TOTAL WELDING
SOLUTIONS FOR THE LNG INDUSTRY

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LINCOLN ELECTRIC

LNG
WELDING SOLUTIONS

As the world's energy demands increase, natural gas is becoming an ever more viable option. This demand has stimulated a growth in the construction of Liquid Natural Gas infrastructure.

Lincoln Electric offers a Total Welding Solution for all parts of the LNG value chain - Storage Tanks, Cryogenic Piping, Carriers and Heat Exchanger.

Welding is a small but key element in the execution of LNG projects. Quality consumables along with mechanized welding solutions, minimize the risks of day to day operations during on-site conditions.

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LNG
LIQUEFIED NATURAL GAS

Natural gas mainly in the form of Methane, after being extracted from gas fields , will be processed in a gas processing plant where its impurities such as CO_2, Water & Sulfur will be removed. Now it is time to transport the gas to the end users for distribution.

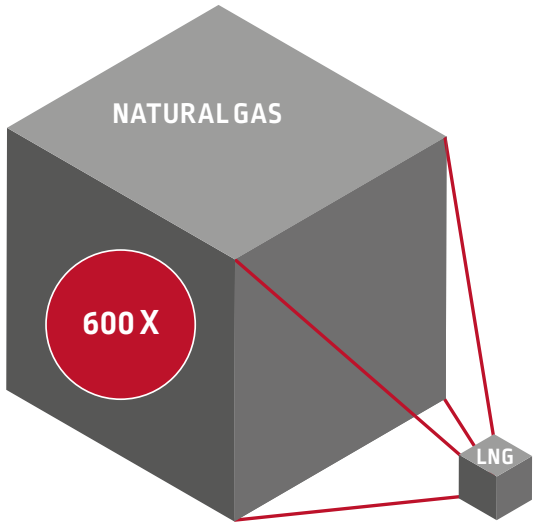
Eventually, either a gas pipeline will be used or Natural gas gets liquefied at cryogenic temperature of -265° F (-160° C).

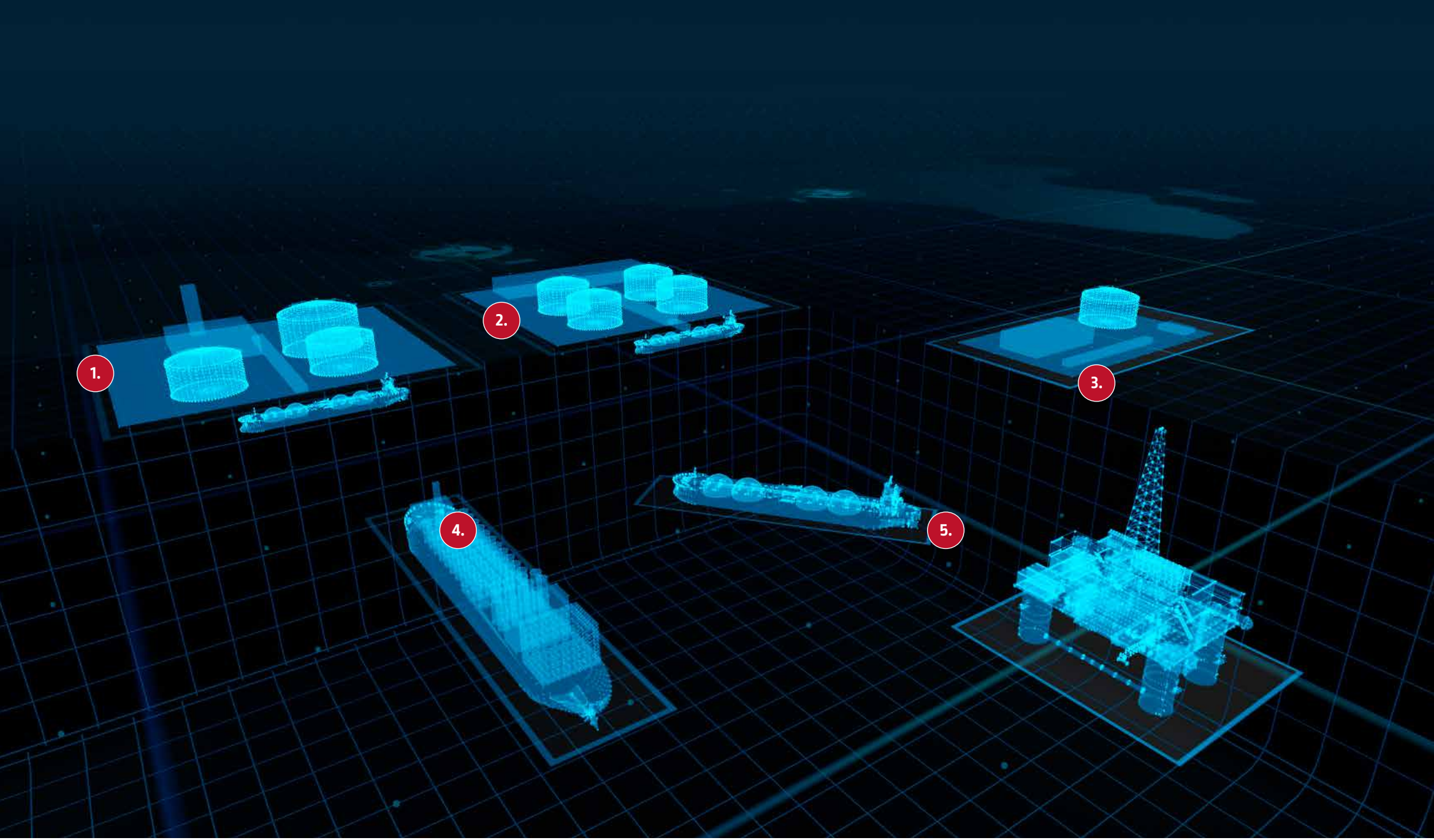
When natural gas is turned into LNG, its volume shrinks by a factor of 600. This reduction in volume enables the gas to be transported economically over long distances.

Lincoln Electric offers Total Welding Solution for all parts of the LNG value chain. Storage Tanks, Cryogenic Piping, Carriers and Heat Exchanger.

FIVE DIFFERENT TYPES OF LNG FACILITIES

1. LNG Export Terminal (Liquefaction)
2. LNG Import Terminal (Regasification)
3. LNG Peak-shaving
4. Floating LNG (FLNG)
5. LNG Carriers




1.
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1.

LNG EXPORT TERMINAL (LIQUEFACTION)

Refrigeration process is the core of an LNG plant in which natural gas is cooled and liquefied to –160° C or less using the principle of refrigeration. Because gas is cooled and liquefied to an extremely-low temperature during the process, an enormous amount of energy is consumed. How much this energy can be reduced is important, so various ingenious processes are used. Such as C3-MR, AP-X, Cascade, DMR & SMR. The refrigeration process happens in multiple steps and requires various Heat Exchanger types and Compressor systems.

2.

LNG IMPORT TERMINAL (REGASIFICATION)

LNG will be shipped to destination port. In order to be used as Natural gas again it has to get vaporized (Re-gasified). There are various Heat Exchangers (vaporizers) used to vaporize the LNG. Depending on the vaporizer type, Seawater, Ambient Air, Propane or Burnt LNG is used to vaporize the LNG. We have specialized welding solutions for fabrication of Re-gasification plant components.

3.

LNG PEAK-SHAVING

LNG as fuel has seasonality, in some export terminals there is a peak shaving facility to store the LNG for most of the year and export it at the most demanding season of the year.

4.

FLOATING LNG (FLNG)

Floating LNG is a floating Offshore unit which has the capability of Liquefaction or Regasification of Natural gas right at the Offshore topside. LNG FPSO refers to LNG Floating Production Storage and Offloading Unit which does the gas processing and Liquefaction.

Floating LNG can also be Regasification units. Instead of investing in fix regasification terminals, a floating unit can travel to the end destination to re-gasify the LNG. It is called FSRU referring to Floating Storage & Regasification Unit.

5.

LNG CARRIERS

In order to transport LNG from liquefaction or Peak shaving terminal to an end user location, LNG carriers are needed. There are also ships which sail with LNG as fuel. All such carriers require special materials, insulation and welding solutions. We offer Total welding solutions for all LNG carrier types.

MAIN APPLICATIONS
AND BASE MATERIALS

STORAGE TANKS

- 9% Nickel
- C-Mn steel
- Al 5083
- Piping: 304L

CRYOGENIC HEAT EXCHANGER

- Al 5083
- Al 6063
- 304L
- 316L

CRYOGENIC PIPING

- 304L
- 316L

LNG CARRIER

- 5% Nickel
- 9% Nickel
- Al 5083
- 304L
- FeNi36 (Invar) alloy

LNG PROJECT

A LNG project can take more than 6 years to build from the Final Investment Decision (FID). Due to complexity of construction and high level of safety control, construction of storage tanks alone can take up to 3 years.

Welding is a small but key element in execution of LNG projects. Quality consumables along with mechanized welding solutions minimize the risks.

LNG STORAGE TANKS
& CONTAINMENT TYPES

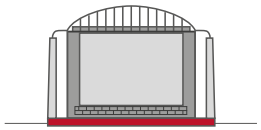
LNG storage tanks are highly critical components of LNG industry. Storage tanks can be categorized from different aspects.

- Fix or on carrier tanks
- Containment Type
- Above Ground, In-Ground types & Under-Ground

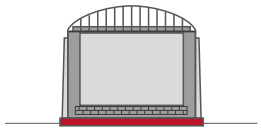
FIXED STORAGE TANKS CAN NORMALLY BE DESIGNED USING ONE OF FOUR CONTAINMENT TYPES

- Single Containment
- Double Containment
- Full Containment
- Membrane Type

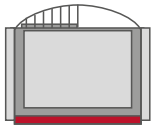
Single Containment



Double Containment



Full Containment



Membrane

DESIGN
ASPECTS

The balance between the required land, construction, cost and local legislation defines the containment type. Various design codes govern the construction of LNG tanks.

- ASME BPVC Sec. VIII, Div. 1
- ASME BPVC Sec. VIII Div. 2
- API 620
- NFPA 59A
- API 660
- BS EN 14620-1:
- JIS B8265:
- JIS B8267

9% NICKEL IS THE MAIN GRADE USED FOR FABRICATION OF LNG INNER TANKS CONSIDERING THE VERY LOW OPERATING TEMPERATURE

Liquefaction temperature for some types of gas and its suitable material for transport or storage

Table 1) Boiling temperature of cryogenic gases vs materials for liquid storage

Steel grade	Boiling temp. (°C)	Gas
Fine grained steel	-28	CO2 (to 1.5)
1% Ni steel	-42	Propane
2.5% Ni steel	-78	CO2 (solid)
	-84	Acetylene
	-88	Ethane
3.5% Ni steel	-104	Ethylene
5% Ni steel	-153	Krypton
9% Ni steel	-161	Methane
Aluminium	-183	Oxygen
	-186	Argon
	-196	Nitrogen
	-253	Hydrogen
	-269	Helium

Table 2) Typical properties of 9% Nickel steel plates

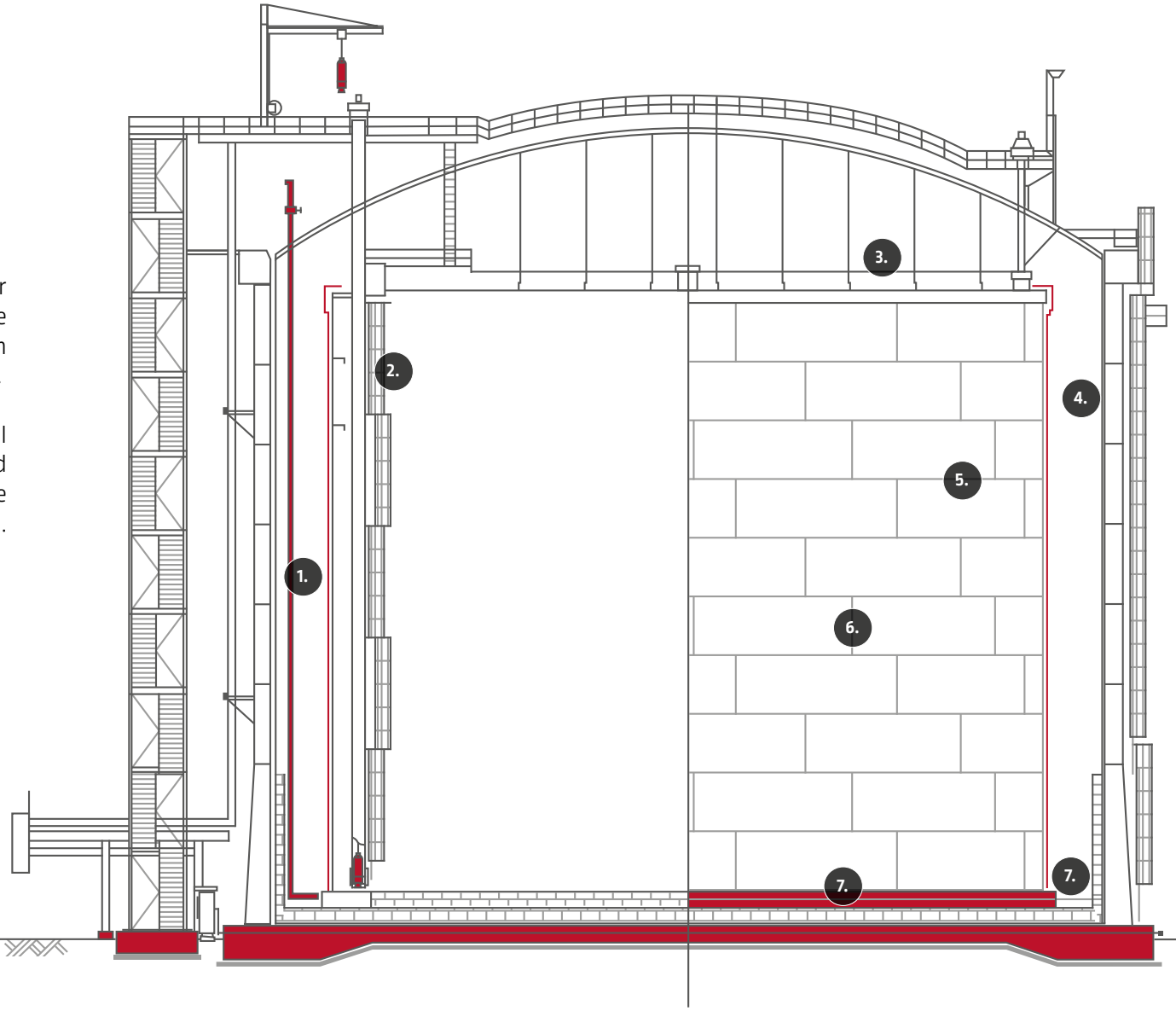
Item	ASTM	
	A353	A553 Type I
Yield strength 0.2% Proof stress (MPa)	≥515	≥585
Tensile strength (MPa)	690-825	
Elongation (%), t:Thick (mm)	≥20.0	
Charpy (J) at -196°C	≥34	
Lateral expansion*3 (mm) at -196°C	≥0.38	
Thickness (mm)	50	50
Heat treatment	Normal-ized/T	QT
C (%)	≤0.13	
Si (%)	0.15-0.40	
Mn (%)	≤0.90	
P (%)	≤0.035	
S (%)	≤0.035	
Ni (%)	8.50-9.50	

FULL CONTAINMENT
LNG TANK

Full containment has become the most commonly built LNG tank type due to its safety and economical value.

The inner tank is made of 9% Nickel steel and the outer tank is made of Pre-stressed concrete (PC). Between the inner and outer tank there is a vapor barrier made of thin carbon steel plate and many different types of insulations.

The roof can be made of concrete or 9% Nickel material depending on the design. There is an Aluminium suspended deck hanging from the roof. You can view the complete LNG tank fabrication sequence in our LEAD application.



1. VAPOR BARRIER

It is made of carbon steel and is normally of a very low thickness. This is a protective layer between the inner tank insulation and concrete. Having a very low thickness the best method to weld this application will be cored wire to avoid unnecessary distortion.

SMAW:
- Conarc 51
- Conarc 49C

FCAW:
- Outershield MC710RF-H

2. INTERNAL PIPING

Liquefied gas is transferred to and from the tank via stainless steel piping. The piping requires special consumables to guarantee the required toughness / lateral expansion.

SMAW:
- Ultramet B308LCF
- Ultramet B316LCF

FCAW:
- Supercore 308LCF
- Supercore 316LCF

GTAW:
- ER308LCF
- ER316LCF

SAW:
- ER308LCF + P2007
- ER316LCF + P2007

3. SUSPENDED DECK

Carbon or stainless steel rods are attached from deck stiffeners to the roof girders or rafters. The suspended decks require a deck annular plate to provide a vapor seal between the liquid product and the vapor space above the primary containment. The deck is made of Aluminium alloy 5083.

GTAW:
- Superglaze 5183

GMAW:
- Superglaze 5183

4. INNER TANK KNUCKLE JOINTS

Top stiffener joints require welding in 4F/4G position. To that end we have developed Nyloid 4 electrode to be able to weld in overhead position. The electrode has special slag design ensuring stable arc and providing sound weld metal.

SMAW:
- Nyloid 4

5. INNER TANK HORIZONTAL JOINTS

Each two 9% Nickel plates are welded in the vertical up position. Welding can be performed simultaneously from both sides or one followed by another. Typically alloy 276 is used for this application.

SAW:
- LNS NiCroMo 60/16 + P2007
- LNS NiCro 60/20 + P2007
- Techalloy 276 + P2007
- Techalloy 625 + P2007

6. INNER TANK VERTICAL JOINTS

9% Nickel vertical joints are welded in vertical up. For this reason either SMAW electrode is applied manually or FCW for semi-automatic and fully automatic welding.

SMAW:
- Nyloid 2
- NIMROD 625KS

FCAW:
- Supercore 625P

7. INNER TANK BOTTOM

The bottom plates corners are normally welded in the 2G welding position. In most of the designs a horizontal 2G joint is used. Normally bottom plates are pre-joined in workshop using the SAW process and then will be welded together with FCAW or SMAW on the jobsite.

SMAW:
- Nyloid 2
- NIMROD 625KS

FCAW:
- Supercore 625P

SAW:
- LNS NiCroMo 60/16 + P2007
- LNS NiCro 60/20 + P2007

INNER TANK
HORIZONTAL JOINTS

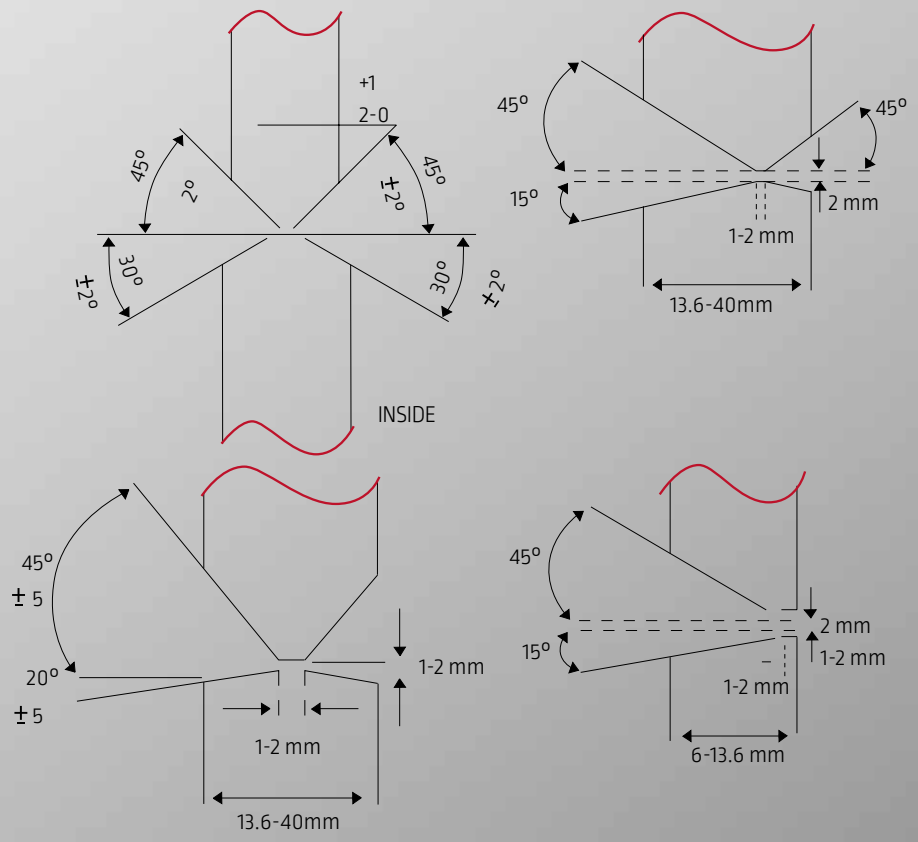
Welding of horizontal joints in the 2G welding position is one of the most critical steps of LNG tank fabrication. Lincoln Electric offers a full product portfolio of consumables and equipment as well as the automation package.

A 200,000m³ LNG TANK CAN HAVE AN INNER TANK WITH 10 SHELL COURSES.

- Welding Sequence
  - > Single sided
  - > Double sided
- Joint Symmetry
  - > Compound ½ - ½
  - > Compound ⅓ - ⅔
- Joint Opening
  - > With Opening
  - > W/O Opening

SAW is the dominant process for welding of horizontal joints. It offers the highest productivity. It is key to keep the balance among penetration, dilution and deposition rate.

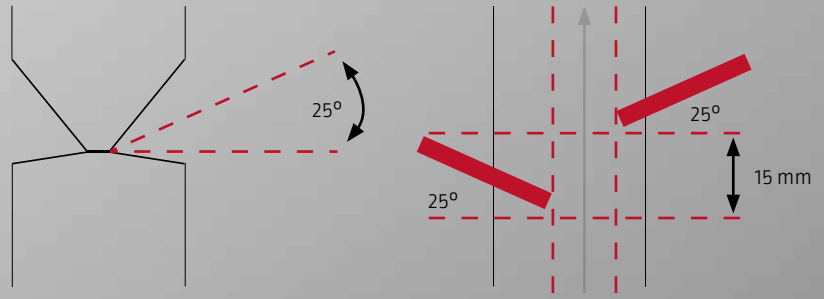
Figure 1) Various joints design for 2G SAW



THERE ARE GENERALLY TWO METHODS OF SAW WELDING OF 2G JOINTS:

- Single-sided: Whether it is a single V joint or a compound joint, welding will be finished on one side and then welding on the opposite side will be started.
- Double-sided welding: Will be performed on compound joint, which has currently become a standard joint design for thicknesses above 11 mm.

Figure 2) Torch positioning for 2G double sided SAW



Torch Angle - Front view

Torch Angle - Top view

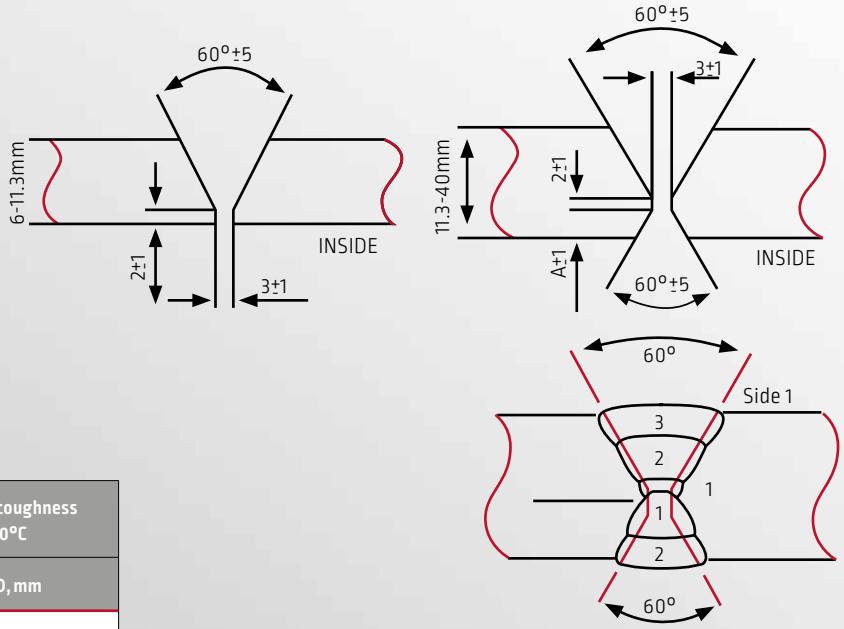
Alloy 276 has been the dominant alloy due to its higher resistance to hot cracking and subsequently larger diameter welding.

Alloy type	SA wire	Flux
Ni 625	LNS NiCro 60/20	P2007
Ni 276	LNS NiCroMo 60/16	P2007

With the help of PowerWave® and Waveform Control Technology we can achieve a balance among penetration, mechanical properties, heat input and productivity.

We have conducted numerous trials and been able to design a special Waveform for Nickel base alloys applied for double sided SAW horizontal welding.

INNER TANK
VERTICAL JOINTS



FOR VERTICAL JOINTS SMAW AND FCAW ARE THE DOMINANT PROCESSES.

For manual process Nyloid 2 has been used for decades in many projects worldwide as the electrode of choice and Supercore 625P FCW is proven to offer the best combination of excellent weldability and mechanical properties.

Table 4) All weld metal mechanical properties of Supercore 625P
(weld type: as per AWS A5.34; shielding gas: M21; Test condition: As-welded)

Welding position	Tensile properties					Impact toughness -196°C		Fracture toughness -170°C
	Rp0.2, MPa	Rm, MPa	A4, %	A5, %	Z, %	CVN, J	LE, mm	CTOD, mm
PA-1G	500	770	44	43	41	70	1.20	-
PF-3G	500	760	46	43	42	86	1.44	0.50

Table 5) 9%Ni steel joint procedure test data of Supercore 625P
(shielding gas: M21; Test condition: As-welded)

Welding position	Method	Thickness mm	Joint type[1]	Cross-weld tensile	Bend test			Charpy impact test -196°C		
				MPa	T-V[2]	L-face[3]	L-root[3]	Location	CNV, J	LE, mm
PF-3G	Semi-Auto	13	60° D-V (2/3, 1/3)	750	pass	pass	pass	Mid-T	89	1.22
PF-3G	Semi-Auto	20	60° D-V (1/2, 1/2)	739	pass	pass	pass	Mid-T	75	1.05
PF-3G	Full mech.	25	60° D-V (2/3, 1/3)	715	pass	pass	pass	Mid-T	86 72	1.6 0.9
PF-3G	Semi-Auto	13	45°+15° (2/3, 1/3)	742	pass	pass	pass	Mid-T	91	0.79

Note : [1] D-V=double V; [2] T=transverse; [3] L=Longitudinal

Process	Classification	Product name
SMAW	A5.11: ENiCrMo-3	**NIMROD 625KS**
SMAW	A5.11: ENiCrMo-6	**Nyloid 2**
FCAW	A5.34: ENiCrMo3T1-1/4	**Supercore 625P**

Nyloid 2 has been applied for decades in numerous LNG projects. Its extra high metal recovery revolutionized the manual welding of the vertical joint.

Supercore 625P is now the reference FCW that combines excellent weldability and mechanical properties.

CRYOGENIC PIPING
STAINLESS STEEL

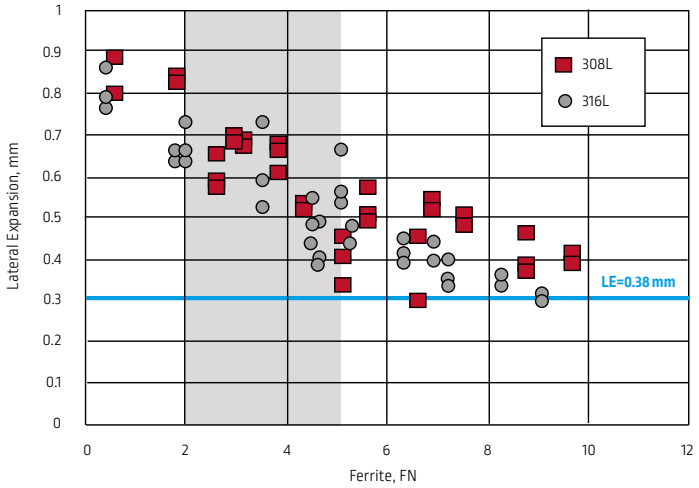
FERRITE CONTROL
Base materials are carefully processed. Weld metals are as-cast and do not necessarily achieve the required toughness.

HOW TO ACHIEVE WELD METAL IMPACT PROPERTIES?
- Solution annealing
- Fully austenitic consumables
- Gas shielded processes
- Specially designed **Controlled Ferrite** consumables

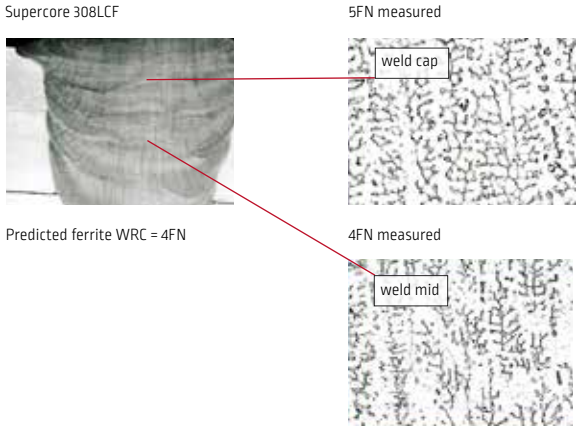
VARIOUS STANDARDS HAVE FERRITE LIMITS FOR STAINLESS STEELS, FOR EXAMPLE:
ASME III requires 5FN minimum; 3-10FN for service above 427° C. API 582 has 3FN minimum, it is noted that for cryogenic service lower FN may be required.

It is proven that a narrow controlled Ferrite between 2-5FN guarantees the required mechanical properties under cryogenic conditions. Our LCF consumables have been welded in LNG projects for the last 3 decades.

308L & 316L welds: ferrite control range



Figures 3) Effect of FN on lateral expansion for Austentic grades



LNG
CARRIERS

LNG CARRIER HAVE DIFFERENT STORAGE TANK DESIGNS:

- Integral (Dependent)
- Independent

Integral tanks are built inside the carrier hull. The base material is carbon steel covered by Insulation and on top of the insulation there is membrane cladding with stainless steel or Invar (36% Nickel) straps.

ALUMINIUM
WELDING

Let us put our experience to work for you

FULLY INTEGRATED ALUMINIUM MIG WIRE FACILITY

As a major supplier of welding wire, Lincoln Electric is the leader in GMAW wire manufacturing technology. We carry that same technology and expertise to our Aluminium GMAW wire manufacturing. Lincoln Electric has the only fully integrated Aluminum GMAW wire facility in the world. We start from raw primary aluminum and then use state-of-the-art equipment to produce a complete range of aluminum alloys including 1100, 1070, 2319, 4043, 4047, 5087, 5183, 5356, 5554 and 5556. This gives us full control of welding chemistry throughout the process as well as the ability to always deliver product to our customer, regardless of market conditions.

GTAW/SMAW EQUIPMENT

INVERTEC® 220 TPX

115/230/1Ph – Output current: 220A @25%

- Advanced inverter technology for superior TIG performance
- Very good HF arc ignition; stable, focused and fast arc
- Simple control panel – easy setup, full control
- Energy efficient – PFC circuit, high efficiency, green mode
- Robust design – potted PCBs, true HD design
- Optional remote control
- Up/down function

Processes

Stick, Lift TIG, TIG HF, TIG pulse

INVERTEC® 400 TP

400V/3Ph – Output current: 400A@40%

- Idle power 22W and efficiency > 88%
- TIG manual and Synergic, MMA manual and Synergic, Pulse and Double Pulse
- Intelligent F.A.N. (Fan As Needed)
- Customer Support
- USB Connectivity
- Voltage Reduce Device (VRD)
- Cellulosic 6010 stick capability
- Water cooler and cart available

Processes

Stick, Lift TIG, TIG HF, TIG pulse

INVERTEC® 275 TP & 300 TP

400V/3Ph – Output current: 270A@40%/300@40%

- Idle power 19W and efficiency > 85%
- SMAW capacity
- Intelligent F.A.N. (Fan As Needed)
- Customer support
- USB connectivity, data monitoring and software update
- Voltage Reduce Device (VRD)
- Cellulosic 6010 stick electrode capability
- Water cooler and cart available

Processes

Stick, Lift TIG, TIG HF, TIG pulse

ASPECT® 300 AC/DC

400V/3Ph – Output current: 300A/40%

- Advanced waveform technology for the best aluminium welding performance
- Advanced TIG AC & DC Functions – four wave shapes, pulse, adjustable balance and offset, innovative and simple control panel, AC auto setting
- Variable AC frequency (40-400 Hz) for the control of travel speed and penetration
- Fully functional, user-friendly control panel layout with graph and a numeric display makes it easy to set all welding parameters

Processes

Stick DC, Stick AC, TIG DC, TIG AC, Lift TIG, TIG HF, TIG Pulse

FCAW AND GMAW EQUIPMENT

SPEEDTEC® 400SP & 500SP

400V/3Ph - Output current: 420A@100% / 500A@60%

- High Efficiency Processes (Speed Short Arc™, Soft Silent Pulse™, High Penetration Speed™)
- MECHAPULSE™ produces very high quality welds with rippled seam appearance
- Modular concept to build configuration for any requirements
- Double-side fully potted PCB with superior resistance for dust, humidity, jerk or vibrations
- MIG processes with synergic programs for steel, stainless steel, aluminium. GMAW, FCAW & SMAW capabilities

Processes

Pulsed MIG, MIG, Flux-Cored, Stick, Lift TIG

LF-52D OR LF-56D OR LF-5D

4-Roll digital industrial wire feeders built to deliver reliable performance day after day

- Small, rugged and easy to handle feeders with bright digital meters
- Digital communication protocol for welding
- Perfect feedability, four roll drive system with powerful motor
- Optimized wire spool installation, inspection window and lifting eye
- Equipped with wheels as standard
- LF-52D with LEDs user interface, LF-56D with Color TFT, 49 memory jobs, USB connectivity, clock, calendar, speaker and stronger encoders
- LF-5D for 5kg wire spools: Available in standard version with LEDs user interface and Advanced with 5'' Color TFT

FLEXTEC® 350XP

380/460/575V/3- Output current: 350A@60%

- Equipped with CrossLinc® Technology
- Desert Duty® and IP23 rated, designed to withstand harsh outdoor conditions and outperform other welders in its class
- Capable of open gap root passes on pipe with the STT process using the Activ8X Pipe wire feeder
- Built in pulse programs for carbon steel, stainless steel, metal core and aluminum
- Ultimate process flexibility. Supports GMAW, GTAW, SMAW, FCAW and CAG

LN-25X

- Full control with no control cables
- Remotely controls preset voltage without a control cable
- Trigger interlock switch facilitates long welds
- Arc hour meter for tracking maintenance and productivity
- Digital meters display voltage, current and wire feed speed
- Industry-proven Maxtrac® Wire Drive System
- Fully encapsulated and environmentally protected electronics
- Replaceable, flame resistant case
- CrossLinc® Technology
- True Voltage Technology™ (TVT™) automatically compensates for voltage drops across long welding cables

ACTIV8-PIPE

- Waveform controlled STT-Field arc for full penetration, full fusion, open root passes on pipe
- No control cables and no sense lead needed
- Portable, compact package, simple setup

SAW EQUIPMENT

FLEXTEC® 650X

380/460/575V/3Ph – Output current: 750A@60%

- Engineered for outdoor use and harsh environments (IP23 rated)
- Equipped with CrossLinc® Technology
- Desert Duty® rated for extreme temperatures up to 55° C

DC-1000

380/440V/3Ph – Output current: 1000A/100%

- 500 amp output connections – provide enhanced arc characteristics for low amperage submerged arc and MIG welding procedures.
- Single range control – for precise output control and easy operation.
- Up to 800A output current

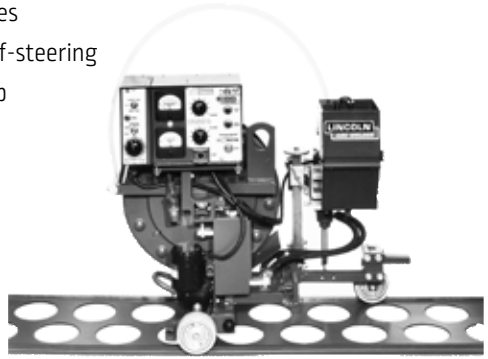
POWER WAVE® AC/DC 1000® SD

380/400/460/500/575V/3Ph – Output current: 1000A/44V/100%

- Inverter power source
- 1,000 Amps @ 100% duty cycle
- DC+, DC- & AC
- CV and CC modes
- AC Sine Wave and AC Square Wave
- Designed for severe duty (SD)
- 3 machine paralleling capability

LT-7 TRACTOR

- The LT-7 Tractor is a self-propelled mechanized wire feeder, designed for the submerged arc process with track system capabilities
- Control box is conveniently located on the tractor, eliminating the need to return to the power source for routine procedure changes
- Exceptional tracking control and self-steering
- Welds butts, horizontal fillet and lap joints to the left or right side
- Input voltage: 115VAC
- Input current: 600A
- Rated output: 600A/100%

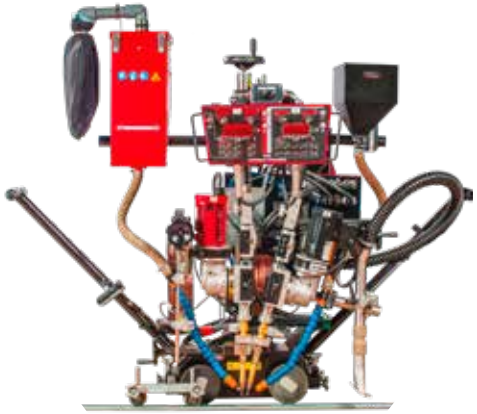


MEGATRAC SUBMERGED ARC WELDING TRACTOR

The best solution for the harshest environments and applications

This very robust and stable carriage is specially designed for single and tandem welding applications, which includes the Long Stick Out process

- Up to 2 flux supply systems
- Up to 2 wire spool capabilities
- 4 slides to adjust head position
- Optional transportation platforms
- Also available in single wire form
- Delivered with the POWER WAVE AC/DC 1000 SD power source



MECHANISED EQUIPMENT

APEX® 30S HELIX® M45 GTAW READY-PAK®

Orbital TIG welding package

- Fully integrated and synchronized digital platform for controlling welding, torch motion and wire delivery
- Complete mechanized welding system configured for the GTAW welding process
- Rated output: (Current/Voltage/Duty Cycle) – 450A/36.5V/100%
- Robust design
- Pipe track size – 8" to 92"
- Straight track size: 48" & Above

APEX® 30M HELIX® M85 MIG READY PAK® CE

Complete mechanized welding system configured for GMAW and FCAW

- Fully integrated and synchronized digital platform for controlling welding, torch motion and wire delivery
- Complete mechanized welding system configured for GMAW, and FCAW, with built in Inclinometer & Auto Height Control
- Rated output: (Current/Voltage/Duty Cycle) – 450A/36.5V/100%
- Robust design
- Pipe track size – 8" to 92"
- Straight track size: 48" & Above

APEX® 30S HELIX® M627 TIG READY-PAK®

Orbital TIG welding package

- Latest digital motor control allows for zero calibration during setup precise travel speed and true oscillation width/speed control delivers repeatable welds with minimal setup Auto-Pilot and Auto-Sectors technology provide automated control for lower operator training and improve operator availability
- Low radial clearance – 68.5 mm water cooled motor housing and torch helps eliminate overheating proven, versatile clamping mechanism allows the weld head to be disengaged and repositioned with on easy motion
- The HELIX M627 comes complete and ready to weld right out of the box. As expected, the package includes the weld head, and its storage case

HELIX® OD TRACK RINGS

Constructed for consistent weld head travel

- Lincoln Electric's HELIX® track is available in three types: flat, orbital outside (OD) and orbital inside (ID)
- The steel-constructed tracks are engineered to allow easy movement of a weld head with minimal adjustment
- The tracks can also sustain a wide range of temperatures, which is important when working with preheated pipe or in harsh environments
- Quick release latches (OD tracks) and simple bolts (ID tracks) make assembly and dismantling fast and easy in the field or in the shop
- All orbital track rings can be fitted with shoe extensions of various sizes, allowing for a single track ring to cover a range of different pipe sizes

MECHANISED EQUIPMENT

WELDYRAIL

Railway portable welding carriage MIG/MAG welding in all positions

Options

- Magnetic railway
- Pneumatic suction cup railway
- Linear oscillator
- Electric or battery powered
- Oscillation width: 2 to 56 mm
- Travel speed: 5 to 80 cm/min
- Guiding magnetic or pneumatic railway (Ø min. 1 m)
- Universal torch support with quick attachment
- Overall dimension (L x W x H) 270 x 220 x 230 mm

APEX® 30M WITH HELIX® M85 HEAD

The mechanized APEX® 3 Series welding system sets up quickly and delivers precision calculation and control of travel time, weld distance, weld speed and other essential variables. The HELIX M85 weld head, a central component of this system, provides consistent, high quality results with little or no time wasted on setup or rework.

- Travel Speed - 2.54mm to 3048 mm
- Axial – 501.7 mm
- Radial - 215.9 mm
- Oscillation Stroke – 50.8 mm
- Motorized Height Control Stroke – 50.8 mm
- Torch Tilt - 60º in & 30º Out
- Input Power – 24V DC
- Input Current – 9A
- Track – Magnetic or Pneumatic Feet
- H x W x D - 211.6 mm x 362 mm x 174 mm

Processes

GMAW, FCAW, GTAW (Hot & Cold Wire)

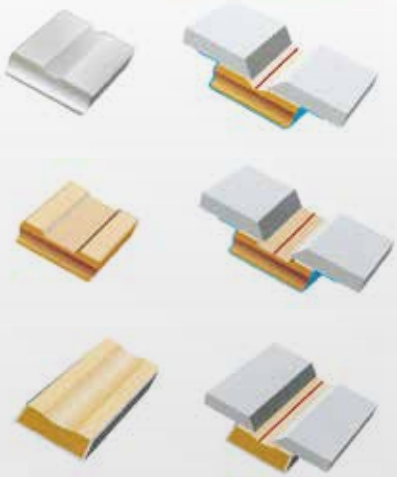
CERAMIC BACKINGS

KERALINE RANGE

Our range of ceramic holders allows you to build a much more efficient weld root: no gouging, no grinding, no re-welding, no rework. With a large gap between the edges with a larger root thickness allows for a higher welding current for the hot pass.

Characteristics

- The use of ceramic supports allows you to weld with greater intensity
- The quality of the weld bead will be improved with greater penetration
- Minimal risk of fusion failure
- Smooth profile of the root pass



PLASMA CUTTING

TOMAHAWK® 30K

230V/1Ph – Output current: 30A @60%

- Gas pressure required:: 5,0bar – 6,0bar / 125 ±10% l/min
- Internal air compressor (external air connection also standard)
- LC30 torch with 4 m cable
- Air regulator and pressure gauge
- Internal water separator
- Work clamp and cable
- Spare consumables
- Input power cord

TOMAHAWK® 45

120-230V/1Ph – Output current: 45A @45% (230Vac) – 22A @60% (120Vac)

- Gas pressure required: 5,0bar – 6,0bar ,200 ±10% l/min
- TFT 2.8" screen – for an easier and user friendly user interface
- Continuous output control – focus the arc for different material thickness
- Front panel purge control – makes it easy to set the air flow rate without initiating the plasma arc
- Lightweight and portable – easily carried by one person
- Output range: 15A-45A (230Vac) – 15A-22A (120Vac)

LINCOLN ELECTRIC
CONSUMABLES SOLUTION

UNALLOYED STEELS
// MILD STEEL CONSUMABLES

Alloy type	Welding process	Product name and specification		
		Product name	AWS	EN / ISO
C-Mn	SMAW	**CONARC 49C**	A5.1: E7018-1-H4R	EN ISO 2560-A: E 46 4 B 32 H5
		CONARC 51	A5.1: E7016-1 H4	EN ISO 2560-A: E 42 4 B 12 H5
	GMAW	**SUPRAMIG ULTRA**	A5.18: ER70S-6	EN ISO 14341-A : G46 3 C1 4Si1 / G50 5 M21 4Si1
	GTAW	**LNT 25**	A5.18: ER70S-3	EN ISO 636-A : W 42 5 2Si
		LNT 26	A5.18: ER70S-6	EN ISO 636-A : W 42 5 3Si1
	MCAW	**OUTERSHIELD MC710RF-H**	A5.18: E70C-6M H4	EN ISO 17632-A: T 46 3 M M21 2 H
	SAW (780)	**L-61**	A5.17: EM12K	EN ISO 14171-A: S2Si
	SAW (P230)	**L-50M**	A5.17: EH12K	EN ISO 14171-A: S3Si

STAINLESS STEEL
// CRYOGENIC STAINLESS STEEL CONSUMABLES

Alloy type	Welding process	Product name and specification		
		Product name	AWS	EN / ISO
Cryogenic 308L	SMAW	**ULTRAMET B308LCF**	A5.4: E308L-15	EN ISO 3581-A: E 19 9 L B 4 2
	GTAW	**ER308LCF**	A5.9: ER308L	EN ISO 14343-A: W 19 9 L
	FCAW	**SUPERCORE308LCF**	A5.22: ER308LT1-1/4J	EN ISO 17633-A: T 19 9 L P C/M 2
	SAW (P2007)	**ER308LCF**	A5.9: ER308L	EN ISO 14343-A: S 19 9 L
Cryogenic 316L	SMAW	**ULTRAMET B316LCF**	A5.4: E316L-15	EN ISO 3581-A : E 19 12 3 L B 4 2
	GTAW	**ER316LCF**	A5.9: ER316L	EN ISO 14343-A: W 19 12 3 L
	FCAW	**SUPERCORE316LCF**	A5.22: E316LT1-1/4	EN ISO 17633-A : T 19 12 3 L P C/M 2
	SAW (P2007)	**ER316LCF**	A5.9: ER316L	EN ISO 14343-A: S 19 12 3 L

NICKEL BASE ALLOYS
// ALLOY C & B CONSUMABLES

Alloy type	Welding process	Product name and specification		
		Product name	AWS	EN / ISO
59	GMAW	**HAS 59**	A5.14: ERNiCrMo-13	EN ISO 18274: S Ni 6059
	GTAW	**HAS 59**	A5.14: ERNiCrMo-13	EN ISO 18274: S Ni 6059
C276	SMAW	**NIMROD C276KS**	A5.11: ENiCrMo-4	EN ISO 14172: E Ni 6276
	GMAW	**HAS C276**	A5.14: ERNiCrMo-4	EN ISO 18274: S Ni 6276
		TECHALLOY 276	A5.14: ERNiCrMo-4	–
	GTAW	**HAS C276**	A5.14: ERNiCrMo-4	EN ISO 18274: S Ni 6276
		TECHALLOY 276	A5.14: ERNiCrMo-4	–
	SAW (P2007)	**LNS NiCroMo 60/16**	A5.14: ERNiCrMo-4	EN ISO 18274: S Ni 6276 (NiCr15Mo16Fe6W4)
	SAW (P2007)	**TECHALLOY 276**	A5.14: ERNiCrMo-4	–

NICKEL BASE ALLOYS
// 625 ALLOY CONSUMABLES

Alloy type	Welding process	Product name and specification		
		Product name	AWS	EN / ISO
625	SMAW	**NIMROD 625KS**	A5.11: ENiCrMo-3	EN ISO 14172: ENi 6625
	GMAW	**62-50**	A5.14: ERNiCrMo-3	EN ISO 18274: SNi 6625
		TECHALLOY 625	A5.14: ERNiCrMo-3	
	GTAW	**62-50**	A5.14: ERNiCrMo-3	EN ISO 18274: SNi 6625
		TECHALLOY 625	A5.14: ERNiCrMo-3	
	FCAW	**SUPERCORE 625P**	A5.34: ENiCrMo3T1-1/4	EN ISO 12153: T Ni 6625 P C/M 2
	SAW (P2007)	**LNS NiCro 60/20**	A5.14: ERNiCrMo-3	EN ISO 18274: SNi 6625
	SAW (P2007)	**TECHALLOY 625**	A5.14: ERNiCrMo-3	

NICKEL BASE ALLOYS
// SPECIAL NICKEL BASE ALLOY CONSUMABLES

Alloy type	Welding process	Product name and specification		
		Product name	AWS	EN / ISO
NiCrMo-6	SMAW	**NYLOID 2**	A5.11: ENiCrMo-6	EN ISO 14172 : E Ni 6620
		NYLOID 4	A5.11: ENiCrMo-6	EN ISO 14172 : E Ni 6620

ALUMINIUM ALLOYS

Alloy type	Welding process	Product name and specification		
		Product name	AWS	EN / ISO
Al 5183	GMAW	**SUPERGLAZE 5183**	AWS A5.10 : ER5183	EN ISO 18273-A : S Al 5183 (AlMg4,5Mn07(A))
	GTAW	**SUPERGLAZE 5183**	AWS A5.10 : ER5183	EN ISO 18273-A : S Al 5183 (AlMg4,5Mn07(A))

FLUX FOR SUBMERGED ARC WELDING

Flux type	Wire	Specification	Basicity index	Polarity
780	L-61	EN ISO 14174: S A AR/AB 1 78 AC H5	0,7	DC/AC
P230	L-50M	EN ISO 14174: S A AB 1 67 AC H5	1,6	DC/AC
P2007	ER308LCF ER316LCF LNS NiCro 60/20 LNS NiCroMo 60/16 TECHALLOY 276	EN ISO 14174: S A AF 2 5643 AC H5	1,6	DC/AC

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

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LE-S4-24EN-L2079

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