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THE WELDING EXPERTS<sup>SM</sup>

## Waveform Control Technology™

### Polaris Industries Inc.

**Polaris Industries Inc., a manufacturer of ATV's, snowmobiles, personal watercraft, off-road vehicles, and motorcycles, was looking for ways to increase welding productivity and improve profits.**

#### - CHALLENGE -

Rework of CV MIG weld spatter and distortion on chassis, steering and suspension components was stifling productivity.

#### - SOLUTION -

- Lincoln Electric Power Wave® 355M power sources and Power Feed™ 10M wire drive systems.
- Lincoln Electric Rapid Arc™ pulsed spray transfer process.

#### - RESULTS -

- A 35 percent increase in productivity attributed to a virtual elimination of post-weld clean-up operations.
- Improved arc consistency, reduced weld spatter and achieved higher travel speeds.
- The increased arc travel speed, also which resulted in lower shielding gas usage.



**F**or thrill seekers and outdoor enthusiasts, the name Polaris is synonymous with speed, freedom and an escape from the ordinary. For 50 years, the company's snowmobiles, all-terrain vehicles, personal watercraft, off-road utility vehicles and Victory Motorcycles have been must-have items for those who thrive on adventure. In addition to these recreational vehicles, Polaris Industries Inc. also has a new line of commercial-grade utility vehicles and equipment called Professional Series Workmobiles. In each of their respective markets, Polaris machines are set apart by superior quality construction, exceptional performance and durability.

In a quest for even higher quality, Craig Cerninara, Welding Engineer, at the 1,900 employee Polaris plant in Roseau, MN, made a switch to a new welding process and the latest technology power sources available. Formerly, the plant was utilizing a Conventional CV MIG process to weld chassis, steering and suspension components for the snowmobiles, all-terrain vehicles,

and Ranger utility vehicles manufactured at the plant. Polaris Industries Inc. goal in seeking new equipment was to reduce spatter, distortion and rework, each ultimately leading to increased productivity and profitability.

Polaris Industries Inc. turned to the use of Waveform Control Technology™ in the form of Lincoln Electric's Power Wave® 355M power source and Power Feed™ 10M wire drive and control. In making the switch, Polaris implemented the use of Rapid Arc™ high travel speed and low spatter pulsed spray transfer. In so doing Polaris improved arc consistency, reduced weld spatter loss, and achieved higher travel speeds. The benefit was calculated in terms of increased through-put and reduced welding-related distortion.

In just the first application where Polaris used the Power Wave 355M, the company experienced a 35 percent increase in productivity, attributed to the elimination of post-weld clean-up operations.



The future of welding is here.®

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"For Polaris there are numerous benefits with the Power Wave 355M. Using a Pulsed MIG process, it doesn't matter what wire feed speed the operator sets, he or she will always run the same process and we will always get consistency in the welds," says Cerminara.

"Formerly, using the CV MIG process, our operators were utilizing various modes of metal transfer depending on the particular preference of each operator. We were lacking repeatability from one operator to the next. One operator might be using a spray transfer method while his neighbor was using a globular transfer method. With the Power Wave 355M units, we provide a set range for our operators and then they have the ability to fine tune for their particular welding style," explains Cerminara.

According to Cerminara, the Power Wave provides a tight, crisp arc that is forgiving, which is important because of the thinness of materials used for components. "The Pulsed MIG process reduces the amount of heat input into the weld and therefore decreases distortion. Spatter has also been reduced translating into a huge cost savings in labor and rework time," notes Cerminara.

Quality is of the utmost importance for Polaris vehicles because the safety of the operator depends on it. A quality product also equates to repeat customers.

### Head-to-Head Competition

The welding at Polaris is particularly challenging because of the limited weld lengths, two inches or less on most parts, the arc is only on for a brief period of time for each weld and the arc does not have much time to establish itself. This challenge requires a machine that can quickly provide arc stability.

To find the best power source for the job and overcome these challenges, Polaris put Lincoln Electric's Power Wave 355M head-to-head with its competition. What sold Polaris Industries Inc. on the Power Wave was the arc. With the machine's advanced Waveform Control Technology™, part of Lincoln's Nextweld™ Technology,

Polaris Industries Inc. immediately noticed a difference in the quality and consistency of the arc as compared to the competitive unit.

Initially, Polaris purchased 16 Power Wave units, but as the machines proved their ability to achieve the desired welding outcome, the company has added another 12 systems and plans to add more in the future.

### Programming

The Power Wave 355M's waveform is shaped digitally using software. To develop custom waveforms tailored to Polaris's parts, local Lincoln District Manager Howard Morris called on the experts at Lincoln's Welding Technology Center in Cleveland. Jeff Nadzam, Senior Application Engineer, programmed the Power Wave's waveforms to create the tight, crisp arc Polaris Industries Inc. was seeking.



"Jeff Nadzam was a tremendous resource and spent a lot of time at our facility," notes Cerminara. "We were looking for a specific type of Pulsed MIG arc that was forgiving and one that could consistently handle gaps. With Jeff's help, we developed five custom waveforms that we use for our welding. Eventually we will pare that down to three for even better consistency."

For companies not interested in tailoring their own waveforms, the Power Wave 355M comes standard with more than 60

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factory-programmed waveforms optimized for specific wire types and sizes.

### Pulse Welding

During the Pulsed MIG mode of metal transfer, molten metal is transferred one drop per pulse peak, and the pulse peak may occur up to two hundred times per second. Additionally, the current alternates between a high peak current value and a lower current background value. Benefits of Pulsed MIG include a wide operating range typically from 80 inches per minute of wire feed speed to 800 inches per minute. In addition, Pulsed MIG results in high quality welds with a uniform bead appearance and excellent penetration. Pulsed MIG finds use in both thin sheet metal type applications and heavier structural type components.

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With the custom programs of the Power Wave 355M, an increase in the arc travel speed resulted in lower shielding gas usage and because it was easier to achieve the desired weld size, less overwelding occurred. These added benefits translated into a significant welding cost reduction.

### Cross-Functional Welding

Unlike many plants which rely on an assembly line and have set jobs for each employee, welding at Polaris is performed in a cellular fashion with similar parts being welded in the same area. All



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operators are cross-trained with flexibility in mind, and each worker is able to perform high quality work in many different areas of manufacturing.

According to Cerminara, most of the welding performed at Polaris is positioned for the flat and horizontal positions, as well as vertical down. "With the Pulsed MIG process, we have seen a big improvement in our vertical down

welding. Because of the cooling cycle between every droplet transferred, the puddle freezes and makes this type of welding easier," he says.

#### **Lincoln Technical Services**

According to Cerminara, Lincoln played a large part in ensuring the success of the Power Wave 355M units in the plant. Over a three-month period, Lincoln's Morris spent four days a week at Polaris training the company's more than 250 operators on how to use the new machines and the

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nuances of the Pulsed MIG process. "We've been absolutely pleased with the support we have received from Lincoln- everyone was professional and the response to issues was timely and useful," says Cerminara.

Cerminara notes that the training went a long way to address issues and provide one-on-one assistance to operators. "I would not consider it a difficult transition moving from the CV to a Pulsed MIG process and attribute that mostly to the training provided."

### Future

Polaris Industries is currently expanding many of its plants and is building a new facility in Wyoming, Minn. The company's commitment to quality will ensure the continued growth of technologically advanced welding at all of these manufacturing centers.

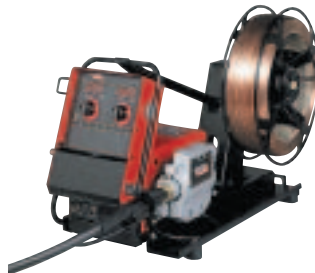
Lincoln and Polaris...it's a fun ride.

## Featured Lincoln Products



### Power Wave® 355M

The Power Wave 355M features some of Lincoln's best performance technologies and processes all rolled into one highly efficient inverter power source designed for high-end semiautomatic welding. Lincoln's Waveform Control Technology™ is at the heart of the Power Wave 355M's performance, enabling processes such as Pulse-On-Pulse™ and Power Mode™. Precise control of process parameters allows you to weld on a variety of materials, including steel, stainless steel, aluminum and nickel alloys in virtually any application. Optimize the arc for each wire type and size for a consistent weld time after time with the Power Wave 355M.



### Power Feed™ 10M

When you need a versatile, multi-process industrial wire feeder for welding virtually any material, you need the Power Feed 10M. Choose the Power Feed 10M for automotive manufacturing, shipbuilding, pressure vessels/heavy plate, oil, gas and pipeline construction, particularly when code-quality work is required. The new MSP4 user interface panel features the Infrared Port with a Palm OS-based interface, allowing wireless communication between a handheld device and the welding system for fast, easy and accurate process control.

## WHAT IS NEXTWELD?

*The challenges facing industrial fabricators today are increasingly difficult. Rising labor, material, and energy costs, intense domestic and global competition, a dwindling pool of skilled workers, more stringent and specific quality demands.*



*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.*

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