

SUCCESS

**LINCOLN**  
**ELECTRIC**  
THE WELDING EXPERTS®

## 35% Reduction in Welding Costs

### Ward Tank & Heat Exchanger Corporation of Charlotte, North Carolina

Ward Tank & Heat Exchanger Corporation, with operations in North Carolina and Houston, Texas, specializes in the custom design, engineering and fabrication of stainless steel, nickel alloy and carbon steel process equipment for the chemical processing and related industries.

#### - CHALLENGE -

Increase productivity without sacrificing quality. Its products are all tested to meet American Society of Mechanical Engineers Section VIII standards.

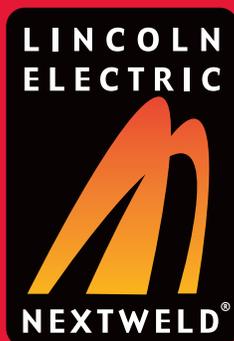
#### - SOLUTION -

- The Lincoln Electric Company's Power Wave® AC/DC 1000™ power source with Waveform Control Technology® for submerged arc welding.
- Blue Max® 316L submerged arc wire and Blue Max® 2000 flux.

#### - RESULTS -

Ward Tank & Heat Exchanger used the Power Wave® AC/DC 1000™ to increase weld deposition rates and penetration, reduce joint prep time and virtually eliminate the need for beveling.

- **35% reduction in welding costs.**



Like many large fabricators today, Ward Tank and Heat Exchanger Corp. has struggled to attract qualified welding operators to fabricate one of the company's principle products, large pressure vessels. Adding to the challenge, the Charlotte, N.C., company maintains some of the industry's highest quality standards for customers such as Dow Chemical, DuPont and BASF.

The vessels are used to contain various chemicals, solvents and raw materials, many of which require tightly regulated procedures for safety, handling and proper storage. Because of this, the company adheres to The American Society of Mechanical Engineers (ASME) Section VIII code, which dictates

specific guidelines and procedures for the design and fabrication of pressure vessels for chemical use.

Ward performs a radiographic inspection on all of its welds, and metals are redundantly tested with a nuclear analyzer. Defects are not accepted, structurally or aesthetically. This exceptionally high quality standard led Ward to rely on veteran welders who average some 15 years in the industry.

But even entry-level welders have been hard to find, and with a growing demand from customers, something needed to change. Ward needed to significantly increase productivity without the help of a larger workforce.

The future of welding is here.®

# 35% Reduction in Welding Costs

## Ward Tank & Heat Exchanger Corporation of Charlotte, North Carolina

Robotic welding automation, however, was not an option because pressure vessels as large as 75 tons and 120 feet long were simply too large to be welded in a typical robotic cell. Nonetheless, increased customer demand had driven Ward's operations into a larger Charlotte plant as well as a second facility in Houston. The company's production space now totaled more than 60,000 square feet. Demand continued to rise and a change needed to be made.

### Analyzing the Process

For many of the company's large pressure vessels, the projects begin with flat plate stainless steel that is square cut at the edges and then placed on an 11-by-40 foot burn table and plasma cut to CAD specifications. For material thicker than 3/8 inch, the edges are first beveled and then the steel is plate rolled into a cylinder.

Inside the cylinder, at the longitudinal seam, workers MIG weld the beveled joint. Outside of the cylinder, they then gouge the same butt weld, usually on one pass, down to the filler metal previously deposited on the opposite side. They then MIG weld the outside seam and make subsequent weld passes as needed. The initial outside gouging helps welders ensure 100 percent penetration.

The semi-automatic MIG work required constant concentration and a steady touch. Because of the high standards, any imperfections were reworked, and less qualified welders slowed production. The process demanded experienced welders

who could be effective enough to meet the rigorous quality standards, while also being productive.

Because of this, finding a way to increase productivity in the wake of increased demand became a challenge. Submerged arc welding was one option, especially for the type of work performed, but submerged arc has limitations.

Traditionally, submerged arc set-ups allowed operators to weld in set modes that favored only shallow penetration with high deposition, or deep penetration with low

---

**"It's amazing the amount of metal we are able to deposit into these joints now," Besh said. "Nothing compares to it."**

---

deposition. Optimizing the two was difficult and fine-tuning was often nearly impossible.

### A New Solution

The Lincoln Electric Company recently released its Power Wave® AC/DC 1000™, an inverter-based, software-driven submerged arc power source capable of producing 1000 amps. Unlike its predecessors, the built-in software allows users infinite controllability between penetration and deposition for each weld.

As one of the first major fabricators to put the new Power Wave® AC/DC 1000™ to work, Ward was a perfect fit. Their operations often required rapid switching between

favored deposition and favored penetration, moving from the inside diameter welds to the outside diameter welds.

And, while every job is different, welders can zero in on the precise settings for each project. The system allows Ward to adjust polarity between DC+ and DC-, allowing variable penetration or deposition rates depending on each specific application.

The choice was obvious. Ward soon incorporated the power source into an automatic setup using a Pandjiris manipulator. The manipulator was specifically designed for long continuous welding, such as joining both sides of the longitudinal cylinder seams of Ward's pressure vessels – similar to large pipe welding.

### The Results

During the inside weld in the beveled joint, the welding power source is set for high deposition. On the outside – where workers previously gouged to achieve 100% penetration from both sides – the settings now are adjusted for high penetration, often eliminating the need to gouge altogether.

"This really saves us a lot of time by often not having to gouge the outside," said Plant Manager Bob Besh. "On the inside pass, we shift the waveform to a high DC- setting for massive deposition. Then, we look to the DC+ side for great penetration on the outside."

Besh noted that while penetration rates have increased three to five times more than semi-automatic MIG welding, temperatures have

# 35% Reduction in Welding Costs

## Ward Tank & Heat Exchanger Corporation of Charlotte, North Carolina

not, helping to prevent distortion with stainless steel.

He said the deposition rates have increased 10 to 25 times more than semi-automatic MIG, greatly reducing the number of passes needed. With this, the total cost to weld, he added, has been reduced 20 to 25 percent.

“It’s amazing the amount of metal we are able to deposit into these joints now,” Besh said. “Nothing compares to it.”

Ward uses materials that include a variety of stainless steel, both solid and clad; nickel alloy; duplex stainless; Hastelloy and carbon steels – many of which range in thickness from 1/4 inch to 2 3/4 inches.

The company uses 1/16- and 3/32-inch diameter Lincoln Blue Max<sup>®</sup> wire, and averages at least one size larger for the corresponding metal thickness compared to the company’s previous operation.

The ability to increase deposition on the inner diameter welds allows operators to use heavier wire, which provides greater weld forgiveness. In some cases, it even eliminates the need to bevel the work at all, Besh said.

In fact, any metal thinner than 3/8 inch is no longer beveled. The new control over penetration abilities allows a deeper and more precise weld without blow through. And, for thicker materials, the time required for bevel preparation has been reduced. Previously, most beveled material had been ground down to a sharp angle of about 20 to 30 degrees on each side. Now,

the bevels are made at just a 45-degree angle, substantially reducing prep time.

Other productivity savings have been captured by eliminating post-weld clean up operations. For example: cleaning MIG welding spatter from the plate required significant man hours. And, while the company accepts no defects, the percentage of welds requiring rework has substantially decreased.

The improved quality is due in part to the Power Wave’s<sup>®</sup> Waveform Control Technology<sup>®</sup>, which gives

---

**“We’ve been very pleased with this new process,” Besh said. “It’s hard to look back and imagine where we’d be had we not switched.”**

---

users the ability to adjust waveform outputs. It offers the ability to choose a weld program from a predefined set of programs and manipulate the parameters of each program to best fit particular applications. Waveform Control Technology<sup>®</sup> is a Nextweld<sup>®</sup> innovation – one several technologies developed by Lincoln Electric.

For Besh, “dialing in the frequency” helps stabilize the arc. The amplitude and duration of positive and negative cycles are independently adjustable for controlling bead shape and heat input. This helps maintain consistent welds and to minimize distortion and expansion issues associated with stainless steel.

While the machine also makes synergic adjustments during the weld, a variety of operating modes can be used to further increase deposition or travel speeds, depending on need.

### Lessening Dependence on Labor

Now, with substantially increased productivity, more junior-level workers monitor the submerged arc process 24 hours a day. The process has yielded overall higher-quality welds, while veteran welders set the Power Wave<sup>®</sup> parameters for the appropriate arc waveform.

They then can continue work on other specialized projects that require skilled handheld MIG welding, such as installing the vessel footings, fittings and other custom parts not practically welded on the manipulator. The change has lessened the company’s need to bring on experienced welders, while allowing production to grow, Besh said.

“We’ve been very pleased with this new process,” he said. “It’s hard to look back and imagine where we’d be had we not switched. And, training on this new system took one day, compared to three to six days on the old system.”

# 35% Reduction in Welding Costs

Ward Tank & Heat Exchanger Corporation of Charlotte, North Carolina

## Featured Lincoln® Products



### Power Wave® AC/DC 1000™

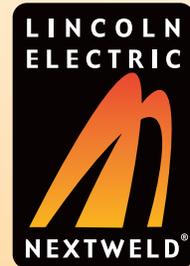
The Power Wave® AC/DC 1000™ is the first power source to introduce Waveform Control Technology® to submerged arc welding. Variable frequency and amplitude AC, DC positive or DC negative output allows the user to control the deposition rate and penetration. An operator can increase weld speeds, yield higher quality welds and improve efficiencies in a single or multi-arc environment. The phase angle and frequency of different machines can also be synchronized to balance the interactions between multiple arcs and minimize arc blow. Depending on the output, a welding arc may be driven by a single machine or multiple machines in parallel for applications that require more than 1000 amps of continuous operation.

Order K2344-1

### WHAT IS NEXTWELD®?

The challenges facing industrial fabricators today are growing in number and complexity. Rising labor, material and energy costs, intense domestic and global competition, a dwindling pool of skilled workers, more stringent and specific quality demands all contribute to a more difficult welding environment today.

Through our commitment to extensive research and investments in product development, Lincoln Electric® has established an industry benchmark for



applying technology to improve the quality, lower the cost and enhance the performance of arc welding processes. Advancements in power electronics, digital communications and Waveform Control Technology® are the foundation for many of the improvements.

NEXTWELD® brings you a series of Process, Technology, Application and Success Story documents like this one. NEXTWELD® explains how technologies, products, processes and applications are linked together to answer the important questions that all businesses face:

- How can we work faster, smarter, more efficiently?
- How can we get equipment and people to perform in ways they've never had to before?
- How do we stay competitive?

NEXTWELD® is the future of welding but its benefits are available to you today. Ask your Lincoln Electric® representative how to improve the flexibility, efficiency and quality of your welding operations to reduce your cost of fabrication.

**LINCOLN**  
**ELECTRIC**  
THE WELDING EXPERTS®

THE LINCOLN ELECTRIC COMPANY®  
www.lincolnelectric.com  
1.216.481.8100