THERMAL DYNAMICS®

A THERMADYNE® Company

PAK MASTER® 50

Air Plasma Cutting System

Service Manual

March 13, 1998 Manual No. 0-2444

WARNING Read and understand this entire Service Manual and your employer's safety practices before installing, operating, or servicing the equipment.

WARNING While the information contained in this manual represents our best judgement, Thermal Dynamics Corporation assumes no liability for its use.

Pak Master® 50 Air Plasma Cutting System
Service Manual Number 0-2444

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RECORD SERIAL NUMBERS FOR WARRANTY PURPOSES

Purchase Date	
Power Supply	
Torch	

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INTRODUCTION

NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE — An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION — A procedure which, if not properly followed, may cause damage to the equipment.

WARNING — A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

IMPORTANT SAFETY PRECAUTIONS

WARNING

Operation and maintenance of plasma arc equipment involves potential hazards. All operators and personnel should be alerted to possible hazards and precautions should be taken to prevent possible injury.

Gases and Fumes

GASES AND FUMES produced during the plasma cutting process can be dangerous and hazardous to your health.

- Ventilation must be adequate to remove gases and fumes during operation. Threshold limit values and how to measure the amounts to assure adequate ventilation are found in publication (A), page *iv*.
- Vapors of chlorinated solvents can form the toxic gas phosgene when exposed to ultraviolet radiation from an electric arc. Solvents, degreasers, and potential sources of these vapors must be removed from the cutting area.
- Keep all fumes and gases from the breathing area.
- Use a downdraft cutting table or water table to capture fumes and gases.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.

Arc Rays

ARC RAYS can injure eyes and burn skin.

- Use a welding shield with proper filter. A #4 filter or darker is recommended for drag cutting. A #10 filter or darker is recommended when cutting with a standoff.
- Wear proper protective clothing.
- Make sure others in the operating area are protected from arc rays.

IMPORTANT SAFETY PRECAUTIONS (continued)

Electric Shock

ELECTRIC SHOCK can kill.

- Install and maintain equipment according to USA Standard C1, National Electric Code.
- Proper grounding procedures must be adhered to when using plasma arc cutting equipment. The workpiece must be grounded to a solid electrical ground.
- Do not contact electrically live parts. Do not touch torch parts when input power is present in the power supply.
- Insulate yourself and others from the workpiece and ground.
- Replace any cracked or damaged insulating parts including torches, hoses, and leads.
- Disconnect power source before disassembling the torch. Turn off primary power before working on torch parts, including changing cups and tips.
- The shield cup must be installed prior to operating the torch.
- When operating plasma arc cutting equipment in a damp or wet area, extra care should be taken.
- Use this equipment for plasma cutting and gouging only. It is not designed for any other cutting or welding process.
- Use only the torches specified in this instruction manual.

Fire

FIRE can be caused by hot slag and sparks.

- Remove combustibles from working area or provide a fire watch.
- Do not cut containers that have held combustibles. Remove all flammable and combustible materials in the operating area that may be ignited by sparks.
- Do not mount this equipment over combustible surfaces.

Noise

NOISE can cause permanent hearing loss.

- Wear proper protective ear muffs or plugs.
- Make sure others in the operating area are protected from noise.

Compressed Gas Cylinders

Compressed gas cylinders are potentially dangerous.

Refer to suppliers for proper handling procedures.

IMPORTANT SAFETY PRECAUTIONS (continued)

Publications

The following publications provide additional information on safety precautions:

(A) Bulletin No. C5.2-83 “Recommended Safe Practices for Plasma Arc Cutting”

(B) American National Standard ANSI Z49.1-1983 “Safety in Welding and Cutting”

Both publications are available from:

American Welding Society Inc.
2501 Northwest 7th Street
Miami, Florida 33125
Telephone (305) 443-9353

(C) OSHA Safety and Health Standards, 29CFR1910 available from:

The U.S. Department of Labor
Washington, D.C. 20210

D) CSA Standard W117.2 “Safety in Welding, Cutting, and Allied Processes” obtainable from:

The Canadian Standards Association
178 Rexdale Blvd.
Toronto, Ontario M9W1R3, Canada

E) AS1674, AS2745, WITA Technical note 7 obtainable from:

Standards Australia's Quality Assurance Services
80 Arthur Street
North Sydney, N.5.W. 2060

WARNING Read and understand this instruction manual and your employer’s safety practices.

PRÉCAUTIONS

AVERTISSEMENT

La mise en oeuvre et l'entretien de tout équipement plasma implique des dangers potentiels. Le personnel doit etre mis en garde contre les risques suivants et toutes les précautions doivent etre prises pour eviter de prendre des risques pour la santé.

Les gaz et les fumees

LES GAZ ET LES FUMEES peuvent etre dangereux et constituer un risque pour votre sante.

- La ventilation doit être suffisante pour évacuer les fumées lors de la coupe. (Dans la publication (A), page *vii*, vous trouverez la façon de mesurer les quantités permettant d'affirmer que la ventilation est adéquate, ainsi que les valeurs limites à ne pas dépasser.)
- Les vapeurs de solvants chlorés peuvent former un gaz toxique, le Phosgène, lorsqu'elles sont exposées aux radiations ultraviolettes émises par l'arc électrique. Tous les solvants, dégraissants et sources potentielles de ces vapeurs doivent être enlevés de l'aire de coupe.
- Evacuer toutes les fumées et les gaz de l'aire de respiration.
- Utiliser un établi de coupe à tirage vers le bas pour attirer les fumées et les gaz.
- Utiliser un masque aves arrivée d'air si la ventilation n'est pas suffisante pour éliminer tous les gaz et fumées.

PRÉCAUTIONS (continuer)

Les rayons de l'arc

LES RAYONS DE L'ARC peuvent abimer les yeux et bruler la peau.

- Utiliser un écran de soudage muni d'un filtre numéro 4 ou plus sombre en coupant "au contact" ou numéro 10 ou plus sombre en coupant à distance.
- Porter des vêtements protecteurs adéquats.
- Assurez vous que les autres personnes ne soient pas atteintes par les rayons.

Decharge electrique

Une DECHARGE ELECTRIQUE peut tuer.

- Faire l'installation et l'entretien de l'appariel selon les normes du Code Electrique des Etats-Unis (Norme NEC-USA Standard C1), ou celles en vigueur dans votre pays.
- Il faut appliquer les procédures de mise à la terre spécifiques à l'utilisation de dispositifs de coupe au plasma. La pièce ou le métal sur lequel une personne coupe doit être reliée à une bonne prise de terre.
- Ne pas toucher à des pièces sous tension.
- Isolez-vous du courant de coupe et de la terre.
- Remplacer toute pièce isolante fendue ou endommagée, y compris le corps de torche et les câbles.
- Couper l'alimentation avant la depose du chalumeau. Couper l'alimentation avant d'intervenir sur la torche, y compris pour changer la buse ou l'électrode.
- Avant d'utilisere le chalumeau s'assurer que l'ecran de protection est en place.
- Soyez particulièrement vigilant lorsque vous coupez avec un appariel de coupe au plasma dans un endroit humide.

Un encendie

Les etincelles et les scories peuvent provoquer UN ENCENDIE.

- Oter tout combustible de l'aire de coupe ou installer un détecteur de flammes.
- Ne pas couper de récipient ayant contenu des combustibles. Tout matériel inflammable ou combustible pouvant être allumé par une étincelle doit être enlevé de l'aire de coupe.

PRÉCAUTIONS (continuer)

Le bruit

LE BRUIT peut causer la surdité.

- Proté des protecteurs auditifs.
- Assuré que tous les autres sont protégé du bruit.

Bouteilles de gaz comprimes

LES RÉSERVOIRS DE GAZ SONT DANGEREUX.

Se référer aux directives du constructeur pour une bonne utilisation.

Les publications

LES PUBLICATIONS suivantes contiennent des renseignements supplémentaires sur les précautions à prendre pour garantir la sécurité.

(A) Bulletin No. C5.2-83 “Recommended Safe Practices for Plasma Arc Cutting”

(B) American National Standard ANSI Z49.1-1983 “Safety in Welding and Cutting”

Vous pouvez vous les procurer toutes les deux auprès de:

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2501 Northwest 7th Street
Miami, Florida 33125 U.S.A.
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(C) OSHA Safety and Health Standards 29CFR 1910, disponible auprès du:

U.S. Department of Labor
Washington DC 20210, USA

(D) Norme de l'ACNOR W117-2, “Safety in Welding, Cutting, and Allied Processes” que l'on peut obtenir auprès de:

L'Association Canadienne Des Normes
178 Rexdale Blvd
Toronto, Ontario, Canada, M9W 1R3

(E) AS1674, AS2745, WITA Technical note 7 obtainable from:

Standards Australia's Quality Assurance Services
80 Arthur Street
North Sydney, N.5.W. 2060

AVERTISSEMENT

Lire et comprendre ce manuel d'instructions, ainsi que les pratiques sur la securite emises par votre employeur.

STATEMENT OF WARRANTY

LIMITED WARRANTY: Thermal Dynamics Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommen dations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of STAK PAK II): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the following further limitations on such two (2) year period. The limited warranty period for STAK PAK II shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the following further limitations on such three (3) year period:

PAK UNITS, POWER SUPPLIES	STAK PAK II	All OTHERS	PARTS LABOR
MAIN POWER MAGNETICS	3 YEARS	2 YEARS	1 YEAR
ORIGINAL MAIN POWER RECTIFIER	3 YEARS	2 YEARS	1 YEAR
CONTROL PC BOARD	3 YEARS	2 YEARS	1 YEAR
ALL OTHER CIRCUITS AND COMPONENTS	1 YEAR	1 YEAR	1 YEAR
INCLUDING, BUT NOT LIMITED TO, STARTING CIRCUIT, CONTACTORS, RELAYS, SOLENOIDS, PUMPS, POWER SWITCHING SEMI-CONDUCTORS			
CONSOLES, CONTROL EQUIPMENT, HEAT	1 YEAR	1 YEAR	1 YEAR
EXCHANGES, AND ACCESSORY EQUIPMENT			
TORCH AND LEADS	180 DAYS	180 DAYS	180 DAYS
REPAIR/REPLACEMENT PARTS	90 DAYS	90 DAYS	NONE

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Arc® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Thermal Arc® is a Registered Trademark of Thermal Dynamics.

Effective February 1, 1995

SECTION 1: GENERAL INFORMATION

1.1 SYSTEM DESCRIPTION

The Pak Master® 50 Air Plasma Cutting System Includes:

- Pak Master® 50 - The power supply provides 35 amp maximum output and includes all control circuitry, electrical and gas inputs and outputs, pilot circuitry, and a quick disconnect torch leads receptacle. The power supply is shipped with a work cable and clamp attached. A 230V single-phase primary input power cable with molded 50 amp plug is optional. Machine torch systems also include a remote hand control and remote control wire harness.
- PCH/M-35 Torch with Leads (Packaged Separately) - The torch provides a maximum 1/2 inch (12 mm) cut capacity. Hand torches are available in 70° and 90° configurations which include a handle and multi-position switch assembly. Machine torches include a rack and pinion mounting assembly. A phenolic (plastic) pinch block mounting assembly is optional. Torch leads are available in 12.5, 25, or 50 ft (3.8, 7.6, or 15.2 m) lengths with a quick disconnect torch leads fitting for simple installation. The PCH/M-35 includes a spare parts kit which provides an assortment of replacement consumable torch parts.
- See page 4 for a list of other system options and accessories.

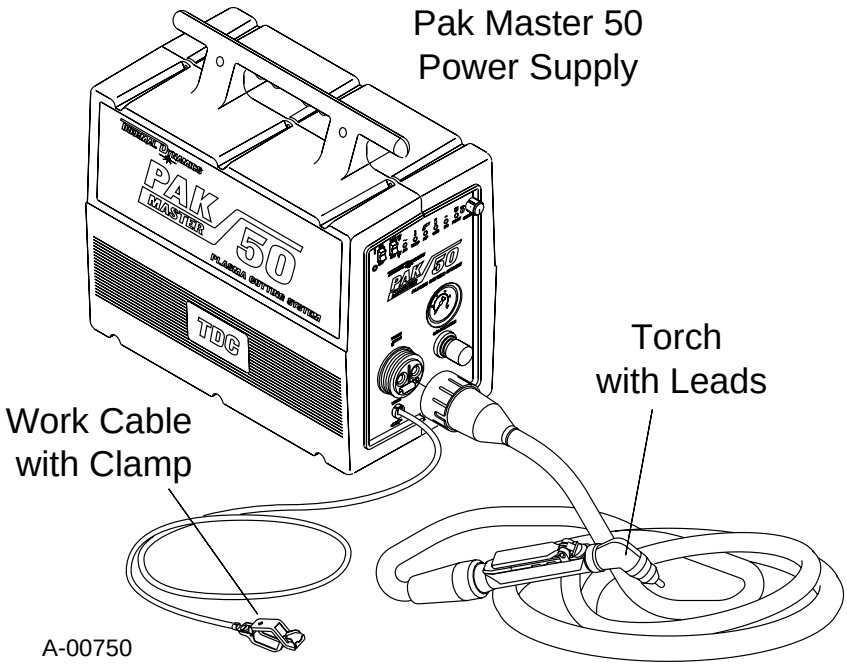


Figure 1-A System Components

1.2 SPECIFICATIONS

Controls	ON/OFF Switch RUN/SET Switch Output Current Control Corner Slowdown Control Pressure Regulator Control
Panel Indicators	LED Indicators: AC Power, TEMP, PIP (Parts-In-Place), GAS, DC Power, PILOT Pressure Gauge
Input Power	200 to 460 VAC (±10%), 50 or 60 Hz, Single or Three-Phase 575V Additional Transformer Required (Catalog No. 9-6211)
Output Power	Continuously variable from 15 to 35 Amps maximum 70% Duty Cycle
Cut Capacity	1/2 in (12.7 mm) at 10 ipm
Pilot Circuitry	High Frequency (HF), Constant DC
CNC Capability	Remote Start/Stop, OK-to-Move, and Corner Slowdown (CSD)
Weight	69.8 lbs (31.7 kg)
Dimensions	18.5" High x 11.1" Wide x 21.7" Long (470 x 282 x 551 mm)

Table 1-A Power Supply Specifications

Configurations	70° or 90° Hand Torch, 180° Machine Torch
Current Rating	35 amps Maximum, DC Straight Polarity
Duty Cycle	100% @ 35 amps
Cutting Range	Most materials up to 1/2 in (12.7 mm)
Pierce Rating	1/4 in (6.3 mm)
Transfer Distance	3/8 in (9.5 mm)
Consumable Parts	Gas Distributor, Electrode, Tip, Shield Cup
Gases	Compressed Air, Nitrogen (N_2)
Pressure Requirements	70 psi (4.8 BAR)
Flow Requirements	Cutting - 200 scfh (94.4 lpm) Gouging - 230 scfh (108.5 lpm)
Available Leads Lengths	12.5 ft (3.8 m), 25 ft (7.2 m), or 50 ft (15.2 m) Extendable to 150 ft (45.6 m)

Table 1-B Torch Specifications

1.2 SPECIFICATIONS (continued)

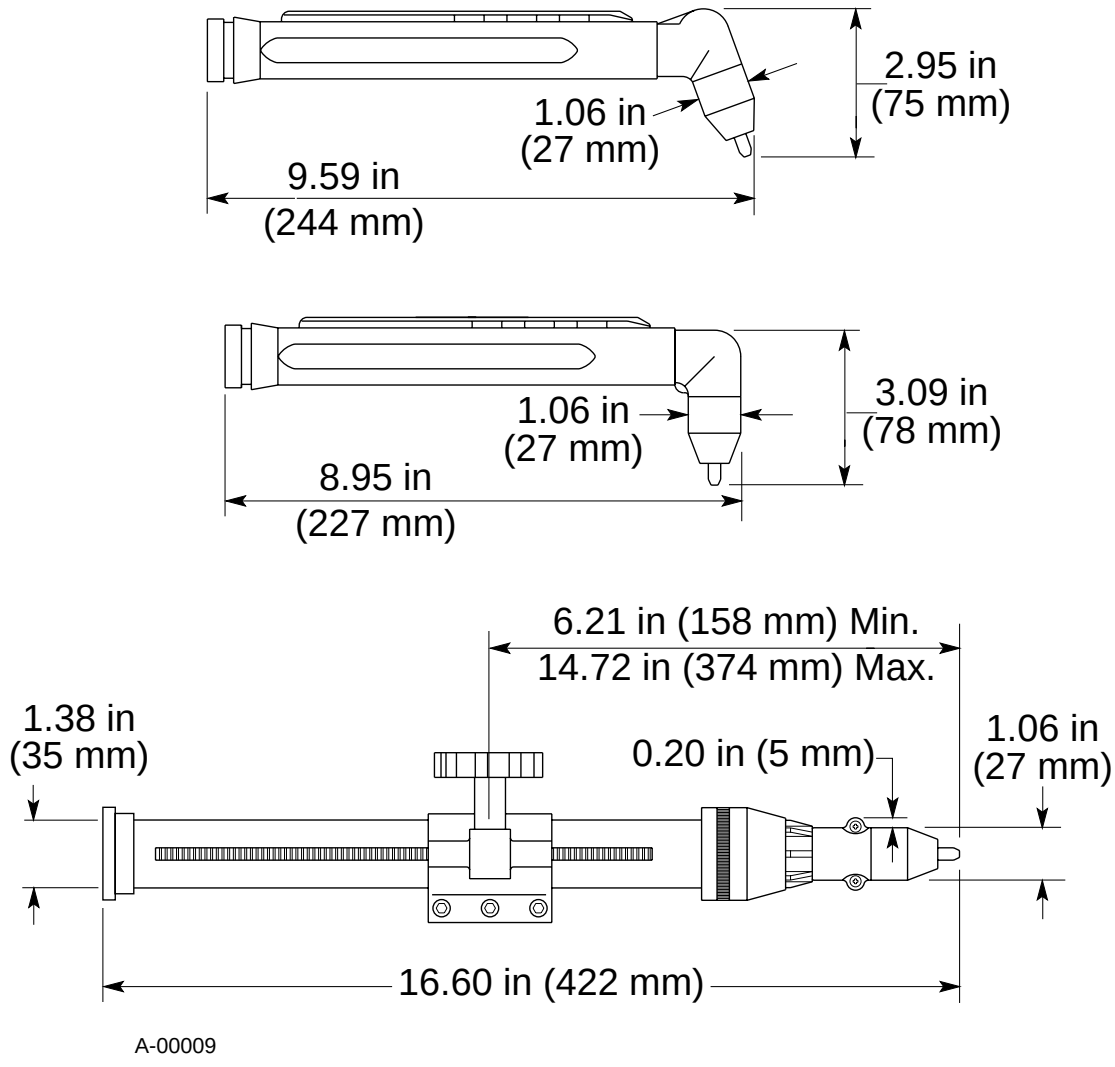


Figure 1-B PCH / M-35 Torch Dimensions

1.3 OPTIONS AND ACCESSORIES

Pak Master 50 System Options and Accessories

- Remote Control (RC) Wire Harness ..... Cat. No. 9-6210
  For converting a hand cutting system to mechanized use with a remote hand pendant control or computer control (CNC) cable.
- Remote Hand Pendant Control ..... Cat. No. 7-3114
  Hand-held remote ON / OFF control device for systems with remote wire harness installed. Includes a 25 ft (7.6 m) cable.
- Computer (CNC) Interface Cable - 25 ft (7.6 m) .. Cat. No. 8-5557
  Computer (CNC) Interface Cable - 50 ft (15.2 m) Cat. No. 8-5558
  For interfacing the power supply with a computer or auxiliary control device. Provides ON / OFF, OK-to-move, and corner slowdown signals. (Remote wire harness must be installed.)
- High Pressure Regulator - Air ..... Cat. No. 9-3022
  High Pressure Regulator - Nitrogen (N_2) ..... Cat. No. 9-2722
- Running Gear ..... Cat. No. 7-3201
  For transporting the system with torch and leads storage.
- Air Line Filter - Single Stage ..... Cat. No. 7-3265
  Air Line Filter - Two Stage ..... Cat. No. 7-3340
  Remove damaging moisture and contaminants from the air stream when using compressed air.
- 575V Transformer Unit ..... Cat. No. 9-6211
  For operating standard systems with 575V three-phase input.

Torch Options and Accessories

- Spare Parts Kit - Standard Cutting ..... Cat. No. 5-6001S
  Spare Parts Kit - Gouging ..... Cat. No. 5-6015
  Spare Parts Kit - Long Life ..... Cat. No. 5-6001
  Kits contain replacement front-end torch parts (see detailed description of spare parts kit contents on page 72).
- Leads Extension Kit - PCH-35, 25 ft (7.6 m) ..... Cat. No. 4-6007
  Leads Extension Kit - PCH-35, 50 ft (15.2 m) ..... Cat. No. 4-6008
  Leads Extension Kit - PCM-35, 25 ft (7.6 m) ..... Cat. No. 4-6009
  Leads Extension Kit - PCM-35, 50 ft (15.2 m) ..... Cat. No. 4-6010
  For extending torch leads up to 150 ft (45.7 m).
- Phenolic Mounting Tube ..... Cat. No. 7-3251
  Phenolic Pinch Block Mounting Assembly ..... Cat. No. 7-3252
  For machine mounted torch applications where a non-metal mounting assembly is desired.
- Switch Lever Kit ..... Cat. No. 8-5170
  Provides a lever for activating the hand torch control switch.

NOTE Refer to Section 5, Parts Lists, for ordering information.

SECTION 2: INSTALLATION

2.1 REMOTE CONTROL HARNESS INSTALLATION

RC Wire Harness

Installation of the remote control (RC) wire harness is required for machine torch systems. Installation requires four #6-32 screws with locknuts.

WARNING

Disconnect primary power at the source before assembling or disassembling the power supply, torch parts, or torch and leads assemblies.

Refer to Figure 2-A and:

Remove the Hole Plug

1. Remove the hole plug from the hole marked “REMOTE CONTROL” on the upper left rear panel of the power supply.

Open the Enclosure

2. Locate the eight screws which hold together the two halves of the power supply enclosure. Lay the power supply on its side with the screw heads facing UP. Remove all eight mounting screws and carefully lift the upper half of the enclosure from the unit. Lift the unit from the lower half of the enclosure and set the unit in upright position on a secure working surface.

(continued on next page)

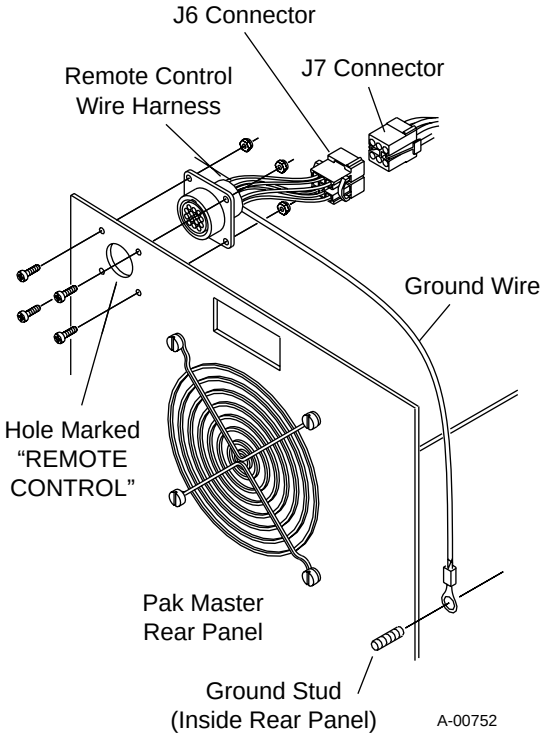


Figure 2-A Installing the RC Wire Harness

2.1 REMOTE CONTROL HARNESS INSTALLATION (continued)

Install the Wire Harness

3. Inside the power supply, locate the white 6-pin connector J7 on the top panel, close to the "REMOTE CONTROL" hole location.
4. Connect the 6-pin plug on the remote control wire harness to the 6-pin connector J7.
5. Locate the ground stud on the RIGHT side of the rear panel, inside the panel, at approximate center height. Connect the ground wire of the remote control wire harness to the ground stud.

CAUTION

Do not ground the remote control wire harness to the system ground stud, which is visible on the top panel of the power supply.

6. Using the four #6-32 screws with locknuts, install the remote control receptacle (J24) in the rear panel (position the receptacle in the hole from INSIDE the unit).

Reassemble the Enclosure

7. Before reassembling the power supply enclosure, check that all wire harnesses and ribbon cables are properly located in the notches of the top and middle panels.
8. Position the unit in an upright position. Tip the unit and slide one of the case halves onto the chassis. Then lift the unit and set it down on its side with the case half down.
9. Before installing the other case half, make sure the edges of the bottom, middle, and top chassis panels are fully inserted into the slots in the case. Look for gaps between the front and rear panels and the edge of the case. Look into the case to see that the notches in the top corners of the front and rear panels are flush against the plastic stops of the case. Some lifting and re-settling of the chassis may be required to get all components aligned correctly.
10. Gently lower the other half of the enclosure onto the other side of the chassis by tipping it slightly so that the top is slightly lower than the bottom. Then push and gently tap down until the two case halves are within l/16 inch. (If you have trouble getting the case halves close enough, remove the top half and check to see that the bottom half is fully engaged and that there are no wires out of place on the top and middle panels.
11. Install the eight screws, lockwashers and nuts to complete the assembly.

2.2 ELECTRICAL CONNECTIONS

Primary Input Voltages

The unit can accept any input voltage from 200V to 460V (± 10%), single or three phase, 50 or 60 Hz. 575V input requires an additional step-down transformer (Catalog No. 9-6211).

CAUTION

Input voltage settings must be verified before applying power to the unit. Refer to Figure 2-B, below.

WARNING

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Input Voltage Changeover

1. Remove the voltage selection access panel.
2. Connect the 9-circuit plug on the rear panel to the receptacle which corresponds with the actual primary input voltage (HIGH for 380 / 415 / 460V or LOW for 200 / 220V).
3. Connect the single-circuit plug on the rear panel to the receptacle which corresponds to the actual primary input voltage (460V, 380 / 415V, or 200 / 220V).
4. Replace the voltage selection access panel.

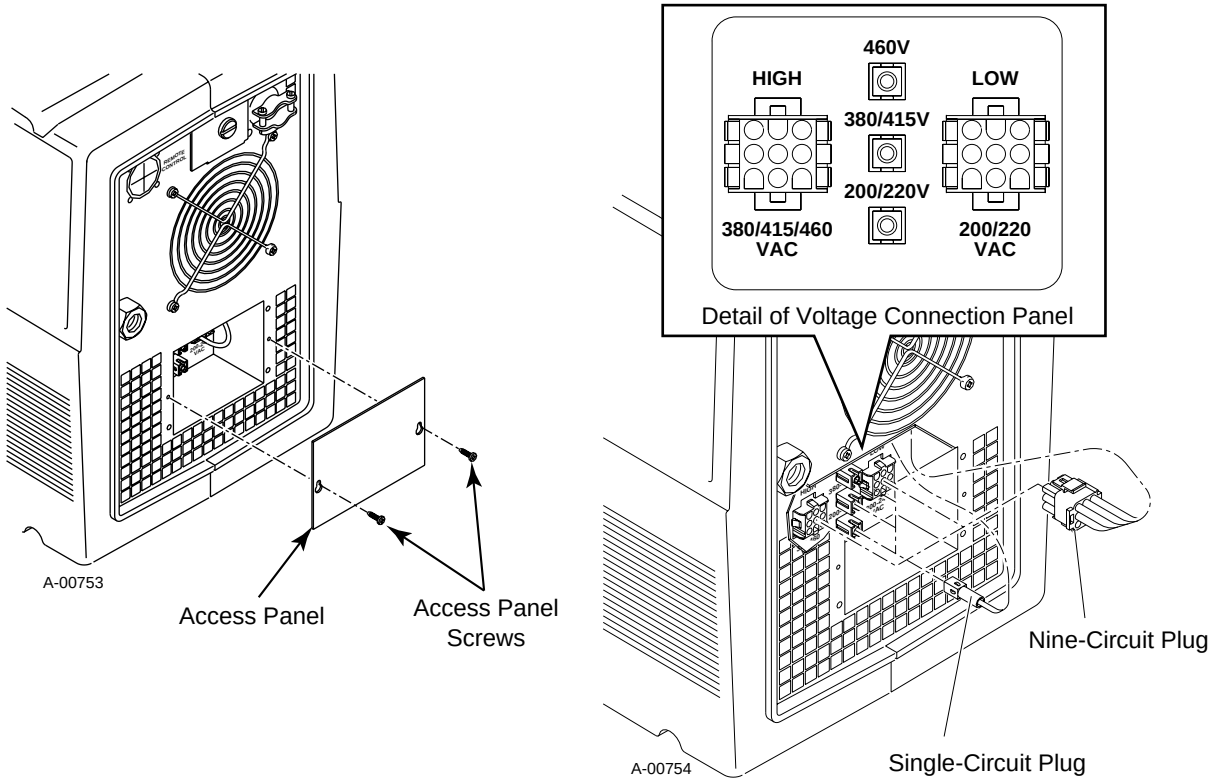


Figure 2-B Input Voltage Selection

2.2 ELECTRICAL CONNECTIONS (continued)

CAUTION

Both input voltage settings on the power supply must correspond to the actual primary input voltage.

Input Power Cable Connections

Systems ordered for 230V operation come supplied with a 230V single-phase input power cable attached. For any other input voltage, the 230V input power cable must be removed and replaced with an appropriate power cable.

WARNING

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Refer to Figure 2-C (page 9) and:

1. Remove the access panel on the rear panel of the unit and disconnect the factory-installed 230V input power cable. Loosen the strain relief and remove the cable.

NOTE

Input power connections can be made directly to a properly fused disconnect or by using a plug which conforms to the recommended ratings.

CAUTION

The primary power source, power cable, and plug all must conform to local electric code and the recommended circuit protection and wiring requirements (see Table 2-A, page 9).

2. Before connecting the replacement input power cable, strip back the outer covering approximately 3 inches (76 mm) to expose the individual wires. Then cut back the insulation on the individual wires approximately 1/8 - 3/16 inch (3-5 mm).
3. Install a #10 ring terminal on the ground (GND) wire of the input power cable.

WARNING

Make sure the ground wire is designated as GND on the other end of the cable. Electric shock and damage to the unit could occur if power is applied to the GND terminal.

4. Connect the input power cable according to Figure 2-F. Terminal L3 is not used for single-phase connections.

2.2 ELECTRICAL CONNECTIONS (continued)

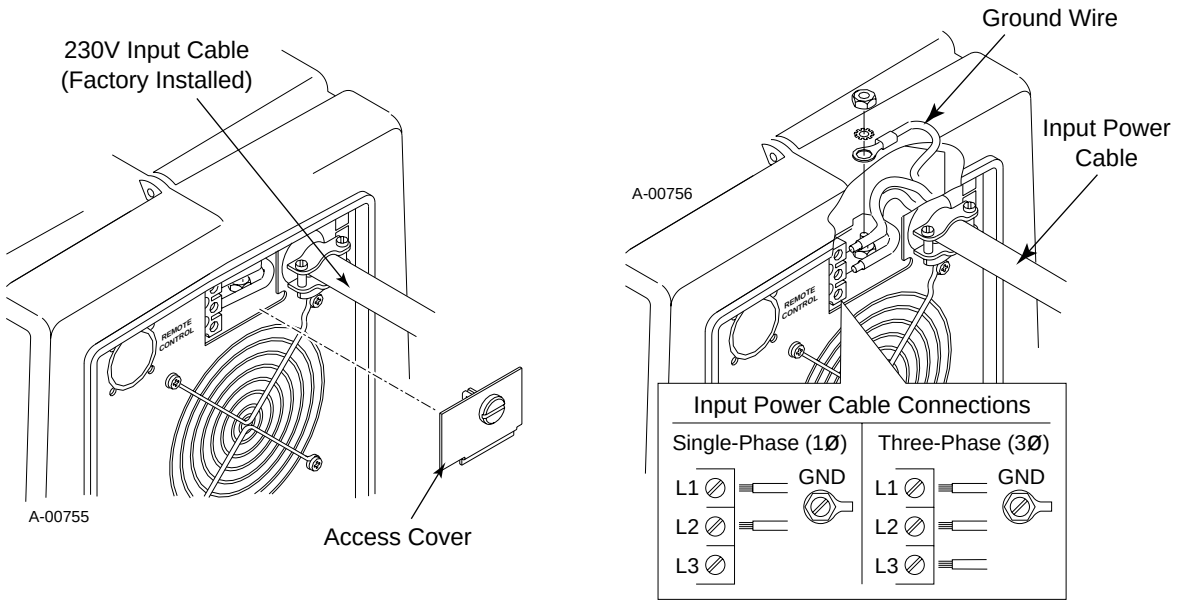


Figure 2-C Input Power Cable Connections

Input Voltage (Volts)	Power 1-Ph (kVA)	Power 3-Ph (kVA)	Input Current 1-Ph (Amps)	Input Current 3-Ph (Amps)	Freq. (Hz)	Recommended Sizes Fuse (Amps) 1-Ph	Fuse (Amps) 3-Ph	Wire (AWG) 1-Ph	Wire (AWG) 3-Ph	Wire (Canada) 1-Ph	Wire (Canada) 3-Ph
180	7	5	37	17	50/60	45	20	10	14	8	10
200	7	5	33	15	50/60	40	20	10	16	8	12
220	7	5	30	14	50/60	35	20	10	16	8	12
240	7	5	28	13	50/60	35	15	12	12	8	12
380	7	5	18	8	50/60	25	10	14	18	10	12
460	7	5	14	7	50/60	20	10	16	18	10	12
506	7	5	13	6	50/60	15	8	16	18	12	12

Table 2-A Line Voltages with Recommended Circuit Protection and Wire Sizes (Based on Table 310-16, 1987 National Electric Code) and Table 4, Canadian Electrical Code.

2.3 WORK CABLE AND GROUND CONNECTIONS

Electromagnetic Interference (EMI)

High frequency pilot arc initiation generates electromagnetic interference (EMI), commonly called RF noise. EMI may interfere with nearby electronic equipment such as CNC controllers, etc. Torch leads are shielded to help prevent this problem. To further minimize RF interference, follow these grounding procedures when installing mechanized systems:

Creating an Earth Ground

1. Install a ground wire (not included) between the internal ground stud in the power supply and a solid earth ground (or star ground). To create a solid earth ground, drive a 1/2 in (12 mm) copper rod approximately 6-8 ft (1.8-2.4 m) into the earth so that the rod contacts moist soil over most of its length. The depth required will vary depending on location. Locate the rod as close as possible to the power supply. The work table should be connected to the same earth ground.
2. Connect the control device (CNC) to a separate earth ground. The ground cable should be at least 12 gauge wire.
3. To minimize RF interference, position torch leads as far as possible (at least 1 ft or 0.3 m) from any CNC components, control cables, or primary power lines.
4. Keep torch leads clean. Dirt and metal particles bleed off energy, which causes difficult starting and increased chance of RF interference.

Work Cable Connection

Refer to Figure 2-D and:

5. Make sure the work cable is properly connected to the workpiece before operating the system.

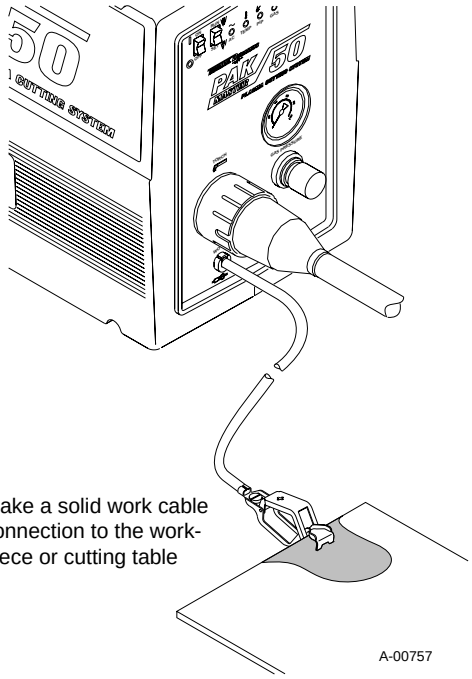


Figure 2-D Work Cable Connection

2.4 GAS CONNECTIONS

Gases	Compressed Air or Nitrogen (N_2 Only)
Pressure	70 psi (4.8 BAR)
Flow	Cutting - 200 scfh (94.4 lpm) Gouging - 230 scfh (108.5 lpm)
CAUTION	Max input pressure must not exceed 125 psi (8.6 BAR / 860 kPa)
CAUTION	Air supply must be free of oil, moisture, and other contaminants. Excessive oil and moisture may cause double-arcing, rapid tip wear, or even complete torch failure. Contaminants may cause poor cutting performance and rapid electrode wear.
Checking Air Quality	To test the quality of air, place a welding filter lens in front of the torch and turn on the gas. Any oil or moisture in the air will be visible on the lens. Do not initiate an arc!
Filtering	An air line filter (not included) is required when using air from a compressor to insure that moisture and debris from the supply hose does not enter the torch. The filter must be capable of filtering to at least 5 microns, For highly automated applications, a refrigerated drier may be used.
Gas Connections	The rear panel of the power supply is equipped with a 1/4 NPT gas input fitting. A quick disconnect coupling (1/4 NPT to #6 barb) is supplied with the unit.
Using High Pressure Gas Cylinders	Refer to the manufacturer's specifications for installation and maintenance procedures for high pressure gas regulators. Do not use an air line filter with high pressure gas cylinders. To use air or nitrogen from a high pressure gas cylinder: 1. Examine the cylinder valves to be sure they are clean and free of oil, grease or any foreign material. Momentarily open each cylinder valve to blow out any dust which may be present. 2. Each cylinder must be equipped with an adjustable high-pressure regulator capable of pressures up to 125 psi (8.6 BAR) maximum and flows of up to 700 scfh (328 lpm). Refer to Figure 2-E (page 12) and: 3. Connect the 1/4 NPT adaptor fitting to the gas input fitting on the rear panel of the power supply. 4. Connect the 1/4 NPT male side of the quick disconnect coupling to the adaptor fitting. 5. Connect the supply hose from the high pressure regulator to the barb side of the quick disconnect coupling. 6. Connect the quick disconnect coupling.

2.4 GAS CONNECTIONS (continued)

Using Shop Air

An air line filter (ordered separately) is required when using air from a compressor to insure that moisture and debris from the supply hose does not enter the torch.

The LeMan two stage air line filter kit is recommended for most applications. Follow the installation instructions for this kit on page 13.

Air Line Filter Kit - Two Stage ..... Cat. No. 7-3340

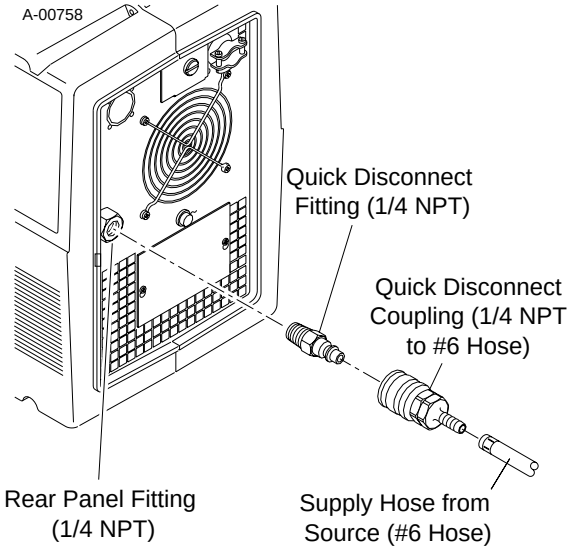


Figure 2-E Gas Connections

2.4 GAS CONNECTIONS (continued)

Installing Air Line Filter

Refer to Figure 2-F and:.

1. Press fit the nylon screw receptacles into the rear panel openings as shown.
2. Secure the air filter with bracket to the power supply with the 1/2 in pan head screws.
3. Connect the 1/4 NPT male coupling of the gas hose assembly to the power supply first, then connect the female JIC fitting to the air filter . Tighten both fittings with a 9/16 in wrench.

NOTE Supply hoses must be at least #6 hose (3/8 in or 9.5 mm I.D.).

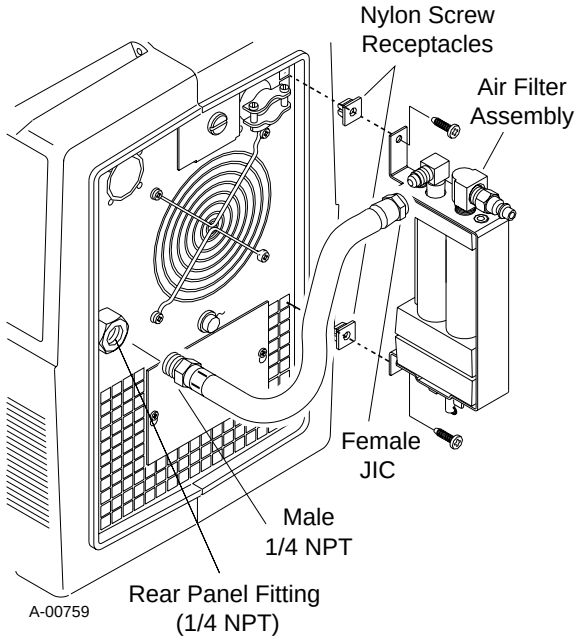


Figure 2-F Gas Connections Using Optional Air Line Filter

SECTION 3: OPERATION

3.1 OPERATING CONTROLS

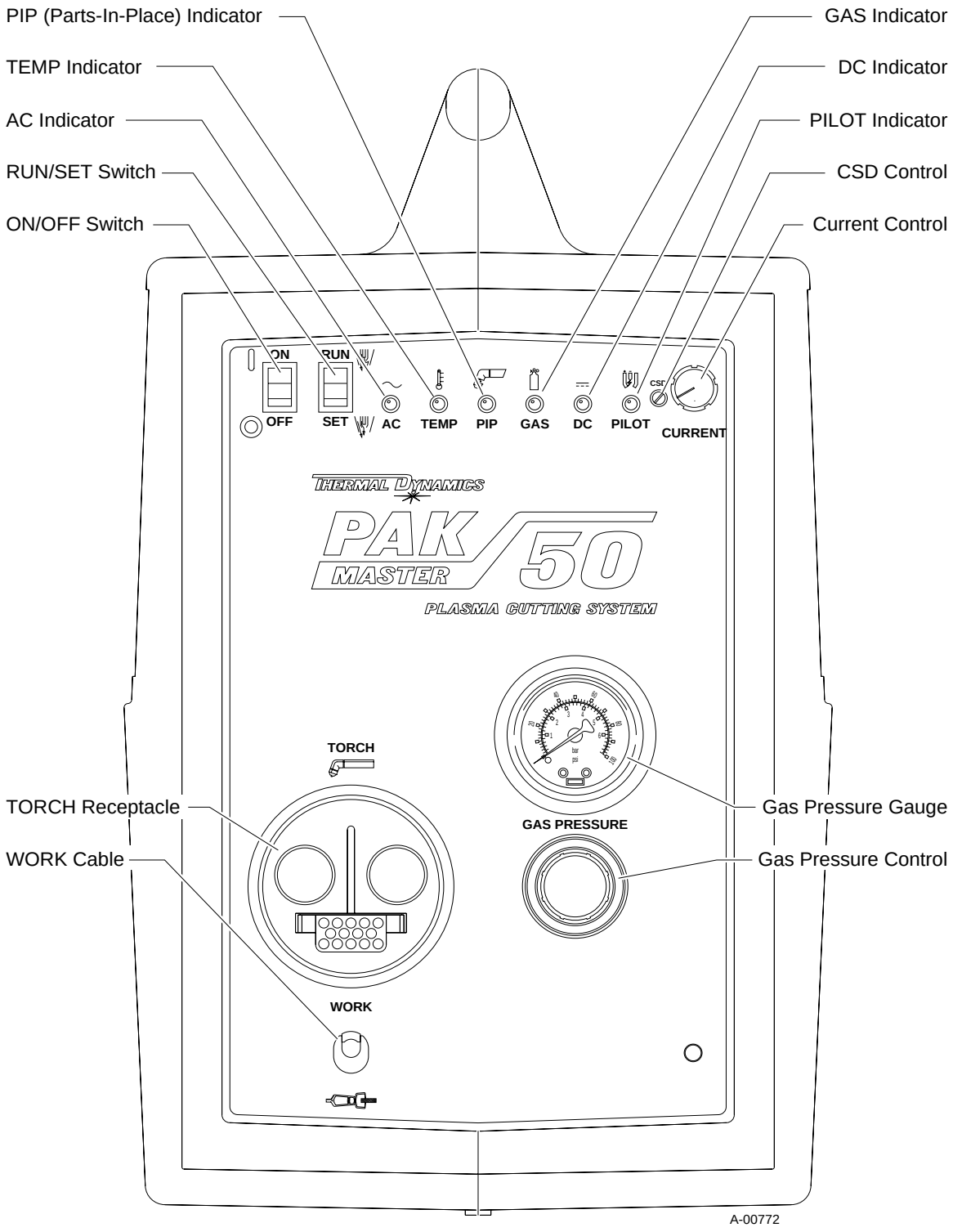


Figure 3-A Operating Controls (See Table 3-A, page 16)

3.1 OPERATING CONTROLS (continued)

INDICATOR	FUNCTION
1. ON/OFF Switch	ON position supplies AC power to activate all system control circuits. OFF position deactivates control circuits.
2. RUN/SET Switch	RUN position is used for torch operation. SET position is used for setting gas pressure and purging lines.
3. AC Indicator	Green LED light indicates AC input power is present in the system when the ON/OFF switch is in ON position.
4. TEMP Indicator	Green LED light indicates proper operating temperature range. Red light indicates overheating; unit must be allowed to cool.
5. PIP (Parts-In-Place) Indicator	Yellow LED light indicates proper torch assembly. Light goes out if the shield cup is not fully seated against the PIP pins in the torch body.
6. GAS Indicator	Yellow LED light (with RUN/SET switch in SET position) indicates adequate gas pressure (42 psi or 2.9 BAR) flowing to the torch. Light goes out in RUN position until torch is activated.
7. DC Indicator	Yellow LED light indicates adequate DC power output for main arc when the torch is activated.
8. PILOT Indicator	Yellow LED light indicates pilot arc circuit is activated. Light goes out when main arc is established and comes back on if the main arc is interrupted and pilot arc restarts.
9. Corner Slowdown Adjustment	Sets corner slowdown (CSD) output to a percentage of main output. Minimum output during CSD is 15 amps. Turn fully clockwise for maximum output (100% of main current) during CSD. See Corner Slowdown Operation, page 29.
10. Current Control	Selects output current.
11. Pressure Gauge	Displays input pressure to the torch.
12. Pressure Control	Adjusts pressure from the regulator. Pull knob out and turn clockwise to increase pressure to desired level.

Table 3-A Operating Controls

3.2 GETTING STARTED

WARNING Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Follow this set-up procedure each time the system is operated:

Check Torch Parts

1. Check the torch for proper assembly and appropriate front end torch parts (see Operators Manual 0-2344).

Check Input Power

2. Check primary power source as follows:
   a. Check the power source for proper input voltage. Make sure the power source meets circuit protection and wiring requirements (see Table 2-A, page 9).
   b. Make sure that the power supply is set for the proper voltage (see Electrical Connections, page 7).
   c. Connect the input power cable (or close the main disconnect switch) to supply power to the system.

Connect Work Cable

3. Check for a solid work cable connection to the workpiece.

Check Gas Supply

4. Select desired gas (air or nitrogen). Make sure gas sources meet pressure and flow requirements (see Gas Connections, page 11). Check connections and turn gas supply on.

Purge the System (Gas Pre-Flow)

5. Move the ON / OFF switch to ON position. When the unit is switched on, an automatic 20-second pre-flow gas purge will remove any moisture that may have accumulated in the torch and leads while the system was shut down. The torch cannot be activated during pre-flow. After 20 seconds, if the RUN / SET switch is in SET position, gases will flow. If the RUN / SET switch is in RUN position, there will be no gas flow.

Select Output Current

6. Select the desired current output level (15 to 35 amps).

Set Operating Pressure

7. Move the RUN / SET switch to SET position. Adjust the gas pressure to 70 psi (4.8 BAR).
8. Set the RUN / SET switch to RUN position.

The system is now ready for operation.

3.3 SEQUENCE OF OPERATION

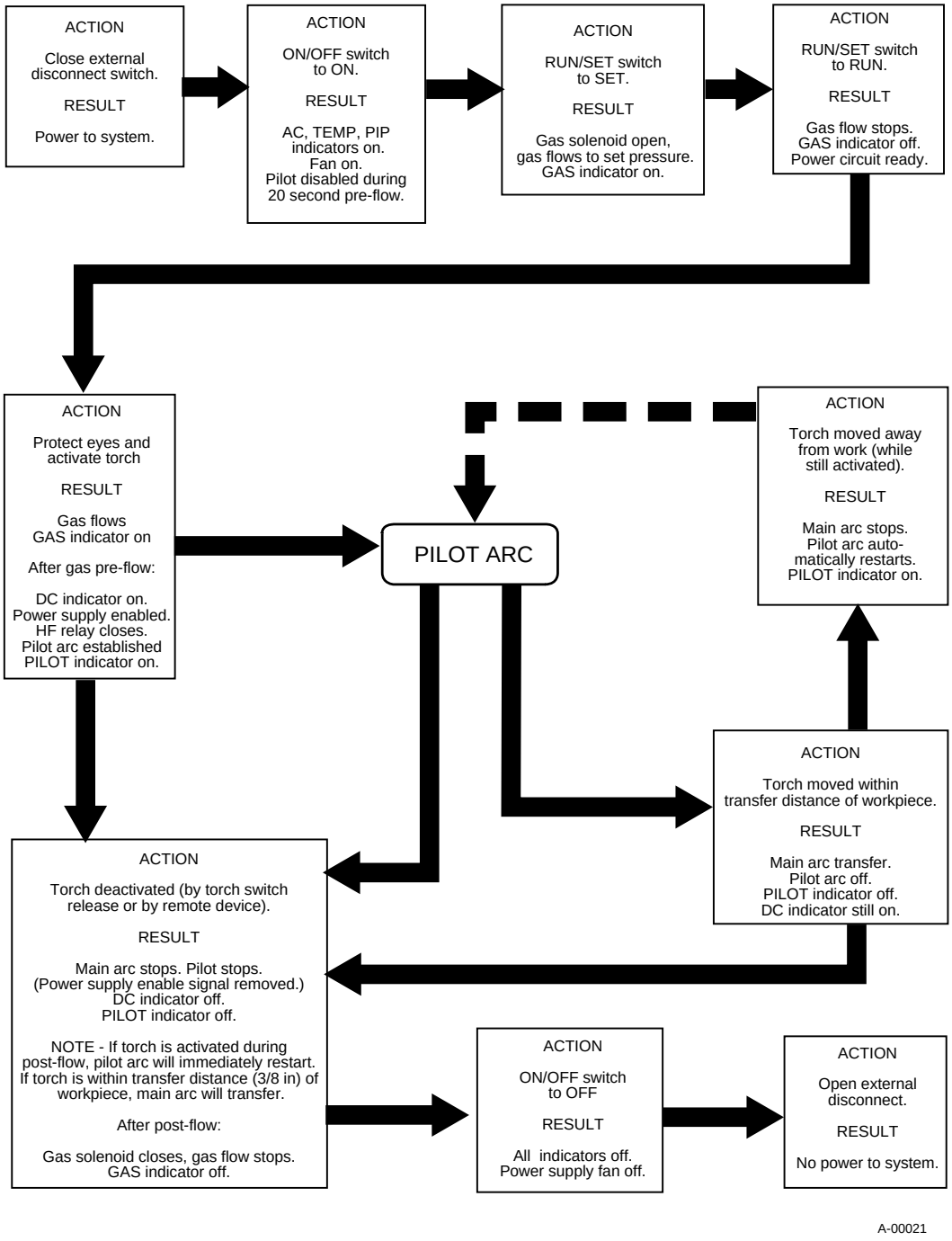


Figure 3-B Sequence of Operation

3.4 OPERATING THE SYSTEM

WARNING	Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

WARNING	Frequently review the Important Safety Precautions (page *ii*). Be sure the operator is equipped with proper gloves, clothing, eye and ear protection. Make sure no part of the operator's body comes into contact with the workpiece while the torch is activated.

CAUTION	Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.
NOTE	Handle torch leads with care and protect them from damage.
Piloting	Piloting is harder on parts life than actual cutting because the pilot arc is directed from the electrode to the tip rather than to a workpiece. Whenever possible, avoid excessive pilot arc time to improve parts life.
Torch Standoff	Improper standoff (the distance between the torch tip and workpiece) can adversely affect tip life as well as shield cup life. Standoff may also significantly affect the bevel angle. Reducing standoff generally results in a more square cut. A specially designed shield cup attachment is available for drag cutting, which allows the operator to keep the torch in contact with the workpiece during operation. Drag cutting also requires special cutting tips.
Edge Starting	For edge starts, hold the torch perpendicular to the workpiece with the front of the tip on the edge of the workpiece at the point where the cut is to start. When starting at the edge of the plate, do not pause at the edge and force the arc to "reach" for the edge of the metal. Establish the cutting arc as quickly as possible.
Direction of Cut	In the PCH / M-35 torch, the plasma gas stream swirls as it leaves the torch. The purpose of the swirl is to maintain a smooth column of gas. The swirl effect results in one side of a cut being more square than the other. Viewed along the direction of travel, the right side of the cut is more square than the left.
Dross	If dross is present on carbon steel, it is commonly referred to as either "high speed, slow speed, or top dross". Dross present on top of the plate is normally caused by too great a torch to plate distance. Top dross is normally very easy to remove and can often be wiped off with a welding glove. Slow speed dross is normally present on the bottom edge of the plate. It can vary from a light to heavy bead, but does not adhere tightly to the cut edge, and can be easily scraped off.

Dross (continued)

High speed dross usually forms a narrow bead along the bottom of the cut edge and is very difficult to remove. When cutting a troublesome steel, it is sometimes useful to reduce the cutting speed to produce slow speed dross. Any resultant cleanup can be accomplished by scraping, not grinding.

Common Cutting Faults	
Problem	**Possible Cause**
Insufficient Penetration	1. Cutting speed too fast 2. Torch tilted too much 3. Metal too thick 4. Worn torch parts 5. Cutting current too low
Main Arc Extinguishes	1. Cutting speed too slow 2. Torch standoff too high from workpiece 3. AC line too low - reduce output current 4. Work cable disconnected 5. Worn torch parts
Excessive Dross Formation	1. Cutting speed too slow (bottom dross) Easily removed 2. Cutting speed too fast (bottom dross) Tight bead, Difficult to remove 3. Torch standoff too high from workpiece (top dross) Easily removed 4. Worn torch parts 5. Improper cutting current
Short Torch Parts Life	1. Oil or moisture in air source 2. Exceeding system capability (material too thick) 3. Excessive pilot arc time 4. Air flow too low (incorrect pressure) 5. Improperly assembled torch

Table 3-C Common Causes of Operating Problems

3.5 RECOMMENDED CUTTING SPEEDS

Recommended Cutting Speeds

Cutting speed depends on material, thickness, and the operator's ability to accurately follow the desired cut line. The following factors may have an impact on system performance:

- Torch parts wear
- Air quality
- Line voltage fluctuations
- Torch standoff height
- Proper work cable connection

NOTE This information represents realistic expectations using recommended practices and well-maintained systems. Actual speeds may vary up to 50% from those shown.

Thickness (Inches)	Tip (Cat. No.)	Gas(es)	Voltage (Volts)	Amperage (Amps)	Speed (Per Minute) (Inches)	(Meters)	Standoff (Inches)
1/16	9-6500	Air	97	35	260	6.6	1/8
1/8	9-6500	Air	102	35	75	1.9	1/8
1/4	9-6500	Air	108	35	45	1.1	1/8
3/8	9-6500	Air	115	35	22	0.6	1/8
1/2	9-6500	Air	120	35	12	0.3	1/8

Table 3-D PCM-35 Cutting Speeds - Air Plasma on Mild Steel

Thickness (Inches)	Tip (Cat. No.)	Gas(es)	Voltage (Volts)	Amperage (Amps)	Speed (Per Minute) (Inches)	(Meters)	Standoff (Inches)
1/16	9-6500	Air	100	35	250	6.6	1/8
1/8	9-6500	Air	118	35	100	1.9	1/8
1/4	9-6500	Air	124	35	25	1.1	1/8
3/8	9-6500	Air	130	35	15	0.6	1/8
1/2	9-6500	Air	136	35	5	0.3	1/8

Table 3-E PCM-35 Cutting Speeds - Air Plasma on Aluminum

Thickness (Inches)	Tip (Cat. No.)	Gas(es)	Voltage (Volts)	Amperage (Amps)	Speed (Per Minute) (Inches)	(Meters)	Standoff (Inches)
1/16	9-6500	Air	110	35	250	6.6	1/8
1/8	9-6500	Air	112	35	75	1.9	1/8
1/4	9-6500	Air	114	35	20	1.1	1/8
3/8	9-6500	Air	117	35	10	0.6	1/8
1/2	9-6500	Air	124	35	7	0.3	1/8

Table 3-F PCM-35 Cutting Speeds - Air Plasma on Stainless Steel

NOTE: Speed performance shown for the 9-6500 Tip is the same as the 9-6000 Tip

SECTION 4: CUSTOMER/OPERATOR SERVICE

4.1 GENERAL POWER SUPPLY MAINTENANCE

Routine Maintenance

The only routine maintenance required for the power supply is a thorough cleaning and inspection, with the frequency depending on the usage and the operating environment.

WARNING

Disconnect primary power to the system before disassembling the torch, leads, or power supply.

CAUTION

Do not blow air into the power supply during cleaning. Blowing air into the unit can cause metal particles to interfere with sensitive electrical components and cause damage to the unit.

To clean the unit, open the enclosure (see Service Procedures. page 35) and use a vacuum cleaner to remove any accumulated dirt and dust. The unit should also be wiped clean. If necessary, solvents that are recommended for cleaning electrical apparatus may be used.

4.2 POWER SUPPLY TROUBLESHOOTING

Troubleshooting and repairing the Pak Master 50 power supply is a process which should be undertaken only by those familiar with high voltage high power electronic equipment.

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

Basic and Advanced Troubleshooting

Two levels of troubleshooting are covered in the troubleshooting guide. The first (basic) level of troubleshooting are those which can be performed without special equipment or knowledge, and without removing the plastic enclosure from the unit. The second (advanced) level of troubleshooting provides procedures for replacing components and subassemblies which will allow the technician with a few common tools to remove the plastic enclosure and analyze some failures.

NOTE

Advanced troubleshooting steps are marked with an asterisk (*).

If major complex subassemblies are faulty, the unit must be returned to an authorized service center for repair.

4.2 POWER SUPPLY TROUBLESHOOTING (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. AC indicator not lit.	1. Input power not properly connected to input panel	1. Check that input power is present and properly connected (see Electrical Connections, page 9)
	2. Input power selection does not correspond to actual input voltage	2. Check actual line voltage vs. voltage selection on rear panel (see Electrical Connections, page 7)
	3. Input fuse blown	3. Check fuse on rear panel. If blown, doublecheck voltage selection and replace fuse. If fuse blows again, return unit to an authorized service station
	4. Faulty LDD PC board*	4. Check and replace if necessary (see Service Procedures, page 42)
B. AC indicator lit. TEMP indicator red	1. Unit is overheated	1. Make sure the unit has not been operated beyond 70% duty cycle limit
	2. Fan not running (or airflow obstructed)	2. Check for obstructed air flow (see Service Procedures, page 43)
	3. Faulty LDD board*	3. Check and replace if necessary (see Service Procedures, page 42)
C. AC indicator lit, TEMP indicator green, PIP indicator not lit	1. Torch not properly connected to power supply	1. Check that quick disconnect is properly attached
	2. Shield cup not properly installed on torch	2. Check that shield cup is fully seated against torch head (do not overtighten)
	3. Faulty PIP assembly in torch holder	3. Check PIP assembly
	4. Faulty pins inside torch quick disconnect	4. Check for continuity between pins 1 and 6. Check that pins in either half of quick disconnect are not pushed back.

4.2 POWER SUPPLY TROUBLESHOOTING (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
C. (continued)	5. Faulty LDD board*	5. Check and replace if necessary. See Service Procedures (page 42)
D. AC indicator lit, TEMP indicator green, PIP indicator lit, GAS indicator not lit	1. Gas not connected or pressure too low	1. Check source for at least 70 psi (4.8 BAR). In SET position, adjust gas pressure to 70 psi
	2. Faulty pressure switch*	2. Check and replace if necessary. See Service Procedures (page 42)
	3. Faulty regulator*	3. Check and replace if necessary. See Service Procedures (page 42)
	4. Faulty LDD board*	4. Check and replace if necessary. See Service Procedures (page 42)
E. When power is applied to unit, GAS indicator remains lit for more than 20 seconds	1. RUN / SET switch in SET position	1. Set switch to RUN position
	2. Faulty LDD board*	2. Check and replace if necessary. See Service Procedures (page 42)
	3. Faulty solenoid*	3. Check and replace if necessary. See Service Procedures (page 42)
F. Torch will not pilot when torch switch is activated	1. Switch activated during 20 second pre-flow	1. Release switch and wait at least 20 seconds before activating switch again
	2. Faulty torch parts	2. Inspect torch parts and replace if necessary
	3. Gas pressure too high	3. Set pressure to 70 psi (4.8 BAR)
	4. Faulty high frequency trigger circuit*	4. Check spark gap assembly

4.2 POWER SUPPLY TROUBLESHOOTING (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
G. DC indicator not lit when torch switch is activated	1. Switch activated during 20 second pre-flow	1. Release switch and wait at least 20 seconds before activating switch again
	2. DC output not present*	2. Check DC output
H. Torch pilots but does not cut	1. Torch too far from workpiece	1. Hold torch 1/8-3/8 inch (3-9 mm) from workpiece
	2. Work lead not connected	2. Make sure work lead is connected securely (check continuity if necessary)
	3. Power supply not sensing transfer current*	3. Check D23 indicator on LDD board. If not lit, send unit to an authorized service center
I. Torch cuts but not adequately	1. Current set too low	1. Increase current setting
	2. Torch is being moved too fast across workpiece	2. Reduce cutting speed
	3. Excessive oil or moisture in torch	3. Hold torch 1/8 inch (3 mm) from clean surface while purging and observe oil or moisture buildup (do not activate torch)
J. No Current control using front panel pot	1. Bad CSD relay on LDD board	1. Try adjusting output using CSD pot through front panel
K. Poor tip life	1. K1 relay on Pilot board not working properly	1. Check D9 on Pilot board. If it is not on when cutting, replace the Pilot board (see page 44)

4.3 ADVANCED TROUBLESHOOTING AND TESTING

If the problem cannot be solved by the basic (external) trouble-shooting guide, the power supply enclosure will have to be removed. If the technician does not have the proper training or equip[ment to prcoeed with this Section, send the unit to an authorized service center for repair.

Tools Required

Digital Volt-Ohmmeter

Never open the power supply enclosure unless the primary input power to the system is disconnected from the source.

Opening the Enclosure

To remove the enclosure:

1. Remove the five screws at the top of the unit and the three screws at the bottom which hold the two halves of the enclosure together. Save all the screws, nuts and lockwashers for reassembly.
2. With the unit in an upright position, carefully separate the two halves of the enclosure.

Leave the input power source disconnected from the unit during the visual inspection.

3. Visually inspect the inside of the power supply. The high levels of power present in the unit can cause burning or arcing of components and PC boards when a failure occurs. Carefully inspect all components on the base (bottom) panel and the pilot and FET PC boards. Look in particular for the following:
   - Loose or broken wires or connectors
   - Cracked or broken cores on the high frequency magnetics T3, L4, and L6 .
   - Burned or scorched parts or wires or evidence of arcing
   - Any accumulation of metal dust or filings which may have caused shorting or arcing

4.3 ADVANCED TROUBLESHOOTING (continued)

If any parts are damaged, they must be replaced. Listed here are the subassemblies which are replaced if they are seen to be damaged or if they are found to be faulty. If other subassemblies are obviously damaged, or if the problem cannot be located, the unit must be returned to an authorized service center.

Input Bridge Rectifiers (BR1, BR2, BR3)
Input Capacitor Boards
Main FET Heatsink Assembly
Main Transformer (T3)
Pilot Inductor (L4)
Work Lead Inductor (L7)
Main Output Choke (L6)
Auxiliary Transformer (T1)
High Frequency Transformer (T2)
Spark Gap Assembly
Air Core Inductor (L5)
Solenoid / Regulator / Gauge Assembly
LDD PC Board Assembly
Fan Assembly

If the visual inspection shows any parts that are burned or scorched, it is an indication that something has gone wrong in the major power processing portions of the unit. Do not attempt to repair the burned portion and re-apply power or more serious damage to the unit may occur. Instead, return the unit to an authorized service repair center.

The following tests should be performed with no input power connected to the unit:

Remove one wire from power resistor R1 and one from R2. These are located on the underside of the middle panel adjacent to the FET board assembly. With a digital volt-ohmmeter (DVM), measure the resistance of each of these resistors. Each should measure 6k ohms (±5%). Then measure the resistance of each cap bank A and B. This is done by connecting the positive (+) lead of the meter to terminal E1 or E1A of cap bank A and the negative (-) lead of the meter to terminal E2 or E2A. As the cap bank charges, the meter reading should increase to greater than 100k ohms. Repeat for the B cap bank.

If these meter readings are not greater than 100k ohms, there is a problem with the major power processing circuits in the unit and it should be returned to an authorized service center.

If readings are greater than 100k ohms, replace the wires which were removed from R1 and R2 and proceed.

4.3 ADVANCED TROUBLESHOOTING (continued)

The following table is a guide for analyzing problems and making repairs to the unit.

At this point, make sure the input power selection connectors are plugged in correctly as in Section 2.2 and apply input power to the unit. If at any point electrical arcing, parts smoking or burning, or unknown noises occur, immediately disconnect input power and return the unit to an authorized service center.

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

Once power is applied to the unit, there are extremely hazardous voltage and power levels present. Do not touch any live parts and do not attempt to measure voltages on the output side of the high frequency transformer (T2) or at the spark gap assembly. The AC switch in the upper left corner of the front panel only turns control power on and off. There are hazardous voltages present whenever input power is connected to the unit regardless of the position of the ON / OFF switch.

4.3 ADVANCED TROUBLESHOOTING (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. No front panel LED indicators lit	1. ON / OFF switch OFF	1. Turn ON / OFF switch to ON position
	2. AC from control transformer T1 not present (blown fuse, incorrect voltage selection, or faulty control transformer)	2. Slide plastic cover off top of connector J1 on LDD board. Measure 18 VAC from J1-6 to J1-9 and the same from J1-7 to J1-9. If 18 VAC is not present: a. check fuse b. check for proper voltage selection c. check T1 connectors If still no voltage, replace control transformer T1.
	3. Faulty LDD board	3. Replace LDD board
B. AC indicator lit, TEMP indicator red	1. Unit is overheated	1. Allow time for unit to cool.
	2. Faulty LDD board	2. If TEMP indicator is still red after unit has cooled, replace LDD board
	3. Shorted thermal sensor on FET or pilot assembly	3. Return unit to authorized service center
C. AC indicator lit, TEMP indicator green. PIP indicator not lit	1. Torch not properly connected or shield cup not in place	1. Check torch quick disconnect and torch parts for proper assembly
	2. Faulty pins in torch quick disconnect	2. With power off, check continuity between J1-17 and J1-18. If no continuity check PIP wires.
	3. Faulty LDD board	3. Measure voltage between J1-17 and J1-18. If less than 1 volt, replace LDD board.
	4. Faulty wiring to torch or torch connector	4. Check wiring to torch and torch connector from J1-17 and J1-18 to Quick Disconnect (QD).

4.3 ADVANCED TROUBLESHOOTING GUIDE (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
D. AC indicator on, TEMP indicator green, PIP indicator on. GAS indicator not lit	1. Insufficient gas pressure	1. Check gas connections. Set regulator to at least 50 psi
	2. Faulty pressure switch	2. Check for 0 VDC between terminals J1-11 and J1-12. If voltage is greater than 1 VDC, replace solenoid / regulator / gauge assembly
	3. Faulty LDD board	3. If voltage between terminals J1-11 and J1-12 is less than 1 VDC, replace LDD board
E. Fan does not turn	1. Air flow obstructed	1. Check for obstructions.
	2. Faulty fan	2. Remove input power from unit. Remove terminals from fan and check for 120 VAC on terminals with input power reapplied.If 120 VAC is present, replace fan.

Apply input power to the unit. If the AC, TEMP (green), PIP, and GAS indicators are all lit, then proceed. The GAS indicator should go out when the 20 second gas pre-flow is complete.

SYMPTOM	POSSIBLE CAUSE	REMEDY
F. GAS indicator does not go out after 20 second pre-flow	1. RUN / SET switch in SET position	1. Make sure RUN / SET switch is in RUN position
	2. Gas solenoid stuck open.	2. Replace solenoid (or clean) if gas flows with power on / off switch off.
	3. Faulty LDD board or wiring	3. Check for 15 VDC on gas switch terminals (see Figure 6-D). If 15 VDC is present, replace LDD board (see Section 6.4). If no 15 VDC, check LDD wires and connection terminals

4.3 ADVANCED TROUBLESHOOTING GUIDE (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
G. Two seconds after activating torch, DC indicator does not come on	1. Faulty LDD board	1. Replace LDD board
	2. Faulty FET or pilot PC board	2. Check for 300 VDC ±10% between terminal E1 and E2 of capacitor PC board A. Repeat for cap board B. If 300 VDC is present, FET or pilot PC board is faulty.
	3. Faulty connections or wiring	3. If 300 VDC is not present on either side check wiring and connections between input block and bridges BR1-BR3 on FET and pilot boards. If no wiring problem is found or if voltages on cap boards A and B are unbalanced by more than 4 VDC, or D51 is lit on the LDD board, check the 6K pwr resistors (near rear under heatsinks) If OK, replace LDD board.
H. After activating torch switch, DC indicator comes on but no pilot arc	1. No spark at spark gap (faulty transformer T2 or LDD board)	1. Observe spark gap when activating torch . If no spark is evident, check for 120 VAC between J18-1 and J18-3 when the torch is activated. If 120 VAC is present, replace T2. If 120 VAC is not present, replace LDD board. DO NOT ATTEMPT TO MEASURE ANY VOLTAGES AT THE SPARK GAP ASSEMBLY
	2. Faulty torch or torch parts	2. If spark is visible when torch is acticvated, check torch parts or replace torch if necessary.

4.3 ADVANCED TROUBLESHOOTING GUIDE (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
I. Intermittent pilot arc	1. Worn torch parts	1. Check and replace torch parts if necessary
	2. Low input voltage	2. Measure actual input voltage. Low input voltage levels may cause 'sputtering' pilot but should not affect main arc transfer and cutting operation if within recommended voltages ranges.

4.4 SERVICE PROCEDURES

This section explains how to remove and replace any of the replaceable subassemblies listed in the Troubleshooting Guide.

WARNING Disconnect primary power to the system before disassembling the torch, leads, or power supply.

Opening the Enclosure

There are eight mounting screws with nuts which secure the enclosure. Lay the power supply on its side with the mounting screw heads facing up. Remove the mounting screws and carefully lift the upper enclosure half from the chassis.

Power Component Service

If a main power supply failure is suspected, it is important to test the input bridge rectifiers, main filter capacitors, and main FET switching assembly. Typically a failure of one of these components will result in the failure of one of the other.

The first three procedures in this section are meant to be done as a group.

4.4 SERVICE PROCEDURES (continued)

Input Bridge Rectifiers

If the mains circuit breaker has tripped or fuses blown, the input bridge rectifiers must be tested. If any are found to be failed, all three must be replaced.

Testing Bridges

Refer to Figure 4-A. and locate BR2 and BR3 on the left hand side of the unit. BR1 is located on the right hand side of the unit. Set the digital volt meter to the diode voltage drop range.

NOTE

All Measurements are made with the input wires attached to bridge rectifier terminals. DO NOT bend terminals or remove wires to test. This may weaken the diode and result in failure.

Each bridge rectifier (BR1, BR2, and BR3) should read the same.

Terminal	Reading
- to AC	≈ .4v
- to AC	≈ .4v
+ to AC	≈ .4v
+ to AC	≈ .4v
- to +	≈ .7v

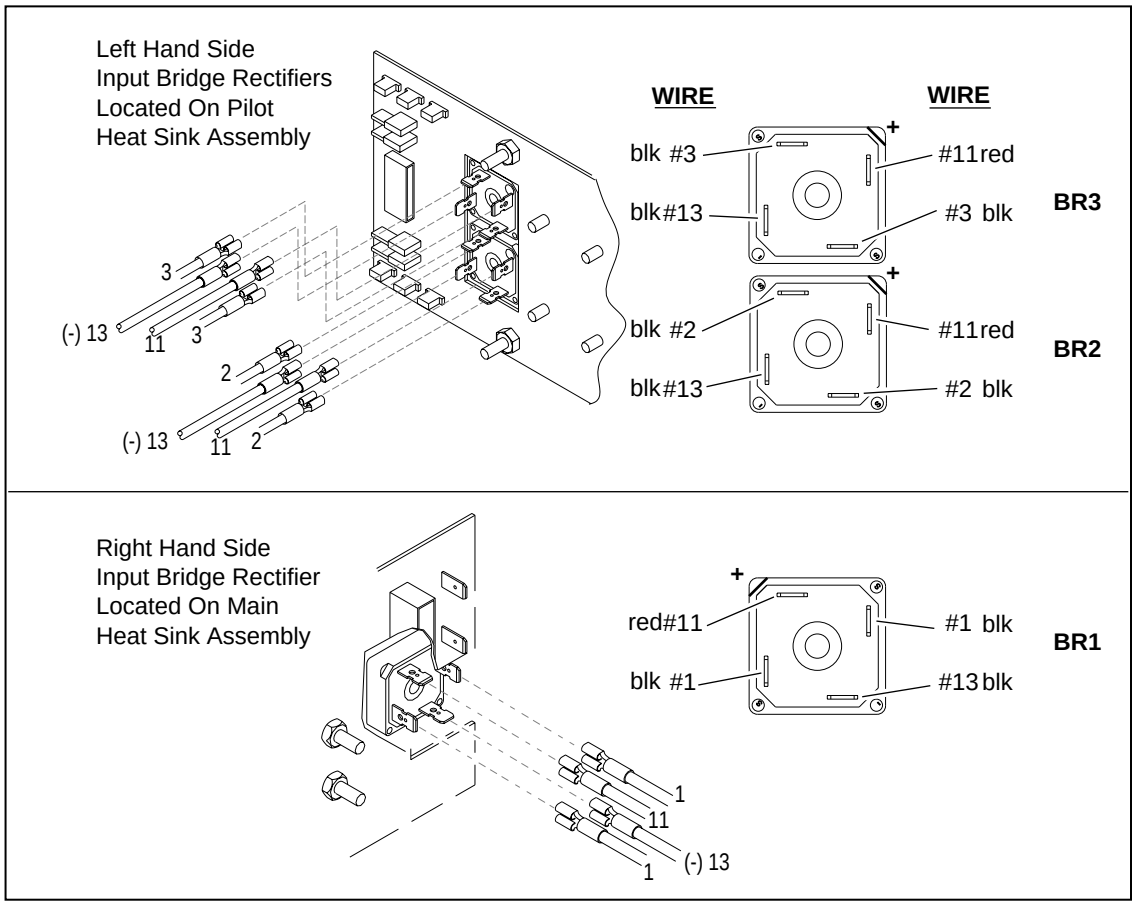


Figure 4-A Input Rectifier Terminals

4.4 SERVICE PROCEDURES (continued)

Replacing Bridge Rectifiers

Replacement input rectifier kits include three sets of bridge rectifiers with new thermal pads and mounting hardware. When replacing the input rectifiers observe the following:

1. Take extra care not to bend the rectifier terminals. Push the connectors on with a single, firm, straight push. Do not wiggle the connector as it is pushed on.
2. There should be no strain on the rectifier terminals. One AC input wire is longer than the other, wire accordingly.
3. Use a new insulator pad between the heatsink and bridge rectifier. Be sure both surfaces are clean and smooth before mounting replacement rectifier.
4. Use a star washer between the screw head and the rectifier. Cover the screw head with RTV (silicon caulk) to prevent electrical arcing.

Input Capacitor Boards

Two input filter capacitor boards are mounted to the main FET heatsink assembly. Both capacitor boards must be replaced if one is found to have failed or is suspect.

NOTE

Proper measurement of the capacitor boards requires the use of a capacitance meter. If the capacitor boards can not be tested, and the input rectifiers or main FET assembly are failed, replace the capacitor boards as well.

Be sure that the voltage selection plug is set for HIGH (380-460v).

1. Each capacitor board should measure ≈ 1,100μf between E1 and E2.
2. D1, D2, and D3 on each capacitor board must also be tested. Scrape away a small amount of conformal coat from the diode leads to make these measurements. With the digital voltmeter set to the diode drop range D1 and D2 should read ≈ 1.0v, D3 should read ≈ 0.4v.

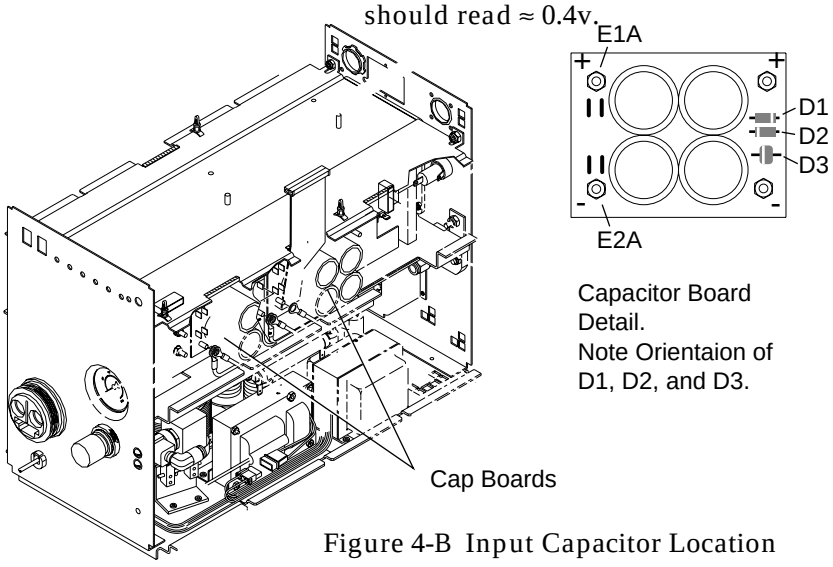


Figure 4-B Input Capacitor Location

Main FET Heatsink Assembly

If the input bridge rectifiers or capacitor boards are found to be faulty, the main FET heatsink assembly must be checked as well.

Refer to Figure 4-C. and locate the main FET heatsink assembly on the right hand side of the unit. Set the digital volt meter to the diode voltage drop range.

Make the following measurements to each capacitor board.

Terminal	Reading
E8 to E1A (cap Bd. B)	≈ .4v
E9 to E2A (cap Bd. B)	≈ .4v
E10 to E1 (cap Bd. A)	≈ .4v
E11 to E2 (cap Bd. A)	≈ .4v

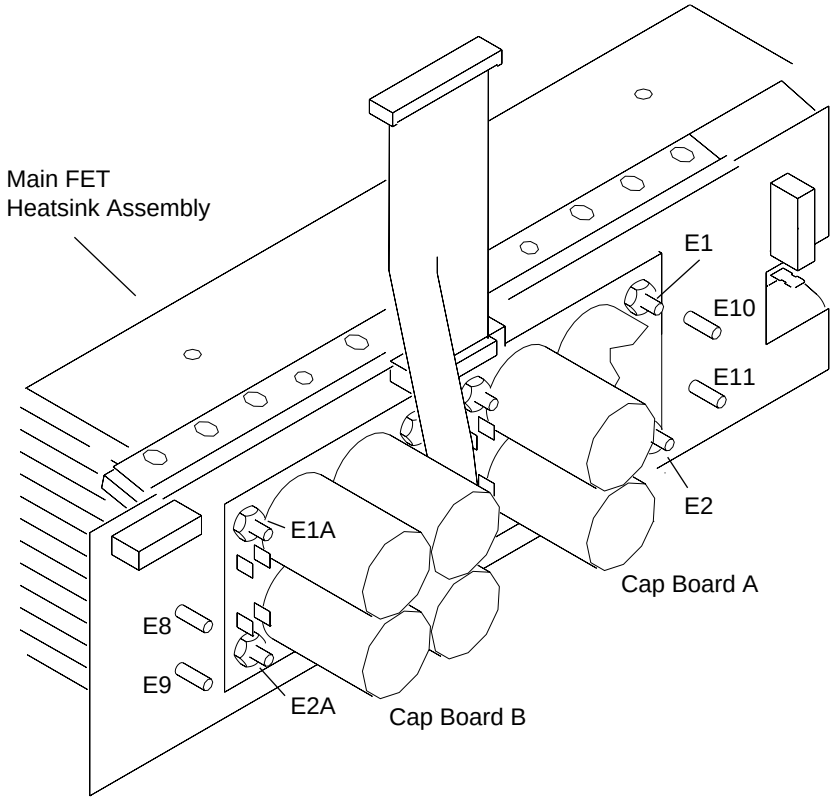


Figure 4-C Main FET Heatsink Assembly

NOTE

Replacement main FET heatsink assemblies come complete with both input capacitor boards and input bridge rectifier.

When replacing the FET heatsink assembly, keep the ribbon cables and wires recessed in the panels to avoid pinching in the case.

Main Transformer (T3)

The only reason the main transformer should be replaced is if the cores are cracked due to shipping damage or the unit being dropped. Minor chips are normal. If any burning or arcing is visible on the main transformer, return the unit to an authorized service center.

To remove the transformer:

1. Remove the four mounting nuts on the FET board and the four mounting nuts on the pilot board which fasten the Blk and Wht wire or flat copper transformer leads to the PC boards.
2. Remove current sensor plugs from pilot (and LDD if present) PC boards.
3. Remove the four screws which hold the mounting plate to the bottom chassis.

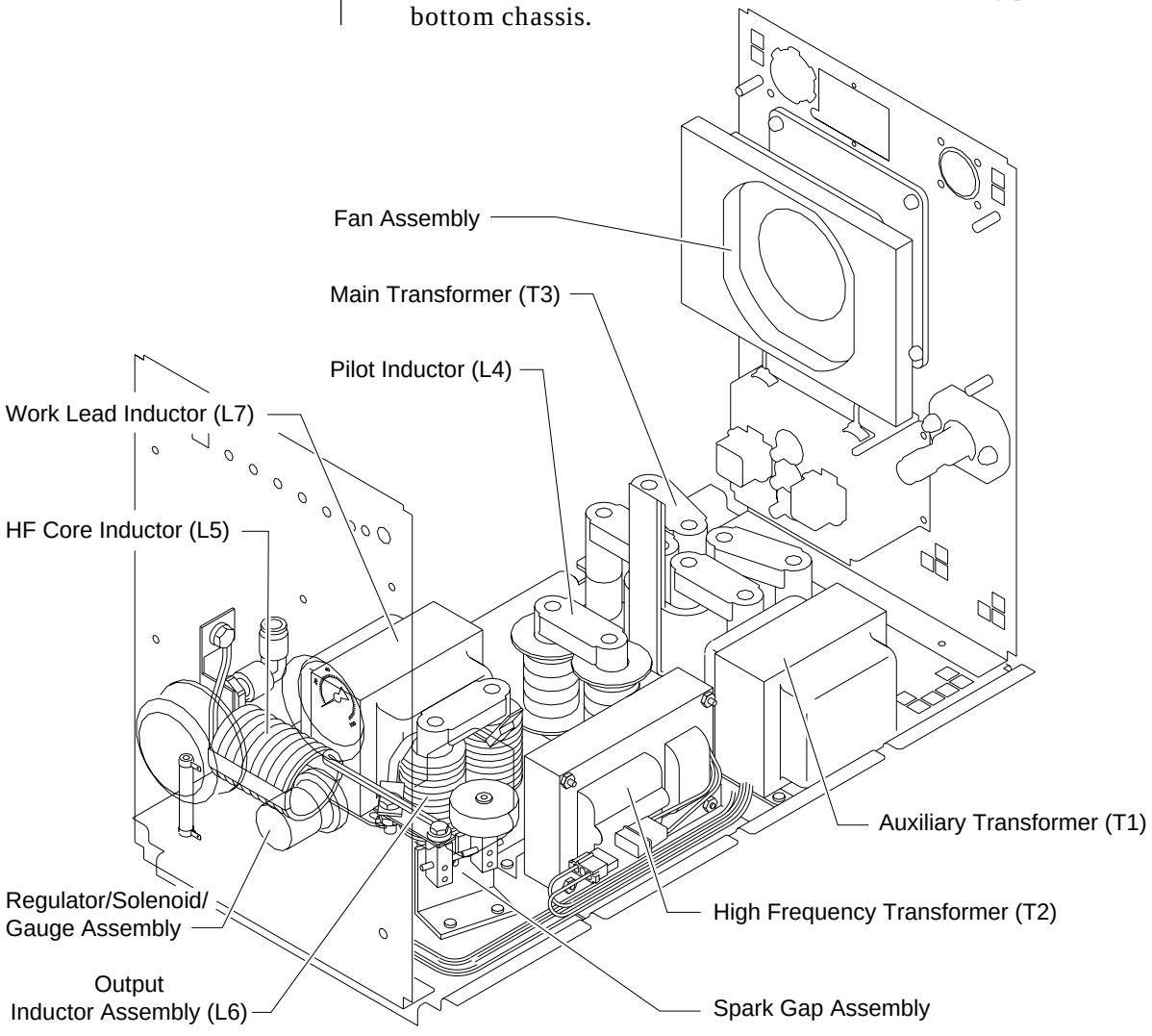


Figure 4-D Base Panel Component Locations

4. Carefully remove the transformer from the unit.
5. Install the replacement transformer by reversing the above procedure. If the transformer has flat copper leads, make sure the leads do not twist so that one could short against another.

Pilot Inductor (L4)

The only reason the pilot inductor should be replaced is if the cores are cracked due to shipping damage or the unit being dropped. Minor chips are normal. If any burning or arcing is visible on the pilot inductor, return the unit to an authorized service center.

To remove the pilot inductor:

1. Disconnect the wire from one lead of the pilot inductor and the connecting copper link from the other lead.
2. Turn the unit on its side to access the two mounting nuts and lockwashers which attach it to the chassis. Remove the inductor from the unit.
3. Install the replacement inductor by reversing the above procedure. To avoid damaging the core of the replacement inductor, do not force it into place.

Work Lead Inductor (L7)

The work lead inductor has a core of steel laminations and should never need replacing. If any burning or arcing is visible on the work lead inductor, return the unit to an authorized service center.

Main Output Inductor (L6)

The only reason the main output inductor should be replaced is if the cores are cracked due to shipping damage or the unit being dropped. Minor chips are normal. If any burning or arcing is visible on the output inductor, return the unit to an authorized service center.

To remove the main output choke :

1. Remove the hardware which connects the lead wire on one terminal and the copper link on the other terminal.
2. Turn the unit on its side and remove the two mounting nuts and lockwashers which secure the main output choke to the bottom chassis. Remove the component from the unit.
3. Install the replacement main output choke by reattaching the mounting and terminal hardware.

4.4 SERVICE PROCEDURES (continued)

Auxiliary Transformer (T1)

To replace the auxiliary transformer:

1. Disconnect the single pin connector on the white wire coming from the auxiliary transformer.
2. Using a pin removal tool, remove the pins from connectors J14-A, J14-B, and J14-C on the voltage selection panel.
3. Disconnect the secondary wires by unplugging the J15 connector from the auxiliary transformer.
4. Removing the four mounting screws and washers and remove the auxiliary transformer from the unit.
5. Install the replacement transformer on the bottom chassis panel. Reattach the J15 connector. Connect the brown wire to the top connector on the voltage selection panel, connect the orange wire to the middle connector, and connect the black wire to the lower connector. Connect the white wire to the free hanging single pin connector.

High Frequency Transformer (T2)

To replace the high frequency transformer:

1. Disconnect the two high voltage leads from the spark gap assembly.
2. Unplug the J18 connector.
3. Remove the four mounting screws.
4. Install the replacement HF transformer on the bottom chassis. Plug in the J18 connector and replace the high voltage leads to the spark gap assembly.

Spark Gap Assembly

To replace the spark gap assembly:

1. Disconnect wires and remove the two mounting screws. Remove the spark gap assembly from the unit.
2. Install the replacement spark gap assembly.
3. Connect the wiring.
4. With a feeler gauge, check the gap between the two electrodes. The gap should be .035 inches. Adjust if necessary and tighten set screws.

HF Inductor (L5)

There should be no reason to replace the HF inductor unless it somehow gets bent so it interferes with other components or the chassis. To replace the HF inductor:

1. Disconnect the HF inductor from the spark gap assembly and the torch connecting lug. Keep it away from other components and sheet metal as it has very high voltages on it, and it can emit electrical interference into critical circuitry.
2. Install a replacement HF inductor and connect.

4.4 SERVICE PROCEDURES (continued)

Solenoid/Regulator/ Gauge Assembly

To check the solenoid, measure for 115 VAC between wires 18 and 21. If 115 VAC is present, replace the solenoid:

1. Disconnect the two connecting hoses by pushing the slip ring at the end of each quick disconnect fitting toward the fitting and holding while pulling on the hose.
2. Disconnect the four wires from the pressure switch and solenoid.
3. If present, remove the two mounting screws through the front panel and the regulator nut and remove the assembly.
4. Install a new assembly on the front panel and reattach the hoses by pushing the hose into the fitting until it stops (about 3/8 inch penetration).
5. Reconnect the wires to the pressure switch and solenoid.

Checking the LDD Board

To check the Log/Gate Drive/Display (LDD) PC board assembly, measure for 15-18 VAC from J1-9 to J1-7 and from J1-9 to J1-6. If 15-18 VAC is present, replace the LDD board.

Replacing the LDD Board

Since the LDD board contains no high power circuitry, but does contain all the controlling logic for the unit, many problems could be caused by a faulty board. Never replace the LDD board to try to fix a problem if there is any evidence of burning or arcing anywhere in the unit. When disconnecting or connecting any of the connectors from the board, support the board under the connector to keep from putting too much stress on the board.

To replace the LDD board assembly:

1. Disconnect Jl, J2, J4, J5, and J16 (if present) from the LDD board, gently folding back the harness and ribbon cables out of the way. New LDD boards have no J16. The J16 cable should be removed from the unit when updating to a new LDD board.
2. Remove the mounting screw near the middle of the board.
3. With a small screwdriver loosen the locking screw in the current adjust knob and remove the knob.
4. Gently squeeze the top of the two rear plastic mounting standoffs to release the board. Lift the rear end of the board just enough to clear the locking tabs.
5. Squeeze the tops of the two front standoffs and lift the board enough to clear the locking tabs. By lifting the rear of the board, gently remove it, taking care not to get it caught on the front panel holes for the switches or current control pot.
6. Install new board by tipping the front end of the board down and putting the switches, LED and current control pot

through the front panel openings, and moving the board until the two front mounting holes are over the standoffs.

7. Lower the board onto the four standoffs and screw in the board mounting screw.
8. Reconnect J1, J2, J4, and J5. The connectors all go in one way only except Jl. Make sure J1 is connected so both ends of the cable half of the connector line up with the ends of the board mounted connector.
9. Turn the shaft of the pot all the way clockwise and reattach the knob by tightening the screw with the line on the knob at the straight down position.

Fan Assembly

The fan assembly consists of a rotary fan, an attached spacer plate, and a foam seal. To replace the fan assembly:

1. Remove the LDD board to expose the top panel.
2. Remove the two nuts which hold the input connection block from the top panel. Move the input block and its mounting panel up out of the way.
3. Remove the four nuts which hold the top panel to the front and rear panel and lift the top panel to allow the fan assembly to be removed by lifting it out.
4. Remove the old fan by removing the two wires from the fan terminals and removing the four mounting screws from the rear panel. A small socket wrench or needlenose pliers may be necessary to hold the nuts while removing the screws.
5. Replace with a new fan assembly. Slide the assembly in gently so that the foam seal doesn't catch and seals tightly against the heatsinks.
6. Place the fan guard on the outside of the unit and reinstall the four fan mounting screws and nuts.
7. Connect the two wires back onto the fan terminals (polarity doesn't matter).
8. Put the top panel onto its mounting studs and make sure the studs on the bottom of the panel enter the holes in the top of the heatsinks. Some slight wiggling of the heatsinks may help this alignment. Tighten the panel mounting nuts to just short of fully tight and measure the distance between the middle and top panels. Move the panel slightly until this distance is 4 1/16 inches from the top of the middle panel to the top of the top panel. Tighten the mounting screws the rest of the way. Check this measurement again, because if it is off, you will have difficulty reassembling the enclosure.
9. Install the LDD board and remount the input block to the top panel.

K1 Pilot Relay

D9 indictes the status of K1 pilot relay and is located on the back of the pilot board. In order to view the LED you must use a mirror in behind the heatsink assembly, towards the front of the machine. D9 is lit when the unit is cutting, D9 is off when the unit is piloting.

Reassembling the Enclosure

Before reassembling the power supply enclosure, check that all wire harnesses and ribbon cables fit into the notches in the edge of the top and middle panels so that wires don't get pinched.

1. With the unit in an upright position, tip the unit so that one of the case halves may be slid onto the chassis. Then lift the unit and set it down on the side with the case half down.
2. Before installing the other case half, make sure the edges of the bottom, middle, and top chassis panels are fully inserted into the slots in the case. Look for gaps between the front and rear panels and the edge of the case, and look into the case to see that the notches in the top corners of the front and rear panels are flush against the plastic stops of the case. It may take some lifting and re-settling of the chassis to get this all lined up.
3. Once the chassis is properly aligned in one case half, gently lower the other half onto the other side of the chassis by tipping it slightly so that the top is slightly lower than the bottom. Then push and gently tap down until the two case halves are within l/16 inch. (If you have trouble getting the case halves close enough, remove the top half and check to see that the bottom half is fully engaged and that there are no wires out of place on the top and middle panels.
4. Install the eight screws, lockwashers and nuts to finish the assembly.

SECTION 5: PARTS LISTS

5.1 ORDERING INFORMATION

About the Parts LIst

Ordering Information

Parts listed without item numbers are not shown, but may be ordered by the catalog number shown.

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the description column of the Parts List. Also include the model and serial number of the unit. Address all inquiries to your authorized Thermal Dynamics distributor.

If a Thermal Dynamics product must be returned for service, contact your Thermal Arc distributor. Materials returned to Thermal Dynamics without proper authorization will not be accepted.

5.2 SYSTEM COMPONENTS AND ACCESSORIES

Item No.	Qty.	Catalog Number	Description
Complete systems include power supply with 230V primary power cable, work lead, PCH / M-35 torch with leads, and torch spare parts kit. Machine torch systems include metal mounting tube and pinion assembly and remote pendant control with ON / OFF switch:			
-	1	1-6249	Pak Master 50 with PCH-35 70° Torch and 12.5 ft (3.8 m) Leads
-	1	1-6250	Pak Master 50 with PCH-35 70° Torch and 25 ft (7.6 m) Leads
-	1	1-6251	Pak Master 50 with PCH-35 70° Torch and 50 ft (15.2 m) Leads
-	1	1-6252	Pak Master 50 with PCH-35 90° Torch and 12.5 ft (3.8 m) Leads
-	1	1-6253	Pak Master 50 with PCH-35 90° Torch and 25 ft (7.6 m) Leads
-	1	1-6254	Pak Master 50 with PCH-35 90° Torch and 50 ft (15.2 m) Leads
-	1	1-6255	Pak Master 50 with PCM-35 Machine Torch and 12.5 ft (3.8 m) Leads
-	1	1-6256	Pak Master 50 with PCM-35 Machine Torch and 25 ft (7.6 m) Leads
-	1	1-6257	Pak Master 50 with PCM-35 Machine Torch and 50 ft (15.2 m) Leads
Complete 575V Systems Only:			
Complete 575V systems include power supply with work lead, 575 VAC transformer assembly, PCH / M-35 torch with leads, and torch spare parts kit. Machine torch systems include metal mounting tube and pinion assembly and remote pendant control with ON / OFF switch:			
-	1	1-6260	Pak Master 50(575V) with PCH-35 70° Torch and 12.5 ft Leads
-	1	1-6261	Pak Master 50(575V) with PCH-35 70° Torch and 25 ft Leads
-	1	1-6262	Pak Master 50(575V) with PCH-35 70° Torch and 50 ft Leads
-	1	1-6263	Pak Master 50(575V) with PCH-35 90° Torch and 12.5 ft Leads
-	1	1-6264	Pak Master 50(575V) with PCH-35 90° Torch and 25 ft Leads
-	1	1-6265	Pak Master 50(575V) with PCH-35 90° Torch and 50 ft Leads
-	1	1-6266	Pak Master 50(575V) with PCM-35 Machine Torch and 12.5 ft Leads
-	1	1-6267	Pak Master 50(575V) with PCM-35 Machine Torch and 25 ft Leads
-	1	1-6268	Pak Master 50(575V) with PCM-35 Machine Torch and 50 ft Leads

5.3 FRONT PANEL COMPONENTS

Item No.	Qty.	Catalog Number	Description	Reference Designator
1	1	9-6236	Front Panel	
2	1	9-6207	Regulator / Solenoid Assembly (Refer to Section 5.4 for parts)	
	1	9-5834	Quick Disconnect Replacement Kit - Includes Items 3-6:	
3	1	-	Quick Disconnect Body	
4	1	-	Quick Disconnect Retaining Ring Clip	
5	1	-	Quick Disconnect Body Wave Spring Washer	
6	2	-	Socket Retaining Ring Clip	
7	1	9-6237	RF Filter PC Board Assembly	PCB
8	1	9-6221	Socket Assembly - Plasma	
9	1	8-6332	Socket Assembly - Secondary	
10	2	8-7071	Hole Plug - 1/4	
11	2	9-6240	Bumper, Locking Tab, Signal Connector	
12	1	8-4249	Strain Relief (Work Cable)	
13	1	8-4247	Work Cable with Clamp - 10 ft	
	1	8-5560	Work Cable Clamp	
	1	8-4243	Ground Tag (Not Shown)	

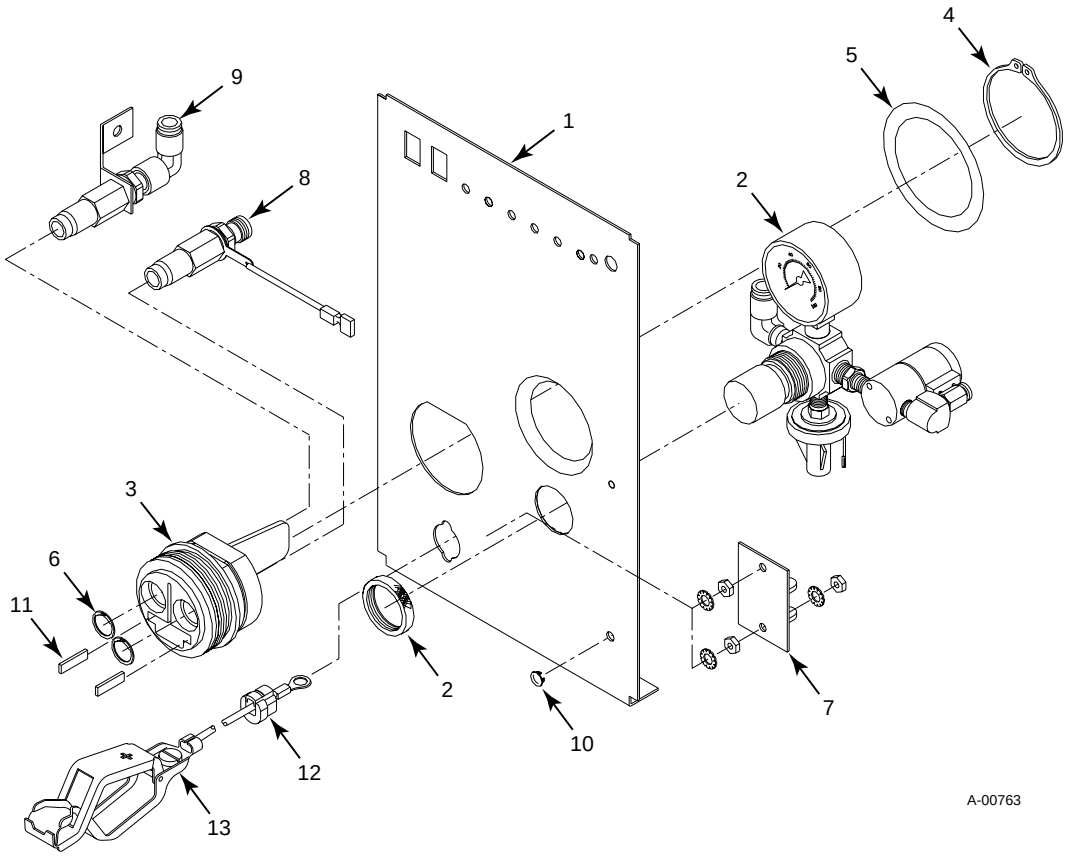


Figure 5-A Front Panel Components

5.4 REGULATOR/SOLENOID ASSEMBLY

Item No.	Qty.	Catalog Number	Description	Reference Designator
	1	9-6207	Regulator/Solenoid Assembly - Includes:	
1	1	8-4382	Regulator	
2	1	8-3370	Solenoid Valve, 1/8 NPT	SOL
3	1	8-5533	Pressure Switch, 42 psi	PS
4	1	8-0354	Fitting - 1/8 NPT Close Nipple	
5	1	8-3369	Street Elbow, 1/4 NPT Female to 1/8 NPT Male	
6	1	9-6220	Gauge - 0-100 PSI/BAR	
7	1	9-6230	Fitting - 1/4 NPT x 3/8 Tube, Straight	
8	1	9-2023	Fitting - 1/4 - 1/8 NPT Reducer	
9	1	9-6219	Fitting - 1/4 NPT x 3/8 Tube 90 Degree	

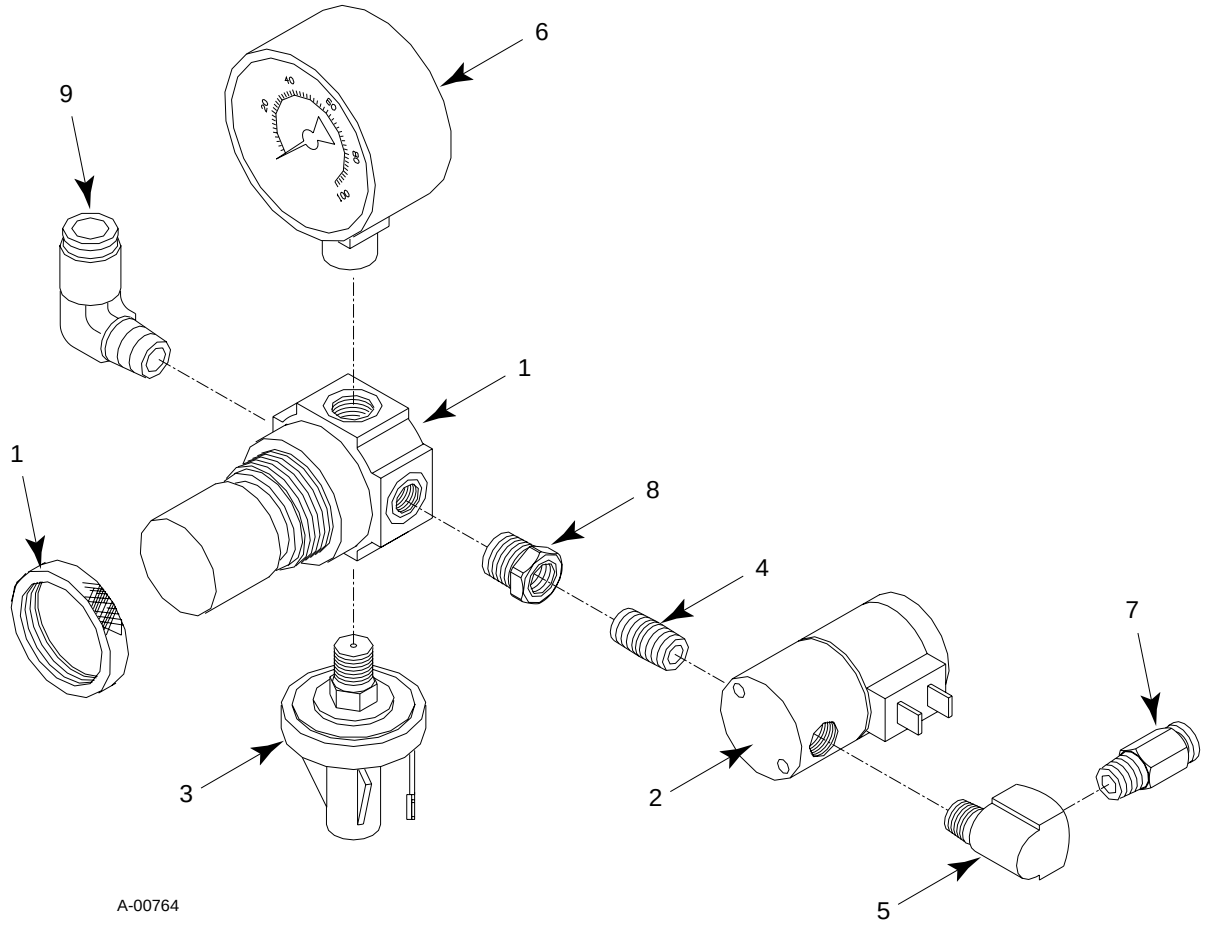


Figure 5-B Regulator/Solenoid Assembly

5.5 BASE PANEL COMPONENTS

Item No.	Qty.	Catalog Number	Description	Reference Designator
1	1	8-2192	Auxiliary Transformer	T1
2	1	9-6202	Work Lead Inductor	L7
3	1	9-6203	Inductor Assembly	L6
4	1	9-5528	High Frequency Transformer Assembly	T2
5	1	9-6205	Spark Gap Assembly	
6	1	9-6229	Single Circuit Receptacle	
7	1	9-6200	Main Transformer	T3
8	1	9-6201	Pilot Inductor Assembly	L4
9	1	9-6213	Base Panel	
10	2	9-3133	Fiber Washer	
11	1	9-6214	Resistor - 10 ohm, 12 watt	R
12	1	8-4281	Male Adaptor	
13	1	9-5770	Disc Capacitor	C
14	1	9-6239	Bracket, Inductor Lead Connection	
15	1	9-6203	HF Inductor Coil	
	1	8-4243	Ground Tag (Not Shown)	

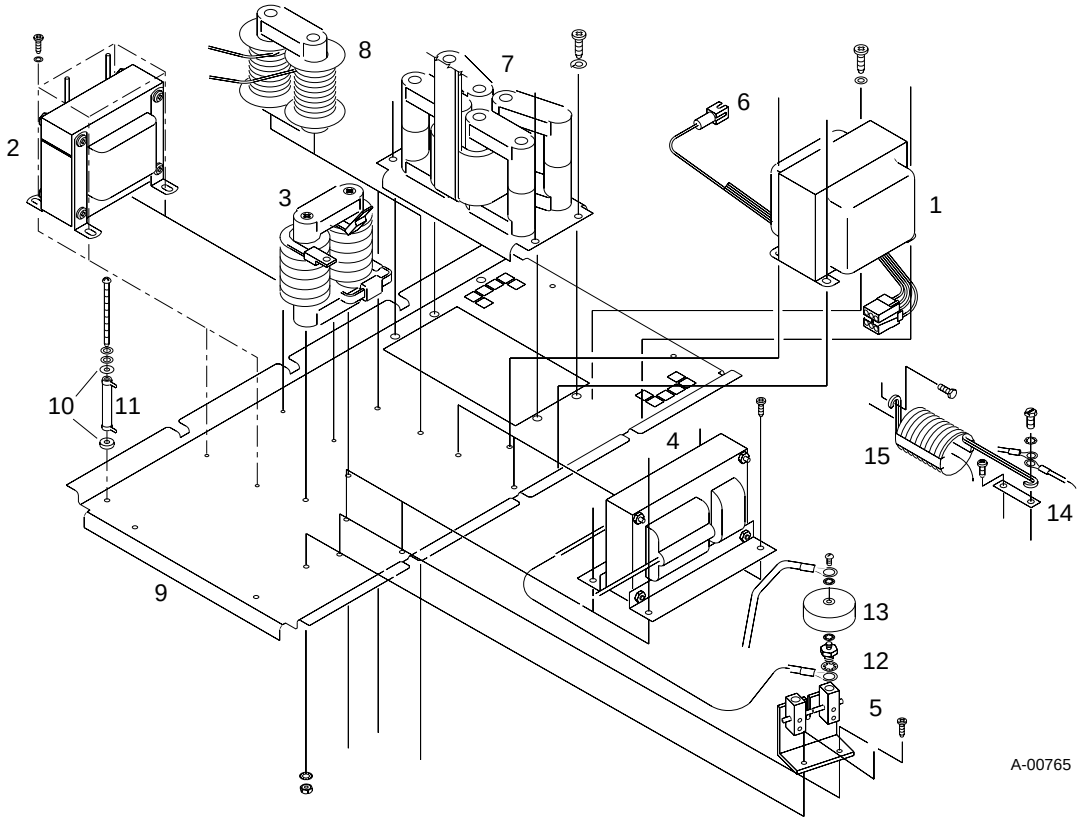


Figure 5-C Base Panel Components

5.6 CHASSIS COMPONENTS

Item No.	Qty.	Catalog Number	Description
1	1	9-6241	Input Voltage Connection Panel
2	1	9-6242	Terminal Block
3	1	9-6217	Pilot PC Board / Heatsink Assembly
4	1	9-6243	Insulator - Input Voltage Block
5	4	8-0381	Rubber Feet
6	1	9-4146	Current Control Knob
7	1	9-6215	FET PC Board / Heatsink Assembly (Tested, with Cap Bds., Rectifier)
8	1	9-6244	Dust Shield - Pilot PC Board
9	1	9-6245	Dust Shield - FET PC Board
10	1	9-6208	LDD (Log / Gate Drive / Display) PC Board Assembly
11	1	9-6248	Ribbon Cable Assembly - 34 Circuit
12	1	9-6249	Ribbon Cable Assembly - Dual 10-20 Circuit
13	1	9-6250	Access Panel - Input Voltage Connection
14	1	9-6251	Access Panel - Voltage Changeover
15	1	9-6252	Vinyl Cap - Torch Quick Disconnect
16	1	9-6253	Voltage Tag
17	2	9-6254	Upper Side Panel Overlay “Pak Master 50”
18	2	9-6255	Lower Side Panel Overlay “TDC”
19	1	9-6256	Input Power Connection Label
20	1	8-3216	USA Label
21	1	8-6244	Warning Label
22	2	9-6257	Enclosure Half
23	1	8-4384	Input Power Cable Assembly, 220V
24	1	9-6224	Middle Chassis Panel
25	2	9-6225	Resistor, 50 ohm, 50 watt
26	2	9-6226	Resistor, 6k ohm, 50 watt
27	8	9-6227	Resistor Mounting Clip
28	1	9-6222	Top Chassis Panel
29	4	9-6223	PC Board Support
30	1	8-4243	Ground Tag
31	1	9-6281	Input Filter Capacitors (Kit is Two Complete Boards)
32	1	9-6273	Input Rectifier Bridges (Kit is Three Bridges with all hardware)
33	1	9-6276	Overvoltage Protection Board

5.6 CHASSIS COMPONENTS (continued)

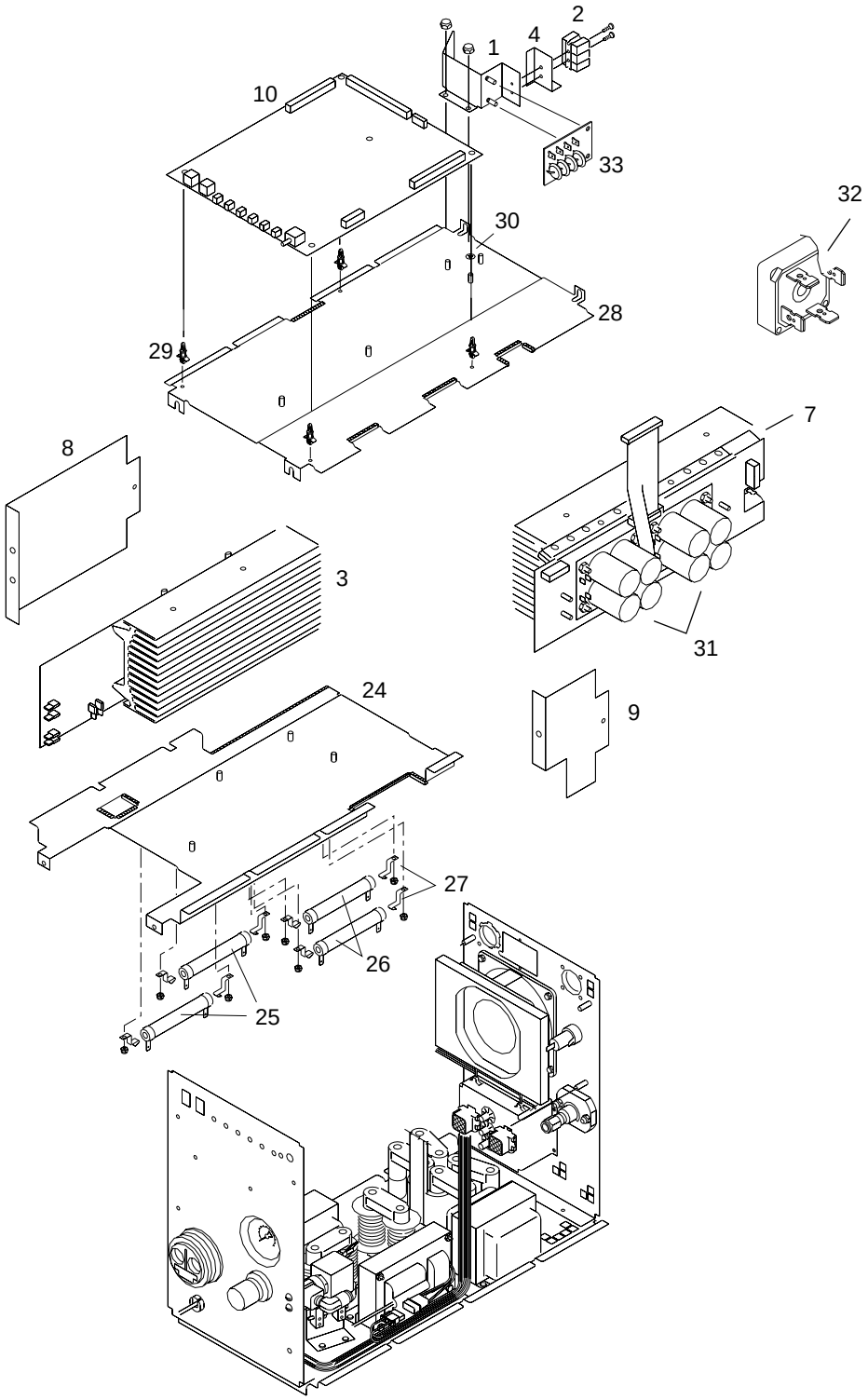


Figure 5-D Chassis Components

5.7 REAR PANEL COMPONENTS

Item No.	Qty.	Catalog Number	Description
1	1	9-6228	Rear Panel
2	1	9-6209	Fan Assembly
3	3	9-6229	Single Circuit Receptacle
4	1	9-6230	Fitting - 1/4 NPT x 3/8 Tube
5	1	8-4289	Flex Connector
6	1	8-4251	Finger Guard
7	2	9-6231	Nine Circuit Receptacle
8	1	9-3861	Fuse - 2 amp, 600V
9	3		Retaining Ring (.300 inch I.D.)
10	1	9-2937	Fuse Holder
11	1	9-6232	Adaptor - Inert B to 1/4 NPT Female
12	1	9-6233	Retaining Ring (.75 inch I.D.)
13	1	9-6234	Hole Plug
14	1	8-6214	Amber Lamp
15	1	8-4243	Ground Tag
16	1	9-6247	Adaptor - Rear Panel Fitting
17	1	9-6235	Fan / Heatsink Gasket
	1	9-6250	Primary Block Cover
	1	9-6251	Voltage Selection Panel Cover
	1	9-3294	14 Pin Plug for J24

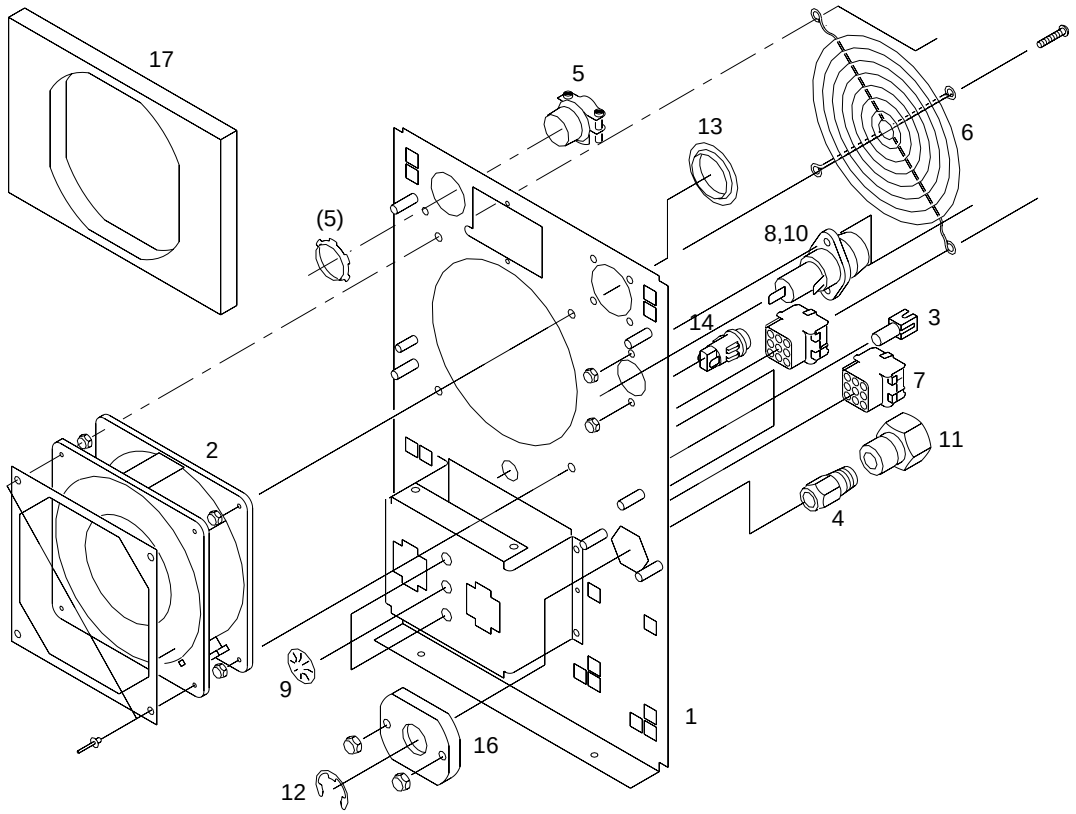
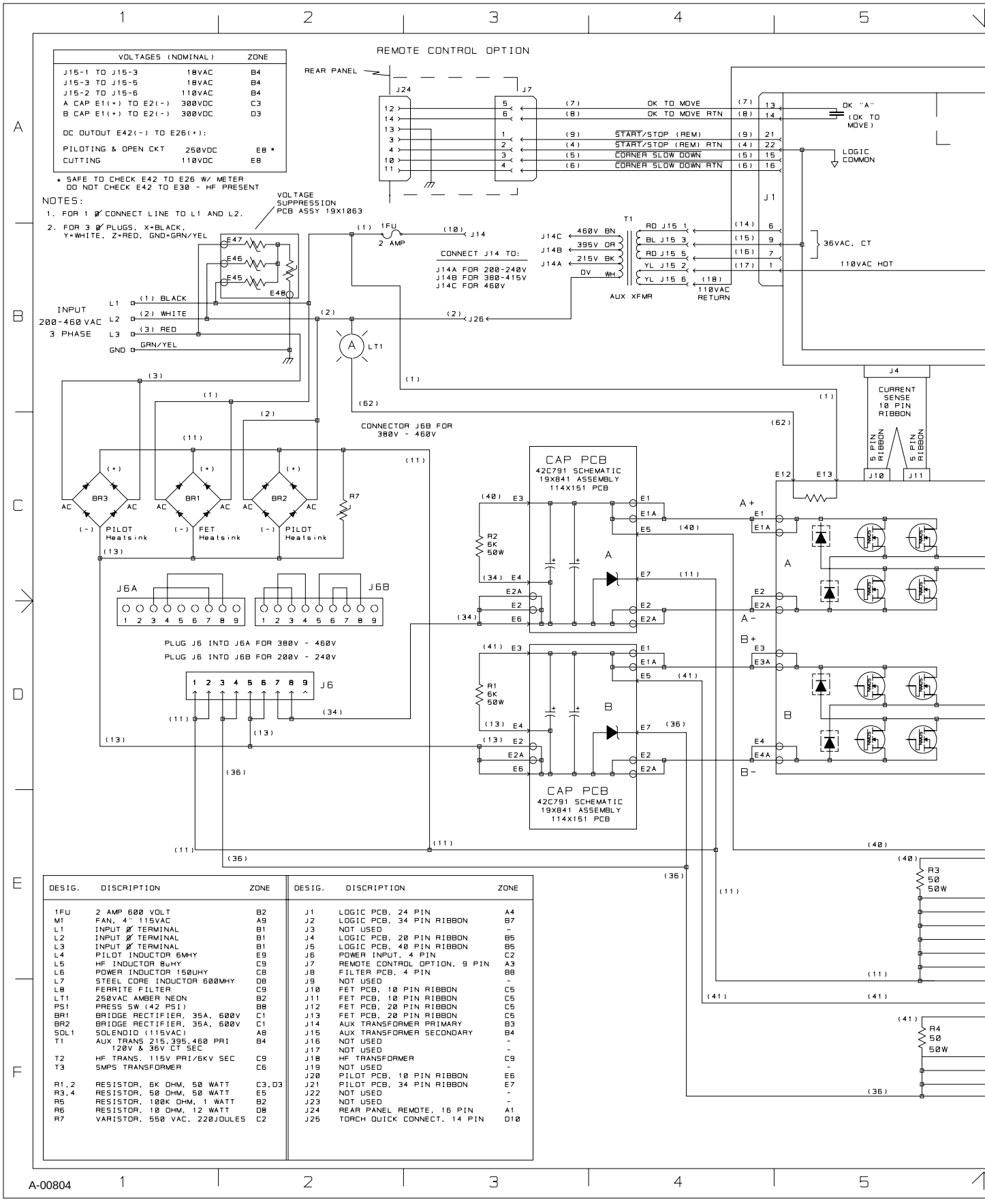


Figure 5-E Rear Panel Components

APPENDIX I: SYSTEM SCHEMATIC



DESIG.	DISCRIPTION	ZONE
1FU	2 AMP 600 VOLT	B2
M1	FAN, 4" 115VAC	A9
L1	INPUT Ø TERMINAL	B1
L2	INPUT Ø TERMINAL	B1
L3	INPUT Ø TERMINAL	B1
L4	PILOT INDUCTOR 6MHY	E9
L5	HF INDUCTOR 8uHY	C9
L6	POWER INDUCTOR 150UHY	C8
L7	STEEL CORE INDUCTOR 600MHY	D8
L8	FERRITE FILTER	C9
LT1	250VAC AMBER NEON	B2
PS1	PRESS SW (42 PSI)	B8
BR1	BRIDGE RECTIFIER, 35A, 600V	C1
BR2	BRIDGE RECTIFIER, 35A, 600V	C1
SOL1	SOLENOID (115VAC)	A8
T1	AUX TRANS 215,395,460 PRI 120V & 36V CT SEC	B4
T2	HF TRANS. 115V PRI/6KV SEC	C9
T3	SMPS TRANSFORMER	C6
R1,2	RESISTOR, 6K OHM, 50 WATT	C3,D3
R3,4	RESISTOR, 50 OHM, 50 WATT	E5
R5	RESISTOR, 100K OHM, 1 WATT	B2
R6	RESISTOR, 10 OHM, 12 WATT	D8
R7	VARISTOR, 550 VAC, 220JOULES	C2

DESIG.	DISCRIPTION	ZONE
J1	LOGIC PCB, 24 PIN	A4
J2	LOGIC PCB, 34 PIN RIBBON	B7
J3	NOT USED	-
J4	LOGIC PCB, 20 PIN RIBBON	B5
J5	LOGIC PCB, 40 PIN RIBBON	B5
J6	POWER INPUT, 4 PIN	C2
J7	REMOTE CONTROL OPTION, 9 PIN	A3
J8	FILTER PCB, 4 PIN	B8
J9	NOT USED	-
J10	FET PCB, 10 PIN RIBBON	C5
J11	FET PCB, 10 PIN RIBBON	C5
J12	FET PCB, 20 PIN RIBBON	C5
J13	FET PCB, 20 PIN RIBBON	C5
J14	AUX TRANSFORMER PRIMARY	B3
J15	AUX TRANSFORMER SECONDARY	B4
J16	NOT USED	-
J17	NOT USED	-
J18	HF TRANSFORMER	C9
J19	NOT USED	-
J20	PILOT PCB, 10 PIN RIBBON	E6
J21	PILOT PCB, 34 PIN RIBBON	E7
J22	NOT USED	-
J23	NOT USED	-
J24	REAR PANEL REMOTE, 16 PIN	A1
J25	TORCH QUICK CONNECT, 14 PIN	D10

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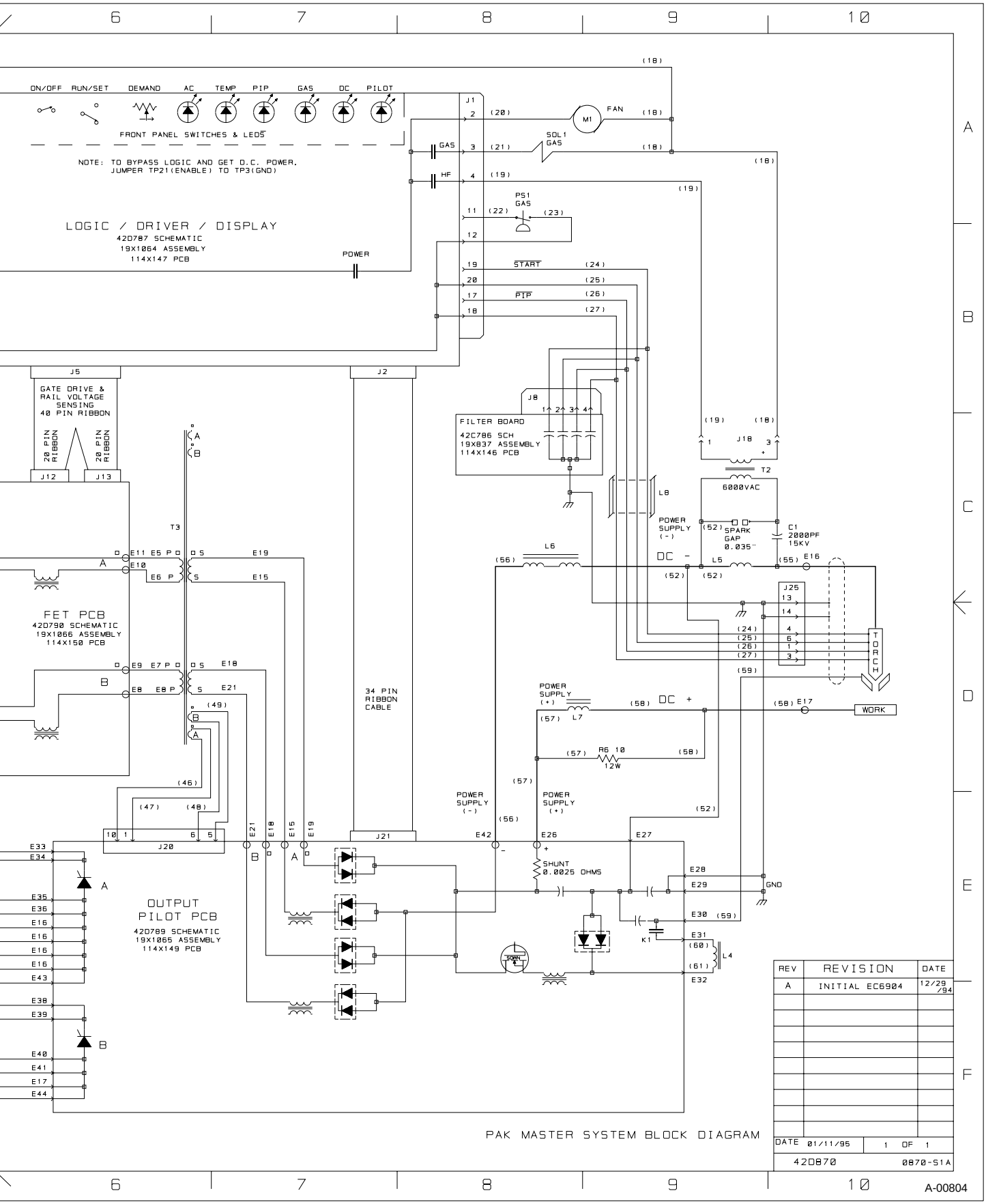
ON/OFF
RUN/SET
DEMAND
AC
TEMP
PIP
GAS
DC
PILOT
FRONT PANEL SWITCHES & LEDS
NOTE: TO BYPASS LOGIC AND GET D.C. POWER, JUMPER TP21(ENABLE) TO TP3(GND)
LOGIC / DRIVER / DISPLAY
42D787 SCHEMATIC
19X1064 ASSEMBLY
114X147 PCB
POWER
FAN
M1
SOL1 GAS
GAS
HF
PS1 GAS
START
PIP
J1
J2
J5
GATE DRIVE & RAIL VOLTAGE SENSING 40 PIN RIBBON
20 PIN RIBBON
J12
J13
FILTER BOARD
42C786 SCH
19X837 ASSEMBLY
114X146 PCB
J8
J18
T2
6000VAC
L8
POWER SUPPLY (-)
SPARK GAP 0.035"
C1 2000PF 15KV
L6
L5
DC -
E16
J25
TORCH
T3
FET PCB
42D790 SCHEMATIC
19X1066 ASSEMBLY
114X150 PCB
34 PIN RIBBON CABLE
POWER SUPPLY (+)
DC +
L7
WORK
R6 .10 12W
SHUNT 0.0025 OHMS
GND
K1
L4
SCRN
J20
J21
OUTPUT PILOT PCB
42D789 SCHEMATIC
19X1065 ASSEMBLY
114X149 PCB
PAK MASTER SYSTEM BLOCK DIAGRAM
REV
REVISION
DATE
A
INITIAL EC6904
12/29/94
DATE 01/11/95
1 OF 1
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