

# INSTRUCTION MANUAL FOR TIG WELDING MACHINES

## IMPORTANT:

READ THIS MANUAL CAREFULLY BEFORE INSTALLING, USING, OR SERVICING THE WELDING MACHINE, PAYING SPECIAL ATTENTION TO SAFETY RULES. CONTACT YOUR DISTRIBUTOR IF YOU DO NOT FULLY UNDERSTAND THESE INSTRUCTIONS.

Upon arrival, make sure that there are no broken or damaged parts.

The purchaser must file any complaint due to loss or damages with the shipping agent. Whenever asking for information about the welding machine, please indicate the article and serial number.

## 1 INTRODUCTION

This device must be used for welding only.

In any case, it is essential to pay special attention to the chapter on SAFETY PRECAUTIONS.

The symbols next to certain paragraphs indicate points requiring extra attention, practical advice or simple information.

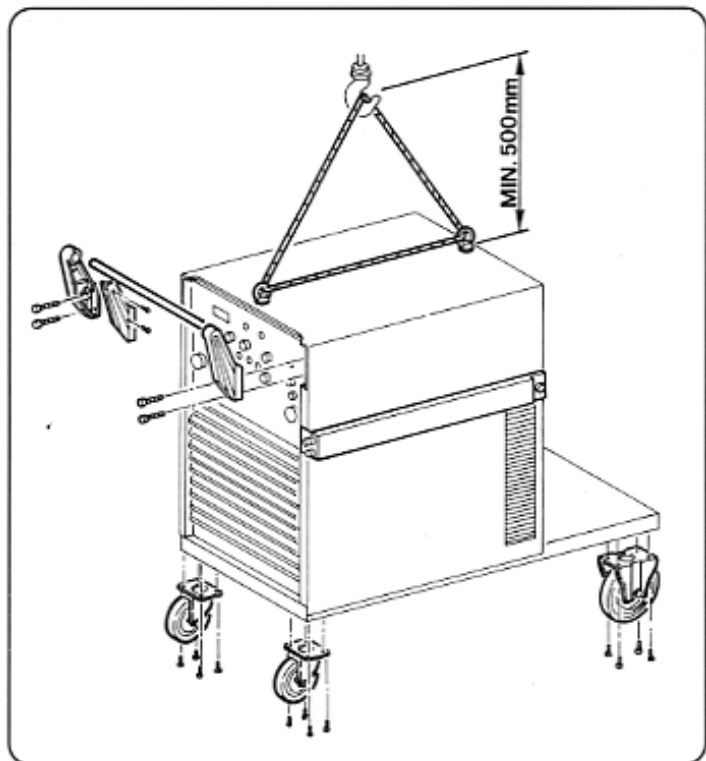
This manual must be kept carefully in a place familiar to everyone involved in using the machine. It must be consulted whenever doubts arise and be kept for the entire life-span of the machine; it will also be used for ordering replacement parts.

### 1.1 PLACEMENT

Unpack the machine and place it in an adequately ventilated area, dust-free if possible, taking care not to block the air intake and outlet from the cooling slots.

CAUTION: REDUCED AIR CIRCULATION causes overheating and could damage internal parts.

- Keep at least 500 mm of free space around the device.
- Never place any filtering device over the air intake points of this welding machine.
- The warranty shall become void if any type of filtering device is used.



## 2 DESCRIPTION OF THE DEVICE

### A - Remote control connector

Various accessories for regulating the welding current are attached here.

### B - Welding current regulator device

This must always be connected to the adapter (A).

### C - Procedure selector

This selects either the TIG or MMA covered electrode welding process.

### D - Pilot light

Lights when the machine is turned on.

### E - Pilot light

Lights when the thermostat is tripped.

### F - Main switch

Turns the machine off and on.

### G - Slope down current time setting (0.2-10 sec.)

This adjusts the time required for the welding current to drop from the set value until the arc is off.

It is activated each time the command is given to stop welding; it enables the crater filler at the end of the weld. It is operative whenever the TIG procedure is selected.

### H - Fitting (1/4" gas)

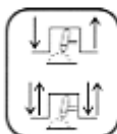
The gas hose for the TIG welding torch is connected here.

### I - Connector

The torch command plug is attached here.


It is operative whenever the TIG procedure is selected.

### L - Selector



Manual

Automatic

This is operative during the TIG procedure except during the function .

- In automatic position: once the torch trigger is pressed, it may be released without turning off the arc; to turn off, press and release again.

- In manual position: when the operator presses the trigger, the machine distributes current, when released the arc goes off.

### M - Digital amp meter


Displays the welding current.

**Note:** The welding current may be pre-set and displayed on this instrument. For this function, see the paragraph on pre-setting the working current.


### N - LED

This lights when the current reaches the welding current during the TIG procedure. It is always lit during the MMA procedure.

### O - LED

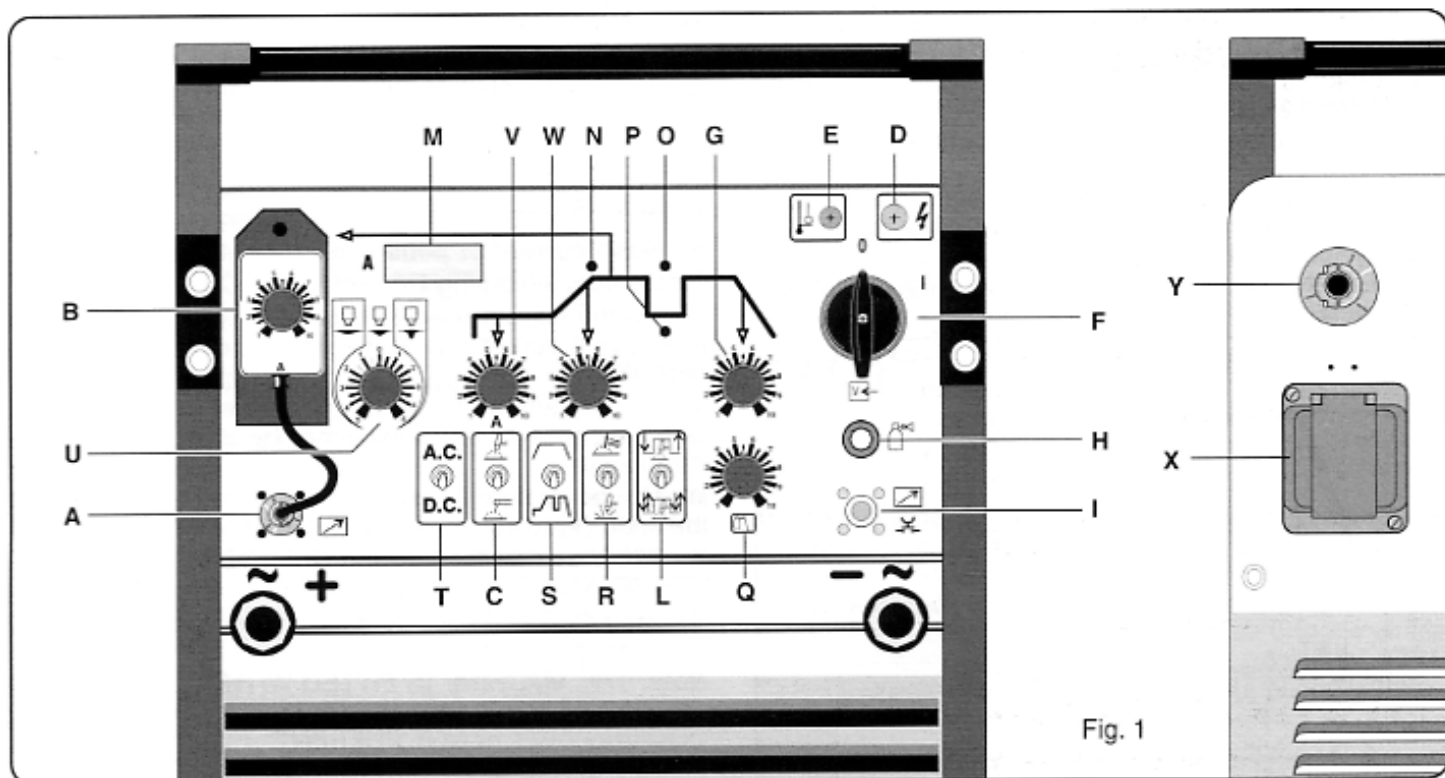
This lights when the peak welding current is operative in the logic system  pre-set using the knob (B).



### P - LED

This lights when the pause current is operative in the logic system  pre-set using the knob (V).

### Q - Gas delay


This adjusts the gas outlet time after welding is finished. The setting field is between a minimum of 0.3 sec. and a maximum of 30 sec.



R - Selector for lighting with H.F.  or scratch start 

This is automatically cut out during MMA welding. It must always be on during TIG welding with alternating current (A.C.). It may be turned off during direct current (D.C.) welding if scratch start is desired.



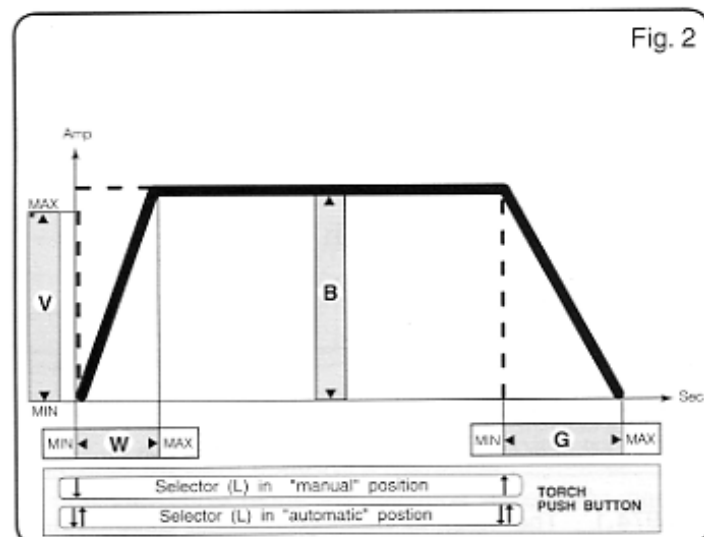
**S - Welding program selector**  
If is selected,  the machine carries out the program set on the knobs:  
**V** - Starting welding current or base current.  
**W** - Up slope time for current to rise from base current to welding current.

**B** - Welding current.

**G** - Down slope time for crater filler current.

The welding cycle thus follows the following pattern:

- manual position:

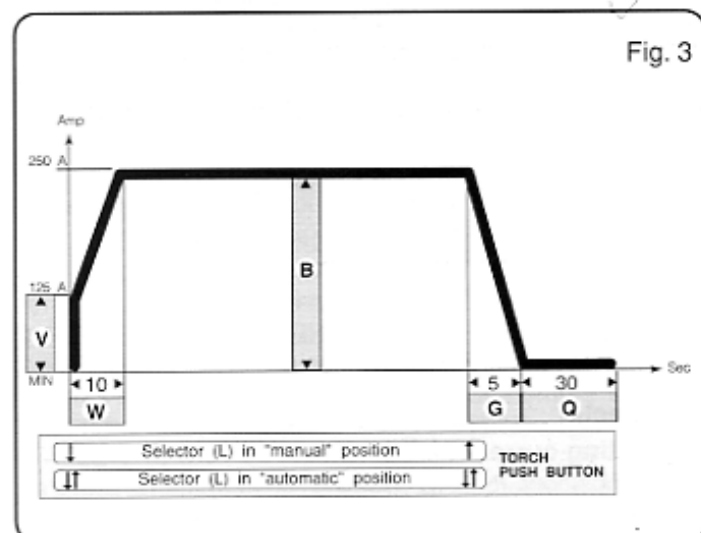


Press the torch trigger. Welding begins at the current set using the knob (V).


It takes the time set using the knob (**W**) to reach the welding current set using the knob (**B**). Welding continues until the trigger is released, then the current drops to the minimum during the time set using the knob (**G**). The gas post-flow then follows, as set using the knob (**Q**).

**Example:**

- Welding current 250A (knob B)
- Base current 125A (knob V) pos. 5
- Up slope time from base current to MAX. welding current (knob W)
- Down slope time for welding current in pos. 5 = 5 sec. (knob G)
- Gas post-flow in pos. 10 = 30 sec. (knob Q)



**Note:** If the trigger is pressed again during the down slope of the current (**G**), the cycle starts over from the beginning.

If the program  is set, the machine carries out the program by adjusting the knobs:

V - Starting welding current and pause current.

**W** - Up slope time for current to rise from base current to welding current.

**B** - Welding current.

**G** - Down slope time for crater filler current.

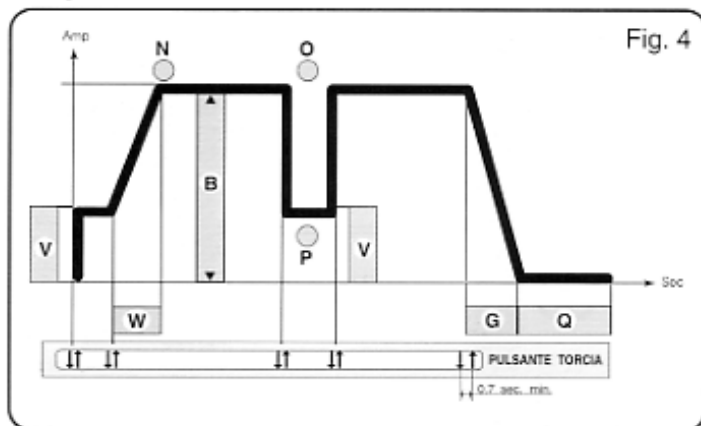
**Q** - Gas post-flow time.

This program was developed for applications requiring two different welding current levels.

The pedal control device **Art. 182** cannot be applied here.

In this program, the current set using the knob (**V**) is not only the starting welding current, but also the current during pauses within the cycle.

The LEDs **N** - **O** - **P** indicate what part of the program is being welded.



The welding cycle described above proceeds as follows:  
**PRESS THE TORCH TRIGGER AND RELEASE IT IMMEDIATELY. THE ARC WILL NOT LIGHT UNTIL THE TRIGGER IS RELEASED.**

The welding current will automatically set to the value on knob (**V**). The operator can maintain this current as long as desired (for example, until the part is pre-heated).

By pressing the torch trigger again and releasing it immediately, the current changes from the value set on knob (**V**) to the value set on knob (**B**), in the time lapse selected using the knob (**W**). When the welding current is reached, the LED (**N**) comes on. If it is necessary to reduce the current during execution but without turning off the arc (for example, changing the filler material, changing position, changing from a horizontal to a vertical position, etc.), press the torch trigger again briefly: the current will change to the value set on (**V**), and the LED (**P**) will light. To return to the previous current, press the trigger briefly once again. The LED (**O**) will light, while (**P**) will go off.

If you wish to stop welding at any time, press the torch trigger and hold it down a bit longer (0.7 sec.) before releasing it. The current will begin to drop to zero over the time set on the knob (**G**).

This is followed by the post gas set on the knob (**Q**).

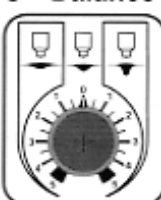
**Note:** The phrase "PRESS THE TRIGGER BRIEFLY" indicates pressing the trigger for not more than 0.5 sec.

#### T - Selector

**Alternating current (A.C.) - Direct current (D.C.)**

- A.C. position: for TIG welding of aluminum, brass or magnesium.
- D.C. position: for TIG welding of all other materials, and for MMA welding with all types of covered electrodes.

#### U - Balance control



This knob makes it possible to vary the half-periods of the square wave when working in TIG A.C., welding aluminum.


The point where the two half-waves meet is zero.

This position will give you less current absorption, reduced electrode consumption and an ideal ratio between the width and depth of the bead. If you wish to increase penetration, turn the knob clockwise; for a cleaner weld with less penetration, turn the knob counter-clockwise. **THIS FUNCTION IS ENABLED ONLY WHEN TIG WELDING IS SELECTED IN A.C.**

#### V - Base current or pause current setting

This is enabled during TIG welding (A.C. or D.C.).

This is the current used to begin any type of program. It is always a percentage of the welding current set on the knob (**B**).

In the program , the current set on this knob is also the pause current, which may be chosen from within the program.

**W - Up slope time** for the current, from the value set on the knob (**V**) to the value set on the knob (**B**).

**X - 220-V socket for Cooling Unit (DO NOT CONNECT OTHER TOOLS).** max. power 440 W.

**Y - Socket.** This is for connecting the safety device of the cooling unit, art. 1334.







**Note:** THE MACHINE IS FITTED WITH A CONNECTOR THAT MUST BE ATTACHED TO THE SOCKET Y IF THE COOLING UNIT IS NOT PRESENT.

### 3 GENERAL DESCRIPTIONS

#### 3.1 SPECIFICATIONS


The TIG STAR 251 AC/DC is a constant current source suited for welding with TIG or covered electrode procedures. The unique setting range (5/250 A), square-wave technology and complete welding current control make this generator a quality high-technology product.

#### 3.2 EXPLANATION OF TECHNICAL SPECIFICATIONS

		N°			
1 ~ 		EN 60 974-1			
	U <sub>0</sub> V	- / - - - / -	X	-	-
	-	-	I <sub>2</sub>	-	-
		-	U <sub>2</sub>	-	-
	U <sub>0</sub> V	- / - - - / -	X	-	-
	-	-	I <sub>2</sub>	-	-
		-	U <sub>2</sub>	-	-
	U <sub>1</sub> V	I <sub>1</sub>	I <sub>1</sub> A	I <sub>1</sub> A	I <sub>1</sub> A
1 ~ 50/60 Hz	-		-	-	-
I. Cl. H	-		-	-	-
IP 21	-		-	-	-
	-		-	-	-
PROTEZIONE TERMICA THERMAL PROTECTION PROTECTION THERMIQUE TERMISCH GESCHÜTZ PROTECCION TERMICA		MADE IN ITALY		VENTILAZIONE FORZATA FORCED VENTILATION VENTILE KÜHLART F VENTILACION	

IEC 974.1 The welding machine is built according to EN60974.1 these international standards

N°. ..... Serial number, which must always be indicated in any inquiry regarding the welding machine.

1~ transformer - rectifier - single-phase

 Downslope characteristic

 Suited for welding with covered electrodes

 Suited for TIG welding.

$U_0$  ..... Secondary no load voltage (peak value)

X ..... Percentage service factor.

The service factor expresses the percentage of 10 minutes during which the welding machine may run at a certain current without overheating.

$I_2$  ..... Welding current.

$U_2$  ..... Secondary voltage with welding current 12  
Rated power voltage

1~ 50/60Hz Single-phase 50- or 60-Hz power supply  
Current absorbed at the corresponding welding current 12

IP21 ..... Degree of housing protection.

Grade one as the second digit means that this device is not suitable for use outdoors in the rain.

NOTE: The welding machine has also been designed for use in environments with grade 3 pollution (see IEC 664).

### 3.3 DESCRIPTION OF PROTECTION

This device is protected by a normally closed thermostat. When the thermostat is tripped the machine stops welding, while the motor-driven fan continues to run. After it has been tripped, wait a few minutes to allow the generator to cool down.

## 4 INSTALLATION

### 4.1 PROTECTION FROM HIGH-FREQUENCY INTERFERENCE

The high-frequency generator inside the welding machine is comparable to a radio transmitter. Improper installation of the welding machine may generate radio or TV disturbance.

Interference may develop in four different ways:

- 1) Interference radiated by the welding machine
- 2) Interference radiated by the welding cables
- 3) Interference radiated on the power line
- 4) Interference collected and radiated by ungrounded metal objects.

INSTALL THE WELDING MACHINE ACCORDING TO THE INSTRUCTIONS IN ORDER TO REDUCE THESE PROBLEMS.

- Keep the connections between the machine and power line as short as possible. If necessary, pass the power cord through a metal tube connected to a buried grounding socket.

- Keep the welding cables as short as possible. The length should not exceed 7/8 mt. Wrap or tape them together if possible.

- Make sure that the rubber insulation of the welding cables is not cut, burnt or torn. Cables with a high content of natural rubber resist high frequency leaks better.

- Keep the clamps tight and the welding torch in excellent condition to reduce high frequency leaks.
- The earth clamp should not only be connected to the

part to be welded, but also to a grounding system within a range of 3 mt. The grounding system should consist of a solid copper or galvanized steel bar with a diameter of at least 16 mm.

**NOTE:** For this connection, which must be as short as possible, use a cable the same size as or larger than the welding cables

- Keep the panels and cover of the welding machine closed.

- All conductors within a range of 15 mt. must be closed in metal tubes, and these tubes must be grounded. Helical hoses are not suitable.

**DO NOT USE WATER PIPES AS GROUNDING CONDUCTORS.**

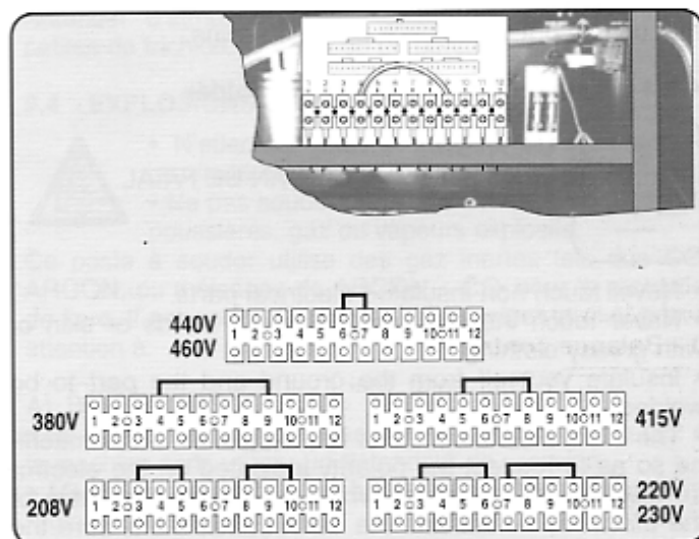
Before using this welding machine, carefully read the regulations CEI 26/9 or CENELEC HD 407 and CEI 26/11 or CENELEC HD 433. Also make sure that the insulation on cables, torch and grounding cord is intact. Before installing welding equipment, the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a) Other power cables, control cables, signalling and telephone cables; above, below and adjacent to the welding equipment.
  - b) Radio and television transmitters and receivers.
  - c) Computers and other control equipment.
  - d) Critical safety equipment, e.g. guarding of industrial equipment.
  - e) The health of the people around, e.g. the use of pacemakers and hearing aids.
  - f) Equipment used for calibration or measurement.
  - g) The immunity of other equipment in the environment.
- The user shall ensure that other equipment being used in a specified environment is compatible. This may require additional protection from immunity.
- h) The time of day that welding or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

### 4.2 INTERNAL CONNECTIONS

- The machine must be connected by skilled personnel.
- Before working inside the welding machine, make sure it is unplugged from the power socket.
- After the final inspection, the welding machine should be connected to the power voltage indicated on the power cord.
- If you wish to change the power voltage, remove the





upper cover, find the voltage changer terminal board and arrange the connections as shown in the figure.

- Apply a plug suitable for the absorbed current.
- Connect the yellow-green conductor of the welding machine to a good grounding socket.

### 4.3 EXTERNAL CONNECTIONS

#### 4.3.1 Connecting the TIG torch

Use the shortest possible torch suitable for your operating needs, to minimize possible radio interference problems.

- **Do not touch electrical parts with your hands.**
  - **Do not touch the hot electrode with hands or cloths.**
  - **Insulate yourself from the ground and the part to be welded.**
  - **To prevent high-frequency discharges, keep the torch in good condition.**
  - Turn the machine off.
  - Connect the power cable to the negative pole (insert and turn right) so that it is firmly inserted.
- Choose the diameter and type of electrode suited for the type of material and current you plan to use.
- Connect the gas outlet hose from the torch to the 1/4" gas fitting (H) on the front panel.
- The torch may also be water-cooled. In this case, connect the two hoses leaving the torch as described in paragraph 6.

#### 4.3.2 Connecting the earth cable

- Connect the power plug to the + or - pole depending on the procedure used. Insert and turn it clockwise until the connector is firmly tightened.
- Connect the earth clamp to the part to be welded.

#### 4.3.3 Connecting the gas hose



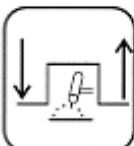
CAUTION !!

CYLINDERS MAY EXPLODE  
IF DAMAGED.

- Keep cylinders straight and chained to their support.
- Store cylinders where they cannot be damaged.
- Do not lift the machine with the cylinder attached.
- Make sure never to touch the cylinder with an electrode.
- Keep the cylinder away from the welding area or non-insulated electrical circuits.
- The inert gas cylinder must be fitted with a pressure reducer and flow meter.

Only after positioning the cylinder, connect the gas hose that comes out of the back of the machine.

#### 4.3.4 Connecting the electrode holder



CAUTION !!

ELECTRIC SHOCK CAN BE FATAL.


- Never touch non-insulated electrical parts.
- Never touch the electrode with your hands or skin or with greasy clothing.
- Insulate yourself from the ground and the part to be welded.
- The *electrode holder* must be connected to the machine so as to respect the polarity indicated on the electrode box you will be using. When connecting the cable of the *electrode holder* and the earth cable, make sure the

power clamps of the wires are tight.

- The welding circuit must never deliberately be placed in direct or indirect contact with the protection conductor except on the part to be welded.
- If the part being worked on is deliberately grounded through the protection conductor, the connection must be as direct as possible and made using a conductor at least as large as the return welding current conductor, and connected to the workpiece at the same point as the return conductor using the return conductor clamp, or using a second earth clamp placed right next to it.
- All precautions must be taken to avoid wandering welding currents.


### 4.4 PRE-SELECTING THE WORKING CURRENTS

#### 4.4.1 MMA

After setting the selector (C) to , make sure the LED (N) lights. Then adjust the knob (B); the welding current will be displayed on the amp meter (M).

#### 4.4.2 TIG: (Selecting a single welding current)

Selector (R) pos. 

Selector (S) pos. 

Selector (L) pos.

Press the torch trigger; when the LED (N) lights, adjust the knob (B).

You will see the welding current displayed on the amp meter (M).

#### 4.4.3 TIG: (Selecting dual current)

Selector (R) pos. 

Selector (S) pos. 

Press and release the torch trigger twice. When the LED (N) lights, set the maximum welding current using the knob (B), displayed on the amp meter (M). To set the base current, press and release the torch trigger. When the LED (P) lights, adjust the current value using the knob (V).



When you have completed this step, hold the torch trigger down for at least 0.7 sec. All LEDs will go off.

## 5 WELDING

### 5.1 GUIDE TO SELECTING ELECTRODES AND CURRENTS IN TIG WELDING

- The flow of inert gas must be set to a value (in liters per minute) approximately 6 times the diameter of the electrode.  
(Ex. diam. 2.4x6 = 15 lt/min.)
- If you are using accessories such as a gas-lens, the gas capacity may be reduced to approximately 3 times the electrode diameter. The diameter of the ceramic nozzle must be 4 to 6 times that of the electrode.

### 5.2 WELDING ALUMINUM IN TIG MODE

- Set the selector (T) to A.C., the selector (R) to  and the selector (C) to  (TIG). All other controls depend on the diameter of the electrode you will be using and the current to be set. For this type of welding you must use pure tungsten electrodes (DIN GREEN in color) or zirconium-coated tungsten (DIN WHITE in color).
- During welding, the tip of the electrode will tend to be hemispheric in shape. If the bead at the end of the elec-

Electrode Type O ▼	D.C.	A.C.					
		Pos. Max. Penetration		Pos. Zero Balance		Pos. Max. Cleaning	
	Tungsten Thoriated 2%	Tungsten pure	Tungsten ZR 0.8%	Tungsten pure	Tungsten ZR 0.8%	Tungsten pure	Tungsten ZR 0.8%
1.6	70A ÷ 150A	50A ÷ 100A	70A ÷ 150A	30A ÷ 60A	50A ÷ 80A	20A ÷ 40A	30A ÷ 60A
2.4	150 A ÷ 250A	100A ÷ 160A	140A ÷ 235A	60A ÷ 120A	80A ÷ 140A	40A ÷ 100A	60A ÷ 120A
3.2	200A ÷ 350A	150A ÷ 210A	225A ÷ 325A	80A ÷ 160A	100A ÷ 180A	60A ÷ 140A	80A ÷ 160A
4	300A ÷ 400A	200A ÷ 275A	300A ÷ 400A	100A ÷ 240A	150A ÷ 280A	80A ÷ 200A	150A ÷ 250A

trode is larger than the diameter of the electrode itself, this means the current you are using is too high for the electrode. Therefore, replace it with a larger electrode.

Preparation of the electrode is very important.

- The post-gas adjustment, knob (Q), must be sufficient to cool the electrode and keep the tip bright.

- To adjust the square wave balance, read letter (U) of paragraph 2.

- To pre-select the working currents, read paragraph 4.4.

- To select the welding program, read point (S) of paragraph 2.

**It is essential to become familiar with the functions available to you in order to achieve optimum welding results.**

- The added material must have a diameter less than or equal to the workpiece.

- The ratio between the current to be used and the thickness of the piece is 40 Amp./mm. Ex.: thickness 2 mm x 40 = 80 Amperes.

**CAUTION: THESE SPECIFICATIONS MAY CHANGE ACCORDING TO THE VOLUME OF THE PART TO BE WELDED.**

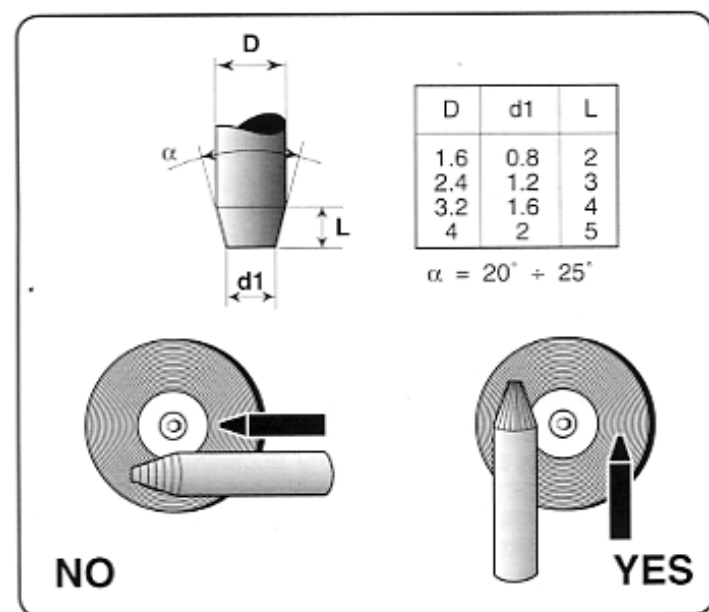
- Aluminum oxide (AL<sub>2</sub>O<sub>3</sub>) must be removed to prevent grabbing and sticking, typical defects in welding this material.

- The aluminum oxide can be eliminated by mechanical brushing. The brush must be made of stainless steel wires. Aluminum oxide must be eliminated within a range of 5 cm of where welding is to be performed.

- Use protective glasses of at least DIN 11.

- Use pure ARGON as a protective gas.

#### ELECTRODE PREPARATION FOR A.C. TIG WELDING



#### 5.3 TIG D.C. WELDING

- Selector (T) on D.C.

- Selector (C) on

- The TIG torch must be connected to the negative pole (-).

- The earth must be connected to the positive pole.

- The selector (R) on if you wish to turn on the arc

without touching the part; on if you wish to start the arc on contact.

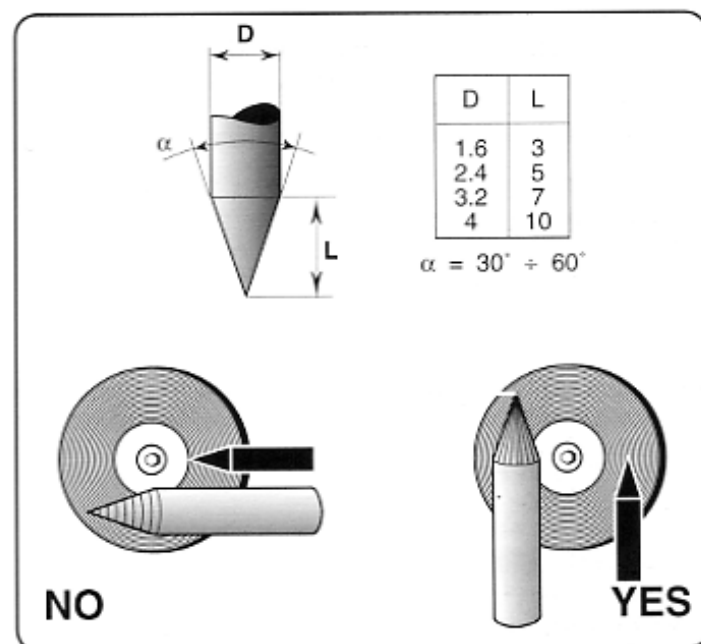
- To pre-select the working currents, read paragraph 4.4.

- To select the welding program, read point (S) of paragraph 2.

- The added material must have a diameter equal to or less than that of the workpiece.

- The ratio between the current to be used and the thickness of the part is: for carbon steels and stainless steels, 20/30 Amp. every mm; for copper, 80 Amp. for every mm. **CAUTION: THESE SPECIFICATIONS MAY CHANGE ACCORDING TO THE VOLUME OF THE PART TO BE WELDED.**

#### ELECTRODE PREPARATION FOR D.C. WELDING

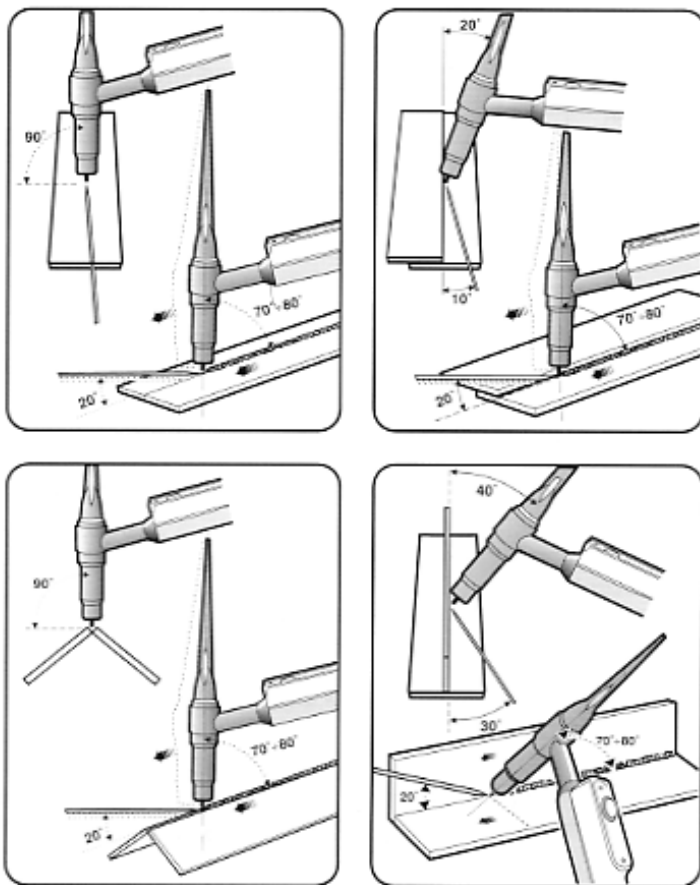


- For the currents to be used in relation to the diameter of the electrodes, see the table in paragraph 5. It gives information valid also for TIG D.C. welding.

- If using helium gas, increase the liters per minute to up to 10 times the diameter of the electrode (Ex.: diam. 1.6 x 10 = 16 lt/min. of helium).

- Electrode preparation is especially important (see fig.).
- The electrodes to be used are those thorium-coated at 2%, DIN red in color.
- Use DIN 10 protective glasses for up to 75A, and DIN 11 from 75A up.

#### 5.4 RECOMMENDED POSITIONS FOR WELDING



#### 5.5 PROTECTIVE GAS

- The most commonly used gas is ARGON, because it costs less than other inert gases, but ARGON mixtures may be used with no more than 2% HYDROGEN for welding stainless steel, and HELIUM or a mixture of ARGON or HELIUM for welding copper. These mixtures increase the heat of the arc during welding.

#### 5.6 WELDING WITH COVERED ELECTRODES

This welding machine can weld any type of electrode.

- Selector (C) on
- When the LED (N) lights, you are ready to weld.
- Connect the *electrode holder* and earth in accordance with the polarity required by the electrode manufacturer (normally earth to +).

### 6 ACCESSORIES

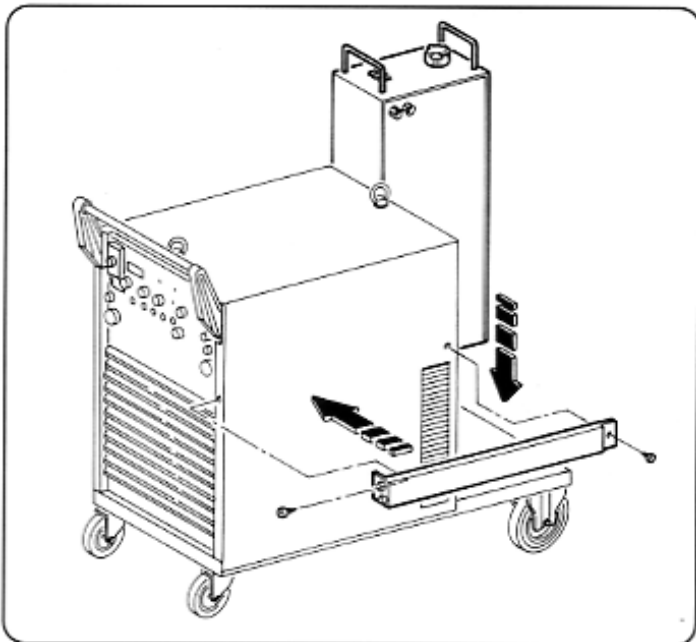
#### ART. 1334 COOLING UNIT

This must be attached and connected to the machine as shown in the figure. The mains cable must be connected to the socket (X) on the machine.

The safety cable must be connected to the socket (Y) of the machine and to the socket on the cooling unit.

If any errors occur in the cooling unit, the machine stops welding and the pilot light (E) lights on the front panel.

#### ART. 138 TUBE KIT



#### ART. 1326 5-mt EXTENSION CORD FOR REMOTE CONTROL

The pulse remote control Art. 180 and the remote control (B) can be taken near the welding site using this article.

#### ART. 180 PULSE REMOTE CONTROL

Essential for TIG welding of very thin sheet metal. This must be connected to the connector (A). When this accessory is used, the knob (V) must be set to the minimum (counter-clockwise).

#### ART. 182 PEDAL CONTROL

This makes it possible to adjust the current during welding.

It cannot be used with the program

### 7 MAINTENANCE AND CHECKS

#### 7.1 GENERAL NOTES



CAUTION !!

ELECTRIC SHOCK CAN BE FATAL.

- Never touch electrical parts under voltage.
- Turn off the welding machine and unplug the power cord from the socket before each checking and maintenance operation.
- **Moving parts can cause serious injury!**
- Keep away from moving parts.
- INCANDESCENT SURFACES can cause serious burns.
- Let the unit cool before servicing.
- Periodically remove any dust or foreign matter that may have deposited on the transformer or diodes; to do so, use a jet of clean, dry air.

#### 7.2 REPAIRING THE WELDING MACHINE

Experience has shown that many accidents are caused by repairs performed incorrectly. That is why it is just as important to check a repaired welding machine carefully and completely as it is for a new welding machine. In addition, this protects the manufacturer from being held liable for defects when the true fault lies elsewhere.

### 7.2.1 Instructions for performing repairs

- After rewinding the transformer or inductance, the welding machine must pass the applied voltage tests as indicated in table 2 of paragraph 6.1.3 of the standard EN 60974.1 (CEI 26.13). Compliance must be verified as specified in 6.1.3.
- If no rewinding has been done, a welding machine that has been cleaned and/or revised must pass an applied voltage test with test voltage values equal to 50% of the values given in table 2 of paragraph 6.1.3. Compliance must be verified as specified in 6.1.3.
- After rewinding and/or replacing parts, the no load voltage must not exceed the values given in paragraph 10.1 of EN 60974.1.
- If the repairs have not been performed by the manufacturer, repaired welding machines in which some components have been replaced or altered must be marked in such a way that the person who performed the repairs is clearly identifiable.

### 7.2.2 Precautions to take during repairs

- **EXCESSIVE PRESSURE** can cause the control circuit to break.
- Exert only minimal pressure and make small movements whenever connecting or disconnecting the circuit connectors, or removing or installing a control circuit.
- **INCORRECT INSTALLATION** or unaligned connectors may damage the circuit.
- Make sure the connectors are correctly installed and aligned before installing the guard.
- After making repairs, take care to re-order the wiring so that there is certain insulation between the primary side and the secondary side of the machine.
- Prevent the wires from coming into contact with moving parts or parts that heat up during operation. Replace all clamps as on the original machine to prevent a connection from occurring between the primary and secondary side if a conductor accidentally breaks or disconnects.

## 8 TROUBLE-SHOOTING INSTRUCTIONS

Read this paragraph carefully.

**REMEMBER:** Many problems are caused by incorrect settings on the selectors on the front panel of the machine.

If you are sure that the settings are correct, make sure the line fuses are in good working order. After turning the machine off and unplugging it, make sure that all wires are correctly and firmly connected.

### 8.1 ERRORS IN MACHINE CONNECTIONS

#### 1 - DEFECT - The machine does not turn on.

- CAUSES**
- Power cord not plugged in.
  - The power phase is missing.
  - The machine is not connected to the correct power voltage.

#### 2 - DEFECT - The machine turns on but does not distribute current. The amp meter is blank.

- CAUSES**
- Current setting device (B) not connected to the connector (A).
  - Drawer dial (B) is damaged.
  - Welding accessories not connected.

#### 3 - DEFECT - The machine turns on, the yellow pilot light (E) remains lit, but the machine does not distribute current.

- CAUSES**
- Thermostat tripped. Let the machine cool.

- If the machine is used with the Cooling Unit Art. 1332:


- A) Defect in cooling unit.
- B) Cooling unit turned off.

#### 4 - DEFECT - The line fuses blow.

- CAUSES**
- Installed power insufficient.
  - The machine is not connected to the correct power voltage.
  - Power transformer has short-circuited.
  - S.C.R. diodes have short-circuited.

### 8.2 ERRORS IN TIG PROCEDURE

#### 1 - DEFECT - No high frequency.

- CAUSES**
- Check the welding cables: they must not be damaged.
  - There is no protective gas.
  - Selector (R) is set to .
  - Selector (C) is set to MMA.

#### 2 - DEFECT - The amp meter does not pre-select the current.

- CAUSES**
- Read the paragraph on pre-setting working currents.
  - Amp meter defective.
  - Current setting device (B) not connected to the connector (A).
  - With Art. 182 (pedal control) attached, you must press the pedal all the way down and set the current using the MIN and MAX knobs on the pedal.

#### 3 - DEFECT - The arc is difficult to light in TIG mode.

- CAUSES**
- No protective gas.
  - Welding current is set too low.
  - Tungsten electrode is contaminated. Fix the tip.
  - Incorrect choice of the tungsten electrode. Zirconium-coated tungsten is suitable for A.C. Thorium-coated tungsten is suitable for D.C.
  - Defect in torch trigger.
  - Torch connector not fastened to connector (I).
  - Electrode diameter is too large for the current used for welding.

**NOTE:** If the welding machine is connected to an automatic system, it is best to connect the ceramic nozzle to the mass of the part using a flexible copper wire.

#### 4 - DEFECT - The tungsten electrode wears out quickly or is transferred into the welding bath.

- CAUSES**
- The current is too high for the electrode diameter used.
  - In A.C. welding, the knob (U) is set all the way to the left for maximum cleaning.
  - If you wish to maintain the position selected on the knob (U), increase the electrode diameter.


#### 5 - DEFECT - The arc deviates from the welding bath.

- CAUSES**
- In A.C. welding, the electrode is too large for the current used.
  - In the slope down phase, this effect occurs when the current is less than the power of the electrode.
  - Earth clamp not connected correctly.
  - Using the pulse accessory, the base current is lower than the capacity of the electrode in Amperes.



## 8.3 PROCEDURAL ERRORS IN MANUAL METAL ARC (MMA) WELDING

### 1 - DEFECT - The machine does not distribute current.

- CAUSES
- Selector (C) is set to .
  - Device (B) not connected to the connector (A).
  - Thermostat tripped. Lamp (E) lit.
  - Welding cables disconnected.

### 2 - DEFECT - The arc lights then tends to go out.

- CAUSES
- Using basic electrodes:
- Selector (T) set to A.C.
  - Incorrect polarity of the *electrode holder*.

## 9 SAFETY PRECAUTIONS

### 9.1 FIRE



- Avoid producing flames caused by sparks and hot slag or incandescent pieces.
- Make sure that the appropriate fire-prevention devices are available near the welding area.
- Remove all flammable and combustible materials from the welding area and its surroundings (minimum 10 meters).
- Never weld fuel or lubricant containers, even when empty. These must be cleaned thoroughly before cutting.
- Let the welded material cool before touching it or placing it in contact with combustible or flammable materials.
- Never weld parts with cavities containing flammable materials.
- Do not work in atmospheres with a high concentration of combustible fumes, gases and flammable dust.
- Always check the work area half an hour after welding, to make sure no fire has begun.
- Do not keep flammable materials such as cigarette lighters or matches in your pockets.

### 9.2 BURNS

- Protect the skin against the burns caused by the ultra-violet radiation emitted by the arc, sparks and melted metal waste by using fire-proof clothing to cover all exposed body surfaces.
- Wear protective garments/gloves for welders, a hat and high-top shoes with safety tips. Button your shirt collar and pocket flaps, and wear slacks without cuffs to prevent sparks and slag from falling into them.
- Wear a mask with protective glass inside and filtering glass inside. This is MANDATORY for welding operations, to protect the eyes from radiant energy and volatile metals. Replace the protective glass if broken, pitted or stained.
- Avoid wearing greasy or oil-stained clothing. A spark could ignite them.
- Incandescent metal parts such as pieces of electrode and workpieces must always be handled with gloves.
- First aid equipment and a qualified person should be available for each work shift, unless there are health facilities nearby that can immediately treat burns to eyes or skins.
- Earplugs should be used when working overhead or in a small area. A hard-hat must be used when others are working in the area above.
- Anyone preparing to weld or cut should not use flammable hair care products.

### 9.3 FUMES



The welding operations produce harmful fumes and metal dust that can be harmful to one's health. Therefore:

- Work in properly ventilated areas.
  - Keep your head away from fumes.
  - In closed areas, use adequate ventilators.
  - If ventilation is not sufficient, use approved respirators.
  - Clean the material to be welded if halogen degreasers or solvents are present which create toxic gases during welding; some chlorinated solvents may be decomposed by the radiation emitted by the arc, generating phosgene gases.
  - Never weld coated metals or those containing lead, graphite, cadmium, zinc, chrome, mercury or beryllium if an adequate respirator is not available.
  - The electric arc generates ozone. Prolonged exposure to areas with a high ozone content may cause headaches and irritation in the nose, throat and eyes, as well as serious congestion and chest pains.
- IMPORTANT: NEVER USE OXYGEN FOR VENTILATION.
- It is important to avoid gas leaks in small areas. Large gas leaks can dangerously affect the oxygen concentration. Do not place cylinders in small areas.
- NEVER WELD or cut where solvent fumes can be drawn into the welding or cutting atmosphere or when radiant energy could penetrate into atmospheres containing even miniscule amounts of trichloroethylene or perchloroethylene.

### 9.4 EXPLOSIONS



- Do not weld above or near containers under pressure.
  - Do not weld in atmospheres containing explosive fumes, dust, or gases.
- This welding machine uses inert gases such as CO<sub>2</sub>, ARGON or mixtures of ARGON + hydrogen or helium to protect the arc; it is therefore necessary to pay the utmost attention to:

#### A) CYLINDERS

- Never connect the cylinder directly to the gas hose on the machine without using a pressure reducer.
- Handle and use cylinders under pressure in accordance with current regulations.
- Do not use cylinders that leak or that are physically damaged.
- Do not use cylinders that are not firmly attached.
- Do not move cylinders without the protection of the valve mounted.
- Do not use cylinders whose contents are not clearly identified.
- Do not place the cylinder into electrical contact with the arc.
- Do not expose the cylinders to excessive heat, sparks, melted slag or flames.
- Do not tamper with the cylinder valves.
- Do not attempt to use hammers, wrenches or other tools to loosen stuck valves.
- Never erase or change the name, number or other identifying marks on the cylinders. This is both illegal and dangerous.
- Never attempt to lift the cylinder by grabbing it by the valve or cap, or using chains, harnesses or magnets.
- Never attempt to mix any gases inside the cylinders.
- Never refill cylinders.
- Cylinder adapters must never be altered or switched.

## B) PRESSURE REGULATORS

- Keep pressure regulators in good condition. Damaged regulators can cause damage or accidents; they must be repaired only by qualified personnel.
- Do not use regulators for gases other than those for which they are manufactured.
- Never use a regulator that leaks or that appears to be physically damaged.
- Never lubricate a regulator with oil or grease.

## C) HOSES

- Replace any hoses that appear to be damaged.
- Keep the hoses pulled taut to avoid creasing.
- Keep excess hose coiled and away from the working area, to prevent possible damage.

## 9.5 RADIATION



The ultraviolet radiation emitted by the arc can damage eyes and burn skin. Therefore:

- Wear the appropriate protective clothing and masks.
- Do not use contact lenses!! The intense heat emanated by the arc could cause them to stick to the cornea.
- Use masks or goggles with lenses that offer a degree of protection of at least DIN 10 or DIN 11.
- Protect anyone present near the welding area.
- Remember: the arc can temporarily blind or damage eyes.
- The arc is hazardous up to a distance of 15 meters.
- Never look at the arc with bare eyes!
- Prepare the welding area to reduce the reflection and transmission of ultraviolet radiation: paint exposed walls and other surfaces black to reduce reflection, install protective screens or curtains to reduce ultraviolet transmission.
- Replace goggle lenses when damaged or broken.

## 9.6 ELECTRIC SHOCK



Electric shock can cause death. All electric shock is potentially fatal.

- Never touch parts under voltage.
- Insulate yourself from the part to be cut and from the floor by wearing insulated gloves and clothing.
- Keep all garments (gloves, shoes, headgear, clothing) and your body dry at all times.
- Never work in damp or wet areas.
- Do not lean against the piece to be welded.
- If you must work in or near a hazardous area, take every possible precaution.
- If you notice even a slight sense of an electric jolt, stop welding immediately. Do not use the device again until the problem has been identified and solved.
- Place a sufficiently powerful automatic wall switch as close to the machine as possible, so that the device may be turned off immediately in case of emergency.
- Frequently check the power cord.
- Unplug the power cord before working on the cables or opening the machine.
- Never use the machine without its protective guards.
- Always use original materials to replace any damaged parts of the machine.
- Never disengage the safety devices in the machine.
- Make sure that the power line has an efficient grounding socket.

- Any maintenance operations must be performed by qualified personnel only, aware of the risks due to the dangerous voltages necessary to operate the equipment.

## 9.7 PACEMAKER

- The magnetic fields deriving from high currents can affect the operation of the pacemaker. Wearers of vital electronic equipment (pacemakers) should consult their physician before undertaking arc welding, cutting, or spot-welding.

## 9.8 MOVING PARTS MAY BE HAZARDOUS.

Moving parts, such as the fan, can cut fingers and hands and get hooked on clothing.

- Keep all doors, coverings and guards closed and firmly in place.
- Guards and coverings may be removed for maintenance or checks only by qualified personnel.
- Never place hands, hair, loose clothing or tools near moving parts.
- Replace coverings and guards and close all doors after finishing the operation and before starting the machine.
- **The motor-driven fan is started when the generator heats up. It is therefore extremely important to turn the welding machine off before doing any kind of work inside it.**

## 9.9 NOISE



This device alone does not produce noise above 80 dB. The welding procedure may produce noise levels above this limit; therefore, users must take the precautions required by law.