DOLPHIN – The Advanced System in the Field of Pod Drives
DOLPHIN - A Highly Advanced Podded Propulsion System

SAM Electronics and Wärtsilä Propulsion cooperate in the business field of podded propulsion drive systems. This consortium having extensive experience in merchant marine and naval applications of propulsion systems has developed the new podded propulsion drive and markets the product under the name of “DOLPHIN”.

Description
The main principle of this new podded propulsion system is a powerful electric motor, which directly drives the propeller, installed in a streamlined pod under the ship. Up to 360 degrees of freedom around the vertical axis of rotation ensures an optimum level of manoeuvrability. The power range of DOLPHIN is available for applications up to more than 10 MW. DOLPHIN is applicable for a large variety of ship types when high speed or manoeuvrability or a combination of both is required.

The electric motor in the underwater part is a six phase synchronous, air cooled machine based on proven and reliable technology. The gears of a conventional thruster are replaced by the low speed motor directly coupled to the propeller. A fixed pitch propeller is used with industry standard lip seals for the propeller shaft.

Azimuthal steering is electro-hydraulic with a number of motors driving a geared ring. The number of motors depends on the required steering capabilities and on the requested level of redundancy.

Installation of the drive comprises two stages. An installation block, which is a complete module containing the steel structure, steering mechanism and necessary components to support the thruster, is delivered during the building of the ship. Connection of the thruster itself takes place in one of the last stages of the process.

For special demands the propulsion unit can be designed for mounting and dismounting while the ship is afloat.

Performance
Operation with this propulsion system is characterised by the excellent manoeuvring capabilities and outstanding performance, such as the short crash-stop distance, the small turning circle and the rapid dynamic response of the drive system.

Hydrodynamic Aspects, Efficiency
The propulsive performance of a DOLPHIN-driven vessel compared to a twin screw vessel with conventional fixed pitch propellers is considerably better. The improvement is mainly due to the omission of the rudder, appendages, shafts and stern thrusters and also to an optimized stern. Because the propeller is pulling, the axial inflow towards it is also improved compared to a conventional twin screw vessel.

This results in better cavitation behaviour with low excitation, lower noise and reduced propulsion power demand.

Manoeuvrability
Energy transmission is by sliprings allowing unlimited azimuthing. Combined with the ability to give smooth or full thrust in all directions, excellent manoeuvrability is guaranteed by the podded drive.

Monitoring
All relevant parts of the drive are monitored such as temperatures of windings and bearings, prevention of leakages etc. by a redundant programmable logic controller with decentralized I/O modules.

Converter Drives
In the standard solution, the double winding synchronous motor is speed controlled by a synchroconverter. For low power ranges or special demand, PWM converters are available. The design of the propulsion system meets two main requirements:
- reduced number of electrical components
- and high reliability due to simple system structure
The Electrical Plant

Furthermore, the electric thruster is part of a power-plant concept, i.e. power generation is centralized and all electrical consumers are fed from the ship’s main bus-bar. This provides a highly efficient and flexible system that is capable of handling electrical load fluctuations induced by propulsion as well as bowthrusters, pumps, compressors and other consumers.

In addition, the power plant concept together with the DOLPHIN propulsion concept has a high degree of redundancy, so that the propulsion function of the system is always guaranteed.

Advantages of the power plant concept versus diesel mechanical systems:

- Maximized loading capacity due to:
  - installation of diesel generator sets at any desired place on board, for maximum space optimization
  - reduced volume and decentralized installation of the propulsion system components
  - electric motor outside the hull
- Reduced wear, maintenance and spare parts due to:
  - simplification and reduction of systems and components
  - operation of diesel engines at constant speed
- More economic operation with especially good efficiency in partial load mode due to automatic, load-dependent stopping of diesel generator sets via the automatic power management system
- Reduced exhaust gas emission as well as reduced fuel consumption due to the operation of diesel engines at constant speed in the optimum operating range, even when the propulsion plant is operating at partial load
- Smooth and operation due to elastic mounting of diesel generator sets

Summary of Advantages of the DOLPHIN Propulsion System:

- Modular design of the propulsion unit
- Flexible design of stern and engine room
- Elimination of shaftline, rudder, stern thrusters and reduction gears
- Late integration of the completely tested propulsion unit into the ship
- Higher electrical and hydrodynamic efficiency
- Better dynamic manoeuvring
- Lower fuel oil consumption and reduced exhaust emissions
- Reduced noise and vibration level

Scope of Delivery

- Complete electric thruster propulsion unit
- Hydraulic power pack
- Cooling system
- Steering controls
- Installation block
- Bridge control system
- DP system
- Main switchboard
- Power management
- Converter
- Diesel Generators

Power Range:
This new propulsion system covers a standard power range of 5...10 MW (D1 to D3). Other power ranges on request.
## Technical Data

### General

<table>
<thead>
<tr>
<th>Type</th>
<th>Power kW</th>
<th>Speed rpm</th>
<th>Torque kNm</th>
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<tr>
<td>1</td>
<td>5000</td>
<td>180</td>
<td>265</td>
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<tr>
<td>2</td>
<td>7000</td>
<td>170</td>
<td>393</td>
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<td>3</td>
<td>10000</td>
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### Dimension

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<tr>
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<th>D mm</th>
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<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>Clearence</td>
<td>cl mm</td>
<td>between 25 and 40 % of the propellerdiameter</td>
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<tr>
<td>Length</td>
<td>L mm</td>
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<td>9075</td>
<td>10100</td>
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<tr>
<td>Mean height of insert2</td>
<td>Hw mm</td>
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<td>1250</td>
<td>1450</td>
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<tr>
<td>Diameter of insert2</td>
<td>Dw mm</td>
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<td>4850</td>
<td>5650</td>
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<tr>
<td>Height of package</td>
<td>Hm mm</td>
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<td>2150</td>
<td>2250</td>
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### Weight

<table>
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<th>ton</th>
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<td>91</td>
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