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ARCLINE[®] PAW: Assisting with the tank storage dilemma

Author Linde

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Tank storage: facing change on every level



Oil refinery storage tanks

According to analysts, the global worldwide oil storage market was valued at USD 3.6 billion in 2019 and is forecast to grow at a rate of over 4.4% between 2020 to 2027. There are several drivers fostering this growth – from rapid expansion of the oil and gas sector globally, owing to increased demand from various industry verticals such as chemical, automotive, and pharmaceutical to the very considerable demand for increased storage capacity due to the COVID-19 pandemic.

The International Energy Agency (IEA) reported that the daily demand for crude oil worldwide grew from 96.2 million barrels in 2016 to around 100.6 million barrels in 2019. Likewise, global natural gas production increased 3.3% in 2019 from the previous year, with 4,088 billion cubic meters generated. Continuously rising energy demand, together with other factors like increasing natural gas production, fluctuating prices of oil, and soaring government expenditure in oil and gas (O&G) projects are positively impacting global oil storage market dynamics.

Growing O&G activities have also contributed significantly to increased demand for water storage systems.

Global oil storage market size tends to be divided into North America, Latin America, Europe, Asia Pacific, and Rest of the world, with Latin America, the Middle East and Africa currently accounting for the majority of the market share, and likely to maintain their positions in the coming years. Increasing oil & gas exploration and production activities, coupled with strong presence of industry vendors are fuelling regional market growth.

Meanwhile, Asia Pacific market is anticipated to demonstrate strong growth during 2020–2027, owing to spike in demand for crude oil and gas, and growing investment in onshore and offshore oil operations across emerging economies like India and China.

The production, storage, refining, and distribution of crude and its derivative products call for a range of different types and sizes of storage tanks. While smaller bolted or welded tanks might be ideal for production fields, larger, welded storage tanks tend to be required for distribution terminals and refineries across the globe, with product, operating conditions and storage capacities influencing the design and manufacturer selection process.

Storage tanks can be fabricated to almost any size and shape, with certain applications requiring horizontal or even spherical designs, with the most common shape being the vertical, cylindrical storage tank. Such tanks can range from around 3 metres (approximately 10 ft) in diameter to over 126 metres (412 ft) in diameter for some of the largest floating-roof tanks ever constructed, with gross capacities ranging from 100 barrels to over 1.5 million barrels for a single storage tank.

Refineries consist of a complex array of storage tanks, other pressure vessels, piping, structural carbon steel, and other components – primarily constructed of carbon steel – that depends on welding for its structural integrity. There are literally miles and miles of welds that go into the makeup of a refinery, and due to the potentially hazardous nature of the products, the welding techniques employed need to guarantee safety, resilience, longevity and cost-effectiveness.

Tank production construction

The type of manufacturing method for a storage tank depends on the size of tank required and will be dependent on the type of product being stored, the location and space available for storage, prevailing weather conditions and environmental considerations.

The earliest storage tanks used by the petroleum industry were constructed from various types of wood and riveted tanks dating back to the early 1900s can still be found around the world, with some surprisingly still in service. However, ongoing maintenance costs and increasingly stringent environmental legislation – with potential penalties for non-compliance – dictate that older riveted tanks be replaced with new, state-of-the-art storage tanks. While bolted tanks are still used – especially for smaller quantities, most large capacity storage tanks are welded.

Welded refinery storage tanks are either “shop welded” or welded on-site – with the size and capacity of the tank determining the method used. Typically, the decision is made by the feasibility and method available of transportation used to transfer the shop-built tank to its final location. Pre-tested for leaks, it is generally ready for use once it arrives on site.



ARCLINE® PAW at work

Unprecedented need for more storage

In the 1980s the world concerned itself with what to do if it ran out of oil. Today, however, we are witnessing an alternative perspective, with a surplus of oil, but not enough storage. Less than a year ago, oil storage briefly became a commodity that was more valuable than oil itself.

The global public health crisis brought on by COVID-19 resulted in industries across the globe essentially shutting down operations, with many governments imposing restrictive measures on the daily lives of billions of people in an effort to slow the spread of the virus.

The pandemic put on hold much of the world's economy, closing factory gates and grounding aircraft, and leaving cars and other vehicles stationary for months at a time. In doing so, it dramatically reduced the need for fuel, leaving the world awash with oil supplies. From a storage perspective, massive storage tanks in places like Rotterdam, Trieste in Italy and the United Arab Emirates quickly filled to capacity.

Oil producers, refiners and traders found themselves turning to more unusual locations to store oil including ships, railcars and unused pipelines as more conventional storage facilities became scarce.

Rising sea storage is usually an indicator of reduced availability of on-shore storage tanks, as it is more expensive and is more technically complex. But in 2020, just off the coasts of Texas and Scotland there were over 80 tankers – each holding up to 80 million gallons – filled with oil. Even salt caverns in Sweden and other Scandinavian countries became full.

As one global oil analyst commented, “there is a chaotic mismatch between the supply and demand for oil is saturating the world's ability to store it all”.

“We are now working on the most oddball storage locations, really tough locations where there are operational constraints,” added Krien van Beek, a broker at ODIN – RVB Tank Storage Solutions in Rotterdam. “The big tanks where you pull a ship in and empty the whole thing, that's all gone. What you have now is pots and pans,” he said.

The economic shocks from the current coronavirus pandemic are likely to last for some time and oil producers cannot simply shut off the tap, meaning that reduced oil demand may continue for some time. Although coronavirus lockdowns are coming to an end, extra storage capacity is likely to continue to be in high demand.



Refinery and its storage tanks

The great crew change

Using a term well recognised within the O&G industry, the “great crew change” refers to the challenge faced by employers to replace those skilled employees that are reaching retirement age. The situation among fabricators is no different. Welding operators of the baby-boom generation are reaching retirement age while fewer people are choosing careers in welding. The American Welding Society (AWS) estimates there will be a shortage of nearly 400,000 welding operators in the industry by 2024.

The shortage is being felt across all sectors of welding – from fabrication and construction to manufacturing. For employers, this can mean missing deadlines or productivity targets, a reduced ability to take on more work, or cost increases in the operation due to added rework and scrap stemming from less-experienced welding operators.

Struggling to find enough welders to fill open jobs is one obvious impact. Another challenge for employers is the lack of experience of new welding operators coming into the trade. Beyond the first step of finding qualified employees, companies then must train them to ensure they’re properly prepared to weld in a manufacturing environment. This training can be a lengthy process and requires investing additional time, money and effort.

Both of these factors impact a company’s ability to remain competitive by completing projects on time while maintaining high quality – as well as their ability to grow and take on more work.

Advancements in technology can help fill this gap. Welding equipment manufacturers are stepping up with a variety of solutions that can help companies address the welding operator shortage.



ARCLINE PAW gives precise robust and stable performance

Reinventing plasma arc welding

Plasma Arc Welding (PAW) is an extremely productive, high-quality welding process, typically deployed for quality-critical applications where reliable outcomes are essential. It is also a popular welding process for exotic materials, such as high-alloyed steels and titanium.

PAW bears many similarities to TIG welding, with both forming an arc of highly ionized gas (plasma) between a pointed tungsten electrode and the workpiece. But in PAW, the electrode is positioned within the body of the torch, which means plasma can then be fed through a nozzle, constricting the arc and forcing the plasma out at a much higher speed and temperature – upwards of 20,000 °C (50,000 °F). The more concentrated arc energy allows you to weld in a single run and without filler metal, giving you faster travel speeds with total and uniform penetration. Perfect for quality-critical applications in the oil and gas industry where reliable outcomes are vital.

However, adoption rates of PAW have remained low because PAW is still often viewed as a complicated, sophisticated technique that requires a high level of skill and experience on the part of the welder. With conventional plasma torches – which haven't changed much since the 1970s – the preparation and assembly is complex, time-consuming and prone to error. The welder has to align and adjust the electrode to a very specific height, grind the electrode, orient the nozzle correctly and ensure the right mixture and flow of gases.

With such complexity, comes a high chance of variation and with that, reduced reliability and repeatability. While highly skilled and specialised welders are capable of reducing the variation in their setup, the problem is, such welders are becoming more and more difficult to find. Consequently, many manufacturers and welding engineers opt for simpler techniques even in cases where PAW would clearly be the better choice.

Linde, a world leader in atmospheric gas technology, has developed a unique and highly advanced torch which lowers the barriers to entry when it comes to PAW – and delivers all the benefits of speed and weld quality but without the drawbacks of complexity at set up. The

ARCLINE® PAW is more than just a re-design of a plasma arc welding torch; it might just be the revival of a dying art.

The fail-safe intuitive design means that the torch can be assembled in just 15 seconds, without the need to adjust electrodes and its one-click bayonet allows for precise attachment of consumables. Its highly efficient cooling action also mean that those consumables last longer and require fewer replacements. The torch gives precise, robust and stable performance for spatter-free welds and improved repeatability, resulting in less re-work. This is particularly important for manufacturers of storage tanks, as bottlenecks at welding stations create the problems of material build-up at one end of the production process, with little happening at the end stage. As well as delivering greater productivity, the novel features combine to bring the advantages of plasma welding to fabricators that are experiencing the loss of more experienced PAW welding operators.

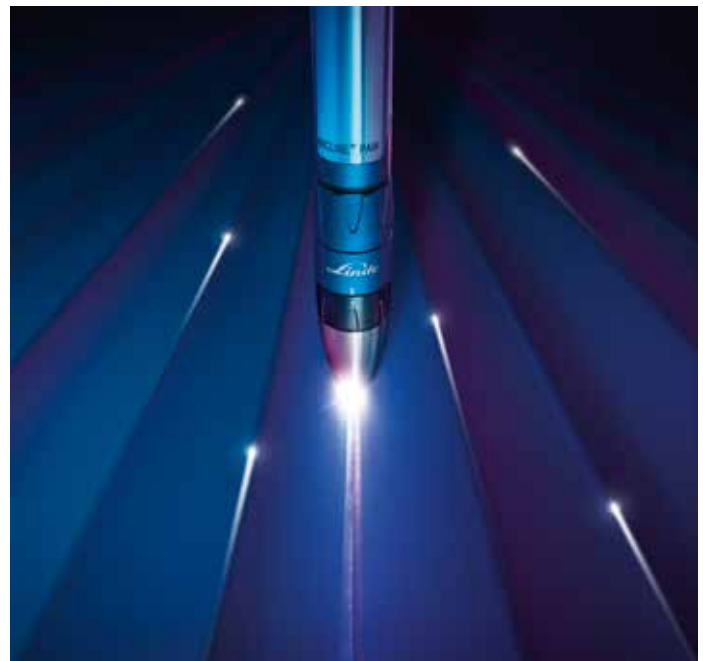


Spatter-free welds and improved repeatability, result in less re-work.

ÖMV: A case in point

In 2019 Swedish process equipment manufacturer, ÖMV, was the first company in the world to benefit from this new, cutting-edge technology. With the company manufacturing advanced process equipment such as reactors, heat exchangers and storage tanks for the refining industry, it well understands the need for superior welding for quality-critical applications. As Ulf Pehrson, Technical Manager at ÖMV explained, “There’s no room for error in our welding process,” adding that the company has used plasma welding for many years, as it is the most reliable welding method for challenging applications. Nevertheless ÖMV was looking for a better method for welding titanium, which had been causing the torch heads on their old plasma welders to overheat, resulting in the welding operator having to switch nozzles and adjust the settings for every new weld.

Of Linde’s ARCLINE PAW torch, Roger Andersson, a welding operator at ÖMV says “This new welder is far more durable, even with daily use. The nozzles on our old plasma welders rarely survived more than a few days, whereas an ARCLINE PAW nozzle can last up to two months and it never overheats.” He continued, “When I do have to replace it, it’s so easy – like changing a light bulb. Ulf Pehrson concluded “We save time and money, because we don’t have to buy so many parts or waste time replacing them.”



ARCLINE PAW: Simply plasma welding

Conclusion and References

Conclusion

The global oil storage market has been facing a catch-22 – the urgent requirement for increased storage capacity, but a dwindling skilled workforce able to manufacture the storage tanks needed. But as in so many cases of manufacturing dilemmas, it is technology innovation that will lead the way out.

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Getting ahead through innovation

With its innovative concepts, Linde is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde offers more. We create added value, clearly discernible competitive advantages, and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardized as well as customized solutions. This applies to all industries and all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimization, and enhanced productivity are part of daily business. However, we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

Linde – ideas become solutions.

Linde GmbH
Gases Division, Carl-von-Linde-Strasse 25, 85716 Unterschleissheim, Germany
Phone +49 89 31001-0, www.linde-gas.com/arcline

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