RapidArc® Weld Process Guide

TE12.012

Overview

RapidArc® Shorter Arc Length - Faster Travel Speeds.

- **Increases Travel Speed by over 50%**
- **Reduces Spatter by 15%**
- **Reduces Heat Input**
- **Reduces Distortion**

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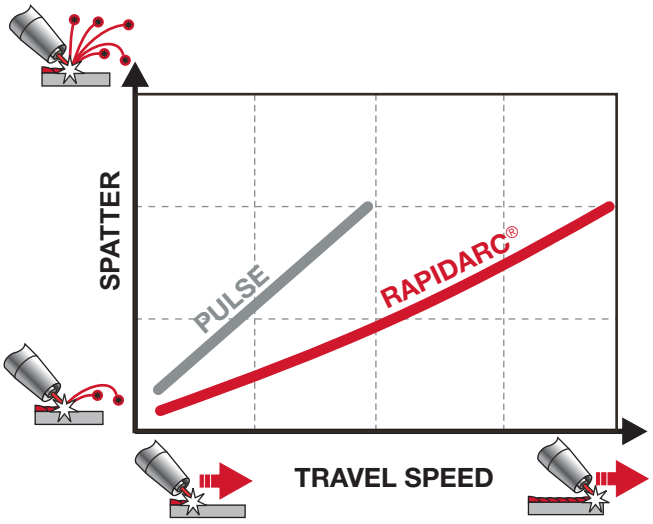
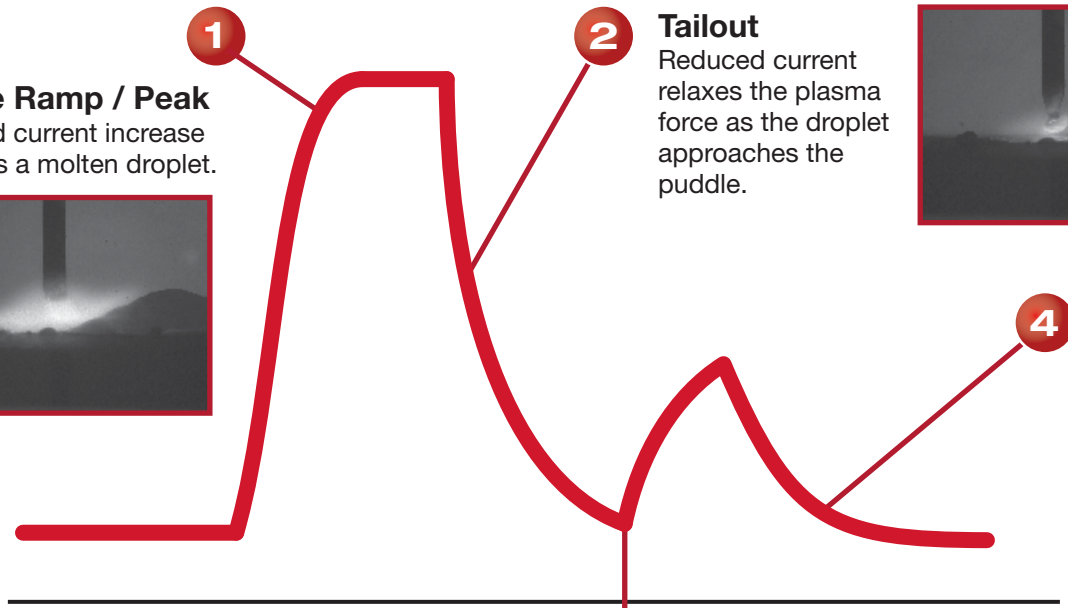
Process Description

The **RapidArc**® process is designed to reduce cycle time in semi-automatic, robotic, and hard automation applications by utilizing increased travel speeds.

Traditional Pulse uses a longer arc length to avoid spatter which also limits travel speed. With **RapidArc**®, arc length is kept short and tight, and spatter is avoided with precise control of droplet transfer. As the droplet is transferred, it contacts the puddle resulting in a short. The **RapidArc**® waveform features a short-circuit response which allows the short to clear with minimal spatter. A plasma boost function creates electrode to puddle separation, and increases stability by establishing rhythm. Ultimarc™ completes the advanced controls for fine tuning travel speed, spatter, puddle fluidity and penetration. The result is a highly versatile, advanced pulse application.



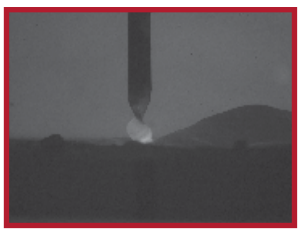
Waveform



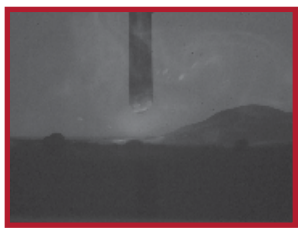
1 Pulse Ramp / Peak
A rapid current increase creates a molten droplet.

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

3 Short
The arc collapses, and the droplet contacts the puddle.



4 Puddle Repulsion
A plasma boost pushes the puddle away, creating separation and a stable rhythm of the weld pool.



Synergic Welding

1. Adjust WFS to the desired setting. Based on WFS a preprogrammed nominal voltage is selected. Refer to the Application section for the recommended settings.

Trim And Ultimarc™

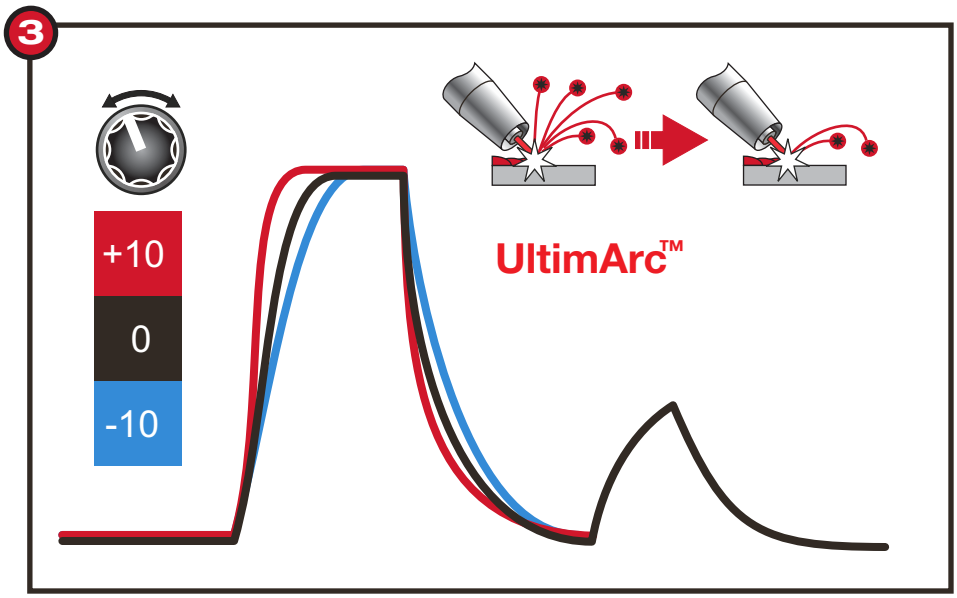
2. Trim: Regulates voltage by adjusting Peak, background, and tailout.

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

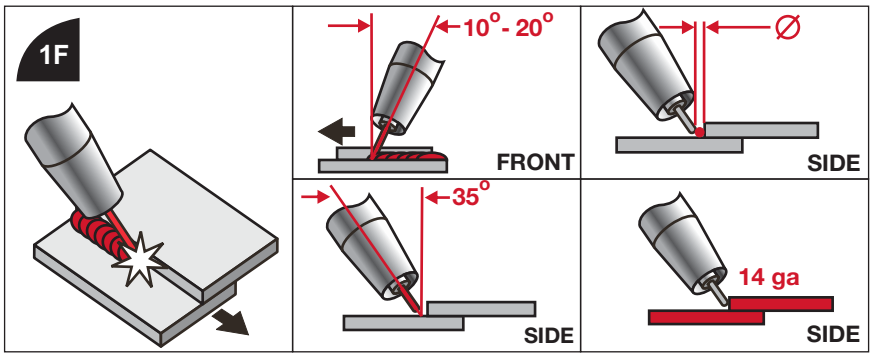
3. UltimArc™: Fine adjustment of the arc.

The **UltimArc**™ control fine tunes the ramp and tailout rates with a single control. Increase (+) or decrease(-) this setting to minimize spatter levels.

This feature is available as a function of the user interface or pendant.



1F / PA Lap



- Use a 10-20° push angle.
- Use a 35° work angle.
- Position the electrode approximately one electrode diameter outside the joint favoring the bottom leg.
- For 14 ga applications position the electrode directly in the joint or slightly favoring the top edge. May require decreased work angle.

90Ar / 10CO_2

3/4 in.

		in/min	in/min	V	A
SuperArc® L-56 0.035”	1/4 in	800	30	24.0	245
	3/16 in	800	45	23.0	245
	10 ga	800	55	23.5	235
	12 ga	750	60	23.8	235
	14 ga	615	60	22.5	210
SuperArc® L-56 0.045”	1/4 in	550	40	23.0	280
	3/16 in	525	45	21.3	275
	10 ga	500	50	21.4	280
	12 ga	450	52	20.0	260
	14 ga	375	55	19.0	210

See Customer Assistance Policy and Disclaimer Notice on page 9.

Metric

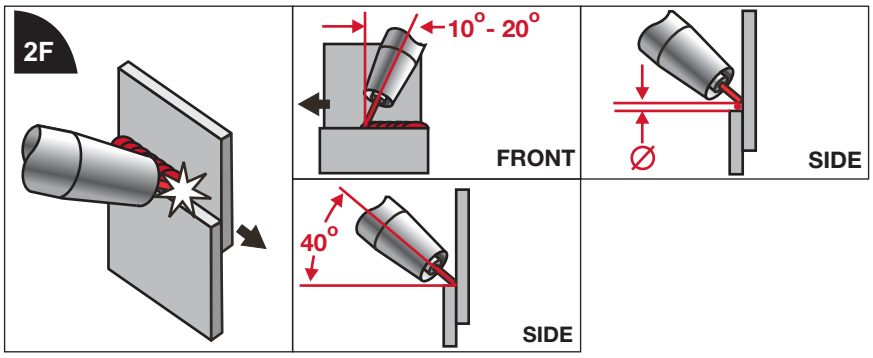
80Ar / 20CO_2

19 mm

	mm	m/min	cm/min	V	A
SupraMig® 1.0mm	6.4	19	95	25.0	265
	4.8	18	107	24.5	245
	3.4	16	121	24.0	235
	2.6	15	132	23.5	205
	1.9	13	147	23.3	185
SupraMig® 1.2mm	6.4	13	80	25.5	310
	4.8	13	107	25.0	295
	3.4	11	133	24.5	270
	2.6	10	147	24.0	255
	1.9	10	160	23.8	240

See Customer Assistance Policy and Disclaimer Notice on page 9.

2F / PB Lap



- Use a 10-20° push angle.
- Use a 40° work angle.
- Position the electrode approximately one electrode diameter outside the joint favoring the top leg.

90Ar / 10CO_2

3/4 in.

		o|o		V	A
SuperArc® L-56 0.035”		**in/min**	**in/min**		
	1/4 in	800	40	24.0	250
	3/16 in	780	50	23.2	240
	10 ga	740	70	23.0	240
	12 ga	700	75	21.7	235
	14 ga	615	80	20.3	210
SuperArc® L-56 0.045”	1/4 in	500	45	21.7	265
	3/16 in	475	50	21.2	260
	10 ga	450	60	20.0	255
	12 ga	425	65	19.8	240
	14 ga	375	70	18.0	235

See Customer Assistance Policy and Disclaimer Notice on page 9.

Metric

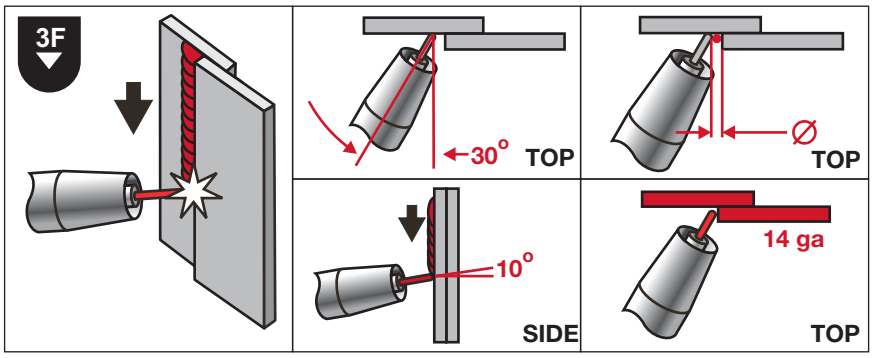
80Ar / 20CO_2

19 mm

		o|o		V	A
SupraMig® 1.0mm	**mm**	**m/min**	**cm/min**		
	6.4	18	95	24.0	250
	4.8	17	104	23.5	240
	3.4	15	131	22.5	230
	2.6	15	145	22.0	220
	1.9	13	152	21.5	165
SupraMig® 1.2mm	6.4	13	80	25.0	290
	4.8	12	106	23.0	280
	3.4	11	133	21.5	260
	2.6	10	147	20.5	240
	1.9	10	155	20.5	200

See Customer Assistance Policy and Disclaimer Notice on page 9.

3F / PG Lap



- Use a 10° drag angle.
- Use a 30° work angle.
- Position the electrode approximately one electrode diameter outside the joint favoring the bottom leg.
- For 14 ga applications position the electrode directly in the joint or slightly favoring the edge.

90Ar / 10CO_2

3/4 in.

		o|o		V	A
SuperArc® L-56 0.035”		**in/min**	**in/min**		
	1/4 in	780	35	24.4	265
	3/16 in	780	50	24.0	245
	10 ga	650	50	23.0	220
	12 ga	650	60	23.0	220
	14 ga	600	70	22.4	200
SuperArc® L-56 0.045”	1/4 in	475	35	22.0	260
	3/16 in	475	50	23.5	275
	10 ga	400	50	22.0	240
	12 ga	400	62	22.5	245
	14 ga	360	65	20.5	225

See Customer Assistance Policy and Disclaimer Notice on page 9.

Metric

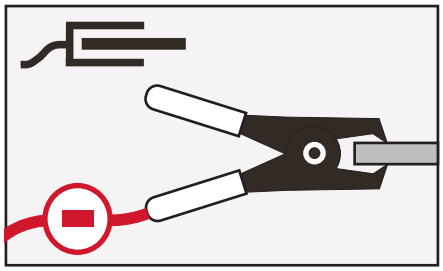
80Ar / 20CO_2

19 mm

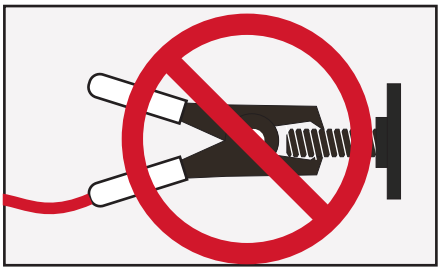
		o|o		V	A
SupraMig® 1.0mm	**mm**	**m/min**	**cm/min**		
	4.8	17	132	24.5	240
	3.4	16	147	24.5	230
	2.6	15	160	23.8	220
	1.9	13	172	23.5	205
SupraMig® 1.2mm	4.8	13	133	23.0	280
	3.4	11	133	21.5	245
	2.6	11	160	21.5	250
	1.9	10	187	20.5	225

See Customer Assistance Policy and Disclaimer Notice on page 9.

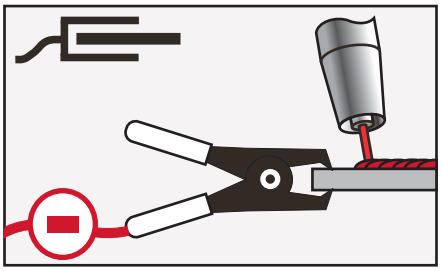
Sense Leads



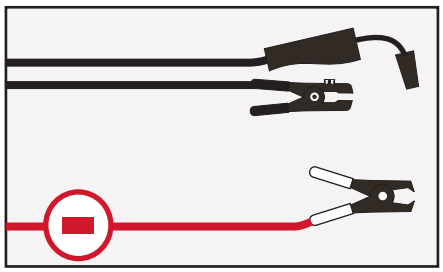
A work (-) sense lead is optional and should be connected directly to the workpiece without being in the path of current flow.



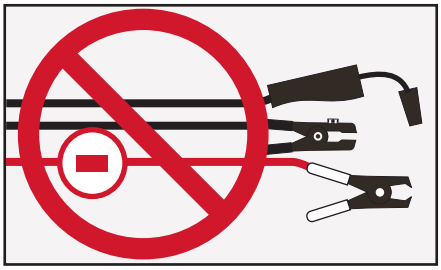
DO NOT connect either sense lead to a welding stud as this may result in erratic arc or increased spatter.



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



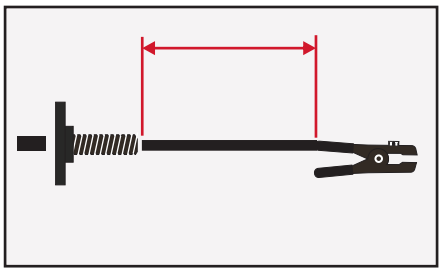
The work (-) sense lead should be separated away from welding cables to minimize interference.



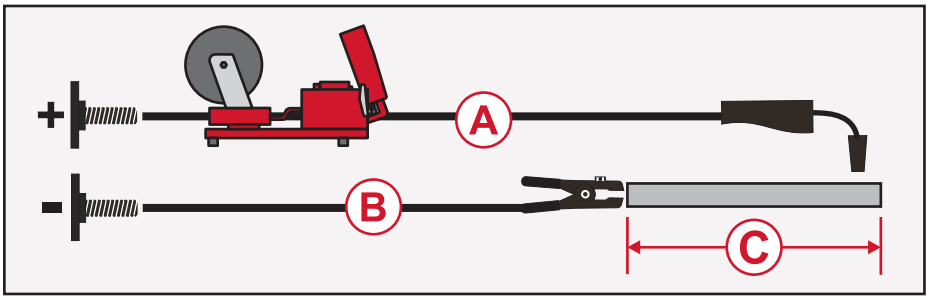
DO NOT route sense lead cable close to high current welding cables as this may distort the sense lead signal.

For non-Lincoln Electric Power Feeders assistance, call the Lincoln Electric Application Engineering Group staffed by experienced engineers, technologists and technicians in Cleveland, Ohio, USA at (866) 635-4709.

Work Leads

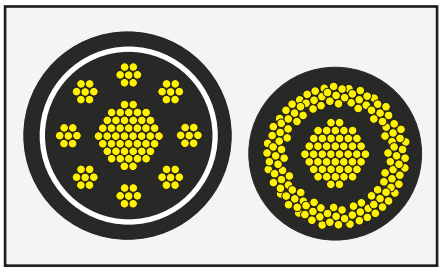


Connect the work lead to the negative stud on the power source and directly to the work piece. Maintain the shortest connection length possible.

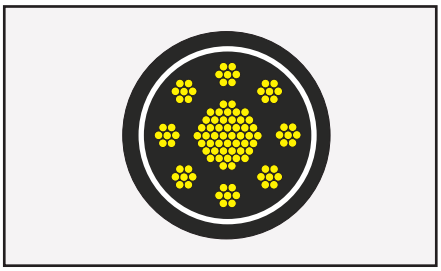


The total length of the welding current loop (A+B+C) should be minimized to reduce inductance.

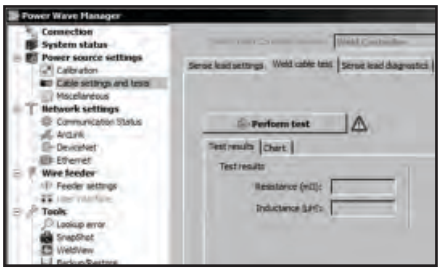
Route cables (A,B) close together to further reduce cable inductance.



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

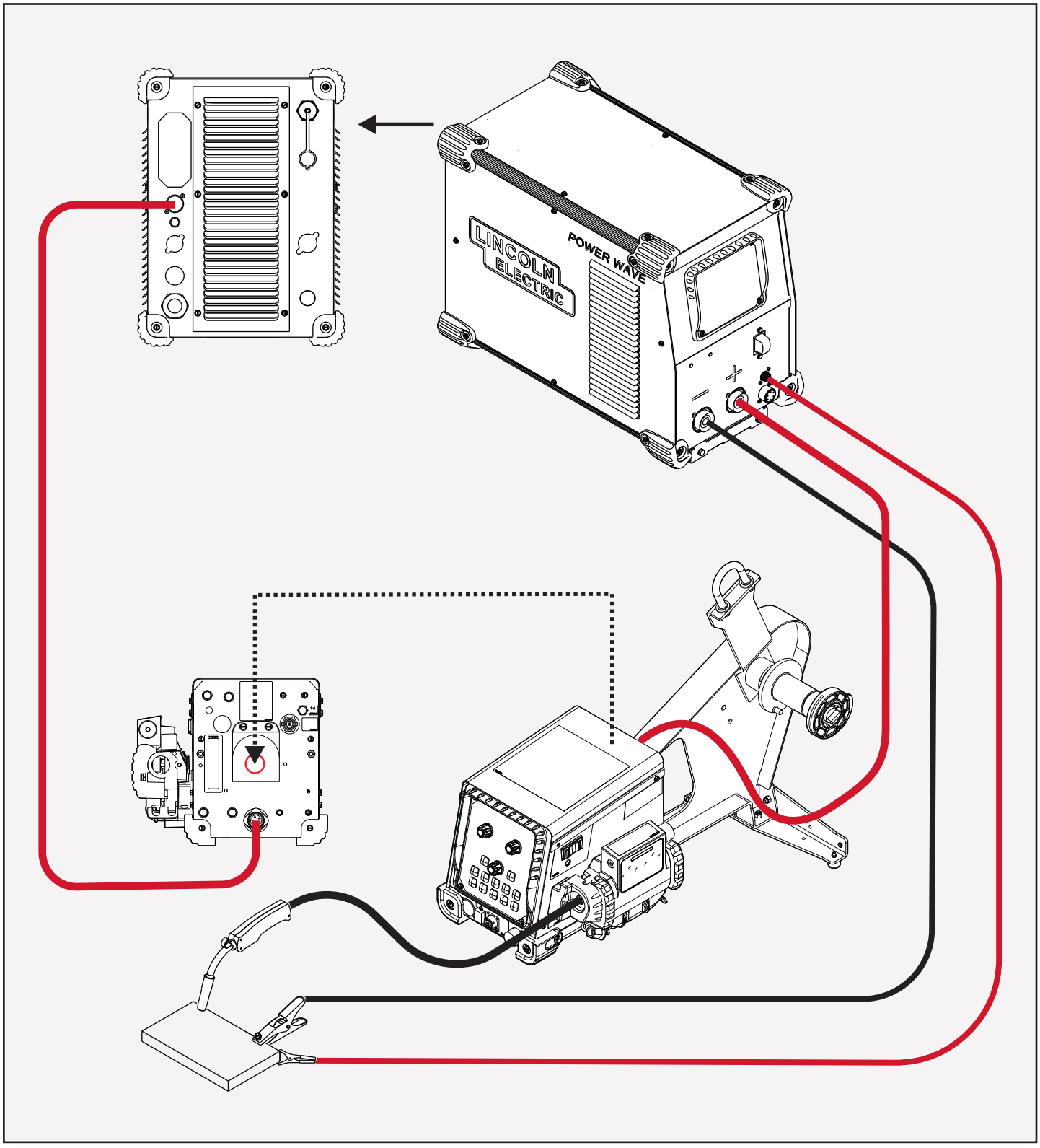


Lincoln Electric® coaxial cables combine the positive and negative welding leads into one cable to minimize cable inductance.

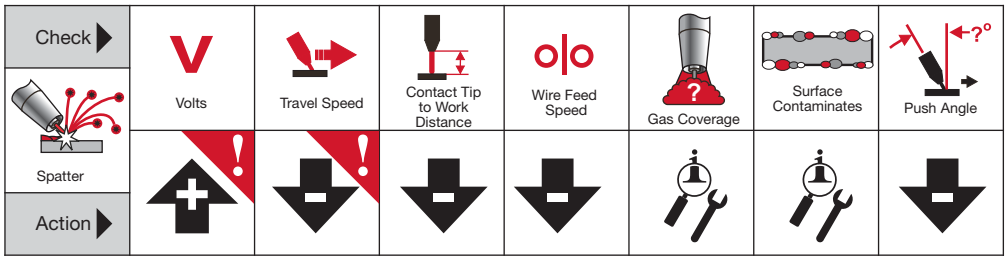


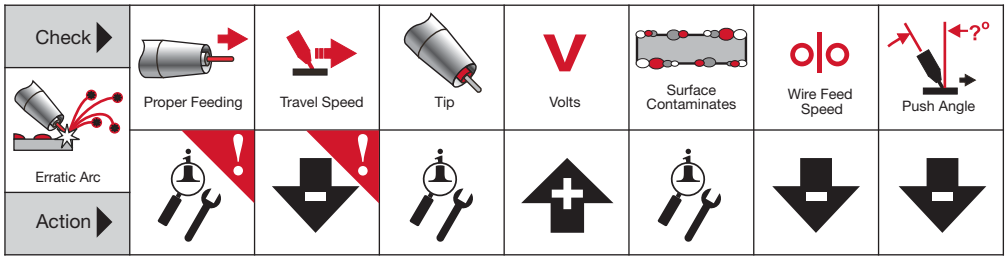
Test cable inductance levels using the Power Wave® Manager software exclusively from Lincoln Electric®.

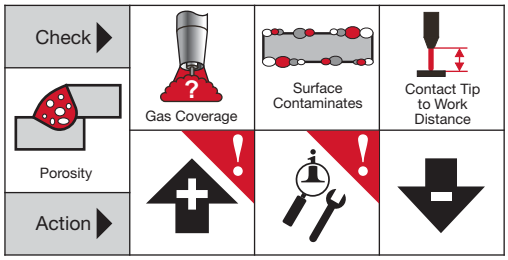
Connection Diagram

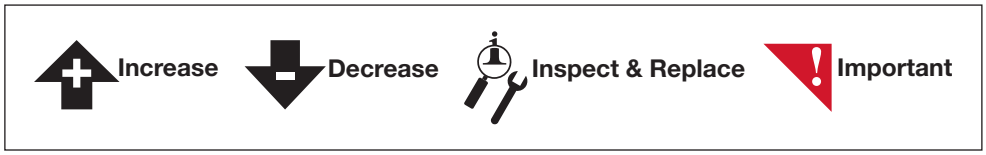


Troubleshooting

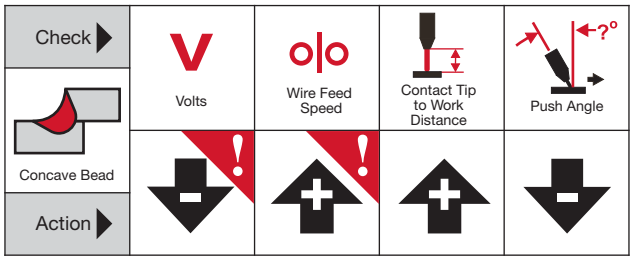


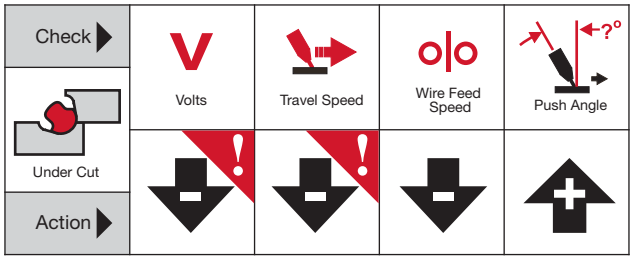


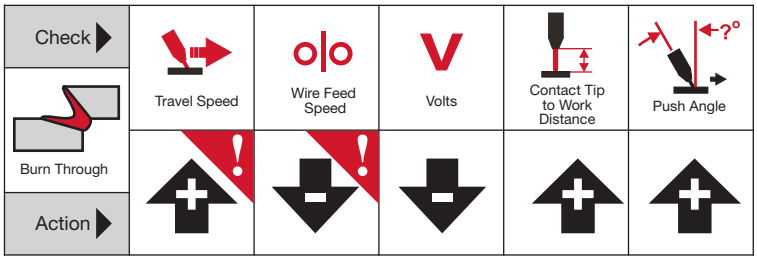


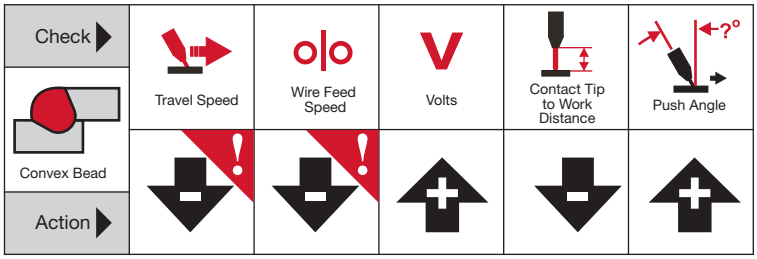


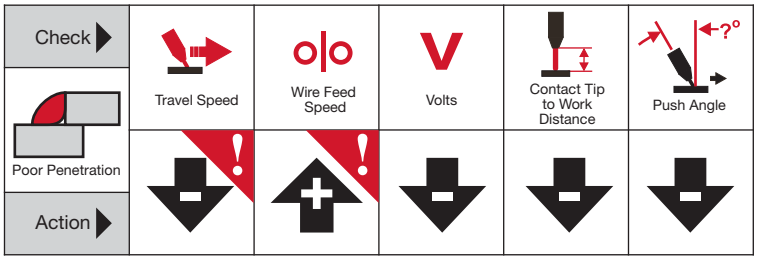
Troubleshooting

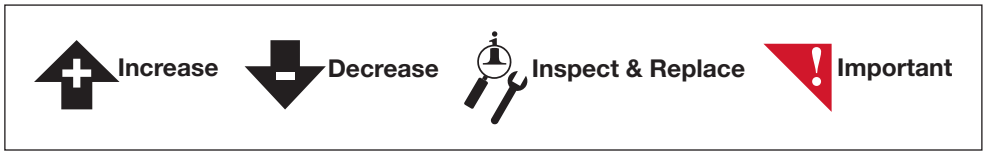




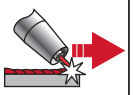








Icons

 Wire Type	 Gas	 Material Thickness	Wire Feed Speed	 Travel Speed	V Volts	A Amps	 Contact Tip to Work Distance	 Arc Length	 Control Knob	 Stop / Avoid
 Weld Stud	 Torch	 Positive Sense Lead	 Negative Sense Lead	 Work Clamp	 Torch Nozzle	 Travel Speed (Slow)	 Travel Speed (Fast)	 Spatter (Minimal)	 Spatter	

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.

Push Angle — The angle at which the electrode leads the weld pool relative to the direction of travel.

Synergic — A mode of control which automatically selects a preprogrammed 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.

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 and arc length must be maintained so that the puddle properly follows the arc. Operators typically reduce the arc length control (Trim) 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.

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 customer and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric is not in a position to warrant or guarantee such advice, and assumes no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

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