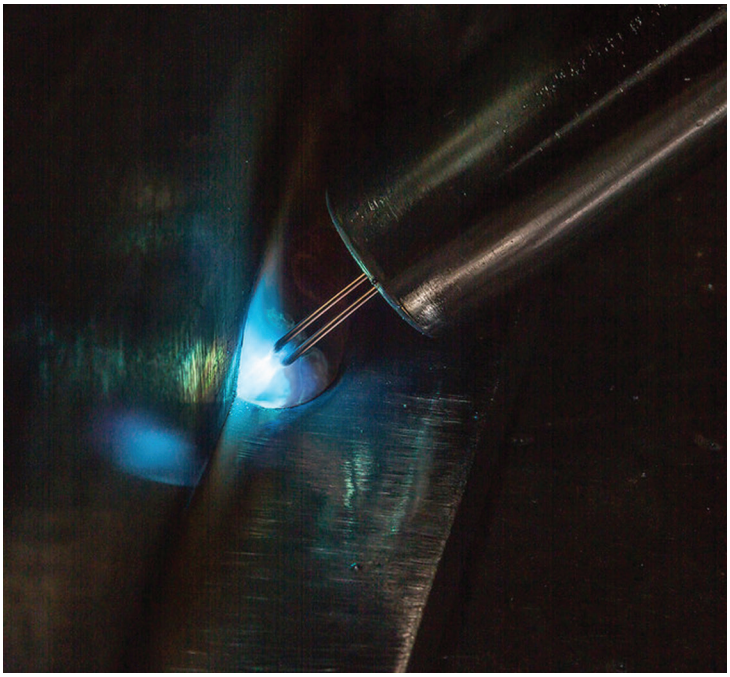
HYPERFILL®

Higher Deposition Welds – Faster. Easier.

- Increase deposition rates
- Easily control large weld puddles
- Robust penetration profiles



View for more information

https://lered.info/45fkgm7

HYPERFILL®

Index

Weld Settings

Synergic Welding

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

Voltage and UltimArc

Based on WFS, a pre-programmed nominal voltage is selected.

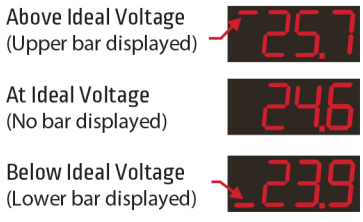
Arc Length

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

Synergic Weld Modes

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



Amperage Requirements

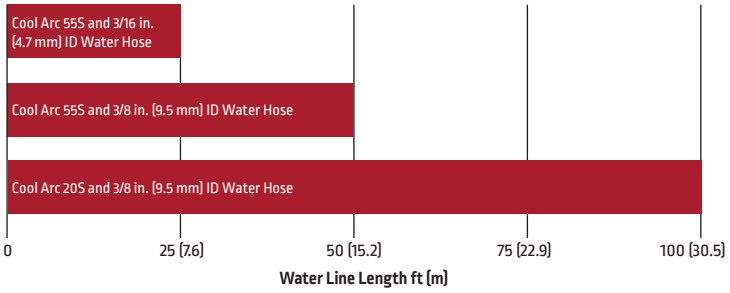
HyperFill is a high amperage process which requires the use of welding guns which can withstand the duty cycle while keeping the system cool. The solution matrix below will help select the right welding gun for your application based on wire type and size.

Wire Type	Solid Wire			Cored Wire	
Wire Diameter	0.035 in.	0.040 in.	0.045 in.	1.2 mm	1.4 mm
Magnum PRO 500 Water-Cooled Welding Gun	●	●	●	●	●
Magnum PRO HDE 350 Welding Gun				●	
Magnum PRO HDE 450 Welding Gun				●	●

Note: The 1.2 mm FCAW HyperFill process can exceed the duty cycle of the 350 HDE welding guns when used at the upper end of the procedure. When pushing past the 350A 100% mixed gas duty cycle of these guns, it is recommended to size up to the 450 HDE welding guns.

Cooling Solution Selection

The cooling equipment suggestions in the chart to the right are minimum requirements for proper cooling performance. All systems can be sized up but should not be sized down. For HyperFill applications using 0.045 in. (1.2 mm) solid wire or exceeding 425A @ 70% duty cycle, the Cool Wave™ 20S should be used. For all applications with hose lengths longer than 25 ft (7.6 m), 3/8 in. (9.5 mm) water hoses should be used.



Note: Water line length is defined as the one-way distance between the water cooler and gun/torch water line connections

HyperFill Contact Tips

The innovative twin wire contact tips are offered in a wide range of wire diameters and styles which have each been designed to provide the wide, smooth arc cone specific to the HyperFill process. In addition to the second hole which is different from a standard Magnum PRO contact tip, the HyperFill tips also use a Camlock Connection for easy, efficient installation.

The selection matrix below provides a quick guide to the contact tip you should use based on your HyperFill application.

	Solid Wire				Metal-Cored Wire	Flux-Cored Wire	
Part Number	0.035 in (0.9 mm)	0.040 in (1.0 mm)	0.045 in (1.2 mm)	0.047 in (1.2 mm)	0.045 in (1.2 mm)	0.045 in (1.2 mm)	0.052 in (1.4 mm)
KP4482-035	●						
KP4482-040		●					
KP4482-045			●		●		
KP4482-047				●			
KP5344-047						●	
KP5344-052							●

Camlock Connection

KP4482 Series HyperFill Contact Tip

KP5344 Series HyperFill FCAW Contact Tip

HyperFill Gas Diffusers

The special Camlock Connection specific to the HyperFill Contact Tips requires the use of a HyperFill Gas Diffuser. Offered in both Water-Cooled and Air- Cooled styles, the selection matrix below will help you understand which diffuser will best fit your application.

Gas Diffuser Series	HyperFill Water-Cooled Gas Diffuser		HyperFill Air-Cooled Gas Diffuser
Part Number	KP4481-1	KP4481-1-B25	KP5367-1
Package Quantity	1	25	1
Magnum PRO 500 Water-Cooled Welding Gun	•	•	
Magnum PRO HDE 350 Welding Gun			•
Magnum PRO HDE 450 Welding Gun			•

Water-Cooled Diffuser

Air-Cooled Diffuser

Cable Liners

Choosing the proper cable liner is important when running HyperFill. Unlike selecting the cable liner size for the wire diameter, you are running 0.035 in. (0.9 mm) liner for 0.035 in. (0.9 mm) wire, it is necessary to select a liner that can accommodate the diameters of two wires running simultaneously through the gun. The table below helps determine the proper liner size for each HyperFill process.

	Solid Wire				Metal-Cored Wire	Flux-Cored Wire	
Part Number	0.035 in (0.9 mm)	0.040 in (1.0 mm)	0.045 in (1.2 mm)	0.047 in (1.2 mm)	0.045 in (1.2 mm)	0.045 in (1.2 mm)	0.052 in (1.4 mm)
KP44-564-15	•	•					
KP44-564-25							
KP44-332-15			•	•	•	•	•
KP44-332-25							

Note: KP44-332-15-25 liners are recommended for use with air-cooled and water-cooled HyperFill guns. Gun cables up to 15 ft in length are recommended with Hyperfill GMAW with 0.045 in. (1.2 mm) wires or Hyperfill FCAW wires.

Gas Nozzles

Selecting the proper gas nozzle will ensure the welding gun is providing sufficient gas to the weld joint. The surface area of the HyperFill Contact Tips are larger than a standard contact tip and limits the minimum nozzle size which can be used in the application.

We recommend using 3/4 in. (19.1 mm) ID nozzles for all HyperFill application to deliver enough gas to the weld puddle. In some tighter joint fit ups a 5/8 in. (15.9 mm) ID nozzle can be used, but it is important to thoroughly test to insure proper gas shielding is being provided.

Nozzle Type	Magnum PRO 500 Water-Cooled Guns		Magnum PRO HDE Air-Cooled Guns		Magnum PRO Robotic Torches	
	5/8 in. ID	3/4 in. ID	5/8 in. ID	3/4 in. ID	5/8 in. ID	3/4 in. ID
1/4 in. (6.36 mm) Recess	-	KP4523-3-75R	-	-	-	-
	-	KP4523-3-75R-B25	-	-	-	-
1/8 in. (3.18 mm) Recess	KP4523-1-62R	KP4523-1-75R	KP2743-1-62R	KP2743-1-75R	KP4120-1-62R	KP4120-1-75R
	KP4523-1-62R-B25	KP4523-1-75R-B25	KP2743-1-62R-B25	KP2743-1-75R-B25	KP4120-1-62R-B25	KP4120-1-75R-B25
Flush	KP4523-1-62F	KP4523-1-75F	KP2743-1-62F	KP2743-1-75F	KP4120-1-62F	KP4120-1-75F
	KP4523-1-62F-B25	KP4523-1-75F-B25	KP2743-1-62F-B25	KP2743-1-75F-B25	KP4120-1-62F-B25	KP4120-1-75F-B25
1/8 in. (3.18 mm) Stickout	KP4523-1-62S	KP4523-1-75S	KP2743-1-62S	KP2743-1-75S	KP4120-1-62S	KP4120-1-75S
	KP4523-1-62S-B25	KP4523-1-75S-B25	KP2743-1-62S-B25	KP2743-1-75S-B25	KP4120-1-62S-B25	KP4120-1-75S-B25

Applications

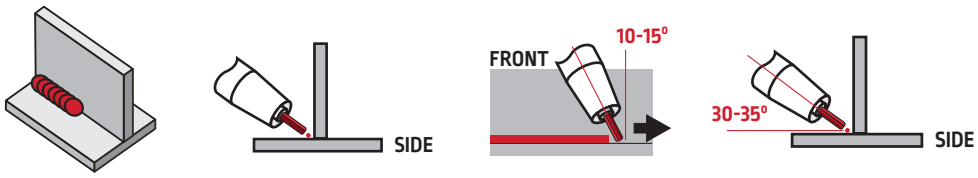
GMAW Carbon Steel Solid Wire

Weld Mode Guide

Mode	Description	Comments
601	0.035 in. (0.9 mm) Solid Wire	Ultimarc, Cableview
602	0.040in. (1.0mm) Solid Wire	Ultimarc, Cableview
603	0.045in. (1.2mm) Solid Wire	Ultimarc, Cableview

Fillet Weld Procedures - 5/16 in. (8 mm)

PLAIN CARBON STEEL	
Travel Angle	10-15° Push
Work Angle	30-35°
CTWD	0.875 - 1 in (22 - 25 mm)
Position	2F/PB
Gas Flow	55 ft³/h (28 l/min)



Position the wire approximately one wire diameter outside the joint

HyperFill® 0.035 in (0.9mm)	in/mm	lbs/hr	kg/hr	in/min	m/min	in/min	cm/min
	0.375 in. (10 mm) and up	16	7	515	13.1	16	41
		18	8	580	14.7	18	46
		20	9	645	16.4	20	51
		22	10	710	18.1	22	56

HyperFill® 0.040 in. (1.0mm)	in/mm	lbs/hr	kg/hr	in/min	m/min	in/min	cm/min
	0.375 in. (10 mm) and up	16	7	375	9.5	16	41
		18	8	425	10.8	18	46
		20	9	468	11.9	20	51
		22	10	515	13.1	22	56
		24	11	562	14.3	24	61

* The typical current output for the following process exceeds 500A

HyperFill® 0.045 in. (1.2mm)	in/mm	lbs/hr	kg/hr	in/min	m/min	in/min	cm/min
	0.375 in. (10 mm) and up	16	7	296	7.5	16	41
		18	8	333	8.5	18	46
		20	9	370	9.4	20	51
		22	10	407	10.3	22	56
		24	11	444	11.3	24	61

* The typical current output for the following process exceeds 500A

Material Thickness Deposition Rate Wire Feed Speed Travel Speed

Applications

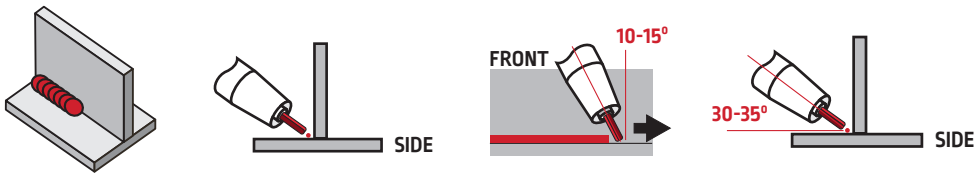
GMAW Carbon Steel Metal-Cored Wire

Weld Mode Guide

Mode	Description	Comments
608	0.045in.(1.2mm) MC Wire	Ultimarc, Cableview

Fillet Weld Procedures - 5/16 in. (8 mm)

PLAIN CARBON STEEL	
Travel Angle	10-15° Push
Work Angle	30-35°
CTWD	0.875 - 1 in (22 - 25 mm)
Position	2F/PB
Gas Flow	55 ft³/h (28 l/min)



Position the wire approximately one wire diameter outside the joint

HyperFill® 0.045 in (1.2 mm)	in/mm	lbs/hr	kg/hr	in/min	m/min	in/min	cm/min
	0.375 in. (10 mm) and up	16	7	302	7.7	16	41
		18	8	339	8.6	18	46
		20	9	377	9.6	20	51
		22	10	415	9.6	22	56
		24	11	452	11.5	24	61

Material Thickness | Deposition Rate | Wire Feed Speed | Travel Speed

Applications

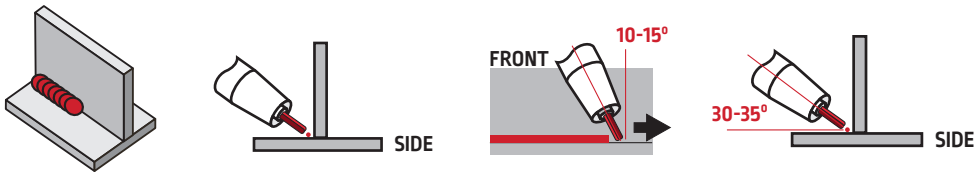
FCAW

Weld Mode Guide

Mode	Description	Comments
617	.045/1.2mm Cored Wire 100% CO2	Synergic, "pulsing"
618	.045/1.2mm Cored Wire Mixed Gas	Synergic, S700 only
619	.052/1.4mm Cored Wire Mixed Gas	Synergic, S700 only
621	.052/1.4mm Cored Wire 100% CO2	Synergic, S700 only, "pulsing"

Fillet Weld Procedures - 5/16 in. (8 mm)

PLAIN CARBON STEEL	
Travel Angle	10-15° Push
Work Angle	30-35°
CTWD	0.875 - 1 in (22 - 25 mm)
Position	2F/PB
Gas Flow	55 ft³/h (28 l/min)



Position the wire approximately one wire diameter outside the joint

HyperFill® 0.045 in (1.2 mm)	in/mm	lbs/hr	kg/hr	in/min	m/min	in/min	cm/min
	0.375 in. (10 mm) and up	16	7	355	9	16	41
		18	8	399	10.1	18	46
		20	9	443	11.3	20	51
		22	10	488	12.4	22	56
		24	11	532	13.5	24	61

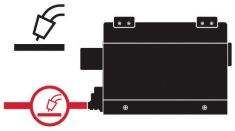
HyperFill® 0.052 in (1.4mm)	in/mm	lbs/hr	kg/hr	in/min	m/min	in/min	cm/min
	0.375 in. (10 mm) and up	16	7	266	6.8	16	41
		18	8	299	7.6	18	46
		20	9	332	8.4	20	51
		22	10	365	9.3	22	56
		24	11	399	10.1	24	61

Material Thickness Deposition Rate Wire Feed Speed Travel Speed

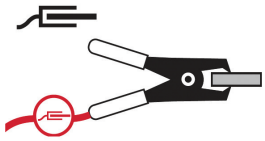
Set-Up

Sense Leads*

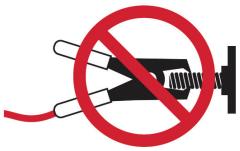
An electrode sense lead is required. This is a standard connection in an ArcLink® cable.



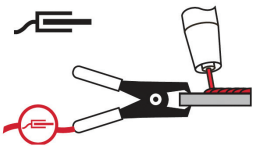
A work sense lead (optional) is highly recommended for total welding cable lengths >50 ft. and should be connected directly to the workpiece.



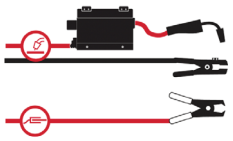
DO NOT connect either sense lead to a welding stud on the power source as this may result in erratic arc behavior.



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.

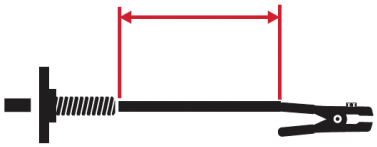


DO NOT route sense lead cable close to high current welding cables as this may distort the sense lead signal.

* Sense leads are not necessary for Cableview enabled machines.

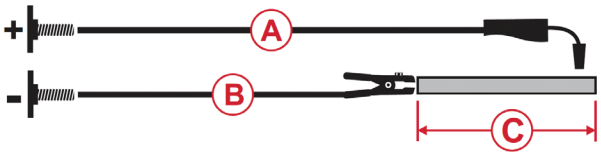
Work Leads

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

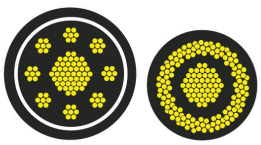


Test cable inductance levels using the Power Wave® Manager software exclusively from Lincoln Electric® Software. Available here.

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

SPATTER	Check	Volts	Travel Speed	Contact Tip to Work Surface	Wire Feed Speed	Gas Coverage	Push Angle	Work Sense Lead
	Action	↑ !	↓ !	↓	↓	inspect	↓	inspect

ERRATIC ARC	Check	Travel Speed	Proper Feeding	Volts	Wire Feed Speed	Push Angle	Tip	Surface Contaminates	Work Sense Lead
	Action	↓ !	inspect !	↑	↓	↓	inspect	inspect	inspect

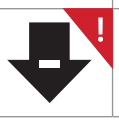
POROSITY	Check	Gas Coverage	Surface Contaminates	Contact Tip to Work Surface
	Action	↑ !	inspect !	↓

CONCAVE BEAD	Check	Volts	Wire Feed Speed	Contact Tip to Work Surface	Push Angle
	Action	↓ !	↑ !	↑	↓

CONVEX BEAD	Check	Travel Speed	Wire Feed Speed	Volts	Contact Tip to Work Surface	Push Angle
	Action	↓ !	↓ !	↑	↓	↑

Increase | Decrease | Inspect & Replace | Important

 BURN THROUGH	Check ▶	 Travel Speed	 Wire Feed Speed	 Volts	 Contact Tip to Work Surface	 Push Angle
	Action ▶					

 POOR PENETRATION	Check ▶	 Travel Speed	 Wire Feed Speed	 Contact Tip to Work Surface	 Push Angle
	Action ▶				

 Increase

 Decrease

 Inspect & Replace

 Important

Glossary

Icons

 Wire Type	 Gas	 Material Thickness	 Wire Feed Speed	 Travel Speed	 Volts	 Amps	 Contact Tip to Work Surface	 Drag Angle	 Arc Length
 Control Knob	 Weld Stud	 Torch	 Work Sense Lead	 Work Clamp	 Torch Nozzle	 Spatter	 Erratic Arc	 Proper Feeding	 Stop / Avoid
 Knurled Drive Rolls	 Gas Coverage	 Porosity	 Concave Bead	 Burn Through	 Under Cut	 Convex Bead	 Poor Penetration		

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 (Voltage) 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.

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 pre-programmed nominal voltage based on the wire feed speed (WFS) set by the operator.
Work Angle	The angle of the electrode, relative to the work piece surface.

Policies and Statements

For best welding results with Lincoln Electric equipment, always use Lincoln Electric consumables. Visit www.lincolnelectric.com for more detail.

The HyperFill® process was designed and optimized with premium Lincoln Electric wire. The premium wire's tight manufacturing tolerances and chemistry control ensure consistent wire feeding and arc performance. Please consult your local Lincoln Electric representative for wire recommendations based on your specific application. HyperFill® Waveform Activation Capability with Power Wave® and PIPEFAB™ Systems Your purchase of a Lincoln Power Wave or PIPEFAB Welding System comes with (i) a license to use Lincoln Electric standard Power Wave / PIPEFAB waveforms, and (ii) HyperFill waveform capability, which requires the purchase of premium Lincoln Electric wire or purchase of a separate license. Unless one of these is purchased, the HyperFill® waveform will not be available for use on these machines, and only the standard Power Wave / PIPEFAB waveforms are usable.

TEST RESULTS - Test results for mechanical properties, deposit or electrode composition and diffusible hydrogen levels were obtained from a weld produced and tested according to prescribed standards, and should not be assumed to be the expected results in a particular application or weldment. Actual results will vary depending on many factors, including, but not limited to, weld procedure, plate chemistry and temperature, weldment design and fabrication methods. Users are cautioned to confirm by qualification testing, or other appropriate means, the suitability of any welding consumable and procedure before use in the intended application.

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