
CSV

Deck Space

how to make full use of it

The free deck area on board a wind farm installation vessel is, of course, a finite space which is defined by the length and beam of the vessel when it was built. The area that is accessible to the vessel's cranes installed in the shipyard is also finite, defined by the position of the crane and the vessel's legs, as well as the crane's load chart (lifting capacity in relation to boom length and working radius). But how that space is used is anything but finite. This space is maximised by the ingenuity of the specialist engineers to allow for the ever increasing dimensions of the foundations, transition pieces, towers, nacelles and blades that the wind turbine component manufacturers are producing.

Offshore WIND spoke to Temporary Works Design (TWD) about their work in this field designing sea fastening structures and installation tools. TWD is a Dutch engineering firm specialised in designing structures and tools that help a wide variety of contractors to perform their installation works safely and on time. For almost 10 years their solutions have been used realizing the majority of Europe's offshore wind farms. The design of smart seafastening structures for the ever growing offshore wind market is daily business for them.

Matching the component's size to the strong points of the vessel's deck is actually the main function of designing individual sea fastening constructions. Combining these points with the access limitations becomes an ever bigger challenge for the contractors and the designers. both an artistic science and a scientific art.

Foundations

Starting with the foundations of the wind farms they have seen that each consecutive project taken on by their naval engineering team has been for increasingly heavier monopile foundations. This has recently been 'crowned' by them designing the sea fastenings for Boskalis on the Seajacks Scylla for the largest monopile foundations ever made. The heaviest of these foundations, for the Veja Mate wind farm, is the 1,302.5 tonne monopile, 82.2 metres long with a diameter of 7.8 metres, was it was manufactured by EEW Special Pipe Constructions GmbH in Rostock, and installed earlier this year.

Enabling lifts from deck today is vastly different from how it was done even 10 years ago. The earlier, smaller monopiles were secured by something as simple as a beam with wedges to stop it rolling from side to side. Today they are designing pieces of equipment, cradles, able to be compatible for monopiles of different diameters and lengths, which can be re-used on the same vessel or sister vessel for different projects in the future. For the Gemini wind farm, they were asked to provide cradles for three monopiles with three different diameters, 6.6 metres, 6.8 metres and 7 metres. Each cradle has been designed to make contact with the monopile at an asymmetric triangular interface head which can be rotated on an off centre axis. To make loading more simple, faster and therefore less expensive these interface heads were rotated as the load required.

To lift monopiles as heavy as 1,300 tonnes even the largest WTIV crane has to be in the upright position for maximum lift. Therefore, when upending the monopile that has been loaded in a longitudinal direction, the lower end of the monopile is placed on a SPMT which travels towards the after end of the vessel as the top end is lifted closer to the crane's vertical axis. The cradles are able to swing away allowing a free path of travel for the SPMT. Even using the SPMT to bring the monopile into the vertical position has some negative limitations as deck space has to be left free and unused simply to allow the vehicle to travel when required.

But there are WTIV Operators who have preference for loading the monopiles in a transversal mode which, because half of the monopile is hanging over the vessel's side, leaves a lot more room on the vessel deck for more piles or other material.

Stacking these piles above each other enables contractors to bring even more piles and TPs offshore. However, this solution brings other challenges. Besides increased deck loads, stacking requires the top seafastening structures to be removable to reach the pile on the lower level. By making foldable or rotating cradles TWD managed to come up with an effective solution without introducing new operational difficulties offshore. Another challenge with transverse seafastening is that the crane has to be strong enough with a longer reach. In cases where the crane couldn't reach the farthest monopiles, TWD has applied skidding seafastening structures, which, when required, bring the farthest monopiles within the crane's reach. Other challenges include the overhang on each side of the vessel, when attaching the monopile to the crane at a point hanging overboard can be more difficult.

Floating cranes

At TWD they see a trend towards floating installation, maybe partially thanks to one of their latest developments: the Motion Compensated Pile Gripper. Most conventional jackups are being limited by jacking height, capacity and deck space for the future XXL foundations. Making existing and new floating crane vessels able to install these foundations with the same workability as a conventional jackup will change the market we know today. Their Motion Compensated Pile Gripper increases the workability of these vessels which is otherwise limited by movement caused by sea state. It provides sufficient control and stability for floating cranes with capacities ranging between 1,500 and 4,000 tonnes. These multiple DP vessels will also be able to carry more of the large XXL monopiles than existing jackups, and also work in areas with unsuitable seabed conditions where jacking up is problematic.

Other foundations, jackets, suction buckets and tripods, all create challenges for deck space optimization and crane accessibility which have to be studied carefully and solved in a creative and efficient way.

Towers, nacelles and blades

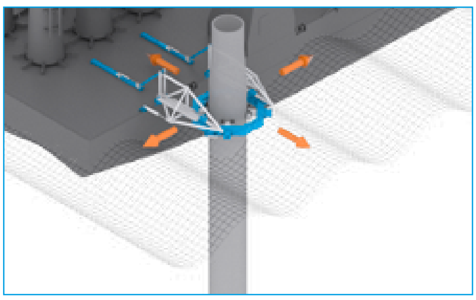
Moving on, the challenges involved with foundations are not the only limitations for matching vessels to work load. The out of water wind farm components all require special attention which is continually changing with increases in the size of the towers, nacelles, and blades. Towers, assembled on-shore with internal fittings, are being carried to the windfarm location in vertical position. The footprint of the deck fastening required to distribute this huge overturning moment is vast and has to be matched to the strong points in the deck without over loading the deck, requiring ever bigger grillages. To avoid the need for creating an entire second deck, it is required to carefully match this frame work to the vessel's strong points to increase the number of towers that can be transported.

Multiple cradles stacked horizontally across the vessel to hold the blades have long been used, allowing the complete range of out of water components to be carried. These allows for as many as eight installation sets with the smaller wind turbines, or four or five sets of the currently largest turbines to be loaded at one time.

Upgrading vessels

For the larger turbines with blade lengths in the range of 80 metres, the hub has to be around 120 metres above sea level. Recently this has led several operators of the larger installation vessels to increase the crane's overall lifting capacity and adding to the length of the boom. Leg extensions to allow for bigger water depths have also been undertaken. As recently announced by Huisman, the Aeolus in the Van Oord fleet will have a new 1,600 tonne crane fitted in 2017 to replace the original 900 tonne crane. These trends mean that sea fastenings and other tools will also have to be upgraded or redesigned. In an attempt to further reduce the costs of offshore wind installations, TWD designed for GeoSea a range of versatile, high-capacity seafastening structures. With all their flexibility, you can almost call these designs machine, instead of static structures. They allow for modifications to be added at a later date for future projects with different dimensions or project requirements.

One thing that is improving is the compatibility between the different manufacturers' components. Although wind farm components of one manufacturer will not all be exactly the same size as those from another, TWD is able to design seafastening construction that can be sufficiently adjusted, as with the foundation cradles, so that will allow flanges, towers, nacelles etc., to fit within one set of seafastenings for each component range. It is certain the size and weight of offshore wind farm components will continue to increase as they become more powerful and efficient, but whether there will ever be overall conformity with lifting and fastening points is doubtful. With all their experience, this company will likely be designing new smart solutions for as long as the offshore wind industry exists, long into the future.



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