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## CONTINUOUS WIRE WELDING MACHINE FOR MIG-MAG AND FLUX, TIG, MMA WELDING FOR PROFESSIONAL AND INDUSTRIAL USE.

Note: The term "welding machine" will be used in the text that follows.

### 1. GENERAL SAFETY CONSIDERATIONS FOR ARC WELDING

The operator should be properly trained to use the welding machine safely and should be informed about the risks related to arc welding procedures, the associated protection measures and emergency procedures.

(Please refer to the applicable standard "EN 60974-9: Arc welding equipment. Part 9: Installation and Use).



- Avoid direct contact with the welding circuit: the no-load voltage supplied by the welding machine can be dangerous under certain circumstances.
- When the welding cables are being connected or checks and repairs are carried out the welding machine should be switched off and disconnected from the power supply outlet.
- Switch off the welding machine and disconnect it from the power supply outlet before replacing consumable torch parts.
- Make the electrical connections and installation according to the safety rules and legislation in force.
- The welding machine should be connected only and exclusively to a power source with the neutral lead connected to earth.
- Make sure that the power supply plug is correctly connected to the earth protection outlet.
- Do not use the welding machine in damp or wet places and do not weld in the rain.
- Do not use cables with worn insulation or loose connections.



- Do not weld on containers or piping that contains or has contained flammable liquid or gaseous products.
- Do not operate on materials cleaned with chlorinated solvents or near such substances.
- Do not weld on containers under pressure.
- Remove all flammable materials (e.g. wood, paper, rags etc.) from the working area.
- Provide adequate ventilation or facilities for the removal of welding fumes near the arc; a systematic approach is needed in evaluating the exposure limits for the welding fumes, which will depend on their composition, concentration and the length of exposure itself.
- Keep the gas bottle (if used) away from heat sources, including direct sunlight.



- Use electric insulation that is suitable for the torch, the workpiece and any metal parts that may be placed on the ground and nearby (accessible). This can normally be done by wearing gloves, footwear, head protection and clothing that are suitable for the purpose and by using insulating boards or mats.
- Always protect your eyes with the relative filters, which must comply with UNI EN 169 or UNI EN 379, mounted on masks or use helmets that comply with UNI EN 175. Use the relative fire-resistant clothing (compliant with UNI EN 11611) and welding gloves (compliant with UNI EN 12477) without exposing the skin to the ultraviolet and infrared rays produced by the arc; the protection must extend to other people who are near the arc by way of screens or non-reflective sheets.
- Noise: If the daily personal noise exposure (LEPd) is equal to or higher than 85 dB(A) because of particularly intensive welding operations, suitable personal protective means must be used (Tab. 1).



- The flow of the welding current generates electromagnetic fields (EMF) around the welding circuit. Electromagnetic fields can interfere with certain medical equipment (e.g. Pacemakers, respiratory equipment, metallic prostheses etc.). Adequate protective measures must be adopted for persons with these types of medical apparatus. For example, they must be forbidden access to the area in which welding machines are in operation. This welding machine conforms to technical product standards for exclusive use in an industrial environment for professional purposes. It does not assure compliance with the basic limits relative to human exposure to electromagnetic fields in the domestic environment.

The operator must adopt the following procedures in order to reduce exposure to electromagnetic fields:

- Fasten the two welding cables as close together as possible.
- Keep head and trunk as far away as possible from the welding circuit.
- Never wind welding cables around the body.
- Avoid welding with the body within the welding circuit. Keep both cables on the same side of the body.
- Connect the welding current return cable to the piece being welded, as close as possible to the welding joint.
- Do not weld while close to, sitting on or leaning against the welding machine (keep at least 50 cm away from it).
- Do not leave objects in ferromagnetic material in proximity of the welding

circuit.

- Minimum distance  $d = 20$  cm (Fig. R).



- Class A equipment:

This welding machine conforms to technical product standards for exclusive use in an industrial environment and for professional purposes. It does not assure compliance with electromagnetic compatibility in domestic dwellings and in premises directly connected to a low-voltage power supply system feeding buildings for domestic use.



#### EXTRA PRECAUTIONS

- WELDING OPERATIONS:

- In environments with increased risk of electric shock;
- In confined spaces;
- In the presence of flammable or explosive materials; **MUST BE evaluated in advance by an "Expert supervisor" and must always be carried out in the presence of other people trained to intervene in emergencies.**

All protective technical measures **MUST** be taken as provided in 7.10; A.8; A.10 of the applicable standard EN 60974-9: Arc welding equipment. Part 9: Installation and Use".

- Welding **MUST NOT** be allowed if the welding machine or wire feeder is supported by the operator (e.g. using belts).
- The operator **MUST NOT BE ALLOWED** to weld in raised positions unless safety platforms are used.
- **VOLTAGE BETWEEN ELECTRODE HOLDERS OR TORCHES:** working with more than one welding machine on a single piece or on pieces that are connected electrically may generate a dangerous accumulation of no-load voltage between two different electrode holders or torches, the value of which may reach double the allowed limit. An expert coordinator must be designated to measuring the apparatus to determine if any risks subsist and suitable protection measures can be adopted, as foreseen by section 7.9 of the applicable standard "EN 60974-9: Arc welding equipment. Part 9: Installation and Use".
- The use of the machine must be limited to the operator only.
- The operator must disconnect the cable and the electrode holder from the machine once the MMA welding is over.
- The area around the welding machine must be forbidden to third parties. It also should not be left unattended.
- The torches not in use should be stored in their housing.



#### RESIDUAL RISKS

- **OVERTURNING:** position the welding machine on a horizontal surface that is able to support the weight: otherwise (e.g. inclined or uneven floors etc.) there is danger of overturning.
- **IMPROPER USE:** it is hazardous to use the welding machine for any work other than that for which it was designed (e.g. de-icing mains water pipes).
- **IMPROPER USE:** the use the welding machine by more than one operator at the same time may be dangerous.
- **MOVING THE WELDING MACHINE:** Always secure the gas bottle, taking suitable precautions so that it cannot fall accidentally (if used).
- Do not use the handle to hang the welding machine.



The safety guards and moving parts of the covering of the welding machine and of the wire feeder should be in their proper positions before connecting the welding machine to the power supply.



**WARNING!** Any manual operation carried out on the moving parts of the wire feeder, for example:

- Replacing rollers and/or the wire guide;
- Inserting wire in the rollers;
- Loading the wire reel;
- Cleaning the rollers, the gears and the area underneath them;
- Lubricating the gears.

**SHOULD BE CARRIED OUT WITH THE WELDING MACHINE SWITCHED OFF AND DISCONNECTED FROM THE POWER SUPPLY OUTLET.**

## 2. INTRODUCTION AND GENERAL DESCRIPTION

This welding machine is a source of current for arc welding, made specifically for MAG welding carbon steel or weak alloys with CO<sub>2</sub> protective gas or Argon/CO<sub>2</sub> mixes, using tubular full or core electrode wires.

It is also ideal for MIG welding stainless steel with Argon gas containing + 1-2% oxygen and aluminium and CuSi3, CuAl8 (brazing) with Argon gas, using electrode wires that are suitable for the workpiece to be welded.

It is particularly suitable for light metalwork fabrication and in body shops, for welding galvanized plates, high stress stainless steel and aluminium. SYNERGIC operation ensures fast and easy welding parameter setting, always guaranteeing high arc control and welding quality.

The welding machine is designed for use with the SPOOL GUN torch, used to weld aluminium and steel in the presence of wide spaces between the generator and the piece to be welded (single torch version only).

The welding machine can be used for TIG welding in direct current (DC), with arc striking upon contact (LIFT ARC mode). It welds all types of steel (carbon, low- and high-alloy) and heavy metals (copper, nickel, titanium and their alloys) with a gas shield of pure (99.9%) Ar or, for special uses, with an Argon/Helium mix. It can also be used for MMA electrode welding in direct current (DC) using coated electrodes (rutile, acid, basic).

## 2.1 MAIN CHARACTERISTICS

### MIG-MAG

- Operating modes:

- manual;
- synergic;
- AB Pulse;
- AB PoP;
- Root Mig;
- Wire speed, welding current and voltage shown on the display.
- 2T, 4T, 4T Bi-level, Spot operation selection.
- SPOOL GUN (single torch version only), PUSH PULL, CONTROL TORCH automatic recognition.
- Automatic recognition of G.R.A. water cooling unit. (R.A. version only).

### TIG

- Start LIFT.
- Welding voltage and current shown on the TFT display.

### MMA

- Arc force, hot start adjusting.
- VRD device.
- Anti-stick protection.
- Welding voltage and current shown on the TFT display.

### OTHER

- Setting the language.
- Setting the metric or UK system.
- Setting the view mode (standard or easy).
- Possibility to set the machine parameters (voltage, current, wire speed).
- Possibility to save, retrieve, import and export customised software.
- Possibility to record and save welding jobs.

### PROTECTIONS

- Thermostatic safeguard.
- Protection against accidental short-circuits caused by contact between torch and earth.
- Protection against irregular voltage (power supply voltage too high or too low).
- Anti-stick (MMA).
- Protection against low pressure of the water cooling system of the torch (for the AQUA version only).

## 2.2 STANDARD ACCESSORIES

- Torch (single torch version only).
- 3 Torches (three torch version only).
- Torch holder stand.

## 2.3 OPTIONAL ACCESSORIES


- Argon bottle adapter.
- SPOOL GUN (single torch version only).
- Self darkening mask.
- MIG/MAG welding kit.
- MMA welding kit.
- TIG welding kit.
- CONTROL torch (UP & DOWN)
- PUSH PULL torch.
- PUSH PULL board kit.
- G.R.A. water cooling unit (R.A. version only).

## 3. TECHNICAL DATA

### 3.1 DATA PLATE

The most important data regarding use and performance of the welding machine are summarised on the rating plate and have the following meaning:

#### Fig. A

- 1- EUROPEAN standard of reference, for safety and construction of arc welding machines.
- 2- Symbol for internal structure of the welding machine.
- 3- Symbol for welding procedure provided.
- 4- Symbol **S**: indicates that welding operations may be carried out in environments with heightened risk of electric shock (e.g. very close to large metallic volumes).
- 5- Symbol for power supply line:
  - 1- : single phase alternating voltage;
  - 3- : 3-phase alternating voltage.
- 6- Protection rating of the covering.
- 7- Technical specifications for power supply line:
  - $U_1$  : Alternating voltage and power supply frequency of welding machine (allowed limit  $\pm 10\%$ ).
  - $I_{1\max}$  : Maximum current absorbed by the line.
  - $I_{1\text{eff}}$  : effective current supplied.
- 8- Performance of the welding circuit:
  - $U_0$  : maximum no-load voltage (open welding circuit).
  - $I_2/U_2$  : current and corresponding normalised voltage that the welding machine can supply during welding.
  - **X** : Duty cycle: indicates the time for which the welding machine can supply the corresponding current (same column). It is expressed as %, based on a 10 min. cycle (e.g. 60% = 6 minutes working, 4 minutes pause, and so on). If the usage factors (on the plate, referring to a 40°C environment) are exceeded, the thermal safeguard will trigger (the welding machine will remain in standby until its temperature returns within the allowed limits).
  - **AV-AV** : shows the range of adjustment for the welding current (minimum maximum) at the corresponding arc voltage.
- 9- Manufacturer's serial number for welding machine identification (indispensable for technical assistance, requesting spare parts, discovering product origin).
- 10-  : Size of delayed action fuses to be used to protect the power line.
- 11- Symbols referring to safety regulations, whose meaning is given in chapter 1 "General safety considerations for arc welding".

Note: The data plate shown above is an example to give the meaning of the symbols and numbers; the exact values of technical data for the welding machine in your possession must be checked directly on the data plate of the welding machine itself.

### 3.2 OTHER TECHNICAL DATA:

- **WELDING MACHINE:** see table 1 (TAB. 1)
  - **MIG TORCH:** see table 2 (TAB. 2)
  - **TIG TORCH:** see table 4 (TAB. 4)
  - **ELECTRODE-HOLDER CLAMP:** see table 5 (TAB. 5)
- The weight of the welding machine is given in table 1 (TAB. 1).

## 4. WELDING MACHINE DESCRIPTION

### 4.1 CONTROL, ADJUSTMENT AND CONNECTING DEVICES.

#### 4.1.1 WELDING MACHINE (Fig. B)






##### At the front:

- 1- Control panel (see description);
- 2- Torch connection and SPOOL GUN (single torch version only);
- 3- PUSH PULL, CONTROL and SPOOL GUN (single torch version only) control cable connector;
- 4- Positive (+) quick coupling for connecting the welding cable;
- 5- Negative (-) quick coupling for connecting the welding cable;
- 6- Earth return cable and clamp;
- 7- SPOOL GUN (optional);
- 8- Welding cable and torch;
- 9- Return connector (red) for cooling liquid (for the AQUA version only);
- 10- Input connector (blue) for cooling liquid (for the AQUA version only);
- 11- Liquid tank cap (for the AQUA version only).

##### At the back:

- 12- Main ON/OFF switch;
- 13- Power cable;
- 14- Hose connector for torch protective gas;
- 15- G.R.A. protection fuse (R.A. version only);
- 16- Pipe connector for torch shielding gas T1;
- 17- Pipe connector for torch shielding gas T2;
- 18- Pipe connector for torch shielding gas T3;

#### 4.1.2 WELDING MACHINE CONTROL PANEL (Fig. C)

- 1- TFT Display.
- 2- Manual wire jog button. This jogs the wire forward in the torch sheath without having to touch the torch button; this is a momentary action and the speed is set and fixed.
- 3- Manual gas solenoid valve start button. This enables the flow of gas (pipe bleeds, flow rate adjustment) without the need to use the torch button; once pressed, the solenoid valve remains enabled for 10 seconds or until it is pressed again.
- 4- Multi-function button:
  -  : access to the main menu;
  -  : enabling/disabling of the parameter to be displayed on the welding screen;
- 5- Multi-function knob:
  - rotate the knob to scroll through the various menu items;
  - press to access the selected item, rotate to change the setting, press again to confirm the value;
  - press and hold for at least 3 seconds to set the variables in synergic mode (material type, wire diameter, gas type, 2T, 4T, 4T bi-level, SPOT).
- 6- Multi-function button:
  -  : access to the parameter to be displayed on the welding screen;
  -  : back to the main menu.
  -  : confirmation of the chosen values.
- 7- USB port.

## 5. INSTALLATION



**WARNING! ALL INSTALLATION OPERATIONS AND ELECTRICAL CONNECTIONS MUST ALWAYS BE CARRIED OUT WITH THE WELDING MACHINE SWITCHED OFF AND DISCONNECTED FROM THE POWER SUPPLY. THE ELECTRIC CONNECTIONS MUST ONLY BE CARRIED OUT BY EXPERT OR QUALIFIED TECHNICIANS.**

#### ASSEMBLY (Fig. D, D1, D2a-b)

Unpack the welding machine and assemble the separate parts included in the package.

#### Assembling the clamp-return cable Fig. E

#### Assembling the welding cable electrode-holder clamp FIG. F

**G.R.A. installation (AQUA version only): see instruction manual inside the water cooling system.**



#### 5.1 POSITIONING THE WELDING MACHINE

Choose the place where the welding machine is to be installed so that there are no obstructions to the cooling air inlets and outlets; at the same time make sure that conductive dust, corrosive vapours, humidity etc. cannot be drawn into the machine. Leave at least 250 mm of free space all around the welding machine.



**WARNING! Position the welding machine on a level surface with sufficient load-bearing capacity, so that it cannot be tipped over or shift dangerously.**

#### 5.2 CONNECTION TO THE MAIN POWER SUPPLY

- Before making any electrical connection, check the rating plate data on the welding machine to make sure they correspond to the voltage and frequency of the available power supply where the machine is to be installed.
- The welding machine must be connected only and exclusively to a power supply with the neutral conductor connected to earth.
- To guarantee protection against indirect contact use the following types of residual current devices:
  - Type A (  ) for single-phase machines.
  - Type B (  ) for 3-phase machines.
- In order to satisfy the requirements of the EN 61000-3-11 (Flicker) standard we recommend connecting the welding machine to the interface points of the main power supply that have an impedance of less than  $Z_{max} = 0,24 \text{ ohm}$ .
- The welding machine is not within the requirements of standard IEC/EN 61000-3-12.

If it is connected to a public power mains, the installer or the user is responsible for checking the welding machine can be connected (if necessary, consult the mains power supply provider).

#### 5.2.1 Plug and socket

##### (1-)

Connect the power cable plug to a mains socket equipped with fuses or an automatic switch; the specific earth lug must be connected to the earth conductor (yellow-green) of the power supply line.

##### (3-)

Connect a standard plug (3P + E) to the power supply cable with adequate capacity and use a mains socket equipped with fuses or an automatic switch; the specific earth lug must be connected to the earth conductor (yellow-green) of the power supply line. Table 1 (TAB. 1) provides the recommended values in amperes of the line slow blow fuses chosen based on the max. nominal current supplied by the welding machine, and at the power supply nominal voltage.



**WARNING! Non-compliance with the above regulations renders the manufacturer's safety system (class I) inefficient, with resulting serious risks to people (e.g. electric shock) and things (e.g. fire).**

#### 5.3 WELDING CIRCUIT CONNECTION

##### 5.3.1 Recommendations



**ATTENTION! BEFORE CARRYING OUT THE FOLLOWING CONNECTIONS, MAKE SURE THE WELDING MACHINE IS OFF AND DISCONNECTED FROM THE MAINS.**

Table 1 (TAB. 1) gives the recommended values for welding cables (in mm<sup>2</sup>) according to the maximum energy supplied by the welding machine.

In addition:

- Fully rotate the welding cable connectors in the quick couplings (if present), to guarantee perfect electric contact; if this is not the case the connectors will overheat with consequent fast deterioration and loss of efficiency.
- Use the shortest welding cables possible.
- Do not use metal structures that are not part of the workpiece to replace the welding current return cable; this can endanger safety and give unsatisfactory welding results.

##### 5.3.2 WELDING CIRCUIT CONNECTION IN MIG-MAG MODE

###### 5.3.2.1 Connecting the gas bottle (if used)

- Gas bottle that can be loaded onto the supporting surface of the trolley: max. 30 kg.
- When using Argon gas or an Argon/CO<sub>2</sub> mixture, screw the pressure reducer(\*) onto the gas bottle valve, placing the relative pressure reducing valve supplied as an accessory.
- Connect the gas input hose to the pressure reducing valve and tighten the strip.
- Loosen the adjustment ring nut of the pressure reducing valve before opening the gas bottle valve.

(\*) Accessory to be purchased separately if not supplied with the product.

###### 5.3.2.2 Connecting the welding current return cable

Connect the cable to the piece to be welded or the metal bench on which the workpiece is placed, as close as possible to the joint being worked.

###### 5.3.2.3 Torch (Fig. B)

Insert the torch (B-8) into the dedicated connector (B-2), fully tightening the locking ring nut manually. Prepare the torch to receive the wire for the first time, removing the nozzle and the contact pipe, to make exiting easier.

Connect the outside cooling pipes to the relative plugs and pay attention to the following:



: LIQUID INPUT (Cold - blue connector)



: RETURN LIQUID (Hot - red connector)

###### 5.3.2.4 Spool gun (single torch version only) (Fig. B)

Insert the spool gun (B-6) into the dedicated connector (B-2), fully tightening the locking ring nut manually. Also insert the control cable connector into the relative socket (B-5). The welding machine automatically acknowledges the spool gun.

#### 5.3.3 WELDING CIRCUIT CONNECTION IN TIG MODE

##### 5.3.3.1 Connecting the gas bottle

- Screw the pressure reducer onto the gas bottle valve, placing the relative reduction supplied as an accessory between them;
- Connect the gas input hose to the pressure reducing valve and tighten the supplied strip.
- Loosen the adjustment ring nut of the pressure reducing valve before opening the gas bottle valve.
- Open the gas bottle and adjust the quantity of gas (l/min.) according to the recommended usage data, see table (TAB. 6); the gas flow can be adjusted while welding, always using the ring nut of the pressure reducer. Check the seal of the hoses and connections.



**ATTENTION! Always close the gas bottle valve when you have finished working.**

##### 5.3.3.2 Connecting the welding current return cable

- Connect it to the piece to be welded or the metal bench on which the workpiece is placed, as close as possible to the joint being worked. Connect this cable to the clamp with the symbol (+) (Fig. B-7).

##### 5.3.3.3 Torch

- Insert the current cable into the relative quick coupling (-) (Fig. B-8). Connect the gas hose of the torch to the gas bottle

#### 5.3.4 WELDING CIRCUIT CONNECTION IN MMA MODE

Almost all the coated electrodes are connected to the positive pole (+) of the generator, with an exception for acid coated electrodes, which must be connected to the negative pole (-).

### 5.3.4.1 Welding wire clamp electrode-holder connection

Takes a special clamp for tightening the uncovered part of the electrode to the terminal. Connect this cable to the clamp with the symbol (+) (Fig. B-7).

### 5.3.4.2 Connecting the welding current return cable

Connect it to the piece to be welded or the metal bench on which the workpiece is placed, as close as possible to the joint being worked. Connect this cable to the clamp with the symbol (-) (Fig. B-8).

### 5.4 LOADING THE WIRE SPOOL (Fig. G, G1, G2)



**ATTENTION! BEFORE LOADING THE WIRE, MAKE SURE THE WELDING MACHINE IS OFF AND DISCONNECTED FROM THE MAINS.**

MAKE SURE THE WIRE FEEDERS, THE WIRE GUIDE HOSE AND THE TORCH CONTACT PIPE CORRESPOND WITH THE DIAMETER AND NATURE OF THE WIRE TO BE USED AND THAT THEY ARE CORRECTLY MOUNTED. DO NOT WEAR PROTECTIVE GLOVES WHEN THREADING THE WIRE.

- Open the reel area door.
- Unscrew the spool lock nut.
- Position the wire spool on the reel; make sure the reel pulling pin is correctly housed in its hole (1a).
- Tighten the spool lock nut, using spacers as and where necessary (1a).
- Free the pressure counter-roller/s and distance it/them from the lower roller/s (2a);
- Make sure the pulling feeder/s is/are suitable for the wire being used (2b).
- Free the wire end, cut off the misshaped end by cutting it cleanly and without leaving a burr; rotate the spool counter-clockwise and position the wire end into the wire feed input, pushing it by 50-100 mm into the torch connecting wire feed (2c).
- Reposition the counter-roller/s, adjusting the pressure at an intermediate value, make sure the wire is positioned correctly in the hollow of the lower feeder/s (3).
- Remove the nozzle and contact tube (4a).
- Insert the welding machine plug into the mains socket, switch on the welding machine, press the torch push-button or the wire forward push-button (Fig. C-2) and wait for the end of the wire which is running along the whole wire feed casing, to exit by 10-15 cm from the front of the torch, then release the push-button.



**ATTENTION! During these operations the wire is being powered and is subject to mechanical force; if suitable precautions are not taken there is a danger of electric shock and wounds, and electric arcs striking:**

- Do not direct the torch mouth against parts of the body.
- Do not approach the torch gas cylinder.
- Remount the contact tube and the nozzle onto the torch (4b).
- Make sure the wire exits regularly; set the roller pressure and reel braking (1b) to the lowest values possible, making sure the wire does not slide in the hollow and that when the drive stops the wire turns do not become loose because of too much spool inertia.
- Cut the end of the wire that exits from the nozzle by 10-15 mm.
- Close the reel area door.

### 5.5 REPLACING THE TORCH WIRE GUIDE SHEATH (FIG. H)

Before replacing the sheath, straighten out the torch cable to make sure there are no loops.

#### 5.5.1 Spiral sheath for steel wire

- 1- Remove the nozzle and contact tube from the torch head.
- 2- Unscrew the sheath lock nut on the central connector and slide out the existing sheath.
- 3- Slide the new sheath into the torch cable and gently push it until it comes out of the torch head.
- 4- Hand tighten the sheath lock nut back in place.
- 5- Cut the wire flush with the sheath and gently squeeze them together; remove it from the torch cable.
- 6- Bevel the sheath cutting zone and reposition it in the torch-cable duct.
- 7- Use a key to tighten the lock nut back in place.
- 8- Remount the contact tube and the nozzle.

#### 5.5.2 Synthetic sheath for aluminium wire

Perform operations 1, 2 and 3 foreseen for steel sheaths (do not consider operations 4, 5, 6, 7 and 8).

- 9- Screw the aluminium contact tube back in place checking that it comes into contact with the sheath.
- 10- Insert the brass nipple, the OR ring onto the opposite end of the sheath (torch coupling side), maintain a light pressure on the sheath and tighten the sheath lock nut. The excess section of the sheath shall be removed later on (see (13)). Slide out the capillary tube for steel sheaths from the wire feeder torch coupling.
- 11- NO CAPILLARY TUBE IS FORESEEN for aluminium sheaths with diameters of 1.6-2.4 mm (yellow colour); the sheath will be inserted in the torch coupling without it.  
Cut the capillary tube for aluminium sheaths measuring 1-1.2 mm (red colour) to a length of 2 mm less than the one used for the steel tube and insert it on the free end of the sheath.
- 12- Insert and block the torch in the wire feeder coupling, mark the sheath at 1-2 mm from the rollers, now extract the torch again.
- 13- Cut the sheath to the foreseen measurement without deforming the inlet hole.  
Remount the torch in the wire feeder coupling and mount the gas nozzle.

### 5.6 LOADING OF THE WIRE COIL ON SPOOL GUN (single torch version only) (Fig. I)



**ATTENTION! BEFORE LOADING THE WIRE, MAKE SURE THE WELDING MACHINE IS OFF AND DISCONNECTED FROM THE MAINS. OR THAT THE SPOOL GUN IS DISCONNECTED FROM THE WELDING MACHINE.**

MAKE SURE THE WIRE FEEDERS, THE WIRE GUIDE HOSE AND THE SPOOL GUN CONTACT PIPE CORRESPOND WITH THE DIAMETER AND NATURE OF THE WIRE TO BE USED AND THAT THEY ARE CORRECTLY MOUNTED. DO NOT WEAR PROTECTIVE GLOVES WHEN THREADING THE WIRE.

- Remove the cover by unscrewing the relative screw (1).
- Position the wire coil onto the reel.
- Release the pressure counter-roller and distance it from the lower roller (2).
- Free the wire end, cut off the misshaped end by cutting it cleanly and without leaving a burr; rotate the reel counter-clockwise and position the wire end into the wire feed

input, pushing it by 50-100 mm into the torch swan neck (2).

- Reposition the counter-roller, adjusting the pressure at an intermediate value, make sure the wire is positioned correctly in the hollow of the lower roller (3).
- Gently stop the reel, using the relative adjustment screw.
- With the SPOOL GUN connected, insert the welding machine plug into the mains socket, switch on the welding machine, press the spool gun push-button and wait for the end of the wire which is running along the whole wire feed casing, to exit by 100-150 mm from the front of the torch, then release the torch push-button.

## 6. MIG-MAG WELDING PROCESS DESCRIPTION

### 6.1 SHORT ARC

The wire melts and the weld bead detaches because the wire tip in the weld pool short-circuits (up to 200 times per second). The free length of the wire (stick-out) is normally between 5 and 12 mm.

#### Carbon, low-alloy steel

- Usable wire diameter: 0.6-0.8-0.9-1.0 mm (1.2 mm version 270A only)  
(1.2 and 1.6 mm version 400A only)  
CO<sub>2</sub> or Ar/CO<sub>2</sub> mixtures

#### Stainless steel

- Usable wire diameter: 0.8-0.9-1.0 mm (1.2 mm version 270A only)  
(1.2 and 1.6 mm version 400A only)  
Ar/O<sub>2</sub> or Ar/CO<sub>2</sub> mixtures (1-2%)

#### Aluminium and CuSi/CuAl

- Usable wire diameter: 0.8-1.0 mm (1.2 mm version 270A and 400A only)
- Usable gas: Ar

### PROTECTIVE GAS

The protective gas flow rate must be 8-14 l/min.

### 6.2 TRANSFERRING TO AB PULSE MODE (PULSE ARC)

This is a "controlled" transfer located in the "spray-arc" (modified spray-arc) function zone and therefore has the advantages of fast welding and no seams with remarkably low current values, which can satisfy the requirements of many typical "short-arc" applications.

Each current pulse corresponds to the detachment of a single drop of the electrode wire; this takes place at a frequency which is proportionate to the wire feeder speed, with variations related to the type and diameter of the wire itself (typical frequency values: 20-300Hz).

#### Aluminium:

- Usable wire diameter: 0.8-1.0 mm (1.2 mm version 270A, 400A and 3 torches only)
- Welding current range: 30÷200A
- Welding voltage range: 16-27V
- Usable gas: Ar 99.9%

#### CuSi/CuAl:

- Usable wire diameter: 0.8 mm (1.0 mm version 270A and 400A only)
- Welding current range: 40÷200A
- Welding voltage range: 17-25V
- Usable gas: Ar 99.9%

#### Stainless steel (version 270A, 400A and 3 torches only):

- Usable wire diameter: 0.8-1.0 mm
- Welding current range: 40÷250A
- Welding voltage range: 15-25V
- Usable gas: Ar/O<sub>2</sub> or Ar/CO<sub>2</sub> mixtures (1-2%)

Typically the contact tube must be inside the nozzle by 5-10 mm, the further it is in, the higher the arc voltage will be; the stick-out of the wire will normally measure from 10 to 12 mm.

**Application:** welding in "position" on medium-small thicknesses and on thermally susceptible materials, particularly suitable for light alloys (aluminium or al alloys) even on thicknesses under 3 mm.

### PROTECTION GAS

The protective gas flow rate must be 12-20 l/min.

### 6.3 TRANSFERRING TO ROOT MIG MODE







ROOT MIG is a particular type of Short Arc MIG welding designed to maintain the welding bath even colder than the Short Arc itself. Thanks to the very low level of heat, it is possible to deposit welding material with minimal deformation of the surface of the piece being processed. ROOT MIG is therefore ideal for manual filling of gaps and cracks. Furthermore, compared to the TIG welding mode, the filling operation does not require filling material and is easier and quicker to perform. The ROOT MIG programs are specific for working carbon steel and low-alloy steels.

## 7. MIG-MAG OPERATION MODE

### 7.1 Operating in manual mode

Manual mode settings (Fig. L-1)

The user can customise the following welding parameters (Fig. L-2):

-  : welding voltage;
-  : wire feed speed;
-  : Post-gas. Use to adapt the protective gas outflow starting from when welding is stopped.
-  : Electronic reactance. A higher value determines a hotter welding bath;
-  : Burn-back. Use to adjust the wire burn-back time when welding is stopped;
-  : Soft-start. Use to adjust wire feed rate as welding starts, in order to optimise arc strike.

The actual welding settings (wire speed, welding current and voltage) are shown in the top section of the display.

#### 7.1.1 Parameters setting with spool gun (single torch version only)









In manual mode, the wire feeding speed and the welding voltage are adjusted separately. The spool gun knob (Fig. L-5) adjusts the wire speed, whilst the welding voltage is adjusted via the display.

## 7.2 Synergic operating mode.

Synergic mode settings (Fig. L-3).

Press and hold the knob C-5 for at least 3 seconds to access the material, thread diameter and gas type settings menu. (Fig. L-4). The welding machine sets itself automatically in the best operation conditions established by the different synergy curves that are saved. The user only has to select the material thickness to begin welding.

The user can also customise the following welding parameters (Fig. L-5):

-  : Arc correction according to preset arc voltage.
-  : Wire feed speed.
-  : Material thickness.
-  : Welding current.
-  : Electronic reactance correction according to preset value.
-  : Burn-back correction. Use to correct the wire burn-back time when welding is stopped in relation to the preset time.
-  : Post-gas. Use to adapt the protective gas outflow starting from when welding is stopped.
-  : Welding current SLOPE DOWN. Used to gradually reduce the current on releasing the torch button.

N.B.: The current welding parameters, wire feeding speed and material thickness are related to each other based on a synergic curve.

The actual welding settings (wire speed, welding current and voltage) are shown in the top section of the display.

### 7.2.1 ATC Mode (Advanced Thermal Control)



This is enabled automatically when the thickness selected is less or equal to 1.5 mm. Description: the particular instantaneous control of the welding arc and the ultra rapid correcting of parameters minimize current spikes, something that is characteristic of Short Arc transfer procedures, to the advantage of a low thermal load on the piece to be welded. The result, on the one hand, is reduced deformation of materials and, on the other, a fluid and accurate transfer of the weld material and the creation of a welding seam that is easy to model.

Advantages:

- easy welding of thin materials;
- decreased deformation of material;
- stable arc even when working with low currents;
- rapid and accurate spot welding;
- easier coupling of spaced sheets.

### 7.2.2 Use of the spool gun (single torch version only)

All the settings procedures (material, wire diameter, gas type) are described above.



The spool gun knob (Fig. I-5) adjusts the wire speed (and the welding current and thickness simultaneously). The user only has to adjust the arc voltage via the display (if necessary).

### 7.3 AB Pulse operating mode

Pulse mode settings (Fig. L-6).

Press and hold the knob C-5 for at least 3 seconds to access the material, thread diameter and gas type settings menu. (Fig. L-4). The welding machine sets itself automatically in the best operation conditions established by the different synergy curves that are saved. The user only has to select the material thickness to begin welding.

An additional two parameters are available compared to the synergic operating mode:







-  : Inrush current.
-  : Duration of inrush current. If the parameter is set to zero, this function is disabled.

### 7.4 AB PoP (PULSE on PULSE) operating mode

Pulse mode settings (Fig. L-7).

PoP mode is used to perform pulse welding with 2 current levels ( $I_2$  and  $I_1$ ) with a duration of T2 and T1 respectively.

The following variables are available compared to the PULSE operating mode:

-  : Secondary welding current;
-  : Secondary arc correction according to preset arc voltage;
-  : Secondary wire feed speed;
-  : Secondary material thickness;
-  : Duration of  $I_2$  current;
-  : Duration of  $I_1$  current.

### 7.5 ROOT MIG operating mode

ROOT MIG mode settings (Fig. L-8).

The settings available are the same as those for synergic mode (see 7.2).

## 7.6 Setting of T1, T2, T3 torch (3 torch version only)

The setting of the torch T1, T2, T3 can be done in two ways:

- Press the torch button of the torch to be used for one second until you select the corresponding icon;
- Select the torch via the SETTINGS menu (see chap. 13.5).

**Note:** by pressing the two buttons (Fig. C-2 and Figure C-3) at the same time, you get a display of the setting of all the three torches.

For optimum welding it is advisable to use the correct combination of torch, wirefeeder and material. See Table 3 (TAB. 3).

## 8. CONTROLLING THE TORCH PUSH-BUTTON

### 8.1 Setting the torch push-button control mode (Fig. L-9)

Press the knob (Fig. B-5) for at least 3 seconds to access the parameter settings menu.

### 8.2 Torch push-button control mode

It is possible to set 4 different torch push-button control modes:

#### 2T mode



Welding begins when the torch push-button is pressed and ends when the push-button is released.

#### 4T mode



Welding begins when the torch push-button is pressed and released, and ends only when the torch push-button is pressed and released a second time. This mode is useful for long welding operations.

#### 4T Bi-Level mode




Welding begins when the torch push-button is pressed and released. Each time it is pressed/released it switches from current ( $I_2$  symbol) to current ( $I_1$  symbol) and vice-versa. It only terminates when the torch push-button is pressed for a certain set time.

#### Spot welding mode



Used for MIG/MAG spot welding with control of welding duration.

## 9. WELDING WITH G.R.A. (R.A. version only).

The welding machine recognizes automatically the G.R.A. connection. On the display there appears the symbol . When the torch pushbutton is pressed, the G.R.A.

is activated. It is possible to disable the G.R.A. function, by following the instructions reported in chap. 12. In this case on the display there appears the symbol .

## 10. MMA WELDING: PROCESS DESCRIPTION

### 10.1 GENERAL PRINCIPLES

- It is essential to follow the recommendations provided by the manufacturer on the electrode packaging which indicates the correct electrode polarity and relative rated current.
- Welding current is regulated to suit the diameter of the electrode being used and the type of soldering to be performed; an example of the currents used for the various electrode diameters can be seen below:

Ø Electrode (mm)	Welding current (A)	
	Min.	Max.
1.6	30	50
2.0	40	80
2.5	60	110
3.2	90	140
4.0	120	180
5.0	170	250
6.0	230	270

- One can see that for the same diameter electrode, high levels of current will be used for flat welding, whilst lower current levels will be used for vertical or overhead welding.

- The mechanical characteristics of the welded joint are determined by the intensity of the selected current and also other welding parameters such as the length of the arc, the operating speed and position, the diameter and quality of the electrodes (to ensure correct conservation, use special packaging or containers to store and protect the electrodes against humidity).

#### WARNING:

**Instability of the arc due to the composition of the electrode can occur, depending on the brand, type and thickness of the electrode coatings.**

### 10.2 PROCEDURE

- Keeping the mask IN FRONT OF YOUR FACE, rub the tip of the electrode on the piece to be welded, moving as if striking a match; this is the most correct method for igniting the arc.


**WARNING: DO NOT TAP the electrode against the workpiece, which could damage the coating and make arc striking difficult.**

- As soon as the arc has struck, try to keep the electrode at a distance from the workpiece that is equivalent to the diameter of the electrode being used, and keep this distance as constant as possible while welding; remember that the electrode angle while moving forward must be approx. 20-30 degrees.

- At the end of the welding seam, take the electrode end slightly back as to the forward direction, above the crater to fill it, then quickly lift the electrode from the weld pool to switch off the arc (Aspects of the welding seam - FIG. M).

### 10.3 MMA mode settings (Fig. L-10)

The user can customise the following welding parameters (Fig. L-11):

-  : Welding current measured in Amperes.

**HOT START** : This is the initial "HOT START" overcurrent, the display shows the percentage increase as to the value of the selected welding current. This adjustment improves starting.

**ARC FORCE** : This is the dynamic "ARC-FORCE" overcurrent, the display shows the percentage increase as to the value of the pre-selected welding current. This adjustment improves welding fluidity, prevents the electrode from adhering to the workpiece and makes it possible to use different types of electrodes.

**VRD** : ON/OFF: this enables or disables the device that reduces the loadless output voltage (ON or OFF setting). With the VRD enabled, operator safety increases when the welding machine is on but not in the welding mode. The actual welding settings (welding current, voltage and the diameter of the suggested electrode) are shown in the left section of the display.

## 11. TIG DC WELDING: PROCESS DESCRIPTION

### 11.1 GENERAL PRINCIPLES

TIG DC welding is suitable for all types of low-alloy and high carbon steel, and heavy metals such as copper, nickel, titanium and their alloys (FIG. N). An electrode with 2% Cerium (grey band) is normally used for TIG DC welding with electrode at the (-) pole. The tungsten electrode must be axially sharpened using a grinding wheel, see FIG. O; make sure the tip is perfectly concentric to prevent arc deviation. The electrode must be ground along its length. This operation must be repeated periodically according to the use and wear state of the electrode, or when the electrode itself has been accidentally contaminated, oxidised or used incorrectly. For the welding to be good, the exact diameter of the electrode must be used with the exact current, see table (TAB. 6). The electrode normally projects from the ceramic nozzle by 2-3 mm, but can reach 8 mm for welding edges.

The weld is created by the edges that melt. Filler metal is not needed when welding suitably prepared thin material (up to about 1 mm) (FIG. P).

A greater thickness requires rods made from the same material as the basic material and with a suitable diameter, with edges that have been suitably prepared (FIG. Q). For welding to be successful, the pieces must be carefully cleaned and free from oxide, grease, oil, solvent, etc.

### 11.2 PROCEDURE (LIFT STRIKE)

- Use the knob B-5 to adjust the welding current to the required rate; adjust this value during welding processes to adapt to the actual heat transfer required.
- Make sure the gas is flowing correctly. The arc ignites through contact, distancing the tungsten electrode from the workpiece. Igniting in this manner causes less electric-irradiated disturbances and reduces tungsten inclusions and electrode wear to a minimum.
- Place the tip of the electrode on the workpiece, pressing gently.
- Immediately lift the electrode by 2-3 mm to obtain the ark strike. The welding machine initially supplies reduced current. After a few seconds, the set welding current is issued.
- Quickly lift the electrode from the workpiece to interrupt welding.

### 11.3 TFT DISPLAY IN TIG MODE (Fig. L-12)

The actual welding settings (welding current and voltage) are shown in the left section of the display.

## 12. ALARM SIGNALS (TAB. 7)

Reset is automatic when the reason for alarm activation stops. Alarm messages that can appear on the display:



DESCRIPTION
Thermal protection alarm
Overvoltage/undervoltage alarm
Auxiliary voltage alarm
Welding overcurrent alarm
Torch short-circuit alarm
Alarm for wirefeeder failure
Off-line alarm
Line-error alarm
Cooling unit alarm

When the welding machine is switched off, the Over/under voltage alarm signal may appear for a few seconds.

## 13. SETTINGS MENU (Fig. L-13)




### 13.1 MODE MENU (Fig. L-14)

Use to select settings on the screens in MIG-MAG mode:



-  : all settings are displayed as described above.
-  : Fig. L-17. The piece to be welded and the welding seam shape are indicated in this mode. Press button C-6 to access all the other settings. When operating in "EASY" mode, it is impossible to weld in MIG MANUAL and PoP mode.

### 13.2 SET UP MENU (Fig. L-15)



Used to set the following:


-  : language.
-  : time and date.
-  : metric or UK unit of measure.

### 13.2.1 FUNCTIONS BLOCK

After selecting the setup icon , press the wire feed (C-2) and gas bleed (C-3) push buttons simultaneously and then confirm by pressing the multifunction knob (C-5). The screen displays the icon  used to set 3 different function block levels

when pressed:




-  : no protection; it is possible to browse, set and modify all welding parameters.
-  : intermediate protection; it is only possible to modify the basic welding parameters.

-  : maximum protection; it is impossible to modify any parameters.




## 13.3 SERVICE MENU (Fig. L-16)

This provides information on the welding machine status.

### 13.3.1 INFO MENU

-  : welding machine operations in days (DDDD), hours (HH), minutes (mm).
-  : welding machine working days (DDDD), hours (HH), minutes (mm).
-  : alarms list.

### 13.3.2 FIRMWARE MENU

-  : use to update the welding machine software via USB pen drive.
-  : use to reset the welding machine to its default settings.
-  : software release installed.

### 13.3.3 REPORT MENU

Use to generate a report and save it to a USB pen drive. The report contains various information on the welding machine status (software installed, life/working hours, alarms, selected welding process etc.).

### 13.3.4 CALIBRATION


After selecting the service icon , press the wire feed (C-2) and gas bleed (C-3) push buttons simultaneously and then confirm by pressing the multifunction knob (C-5). The screen displays the icon  used to calibrate the welding machine to




meet EN 50504 standard requirements when pressed.

## 13.4 AQUA MENU

It allows to activate  / deactivate  the G.R.A. function.







## 13.5 Menu setting for torch T1,T2,T2 (3 torch version only)

After selecting the  icon, on the screen there will appear the icons of the three torches (Tab. 3):

-  : Torch T1
-  : Torch T2
-  : Torch T3

## 13.6 JOBS MENU (Fig. L-18)

Used to:

-  : save a job in the welding machine internal memory.
-  : retrieve and load a previously saved job.
-  : cancel a previously saved job.
-  : import jobs from a USB device.
-  : export jobs to a USB device.
-  : allow saving of welding parameters to the USB device.

## 14. MAINTENANCE



**WARNING! BEFORE CARRYING OUT MAINTENANCE OPERATIONS MAKE SURE THE WELDING MACHINE IS SWITCHED OFF AND DISCONNECTED FROM THE MAIN POWER SUPPLY.**

### 14.1 ROUTINE MAINTENANCE:

**ROUTINE MAINTENANCE OPERATIONS CAN BE CARRIED OUT BY THE OPERATOR.**

#### 14.1.1 Torch

- Do not put the torch or its cable on hot pieces; this would cause the insulating materials to melt, making the torch unusable after a very short time.
- Make regular checks on the gas pipe and connector seals.
- Accurately match collet and collet body with the selected electrode diameter in order to avoid overheating, bad gas diffusion and poor performance.
- At least once a day check the terminal parts of the torch for wear and make sure they are assembled correctly: nozzle, electrode, electrode-holder clamp, gas diffuser.
- Before using the welding machine, always check the terminal parts of the torch for wear and make sure they are assembled correctly: nozzle, electrode, electrode-holder clamp, gas diffuser.

#### 14.1.2 Wire feeder

- Make frequent checks on the state of wear of the wire feeder rollers, regularly remove the metal dust deposited in the feeder area (rollers and wire-guide infeed and outfeed).

### 14.2 EXTRAORDINARY MAINTENANCE

**EXTRAORDINARY MAINTENANCE MUST ONLY BE CARRIED OUT BY TECHNICIANS WHO ARE EXPERT OR QUALIFIED IN THE ELECTRIC-MECHANICAL FIELD, AND IN FULL RESPECT OF THE IEC/EN 60974-4 TECHNICAL DIRECTIVE.**



**WARNING! BEFORE REMOVING THE WELDING MACHINE PANELS AND WORKING INSIDE THE MACHINE MAKE SURE THE WELDING MACHINE IS SWITCHED OFF AND DISCONNECTED FROM THE MAIN POWER SUPPLY**

**OUTLET.**

**If checks are made inside the welding machine while it is live, this may cause serious electric shock due to direct contact with live parts and/or injury due to direct contact with moving parts.**

- Inspect the welding machine regularly, with a frequency depending on use and the dustiness of the environment, and remove the dust deposited on the transformer, reactance and rectifier using a jet of dry compressed air (max. 10 bar).
  - Do not direct the jet of compressed air on the electronic boards; these can be cleaned with a very soft brush or suitable solvents.
  - At the same time make sure the electrical connections are tight and check the wiring for damage to the insulation.
  - At the end of these operations re-assemble the panels of the welding machine and screw the fastening screws right down.
  - Never, ever carry out welding operations while the welding machine is open.
  - After having carried out maintenance or repairs, restore the connections and wiring as they were before, making sure they do not come into contact with moving parts or parts that can reach high temperatures. Tie all the wires as they were before, being careful to keep the high voltage connections of the primary transformer separate from the low voltage ones of the secondary transformer.
- Use all the original washers and screws when closing the casing.

**15. TROUBLESHOOTING (TAB. 7)**

**IN CASE OF UNSATISFACTORY FUNCTIONING, BEFORE SERVICING MACHINE OR REQUESTING ASSISTANCE, CARRY OUT THE FOLLOWING CHECK:**

- Check that when general switch is ON the relative lamp is ON. If this is not the case then the problem is located on the mains (cables, plugs, outlets, fuses, etc.)
- There is no alarm signalling intervention of the thermostat safeguard, over or undervoltage or short-circuit.
- Check that the nominal intermittance ratio is correct. In case there is a thermal protection interruption, wait for the machine to cool down, check that the fan is working properly.
- Check the mains voltage: if the value is too high or too low the welding machine will be stopped.
- Check that there is no short-circuit at the output of the machine: if this is the case eliminate the inconvenience.
- Check that all connections of the welding circuit are correct, particularly that the work clamp is well attached to the workpiece, with no interfering material or surface-coverings (ie. Paint).
- Protective gas must be of appropriate type and quantity.