td>No gearbox: reduces losses and eliminates a source of mechanical failures</td>
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<td>MV7000, PWM converter: flexible power delivery with fewer system components</td>
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<td>Control systems optimized for efficient use of power</td>
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Removing the gearbox provides additional benefits:
- Minimizing the total shaft line sensitive rotating parts (MTBF is increased)
- Increasing the efficiency (no losses from the gearbox)
- Reducing maintenance, spare parts requirements and installation time and costs
- Optimizing the operating flexibility for heavy maneuvering and ice class conditions

Active Front End PWM converters
Recent ships have been equipped by Power Conversion with a propulsion system using induction motors and Pulse Width Modulation (PWM) converters designed with press-pack Insulated Gate Bipolar Transistors (IGBT) components.

Now, thanks to the Active Front End (AFE) technology, both rectifier and inverter bridges of the converters have exactly the same topology and the converters can be directly connected to the 3.3 kV mains.
Power and Propulsion Single Line Diagram

Reduced maintenance
Removing such sensitive main components as gear boxes and transformers has a direct impact on maintenance work. Capital expenses for depot spare parts are avoided.

C-Series vessel control system
The Vessel Control System is part of Power Conversion’s solution. It combines supervisory control and monitoring of all ship systems into a single system. It provides integration of safety systems and Communications packages into an overall bespoke operator package. System components are integrated using a high speed, redundant Ethernet network.

• Network allows for easy future expansion
• Scalable architecture
• High level of system redundancy
• High level diagnostic features
• Remote diagnostic capability

A C-Series dynamic position (DP) control system completes Power Conversions contribution to this ship thus permitting precise position control and manoeuvring.

Flexibility and reduced ecological footprint
Generators are set to fit the vessel’s operational profile (cruising and maneuvering). The Integrated Power Management System (IPMS) adjusts the power load to the actual ship consumption. This guarantees the highest efficiency and lowest emissions whatever the vessel’s power need.

The new architecture, which is able to work in the four quadrants, allows feeding the 60Hz ship service network from the 50Hz shore facility. This cold ironing facility also contributes to minimizing exhaust emissions (no need to run Diesel engines).

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