

Power Mode™ Aluminum Welding Process Guide

Overview

Power Mode™ – For Superior Quality Aluminum Welding.

- **More consistent weld penetration.**
- **Fewer fusion defects in welds.**
- **Provides stable arc performance and less current fluctuation.**

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ELECTRIC

The Performance You Need.
The Quality You Expect.SM

Process Description

A patented process, Power Mode™ uses energy ($V \times I = W$) to regulate the arc length.

Power Mode™ is a process that adjusts the output current in accordance with the difference between the commanded preset power and the actual power. Power Mode™ provides better current stability than CV with spray transfer mode and aluminum welding.

The power supply responds to changes in voltage sensed at the welding arc. However, unlike a Constant Voltage weld process, the Power Mode will respond with less change in current than a Constant Voltage program.

Instead of controlling output voltage, Power Mode controls output power (voltage X current).

Constant voltage (CV) output characteristic has a slightly negative slope. In comparison with CV output characteristic, same arc length fluctuation will result in smaller current adjustment in CC or Power Mode, which will correspond to less effect on penetration.

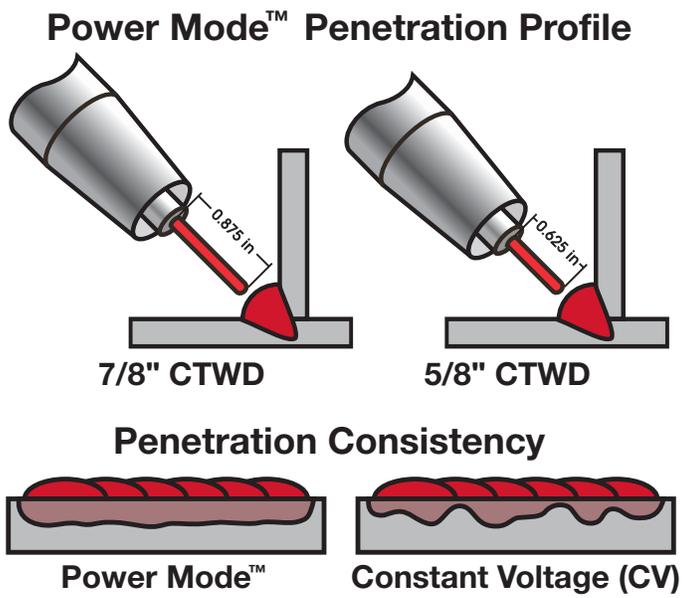
Power Mode aids in the control of the arc's response to variations in stickout. A change in stickout forces a current adjustment so that output power remains constant.

Using PowerMode™ instead of Constant Voltage (CV)

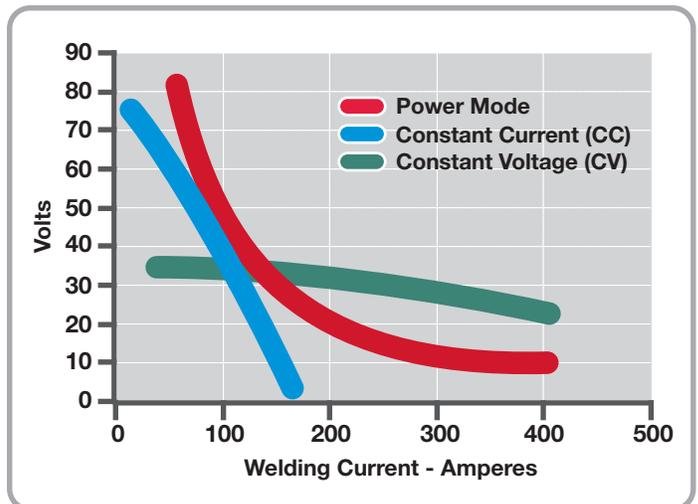
During weld starts, Power Mode operates in constant voltage, eliminating the traditional drooper problems of arc starts during welding. Power Mode behaves similarly to a constant current "drooper" machine during welding, making it an ideal candidate for GMAW welding of aluminum.

The major advantage of Power Mode is the consistency of weld penetration and current while in axial spray transfer. The Power Mode is more adaptive than standard CV to arc length fluctuations in aluminum spray transfer welding because its output characteristic is programmed to react in reducing voltage by increasing current in smaller but more frequent increments, thus maintaining preset power output.

Power Mode™ gives improved penetration profile compared to Constant Voltage (CV). Power Mode™ is suitable for high travel speed welding and is excellent at welding thicker aluminum plate in semi-automatic and automatic modes, giving a desirable penetration profile. The appearance of the weld is excellent.

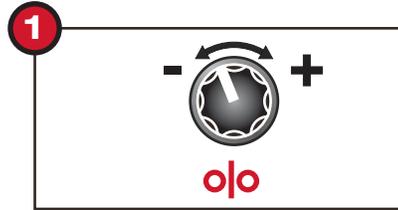


Output characteristics of CC, CV and Power Mode

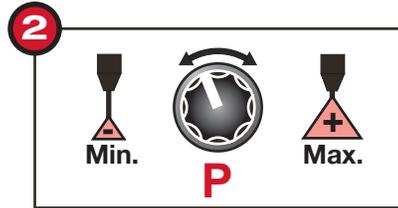


Power Mode™ Controls

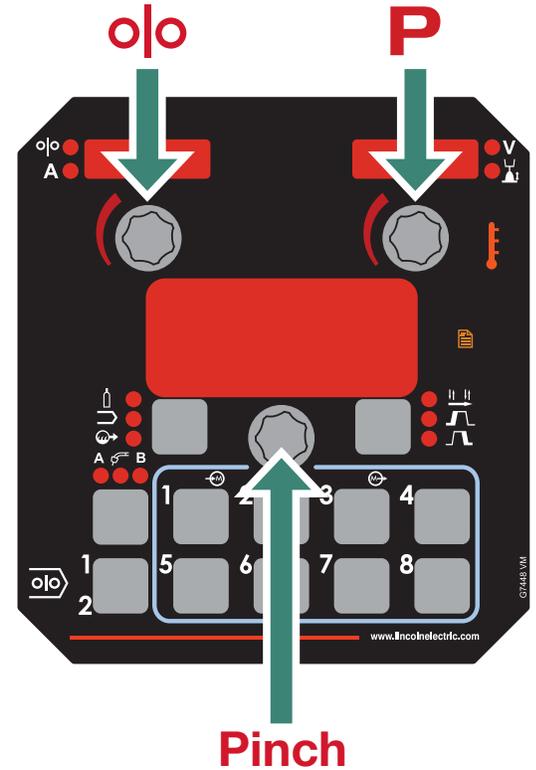
1 Adjust WFS to the desired setting. Refer to the Application section for the recommended settings.



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

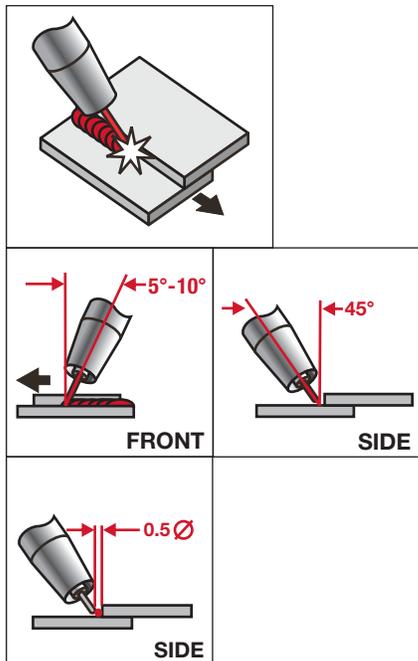


3 Pinch is used as a shorting response to control shorting ramp rates. Pinch has no effect on Spray Transfer.



Pinch

1F / 2F Lap & Fillet – Semi-Automatic & Automatic

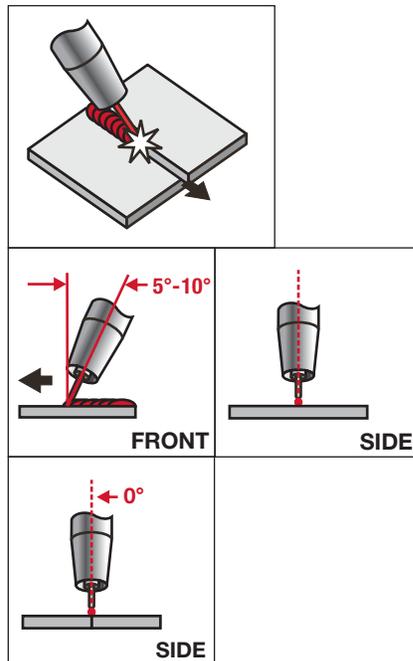


Lap & Fillet Weld – Process: Power Mode™

The following procedures are recommended for lap and fillet welds including high speed robotic fillet welds or semi-automatic lap welds on 6XXX series base materials. The following procedures should be used as a general guideline:

- Shorter contact to work distance (CTWD) is recommended for aluminum: 1/2 in. (12 mm) to 5/8 in. (16 mm).
- To minimize a cold weld bead at the beginning, use the Start feature on the POWER MIG® or Power Wave® power source.
- To reduce the likelihood of crater cracking, use the Crater feature on the POWER MIG® or Power Wave® power source.

1G / 2G Butt & Groove – Semi-Automatic & Automatic



Butt & Groove Weld – Process: Power Mode™

The following procedures are recommended for butt and groove welds including formed truck panels and multi-pass groove welds. The following procedures should be used as a general guideline:

- Shorter contact to work distance (CTWD) is recommended for aluminum: 1/2 in. (12 mm) to 5/8 in. (16 mm).
- To minimize a cold weld bead at the beginning, use the Start feature on the POWER MIG® or Power Wave® power source.
- To reduce the likelihood of crater cracking, use the Crater feature on the POWER MIG® or Power Wave® power source.

100% Ar
1/2-5/8 in.



SuperGlaze® 4043 .035 in (0.9 mm)	in (mm)	in/min	Power		
	1/8 (3.2)	300	2.75	22	125
3/16 (4.8)	400	3.5	23	150	
1/4 (6.4)	500	4.5	25	185	
3/8 (9.5)	600	6	27	215	

SuperGlaze® 4043 3/64 in (1.2 mm)	in (mm)	in/min	Power		
	1/8 (3.2)	200	3.5	23	150
3/16 (4.8)	300	5	24	200	
1/4 (6.4)	400	6.25	25	250	
3/8 (9.5)	500	9	27	335	
1/2 (12.7)	600	11	29	380	

SuperGlaze® 4043 1/16 in (1.6 mm)	in (mm)	in/min	Power		
	1/8 (3.2)	125	4	22	180
3/16 (4.8)	150	5	25	200	
1/4 (6.4)	200	6.75	26	260	
3/8 (9.5)	250	8.75	27	320	
1/2 (12.7)	300	10.5	28	370	

100% Ar
1/2-5/8 in.



SuperGlaze® 5356 .035 in (0.9 mm)	in (mm)	in/min	Power		
	1/8 (3.2)	300	1.8	20	90
3/16 (4.8)	400	2.25	21	110	
1/4 (6.4)	500	3	23	130	
3/8 (9.5)	600	4	25	155	
1/2 (12.7)	700	5	27	180	

SuperGlaze® 5356 3/64 in (1.2 mm)	in (mm)	in/min	Power		
	3/16 (4.8)	300	3.5	22	160
1/4 (6.4)	400	4.5	23	190	
3/8 (9.5)	500	5.5	24	235	
1/2 (12.7)	600	6.75	25	270	
1/2 (12.7)	700	8.5	26	320	

SuperGlaze® 5356 1/16 in (1.6 mm)	in (mm)	in/min	Power		
	3/16 (4.8)	150	3.5	22.5	160
1/4 (6.4)	200	5	25	200	
3/8 (9.5)	250	6	26	230	
1/2 (12.7)	300	7.25	27	265	
1/2 (12.7)	350	8.5	28	300	

See Customer Assistance Policy and Disclaimer Notice on page 7.

Trouble Shooting

Check ▶	P		o o	
	Power	Travel Speed	Wire Feed Speed	Gas Coverage
Action ▶				

Check ▶		o o	P	
	Travel Speed	Wire Feed Speed	Power	Push Angle
Action ▶				

Check ▶			P	
	Proper Feeding	Travel Speed	Power	Tip
Action ▶				

Check ▶	P	o o		
	Power	Wire Feed Speed	Travel Speed	Push Angle
Action ▶				

Check ▶			
	Gas Coverage	Surface Contaminates	Contact Tip to Work Distance
Action ▶			

Check ▶		o o	P	
	Travel Speed	Wire Feed Speed	Power	Push Angle
Action ▶				

Check ▶			
	Gas Coverage	Contact Tip to Work Distance	Push Angle
Action ▶			

Check ▶	P	o o		
	Power	Wire Feed Speed	Travel Speed	Push Angle
Action ▶				

Check ▶		
	Double Back on Crater	Use Crater Settings
Action ▶		

Check ▶	P		o o	
	Power	Travel Speed	Wire Feed Speed	Push Angle
Action ▶				

Increase
 Decrease
 Inspect & Replace
 Important

Icons

 Wire Type	 Gas	 Material Thickness	 Wire Feed Speed	 Travel Speed	 Work Angle	 Power
 Arc Length	 Control Knob	 Weld Stud	 Torch	 Work Clamp	 Contact Tip to Work Distance	 Amps

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.

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.

In welding aluminum, it is important to remember that adequate inert gas shielding is much more critical than when welding steel. In order to maintain a good gas shield, the torch must be held with a “leading” angle of 10 -15 degrees. Additionally, the

Contact Tip to Work Distance (CTWD) should be kept as short as possible, preferentially in the range of 1/2" – 5/8"

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.

Refer to the included trouble-shooting guide for assistance in overcoming welding issues.

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.

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 requirement. Subject to change.

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