

TOTAL WELDING SOLUTIONS

FOR THE SHIPBUILDING INDUSTRY



SHIPBUILDING WELDING SOLUTIONS

For over 125 years, Lincoln Electric has been at the forefront of arc welding, automation, and innovation. Our advanced solutions are paired with unwavering support across the globe.

In shipbuilding, our extensive expertise in welding, cutting, and automation ensures adherence to stringent codes and aims to maximize your return on investment.

Our customized solutions are designed to deliver unmatched efficiency, reliability, and value. Rely on Lincoln Electric for superior shipbuilding solutions, built on a legacy of excellence





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WELDING SOLUTIONS FOR SHIPBUILDING

Lincoln Electric offers Total Welding Solution for all types of vessels:
Regular ships, Chemical tankers, Liquid gas carriers, Submarine vessels,
Defence surface ships, Aluminum boats.

REGULAR SHIPS



Toughness
and strength
Weldability

USED WELDING PROCESSES

- SMAW
- GMAW
- FCAW
- SAW

SUBMARINE VESSELS



High strength
Tempered steels

USED WELDING PROCESSES

- SMAW
- GMAW
- FCAW
- SAW

DEFENCE - SURFACE SHIPS



High strength
Light weight
Stealth technology
Modular design

USED WELDING PROCESSES

- SMAW
- GMAW
- FCAW
- SAW

CHEMICAL TANKERS



Duplex stainless steel
Higher strength
Corrosion resistant

USED WELDING PROCESSES

- SMAW
- GMAW
- FCAW
- SAW

LIQUID GAS CARRIERS



Cryogenic steels
-163° C methane

USED WELDING PROCESSES

- SMAW
- GTAW
- GMAW
- FCAW
- SAW

ALUMINIUM BOATS



Good impact toughness
Light weight
Corrosion resistant

USED WELDING PROCESSES

- GTAW
- GMAW



REGULAR SHIPS, CRUISE LINERS, CONTAINER SHIPS

Major Classification Societies as Det Norske Veritas, Bureau Veritas, Lloyds Register, Germanischer Lloyd and the American Bureau of Shipping, led to grading of mild steels of between **0.16% to 0.23% Carbon content**. Grades **A, CS, DS, B, D, and E** are progressively tougher mild steels. **High strength steels** have three grades, **AH, DH and EH**. Each of these high tensile grades is available in three levels of strength, **32, 36 and 40**, the latter being the strongest. Toughness and strength are determined at the steel mill by means of process control and the addition on traces of aluminium, niobium and/or vanadium.

Weldability is of preliminary importance; shipyards require: “no preheat and no complex procedures”.

This result in a restriction on steel types, high carbon steels can't be used to enhance strength because **HAZ cracking must be avoided**.

High tensile welding consumables are to be used for high tensile steel, f.e. in submarines. Carbon equivalent (CE) is used to indicate permissible levels of alloying elements and carbon in steel for specific welding conditions.



CHEMICAL TANKERS

Chemical tankers are a composition in **duplex stainless steel**. Duplex stainless steel is finding an increasing uptake in the shipbuilding sector, mainly due to its **higher strength** and **corrosion resistance** properties.

The cargo tanks are constructed from **duplex stainless steel UNS S32205 (Mat. Nr. 1.4462)** which is a higher grade of stainless steel as opposed to austenitic AISI 316LN grade (UNS S31653) that is often used for inland navigation tankers.

Duplex stainless steel has a higher strength combined with a **favorable corrosion resistance** (excellent stress and pitting corrosion), two properties that have governed the choice of this material as a way of increasing the number of chemical products that can be loaded and transported by these chemical tankers.

The **corrosion resistance** can be calculated and expressed by the **Pitting Resistance Equivalent (PRE)**, adjusted for nitrogen containing stainless steel.

Duplex stainless steel UNS S32205 (Mat. Nr. 1.4462) also has **excellent weldability**. Depending on the required welding positions during construction, as well as the various base material combinations, the selection of **welding processes** and **welding consumables** have been made and tested in accordance with the rules of the shipbuilding Classification Societies.





DEFENCE - SUBMARINES

For Submarine Vessels, high strength is required due to the pressures encountered at depth. High strength Quenched and Tempered steels with a **high carbon equivalent** value are used. **Welding is consequently more complex**. Typical steels for submarine applications are **HY 80, HY 100, HRS 650M**.



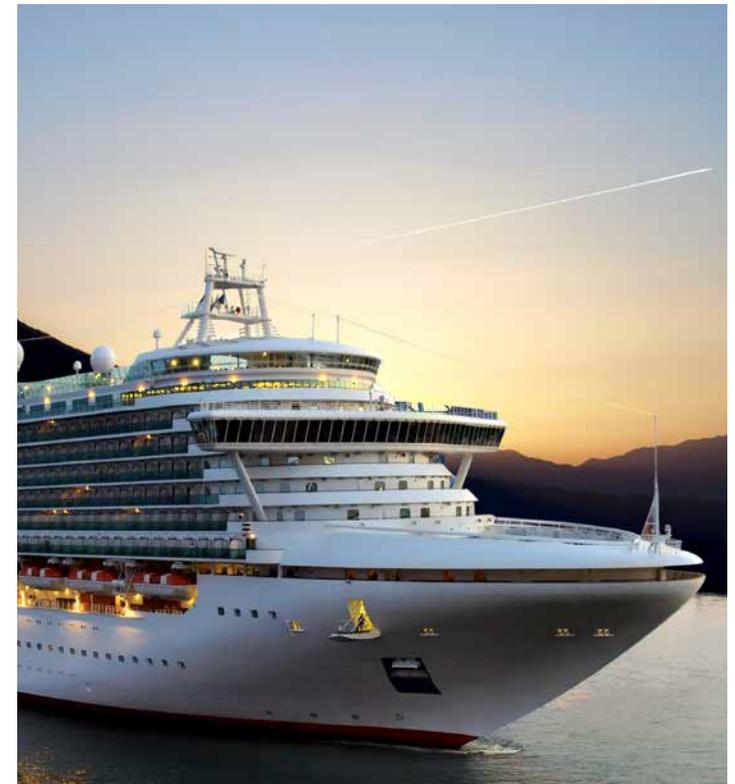
DEFENCE - SURFACE SHIPS

Surface ships in Defence refer to naval warships designed for warfare on the water's surface, capable of engaging various targets. Their main characteristics lightweight, high-strength materials like advanced composites and steels, along with stealth technology to reduce radar and sonar signatures, and modular designs for adaptability and rapid customization. Typical material steel used are **EH32, EH36**.



PLEASURE BOATS

Aluminium has been used in shipbuilding industry as marine vessels, Yachts etc. for more than 100 years because of its light weight and ease of fabrication. **Aluminium combines both good corrosion and fatigue resistance**. For the hull construction commonly **5086 (AlMg4Mn)** and **5083 (AlMg4.5Mn)** are used and are easy to weld. Hull plating of 4.5 mm and above easily accommodates **MIG-Pulse welding**. **TIG welding** will be used for the more difficult detailed work such as attachments.



WELDING CONSUMABLES SOLUTIONS

GMAW

Alloy	Product name	Classifications		Approvals							
		AWS	EN ISO	ABS	LR	BV	DNV	RINA	TUV	DB	Others
Mild steel	ULTRAMAG	ER70S-6	G42 3 C1 3Si1 / G46 4 M20 3Si1 / G46 4 M21 3Si1	3YSA (C1) 4YSA (M21)	3Y40S (C1) 3Y42S (M21)	SA3Y40 (C1) SA3Y42 (M21)	III Y40MS (C1) IV Y40MS (M21)		✓	✓	
	ULTRAMAG SG3	ER70S-6	G46 3 C1 4Si1 / G46 5 M20 4Si1 / G46 5 M21 4Si1	3YSA (C1) 4YSA (M21)	4Y46S (M21)	SA3Y40 (C1) SA4Y46 (M21)	III Y40MS (C1) IV Y40MS (M21)		✓	✓	
	SUPRAMIG HD	ER70S-6	G 42 3 C1 3Si1 / G 46 4 M20 3Si1 / G 46 4 M21 3Si1	3YSA (C1) 4YSA (M21)	3Y40S (C1) 3Y42S (M21)	SA3Y40 (C1) SA3Y42 (M21)	III Y40MS (C1) IV Y40MS (M21)	3Y40 (C1) 3Y40 (M21)	✓	✓	NK; KSW53G(M2)H5
	SUPRAMIG ULTRA HD	ER70S-6	G 46 3 C1 4Si1 / G 50 5 M20 4Si1 / G 50 5 M21 4Si1	3YSA (C1) 4YSA (M21)	2YS (C1) 3Y40S (M21)	S3Y40 (C1) S4Y46 (M21)	IV Y40 (C1) IV Y40 (M20) IV Y40MS (M21)		✓	✓	
	CARBOFIL 1 GOLD	ER70S-6	G42 3 C1 3Si1 / G 42 4 M21 3Si1 / G 42 4 M20 3Si1	3YSA (C1) 4YSA (M21)	3Y (C1) 3Y (M21)				✓	✓	
	CARBOFIL 1A GOLD	ER70S-6	G46 3 C1 4Si1 / G 46 4 M21 4Si1 / G 46 4 M20 4Si1	3YSA (C1) 4YSA (M21)	2YS (C1) 4Y40S (M21)				✓	✓	
Low alloy	LNM MoNiVa	ER110S-G	G 69 4 M21 Mn3NiCrMo	ER100S-G					✓	✓	
	SUPERARC LA-100	ER100S-G, ER110S-G	G 69A 5 A N3M2	4YQ550SA					✓	✓	MIL-E-23765/2: MIL-100S-1
Stainless Steel	LNM 304LSi	ER308LSi	G 19 9 LSi				NV 308 L				
	LNM 309LSi	ER309LSi	G 23 12 LSi				NV 309 L				
	LNM 316LSi	ER316LSi	G 19 12 3 LSi				NV 316 L				
	LNM 4462	ER2209	G 22 9 3 N L								
Nickel	62-50 MIG	ERNiCrMo-3	S Ni6625						✓		
Aluminium	SUPERGLAZE 5183 PLUS	ER5183	S Al 5183 (AlMg4,5Mn07(A))	WC (I-1) WC (I-5)	WC/I-1 S WC/I-5 S	WC	5183	WC	✓	✓	KR; CCS
	SUPERGLAZE 5356 PLUS	ER5356	S Al 5356 (AlMg5Cr(A))	WB	WB/I-1 S	WB	5356	WC	✓	✓	KR; CCS

- Coils (7kg)
- GemPak (136kg)

- Coils (5/15/16kg)
- Drums (250/300/500kg)

WELDING CONSUMABLES SOLUTIONS

FCAW

Outershield®

Impact testing temperature in °C	Yield Strength (MPa)						
	YS355	YS420	YS460	YS500	YS550	YS620	YS690
-20°C	Outershield 71E-H Outershield 71M-H	Outershield 81Ni1-H		Outershield 81Ni1-HSR			
-30°C	Outershield MC710-H Outershield MC710RF-H			Outershield 91Ni1-H Outershield 91K2-HSR		Outershield 101Ni1-HSR	
-40°C	Outershield T55-H		Outershield 71MS-H			Outershield 690-H Outershield 690-HSR	
-50°C	Outershield MC715Ni1-H						
-60°C	Outershield 81K2-H		Citoflux R83C		Outershield MC715-H Citoflux R00NiC		

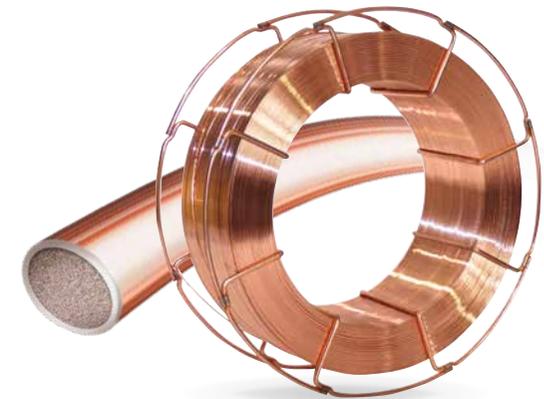
Fluxofil

Impact testing temperature in °C	Yield Strength (MPa)					
	YS355	YS420	YS460	YS550	YS690	YS890
-20°C	Fluxofil M 8		Fluxofil M10		Fluxofil 41	
-30°C	Fluxofil 14 HD Fluxofil 19 HD				Fluxofil 29 HD Fluxofil M 42	
-40°C	Fluxofil 464M Fluxofil 20 HD	Fluxofil 21 HD Fluxofil 31				Fluxofil 45
-50°C				Fluxofil M 41		
-60°C	Fluxofil M 10 S			Fluxofil MC466M Fluxofil 40		Fluxofil 42

NOTE: based on EN ISO and AWS classifications



- Coils (5/16kg)
- PE Foil and/or Aluminum Foil



WELDING CONSUMABLES SOLUTIONS

MCAW/FCAW

Alloy	Product name	Classifications		Approvals								
		AWS	EN ISO	ABS	LR	BV	DNV	RINA	TUV	DB	CWB	PRS
MCAW	Outersield MC710-H	E70C-6M H4	T 46 3 M M212 H5	3YSA H5	3YS H5	SA3YM H5	III YMS (H5)		✓	✓		
	Outersield MC715-H	E70C-6M H4	T 46 4 M M212 H5	4Y400SA H5	4Y40S H5	S3Y H5	IV Y46MS (H5)		✓	✓	✓	
FCAW	Outersield 71M-H	E71T-1/9C-H4 E71T-1/9M-H4	T 46 3 P C11 H5 T 46 2 P M212 H5	3YSA H5 (C1) 3Y400SA H5 (M21)	3YS H5 (C1) 3Y40S H5 (M21)	SA3YM H5 (C1) SA3Y40M H5 (M21)	III YMS (H5) (C1) III Y40MS (H5) (M21)	3Y S H5 3Y40 S H5			✓	3YS H5 (C1) 3Y40S H5 (M21)
	Outersield 71E-H	E71T-1M-J E71T-1C-H4	T 46 3 P M211 H5 T 42 0 P C11 H5	3YSA H5	3YS H5	SA3YM H5	III YMS (H5)	3Y S H5	✓		✓	
	Outersield 81Ni1-H	E81T1-Ni1M-J	T 50 5 1Ni P M212 H5	4Y400 H5	4Y46S H10	SA4YM H5	IV Y46MS (H5)		✓			
	Outersield 690-H	E111T1-K3M-JH4	T69 4 Z P M212 H5	4YQ690SA H5			IV Y69MS (H5)					

Alloy	Product name	Classifications		Approvals										
		AWS	EN ISO	ABS	LR	BV	DNV	RINA	TUV	DB	CWB	CCS	PRS	NK
MCAW	Fluxofil M 8	E70C-3M H4	T 46 2 M M211 H5		3Y40S	SA3YM H5	III Y40MS (H5)	3YSH5	✓	✓				
	Fluxofil M 10	E70C-6M H4	T 46 4 M M211 H5	4YSA H5	4Y46S	SA4YM H5	IV Y40MS (H5)	4YSH5	✓	✓	✓			✓
FCAW	Fluxofil 14 HD	E71T-1M-J E71T-1C-H4	T 46 3 P M211 H5	3Y400SA H5	3Y40S	SA3Y40M H5	III Y40MS (H5)	3Y40SH5	✓	✓	✓		3Y40S H5 (M21)	
			T 46 2 P C11 H5											
	Fluxofil 19 HD	E71T-1C-JH4	T 46 3 P C11 H5	3Y40S H5 (M21)	4Y40S	SA3Y40M H5	IV Y40MS (H5)	3Y40SH5	✓	✓				✓
	Fluxofil 464M	E71T-1M-JH4	T 46 4 P M211 H5	4Y400 H5	4Y46S	SA4Y46 H5	IV Y40MS (H5)	4Y40SH5	✓	✓	✓			
Fluxofil 42	E110T5-K4M-H4	T 69 6 Mn2NiCrMo B M212 H5	4YQ690SA H5		SA4Y69M H5	IV Y69MS (H5)		✓	✓		✓			

WELDING CONSUMABLES SOLUTIONS

MMA

Yield Strength [MPa]

Impact testing temperature in °C	Low strength		High strength				
	YS380	YS420	YS460	YS500	YS550	YS690	YS890
0°C	PANTAFIX SUPRA	SAFER G 48N SAFER GT1 FERROD 135T FERROD 160T					
-20°C		FERROD 165A					
-30°C	SPEZIAL		CONARC 49				
-40°C		SUPERBAZ SAFER NF 510S VANDAL	CONARC 49C				TENAX 140
-50°C		SUPERCITO SUPERCITO 7018S TENAX 35S		KRYO 1-180	SAFER MD 56	CONARC 85	
-60°C			KRYO 1R	KRYO 1 KRYO 1P TENAX 88S		TENACITO 80 TENACITO 80CL	

NOTE: based on EN ISO and AWS classifications

Carton Boxes

Universal packaging for stick electrodes



VPMD vacuum pack

A rugged multi-layer Al-PE foil is used as barrier against moisture absorption.



WELDING CONSUMABLES SOLUTIONS

MMA

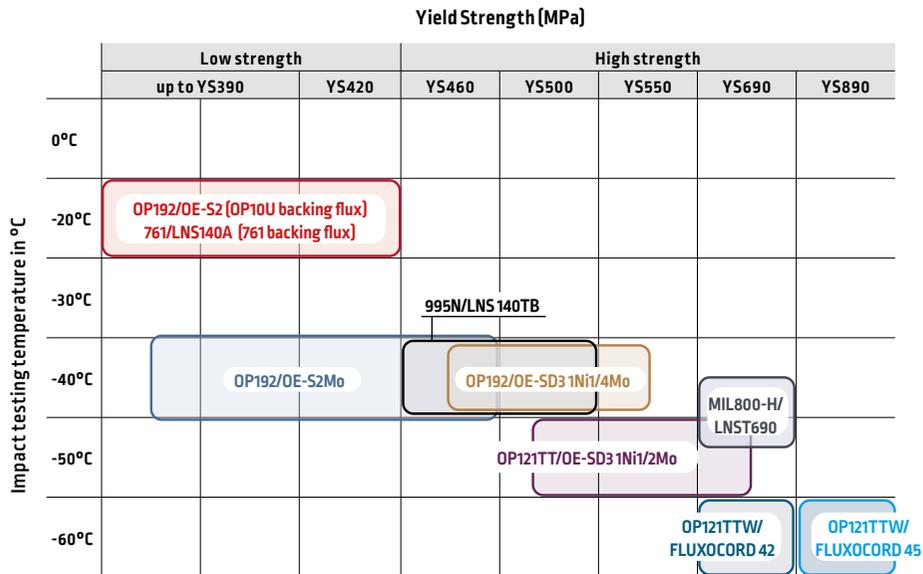
* Double Coated

• Low Chromium Hexavalent

Alloy	Subapplication	Product name	Classifications		Approvals						
			AWS	EN ISO	ABS	LR	BV	DNV	RINA	TUV	DB
Mild steel	E6012	SUPRA	E6012	E 38 0 RC 11		2M	2	2		E 38 0 RC 11	✓
	E6013 Rutil cellulosic	PANTAFIX	E6013	E 38 0 RC 11						E 38 0 RC 11	
		SAFER G 48N	E6013	E 42 0 RC 11	2	2M	2	2			
		SAFER GTI	E6013	E 42 0 RC 11	3	3Y	3	3		E 42 0 RC 11	
	High recovery 130	FERROD 135T	E7024	E 42 0 RR 53	2Y		2Y			E 38 0 RR 53	
	High recovery 160	FERROD 160T	E7024	E 42 0 RR 73			2Y			E 42 0 RR 73	
		FERROD 165A	E7024-1	E 42 2 RA 73		2YM		2		E 42 2 RA 73	
	E7016	SPEZIAL*	E7016 H8	E 38 3 B 12 H10	3YH10	3Y	3, 3Y H10	3Y40H10		E 38 3 B 12 H10	✓
	E7018 H4	SAFER NF 510A	E7018 H4	E 42 4 B 32 H5	3YH5	3Y	3YH5	4Y40H5	3YH5	E 42 4 B 32 H5	
		SUPERBAZ	E7018 H4	E 42 4 B 42 H5	3YH5	3Y	3YH5	3YH5	3YH5	E 42 4 B 42 H5	✓
		CONARC 49	E7018 H4	E 46 3 B 42 H5	3YH5	3YM	3, 3Y H5	3YH5	3Y H5	E 46 3 B 32 H5	
		SUPERCITO	E7018-1 H4	E 42 5 B 42 H5	4Y400H5	3YM	4Y40H5	4Y40H5		E 42 5 B 42 H5	✓
	E7018-1 H4	SUPERCITO 7018S	E7018-1 H4	E 42 5 B 32 H5	3YH5	3YMH5	3Y H5			E 42 5 B 32 H5	
		TENAX35S	E7018-1 H4	E 42 5 B 32 H5	4YH5	3Y	3YH5	4Y40H5	4YH5	E 42 5 B 32 H5	✓
		VANDAL	E7018-1 H4	E 42 4 B 32 H5	3YH5	3YM	3YH5	4Y40H5	3Y H5	E 42 4 B 32 H5	
E7018-1 H4R	CONARC 49C	E7018-1 H4R	E 46 4 B 32 H5	3YH10	3YM	3Y H5	3YH5		E 46 4 B 32 H5	✓	
Low alloy	1%Ni	KRYO 1R	E7018-G-H4R	E 46 6 1Ni B 32 H5	5YQ460H5	5Y46M H10	5Y H5	5Y46H5			
		KRYO 1-180	E7018-1 H4	E 50 5 1Ni B 73 H5		4YM		4 Y46H5			
		KRYO 1	E7018-G-H4R	E 50 6 Mn1Ni B 32 H5	3YH5	5Y46MH5	4Y46H5	5Y46H5		E 50 6 Mn1Ni B 32 H5	✓
		KRYO 1P	E8018-G-H4R	E 50 6 Mn1Ni B 32 H5	5YQ420H5	5Y46M H5	4Y46H5	4Y46H5			
	YS 500Mpa	TENAX 88S	E8016-G H4	E 50 6 Mn1Ni B 12 H5	3YH5	5Y42MH5		5 YH10			
	YS 550Mpa	SAFER MD 56	E8018-G H4	E 55 5 1NiMo B 32 H5	E8018-G		E 55 5 1 NiMo B 3 2 H5	3Y46H5		E 55 5 1NiMo B 3 2 H5	
	690MPa @ -60°C	TENACITO 80CL	E11018-G H4	E 69 6 Z B 32 H5	5YQ690 H5			5 Y69H5		E 69 6 Mn2NiCrMo B 4 2 H5	✓
		TENACITO 80*	E11018-G H4	E 69 6 Mn2NiCrMo B 42 H5				4 Y69H5		E 69 6 Mn2NiCrMo B 4 2 H5	
	NiMoCr	CONARC 85	E12018-G-H4R	E 69 5 Mn2NiCrMo B 32 H5	E12018-G H4R			4 Y69H5			
	YS 890Mpa	TENAX 140	-	E 89 4 Z Mn3Ni1Cr1Mo B 32 H5							
Stainless steel	Duplex	ULTRAMET 2205 (Arosta 4462)	E2209-16	E 22 9 3 N L R 32			2209	✓	2209	E 22 9 3 N L R 3 2	
	E308L-16	AROSTA 304L	E308L-16	E 19 9 L R 12			308L				
	E308L-17	LIMAROSTA 304L	E308L-17	E 19 9 L R 12		E308-17		NV 308 L H10		E 19 9 L R 12	✓
	E308LMo-16 (semi-sintetic)	NICHROMA	E308LMo-16	E 20 10 3 R 32			E308LMo-16	NV 308 Mo		E 20 10 3 R 3 2	
	E308Mo	JUNGO 308Mo	-	E 20 10 3 B 42							
	E309L-16	AROSTA 309S	E309L-16	E 23 12 L R 12	E 23 12 L R 3 2		309L			E 23 12 L R 12	
	E309L-17	LIMAROSTA 309S	E309L-1	E 23 12 L R 12		SS/CMn		NV 309 L		E 23 12 L R 12	✓
	E309LMo	AROSTA 309MO	E309LMo-16	E 23 12 2 L R 32	E 23 12 L R 3 2	SS/CMn	309Mo	NV 309 Mo	309Mo	E 23 12 2 L R 3 2	✓
	E316L-16	AROSTA 316L	E316L-16	E 19 12 3 L R 12	E 19 12 3 L R 12	316L	316L	NV316 L		E 19 12 3 L R 12	✓
	E312	29.9 SUPER R (Limarosta 312)	E312-17	E 29 9 R 12							
	E316L-17	LIMAROSTA 316L	E316L-17	E 19 12 3 L R 12		316L		NV 316L H10		E 19 12 3 L R 12	✓
	E308L-17	CLEARINOX E 308L **	E308L-17	E 19 9 L R 22	E308L-17		308L	VL 308 L		E 19 9 L R 22	
E309L-17	CLEARINOX E 309L **	E309L-17	E 23 12 L R 22	E309L-17		309L	VL 309L		E 23 12 L R 22		
E316L-17	CLEARINOX E 316L **	E316L-17	E 19 12 3 L R 22	E316L-17		316L	VL 316 L		E 19 12 3 L R 22		
Nickel	Inconel 625	NIMROD 625KS (MICRO 60/20)	ENiCrMo-3	E Ni 6625			NV 1.5Ni; NV 3.2Ni; NV 5Ni		E Ni 6625		

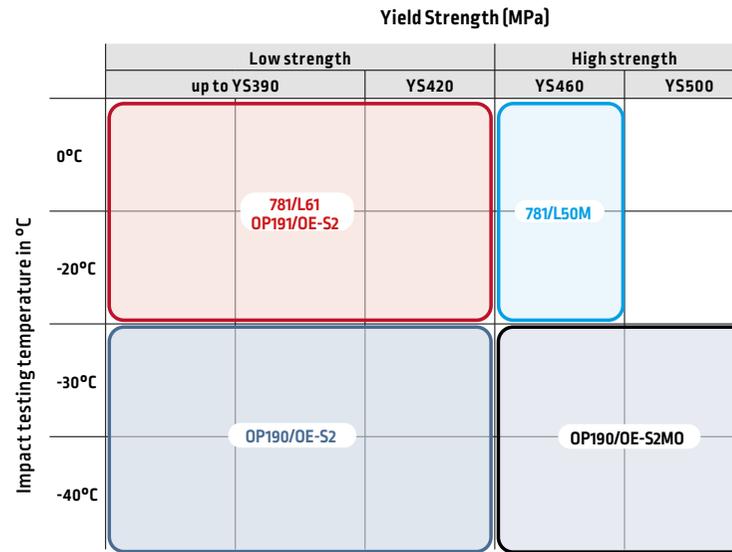
WELDING CONSUMABLES SOLUTIONS

SAW - BUTT WELDS

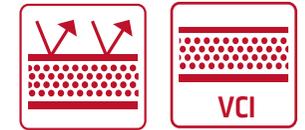


NOTE: based on EN ISO and AWS classifications

SAW - FILLET WELDS



NOTE: based on EN ISO and AWS classifications



Enhanced corrosion protection

No need for pre-drying
(Sahara ReadyBag only)

- Drums (300, 350, 400, 600, 1000 kg)
- Reel (300 kg)
- Drybag/ SRB for flux (25, 1000 kg)

Product name	Classifications		Approvals							
	AWS	EN ISO	ABS	BV	DNV	LR	PRS	RINA	CRS	TUV
OP121TT/OE-SD3 1Ni/2Mo	F9A8/F9P8-EF3-F3		5YQ550M		5Y55M/3Y50T	3Y50M				✓
OP190/OE-S2	F7A5/F6P5-EM12K	S 38 5 AB S2Si		A4YM/A3YT	4YM/ IIIYT_LT	4Y40M/3YT_LT	4Y40M/3Y40T	4YM/4YT		✓
OP190/OE-S2Mo	F8A5/F8P2-EA2-A4	S 46 5 AB S2Mo			4Y40M/IIIIY40T	4Y40M/3Y40T_LT	4Y40M/3Y40T			✓
OP191/OE-S2	F7A0-EM12K	S 42 0 AR S2	2YM/2YT	A3YT		2YM/2YT_LT		2YM/2YT		✓
OP192/OE-S2	F7A2/F7P4-EM12K		3YM/2YT	A3M, 3YM/A2T, 2YT	IIIIYM/IIYT_LT/3YOS	3YM/2YT_LT		3YDM/2YT		
OP192/OE-S2Mo	F8A2/F8P2-EA2-A2		3YM/3YT	A3YM/A3YT	IIIIYM/IIIIYT	3YM/3YT_LT		3YM/3YDM/3Y40T	3YM/3YT	✓
OP192/OE-SD3 1Ni/4Mo					4YOS					
781/L61	F7A0-EM12K	S 4T 0 ZS S2Si								
781/L50M		S 4T 2 ZS S3Si	3Y400T	A3Y40T	IIIIY40T_LT	3YT		3Y40T		
995N/LNS140TB	F9TA6G-EA2TiB	S 5T 5 AB S2MoTiB			4YM/5Y42T_LT/5Y42T					
OP121TTW/FLUXOCORD 42	F11A8/F11P5-EC-F5	S 69 6 FB (T3Ni2,5CrMo) H5								



INDUSTRY CHALLENGES

Skills Shortage

- ▶ Automation
- ▶ Mechanization
- ▶ Robotics
- ▶ Leveraging ARC for customer training
- ▶ Virtual Welding

Global Competitiveness [Quality/Productivity]

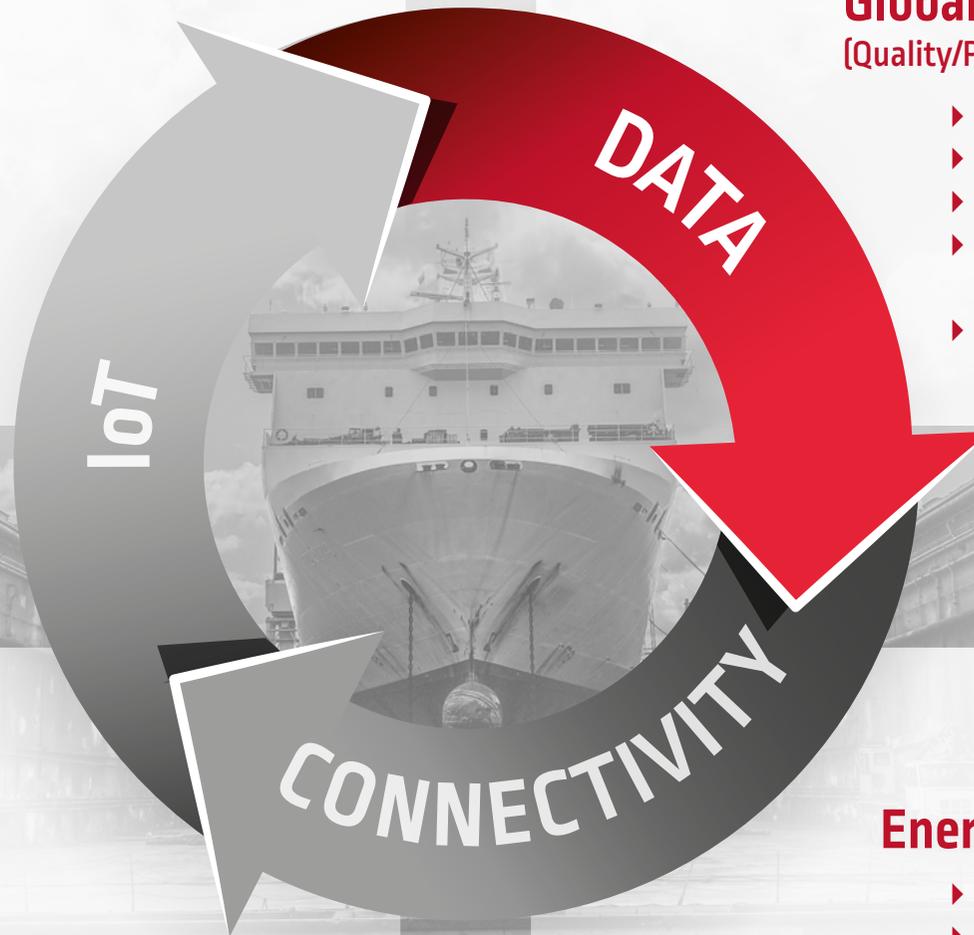
- ▶ Automation/Mechanization
- ▶ Increased Productivity
- ▶ Reduced Distortions
- ▶ Dedicated After Sales and Support
- ▶ Additive Manufacturing

Health and Safety

- ▶ Automation/Mechanisation
- ▶ PPE : PAPR
- ▶ Low Fume consumable range
- ▶ Fume extraction
- ▶ Ergonomics and Weight control <25 kg
- ▶ Cable management

Energy Cost

- ▶ Inverter Technology
- ▶ Data Collection
- ▶ Equipment monitoring



HYPERFILL®

ONE PROCESS
FOR ALL APPLICATIONS

STT®, FCAW, GMAW, RAPIDARC®

1F/1G/PA 2F/PB 3F/5G/PF,PG 4F/PD 2G/PC



TWO WIRES
A SINGLE ARC

GMAW PROCESS

Due to its innovative twin-wire design, HyperFill® is able to utilise two smaller diameter wires to produce a larger weld droplet and arc cone.

In return, this generates a large weld puddle that is easy to manage and control, allowing operators to increase deposition by an average of 50% over traditional single wire processes.

STT

HyperFill technology combined with the waveform benefits of STT will allow pipe manufacturers to take advantage of faster, more precise welding. The STT (surface tension transfer) waveform is primarily used on open root pipe welding, making it possible to increase root pass travel speeds up to 57% and delivering increased pipe diameter (inches/day). The combination of this waveform with the productivity gains of HyperFill will allow operators to see increased efficiencies throughout the welding process.

FCAW PROCESS

Thanks to a new high-performance contact tip, operators can use the HyperFill process in flux-cored applications for increased deposition rates up to 15lb/h. This solution also delivers the flexibility to weld in flat, horizontal, vertical-up, and overhead positions.

RAPIDARC®

HyperFill technology combined with RapidArc® waveform allows for tighter and more focused arcs with increased travel speeds of up to 58% compared to traditional CV or pulse single wire processes in automotive and heavy fabrication industries

ADVANCED SOLUTIONS

POWER WAVE® S500

When you are facing demanding production schedules, you need a welding power source you can rely on. The Power Wave® advanced welding platform delivers just that. From semiautomatic welding applications to complete robotic welding systems, the Power Wave® platform has you covered – day after day, shift after shift



TWIN WIRE
SOLUTION ON A
SINGLE SETUP

AUTOMATION/MECHANIZATION SOLUTIONS

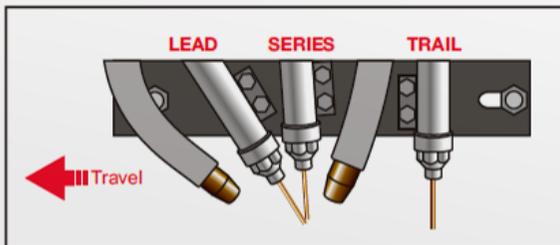
LONG STICK OUT PROCESS (LSO)

The long stick-out (LSO) is a highly efficient submerged arc welding process developed by Lincoln to maximize productivity. This technique leverages the natural resistivity of the welding wire. By significantly increasing the electrical stick-out, the wire is preheated, making it easier to melt. Consequently, for a given amperage, the deposition rate can be doubled compared to conventional stick-out procedures.



THE MODIFIED SERIES ARC™

The Modified Series Arc™ Welding process was developed to join plates from one side using an open gap. Modified Series Arc™ is different from conventional Tandem SAW because the lead and series electrodes are connected to the same power supply(s) and the electrodes intersect above the bottom of the joint.



Electrodes

The Lead, Series and Trail electrodes are located, as illustrated above.

To date, the Modified Series Arc™ process has been in use with a 3/16" (4.8 mm) dia. lead electrode and a 1/8" (3.2 mm) dia. series electrode. The purpose of the first two electrodes is to make a weld in the open gap that will have a good bead appearance on the bottom of the plate. A trail electrode is used to fill the remainder of the joint when needed.

POWER WAVE® AC/DC 1000SD

Software-driven AC, DC positive or DC negative output allows for advanced control over deposition rate and penetration leading to increased weld speeds, consistently higher quality welds and improved efficiency in both single or multi-arc configuration



DC-1000

Delivers up to 1000A of welding power @100% duty cycle. 500 amp output connections enhance arc characteristics for low amperage submerged arc procedures. The single range control ensures precise output and easy operation. Its low profile case allows for installation under a workbench and stacking up to two machines, conserving valuable floor space



FLEXTEC® 650 SUBARC

Delivers up to 815A of welding power, making it ideal for a wide range of applications, including construction, shipbuilding, and heavy fabrication. It operates on a broad spectrum of voltage inputs and is IP23 rated for outdoor use and storage. With extensive compatibility, the Flextec 650 Subarc works seamlessly with nearly any Lincoln Electric® SAW wire feeder and controller.



INROTECH'S ADVANCED AUTOMATED SOLUTIONS



Inrotech's welding automation systems are built on adaptive intelligence - a proprietary operational logic embedded in the company's self-developed software. This software seamlessly integrates with robots and welding power sources from various manufacturers.

Unlike traditional welding automation, which often relies on repetitive, simple programming for identical tasks, Inrotech offers advanced solutions tailored to complex environments. For instance, in shipyards where components and tolerances vary significantly, Inrotech's robotic welding systems, such as the Inrotech-Classic and Inrotech-MicroTwin, automatically identify weld requirements and assess tolerances. They calculate, in real time, critical parameters such as the number of weld passes needed. This adaptive and intelligent approach is what sets Inrotech's solutions apart from conventional systems.



Shipbuilding Industry

Specifically designed for the welding of **micro panels, sub-assemblies and T-profiles** in the shipbuilding industry, however it can be used for a number of other purpose.



Sensologic Technology

Works fully automatic, push the "start" button; after completed scanning the **welding starts automatically**. It only takes a few minutes with a scanning speed of 36 sqm per minute.



User-friendly interface

The user-friendly interface gives you **full control over the robot** from one single touch screen, while providing accurate report from the process.



Shipbuilding Industry

This welding robot is intended for the welding of **open block assemblies** in the shipbuilding industry, yet this welding robot can be used for a number of other purposes.



Sensologic Technology

Once the object has been recognized, the **welding process commences automatically**. This continues until the entire panel is welded.



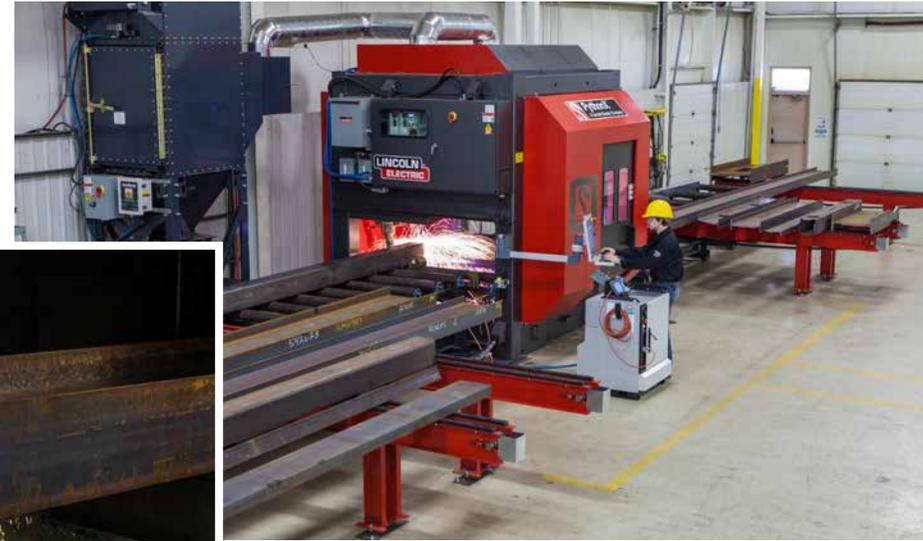
Two Simple Instructions

One operator is able to **handle six Inrotech-Classic** with Inrotech's intuitive user interface that does not require any robot programmer experience or knowledge.

PYTHON X CUTTING SOLUTIONS

PythonX Systems from Lincoln Electric® are the trusted international name in robotic fabrication systems. New machines and capabilities allow you to fabricate structural steel and pipe.

PythonX machines are versatile and complete solutions that automate your processing operations in your fabrication shop while providing you with increased productivity, unmatched cut quality, and predictable and consistent throughput. In addition, our signature simplicity of operation gives you the confidence to implement a new machine and start seeing a return on your investment immediately. PythonX machines deliver the solutions that you need to help your business where it counts the most . . . your bottom line.

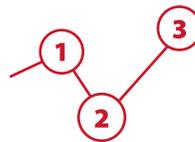


COBOT SOLUTIONS



Easy User Interface

Step-by-step on-screen instructions allow operators to learn how to teach points and create a program fast.



Smart Torch

Smart Torch design provides an ergonomic grip for users to easily move the collaborative robotic arm. The integrated buttons allow users to program from the torch.



THE COOPER APP

The Cooper App includes presets based on wire size, type, gas mix, and thickness of material being welded and/or joined. The Weld By Numbers™ feature offers preset weld settings. Dozens of parameters are preset in these numbers, which correlate to the material thickness to optimize weld performance and quality.



ADDITIVE SOLUTIONS

Lincoln Electric Additive Solutions 3D metal printing services gives your business a big advantage over castings, forgings and other traditional manufacturing processes with the fast delivery of new and replacement parts and tooling. With the **largest 3D metal printing capacity in North America**, we can expedite production for large industrial parts for your application and industry.



- Making large parts quickly
- Faster turn-around time
- Reduction in lead times from months to weeks
- Faster prototype testing

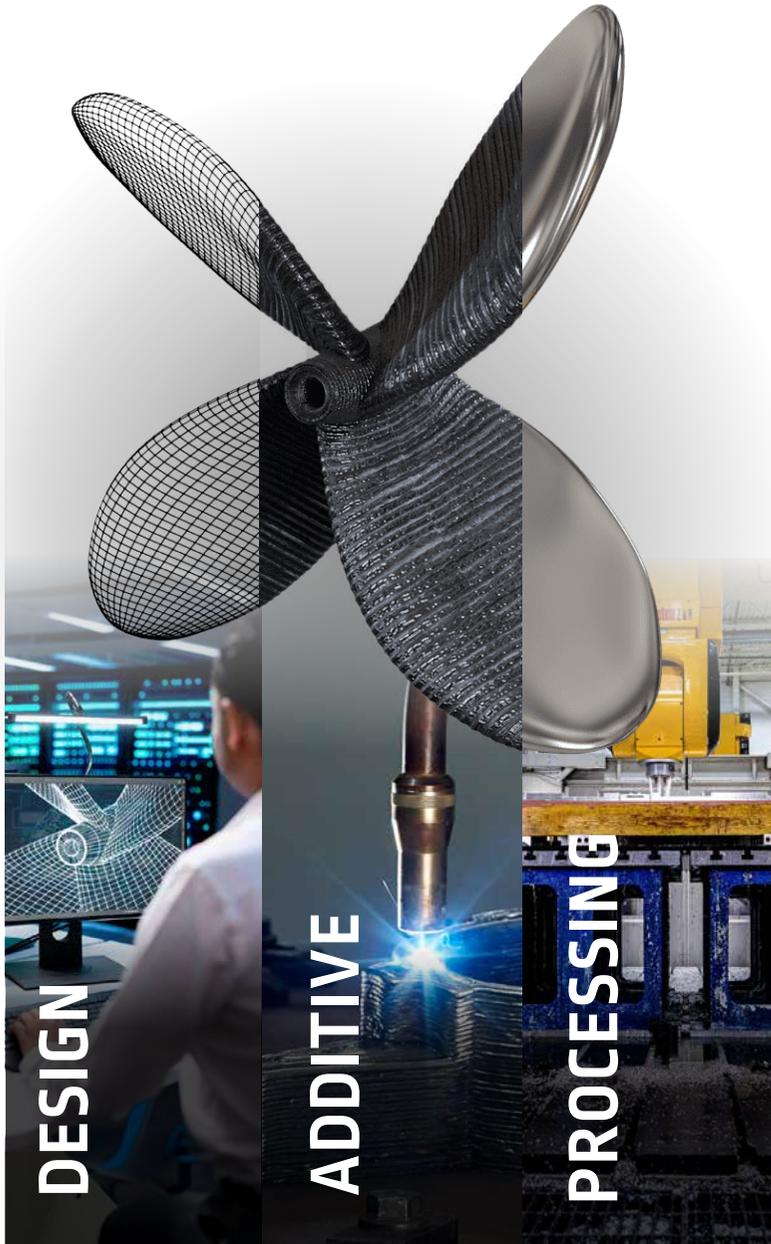


- More design freedom
- Less waste, virtual inventory
- Complete finished part provider

7,000 m²
FOR LARGE FORMAT
PRINTING SYSTEMS

Approximate build volume: 1.2m x 1.5m x 2m
With positioner (more complex geometries):
up to 1,500kg and 1.5m high.
Off the floor: 3,600kg and 2.5m high

ADDITIVE MANUFACTURING



COMPLEX



Post Printing Machining & Fab

28+ years of
Aerospace and
Automotive machine
& fabrication



Metallurgy and Deposition Know-How

100+ years of arc welding
innovation



Feedstock Production

U.S. market share
leader with presence
in 18 countries



Automation Hardware & Robotics

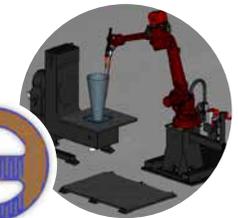
A pioneer in
robotic welding,
with largest-
part handling
capabilities in the
industry



18 Additive Systems 24/7 Production

Advanced Process Control & Software

Inventor of industry-
defining process control
and AM software-
ScluptPrint™ OS



SOLUTIONS

MANUAL EQUIPMENT WELDING SOLUTIONS

SMAW/GTAW EQUIPMENT

SPRINTER 160S & 180S

Unmatched Power, Unparalleled Portability

- Experience high performance in a compact form. Weighing under 9kg, the Sprinter S is your lightweight, portable powerhouse. With an impressive 180A output, you can easily weld all types of electrodes (up to 4.0mm), including 7018 and 6010. But that's just the beginning. The Sprinter S isn't just a stick welder; it combines superior stick functionality with DC LIFT TIG mode and dual input voltage (120V/230V), giving you ultimate versatility

- DC Stick • DC Lift TIG



SQUARE WAVE® 400 ADV

Prime choice for industrial aluminum welding
Struggling with inconsistent weld quality and high energy costs? The SQUARE WAVE® 400 ADV addresses these issues by combining power and precision for superior welding results.

Tired of equipment failing in tough conditions? Its robust design ensures reliable performance in the most challenging environments. Plus, with the latest energy-saving technology, you can significantly reduce operational costs while boosting productivity.

- TIG (GTAW) • Pulsed TIG (GTAW-P) • Stick (SMAW) • Air carbon arc (CAC-A)
- Aluminum • Magnesium • Copper alloys • Steel • Stainless steel • Low alloy steel

ALUMINUM



LINC® i400S

The LINC i400S® is engineered with cutting-edge energy-saving technology, making it exceptionally suited for the most challenging environments. Its unique design incorporates advanced communication devices and digital transmission systems, enabling operators to effortlessly monitor and track welding operations. With a dedicated kit paralleling system, the LINC® i400S can deliver up to 800 A of output by utilizing two power sources simultaneously.

- MMA • Gouging • TIG lift
- MMA manual & Synergic Pulse
- Premium Cellulosic 6010 Stick capability
- Steel • Stainless steel • Low alloy steel

UP TO
800 Amps



PLASMA CUTTING

TOMAHAWK® 30K

The Tomahawk® 30K plasma cutting system arrives ready to go for fast and precise cutting. With the 30K, forget the grinder – simply pick up the torch and cut in seconds.

INTERNAL
COMPRESSOR OR
EXTERNAL AIR



MANUAL EQUIPMENT WELDING SOLUTIONS

MULTI-PROCESS EQUIPMENT

YARDTEC® 300C

Lightweight, portable multi-process **power source** with an integrated **wire feeder**, making it an ideal solution for shipyards and construction sites. This versatile product is perfect for customers who need to perform welding in large facilities, where moving equipment, extending its range, and working in hard-to-reach areas can be challenging.

- GMAW Manual and Synergic • FCAW Manual and Synergic
- SMAW • GTAW (Lift TIG) • Gouging (with 4mm electrode)
- Steel • Stainless steel • Aluminium



Compact case designed for harsh welding environments with limited access.

An ergonomically designed handle made for safe transport and handling - manually or crane-lifted by cable.



PORTABLE, LIGHTWEIGHT & SMALL SIZE



FLEXTEC® 350XP

Equipped with CrossLinc® technology, the Flextec 350XP can be controlled from hundreds of feet away without expensive and inconvenient control cables. Desert Duty® and IP23 rated, these welders can withstand harsh outdoor conditions and outperform other welders in their class.



LN-25X

CrossLinc® and True Voltage Technology™ (TVT™) helps you get the job done with drastically less movement



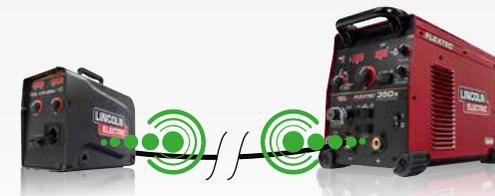
ACTIV8X®

Small enough to fit through manways and light enough to carry around the site



ACTIV8X® PIPE™

Features STT Field and Pulse waveform outputs



CROSSLINC® TECHNOLOGY

Output Control at the Arc, No Additional Cable CrossLinc feeders enable voltage control at the feeder without the extra cable. The result is greater productivity, safety, and quality. Avoid the negative aspects of across the arc models and adding a control cable, while enjoying all the benefits.

WALK LESS. WELD MORE.

Output Control at the Arc

No Additional Cable

CrossLinc feeders enable voltage control at the feeder without the extra cable. The result is greater productivity, safety, and quality. Avoid the negative aspects of across the arc models and adding a control cable, while enjoying all the benefits.



PRODUCTIVITY

Work faster, reduce movement, and minimize rework



SAFETY

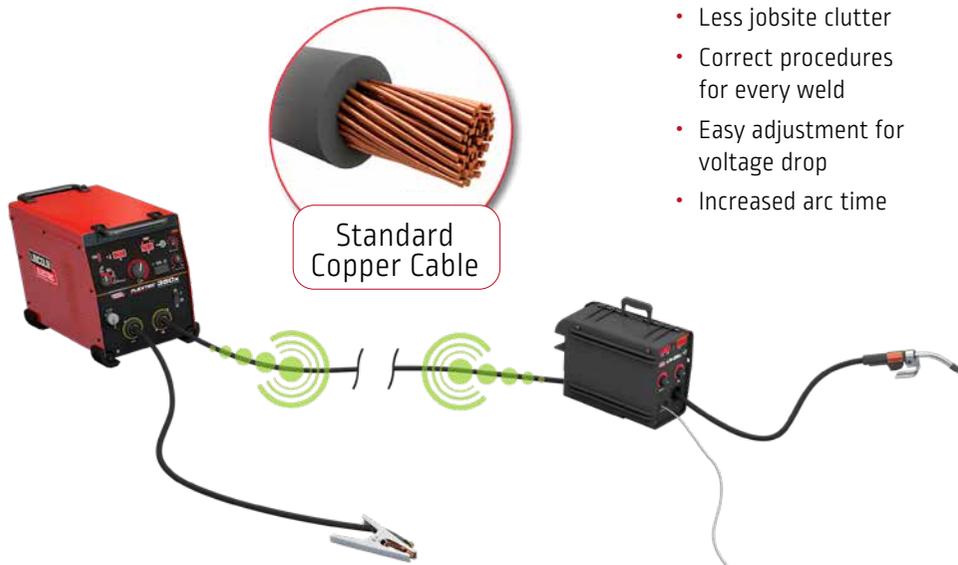
Reduce the chance for injury by reducing the number of cables underfoot.



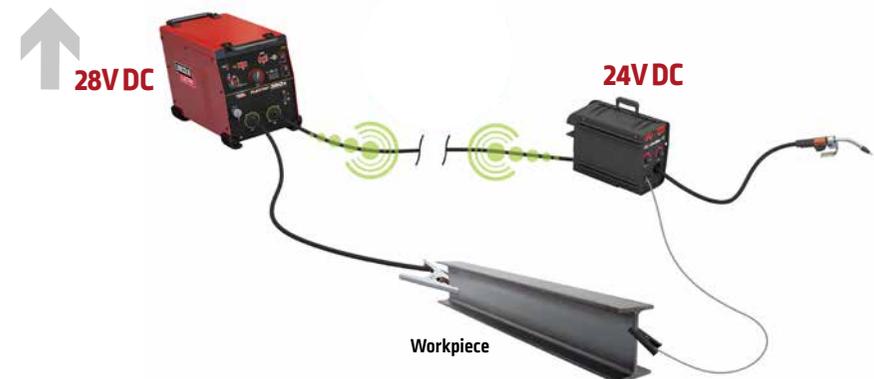
QUALITY

Meet WPS specifications more easily with greater operator control

CrossLinc® Technology



CrossLinc® Technology + True Voltage Technology™ (TVT™)



In outdoor welding, long cables cause voltage drop, so the voltage at the arc is lower than the value set on the machine (e.g., 24 V set → only 20 V at the arc → cold weld).

True Voltage Technology (TVT) detects this loss and automatically boosts machine output so the set voltage reaches the arc (e.g., outputs 28 V to ensure 24 V at the arc).

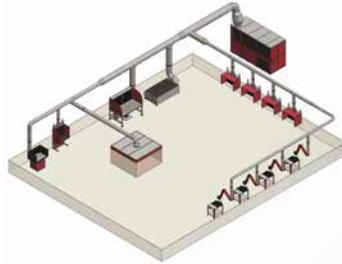
SAFETY AND PPE SOLUTIONS

FUME MANAGEMENT

With experience gained on major shipyard projects, Lincoln Electric can assess your needs and tailor technical solutions for all welding, cutting, and grinding processes. We offer a full range of air-treatment equipment compliant with current European standards. Our team of air-treatment specialists is here to support you. We recommend source-capture systems to ensure maximum efficiency and optimal welder health protection. We also provide maintenance contracts to ensure long-term system reliability

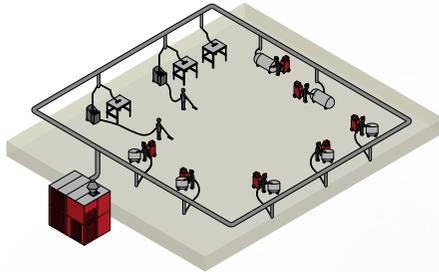
LOW-VACUUM PROCESS

for arm-type, extraction panel, down-draft table, or hood extraction systems.



HIGH-VACUUM PROCESS

for torch extraction systems, suction nozzles, and floor-cleaning equipment



COMPLETE RANGE OF HIGH-VACUUM CENTRAL UNITS

- Capacity for 5 to 30 welders
- Nominal vacuum level of 25,000 Pascals
- Integrated cyclofilter with high-efficiency filtration



AEROMIG 3D

Ergonomic booms for torches and wire feeders

- Designed to optimize workstation layout
- Enhanced operator comfort



COMPLETE RANGE OF EXTRACTION ARMS

with a working reach from 2 to 8 meters



LINC EXTRACTOR

Extraction turbine for MIG and TIG torches

- W3-certified
- HMI touch-screen control
- Dual Flow function included as standard
- Automatic filter cleaning
- High-efficiency filtration



PRISM

Range of automatic self-cleaning filters

- Compact design
- Smart Connect technology
- High-efficiency filtration



LINC GUN® FX II

Fume extraction guns

LGFX II extraction guns feature our patented Dualflow system, adapting suction flow to the weld configuration.

- High capture performance
- Air- or water-cooled
- Ball socket joint for easier handling
- 150–450 A welding range



RESPIRATORY PROTECTION

EuropurePLUS™ RANGE TH3 Class

Ergonomic and smart protection.
Fully integrated safety, with respiratory,
head, eye and skin protection options.
Designed to work together for maximum comfort.

EuropurePLUS™
5500 LS

WELDING
GRINDING, ...



EuropurePLUS™
CLEAR

**GRINDING, BRAZING,
CUTTING**



EuropurePLUS™
LE FACE SHIELD

**GRINDING, BRAZING,
CUTTING**



Superior Battery Life

Lincoln Electric
Extended Battery 16 hrs

Lincoln Electric
Standard Battery 9 hrs

Competitor 6 hrs



EuropurePLUS™
WAVE 3.0 LS

WELDING
GRINDING, ...



AUTODARKENING HELMETS

VIKING™ 3250D FGS™



VIKING™ 3350 SERIES



EUROWAVE 3.0 LS



LEATHER MASKS



LEATHER HELMET
FLIP UP
WITH VARIABLE
SHADE 8-13



LEATHER HELMET
FLIP UP
WITH SHADE 11



ACCESSORIES SOLUTIONS

LINGGUN® PROMIG

PRECISION WELDING, EVERY TIME.

The LINGGUN® PROMIG™ line guarantees exceptionally smooth welding across a broad range of processes, enabling operators to handle applications from light-industrial work to professional environments. It was designed with a clear objective: to offer our customers MIG guns that deliver outstanding performance while remaining reliable and cost-effective. The result is a range of products that make welding easier, more effective, and more efficient.

- Durable & Heat-Resistant – Built to withstand impact and high temperatures.
- Longer Consumable Life – Proprietary parts deliver up to 70% more wire per contact tip.
- Smooth Wire Feeding – Premium liners ensure consistent performance.
- Reduced Downtime – Simplified design for fast, easy part replacement.
- Secure Fit – Screwed nozzle for enhanced stability.
- Versatile Options – Multiple models for various applications.
- Double Warranty – Extended coverage, twice the industry standard.
- Ready to Weld – Includes long-life contact tip and liner.
- Standards Compliant – Meets EN 60974-7 safety and performance requirements.



**Mechanical
Resistance**



**Resistance to
overheating**



**Reduced
downtime**



**Unfailing
Power Cables**



ACCESSORIES SOLUTIONS

CUTTING AND GRINDING DISCS

DUCTIFLEX PRO

Top quality cutting disks for professional use.



DUCTIFLEX

A grinding range for standard structural steel.



DUCTIFLAP

Abrasive flap disks. These disks are made by cutting abrasive fabrics, then cutting as flaps and bonding them on a fiberglass or nylon backing plate by an adhesive.



GOUGING ELECTRODES



CARBONAIR

Pointed electrodes

Versatile multi-purpose round gouging electrodes *(most popular type)*



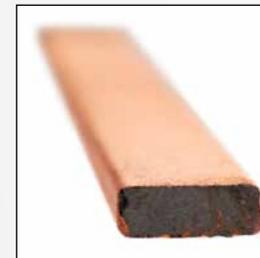
Hollow electrodes

Versatile multi-purpose round gouging electrodes



Flat electrodes

Rectangle shape for close tolerance metal removal and/or to create rectangle grooves.



CARBONAIR PLUS

Jointed electrodes

Round electrodes with male and female ends to eliminate stub loss



ACCESSORIES SOLUTIONS

GAS AND FLAME

Our Gas & Flame solutions are designed to support **all critical flame and gas processes in shipyards**, from steel preparation to final outfitting.

Applications covered



CUTTING

- Manual oxy-fuel cutting
- Plate cutting and part preparation
- Weld removal



HEATING

- Flame straightening
- Steel forming and shrinking
- Pre-heating prior to welding



GAS HANDLING

- Regulation of oxygen, fuel gases, and shielding gases (Ar, Ar/CO₂ mixes)
- Equipment for workshop, cylinder, or mobile distribution systems
- Solutions to reduce shielding gas consumption



OUR OFFER INCLUDES:

Safety devices

- Flashback arrestors
- Non-return valves
- Shut-off and pressure protection devices

Accessories

- **Quick couplings** for oxygen, fuel gases and shielding gases
- **Hoses** designed for harsh shipyard environments
- **Hose reels** for safer, cleaner and more organized work areas

By combining Harris and SAF-FRO technologies, we deliver:

- Proven safety solutions
- High industrial robustness
- Optimized gas management
- Reduced operating costs
- Solutions tailored to demanding shipyard environment

**SAFETY
EFFICIENCY
COST-OPTIMIZED**

ACCESSORIES SOLUTIONS

CERAMIC BACKINGS

KERALINE RANGE

How to improve the process and increase productivity [DCR]?



Avoid welding both sides of the metal part

NOT NECESSARY TO TURN THE METAL PARTS



Save filler metal

REDUCES OVERHANG

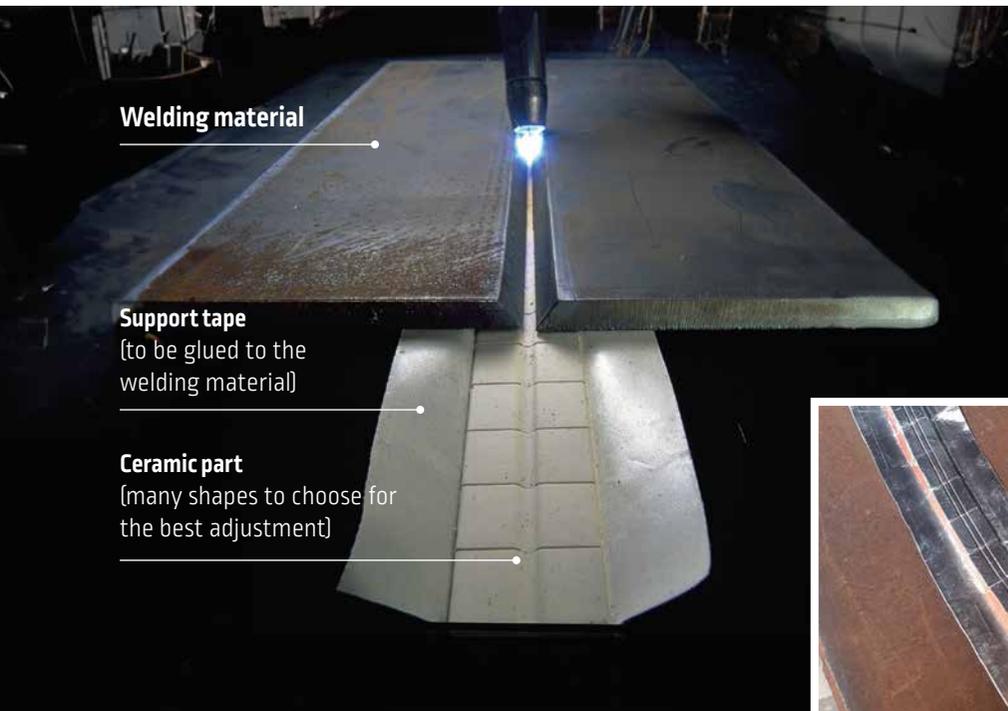


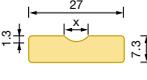
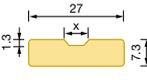
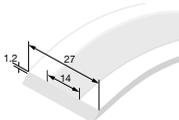
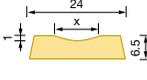
Nice appearance of the root pass

CURVED OR FLAT



OUR KERALINE IS NOT SENSITIVE TO AMBIENT TEMPERATURE VARIATIONS



Type	Dimensions (mm)	3D diagram	Application	Process
Cylindrical / round type				
TR	 d = 6, 7, 8, 9, 12 or 15 mm		Medium to heavy thickness. V- or X-grooves for identical or dissimilar thickness	GMAW, FCAW, SMAW
Flat with rounded concave groove				
TA	 x = 6, 9 or 13 mm		Medium to heavy thickness	Metal cored or solid wire without slag
Flat with square concave groove				
TF	 x = 6, 9 or 13 mm		Same thickness, medium or thick	Cored wire with slag, MIG MAG, V-bevel
Circular ceramic backings				
RAD	 1.2, 27, 14			
Flat with rounded concave groove				
TM	 x = 13 or 18 mm			

Keraline support type:

Ceramic on aluminum-tape

Articulated, Flexible following the parts geometry, adjustable, heat resistant, easily detachable after welding.

Ceramic on metallic support

Quick implementation, easily positioned, adjustable, heat resistant.

ARC

APPLICATION RESOURCE CENTER

Application Resource Centers, or ARC facilities, feature Lincoln Electric's newest technologies and experts who develop and deliver productivity solutions.

These centers provide dedicated spaces and equipment for demonstrating and testing welding, cutting, virtual welding, and automation solutions. Each ARC also includes classrooms for training on available processes, machines, and products to develop and conquer any shipbuilding needs, along side dedicated application experts who assist customers with welding problems, procedures, and more.





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.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.eu for any updated information.

www.lincolnelectric.eu

