THE GAME CHANGER IN PIPE MILLS

Uhrhan-Schwill SCHWEISSTECHNIK
A Lincoln Electric Company

LINCOLN® ELECTRIC
THE WELDING EXPERTS®

FOR OVER 120 YEARS, KNOWN WORLDWIDE
FOR RELIABILITY AND PERFORMANCE

11 000 Employees worldwide

160 Active in 160 countries

48 Manufacturing locations for consumables and equipment

325 R&D engineers worldwide

42 Solution Centers

2.7 Billion USD Revenue

Uhrhan-Schwill SCHWEISSTECHNIK

A Lincoln Electric Company

THE GAME CHANGER IN PIPE MILLS

By providing a full solution including equipment, consumables, integration and expertise we are the GAME CHANGER IN PIPE MILLS.

FULL EQUIPMENT RANGE

- Turn-key welding equipment packages
- State-of-the-Art Digital Welding system Z5 with Real Time Data Logging & Traceability

FULL TECHNICAL SERVICE TO CUSTOMER

- Assistance with to WPS development to Customer
- Lab equipment for trial purposes available

FULL CONSUMABLE PACKAGES

- Wire & Flux specially designed for Pipe Mill requirements

Industry Challenges

We understand the critical nature of welding requirements in the pipe mill industry. From stringent requirements on extreme wall thicknesses to consumables for pipe used in highly corrosive environments, consistency and reliability are key to delivering a project on time and under budget.

Typical Pipe Mill Applications

Whether the pipe you're making is destined for an oil field or a stadium, you're likely to encounter demanding customers, exacting line specifications and unforgiving delivery schedules. We understand the necessity of welding that is done right the first time. Online SAW-H, offline SAW-H or SAW-L, no matter the pipe-making process, we have the equipment, consumables and technical know-how to ensure that you will be able to deliver the highest-quality pipe on time. With manufacturing locations around the globe, we're able to quickly and efficiently provide the products you need when you need them.

Uhrhan & Schwill, a Lincoln Electric company, is the recognized industry leader with decades of experience in the development of integrated systems for pipe mills. The unique welding expertise allows us to provide unmatched technical support in application, procedure and product development tailored specifically to pipe-making.

Solutions and Training

To make a quality pipe every time, you need the right resources. We offer a complete solution to support your mill: integrated equipment solutions that are reliable and cutting-edge, consumables to weld everything from mild steel up to X100 paired with welding support. We believe every production campaign is unique and we have a team of technologists, engineers, metallurgists, programmers and specialists to support your mill.

We also offer a variety of on-site, regional and global training programs specifically designed to address the welding and cutting challenges you face every day.

Today, we are setting new standards in the art of multiple arc welding technology and automation. Thanks to continuous research, further development and combined efforts, large diameter pipe mills worldwide trust our technology and integrated our systems into their production processes very successfully.

Our advance is our customers' advance.

Uhrhan - Schwill
Essen
DE

Lincoln Electric
Cleveland
USA

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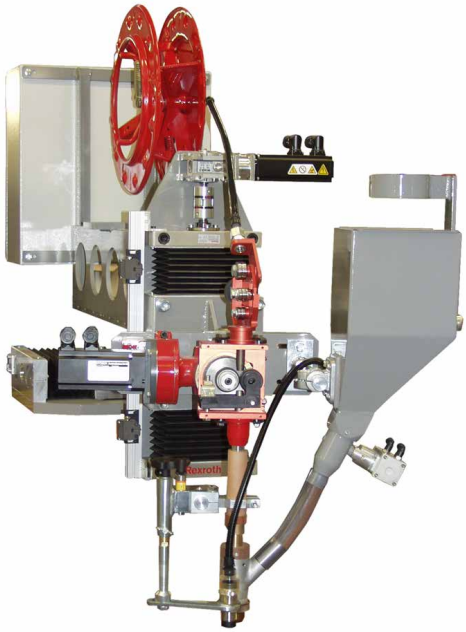
EQUIPMENT
MACHINERY

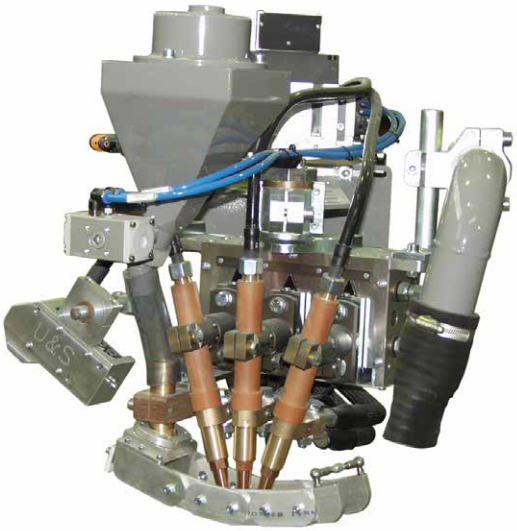
Tack Welding Machines

In the process of welding a pipe, GMAW tack welding machines serve to weld a tack weld in GMAW welding so that afterwards the pipe can be welded by submerged arc welding process. Our GMAW tack welding equipment is available in the most diverse designs to allow the integration into new or already established lines.

We are guided entirely by your wishes and needs when it comes to the components a GMAW tack welding machine shall be composed of. Uhrhan & Schwill GMAW tack welding machines are available in the most diverse designs.

Our service is not limited to development, assembly and commissioning of the tack welding machine and also includes the supply of appropriate welding consumables.





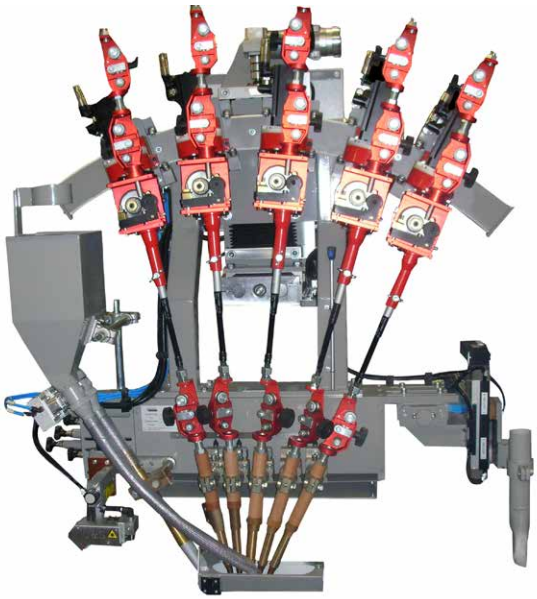
Internal & External Welding Systems

In the process of welding longitudinal or spiral pipes, SAW welding systems serve to weld a pipe from inside/outside in submerged arc welding process.

This is done after the pipe has been tack welded.

As all other Uhrhan & Schwill welding systems, internal and external welding systems are available in special executions to fulfil even very special applications. The number of electrodes varies between 1 to 6 depending on the application.

Further advanced welding solutions like cold wire, long stick-out can be integrated for special requirements.



MOVING YOUR WELDING SOLUTION TO THE NEXT LEVEL

WIRE DEPOSITION RATES for MULTIPLE POWER SOURCES SUBMERGED ARC WELDING POWER SOURCES (MILD STEEL & LOW ALLOY)

Average Deposition Rate in (kg/h)
Improvement versus standard 3-Arc in [%]

	DC+/AC/AC	
	Standard Stick Out	1 x Long Stick Out
3-Arc 3 x 4.0 mm	36 kg/h	40 kg/h ***+11%***
3 x Tandem Twin 2 x 2.4 mm	48 kg/h ***+33%***	–

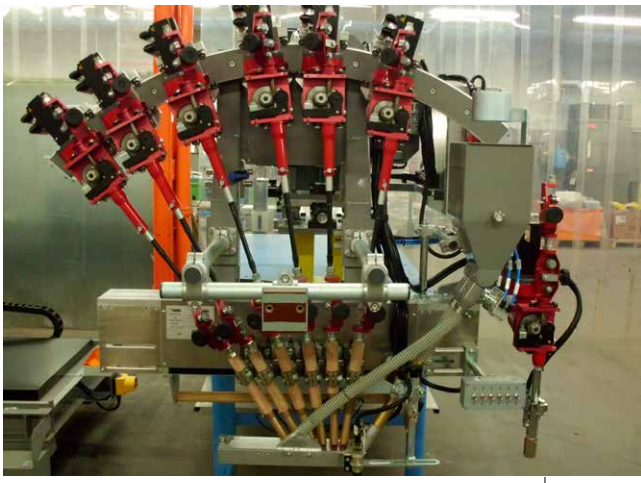
	DC+/AC/AC/AC	
	Standard Stick Out	2 x Long Stick Out
4-Arc 1 x 4.8mm + 3 x 4.0mm	70 kg/h ***+94%***	76 kg/h ***+111%***

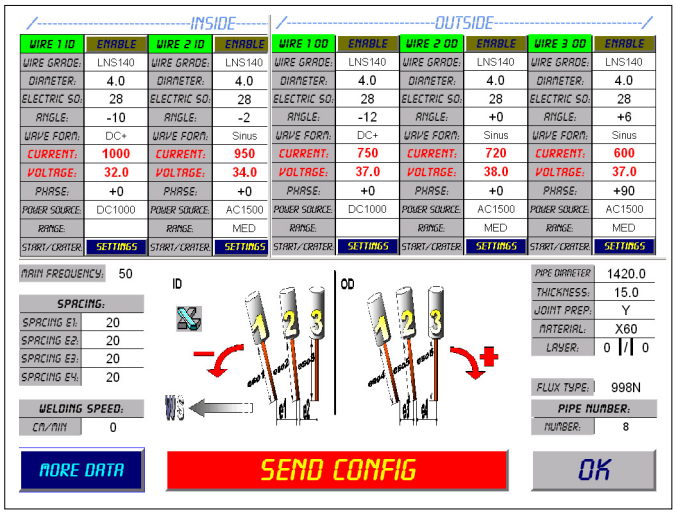
	DC+/AC/AC/AC/AC	
	Standard Stick Out	3 x Long Stick Out
5-Arc 2 x 4.8mm + 3 x 4.0mm	85 kg/h ***+136%***	100 kg/h ***+178%***

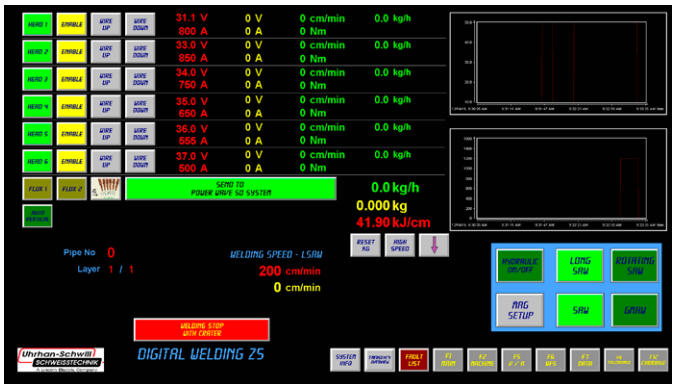
	DC+/AC/AC/AC/AC/DC-AC	
	Standard Stick Out	4 x Long Stick Out
6-Arc 2 x 4.8mm + 4 x 4.0mm	105 kg/h ***+192%***	120 kg/h ***+233%***

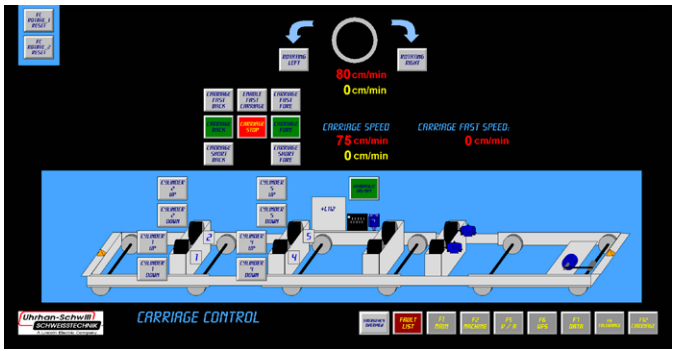
GO FOR NEXT STEP

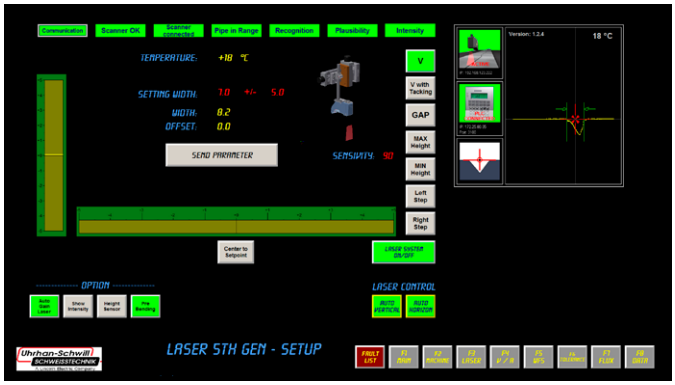
We support you to select:
- Optimum process
- Ideal parameters
- Consumables that guarantee the required mechanical properties customized to your application











AUTOMATIC WELDING CONTROL & DATA LOGGING SYSTEM Z5

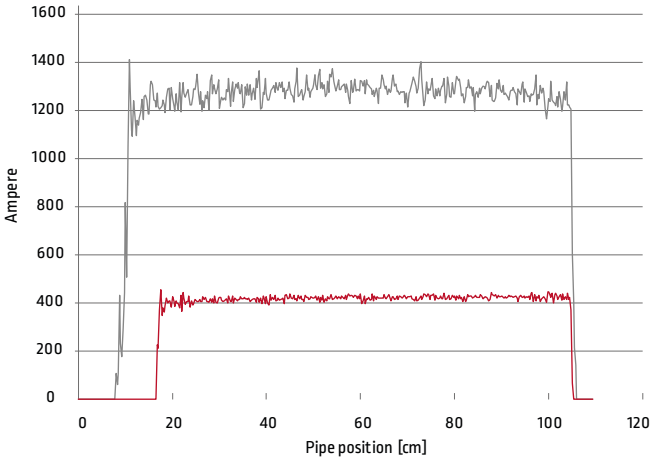
Digital Welding System Z5 READY FOR INDUSTRY 4.0

The Uhrhan & Schwill welding systems are equipped with a digital control system with an especially developed software to control and monitor the entire welding process in default languages.

A consistent user interface combined with modern touch screen technology for a digital real time control of the tack welding, inside welding and outside welding processes enables customers to work in a user-friendly environment.

Pre-selection of all relevant welding parameters and permanent control of the set values via closed loop control enable to weld a complete pipe in automatic mode. All periphery equipment, such as flux, seam tracking and transport systems are implemented into the user interface of the control software.

The integrated quality control system includes the storage of welding data sets. This allows to recall all sets of parameters for different pipe diameters and wall thicknesses. This will create a Know How base for different production ranges and will help to fulfill the required documentation work during end customer inspection. Beside a fault indication system in real text mode enables the operator to detect any fault and the exact position at the pipe for any welding parameter witch is outside the adjustable tolerance range. This analyzing tool can reduce repair time and maintenance time significantly.



WELDING POWER SOURCES

Uhrhan & Schwill welding systems are equipped with power sources from Lincoln Electric. All sources are optimized for the requirements of multiple arc applications in rough pipe mill environments.

Beside rectifiers and transformer we offer the newest Waveform Control Technology by usage the Power Wave AC/DC 1000® SD.

The following power sources are available:

- US-DC-1000
- US-AC-1500
- US-Power Wave® AC/DC 1000® SD

Idealarc® US-DC-1000

The US-DC-1000 is a high-performance DC power source and perfect for submerged arc welding when high output power is required. Four power sources are switched in parallel to achieve a power range of up to 4000 A.

- high process safety
- outstanding arc characteristics on constant voltage and constant current processes
- high efficiency and lasting welding quality
- data consistency for repetitive welding applications due to stable control design
- consistent operation, even with line voltage changes of up to ± 10 % due to built-in line voltage compensation
- easy access for maintenance activities due to removable side panels
- manufactured accordig to DIN EN 60974-1
- three-year manufacturer warranty on parts and labour
- seven-year manufacturer warranty on the power rectifier
- many years of practical experience, even in rough operating environment

Idealarc® US-AC-1500

The US-AC-1500 are electronically-controlled AC power sources with transductor and perfect for submerged arc welding when high output power is required.

- outstanding arc characteristics
- Scott connection for two AC welding heads operated in tandem
- adjustment of output settings through Rheostat while welding or at idle
- three output studs with overlapping ranges
- consistent operation, even with line voltage changes of up to ± 10 % due to built-in line voltage compensation
- extra long life for repetitive welding applications through solid state circuitry
- easy access for maintenance activities due to removable side panels
- UL listed

US-Power Wave® AC/DC 1000® SD

The Power Wave® AC/DC 1000® SD delivers Waveform Control Technology® to submerged arc welding.

- 380-575 VAC, 50/60 Hz Voltage Input – can be connected anywhere in the world
- No hardware reconfiguration required with easy polarity switching – eliminates downtime.
- ArcLink®, ethernet and DeviceNet™ communication
- IARC™ digital control – 90 times faster than the previous generation

TECHNICAL SPECIFICATIONS

	Output Range	Weight	Dimensions W x D x H [mm]
Idealarc® US-DC-1000	150 – 1250 A	372 kg	560 x 1000 x 780
Idealarc® US-AC-1500	240 – 1500 A	820 kg	580 x 1210 x 1460
Power Wave® AC/DC 1000® SD	100 – 1000 A	368 kg	488 x 1174 x 1250

POWER WAVE TECHNOLOGY

In most of the submerged arc applications it is possible to work in DC current with the electrode being either positive or negative.

Thanks to ***Lincoln Electric Waveform Control Technology®*** *embedded in the new Power Wave® AC/DC 1000® SD power source,* ***we can now take over the full area between DC+ and DC-.***

DC +

- Most common mode
- Deep penetration and stable arc

DC-

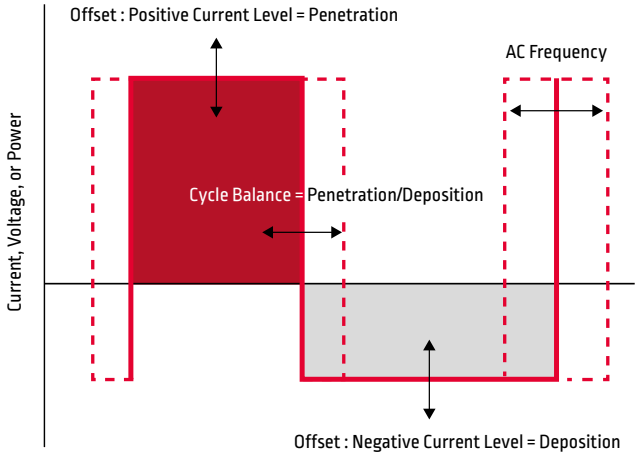
- Improves deposition rate (25%)
- Limits penetration
- Limited arc stability

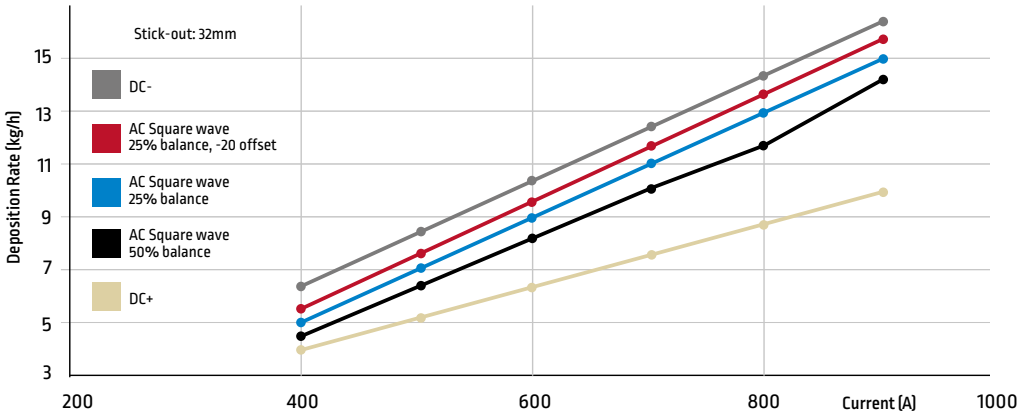
AC

- A compromise between the two DC modes
- The optimum choice with Power Wave® AC/DC 1000® SD

Waveform Control Technology® capability provides precise control over:

- Frequency (Number of switch per second from positive to negative polarity)
- Balance (Percentage of time in the positive polarity portion of one cycle)
- Offset (Positive/Negative Amplitude)





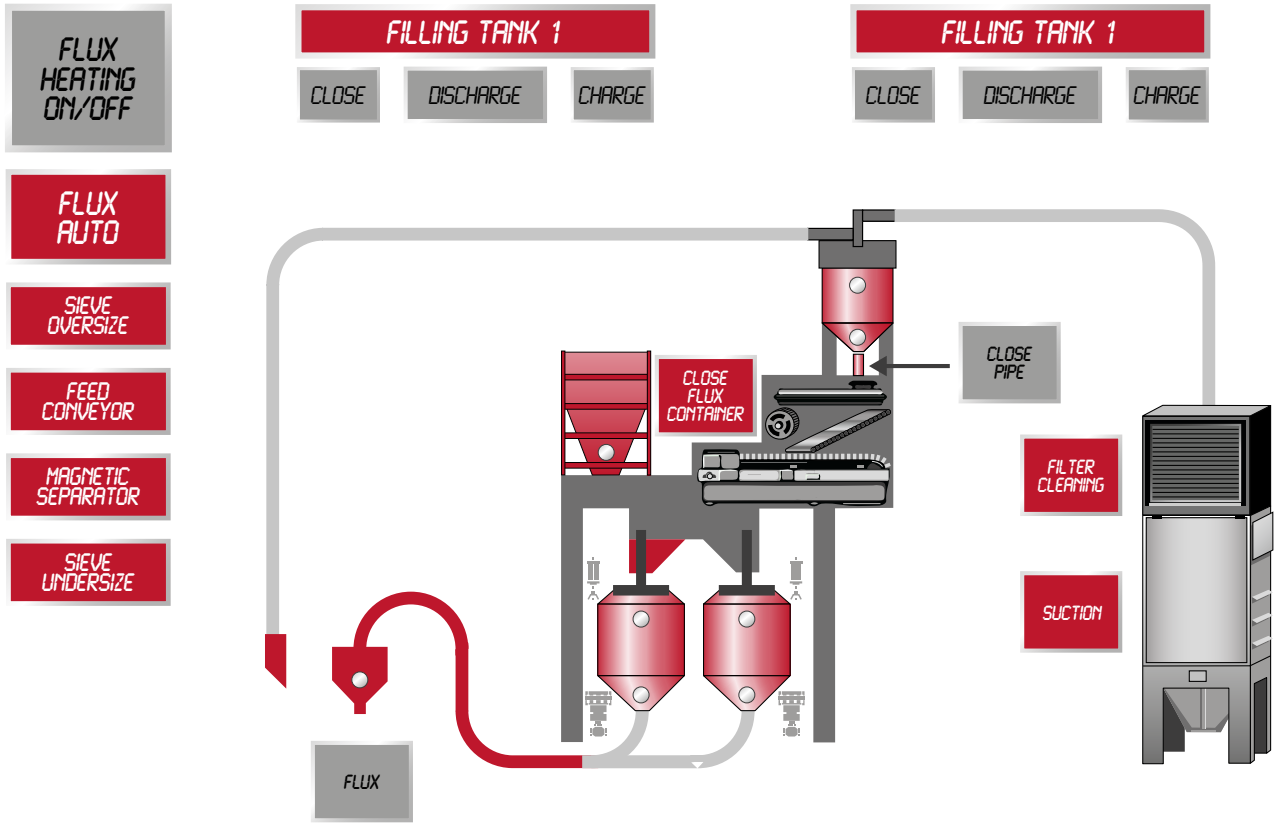
FLUX HANDLING SYSTEM

Independently of the number of electrodes, the flux employed in Uhrhan & Schwill submerged welding systems has to be supplied, sucked off and afterwards prepared. This cycle of feed, suction and preparation is established by flux supply systems. We offer flux supply systems in the most diverse designs. The product range equally includes the simple flux suction device and the fully automatic suction and preparation system.

Undersize, oversize and slag sieving, descaling or heated flux storage containers - the flux supply systems integrated into our welding systems allow a smooth production process that can only be ensured through continuous flux supply of the welding system. For maximum user friendliness, the flux supply system control is integrated into the welding system control.

Our engineered solutions are available in heated executions to full fill the stringent flux moisture requirements.

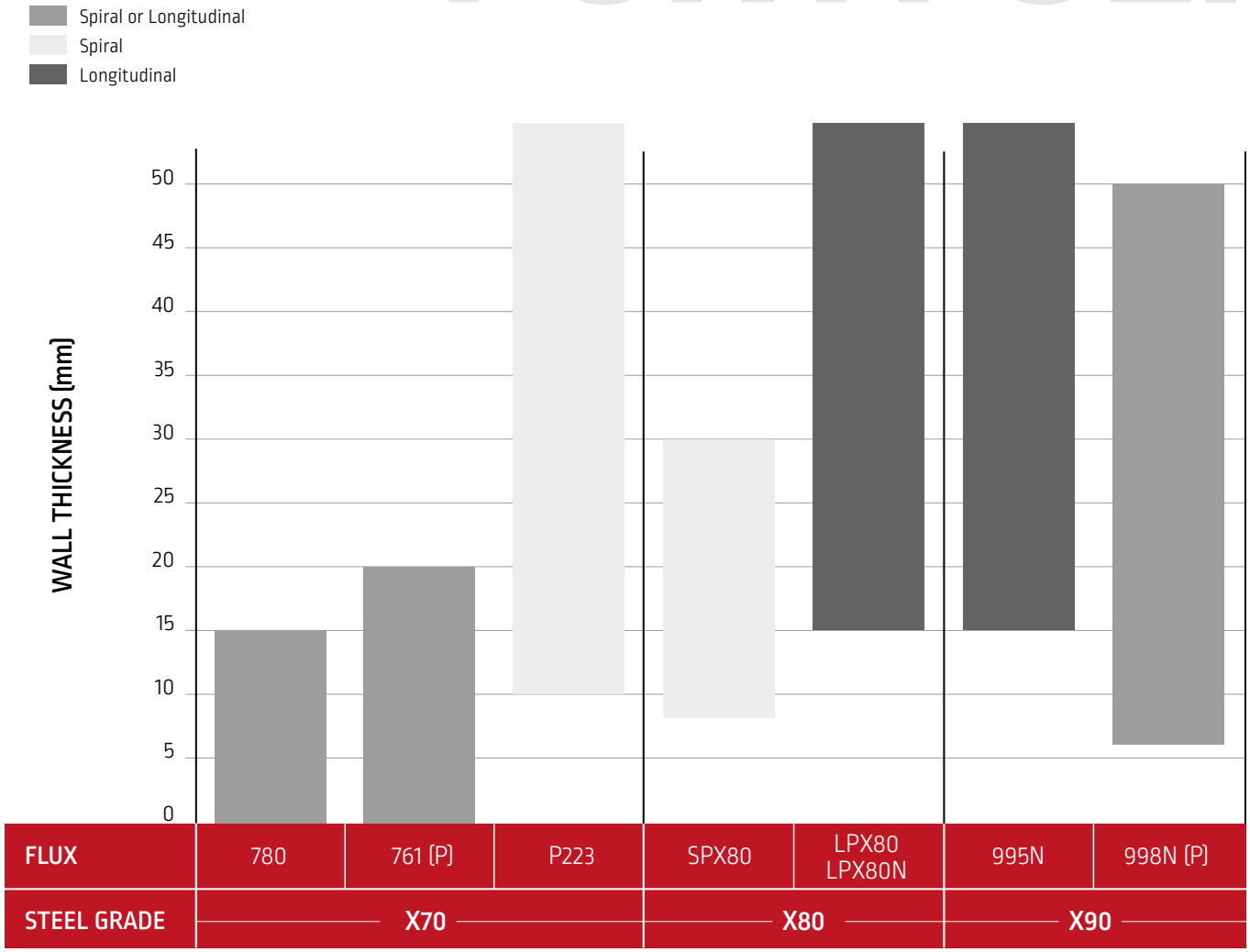
Flux handling system

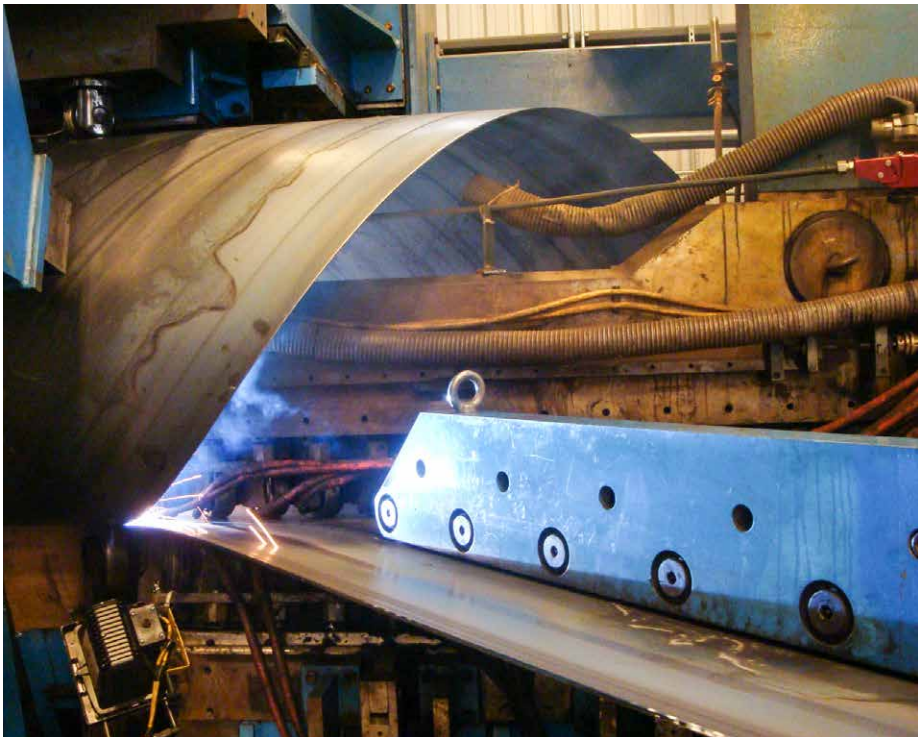


CONSUMABLES PORTFOLIO

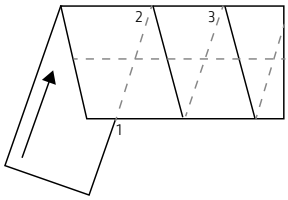
Lincoln Electric treats consumables as engineered products that must meet all project specifications as well as industry and regulatory standards. Lincoln Electric operates the industry's most advanced research center and is constantly developing better-performing wire and flux for the pipe mill industry. In order to increase customer efficiency, Lincoln Electric sells consumables in different packaging sizes.

CONSUMABLES PORTFOLIO





GUARANTEED WELDING SPEEDS



SPIRAL PIPE WELDING (SAW-H)

Welding is a fundamental process in the pipe mill industry. Modern spiral mills produce pipes with diameters from 300 to 3556 mm and wall thicknesses ranging from 6.4 to 30mm. Within the online process the final internal and external SAW process are carried out while the steel strip is formed into a pipe. The Hyprid online process includes an upstream GMAW tack welding process.

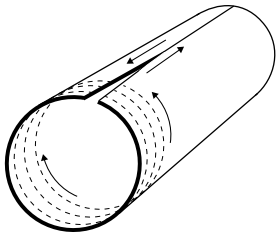
In the offline process, the pipe is tack welding during forming in the spiral machine and afterwards shortened to the appropriate length. The subsequent submerged arc inside and outside welding is carried out on combined inside/outside re-welding stands in two-run technique.

Whether welding online or offline SAW-H, we provide industry-leading solutions for every aspect of pipe-welding process, including consumables specifically engineered for spiral welding applications.

ONLINE	OFFLINE	HYBRID
• Coil Splice	• Coil Splice	• Coil Splice
• ID/OD: ~2.3m/min	• Tack weld: Up to 15m/min	• Tack weld: ~2.5m/min
• OD Cross weld	• AutoTab Weld	• ID/OD: ~2.4m/min
	• ID/OD: ~2.4m/min	• OD Cross weld
	• AutoTab Cut	• Production mix
	• OD Cross weld	

LONGITUDINAL PIPE WELDING (SAW-L)

GUARANTEED WELDING SPEEDS



To a large extent welding processes influence the productivity and quality within a longitudinal pipe making process. In a longitudinal pipe mill, pipes with diameters from 406 to 1625mm and with wall thickness ranging from 6,4 to 45 mm are produced. Pipe lengths vary between 12 and 18 meter. For special applications, the pipe diameters even go below 254 mm.

Rolled plates are used as base material within a longitudinal pipe production. Different forming process like UOE, C-ing and 3-roll-bending are available on the market. While the continuous GMAW tack welding process is carried out in the tacking machine, the subsequent inside and outside submerged arc welding processes will be carried out on separate welding stands. Thus, a tack-welding machine can provide pipes for up to four submerged arc welding lines.

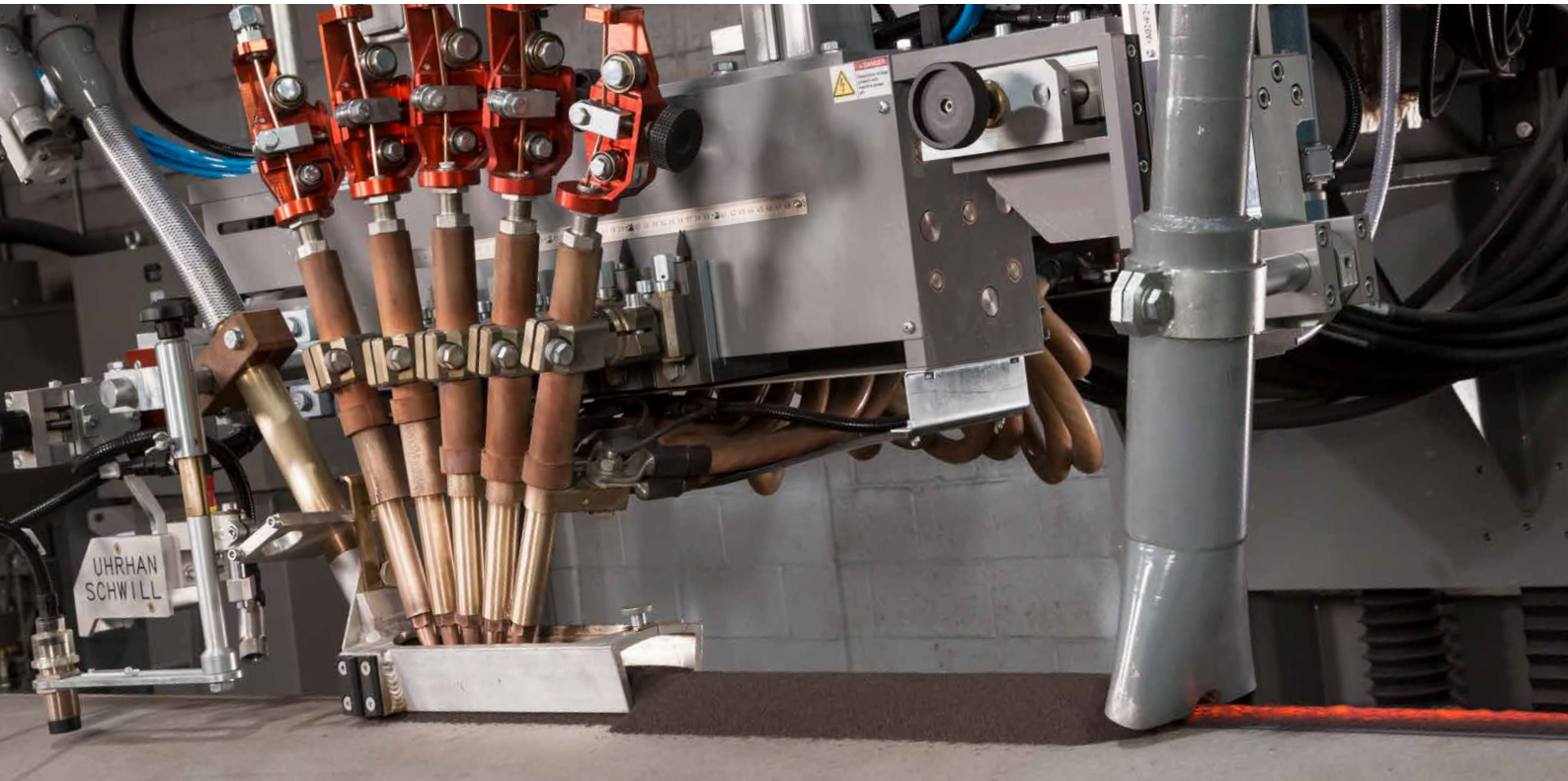
Several decades of experience allow us to provide reliable, highly productive and cost-saving solutions for all welding applications within the mill. Our unmatched ability as special welding machine supplier allows us to to engineer custom-made solutions for special applications and to implement various innovative welding applications into our equipment design.

Based on our knowledge in pipe making industry we can offer beside a full spectrum of equipment also a wide variety of consumables developed for this industry and the corresponding welding support with regard to procedure development.

OUTPUT	
Tack welding	Up to 4-8m/min
Tab welding	AutoTab
Inside welding	Up to 5 arcs
Outside welding	Up to 6 arcs
Tab removal	AutoTab

- Each forming process has advantages and disadvantages – but we weld them all
- Relationships with all major mainline suppliers

	U-O-E	J-C-O	3-ROLL
Output	+	–	0
Flexibility	–	0	+
Bevel Quality	0	+	–
Roundness	0	–	+
Heavy WT + SmallDiameter	+	+	0
Investment	–	0	+



RECOMMENDED FLUXES FOR SPIRAL AND LONGITUDINAL APPLICATIONS - SPX80™ & LPX80/LPX80N

Straight to Coat

The industry leading SPX80™ flux is designed for fast welding speeds, excellent wetting, excellent bead shape and a "straight to coat" finish. With most welding fluxes, pipes sit for hours or even days to properly out-gas prior to coating. But with SPX80™, your pipe is ready to "straight to coat", eliminating WIP and more efficiently moving pipe to ship.

Limitation in Nitrogen

LPX80/LPX80N are nitrogen limitation fluxes designed for seam welding of pipe. Used with copper coated and non copper coated Emergence wire, diffusiblehydrogen in the weld deposit is less than 5ml/100g.

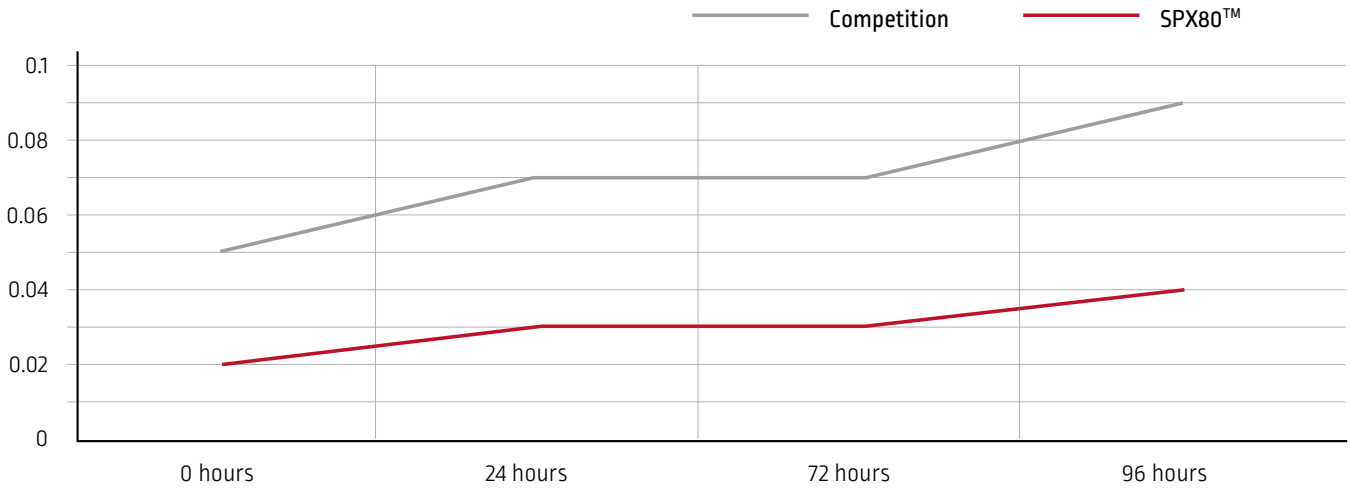
Maximize Productivity and Quality, Minimize Obstacles

While productivity is critical, quality and appearance are also high priorities with pipe welding. SPX80™ and LPX80/LPX80N fluxes ensure a combination of consistent mechanical properties and a smooth bead appearance.

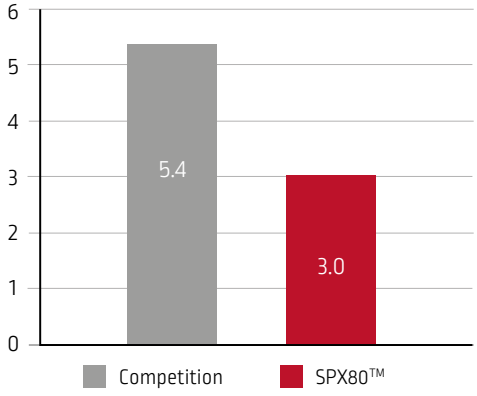
Hassle-Free Detectability

Producing pipe with SPX80™ and LPX80/LPX80N not only produces consistent and quality welds, it does so hassle-free. With excellent slag detectability, pipes move easier through your mill and eliminate the need for any post-weld operations prior to inspection, testing and coating.

SPX80™ : Moisture Pickup Over Time



SPX80™ : Diffusible Hydrogen



Competition SPX80™

FLUX BREAKDOWN

FLUX TO WIRE RATIO IDENTIFIED AS KEY COST DRIVER FOR SAW

- Numerous variables influence this value
- Target project to eliminate variables
- Evaluate independent of flux delivery&recovery systems

CONSUMPION LINKED TO TWO MAJOR FACTORS

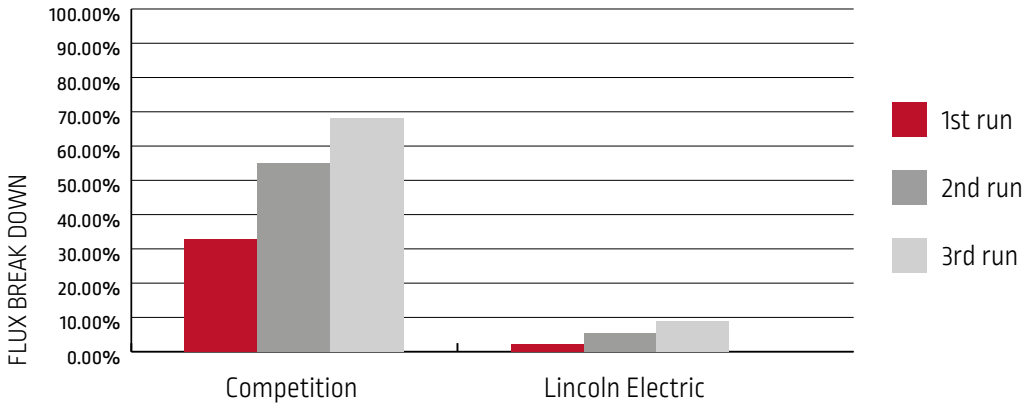
- Melting rate found to be nearly consistent
- **Particle breakdown** found to be critical component

SAMPLING METHOD CRITICAL FOR REPEATABILITY

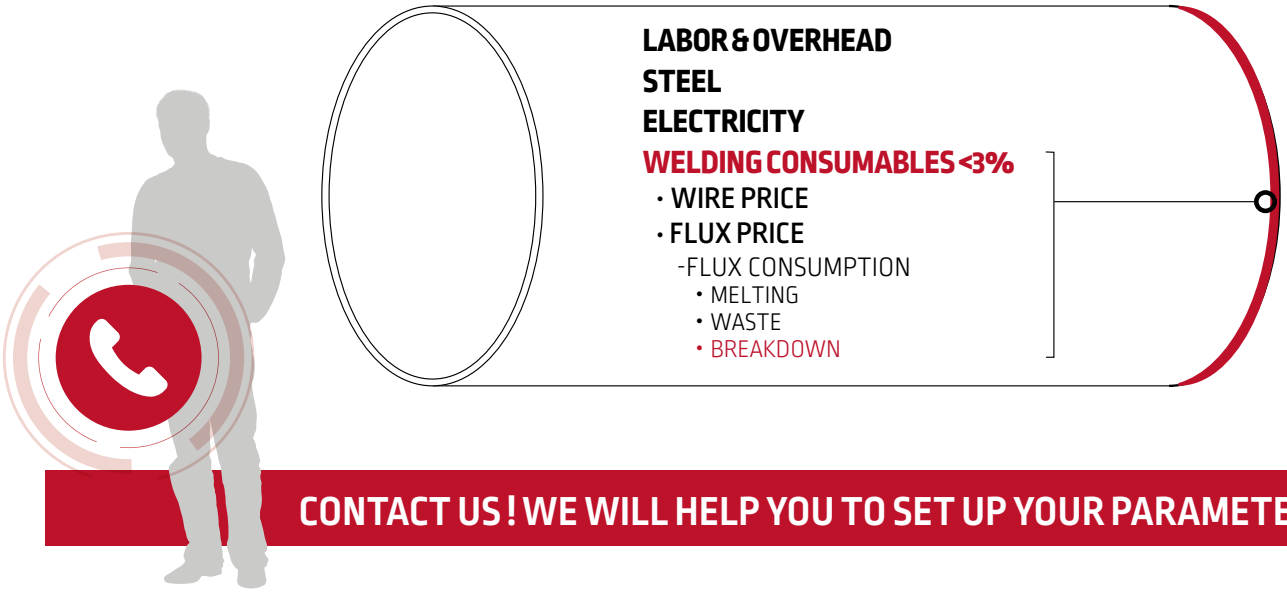
Trials include only agglomerated fluxes as fused fluxes are not prevalent in Pipe Mills

Lincolnweld® fluxes have best-in-class particle strength
Trends expected to be exacerbated in mill environments (ID and OD)

Pipe Mills can expect significant cost-savings when using Lincolnweld® fluxes

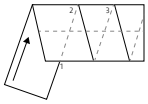


COSTS TO PRODUCE PIPE



CONTACT US ! WE WILL HELP YOU TO SET UP YOUR PARAMETERS

SPX80™

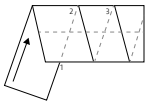


- Designed to meet the specific requirements of spiral pipe seam welding of up to API X80 grade pipe
- High speed welding capability for increased productivity
- Smooth bead profile achieves optimal appearance on both inner and outer diameter welds
- Self-peeling slag allows for clean and easy slag removal for reliable non-destructive testing results

MECHANICAL PROPERTIES

Flux/Wire Combination	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Elongation (%)	Impact ISO	
				V(J)	@°C
L-61	510	620	30	57	-18
L-70	570	660	26	76	-40
LNS140TB	550	640	28	40	-40

761

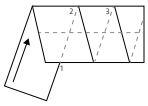


- Active flux for limited pass welding
- High current capacity
- High restraint cracking resistant
- Suitable for rusty/dirty plates (at high current)
- Applicable for low quality steels
- Coarse grain flux more suitable with the most rusty and dirty plates

MECHANICAL PROPERTIES

Flux/Wire Combination	Condition	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Elongation (%)	Impact ISO		AWS Classification (A5.23/A5.17)
					V(J)	@°C	
L-60	Multirun	380	500	28	50	-20	F7A2-EL12
L-61	Multirun	440	530	28	100	-20	F7A2-EM12K
LNS 140A/L-70	Multirun	480	600		80	-40	F9A0-EA2-G

780



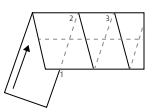
- Active flux for limited pass welding
- Good general purpose flux, including semi-automatic
- High speed on dirty plate
- Good resistance to porosity on rust and primer
- Good slag removal, good bead shape
- Product also available in a fine grain and coarse formula
- Good on circumferential welds on small diameters with low voltage

MECHANICAL PROPERTIES

Flux/Wire Combination	Condition	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Elongation (%)	Impact ISO		AWS Classification (A5.23/A5.17)
					V(J)	@°C	
L-60	Multirun	>420	510	28	50	0	F7A0-EL12
L-61	Two-run	>420	>540	28	50	-20	F7A2-EM12K
LNS 140A/L-70	Two-run	>420	>550	25	60	-20	F8A2-EA2-G

All these fluxes are available in 25kg standard plastic and SRB bags as well as 500kg/1000 bulk bags

P223

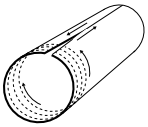


- Aluminate basic agglomerated flux
- Good impact values in two-run and multi-run technique
- Low hydrogen content
- Very suitable for longitudinal and spiral pipe welding
- Usable up to 3 wire systems
- Fine grain version available for the thinest wall and fastest welding speed

MECHANICAL PROPERTIES

Flux/Wire Combination	Condition	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Impact ISO		AWS Classification (A5.23/A5.17)
				V(J)	@°C	
L-61	Two-run	450	550	60	-20	F7A4-EM12K
L-50M (LNS 133U)	Two-run	470	570	80	-20	F7A5-EH12K
LNS 140A (L-70)	Two-run	500	600	50	-40	F8A4-EA2-A2
LNS 133TB	Two-run	510	610	60	-40	F8TA4-G-EG

LPX80N / LPX80

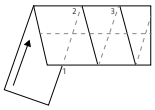


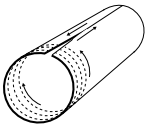
- A nitrogen limiting flux designed for seam welding of pipe
- Recommended for longitudinal seam welding on a range of pipe steels
- Less than 5ml/100g of diffusible hydrogen in the weld deposit with both copper coated and non-copper coated (Emergence) welding wire

MECHANICAL PROPERTIES

Flux/Wire Combination	Condition	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Elongation (%)	Impact ISO		AWS Classification (A5.23/A5.17)
					V(J)	@°C	
L-61	As welded	540(78)	630(92)	28	35(26)	-29	F6TA2-EM12K-H8
L-70	As welded	510(74)	620(90)	26	61(45)	-29	F8TA2-EA1-H8
LA-81	As welded	560(82)	650(94)	25	50(37)	-51	F8TA6-EA2TiB-H8
LNS 140A	As welded	510(74)	620(90)	25	40(29)	-29	F8TA2-EA2-H8

998N



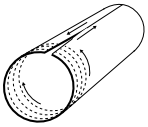


- Flux designed for longitudinal multi-arc welding pipe mill station also suitable for spiral welds
- High end pipe mill applications up to X80
- Superior resistance to undercuts on thin metal sheet work at high speed
- Designed to operate on all the range of pipe thickness (6 to 50 mm)
- Nitrogen controlled weld metal providing good impact toughness on arctic grade pipes
- Superior resistance to surface defects
- Very low diffusible hydrogen level in the weld deposit
- 998N-P is a coarser size distribution of 998N for flux consumption reduction

MECHANICAL PROPERTIES

Flux/Wire Combination	Condition	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Elongation (%)	Impact ISO		AWS Classification (A5.23)
					V(J)	@°C	
LNS140A	As welded	570	680	27	75	-40	
LNS140TB	As welded	610	700	27	50	-50	F9TA6-G-EA2TiB
LNS 133TB	Two-run	610	730	26	120	-50	F9TA6-G-EG

995N



- A nitrogen limiting flux designed for seam welding of pipe
- Recommended for automatic single pass welding with up to five arcs
- Produces welds with minimal buildup and good penetration
- Capable of producing Charpy V-Notch test results required for arctic grade service

MECHANICAL PROPERTIES

Flux/Wire Combination	Yield Strength (N/mm²)	Tensile Strength (N/mm²)	Elongation (%)	Impact ISO		AWS Classification (A5.23)
				V(J)	@°C	
LNS140A	580	680	30	65	-40	
LNS140TB	630	700	27	75	-50	F9TA6-G-EA2TiB

RECOMMENDED WIRES FOR PIPE MILL APPLICATIONS

L-50M (LNS 133-U)

AW S A 5.17 : EH12K

- A low carbon, high manganese, low silicon general purpose submerged arc wire
- Suitable for both single and multiarc subarc applications
- Provides extra mechanical properties compared to an EM12K wire grade

L-61

AW S A 5.17 : EM12K

- Industry standard for submerged arc welding applications
- A low carbon, medium manganese, low silicon general purpose submerged arc wire
- A good choice for a wide range of applications with single or multiple pass subarc welding

Exists in non-copper coated version : EMERGENCE™ 61

LNS 133TB

AW S A 5.13 : EG

- Titanium and boron micro alloy wire to achieve optimum impact properties with the 2-run technique, especially with pipe mill fluxes
- Exclusively for as-welded applications

Exists in non-copper coated version : EMERGENCE™ 83

LNS 140A (L-70)

AW S A 5.23 : EA2

- A 0,5%Mo wire to be used on steel grades such as 16Mo3 or on non alloy steels to improve impact properties when welding in 2-run technique

Exists in non-copper coated version : EMERGENCE™ 70 and 74

LNS 140TB

AW S A 5.13 : EA2TIB

- Titanium and boron micro alloy wire to achieve optimum impact properties with the 2-run technique, especially with pipe mill fluxes
- Exclusively for as-welded applications

Exists in non-copper coated version : EMERGENCE™ 81

LA 90

AW S A 5.23 : EA3K

- A low carbon, high manganese, high silicon, 1/2% molybdenum special purpose wire
- Recommended for seam welding of pipe and for the general welding of high strength plate

Exists in non-copper coated version : EMERGENCE™ 90

LINCOLNWELD® EMERGENCE™

NON-COPPER COATED SUBMERGED ARC WIRE FOR PIPE SEAM APPLICATIONS

Copper is not normally a problem in welding, however in the right situation it can cause Liquid Metal Embrittlement (LME), leading to costly downtime and repairs.

Traditional Bare Wires are Not the answer

Traditional bare wires suffer from severe tip wear, high diffusible hydrogen, pockmarking and decreased corrosion resistance.

Beyond the Surface

Lincolnweld Emergence submerged arc wires feature a patented surface coating to address these issues.

Proprietary Surface Treatment

- Elimination of copper in the coating decreases the risk of copper contamination in the weld
- Proprietary surface treatment offers comparable corrosion resistance to copper coated wires, without adding hydrocarbons that could increase diffusable hydrogen levels
- More than double the contact tip life when compared to competitive non-copper coated wire alternatives

Wire Conversions

Product Name	AWS Classification	ISO Classification	Equivalent Copper Coated Product (s)
Lincolnweld Emergence 60	EL12	S1	Lincolnweld L-60 LNS 143
Lincolnweld Emergence 61	EM12K	S2Si	Lincolnweld L-61
Lincolnweld Emergence 70	EA1	S2Mo	Lincolnweld L-70
Lincolnweld Emergence 73	EG (EH12K)*	S3Si	Lincolnweld L-S3 LNS 133-U
Lincolnweld Emergence 74	EA2	S2Mo	LNS 140-A
Lincolnweld Emergence 81	EA2TiB	SZ	Lincolnweld LA-81 LNS 140-TB
Lincolnweld Emergence 83	EG	SZ	LNS 133-TB
Lincolnweld Emergence 90	EA3K	SZ	Lincolnweld LA-90

* Lincolnweld Emergence 73 uses the same green rod as Lincolnweld L-S3 and LNS 133-U, and has an AWS Classification of EG. Please call for additional information.

Recommended Flux

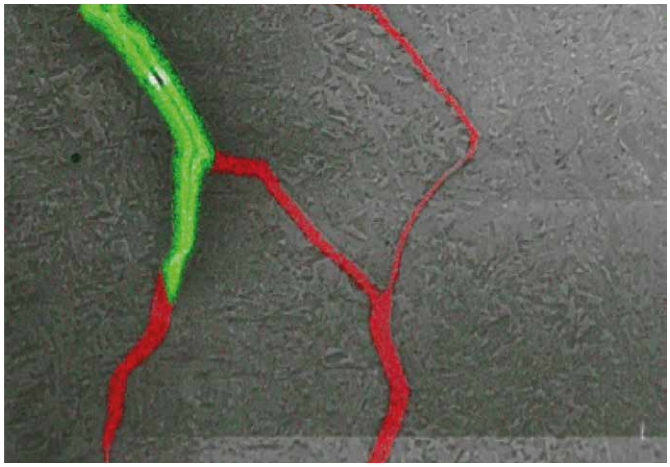
Product Name
· Lincolnweld 998N™
· Lincolnweld 995N™
· Lincolnweld 761-Pipe™
· Lincolnweld 761®
· Lincolnweld P223®
· Lincolnweld SPX80®

Package Options

Package Type
· Drum
· Stem
· Spider Stem
· Reel

Liquid Metal Embrittlement

Caused by molten copper wetting the steel grain boundaries at elevated temperatures.



Energy Dispersive X-Ray Spectroscopy (EDS) map showing copper (red) present along grain boundaries. Also shown is slag (green) which followed copper during the wetting process.

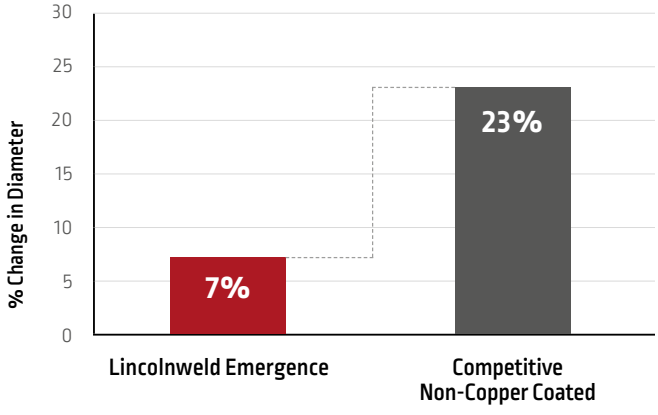
Diffusible Hydrogen

	Copper Coated	Competitive Non-Copper Coated	Emergence
Typical Diffusible Hydrogen - mL/100g	3.5	5.0	3.6

Represents average diffusible hydrogen values from testing with multiple Lincoln Electric Fluxes

Contact Tip Life[1]

Less Than Half the Tip Wear of Competitive Non-Copper Coated Wire



(1) Contact tips from welding with 900A DC+.

PACKING & STORAGE

STANDARD INDUSTRY PRACTICES

SAW Pipe Mill Consumables Usage – Standard Industry Practices for Consumables Manufactured by Lincoln Electric.

Both SAW-H and SAW-L pipe mills must take care in the handling, storage and usage of both flux and wire for quality pipe production. While there are numerous options for guaranteeing optimal welding performance, this document is intended to outline standard industry practices and Lincoln Electric's position:

Fluxes

1. Lincoln Electric selects raw materials and manufacturing practices to ensure low moisture in the finished flux. The flux is tested at point of manufacture and this value is reported on the 3.1 lot certification for each lot of flux. Moisture testing is done at 980°C (1800°F) in an oxygen carrier gas to determine total water in the flux, with a maximum specification limit of 0.05% by weight. Further, the pipe mill fluxes are formulated to limit the diffusible hydrogen transferred to the weld metal.

2. Hermetically sealed packages, such as metal drums, plastic pails or the Sahara Ready Bag (SRB), when undamaged, will ensure the moisture levels of the flux do not change from the time of manufacture. Lincoln Electric fluxes can be used directly from these packages with the assurance that the flux will deliver the diffusible hydrogen level to which it is certified.

3. When Lincolnweld® flux is purchased in a hermetically sealed package, storing it in a climate-controlled environment is not required. However, to eliminate contamination concerns during filling of an Uhrhan & Schwill flux container, it is standard industry practice to store both flux and wire in a climate controlled storage facility. Further details can be found in the enclosed document, Storage & Handling C5.660.pdf. The driving force for moisture pickup is relative humidity, rather than absolute humidity. Either heating the air or dehumidifying the air will provide a low relative humidity. Once a package has been opened it is most important to protect the flux from condensation since direct contact of the flux with moisture can lead to rapid moisture pickup. In some cases, it is easier to do so with hot flux rather than cold flux from an air-conditioned room. A psychrometric chart can be referenced to ensure that the dew point of the air is always above the temperature of the flux.

4. Upon opening the flux, it should be directly transferred to a heated, covered flux storage container. These containers are generally kept at 100-120°C to eliminate concerns of condensation. They also protect the flux from contamination.

5. The flux must be protected from high humidity and contamination during use. Any conveyance air must be of low moisture. Any compressed air should be filtered to remove water, and special emphasis should be placed on the maintenance of the filters. Further, the air must not contain oils or other sources of moisture and/or hydrogen. The flux should also be protected from and cleaned of contamination during recovery and reuse. A well-designed and maintained magnetic separator will remove magnetic mill scale, grinding debris, electrode stubs, etc. from the flux. For optimal performance, it is also important to maintain the particle size integrity of the flux. Coarse "top" screens are important to remove large contaminants such as pieces of slag and fine "bottom" screens are important to remove fines from the system. Neither will fully clean the flux of all contaminants, so it is important to keep nonmagnetic contamination such as copper and general dirt from entering the flux at any point of its use or conveyance to and from the pipe. In addition to appropriate screens, new flux should be added to the flux hopper at regular intervals to maintain a consistent particle size distribution.

6. Maintaining the flux integrity from package to use and reuse can be accomplished by using a Uhrhan & Schwill flux system. This system extends the ability to use Lincoln Electric's fluxes without conditioning by further guaranteeing that flux within the system and used in continuous production will retain similar characteristics for both moisture content and grain size distribution thus having no adverse effects on welding performance.

Wires

1. To eliminate contamination concerns it is standard industry practice to store both flux and wire in a climate controlled storage facility.

2. Lincolnweld® submerged arc wires are designed and manufactured to provide optimum performance in the as manufactured condition. No attempt should be made to clean the electrode surface or add any type of surface material to the electrode.

3. The wire delivery systems should be designed and maintained to provide smooth feeding of the wire. Moving parts such as directional rolls should be used to ensure that the wire is not damaged by dragging or scraping across any surface. The drive rolls and wire straightener should not be excessively tight, again to avoid damaging the wire. It is helpful to monitor the current draw of the wire feed motors to detect when there is excessive drag placed on the electrode.

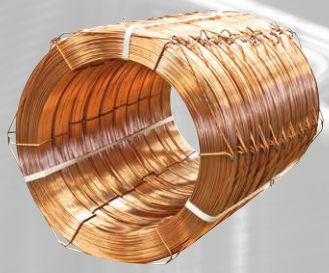
4. Wires should be stored as shown on the attached document. Again, great care must be taken if removing wire from a cold storage area into a warmer area to avoid condensation.

5. Lincolnweld® SAW wire with any visible signs of rust or discoloration should be set aside and held in climate controlled storage until investigation has been made between the mill and Lincoln Electric.

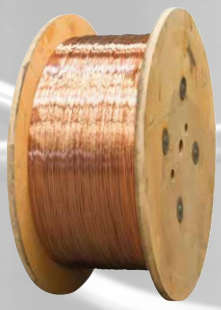
Lincoln Electric has a long history of selling pipe mill consumables to mills around the world with a very successful track record. Combining these products with integrated welding solutions from U&S, including flux storage, handling, delivery and recovery, provides mills with the confidence and support required for successful daily production.

PACKAGING

25 kg Spool
VCI packaging for optimum corrosion protection during transportation and storage



100 kg Coil
High capacity packaging for column/boom applications, optimum for multi-wire applications (tandem/triple arc)



300 kg Spool
wooden reel

1000 kg Coil
liftable

SPEED-FEED® Drum
350 kg/600 kg

ACCUTRAK® / SPEED-FEED® Drums
600 kg/1000 kg

25 KG BAG
- Standard plastic
- Moisture resistant Sahara ReadyBag™

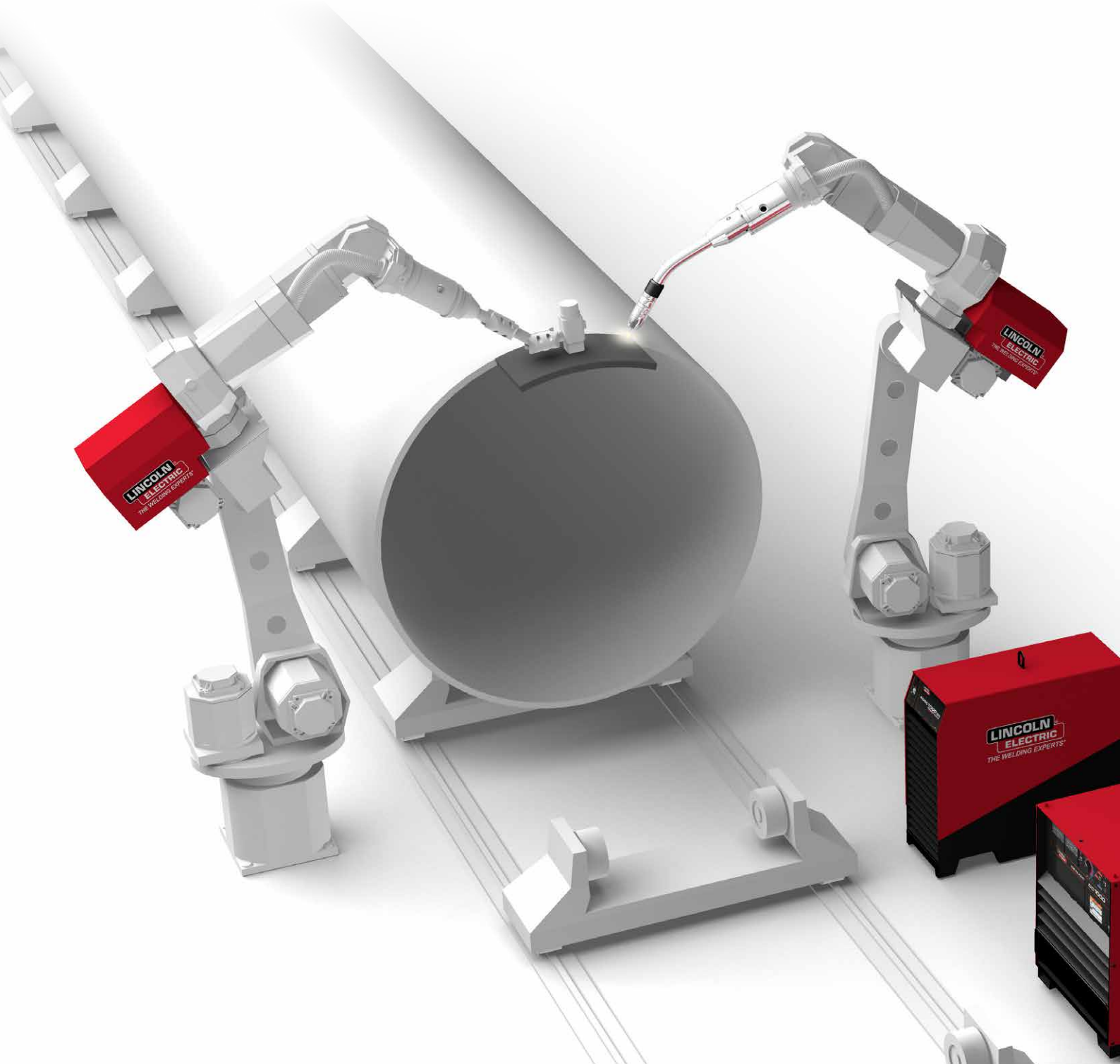
BULK BAG 1000 kg
- Standard bulk bag
- Moisture resistant aluminium lined bulk bag

SPECIAL BULK BAG 1000KG
-Bulk bag with special bucked lid closure
- Moisture resistant aluminum bulk bag

AUTOTAB WELDING & CUTTING PROCESS

The AutoTab system is intended for automated welding and cutting of run on/off tabs for pipe fabrication inline with a mill's exisiting production flow. System solutions exist for both the attachment of tabs to formed pipe or flat plate intended to be formed after the tab attachment process as well as the tab removal process.

AutoTab – Welding on Formed Pipe (Spiral or Longitudinal)



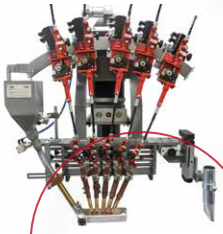
GAME CHANGING SOLUTIONS FROM ONE SOURCE

WELDING CONSUMABLES

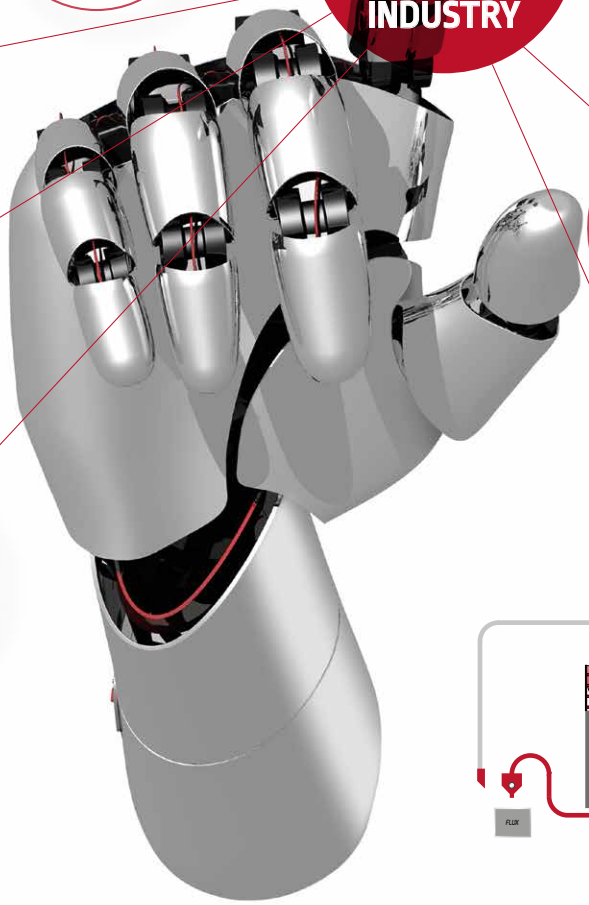
AUTOMATIC CONTROLLER AND DATA LOGGING UNIT

WELDING SOLUTIONS FOR THE PIPE-MAKING INDUSTRY

PERIPHERIC EQUIPMENT

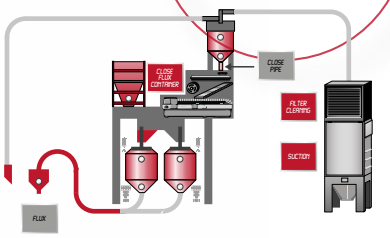


MACHINERY

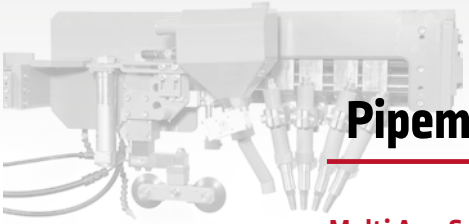


POWER SOURCES

FLUX HANDLING SOLUTIONS



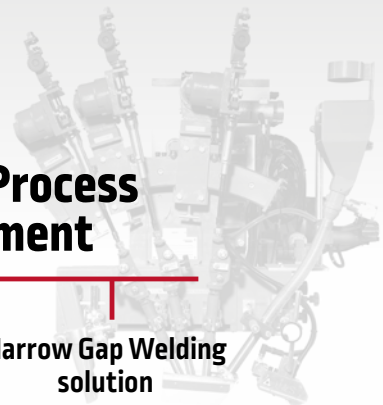
Uhrhan-Schwill
SCHWEISSTECHNIK
A Lincoln Electric Company



Pipemills

Multi Arc, Sub Arc Technology

Global Leader in Longitudinal Pipe Welding and Leading Position in Spiral Pipe Welding



Critical Process Equipment

Strip Cladding solution

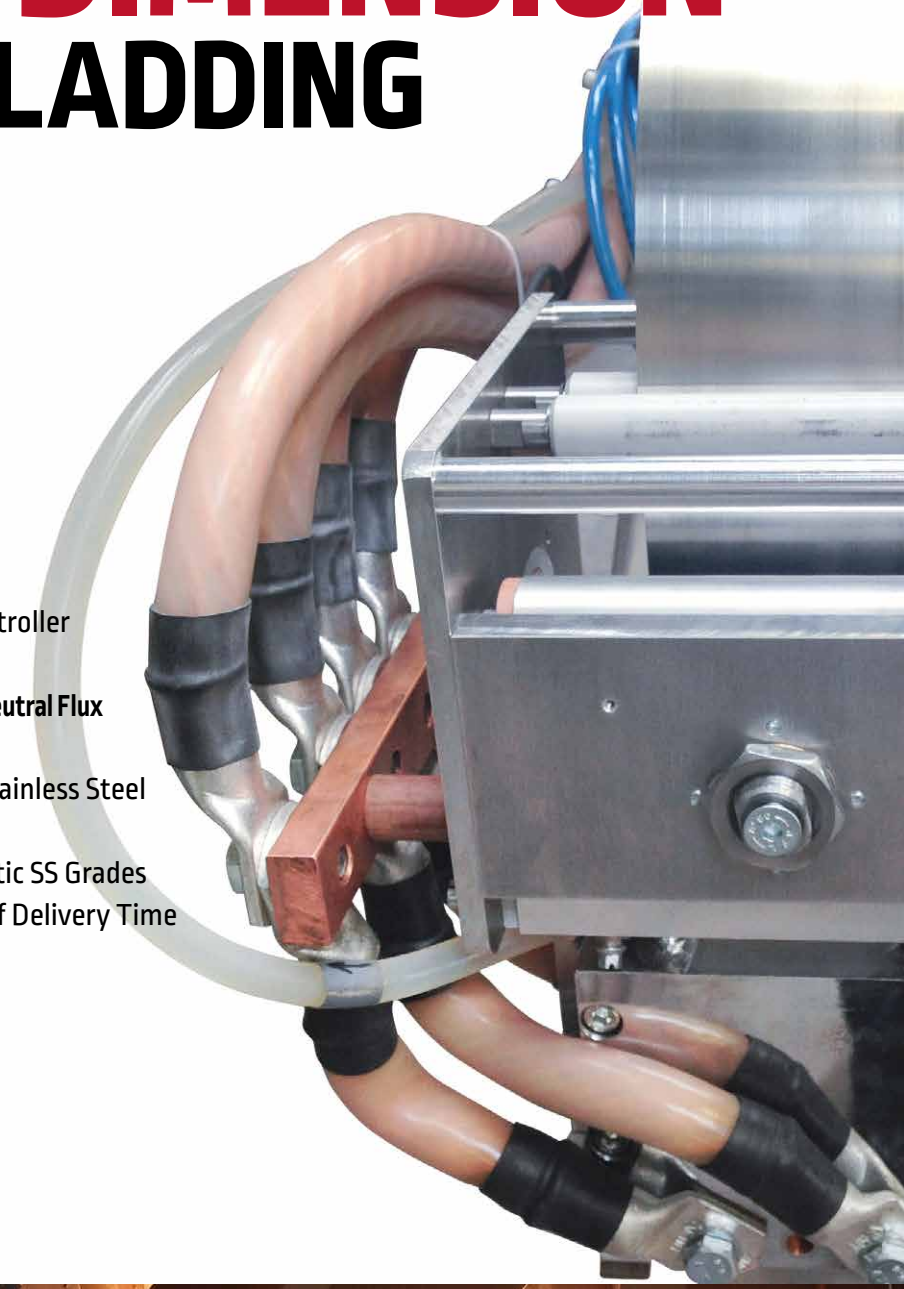
Narrow Gap Welding solution

LINCOLN® ELECTRIC

www.lincolnelectric.eu www.uhrhan-schwill.de

YOUR NEXT POWER WAVE® DIGITAL APPLICATION

THE NEW DIMENSION IN STRIP CLADDING



70% Time and 40% Cost Saving
- Always Single Layer Solution
- High Speed Cladding Process

Homogeneous and Cleaner Chemistry
- < 5% Fe in Ni-625
- Improved Quality

Full Process Control
- State-of-the-Art Digital Hybrid 3D Z5 Controller
- Real Time Data Logging and Traceability

First Proven Single Layer High Speed Solution with Neutral Flux
- < 5% Fe in Ni-625
- Required Undiluted AWS Chemistry for Stainless Steel

Reduction in Working Capital
- Single Stainless Steel Strip for All Austenitic SS Grades
- Faster Delivery of MCW and Full Control of Delivery Time

Instant Technical Service to Customer

DOWNLOAD BROCHURE

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 inquiries 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.

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