

Free Robotic Assessments Can Quickly Determine Company's Return on Investment

Robotic Welding Increases Productivity In Unlikely Applications

Crown Equipment Corp. Greencastle, IN

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 -

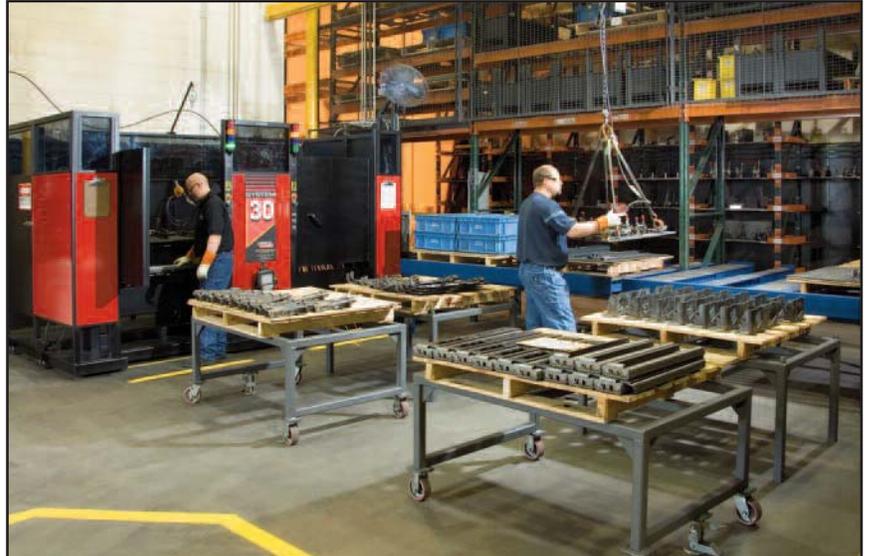
- 1,500 individual parts per lift truck had to be welded in one of only nine welding stations.
- Increased downtime associated with changing welding procedures and fixtures for each part.
- Manual MIG and stick welding processes resulted in inconsistency and variable weld quality.

- 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.

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They discovered hundreds of parts could in fact be welded better, faster and more consistently with robots, despite the small unit quantities.

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.

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.

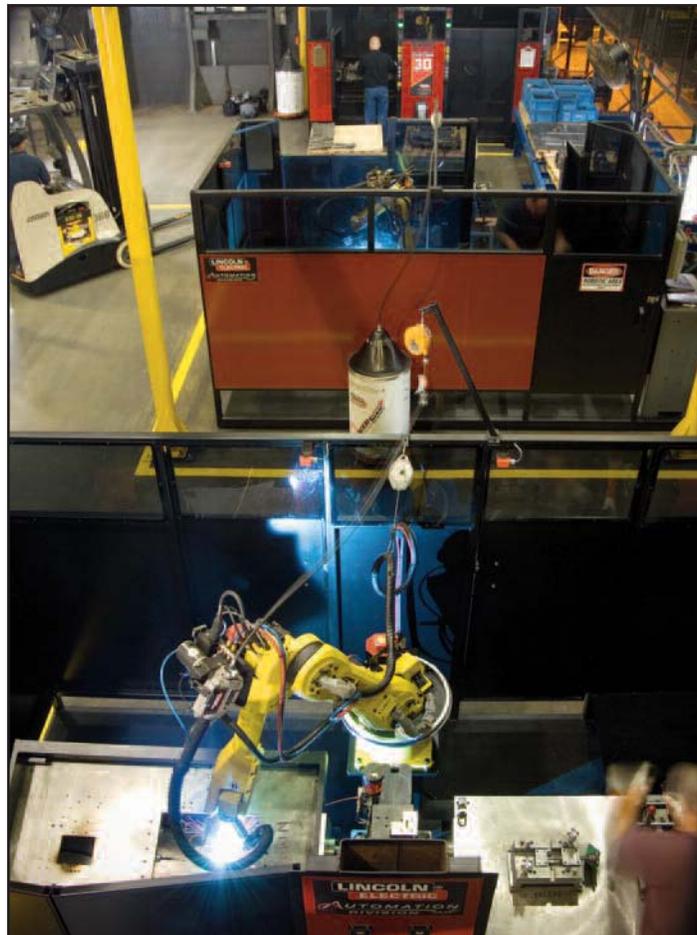
This is one reason that despite the small unit production, robotic welding has helped Crown's overall process.

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.

Quantifying Productivity

According to Crown, the robot's speed outperforms manual welding so well that it overcomes any downtime associated with automation, even when producing a single unit. The new fixtures have been designed to eliminate the need for tack welding previously used in their manual operations, providing additional time savings.

Companies such as Lincoln Electric and FANUC Robotics routinely perform free welding evaluations for companies to determine a variety of needs. The process can increase productivity and in some cases, even improve the quality of the finished product without spending a dime.



Utilizing robotics has allowed Crown to increase productivity by a factor of 3 to 4.

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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.

The 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.

“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. Both of these successes resulted in the company looking to add more automation, and a Lincoln Electric System 50HP has recently been purchased and installed. The automation survey provided Crown with a sense of due diligence and an independent assessment, which its engineers could provide to senior management to support their own estimates.

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



Crown engineers built dozens of robotic welding fixtures for the new welding cells allowing numerous part manufacturing capability with each robot.

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.” ■

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Featured Lincoln Products



System 30

The Lincoln Electric System 30 is a pre-engineered turntable robotic welding system that features the latest equipment and welding process technologies from Lincoln Electric.

- Power Wave® i400 Power Source – high-speed, multi-process robotic welding power source
- AutoDrive® 4R90 Wire Feeder – 4-roll gear-driven system
- FANUC ARC Mate® 100iC – universal process robotic arm featuring the industry's fastest air-cut movements



Power Wave® 455M Robotic

The Power Wave® 455M Robotic is a high performance, digitally controlled inverter power source designed for robotic, hard automation and semiautomatic applications. It is designed to be part of a modular, multi-process welding system that can be arranged in a variety of ways for optimum, customized performance and easy maintenance. Optional DeviceNet™ and Ethernet communication modules provide networking capabilities and allow the power sources to communicate with other industrial machines to create a highly integrated and flexible welding cell.

SuperArc® L-56

Lincoln's premium copper coated MIG wire, SuperArc® L-56 is an excellent choice for welding on metals with a medium to high presence of millscale. For best performance use on clean, oil-free, and rust-free base material. Best weld appearance and toe wetting when compared to ER70S-3 and ER70S-4 classifications. SuperArc® L-56 has high silicon and manganese deoxidizer levels. Superior feedability and excellent arc characteristics are trademarks of SuperArc® L-56.



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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