



Operating Manual

Sabre-arc 40*i* **PT - 50** **Air Plasma Cutting System**



**Please ensure that this
Instruction Manual
is made available
to the user
of the equipment.**



Contents

	Page
• Safety.....	4
• Introduction.....	5
• Specification.....	5
• Unpacking.....	6
• Installation.....	6
• Assembling PT - 50 Torch Consumables	7
• Controls & Facilities.....	7
• Operation.....	8
• Common Cutting Problems.....	9
• Maintenance.....	10
• Troubleshooting.....	10
• Optional Extras.....	14
• Spare Parts Information.....	14



WARNING



This welding equipment has been designed, manufactured and tested to the highest standards to ensure long and trouble free life. However, regular maintenance is an essential part of keeping the machine operating in a reliable and safe manner and your attention is drawn to any maintenance instructions that are contained in this manual.

In general, all welding equipment should be thoroughly inspected, tested and serviced at least annually. More frequent checking will be required when the equipment is heavily used.

Wear and tear, particularly in electro-mechanical and moving components, are gradual processes. Caught in time, repair and costs are small and the benefits in performance reliability and safety are significant. Left alone, they can put the equipment, and you, at risk.

Have this equipment regularly inspected and maintained by an approved service centre.



WARNING



**ARC WELDING AND CUTTING CAN BE INJURIOUS TO YOURSELF AND OTHERS.
TAKE PRECAUTIONS WHEN WELDING. ASK FOR YOUR EMPLOYER'S SAFETY
PRACTICES WHICH SHOULD BE BASED ON MANUFACTURERS' HAZARD DATA.**

ELECTRIC SHOCK - Can Kill

- Install and earth the welding unit in accordance with applicable standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves, or wet clothing.
- Insulate yourself from earth and work.
- Ensure your working position is secure.

FUMES AND GASES - Can be Dangerous to Health

- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to keep fumes and gases from your breathing zone and the general area.

ARC RAYS - Can Injure Eyes and Burn Skin

- Protect your eyes and body. Use the correct welding screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

NOISE- Excessive noise can damage hearing

- Protect your ears. Use ear defenders or other hearing protection.
- Warn bystanders of the risks.

**READ AND UNDERSTAND THE INSTRUCTION MANUAL
BEFORE INSTALLING OR OPERATING AND SEE WMA PUBLICATION 237
'The arc welder at work' AVAILABLE FROM THE MANUFACTURER.**

PROTECT YOURSELF AND OTHERS

SAFETY

In any plasma cutting or gouging operation, it is the responsibility of the user to observe certain safety rules to ensure his personal safety and to protect those working near him.

Read all safety articles relevant to plasma cutting published by the WMA. Pay particular attention to any CAUTION or WARNING Notes included in this manual. CAUTION indicates possible equipment damage. WARNING indicates possible hazard to life.

⚠ WARNING ⚠

The ON/OFF switch on this equipment does not isolate the unit from the mains electrical supply. AC POWER IS PRESENT ON THE ON/OFF SWITCH TERMINALS.

The On/Off lamp is an indication that the supply is switched on and does not imply that the unit is isolated from the supply. BEFORE REMOVING THE COVERS FOR MAINTENANCE, ISOLATE THE UNIT FROM THE MAINS ELECTRICAL SUPPLY.

1. Electrical

- ⚠ Treat electricity with respect. The open circuit voltage of this equipment is a high dc voltage therefore contact with any live parts of the torch can be dangerous. Adjustments to the torch or replacement of torch parts should be undertaken with the mains supply isolated from the unit. If damaged torch cables or torch components are found, the unit must be disconnected from mains and defective parts must be replaced using only Murex spare parts.
- ⚠ Do not work on live circuits or cables. Disconnect the main power supply before checking the machine or performing any maintenance operation.
- ⚠ Be sure the case of the welding machine is properly connected to a good electrical earth.
- ⚠ Have the wiring for the welding machine installed by a qualified electrician. All connections must be made according to specifications in force and to general safety standards.
- ⚠ Do not stand in water or on damp floors while using an arc welder or cutter. Do not cut in the rain.
- ⚠ Do not operate with worn or poorly connected cables. Inspect all cables frequently for insulation failure, exposed wires and loose connections.
- ⚠ Do not overload cables or continue to operate with overheating cables. Cables which are too small for the current carried will overheat, causing rapid deterioration of the insulation.
- ⚠ Pay attention that live parts of the torch do not touch any metal which is connected to the earth cable. Fix an insulated hook to hang the torch on when it is not in use.

- ⚠ Switch off and isolate from the mains whilst changing cutting tips and electrodes.

2. Ventilation

- ⚠ Do not weld or cut on containers which have held combustible or flammable materials, or materials which give off flammable or toxic vapours when heated, without proper cleaning.
- ⚠ Locate the welding/cutting operation far enough from any vapour-type degreaser using trichlorethylene or other chlorinated hydrocarbons as solvents. The ultraviolet light from the arc can decompose these vapours into toxic gases at a considerable distance from the arc, even though the concentration of the gases is low enough to be undetectable by smell.
- ⚠ Be sure to provide adequate ventilation for removal and dilution of fume and gases. Fume exhaust facilities near the arc, or a ventilated helmet should be used when cutting in confined spaces or on toxic material.

3. Glare

- ⚠ Never look at the arc without wearing eye protection.
- ⚠ Always use the proper protective clothing, filter glasses, and gloves. Be careful to avoid exposed skin areas. Do not use cracked or defective helmets or shields.
- ⚠ Never strike an arc when there is someone near who is not protected from the strong light of the arc.
- ⚠ Warn bystanders who are not aware of the dangers of ultra-violet light.

4. General

- ⚠ Take care when lifting the unit.
- ⚠ Ensure that cylinders are secured by chains.
- ⚠ Locate the unit so that there is adequate air flow to the ventilation louvres.
- ⚠ Always dress correctly to protect against glare, radiation and spatter.

5. Fire

- ⚠ Ensure that the correct type of fire extinguisher is available in the cutting area.
- ⚠ Do not cut near flammable materials or liquids, in or near explosive atmospheres, or on pipes carrying explosive gases.

6. Vehicle Electrics

- ⚠ When working on motor vehicles, remove the battery and any circuitry which may be damaged by the arc.
- ⚠ Whilst cutting be aware of the possibility of 'hidden wires' behind panels or bulkheads.

INTRODUCTION

1. Sabre-arc 40i Power Source

The Murex Sabre-arc 40i is a small portable plasma cutting system designed to work on industrial 380/415V power supplies and utilises factory compressed air for both the plasma and secondary cooling gas. The power source uses inverter technology to give precise control of cutting current and, together with the PC-50 torch and patented HD consumables, enables conducting materials up to 15mm thick to be cleanly cut.

PT - 50 Plasma Cutting Torch

The patented Murex PT-50 torch and HD consumables are designed for manual plasma cutting up to 50A at 100% duty using **clean dry air** as both plasma and cooling gases. The PT-50 torch head contains an air flow check valve which, in conjunction with a flow switch in the Murex Sabre-arc power source, provides a safety interlock preventing the torch from being accidentally energised when the heatshield is removed.

The PT-50 is available with either 7.6 or 15m cables (7.6m standard with the Sabre-arc 40i) and has a 75° head angle. A pencil type 180° head is available as an optional extra, see Fig. 1 and Optional Extras section.

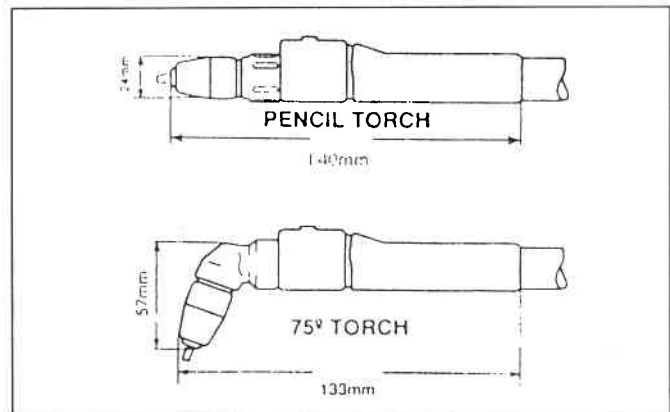


Fig. 1 PC - 50 Torch

The torch can be used in either contact cutting mode for sheet metals up to 5-6mm thick. A stand off (tip to work) distance of 2-3mm is recommended for plates greater than 6mm thickness.

A cutting guide plate can be used to aid straight line cutting, see OPERATION, this technique is also useful when cutting mesh or grilles. In addition a Circle Cutting Attachment is available as an Option for cutting accurate circles from 125 to 680mm in diameter. The circle cutting attachment dual castor assembly is also useful for maintaining a constant standoff for general sheet cutting.

SPECIFICATION

Sabre-arc 40i Power Source		PT - 50 Torch	
Output:		Current Rating	50A 100% duty
Open Circuit Voltage	200V dc	Plasma/Cooling Gases	Air
Output Current	10-40A	Head Angle	75° (180° 'Pencil' Option)
	continuously variable	Cable Length	7.6m (15m Optional)
Output Voltage	120V dc	Weight (shipping)	0.9kg
Cutting Thickness (mild steel)	0.5 - 15mm	Air Pressure	60-70 psi
Rating (10 minute cycle)	40A 60% duty	Air Flow	120 lpm/250cfh
Input:			
Mains Voltage	380/415V		
Frequency	50/60Hz		
Phases	1 (2)		
Input Fuse	30A		
Dimensions			
Height	438mm		
Width	210mm		
Depth	420mm		
Weight	21kg		

UNPACKING

The Murex Sabre-arc 40i system comprises the following items:

Pt.No. 1414201	Sabre-arc 40i Power Source with fitted primary cable
1414206	PT - 50 plasma torch with 7.6m lead
1414203	Air filter regulator and mounting hardware
1414204	Air hose assembly 0.75m
1414205	Work return lead and earth clamp 7.6m long
1414207	Kit of consumables for the PT-50 torch:-

Check that all required items are present and inspect carefully for evidence of damage which may not have been apparent on the external packing. If necessary notify the carrier or your Murex Distributor immediately.

INSTALLATION - see Fig. 2

Installation must only be undertaken by a qualified electrician or suitably trained person.

1. Choose a location so that the louvres on the front and rear are clear of any obstruction and permit free flow of air through and around the unit. Refer to Safety section for other precautions regarding siting the unit.

WARNING

Electric shock can kill! Precautionary measures should be taken to provide maximum protection against electric shock. Be sure that all power is off by opening the line (wall) disconnect switch and by unplugging the primary cable to the unit when connections are made inside the power supply.

2. The Sabre-arc 40i power source is equipped with a 3m, 3 conductor primary input cable suitable for use on 380/415V 50hz 1(2) phase power. Connection should be made as follows:-

Brown	-	L1
Blue	-	L2
Green/Yellow	-	Earth

A suitable switched isolator should be used and the circuit must be protected by a 30A fuse.

3. Set the mains voltage selector switch on the rear panel of the unit to the correct value for the supply to be used, 380 or 415V. Note that failure to do this will not damage the machine but may cause the overload/fault light to illuminate.

4. For operator safety, the torch and work return cable connections are located on a panel behind the cover on the front bottom of the unit. Note that a safety interlock prevents the unit being operated whilst the cover is removed.

5. Remove the cover and thread the lug end of the work return through the RH bushing and connect it to the work terminal. It may be necessary to slit the rubber skin inside the bushing.

6. Thread the power cable and torch switch lead of the PT-50 torch through the L.H. bushing in the cover and connect the power cable to the torch fitting (LH threads). Connect the torch switch plug to the receptacle provided. Ensure all three connections are tight. Refit the cover to the unit.

7. Assemble the air filter regulator to the rear of the unit as shown in Fig. 2. Connect the 0.75m long air hose to the filter regulator output (LH thread) and to the air inlet connection on the rear of the power source (RH thread). Ensure both hose connections are tight.

8. Connect a supply of CLEAN DRY COMPRESSED AIR to the regulator input nipple. Supply requirements are 6 bar minimum, 10 bar maximum (90 - 150 psi) at 100-150 L/minute. Do not use compressed air that has been oil loaded for pneumatic tools etc.

9. Clamp the earth clamp onto the workpiece ensuring that connection point is free from rust, scale or paint.

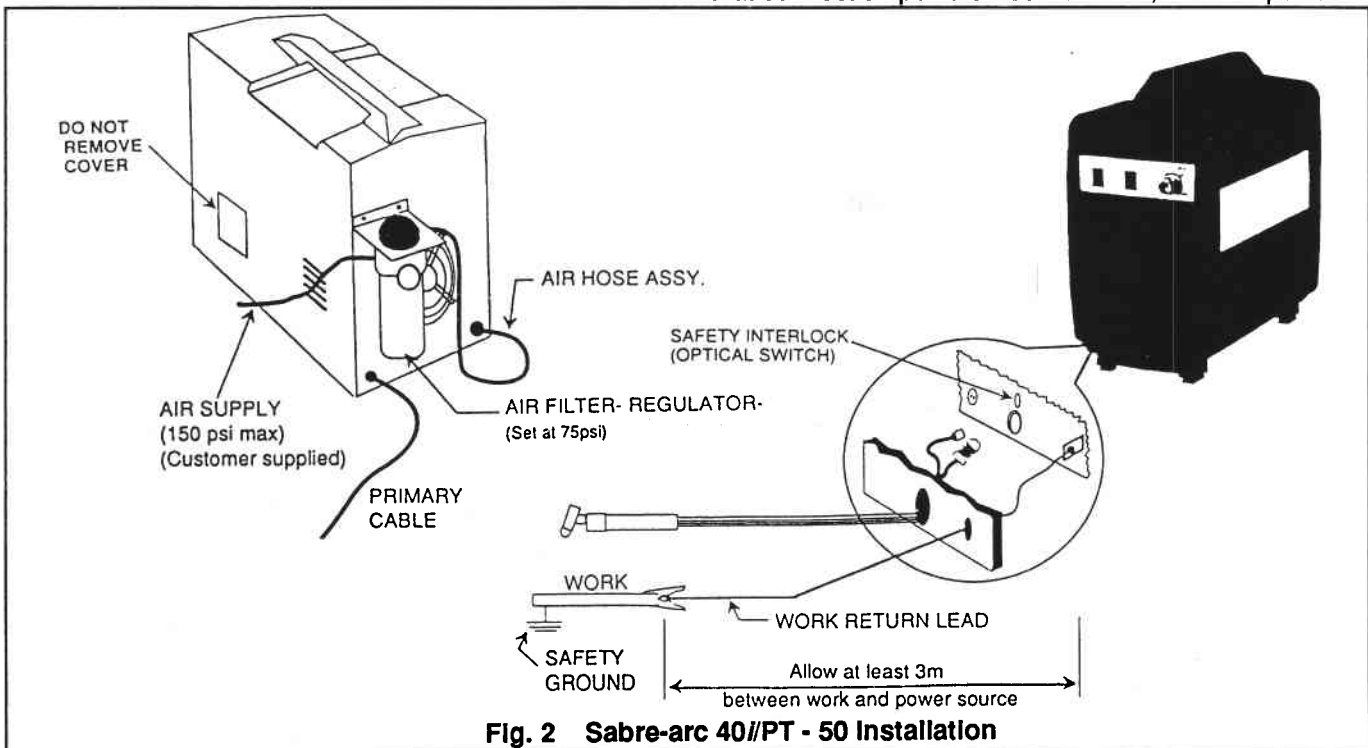


Fig. 2 Sabre-arc 40i/PT - 50 Installation

ASSEMBLING PT-50 TORCH CONSUMABLES - see Fig. 3

This section deals with fitting the electrode, tip etc. to the torch head.

WARNING

Ensure the power switch on Sabre-arc 40i is in the off position before installing or inspecting torch consumable parts

The Sabre-arc 40i package is supplied with a kit of consumables parts (Pt.No. 1414207) as follows:-

2	Plunger	Part No. 1414212
3	Electrode HD	Part No. 1414210
1	Swirl baffle	Part No. 1414211
4	Tip HD	Part No. 1414209
2	Heatshield	Part No. 1414208

Remove the Seat (1414229) from the torch using a suitable spanner. Insert a Plunger (1414212) into the head (the Plunger is reversible). Reassemble the Seat into the torch tightening firmly with a spanner. Install the Electrode (1414210), Swirl baffle (1414211), tip (1414209) and Heatshield (1414208) as shown in Fig. 3 tightening the Heatshield firmly by hand.

Note: The torch head contains a flow check valve that, along with flow sensing circuitry in the Sabre-arc power source, prevents the torch from being accidentally energised with the Heatshield removed.

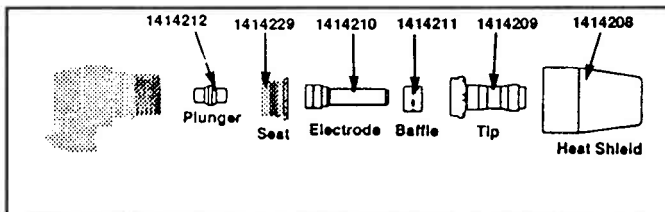


Fig. 3 PT - 50 Consumables

CONTROLS AND FACILITIES - see Fig. 4

1. Power On/Off Switch (rear panel). In the ON position the green pilot lamp is illuminated, the control circuitry is powered and the fan will run.

WARNING

Placing the power switch in the OFF position does not totally isolate the unit from mains electrical power. Always isolate the machine from the electrical supply before carrying out any work on or in the power source.

2. Mains Voltage Selector (rear panel). Sets the machine for use with either 380 or 415V supplies. Note the machine includes circuitry providing both under and over voltage protection hence inadvertent operation on the wrong setting will not damage the unit.

3. Output Current Control. Enables the precise cutting current to be set for the plate to be cut. Control range is 10-40A. see Fig. 5.

4. Air Check Switch. In the ON position, the air filter regulator can be adjusted to the required pressure, normally 60-70 psi, before cutting operations. In this mode air flows continuously and it is recommended, at least at the beginning of each shift, that the system is purged of any condensation that may have accumulated during the off period. Ensure the switch is in the OFF position before cutting.

5. Lock-in Switch In the ON mode the torch switch can be released after the cutting arc has been established. To stop the cutting operation momentarily operate the torch switch again or pull the torch away from the work. In the OFF mode the torch switch must be pressed during the entire cutting cycle.

6. Overload Light This light will be illuminated (Red) and the machine output will be shut off under the following conditions:

a. When the duty cycle has been exceeded. The duty cycle of the Sabre-arc 40i is 60% at rated output current of 40A based on a 10 minute cycle, i.e., 6 minutes cutting and 4 minutes idling. Leave the machine with the power on and fan running, the thermal protection will automatically reset after a few minutes.

b. When the mains input voltage is outside acceptable limits i.e., $\pm 10\%$ of nominal values. Ensure the rear panel Mains Voltage Selector is correctly set for the mains supply in use. To reset the machine turn the Power On/Off switch Off and then On.

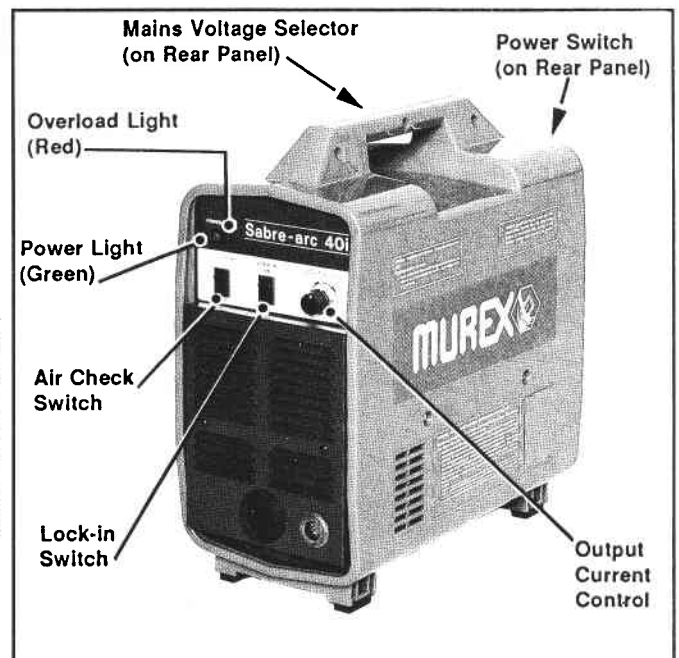


Fig. 4 Sabre-arc 40i Controls

OPERATION

WARNING
 Before attempting cutting operation read the safety notes at the front of this manual.
PROTECT YOURSELF AND OTHERS

WARNING
 Never touch any parts forward of the torch handle (electrode, tip, heatshield etc.) unless the Power Switch is in the Off position.

Note: Do not depress the torch switch unless the torch tip is touching or within 0.5mm of the workpiece. Locate the power supply at least 3m from the work area. Sparks and hot slag from the cutting process can damage it.

1. Hold the tip of the torch on or within 0.5mm of the workpiece where cutting is to start. To prevent damage to the tip from splash back or spatter it is recommended that the torch is held at a 15-30° angle from the vertical in a slightly trailing mode, see Fig. 6.

Note: If the plate to be cut is heavily painted or coated in an insulating medium it may be necessary to scratch or score through the surface where cutting is to start to aid initiation.

2. Depress the torch switch - air should start flowing through the torch.

3. Two seconds later the plasma arc will start cutting. If the Lock-In switch is in the ON position the torch switch can now be released.

4. After starting the cut, the tip can be dragged along the work if cutting up to 6mm thick sheet. When cutting plates greater than 6mm, maintain a stand off distance (tip to work) of 2-3mm. Fig 5 and 6 are a guide to cutting settings and technique, see also below regarding Piercing, Mesh Cutting and Cutting Guides.

5. When ending a cut, the torch switch should be released (press and release in Lock-in ON mode) and lifted away from the work just before the end to minimise possible double arcing which can damage the torch consumables.

6. In the postflow mode, the arc can be reignited immediately by operating the torch switch. The two second preflow will be automatically overridden.

Piercing

Materials up to 6mm thick can be pierced with the tip touching the work. When piercing ensure the torch tip is immediately lifted off the work to a 2-3mm standoff after arc start. This will reduce the possibility of spatter entering the torch or welding the tip to the plate. The torch should be angled at about 30° from the vertical when starting the pierce and then straightened after piercing has been accomplished.

Mesh Cutting

For rapid restarts use the Lock-In OFF torch switch mode and do not release the torch switch. This avoids the 2 second preflow period. Alternatively a cutting guide plate can be used to keep the arc alive during the 'gaps' in the mesh, see below.

Cutting Guides - see Fig. 7

To assist in maintaining a straight cut line a cutting guide can be used, see Fig. 7. The guide plate should be no more than 2mm thick and of a conducting material, stainless or mild steel are ideal. The guide plate should be placed on the work and the specially machined step in the end of the torch tip rested on its edge so that the hole in tip is over the line to be cut and within 1mm of the work.

After arc strike the torch can be simply moved along the edge of the guide.

Do not use cutting guides more than 2mm thick.

Material	Thickness mm	Current Amps	Travel m/min
Carbon Steel	1.6	30	4.5
	3	30	2
	3	40	2.5
	6	40	1
	10	40	0.3
	12	40	0.25
	16	40	0.18
Stainless Steel	1.6	30	5
	3	30	2
	3	40	2.5
	6	40	1
	10	40	0.3
	12	40	0.2
Aluminium	1.6	30	5
	3	30	2
	3	40	2.5
	6	40	1
	10	40	0.33
	12	40	0.2

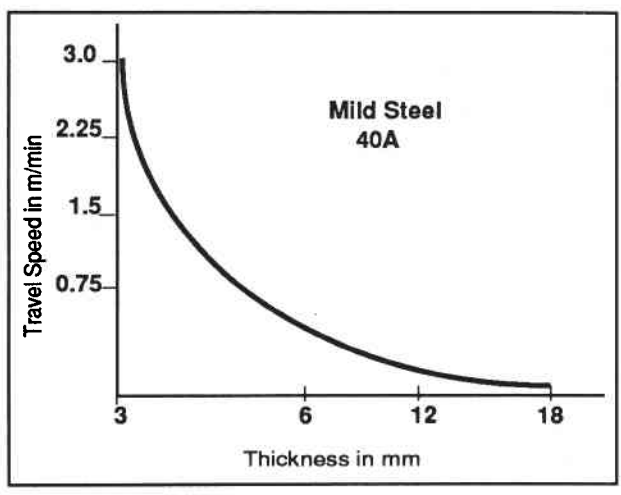


Fig. 5. Sabre-arc 40I/PT - 50 Cutting Range

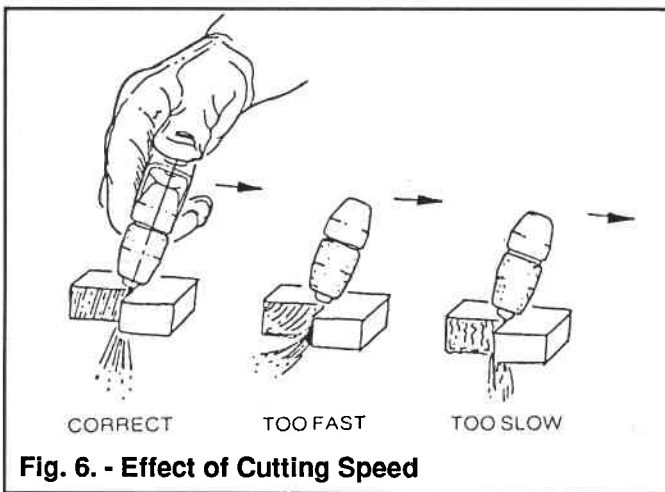


Fig. 6. - Effect of Cutting Speed

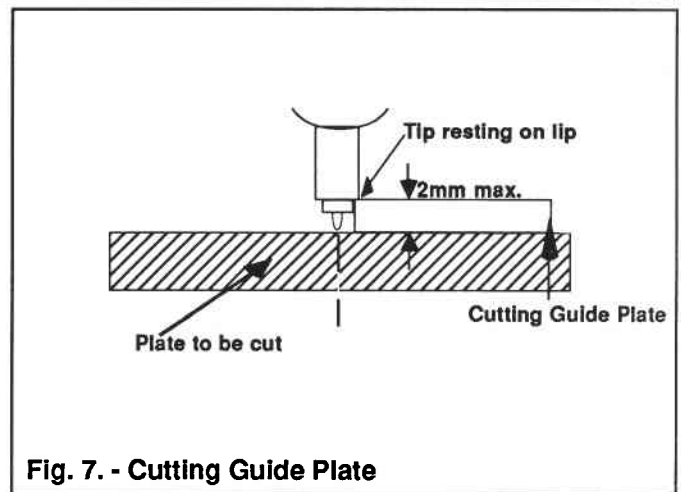


Fig. 7. - Cutting Guide Plate

COMMON CUTTING PROBLEMS

Problem	Remedy
<p>1. Insufficient Penetration</p>	<ul style="list-style-type: none"> • Cutting speed too fast • Damaged tip • Air pressure incorrect • Current too low
<p>2. Main Arc Extinguishes</p>	<ul style="list-style-type: none"> • Cutting speed too slow • Stand off distance too large • Earth clamp loose • Worn electrode and tip • Duty cycle exceeded
<p>3. Excessive Dross Formation Note it may be impossible with some materials and thicknesses to get totally dross-free cuts</p>	<ul style="list-style-type: none"> • Incorrect cutting speed • Incorrect air pressure • Faulty tip or electrode
<p>4. Double Arcing</p>	<ul style="list-style-type: none"> • Low air pressure • Contact cutting at high current • Damaged or loose tip • Heavy spatter
<p>5. Uneven Arc</p>	<ul style="list-style-type: none"> • Damaged or worn tip and/or electrode
<p>6. Unstable Cutting Conditions</p>	<ul style="list-style-type: none"> • Incorrect cutting speed • Loose cables and connections • Faulty air supply
<p>7. Main Arc Does Not Strike</p>	<ul style="list-style-type: none"> • Heavily insulated plate • Work return not connected • Excess air pressure • Worn electrode and tip • Tip too far from work
<p>8. Poor Consumable Life</p>	<ul style="list-style-type: none"> • Improper air pressure • Contact cutting at high currents • Piercing thick plate • Spatter • Contaminated air supply

MAINTENANCE

1. PT - 50 Torch

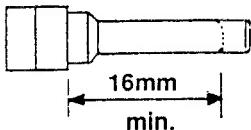
WARNING

Set power switch to OFF before removing consumables.

Inspect the torch and consumables at frequent intervals for excessive wear and erosion. Failure to do so may result in damage to the torch head itself or a safety risk.

1. With the torch head facing up unscrew and remove the heatshield. Examine the heatshield, tip, swirl baffle and electrode, see Fig 3.
2. Replace the heatshield if it is chipped, cracked or excessively eroded.
3. Replace the electrode when it has worn down to a length of 16mm.

HD Electrode Pt.No. 1414210



Replace electrode when it erodes to less than 16mm

4. Replace the tip if the hole is excessively oversized or elongated or excess side wall damage is evident.
5. Replace the swirl baffle if the holes become blocked or damaged.
6. Visually inspect the seat and plunger for signs of deterioration or damage.

7. Inspect the "O" ring on the torch head for signs of deterioration and replace if necessary. Ensure the new ring is located in the 2nd groove, see Spare Parts section, and apply a small quantity of Silicon grease to the ring.

8. The air flow check valve is part of the safety interlock and is permanently assembled inside the torch head. The head must be replaced should this valve malfunction. The light spring force used to close the valve can be felt by pushing down on the electrode when assembling the torch front end parts.

9. The torch cable and connections should be periodically inspected for signs of deterioration or damage. See Spare Parts section for notes on how to disassemble the torch.

2. Sabre-arc 40/ Power Source

WARNING

The unit must always be isolated from the mains electrical supply before any maintenance work is undertaken.

1. At regular intervals, and wearing eye and face protection, blow out the inside of the unit using low-pressure clean dry compressed air.
2. Check all electrical connections and fittings are tight and that cables are in good condition.
3. Check the air system for leaks.
4. Check and bleed water or oil from the air regulator filter assembly.

TROUBLESHOOTING

For cutting difficulties see Common Cutting Problems section.

WARNING

Ensure the machine has been isolated from the mains supply before attempting inspection or work inside the unit.

The troubleshooting flow chart, Fig. 8 is a guide to fault finding in the Sabre-arc 40i. If the cause cannot easily be located, disconnect the input power, remove the side covers and carry out a simple visual inspection. Look for secure connections, loose or burned wiring or components, damaged capacitors etc.

The cause of the control malfunction can usually be found by referring to the operating sequence and electrical schematic Figs. 9 and 10 and testing various components using a volt-ohmmeter.

Note: Before checking voltages disconnect the power from the High Frequency Unit.

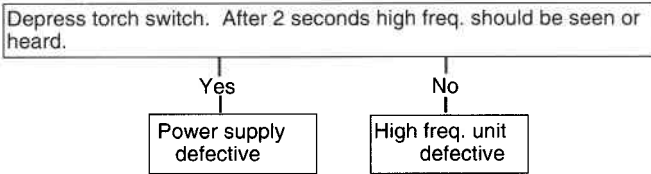
WARNING

Voltages inside this plasma cutting unit are high enough to cause injury or even death. Be careful around the equipment whilst the covers are off.

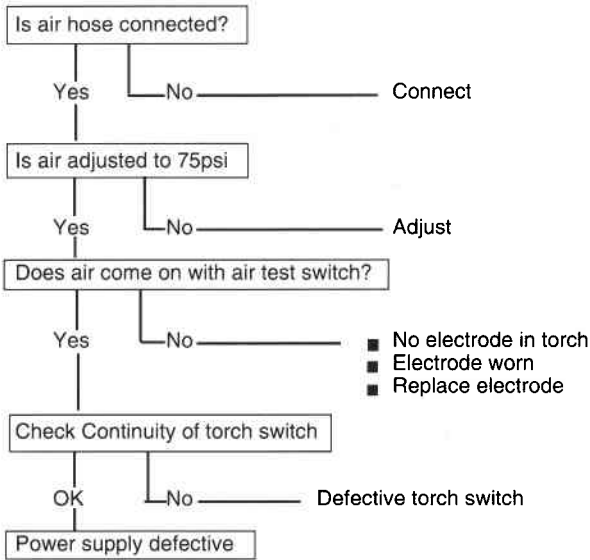
Fig. 8 - Troubleshooting Flow Chart

1. Difficult Starting

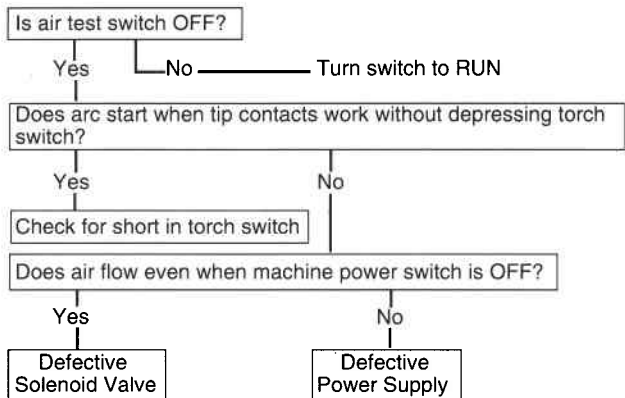
- Change electrode
- Change Tip
- Check for clean ground connection
- Check air pressure - 60-70psi
- Check torch power cable for continuity



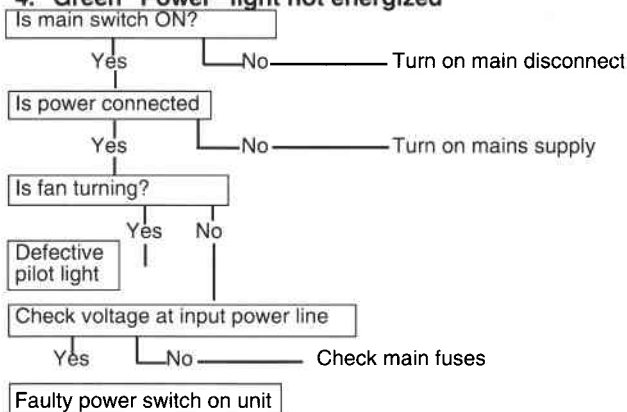
2. No Air



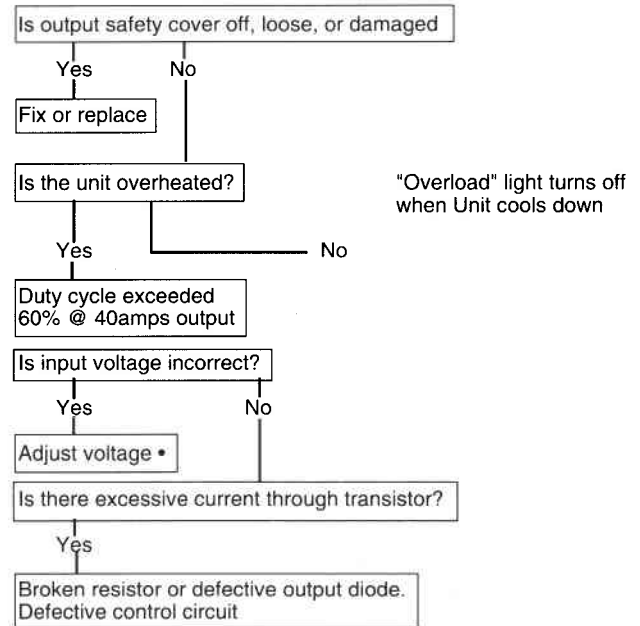
3. Air does not shut off



4. Green "Power" light not energized



5. Red "overload" light ON. (See also Symptom 6 below)



- Overload light will energise if voltage falls below 340 volts for 0.3 seconds or exceeds 450 volts even for an instant. The light will not turn OFF even when correct voltage is restored. Reset by placing power switch OFF and then ON again.

6. Red "Overload" light immediately turns ON when the power switch is ON and torch is OFF.

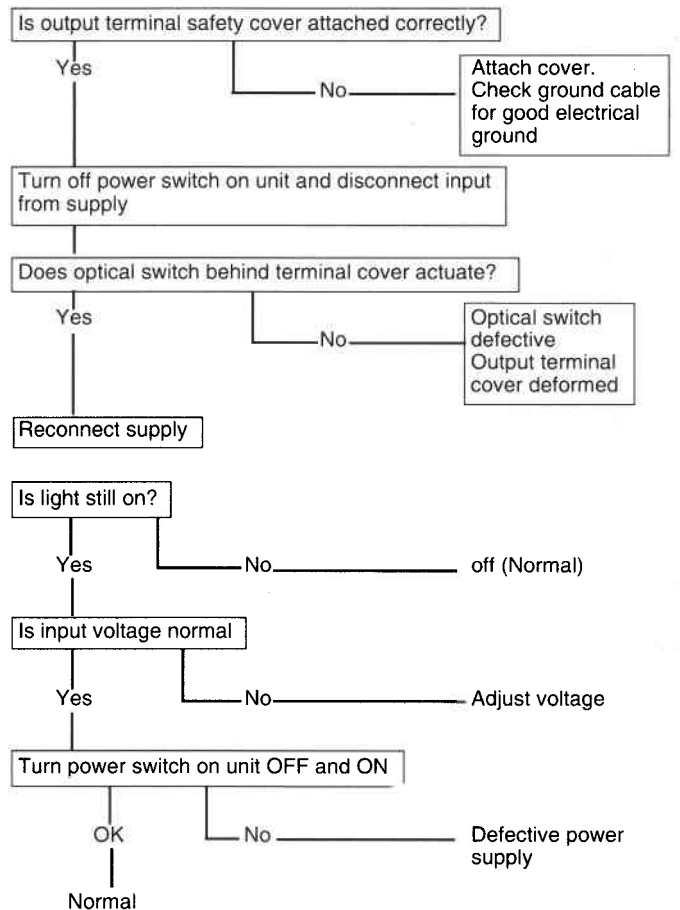
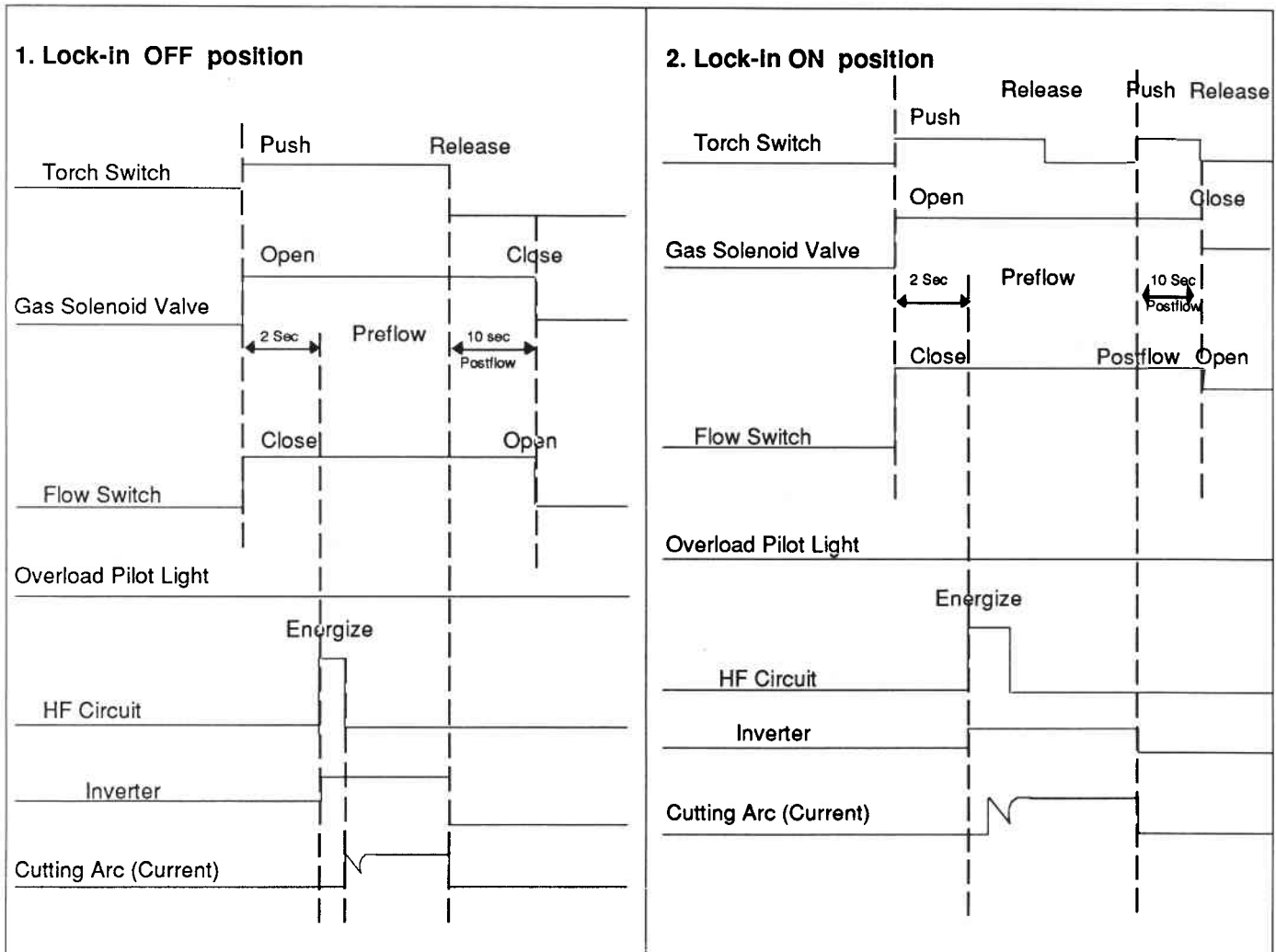


Fig. 9 Operational Sequence



Notes:

1. When the torch switch is pushed during postflow period, the postflow and preflow times are cancelled, and the HF is energized immediately.
2. When the red overload pilot light comes on, cutting operation should be stopped. The postflow time starts from the moment the torch switch is released.

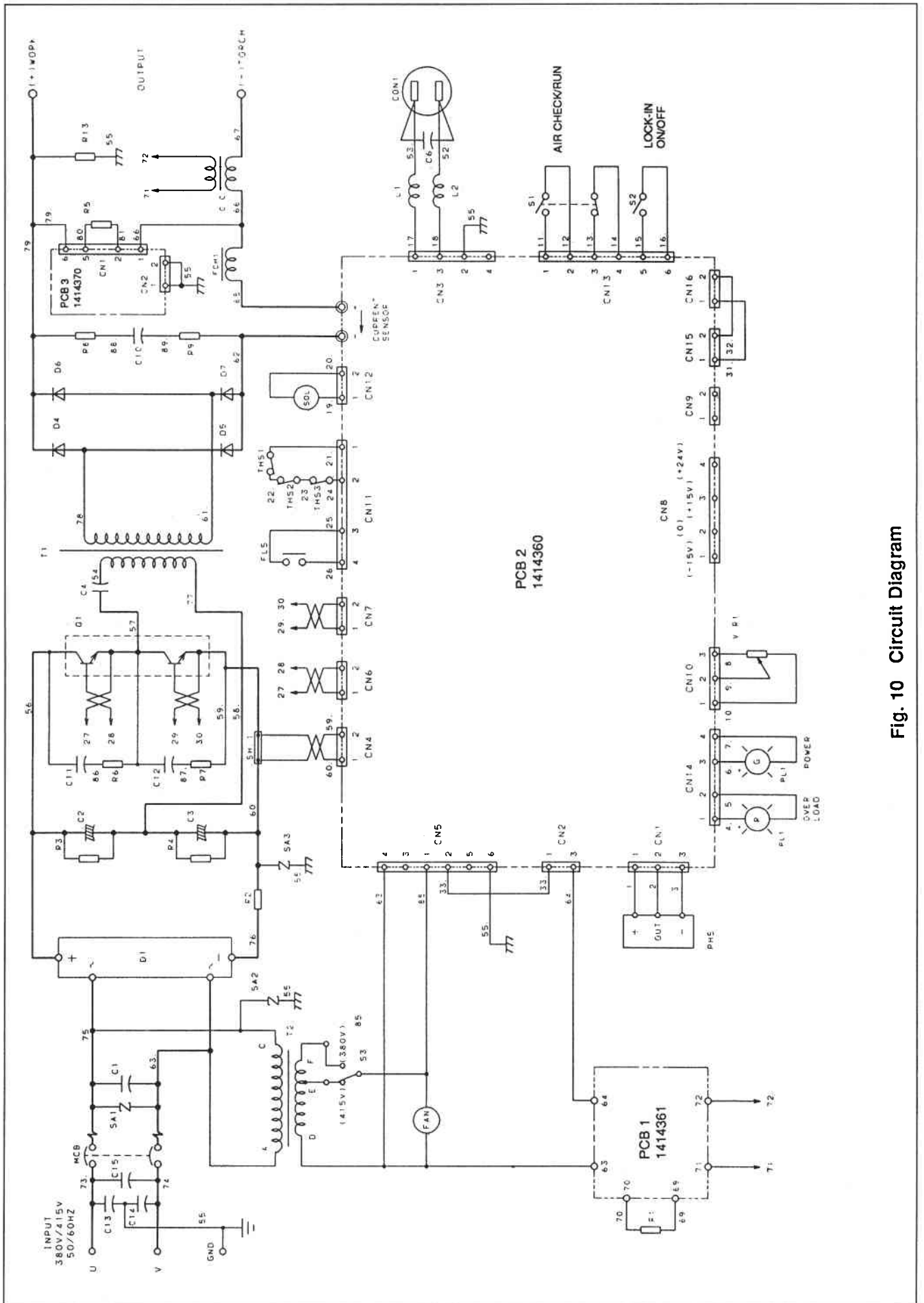


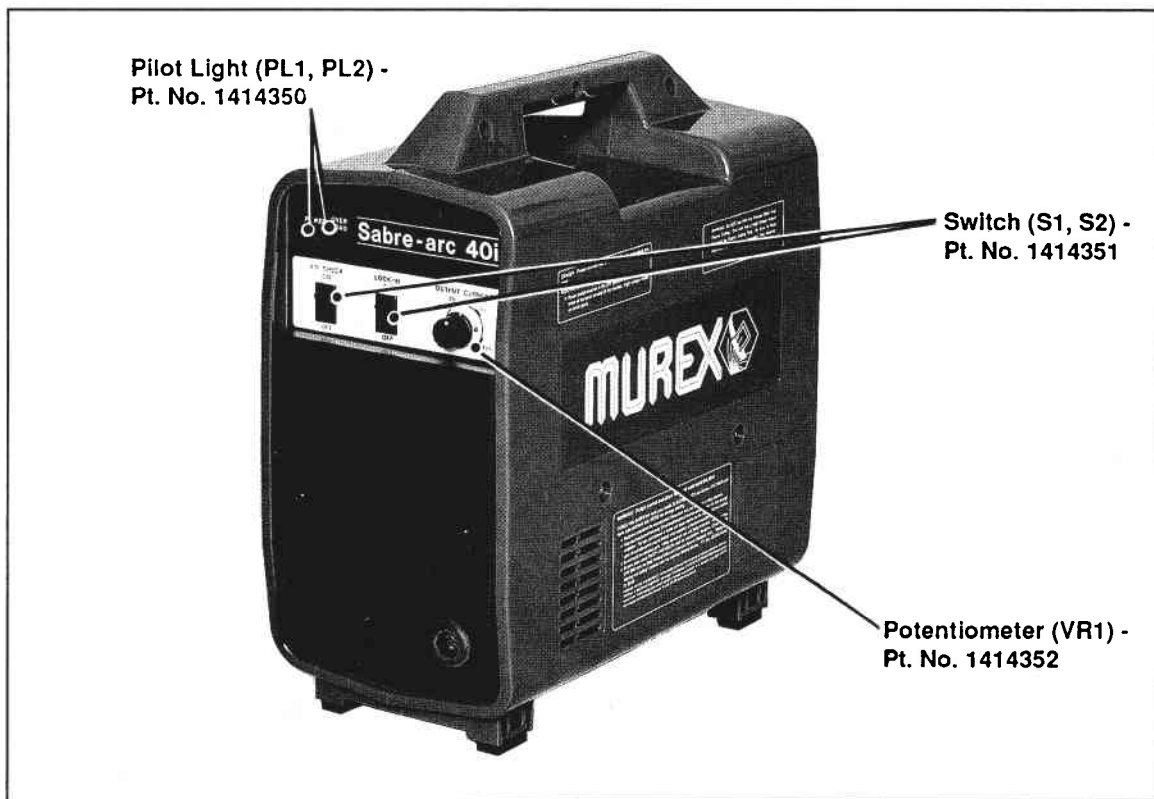
Fig. 10 Circuit Diagram

Sabre-arc 40i & PT-50 Parts List

OPTIONAL EXTRAS

PT-50 Torch 75° Head 15m
PT-50 180° Pencil Torch Head
Circle Cutting Attachment
HD Consumables Kit

Pt. No. 1414228
Pt. No. 1414213
Pt. No. 1414214
Pt. No. 1414207



Pilot Light (PL1, PL2) -
Pt. No. 1414350

Switch (S1, S2) -
Pt. No. 1414351

Potentiometer (VR1) -
Pt. No. 1414352

Fig. A

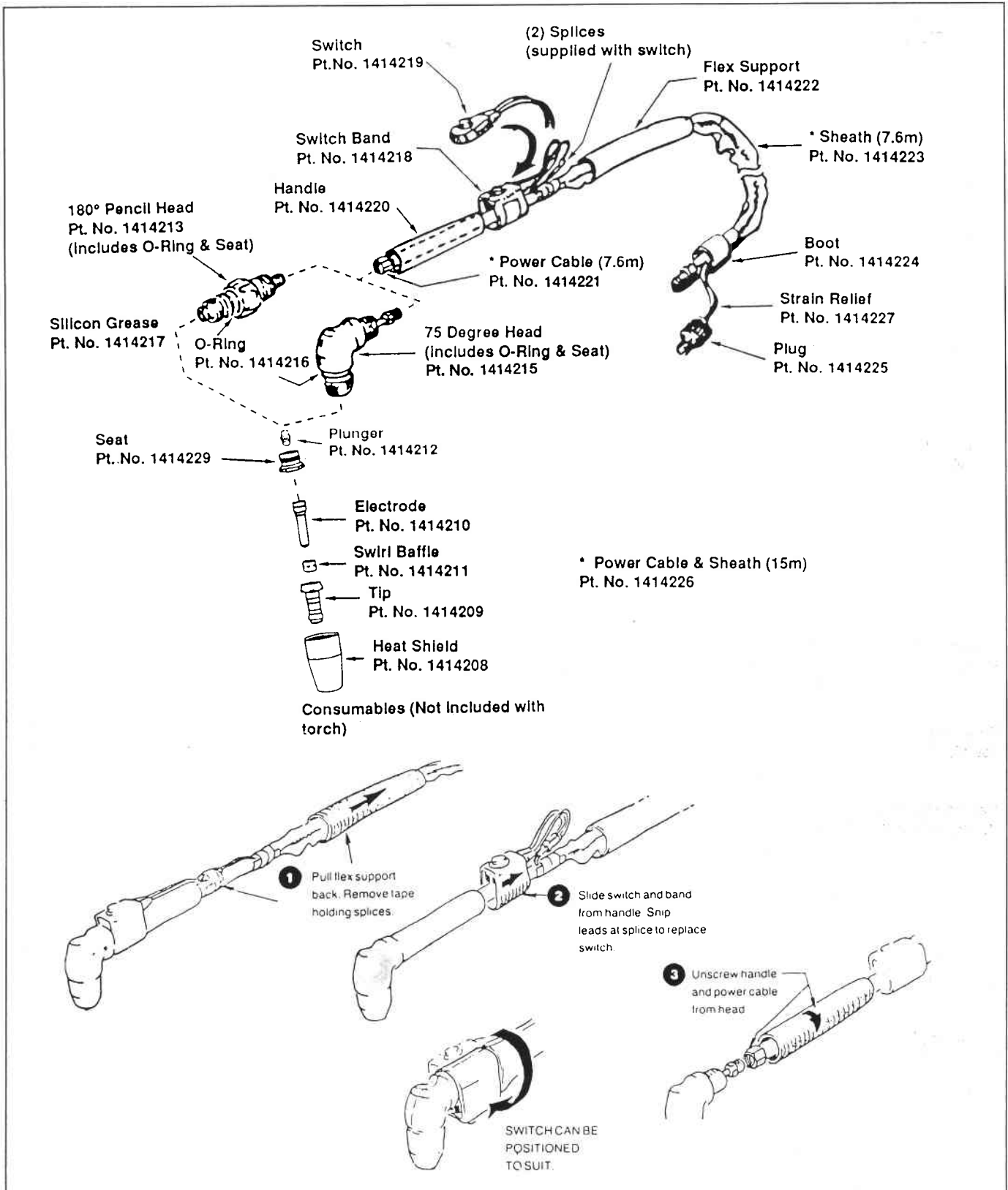


Fig. B -

By following steps 1, 2 and 3 the leads can be removed from the torch. To disassemble the lead, lay the cable out straight, remove the tape from around the switch lead splices, and free the switch by cutting the leads close to the splices. (Replacement switches have extra long leads to make up for any loss due to cutting). Remove the rubber boot from the inlet

end of the cable and remove the tape that secures the sheath at each end. Pull the sheath off the cable (over small fitting at torch end). Note that the switch leads wrapped around the power cable are secured with tape several places along the cable. The leads, switch plug, and strain relief can now be

removed. DO NOT remove the white tape that forms a band around the power cable at each end. The sheath is taped to the cable in front of the band which acts as a shoulder to prevent the sheath from sliding back on the cable. (Replacement cables have this tape in place). Reassemble in reverse order.

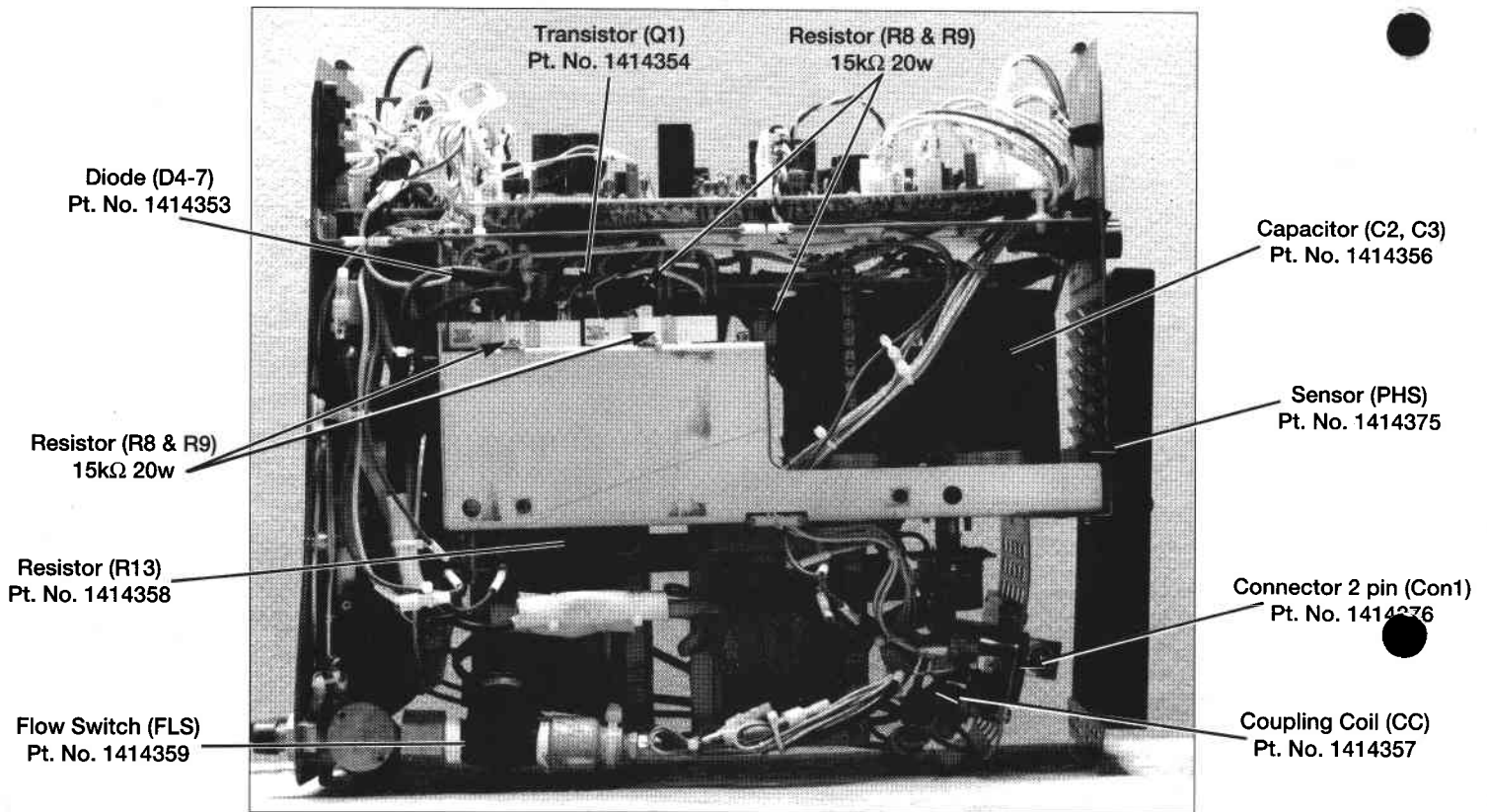


Fig. C

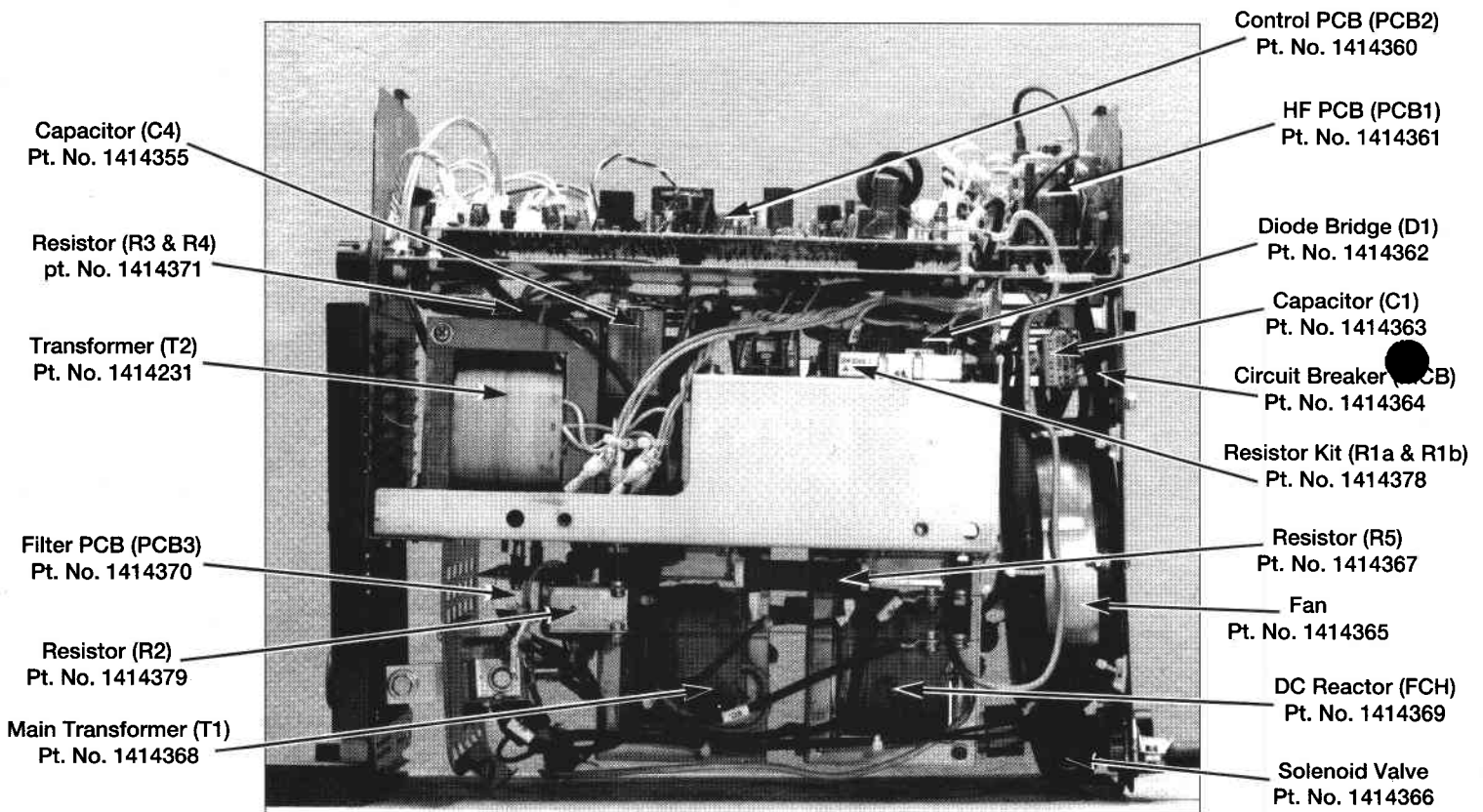


Fig. D



Murex Welding Products Limited
 Hertford Road, Waltham Cross,
 Herts. EN8 7RP. England
 Telephone: Lea Valley (0992) 710000
 Telex: 25743

Pt. No. 100484-1
 Issue 3