Fortum´s Double Acting Tankers

Sister ships M/T Tempera and Mastera, the world's first Double Acting Tankers (DAT), were built by Sumitomo Heavy Industries of Japan and delivered to Fortum Shipping of Finland in 2002 and 2003 respectively. These icebreaking oil tankers are the first in the world to use the DAT design from Kvaerner-Masa Yards to travel bow-first in open waters and stern-first in ice.

ABB Scope of Supply to each vessel:

- 2 x 6000 kW Diesel Generators
- 2 x 4000 kW Diesel Generators
- 1 x 1700 kW Auxiliary Generator
- 2 x 6.6 kV Main Switchboards
- 2 x 15000 kVA Propulsion Transformers (6600/1200 V)
- 2 x 1200 V Propulsion Switchboards (cycloconverters)
- 1 x 16000 kW Azipod® Propulsion
- 2 x 700 kVA Exitation Transformers (6600/690 V)
- 2 x 1800 kVA Ship Supply Transformers (6600/450 V)
- 2 x 5200 kVA Supply Transformers (6600/2 x 725 V)
- 2 x 5200 kVA ACS 600 Marine Drive
- 1 x 800 kW AMA 400L6L Ballast Pump
- 3 x 1600 kW AMA 450L6L Cargo Pumps
- 2 x 1750 kW AMA 450L6D Thruster Motors
- 1 x 330 kW M2BA Ballast Pump
- 2 x UPS

A Global Technology Partner to the Marine Industry

ABB Marine is the leading manufacturer of electric power and propulsion systems.
We are a highly competent maritime organization with over half a century of experience.
Through our global presence, we provide reliable, safe and environmentally-friendly solutions and qualified services to ship owners, operators and yards - reducing operational costs and ensuring optimum vessel lifecycle.

www.abb.com/marine

Center of Excellence
Cruise & Ferry Vessels:

ABB Oy
Marine
P.O. Box 185
FIN-00381 Helsinki
Finland
Phone: +358 10 2211
Fax: +358 10 222 2350

Center of Excellence
Oil & Gas Related Vessels:

ABB AS
Marine and Turbocharging
P.O. Box 6540 Rodeløkka
N-0501 Oslo
Norway
Phone: +47 22 87 20 00
Fax: +47 22 35 36 80

www.sundheim-madison.no 9-04

Tempera and Mastera

World´s First Double Acting Tankers (DAT)

Azipod® Propulsion

Built by Sumitomo Heavy Industries, Japan

Operated by Fortum Shipping, Finland

ABB Delivery to Each:

- **1 x 16 MW Azipod® Propulsion**
- **Electric Power System**
- **Thruster Motors and AC Drives**
- **Cargo and Ballast Pump Motors and AC Drives**
- **Propulsion Control System**
- **Pump Control System**

M/T Tempera and Mastera

Keeping Shipping Lanes Open with Azipod® Propulsion

The superiority of the DAT concept when running in ice was proven in winter 2002-2003 in the Gulf of Finland, where ice can severely affect marine traffic during the long winters. The winter was exceptionally hard - with no cargo, bulk or tanker traffic possible without icebreaker assistance. The only exceptions were TEMPERA and MASTERA, who performed well in existing ice thickness of 70-80 cm and upcoming ice ridges. The ships made it possible to keep constant traffic flow between the Russian port of Primorsk and Skjöldvik in Finland.

Fast and Safe Unloading with AC Drives

Wasted time is very expensive for a high-value asset like an oil tanker. For fast and reliable unloading, the 106,000 dwt sister ships TEMPERA and MASTERA were fitted with electric cargo and ballast pumps controlled by AC drives, which provide a number of advantages over conventional steam turbine or hydraulic pumping systems. With quick start-up and smooth control to avoid pressure transients, their cargo oil tanks are drained using three electrically-driven pumps of 1,600 kW each, with a combined capacity of 10,000 m³ per hour.

The Double Acting Tanker (DAT) concept used by TEMPERA and MASTERA means that the ships are designed to operate in two totally different environments. This is made possible by designing the hull and propulsion system to operate optimally in both open water and on frozen seas. The stern of the ships are designed as an icebreaker bow. In open waters, the ships operate with the bow ahead. When they meet heavy ice, they turn around and advance with the icebreaking stern ahead.

Optimum Performance in Open Waters and Ice

The unique naval architecture of Tempera and Mastera is possible because the propulsion of the ship is done with a 16 MW Azipod® electric propulsion unit. Both vessels are equipped with Azipod® units that can freely rotate 360°, pulling the ship in both directions. The open water, ahead-running efficiency is proven with good annual fuel economy compared to same size of ships with conventional propulsion.

"Our Azipod® gives us a maximum speed of 17 knots in open water. We can maintain a speed of 3 knots in ice one meter thick. When we're traveling through ice, the Azipod® 'lubricates' the area of contact by forcing a stream of water between the ice and the hull."

Antero Nykänen
Captain of Tempera

Equipped with AC Motors and Drives...

The ships' owners specified electrically driven pumps controlled by frequency converters rather than the conventional solution of steam turbines or hydraulic motors. ABB supplied water-cooled multidrive frequency converters from its industrial drives range for installation in the two ships.

Markku Nykänen, Tempera's Chief Engineer, states that the soft start feature of the drives is a major benefit onboard ships - "...generators are used to produce electricity onboard, and without AC drives the supply is disturbed every time a big electric motor starts up. The drives have a short payback time, because they are very energy efficient and therefore help to save fuel," he adds.

...for Efficient Pump Control

Straightforward and precise pump speed control by AC drives enables the operators to quickly find the optimum flow rate and pressure.

As Eerik Aaltonen, Tempera's electrician, says: "AC drives are being used more and more in marine applications - they provide good controllability and a wide range of control. These drives enable us to eliminate many items of equipment that can be problematic onboard ships, including gear boxes and hydraulic systems."