Weld Process Guide

PRECISION PULSE™ - ALUMINUM

Superior Aluminum Arc Performance

- Increased puddle control
- Improved cleaning action for less soot
- Improved voltage control
- Faster arc reaction
- Ideal for out-of-position,or step / shuffle welding technique.

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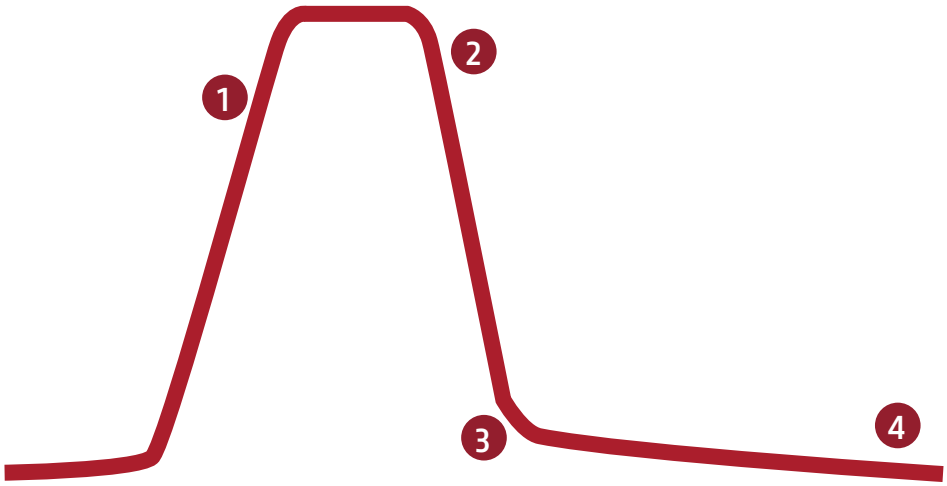
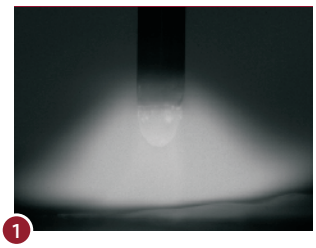
Precision Pulse - Aluminum

Process Description

Based off of the field-proven Precision Pulse weld mode, Aluminum Precision Pulse provides a shorter, more focused arc that helps to improve puddle control and reduce soot for increased weld quality over traditional Aluminum Pulse modes. With a fixed pulse frequency to help create a more consistent droplet transfer, Aluminum Precision Pulse allows for faster arc reaction during CTWD changes – making it the ideal aluminum process when welding out-of-position or using the step/shuffle welding technique.



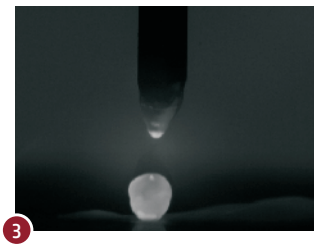


1

PULSE RAMP/PEAK
A controlled current increase creates a molten droplet without disturbing the puddle and minimizes the size of the arc cone.

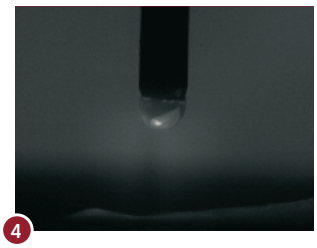
2

TAILOUT
Reducing current relaxes the plasma force as the droplet approaches the puddle creating a clean droplet transfer.



3

BACKGROUND
Lower background helps maintain control by minimizing the puddle heating.



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FREQUENCY
Frequency is a preset value. The UltimArc control allows the operator to fine tune the pulse frequency.

Optimization

Synergic Welding

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

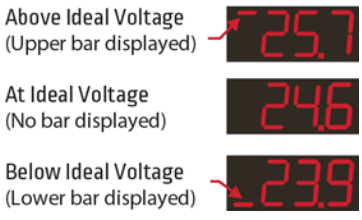
Voltage and UltimArc®

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



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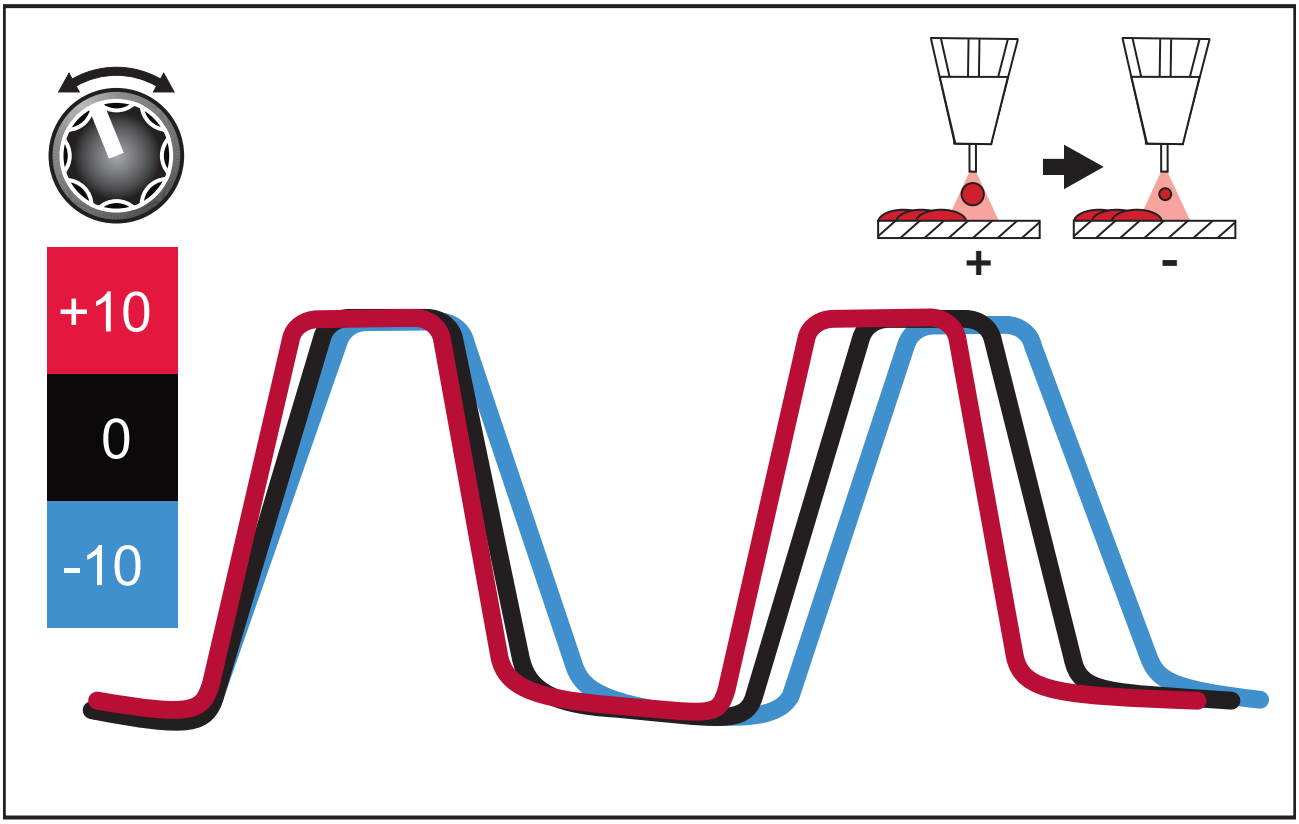
UltimArc Control

The UltimArc™ control allows the user to make all the necessary adjustments to fine tune the frequency through a single dial. Increase (+) or decrease(-) this setting to optimize the focus and droplet transfer of the arc.



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Arc Optimization

Gas Preflow

Preflow starts the inert gas shield before the welding process begins. A minimal Preflow Time is recommended so that the inert shield is established before the arc is struck. If an excessive gas surge is experienced, the preflow time should be extended to allow the surge to dissipate.

Preflow Time

0.1 – 1.0 SECONDS

Strike

Run-In WFS controls the wire feed speed before the arc ignites. Slower Run-In speeds require less strike current to initiate an arc and generally result in better arc starting performance and longer tip life. For large diameter aluminum wires that are very conductive, a very low Run-In WFS provides the best method of positive arc striking.

WIRE SIZE	RUN-IN WFS
1/16 IN.	30 – 40 IPM
3/64 IN	30 – 50 IPM
.035 IN	30-70 IPM

Crater

Crater is an optional set of procedures for filling the crater at the end of the weld cycle. When turned on (Crater time set for non-zero time) the Crater procedure defines a set point the output will end at. Crater begins when the trigger is released (2 step operation) and continues until the crater timer has timed out. Typically the crater serves 2 purposes:

1. A controlled reduction of the puddle size.
2. Fills the crater and leaves a "button" of weld metal.

The optimum crater time will depend on the size of the puddle. Larger, hotter puddles will require longer Crater times.

Burnback

Burnback is an optional timer that delays the turn off of the power source to allow excess wire to burn off and not stick in the weld puddle. The optimum setting for Burnback depends on the actual WFS just before the feeder is commanded to turn off. Burnback must be set long enough to eliminate wire sticking, and not long enough to burn back to the tip.

If Crater is being used and/or the WFS is low, minimal Burnback is required. If the WFS is high, and there is a large puddle, longer Burnback times are required to insure the end of the wire has cleared the top of the puddle.

Postflow

The Postflow Timer is an optional timer that insures the inert gas covers the puddle after welding has stopped and until the puddle has solidified. The optimum time depends on the puddle size at the time the arc is turned off. If Crater is used to reduce the puddle size, the Postflow time can be minimized.

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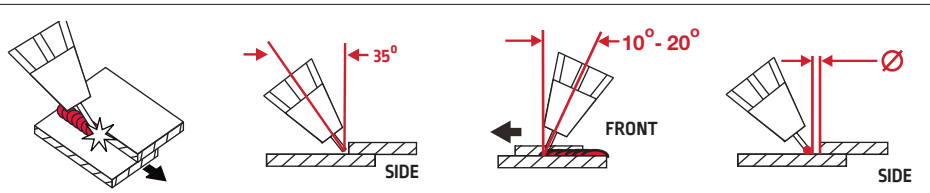
Flat Lap Weld

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	35°



Ø - placement of wire position one wire diameter from joint

Argon 13 mm		in./min	in./min	T	
3/64" 5XXX	1.5mm	250	60	17	0
	3.0mm	400	40	20	0
	6.0mm	550	20	21.5	0
3/64" 4XXX	1.5mm	150	53	16	-8
	3.0mm	280	40	18	0
	6.0mm	385	20	20	0

Argon 15 mm		in./min	in./min	T	
1/16" 5XXX	1.5mm	125	50	15.5	0
	3.0mm	250	50	19.5	0
	6.0mm	375	30	21	0
1/16" 4XXX	1.5mm	85	45	15.5	
	3.0mm	150	40	18.5	0
	6.0mm	275	35	20.5	0

Material Thickness | Wire Feed Speed | Travel Speed | T Trim | UltimArc

See Customer Assistance Policy and Disclaimer Notice on page 9.

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2F T-Joint

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	40°

Argon 15 mm		in./min	in./min	T	
3/64" 5XXX	1.5mm	250	45	16	0
	3.0mm	400	30	19	0
	6.0mm	550	19	21.5	0
3/64" 4XXX	1.5mm	150	30	16	-8
	3.0mm	300	30	20	0
	6.0mm	385	19	22	0

Argon 15 mm		in./min	in./min	T	
1/16" 5XXX	1.5mm	140	35	15.5	0
	3.0mm	275	40	20	0
	6.0mm	375	45	22.5	0
1/16" 4XXX	1.5mm	95	35	15.5	
	3.0mm	200	40	20	0
	6.0mm	275	30	22.5	0

Material Thickness | Wire Feed Speed | Travel Speed | T Trim | UltimArc

See Customer Assistance Policy and Disclaimer Notice on page 9.

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Aluminum Welding Setup

Wire Feed Guides
Select the proper sized non-metallic guides, and liners to reduce feeding friction and properly support wire. Reduce or eliminate wire contact to metallic surfaces. Wire shavings in the feeding system are an indication of metal to metal contact or other wire feeding problem.

Drive Rolls
Use the proper size “Aluminum” type drive rolls built with “U” grooves. Polish the U groove surfaces to eliminate rough surfaces where aluminum can accumulate. Drive roll tension should be set to consistently feed wire but do not over-tight. Over tightened drive rolls will deform / flatten the wire, which will be difficult to feed well.

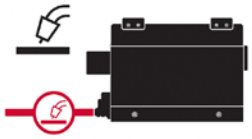
Welding Torches / Guns
Use water cooled torches when possible especially in high duty cycle applications. Water cooled guns run cooler with less feeding resistance because the tip remains cooler.

Use push-pull or spool guns when necessary

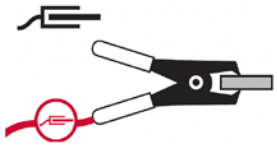
Set-Up

Sense Leads

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

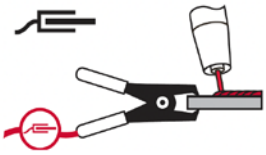


A work sense lead (optional) is highly recommended for total welding cable lengths >50 ft. and should be connected directly to the workpiece.

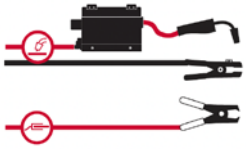


DO NOT connect either sense lead to a welding stud on the power source as this may result in erratic arc behavior.

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.



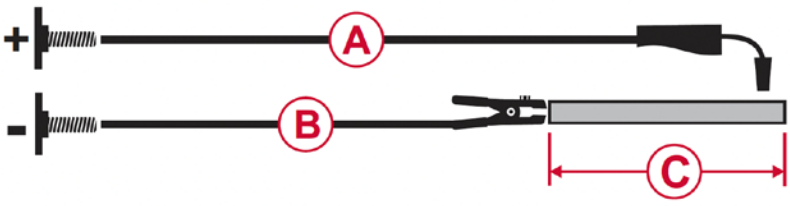
DO NOT route sense lead cable close to high current welding cables as this may distort the sense lead signal.

Work Leads

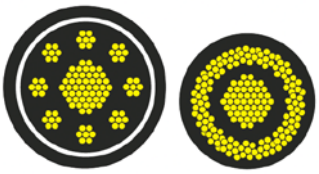
Connect the work lead to the negative stud on the power source and directly to the workpiece. Maintain the shortest connection length possible.

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.

Troubleshooting

Erratic Arc	Check	Proper Feeding	Spring Loaded Tip* (5000 Series)	Surface Contaminates	Volts	Travel Speed	Wire Feed Speed	Tip	Electrode Sense Lead
	Action	!	!		+	-	-		
Fine Spatter	Check	Volts	Gas Coverage						
	Action	- !	!						
Large Spatter	Check	Volts	Travel Speed	Wire Feed Speed	Push Angle	Gas Coverage	Contact Tip to Work Distance		
	Action	+ !	- !	-	-		-		
Porosity	Check	Gas Coverage	Surface Contaminates	Contact Tip to Work Distance	Tip	Travel Speed	Push Angle		
	Action	!	!	-		-	-		
Concave Bead	Check	Wire Feed Speed	UltimArc™	Volts	Push Angle				
	Action	- !	!	-	-				

* The use of a spring loaded tip is recommended for semi-automatic welding applications using 5000 series electrode.

+ Increase
- Decrease
Inspect & Replace
! Important

Troubleshooting

	Check	Wire Feed Speed	UltimArc™	Volts	Travel Speed	Contact Tip to Work Distance	Push Angle
Convex Bead	Action	↑ !	↑ !	↑	↓	↓	↑

	Check	Wire Feed Speed	UltimArc™	Travel Speed	Volts	Push Angle
Poor Penetration	Action	↑ !	↑ !	↓	↓	↓

	Check	Wire Feed Speed	UltimArc™	Travel Speed	Volts	Push Angle
Burnthrough	Action	↓ !	↓ !	↑	↓	↑

	Check	Wire Feed Speed	UltimArc™	Volts	Travel Speed	Push Angle
Under Cut	Action	↓ !	↓ !	↓	↓	↑

	Check	Wire Feed Speed	Travel Speed	UltimArc™	Weave
Gap Bridging	Action	↓ !	↓ !	↑	↑

↑ Increase
↓ Decrease
Inspect & Replace
! Important

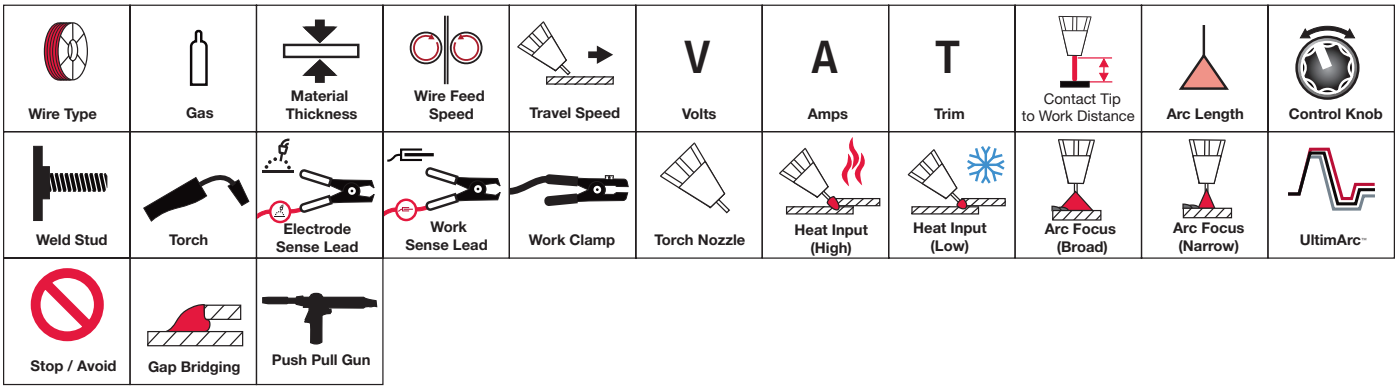
Troubleshooting

Cracking	Check	Wire Type	Wire Feed Speed	Double Back on Crater		
	Action					
Soot	Check	Gas Flow	Volts	Contact Tip to Work Distance	Travel Speed	Surface Contaminates
	Action					
Cold Starting	Check	Wire Feed Speed	Gas Pre-flow	Burnback	Run-in Speed	
	Action					
Noodle Welding	Check	Volts	Travel Speed	Weave	Electrode Sense Lead	
	Action					

Increase
Decrease
Inspect & Replace
Important

Glossary

Icons



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.