DCR
DOCUMENTED COST
REDUCTION

SEMI-AUTOMATIC PROCESS

Reduce your welding cost with HyperFill® and increase your productivity

See some examples of cost reduction on typical welding joints

Solution Requirements:

HyperFill® is a patented and licensed twin-wire MIG solution that is designed to perform specifically with select Lincoln Electric welding wire. The solution requires a licensed waveform which may require an additional purchase. For more details, reference document MC20-106.

LINCOLN ELECTRIC

What is HyperFill®?

HyperFill® is a patented and licensed twin-wire GMAW-P solution that utilizes two electrically conductive wires, energized by a single power source and fed through a single wire feeder, single gun liner and a single tip.

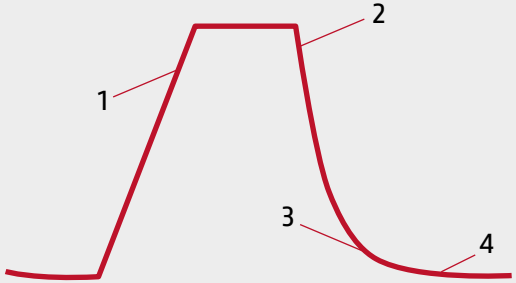
HyperFill® allows for deposition rate above 8,2 kg/h (+10,9 kg/h robotic), combined with Lincoln Electric Premium wires, allows to make larger welds, faster and more easier, resulting in an increasing of productivity.


1. Ramp

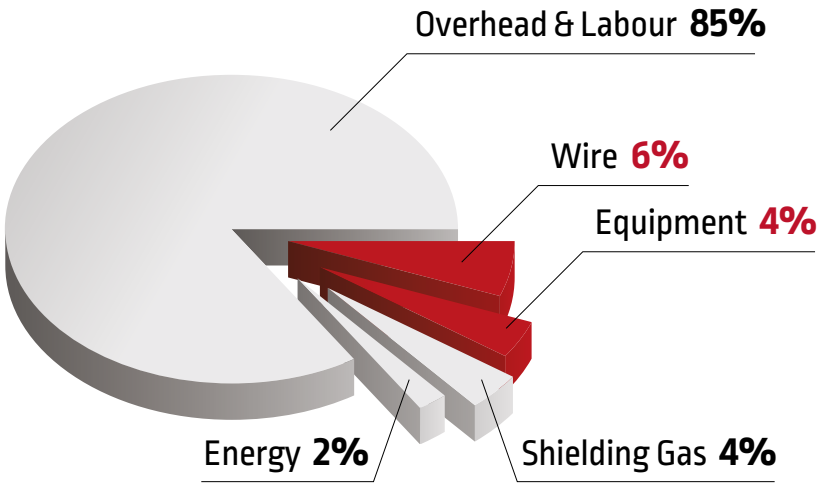

2. Peak


3. Tailout


4. Background



Typical customer's production cost composition



Overhead and Labour typically account for over 80% of production cost. HyperFill®, the innovative twin-wire MIG solution is effective on this part of production cost, where a reduction, even if minimal, has a great impact.

Cost of wire and equipment is important, but accounts for only 10% of overall production cost.

Performance issues (spatter, wire feeding...) due to the utilization of low market value commodities could possibly add to the total cost of production.

HyperFill's effect on welding cost reduction

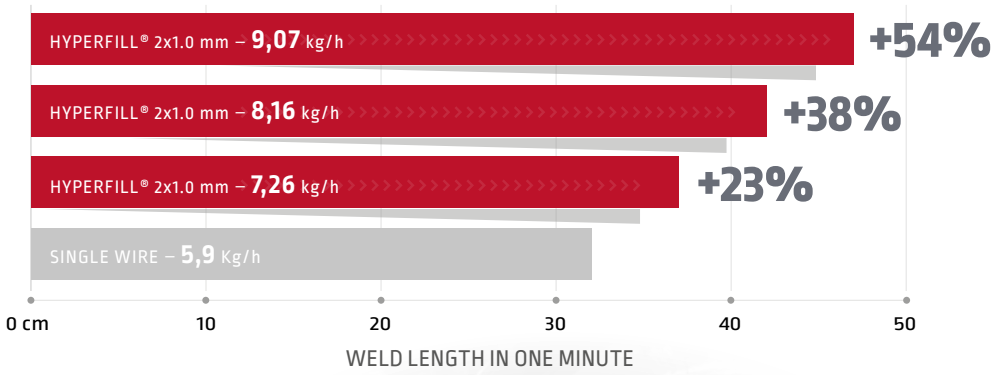
Comparison with spray-arc process, delivered by conventional CV power sources and welding parameters commonly used with mild steel solid wire 1,2 mm diameter

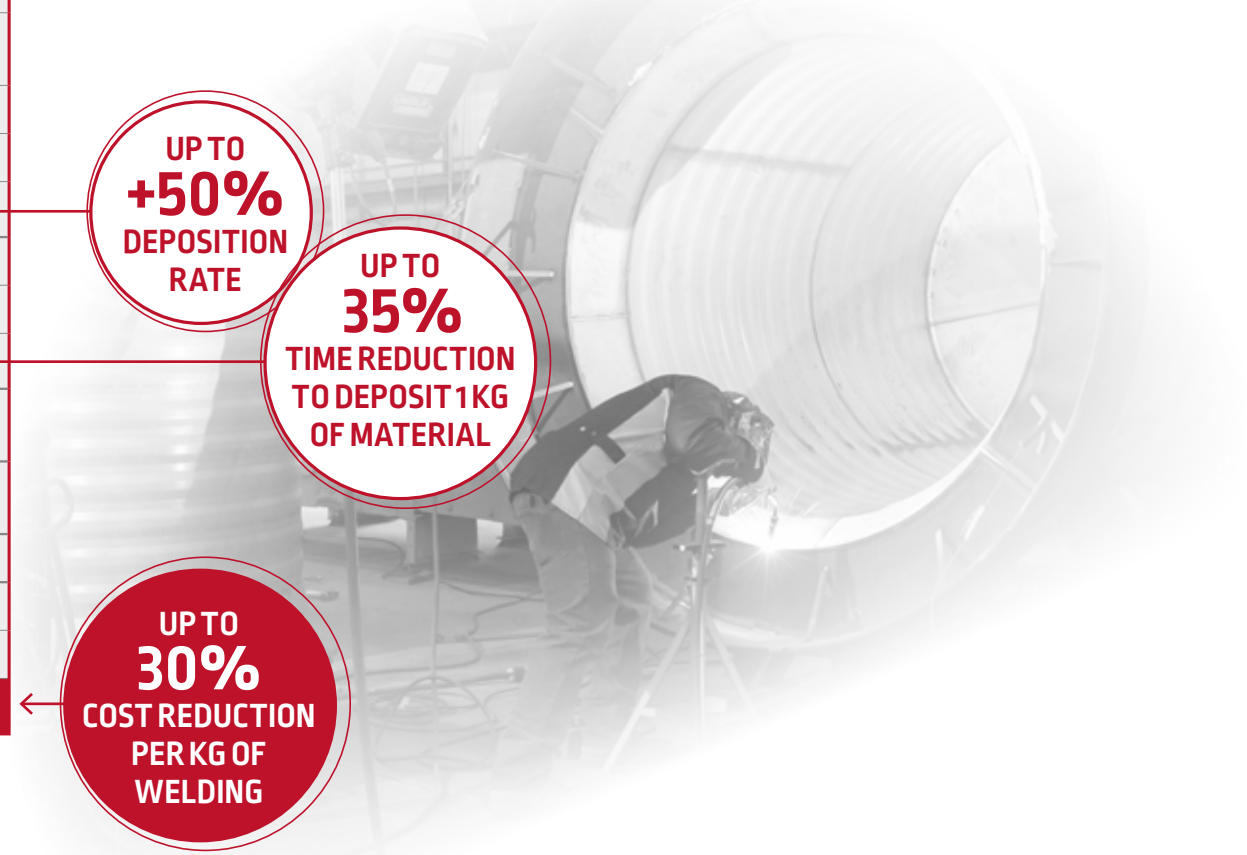
			135-GMAW	HyperFill®
Electrode / Flux Name – Class. Number			ER70S-6	Supramig HD G3Si HF
Electrode Diameter – Shielding Gas			1,2 mm – M21 80% Ar / 20% CO_2	1,0 mm – M21 80% Ar / 20% CO_2
WFS / Amps / Volts			10 / 300A / 32V	11 / 370A / 32V
Polarity			DC+	DC+
Deposition Rate @ 100%		(kg/h)	**5,3**	**8,1**
Operating Factor			30%	30%
		(kg/h)	1,6	2,4
		(h/kg)	**0,6**	**0,4**
LABOUR AND OVERHEAD	Labour & OH Rate	(€/h)	40,00	40,00
MATERIAL DATA	Electrode Cost	(€/kg)	1,30	1,80
Gas Flow Rate		(l/min)	18 000	30 000
Total Material Costs		**(€/kg)**	**3,38**	**4,08**
Grand Total Costs		**(€/kg)**	**28,54**	**20,54**
SAVINGS*		**(€/kg)**		**8,00**

* estimates

HyperFill® effect on travel speed

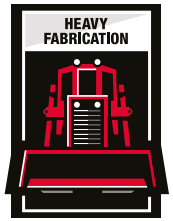
Based on 8 x 8 mm weld size

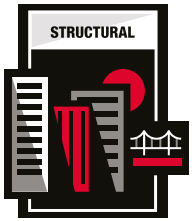




Segments where HyperFill® can find best applicability:

- **STRUCTURAL:** general metal frames production
- **HEAVY FABRICATION:** Construction equipment, cranes, lifting equipment
- **PIPE WELDING :** rotating pipes horizontal axe
- **OFF-SHORE STRUCTURES**
- **LPG TANK**





Equipment configuration guide

Wire diameter	Recommended power source
1,0 mm	Power Wave® S500 / R450
1,0 mm, 1,2 mm	Power Wave® S700

S500

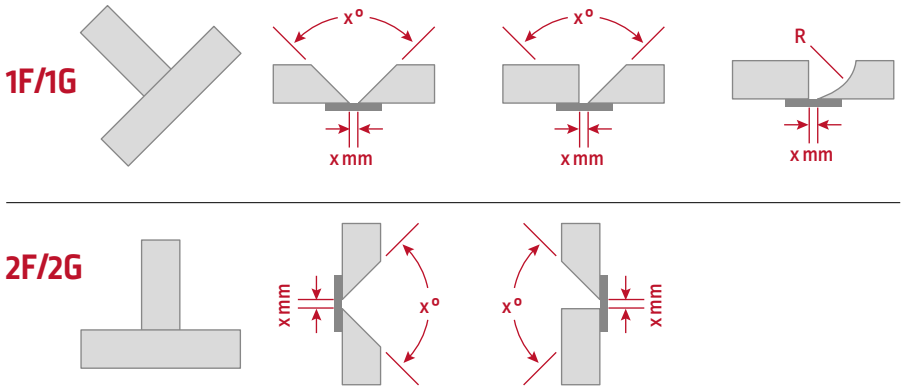
S700

R450

Examples of HyperFill® applications

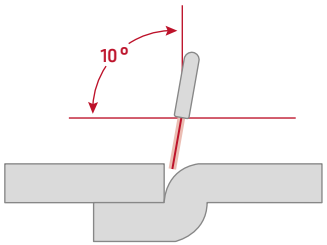
HyperFill® applications for plates welding

Typical joint configuration and welding positions



HyperFill® application for LPG tank welding

Travel speed achievement (depending thickness and diameter) up to 3 m/min

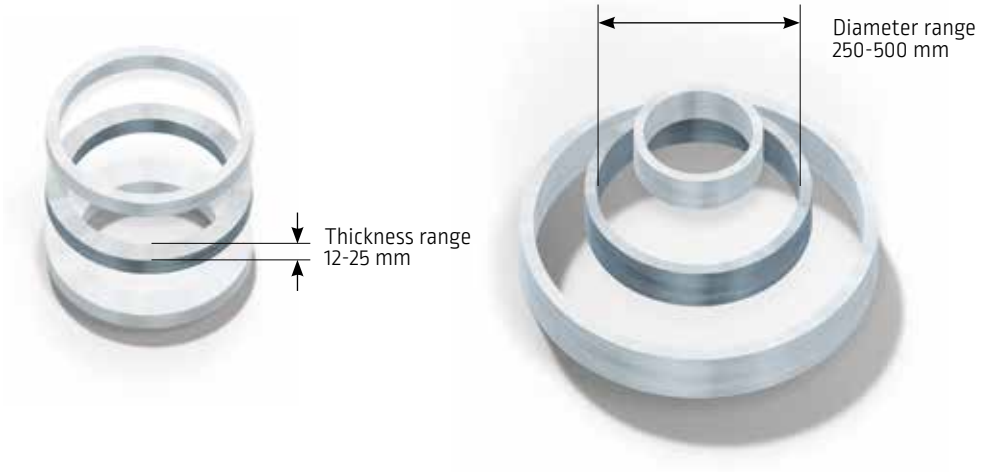


HyperFill® applications for rotating pipe welding

Reccomended pipe diameter and thickness range

THICKNESS

PIPE DIAMETER



HyperFill®, up to 25 mm thichness, allows welding in narrow V-joint (open angle up to 20°) in single pass per layer with backing support.

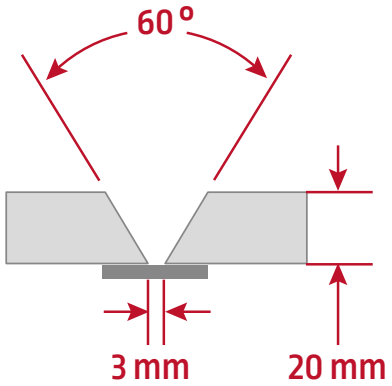
An optimized configuration, which combines quality and productivity is realized with Power Wave® S500 and Power Feeder 84 Dual.

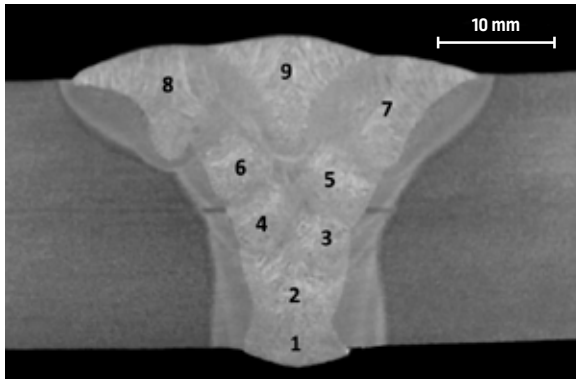
Thanks to the Dual feeder, a single power source welds both the root pass, with STT (Surface Tension Transfer process) and the filling passes with HyperFill® process.

Cost reduction: example 1

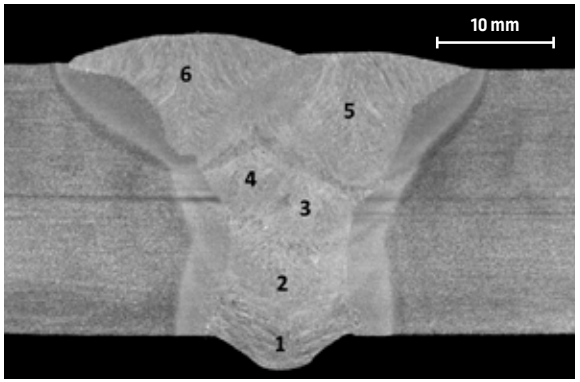
Typical butt-weld joint, multipass technique

Welding conditions in semi-automatic mode									
Process	**Run n°**	**Wire diam. (mm)**	**WFS (m/min)**	**Voltage (V)**	**Current (A)**	**Travel speed (mm/min)**	**Gas flow (l/min)**	**Heat input EN1011-1 (kJ/mm)**	**Welding time (min/m)**
135 GMAW	1-2	1,2	9	28,5	280	250	20	1,53	8,00
	3-8				275-290	300		1,25-1,32	20,00
	9				285	350		1,11	2,86
								Total welding time @100%OF	**30,86**
								Welding time @30% OF	**102,86**
HyperFill® – 135 GMAW-P	1-2	1	11	32	375-385	300	30	1,92-1,97	6,67
	3-6		11	32	355-390	390	30	1,40-1,54	10,26
								Total welding time @100%OF	**16,92**
								Welding time @30% OF	**56,41**





Macrographic section of the butt joint realized with GMAW



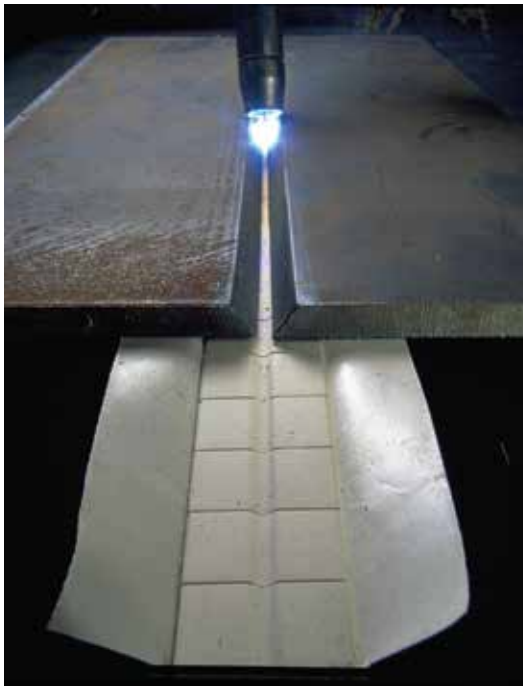
Macrographic section of the butt joint realized with HyperFill®

Cost reduction: example 1 continued

Economical parameters		
Labour cost and OH rate	€/h	**40**
ER 70S-6 diam 1,2 mm cost	€/kg	**1,5**
Supramig HD G3Si1 diam 1,0 mm	€/kg	**1,8**
Operating Factor OF	%	**30**

Process		135-GMAW	HyperFill®
Wire diameter	mm	1,2	2 x 1,0
Deposition rate	kg/h	4,8	8,1
Welding time @30 % OF	min/m	102,9	56,4
Labour cost & OH rate	€/m	68,6	37,6
Material	kg/m	2,5	2,3
Material cost	€/m	3,8	4,3
TOTAL WELDING COST	**€/m**	**72,4**	**41,9**

UP TO
30,5 €/m
SAVINGS



Butt Weld realized in PA position on ceramic backing support type Weldline Keraline TA3

Concerned about heat Input?

Heat Input:

Joules = Volts x Amps x Time

Traditional process (A x V x D)
HyperFill® (↑ A x ↑ V x ↓ D)

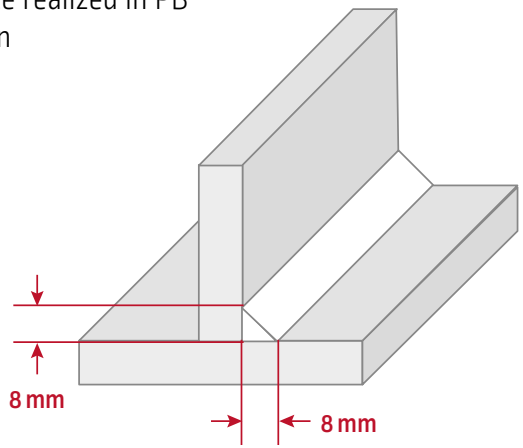
= similar kJ

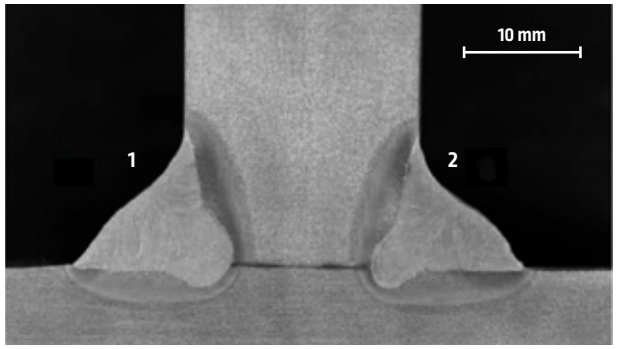
Cost reduction: example 2

Typical Fillet-weld joint, single pass technique

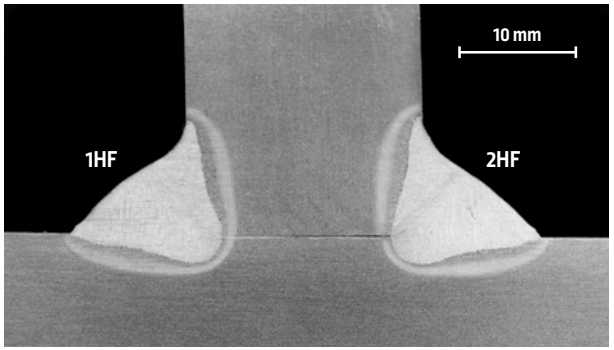
Welding conditions in semi-automatic mode								
Process	**Run n°**	**Wire diam. (mm)**	**WFS (m/min)**	**Voltage (V)**	**Current (A)**	**Travel Speed (mm/min)**	**Gas flow (l/min)**	**Heat Input EN1011-1 (kJ/mm)**
135 GMAW	1	1,2	9	28,5	275	250	20	1,5
HyperFill® – 135 GMAW-P	1	2 x 1,0	11	32	370	380	30	1,5

Fillet weld 8 x 8 mm legs size realized in PB position



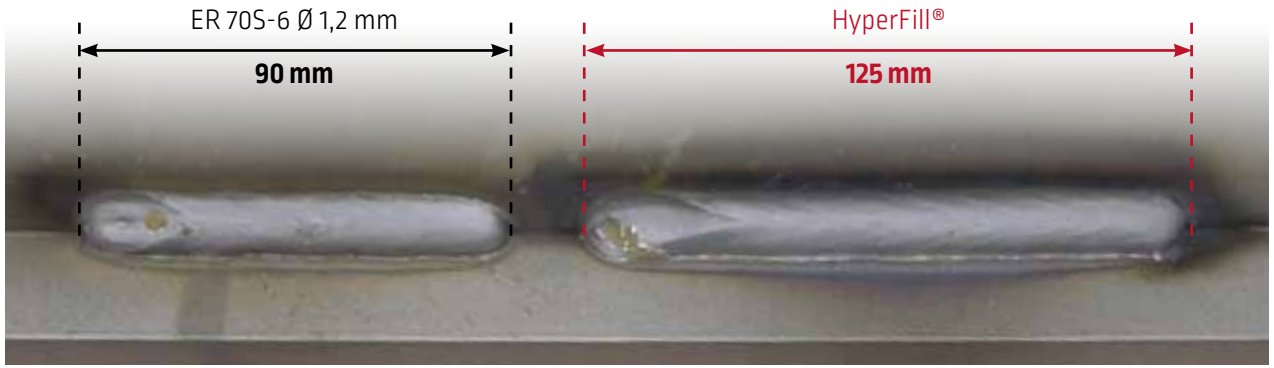


Macrographic section of the corner joints realized with GMAW



Macrographic section of the corner joints realized with HyperFill®

Same welding time c.a. 20 sec. for 8 x 8 mm fillet



Cost reduction: example 2 continued

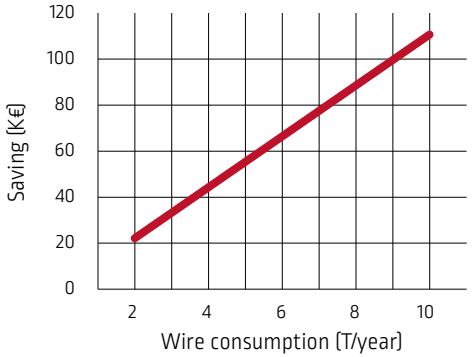
Economical parameters		
Labour cost and OH rate	€/h	**40**
ER 70S-6 diam 1,2 mm cost	€/kg	**1,5**
Supramig HD G3Si1 diam 1,0 mm	€/kg	**1,8**
Operating Factor OF	%	**30**

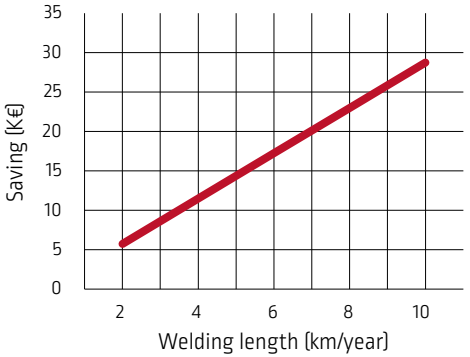
Process		135-GMAW	HyperFill®
Wire diameter	mm	1,2	2 x 1,0
Travel speed	cm/min	25	38
Deposition rate	kg/h	4,8	8,1
Deposition rate @ 30 % OF	kg/h	1,44	2,44
	kg/m	0,32	0,36
Labour cost per Kg of weld	€/kg	27,8	16,4
Price of welding electrode	€/kg	1,5	1,8
TOTAL WELDING COST	**€/kg**	**31,6**	**20,5**
	€/m	**10,1**	**7,3**

GMAW		HyperFill®	
Section 1	**Section 2**	**Section 1HF**	**Section 1HF**
6,2 mm	6 mm	6,4 mm	6,45 mm

Throat thickness of the fillet weld

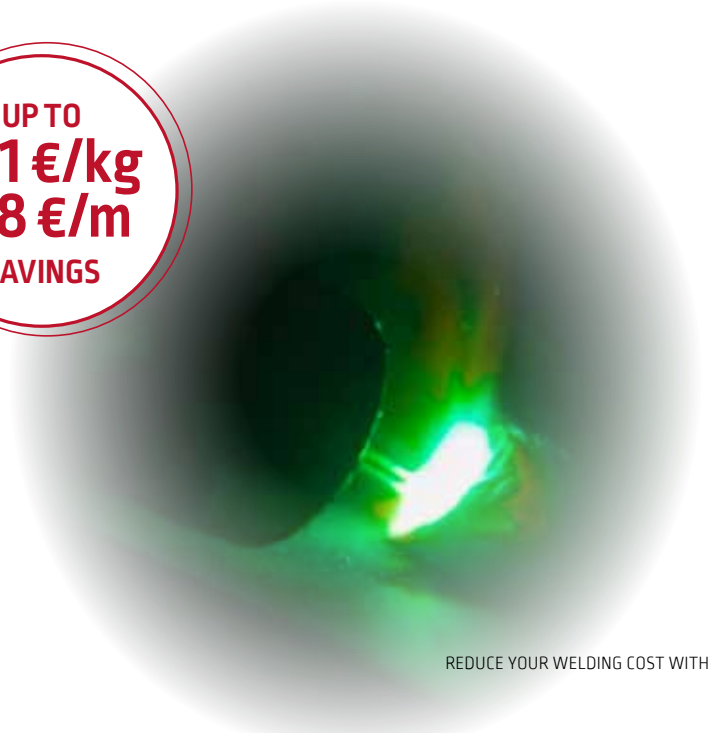
Economical saving estimation*





*based on this example

UP TO
11,1 €/kg
2,8 €/m
SAVINGS



Increased productivity through the use of HyperFill® can enable a faster return on equipment investment

HyperFill® Payback example

System Type	Present	Proposed
	1,2 mm GMAW	1,0 mm HyperFill®
Amount of Wire Used Per Year (kg)	5 000	
Deposition Rate (kg/h)	**6,0**	**8,1**
Operating Factor (%)	30%	30%
Man Hours Per Metric Tonnes at Operating Factor	556	412
Man Hours Saved Per Metric Tonne	144	
Labour and Overhead Cost (€/h)	40	
Man Hours Saved Per Year	720	
Labour and Overhead savings per year (€)	28 000	
Wire cost differential per year [1]	-2 500	
Shielding gas cost differential per year [2]	-2 110	
Energy cost saving per year [3]	412	
Wear parts cost differential [4]	-956	
Labour, Overhead and material Savings (€/year)	**23 651, 57**	

PAYBACK PERIOD CALCULATION	
Savings Per Month	1 971 €
Proposed System	PW S500 PF84
Budgetary Cost of Proposed System	20 000 €
Payback Period (months)*	**10,1**

* estimates

INCREASED DEPOSITION RATES = MORE COST SAVINGS

More production output. Faster completion time.

167 h *

111 h * (saved 56 h)

91 h * (saved 76 h)

* Welding Time Study – **arc time to deposit 1 000 kg weld metal** at 100% operating factor.

Assumptions

(1) 1,30 €/kg for 1,2 mm ER70S-6 / 1,80 €/kg for 1,0 mm SUPRAMIG HG G3Si1 HF

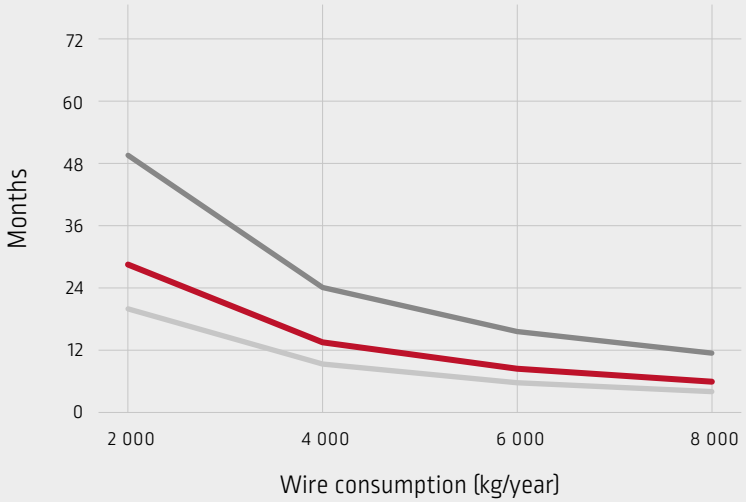
(2) Shielding gas cost: 0,01 €/l – flow rate GMAW 18 l/min / HyperFill® 30 l/min; Shielding gas cost GMAW: 5000 kg ÷ 6 kg/h = 833 h; 833 h x 60 x 18 x 0,01 = 8996 €; Shielding gas cost HyperFill®: 5000 kg ÷ 8,1 kg/h = 617 h; 617 h x 60 x 30 x 0,01 = 11106 €

(3) Energy cost 0,16 €/kWh; Power consumption GMAW: 338A x 36,8V ÷ 0,85 = 14,63 kW 14,63 kW x 833 h= 12162 kWh; Power consumption GMAW: 385A x 34,4V ÷ 0,85 = 15,76 kW 15,76 kW x 617 h = 9725 kWh

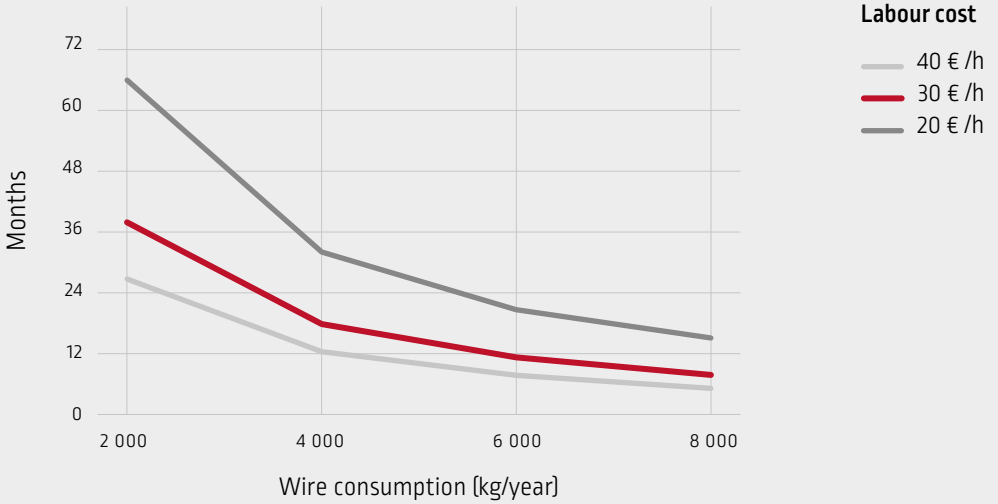
(4) 1 conct tip/day; Tip cost GMAW: 6 kg/h x 30%OF x 8 h/day = 14,4 kg/day 5000 kg ÷ 14,4 kg/day x 0,95 € = 330 €; Tip cost HyperFill®: 8,1 kg/h x 30% OF x 8 h/day = 19,4 kg/day; 5000 kg ÷ 19,4 kg ÷ day x 5 € = 1288 €; 338A x 36,8V ÷ 0,85 = 14,63 kW; 385A x 34,4V ÷ 0,85 = 15,76 kW

Potential savings projections using HyperFill®

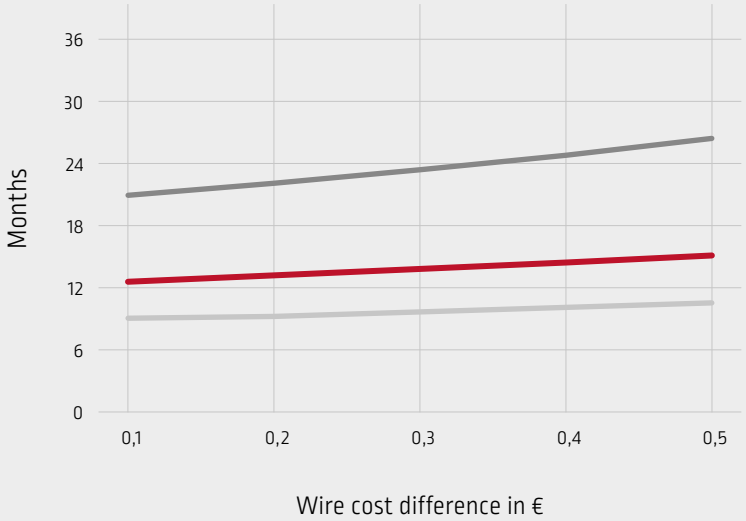
Payback for an investment of 15 k€



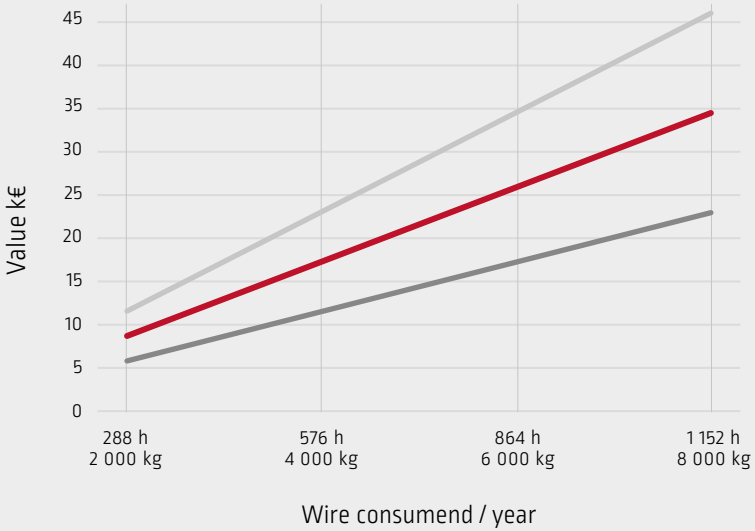
Payback for an investment of 20 k€



Premium MIG wire cost difference inpact on payback based on yearly consumption of 5 000 kg



Welding time reduction according to wire consumption time saved can be used for other activities, resulting in extra production



Low labour cost? HyperFill® is relevant even there

Customer case with a labour cost of 15€/h

GMAW Process
Standard Pulse Power Source

Process:	GMAW multi pass
Weld:	FW a = 14 mm
Parameters:	340A@31V
Deposition Rate:	5,9 kg/h@100%
Consumable:	1,2 mm FILCORD C (ER70S-6)
Travel Speed:	30 cm/min
Heat Input:	21,08 kJ/cm

Proposed Process
HyperFill®

Process:	HyperFill® multi pass
Weld:	FW a = 14 mm
Parameters:	400A@32V
Deposition Rate:	8,2 kg/h@100%
Consumable:	2 x 1 mm SUPRAMIG® G3Si1 HD
Travel Speed:	60 cm/min
Heat Input:	12,8 kJ/cm

Calculated Saving

GMAW vs HyperFill®

		GMAW		HyperFill®
Deposition rate	(kg/h)	5,9	↗	8,2
Travel speed	(cm/min)	30	↗	60
Heat input	(kJ/cm)	21,08	↘	12,8
Cycle time per unit	(h)	2 x 8	↘	1 x 4
Labour cost per unit*	(€)	240	↘	60
Capital investment	(€)	Owned		15 000
Saving per unit	(€)	–		180
Hours saved**	(h)	–		**4**
Welders involved	n°	2		1

* 2 welder used / unit x 15 €/h x 8 h = 240 € / unit; 1 welder used / unit x 15 €/h x 4 h = 60 € / unit
** estimates

With an average production of 100 units / year, the calculated annual saving sums at 18 000 € or better 400 hours, which can be used for extra production

Improve HyperFill® deliverables adopting Premium MIG wire & Accu-trak

Reduce downtime for packaging change, preferring drums to spools

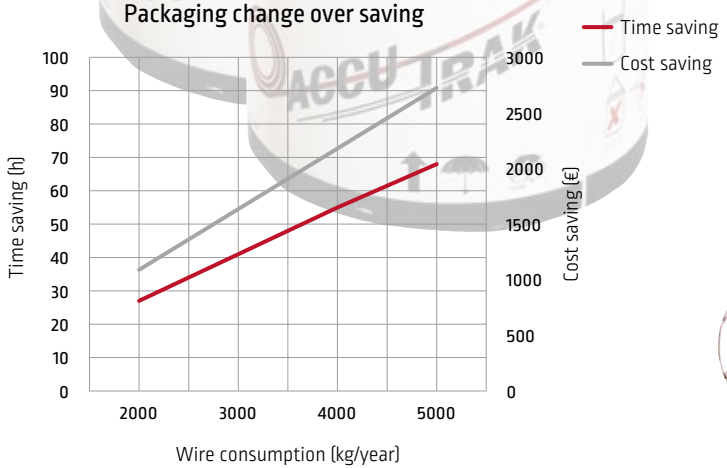
COST

Change over cost saving -87%
(-2 725 €)

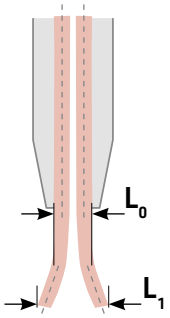
PACKAGING			Spool 16 kg	250 kg Accu-Trak® drum
WEIGHT		[kg]	16	250
CHANGE OVER COST	Labour cost	[€/h]	40	40
	Change over time	[min]	15	30
	# of change over		313	20
	Consumption per year	[kg]	5 000	
TOTAL	Change over time	[h]	78	10
	Change over cost	[€]	3 125	400
	Total cost	**[€]**	**3 125**	**400**
	Time saving	[h]		**68 h**
	Change over cost saving*	[€]		**-2 725 €**
				-87%

* estimates

Packaging change over saving

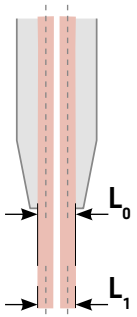


Reduce cleaning time with right wire geometry



L0 ≠ L1

Wire geometry inconsistency can result in an unstable electrical arc with the generation of spatter.



L0 = L1

Premium MIG wires, characterized by precise geometry ensure better arc stability.

Is your job mechanizable?
Consider HyperFill® to maximize the benefits

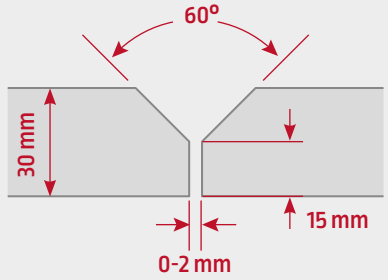
Customer case

Application: Semi-automatic welding on large square beams for building construction, for an initial job of 20 units.

Welding Condition	Welding time / unit		Total cost	Saving			Hours saved / 20 units
	Min.	Diff.	€/kg	€/kg	€/unit	€/20 units	h/20 units
Present	1162		26,6				
PROP. n°1 (HyperFill® 2 x 1,0)	745	-36%	17,54	9,06	280	5 600	140
PROP. n°1 (HyperFill® + Weldycar)	375	-68%	9,7	16,9	520	10 400	260

Solution provided:

Complete station consisting in Power Wave® S500, PF 84 single and HyperFill® accessories for manual application and Weldycar.



Partial penetration joint

Productivity increasing

- Production time reduction:
- 7 h / unit with HyperFill® in Semi-automatic
- 13 h/pcs using HyperfFill and Weldycar
- No fine to pay for late delivery
- Quick return of investment

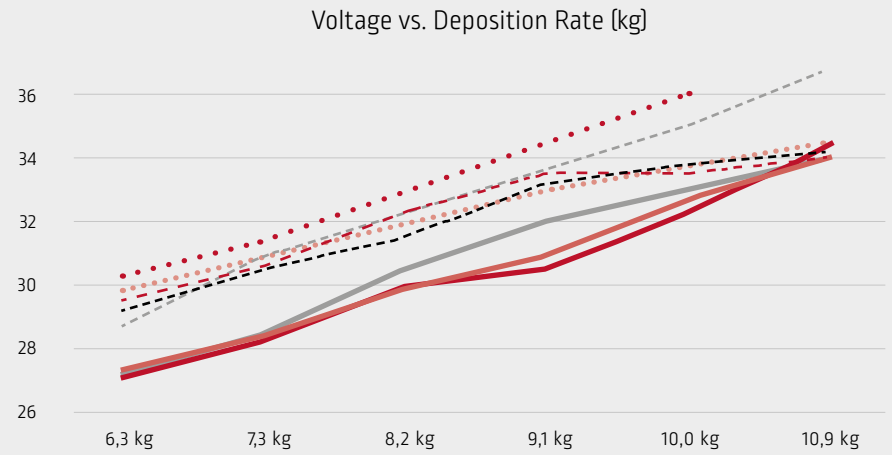
Weldycar

Weldystiffener

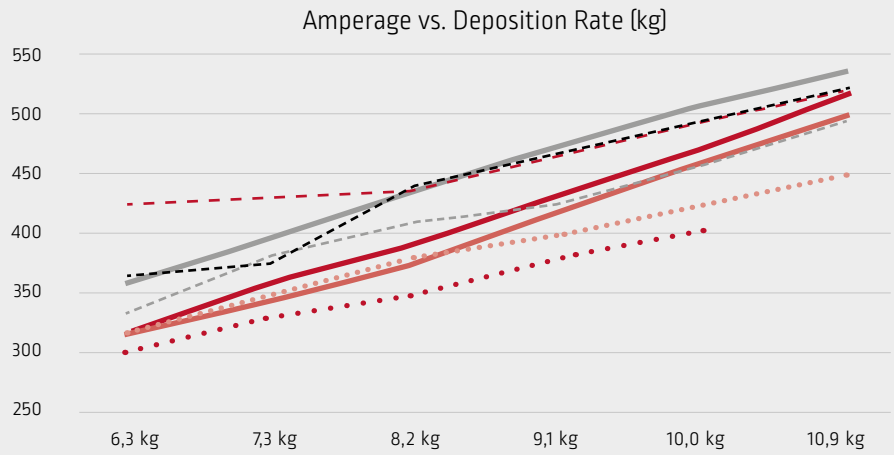
Time savings up to **60%**

HyperFill® verses single wire – process parameter comparison

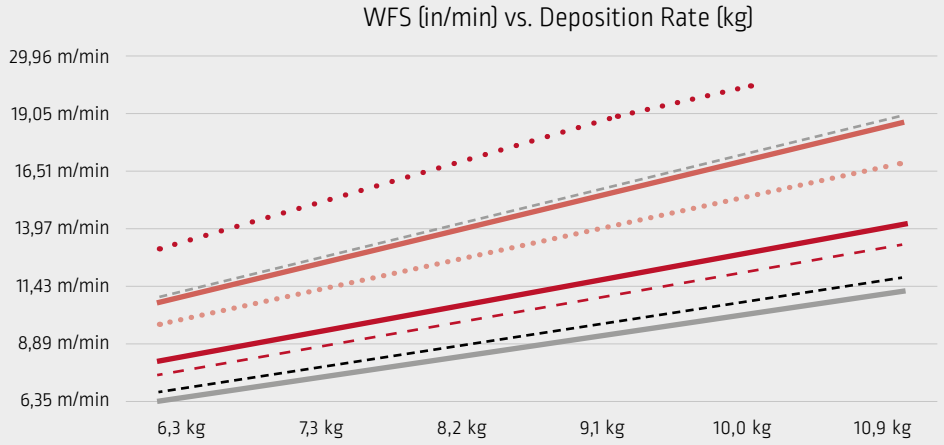
The HyperFill® operates at a lower voltage at elevated deposition rates compared to single wire processes



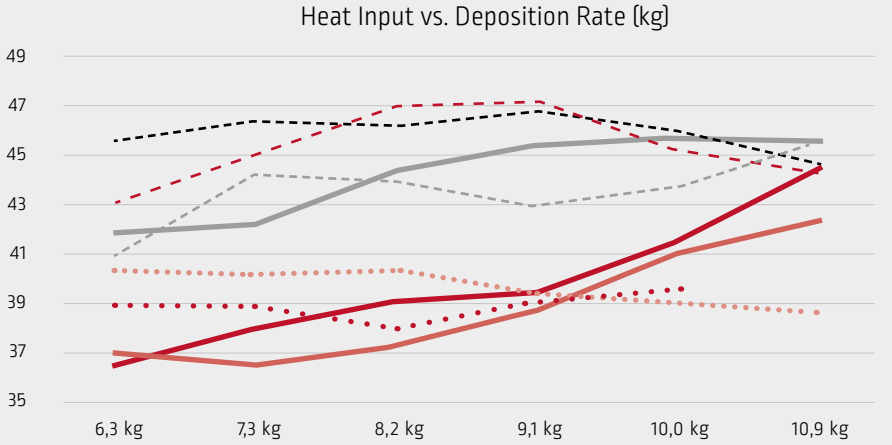
HyperFill® produces similar amperages compared to single wires



HyperFill® requires lower or similar Wire Feed Speeds than 1,4 Ø wires



HyperFill® generates similar heat inputs compared to single wire processes



1,2 mm HyperFill®
1,0 mm HyperFill®
0,9 mm HyperFill®
1,2 mm single wire
1,4 mm single wire
1,6 mm single wire
1,4 mm metal core
1,6 mm metal core

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.

HYPERFILL® COST SAVING ESTIMATES

The cost and savings estimates provided in this document are for reference purposes only. They are an estimate and not a guarantee of savings. Actual results may vary. The [PRICE] used as part of this calculation does not imply that the [PRICE] is guaranteed. Actual [PRICE] may vary and is determined at the time the product is shipped.

CUSTOMER ASSISTANCE POLICY

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LE-54-21EN-M913

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