

# INSTRUCTION MANUAL FOR PLASMA ARC CUTTING DEVICE



Read this manual carefully before using the machine. Failure to respect the rules described herein shall exempt the manufacturer from any liability.

The machine has been designed, built and protected (per standards: IEC 974.1 - EN 60974.1) for the functions described below. Any other use not explicitly included shall be considered FORBIDDEN.

The machine must be used in sufficiently ventilated rooms, in the absence of dust and moisture; in any case, where there is no risk of fire, explosion, or flooding.

The machine must be started, used and serviced by qualified personnel. Always follow current safety regulations. The manufacturer shall not be held responsible for any damage caused by incorrect use of the machine.

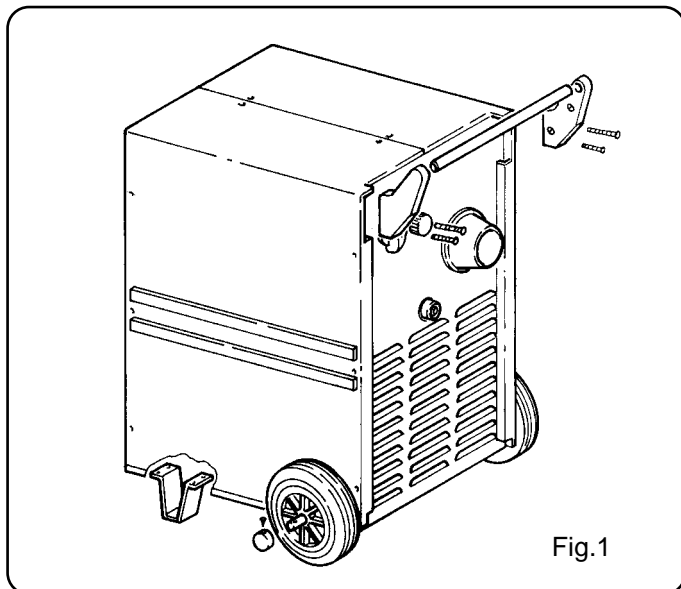
## INTRODUCTION

This device must be used exclusively for cutting on any electrically conductive material (metals and alloys). PLASMA cutting takes place due to the high temperature generated by a concentrated electric arc, and thus highly dangerous situations may arise; it is therefore essential to pay the utmost attention to the chapter entitled SAFETY PRECAUTIONS.

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 INSTALLATION

Unpack the unit, fit wheels, stand and handle following the instructions of picture 1.



1.1 TORCH ASSEMBLY (fig.2)

**This system is suitable for use only with CEBORA P70 and P150 torches, both manual and automatic.**

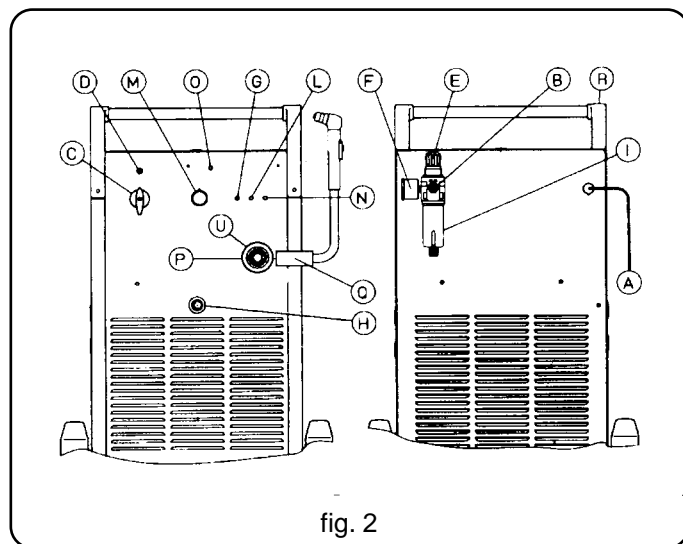
After inserting the torch fitting **Q** into the guard **U**, insert the torch into the fixed connector **P**, screwing the ring-nut of the fitting **Q** all the way down to avoid any air leaks,

which could damage or interfere with smooth operation of the torch.



Do not dent the terminal pin or bend the pegs in the torch fitting **Q**. A dented pin cannot be connected, while a bent peg does not allow the fitting **Q** to be fitted firmly into the fixed connector **P**, preventing the machine from operating. Screw the guard **U** on to the panel.

## 1.2 DESCRIPTION OF UNIT DEVICES (see picture 2)



- A) Feed cable
- B) Compressed air fitting (1/4" female gas thread)
- C) Mains switch
- D) Mains pilot light
- E) Air pressure reducing unit
- F) Gauge
- G) Light signalling thermostat is open
- H) Work clamp
- I) Water trap
- L) Light signalling air pressure is not enough
- M) Cutting power adjusting sknob
- N) Light signalling electrode is worn out producing a dangerous condition
- O) This warning lights up to indicate that you must not cut with the nozzle in contact with the work piece.
- P) Fixed fitting for torch.
- Q) Torch fitting.
- R) Handle. Must not be used to lift the machine.

## 1.3 SAFETY DEVICES

This unit is provided with the following safety devices:

### Thermic:



located on the power transformer windings to avoid overloads and signalled by indicator light **G** on (see picture 2).

### Pneumatic:



located on the torch feed line to avoid insufficient air pressure and signalled by indicator light **L** (see picture 2).

**Electric:** 1) located on torch body to avoid dangerous

voltages while replacing nozzle, diffuser, electrode or nozzle holder.



2) To stop the unit when the electrode is so worn that it is required to be replaced. This second function is signalled by indicator light (N) (picture 2).

• Do not remove or short-circuit the unit safety devices.







• Only use original spares.

• Always replace any damaged part of the unit or torch with original material.

• Do not use any torches other than the original one.

• Do not let the unit work without covers. This would be dangerous for operator and for those who are surrounding the work area and would prevent the unit from cooling efficiently.

#### 1.4 DESCRIPTION OF TECHNICAL SPECIFICATIONS

			N°			
3~ 			EN 60974-1			
 P.A.C. TORCH TYPE CEBORA P70 - P150	 U <sub>0</sub> V PEAK	A / V - A / V				
		X	%	%	%	
		I <sub>2</sub>	A	A	A	
		U <sub>2</sub>	V	V	V	
 						
3~ 50/60 Hz	U <sub>1</sub>	V V V	I <sub>1</sub>	A A A	A A A	A A A
PROTEZIONE TERMICA THERMAL PROTECTION PROTECTION THERMIQUE THERMISCH GESCHÜTZ PROTECCION TERMICA		IP 21 CL. H			VENTILAZIONE FORZATA FORCED VENTILATION VENTILE KÜHLART F VENTILACION FORZADA	

IEC 974.1 This machine is manufactured according to these international standards.

Nº ..... Machine Serial Number which must appear on requests or inquiries concerning the machine.

..... Three-phase transformer-rectifier.

..... Drooping characteristic.

..... Plasma Arc cutting.

U<sub>0</sub> PEAK ..... Peak value.

X ..... Duty-Cycle Percentage.

The duty-cycle is the number of minutes, expressed as a percentage, the machine can operate (arc on) within a ten minute period without overheating. The duty cycle varies according to the output current.

I<sub>2</sub> ..... Output cutting current

U<sub>2</sub> ..... Secondary voltage, cutting current = I<sub>2</sub>

U<sub>1</sub> ..... Nominal supply voltage

3~50/60Hz ..... Three-phase input supply at 50 or 60 Hz

I<sub>1</sub> ..... Input Amps absorbed corresponding to different output levels (I<sub>2</sub>).

IP21 ..... Machine case protection class.

The 1 in the second digit place means that

this unit is not fit to work outdoors in the rain.

..... Fit to work in hazardous areas.

NOTE: This machine has also been designed to work in class 3 pollution areas (see IEC 664).

#### 1.5 SETTING AT WORK

The unit must be installed by skilled personnel. All fittings must be in conformity with the existing rules and in full compliance with safety regulations (see CENELEC HD427).

Connect the air feed to fitting B making sure that pressure is 88PSI (6bar or KPa X100) at least with a minimal capacity of 420 CFH (250 liters/min.)

Should air feed come from a pressure reducing unit of a compressor or of a centralized plant, the reducing unit should be adjusted at an output pressure which should not exceed 120 PSI (0,8 MPa). Should air feed come from a compressed air bottle, this should be provided with a pressure regulator; **never connect compressed air bottles directly to the reducing unit! Pressure may exceed the reducing unit capacity and then explode!**

Check that the mains power supply matches that indicated on the rating plate attached to the power supply cable. If this is not the case, change the connections on the change voltage terminal board inside the equipment.

Connect supply cable A: the yellow-green wire of cable must be connected to an efficient earth plug of the

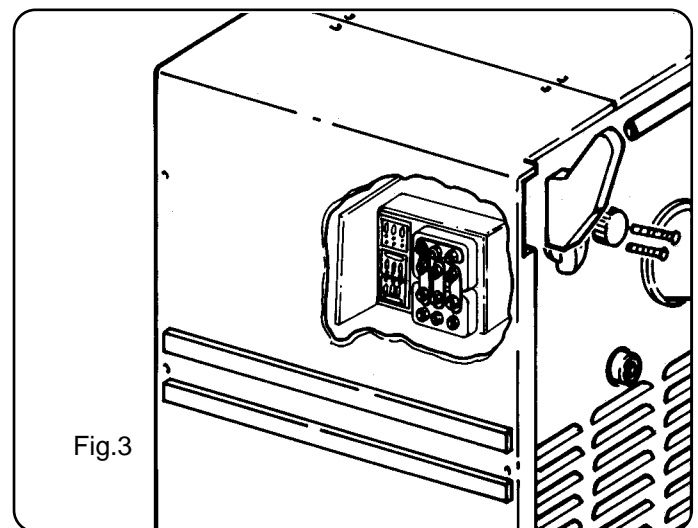


Fig.3

system, the remaining wires should be connected to the feed line by means of the switch placed, if possible, close to the cutting area so as to switch the unit off quickly if necessary.

The magnetothermic switch capacity or of fuses in series with switch should be equal to the current I<sub>1</sub> absorbed by the unit.

Current I<sub>1</sub> absorbed is known by reading the technical specifications on the unit i.e. feed voltage U<sub>1</sub> available. Any extensions should have adequate sections for current absorbed I<sub>1</sub>.

#### 2 USE

Before using this machine, carefully read the CENELEC

standards HD 407 and HD 433 also check insulation of cables.

Switch the unit on by turning knob **C** of the mains switch; this is shown by light **D** which is on.

By pressing for a second the torch button, the compressed air flow is opened. Check that, under this condition, the pressure shown on gauge **F** is about 5 bar (0,5 MPA), otherwise adjust it by means of knob **E** of reducing unit, then lock this knob by pressing it down.

Connect work clamp to the piece to be cut.

Cutting circuit should not be deliberately placed in direct or indirect contact with protection wire if not in the workpiece. If earthing is deliberately made on the workpiece by means of protection wire, the connection must be as direct as possible, with the wire having a section at least equal to the welding return current wire and connected to the piece being worked on, in the same place as the return wire, using the return wire terminal or a second earth terminal closeby.

All possible precautions must be taken in order to avoid stray currents.

Set the cutting current by means of the knob **M**.

**Use the Ø 1,1 mm nozzle up to 50 A and the Ø 1,3 mm one from 45 to 90 A.**

N.B. Cut quality is greatly improved if the nozzle is kept at a distance of approx. 4 mm from the workpiece. Often for practical reasons, however, cutting is performed with the nozzle in contact with the workpiece. **Cutting with the nozzle in contact with the workpiece must not be performed at currents above 45/50A as this leads to rapid (sometimes even instantaneous) destruction of the nozzle hole; this in turn leads to poor cutting quality.**

**When the red warning light (O) lights up this indicates that cutting must be performed using the spring (part no 1394) or the spacer (part no 1405).**

Clean the work piece to ensure good electrical contact of the work clamp.

Do not connect work clamp to the material to be removed. Press torch button to start pilot arc, if cutting does not start after 2 or 3 seconds, the pilot arc turns off and the button should be pressed again to repeat the operation.

When possible, the torch should be pulled. Pulling is easier than pushing.

Keep torch in vertical position when cutting.

Once cutting is over and after releasing button, air continues to flow out of the torch for about 100 seconds so it enables torch to cool down. It is recommended not to turn the unit off before that time.

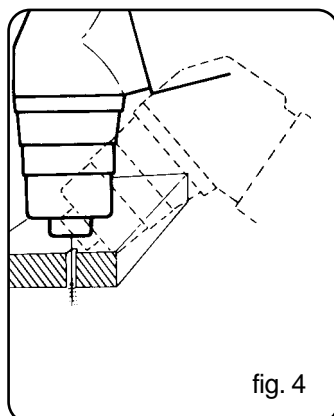


fig. 4

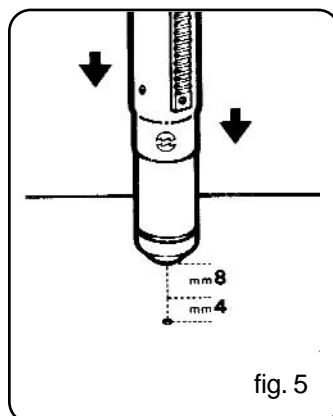


fig. 5

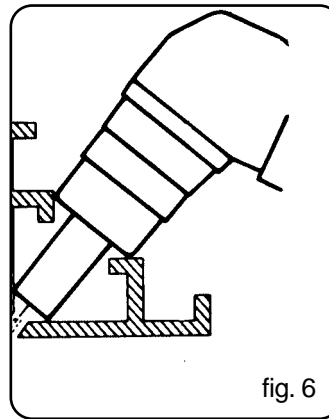


fig. 6

If you need to make holes or begin cutting from the center of the workpiece, the torch must be held at an angle and straightened slowly, to prevent melted metal from being sprayed onto the tip (see fig. 4). This must be done when si forano pieces more than 3 mm thick.

In automatic mode (see fig. 5), keep the tip 7/8 mm from the workpiece; after making the hole, if possible, move it

to a distance of approximately 4 mm. Do not drill thicknesses greater than 10/12 mm. For thicker pieces, the workpiece must be perforated before cutting.

If you need to cut on the corners or in notches (Fig. 6), we recommend that you use extended electrodes and tips. If circular cutting is required, we recommend that you use the special compass supplied upon request. Remember that the compass may make it necessary to use the starting technique described above (fig.4).

**NOTE:** Avoid keeping the pilot arc lit needlessly when not using the device, to prevent unnecessary wear on the electrode, diffusor and tip.

**When you have finished working, turn off the machine.**

## 2.1 GOUGING

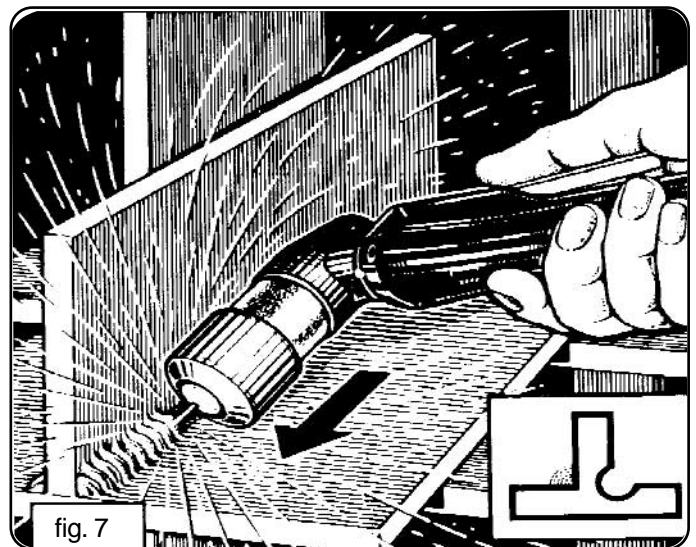


fig. 7

This machine may be used for gouging, making it possible to remove defective welds, separate welded pieces, prepare edges, etc.

To do so, you must use the tip **E** (fig. 8), diam. 3 mm, and mount the spacer **C** on the shield cup bushing **D**. The spacer **C** serves to prevent melted metal from burning the insulation on the shield cup bushing **D** during gouging.

The current to be used is based on the thickness and amount of material to be removed.

This must be done holding the torch at an angle (fig. 7) and moving towards the melted material so that the compressed air leaving the torch pushes it away. The angle of the torch with respect to the workpiece depends on the penetration desired. Since melted waste tends to stick to the spacer and tip during this procedure, it is best to clean them frequently to

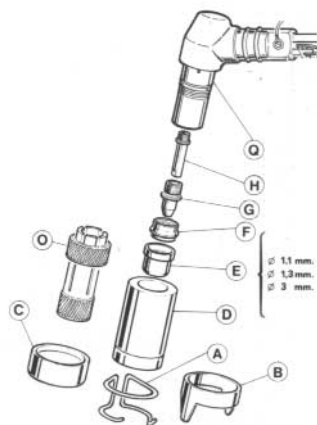


fig. 8

prevent certain phenomena (double arc) that can destroy the tip in just a few seconds.

Given the high amount of radiation (infrared and ultraviolet) emitted during this procedure, we recommend that the operator be carefully protected, as well as anyone else near the work area.

**When you have finished working, turn off the machine**

## 2.2 USING THE TORCH P70 (UPON REQUEST)

The machine can also operate with the torch CEBORA P70. When this torch is mounted, the machine automatically sets itself to a cutting current of max. 50 A, and settings are available starting at 20 A.

The workpiece can be cut in contact, using either a standard tip and electrode or a long tip and electrode, because when this torch is connected the max. cutting current is 50A.

**NOTE: When using the torch P70, the electrical safety device to block the unit when the electrode is worn could fail to work.**

**Always turn the machine off after use.**

## 3 CUTTING TROUBLE

### 3.1 INSUFFICIENT PENETRATION

This may be due to:

- high speed. Always make sure that arc thoroughly passes through the piece to be cut and that it is not tilted, when going forward, by a percentage above 10 - 15°. It is thus avoided to wear nozzle out and to burn the nozzle holder.
- Excessive thickness of piece (see graph of cutting speed)
- Work clamp not properly in electric contact with piece
- Worn nozzle and electrode
- Too low cutting current.

N.B. : When the unit does not thoroughly pass through, nozzle is clogged by scums.

### 3.2 CUTTING ARC SWITCHES OFF

This may be due to:

- worn nozzle, electrode or diffuser

- too high air pressure
- too low feed voltage

### 3.3 THE CUT IS SLANTED

If the cut is slanted, turn off the machine and replace the tip. Prevent the tip from coming into electrical contact with the workpiece (even through shreds of melted metal).

This causes the nozzle hole to be destroyed rapidly, at times instantaneously, and leads to a poor quality cut.

### 3.4 EXCESSIVE WEAR OF CONSUMABLE PARTS

This may be due to :

- a) too low air pressure with respect to the recommended one
- b) excessive burns on the end part of nozzle holder.

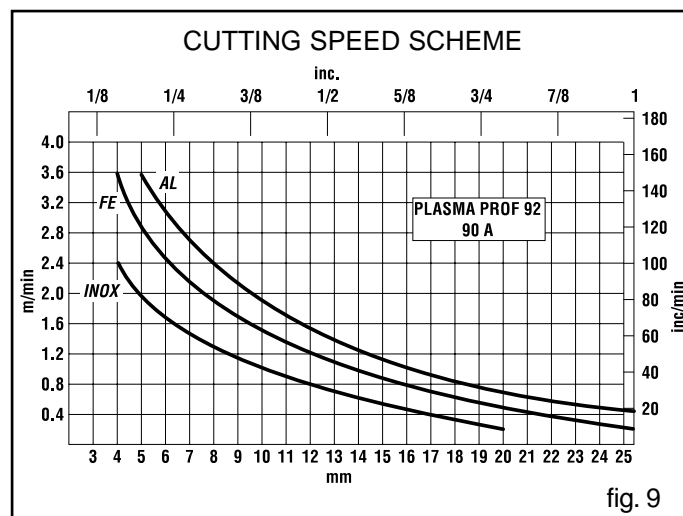


fig. 9

## 4 PRACTICAL RECOMMENDATIONS

- If the system air contains much humidity and oil it is required to use a drying filter to avoid excessive oxidation and wear of consumable parts, to avoid torch damage or to reduce speed and quality of cutting.
- Impurities of air favour oxidation of electrode and nozzle and make it difficult to start pilot arc. If this occurs, clean the end part of electrode and inside the nozzle with fine abrasive paper.
- Make sure that new electrode and nozzle to fit are clean and degreased.
- **To avoid damage of torch always use original spares.**

## 5 TORCH MAINTENANCE (FIG. 10)

**Always cut off power to the machine before working on the torch.**

### 5.1 REPLACING THE CONSUMABLE PARTS

The parts subject to wear are the electrode **G**, the diffuser **F**, and the tip **E**.

Any of these parts may be replaced only after unscrewing the shield cup **D**.

The electrode to be replaced has a crater in the middle, approximately 1.5 mm deep.

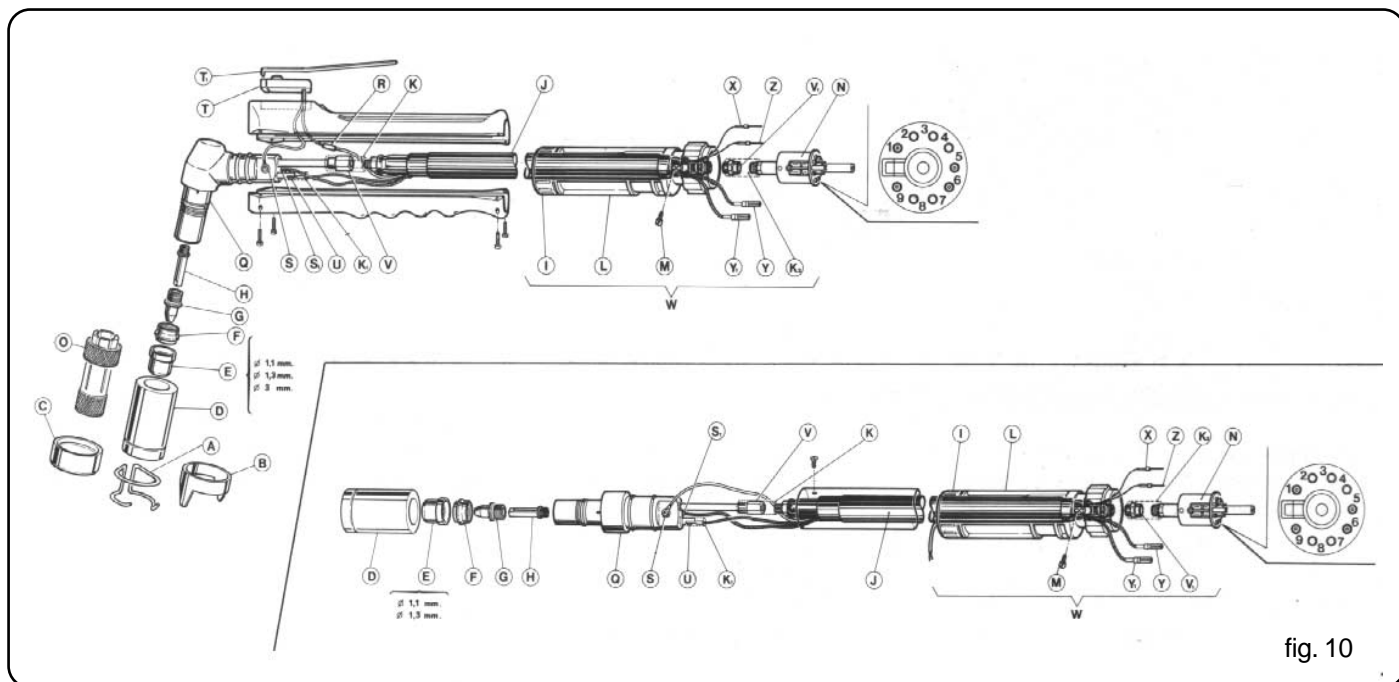


fig. 10

If this is not replaced when worn, the device blocks itself and the indicator lamp **N** lights (Fig. 2). To reset, you must turn off the device, replace the electrode and turn it back on using the knob **C**.

**CAUTION!** Do not use sudden force to unscrew the electrode; exert a gradually progressive force until the threading is released.

**Lubricate the threading of the new electrode using silicone lubricant (provided with the machine).**

**The new electrode must be screwed into its housing and fastened in place without over tightening.**

The tip should be replaced when the central hole is damaged or much wider than that of a new tip. The diffuser **F** should be replaced when one of its ends tends to char. Often, due to the thermal and mechanical stress to which it is subjected, this part tends to stick to the electrode **G** or the tip **E**. To detach it, we suggest that you use the extractor **O** provided with the device, which allows you to detach the diffuser without damaging it.

Make sure that the electrode **A**, the diffuser **B** and the tip **C** have been mounted correctly, and that the shield cup **D** is screwed on tightly. If the unit is used without these parts, it can damage the device and is especially hazardous to the operator's safety.

## 5.2 REPLACING THE TORCH ASSEMBLY Q

Open the grip by removing the screws. Remove the screws holding the terminals of the safety conductors **S-S1**. Remove the screw holding the conductor for the pilot arc **U** after first cutting the insulating tube **K1**. Remove the fitting **V** after first cutting the insulating tube **K**. Mount the new torch assembly by performing the above steps in reverse order.

The fitting **V** and conductor **U** are insulated by attaching the heat-shrink tubes **K** and **K1** directly to the fittings themselves. Do this by heating the tube with a small heat source (i.e., a cigarette lighter). Before replacing the grip, make sure that all connections have been firmly tightened.

## 5.3 REPLACING THE TORCH FITTING W

Remove the ring-nut **I** and cut the clamps holding the cable **J**. Unscrew the screw **M** and slide the cover **L** out backwards. Remove the control cable pegs **X** and **Z** and the red pilot arc wire pegs **Y** and **Y1**. Cut the insulating tube **K2** and unscrew the assembly **N** from the fitting **V1**. Mount the new assembly by performing the above steps in reverse order. To lock the thread of assembly **N** onto the fitting **V1**, use sealing adhesive for threads. The pegs **X** and **Z** of the control cable must be connected to contacts 1 and 9 of the assembly **N**. The pegs **Y** and **Y1** of the red cables for the pilot arc must be connected to the contacts 5 and 6 of the assembly **N**. The tube **K2** acts as insulation, and is attached to the fitting **V1** by heating it.

## 5.4 REPLACING THE CABLE J

To replace the cable, proceed as described in points 5.2 and 5.3. For the manual torch, it is necessary to make the connection **R**.

**NOTE:** The connection **R** must be carefully insulated.

## 5.5 REPLACING THE BUTTON T (manual torch)

Remove the lever **T1**, unscrew the screws and open the grip. Then unscrew the screw **S** holding the cable terminal of the button, cut the connection **R**, remove the button, insert the new button and perform the above steps in reverse order. Insulate the connection **R** carefully.

## 5.6 REPLACING THE GRIP (manual torch)

The grip can be replaced by following the instructions given in point 5.5.

## 5.7 REPLACING THE GRIP (torch for use in automatic mode)

The grip can be replaced by following the dismantling

instructions given in point 5.2; remove the grip and mount the new one, then follow the previous steps in reverse order to reassemble.

## 5.8 REPLACING THE DIFFUSOR TUBE H

Unscrew the shield cup **D**, remove the tip **E** and the diffuser **F**; unscrew the electrode **G** and then the tube **H**. Mount the new diffuser tube by screwing it on with the 6-gauge wrench provided, then perform the above steps in reverse order.

## 6 MAINTENANCE AND CHECKS

Before opening the machine, always disconnect the plug from the mains.

In case of repairs inside the machine, make sure that the switch **C** is in "O" position and **that the mains cable is disconnected from the socket. The fan not turning does not mean that the machine is OFF.**

Any maintenance must be performed only by qualified personnel, aware of the risks due to the high voltages necessary in order for the device to operate.

It is important to keep the tip clean of metal waste. Do not use sharp objects to avoid deteriorating the hole of the tip. If you have trouble removing the electrode, proceed as follows: lubricate the threading of the electrode with penetrating lubricating fluid, then unscrew the electrode. If the threading of the electrode holder support on the torch assembly is damaged while removing the electrode, tap it with a male M11 after first removing the diffuser tube **H** (fig. 8).

To prevent metal residue from remaining inside the torch assembly during this operation, we recommend blowing into the torch with compressed air while tapping.

Although the machine is equipped with an automatic condensation drainage device, which is started each time the air supply is cut off, it is a good habit to periodically make sure that there is no trace of condensation in the tray **I** (fig. 2) of the reducer.

Accumulated metal dust must be cleaned from the inside of the machine periodically, using compressed air.

### 6.1 PRECAUTIONS TO TAKE AFTER A REPAIR

After making repairs, take care to re-order the cables so that there is sure to be insulation between the primary and secondary sides of the machine. Make sure that the wires cannot come into contact with moving parts or parts that heat during operation. Replace all clamps in their original positions on the machine, to prevent a connection between the primary and secondary circuits if a conductor accidentally breaks or disconnects.

Mount also the screws with the toothed washer in the original position.

## 7 BASIC SAFETY PRECAUTIONS

### 7.1 ELECTRIC SHOCK



Electric shock can kill. All electric shocks are potentially fatal.

This plasma cutter requires high voltages for arc

spark starting (approx.  $250 \div 300$  V). The following safety rules must be therefore observed when using the unit:

- Do not touch live parts.
- Insulate yourselves from the piece to be cut and from earth by wearing insulating gloves and clothing
- Keep your clothing (gloves, shoes, hats, dresses) and body dry
- Do not work in humid or wet areas
- Avoid touching or holding by hand the piece to be cut
- Should you work close to or in a dangerous area use all possible precautions.
- If you feel even the slightest electric shock sensation, stop cutting at once. Do not use the machine until the problem is identified and solved.
- Always fit an automatic wall switch with adequate power, if possible close to the machine so as to immediately switch the unit off in an emergency event.
- Check often mains cable, torch cable, earth cable and torch.

Never use the unit when one of them is damaged. Replace them immediately.

- Disconnect mains cable from mains before replacing cables or before removing unit covers.
- Always switch the unit off or disconnect it before replacing nozzle, swirl ring, electrode or nozzle holder.
- Do not use the unit without protecting covers.
- Always replace any damaged parts of the unit, torch and cables with original material.
- Never remove torch or unit safety devices.
- Make sure that the supply mains line is equipped with an efficient earth plug.
- Any maintenance should be only carried out by qualified personnel aware of the risks due to dangerous voltages necessary to make the unit work.



**Make sure that the electrode **G**, swirl-ring **F** and nozzle **E** are properly mounted and that the nozzle holder **D** is screwed and tight. The absence of such parts jeopardizes the machine functioning as the operator safety.**

### 7.2 RADIATIONS



Ultraviolet radiations created by the arc may damage your eyes and burn your skin. Then:

- Wear proper clothing and helmets.
- Do not use contact lenses!! The intense heat coming from the arc may stick them on the cornea.
- Use masks with grade DIN 10 safety lenses, at least.
- Protect people surrounding the cutting area.

### 7.3 FUMES



Cutting operations give off fumes and harmful metal dusts which may damage health, therefore:

- Do not work in areas without proper ventilation.
- Keep your head out of fumes.
- In closed rooms use suitable exhaust fans, placed under the cutting area, if possible.
- If ventilation is not enough, use breathing sets approved for this procedure.
- Clean the material to be cut of any solvents or halogen degreasers giving rise to toxic gases when cutting: Some chlorine solvents may decompose with radiation emitted by the arc and create phosgene gas.

• Do not cut plated metals or metals containing lead, graphite, cadmium, zinc, chrome, quicksilver or beryllium unless you have a proper breathing set.

• The electric arc creates ozone. After long exposure to high concentrations of ozone you may have headache, nose, throat and eyes irritation as well as serious congestion and chest pains.

**IMPORTANT: DO NOT USE OXYGEN FOR VENTILATION.**

#### 7.4 FIRE



• Avoid causing fire because of sparks, hot metal or pieces.

• Make sure that suitable fireproof devices are available close to cutting area.

• Remove from cutting area and surrounding area (33 feet at least) all inflammable and combustible material.

• Do not cut containers of combustible or lubricating material, even when empty. These should be carefully cleaned before being cut.

• Let the material cut cool down before touching it or putting it in contact with combustible or inflammable material.

• Do not cut parts with hollow spaces including inflammable material.

• Do not work under conditions of high concentration of combustible vapours, gases or inflammable dust.

• Always check the work area half an hour after cutting so as to make sure that no fire is starting to burn.

#### 7.5 BURNS

• Wear fire-proof clothes all over your body to protect your skin against burns caused by ultraviolet radiations from the arc, from sparks and hot metal.

• Wear no turn-up trousers to prevent sparks and metal to deposit in them.

• Wait for the torch to be cooled down and then switch the unit off before touching the front side of the torch.

• **Torch is provided with a pilot arc, then as soon as you press the button, the plasma spark starts even if earth cable is not connected. Avoid directing jet towards your own body or towards other people surrounding the cutting area.**

• **To prevent spark to start by chance, always switch the unit off before putting down your torch.**

• Do not carry combustible material, such as lighters or matches in pocket.

#### 7.6 EXPLOSIONS

• Do not cut above or near containers under pressure.

• Do not cut in environments containing explosive dusts, gases or vapours.

This plasma cutter uses compressed air to work; should you use compressed air bottles follow suitable precautions:

##### A) CYLINDERS

• Do not directly connect cylinders to reducing unit without a pressure regulator; pressure might exceed the reducing unit capacity making it explode.

• Feeding pressure must not exceed 120 PSI (8bar/0.8 MPa)

• Handle or use pressure cylinders in conformity with the

existing rules.

• Do not use leaking or damaged cylinders.

• Do not use cylinders which are not properly secured.

• Do not carry cylinders whose content is not clearly identified.

• Never lubricate cylinder valves with oil or grease.

• Do not put electrically in contact cylinder with plasma arc.

• Do not expose cylinders to excessive heat, sparks, hot metal or flames.

• Do not tamper with cylinder valves.

• Do not try to loosen all tight valves by means of hammers, keys or something else.

##### B) PRESSURE REGULATORS

• Keep pressure regulators in good conditions. Damaged regulators may give rise to damage or accidents; they should only be repaired by skilled personnel.

• Do not use regulators for gases other than those they are manufactured for.

• Never use a leaking or damaged regulator.

• Never lubricate regulators with oil or grease.

##### C) AIR HOSES

• Replace air hoses if damaged.

• Keep hoses unwound so as to avoid bending.

• Keep excess hose wound and keep it out of the working area to avoid any damage.

#### 7.7 NOISE



These power sources alone do not produce noise levels exceeding 80 dB. The cutting procedure, however, may produce noise levels in excess of 80 dB in which case the operator must take the necessary safety precautions as prescribed by the national safety regulations.

#### 7.8 PACEMAKER

Magnetic fields created by the high currents in the cutting circuit can affect pacemaker operation. Persons wearing electronic life support equipment (pacemakers) should consult their doctor before going near any arc welding, gouging, cutting, or spot welding equipment in operation.