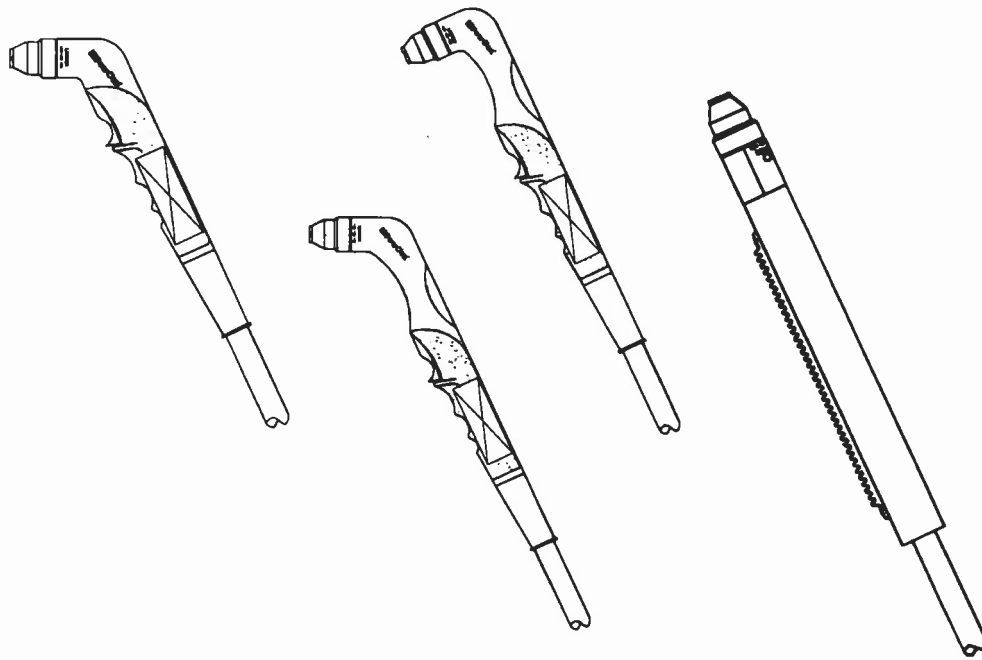


! IMPORTANT !
-FOR YOUR SAFETY-
READ THIS MANUAL BEFORE
INSTALLING OR USING EQUIPMENT

OPERATION MANUAL



PT-80 and PT-90 Plasma Torches

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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 **PowCon** PT-80 and PT-90 torches are warranted for 90 days from the date of purchase. Please fill out and return the warranty card shipped with each torch.

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SAFETY

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 ground cable 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.

SAFETY

- G) Keep everything dry you might touch, including clothing, the work area, welding gun, 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 (#10 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.

SAFETY

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.

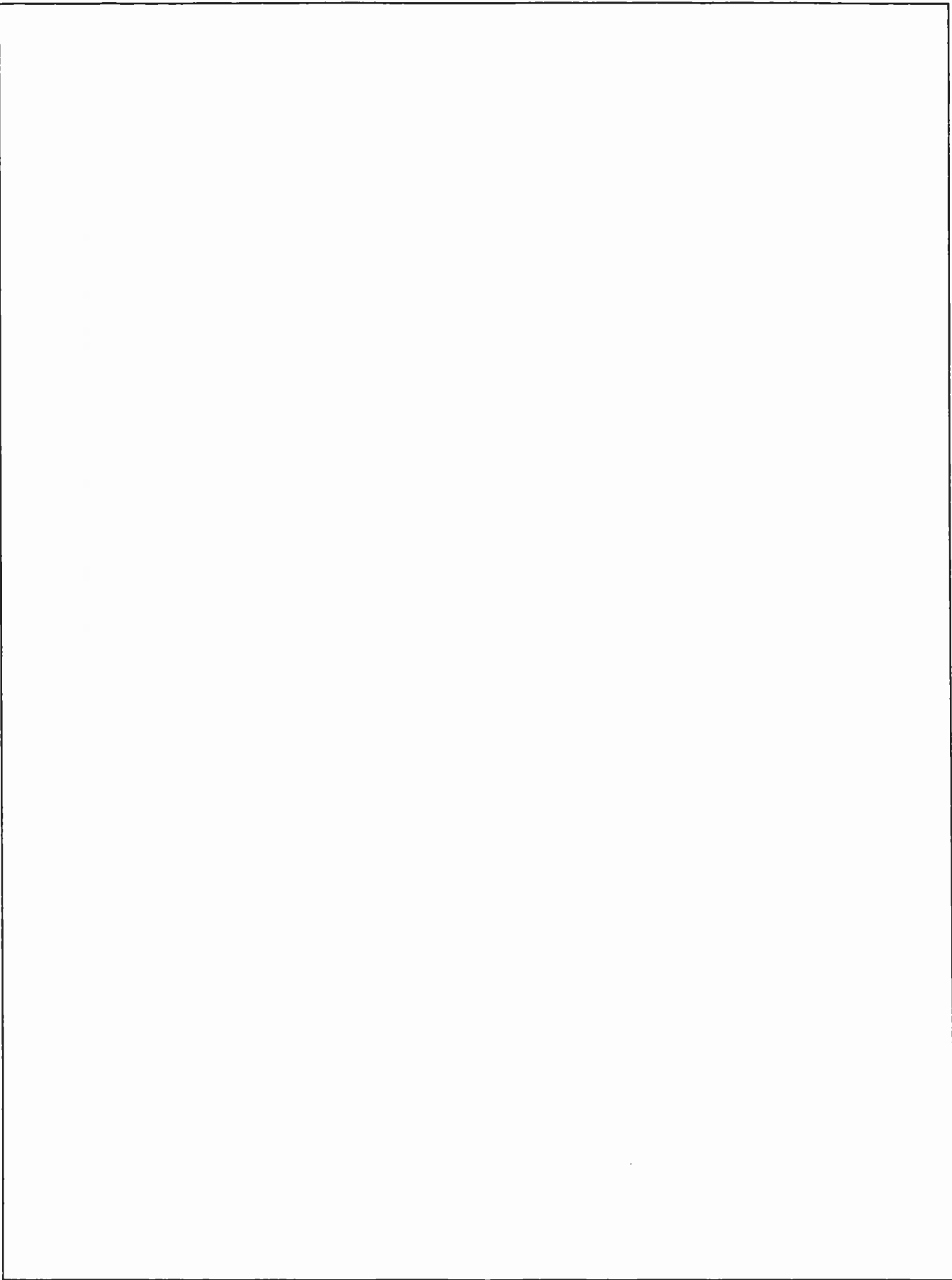
- A) At all times, provide adequate ventilation in the welding and cutting area by either natural or mechanical means. Do not weld or cut on galvanized, zinc, lead, beryllium or cadmium materials unless positive mechanical ventilation is provided to prevent inhaling fumes and gases from these materials.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

GENERAL INFORMATION

DESCRIPTION OF EQUIPMENT

The PowCon PT-90 series of PAC (Plasma Arc Cutting) torches are rugged, high quality products available as standard equipment with the PowCon StarCut. These torches can also be used with a variety of PAC power sources to achieve excellent cutting and gouging performance. Based on the field proven PT-80 and PT-80M models, improvements have been made to increase ruggedness and parts life as well as improvements to the feel of the torch and its ergonomics. The PT-80 is still available and is standard equipment for PlasmaPlus systems. A full range of replacement parts is also available. In this manual, unless otherwise noted comments on the PT-90 are also applicable to the PT-80. Figure 1, "PT-80 and PT-90 Series Torches", shows the PowCon line of PAC torches. See Table 1 for specifications

Features of these torches include a split shell handle design for ease of repair, 25 foot and 50 foot leads, one piece head for rugged, reliable cutting, and a wide variety of consumables and parts kits to match your application. Now with the PT-90 additions to the PowCon PAC torches, an extended handle with the choice of either 75 degree or 90 degree head angles, operator safety and ergonomic ease make for more productive PAC work. These are the PT-90/90 and PT-90/75. New handle material also resists burning from flying sparks. All ceramic pieces have been removed from the torch head to prevent shattering, and gas cups are now available in durable fiberglass.

SPECIFICATIONS

Table 1 - PT-80 and PT-90 Torch Specifications

| | |
|---|-------------------|
| Current Range (set by PAC power source) | 20-100 Amps |
| Voltage Range | 100-130 Volts |
| Gas Connection | 1/2-20 UNF |
| Pilot Connection | 3/8" Round Lug |
| Trigger Connection | 2-pin Amp Housing |
| Duty Cycle* (12kW: 100 Amps @ 120Volts) | 100% |
| Plasma Gas and Secondary Gas | Compressed Air |
| Operating Air Pressures | Cutting/Gouging |
| 25 foot torch | 70/50 PSI |
| 50 foot torch | 90/70 PSI |
| Air Flow | 240 CFH |
| Air Quality Requirements | |
| 5 micron Maximum Particle Size | |
| 1PPM Oil/Water Aerosol Maximum Content | |
| Dew Point: 18 degrees F below Ambient | |
| Recommended Eye Protection Filter Grade | #8 to #12 |

*PT-80 recommended duty cycle 60% (80 Amps @ 120 Volts)

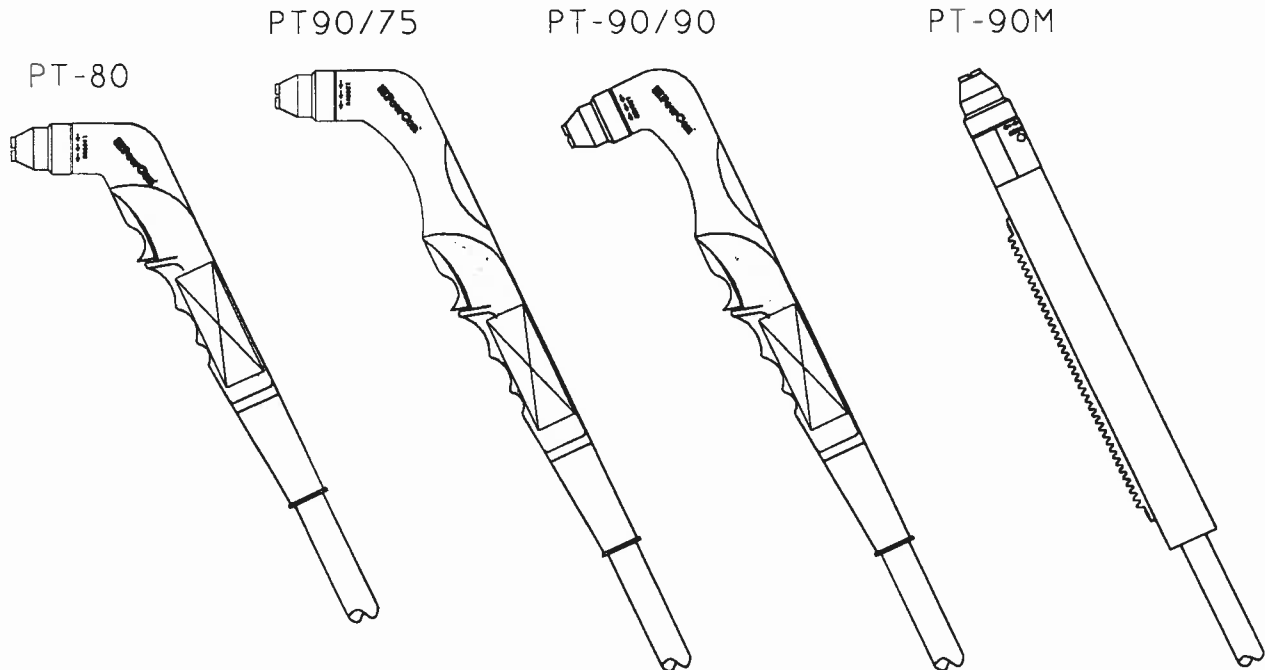


Figure 1 - PT-80 and PT-90 Series PAC Torches

GENERAL INFORMATION

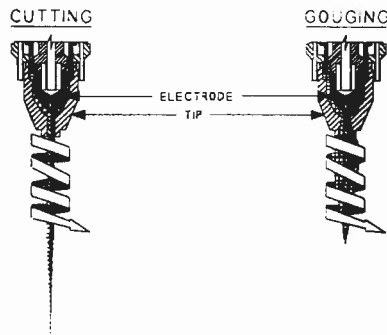


Figure 2 - PT-90 Torch Air Columns

Also available in this line of PAC torches is a 180 degree, or straight barrel machine torch. A machine torch has a short straight handle which holds the torch head, pressed onto the handle is a standard diameter barrel which works with most machine torch mechanisms. Machine torches come with the 32 Pitch rack standard, but a 24 pitch rack is also available if necessary for your application. The machine torch has no trigger switch, so remote trigger pendants are available with a momentary trigger switch or an ON-OFF set of switches. The PT-90M machine torch has received the same benefits of the new internal head improvements as the hand held torch. StarCut and PlasmaPlus systems are available with this torch.

Torches shipped by PowCon include everything required for PAC cutting, as well as this manual. Torches sold with PowCon PAC power source systems also include a system manual and a spare parts kit of consumables (also available separately). Included in the Parts List section of this manual are part numbers for a wide variety of consumable parts, a complete list of repair parts, and a number of conversion kits which allow these torches to be used with other PAC power sources.

THEORY OF OPERATION

Plasma Arc Cutting is a process used to cut most steels and aluminum using a high energy column of compressed air. Torches consist of a torch head assembly and torch leads. Connections made from the torch head include the main gas hose which brings compressed air to the head, and also running inside this hose is the main heavy gauge electrical connection to the electrode. Second is a connection to the tip of the torch head, this is a smaller electrical wire used only during pilot operation. Third is the two wire trigger connection which also incorporates a "parts-in-place" safety interlock in series with the trigger in the hand held models. In the machine torch, this is a parts-in-place connection only and must be externally connected to a remote trigger pendant with a special three way adaptor.

Clean, dry compressed air is supplied to the torch head through the lead assembly. This high pressure air flows through the center body tube of the torch head and cools the electrode as it passes through to be diverted into two separate paths. One is used for cooling the torch head

and travels outside the tip and inside the gas cup. This also helps to blow away any excess ionized air. The second flow goes through a series of angled holes in the body tube to generate a spinning air flow which goes between the electrode and the tip. As it leaves the orifice of the tip, it is formed into a very tight spiral column of air. Figure 2, "PT-90 Torch Air Columns" shows the different shapes for cutting and gouging columns.

When setting air pressures, PAC power sources run compressed air from the regulator (and solenoid) through the torch without applying any electrical power, this air column is just compressed air like any nozzle would create. When cutting, electrical power is applied to the electrode and a current flows in an arc between the electrode and the workpiece, without touching the tip. Actually, the current flows from a small insert in the electrode made from Hafnium, an element similar to Tungsten which allows electrons to be emitted without quickly eroding the electrode. This arc has enough energy to strip away the outer electrons from the air molecules in the column and creates what is called a plasma state. When the plasma column comes in contact with the workpiece, these "stripped molecules" attract the electrons which hold together the metal crystal, which falls away as dross and is blown clear.

In order to initiate this arc, some form of pilot arc starter is required. PowCon's PlasmaPlus and StarCut PAC power sources use a capacitor discharge circuit which creates a 5-10 kVolt pulse between the tip and electrode, temporarily ionizing the air inside the tip. The 200 Volt open circuit voltage then delivers a strong pilot pulse. If the torch is brought near to the workpiece, this pulse will be transferred to the workpiece and a transferred or cutting arc begins. At this point, a relay will disconnect the tip from the circuit and current flows to the workpiece.

Another comparison to the TIG process concerns operating voltages and currents. Like TIG, plasma arc cutting is typically a current controlled process with positive output connected to workpiece, and negative output supplying the torch. Arc voltage is set basically by arc length, sometimes called standoff height, and is much higher in PAC: between 100 and 130 volts. PowCon PT-90 torches have the advantage of running at lower voltages than most torches for a more efficient arc with less waste heat.

GENERAL INFORMATION

TORCH PARTS IDENTIFICATION

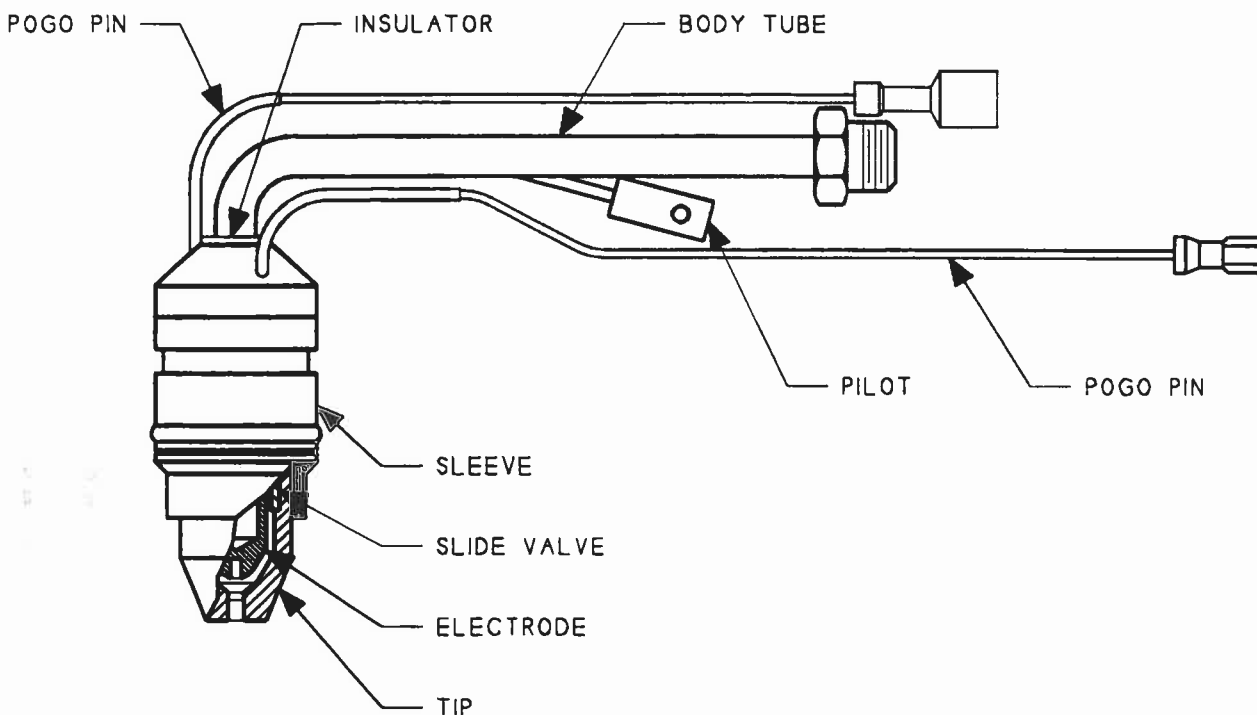


Figure 3 - Torch Head Description

TORCH PARTS

TORCH HEAD COMPONENTS

BODY TUBE: center conducting part of torch head

- Carries negative (-) voltage for pilot and transferred arc from electrical lead in gas hose to electrode threads
- Directs air flow from gas hose to rear of electrode, splits air flow into cooling flow and plasma flow
- Swirls air going into the plasma column chamber

INSULATOR: molded section between the Body Tube and the Sleeve

- Mechanically ensures concentricity between the electrode and the sleeve which holds the tip.
- Provides electrical insulation between the electrode and the sleeve
- Houses the two pogo pins which provide the safety parts-in-place interlock.

SLEEVE: metal sleeve surrounding the insulator

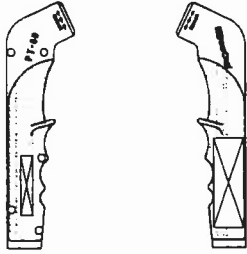
- Holds the torch head by molded sections of the handle
- Carries positive (+) voltage (near workpiece potential) to the tip during pilot arc operation
- Has solid wire which connects to the pilot wire of the lead assembly.
- Contains a baffle of holes through which the cooling gas flows
- Features a groove which holds the gas cup "O" ring

SLIDE VALVE: tube of Vespel material between the body tube and sleeve

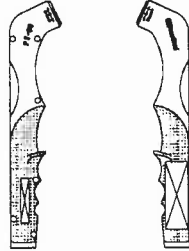
- Provides further insulation function provided by the insulator
- Holes allow cooling gas to flow to the sleeve and then to the gas cup.
- Has a ring of conductive metal at rear end comprising the switch element of the safety parts-in-place interlock

GENERAL INFORMATION

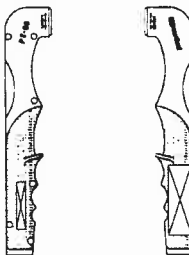
PT-80/75



PT-90/75



PT-90/90



MACHINE

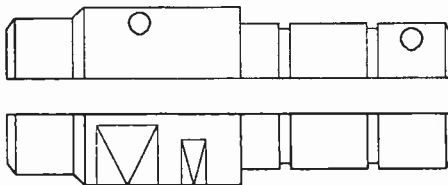


Figure 4 - Handles

HANDLES

- Positively positions the torch head.
- Firmly holds the boot and lead assembly
- Holds trigger or barrel in the machine torch
- Provides additional insulation between the live torch components and the operator
- Easily removable design allows access to torch components

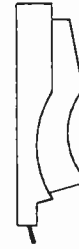


Figure 5 - Trigger Switch

TRIGGER SWITCH

- Operator input to activate the PAC power source
- Wired in series with parts-in-place contacts to provide safety interlock
- Rugged, normally open, leaf switch
- Easily replaceable if damaged by splatter



Figure 6 - Boot

BOOT

- Tough rubber provides strain relief for lead assembly exiting handle
- Helps hold lead assembly firmly in handles

GENERAL INFORMATION

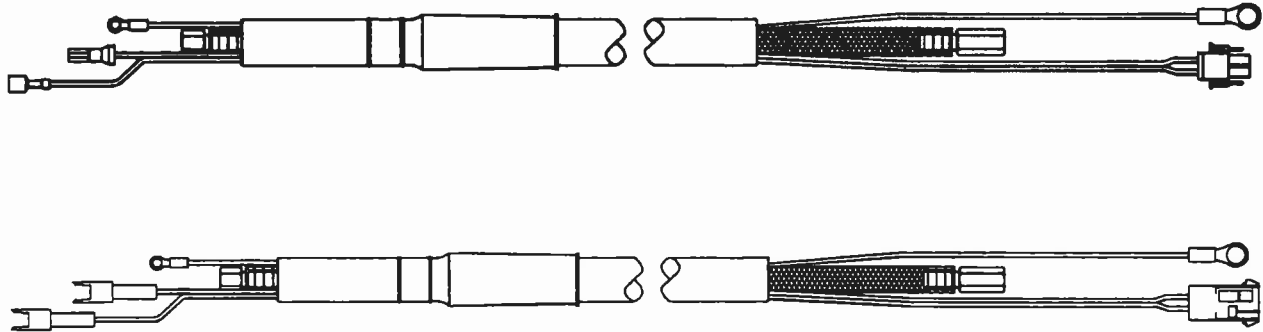


Figure 7 - Lead Assembly

LEAD ASSEMBLY

- Rugged, cloth reinforced tubing gas hose provides path for compressed air to the torch head
- Wire inside gas hose carries negative (-) voltage to the body tube of the torch head
- Single lead for pilot operation
- Doubled leads for trigger and parts-in-place function (parts-in-place only for machine torch)
- Tough outer sheath to protect leads
- 25' or 50' available



Figure 8 - Barrel

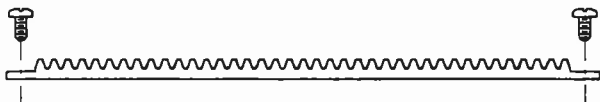


Figure 9 - Rack

BARREL AND RACK (MACHINE TORCH ONLY)

- Provides a standard size barrel to mount in most machine torch fixturing
- Rack mounted to the barrel allows for vertical standoff adjustment while cutting
- Racks are available with two different tooth pitches

CONSUMABLES

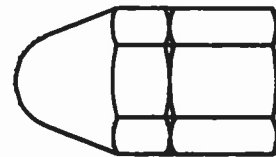
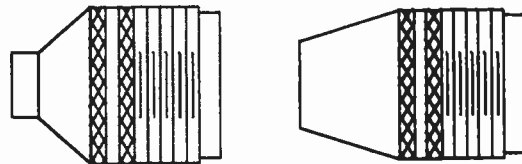


Figure 10 - Electrode

ELECTRODE

- Serves as cathode during pilot and transferred arc operation
- Contains insert of hafnium metal which erodes slowly in high temperature emission of electrons (similar to a tungsten in a TIG torch)
- Directly cooled from air supplied by gas hose to body tube



**Figure 11 - Tips, Cutting and Gouging
TIPS, CUTTING AND GOUGING**

- Geometry creates a coherent compressed air column through orifice
- Available with different sizes of orifice for different cutting currents
- Carries positive voltage during pilot operation only
- Activates the parts-in-place safety interlock when fully installed
- Available in a gouging configuration which creates a more rounded column (.093" recommended)

GENERAL INFORMATION

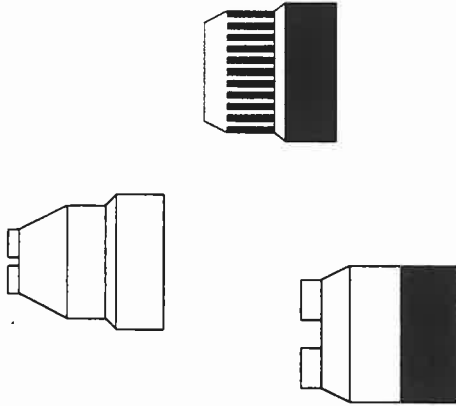


Figure 12 - Gas Cups

GAS CUPS

- Directs cooling air flow over the tip
- Keeps splatter off the torch head
- Insulates electrically between the torch head and the operator
- Insulates the operator from the hot torch head
- Available in standoff style which allows the operator to rest the gas cup on the workpiece while cutting to keep the tip from touching the workpiece

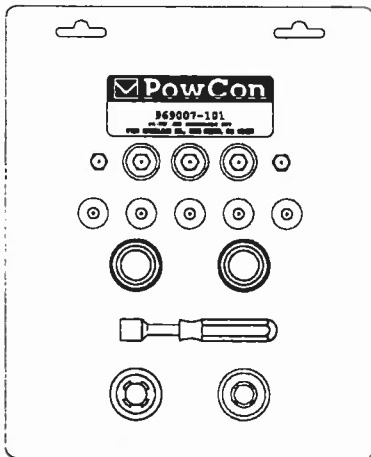


Figure 13 - Parts Kits

PARTS KITS

- One parts kit comes standard with every PAC system sold by PowCon
- Contains a complete set of consumable tips, electrodes and gas cups for start up
- Available with different sets of consumables for different applications
- Each part kit contains gas cup "O" rings and an electrode wrench

MISCELLANEOUS

CONVERSION KITS

- Kits to allow PowCon series PAC torches to be used with other PAC power sources
- Provides conversion for gas hose, trigger connector and pilot termination

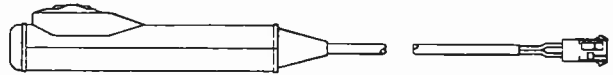


Figure 14 - Remote Pendant

REMOTE PENDANT SWITCHES AND THREE WAY CONNECTOR

- Used only with machine torches for operator trigger function
- Available with a single Momentary push button switch
- Available with linked ON/OFF switches
- Available in 25' or 50' lengths
- Must be used with three way connector to ensure parts-in-place safety interlock function

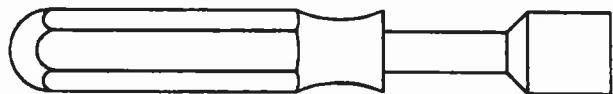


Figure 15 - Electrode Wrench

ELECTRODE WRENCH

- Allows for easy removal and installation of electrode
- Provided with every parts kit
- Standard 11/32" hex nut driver

GENERAL INFORMATION

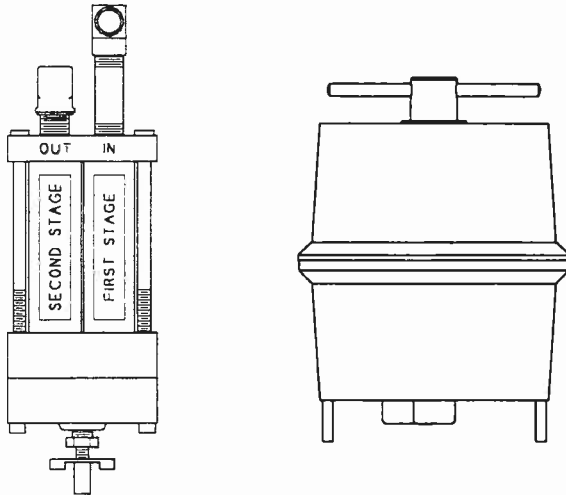


Figure 16 - Air Filters

AIR FILTERS

IN LINE PAPER FILTER

- Canister style air filter with replaceable elements
- Sufficient for most air supplies

EXTRACTOR/DRYER

- Two-stage air filter with replaceable elements
- High quality air filtering for most compressed air sources
- Mounts directly to air regulator in StarCut PAC systems
- Compact, lightweight design for easy installation

SAFETY INTERLOCK

Since a very high voltage pulse is required for pilot operation, the PT-90 torches are equipped with a safety interlock to minimize the risk for an operator. The tip is connected to the workpiece in most PAC power sources, through a low value resistor, and is kept at a relatively low voltage, however the electrode has several thousand volts during pilot. So the safety interlock should prevent pilot operation with the tip removed.

Inside the torch head is a slide valve which is depressed when the tip is installed. At the end of this slide valve is a ring of metal, which contacts two pogo pins. These pogo pins create a switch which is wired in series with the trigger switch. With the tip removed, the slide valve loses contact with the pogo pins and even if the trigger is pressed the torch will not fire.

In the machine torch, there is no trigger built in, so the parts-in-place interlock is not hard wired in series with a trigger. That is why the two position connector on the PAC power source end of the lead assembly is of a different style. In order to correctly connect the safety interlock, a three way connector is used to connect the

torch parts-in-place in series with PowCon remote pendants. Refer to the "Installation" section for information on making this connection.

Operating the torch without an electrode is not as dangerous, since the tip provides shielding from the high voltage. However, the torch head will be damaged if the torch is piloted without the electrode installed.

CONSUMABLE PARTS SELECTION

NOTE

REFER TO THE PARTS LIST SECTION FOR A COMPLETE LISTING OF ALL PART NUMBERS FOR PT-90 TORCHES, CONSUMABLES AND REPLACEMENT PARTS.

PowCon PT-90 torches use left hand threads for both the tip and the electrode to ensure that only quality PowCon consumables will be used. These parts have been optimized for use with the PT-90 and are especially effective in use with PowCon PAC systems with their non-disruptive pilot electronics.

Electrodes are available both in bulk and in convenient "5-pack" blister packs. Electrodes can be used typically 4 to 6 times longer than can a tip. When cutting or piloting performance is degraded, or when the hafnium insert is worn away, the electrode must be replaced.

Table 2 - Cutting Tip Selection

| Cutting Current (in Amps) | Tip Orifice Size | |
|------------------------------|------------------------------------|----------------------------|
| | StarCut [®] PlasmaPlus | SinglePhase Plasma Plus |
| Less than 40 Amps | .040" | .048" |
| 40 to 55 Amps | .048" | .055" |
| 55 to 80 Amps | .055" | N/A |
| 80 to 100 Amps | .060" | N/A |

*Use this column for most PAC power sources

Cutting Tips come with various orifice hole sizes and selection of the correct size will affect both the cut quality and the life of the tip. Basically the orifice is selected by cutting current value. Table 2, "Cutting Tip Selection" shows recommended orifice sizes for different values of cutting current. These are appropriate for the StarCut and PlasmaPlus models as well as most other PAC power sources. Also included is a column for the single phase PlasmaPlus model. This power source has slightly higher ripple current and requires a larger orifice size for a given current. Use of a smaller orifice will cause double arcing and will destroy the orifice quickly, a larger orifice will cause a concave curve to the vertical sides of the cut.

GENERAL INFORMATION

Gouging Tips are available for doing PAC gouging with the PT-90 torches. They are slightly larger and have a tapered orifice instead of the straight sided orifice of the cutting tips. The four different orifice sizes are: .060", .078", .093", .100". Selection of gouging tip sizes is slightly different than for cutting tips since most gouging is done at full current. Experience has shown that for most applications, the most effective gouging tip is the .093" size for currents in the 60 to 80 Amp range. Smaller sizes are available for lower output currents, and a larger size for currents to 100 Amps.

Gas cups are available in two types with several different materials. The two types are standard and standoff (or castellated). For better arc visibility in hand held operation or for machine held operation the standard gas cup is most useful. When doing rough hand cutting, or with limited access for proper hand positioning, a standoff gas cup can be used. This allows the operator to hold the torch against the workpiece while cutting, and the gas cup holds the tip off of the workpiece.

Most common for gas cup material is alumina, or ceramic; this is a cost effective material but is brittle enough to break if dropped. Standoff gas cups are also available with this material, or with a metal sleeve which comes in contact with the workpiece. Another popular option is a fiberglass material. This will not break but is susceptible to charring if brought in contact with slag. The standoff gas cup with fiberglass also has a metal outer section which comes in contact with the workpiece. A fiberglass/metal standoff gas cup is supplied with each hand held torch, and a standard fiberglass gas cup is supplied with each machine torch.

Several parts kits are available with a selection of consumables tailored for the StarCut or PlasmaPlus systems. Some have just alumina gas cups, some have a combination. One is meant for machine application without any standoff gas cups, but with a wider selection of orifice sizes to allow optimization of cut quality with different currents. All consumables are available in convenient 5-pack containers or in bulk and can be ordered separately.

AIR QUALITY

Clean, dry, filtered air is absolutely essential for normal, high quality PAC cutting. Use of compressed air containing moisture, oil aerosols, or particulate matter will result in poor cutting performance, short parts life, torch damage, and loss of warranty.

Since air compressors use ambient air which contains water vapor (in the form of humidity), and also use moving pistons which require oil, the compressed air usually requires filtering. Some air compressors actually drip oil into the compressed air supply to lubricate pneumatic tools "downstream", this should be avoided if possible, or the air supply should be tapped off before lubrication of any type. Most PAC power sources include an air regulator with a built in filter which may be sufficient for some compressed air supplies. To ensure long parts life and high quality PAC cuts, a two stage extractor/dryer air filter is now available from **PowCon** with replaceable filter elements. This small, two stage technology performs well with particle, moisture and vapor contamination. **PowCon** continues to offer the canister style in line air filter. Replacement cartridges are also available for this filter. See the Parts List section for part numbers.

INSTALLATION

INSTALLATION

UNPACKING NEW EQUIPMENT

Remove the PowCon torch 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 the PowCon PT-80, PT-90 series plasma torch manual P/N 201187-001 (this manual) is included with each PowCon torch.

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 designation and/or part number of the equipment be supplied.

NOTE

TO ASSURE A VALID WARRANTY, YOU MUST COMPLETE AND RETURN THE WARRANTY CARD (ENCLOSED WITH ALL PRODUCTS) WITHIN TEN (10) DAYS OF THE PURCHASE DATE

GENERAL INSTALLATION

Refer to the Installation procedure in the OPERATOR manual for your PAC power source before attempting to install any torch. Be sure to follow all instructions carefully.

PowCon offers adaptor kits to connect the PT-90 series torches to many PAC power sources. Table 3 - "PT-90 Adaptor Kits" lists those kits which are available. Three connections are necessary for air PAC torches: main gas hose, pilot return lead, and trigger connection (two wires). This is the same for most PAC power sources, if your PAC power source is not listed here, it may be possible to ask your distributor which of these power sources is similar in torch connections and use one of these kits or contact PowCon for assistance. The terminations of the PT-90 torches are defined in Table 1 - "Specifications".

DANGER

WHEN INSTALLING A TORCH INTO ANY PAC POWER SOURCE, MAKE SURE THE UNIT IS DE-ENERGIZED. FOLLOW ALL PROCEDURES IN YOUR POWER SOURCE MANUAL FOR SERVICING THE UNIT OR CONNECTING TORCHES.

MACHINE TORCH INSTALLATION

Refer to the INSTALLATION section of the OPERATION manual for your PAC power source before attempting to install the PT-90M into your unit. Be sure to follow all instructions carefully.

The PT-90M machine torch does not have a trigger switch built in, and is meant to be used with a PowCon remote trigger pendant. However, the parts-in-place circuitry is still built into the torch head, so there is a two pin connector on the PT-90M. The connector is different than the hand held "trigger plus parts-in-place" connector so that it cannot be plugged directly into the PAC power source trigger input.

When using the PT-90M it is important to connect the remote trigger and the torch parts-in-place together. This is done using the three way connector. The torch connector plugs into one housing, the trigger pendant plugs into another housing, and the third housing is to be connected to the PAC trigger input. Refer also to the section "Machine Torch Application" in the OPERATION chapter to check the function of the parts-in-place circuitry before using the machine torch.

CAUTION

THE THREE WAY CONNECTOR MUST BE USED TO ENSURE SAFE OPERATION OF THE TRIGGER SWITCH AND TORCH PARTS-IN-PLACE CIRCUIT.

Installation of the machine torch is the same as the hand held torch for the gas hose and the pilot wire.

Table 3 - PT-90 Adaptor Kits

| PAC Power Source | Kit Part Number |
|---|-----------------|
| Thermal Dynamics PAK 10 | 969007-336 |
| Thermal Dynamics PAK 5 | 969007-339 |
| Thermal Dynamics PAK 5XR, PAK 7XR, PAK 10XR | 969007-340 |
| Harris | 969007-341 |
| Miller "Zip Units" | 969007-342 |
| Hypertherm | 969007-343 |
| L-Tec | 969007-344 |

INSTALLATION

StarCut CAPACITOR DISCHARGE

Before opening the StarCut case, be sure that the unit is disconnected from the welding power source and that the workpiece 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 this procedure once the case top is removed, and before touching any metal parts inside the StarCut unit.



DANGER

DO NOT ATTEMPT TO PERFORM THIS PROCEDURE WITHOUT THE WELDING POWER SOURCE BEING DISCONNECTED FROM THE StarCut UNIT

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.

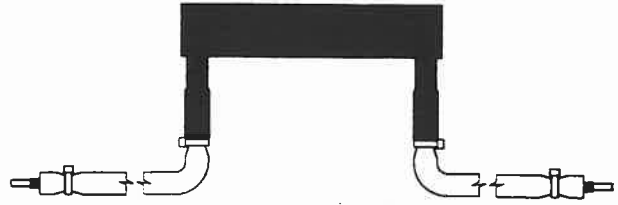


Figure 17 - Capacitor Discharge Resistor

A capacitor discharge (or 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 components are required 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; refer to Figure 17, "Capacitor Discharge 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.

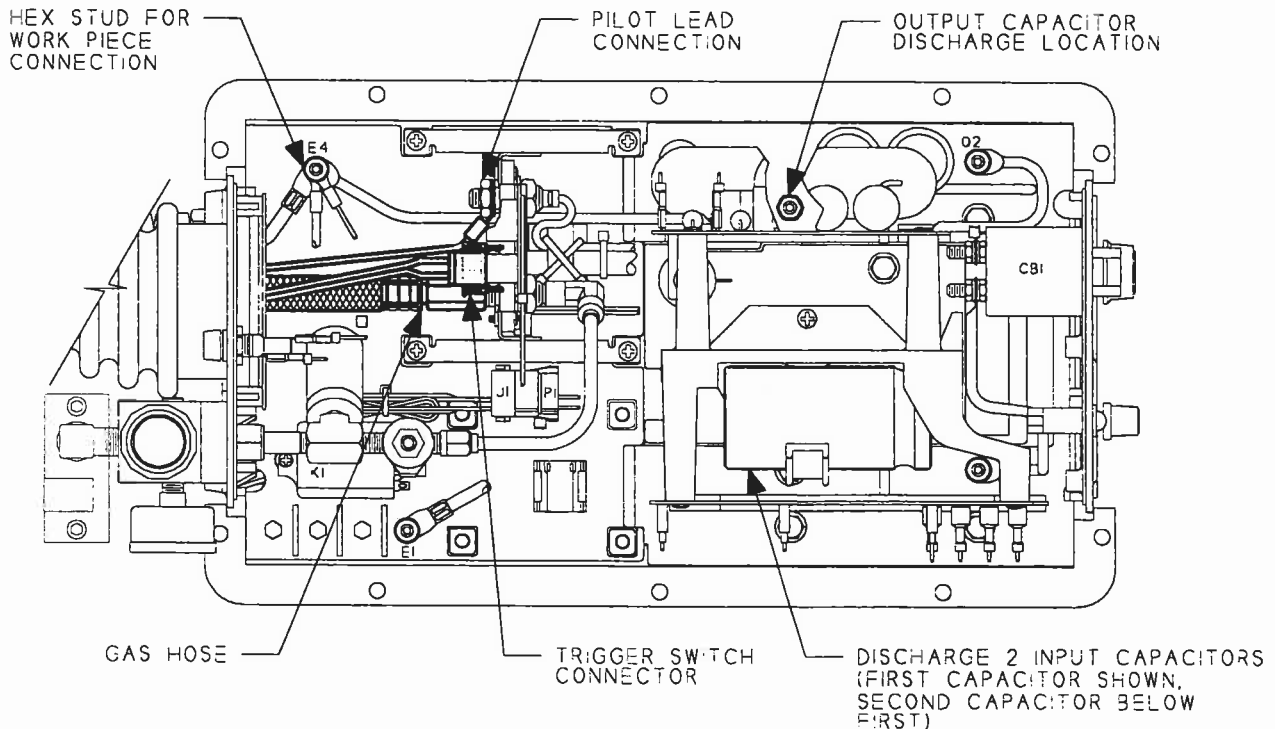


Figure 18 - StarCut Top View Cover Off

INSTALLATION

- A) Make sure the StarCut unit is 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 may 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 Figure 18, "StarCut 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 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.)

StarCut HAND HELD TORCH INSTALLATION

WARNING

BEFORE PROCEEDING WITH THIS PROCEDURE PLEASE MAKE SURE YOU HAVE COMPLETED THE SECTION ON STARCUT CAPACITOR DISCHARGE

Refer to Figure 19, "StarCut Hand Held Torch Installation".

- A) With the case top removed, feed the gas hose, trigger switch connector, and 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 the nut & washers from step B).

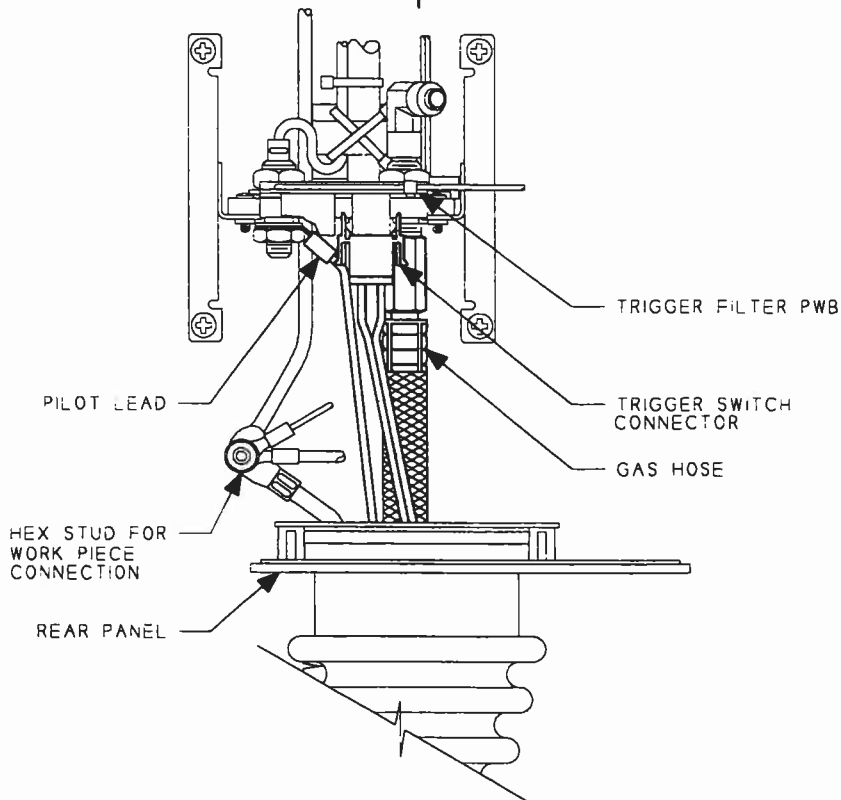


Figure 19 - StarCut Hand Held Torch Installation

INSTALLATION

- D) Connect the gas hose to the fitting on the torch connector bracket. Do not over tighten.
- E) Connect the trigger switch connector to the mating connector on the trigger filter PWB.
- F) Replace the cover. Make 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.

StarCut MACHINE TORCH INSTALLATION

WARNING

BEFORE PROCEEDING WITH THIS PROCEDURE PLEASE MAKE SURE YOU HAVE COMPLETED THE SECTION ON STARCUT CAPACITOR DISCHARGE

Refer to Figure 20, "StarCut Machine Torch Installation".

- A) With the case top removed, feed the remote trigger pendant through the boot from the rear of the unit. Next feed the gas hose, parts-in-place connector, and the pilot lead through the boot.

- 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 the nut & washers from step B).
- D) Connect the gas hose to the fitting on the torch connector bracket. Do not over tighten.
- E) Connect the remote trigger pendant connector to one plug of the three-way connector. Next connect the torch parts-in-place to another plug of the three-way connector. Finally connect the remaining plug to the mating connector on the trigger filter PWB.

CAUTION

THE THREE WAY CONNECTOR MUST BE USED TO ENSURE SAFE OPERATION OF THE TRIGGER SWITCH AND TORCH PARTS-IN-PLACE CIRCUIT.

- F) To prevent the remote trigger pendant from being pulled out of the unit, install the strain relief which is included with the three way connector. Remove the outside rear screw holding the torch connector assembly to the chassis.

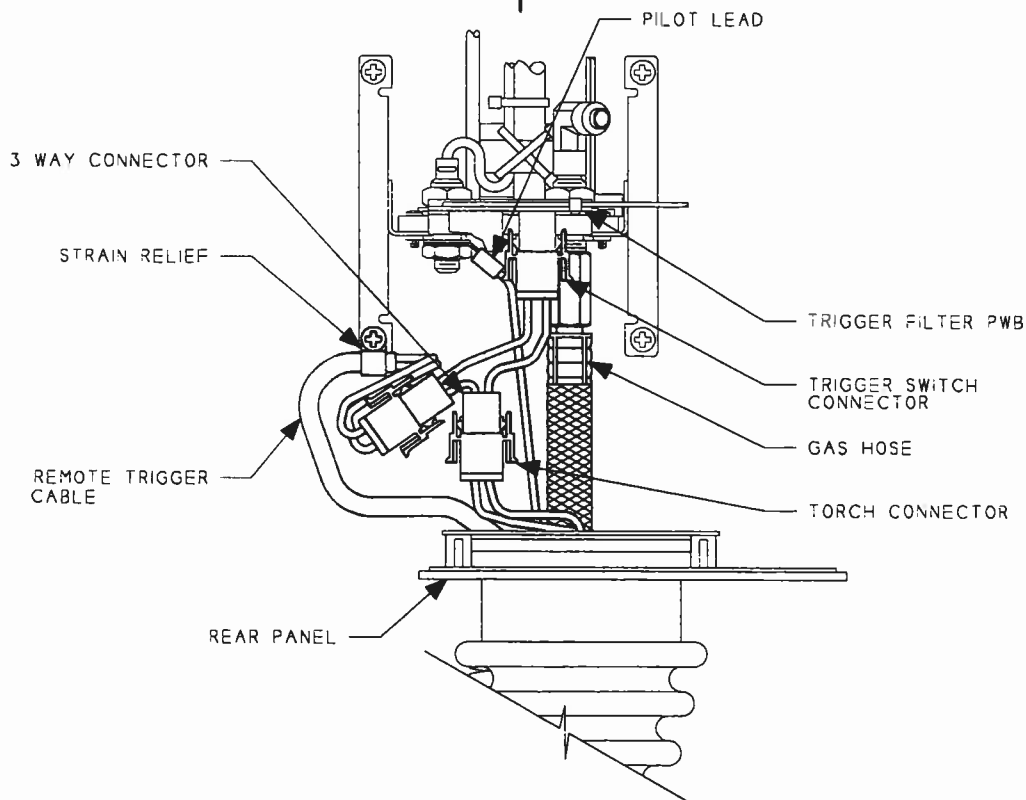


Figure 20 - StarCut Machine Torch Installation

INSTALLATION

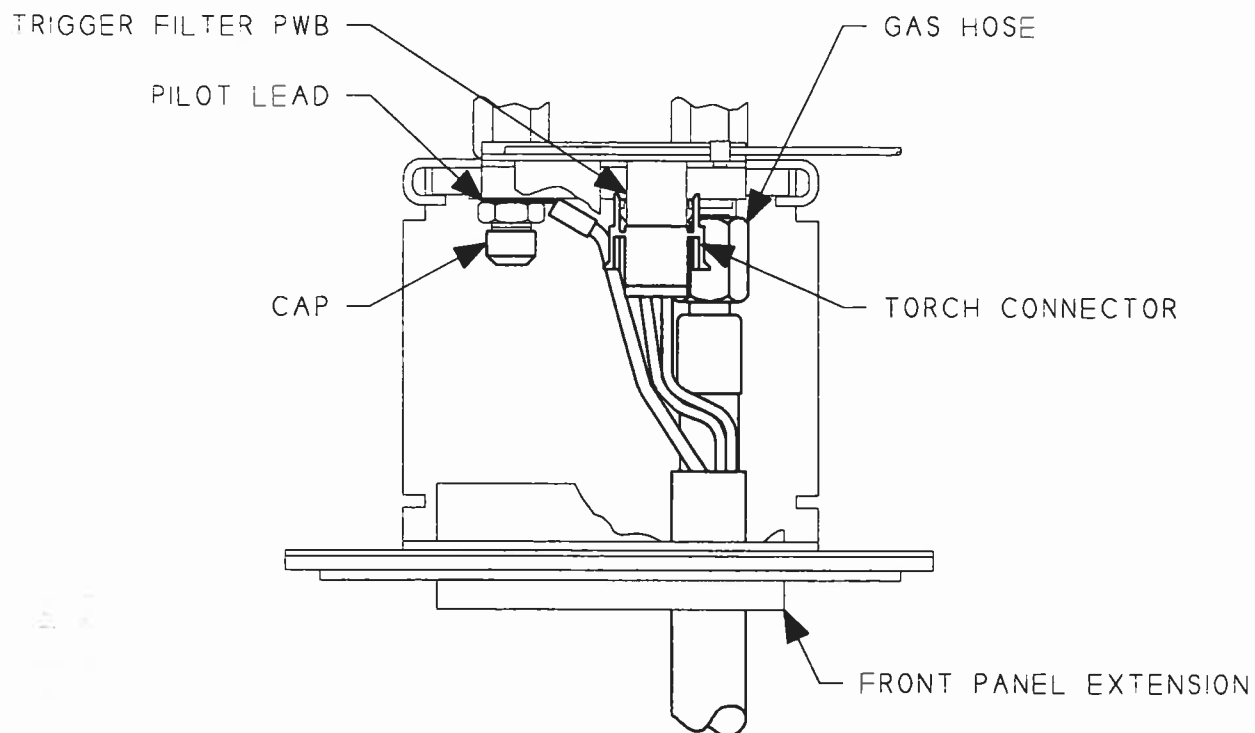


Figure 21 - PlasmaPLUS Hand Held Torch Installation

- G) Place the strain relief onto the remote trigger cable. Replace the screw from step F) using it to hold the strain relief. Make sure the strain relief prevents the remote trigger cable from being pulled out of the unit. **DO NOT OVER-TIGHTEN THIS SCREW TO PREVENT STRIPPING THE CHASSIS.**
- H) Replace the cover. Make sure that the front and rear panels are in the molded grooves in the cover.
- I) 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.

PlasmaPLUS HAND HELD TORCH INSTALLATION

DANGER

HIGH VOLTAGE IS PRESENT IN THE CONNECTOR BRACKET. DISCONNECT THE PRIMARY INPUT TO THE UNIT BEFORE PERFORMING ANY TORCH INSTALLATION STEPS.

Refer to Figure 21, "PlasmaPLUS Hand Held Torch Installation".

- A) Rotate quarter turn panel fasteners which hold the front panel extension to the tray assembly. **DO NOT TRY TO REMOVE THEM, they are captive door fasteners.**

- B) Slide the connector bracket out from the tray, exposing the enclosed fittings.
- C) Feed the gas hose, pilot return wire and trigger wires through the boot from the outside. Some PlasmaPLUS models have two holes instead of a boot, if so, use the right hand hole.
- D) Remove the manifold cap (with rubber gasket inside) and the nut and washers from the left side connector fitting. Connect the pilot lead to this fitting with the nut and washers just removed. Screw the cap back on.
- E) Connect the torch gas hose to the gas fitting on the right side connector fitting. Do not over tighten.
- F) Plug the trigger connector into the trigger filter board housing.
- G) Slide the connector bracket back into place and re-tighten the quarter turn panel fasteners.

NOTE

THE PROPER OPERATION OF YOUR TORCH DEPENDS ON THE PILOT ARC AND MAXIMUM CUTTING POWER DIP SWITCH SETTINGS. SEE YOUR PlasmaPLUS OPERATION MANUAL FOR A COMPLETE EXPLANATION OF THE PROPER PROCEDURE.

INSTALLATION

PlasmaPLUS MACHINE TORCH INSTALLATION

DANGER

HIGH VOLTAGE IS PRESENT IN THE CONNECTOR BRACKET. DISCONNECT THE PRIMARY INPUT TO THE UNIT BEFORE PERFORMING ANY TORCH INSTALLATION STEPS.

Refer to Figure 22, "PlasmaPLUS Machine Torch Installation".

- A) Rotate quarter turn panel fasteners which hold the front panel extension to the tray assembly. **DO NOT TRY TO REMOVE THEM**, they are captive door fasteners.
- B) Slide the connector bracket out from the tray, exposing the two torch connection fittings and the trigger filter board.
- C) Feed the remote trigger cable connector through the boot, or left side opening. Place the strain relief onto the cable about one inch from the connector on the end of the cable. Use the door stop screw to secure the strain relief as shown in the close up of Figure 22.
- D) Feed the gas hose, pilot return wire and trigger wires through the boot from the outside. Some PlasmaPLUS models have two holes instead of a boot, if so, use the right hand hole.

- E) Remove the manifold cap (with rubber gasket inside) and the nut and washers from the left side connector fitting. Connect the pilot lead to this fitting with the nut and washers you just removed. Screw the cap back on.
- F) Connect the torch gas hose to the gas fitting on the right side connector fitting. Do not over tighten.
- G) Connect the remote trigger pendant connector to one plug of the three-way connector. Next connect the torch parts-in-place connector to another plug of the three-way connector. Finally connect the remaining plug to the mating connector on the trigger filter PWB.

CAUTION

THE THREE WAY CONNECTOR MUST BE USED TO ENSURE SAFE OPERATION OF THE TRIGGER SWITCH AND TORCH PARTS-IN-PLACE CIRCUIT.

- H) Slide the connector bracket back into place and re-tighten the quarter turn panel fasteners.

NOTE

THE PROPER OPERATION OF YOUR TORCH DEPENDS ON THE PILOT ARC AND MAXIMUM CUTTING POWER DIP SWITCH SETTINGS. SEE YOUR PlasmaPLUS OPERATION MANUAL FOR A COMPLETE EXPLANATION OF THE PROPER PROCEDURE.

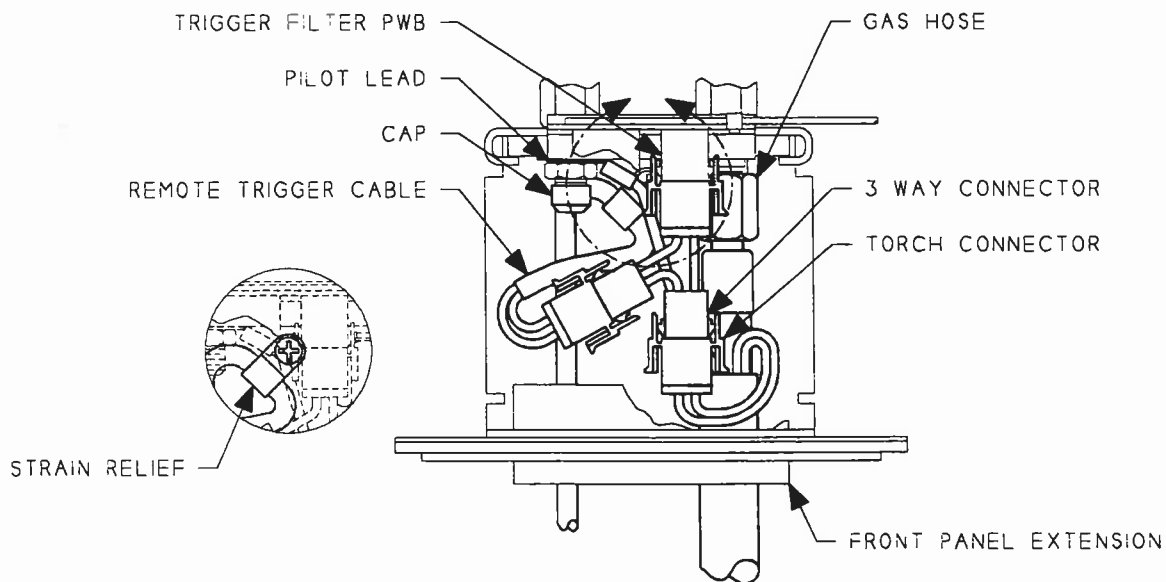


Figure 22 - PlasmaPlus Machine Torch Installation

OPERATION

OPERATION

HAND HELD CUTTING

See the OPERATION manual for your PAC power source before operating with the PT-90 series torch. This description covers only the basic operation of the torch. Before applying power to your PAC power source, check that the torch is installed correctly, and all connections are tight. Check that all consumables are installed; refer to the section "Consumables Parts Selection" to choose appropriate tips and electrodes. Also see the section "Consumable Parts Life and Replacement".

Be sure to observe the safety practices described in the SAFETY section of this manual and in the manual for your PAC power supply. Also be sure to follow those practices established at your place of business or job site.

When power is applied to the PAC power source, set the air pressure to the correct value. Make sure air is flowing through the torch and that the electrode and correct tip is installed when you make this adjustment. Most PAC units have a switch to allow for GAS SET mode. See Table 1 - "PT-80 and PT-90 Torch Specifications" for correct operating air pressures.

Next, hold the torch away from the workpiece and press the trigger; check if gas flows. Most PAC power sources allow several seconds after the trigger is pressed before piloting will begin. Check for a strong pilot arc to extend about 1/4" inch past the end of the tip.

With the trigger not engaged, position the torch over the workpiece, slightly off of the edge where the cut is to begin. Press the trigger and wait for the pilot, then slowly bring the torch over the workpiece and allow the pilot arc to touch the top edge of the workpiece. The pilot arc should then transfer to the workpiece and transferred arc cutting begins. Do not allow the tip to touch the workpiece

Cut with a slow steady motion to allow the plasma arc to cut the metal and blow the slag clear of the cut. Keep the standoff (or arc length) to approximately 1/8" to 1/4" maximum. Also, do not touch the tip to the workpiece or it will be damaged. If this happens, replace the tip.

To complete a cut, either move the torch off the workpiece or simply release the trigger. Most PAC units allow the air to continue to flow for several seconds after the trigger is released in order to cool the torch head.

If the required cut does not have an edge to begin a cut, it is possible to pierce most metals up to 1/2" or 3/4" (some experienced operators can pierce 1" mild steel). Choose a spot inside the scrap area to be removed and hold the torch almost parallel to the workpiece. While piloting, slowly raise the torch towards vertical, until transfer is achieved. When the transferred arc is first initiated, metal will splatter sideways and upwards, be sure to keep clear of this hot dross splatter. Slowly raise the torch vertically and allow the plasma arc to create a trench which will get deeper until the workpiece has been pierced. When you have gone through the workpiece, it is usually best to re-position yourself over the hole you have just pierced,

and begin cutting towards your marked line and complete the cut.

HAND HELD GOUGING

Another application for the PAC process is plasma arc gouging. Sometimes referred to as PAG or PAC gouging. PAC gouging has some advantages over carbon arc gouging such as less fumes and less rework preparation before welding. The main disadvantages are more passes may be required to remove the weld, and sometimes the size of the head limits access. But for simple butt welds or accessible fillet welds, PAC gouging can be very effective.

Check Table 1 - "PT-80 and PT-90 Torch Specifications" for the correct air pressure for gouging. Some experimentation with air pressure, cutting current setting and gouging orifice size selection may be necessary to get best results. The lower air pressure and the tapered orifice of the gouging tip together create a plasma column that is not long and straight, but rather shorter and more rounded. This allows material to be removed to a controlled, shallow depth instead of "digging into" the workpiece.

Follow the section preceding this, on "Hand Held Torch Cutting Operation" to check air pressure and correct pilot operation. The technique of gouging is similar to initiating piercing. Start with the torch at a shallow angle to the workpiece and press the trigger to initiate piloting. Raise the torch towards vertical if necessary to achieve a transferred arc, once the transfer is complete, lower the torch to a shallow angle (about 30 degrees from the workpiece).

Push the arc in front of the torch; as material is removed, allow the column to blow the material clear. A slight side to side motion can be used to remove a wider section of material. Several passes will be required to remove the necessary material. Any dross left on the surface of the workpiece is usually very loosely held and can be easily removed with a chipping hammer by sliding the flat edge over the workpiece.

MACHINE TORCH APPLICATION

Using a PT-90M machine torch is similar to hand held cutting. The most noticeable difference is the trigger switch which is a pendant on a remote cable. PowCon offers two different remote trigger pendants both in 25' and 50' lengths. The two types are Momentary and ON/OFF. Momentary pendants have one switch and it must be continuously pressed while operating the torch similar to a hand held torch. The other pendant has two switches, one ON, the other OFF. When the ON button is pressed, the trigger action will remain on until the OFF button is pressed.

When using the PT-90M, be sure to follow the instructions in the section on "Machine Torch Installation" or the appropriate StarCut or PlasmaPLUS machine torch

OPERATION

installation section. It is important to use the three way connector to properly connect the parts-in-place safety interlock circuitry and the remote trigger. To check if this is functioning, activate the trigger and check that gas flows correctly in response. Then remove the tip from the machine torch and again activate the trigger, if the gas does not flow, then the safety interlock is functioning.

Check that the standoff height set by the torch holding mechanism is correct: between 1/8" and 1/4". It is recommended to use a standard gas cup for machine torch application, so that the gas cup will not drag on the surface of the workpiece. Start with a relatively slow travel speed per the recommendations of the PAC power source manual. Make sure you are in pilot mode when the torch first approaches the edge of the workpiece so transfer will not occur in the middle of the workpiece. It is not recommended to pierce (or gouge) with a machine torch except on thin plate.

CONSUMABLE PARTS LIFE AND REPLACEMENT

NOTE

ALL GENUINE PowCon CONSUMABLES USE LEFT HAND THREADS

Parts considered as consumable in the PT-90 series torches are the tip and electrode, and also the gas cup and the gas cup "O" ring. Figure 23, "Consumables Removal and Installation", shows the consumables in the order they are removed. The gas cup and "O" ring should be inspected regularly for wear, the gas cup can be clearly seen while cutting and is generally charred by arc heat or from dross splatter if fiberglass, or shattered if alumina. The gas cup should be replaced if it does not cover the tip, as it will not direct cooling flow over the torch head if damaged.

Occasionally check the gas cup "O" ring for wear and if the gas cup does not remove easily, or if the gas cup does

not stay on, the "O" ring should be replaced. To replace the "O" ring, first remove the gas cup by sliding it off of the torch head with a gentle twisting motion. Then, use a small screwdriver or knife to pry the old "O" ring off. Place the new "O" ring onto the torch head sleeve and gently work it into the groove with your fingers. Do not use tools for this, as the "O" ring is made of rubber which can be easily knicked or cut.

A cutting tip can be used for over 50 feet of cutting if not damaged by dross splatter or touch down. The orifice opening is the first part of the tip to be destroyed. Some rounding of the outside face of the orifice end is normal, especially in pilot operation (more so in the PlasmaPLUS steady pilot mode). If cut quality becomes worse, or if 50 feet or more of cutting has been done, the inside of the orifice should be examined, as this is most critical in forming the plasma column.

To remove the tip, first slide off the gas cup. Next, using gloves, remove the tip with a clockwise motion. Refer to Figure 24, "Left Hand Thread Consumables", for a visual aid to remember the left hand threads used with all PowCon PAC consumables. When removing a tip or electrode, it may be useful to picture screwing a standard screw inward: this is the correct direction for removing a left hand thread consumable. When the tip has been removed, carefully inspect the inside of the orifice opening. Any deviation from a perfect circle is a sign of a secondary emission and the tip should be replaced. Some swirling emission marks on the inside of the tip is a normal sign of the capacitive discharge arc starter. Install the new tip with a counter-clockwise direction. Hand tighten tips only, avoid using wrenches with these parts.

The electrode is worn as the hafnium insert is slowly eroded. The hafnium insert is slightly over 1/8" deep into the electrode. The electrode does not need replacing until the hafnium is nearly removed, however, pilot or cut quality is sometimes degraded before the hafnium is completely gone, and the electrode may need to be replaced. Figure 25, "Electrode Wear" shows a cross section of electrode wear. An electrode can last four

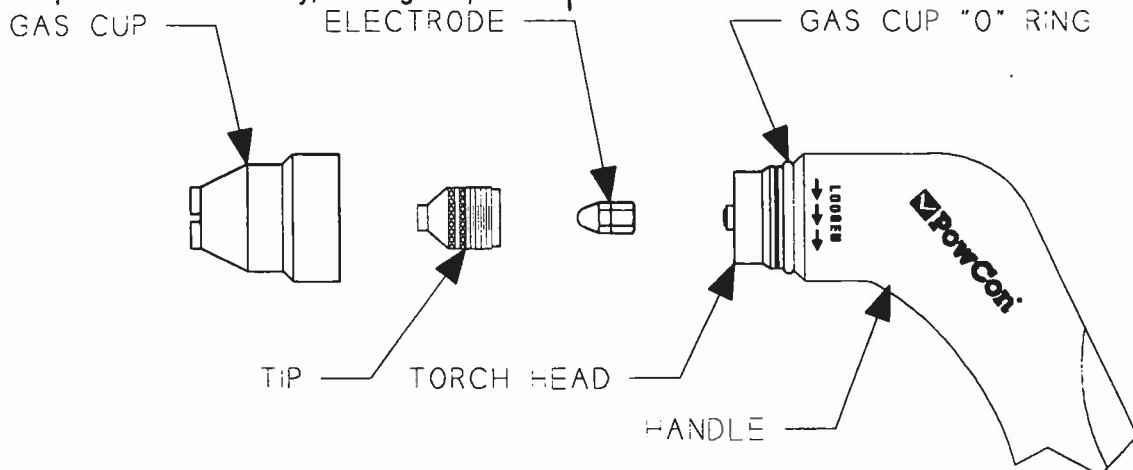


Figure 23 - Consumable Removal and Installation

OPERATION

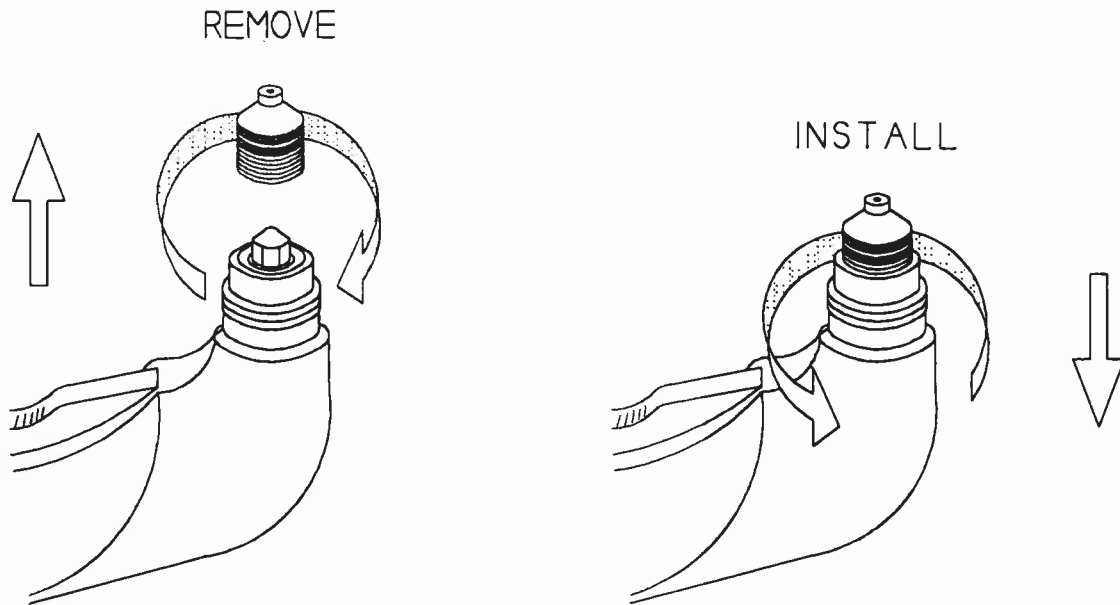


Figure 24 - Left Hand Thread Consumables

times as long as a tip in typical operation. Some discoloration or material build up on the electrode is normal, and also swirling emission marks on the copper body of the electrode are normal marks of the StarCut and PlasmaPLUS capacitive discharge arc starter.

To replace the electrode, first remove the gas cup and the tip and using only the electrode wrench provided with your parts kit, unscrew the electrode with a clockwise motion. Install the new electrode with a counter-clockwise motion until hand tight.

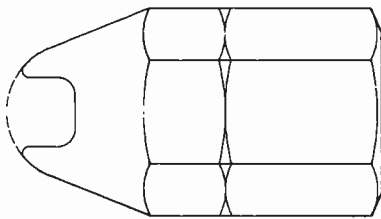


Figure 25 - Electrode Wear

TIP ORIFICE BLOWOUT

There are two reasons for the orifice of the tip to become deformed or blown out. First is touching the tip to the workpiece during transferred arc cutting, or during the transition from piloting to transferred arc cutting. Second occurs when a secondary arc emission from the tip to the workpiece forms momentary bluish clouds of light. This is called tip arcing or double arcing. No matter how the tip orifice becomes changed, any irregularity in the orifice will change the shape of the plasma column and cut

quality will be seriously degraded; the tip should be replaced.

Normally the tip is disconnected from any electrical circuit during cutting operation. However, if the tip is touched to the workpiece during cutting, the tip becomes the same potential as the workpiece and the arc from the electrode is attracted to the tip as well as to the workpiece. When this happens, the orifice is blown open to a much larger size. If the tip is in contact with the workpiece during the moment of transferring from pilot to cutting, the tip end may be completely removed.

Another way for the tip orifice to be damaged is for the plasma column to touch the tip during cutting. If this happens, a secondary arc path is created from the tip to the workpiece. This arc discharge is in the form of a bluish cloud between the face of the tip and workpiece. In normal operation, the shape of the column must be very tight and symmetric for the high energy plasma column to go through the tip orifice without touching it. If the hafnium insert is worn towards one edge of the electrode instead of from the center, this is a sign that the torch head is no longer concentric, and the torch head may need to be replaced. This condition can cause double arcing and short tip parts life. The size of the orifice is basically determined by the cutting current value, the greater the current, the greater the orifice must be. Table 2, "Cutting Tip Selection" gives recommended orifice sizes for current ranges. If double arcing occurs try the next size larger orifice, or turn the current control down on your PAC power source.

Other factors which may make double arcing worse are too low standoff height, poor air quality, mill scale or flaking paint on the workpiece, and too fast of travel speed while cutting. Standoff gas cups can be useful where it is difficult to control hand held standoff heights or for inexperienced operators.

MAINTENANCE

MAINTENANCE

TORCH

Plasma torches do not require any regular maintenance except for normal replacement of consumables. It is recommended that periodic inspections are made. A good rule of thumb would be to perform an inspection after completing a field job or at least once a month. Breaks or cracks in the handle, or bare wires showing through, abrasions, cuts or burns in the cable assembly, or any damage to the gas hose should be repaired immediately. Also check the parts-in-place slide valve for any damage to the outer surface where it touches the tip.

The following section on "Troubleshooting" and the section on "Repair/Refurbishment" may be useful in finding and fixing any problems you may have with your PT-90 series torch. A complete list of part numbers for replacement parts is available in the section "Parts List".

Machine torch repair is very similar to the hand held torch, notes are used where there are differences from the hand held torch.

TROUBLESHOOTING

No Response To Trigger Switch:

If nothing happens when the trigger is pressed, make sure you have installed the PT-90 torch correctly per instructions in your PAC power source manual. Also, check that the tip is installed in the torch and is screwed in completely. Visually check the torch leads and make sure there are no breaks in the lead cover which may be a sign of broken wires.

To determine if the torch is at fault, remove the torch from the PAC power source and use a DVM Ohm-meter to check torch trigger function. Connect the meter leads to the two pins on the torch trigger connector and press the trigger, if the meter reads between 0 and 10 ohms, the torch is operating correctly. If the meter reads open circuit, then the torch is faulty.

It is now necessary to find if the problem is in the torch head or in the leads. Remove the screws which hold the torch handles together, and separate the handles. Unplug the two wires which come from the trigger connector from the trigger and from the parts-in-place lead. Check torch lead continuity with your meter from the trigger wires near the torch head to the connectors at the power source end.

If the lead assembly is good, the torch head is at fault, it can be either the trigger switch or the parts-in-place pogo pins. Remove the other connector from the trigger switch and check the continuity of the trigger switch. Then check that the parts-in-place makes continuity between the two wires exiting the torch head. Make sure a tip is fully installed.

No Gas Flows:

If the PAC power source indicates that the trigger has been pressed, and nothing happens when the trigger is pressed, the torch may be blocked. This can be checked by unscrewing the gas hose from the PAC power source fitting, and leaving the trigger and pilot return attached. Being careful not to touch any bare metal inside the PAC unit, press the trigger momentarily and check if gas flows from the fitting inside the PAC unit. If the torch is blocked, remove the torch head following the procedure in the section "Repair/Refurbishment", and check if the torch head or the torch lead gas hose is blocked; replace as necessary.

Pilot Is Weak or No Pilot:

If pilot is weak, immediately check the condition of the tip and electrode, and replace to see if pilot improves.

If gas flow is unrestricted, but there is no pilot, look to see if any sparks are being created inside the orifice. BE CAREFUL NOT TO LOOK AT THE PILOT ARC WITHOUT AN APPROPRIATE FACE SHIELD. If no sparks at all are observed, the PAC power source may be at fault. If possible, use another torch to check if your unit is operating correctly.

If the pilot arc is still weak or does not exist, remove the torch from the PAC unit. Take the screws out which hold the handles together and separate the handle halves. Carefully check the pilot return wire where it attaches to the torch head, make sure that lead is not damaged or broken. Look for any signs of arc damage inside the handles and around the torch head. Replace as necessary.

If possible, check continuity of the pilot wire with a DVM from the sleeve to the pilot lug at the power source end of the leads. Also check continuity from the electrode to the gas hose connector at the power source end of the leads.

Cut Quality Is Poor

First, replace the tip, and then the electrode to see if cut quality improves. If not, check all operation parameters. Especially double check air pressure. When adjusting, make sure that air is flowing through the torch with all consumables installed. If necessary, try 5 or 10 PSI more or less than recommended to see if the cut improves.

Check also that all PAC connections are secure, especially the workpiece connection. Check that cutting current is sufficient and that travel speed and standoff are appropriate.

REPAIR/REFURBISHMENT

The PT-90 torch series is designed to be rugged enough for the tough plasma cutting/gouging environment. Should your torch be damaged, or if normal use requires refurbishment, replacement parts are available to bring your torch back to original condition. If you do not wish to service your torch, factory refurbished torches are

MAINTENANCE

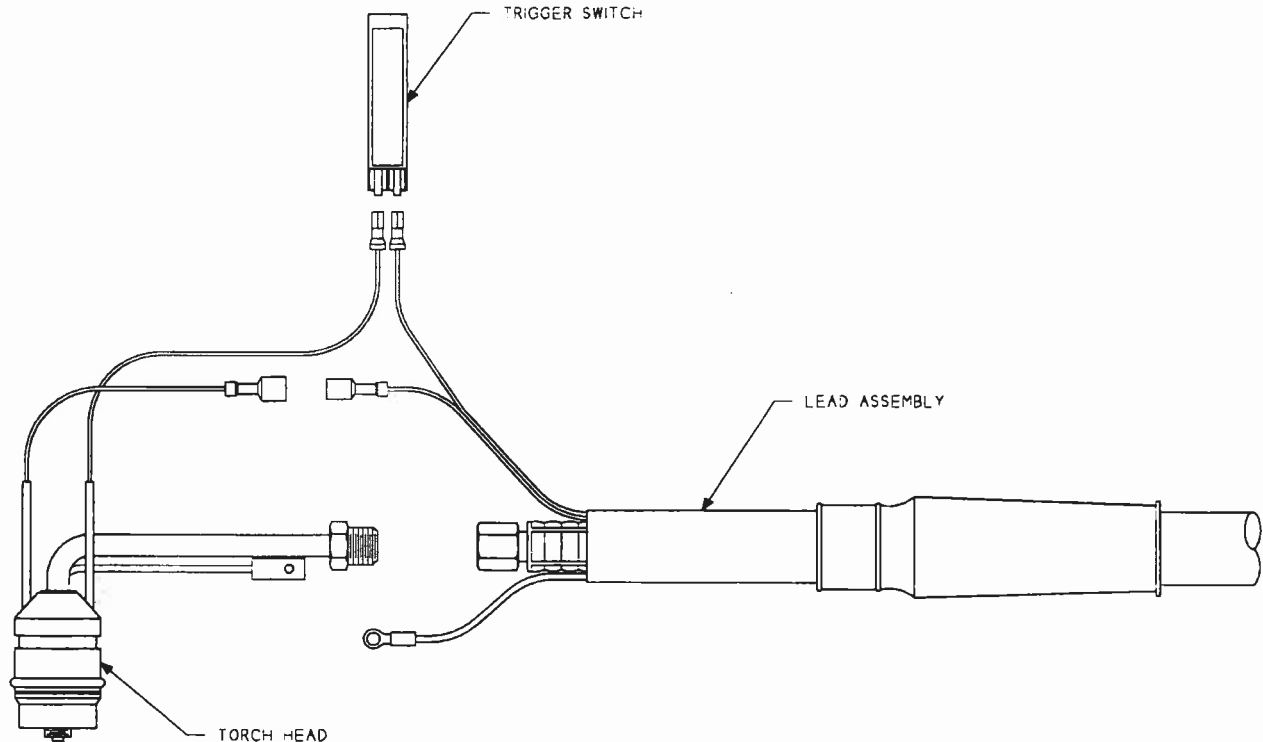


Figure 26 - Hand Held Repair/Refurbish

available. Contact your PowCon distributor or service center for more information.

Remove the torch from the PAC power source. Next, follow this procedure to disassemble the torch to the level necessary to replace the damaged component and to re-assemble the torch for use. Refer also, to the "Troubleshooting" section to help identify which components to replace.

Refer to Figure 26, "Hand Held Repair/Refurbish" and Figure 27, "Machine Torch Repair/Refurbish".

Handles and Trigger Switch Removal

Remove the screws which hold the handle halves together. Separate the handle halves. Replace if necessary. To replace the trigger switch, slide the switch out of the handle, unplug the two connectors and replace the switch. To remove the handle from a machine torch, first slide the barrel off of the handles.

Torch Head Removal (Boot Replacement)

With the handles separated, slide the head and the trigger switch out of the handle half. Disconnect the parts-in-place connectors from the trigger switch and the lead assembly. Machine torches have only the two parts-in-place wires attached directly to the lead assembly "trigger" wires. Next slide back the insulating sleeve from the pilot wire connection. Remove the small screw attaching the pilot wire to the torch head pilot lead.

Carefully cut away the heat shrink which covers the gas hose fitting where it connects to the torch body tube. Use one wrench (1/2") to hold the body tube fitting and use another (9/16") to unscrew the gas hose lead. If the boot is to be replaced, slide (or tear) the old boot off and carefully slide the new one onto the leads.

Torch Head Installation (Lead Replacement)

Your replacement head comes with a new piece of heat shrink to cover the exposed fittings of the body tube and gas hose. This is very important to prevent electrical shock from cutting and especially pilot voltages, as well as damage to the PAC power source.

Place the heat shrink over the body tube and use two wrenches to connect the new torch head to the gas hose. Tighten completely. Slide the heat shrink to cover this connection and use a heat shrink hot air gun to shrink the tube until it tightly covers the exposed fittings. A hot soldering iron can be used if a hot air gun is not available.

Attach the pilot lead from the torch head to the lug of the pilot lead from the lead assembly. Use the screw removed from the previous step. Re-attach the connection from the parts-in-place wire to the trigger wire of the lead assembly. Re-attach the connection from the other parts-in-place wire to the trigger switch. Re-attach the connection from the other trigger wire from the lead assembly to the trigger switch.

MAINTENANCE

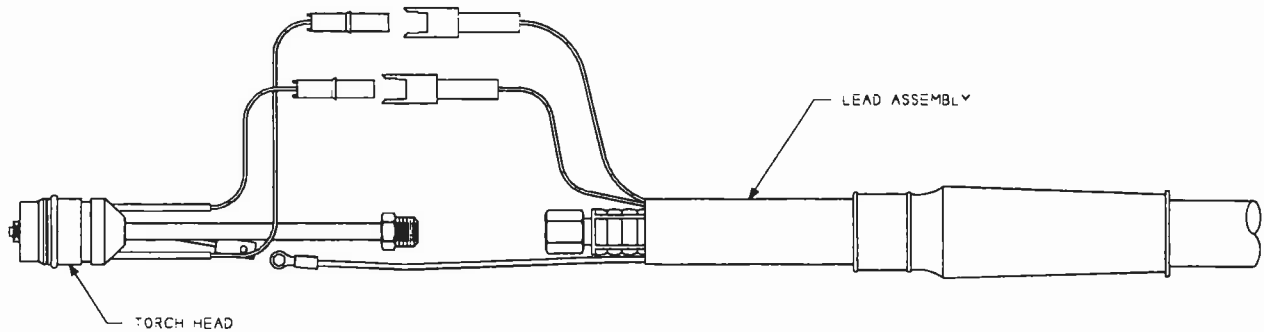


Figure 27 - Machine Torch Repair/Refurbish

Handle Replacement

Carefully examine your work to make sure there is no exposed metal from the gas hose or body tube. Reposition the torch head and trigger switch into one handle half. Make sure the ring in the handle seats in the groove of the sleeve. Neatly tuck the wires into the handle halves. Place the other handle half onto the torch and make sure that no wires are pinched when the handle halves come together. Replace and tighten all handle screws.

When trying your newly repaired or refurbished torch, carefully check function. Especially make sure that the parts-in-place circuitry is functioning by attempting trigger without a tip installed, make sure gas does not flow. Do not allow the torch to pilot without both tip and electrode installed.

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PARTS LIST

PARTS LIST

TORCHES

All torches listed below include two spare tips (.048 and .055), a fiberglass/metal standoff gas cup, as well as a copy of this manual. Refurbished torches are designated with an "R" following the part number such as 969007-002R

| PT-80 Torches | |
|---------------------------|-----------------------|
| PT-80 25' Hand Held Torch | 969007-882 |
| PT-80 50' Hand Held Torch | 969007-052 |

| PT-90 Torches | |
|--|------------|
| PT-90/90 25' Hand Held Torch | 969007-902 |
| PT-90/90 50' Hand Held Torch | 969007-952 |
| PT-90/75 25' Hand Held Torch | 969007-802 |
| PT-90/75 50' Hand Held Torch | 969007-852 |
| PT-90M 25' Machine Torch | 969007-202 |
| PT-90M 25' Machine Torch with Momentary Remote | 969007-203 |
| PT-90M 25' Machine Torch with ON/OFF Remote | 969007-204 |
| PT-90M 50' Machine Torch | 969007-252 |
| PT-90M 50' Machine Torch with Momentary Remote | 969007-253 |
| PT-90M 50' Machine Torch with ON/OFF Remote | 969007-254 |

PARTS LIST

CONSUMABLE PARTS

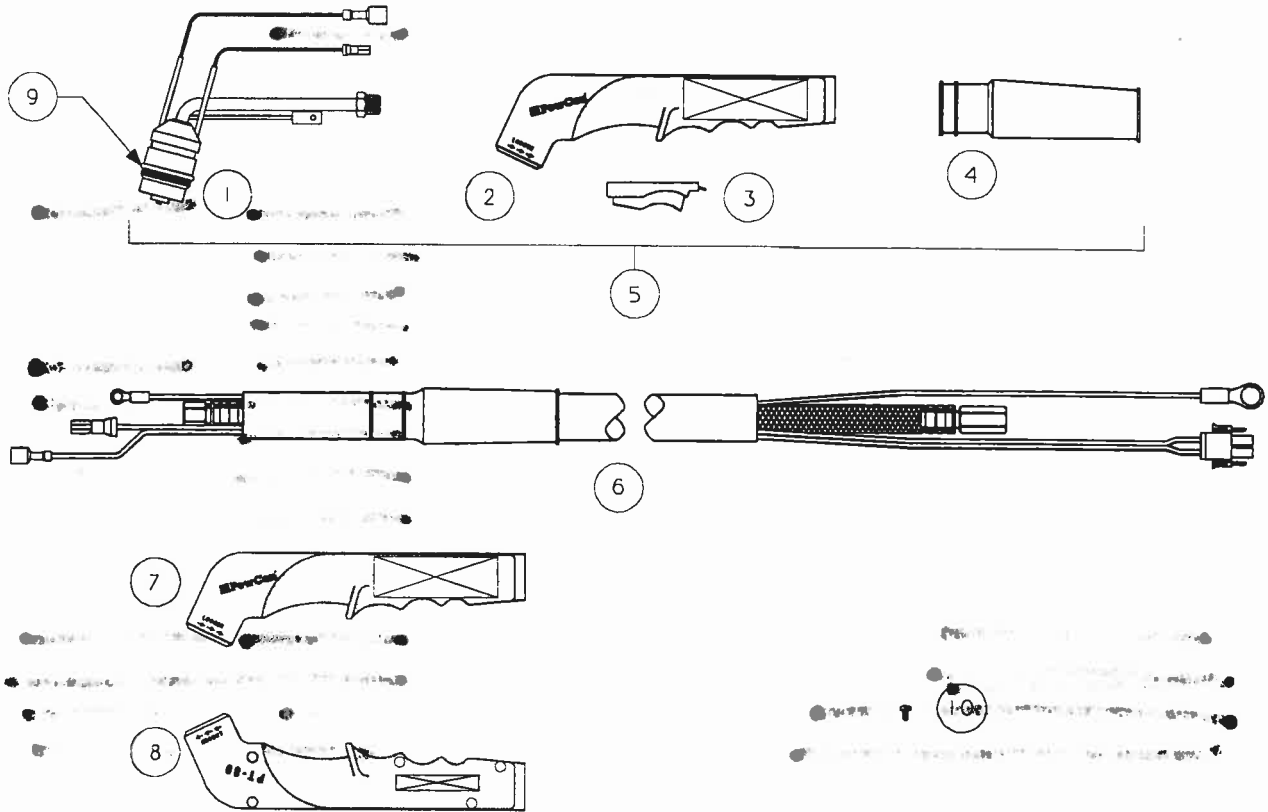
Note: All Genuine PowCon Consumable Electrodes And Tips Have Left-Hand Threads.

| Electrodes | BULK | 5-PACK |
|--------------------------------------|-----------------------|---------------|
| Electrodes | 969007-014 | 969007-511 |
| Electrode Wrench (1 1/32 Nut Driver) | 969007-016 | |

| Tips | BULK | 5-PACK |
|--|-----------------------|-----------------------|
| .040" Cutting Tips | 969007-010 | 969007-510 |
| .048" Cutting Tips | 969007-010 | 969007-519 |
| .055" Cutting Tips | 969007-012 | 969007-512 |
| .060" Cutting Tips | 969007-000 | 969007-560 |
| .060" Gouging Tips | 969007-020 | 969007-500 |
| .078" Gouging Tips | 969007-020 | 969007-500 |
| .093" Gouging Tips | 969007-030 | 969007-530 |
| .100" Gouging Tips | 969007-001 | 969007-531 |
| Sample Kit - 1 each .048" and .055" Cutting Tips | 969007-045 | |

| Gas Cups | BULK | 5-PACK |
|---|-----------------------|-----------------------|
| Standard Alumina Gas Cup | 969007-010 | 969007-510 |
| Standard Fiberglass Gas Cup | 969007-014 | 969007-514 |
| 1/16" Standoff Metal/Alumina Gas Cup | 969007-045 | 969007-545 |
| 1/8" Standoff Metal/Alumina Gas Cup | 969007-047 | 969007-547 |
| Standard Fiberglass Gas Cup | 969007-033 | 969007-533 |
| 1/16" Standoff Metal/Fiberglass Gas Cup | 969007-034 | 969007-534 |
| 1/8" Standoff Metal/Fiberglass Gas Cup | 969007-035 | 969007-535 |

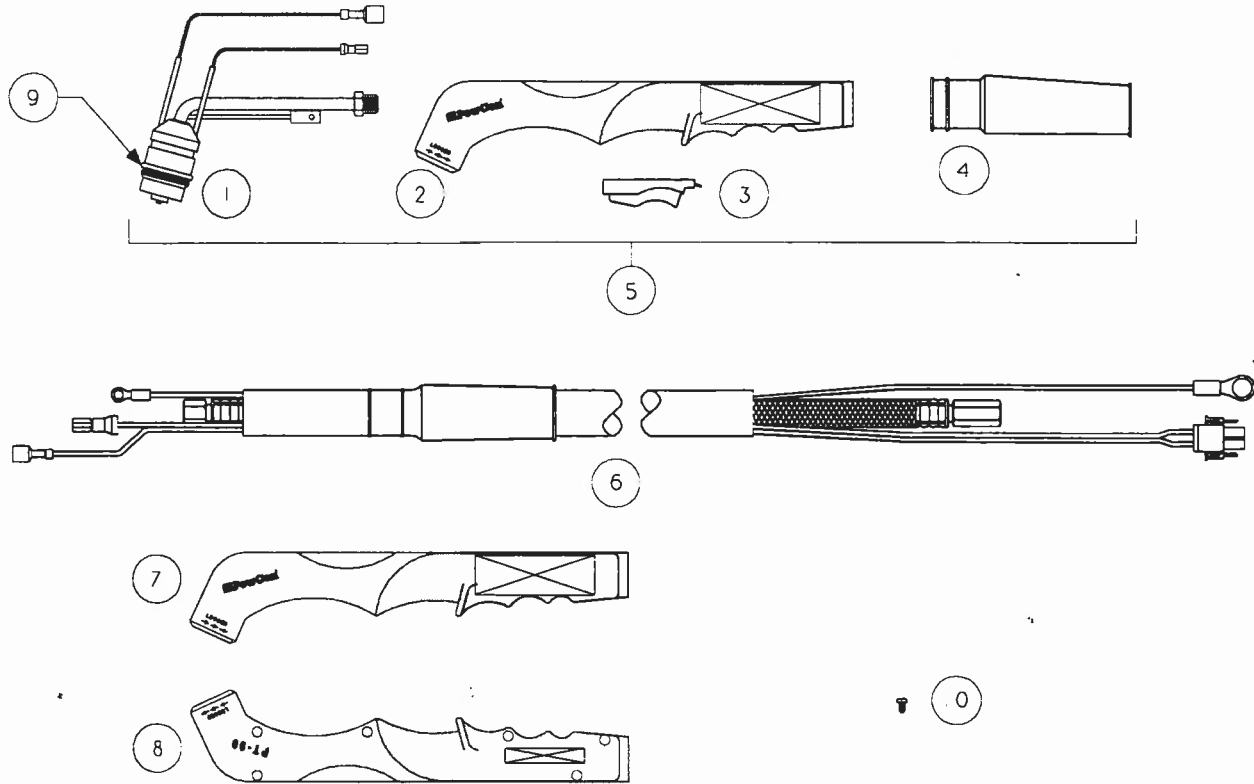
PARTS LIST



| Item No. | Description | Part Number |
|----------|---|-------------|
| 1 | PT-80 Torch Head with Gas Cup "O" Ring | 969007-039 |
| 2 | PT-80 Handle Assembly (contains items 7, 8, and 5 each of item 10) | 969007-022 |
| 3 | Trigger Switch | 969007-023 |
| 4 | Boot | 969007-006 |
| 5 | PT-80 Torch Body Assembly (contains items 1 thru 4) Assembled with Electrode, .055" Tip and Gas Cup | 969007-003 |
| 6 | 25' Lead Assembly | 969007-004 |
| | 50" Lead Assembly | 969007-054 |
| 7 | PT-80 Left Handle Half | 969007-008 |
| 8 | PT-80 Right Handle Half | 969007-007 |
| 9 | Gas Cup "O" Ring | 969007-010 |
| 10 | Handle Screw (5 required) | 970000-204 |

PT-80 Replacement Parts

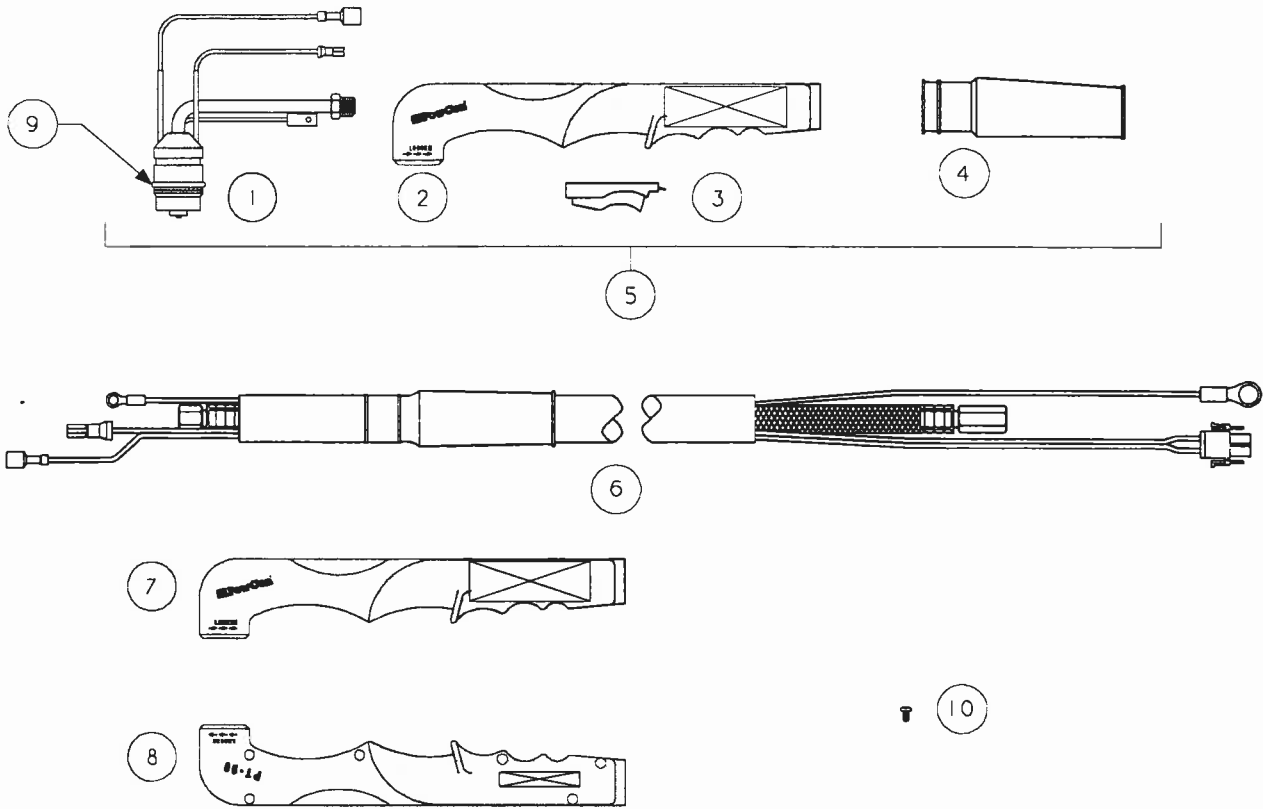
PARTS LIST



| Item No. | Description | Part Number |
|----------|---|-------------|
| 1 | PT-90/75 Torch Head with Gas Cup "O" Ring | 969007-039 |
| 2 | PT-90/75 Handle Assembly (contains Items 7, 8, and 6 each of Item 10) | 969007-822 |
| 3 | Trigger Switch | 969007-023 |
| 4 | Boot | 969007-006 |
| 5 | PT-90/75 Torch Body Assembly (contains items 1 thru 4) Assembled with Electrode, .055" Tip and Gas Cup | 969007-803 |
| 6 | 25' Lead Assembly | 969007-004 |
| | 50" Lead Assembly | 969007-054 |
| 7 | PT-990/75 Left Handle Half | 969007-808 |
| 8 | PT-90/75 Right Handle Half | 969007-807 |
| 9 | Gas Cup "O" Ring | 969007-010 |
| 10 | Handle Screw (6 required) | 970000-204 |

PT-90/75 Replacement Parts

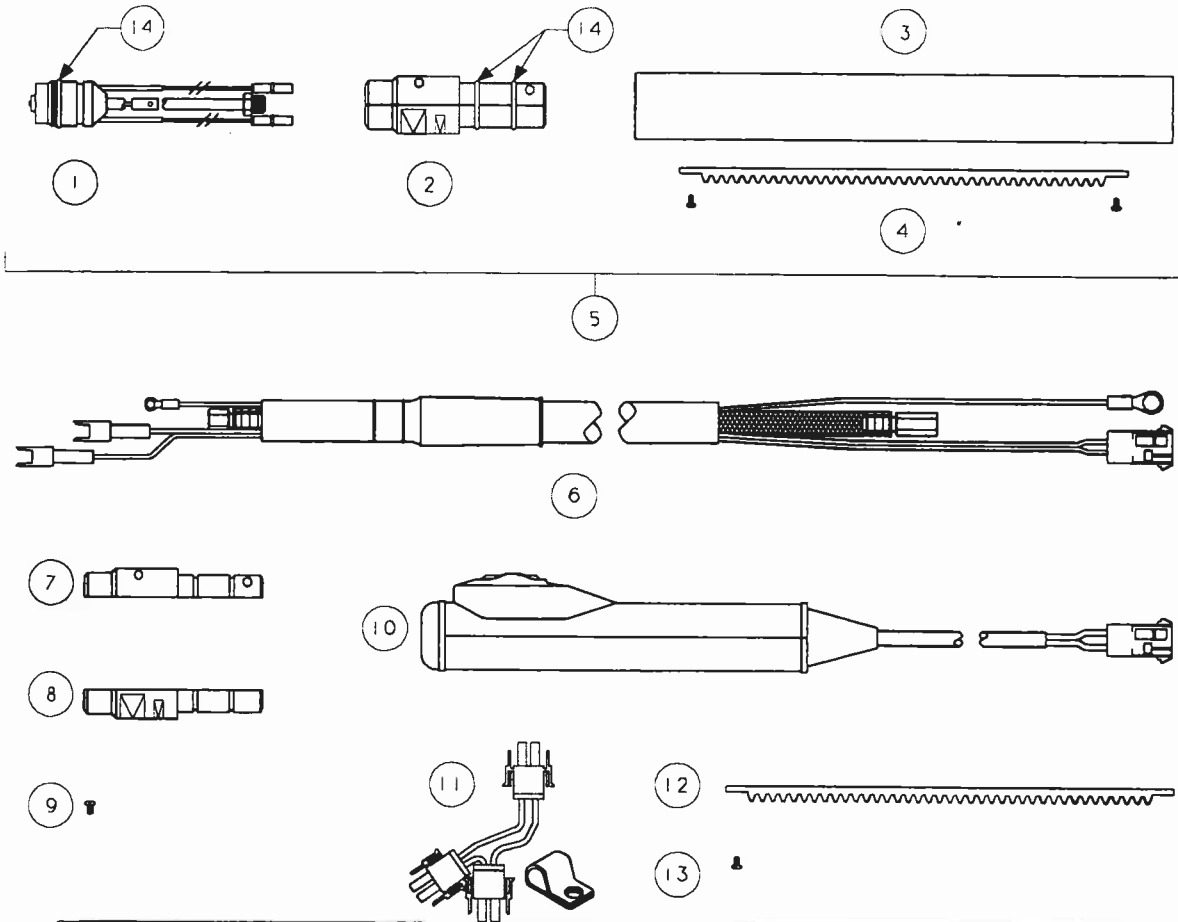
PARTS LIST



| Item No. | Description | Part Number |
|----------|---|-------------|
| 1 | PT-90/90 Torch Head with Gas Cup "O" Ring | 969007-939 |
| 2 | PT-90/90 Handle Assembly (contains Items 7, 8, and 6 each of Item 10) | 969007-922 |
| 3 | Trigger Switch | 969007-023 |
| 4 | Boot | 969007-006 |
| 5 | PT-90/90 Torch Body Assembly (contains items 1 thru 4) Assembled with Electrode, .055" Tip and Gas Cup | 969007-903 |
| 6 | 25' Lead Assembly | 969007-004 |
| | 50" Lead Assembly | 969007-054 |
| 7 | PT-90/90 Left Handle Half | 969007-908 |
| 8 | PT-90/90 Right Handle Half | 969007-907 |
| 9 | Gas Cup "O" Ring | 969007-010 |
| 10 | Handle Screw (6 required) | 970000-204 |

PT-90/90 Replacement Parts

PARTS LIST



| Item No. | Description | Part Number |
|----------|---|-------------|
| 1 | PT-90M Torch Head with Gas Cup "O" Ring | 969007-239 |
| 2 | PT-90M Handle Assembly (contains Items 7, 8, 2 each of Item 9 and 2 each of Item 14) | 969007-213 |
| 3 | Barrel | 969007-212 |
| 4 | Standard Rack (32 Pitch) with Screws | 969007-211 |
| 5 | PT-90M Torch Body Assembly (contains items 1 thru 4) Assembled with Electrode, .055" Tip and Gas Cup | 969007-205 |
| 6 | 25' Machine Torch Lead Assembly | 969007-206 |
| | 50" Machine Torch Lead Assembly | 969007-256 |
| 7 | PT-90M Left Handle Half | 969007-208 |
| 8 | PT-90M Right Handle Half | 969007-207 |
| 9 | Handle Screw (2 required) | 970000-204 |
| 10 | 25' Momentary Trigger Pendant | 969007-301 |
| | 50' Momentary Trigger Pendant | 969007-351 |
| | 25' ON/OFF Trigger Pendant | 969007-302 |
| | 50' ON/OFF Trigger Pendant | 969007-352 |
| 11 | Three-way Connector with Strain Relief | 969007-325 |
| 12 | Optional Rack 24 Pitch with Screws | 969007-210 |
| 13 | Rack Screws (2 Required) | 969007-209 |
| 14 | Gas Cup and Barrel "O" Ring | 969007-010 |

PT-90M Replacement Parts

PARTS LIST

PARTS KITS

| 969007-101 80 Amp Cutting Parts Kit - Mixed Gas Cups | | |
|---|------|------------|
| Electrodes | 5 ea | 969007-011 |
| .055" Cutting Tip | 5 ea | 969007-012 |
| Standard Alumina Gas Cup | 1 ea | 969007-013 |
| Standoff Alumina Gas Cup | 1 ea | 969007-014 |
| Standard Fiberglass Gas Cup | 1 ea | 969007-033 |
| 1/8" Standoff Metal/Fiberglass Gas Cup | 1 ea | 969007-035 |
| Electrode Wrench | 1 ea | 969007-016 |
| "O" Ring for Gas Cup | 3 ea | 969007-010 |

| 969007-102 60 Amp Cutting Parts Kit - Mixed Gas Cups | | |
|---|------|------------|
| Electrodes | 5 ea | 969007-011 |
| .048" Cutting Tip | 5 ea | 969007-019 |
| Standard Alumina Gas Cup | 1 ea | 969007-013 |
| Standoff Alumina Gas Cup | 1 ea | 969007-014 |
| Standard Fiberglass Gas Cup | 1 ea | 969007-033 |
| 1/8" Standoff Metal/Fiberglass Gas Cup | 1 ea | 969007-035 |
| Electrode Wrench | 1 ea | 969007-016 |
| "O" Ring for Gas Cup | 3 ea | 969007-010 |

| 969007-005 80 Amp Cutting Parts Kit - Alumina Gas Cups | | |
|---|------|------------|
| Electrodes | 5 ea | 969007-011 |
| .055" Cutting Tip | 5 ea | 969007-012 |
| Standard Alumina Gas Cup | 3 ea | 969007-013 |
| Standoff Alumina Gas Cup | 3 ea | 969007-014 |
| Electrode Wrench | 1 ea | 969007-016 |
| "O" Ring for Gas Cup | 3 ea | 969007-010 |

| 969007-105 60 Amp Cutting Parts Kit - Alumina Gas Cups | | |
|---|------|------------|
| Electrodes | 5 ea | 969007-011 |
| .048" Cutting Tip | 5 ea | 969007-019 |
| Standard Alumina Gas Cup | 3 ea | 969007-013 |
| Standoff Alumina Gas Cup | 3 ea | 969007-014 |
| Electrode Wrench | 1 ea | 969007-016 |
| "O" Ring for Gas Cup | 3 ea | 969007-010 |

PARTS LIST

| 969007-107 80 Amp Cutting and Gouging Parts Kit - Mixed Gas Cups | | |
|---|------|------------|
| Electrodes | 5 ea | 969007-011 |
| .055" Cutting Tip | 5 ea | 969007-012 |
| .093" Gouging Tip | 2 ea | 969007-030 |
| Standard Alumina Gas Cup | 1 ea | 969007-013 |
| Standoff Alumina Gas Cup | 1 ea | 969007-014 |
| Standard Fiberglass Gas Cup | 1 ea | 969007-033 |
| 1/8" Standoff Metal/Fiberglass Gas Cup | 1 ea | 969007-035 |
| Electrode Wrench | 1 ea | 969007-016 |
| "O" Ring for Gas Cup | 3 ea | 969007-010 |

| 969007-108 80 Amp Machine Cutting Parts Kit - Mixed Gas Cups | | |
|---|------|------------|
| Electrodes | 5 ea | 969007-011 |
| .048" Cutting Tip | 2 ea | 969007-019 |
| .055" Cutting Tip | 3 ea | 969007-012 |
| Standard Alumina Gas Cup | 3 ea | 969007-013 |
| Standard Fiberglass Gas Cup | 1 ea | 969007-033 |
| Electrode Wrench | 1 ea | 969007-016 |
| "O" Ring for Gas Cup | 3 ea | 969007-010 |

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