

RAISE YOUR
DEPOSITION
RATE TO

40 kg/h

**HIGH PRODUCTIVITY WELDING SOLUTION
FOR THE WIND INDUSTRY**

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LINCOLN[®]
ELECTRIC

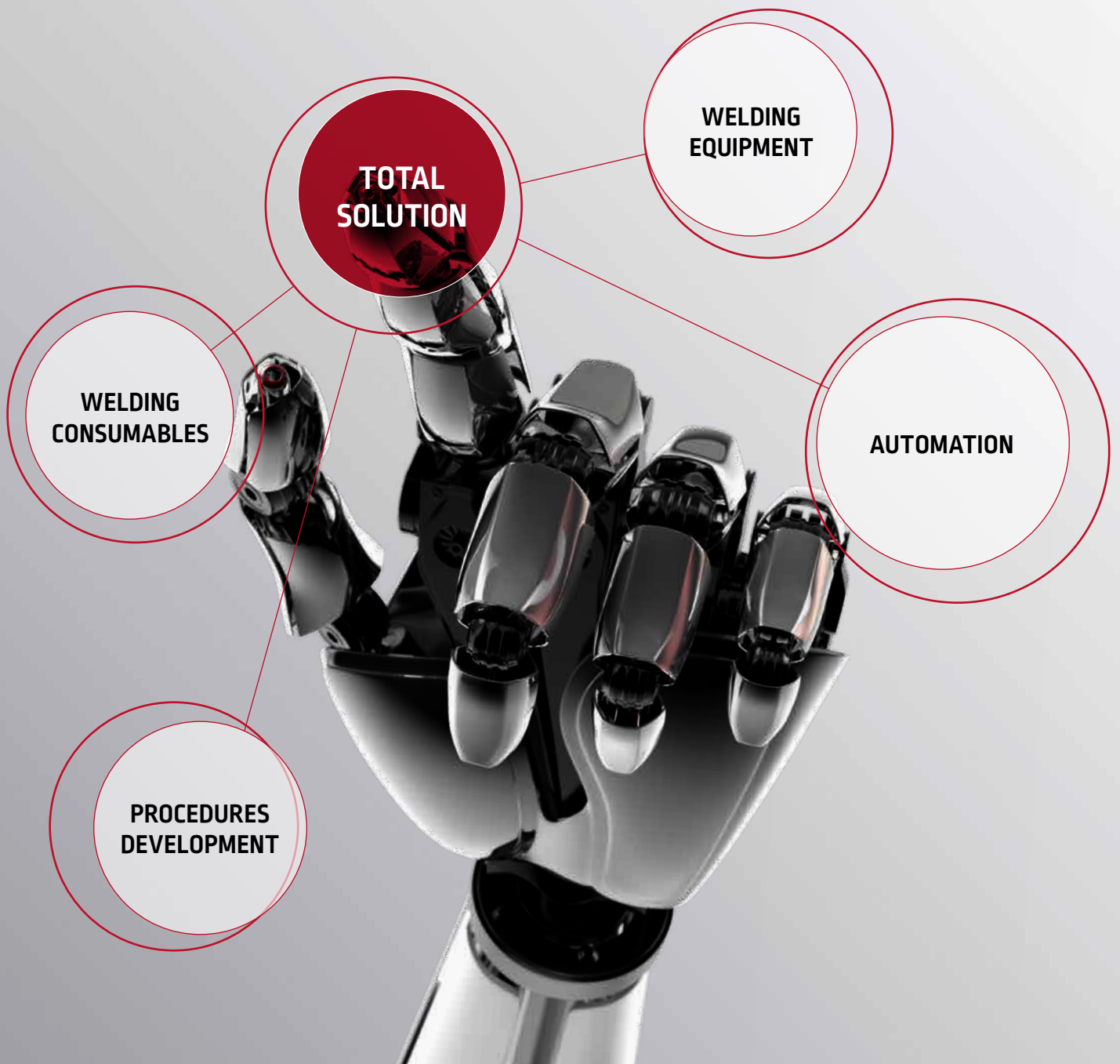


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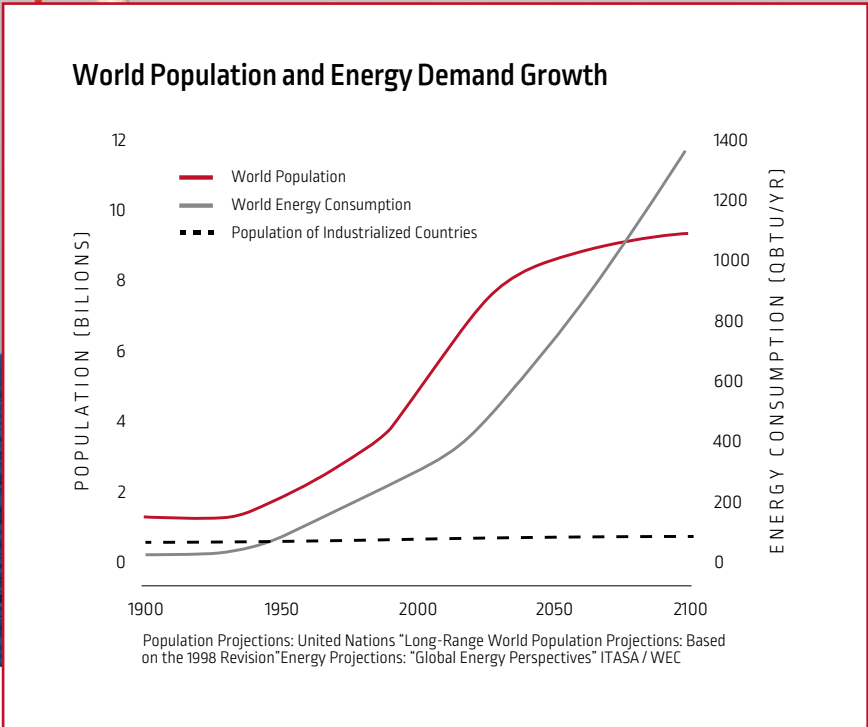
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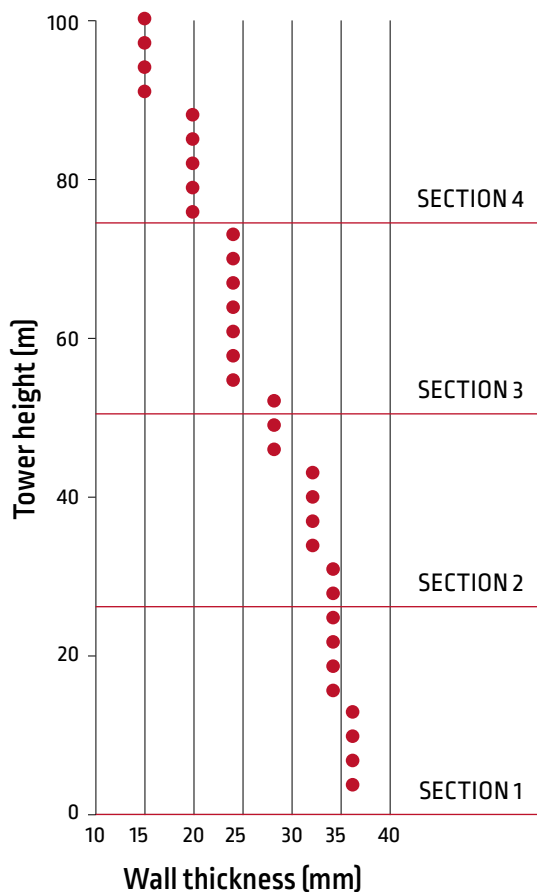
DEMAND FOR GREEN ENERGY IS RISING SHARPLY

As the world population approaches 8 billion, global energy consumption is growing exponentially. To fight global warming, clean energies are increasingly popular. Hence the number of Wind farms is rising sharply across the globe.

At the same time, governments are reducing or eliminating clean energy subsidies and the Wind industry is challenged with producing at lower costs. To remain profitable, the only way forward is to **increase productivity** whilst **maintaining quality**.

Regarding welding productivity, Lincoln Electric has the products, knowledge, experience and support teams to help wind tower manufacturers achieve their targets. In particular, the Tandem Long Stick Out (TLSO) submerged arc welding process can deliver **substantial savings**.





REDUCE YOUR WELDING TIME WITH THE SAW TANDEM LONG STICK OUT PROCESS

On-shore tower

- Height: 96 m
- 4 m diameter at the base and 3 m at the top
- 14-35mm wall thickness
- Symmetrical 60° X bevel type used between 14 and 20 mm
- 60° Y bevel type used above 20 mm

Tandem Process	Average Deposition Rate (kg/h)		Welding time per tower (h) using 85% operating factor
	Multi Run	Two Run	
2 torches with standard SO*	18	15	74
2 torches with long SO*	32	15	50

*SO – Stick out

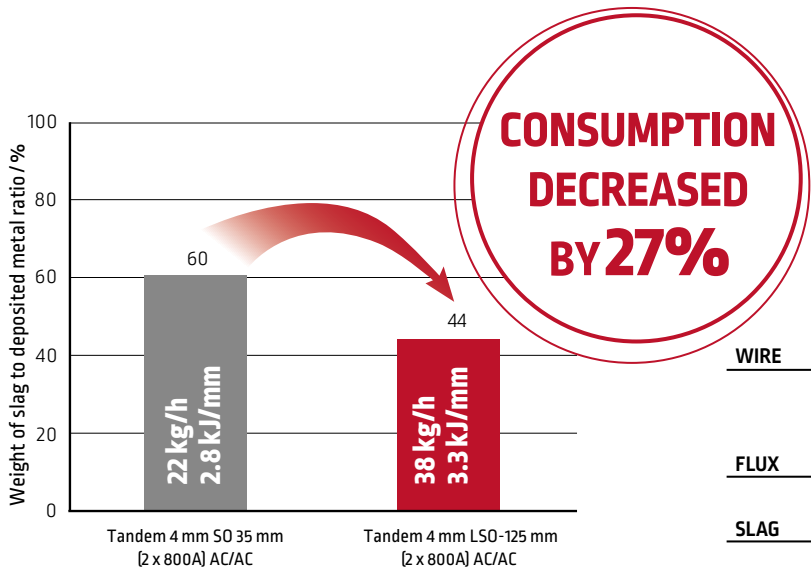
CUT YOUR WELDING TIME BY 33%

REDUCE YOUR FLUX CONSUMPTION WITH TANDEM LONG STICK OUT

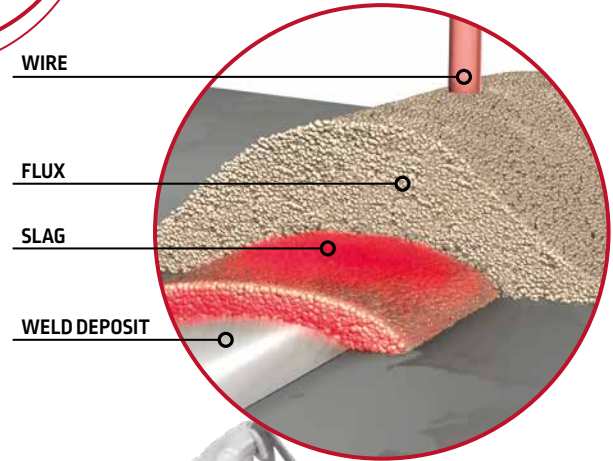
- LSO increases the deposition rate and at the same time significantly reduces the flux consumed during welding
- Higher volumes of metal are deposited whilst the amount of slag produced is moderately increased
- Due to the difference in materials density the consumed flux to deposited metal ratio decreases

USER'S ADVANTAGES

- Purchase less flux for completing your project
- Reduce your waste generation



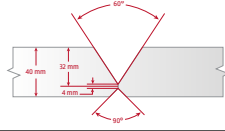
* At 1m/min travel speed, 30 and 35V for standard and Long Stick Out respectively.
 For 100 kg of deposited weld metal, the quantity of additional recyclable flux is 16 kg.



SAVINGS CALCULATION



Application:



Joint welding

Base material: S355 G10+M

Thickness: 40 mm

Length per year: 10,000 m

40 mm welds

PROCESS: SAW			DC+/AC Tandem Standard SO	DC+/AC Tandem 1 Long SO	AC/AC Tandem 2 Long SO
CONSUMABLE: FLUX + SOLID WIRE			Oerlikon/Lincoln EH 12 K		
PROCESS PARAMETER	Stick Out	[mm]	35	35-120	120
	Wire Diameter	[mm]	4	4	4
	Current range	[A]	[600-720]	[650-850]	[650-850]
	Av. Heat Input	[kJ/mm]	3,6	3,3	3,4
	Av. Deposition Rate	[kg/h]	18,0	25	32,7
CONSUMABLES COST	Wire	[€/kg]	1,20	1,20	1,20
	Flux	[€/kg]	1,70	1,70	1,70
	Ratio Flux/Wire		0,73	0,67	0,53
	Total cost/kg weld	[€/kg]	2,44	2,34	2,10
PRODUCTION COST	Labour cost	[€/h]	60	60	60
	Duty cycle	[%]	100	100	100
	Weight per meter weld	[kg/m]	6,00	6,00	6,00
	Time per meter weld	[h/m]	0,33	0,24	0,18
	Cost per meter weld	[€/m]	35	28	24
TOTAL	Total length	[m]	10 000		
	Total weight	[kg]	60 000		
	Total welding time	[h]	3 333	2 400	1 835
	Total cost	[€]	346 460	284 340	236 152
TIME SAVINGS VS TANDEM STANDARD STICK OUT				-933 h	-1498 h
COST SAVINGS VS TANDEM STANDARD STICK OUT				-62 120 €	-110 308 €

Tandem
2 LSO vs
Tandem
2 standard
SO means
saving
a 25 kg
flux bag
every 21 m

-45%**-32%**

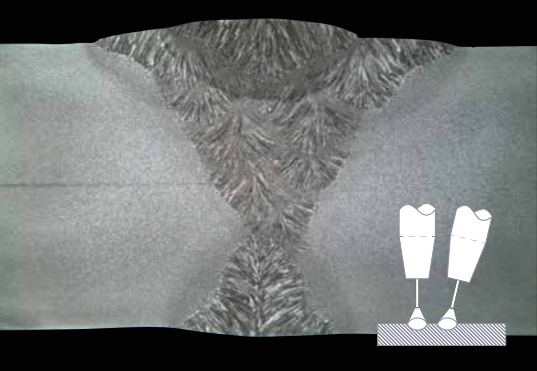
EXAMPLE : PERFORMANCE COMPARISON OF TANDEM WELDS

Application: S355G10+M, 40 mm plate thickness, 1 m length

Heat input range: 3.3-3.6 kJ/mm

Consumables: Oerlikon OP128TT with OE-SD3 (EH12K) wire (diameter 4 mm)

weld A



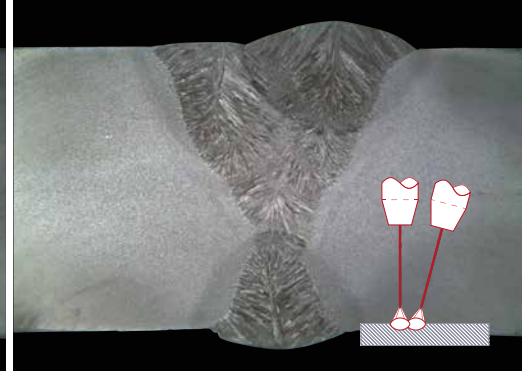
- Tandem Standard Stick Out (DC+/AC)
- Max deposition rate 21.3 kg/h
- Average deposition rate 18 kg/h
- Average heat input 3.6 kJ/mm
- 11 passes
- Average CVN at -50°C : 103 J

weld B

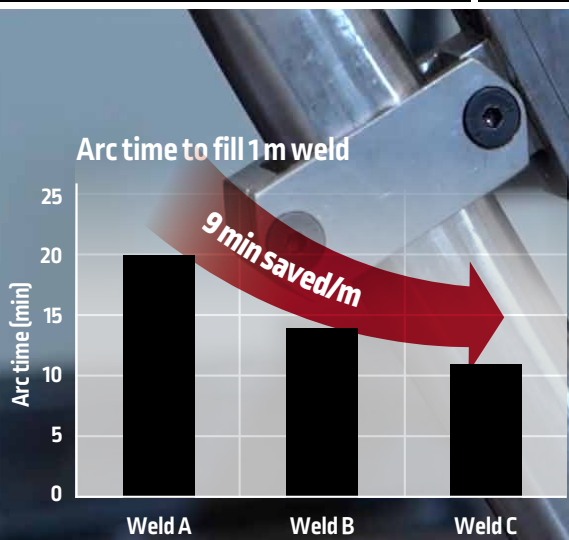


- Tandem 1 Long Stick Out (DC+/AC) (trail)
- Max deposition rate 29.4 kg/h
- Average deposition rate 25 kg/h
- Average heat input 3.3 kJ/mm
- 10 passes
- Average CVN at -50°C : 116 J

weld C

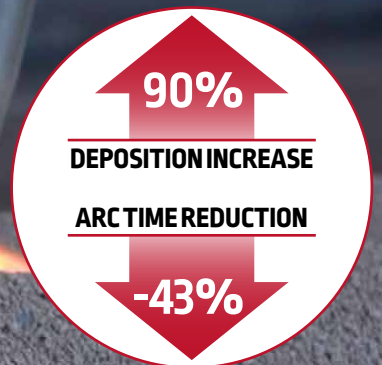


- Tandem 2 Long Stick Out (AC/AC)
- Max deposition rate 39,7 kg /h
- Average deposition rate 32,7 kg/h
- Average heat input 3.5 kJ/mm
- 8 passes
- Average CVN at -50°C : 131 J



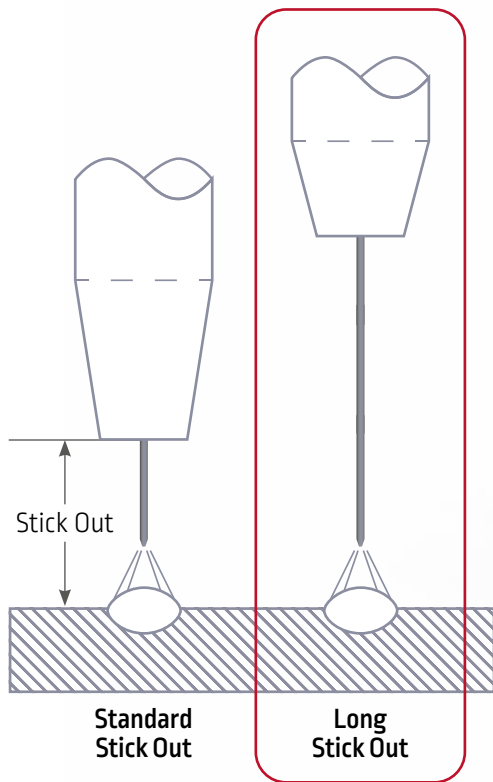
USER'S ADVANTAGE

- 40 kg/h in tandem with heat input below 3.5 kJ/mm
- Number of passes reduced by 27%
- Preserved Charpy impact toughness

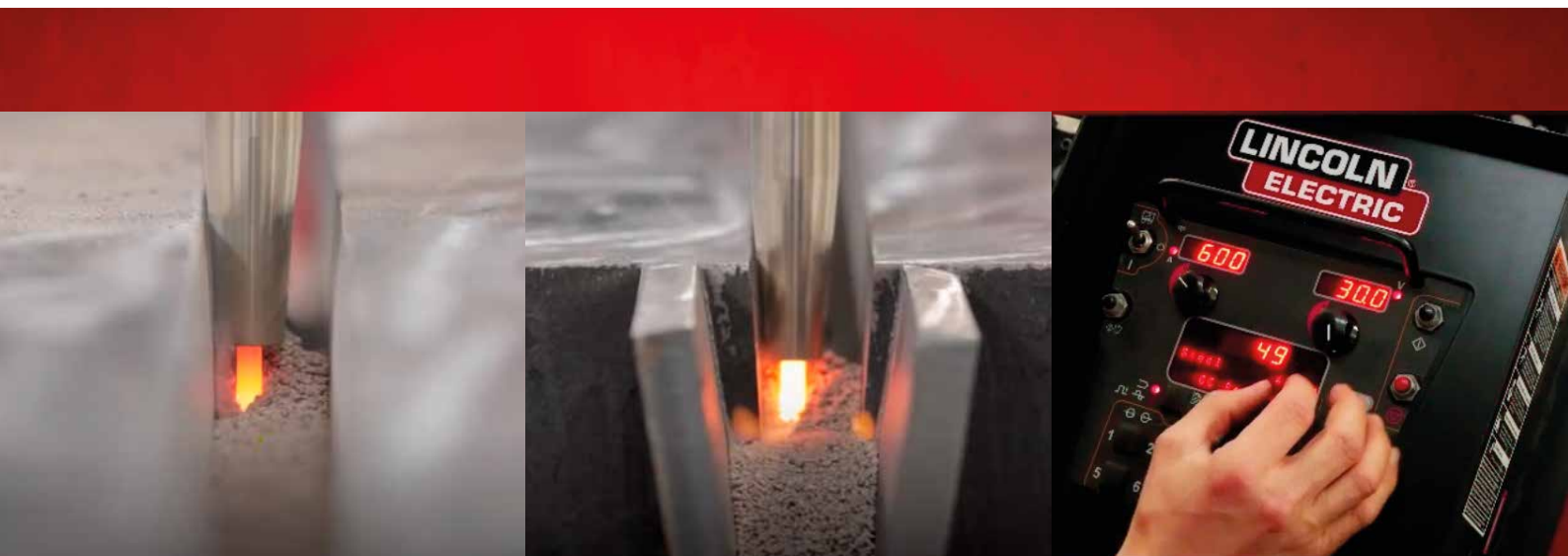
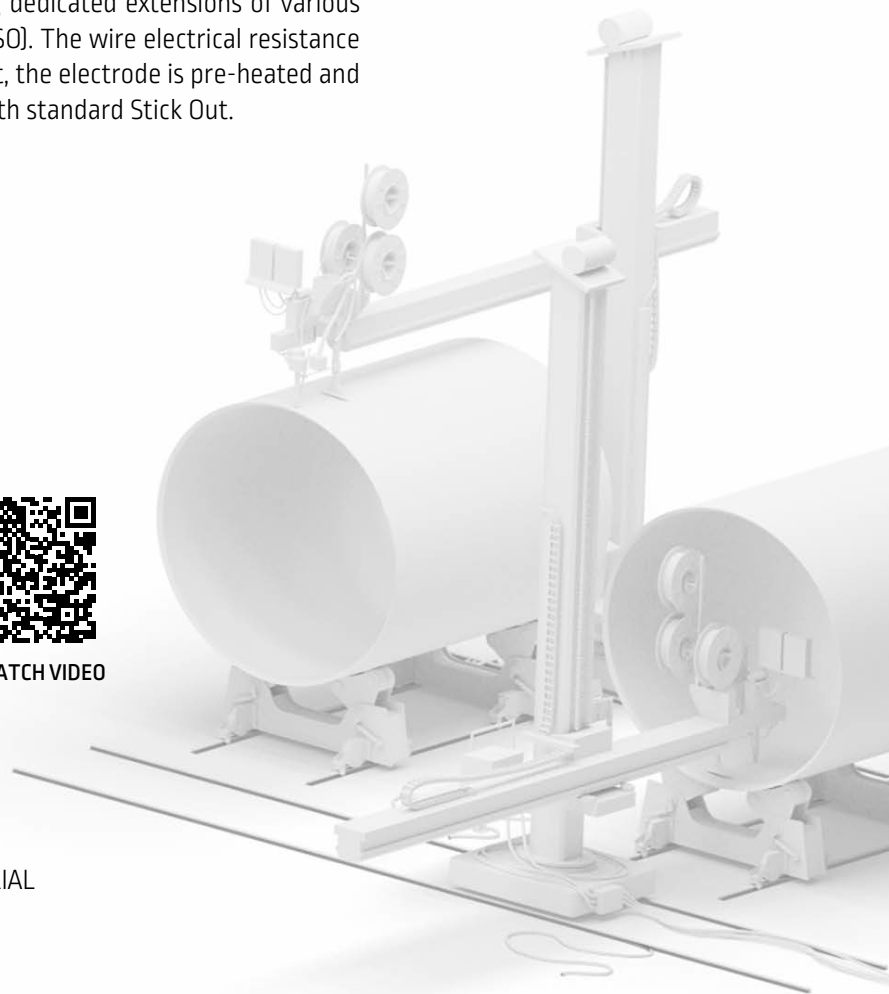


THE LONG STICK OUT PROCESS

In submerged arc welding, Stick Out, is the distance between the contact tip and the work piece. This distance can be increased using dedicated extensions of various lengths to obtain what is known as Long Stick Out (LSO). The wire electrical resistance increases with its length. Thanks to the "Joules" effect, the electrode is pre-heated and melts faster than it would, at the same amperage, with standard Stick Out.



WATCH VIDEO



KEY COMPONENTS

REQUIRED equipments:

- **Power Wave® AC/DC1000® SD:** State of the art power source which insures consistent arc starts.
- **Maxsa 10&22 controller and head :** Robust and easy to use operator interface.
- **Positive contact torch (K148) and its extension (K149):** Easy to mount and engineered for LSO.



Power Wave® AC/DC1000® SD

WELDING POLARITY CHARACTERISTICS

DC +	DC-	AC
<ul style="list-style-type: none"> • Most common mode • Deep penetration and stable arc 	<ul style="list-style-type: none"> • Improves deposition rate • Limits penetration • Limited arc stability 	<ul style="list-style-type: none"> • A compromise between the two DC modes • The optimum choice

Waveform Control Technology® : customised AC mode

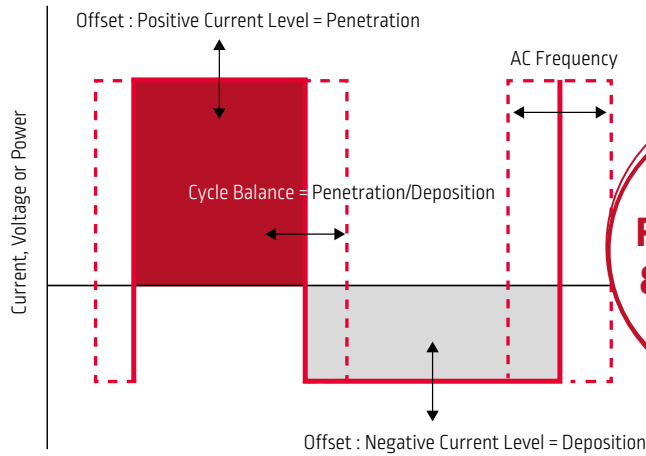
- **Frequency**
Number of switches per second from positive to negative polarity
- **Balance**
Percentage of time in the positive polarity part of a cycle
- **Offset**
Positive/Negative Amplitude



KNOW MORE

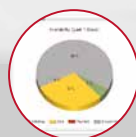
USER'S ADVANTAGES

- Wave form control
- Low electrical consumption
- Easy set up and control of multiples arcs
- Check Point (welds recording and monitoring)



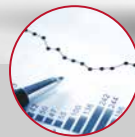
ALERTS

Receive email notifications based on equipment conditions and wire consumption.



PRODUCTION MONITORING

View live status of each welder and weld details.



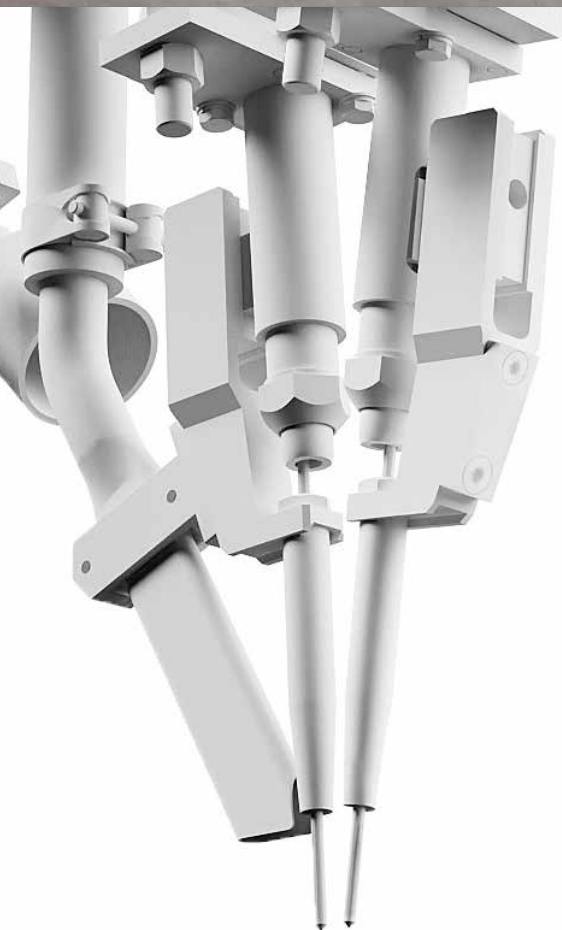
TRACEABILITY

Satisfy reporting requirements by capturing audit trail data.



FOR MORE INFORMATION
SCAN HERE

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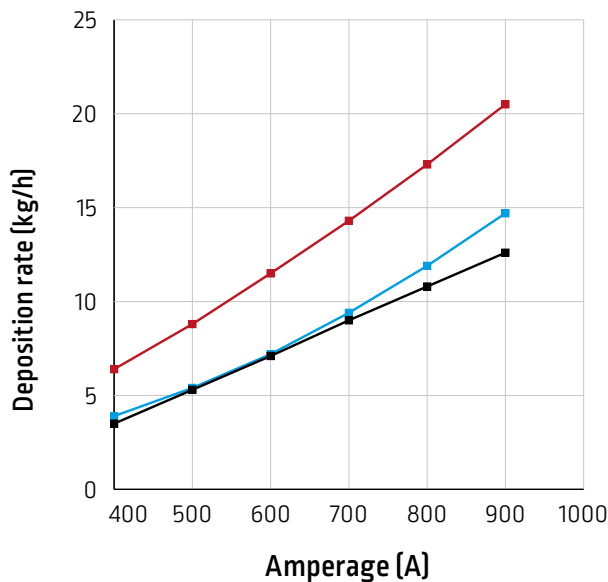
TANDEM LSO:
40kg/h at
3.5 kJ/mm

- USER'S ADVANTAGES**
- Easy torch installation
 - Reduced number of passes
 - Reduced flux consumption
 - Preserved mechanical properties

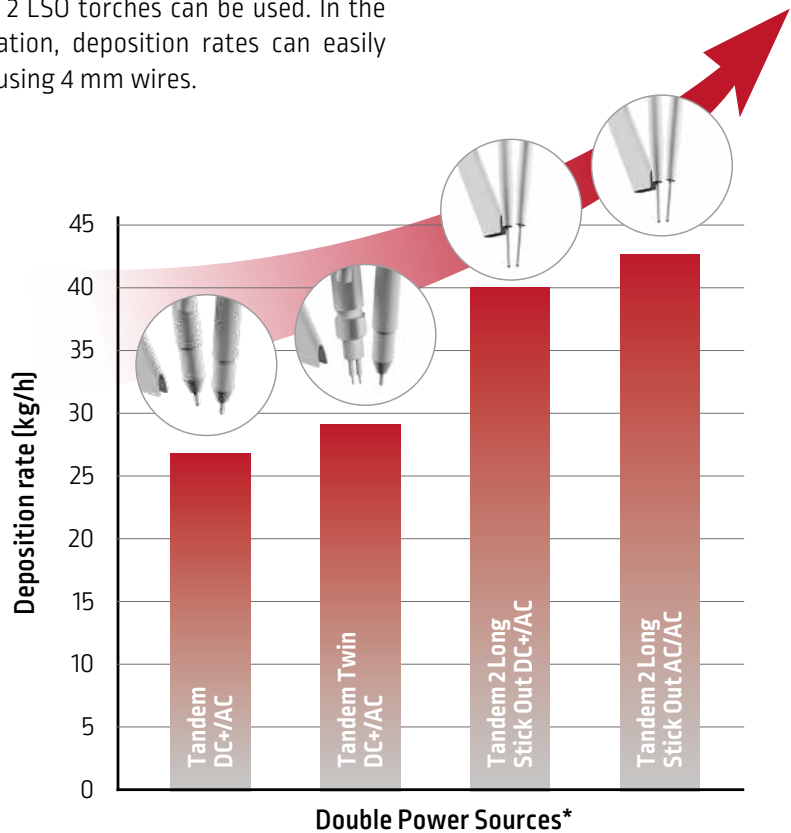
Positive Contact torch and its extension providing Long Stick Out (125 mm)

The long stick out process is the most productive of the single power source processes.

In Tandem, 1 or 2 LSO torches can be used. In the 2 LSO configuration, deposition rates can easily exceed 40 kg/h using 4 mm wires.



- Mono 4mm DC+ (SO : 125mm)
- Twin 2x2.4mm DC+ (SO : 25mm)
- Mono 4mm DC+ (SO : 25mm)



Double Power Sources*

Comparison carried out at :
 *800/875A for double power source processes

SPECIFIC CONSUMABLES

Lincoln Electric offers a wide portfolio of welding consumables fulfilling the highest standard requirements. The most frequently used in the wind industry are reported below. Depending on required mechanical properties and joint configuration more options are available.*

	Two and Multi-run welds	Multi-run welds with CVN down to -60°C
FLUX	<ul style="list-style-type: none"> • OP 128TT 	<ul style="list-style-type: none"> • OP 121TT
WIRE OPTIONS	<ul style="list-style-type: none"> • OE-SD2 • OE-SD3 • OE-S2Mo 	<ul style="list-style-type: none"> • OE-SD3 • OE-SD3 1Ni 1/4Mo

FLUXES ADVANTAGES

- Excellent slag release
- Multi-wire configuration
- High purity weld deposits
- Low diffusible hydrogen
- Excellent resistance to moisture pick up



Want to learn more?
Please contact us to book an appointment.



*Please contact your local representative for advice on other consumables alternatives.

BEING PRESENT LOCALLY MAKES US MORE AWARE GLOBALLY

125
YEARS OF EXPERIENCE

325+
GLOBAL R&D TEAM

38
SOLUTION
CENTERS

3.0
BILLION USD REVENUE

11 000
EMPLOYEES WORLDWIDE



-  Global Headquarters
-  Solution Centers

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 customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to enquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

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