

MAX42

Plasma Arc Cutting System

***Instruction Manual
800850 - Rev. 6***

HYPERTHERM[®]


MAX42[®]
Plasma Arc Cutting System

Instruction Manual
IM-85
(P/N 800850)

for systems beginning with serial number
MX42-8553

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ATTENTION



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WARRANTY

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SAFETY

INTRODUCTION

Abbreviated safety precautions are printed on the power supply.

Before using the plasma arc cutting equipment (including compressed gas), each person operating, maintaining or supervising the use of this equipment must read the following safety instructions.

NOTES, CAUTIONS & WARNINGS

Throughout this manual, notes, cautions, and warnings are used to describe situations that require additional information. The following formats are used for each:

Notes: A note offers additional information, such as an operating tip, that aids the user in operating the plasma system.

Caution: A caution describes a situation that may cause damage to the plasma system and offers advice to avoid or rectify the situation.



WARNING



A warning describes a situation that presents a physical danger to the operator, and offers advice to avoid or rectify the situation. Each type of warning displays an applicable danger symbol, ie. fire, explosion, electrical shock, etc.

WARNING - INSTANT-ON TORCHES



WARNING



The PAC121 hand-held torches and machine torch are instant-on torches. These torches fire (produce a plasma arc) immediately after torch switch closure or remote switch closure for a machine torch. Always hold the hand torch away from your body as a precaution against accidental torch firing. Be aware of this hazardous potential, failure to do so can result in serious bodily injury.

The PAC121T torch with safety trigger allows an operator the ability to safely handle the torch before and after the cut and to minimize the possibility of accidental torch firing.

WARNING

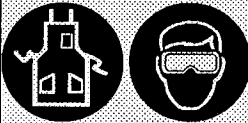


ELECTRIC SHOCK CAN KILL.

- Do not touch live electrical parts.
- Keep all panels and covers in place when the machine is connected to a power source.
- Insulate yourself from work and ground: wear insulating gloves, shoes and clothing.
- Keep gloves, shoes, clothing, work area, torch, and this machinery dry.



EXPLOSION WILL RESULT IF PRESSURIZED CONTAINERS ARE CUT.



ARC RAYS CAN INJURE EYES AND BURN SKIN.

- Wear correct eye and body protection.



NOISE CAN DAMAGE HEARING.

- Wear correct ear protection.



FUMES AND GASES CAN INJURE YOUR HEALTH.

- Keep your head out of the fumes.
- Provide ventilation, exhaust at the arc, or both to keep the fumes and gases from your breathing zone and the general area.
- If ventilation is inadequate, use an approved respirator.



HEAT, SPLATTER AND SPARKS CAUSE FIRE AND BURNS.

- Do not cut near combustible material.
- Do not cut containers that have held combustibles.
- Do not have on your person any combustibles such as a butane lighter or matches.
- Pilot arc can cause burns. Keep the torch nozzle away from yourself and others when the switch is depressed.
- Wear correct eye and body protection.

SAFETY


SAFETY INSTRUCTIONS

Burn Prevention

Eye Safety

To protect eyes against burns caused by high-intensity ultraviolet light, sparks and hot metal:

- Wear dark safety glasses/goggles with side shields or a welding helmet. Refer to the chart below for recommended lens shades:

<u>Arc Current</u>		<u>Shield Shade</u>
Up to 100 Amps		Shade No. 8
100 - 200 Amps		Shade No. 10
200 - 400 Amps		Shade No. 12
Over 400 Amps		Shade No. 14

- Replace the glasses/goggles or helmet when the shield becomes pitted or broken.
- Warn other people in the area not to look directly at the arc unless they wear a glasses/goggles or helmet.
- Prepare the cutting area in a manner that reduces the reflection and transmission of ultraviolet light:
 - Paint walls and other surfaces with dark colors to reduce reflection.
 - Install protective screens or curtains to reduce ultraviolet transmission.

Skin Safety

To protect skin against burns caused by high-intensity ultraviolet light, sparks and hot metal:

- Wear protective clothing:
 - Gauntlet gloves, safety shoes and hat.
 - Flame-retardant clothing which covers all exposed areas.
 - Cuffless trousers to prevent entry of sparks and slag.
- Hold any hand torch away from your body when pressing the start button because the pilot arc will come on immediately.

- Do not touch the front of the torch when starting it. After cutting, allow time for the front of the torch to cool.

Toxic Fume Prevention



To protect against the danger of toxic fumes which may be produced during cutting:

- Keep the cutting area well-ventilated.
- Remove all chlorinated solvents from the cutting area before cutting. Certain chlorinated solvents decompose when exposed to ultraviolet radiation to form phosgene gas.
- Wear proper breathing mask when cutting galvanized metal and use proper ventilation.
- Do not cut containers with toxic materials inside or containers that have held toxic materials. Clean such containers thoroughly before cutting.



WARNING



Do not cut metal or painted metals containing zinc, lead, cadmium or beryllium unless the operator, or anyone else subjected to the fumes, is wearing respiratory equipment or an air-supplied helmet.

Fire Prevention



Cutting with a plasma system produces hot metal, sparks and slag. Take the following precautions against fire:

- Make fire extinguishers available in the cutting area.
- Remove combustible material from the immediate cutting area to a distance of at least 35 feet (10 meters):
- Quench freshly cut metal or allow metal to cool before handling it or bringing it into contact with combustible materials.
- Never use a plasma system to cut containers with potentially flammable materials inside. Such containers must be thoroughly cleaned prior to cutting.

SAFETY

- Ventilate potentially flammable atmospheres before cutting with a plasma system. Never operate the plasma system in an atmosphere which contains heavy concentrations of dust, flammable gas or combustible liquid vapors.

Electric Shock Prevention



All Hypertherm plasma systems use high voltage (up to 300 VDC) to initiate the plasma arc. Take the following precautions when operating the plasma system:

- Keep your body and clothing dry.
- Do not stand in, sit on or lie on any wet surface when using the plasma system.
- Maintain proper insulation against electrical shock. If you must work in or near a damp area, use extreme caution. Wear insulated gloves and boots.
- Provide a wall-mounted disconnect switch with proper size fuses close to the power supply. This switch allows the operator to turn the power supply off quickly in an emergency situation.
- Conform to all local electrical codes for primary wiring sizes and types.
- Inspect the primary power cord frequently for damage or cracking of the cover. **Bare wiring can kill.** Do not use the system with a damaged power cord. If a power cord is damaged, replace it immediately.
- Inspect the torch leads. Replace if frayed or damaged.
- Never operate the plasma system unless the power supply unit covers are in place. Exposed power supply connections present a severe electrical hazard.
- Do not pick up the workpiece, including the waste cutoff, while you cut. Leave the workpiece in place or on the workbench with the work cable attached at all times.
- Before changing the torch parts, disconnect the main power or unplug the power supply. After changing the torch parts and returning the retaining cap to its operating position, plug the power supply in again.
- Never bypass or shortcut the safety interlocks.
- Before removing a power supply cover for maintenance, disconnect the main power at the wall disconnect switch or unplug the power supply. To avoid exposure to severe electrical hazard, wait five minutes after disconnecting the main power to allow capacitor discharge to occur.

Explosion Prevention



WARNING



The plasma system uses compressed gas. Proper precautions must be observed when handling and using compressed gas equipment and cylinders. Refer to the Standards Index in this manual.

When cutting with the plasma system:

- Do not cut in atmospheres containing explosive dust or vapors.
- Do not cut pressurized cylinders or any closed container.

Pressure Regulators

- Maintain all pressure regulators in proper working condition. Faulty regulators can cause damage or operator injury and must be serviced by trained repair technicians.
- Never use a regulator for any gas other than that for which it is intended.
- Never use a regulator that leaks, creeps excessively or is physically damaged in any way.
- Never attempt to lubricate a regulator with oil or grease.

Compressed Gas Cylinders

- Handle and use compressed gas cylinders in accordance with safety standards published by the Compressed Gas Association (CGA), American Welding Society (AWS) and Canadian Standards Association (CSA).
- Never use a cylinder that leaks or is physically damaged.
- Never use a cylinder that is not upright and secured in place.
- Never move or transport a cylinder without the protective valve cover in place.
- Never use a gas cylinder or its contents for any purpose other than that for which it is intended.
- Never lubricate cylinder valves with oil or grease.

SAFETY

- Never allow electrical contact between the plasma arc and a cylinder.
- Never expose cylinders to excessive heat, sparks, slag or open flame.
- Never use hammers, wrenches or other tools to open stuck cylinder valves.

Hoses

Label and color-code all gas hoses in order to clearly identify the type of gas in each hose. Consult applicable national or local codes.

- Never use the oxygen hose for any gas other than oxygen.
- Replace hose that is damaged by physical abuse or by sparks, heat or open flame.
- Lay hose out straight to prevent kinks.
- Coil excess hose and place it out of the way to prevent damage and to eliminate tripping danger.
- Examine hoses at regular intervals for leaks, wear, loose connections or other hazard.
- Keep hose lengths to a minimum to prevent damage, reduce pressure drop and to prevent possible volume flow restriction.

Grounding

Before operating the plasma system:

Input Power

- Be sure the power cord is plugged into a properly grounded outlet or that the power cord ground wire is properly connected to the ground in the disconnect box.
- If installation of the plasma system involves connecting the power cord to the power supply, ensure that the power cord ground wire is properly connected. Conform to CSA standards by placing the power cord ground wire on the stud first; then place the other wires on top of the power cord ground. Fasten the retaining nut tightly.
- Make sure that all electrical connections are tight to avoid excessive heating.

Work Table

- Clamp the work cable with good metal-to-metal contact to the workpiece (not the portion that will fall away) or to the work table.

Work Table

- Connect the work table to a good earth ground. Consult the U.S. National Electrical Code, Article 250, Section H *Grounding Electrode System*, or other appropriate national or local codes.

For additional information, refer to the *Standards Index* in this manual.

SAFETY REMINDERS

- All Hypertherm torches are designed with a safety interlock, which turns off the power supply when the retaining cap is loosened.
- Never bypass or shortcut the safety interlocks on any of the plasma system units.
- Never operate the plasma system with any of its covers not in place. This would be hazardous to the operator and other people in the area, and prevents the proper cooling of the equipment.
- Each Hypertherm plasma system is designed to be used only with specific Hypertherm torches. Do not substitute other torches which could overheat and present a potentially dangerous situation to the operator and any personnel in the area.

STANDARDS INDEX

The *Standards Index* contains a list of publications dealing with plasma arc cutting equipment safety practices. For additional information, refer to this *Standards Index*.

Section 1-B SÉCURITÉ

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SÉCURITÉ

INTRODUCTION

Des consignes de sécurité condensées sont imprimées sur l'appareil du MAX42. En outre, il est impératif que chaque personne qui utilise, entretient ou surveille l'emploi de cet appareil lise les instructions suivantes.

NOTES, PRÉVENTION ET AVERTISSEMENT

À travers ce manuel, des indications de prévention sont utilisées pour décrire des situations qui nécessitent de l'information supplémentaire. Les formats suivant sont utilisé pour:

Notes: Une note offre de l'information supplémentaire comme des modes d'emploi qui permettent d'utiliser le MAX42.

Prévention: Un signe de prévention décrit une situation qui risquerait d'endommager le MAX42, et indique comment éviter ou rectifier la situation.



AVERTISSEMENT



Un signe d'avertissement décrit une situation qui présente un danger à l'opérateur, et permet d'éviter ou rectifier ce problème. Chaque type de danger produit un signe correspondant, comme le feu, l'explosion, le choc électrique, etc.

AVERTISSEMENT



LES CHOCs ÉLECTRIQUES PEUVENT ÊTRE MORTELS.



- Ne pas toucher les pièces électriques sous tension.
- Les panneaux et les couvercles de protection doivent être en place lorsque la machine est raccordée au réseau.
- S'isoler de la pièce à couper et du sol en portant des gants, des chaussures et des habits isolants.
- Garder au sec les gants, les chaussures, les habits, la zone de travail et l'appareil.



RISQUE D'EXPLOSION SI ON COUPE DES RÉSERVOIRS SOUS PRESSION.



RISQUE DE BRÛLURES AUX YEUX ET À LA PEAU PAR LE RAYONNEMENT DE L'ARC.

- Porter des protecteurs pour les yeux et pour le corps.



LE BRUIT PEUT ENDOMMAGER L'OUÏE.

- Porter des protecteurs auditifs appropriés.



LES VAPEURS ET LES GAZ PEUVENT ÊTRE TOXIQUES.

- Éloigner le visage des vapeurs.
- Prévoir une ventilation et(ou) une évacuation à proximité de l'arc pour éliminer les vapeurs et gaz de la zone de travail et de ses abords.
- Si la ventilation est inefficace, utiliser un appareil respiratoire agré.



LA CHALEUR, LES PROJECTIONS DE MÉTAL ET LES ÉTINCELLES PEUVENT PROVOQUER DES INCENDIES ET DES BRÛLURES.

- Ne pas couper à proximité de matières inflammables.
- Ne pas couper des récipients ou réservoirs ayant servi à des produits inflammables.
- Ne pas porter sur soi des objets (briquets à gaz, allumettes) ou vêtements inflammables.
- L'arc pilote peut causer des brûlures. Éloigner la buse de la torche de soi-même et des autres lorsque l'interrupteur est enclenché.
- Porter des protecteurs appropriés pour les yeux et le corps.

SÉCURITÉ


CONSIGNES DE SÉCURITÉ

Prévention des brûlures

Protection des yeux

Pour se protéger les yeux des brûlures que peuvent causer le rayonnement ultraviolet de forte intensité, les étincelles et le métal brûlant:

- Porter des lunettes de sécurité à verres teintés munies d'écrans latéraux. Le tableau ci-dessous indique les pouvoirs obscurcissants recommandés pour les verres.

<u>Courant</u>		<u>Pouvoir obscurcissant des verres</u>
Jusqu'à 100 A		No. 8
100 - 200 A		No. 10
200 - 400 A		No. 12
Plus de 400 A		No. 14

- Remplacer les lunettes quand les verres sont brisés ou endommagés.
- Avertir les autres personnes se trouvant dans l'endroit de travail de ne pas regarder directement l'arc, à moins de porter des lunettes à verres teintés.
- Préparer l'endroit de travail de façon à réduire la réflexion et la transmission du rayonnement ultraviolet:
 - Peindre les murs et autres surfaces de couleur foncée pour réduire la réflexion.
 - Installer des écrans et des rideaux protecteurs pour réduire la transmission du rayonnement ultraviolet.

Pour protéger la peau des brûlures que peuvent causer le rayonnement ultraviolet à haute intensité, les étincelles et le métal brûlant:

Protection de la peau

- Porter des habits de sécurité:
 - Des gants à crêpe et des chaussures et un casque de sécurité.
 - Des habits en tissu ignifuge couvrant toutes les parties du corps qui sont exposées.
 - Un pantalon sans revers pour éviter que des étincelles ou des scories puissent s'y loger.

- Éloigner la torche du corps à l'amorçage. L'arc pilote jaillit aussitôt que l'on appuie sur le bouton d'amorçage.
- A l'amorçage, ne pas toucher l'extrémité de la torche. Après le coupage, laisser l'extrémité de la torche se refroidir.

Vapeurs toxiques



Pour se protéger contre les vapeurs toxiques qui peuvent éventuellement se dégager lors du coupage:

- Tenir l'endroit de travail bien aéré.
- Enlever avant le coupage tous les solvants chlorés de l'endroit de coupage. Certains solvants chlorés se décomposent sous l'effet du rayonnement ultraviolet et forment du phosgène.
- Porter un masque approprié lors du coupage de métaux galvanisés, et s'assurer à ce que la ventilation soit efficace.
- Ne pas couper de réservoirs contenant ou ayant servi à des matières toxiques. Nettoyer soigneusement les réservoirs avant le coupage.



AVERTISSEMENT



Ne pas couper de métaux ni de métaux peints qui contiennent zinc, plomb, cadmium ou béryllium, à moins que l'utilisateur et toute personne exposée au vapeurs ne portent un appareil respiratoire ou un casque ventilé.

Prévention des incendies



Le coupage avec le MAX42 génère du métal brûlant, des étincelles et des scories. Il faut donc prendre des précautions contre les incendies:

- Des extincteurs d'incendie doivent être accessibles dans l'endroit de coupage.
- Les matières inflammables doivent être maintenues à au moins 10 m (35 pieds) de l'aire du coupage.

SÉCURITÉ

- Arroser le métal fraîchement coupé ou le laisser refroidir avant de le manipuler ou de le mettre en contact avec des matériaux inflammables.
- Ne jamais utiliser le MAX42 pour découper des réservoirs contenant des matières potentiellement inflammables. De tels récipients doivent être soigneusement nettoyés avant le coupage.
- Évacuer toute atmosphère potentiellement inflammable avant de faire fonctionner le MAX42. Ne jamais faire fonctionner le MAX42 dans une atmosphère qui comporte une forte concentration de poussière, de gaz inflammables ou de vapeurs de liquides inflammables comme l'essence.

Prévention des chocs électriques

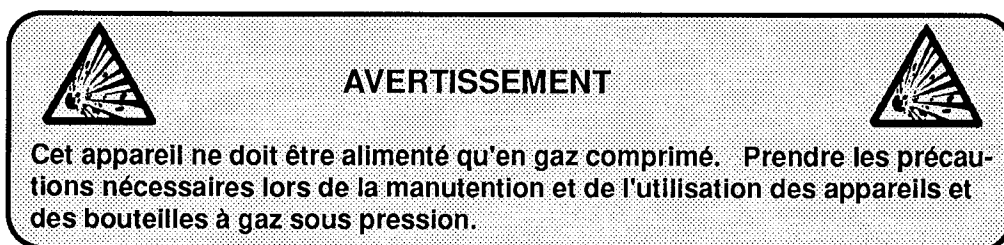


Le MAX42 produit une forte tension (environ 215 VDC) pour amorcer l'arc-plasma. On doit prendre les précautions suivantes en utilisant cet appareil:

- Garder le corps et les habits à sec.
- Ne pas se tenir, s'asseoir ou se coucher dans une surface mouillée quand on utilise le MAX42.
- S'isoler contre le choc électrique. Prendre garde si l'on travaille près d'un endroit humide. Porter des gants et bottes isolants.
- Installer un interrupteur mural à fusibles, de caractéristiques appropriées, à proximité du bloc d'alimentation du MAX42. Cet interrupteur doit permettre à l'utilisateur d'arrêter rapidement le MAX42 en cas d'urgence.
- Conformer aux codes électriques pour les types et grandeurs de la filerie électrique primaire.
- Inspecter fréquemment le cordon d'alimentation primaire pour s'assurer à ce qu'il ne soit ni endommagé ni fissuré. **Un conducteur peut tuer.** Ne pas utiliser l'appareil si le cordon d'alimentation est endommagé. Remplacer immédiatement le cordon s'il est endommagé.
- Inspecter les câbles de la torche. S'ils sont effilochés ou endommagés, les remplacer.
- S'il faut retirer le couvercle du bloc d'alimentation après usage, couper l'alimentation et attendre cinq minutes pour laisser les condensateurs se décharger, sinon, on s'expose à des chocs électriques importants.
- Ne jamais utiliser le MAX42 si le couvercle du bloc d'alimentation n'est pas en place. Si elles sont exposées, les connexions du bloc d'alimentation sont extrêmement dangereuses.

- Ne pas saisir la pièce à travailler, (y compris la chute) lors du coupage. Laisser la pièce à travailler en place ou sur l'établi, et le câble de masse toujours connecté.
- Avant de changer les pièces de la torche, couper l'alimentation ou débrancher le bloc d'alimentation. Après avoir changé les pièces de la torche et ramené le capuchon de retenue à sa position de marche, rebrancher l'appareil.
- Ne jamais neutraliser les verrouillages de sécurité.

Prévention des explosions



Quand on utilise le MAX42:

- Ne pas couper en présence de poussière ou de vapeurs explosives.
 - Ne pas couper de réservoirs sous pression.
- Régulateurs de pression**
- Bien entretenir les régulateurs de pression. Un régulateur défectueux peut entraîner des dommages et causer des blessures; on doit en confier la réparation à un technicien qualifié.
 - Ne jamais utiliser un régulateur avec un autre gaz que celui pour lequel il a été conçu.
 - Ne jamais utiliser un régulateur qui fuit, présente une dérive excessive ou est endommagé.
 - Ne jamais lubrifier un régulateur à l'aide d'huile ou de graisse.
- Bouteilles de gaz comprimé**
- Manipuler et utiliser les bouteilles de gaz comprimé conformément aux normes de sécurité de la CGA, de l'AWS et de la CSA.
 - Ne jamais utiliser une bouteille qui fuit ou est endommagée.
 - Ne jamais utiliser une bouteille qui n'est pas placée dans le bon sens et bien assujettie.

SÉCURITÉ

- Ne jamais transporter une bouteille si le chapeau de protection du robinet n'est pas en place.
- Ne jamais utiliser une bouteille à gaz ou son contenu à des fins autres que celles pour lesquelles elle est conçue.
- Ne jamais lubrifier les valves des cylindres avec de l'huile ou de la graisse.
- Éviter à tout prix le contact électrique entre l'arc de plasma et le cylindre.
- Ne jamais exposer des cylindres à une chaleur excessive, étincelles, scories ou flammes.
- Ne jamais utiliser de marteaux, clés anglaises ou autres outils pour d'ébloquer des valves de cylindres.

Tuyaux

- Des tuyaux à gaz pour la coupe de plasma à l'arc doivent adhérer aux codes de couleurs suivant:

Vert	Oxygène
Noir	Air et gaz inerte

- Jamais utiliser de tuyau à oxygène vert pour un autre gaz.
- Le tuyau endommagé par l'usure, les étincelles, la chaleur ou la flamme doit être remplacé.
- Poser le tuyau à plat pour éviter des noeuds.
- Enrouler le tuyau en trop et le placer à l'abri pour éviter tout dégât ou encouplement.
- Examiner le tuyaux à intervalles réguliers pour des fuites, de l'usure des mauvaises connections ou d'autres dangers.
- Garder les longueurs de tuyaux à un minimum pour éviter des dégâts, réduire la chute de pression et éviter la pénurie.

Mise à la masse

Avant de faire fonctionner le MAX42:

Alimentation du poste

- S'assurer à ce que le fil de terre du cordon d'alimentation soit bien mis à la terre dans le coffret de l'interrupteur.

S'assurer à ce que le fil de terre du cordon d'alimentation soit correctement relié à la cosse de mise à la terre du bloc d'alimentation. Se conformer aux exigences de la CSA en reliant le fil de terre à la cosse de terre avant les autres fils. Bien serrer l'écrou de retenue.

- S'assurer à ce que toutes les connexions soient bien serrées pour éviter le surchauffement.

Dépense d'énergie

- Le câble de masse doit être fixé à la pièce à travailler de façon à assurer un bon contact entre les métaux. Ne pas fixer la câble de masse à la partie de la pièce à travailler qui doit se détacher.

- Mettre le plan de travail à la terre de façon fiable. Consulter le National Electrical Code, Article 250, Section H, intitulée "Grounding Electrical System" (Système de tiges de mise à terre) ou un autre code approprié.

Pour de plus amples renseignements sur la mise à terre, consulter le chapitre *Index des normes*.

DISPOSITIFS DE SÉCURITÉ

- Le MAX42 comporte un verrouillage de sécurité qui met hors service le bloc d'alimentation lorsque le capuchon de retenue est desserré.
- Ne jamais neutraliser les verrouillages de sécurité.
- Le MAX42 est conçu pour les torches MAX42. Ne pas utiliser d'autre torche.
- Utiliser seulement des pièces de rechange et des pièces fusibles Hypertherm. La garantie de Hypertherm ne couvre pas des dégâts causés par l'utilisation d'autres pièces de rechange que celles de Hypertherm.
- Ne jamais faire fonctionner le MAX42 si tous les couvercles du bloc d'alimentation ne sont pas en place car cela mettrait en danger l'opérateur et les autres personnes présentes, en plus de compromettre le refroidissement des pièces.

INDEX DES NORMES

L'index des normes énumère des publications traitant des mesures de sécurité à suivre lorsque l'on utilise un appareil de coupage à l'arc-plasma. Cet index peut fournir des renseignements supplémentaires et la norme ACNOR (CSA) W117.2 y figuré.

Section 2 DESCRIPTION & SPECIFICATIONS

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PAC121P Pushbutton Torch (Optional)	2-4
PAC121M Machine Torch (Optional)	2-4
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DESCRIPTION & SPECIFICATIONS

GENERAL

Hypertherm's MAX42 plasma cutting system is designed for hand cutting of most metals from gauge to 1/2 inch (13mm) thick.

The MAX42 provides continuously variable current output from 15 to 40 amps on all thicknesses up to 1/2 inch (13mm). This allows the operator wide variations in cutting speeds on the same thickness of metal. The 15-amp setting is for metals up to 1/16 inch (1.6mm) thick, while the 40-amp setting is used for thicker metals.

Because of the unique new power supply design, MAX42 cut quality is superior and the parts life is longer compared to other plasma systems using air as the plasma gas. The inverter design provides smooth output DC voltage contributing to outstanding cut quality.

Air is used as the primary plasma gas, providing low operating costs combined with high-speed performance. Cylinder air or shop air can be used as long as it is free of moisture, oil and particulate matter contamination. For better cut quality on metals such as stainless steel and aluminum, nitrogen can be used as the plasma gas. A regulator and air filter are provided to ensure that the right pressure and air flow are supplied to the system at the proper quality.

DESCRIPTION & SPECIFICATIONS

SPECIFICATIONS

MAX42 Power Supply

The MAX42 is a constant current inverter power supply providing continuously variable amperage from 15 amps to 40 amps. It conforms to the following specifications:

Maximum OCV (U_0)	215 VDC
Output Current (I_2)	40 Amps Maximum
Output Voltage (U_2)	120 VDC @ 40 amps, increasing to 215 VDC @ 0 amps
Duty Cycle Rating (X)	80% at 40 amps at 40° C
Ambient Temperatures/Duty Cycle	Power supplies will operate between +14° and 104°F (-10° and +40°C). Power supplies operated in an ambient temperature above 86°F (30°C) may show some decrease in duty cycle.
Input Line Voltage (U_1) and Input Line Current (I_1):	
# 071003	208-240V, 1Ø, 50/60 Hz, @ 37-32 amps
# 071004	400V, 3Ø, 50Hz @ 12 amps
# 071011	480V, 3Ø, 60Hz @ 10 amps
Dimensions	Width — 8 " (203mm) Height — 13 " (330mm) Length — 20 " (508mm)
Weight	49 pounds (22 kg)
Gas Type	Air or Nitrogen
Gas Quality	Clean, Dry, Oil-Free
Gas Flow	270 scfh/4.5 scfm (127 l/min)

DESCRIPTION & SPECIFICATIONS

Gas Pressure Setting 70 psig (4.9 bar)

Gas Requirements 80-125 psig (5.5-8.6 bar)

PAC121T Trigger Torch

Maximum cutting thickness range 1/2 inch (13 mm)

Maximum current at 80% duty cycle @ 40° C 40 amps

Gas Flow 270 scfh/4.5 scfm at 70 psi
(127 l/min at 4.8 bar)

Weight 6 pounds (2.7 kg) with 25 ft.
(7.6 m) lead

PAC121P Pushbutton Torch (Optional)

Maximum cutting thickness range 1/2 inch (13 mm)

Maximum current at 80% duty cycle @ 40° C 40 amps

Gas Flow 270 scfh/4.5 scfm at 70 psi
(127 l/min at 4.8 bar)

Weight 6 pounds (2.7 kg) with 25 ft.
(7.6 m) lead

PAC121M Machine Torch (Optional)

Maximum cutting thickness range 1/2 inch (13 mm)

Maximum current at 80% duty cycle @ 40° C 40 amps

Gas Flow 270 scfh/4.5 scfm at 70 psi
(127 l/min at 4.8 bar)

Weight 6 pounds (2.7 kg) with 25 ft.

DESCRIPTION & SPECIFICATIONS

IEC SYMBOLS USED



Direct Current (DC).



Alternating current (AC).



Plasma cutting torch.



AC input power connection.



The terminal for the external protective (earthed) conductor.



An inverter-based power source.



Anode (+) work clamp.



Temperature switch.



Pressure switch.



Plasma torch in the TEST position (cooling and cutting gas exiting nozzle).



The power is on.



The power is off.



Volt/amp curve.

Section 3 SETUP

In this section:

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Power Requirements	3-3
Torch Lead Connection	3-4
Grounding.....	3-4
PAC121M Torch On/Off Switch Connection Data.....	3-5
Torch Alignment.....	3-5
Gas Supply	3-5
Shop Compressed Air	3-6
Cylinder Compressed Air	3-6
Nitrogen	3-6

SETUP

UPON RECEIPT

1. Remove the unit and save the carton. The carton is reusable and provides an impact-resistant box for transporting or storing the unit.

The carton should include:

- MAX42 Power Supply
- PAC121T Trigger Torch and Lead (25 or 50 ft./7.63 or 15.25 m)
- Consumable Parts Kit
- Instruction Manual 800850 (IM-85)

Options:

- PAC121P Pushbutton Torch
- PAC121M Machine Torch
- PAC121M Torch On/Off Pendant

2. Verify that all parts and items are included. Alert your distributor if any parts or items are missing.
3. Inspect the power supply for any physical damage that may have occurred during shipping. If there is evidence of damage, see the *Claims* section for instructions.

Before operating the MAX42, read the *Safety* and *Operation* sections of this manual.

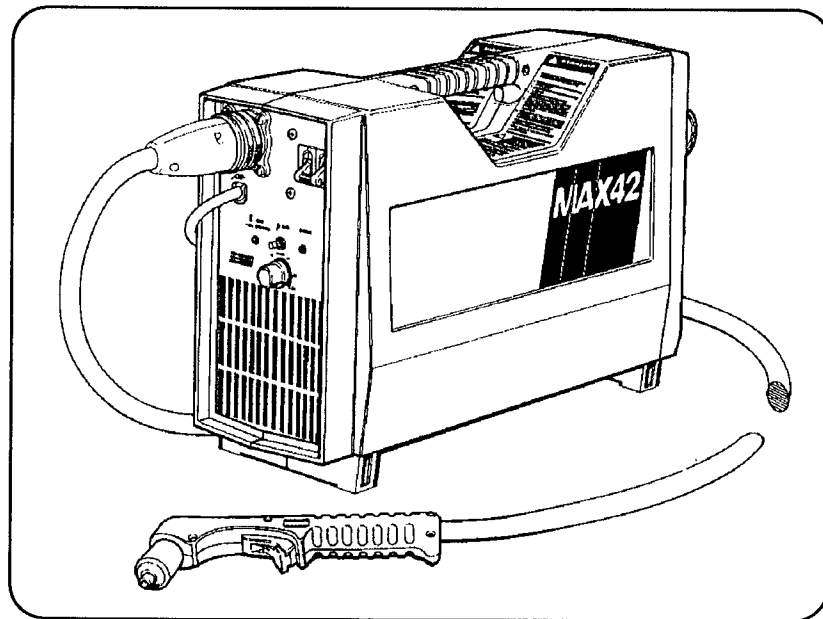


Figure 3-1 MAX42 Plasma Cutting System

PRIMARY CONNECTIONS

- Use a primary line disconnect switch for each power supply. This switch allows the operator to turn the power supply off quickly in an emergency situation. The switch should be located on a wall near the power supply, and should be easily accessible to the operator. The interrupt level of the switch must be equal to or exceed the continuous rating of the fuses.
- Use fuses (class K5) according to the power requirements listed below.
- Connect the power cord plug on the 208-240 volt power unit to a properly grounded receptacle.
- The MAX42, 400 volt (# 071004) and 480 volt (# 071011) power supplies are shipped without the plug connected to the power cord. The user must obtain a plug that is certified by local and national electrical codes. The plug should be connected to the power cord by a licensed electrician.
- Whether you use pipeline shop air, compressed air, or nitrogen:
 - Use an inert gas hose to connect the gas supply to the input connection on the air regulator mounted on the rear of the power supply.
 - Use a filter to maintain a high air purity level. All oil, moisture and other contaminants must be removed.

POWER REQUIREMENTS

A separate line disconnect switch should be provided for each MAX42 power supply. The disconnect box should be sized to the following requirements:

<u>Input Voltage Range</u>	<u>Phase</u>	<u>Input Current Range @ 4.8 kw Output</u>	<u>Recommended Fuse Size</u>
208-240 VAC	1	37-32 amps	50 amps
400 VAC	3	12 amps	15 amps
480 VAC	3	10 amps	15 amps

SETUP

TORCH LEAD CONNECTION

To connect the torch lead to the power supply:

- Align the connector plug key (on torch lead) with the connector receptacle key slot (on power supply) and push in until pins seat.
- Turn the connector securing ring 1/4 turn counter-clockwise (ccw) to ensure that the securing ring threads and the connector receptacle threads are aligned prior to tightening.

<p>Caution: The connector is fine-threaded. Cross threading can easily occur which could cause thread damage.</p>

- Turn the connector securing ring clockwise (cw) to tighten.

GROUNDING

To ensure personal safety and to reduce emission of radio frequency interference, the MAX42 must be properly grounded:

- Connect the work table to a high-quality earth ground within 20 feet (6 meters) of the table. A suitable ground consists of a solid copper rod of at least 1/2-inch (13 mm) diameter driven to a depth of at least 8 feet (2.4 meters) into the earth below the permanent moisture level.
- Attach the system work clamp to the workpiece or to the work table. Make sure that the work clamp and the workpiece or work table make good metal-to-metal contact (see Fig. 3-2).
- Do not attach the work clamp to the portion of the workpiece being cut away.
- For more information, refer to the National Electrical Code, Article 250, Section H, "Grounding Electrode System" or other appropriate code.

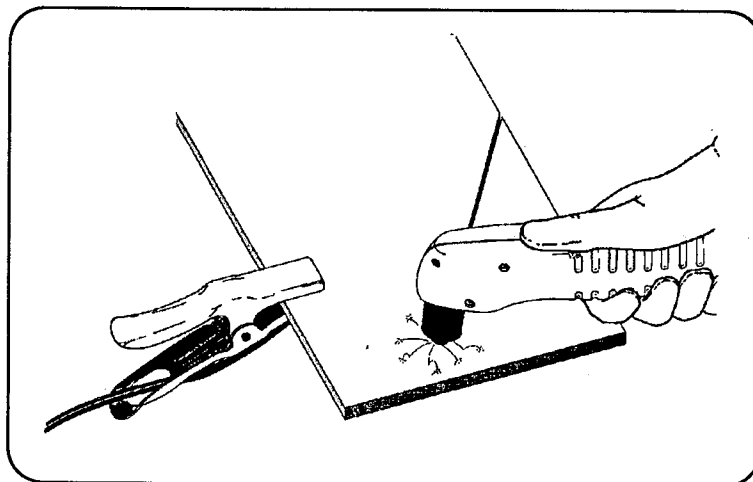


Figure 3-2 Proper Work Clamp Connection

PAC121M TORCH ON/OFF SWITCH CONNECTION DATA

The PAC121M torch lead is supplied with a pigtail so that the optional on/off pendant (028461, 028462 or 028463) may be used. If you want to use a different on/off switch configuration, note that the wiring configuration to the 3-pin male plug on the pigtail is as follows:

Pin A	White Wire
Pin C	Black Wire
Pin B	Not Used

TORCH ALIGNMENT

Before cutting with the PAC121M torch, ensure that the torch is mounted at right angles to the workpiece to get a clean, vertical cut. Use a square to align the torch.

GAS SUPPLY

The gas supply for the MAX42 can be either air or nitrogen. Air can be supplied as shop compressed air or cylinder compressed air. Nitrogen can be supplied from compressed gas cylinders or liquid containers. A minimum of 80 psi (5.5 bar) must be supplied to the MAX42 pressure regulator.

SETUP

Caution: The MAX42 pressure regulator is rated at a maximum of 150 psi (10.3 bar) at the input. Do not set the air or nitrogen cylinder regulator to a pressure greater than 150 psi (10.3 bar).

Shop Compressed Air

Clean, dry, oil-free shop air can be used to supply the MAX42. Shop air must be available at a minimum pressure of 80 psi (5.5 bar) and must be routed through the regulator and filter supplied with the system. The regulator and filter are mounted at the top rear of the MAX42 power supply.

Cylinder Compressed Air

The cylinder air supply must be clean, dry and oil-free. The regulator must be used only for compressed air and must be capable of delivering at least 270 scfh/4.5 scfm (127 l/min) of air at 80 psi (5.5 bar) output pressure.

Caution: The regulator supplied with the system must be used in conjunction with the regulator on the air cylinder. The pressure from the cylinder must not be allowed to exceed the pressure limit of the MAX42. Do not set the cylinder regulator to a pressure greater than 150 psi (10.3 bar).

Nitrogen

To use nitrogen as the plasma gas, it must be supplied to the MAX42 at 99.995% purity. The nitrogen source can be compressed gas cylinders or liquid containers. It must be capable of delivering a minimum of 270 scfh/4.5 scfm (127 l/min) at a delivery pressure of 80 psi (5.5 bar).

If the purity level of the nitrogen is too low, cut speeds decrease, cut quality deteriorates, cutting thickness capability decreases, and parts life shortens. (Note: These conditions also occur if there are leaks in the gas supply hoses or connections.)

Caution: The regulator supplied with the system must be used in conjunction with the regulator on the nitrogen cylinder. The pressure from the cylinder must not be allowed to exceed the pressure limit of the MAX42. Do not set the cylinder regulator to a pressure greater than 150 psi (10.3 bar).

Section 4 OPERATIONS

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OPERATION

DESCRIPTION OF CONTROLS

On the front panel, there are two indicator lights (LEDs), an **AMPS** output adjustment knob, a **TEST** switch, and an I/O (on/off) switch. The **pressure gauge** is located at the rear of unit.

- The **POWER** LED indicates that main power is on.
- The **TEMP/PRESSURE** LED indicates that the temperature and pressure are within operating limits. It goes out if:
 - The incoming air pressure is too low.
 - The duty cycle rating of the system has been exceeded and the thermal overload circuit has opened and disabled the power supply. The thermal overload switch remains open to allow the power supply to cool down.
- The **AMPS** output current adjustment knob controls the amount of plasma current at the torch. The greater the amperage setting, the thicker the metal you can cut or the faster you can move the torch.
- The **TEST** switch permits you to see if the pressure is set correctly at 70 psi (4.9 bar). To view the pressure, push the switch and hold it down. If the gauge reads 2 psi (.138 bar) more or less than the recommended pressure, an adjustment maybe required.

Caution: Do not exceed the 70 psi (4.9 bar) pressure setting at the pressure regulator gauge. Exceeding 70 psi (4.9 bar) will cause shortened torch parts life.

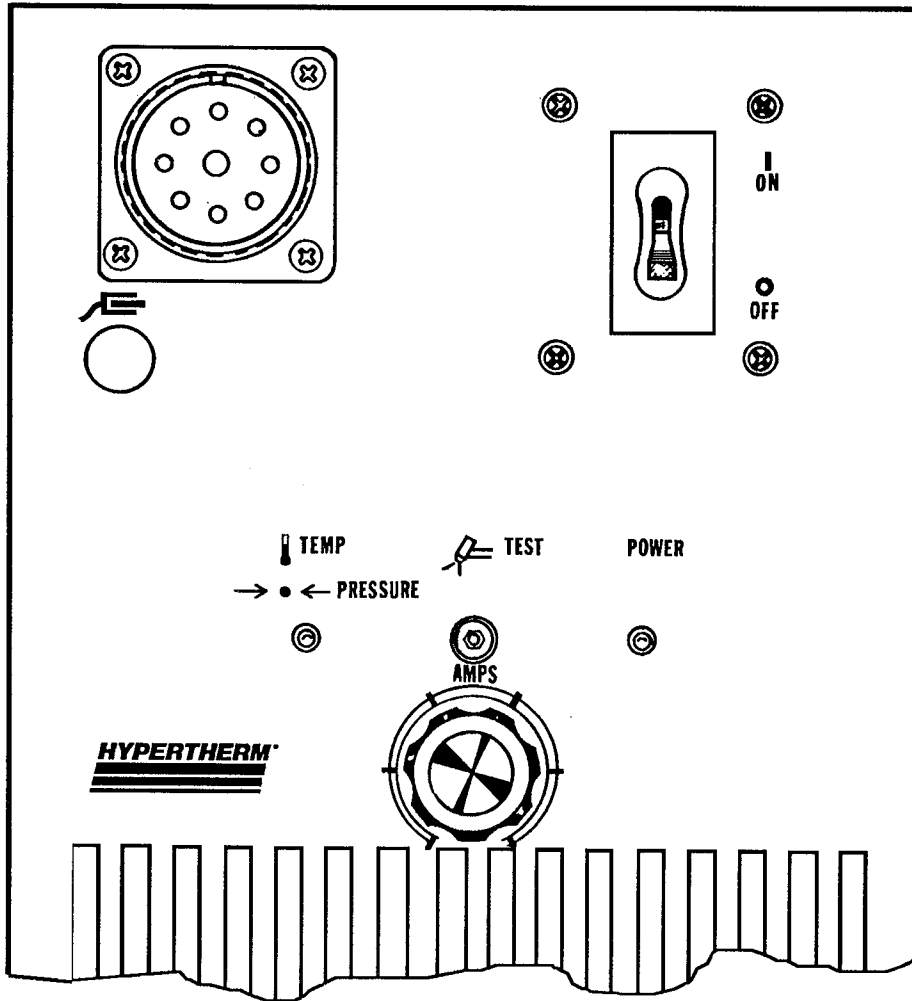


Figure 4-1 Front Panel Controls

OPERATION

OPERATING INSTRUCTIONS

1. Ensure that the work environment and your clothing meet the safety requirements outlined in the *Safety* section.
2. Place the power supply in an area where the air flow is not blocked or impeded.
3. Plug the 208-240-V unit into a grounded outlet or connect the 400V or 480V unit to a switch disconnect box.
4. Using a quick connect air fitting, attach the compressed air or nitrogen to the male fitting on the pressure regulator.
5. The filter bowl should automatically drain itself. If it doesn't drain properly, refer to *Maintenance* in the *Troubleshooting* section for maintenance or replacement.
6. Move the **I/O** switch to the **I** position. The **POWER** LED should indicate the unit is "on." The **TEMP/PRESSURE** LED should indicate the temperature and air pressure are within the range of operation.
7. Push the **TEST** switch. Check the air pressure setting to ensure the pressure on the pressure gauge is set to 70 psi (4.9 bar). If not, refer to *Maintenance* in the *Troubleshooting* section to adjust the regulator. Look for moisture coming out of the torch. If there is moisture, purge the lines by pressing the **TEST** switch again and holding it until all trace of moisture has disappeared.
8. Attach the work clamp securely to the workpiece.



WARNING



The pilot arc starts immediately (no preflow) when the torch switch is pressed.

9. The unit is now ready to operate. When you are ready to cut, place the torch on the workpiece. Push the start button on top of the torch handle.
10. The arc transfers from the torch to the workpiece. Move the torch in the desired direction, at a speed which gives good cut quality.
11. When the cut is finished, release the torch button to stop the arc.

OPERATION

OPERATING DATA CHART

<u>Thickness</u>	<u>Material</u>	<u>Current</u>	<u>Travel Speed</u>
26 ga. (.477 mm)	Mild/galvanized steel	20 amps	180 ipm (4572 mm/min)
24 ga. (.635 mm)	Mild/galvanized steel	30 amps	280 ipm (7112 mm/min)
18 ga. (1.27 mm)	Mild/galvanized steel	30 amps	200 ipm (5080 mm/min)
1/16" (1.5 mm)	Mild/galvanized steel	40 amps	180 ipm (4572 mm/min)
1/8" (3 mm)	Mild steel	40 amps	110 ipm (2794 mm/min)
1/4" (6 mm)	Mild steel	40 amps	35 ipm (889 mm/min)
3/8" (10 mm)	Mild steel	40 amps	15 ipm (381 mm/min)
1/2" (13 mm)	Mild steel	40 amps	10 ipm (254 mm/min)
28 ga. (.396 mm)	Stainless steel	40 amps	250 ipm (6350 mm/min)
24 ga. (.635 mm)	Stainless steel	40 amps	200 ipm (5080 mm/min)
1/16" (1.5 mm)	Stainless steel	40 amps	125 ipm (3175 mm/min)
1/8" (3 mm)	Stainless steel	40 amps	60 ipm (1524 mm/min)
1/4" (6 mm)	Stainless steel	40 amps	22 ipm (559 mm/min)
3/8" (10 mm)	Stainless steel	40 amps	12 ipm (305 mm/min)
1/2" (13 mm)	Stainless steel	40 amps	9 ipm (229 mm/min)
1/32" (.800 mm)	Aluminum	40 amps	400 ipm (10160 mm/min)
1/16" (1.5 mm)	Aluminum	40 amps	200 ipm (5080 mm/min)
3/32" (2.4 mm)	Aluminum	40 amps	120 ipm (3048 mm/min)
1/8" (3 mm)	Aluminum	40 amps	100 ipm (2540 mm/min)
1/4" (6 mm)	Aluminum	40 amps	30 ipm (762 mm/min)
3/8" (10 mm)	Aluminum	40 amps	13 ipm (330 mm/min)
1/2" (13 mm)	Aluminum	40 amps	8 ipm (203 mm/min)

OPERATION

OPERATING TIPS

Changing Consumable Parts

WARNING

Always unplug the power supply before inspecting or changing the torch parts. Do not use the cap on sensor switch to remove power from the power supply by causing circuit breaker S1 to trip off when the retaining cap is removed with the power on. Do not rely on the cap on sensor switch to remove power. It is provided strictly for safety backup.

Inspect the nozzle for damage or wear. If the hole in the nozzle is worn or oval-shaped, it is time to change it. Inspect the electrode. If the center of the electrode has a pit more than 1/16" (1.5 mm) deep, replace it.

Changing the consumable parts requires no tools. Unscrew the retaining cap and the remaining parts will come apart easily. When you unscrew the retaining cap, you'll hear a click. This click is a microswitch disabling the power supply (if it has not been unplugged) so that the torch cannot accidentally be activated. Replace the parts as illustrated in Figure 4-2. Each part fits in only one direction, so you cannot put the parts in backwards. Also, the torch will not fire if the parts are improperly assembled.

When the nozzle, electrode and swirl ring are properly in place, replace the retaining cap. When the retaining cap is tightened, the microswitch will click, indicating that the torch is operable again. Plug the power supply back in. For a detailed description of the consumables, refer to Section 5 Standard Parts, *Consumable Parts*.

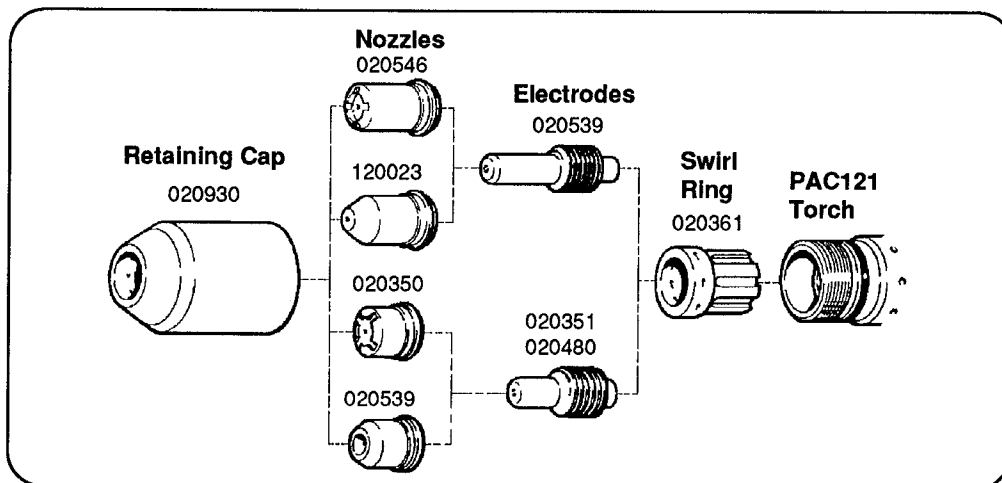


Figure 4-2 PAC121 Consumable Parts



WARNING



The PAC121 hand-held torches and machine torch are instant-on torches. These torches fire (produce a plasma arc) immediately after torch switch closure or remote switch closure for a machine torch. Always hold the hand torch away from your body as a precaution against accidental torch firing. Be aware of this hazardous potential, failure to do so can result in serious bodily injury.

PAC121T Safety Trigger Operation

The PAC121T safety trigger torch allows operators the ability to safely handle the torch before and after the cut and to minimize the possibility of accidental torch firing. The safety trigger is easy to operate. Follow the steps below:

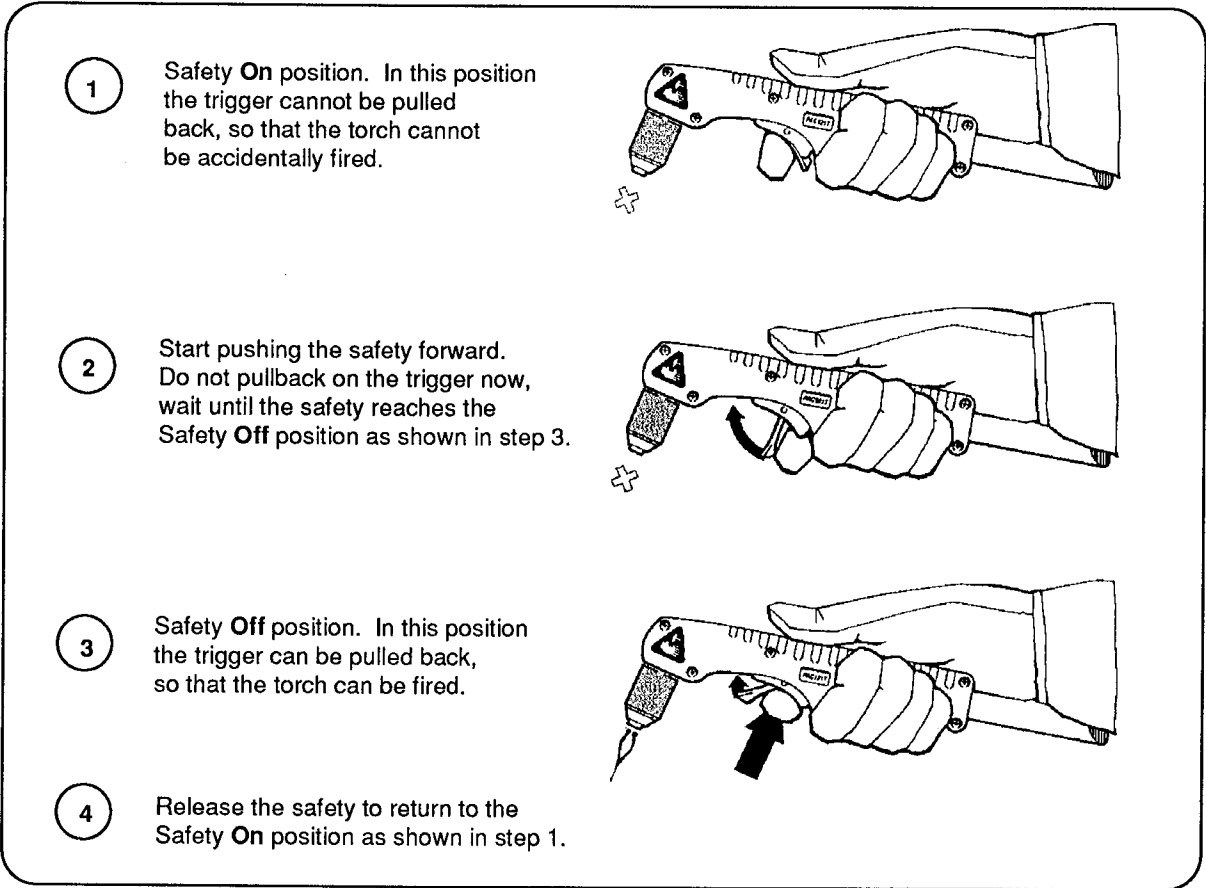


Figure 4-3 PAC121T Torch Safety Trigger Operation

OPERATION

Cutting

- Do not fire the pilot arc into the air needlessly—doing so causes a significant reduction of the nozzle and electrode life.
- If arc transfer does not occur within three seconds, the pilot arc will stop. Release the torch start button and press it again to reset the pilot arc timer.
- Start cutting from the edge of the workpiece (Fig. 4-4) unless you are piercing.
- When cutting, make sure that the sparks are coming out of the bottom of the workpiece. If they are spraying on top of the workpiece, you are moving the torch too fast, or you do not have sufficient power to fully penetrate the workpiece.
- Hold the torch lightly on the metal or just off the metal. Holding the torch firmly to the workpiece causes the nozzle to stick and makes smooth cutting difficult. The arc transfers once the torch is within 1/8 inch (3 mm) of the workpiece.
- Cut circles by using a template or a radius cutter attachment (Fig. 4-5).
- Pull the torch through the cut. Pulling it is easier than pushing it.
- Hold the torch nozzle at a vertical position and watch the arc as it cuts along the line (Fig. 4-6). By lightly dragging the nozzle on the workpiece, you can maintain a steady cut. For straight-line cuts, use any straight edge as a guide.
- When cutting thin material, reduce the amps until you get the best quality cut.

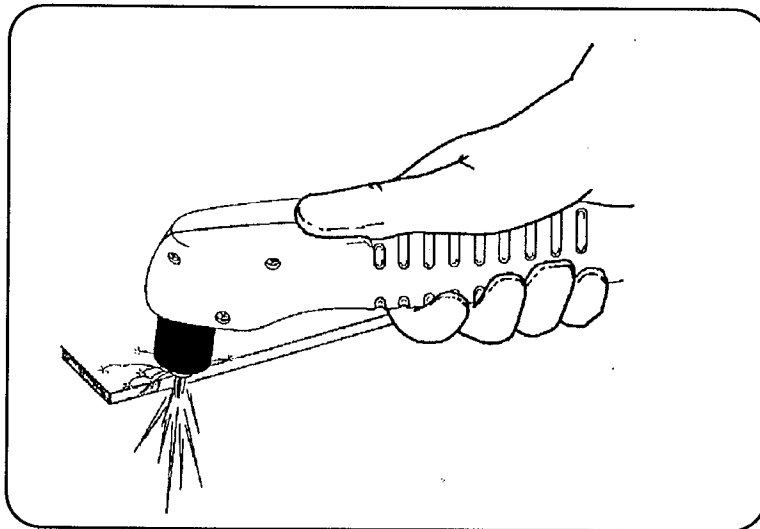


Figure 4-4 Starting a Cut

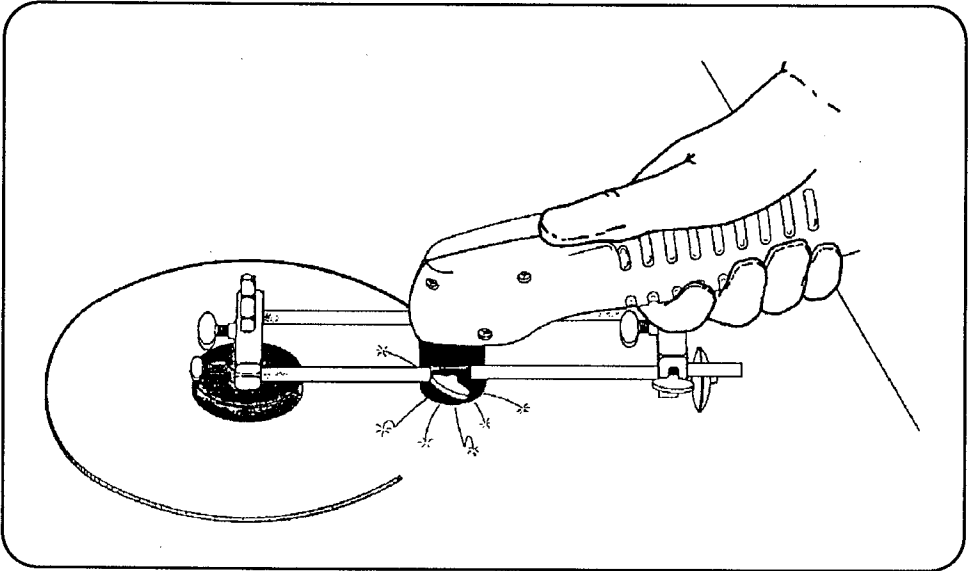


Figure 4-5 Cutting a Circle

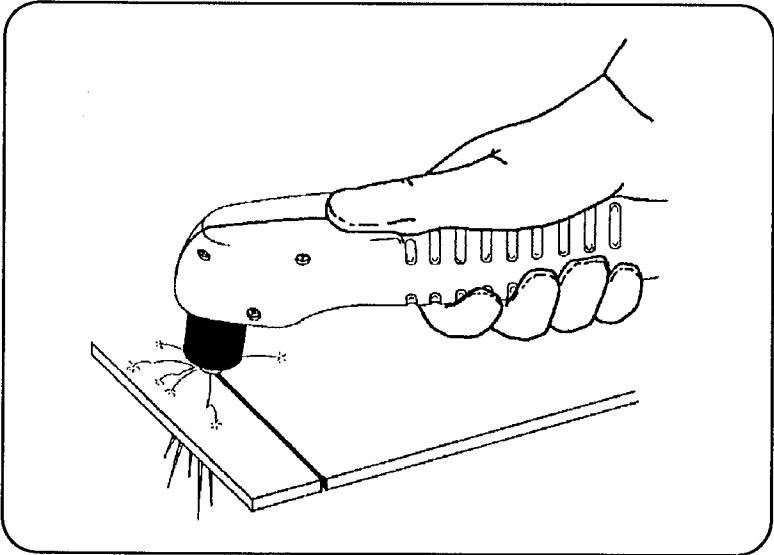


Figure 4-6 Dragging the Torch

OPERATION

Piercing

- Hold the torch so that the nozzle is approximately 1/16 inch (1.5 mm) away from the workpiece before pushing the start button. This method maximizes the life of the nozzle.
- Hold the torch at an angle to the workpiece away from yourself, then slowly roll it to a vertical position. (This is particularly important when cutting thicker material.) Make sure that the torch is pointed away from you and the people around you to avoid any danger from sparks and hot metal.
- Start the cut at an angle rather than in an upright position. This method permits the hot metal to escape to one side rather than splashing back against the nozzle, protecting the operator from the sparks and extending the life of the nozzle (Fig. 4-7).
- When the pierce is complete, proceed with the cut.

Gouging

The MAX42 can be used for gouging mild steel by using the optional gouging nozzle (part number 020539). To gouge:

1. Always wear full protection:
 - A welding helmet with at least a # 6 glass
 - Welding gloves
 - A welding jacket.

The arc is fully exposed and will cause serious burns if the skin is not covered.

2. Install the gouging nozzle just as you would install a standard cutting nozzle.
3. Adjust the air pressure to 50-55 psi (3.4-3.8 bar) with air flowing from the torch. Note that this is slightly lower than the cutting pressure.
4. Tilt the torch approximately 45° from the surface to be gouged and feed into the gouge. Try not to allow the nozzle to come into contact with the workpiece since this can cause premature wear of the nozzle. Multiple passes or "wearing" may be necessary to gouge wider and deeper sections. See Figure 4-8.

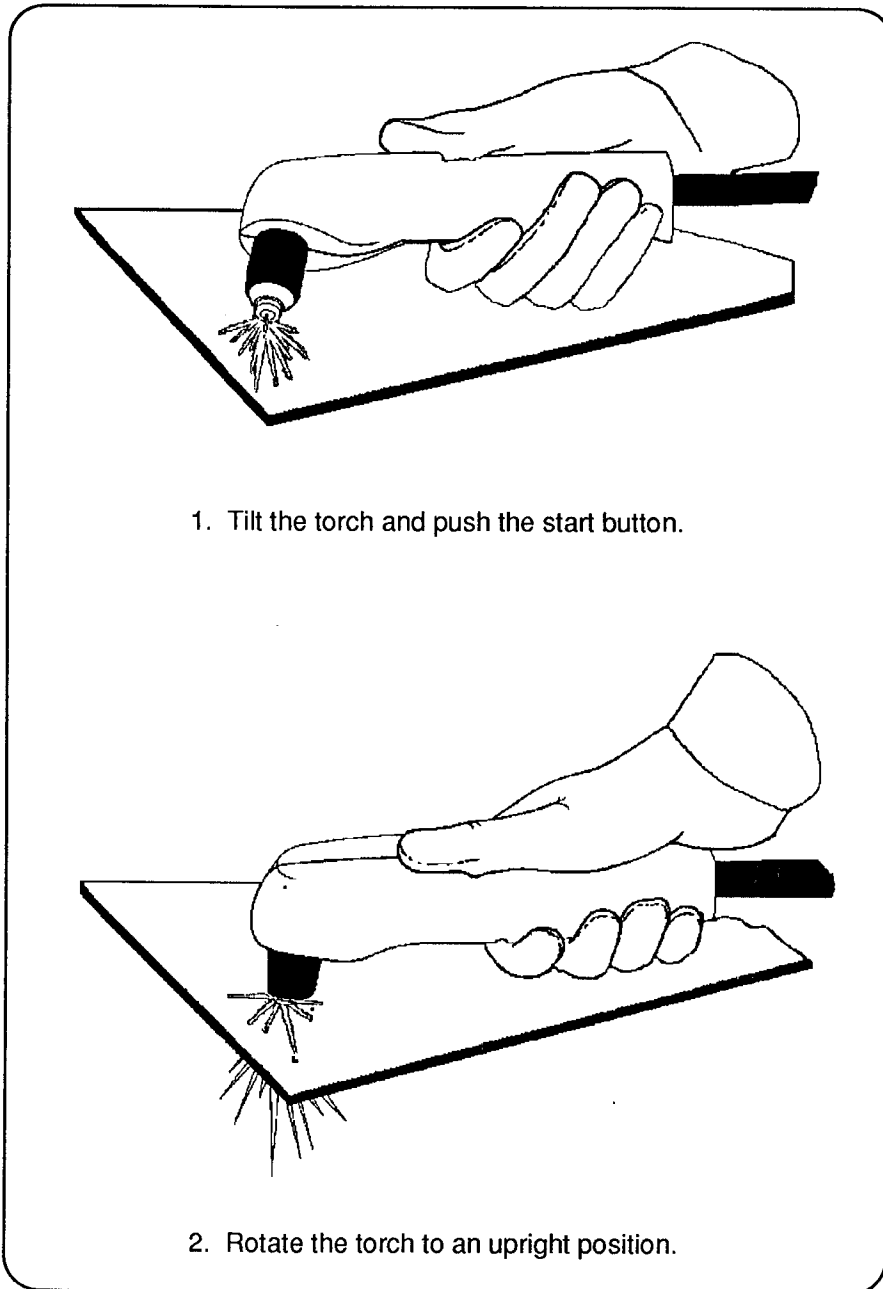


Figure 4-7 Piercing

OPERATION

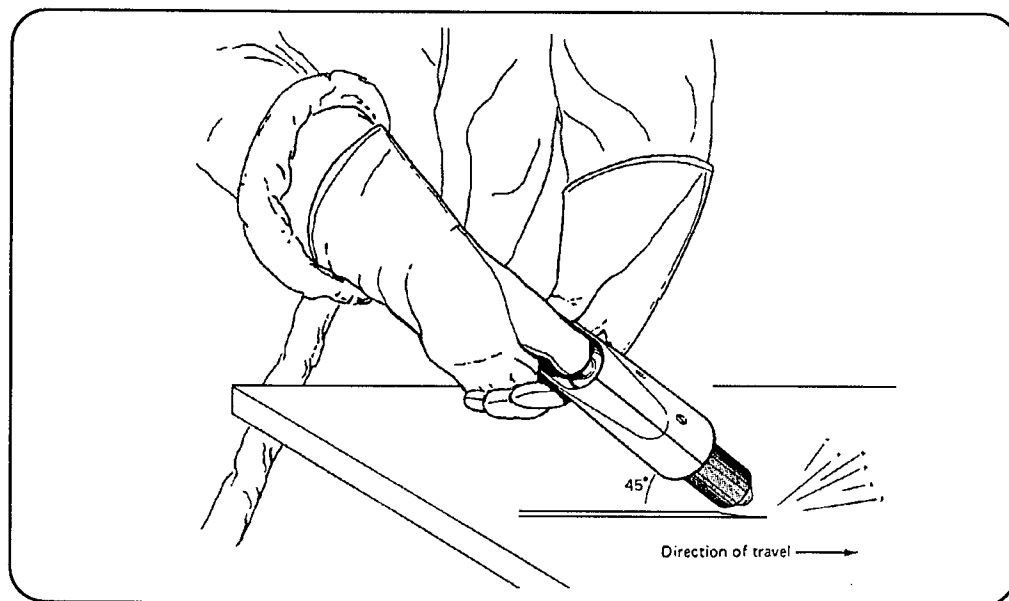


Figure 4-8 Gouging

Common Cutting Faults

- The workpiece is not totally penetrated. Causes can be:
 - The current is too low.
 - The cut speed is too high.
 - The torch parts are worn.
 - The metal being cut is too thick.
- Dross forms on the bottom of the cut. Causes can be:
 - The cutting speed is too slow.
 - The torch parts are worn.
 - The metal being cut is too thick.
 - The current is too low.

Duty Cycle

The duty cycle, or the amount of time the pilot or plasma arc can remain "on" in minutes within a 10-minute period, is affected by many factors. When the current is set at 40 amps, the MAX42 has an 80% duty cycle at 40° C. During normal operation, the plasma arc can remain on 8 minutes out of every 10 minutes without causing the temperature sensors to disable the unit. The duty cycle increases to 100% when the current is set at 35 amps.

OPERATION

Gas Pressure

Compressed air or nitrogen must be available at a flow rate of 4.5 scfm (127 l/min) and a minimum pressure of 80 psi (5.5 bar). If the pressure is below 40 psi (2.8 bar), the torch goes out.

Do not exceed 150 psi (10.3 bar). The filter/regulator is rated for 150 psi (10.3 bar) maximum.

Torch Heat

After several minutes of running, the torch retaining cap may become hot. To cool it, push the **TEST** switch and hold it until the cap cools down.

CLAIMS AND TECHNICAL QUESTIONS

Claims for defective merchandise — All units shipped from Hypertherm undergo rigorous quality control testing. However, if your unit does not function correctly:

1. Read the Maintenance section of this manual. You may find the problem is quite easy to fix, such as a loose connection.
2. If you are unable to solve the problem, call your distributor. He will be able to help you, or refer you to an authorized Hypertherm repair facility.

Section 5 STANDARD COMPONENTS

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STANDARD COMPONENTS

MAX42 POWER SUPPLIES

Power Supplies	Description
071003	208-240 VAC, 1 Ø, 50/60 Hz
071004	400 VAC, 3 Ø, 50 Hz
071011	480 VAC, 3 Ø, 60 Hz

Hand System-Power Supplies with Leads	Description
071007	208-240 VAC, 1 Ø, 50/60 Hz w/25-ft. (7.6 m) leads
071008	208-240 VAC, 1 Ø, 50/60 Hz w/50-ft. (15.2 m) leads
071009	400 VAC, 3 Ø, 50 Hz w/25-ft. (7.6 m) leads
071010	400 VAC, 3 Ø, 60 Hz w/50-ft. (15.2 m) leads
071012	480 VAC, 3 Ø, 60 Hz w/25-ft. (7.6 m) leads
071013	480 VAC, 3 Ø, 60 Hz w/50-ft. (15.2 m) leads

Machine System-Power Supplies with Leads	Description
071030	208-240 VAC, 1 Ø, 50/60 Hz w/25-ft. (7.6 m) leads
071031	208-240 VAC, 1 Ø, 50/60 Hz w/50-ft. (15.2 m) leads
071032	400 VAC, 3 Ø, 50 Hz w/25-ft. (7.6 m) leads
071033	400 VAC, 3 Ø, 60 Hz w/50-ft. (15.2 m) leads
071034	480 VAC, 3 Ø, 60 Hz w/25-ft. (7.6 m) leads
071035	480 VAC, 3 Ø, 60 Hz w/50-ft. (15.2 m) leads

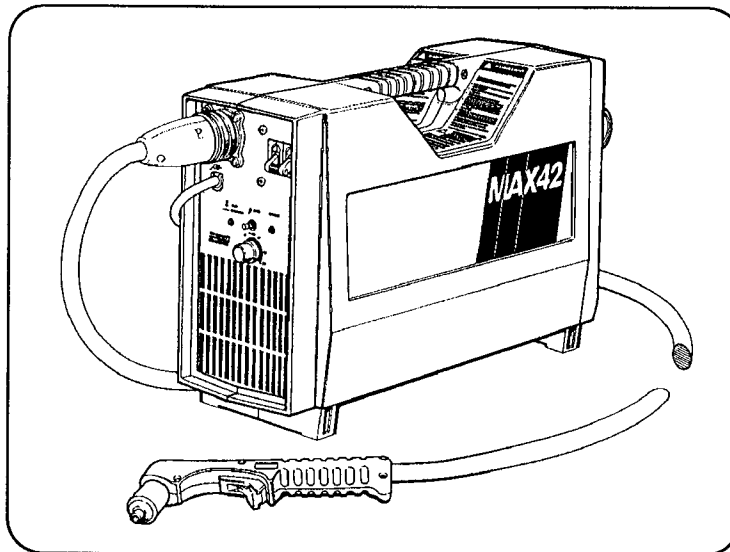


Figure 5-1 MAX42 Power Supply

STANDARD COMPONENTS

Power Supplies - Interior (Figure 5-2)

This parts list and an exploded view illustration will help familiarize the user with the subassemblies that make up the power supplies. For a more detailed power supply parts breakdown and recommended spare parts, refer to the following MAX42 Service Manuals:

SM-116 (# 801160) - 208/240V, 1 PH, 50/60 Hz
 SM-134 (# 801340) - 400V, 3 PH, 50 Hz
 SM-116 (# 801370) - 480V, 3 PH, 60 Hz

Index No.	Ref. Desig.	Part No.	Description	Quantity
1		001216	Enclosure, Half 1	2
2	PCB15	041307	PC BD Assy, Pilot Arc Control	1
3*		008277	Cord, Primary Power 8-3 SO 7.3 ft (2.2 m)	1
4**		023392	Line Cord Euro, MAX42	1
5***		023393	Line Cord 480V, MAX42	1
6*,***		029338	Rear Panel Subassembly, MAX42	1
7**		029429	Rear Panel Subassembly, Euro	1
8		011023	Filter, Air Regulator	1
		011036	Filter Element (inside 011023)	1
9*		029289	Inverter Subsystem Assembly, 208-240V	1
10**		029752	Inverter Subsystem Assembly, 400V	1
11***		029754	Inverter Subsystem Assembly, 480V	1
12*	S1	003101	Circuit Breaker, 1A 240V 40 A 1 PH	1
13**		003109	Circuit Breaker, 400V 20A 3 PH W/TC	1
14***		003106	Circuit Breaker, 480V 15A 3 PH	1
15*		029305	Front Panel SA, 1 PH	1
16**,***		029402	Front Panel SA, 3 PH	1
17		023205	Cable, Ground # 8 W/Clamp 15 ft (4.5 m)	1
18*		029339	Bracket SA, AP-PS	1
19**		029716	Brckt SA, AP-PS 400V (w/TimeDelay Relay)	1
20***		029715	Brckt SA, AP-PS 480V (w/TimeDelay Relay)	1
21*		029351	Pneumatics Subassembly	1
22**,***		029714	Pneumatics Subassembly	1

* Used in 208/240V, 1 PH, 50/60 Hz units. ** Used in 400V, 3 PH, 50 Hz units.

*** Used in 480V, 3 PH, 60 Hz units.

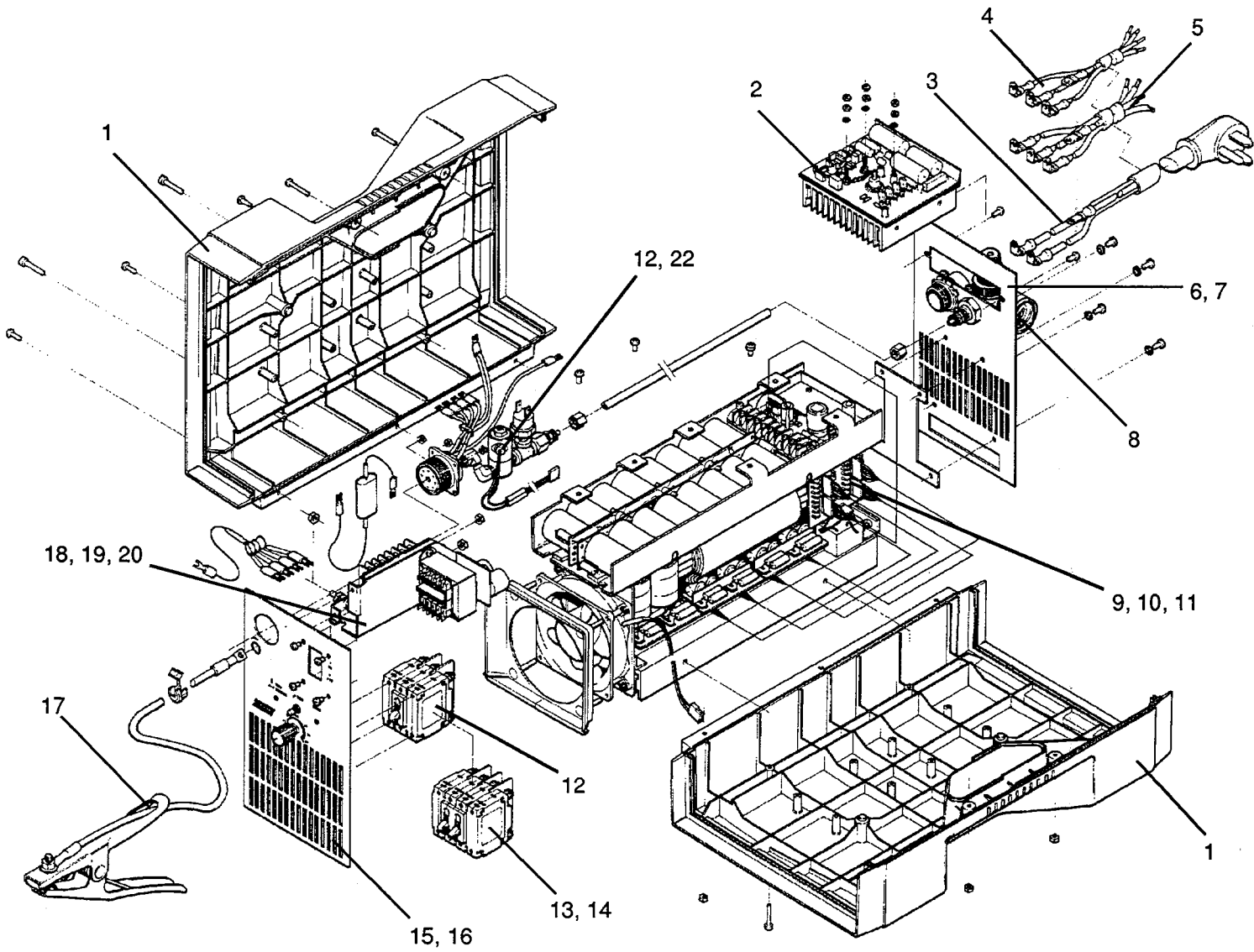


Figure 5-2 MAX42 Power Supply, All Voltages - Exploded View

STANDARD COMPONENTS

PAC121 TORCH ASSEMBLIES AND LEADS

PAC121T Torch Assembly and Lead (25 Ft/7.63 M) - 071065

001288	.....	Handle, PAC121T
075340	.....	Screws, P/S, # 4 x 5/8, PH, RND, S/B
002244	.....	Safety Trigger, PAC121T
027254	.....	Trigger Spring, PAC 121T
005094	.....	Switch, Torch Pushbutton
020932	.....	Torch Main Body w/Switch, PAC121T
029549	.....	Torch Lead, 25 ft. (7.63 m)
044009	.....	Quick Disconnect O-Ring (see Figure 5-8)
027283	.....	Ring, Gutcha
020350*	.....	Nozzle
020351*	.....	Electrode, Air
020361*	.....	Ring, Swirl
020930*	.....	Cap, Retaining

PAC121T Torch Assembly and Lead (50 Ft/15.25 M) - 071066

001288	.....	Handle, PAC121T
075340	.....	Screws, P/S, # 4 x 5/8, PH, RND, S/B
002244	.....	Safety Trigger, PAC121T
027254	.....	Trigger Spring, PAC 121T
005094	.....	Switch, Torch Pushbutton
020932	.....	Torch Main Body w/Switch, PAC121T
029550	.....	Torch Lead, 50 ft. (15.25 m)
044009	.....	Quick Disconnect O-Ring (see Figure 5-8)
027283	.....	Ring, Gutcha
020350*	.....	Nozzle
020351*	.....	Electrode, Air
020361*	.....	Ring, Swirl
020930*	.....	Cap, Retaining

* Consumables shown on Fig. 5-7.

STANDARD COMPONENTS

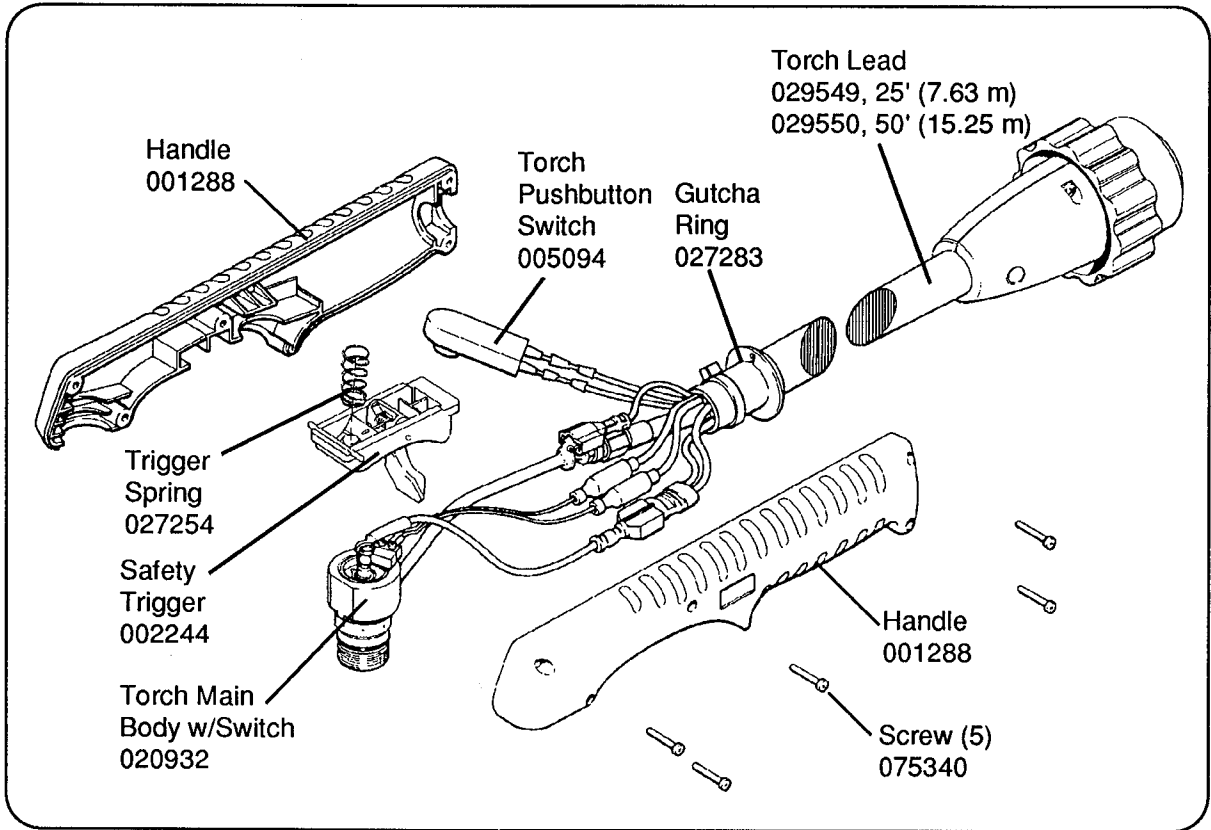


Figure 5-3 PAC121T Torch Assembly and Leads

STANDARD COMPONENTS

PAC121P Torch Assembly and Lead (25 Ft/7.63 M) - 071069

001215	Handle, PAC121P
075365	Screws, P/S, # 6 x 3/4, PH, RND, S/B
005094	Switch, Torch Pushbutton
120013	Torch Main Body w/Switch, PAC121P
029391	Torch Lead, 25 ft. (7.63 m)
044009	Quick Disconnect O-Ring (see Figure 5-8)
027283	Ring, Gutcha
046080	Tubing, 1-1/4" Black PVC
020350*	Nozzle
020351*	Electrode, Air
020361*	Ring, Swirl
020930*	Cap, Retaining

PAC121P Torch Assembly and Lead (50 Ft/15.25 M) - 071070

001215	Handle, PAC121P
075365	Screws, P/S, # 6 x 3/4, PH, RND, S/B
005094	Switch, Torch Pushbutton
120013	Torch Main Body w/Switch, PAC121P
029392	Torch Lead, 50 ft. (15.25 m)
044009	Quick Disconnect O-Ring (see Figure 5-8)
027283	Ring, Gutcha
046080	Tubing, 1-1/4" Black PVC
020350*	Nozzle
020351*	Electrode, Air
020361*	Ring, Swirl
020930*	Cap, Retaining

* Consumables shown on Fig. 5-7.

STANDARD COMPONENTS

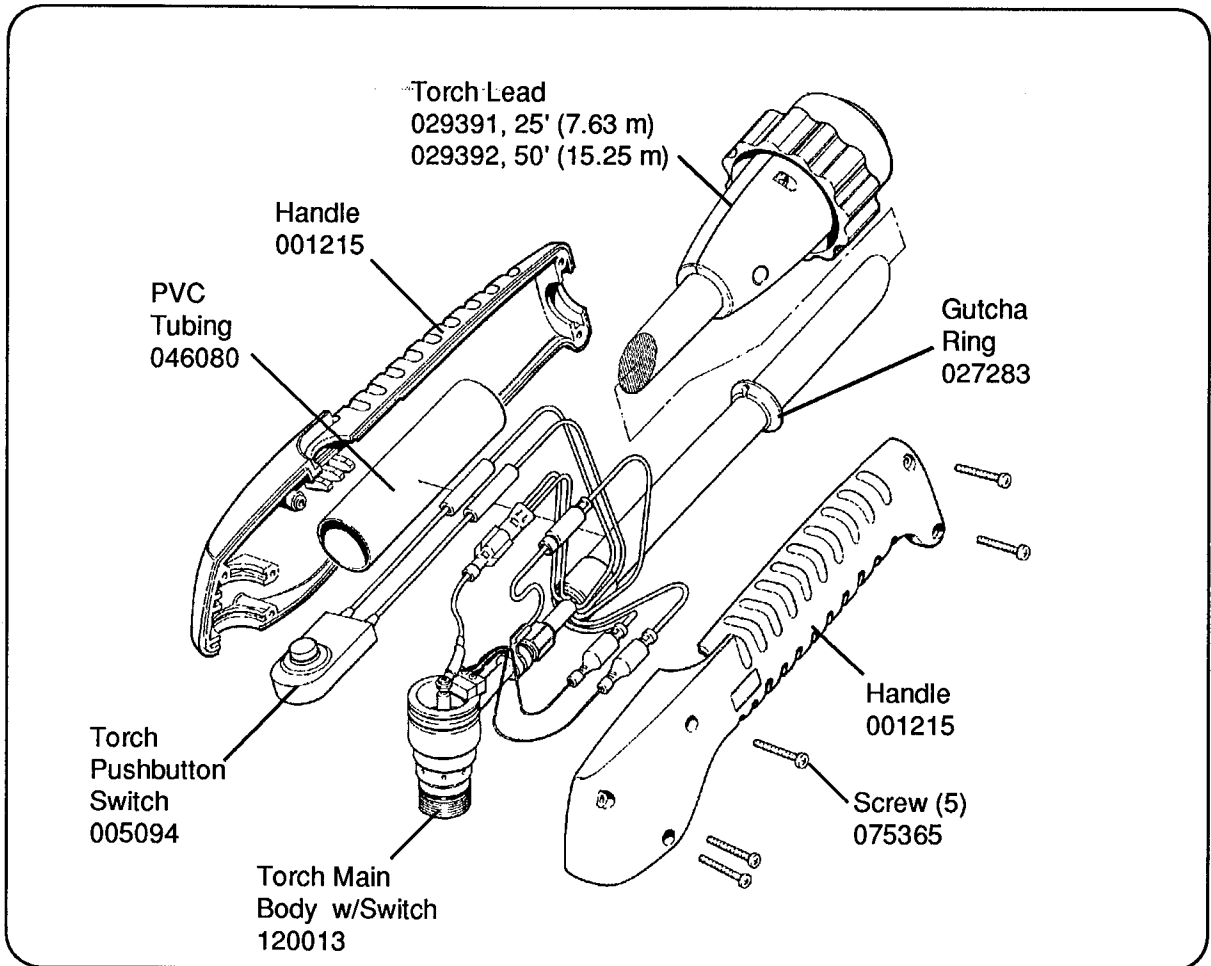


Figure 5-4 PAC121P Torch Assembly and Leads

STANDARD COMPONENTS

PAC121M Torch Assembly and Lead (25 Ft/7.63 M) - 071067

020620	Sleeve, Torch Position, PAC121M
020619	Sleeve, Insulator, PAC121M
020229	Ring, Locking PAC121M
020559	Sleeve, Machine Torch, PAC121M
120007	Torch Main Body w/Switch, PAC121M
028451	Torch Lead, 25 ft. (7.63 m)
044009	Quick Disconnect O-Ring (see Figure 5-8)
075321	Socket Cap, 4-40 x 1/2, HX, SS
075322	M/S, 4-40 x 1/4, SL, SZ
120023*	Nozzle, Pipe Saddle, Extended
020547*	Electrode, Extended
020361*	Ring, Swirl
020930*	Cap, Retaining

PAC121M Torch Assembly and Lead (50 Ft/15.25 M) - 071068

020620	Sleeve, Torch Position, PAC121M
020619	Sleeve, Insulator, PAC121M
020229	Ring, Locking PAC121M
020559	Sleeve, Machine Torch, PAC121M
120007	Torch Main Body w/Switch, PAC121M
028452	Torch Lead, 50 ft. (15.25 m)
044009	Quick Disconnect O-Ring (see Figure 5-8)
075321	Socket Cap, 4-40 x 1/2, HX, SS
075322	M/S, 4-40 x 1/4, SL, SZ
120023*	Nozzle, Pipe Saddle, Extended
020547*	Electrode, Extended
020361*	Ring, Swirl
020930*	Cap, Retaining

On/Off Pendant - Optional

028461	On/Off Pendant w/Lead, 25 ft. (7.63 m)
028462	On/Off Pendant w/Lead, 50 ft. (15.25 m)
028463	On/Off Pendant w/Lead, 75 ft. (22.9 m)

* Consumables shown on Figure 5-7.

STANDARD COMPONENTS

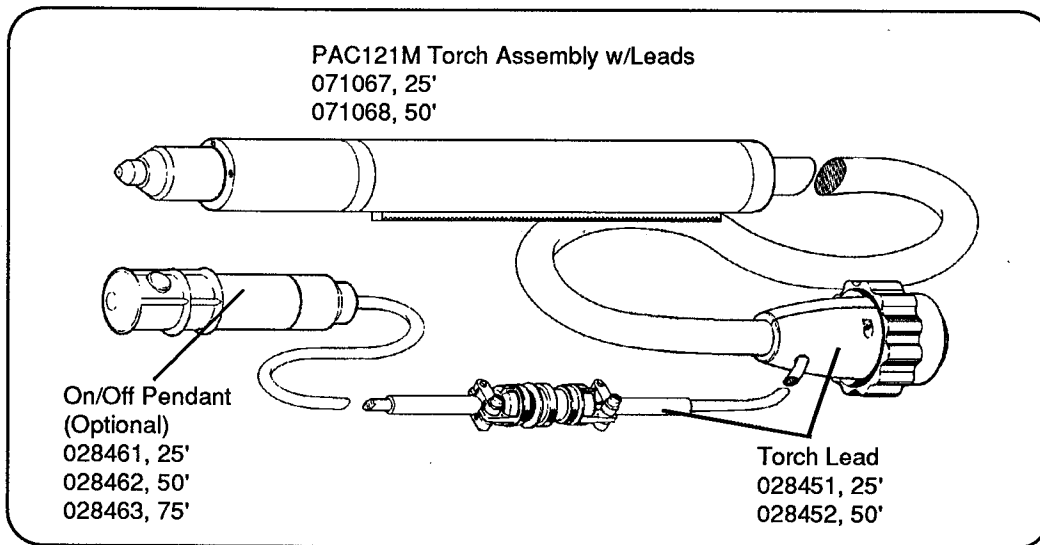


Figure 5-5 PAC121M Torch Assembly with Leads and Optional On/Off Pendant

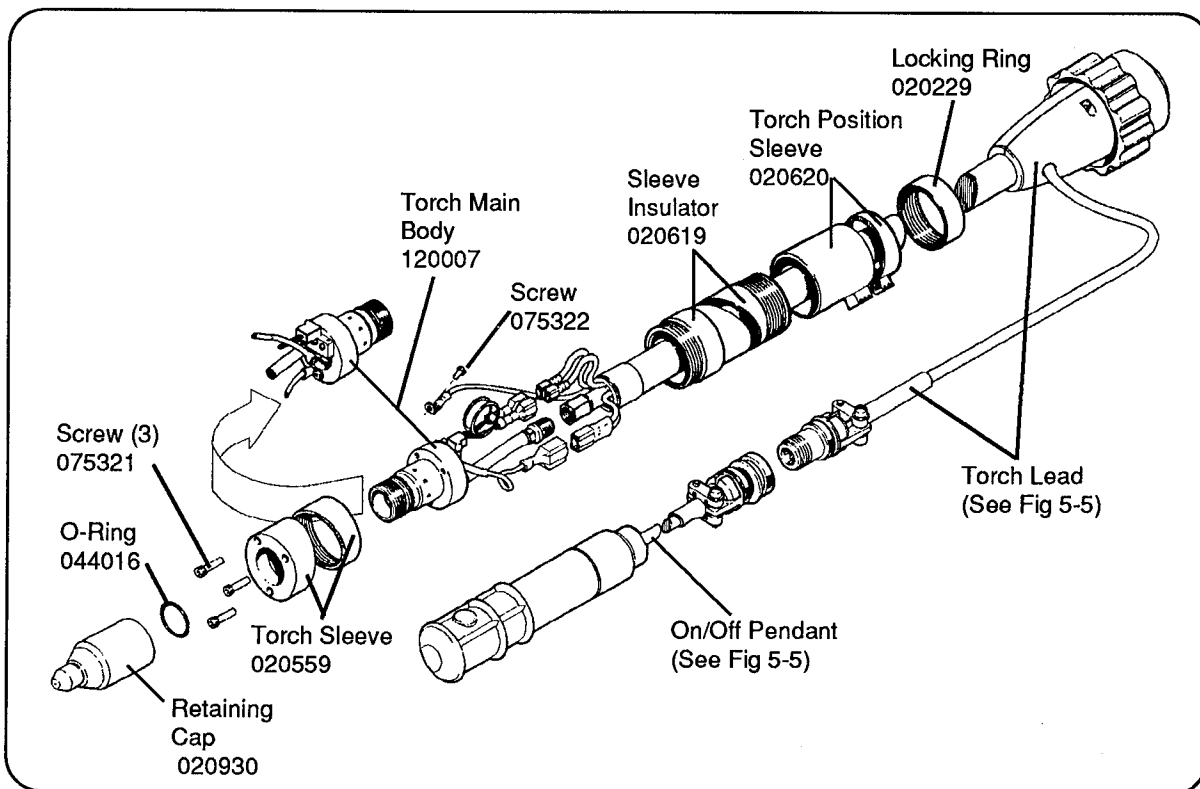


Figure 5-6 PAC121M Torch Assembly and Leads

STANDARD COMPONENTS

CONSUMABLE PARTS

Consumable Parts

020930	.....	Cap, Retaining
020361	.....	Ring, Swirl
020351	.....	Electrode, Air
020480	.....	Electrode, Nitrogen
020547	.....	Electrode, Extended
020350	.....	Nozzle
020539	.....	Nozzle, Gouging
120023	.....	Nozzle, Pipe Saddle, Extended
020546	.....	Nozzle, Extended

PAC121T and P Torch Consumable Parts Kit - 028735

001285	.....	Box, Consumable Parts (1)
020361	.....	Ring, Swirl (1)
020930	.....	Cap, Retaining (1)
020351	.....	Electrode, Air (5)
020350	.....	Nozzle (5)
020546	.....	Nozzle, Extended (5)
020547	.....	Electrode, Extended (5)
044016	.....	O-Ring (5)
015152	.....	Nipple, 1/8 NPT,QDisc, Steel (1)
015153	.....	Coupler, 1/8 FPT,QDisc, Brass (1)
015570	.....	Bushing, Reducer, 1/4 X 1/8, Brass (1)
015604	.....	Reducer, 1/4 FPT X 1/8 NPT, Brass (1)
027055	.....	Lubricant, Silicone 1/4 Oz Tube (1)

PAC121M Torch Consumable Parts Kit - 028736

001285	.....	Box, Consumable Parts (1)
020361	.....	Ring, Swirl (1)
020930	.....	Cap, Retaining (1)
020547	.....	Electrode, Extended (5)
120023	.....	Nozzle, Pipe Saddle, Extended (5)
044016	.....	O-Ring (5)
015152	.....	Nipple, 1/8 NPT,QDisc, Steel (1)
015153	.....	Coupler, 1/8 FPT,QDisc, Brass (1)
015570	.....	Bushing, Reducer, 1/4 X 1/8, Brass (1)
015604	.....	Reducer, 1/4 FPT X 1/8 NPT, Brass (1)
027055	.....	Lubricant, Silicone 1/4 Oz Tube (1)

STANDARD COMPONENTS

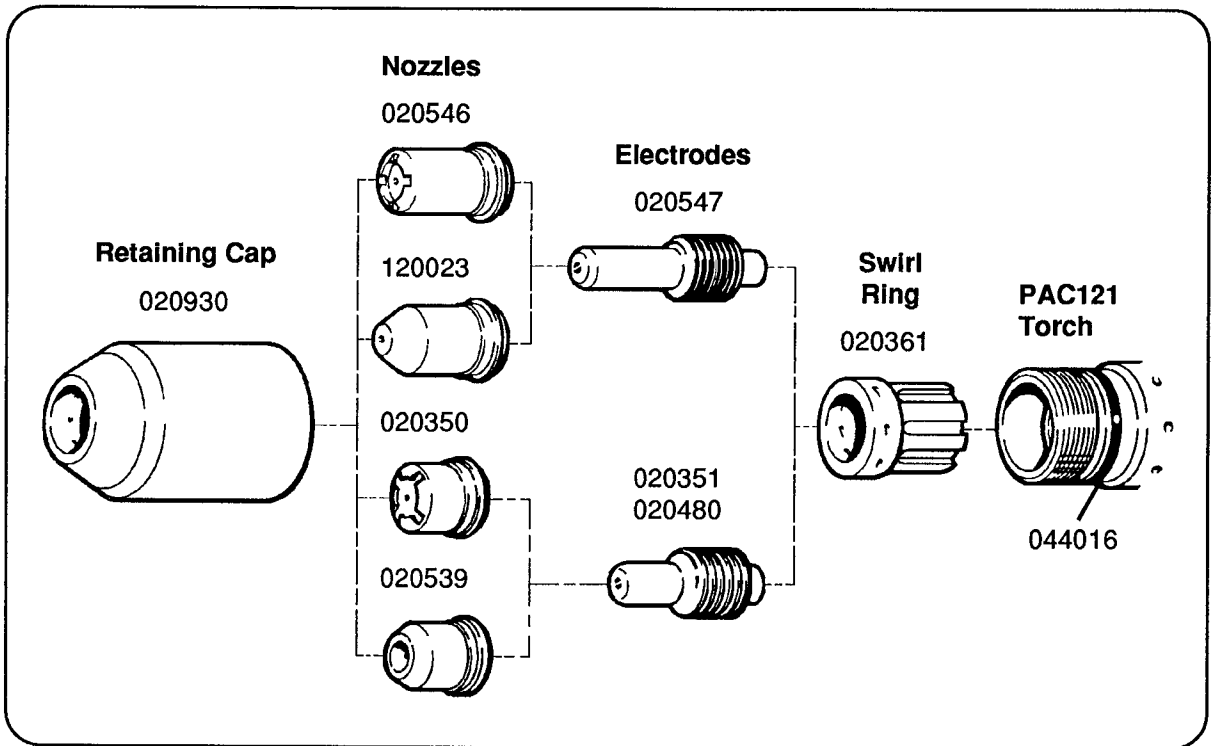


Figure 5-7 PAC121 Torch Consumables Parts

STANDARD COMPONENTS

RECOMMENDED SPARE PARTS

Power Supplies

Part No.	Description	Quantity
041307	PC BD Assy, Pilot Arc Control	1
008277*	Cord/Plug Set, 8-3 SO 7.3 ft (2.2 m)	1
023392**	Line Cord Euro, MAX42	1
023393***	Line Cord 480V, MAX42	1
011023	Filter, Regulator, Air (includes 011038 press. gauge)	1
011036	Filter Element (inside 011023)	3
011038	Pressure Gauge	1
029289*	Inverter Subsystem Assembly, 208-240V	1
029752**	Inverter Subsystem Assembly, 400V	1
029754***	Inverter Subsystem Assembly, 480V	1
003101*	Circuit Breaker, 1A 240V 40A 1 PH	1
003109**	Circuit Breaker, 400V 20A 3 PH W/TC	1
003106***	Circuit Breaker, 460V 15A 3 PH	1
029305*	Front Panel SA, 1 PH	1
029402**,***	Front Panel SA, 3 PH	1
008164	Knob	1
023205	Cable, Ground # 8 W/Clamp 15 ft (4.5 m)	1
029339*	Bracket SA, AP-PS	1
029716**	Brckt SA, AP-PS 400V (w/Time Delay Relay)	1
029715***	Brckt SA, AP-PS 480V (w/Time Delay Relay)	1
029351*	Pneumatics Subassembly	1
029714**,***	Pneumatics Subassembly	1

* Used in 208/240V, 1 PH, 50/60 Hz units.

** Used in 400V, 3 PH, 50 Hz units.

*** Used in 480V, 3 PH, 60 Hz units.

STANDARD COMPONENTS

RECOMMENDED SPARE PARTS (Continued)

PAC121T Torch Assembly and Leads

Torch Assembly

Part No.	Description	Quantity
001288	Handle, PAC121T	1
075340	Screws,P/S, # 4 x 5/8, PH, RND, S/B	5
002244	Safety Trigger, PAC121T	1
027254	Trigger Spring, PAC 121T	1
005094	Switch, Torch Pushbutton	1
020932	Torch Main Body w/Switch, PAC121T	1

Lead Assemblies

Part No.	Description	Quantity
029549	Torch Leads, 25 ft. (7.63 m)	1
029550	Torch Leads, 50 ft. (15.25 m)	1
044009	Quick Disconnect O-Ring	1

PAC121P Torch Assembly and Leads

Torch Assembly

Part No.	Description	Quantity
001215	Handle, PAC121T	1
075365	Screws,P/S, # 6 x 3/4, PH, RND, S/B	5
005094	Switch, Torch Pushbutton	1
120013	Torch Main Body w/Switch, PAC121P	1

Lead Assemblies

Part No.	Description	Quantity
029391	Torch Leads, 25 ft. (7.63 m)	1
029392	Torch Leads, 50 ft. (15.25 m)	1
044009	Quick Disconnect O-Ring	1

STANDARD COMPONENTS

PAC121M Torch Assembly and Leads

Torch Assembly

Part No.	Description	Quantity
020620	Sleeve, Torch Position, PAC121M	1
020619	Sleeve, Insulator, PAC121M	1
020229	Ring, Locking PAC121M	1
020559	Sleeve, Machine Torch, PAC121M	1
120007	Torch Main Body w/Switch, PAC121M	1
075321	Socket Cap, 4-40 x 1/2, HX, SS	
075322	M/S, 4-40 x 1/4, SL, SZ	

Lead Assemblies

Part No.	Description	Quantity
028451	Torch Leads, 25 ft. (7.63 m)	1
028452	Torch Leads, 50 ft. (15.25 m)	1
044009	Quick Disconnect O-Ring	1

Section 6 MAINTENANCE

In this section:

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MAINTENANCE

GENERAL

This section provides basic troubleshooting of the power supply. This section also includes the removal and replacement procedures of the PAC121T torch and the optional PAC121P torch and PAC121M torch parts; and quick disconnect O-ring removal and replacement. Wiring diagrams of the power supplies and inverters for all voltage configurations are provided at the end of this section.

For detailed troubleshooting of the power supply, refer to the following MAX42 Service Manuals:

- SM-116 (# 801160) - 208-240V, 1 PH, 50/60 Hz
- SM-134 (# 801340) - 400V, 3 PH, 50 Hz
- SM-137 (# 801370) - 480V, 3 PH, 60 Hz



WARNING



Do not remove the power supply cover to service the unit, unless there is a qualified service technician familiar with inverter power supply technology. MAX42 Service Manuals SM-116 (208-240V, 1 PH, 50/60 Hz), SM-134 (400V, 3 PH, 50 Hz) and SM-137 (480V, 3 PH, 60 Hz) are available to aid in servicing.

MAINTENANCE

TROUBLESHOOTING

Problem: The POWER switch is set to I (on), but there is no power or fan. The green POWER light is not lit.

Cause: The wall disconnect power switch is not on or there is no power available at the wall disconnect.

Solution: Turn the power switch on or check facility power.

Problem: The circuit breaker on the incoming power line fails during cutting, or the internal on/off switch/circuit breaker turns off.

Cause: The power supply has exceeded the capacity of the circuit breaker.

Solution: Check the circuit breaker for proper amperage rating.

Check power cable for a short or loose connection.

Cause: The inverter assembly is defective.

Solution: Return for service.

Cause: The voltage to the power supply is too low.

Solution: Measure the incoming line voltage. 191 VAC is the minimum while cutting.

Problem: The unit shuts itself off after it is turned on.

Cause: The retaining cap is loose or missing.

Solution: Tighten the retaining cap.

Problem: The arc does not transfer after three seconds.

Cause: The three-second time-out for the pilot arc has occurred.

Solution: Press the torch start button again.

Cause: The work clamp is not connected or it is broken.

Solution: Connect or repair the work clamp.

Problem: The arc blows out, but re-ignites when the torch is depressed.

Cause: There are faulty consumable parts.

Solution: Inspect and change the consumable parts if necessary.

Cause: The gas pressure is incorrect.

MAINTENANCE

Solution: Adjust the gas pressure (refer to Filter/Regulator Pressure Adjustment).

Solution: Clean or replace the pressure regulator filter (refer to Filter/Regulator Cleaning or Replacement).

Problem: The arc sputters and hisses.

Cause: The automatic water drain in the pressure regulator is not working.

Solution: Drain the water from the filter bowl and check the plunger:

1. Always **disconnect** the gas supply hose from the pressure regulator before unscrewing the filter bowl.
 2. Unscrew the filter bowl and empty water. Ensure that the plunger inside the bowl is not stuck and seats properly. Replace if damaged.
 3. Replace bowl and reconnect the gas supply hose.
-

FILTER/REGULATOR PRESSURE ADJUSTMENT

To adjust the filter/regulator pressure, perform the following procedure and refer to Figure 6-1.

1. Ensure the gas supply to the filter/regulator on the power unit is at 80-125 psi (5.5-8.6 bar) with at least 4.5 scfm (127 l/min) flow capacity.
2. At the pressure regulator, pull the locking ring (red) up to free the adjustment knob.
3. At the front panel, push the **TEST** switch in and hold and view the pressure gauge while adjusting the adjustment knob. Adjust until the pressure gauge reads 70 psi (4.8 bar).
4. Release **TEST** switch and push the locking ring down to secure the adjustment knob.

FILTER/REGULATOR FILTER CLEANING AND REPLACEMENT

To clean or replace the filter/regulator filter, perform the following procedure and refer to Figure 6-1.

1. Always **disconnect** the gas supply hose from the filter/regulator before unscrewing the filter bowl.
-

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2. Unscrew the filter bowl and then unscrew the filter and clean or replace if required.
3. Replace the filter and filter bowl.
4. Reconnect the gas supply hose to the filter/regulator.

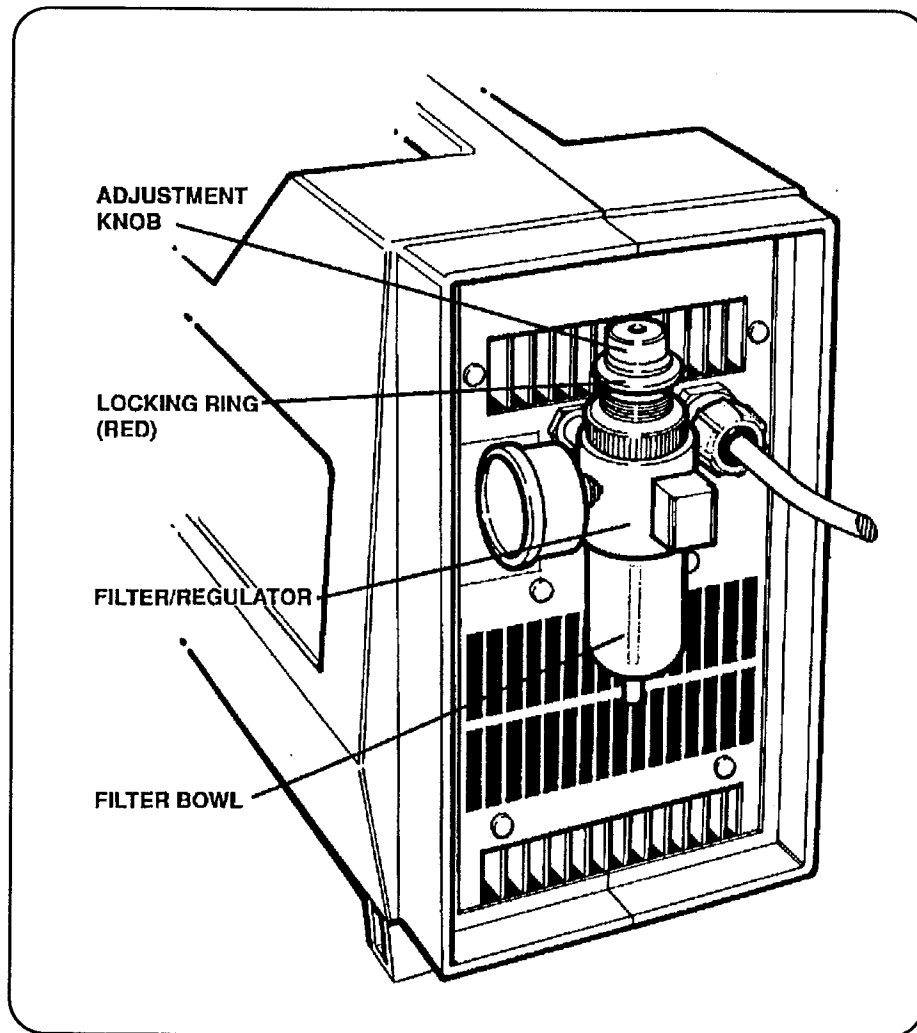


Figure 6-1 Filter/Pressure Regulator

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PAC121T TORCH PARTS REMOVAL AND REPLACEMENT

Repair of the PAC121T torch normally requires that either the torch main body or the torch switch be replaced. Refer to Section 5, *Standard Components* for a torch parts breakdown.

Torch Main Body Removal and Replacement

To remove and replace the torch main body, order the PAC121T torch main body with switch (020932) and refer to the following procedure and Figure 6-2.

1. Ensure the MAX42 power switch is positioned to OFF (0), unplug the power cable, and disconnect the gas supply.
2. Remove the five (5) screws which secure the handle halves together.
3. Remove the torch main body and torch switch from the handle halves.
4. Remove the Tyrap that holds wiring bundle in place.
5. Disconnect the black plunger wire and two white wires of the cap sensor microswitch from the torch leads.

Note: Disconnect wires by pulling on terminals. Do **not** pull on wires.

6. Disconnect the red wire attached to the pilot arc tab.
7. Disconnect torch main body and torch lead gas fittings using 5/16" and 7/16" wrenches.
8. Connect and tighten the new torch main body with the torch lead gas fittings.
9. Connect the terminal of the two white wires from the torch lead to the black plunger wire terminal of the torch main body.
10. Connect the bullet receptacles and plugs connecting the two blue wires from the torch lead to the white wires from the cap sensor microswitch.
11. Connect the red wire from torch leads to the pilot arc tab.
12. Bundle wires and attach Tyrap as necessary.
13. Install the torch main body and torch switch back into handle. Be certain that torch switch slides into position above safety trigger, and that trigger movement activates the button of the switch and then releases.
14. Position the handle halves together (be careful not to pinch any wires) and replace the five (5) screws to secure the handle halves together.

Torch Switch Removal and Replacement

To remove and replace the torch switch, order the torch switch (005094) and two (2) splices (074069) and refer to the following procedure and Figure 6-2.

1. Ensure the MAX42 power switch is positioned to OFF (0), unplug the power cable, and disconnect the gas supply.
2. Remove the five (5) screws which secure the handle halves together.
3. Remove the torch switch from the handle.
4. Remove the torch switch by cutting the two (2) splices at the torch lead (violet wires).
5. Replace the torch switch by crimping the switch leads and the violet leads from the torch lead together with the splices.
6. Install the torch switch back into handle. Be certain that torch switch slides into position above safety trigger, and that trigger movement activates the button of the switch and then releases.
7. Position handle halves together (be careful not to pinch any wires) replace the five (5) screws to secure the handle halves together.

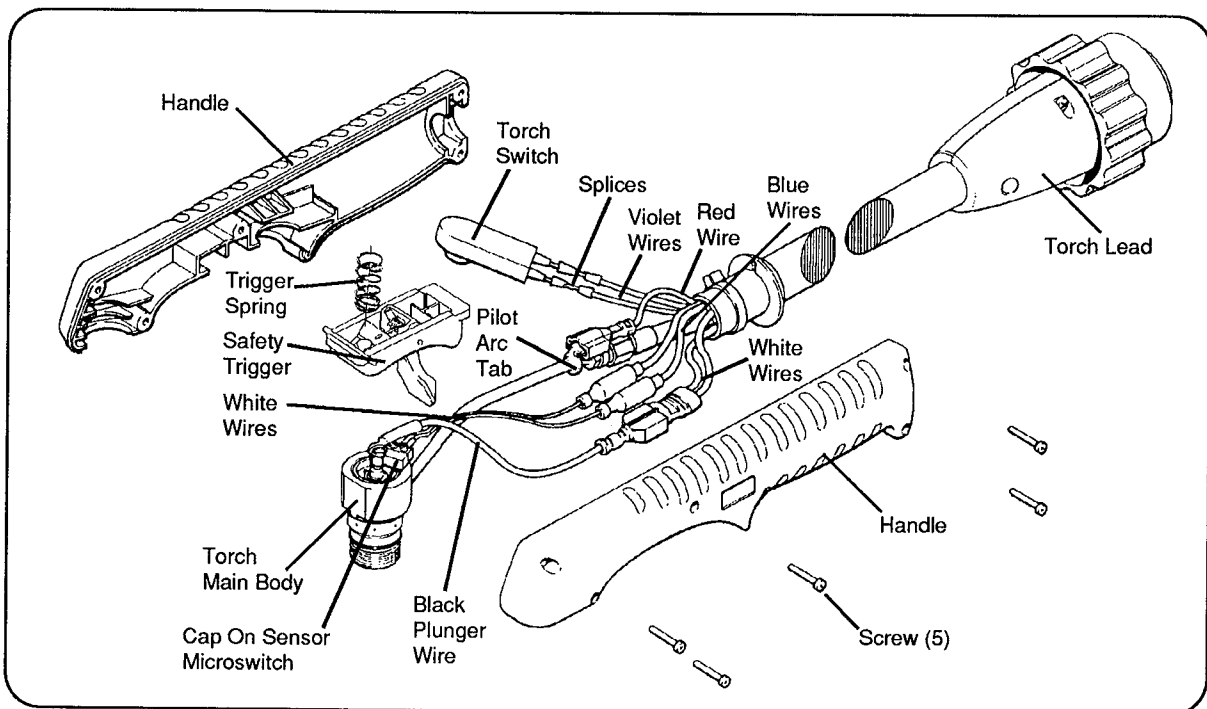


Figure 6-2 PAC121T Torch Assembly

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PAC121P TORCH PARTS REMOVAL AND REPLACEMENT

Repair of the PAC121P torch normally requires that either the torch main body or the torch switch be replaced. Refer to Section 5, *Standard Components* for a torch parts breakdown.

Torch Main Body Removal and Replacement

To remove and replace the torch main body, order the PAC121P torch main body with switch (120013) and refer to the following procedure and Figure 6-3.

1. Ensure the MAX42 power switch is positioned to OFF (0), unplug the power cable, and disconnect the gas supply.
2. Remove the five (5) screws which secure the handle halves together.
3. Remove the torch main body assembly and torch switch from the handle halves.
4. Slide the protective PVC tubing back away from the connections and disconnect the torch main body wires from the torch lead wires.

Note: Disconnect wires by pulling on terminals. Do **not** pull on wires.

5. Disconnect torch main body and torch lead gas fitting using 5/16" and 7/16" wrenches.
6. Connect the new torch main body and torch lead gas fitting using the wrenches.
7. Connect the terminals connecting the two white wires from the torch lead to the black plunger wire from the torch main body.
8. Connect the bullet receptacle and plug connecting the red wire from the torch lead to the red wire from the pilot arc fitting.
9. Connect the bullet receptacles and plugs connecting the two blue wires from the torch lead to the white wires from the cap sensor microswitch.
10. Slide the protective PVC tubing back over the connections.
11. Install the torch main body and torch switch into one of the handle halves. While positioning the handle halves together, be careful not to pinch any wires. Be especially careful around the torch switch retainers.
12. Replace the five (5) screws to secure the handle halves together.

Torch Switch Removal and Replacement

To remove and replace the torch switch, order the torch switch (005094) and two (2) splices (074069) and refer to the following procedure and Figure 6-3.

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1. Ensure the MAX43 power switch is positioned to OFF (0), unplug the power cable, and disconnect the gas supply.
2. Remove the five (5) screws which secure the handle halves together.
3. Remove the torch main body assembly, torch switch and wire bundle from the handle halves.
4. Slide the protective PVC tubing back away from the connections.
5. Remove the torch switch by cutting the two (2) splices at the torch lead (violet wires).
6. Replace the torch switch by crimping the switch leads and the violet leads from the torch lead together with the splices.
7. Slide the protective PVC tubing back over the connections.
8. Install the torch main body, torch switch and wire bundle into one of the handle halves.
9. Position the handle halves together (be careful not to pinch any wires) and replace the five (5) screws to secure the handle halves together.

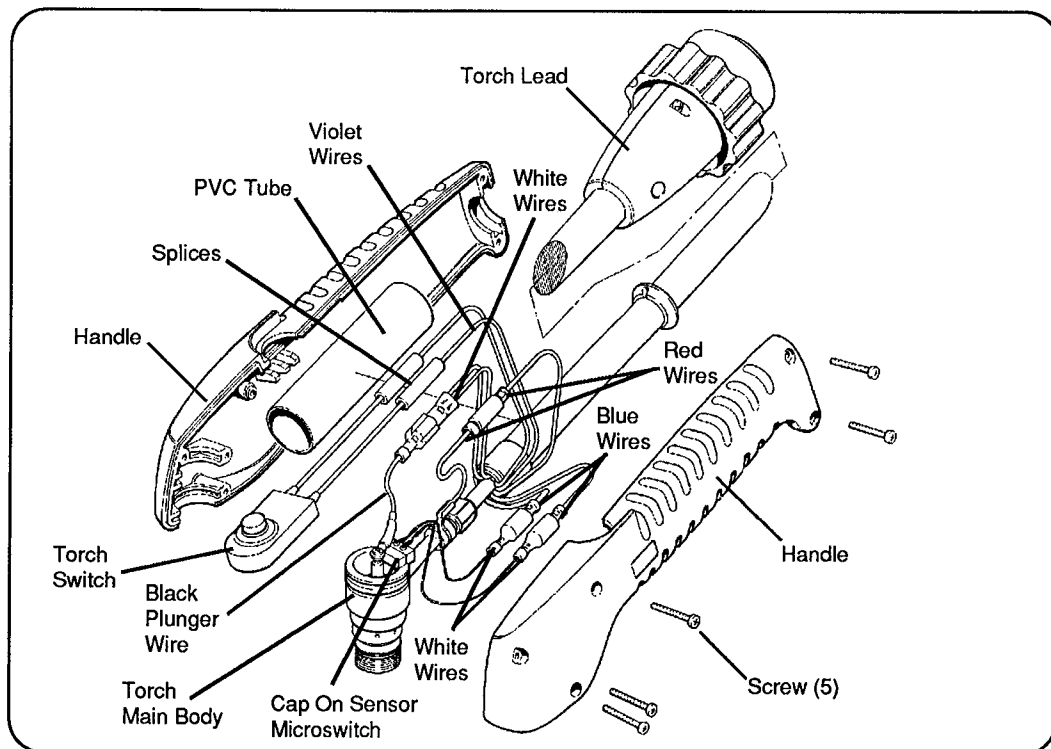


Figure 6-3 PAC121P Torch Assembly

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PAC121M TORCH PARTS REMOVAL AND REPLACEMENT

Repair of the PAC121M torch normally requires that the torch main body and/or torch lead be replaced. Refer to Section 5, *Standard Components* for a torch parts breakdown.

Torch Main Body Removal and Replacement

To remove and replace the torch main body, order the PAC121M torch main body with switch (120007) and refer to the following procedure and Figure 6-4.

1. Ensure the MAX42 power switch is positioned to OFF (O), unplug the power cable, and disconnect the gas supply.
2. Disconnect the torch lead quick disconnect from the power supply. Turn the connector securing ring counterclockwise (ccw).
3. Unscrew the retaining cap (020930) and remove the remaining parts (nozzle, electrode and insulator ring).
4. Remove the O-ring (44016) from the torch main body (120007).
5. Remove the three (3) screws (075321) securing the torch sleeve to the torch main body.
6. Unscrew the torch position sleeve (020620) from the torch sleeve (020559) and slide it back out of the way.
7. Remove the screw (075322) securing the red wire from the torch lead to the torch main body.

Note: Disconnect wires by pulling on terminals. Do **not** pull on wires.

8. Disconnect the terminals between the two (2) white wires from the torch lead and the black plunger wire from the torch main body .
9. Disconnect the terminals between the two (2) white wires from the microswitch and the blue wires from the torch lead.
10. Disconnect torch main body and torch lead gas fitting using 5/16" and 7/16" wrenches.
11. Remove O-ring (044016) from the replacement torch main body (120007). **Use caution when removing the O-ring, it can easily be damaged.**
12. Connect the torch main body and torch lead gas fitting using open-end wrenches.
13. Connect the terminals from the two (2) blue wires from the torch lead to the two (2) white wires from the cap sensor microswitch.

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14. Connect the terminals from the two (2) white wires from the torch lead and the black plunger wire from the torch main body.
15. Secure the red wire from the torch lead to the torch main body with screw (075322).
16. Position the torch sleeve (020559) on to the torch main body and secure it with the three (3) screws.(075321).
17. Use caution when installing O-ring (044016) on to the torch main body, it can be easily damaged. Lightly coat with silicone.
18. Screw the torch position sleeve (020620) and the torch sleeve (020559) together.
19. When the nozzle, electrode and swirl ring are properly in place, replace the retaining cap. When the retaining cap is tightened, the microswitch will click, indicating that the torch main body has been replaced correctly.
20. Align the connector plug key (on torch lead) with the connector receptacle key slot (on power supply) and push it in until the pins seat.
21. Turn the connector securing ring clockwise (cw) to tighten.

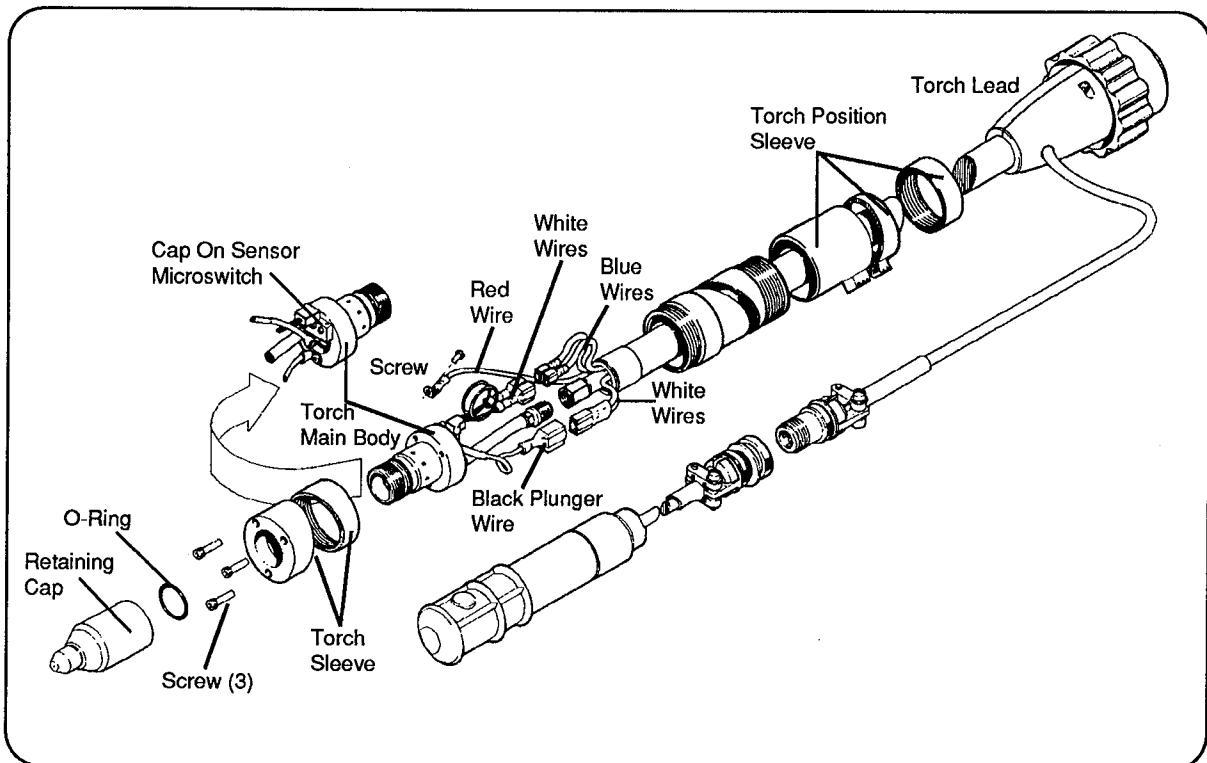


Figure 6-4 PAC121M Torch Assembly

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QUICK DISCONNECT O-RING REMOVAL AND REPLACEMENT

The quick disconnect o-ring (044009) on the PAC121 torch leads is required to provide a tight seal between the quick disconnect and receptacle on the power supply, so that the plasma gas does not leak during cutting. To remove and replace the o-ring in event of damage or wear, proceed as follows and refer to Figure 6-5 .

1. Ensure the MAX42 power switch is positioned to OFF (0), unplug the power cable, and disconnect the gas supply.
2. Disconnect the torch lead quick disconnect from the receptacle on the power supply.
3. Remove the O-ring as shown on Figure 6-5 using needle nose pliers, tweezers, etc.
4. Replace the O-ring. Ensure it seats properly.

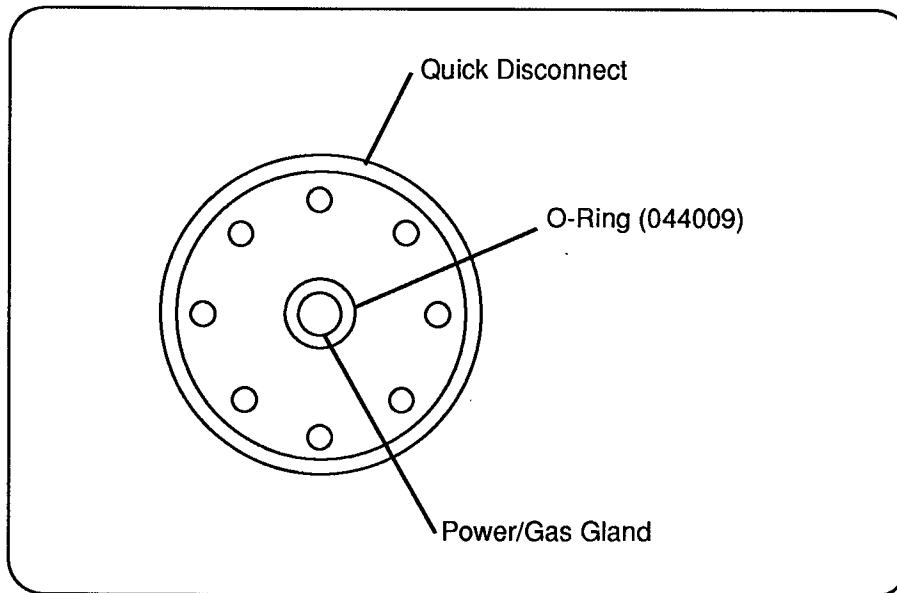


Figure 6-5 Quick Disconnect O-Ring Removal and Replacement

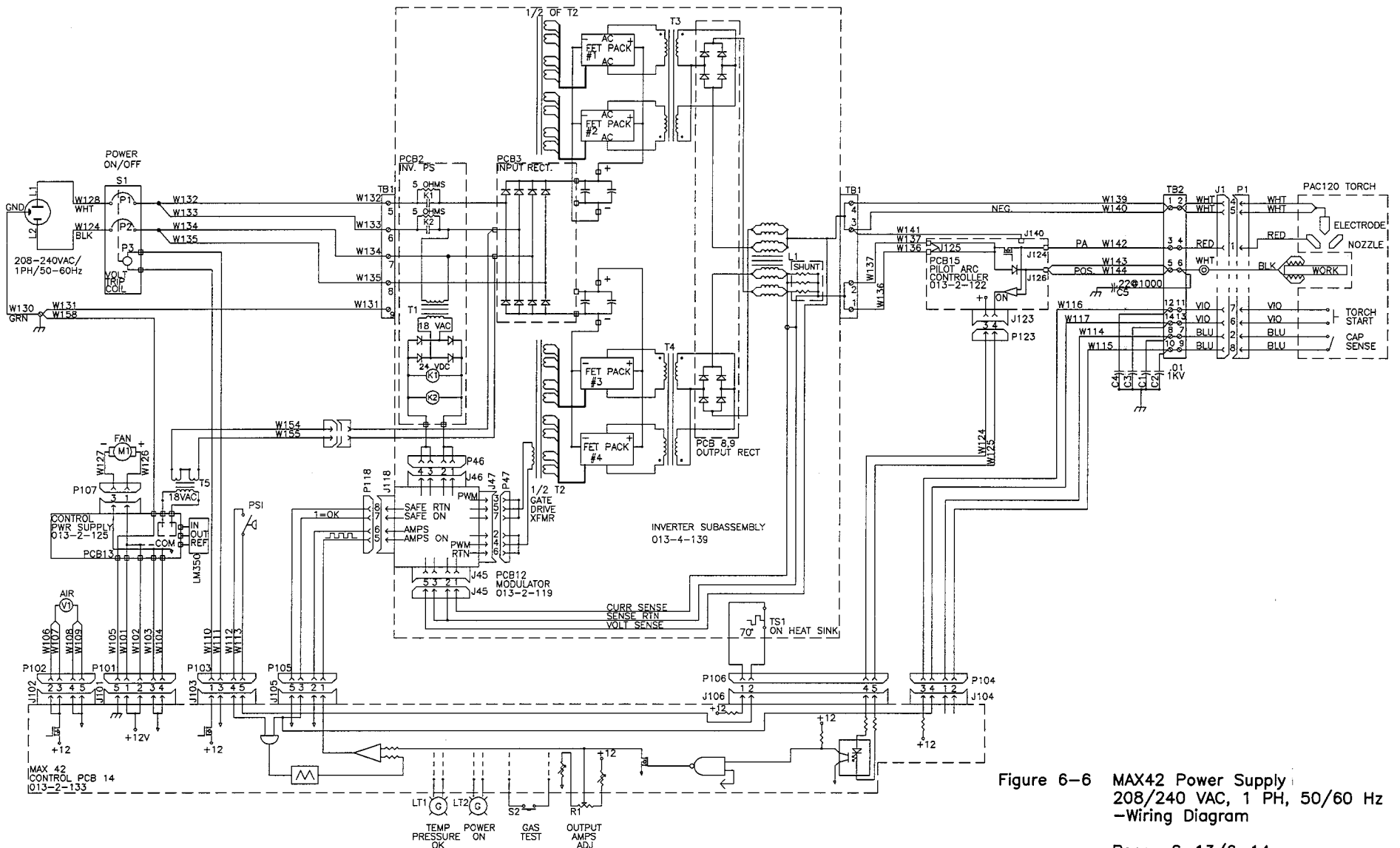


Figure 6-6 MAX42 Power Supply
 208/240 VAC, 1 PH, 50/60 Hz
 -Wiring Diagram

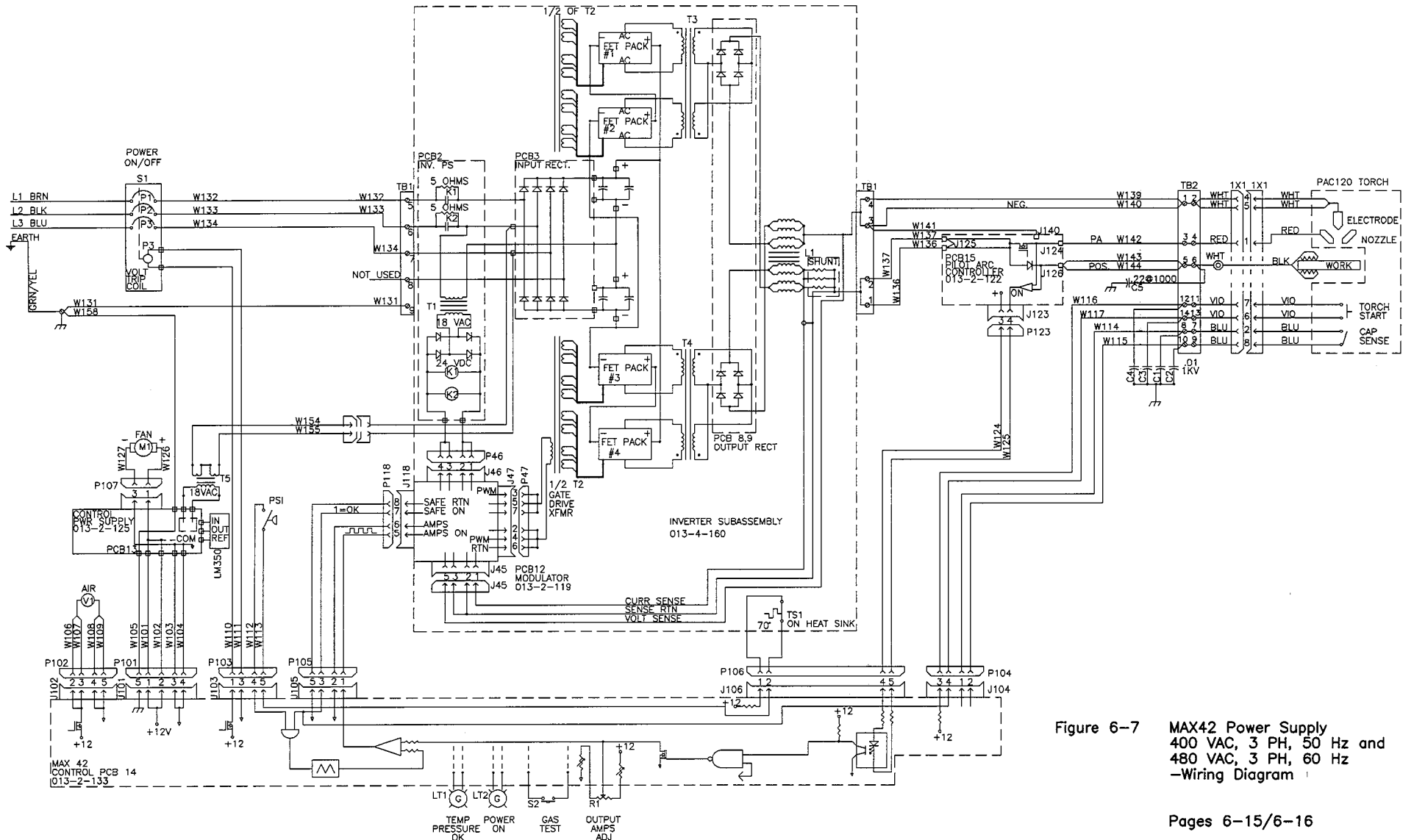


Figure 6-7 MAX42 Power Supply
400 VAC, 3 PH, 50 Hz and
480 VAC, 3 PH, 60 Hz
-Wiring Diagram

Section 7 STANDARDS INDEX

In this section:

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STANDARDS INDEX

For further information concerning safety practices to be exercised with plasma arc cutting equipment, please refer to the following publications:

1. ANSI Standard Z49.1, *Safety in Welding and Cutting*, obtainable from the American Welding Society, 550 LeJeune Road, P.O. Box 351020, Miami, FL 33135.
2. NIOSH, *Safety and Health in Arc Welding and Gas Welding and Cutting*, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
3. OSHA, *Safety and Health Standards*, 29FR 1910, obtainable from the U.S. Government Printing Office, Washington, D.C. 20402.
4. ANSI Standard Z87.1, *Safe Practices for Occupation and Educational Eye and Face Protection*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
5. ANSI Standard Z41.1, *Standard for Men's Safety-Toe Footwear*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
6. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
7. AWS Standard A6.0, *Welding and Cutting Containers Which Have Held Combustibles*, obtainable from the American Welding Society, 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135.
8. NFPA Standard 51, *Oxygen — Fuel Gas Systems for Welding and Cutting*, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
9. NFPA Standard 70-1978, *National Electrical Code*, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
10. NFPA Standard 51B, *Cutting and Welding Processes*, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.
11. CGA Pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders*, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.
12. CSA Standard W117.2, *Code for Safety in Welding and Cutting*, obtainable from the Canadian Standards Association Standard Sales, 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3, Canada.
13. NWSA booklet, *Welding Safety Bibliography*, obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.

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14. American Welding Society Standard AWS F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances*, obtainable from the American Welding Society, 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135.
15. ANSI Standard Z88.2, *Practices for Respiratory Protection*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.
16. Canadian Electrical Code Part 1, *Safety Standards for Electrical Installations*, obtainable from the Canadian Standards Association, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W1R3.

GLOSSARY

AC	Alternating Current. Motion of current alternately in one direction, then the other. The number of times per second the direction changes (the "frequency") is measured in hertz.
amp	Amperes. Measurement of the electron flow (the number of electrons per second) in an electrical circuit.
anode	The "positive" (+) side of a DC power source. Electrons leave the cathode and move toward the anode; ions move in the opposite direction. Plasma cutting requires the work and the nozzle to be the anode, and the electrode to be the cathode.
arc	Motion of electricity in a gas.
AWG	American Wire Gauge. Defines the diameter of wires.
bar	A unit of pressure equal to one million dynes per square centimeter.
breaker	A device which interrupts an electrical current if the current exceeds a preset amperage setting. Breakers can be returned to their conducting (non-interrupting) state by some mechanical action, such as flipping a switch.
cap	Nozzle retaining cap. Holds the swirl ring, electrode and nozzle inside the torch.
capacitor	A device that stores electric energy in the form of voltage.
cathode	The "negative" (-) side of a DC power source. (See anode)
consumable	Electrode, nozzle, swirl ring and retaining cap.
cos ϕ	Power factor defined as true input power as divided by apparent input power S_1 measured at rated load conditions. Apparent input power is defined as $S_1 = U_1 I_1$. True input power is measured with special instrumentation.
CSA	Canadian Standards Association. A product standards and testing agency.
current	Movement of electricity, measured in amperes. Current is said to move in a direction opposite that of electron flow.
DC	Direct Current. Motion of current in one direction only, from anode (+) to cathode (-).
dross	Globs of metal hanging around the kerf, usually on the bottom side.
duty cycle (X)	Percentage of on-time (measured in minutes) in a 10 minute period in which a device can be operated.
electricity	Fundamental property of atoms that atoms can have their electrons pulled away ("ionized") and then the electrons can move about in metals or gases. An atom missing one or more electrons is called an ion. Both electrons and ions can move about in gases.

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electrode	A part inside the torch connected to the cathode (-) of the power supply. Electrons come out of the electrode.
ferrule	A ring of metal surrounding the end of a cable or wire to strengthen a connection.
fuse	A protective device which melts when the current running through it exceeds the usage rating.
ground	An electrical connection buried in the earth to establish a voltage of zero (0) volts.
Hertz (Hz)	Measurement of "frequency" of an AC voltage or current in cycles per second.
IEC	International Electrotechnical Commission. An international standards organization.
interlock	A safety device which must be activated before another device can be activated.
ion	An atom which has an excess or shortage of electrons.
IP	International Protection. An IEC designator, describing the degree of protection an enclosure offers against entry of objects and water.
I₁	Rated supply current in RMS amps (Root-Mean-Square). The supply current to the power source at a rated cutting condition (given U ₁ , U ₂ and I ₂).
I₂	Rated output cutting current.
kerf	Slit made in a workpiece by a cutting torch.
kilowatt	Thousand (kilo) watts. Measurement of electrical power.
LED	Light Emitting Diode. An electronic indicator lamp.
line	As in "line voltage." Utility voltage from a branch circuit (wall outlet).
liters/minute	A measure of gas flow.
nozzle	Tip of the plasma torch, made from copper, out of which the plasma arc comes. The nozzle pinches the plasma arc. It is usually an anode (+).
OCV	Open Circuit Voltage. U _o . The highest voltage from a electrical power supply. It occurs when the power supply is on and active but not producing a plasma arc.
pilot arc	A plasma arc that attaches to the torch nozzle rather than the work.
plasma	An electrically charged gas is said to be "ionized". A cloud of ionized gas together with its electrons is called "plasma."
plasma arc	Movement of electric current in a plasma (ionized gas). An intensely hot and bright

GLOSSARY

	arc which exists between the cathode (-) (electrode) and the anode (+) (either the nozzle or the work).
pressure	Force per unit area.
psi	Pounds per Square Inch. Measurement of gas pressure.
quench	Put in water to cool.
regulator	A mechanical device to control the outlet pressure of a gas supply.
ripple	Unwanted variations in current or voltage from an electrical power supply.
scfm	Standard cubic feet per minute. A measurement of gas flow.
S₁	Rated apparent input power. $S_1 = U_1 I_1$
single phase	An alternating current carried by only two wires. In the U.S. the "hot" carries the AC voltage and the "neutral" is at approximately "ground" voltage. The "ground" wire carries current only in fault conditions.
swirl ring	An insulating ring that separates the electrode from the nozzle and causes the air inside the plasma torch to swirl and aid in squeezing the arc.
transfer	A pilot arc <i>transfers</i> to the work when the plasma arc leaves the surface of the nozzle and attaches to the work.
U₀	Rated Open Circuit Voltage occurring at the rated input voltage (U ₁).
U₁	Rated Supply Voltage. The supply voltage for which the power source is constructed.
U₂	Conventional load voltage. The output load voltage at which rated input current (I ₁), rated output current (I ₂) and duty cycle (X) are measured.
VAC	Volts Alternating Current.
VDC	Volts Direct Current.
volt	Measurement of electrical force required to move an electric current through an electrical circuit.
watt	Measurement of electrical power. The ability to heat the work equivalent to a current of one ampere times an electrical force of one volt.
work(piece)	The object to be cut.
X	Duty cycle at a given U ₁ , U ₂ and I ₂ .