

WORLD PIPELINES[®]

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Figure 1. An aerial shot of New Industries facility during the loadout of a pipeline 'jumper,' which is used in deepwater subsea development in the Gulf of Mexico.

BRAVING the elements

PETER PLETCHER, LINCOLN ELECTRIC, USA, WRITES ABOUT MAINTENANCE AND REPAIR OPERATIONS FOR OFFSHORE WELDING INSTRUMENTS.

Industry experts predict that energy consumption will increase by nearly 60% by 2030. Given this projected growth, access to additional undeveloped oil and natural gas resources located beneath the ocean floor has become a major priority for organisations in the market for offshore drilling and production.

The National Petroleum Institute reported that, in the US, approximately 25% of oil and natural gas production comes from offshore fields. This includes more than

4000 platforms currently operating in US waters. Advancements in technology have allowed oil and gas producers to explore deeper waters, including those in the Gulf of Mexico. This, coupled with rising demand, has further increased the number of new rigs and platforms being ordered, and will require the life span of existing operations to be extended.

Offshore drilling rigs and production platforms operate under much more extreme conditions than land-based pipeline and power plant operations. These



Figure 2. At New Industries, a worker is welding the inside longitudinal seam of a 1 1/2 in. thick pressure vessel using Lincoln Electric Power Wave® AC/DC 1000® submerged arc power sources in a two arc configuration.



Figure 3. New Industries' pressure vessels are also used to transport barite, which is utilised during the 'drilling mud' phase of drilling oil and gas wells.

conditions include corrosive sea salt, high winds, rough seas, isolated locations and potential damage from dropped objects as well as contact with vessels.

These elements, in addition to the unpredictable havoc that hurricanes can inflict on rigs and platforms, explain why the oil and gas industry pays diligent attention to the construction and maintenance of offshore operations.

Welding plays a significant and vital role in the construction, maintenance and repair of rigs and production platforms. Welding applications are also found on supply vessels and the equipment supporting offshore operations.

Maintenance and repair operations

More than 130 offshore platforms were destroyed or damaged when Hurricane Gustav roared through the Gulf of Mexico in 2008. That same year, Hurricane Ike, the most damaging storm of the Atlantic Ocean hurricane season, resulted in similar damage when it hit. As a result, 2008 proved to be a difficult year for offshore operations in the Gulf of Mexico.

The uncertainty of the annual hurricane season makes it difficult for maintenance and repair contractors to gauge how much welding equipment to include in their fleets. Therefore, many of them rely heavily on rental equipment during natural disasters when there is a tremendous surge in business.

"Most of these fabricators hold annual contracts with the major oil and gas producers for maintenance and repair of rigs and platforms," explains Mike Lambert, Offshore Sales Manager for Neff Rental, which has more than 20 branches in Texas, Louisiana and Florida serving the Gulf of Mexico market.

"But it doesn't make sense for them to carry the cost of a large quantity of equipment, such as welders, that they may only need during just four or five months out of the year," Lambert says. "During these repair surges, they turn to rental equipment companies to beef up their MRO (maintenance and repair operations) fleets."

According to Lambert, the majority of maintenance and repair work being performed is the manual process of stick welding. This includes maintenance welding work on literally thousands of components, including piping systems, structural components, grating and walkways.

Due to the type and location of the work, the welding machines being used must be durable enough to withstand the extreme conditions of offshore operations. A diesel powered, engine-driven welder – such as Lincoln Electric's SAE-400 Severe Duty or its new replacement, the SAE-500 Severe Duty – is often the ideal choice for these applications, which usually require high-amperage capabilities.

The SAE-400 Severe Duty and SAE-500 Severe Duty were designed specifically for use in the offshore salt air environment and are the industry's preferred machines due to their exceptional arc characteristics produced from a true DC generator with dual continuous output controls. To produce the level of power needed for rugged construction conditions and demanding applications, they feature a 100% duty cycle at 400 amps and a heavy gauge stainless steel case. These particular machines also meet the Mineral Management Services (MMS) code for use on an offshore rig.

Additionally, an industrial diesel engine offers reliable performance and low maintenance and can serve as a generator to run other power tools when needed. This is a key benefit in post-hurricane conditions, and this type of welder can also provide the much-needed flexibility for applications requiring gouging.

A supporting role

Welding is not only relevant to maintenance and repair work on production platforms. In fact, many of the processing systems and equipment used on the platforms and workboats are welded as well. One example is the large-diameter pressure vessels manufactured by New Industries, a Morgan City, Louisiana-based fabricator serving the offshore oil and gas and marine industries.

On a platform, oil, gas, water and other materials must be separated, treated and processed before the energy resource is transported back to land. New Industries' pressure vessels are used extensively as part of the separation process.

The company's pressure vessels are also used during the 'drilling mud' phase of work. This process involves a special drilling fluid used to drill oil and gas wells and requires the use of a hard rock mineral commonly referred to as barite. Barite (barium sulfate) is then mixed with water to help balance out the pressure generated at great water depths during the well drilling process.

Barite is transported out to the platform prior to being mixed with water, and pressure vessels housed on a supply boat are used to transfer the barite to the platform. Therefore, the successful transport of the barite depends on the integrity of the pressure vessels.

"Our pressure vessels must withstand the rigours of the process of pneumatic conveyance, which is used to get the barite onto the ships and then onto the platform," explains Bill New, President of New Industries.

The company uses both submerged arc and flux-cored welding to construct the carbon steel vessels, which measure 12 - 18 ft in diameter.

"Our pressure vessels have very stringent welding requirements due to the contents and the locations where they are used, and the integrity of the welds is imperative," adds New, who uses Lincoln Electric Power Wave® AC/DC 1000®s and Power Wave 455s for his welding applications. "The AC/DC 1000 allowed us to increase weld deposition, which in turn increased our overall productivity. With the offshore industry booming the way it is, we've benefited significantly from our move to the Lincoln Electric equipment."

Deepwater production

Technology in today's oil and gas industry is allowing companies to explore fields in deeper water depths. This increase in water depth exploration and production creates a more hostile work environment, resulting in many obstacles for engineers, project managers and structural fabricators to overcome. A few of these challenges include high pressure equipment operated at lower than normal encountered temperatures than most carbon steels and their associated weld procedure specifications (WPS) have experienced in the past.



Figure 4. A New Industries welder is TIG (GTAW) welding.



Figure 5. Duron Systems has patented a articulating walk-over structure that allows crews to safely gain access to platforms to perform routine inspections of trees and their associated equipment.

Today, oil companies utilise two types of wellheads to manage the production of the sizeable oil and gas fields being found in deeper water. These wellheads are referred to as 'trees' due to the many chokes, wing valves and actuators that extend from the main wellhead, resembling branches from a tree.

There are two types of trees: dry trees are above the surface of the water and are located within the centre of the production platform. Subsea trees are likewise named because of their location on the sea floor.

Wave activity in the ocean, especially in storm-type conditions, requires that the dry trees maintain

independent movement from the production platform and one another.

Houston-based Duron Systems Inc., a fabricator serving the offshore oil and gas market, has designed an independent platform to attach to these dry trees. The company later patented an articulating walk-over structure that allows crews to safely gain access to each dry tree, allowing them to perform the various routine inspections on the trees. Because these systems are often used in demanding and sometimes harsh environments, Duron Systems, in partnership with its customers, has developed very stringent quality and welding procedure specifications.

"Duron is audited regularly by our major customers, and together they agreed upon welding procedure specifications – which factor in everything from base material selection, consumables, part/structure configurations and the consistency of the weld profile itself – in order to guarantee both the quality integrity of our products," explain Phillip Lower and Tom Lower, the two majority partners for Duron Systems.

Conclusion

These are just a few of the examples of the many offshore applications that require welding. As the demand for both oil and natural gas continues to increase across the globe, offshore fabricators and contactors will continue to utilise the latest welding technology and processes to meet the challenging needs of this growing industry. **WP**

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