

Azipod® - the Propulsion System of Choice for Icebreaking and Icegoing Vessels



www.abb.com/marine

**Center of Excellence
Cruise & Ferries:**

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

**Center of Excellence
Oil & Gas Related Vessels:**

ABB AS
Marine and Turbocharging
Bergerveien 12
P.O. Box 94
N-1375 Billingstad
Norway
Phone: +47 03 500
Fax: +47 22 35 36 80

Sundheim-Madsen 4-2008



The need for year-round ship services in frozen, remote areas is rapidly increasing. Developing these sensitive arctic territories requires proven marine technology that meets the high environmental and performance standards necessary for operation in extreme climatic conditions.

70 years of icebreaking experience

In 1939, ABB delivered electric propulsion to an icebreaker for the first time. Since then, more than 80 icebreaking vessels have been equipped with electric propulsion solutions from ABB.

At an early stage, electric propulsion established an industry standard for icebreaking vessels. Vessels operating in ice need high torque at the propeller shaft, especially when the propeller is surrounded by ice. Contrary to diesel driven motors, electric motors have a torque characteristic that gives maximum torque at low propeller speeds - which is an ideal attribute for icebreaking vessels.

But two main challenges remained; the lack of sufficient maneuverability in ice with shaftline propulsion and the torsional vibration and strength problems with mechanical thrusters with gears. *This paved the way for Azipod®.*

Azipod® - the ultimate propulsion in ice

Azipod® was developed to address the specific power and maneuverability requirements necessary for ships to operate effectively in ice. Introduced in 1990, Azipod® has proven its unique advantages and reliability for almost 20 years in millions of operational hours.

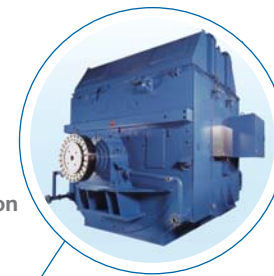
- **Enhanced maneuverability in heavy ice conditions** - 360 degree rotation provides full torque and thrust in any direction, even at zero propeller speed and in reverse.

- **Robust mechanical design** - no bevel gears and a single short shaft means that the torque capacity of the electric motor can be fully utilized.

- **Strength and stiffness** - Azipod® hull with framed structure withstands quick thrust changes and high impact loads during ice-milling. Easy shaftline dimensioning for dynamic load conditions.

- **Freedom in ship design** - Azipod® provides great design flexibility and the possibility for revolutionary new vessel designs and icebreaking technologies.

Electric Power Generation



Electric Power Distribution



Propulsion Transformers



Variable Speed Propulsion Drives



COMPLETE ELECTRIC POWER PLANT AND PROPULSION SYSTEM



A remarkable track record in ice operations:

- ABB has delivered electric propulsion to over 80 icebreaking vessels
- First Azipod® delivered to icebreaking vessel in 1990
- ABB market share for high ice class vessels (>1 A Super) during the last 10 years:
 - Azipod® market share 64%
 - ABB Electric Propulsion market share 80%
- 99.75% on-hire time of all Azipod® units in operation
- 0% ICE DAMAGE

A Single Source Electric Power & Propulsion Solution

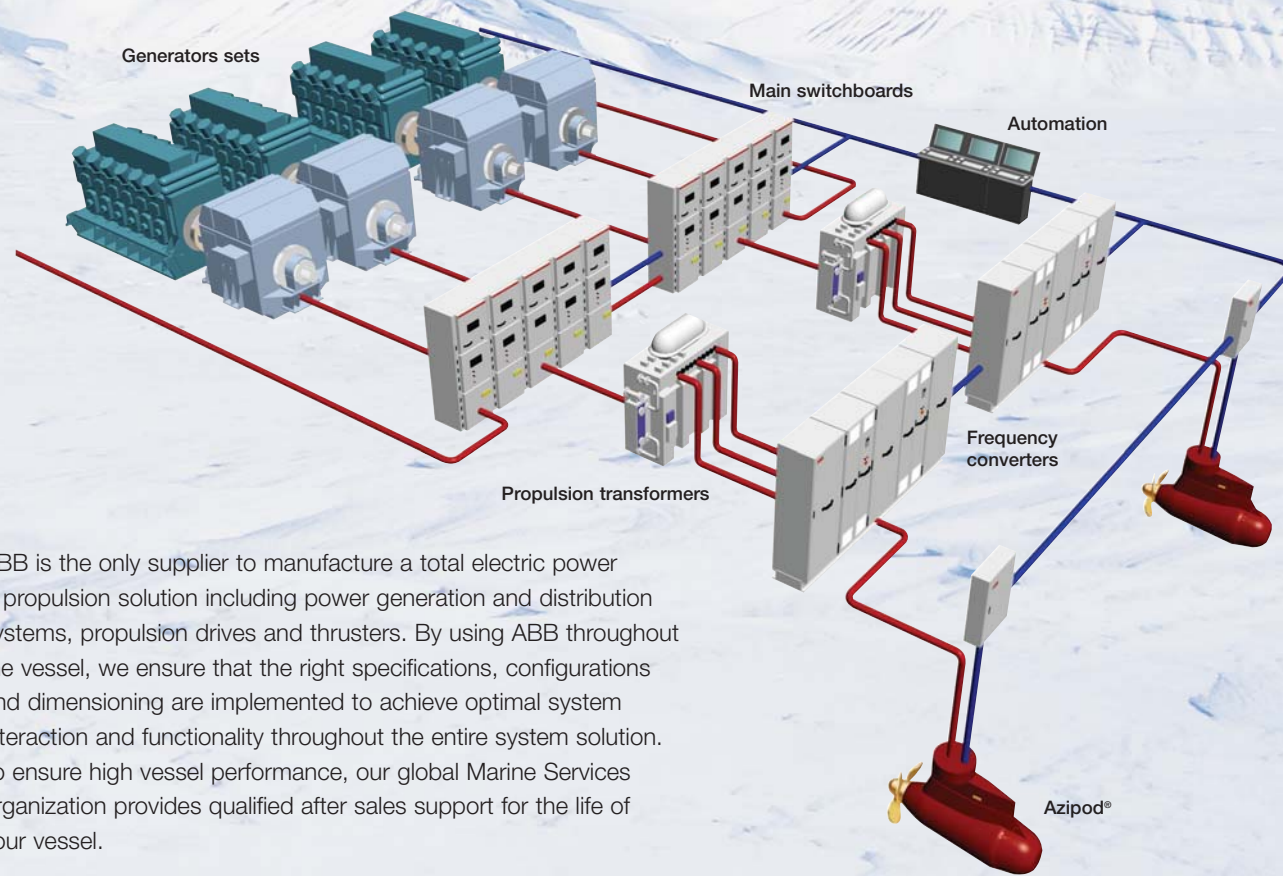


ABB is the only supplier to manufacture a total electric power & propulsion solution including power generation and distribution systems, propulsion drives and thrusters. By using ABB throughout the vessel, we ensure that the right specifications, configurations and dimensioning are implemented to achieve optimal system interaction and functionality throughout the entire system solution. To ensure high vessel performance, our global Marine Services organization provides qualified after sales support for the life of your vessel.

Icebreaking Vessels with Azipod® Propulsion



Norilskiy Nickel

Yard: Aker Yards
Owner: Norilsk Nickel



FESCO Sakhalin

Yard: Aker Yards
Owner: FESCO - Far Eastern Shipping Co.



Mackinaw

Yard: Marinette Marine
Owner: U.S. Coast Guard



Tempera & Mastera

Yard: Sumitomo Heavy Industries
Owner: Neste Shipping



Svaldbard

Yard: Aker Yards
Owner: Royal Norwegian Navy



Botnica

Yard: Aker Yards
Owner: Finnish Maritime Administration

A close project partner with our customers

From a very early project phase, ABB customers utilize our unique ice expertise in dimensioning and designing the propulsion system. Our know-how in vessel power control and electric power plant design contributes greatly to achieving safe and reliable operations in harsh frozen environments.

Differences in classifications society requirements for different ice classes and different technical requirements for each project often result in the need for a tailor-made Azipod®. This is possible due to the modular Azipod® design, which allows for standard components to be combined together to create a fit-for-purpose ice propulsion unit.



For icegoing vessels, it is critical to have AC converters with good control capabilities across the entire speed range including low RPM. ABB's compact and highly reliable ACS6000 propulsion drives with the unique DTC (Direct Torque Control) motor control method provide the fastest and most accurate speed and torque control of any variable speed drive system available.

Innovation built on experience

Throughout the years, ABB has gained broad experience and a deep understanding of the arctic environment, ice conditions and not least the forces and ice-loads working on ships and Azipod® in frozen waters. Today, we are working with a broad spectrum of icebreaking vessel types including oil tankers, container ships, ferries, tugs, offshore support vessels and icebreakers.

One innovative project we are working on is with Russian shipowner Sovcomflot, who has ordered 5 icebreaking crude oil tankers with Azipod® propulsion for year-round oil transport in Russian arctic waters. Delivered in January 2008, MT Vasily Dinkov is the first of three tankers built by Samsung for oil transport from the Varandey terminal in the Pechora Sea to the Murmansk transshipment terminal. In addition, Admiralty Yards are constructing two arctic shuttle tankers for transport services for the Prirazlomnoye field.

