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Thrusters

Underwater Retrofit of Steerable Thrusters

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Underwater Retrofit of Azimuthing Thrusters

The semi-submersible crane vessel Thialf owned by Heerema Marine Contractors recently required more powerful azimuthing thrusters to keep on station in more adverse sea conditions. The retrofit set an interesting challenge as the work had to be completed underwater with the vessel afloat.

When making heavy lifts during the building or refurbishment of offshore oil and gas platforms, the enormous crane vessels employed need to work close to the platforms in areas where there are pipelines and cables on the seabed, or simply in very deep water. In neither situation is it possible to use anchors. Instead, the vessels need to be dynamically positioned (DP) using a number of azimuthing thrusters to manoeuvre or to remain accurately in one fixed position.

The SSCV Thialf, built in 1985, has twin cranes with a combined lifting capacity of 14,200 tonnes. It is the largest in the crane vessel fleet of Heerema Marine Contractors (HMC) and is employed in all types of heavy lifting at offshore projects around the world. Thialf has an overall length of 201.6 m and a breadth of 88.4 m. In operation, it can accommodate hundreds of workers.

Upgrading Thialf underwater

The SSCV Thialf recently needed to be retrofitted with more powerful azimuthing thrusters to keep on station in more adverse sea conditions.
In April 2001 Wärtsilä received the contract from Heerema to design, construct and deliver six retractable azimuthing thrusters, to be installed during the vessel's upgrade. The contract also included supervision during the mounting, installation and commissioning of the thrusters.
The thruster units delivered are type FS3500-671/MNR, with a 3.4 m fixed pitch propeller mounted in a nozzle. Each electrically driven thruster is rated at 5500 kW. They are specially designed to fit into the existing 4.85 m diameter cylindrical wells of the original thrusters.

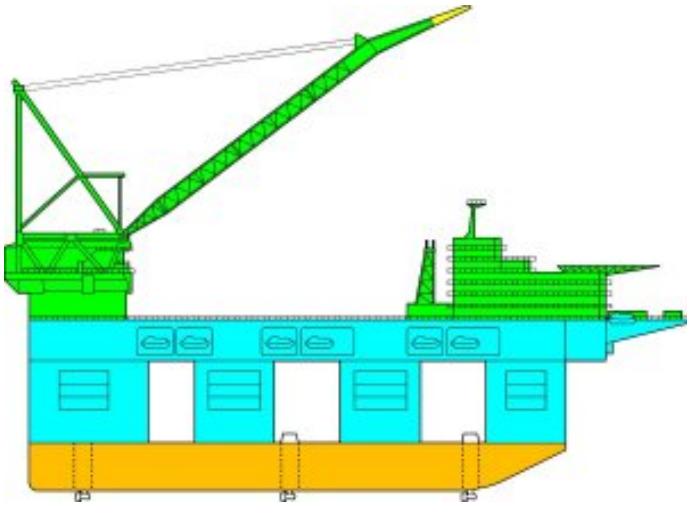

Fig. 1 The thruster units delivered are type FS3500-671/MNR, with a 3.4 m fixed-pitch propeller mounted in a nozzle. Position of the thrusters can be seen from the picture.

The installation of the thrusters was done alongside HMC's quay in Caland Canal, Rozenburg, The Netherlands. The fact that the whole job had to be carried out while the vessel was afloat made the project a special challenge.

For the installation work, two special underwater enclosures or 'habitats' were developed by HMC, complete with ballast facilities, pumps and brackets. These were to provide watertight compartments during final construction of the thruster well and during the mounting and installation of the thrusters. The habitats are handled, mounted and secured by divers.
The smaller habitat allows the mounting of the thruster except for its lower gearbox, propeller and nozzle. This habitat can also be used for the transportation of smaller thruster components.
The other habitat is of greater depth so that it can be used to transport the thruster gearbox, propeller and nozzle, and enable the mounting and installation of all the thruster subassemblies. This larger habitat can also be used for future inspections and overhaul of the thruster underwater assemblies, while afloat.

Fig. 2 The installation of the habitat which contains the thruster gearbox, propeller and nozzle.

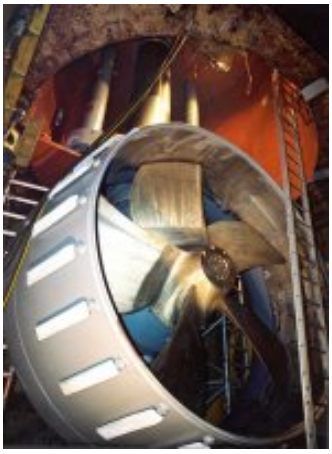

Fig. 3 The mounting of the thruster gearbox, propeller and nozzle seen from inside the large habitat.

Installation step by step
A complete procedure was created for the thrusters' installation work, including step-by-step instructions. A delivery schedule for all six thrusters, in- and out-board subassemblies and auxiliaries was made in compliance with the procedure and work planning.
The main steps in the retrofit procedure were as follows:

1. After the well was emptied, the 'foundation plate' was lowered into position, aligned correctly and then welded to the vessel's structure.
2. The stem section (steering section) including steering gearbox foundation was installed.
3. The retraction spindles and the electric motor (MDM) foundation were mounted.
4. The retraction spindles were aligned, and underwater guides (which transfer the thrust to the vessel) were installed and aligned.

5. The retraction parts and the telescopic drive shaft were installed. Initial start-up of the retraction system.
6. The MDM was installed and mounted, including alignment to the thruster.
7. Some auxiliaries were mounted, and the passage covers to the foundation plate were installed. The unit was ready for removal of the smaller habitat.
8. The other habitat containing the thruster gearbox, propeller and nozzle was put into place.
9. The thruster gearbox, propeller and nozzle were mounted.

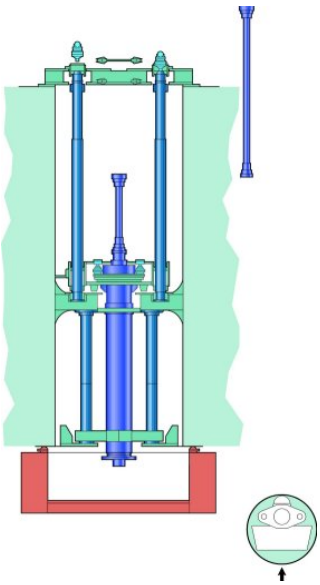

Fig. 4 The retraction parts and the telescopic drive shaft were installed. Initial start-up of the retraction system (Step 5).

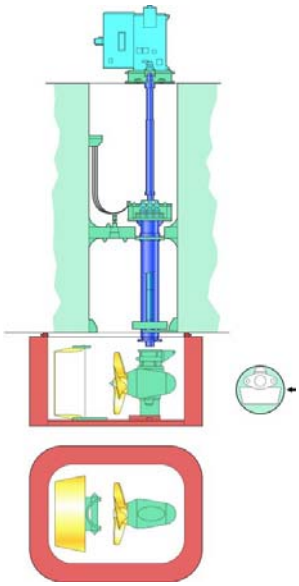

Fig. 5 The habitat containing the thruster gearbox, propeller and nozzle was put into place (Step 8).

After completion of step 9, the thruster unit's alignment and adjustment of the retraction system were finalized and commissioning of the auxiliary systems could start. The same procedure was followed for each of the six thrusters.

The installation process, managed by HMC with installation supervised by Wärtsilä, started in November 2001 and was finished by the end of March 2002. The commissioning of the new thrusters and trials were finished in mid-April 2002.
The complete job can be considered a great success. With a large effort from all parties involved, the delivery and work schedules were met and the Thialf was ready in time to go back to business.

Pioneering semi-submersible crane vessels
Heerema started operations in 1948 constructing oil-drilling platforms on Lake Maracaibo in Venezuela. It was Heerema that pioneered the use of semi-submersible crane vessels in 1978 with the Balder and Hermod, enabling oil companies to drastically reduce the expensive hook-up costs offshore.
Since then Heerema has played a leading role in developing crane vessels with large lifting capacities. Today this business comes under Heerema Marine Contractors, one of Heerema's four autonomous entities that provide a wide range of services to the offshore oil and gas industry. Of the other three, one specializes in engineering and project management of pipelines, and fixed, subsea and floating production facilities. Another focuses on fabricating constructions, while the third provides heavy transportation services.
HMC is established in Leiden, the Netherlands, and Houston, USA. Operating a fleet of crane vessels with lifting capacities of 8,000 to 14,200 tonnes, HMC's strength lies in transporting, installing and removing all types of offshore facilities, including pipelines. Its offshore construction work is mainly focused on development of reserves in deep water (currently up to 3000 m).