

MAX40

Plasma Arc Cutting System

***Instruction Manual
800640 - Rev. 5***

HYPERTHERM[®]


MAX40
Plasma Arc Cutting System

Instruction Manual
IM-64

for Serial Nos.
60-7602 -

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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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SAFETY

INTRODUCTION

Abbreviated safety precautions are printed on the MAX40 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 MAX40.

Caution: A caution describes a situation that may cause damage to the MAX40, 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

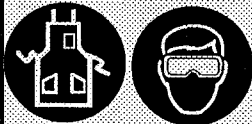


ELECTRIC SHOCK CAN KILL.

- 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. During postflow, the pilot arc may 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 may 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.

SAFETY

Fire Prevention

Cutting with the MAX40 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 (ten meters).
- Quench freshly cut metal or allow metal to cool before handling it or bringing it into contact with combustible materials.
- Never use a MAX40 to cut containers with potentially flammable materials inside. Such containers must be thoroughly cleaned prior to cutting.
- Ventilate potentially flammable atmospheres before using the MAX40. Never operate the MAX40 in an atmosphere which contains heavy concentrations of dust, flammable gas or combustible liquid vapors.

Electric Shock Prevention

The MAX40 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 MAX40.
- 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 MAX40 power supply. This switch allows the operator to turn the MAX40 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 MAX40 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, disconnect the main power or unplug the power supply. After changing the torch parts and returning the retaining cap to its operating position, plug the unit in again.
- Never bypass or shortcut the safety interlocks.

Explosion Prevention

When cutting with the MAX40:

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

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 , AWS and CSA safety standards.
- Never use a cylinder that leaks or is physically damaged.

SAFETY

- 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.

Grounding

Before operating the MAX40:

Input Power

- Be sure the power cord ground wire is properly connected to the ground in the disconnect box.

Be sure the power cord ground wire is properly connected to the ground stud in the power supply. Conform to CSA standards by placing the power cord ground wire first on the stud and place other wires on top of the power cord ground. Fasten the retaining nut tightly.

- Make sure that all electrical connections are tight to avoid excessive heating.

Output Power

- 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.
- 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. CSA (Canadian Standards Association) W117.2 is included.

SAFETY DEVICES

- The MAX40 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 MAX40 is designed specifically to be used with the PAC140 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 MAX40 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 Standards Index. CSA (Canadian Standards Association) W117.2 is included.

Section 1-B SÉCURITÉ

Cette section comprend:

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SÉCURITÉ

INTRODUCTION

Des consignes de sécurité condensées sont imprimées sur le MAX40. Avant d'utiliser l'appareil (y compris le gaz comprimé), il est impératif que chaque personne qui utilise, entretient ou surveille l'emploi de cet appareil lise les instructions de sécurité 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 MAX100.

Prévention: Une signe de prévention décrit une situation qui risquerait d'endommager le MAX100, 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.
- 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.
- Éloigner la torche du corps à l'amorçage. Lorsqu'il reste du gaz dans la torche, l'arc pilote jaillit aussitôt que l'on appuie sur le bouton d'amorçage.
- 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.

<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

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:
 - Porter des gants à crispin et des chaussures et un casque de sécurité.
 - Porter des habits en tissu ignifuge couvrant toutes les parties du corps qui sont exposées.
 - Porter 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 que la ventilation est efficace.
- Ne pas couper de réservoirs contenant ou ayant servi à des matières toxiques. Nettoyer soigneusement les réservoirs avant le coupage.



AVERTISSEMENT



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

SÉCURITÉ

Prévention des incendies

Le coupage avec le MAX40 génère du métal brûlant, des étincelles et des scories. Il faut donc prendre des précautions contre les incendies:

- Des extincteurs d'incendie doivent être accessibles dans l'endroit de coupage.
- Les matières inflammables doivent être maintenues à au moins 35 pi (10m) 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 MAX40 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 MAX40. Ne jamais faire fonctionner le MAX40 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 MAX40 produit une forte tension (environ 250 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 MAX100.
- 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 MAX40. Cet interrupteur doit permettre à l'utilisateur d'arrêter rapidement le MAX40 en cas d'urgence.
- S'assurer que les types et dimension de conducteurs primaires sont conformes aux normes en vigueur.

- Inspecter fréquemment le cordon d'alimentation primaire et le câble de la torche pour s'assurer qu'il n'est ni endommagé ni fissuré. **Un conducteur peut tuer.** Ne pas utiliser l'appareil si le cordon d'alimentation ou le câble de la torche est endommagé. Remplacer immédiatement le cordon ou le câble de la torche s'il est endommagé.
- 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 MAX40 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 MAX40:

- 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; ou 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.

SÉCURITÉ

- Bouteilles de gaz comprimé**
- Manipuler et utiliser les bouteilles de gaz comprimé conformément aux normes de sécurité de la CGA, de l'AWS et de la CSA.
 - Ne jamais utiliser une bouteille qui fuit ou est endommagée.
 - Ne jamais utiliser une bouteille qui n'est pas placée dans le bon sens et bien assujettie.
 - 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 un robinet de bouteille à l'aide d'huile ou de graisse.
 - Ne jamais mettre en contact l'arc-plasma et la bouteille.
 - Ne jamais exposer les bouteilles à une chaleur excessive, aux étincelles, aux scories ou à une flamme.
 - Ne jamais utiliser un marteau, un clé ou un autre outil pour ouvrir un robinet bloqué.

Mise à la masse

Avant de faire fonctionner le MAX40:

- Consommation**
- S'assurer que le fil de terre du cordon d'alimentation est bien mis à la terre dans le coffret de l'interrupteur.
- S'assurer que le fil de terre du cordon d'alimentation est 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 que toutes les connexions sont bien serrées pour éviter la surchauffement.
 - 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.

Output Power

- 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 "Préparation et l'index des normes."

DISPOSITIFS DE SÉCURITÉS

- Le MAX40 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 MAX40 est conçu pour la torche MAX40. 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 dégats causés par l'utilisation d'autres pièces de rechange que celles de Hypertherm.
- Ne jamais faire fonctionner le MAX40 si tous les couvercles du bloc d'alimentation ne sont pas en place car cela mettrait en danger l'opérateur et les autres personnes présentes, en plus de compromettre le refroidissement des pièces.

INDEX DES NORMES

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

Section 2 SPECIFICATIONS

In this section:

General.....	2-2
Product Specifications.....	2-3
MAX40 Power Supply	2-3
PAC140 Torch	2-4
Machine Torch	2-4

SPECIFICATIONS

GENERAL

Hypertherm's MAX40 plasma cutting system is designed for hand cutting of most metals from gauge to 3/8 inch thick.

The MAX40 provides continuously variable current output from 20 to 40 amps on all thicknesses up to 3/8 inch 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 thick, while the 40-amp setting is used for heavier metals.

Because of the unique new power supply design, MAX40 cut quality is superior and the parts life is longer compared to other plasma systems using air as the plasma gas. The series forward regulator or "chopper" design minimizes DC ripple which contributes to outstanding cut quality.

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

SPECIFICATIONS

PRODUCT SPECIFICATIONS

MAX40 Power Supply

The MAX40 is a constant current, buck regulator (chopper) power supply providing continuously variable amperage from 20 amps to 40 amps. It conforms to the following specifications:

Maximum OCV	235 VDC
Output Current	40 Amps
Output Voltage	100 VDC
Duty Cycle Rating	50% Duty Cycle
Input Power at rated output (4.0 kw):	
Model # 057018	220V, 1Ø, 60 Hz, 6.2 KVA
Model # 057038	460V, 3Ø, 60 Hz, 5.8 KVA
Model # 057046	230/460V, 1Ø, 60 Hz, 6.2 KVA
Model # 057061	575V, 3Ø, 60 Hz, 5.8 KVA
Dimensions	Width — 19" Height —39-1/8 " Length —16-5/8"
Weight.....	180 pounds
Gas Type	Shop Compressed Air, Cylinder Compressed Air, or Nitrogen (clean, dry, oil-free)
Shop Compressed Air	240 scfh (4.0 scfm) @ 70 -120 psi (supplied to power supply filter/pressure regulator)
Cylinder Compressed Air or Nitrogen	240 scfh (4.0 scfm) @ 70-120 psi (supplied to power supply filter/pressure regulator)
Power Supply Regulator Pressure Setting	60 psi

SPECIFICATIONS

PAC140 Torch

The PAC140 torch conforms to the following specifications:

Maximum cutting thickness range 3/8 inch
Maximum current at 100% duty cycle 40 Amps
Gas Flow.....240 scfh (4.0 scfm) at 60 psi
Weight..... 6 oz.

Machine Torch

The machine torch conforms to the following specifications:

Maximum cutting thickness range 3/8 inch
Maximum current at 100% duty cycle 40 Amps
Gas Flow.....240 scfh (4.0 scfm) at 60 psi
Weight..... 12 oz.

Section 3 SETUP

In this section:

Upon Receipt.....	3-2
Power Supply Placement	3-4
Primary Connections	3-4
Secondary Connections	3-5
Grounding.....	3-6
Air Supply	3-7
Cylinder Compressed Air	3-7
Shop Compressed Air	3-7
Nitrogen	3-8
Power Requirements	3-8

SETUP

UPON RECEIPT

The MAX40 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.

The carton should include:

- MAX40 power supply
- 10-foot power cable
- PAC140 torch and cable assembly
- 15-foot ground cable with clamp
- Spare parts kit
- Instruction Manual IM-64

2. 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.

3. Remove the power supply unit from the shipping skid.
4. Inspect the unit:

Primary Power Cord

- All 220-volt units have a primary power cord attached to the multi-plug in place. All other voltage units have the power cords attached without a plug in place.
- The ground cable is labeled in all cases.

Linkboard (230/460V version)

- For 230/460 volt units, (model # 057046), ensure that the linkboard is configured properly to the appropriate input voltage line. Check the placement of the links. (See Figure 3-2.)

The linkboard is located in the upper left hand corner (rear view) adjacent to the pilot arc relay. (See Figure 5-18.)



WARNING



Danger: High Voltage. Line voltage present on this board. Disconnect input power before servicing.

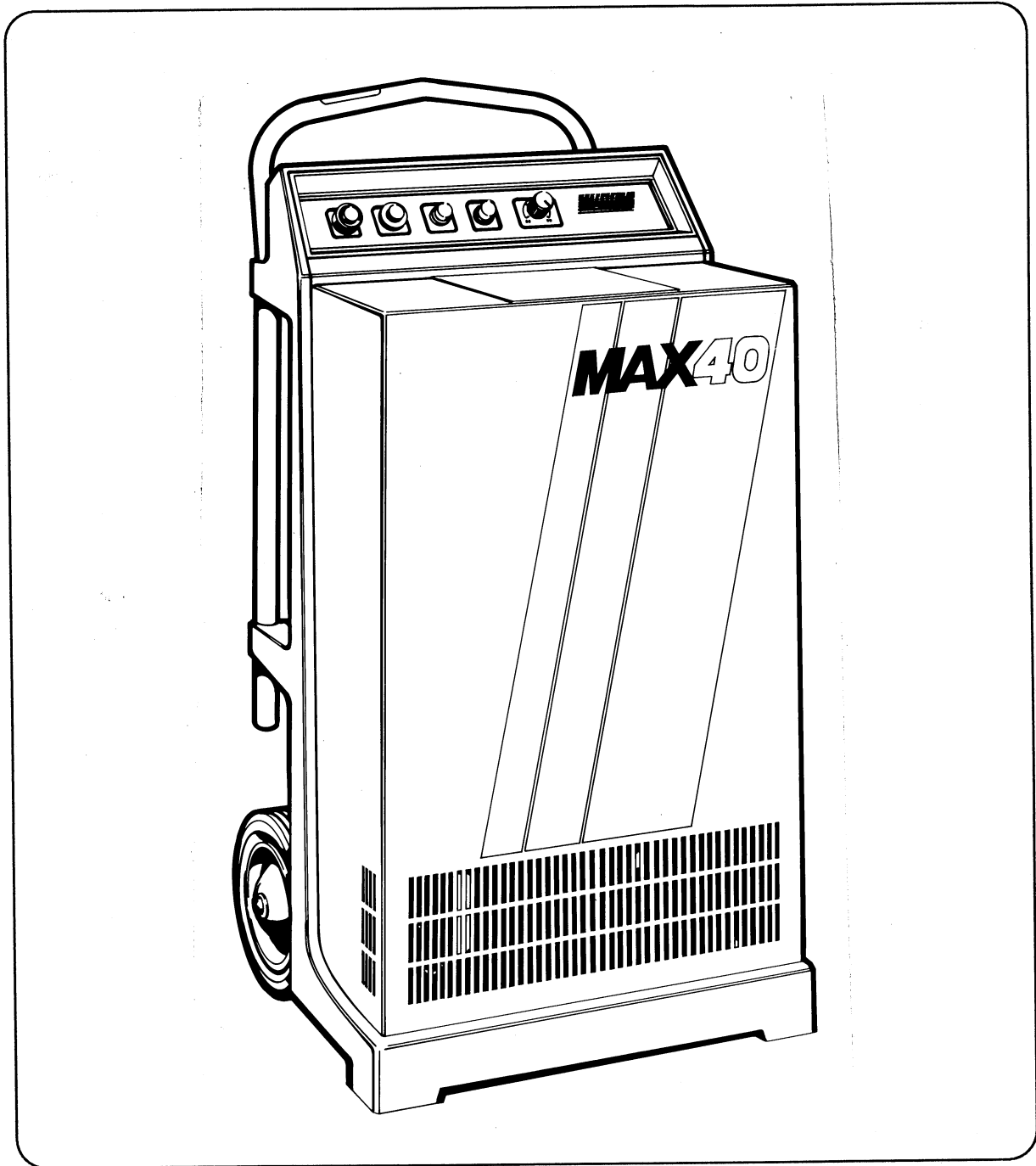


Figure 3-1 MAX40 System

SETUP

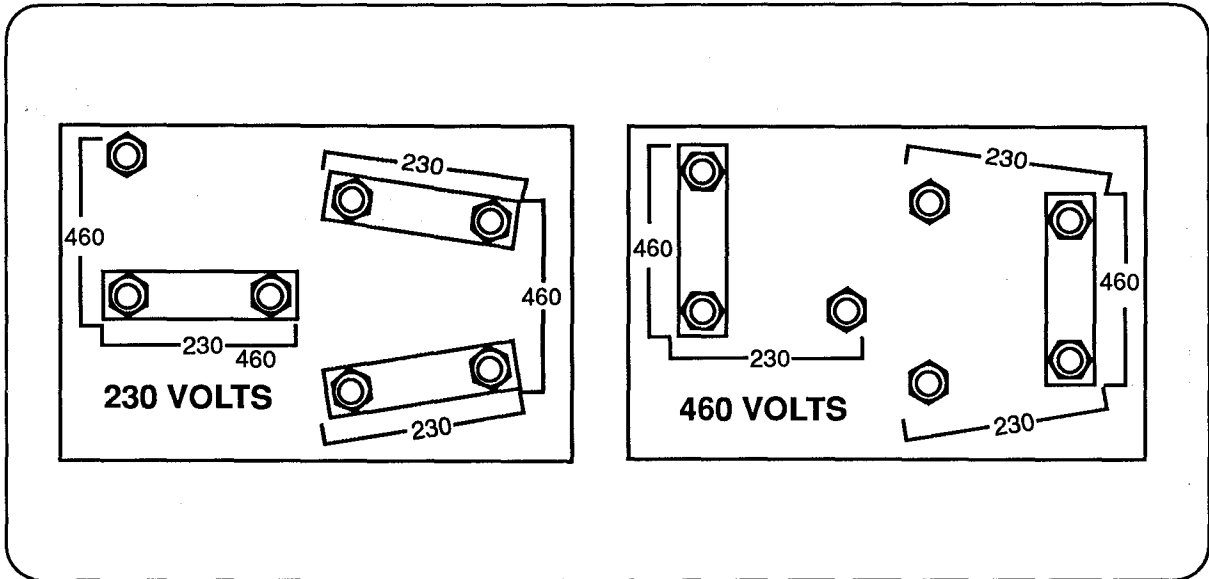


Figure 3-2 Dual Voltage 230/460 Volt Linkboard

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.)
- Do not place any filter device over the air intake locations. This reduces cooling efficiency and **VOIDS THE WARRANTY**.

PRIMARY CONNECTIONS

- Use a primary line disconnect switch for each power supply. This switch allows the operator to turn the power supply off quickly in an emergency situation. The switch should be located on a wall near the power supply, and should be easily accessible to the operator. The interrupt level of the switch must be equal to or exceed the continuous rating of the fuses.
- Use fuses according to the table on page 3-8.

SETUP

- Connect the receptacle provided with 208/230 volt power units to the main disconnect switch box using AWG wire sizes as outlined by applicable local electrical codes. Wire sizes vary based on the distance of the receptacle from the main box.
- Use 3-conductor - # 8 AWG - Type SO input power cable supplied with the system for 208/230 volt AC, 1-phase, 60 Hz input power.
- For 230/460-volt units, ensure that the linkboard is configured properly to the appropriate input voltage line. For instructions, see Figure 3-2.
- Connect the two hot lines L1 and L2 to the 1CON contactor located in the rear, lower right hand side of the power supply. For 3-phase units, connect the third hot line to L3 of 1CON contactor. The ground lead must be connected to the ground stud provided on the case of the machine near the input connections. (See Figures 5-6, 5-12, 5-18 and 5-24.)
- 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 at the rear of the power supply.
 - Use a filter to maintain a high air purity level. All moisture, oil and other contaminants must be removed.

SECONDARY CONNECTIONS

To connect the torch lead assembly to the power supply:

1. Pass the torch lead assembly through the hole at the rear left side of the power supply.
2. Connect the air-cooled power cable to the cathode (4T) fitting at the center of the large white plastic insulated panel on the power supply.
3. Attach the pilot arc lead to the stud marked "Pilot Arc." Be sure to tighten the connection securely to prevent arcing.
4. Connect the ground lead to the stud marked "Ground" on the center insulator board in the power supply.
5. Connect the other end of the ground lead to the workpiece or to the work table.
6. Connect the torch start switch leads 33 and 34 to terminals 1 and 2 on the terminal strip 2TB. (See Figures 5-1, 5-7, 5-13 and 5-19.)

SETUP

GROUNDING

To ensure personal safety and to reduce emission of radio frequency interference, the MAX40 must be properly grounded:

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

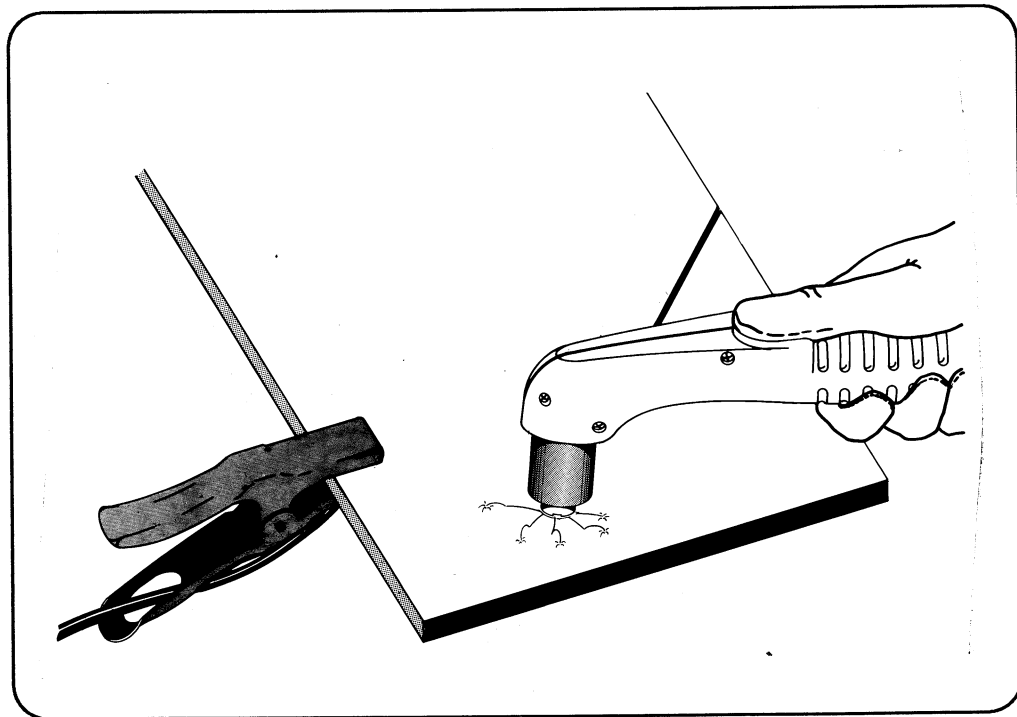


Figure 3-3 Proper Work Clamp Connection

AIR SUPPLY

Two different sources of air can be used to supply the MAX40:

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 must be capable of delivering an output of 240 scfh of air at a pressure of between 70 and 120 psi. 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 MAX40 power supply.



WARNING



Do not exceed 250 psi 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 60 psi delivery pressure to the power supply. Exceeding 60 psi will cause shortened torch parts life.

Shop Compressed Air

Clean, dry, oil-free shop air must be used to supply the MAX40. Shop air must be available at a pressure of between 70 psi and 120 psi and must be routed through the filter/pressure regulator on the power supply. The filter/pressure regulator is mounted at the top rear of the MAX40 power supply.

Caution: Adjust the filter/pressure regulator for 60 psi delivery to the power supply. Exceeding 60 psi will cause shortened torch parts life.

SETUP

NITROGEN SUPPLY

The nitrogen supply to the MAX40 must be 99.995% pure. The nitrogen supply can be from compressed gas cylinders or liquid containers. A high pressure regulator on the cylinder must be used and must be capable of delivering an output of 240 scfh of nitrogen at a pressure of between 70 and 120 psi. 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 MAX40 power supply.



WARNING



Do not exceed 250 psi 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 60 psi delivery pressure to the power supply. Exceeding 60 psi will cause shortened torch parts life.

POWER REQUIREMENTS

A separate line disconnect switch should be provided for each MAX40 power supply. The disconnect box should be sized to the following requirements:

<u>Input Voltage</u>	<u>Phase</u>	<u>Input Current @ 4.0 kw Output</u>	<u>Recommended Fuse Size</u>
220 VAC	1	28 amps	50 amps
230/460 VAC	1	26/13 amps	50/20 amps
460 VAC	3	9/8 amps	15 amps
575	3	31/27 amps	50 amps

Section 4 OPERATION

In this section:

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Operating Instructions	4-3
Operating Tips	4-5
Changing Consumable Parts	4-5
Cutting	4-6
Gouging	4-8
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Common Cutting Faults	4-12
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OPERATION

DESCRIPTION OF CONTROLS

Located on the front panel are:

- **Green ON button**
Activates the power supply and its control circuits.
- **Red OFF button**
Shuts the power supply down.
- **White READY light**
Indicates that all control circuits are activated, safety interlocks are satisfied, and the system is ready for operation.
- **Red DC POWER light**
Indicates that DC power is present at the torch.
- **AMPS output adjustment knob**
Adjusts output current infinitely between 20 and 40 amps. (Increasing the amperage increases the thickness that can be cut.)

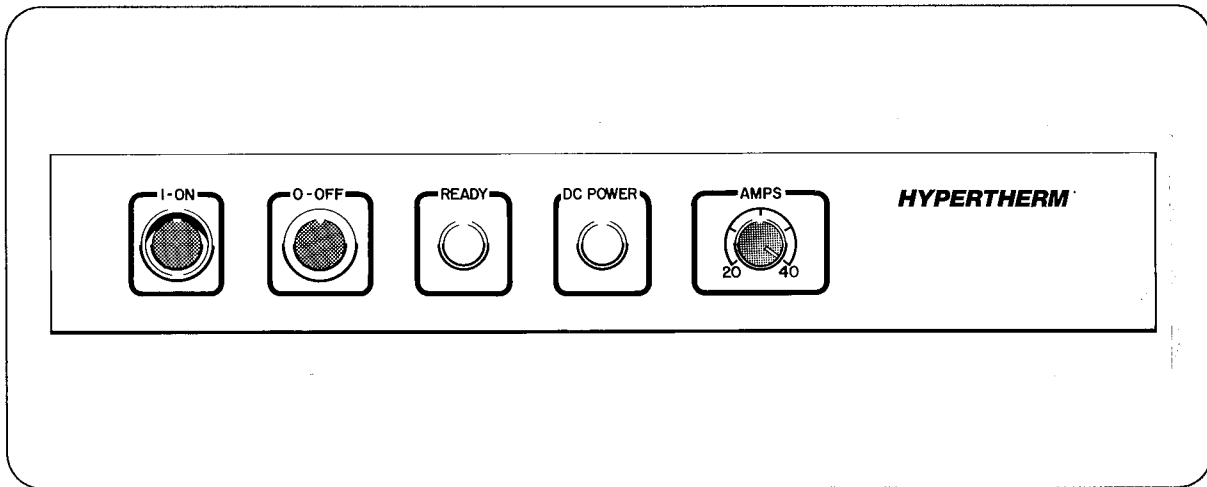


Figure 4-1 Front Panel Controls

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. Turn on the air supply to the MAX40 and adjust the pressure to 60 psig.
4. Apply power to the power supply via the wall disconnect switch.



WARNING



There is no indication that power has been applied to the power supply. Disconnect the power before servicing the unit.

5. Press the green ON button to power up the system. The white READY button lights up.

If the torch parts are not in place, or if one of the other safety interlocks is not satisfied, the safety contactor (1CON) does not energize and the READY button does not light.

6. Momentarily push the torch start button, then release it. Air begins to flow through the system.

Adjust the air pressure to the correct pressure. After 10 seconds, the air automatically shuts off.

7. With the current adjustment potentiometer, select 20 to 40 amps, depending on the workpiece to be cut.

8. Push and hold down the start switch on the torch to activate the pilot arc:

- A two-second gas preflow delay starts timing.
- After the two-second preflow, the following occurs simultaneously:
 - The main contactor (2CON) closes, illuminating the DC red light.
 - High frequency energizes and times out after one second.
 - The pilot arc circuit activates.

OPERATION

9. The pilot arc initiates and transfers to the workpiece if the torch is near (0.15") or touching the workpiece.

If the torch is not close enough to the workpiece, high frequency and pilot arc shuts off after one second and must be restarted by releasing and re-pressing the torch start switch.

10. Move the torch in the desired direction, at a speed which gives good cut quality.
11. When the cut is finished, release the torch button to stop the arc.
12. A sensing circuit detects the transferred arc and automatically shuts off the high frequency and pilot arc circuits. If arc transfer does not occur within one second, the high frequency and pilot arc circuits shut off and can only be reactivated by releasing and re-pressing the torch start switch.

Arc transfer will not occur if:

- There is no material under the arc.
- The red OFF (2PB) button on the MAX40 control panel is pressed.
- The torch start switch is released.
- A safety interlock is not satisfied. For example, the thermal switch or pressure switch has opened or if torch parts are removed. If the safety contactor (1CON) opens, the main contactor (2CON) also opens, shutting off AC power to the torch. The safety contactor also shuts off AC power to the power supply, turning off the white READY light.
- The ground clamp is disconnected from the workpiece.



WARNING



All input power to the power supply is not turned off until the wall disconnect switch is turned off.

13. A postflow of air lasts for ten seconds after the transferred arc is shut off.



WARNING



If the torch start switch is pressed during the postflow sequence, the preflow delay is bypassed and high frequency and the safety contactor are immediately activated, causing the pilot arc to initiate. Transferred arc occurs if the torch is within 1/8" of the workpiece.

OPERATING TIPS

Changing Consumable Parts



WARNING



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



AVERTISSEMENT



Couper l'alimentation avant d'inspecter ou changer les pièces de la torche.

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 2.0 mm (1/16") deep, replace it.

Changing the consumable parts requires no tools. Unscrew the retaining cap and the remaining parts will come apart easily. Replace the parts as illustrated in Figure 4-2. Each part fits in only one direction, so you cannot put the parts in backwards. Also, the torch will not fire if the parts are improperly assembled.

When the nozzle, electrode and swirl ring are properly in place, replace the retaining cap. When the retaining cap is tightened, the microswitch will click, indicating that the torch is operable again.

OPERATION

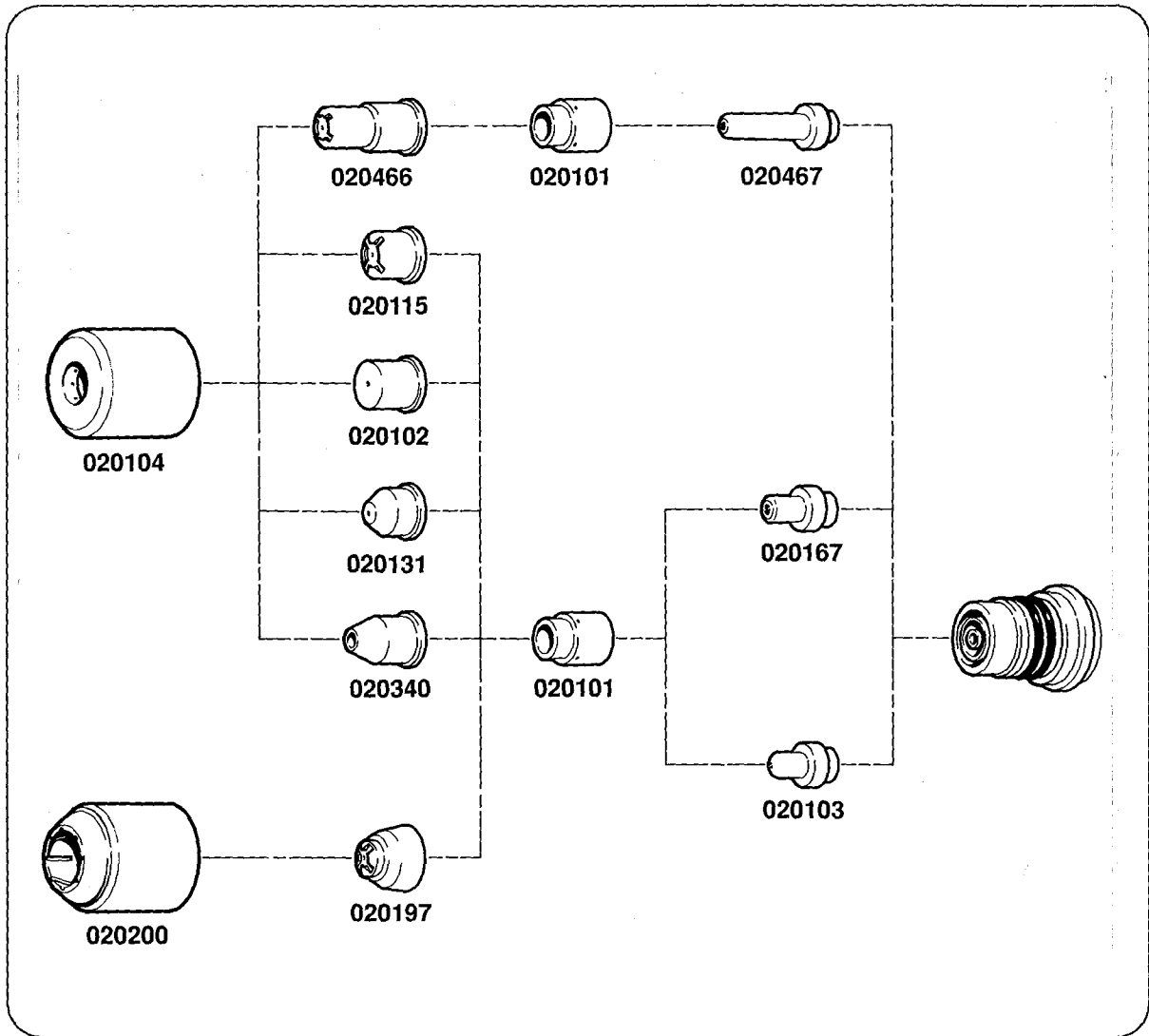


Figure 4-2 Torch Parts

Cutting

- Do not fire the pilot arc into the air needlessly—doing so causes a drastic reduction of the nozzle and electrode life.

OPERATION

- Start cutting from the edge of the workpiece (Fig. 4-3) unless you must pierce. For tips on piercing, see *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 3 mm (1/8 inch) of the workpiece.
- To cut perfect circles for spin fittings, use a template or a radius cutter attachment (Fig. 4-4).
- 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.

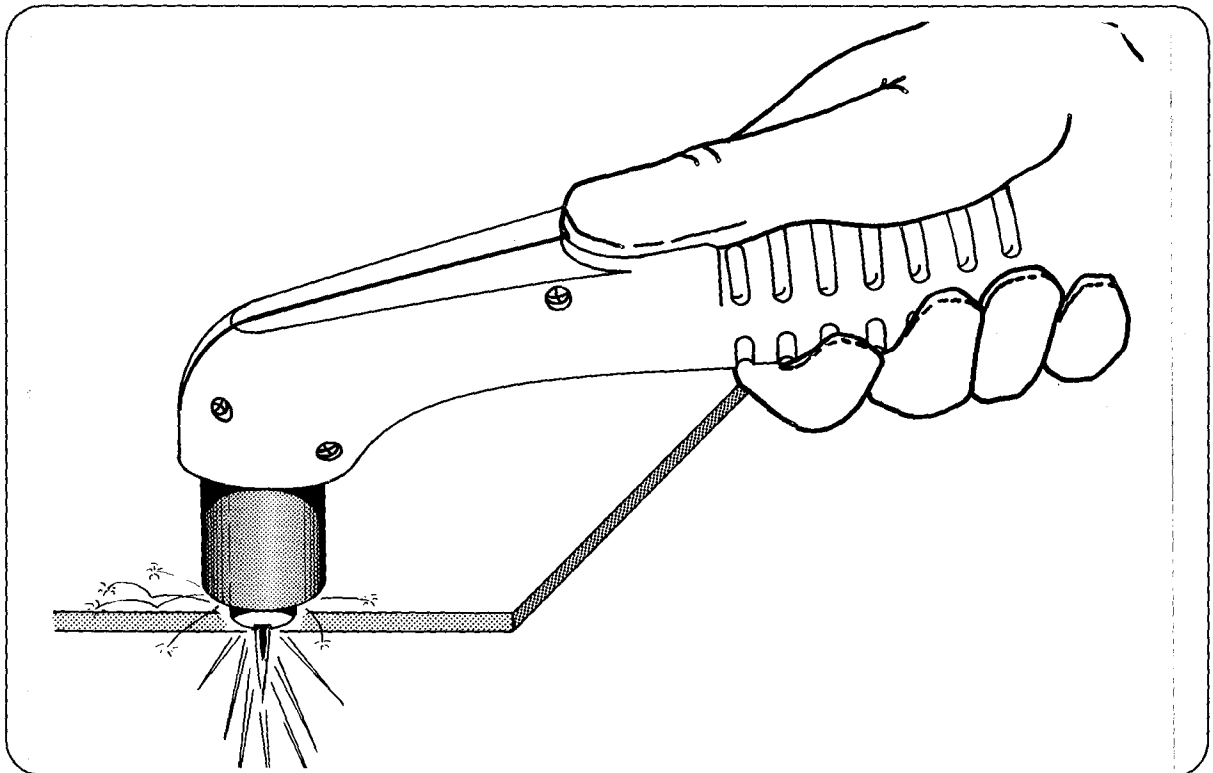


Figure 4-3 Starting a Cut

OPERATION

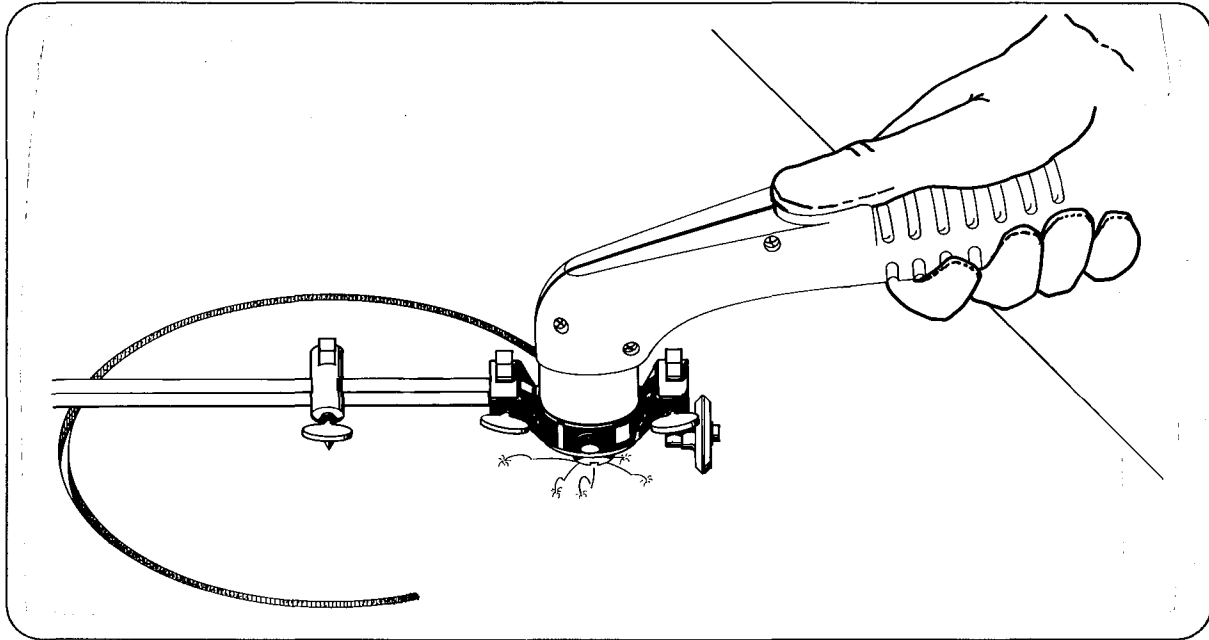


Figure 4-4 Cutting a Circle

Gouging

The MAX40 can be used for gouging mild steel by using the optional gouging nozzle (part number 020340). Use the following guidelines to assist you with the gouging process:

1. When gouging, it is absolutely necessary to wear full protection - a welding helmet with at least a #6 glass, welding gloves and a welding jacket. The arc is fully exposed and will cause serious burns if skin is not covered.
2. Install the gouging nozzle just as you would install a standard cutting nozzle.
3. Adjust the air pressure to 60 psi (with air flowing at 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 in contact with the plate since this can cause premature wear. Multiple passes or "wearing" may be necessary to gouge wider and deeper sections. (See Figure 4-5.)

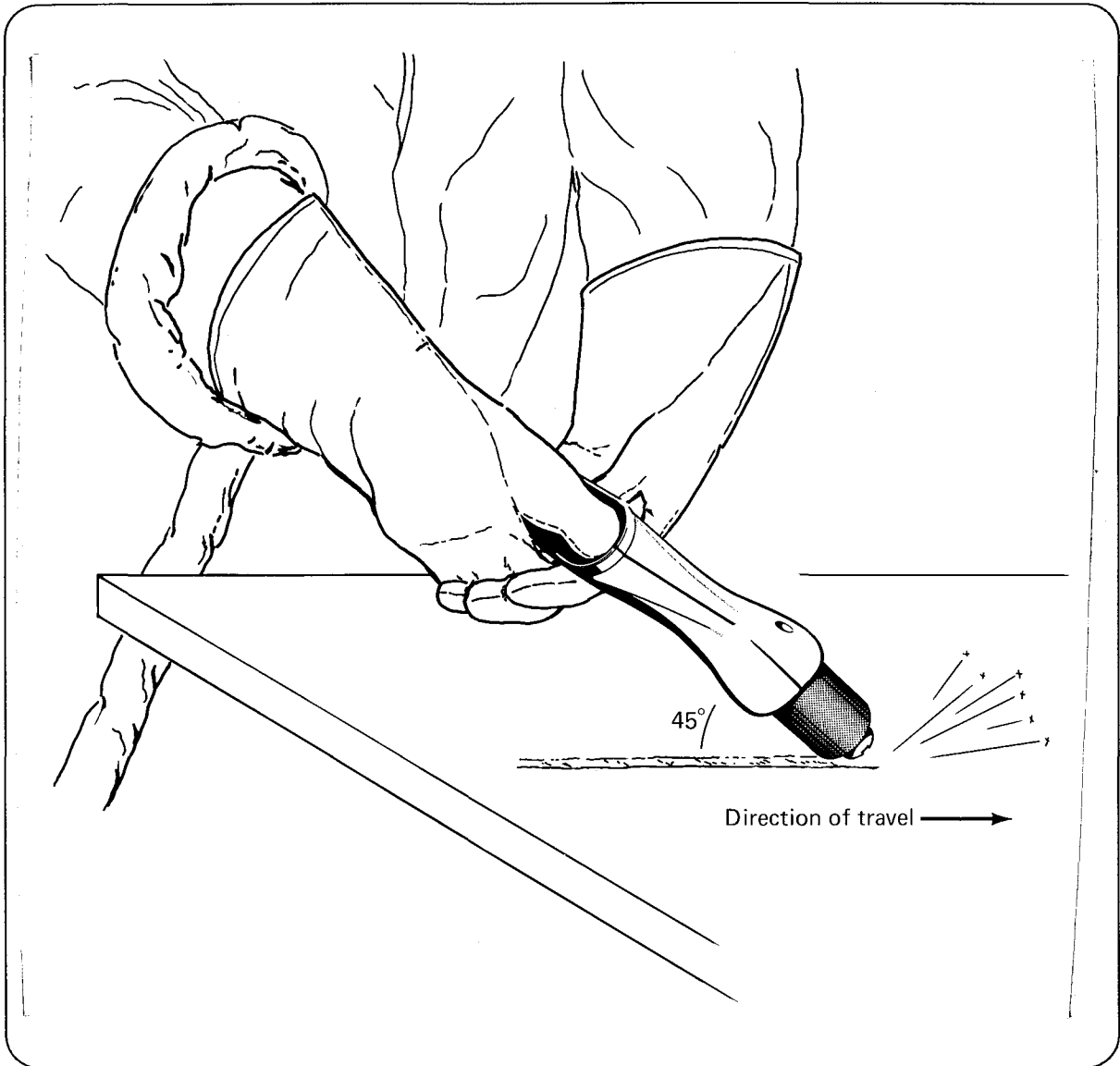


Figure 4-5 Gouging

OPERATION

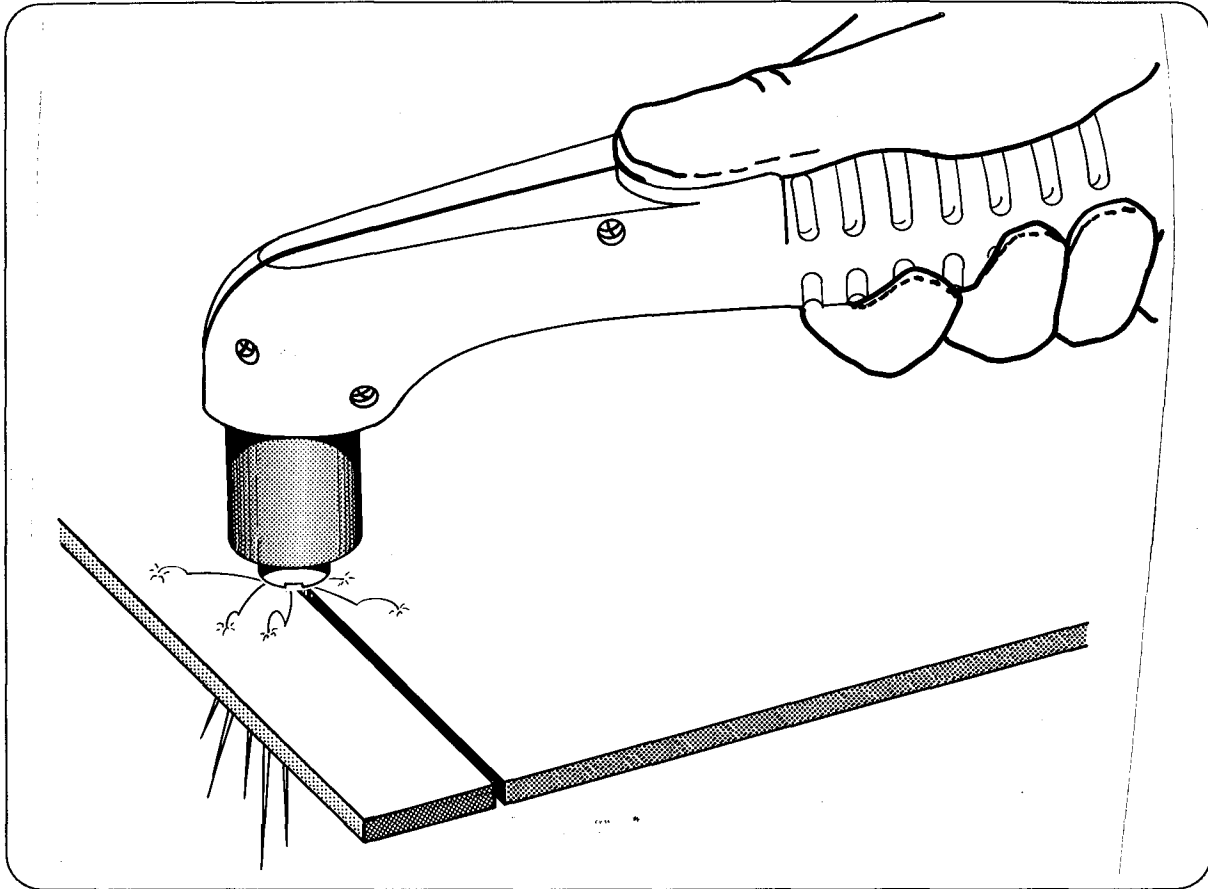


Figure 4-6 Dragging the Torch

Piercing

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

OPERATION

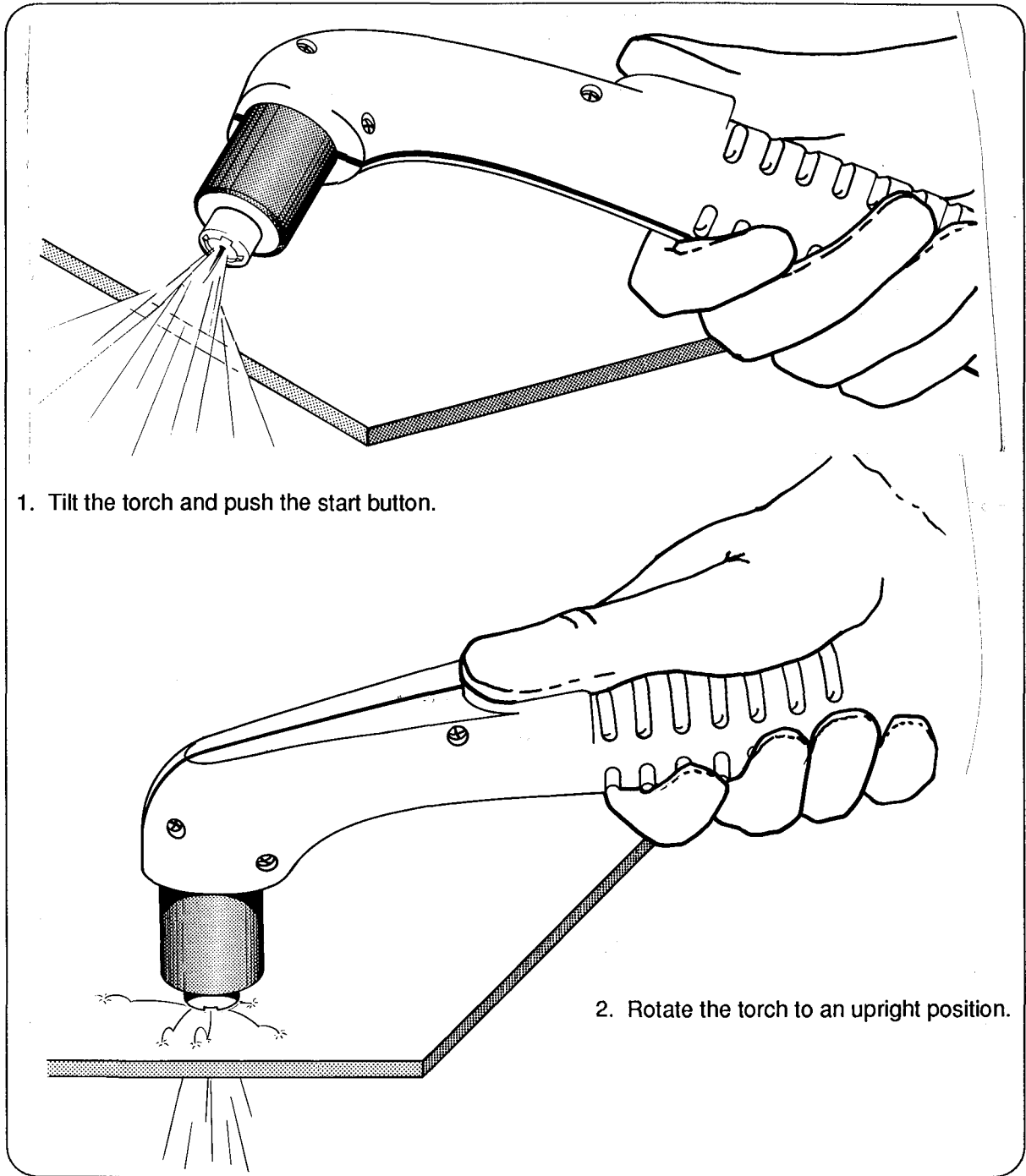


Figure 4-7 Piercing

OPERATION

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.

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 20 amps, the MAX40 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 40% when the current is set at 14 amps, and 80% at 10 amps.

The duty cycle is reduced if:

- The work clamp is not connected to the workpiece. This causes the power supply heatsink to overheat rapidly causing the temperature sensor on the heatsink to shut the machine off.
- The pilot arc is fired when the nozzle is more than 1/8 inch from the workpiece.
- The work clamp is not making a good electrical contact to the workpiece due to paint, rust, etc.

Gas Pressure

Compressed air or nitrogen must be available to the power supply filter/pressure regulator at a flow rate of 240 scfh and at a pressure of between 70-120 psi. If the pressure to the power supply is below 40 psi, the torch goes out.

WARNING

Do not exceed 250 psi 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.

OPERATION

OPERATING DATA CHART

<u>Thickness</u>	<u>Material</u>	<u>Current</u>	<u>Travel Speed</u>
26 ga.	Mild/galvanized steel	20 amps	180 ipm
24 ga.	Mild/galvanized steel	30 amps	280 ipm
18 ga.	Mild/galvanized steel	30 amps	200 ipm
1/16"	Mild/galvanized steel	40 amps	180 ipm
1/8"	Mild steel	40 amps	100 ipm
1/4"	Mild steel	40 amps	35 ipm
3/8"	Mild steel	40 amps	15 ipm
28 ga.	Stainless steel	20 amps	80 ipm
24 ga.	Stainless steel	30 amps	80 ipm
1/16"	Stainless steel	40 amps	50 ipm
1/8"	Stainless steel	40 amps	20 ipm
1/4"	Stainless steel	40 amps	15 ipm
3/8"	Stainless steel	40 amps	7 ipm
1/32"	Aluminum	20 amps	200 ipm
1/16"	Aluminum	30 amps	180 ipm
3/32"	Aluminum	40 amps	100 ipm
1/8"	Aluminum	40 amps	90 ipm
1/4"	Aluminum	40 amps	25 ipm
3/8"	Aluminum	40 amps	10 ipm

Section 5 Standard Components

In this section:

Model 057018: 220V, 1 Phase, 60 Hz	5-3
Illustrations/Parts Lists	5-5
Recommended Spare Parts	5-14
Model 057038: 460V, 3 Phase, 60 Hz	5-15
Illustrations/Parts Lists	5-17
Recommended Spare Parts	5-26
Model 057046: 230/460V, 1 Phase, 60 Hz	5-27
Illustrations/Parts Lists	5-29
Recommended Spare Parts	5-38
Model 057061: 575V, 3 Phase, 60 Hz	5-39
Illustrations/Parts Lists	5-41
Recommended Spare Parts	5-50

MAX40 Power Supply

Model 057018
220 Volt, 1 Phase, 60 Hz

STANDARD COMPONENTS (220V, 1 Phase, 60 Hz)

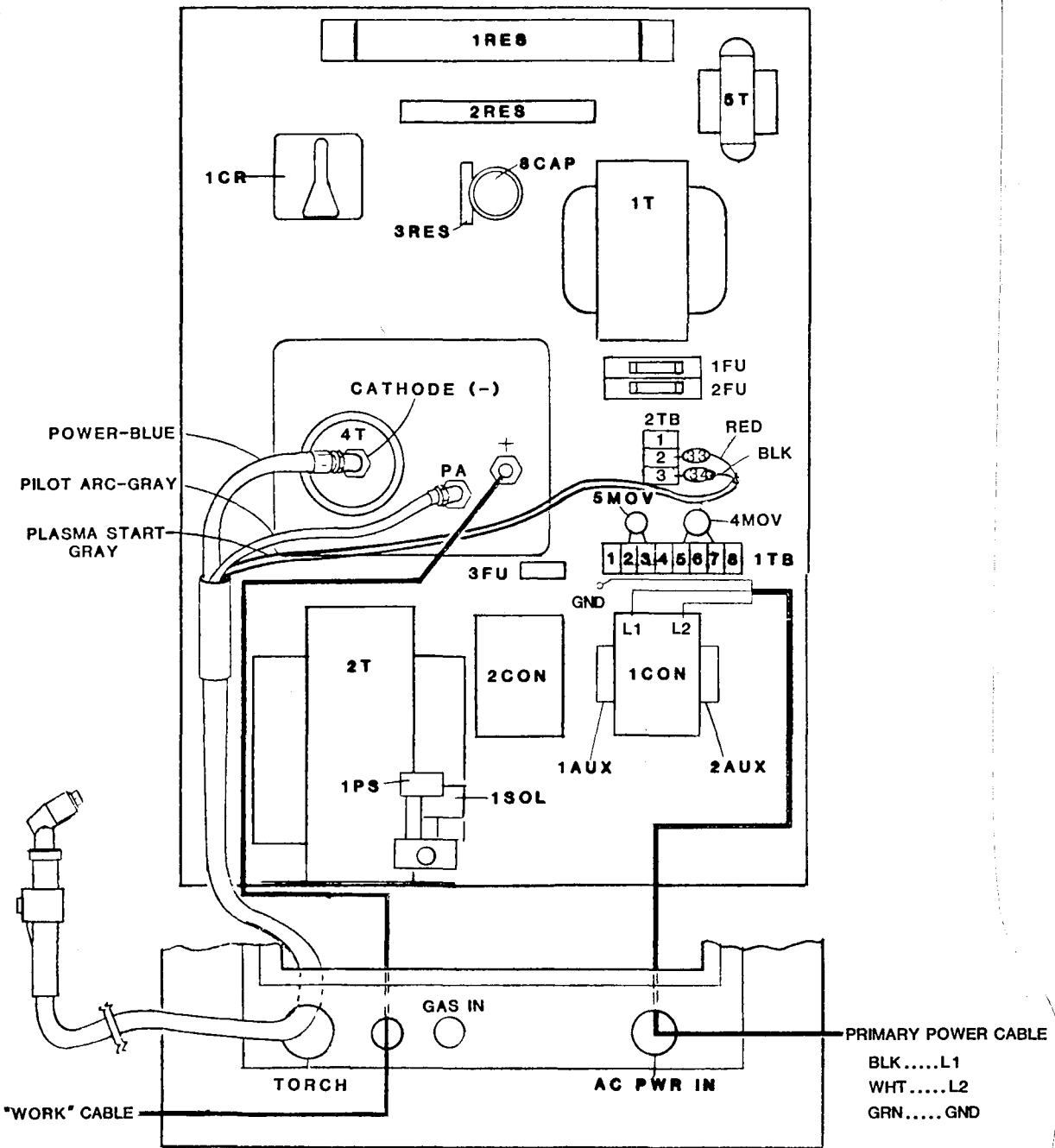


Figure 5-1
Power Supply & External Cable Connections, Rear View

Standard Components (220V, 1 Phase, 60 Hz)

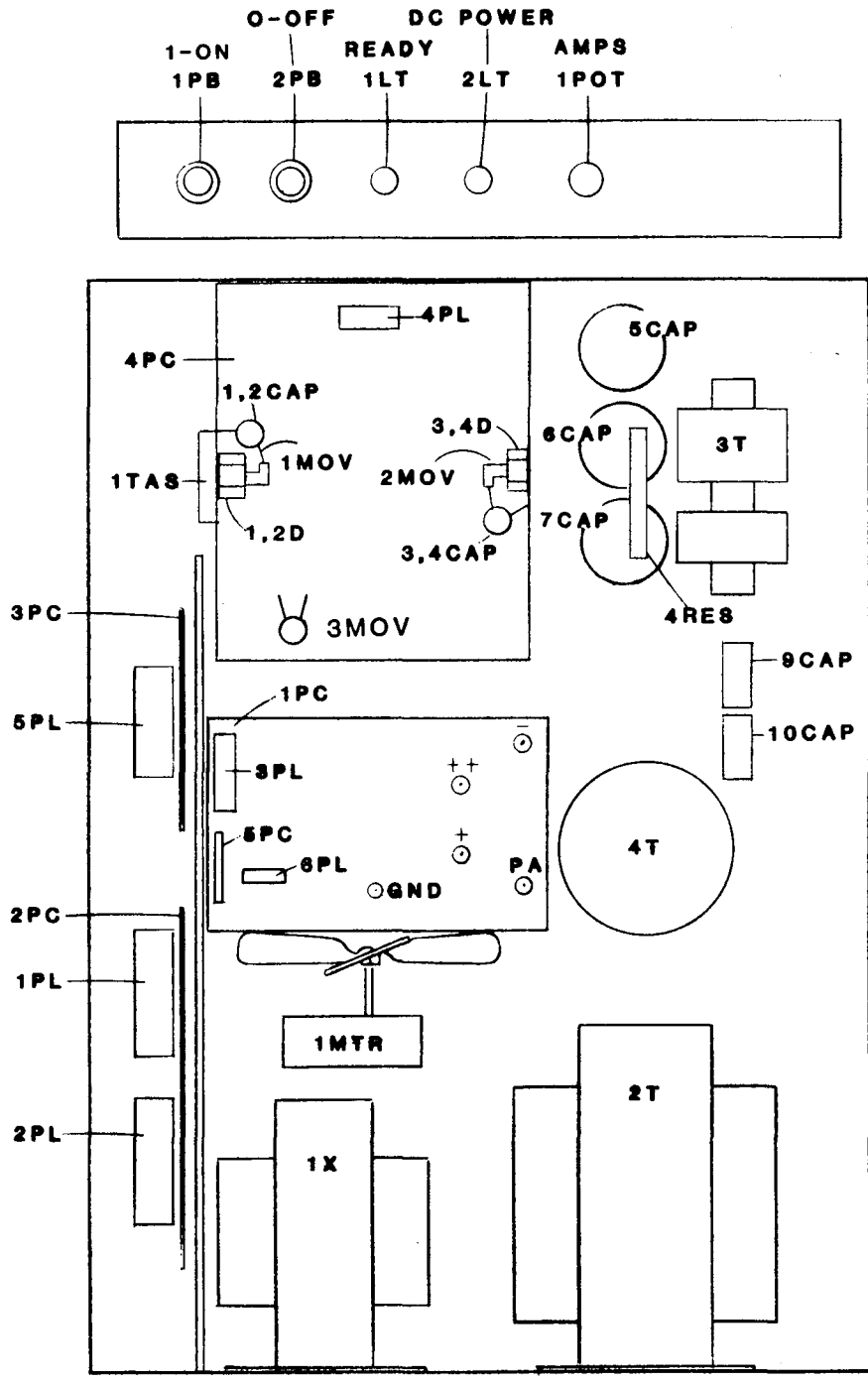
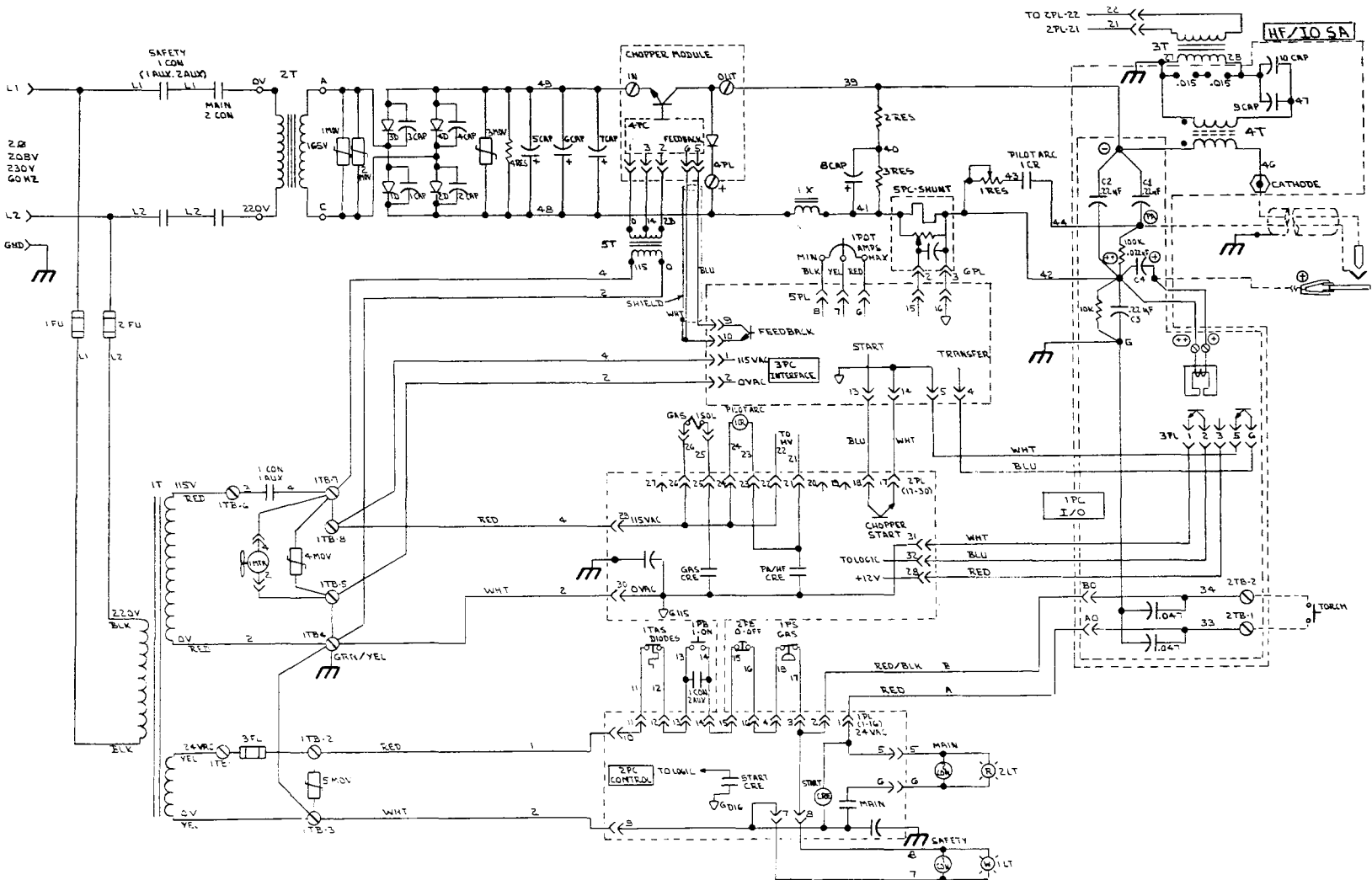


Figure 5-2 Power Supply, Front View

Figure 5-3 Power Supply Schematic



STANDARD COMPONENTS
(220V, 1 Phase, 60 Hz)

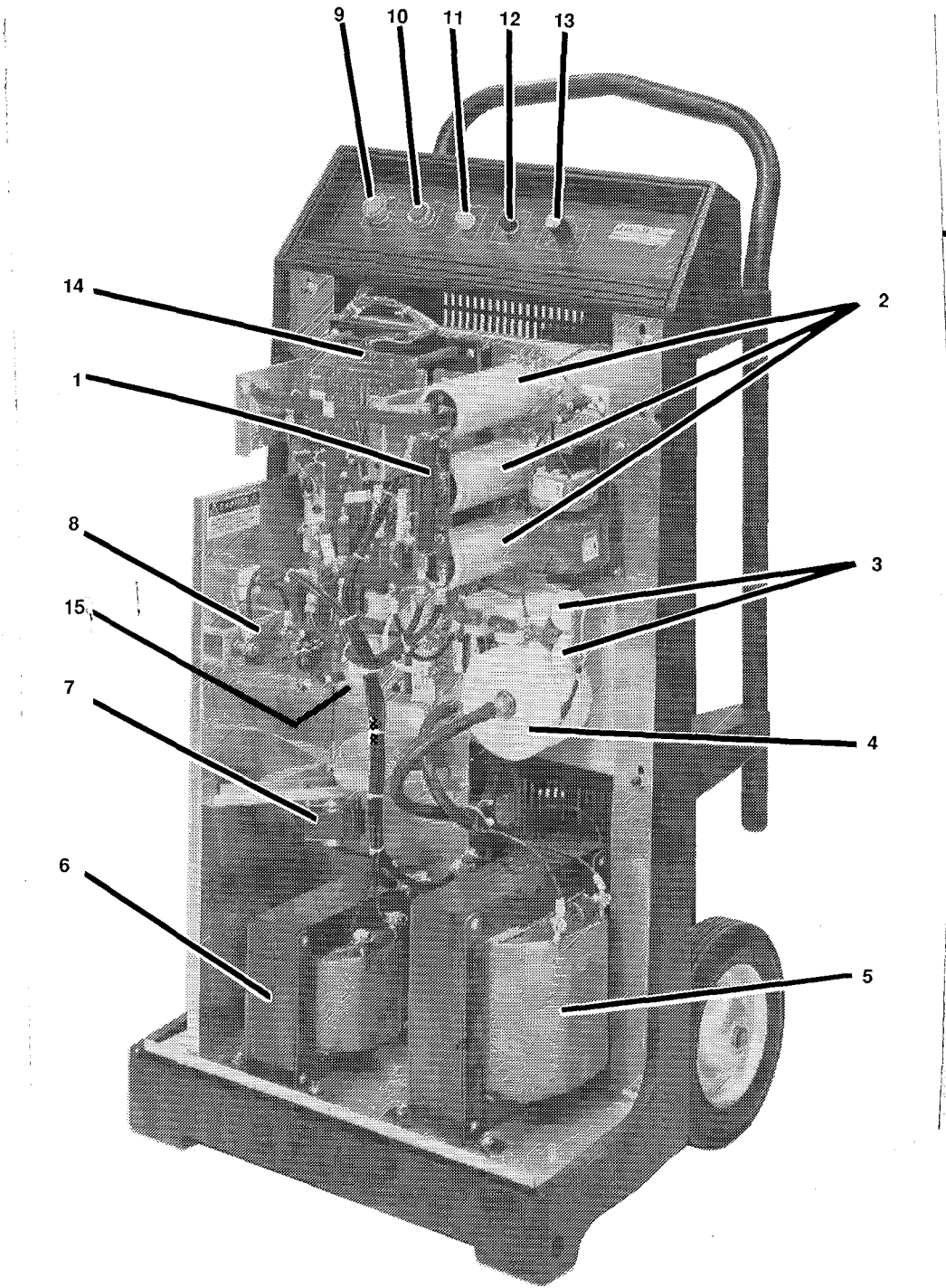


Figure 5-4 Power Supply - Front Right, Side View

STANDARD COMPONENTS
(220V, 1 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009623	Resistor, 1.5K ohm, 50W, 5%	4RES	1
2	009295	Capacitor, ELE 2500 UF, 250 VDC	5,6,7CAP	3
3	009280	Capacitor	9,10CAP	2
4	009349	Coil assembly, high frequency, HT40	4T	1
5	014030	Transformer, 6.6KVA, 220-1Ø, 60Hz	2T	1
6	014031	Inductor, ADC MAX40	1X	1
7	031086	Motor, fan, MAX40	1MTR	1
	027058	Blade, fan		1
8	041109	PC board assembly, shunt	5PC	1
9	005092	Green ON push button	1PB	1
10	005095	Red OFF push button	2PB	1
11	005090	Light bulb	1LT	1
	005089	White READY cap		1
12	005090	Light bulb	2LT	1
	005091	Red DC POWER cap		1
13	009450	Current control	1POT	1
14	029127	Chopper SA	4PC	1
15	041103	PC board assembly, I/O	1PC	1

STANDARD COMPONENTS
(220V, 1 Phase, 60 Hz)

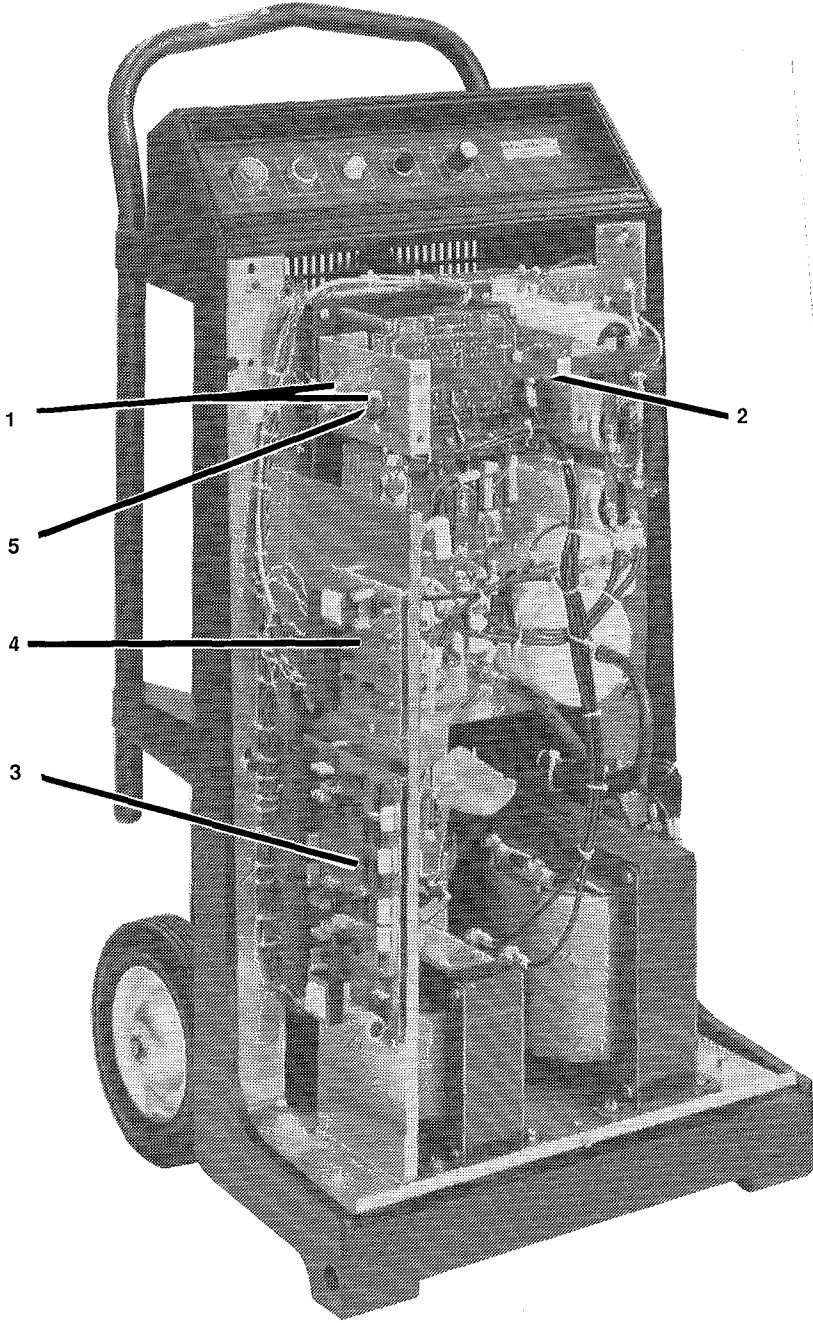


Figure 5-5 Power Supply - Front Left, Side View

STANDARD COMPONENTS
(220V, 1 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009351	Diode, forward, bridge	1,2D	2
2	009352	Diode, reverse, bridge	3,4D	2
3	041101	PC board assembly control, MAX40	2PC	1
4	041105	PC board assembly I-FACE/CHOPPER	3PC	1
5	005086	Thermostat, 75°C	1TAS	1

STANDARD COMPONENTS (220V, 1 Phase, 60 Hz)

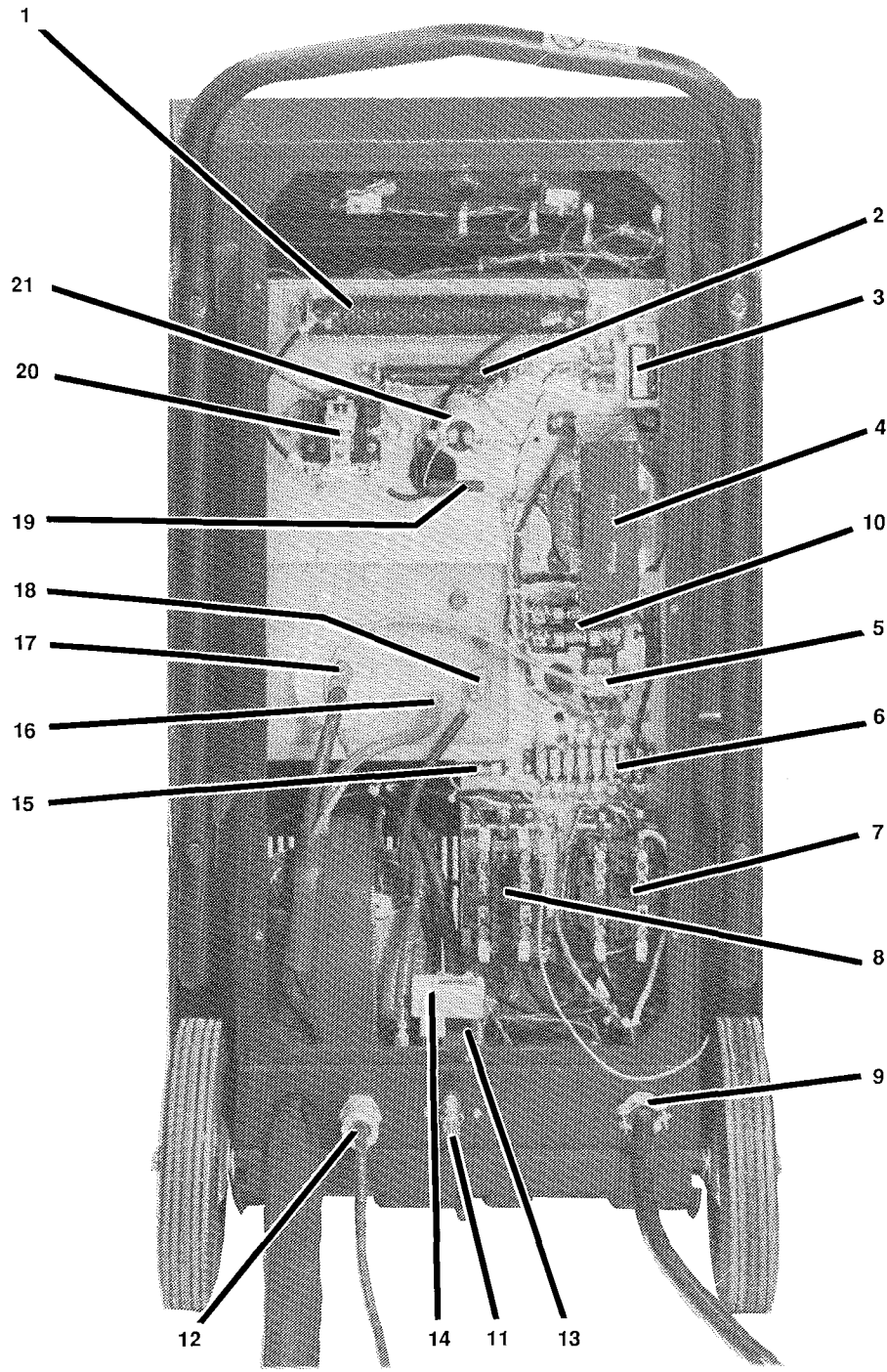


Figure 5-6 Power Supply - Rear View

STANDARD COMPONENTS
(220V, 1 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009624	Resistor, 1.6 ohm, 300W fixed	1RES	1
2	009622	Resistor, 10 ohm, 50 W, 5%	2RES	1
3	014033	Transformer, chopper control	5T	1
4	014032	Transformer, control 220V, MAX40	1T	1
5	008063	Terminal strip (3)	2TB	1
6	008134	Terminal strip (8)	1TB	1
7	003062	Contact assembly, 40A, 1 phase	1CON	1
8	003059	Contact, 40A, 1 phase	2CON	1
9	008228	Strain relief, power cord		1
10	008239	Fuse, 2A, 600 V, FLQ-2	1,2FU	2
11	029131	Compressed air inlet		1
12	008402	Strain relief, work cable (anode)		1
13	006014	Valve, SOL90 #, 1/4 NPTF Water	1SOL	1
14	005093	Switch, pressure 0-90 psi	1PS	1
15	008259	Fuse, 3 amp, 250VDC, UL/CSA, SLO-BLO	3FU	1
16	023157	Torch pilot arc cable, gray		1
17	023156	Torch power cable, blue (cathode)	PA	1
18	023205	Work cable (anode +)		1
19	009015	Resistor, 10K ohm, 10 W	3RES	1
20	003021	Relay, 120 VAC NO SPST	1CR	1
21	009506	Capacitor, 250 UF, 350 VDC	8CAP	1

STANDARD COMPONENTS
(220V, 1 Phase, 60 Hz)

RECOMMENDED SPARE PARTS - 057018

<u>Number</u>	<u>Description</u>	<u>Designator</u>	<u>10-50*</u>	<u>50-100**</u>
011023	Filter/regulator air		1	2
005090	Bulb, 28 VDC, 40 MA, T-3, 1/4	1,2 LT	10	20
005093	Switch, pressure 0-90 psi	1PS	1	2
006014	Valve, SOL 90#, 1/4 NPTF Water	1SOL	1	2
003021	Relay, 120VAC, No SPST	1CR	1	2
003059	Contactor, 40A	2CON	1	2
003062	Contactor assembly, HT40/MAX40	1CON	1	2
008239	Fuse, 2A, 600V, FLQ-2	1,2FU	10	20
009015	Resistor, 10K ohm, 10W	3RES	1	2
009295	Capacitor, Ele 2, 2500 UF, 250VDC	5, 6, 7CAP	2	4
009622	Resistor, 10 ohm, 50W, 5%	2RES	1	2
009623	Resistor, 1.5K ohm, 50W, 5%	4RES	1	2
009506	Capacitor, 250 UF, 350 VDC	8CAP	2	4
009624	Resistor, 1.6 ohm, 300W fixed	1RES	1	2
005086	Thermostat, 75°C	1TAS	1	2
009351	Diode, forward bridge	1,2D	6	12
009352	Diode, reverse bridge	3, 4D	6	12
014021	Transformer, HV 500V, 20 MA	3T	1	2
008259	Fuse, 3 amp, 250VAC, UL/CSA,SLO-BLO	4MOV	10	20
009450	Pot, 1K ohm, 2W, 10%, 1T	1POT	1	2
014032	Transformer, control 220V, MAX40	1T	1	2
031086	Motor, fan MAX40	1MTR	1	2
041101	PC board assembly control, MAX40	2PC	2	4
041105	PC board assembly I-face/Chopper	3PC	2	4
041109	PC board assembly shunt	5PC	2	4
020479	PAC140 hand torch		2	4
001214	PAC140 torch handle		2	4
001260	PAC140 torch boot		2	4
057012	PAC140 hand torch, 25 feet		2	4
057013	PAC140 hand torch, 50 feet		2	4
028287	Machine torch		2	4
057053	Machine torch, 25 feet		2	4
057054	Machine torch, 50 feet		2	4
029129	Leads SA, 25 feet		2	4
029130	Leads SA, 50 feet		2	4
029127	Chopper module		1	2

* Stock quantities for 10-50 units working in the field.
 ** Stock quantities for 50-100 units working in the field.

MAX40 Power Supply

Model 057038
460 Volt, 3 Phase, 60 Hz

STANDARD COMPONENTS (460V, 3 Phase, 60 Hz)

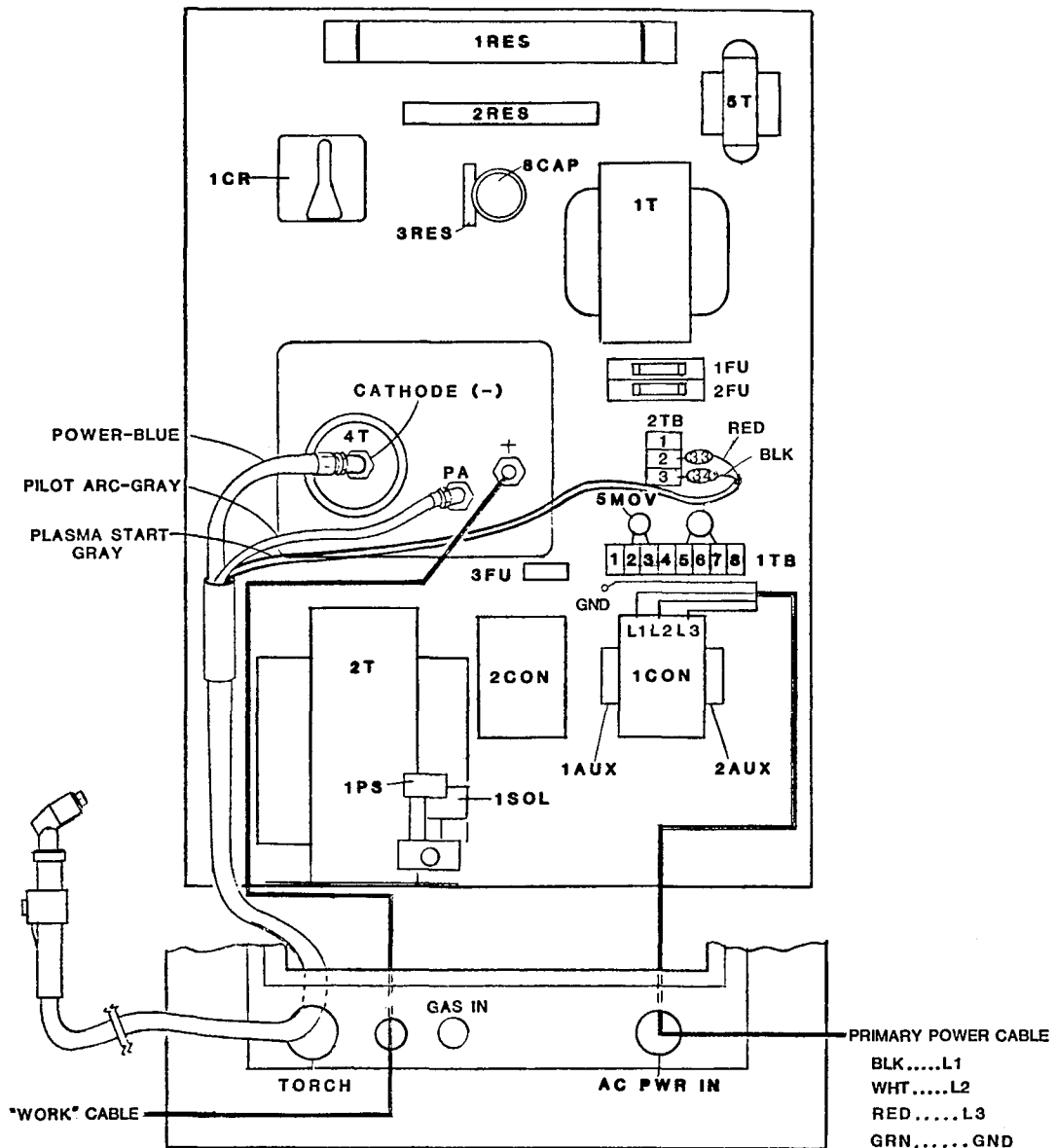


Figure 5-7 Power Supply & External Cable Connections - Rear View

STANDARD COMPONENTS (460V, 3 Phase, 60 Hz)

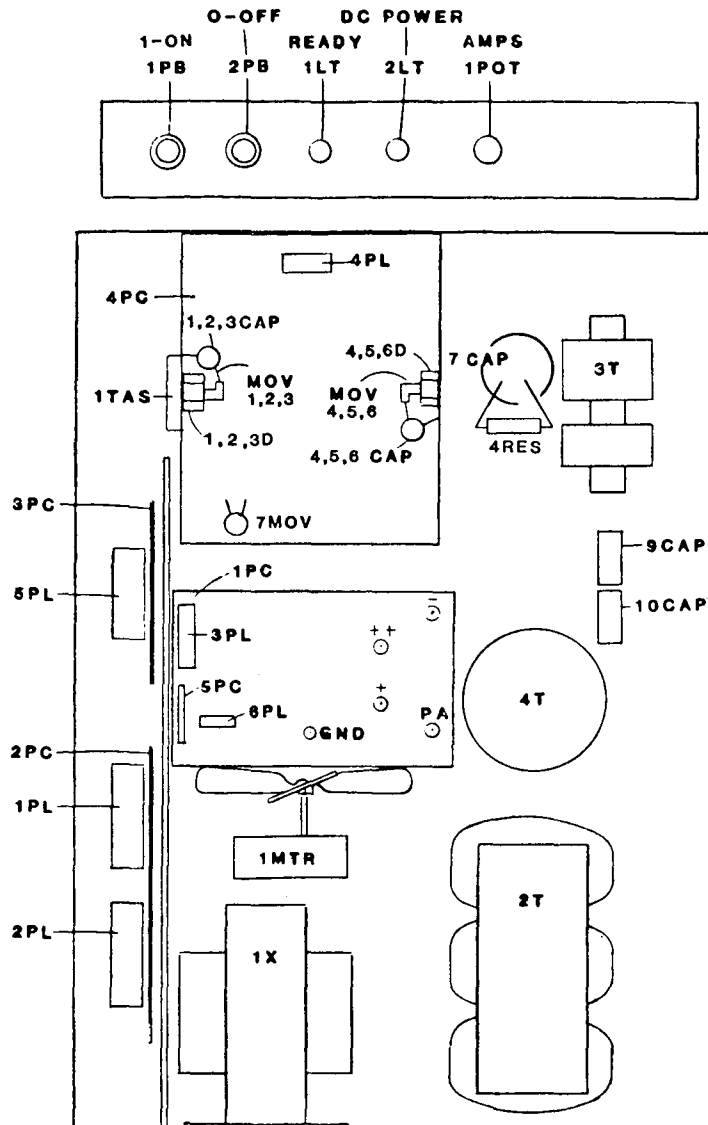
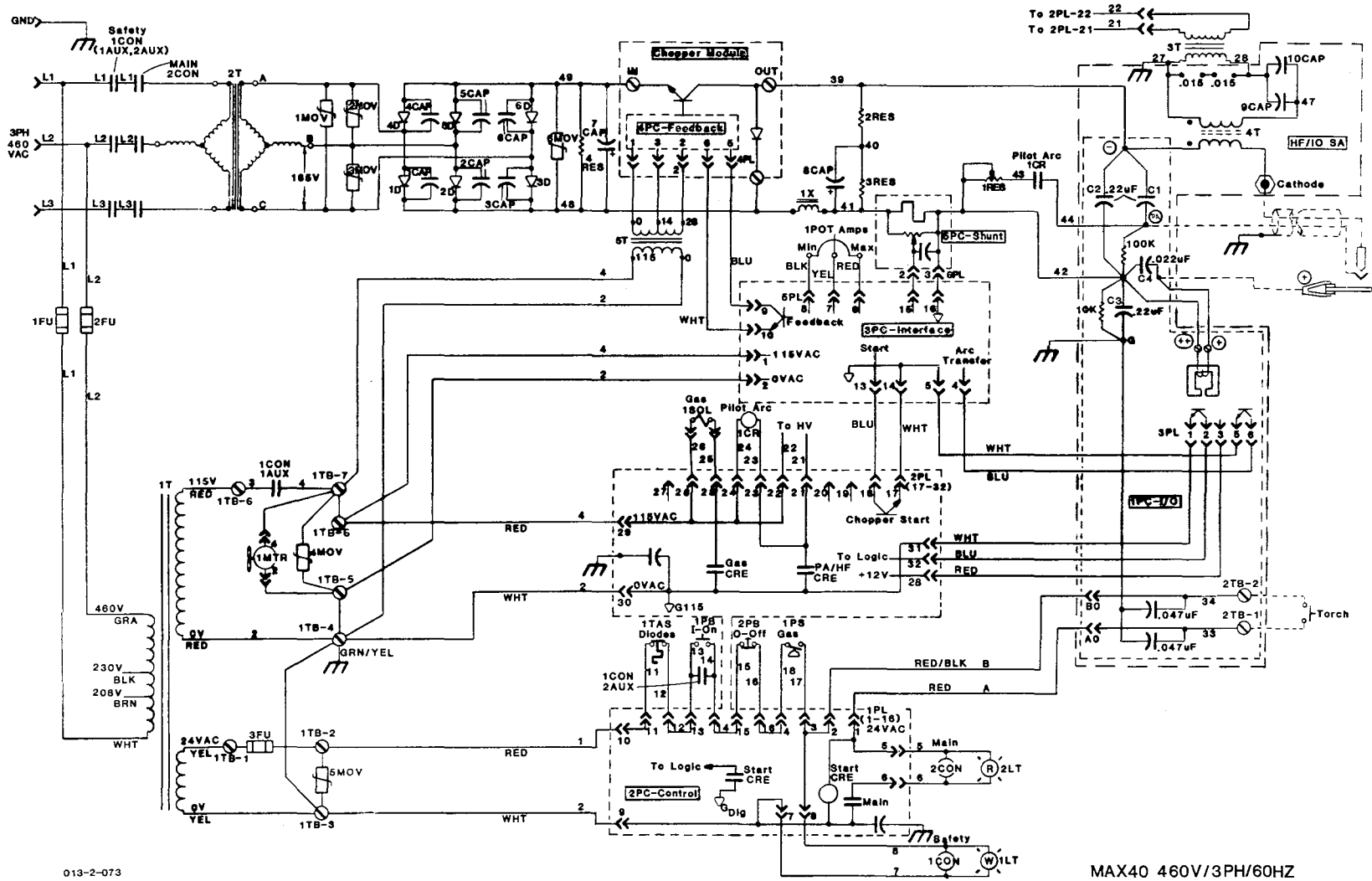


Figure 5-8 Power Supply - Front View

Figure 5-9 Power Supply - Schematic



STANDARD COMPONENTS
(460V, 3 Phase, 60 Hz)

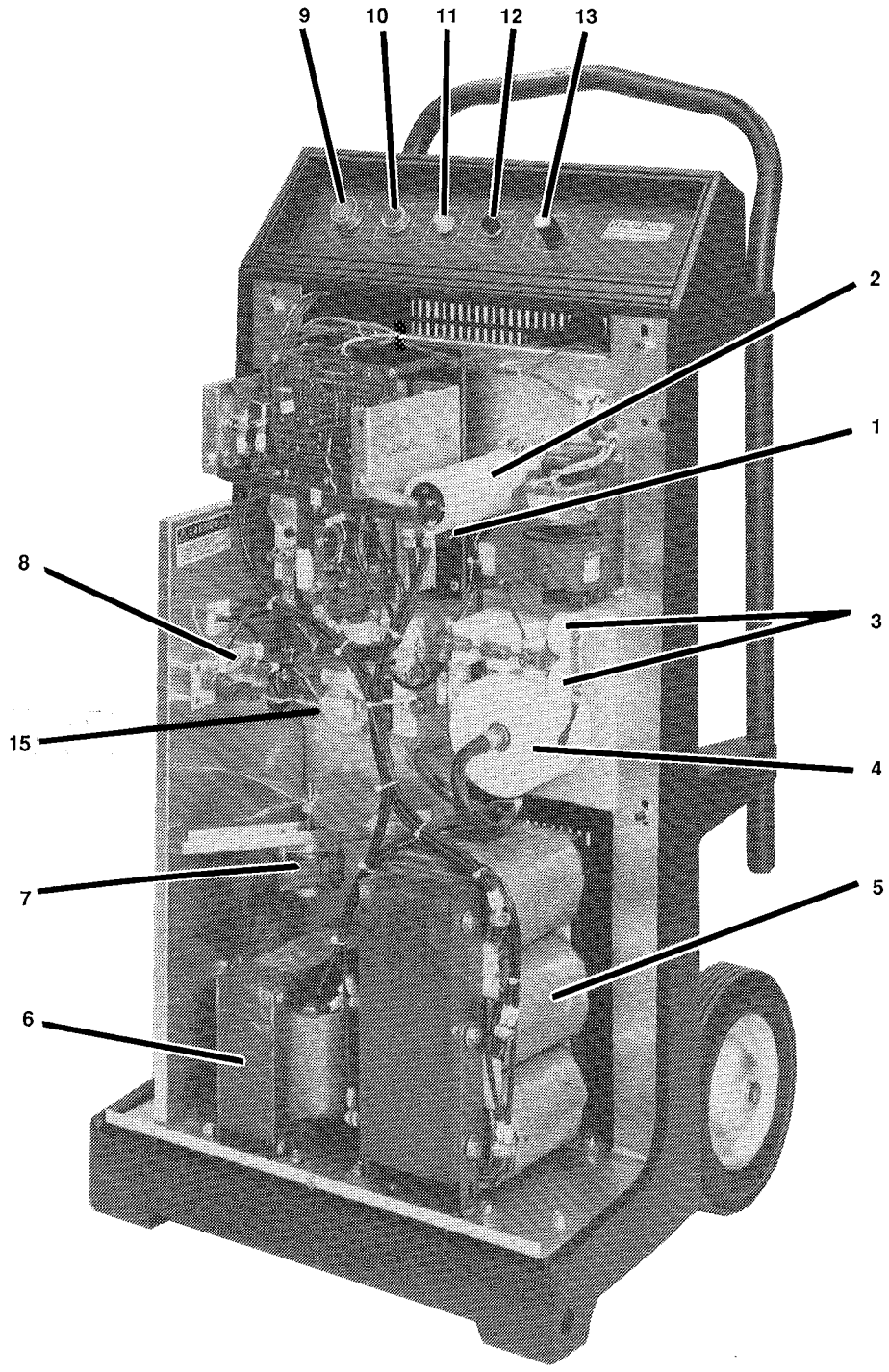


Figure 5-10 Power Supply - Front Right, Side View

STANDARD COMPONENTS (460V, 3 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009459	Resistor - 5K ohm, 10 watt	4RES	1
2	009295	Capacitor, ELE 2500 UF, 250 VDC	7CAP	1
3	009280	Capacitor, .002 UF, 15KV	9,10CAP	2
4	009349	Coil Assembly, High frequency, HT40	4T	1
5	014036	Transformer - 460V/3Ph/60 Hz	2T	1
6	014031	Inductor, MAX40	1X	1
7	031086	Motor, fan, MAX40	1MTR	1
	027058	Blade, fan		1
8	041109	PC board assembly shunt	5PC	1
9	005092	Green ON push button	1PB	1
10	005095	Red OFF push button	2PB	1
11	005090	Light bulb	1LT	1
	005089	White READY Cap		1
12	005090	Light bulb	2LT	1
	005091	Red DC POWER Cap		1
13	009450	Current control	1POT	1
14	029140	Chopper SA	4PC	1
15	041103	PC board assembly, I/O	1PC	1

STANDARD COMPONENTS
(460V, 3 Phase, 60 Hz)

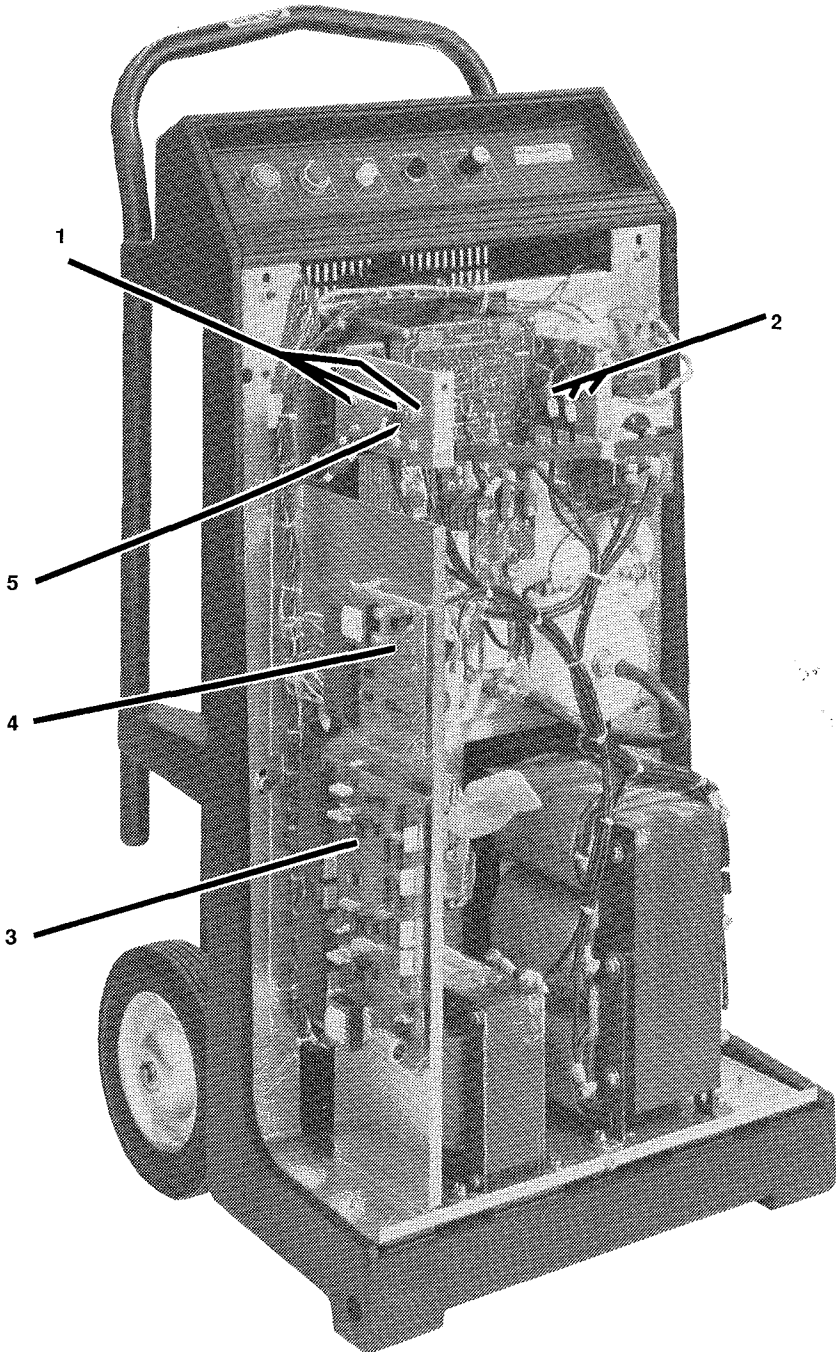


Figure 5-11 Power Supply - Front Left, Side View

STANDARD COMPONENTS
(460V, 3 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009352	Diode, reverse	4,5,6D	3
2	009351	Diode, forward	1,2,3D	3
3	041101	PC board assembly control, MAX40	2PC	1
4	041105	PC board assembly I-FACE/CHOPPER	3PC	1
5	005086	Thermostat	1TAS	1

STANDARD COMPONENTS (460V, 3 Phase, 60 Hz)

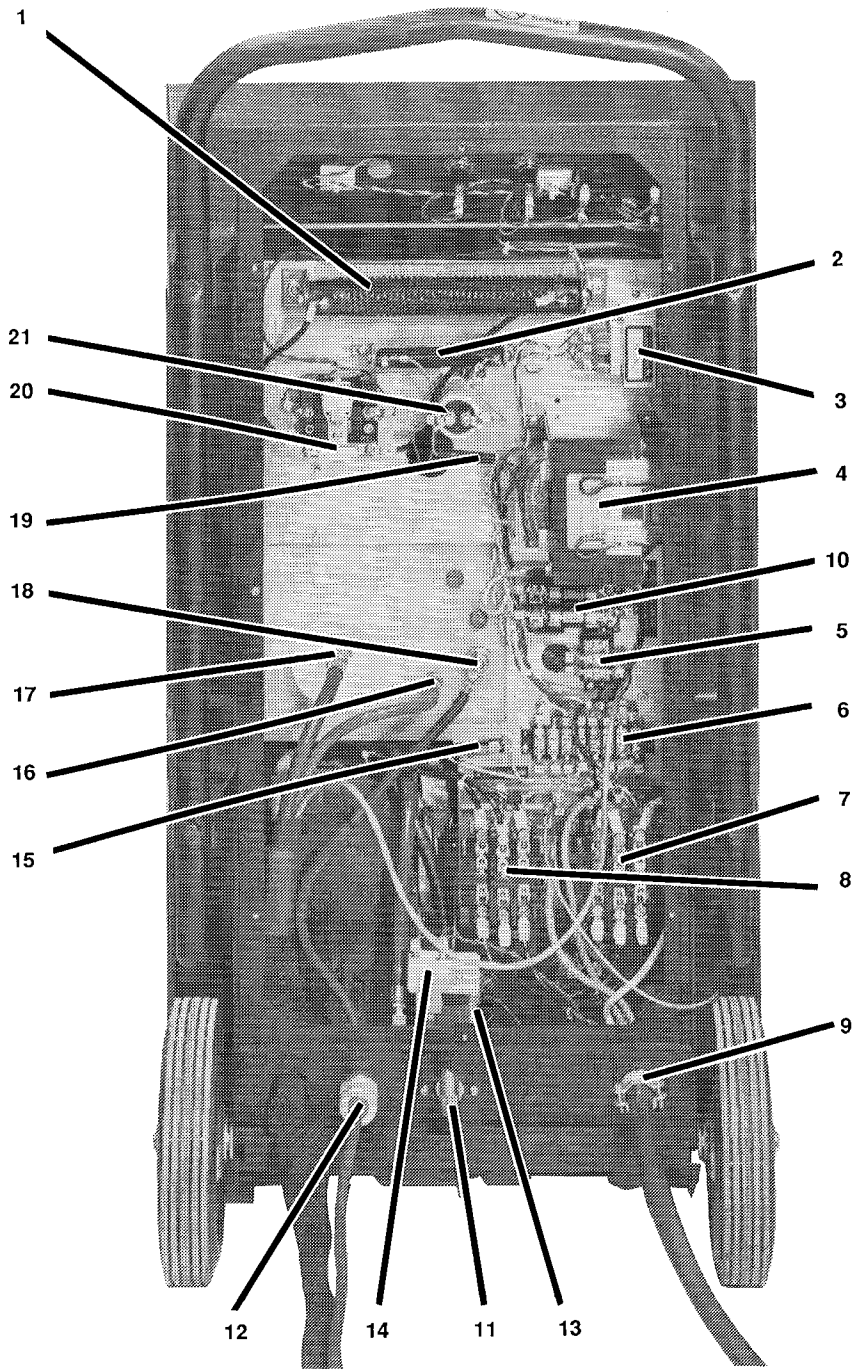


Figure 5-12 Power Supply - Rear View

STANDARD COMPONENTS
(460V, 3 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009624	Resistor, 1.6 ohm, 300 watt fixed	1RES	1
2	009622	Resistor, 10 ohm, 50W, 5%	2RES	1
3	014033	Transformer, chopper control	5T	1
4	014023	Transformer, control 230-460 V	1T	1
5	008063	Terminal strip (3)	2TB	1
6	008134	Terminal strip (8) 30A		1
7	003073	Contact assembly, 30A, 3 phase	1CON	1
8	003053	Contact, 30 A, 3 phase	2CON	1
9	008228	Strain relief, power cord		1
10	008239	Fuse, 2A, 600 V, FLQ-2	1,2FU	2
11	029131	Compressed air input		1
12	008402	Strain relief, work (anode (+))cable		1
13	006014	Valve, SOL90 #, 1/4 NPTF Water	1SOL	1
14	005093	Switch, pressure 0-90 psi	1PS	1
15	008259	Fuse, 3 amp, 250 VAC, UL/CSA, SLO-BLO	3FU	1
16	023157	Torch pilot arc cable - gray	PA	1
17	023156	Torch power cable - blue		1
18	023205	Work cable (anode +)		1
19	009015	Resistor, 10K ohm, 10 W	3RES	1
20	003021	Relay, 120 VAC NO SPST	1CR	1
21	009506	Capacitor, 250 UF, 350 VDC	8CAP	1

STANDARD COMPONENTS

(460V, 3 Phase, 60 Hz)

RECOMMENDED SPARE PARTS - 057038

<u>Number</u>	<u>Description</u>	<u>Designator</u>	<u>10-50*</u>	<u>50-100**</u>
011023	Filter/regulator air		1	2
005090	Bulb, 28 VDC, 40 MA, T-3, 1/4	1,2LT	10	20
005093	Switch, pressure 0-90 psi	1PS	1	2
006014	Valve, SOL 90#, 1/4 NPTF Water	1SOL	1	2
003021	Relay, 120 VAC, No SPST	1CR	1	2
003053	Contactor, 40A	2CON	1	2
003073	Contactor assembly, HT40/MAX40	1CON	1	2
008239	Fuse, 2A, 600V, FLQ-2	1,2FU	10	20
009015	Resistor, 10K ohm, 10W	3RES	1	2
009295	Capacitor, Ele 2, 2500 UF, 250VDC	5,6,7CAP	2	4
009622	Resistor, 10 ohm, 50W, 5%	2RES	1	2
009623	Resistor, 1.5K ohm, 50W, 5 %	4RES	1	2
009506	Capacitor, 250 UF, 350 VDC	8CAP	2	4
009624	Resistor, 1.6 ohm, 300 W fixed	1RES	1	2
005086	Thermostat, 75°	1TAS	1	2
009351	Diode, forward bridge	1,2D	6	12
009352	Diode, reverse bridge	3,4D	6	12
014021	Transformer, HV 500V, 20 MA	3T	1	2
008259	Fuse, 3amp, 250VAC, SLO-BLO	4MOV	10	20
009450	Pot, 1K ohm, 2W, 10%, 1T	1POT	1	2
014023	Transformer, control 220V, MAX40	1T	1	2
031086	Motor, fan MAX40	1MTR	1	2
041101	PC board assembly control, MAX40	2PC	2	4
041105	PC board assembly I-face/Chopper	3PC	2	4
041109	PC board assembly shunt	5PC	2	4
020479	PAC140 hand torch		2	4
001214	PAC140 torch handle		2	4
001260	PAC140 hand boot		2	4
057012	PAC140 hand torch, 25 feet		2	4
057013	PAC140 hand torch, 50 feet		2	4
028287	Machine torch		2	4
057053	Machine torch, 25 feet		2	4
057054	Machine torch, 50 feet		2	4
029129	Lead SA, 25 feet		2	4
029130	Lead SA, 50 feet		2	4
029140	Chopper module		1	2

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

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

MAX40 Power Supply

Model 057046
230/460 Volt, 1 Phase, 60 Hz

STANDARD COMPONENTS (230/460V, 1 Phase, 60 Hz)

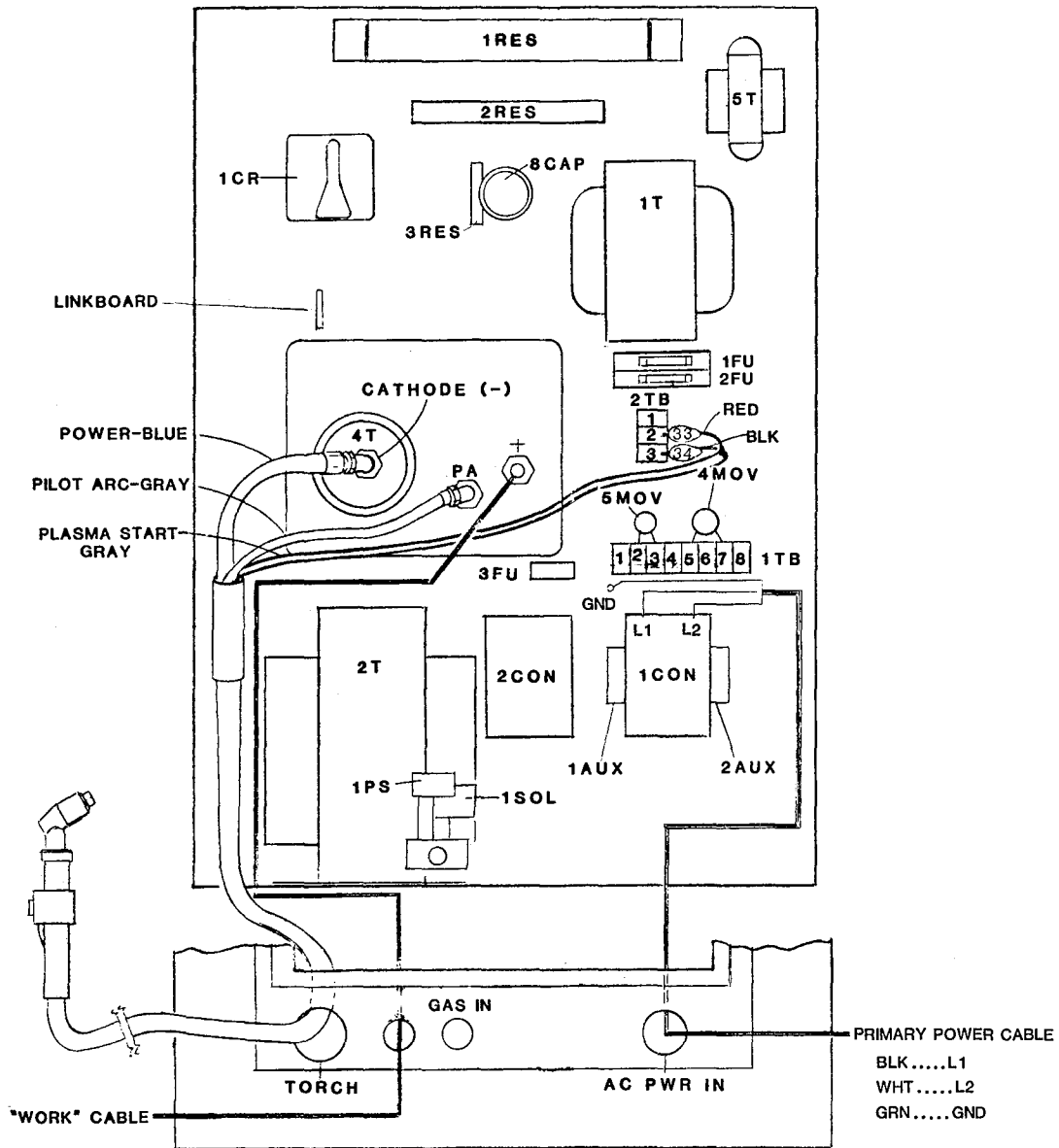


Figure 5-13 Power Supply & External Cable Connections, Rear View

STANDARD COMPONENTS (230/460V, 1 Phase, 60 Hz)

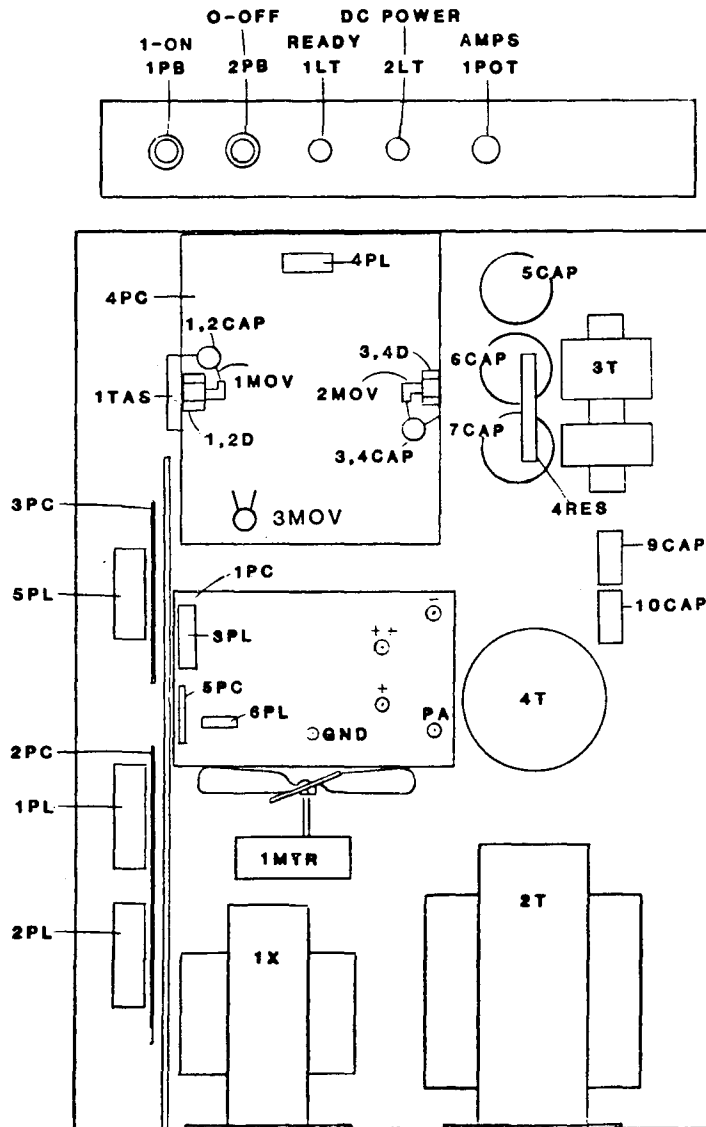


Figure 5-14 Power Supply - Front View

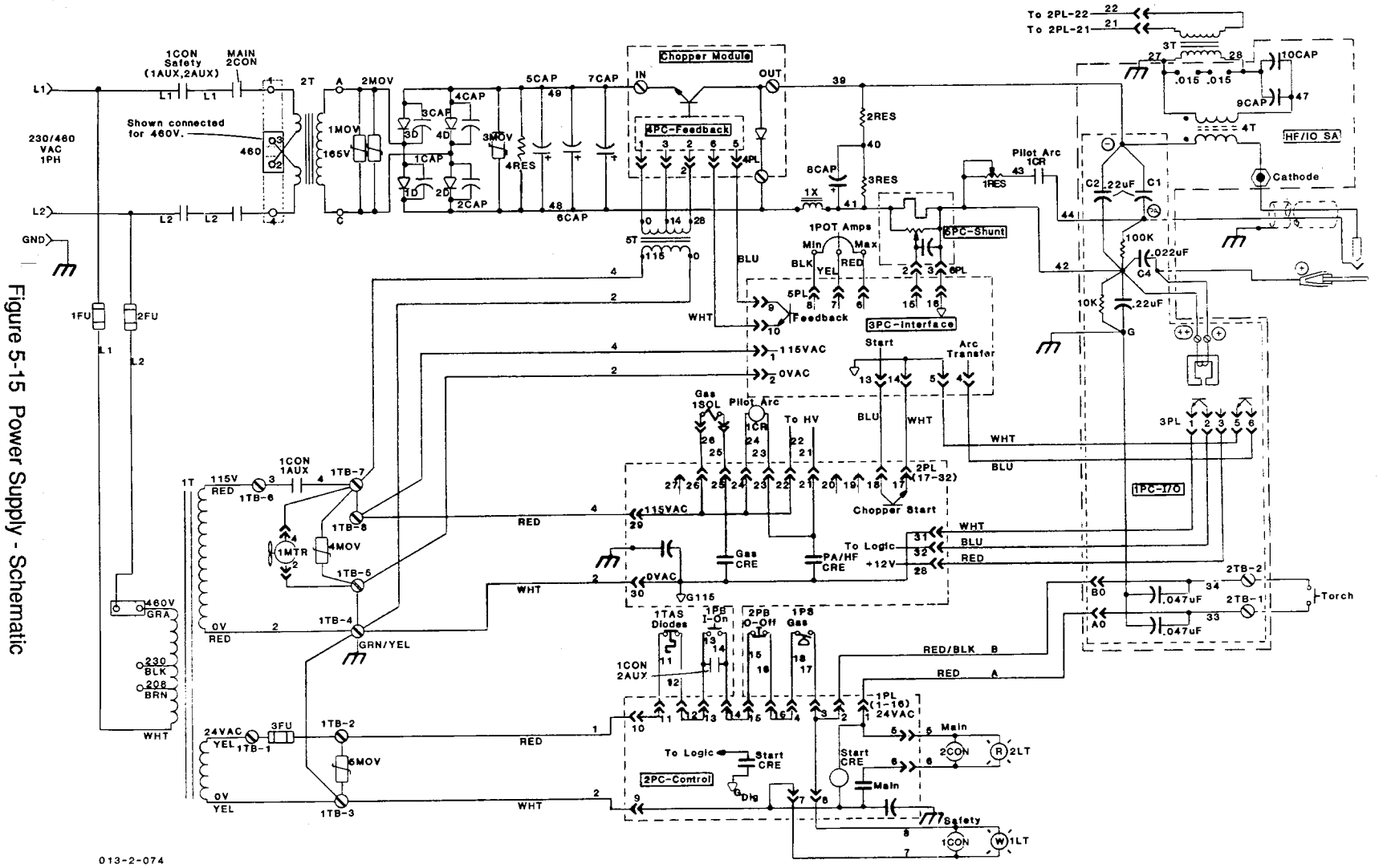


Figure 5-15 Power Supply - Schematic

STANDARD COMPONENTS
(230/460V, 1 Phase, 60 Hz)

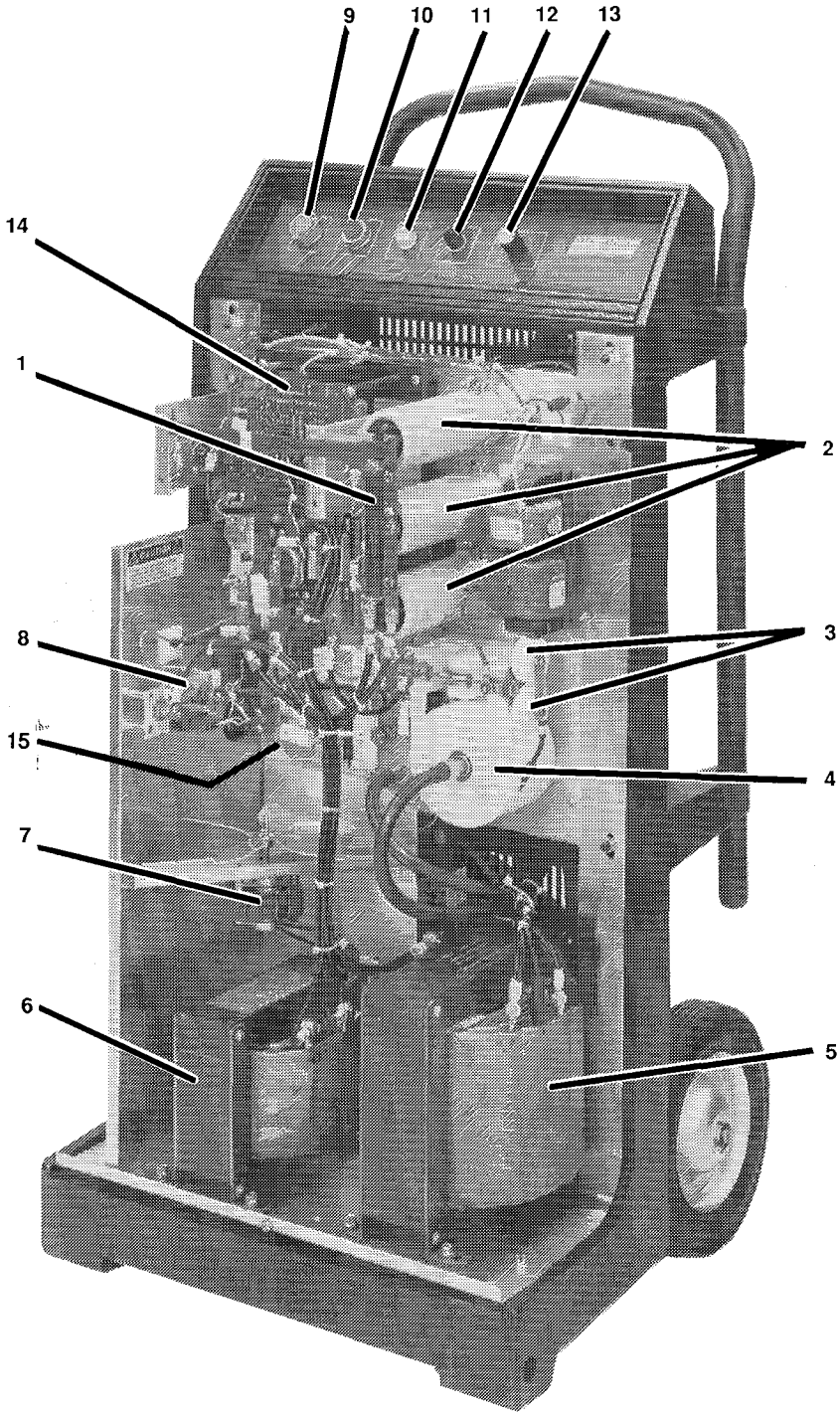


Figure 5-16 Power Supply - Front Right, Side View

STANDARD COMPONENTS (230/460V, 1 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009623	Resistor, 1.5K ohm, 50W, 5%	4RES	1
2	009295	Capacitor, ELE 2500 UF, 250 VDC	5,6,7CAP	3
3	009280	Capacitor	9,10CAP	2
4	009349	Coli assembly, high frequency, HT40	4T	1
5	014037	Transformer, 460V/1PH/60Hz	1T	1
6	014031	Inductor, ADC MAX40	1X	1
7	031086	Motor, fan, MAX40	1MTR	1
	027058	Blade, fan		1
8	041109	PC board assembly, shunt	5PC	1
9	005092	Green ON pushbutton	4PB	1
10	005095	Red OFF pushbutton	2PB	1
11	005090	Light bulb	1LT	1
	005089	White READY cap		1
12	005090	Light bulb	2LT	1
	005091	Red DC POWER cap		1
13	009450	Current control	1POT	1
14	029127	Chopper SA	4PC	1
15	041103	PC board assembly, I/O	1PC	1

STANDARD COMPONENTS
(230/460V, 1 Phase, 60 Hz)

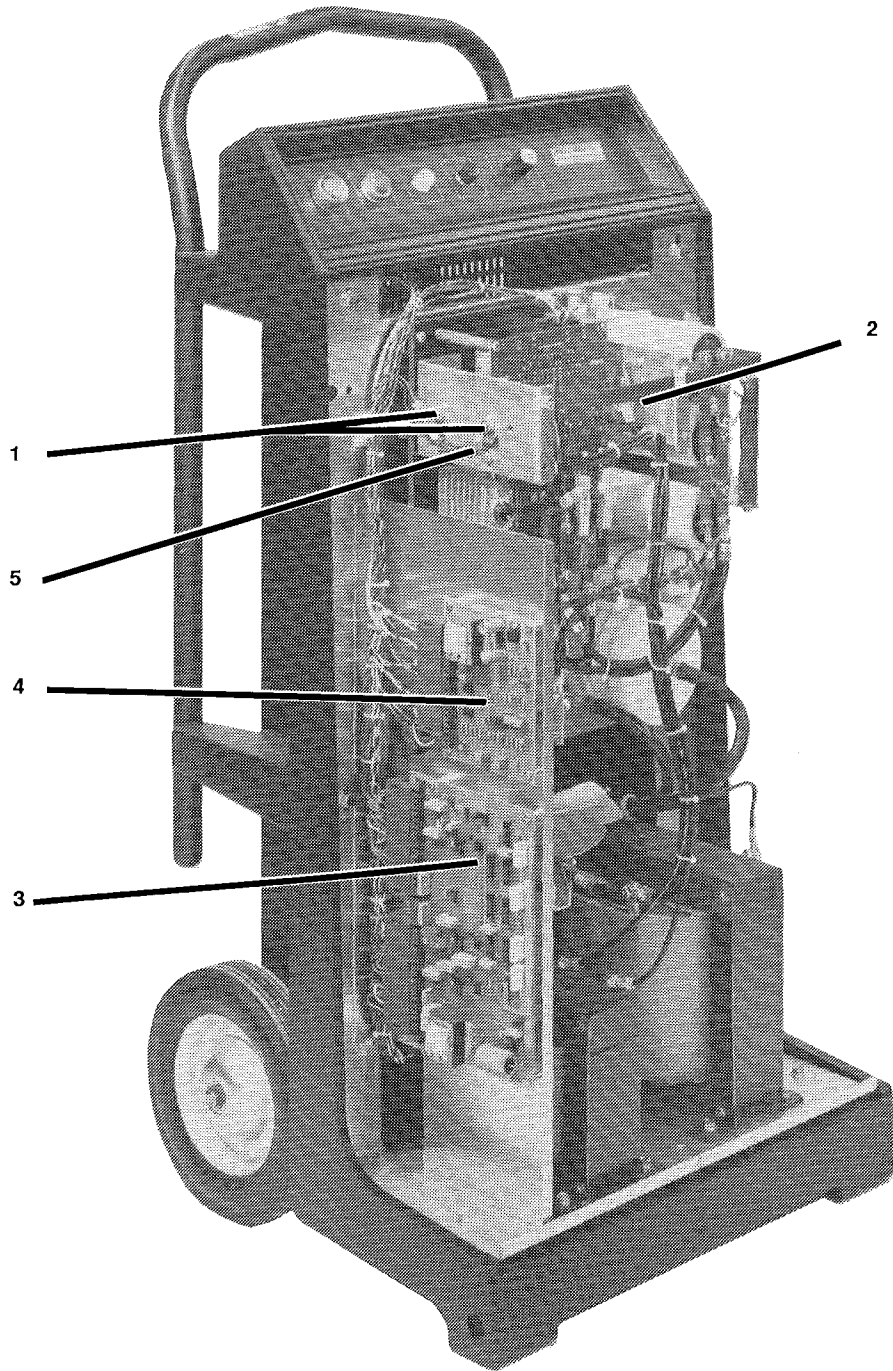


Figure 5-17 Power Supply - Front Left, Side View

STANDARD COMPONENTS
(230/460V, 1 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009351	Diode, forward, bridge	1,2D	2
2	009352	Diode, reverse, bridge	3,4D	2
3	041101	PC board assembly control, MAX40	2PC	1
4	041105	PC board assembly I-FACE/CHOPPER	3PC	1
5	005086	Thermostat, 75°C	1TAS	1

STANDARD COMPONENTS (230/460V, 1 Phase, 60 Hz)

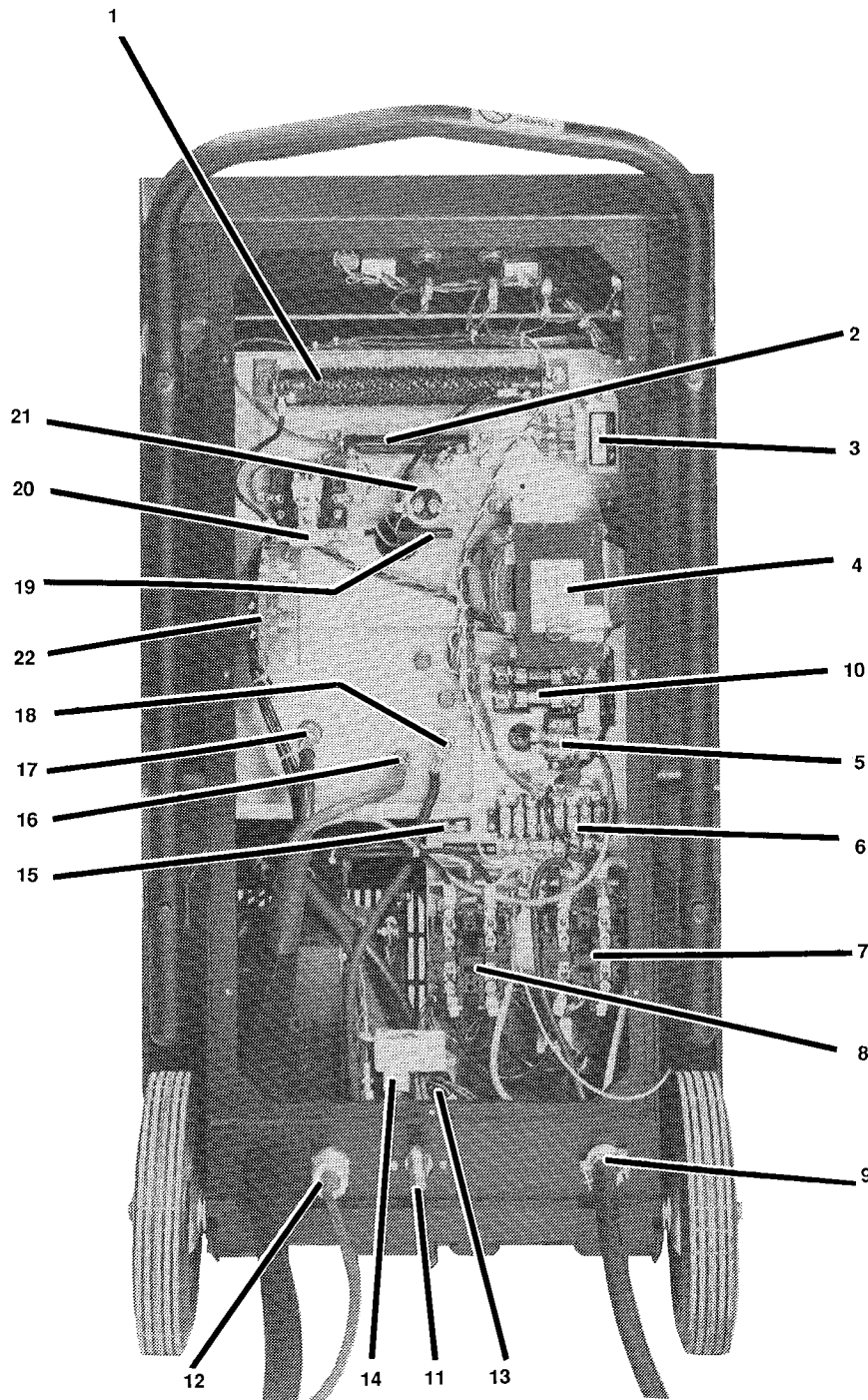


Figure 5-18 Power Supply - Rear View

STANDARD COMPONENTS
(230/460V, 1 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009624	Resistor, 1.6 ohm, 300W fixed	1RES	1
2	009622	Resistor, 10 ohm, 50 W, 5%	2RES	1
3	014033	Transformer, chopper control	5T	1
4	014023	Transformer, control 230-460 V, MAX40	1T	1
5	008063	Terminal strip (3)	2TB	1
6	008134	Terminal strip (8)	1TB	
7	003062	Contactor assembly, HT40/MAX40	1CON	1
8	003059	Contactor, 40A1 phase	2CON	1
9	008228	Strain relief, power cable		
10	008239	Fuse, 2A, 600 V, FLQ-2	1,2FU	2
11	029131	Compressed air input		
12	008402	Strain relief, work (anode(+)) cable		
13	006014	Valve, SOL90 #, 1/4 NPTF Water	1SOL	1
14	005093	Switch, pressure 0-90 psi	1PS	1
15	008259	Fuse, 3 amp, 250 VAC, UL/CSA, SLO-BLO	3FU	1
16	023157	Torch pilot arc cable	PA	
17	023156	Torch power cable (cathode)		
18	023205	Work cable (anode +)		
19	009015	Resistor, 10K ohm, 10W	3RES	1
20	003021	Relay, 120 VAC NO SPST	1CR	1
21	009506	Capacitor, 250 UF, 350 VDC	8CAP	1
22	004218	Linkboard		

STANDARD COMPONENTS

(230/460V, 1 Phase, 60 Hz)

RECOMMENDED SPARE PARTS - 057046

<u>Number</u>	<u>Description</u>	<u>Designator</u>	<u>10-50*</u>	<u>50-100**</u>
011023	Filter/regulator air		1	2
005090	Bulb, 28 VDC, 40 MA, T-3, 1/4	1,2 LT	10	20
005093	Switch, pressure 0-90 psi	1PS	1	2
006014	Valve, SOL 90#, 1/4 NPTF Water	1SOL	1	2
003021	Relay, 120VAC, No SPST	1CR	1	2
003059	Contactor, 40A	2CON	1	2
003062	Contactor assembly, HT40/MAX40	1CON	1	2
008239	Fuse, 2A, 600V, FLQ-2	1,2FU	10	20
009015	Resistor, 10K ohm, 10W	3RES	1	2
009295	Capacitor, Ele 2, 2500 UF, 250VDC	5, 6, 7CAP	2	4
009622	Resistor, 10 ohm, 50W, 5%	2RES	1	2
009623	Resistor, 1.5K ohm, 50W, 5%	4RES	1	2
009506	Capacitor, 250 UF, 350 VDC	8CAP	2	4
009624	Resistor, 1.6 ohm, 300W fixed	1RES	1	2
005086	Thermostat, 75°C	1TAS	1	2
009351	Diode, forward bridge	1,2D	6	12
009352	Diode, reverse bridge	3, 4D	6	12
014021	Transformer, HV 500V, 20 MA	3T	1	2
008259	Fuse, 3 amp, 250VAC, UL/CSA,SLO-BLO	4MOV	10	20
009450	Pot, 1K ohm, 2W, 10%, 1T	1POT	1	2
014023	Transformer, control 220V, MAX40	1T	1	2
031086	Motor, fan MAX40	1MTR	1	2
041101	PC board assembly control, MAX40	2PC	2	4
041105	PC board assembly I-face/Chopper	3PC	2	4
041109	PC board assembly shunt	5PC	2	4
020479	PAC140 hand torch		2	4
001214	PAC140 torch handle		2	4
001260	PAC140 torch boot		2	4
057012	PAC140 hand torch, 25 feet		2	4
057013	PAC140 hand torch, 50 feet		2	4
028287	Machine torch		2	4
057053	Machine torch, 25 feet		2	4
057054	Machine torch, 50 feet		2	4
029129	Leads SA, 25 feet		2	4
029130	Leads SA, 50 feet		2	4
029127	Chopper module		1	2

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

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

MAX40 Power Supply

Model 057061
575 Volt, 3 Phase, 60 Hz

STANDARD COMPONENTS (575V, 3 Phase, 60 Hz)

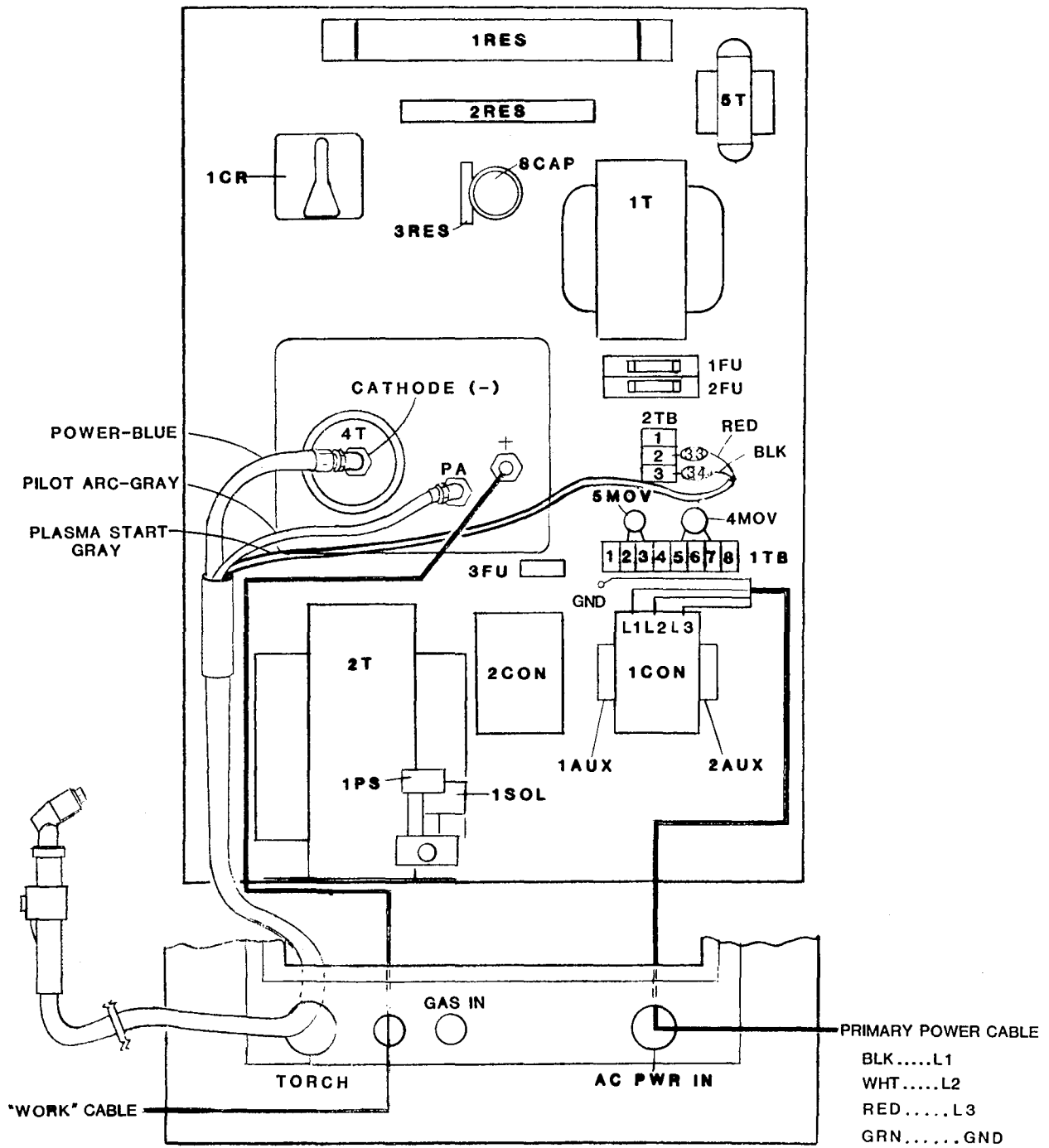


Figure 5-19 Power Supply & External Cable Connections - Rear View

STANDARD COMPONENTS (575V, 3 Phase, 60 Hz)

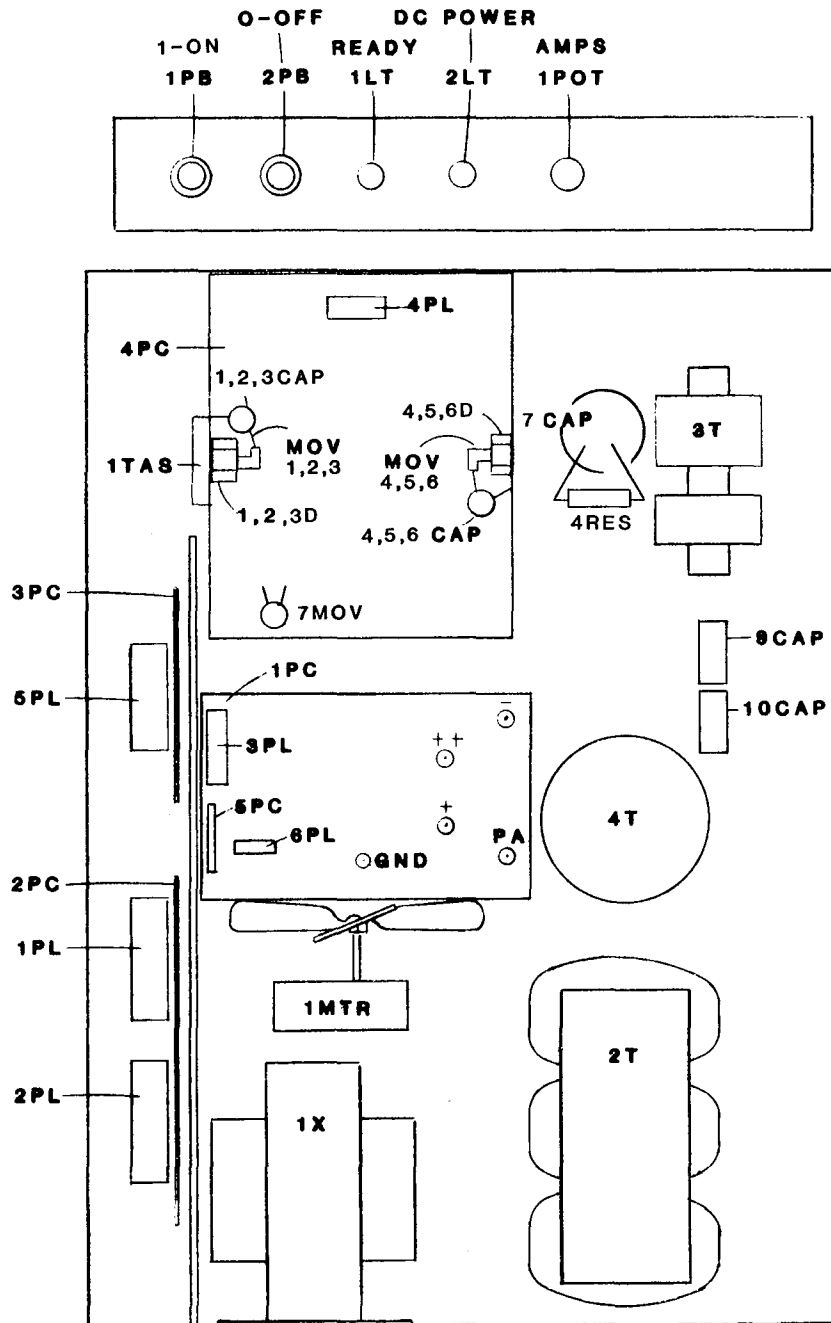


Figure 5-20 Power Supply - Front View

STANDARD COMPONENTS (575V, 3 Phase, 60 Hz)

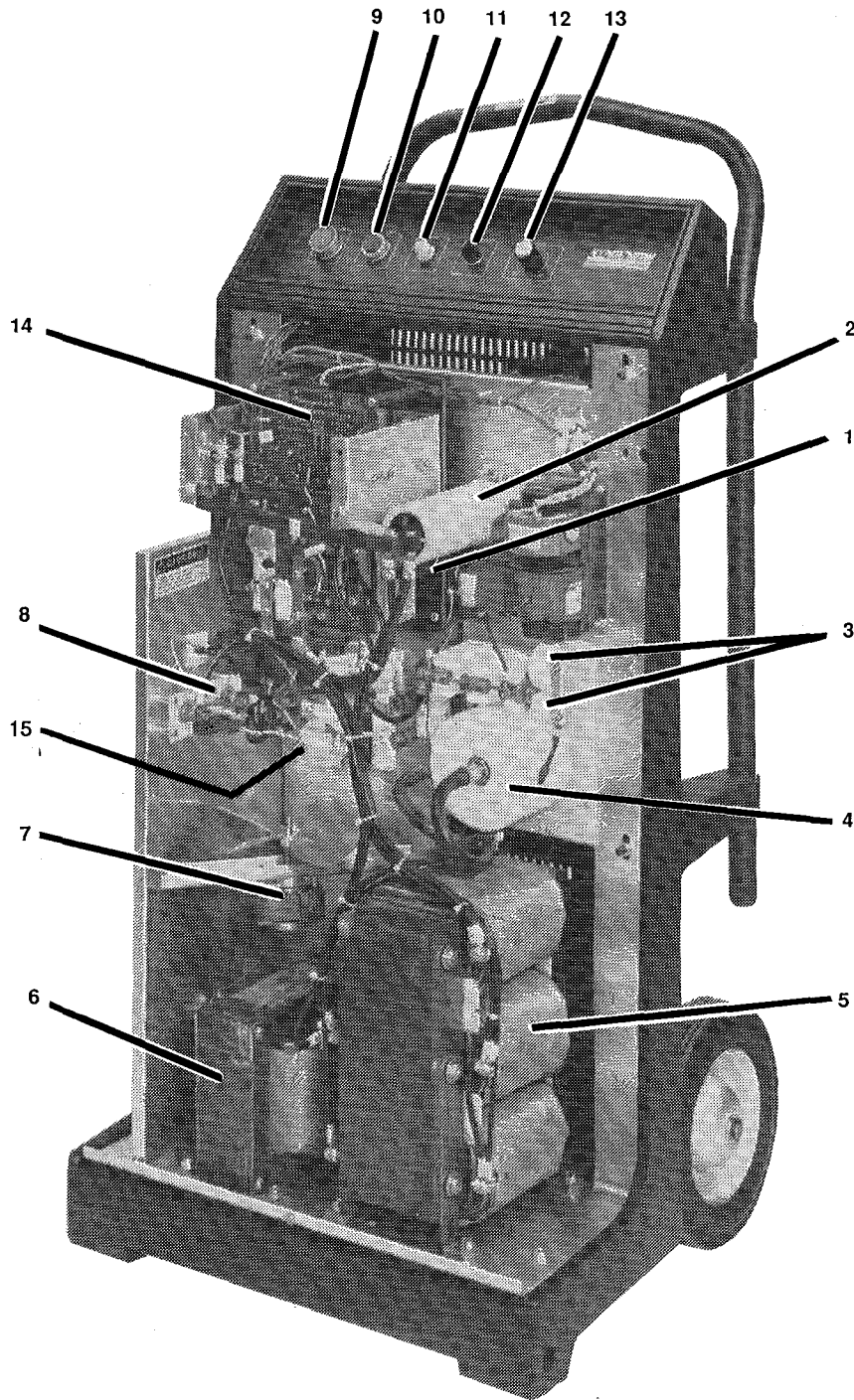


Figure 5-22 Power Supply - Front Right, Side View

STANDARD COMPONENTS
(575V, 3 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009459	Resistor - 5K ohm, 10 watt	4RES	1
2	009295	Capacitor, ELE 2500 UF, 250 VDC	7CAP	1
3	009280	Capacitor, .002 UF, 15KV	9,10CAP	2
4	009349	Coil assembly, high frequency, HT40	4T	1
5	014038	Transformer - 575V/3PH/60Hz	2T	1
6	014031	Inductor, MAX40	1X	1
7	031086	Motor, fan, MAX40	1MTR	1
	027058	Blade, fan		1
8	041109	PC board assembly, shunt	5PC	1
9	005092	Green ON pushbutton	1PB	1
10	005095	Red OFF pushbutton	2PB	1
11	005090	Light bulb	1LT	1
	005089	White READY cap		1
12	005090	Light bulb	2LT	1
	005091	Red DC POWER cap		1
13	009450	Current control	1POT	1
14	029140	Chopper SA	4PC	1
15	041103	PC board assembly, I/O	1PC	1

STANDARD COMPONENTS (575V, 3 Phase, 60 Hz)

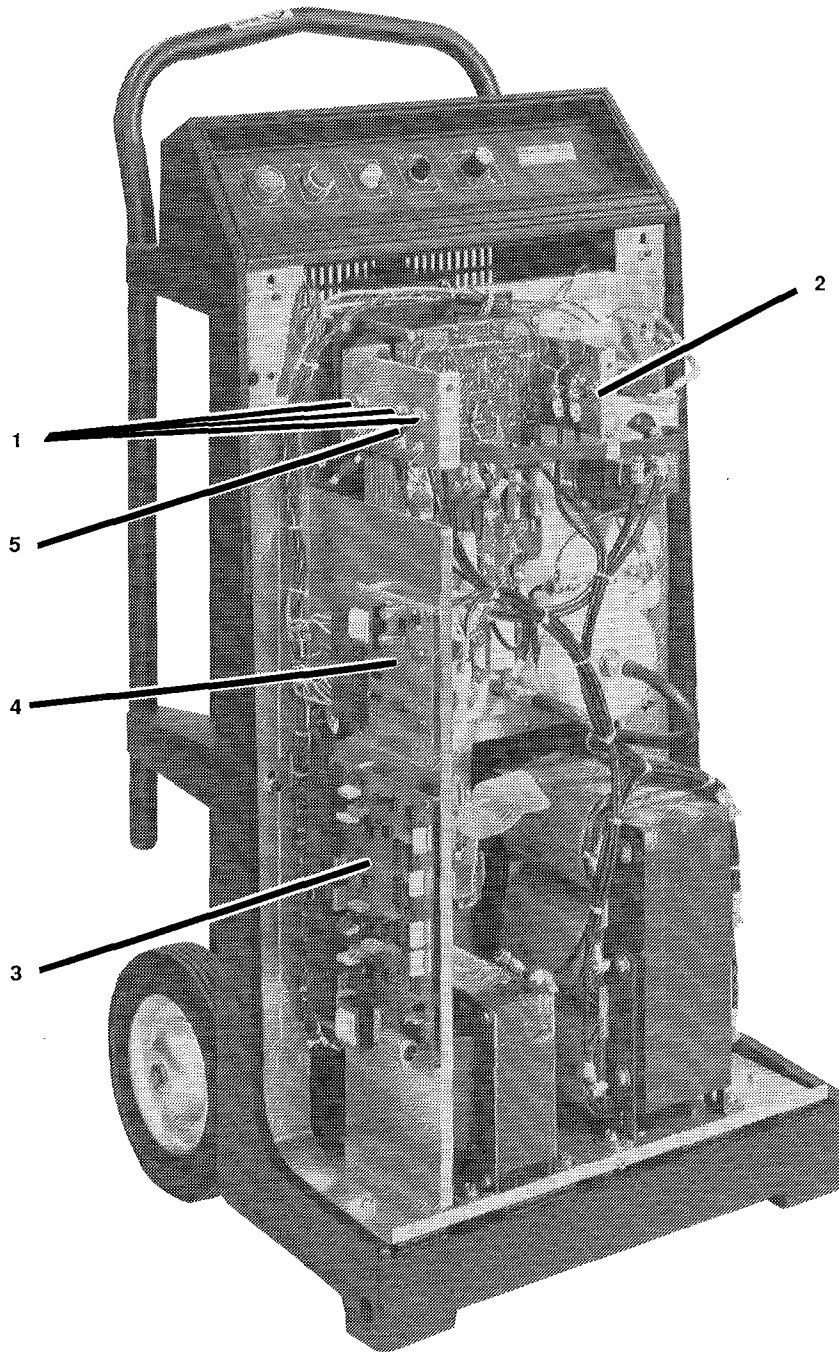


Figure 5-23 Power Supply - Front Left, Side View

STANDARD COMPONENTS
(575V, 3 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009352	Diode, reverse, bridge	3,4D	2
2	009351	Diode, forward, bridge	1,2D	2
3	041101	PC board assembly control, MAX40	2PC	1
4	041105	PC board assembly I-FACE/CHOPPER	3PC	1
5	005086	Thermostat	1TAS	1

STANDARD COMPONENTS
(575V, 3 Phase, 60 Hz)

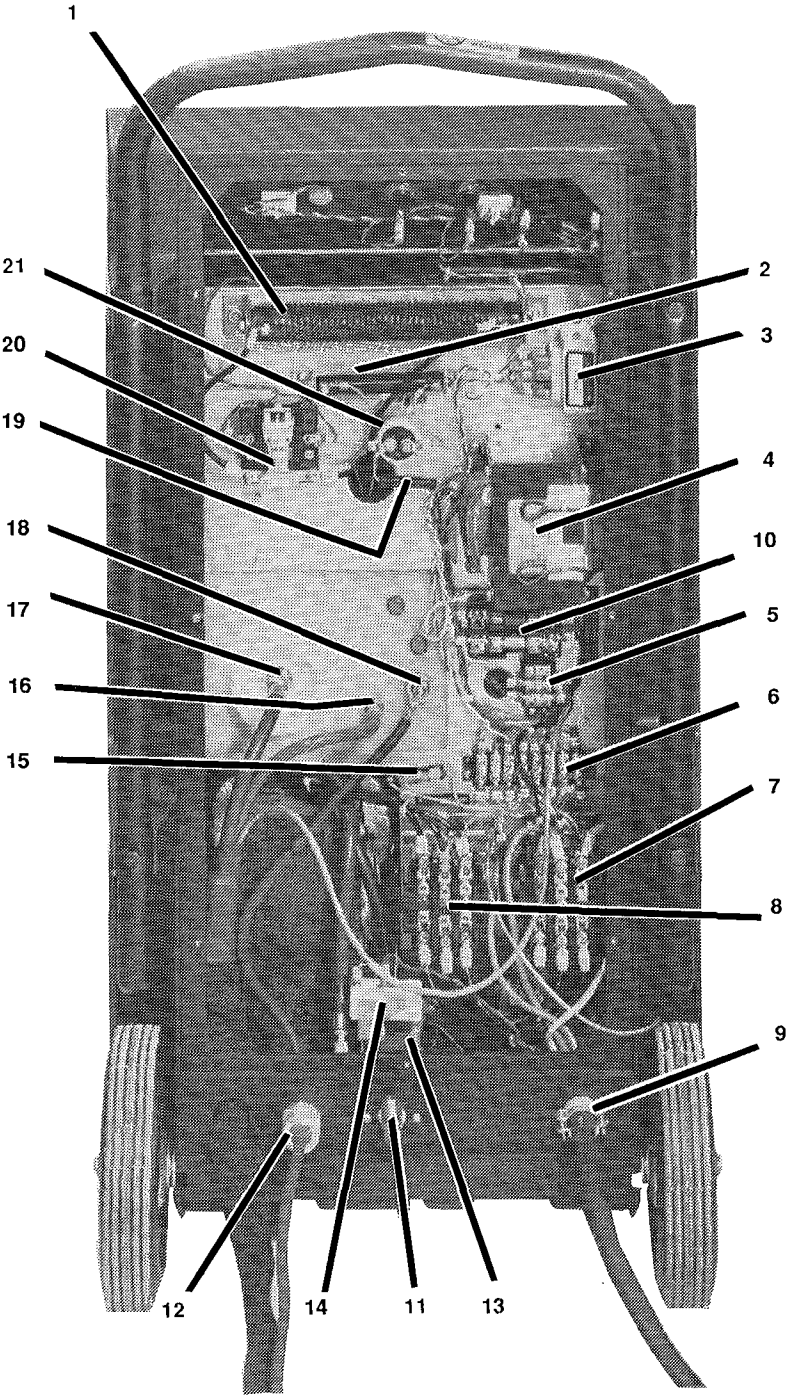


Figure 5-24 Power Supply - Rear View

STANDARD COMPONENTS
(575V, 3 Phase, 60 Hz)

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	009624	Resistor, 1.6 ohm, 300 watt fixed	1RES	1
2	009622	Resistor, 10 ohm, 50 W, 5%	2RES	1
3	014033	Transformer, chopper control	5T	1
4	014039	Transformer, control 575V	1T	1
5	008063	Terminal strip (3)	2TB	1
6	008134	Terminal strip (8) 30A		1
7	003073	Contact assembly, 30 A, 3 phase	1CON	1
8	003053	Contact, 30 A, 3 phase	2CON	1
9	008228	Strain relief, power cord		1
10	008239	Fuse, 2A, 600 V, FLQ-2	1,2FU	2
11	029131	Compressed air input		1
12	008402	Strain relief, work (anode +) cable		1
13	006014	Valve, SOL90 #, 1/4 NPTF Water	1SOL	1
14	005093	Switch, pressure 0-90 psi	1PS	1
15	008259	Fuse, 3 amp, 250VAC, UL/CSA, SLO-BLO	3FU	1
16	023157	Torch pilot arc cable - gray	PA	1
17	023156	Torch power cable - blue		1
18	023205	Work cable (anode +)		1
19	009015	Resistor, 10K ohm, 10 W	3RES	1
20	003021	Relay, 120 VAC NO SPST	1CR	1
21	009506	Capacitor, 250 UF, 350 VDC	8CAP	1

STANDARD COMPONENTS

(575V, 3 Phase, 60 Hz)

RECOMMENDED SPARE PARTS - 057061

<u>Number</u>	<u>Description</u>	<u>Designator</u>	<u>10-50*</u>	<u>50-100**</u>
011023	Filter/regulator air		1	2
005090	Bulb, 28 VDC, 40 MA, T-3, 1/4	1,2 LT	10	20
005093	Switch, pressure 0-90 psi	1PS	1	2
006014	Valve, SOL 90#, 1/4 NPTF Water	1SOL	1	2
003021	Relay, 120VAC, No SPST	1CR	1	2
003053	Contactora, 40A	2CON	1	2
003073	Contactora assembly, HT40/MAX40	1CON	1	2
008239	Fuse, 2A, 600V, FLQ-2	1,2FU	10	20
009015	Resistor, 10K ohm, 10W	3RES	1	2
009295	Capacitor, Ele 2, 2500 UF, 250VDC	5, 6, 7CAP	2	4
009622	Resistor, 10 ohm, 50W, 5%	2RES	1	2
009623	Resistor, 1.5K ohm, 50W, 5%	4RES	1	2
009506	Capacitor, 250 UF, 350 VDC	8CAP	2	4
009624	Resistor, 1.6 ohm, 300W fixed	1RES	1	2
005086	Thermostat, 75°C	1TAS	1	2
009351	Diode, forward bridge	1,2D	6	12
009352	Diode, reverse bridge	3, 4D	6	12
014021	Transformer, HV 500V, 20 MA	3T	1	2
008259	Fuse, 3 amp, 250VAC, UL/CSA,SLO-BLO	4MOV	10	20
009450	Pot, 1K ohm, 2W, 10%, 1T	1POT	1	2
014039	Transformer, control 220V, MAX40	1T	1	2
031086	Motor, fan MAX40	1MTR	1	2
041101	PC board assembly control, MAX40	2PC	2	4
041105	PC board assembly I-face/Chopper	3PC	2	4
041109	PC board assembly shunt	5PC	2	4
020479	PAC140 hand torch		2	4
001214	PAC140 torch handle		2	4
001260	PAC140 torch boot		2	4
057012	PAC140 hand torch, 25 feet		2	4
057013	PAC140 hand torch, 50 feet		2	4
028287	Machine torch		2	4
057053	Machine torch, 25 feet		2	4
057054	Machine torch, 50 feet		2	4
029129	Leads SA, 25 feet		2	4
029130	Leads SA, 50 feet		2	4
029140	Chopper module		1	2

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

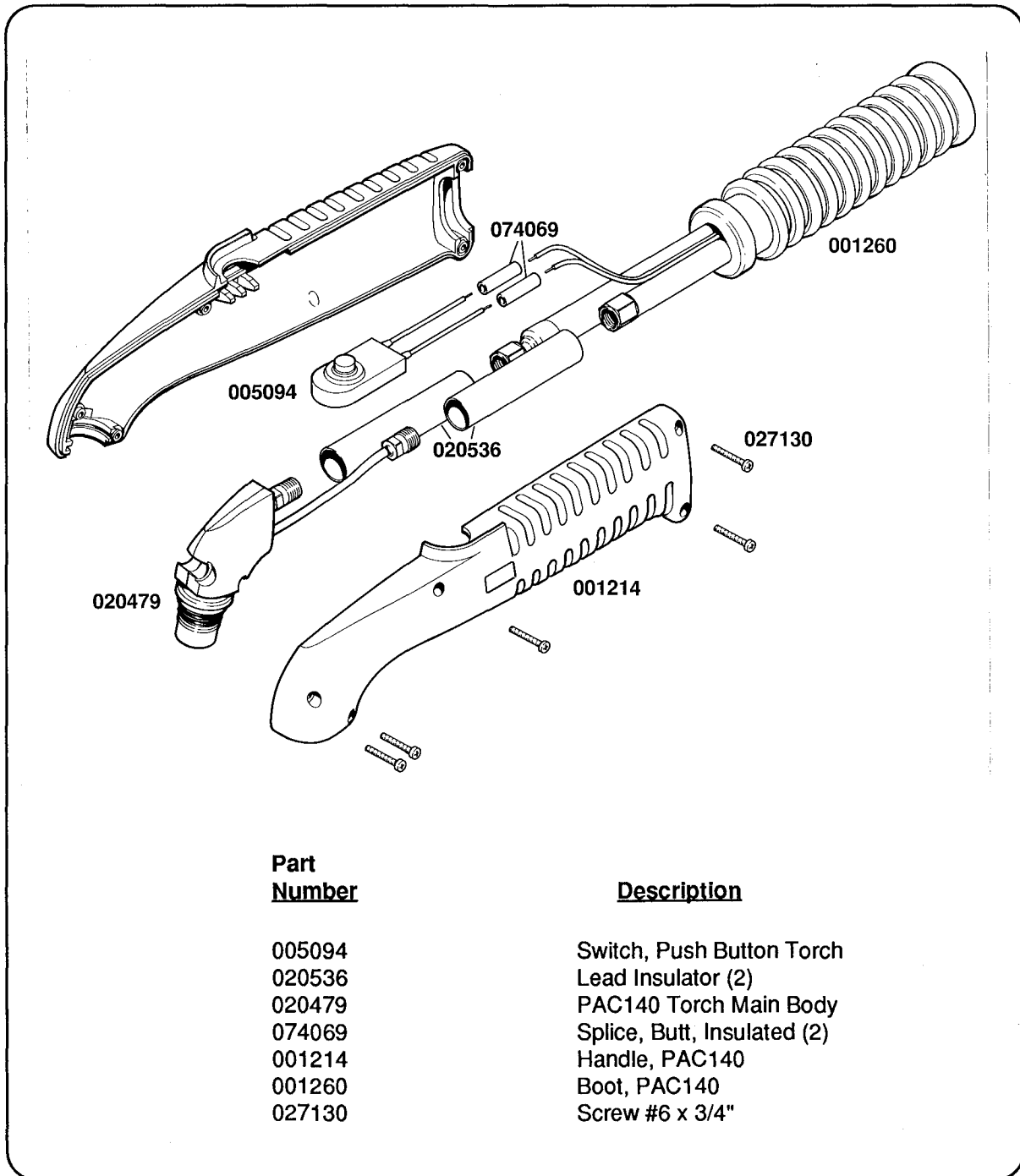
** Stock quantities for 50-100 units working in the field.

Section 6 MAX40 Torches

In this section:

PAC140 Torch Assembly	6-2
MAX40 Machine Torch Assembly	6-3
MAX40 Consumable Parts.....	6-4
Spare Parts Kit	6-5

MAX40 TORCHES



<u>Part Number</u>	<u>Description</u>
005094	Switch, Push Button Torch
020536	Lead Insulator (2)
020479	PAC140 Torch Main Body
074069	Splice, Butt, Insulated (2)
001214	Handle, PAC140
001260	Boot, PAC140
027130	Screw #6 x 3/4"

Figure 6-1 PAC140 Torch Assembly

MAX40 TORCHES

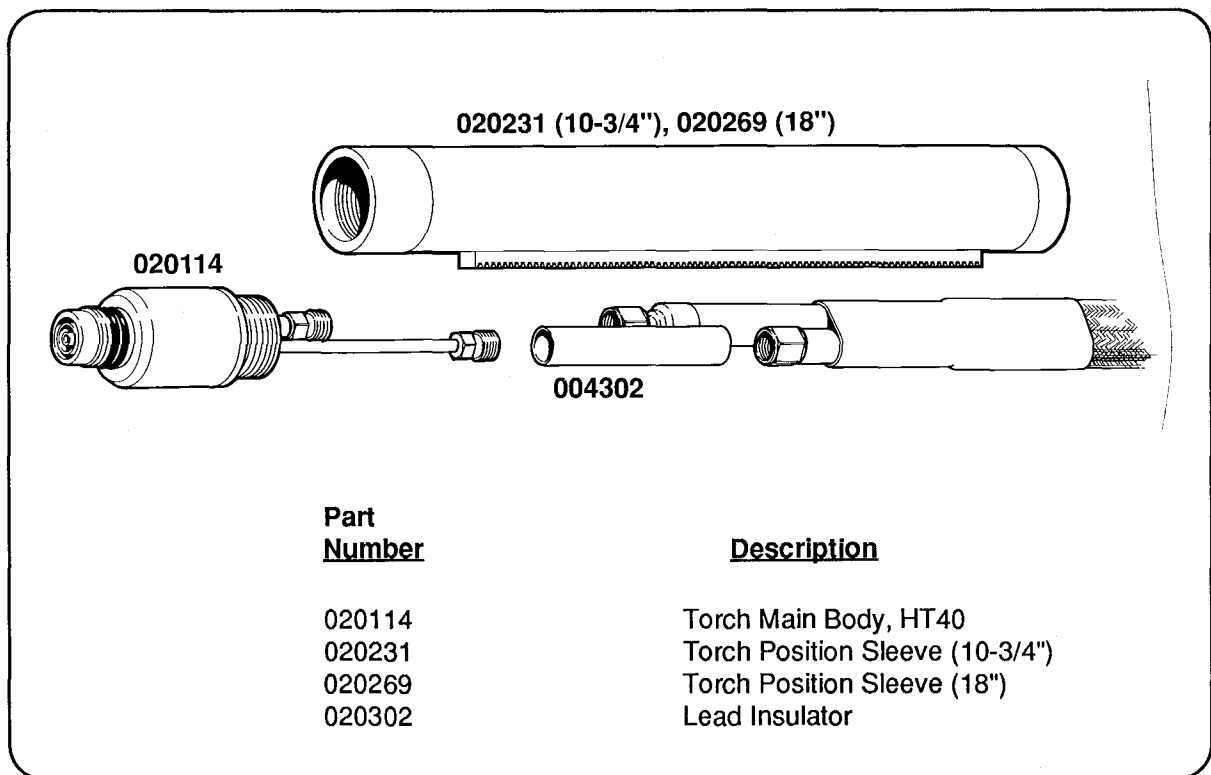


Figure 6-2 MAX40 Machine Torch Assembly

MAX40 TORCHES

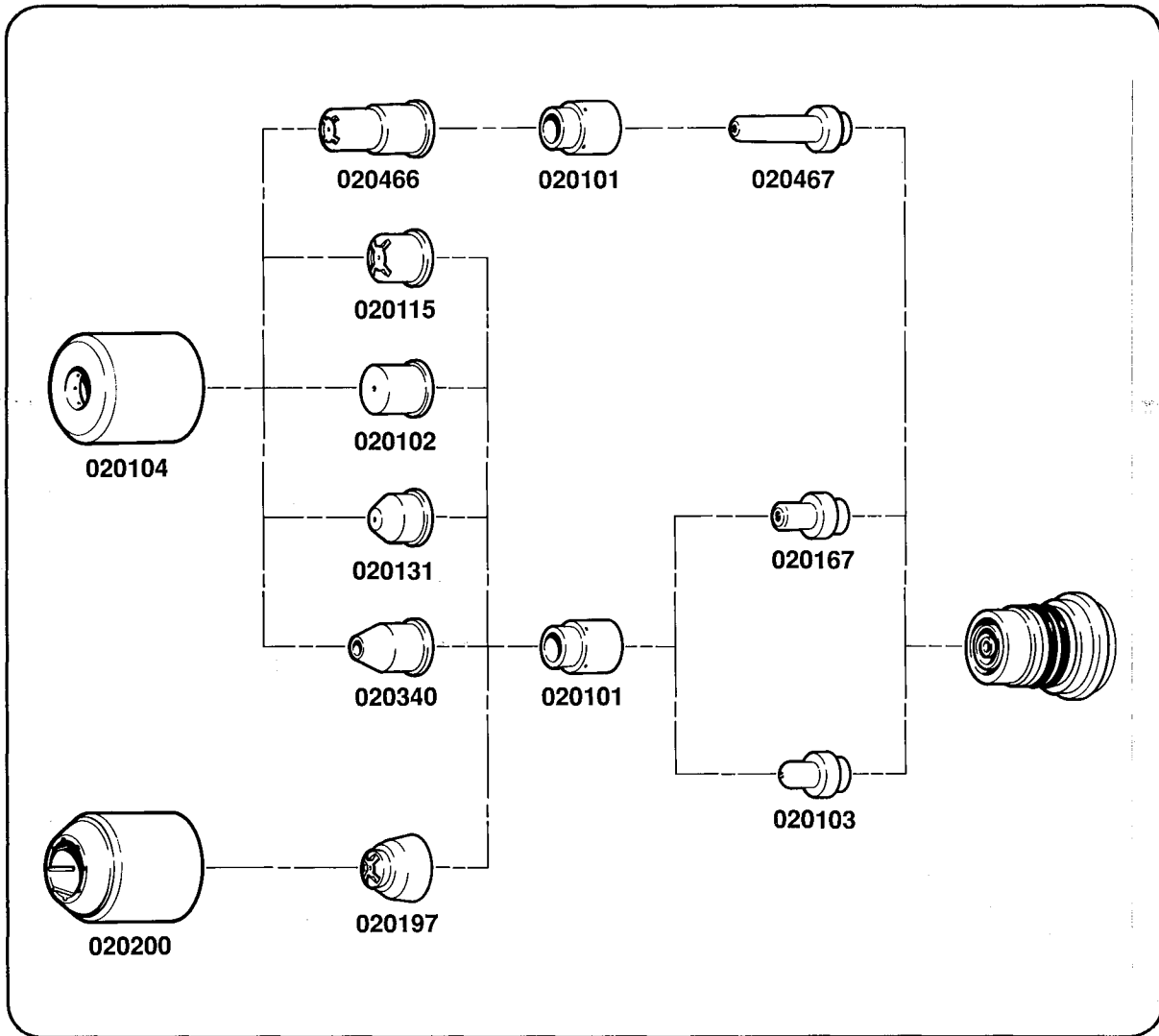


Figure 6-3 MAX40 Consumable Parts

MAX40 TORCHES

Consumable Parts (See Figure 6-3)

	Part Number	Description
Extended Parts	020104*	Cap, Retaining, Standard, HT40/PAC140
	020466	Nozzle, Extended, PAC140
	020101*	Swirl Ring, HT40/PAC140
	020467	Electrode, Air Extended, PAC140
Standard Length Parts	020104	Cap, Retaining, Standard, HT40/PAC140
	020115	Nozzle, 40 Amp, PAC140
	020340	Nozzle, Gouging, PAC140
	020101	Swirl Ring, HT40/PAC140
	020167	Electrode, Nitrogen, HT40/PAC140
	020103	Electrode, Air, HT40/PAC140
Tapered Parts	020200	Cap, Retaining, Tapered, HT40/PAC140
	020197	Nozzle, 40 Amp, Tapered, HT40/PAC140
	020101*	Swirl Ring, HT40/PAC140
	020167*	Electrode, Nitrogen, HT40/PAC140
	020103*	Electrode, Air, HT40/PAC140

* Standard parts used with tapered and extended parts

Spare Parts Kit - 028292

<u>Part Number</u>	<u>Description</u>	<u>Qty.</u>
001285	Box, consumable parts	1
015111	Adpt, 1/4 NPT X "B" LH Inert	1
020101	Swirl ring, HT40/PAC140	2
020103	Electrode, air HT40/PAC140	5
020115	Nozzle, 40A PAC140	5
020115	Nozzle, 40A taper HT40/PAC140	5
020200	Cap, retaining, taper HT40/PAC140	1
044016	O-ring	5
027055	Lubricated, silicon, 1/4 oz. tube	1

Section 7 MAINTENANCE

In this section:

Troubleshooting	7-2
Torch Removal and Replacement	7-6

MAINTENANCE

TROUBLESHOOTING



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).



AVERTISSEMENT



DANGER DE CHOC: Les gros condensateur(s) électrolytiques (cylindre(s) bleus) emmagasinent une quantité importante d'énergie sous forme de charge électrique. Même lorsque l'alimentation est coupée, une tension dangereuse subsiste aux bornes des condensateurs, sur le circuit de découpage et sur les dissipateurs. Ne jamais décharger un condensateur à l'aide d'un tournevis ou autre outie; cela peut causer une explosion, des dégâts et des blessures. Attendre au moins cinq minutes après avoir coupé l'alimentation avant de toucher à le circuit de découpage ou aux condensateurs.

MAINTENANCE

Problem: The green ON button is pushed, but there is no power or fan. The white READY light is not lit.

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

Solution: Turn the gas on. Adjust the pressure to 60 psi.

Cause: The thermal overload switch 1TAS is open.

Solution: Allow the unit to cool and try again.

Cause: The torch parts are not in place or are not properly installed.

Solution: Install the torch parts properly.

Cause: The wall disconnect power switch is not on.

Solution: Turn the power switch on.

Cause: Fuses 1FU, 2FU and/or 3FU are blown.

Solution: Replace the fuse(s).

Problem: The white READY light is lit, but the red DC POWER light is not lit and there is no high frequency (HF).

Cause: The main control PC board 2PC is defective.

Solution: Replace 2PC.

Cause: No START command.

Solution: Check the torch start switch. Check 2TB1 and 2TB2. Check for loose or broken wiring.

Problem: The circuit breaker on the incoming 220 or 240V line fails during cutting.

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

Solution: Decrease the cutting current by reducing the amperage setting on the front panel, or decrease the time of the cut.

Reduce the length of the extension cord, or increase the gauge of the extension cord.

Cause: There is a defective diode on the main rectifier assembly.

Solution: Replace as necessary.

MAINTENANCE

Problem: The white READY and red DC POWER light are lit, but there is no high frequency (HF).

Cause: The spark gaps are dirty or gapped wrong.

Solution: Clean the spark gaps with emery cloth and regap .015" per gap.

Cause: Tank capacitors 9CAP and 10CAP are defective.

Solution: Replace 9CAP and 10CAP.

Cause: High voltage transformer 3T is defective.

Solution: Replace 3T.

Cause: There is loose wiring.

Solution: Check all terminal connections.

Problem: High frequency (HF) is working, but there is no pilot arc.

Cause: The torch parts are worn.

Solution: Install new consumable parts.

Cause: The torch or torch leads are defective or loose.

Solution: Replace or tighten as required.

Cause: The coupling capacitors are defective.

Solution: Replace 1PC I/O board.

Cause: The surge injection unit is defective.

Solution: Check 8CAP and 2RES; replace as necessary.

Cause: Contactor 2CON is defective.

Solution: Replace 2CON.

Cause: The pilot arc relay 1CR is defective.

Solution: Replace 1CR.

Cause: The main control PC board is defective.

Solution: Replace 2PC.

Cause: The 3PC interface board is defective.

Solution: Replace 3PC.

MAINTENANCE

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

Cause: The system has overheated.

Solution: Wait for the unit to cool down.

Cause: Insufficient air pressure.

Solution: Check the gauge on the back panel. Increase the air pressure to the unit.

Cause: Auxillary switches on the safety contactor are loose.

Solution: Tighten the switches.

Cause: The pilot arc fitting on the torch is leaking, or the retaining cap is off.

Solution: Repair the leak or replace the retaining cap and O-rings.

Problem: The arc fails after two seconds.

Cause: The arc transfer sensor failed on the 1PC I/O board.

Solution: Replace 1PC.

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

Solution: Connect or repair the ground clamp.

MAINTENANCE

REMOVAL AND REPLACEMENT OF THE MACHINE TORCH

To remove and replace the torch main body from the torch lead, perform the following procedure. Refer to the *MAX40 Machine Torch Assembly*, page 6-3.

Removal

1. Unscrew the torch position sleeve from the torch main body and slide the sleeve back in order to expose the torch lead fittings. Slide the lead insulator covering the pilot arc lead fittings forward.
2. Disconnect the torch leads from the torch main body. Use a 5/16" open-end wrench to hold the torch main body fittings and a 7/16" open-end wrench to turn the torch lead fittings counter clockwise (ccw) to loosen the connections.
3. Remove the torch main body from the torch lead.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Use a 5/16" open-end wrench to hold the torch main body fittings and a 7/16" open-end wrench to tighten the connections.
2. Slide the lead insulator over the pilot arc lead fittings.
3. Slide the torch position sleeve forward to the torch main body and screw together.

MAINTENANCE

REMOVAL AND REPLACEMENT OF THE PAC140 TORCH

To remove and replace the torch main body from the torch lead, perform the following procedure. Refer to *PAC140 Torch Assembly*, page 6-2.

Removal

1. Remove the five (5) screws securing the two handle halves and separate.
2. Remove the torch main body and torch switch from the handle.
3. Slide the lead insulators away from the torch lead fittings. 4. Disconnect the torch leads from the torch main body. Use a 5/16" open-end wrench to hold the torch main body fittings and a 7/16" open-end wrench to turn the torch lead fittings counter clockwise (ccw) to loosen the connections.
5. Remove the torch main body from the torch lead.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Use a 5/16" open-end wrench to hold the torch main body fittings and a 7/16" open-end wrench to tighten the connections.
2. Slide the lead insulators over the torch lead fittings.
3. Insert the torch main body into one of the handle halves and then align the body in the handle.
4. Insert the torch switch into the handle switch holder.
5. Insert the top rib of the boot into the handle just above the screw holes.
6. Align both halves of the handle, press together, and secure with the five (5) screws.

MAINTENANCE

REMOVAL AND REPLACEMENT OF THE TORCH LEAD

To remove the hand or machine torch lead, perform the following procedure. See Figures 5-1, 5-7, 5-13 and 5-19.

Removal

1. At the power supply, disconnect the torch start switch leads 33 and 34 from terminals 1 and 2 on terminal strip 2TB (hand torch lead only).
2. Disconnect the air-cooled power cable to the cathode (4T) fitting at the center of the large white plastic insulated panel on the power supply.
3. Disconnect the pilot arc lead from the stud marked PA .
4. Pass the torch lead assembly through the hole at the rear left side of the power supply.
5. Remove the torch lead from the torch. If removing a machine or hand torch lead, refer to the associated machine or hand torch procedure on page 7-6.

Replacement

1. Connect the torch lead to the power supply by reversing the torch lead removal procedure, steps 4 through 1, on page 7-7.
2. Connect the torch lead to the torch by referring to the associated machine or hand torch procedure on page 7-6 and 7-7.

Section 8 STANDARDS INDEX

In this section:

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STANDARDS INDEX

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

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

STANDARDS INDEX

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 hanging 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 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.

GLOSSARY

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).
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.
pilot arc	A plasma arc that attaches to the torch nozzle rather than the work.
plasma	An electrically charged gas is said to be "ionized." A cloud of ionized gas together with its electrons is called "plasma."
plasma arc	Movement of electric current in a plasma (ionized gas). An intensely hot and bright 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.

GLOSSARY

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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