Weld Process Guide

RAPID X® LS

Automotive component manufacturers are facing increased demand for better paint adhesion and longer resulting corrosion life of their components. To help meet this challenge, Lincoln Electric has developed a low silicate wire that reduces surface silicates to help improve paint adhesion. The Rapid X® process was developed for high travel speed applications by combining a very short arc length with very low spatter operation to provide industry-leading results on thin material. Rapid X® LS is a modification to this industry leading technology to adapt the Rapid X® waveform for the unique chemistry of low silicate wires like Lincoln Electric's SuperArc® XLS.

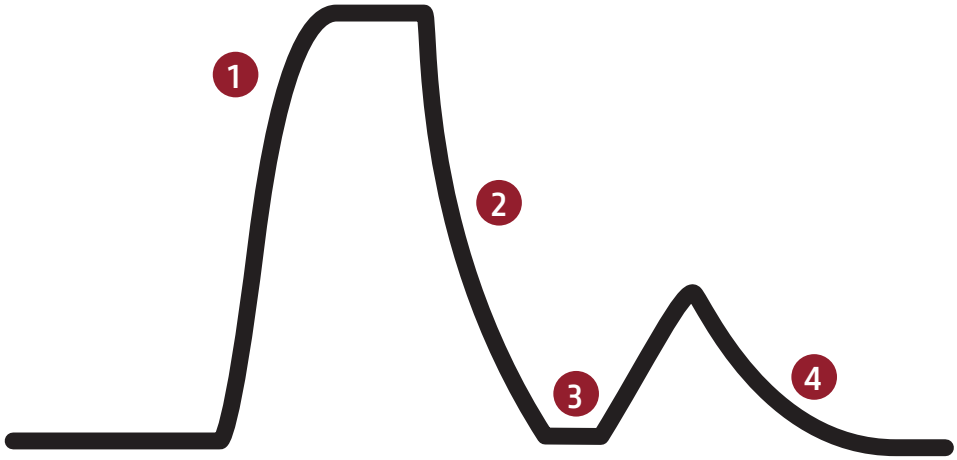
Rapid X® LS provides low spatter, high speed operation to deliver low silicate weld deposits that meet new industry standards for productivity, quality and weld appearance.

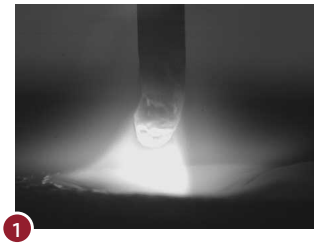
RAPID X® LS

Index

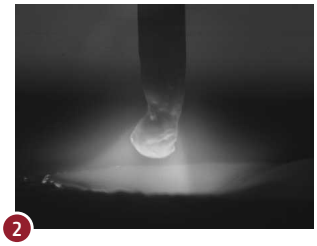
RAPID X® LS

Waveform

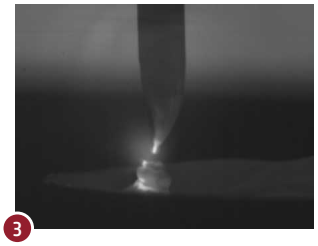



1

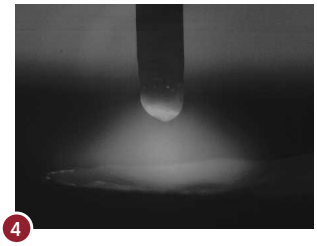
PULSE RAMP/PEAK
A rapid current increase creates a molten droplet.


2

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


3

WET-IN
Proprietary hardware quickly reduces the current at the instant the droplet contacts the puddle, reducing spatter after the droplet detaches.


4

PUDDLE REPULSION
A plasma boost pushes the puddle away, creating separation and a stable rhythm of the weld pool.

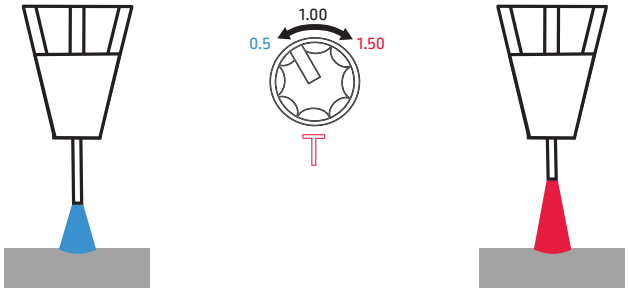
Optimization

Synergic Welding

1. Adjust WFS to obtain proper fill rate at desired travel speed (See applications section for recommended settings).

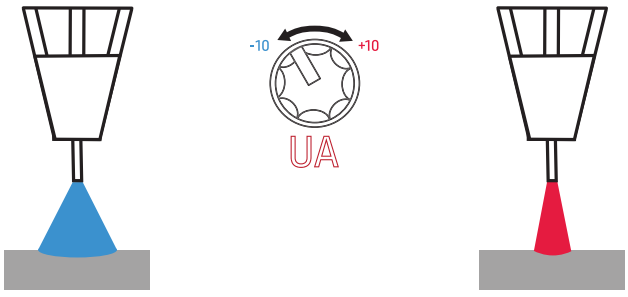
TRIM

2. Adjusting Trim increases or decreases the arc length, allowing the user to fine tune arc characteristics. Based on WFS, a pre-programmed nominal voltage is selected.



ULTIMARC®

3. The UltimArc® control adjusts the pulse frequency to fine tune droplet transfer. It can be used to modify arc focus for varied welding positions and joint configurations.



- ULTIMARC® –DECREASED ARC FOCUS

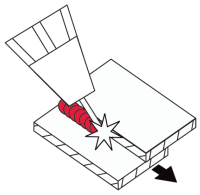
+ ULTIMARC®– INCREASED ARC FOCUS

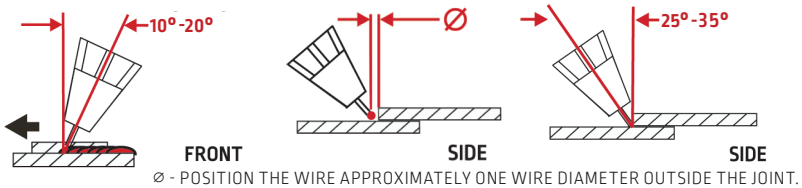
RAPID X® LS

Flat Lap Weld Procedures

Imperial

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	25°-35°





Ø - POSITION THE WIRE APPROXIMATELY ONE WIRE DIAMETER OUTSIDE THE JOINT.

Imperial

90AR / 10CO$_2$ 1/2 in		in/min	in/min	T	A	V
SuperArc®XLS 0.035 in	0.9 mm	45	200	1.00	98	19.8
	1.2 mm	45	300	1.00	139	21.1
	1.4 mm	45	350	1.00	156	21.7
	1.9 mm	45	450	1.00	193	23.1
	2.6 mm	45	630	0.95	252	24.0

Imperial

90AR / 10CO$_2$ 3/4 in		in/min	in/min	T	A	V
SuperArc®XLS 0.045 in	1.4 mm	45	215	1.00	148	20.8
	1.9 mm	45	330	1.00	218	22.6
	2.6 mm	45	440	1.00	281	24.8
	3.3 mm	45	510	1.00	320	26.2
	3.8 mm	45	560	1.00	341	27.2

Imperial

90AR / 10CO$_2$ 5/8 in		in/min	in/min	T	A	V
SuperArc®XLS 0.040 in	1.2 mm	45	215	1.00	112	20.5
	1.4 mm	45	260	1.00	134	21.1
	1.9 mm	45	385	1.00	190	22.8
	2.6 mm	45	500	1.00	234	24.3
	3.3 mm	45	580	1.00	261	25.3

Material Thickness | Travel Speed | Wire Feed Speed | **T** Trim | **A** Workpoint in Amps | **V** Trim in Volts

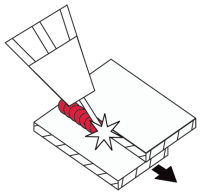
See Customer Assistance Policy and Disclaimer Notice on page 13.

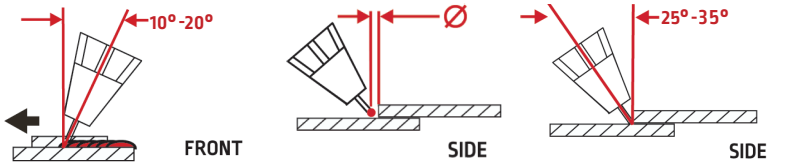
RAPID X® LS

Flat Lap Weld Procedures

Metric

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	25°-35°





Ø - POSITION THE WIRE APPROXIMATELY ONE WIRE DIAMETER OUTSIDE THE JOINT.

Metric

90AR / 10CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.0 mm	1.2 mm	114	5.46	1.00	112	20.5
	1.4 mm	114	6.60	1.00	134	21.1
	1.9 mm	114	9.78	1.00	190	22.8
	2.6 mm	114	12.70	1.00	234	24.3
	3.3 mm	114	14.73	1.00	261	25.3

Metric

90AR / 10CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.2 mm	1.4 mm	114	5.08	1.00	163	21.0
	1.9 mm	114	7.62	1.00	229	21.9
	2.6 mm	114	9.53	1.00	283	23.5
	3.3 mm	102	12.70	1.00	358	26.0
	3.8 mm	102	13.46	0.95	374	25.3

Metric

80AR / 20CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.0 mm	1.2 mm	114	5.46	1.00	115	23.1
	1.4 mm	114	6.60	1.00	130	23.5
	1.9 mm	114	9.78	1.00	182	25.5
	2.6 mm	114	12.70	1.00	234	27.4
	3.3 mm	114	14.73	1.00	256	28.7

Metric

80AR / 20CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.2 mm	1.4 mm	114	5.08	1.00	160	24.5
	1.9 mm	114	7.62	1.00	221	26.0
	2.6 mm	114	9.91	0.98	284	27.9
	3.3 mm	102	12.07	0.90	329	27.7
	3.8 mm	102	12.70	0.90	340	28.1

Material Thickness | Travel Speed | Wire Feed Speed | **T** Trim | **A** Workpoint in Amps | **V** Trim in Volts

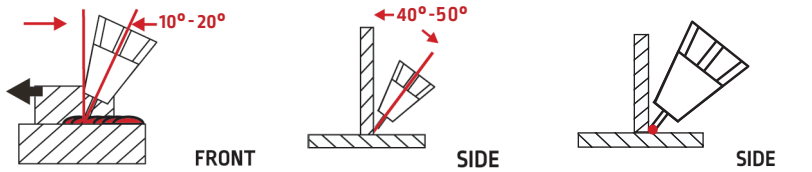
See Customer Assistance Policy and Disclaimer Notice on page 13.

RAPID X® LS

2F/PB T-Joint Weld Procedures

Imperial

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	40°-50°



Ø - POSITION THE WIRE IN THE ROOT OF THE JOINT.

Imperial

90AR / 10CO$_2$ 1/2 in		in/min	in/min	T	A	V
SuperArc®XLS 0.035 in	0.9 mm	45	215	0.95	105	19.0
	1.2 mm	45	300	0.95	139	20.1
	1.4 mm	45	385	0.95	169	21.1
	1.9 mm	40	450	0.95	193	22.0
	2.6 mm	40	570	0.95	229	23.3

Imperial

90AR / 10CO$_2$ 3/4 in		in/min	in/min	T	A	V
SuperArc®XLS 0.045 in	1.4 mm	45	240	1.00	166	21.2
	1.9 mm	45	310	0.95	205	21.0
	2.6 mm	45	430	0.95	274	23.4
	3.3 mm	40	430	0.95	274	23.4
	3.8 mm	40	450	0.95	288	23.8

Imperial

90AR / 10CO$_2$ 5/8 in		in/min	in/min	T	A	V
SuperArc®XLS 0.040 in	1.2 mm	45	220	0.95	115	19.6
	1.4 mm	45	260	0.95	134	20.1
	1.9 mm	45	420	0.93	202	21.7
	2.6 mm	40	420	0.95	202	22.1
	3.3 mm	40	600	0.95	269	24.2

Material Thickness | Travel Speed | Wire Feed Speed | **T** Trim | **A** Workpoint in Amps | **V** Trim in Volts

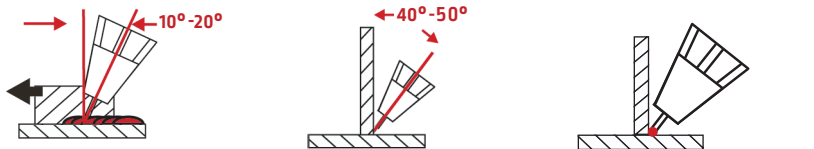
See Customer Assistance Policy and Disclaimer Notice on page 13.

RAPID X® LS

2F/PB T-Joint Weld Procedures

Metric

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	40°-50°



Ø - POSITION THE WIRE IN THE ROOT OF THE JOINT.

Metric

90AR / 10CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.0 mm	1.2 mm	114	5.59	0.95	115	19.6
	1.4 mm	114	6.60	0.95	134	20.1
	1.9 mm	114	10.67	0.93	202	21.7
	2.6 mm	102	10.67	0.95	202	22.1
	3.3 mm	102	15.24	0.95	269	24.2

Metric

90AR / 10CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.2 mm	1.4 mm	114	5.08	0.95	163	20.0
	1.9 mm	114	6.99	0.95	213	20.5
	2.6 mm	114	9.40	0.95	279	22.2
	3.3 mm	102	10.16	0.95	301	22.8
	3.8 mm	102	10.67	0.97	314	23.7

Metric

80AR / 20CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.0 mm	1.2 mm	114	6.10	1.00	124	23.3
	1.4 mm	114	7.11	0.95	137	22.6
	1.9 mm	114	10.16	0.95	190	24.4
	2.6 mm	114	12.32	0.95	227	25.8
	3.3 mm	102	15.24	0.97	264	28.1

Metric

80AR / 20CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.2 mm	1.4 mm	114	5.08	0.92	160	22.5
	1.9 mm	114	6.60	0.95	195	23.8
	2.6 mm	114	8.64	0.95	251	25.7
	3.3 mm	114	10.67	0.95	301	28.0
	3.8 mm	114	11.68	0.95	322	29.1

Material Thickness | Travel Speed | Wire Feed Speed | **T** Trim | **A** Workpoint in Amps | **V** Trim in Volts

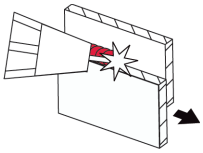
See Customer Assistance Policy and Disclaimer Notice on page 13.

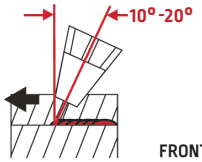
RAPID X® LS

2F/PB Lap Weld Procedures

Imperial

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	25°-35°





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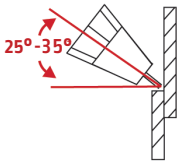
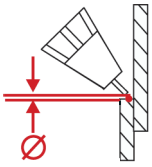


SIDE



SIDE

Ø - POSITION THE WIRE APPROXIMATELY ONE WIRE DIAMETER OUTSIDE THE JOINT.

Imperial

90AR / 10CO$_2$ 1/2 in		in/min	in/min	T	A	V
SuperArc®XLS 0.035	0.9 mm	45	180	1.00	88	19.5
	1.2 mm	45	300	1.00	139	21.1
	1.4 mm	45	340	0.97	153	20.9
	1.9 mm	45	500	0.95	208	22.6
	2.6 mm	45	650	0.93	258	23.7

Imperial

90AR / 10CO$_2$ 3/4 in		in/min	in/min	T	A	V
SuperArc®XLS 0.045 in	1.4 mm	45	215	1.00	148	20.8
	1.9 mm	45	310	0.97	205	21.5
	2.6 mm	40	360	0.97	236	22.5
	3.3 mm	40	420	0.97	268	23.7
	3.8 mm	40	500	0.97	316	25.2

Imperial

90AR / 10CO$_2$ 5/8 in		in/min	in/min	T	A	V
SuperArc®XLS 0.040 in	1.2 mm	45	280	1.00	145	21.4
	1.4 mm	45	340	1.00	172	22.2
	1.9 mm	45	360	1.00	180	22.5
	2.6 mm	45	500	1.00	234	24.3
	3.3 mm	45	550	1.00	250	25.0

Material Thickness | Travel Speed | Wire Feed Speed | **T** Trim | **A** Workpoint in Amps | **V** Trim in Volts

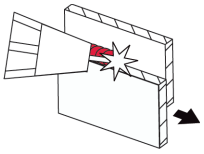
See Customer Assistance Policy and Disclaimer Notice on page 13.

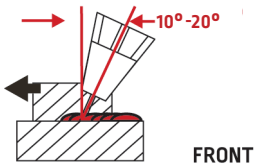
RAPID X® LS

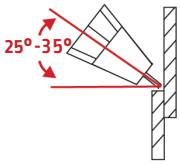
2F/PB Lap Weld Procedures

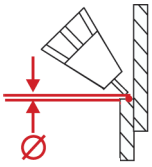
Metric

PLAIN CARBON STEEL	
Travel Angle	10-20°
Work Angle	25°-35°









⌀ - POSITION THE WIRE APPROXIMATELY ONE WIRE DIAMETER OUTSIDE THE JOINT.

Metric

90AR / 10CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.0 mm	1.2 mm	114	7.11	1.00	145	21.4
	1.4 mm	114	8.64	1.00	172	22.2
	1.9 mm	114	9.14	1.00	180	22.5
	2.6 mm	114	12.70	1.00	234	24.3
	3.3 mm	114	13.97	1.00	250	25.0

Metric

90AR / 10CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.2 mm	1.4 mm	114	4.32	0.95	140	19.6
	1.9 mm	114	6.86	0.97	209	20.9
	2.6 mm	114	10.16	0.97	301	23.3
	3.3 mm	102	10.16	0.97	301	23.3
	3.8 mm	102	12.19	0.97	348	24.8

Metric

80AR / 20CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.0 mm	1.2 mm	114	5.46	1.00	115	23.1
	1.4 mm	114	6.60	1.00	130	23.5
	1.9 mm	114	9.78	1.00	182	25.5
	2.6 mm	114	12.70	1.00	234	27.4
	3.3 mm	114	14.22	1.00	249	28.4

Metric

80AR / 20CO$_2$ 15 mm		cm/min	m/min	T	A	V
SuperArc®XLS 1.2 mm	1.4 mm	114	4.06	0.97	134	23.0
	1.9 mm	114	6.60	1.00	195	25.0
	2.6 mm	114	8.64	0.98	251	26.5
	3.3 mm	102	10.80	0.95	304	28.1
	3.8 mm	102	12.07	0.90	329	27.7

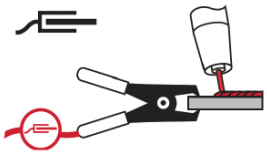
Material Thickness | Travel Speed | Wire Feed Speed | **T** Trim | **A** Workpoint in Amps | **V** Trim in Volts

See Customer Assistance Policy and Disclaimer Notice on page 13.

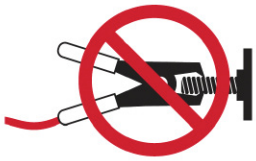
Set-Up

Sense Leads

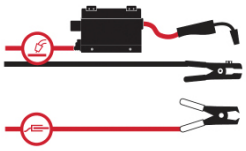
A work sense lead (optional) is highly recommended for total welding cable lengths >50 ft. For best performance, connect the work sense lead close to the welding arc.



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



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

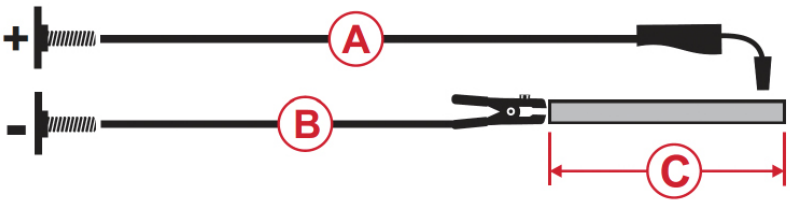


Work Leads

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.



Troubleshooting

Spatter	Check	Trim/Volts	Travel Speed	Wire Feed Speed	Gas Coverage	Push Angle	UltimArc®	Work Sense Lead
	Action	!	!					

Erratic Arc	Check	Proper Feeding	Contact Tip	Travel Speed	Trim/Volts	Wire Feed Speed	Work Sense Lead
	Action	!	!	!			

Porosity	Check	Gas Coverage	Proper Feeding	Contact Tip to Work Distance	Travel Speed
	Action	!			

Concave Bead	Check	Trim/Volts	Wire Feed Speed	Travel Speed
	Action	!		!

- Check Parameters
- Increase
- Decrease
- Inspect & Replace
- Important

Troubleshooting

Burnthrough	Check	Travel Speed	Wire Feed Speed	T/V Trim/Volts	Contact Tip to Work Distance	Push Angle
	Action	↑ !	↓ !	↓	✓	✓

Convex Bead	Check	T/V Trim/Volts	Wire Feed Speed	Push Angle	Contact Tip to Work Distance	Travel Speed
	Action	↑ !	↓ !	✓	✓	↑

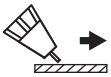
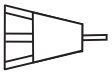
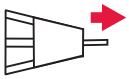
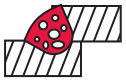
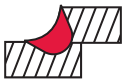
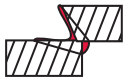
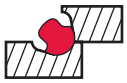
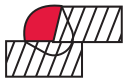
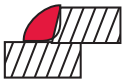
Poor Penetration	Check	Travel Speed	Wire Feed Speed	UltimArc®	Contact Tip to Work Distance	Push Angle
	Action	↓ !	↑ !	↑	✓	✓

- ✓ Check Parameters
- ↑ Increase
- ↓ Decrease
- Inspect & Replace
- ! Important

RAPID X® LS

Glossary

Icons

 Wire Type	 Gas	 Material Thickness	 Wire Feed Speed	 Travel Speed	V Trim in Volts	A Workpoint in Amps	 **UltimArc®**	 Contact Tip to Work Distance	 Push Angle
 Control Knob	 Weld Stud	 Torch	 Work Sense Lead	Work Clamp	 Torch Nozzle	 Spatter	 Erratic Arc	 Proper Feeding	 Arc Length
T Trim	 Gas Coverage	 Porosity	 Concave Bead	 Burnthrough	 Under Cut	 Convex Bead	 Poor Penetration	 Stop/Avoid	

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 – Spherical or elongated entrapments of gas in solidified weld metal.

Travel Angle – The angle of the welding torch 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 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.

