Crown Equipment manufactures electric lift trucks used to transport materials and goods in warehouses, distribution centers and manufacturing facilities worldwide. Nearly 92 percent of the truck parts are made on site, requiring more than 1,500 parts to be manually welded.

**- Challenge -**

- 1,500 individual parts per lift truck had to be welded in one of only nine welding stations.
- Increased downtime associated with changing welding procedures and fixtures for each part.
- Manual MIG and stick welding processes resulted in inconsistency and variable weld quality.

**- Solution -**

- Lincoln Electric System 30 Robotic Cell
- Lincoln Electric System 30HS Robotic Cell
- Lincoln Electric Power Wave® 455M
- Lincoln Electric SuperArc® L-56

**- Results -**

- 80% decrease in lift truck production time.
- More consistent welds of a higher quality—passing destructive testing after each run.
- Reduction in welding stations enabled the addition of a new production line and increased manufacturing capacity without adding more employees.
- Robotic programs made operator’s job easy with the simple entry of a code, placing the raw material in the fixture, and pressing start.

Crown Equipment manufactures almost all lift truck parts within the company and small production runs of less than twenty parts are common.

Many fabricators are discovering the benefits of robotic welding in areas they never before suspected.

While robotics was once considered a means exclusively for mass production, companies such as Crown Equipment Corp. have dispelled that myth and continue to find substantial gains welding as few as one unit for a variety of separate parts using automation.

Crown manufactures electric lift trucks worldwide as high as 45 feet to assist in a variety of material handling and manufacturing applications. The company’s trucks are used to transport materials and goods in warehouses, distribution centers and manufacturing facilities.

In a unique production model, the company produces nearly 85 percent of all its truck parts within the company. Each part is often made in small quantities – as few as one to twenty at a time, to meet real-time demand on the assembly line.

For years, however, the Greencastle, Indiana location had manually welded more than 1,500 miscellaneous parts in nine welding stations using MIG processes, along with the welding of the frame of four different models of lift trucks. Five years ago the company began reevaluating that strategy.

Crown Chooses Lincoln Electric

A Crown manufacturing engineering team began looking into automation. The first step was to ask for an automation survey of Crown, its parts and its processes by a team composed of Crown personnel and experts from the welding and robotic industry. As a result, Crown invited FANUC Robotics, The Lincoln Electric Company and several other automation and welding companies to review their operations.
The invited companies performed a two-day review of Crown’s complete welding operations and procedures, both manual and robotic. They discovered hundreds of parts could in fact be welded better, faster and more consistently with robots, despite the small unit quantities. Moreover, the data showed Crown that the investment would pay for itself in a matter of months.

Lincoln Electric tested its assessment in its Cleveland headquarter laboratories and presented Crown with the final results. Crown engineers took those findings to its senior management team and purchased the first of three FANUC Robotics robots and Lincoln Electric welding cells, with Lincoln Electric Power Wave® 455M power sources and SuperArc® L-56 MIG wire.

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The Welding and Material Handling Process
But the changes didn’t stop there. Crown engineers, using a universal mounting and fixture plate system, started building dozens of robotic welding fixtures for the new welding cells. They were all built on common fixture plates that matched up with the locating pins on the frames and tables in the robotic weld cells for easy installation and removal. This allowed every welding fixture the ability to be quickly changed in and out as needed or moved from one robotic weld cell to the other.

As soon as a new fixture is installed into the welding cell, an operator calls up the stored programming code for the part to be welded by entering a three digit code using a thumbwheel switch on the operator panel of the robotic weld cell. This automatically loads the stored program into the robot’s teach pendant that corresponds to that specific fixture.

FANUC Robotics robots and Lincoln Electric power sources interface with each other so that operators need only enter one code into the robot. This stored code retrieves all the previously programmed instructions for both the robot and power source for each part, including travel path, travel speed and arc characteristics, such as constant voltage or Pulse-on-Pulse®.

The programs can even be designed to change arc characteristics within a single program. For instance, the robot and power source can instantly switch to Pulse-on-Pulse® process when the arm shifts to a vertical weld. When the arm swings back to a horizontal weld, the power source can instantly change back to constant voltage.

This is one reason that despite the small unit production, robotic welding has helped Crown’s overall process.

Crown reports dramatic improvement in productivity – by a factor of at least three or four. Welds are more consistent and are overall better in quality. Crown performs destructive testing on the first run of each part and periodically thereafter, and the improved quality is clear.

Utilizing robotics has allowed Crown to increase productivity by a factor of 3 to 4.
The survey begins when robotic welding specialists audit operations and first identify immediate opportunities for cost savings and productivity gains. If automation is seen as a viable option, Lincoln Electric can actually simulate a specific automated welding process in its Cleveland laboratories and determine realistic costs savings in each case.

"Customers really appreciate seeing their parts welded first-hand. It allows production personnel to see how a proposed welding process performs with actual travel speeds and cycle times – and how forgiving a process might be for expected gaps, fixture tolerance, or if improvement in component part fit-up is needed to make the application a successful one," said Geoff Lipnevicius, Automation Engineering/Development Manager for Lincoln Electric. "This gives companies a sense of expected productivity gains in an effort to avoid any surprises after the purchase. It also allows the finance committee, prior to the commitment of an investment, to make an informed decision with real data to insert into payback or return on investment (ROI) calculations."

Crown’s first robotic welding cell, a Lincoln Electric System 30, paid for itself in just four months. The second cell, a Lincoln Electric System 30HS, paid for itself in nine months. Crown engineers built dozens of robotic welding fixtures for the new welding cells allowing numerous part manufacturing capability with each robot.

Robotic welds tackle a variety of Crown’s work on carbon steel in thicknesses ranging from 16 gauge to ¾ inch. Crown uses Lincoln Electric SuperArc® L-56 wire in .035 and .045 diameters. Raw plate steel first enters the plant, where it is laser cut, formed, machined and, in many cases, welded into the final part. From there, it is painted and sent to assembly for final installment.

Parts production had been slower before automation, but organizing the entire process accomplished several improvements. Crown first organized the production process overall, as well as precise procedures for each part. It reduced the space of the welding area, organized the fixtures for easy retrieval and dramatically increased product flow to assembly.

Return on Investment

The average welding time of each part dropped from five to ten minutes down to two to three minutes. The Lincoln Electric robotic cells are a System 30, a System 30HS and a System 50HP. All are dual station cells, which allow the robotic arms to alternate between two work areas.

As work is replaced on one side, the robot welds on the other, and vice-versa. The operator simply replaces finished product with the component parts to be welded next. In doing so, the robot is always kept in motion resulting in total time savings of nearly 80 percent.

This newfound productivity has allowed Crown to begin new production in the Indiana facility without a significant impact on employment.

"We have not had a single equipment failure with any of these products. We are very pleased with all the results."

"Lincoln Electric and Fanuc Robotics really helped us realize this change, and it was their experience finding these kinds of opportunities and making them work, along with the equipment design and integration, that ultimately resulted in Crown choosing Lincoln Electric and FANUC," said David Besser, Crown Senior Vice President – Manufacturing. "And quite frankly we have not had a single equipment failure with any of these products. We are very pleased with all the results."

"The future of welding is here."
WHAT IS ROBOTIC WELDING?

World-class welding and automation expertise. Single-source efficiency
Lincoln Electric’s strategic alliance with FANUC Robotics North America translates to an unparalleled combination of welding and robotics expertise, plus single-source efficiency for our customers.

Local support – no matter where “local” is for your company
Lincoln’s global network of more than 300 sales engineers means fast, sure support for your robotic welding needs. No matter where your welding operations are today, no matter where they’ll be tomorrow, Lincoln is there for you.

Custom integrated or pre-engineered solutions
The ideal robotic welding solutions for your company may come from our menu of pre-engineered configurations. Or, they may require the development of custom cells, designed specifically around your needs. In either case, Lincoln’s welding automation experts will guide you through the processes efficiently – from decision-making to installation to training and start-up.

Computer simulation
Lincoln’s computer simulation systems allow you to explore options before you make crucial hardware and software decisions. Using your drawings or CAD files, the Lincoln team builds a computer model of your part, and creates a 3D animation of your proposed automated production process for comprehensive on-screen analysis.

Rebuild & Repair
Lincoln’s experts can also help repurpose or upgrade your company’s older robotic systems, thus helping you convert unproductive machines into profit-enhancing assets.

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