

Pipe Producer Pushes the Quality Envelope While Slashing Energy Use



A Tata Steel operator confirms the correct lead to trail arc distance.

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As one of the world's premier pipe producers, Tata Steel's LSAW Pipe Mill in Hartlepool, U.K., can produce up to 330,000 metric tons of pipe per year. The mill recently replaced more than 50 of its traditional transformer/rectifiers on five production lines with energy-efficient inverters from the Lincoln Electric Company, integrated through Uhrhan & Schwill GmbH, a Lincoln Electric Company. Uhrhan & Schwill's Z5 digital control system further enhanced Tata's emphasis on quality as the upgrade enabled rigorous traceability of all pipe welding variables.

The integration of the UOE LSAW pipe mill's new welding power sources also facilitates quick and repeatable setups and is maintaining weld repair rates at industry-leading levels. At a time when pipe manufacturers are facing pressures to reduce energy consumption, both to save money and for environmental sustainability, the upgrade has cut the mill's electricity demand for welding by nearly a third.



A Tata associate visually inspects the inner diameter of the pipe.

A Business Decision

Although the potential for energy savings was a significant factor in Tata Steel's decision to upgrade, the prospect for improved quality and quality assurance was the primary draw.

"We need to stay at the forefront of welding technology and meet the increasingly onerous demands of the oil and gas sector," says Andy Hill, Tata Steel Works Manager-SAW mills. "This [upgrade] allows reduction of total cost of ownership, and ultimately risk, by supplying a fully compliant product. The SAW mill's focus on continual improvement is embedded, providing the ability to innovate our products and processes to deliver sustainable solutions, which meet the industry aspirations."

The UOE LSAW pipe mill for years has used Uhrhan & Schwill's multiple-arc SAW solutions to make both the inside and outside longitudinal welds. Tata has the capacity to run up to six arcs for its outside welds, while it can utilize up to five arcs on the inside welds. The number of active, hot, or twin arcs or even utilizing cold wires depends on the particular pipe being produced and numerous other production and pipe requirements. One weld may use up to 6,000 amperes output, which creates a significant input draw.

Tata Steel began by upgrading a single production line. It then ran further production evaluations on an additional line for several months before moving ahead with upgrades on the final three additional lines. The five upgraded lines produce API 5L pipe from 16 to 42 inches (406.4mm to 1066.8 mm) in diameter from plate that is 0.3 to 2 inches (7.9 mm to 50.8 mm) thick and up to X80 grade. Other lines in the mill produce up to 84-inch (2133.6 mm) pipe.

Upgrading from Lincoln's traditional Idealarc® power sources to the Power Wave® 1000 AC/DC SD inverters combined with Uhrhan & Schwill's Z5 digital welding system control created a game-changing SAW welding solution. The Z5 control system controls and monitors the entire welding process on the production line. Operators set and record all welding parameters through the Z5 system. In addition, it provides control for all system components, including welding heads, boom, power sources, flux supply system, grounding brushes, carriages, seam tracking and slides.

"The Power Wave 1000 AC/DC SD is the only proven inverter used in multiple-arc SAW applications," says Elmar Schwill, chief engineer at Uhrhan & Schwill. "Combining it with our Z5 gives Tata the ultimate flexibility, enabling it to produce at the highest output rates with exceptional prime rates (prime pipe is pipe produced with zero indications – meaning it meets all quality requirements in line). Tata has always been at the forefront of pipe production expertise, and this upgrade reinforces this position."



Preparing to perform another multi-arc weld.



The Power Wave® AC/DC 1000 SD advanced process welding power source produces software-driven AC, DC positive or DC negative output, allowing Tata to control the deposition rate and penetration. The result over conventional power sources is increased weld speeds, consistently higher quality welds and improved efficiencies in a single or multi-arc environment.

For proactive quality assurance during welding, the Z5 system continuously records all welding parameters, including travel speed, welding currents, voltages, wire-feed speeds and wire-feed motor torques. The system automatically generates pipe reports for each weld produced. These contain all mechanical, electrical and welding setup parameters for the entire welding process. If any deviation from tolerances is detected, the Z5 system notes the corresponding pipe position, making it easy to locate potential indications.

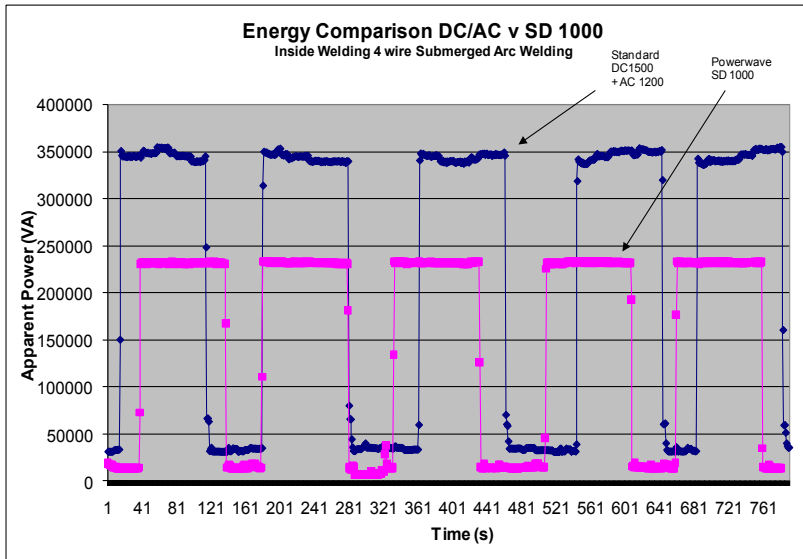
Tata Steel welding engineer Karl Nicholson says upgrading the power sources and control system is a key part of the mill's focus on continual improvement and sustainability. "We have seen significant improvements in our welding quality performance since we launched our welding excellence program in 2011, with an incremental sustainable approach to all activities," Nicholson says. "Part of this program has been the upgrade to PW1000SD and Z5 control systems."

Nicholson further notes that Tata Steel demonstrated its world-leading welding performance on its recent Gulf of Mexico project, where it achieved ID and OD repair rates of 0.19 percent and 0.32 percent, respectively, in producing almost 124 miles (200 km) of 18 inch by 1.125 inch (457mm by 28.6mm) pipe.

The Power Wave AC/DC 1000 power sources also include Lincoln's Waveform Control Technology®. This affords Tata the ability to manipulate the shape of the weld bead without changing any of the critical variables, for example, tuning the weld bead to the particular details of a given production run. Because all parametric data is recorded and stored, it's easy to replicate the same finely tuned settings the next time the same type of pipe goes into production.



(1) A view of the Tata outer diameter welding operations.
 (2) The entire process is monitored from a centralized control room.



Relative energy consumption levels comparing the traditional equipment and new Power Wave 1000 AC/DC SD inverters. Energy use comparison courtesy of Tata Steel.

Checking the Energy Savings

With its first Z5 system in place, Tata began collecting production welding data for careful analysis and comparison. It came as no surprise to find that energy use while welding was significantly reduced – generally by about a third. But, energy consumption also was reduced when the arc was not on and the power source was simply idling.

The accompanying graph shows a plot of real-time energy use data collected during the early trial operation of the Z5 installation. The upper lines, rendered in blue and hovering around 350 kW, show the power draw of the traditional power sources during welding. The pink segments, indicating a stable power draw somewhat less than 250 kW, show the operation of the Power Wave 1000 SD, also during welding.

The lower segments below the 50 kW line show the ongoing power draw as the power sources idle between welds. Even when in standby mode, energy is clearly being saved.

Some of the energy savings can be attributed simply to changing to inverter technology, which is inherently more energy-efficient than traditional equipment. But, a larger portion of the savings results from better control, namely the Z5 system, which constantly communicates with each of the power sources.

Standardization, Another Benefit

When welding the longitudinal seam on a pipe, the first arc is typically DC while the subsequent arcs are phased AC. Prior to upgrading, Tata Steel's traditional pipe welding line using older equipment required two different machines to achieve this configuration. Switching to Lincoln's Power Wave 1000 AC/DC SD power sources, which can run both AC and DC, means only one machine is required. Besides simplifying the physical setup, the switch also eliminated the need to stock two different machines and repair parts. It also simplified the knowledge base needed by maintenance and repair crews.

All in all, Tata Steel's Hartlepool Pipe Mill has accrued numerous benefits as a result of upgrading to Power Wave 1000 AC/DC SD power sources and Uhrhan & Schwill GmbH's Z5 digital welding system control. Its customers also benefit over the long term from the mill's improved productivity and heightened levels of quality assurance. Finally, its ability to operate more sustainably, producing more pipe using less energy, is a universal benefit to us all.