

# **MAX81**

**Plasma Arc  
Cutting System**

**Instruction Manual  
800810**

**HYPERTHERM<sup>®</sup>**

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## SECTION 1 -- SAFETY

### 1.1 INTRODUCTION

Many years of plasma cutting experience have shown that the process can be used with a high degree of safety. As with most industrial processes, there are some definite hazards which are readily controllable with proper care and attention. The known hazards and recommended methods of dealing with them are described in the paragraphs that follow. It is the responsibility of management at the user's facility to make certain that all personnel who operate or maintain the plasma equipment be given the opportunity to read this information.

### 1.2 GENERAL PRECAUTIONS

The plasma arc cutting process can produce fumes, noise, and ultraviolet radiation levels which require precautionary measures to prevent operator injury.

#### 1.2.1 Burn Prevention

High intensity ultraviolet radiation is produced by the plasma arc and is of similar intensity to typical high current welding arcs. This radiation is damaging to the eyes and skin. As the operator comes closer to the torch, the level of exposure increases rapidly. Proper protective clothing and equipment must be worn by the operator and any other persons working in the vicinity of the arc. Gauntlet gloves designed for use in welding, safety shoes, and a hat are required. Flame retardant clothing which covers all exposed areas and cuffless trousers to prevent entry of sparks and slag are recommended. Proper safety goggles or glasses with side shields of the appropriate welding lens shade MUST be worn to protect the operator's eyes from radiant energy and flying sparks or hot metal. Replace glass or covers when pitted or broken.

Medical treatment facilities and a qualified first-aid person should be available for immediate treatment of flash burns to the eyes or skin.

It is recommended that the cutting area be prepared in a manner that will reduce the reflection and transmission of ultraviolet radiation. Walls and other surface areas should be painted with dark colors to reduce reflection. Protective screens or curtains may be installed to avoid unnecessary ultraviolet transmission.

### 1.2.2 Toxic Fumes

Proper precautions MUST be exercised to prevent the exposure of the operator or others in the surrounding area to possible toxic fumes which may be generated during plasma arc cutting.

Certain chlorinated solvents will decompose under ultraviolet radiation to form phosgene gas. Care must be exercised to avoid the use of these solvents on materials being cut with plasma arc cutting equipment. Containers of these solvents and other degreasing agents must be removed from the immediate area near the plasma arc.

Metals coated with or containing significant amounts of lead, cadmium, zinc, mercury, and beryllium can produce harmful concentrations of toxic fumes when plasma arc cut. Adequate local exhaust ventilation must be used or the operator must be wearing special equipment to guarantee a supply of fresh air such as a respirator or air supplied helmet.

Metals coated with materials which emit toxic fumes must not be cut unless (1) the coating is removed prior to cutting, (2) the area is adequately ventilated, or (3) the operator is supplied with fresh-air breathing equipment.

Do not work in a confined space without adequate ventilation or air supplied breathing equipment.

### 1.2.3 Fire Prevention

Since plasma arc cutting produces hot metal, sparks, and slag, precautions must be taken to prevent fire and/or explosions.

All combustible materials must be removed from the immediate cutting area to a distance of at least 10 meters (35 feet) away. Appropriate fire extinguishing equipment MUST be available in the immediate cutting area.

After cutting, be sure to allow the metal to cool sufficiently before handling or before allowing any contact with combustible materials.

NEVER plasma cut empty containers which have held toxic or potentially explosive materials. Those containers must be thoroughly cleaned prior to cutting or welding.

NEVER plasma cut in an atmosphere which contains heavy concentrations of dust, flammable gas, or combustible liquid vapors (such as gasoline).

#### 1.2.4 Compressed Gas Equipment

Proper precautions must be observed when handling and using compressed gas equipment and cylinders. Refer to local regulations for further information.

##### A. Pressure regulators

All regulators used to operate plasma equipment must be maintained in proper working condition.

Faulty equipment can cause equipment damage or operator injury. Faulty equipment must be serviced at the manufacturer's designated facility by trained repair technicians.

NEVER use a regulator for any other gas than that for which it is intended.

NEVER use a regulator that leaks, excessively creeps, or is physically damaged in any way.

NEVER attempt to lubricate a regulator with oil or grease.

##### B. Cylinders

- . NEVER use a cylinder which is physically damaged or leaks.
- . NEVER use a cylinder that is not upright and secured in place.
- . NEVER move or transport a cylinder without the protective valve cover in place.
- . NEVER use a gas cylinder or its contents for any other purpose than that for which it is intended.
- . NEVER lubricate cylinder valves with oil or grease.
- . NEVER allow electrical contact such as welding arcs with cylinders.
- . NEVER expose cylinders to excessive heat, sparks, slag, or open flame, as these may cause rupture.

- . NEVER use hammers, wrenches, or other tools to open stuck valves. Send these cylinders back to the supplier.

#### C. Hose

Gas hose used for plasma arc cutting systems adheres to the following color coding:

##### Western Europe

Red -- For combustible gases, e.g., hydrogen  
Blue -- For oxygen  
Black -- For noncombustible gases, e.g., nitrogen, compressed air

##### North America

Red -- For combustible gases  
Green -- For oxygen  
Black -- For noncombustible gases

- . Replace hose that is damaged by physical abuse or from sparks, heat, or open flame.
- . Lay hose out straight to prevent kinks.
- . Coil excess hose and place out of the way to prevent damage and tripping hazard.
- . Examine hose at regular intervals for leaks, wear, loose connections, or other damage.
- . Keep hose lengths to a minimum to prevent damage, reduce pressure drop, and prevent possible volume flow restriction.

#### 1.2.5 Electric Shock Prevention

Plasma cutting equipment uses high open circuit voltages to initiate the plasma arc. Normal load voltages are higher than experienced with other types of welding equipment. CAUTION must be exercised when operating or servicing this equipment.

##### A. Input connections:

- . Provide a wall-mounted disconnect switch as close to the MAX81 power supply as possible.
- . Consult and conform to all local electrical codes for primary wiring sizes and types.

- . Frequently inspect the primary power cable for damage or cracking of the cover. BARE WIRING CAN KILL. DO NOT USE THE SYSTEM WITH DAMAGED POWER CABLE. Replace damaged cable immediately.

B. Grounding:

1. Input power

- . Connect the green-yellow ground lead of the primary wiring to the system ground in the disconnect box.
- . Make sure all connections are tight to avoid resistive heating.

2. Output

- . The system ground clamp is attached to the work or work table. Make sure all connections are tight.
- . The work table must be connected to a good earth ground. Consult your local regulations for electrical grounding.

C. Personal Protection

- . Keep operator's body and clothing dry.
- . DO NOT stand in, sit on, lie in or on any wet surfaces when using this equipment.
- . NEVER work in a damp or wet area without proper insulation against electrical shock.
- . DISCONNECT main power before servicing the torch, power supply, or service connections to the MAX81 system.
- . NEVER attempt to operate the system if any electrical cables, torch, or torch leads are damaged.

#### D. Safety Devices

The MAX81 is provided with certain safety interlocks designed to prevent equipment damage and/or personal injury.

NEVER short out or in any other way defeat the safety interlock devices.

NEVER attempt to operate the MAX81 with any of the power supply covers not in place. This is extremely hazardous to the operator or any other person in the area. It also prevents the equipment from properly cooling critical components which could result in equipment damage.

All exposed electrical connections must be covered with the proper insulation material.

Safety devices must be regularly checked for proper operation and REPLACED IMMEDIATELY if found to be inoperative.



## SECTION 2 -- GENERAL INFORMATION AND PRODUCT SPECIFICATIONS

### 2.1 INTRODUCTION

Hypertherm MAX81 plasma arc cutting system is designed for hand cutting of most metals up to 25 mm (1 inch) thick.

The MAX81 provides a continuously variable current output between 20 to 80 amps for optimum performance on all thicknesses up to 1 inch. This allows the operator wide variations in cutting speeds on the same thickness of metal. The low end setting is for metals up to 1/16" thick, while the 80-amp setting is used for heavier metals. In addition, the circuit design provides for an instant re-ignition of the pilot arc allowing the unit to cut perforated or expanded metal.

The MAX81 power supply is a new transistorized inverter design which offers the following benefits:

- A. Weighing only 28 kilograms (62 pounds), it offers maximum portability for the shop or job site.
- B. The high operating frequency of 23 KHz eliminates the audible noise of other types of inverters.
- C. Operating volt/amp curve provides true constant current output, which allows operation of the torch from touching the work to a long standoff without change in the current output.
- D. Pilot arc ignition allows cutting of coated, painted, or rusted metals.
- E. Extensive use of solid state components and PC boards provides long life and high reliability.
- F. Output current does not change with variations in input voltage.

Air is used as the plasma gas providing low operating costs combined with high-speed performance. Cylinder or shop air can be used as long as it is free of moisture, oil, and particulate matter contamination. A regulator and air filter are provided to insure that the right pressure and air flow are supplied to the system.

## 2.2 STANDARD COMPONENTS OF THE MAX81 PLASMA CUTTING SYSTEM

SYSTEM  
PART NO.

DESCRIPTION

059044 MAX81 System, 75° Torch, 380V, 3-Phase,  
50 Hz, 7.5-Meter (25-Foot) Torch Leads

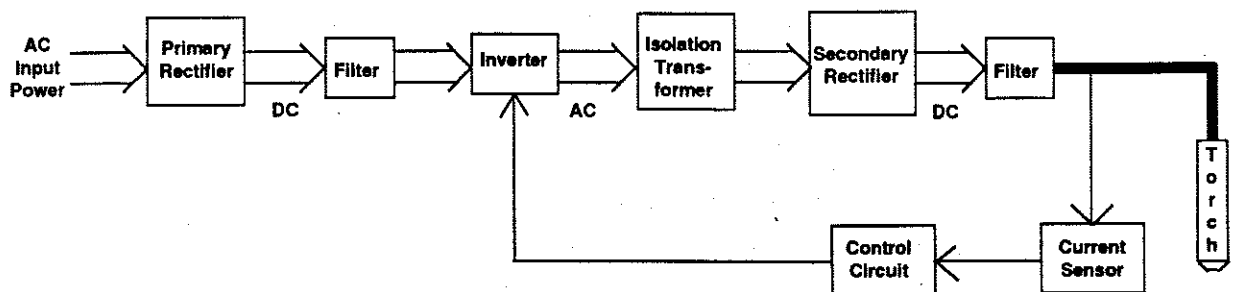
Component  
Part No.

Description

Quantity

059043	MAX81 Power Unit, 380V, 3 Phase, 50 Hz	1
059047	MAX81 Torch Assembly, 75°, 7.5 Meters (25 Ft.) Torch Leads	1
028363	Kit, Consumable Parts	1

## 2.3 POWER SUPPLY BLOCK DIAGRAM



- A. Incoming 380-volt, three-phase AC power is converted to DC by the primary rectifier.
- B. The DC current is converted back into high frequency AC current (23 Khz) by the inverter.
- C. Isolation transformer couples voltage from the inverter to the secondary rectifier.
- D. The secondary rectifier converts the AC back to DC for output current to the torch.

## 2.4 PRODUCT SPECIFICATIONS

### MAX81 Power Supply

Type: Constant current inverter unit providing continuously variable current from 20 amps (minimum) to 80 amp (maximum)

Max OCV: 300 VDC

Output Current: 80 Amps

Output Voltage: 120 Volts DC

Duty Cycle Rating: 35% Duty Cycle at 80 Amps

Input Power: 380 Volts -- three phase -- 50 Hz  
23 Amps at 9.6 KW output

Dimensions: 350 mm (13.5 inches) high x 220 mm (8.5 inches) wide x 530 mm (23.5 inches) deep

Weight: 28 kilograms (62 pounds)

Gas Supply: Type -- Air  
Quality -- Clean, dry, and oil free  
Flow -- 220 liters/minute (7.8 scfm)

Flow Pressure: 6.5 Bar (94 psi)

### Model MAX100 Torch

Maximum Cutting Thickness Range: 25 mm (1 inch)

Maximum Current at 100% Duty Cycle: 100 Amps

Gas Flow: 220 liters/minute at 6.5 Bar (7.8 scfm at 94 psi)

Dimensions: See Figure 2, Section 6, Page 26.

Weight: 170 Grams (6 oz.) without torch leads

## 2.5 PREINSTALLATION REQUIREMENTS

### 2.5.1 Primary Power:

A separate line disconnect switch should be provided for each MAX81 power supply. Install according to all applicable electrical codes. The disconnect box should be sized to the following requirements:

<u>Input Voltage</u>	Input Current at <u>9.6 KW Output</u>	<u>Recommended Fuse Size</u>
380 VAC	23 Amps	30 Amps

#### 2.5.2 Air

Two different sources of air can be used to supply the system.

- A. Cylinder compressed air -- Specify dry, oil-free compressed air when using cylinder air. The regulator must be used only for compressed air and must be capable of delivering at least 220 liters/ minute (7.8 scfm) of air at 6.5 bar (94 psi) output pressure.
- B. Shop compressed air -- Clean, dry, oil-free shop air can be used to supply the MAX81 system. Shop air must be available at a minimum pressure of 6.5 bar (94 psi) and must be routed through the regulator and filter supplied with the system. The regulator and filter are mounted at the top rear of the MAX81 power supply.

DO NOT EXCEED 8.3 BAR (120 PSI) DELIVERY TO THE SYSTEM.

## SECTION 3 -- INSTALLATION PROCEDURE

### 3.1 UNPACKING EQUIPMENT AND SETUP

#### 3.1.1 Unpacking Equipment

Carefully inspect the equipment for shipping damage. Any claims for damage which might have occurred during transit must be filed by the purchaser with the carrier. A copy of the bill of lading will be furnished by the manufacturer upon request, if the occasion to file a claim arises.

All communications regarding this equipment must indicate the model number and serial number, located on the top of the power supply.

Do not leave packing materials in the cutting area, as they may create a fire hazard.

Verify that all components of the system are provided.

- . Power supply
- . Power cable
- . MAX100 torch and cable assembly
- . 7-meter (23-foot) ground cable with clamp
- . Spare parts kit

### 3.2 POWER SUPPLY LOCATION

3.2.1 Place the power supply in an area that will keep it free of excessive moisture, relatively clean, and allow proper ventilation.

3.2.2 Cooling air is drawn in through the side panel grating and is exhausted through the rear of the unit by a cooling fan. Ambient air temperature should not exceed 40° Centigrade (105° Fahrenheit).

It is essential that air flow not be blocked in any way. Do not place any filter device over the air intake locations, as this will reduce cooling efficiency and will VOID THE WARRANTY.

### 3.3 PRIMARY CONNECTIONS

3.3.1 A primary line disconnect switch should be used for each power supply. The switch should be located on the wall near the power supply and be easily accessible to the operator. The interrupt rating of the switch must be equal to or exceed the continuous rating of the fuses.

3.3.2 The recommended fuse size for the MAX81 380 input voltage is 30 amperes.

3.3.3 Connect the power cable provided with 380-volt power units to the main disconnect switch box, as outlined by applicable local electrical codes.

3.3.4 Gas Supply -- Air

There are three possible sources of air -- pipeline shop air, portable air compressor, or cylinder compressed air.

Use an inert gas hose to connect between the gas supply and the input connection on the air regulator mounted at the rear of the power supply.

Air must be filtered to maintain a high purity level. All moisture, oil, and other foreign contaminants must be removed.

### 3.4 SECONDARY CONNECTIONS

3.4.1 Pass the torch lead assembly through the hole at the front right side of the power supply front cover and connect as follows:

- A. Air-cooled power cable is connected to the cathode fitting at the right side of the insulator front panel of the power supply. See Figure 4, Page 28.
- B. Attach the pilot arc lead to stud left of center. Be sure to tighten the connection securely to prevent arcing.
- C. Connect the ground lead to the left side stud on the insulator board at the front of the power supply.
- D. Connect the other end of the ground lead to the workpiece or metal work table.

- E. Connect the torch start switch leads to Terminals 1 and 2 on terminal strip on the front insulator board. See Figure 4, Page 28.
- F. Refasten cover with the screws provided.

### 3.5 TORCH

#### 3.5.1 Attach the torch to the torch leads by using the following procedure:

- A. Unscrew the handle tube set screws (Page 26, Item 6) from the torch body and slide over the torch leads. For a machine torch, unscrew the torch barrel (Item 6, Page 26), and slide over the torch leads.
- B. Using two wrenches, attach the small blue pilot arc lead to the torch main body (Item 5) pilot arc connection. Be sure that the connection is secure or arcing will occur.
- C. Using two wrenches, tighten the air-cooled power cable to the power connection on the torch main body. Be careful not to damage the insulator on the pilot connector.
- D. Slide the insulating sleeve to the torch main body and secure with the set screws for a hand torch or thread the sleeve to the machine torch.

#### 3.5.2 To assemble the front end of the torch, the following procedure is to be used: (See Page 26.)

- A. Install the electrode using the wrench provided in the spare parts kit. DO NOT OVERTIGHTEN the electrode or damage can occur to the torch body.
- B. Slide the swirl ring, Item Number 3, around the electrode -- tapered surface toward torch. (See Page 26.)
- C. Press the nozzle, Item Number 2, on the end of the swirl ring.
- D. Thread the retaining cap, Item Number 1, to the torch main body and tighten securely.
- E. The torch is now ready for operation.

#### 3.5.3 Disassembly of torch is accomplished by reversing the procedure outlined in 3.5.2 above.

### 3.6 EARTH GROUND

- 3.6.1 Proper grounding is essential for reasons of personnel safety and to reduce emission of radio frequency interference. The work table should be connected to a high-quality earth ground within 7 meters (20 feet) of the table. A suitable ground consists of a solid copper rod of at least 13 mm ( $\frac{1}{2}$ -inch) diameter driven to a depth of at least 2.5 meters (8 feet) into the earth below the permanent moisture level. For further information, please consult your local electrical code.

Attention: Do not begin cutting until the workpiece is properly grounded.



## SECTION 4 -- OPERATION

### 4.1 DESCRIPTION OF CONTROL PANEL INDICATOR FUNCTIONS

#### 4.1.1 Rear Panel

- A. Red light illuminates when power switch is turned "on." This indicates AC power has been applied to the power supply.

#### 4.1.2 Front Panel

I

- A. LED1 indicates that AC power has been applied and DC power is available to the primary side of the circuit.



- B. LED2 illuminates when the torch switch has been closed and DC power is available to the secondary (torch) side of the circuit.



- C. LED3 is illuminated when air pressure is too low to operate the system or when torch parts are not in place. The power supply will not operate until the condition is corrected.



- D. LED4 illuminates when AC power is applied for a time of 6 seconds. During this time, the input line voltage is monitored and if it is outside of the  $\pm 10\%$  allowable range, the unit will not operate. If still lit after 10 seconds, then power input is faulty.



- E. LED5 illuminates when the thermal overload disconnects the system. After cooling down, the light will go out and allow the unit to operate again.
- F. Current adjustment knob allows continuous adjustment of the output current from 20 amps to 80 amps. Rotate clockwise to increase current. Adjustment can be made at anytime -- even when cutting.
- G. TEST/RUN switch allows operation of the air solenoid without the arc when in the "TEST" position. This allows additional cooling of the torch and power cable if overheating occurs. It also allows air pressure to be preset under a flow condition.

NOTE: If the torch start switch is pressed with the TEST/RUN switch in the "TEST" position, a pilot arc and main arc can occur.

#### 4.2 SEQUENCE OF EVENTS

After all primary and secondary connections have been completed and the torch consumables are in place, the following is the start-up and operating sequence of events:

- A. Turn on the air to the MAX81 and adjust the pressure to 6.5 bar (94 psi).
- B. Apply power to the power supply via the wall disconnect switch.
- C. Turn power switch at the rear of unit to the on position (1) to energize input power to the system. See Figure 7, Page 31. All safety interlocks are monitored and an auto-check is performed on the input line voltage. Pilot arc relay closes at this time.

Note: If torch parts are NOT in place or if one of the other interlocks is NOT satisfied, the unit will not function.

- D. Place the TEST/RUN switch in the "TEST" position. Air will flow through the system. Adjust the air pressure to the correct pressure. After adjusting the pressure, place the TEST/RUN switch in the "RUN" position.
- E. Select 20 amps to 80 amps, depending on the work to be done, by using 1POT current adjustment potentiometer.
- F. Push and hold down the start switch on the torch to energize plasma start. The following events occur.

- 1. One-second gas preflow delay starts timing.
- 2. After the one-second preflow, the HF high frequency is energized.

Pilot arc will initiate and transferred arc will occur if the torch is near or touching the workpiece (within 4 mm (0.15 inch)).

- 3. A sensing circuit detects the pilot arc (PA) and automatically shuts off the high frequency (HF) circuit. As long as the torch start button remains depressed, the pilot arc will stay on or will instantly be reactivated with HF if transferred arc is broken.

If torch start button is released, transferred arc will shut off.

4. One of several events will stop the plasma transferred arc:
  - a. No material remains under the arc.
  - b. Main power switch on the power supply turned off.
  - c. Torch start switch is released.
  - d. Ground is disconnected from the work.
  - e. Safety interlock is not satisfied, i.e., thermal overload switch or pressure switch opens.
  - f. Blown fuse in the control circuit or main disconnect box.

WARNING: All input power to the system is not off until the wall disconnect switch is turned OFF or the plug is removed from the receptacle.

- G. Postflow of air is timed at 10 seconds after the torch switch is released and transferred arc shuts off.

#### 4.3 TORCH OPERATION

##### 4.3.1 Preparation

- A. Operator must be equipped with the proper safety protection, i.e., shaded welding hood or goggles, gloves, flame retardant clothing, etc.
- B. Material to be cut must be free of solvents or other potentially toxic substances.
- C. Work must be properly grounded to the positive terminal of the MAX81 power unit using the ground clamp and cable supplied with the system.
- D. Operator should position himself to be comfortable for best cutting results.

##### 4.3.2 Piercing

- A. Place the torch nozzle against the workpiece at an angle so that hot metal will be directed away from the operator or those people in the immediate area.
- B. Push torch start button. After the pilot arc and transferred arc have established, slowly rotate the torch to the vertical position as the arc penetrates the work.
- C. After piercing is complete, proceed to drag the torch nozzle along the predetermined cut path.

#### 4.3.3 Cutting

- A. Transferred arc will occur if the pilot arc is within approximately 4 mm (0.15 inch) of the workpiece.
- B. Cutting can be accomplished with the nozzle touching the work throughout the entire thickness range of cutting.
- C. Adjust the current and the cutting speed according to the chart for each material and thickness. For best results, use the maximum current possible for each thickness.
- D. The retaining cap insulated edge can be used as a guide for templates.

#### 4.3.4 Common Cutting Faults

- A. Lack of total penetration. Causes:
  - 1. Current too low.
  - 2. Cut speed too high.
  - 3. Worn torch parts.
- B. Transferred arc stops. Causes:
  - 1. Speed too slow.
  - 2. Current too high.
  - 3. Torch standoff too great.
  - 4. Safety interlock not satisfied.
  - 5. Ground connection broken.
  - 6. Worn torch parts.
- C. Dross formed on bottom of work. Causes:
  - 1. Speed too slow.
  - 2. Worn torch parts.
  - 3. Current too high.

#### 4.4 OPERATING DATA CHARTS

The cutting speed to be applied for cutting metals depends upon various parameters, such as:

- thickness and composition of the material,
- selected cutting current, and
- geometrical characteristics of the line to be cut (straight or curved).

The amount of current used when cutting greatly influences the cleanliness of the cut. Therefore, it is very important to adjust the current properly. A well-adjusted cutting current will leave a very neat and clean cut.

As a guide for achieving optimum cutting performance, the following operating data chart was prepared.

##### SUGGESTED CUTTING SPEEDS FOR THE MAX81

Air pressure: 6.5 bar (94 psi)

Thickness (mm/inches)	Material	Current (Amp)	Travel Speed (mm/min)/(inches/min)	
28 Gauge	Mild Steel	40 (.038)*	8600	340
24 Gauge	Mild Steel	40 (.038)	7500	295
16 Gauge	Mild Steel	40 (.038)	3900	150
6.0 (1/4")	Mild Steel	80 (.052)	1960	75
12.0 (1/2")	Mild Steel	80 (.052)	700	30
18.0 (3/4")	Mild Steel	80 (.052)	440	15
25.0 (1")	Mild Steel	80 (.052)	220	8
<hr/>				
22 Gauge	Aluminum	40 (.038)	6000	235
16 Gauge	Aluminum	40 (.038)	3900	150
6.0 (1/4")	Aluminum	80 (.052)	1600	60
12.0 (1/2")	Aluminum	80 (.052)	600	25
18.0 (3/4")	Aluminum	80 (.052)	350	15
<hr/>				
28 Gauge	Stainless Steel	40 (.038)	7300	290
24 Gauge	Stainless Steel	40 (.038)	6350	250
16 Gauge	Stainless Steel	80 (.052)	3300	130
6.0 (1/4")	Stainless Steel	80 (.052)	1650	65
12.0 (1/2")	Stainless Steel	80 (.052)	600	25
18.0 (3/4")	Stainless Steel	80 (.052)	350	15

\*Nozzle size is listed in parentheses.

## SECTION 5 -- PARTS LIST

### 5.1 MAX81 POWER UNIT -- 380V, 3 Phase -- PART NO. 059043

<u>Part No.</u>	<u>Description</u>	<u>Designation</u>
049066	.47 uF, 630V, Film Capacitor	1CAP
049017	1,000 uF, 400V, Elec. Capacitor	2CAP
049017	1,000 uF, 400V, Elec. Capacitor	3CAP
049067	6.8 NF, 1,000V, Capacitor	4CAP
049067	6.8 NF, 1,000V, Capacitor	5CAP
049068	.01 uF, 1,000V, Capacitor	6CAP
049067	6.8 NF, 1,000V, Capacitor	7CAP
049070	.68 uF, 630V, Capacitor	8CAP
049069	22 NF, 1,000V, Capacitor	9CAP
049084	Pilot Arc Relay w/Aux. Contact	1CR
049046	Rectifier Diode, Norm	1D
044040	Rectifier Diode, Reverse	2D
049046	Rectifier Diode, Norm	3D
049040	Rectifier Diode, Reverse	4D
049046	Rectifier Diode, Norm	5D
049040	Rectifier Diode, Reverse	6D
049085	Flyback Diode	7D
049085	Flyback Diode	8D
049085	Flyback Diode	9D
049052	Rectifier Diode	10D
049052	Rectifier Diode	11D
049044	2-Amp Fuse	1FU
049044	2-Amp Fuse	2FU
049047	380V Neon Lamp	1LT
049055	480V 40 Amp	1MOV
049039	Fan	1MTR
049034	High Frequency	1PC
049086	Process Control	2PC
049019	Inverter Control	3PC
049026	Logic Power Supply	4PC
049087	Power Inverter	5PC
049011	Bypass Control	6PC
049032	Auxiliary Power w/1T	7PC
049027	Air Control	8PC
049093	HF Filter	9PC
049054	Pressure Switch	1PS
049008	4 Ohm, 25W Resistor	1RES
049071	8.2K Ohm, 25W Resistor	2RES
049023	50 Ohm, 150W Resistor	3RES
049023	50 Ohm, 150W Resistor	4RES
049088	100 Ohm, 50W Resistor	5RES
049088	100 Ohm, 50W Resistor	6RES
009461	500 Ohm, 50W Resistor	7RES
049073	18 Ohm, 50W Resistor	8RES
049074	47 Ohm, 10W Resistor	9RES

5.1 MAX81 POWER UNIT -- 380V, 3 Phase -- PART NO. 059043 (Cont.)

<u>Part No.</u>	<u>Description</u>	<u>Designation</u>
009075	1K, 1/4W Resistor	10RES
049071	8.2K Ohm, 25W Resistor	11RES
049013	SCR	1SCR
049089	2 Milliohm, 80 Amp	1SHUNT
049089	2 Milliohm, 80 Amp	2SHUNT
049045	Main Power Switch	1SW
049076	Cover Interlock Switch	2SW
049053	Auxiliary Power Transformer	1T
049090	Power Transformer	2T
049021	HF Transformer	3T
049094	Temperature Switch	1TS
049083	Saturable Reactor	1XS
049091	Inductor	1X
049035	Solenoid, Low Flow	1SOL
049035	Solenoid, Gas On	2SOL
049092	Solenoid, High Flow	3SOL
049001	Workpiece Connector	B01
049006	Torch Lead Connector	B02
049002	Pilot Arc Lead Connector	B03
049005	Torch Switch Connector	P1
049005	Torch Switch Connector	P2
049003	Current Control Knob	
049065	Fuse Holder, Control	1FU
049065	Fuse Holder, Control	2FU
023209	Ground Cable w/Clamp	
049004	Carry Strap	
011006	Air Regulator	
049049	Insulator, PA Fitting	
049057	Cover, Left Side	
049058	Cover, Right Side	
049059	Control Panel	
049060	Panel, Front, Leads Connection	
049061	Cover, Leads Connection	
049062	Rear Panel	
049063	Fan Cover	
049038	Fuse Cover	

5.2 MAX81 TORCH ASSEMBLY, 75°, 7.5-METER (25-FOOT) LEADS -- PARENT PART NO. 059047

<u>Part No.</u>	<u>Description</u>	<u>Item No.*</u>	<u>Qty.</u>
020184	Cap, Nozzle Retaining	1	1
020203	Nozzle, .038, MAX100	2	1
020345	Nozzle, .052	2	1
020194	Swirl Ring, .038, .052, MAX100	3	1
020191	Electrode, Air, MAX100	4	1
020189	Torch Main Body, 75°, MAX100	5	1
020185	Torch Handle Tube, MAX100	6	1
020187	Switch Holder, MAX100	7	1
005094	Switch, PB, Torch	8	1
029198	Leads, Hand Torch, 25 Ft., MAX100	9	1

\*See Figure 2, Page 26.

5.3 MAX81 GROUND CABLE WITH CLAMP, 7 METERS (23 FEET) -- PARENT PART NO. 023209

<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>
008337	Clamp, Ground	1
047031	Cable, #6, 600V Welding	7m (23 Ft.)
008333	Terminal, 5/16" Ring #4 AWL	

5.4 SPARE PARTS KIT -- MAX81 -- PARENT PART NO. 028363

<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>
020194	Swirl Ring	2
020191	Electrode	8
020184	Cap, Nozzle Retaining	2
020345	Nozzle	5
020203	Nozzle	5
026018	O-Ring	2
027055	Lubricant, Silicon, 7-Gram (1/4-Oz.) Tube	1
027102	Wrench, Electrode (3/8")	1



## 5.5 LIST OF RECOMMENDED SPARE PARTS FOR MAX81

<u>Part No.</u>	<u>Description</u>	<u>Schematic Name</u>	<u>10- 50*</u>	<u>50- 100**</u>
049044	Fuse	2FU	5	10
049037	Fuse	1FU	6	12
049040	Diode 3 PH	2D	3	6
049046	Diode 3 PH	1D	3	6
049013	Thyristor	SCR1	1	1
049017	Capacitor	2CAP	2	6
049008	Resistor	1RES	1	3
049031	Power Inverter Module	5PC	1	2
049029	Transformer	2T	1	2
049051	Diode	DO3	2	4
049052	Diode	DO4	1	2
049020	Relay, Pilot	1REL	1	1
049021	Air Core Transformer	3T	1	1
049035	Sol. Valve Air	1SOL	1	1
049039	Cooling Fan	1MTR	1	1
049032	Transformer & PC BD	1T, 7PC	1	1
049019	PC BD	3PC	1	2
049034	PC BD	1PC	1	2
049048	PC BD	2PC	2	4
049026	PC BD	4PC	2	3
020122	Torch 75°			4
020104	Retaining Cap		5	10
057012	Lead, 7.5 Meters (25 Feet)		2	4
057013	Lead, 15 Meters (50 Feet)		2	4
020120	Sleeve		2	4
049049	Pilot Arc Insulation		2	4
049054	Pressure Switch		2	4
049055	Transient Suppressor	1MOV	1	2

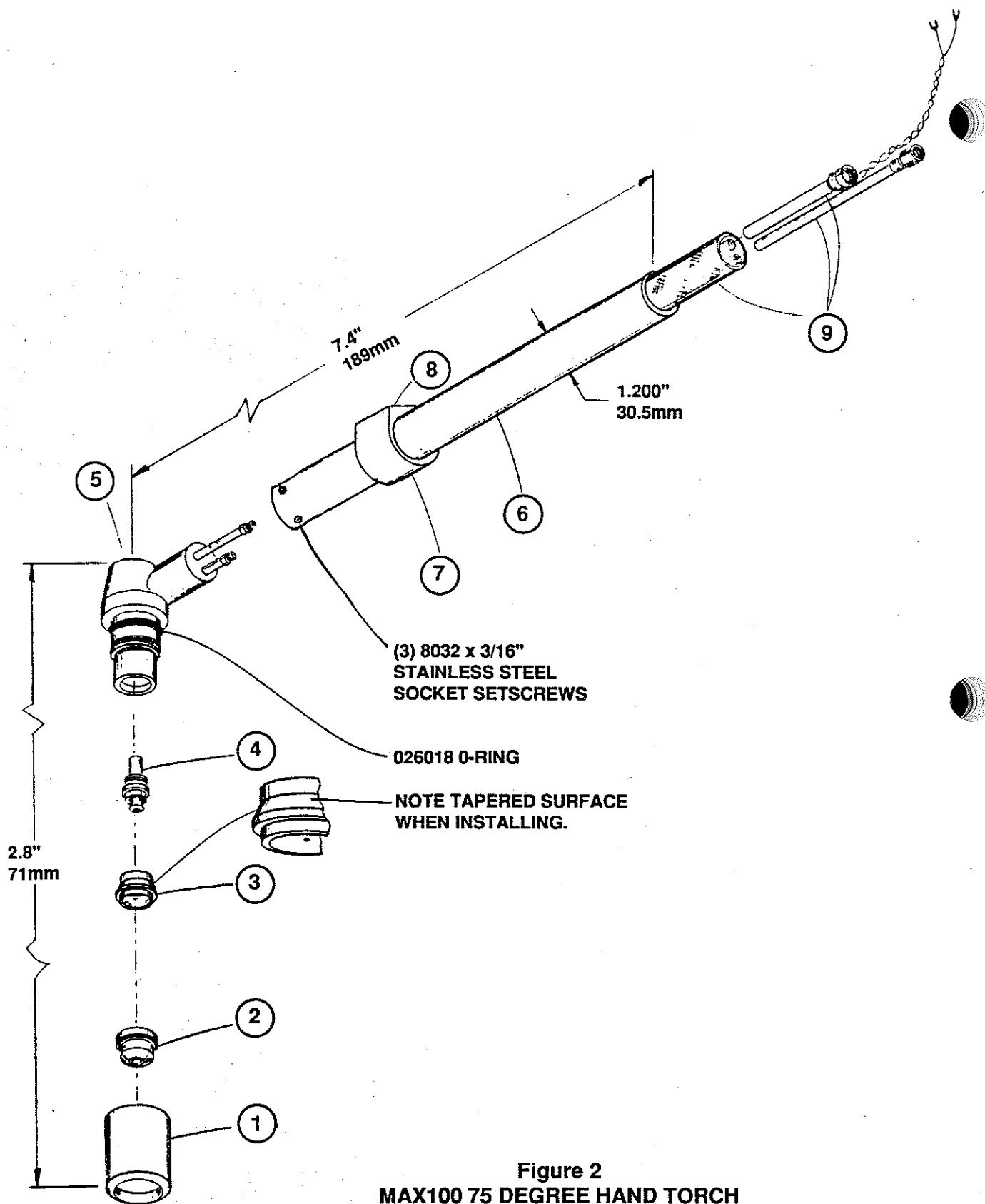
\*Stock quantities for 10-50 units working in the field.

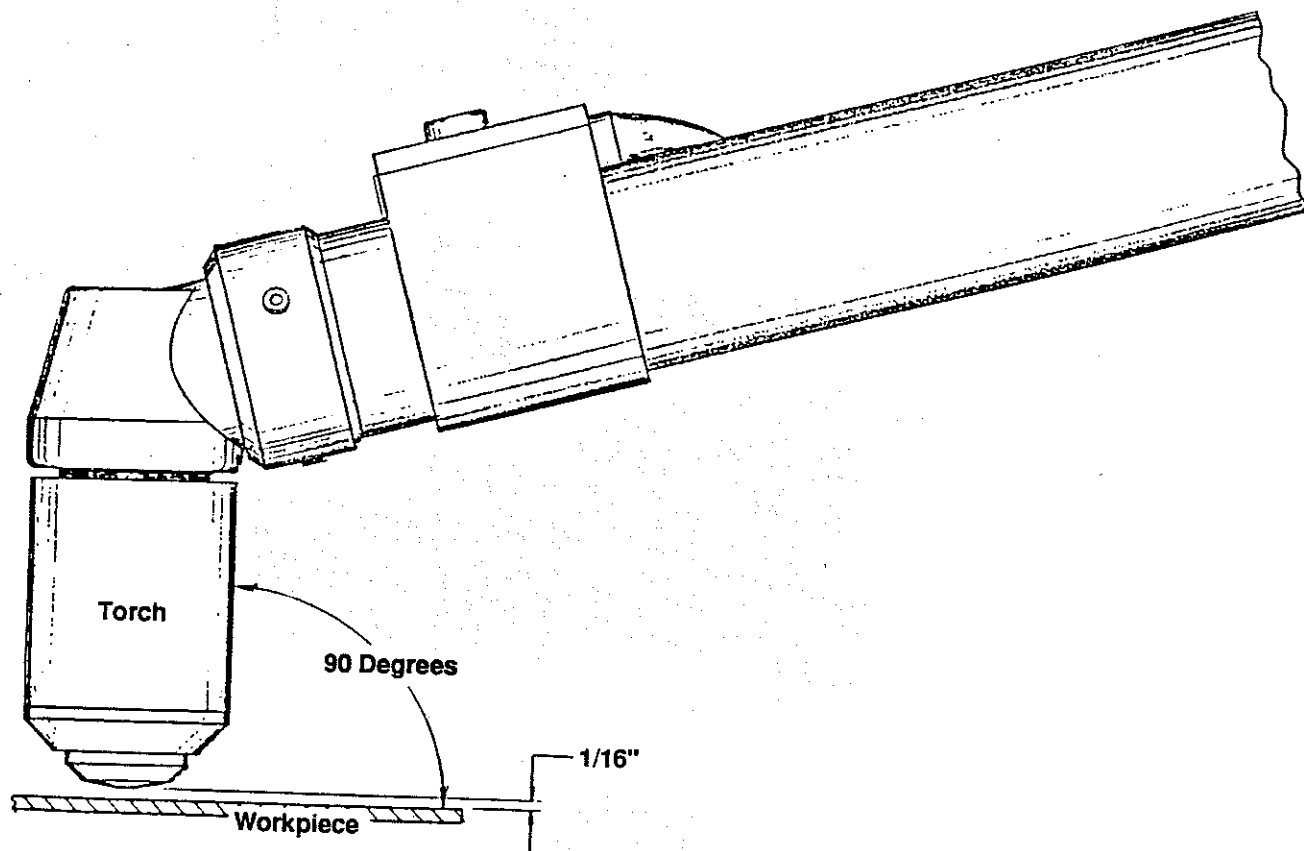
\*\*Stock quantities for 50-100 units working in the field.

## ILLUSTRATIONS

- Figure 1 -- MAX81 Wiring Diagram -- 380V, 3 Phase, 50 Hz
- Figure 2 -- MAX100 Torch -- 75° Head
- Figure 3 -- MAX81 Power Supply -- Front View without Cover
- Figure 4 -- MAX81 Power Supply -- Front View with Cover
- Figure 5 -- MAX81 Power Supply -- Right Side -- 380 Volt, Three  
Phase
- Figure 6 -- MAX81 Power Supply -- Left Side -- 380 Volt, Three Phase
- Figure 7a -- MAX81 Power Supply -- Rear -- 380 Volt, Three Phase
- Figure 7b -- MAX81 Power Supply -- Rear View with Cover
- Figure 8 -- MAX81 5PC Control Wiring
- Figure 9 -- MAX81 5PC Power Wiring







**Figure 2a. MAX100 Torch  
Recommended Operating Position**

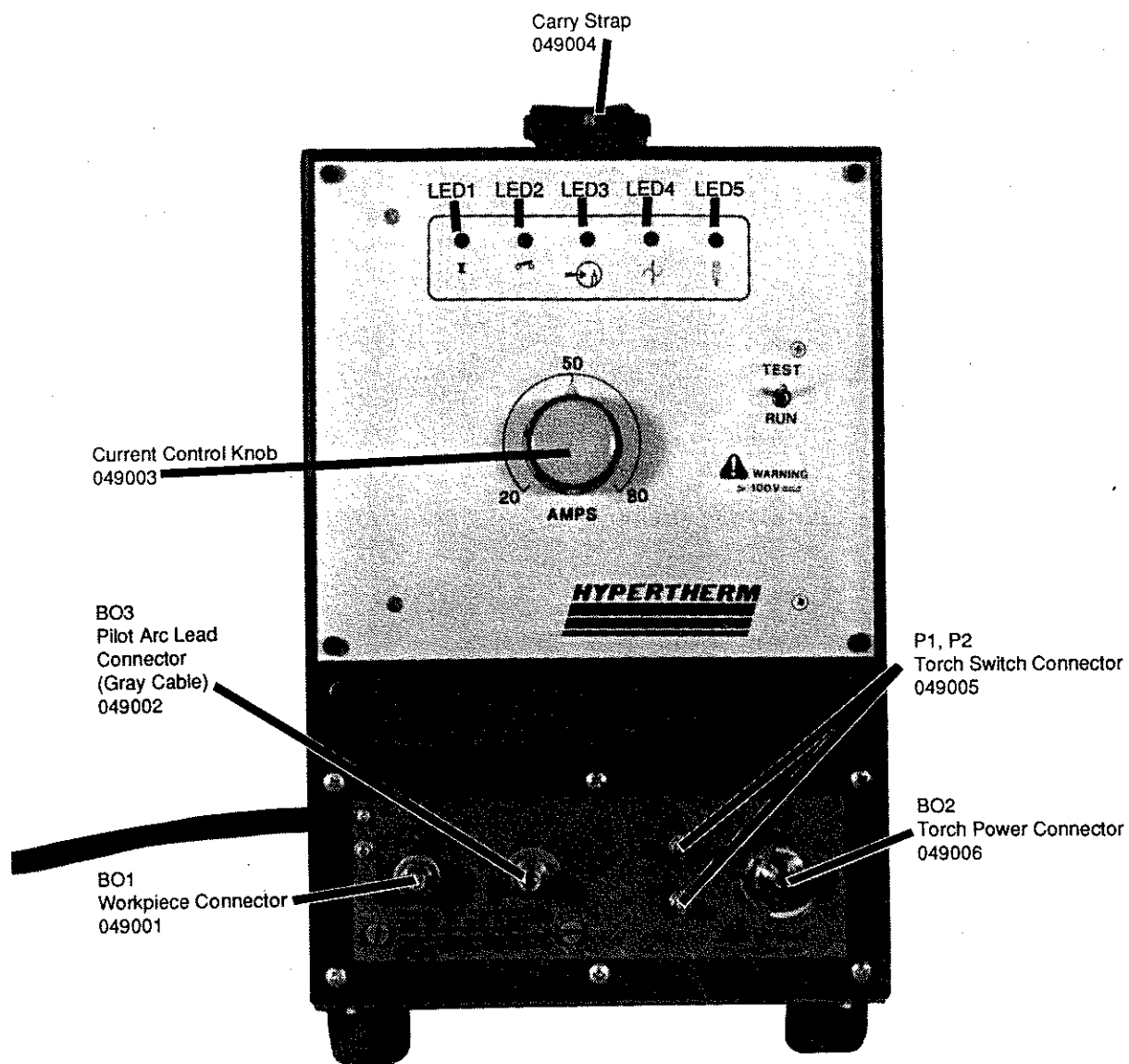
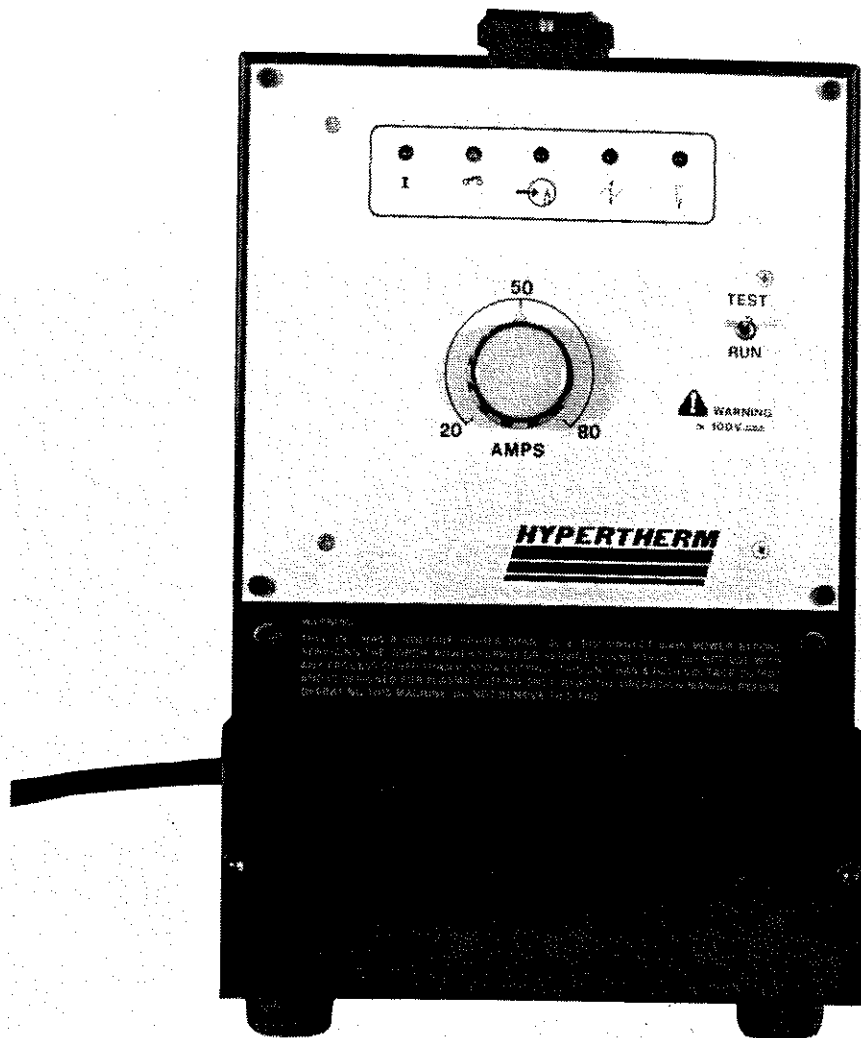


Figure 3  
MAX81 POWER SUPPLY  
FRONT VIEW without COVER



**Figure 4**  
**MAX81 POWER SUPPLY**  
**FRONT VIEW with COVER**

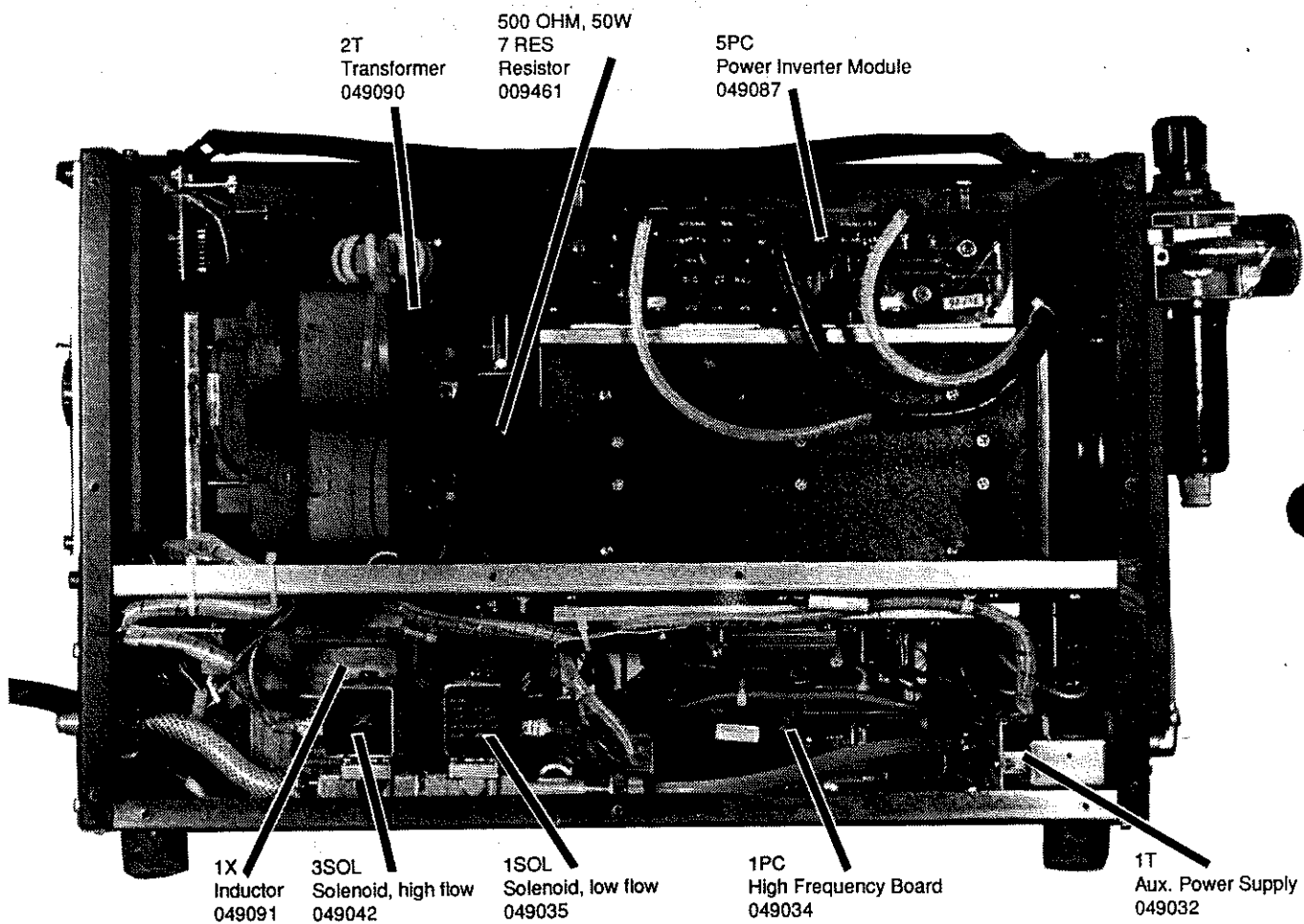


Figure 5  
MAX81 POWER SUPPLY  
RIGHT SIDE  
380 Volt, Three Phase



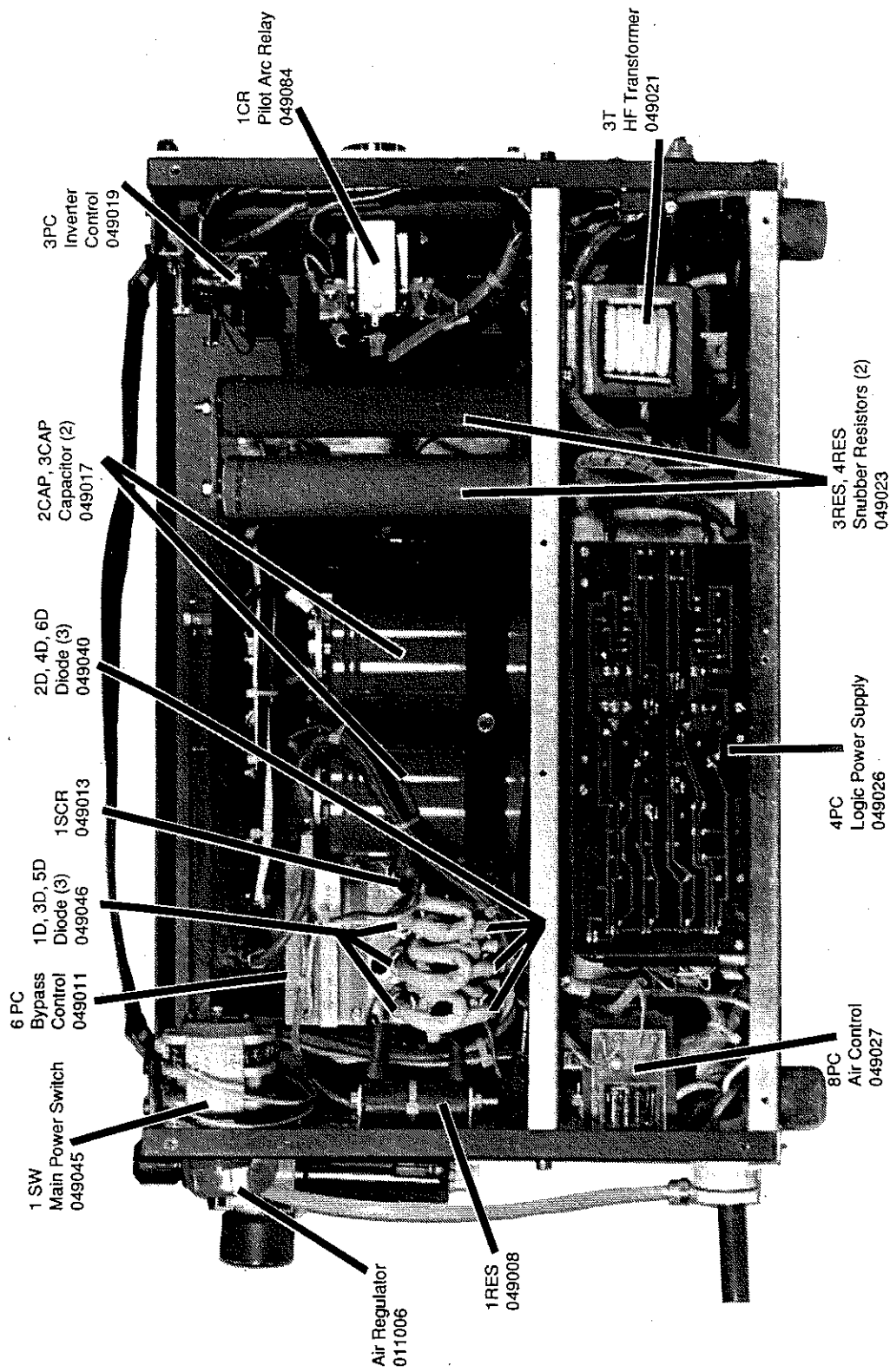
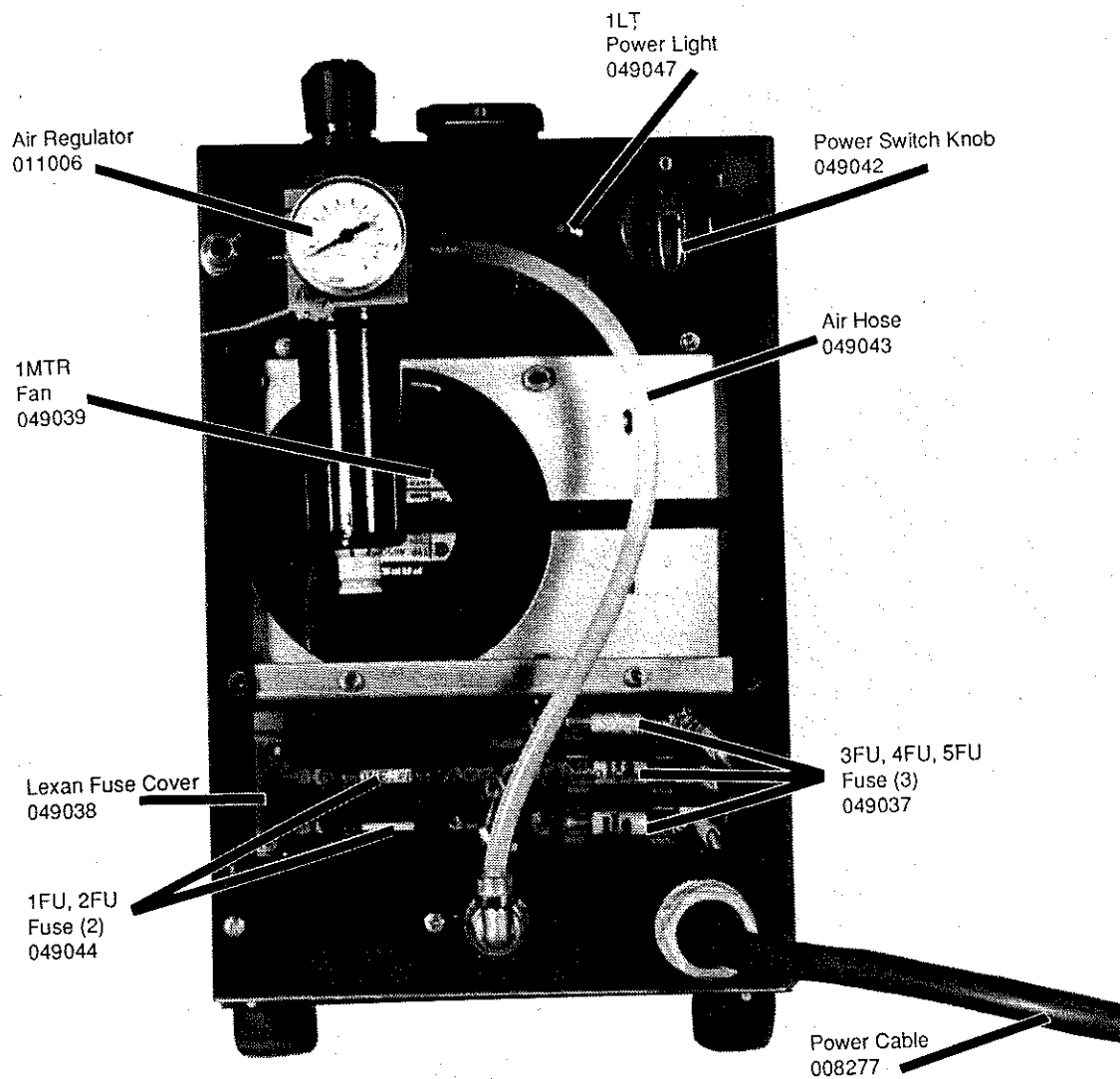
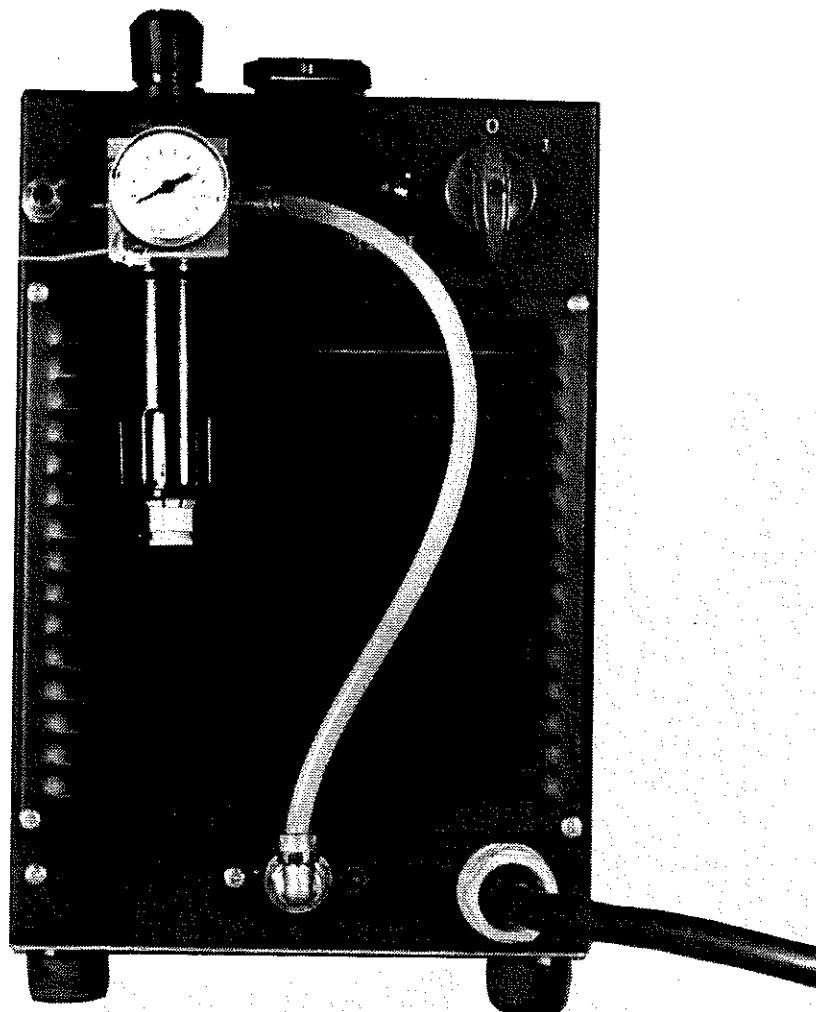


Figure 6  
MAX81 POWER SUPPLY  
LEFT SIDE  
380 Volt, Three Phase



**Figure 7A**  
**MAX81 POWER SUPPLY**  
**REAR VIEW without COVER**  
**380 Volt, Three Phase**



**Figure 7B**  
**MAX81 POWER SUPPLY**  
**REAR VIEW with COVER**

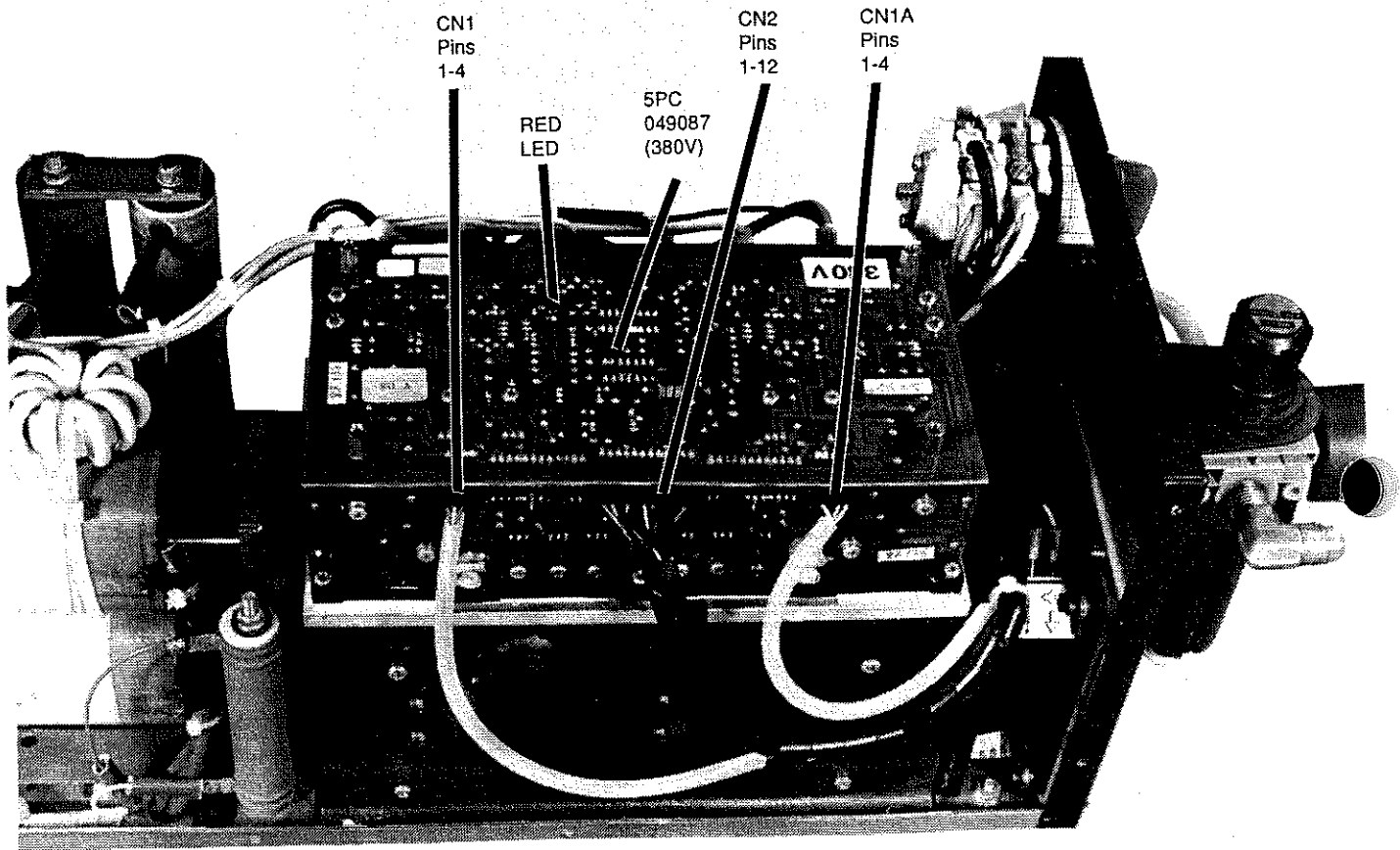


Figure 8  
POWER INVERTER

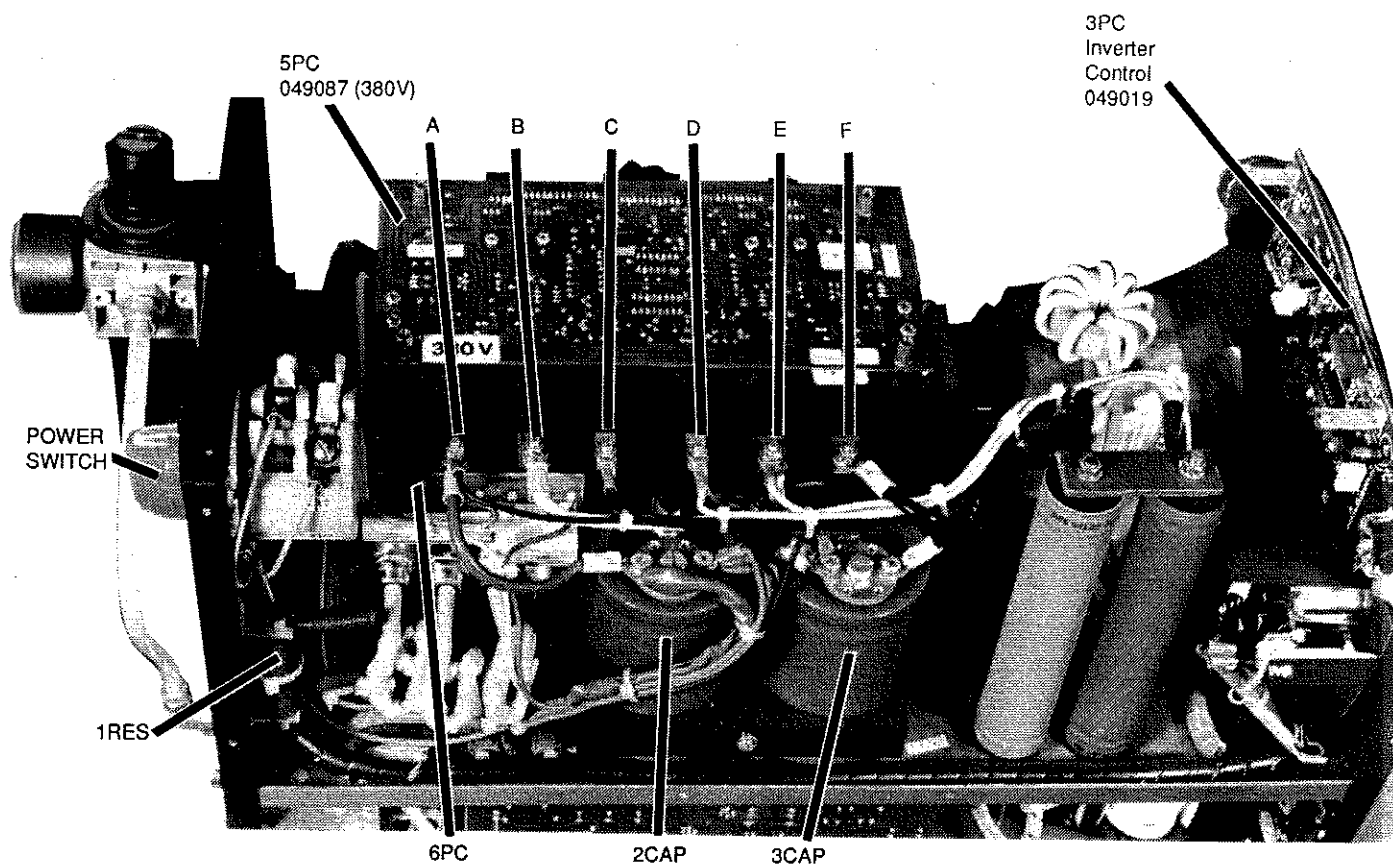


Figure 9  
POWER INVERTER