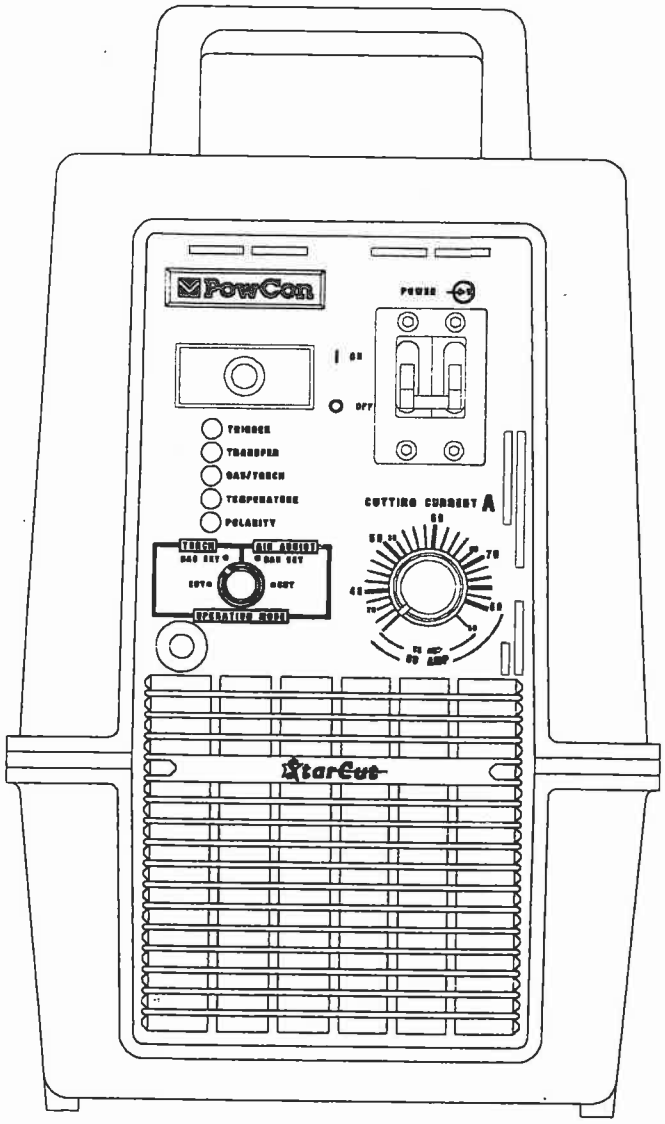
PowCon®

201333-001 Rev. A1

! IMPORTANT !
-FOR YOUR SAFETY-
READ THIS MANUAL BEFORE
INSTALLING OR USING EQUIPMENT

OPERATION MANUAL



StarCut

PowCon Incorporated
8123 Miralani Drive, San Diego, CA 92126
(619) 578-8580 • FAX (619) 621-6301

THANK YOU!!!

. . . for purchasing **PowCon Incorporated** products. Our commitment to you is to provide an ever expanding family of quality welding and welding/cutting power sources, arc positioning equipment and accessories. Please take a moment to read the following pages as they contain important information regarding proper welding/cutting safety and procedures.

The StarCut model Plasma Arc Cutter is warranted for one year from the date of purchase. Please fill out and return the warranty card shipped with each StarCut system.

TABLE OF CONTENTS

TABLE OF CONTENTS

SAFETY

GENERAL INFORMATION

INSTALLATION

OPERATION

MAINTENANCE

TURBO StarCut OPTION

TABLE OF CONTENTS

DRAWINGS & PARTS LISTS

FIGURES

TABLES

SAFETY

! IMPORTANT !

THIS MANUAL HAS BEEN DESIGNED FOR EXPERIENCED WELDING AND CUTTING EQUIPMENT OPERATORS AND MUST BE READ COMPLETELY BEFORE USING THIS EQUIPMENT. IF YOU LACK EXPERIENCE OR ARE UNFAMILIAR WITH THE PRACTICES AND SAFE OPERATION OF WELDING AND CUTTING EQUIPMENT, PLEASE CONSULT YOUR FOREMAN. DO NOT ATTEMPT TO INSTALL, OPERATE, OR PERFORM MAINTENANCE ON THIS EQUIPMENT UNLESS YOU ARE QUALIFIED AND HAVE READ AND UNDERSTOOD THIS MANUAL. IF IN DOUBT ABOUT INSTALLING OR OPERATING THIS EQUIPMENT, CONTACT YOUR DISTRIBUTOR OR THE CUSTOMER SERVICE DEPARTMENT OF PowCon.

DEFINITIONS

Throughout this manual, **NOTE, CAUTION, WARNING** and **DANGER** are inserted to call attention to particular information. The methods used to identify these highlights and the purpose for which each is used, are as follows:

NOTE

Operational, procedural, and background information which aids the operator in the use of the machine, helps the service personnel in the performance of maintenance, and prevents damage to the equipment.

CAUTION

An operational procedure which, if not followed, may cause minor injury to the operator, service personnel and/or bystanders.

WARNING

An operational procedure which, if not followed, may cause severe injury to the operator, service personnel, or others in the operating area.

DANGER

An operational procedure which, if not followed, will cause severe injury or even death to the operator, service personnel or bystanders.

SAFETY INFORMATION

Safety is a combination of good judgement and proper training. Operation and maintenance of any arc welding and cutting equipment involves potential hazards. Individuals who are unfamiliar with cutting and welding equipment, use faulty judgement or lack proper training, may cause injury to themselves and others. Personnel should be alerted to the following potential hazards and the safeguards necessary to avoid possible injury. In addition, before operating this equipment, you should be aware of your employer's safety regulations.

BE SURE TO READ AND FOLLOW ALL AVAILABLE SAFETY REGULATIONS BEFORE USING THIS EQUIPMENT.

ELECTRIC SHOCK

THE VOLTAGES PRESENT IN THE WELDING AND CUTTING ENVIRONMENT CAN CAUSE SEVERE BURNS TO THE BODY OR FATAL SHOCK. THE SEVERITY OF ELECTRICAL SHOCK IS DETERMINED BY THE PATH AND THE AMOUNT OF CURRENT THROUGH THE BODY.

A) Install and continue to maintain equipment according to USA Standard C1, National Electric Code.

B) Never allow live metal parts to touch bare skin or any wet clothing. Use only dry gloves.

C) When welding or cutting in a damp area, or when standing on metal, make sure you are well insulated by wearing dry gloves, rubber soled shoes, and by standing on a dry board or platform.

D) Do not use worn or damaged welding or torch cables. Do not overload the cables. Use well maintained equipment.

E) When not welding/cutting, turn equipment **OFF**. Accidental grounding can cause overheating and create a fire hazard. Do not coil or loop the cable around parts of the body.

F) The workpiece clamp should be connected to the workpiece as close to the work area as possible. Grounds connected to building framework or other locations remote to the work area reduce efficiency and increase the potential hazard of electric shock. Avoid the possibility of the cutting current passing through lifting chains, crane cables or other electrical paths.

G) Keep everything dry you might touch including: clothing, workpiece, welding power supply, torch and welding or cutting machines. Fix water leaks immediately. Do not operate equipment standing in water.

H) Never use a cutting torch or welding gun which is damaged or contains cracks in its housing.

I) Refer to AWS-Z49.1 for grounding recommendations.

PERSONAL PROTECTION

SKIN AND EYE BURNS RESULTING FROM BODY EXPOSURE TO ELECTRIC-ARC WELDING AND CUTTING RAYS OR HOT METAL CAN BE MORE SEVERE THAN SUNBURN.

A)

Use a proper face shield fitted with the correct filter (#8 or greater) and cover plates to protect your eyes, face, neck and ears from the sparks and rays of the cutting/welding arc when cutting/welding or observing cutting/welding. Warn bystanders not to watch the arc and not to expose themselves to the cutting/welding arc rays or to hot metal.

B) Wear flameproof gauntlet-type gloves, a heavy long-sleeve shirt, cuffless trousers, high-topped shoes, and a welding helmet or cap (for hair protection) to protect the skin from arc rays and hot sparks or hot metal.

C) Protect other nearby personnel from arc rays and hot sparks with a suitable non-flammable partition.

D) Always wear safety glasses or goggles when in a cutting or welding area. Use safety glasses with side shields or goggles when chipping slag or grinding. Chipped slag is hot and may travel a considerable distance. Bystanders should also wear safety glasses or goggles.

E) Compressed gas cylinders are potentially dangerous, refer to the suppliers for proper handling procedures.

F) Wear ear plugs or other ear protection devices when operating cutting or welding equipment.

FIRE SAFETY

HOT SLAG OR SPARKS CAN CAUSE A SERIOUS FIRE WHEN IN CONTACT WITH COMBUSTIBLE SOLIDS, LIQUIDS OR GASES.

A)

Move all combustible materials well away from the cutting area or completely cover materials with a non-flammable covering. Combustible materials include but are not limited to wood, clothing, sawdust, gasoline, kerosene, paints, solvents, natural gases, acetylene, propane, and similar articles.

B) Do not weld, cut or perform other hot work on used barrels, drums, tanks or other containers until they have been completely cleaned. There must be no substances in the container which might produce flammable or toxic vapors.

C) For fire protection, have suitable extinguishing equipment handy for instant use.

VENTILATION

WELDING AND CUTTING FUMES AND GASES, PARTICULARLY IN CONFINED SPACES, CAN CAUSE DISCOMFORT AND PHYSICAL HARM IF INHALED OVER AN EXTENDED PERIOD OF TIME.

A) At all times, provide adequate ventilation in the welding and cutting area by either natural or mechanical means. Do not weld or cut on galvanized, zinc, lead, beryllium or cadmium materials unless positive mechanical ventilation is provided to prevent inhaling fumes and gases from these materials.

B) Do not weld or cut in locations close to chlorinated hydrocarbon vapors coming from degreasing or spraying operations. The heat of arc rays can react with solvent vapors to form phosgene, a highly toxic gas, and other irritant gases.

C) If you develop momentary eye, nose or throat irritation during welding or cutting, it is an indication that the ventilation is not adequate. Stop work and take the necessary steps to improve ventilation in the welding or cutting area. Do not continue to weld or cut if physical discomfort persists.

D) Use an air supplied respirator if ventilation is not adequate to remove all fumes and gases.

E) Beware of gas leaks. Welding or cutting gases containing argon are more dense than air and will replace air when used in confined spaces. Do not locate gas cylinders in confined spaces. When not in use, shut OFF the gas supply at its source.

F) Refer to AWS Standard Z49.1 for specific ventilation recommendations.

SAFETY REFERENCES

The following publications provide additional information on important welding safeguards.

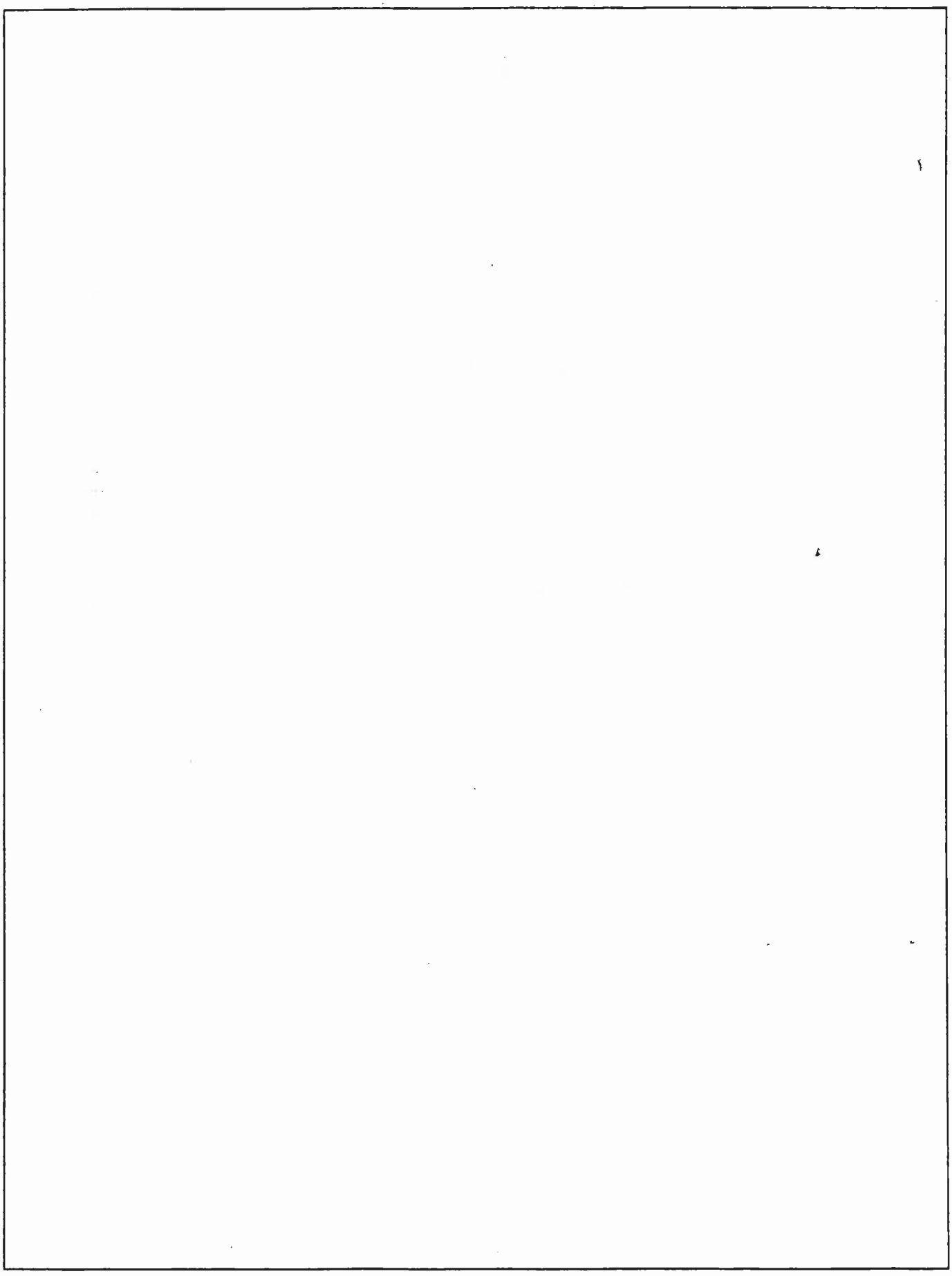
A) ANSI/ASC Z49.1-1988, American National Standard "Safety in Welding and Cutting".

B) Bulletin No. F4-1, "Recommended Safe Practices for the Preparation for Welding and Cutting Containers and Piping that have held Hazardous Substances".

C) OSHA Safety and Health Standards, 29CFR 1910, available from the United States Department of Labor, Washington, DC 20210.

D) NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 00210.

E) NEMA Standards Publication/No. EW1-1989, Electric Arc-Welding Apparatus, approved as ANSI C87.1-1989. Available from National Electrical Manufacturers Association, 155 E. 44th Street, New York, NY 10017.



GENERAL INFORMATION

DESCRIPTION OF EQUIPMENT

The **PowCon** StarCut is a lightweight, boost inverter style, portable Plasma Arc Cutting (PAC) power source. It is powered from the DC output of a low voltage welding power source, with no connection to three-phase AC utility power. This allows a welding operator to quickly and easily convert from welding to PAC without a utility or primary power connection.

The StarCut has a cut capacity of up to 1 inch (25 mm) thick mild steel at 80 Amps of cutting current, when powered by an appropriate DC welding power supply. Refer to Table 1, "Specifications" for a summary of the StarCut PAC system specifications. Maximum capacity is achieved with most inverter style welding power sources as well as three phase, engine driven alternators. Also, most engine driven generators and single phase constant voltage power sources will power StarCut. Some welding power sources may limit the StarCut output current which will limit cutting capacity (see section on Power Supply Selection). When StarCut is used with a power supply which limits cutting capacity, a Low Range current changeover allows smooth high quality cutting of up to 50 Amps or a capacity of 0.5 inches (12.5 mm).

Cut quality is optimized by the StarCut's inverter design, as well as by the specially designed **PowCon** line of PAC torches. The popular PT-90 torch with the 90 degree head has the feel of an oxy fuel torch with superior PAC performance. Not only are superior quality cuts achieved with the StarCut and PT-90, but high quality gouging is also available with a gouging tip installed in the torch.

A standard PAC system consists of a StarCut with a 25 foot PT-90/90 torch installed, and the 12 foot workpiece cable and clamp. A standard integrated air regulator/filter comes installed on the rear panel. Also recommended is the extractor/dryer air filter which is attached to the regulator, and wireform guards to protect the front and rear panel areas. A spare parts kit for the torch and manuals for the StarCut and PT-90 torches are also shipped with every system.

Table 1 - Specifications

StarCut POWER SUPPLY	
Input Voltage Range	40-125 VDC
Max Input Current - Normal Operation	185 Amps
Max Input Current - Circuit Breaker Protected	200 Amps
Max Open Circuit Voltage	200 VDC
High Range Cutting Current Input Voltage Greater than 60 VDC	35-80 Amps
Low Range Cutting Current	20-50 Amps
Duty Cycle Rating*	Up to 100%
Recommended Cutting Capabilities	Up to 1" Mild Steel
Physical Dimensions:	
Height	17 in. (43.2 cm)
Width	10 in. (25.4 cm)
Length	19 in. (48.3 cm)
Weight (without torch)	68lbs. (30.8 kg)

PT-90 TORCH**	
Max Current Capacity	100 Amps
Air Flow Rate	240 CFH
Cutting Air Pressure - 25 foot Torch	70 PSI
Cutting Air Pressure - 50 foot Torch	90 PSI
Gouging Air Pressure - 25 foot Torch	50 PSI
Gouging Air Pressure - 50 foot Torch	70 PSI
Cutting Tip Orifice 20 - 50 Amps	.048 in.
Cutting Tip Orifice 50 - 80 Amps	.055 in.
Gouging Tip Orifice	.093 in.

*See "Power Supply Considerations" and "Cutting Time Operation Voltage, Figure 10

**See also Torch Manual (P/N 201187-001)

NOTE

The values in this table are given as approximate, and are intended for operator's guidance only. Actual results may vary with specific manufacturer's model of welding power sources used.

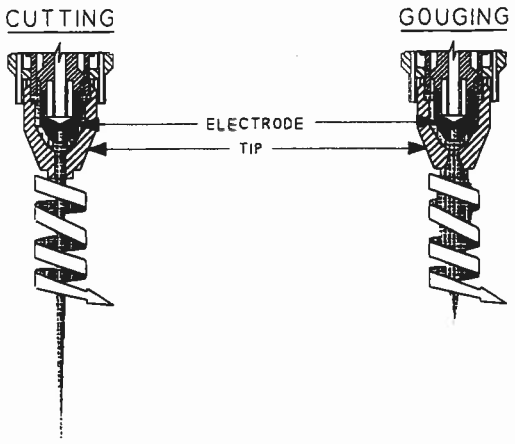


Figure 1 - PT-90 Torch Air Columns

THEORY OF OPERATION

Plasma Arc Cutting (PAC) is a process used to cut or gouge most steels and aluminum. The standard StarCut system uses air at about 70 PSI to supply the cutting torch (StarCut systems are available which use an Argon-Hydrogen gas mixture to give a better cut finish on stainless steel and aluminum). This compressed air is passed through the torch lead and is shaped into a tight spiral column as it passes through the torch cutting tip orifice (as shown in Figure 1, "PT-90 Torch Head Cross Section). When cutting current is engaged, the StarCut applies electrical power to this column of air. This power is sufficient to remove the outer electrons from the atoms in the air column; this condition is referred to as a "plasma" state. When this high energy column comes in contact with the workpiece's metal crystal structure, the electrons which hold the metal together are torn away, the metal structure falls apart and is blown down as slag.

Plasma arc cutting with air requires voltages of 100 to 140 volts DC, and initiating the arc requires an output open circuit voltage (OCV) of 180 to 200 volts DC. Welding power supplies are not able to do PAC, since they have typical operating voltages of 10 to 50 VDC with an OCV of 70 to 80 VDC. StarCut uses "boost" inverter electronics to convert this relatively low voltage from a welding power source to a higher voltage able to sustain the plasma arc. By using high speed switching electronics, the StarCut is also able to accurately control the cutting current for a smooth, constant cutting arc.

Electronic boosting of voltage is simply described as energizing an inductor with current, and then breaking the current flow suddenly. The energy that was stored in the inductor is then released at a higher voltage. Refer to Figure 2, "Electronic Block Diagram of Boost Inverter Principle", and the Schematic in the rear of this manual. StarCut uses a silicon controlled rectifier (SCR) Q1, to switch the welding power source through the main inductor, L1. The output rectifier Q2, switches on to transfer the boosted voltage to the output capacitors, C3 and C4. Then through the output inductor L3 for a smooth steady cutting current.

Other features shown in the block diagram include the input circuit breaker which acts as a "Power ON" switch, and also protects the StarCut and the welding power supply from currents over 200 Amps. An input diode protects from accidental application of straight polarity (positive power supply output applied to StarCut input connector). There are two "Hall effect" current sensing assemblies which feed signals to the control board, these are used to monitor the boost current from the power supply, and to monitor output cutting current. The main control PWB receives signals from the current sensors as well as the front panel, gas sensors, torch trigger and sends out signals to the two SCRs to control the inverter boost electronics. The main control PWB also controls the solenoid which allows air to flow through the torch and the relay which activates the arc starter PWB.

To first initiate the plasma arc, the arc starter PWB generates a series of high voltage pulses. These are coupled to the torch through an arc starter transformer to generate 8,000 volt pulses between the electrode and the tip of the torch. These pulses and an OCV of 200 Volts cause the torch to emit strong pilot pulses. When the torch is brought near the workpiece, the output current sensor recognizes when current is transferred through the workpiece and the transferred cutting arc is initiated.

Inverter design is the cornerstone of **PowCon** products, and allows the StarCut to convert most DC welders to plasma arc cutting. **PowCon** has pioneered the use of inverter technology in the welding and cutting industry and the unique StarCut PAC power source is a further innovation from **PowCon**.

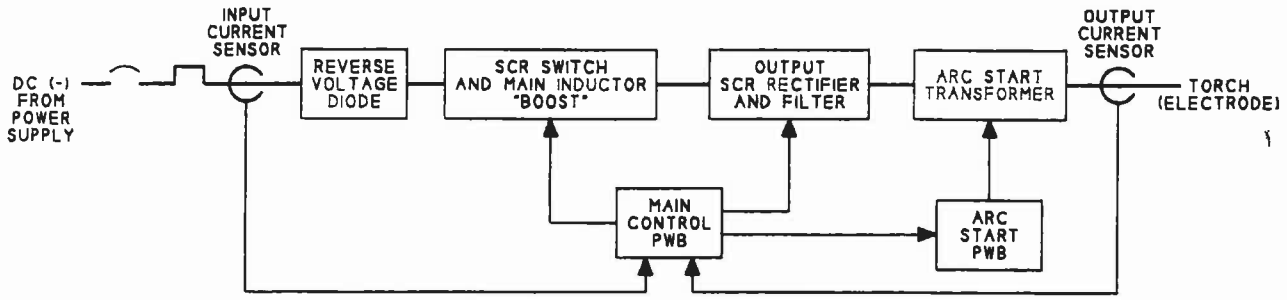


Figure 2 - Electronic Block Diagram of Boost Inverter

POWER SUPPLY CONSIDERATIONS

As described in the Theory of Operations section, StarCut is a boost inverter which increases the low voltage of a welding supply (40 to 80 VDC) up to the 100 to 200 VDC needed for the PAC process. Another way to consider this is to view the StarCut as an "electronic transformer", which when used to transform a voltage from lower to higher, also must transform current from higher to lower since energy is not destroyed, just transformed. For example:

Power Supply		StarCut
(80 volts) x (100 amps)	=	(100 volts) x (80 amps)

This simple formula represents the boost action of the StarCut on the power supply DC voltage, and also reflects the requirement for more current from the power supply than is used for cutting. This formula does not take into account the heat lost when making this transformation. Conventional transformers will lose up to 50% of the incoming power to heat allowing only half to be used productively. By using the high speed switching inverter design, the StarCut is able to use 75 - 85 % of the power from the welding power supply as cutting power.

From this formula only, it would seem that StarCut could use even lower power supply voltages and still produce the higher voltage necessary for PAC. However, lower power supply voltages require more input current, and the StarCut main Control PWB limits normal operation to 185 Amps from the power supply (the input circuit breaker is rated at 200 Amps maximum) Also, StarCut has a limit on how fast it can switch to create the boost voltage.

These considerations make power supply selection important; and if a less than ideal power supply is chosen, what will be its effect on StarCut cut capacity and duty cycle? Table 2, "Power Supply and StarCut Voltages and Currents", gives a brief summary of power supply operating voltages and currents, and StarCut outputs. Because PAC gouging requires a greater torch voltage than does PAC cutting, a separate section is included for gouging.

Table 2 - Power Supply and StarCut Voltages and Currents

PLASMA ARC CUTTING			
Welding Power Supply		StarCut	
Voltage	Current	Voltage	Current
40*	185	110	57
50*	185	110	71
60	173	110	80
70	148	110	80
80	129	110	80
PLASMA ARC GOUGING			
Welding Power Supply		StarCut	
Voltage	Current	Voltage	Current
40*	185	130	48
50*	185	130	60
60*	185	130	73
70	175	130	80
80	153	130	80

* Power Supply limited cutting capacity.

This table illustrates how different power supply voltages can affect the StarCut maximum cutting current. When using a power supply that can deliver more than 60 Volts, the maximum cutting current is 80 Amps. When the power supply cannot deliver 60 Volts, the StarCut is limited to 185 Amps from the power supply, and the cutting current is limited to less than 80 Amps. Also, when doing PAC gouging, the torch voltage requirement is 130 Volts, and the power supply restriction is more noticeable. For example, a 50 Volt power supply can supply 71 Amps for cutting, but for gouging is limited to 60 Amps. If more than one power supply is available, the best method for determining performance is to try cutting and gouging with all of the power supplies.

INSTALLATION

UNPACKING NEW EQUIPMENT

Remove the **PowCon** StarCut power source from its shipping carton and inspect for any possible damage that might have occurred during shipping. Make sure that all items on the packing list are accounted for and identified. One copy of this StarCut Operation Manual is packed with each **PowCon** StarCut unit.

Any claims for loss or damage that may have occurred in transit must be filed by the PURCHASER with the CARRIER. Copies of the bill of lading and freight bill will be furnished by the carrier on request if the need to file a claim arises. When requesting information concerning this equipment, it is essential that model description, serial number and/or part number of the equipment be supplied.

EQUIPMENT LOCATION

The StarCut cutter should be placed so that front panel controls are visible and accessible. The best placement for the cutter is on a table or platform off the floor so that the controls can be reached easily from a standing position. The torch cables exit the rear of the StarCut cutter, therefore, rear clearance space must be allowed for the torch cables.

Cooling air moves into the front grille, through the unit and exits the rear. Care must be taken to allow this airflow without obstruction. If duty cycle is limited, placing the StarCut in a cool location with air movement over the unit will increase cutting time. Do not place the cutter in an area where dirt, water, or grinder grit will be sucked in the unit.

Since the torch leads are 25 feet (50 ft. leads and torches are available if needed), the cutter must be located within about 20 feet of the cutting work area. The StarCut can be located at distances of as much as 200 to 300 feet from the welding power source if necessary as long as the cable lead to the cutter from the welding power source is of the appropriate gauge (See Electrical Connections Section). However, longer leads will lower the input voltage to StarCut and may limit the cutting capacity and duty cycle, refer to sections "Power Supply Considerations", and "Recommended Welding Cable Gauge". Please refer to the safety information provided in this manual regarding portability and location of equipment.

CHOOSING THE RIGHT WELDING POWER SOURCE

The cutting performance you get from the StarCut Plasma cutter depends on the welding power source used with it. The best results are obtained from a 3 Phase welding power source with a high open circuit voltage of 70 to 90 volts and a fast current response time.

Table 3 - Welding Power Supply Classes

Machine Class	Type	Nema Rating	
		200 Amp	300 Amp and higher
STATIC	3Ø CC	G	E
	3Ø CV	G	G
	3Ø CC/CV	G	E
	1Ø CC, AC/DC or AC	NR	NR
	1Ø CV	G	G
	1Ø CC/CV (use CV mode)	G	G
	INVERTER	E	E
ROTATING	Engine Generator	G	E
	Motor Generator	G	E
	3Ø Alternator/ Rectifier CC	G	E
	3Ø Alternator/ Rectifier CC/CV	G	G
	1Ø Alternator/ Rectifier CC, AC/DC or AC	NR	NR
	1Ø Alternator/ Rectifier CC/CV (use CV mode)	G	G

Table 3, "Welding Power Supply Classes", shows the expected results for various types and ratings of power sources. Welding power supplies are divided into "rotating" and "static" classes. Rotating power supplies are alternators and generators (those which use rotating components to generate electrical power). Static refers to everything else, and is divided into conventional transformer types, and inverter types. Table 3 lists various types of these classes of power supplies, and rates them for expected performance when used with the StarCut PAC.

If you are not sure what type your welding power source is:

1. Copy down the welding power source model number.
2. Contact the welding power source manufacturer.
3. Read the types of power sources from the chart and have the manufacturer identify the type from the chart which best describes the power source you have.

Once you have identified the welding power source type and rating, read from the chart the expected results. The results can be described as follows:

"E" - Excellent:
Starting and arc transfer will be smooth. Cutting capacity will be up to 1" steel (80 amps).

"G" - Good:
Starting and arc transfer will be acceptable. Cutting capacity will be up to 1/2" steel (50 amps). Low current range may increase arc stability and cut quality.

"N/R" - Not Recommended:
Starting and arc transfer will be difficult or impossible. Cutting arc will be unstable and go out causing numerous cutting interruptions. This type of welding power source is not recommended for use.

PowCon has collected data from customers, internal testing and from other sources on StarCut performance with various manufacturer's models of welding power sources. Below in Table 4, "StarCut Performance Matrix", is listed some of the power supplies that have been successfully tested with the StarCut. This data represents our best estimate, actual performance may vary based on model used.

Table 4 - StarCut Performance Matrix

MANUFACTURER: MILLER ELECTRIC			
Welding Power Source Model	1/2"	3/4"	1"
SRH-222		Y	
SRH-333			Y
SRH-444			Y
GOLDSTAR 300SS			Y
GOLDSTAR 400SS			Y
GOLDSTAR 500SS			Y
GOLDSTAR 600SS			Y
MARK VIII-2			Y
DELTAWELD 451	Y		
DELTAWELD 651	Y		
MAXTRON 300			Y
MT 300 SERIES			Y
DIMENSION 400			Y
Engine Driven Welding Power Source			
TRAILBLAZER (only air cooled)	Y		
BIG BLUE		Y	
BIG BLUE 251D		Y	
BIG 30A DIESEL			Y
BIG 40G			Y
BIG 40 DIESEL			Y
BIG 50 DIESEL			Y
BIG BLUE 400D			Y
BIG BLUE 600D			Y
MILLER AIR PAK			Y
TRAILBLAZER 44G & D			Y
TRAILBLAZER 55G & D (CC)			Y

MANUFACTURER: KEMPII			
Welding Power Source Model	1/2"	3/4"	1"
PS3500	Y		
PS5000		Y	

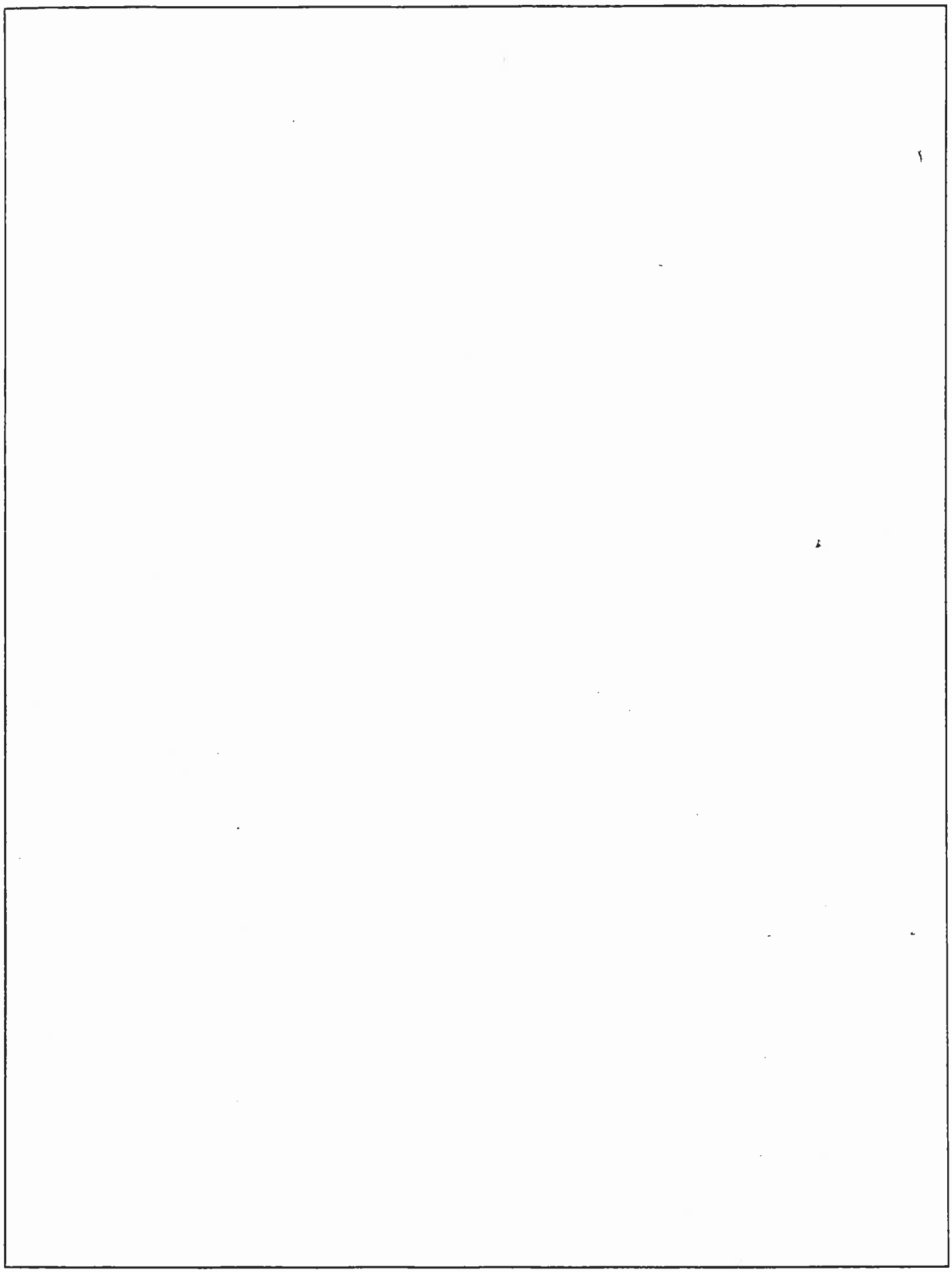
MANUFACTURER: L-TEC/AIRCO/ESAB			
Welding Power Source Model	1/2"	3/4"	1"
SVI 450i CV/CC			Y
L-TEC 400i CV/CC			Y

MANUFACTURER: LINCOLN ELECTRIC COMPANY			
Welding Power Source Model	1/2"	3/4"	1"
INVERTEC V-300 PRO			Y
IDEALARC R3R 300			Y
IDEALARC R3R 400			Y
IDEALARC R3R 500			Y
IDEALARC DC 400			Y
IDEALARC DC 600			Y
Engine Driven Welding Power Sources			
SA-200		Y	
SA-250			Y
SAE-350			Y
SAE-400			Y
SAM-650			Y
SAM400			Y
SAE 400 ELECTRIC MOTOR		Y	

MANUFACTURER: HOBART			
Welding Power Source Model	1/2"	3/4"	1"
R-400-S (MEGA ARC)			Y
RCC-450 RVS			Y
RCC-650 RVS			Y
Engine Driven Welding Power Sources			
TITAN COMBO D	Y		
MA-350-D		Y	
MA-400-D			Y

MANUFACTURER: PowCon			
Welding Power Source Model	1/2"	3/4"	1"
200, 225	Y		
300/400 Series (Single Phase)	Y		
300/400 Series (Three Phase)			Y
500SM/500SM AC/DC		Y	
550SMP/630SMP			Y
300STP	Y		

"Y" Recommended for listed material thickness.



ELECTRICAL CONNECTIONS

Before making any connections to the StarCut PAC, be sure your welding power source is properly installed and ready to operate per the power source manufacturers instructions.

CAUTION

Be sure the welding power source output is deactivated and the power source is turned off before making any connections to the StarCut plasma cutter.

Please refer to Figure 3, "StarCut Setup: Electrical Connections", for a diagram on making the electrical connections between the welding power source, the workpiece and the StarCut.

First be sure that the welding power source is properly installed and is operating correctly. The positive lead of the welding power source is connected to the workpiece or a suitable metal table or metal structure which will be in contact with the workpiece. If a metal structure such as a building frame, storage tank, or ship hull is used, make sure it is capable of carrying up to 200 Amps safely. Also make sure that there are no unwanted electrical paths, such as chains, conveyers, etc. The negative lead of the power source is connected to the StarCut rear panel input terminal. This is a male terminal, either Tweco or Dinse style connector. The StarCut workpiece cable is held in the rear panel of the unit, but may be replaced by an optional cable of 20 ft. or 30 ft. length (see spare parts section). Connect the workpiece clamp to the workpiece or to where the power source positive lead is connected.

All the connections to the welding power source terminals may be made with standard welding cable.

RECOMMENDED WELDING CABLE GAUGE

Table 5, "Gauge of the Welding Cable and Voltage Drop" shows recommendations for cable selection to connect the welding power source to the StarCut. Voltage drops are shown to illustrate how the cable size can affect the voltage delivered to the StarCut. As described in Table 2, "Power Supply and StarCut Voltages and Currents", StarCut capacity can be limited by the voltage which is supplied to the unit. If you are running the StarCut some distance from the power supply, be sure to take into account the voltage dropped by both the supply (negative) cable and the return cable (positive). For local, more typical installations, the voltage drop in the cable is not noticeable.

Table 5 - Gauge of the Welding Cable and Voltage Drop

WIRE GAUGE	WIRE LENGTH		
	100 ft.	200 FT.	300 FT.
2	3.7	N/R	N/R
1	3.0	N/R	N/R
1/0	2.4	4.8	N/R
2/0	2.0	4.0	6.0
4/0	1.2	2.4	3.6

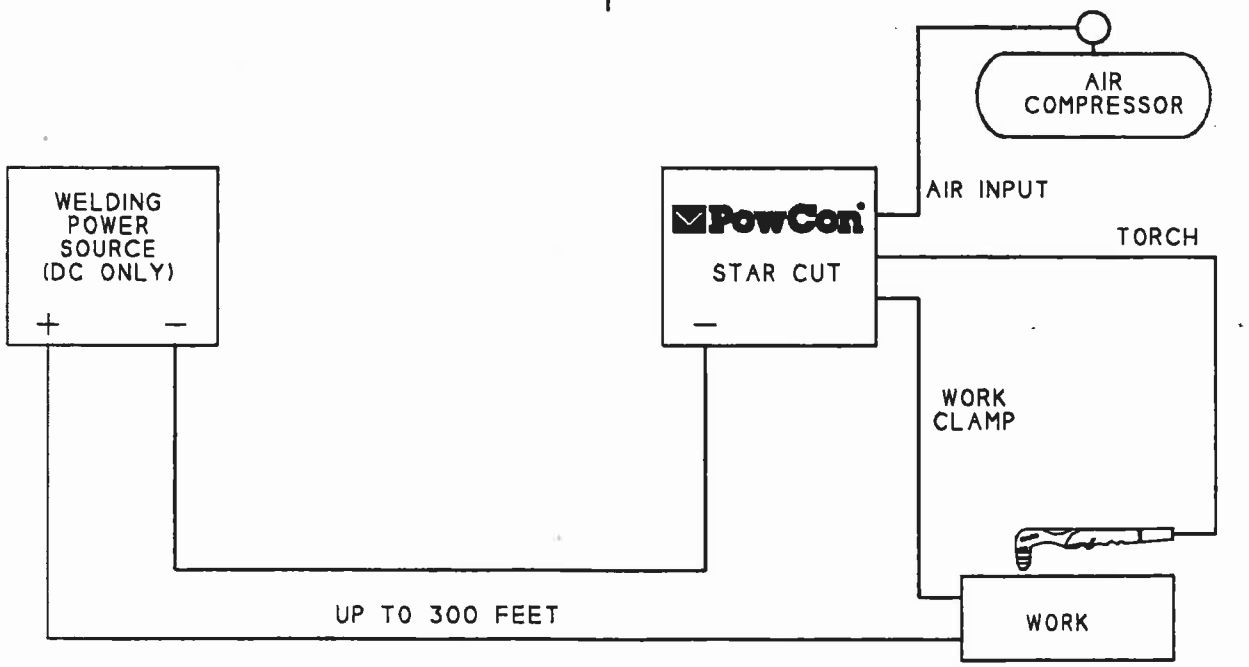


Figure 3 - StarCut Setup Electrical Connections

COMPRESSED AIR CONNECTION

Plasma cutting requires a flow of either air or gas for plasma gas and also for cooling the torch head and consumable components. The standard StarCut system with the PowCon brand PT-90 torch is designed to cut with compressed air. It is critical that the air supplied to the torch must be clean and dry, and should not contain either water or oil aerosols. Poor cut quality, short parts life or double arcing will occur as well as possible contamination of the StarCut air components and the torch leads and head.

Figure 8, "Rear Panel", in the OPERATION section shows the air connection for the StarCut PAC, this figure shows the recommended extractor/dryer air filter. A ¼ NPT pipe fitting is accessible facing the rear for compressed air input, a quick-connect fitting may be installed for convenience. Use a thread compound on this connection to provide good thread sealing. If the extractor/dryer is not installed, the compressed air is applied directly to the 1/4 NPT threads in the regulator/filter. Spare parts for the air filter and regulator are located in the PARTS LIST section. Maintenance requirements are located in the OPERATION section.

Refer also to Table 1, "Specifications" for air supply pressure and flow requirements. If your unit was shipped with a torch installed and your power source is capable of full StarCut output, you may move forward to the "Operation" section.

OPENING THE StarCut CASE— CAPACITOR DISCHARGE

Before opening the StarCut case, be sure that the unit is disconnected from the welding power source and that the ground clamp is removed from any possible live metal. The StarCut circuit breaker should be in the OFF position to help prevent electrical shock. Also be sure to **COMPLETE THE CAPACITOR DISCHARGE PROCEDURE** once the case top is removed, and before touching any metal parts inside the StarCut unit. Refer to Figure 4, "Top View, Cover Off" during this section.

WARNING

The capacitors in the PowCon StarCut PAC are charged with voltage. The capacitors will discharge normally over a period of time after power is removed. However, in order to avoid an electrical shock when the case is removed, the capacitors must be discharged with a bleeder resistor, as described in this section.

DANGER

Do not attempt to perform this procedure without the power source being disconnected from StarCut unit

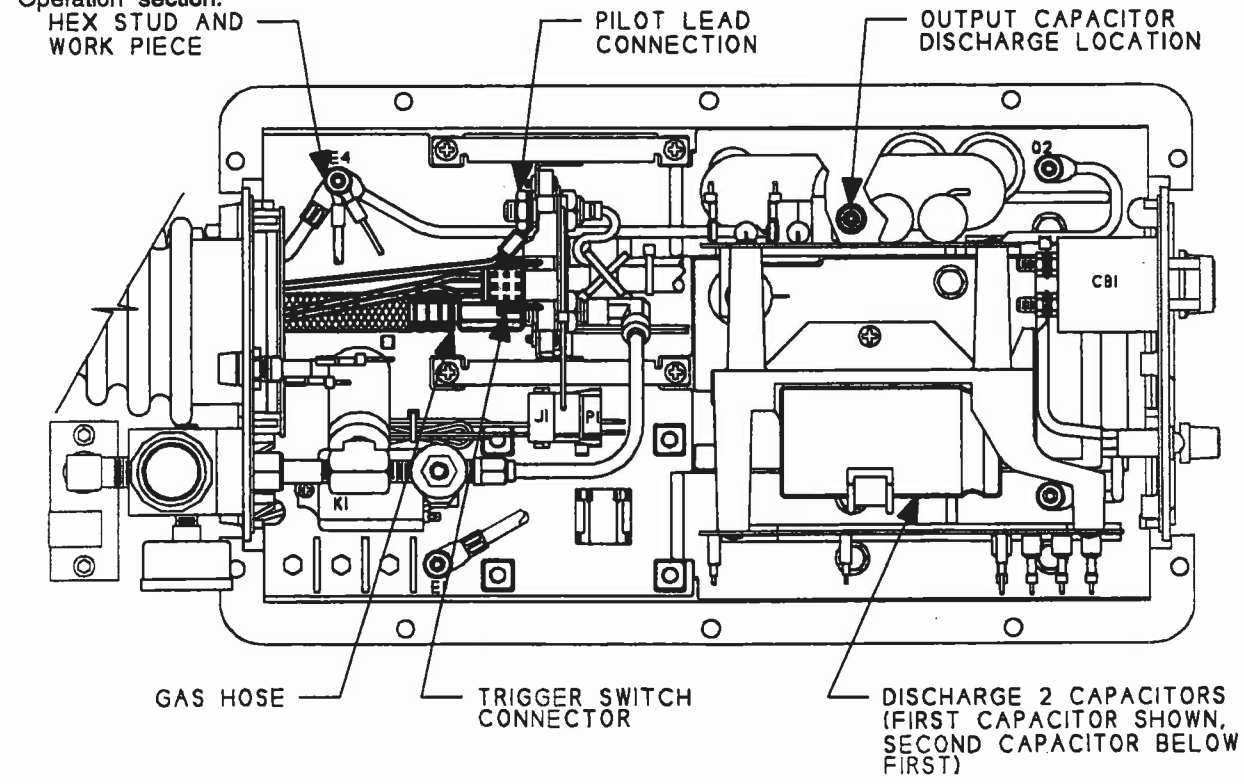


Figure 4 - Top View, Cover Off

A) ⚠ With the StarCut unit disconnected, upright and secure. Remove the nuts from the ten (10) bolts securing the case top and the case bottom which sandwich the white chassis, push out the bolts. Save all hardware for later reassembly. Four (4) bolts will be longer if wireform guards are installed on your StarCut.

B) You may wish to disconnect the compressed air line from the rear panel for convenience. Remove the top cover by lifting on the handles.

C) Locate the two input capacitors inside the unit as shown in the Figure 4, "Top View, Cover Off". Being careful not to touch any metal parts, connect one end of the bleeder resistor assembly to one of the terminals of the top capacitor and attach the other end of the bleeder assembly to the other terminal. Leave bleeder resistor connected for at least 10 seconds.

NOTE

A spark discharge may be noticed

D) Repeat the step C) procedure for the second capacitor.

E) To discharge the output capacitors, connect one end of the bleeder resistor to the workpiece hex stud, and connect the other end to the single hex bolt head under the capacitor board.

F) The top of the StarCut unit is now safe to handle. If working on the bottom of the unit, disconnect the arc start card harness to prevent shock from capacitors on the card. If necessary, discharge the capacitors on the arc start card before handling.

BLEEDER RESISTOR

A capacitor discharge (bleeder) resistor assembly is available from **PowCon** (P/N 250040-001). Contact your local distributor or the factory if you wish to obtain one.

If you wish to construct a bleeder resistor assembly, the following component requirements must be met to be considered acceptable for capacitor discharge:

RESISTOR: 5 ohm of at least 50W.

CONDUCTOR: #16 AWG 600 VDC insulation rating.

A bleeder resistor consists of a power resistor with leads connected to each end with clips on the ends of the leads, refer to Figure 5, "Capacitor Discharge Bleeder Resistor". All connections must be hard wired (soldered). Conductors should be approximately three (3) inches in length. Entire resistor body and soldered connections to resistor must be encapsulated with 600 VDC rated "heat shrink" insulation.

TORCH INSTALLATION

Most StarCut units are shipped with a PowCon brand torch already installed, a brief procedure for installing the PT-90 hand held torch is included here. For further information on installing PowCon brand torches into either the StarCut PAC or the PlasmaPLUS multi-process PAC/SMAW/GTAW/GMAW unit, refer to the PT-90 Torch manual P/N 201187-001. This manual covers both hand held and machine torches with remote pendants.

NOTE

Before proceeding with this procedure please make sure you have completed the section on OPENING THE STARCUT CASE—DISCHARGE CAPACITORS.

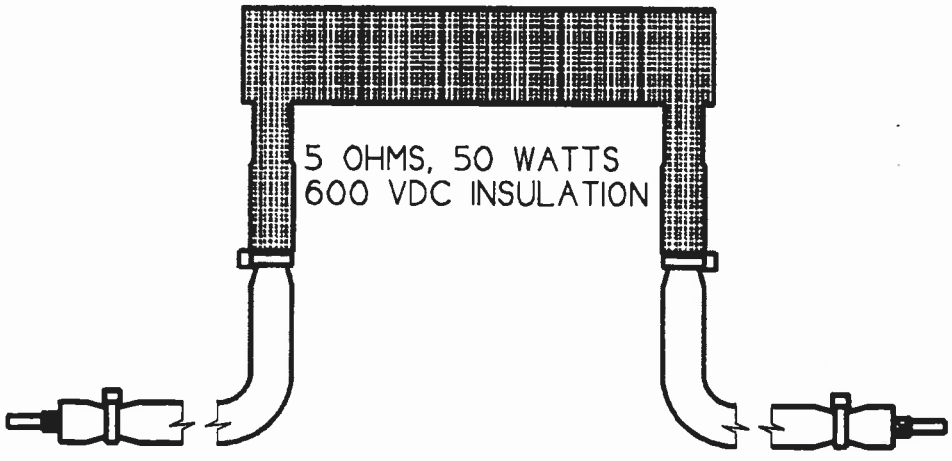


Figure 5 - Capacitor Discharge Bleeder Resistor

A) With the case top removed, feed the gas hose, trigger switch connector, and the pilot lead through the boot from the rear of the unit.

B) Remove the nut and washers from the pilot lead stud connection located on the left side of the torch connector bracket.

C) Connect the pilot lead to this connection using this nut & washers.

D) Connect the gas hose to the fitting on the torch connector bracket. Do not overtighten.

E) Connect the trigger switch connector to the mating connector on the trigger filter PWB.

F) Replace the cover. Making sure that the front and rear panels are in the molded grooves in the cover.

G) Fasten the cover to the case using the bolts removed in Step A). Note that there may be two (2) or four (4) longer bolts for attaching wireform panel guards.

CURRENT RANGE CHANGEOVER

The StarCut Plasma cutter has two current range settings: 20-50 Amps and 35-80 Amps. StarCut Plasma cutters leave the factory set for high current range; most users will want to have an 80 amp maximum setting for cut capacities up to 1" steel. However, there are situations where a 50 amp maximum setting may give better results.

When a welding power source is used which has low open circuit voltage or a limited current rating, the cutting capacity or stability of the plasma arc can be impaired (See section on "Choosing the Right Welding Power Source"). If such a power source will be used most of the time, better arc stability and arc transfer characteristics will be achieved on the low current range of 50 Amps maximum. Since this type power source with its low operating voltage and/or current rating would limit the cutter to a 1/2" capacity anyway, there is no lost capacity, however there is increased stability.

Figure 6, "Current Range Changeover Locations", shows the two locations where the cutter is changed between a 50 amp max current setting and an 80 amp max current setting.

NOTE

Remove the top cover and complete the section "Opening the StarCut Case—CAPACITOR DISCHARGE" and follow the procedure below to change the max current setting.

A) Locate the two position dip switch on the main control board shown in Figure 6, "Current Range Changeover Locations".

B) Set both switches in the OPEN position for Low Range: 50 amps maximum. Set both switches in the 1,2 position for High Range: 80 amps maximum.

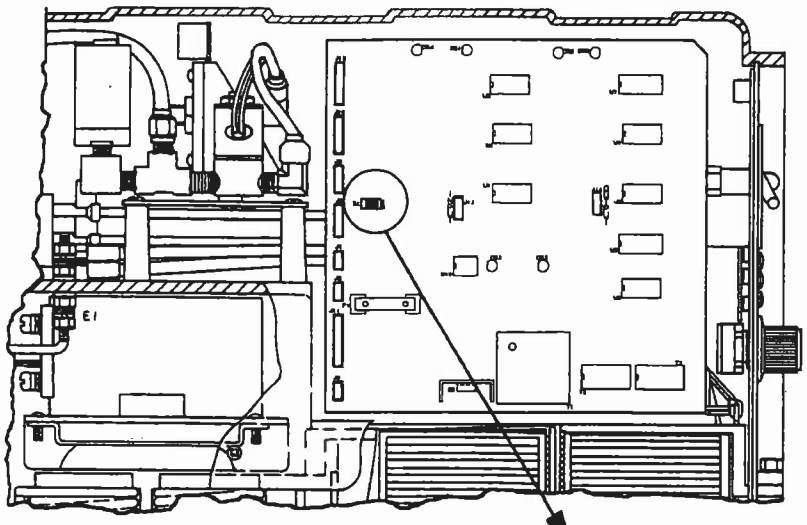
C) Replace the case top and lay the unit upside down on the handles and slide the case bottom off to expose the output plasma inductor with changeover shorting bars.

D) Refer to Figure 6 to place the buss bars in the 50 amp or 80 amp position matching the dip switches.

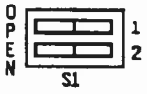
E) Slide the case bottom back on, turn unit right side up and replace all wireforms and case bolts.

NOTE

Both max current setting locations must be set for the same setting. Different settings for these locations may result in arc instability or overheating of internal parts.

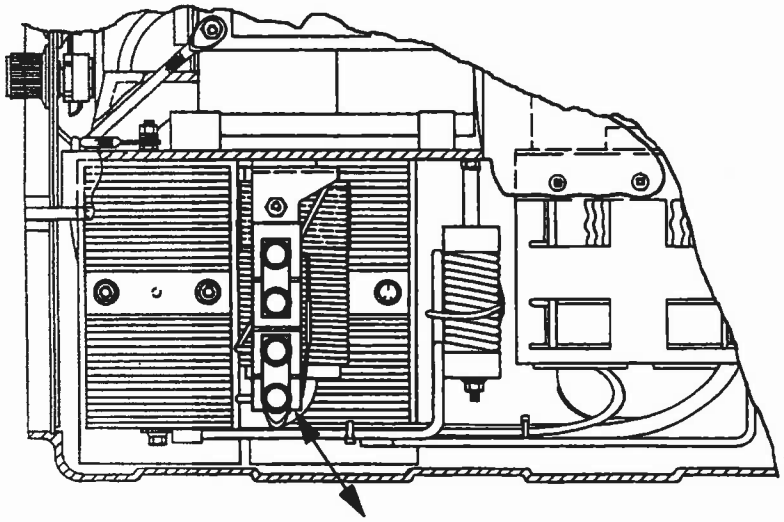


50 Amp Setting: Press both switches down to the OPEN position.



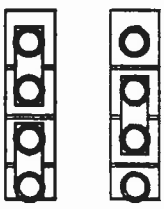
CONTROL BOARD DIP SWITCH

80 Amp Setting: Press both switches down opposite the open position



CURRENT CHANGE OVER

80 Amp



50 Amp

Figure 6 - Current Range Changeover Locations

OPERATION

SEQUENCE OF OPERATION

Be sure that the StarCut PAC is properly installed as described in the INSTALLATION section of this manual. Also be sure to observe the safety practices described in the SAFETY section, as well as the practices established at your place of business or job site.

For more in depth discussion of cutting and gouging operations, see the rest of this section. This sequence covers only the basics of operation.

Before beginning cutting operations with the StarCut PAC, the welding power source controls must be properly set to get the best results. Refer to Table 6, "Welding Power Source Setup", below see Figure 7, "Front Panel Controls and Indicators" and Figure 8, "Rear Panel Controls and Indicators" for a description of front and rear panels while reading this section. This sequence is also included on a label located on the case top of the StarCut PAC.

Table 6 - Welding Power Source Setup

If your welding power source has a:	Then set it for:
CC/CV switch	CC if 3ø, CV if 1ø
Contactor switch	"ON" or "Local"
High Frequency Switch	"OFF"
Idle Control	"OFF" (not automatic)
Range Switch	Maximum Range
Amperage Control	Max or 400 amps whichever is less
Voltage Control	Max
Polarity	DC

A) Turn the StarCut circuit breaker on. Check that the fan is running and that the yellow Power ON indicator is lit.

B) Turn the Gas Set / Current Control to GAS SET and adjust the air regulator to 70-75 PSI for a 25 ft. torch and 85-90 PSI for a 50 ft. torch (for gouging, air pressure should be set approximately 20 PSI lower).

C) Turn the Gas Set / Current Control switch to PANEL.

D) Set the cutting current to the desired cutting current.

E) Hold the torch to the side and above the work piece then press and hold the trigger switch. A high repetition pilot arc will begin approximately 2 seconds after the trigger switch is pressed. This preflow time allows air flow to stabilize.

F) Move the torch towards the work piece until you establish a transferred plasma arc. The tip must be within 1/8 inch from the workpiece in order for a transferred arc to be established but must not touch the workpiece or the tip will be damaged and need to be replaced. Standoff gas cups are supplied to help prevent tip contact.

G) If you do not achieve a transferred arc within approximately 5 seconds, the arc starter will time out and stop piloting. Release the trigger. Wait for air to stop flowing to allow the arc start timer to reset, and repeat steps E) and F).

CAUTION

Do not touch the torch tip to the work piece, it will ruin the tip.

H) Cut with a slow steady motion to allow the plasma arc to cut the metal and blow the slag clear of the cut.

I) To stop the Plasma arc either release the trigger switch or move the torch off the end of the work piece when completing the cut. The transferred arc extinguishes and the pulsing pilot arc resumes until the trigger is released.

J) Gas will continue to flow for approximately 10 seconds after the trigger switch is released. This is "Postflow" and continues to cool the torch.

NOTE

If the StarCut PAC pilots correctly but does not maintain a transferred arc, the welding power source may not be compatible. See the section "Choosing the Right Welding Power Source", in the INSTALLATION section.

In order to remove material such as cracked or porous welds, the StarCut PAC may be used in place of carbon arc gouging. In order to perform gouging, replace the cutting tip with a gouging tip of appropriate orifice (the .093 inches is recommended for 65-80 Amps). Use the GAS SET mode to set the air pressure down to 50 PSI for a 25 foot torch. When gouging, do not use a standoff gas cup. Position the torch at a shallow angle to the workpiece when transferred arc is achieved. Work the torch forward, pushing the slag as the old weld is removed. A slight side to side motion may be useful to remove a wider area of material. Several passes will probably be necessary to remove the entire weld. PAC gouging usually requires little or no grinding to prepare the workpiece for the new weld.

Table 7 - Front Panel Controls and Indicators

Item	Control	Function
1	Circuit Breaker	Controls power to the StarCut and reacts to over load conditions.
2	Power On Indicator	Lights when StarCut power is ON
3	OPERATION MODE	
	TORCH: CUT	Responds to torch trigger for air flow to the torch only, and OCV two seconds after air flows.
	TORCH: GAS SET	Air flows through torch only to allow air regulator pressure adjustment. No power is applied to the torch.
	AIR ASSIST: GAS SET	Air flows through torch and air amplifier if the TURBO option is installed. Without the TURBO option, operation is identical to TORCH: GAS SET.
	AIR ASSIST: CUT	Responds to torch trigger for air flow to the torch and the air amplifier if the TURBO option is installed. Without the TURBO option, operation is identical to TORCH: CUT.
4	Cutting Current Control	Used to set the plasma cutting (transferred) current. 80 Amp scale for high current range. 50 Amp scale for low current range.
5	Indicator LEDs:	
	A) TRIGGER (green)	Lights when the torch trigger switch is pressed (with parts-in-place).
	B) TRANSFER (green)	Lights when transfer from pilot to plasma (transferred) arc occurs and stays on as long as the transferred plasma arc is present.
	C) GAS / TORCH (red)	Lights when gas pressure is not sufficient and stops plasma arc and pilot.
	D)TEMPERATURE (red)	Lights when the internal maximum operating temperature is reached. No cutting or pilot arc will take place when this is lit.
	E) POLARITY (red)	Lights when the welding power source polarity to the StarCut is incorrect. The negative output of the power source should be connected to the StarCut.

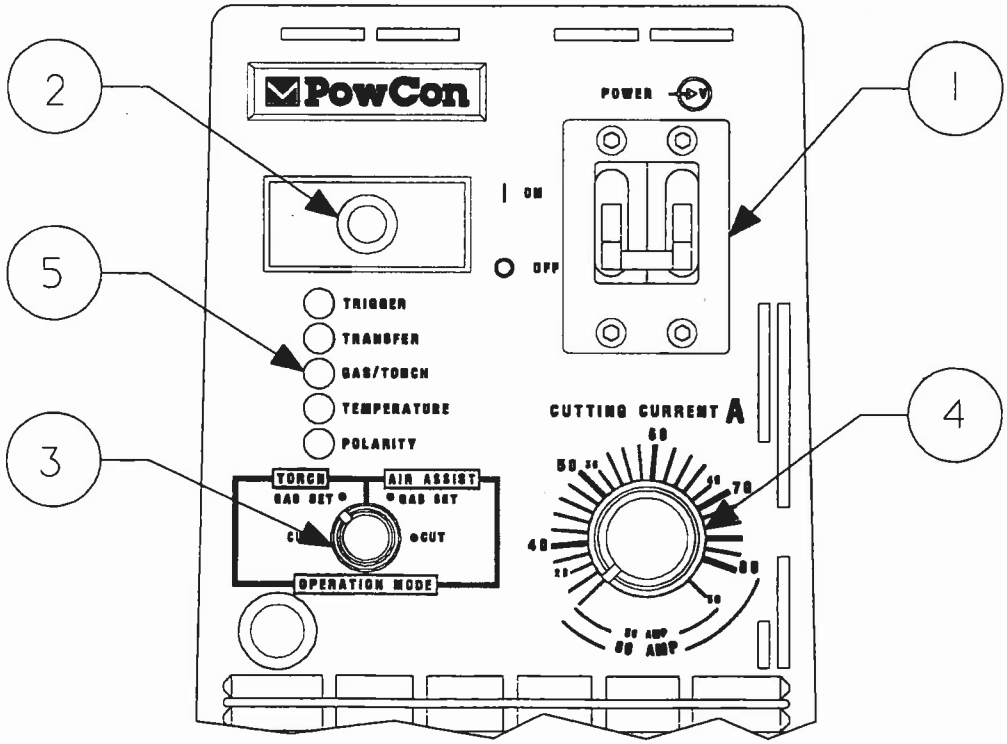


Figure 7 - Front Panel Controls and Indicators

Table 8 - Rear Panel Controls and Indicators

Item	Control	Function
1	Torch Boot	The torch connections are made through this boot.
2	Work Cable	This lead is to be connected to the work piece.
3	Negative Input Jack	Negative (-) power from the power source.
4	Pilot Ckt Fuse	Protects for faults in pilot ckt - 10 Amp Fast-blo (10AGC)
5	Filter/Regulator	Provides 5 micron particle filtering. Allows pressure adjustment and displays pressure on gauge.
6	Extractor/Dryer	Provides two stages of air filtration; first stage is a 5 micron particle filter, second stage is an aerosol absorber.

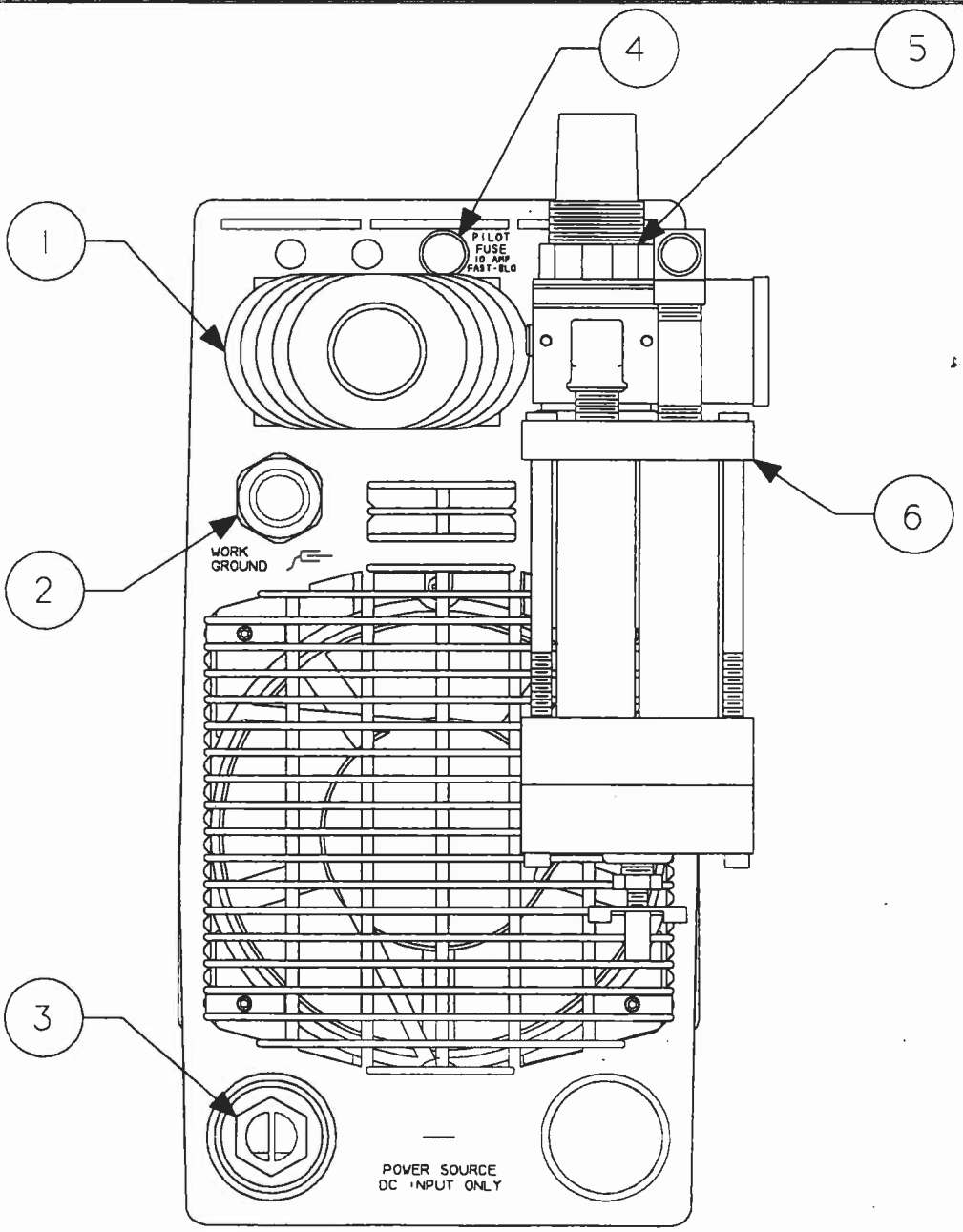


Figure 8 - Rear Panel Controls and Indicators

CUTTING CURRENT - MATERIAL THICKNESS AND TRAVEL SPEED

Selecting a travel speed for a given cutting current will affect the cut quality for any material thickness and type. Figure 9, "Thickness vs. Cutting Speed" should be used as a guide showing a range of settings, try some sample cuts to optimize cutting performance. For a given current, too fast of a cutting speed will cause the arc to trail behind the cut and eventually will not penetrate the workpiece. Too slow of a cutting speed will cause excessive slag and will increase torch voltage (causing shorter cutting times) or the arc may go out.

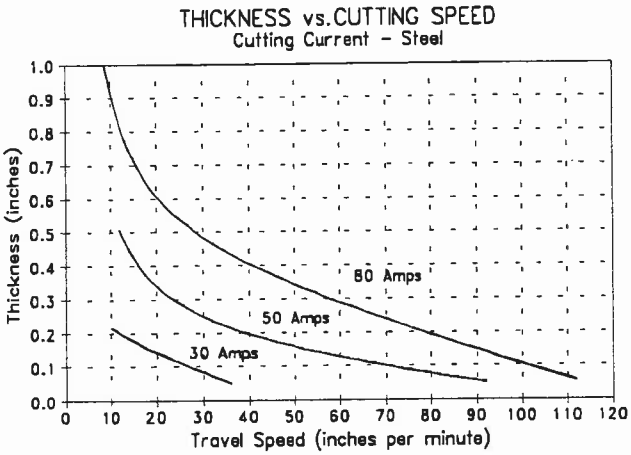


Figure 9 - Thickness vs. Cutting Speed

CUTTING TIME AND COOL DOWN TIME

Since the efficiency of the StarCut is 75 - 85 %, some heat is generated inside the unit. If the maximum allowable temperature of the unit is reached, the cutting current shuts off the and the front panel TEMPERATURE light glows red. The fan will continue to cool the unit and the light will soon go out. It is recommended that cutting is not resumed immediately, but that the unit is allowed to cool for a period of time. These charts are calculated for 10 minute cycles; that means if 8 minutes cutting time is called for, a 2 minute cool down period should be allowed. This section should provide some background and guidelines to use when duty cycle is critical.

The amount of heat generated depends on how much current is coming from the welding power source, how much boost is required (welding source voltage) and on how much cutting current is being produced. As shown in Figure 10, "Cutting Time—Operating Voltage", the higher power supply voltages will allow longer cutting times. Likewise a lower cutting current will also allow longer cutting times.

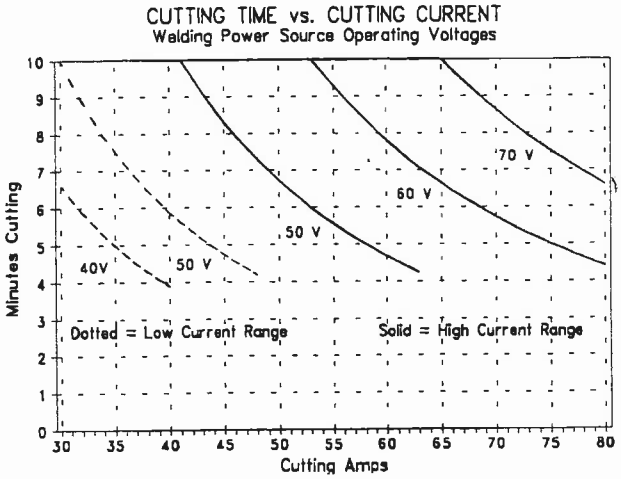


Figure 10 - Cutting Time—Operating Voltage

StarCut duty cycle capability depends a great deal on these variables, and also on torch operating voltage, which is determined by arc length (also called standoff distance). Optimal cutting standoff of 1/16 - 1/8 inch gives a voltage of about 105 volts. Longer standoff distances will generate 125 volts or more. Gouging also creates larger torch voltages. These larger torch voltages can affect duty cycles as shown in Figure 11, "Cutting Time—Torch Voltage".

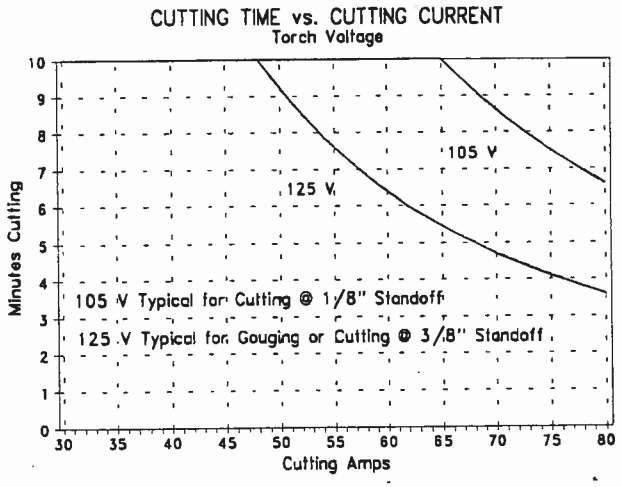


Figure 11 - Cutting Time—Torch Voltage

Use Figure 10 as a guide for how much cut time and cool down time to allow as a function of cutting current. The cut time and cool down times are also shown for several input voltages from the welding power source. Have someone take a reading from the welding power source meters while you are cutting. If the welding power source does not have meters, you should take a reading with a hand held voltmeter at the StarCut input connector. Remember that when the welding power supply is 50 to 300 feet from the StarCut, the voltage drop in the weld cable can significantly reduce the voltage supplied to the StarCut as seen in Table 5.

CAUTION

Never measure the StarCut torch output with a voltmeter during pilot operation, the high voltage arc starter will damage the meter.

Several cycles may be required to establish required cut and cool down times; use Figures 10 and 11 as guides. The 10 minute period is not necessary to protect the StarCut, longer or shorter cut and cool down periods may be used as convenient. Cutting can begin as soon as the red TEMPERATURE light goes out, however, the StarCut will still be hot, and the unit will shut down again after only a brief cutting period.

StarCut cutting current affects duty cycle as described above. It may be useful to decrease cutting current and travel speed to achieve a 100 % duty cycle condition. For example, when cutting 1/2 inch material with 50 Amps, the travel speed would be about 12 IPM. When cutting the same material with 80 Amps, the cutting speed is 28 IPM allowing more production for a given time. Both settings will give about 120 inches of cut in 10 minutes. In a machine torch application, however, you may wish to use 50 Amps, which allows StarCut to cut for longer than 10 minutes without the unit reaching temperature limit in the middle of a job.

USING STARCUT WITH A PowCon INVERTER POWER SOURCE

PowCon models 400SS, 400SM and 400SMT are popular choices for use with StarCut because of their ability to achieve full 80 Amps of cutting power when supplied by three phase AC power. Also, their superior arc characteristics make them productive in their role as inverting style multi-process welding power sources.

Live arc testing with the 400SMT power source was done on 1" mild steel plate, with a travel speed of 8 inches per minute and a standoff height of approximately 1/8". The 400SMT was delivering 175 Amps at 60 volts.

The StarCut unit, in the sun at 90 degrees Fahrenheit, cut continuously for over 64" (8 minutes) before reaching temperature limit and was allowed a 5 minute cool down period before cutting an additional 37" (4 minutes 44 seconds). This represents a duty cycle of slightly under 50 % and was sustained for several cycles.

MAINTENANCE

AIR FILTER/REGULATOR

Clean, dry compressed air is critical to reliable, high quality PAC cutting. The integral regulator/filter on the rear panel should have the filter element replaced on a regular schedule, depending on the usage of the StarCut. If the unit is used daily, replacement of the filter element should be done twice a year, more often if not used with the recommended extractor/dryer. Refer to the section of "Parts List" for PowCon part numbers for replacement parts.

To access the filter element, simply rotate the bowl counter clockwise to remove it. Then unscrew the filter retaining ring and remove the filter with the swirl diverter, and replace the filter element. If the bowl is difficult to remove, the extractor/dryer elements and lower chamber can be removed by completely loosening and removing the two long bolts from the top of the extractor/dryer.

EXTRACTOR/DRYER

Use of the recommended extractor/dryer should adequately clean most sources of compressed air for use with the StarCut. There are two elements within the extractor/dryer which require regular replacement. The second stage element should be replaced approximately 2 - 4 times per year, the first stage should be replaced every three times the second stage is replaced.

The first and second stage elements can be easily removed by loosening the two long bolts at the top of the assembly. Then simply slide the element to be replaced forward and replace with a new element and gasket pieces. Tighten the two bolts.

INTERNAL CLEANING

The use of a **PowCon** StarCut unit in an environment containing airborne dust and dirt requires occasional blowing out or vacuuming of the unit. The frequency of the cleaning operation should be done dependent upon the severity of the environment. Use only clean, dry air or a vacuum suction to clean the unit. Do not open the case; just direct cleaning air through the vents while the unit is turned **OFF** and disconnected from the welding power source.

The PT-90 torch may be used to apply a stream of air into the front panel for cleaning. Remove the tip and electrode and turn the front panel switch to GAS SET, aim the torch into the grill. Be sure to replace the electrode when finished.

CAUTION

Avoid damage to fan bearings from excessive rpms while cleaning unit with compressed air

TORCH

Inspect the torch handle for breakage or cracks periodically. Also inspect torch cables for any cuts of insulation covering or leakage in the gas hose. A good "rule of thumb" for frequency of inspection would be to perform such an inspection after completing a field job or at least once a month. Also before beginning any cutting operations, remove the torch tip and inspect the tip and electrode for excessive wear. Replace if necessary.

TROUBLESHOOTING

PowCon wants you to be satisfied with the product you have purchased, however, from time to time equipment such as the StarCut may malfunction or need repair. Refer to Table 9, "Troubleshooting", to help identify problems and recommend actions which are reasonable for a welding operator or on site electrician to perform. Refer to Figure 13, "Schematic" while using Table 9, "Troubleshooting". Please contact your distributor or **PowCon** factory service for warranty repair or if you cannot solve a problem using this troubleshooting chart.

Before You Use This Chart

Please be sure that you have properly installed the StarCut Plasma cutter according to the installation instructions in this manual. It may be helpful to perform troubleshooting with the top cover removed to observe indicator lights on the control circuit board. Follow the instructions in "Opening the StarCut Case—CAPACITOR DISCHARGE" in the INSTALLATION section.

DANGER

High voltage is present inside the StarCut cover. Do not touch any internal parts while the circuit breaker is on. After performing any test and observing indicator lights on the control circuit board, turn the circuit breaker off. Replace the top cover when indicator lights do not need to be observed for any test.

The control circuit board has six indicator lights, (DS1-DS6) which can be used for troubleshooting. Refer to Figure 12, "Control Board", and Table 10, "Control Board Indicator Lights", while using the Troubleshooting Table.

Table 9 - Troubleshooting

Problem	Cause	Solution
No torch trigger	Tip not installed in torch, or not tight	Check torch parts in place, make sure electrode and tip are installed tightly. Both parts have left handed threads.
	Loose torch connections to **StarCut**	With cover off and power off, check torch trigger connections for proper installation.
	Bad torch trigger switch	Disassemble torch halves and check for pinched or loose trigger switch wires in the torch. Check the torch switch for proper action and replace if necessary. Check parts in place pogo pin leads.
No pilot or arc starting	Bad Pilot Fuse F1	Replace fuse on rear panel with 10A fast-blo
	Bad pilot resistor R5	Check R5 on bottom of unit - contact service assistance.
	Bad torch	See torch manual P/N 201187-001.
	Loose torch connections to **StarCut**	With power off check torch connections, particularly the pilot lead connection.
	Gas pressure too high or too low	Switch to "gas set" and adjust pressure for 60 - 70 psi.
	Unit too hot	Check if temperature light on front panel is lit. Allow for cool down.
	Bad transfer relay K1 contacts burned open	Check if relay K1 transfer (see Table 17) operates when triggered after postflow has timed out (approximately 10 seconds after last torch trigger). Check if relay contacts are burned open - replace if necessary.
	Bad arc starter board	Contact service assistance.
	No OCV when arc is supposed to start	Check if DS5 on the control PWB is lit, if so, OCV is approximately 200V , if not, contact service assistance.
No light, no fan, unit seems dead	Welding power source contactor OFF	Turn ON power source and contactor.
	Wrong input polarity	Check polarity lamp on front panel; use correct input polarity; welding power source with positive ground and negative to StarCut cutter.
	Welding power source or cutter not properly grounded	Make sure welding power source ground clamp and StarCut cutter ground clamp are connected to ground at the same point.
	Bad control Printed Wiring Board fuse F1	Replace fuse F1. Table 14
	Bad control Printed Wiring Board	Contact service assistance.
Circuit breaker trips immediately when turned ON	Major internal short	Contact service assistance.
Circuit breaker trips when cutting	Input current demand too high with welding power source used and selected cutting current.	Turn down cutting current 10 Amps and reduce travel speed, OR Change welding power source to higher capacity unit if possible.
Circuit breaker trips when cutting even after turning down cutting current	SCR's mis-triggering	Contact service assistance.
No gas flow	Air supply disconnected or obstructed	Check lines and pressure.
	Regulator set too low	Set for 60 - 70 psi
	Solenoid not operating	Set switch for GAS SET. Observe DS6 on the control PWB is lit. Check gas solenoid connections.
	Torch hoses blocked	Check gas by disconnecting main torch cable. If gas flows then check for restriction in torch or cables and replace.

Table 10 - Troubleshooting

Problem	Cause	Solution
Gas flows in "GAS SET" mode, does not flow when triggered	Bad torch trigger connections	Check "Trigger" lamp on front panel and DS4 on control PWB. If they do not respond to torch trigger see "No Torch Trigger".
Unit pilots but does not transfer	Welding power source not compatible	If polarity light is lit on front panel it indicates improper use of AC input. Use DC power source. If a 1 phase power source is used, it may not be compatible. Try different welding power source.
	Welding power source set on too low a setting	Increase welding power supply setting to max in highest range.
	Too large a torch to work standoff	Shorten standoff to 1/16" to 1/8". Use standoff cup to maintain proper distance if necessary.
	Engine drive auto idle mechanism doesn't come to full RPM fast enough.	Turn engine drive auto idle to OFF and run at full RPM.
Transferred arc stops	Torch travel speed too slow	Increase as required.
	Current too high	Decrease cut current.
	Torch to work standoff too great	Shorten standoff to 1/16" to 1/8". Use standoff cup to maintain proper distance if necessary.
	Ground connection broken	Inspect and replace as required.
	Loss of gas/air pressure	Inspect air supply and correct as necessary.
	Unit too hot	Check if temperature light on front panel is lit. Allow for cool down. See Table 17.
Cutting capacity low, Bad ground quality insufficient	Check power source capability in StarCut application	See chart on Page 7
	Clean surface.	
	Cutting tip orifice worn out	Replace tip.
	Gas flow too high or low	Check flow.
	Cutting tip orifice too big	Replace with correct size.
Cutting capacity low. Torch body & tip very hot	Electrode burned back too far	Measure & replace if necessary.
	Electrode burned back too far	Measure & replace if necessary.
	Cutting tip orifice too small	Measure & replace if necessary.
	Short circuit inside torch	Change body.
	Water in line	Purge.
	Tip or electrode loose	Tighten.
Dross formed on bottom of work	Speed too slow	Increase as required.
	Worn or damaged torch parts	Inspect and replace as required.
	Current too high	Decrease cut current.
Lack of total penetration	Current too low	Increase cut current.
	Cut speed too high	Decrease as required.
	Worn torch parts	Inspect/replace as required.
Short consumables life	Contact of tip to workpiece (even momentary contact) at amperages over 40 amps	Maintain 1/16" - 1/8" standoff or use standoff cup.
	Dirty air	Add air line filter or replace filter cartridge.
	Cutting speed too fast/slow	Adjust travel speed.
	Parts incorrectly fitted, not tight	Check & replace.
	Cooling gas insufficient	Check pressure for 60 - 70 psi
	Mishandling of torch	Replace damaged or worn parts.
	Too many starts	Replace consumables.

Table 11 - Control Board Indicator Lights

Light	Color	Function	State
DS1	Red	Oscillator Inhibit	On dimly during proper plasma cutting
DS2	Green	+12 volt power source	On bright when +12 is OK
DS3	Green	-12 volt power source	On bright when -12 is OK
DS4	Red	Trigger	On when the torch is triggered
DS5	Red	Open circuit voltage	On when open circuit voltage (approximately 200V) is present at torch
DS6	Red	Gas solenoid	On when gas solenoid is energized
		F1 Input control circuit fuse	2 Amps
		S1 Max control current setting	50 Amp / 80 Amps

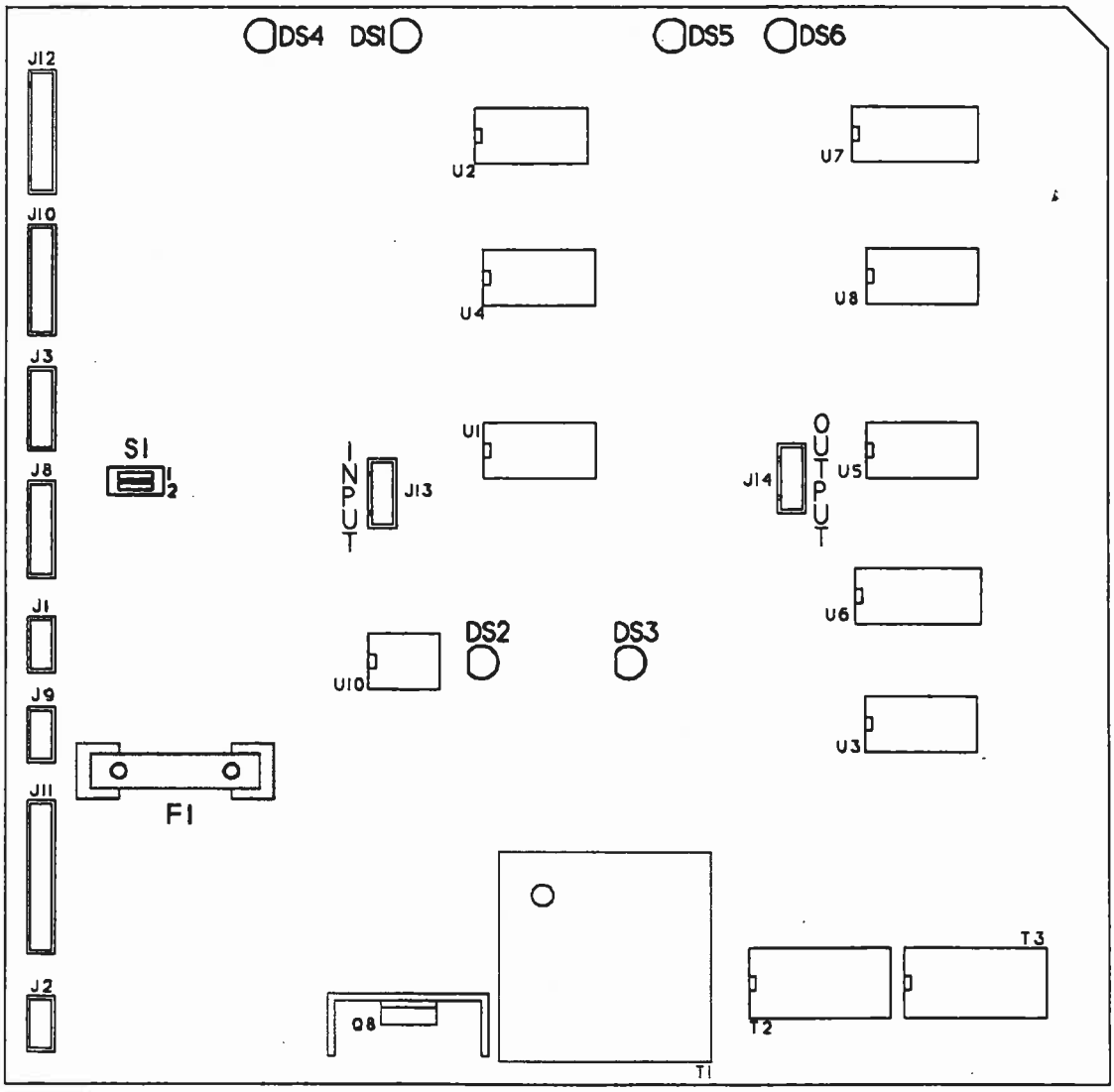


Figure 12 - StarCut Cutter Control Board Assembly, 107451

SERVICE

Unauthorized service to this unit by anyone other than a **PowCon** trained and authorized technician will void the warranty. Any modifications or repairs not recommended in this manual are considered unauthorized.

If the StarCut unit cannot be repaired, or does not operate correctly after using the TROUBLESHOOTING Section, please contact your distributor or call **PowCon** factory service for repair.

USING THE DRAWINGS AND PARTS LISTS

In order to help identify and order replacement parts for your StarCut unit, the following pages include part numbers with figures. Some parts shown may not be appropriate for an on-site operator or electrician to replace. If the necessary part is not described in the TROUBLESHOOTING guide, please contact your distributor or **PowCon** factory service before proceeding.

The parts lists use item numbers from the corresponding figure to help identify which part number to order. Often a high level sub-assembly is referenced by a number, however, a part within this sub-assembly may be all that is required. If a sub-assembly can be broken down further, it may have its own parts list with figure, or several parts may be listed with "decimal point item numbers". For example, in Table 12 - Top View, item 1 is the Solenoid and Pressure Switch Assembly. The Pressure Switch is listed as item 1.1 and is a part of the assembly. This may be ordered separately, but will require more effort to replace within your sub-assembly.

Also, where hardware is used with an assembly and may need to be replaced, they are listed directiy under the assembly, and are referred to as "U/W" meaning "used with".

Table 12 - Top View

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	107634-001	Assembly, Solenoid and Pressure Switch	
1.1	1	250061-001	Kit, Pressure Sensing Switch 35 PSI	
1.2	1	250060-001	Kit, Solenoid Valve 24 VDC	
2	1	107648-001	Solenoid and Relay Harness	
3	1	107527-001	Assembly, Work Clamp and Cable (12 ft. Standard)	Work
3.1	1	107663-012	Work Cable, 12 ft.	
3.2	1	107662-001	Work Clamp with Vinyl Grips	
4	1	107528-001	Buss Wire, Cap PWB to Shoulder Screw	
5	2	100117-001	Screw, Special Shoulder #1/4-20	
6	1	107533-001	Buss Wire, Cap PWB to Hex Stud	
7	1	974002-008	Washer, Flat .812" x .406" x.083" Brass	
	1	974016-008	Washer, Split Lock .683" x .393" x .094" Brass	
	1	972010-023	Nut, 3/8 - 24 Steel Hex	

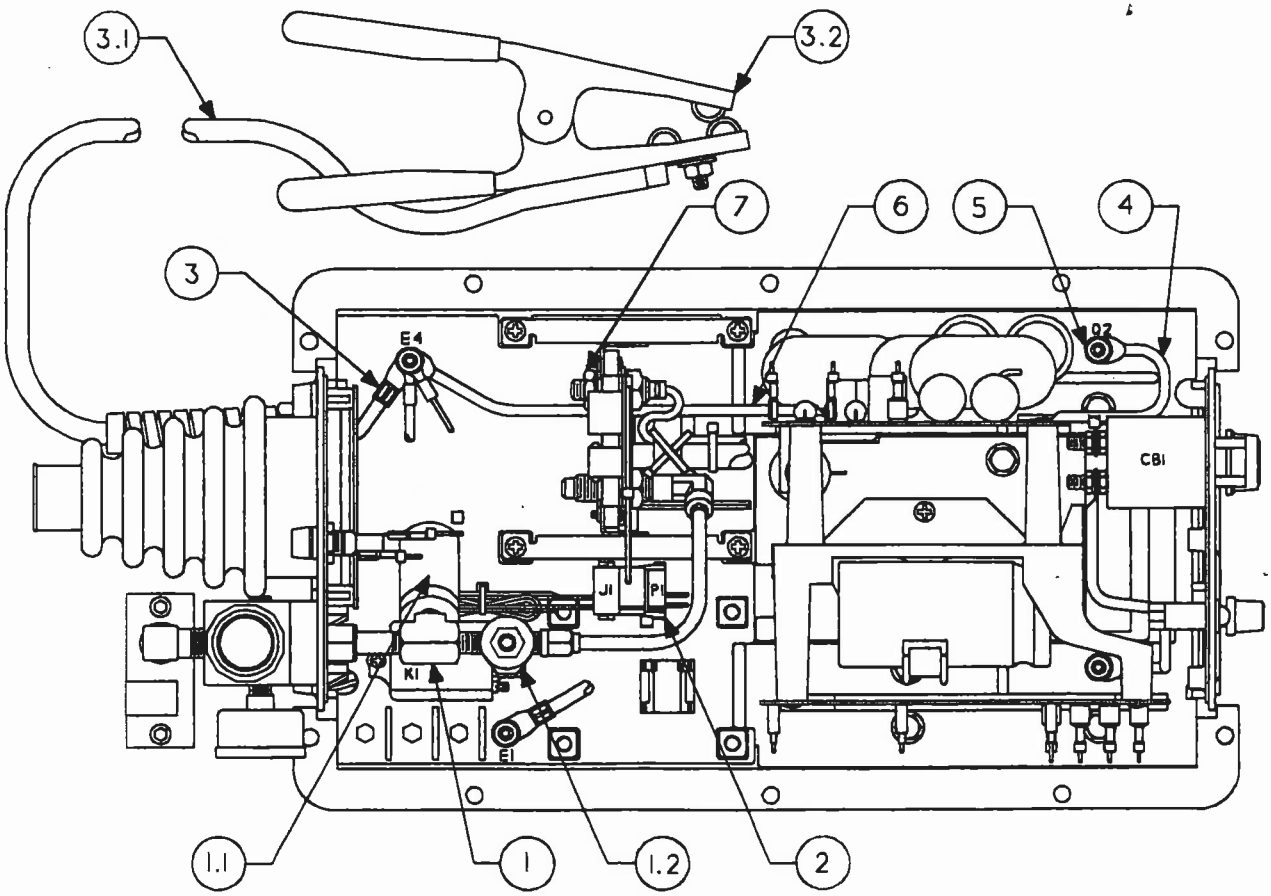
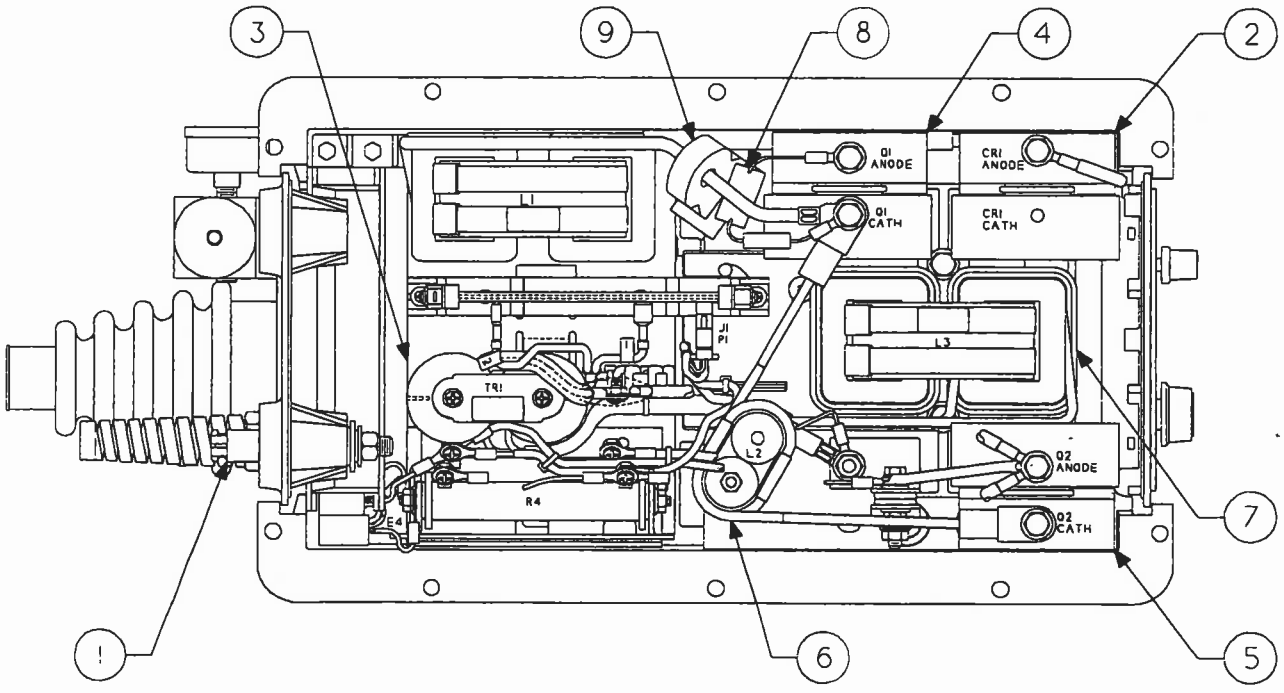


Table 13 - Bottom View

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	100327-001	Connector, Input Jack TWECO	INPUT (-)
		100380-001	Connector, Input Jack DINSE	
U/W	1	974001-008	Washer, Flat 1.00" x .438" x .083" Brass	
	1	974002-008	Washer, Flat .812" x .406" x 065" Brass	
	1	974016-008	Washer, Split Lock .683" x .393" x .094" Brass	
	1	972005-008	Nut, 3/8 - 16 Hex Brass	
2	1	107630-001T	Heatsink Assembly, Short Diode	
3	1	107639-001	Assembly, Arc Starter	
Refer to Table 22, "Arc Starter Tray", page 38				
4	1	107477-002	Heatsink Assembly Switch SCR	Q1
5	1	107477-001	Heatsink Assembly Rectifier SCR	Q2
6	1	107649-001	Commutating Inductor, Tall w/PTC	L2. RT1
7	1	107510-002	Assembly, Output Inductor	L3, VR2, CR2
Refer to Table15, "Right Side", page 30				
8	1	105115-001	Snubber, Switch SCR	C11, R1
9	1	107554-001	Current Sensing PWB	CS1



DRAWINGS AND PARTS LIST

250125-001

Table 14 - Left Side

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	107451-002T	Control Board	
1.1	1	921014-002	Fuse, Non-time Delay 2 Amp	F1
2	2	970002-404	Screw, #8-32 x .38" Phillips w/Nylock	
3	1	107648-001	Assembly, Solenoid/Relay Harness	
4	1	107088-001	Assembly, Front Panel Indicators PWB	DS1-5
Refer to Table 19, "Front Panel", page 35				
5	1	107650-001	Assemby, Arc Starter Harness	
Refer to Table 22, "Arc Starter Tray", page 38				
6	1	107006-002	Assembly, Trigger Filter PWB	
Refer to Table 20, "Rear Panel", page 36				
7	1	107526-001	Assembly, Sensing Harness	
8	1	107574-001	Assembly, Fan w/Mount	
Refer to Table 20, "Rear Panel", page 36				

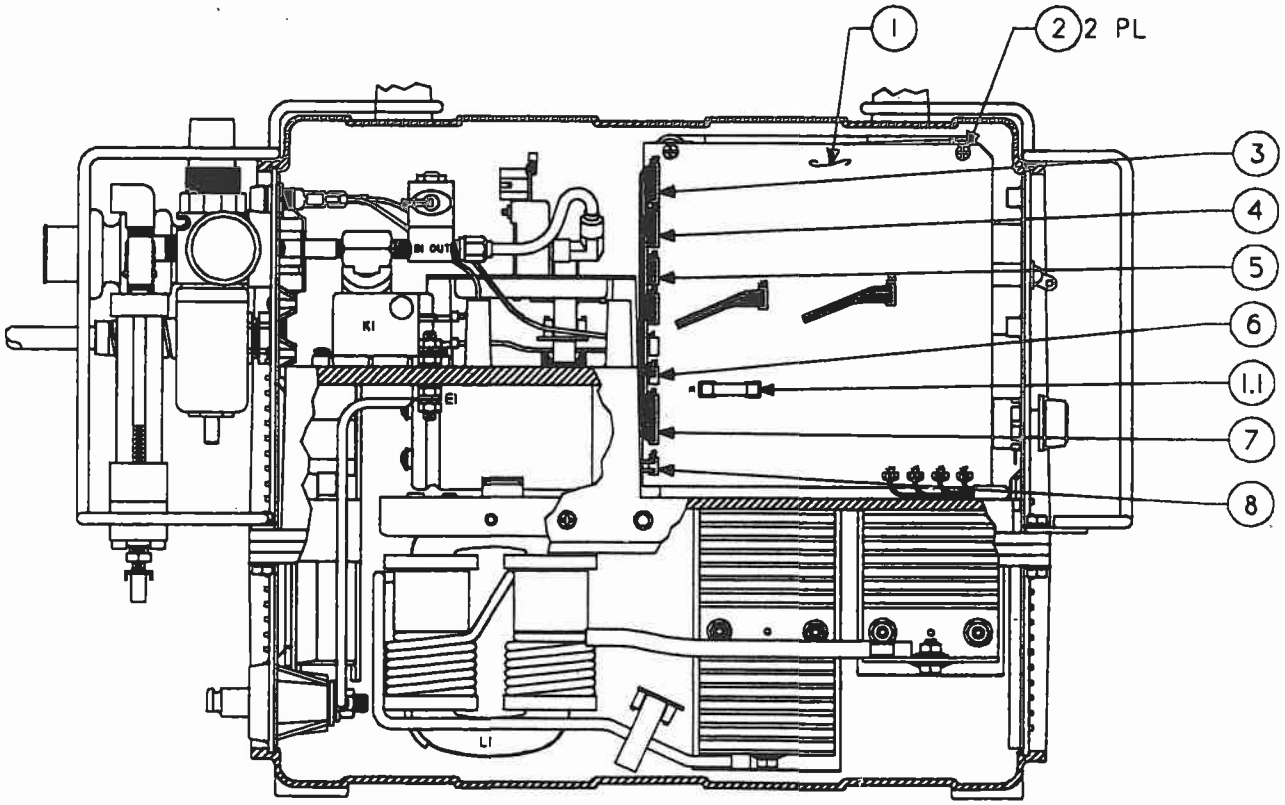


Table 15 - Right Side

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	107468-002T	Capacitor Board - High Duty Cycle	
Refer to Table 21, "Capacitor PWB Assembly", page 37				
2	1	107660-001	Assembly, Capacitor Filters	C1, C2, R1
3	4	970011-506	Screw, #10-32 x .50" Phillips Flat Head	
4	1	982009-001	Spacer, 5/16" Hex #10-32 x .75" Stainless Steel	
5	1	970004-560	Screw, #10-32 x 5" Phillips Stainless Steel Pan Head	
6	1	107510-002	Assembly, Output Inductor	L3, CR2, VR2
6.1	1	107506-001	Assembly, Diode	
6.2	2	100151-004	Buss Bar, Current Changeover	
6.3	1	107519-001	Assembly, 175 Volt Varistor	
7	1	107652-002	Panel Guard, Rear - Black	
8	1	100374-002	Panel Guard Front - Black	
9	1	107143-001	Tag, Warranty Void	

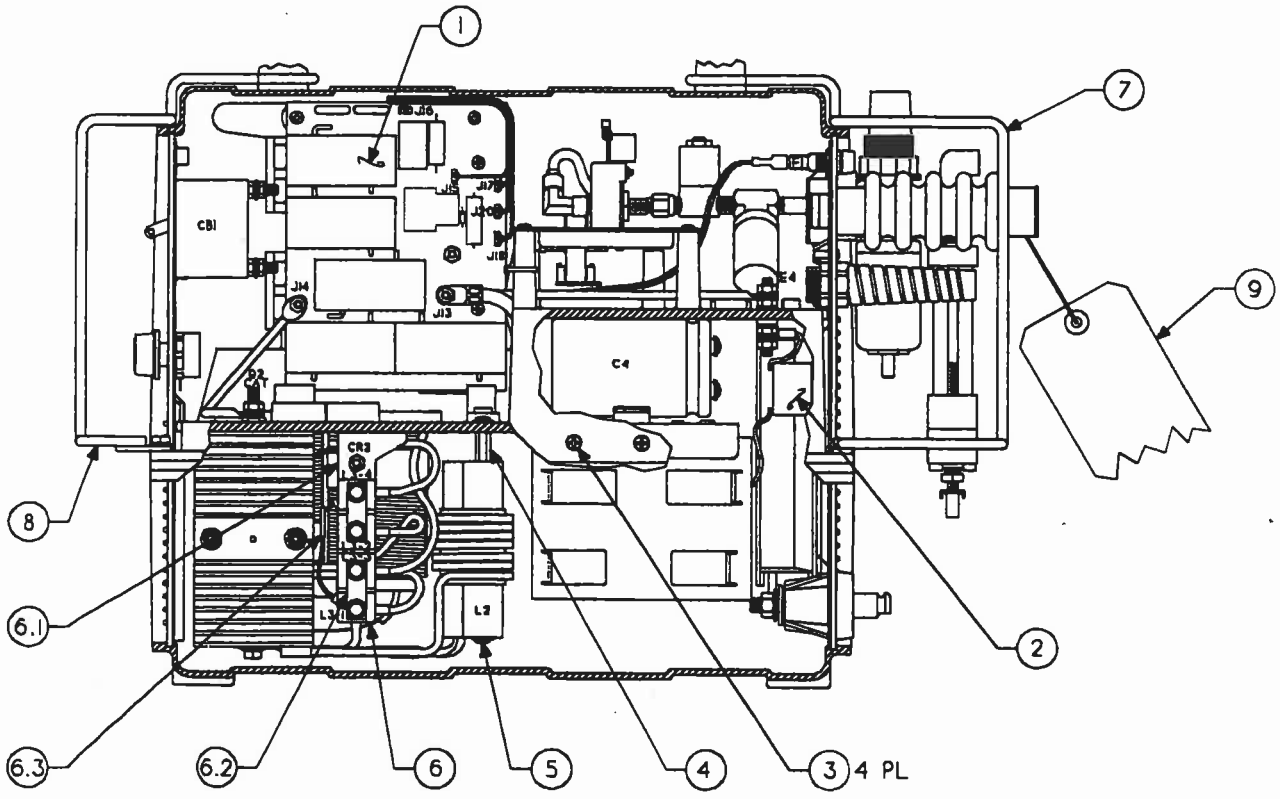


Table 16 - Front View

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	900001-006	Capacitor, Al. Electrolytic 31 kuF, 60 VDC	C1
2	1	900001-005	Capacitor, Al. Electrolytic 3.4 kkuF, 200 VDC	C2
3	2	100230-411	Lead and Terminal 6 AWG Red	
4	1	104067-001	Buss Wire, Capacitor	
5	1	107534-001	Buss Wire, Circuit Breaker to Hex Stud	
6	1	105038-002	Assembly, Capacitor Bracket	

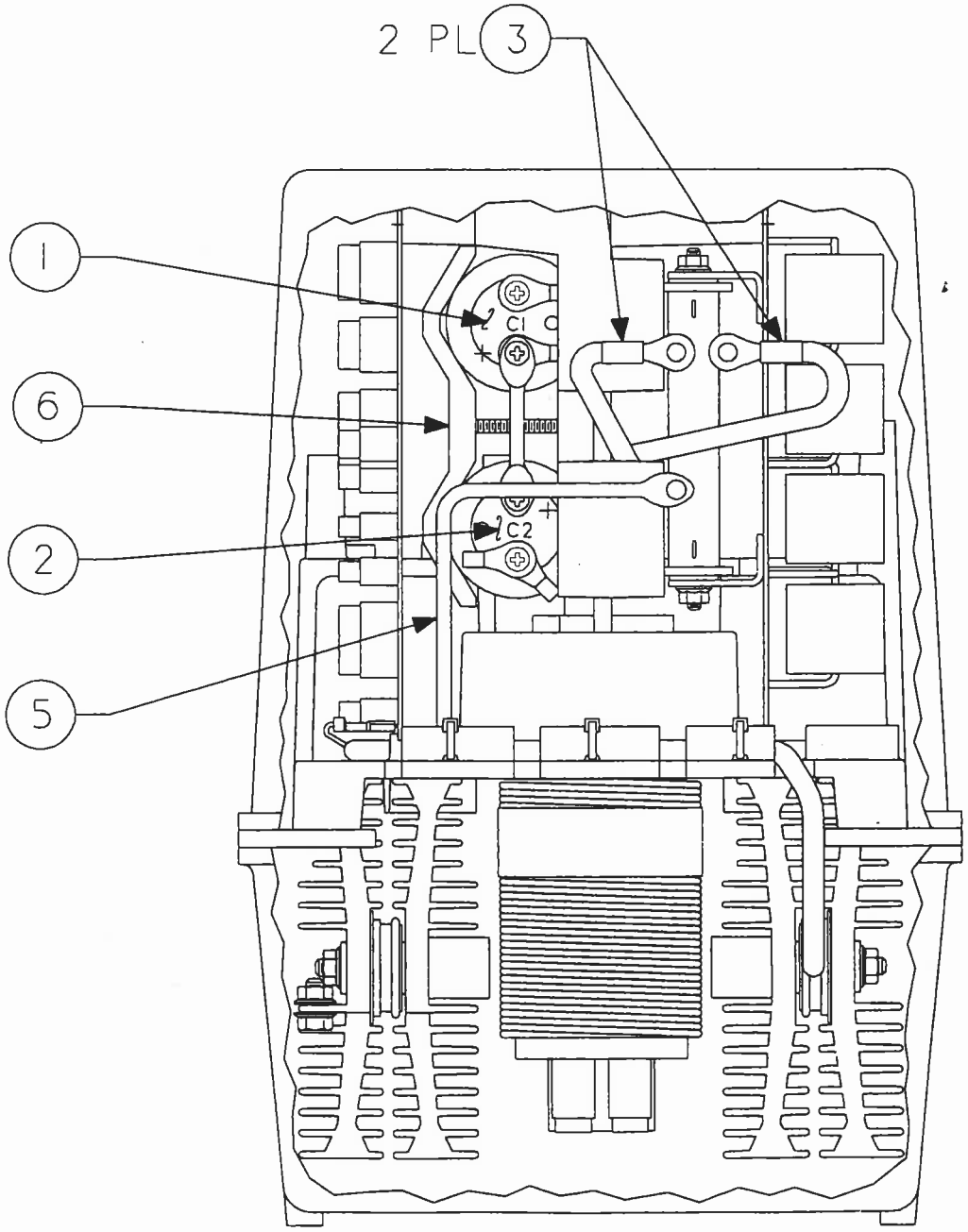


Table 17 - Rear View

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	107475-001	Assembly Connector Bracket	
1.1	1	107554-001	Current Sensing PWB	
1.2	1	107476-001	Bracket, Right	
1.3	1	107476-002	Bracket, Left	
1.4	1	107006-002	Trigger Filter PWB	
2	1	107548-001	Assembly, Output Capacitors	
2.1	2	900001-004	Capacitor, Al. Electrolytic, 1.5 kuF 100VDC	C3, C4
2.2	2	107523-001	Bleeder Resistor	R2, R3
U/W	4	932005-002	Terminal, .250" Faston, .265" Dia. hole	
	4	970001-006	Screw, #1/4-28 x .50" Phillips	
	4	974006-006	Washer Flat .468" x .255 x .064"	
	4	974016-006	Washer Split Lock 1/4, .489" x .263" x .062"	
2.3	1	107530-001	Buss Wire, Output Capacitors	
3	1	107531-001	Buss Wire, Output Jack to Hex Stud	
4	2	104043-001	Hex Stud	
U/W	8	972005-006	Nut, #1/4-20 Hex Brass	
	4	974012-006	Washer Flat #1/4, .500" x 281" x .063 Brass	
	4	974016-006	Washer, Split Lock #11/4 .489" x .263" x .062" Brass	
5	1	107567-001	Assembly, Pilot Relay	K1
5.1	2	929009-001	Magnet, .50" Dia. x .2"	
U/W	2	963008-003	Tape Circle, double-sided .50" Diameter	
	2	963008-003	Cap, Vinyl .468" x .250" Black	

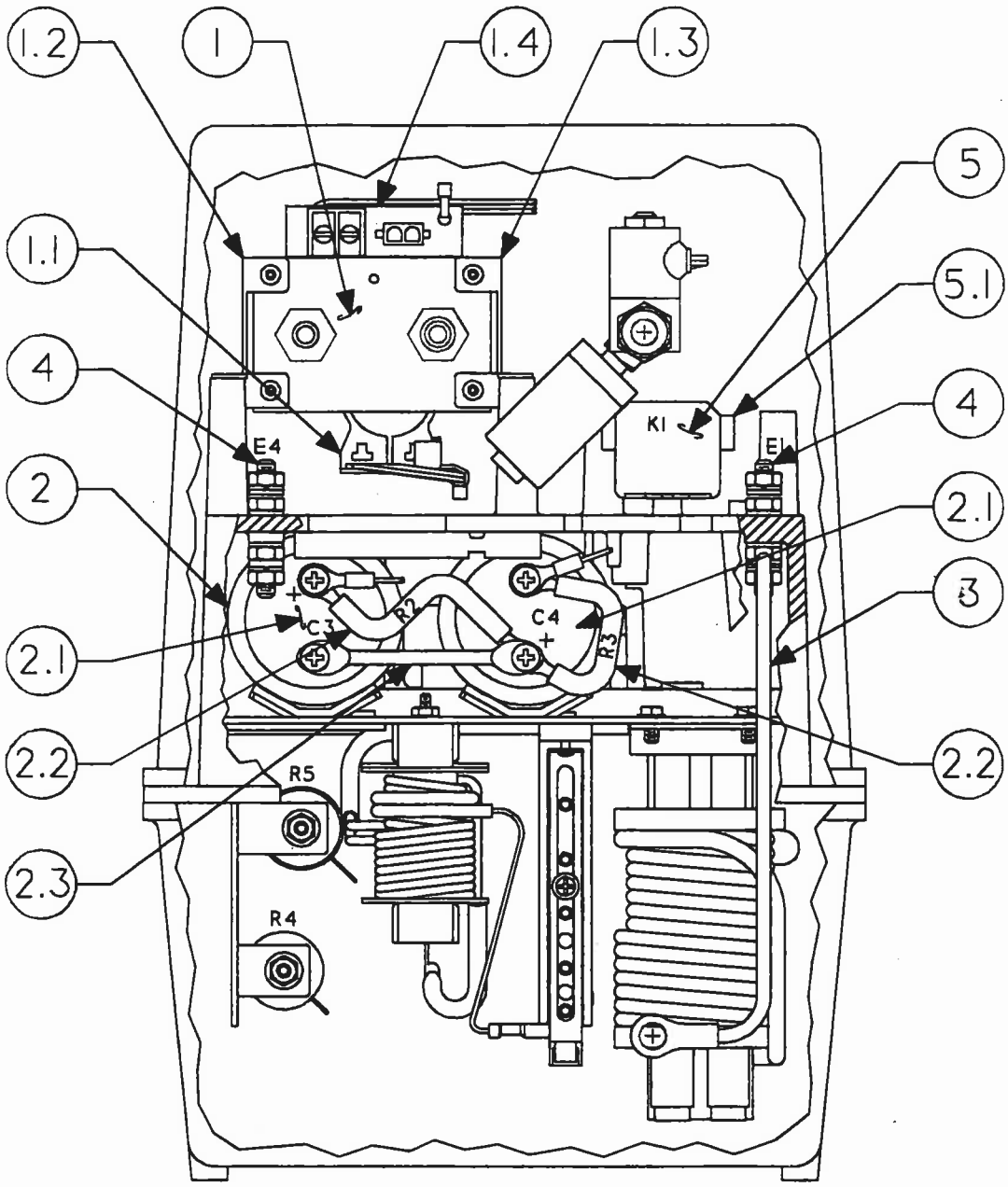


Figure 18 - Rear View

DRAWINGS AND PARTS LIST

Table 18 - Outside View

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	250018-004	Kit, Replace Case Top StarCut	
2	1	250017-002	Kit, Replacement Handle-Black	
3	1	107560-001	Label, with Info-81C	
4	1	100006-001	Case Bottom, Red	

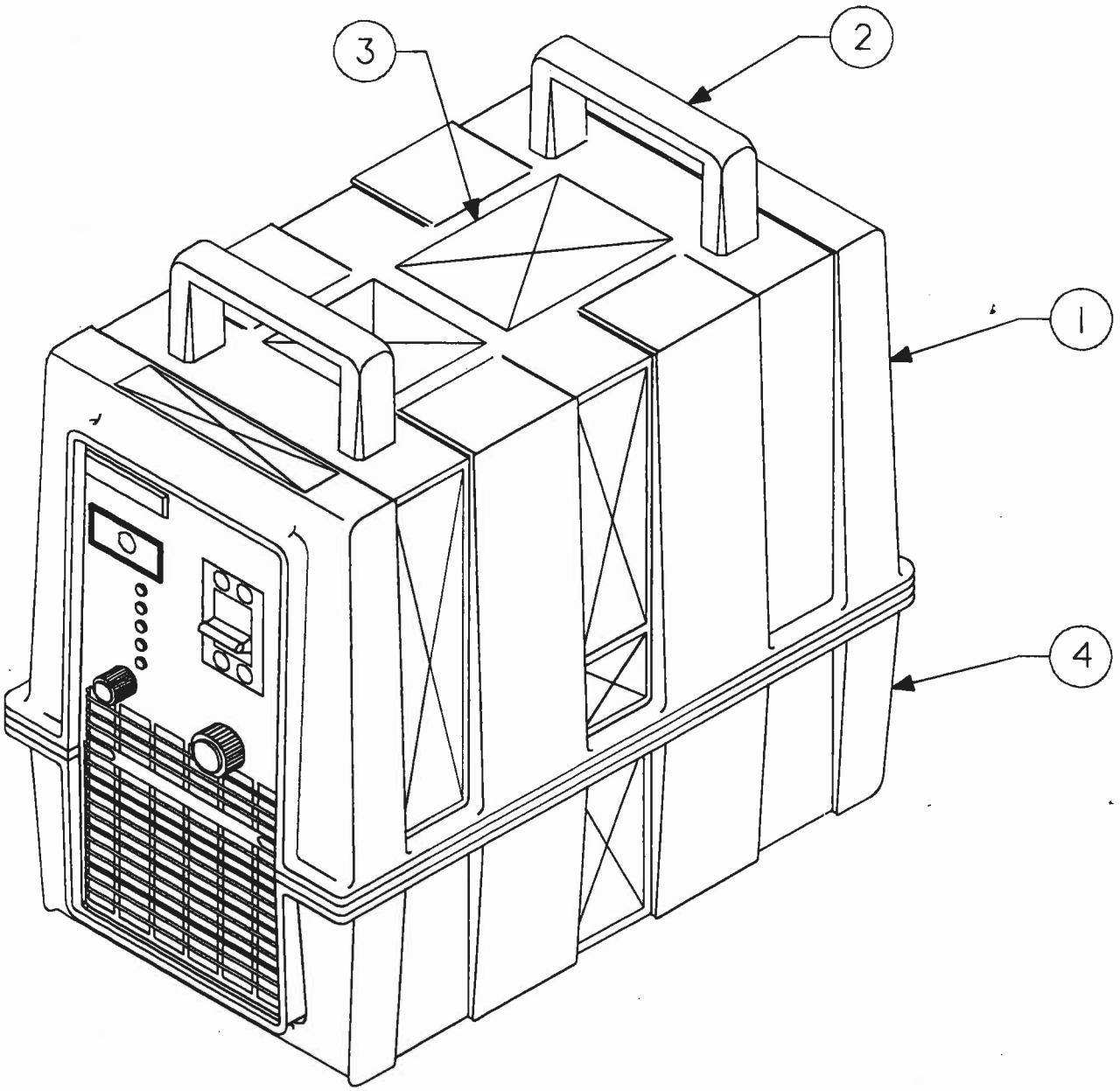


Table 19 - Front Panel Assembly

Part Number 107655-001				
Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	107656-001	Silkscreened Front Panel (TURBO Compatible)	
		*107459-001	Silkscreened Front Panel	
2	1	107500-001	Bezel, Circuit Breaker	
3	4	970013-306	Screw, #6-32 x .50" Allen Flat Head Black w/Nylock	
4	1	921012-001	Circuit Breaker DC	CB1
5	1	107518-001	Assembly, Varistor 130 V, 20J	VR1
6	1	107525-001	Plate, Circuit Breaker Shorting	
7	2	100230-411	Lead and Terminal 6 AWG Red	
8	1	107534-001	Buss Wire, Circuit Breaker to Shoulder Screw	
9	1	941006-001	Front Panel Power ON Indicator Lamp	DS1
10	1	107088-001	Front Panel Indicator PWB	DS1-5
11	5	941004-004	Front Panel Indicator Lens, Clear	
12	1	940016-001	Knob, Round w/Indicator Dot	
13	1	940000-002	Knob, Small Control	
15	1	903000-002	Potentiometer, 5 kohm Single Turn 10%	R8
16	1	920019-008	Switch, 4-position 2-pole, 60°	S1
		*920019-001	Switch, 3-position 2-pole, 60°	

*If your StarCut front panel is equipped with a 3-position mode switch use these Part Numbers for replacement.

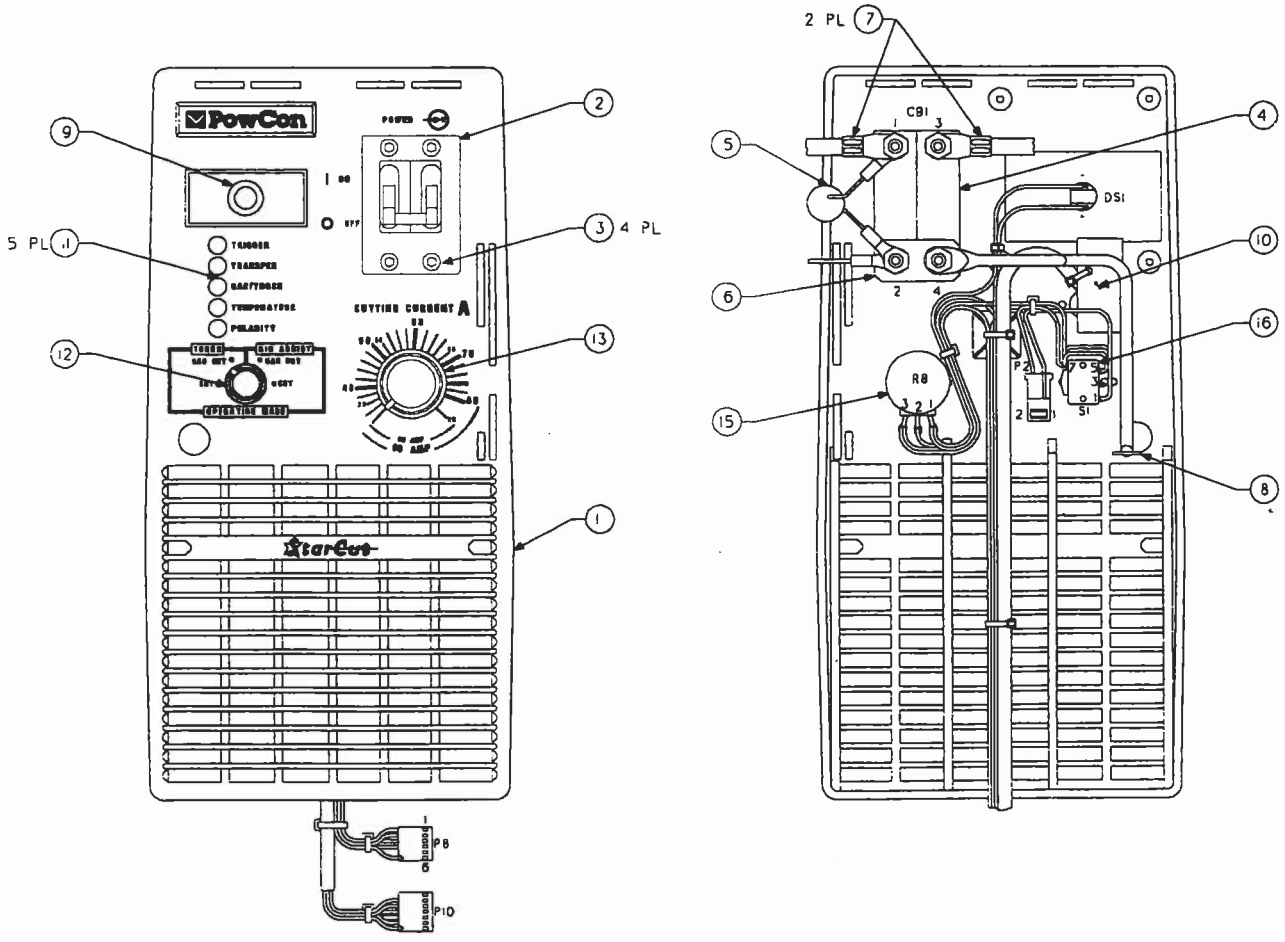


Table 20 - Rear Panel Assembly

Part Number 107635-001				
Item No.	**Qty.**	**Part Number**	**Description**	**Ref. Des.**
1	1	107636-001	Rear Panel, Silkscreened	
2	1	107574-001	Assembly, Fan w/Mount	
2.1	1	107571-001	Fan Mount, Molded Gray	
Consists of: (not available individually)				
2.1	1		Fan Mount, Molded Gray	
2.2	4		Fan Mount Clips	
2.3	1		Output Plug	
2.4	1		Vent Plug	
U/W	4	970041-206	Screw, #4/40 x .50" Socket Cap w/Nylock	
3	1	107600-001	Plate, Remote Cover	
U/W	4	970025-304	Screw, #4/40 x .50" Thread Forming Phillips Pan Head	
4	2	940002-001	Hole Plug .375" Diameter	
5	1	921005-002	fuse Holder with .187" Faston Connectors	
6	1	921014-001	Fuse, Non-time Delay 10 AMP (automotive type)	F1
7	1	107137-001	Boot	
8	1	107501-001	Frame, Boot	
9	1	107502-001	Mount, Boot, Gray	
U/W	4	970025-506	Screw, #10-10 x .50" Thread Forming Phillips Pan Head	
10	1	100334-001	Bushing, Strain Relief	
11	1	940015-001	Strain Relief - 16	

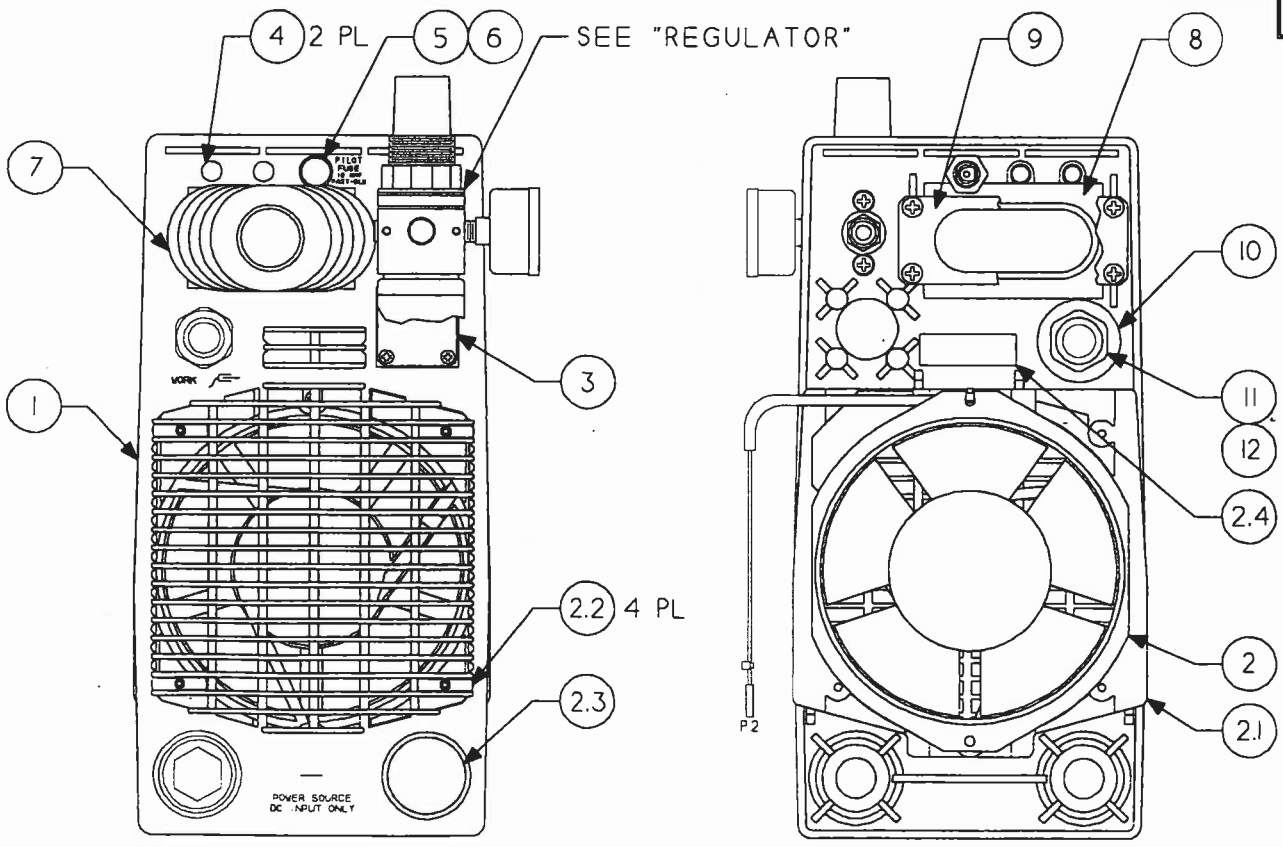


Table 21 - Capacitor PWB Assembly

Part Number 107468-002				
Item No.	Qty.	Part Number	Description	Ref. Des.
1	5	901001-005	Capacitor, Polypropylene, 12 uF	C5-9
2	1	901003-002	Capacitor, Metal Polyester "X" type, .68 uF, 300 VDC	C10
3	1	923019-001	Relay, Input Capacitor Filter	K2
4	1	902004-016	Resistor, Wire Wound, 4 ohm +/- 5%, 5 W	R7
5	1	902004-008	Resistor, Wire Wound, 4.7 kohm +/- 10%, 5 W	R8
6	1	913003-003	Zener Diode 1N5368, 47 V, 5 W	VR1
7	1	902011-009	Varistor, 250 V, 40 J	VR3
8	1	902011-001	Varistor, 130 V, 20 J	VR4
9	5	932004-001	Terminal, Male Faston, PWB Mount .250	J15-18, J20
10	1	912000-001	Input Diode, Anode Stud	CR3
11	1	902015-002	Resistor Wire Wound, 3 ohm, 60W, 10%	R6
12	2	104079-001	Mounting Bracket, PWB	
13	2	970000-504	Screw, #10-32 x .38" Phillips Pan Head	
14	2	972000-005	Nut, #10-32 Hex	
15	1	100128-001	Threaded Rod #10-32 x 5.25" Aluminum	

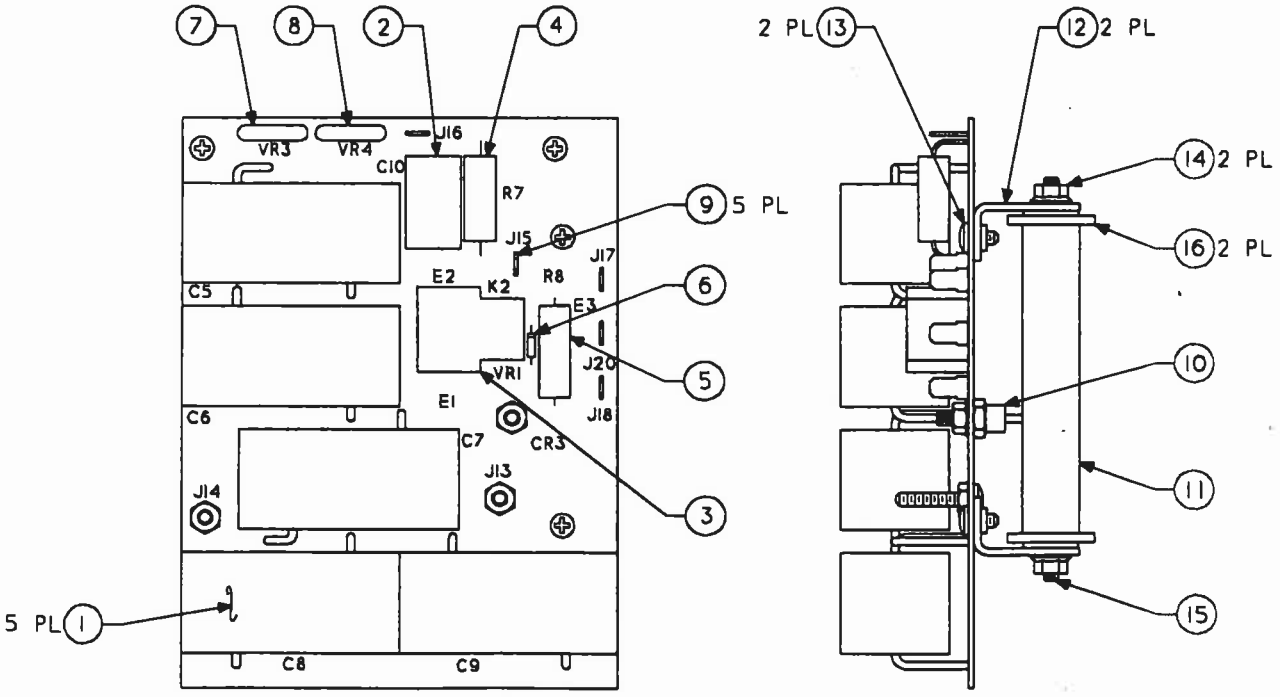


Table 22 - Arc Starter Tray

Part Number 107639-001				
Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	107647-001	Main inductor w/PTC Temperature Sensor	L1, RT2
1.1	1	100141-001	PTC Temperature Sensor	
2	1	107645-001	Arc Start Transformer	TR1
3	1	107640-001	Arc Start PWB	
4	1	107546-001	Mount, Arc Start PWB	
5	2	939008-001	Bracket, PWB Support	
6	2	939008-002	PWB Card Guide	
7	2	939008-003	Card Lock Bar w/Hardware	
8	2	979001-004	Cable Tie, 1.88 Bundle Diameter	
9	1	107650-001	Arc Start PWB Harness	
10	1	902006-004	Surge Resistor 3 ohm, 150 W	R5
11	1	902015-002	Resistor Wire Wound, 3 ohm, 60 W	R4
U/W	2	970001-403	Screw #8-32 x .31" Phillips Pan Head	
	2	972000-004	Nut, #8-32 Hex	
	2	974010-004	Washer, Split Lock #8 .293" x .175" x .040"	
	1	100128-001	Threaded Rod 10-32 5.25"	
	2	972001-005	Nut, #10-32 Flanged Head	
	2	100205-001	Washer Locating Ryton	

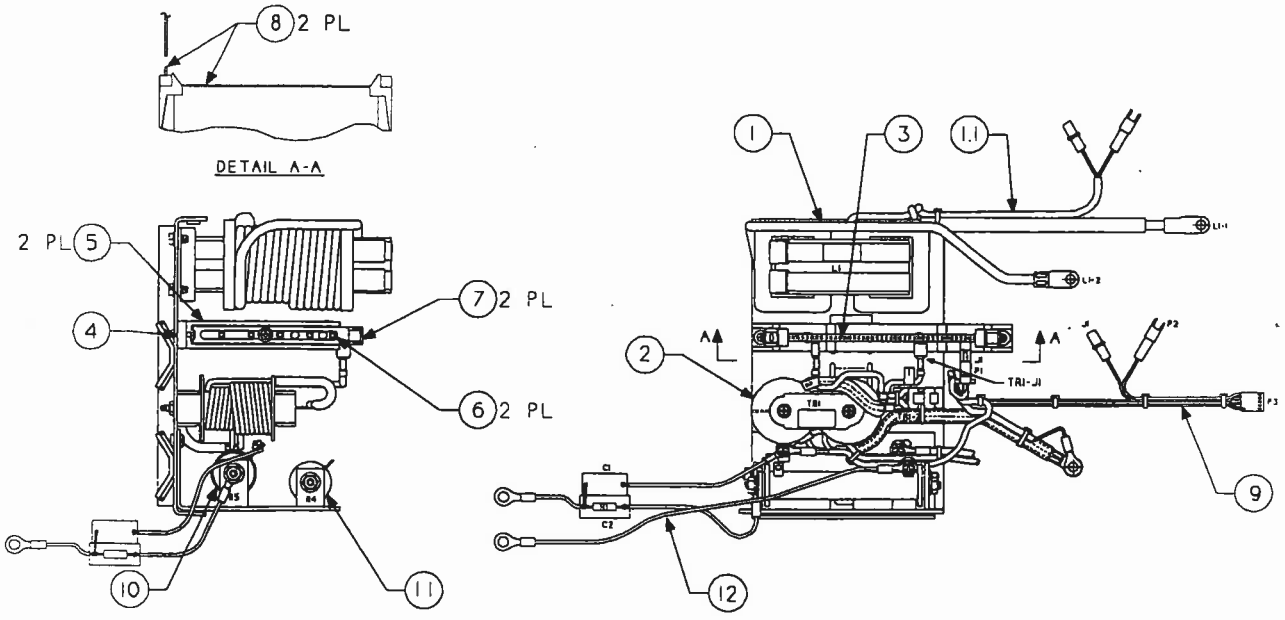


Table 23 - Air Regulator Assembly

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	923008-101	Filter/Regulator 125 PSI	
Refer to Table 29, "Air Regulator Exploded", page 40				
2	1	923008-003	Gauge, 1-160 PSI	
3	1	924011-040	Fitting, Coupler #1/4-18 NPT to Male "B" Nipple	
4	1	107659-001	Mount, Regulator	
5	2	970041-406	Screw, #8-32 x .50" Socket Cap w/Nylock	
6	2	974005-005	Washer, Flat #10 .354" x .195" x .032"	
7	2	970002-508	Screw, #10-32 x .62" Phillips Pan Head w/Nylock	
8	1	107661-001	Assembly, Extractor/Dryer	
8.1	1	923021-001	Extractor/Dryer	
Refer to Table 25, "Extractor/Dryer Exploded", page 41				
8.2	1	924020-002	Fitting, 90 deg. Fem 1/4 NPT x Fem 1/4 NPT	
8.3	1	924013-001	Fitting, Long Nipple 1/4 NPT x 1/4 NPT x 2"	
8.4	1	924007-001	Fitting, 90 deg. Street Elbow 1/4 NPT	
8.5	1	924004-002	Fitting, Close Nipple 1/4 NPT	

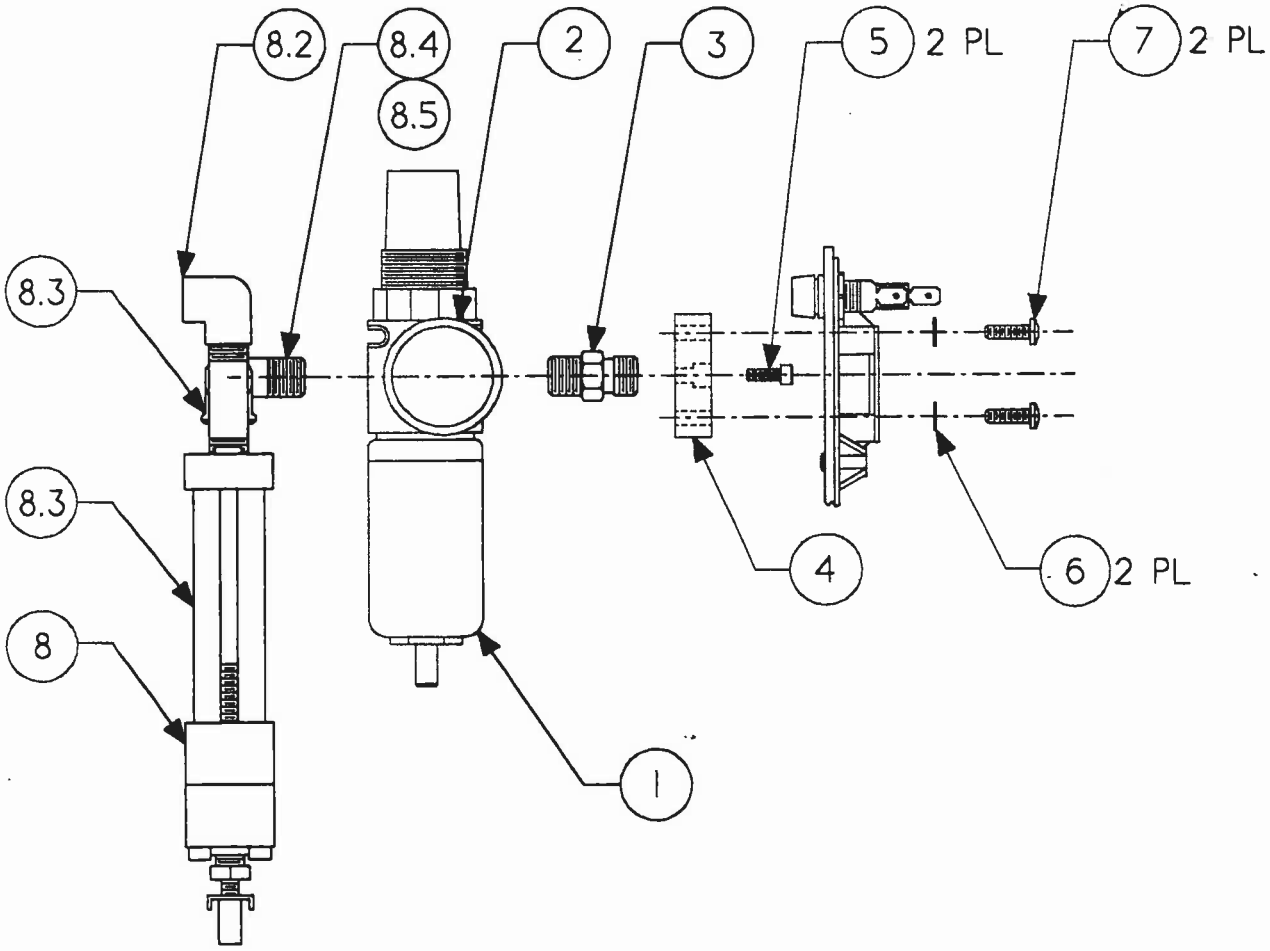


Table 24 - Air Regulator Exploded

Item No.	Qty.	Part Number	Description	Ref. Des.
1	1	923008-108	Knob	
2	1	923008-104	Kit, Cage	
3	1	923008-106	Kit, Regulator Repair	
4	1	923008-105	Filter, 5 Micron Element	
5	1	923008-107	Kit, Filter Repair	
6	1	923008-103	Bowl, Zinc	

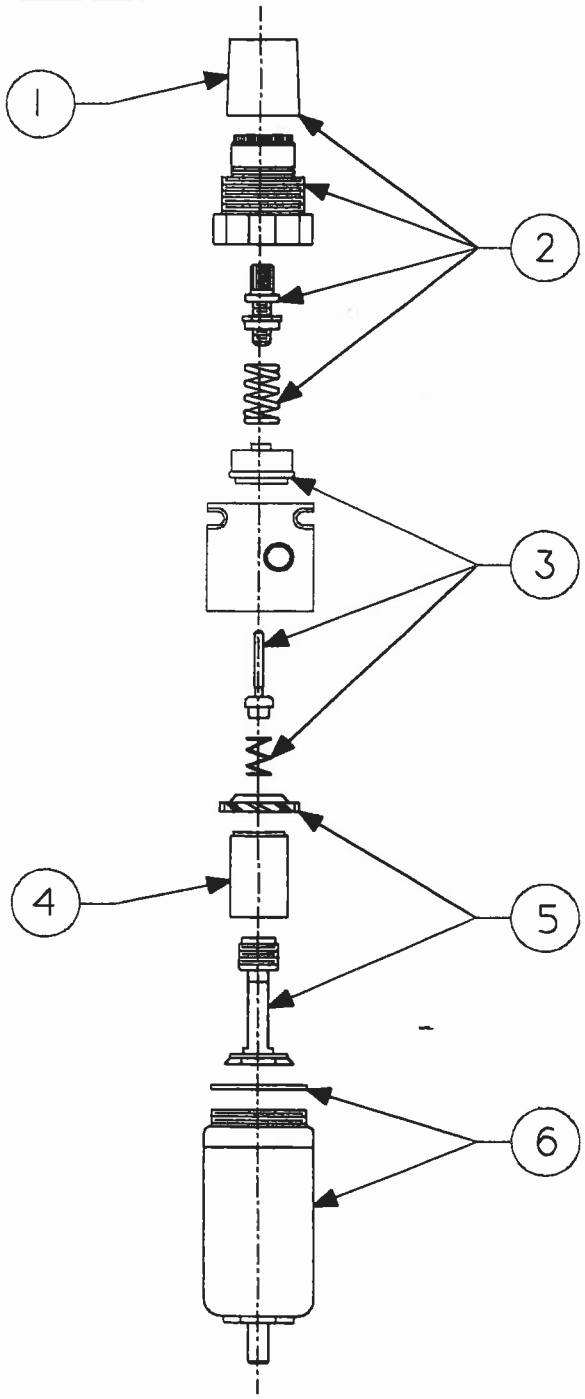
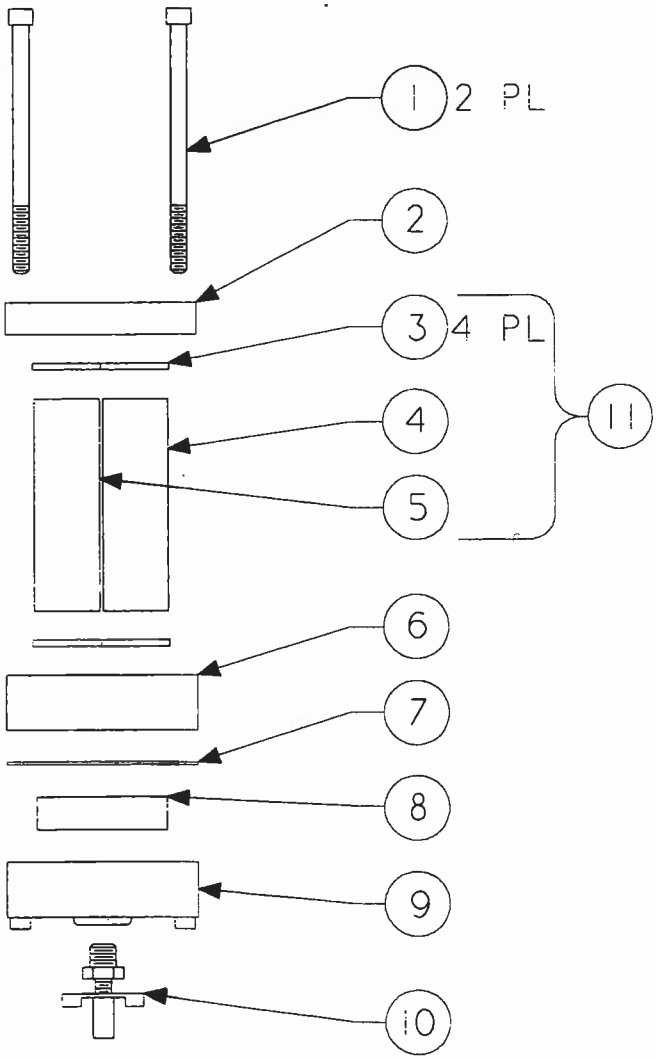


Table 25 - Extractor/Dryer Exploded

Item No.	Qty.	Part Number	Description	Ref. Des.
1	2	923021-002	Bolt	
2	1	923021-003	Manifold 1/4 NPT Top Ports	
3	4	923021-004	Cap Gasket	
4	1	923021-005	First Stage Cartridge	
5	1	923021-006	Second Stage Cartridge	
6	1	923021-007	Chamber	
7	1	923021-008	Gasket	
8	1	923021-009	Base Core	
9	1	923021-010	Base	
10	1	923021-011	Weep Drain	
11	1	923021-012	Kit, Cartridge	
	Kit consists of:			
	8	923021-004	Cap Gasket	
	1	923021-005	First Stage Cartridge	
	3	923021-006	Second Stage Cartridge	



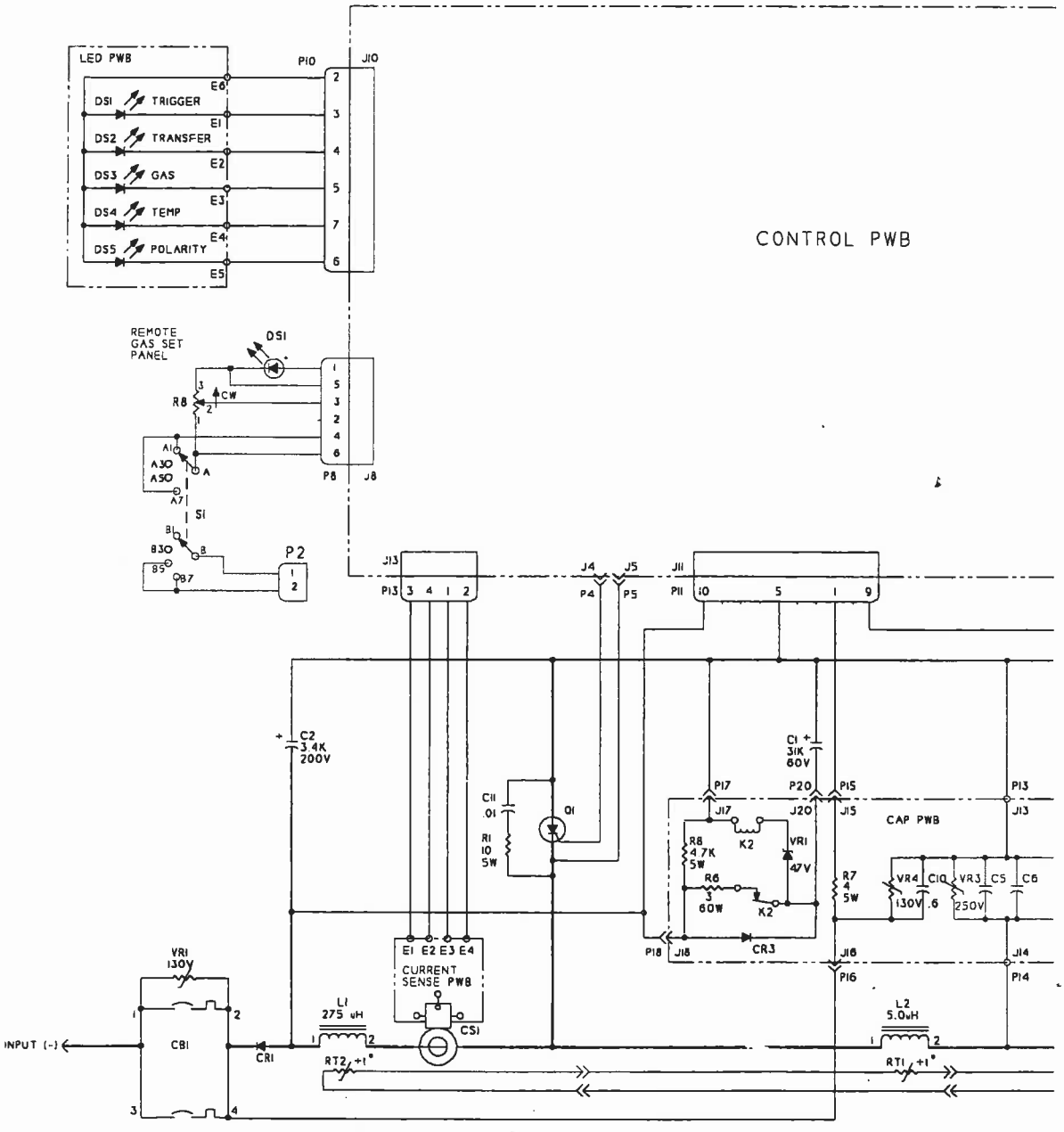

LED PWB
DS1 TRIGGER
DS2 TRANSFER
DS3 GAS
DS4 TEMP
DS5 POLARITY
P10
J10
CONTROL PWB
REMOTE GAS SET PANEL
DS1
R8
CW
P8
J8
S1
P2
J13
P13
J4
J5
P4
P5
J11
P11
C2 3.4K 200V
C1 31K 60V
C11 .01
R1 10 5W
Q1
P17
P20
P15
P13
J17
J20
J15
J13
CAP PWB
R8 4.7K 5W
K2
VR1 47V
R6 5 60W
R7 4 5W
VR4 C10 VR3 C5 C6
130V .6
250V
P18
J18
CR3
J16
J14
P16
P14
E1 E2 E3 E4
CURRENT SENSE PWB
CS1
VR1 130V
L1 275 uH
L2 5.0uH
INPUT (-)
CB1
CR1
RT2 +1°
RT1 +1°

Figure 13

DRAWINGS AND PARTS LIST