Pulse-On-Pulse™ GMAW Weld Process Guide

Overview

Pulse on Pulse GMAW® – GTAW appearance with GMAW productivity.

- **Excellent control of heat input on thinner materials.**
- **Eliminates in-line weaving.**
- **Optimum productivity in robotic and semi-automatic applications.**
- **Uniform, consistent beads on welds in which appearance is critical.**
- **Easier training/Skill level.**

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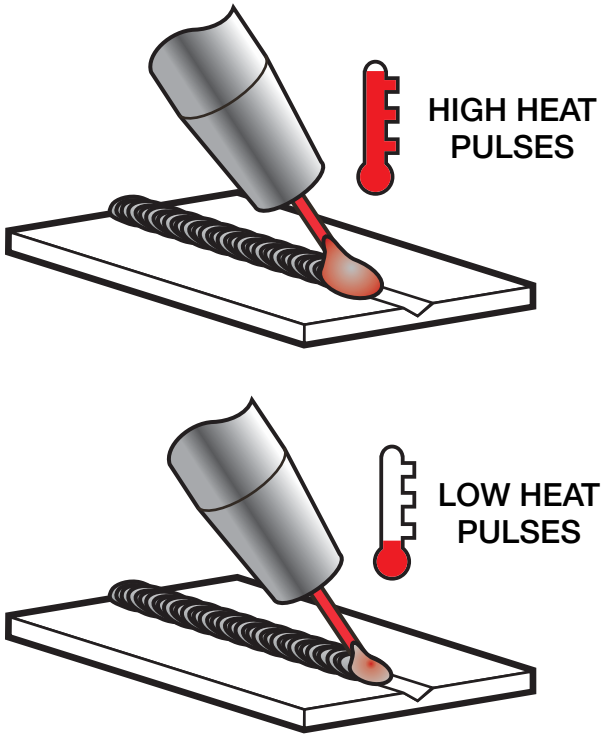
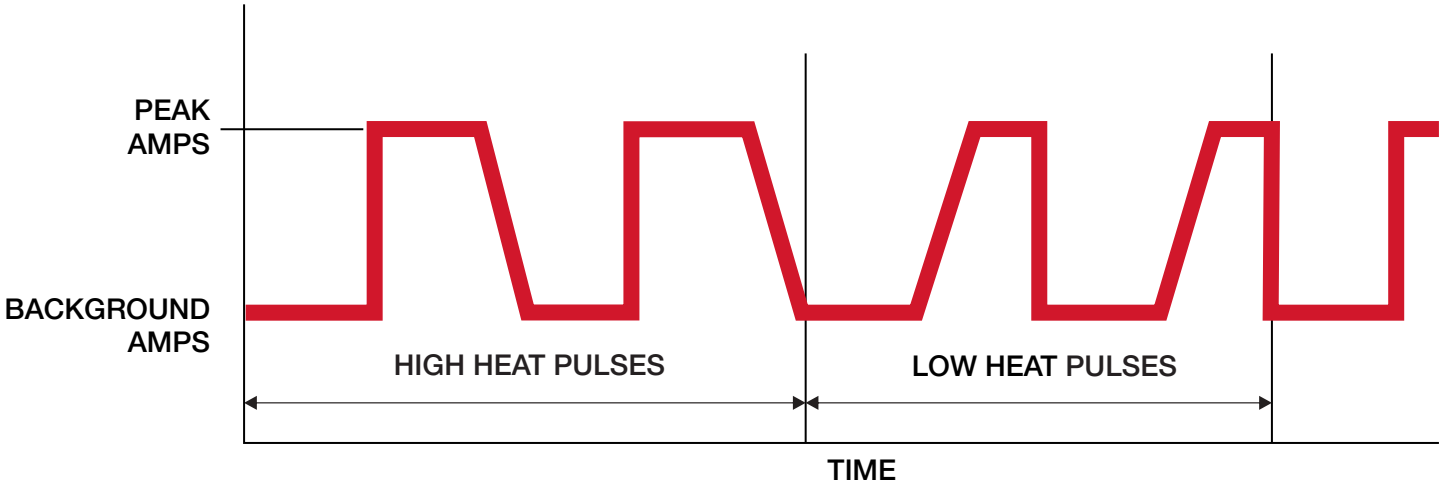
Process Description

Pulse on Pulse™ (GMAW-PP) is a Lincoln patented process specifically designed for use in welding relatively thin (less than 1/4" thick) aluminum. It produces weld beads with very consistent uniform ripple.

In Pulse on Pulse modes, two distinct pulse types are used, instead of the single pulse type normally used in GMAW-P. A number of high energy pulses are used to obtain spray transfer and transfer metal across the arc. After a number of such pulses, depending on the wire feed speed used, an identical number of low energy pulses are performed. The Peak Current, Background Current, and Frequency are identical for the high energy and low energy pulses. However, the details of the current ramp up and ramp down rates mean that a low energy pulse contains less energy than a high energy pulse In addition to cooling the weld down, the major effect of the low energy pulses is that they form a weld ripple. Since they occur at very regular time intervals, the weld bead obtained is very uniform with a very consistent ripple pattern. In fact, the bead has its best appearance if no oscillation of the welding gun ("whipping") is used.

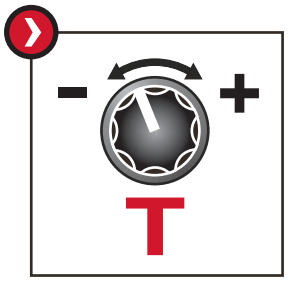


Waveform

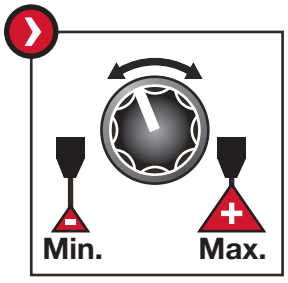


Utilizing Pulse-On-Pulse™

Adjust WFS to:
- Control the weld deposition rate.
- Control heat input.



Adjust TRIM to:
- Control the arc length for a more stable process.



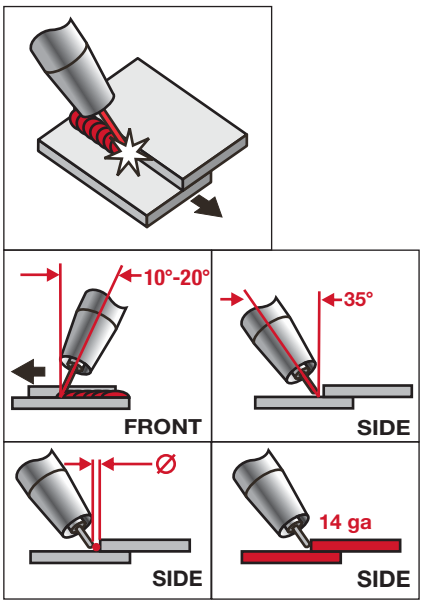
Adjust UltimArc™ to:
- Increase or decrease the space between the "ripples."

+10

0

-10

1F / PA Lap & Fillet



- 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.

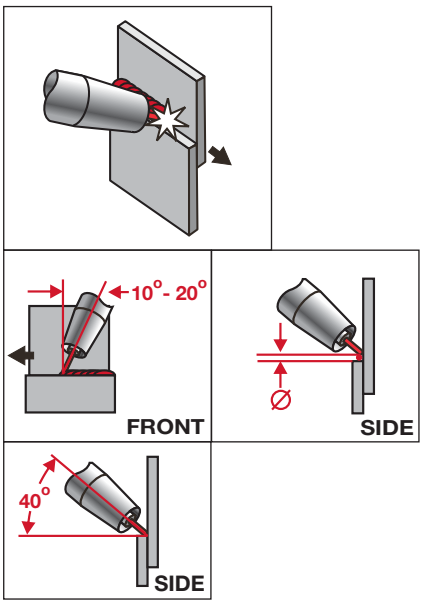
100% Ar

		in/min
4043 Alloy 0.035" dia.	1/4 in	600.0
	3/16 in	550.0
	10 ga	400.0
	12 ga	300.0
	14 ga	220.0
	16 ga	150.0
4043 Alloy 3/64" dia.	1/4 in	400.0
	3/16 in	340.0
	10 ga	300.0
	12 ga	250.0
	14 ga	135.0
	16 ga	100.0

100% Ar

		in/min
5356 Alloy 0.035" dia.	1/4 in	700.0
	3/16 in	670.0
	10 ga	550.0
	12 ga	400.0
	14 ga	300.0
	16 ga	225.0
5356 Alloy 3/64" dia.	1/4 in	500.0
	3/16 in	375.0
	10 ga	300.0
	12 ga	200.0
	14 ga	175.0
	16 ga	125.0

2F / PB Lap & Fillet



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

100% Ar

		in/min
4043 Alloy 0.035" dia.	1/4 in	600.0
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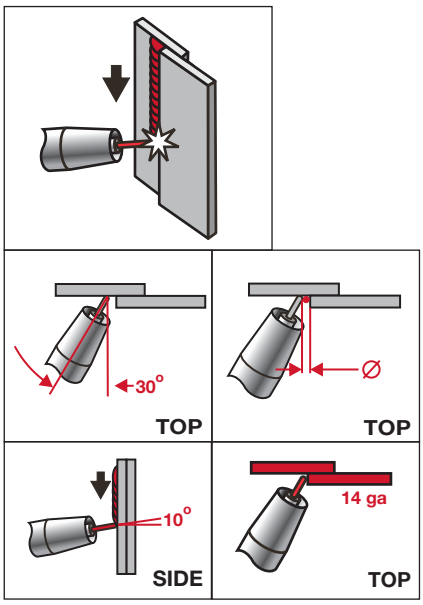
	16 ga	125.0

Trim and Ultimarc should be used at the nominal settings. Adjust to application settings.

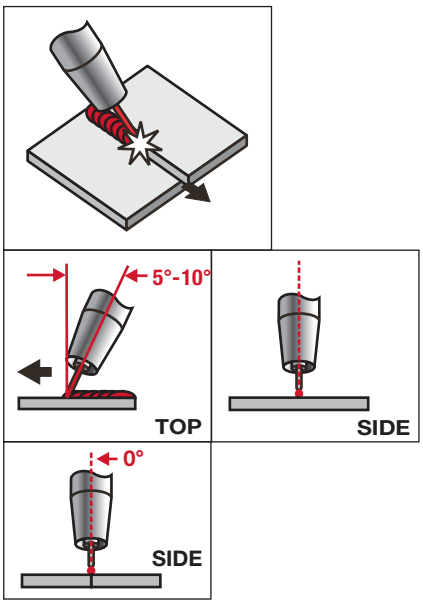
See Customer Assistance Policy and Disclaimer Notice on page 8.

3F / PG Lap & Fillet



- 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.

1G / 2G Butt & Groove



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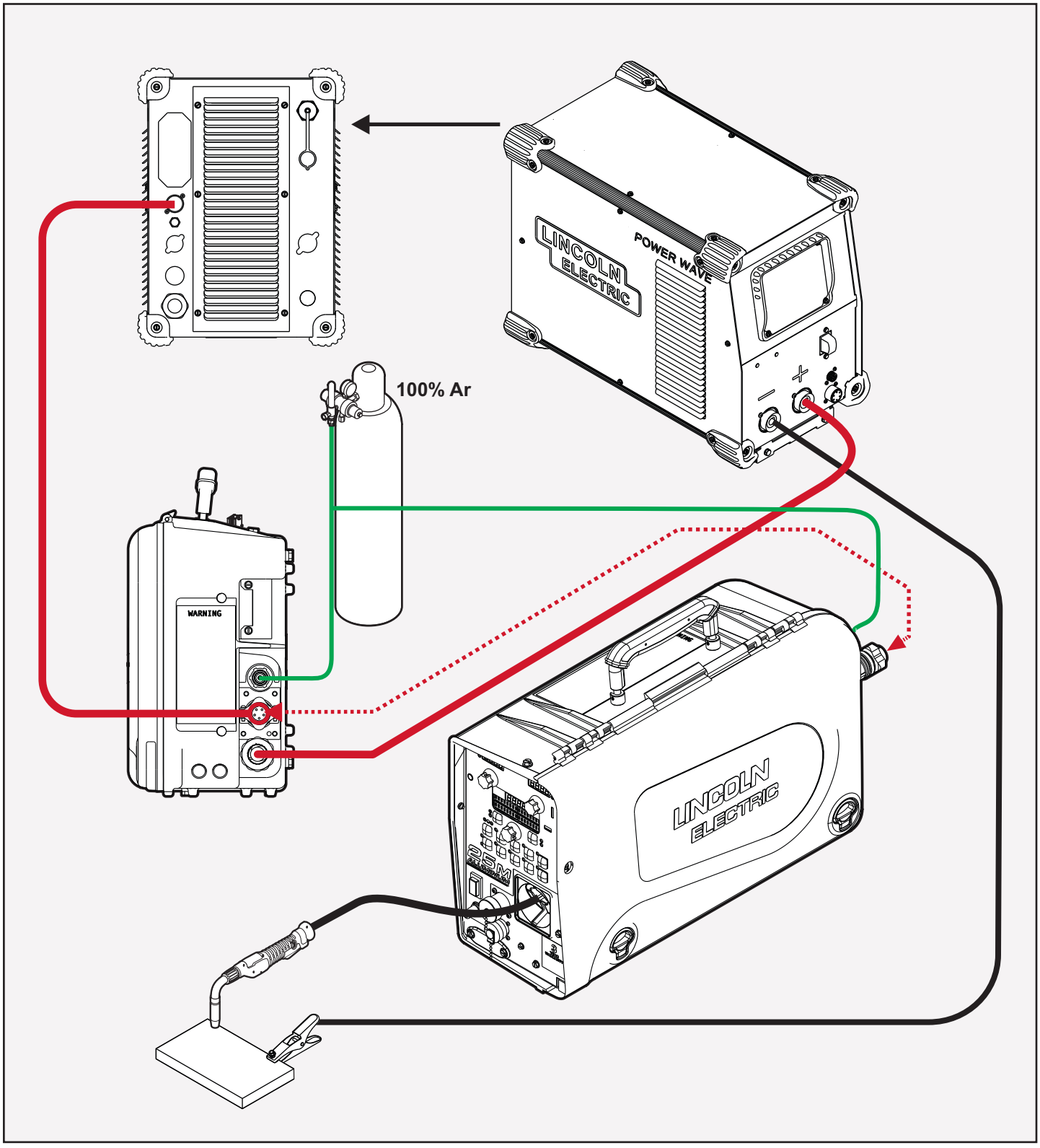
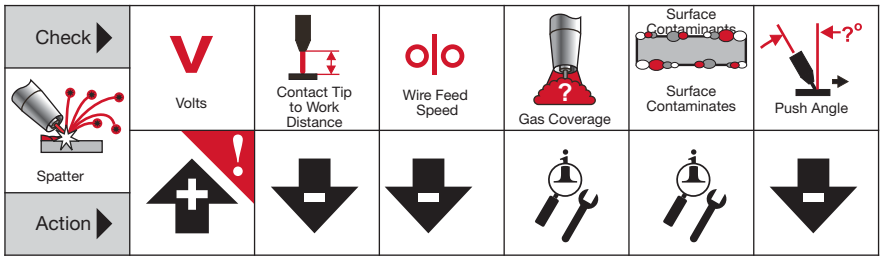
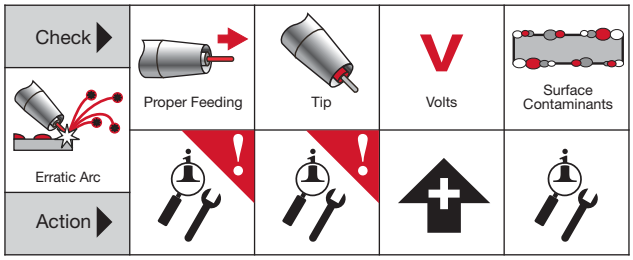
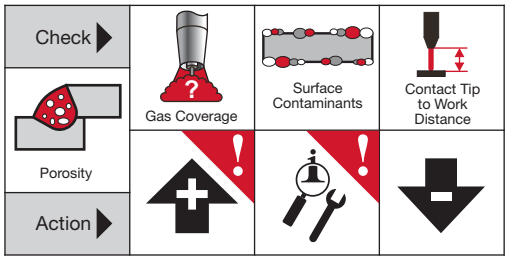
Connection Diagram

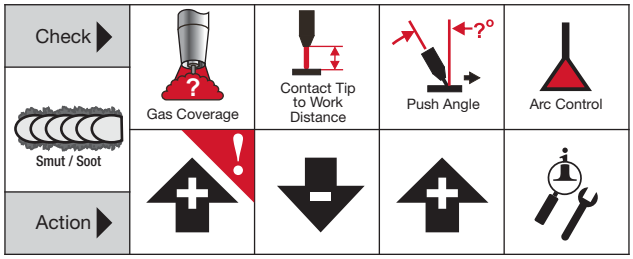


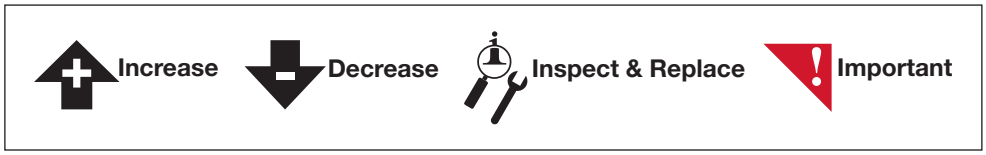
Troubleshooting











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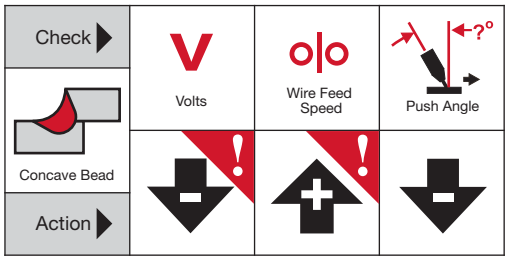
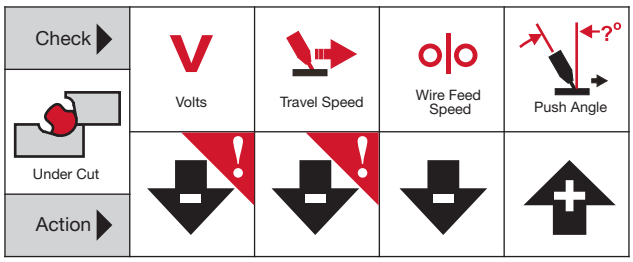
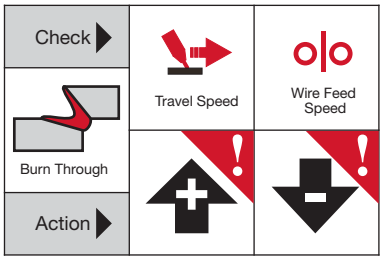
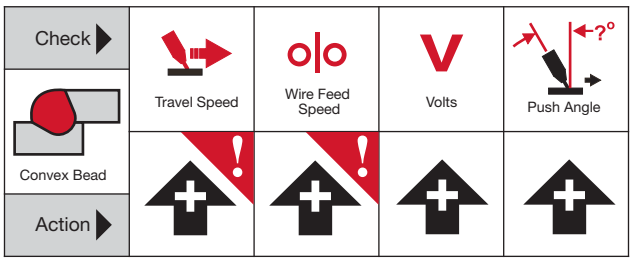
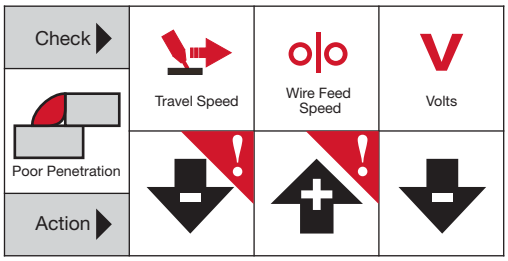
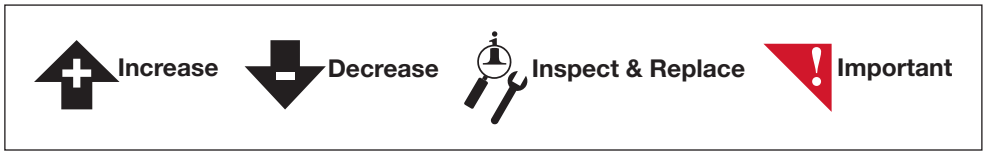








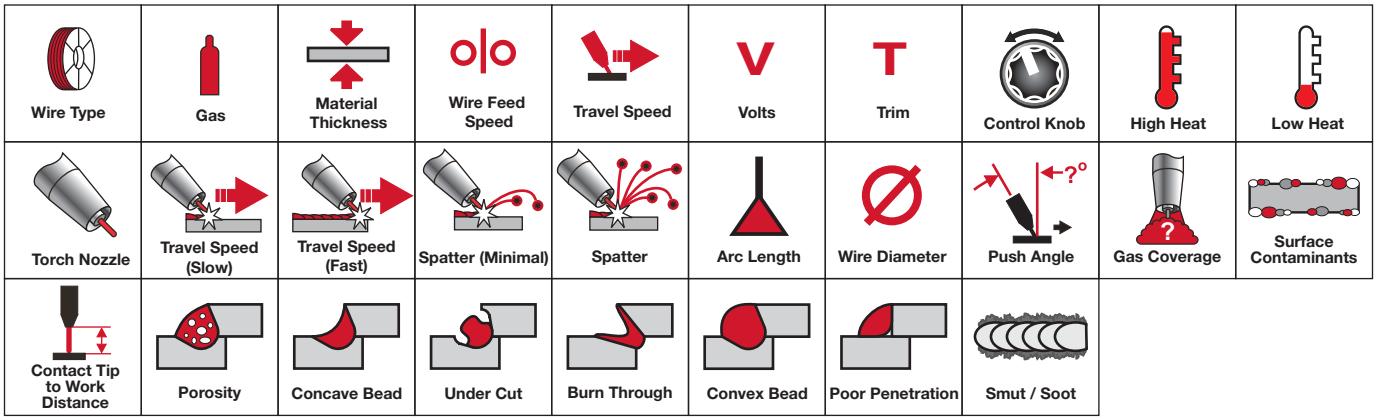




Pulse-On-Pulse™ GMAW Glossary

TE12.018

Icons



Technical Terms

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

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