

MAX40cs[®]

***Plasma Arc
Cutting System***

***Instruction Manual
801000 - Rev. 6***

HYPERTHERM[®]


MAX40cs[®]
Plasma Arc Cutting System

Instruction Manual
IM-100
(P/N 801000)

for Serial Numbers beginning with
61-1314

Revision 6 May 1995

HYPERTHERM, Inc.
P.O. Box 5010
Hanover, New Hampshire 03755-5010
Tel.: (603) 643-3441
Fax: (603) 643-5352

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Hypertherm Offices Worldwide:

Hypertherm, Inc.

Etna Road, P.O. Box 5010
Hanover, NH 03755 USA
Tel.: (603) 643-3441 (Main Office)
Fax: (603) 643-5352 (All Departments)
Tel.: (800) 643-9878 (Technical Service – toll-free in USA and Canada)
Tel.: (800) 737-2978 (Customer Service – toll-free in USA and Canada)
email: info@hypertherm.com (General Information)
email: service@hypertherm.com (Technical/Customer Services)

Hypertherm Plasmatechnik GmbH

Technologiepark Hanau
Rodenbacher Chaussee 6
D-63457 Hanau-Wolfgang, Germany
Tel.: 49 6181 58 2100
Fax: 49 6181 58 2134

Hypertherm (S) Pte Ltd

No. 19 Kaki Bukit Road 2
K.B. Warehouse Complex
Singapore 417847
Tel.: 65 841 2489
Fax: 65 841 2490

Hypertherm UK Ltd

9 Berkeley Court, Manor Park
Runcorn, Cheshire, England WA7 1TQ
Tel.: 44 1928 579 074
Fax: 44 1928 579 604

France

15 Impasse des Rosiers
95610 Eragny, France
Tel.: 33 1 30 37 15 28
Fax: 33 1 30 37 15 79

Hypertherm S.r.L.

Via Torino 2
20123 Milan, Italy
Tel.: 39 02 725 46 312 (Customer Service)
Tel.: 39 02 725 46 314 (Technical Service)
Fax: 39 02 725 46 400 (All Departments)

Hypertherm B.V.

Burg, Haverkampstraat 13
7091 CN Dinxperlo, The Netherlands
Tel.: 31 315 655 866 (Customer Service)
Fax: 31 315 655 886

European Technical Support Organization (ETSO)

Edisonstraat 12
3281 NC Numansdorp, The Netherlands
Tel.: 00 800 4973 7843 (00 800 Hypertherm) – (toll-free Technical Service)
Tel.: 31 186 659494
Fax: 31 186 659495

Japan

Shinjuku Park Tower
30th Floor
3-7-1 Nishi-Shinjuku
Shinjuku-ku, Tokyo
163-1030, Japan
Tel.: 81 03 5326 3142
Fax: 81 03 5326 3001



ATTENTION



Genuine Hypertherm parts are the factory-recommended replacement parts for your Hypertherm system. Any damage caused by the use of other than genuine Hypertherm parts is not covered by the Hypertherm warranty.

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HYPERTHERM, Inc. warrants that Products shall be free from defects in materials and workmanship, under proper and normal use for which such Equipment is recommended, for a period of two (2) years, except only with respect to the Torch, for which the warranty period shall be one (1) year, from the date of its delivery to you or to a customer by you, BUT IN NO EVENT SHALL THIS WARRANTY EXTEND BEYOND 36 MONTHS FROM THE DATE OF ORIGINAL DELIVERY TO YOU BY HYPERTHERM.

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SAFETY

INTRODUCTION

Abbreviated safety precautions are printed on the MAX40cs unit. Before using the 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 MAX40cs.

Caution: A caution describes a situation that may cause damage to the MAX40cs, 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, 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 or goggles with side shields. Refer to the chart below for recommended lens shades.
- Replace glasses/goggles when the lenses become pitted or broken.
- Warn other people in the area not to look directly at the arc unless they wear dark safety glasses.
- Hold the torch away from your body when starting. The pilot arc will come on immediately when you press the start button.
- 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.

<u>Arc Current</u>		<u>Lens 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

Skin Safety

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

- Wear protective clothing:
 - Wear gauntlet gloves, safety shoes and hat.
 - Wear flame-retardant clothing which covers all exposed areas.
 - Wear cuffless trousers to prevent entry of sparks and slag.

- Hold the torch away from your body when starting. The pilot arc will come on immediately when you depress the start button.
- 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 the MAX40cs 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.

SAFETY

- Never use a MAX40cs to cut containers with potentially flammable materials inside. Such containers must be thoroughly cleaned prior to cutting.
- Ventilate potentially flammable atmospheres before using the MAX40cs. Never operate the MAX40cs in an atmosphere which contains heavy concentrations of dust, flammable gas or combustible liquid vapors.

Electric Shock Prevention



The MAX40cs uses high voltage (approximately 250 VDC) to initiate the plasma arc. Take the following precautions when operating this equipment:

- Keep your body and clothing dry.
- Do not stand in, sit on or lie on any wet surfaces when using the MAX40cs.
- 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 MAX40cs power supply. This switch allows the operator to turn the MAX40cs off quickly in an emergency situation.
- Conform to all local electrical codes for primary wiring sizes and types.
- Inspect the power cord and torch lead frequently for damage or cracking of the covers. **Bare wiring can kill.** Do not use the system with a damaged power cord or torch lead. If a power cord or torch lead is damaged, replace it immediately.
- Should you need to remove the power supply cover after operation, disconnect the main power or unplug the power supply. Wait five minutes to allow capacitor discharge to occur. Failure to do so exposes you to severe electrical hazard.
- Never operate the MAX40cs unless the power supply unit cover is 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, switch the power supply off or unplug the power supply. After changing the torch parts and returning the retaining cap to its operating position, plug the unit in again.
- Never bypass or shortcut the safety interlocks.

Explosion Prevention



When cutting with the MAX40cs:

- Do not cut in atmospheres containing explosive dust or vapors.
- Do not cut pressurized cylinders.
- Do not cut 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 CGA and AWS safety standards.
- 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.
- 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.

SAFETY

Grounding

Before operating the MAX40cs:

Input Power

- Be sure the power cord is properly connected to the ground in the disconnect box.
- Be sure that the power cord ground wire is properly connected to the ground stud in the power supply. Place the power cord ground wire first on the stud, then place the other wires on top of the power cord ground.
- Make sure that all electrical connections are tight to avoid excessive heating.
- 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.

Output Power

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

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

SAFETY DEVICES

- The MAX40cs is designed with a safety interlock which turns off the power unit when the retaining cap is loosened.
- Never bypass or shortcut the safety interlocks.
- The MAX40cs is designed specifically to be used with the PAC120, PAC120T, or Machine torch. Do not use other torches.
- Use only Hypertherm replacement and consumable parts. Any damage caused by the use of other than genuine Hypertherm parts is not covered under the Hypertherm warranty.
- Never operate the MAX40cs with any of the power supply covers not in place. It is hazardous to the operator and other people in the area, and prevents the equipment from properly cooling the components.

STANDARDS INDEX

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

Section 1-B SÉCURITÉ

Cette section comprend:

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SÉCURITÉ

INTRODUCTION

Des consignes de sécurité condensées sont imprimées sur l'appareil du MAX40CS. 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 MAX40CS.

Prévention: Un signe de prévention décrit une situation qui risquerait d'endommager le MAX40CS, 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



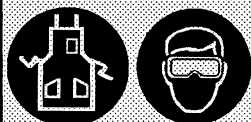
LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE MORTELS.



- 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 agréé.



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.
- Refroidir le bouchon de la torche et les pièces consommables après une longue coupe en mettant le commutateur RUN/TEST en position TEST.
- 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.

Protection de la peau

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

- Porter des habits de sécurité:
 - Des gants à crispin 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 aux vapeurs ne portent un appareil respiratoire ou un casque ventilé.

Prévention des incendies



Le coupage avec le MAX40CS 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.

SÉCURITÉ

- Les matières inflammables doivent être maintenues à au moins 10 m (35 pieds) de l'aire du coupage.
- 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 MAX40CS 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 MAX40CS. Ne jamais faire fonctionner le MAX40CS 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 MAX40CS produit une forte tension (environ 280 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 MAX40CS.
- 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 MAX40CS. Cet interrupteur doit permettre à l'utilisateur d'arrêter rapidement le MAX40CS 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 MAX40CS 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 MAX40CS:

- 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.

SÉCURITÉ

- Ne jamais utiliser une bouteille qui n'est pas placée dans le bon sens et bien assujettie.
- 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.
- Eviter 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.
- Des tuyaux à gaz pour la coupe de plasma à l'arc doivent adhérer aux codes de couleurs suivant:

Tuyaux

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 encoulement.
- 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 MAX40CS:

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 MAX40CS 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 MAX40CS est conçu pour les torches MAX40CS. 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 MAX40CS 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.

SÉCURITÉ

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 SPECIFICATIONS

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MAX40cs Power Supply	2-3
PAC121P/121T Hand Torch.....	2-4
PAC121M Machine Torch	2-4

SPECIFICATIONS

GENERAL

Hypertherm's MAX40cs plasma cutting system is designed for hand cutting of most metals from gauge to 3/8 inch (10 mm) thick.

The MAX40cs provides continuously adjustable current output from 20 to 40 amps on all thicknesses up to 3/8 inch (10 mm) thick. This allows the operator wide variations in cutting speeds on the same thickness of metal. The 20-amp setting is for metals up to 1/16 inch (1.6 mm) thick, while the 40-amp setting is used for heavier metals.

The "chopper" power supply design provides superior cut quality and long parts life. This design minimizes DC ripple which contributes to outstanding cut quality.

The MAX40cs features a contact-start system that eliminates the need for high frequency starting.

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.

SPECIFICATIONS

PRODUCT SPECIFICATIONS

MAX40cs Power Supply

The MAX40cs is a constant current, chopper power supply providing continuously variable amperage from 20 amps to 40 amps.

Maximum OCV 245 VDC

Output Current 20-40 Amps

Output Voltage 110 VDC

Duty Cycle Rating at 40°C 50%

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 Power at rated output (4.1 kw):

057116 208-240-480 VAC, 1 PH, 60 Hz, 30/26/13 Amps

057117 575 VAC, 3 PH, 60 Hz, 7 Amps

057118 200-230 VAC, 1 PH, 50-60 Hz, 31/27 Amps

057119 220-380-415 VAC, 3 PH, 50 Hz, 16.2/9.4/8.6 Amps

057130 460 VAC, 3 PH, 60 Hz, 8 Amps

Dimensions Width — 19 inches (480 mm)
Height — 39-1/8 inches (995 mm)
Length — 16-5/8 inches (420 mm)

Weight 175 pounds (79 kg)

Gas Type Shop Compressed Air, Cylinder Compressed Air, or Nitrogen (clean, dry, oil-free)

SPECIFICATIONS

Shop Compressed Air	270 scfh/4.5 scfm (127 l/min) @ 80 - 120 psi (5.5 - 8.3 bar) supplied to power supply pressure regulator
Cylinder Compressed Air or Nitrogen	270 scfh/4.5 scfm (127 l/min) @ 80 - 120 psi (5.5 - 8.3 bar) supplied to power supply pressure regulator
Power Supply Regulator Pressure Setting	70 psi (4.8 bar)

PAC121P/121T Hand Torch

Maximum cutting thickness range	3/8 inch (10 mm)
Maximum current at 50% duty cycle	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 (7.63 m) lead

PAC121M Machine Torch

Maximum cutting thickness range	3/8 inch (10 mm)
Maximum current at 50% duty cycle	40 Amps
Gas Flow	270 scfh/4.5 scfm at 70 psi (127 l/min at 4.8 bar)
Weight	7.5 pounds (3.4 kg) with 25-ft (7.63 m) lead

Section 3 SETUP

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PAC121P/121T Torch Lead Connections	3-8
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SETUP

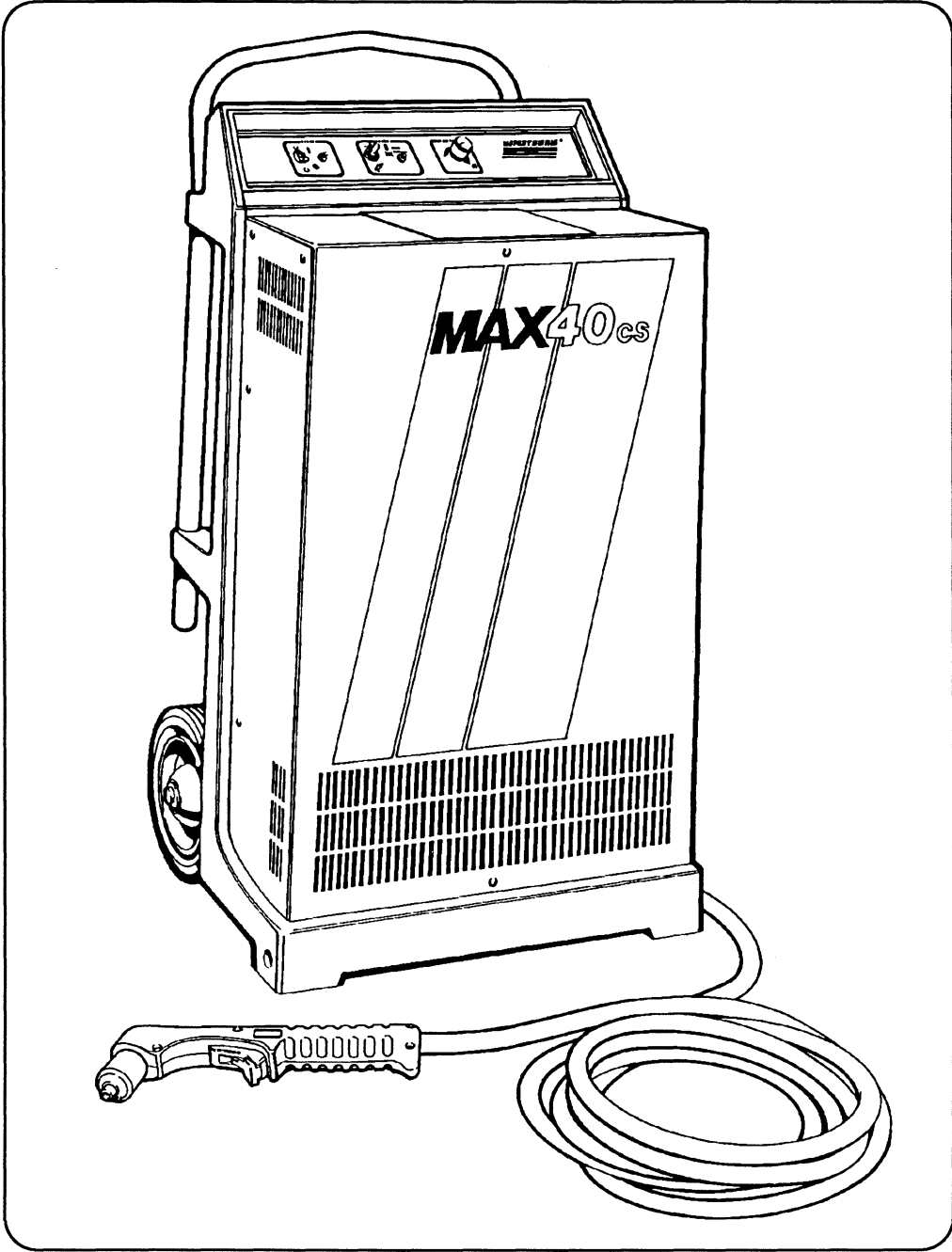


Figure 3-1 MAX40cs System

UPON RECEIPT

The MAX40cs power supply is shipped mounted to a skid and protected by a heavy carton cover. Before unpacking the unit, inspect the carton for evidence of damage during shipment.

1. Remove all packing material and discard. Do not leave the packing material in the cutting area; it can create a fire hazard.
2. Remove the power supply unit from the shipping skid. The shipped items should include:
 - MAX40cs Power Supply
 - 10-foot (3 m) power cable
 - PAC121 torch and torch lead assembly
 - 15-foot (4.6 m) work cable with clamp
 - Spare parts kit
 - Instruction Manual IM-100 (P/N 800100)
 - Remote Switch, MAX40cs, 25', 50', or 75' - optional
 - Remote Switch, MAX100/200, 25' - optional
3. Verify that all components are present. Alert your distributor if any parts are missing.

Damage Claims

Claims for damage during shipment — If your unit was damaged during shipment, you must file a claim with the carrier. Hypertherm will furnish you with a bill of lading upon request. Call our Customer Service group at 1-800-643-0030.

POWER SUPPLY PLACEMENT

- Place the power supply in an area that is free of excessive moisture, has proper ventilation, and is relatively clean.
- Place the power supply so that air flow is not blocked in any way. (Cooling air is drawn in through the front and side panel grating, and is exhausted through the rear of the unit by a cooling fan.)

SETUP

POWER REQUIREMENTS

Line Disconnect Switch

A separate line disconnect switch should be provided for each MAX40cs 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. The disconnect box should be sized to the following requirements:



<u>Input Voltage</u>	<u>Phase</u>	<u>Input Current @ 4.1 kw Output</u>	<u>Recommended Fuse Size</u>
208-240-480V	1	30/26/13 Amps	50/45/25 Amps
575V	3	7 Amps	15 Amps
200-230V	1	31/27 Amps	50/45 Amps
220-380-415V	3	16.2/9.4/8.6 Amps	30/20/15 Amps
460V	3	8 Amps	15 Amps

Power Cord

- The 208-240-480 volt units are supplied with a 8-3 type SO power cord without a plug. A correctly sized plug should be installed by a licensed electrician.
- The 575 volt units, 220-380-415 volt units, and 460 volt units are supplied with a 10-4 type SO power cord without a plug. A correctly sized plug should be installed by a licensed electrician.
- The 200-230 volt units are supplied with a 8-3 type SO power cord without a plug. A correctly sized plug should be installed by a licensed electrician.

Linkboard

- For 208-240-480 volt units, (# 057116), ensure that the linkboard is configured properly to the appropriate input line voltage. Check the placement of the links. (See Figure 3-2.) The linkboard is located in the center at the rear of the power supply. Refer to Section 5, *Standard Components*, Figure 5-3, item 9.)

**WARNING**

Danger: High Voltage. Line voltage is present in the power supply unless disconnected. Always disconnect input power at the line disconnect switch before servicing.

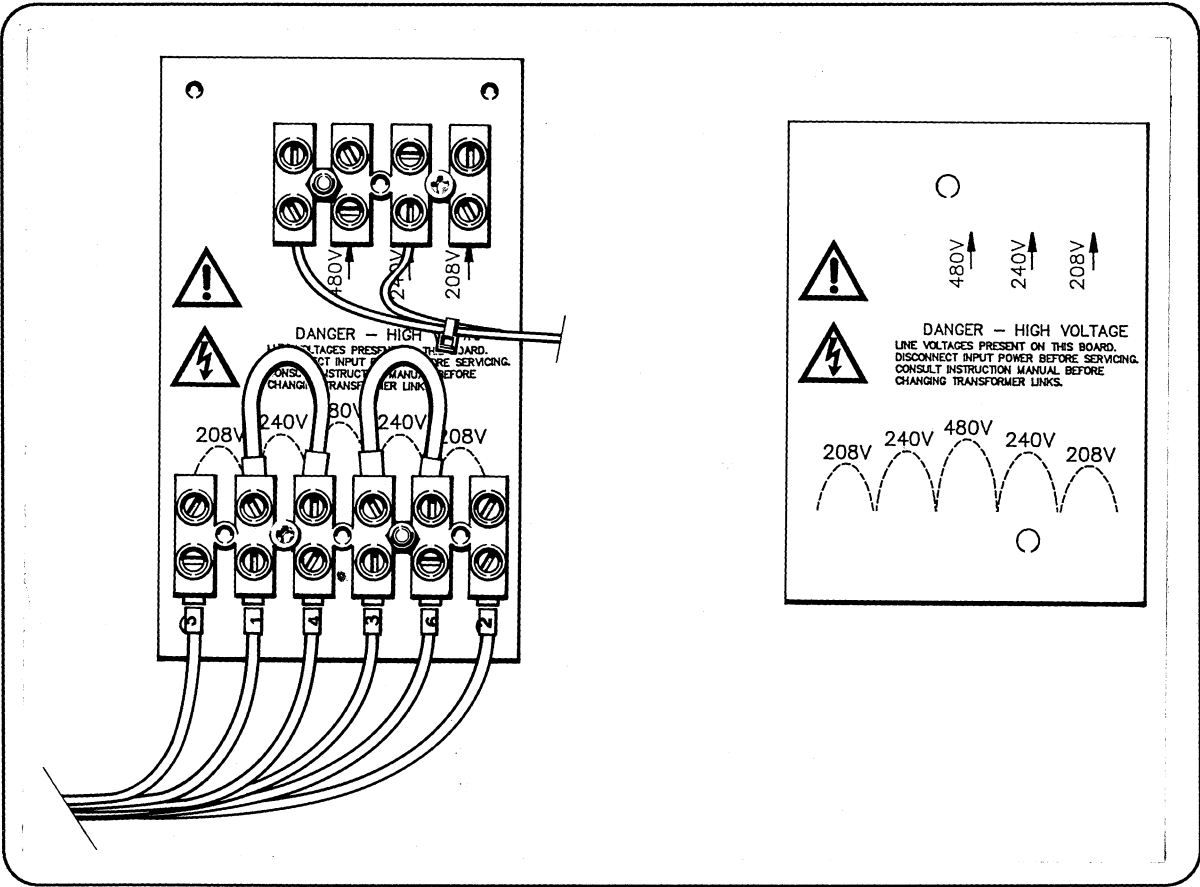


Figure 3-2 Linkboard - 208-240-480V

SETUP

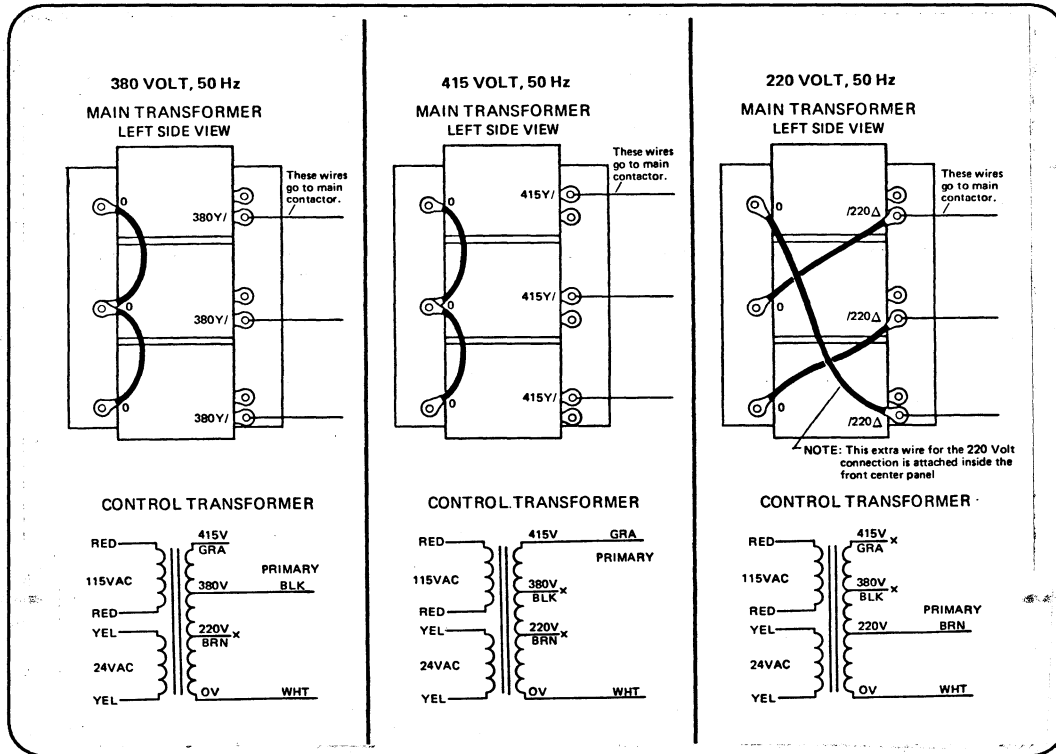


Figure 3-3 220-380-415V Transformer T1 and T2 Configurations

220-380-415V Transformer T1 and T2 Configurations

- The 220-380-415 volt, 3 PH, 50 Hz power supply (# 057019) is normally shipped from the factory set up for 380-volt operation, unless otherwise specified. To change the power supply to a different voltage (220 or 415 volts), the control transformer T1 and 4.1 kw transformer T2 must be reconfigured (see Figure 3-3). Refer to Section 5, *Standard Components*, Figure 5-2, item 11, to locate transformer T2 and Figure 5-3, item 8, to locate transformer T1.

GROUNDING REQUIREMENTS

To ensure personal safety, the MAX40cs must be properly grounded:

- Connect the work table to a high-quality earth ground within 20 feet (6 m) 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 m) into the earth below the permanent moisture level.
- Ensure the power cord is properly connected to the ground in the disconnect box.

SETUP

- Ensure that the power cord ground wire is properly connected to the ground stud in the power supply. Place the power cord ground wire first on the stud, then place the other wires on top of the power cord ground.
- Ensure that all electrical connections are tight to avoid excessive heating.
- Connect the work table to a good earth ground. Consult the National Electrical Code, Article 250, Section H *Grounding Electrode System*, or other appropriate code.

GAS SUPPLY

- Whether you use pipeline shop air or a compressed gas cylinder:
 - Use an inert gas hose to connect the gas supply to the input connection on the air regulator mounted on the right side of the power supply.
 - Use a filter to maintain a high air purity level. All moisture, oil and other contaminants must be removed.

Two different sources of air can be used to supply the MAX40cs:



WARNING



Do not exceed 150 psi (10.3 bar) to the filter/pressure regulator. The plastic filter bowl may explode if this pressure is exceeded. See the warning label on the filter bowl for other safety warnings.

Caution: Adjust the filter/pressure regulator for 70 psi (4.8 bar) delivery pressure to the power supply. Exceeding 70 psi (4.8 bar) will cause shortened torch parts life.

Cylinder Compressed Air

The cylinder air supply must be clean, dry and oil-free. A high-pressure regulator on the cylinder must be used and be capable of delivering an output of 270 scfh/4.5 scfm (127 l/min) at a pressure of between 80 and 120 psi (5.5 - 8.3 bar). Feed the output of the cylinder high pressure regulator into the filter/pressure regulator on the power supply. The filter/pressure regulator is mounted at the top rear of the MAX40cs power supply.

SETUP

Shop Compressed Air

Use clean, dry, oil-free shop air to supply the MAX40cs. Shop air must be capable of delivering an output of 270 scfh/4.5 scfm (127 l/min) at a pressure of between 80 psi and 120 psi (5.5 - 8.3 bar) and must be routed to the filter/pressure regulator on the power supply. The filter/pressure regulator is mounted at the side rear of the MAX40cs power supply.

Nitrogen

The nitrogen supply to the MAX40cs must be 99.995% pure. Use compressed gas cylinders or liquid containers for the nitrogen supply. A high pressure regulator on the cylinder must be used and be capable of delivering an output of 270 scfh/4.5 scfm (127 l/min) of air at a pressure of between 80 and 120 psi (5.5 - 8.3 bar). Feed the output of the cylinder high pressure regulator into the filter/pressure regulator on the power supply. The filter/pressure regulator is mounted at the top rear of the MAX40cs power supply.

PAC121P/121T TORCH LEAD CONNECTIONS

The PAC121 torch lead is connected to the power supply prior to shipment. Refer to Section 6, Maintenance for instructions on how to remove and replace the torch lead.

MACHINE TORCH LEAD AND REMOTE SWITCH CONNECTIONS

To install the optional machine torch lead and remote switch, refer to Figure 3-4 and connect the torch lead and remote switch leads to TB1 as follows:

1. Remove the rear panel by removing the eight (8) screws.
2. Refer to Section 5, Standard Components, Figure 5-3, item 13 to locate TB1.
3. Connect the two blue wires from the torch lead to CAP (cap sensor switch) terminals 1 and 2.
4. Connect the black and red wire pair from the remote switch cable to the START (start switch) terminals 3 and 4.
5. Connect the white (Neut) and black (Hot) wire pair from the remote switch cable to the 24 VAC terminals 5 (NEUT) and 6 (HOT).
6. Connect the white wire pair from the torch lead to the the ELECTRODE (-) terminal.
7. Connect the red wire from the torch lead to the the PILOT (+) terminal.

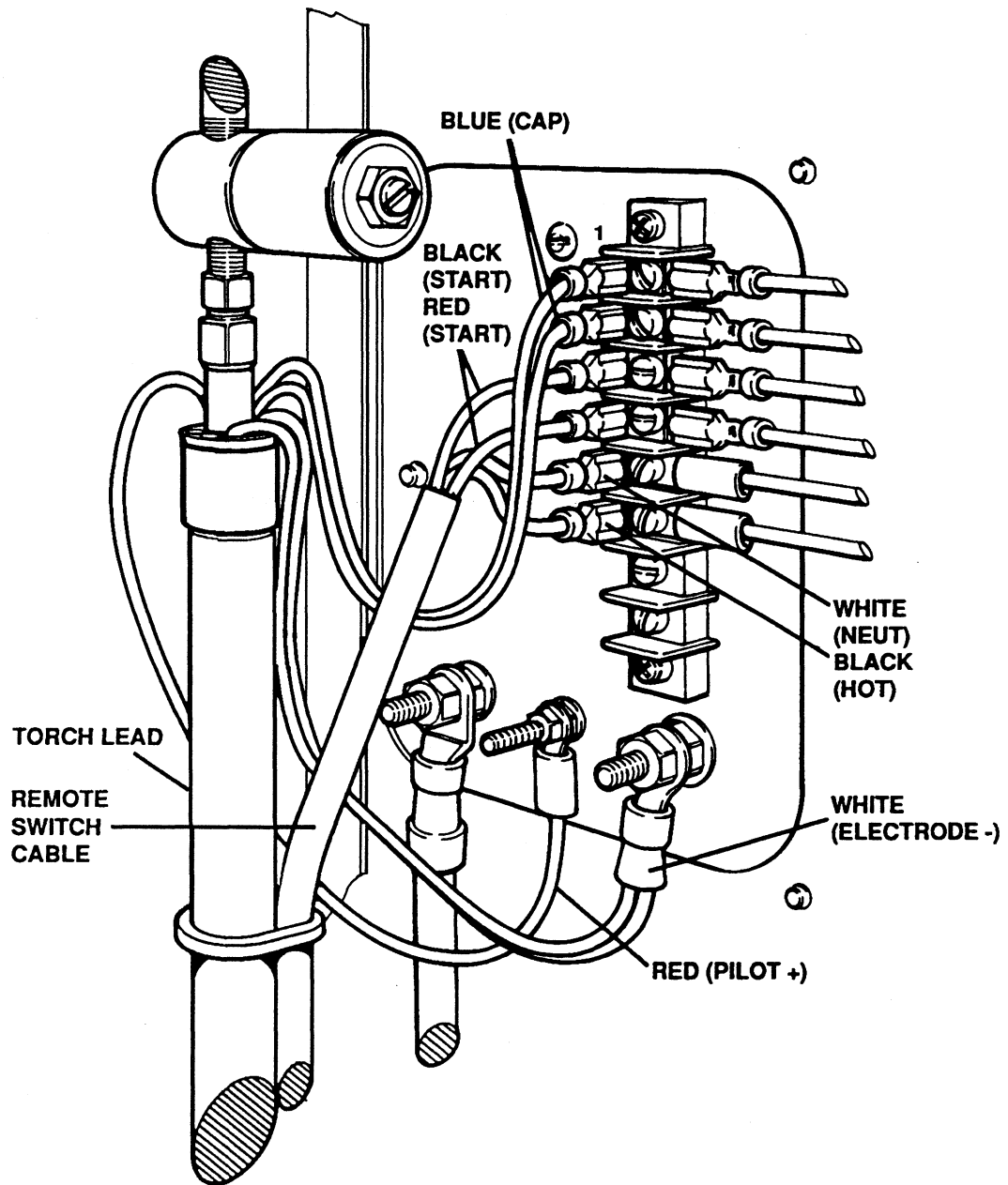


Figure 3-4 Machine Torch Lead and Remote Switch Connections

Section 4 OPERATION

In this section:

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OPERATION

DESCRIPTION OF CONTROLS

Located on the front panel are:

- **ON/OFF Power Switch**
Activates the power supply and its control circuits.
- **Green POWER ON LED**
Indicates that all control circuits are activated, safety interlocks are satisfied, and the system is ready for operation. Indicates that DC power is present at the torch.
- **TEST/RUN Switch**
Allows the operator to view and adjust pressure setting (if required) in the TEST mode. Refer to *Operating Instructions*, step 6, on page 4-3 in order to adjust the pressure regulator.
- **Green TEMP/PRESSURE LED**
Indicates that the the temperature and pressure are within operating limits.
- **AMPS output adjustment knob**
Adjusts output current infinitely between 20 and 40 amps. (Increasing the amperage increases the thickness that can be cut.)

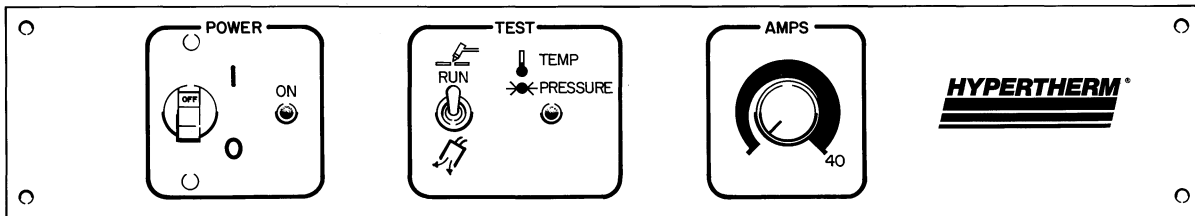


Figure 4-1 Front Panel Controls

OPERATING INSTRUCTIONS

1. Ensure that the work environment and your clothing meet the safety requirements outlined in the *Safety* section.
2. Follow the instructions in the *Setup* section.
3. Apply power to the MAX40cs power supply via the wall disconnect switch.
4. Using a quick connect air fitting, attach the compressed air or nitrogen to the male fitting on the pressure regulator.
5. Move the POWER switch to the ON position (I). The POWER LED should indicate that the air and pressure are within the range of operation.
6. Move the TEST/RUN to the TEST position. Check the filter/pressure regulator gauge for a reading of 70 psi (4.8 bar). If the reading is incorrect adjust the pressure regulator as follows:
 - Ensure the gas supply is at 80-120 psi (5.5-8.3) bar with at least 270 scfh/4.5 scfm (127 l/min) flow capacity.
 - If not, perform the procedure in Section 6 *Maintenance, Troubleshooting*, on page 6-5.
7. Look for moisture coming out of the torch. If there is moisture, purge the lines. The filter bowl is drained at the bottom by turning the knurled drain valve. If the bowl doesn't drain properly, clean the bowl or clean or replace the filter by the following procedure:
 - Always **shut the gas supply off and disconnect** the gas supply hose from the pressure regulator before unscrewing the filter bowl.
 - Unscrew the filter bowl and then remove the filter and clean or replace if required.
 - Replace the filter and filter bowl.
 - Reconnect the gas supply hose.
8. Attach the work clamp securely to the workpiece. Do not attach it to the portion that will fall away (see Figure 4-2).
9. To ensure optimum cutting, refer to the *Operating Data Chart* on page 4-13.
10. Move the TEST/RUN switch to the RUN position.

OPERATION



WARNING



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

11. The unit is now ready to operate. When you are ready to cut, place the torch on the workpiece.
12. The arc transfers from the torch to the workpiece. Move the torch in the desired direction, at a speed which gives good cut quality.
13. When the cut is finished, release the torch switch to stop the arc.

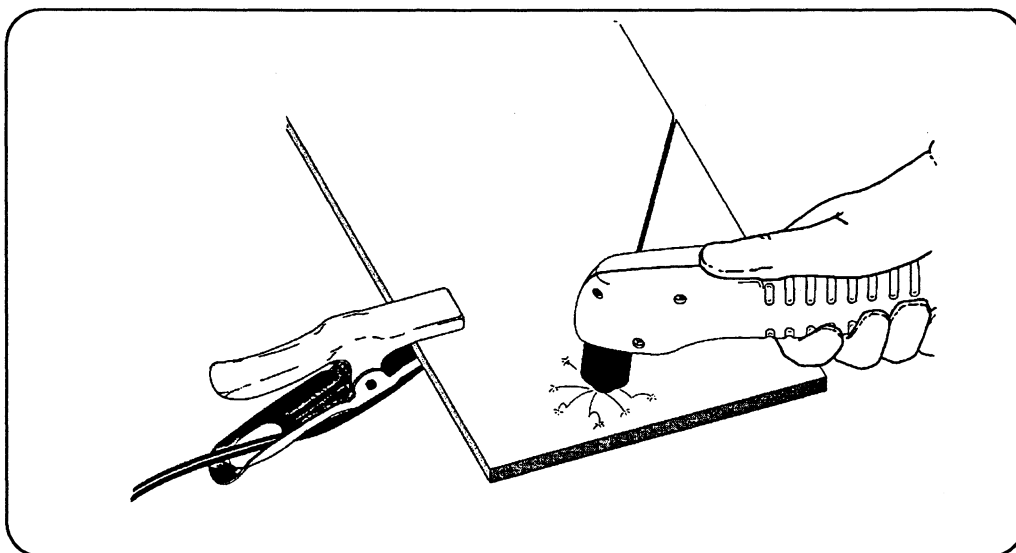


Figure 4-2 Proper Work Clamp Connection

OPERATING TIPS

Changing Consumable Parts



WARNING



Always unplug the power supply before inspecting or changing the torch parts.

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" (1.6 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 5-8. 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.

Note: If the retaining cap is removed with the power on, a "safety fault" occurs and the power supply power switch/circuit breaker will automatically turn itself off.

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.

OPERATION



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:

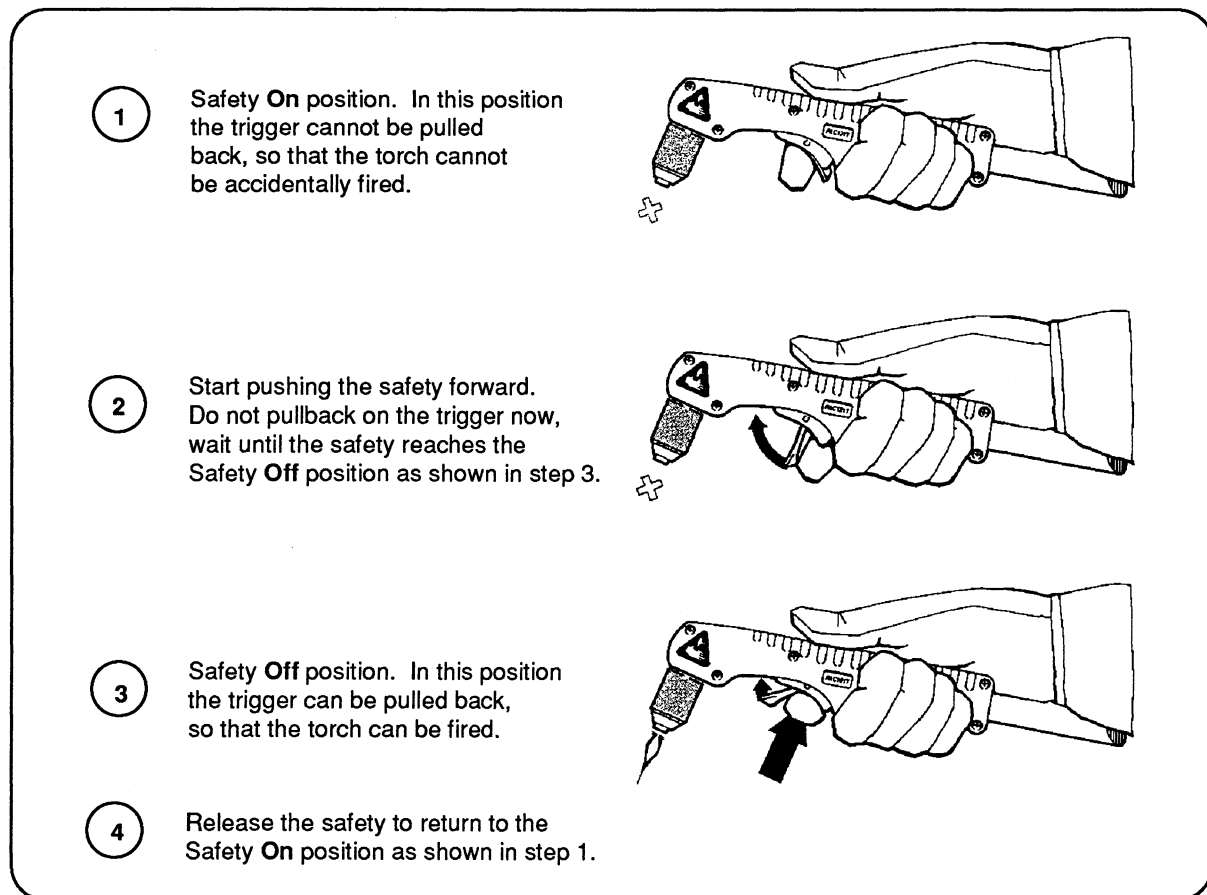


Figure 4-3 PAC121T Torch Safety Trigger Operation

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 of the workpiece.
- To cut circles, use 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.

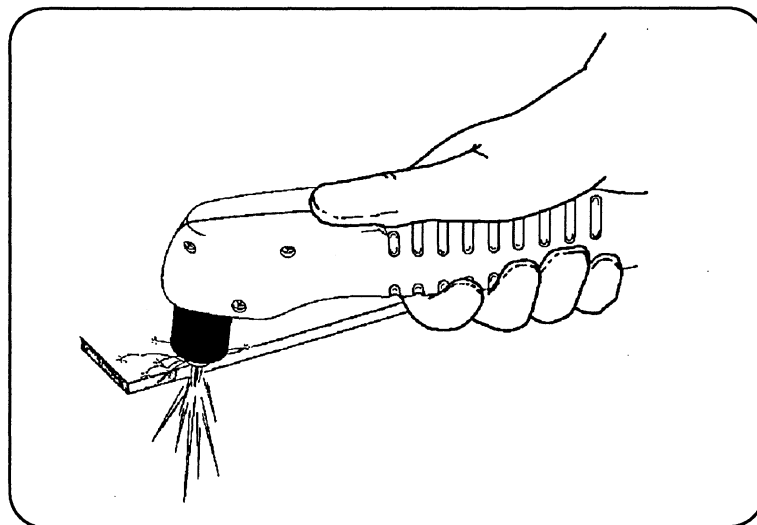


Figure 4-4 Starting a Cut

OPERATION

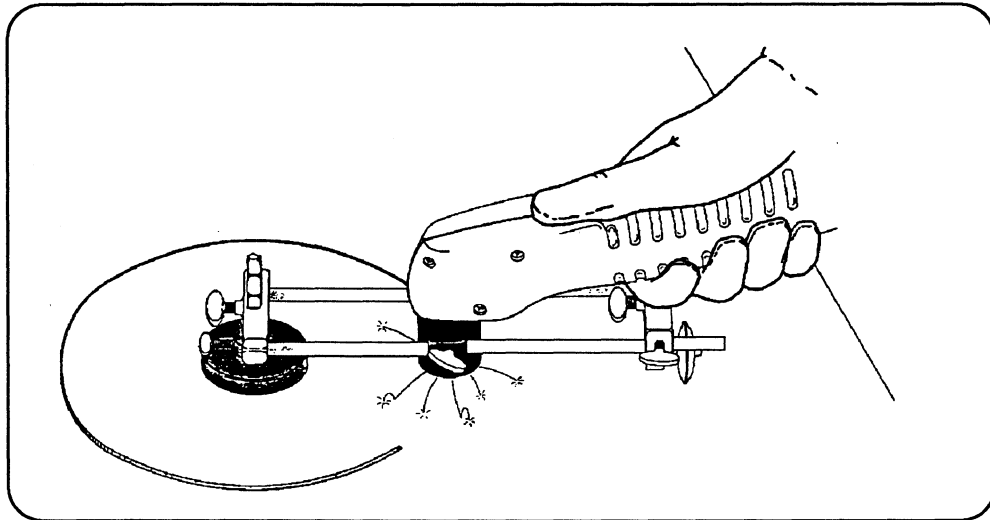


Figure 4-5 Cutting a Circle

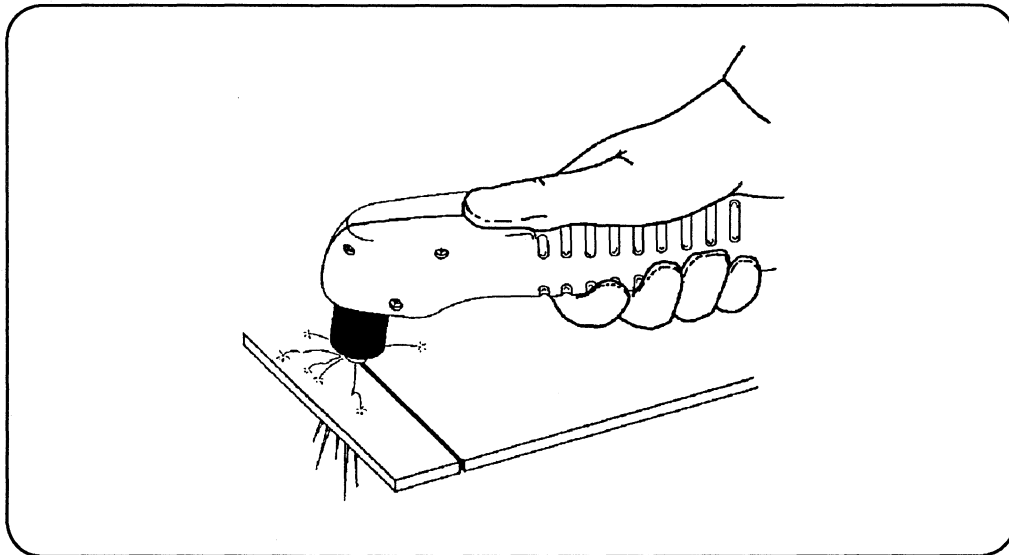


Figure 4-6 Dragging the Torch

Piercing

- Hold the torch so that the nozzle is approximately 1/16 inch (1.6 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 nozzle life. (Fig. 4-7).
- When the pierce is complete, proceed with the cut.

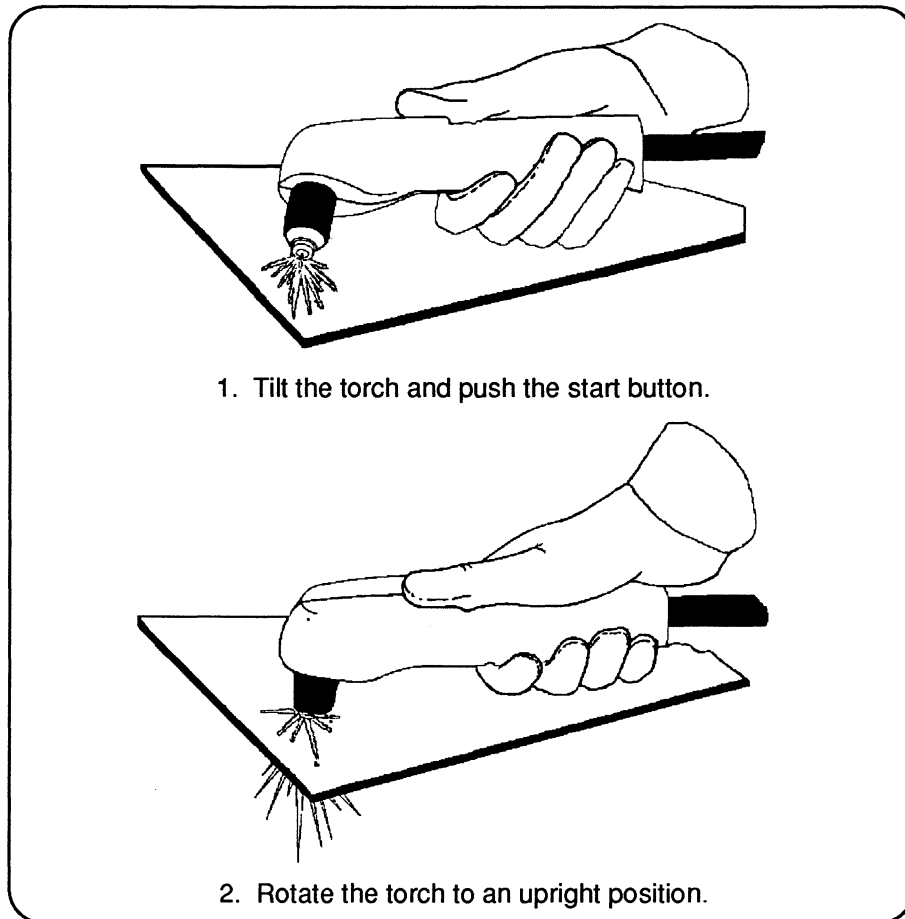


Figure 4-7 Piercing

OPERATION

Gouging

The MAX40cs 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.

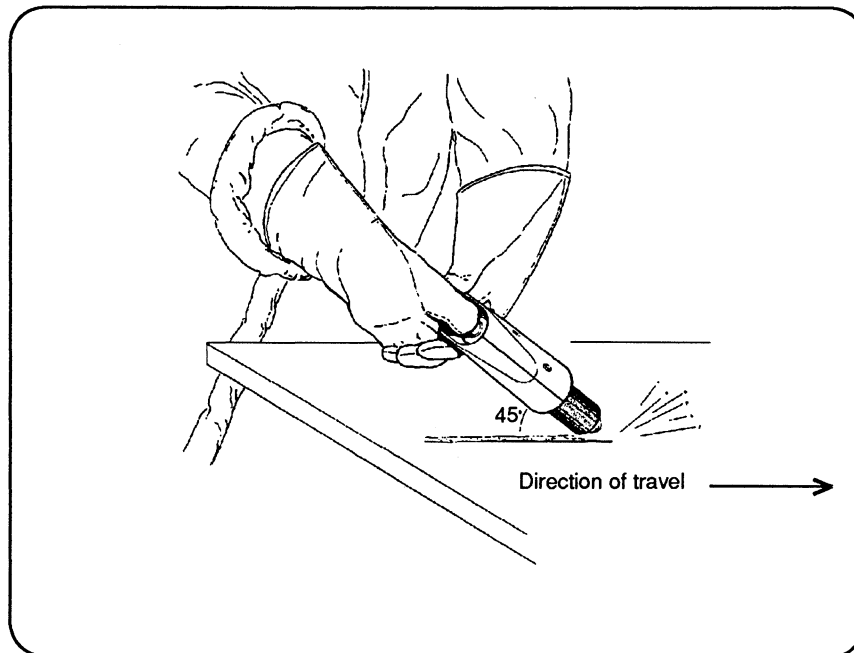


Figure 4-8 Gouging

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 MAX40cs has a 50% duty cycle. During normal operation, the plasma arc can remain on 5 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 28 amps.

Gas Pressure

Compressed air or nitrogen must be available to the power supply filter/pressure regulator at a flow rate of 270 scfh/4.5 scfm (127 l/min) and a pressure of 70 psi (4.8 bar). If the pressure to the power supply is below 40 psi, the torch goes out.

Torch Heat

After several minutes of running, the torch retaining cap may become hot. To cool it, place the TEST/RUN switch in the TEST position and hold it until the cap cools down.

OPERATION

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.
3. If you need additional assistance, call our Customer Service at 1-800-643-0030 or Field Service group at 1-800-643-9878.

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	100 ipm (2540 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)
28 ga. (.396 mm)	Stainless steel	20 amps	80 ipm (2032 mm/min)
24 ga. (.635 mm)	Stainless steel	30 amps	80 ipm (2032 mm/min)
1/16" (1.5 mm)	Stainless steel	40 amps	50 ipm (1270 mm/min)
1/8" (3 mm)	Stainless steel	40 amps	20 ipm (508 mm/min)
1/4" (6 mm)	Stainless steel	40 amps	15 ipm (381 mm/min)
3/8" (10 mm)	Stainless steel	40 amps	7 ipm (178 mm/min)
1/32" (.800 mm)	Aluminum	20 amps	200 ipm (5080 mm/min)
1/16" (1.5 mm)	Aluminum	30 amps	180 ipm (4572 mm/min)
3/32" (2.4 mm)	Aluminum	40 amps	100 ipm (2540 mm/min)
1/8" (3 mm)	Aluminum	40 amps	90 ipm (2286 mm/min)
1/4" (6 mm)	Aluminum	40 amps	25 ipm (635 mm/min)
3/8" (10 mm)	Aluminum	40 amps	10 ipm (254 mm/min)

ROUTINE INSPECTION AND CLEANING

Inspection

Inspect the power supply on a routine basis.

- Check the exterior for any damage. If there is damage, ensure it does not affect safe operation of the power supply.
- Remove covers and inspect the interior. Check wiring harnesses and connections for wear and damage. Check for loose connections, look for areas of discoloration due to overheating.
- On the right side of the power supply, inspect the filter/regulator. Unscrew and remove the bowl and check for excess moisture or dirt. If the filter element inside of the bowl is dirty, remove and blow out with compressed air.
- At the rear of the power supply, inspect the torch lead and power cable for wear and damage. Ensure all connections are tight. Do not overtighten.

Cleaning

Cleaning the power supply periodically is necessary to keep dust and foreign matter from inside the unit.

- Remove the covers and blow out the unit with compressed air. Clean the power supply on a weekly basis.

Section 5 Standard Components

In this section:

MAX40cs Power Supplies	5-2
PAC121T Torch Assembly and Leads.....	5-10
PAC121P Torch Assembly and Leads.....	5-11
PAC121M Machine Torch Assembly, Leads & Remote Switches	5-12
Consumable Parts	5-15
Recommended Spare Parts	5-16

STANDARD COMPONENTS

MAX40cs POWER SUPPLIES

<u>Power Supply</u>	<u>Description</u>
057116	208-240-480 VAC, 1 PH, 60 Hz
057117	575 VAC, 3 PH, 60 HZ
057118	200-230 VAC, 1 PH, 50/60 HZ
057119	220-380-415 VAC, 3 PH, 50 HZ
057130	480 VAC, 3 PH, 60 Hz

<u>Power Supply With Leads</u>	<u>Description</u>
057122	208-240-480 VAC, 1 PH, 60 Hz (w/25-ft. leads)
057123	208-240-480 VAC, 1 PH, 60 Hz (w/50-ft. leads)
057124	575 VAC, 3 PH, 60 Hz (w/25-ft. leads)
057125	575 VAC, 3 PH, 60 Hz (w/50-ft. leads)
057126	200-230 VAC, 3 PH, 50/60 Hz (w/25-ft. leads)
057127	200-230 VAC, 3 PH, 50/60 Hz (w/50-ft. leads)
057128	220-380-415 VAC, 3 PH, 50 Hz (w/25-ft. leads)
057129	220-380-415 VAC, 3 PH, 50 Hz (w/50-ft. leads)
057131	480 VAC, 3 PH, 60 Hz (w/25-ft. leads)
057132	480 VAC, 3 PH, 60 Hz (w/50-ft. leads)

STANDARD COMPONENTS

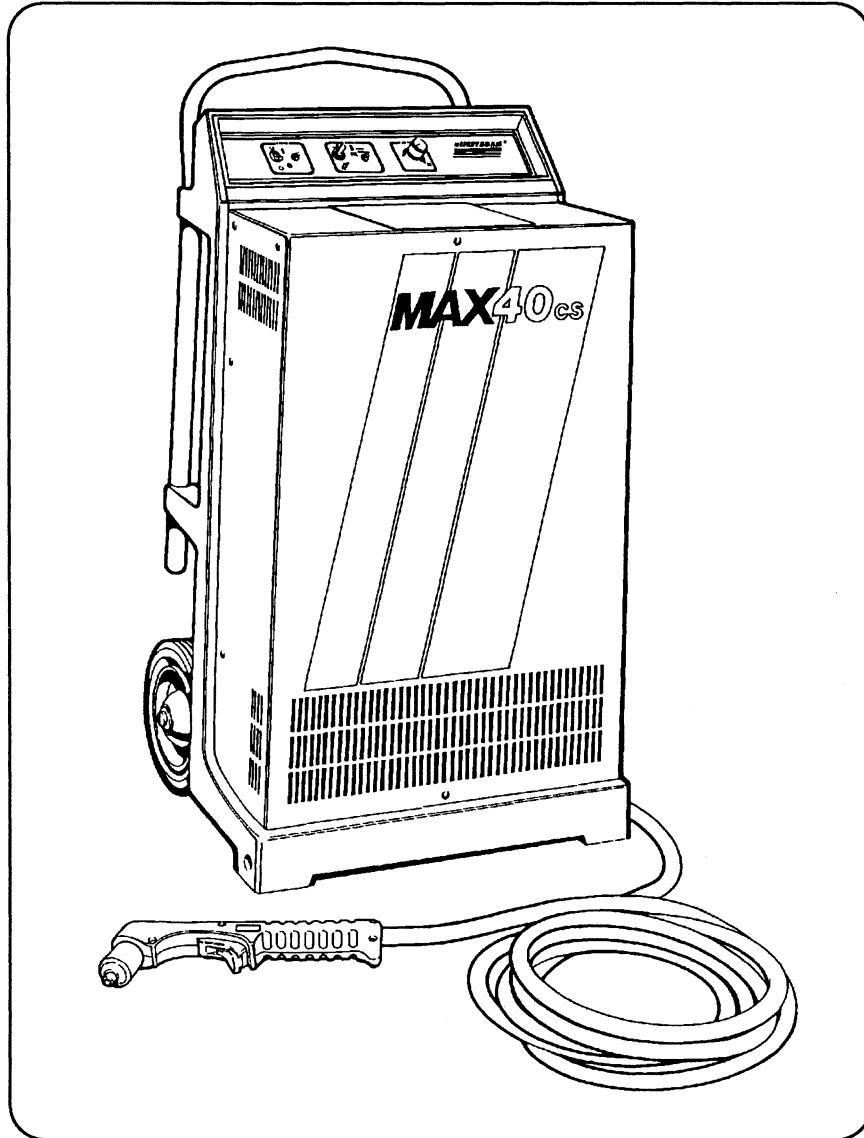


Figure 5-1 MAX40cs Power Supply

STANDARD COMPONENTS

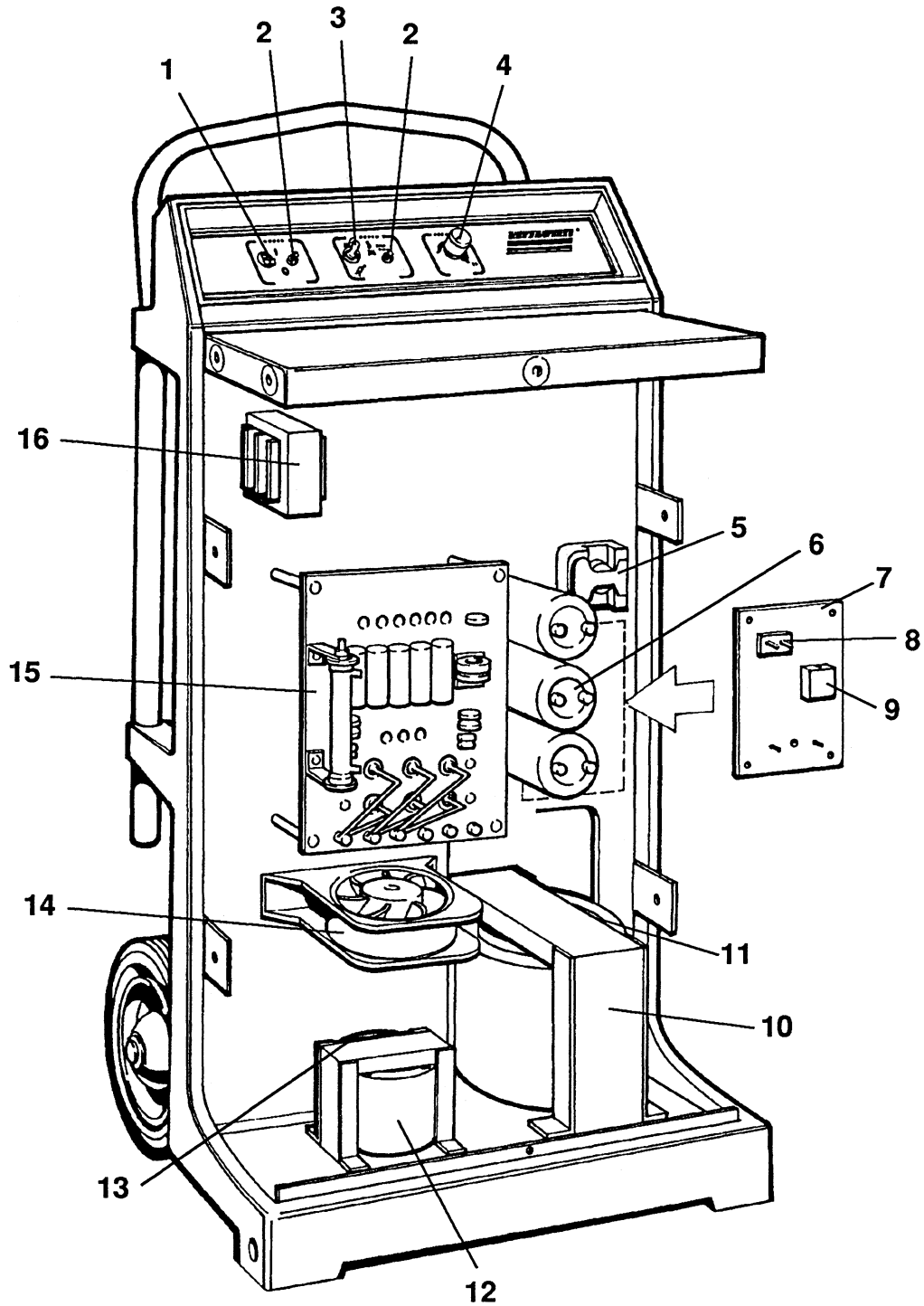


Figure 5-2 Single-Phase Power Supply w/ CH50 Chopper - Front View

STANDARD COMPONENTS

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	005110	Switch, Toggle, 1PH, 30 A	S1	1
2	009382	Light, Green, LED 24 VAC	LT1, LT2	2
3	005044	Switch, TG, SPDT	S2	1
4	009480	Resistor, Cermet, 250 Ohm, 1T, 1W	R4	1
5	003078	Relay, 30 A, NO Mag Blowout, AC	CR1	1
6	009295	Capacitor, Ele 2500 UF, 250 VDC	C7, C8, C9	3
7	029436	I/O Panel SA	PCB1	1
8	007025	Shunt, 50 A, 100 MV	R1	1
9	009373	Current Sensor	CS1	1
10	014119	Xfmr, 6.6 KVA 208-240-480V, 1PH, 60 Hz	T2	1
	014050	Xfmr, 6.6 KVA 200-230V, 1PH, 50 Hz	T2	1
11	005102	Thermostat, 165° C (not shown)	TS2	1
12	014125	Inductor, 4 MHY, 40 A DC	L1	1
13	005136	Thermostat, 135° C (not shown)	TS1	1
14	031116	Fan, 100-115 SCFM, 120 VAC, 50/60 Hz	M1	1
	029676	Chopper SA, 1PH MAX40, 40cs, HT40C	-	1
15	029631	CH50 Chopper Assembly	Chopper SA	1
16	014033	Transformer, Chopper Control	T3	1

STANDARD COMPONENTS

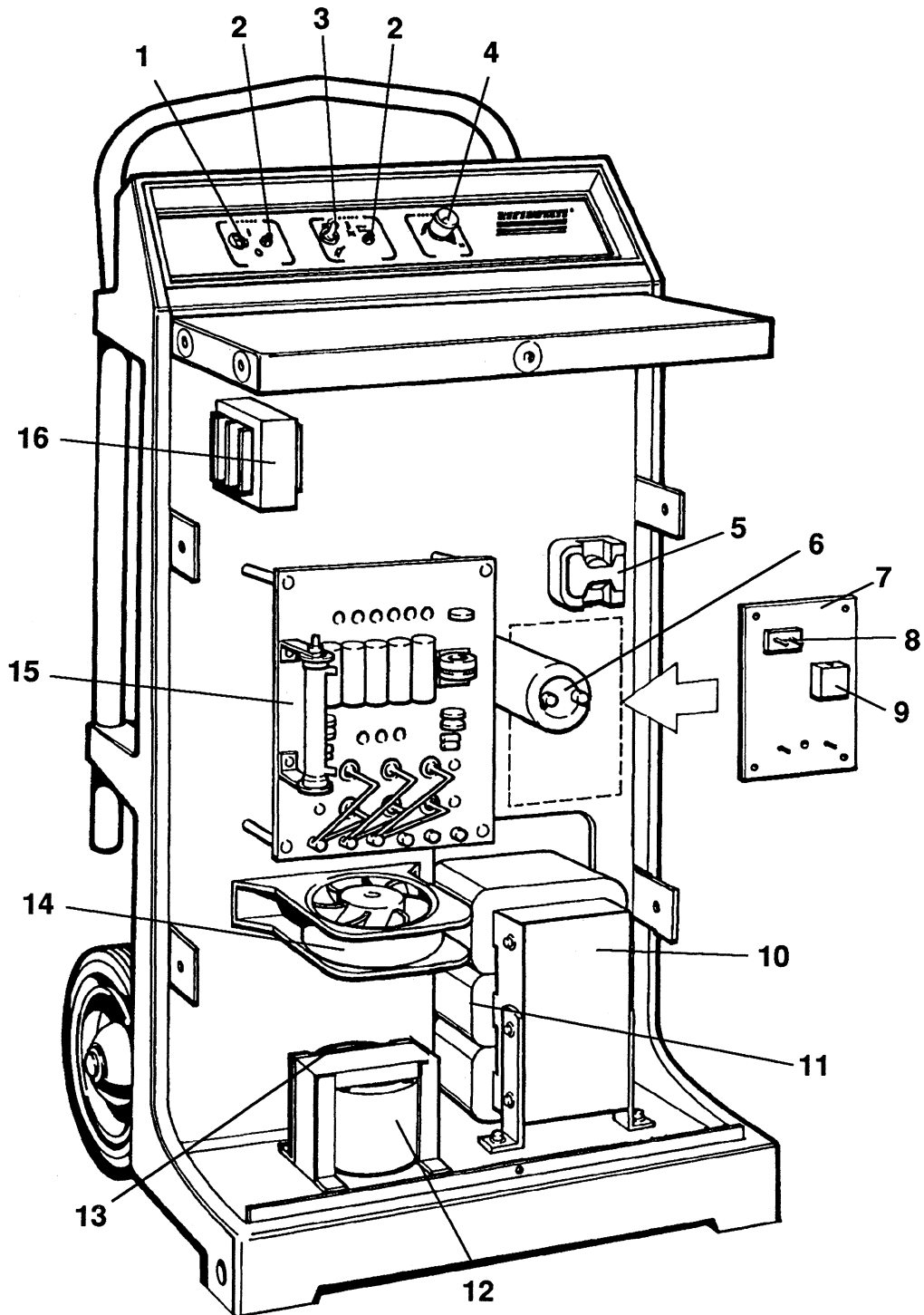


Figure 5-2A Three-Phase Power Supply w/ CH50 Chopper - Front View

STANDARD COMPONENTS

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	005110	Switch, Toggle, 1PH, 30 A	S1	1
2	009382	Light, Green, LED 24 VAC	LT1, LT2	2
3	005044	Switch, TG, SPDT	S2	1
4	009480	Resistor, Cermet, 250 Ohm, 1T, 1W	R4	1
5	003078	Relay, 30 A, NO Mag Blowout, AC	CR1	1
6	009295	Capacitor, Ele 2500 UF, 250 VDC	C9	1
7	029436	I/O Panel SA	PCB1	1
8	007025	Shunt, 50 A, 100 MV	R1	1
9	009373	Current Sensor	CS1	1
10	014038	Xfmr, 5.4 KVA 575V, 3PH, 60 Hz	T2	1
	014034	Xfmr, 5.4 KVA 220-380-415V, 3PH, 50 Hz	T2	1
	014036	Xfmr, 5.4 KVA 460V, 3PH, 60 Hz	T2	1
11	005138	Thermostat, 165° C, 4.5" (not shown)	TS2	1
12	014125	Inductor, 4 MHY, 40 A DC	L1	1
13	005136	Thermostat, 135° C (not shown)	TS1	1
14	031116	Fan, 100-115 SCFM, 120 VAC, 50/60 Hz	M1	1
	029678	Chopper SA, 3PH, MAX40, MAX40cs, HT40C	-	1
15	029631	CH50 Chopper Assembly	Chopper SA	1
16	014033	Transformer, Chopper Control	T3	1

STANDARD COMPONENTS

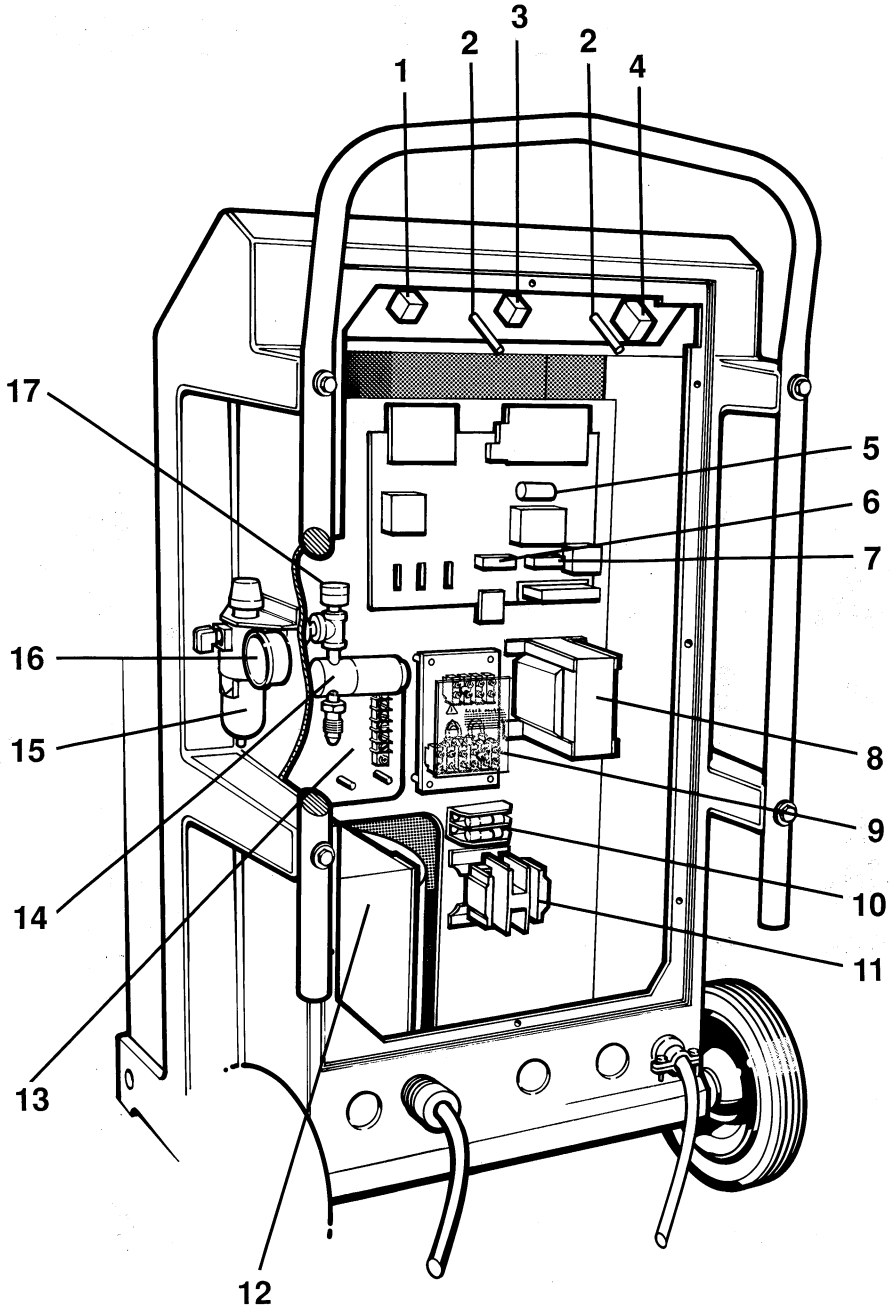


Figure 5-3 Power Supply - Rear View

STANDARD COMPONENTS

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009480	Resistor, Cermet, 250 Ohm, 1T, 1W	R4	1
2	009382	Light, Green, LED 24 VAC	LT1, LT2	2
3	005044	Switch, TG, SPDT	S2	1
4	005110	Switch, Toggle, 1Ø, 30 A	S1	1
5	041216	PC Board Assy, Control	PCB2	1
6	008259	Fuse, 3 A, 250 VAC, UL/CSA SLO-BLO	F2	1
7	008658	Fuse, 1 A, 250 VAC, UL/CSA SLO-BLO	F1	1
8	014121	Xfmr, Cntrl, 208-240-480V, 1PH, 60 Hz, 125VA	T1	1
	014117	Xfmr, Cntrl, 575V, 1PH, 60 Hz, 100VA	T1	1
	014128	Xfmr, Cntrl, 200-230V, 1PH, 50 Hz, 100VA	T1	1
	014116	Xfmr, Cntrl, 220-380-415V, 1PH, 50 Hz, 125VA	T1	1
	014121	Xfmr, Cntrl, 460V, 1PH, 60 Hz, 100VA	T1	1
•••9	004424	Linkboard	LB1	1
10	008660	Fuse, 2 A, 600 V	F1, F2	2
• 11	003059	Contact, 40 A, 1PH	CON1	1
••	003053	Contact, 30 A, 3PH	CON1	1
12	014119	Xfmr, 6.6 KVA 208-240-480V, 1PH, 60 Hz	T2	1
	014038	Xfmr, 5.4 KVA 575V, 3PH, 60 Hz	T2	1
	014050	Xfmr, 6.6 KVA 200-230V, 1PH, 50 Hz	T2	1
	014034	Xfmr, 5.4 KVA 220-380-415V, 3PH, 50 Hz	T2	1
	014036	Xfmr, 5.4 KVA 460V, 3PH, 60 Hz	T2	1
13	008648	Terminal Strip, 8 - Position	TB1	1
14	006054	Valve, Solenoid, 24 VAC, 100 PSI	V1	1
15	011039	Filter/Regulator 5 MIC, 120 PSI	FR1	1
	011054	Filter Element (used with 011039)		1
16	022019	Gauge, Pressure 0-100 PSIG, 1 1/2"	PG1	1
17	005112	Switch, Pressure, 39 PSI	PS1	1

- For 1-phase systems
- For 3-phase systems
- For 208-240-480, 1PH, 60 Hz system only

* Filter element 011054 can also be obtained by contacting the following sources:

In the USA, contact Watts FluidAir, Inc. Customer Service Department at 207-439-9511 for the name of the nearest authorized Watts FluidAir distributor. Order element replacement kit EK504VY.

Overseas customers should contact their local Hypertherm distributor.

STANDARD COMPONENTS

PAC121T TORCH ASSEMBLY AND LEADS

Torch Assembly

Description

001288	Handle, PAC120/121T
075340	Screws,P/S, # 4 x 5/8, PH, RND, S/B
002244	Safety Trigger, PAC120/121T
027254	Trigger Spring, PAC120/121T
005094	Switch, Torch Push-button
020932	Torch Main Body w/Switch, PAC121T

Torch & Lead Assemblies

Description

057172	Torch Assembly w/25 ft. (7.6 m) lead
057173	Torch Assembly w/50 ft. (15.2 m) lead

Lead Assemblies

Description

029556	Torch Leads, 25 ft. (7.6 m)
029557	Torch Leads, 50 ft. (15.2 m)

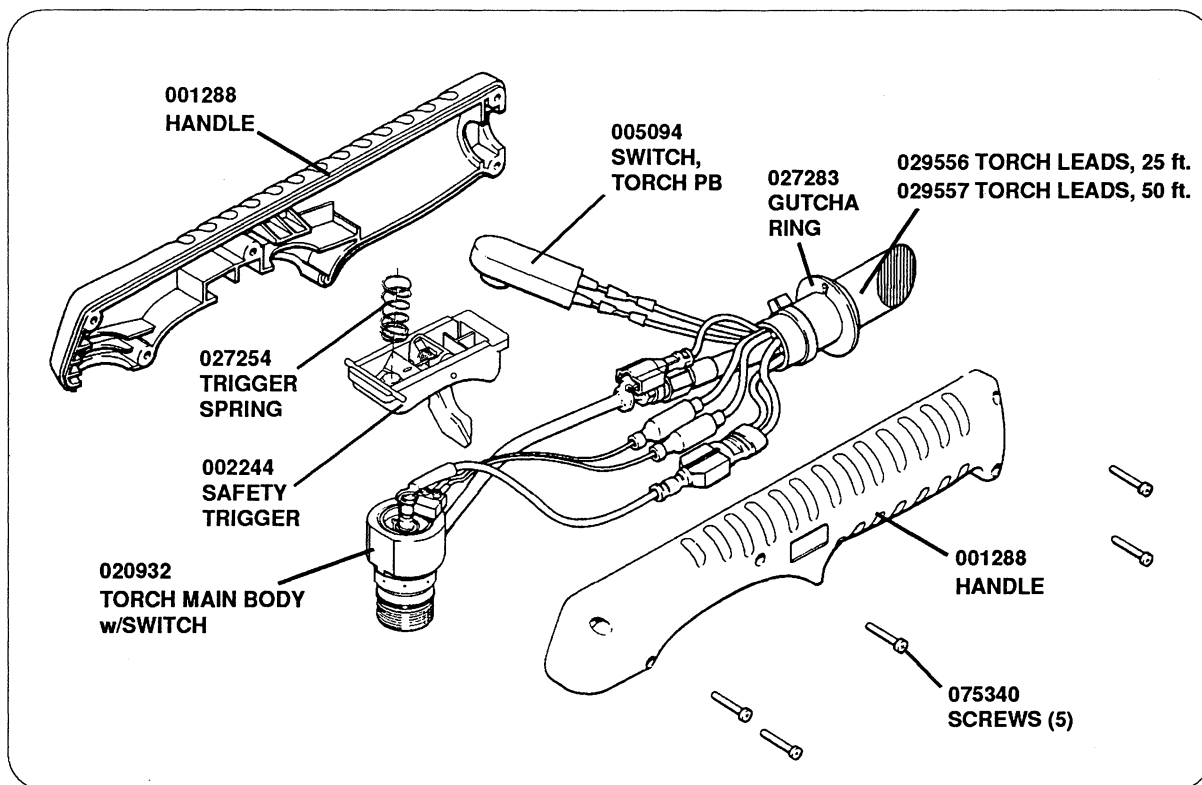


Figure 5-4 PAC121T Torch Assembly & Leads

STANDARD COMPONENTS

PAC121P TORCH ASSEMBLY AND LEADS

<u>Torch Assembly</u>	<u>Description</u>
-----------------------	--------------------

001215	Handle, PAC120/121T
075365	Screws, P/S, # 6 x 3/4, PH, RND, S/B
005094	Switch, Torch Push-button
120013	Torch Main Body, PAC121P

<u>Torch & Lead Assemblies</u>	<u>Description</u>
------------------------------------	--------------------

057176	Torch Assembly w/25 ft. (7.6 m) lead
057177	Torch Assembly w/50 ft. (15.2 m) lead

<u>Lead Assemblies</u>	<u>Description</u>
------------------------	--------------------

029483	Torch Leads, 25 ft. (7.6 m)
029484	Torch Leads, 50 ft. (15.2 m)

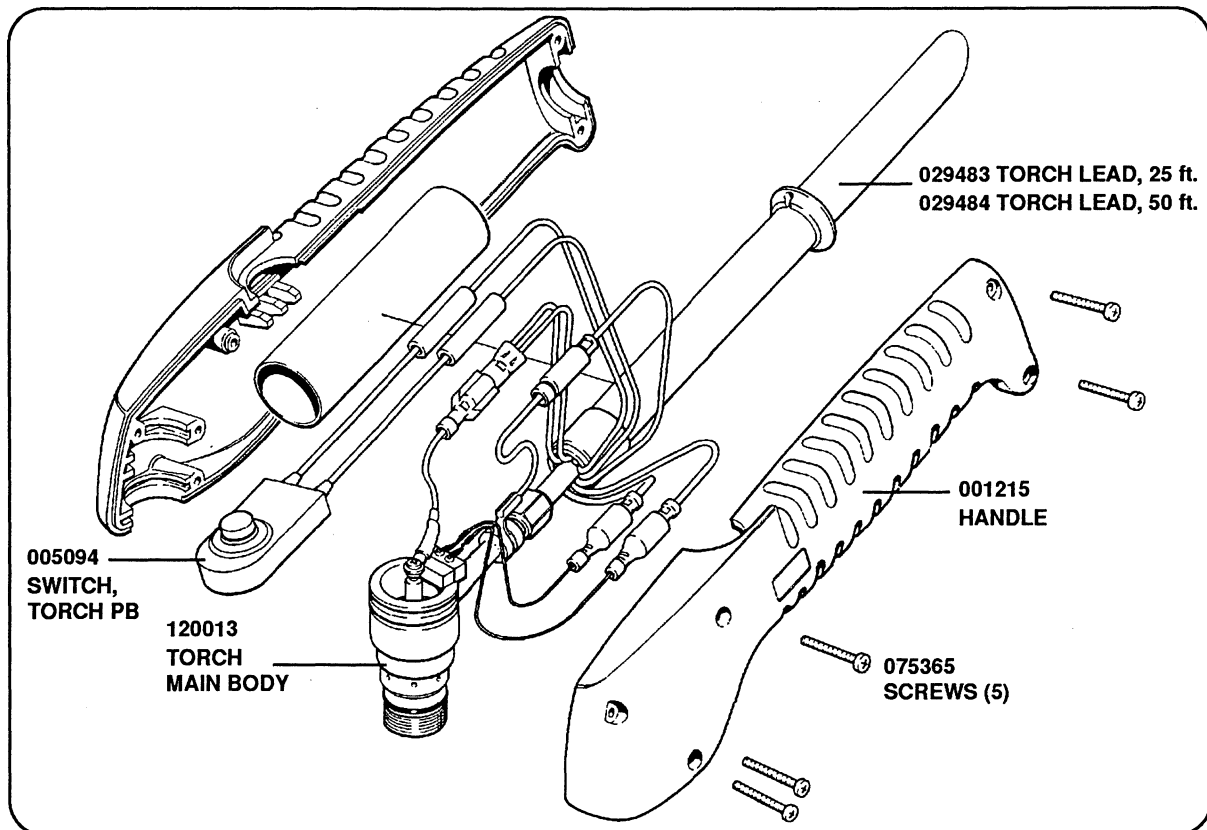


Figure 5-5 PAC121P Torch Assembly & Leads

STANDARD COMPONENTS

MAX40cs/PAC121M MACHINE TORCH ASSEMBLY, LEADS & REMOTE SWITCHES

Torch Assembly.....Description
 020620 Torch Position Sleeve 40cs/42/43
 020559 Torch Sleeve, Machine Torch 40cs/42/43
 020619 Insulator, Torch Position Tube
 120007 PAC121M Torch Main Body w/Cap SensorSwitch

Torch Assembly with Lead AssembliesDescription
 057174 PAC121M/40cs Mach. Torch Assembly w/25 ft. (7.6 m) lead
 057175 PAC121M/40cs Mach. Torch Assembly w/50 ft. (15.2 m) lead

Lead AssembliesDescription
 028477 Torch Leads, PAC120/121M/40cs 25 ft. (7.6 m)
 028478 Torch Leads, PAC120/121M/40cs 50 ft. (15.2 m)

Remote Switch Assembly with Cable - OptionalDescription
 028328 Remote Switch Assembly w/25 ft. (7.6 m) cable

On/Off Pendant with Cable - OptionalDescription
 028479 On/Off Pendant w/25 ft. (7.6 m) cable
 028480 On/Off Pendant w/50 ft. (15.2 m) cable
 023481 On/Off Pendant w/75 ft. (22.8 m) cable

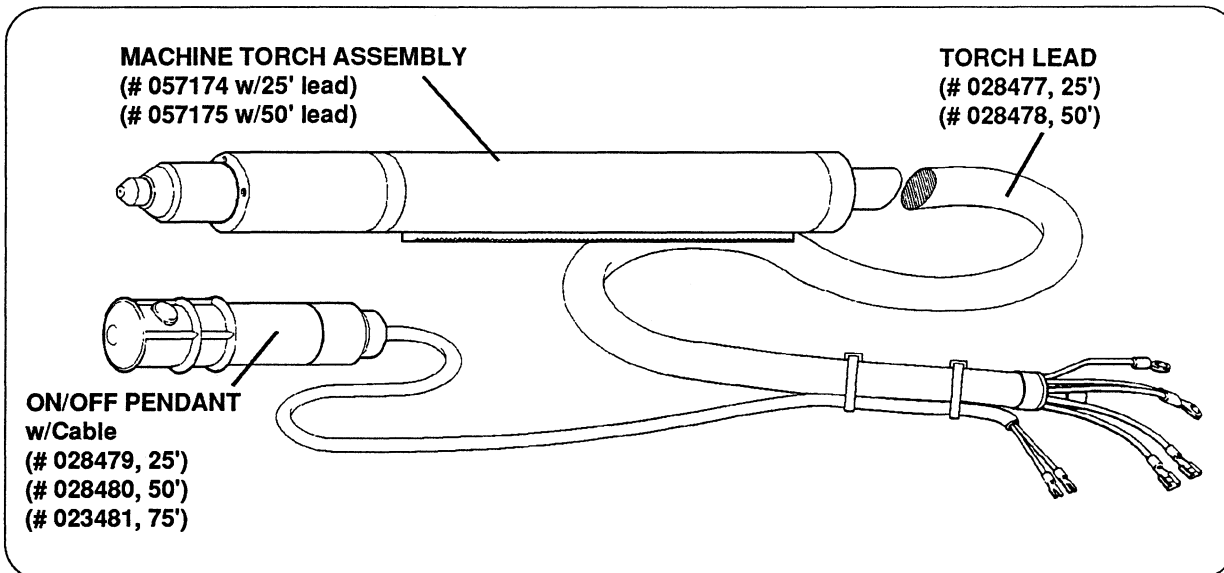


Figure 5-6 PAC121M Machine Torch Assembly, Leads and On/Off Pendant

STANDARD COMPONENTS

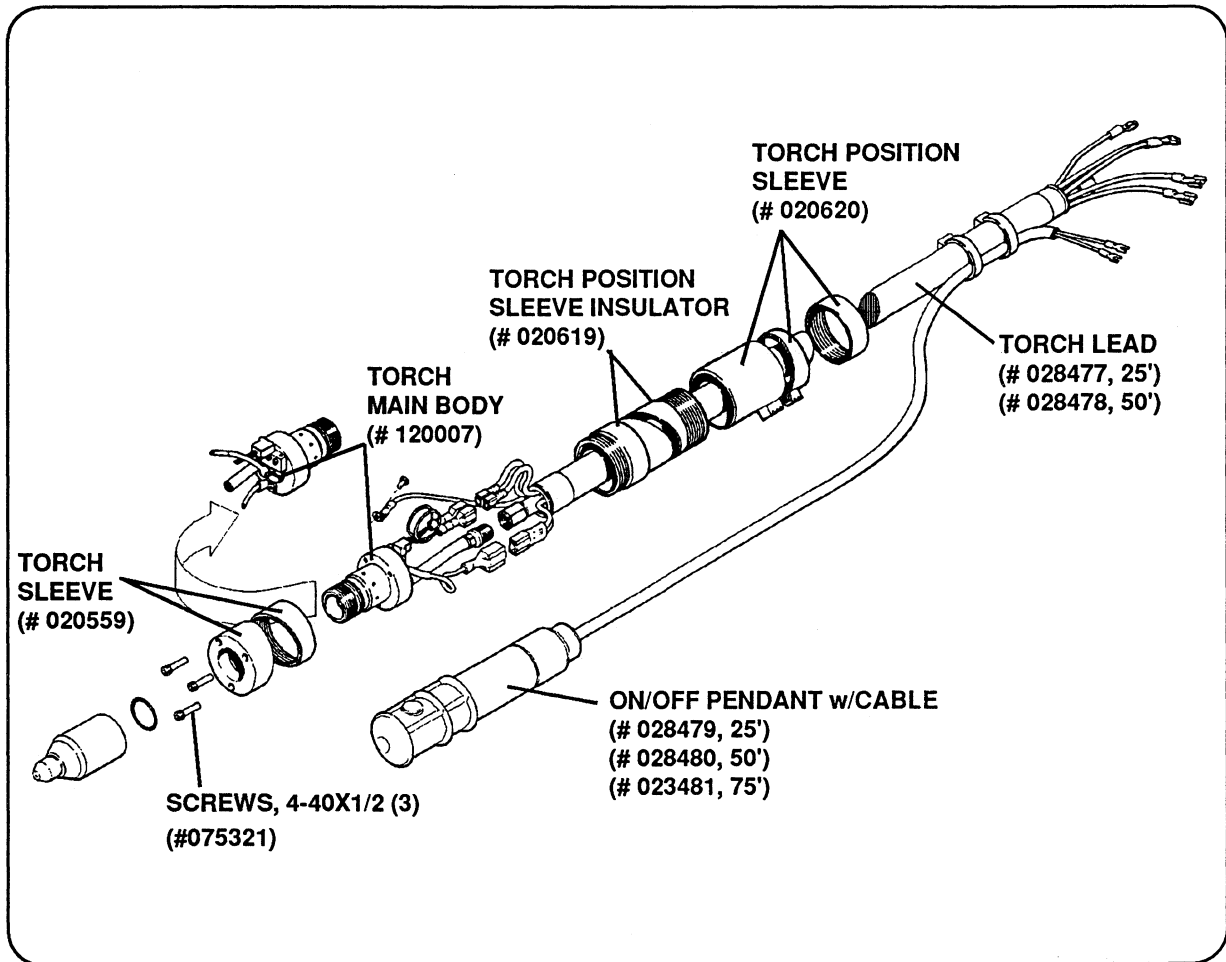


Figure 5-7 PAC121M Machine Torch Assembly - Exploded View

STANDARD COMPONENTS

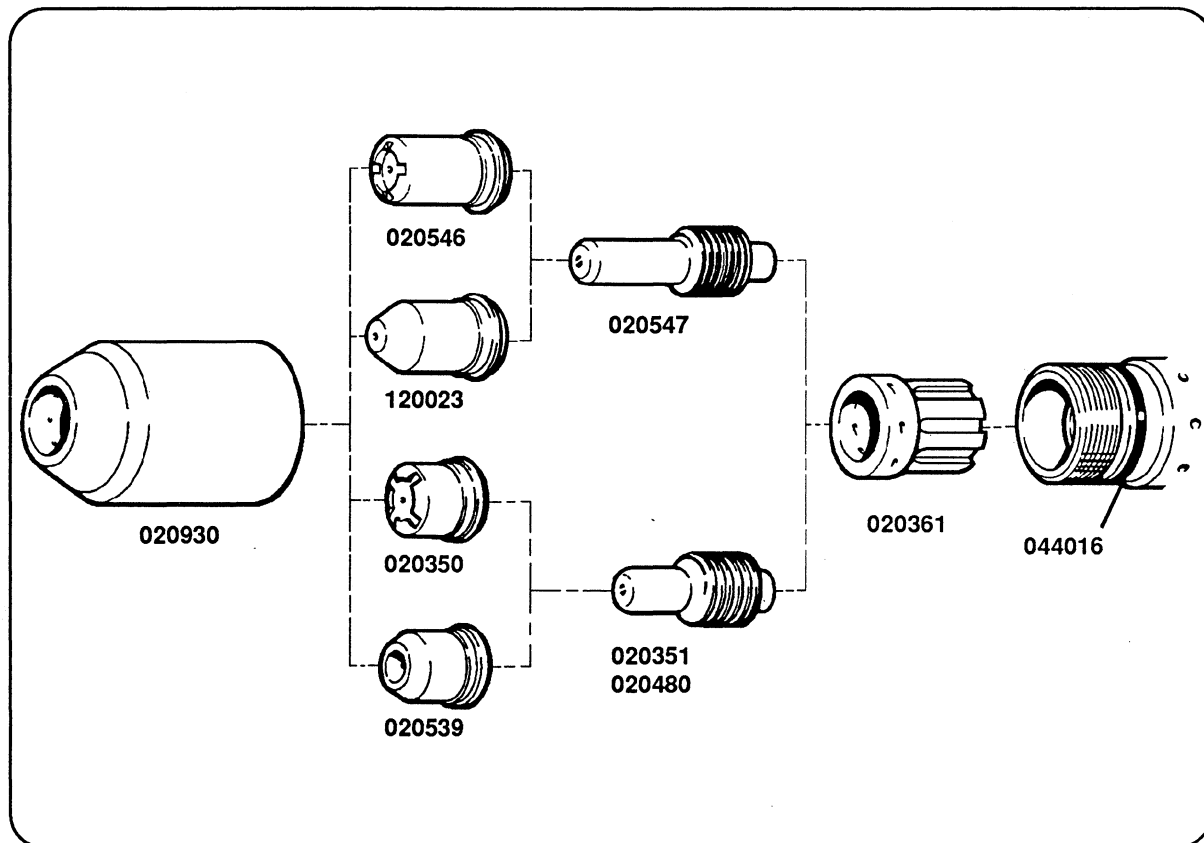


Figure 5-8 Consumable Parts

STANDARD COMPONENTS

CONSUMABLE PARTS

<u>Consumable Parts</u>	<u>Description</u>
020930	Retaining Cap
020546	Nozzle, Extended
120023	Nozzle, Pipe Saddle
020350	Nozzle
020539	Nozzle, Gouging
020547	Electrode, Extended
020351	Electrode, Air
020480	Electrode, Nitrogen
020361	Ring, Swirl
044016	O-Ring

<u>PAC121P/T Consumable Parts Kit (028735)</u>	<u>Description</u>
--	--------------------

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

<u>PAC121M Mach. Torch Consumable Parts Kit (028736)</u>	<u>Description</u>
--	--------------------

001285	Box, Consumable Parts (1)
020930	Cap, Retaining (1)
120023	Nozzle, Pipe Saddle (5)
020547	Electrode, Extended (5)
020351	Electrode, Air (5)
020361	Ring, Swirl (1)
044016	O-Ring (5)
015152	Nipple, 1/8NPT QDisc., Steel (1)
015153	Coupler, 1/8FPT QDisc., Brass (1)
015570	Reducer Bushing, 1/4 X 1/8, Brass (1)
015604	Reducer, 1/4FPT X 1/8NPT, Brass (1)
027055	Lubricant, Silicon, 1/4 oz. Tube (1)

STANDARD COMPONENTS

RECOMMENDED SPARE PARTS

The recommended spare parts for the MAX40cs are listed below. Also listed are the torch main bodies and torch assemblies (with leads).

<u>Part Number</u>	<u>Description</u>	<u>Designator</u>
029436	I/O Panel SA	PCB1
041216	PC Board Assy, Control	PCB2
• 003059	Contactor, 40 A, 1PH	CON1
•• 003053	Contactor, 30 A, 3PH	CON1
008259	Fuse, 3A, 250V, Slo-Blow	F2
008658	Fuse, 1A, 250V, Slo-Blow	F1
008660	Fuse, 2A, 600V	F1, F2
011039	Filter/Regulator 5 MIC, 120 PSI	FR1
022013	Gauge, Pressure 0 - 100, 1-1/2" STM MT	PG1
020932	Torch Main Body, PAC121T	-
120013	Torch Main Body, PAC121P	-
120007	Torch Main Body, PAC121M Machine	-
057172	PAC121T Torch Assembly (w/25 ft. lead)	-
057173	PAC121T Torch Assembly (w/50 ft. lead)	-
057176	PAC121P Torch Assembly (w/25 ft. lead)	-
057177	PAC121P Torch Assembly (w/50 ft. lead)	-
057174	PAC121M Torch Assembly (w/25 ft. lead)	-
057175	PAC121M Torch Assembly (w/50 ft. lead)	-

- For 1-phase systems
- For 3-phase systems

Section 6 MAINTENANCE

In this section:

Troubleshooting	6-2
Chopper Module Test Procedure	6-6
PAC121T Torch Parts Removal & Replacement	6-7
Torch Main Body Removal & Replacement	6-7
Torch Switch Removal & Replacement	6-8
PAC121P Torch Main Body Replacement	6-9
PAC121P or PAC121T Torch Lead Replacement	6-11
Removal and Replacement at Torch Main Body	6-11
Removal and Replacement at MAX40cs	6-11
PAC121M Machine Torch Main Body and Lead Replacement	6-13
Removal of Torch Main Body	6-13
Replacement of Torch Main Body	6-15
Removal and Replacement of Torch Lead at MAX40cs	6-16
Removal and Replacement of Remote Switch	6-17

MAINTENANCE

TROUBLESHOOTING

Becoming familiar with the contents of this manual will aid in safely troubleshooting the MAX40cs power supply and torch should the need arise. The following procedures will show the user how to locate the most common problems. Refer to Section 7 Figure 7-1 for the 24 VAC and 120 VAC ladder diagram which is used for all the different voltage power supplies. Figures 7-2 and 7-3 are the wiring diagrams for all power supplies. Refer to Section 5, *Standard Components* to locate the components when using these troubleshooting procedures.

If you need additional assistance, call our Customer Service at 1-800-643-0030 or Technical Service at 1-800-643-9878.



WARNING



SHOCK HAZARD: The large electrolytic capacitor(s) (blue-cased cylinder(s)) store large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper, and the diode heatsinks. Never discharge the capacitor(s) with a screwdriver or other implement...explosion, property damage and/or personal injury will result. Wait at least five minutes after turning the power supply off before touching the chopper or the capacitor(s).

MAINTENANCE

Problem: The POWER switch is set to 1 (on), but the green POWER LED (LT1) does not light and the fan (M1) is not running.

Cause: The air or nitrogen is not turned on, or the pressure is too low.

Solution: Turn on the air or nitrogen at source. Adjust the pressure to 60 psi (4.1 bar) at the pressure regulator on the power supply.

Cause: The retaining cap on the torch is loose causing the power switch trip coil to open S1.

Solution: Tighten the retaining cap.

Cause: Main power is not available to the power supply.

Solution: Turn on power at the main power panel or at the line disconnect switch box.

Cause: The fuse(s) inside the line disconnect switch box are blown.

Solution: Verify the fuse(s) are sized correctly. Replace the fuse(s).

Cause: Fuse F1 or F2 is blown.

Solution: Verify the fuse is sized correctly. Replace the fuse.

Cause: Control transformer T1 is defective.

Solution: Call the Technical Service Department.

Problem: The POWER switch will not stay in the I (on) position.

Cause: The retaining cap is loose.

Solution: Gently tighten the cap.

Cause: The consumables are not installed properly.

Solution: Check the consumables for correct installation (See Figure 5-8).

Cause: The cap sensing circuit is inoperative.

Solution: Call the Technical Service Department.

Problem: The POWER switch is set to 1 (on), but there is no air flow or arc when the torch switch is pressed and the TEMP/PRESSURE LED (LT2) is not lit.

Cause: The air or nitrogen pressure is low or the duty cycle rating has been exceeded.

Solution: Check the air or nitrogen pressure and adjust if required. Refer to page 6-5 for adjustment procedure. If the pressure setting is correct, check the air filter for blockage. (Remove the air or nitrogen supply before changing the filter element in the filter/pressure regulator.)

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Cause: The unit is overheated.
Solution: Allow the unit to cool with the POWER switch set to 1 (on). The unit cools down faster with the fan on. Let it cool for approximately 5 minutes or until the TEMP/PRESSURE LED (LT2) lights before operating the torch.

Cause: Thermal overload switches TS1 or TS2 or pressure switch PS1 is defective.
Solution: Call the Hypertherm Service Department.

Problem: Air flows from the torch, but no plasma arc.

Cause: The nozzle and electrode may be worn out.
Solution: Check these consumables, and replace if necessary. See Figure 5-8 for installation.

Cause: The retaining cap has been over tightened.
Solution: Tighten the retaining cap only until the nozzle does not rotate. Do not over tighten as this can distort the swirl ring.

Cause: The plunger is stuck in the torch. When installing the electrode in the torch, it should "spring out" towards you. If it does not, the plunger is stuck.
Solution: Set the POWER switch to 0 (off). Disassemble the torch handle. Check the snap rings in the rear of the torch head. Push the rings back into their respective grooves if necessary. If the plunger is still stuck or if there is any sign of electrical arcing, replace the torch.

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.

Cause: Chopper module has failed.
Solution: See *Chopper Module Test Procedure* later in this section.

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Problem: The arc sputters and hisses.

Cause: The filter bowl has water in it.

Solution: Drain the water from the filter bowl.

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

Cause: There are faulty consumable parts.

Solution: Inspect and change the consumable parts if necessary.

Cause: The air or nitrogen pressure is incorrect.

Solution: Adjust the air or nitrogen pressure using the following procedure:

1. Apply air supply at 80-120 psi (5.5-8.3 bar) with at least 270 scfh/4.5 scfm (127 l/min) flow capacity.
2. At the pressure regulator, pull the regulator cap up to adjust pressure.
3. Adjust the pressure downward ("relieve the regulator") by turning the knob in the direction shown on the regulator cap ("- is counter-clockwise). Adjust the pressure below 40 psi (2.8 bar) using the gauge.
4. Slowly increase the pressure by turning the knob clockwise until 70 psi is reached. STOP! DO NOT BACK OFF ADJUSTMENT. IF YOU DO, YOU MUST RETURN TO STEP 3.
5. Being careful not to change the pressure adjustment, push the cap down to lock the regulator cap.
6. If consistent pressure cannot be maintained, the pressure gauge is probably faulty and/or the pressure regulator may be faulty.

Solution: Clean or replace the pressure regulator filter:

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

MAINTENANCE

Chopper Module Test Procedure



WARNING



SHOCK HAZARD: The large electrolytic capacitor(s) (blue-cased cylinder(s)) store large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper, and the diode heatsinks. Never discharge the capacitor(s) with a screwdriver or other implement...explosion, property damage and/or personal injury will result. Wait at least five minutes after turning the power supply off before touching the chopper or the capacitor(s).

Note: When taking the following chopper voltage readings, levels will drop to 0 after three seconds.

1. Connect a DC voltmeter to points #48 (CAPS+) and #49 (CAPS-) and depress the torch switch. The voltage should read +230 VDC. If not, check chopper diodes. Also, check the contactor, connections and associated wiring to the contactor.
2. If voltage reads +230 VDC in the above step, then input to chopper is OK. Check the output by keeping voltmeter lead on point #48 and moving the negative lead to #39 (OUT). Again, depress the torch switch. The voltmeter should read +230 VDC. If the voltmeter reads +230 VDC, then chopper module is OK. Check continuity to the torch via shunt resistor R1 and pilot arc relay CR1.
3. If voltage from above step is not +230 VDC, remove connector JP4 from control board PCB2. Again, depress the torch switch. If voltage is now present at points #48 and #39, PCB2 is defective: replace PCB2.
4. If voltage from above step is not +230 VDC, check transformer T3 for 28 VAC on the secondary. If voltage is present, replace chopper module (Chopper SA).
5. If there is no voltage from above step, check for 120 VAC on primary of T3. If there is 120 VAC on the primary replace T3.
6. If there is no 120 VAC on the primary of T3, check wiring and connections to control board PCB2. If wiring is OK, replace PCB2.

PAC121T TORCH PARTS REMOVAL & REPLACEMENT

Repair of the PAC121T torch normally requires replacement of either the torch main body or the torch switch.

Torch Main Body Removal & 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 6-1.

1. Move the MAX40cs power switch to the OFF (0) position, unplug the power cable, and disconnect the gas supply.
2. Remove the five (5) screws which secure the handle halves.
3. Remove the torch main body assembly and torch switch from the handle halves.
4. Remove the Tyrap that holds wiring bundle in place and disconnect the torch main body wires from the torch lead wires.

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

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

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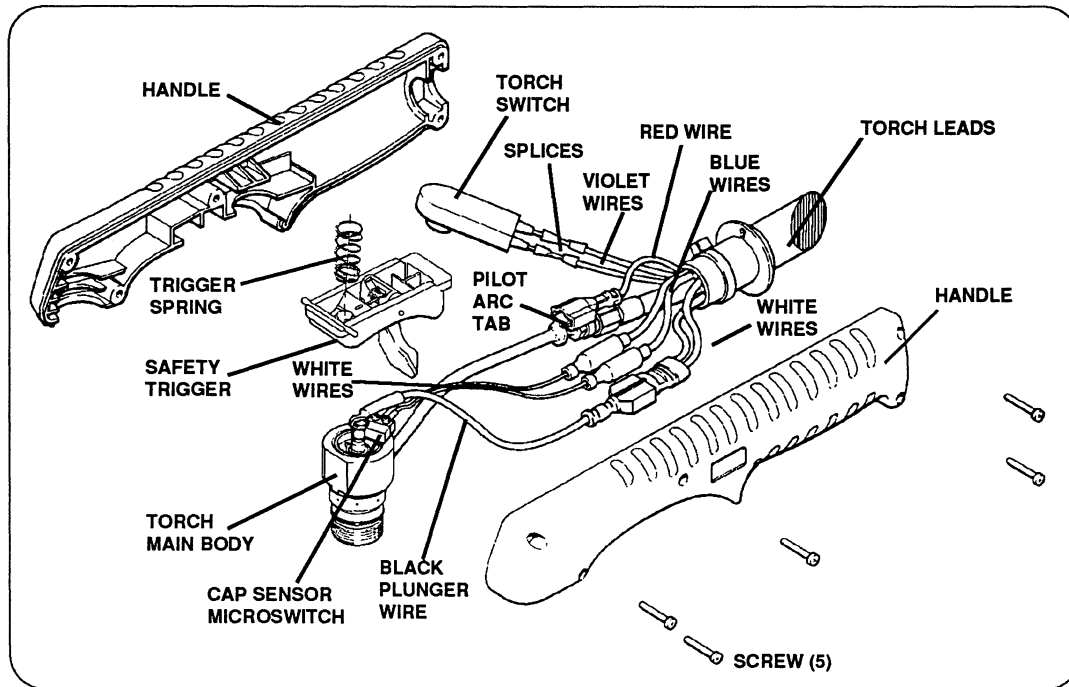


Figure 6-1 PAC121T Torch Assembly

Torch Switch Removal & 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 6-1.

1. Move the MAX40cs power switch to the OFF (0) position, unplug the power cable, and disconnect the gas supply.
2. Remove the five (5) screws which secure the handle halves.
3. Remove the torch switch from the handle.
4. Disconnect 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 with the violet leads from the torch lead together with the splices.

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6. Install the torch switch back into handle. Be certain that torch switch slides into position above the safety trigger, and that trigger movement activates the switch pushbutton and releases. While positioning the handle halves together, be careful not to pinch any wires.
7. Replace the five (5) screws to secure the handle halves together.

PAC121P TORCH MAIN BODY REPLACEMENT

To replace the torch main body, order the PAC121P torch main body (#120013) and refer to the following procedure and Figure 6-2.

1. Move the MAX40cs power switch to the OFF (0) position, unplug the power cable, and disconnect the gas supply.
2. Remove the five (5) screws which secure the handle halves.
3. Remove the torch main body assembly and torch switch from the handle halves.
4. Slide the protective tubing back away from connections and disconnect the torch main body wires from the torch lead wires.

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

5. Disconnect the torch main body and torch lead gas fittings using 5/16" (8 mm) and 7/16" (11 mm) open-end wrenches.
6. Connect and tighten the new torch main body with torch lead gas fitting.
7. Attach the terminals connecting the two white wires of the torch lead to the black plunger wire from the torch main body.
8. Attach the bullet receptacle and plug connecting the red wire of the torch lead to the red wire from the pilot arc fitting.
9. Attach the bullet receptacles and plugs connecting the two blue wires of the torch lead to the white wires from the cap sensor microswitch.
10. Slide the protective 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.
12. Replace the five (5) screws to secure the handle halves together.

MAINTENANCE

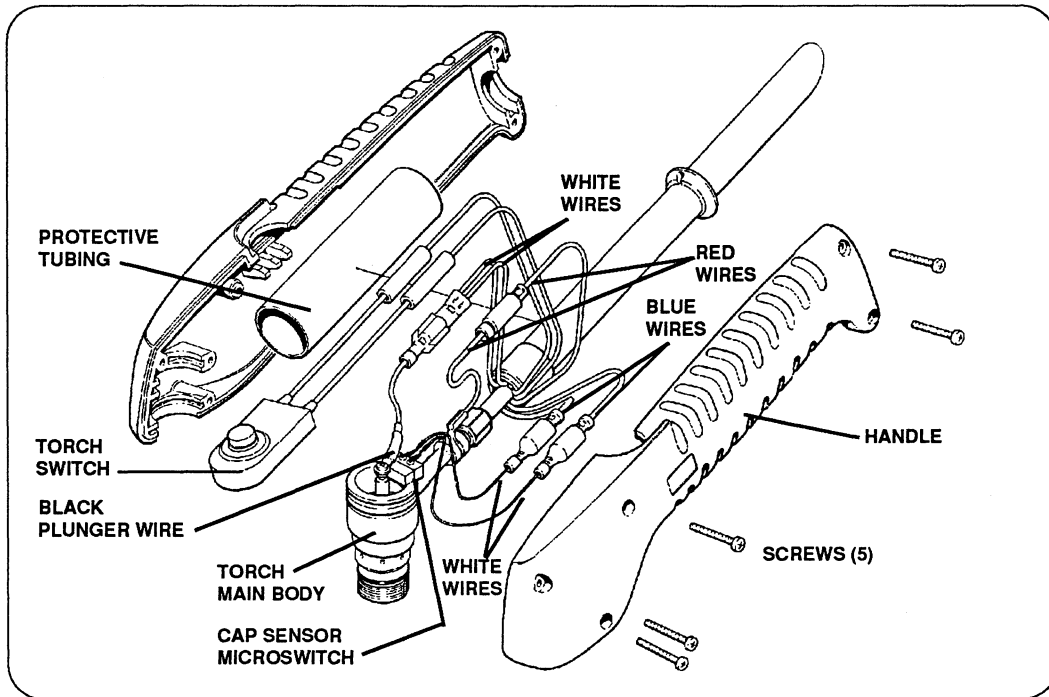


Figure 6-2 PAC121P Torch Main Body Removal and Replacement

PAC121P or PAC121T TORCH LEAD REPLACEMENT

To replace the PAC121 torch lead, remove the torch lead at the PAC121 torch and the MAX40cs power supply and then replace with a new torch lead.

Removal and Replacement at Torch Main Body

To remove and replace the torch lead at the torch main body, refer to the *PAC121P Torch Main Body Replacement* procedure.

Removal and Replacement at MAX40cs

To remove and replace the torch lead at the MAX40cs, refer to Figure 6-3 and proceed as follows:

1. Move the MAX40cs power switch to the OFF (0) position, unplug the power cable, and disconnect the gas supply.
2. Remove the rear panel by removing the eight (8) screws.
3. Refer to Section 5, Standard Components, Figure 5-3, item 13 to locate TB1.
4. Disconnect the two blue wires from the CAP (cap sensor switch) terminals 1 and 2.
5. Disconnect the two violet wires from the START (start switch) terminals 3 and 4.
6. Disconnect the white wire pair from the torch lead to the ELECTRODE (-) terminal.
7. Disconnect the red wire from the PILOT (+) terminal.

To replace the torch lead at the MAX40cs, refer to Figure 6-3 and proceed as follows:

1. Perform steps 1 through 3 above.
2. Connect the two blue wires from the new torch lead to the CAP (cap sensor switch) terminals 1 and 2.
3. Connect the two violet wires from the new torch lead to the START (start switch) terminals 3 and 4.
4. Connect the white wire pair from the new torch lead to the ELECTRODE (-) terminal.
5. Connect the red wire from the new torch lead to the PILOT (+) terminal.

MAINTENANCE

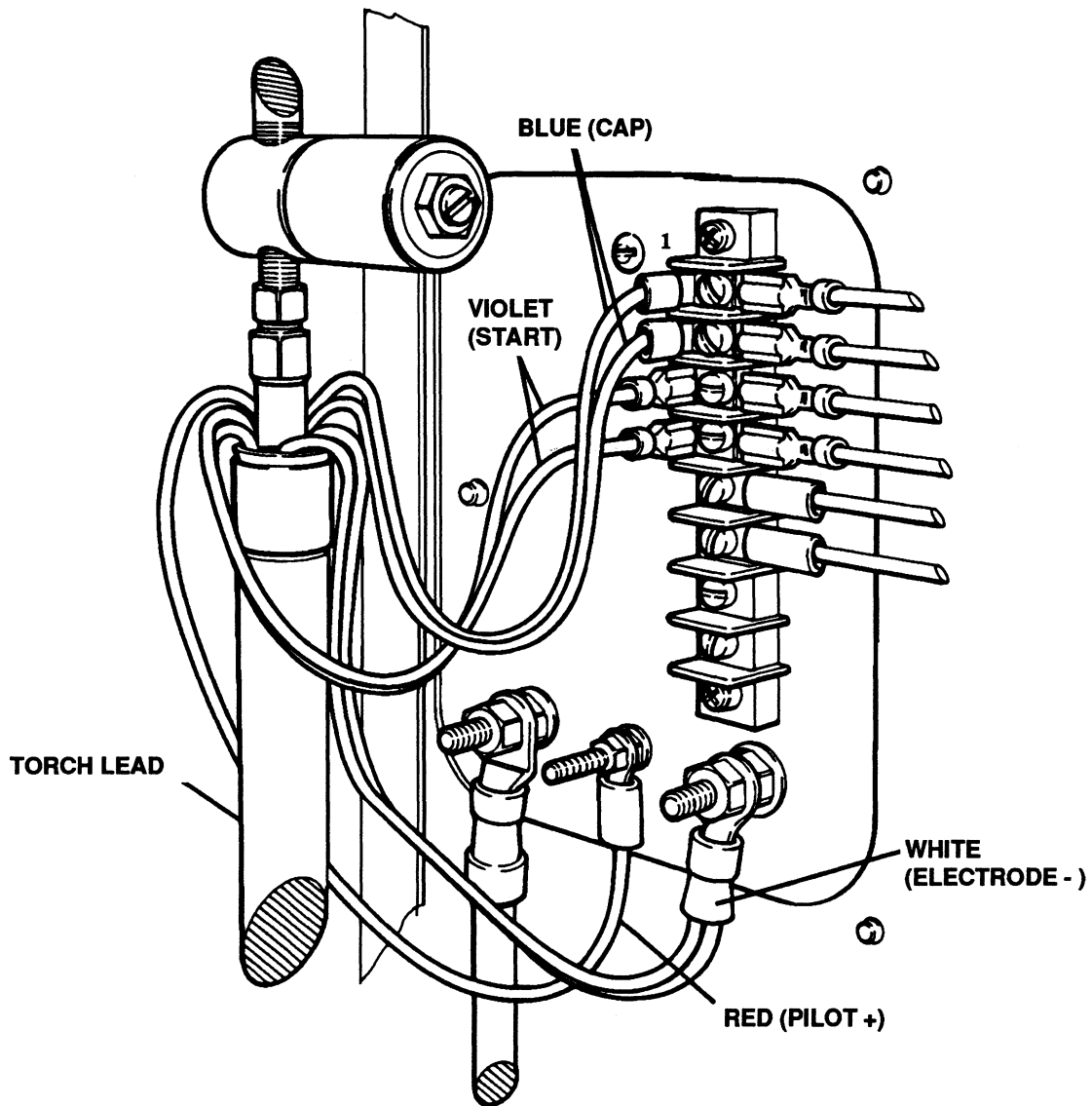


Figure 6-3 PAC121P/121T Torch Lead Connections at MAX40cs

PAC121M MACHINE TORCH MAIN BODY AND LEAD REPLACEMENT

Repair of the PAC121M machine torch normally requires replacement of the torch main body. Order the torch main body (# 120007), refer to figure 6-4 and follow instructions below for removal and replacement.

Removal of Torch Main Body

1. Move the MAX40cs power switch to the OFF (0) position, unplug the power cable, and disconnect the gas supply.
2. To disconnect torch leads at the MAX40cs power supply, refer to *Removal and Replacement of Torch Lead at MAX40cs* later in this manual.
3. Unscrew the torch position sleeve (# 020620) from the torch sleeve (# 020559) and slide it back out of the way.
4. Unscrew the retaining cap (# 020930) and remove the remaining parts (nozzle, electrode and swirl ring). Refer to figure 5-8 Consumable Parts for orientation.
5. Remove the three (3) screws securing the torch sleeve to the torch main body. Remove the torch sleeve.

Note: Use pliers to pull apart the connections in steps 6 through 8.

6. Disconnect the terminals between the two (2) white wires from the torch lead and the black plunger wire from the torch main body.
7. Disconnect the red wire of the torch lead from the torch main body.

Caution: The terminals on the cap sensor microswitch can easily be broken. Before disconnecting the blue wires in step 8, hold the terminals on the cap sensor microswitch securely with pliers.

8. Disconnect the two (2) wires of the torch lead from the terminals on the cap sensor microswitch.
9. Disconnect the torch main body (# 120007) and torch lead gas fitting using 5/16" (8 mm) and 7/16" (11 mm) open-end wrenches.

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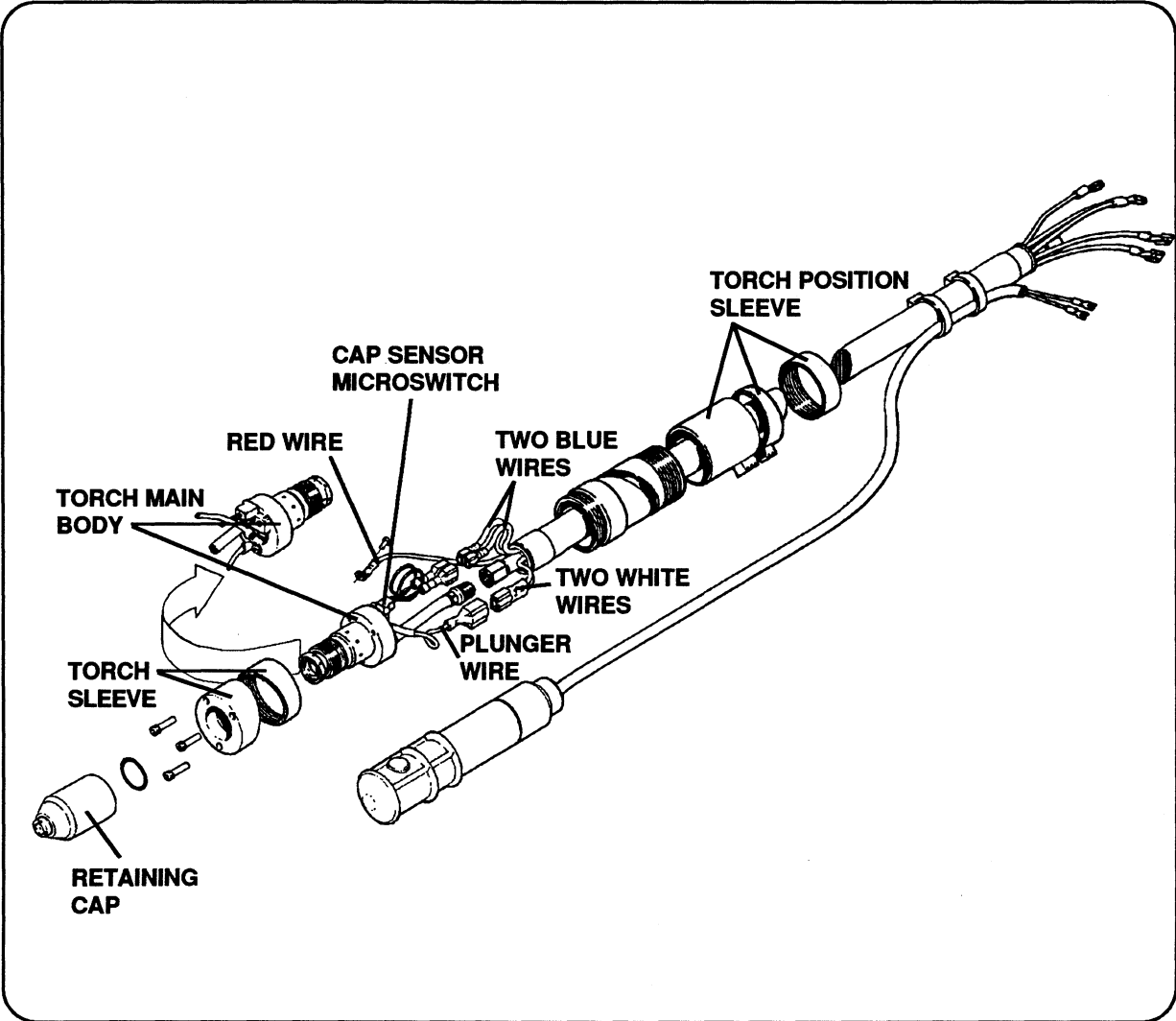


Figure 6-4 Machine Torch Assembly

Replacement of Torch Main Body

1. Connect and tighten the torch main body (# 120007) and torch lead gas fitting.

<p>Caution: The terminals on the cap sensor microswitch can easily be broken. Before connecting the blue wires in step 2, hold the terminals on the cap sensor microswitch securely with pliers.</p>

2. Attach the two (2) blue wires of the torch lead to the terminals from the cap sensor microswitch.
3. Attach the terminals connecting the two (2) white wires of the torch lead to the black plunger wire from the torch main body.
4. Attach the red wire from the torch lead to the torch main body.
5. Position the torch sleeve on to the torch main body and secure it with the three (3) screws.
6. Screw the torch position sleeve (# 020620) and the torch sleeve (# 020559) together.
7. 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 ready for operation.
8. To reconnect torch leads at the MAX40cs power supply, refer to *Removal and Replacement of Torch Lead at MAX40cs* later in this manual.
9. Connect the On/Off Pendant if required.
10. Ensure the MAX40cs power switch is positioned to OFF (0), plug in the power cable, and connect the gas supply.

The MAX40cs is now ready for use.

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Removal and Replacement of Torch Lead at MAX40cs

To remove and replace the machine torch lead at the MAX40cs, refer to Figure 6-5 and proceed as follows:

1. Move the MAX40cs power switch to the OFF (0) position, unplug the power cable, and disconnect the gas supply.
2. Remove the rear panel by removing the eight (8) screws.
3. Refer to Section 5, Standard Components, Figure 5-3, item 13 to locate TB1.
4. Disconnect the two blue wires from the CAP (cap sensor switch) terminals 1 and 2.
5. Disconnect the white wire pair from the torch lead to the ELECTRODE (-) terminal.

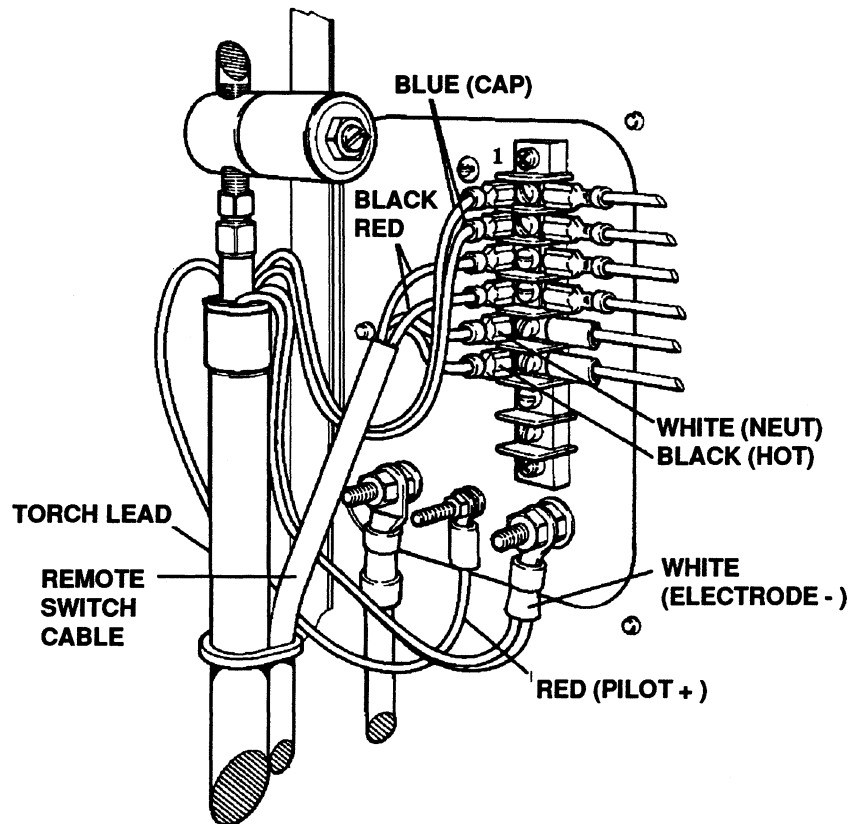


Figure 6-5 Machine Torch Lead and Remote Switch Connections at MAX40cs

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6. Disconnect the red wire from the PILOT (+) terminal.

To replace the machine torch lead at the MAX40cs, refer to Figure 6-5 and proceed as follows:

1. Perform steps 1 through 3 above.
2. Connect the two blue wires from the new torch lead to CAP (cap sensor switch) terminals 1 and 2.
3. Connect the white wire pair from the new torch lead to the ELECTRODE (-) terminal.
4. Connect the red wire from the new torch lead to the PILOT (+) terminal.

REMOVAL AND REPLACEMENT OF REMOTE SWITCH

To remove and replace the remote switch cable at the MAX40cs, refer to Figure 6-5 and proceed as follows:

1. Move the MAX40cs power switch to the OFF (0) position, unplug the power cable, and disconnect the gas supply.
2. Remove the rear panel by removing the eight (8) screws.
3. Refer to Section 5, Standard Components, Figure 5-3, item 13 to locate TB1.
4. Disconnect the black and red wire pair from the START (start switch) terminals 3 and 4.
5. Disconnect the white (Neut) and black (Hot) wire pair from the 24 VAC terminals 5 (NEUT) and 6 (HOT).

To replace the remote switch cable at the MAX40cs, refer to Figure 6-5 and proceed as follows:

1. Perform steps 1 through 3 above.
2. Connect the black and red wire pair from the new remote switch cable to the START (start switch) terminals 3 and 4.
7. Connect the white (Neut) and black (Hot) wire pair from the new remote switch to the 24 VAC terminals 5 (Neut) and 6 (Hot).

Section 7 WIRING DIAGRAMS

In this section:

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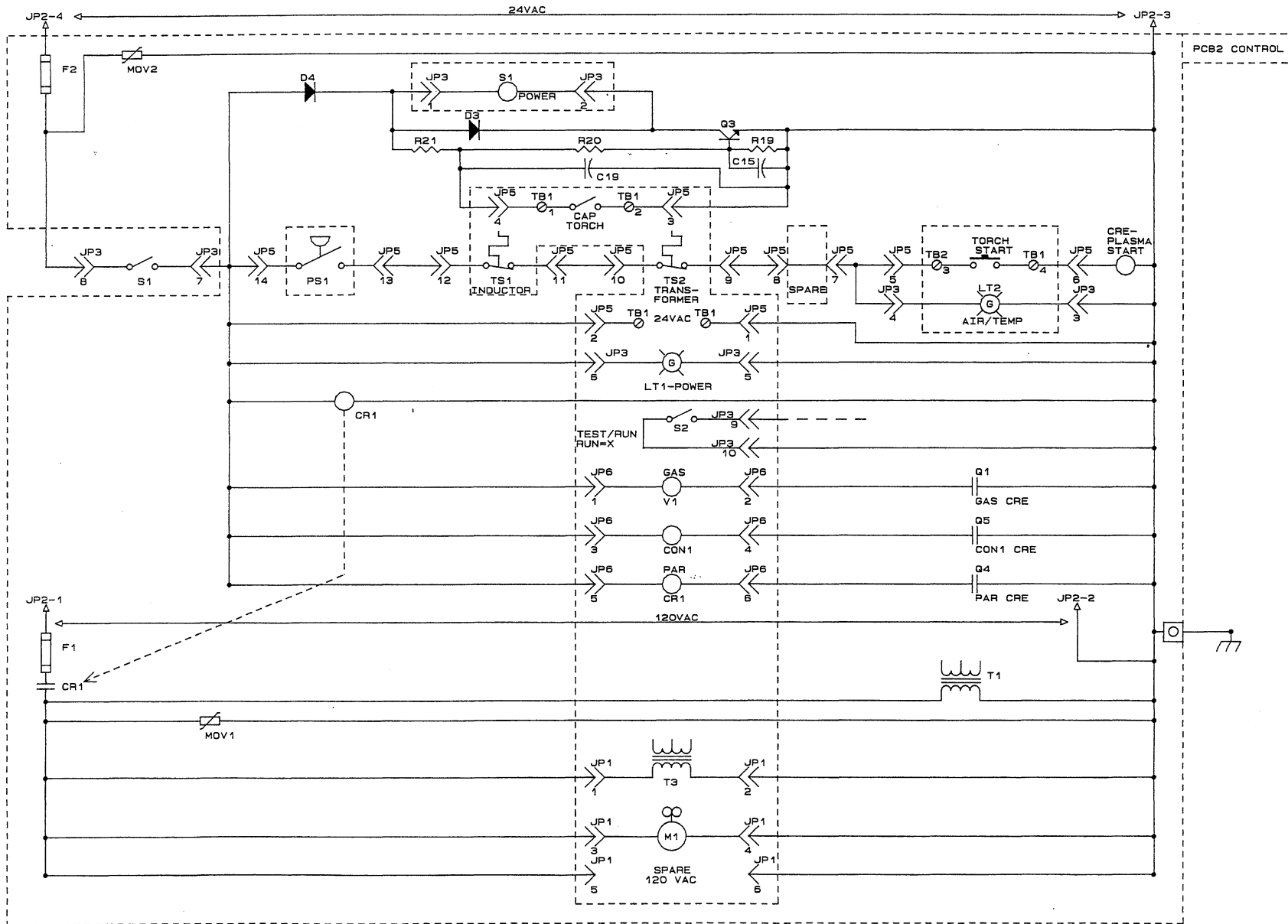


Figure 7-1
24 VAC and 120 VAC
Ladder Diagram

SEE SHEET 2
FOR DETAILS

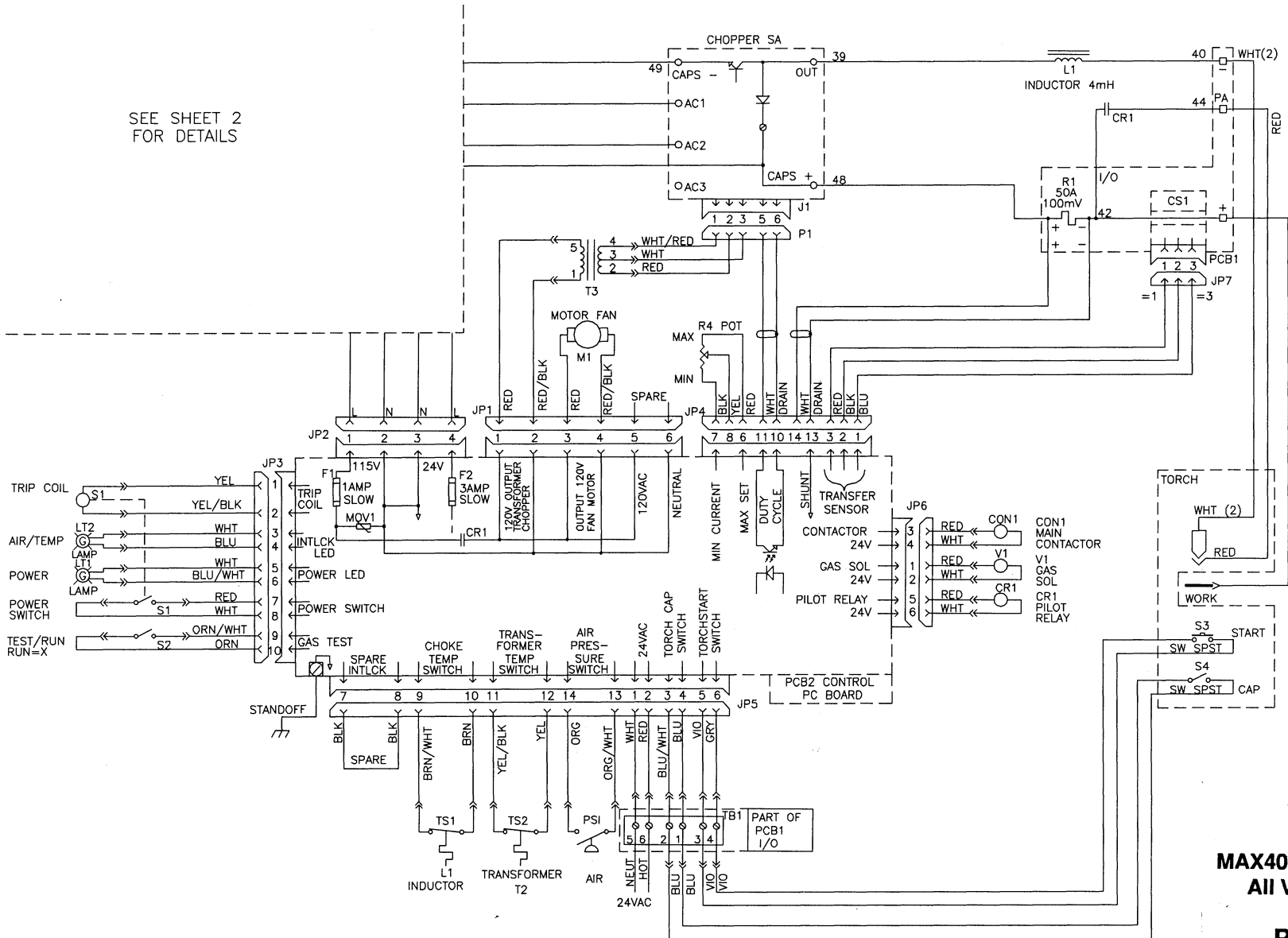
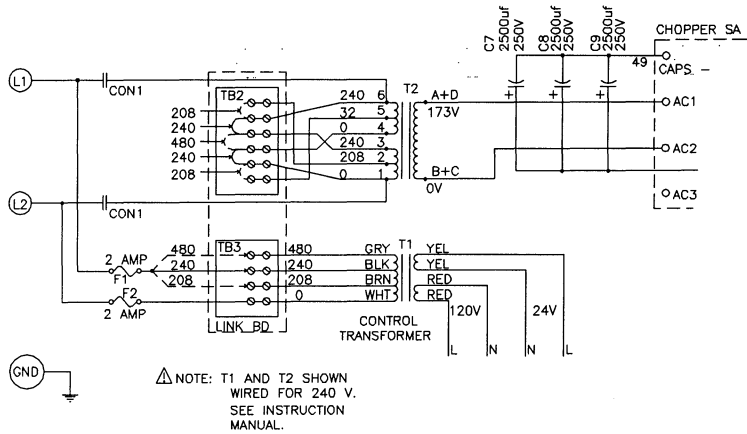
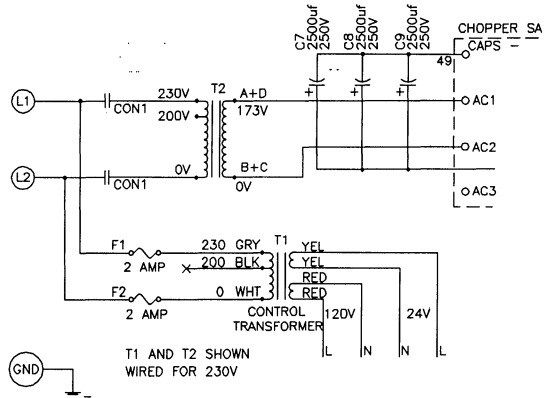


Figure 7-2
MAX40cs Wiring Diagram
All Voltages - 1 of 2

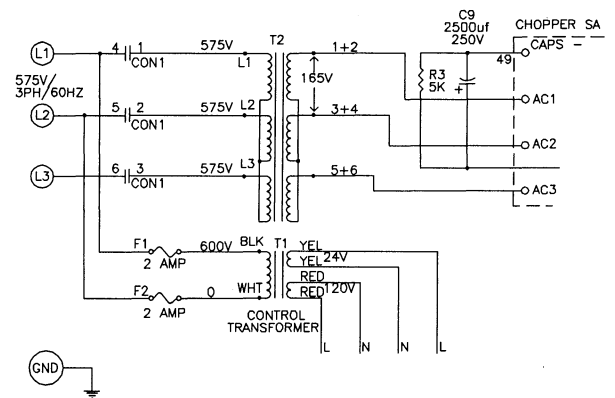
240V/1PH



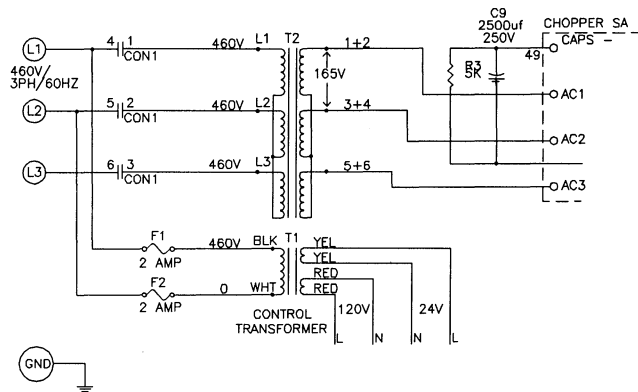
200-230V/1PH/50-60Hz



575V/3PH/60Hz



460V/3PH/60Hz



220Δ 380-415V/3PH/50-60Hz

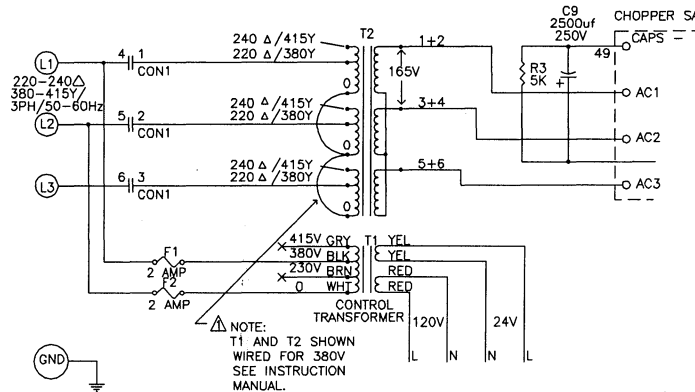


Figure 7-3
MAX40cs Wiring Diagram
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STANDARDS INDEX

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.
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.
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.
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 extending around the kerf, usually on the bottom side.
duty cycle	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.
electrode	A consumable part inside the torch connected to the cathode (-) of the power supply. Electrons come out of the electrode.
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.
interlock	A safety device which must be activated before another device can be activated.
ion	An atom which has an excess or surplus of electrons.
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).

GLOSSARY

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. The highest voltage from a electrical power supply. It occurs when the power supply is on and active but not producing a plasma arc.
PAC	Pilot Arc Controller
pilot arc	A plasma arc that attaches to the 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 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.
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.
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.

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