



Welding Solutions for Aluminum



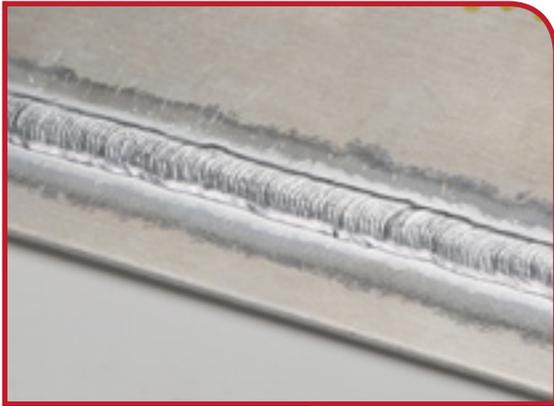
Game Change

By 2025, the average car on the road in North America is projected to be 18% aluminum.¹ The new CAFÉ standards as well as consumer demand are forcing lightweighting to improve fuel economy. With bumpers and body parts next in line for conversion, more plants will be faced with arc welding on thin aluminum parts.

You still have high production targets, but welding on aluminum can be trickier than on mild steel. Costly rework due to burn-through and distortion rises. Aluminum wire is soft and can be a real problem to feed. And a robotic automation system that could easily manage mild steel now doesn't operate at the same level of efficiency.

Lincoln can help. We are at the forefront of aluminum welding technology and have developed a proven, innovative waveform to speed up the aluminum welding process. Both travel speed and weld integrity are impacted by welding wire, and our aluminum wire is the highest quality in the industry with unique feedability. Lincoln's robotic automation is state-of-the-art and our automation expertise extends to upstream processes, including hydroforming, machine tending, progressive stamping presses, laser processing and a wide range of fastening and welding systems. We stay a step ahead, so when the game changes, we can help you do the same.

¹ Why-automotive-engineers-are-increasing-use-of-aluminum-now. (2015, January 1). Retrieved January 1, 2015.



Precision Welding

There is no doubt welding thin-gauge aluminum auto parts presents a challenge. There are issues of travel speed, burn-through and distortion. Lincoln has optimized every element of aluminum arc welding to help you master the process.

Superior welding wire

All welding wire is not created equal. Wire quality is a key factor in productivity, and aluminum wire quality is even more critical because it is soft and difficult to feed. Generic wire can cause burnback and the line can be interrupted by tangles at the feeder. Lincoln Electric's SuperGlaze® aluminum welding wire, manufactured to specifications higher than industry standards, is chemically and mechanically consistent, to deliver consistently high performance.

Unique wire feedability

Superior welding wire is not the complete answer; a fully engineered solution includes the wire packaging. Lincoln has developed Gem-Pak™, a unique bulk welding wire packaging system that ensures consistent wire delivery. The combination of high quality wire and even dispensing results in the highest aluminum welding wire feedability in the industry, for less downtime, less rework and cost savings. Our automotive customers have proved it.

Advanced waveform

Lincoln has long been a technology leader in welding, and we are at the forefront of the auto industry's recent use of aluminum. We have developed AC Aluminum Pulse™, an innovative waveform that eliminates burn-through and improves travel speed and deposition for better and faster aluminum welds.





Robotic Welding Automation

Lincoln Electric has a full portfolio of robotic automation equipment and deep experience supporting the automotive industry. We can help you design, build, install and run a reliable, robotic line that will perform, even with the challenges of welding aluminum.

Our automation lines include arc welding, spot welding, mixed spot/MIG welding and material handling, and can be customized to your part. We have partnered with robotic providers to provide aluminum-specific equipment. With Lincoln as your automation supplier, travel speed is optimized and reprogramming is user-friendly. We work toward your objectives of decreasing manufacturing costs, increasing weld quality and improving welding productivity.

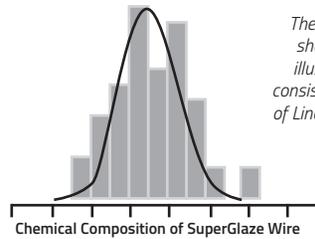


Upstream automation

The effectiveness of upstream processing impacts costs, assembly repeatability and of course, welding. Look to Lincoln for experienced automation solutions for hydroforming, machine tending, progressive stamping presses, laser processing, and a wide range of fastening and welding procedures. Lincoln's upstream systems can be found on the latest subassembly and assembly lines. Our hydroform tube handling, laser cutting, and flow drill screw equipment has been integrated into compact, reliable and high-performing systems for major automakers. You can also count on Lincoln for stand-alone laser cutting systems.

LINCOLN ELECTRIC: WELDING SOLUTIONS FOR ALUMINUM

CHALLENGE: Aluminum welding is difficult enough, but welding with inconsistent wire chemistry can make it even more challenging, creating variations in the weldability.



The tight distribution shown in this graph illustrates the highly consistent composition of Lincoln's SuperGlaze aluminum wire.

SOLUTION: Lincoln SuperGlaze aluminum wire performs better because it's engineered to specifications beyond the industry standard. We use only prime aluminum ingot, no scrap, then process the wire to a precise diameter in a multi-step cleaning and finishing operation. The result is wire that is chemically and mechanically consistent with a smooth surface finish, so it's easier to feed and provides a more stable arc.

CHALLENGE: Generic aluminum wire is hard to feed. It can tangle into "bird's nests" at the drive roll, slowing productivity.

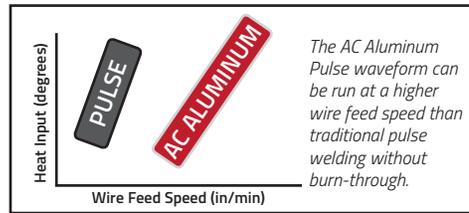
SOLUTION: SuperGlaze wire not only surpasses industry specifications, it is also bulk packaged with a controlled winding process. As a result, SuperGlaze wire in Gem-Paks is guaranteed tangle-free, with less spatter and fewer liner and tip changes. With Gem-Pak, automotive plants have realized savings up to 100% of the cost of the wire.



Annualized savings converting to Lincoln Electric SuperGlaze aluminum wire in Gem-Pak bulk packaging	Savings	\$	Data collected over 13,800 production shifts using 30 welding robots at an automotive parts plant
	Contact tip usage	31,000	
	Contact tip labor	86,000	
	Liner usage	28,000	
	Liner labor	12,000	
	Average cost to reweld	233,000	
	Increase In production	327,000	
	Conversion to bulk pack	6,000	
		\$723,000	

WELDING

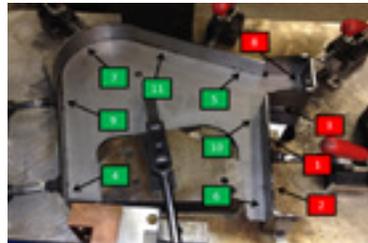
CHALLENGE: When optimized, aluminum welding is performed "hot and fast". The high thermal conductivity of aluminum means temperature settings have to be higher for effective welds, but unless travel speed is fast, you risk burn-through, especially on thin parts.



The AC Aluminum Pulse waveform can be run at a higher wire feed speed than traditional pulse welding without burn-through.

SOLUTION: AC Aluminum Pulse is Lincoln's proprietary waveform for aluminum. Compared to traditional pulse welding, the waveform increases travel speed up to 40%, decreases burn-through, increases deposition up to 75%, improves gap bridging and improves weld bead profile. Show side weld distortion appearance is also improved.

CHALLENGE: Multi-step welding operations can be complex, especially when there are varying part designs and multiple welds.



The Weld Sequencer® software for the assembly of this part controls 11 welds, 2 welding procedures and a welding sequence to minimize distortion.

SOLUTION: Weld Sequencer is process control software for Power Wave® welders that can assist operators in programming multi-step operations. It can improve procedures for every weld and maintain tight control of weld parameters when part designs and weld sequences vary. Weld integrity improves and rework is reduced.

ROBOTIC WELDING AUTOMATION

CHALLENGE: The tricky process of welding aluminum requires automated lines that are state-of-the-art, flexible and reliable.

SOLUTION: Lincoln offers a full portfolio of robotic automation equipment to support aluminum arc welding technology. Both pre-engineered and custom solutions are available. What sets us apart is our integrated approach, coordinating robots and hardware with software, waveforms, best-in-class consumables and even automated upstream equipment. Robotic systems for aluminum welding can increase weld quality, decrease manufacturing costs and free up your skilled workers for more challenging tasks.

Our Power Wave advanced welding system is a proven, reliable solution for robotic aluminum welding. The Lincoln AutoDrive™ SA servo torch system is a fully integrated push-pull wire feeding system, optimized for aluminum feeding.



Automation Solutions

Lincoln Electric's expertise goes beyond the weld process to all aspects of automated metal fabricating.

- Flexible, automated systems for metal forming, fabricating and joining, including fixturing, laser and plasma cutting systems, press automation, tube bending and fabricating systems, tubular hydroform/structural frame automation and build-to-print manufacturing services
- Turntables, positioners, robot transport units, tool shuttles, transfer fixtures, conveyors and lifters
- High quality toggle, tube and wire clamps and retract pin devices
- Lincoln's advanced automation team is experienced in all sorts of upstream automation, including stretch bend capabilities, components processing such as machining and de-burring, and laser cutting and welding



Environmental Solutions

Lincoln Electric supports safety and regulatory responsibility around the welding process with a full suite of audit services and safety equipment, including:

- Portable, stationary and engineered weld fume control systems
- Systems for fire detection and suppression

Robotic Welding Solutions

Lincoln Electric knows welding, and we also know automation. We have the depth and breadth of experience to deliver the fastest, highest quality, most repeatable results for your robotic line. Our advanced technologies include:

- Workhorse welders
- AutoDrive SA Servo driven feeding
- Innovative waveform technologies for strong, clean welds
- Unique welding consumables to optimize your results
- Laser welding systems



Lincoln Electric is the world leader in arc welding equipment, consumables and automation. We have been at the forefront of welding technology for more than one hundred years. Our product line now spans the breadth of the assembly floor, from plasma and oxyfuel cutting systems to arc welding products, weld fume removal products and robotic welding systems.

We offer a complete line of welding automation equipment and solutions for automotive assembly plants. We can customize your system with flexibility to meet the rapid changes in the industry. And with Lincoln, you receive full support, including modeling, procedure development, on-site programming, and training.

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company® is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

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