TOPTIG

A new robot welding process for industry

TIG quality no spatter guaranteed
Plasma / TIG machine range

The PLASMA/TIG solutions are often used to weld vessels or pipes in various domains as food, transport, petrochemical or aeronautical industries.

Air Liquide Welding proposes a large range of machines adapted and dedicated to each activity sector.

**Mechanisation machines**
with TIG or plasma process
for automatic welding of pipes or vessels with low diameter.

**Tricathode installation**
for in line pipe welding with high productivity level.

**Autonomous and multi-purpose welding installation** in monocathode Plasma/TIG version or in bicathode Plasma + TIG configuration for higher productivity.

**CITOTURN lathe**
with microplasma installation used for high precision welding of thin noble metals.
Plasma/TIG seamer benches
for longitudinal welding of flat sheet metal
or large vessels (internal or external welding)

Plasma/TIG column
and booms with rotators or turntable
for circumferential, cornice, flat or vertical down welding

Specific machines
built from standard equipment and adapted to the customer applications

For all other specific requests: consult us.
Applications:
Multi-purpose welding installation to enable the following processes to be used in automatic applications:
- DC TIG with smooth or pulsed current,
- AC TIG with variable polarity,
- DC plasma with smooth or pulsed current.

This installation meets the highest quality standards for welding and productivity for industries as diverse as boiler-making using stainless steels, aeronautics using noble metals, chemical engineering, energy production, transformation and transport as well as prefabrication of gas and petrol pipelines etc.

TIG / PLASMA process and performances:
The Plasma process is the ideal extension of TIG for thicknesses greater than 3 mm. It ensures the same level of quality, higher performances and 100% penetration thanks to Key-Hole technology. The diagram shows the different welding performances according to the materials and thicknesses.

Maximum thickness which can be welded in a single pass is reduced for:
- vertical down and cornice (2G) welding positions,
- small diameter and very thick tubes.

Improvement productivity with PLASMA + TIG Process
The Plasma + TIG process is specially designed for assembling panels for the prefabrication of vessels longer than 4 meters and carrying out circular welds for diameters greater than 2 meters.

This process of using 2 torches in tandem gives a productivity gain of 30-50 % over a single-torch plasma installation.

The “plasma” arc penetrates the butt-jointed panels. The “TIG” arc equipped with filler metal, electromagnetic arc oscillation and a gas trailing shield produces a perfect surface finish which can often be left without any further treatment.
**Installation**

NERTAMATIC 450 Plus integrates the management of the complete welding process controlled from a central panel, robust and easy to use with a clear text LCD screen display of 4 lines of 20 characters which allows:

- storing of 50 welding programs (voltage, current, wire speed, plasma gas, movement speed, magnetic oscillation...),
- parameters modification during welding,
- cycle start/stop, manual control of gas/wire/AVC/ movement,
- complete management of key hole closure,
- pulse current settings for fine thickness welding and vertical or cornice welding,
- easy integration and communication with external PLC thanks to Open PLC function,
- import/export via USB key for uploading or downloading programs,
- edition of programs on external computer, thanks to Off-line software.

**TIG/PLASMA equipments**

Air Liquide Welding offers two types of control panel.

**NERTAMATIC 450 Plus**

**HPW**

HPW NERTAMATIC 450 is an industrial PC allowing the global management of the complete welding process and machine axes. Its main characteristics are:

- touch screen with a friendly and intuitive interface allowing the programming, controls and follow up,
- numerical management of the welding process, its associated movements and drive units via industrial PC,
- traceability, a program integrates all the parameters allowing the repetitivity of the welding operation,
- quality follow-up in option, record and storage of the essential parameters of welding (current, voltage, gas, wire feeding, movement),
- wireless remote control (option),
- import/export via USB key for uploading or downloading programs and WPS edition.
TIG and Plasma

POWER SOURCE
The power source NERTAMATIC 450 Plus centralizes the global management of the welding cycle: the control of the current, the voltage, the wire speed, the gases flow, the magnetic oscillation and the welding speed.

An optional AC module can be integrated to control the current for variable polarity aluminium welding.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Duty cycle</td>
<td>450 A @ 100%</td>
</tr>
<tr>
<td>Pulsed current</td>
<td>1 to 100 Hz</td>
</tr>
<tr>
<td>AC current</td>
<td>50 to 200 Hz</td>
</tr>
<tr>
<td>Data exchange</td>
<td>USB</td>
</tr>
<tr>
<td>Primary power supply</td>
<td>3 x 230 V - 400 V - 415 V - 440 V / 50-60 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>22 kVA</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP23</td>
</tr>
<tr>
<td>Weight and dimensions</td>
<td>1200 (h) x 500 (w) x 850 (d) mm</td>
</tr>
</tbody>
</table>

TORCHES
High performance water cooled torches to ensure quality and stability of the process and its equipments.

Torches are equipped with quick connection systems for easy change and maintenance.

MEC4:
For TIG welding:
- 500 A at 100%,
- standard electrode simple to replace,
- twin HF ignition for better arc striking.

Options:
- gas trailing shield to protect welds of sensitive metals,
- magnetic arc oscillation equipment.

PLASMA GAS
For thicknesses greater than 2.5 mm, PLASMA welding uses the Key-Hole technique.

If one cuts the arc current off instantly, the key hole remains in the work piece.

In order to remedy this disadvantage on circular welding, and in order to make the Key-Hole disappear, it is necessary, before extinguishing the arc, to gradually reduce the torch’s plasma gas flow simultaneously with the arc current. This made possible with a numerical valve controlling the plasma gas cycle.

WIRE FEED DEVICE
It is often necessary to feed the molten pool with metal during the welding operation in order to prevent the seam from showing hollows, to supply soft steels with deoxidizing elements and for successive seams.

The system allows to quickly and accurately adjust the wire impact point in the welding pool thanks to micrometer slides.

The adjustment can be manual or motorised for remote control.

SP7:
This torch is the reference in the market, for soft and key hole plasma welding:
- 450 A at 100%,
- standard electrode simple to replace and self-aligning,
- cooled nozzle ensuring long life time of consumables.

Options:
- gas trailing shield to protect welds of sensitive metals.

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<td>Carbon steel Stainless steel Titanium wires</td>
<td>Ø 0.8 / 1.0 / 1.2 mm</td>
</tr>
<tr>
<td>Aluminium wire</td>
<td>Ø 1.2 / 1.6 mm</td>
</tr>
<tr>
<td>Max wire speed</td>
<td>6 m/min</td>
</tr>
</tbody>
</table>

Gas Flow
Gas flow range: 0 to 10 l/min
Accuracy: 0.1 l/min
**AVC SYSTEM**
A constant distance between the torch and the workpiece is a key of quality to ensure a constant penetration and bead width.

The Arc Voltage Control (AVC) keeps this constant distance by automatic regulation of the arc voltage: function fully integrated into the Air Liquide Welding system composed of an electrical vertical slide travel 200 mm.

**OSCILLARC PLUS**
**Arc deviation**

This technique is used to electrically deflect the TIG arc forward in the welding axis, increasing the speed by 30 to 50% for thicknesses of less than 2 mm.

**Arc oscillation**

Arc oscillation is used to deposit metal over areas up to 15 mm wide to fill bevels or reconstitute surface coating.

**COOLING UNIT**
The FRIOJET 300 cooling unit is compact with coolant constant supply, in closed circuit, used to cool down torches.

Water circulation in closed circuit makes it possible:
- to prevent the deposit of boiler scale in conduits and in the torches to be cooled,
- to save water, to have a constant water flow-rate,
- the regulation of water temperature provides a constant production quality and extends significantly useful life of torches and of wearing parts (steady temperature).

Cooling unit equipped with display of temperature and control of return flow plus coolant level.

**HOT WIRE**
Productivity improvement by increasing the deposition rate

For filling bevels 40 mm deep, the use of hot filler wire provides a good solution and is particularly suited to applications where a high specification of the welded joint is required. This special technique uses an auxiliary current to bring the end of the wire to near its melting point.

Viable for plates of thickness 10 mm and above, the use of hot filler wire enables 2.5 to 3 kg of metal to be deposited per hour for filling bevels using multiple passes or for quality hard-surfacing:
- additional power source for the hot wire current between 60A and 120A,
- no additional wire feed thanks to direct connection on the cold wire system.
Welding in line pipe

Applications:
Air Liquide Welding proposes solutions for in line pipe welding to be integrated into pipe mills:
- monocathode installation with MEC4 TIG torch for tube thickness 0.5 to 3 mm,
- monocathode installation with SP7 plasma torch for tube thickness 2.5 to 8 mm,
- tricathode installation with E16 torch for tube thickness 0.5 to 1.5 mm,
- tricathode installation with E25 torch for tube thickness 1 to 3.5 mm,
- tricathode installation with combination of TIG + PLASMA + TIG torches for tube thickness 2.5 to 8 mm.

Piping: Chemical, Petrochemical, Nuclear power industry, Boilers and heat exchanger, Off shore, Cryogenic, Shipbuilding, Military and Aeronautic...
Structure: Industrial building, Commercial center...
Ornamental: Door, Windows, General railing, Furniture, Decoration...

Typical performances:

TRICATHODE process:
TRICATHODE welding consists of a sequence of three dual-flow TIG processes or a combination of TIG and Key hole plasma processes using a special welding torch. The first arc is fitted with an electromagnetcic arc deviation device.

Compared to other welding process used for this type of fabrication, Air Liquide Welding's TRICATHODE process is of particular interest in terms of performance flexibility, investment/performance ratio and operating costs.
Monocathode MEC4 or SP7
Package dedicated to TIG or plasma process without wire feed device and arc voltage control, the pipe line machine assuring a constant arc height.
Main components of the package:
- power source 450 A at 100%, smooth current welding,
- MEC4 TIG torch or SP7 plasma torch,
- remote control,
- HF starting unit.

Tricathode E16 or E25
The basic system consists mainly of:
- 3 x power sources 400 A each at 100%, smooth current welding,
- E25 or E16 welding torch with combinaison of 3 x TIG dual flux arcs,
- Control panel with current control, digital voltage and current displays for each arc, adjustment and displays of gas flow setting, adjustment of electromagnetic arc on first electrode,
- HF starting unit,
- welding head mounting assembly.

E16 torch
- Implements the dual flow tricathode process
- 200 Amp per electrode (total 600 Amp)
- Independant adjustment of each electrode to the shoe (one piece design)
- Electrode tungsten Ø 2.4 mm and 3.2 mm
- Typical application (wall thickness): 0.5 to 1.5 mm

E25 torch
- Implements the dual flow tricathode process
- 400 Amp per electrode (total 1200 Amp)
- Independant adjustment of each electrode to the shoe (one piece design)
- Electrode tungsten Ø 3.2 and Ø 4 mm
- Typical application (wall thickness): 1 to 3.5 mm

SP7 plasma torch
- 450 A at 100%
- Typical application (wall thickness): 2.5 to 8 mm

Tricathode TIG + PLASMA +TIG
The basic system consists mainly of:
- 3 x power sources NERTAMATIC 450 Plus,
- 450 A each at 100%, smooth or pulsed current welding,
- combination of 3 x welding torches: TIG + PLASMA + TIG process,
- control panel with current control, digital voltage and current displays for each arc, adjustment and displays of gas flow setting, adjustment of electromagnetic arc on first electrode,
- torches interface including HF source,
- welding head mounting assembly.

TPT welding head
- Two MEC4 TIG torches
- One SP7 plasma torch
- Independant adjustment on each torch
- Typical application (wall thickness): 2.5 to 8 mm
Applications:

TOPTIG process is a major innovation in the world of automatic welding. Developed in the Air Liquide Welding research center, TOPTIG is a new process development from arc welding classical solutions. This new process can be used effectively on carbon or stainless steel plates up to 3 mm or on galvanized sheets with weld brazing. The activities sectors are:

- automotive subcontracting,
- fine boiler making,
- metal furniture,
- aeronautics subcontracting.

Process

TOPTIG allows a better accessibility for welding complex structures. It offers very good performance concerning speed, and quality (spatter free).

Installation

Air Liquide welding offers two types of TOPTIG installation with flat or pulsed current. It can drive a constant or pulsed wire feed which is synchronized with the welding current.

TOPTIG 220DC

TOPTIG 220 DC supplies 220 A at 100% duty cycle. The RC-JOB permits a complete welding cycle to be programmed. Program selection and chaining is carried out by analog signals.

TOPTIG NERTAMATIC 450 PLUS

NERTAMATIC 450 Plus supplies 450 A at 100% duty cycle. The console permits a complete welding cycle to be programmed. Program selection is carried out by binary code, and program chaining by pulse. Torch capacity limited to 350 A at 100% using a water cooled nozzle.

TOPTIG innovative process principle

In TIG automatic welding mode, the filler wire is fed into the weld pool in front of the torch. In the TOPTIG process, the filler wire is fed through the welding nozzle in the area where the temperature is the highest. The wire therefore melts into small droplets exactly as in the MIG process.

The use of a pulsed current synchronized with wire gives better control over the welding operation.

Torch accessibility

Compared with a traditional automatic TIG torch, the compactness of the wire lead-in incorporated into the nozzle gives accessibility at an angle comparable with that obtained using a MIG/MAG torch.

This increases the scope for robotization and extends the range of workpieces which can be welded automatically.
Microplasma

Manual and automatic welding applications
For the manual or automatic assembly of thin precious metals in the thickness range: 0.05 - 1.0 mm (stainless steels, Inconel, titanium, silver and gold alloys). For the electric and electronics components industries, small containers, metal filters and tool repairs as well as sectors of the horology, goldsmith and medical industries.

Installation
PLASMAFIX 51 Characteristics:
- user friendly front panel,
- multilingual display,
- programmable welding cycles,
- 100 programmes memory,
- configuration adapted to the user’s needs,
- programme print out,
- also for TIG welding,
- equipped of RS 232 for coupling a P.C or printer,
- cooling by a liquid,
- tungsten electrodes: Ø 1.0 or 1.6 mm, 75 or 150 mm long

Installation with cooling unit on trolley

Torch maintenance box with set of wear

Torch maintenance box with set of wear

Torch command pedal
(replaces the torch’trigger)

Trigger and current adjustment pedal

Trolley
Able to receive the PLASMAFIX 51 power source, the cooling unit and two gas bottles.

Complements

Welding lathes
Precision circumferential machine for microplasma and TIG welding.

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Torches
Two types of torch for use in manual or automatic mode:

SP45 automatic
An SP20 manual or automatic torch can be supplied. This weights considerably less and has a maximum current rating of 20 A at 100%.
Plasma / TIG machines

The Plasma / TIG applications are multiple and varied, here some examples of machines which answer to the main customer needs.

Assembly of flat sheet metal and closure of vessel sections
Seamer bench for longitudinal welding.
The vessel is welded by plasma / TIG or plasma + TIG process inside the INTER seamer bench.

Assembly of vessels by conventional technique
Column and boom with rotators for circumferential welding.
To assemble 2 vessels, it’s possible to put them on rotators and the plasma column and boom carries out the circumferential welding.
Safety and operator comfort are guaranteed thanks to the control of the welding operation from the ground.

Assembly of vessels in vertical position
This technique is used mainly for large diameter vessels or products whose rigidity is low (ratio diameter, thickness, dimension).
The vertical assembly facilitates the handling of workpieces and reduce tooling needed.

Column and boom with turntable
for longitudinal and circumferential welding:
- longitudinal in vertical down position,
- circumferential in cornice position
**Pipe prefabrication assembly**

Mechanisation machine with plasma process and HPW control to weld pipes with elbows and flanges.

The work piece is positioned on the X-rotators and the motorised headstock carries out the rotation.

**Elliptical tank**

The plasma torch movement is controlled by the column and boom.

The Headstock HLM+F allows the rotation of the tank and ensures a high flexibility for the mounting and the holding of the piece.

**Pipe production full automatised process according to ASME codes**

Complete welding system with:

- Column and boom equipped with plasma + TIG process for external longitudinal and circular welding.
- Fixed internal boom equipped with TIG head for internal remelting.
- Pipe holding device with rotators on carriages to turn and move the pipe.