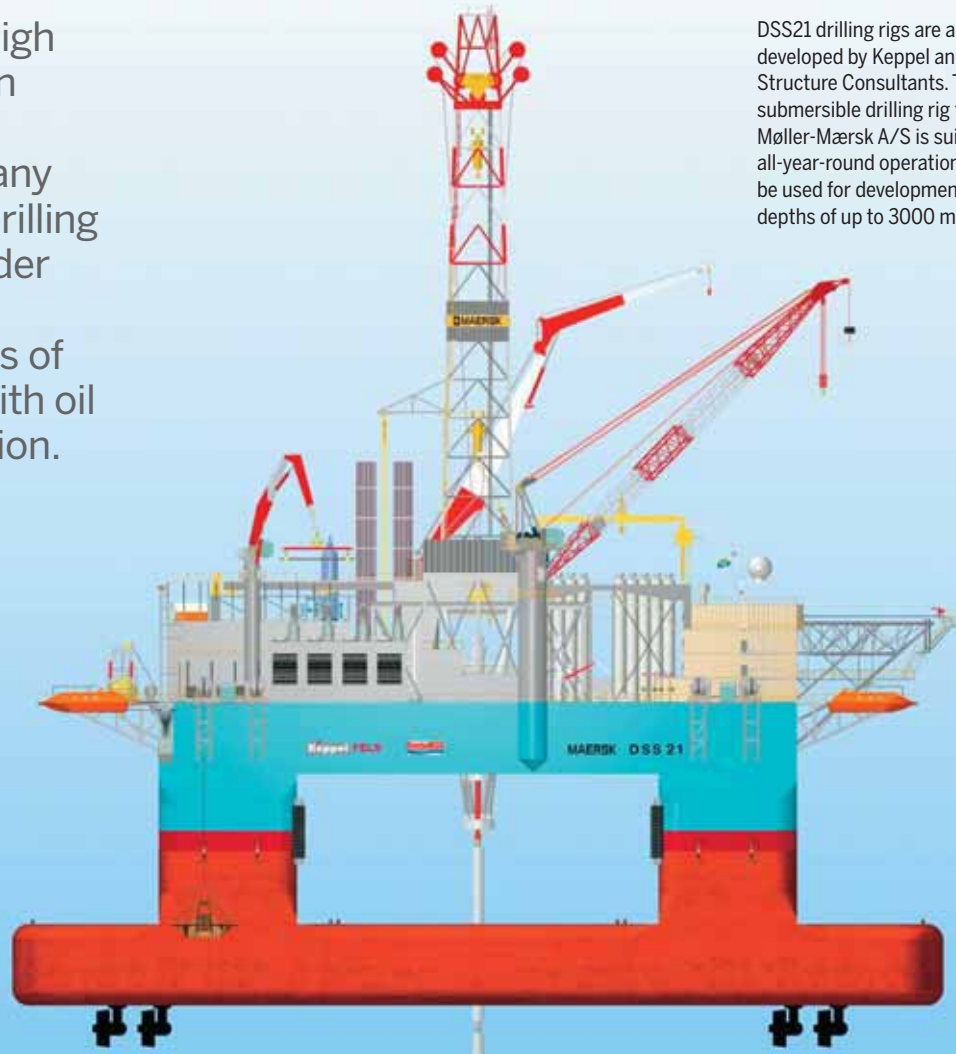


WÄRTSILÄ THRUSTERS

the driving force behind dynamically positioned Offshore Applications

THERE IS NO DOUBT that high oil prices have resulted in increased activity in the offshore market. The many new semi-submersible drilling rigs and drill ships on order are a direct result of the high demand for all types of equipment connected with oil exploration and production.

DSS21 drilling rigs are a design developed by Keppel and Marine Structure Consultants. This semi-submersible drilling rig for AP Møller-Mærsk A/S is suitable for all-year-round operation and can be used for development drilling in depths of up to 3000 metres.



The Safe Concordia accommodation rig, owned by Consafe and built at Keppel Fels, is equipped with four Wärtsilä thrusters with an input power of 2500kW.



KEY DATA: STEERABLE THRUSTERS FOR DSS21 SEMI SUB DRILLING RIG

Rig type	DSS21 Semi Submersible Drilling Rig
Number of thrusters and type	8 x FS3500-671/NU
Input speed	0 - 600 rpm
Input torque	63,667 Nm
Reduction ratio	3.538
Input power	4000 kW
Propeller diameter	3800 mm
Nozzle type	Wärtsilä High Efficiency, 3 degrees tilted

► TEXT: HANS LAHEIJ | ILLUSTRATION: WÄRTSILÄ AND KEPPEL FELS

In addition to the increased demand for equipment, there is a drive for offshore activities to move to deeper water. Operating in these conditions requires that offshore structures be dynamically positioned (DP) and these units thus require their own propulsive power. As it is the driving force, propulsion equipment plays an important role in the successful operation of an offshore installation. This article takes a closer look at this type of propulsion equipment, the Steerable Thruster.

Wärtsilä thrusters have their origins in Lips offshore thruster design. First delivered in 1967, the Lips thruster has been further developed to have a power range of 800-7000 kW and comply with the highest requirements for offshore installations.

Wärtsilä offshore thrusters are employed in heavy-duty seagoing applications such as semi-submersible drilling rigs, drilling ships, cable layers, research vessels, and product tankers. The Wärtsilä offshore thruster range covers all types of thruster. To ensure it fulfils the operational requirements of an offshore application, the design criteria for each type and size of Wärtsilä offshore thruster focus on:

1. Using components suitable for continuous operation in heavy offshore conditions,
2. Ensuring reliability and durability to minimize down-time, and
3. Providing a lifetime of at least of 25,000 hours at full continuous load (i.e. at 100% power for 100% of the time)

Design of the Wärtsilä thruster also involves a modular approach which means that standardized sub-assemblies can be used to fabricate different types of the same size of thruster. This approach means that the following types are available:

1. Modular Thruster in weld-in, bolt-in or can-mounted execution
2. Retractable Thruster
3. Containerised Thruster
4. Underwater (de)mountable thruster

All these thruster types are available in input power ratings of up to 7000 kW and can be supplied with either fixed-pitch propellers (FPP) or controllable-pitch propellers (CPP). Nozzles are commonly used in DP applications to increase thrust, but thrusters can also be supplied without nozzles for specific applications.

Reliable and durable

As already mentioned, the design philosophy in Wärtsilä thrusters focuses on ensuring reliability and durability, both of which are important in ensuring availability of the system and minimizing downtime. All aspects of Wärtsilä thrusters cannot be fully described here, but a few key features are mentioned below.

Transmission parts (i.e. gearwheels and bearings) are designed for continuous running in dynamic positioning conditions. All gearboxes are fitted with a spiral-bevel gear set, made of special high-quality forged steel, case-hardened and fine-machined after hardening to Class 6 - DIN 3965 - (H.P.G. process) or better.

Performance requirements demand that thrusters incorporate a large number of anti-friction bearings. Every Wärtsilä azimuth thruster is fitted with separate bearings that take axial and radial loads. This ensures long bearing life. The pinion shaft is also supported on both sides of the pinion wheel,

“RELIABILITY AND DURABILITY ARE THE BASIS FOR DESIGN.”

an arrangement which ensures that there is no deformations in loaded conditions and that tooth contact between the pinion and crown wheels is optimal under all load conditions.

Sealing system

A good sealing system is essential for trouble-free system operation. A high-quality triple-lip Wärtsilä viton seal is therefore installed on the propeller shaft. A ceramic coating is applied over the full length of the liner. As an option, the sealing system can be extended to a 4BL seal (i.e. four viton sealing rings) with special monitoring possibilities.

A triple lip seal is installed between the rotating steering pipe and the stationary support pipe. An extra-heavy-duty type of lip seal is fitted at the outside to prevent debris from entering the area between the support and steering pipes.

Hydraulic steering system

The steering system that provides the azimuth

function of a steerable thruster consists of a hydraulic powerpack connected to a number of hydraulic steering motors. To ensure redundancy in the system, the powerpack is equipped with two 50 % capacity pumps that run at the same time. If one pumps fails, the steering capacity that remains is sufficient to ensure safe operation.

Lubrication oil

The propeller gearbox in a steerable thruster is completely filled with lubrication oil. Each thruster has single lubrication pump which takes suction from the lowest part of the thruster. This ensures optimal circulation of the oil, and also has the advantage that should water enter the unit, it will be immediately noticed as the suction is from the lowest part. As the circulation of oil is not critical, only one pump is supplied for each unit. A header tank is provided to ensure positive pressure across the seals against the surrounding seawater. For semi-submersibles that have a



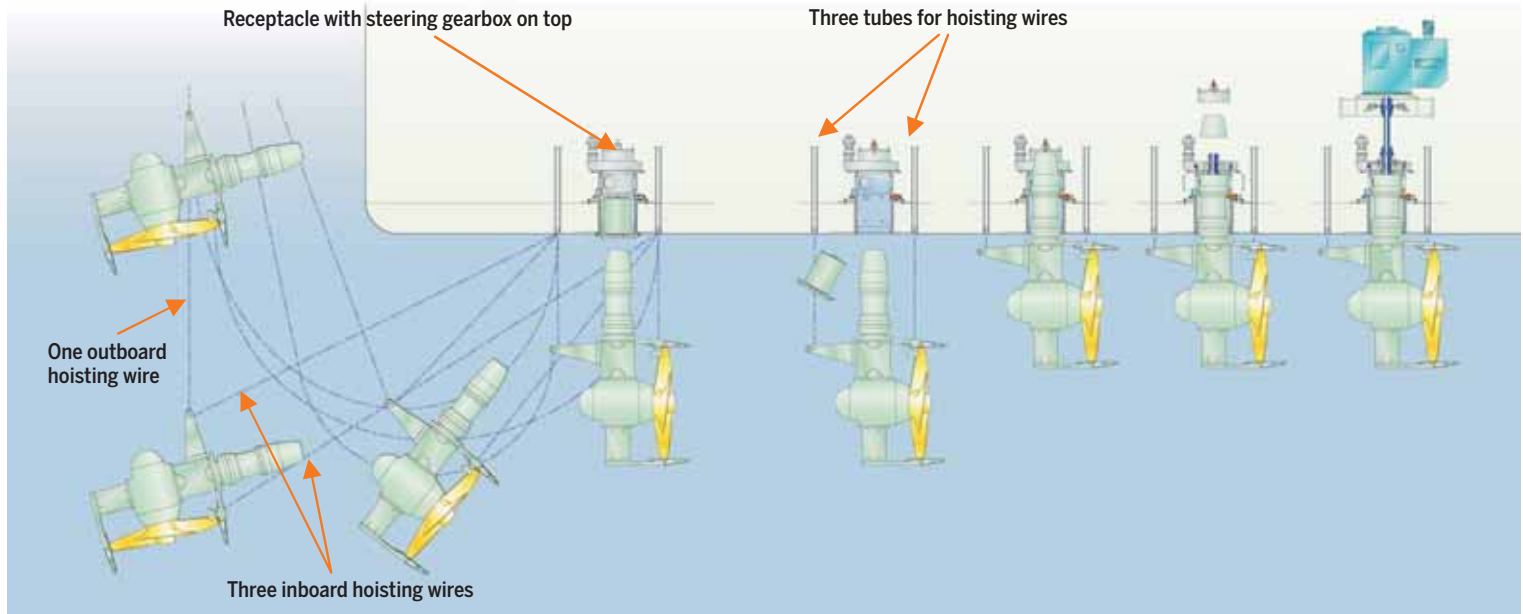
Wärtsilä underwater (de)mountable thrusters ready for installation.

different draft in transit and operation, this system is extended with either an extra (i.e. higher) header tank or a single header tank with adjustable pressurised air to compensate for the difference in water pressure at different draughts.

Underwater mountable thrusters

A type of thruster widely used on semi-submersible drilling rigs and drill ships is the underwater (de)mountable thruster. The first Lips thruster of this type was delivered in 1980. With this type installation, the outboard part can be removed without dry docking the rig or vessel. This arrangement ensures continuous availability of the offshore →

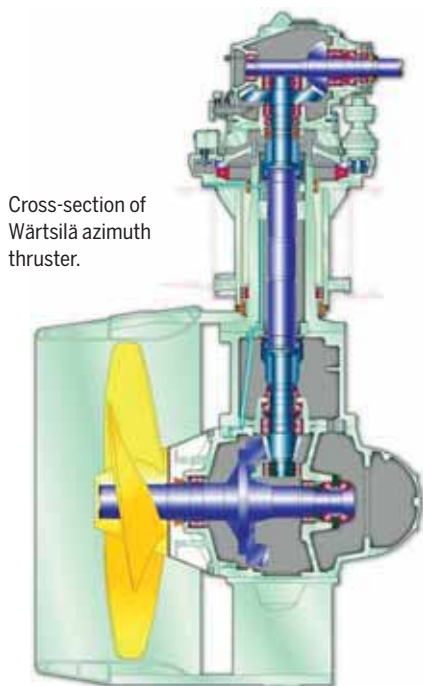
INSTALLATION SEQUENCE FOR UNDERWATER MOUNTABLE THRUSTERS



installation since thrusters can also be exchanged in the open sea. The installation sequence for the thruster outboard part is shown at the top of this page.

DSS21 Semi-submersible drilling rig

One example of an application for Wärtsilä underwater (de)mountable thrusters is the units



Cross-section of Wärtsilä azimuth thruster.

to be supplied for two semi-submersible drilling rigs at Keppel Fels in Singapore.

Keppel Fels, a world leader in the construction of offshore jack-up drilling rigs, semi-submersible platforms and other offshore facilities for the oil and gas industry, ordered a complete package of Wärtsilä generating engines as well as steerable thrusters in August 2005.

The rigs are being built for the Danish company AP Møller-Mærsk A/S and are of the DSS21 design developed by Keppel and Marine Structure Consultants. They will be employed for development drilling in deep water down to a depth of 3000 metres and are intended for all-year-round operation in regions off the coasts of West Africa, Brazil, the Gulf of Mexico and southeast Asia. Delivery of these semi-submersible rigs is scheduled for 2008 and 2009.

Each dynamically-positioned semi-submersible will be equipped with eight Wärtsilä Steerable Thrusters of underwater (de)mountable design. The input power for each unit is 4000 kW at a variable input speed of 0-600 rpm.

To increase thrust in both DP and transit conditions, the thrusters are equipped with Wärtsilä High Efficiency nozzles. To reduce interaction between the thrusters and between thruster and hull, the nozzles are tilted so that the jet produced leaves the thruster at an angle.

A special feature of these steerable thrusters are the quadruple seal arrangements on the

**“LONG EXPERIENCE
COMBINED
WITH IN-HOUSE
EXPERTISE.”**

propeller-shaft seals. These seals are of the Wärtsilä 4BL type and have four viton sealing rings running on a ceramic-coated liner. This multi-barrier seal has two sealing rings facing the water and two seals facing the oil. There is also a special connection for monitoring to allow early detection of any possible seal leakage.

In addition to the thrusters, the DSS21 rigs will be equipped with eight 16-cylinder Wärtsilä 26 generating sets having a combined electrical output of 39,920 kWe.

The reliable partner

Wärtsilä has a long history of supplying steerable thrusters. It also has the in-house hydrodynamic expertise required to make a success of offshore projects. With more than 35 years experience in steerable thrusters, Wärtsilä is the reliable partner in the demanding offshore market. ●

AUTHOR IS GENERAL SALES MANAGER, WÄRTSILÄ IN SINGAPORE