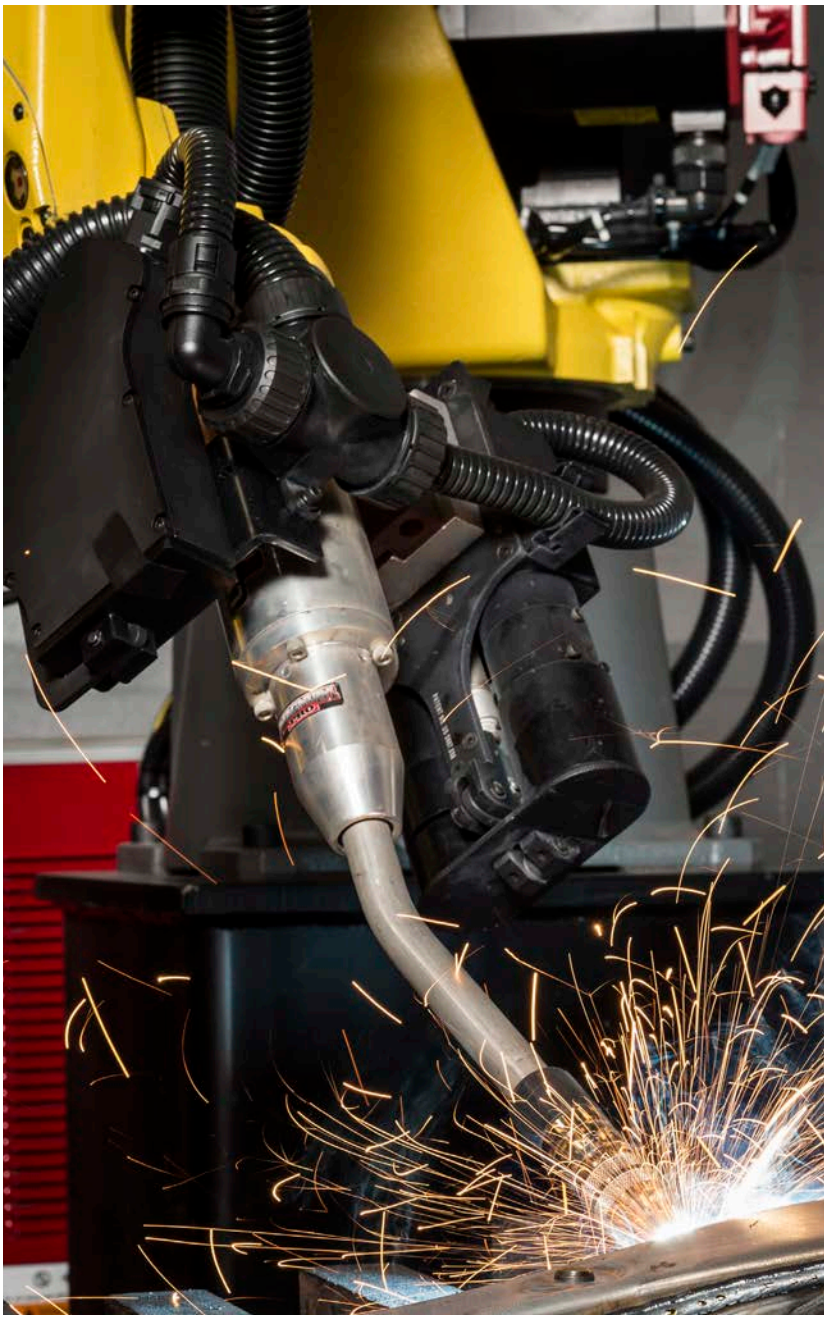
Rapid Z® Galvanized Welding



Overview

Rapid Z® – High Speed, Low Porosity.

- Less Spatter*
- Better Bead Appearance*
- Less Internal & External Porosity*
- Higher Productivity & Less Rework*

Index

**As compared to DCEN with E70C-GS on galvanized steel.*

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www.lincolnelectric.com

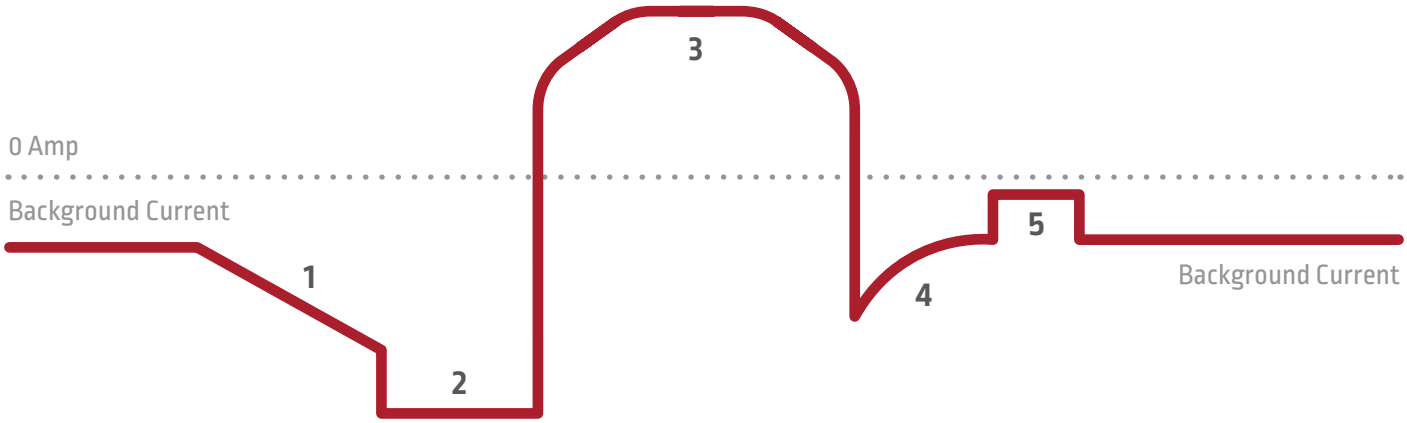
Process Description

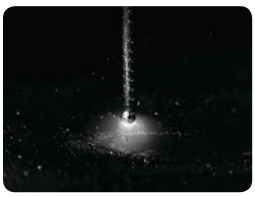
When it comes to making automotive parts, productivity and quality are the highest priorities. But those targets can be hard to hit when welding galvanized material with conventional processes. Welding on galvanized can be difficult for many reasons. The zinc coating thickness varies, part fit up varies, and porosity is likely, forcing a difficult balance between proper weld size, faster weld speed, or good x-ray quality.

Process Z™ provides all three, without compromising. Metalshield® Z gas-shielded wire, combined with Rapid Z® waveform technology operating on AC polarity, minimizes the internal porosity of welds and assures virtually no external porosity while maintaining faster travel speeds.

With the Rapid Z waveform the electrode droplet transfer is focused and predictable. Less of the surrounding zinc coating is introduced into the weld – meaning less internal porosity. Smooth droplet transfer also delivers more stability and less spatter when welding at increased travel speeds.

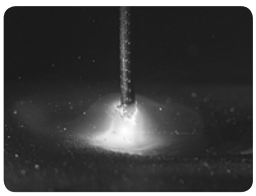
Waveform





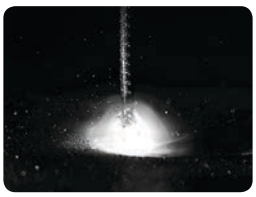
1. Negative Ramp

Ramps current slowly to avoid spatter from a superheated molten droplet.



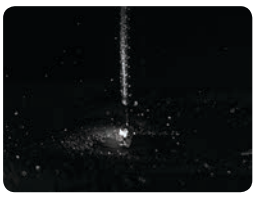
2. Negative Peak

Provides energy to create a molten droplet without transferring.



3. Positive Peak

Provides a pinch force to the droplet.



4. Tailout

Reduced current relaxes the plasma force as the droplet approaches the puddle.

5. Wet-in

Proprietary hardware quickly reduces the current at the instant the droplet contacts the puddle, reducing spatter as the droplet detaches.

Synergic Welding

1. Adjust WFS to the desired setting. Refer to the Applications section for the recommended settings.

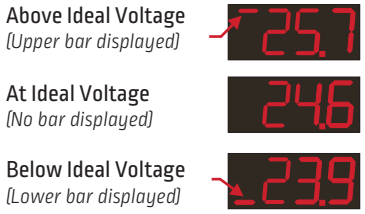
Voltage and UltimArc®

2. Based on WFS, a pre-programmed nominal voltage is selected.

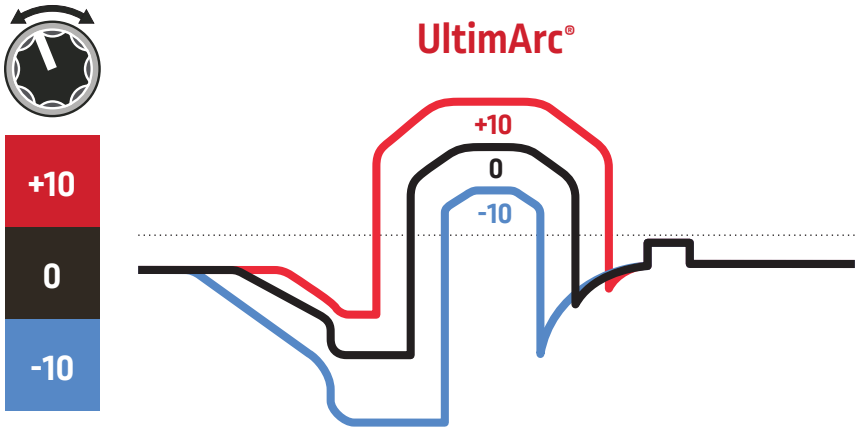
3. Adjusting voltage increases or decreases the arc length, allowing the user to fine tune arc characteristics.

4. Synergic Weld modes improve the ease of set-up by pre-selecting an ideal voltage based on the selected WFS. The user can then fine tune their Voltage setting based on their personal preference and can easily see whether they are above or below the nominal setting.

Voltage Display



5. The UltimArc® control fine-tunes the heat input into the plate.



ASTM Designations for Hot-Dipped Galvanized Plate

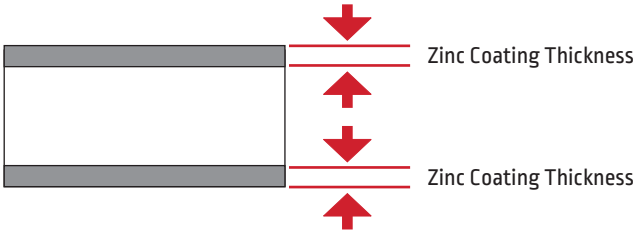
ENGLISH:

60G60G designates the minimum coating weight per ASTM specification.

METRIC:

Z120 designates the minimum coating weight per ASTM specification.

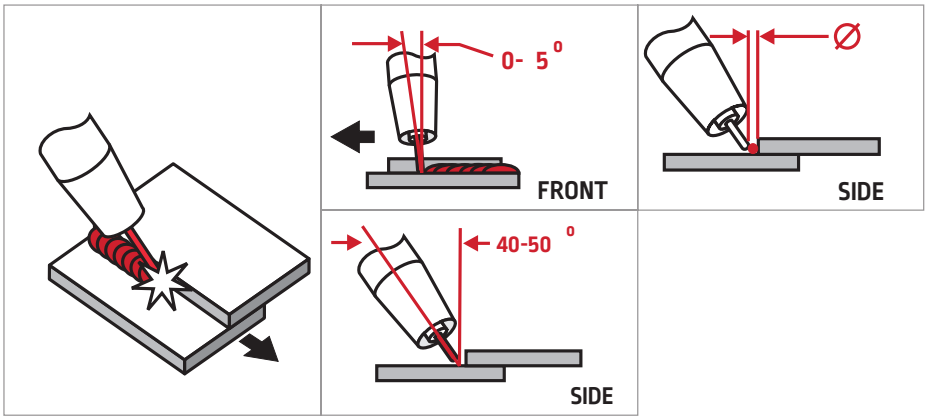
Typical Zinc Coating Thickness for these ASTM specifications average 9.1 microns.

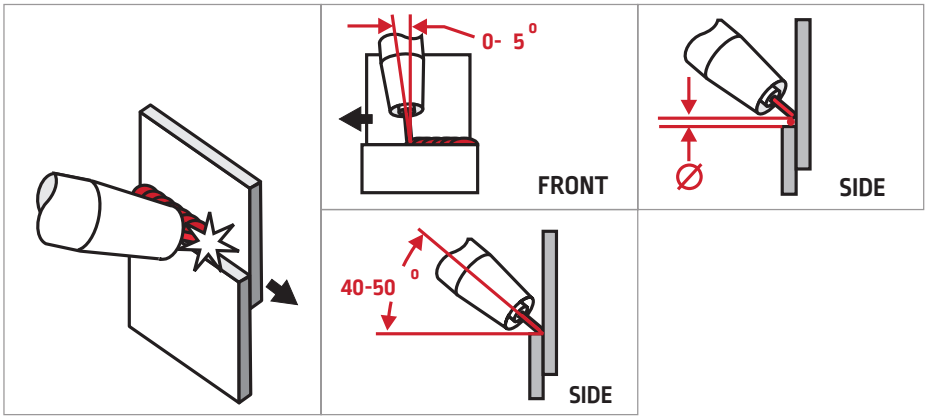


Synergic Procedures – 2F Lap Joint

- Use a 0-5° drag angle.
- Use a 40-50° work angle.
- For 2F-Horizontal, position the electrode approximately one electrode diameter outside the joint favoring the bottom leg.
- For 2F-Vertical, position the electrode approximately one electrode diameter outside the joint favoring the top leg.

Synergic Procedures – 2F Lap Joint continued on page 4





See Customer Assistance Policy and Disclaimer Notice on page 9.

Synergic Procedures – 2F Lap Joint (continued)

ENGLISH

90Ar / 10CO_2 @40-45 CFH

5/8 in - 3/4 in

0°-5° drag angle

Metalshield Z 0.035 in

60G60G*

	in/min	in/min	
20 ga (0.95 mm)	370	40	21.0
20 ga (0.95 mm)	420	50	21.5
18 ga (1.27 mm)	400	40	21.5
18 ga (1.27 mm)	470	50	22.0
14 ga (1.98 mm)	550	40	23.5
14 ga (1.98 mm)	660	50	24.5

*60G60G designates the minimum weight per ASTM specification

METRIC

80Ar / 20CO_2 @40-45 l/min

16 mm - 19 mm

0°-5° drag angle

Metalshield Z 0.9 mm

Z120**

mm	m/min	cm/min	
1.0	9.4	100	21.0
1.0	10.7	125	21.5
1.2	10.2	100	21.5
1.2	11.9	125	22.0
2.0	14.0	100	23.5
2.0	16.8	125	24.5

**Z120 designates the minimum weight per ASTM specification

ENGLISH

90Ar / 10CO_2 @40-45 CFH

5/8 in - 3/4 in

0°-5° drag angle

Metalshield Z 0.040 in

60G60G*

	in/min	in/min	
18 ga (1.27 mm)	280	40	21.5
18 ga (1.27 mm)	350	50	22.0
16 ga (1.2 mm)	350	40	22.0
16 ga (1.2 mm)	430	50	22.5
14 ga (1.98 mm)	420	40	22.5
14 ga (1.98 mm)	520	50	23.5

*60G60G designates the minimum weight per ASTM specification

METRIC

80Ar / 20CO_2 @40-45 l/min

16 mm - 19 mm

0°-5° drag angle

Metalshield Z 1.0 mm

Z120**

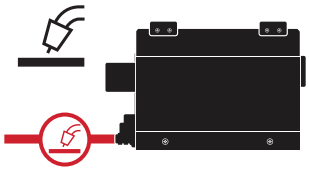
mm	m/min	cm/min	
1.2	7.1	100	21.5
1.2	8.9	125	22.0
1.5	8.9	100	22.0
1.5	10.9	125	22.5
2.0	10.7	100	22.5
2.0	13.2	125	23.5

**Z120 designates the minimum weight per ASTM specification

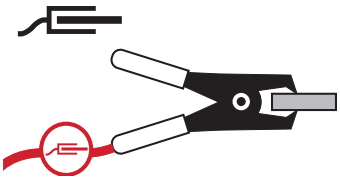
See Customer Assistance Policy and Disclaimer Notice on page 10.

Sense Leads

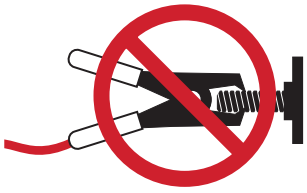
An electrode sense lead is required. This is a standard connection in an ArcLink® cable.



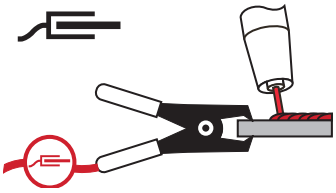
A work sense lead (optional) is highly recommended for total welding cable lengths >50 ft. and should be connected directly to the workpiece.



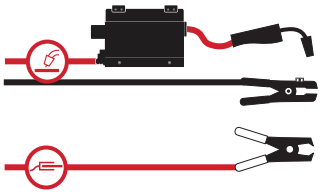
DO NOT connect either sense lead to a welding stud on the power source as this may result in erratic arc behavior.



For best performance, connect the work sense lead close to the welding arc.



The work sense lead should be separated away from welding cables to minimize interference.



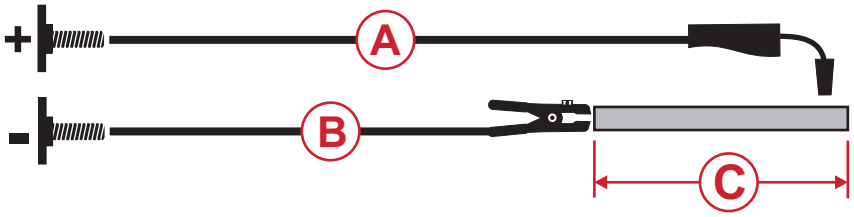
DO NOT route sense lead cable close to high current welding cables as this may distort the sense lead signal.

Work Leads

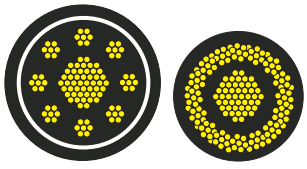
Connect the work lead to the negative stud on the power source and directly to the workpiece. Maintain the shortest connection length possible.

Test cable inductance levels using the Power Wave® Manager software exclusively from Lincoln Electric® Software. Available at www.powerwavesoftware.com.

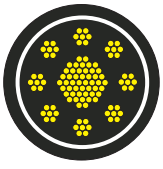
The total length of the welding current loop (A+B+C) should be minimized to reduce inductance. Route cables (A,B) close together to further reduce cable inductance.



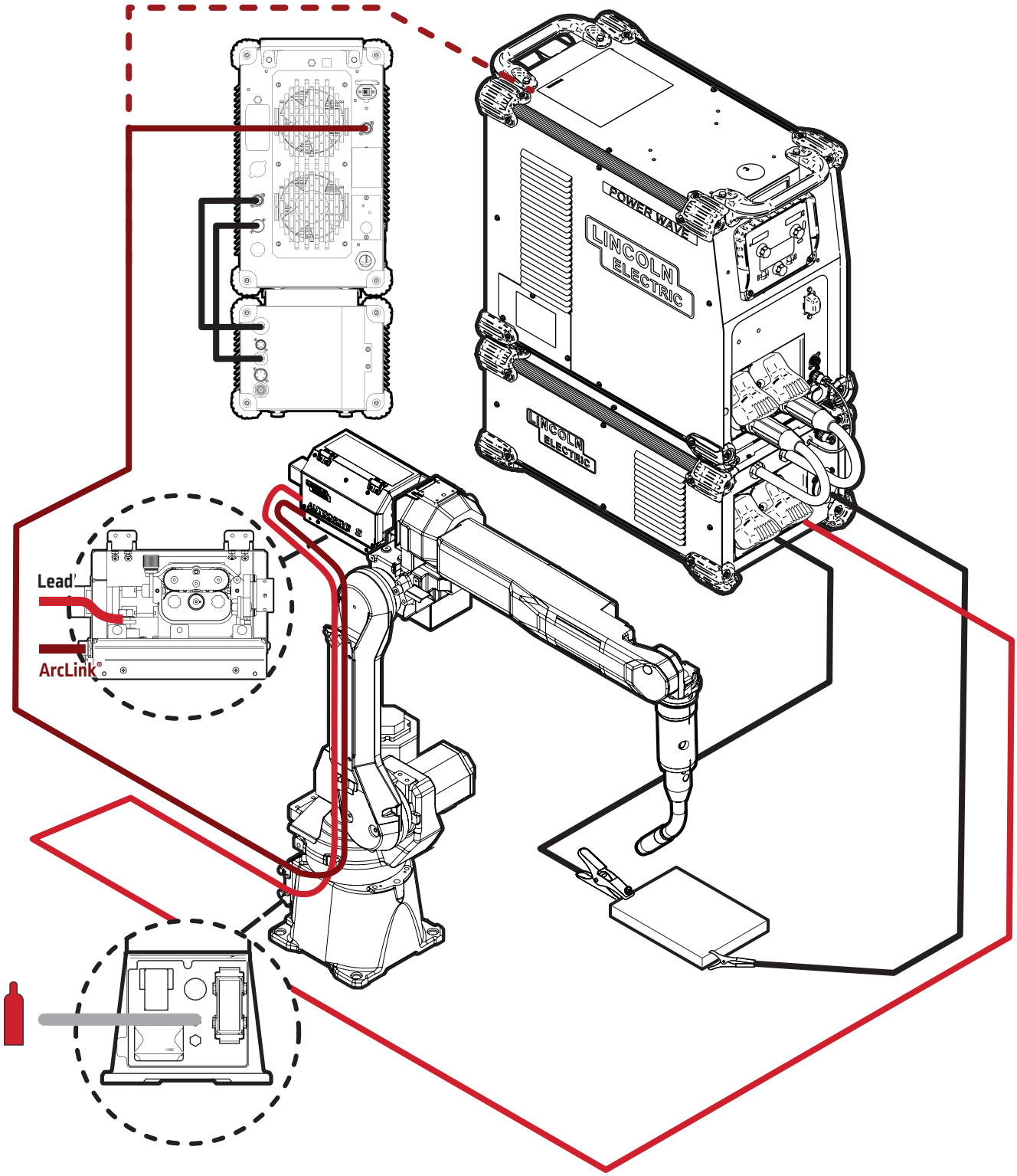
For configurations with excessive inductance, use Lincoln Electric® patented coaxial welding cables.



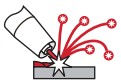
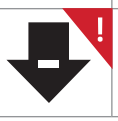
Lincoln Electric® coaxial cables combine the positive and negative welding leads into one cable to minimize cable inductance.

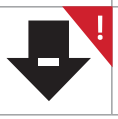


Connection Diagram – Advanced Module



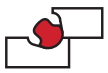
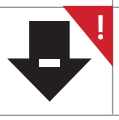
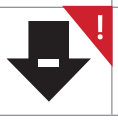
Troubleshooting

 SPATTER	Check ▶	Volts	Travel Speed	Contact Tip to Work Surface	Wire Feed Speed	Gas Coverage	Zinc Coating Thickness	Drag Angle	UltimArc®	Work Sense Lead
	Action ▶									

 ERRATIC ARC	Check ▶	Proper Feeding	Travel Speed	Knurled Drive Rolls	Tip	Volts	Zinc Coating Thickness	Wire Feed Speed	Drag Angle	Work Sense Lead
	Action ▶									

 POROSITY	Check ▶	Gas Coverage	Zinc Coating Thickness	Wire Feed Speed	Contact Tip to Work Surface	Travel Speed
	Action ▶					

 CONCAVE BEAD	Check ▶	Volts	Wire Feed Speed	Contact Tip to Work Surface	Drag Angle	Travel Speed
	Action ▶					

 UNDER CUT	Check ▶	Volts	Travel Speed	Wire Feed Speed
	Action ▶			

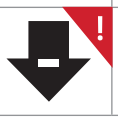
 Increase

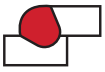
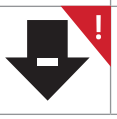
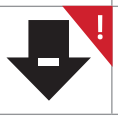
 Decrease

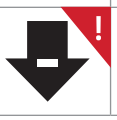
 Inspect & Replace

 Important

Troubleshooting

 BURN THROUGH	Check ▶	Travel Speed	Wire Feed Speed	Volts	Contact Tip to Work Surface	Drag Angle
	Action ▶					

 CONVEX BEAD	Check ▶	Travel Speed	Wire Feed Speed	Volts	Contact Tip to Work Surface	Drag Angle
	Action ▶					

 POOR PENETRATION	Check ▶	Travel Speed	Wire Feed Speed	UltimArc®	Contact Tip to Work Surface	Drag Angle
	Action ▶					

 Increase

 Decrease

 Inspect & Replace

 Important

Icons

 Wire Type	 Gas	 Material Thickness	 Wire Feed Speed	 Travel Speed	 Volts	 Amps	 Contact Tip to Work Surface	 Drag Angle	 Arc Length
 Control Knob	 Weld Stud	 Torch	 Work Sense Lead	 Work Clamp	 Torch Nozzle	 Spatter	 Erratic Arc	 Proper Feeding	 Stop / Avoid
 Knurled Drive Rolls	 Gas Coverage	 Zinc Coating Thickness	 Porosity	 Concave Bead	 Burn Through	 Under Cut	 Convex Bead	 Poor Penetration	 UltimArc®

Technical Terms

Cable Inductance	Resistance to change in current.
GMAW	Gas metal arc welding including metal inert gas (MIG) and metal active gas (MAG) welding.
Porosity	Gas entrapped in solidifying metal forms spherical or elongated pores in the weld.
Drag Angle	The angle at which the electrode trails the weld pool relative to the direction of travel.
Synergic	A mode of control which automatically selects a pre-programmed nominal voltage based on the wire feed speed (WFS) set by the operator.
Work Angle	The angle of the electrode, off perpendicular, relative to the work piece surface.
Zinc Coating Thickness	Thickness of Zinc Coating; typically designated by weight per ASTM specification.

Procedure Notes

All listed procedures are starting points and may require some adjustment depending on the specific application.

Torch angle, electrode placement, contamination, mill scale, joint fit up, and joint consistency are factors that may require special consideration depending on the specific application.

At higher travel speeds, joint fit up, wire placement, and contamination all become factors that are more significant.

The result of welding at higher travel speeds is a tendency to produce more spatter, less penetration, more undercut, and a less desirable bead shape. Depending on the limitations / requirements of the actual application, slower travel speeds and higher arc voltages may be required.

As the travel speed increases in fast follow applications (1/4" to 14 Gauge), a tighter arc length must be maintained so that the puddle properly follows the arc. Operators typically reduce the arc length control (Voltage) to achieve this. At faster travel speeds, the bead-shape can become very convex (or ropy), and the weld will not "wet" well. There is a point at which the arc is set so short that the arc will become unstable and stubbing will occur. This forms a limitation of just how fast the travel speed can be raised.

It is ultimately the responsibility of the end user to ensure the proper weld deposition rate, bead profile, and structural integrity of a given weld application.

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