

Partnering with Automated Welding Experts Can Bring Winds of Change to Offshore Wind Industry

According to The Global Wind Energy Council, despite COVID-related disruptions, 2020 was the secondhighest year for Offshore Wind installations globally, following a record year in 2019. This underscores the global focus and investment in implementing clean energy policies and technologies. A drive through Europe, especially through Spain, Portugal, England, France, Denmark, and other coastal countries, features numerous offshore wind energy farms. More recently, the coasts of the United States and Canada, are creating a tremendous opportunity for the monopile and floating fabricators who are not afraid to take on new massive projects and invest in solutions to streamline the manufacturing processes.



Monopiles and Floating Foundations of the Near Future

Double XL monopiles are forecast to measure 15 meters in diameter in lengths up to 120 meters, weighing approximately 4,000 tons. Monopiles of this size and gigantic floating foundations are going to be a reality



in the next five years. Floating foundations are capable of being anchored in deep water and conceptualized in several different designs depending on water depth and weather conditions. One of the biggest challenges in enlarging floating foundations is finding the right design and material that can handle those heavy weights and large-diameter Offshore Wind Towers.

When manufacturing monopiles and floating foundations of this size, materials weigh approximately 90 to 120 tons or more per segment. However, steel plates are available in 30- to 42-ton plates at the heaviest worldwide. The challenge then becomes more about how to join two to three smaller plates to create one large plate. According to Christian Beltoft, Director Wind Energy Sales & Development, Pemamek Oy, it takes multiple welding passes to complete this process. Floating foundations are particularly challenging due to the high can and section weights and, in some cases, thin plate material and large diameters that require special expertise and machinery, both of which are offered by that Pemamek Oy.







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"Multiple joints might need to be welded depending on the thickness of the material," explained Beltoft. "An entire plate can measure as long as 47 meters and they are difficult to transport via the road to get to the monopile or platform production site. If you look at the surface welds, consider how many welds you have per section. If you have eight seams in one section and are operating from a four-headed platform, you can perform four welds in one welding operation at the same time using our system. All welding parameters are preset so the operator/welder needs to just to press start and observe that everything is working properly."



By welding with narrow or semi narrow grooves, which is ideal for thicker materials because less material is used than in the traditional V-type welding groove, time savings on the weld are realized. Narrow groove welding is effective for plate joining and welding in general when the plates are thicker than 50mm. The plate can be welded 100 percent from one side or the plate can be flipped over halfway in the process for welding the backside, depending on customer specifications.



Collaboration with Welding System Experts for Optimal Plate Joining and Circular Seam Welding

The PEMA WeldControl 500 software system is used to control automated multi-pass-welding and adaptive filling functions. It processes data acquired via laser scan and generates weld paths based on the data and parameters programmed by welding engineers. Because the operator becomes more of an observer, multiple welds can be performed simultaneously, all controlled from one station with one software. The operator is free to ensure slag is removed and that the surface looks good as the robot goes through the second welding pass and so on.

"We work closely with our customers to secure their production processes and by that I mean ensuring they don't experience any welding mistakes," said Beltoft. "We help them with factory layouts and advise a little bit of a buffer in production planning. We are so secure in the abilities of our WeldControl systems that we can guarantee nearly zero defects if customers follow our instructions and install the systems we recommend." PEMA WeldControl solutions are visual, easy to use and can be tailored for customers' production needs.

"Some companies use semetric x-groove for welding. When you have a welding error in something with an x-groove, you need to grind into the middle of the workpiece to repair it. The repair becomes slower, larger, and takes more time to repair than if the weld was made with asymmetric x-groove. If we look at it on paper it appears fine and more efficient with symmetric x-groove, but if you don't have the right equipment and correct welding groove for the material thickness you are working with, you risk getting a higher level of defects. It becomes theory against practical experience," Beltoft said. With the appropriate groove and surface preparation that Pemamek offers for longitudinal and circular milling, a more efficient and higher quality result can be achieved.

Make More.





Monopiles and towers up to a section weight of 1,000 tons can be produced by using two PEMA rollerbeds. When the size and weight of the monopiles are increased significantly, it takes more than two rollerbeds to support and balance the workpieces during welding. "We recommend a 750- 1,000-ton rollerbed set which is specially designed for the extra heavy lines and circular welding. They feature a hydraulic anti-creep function that prevents axial movement and are equipped with a weight balancing system. Because the rollerbeds will be positioned in the middle of the monopile, those sections are not straight (they are a bit like a banana in shape) and the rollerbeds need to be able to move up and down allowing the weight to align evenly. These intelligent rollerbeds "talk together" to balance the weight when joining and aligning sections



like the top and bottom of the monopile making the welding and fit-up process easy and efficient. Jigs are added to the system, a bit like those in the fit-up stations, for best alignment.



Floating platforms can be made of very thin plates with bigger diameters (depending on design) and must be able to float in the ocean while holding a structure that could weigh around 2,000 tons. The construction contains water for stability and air to keep them above the water. This is where working with an automated welding specialist like Pemamek whose 50 plus years of submarine, shipbuilding, monopile, jacket, pressure vessel, and wind tower manufacturing experience helps customers achieve optimal production processes. Beltoft noted that welding expertise across these various marine, offshore and onshore markets is the result of a more customized approach.

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One approach involves the same welding techniques used in offshore wind jacket foundations to cut and weld the tubes. "The same triangles and struts that are used in these structures are used in floating foundations," said Beltoft. The PEMA Nozzle Welding technology is one of these techniques. Built-in lasers scan the groove geometry in the workpieces, which typically contain large milled grooves with thick plates, and automatically create robotic welding programs that adapt to the varying groove layers by continuously welding the grooves until a solid bond is formed. Any discrepancies between the pre-programmed groove geometry and the actual laser-scanned geometry are adjusted by the PEMA WeldControl 300 software which is a 100 percent robotic solution that helps streamline the communication between the operator and machinery during welding operations.





All functions can be performed by one operator on a one-panel control system on the shop floor. "This robotic nozzle welding solution can shave hours off of the amount of time it would typically take to perform multi-pass welding operations in thick-walled workpieces with irregular grooves," said Michael Bell, Sales Director, North America. "By combining the accuracy of laser scanning and the seamless transfer of the resulting scan data to the WeldControl software to generate a program specific to that application, robots can more quickly and accurately perform the multi-layer welding passes while the operator moves on to the next project."





Exploring Optimal Welding Technologies for a Strong Future

To be on the leading edge of green energy efforts, careful consideration must be made in determining which manufacturing processes will yield the best results. Investing in offshore wind technologies is investing in the future. Collaboration with an automated welding solution partner with 50 years experience in various segments in the marine welding industry like Pemamek can put a company knots ahead.

Read more of welding automation: www.pemamek.com

