HyDefinition® HD3070

Plasma Arc Cutting System with AUTOMATIC Gas Console II

Instruction Manual
803460 - Revision 0

CE

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Hypertherm®

The world leader in plasma cutting technology

HyDefinition®
HD3070
Plasma Arc Cutting System
with
Automatic Gas Console II

Instruction Manual
IM-346
(P/N 803460)

Revision 0 November, 1998

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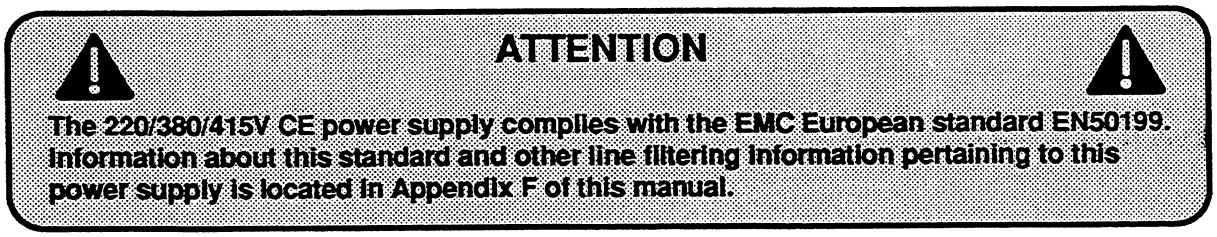
ELECTROMAGNETIC COMPATIBILITY (EMC)



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

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Section 1 SAFETY

RECOGNIZE SAFETY INFORMATION

The symbols shown in this section are used to identify potential hazards. When you see a safety symbol in this manual or on your machine, understand the potential for personal injury, and follow the related instructions to avoid the hazard.

FOLLOW SAFETY INSTRUCTIONS

Read carefully all safety messages in this manual and safety labels on your machine.

- Keep the safety labels on your machine in good condition. Replace missing or damaged labels immediately.
- Learn how to operate the machine and how to use the controls properly. Do not let anyone operate it without instruction.
- Keep your machine in proper working condition. Unauthorized modifications to the machine may affect safety and machine service life.

DANGER WARNING CAUTION

A signal word DANGER or WARNING is used with a safety symbol. DANGER identifies the most serious hazards.

- DANGER and WARNING safety labels are located on your machine near specific hazards.
- WARNING safety messages precede related instructions in this manual that may result in injury or death if not followed correctly.
- CAUTION safety messages precede related instructions in this manual that may result in damage to equipment if not followed correctly.

CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire Prevention

- Be sure the area is safe before doing any cutting. Keep a fire extinguisher nearby.
- Remove all flammables within 35 feet (10 m) of the cutting area.
- Quench hot metal or allow it to cool before handling or before letting it touch combustible materials.
- Never cut containers with potentially flammable materials inside – they must be emptied and properly cleaned first.
- Ventilate potentially flammable atmospheres before cutting.
- When cutting with oxygen as the plasma gas, an exhaust ventilation system is required.

Explosion Prevention

- Do not use the plasma system if explosive dust or vapors may be present.
- Do not cut pressurized cylinders, pipes, or any closed container.
- Do not cut containers that have held combustible materials.

WARNING

Explosion Hazard
Argon-Hydrogen and Methane

Hydrogen and methane are flammable gases that present an explosion hazard. Keep flames away from cylinders and hoses that contain methane or hydrogen mixtures. Keep flames and sparks away from the torch when using methane or argon-hydrogen plasma.

WARNING

Hydrogen Detonation with Aluminum Cutting

- When cutting aluminum underwater, or with the water touching the underside of the aluminum, free hydrogen gas may collect under the workpiece and detonate during plasma cutting operations.
- Install an aeration manifold on the floor of the water table to eliminate the possibility of hydrogen detonation. Refer to the Appendix section of this manual for aeration manifold details.


ELECTRIC SHOCK CAN KILL

Touching live electrical parts can cause a fatal shock or severe burn.

- Operating the plasma system completes an electrical circuit between the torch and the workpiece. The workpiece and anything touching the workpiece are part of the electrical circuit.
- Never touch the torch body, workpiece or the water in a water table when the plasma system is operating.

Electric Shock Prevention

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

- Wear insulated gloves and boots, and keep your body and clothing dry.
- Do not stand, sit or lie on – or touch – any wet surface when using the plasma system.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must work in or near a damp area, use extreme caution.
- Provide a wall-mounted disconnect switch close to the power supply with properly sized fuses. This switch allows the operator to turn off the power supply quickly in an emergency situation.
- When using a water table, be sure that it is correctly connected to earth ground.
- Install and ground this equipment according to the instruction manual and in accordance with national and local codes.
- Inspect the input power cord frequently for damage or cracking of the cover. Replace a damaged power cord immediately. **Bare wiring can kill.**
- Inspect and replace any worn or damaged torch leads.
- 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 during the cutting process.
- Before checking, cleaning or changing torch parts, disconnect the main power or unplug the power supply.
- Never bypass or shortcut the safety interlocks.
- Before removing any power supply or system enclosure cover, disconnect electrical input power. Wait 5 minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply covers are in place. Exposed power supply connections present a severe electrical hazard.
- When making input connections, attach proper grounding conductor first.
- Each Hypertherm plasma system is designed to be used only with specific Hypertherm torches. Do not substitute other torches which could overheat and present a safety hazard.


CUTTING CAN PRODUCE TOXIC FUMES

Cutting can produce toxic fumes and gases that deplete oxygen and cause injury or death.

- Keep the cutting area well ventilated or use an approved air-supplied respirator.
- Do not cut in locations near degreasing, cleaning or spraying operations. The vapors from certain chlorinated solvents decompose to form phosgene gas when exposed to ultraviolet radiation.
- Do not cut metal coated or containing toxic materials, such as zinc (galvanized), lead, cadmium or beryllium, unless the area is well ventilated and the operator wears an air-supplied respirator. The coatings and any metals containing these elements can produce toxic fumes when cut.
- Never cut containers with potentially toxic materials inside – they must be emptied and properly cleaned first.

PLASMA ARC CAN CAUSE INJURY AND BURNS

Instant-On Torches
Plasma arc comes on immediately when the torch switch is activated.

The plasma arc will cut quickly through gloves and skin.
- Keep away from the torch tip.
- Do not hold metal near the cutting path.
- Never point the torch toward yourself or others.

ARC RAYS CAN BURN EYES AND SKIN

Eye Protection Plasma arc rays produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.
- Use eye protection in accordance with applicable national or local codes.
- Wear eye protection (safety glasses or goggles with side shields, or a welding helmet) with appropriate lens shading to protect your eyes from the arc's ultraviolet and infrared rays.

Arc Current	Lens Shade AWS (USA)	ISO 4850
Up to 100 A	No. 8	No. 11
100-200 A	No. 10	No. 11-12
200-400 A	No. 12	No. 13
Over 400 A	No. 14	No. 14

Skin Protection Wear protective clothing to protect against burns caused by ultraviolet light, sparks and hot metal.
- Gauntlet gloves, safety shoes and hat.
- Flame-retardant clothing to cover all exposed areas.
- Cuffless trousers to prevent entry of sparks and slag.
- Remove any combustibles, such as a butane lighter or matches, from your pockets before cutting.

Cutting Area Prepare the cutting area to reduce reflection and transmission of ultraviolet light:
- Paint walls and other surfaces with dark colors to reduce reflection.
- Use protective screens or barriers to protect others from flash and glare.
- Warn others not to watch the arc. Use placards or signs.

GROUNDING SAFETY

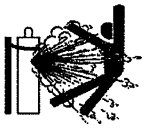
Work Cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

Work Table Connect the work table to an earth ground, in accordance with appropriate national or local electrical codes.

Input Power
- Be sure to connect the power cord ground wire to the ground in the disconnect box.
- If installation of the plasma system involves connecting the power cord to the power supply, be sure to connect the power cord ground wire properly.
- Place the power cord's ground wire on the stud first, then place any other ground wires on top of the power cord ground. Fasten the retaining nut tightly.
- Tighten all electrical connections to avoid excessive heating.

COMPRESSED GAS EQUIPMENT SAFETY

- Never lubricate cylinder valves or regulators with oil or grease.
- Use only correct gas cylinders, regulators, hoses and fittings designed for the specific application.
- Maintain all compressed gas equipment and associated parts in good condition.
- Label and color-code all gas hoses to identify the type of gas in each hose. Consult applicable national or local codes.



GAS CYLINDERS CAN EXPLODE IF DAMAGED

Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

- Handle and use compressed gas cylinders in accordance with applicable national or local codes.
- Never use a cylinder that is not upright and secured in place.
- Keep the protective cap in place over valve except when the cylinder is in use or connected for use.
- Never allow electrical contact between the plasma arc and a cylinder.
- Never expose cylinders to excessive heat, sparks, slag or open flame.
- Never use a hammer, wrench or other tool to open a stuck cylinder valve.

NOISE CAN DAMAGE HEARING

Prolonged exposure to noise from cutting or gouging can damage hearing.

- Use approved ear protection when using plasma system.
- Warn others nearby about the noise hazard.

PACEMAKER AND HEARING AID OPERATION

Pacemaker and hearing aid operation can be affected by magnetic fields from high currents.
Pacemaker and hearing aid wearers should consult a doctor before going near any plasma arc cutting and gouging operations.

To reduce magnetic field hazards:

- Keep both the work cable and the torch lead to one side, away from your body.
- Route the torch leads as close as possible to the work cable.
- Do not wrap or drape the torch lead or work cable around your body.
- Keep as far away from the power supply as possible.

ADDITIONAL SAFETY INFORMATION

1. ANSI Standard Z49.1, *Safety in Welding and Cutting*, American Welding Society, 550 LeJeune Road P.O. Box 351020, Miami, FL 33135
2. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*, American National Standards Institute 1430 Broadway, New York, NY 10018
3. ANSI Standard Z87.1, *Safe Practices for Occupation and Educational Eye and Face Protection*, American National Standards Institute, 1430 Broadway, New York, NY 10018
4. AWS F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances*, American Welding Society 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
5. AWS F5.2, *Recommended Safe Practices for Plasma Arc Cutting*, American Welding Society 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
6. CGA Pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders*, Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202
7. CSA Standard W117.2, *Code for Safety in Welding and Cutting*, Canadian Standards Association Standard Sales 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3, Canada
8. NFPA Standard 51B, *Cutting and Welding Processes*, National Fire Protection Association 470 Atlantic Avenue, Boston, MA 02210
9. NFPA Standard 70–1978, *National Electrical Code*, National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210
10. OSHA, *Safety and Health Standards*, 29FR 1910 U.S. Government Printing Office, Washington, D.C. 20402.

Section 2 DESCRIPTION & SPECIFICATIONS

In this section:

DESCRIPTION & SPECIFICATIONS

DESCRIPTION

General

This manual provides the information needed to install, operate and maintain the HD-3070 plasma cutting system for either robotically controlled or x-y table cutting applications. This precision cutting, dual gas machine-torch system consists of a power supply, RHF console, gas console, torch quick disconnect assembly, off-valve assembly and machine torch assembly. Refer to Figures 2-1 and 2-2.

The HD-3070 can be configured for different cutting applications by providing a selectable current output at 15, 30, 50, 70 or 100 amps for optimum performance on cutting most metals from gauge to 1/2-inch (12.7 mm) thick. This allows the operator wide variations in cutting speeds on the same thickness of metal. The gas console provides four inlets for the different plasma and shield gases required for different cutting applications. The HD-3070 is designed to cut mild steel, stainless steel, copper and aluminum with the appropriate gases and consumables selected. Plasma gases required for cutting are either oxygen or air depending on the application. The shield gas aids in assisting cut quality by providing an atmosphere around the plasma arc on the surface of the workpiece. The shield gas also cools the shield at the front end of the torch.

Under microprocessor control, the HD-3070 provides extended life (LongLife) for the torch nozzle and electrode. To get long life, all cuts must begin and end on the plate surface; this allows for the proper ramping up and down of gases and DC current.

Power Supply

This unit houses a 100-amp, 15 kw chopper which produces a constant current DC output, variable from 15 to 100 amps. It contains a microprocessor control PCB which regulates all the plasma system functions: start sequence, machine interface functions, gas and cut parameters, and off sequence. The power supply main on/off power is controlled remotely by the CNC machine. The cutting current and pierce delay are also provided by the CNC machine. The power supply also houses the cooling system required to cool the torch. The power supply interconnects with the RHF console, machine interface, gas console, and workpiece.

An EMI filter, standard with all 220/380/415V power supplies (078027), meets the CE requirement for filtering incoming power. Refer to Appendix F to connect incoming power to the filter and for part numbers.

Automatic Gas Console

The gas console is a computer controlled unit which is bolted to the top of the power supply. This unit contains all of the plumbing and valve systems, computer controls for remote operation, and manual controls for local operation. The sequencing of the gas valves is under control of the power supply microcomputer.

In remote mode, this unit allows gas flowrates to be set automatically by the CNC machine without an operator present. The robotic controller interface provides the ability to adjust the metering control of the plasma and shield gas flows to a high degree of accuracy and repeatability.

In local mode, the operator can control of the gas metering valve set-points, select the gas test modes and the gas type to be used, and select the calibration modes.

In both remote and local modes, the LCD display panel will display the following data: local or remote control system operation; plasma and shield gas selections; system errors; gas test or calibrate modes; plasma and shield inlet gas pressures; plasma, shield, and preflow outlet gas pressures; and metering valve set-points.

The gas console interfaces with the power supply through two control cables; with the robotic controller interface through an interface cable; with the torch off-valve assembly through the gas lead set; and receives the plasma and shield gas supplies.

RHF Console

This unit houses the high frequency starting circuit which is needed to fire the torch and permits more effective RF shielding. The RHF Console has a water barrier to separate water and electrical components. Also housed in the console is a door interlock switch and a cathode manifold used to interface power/coolant leads between the power supply and torch. The power/coolant leads and a pilot arc lead make up the shielded torch lead set which connects with the torch.

PAC184 Machine Torch Assemblies

The PAC184 machine torch is a dual gas (plasma and shield) plasma arc cutting torch. The slimmer design allows it to be used primarily in robotic cutting applications. The machine torch assembly includes the torch main body and 15 amp consumables. The torch main body is water cooled by a closed-loop system which distributes the coolant to and from the torch by way of the quick disconnect assembly, RHF console and the cooling subassemblies in the power supply. There are two torch assemblies: one torch assembly comes without an IHS tab on the shield cap; the other torch assembly comes with an IHS tab on the shield cap.

PAC186 Machine Torch Assemblies

The PAC186 machine torch is a dual gas (plasma and shield) plasma arc cutting torch designed for X-Y table cutting applications. The machine torch assembly includes the torch main body and 15 amp consumables. The torch main body is water cooled by a closed-loop system which distributes the coolant to and from the torch by way of the quick disconnect assembly, RHF console and the cooling subassemblies in the power supply. There are two torch assemblies: one torch assembly comes without an IHS tab on the shield cap; the other torch assembly comes with an IHS tab on the shield cap.

45° Torch Quick Disconnect Assembly

The torch quick disconnect assembly is primarily used for robotic cutting applications. Inputs from the RHF console using the torch lead set are: electrode cooling water supply and return, power, and pilot arc. Inputs from the off-valve assembly are for torch blow back and plasma and shield gases.

Straight Torch Quick Disconnect Assembly

The torch quick disconnect assembly allows mechanized changing of torches by the cutting machine. Inputs from the RHF console using the torch lead set are: electrode cooling water supply and return, power, and pilot arc. Inputs from the off-valve assembly are for torch blow back and plasma and shield gases.

Off-Valve Assemblies

Two off-valve assemblies are offered: one with a blow back solenoid valve and the other without a blow back solenoid valve. Both off-valve assemblies provide on/off control between the preflow and operate gas flows. This assembly consists of three solenoid valves which provide inlet and outlet gas connections. The inlet connections (plasma gas, shield gas and preflow gas) are input from the gas console using the gas lead set. The outlet connections (blow back [if desired], plasma gas and shield gas) are output to the torch quick disconnect assembly.

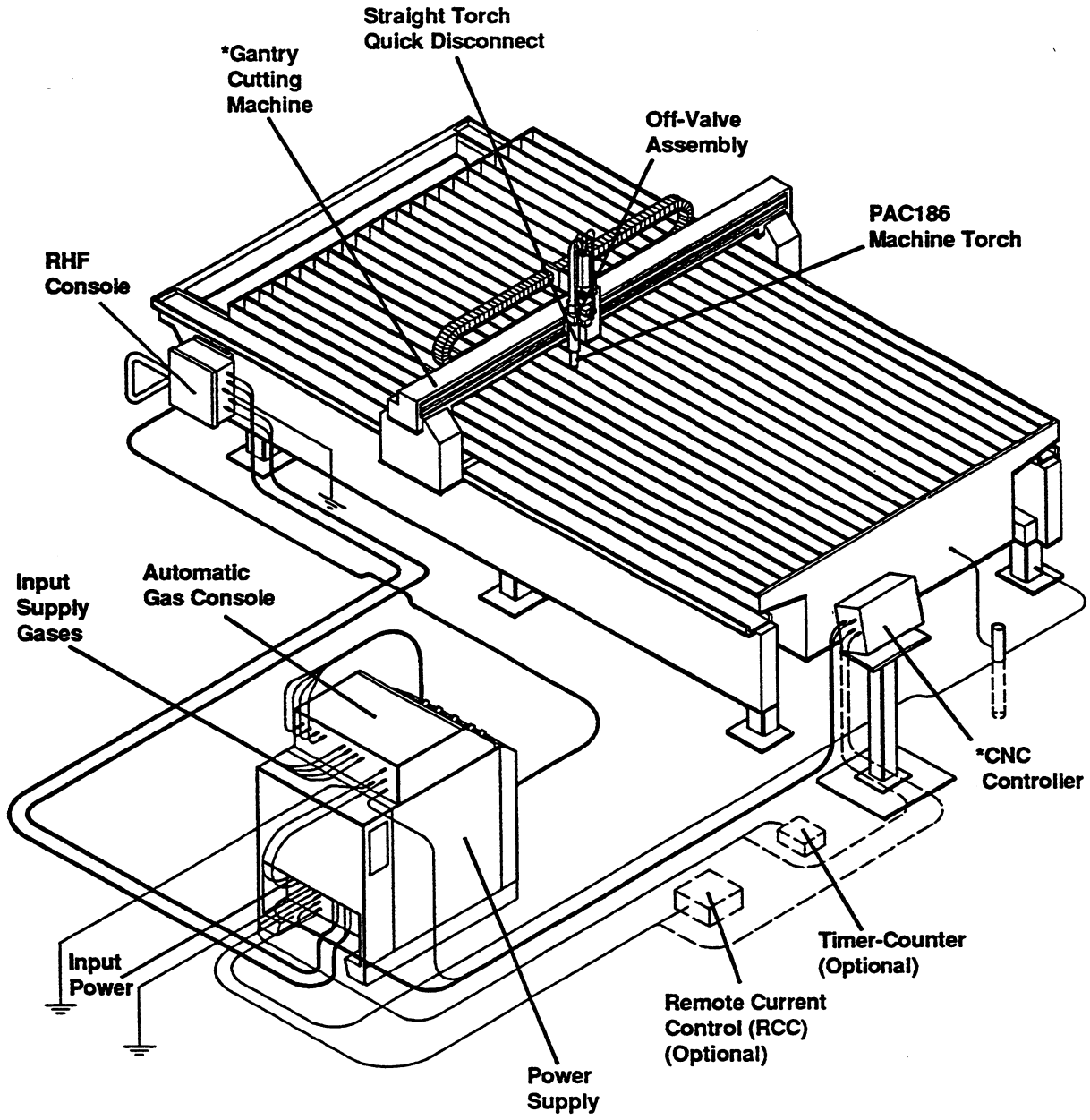
Optional Units

Timer-Counter

The timer/counter allows the operator to monitor the number of arc starts, the cumulative time that the arc is on in hours, and the number of arc blow outs. The arc starts and arc errors LCD counters can be reset. This unit connects with the power supply. Refer to Appendix D for installation, operation and parts information.

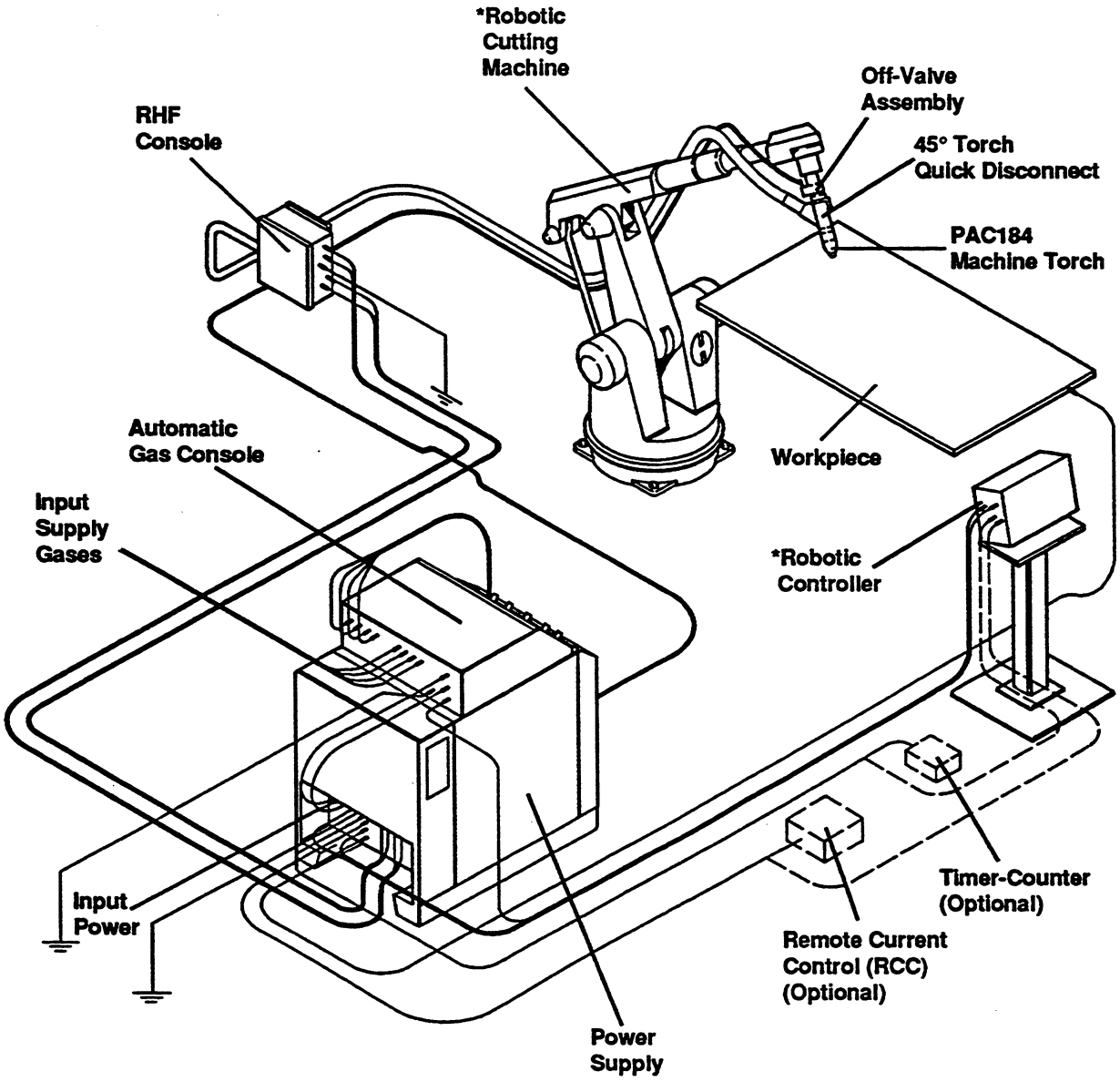
Remote Current Control (RCC)

The RCC allows the operator the ability to select the cutting current from a remote location. This unit connects with the power supply. Refer to Appendix E for installation, operation and parts information.



* Non Hypertherm Components

Figure 2-1 HD-3070 System Components with Gantry Cutting Machine



* Non Hypertherm Components

Figure 2-2 HD-3070 System Components with Robotic Cutting Machine

SPECIFICATIONS

Power Supplies (078020, 078026, 078027, 078028, 078029)

Maximum OCV (U_0)	280 VDC
Output Current (I_2)	15, 30, 50, 70, and 100 amps
Output Voltage (U_2)	150 VDC
Duty Cycle Rating (X)	80% at 100 amps
Cooling	Forced Air (Class F)
Ambient temperatures/duty cycle	Power supplies will operate between +14° and 104°F (-10° and +40°C). Power supplies operated in an ambient temperature above 86°F (30°C) may show some decrease in duty cycle.

Input Power (U_1 Input Voltage, I_1 Input Current):

078020	240/480 VAC, 3 Ph, 60 Hz, 50/25 amps
078026	208 VAC, 3 Ph, 60 Hz, 58 amps
078027	220/380/415 VAC, 3 Ph, 50/60 Hz, 54/30/28 amps (see Appendix F)
078028	600 VAC, 3 Ph, 60 Hz, 20 amps
078029	200 VAC, 3 Ph, 50/60 Hz, 60 amps

Torch Cooling Requirements:

Coolant Tank Capacity	2.9 gallons (11 liters)
Coolant	Propylene glycol/deionized water/ benzotriazole (refer to Section 3, Torch Coolant for specifications, warning, and caution).
Flow Rate	≈ 1 gallon/minute (3.8 liters/minute)
Pressure	150 psi (10.2 bar)

Dimensions and Weight:

Width	24.25 inches (616 mm)
Height	36 inches (914 mm)
Depth	38.25 inches (972 mm)
Weight	545 pounds (247 kg)

Automatic Gas Console (078022)

Input Power from Power Supply (intrlk'd)	120 VAC
Output Power to Off-Valve Assy	120 VAC
Outputs to CNC	Active (low or closed)

Gas Supply Requirements:

Plasma Gas Types	**Oxygen (O_2)** (15, 30, 50, 70 or 100 amp mild steel cutting) **Air** (30, 50, or 70 stainless steel cutting; 70 amp aluminium cutting)

Shield Gas Type	**Oxygen (O_2)** and **Nitrogen (N_2)** mixture (15, 30, 50, 70 or 100 amp mild steel cutting) **Methane (CH_4)** and **Air** mixture (70 amp stainless steel cutting) **Air** (30 and 50 amp stainless steel cutting) **Methane (CH_4)** (70 amp aluminum cutting)
Oxygen Gas Quality	99.95 % pure (liquid gas recommended)
Nitrogen Gas Quality	99.995 % pure (liquid gas recommended)
Air Quality	Clean, dry and oil-free
Methane Quality	93 % (commercial grade)
All Gas and Air Inlet Pressures	120 psi (8.2 bar)
Air Flowrate	81.7 scfh (2313 l/hr) at fullscale
Oxygen Flowrate	77.8 scfh (2203 l/hr) at fullscale
Nitrogen Flowrate	83.1 scfh (2353 l/hr) at fullscale
Methane Flowrate	110 scfh (3114 l/hr) at fullscale
Dimensions and Weight:	
Width	24 inches (610 mm)
Height	8 inches (203 mm)
Depth	22 inches (559 mm)
Weight	60 pounds (27 kg)

RHF Console (078010)

Input Power from Power Supply (intrlk'd)	120 VAC
Output Power	2700 VAC
High Frequency Spark Gap	0.020 ± 0.001 inch (0.51 ± 0.03 mm)
Dimensions and Weight:	
Width	12.63 inches (321 mm)
Height	13.5 inches (343 mm)
Depth	6.5 inches (165 mm)
Weight	20 pounds (9.1 kg)

PAC184 Machine Torch Assemblies (028839, 128199)

Maximum cutting thickness	1/4 inch (6.4 mm)
Maximum current at 100% duty cycle	30 amps
Torch Cooling Requirements:	
Coolant	Propylene glycol/deionized water/ benzotriazole (refer to Section 3, Torch Coolant Requirements for specifications, warning, and caution)
Flow Rate	≈ 1 gallon/minute (3.8 liters/minute)

Pressure ..... 150 psi (10.2 bar)
Dimensions and Weight:
Diameter ..... 1.75 inches (44 mm)
Length ..... 3.44 inches (88 mm)
Weight ..... 1 pound (0.45 kg)

PAC186 Machine Torch Assemblies (128101, 128102)

Maximum cutting thickness ..... 1/2 inch (12.7 mm)
Maximum current at 80% duty cycle ..... 100 amps
Torch Cooling Requirements:
Coolant ..... Propylene glycol/deionized water/ benzotriazole (refer to Section 3, Torch Coolant Requirements for specifications, warning, and caution)
Flow Rate ..... ≈ 1 gallon/minute (3.8 liters/minute)
Pressure ..... 150 psi (10.2 bar)
Dimensions and Weight:
Diameter ..... 1.75 inches (44 mm)
Length ..... 3.44 inches (88 mm)
Weight ..... 1 pound (0.45 kg)

45° Torch Quick Disconnect Assembly (028840)

Dimensions and Weight:
Width ..... 2.13 inches (54 mm)
Length ..... 4.19 inches (107 mm)
Depth ..... 4.56 inches (117 mm)
Weight ..... 1 pound (0.45 kg)

Straight Torch Quick Disconnect Assembly (028855)

Dimensions and Weight:
Diameter (outer) ..... 2 inches (51 mm)
Length ..... 2.5 inches (63 mm)
Weight ..... 1 pound (0.45 kg)

Off-Valve Assemblies (129056, 129174)

Input Power from Gas Console (intrlk'd) ..... 120 VAC
Dimensions and Weight:
Diameter (side to side) ..... 6.5 inches (165 mm)
Diameter (front to back) ..... 5.25 inches (133 mm)
Weight ..... 2 pounds (0.9 kg)

Motion Control System (Customer Supplied)

Travel Speed (maximum)	200 ipm(5.08 m/min)
Braking	Positive (drifting through stop point not acceptable)
Weight	Must be able to handle combined weight of PAC184/PAC186 torch, torch quick disconnect assembly, off-valve assembly, and lead sets.

Optional Units

Timer-Counter (078049)

Receives error signals and machine arc time and machine start signals from power supply	Dry contacts
Dimensions and Weight:	
Width	6.5 inches (165 mm)
Height	2.5 inches (64 mm)
Depth	8.63 inches (219 mm)
Weight	3 pounds (1.4 kg)

Refer to Appendix D for installation, operation and parts information.

Remote Current Control (RCC) (078050)

Receives current setpoint signals from power supply	
Dimensions and Weight:	
Width	6.3 inches (160 mm)
Height	2.37 inches (61 mm)
Depth	8.5 inches (216 mm)
Weight	3 pounds (1.4 kg)

Refer to Appendix E for installation, operation and parts information.

IEC SYMBOLS USED

Direct Current (DC).

Alternating current (AC).

Plasma cutting torch.

AC input power connection.

The terminal for the external protective (earthed) conductor.

A chopper-based power source.

Anode (+) work clamp.

Temperature switch.

Pressure switch.

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

The power is on.

The power is off.

Volt/amp curve.

Hypertherm

Section 3

INSTALLATION

In this section:

INSTALLATION

PRE-INSTALLATION

Prior to the installation of the HD-3070 plasma cutting system, the components must be unpacked and the following requirements must be fulfilled. Their purpose is to aid you in the installation of your plasma cutting system and to allow maximum performance. Installation and service of the electrical and plumbing systems must conform to local electrical and plumbing codes. This work should be performed only by qualified, licensed personnel. If questions arise at any time, please feel free to call Hypertherm Technical Service at 1-800-643-9878.

Upon Receipt

Before unpacking the HD-3070 System, inspect the box(es) for evidence of damage during shipment. If there is evidence of damage, refer to *Claims for Damage During Shipment* below for details. Remove all packing material and discard and remove the units and items from the box(es). Verify that the components listed below are included. Alert Hypertherm if any of the items are damaged or missing. All communications regarding this equipment must include the model number and serial number (located on the back of the units). Refer to *Claims* below for details.

HD-3070 System Components

- Power Supply (078020, 078026, 0768027, 078028 or 078029)
- Automatic Gas Console (078022)
- Remote High Frequency Console (RHF) (078010)
- PAC184 Torch Assembly (028839 or 128199)
  PAC186 Torch Assembly (128101 or 128102)
- 45° Torch Quick Disconnect Assembly (028840) or
  Straight Torch Quick Disconnect Assembly (028855)
- Off-Valve Assembly (129056 or 129174)
- PAC184 Consumable Parts Kit (028842 or 028900)
- PAC186 Consumable Parts Kit (128097 or 128098)
- Power Supply Service Parts Kit (028724)
- System Interconnecting Cables & Hoses
- HD-3070 with Automatic Gas Console Instruction Manual (802180)

Optional Units

- Timer-Counter (078049)
- Remote Current Control (RCC) (078050)

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 copy of the bill of lading upon request. If you need additional assistance, call Customer Service listed in the front of this manual or your authorized Hypertherm distributor.

Claims for defective or missing merchandise — If any of the merchandise is defective or missing, call your authorized Hypertherm distributor. If you need additional assistance, call Customer Service listed in the front of this manual or your authorized Hypertherm distributor.

Gas Requirements

The following gases required by the HD-3070 plasma system for cutting are provided **by the customer.** Bottled liquid gas is recommended. If the purity level of the gas is too low or if there are leaks in the supply hoses or connections:

- System can be contaminated
- Cut speeds can decrease
- Cut quality can deteriorate
- Cutting thickness capability can decrease
- Parts life can shorten

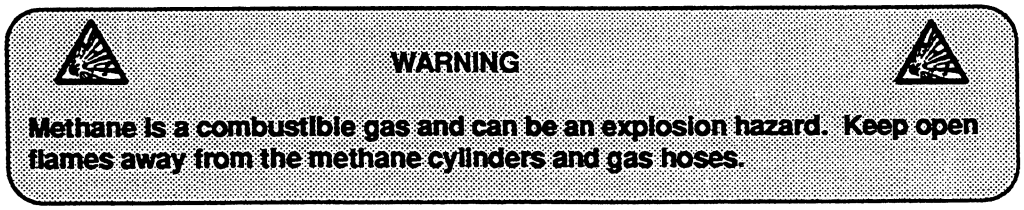
Oxygen (O_2)

The customer must provide a regulated oxygen supply capable of delivering at a pressure of **120 psi (8.2 bar)** to the gas console at 99.95 % purity and at a **flowrate of 77.8 scfh (2203 l/hr).** Connect the oxygen supply to the O_2 input adapter (015009 1/4 NPT, right handed 'B', male) on the gas console.

Nitrogen (N_2)

The customer must provide a regulated nitrogen supply capable of delivering at a pressure of **120 psi (8.2 bar)** to the gas console at 99.995 % purity and at a **flowrate of 83.1 scfh (2353 l/hr).** Connect the nitrogen supply to the N_2 input adapter (015103 1/4 NPT, right handed 'B', inert female) on the gas console.

Methane (AUX B SHIELD)



The customer must provide a regulated 93 % commercial grade methane (CH_4) gas at a delivery rate of **120 psi (8.2 bar)** to the gas console at a **fullscale flowrate of 110 scfh (3114 l/hr).** Bottled liquid gas is recommended. Connect the methane supply to the **AUX B** input adapter (015230 1/4 NPT, left handed 'B', male) on the gas console.

Air (AUX A PLASMA)

The AUX A port is shipped without a gas input adapter. If the user needs to use the AUX A port, ensure the adapter fitting is different than the O_2 015009 fitting, so that oxygen cannot be accidentally connected to the AUX A port.

Either cylinder compressed air or shop compressed air can be used to supply the

plasma and shield gas requirements. The air supply must be clean, dry and oil-free and capable of delivering air at a pressure of **120 psi (8.2 bar)** to the gas console at 99.95 % purity and at a **fullscale flowrate of 81.7 scfh (2313 l/hr).**

Hard Plumbing

If hard plumbing connections are desired, oxygen, nitrogen, methane, and air piping must be **type K** hard copper pipe properly prepared. All joints must be joined by carefully using soft solder to avoid excessive heating. Overheating may create oxides which can flake off and contaminate the gases. After installation, the entire system should be pressurized and checked for leaks. **Never use teflon tape on any joint preparation. A liquid pipe-thread sealant is recommended.**

Power Supply with Automatic Gas Console Placement

Place the power supply with the attached automatic gas console according to the criteria below and the dimensions called out in Figure 3-1. Once the units have been placed, locate the line voltage disconnect box on a wall near the power supply, so that the power supply can be quickly turned off in an emergency situation.

Note: The units may be moved by forklift, if the forks are long enough to extend more than half way the length of the base of the power supply. Care should be used when lifting with the forks so that the underside of the power supply is not damaged.

- Place the units in an area that is free of excessive moisture, has proper ventilation, and is relatively clean. Allow room for accessing the sides of the power supply for servicing.
- Place the power supply so that air flow is not blocked in any way. (Cooling air is drawn in through the front panel grating, and is exhausted through the rear of the unit by cooling fans.) Do not place any filter device over the air intake locations. This reduces cooling efficiency and VOIDS THE WARRANTY.

Power Requirements

Line Voltage Disconnect Box

Use a separate line voltage disconnect box for the power supply. Locate the box on a wall near the power supply, so it iseasily accessible by the operator. The interrupt level at the disconnect box must be equal to or exceed the continuous rating of the fuses. Size the line voltage disconnect box according to the fusing requirements on the next page. **Use slow-blow fuses only.**

Power Cable

The power cable is **customer supplied.** Use an 8-4 conductor Type SO input power cable with a conductor temperature rating of 140°F (60°C)

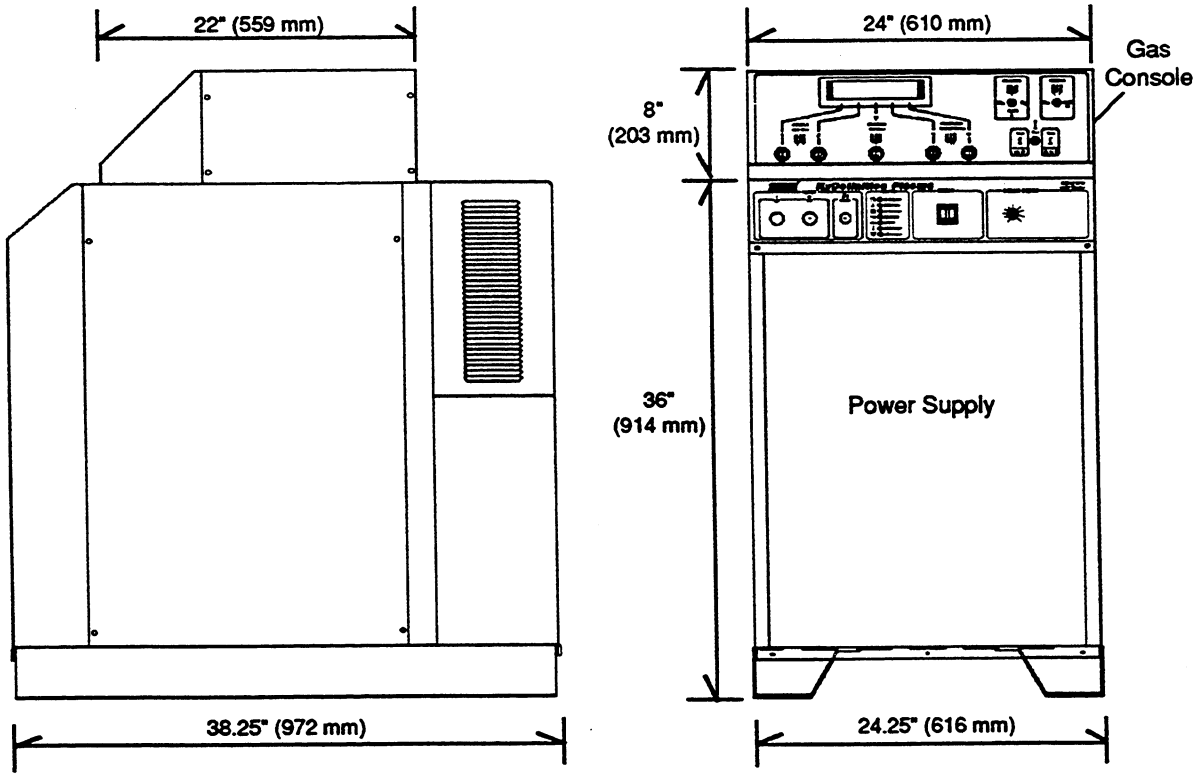


Figure 3-1 HD-3070 Power Supply with Automatic Gas Console - Placement Dimensions

Line Voltage Disconnect Box Fusing Requirements

Input Voltage (VAC)	Phase/Hz	Rated Input Current @ 15 kw Output (amps)	Recommended Slow- Blow Fuse Sizes (amps)
200	3/50-60	60	70
208	3/60	58	70
220	3/50-60	54	70
240	3/60	50	60
380	3/50-60	30	40
415	3/50-60	28	45
480	3/60	25	30
600	3/60	20	25

240/480V Power Supply Linkboard Configurations

- The 240/480-volt power supplies (078020) are shipped configured for 480-volt operation. The links must be moved for 240-volt operation (see Figure 3-2).

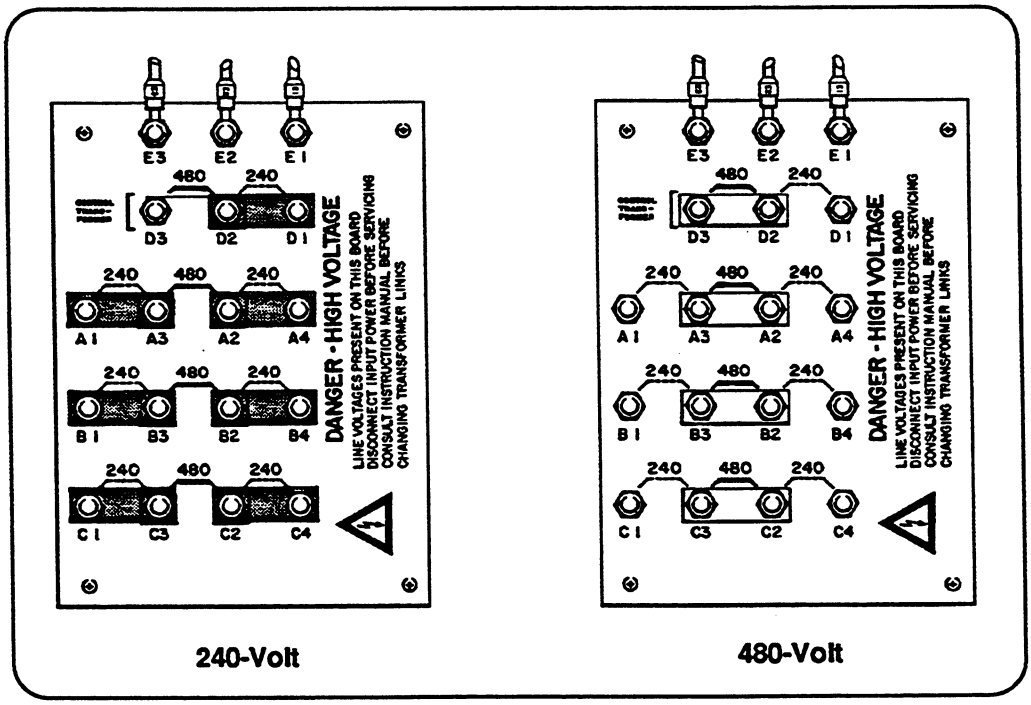


Figure 3-2 Dual Voltage 240/480-Volt Linkboard Configurations

220/380/415V Power Supply Linkboard Configurations

- The 220/380/415-volt, 3PH, 50/60 Hz power supplies (078027) are normally shipped from the factory set up for 380-volt operation, unless otherwise specified. To change the power supply to a different voltage (220 or 415 volts), the links must be moved (see Figure 3-3).

Work Table Grounding

The work table must be grounded properly to ensure personal safety, and to reduce the emission of radio-frequency interferrence.

- Connect the work table to a high-quality earth ground between 3 - 20 feet (1 - 6 m) of the table, in accordance with applicable local and national electrical codes.

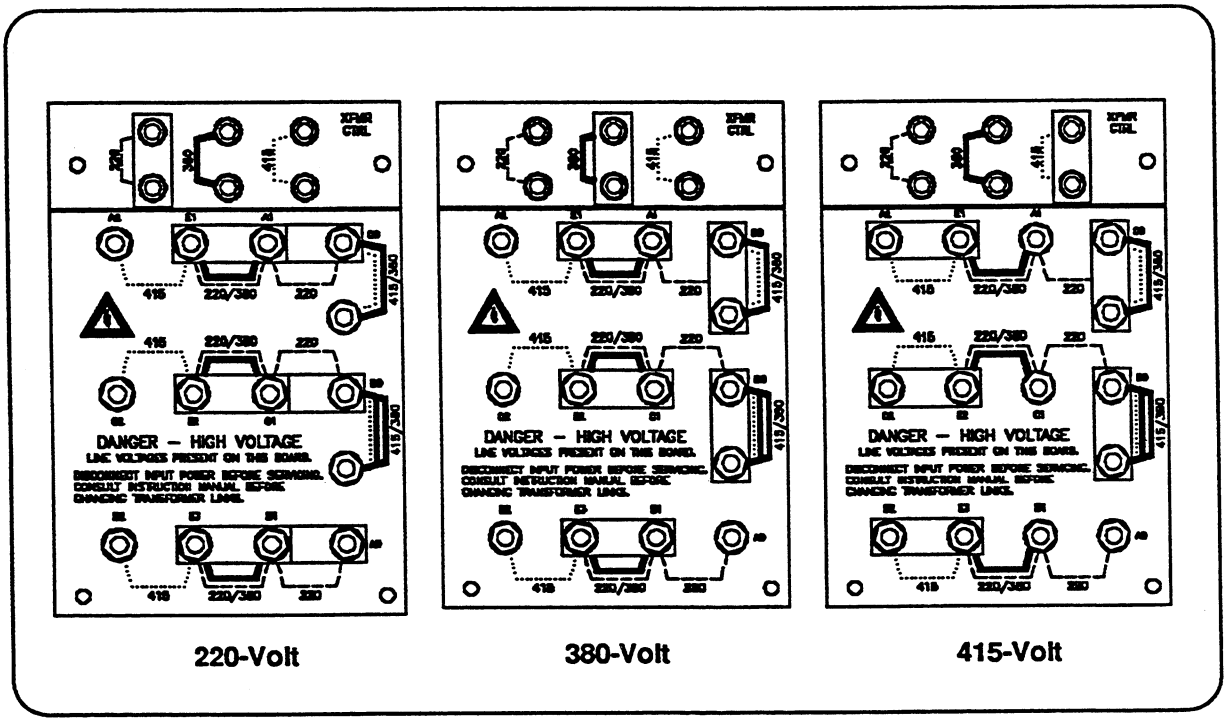


Figure 3-3 220/380/415-Volt Linkboard Configurations

Equipment Grounding

- The power supply, RHF console and gas console provide connections for protective earth (PE) grounding. Each cable should be connected to earth ground.
- The PE cables are customer supplied. If the customer wishes, the cable may be purchased through Hypertherm (047058). If the customer wishes to purchase the cable locally, use 8 AWG UL Type MTW cable. Refer to installation instructions later in this section.

INSTALLATION

Connect Power Cable

After the power supply and line voltage disconnect box have been placed, connect the power cable to the power supply first and then connect it to the line disconnect switch.

Power Supply

To connect the power cable to the 220/380/415V power supply (078027), refer to Appendix F. For other power supply voltages use the procedure below.

1. Insert the power cable through the strain relief at the lower right rear of the power supply. Connect the power cable leads to **TB1** on the rear center panel of the right side (see Figure 3-4).

2. Connect the power leads to the **L1 (U), L2 (V),** and **L3 (W)** terminals of **TB1.** Make sure that all electrical connections are tight to avoid excessive heating.

3. Connect the ground lead to the ground stud.

Line Voltage Disconnect Box

Connecting the power cable to the disconnect box must conform to national and local electrical codes. This work should be performed only by qualified, licensed personnel.

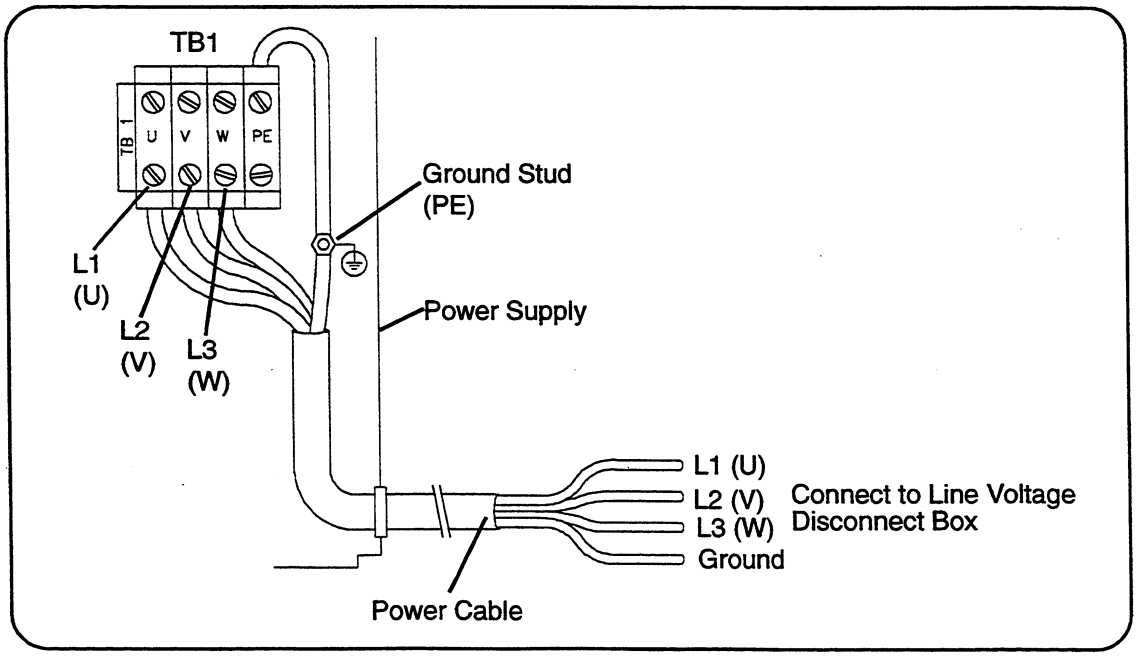


Figure 3-4 Power Supply Power Cable Connections

Local/External Pierce Delay Function

The power supply is shipped with the PIERCE DELAY potentiometer on the power supply control panel enabled. Perform the steps below to enable the external pierce complete function. Refer to Section 6, Figure 6-2, item 5 to locate control board 1XPCB3 and power supply (power unit) wiring diagram for wiring information.

1. Remove the power supply front panel and locate control board 1XPCB3.
2. Disconnect PL10 from REC5 on 1XPCB3.
3. Locate the blue jumper wire connected to PL10 pin 7. Connect the free end of the jumper to PL10 pin 5.
4. Reconnect PL10 to REC5.

To reestablish local control, remove jumper wire from PL10 pin 5

Local/External Current Set Function

The power supply is shipped with the AMPS thumbwheel switch on the power supply control panel enabled. Perform the steps below to enable the external current set function. Refer to Section 6, Figure 6-2, item 5 to locate control board 1XPCB3 and power supply (power unit) wiring diagram for wiring information.

1. Remove the power supply front panel and locate control board 1XPCB3.
2. Disconnect PL27-B (thumbwheel switch connector) from REC27 and then connect PL27-A (external current set) to REC27.
3. Connect the current setpoint cable (Figure 3-22) between 1X2 (rear of power supply) and CNC Interface.

To reestablish local control, disconnect PL27-A from REC27 and connect PL27-B to REC27. Then disconnect current setpoint cable between 1X2 and CNC Interface.

Torch Lifter Requirement

The HD3070 requires a motorized torch lifter with sufficient vertical travel to cut all required metal thicknesses. Vertical travel must be in increments of 0.010 inch (0.25 mm) and have a travel speed of 200 ipm (5.08 m/min) maximum and braking should be positive. A unit which drifts through the stop point is not acceptable.

INSTALLATION

INSTALLATION

This section provides the user with the necessary information to install the HD-3070 system. Installation of the HD-3070 system should not be undertaken unless all of the pre-installation requirements presented in front of this section have been completed. This section includes the following:

- Placing and mounting the system units.
- Interconnecting the units with the electrical control cables, cooling hoses and torch and gas lead sets.
- Mounting the PAC184 or PAC186 torch to the torch quick disconnect.
- Adding the torch coolant.

System Units Placement

Position the RHF console prior to making electrical and coolant connections. Also mount the torch quick disconnect and off-valve assembly. Note that power supply (with the automatic gas console mounted on top of it) placement information is presented in *Pre-Installation* in the front of this section.

Remote High Frequency Console

Place the RHF console in a convenient location to allow easy routing and connection leads, coolant hoses and torch lead set. Bolt the unit to the mounting surface. See Figure 3-5.

Automatic Gas Console

To remove the automatic gas console from the power supply, refer to Figure 3-6. After removal, place the automatic gas console in a convenient location to allow easy routing and connection of the gas hoses, control cables and gas lead set.

Torch Quick Disconnect Assemblies/Off-Valve Assembly

The torch quick disconnect assemblies and off-valve assembly are shipped loose. The 45° quick disconnect, generally used with the PAC184 torch, is normally mounted onto a robotic arm using the four 1/4-20 holes mounting holes. See Figure 3-7 for torch quick disconnect mounting hole dimensions.

The straight quick disconnect assembly, generally used with the PAC186 torch, is normally mounted onto a torch lifter on a x-y cutting table.

The off-valve assembly may be mounted up to a distance of four feet from either of the torch quick disconnects.

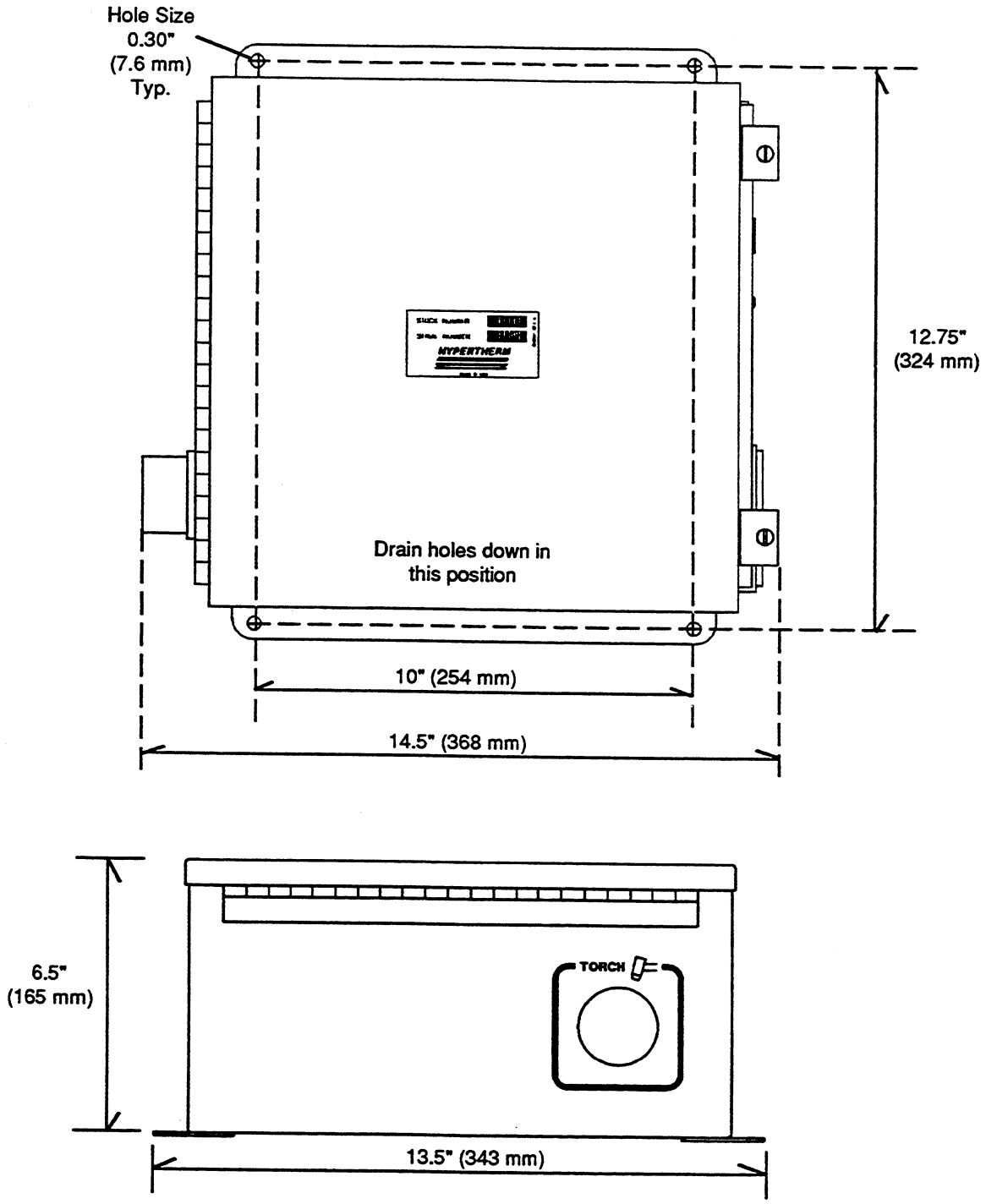
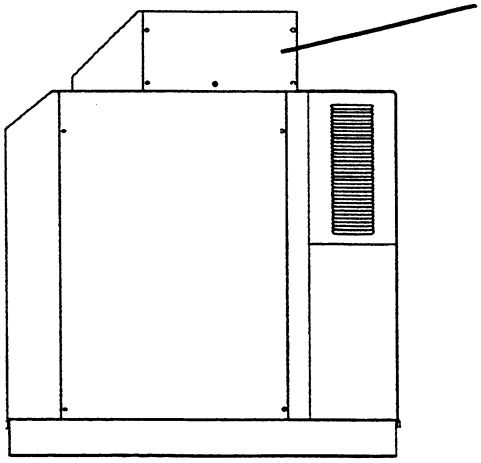


Figure 3-5 RHF Console Mounting Dimensions

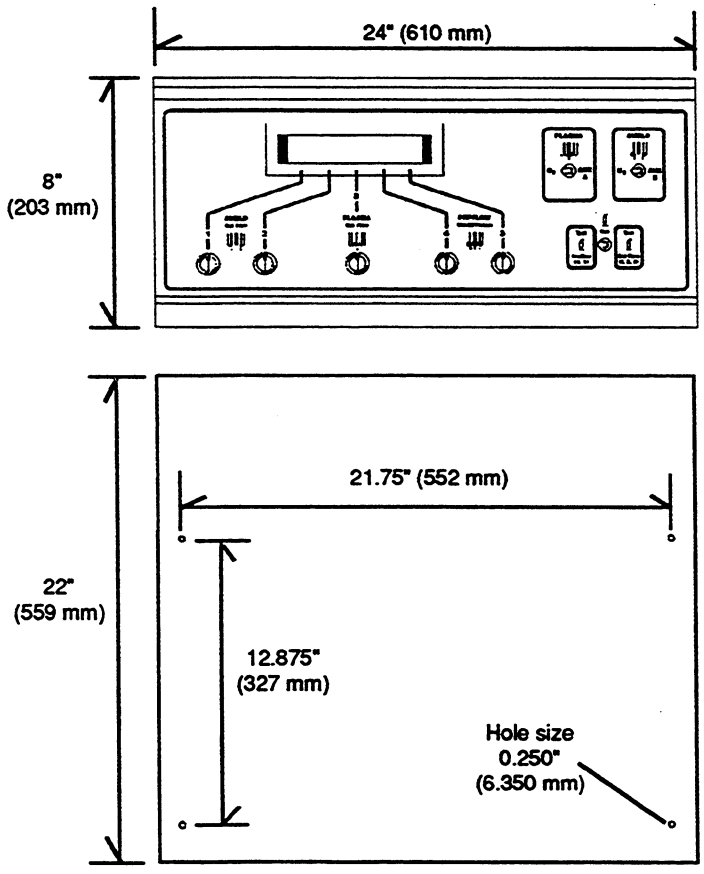


To remove the automatic gas console from the power supply:

1. Remove 10 screws to loosen cover on gas console.
2. From fan side of gas console, slide cover back to disconnect power connector to fan.
3. After disconnecting connector, remove cover.
4. Locate and remove four screws securing gas console to power supply.

   Caution: The automatic gas console weighs 60 pounds (27 kg). Use care when lifting and moving the console.

5. When lifting gas console, note the four flat washers between the power supply and gas console. Reinstall screws with flat washers into screw holes on power supply for future use.



Bottom

Figure 3-6 Automatic Gas Console Removal Procedure and Mounting Dimensions

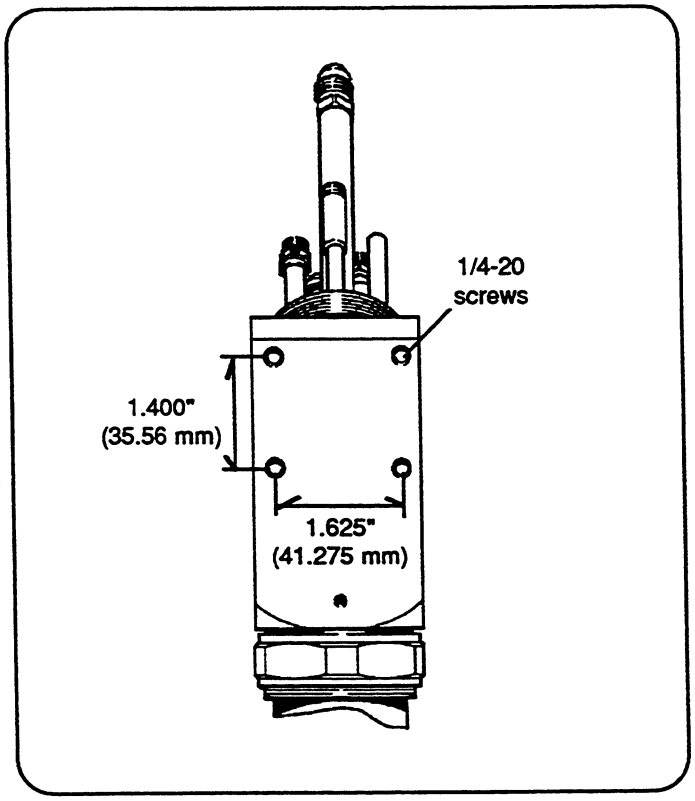


Figure 3-7 45° Torch Quick Disconnect Mounting Hole Dimensions

Cable, Hose & Lead Set Interconnections

The following cable, hose and lead set interconnecting procedures are supported by the system interconnection diagram, Figure 3-8. Also provided are illustrations of each unit showing where the connections are to be made and illustrations of the cables, hoses and lead sets.

Note that these procedures and supporting illustrations are cross referenced (①, ⑨, etc.) to ensure a safe and correct installation. Also note that the cross referencing numbers do not indicate a sequence for interconnecting. It is assumed that in most cases the interconnections will be routed through a power track or festoon system from one point to the other.

IMPORTANT

When interfacing with the CNC, optically isolated I/Os or ground floating interfaces are recommended to avoid ground shift and make the system more immune to EMI noises.

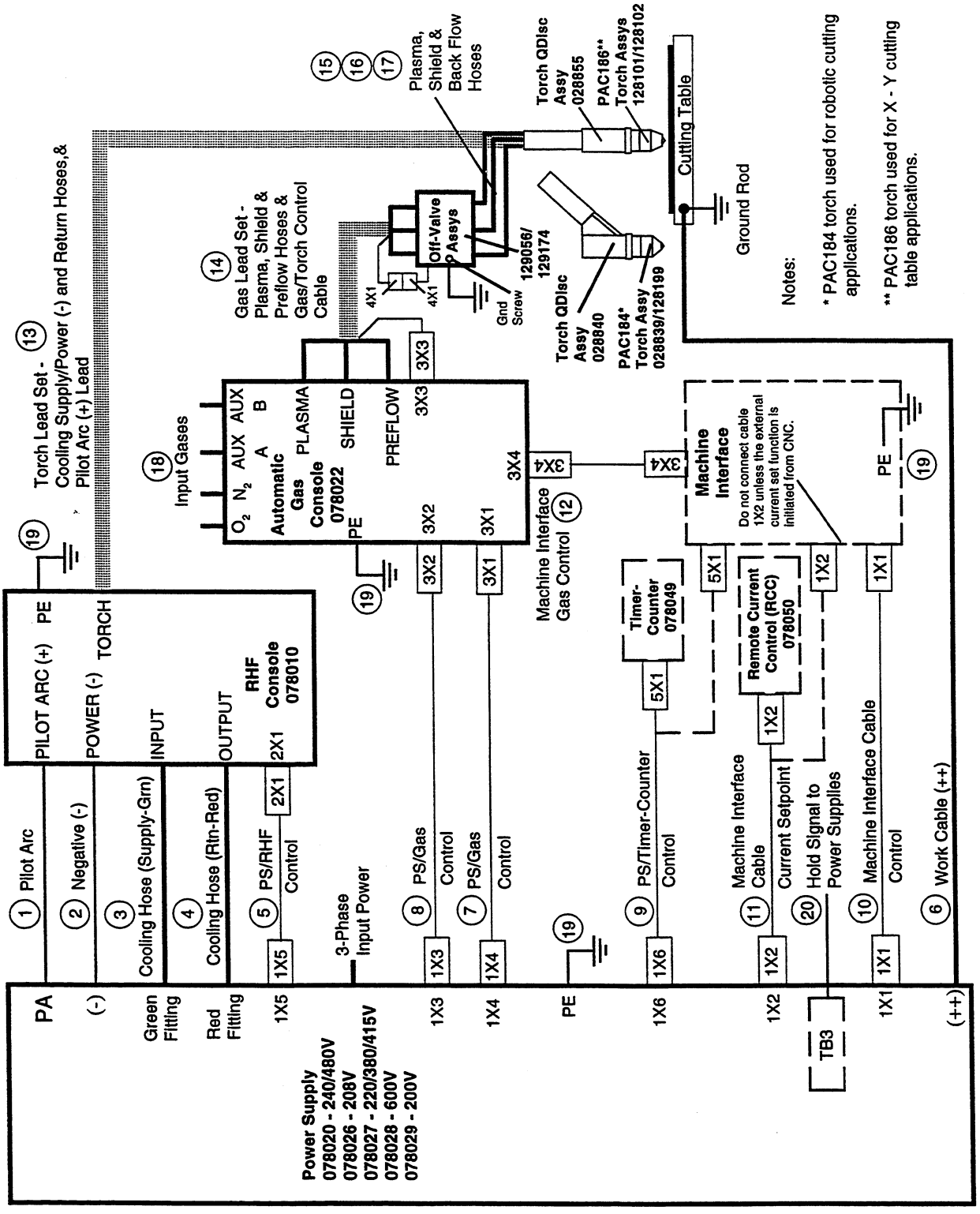


Figure 3-8 HD-3070 System with Automatic Gas Console Interconnect Diagram

Power Supply to RHF Console and Work Table Interconnections ((Figure 3-9)

(1) **Pilot Arc Lead (+) (Figure 3-10)**

1. Route one end of the lead through the feed-through on the rear of the power supply and connect to the pilot arc terminal.
2. Route other end of the lead with strain relief through the **PILOT ARC (+)** on the RHF Console and connect to the pilot arc terminal on the I/O PC BD Assy.

(2) **Negative Lead (-) (Figure 3-11)**

1. Route one end of the lead through the feed-through on the rear of the power supply and connect to the negative terminal.
2. Route the other end of the lead with strain relief through the **POWER (-)** on the RHF Console and connect to the negative terminal on the I/O PC BD Assy.

(3) **Cooling Water Supply Hose /Power Lead (-) (Green) (Figure 3-12)**

1. At the rear of the power supply connect the coolant supply hose (green band) to the check valve connector painted green.
2. Route the other end of the hose through the **IN** feed-through on the RHF Console and connect to the manifold adapter painted green.

(4) **Cooling Water Return Hose (Red) (Figure 3-13)**

1. At the rear of the power supply connect the coolant return hose (red band) to the check valve connector painted red.
2. Route the other end of the hose through the **OUT** feed-through on the RHF Console and connect to the manifold adapter painted red.

(5) **Control Cable (Figure 3-14)**

1. Connect the cable plug marked **1X5** to the receptacle marked **1X5** on the rear of the power supply.
2. Connect the other end of the cable marked **2X1** to the receptacle marked **2X1** on the RHF Console.

(6) **Work Cable (Figure 3-15)**

1. Route one end of the cable through the feed-through on the rear of the power supply and connect to the work (++) terminal. (Figure 3-8)
2. Connect the other end of the cable to the work table ground rod or to the work table. Make sure that good metal-to-metal contact has been made. (Figure 3-8)

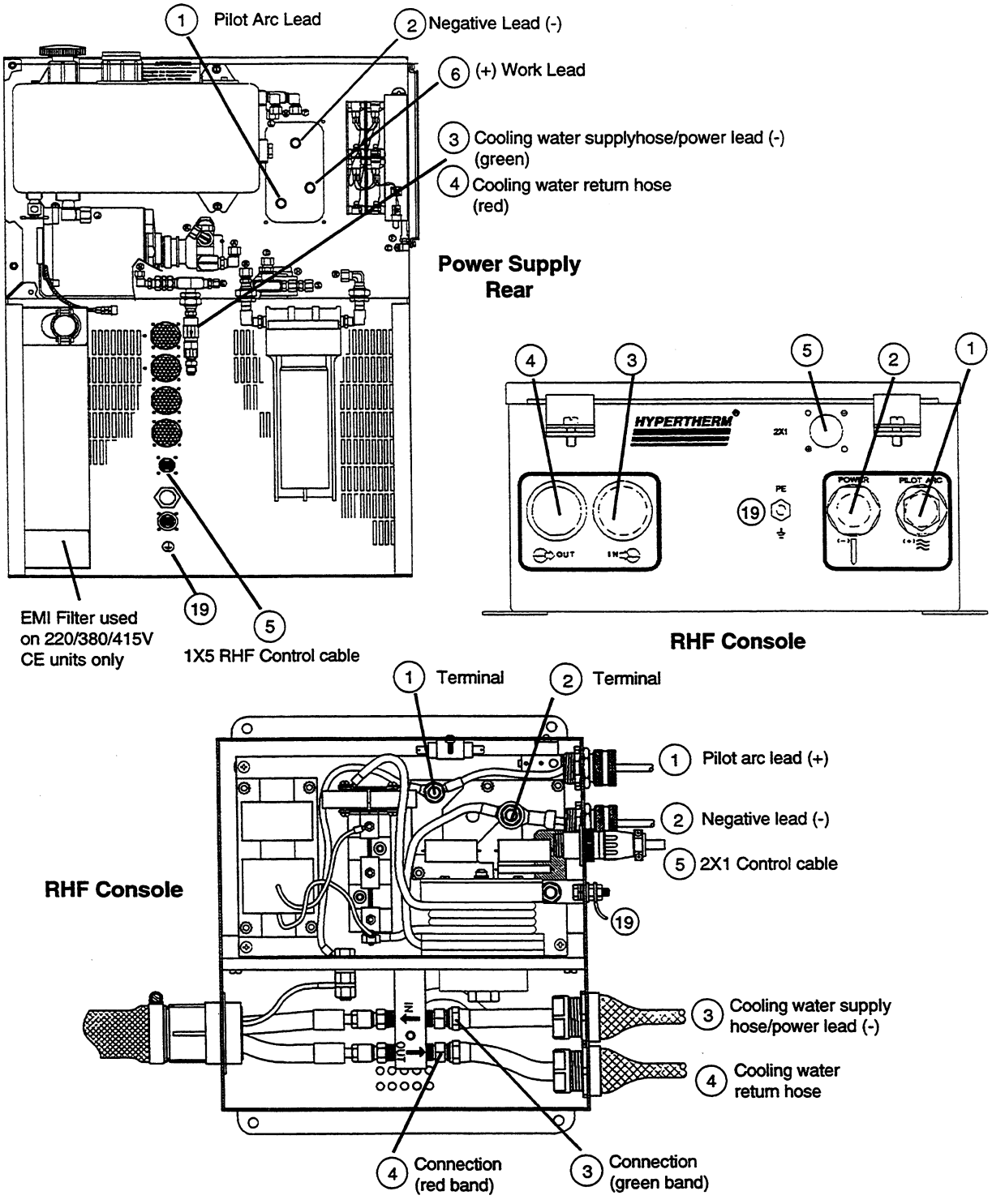


Figure 3-9 Power Supply to RHF Console Interconnections

1

Part Number	Length
023924	4 ft (1.2 m)
023569	15 ft (4.6 m)
023526	25 ft (7.6 m)
023527	50 ft (15.2 m)
023528	75 ft (23 m)
023529	100 ft (30.5m)
023730	115 ft (35 m)
023746	125 ft (38 m)

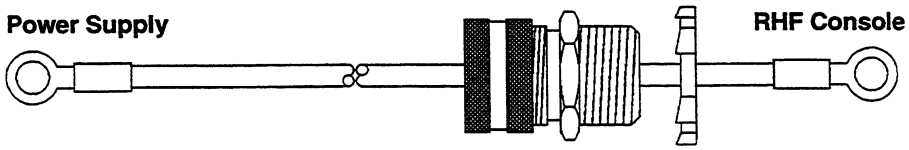


Figure 3-10 Pilot Arc Cable

2

Part Number	Length
023925	4 ft (1.2 m)
023530	15 ft (4.6 m)
023531	25 ft (7.6 m)
023532	50 ft (15.2 m)
023533	75 ft (23 m)
023534	100 ft (30.5 m)
023731	115 ft (35 m)
023747	125 ft (38 m)

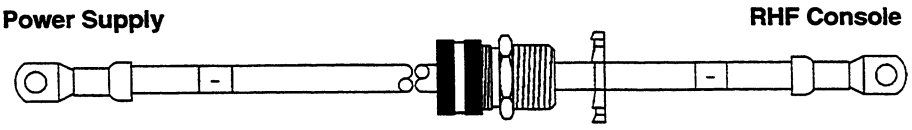


Figure 3-11 Negative Cable (-)

3

Part Number	Length
024421	4 ft (1.2 m)
024290	15 ft (4.6 m)
024291	25 ft (7.6 m)
024263	50 ft (15.2 m)
024264	75 ft (23 m)
024265	100 ft (30.5 m)
024385	115 ft (35 m)
024396	125 ft (38 m)
024459	150 ft (46 m)

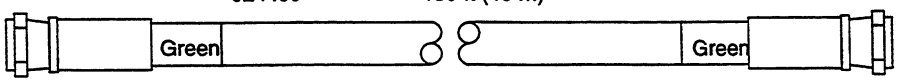


Figure 3-12 Cooling Supply Hose/Power Lead (-)

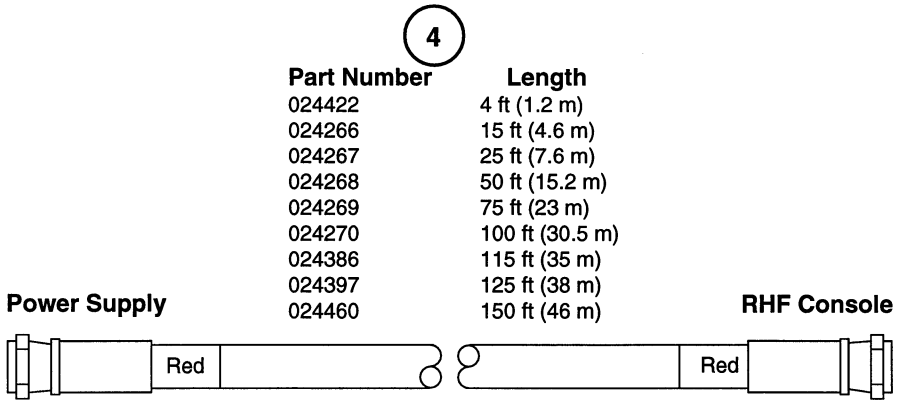
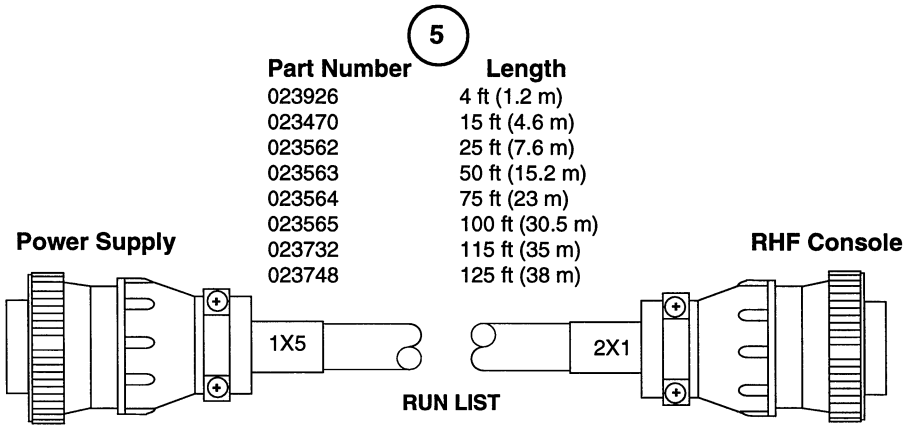


Figure 3-13 Cooling Return Hose



SIGNAL	PLUG 1X5	COLOR	PLUG 2X1
Door Interlock	1	Black	1
	2	Red	2
Ground	5	Shield	Cut
HV Transformer	6	Red	6
	7	Black	7
Ground	3	Shield	Cut

Figure 3-14 PS/RHF Control Cable

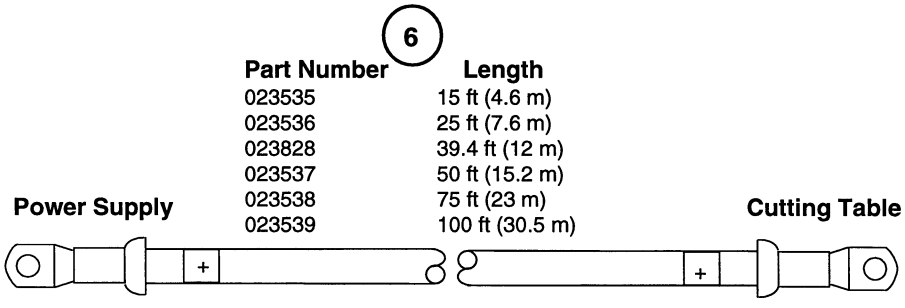


Figure 3-15 Work Cable (+)

Power Supply to Automatic Gas Console Interconnections (Figure 3-16)

(7) **Gas Console Cable (Fig 3-17)**

1. Connect the cable plug marked **1X4** to the receptacle marked **1X4** on the rear of the power supply.
2. Connect the other end of the cable marked **3X1** to the receptacle marked **3X1** on the gas console.

(8) **Gas Console Control Cable (Fig 3-18)**

1. Connect the cable plug marked **1X3** to the receptacle marked **1X3** on the rear of the power supply.
2. Connect the other end of the cable marked **3X2** to the receptacle marked **3X2** on the gas console.

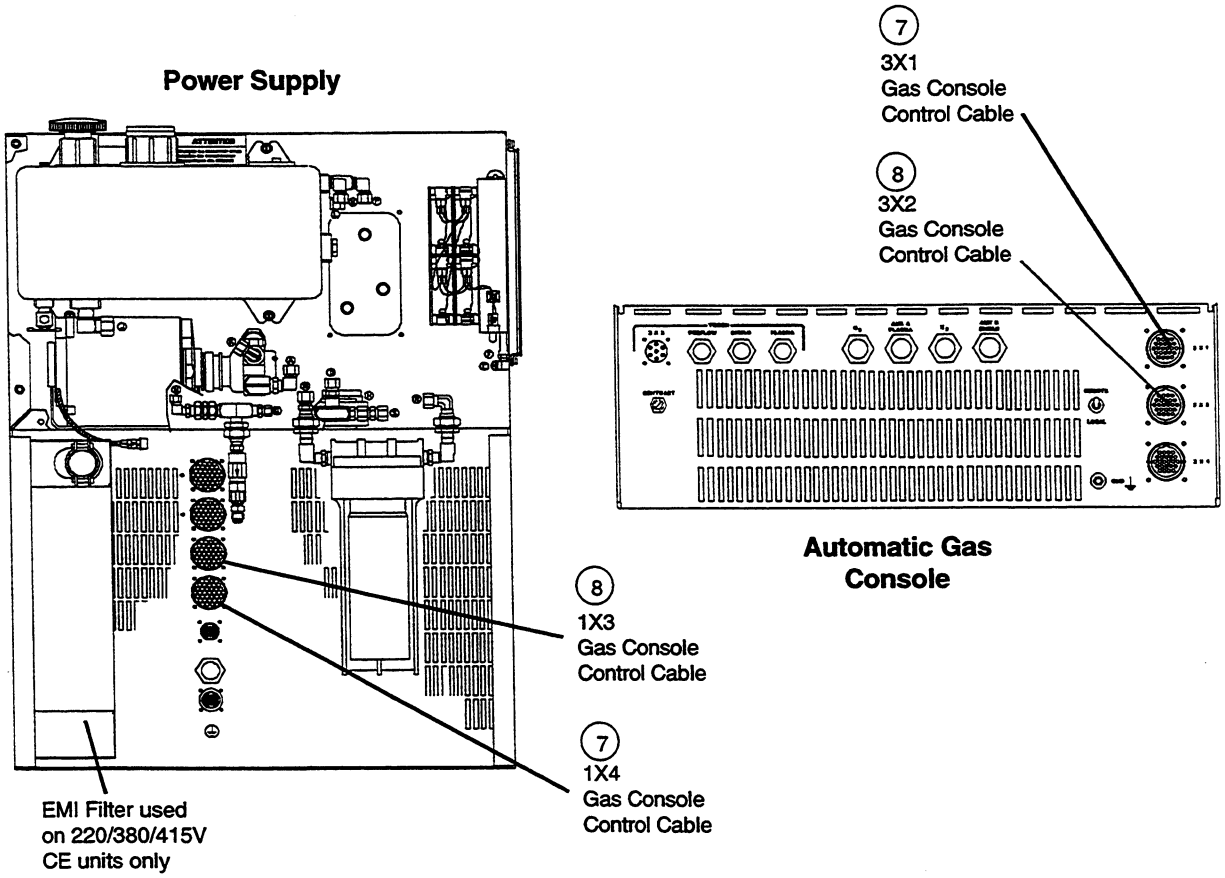
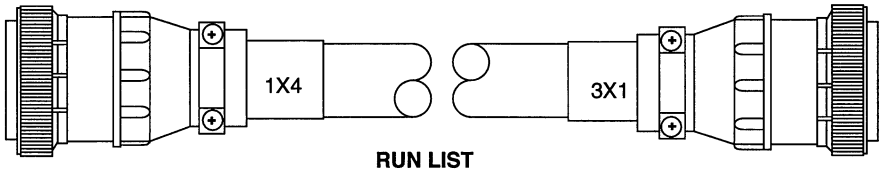


Figure 3-16 Power Supply to Automatic Gas Console Interconnections

7

Part Number	Length
023673	6 ft (1.8 m)
023558	10 ft (3 m)
023472	25 ft (7.6 m)
023556	50 ft 15 m)
023557	75 ft (23 m)
023760	100 ft (30.5 m)
023744	125 ft (38 m)
023733	150 ft (45.6 m)

Power Supply **Automatic Gas Console**



RUN LIST

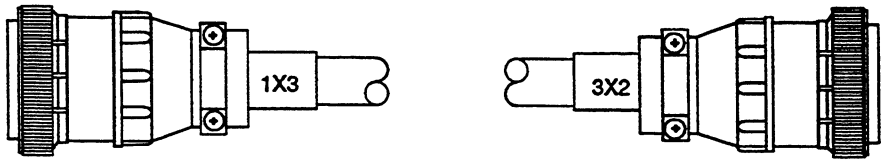
SIGNAL	PLUG 1X4	COLOR	PLUG 3X1
Message Number	14	Black	14
	15	Green	15
-	9	Shield	9
Shield Operate	12	Black	12
	13	Yellow	13
-	7	Shield	7
Air Plasma	23	Black	23
	24	Blue	24
-	29	Shield	29
Shield Preflow	10	Black	10
	11	Orange	11
-	5	Shield	5
H35 & N_2 Plasma	25	Black	25
	26	White	26
-	31	Shield	31
Plasma On & Off	1	Black	1
	2	Brown	2
-	6	Shield	6
O_2 Plasma	27	Red	27
	28	Brown	28
-	33	Shield	33
Unassigned	3	Black	3
	4	Red	4
-	8	Shield	8
Gas System Power	36	Red	36
	37	Brown	37
-	32	Shield	32
Unassigned	34	Black	34
	35	Red	35
-	30	Shield	30
Key	N/A	N/A	16

Figure 3-17 Gas Console Cable

(8)

Part Number	Length
023671	6 ft (1.8 m)
023927	10 ft (3 m)
023672	25 ft (7.6 m)
023928	50 ft 15 m)
023929	75 ft (23 m)
023930	100 ft (30.5 m)
023931	125 ft (38 m)
023932	150 ft (45.6 m)

Power Supply **Automatic Gas Console**



RUN LIST

SIGNAL	PLUG 1X3	COLOR	PLUG 3X2
Gas Pressure	1	Red	1
or Contact Closure	2	Black	2
-	6	Shield	6
Gas System	3	White	3
or Contact Closure	4	Black	4
-	8	Shield	8
Plasma Alt Gas	10	Green	10
Contact Closure	11	Black	11
-	5	Shield	5
Test Operate Flow	14	Yellow	14
Contact Closure	15	Black	15
-	9	Shield	9
Test Preflow	12	Blue	12
Contact Closure	13	Black	13
-	7	Shield	7
Plasma O_2/N_2 Select	21	Brown	21
Contact Closure	22	Black	22
-	17	Shield	17
DC On Light	23	Red	23
	24	White	24
-	19	Shield	19
Shield Alt Gas	20	Orange	20
Contact Closure	18	Black	18
-	16	Shield	16

Figure 3-18 Gas Console Control Cable

Power Supply to Machine Interface /Timer-Counter Interconnection (Figure 3-19)

(9) Timer-Counter Control Cable (Figure 3--20)

1. Connect the cable plug marked **1X6** to the receptacle marked **1X6** on the rear of the power supply.

2. Connect the other end of the cable to the machine interface or or receptacle marked **5X1** on the rear of timer-counter. (Fig. 3-8)

Power Supply to Machine Interface Interconnection (Figure 3-19)

(10) Machine Interface Control Cable (Figure 3-21)

1. Connect the cable plug marked **1X1** to the receptacle marked **1X1** on the rear of the power supply.

2. Connect the other end of the cable to the machine interface. (Fig. 3-8)

Power Supply to Machine Interface /RCC Interconnection (Figure 3-19)

(11) Machine Interface Current Setpoint Cable (Figure 3-22)

Do not connect this cable unless the external current set function is going to be initiated from the CNC controller.

1. Connect the cable plug marked **1X2** to the receptacle marked **1X2** on the rear of the power supply.

2. Connect the other end of the cable to the machine interface or receptacle marked **1X2** on the rear of RCC. (Fig. 3-8)

Gas Console to Machine Interface Interconnection (Fig 3-19)

(12) Machine Interface Gas Control Cable (Fig 3-23)

1. Connect the cable plug marked **3X4** to the receptacle marked **3X4** on the rear of the gas console. (Fig. 3-8)

2. Connect the other end of the cable to the machine interface. (Fig. 3-8)

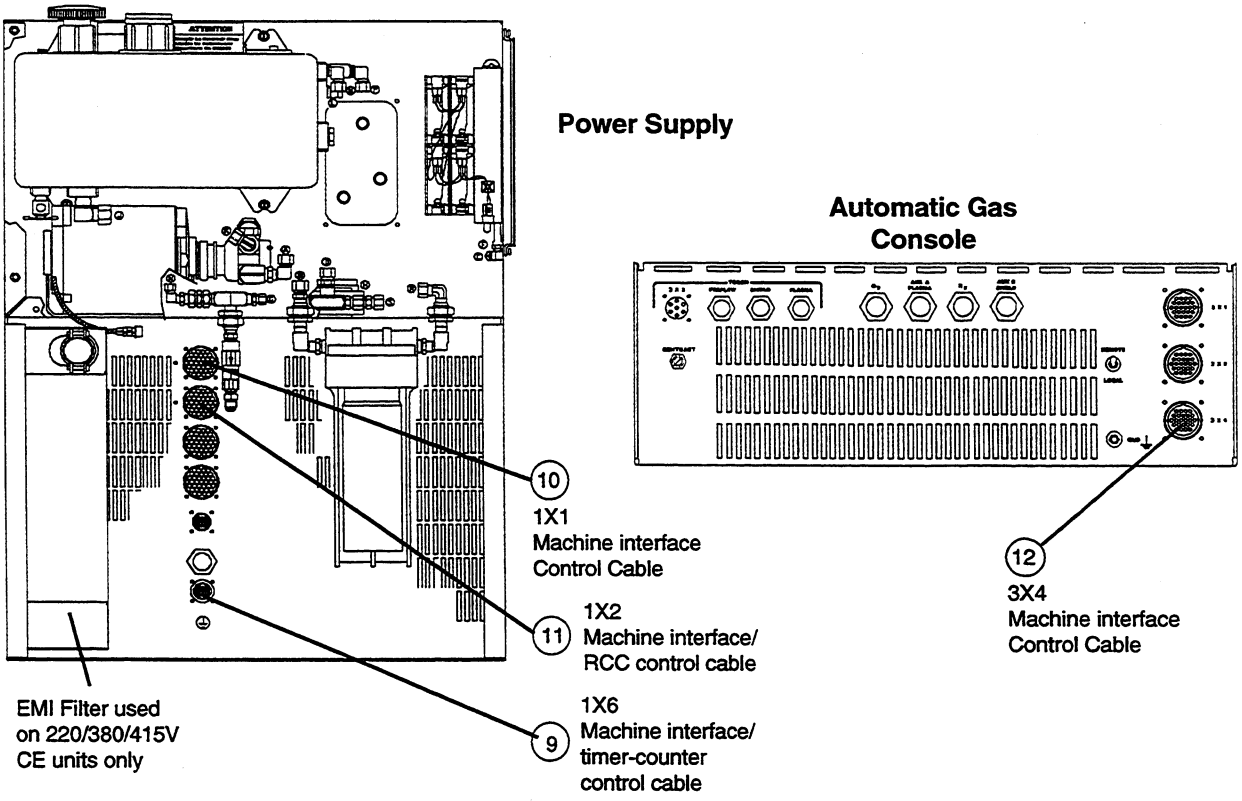
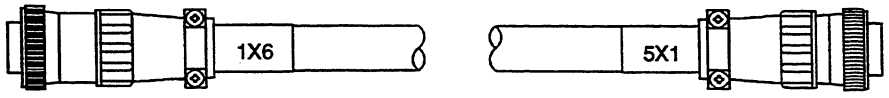


Figure 3-19 Power Supply and Automatic Gas Console Interconnections to Machine Interface

9

Part Number	Length
023946	3.5 ft (1.1 m)
023947	5.5 ft (1.7 m)
023948	6 ft (1.8 m)
023949	25 ft (7.6 m)
023721	28.2 ft (8.6 m)
023950	38 ft (11.6 m)
123111	50 ft (15.2 m)
123100	75 ft (23 m)



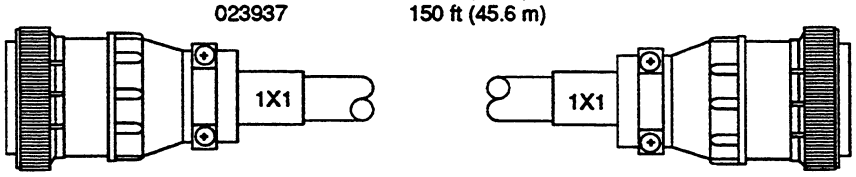
RUN LIST

SIGNAL	PLUG 1X6	COLOR	TIMER-COUNTER/MACHINE INTERFACE
Starts & Arc Time	2	White	2
Starts & Arc Time	3	Black	3
Drain	4	Drain	4
Error Counter	5	Red	5
Error Counter	6	Black	6
Drain	7	Drain	7

Figure 3-20 PS/Machine Interface or Timer/Counter Control Cable

(10)

Part Number	Length
023707	25 ft (7.6 m)
023829	28.2 ft (8.6 m)
023933	50 ft 15 m)
023934	75 ft (23 m)
023935	100 ft (30.5 m)
023936	125 ft (38 m)
023937	150 ft (45.6 m)



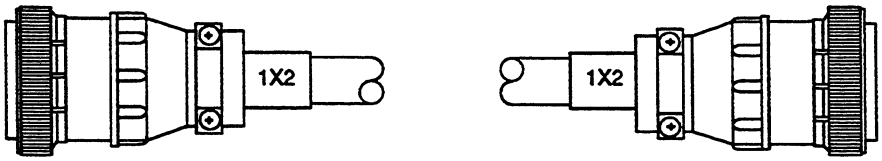
RUN LIST

SIGNAL	PLUG 1X1	COLOR	MACHINE INTERFACE
Hold (Dry)	1	Black	1
Hold (Dry)	5	Red	5
-	10	Drain	10
Pierce Comp (Dry)	2	Black	2
Pierce Comp (Dry)	6	White	6
-	11	Drain	11
Torch Ignition Out (Dry)	3	Black	3
Torch Ignition Out (Dry)	7	Green	7
-	12	Drain	12
Power Off -	4	Black	4
Power Off +	8	Blue	8
-	13	Drain	13
Plasma On (Dry)	9	Black	9
Plasma On (Dry)	15	Yellow	15
-	14	Drain	14
Ext Inter CC (Dry)	16	Red	16
Ext Inter CC (Dry)	17	Blue	17
-	18	Drain	18
Power On Input +	29	Black	29
Power On Input -	34	Brown	34
-	23	Drain	23
1/50 Arc Voltage -	33	Red	33
1/50 Arc Voltage +	28	Green	28
-	27	Drain	27
Power Interlocks (Dry)	35	Red	35
Power Interlocks (Dry)	30	White	30
-	24	Drain	24
Transfer Out (Dry)	37	Black	37
Transfer Out (Dry)	32	Orange	32
-	26	Drain	26

Figure 3-21 PS/Machine Interface Control Cable

(11)

Part Number	Length
023708	25 ft (7.6 m)
023830	28.2 ft (8.6 m)
023709	50 ft 15 m)
023710	75 ft (23 m)
023711	100 ft (30.5 m)
023944	125 ft (38 m)
023945	150 ft (45.6 m)



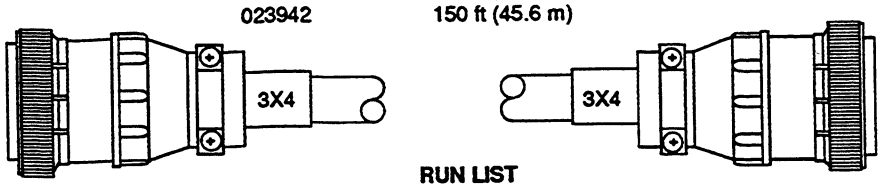
RUN LIST

SIGNAL	PLUG 1X2	COLOR	MACHINE INTERFACE
Shield	10	N/A	10
1 Amp BCD	2	White	2
2 Amp BCD	3	Red	3
4 Amp BCD	4	Green	4
8 Amp BCD	5	Brown	5
10 Amp BCD	6	Blue	6
20 Amp BCD	7	Orange	7
40 Amp BCD	8	Yellow	8
80 Amp BCD	12	Gray	12
100 Amp BCD	13	Violet	13
Common	11	Black	11

Figure 3-22 PS/Machine Interface or RCC Current Setpoint Cable

(12)

Part Number	Length
023667	25 ft (7.6 m)
023831	28.2 ft (8.6 m)
023938	50 ft 15 m)
023939	75 ft (23 m)
023940	100 ft (30.5 m)
023941	125 ft (38 m)
023942	150 ft (45.6 m)



RUN LIST

SIGNAL	PLUG 3X4	COLOR (PAIR)	MACHINE INTERFACE
Gas Flow Set 1 (+)	1	Black	1
Gas Flow Set 2 (+)	2	Red	2
Gas Flow Set 4 (+)	3	Black	3
Gas Flow Set 8 (+)	4	White	4
GFS Common (U) (-)	5	Black	5
Gas Flow Set 10 (+)	6	Green	6
Gas Flow Set 20 (+)	7	Black	7
Gas Flow Set 40 (+)	8	Blue	8
Gas Flow Set 80 (+)	9	Black	9
GFS Common (10) (-)	10	Yellow	10
Gas Flow Set 100 (+)	11	Black	11
Valve Select 1 (+)	12	Brown	12
Valve Select 2 (+)	13	Black	13
Valve Select 4 (+)	14	Orange	14
Valve Select 8 (+)	15	Red	15
Valve Sel Common (-)	16	White	16
Write (+)	17	Red	17
Read Complete Out (+)	18	Green	18
Common (-)	19	Red	19
NC	20	Blue	20
Remote Test/Operate (+)	21	Red	21
Remote Test/Preflow (+)	22	Yellow	22
Spare Input (+)	23	Red	23
Remote Plasma Alt (+)	24	Brown	24
Remote Shield Alt (+)	25	Red	25
Common (-)	26	Orange	26
Error Output (+)	27	Green	27
Common (-)	28	White	28
NC	29	Green	29
NC	30	Blue	30
NC	31	Green	31
NC	32	Yelow	32
NC	33	Green	33
NC	34	Brown	34
NC	35	Green	35
NC	36	Orange	36
Shield O/A	37	N/A	37

Figure 3-23 Gas Console/Machine Interface Control Cable

RHF Console to Torch Quick Disconnect Interconnections (Figure 3-24)

(13) The torch lead set interconnections include connecting the torch lead set between the RHF console and the torch quick disconnect.

Torch Lead Set to RHF Console

Route the pilot arc lead and water hoses from the torch lead set through the brass feed-through on the RHF console marked **TORCH**.

(13A) **Pilot Arc Lead (+)**

- Route the ring end of the cable through the hole in the center section and connect to the pilot arc terminal on the I/O PC BD Assy.

(13B) **Cooling Water Hose Supply Hose /Power Lead (-) (Green)**

- Connect cooling supply hose (green band) to the manifold adapter (green).

(13C) **Cooling Water Return Hose (Red)**

- Connect cooling return hose (red band) to the manifold adapter (red).

Torch Lead Set to Torch Quick Disconnect

Route the other end of the torch lead set through the power track or festoon to connect to the torch quick disconnect. Wrap the hose and lead ends together with electrical tape, so that the ends do not catch while routing.

(13A) **Pilot Arc Lead (+)**

- Connect the pilot arc cable to the pilot pin fitting.

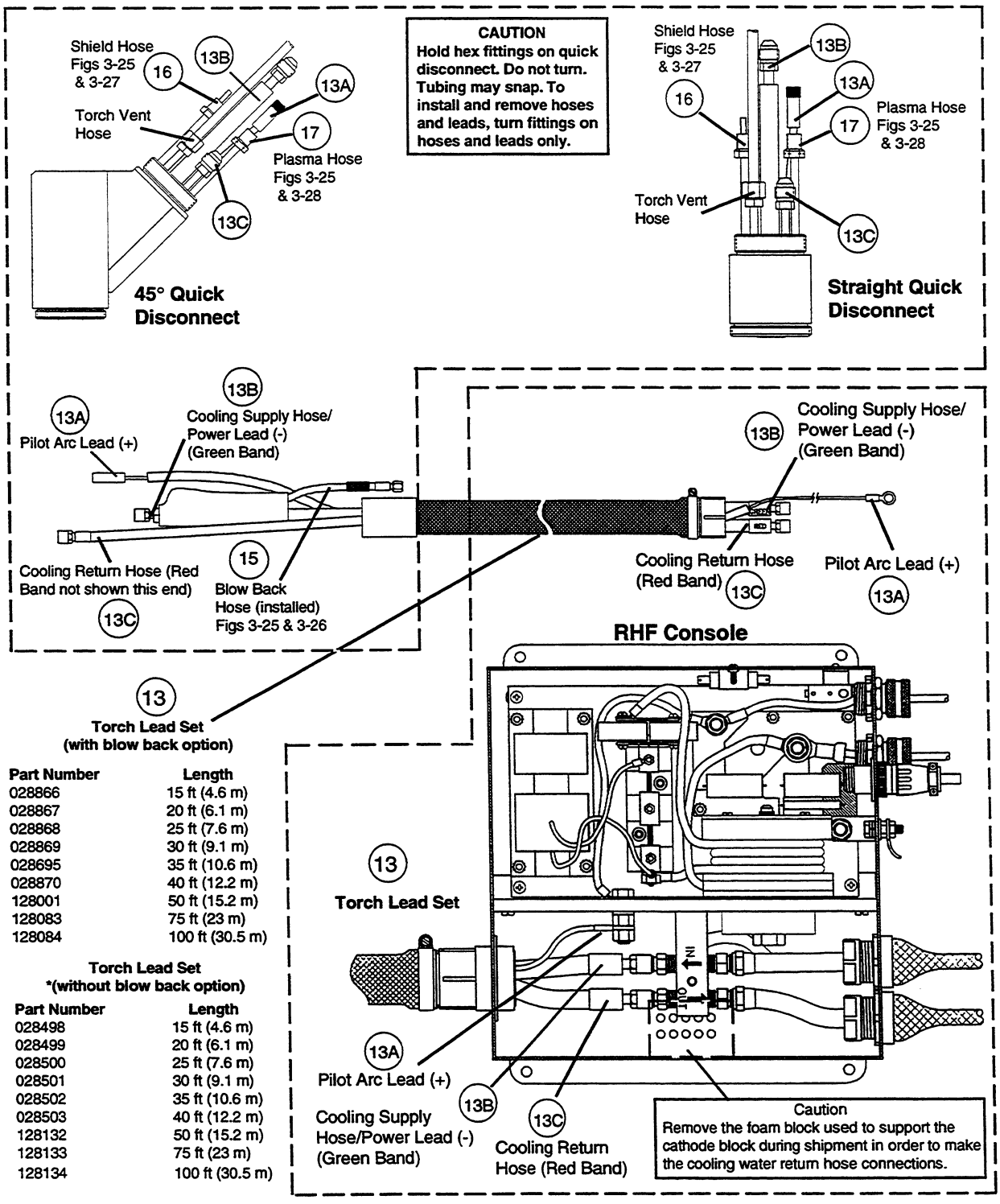
(13B) **Cooling Water Supply Hose /Power Lead (-) (Green)**

- Connect the cooling supply hose (green band) to the water inlet fitting (RH) at the center of the torch.

> Caution: Hold hex fitting on inlet tube with wrench, the tube may snap. Turn fitting on torch lead set only.

(13C) **Cooling Water Return Hose (Red)**

- Connect the cooling return hose (red band) to the water outlet fitting (RH).



Torch Lead Set
(with blow back option)

Part Number	Length
028866	15 ft (4.6 m)
028867	20 ft (6.1 m)
028868	25 ft (7.6 m)
028869	30 ft (9.1 m)
028695	35 ft (10.6 m)
028870	40 ft (12.2 m)
128001	50 ft (15.2 m)
128083	75 ft (23 m)
128084	100 ft (30.5 m)

Torch Lead Set
***(without blow back option)**

Part Number	Length
028498	15 ft (4.6 m)
028499	20 ft (6.1 m)
028500	25 ft (7.6 m)
028501	30 ft (9.1 m)
028502	35 ft (10.6 m)
028503	40 ft (12.2 m)
128132	50 ft (15.2 m)
128133	75 ft (23 m)
128134	100 ft (30.5 m)

* See Fig. 6-33A for torch lead set without the blow back option.

Figure 3-24 RHF Console to Torch Quick Disconnect Interconnections

Gas Console to Off-Valve Assembly Interconnections (Figure 3-25)

(14) The gas lead set interconnections include connecting the torch lead set between the gas console and the off-valve assembly.

Gas Lead Set to Gas Console

Connect the gas lead set to the three fittings and receptacle on the gas console marked **TORCH**.

(14A) **Plasma Gas Hose**

- Connect the hose (clear) to the blue **PLASMA** fitting (LH).

(14B) **Shield Gas Hose**

- Connect the hose (gray) to the green **SHIELD** fitting (RH).

(14C) **Preflow Gas Hose**

- Connect the hose (red) to the red **PREFLOW** fitting (RH).

(14D) **Control Cable**

- Connect the cable plug marked **3X3** to the receptacle marked **3X3.**

Gas Lead Set to Off Valve Assembly

Route the other end of the gas lead set through the power track or festoon to connect to the off-valve assembly. Wrap the hose and lead ends together with electrical tape, so that the ends do not catch while routing.

(14A) **Plasma Gas Hose**

- Connect the hose (clear) to the plasma gas inlet fitting (blue) (LH).

(14B) **Shield Gas Hose**

- Connect the hose (gray) to the shield gas inlet fitting (green) (RH).

(14C) **Preflow Gas Hose**

- Connect the hose (red) to the preflow gas inlet fitting (red) (RH).

(14D) **Control Cable**

- Connect the cable plug marked **4X1** to the receptacle marked **4X1.**

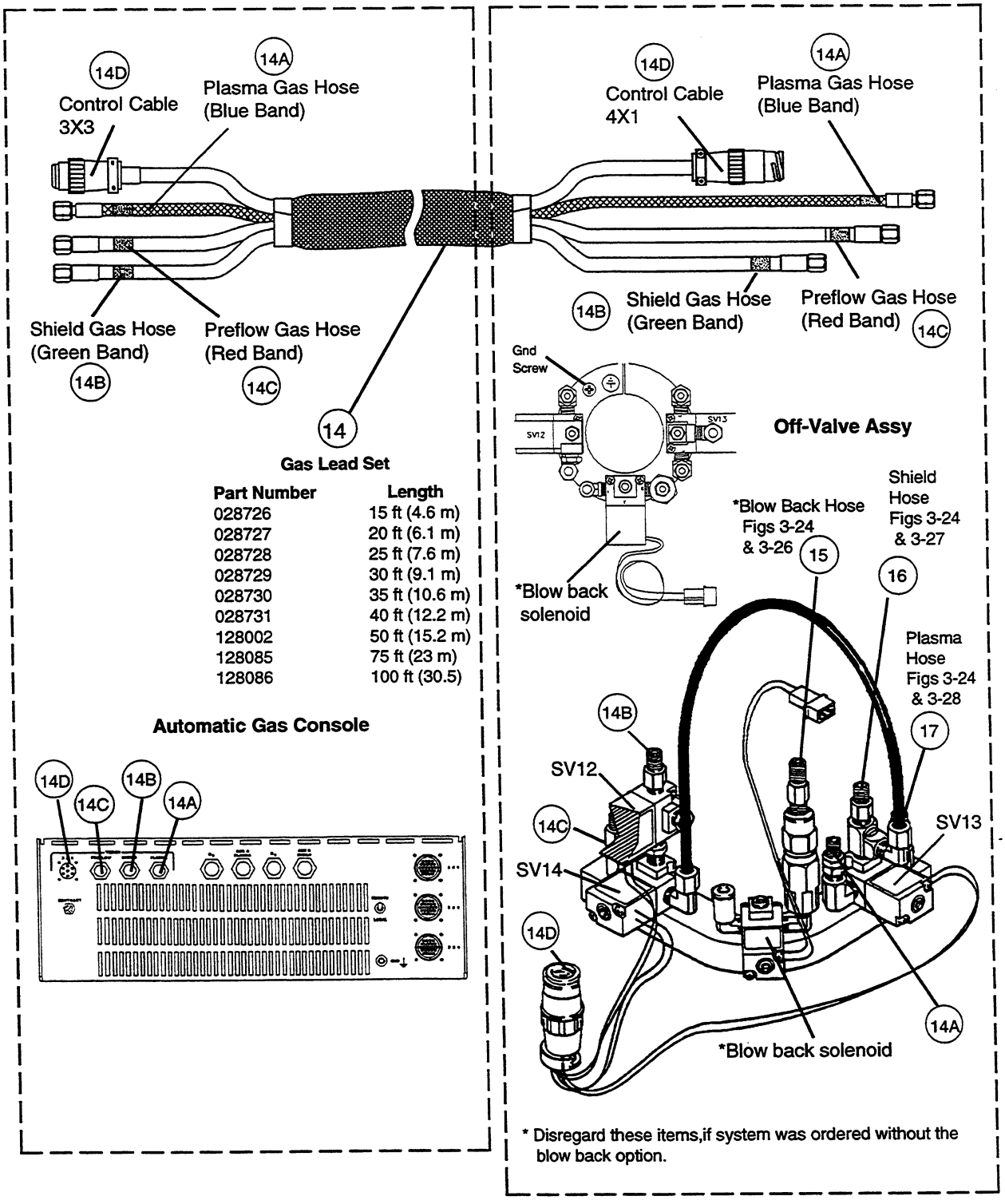


Figure 3-25 Automatic Gas Console to Off-Valve Assembly Interconnections

Off-Valve Assembly to Torch Quick Disconnect Interconnections (Figures 3-24 and 3-25)

After the torch lead set and gas lead set have been connected, connect the plasma and shield gas hoses and blow back hose between the off-valve assembly and torch quick disconnect.

Off-Valve Assembly

(15) ***Blow Back Hose (Figure 3-26)**

- Connect the blow back hose (from torch lead set) to blow back solenoid.

(16) **Shield Gas Hose (Figure 3-27)**

- Connect the gray hose to the shield inlet fitting (RH).

(17) **Plasma Gas Hose (Figure 3-28)**

- Connect the clear hose to the plasma inlet fitting (LH).

Torch Quick Disconnect

Slide the other hose ends through the torch sleeve and connect to torch quick disconnect.

(16) **Shield Gas Hose**

- Connect the hose (gray) to the shield inlet fitting (RH).

(17) **Plasma Gas Hose**

- Connect the hose (clear) to the plasma inlet fitting (LH).

Slide the torch sleeve to the torch quick disconnect, mate threaded ends and tighten.

* Not used, if system was ordered without the blow back option.

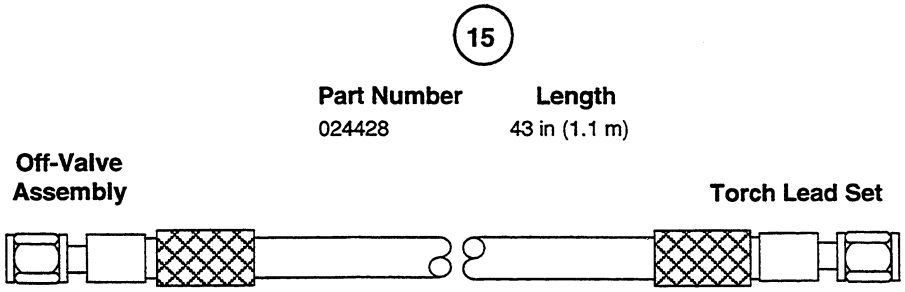


*Figure 3-26 Blow Back Hose Assembly, RH "A"

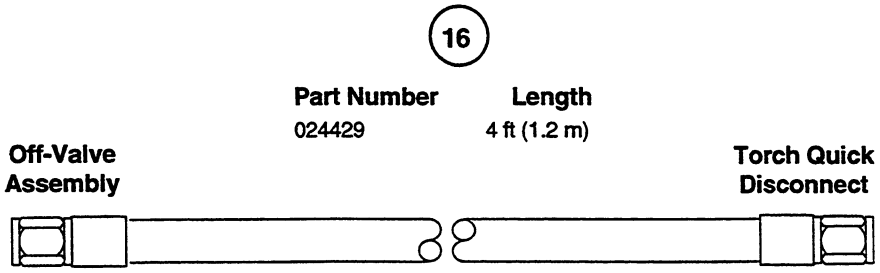


Figure 3-27 Shield Gas Hose Assembly, 3/16 Inch Gray RH "A"

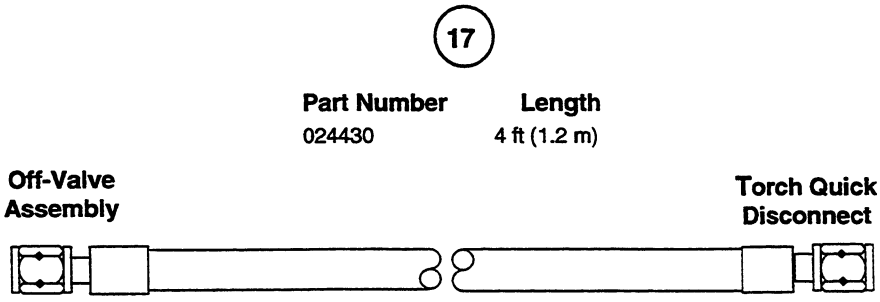


Figure 3-28 Plasma Gas Hose Assembly, LH "A"

* Not used, if system was ordered without the blow back option.

Gas Supply Hose Connections (Figure 3-29)

(18) Gas Supply Hoses

The gas supply hoses are customer supplied.

- Connect the oxygen (O_2) and nitrogen (N_2) gas supplies from the high pressure regulators to the gas console fittings marked **O_2** and **N_2**.
- Connect the air supply to fitting marked **AUX A** and methane (CH_4) gas supply to fitting marked **AUX B** .

Note: The AUX A port is shipped without a gas input adapter. If the user needs to use the AUX A port, ensure the adapter fitting is different than the O_2 015009 fitting, so that oxygen cannot be accidentally connected to the AUX A port.

O_2 input adapter (015009 1/4 NPT, right handed 'B', male)
AUX A PLASMA (adapter not supplied)
N_2 input adapter (015103 1/4 NPT, right handed 'B', inert female)
AUX B SHIELD input adapter (015230 1/4 NPT, left handed 'B', male)

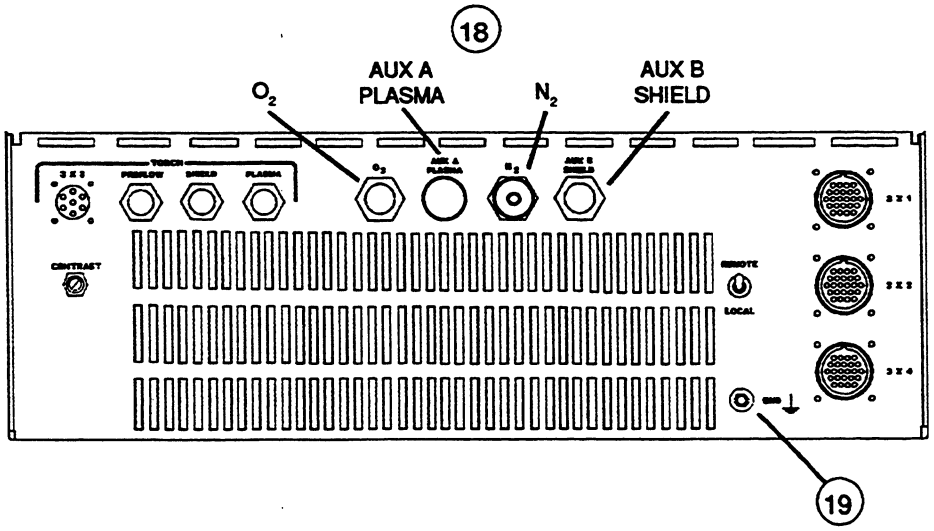


Figure 3-29 Gas Supply Hose and PE Ground Connections

PE Ground Cable Connections (Figures 3-9, 3-10 and 3-29)

(19) PE Ground Cables

The PE ground cables are customer supplied. The power supply, RHF console and gas console provide connections for protective earth (PE) grounding. Each cable should be connected to the worktable earth ground. Refer to *Pre-Installation, Equipment Grounding* for cable specifications in the front of this section.

Hold Signal Connections (Figures 3-8 and 3-30)

(20) Hold Signal Terminal Block TB3

The hold signal is used to synchronize the starting of two or more systems. The hold signal is available at TB3 or at the CNC through cable 1X1. Dry contact start. The hold signal cable is customer supplied.

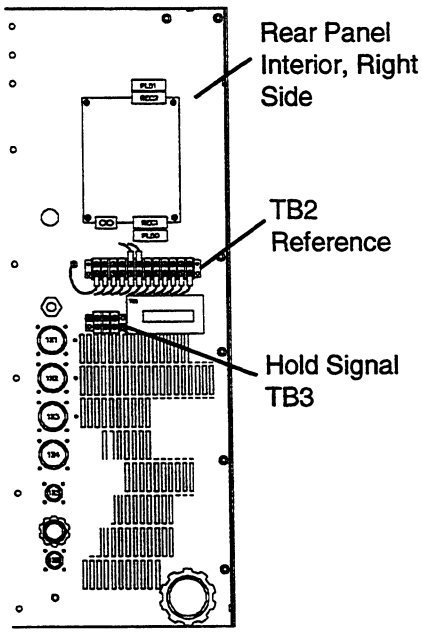


Figure 3-30

TB3 Hold Signal Connection Location

Mount PAC184/PAC186 Torch to Quick Disconnect

1. Align the PAC184 or PAC186 torch ports to the torch quick disconnect receptacle, then push into place. See Figure 3-31.

2. Turn the securing ring clockwise (cw) to lock torch into place.

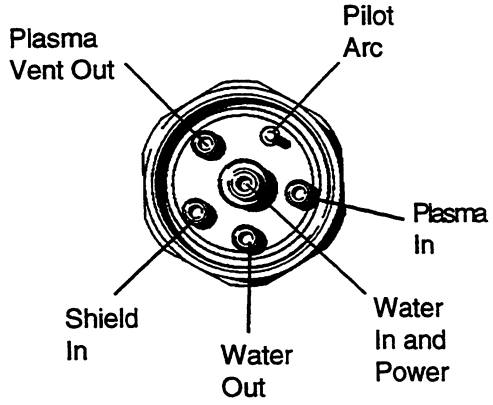


Figure 3-31 PAC184/PAC186 Torch Gas, Coolant and Pilot Arc Port Locations

Torch Coolant Requirements

The power supply is shipped without any coolant in the tank. A standard mixture of propylene glycol (30%), deionized water (69.5%) and benzotriazole (0.5%) is recommended. This mixture resists freezing to +10° F (-12° C) and contains a corrosion inhibitor (benzotriazole) to protect copper surfaces in the coolant loop. This mixture is available in one -gallon containers by ordering 028872. 100% propylene glycol is available by ordering 028873.

For operating temperatures colder than the temperature stated above, the percentage of propylene glycol must be increased. Refer to Figure 3-32 which shows the freezing points of a mixture of propylene glycol (%) and deionized water. Failure to do so could result in a cracked torch head, leads, or other damage to the torch coolant system due to the torch coolant freezing.

Every six months, flush the power supply of its torch coolant and replace with new coolant (028872).

Observe the warning and caution below. Refer to the Material Safety Data Sheets in Appendix C for data on safety, handling, and storage of propylene glycol and benzotriazole.

WARNING

Propylene glycol and benzotriazole are irritating to skin and eyes, and harmful or fatal if swallowed. Upon contact, flush skin or eyes with water. If swallowed drink water and call a physican immediately. Do not induce vomiting.

Caution: Always use propylene glycol in the coolant mixture. Do not use anti-freeze in place of propylene glycol. Anti-freeze contains corrosion inhibitors which will damage the torch coolant system.

Always use purified water in the coolant mixture in order to prevent corrosion in the torch coolant system. The hardness of purified water should be between .206 and 8.5 ppm. If using a conductivity meter to measure water purity, the recommended level is between .5 and 18 µ Siemens/cm at 77° F (25° C).

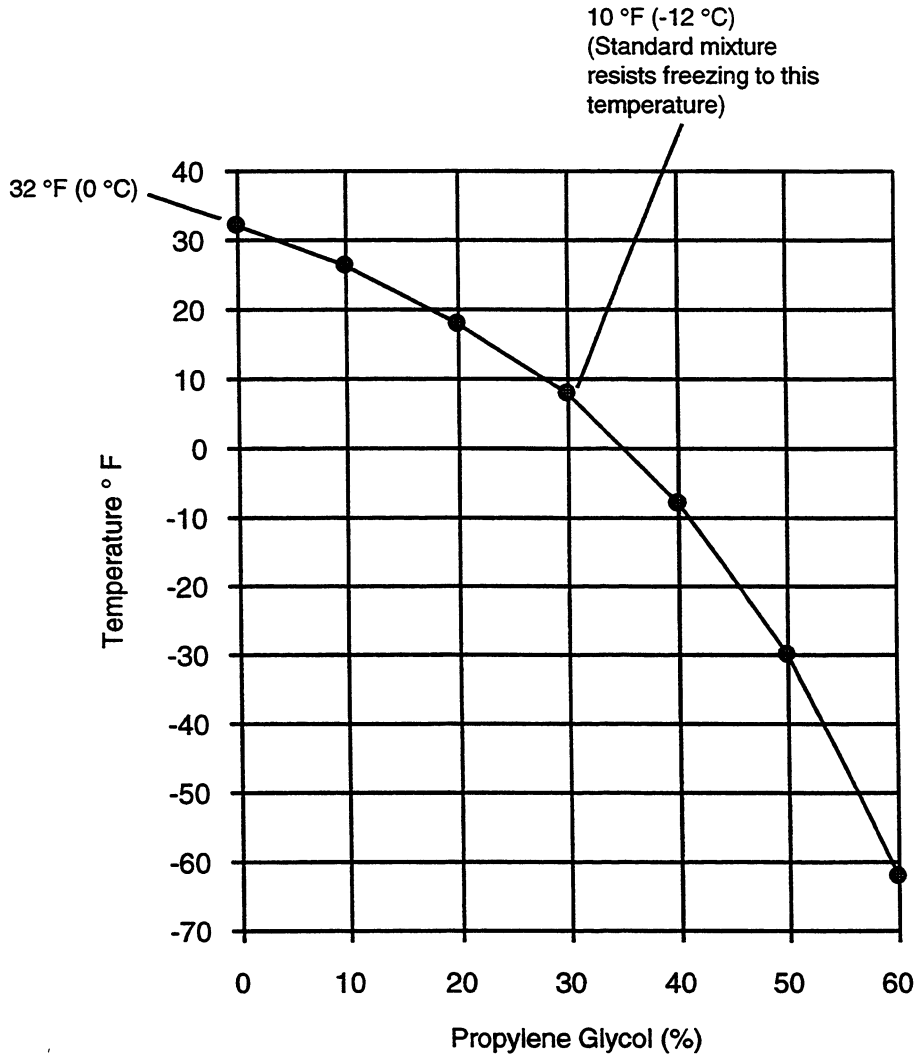


Figure 3-32 Freezing Points of a Mixture of Propylene Glycol (%) and Deionized Water

INSTALLATION

Filling Torch Coolant System

Before proceeding with filling the system with coolant:

- Ensure that your cutting environment and clothing meet the safety requirements. Refer to *Safety*, Section 1 in this manual.
- Ensure that all installation requirements in this manual have been met.

> Caution: Never turn the power supply on before filling the tank.

1. Turn on the inlet gas supplies to the gas console. Ensure the gases are available at 120 psi (8.2 bar).
2. At the rear of the power supply, ensure the coolant shutoff valve is open (Figure 6-10, item 13), unscrew the filler/vent cap on coolant tank (item 9). Fill tank with 8.5 quarts (8 liters) of coolant.

> Caution: Do not over fill the tank.

3. At the line voltage disconnect box set the switch to **On.**
4. Turn on the power supply by depressing and holding the POWER ON (1) pushbutton switch/ indicator (PB1/LT1). The **COOLANT FLOW** LED will remain out until the coolant has pushed all of the air out of the torch cooling hoses and the coolant returns to the tank. This process may take up to 60 seconds.
5. Locate the red button on top of the coolant filter at the rear of the power supply (Figure 6-10, item 6). Press the button until a little coolant comes out and no air bubbles are seen in the clear filter housing.
6. When The **COOLANT FLOW** LED lights, release the **POWER ON (1)** switch (PB1). The green **POWER ON** indicator (LT1) should light, indicating that the system is operating normally.
7. Observe that the coolant gauge indicates F (Full). Refill the tank when the gauge indicates 1/2 or a little under. **Do not allow the coolant to get too low. Low coolant will overheat and cause shorter consumable life.**
8. Check for coolant leaks at hose connections at the power supply, RHF console, and torch quick disconnect.

POST INSTALLATION

To checkout system operation, refer to Section 4 *Operation.*

Section 4 OPERATION

In this section:

OPERATION

CONTROLS AND INDICATORS

Power Supply Control Panel (Fig. 4-1)

POWER

- **ON (I)** Pushbutton/indicator switch (PB1/LT1)
  Activates the power supply and its control circuits. Indicator lights when power up is complete.

- **OFF (O)** Pushbutton switch (PB2)
  Shuts the power supply down.

- **DC POWER ON** Indicator (LT2)
  Illuminates when main contactor closes, indicating DC power is being supplied to the torch.

STATUS*

- **RHF INTERLOCK** LED (LT3)
  Illuminates when RHF Console door is closed. Remains extinguished when door is open.

- **OVERTEMP** LED (LT4)
  Illuminates when power supply main transformer or chopper has overheated. Remains extinguished when transformer and chopper are operating within limits.

- **EXT INTERLOCK** LED (LT5)
  Illuminates when customer machine interlock (optional) is closed. Remains extinguished when interlock is open. If not used, the external interlock option must be jumpered (connector 1X1, pins 16 and 17), so that the plasma system will operate.

- **GAS SYSTEM** LED (LT6)
  Illuminates when gas system is operational. Remains extinguished due to gas system error.

- **GAS PRESSURE** LED (LT7)
  Illuminates when plasma and shield gas pressures are above the low level limit of 105 psi (7.2 bar). Remains extinguished when either the plasma or shield gas is below the limit.

- **COOLANT TEMP** LED (LT8)
  Illuminates when coolant temperature is normal. Remains extinguished when coolant temperature is too high.

- **COOLANT FLOW** LED (LT9)
  Illuminates when coolant flow is adequate. Remains extinguished when coolant flow is inadequate.

* All STATUS LEDs extinguish (except for OVERTEMP which illuminates) when the associated fault condition occurs. Most fault conditions will cause the system to shut down causing all STATUS LEDs to extinguish (except for OVERTEMP which illuminates). When this occurs the operator must depress and hold in the POWER ON (1) switch. The first STATUS LED that does not illuminate (except for OVERTEMP which illuminates) indicates the fault condition.

AMPS thumbwheel switch (S1)
Selects the desired cutting current.

PIERCE DELAY potentiometer (P1)
Delays ramp up of current.

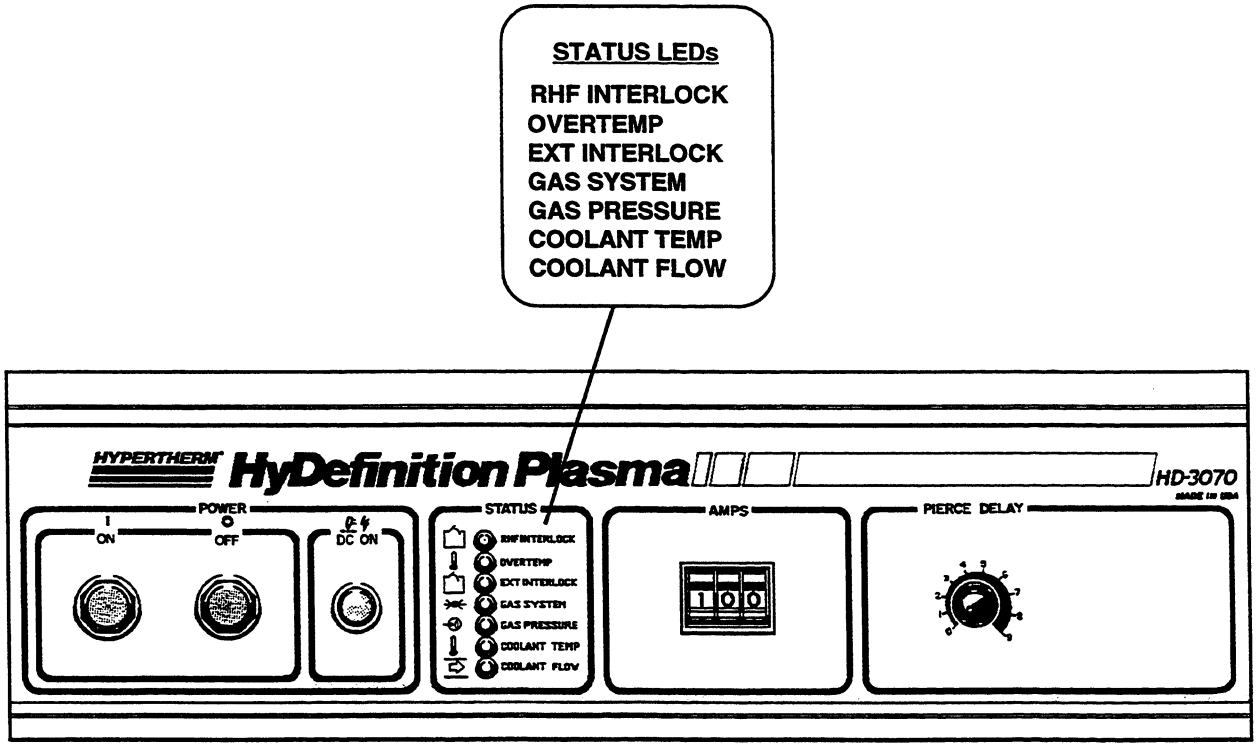


Figure 4-1 HD-3070 Power Supply Control Panel Controls and Indicators

OPERATION

Automatic Gas Console Front Panel (Fig. 4-2)

The front panel controls are under manual control only when the **REMOTE/LOCAL** toggle switch on the rear panel is set to the **LOCAL** position. Note that the LCD display is active in either mode.

- **PLASMA - O_2/AUX A** Toggle Switch*

  Selects the use of either oxygen or the auxilliary (AUX A) gas as the plasma cutting gas.

- **SHIELD - N_2/AUX B** Toggle Switch*

  Selects the use of either nitrogen or the auxilliary (AUX B) gas as the shield gas.

- **Test Preflow/Run/Test Cut Flow** Toggle Switch

  Test Cut Flow - This position is used to test and set the cut gas flowrates on the LCD display using the **SHIELD Cut Flow** potentiometers (1) and (2) and the **PLASMA Cut Flow** potentiometer (3). Test cut flowrate control settings (1), (2) and (3) are specified in the *Cut Charts* in this section. Refer to Figure 4-3, field H for control and display locations. In this test position the arc cannot be fired.

  Test Preflow - This position is used to test and set the preflow gas flowrates on the LCD display using the **PREFLOW Shield/Plasma** potentiometers (4) and (5). Test preflow flowrates (4) and (5) are specified in the *Cut Charts* in this section. Refer to Figure 4-3, field H for control and display locations. In this test position the arc cannot be fired.

  Run - This is the normal operating position. This position enables the firing of the arc.

- **LCD Display**

  The LCD display is divided into eight functional fields. When operating in either the local or remote mode, the following data, as shown in Figure 4-3, are displayed.

* The **PLASMA - O_2/AUX A** and **SHIELD - N_2/AUX B** toggle switches must be positioned to select the proper gas combinations. Select either O_2 and N_2 or AUX A and AUX B. If either O_2 and AUX B or N_2 and AUX A are selected, a GS ERR 20 will be displayed on the gas consle LCD, Figure 4-3 field D and the power supply will shut down until the switches are set to the correct positions.

Also note that changing the switch positions will automatically cause the lead set gas lines to be purged for 40 seconds (20 seconds with preflow and 20 seconds with cut flow gases). Refer to Figure 4-3 field E.

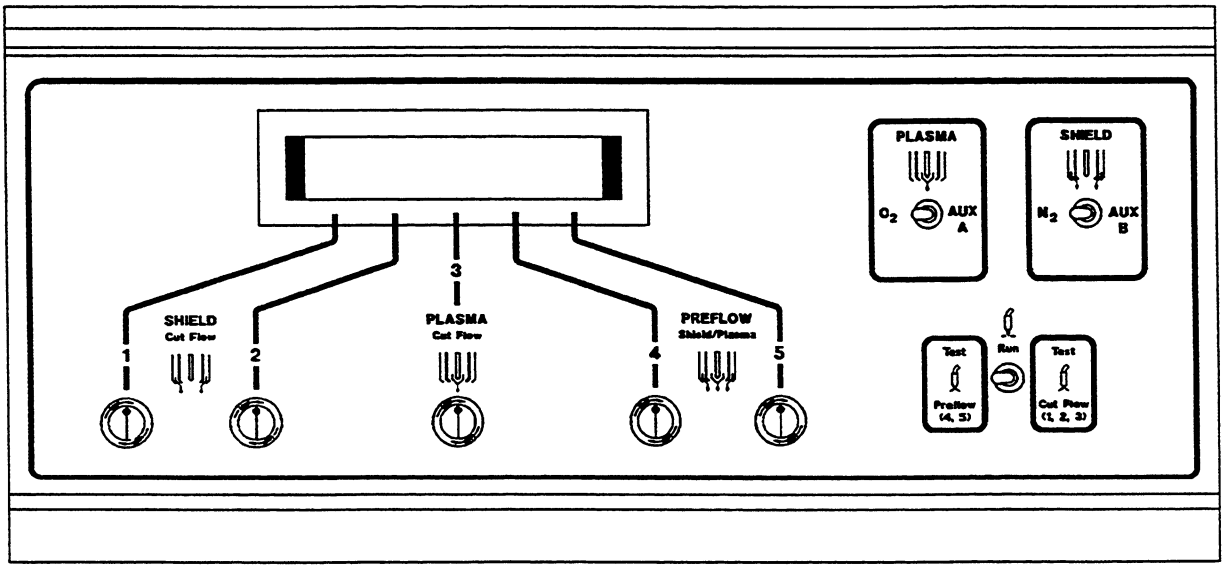
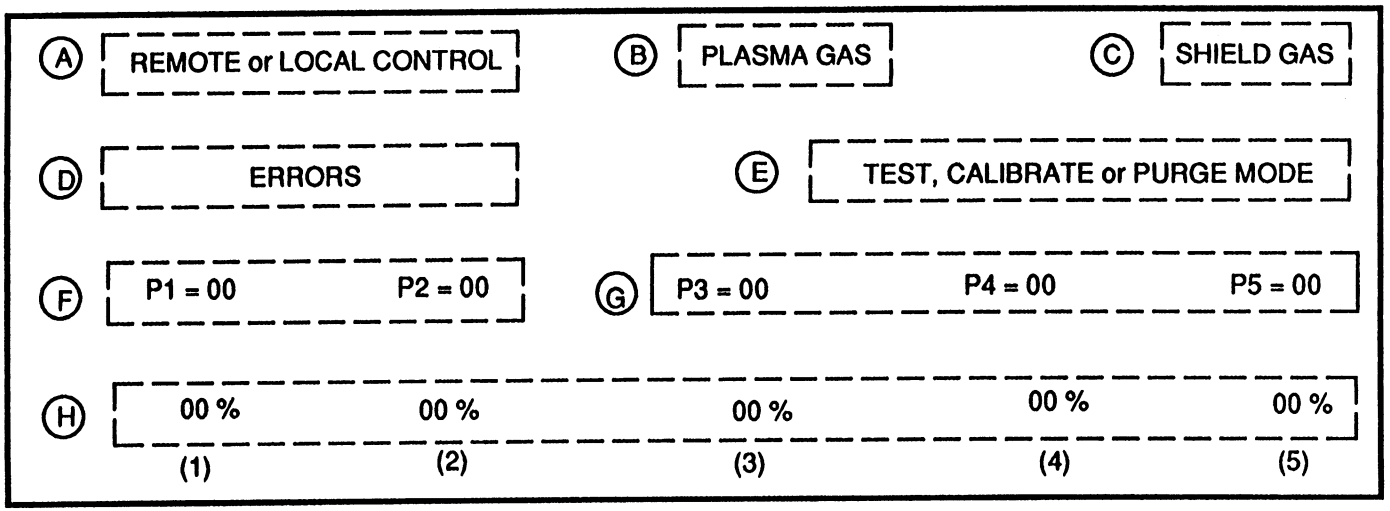


Figure 4-2 Automatic Gas Console Front Panel Controls and Indicators



Ⓐ Indicates either local or remote control system operation.

Ⓑ Indicates either PLASMA - O_2 or AUX A as the plasma gas.

Ⓒ Indicates either SHIELD - N_2 or SHIELD AUX B as the shield gas.

Ⓓ Indicates either NO ERRORS or PS - ERR Power Supply System Error) and/or GS - ERR (Gas System Error). Refer to the Power Supply System and Gas System Error List.

Ⓔ Indicates either of the following system test, calibrate, or purge modes: TEST - PREFLOW or TEST - CUT FLOW; CAL - ZERO or CAL - SPAN; or automatic PURGE - PREFLOW or PURGE - CUT FLOW for 20 seconds each. A blank field indicates the plasma system is in the RUN mode (normal operation).

Ⓕ Indicates the plasma gas (P1) and shield (P2) inlet gas pressures which must be 120 psi (8.2 bar) for all material thickness. Refer to the Notes on the *Cut Charts*.

Ⓖ Indicates the plasma (P3), shield (P4) and preflow (P5) outlet gas pressures expressed in psi or MPa (see Appendix B to set switch). Refer to Section 5, Maintenance, *Gas System Back Pressure Check.*

Ⓗ Indicates the metering valve set-points controlled either manually in LOCAL or from the CNC machine in REMOTE. The set-points are expressed as a percentage (flowrate) of full range (100 %). Refer to the *Cut Charts*.

Figure 4-3 Automatic Gas Console LCD Display

LCD Display Error Messages

Power Supply System (PS-ERR)

Error Message	Error Code	Description
NO ERROR	0	
LOW COOLANT LEVEL	1	This error signal is issued as a warning to the CNC that the coolant reservoir needs to have coolant added.
INTERLOCK ERR	2	This error is issued during operation when one of the pressure or temperature switches connected to the power distribution PCB is opened. Check STATUS LEDs on power supply.
HOLD TIMEOUT ERR	3	This error signal is issued if the HOLD INPUT signal was not released within 10 seconds after the end of preflow.
NO PILOT TIMEOUT ERR	4	This error signal is issued when the high frequency was unable to ignite the pilot arc within 1 second.
PIERCE DELAY ERR	5	This error signal is issued when the PIERCE COMPLETE signal should have been received within 2 seconds of the transfer signal.
TRANSFER TIMEOUT ERR	6	This error signal is issued when the transfer of current to the work was not sensed within 4 seconds of torch ignition.
RAMPUP BLOWOUT ERR*	7	This error signal is issued when the arc was extinguished after current transfer to the workpiece, but before steady-state operation.
RUNNING ARC BLOWOUT ERR*	8	This error signal is issued when the arc was lost during steady-state operation.
ARC OVER VOLTAGE ERR*	9	This error signal is issued during steady-state operation when the measured arc voltage exceeded the programmed maximum allowable arc voltage (200V).
RAMPDWN ARC BLOWOUT ERR*	10	This error signal is issued when the arc was lost during current ramp down, but before the programmed ramp down time has elasped.

Plasma System (PS-ERR) - Continued

Error Message	Error Code	Description
WRONG STATE ERR	12	This error signal should never occur. It indicates that the software has a very serious error that caused it to transfer control to an undefined program state. It is very important to record what the exact operating conditions were prior to the error.

* These errors will also cause the error counter output signal to the CNC to increment.

Gas System (GS-ERR)

Error Message	Error Code	Description
NO ERROR	0	
LOW PLASMA GAS ERR	1	This error signal is issued if the plasma gas inlet pressure is below 105 psig (7.2 bar). (P1 on display)
LOW SHIELD GAS ERR	2	This error signal is issued if the shield gas inlet pressure is below 105 psig (7.2 bar). (P2 on display)
HIGH PLASMA GAS ERR	3	This error signal is issued if the plasma gas inlet pressure is above 135 psig (9.3 bar). (P1 on display)
HIGH SHIELD GAS ERR	4	This error signal is issued if the shield gas inlet pressure is above 135 psig (9.3 bar). (P2 on display)
MV1 ERR*	5	This error signal is issued when the MV1 motor valve does not move when commanded.
MV4 ERR*	6	This error signal is issued when the MV4 motor valve does not move when commanded. When this error occurs service is required.
MV5 ERR*	7	This error signal is issued when the MV5 motor valve does not move when commanded. When this error occurs service is required.
MV6 ERR*	8	This error signal is issued when the MV6 motor valve does not move when commanded. When this error occurs service is required.

Gas System (GS-ERR)-Continued

Error Message	Error Code	Description
MV7 ERR*	9	This error signal is issued when the MV7 motor valve does not move when commanded. When this error occurs service is required.
GS ERR	20	This error signal is issued when the PLASMA and SHIELD gas switches are not positioned to select the proper gas combinations. Select either O_2 and N_2 or AUX A and AUX B. If either O_2 and AUX B or N_2 and AUX A are selected, a GS ERR 20 will be displayed and the power supply will shut down until the switches are set to the correct positions.

* Plasma system must be powered down and then restarted if any of the motor valve errors occur.

Automatic Gas Console Rear Panel (Fig. 4-4)

The rear panel controls are as follows:

- **REMOTE/LOCAL** Toggle Switch

  Selects either remote or local control of the HD-3070 gas console. In **REMOTE** the gas console is under complete control of the CNC machine controller. In **LOCAL** the gas flowrates are set manually on the front panel.

- **CONTRAST** Potentiometer

  Allows the operator to adjust the contrast of the LCD display.

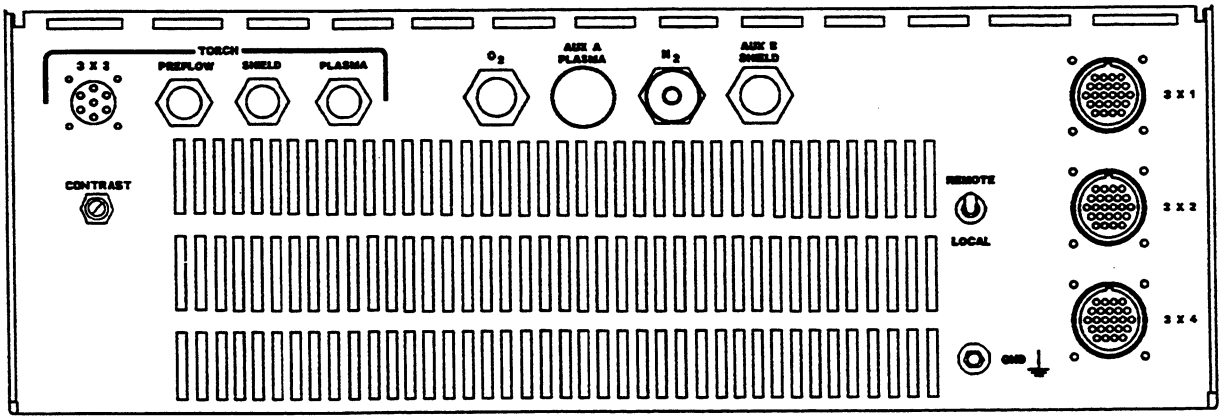


Figure 4-4 Automatic Gas Console Rear Panel Controls

OPERATION

DAILY OPERATING PROCEDURE

The HD-3070 system can be operated in either the local or remote mode. Prior to operation, ensure that your cutting environment and that your clothing meet the safety requirements outlined in the *Safety* section of this manual. If problems occur during start up, refer to Section 3, *Installation* and check the installation data.

Local Mode

To start up the HD-3070 system on a daily basis, in the local mode, proceed as follows:

1. Select consumables based on the material to be cut. If the consumable parts are to be reused, check for wear or damage. Refer to *Changing Consumable Parts* in this section.

2. After checking the consumables, ensure that the torch is at right angles to the workpiece (0° and 90°) to get a clean, vertical cut. Use a square to align the torch.

3. Select the **PLASMA** and **SHIELD** gas combination on the gas console front panel. Select either **O_2** and **N_2** or **AUX A** and **AUX B**.

   If either **O_2** and **AUX B** or **N_2** and **AUX A** are selected, a **GS ERR 20** will be displayed on the gas console LCD at power up and the power supply will shut down and the switches will have to be set to the correct positions. The power supply will have to be restarted.

4. Apply system power by setting the main disconnect switch for the power supply to **On** and turning on the power supply by doing the following:

   - Depress **POWER ON (1)** switch (PB1) until the **STATUS-COOLANT FLOW LED** lights.

   - Ensure the green **POWER ON** indicator (LT1) remains lit. If not check the **STATUS** LEDs on the power supply and check for plasma and gas system error messages on the gas console LCD display. Refer to Figure 4-3 and the *Error Messages* list.

     Note: If the **COOLANT FLOW** LED does not light, unscrew filler/vent cap on coolant tank (item 9, Figure 6-10). Add 2 quarts (1.9 liters) of coolant.

5. Also at initial startup, the gas lines will be automatically purged for 40 seconds total. The gas console LCD display, Figure 4-3 field E will indicate PURGE- PRELFOW for 20 seconds and then PURGE-CUT FLOW for 20 seconds.

6. Ensure that both the selected plasma and shield inlet gas supplies are available at 120 psi (8.2 bar) dynamic pressure on the gas console LCD display fields P1 (plasma) and P2 (shield). (See Figure 4-3.)

7. Set the test cut and test preflow gas flowrate percentages. To do this, proceed as follows:

- Set the shield test cut flowrates (1) and (2) and plasma test cut flowrate (3) as specified in the *Cut Chart.*
- Set the test preflow flowrates (4) and (5) as specified in the *Cut Chart.*
- Set the **Test Preflow/Run/Test Cut Flow** switch (S2) to **Run.**
- At CNC controller, set cutting current, arc voltage, travel speed, initial pierce height and pierce delay time according to cut charts.
- The system is now ready for cutting.

Note: If the system has been powered up, but not in use for a while, purge the gas lines by positioning the **Test Preflow/Run/Test Cut Flow** switch (S2) to **Test Cut Flow** for 5 seconds and then to **Test Preflow** for 5 seconds. After purging the gas lines, set the switch to **Run. Failure to purge the lines may result in short consumable life due to contamination of water residue in the torch.**

Remote Mode

To start up the HD-3070 on a daily basis, in the remote mode, proceed as follows:

1. Select consumables based on the material to be cut. If the consumable parts are to be reused, check for wear or damage. Refer to *Changing Consumable Parts* in this section.
2. After checking the consumables, ensure that the torch is at right angles to the workpiece (0° and 90°) to get a clean, vertical cut. Use a square to align the torch.
3. Apply system power by setting the main disconnect switch for the power supply to **On.**
4. Initiate the power on control signal from the CNC interface to power up the power supply. This signal should be activated for 15 seconds or until the POWER INTERLOCKS OK signal is returned to the CNC controller.
5. Ensure the POWER INTERLOCKS OK signal is returned to the CNC controller. If not check the **STATUS** LEDs on the power supply and check for plasma and gas system error messages on the gas console LCD display. Refer to Figure 4-3 and the *Error Messages* list.

   Note: If the **COOLANT FLOW** LED does not light, unscrew filler/vent cap on coolant tank (item 9, Figure 6-10). Add 1.9 liters (2 quarts) of coolant.
6. Also at initial startup, the gas lines will be automatically purged for 40 seconds total. The gas console LCD display, Figure 4-3 field E will indicate PURGE- PRELFOW for 20 seconds and then PURGE-CUT FLOW for 20 seconds.
7. Initiate the control signals from the CNC interface to select the required input plasma and shield gases at the gas console.

Select either O_2 and N_2 or **AUX A** and **AUX B**. If either O_2 and **AUX B** or N_2 and **AUX A** are selected, a **GS ERR 20** will be displayed on the gas console LCD at power up and the power supply will shut down and the switches will have to be set to the correct positions. The power supply will have to be restarted.

7. Set the gas flowrate percentages on the gas console metering valves from the CNC interface using BCD set-points. The CNC controller should provide the following sequence to set up the gas metering valves:

   - Selects the BCD code for the valve number (1 - 5) to be set on the four VALVE SELECT lines. These signals should be pulled low (common) to make them active.
   - Selects the BCD code for the set- point (0 - 100%) to be set on the nine GAS FLOW SET lines. These signals should be pulled low (common) to make them active.
   - Pulls WRITE line low (common) and wait for return of a READ COMPLETE signal.

   This process should occur in under 100 milliseconds. At this point the CNC controller should release the WRITE signal. The above process should be completed for the remaining four valves.

   Note: The gas console microprocessor stores the the gas flow data for each metering valve during normal operation. If power to the gas console is removed for any reason, it will be necessary to re-send the gas flow data from the CNC interface.

8. The CNC controller should now ensure there is no ERROR OUTPUT signal from the gas console and the POWER INTERLOCKS OK signal is still active from the power supply.

10. The system is now ready for cutting.

Note: Initiate the test cut and test preflow control signals from the CNC interface to purge the gas lines if the system has been powered up, but not in use for a while. Hold each position for 5 seconds.

CHANGING CONSUMABLE PARTS

WARNING

Always disconnect the power supply from the main power source before inspecting or changing the torch parts.

Inspect torch consumable parts before cutting for wear and damage, and replaced when needed. The PAC184 and PAC186 torch consumable parts kits (refer to Section 6, *Parts List*) contain tools for removal and inspection of the consumable parts. To remove, inspect and replace the consumables, proceed as follows. See Figures 4-5 - 4-8.

Removal and Inspection

1. Remove the shield cap and inspect shield for plugged holes or damage. To remove the shield, push on it until it releases. Check the O-ring for wear and damage.

2. Remove the inner cap and inspect for plugged holes or damage.

3. Remove the nozzle using the removal tool. Check for wear and arcing. Also check the O-rings for wear and damage.

4. Remove the electrode using the removal tool. The electrode should be inspected and replaced if there is a pit .040 inch (1 mm) deep. See Figure 4-7 in order to check the pit depth. Check the O-ring for wear and damage.

5. Remove the swirl ring using the removal tool. Insert the tool into the swirl ring until it catches on the lip and then pull back to remove the swirl ring. Inspect the swirl ring for plugged holes or damage. Check O-rings for wear and damage.

Replacement

Do not use an excessive amount of silicone grease when applying to any of the consumable O-rings. Excess grease can easily plug ports and holes, causing improper gas flow during operation. Only apply a light coat of silicone grease.

Avoid touching the tip of the electrode during installation as grease or dirt may affect starting reliability. Check the electode tip and wipe clean if necessary.

1. Apply silicone to the electrode O-ring and then to both O-rings on the swirl ring.

2. Insert the electrode into the the small diameter end of the swirl ring, then insert the swirl ring (large diameter end) into the nozzle. Apply silicone to the nozzle O-rings, then insert the nozzle into the torch and push it into place.

3. Inspect the threads on the torch main body, and clean threads if necessary. Apply silicone to the O-rings on the torch main body.

4. Install the inner cap on to the torch main body. **Hand tighten the inner cap snugly to ensure good electrical contact. Do not overtighten.**

5. Install the shield cap with the shield in place on to the torch main body. If the shield is not in place, apply silicone to the O-ring and insert the shield into the shield cap and push into place. **Hand tighten the shield cap snugly. Failure to tighten the shield cap snugly could result in poor electrical contact and water and gas leaks which will impair cut quality.**

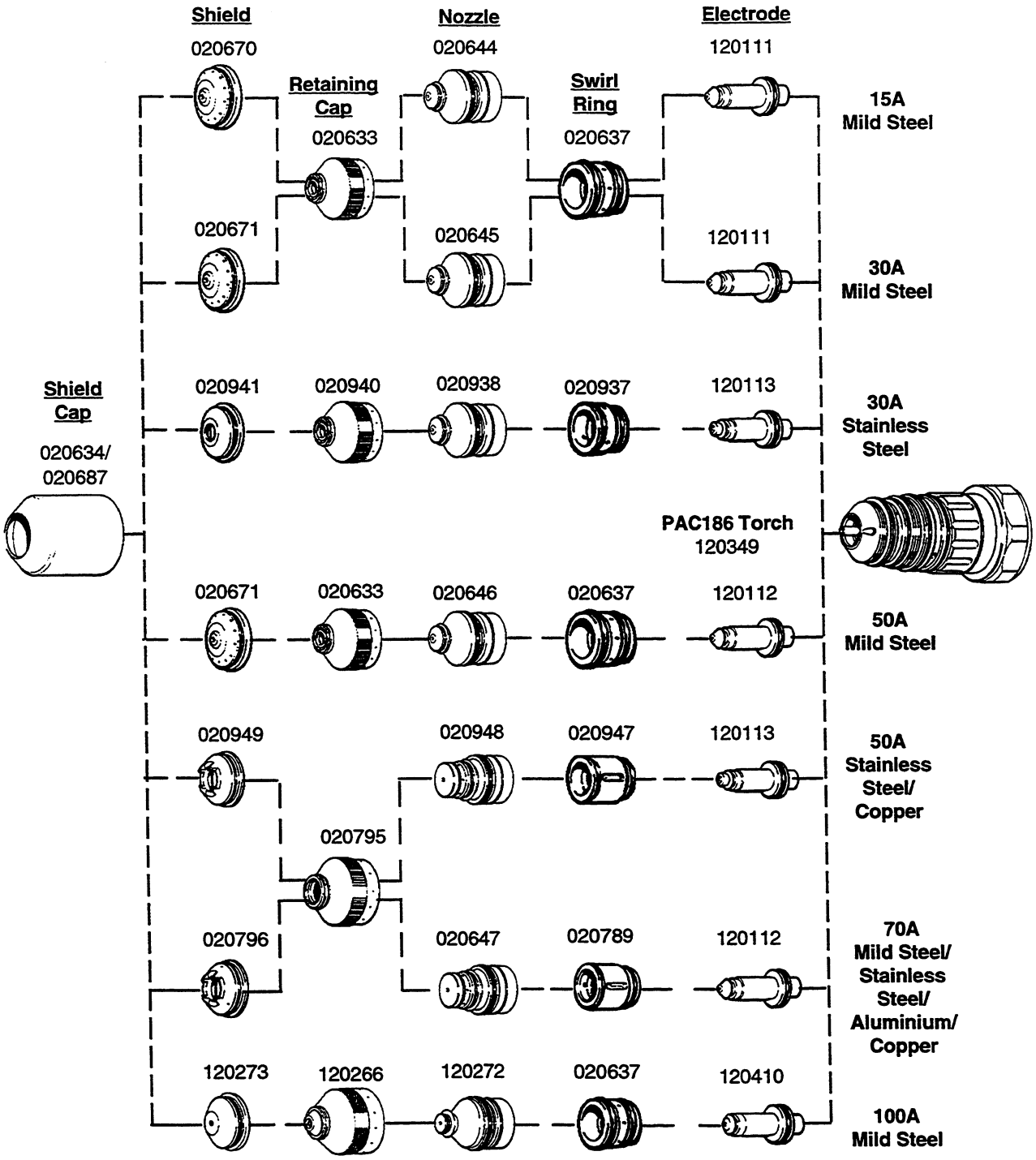


Figure 4-5 PAC186 Torch Consumable Parts

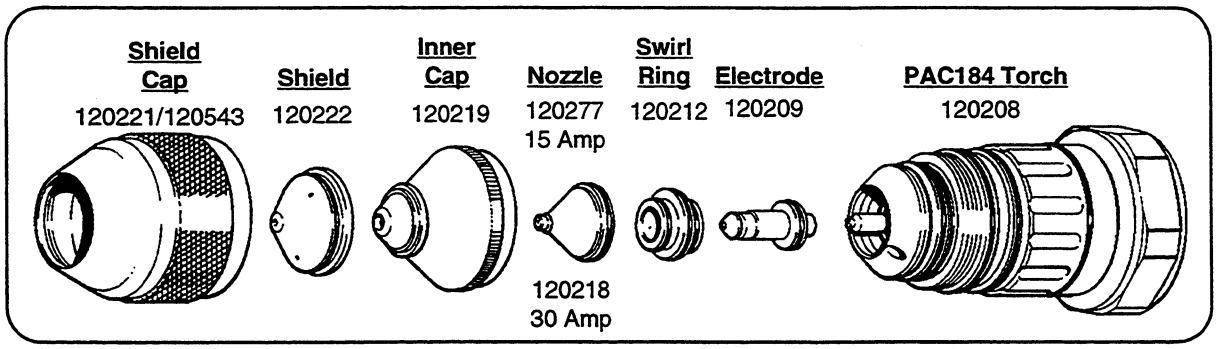


Figure 4-6 PAC184 Torch 15 and 30 Amp Consumable Parts

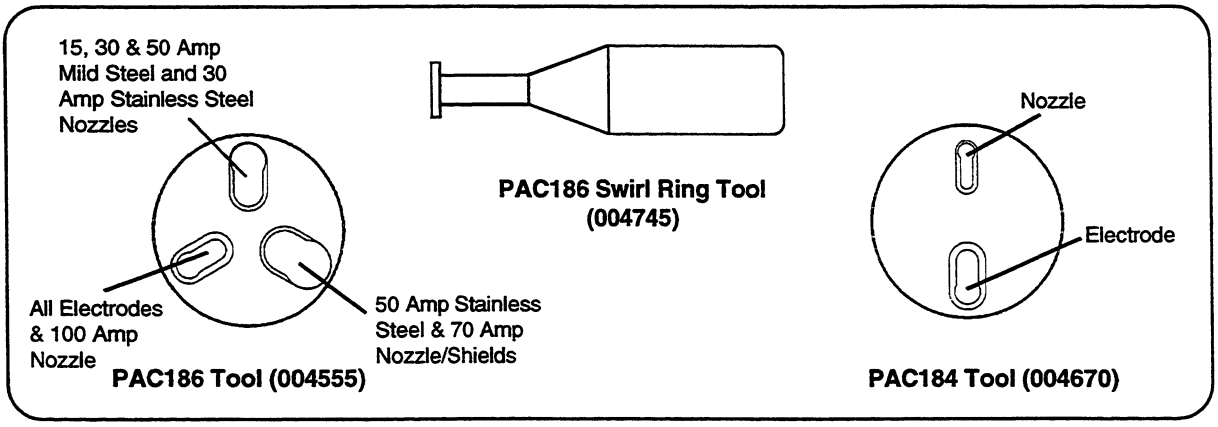
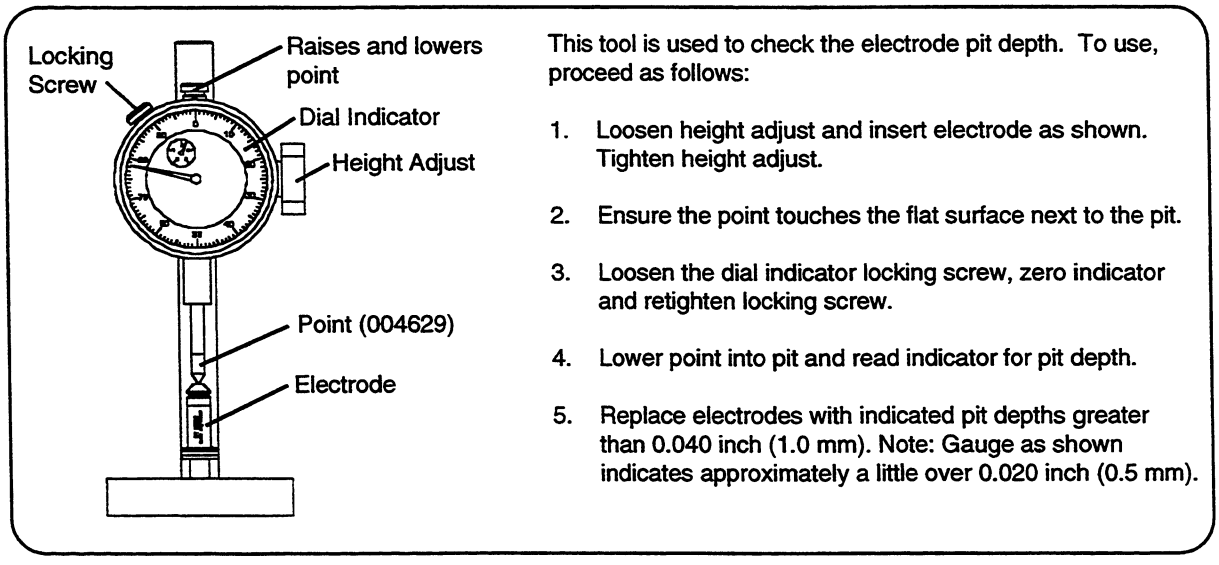


Figure 4-7 Consumable Removal Tools



This tool is used to check the electrode pit depth. To use, proceed as follows:

1. Loosen height adjust and insert electrode as shown. Tighten height adjust.
2. Ensure the point touches the flat surface next to the pit.
3. Loosen the dial indicator locking screw, zero indicator and retighten locking screw.
4. Lower point into pit and read indicator for pit depth.
5. Replace electrodes with indicated pit depths greater than 0.040 inch (1.0 mm). Note: Gauge as shown indicates approximately a little over 0.020 inch (0.5 mm).

Figure 4-8 Electrode Pit Depth Gauge (004630)

OPERATION

BLOW BACK OPTION TO PURGE COOLANT HOSES

Before removing the PAC184 or PAC186 torch, the operator may want to purge the torch coolant from the coolant hoses back into the coolant tank to minimize the coolant dripping when the torch is disconnected from the quick disconnect. After replacing the torch, the coolant hoses should be refilled with coolant. Refer to the procedures below.

Purge Coolant Hoses (Blow Back)

1. Shut the power supply down at the control panel or CNC.
2. At off-valve assembly (Fig. 4-9) connect 1/4-inch air hose to air inlet.
3. Connect 120 VAC power cable from CNC or other source to 120 VAC socket on solenoid valve.
4. Apply air at approximately 20 psi (1.4 bar) to the air inlet. **Air supply should be clean, dry and oil free in order not to contaminate the coolant.**

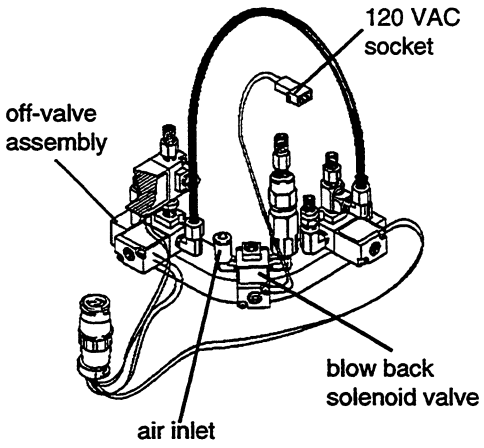


Figure 4-9 Coolant Purging Setup

5. Apply 120 VAC signal for about 3 seconds to open the solenoid valve in order to purge the coolant from the hoses. It **is not necessary to purge longer than 3 seconds.**
6. After the coolant hoses have been purged, disconnect the torch from the torch quick disconnect.

Refill Coolant Hoses

1. Reconnect torch to the torch quick disconnect.
2. Apply power to the power supply at the control panel or from CNC.

   If at the power supply, depress and hold the **POWER ON** pushbutton switch until the **COOLANT FLOW** LED lights. If at the CNC, maintain the Power On signal until the **COOLANT FLOW** LED lights.

   When the **COOLANT FLOW** LED lights, release the **POWER ON** switch at the power supply or the Power On signal at the CNC. The green **POWER ON** indicator should remain on, indicating that the system is operating normally.

   (The **COOLANT FLOW** LED will remain out until the coolant has pushed all of the air out of the torch cooling hoses and the coolant returns to the tank. However, coolant hoses with too many bends can have air pockets even though the **COOLANT FLOW** LED lights and the system appears ready for operation. **The trapped air can cause the torch to lose cooling momentarily and potentially cause damage to the torch.**)

CUTTING TECHNIQUES

How to Get Better Cut Quality

In order to get the best cut quality, ensure the HD-3070 plasma system is set up according to the *Daily Operating Procedure* in this section. The three major components of cut quality are: cut angle, dross, and shape (flatness) and smoothness of the cut surface.

Cut Angle

Cut angle is define as either positive or negative. A positive cut angle is when there is more material removed from the top of the kerf than at the bottom (V-shaped cut). A negative cut angle is when there is more material removed from the bottom of the cut than at the top (undercut).

The two most common cut angle faults are as follows:

1. The average cut angle of four sides is off by 3-4°, this can be caused by:

   - Torch stand off is most likely the problem, if cut angles are either all positve or negative. A positive bevel indicates a stand off that is too high. A negative bevel indicates a stand off that is too low. Vary the arc voltage to correct the cut angle.

   - Damaged consumable parts. If the nozzle orifice is worn uniformly, the cut angle will show positive. Change or check consumables by referring to *Changing Consumable Parts* in this section.

2. Non-uniform cut angles (one side positive and the other negative), this is caused by:

   - Damaged or worn consumable parts, especially damaged nozzle and shield O-ring seals. Change or check consumables by referring to *Changing Conumable Parts* in this section.

   - Torch is out of vertical alignment to workpiece. Ensure that the torch is at right angles to the workpiece (0° and 90°) to get a clean, vertical cut. Use a square to align the torch.

Dross Conditions

Dross can occur in the following ways:

1. Low speed dross happens when the torch travel speed is too slow and the arc shoots ahead. It forms as a heavy, bubbly deposit at the bottom of the kerf and can be easily removed. Normally, increasing the speed will reduce or eliminate dross.

2. High speed dross happens when the torch travel speed is too fast and the arc lags behind. It forms as a thin, linear bead of solid metal attached very close to the kerf and appears to be a fused continuation of the kerf wall. It is welded to the bottom of the cut and is very difficult to remove. High speed dross can be reduced in the following ways:

- Decreasing the travel speed will reduce or eliminate dross. If changing the speed does not remove the dross, varying the following parameters will help.
- Lowering the torch standoff distance by decreasing arc voltage will reduce the dross.
- Adding O_2 in the shield gas will widen the operating range thereby reducing dross.

3. Dross may show at certain parts of the cut (the dross comes and goes), if the consumables are worn or damaged.
4. Dross formation is material dependant. Certain alloys may form more dross than others.
5. Dross formation is dependant upon metal temperature. Warm and hot metal is much more prone to dross accumulation than cool metal. For example, the first cut in a series of cuts will mostly likely have the least amount of dross. As the workpiece heats up, dross levels are likely to increase on the subsequent cuts.
6. Dross formation is dependant upon metal surface conditions. A clean metal surface is more prone to dross accumulation than dirty and rusty surfaces.

Shape of Cut Surface

The ideal shape of the cut face is straight. Sometimes the cut face becomes either concave or convex. Maintaining the correct torch height and cut speed are required to keep the cut face straight.

1. A concave cut face (bevel on inside) is due to torch standoff distance being too low. Increasing the standoff distance will straighten the cut face.
2. A convex cut face (top of cut rounded) is due to the standoff distance being too high. Try reducing the standoff distance.

Smoothness of Cut Surface

Both the plasma jet and the motion of x-y table will affect the smoothness of the cut surface.

1. The plasma jet can cause random roughness. Change the shield gas O_2/N_2 ratio for cutting mild steel. A higher concentration of oxygen in the shield mixture will increase the potential cut speed, but at the expense of cutting edge quality.
2. A regular wavy surface is due to machine motion. Tuning the drives and cleaning the rails will help.

How to Get Longer Consumable Life

The HD-3070 plasma system provides consumable long life. In order to optimize consumable life, the following measures will help.

Piercing Height

Piercing height should be higher than cutting height to prevent pierce splatter from buiding up on the front of the nozzle and/or shield. An initial pierce height that is too high will increase the dwell time of the pilot arc on the nozzle. As a rule, the pierce height should be 1.5 to 2 times as much as the cutting height (stand off).

Pierce Delay

The pierce delay function can be set externally from the CNC controller in the form of a pierce complete signal or from the pierce delay potentiometer on the power supply control panel.

Ramp Down

At the end of a cut, the plasma (arc and gas flows) must be allowed to ramp down while it is still over the workpiece. The plasma arc and gas flows ramp down to an off state. If the arc still extinguishes without a proper ramping down, the consumables life will be decreased. This is particularly a problem when cutting drop parts and the centers drop away leaving holes. There is no metal to be over in order to finish the ramp down. However, in this situation arc blow out does not always occur. Sometimes the arc can stay attached to the edge of the hole long enough to finish the ramp down, removing only a small divot from the workpiece. Running off the edge of the plate will also produce an arc blow out condition which is not desirable in terms of optimizing parts life.

Electrode Life

1. Program the lead out when the drop part is the one wanted, but do not program the lead out into the drop part.
2. Use a chain cut if possible.
3. Purge the gas lines before cutting.

Nozzle Life

1. Do not lead out to the drop part, which will cause the arc to stretch.
2. Purge the gas lines to clean the plasma chamber before cutting.
3. Make sure the torch does not dive to the plate during cutting.

Shield Life

1. Make sure the shield does not touch the plate during cutting.
2. Set the pierce height between 1.5 to 2 times higher than the cutting height. Keep the shield clean to prevent double arcing.

OPERATION

How to Get Better Pierces

1. Start the arc on the edge of the material with a prepunched pilot hole, if possible.

2. Make the IHS setting constant. The initial pierce height should be about 1.5 to 2 times higher than the height during cutting.

3. Make sure the pierce delay is set long enough to allow the arc to pierce through the material before the machine moves.

4. Use a higher shield preflow to help pierce through and blow the molten metal away. This may affect starting reliability.

How to Increase Cutting Speed

1. Lower the torch standoff distance. Do not let the shield touch the plate. The cut surface may have a negative bevel if the standoff distance is too low.

2. Increase the O_2 amount in the shield cut flow. The drawback is that the cut surface may become rougher.

TECHNICAL QUESTIONS

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

1. Recheck all pre-installation and installation and post-installation requirements and connections in Section 3, *Installation.*

2. If you are unable to solve the problem, call your distributor. They will be able to help you, or refer you to an authorized Hypertherm repair facility.

3. If you need assistance, call Customer Service or Technical Service listed in the front of this manual.

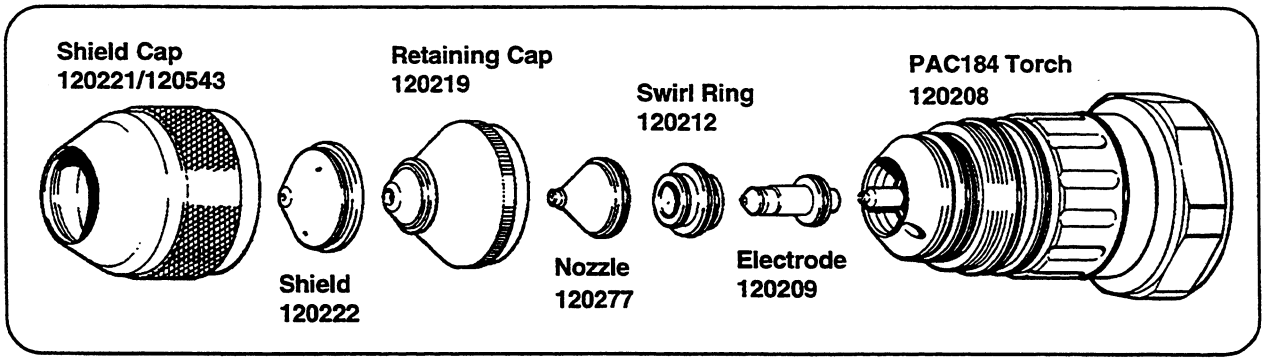
OPERATING DATA (CUT) CHARTS

The *Cut Charts* on the following pages are optimized to provide the best cut angle, least dross and best cut surface finish. Keep in mind that these charts provide a good starting point and that optimum cutting must be tuned to the application and materials on site. Increasing cut speed, lowering the torch standoff, higher current consumables on thinner metals or increasing the oxygen ratio in the shield mix, for example, all present certain tradeoffs as mentioned in *How to Get Better Cut Quality*. Depending on the cutting application, it is up to the operator to determine if the tradeoffs are acceptable.

The cut chart also provides part numbers and illustrations of the consumables required to cut at specific amperage. For more detailed information, refer to the gas console control and indicator descriptions and the daily operating procedure at the front of this section.

Cut Chart Index

HD-3070
PAC184 Torch Operating Data (Cut) Charts
Mild Steel - 15 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness (GA)	(in)	(mm)	Test Cut Flowrates (%) Shield O_2 & N_2 (1)#	(2)#	Plasma O_2 (3)#	Test Preflow* Flowrates (%) Preflow O_2 (4)#	N_2 (5)#	Arc Voltage (volts)	Torch Standoff** (in)	(mm)	Travel Speed (ipm)	(m/min)	Initial Piercing Height (in)	(mm)	Pierce Delay (dial)	(sec)
26	0.018	0.5	30	10	40	5	75	134	0.020	0.5	145	3.68	0.040	1.0	0	0.05
24	0.024	0.6	30	10	40	5	75	135	0.020	0.5	129	3.28	0.040	1.0	0	0.05
22	0.030	0.8	30	10	40	5	75	136	0.020	0.5	115	2.92	0.040	1.0	0	0.05
20	0.036	0.9	30	10	40	5	75	136	0.020	0.5	100	2.54	0.040	1.0	0	0.05
18	0.048	1.3	30	10	40	5	75	137	0.020	0.5	85	2.16	0.040	1.0	0.5	0.16
16	0.060	1.5	30	10	40	5	75	142	0.030	0.8	65	1.65	0.040	1.0	1	0.27
14	0.075	1.9	30	10	40	5	75	144	0.040	1.0	45	1.14	0.060	1.5	1.5	0.37
12	0.105	2.7	30	10	40	5	75	148	0.040	1.0	35	0.90	0.060	1.5	2	0.50
10	0.135	3.4	30	10	40	5	75	151	0.040	1.0	25	0.64	0.060	1.5	2.5	0.60

O_2 (P1)# and N_2 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

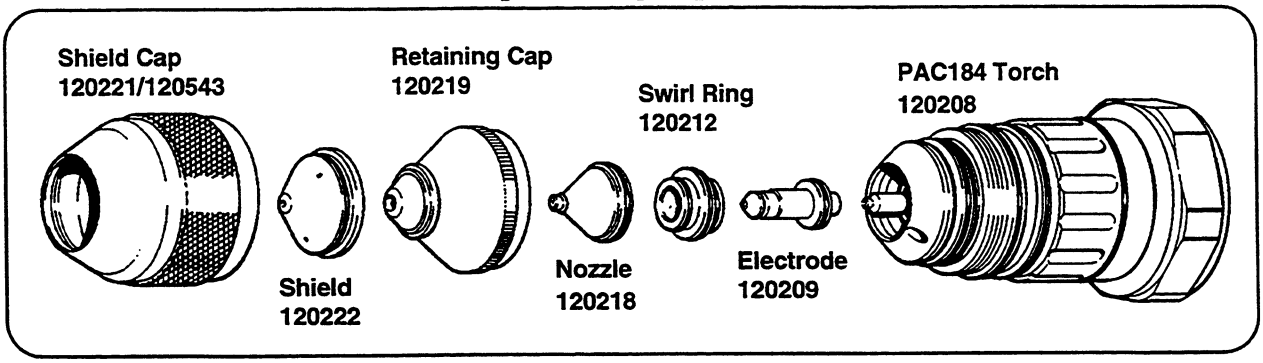
Refer to Figure 4-3 to locate LCD displays.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks*.

HD-3070
PAC184 Torch Operating Data (Cut) Charts
Mild Steel - 30 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage	Torch Standoff**		Travel Speed		Initial Piercing Height		Pierce Delay	
			Shield		Plasma	Preflow										
(GA)	(in)	(mm)	O_2 & N_2 (1)#	(2)#	O_2 (3)#	O_2 & N_2 (4)#	(5)#	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
24	0.024	0.6	15	5	46	5	75	117	0.030	0.8	200	5.08	0.060	1.5	0	0.05
22	0.030	0.8	15	5	46	5	75	121	0.030	0.8	170	4.32	0.060	1.5	0	0.05
20	0.036	0.9	15	5	46	5	75	125	0.040	1.0	140	3.56	0.080	2.0	0	0.05
18	0.048	1.3	15	5	46	5	75	128	0.040	1.0	110	2.80	0.080	2.0	0	0.05
16	0.060	1.5	15	5	46	5	75	128	0.040	1.0	80	2.03	0.080	2.0	0	0.05
14	0.075	1.9	15	5	46	5	75	128	0.040	1.0	60	1.52	0.080	2.0	0.5	0.16
12	0.105	2.7	15	5	46	5	75	135	0.060	1.5	50	1.27	0.100	2.5	1	0.27
10	0.135	3.4	15	5	46	5	75	135	0.060	1.5	35	0.90	0.100	2.5	1.5	0.37
	3/16	4.8	15	5	46	5	75	135	0.060	1.5	32	0.81	0.100	2.5	2	0.50
	1/4	6.4	30	10	46	5	75	136	0.040	1.0	25	0.64	0.100	2.5	2.5	0.60

O_2 (P1)# and N_2 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

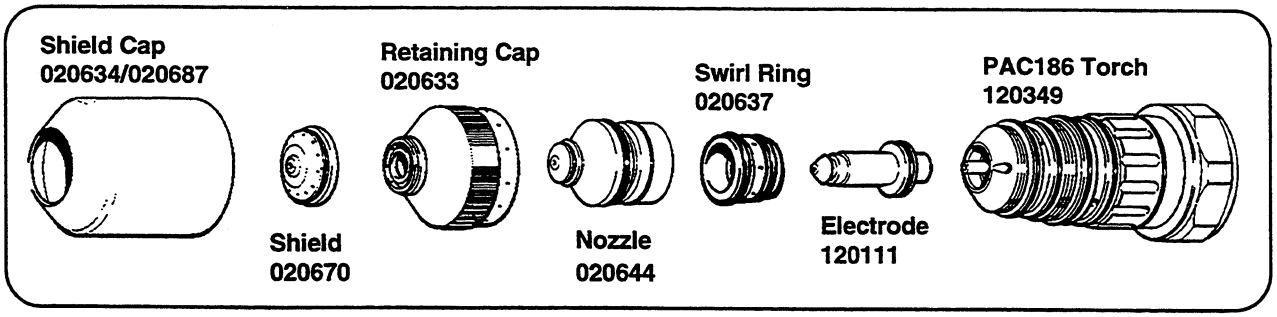
Refer to Figure 4-3 to locate LCD displays.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Mild Steel - 15 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage ***	Torch Standoff **, ***		Travel Speed		Initial Piercing Height		Pierce Delay	
			Shield		Plasma	Preflow										
(GA)	(in)	(mm)	O_2 & N_2 (1)#	(2)#	O_2 (3)#	O_2 & N_2 (4)#	(5)#	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
20	0.036	0.9	30	10	40	5	75	120	0.020	0.5	100	2.54	0.040	1.0	0	0.1
18	0.048	1.3	30	10	40	5	75	121	0.020	0.5	85	2.16	0.040	1.0	0	0.1
16	0.060	1.5	30	10	40	5	75	124	0.030	0.8	65	1.65	0.040	1.0	.5	0.2
14	0.075	1.9	30	10	40	5	75	130	0.040	1.0	45	1.14	0.060	1.5	1	0.3
12	0.105	2.7	30	10	40	5	75	132	0.040	1.0	35	0.90	0.060	1.5	1.5	0.4
10	0.135	3.4	30	10	40	5	75	134	0.040	1.0	25	0.64	0.060	1.5	2	0.50

O_2 (P1)# and N_2 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Refer to Figure 4-3 to locate LCD displays.

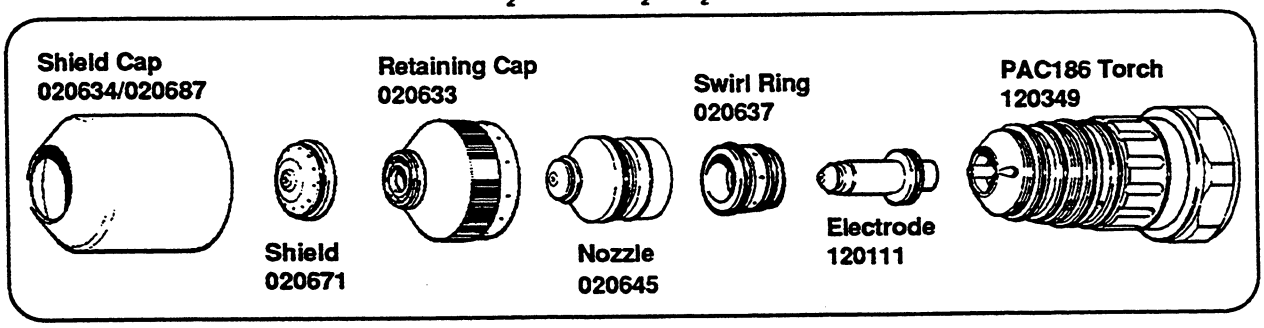
* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** To maintain the 0.020 inch (0.5 mm) torch standoff as the electrode wears, the arc voltage may have to be increased to avoid having the torch dive into the plate.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks*.

HD-3070
PAC186 Operating Data (Cut) Charts
Mild Steel - 30 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness (GA)	(in)	(mm)	Test Cut Flowrates (%) Shield O_2 & N_2 (1)#	(2)#	Plasma O_2 (3)#	Test Preflow* Flowrates (%) Preflow O_2 & N_2 (4)#	(5)#	Arc Voltage (volts)	Torch Standoff** (in)	(mm)	Travel Speed (ipm)	(m/min)	Initial Piercing Height (in)	(mm)	Pierce Delay (dial)	(sec)
24	0.024	0.6	15	5	46	5	75	103	0.030	0.8	200	5.08	0.040	1.0	0	0
22	0.030	0.8	15	5	46	5	75	108	0.030	0.8	170	4.32	0.040	1.0	0	0
20	0.036	0.9	15	5	46	5	75	110	0.040	1.0	140	3.56	0.060	1.5	0	0
18	0.048	1.3	15	5	46	5	75	112	0.040	1.0	110	2.80	0.060	1.5	0	0
16	0.060	1.5	15	5	46	5	75	115	0.040	1.0	80	2.03	0.060	1.5	0	0.1
14	0.075	1.9	15	5	46	5	75	118	0.040	1.0	60	1.52	0.060	1.5	0	0.1
12	0.105	2.7	15	5	46	5	75	121	0.060	1.5	50	1.27	0.080	2.0	.5	0.2
10	0.135	3.4	15	5	46	5	75	124	0.060	1.5	35	0.90	0.080	2.0	1	0.3
	3/16	4.8	15	5	46	5	75	125	0.060	1.5	32	0.81	0.080	2.0	1.5	0.4
	1/4	6.4	30	10	46	5	75	124	0.040	1.0	25	0.64	0.080	2.0	2	0.5

O_2 (P1)# and N_2 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

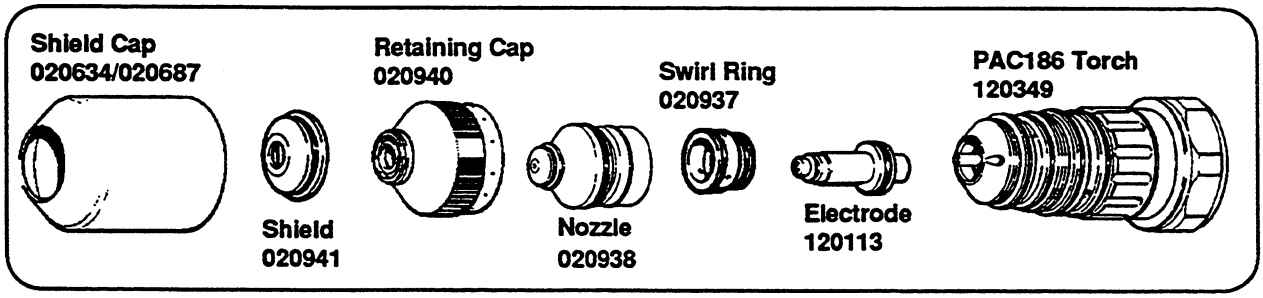
Refer to Figure 4-3 to locate LCD displays.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Stainless Steel## - 30 Amp Cutting
Air Plasma/Air Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage ***	Torch Standoff **,***		Travel Speed		Initial Piercing Height		Pierce Delay	
			Shield Air		Plasma Air	Preflow Air										
(GA)	(in)	(mm)	(1)#	(2)#	(3)#	(4)#	(5)#	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
27	0.016	0.4	30	0	60	75	0	70-75	0.020	0.5	250	6.35	0.040	1.0	0	0
24	0.024	0.6	30	0	60	75	0	70-75	0.020	0.5	220	5.59	0.040	1.0	0	0
22	0.030	0.8	30	0	60	75	0	70-75	0.020	0.5	200	5.08	0.040	1.0	0	0.1
20	0.036	0.9	30	0	60	75	0	70-75	0.020	0.5	180	4.57	0.040	1.0	0	0.1
18	0.048	1.3	30	0	60	75	0	73-78	0.020	0.5	150	3.81	0.060	1.5	.5	0.2
16	0.060	1.5	30	0	60	75	0	73-78	0.020	0.5	120	3.05	0.060	1.5	.5	0.2

Air (P1)# and (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Refer to Figure 4-3 to locate LCD displays.

Stainless steel plate sometimes comes with a protective plastic film. Remove film prior to cutting.

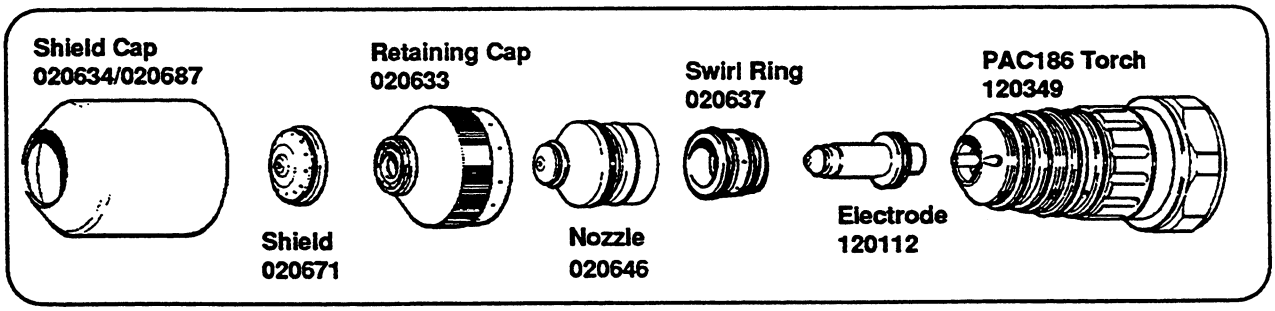
* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** To maintain the 0.020 inch (0.5 mm) torch standoff as the electrode wears, the arc voltage may have to be increased to avoid having the torch dive into the plate.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Mild Steel - 50 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness (GA)	(in)	(mm)	Test Cut Flowrates (%) Shield O_2 & N_2 (1)#	(2)#	Plasma O_2 (3)#	Test Preflow* Flowrates (%) Preflow O_2 & N_2 (4)#	(5)#	Arc Voltage (volts)	Torch Standoff** (in)	(mm)	Travel Speed (ipm)	(m/min)	Initial Piercing Height (in)	(mm)	Pierce Delay (dial)	(sec)
22	0.030	0.8	40	0	40	5	75	103	0.040	1.0	270	6.86	0.060	1.5	0	0
20	0.036	0.9	40	0	40	5	75	103	0.040	1.0	210	5.33	0.060	1.5	0	0
18	0.048	1.3	40	0	40	5	75	104	0.040	1.0	160	4.06	0.060	1.5	0	0
16	0.060	1.5	40	0	40	5	75	109	0.050	1.3	120	3.05	0.080	2.0	0	0
14	0.075	1.9	40	0	40	5	75	113	0.050	1.3	100	2.54	0.080	2.0	0	0
12	0.105	2.7	40	0	40	5	75	119	0.050	1.3	75	1.91	0.100	2.5	0	0.1
10	0.135	3.4	40	0	40	5	75	122	0.060	1.5	55	1.40	0.100	2.5	.5	0.2
	3/16	4.8	40	0	40	5	75	124	0.060	1.5	45	1.14	0.100	2.5	1	0.3
	1/4	6.4	60	0	60	5	75	127	0.080	2.0	35	0.90	0.120	3.0	2	0.5

O_2 (P1)# and N_2 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

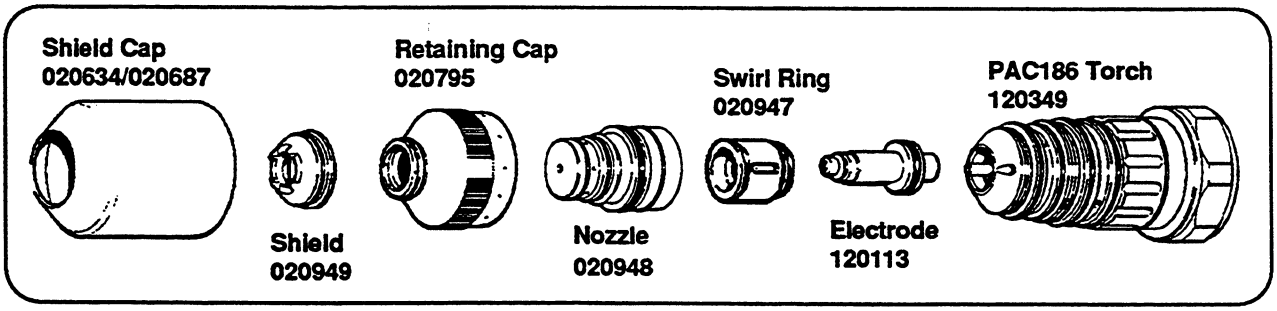
Refer to Figure 4-3 to locate LCD displays.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Stainless Steel## - 50 Amp Cutting
Air Plasma/Air Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage	Torch Standoff**		Travel Speed		Initial Piercing Height***		Pierce Delay	
			Shield Air		Plasma Air	Preflow Air										
(GA)	(in)	(mm)	(1)#	(2)#	(3)#	(4)#	(5)#	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
14	0.075	1.9	80	0	40	60	0	100	0.040	1.0	120	3.05	0.120	3.0	1	0.3
12	0.105	2.7	80	0	40	60	0	100	0.040	1.0	80	2.03	0.120	3.0	1.5	0.4
10	0.135	3.4	60	0	40	60	0	110	0.060	1.5	55	1.40	0.120	3.0	1.5	0.4
	3/16	4.8	50	0	40	60	0	115	0.080	2.0	40	1.02	0.160	4.0	2	0.5

Air (P1)# and (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Refer to Figure 4-3 to locate LCD displays.

Stainless steel plate sometimes comes with a protective plastic film. Remove film prior to cutting.

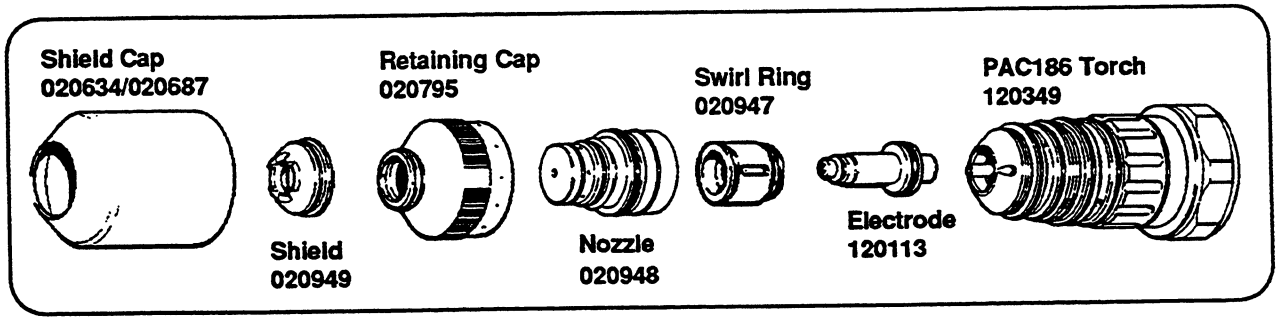
* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020949.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Copper## - 50 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage (volts)	Torch Standoff**		Travel Speed		Initial Piercing Height ***		Pierce Delay	
			Shield		Plasma	Preflow										
(GA)	(in)	(mm)	O_2 & N_2 (1)#	(2)#	O_2 (3)#	O_2 & N_2 (4)#	(5)#		(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
16	0.060	1.5	20	10	40	35	40	92	0.080	2.0	70	1.78	0.100	2.5	4	1.0
14	0.075	1.9	20	10	40	35	40	92	0.080	2.0	70	1.78	0.100	2.5	4	1.0
12	0.105	2.7	20	10	40	35	40	94	0.080	2.0	65	1.65	0.100	2.5	7	1.5
10	0.135	3.4	20	10	40	35	40	94	0.080	2.0	65	1.65	0.100	2.5	9	2.0

O_2 (P1)# and N_2 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Refer to Figure 4-3 to locate LCD displays.

Copper plate sometimes comes with a protective plastic film. Remove film prior to cutting.

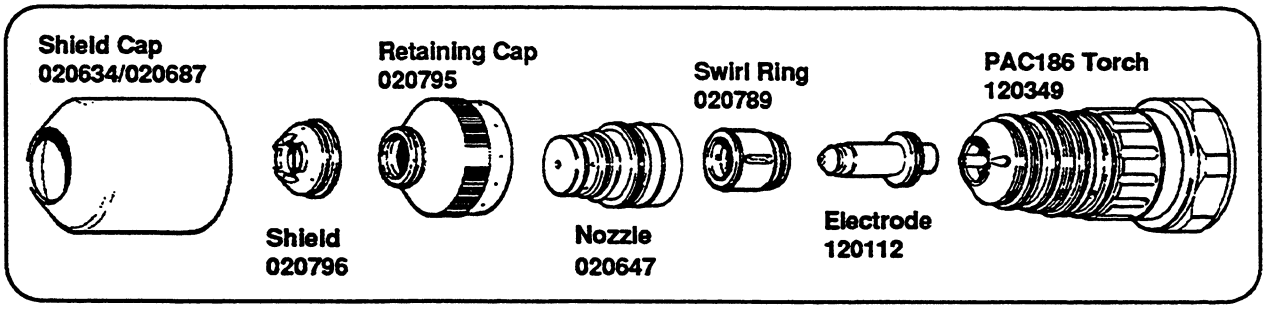
* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020949.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks*.

HD-3070
PAC186 Operating Data (Cut) Charts
Mild Steel - 70 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness (GA)	(in)	(mm)	Test Cut Flowrates (%) Shield O_2 & N_2 (1)#	(2)#	Plasma O_2 (3)#	Test Preflow* Flowrates (%) Preflow O_2 & N_2 (4)#	(5)#	Arc Voltage (volts)	Torch Standoff** (in)	(mm)	Travel Speed (ipm)	(m/min)	Initial Piercing Height *** (in)	(mm)	Pierce Delay (dial)	(sec)
16	0.060	1.5	0	100	25	5	75	107	0.060	1.5	280	7.11	0.100	2.5	0	0.1
14	0.075	1.9	0	100	25	5	75	107	0.060	1.5	230	5.84	0.100	2.5	0	0.1
12	0.105	2.7	0	100	25	5	75	109	0.080	2.0	185	4.70	0.120	3.0	0	0.1
10	0.135	3.4	0	100	25	5	75	114	0.080	2.0	150	3.81	0.120	3.0	.5	0.2
	3/16	4.8	0	100	25	5	75	119	0.080	2.0	120	3.05	0.120	3.0	1	0.3
	1/4	6.4	0	100	40	5	75	129	0.080	2.0	100	2.54	0.120	3.0	2	0.5
	3/8	9.5	0	100	40	5	75	135	0.100	2.5	65	1.65	0.160	4.0	4	1.0

O_2 (P1)# and N_2 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Ensure retaining cap 020795 is tight for good electrical contact.

Refer to Figure 4-3 to locate LCD displays.

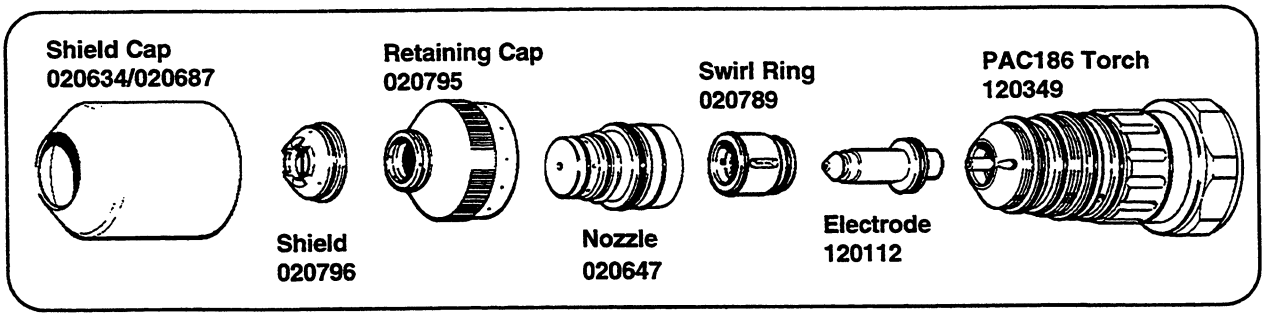
* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Stainless Steel## - 70 Amp Cutting
Air Plasma/Air & CH_4 Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage	Torch Standoff**		Travel Speed		Initial Piercing Height ***		Pierce Delay	
			Shield Air & CH_4		Plasma Air	Preflow Air										
(GA)	(in)	(mm)	(1)*	(2)*	(3)*	(4)*	(5)*	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
10	0.135	3.4	100	0	35	75	0	134	0.060	1.5	100	2.54	0.140	3.5	1	0.3
	3/16	4.8	60	3	35	75	0	139	0.080	2.0	80	2.00	0.140	3.5	1.5	0.4
	1/4	6.4	30	10	35	75	0	149	0.140	3.5	55	1.40	0.180	4.5	2	0.5
	3/8	9.5	30	10	35	75	0	164	0.140	3.5	30	0.76	0.200	5.0	2	0.5
	1/2	12.7	40	20	50	75	0	189	0.250	6.3	25	0.64	****		****	

Air (P1)* and CH_4 (P2)* gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Ensure retaining cap 020795 is tight for good electrical contact.

* Refer to Figure 4-3 to locate LCD displays.

Stainless steel plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

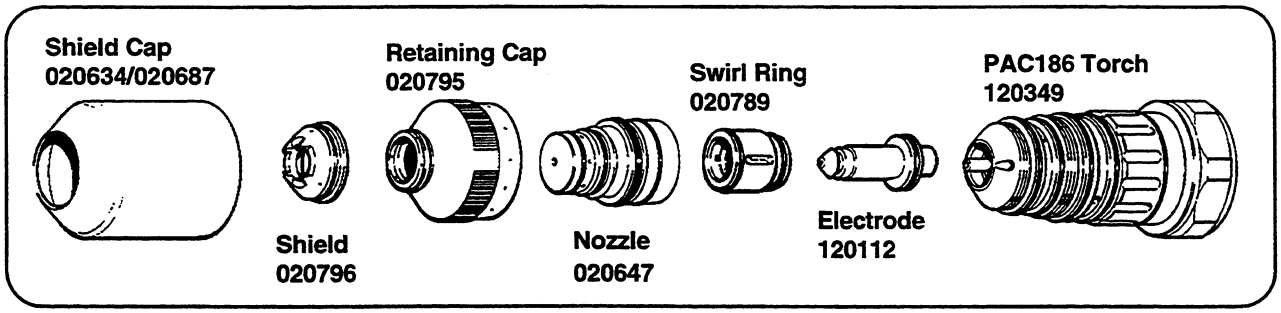
** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

**** Piercing 1/2 inch (12.7 mm) stainless steel is not recommended, it will shorten consumable life. Starting cuts at the edge of the metal is recommended.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Aluminium## - 70 Amp Cutting
Air Plasma/CH_4 Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage	Torch Standoff**		Travel Speed		Initial Piercing Height ***		Pierce Delay	
			Shield		Plasma	Preflow Air										
(GA)	(in)	(mm)	CH_4 (1)#	(2)#	Air (3)#	(4)#	(5)#	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
18	0.048	1.3	0	40	45	75	0	159	0.100	2.5	150	3.81	0.160	4.0	0	0.1
16	0.060	1.5	0	40	45	75	0	159	0.100	2.5	125	3.18	0.160	4.0	0	0.1
14	0.075	1.9	0	40	45	75	0	159	0.100	2.5	100	2.54	0.160	4.0	0	0.1
12	0.105	2.7	0	40	45	75	0	159	0.100	2.5	85	2.16	0.160	4.0	.5	0.2
	1/8	3.2	0	40	45	75	0	179	0.180	4.5	70	1.78	0.200	5.0	.5	0.2
10	0.135	3.4	0	40	45	75	0	179	0.180	4.5	65	1.65	0.200	5.0	.5	0.2
	1/4	6.4	0	40	45	75	0	179	0.180	4.5	45	1.14	0.200	5.0	1	0.3
	3/8	9.5	0	40	45	75	0	179	0.180	4.5	30	0.76	0.200	5.0	1	0.3
	1/2	12.7	0	40	45	75	0	189	0.250	6.3	25	0.64	****		****	

Air (P1)# and CH_4 (P2)# gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Ensure retaining cap 020795 is tight for good electrical contact.

Refer to Figure 4-3 to locate LCD displays.

Aluminum plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

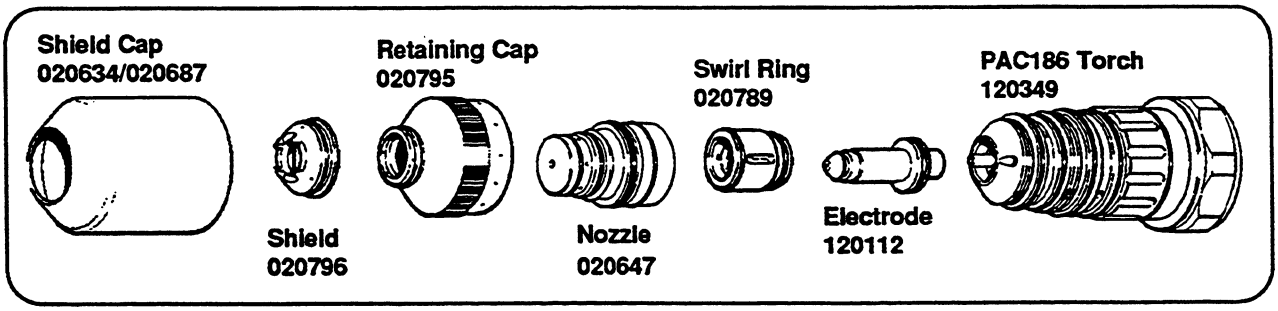
** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

**** Piercing 1/2 inch (12.7 mm) aluminum is not recommended, it will shorten consumable life. Starting cuts at the edge of the metal is recommended.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Copper## - 70 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness			Test Cut Flowrates (%)			Test Preflow* Flowrates (%)		Arc Voltage	Torch Standoff**		Travel Speed		Initial Piercing Height ***		Pierce Delay	
			Shield		Plasma	Preflow										
(GA)	(in)	(mm)	O_2 & N_2 (1)*	(2)*	O_2 (3)*	O_2 & N_2 (4)*	(5)*	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
10	0.135	3.4	75	50	50	5	75	133	0.120	3.0	60	1.52	0.160	4.0	9	2.0
	3/16	4.8	75	50	50	5	75	119	0.120	3.0	55	1.40	0.160	4.0	—	2.5
	1/4	6.4	75	50	50	5	75	124	0.120	3.0	55	1.27	0.160	4.0	—	3.0
	3/8	9.5	75	50	50	5	75	129	0.120	3.0	25	0.64	0.160	4.0	—	5.0

O_2 (P1)* and N_2 (P2)* gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Ensure retaining cap 020795 is tight for good electrical contact.

* Refer to Figure 4-3 to locate LCD displays.

Copper plate sometimes comes with a protective plastic film. Remove film prior to cutting.

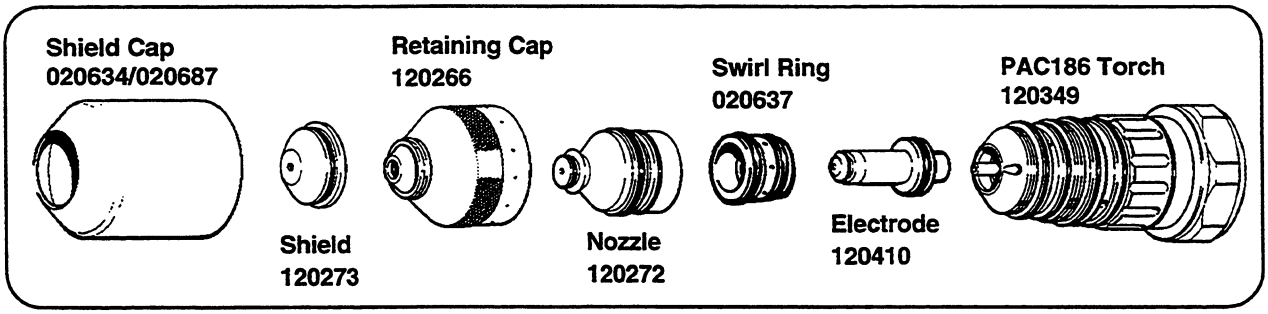
* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

HD-3070
PAC186 Operating Data (Cut) Charts
Mild Steel - 100 Amp Cutting
O_2 Plasma/O_2 & N_2 Shield



Material Thickness (in)	Material Thickness (mm)	Test Cut Flowrates (%) Shield O_2 & N_2 (2)*	Test Cut Flowrates (%) Plasma O_2 (3)*	Test Preflow* Flowrates (%) Preflow O_2 & N_2 (5)*	Arc Voltage (volts)	Torch Standoff** (in)	Torch Standoff** (mm)	Travel Speed (ipm)	Travel Speed (m/min)	Initial Height (in)	Initial Height (mm)	Pierce Delay (dial)	Pierce Delay (sec)
1/8	3.2	90	60	100	137	0.125	3.2	275	7.0	0.180	4.6	0	0.00
1/4	6.4	90	60	100	141	0.125	3.2	135	3.43	0.300	7.6	0.4	0.22
3/8	9.5	90	60	100	145	0.125	3.2	95	2.41	0.300	7.6	0.7	0.27
1/2	12.7	90	60	100	147	0.125	3.2	64	1.62	0.300	7.6	1.0	0.37

O_2 (P1)* and N_2 (P2)* gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Refer to Figure 4-3 to locate LCD displays.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** The torch standoff tolerances are ± 0.005 inch /± 0.125mm. When using a THC, the tolerances are ± 1 volt.

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks*.

Section 5 MAINTENANCE

In this section:

MAINTENANCE

INTRODUCTION

It is assumed that the service personnel performing the troubleshooting testing are high-level electronic service technicians that have worked with high voltage electro-mechanical systems. Knowledge of final isolation troubleshooting techniques is also assumed.

In addition to being technically qualified, maintenance personnel must perform all testing with safety in mind. Refer to the *Safety* section for operating precautions and warning formats.

If you need additional assistance or need to order parts, call Hypertherm Customer Service at 1-800-643-0030 or Hypertherm Technical Service at 1-800-643-9878.

WARNING

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

ROUTINE MAINTENANCE

The HD-3070 system is designed to require little regular maintenance under normal use. The following maintenance checks, are suggested to keep your system in top running condition.

Torch, Quick Disconnect/Off-Valve and Torch Leads Inspection

Inspect the torch and torch leads on a routine basis.

- Inspect the torch main body O-rings and replace, if necessary. For O-ring part numbers, refer to Section 6, Parts List, *PAC184 Machine Torch Assembly or PAC185 Machine Torch Assemblies.*
- The torch consumable parts and torch main body should always be inspected prior to cutting. Worn or damaged parts can cause gas and water leaks which can affect the cut quality. Check for pitting and burn marks on the consumable parts and replace, if necessary. Refer to Section 4, Operation, *Changing Consumable Parts.*
- Ensure that all connections are tight, but do not overtighten.
- The torch leads should be checked occasionally for cracking and damage.

Power Supply Inspection

Inspect the power supply on a routine basis.

- Check the exterior for any damage. If there is damage, ensure it does not affect safe operation of the power supply.
- Remove covers and inspect the interior. Check wiring harnesses and connections for wear and damage. Check for loose connections, and look for areas of discoloration due to overheating.
- At the rear of the power supply, inspect for a dirty particle filter element. Replace the filter element (027005) when it gets dirty.
- Every six months, flush the power supply of its torch coolant and replace with new coolant (028872).

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

- Remove the covers and blow out the unit with dry compressed air. In an excessively dirty environment, clean the power supply on a weekly basis.

- Blow out the fans and heat exchanger at rear of power supply. In an excessively dirty environment, clean on a weekly basis.

Gas Console Inspection

Inspect the gas console on a routine basis.

- Check the exterior for any damage.
- Inspect all interconnecting cables, hoses and leads for wear and damage. Ensure all connections are tight and that there are no leaks. Do not overtighten.

Clean the gas console by periodically checking for dust and foreign matter inside the unit.

- Remove cover and blow out the unit with dry compressed air. It is important to keep the cover closed except when cleaning or maintenance is being performed.

RHF Console Inspection

Inspect the RHF console on a routine basis.

- Check the exterior for any damage. If there is damage, ensure that it does not affect safe operation of the console.
- Open the cover and inspect the interior. Check all cables and hoses for wear and damage. Check for loose connections, look for areas of discoloration due to overheating. Check for plumbing leaks.
- Inspect the two (2) spark gaps. Clean electrodes a with diamond file, align, and/ or regap. Set spark gaps with clean feeler gauge to 0.020 ± 0.001 inch (0.51 ± 0.03 mm). Ensure that the electrode surfaces between the gaps are flat. If surfaces are rounded, replace and regap. See Figure 6-11 for part number information.

Clean the RHF console by periodically checking for dust and foreign matter inside the unit.

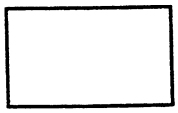
- Open the cover and blow out the unit with dry compressed air. It is important to keep the cover closed except when cleaning or maintenance is being performed.

STARTING SEQUENCE OF HD-3070

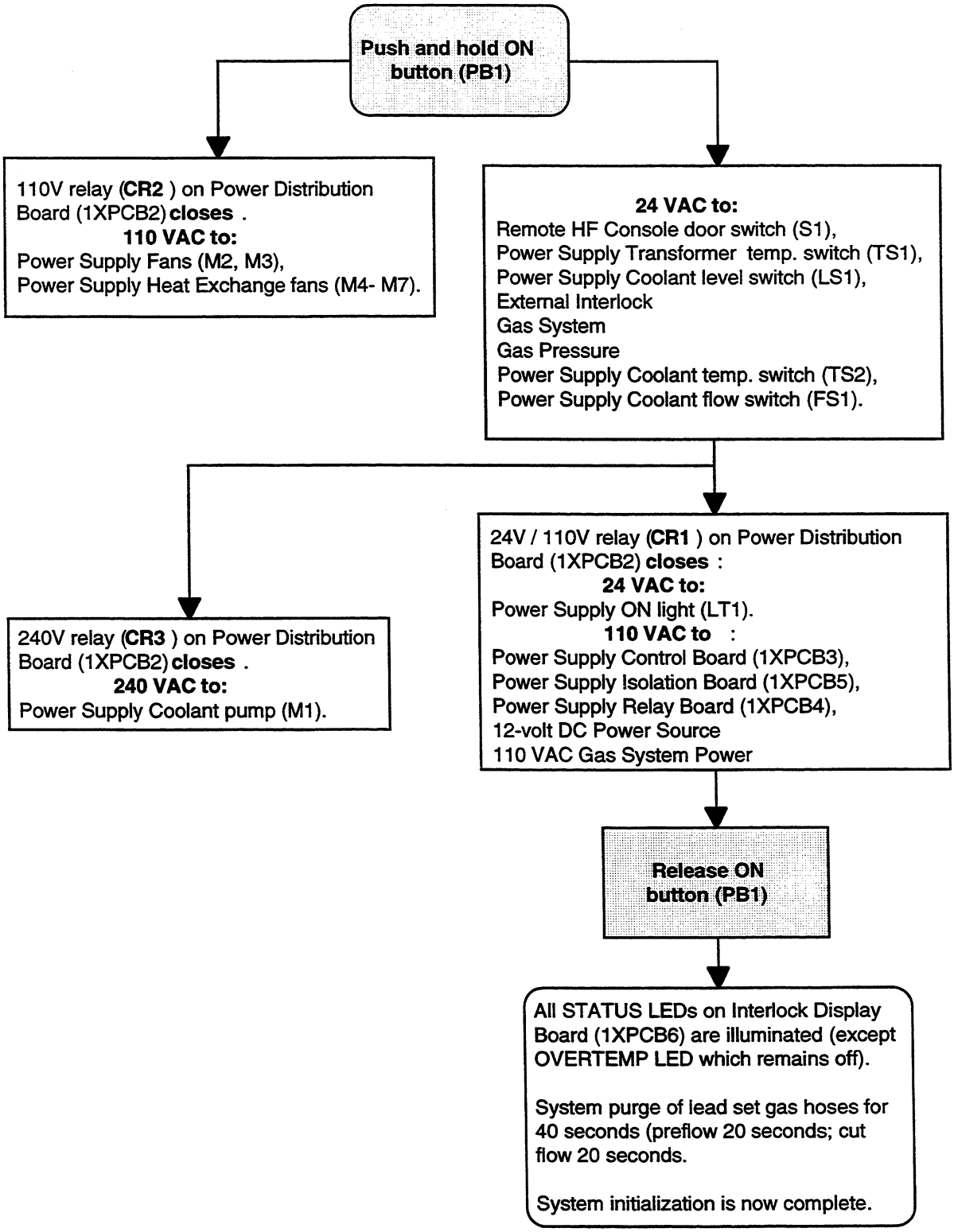
On the following page is a detailed flowchart outlining the starting sequence during proper HD-3070 operation. Shaded boxes represent action taken by the operator.

The following symbols used in the flowchart are ANSI standard flowcharting symbols. Their names and definitions are as follows:

Terminus The terminus is used to indicate the beginning or ending point of a flowchart.



Task/Process Box The process or task box is used to indicate any process or task other than an input/output operation or a decision.


Push and hold ON button (PB1)
110V relay (CR2) on Power Distribution Board (1XPCB2) closes .
110 VAC to:
Power Supply Fans (M2, M3),
Power Supply Heat Exchange fans (M4- M7).
24 VAC to:
Remote HF Console door switch (S1),
Power Supply Transformer temp. switch (TS1),
Power Supply Coolant level switch (LS1),
External Interlock
Gas System
Gas Pressure
Power Supply Coolant temp. switch (TS2),
Power Supply Coolant flow switch (FS1).
240V relay (CR3) on Power Distribution Board (1XPCB2) closes .
240 VAC to:
Power Supply Coolant pump (M1).
24V / 110V relay (CR1) on Power Distribution Board (1XPCB2) closes :
24 VAC to:
Power Supply ON light (LT1).
110 VAC to :
Power Supply Control Board (1XPCB3),
Power Supply Isolation Board (1XPCB5),
Power Supply Relay Board (1XPCB4),
12-volt DC Power Source
110 VAC Gas System Power
Release ON button (PB1)
All STATUS LEDs on Interlock Display Board (1XPCB6) are illuminated (except OVERTEMP LED which remains off).
System purge of lead set gas hoses for 40 seconds (preflow 20 seconds; cut flow 20 seconds.
System initialization is now complete.

INITIAL CHECKS

Before tracking down specific problems, it is good practice to do a visual check, and verify proper voltages are present at the power source, transformer and power distribution board.

WARNING

SHOCK HAZARD: Always use caution when servicing a power supply when plugged in and the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.

1. Disconnect line power by turning line disconnect switch **Off**.

2. Using a Phillips head screwdriver, remove top plate, two side plates, front plate, and rear plate.

3. Inspect interior of unit for discoloration on pc boards, or other apparent damage. If a component or module is obviously defective upon visual inspection, remove and replace it before doing any testing. Refer to the *Parts List,* Section 6 to identify parts.

4. If no damage is apparent, apply power to power unitby turning on the line disconnect switch **On**.

5. For a 200, 208, 240, 480, or 600- volt power supply measure the voltage at TB1 between L1 (U), L2 (V) and L3 (W). Refer to Figure 5-1 for detail of TB1. Also refer to wiring diagram 013-4-266 supplied with manual, if required. The voltage between any two of the three points at TB1 should be equal to the supply voltage (200, 208, 240, 480, or 600 VAC). If there is a problem at this point, disconnect main power and check connections, power cable, and fuses or circuit breaker at line disconnect switch. Repair and/or replace defective component(s) if necessary.

   For a 220/380/415- volt power supply measure the voltage at between the U, V and W studs on the EMI filter. Refer to Appendix F. Also refer to wiring diagram 013-4-266 supplied with manual, if required. The voltage between any two of the three studs should be equal to the supply voltage (220, 380, or 415 VAC). If there is a problem at this point, disconnect main power and check connections, power cable, and fuses or circuit breaker at line disconnect switch. Repair and/or replace defective component(s) if necessary.

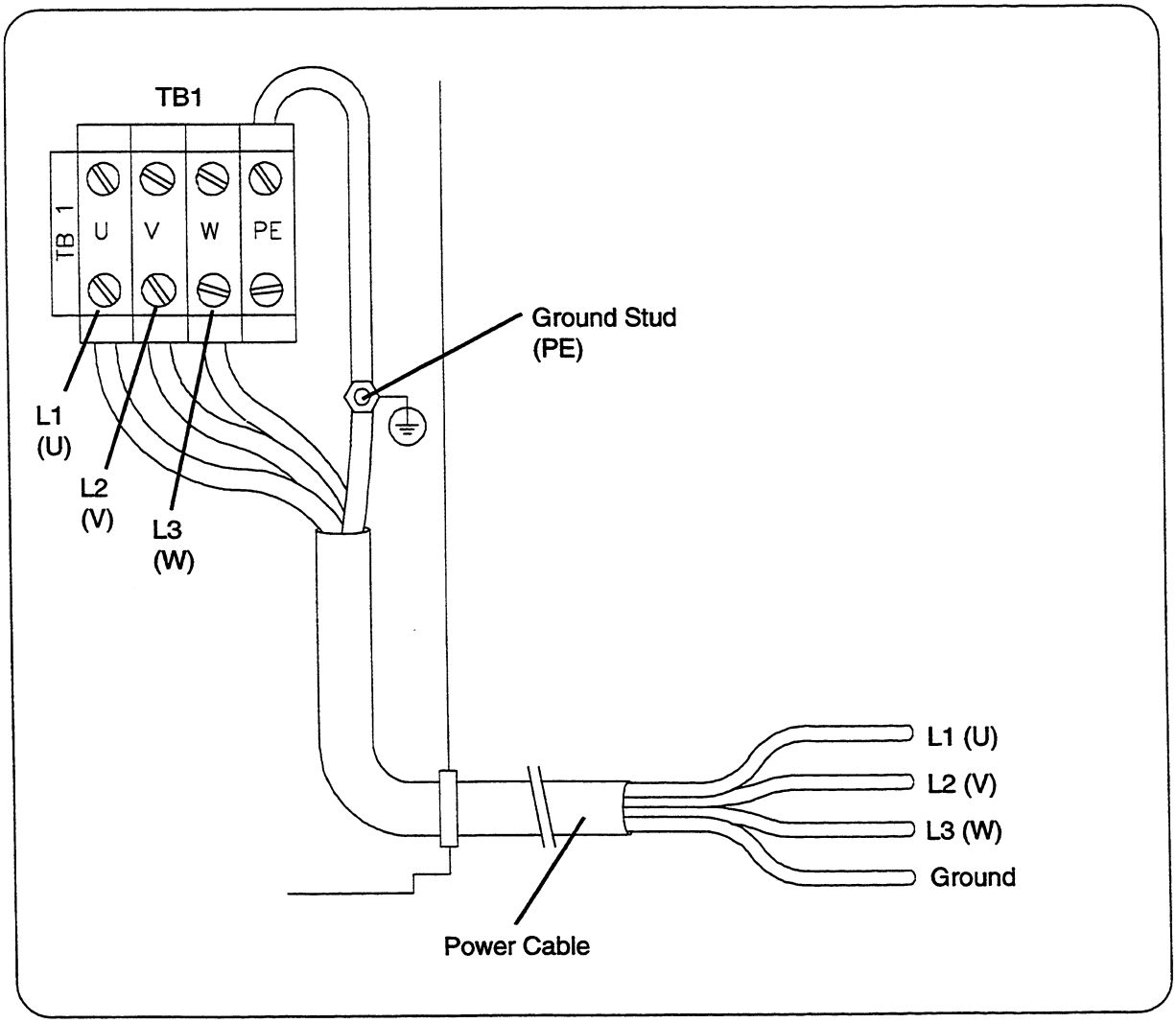


Figure 5-1 Primary Power Measurement Location

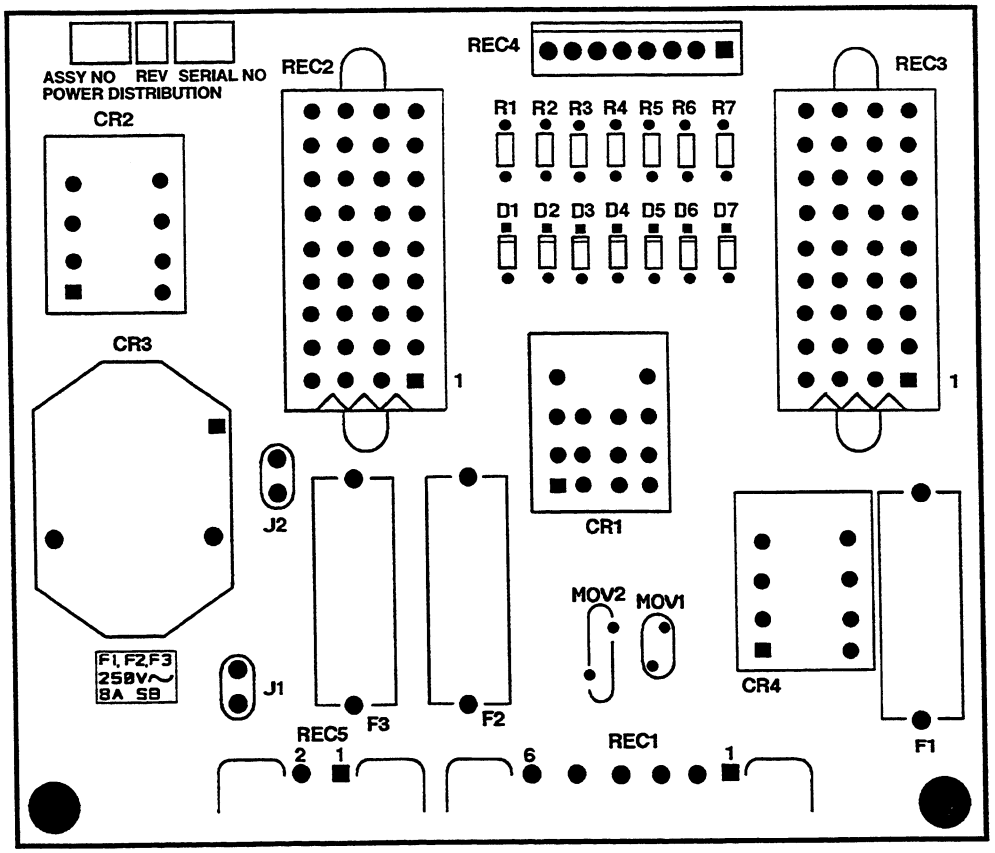


Figure 5-2 Power Distribution Board 1XPCB2

6. Measure voltage at Power Distribution Board 1XPCB2. Refer to Figure 5-2 for detail of 1XPCB2. Also refer to wiring diagram 013-4-266 at back of manual, if required. Look on the board for fuses F1, F2, and F3. Measurements between each fuse and chassis ground should be as follows:

   F1: 24VAC
   F2: 120VAC
   F3: 240VAC

   If voltages are not present, or incorrect at one or more of these points, disconnect power and troubleshoot 1XPCB2 fuses and associated pins, connectors and wiring between power distribution board connector REC1 and transformer secondary T1. Refer to Figure 6-7 for location of T1.

   Check main power fuses F1, F2, and F3 located in Figure 6-3, and associated wiring and connections between T1 and L1 and L2 (including linkboard on 240/480V units).

   Repair and/or replace defective component(s) if necessary.

MAINTENANCE

TROUBLESHOOTING

The troubleshooting section is presented by following normal operational sequence.

Before troubleshooting for specific problems, be sure that unit passes *Initial Checks* as outlined earlier in this section.

WARNING

SHOCK HAZARD: Always use caution when servicing a power supply when the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.

Problem	Possible Causes and Solutions
1. The green POWER ON push-button switch PB1 is pressed, but the fans are not operating and the green POWER ON indicator does not light.	**1.1.** *The green POWER ON (1) PB1 push button is defective.* Check that switch is operating correctly, and that good contact is being made. The POWER ON switch is normally open. **1.2.** *The red POWER OFF (0) PB2 push button is defective.* Check that switch is operating correctly, and that good contact is being made. The POWER OFF switch is normally closed. **1.3.** *Associated wiring not making good contact.* Check wiring and repair or replace, if necessary.
2. The green POWER ON push-button switch PB1 is pressed, the POWER ON indicator lights, but the fans are not running.	**2.1.** *CR2 on the Power Distribution board is defective.* Check that CR2 switches when POWER ON push button is pressed. See Figure 5-2 for location of CR2. If CR2 is defective, unsolder CR2 and replace. **2.2.** *PL25 and REC20 located near the fans (see Figure 6-2 for location of fans) are not seated together securely and/or not getting 120VAC from Power Distribution Board.* • Check pins, connectors and associated wiring for good continuity. • Check for 120VAC at PL25.

Problem	Possible Causes and Solutions
	2.3. *PL2 and REC2 on Power Distribution board* (see Figure 5-2 for location of REC2) are not seated well. Check pins, connectors and associated wiring for good continuity. Repair or replace, if necessary.
3. The green POWER ON push-button switch PB1 is pressed, the fans are operating, but the green POWER ON indicator does not light.	**3.1.** *Push button PB1 was not held down long enough.* Press and hold PB1 for a minimum of five seconds. **3.2.** *Relay CR1 on the Power Distribution board is defective.* Check that CR1 switches when POWER ON push button is pressed. See Figure 5-2 for location of CR1. If CR1 is defective, unsolder CR1 and replace. **3.3.** *One or more of the STATUS LEDs does not lilluminate (except yellow OVERTEMP LED which illuminates) indicating a fault condition.* To troubleshoot STATUS fault conditions, see *Status LED Troubleshooting* later in this section.
4. The green POWER ON indicator is lit, the START command is given and red DC ON indicator is lit, but there is no high frequency and no pilot arc.	**4.1.** *There is no spark between the spark gap electrodes.* Clean (with emery cloth), align, and/or regap 0.020 ± 0.001 inch (0.51 ± 0.003 mm per gap) the electrodes, if necessary. Ensure that the electrode surfaces between the gaps are flat. If surfaces are rounded, replace and regap. See Figure 6-11 for part number information. • Visually inspect the high voltage transformer T1 in the Remote HF console for leaking oil or overheating. See Figure 6-11 for location of T1. Replace T1 if leaking or overheating. • Check for 120VAC at filter (FL1) after START command is given. • If there is no 120VAC at FL1, use 013-4-266 wiring diagram and check pins, connectors and associated wiring from FL1 to REC3 of Relay Board 1XPCB4. If connections are O.K., there may be a problem with either 1XPCB4 or 1XPCB3. See *Relay*

Problem	Possible Causes and Solutions
	Board (1XPCB4) later in this section for location of relays and description of output signals. • If there <u>is</u> 120VAC at FL1, shut down system and remove capacitors C3 and C4. (See Figure 6- 11 for location of C3 and C4) Restart system and see if a faint spark is now observed across the gaps. • If a spark is <u>not</u> observed at the gaps, replace T1. If there <u>is</u> a spark, shut down system, and replace capacitors C3 and C4. **(Always replace the capacitors in pairs).** **4.2.** *There is no high frequency at the torch.* Check for a shorted torch, a damaged pilot arc lead, or loose lead connections. Replace the torch or pilot arc lead or tighten the lead connections.
5. The green POWER ON indicator is lit, the torch START command is given and the red DC ON indicator lights, and there is high frequency, but there is no pilot arc.	**5.1.** *Pilot arc relay CR1 is not closing (not getting 120VAC from the Relay Board 1XPCB4).* See if the CR1 relay contacts close after the START command is given. See Figure 6-7 for location of CR1. If CR1 does <u>not</u> close: • With an AC voltmeter across the relay, see if 120VAC is coming from 1XPCB4 after START command is given. • If there is no 120VAC, check connectors, terminals, pins, and associated wiring to REC3 of 1XPCB4. • If wiring is O.K., there is a problem either with 1XPCB4 or 1XPCB3. **5.2.** *Pilot arc relay CR1 is defective.* If there <u>is</u> 120VAC across the relay (see above steps), and CR1 does not close, replace CR1. **5.3.** *Main contactor (CON1) or 1XPCB4 is defective.* • With an AC voltmeter, see if contactor CON1 is getting 120VAC after START command is given. If there is no 120VAC, check pins, connectors and associated wiring from CON1 to pins 5 & 6 of REC3 of 1XPCB4.

Problem	Possible Causes and Solutions
	• If wiring is O.K., 1XPCB4 or 1XPCB3 may be defective. See *Relay Board (1XPCB4)* later in this section for location of relays and description of output signals. • If CON1 is getting 120VAC from the Relay Board as described above, measure the voltage between all terminals 1A, 1B and 1C of main transformer T2 after the START command is given. See Figure 6-7 for location of T2. The voltage between any two of the three points should be equal to 200VAC. If there is no voltage at any of the above points, replace CON1. If there is voltage at some but not all of the above points, check wiring and connections to and from T2. If wiring checks out OK, return to *Initial Checks* section and repeat steps 1-5. **5.4.** *Chopper is defective or not functioning.* Refer to CH130 Chopper Module Test Procedure on page 5-68.
6. The unit stops cutting during cut, or cuts poorly.	**6.1.** *The work clamp is not connected or it is broken.* Connect or repair the work clamp. **6.2.** *Arc not transferring to workpiece.* Check work clamp and cable connecting clamp to workpiece. Good contact must be made in order for the arc to transfer to the workpiece. **6.3.** *There is insufficient air or gas pressure.* Check gas inlet pressure specifications under *Cut Chart* in **Operation**,Section 4. Check plasma and shield gas pressures in TEST and RUN modes as specified under *Cut Chart* in **Operation**, Section 4. **6.4.** *Torch is getting insufficient current.* Check the arc current setting for the type and thickness of metal you are cutting from the *Cut Chart* in **Operation**, Section 4.

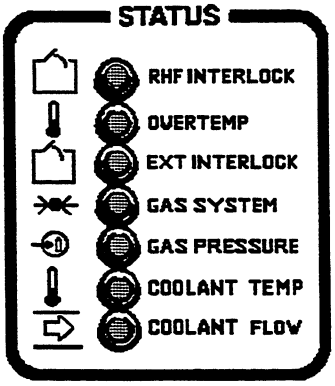
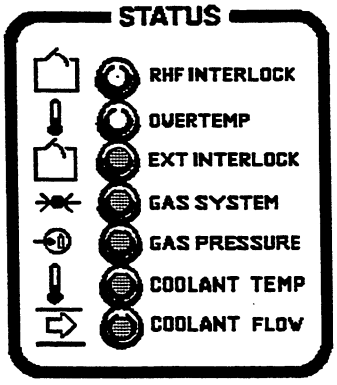
Problem	Possible Causes and Solutions
	6.5. *The power supply has overheated.* Shut down system and wait for unit to cool down. If unit will not restart, see *Status LED Troubleshooting* guide later in this section.
	6.6. *Chopper is defective or not functioning.* Refer to CH130 Chopper Module Test Procedure on page 5-70.

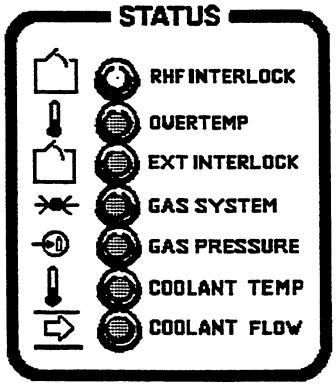
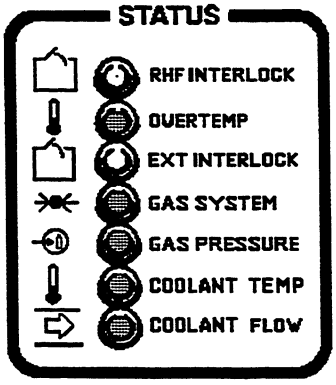
STATUS LED TROUBLESHOOTING

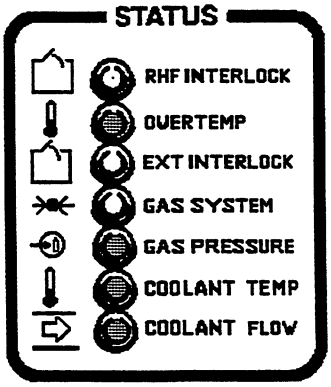
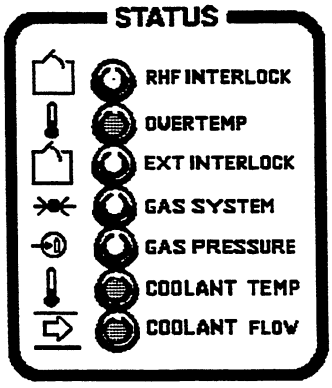
Be certain that the power supply has been through the Initial Checks as outlined earlier in this section before troubleshooting STATUS LEDs. When any one of the STATUS LEDs does not illuminate (except OVERTEMP illuminates) there is a fault condition that must be corrected in order for the HD-3070 power supply to become operational. The LEDs are connected in series, so the upper-most LED that does not illuminate (except OVERTEMP does not extinguish) represents the first condition that must be corrected. Refer to the problems and probable causes and solutions and the troubleshooting flow diagrams below. See wiring diagrams 013-4-266 and 013-4-269 and gas system and coolant system schematics 013-2-268 and 129-2-255 at back of manual for reference.

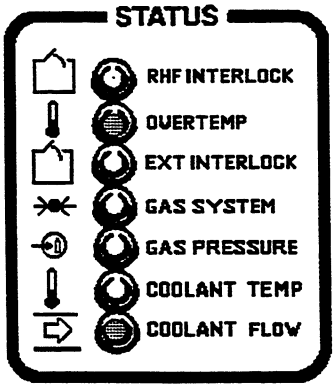
○ **LED illuminated**

◍ **LED extinguished**

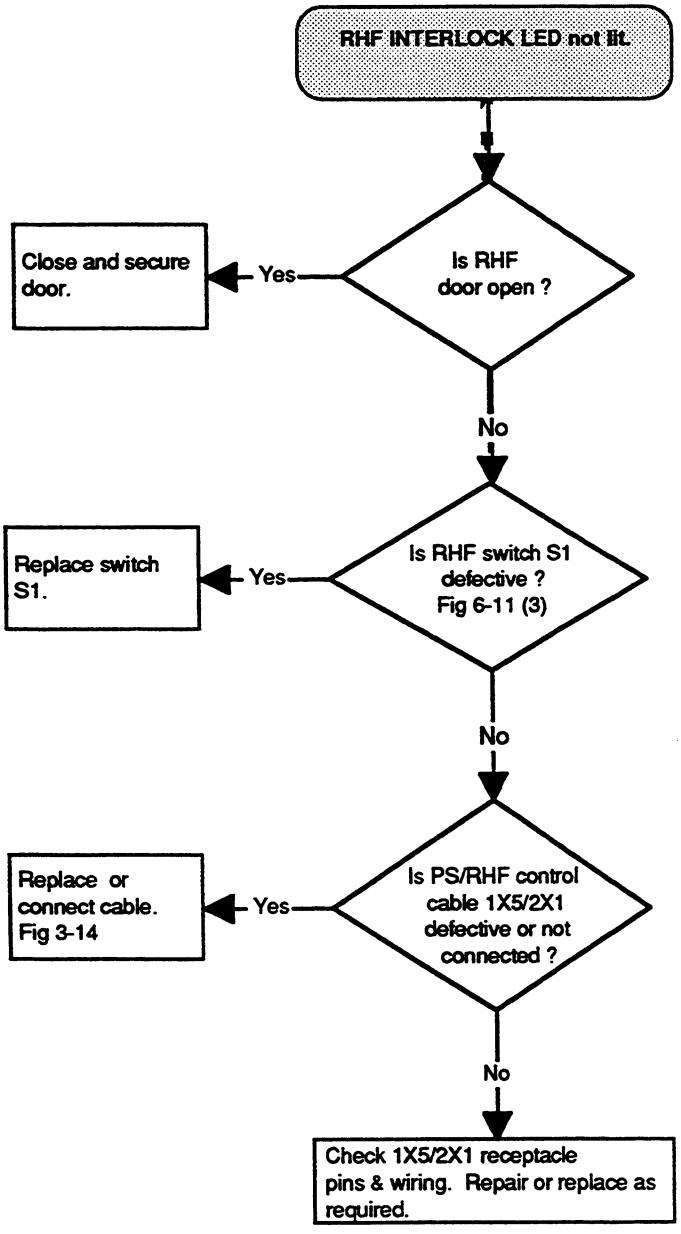
Problem	Possible Causes and Solutions
1. RHF INTERLOCK LED extinguished: 	**1.1** *Door to Remote HF console not completely shut.* This LED will illuminate when switch S1 located in the Remote HF console is closed. If door is closed, check pins, connectors and associated wiring for good continuity from receptacle 2X1 to 1X5. Repair and/or replace defective component(s), if necessary.
2. OVERTEMP LED illuminated: 	**2.1.** *Main Transformer T2 or chopper is overheating.* This LED will extinguish when the main transformer (T2) is operating in a normal temperature range((under 165° Ctr) and the chopper is operating in the normal temperature range (under 82° C). Temperature switch TS1 (transformer) or TSW1 (chopper) will open and will cause the LED to illuminate when overheating occurs. • Check temperature switches TS1 and TSW1 (normally closed). • Check pins, connectors and associated wiring to temperature switches.

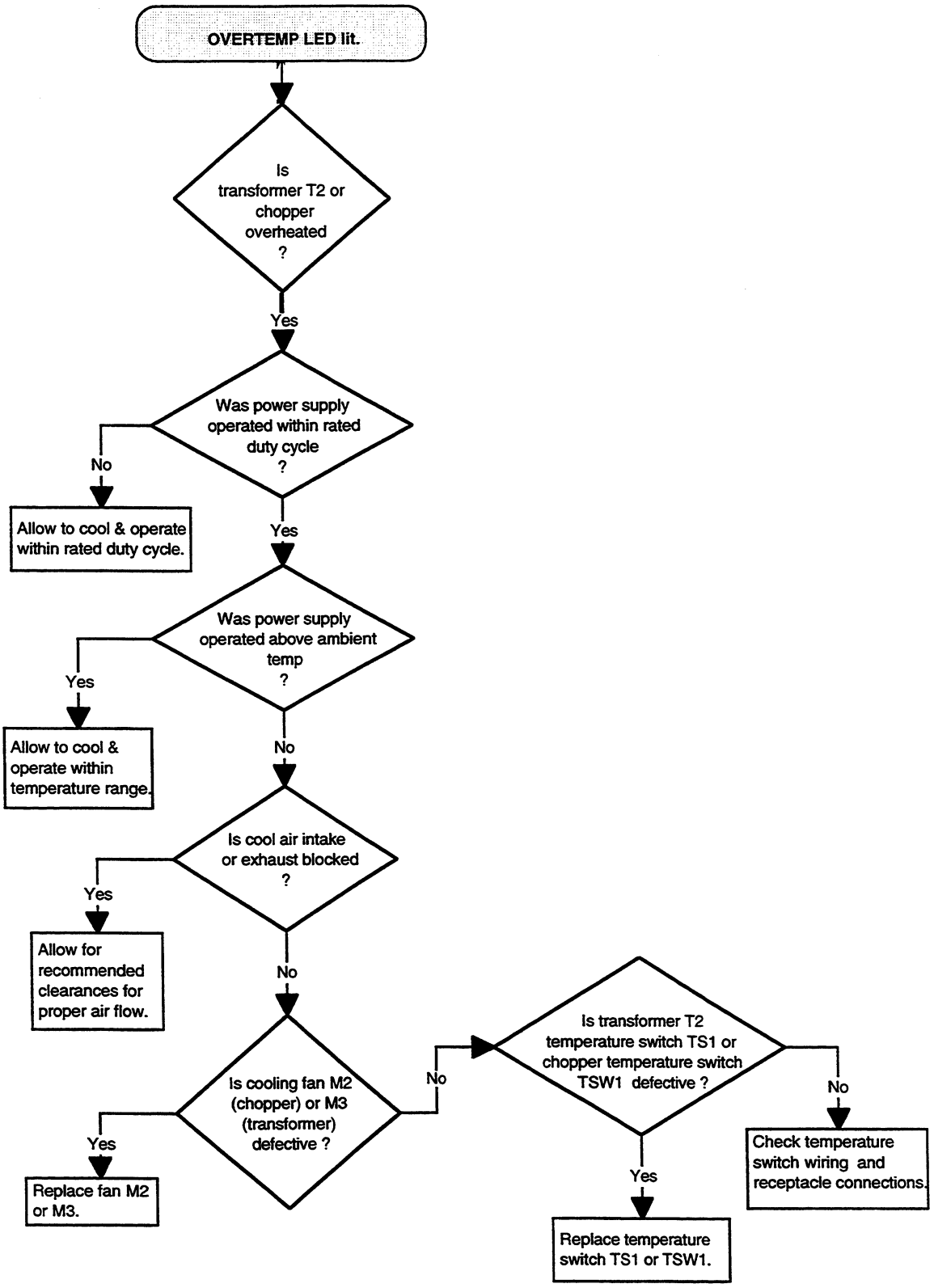
Problem	Possible Causes and Solutions
	• Leave the fans running, and try restarting the unit after one hour. If the LED still illuminates the transformer or chopper may have to be replaced.
3. **EXT INTERLOCK LED extinguished:** 	**3.1** *External interlock supplied for customer use.* **If not used, customer must jumper out signal at CNC machine.**
4. **GAS SYSTEM LED extinguished:** 	**4.1.** *Gas system malfunction.* This LED will light when the gas system has power applied and is operating correctly. This malfunction is **not** an indication that the gas inlet pressure is out of limits. • Using the wiring diagrams, 013-4-266 and 013-4-269, check pins, connectors and wiring associated with cables between 1X3 on power supply and 3X2 on gas console and 1X4 on power supply and 3X1 on gas console. • Check PCB control board 1XPCB3. • Check PCB control board A1 in gas console. Repair and/or replace defective component(s), if necessary.

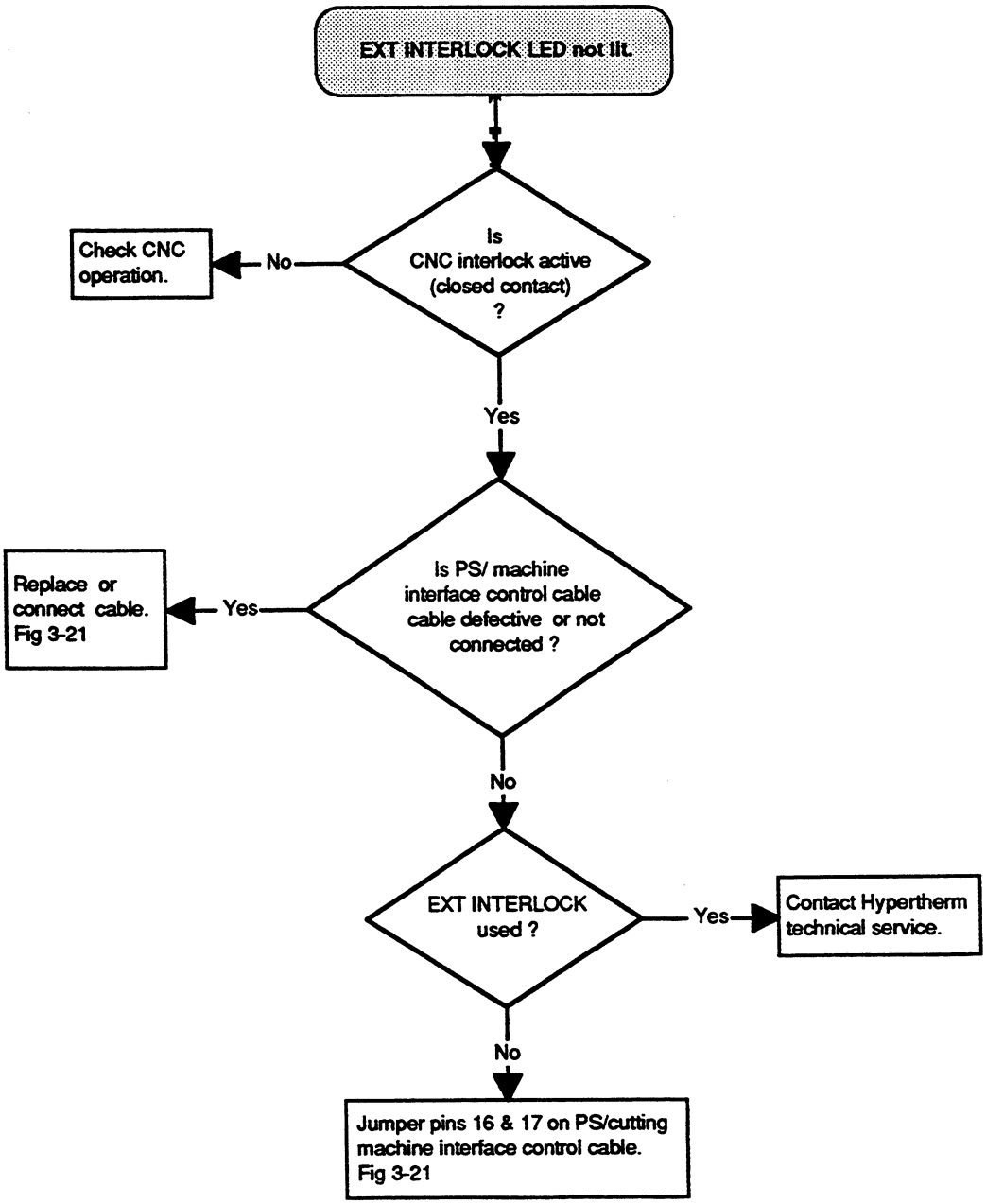
Problem	Possible Causes and Solutions
5. GAS PRESSURE LED extinguished: 	**5.1.** *Plasma or shield input gas pressure too low.* This LED will illuminate if the plasma and shield input gas pressures are above 105 psi (7.2 bar). • Check that input plasma and shield gas pressures are 120 psi (8.2 bar).
6. COOLANT TEMP LED extinguished: 	**6.1.** *Coolant too hot.* This LED will illuminate when temperature switch TS2 senses that the temperature of coolant in the coolant reservoir is under 160°F. • Check to see if water coolant is above **160°F.** • Disconnect PL24 (located in the rear of the power supply near the coolant reservoir) from REC24 and check to see if TS2 is open. TS2 is normally closed, and is opened when a temperature above 160°F is reached. • Using the 013-4-266 wiring diagram, check pins, wires and connections from PL24 to REC3 of 1XPCB2. • Check for proper operation of cooling fans M4, M5, M6 and M7. Ensure that the heat exchanger air flow is not obstructed. Repair and/or replace defective component(s), if necessary.

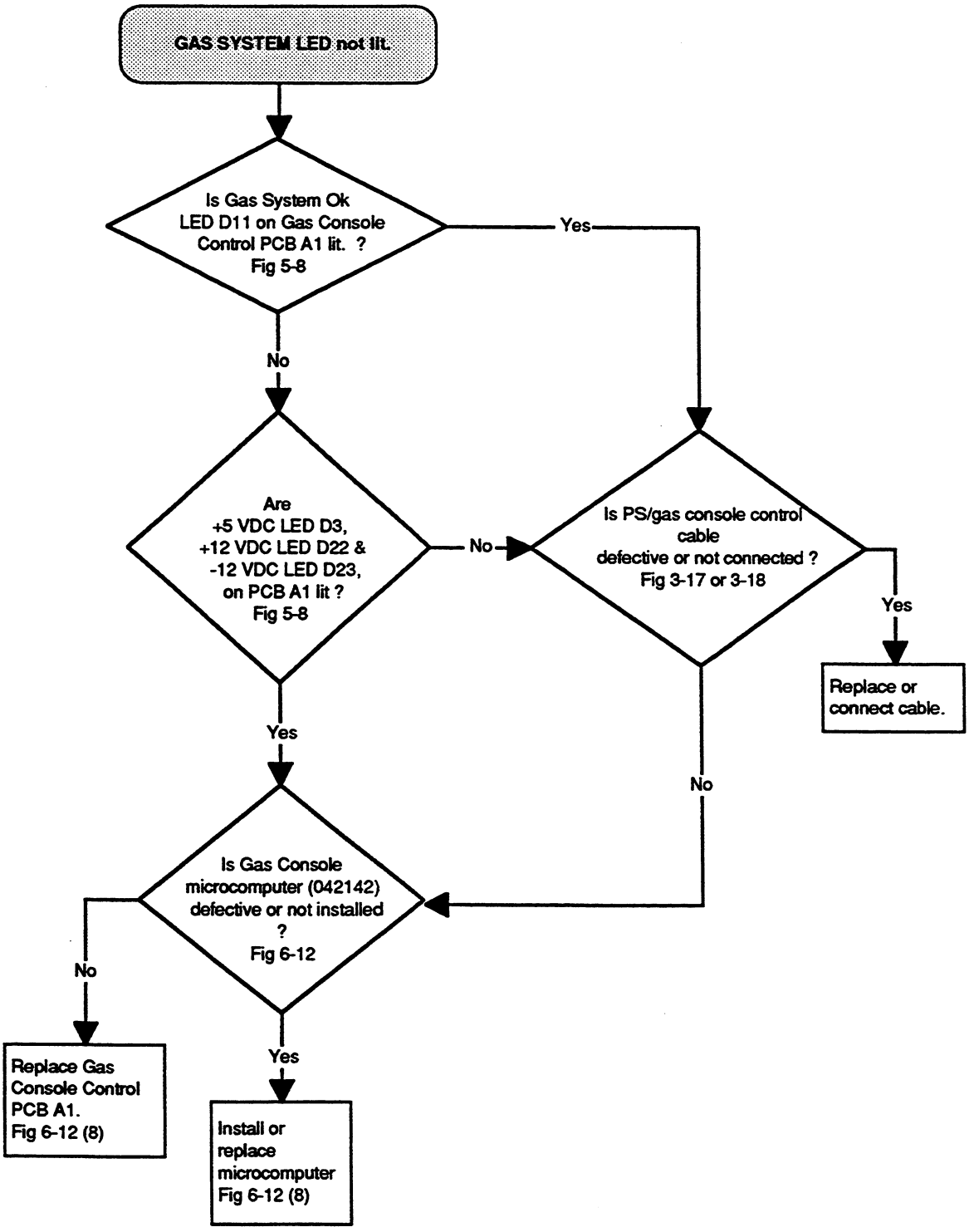
Problem	Possible Causes and Solutions
7. **COOLANT FLOW LED extinguished:** 	**7.1.** *Coolant flow too slow.* This LED will illuminate when flowswitch (FS1) senses a coolant flow of at least .25 gpm to the torch. See Figure 6-10 for location of flowswitch FS1, motor M1, and pump P1. **7.2.** *Motor M1 not functioning.* • Check to see if 240VAC is available at PL21. PL21 is located near the pump. Note: The 240VAC relay (CR3) on 1XPCB2 will not close until the first six (6) interlocks (STATUS indicators) are satisfied. (See *Starting Sequence of HD-3070* flowchart) • Using the 013-4-266 wiring diagram, check pins, connections and associated wiring from PL21 to REC5 of 1XPCB2. If 240VAC is not available at REC5, CR3 may be defective. Replace 1XPCB2 if CR3 is defective. **7.3.** *Flow switch FS1 not functioning.* FS1 is a normally open switch that is closed when a flow greater than .25 gpm is sensed. When FS1 is closed, 24 VAC lights the COOLANT FLOW LED. • Check coolant hoses and connections for leaks. Repair and/or replace defective component(s), if necessary.

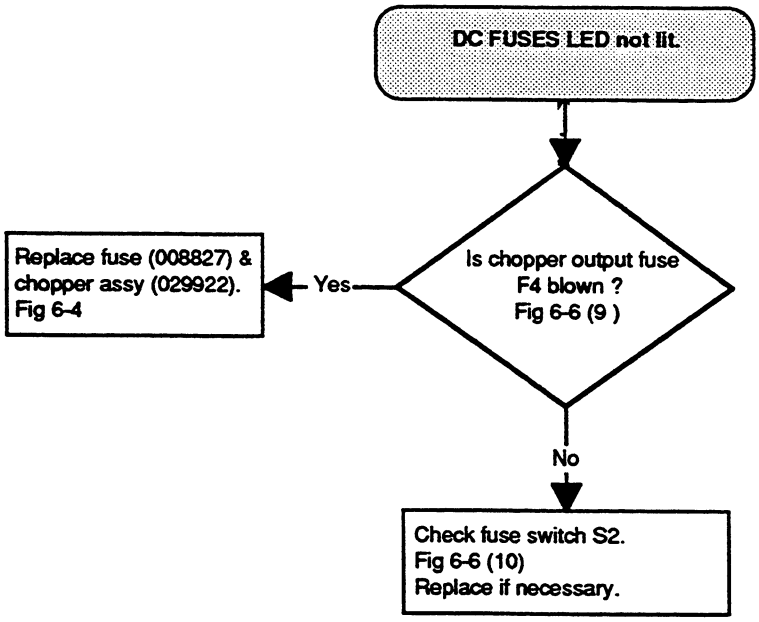
Status LED Troubleshooting Flow Diagrams

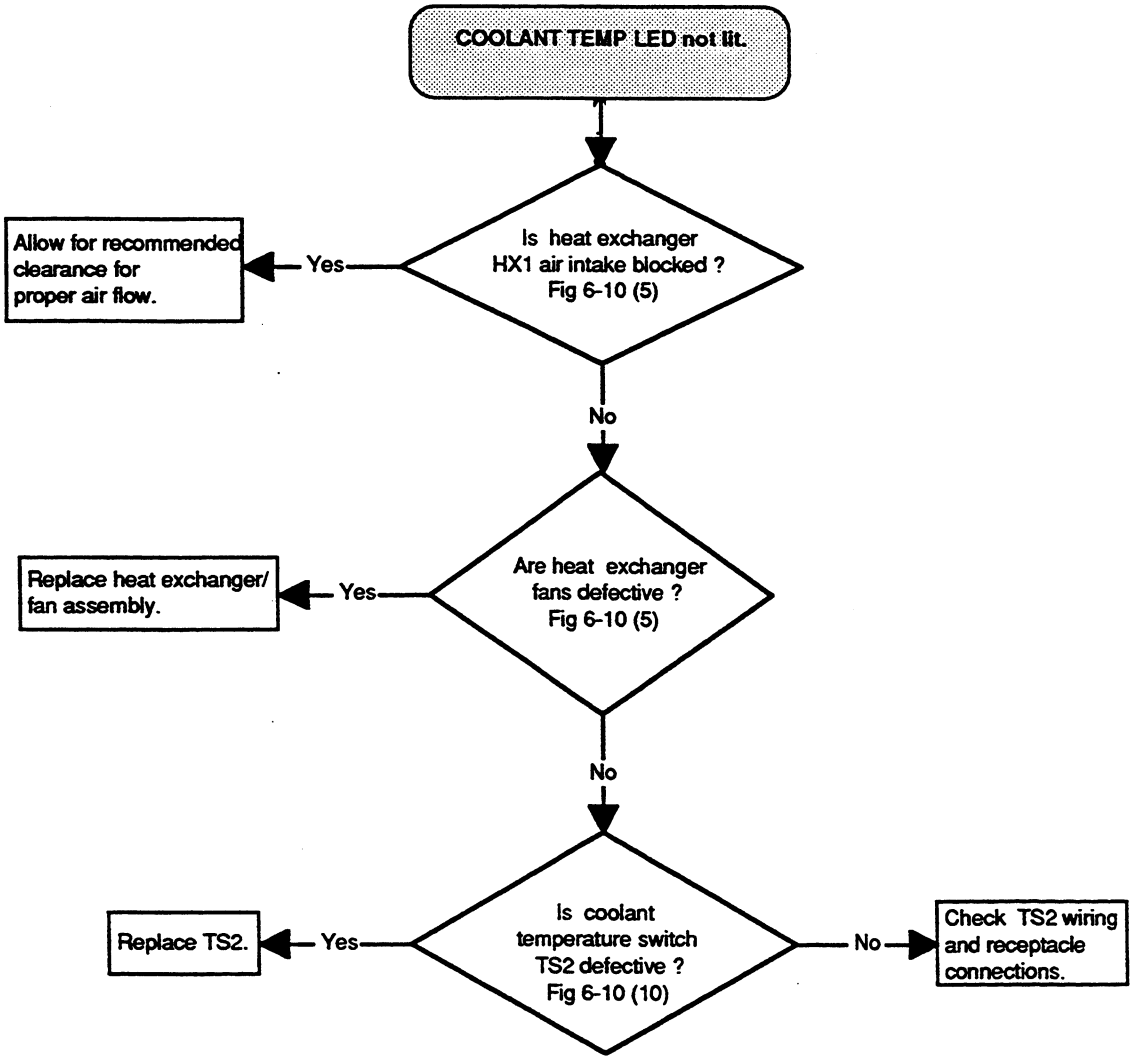


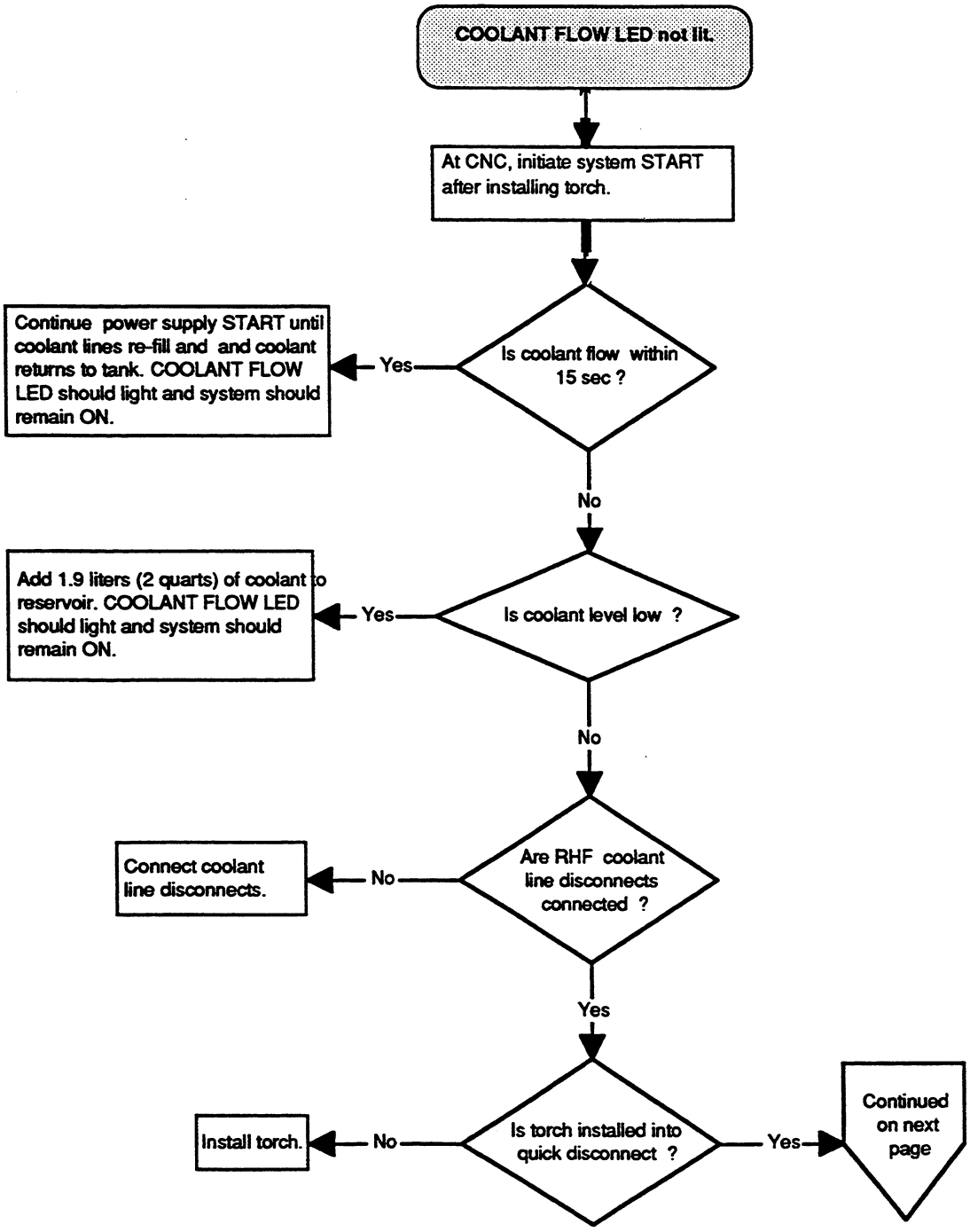

OVERTEMP LED lit.
Is transformer T2 or chopper overheated ?
Yes
Was power supply operated within rated duty cycle ?
No
Allow to cool & operate within rated duty cycle.
Yes
Was power supply operated above ambient temp ?
Yes
Allow to cool & operate within temperature range.
No
Is cool air intake or exhaust blocked ?
Yes
Allow for recommended clearances for proper air flow.
No
Is cooling fan M2 (chopper) or M3 (transformer) defective ?
Yes
Replace fan M2 or M3.
No
Is transformer T2 temperature switch TS1 or chopper temperature switch TSW1 defective ?
Yes
Replace temperature switch TS1 or TSW1.
No
Check temperature switch wiring and receptacle connections.

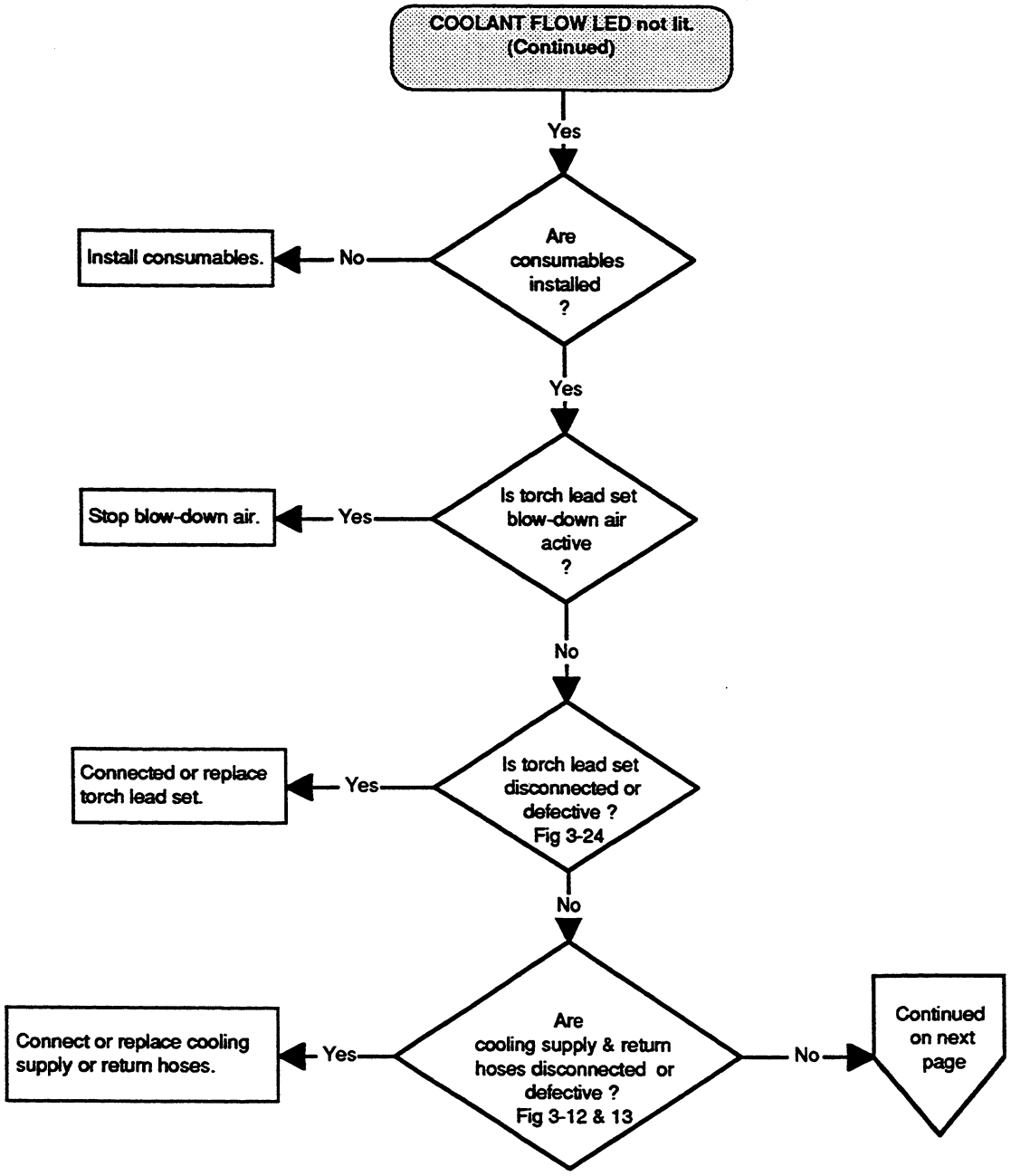

EXT INTERLOCK LED not lit.
Is CNC interlock active (closed contact) ?
No
Check CNC operation.
Yes
Is PS/ machine interface control cable cable defective or not connected ?
Yes
Replace or connect cable. Fig 3-21
No
EXT INTERLOCK used ?
Yes
Contact Hypertherm technical service.
No
Jumper pins 16 & 17 on PS/cutting machine interface control cable. Fig 3-21

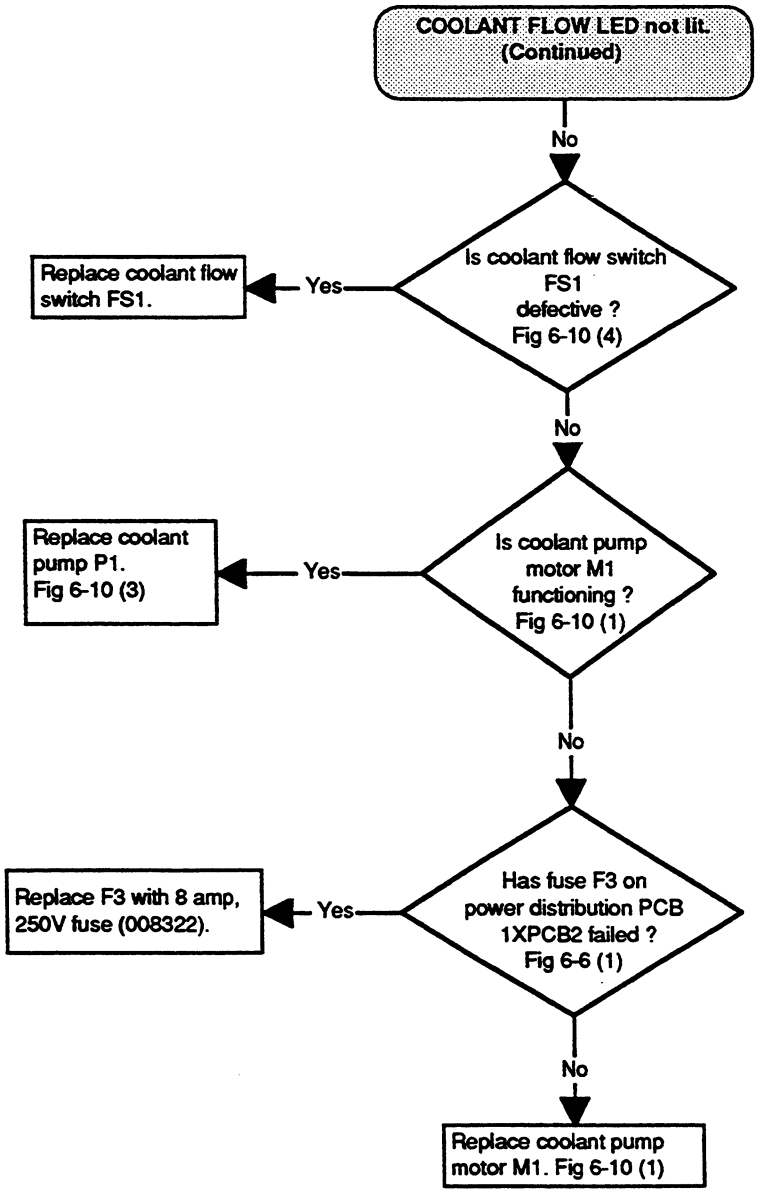

GAS SYSTEM LED not lit.
Is Gas System Ok LED D11 on Gas Console Control PCB A1 lit. ? Fig 5-8
Yes
No
Are +5 VDC LED D3, +12 VDC LED D22 & -12 VDC LED D23, on PCB A1 lit ? Fig 5-8
No
Is PS/gas console control cable defective or not connected ? Fig 3-17 or 3-18
Yes
Replace or connect cable.
Yes
No
Is Gas Console microcomputer (042142) defective or not installed ? Fig 6-12
No
Replace Gas Console Control PCB A1. Fig 6-12 (8)
Yes
Install or replace microcomputer Fig 6-12 (8)


DC FUSES LED not lit.
Is chopper output fuse F4 blown ? Fig 6-6 (9)
Yes
Replace fuse (008827) & chopper assy (029922). Fig 6-4
No
Check fuse switch S2. Fig 6-6 (10) Replace if necessary.


COOLANT TEMP LED not lit.
Is heat exchanger HX1 air intake blocked ? Fig 6-10 (5)
Yes
Allow for recommended clearance for proper air flow.
No
Are heat exchanger fans defective ? Fig 6-10 (5)
Yes
Replace heat exchanger/ fan assembly.
No
Is coolant temperature switch TS2 defective ? Fig 6-10 (10)
Yes
Replace TS2.
No
Check TS2 wiring and receptacle connections.


COOLANT FLOW LED not lit.
At CNC, initiate system START after installing torch.
Is coolant flow within 15 sec ?
Yes
Continue power supply START until coolant lines re-fill and and coolant returns to tank. COOLANT FLOW LED should light and system should remain ON.
No
Is coolant level low ?
Yes
Add 1.9 liters (2 quarts) of coolant to reservoir. COOLANT FLOW LED should light and system should remain ON.
No
Are RHF coolant line disconnects connected ?
No
Connect coolant line disconnects.
Yes
Is torch installed into quick disconnect ?
No
Install torch.
Yes
Continued on next page


COOLANT FLOW LED not lit.
(Continued)
Yes
Are consumables installed ?
No
Install consumables.
Yes
Is torch lead set blow-down air active ?
Yes
Stop blow-down air.
No
Is torch lead set disconnected or defective ? Fig 3-24
Yes
Connected or replace torch lead set.
No
Are cooling supply & return hoses disconnected or defective ? Fig 3-12 & 13
Yes
Connect or replace cooling supply or return hoses.
No
Continued on next page


COOLANT FLOW LED not lit.
(Continued)
No
Is coolant flow switch FS1 defective ? Fig 6-10 (4)
Yes
Replace coolant flow switch FS1.
No
Is coolant pump motor M1 functioning ? Fig 6-10 (1)
Yes
Replace coolant pump P1. Fig 6-10 (3)
No
Has fuse F3 on power distribution PCB 1XPCB2 failed ? Fig 6-6 (1)
Yes
Replace F3 with 8 amp, 250V fuse (008322).
No
Replace coolant pump motor M1. Fig 6-10 (1)

MAINTENANCE

ERROR CODES AND MESSAGES

Power Supply Control Board Error Codes

The microcontroller on control board 1XPCB3 will alert the user when certain errors occur in the HD-3070 system, by flashing the ERROR CODE LED on the control board . The power supply front cover must be removed to observe control board 1XPCB3 and the ERROR CODE LED (see Figure 5-3 below). Note that these errors codes are also displayed on the gas console as error numbers.

The ERROR CODE LED will blink on for 0.5 seconds and off for 0.5 seconds with a two second gap before repeating the blinking sequence. The number of blinks between the two second gap is one of ten error indications listed below. During error code flashing, all outputs from the control board are turned off, and the power supply is in an idle mode. After the error is corrected, you may resume operation of the system.

Note: Eight or nine blinks will occur during normal operation.
If the ERROR CODE LED remains on without blinking, this indicates that a microcontroller internal RAM or ROM self-check error has occurred (power supply will hang up). Replace microcontroller U9 or control PCB 1XPCB3. Refer to Fig 6-2 for part locations.

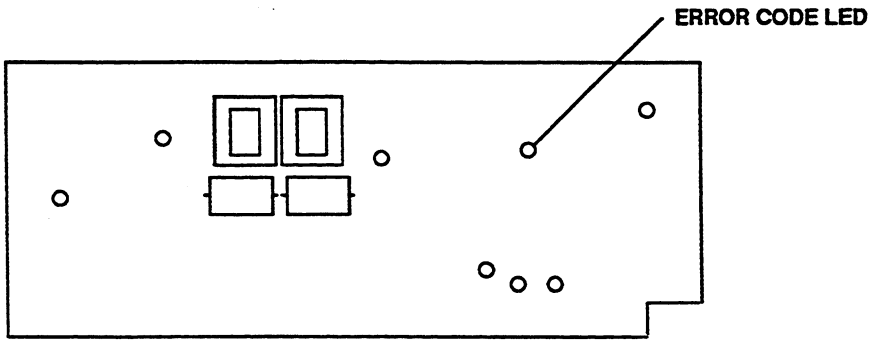


Figure 5-3 Power Supply Control Board Error Code LED Location

Power Supply Control Board Error Code Descriptions

Number of Blinks	Description
1	Indicates the that coolant reservoir needs to have coolant added. This error signal is issued as a warning to the CNC.
2	Iindicate that an "interlock" is not satisfied. Interlock failures are reported by the LEDs on the front panel of the power supply. Refer to *Section 4, Operation, Controls and Indicators.*

Number of blinks	Description
3	Indicate that the HOLD input (for multi-torch systems) was not released within 10 seconds after the end of preflow.
4	Indicate that the high frequency was unable to ignite the pilot arc within one second. Check gas flows and corresponding pressures.
5	Indicate that the PIERCE COMPLETE signal was not received within four seconds after the transfer signal.
6	Indicate that the transfer of the arc to the workpiece was not sensed within two seconds of torch ignition. Check ground clamp to workpiece. Initial torch height maybe too high. This will reduce nozzle life.
7*	Indicate that the arc was extinguished after current transferred to the workpiece, but before steady-state operation. The pierce delay may have been too long, and after arc transfer, too much metal was blown away before the X-Y machine moved leaving the arc no place to transfer to.
8*	Indicate that the arc was lost during steady-state operation. Typically, this error is caused by running the torch off the edge of the plate or by having the cut piece fall out leaving the arc no metal to transfer to.
9*	Indicate that during steady-state operation the measured arc voltage exceeded the programmed maximum. The torch to work distance was too high during a cut, consequently the power supply terminated the arc. Check arc voltage setting and that the torch height control (THC) is working properly.
10*	Indicate that the arc was lost during current ramp down, but before the programmed ramp down time has elapsed. After the start signal was removed from the power supply, it began to ramp down, but did not complete it. The most probable cause is by cutting parts that fall out, leaving the arc no metal to transfer to while the power supply is trying to ramp down. This problem can be improved, if not eliminated, by changing the CNC program. Try different leadouts for different shape cuts. Note: 7,8,9, or 10 blinks in sequence indicate errors that can reduce consumable life, and cause cut quality to erode prematurely.
12*	Indicate that the software has an error. If this error occurs, there is a fatal error in the microprocessor chip and it must be replaced. * These errors will also cause the error counterof the timer/counter to increment or cause an error count output signal to the CNC.

Gas Console Error Messages

The gas console displays error messages for both the plasma system and gas system (see Figure 4-3) in *Operation*, Section 4. The plasma system and gas system messages are listed below. Following these error messages, troubleshooting flow diagrams are provided to help resolve the problems causing the error messages.

Power Supply System (PS - ERR)

Error Message	Error Code	Description
NO ERROR	0	
LOW COOLANT LEVEL	1	This error signal is issued as a warning to the CNC that the coolant reservoir needs to have coolant added.
INTERLOCK ERR	2	This error is issued during operation when one of the pressure or temperature switches connected to the power distribution PCB is opened.
HOLD TIMEOUT ERR	3	This error signal is issued if the HOLD INPUT signal was not released within 10 seconds after the end of preflow.
NO PILOT TIMEOUT ERR	4	This error signal is issued when the high frequency was unable to ignite the pilot arc within 1 second.
PIERCE DELAY ERR	5	This error signal is issued when the PIERCE COMPLETE signal should have been received within 2 seconds of the transfer signal.
TRANSFER TIMEOUT ERR	6	This error signal is issued when the transfer of current to the work was not sensed within 4 seconds of torch ignition.
RAMPUP BLOWOUT ERR*	7	This error signal is issued when the arc was extinguished after current transfer to the workpiece, but before steady-state operation.
RUNNING ARC BLOWOUT ERR*	8	This error signal is issued when the arc was lost during steady-state operation.

Error Message	Error Code	Description
ARC OVER VOLTAGE ERR*	9	This error signal is issued during steady-state operation when the measured arc voltage exceeded the programmed maximum allowable arc voltage (200V)
RAMPDWN ARC BLOWOUT ERR*	10	This error signal is issued when the arc was lost during current ramp down, but before the programmed ramp down time has elasped.
WRONG STATE ERR	12	This error signal should never occur. It indicates that the software has a very serious error that caused it to transfer control to an undefined program state. It is very important to record what the exact operating conditions were prior to the error.

* These errors will also cause the error count output signal to the CNC to increment.

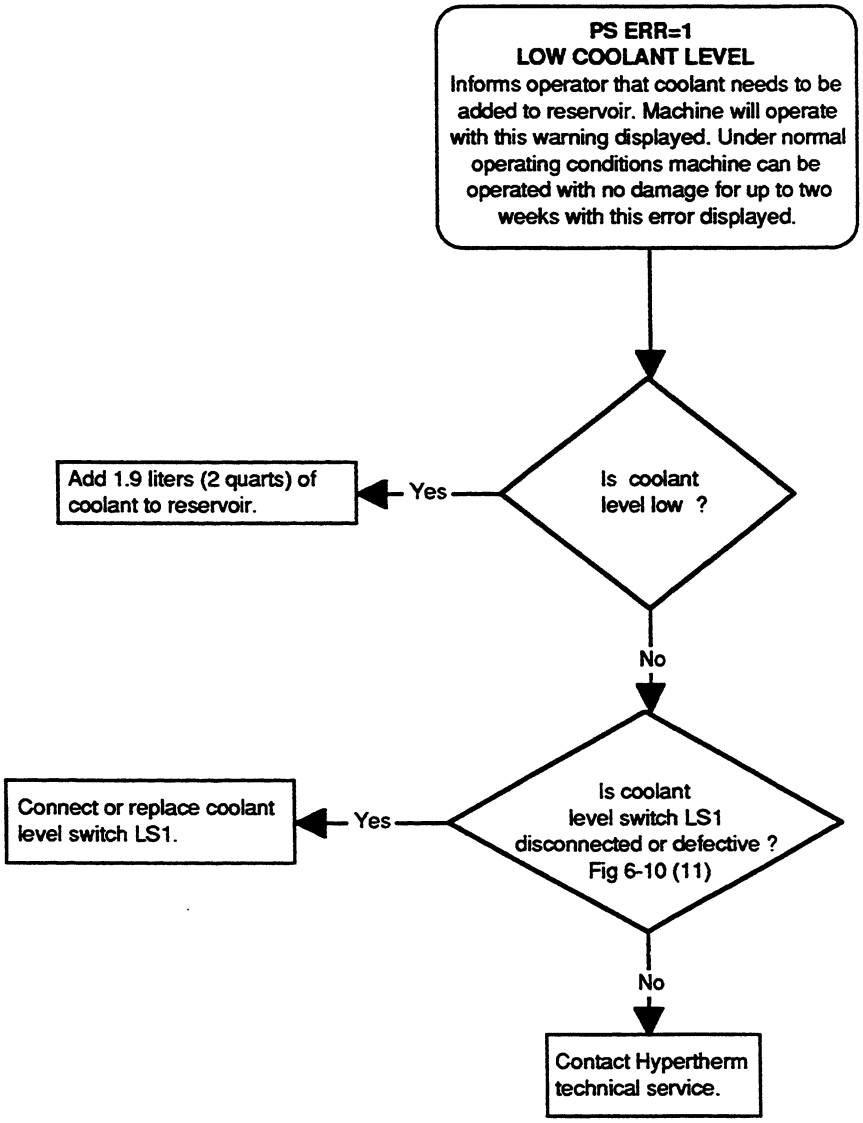
Gas System (GS- ERR)

Error Message	Error Code	Description
NO ERROR	0	
LOW PLASMA GAS ERR	1	This error signal is issued if the plasma gas inlet pressure is below 105 psig (7.2 bar). (P1 on display)
LOW SHIELD GAS ERR	2	This error signal is issued if the shield gas inlet pressure is below 105 psig (7.2 bar). (P2 on display)
HIGH PLASMA GAS ERR	3	This error signal is issued if the plasma gas inlet pressure is above 135 psig (9.3 bar). (P1 on display)
HIGH SHIELD GAS ERR	4	This error signal is issued if the shield gas inlet pressure is above 135 psig (9.3 bar). (P2 on display)
MV1 ERR*	5	This error signal is issued when the MV1 motor valve does not move when commanded. When this error occurs service is required.

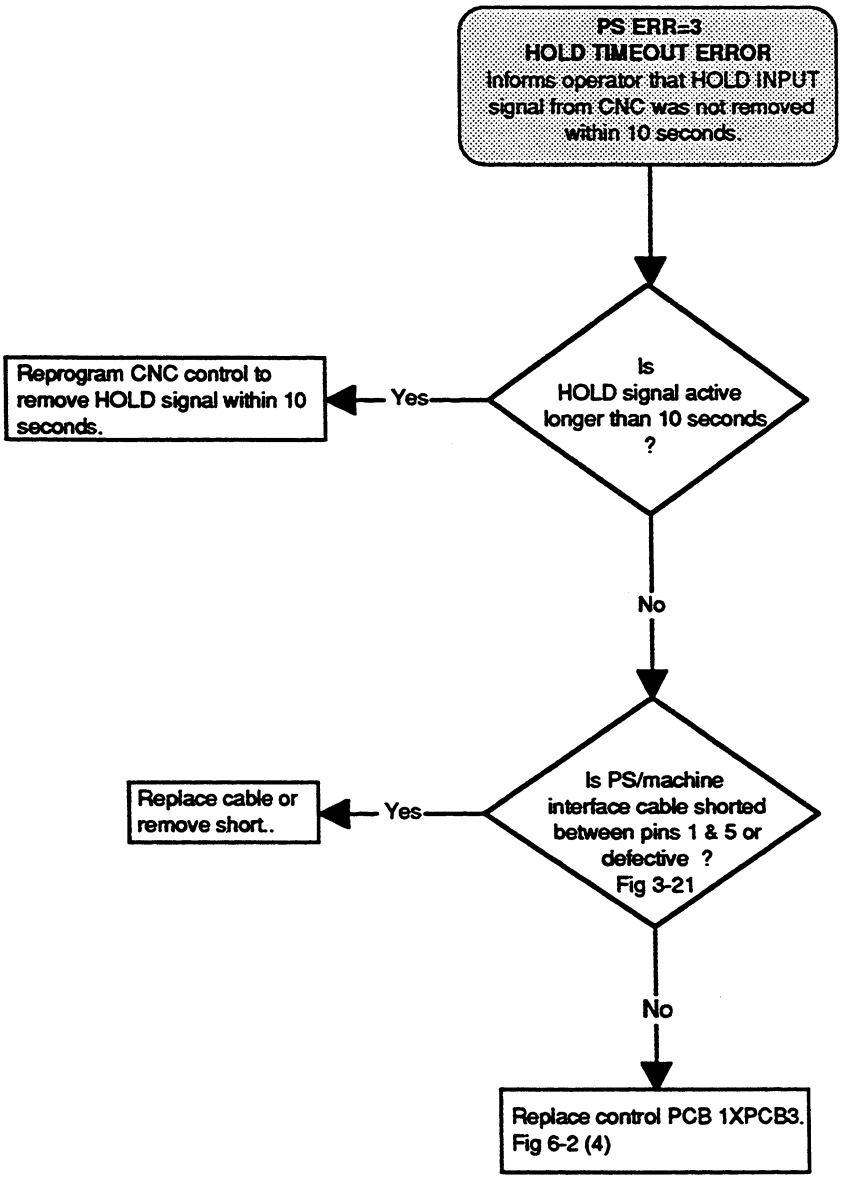
Error Message	Error Code	Description
MV4 ERR*	6	This error signal is issued when the MV4 motor valve does not move when commanded. When this error occurs service is required.
MV5 ERR*	7	This error signal is issued when the MV5 motor valve does not move when commanded. When this error occurs service is required.
MV6 ERR*	8	This error signal is issued when the MV6 motor valve does not move when commanded. When this error occurs service is required.
MV7 ERR*	9	This error signal is issued when the MV7 motor valve does not move when commanded. When this error occurs service is required.
GS ERR	20	This error signal is issued when the PLASMA and SHIELD gas switches are not positioned to select the proper gas combinations. Select either O_2 and N_2 or AUX A and AUX B. If either O_2 and AUX B or N_2 and AUX A are selected, a GS ERR 20 will be displayed and the power supply will shut down until the switches are set to the correct positions.

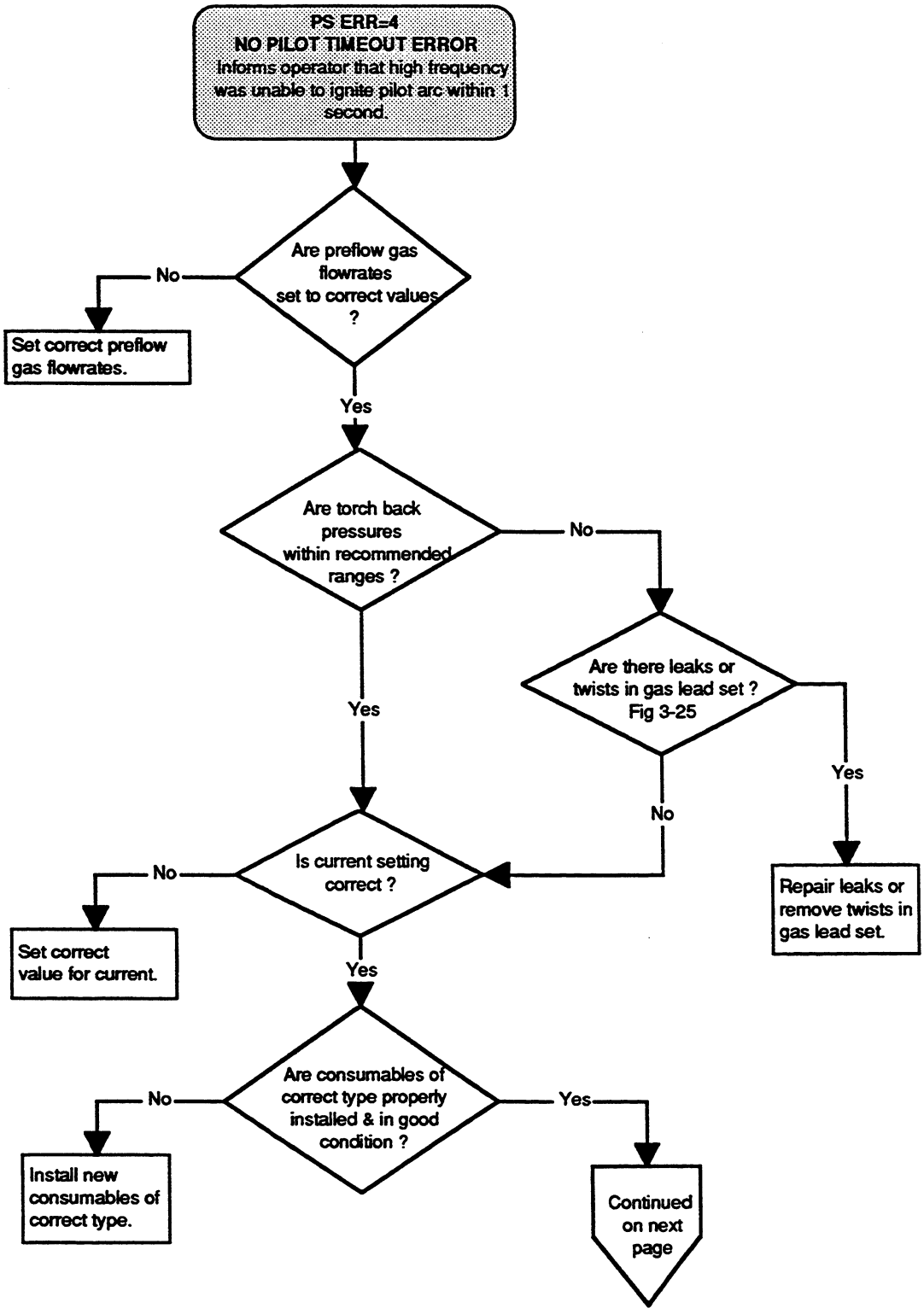
* The plasma system will have to be powered down and then restarted if any of the motor valve errors occur.

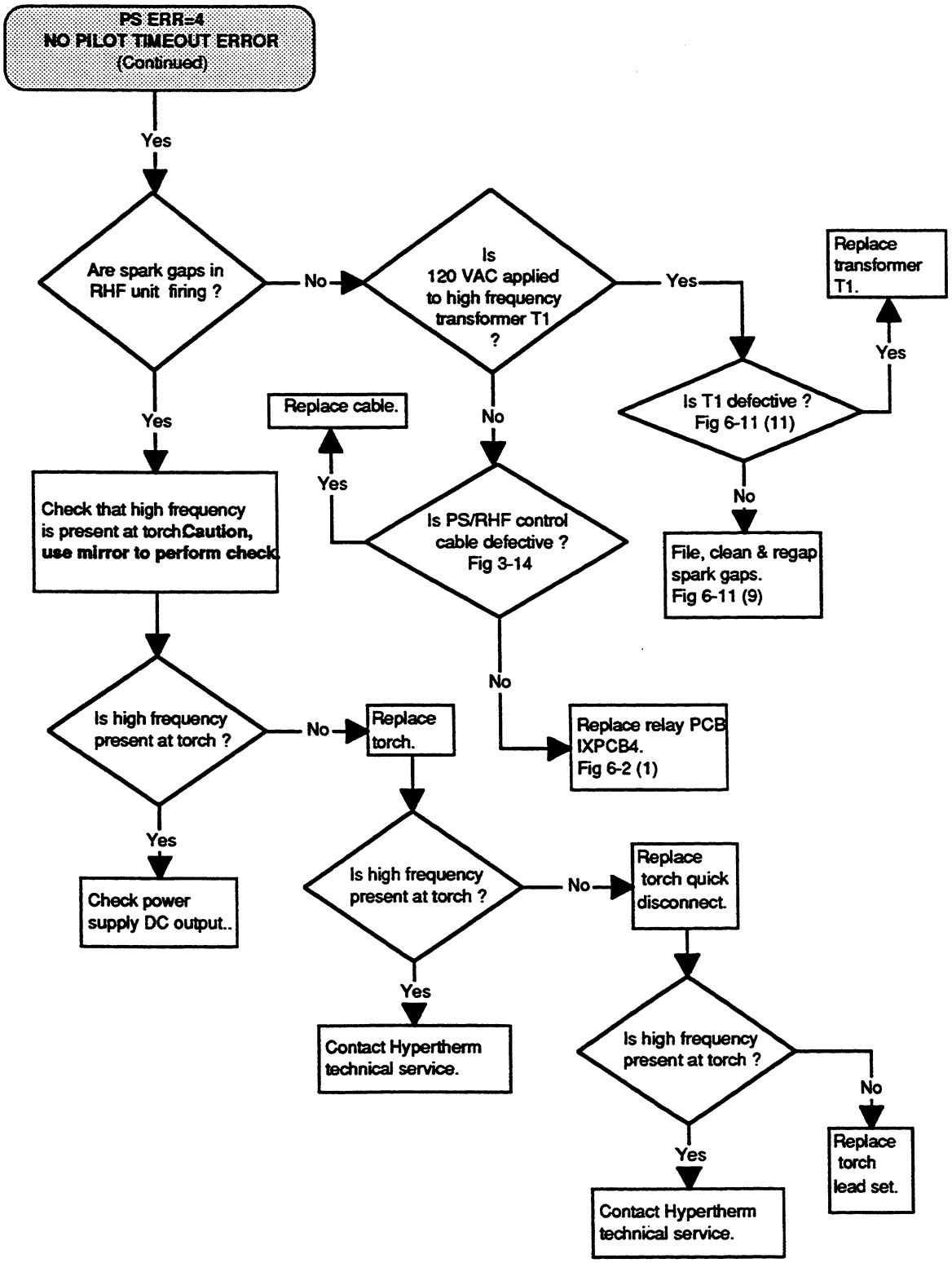
Power Supply System Error Message Flow Diagrams

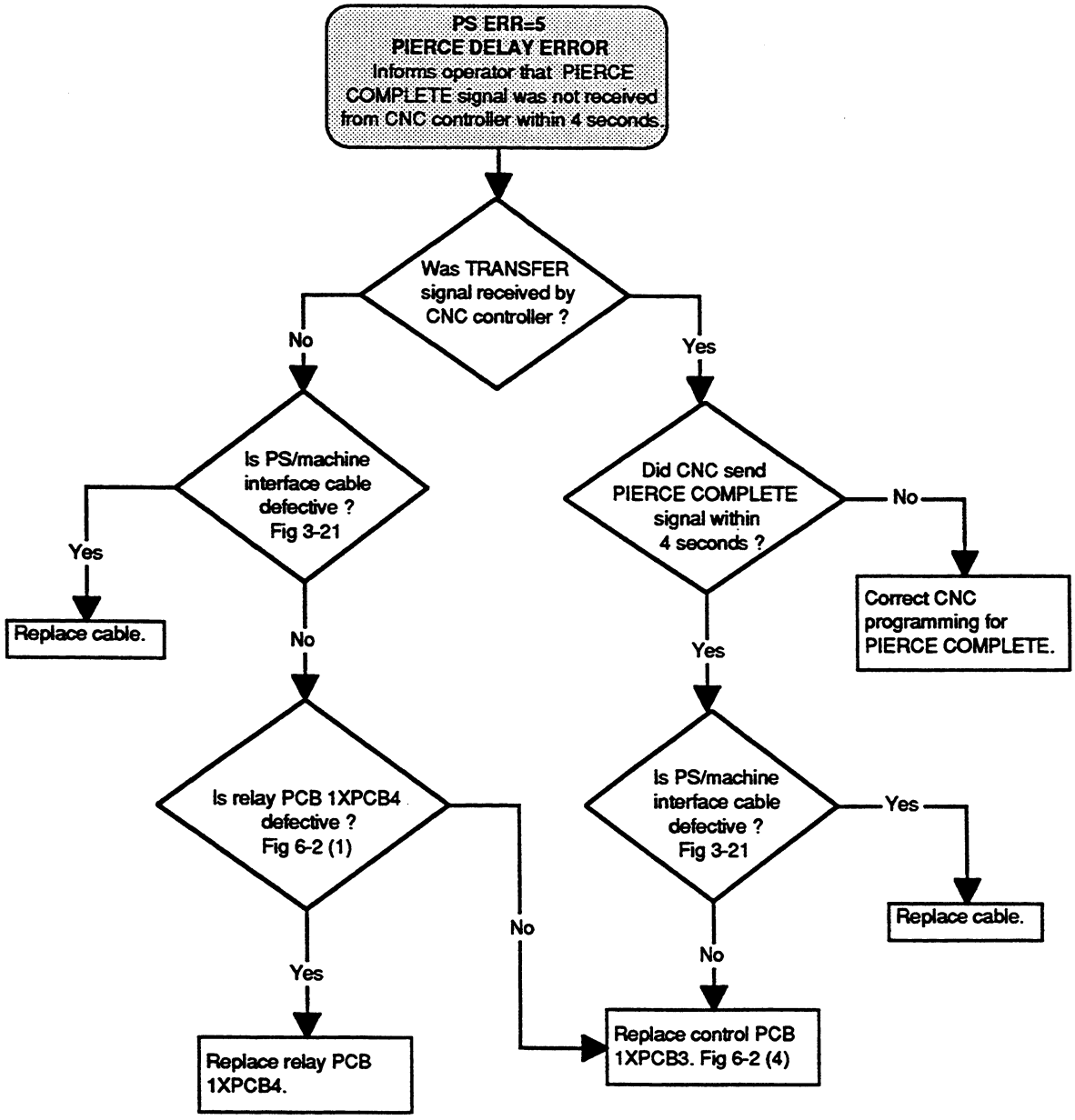


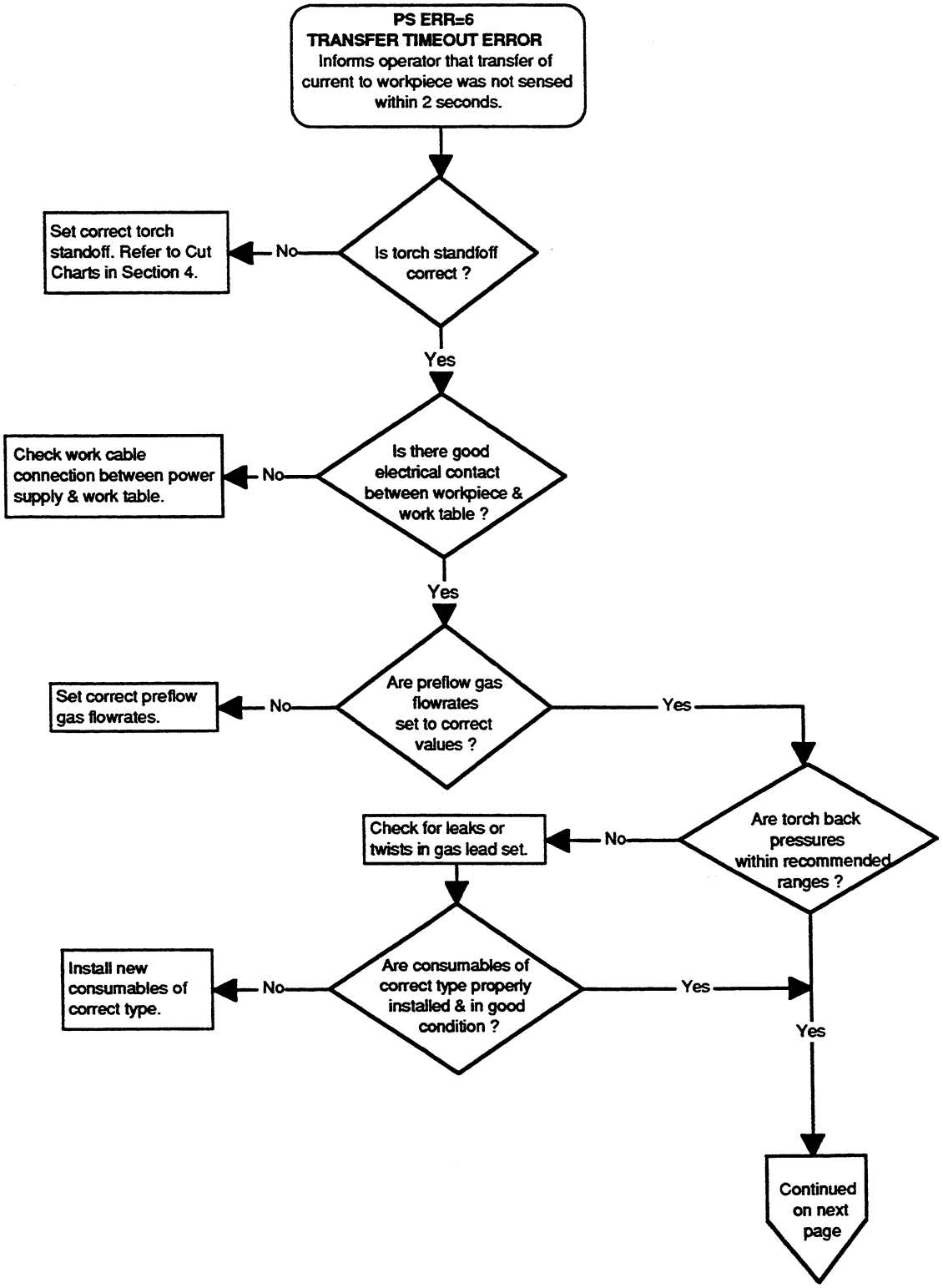
PS ERR=2
INTERLOCK ERROR
Informs operator that one of the power supply interlocks is not satisfied. Refer to the seven power supply status LED troubleshooting flow diagrams.

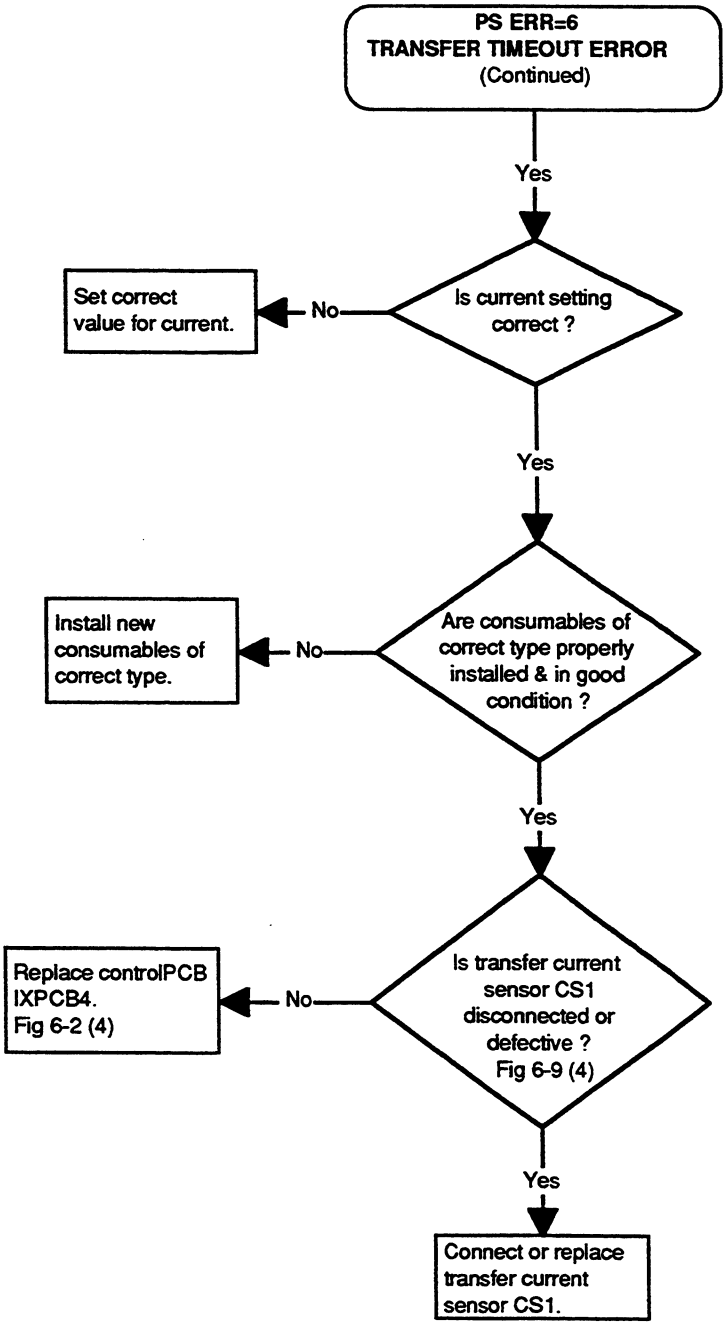

PS ERR=3
HOLD TIMEOUT ERROR
Informs operator that HOLD INPUT signal from CNC was not removed within 10 seconds.
Is HOLD signal active longer than 10 seconds ?
Yes
Reprogram CNC control to remove HOLD signal within 10 seconds.
No
Is PS/machine interface cable shorted between pins 1 & 5 or defective ?
Fig 3-21
Yes
Replace cable or remove short..
No
Replace control PCB 1XPCB3.
Fig 6-2 (4)

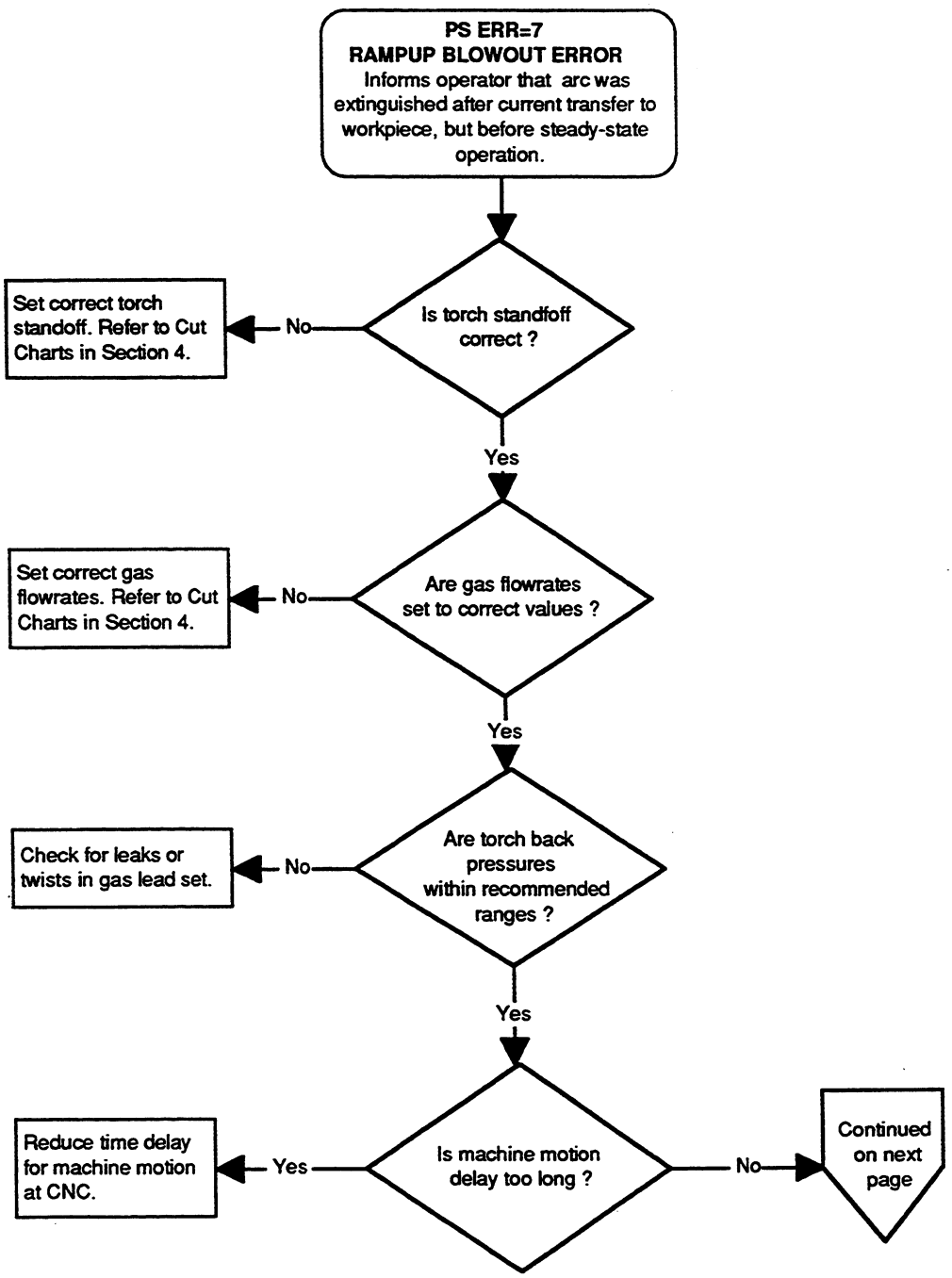

PS ERR=4
NO PILOT TIMEOUT ERROR
Informs operator that high frequency was unable to ignite pilot arc within 1 second.
Are preflow gas flowrates set to correct values ?
No
Set correct preflow gas flowrates.
Yes
Are torch back pressures within recommended ranges ?
No
Are there leaks or twists in gas lead set ? Fig 3-25
Yes
Repair leaks or remove twists in gas lead set.
No
Yes
Is current setting correct ?
No
Set correct value for current.
Yes
Are consumables of correct type properly installed & in good condition ?
No
Install new consumables of correct type.
Yes
Continued on next page

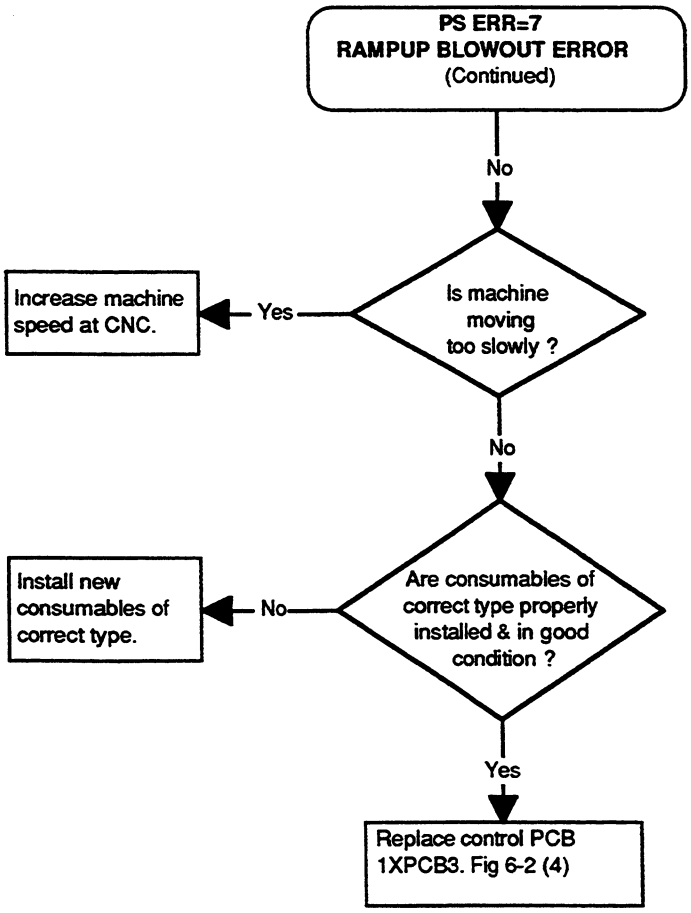

PS ERR=4
NO PILOT TIMEOUT ERROR
(Continued)
Yes
Are spark gaps in RHF unit firing ?
No
Is 120 VAC applied to high frequency transformer T1 ?
Yes
Replace transformer T1.
Yes
Is T1 defective ? Fig 6-11 (11)
No
File, clean & regap spark gaps. Fig 6-11 (9)
Yes
Replace cable.
No
Is PS/RHF control cable defective ? Fig 3-14
Yes
Check that high frequency is present at torch Caution, use mirror to perform check.
No
Replace relay PCB IXPCB4. Fig 6-2 (1)
Is high frequency present at torch ?
No
Replace torch.
Yes
Check power supply DC output..
Is high frequency present at torch ?
No
Replace torch quick disconnect.
Yes
Contact Hypertherm technical service.
Is high frequency present at torch ?
No
Replace torch lead set.
Yes
Contact Hypertherm technical service.

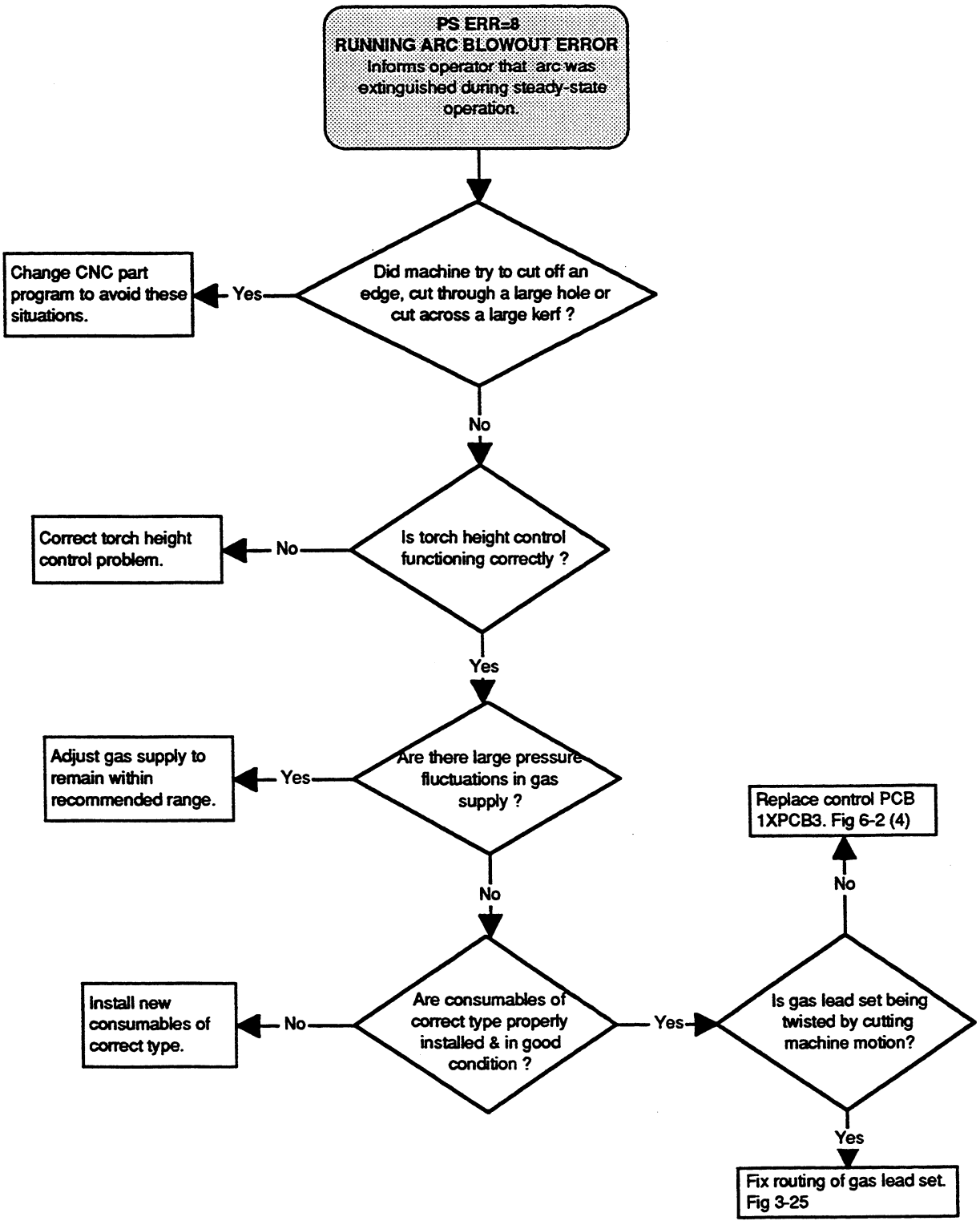

PS ERR=5
PIERCE DELAY ERROR
Informs operator that PIERCE COMPLETE signal was not received from CNC controller within 4 seconds.
Was TRANSFER signal received by CNC controller ?
No
Yes
Is PS/machine interface cable defective ? Fig 3-21
Yes
Replace cable.
No
Is relay PCB 1XPCB4 defective ? Fig 6-2 (1)
Yes
Replace relay PCB 1XPCB4.
No
Replace control PCB 1XPCB3. Fig 6-2 (4)
Did CNC send PIERCE COMPLETE signal within 4 seconds ?
No
Correct CNC programming for PIERCE COMPLETE.
Yes
Is PS/machine interface cable defective ? Fig 3-21
Yes
Replace cable.
No

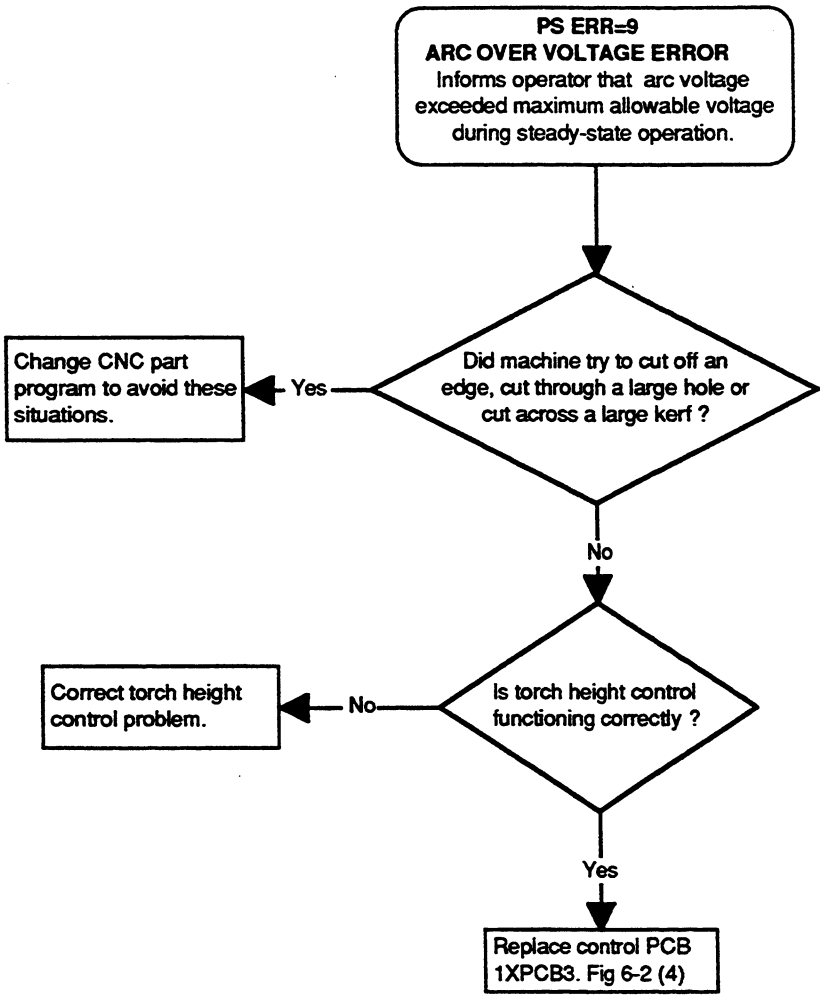

PS ERR=6
TRANSFER TIMEOUT ERROR
Informs operator that transfer of current to workpiece was not sensed within 2 seconds.
Is torch standoff correct ?
No
Set correct torch standoff. Refer to Cut Charts in Section 4.
Yes
Is there good electrical contact between workpiece & work table ?
No
Check work cable connection between power supply & work table.
Yes
Are preflow gas flowrates set to correct values ?
No
Set correct preflow gas flowrates.
Yes
Are torch back pressures within recommended ranges ?
No
Check for leaks or twists in gas lead set.
Are consumables of correct type properly installed & in good condition ?
No
Install new consumables of correct type.
Yes
Yes
Continued on next page

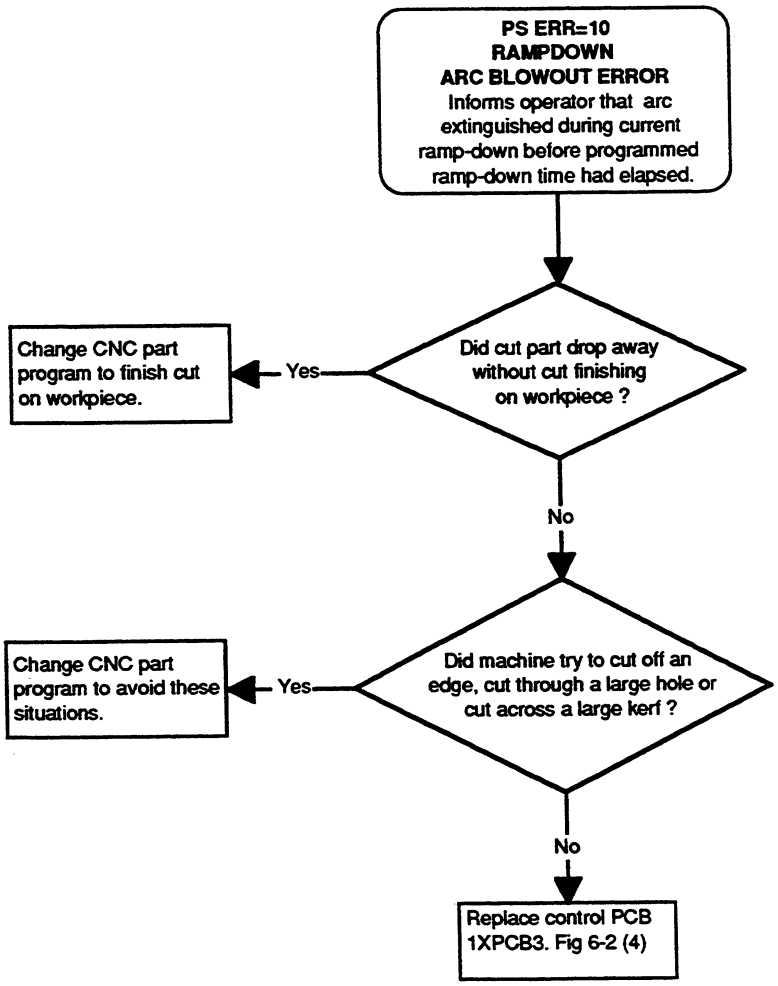

PS ERR=6
TRANSFER TIMEOUT ERROR
(Continued)
Yes
Is current setting correct ?
No
Set correct value for current.
Yes
Are consumables of correct type properly installed & in good condition ?
No
Install new consumables of correct type.
Yes
Is transfer current sensor CS1 disconnected or defective ?
Fig 6-9 (4)
No
Replace controlPCB IXPCB4.
Fig 6-2 (4)
Yes
Connect or replace transfer current sensor CS1.


PS ERR=7
RAMPUP BLOWOUT ERROR
Informs operator that arc was extinguished after current transfer to workpiece, but before steady-state operation.
Is torch standoff correct ?
No
Set correct torch standoff. Refer to Cut Charts in Section 4.
Yes
Are gas flowrates set to correct values ?
No
Set correct gas flowrates. Refer to Cut Charts in Section 4.
Yes
Are torch back pressures within recommended ranges ?
No
Check for leaks or twists in gas lead set.
Yes
Is machine motion delay too long ?
Yes
Reduce time delay for machine motion at CNC.
No
Continued on next page


PS ERR=7
RAMPUP BLOWOUT ERROR
(Continued)
No
Is machine moving too slowly ?
Yes
Increase machine speed at CNC.
No
Are consumables of correct type properly installed & in good condition ?
No
Install new consumables of correct type.
Yes
Replace control PCB 1XPCB3. Fig 6-2 (4)

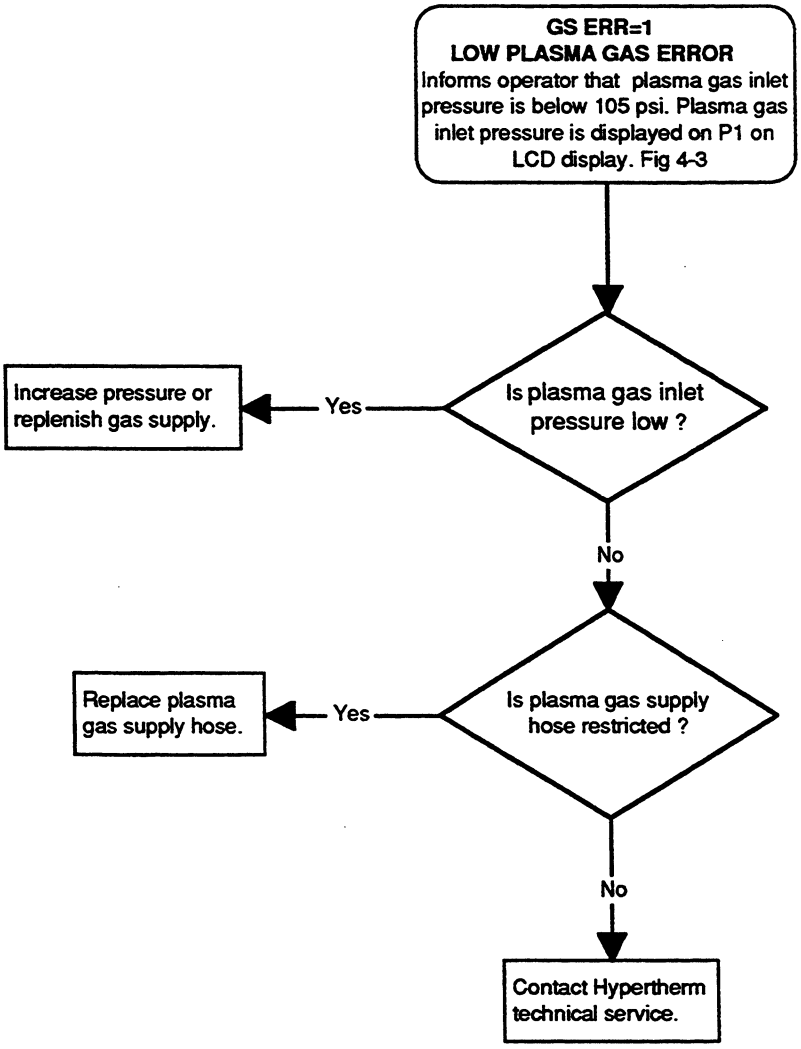

PS ERR=8
RUNNING ARC BLOWOUT ERROR
Informs operator that arc was extinguished during steady-state operation.
Did machine try to cut off an edge, cut through a large hole or cut across a large kerf ?
Yes
Change CNC part program to avoid these situations.
No
Is torch height control functioning correctly ?
No
Correct torch height control problem.
Yes
Are there large pressure fluctuations in gas supply ?
Yes
Adjust gas supply to remain within recommended range.
No
Are consumables of correct type properly installed & in good condition ?
No
Install new consumables of correct type.
Yes
Is gas lead set being twisted by cutting machine motion?
No
Replace control PCB 1XPCB3. Fig 6-2 (4)
Yes
Fix routing of gas lead set. Fig 3-25

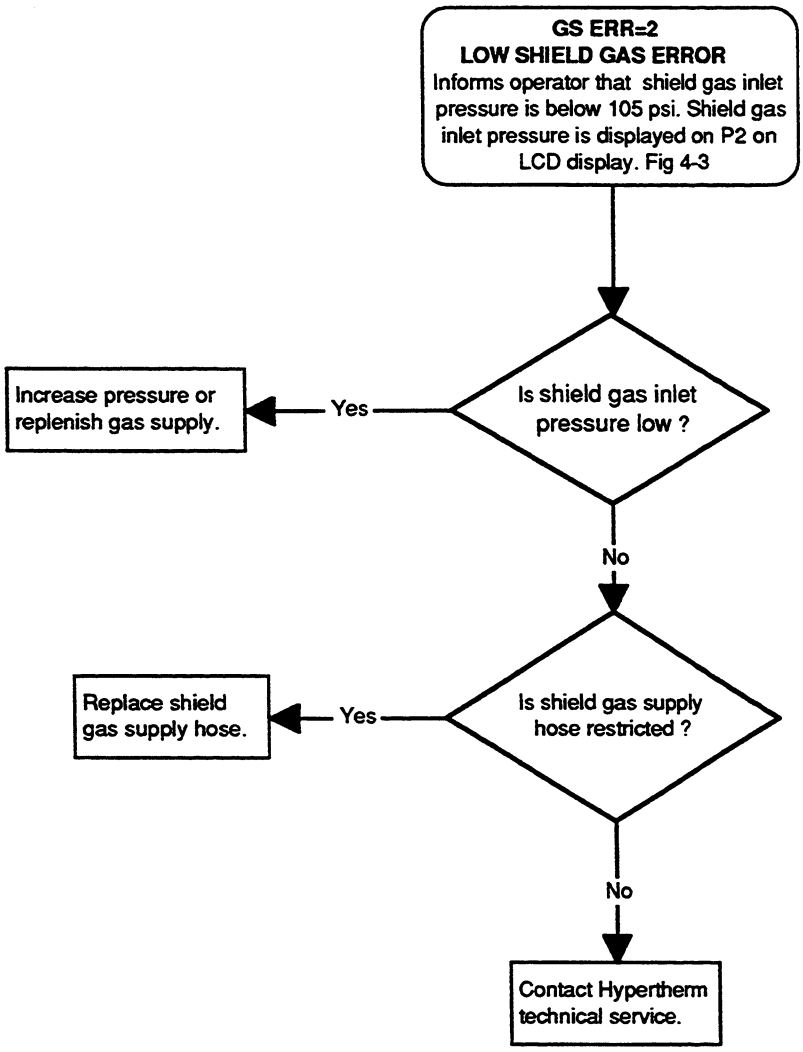

PS ERR=9
ARC OVER VOLTAGE ERROR
Informs operator that arc voltage exceeded maximum allowable voltage during steady-state operation.
Did machine try to cut off an edge, cut through a large hole or cut across a large kerf ?
Yes
Change CNC part program to avoid these situations.
No
Is torch height control functioning correctly ?
No
Correct torch height control problem.
Yes
Replace control PCB 1XPCB3. Fig 6-2 (4)

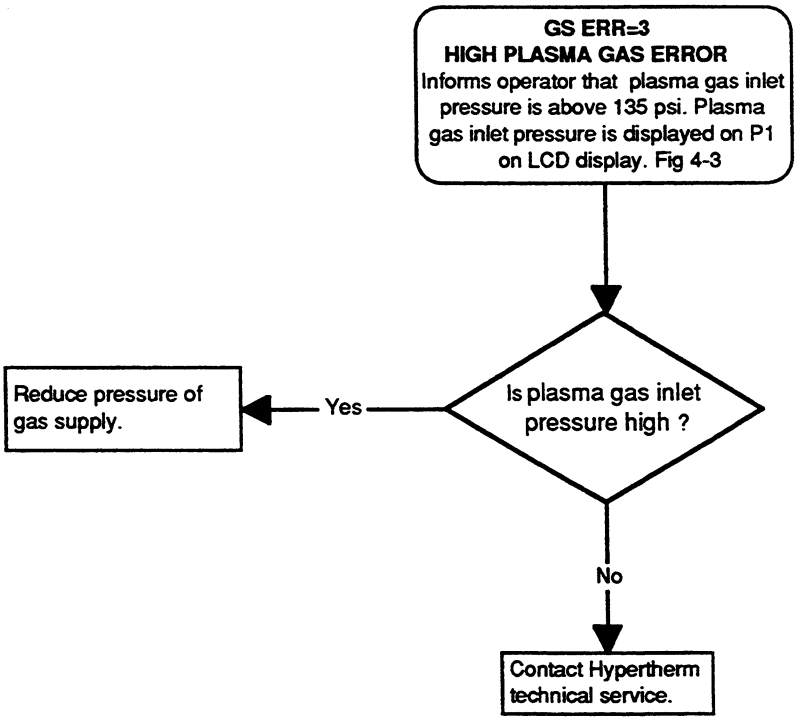

PS ERR=10
RAMPDOWN
ARC BLOWOUT ERROR
Informs operator that arc extinguished during current ramp-down before programmed ramp-down time had elapsed.
Did cut part drop away without cut finishing on workpiece ?
Yes
Change CNC part program to finish cut on workpiece.
No
Did machine try to cut off an edge, cut through a large hole or cut across a large kerf ?
Yes
Change CNC part program to avoid these situations.
No
Replace control PCB 1XPCB3. Fig 6-2 (4)

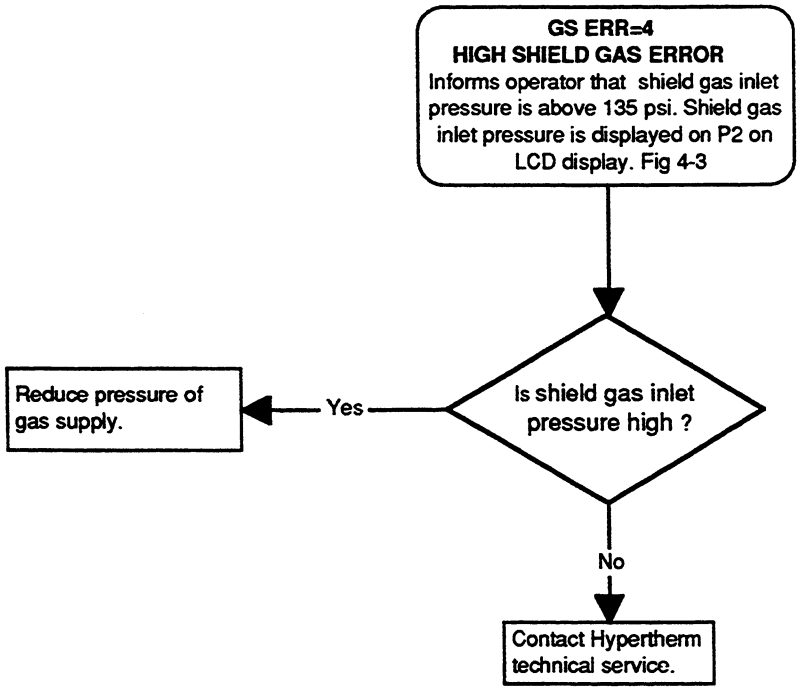
PSERR=12
WRONG STATE ERROR
Informs operator that software has serious error that caused it to transfer control to an undefined program state. Record the exact operating conditions prior to this error and report them to Hypertherm. Replace power supply control PCB 1XPCB3. Fig 6-2 (4)

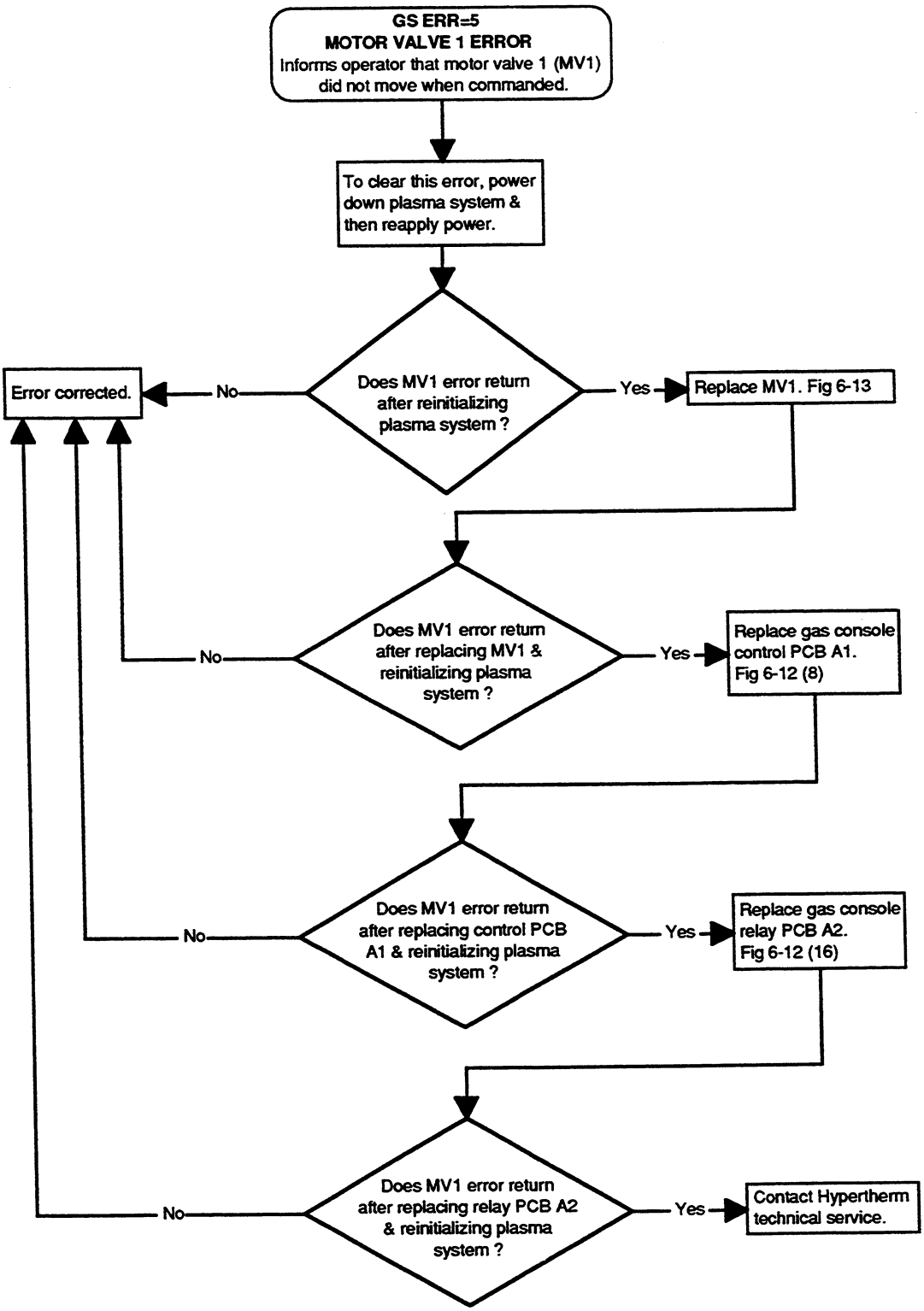
Gas System Error Message Flow Diagrams

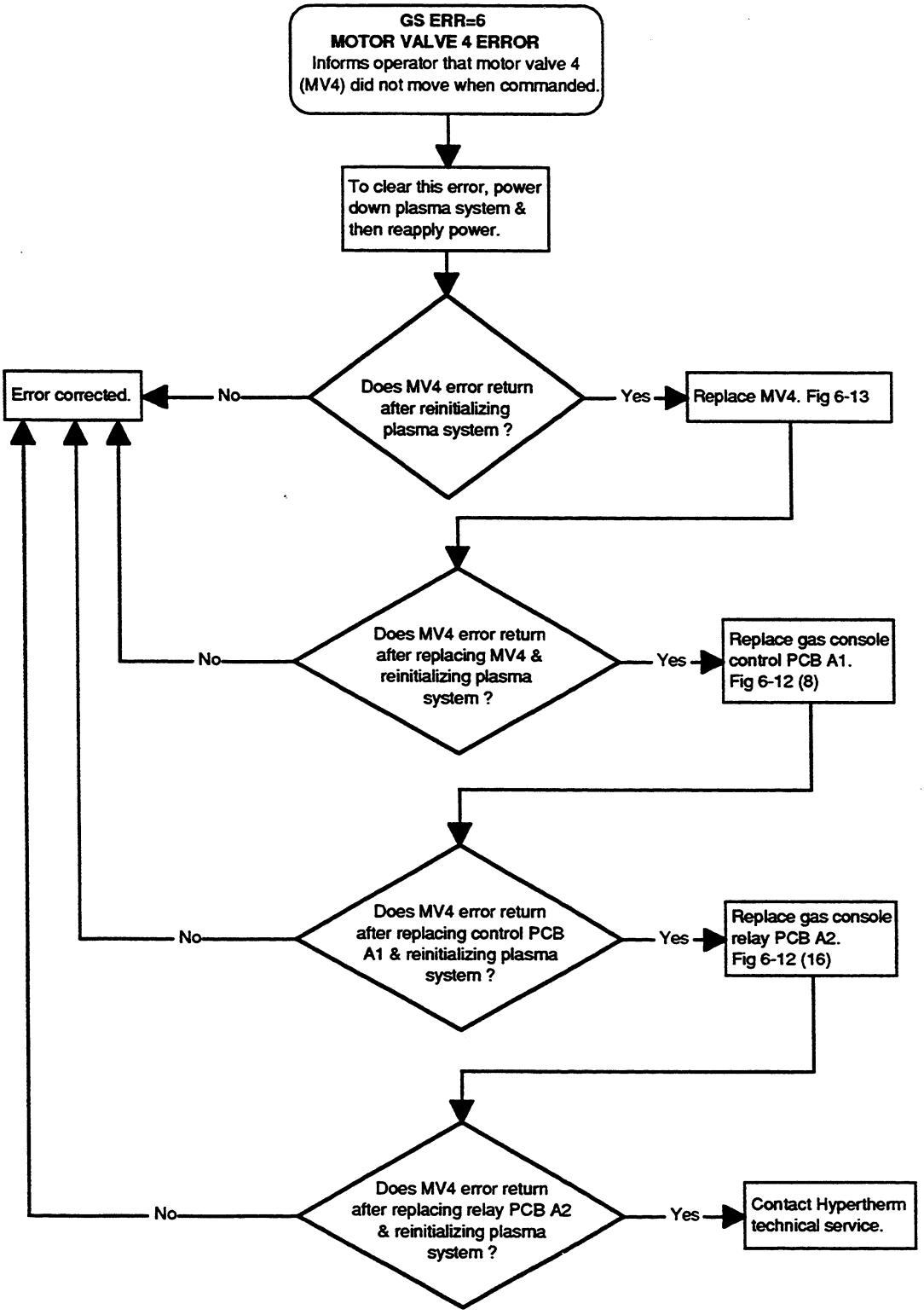


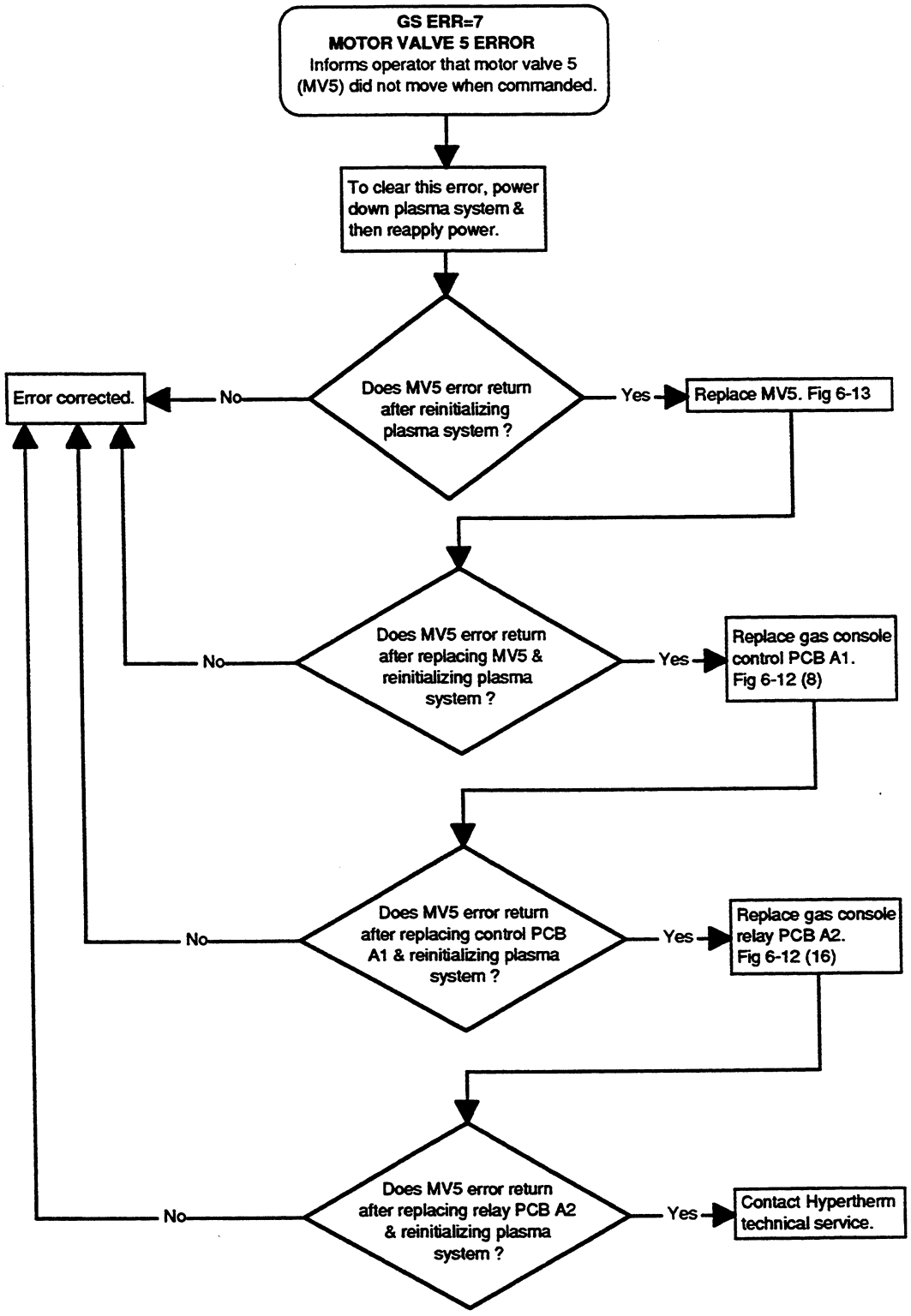

GS ERR=2
LOW SHIELD GAS ERROR
Informs operator that shield gas inlet pressure is below 105 psi. Shield gas inlet pressure is displayed on P2 on LCD display. Fig 4-3
Is shield gas inlet pressure low ?
Yes
Increase pressure or replenish gas supply.
No
Is shield gas supply hose restricted ?
Yes
Replace shield gas supply hose.
No
Contact Hypertherm technical service.

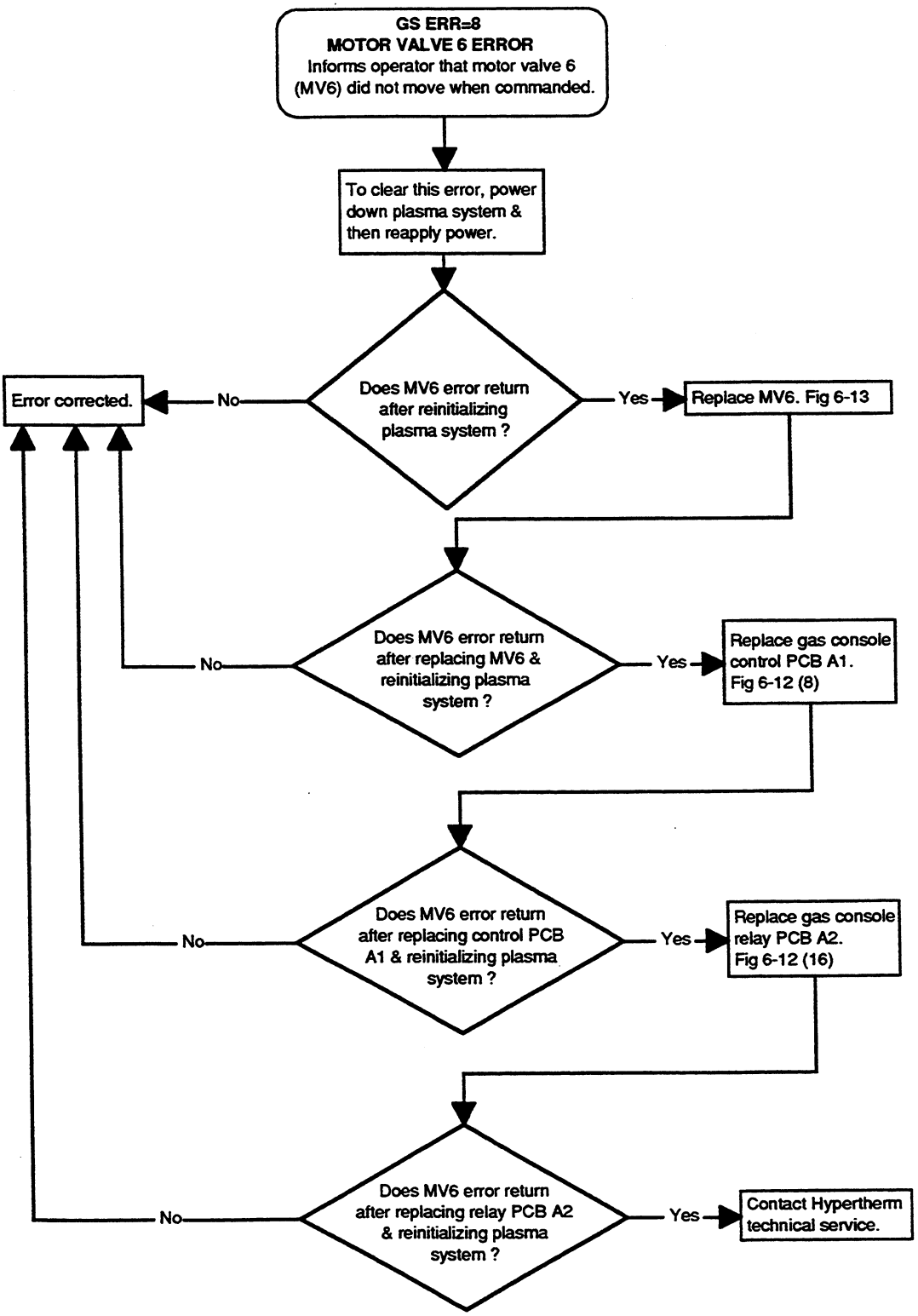

GS ERR=3
HIGH PLASMA GAS ERROR
Informs operator that plasma gas inlet pressure is above 135 psi. Plasma gas inlet pressure is displayed on P1 on LCD display. Fig 4-3
Is plasma gas inlet pressure high ?
Yes
Reduce pressure of gas supply.
No
Contact Hypertherm technical service.

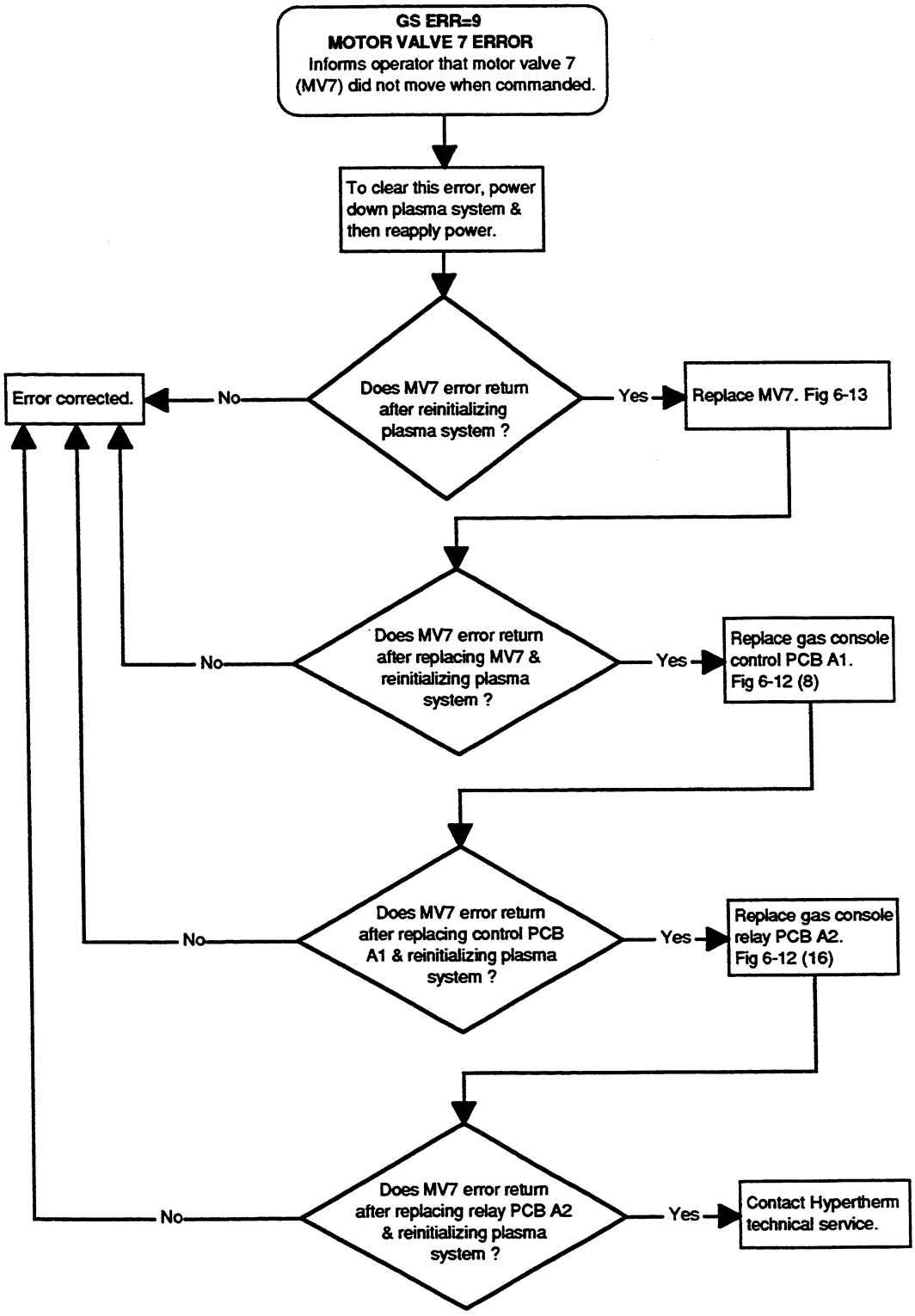

GS ERR=4
HIGH SHIELD GAS ERROR
Informs operator that shield gas inlet pressure is above 135 psi. Shield gas inlet pressure is displayed on P2 on LCD display. Fig 4-3
Is shield gas inlet pressure high ?
Yes
Reduce pressure of gas supply.
No
Contact Hypertherm technical service.


GS ERR=5
MOTOR VALVE 1 ERROR
Informs operator that motor valve 1 (MV1) did not move when commanded.
To clear this error, power down plasma system & then reapply power.
Does MV1 error return after reinitializing plasma system ?
No
Error corrected.
Yes
Replace MV1. Fig 6-13
Does MV1 error return after replacing MV1 & reinitializing plasma system ?
No
Yes
Replace gas console control PCB A1. Fig 6-12 (8)
Does MV1 error return after replacing control PCB A1 & reinitializing plasma system ?
No
Yes
Replace gas console relay PCB A2. Fig 6-12 (16)
Does MV1 error return after replacing relay PCB A2 & reinitializing plasma system ?
No
Yes
Contact Hypertherm technical service.


GS ERR=6
MOTOR VALVE 4 ERROR
Informs operator that motor valve 4 (MV4) did not move when commanded.
To clear this error, power down plasma system & then reapply power.
Does MV4 error return after reinitializing plasma system ?
No
Error corrected.
Yes
Replace MV4. Fig 6-13
Does MV4 error return after replacing MV4 & reinitializing plasma system ?
No
Yes
Replace gas console control PCB A1. Fig 6-12 (8)
Does MV4 error return after replacing control PCB A1 & reinitializing plasma system ?
No
Yes
Replace gas console relay PCB A2. Fig 6-12 (16)
Does MV4 error return after replacing relay PCB A2 & reinitializing plasma system ?
No
Yes
Contact Hypertherm technical service.


GS ERR=7
MOTOR VALVE 5 ERROR
Informs operator that motor valve 5 (MV5) did not move when commanded.
To clear this error, power down plasma system & then reapply power.
Does MV5 error return after reinitializing plasma system ?
No
Error corrected.
Yes
Replace MV5. Fig 6-13
Does MV5 error return after replacing MV5 & reinitializing plasma system ?
No
Yes
Replace gas console control PCB A1. Fig 6-12 (8)
Does MV5 error return after replacing control PCB A1 & reinitializing plasma system ?
No
Yes
Replace gas console relay PCB A2. Fig 6-12 (16)
Does MV5 error return after replacing relay PCB A2 & reinitializing plasma system ?
No
Yes
Contact Hypertherm technical service.


GS ERR=8
MOTOR VALVE 6 ERROR
Informs operator that motor valve 6 (MV6) did not move when commanded.
To clear this error, power down plasma system & then reapply power.
Does MV6 error return after reinitializing plasma system ?
No
Error corrected.
Yes
Replace MV6. Fig 6-13
Does MV6 error return after replacing MV6 & reinitializing plasma system ?
No
Yes
Replace gas console control PCB A1. Fig 6-12 (8)
Does MV6 error return after replacing control PCB A1 & reinitializing plasma system ?
No
Yes
Replace gas console relay PCB A2. Fig 6-12 (16)
Does MV6 error return after replacing relay PCB A2 & reinitializing plasma system ?
No
Yes
Contact Hypertherm technical service.


GS ERR=9
MOTOR VALVE 7 ERROR
Informs operator that motor valve 7 (MV7) did not move when commanded.
To clear this error, power down plasma system & then reapply power.
Does MV7 error return after reinitializing plasma system ?
No
Error corrected.
Yes
Replace MV7. Fig 6-13
Does MV7 error return after replacing MV7 & reinitializing plasma system ?
No
Yes
Replace gas console control PCB A1. Fig 6-12 (8)
Does MV7 error return after replacing control PCB A1 & reinitializing plasma system ?
No
Yes
Replace gas console relay PCB A2. Fig 6-12 (16)
Does MV7 error return after replacing relay PCB A2 & reinitializing plasma system ?
No
Yes
Contact Hypertherm technical service.

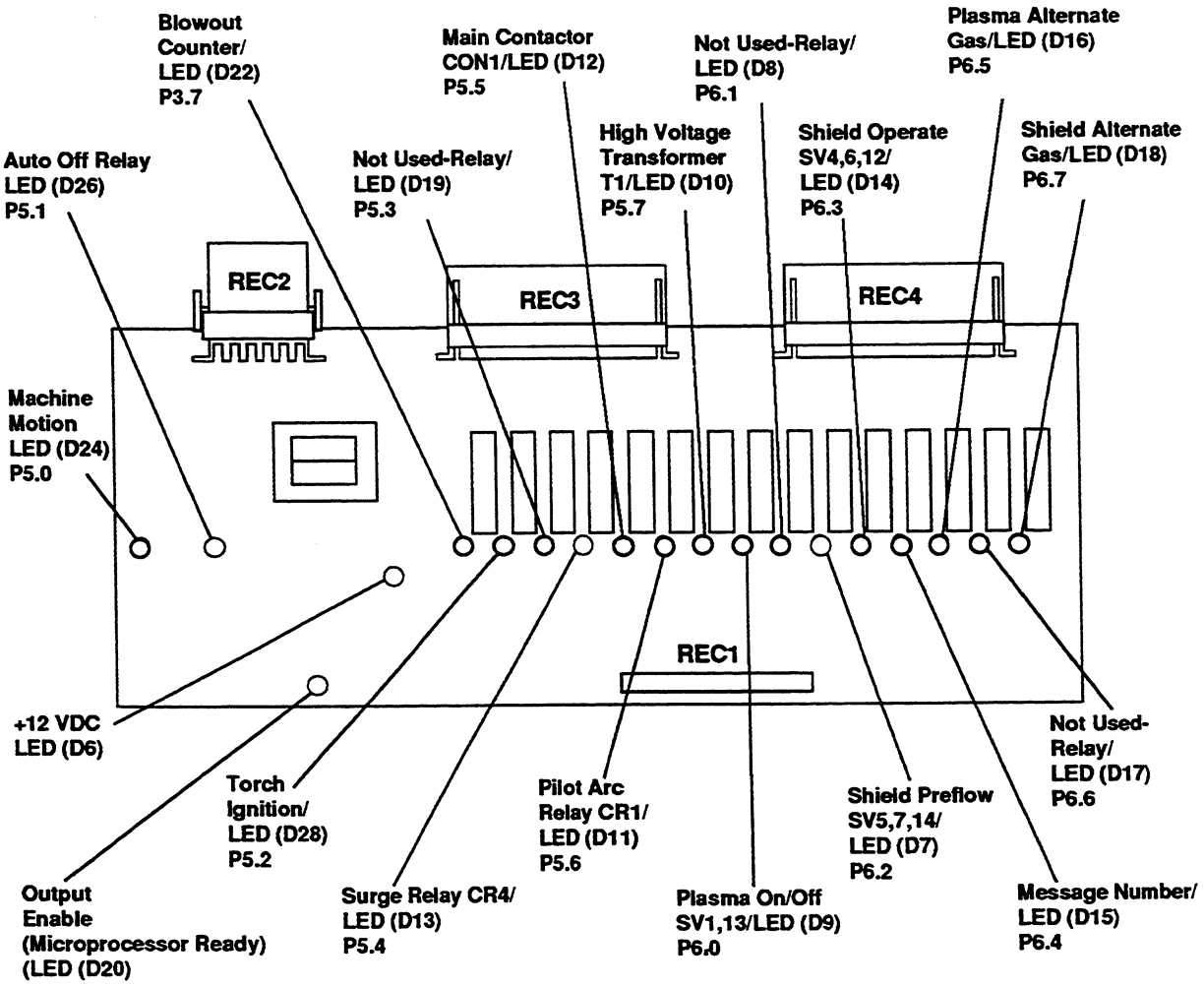
RELAY BOARD LED STATUS INDICATORS

Power Supply

The power supply relay board (1XPCB4) is an interface between solenoid valves, relays, the main contactor, and the control board (1XPCB3). An ON or OFF condition is sent from the control board through REC1 at the bottom of the relay board, which switches one of the relays on 1XPCB4 on or off. The corresponding solenoid or external device is then energized or deenergized (output is sent via REC3 or REC4 at the top of the relay board). Figure 5-4 shows the relay locations on 1XPCB4 as well as the light emitting diode indicators (LEDs). Figure 5-5 shows the relay board LED on/off status during system test and run modes.

Listed below are the pin assignments for REC3 and REC4 of relay board 1XPCB4:

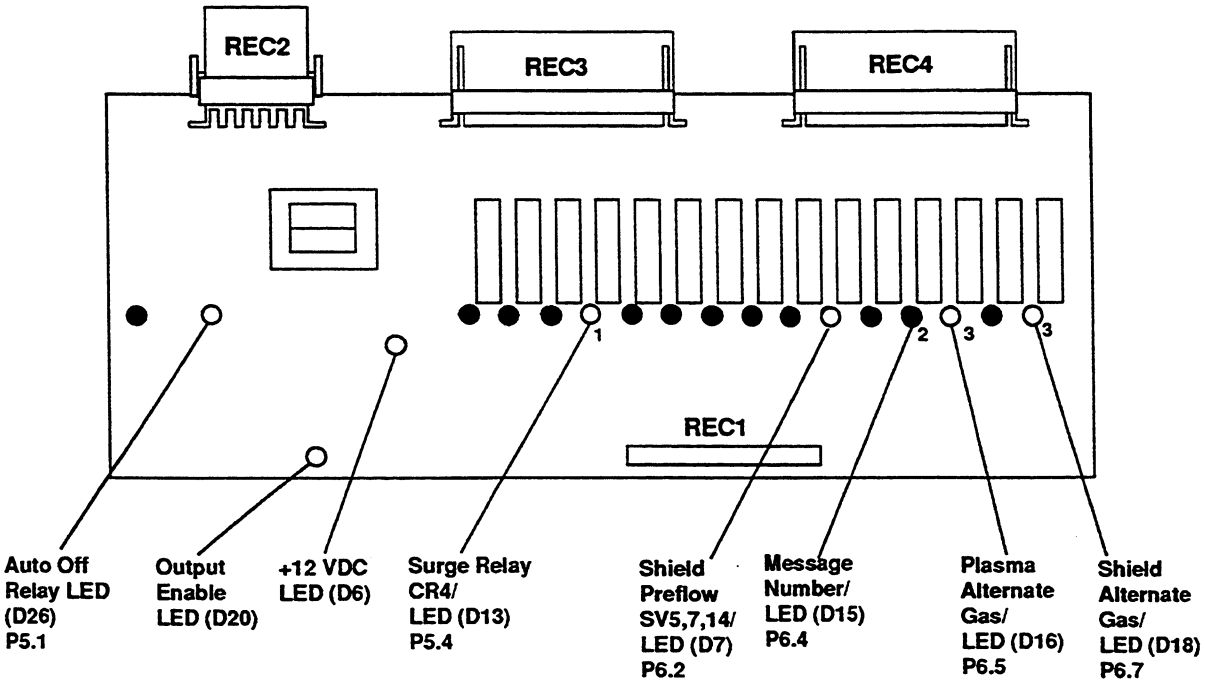
REC3 Pin #	Description
1 & 2	HV Transformer (T1 in Remote HF Console)
3 & 4	Pilot Arc Relay CR1
5 & 6	Main Contactor CON1
7 & 8	Surge Relay CR4
9 & 10	Extra Output
11 & 12	Torch Ignition CRD
13 & 14	Blowout Counter
15 & 16	120 VAC (Input)
REC 4 Pin #	**Description**
1 & 2	Shield Alt Gas Valve
3 & 4	Plasma O_2/N_2 Valve SV15
5 & 6	Plasma Alt Gas Valve
7 & 8	Message Number
9 & 10	Shield Operate Valves SV4. SV6, SV12
11 & 12	Shield Preflow Valves SV5, SV7, SV14
13 & 14	Not Used
15 & 16	Plasma On/Off Valves SV1, SV13



Note: The PX.X numbers called out above denote port locations on the microprocessor chip.

Figure 5-4 Power Supply Relay Board (1XPCB4)

Power Supply
Relay Board LED Status - Test Preflow



○ LED On

● LED Off

1- Lights when using 50 to 70 amps.

2- Remains off until any error.

3- Lights if alternate gas is used.

Figure 5-5 Power Supply Relay Board LED Status (1 of 4)

Power Supply
Relay Board LED Status - Test Cut Flow

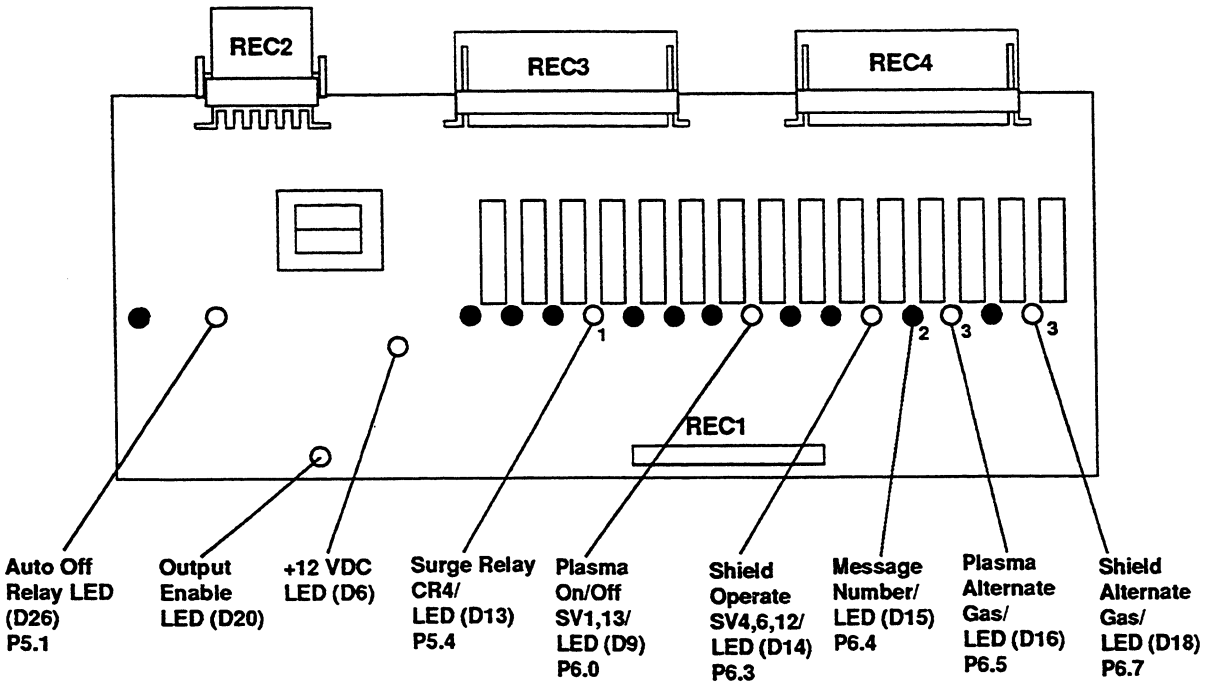
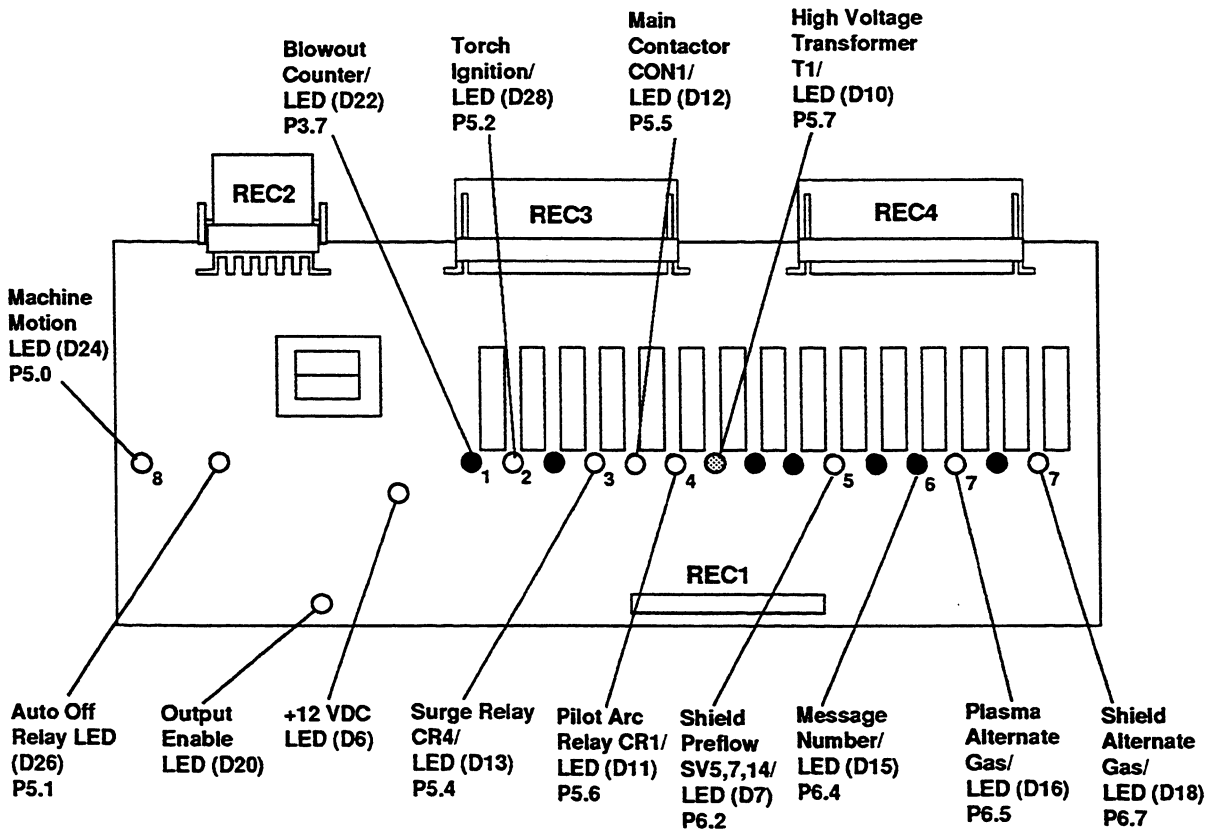


Figure 5-5 Power Supply Relay Board LED Status (2 of 4)

Power Supply
Relay Board LED Status - Run Preflow



LED On
LED Off
LED Momentarily On

1- Lights when error 7, 8, 9, or 10 occur.

2- Remains off until any error.

3- Lights when using 50 to 70 amps.

4- Lights at start; goes out after arc transfer.

5- Lights until arc transfer; goes out after arc transfer.

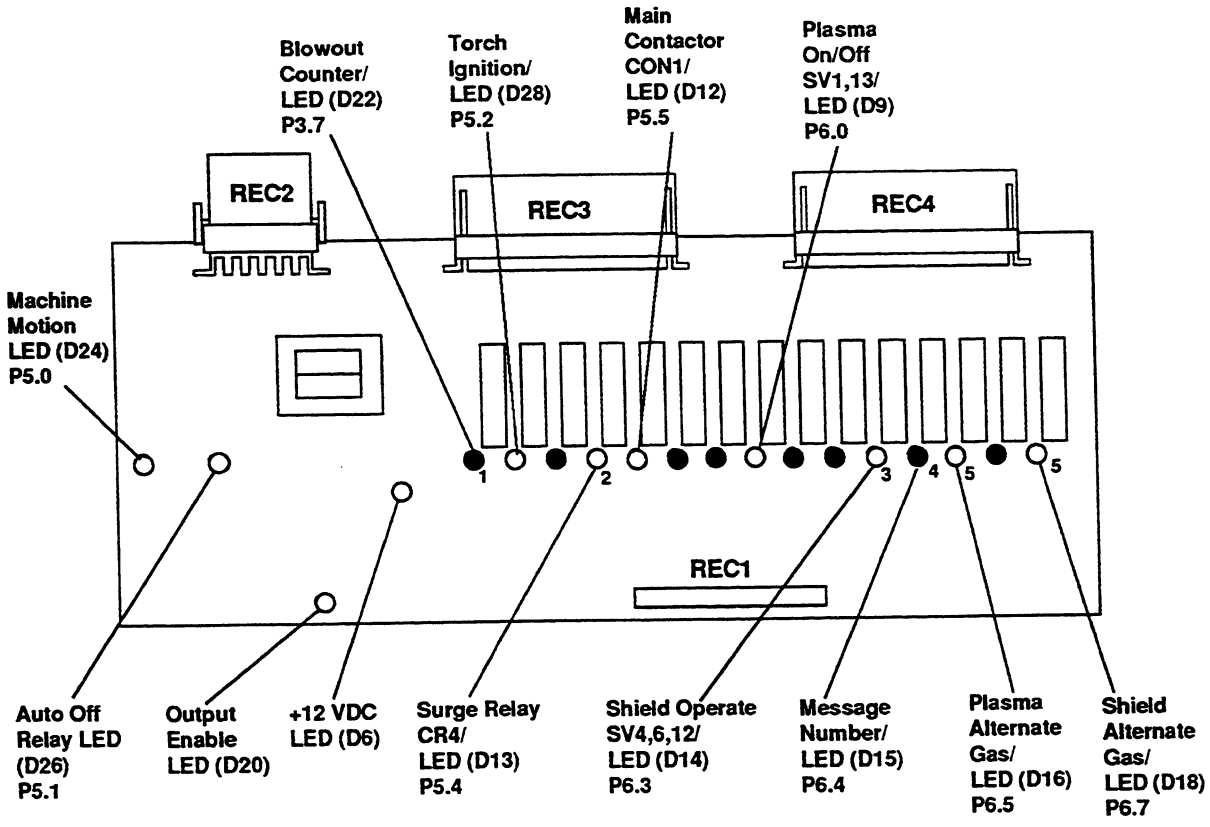
6- Lights at arc transfer.

7- Lights if alternate gas is used.

8- Lights after arc transfer.

Figure 5-5 Power Supply Relay Board LED Status (3 of 4)

Power Supply
Relay Board LED Status - Run Cut Flow



○ LED On

● LED Off

1- Light s when error 7, 8, 9, or 10 occur.

2- Lights when using 50 to 70 amps.

3- Lights after arc transfer and stays on during cut cycle.

4- Remains off until any error.

5- Lights if alternate gas is used.

Figure 5-5 Power Supply Relay Board LED Status (4 of 4)

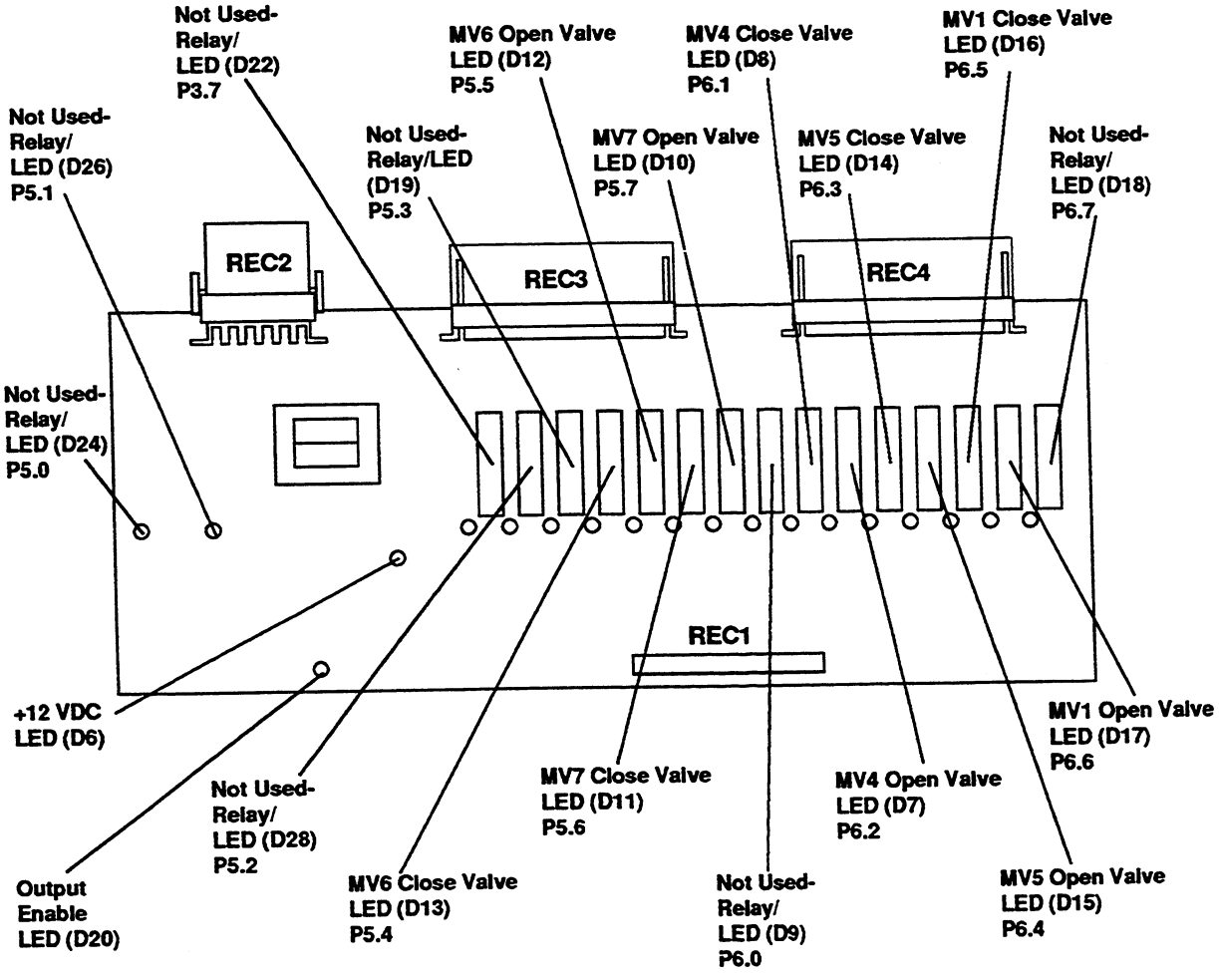
Gas Console

The gas console relay board (A2) is an interface between motor valves and the control board (A1). An ON or OFF condition is sent from the control board through REC1 at the bottom of the relay board, which switches one of the relays on (A2) on or off. The corresponding solenoid or external device is then energized or deenergized (output is sent via REC3 or REC4 at the top of the relay board). Figure 5-6 shows the relay locations on (A2) as well as the light emitting diode indicators (LEDs).

Listed below are the pin assignments for REC3 and REC4 of relay board A2:

REC3 Pin #	Description
1	Open MV7 (Out-17) CR4
2	AC Common
3	Close MV7 (Out-16) CR5
5	Open MV6 (Out-15) CR6
6	AC Common
7	Close MV6 (Out-14) CR7
REC 4 Pin #	**Description**
3	Open MV1 (Out-24) CR11
4	AC Common
5	Close MV1 (Out-23) CR10
7	Open MV5 (Out-22) CR6
8	AC Common
9	Close MV5 (Out-21) CR7
11	Open MV4 (Out-20) CR1
12	AC Common
13	Close MV4 (Out-19) CR2

Gas Console
Relay Board LED Status



Notes: The motor valve (MV) LEDs only light momentarily when valve correction signals are received from the microprocessor.

The PX.X numbers called out above denote port locations on the microprocessor chip.

Figure 5-6 Gas Console Relay Board (A2)

CONTROL BOARD LED STATUS INDICATORS

Power Supply

The control board 1XPCB3 provides other LEDs to notify the user when certain voltages are present and when other certain functions occur in the HD-3070 system as described below. The power supply front cover must be removed to observe control board and theLEDs (see Figure 6-2 and Figure 5-7 below).

- +5 VDC LED (D3) - Lights to indicate that +5 volts is available to microprocessor.
- +12 VDC LED (D14) - Lights to indicate that +12 volts is applied to analog circuitry.
- +12 VDC LED (D9) - Lights to indicate that +12 volts is applied to digital circuitry.
- Interlock LED (D6) - Lights to indicate that interlocks from power distribution board are okay.
- Start LED (D5) - Lights to indicate that a start/run command is active in the system.
- Transfer LED (D4) - Lights to indicate that arc current has transferred to workpiece.
- Feedback Current LED (D19) - Lights to indicate that feedback current is at the input to the analog circuit.
- Error Code LED (D8) - Flashes to indicate an error, if any, in the last start-stop cycle. The flash is coded to indicate an error number. Refer to *Error Codes and Messages, Power Supply Control Board Initiated Error Codes* earlier in this section.

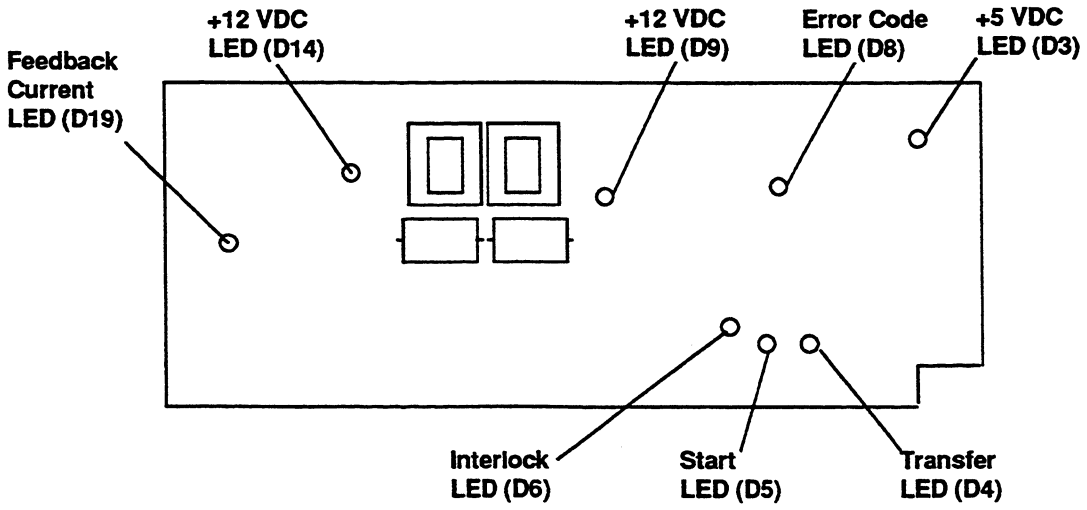


Figure 5-7 Power Supply Control Board LED Locations

Gas Console

The control board A1 provides other LEDs to notify the user when certain voltages are present and when other certain functions occur in the HD-3070 system as described below. The gas console cover and front panel must be removed to observe the LEDs (see Figure 6-12 and Figure 5-8 below).

- +5 VDC LED (D3) - Lights to indicate that +5 volts is available to microprocessor.
- LED (D7) - Spare (not used.)
- Gas Pressure Ok LED (D9) - Lights to indicate that input gas supplies are within correct range of 0.73 - 0.93 MPa (105-135 psig).
- Gas System Ok LED (D11) - Lights to indicate that the gas system has no operational errors.
- +12 VDC LED (D22) - Lights to indicate that +12 volts is applied to PCB
- -12 VDC LED (D23) - Lights to indicate that -12 volts is applied to PCB.

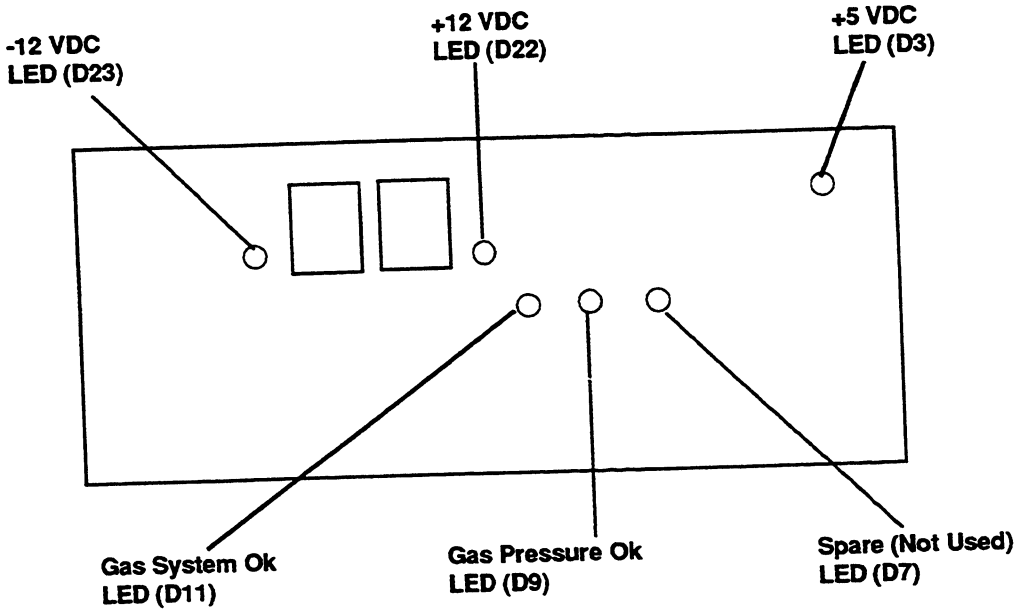


Figure 5-8 Gas Console Control Board LED Locations

GAS SYSTEM BACK PRESSURE CHECKS

Use the back pressure checks to find leaks or restrictions in the gas lines and motor valves. The checks can be done when the system is in the test cut or test preflow mode. In the **Test** modes, set the flowrates as indicated below and check the corresponding pressures (± 10% is allowable). The pressures in the **Run** mode are for reference only. **Back pressures in the Run mode may be different than those in the Test modes.** For a low pressure, check for a leak. For a high pressure, check for a restriction in the gas line or a consumable problem. Refer to Figure 4-2 to locate the flowrate set controls; Figure 4-3 for flowrate and pressure readings; *Cut Charts* in Section 4, Operation for additional information; and to the gas system schematic 013-2-268 at rear of manual.

PAC184 Torch
Mild Steel - Oxygen Plasma
15 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield O_2 & N_2 (1)	N_2 (2)	Plasma O_2 (3)	Preflow (P5)	O_2 & N_2 (4)	N_2 (5)
Test	70/4.8	17/1.2	30	10	40	27/1.9	5	75
Run	90/6.2	17/1.2				27/1.9		

PAC184 Torch
Mild Steel - Oxygen Plasma
30 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield O_2 & N_2 (1)	N_2 (2)	Plasma O_2 (3)	Preflow (P5)	O_2 & N_2 (4)	N_2 (5)
Test	75/5.2	7/0.5	15	5	46	29/2.0	5	75
Run	95/6.5	8/0.6				30/2.1		

PAC186 Torch
Mild Steel - Oxygen Plasma
15 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield O_2 & N_2 (1)	N_2 (2)	Plasma O_2 (3)	Preflow (P5)	O_2 & N_2 (4)	N_2 (5)
Test	85/5.9	15/1.0	30	10	40	25/1.7	5	75
Run	99/6.8	15/1.0				26/1.8		

PAC186 Torch
Mild Steel - Oxygen Plasma
30 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield O_2 & N_2 (1)	(2)	Plasma O_2 (3)	Preflow (P5)	O_2 & N_2 (4)	(5)
Test	77/5.3	9/0.6	15	5	46	27/1.9	5	75
Run	95/6.5	10/0.7				26/1.8		

PAC186 Torch
Stainless Steel - Air Plasma
30 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield Air (1)	(2)	Plasma Air (3)	Preflow (P5)	Air (4)	(5)
Test	47/3.2	6/0.4	30	0	60	17/1.2	72	0
Run	64/4.4	7/0.5				19/1.3		

PAC186 Torch
Mild Steel - Oxygen Plasma
50 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield O_2 & N_2 (1)	(2)	Plasma O_2 (3)	Preflow (P5)	O_2 & N_2 (4)	(5)
Test	53/3.6	12/0.8	40	0	40	27/1.9	5	75
Run	78/5.4	12/0.8				28/1.9		

PAC186 Torch
Stainless Steel - Air Plasma
50 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield Air (1)	(2)	Plasma Air (3)	Preflow (P5)	Air (4)	(5)
Test	70/4.8	59/4.0	80	0	40	30/2.1	60	0
Run	100/6.9	60/4.1				30/2.1		

PAC186 Torch
Mild Steel - Oxygen Plasma
70 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield O_2 & N_2 (1)	(2)	Plasma O_2 (3)	Preflow (P5)	O_2 & N_2 (4)	(5)
Test	79/5.4	42/2.9	0	100	40	27/1.9	5	75
Run	100/6.9	43/3.0				28/1.9		

PAC186 Torch
Stainless Steel - Air Plasma
70 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield Air & CH_4 (1)	(2)	Plasma Air (3)	Preflow (P5)	Air (4)	(5)
Test	64/4.4	13/0.9	40	5	35	30/2.1	75	0
Run	97/6.7	16/1.1				30/2.1		

PAC186 Torch
Aluminium - Air Plasma
70 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield (1)	CH_4 (2)	Plasma Air (3)	Preflow (P5)	Air (4)	(5)
Test	80/5.5	10/0.7	0	40	45	30/2.1	75	0
Run	105/7.2	13/0.9				30/2.1		

PAC186 Torch
Mild Steel - Oxygen Plasma
100 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressures (psi/bar)	Flowrates (%)	
	Plasma (P3)	Shield (P4)	Shield O_2 & N_2 (1)	(2)	Plasma O_2 (3)	Preflow (P5)	O_2 & N_2 (4)	(5)
Test	74/5.1	57/3.9	35	90	60	37/2.5	10	100
Run	99/6.8	58/4.0				38/2.6		

GAS CONSOLE MANIFOLD HOSE CONNECTIONS

The illustration below, Figure 5-9, shows the gas hose interconnections between the gas console manifold and solenoid valves (SV1 and SV4-SV7) of the motor- valves and solenoid valves SV30-SV33. The hoses are indicated by dashed lines. The hose numbers indicated correspond to the numbers affixed to the hoses.

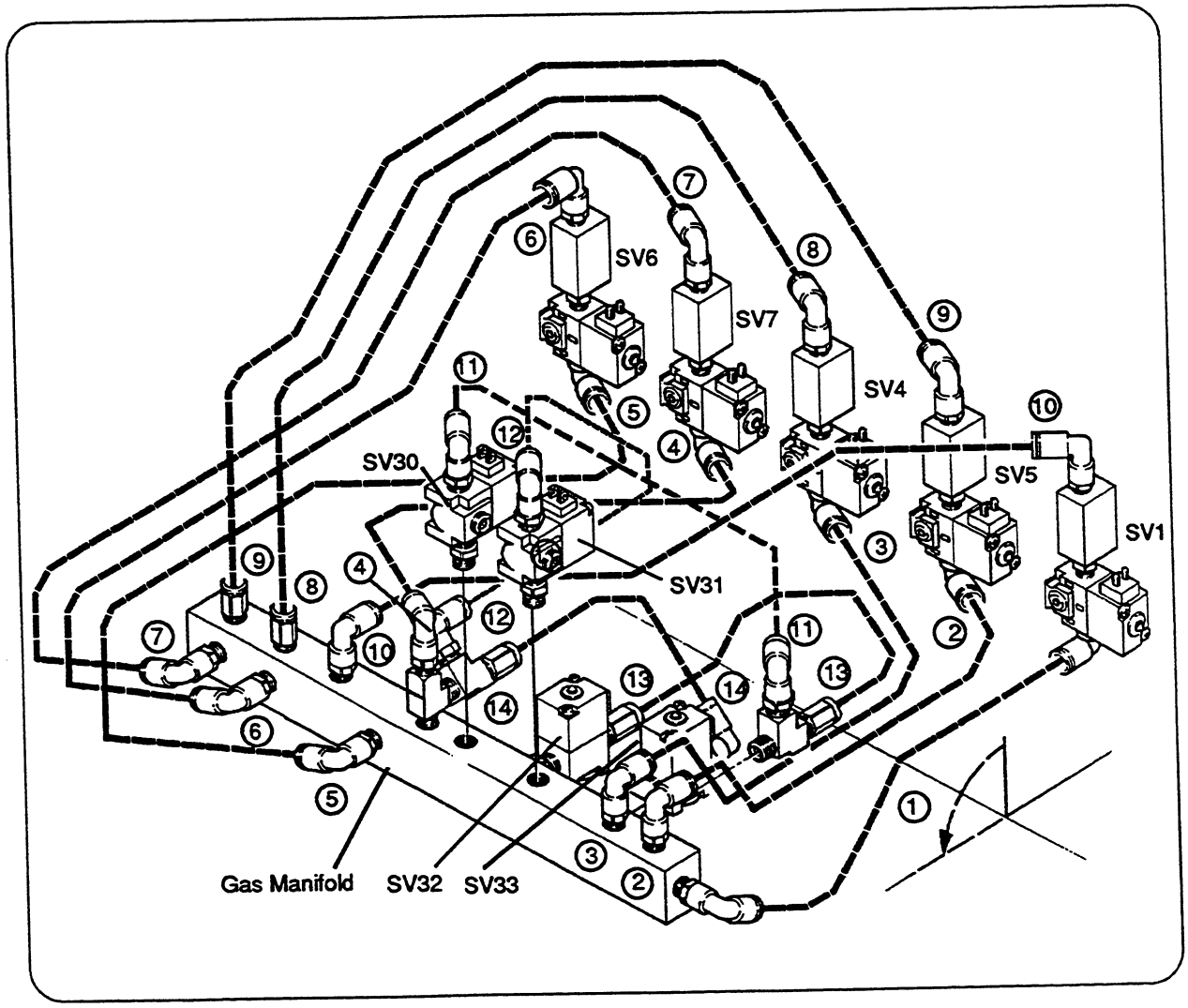


Figure 5-9 Gas Console Manifold and Solenoid Valve Hose Connections

MAINTENANCE

CH130 CHOPPER MODULE TEST PROCEDURE

Use the following procedure as an aid in troubleshooting the chopper module. Refer to the power unit wiring diagram 013-4-266 at rear of this manual.

WARNING

SHOCK HAZARD: Use extreme care when working near the chopper modules. The large electrolytic capacitors (blue-cased cylinders) 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.

1. Turn all power to the HD-3070 OFF.
   Disconnect mating receptacles in the RHF console to disable the high frequency transformer T1. See Figure 6-11 for location of T1.
   Note: RHF console door must be re-shut before attempting to start system.

2. Remove large fuse F4 and check for open. See Figure 6-6 for location of fuse.

3. Place the positive lead to the + side of the bridge and the negative lead to the – side of the bridge. See Figure 5-10. Note that actual connection points are hidden by the cap support bracket in Figure 5-10.

4. Turn power to the HD-3070 ON, and start system up. After the START command has been given, check voltage. The input to the chopper at these points should be about +280 VDC.

   If the input is OK and fuse F4 was blown, replace the chopper module.

   If there is no +280 VDC input, check input to bridge for shorts. Also, check contactor (CON1), connections and associated wiring to the contactor. Repair and/or replace defective component(s) if necessary.

5. If voltage from step 4 is +280 VDC and corresponding fuse is not blown, check the chopper output at TB1 by placing the positive lead of the voltmeter at the (+) WORK terminal (#48A output cable) and the negative lead at the (-) TORCH terminal (#39A output cable). See Figure 5-10.

6. Turn the system on and press the START command. After the START command has been given, check the voltage. If the output from the chopper at these points is +280 VDC, the chopper is OK.

7. If the chopper does not output +280 VDC, check to see if LED1 logic power light is on. If LED1 is not on, check if 120V is going to JP6. If there is no 120V at JP6, check wiring back to power distribution board. Repair or replace defective component(s), if necessary.

   Also check to see if LED3 is turning green when enabled (normal condition). If LED1 is on and LED3 is red when enabled (fault condition), then make sure that JP9 is seated properly. If JP9 is connected, disconnect one side of the thermo switch wire (TS1) and try again. If voltage comes up and LED3 turns green, the unit is either too hot or thermo switch is shorted. Allow unit to cool and repeat test. If LED3 still turns green, replace chopper module.

8. If chopper still does not output 280V after completing step 7, there may be a problem with the control signal or the chopper module. The chopper drive signal comes from control board 1XPCB3 as an analog level from 0 to +8 VDC, which varies the duty cycle and subsequent output current of the chopper. These analog signals are on pins 5 & 6 of REC3 on control board 1XPCB3. See Figure 6-2 for location of 1XPCB3.

   To determine if there is a problem with the chopper module or control board 1XPCB3, proceed as follows:

   - Ensure that high frequency is still disabled (see step 1).
   - Place voltmeter across output terminals of chopper (positive lead to (+) WORK and negative lead to (-) TORCH and press the START command.
   - If the voltmeter reads +280 VDC, then replace control board 1XPCB3.
   - If the voltmeter reads 0 volts, then replace chopper module.

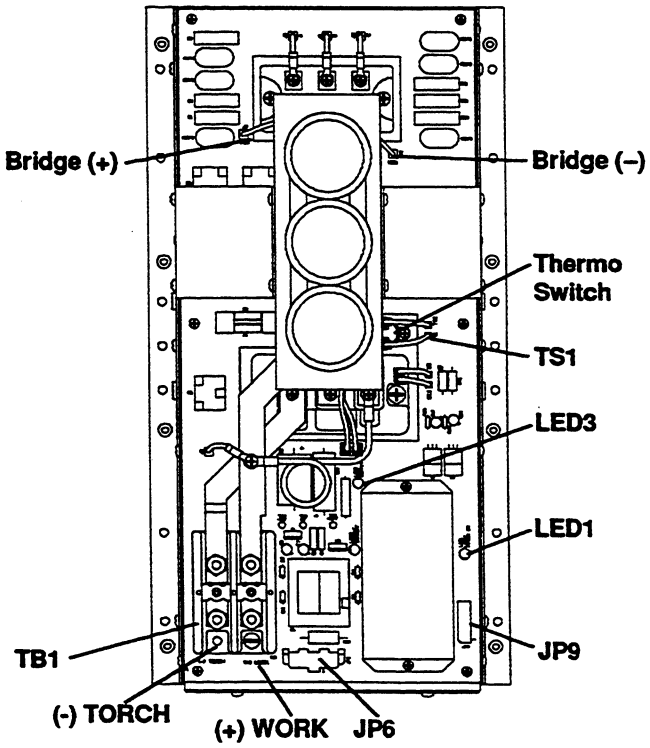


Figure 5-10 CH130 Chopper Module - Front View

PAC186 TORCH MAINTENANCE

WARNING

Turn off all power to the HyDefinition system before working on the torch. Always press the power unit OFF (O) pushbutton switch and set the line disconnect switch to OFF. Lock-out and tag-out switch.

Water Tube Removal and Replacement

To remove the damaged water tube from a PAC186 torch and replace it with a new water tube (120377), proceed as follows:.

1. Use the the nut driver (4.5 mm), located in consumable parts kit, to remove water tube from torch (Fig. 5-11).

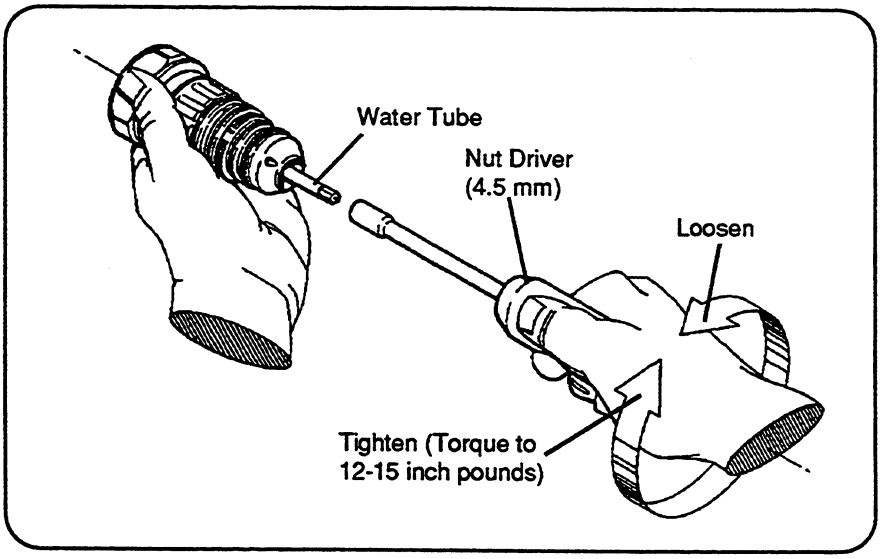
2. Carefully unscrew the water tube in a counterclockwise (ccw) direction.

Caution:	**While cleaning the inside of the torch in step 3. below, be very careful not to dislodge the gold band from the groove inside the torch. If this happens internal arcing damage will occur.**

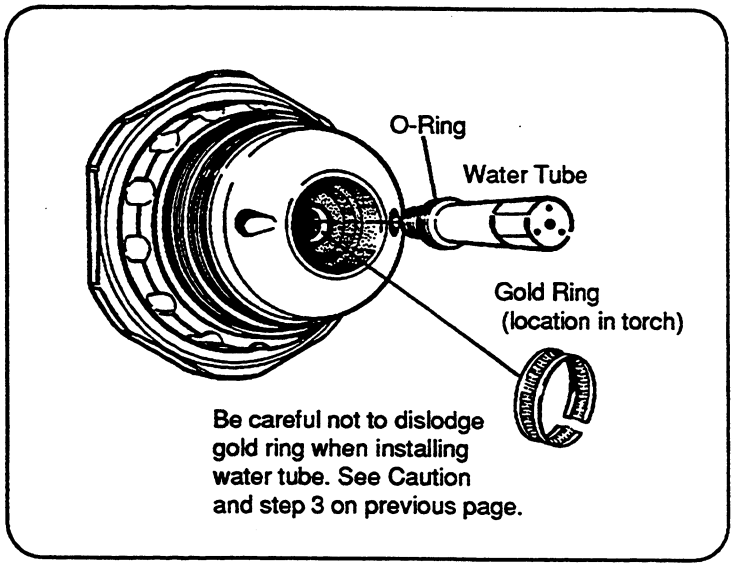
3. After the water tube has been removed, clean the inside of the torch using low pressure compressed air or water. Carefully clean out the seat area of the water tube of any residue using a cotton swab. Be careful not to dislodge the gold band from the groove. If the gold ring gets dislodged, reinstall it by referring to Fig. 5-11.

4. Apply a light coat of silicone to the O-ring located at the base of the new water tube.

5. Screw the new water tube into the torch clockwise (cw) and tighten with nut driver. Torque to 12-15 inch pounds. **Do not over tighten.**



Loosening and Tightening Water Tube



Install New Water Tube

Figure 5-11 Water Tube Removal and Replacement

Bullet Connector Removal and Replacement

To remove a bullet connector (120204) from a PAC186 torch and replace it with a new one, proceed as follows (Fig. 5-12):

1. If the bullet connector is not broken, use 9/32-inch nut driver to remove the connector.
2. If the bullet connector is broken off so that a nut driver cannot be used to remove the connector, use a three-sided file with a tapered end or a similar tool that will provide a grip.
3. Apply a light coat of silicone to the O-rings on the bullet connector.
4. Screw the replacement bullet connector into the receptacle and tighten with nut driver to **3 in - lbs (3.5 kg-cm). Do not over tighten.**

High Current Contact Removal and Replacement

To remove the high current contact (008890) from a PAC186 torch and replace it with a new one, proceed as follows (Fig. 5-12):

1. Grab the high current contact with the tweezers and pull off stud.
2. Replace by pushing the high current contact into the slot on the stud.

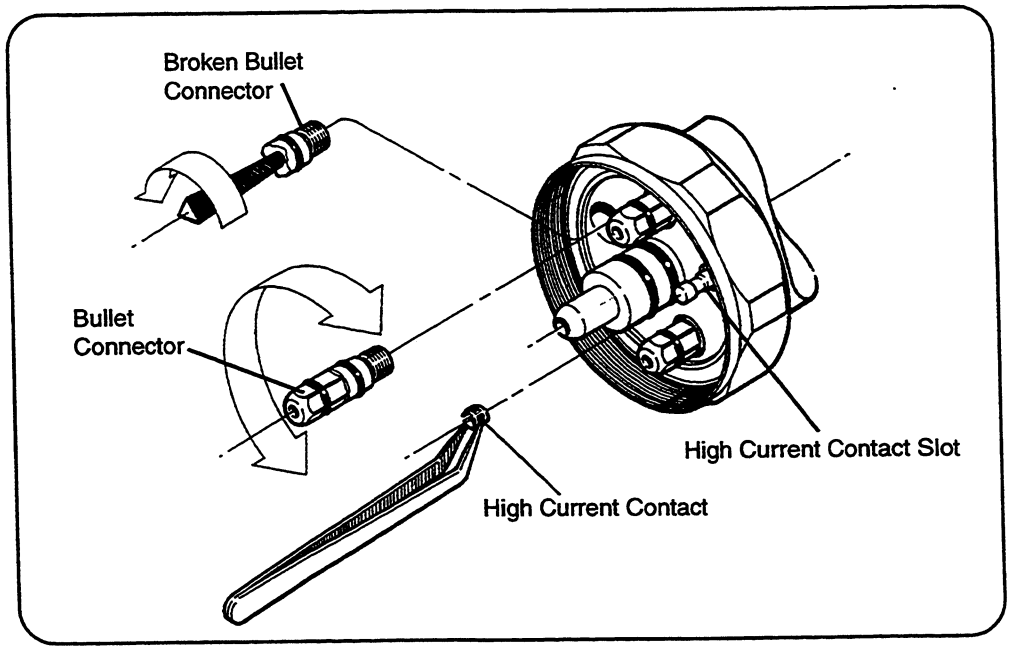


Figure 5-12 Bullet Connector and High Current Contact Removal and Replacement

Section 6 Parts List

In this section:

PARTS LIST

INTRODUCTION

In this section, a parts breakdown with supporting illustrations for the units which comprise the HD-3070 system is given. Part numbers for cables, hoses, and lead sets are also given.

POWER SUPPLIES

078020 - 240/480 VAC, 3 Phase, 60 Hz
078026 - 208 VAC, 3 Phase, 60 Hz
078027 - 220/380/415 VAC, 3 Phase, 50/60 Hz
078028 - 600 VAC, 3 Phase, 60 Hz
078029 - 200 VAC, 3 Phase, 50/60 Hz

Control Panel

Item	Part Number	Description	Designator	Qty.
	029947	**HD-3070 Enclosure SA**		**1**
	029988	**HD-3070 Enclosure SA (for 220/380/415V units)**		**1**
1	001512	Panel, control		1
2	008786	Knob (used on item 11)		1
3	008787	Knob Lock, (used on item 11)		1
4	005088	Holder, lamp		1
5	005168	Bulb, 28VDC, .08 MA T3-1/4		1
6	005091	Cap, red		1
7	005122	Pushbutton, 2 NC, red, extended	PB2	1
8	005121	Pushbutton, 2 NO, green, illmn.	PB1/LT1	1
9	**041545**	**PC BD Assy, interlock display**	**1XPCB5**	**1**
	029977	**Thumbwheel SA, current**		**1**
10	005182	Switch, 3-position BCD	S1	1
	029394	**Potentiometer SA**		**1**
11	009604	Res, variable, 100KΩ, 2W 10% 1 turn	P1	1

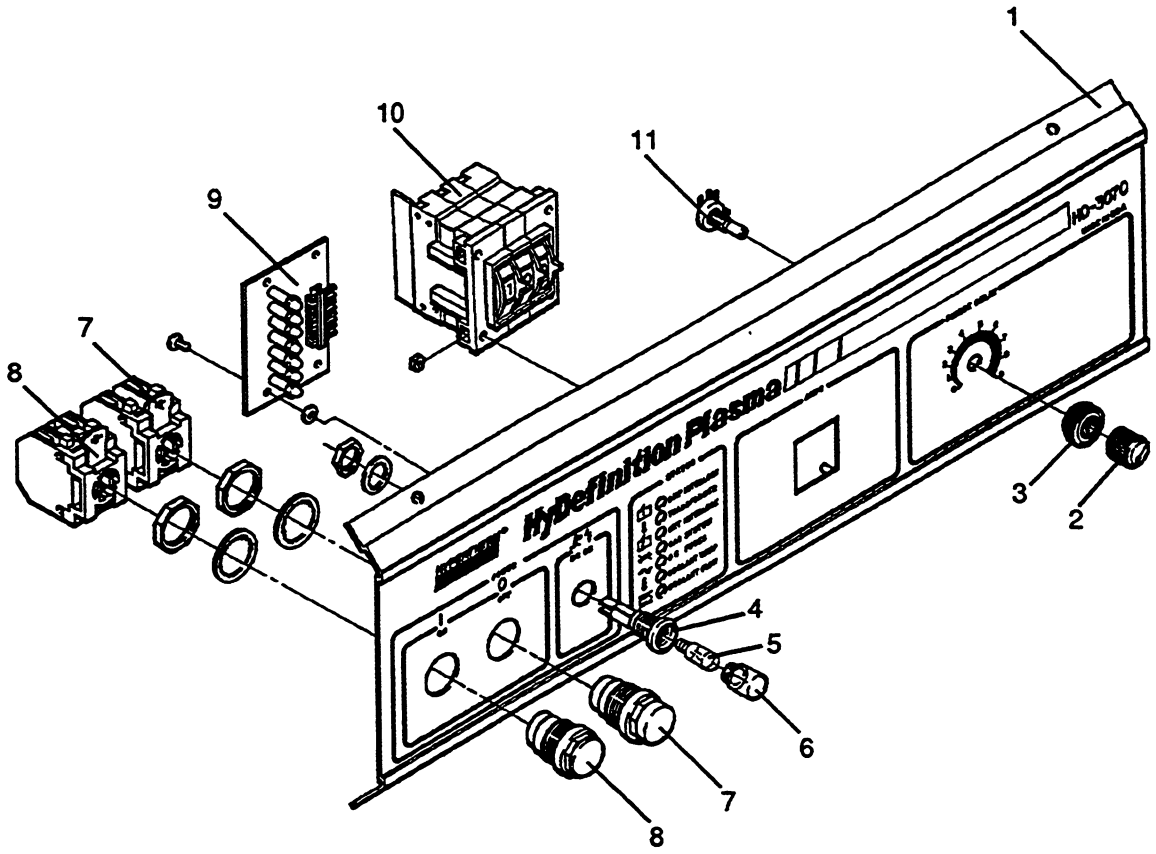


Figure 6-1 Control Panel

PARTS LIST

Front Exterior

Item	Part Number	Description	Designator	Qty.
	029947	**HD-3070 Enclosure SA**		1
1	041246	PC BD assy, relay	1XPCB4	1
2	003113	Relay, DPDT, 12V Coil	CRE	1
3	003142	Relay, DPDT, 120 VAC	CRF, CRG	2
4	041349	Power source, 12V 2.1A		1
5	041470	PC BD assy, controller	1XPCB3	1
	081025	Firmware		1
6	027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M2	1
7	027079	Fan, 450-550 CFM, 120 VAC, 50/60 Hz	M3	1

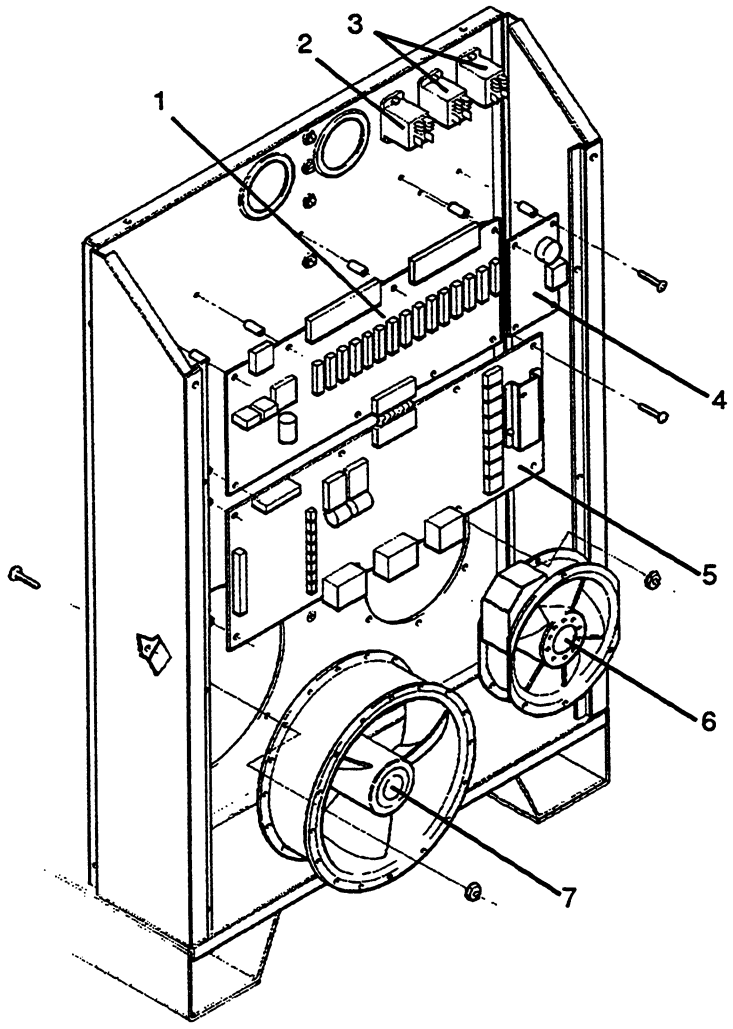
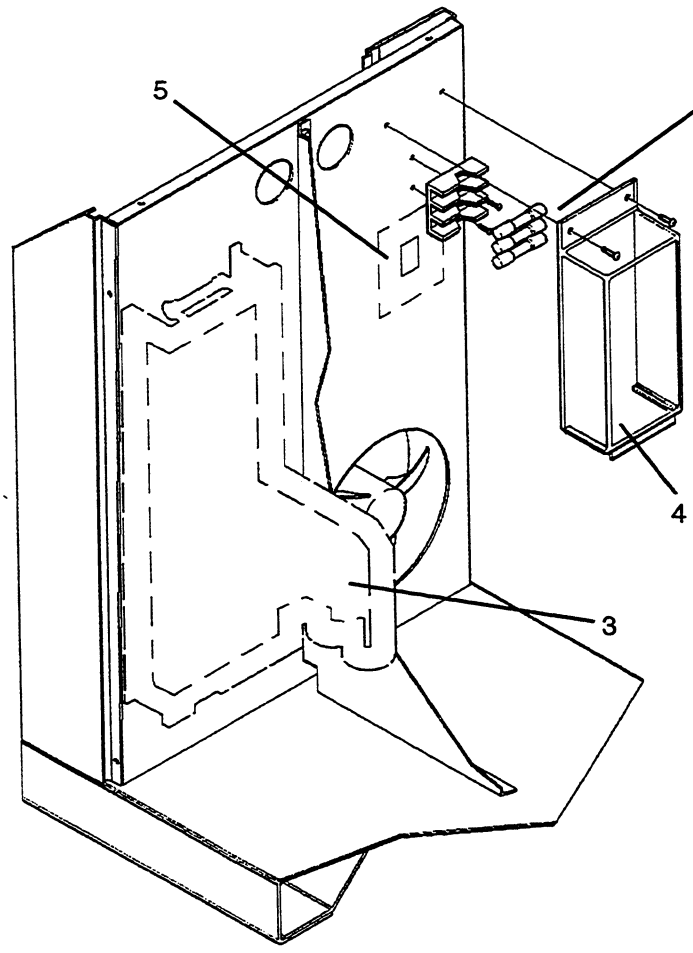


Figure 6-2 Front Exterior

Front Interior - Right and Left Sides

Item	Part Number	Description	Designator	Qty.
1	008709	Fuse, 20A 500V 13/32 X 1-1/2 slow blow	see chart below	
2	008551	Fuse, 7.5A 600V 13/32 X 1-1/2	see chart below	
	029947	**HD-3070 Enclosure SA**		**1**
	029988	**HD-3070 Enclosure SA (for 220/380/415V units)**		**1**
3	**129118**	**Chopper SA, CE/LVD 15KW (Fig 6-4)**	**CH130**	**1**
	005199	Switch, temperature 82° C	TSW1	1
4	002217	Shield cover (used with item 5)		1
5	**029626**	**Linkboard SA, 240-480V (see Fig 6-5)**	**LB1**	**1**



1, 2 Input Power Fuse Chart

Power Unit	F1	F2	F3
240/480V (078020)	20A	20A	7.5A
208V (078026)	20A	20A	
220/380/415V (078027)	20A	7.5A	20A
600V (078028)	7.5A	7.5A	
200V (078029)	20A	20A	

Figure 6-3 Front Interior - Right and Left Sides

PARTS LIST

CH130 Chopper SA

Item	Part Number	Description	Designator	Qty.
	029947	**HD-3070 Enclosure SA**		**1**
	029988	**HD-3070 Enclosure SA (for 220/380/415V units)**		**1**
	129118	**Chopper SA, CE/LVD 15KW (Fig 6-4)**	**CH130**	**1**
	005199	Switch, temperature 82° C	TSW1	1

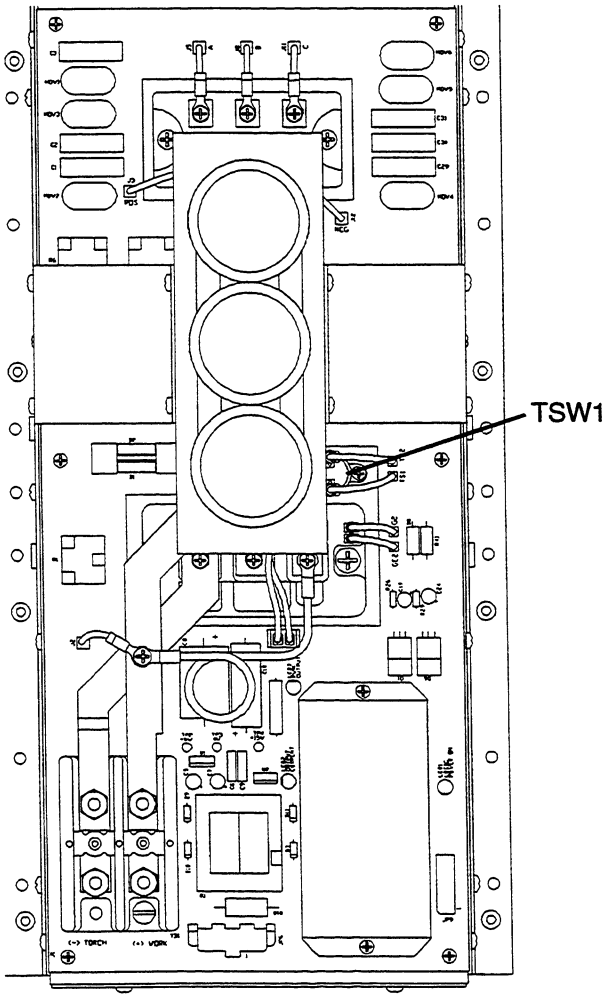


Figure 6-4 CH130 Chopper SA

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PARTS LIST

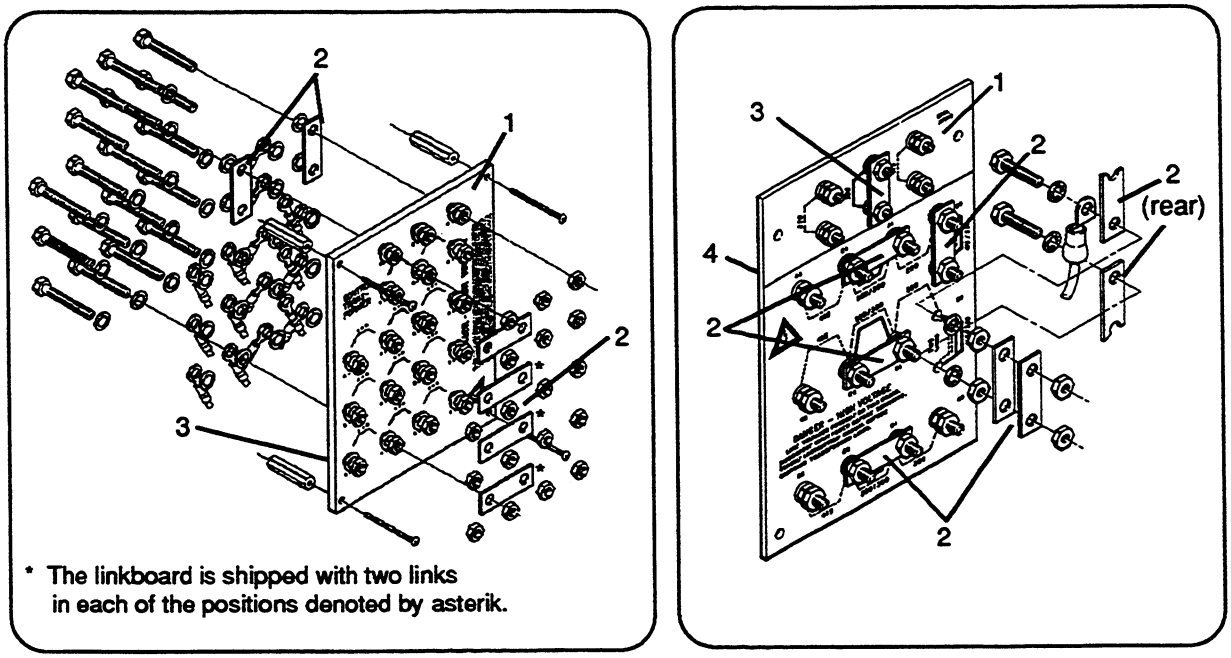
Linkboard Subassemblies

240/480V Linkboard

Item	Part Number	Description	Designator	Qty.
	029626	**Linkboard SA, 240-480V**	**LB1**	**1**
1	004244	Linkboard, 240-480V		1
2	004245	Link, short		9
3	004246	Link, long (on rear of linkboard)		1

220/380/415V Linkboard

Item	Part Number	Description	Designator	Qty.
	029987	**Linkboard SA, 220/380/415V**	**LB1**	**1**
1	004683	Linkboard, 220/380/415V		1
2	004245	Link, short		8
3	004600	Link, MAX70		1
4	004684	Link, long (on back of linkboard		1



240-480V Linkboard

220/380/415V Linkboard

Figure 6-5 Linkboard Subassemblies

Center Panel and Bottom - Right Side

Item	Part Number	Description	Designator	Qty.
	029947	**HD-3070 Enclosure SA**		**1**
	029988	**HD-3070 Enclosure SA (for 220/380/415V units)**		**1**
1	**041544**	**PC BD assy, power distribution**	**1XPCB2**	**1**
2	003021	Relay, 120 VAC NO SPST	CR4	1
3	009685	Resistor, 15 ohms, 50W, 5%	R2A, R2B	2
4	003113	Relay, DPDT, 12V Coil	CRA, CRB	2
5	003074	Relay, DPDT, 24 VAC, 10A	CRC	1
6	003142	Relay, DPDT, 120 VAC	CRD	1
7	003133	Contactor, HD1070, 50A, 3Ph, 120V coil	CON1	1
8	009296	Capacitor, Ele 100 uf 350 VDC	C1	1
9	009015	Resistor, 10 ohms, 10W, 5%	R1	1
10	008317	Fuse, 125A semiconductor	F4	1
11	**029316**	**Terminal Block SA, incoming power**	**TB1**	**1**
12	014043	Inductor, 4 mh, 100A DC	L1	1
13	007022	Shunt, 100A, 100 MV	R3	1

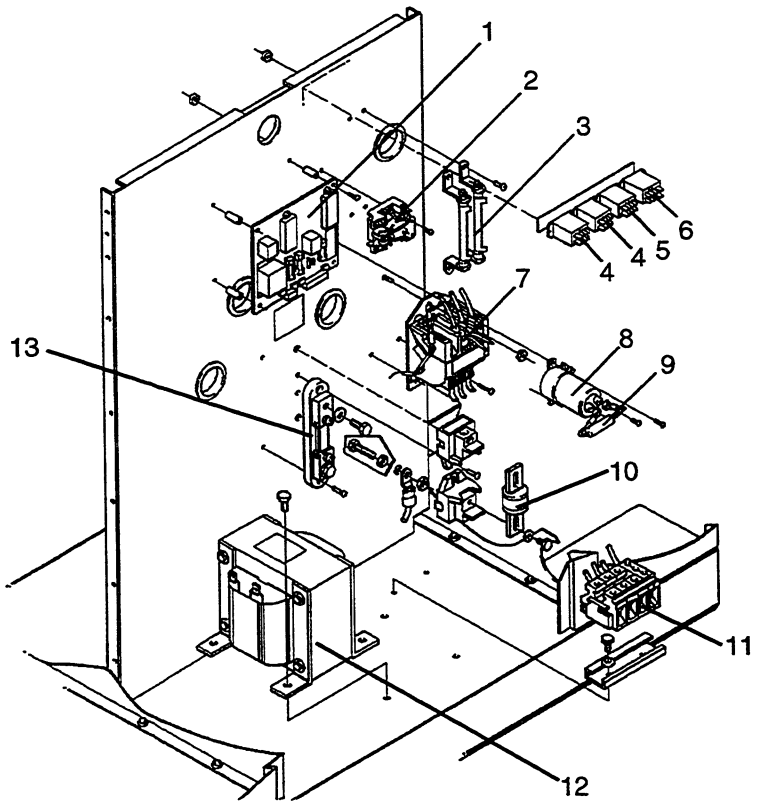


Figure 6-6 Center Panel and Bottom - Right Side

PARTS LIST

Center Panel and Bottom - Left Side

Item	Part Number	Description	Designator	Qty.
1	014068	Transformer, 15 KW, 240-480/3/60	T2	1
	014065	Transformer, 15 KW, 220-380-415/3/50-60		
	014069	Transformer, 15 KW, 200/3/50-60		
	014066	Transformer, 15 KW, 208/3/60		
	014067	Transformer, 15 KW, 600/3/60		
	029624	**Control Transformer SA, 240-480V**		
2	014079	Transformer, control 240-480V/60	T1	1
	029690	**Control Transformer SA, 220-380-415V**		
	014081	Transformer, control 220-380-415V/50-60		
	029671	**Control Transformer SA, 200V & 208V**		
	014110	Transformer, control 200V/50 Hz & 208/60		
	029711	**Control Transformer SA, 600V**		
	014083	Transformer, control 600V/60		
	029947	**HD-3070 Enclosure SA**		
3	003021	Relay, 120 VAC NO SPST	CR1	1

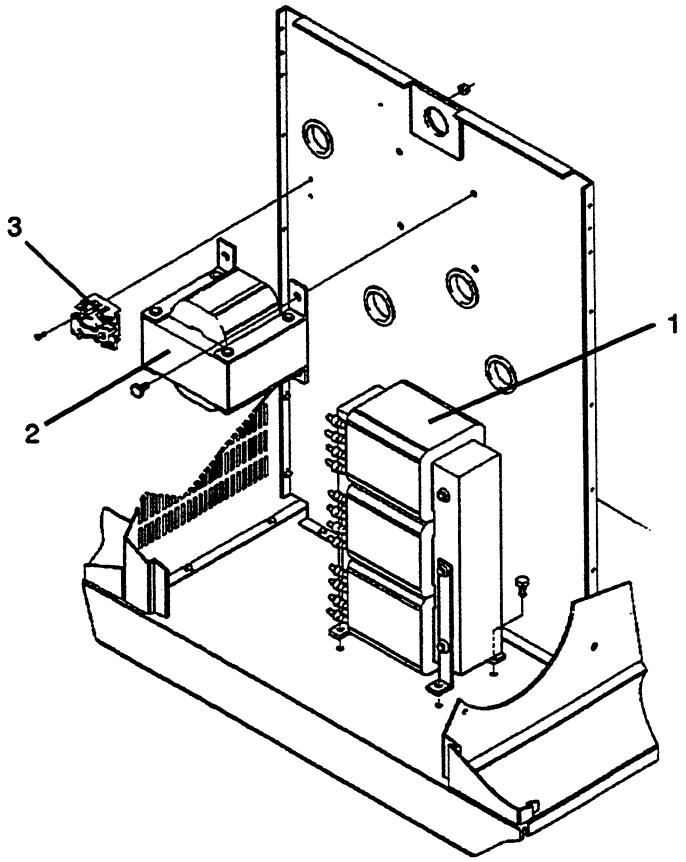


Figure 6-7 Center Panel and Bottom - Left Side

Rear Interior - Right and Left Sides

Item	Part Number	Description	Designator	Qty.
	029947	**HD-3070 Enclosure SA**		**1**
	029988	**HD-3070 Enclosure SA (for 220/380/415V units)**		**1**
1	041274	PC BD assy, ISO amp	1XPCB5	1
	129172	**Harness SA**		**1**
2	008079	Terminal board, 12 terminals	TB2	1
3	008063	Terminal board, 3 terminals	TB3	1
4	108049	Fuse, FLQ30 time delay, 30 amp	F5	1
5	129264	Assembly, pilot arc circuit		1
6	**029623**	**HF I/O Panel SA (see Fig 6-9)**		**1**

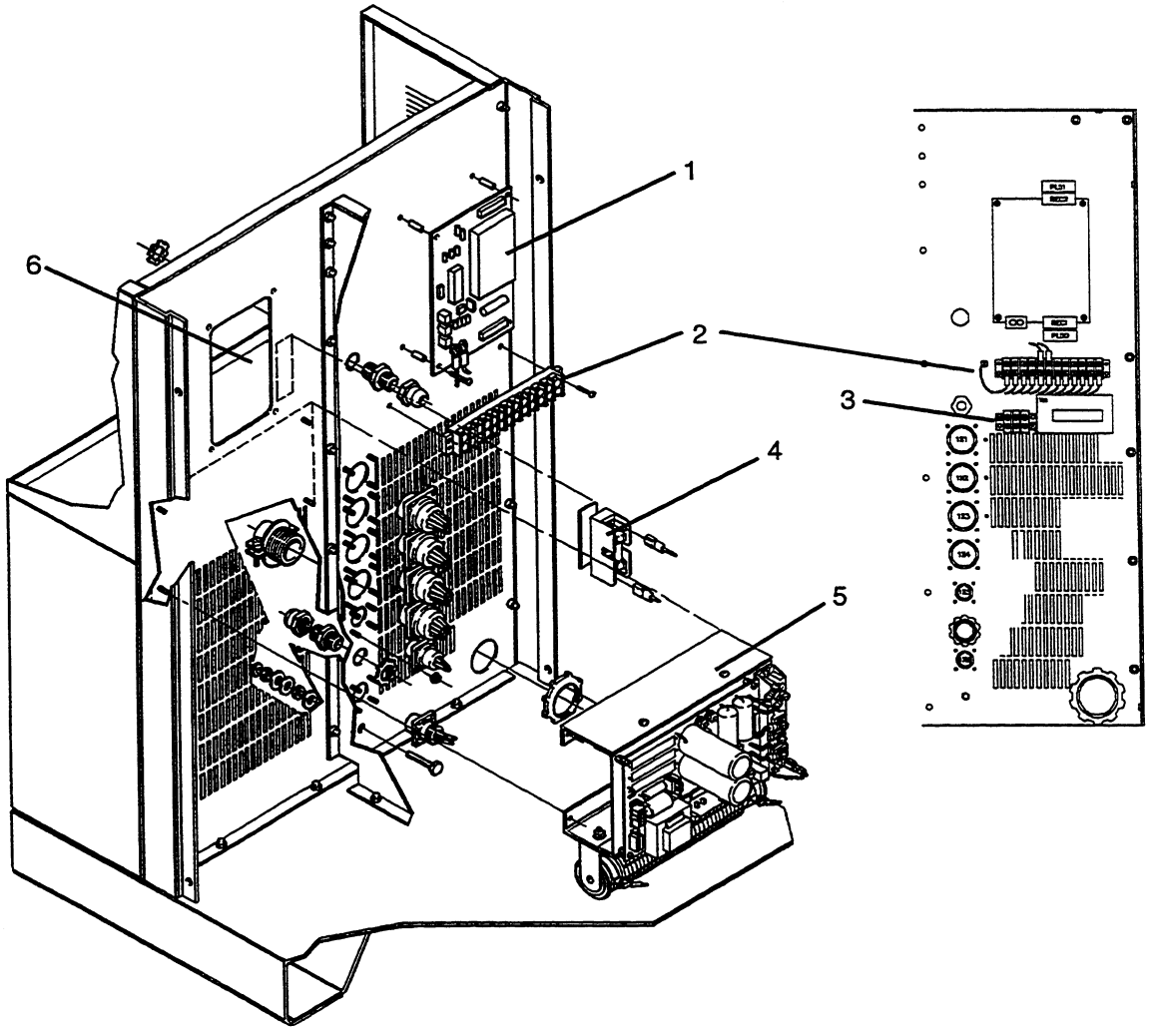


Figure 6-8 Rear Interior - Right and Left Sides

PARTS LIST

HF I/O Panel SA

Item	Part Number	Description	Designator	Qty.
	029947	**HD-3070 Enclosure SA**		1
	029988	**HD-3070 Enclosure SA (for 220/380/415V units)**		1
	029623	**HF I/O Panel SA**		1
1	001350	Panel I/O		1
2	**041291**	**PC BD assy, I/O**	**1XPCB1**	1
3	108049	Fuse, FLQ30 time delay, 30 amp	F5	1
	029202	**Current Sensor SA**		1
4	009373	Current sensor	CS1	1

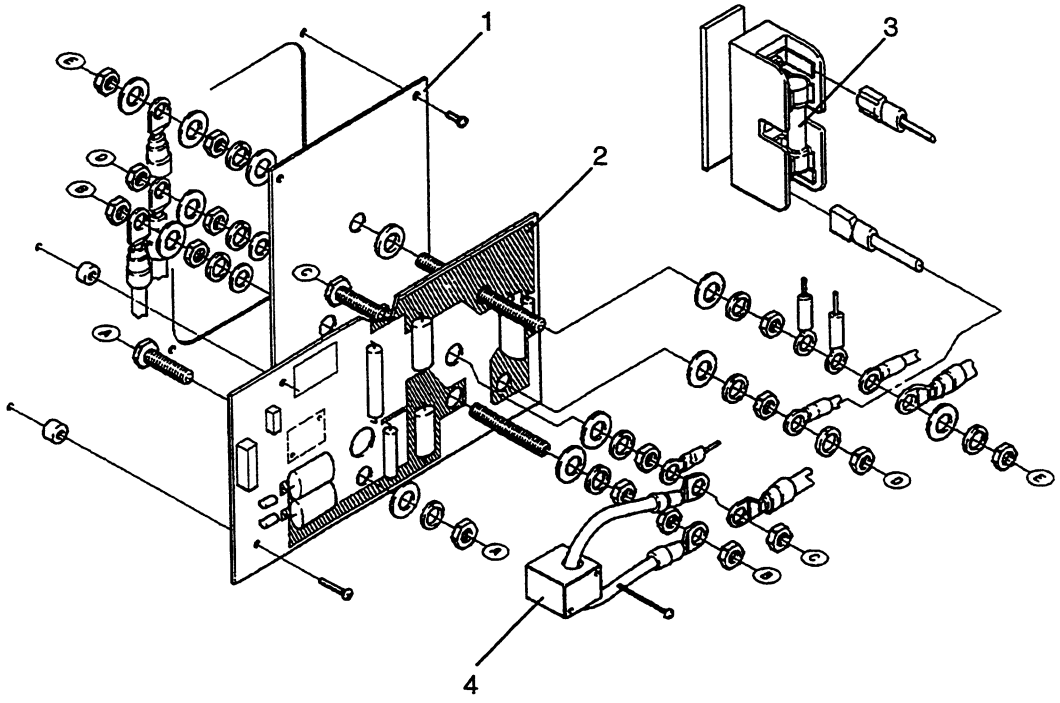


Figure 6-9 HF I/O Panel SA

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PARTS LIST

Rear Exterior

Item	Part Number	Description	Designator	Qty.
	029947	**HD-3070 Enclosure SA**		**1**
	029988	**HD-3070 Enclosure SA (for 220/380/415V units)**		**1**
	129255	**Coolant SA, HD-3070**		**1**
	129252	**Water Pump SA**		**1**
1	031113	Motor, 1/3 hp, carbonator, 120-240 V 50/60 Hz	M1	1
2	031115	Clamp, V-band		1
3	031114	Pump, 70 gph, positive displacement	P1	1
	129254	**Coolant Manifold SA**		**1**
4	005139	Flow switch, 0.25 gpm, 1/4 NPT SPST	FS1	1
	029634	**Heat Exchanger SA**		**1**
5	027136	Heat exchanger water/air (includes four fans M4 - M7)	HX1	1
	129253	**Water Filter SA**		**1**
6	027139	Filter housing, 10" X 3/4 NPT		1
7	027005	Filter, element particulate		1
	129250	**Reservoir SA**		**1**
8	002240	Reservoir, coolant		1
9	004598	Cap, reservoir		1
10	022026	Gauge, liquid coolant		1
	029326	**Level Switch SA**		**1**
11	005117	Switch, Level, 1/2 NPT	LS1	1
	029323	**Water Temp Switch SA**		**1**
12	005118	Switch, Temperature, 160° F	TS2	1
	129251	**Out SA**		**1**
13	006108	Valve, 1/4 FPT		1
14	006075	Valve, check 1/4 NPT		2

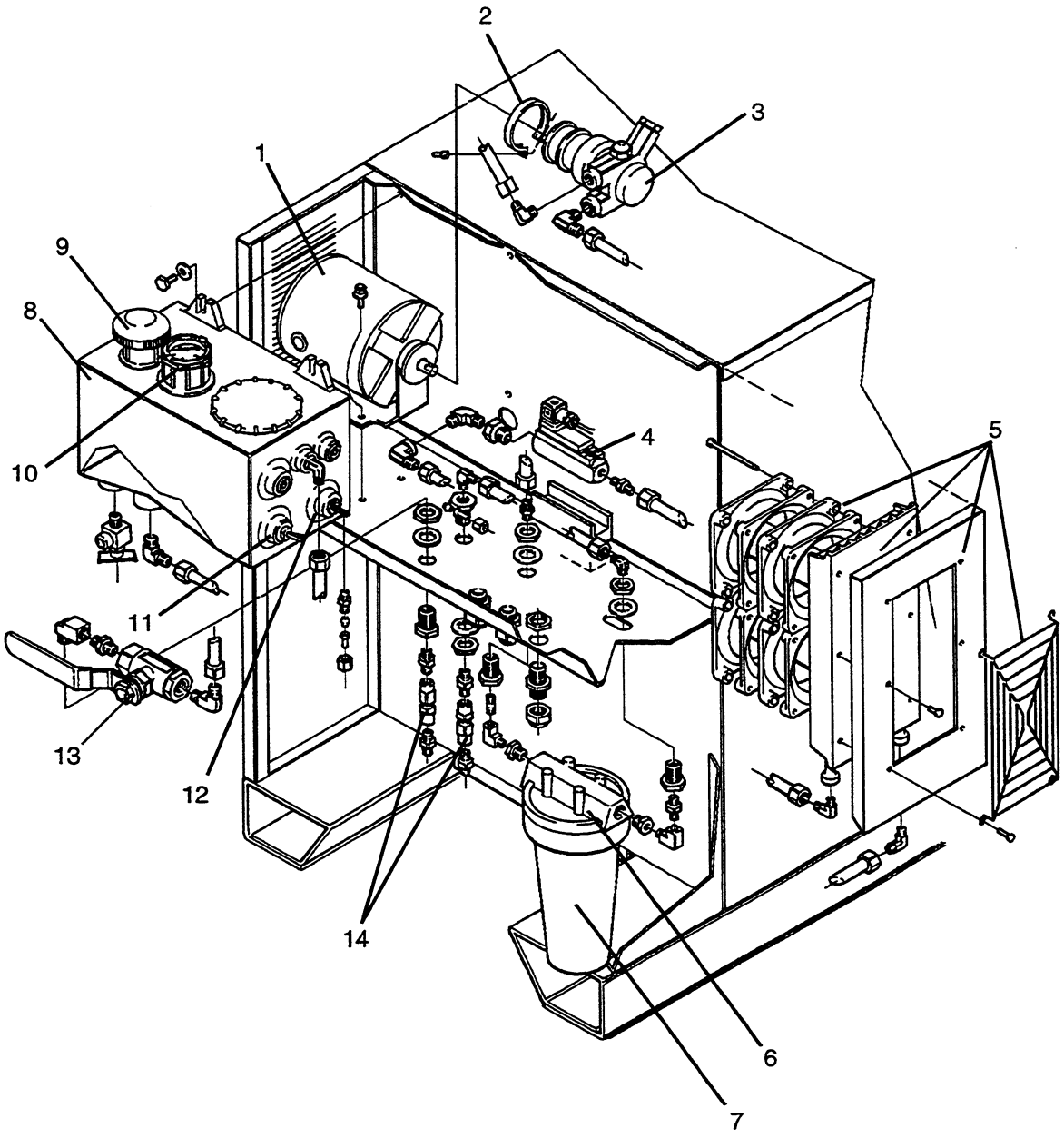
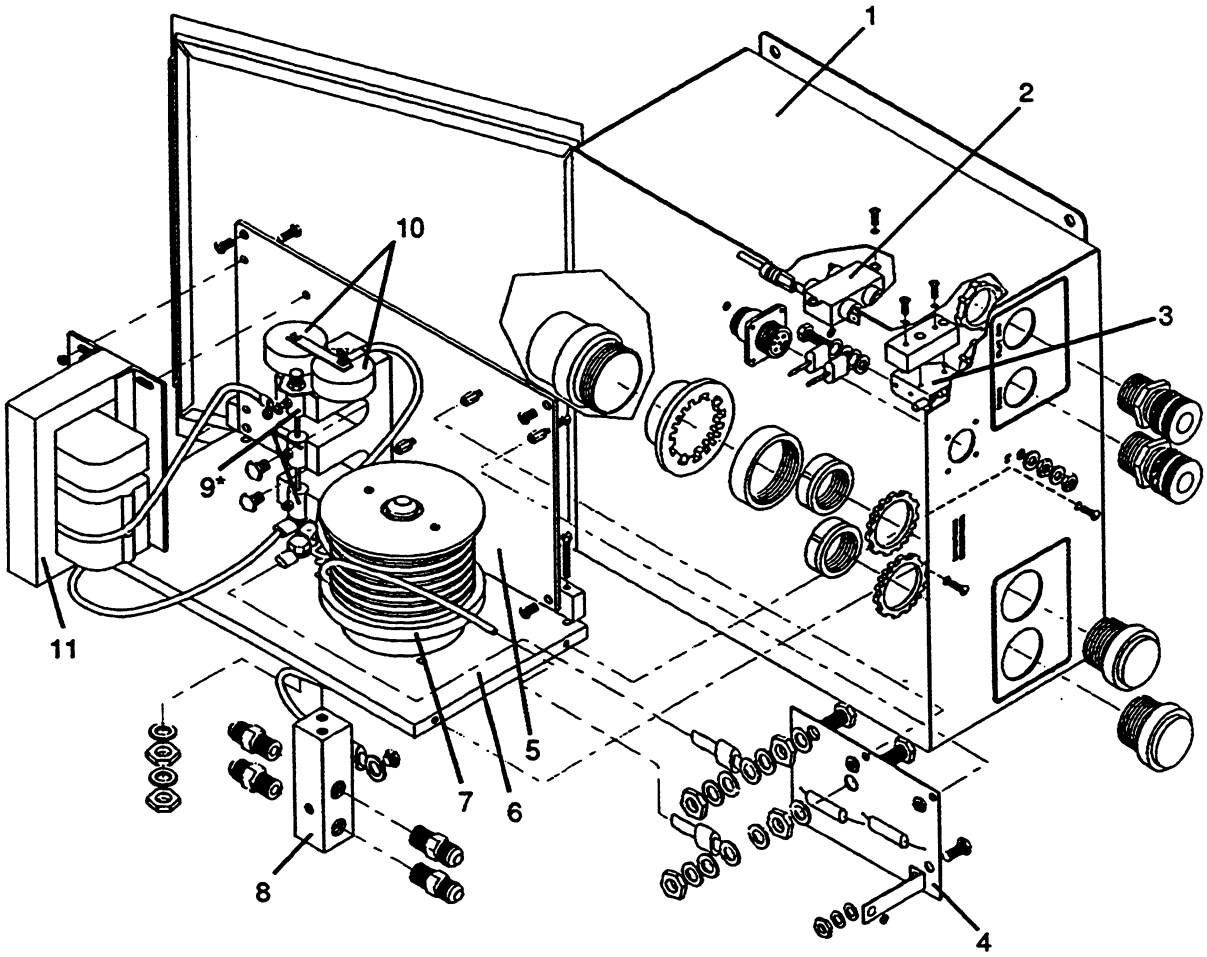


Figure 6-10 Rear Exterior

PARTS LIST

RHF CONSOLE

Item	Part Number	Description	Designator	Qty.
	078010	**Console, RHF**		**1**
1	002227	Enclosure, RHF console		1
2	009045	Filter, AC, 1 amp 1BI	FL1	1
3	005100	Switch, limit door interlock	S1	1
4	**041287**	**PC BD assy, HD plasma**	**PCB1**	**1**
5	001447	Panel, RHF console		1
6	001429	Panel, RHF console enclosure		1
7	009756	Coil assy, HD plasma	T2	1
8	004502	Manifold, RHF cathode		1
	009350	**Spark Gap Assy**	**SG1**	**1**
9	004061	Electrode, spark gap 1/8 X 1.6		3
10	009975	Capacitor, 1400 pF, 20 kV	C3, C4	2
11	129199	Transformer SA, 6 kV	T1	1



* Set spark gap with clean feeler gauge to 0.020 ± 0.001 inch (0.51 ± 0.03 mm). Clean electrodes a with diamond file.

Figure 6-11 RHF Console

PARTS LIST

AUTOMATIC GAS CONSOLE

Enclosure, Front Panel and Interior

Item	Part Number	Description	Designator	Qty.
	078022	**Console, automatic gas**		
1	001415	Panel, control		1
2	005044	Switch, toggle SPDT, ON/ON	SW2, SW3	2
3	005156	Switch, toggle SPDT, ON/OFF/ON	SW1	1
4	029862	LCD display SA	A10	1
5	007032	Bezel, LCD display module		1
	029801	**Harness SA**		**1**
6	009807	Potentiometer, 500 Ω 2W 5% 10T WW	P1 - P5	5
7	008786	Knob, .007 dia 1/4 SFT matte		5
	008787	Knob lock (for 008786)		5
8	041469	PCB assy, gas control	A1	1
	081024	Firmware, Rev 10	U1	1
9	001416	Enclosure		1
10	001417	Cover		1
11	027327	Fan, muffin 3-5/8 inch, 120V	M1	1
12	027328	Filter (for 027327)		1
13	014162	Transformer, 24 VCT @ 0.25A, 120V	T1	1
14	041329	PCB assy, LCD display	A9	1
15	041379	PCB assy, gas valve	A8	1
16	041246	PCB assy, relay	A2	1

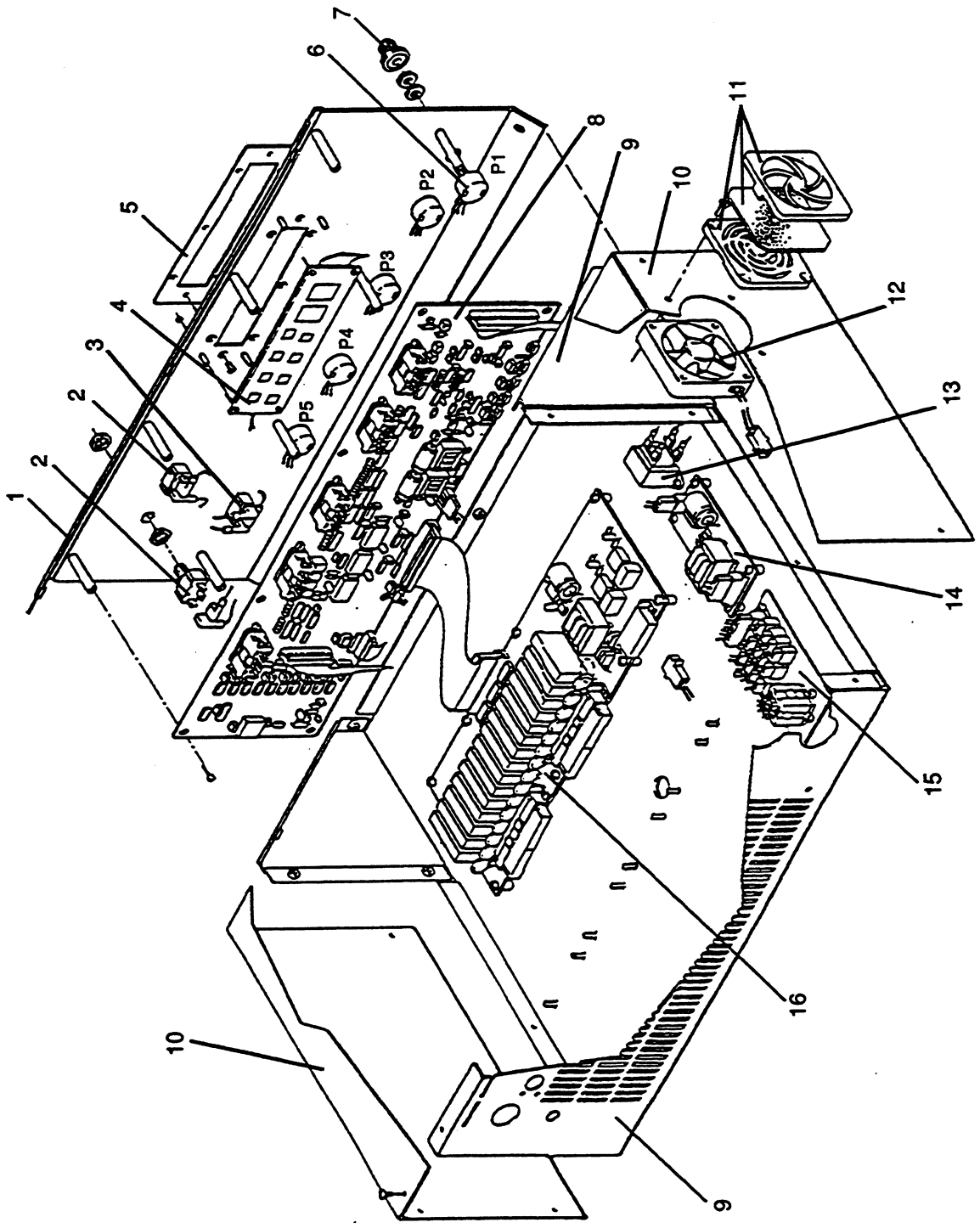


Figure 6-12 Enclosure, Front Panel, & Interior

PARTS LIST

AUTOMATIC GAS CONSOLE (Continued)

Manifold SA, Motor-Valve SA and Rear

Item	Part Number	Description	Designator	Qty.
	129480*	**Motor-valve SA**	**MV1, MV4-7**	**5**
1	-	Gear, 1/4 shaft		1
2	-	Gear, 1/4 shaft		1
3	-	PCB assy, valve calibration	A3 - A7	5
4	-	Motor, 40 rpm rev, gear reduction		5
	-	**Potentiometer SA**		**5**
5	-	Pot, 500 ohm 2W 5% 10T WW		5
6	-	Bracket, motor-valve		5
7	-	Valve, motor 1/8 FPT		5
8	-	Valve, solenoid 120#, 1/8 FPT 120V 3W	SV1, SV4-SV7	5
9	005044	Switch, toggle SPDT, ON/ON	SW4	1
	029801	**Harness SA**		**1**
10	008447	Receptacle, shell CPC 23-37 std sex		2
11	008178	Receptacle, shell CPC 23-24 std sex		1
	129081	**Manifold SA**		**1**
12	004639	Manifold		1
13	029855	Transducer SA	PT1 - 5	5
14	006106	Valve, sol120#, 1/8 FPT 120V 3W	SV30-SV33	4
	029801	**Harness SA**		**1**
15	009802	Pot, 1.0 Kohm 2W 10% 10T WW	P6	1
16	008727	Receptacle, shell CPC 13-7 rev sex		1
Gas Supply Input Adapters				
17	015009	Adapter, 1/4 NPT X right handed (RH) 'B' male brass		1
18	015103	Adapter, 1/4 NPT X right handed (RH) 'B' inert female brass		1
19	015230	Adapter, 1/4 NPT X left handed (LH) 'B' male brass		1

* Motor-valve SAs (129480) are sold as calibrated subassemblies only.

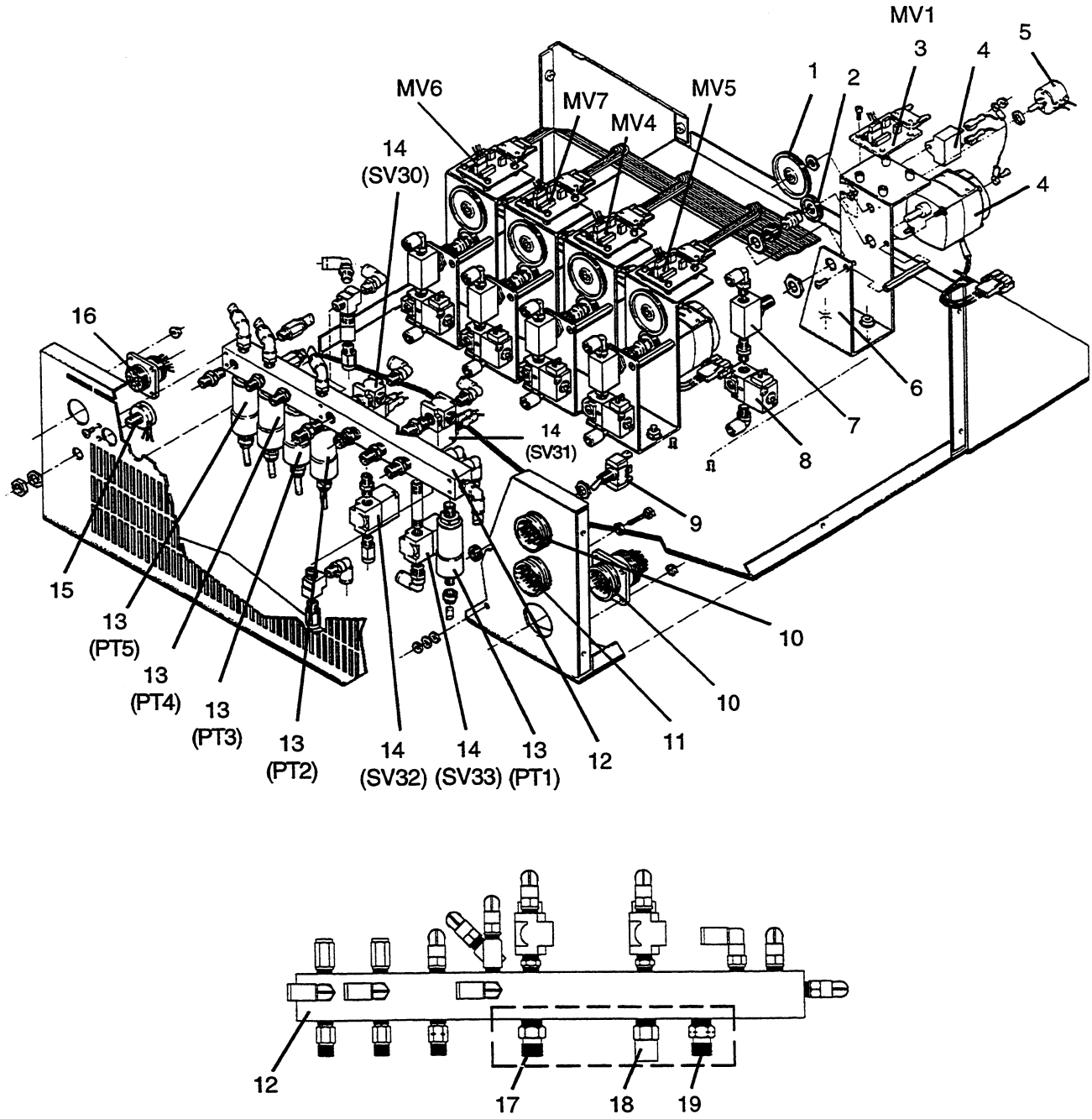


Figure 6-13 Manifold SA, Motor-Valve SA & Rear

PARTS LIST

PAC184 MACHINE TORCH ASSEMBLY

Torch Assembly with IHS tab on Shield Cap (128199)*
Torch Assembly without IHS tab on Shield Cap (028839)**

Item	Part Number	Description	Designator	Qty.
1	120208	Torch Main Body		1
2	044507	O-Ring, Buna, 70 Duro 1.424 X .070		2
3	044025	O-Ring, silicon composition 1.176 X .070		1
4	044012	O-Ring, Buna, 70 Duro 0.364 X .070		2
5	044508	O-Ring, Buna, 70 Duro 0.216 X .053		4
6	120204	Connector, Bullet Brass		4
7	120209	Electrode, 15/30 amp		1
8	120212	Swirl Ring, 15/30 amp		1
9	120218	Nozzle, 30 amp		1
10	120219	Cap, inner nozzle retainer, 15/30 amp		1
11	120222	Shield, 15/30 amp		1
12	120543	Shield Cap (with IHS tab)*		1
	120221	Shield Cap (without IHS tab)**		1

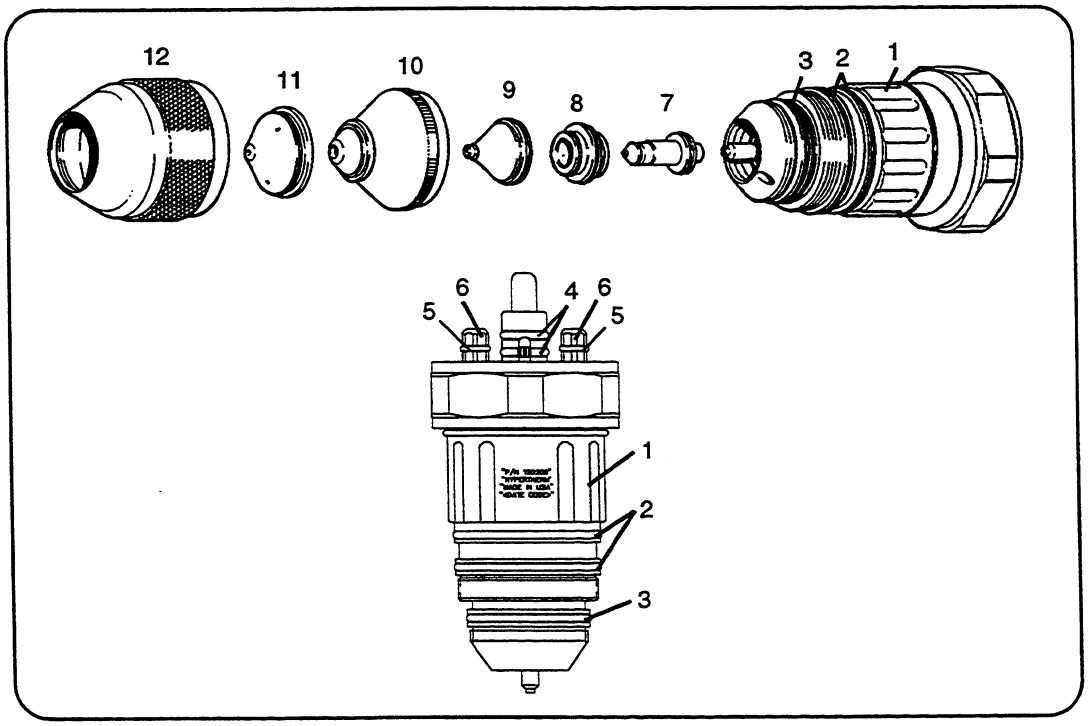


Figure 6-14 PAC184 Machine Torch Assembly

PAC186 MACHINE TORCH ASSEMBLIES

Torch Assembly with IHS tab on Shield Cap (128101)*
Torch Assembly without IHS tab on Shield Cap (128102)**

Item	Part Number	Description	Designator	Qty.
1	120349	Torch Main Body		1
2	044507	O-Ring, Buna, 70 Duro 1.424 X .070		2
3	044026	O-Ring, Buna, 70 Duro 1.239 X .070		1
4	044025	O-Ring, Buna, 70 Duro 1.176 X .070		1
5	044012	O-Ring, Buna, 70 Duro 0.364 X .070		2
6	044508	O-Ring, Buna, 70 Duro 0.216 X .053		4
7	120204	Connector, Bullet Brass		4
8	120377	Tube, Water Electrode Cooling		1
9	120111	Electrode, 15 amp		1
10	020637	Swirl Ring, 15 amp		1
11	020644	Nozzle, 15 amp		1
12	020633	Cap, inner nozzle retainer, 15 amp		1
13	020670	Shield, 15 amp		1
14	020687	Shield Cap (with IHS tab)*		1
	020634	Shield Cap (without IHS tab)**		1

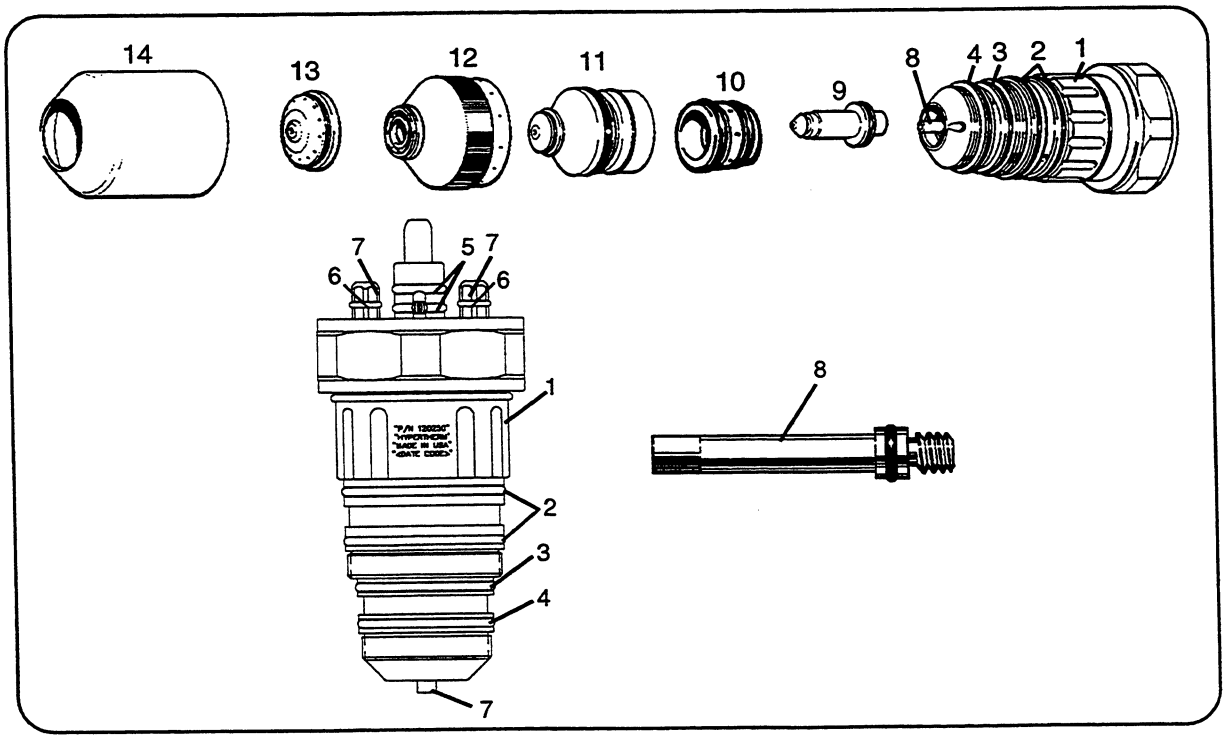


Figure 6-15 PAC186 Machine Torch Assembly

PARTS LIST

45° TORCH QUICK DISCONNECT ASSEMBLY, MOUNTING SLEEVE AND TORCH VENT HOSE

Item	Part Number	Description	Designator	Qty.
1	028840	Assy, 45° torch quick disconnect		1
2	120256	Sleeve, mounting		1
3	024485	Assembly, torch vent hose		1

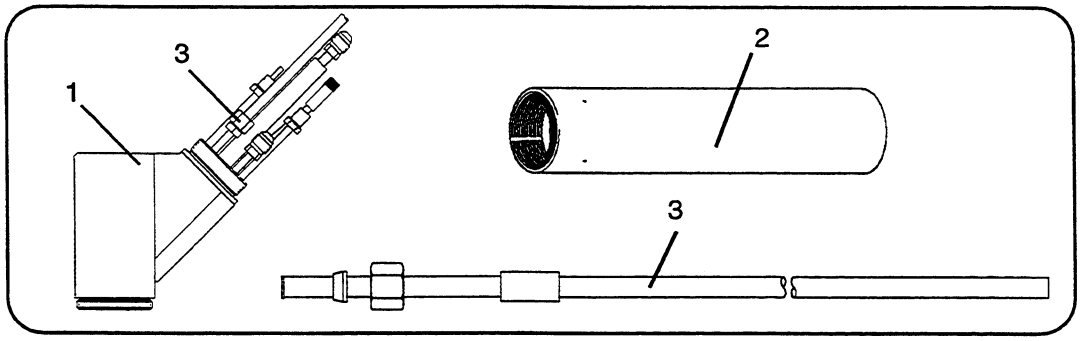


Figure 6-16 45° Torch Quick Disconnect Assembly, Mounting Sleeve and Torch Vent Hose

STRAIGHT TORCH QUICK DISCONNECT ASSEMBLY, MOUNTING SLEEVE, SPACER AND TORCH VENT HOSE

Item	Part Number	Description	Designator	Qty.
1	028855	Assembly, straight torch quick disconnect		1
2	020668	Sleeve, mounting		1
3	120317	Spacer, 2" ID/2-1/4" OD (for mounting off-valve to sleeve)		1
4	024485	Assembly, torch vent hose		1

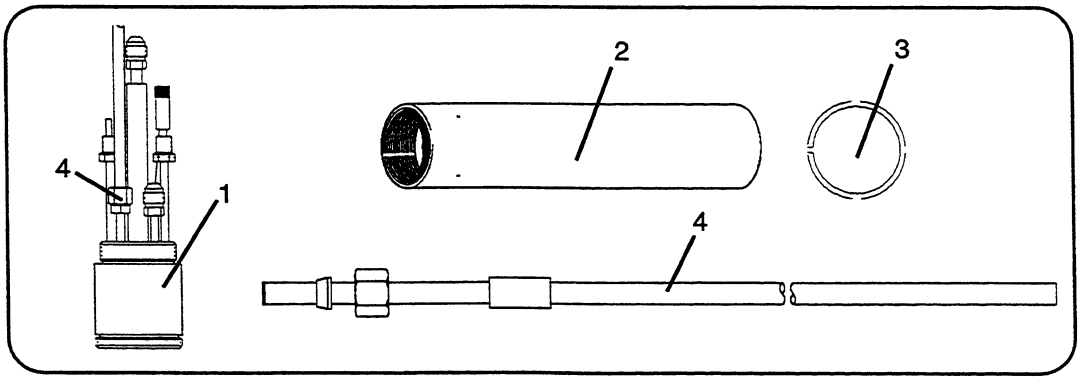


Figure 6-17 Straight Torch Quick Disconnect Assembly, Mounting Sleeve, Spacer and Torch Vent Hose

OFF-VALVE ASSEMBLIES

with blow back solenoid valve (129056)*
without blow back solenoid valve (129174)**

Item	Part Number	Description	Designator	Qty.
1	006067	Valve, solenoid 120# 1/8 FPT 120V NO	SV12, 13, 14, & blow back solenoid *, **	4
2	006077	Valve, check		1
3	120350	Bracket, torch valve mounting		1
4	004622	Receptacle, shell, off-valve		1
	008728	Receptacle, shell CPC 13-7 std sex		1
	008187	Strain relief		1
	008205	Pin, 18-16 Awg type III + CRP		7
5	046077	Tubing, 1/4" OD X .040 nyl		1 ft.
6	008503	Pin housing, 2-position		1
	008504	Pin, 24-18 Awg		2
7	008582	Socket housing, 2 -position		1
	008700	Socket, 24-18 BRZ LS		2
8	075092	M/S, 10-32 X 1/2 phillips head, zinc coated steel (gnd screw)		1
	075174	Washer, lock #10 internal tooth, zinc coated steel		2

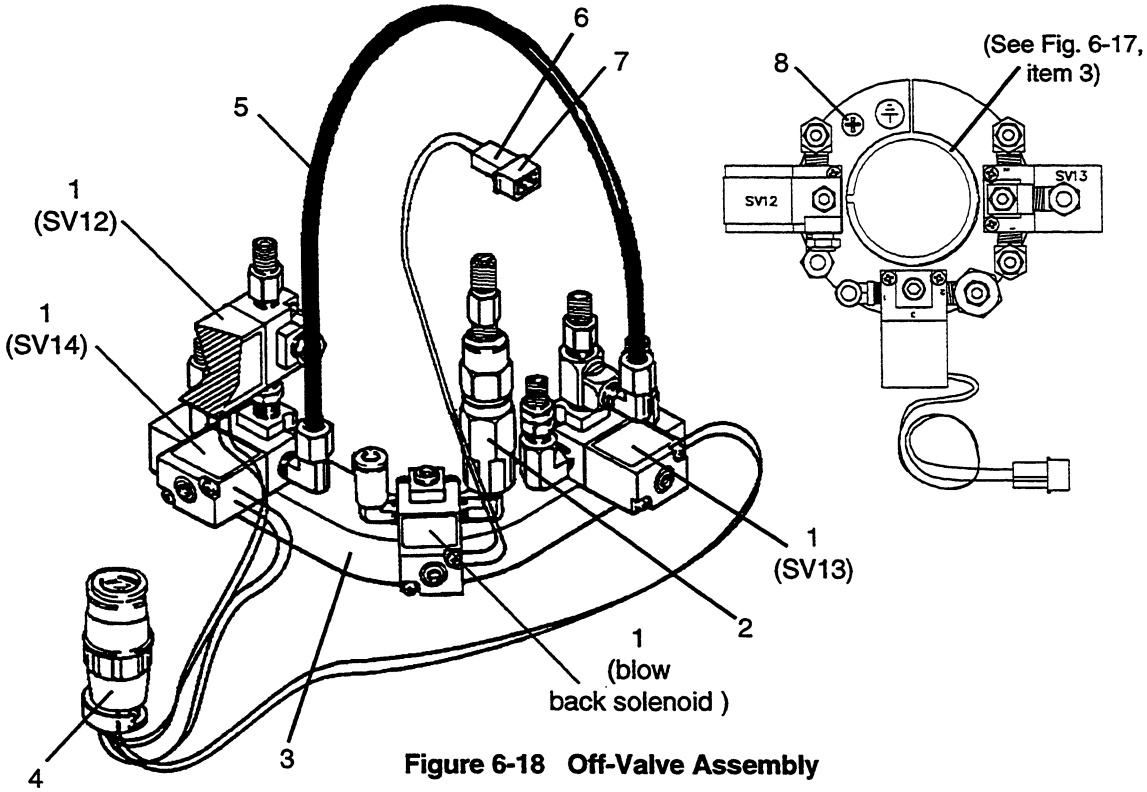


Figure 6-18 Off-Valve Assembly

PARTS LIST

PAC184 TORCH CONSUMABLE PARTS

15 and 30 Amp (Mild Steel)

Part Number	Description	Qty.
120543	Cap, shield (with IHS tab)	1
120221	Cap, shield (without IHS tab)	1
120222	Shield, 15/30 amp	1
120219	Cap, inner nozzle retainer, 15/30 amp	1
120277	Nozzle, 15 amp	1
120218	Nozzle, 30 amp	1
120212	Swirl ring, 15/30 amp	1
120209	Electrode, 15/30 amp	1

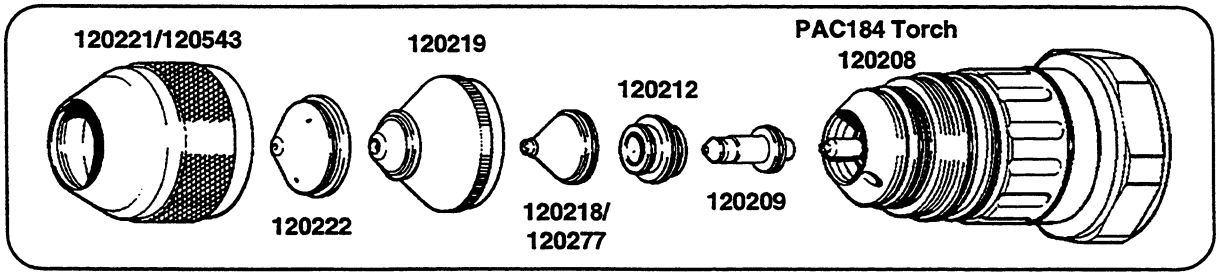


Figure 6-19 PAC184 Torch 15 and 30 Amp Mild Steel Consumable Parts

PAC184 CONSUMABLE PARTS KITS

with spare PAC184 torch (028842)*
without spare PAC184 torch (028900)**

Part Number	Description	Qty.
001067	Box, gray plastic	1
120219	Cap, inner nozzle retainer, 15/30 amp	1
120212	Swirl ring, 15/30 amp	1
120209	Electrode, 15/30 amp	3
120277	Nozzle, 15 amp	3
120218	Nozzle, 30 amp	3
120222	Shield, 15/30 amp	3
120208	Torch, PAC184*,**	1
026518	O-Ring, silicon cmpsn 1.176 X .070	1
044026	O-ring, Buna 70 Duro 1.239 X .070	1
044507	O-ring, Buna 70 Duro 1.424 X .070	2
004670	Tool, consumable parts	1
004630	Electrode gauge assembly	1
027343	Magnifier, loupe, 10X	1
027055	Lubricant, silicone 1/4 oz tube	1

PAC186 TORCH CONSUMABLE PARTS

Part Number	Description	Qty.
15 Amp (Mild Steel)		
020634	Cap, shield (w/o IHS tab)	1
020687	Cap, shield (w/IHS tab)	1
020670	Shield	1
020633	Cap, inner retaining	1
020644	Nozzle	1
020637	Swirl ring	1
120111	Electrode	1
30 Amp (Mild Steel)		
020634	Cap, shield (w/o IHS tab)	1
020687	Cap, shield (w/IHS tab)	1
020671	Shield	1
020633	Cap, inner retaining	1
020645	Nozzle	1
020637	Swirl ring	1
120111	Electrode	1
30 Amp (Stainless Steel)		
020634	Cap, shield (w/o IHS tab)	1
020687	Cap, shield (w/IHS tab)	1
020941	Adapter, shield	1
020940	Cap, inner retaining	1
020938	Nozzle	1
020937	Swirl ring	1
120113	Electrode	1
50 Amp (Mild Steel)		
020634	Cap, shield (w/o IHS tab)	1
020687	Cap, shield (w/IHS tab)	1
020671	Shield	1
020633	Cap, inner nozzle retainer	1
020646	Nozzle	1
020637	Swirl ring	1
120112	Electrode	1

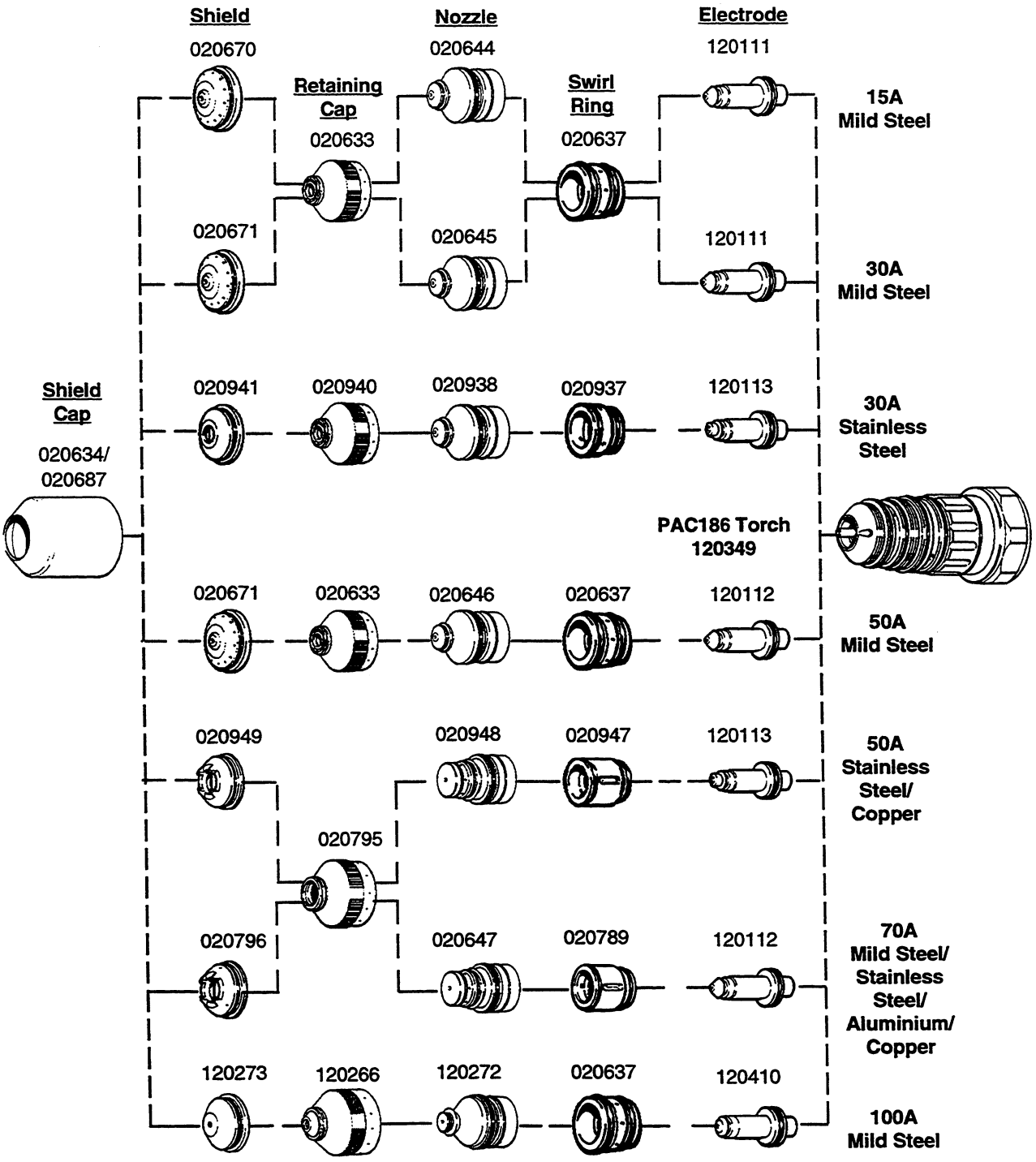


Figure 6-20 PAC186 Torch Consumable Parts

50 Amp (Stainless Steel, Copper)

020634	Cap, shield (w/o IHS tab)	1
020687	Cap, shield (w/IHS tab)	1
020949	Adapter, shield	1
020795	Cap, inner retaining	1
020948	Nozzle	1
020947	Swirl ring	1
120113	Electrode	1

70 Amp (Mild Steel, Stainless Steel, Aluminum, Copper)

020634	Cap, shield (w/o IHS tab)	1
020687	Cap, shield (w/IHS tab)	1
020796	Adapter, shield	1
020795	Cap, inner retaining	1
020647	Assembly, nozzle/shield	1
020789	Swirl ring	1
120112	Electrode	1

100 Amp (Mild Steel)

020634	Cap, shield (w/o IHS tab)	1
020687	Cap, shield (w/IHS tab)	1
120273	Adapter, shield	1
120266	Cap, inner retaining	1
120272	Assembly, nozzle	1
020637	Swirl ring	1
120410	Electrode	1

PAC186 CONSUMABLE PARTS KITS

with spare PAC186 torch (128097)*
without spare PAC186 torch (128098)**

Part Number	Description	Qty.
001067	Box, gray plastic	1
020633	Cap, inner retaining, 15/30 amp	1
020637	Swirl ring, 15/30/50 amp mild steel	1
120111	Electrode, 15/30 amp mild steel	4
020644	Nozzle, 15 amp	2
020645	Nozzle, 30 amp	2
020646	Nozzle, 50 amp mild steel	2
020670	Shield, 15 amp	1
020671	Shield, 30/50 amp mild steel	2
020796	Adapter, shield, 70 amp	2
020795	Cap, inner retaining, 70 amp	1

PARTS LIST

Part Number	Description	Qty.
020647	Assembly, nozzle/shield, 70 amp	2
020789	Swirl ring, 70 amp	1
120112	Electrode, 50 amp mild steel, 70 amp	4
120266	Cap, inner retaining, 100 amp	1
120410	Electrode, 100 amp	3
120272	Nozzle, 100 amp	3
120273	Shield, 100 amp	1
120349	Torch, PAC186*,**	1
044025	O-ring, Buna 70 Duro 1.176 X .070	1
044026	O-ring, Buna 70 Duro 1.239 X .070	1
044507	O-ring, Buna 70 Duro 1.424 X .070	1
120377	Tube, water electrode cooling	1
027055	Lubricant, silicone, 1/4 oz tube	1
004555	Tool, consumable parts	1
004745	Tool, swirl ring	1
004630	Electrode gauge assembly	1
027343	Magnifier, loupe, 10X	1
027503	Nut Driver 4.5 mm	1

Appendix A HD-3070 CNC INTERFACE SIGNAL LIST

In this appendix:

APPENDIX A

POWER SUPPLY CNC INTERFACE SIGNALS

Power Supply Connector 1X1 Standard Interface

SIGNAL	PIN #	POL	DESCRIPTION
EXTERNAL INTERLOCK INPUT	16 17 18	+ - SHLD	CNC MUST PROVIDE A CLOSED CKT TO ALLOW POWER SUPPLY OPERATION. 12Vdc, 80mA SINK REQUIRED.
1/50 ARC VOLTAGE OUTPUT	33 28 27	+ - SHLD	SIGNAL PROPORTIONAL TO ARC VOLTS 4Vdc OUTPUT WITH 200Vdc ARC. OUTPUT IS ISOLATED AND FLOATING
INTERLOCKS OK OUTPUT	35 30 24	DRY DRY SHLD	DRY CONTACT CLOSURE THAT IS CLOSED WHEN ALL POWER SUPPLY INTERLOCKS ARE SATISFIED.
TRANSFER OUTPUT	32 37 26	DRY DRY SHLD	DRY CONTACT CLOSURE THAT IS CLOSED WHEN TRANSFER OCCURS. USED TO START PIERCE COMPLETE AND MACHINE MOTION TIMING
POWER ON INPUT	29 34 23	+ - SHLD	CNC MUST PROVIDE A CLOSED CKT TO POWER UP THE POWER SUPPLY. CNC SHOULD MAINTAIN UNTIL INTERLOCKS OK OUTPUT BECOMES ACTIVE AND THEN REMOVE. IF INTERLOCKS OK OUTPUT IS NOT RECEIVED IN A REASONABLE TIME (20 SEC) THEN CHECK INDIVIDUAL INTERLOCKS. 12Vdc, 80mA SINK REQUIRED
PLASMA ON INPUT	15 9 14	DRY DRY SHLD	CNC MUST INITIATE DRY CONTACT CLOSURE TO START AND OPERATE PLASMA.
POWER OFF INPUT	8 4 13	+ - SHLD	CNC SHOULD PROVIDE A MOMENTARY CLOSED CIRCUIT TO POWER DOWN THE POWER SUPPLY. INPUT IS 12Vdc AND REQUIRES SINKING 80mA.

Power Supply Connector 1X1 Standard Interface (Continued)

SIGNAL	PIN #	POL	DESCRIPTION
TORCH IGNITION OUTPUT	7 3 12	DRY DRY SHLD	CONTACT WILL CLOSE WHEN PLASMA TORCH IGNITES. CAN BE USED TO LOCATE WORK BY STARTING MOTION UNTIL TRANSFER OUTPUT IS ACTIVE.
PIERCE COMPLETE INPUT	2 6 11	+ - SHLD	THIS INPUT CHANGES THE SHIELD GAS FLOW FROM THE PIERCE LEVEL TO THE CUT LEVEL. THE CNC SHOULD PROVIDE A CONTACT CLOSURE ON THIS INPUT A TIME DELAY AFTER THE TRANSFER OUTPUT BECOMES ACTIVE. 12Vdc, 3 mA
HOLD I/O INPUT/ OUTPUT	5 1 10	+ - SHLD	THE CNC CAN EXTEND THE PREFLOW TIME AND DELAY TORCH IGNITION BY PROVIDING A CONTACT CLOSURE ON THIS INPUT. THIS INPUT CAN BE USED TO SYNCHRONIZE MULTIPUL TORCHES OR PROVIDE AN ADVANCED START TO ALLOW PREFLOW DURING MACHINE MOTION BETWEEN CUTS. 12Vdc 3mA

APPENDIX A

Power Supply Connector 1X2 Standard Interface

SIGNAL	PIN #	POL	DESCRIPTION
100 AMP BCD	13	+	
80 AMP BCD	12	+	
40 AMP BCD	8	+	THESE INPUTS ARE FOR THE CNC CONTROLLER TO SET THE POWER SUPPLY CURRENT LEVEL. THE BCD DIGITS ARE MADE ACTIVE BY CONNECTING THEM TO THE SIGNAL COMMON. 12Vdc, 3mA THE POWER SUPPLY OUTPUT WILL FOLLOW THESE SET POINTS DURING A CUT TO ALLOW THE CNC TO COMPENSATE FOR CHANGES IN MACHINE MOTION.
20 AMP BCD	7	+	
10 AMP BCD	6	+	
8 AMP BCD	5	+	
4 AMP BCD	4	+	
2 AMP BCD	3	+	
1 AMP BCD	2	+	
COMMON	11	-	
SHIELD	10	SHLD	

Power Supply Connector 1X6 Timer/Counter

SIGNAL	PIN #	POL	DESCRIPTION
ARC TIME & # STARTS OUTPUT	2 3	DRY DRY	THIS CONTACT WILL CLOSE EACH TIME THE TORCH IS STARTED. THE CONTACT WILL REMAIN CLOSED UNTIL THE TORCH IS EXTINGUISHED. THIS OUTPUT IS USED TO KEEP TRACK OF OR PREDICT CONSUMABLE LIFE. # STARTS & ARC TIME
ERRORS OUTPUT	5 6	DRY DRY	THIS CONTACT WILL PULSE CLOSED (100 mS) EVERY TIME THE TORCH IS IMPROPERLY EXTINGUISHED. THE TORCH MUST REMAIN TRANSFERED DURING TURN OFF TO MAXIMIZE CONSUMABLE LIFE. THIS OUTPUT IS USED TO KEEP TRACK OF OR PREDICT CONSUMABLE LIFE.

GAS CONSOLE CNC INTERFACE SIGNALS

Gas Console Connector 3X4 CNC Interface

SIGNAL	PIN #	POL	DESCRIPTION
GAS FLOW SET 1	1	+	THESE INPUTS ARE USED BY THE CNC MACHINE TO SET THE PERCENT FLOW RATES FOR THE FIVE GAS METERING VALVES. THE BCD INPUTS ARE MADE ACTIVE BY CONNECTING THEM TO THE SIGNAL COMMON. THE DATA ON THESE LINES MUST BE SETUP AND STABLE BEFORE THE CNC ISSUES A WRITE PULSE TO LOCK IN THE SET POINT. FLOW SETPOINTS MUST BE IN THE RANGE 0 TO 100%. 12Vdc, 3mA
SET 2	2	+	
SET 4	3	+	
SET 8	4	+	
COMMON	5	+	
SET 10	6	+	
SET 20	7	+	
SET 40	8	+	
SET 80	9	+	
COMMON	10	-	
SET 100	11	+	
VALVE SELECT SELECT 1	12	+	THESE INPUTS ARE USED BY THE CNC TO DETERMINE WHICH GAS FLOW METERING VALVE IS TO BE CHANGED. THE VALVES ARE NUMBERED FROM ZERO TO FIVE CORRESPONDING TO THE NUMBERS IN THE CUT CHARTS. AN INPUT IS MADE ACTIVE BY CONNECTING IT TO THE SIGNAL COMMON. 12Vdc, 3mA
SELECT 2	13	+	
SELECT 4	14	+	
SELECT 8	15	+	
COMMON	16	-	THE DATA ON THESE LINES MUST BE SETUP AND STABLE BEFORE THE CNC ISSUES A WRITE PULSE.
WRITE INPUT	17	+	THESE TWO SIGNALS ARE USED TO COORDINATE THE DATA TRANSFER BETWEEN THE CNC AND THE GAS

APPENDIX A

Gas Console Connector 3X4 CNC Interface (Continued)

SIGNAL	PIN #	POL	DESCRIPTION
READ COMPLETE OUTPUT	18	OPEN COLL-ECTOR	CONSOLE. THE CNC SHOULD PLACE VALID DATA ON THE GAS FLOW SET AND VALVE SELECT LINES. THE CNC SHOULD THEN ASSERT THE WRITE
COMMON	19	-	SIGNAL UNTIL A READ COMPLETE SIGNAL IS RETURNED. 12Vdc, 3mA
TEST OPERATE INPUT	21	+	THE CNC CAN ACTIVATE THIS INPUT TO FLOW CUTFLOW GAS IN A TEST MODE. 12Vdc, 3mA
TEST PREFLOW INPUT	22	+	THE CNC CAN ACTIVATE THIS INPUT TO FLOW PREFLOW GAS IN A TEST INPUT MODE. 12Vdc, 3mA
SPARE INPUT	23	+	THIS INPUT IS NOT USED.
PLASMA ALT INPUT	24	+	THE CNC WILL ACTIVATE THIS INPUT TO SELECT THE ALTERNATE (AUX-A) PLASMA GAS. 12Vdc, 3mA
SHIELD ALT INPUT	25	+	THE CNC WILL ACTIVATE THIS INPUT TO SELECT THE ALTERNATE (AUX-B) SHIELD GAS. 12Vdc, 3mA
COMMON	26	-	SIGNAL COMMON.
ERROR OUTPUT	27	OPEN COLL-ECTOR	THIS OUTPUT WILL BE ACTIVATED WHENEVER THERE IS AN ERROR DISPLAYED ON THE LCD DISPLAY.
COMMON	28	-	SIGNAL COMMON.

Appendix B GAS CONTROL BOARD DIP SWITCH FUNCTIONS

In this appendix:

APPENDIX B

GAS CONTROL BOARD DIP SWITCH FUNCTIONS

DIP SWITCH	POSITION	FUNCTION
1	OFF ON	PRESSURE DISPLAY IN (PSI) PRESSURE DISPLAY IN (bar)
2		NOT USED
3	OFF ON	NORMAL OPERATION ALL VALVES MOVE TO ZERO POSITION
4	OFF ON	NORMAL OPERATION ALL VALVES MOVE TO FULL SCALE POSITION

Appendix C PROPYLENE GLYCOL SAFETY DATA, BENZOTRIAZOLE SAFETY DATA

In this appendix:

MATERIAL SAFETY DATA SHEET

SECTION 1 -- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	HYPERTHERM TORCH COOLANT
PRODUCT CODE	
ISSUE DATE	11-22-96

EMERGENCY TELEPHONE NUMBERS

MANUFACTURER	**HYPERTHERM**	**Transportation: (703) 527-3887 ***
STREET ADDRESS	**Etna Rd.**	*** For spill, leak, fire or transport accident emergencies.**
CITY, STATE, ZIP	**Hanover, NH 03755**	**Product Information: (603) 643-5638**

SECTION 2 -- COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENT	CAS No.	% by wt.	EXPOSURE LIMITS OSHA PEL	ACGIH TLV	NIOSH REL
Propylene glycol	0057-55-6	< 50	None Established	None Established	None Established

SECTION 3 -- HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	Can cause eye and skin irritation. Harmful if swallowed..

POTENTIAL HEALTH EFFECTS	
INGESTION	Can cause irritation, nausea, stomach distress, vomiting and diarrhea.
INHALATION	May cause mild irritation of nose, throat, and respiratory tract.
EYE CONTACT	Causes eye irritation.
SKIN CONTACT	Prolonged or repeated contact may cause skin irritation.

SECTION 4 -- FIRST AID MEASURES

INGESTION	DO NOT induce vomiting, but give one or two glasses of water to drink and get medical attention.
INHALATION	No specific treatment is necessary, since this material is not likely to be hazardous by inhalation.
EYE CONTACT	Immediately flush eye with cool running water for 15 minutes. If irritation persists, get medical attention.
SKIN CONTACT	Wash with soap and water. If irritation develops or persists, get medical attention.
NOTE TO PHYSICIAN	Treatment based on judgment of the physician in response to reactions of the patient.

SECTION 5 -- FIRE FIGHTING MEASURES

FLASH POINT / METHOD	None / N.A.	FLAMMABLE LIMITS	Not flammable or combustible
EXTINGUISHING MEDIA	If involved in a fire, use foam, carbon dioxide or dry chemical extinguisher. Water may cause frothing.		
SPECIAL FIRE FIGHTING PROCEDURES	None		
FIRE AND EXPLOSION HAZARDS	None		

SECTION 6 -- ACCIDENTAL RELEASE MEASURES

RESPONSE TO SPILLS	Small spills: Flush into a sanitary sewer. Mop up residue and rinse area thoroughly with water. Large spills: Dike or dam the spill. Pump into containers or soak up on inert absorbent.

SECTION 7 -- HANDLING AND STORAGE

HANDLING PRECAUTIONS	Keep container in upright position.
STORAGE PRECAUTIONS	Store in a cool dry place. Keep from freezing.

SECTION 8 -- EXPOSURE CONTROLS / PERSONAL PROTECTION

HYGIENIC PRACTICES	Normal procedures for good hygiene.
ENGINEERING CONTROLS	Good general ventilation should be sufficient to control airborne levels. Facilities using this product should be equipped with an eyewash station.

PERSONAL PROTECTIVE EQUIPMENT

X	**RESPIRATOR**	Recommended for prolonged use in confined areas with poor ventilation
X	**GOGGLES / FACE SHIELD**	Recommended; goggles should protect against chemical splash
	APRON	Not necessary
X	**GLOVES**	Recommended; PVC, Neoprene or Nitrile acceptable
	BOOTS	Not necessary

SECTION 9 -- PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Clear liquid	BOILING POINT	160 deg F
ODOR	Not Appreciable	FREEZING POINT	Not established
pH	4.6-5.0(100% concentrate)	VAPOR PRESSURE	Not applicable
SPECIFIC GRAVITY	1.0	VAPOR DENSITY	Not applicable
SOLUBILITY IN WATER	Complete	EVAPORATION RATE	Not determined

SECTION 10 -- STABILITY AND REACTIVITY

CHEMICAL STABILITY		**STABLE**	X		**UNSTABLE**	
CONDITIONS TO AVOID	No special precautions beyond standard safe industrial practices.					
INCOMPATIBILITY	Avoid contact with strong mineral acids and strong oxidizers, including chlorine bleach.					
HAZARDOUS PRODUCTS OF DECOMPOSITION	Carbon monoxide may be formed during combustion.					
POLYMERIZATION		**WILL NOT OCCUR**	X		**MAY OCCUR**	
CONDITIONS TO AVOID	Not applicable					

SECTION 11 -- TOXICOLOGICAL INFORMATION

CARCINOGENICITY

	THIS PRODUCT CONTAINS A KNOWN OR SUSPECTED CARCINOGEN
X	**THIS PRODUCT DOES NOT CONTAIN ANY KNOWN OR ANTICIPATED CARCINOGENS ACCORDING TO THE CRITERIA OF THE NTP ANNUAL REPORT ON CARCINOGENS AND OSHA 29 CFR 1910, Z**

OTHER EFFECTS

ACUTE	Not determined
CHRONIC	Not determined

SECTION 12 -- ECOLOGICAL INFORMATION

BIODEGRADABILITY		CONSIDERED BIODEGRADABLE	X	NOT BIODEGRADABLE	
BOD / COD VALUE	Not established				
ECOTOXICITY	No data available				

SECTION 13 -- DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD	Product that cannot be used according to the label must be disposed of as a hazardous waste at an approved hazardous waste management facility. Empty containers may be triple rinsed, then offered for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.							
RCRA CLASSIFICATION	NO							
RECYCLE CONTAINER		YES	X		CODE	2 - HDPE	NO	

SECTION 14 -- TRANSPORT INFORMATION

DOT CLASSIFICATION		HAZARDOUS		NOT HAZARDOUS	X
DESCRIPTION	Not applicable				

SECTION 15 -- REGULATORY INFORMATION

USA REGULATORY STATUS

	EPA REGISTERED (UNDER FIFRA)	
	FDA REGULATED	
	KOSHER	
	SARA TITLE III MATERIAL	
	USDA AUTHORIZED	

SECTION 16 -- OTHER INFORMATION

NFPA CLASSIFICATION

1	BLUE	HEALTH HAZARD
1	RED	FLAMMABILITY
0	YELLOW	REACTIVITY
--	WHITE	SPECIAL HAZARD

Information contained in this MSDS refers only to the specific material designated and does not relate to any process or use involving other materials. This information is based on data believed to be reliable, and the Product is intended to be used in a manner that is customary and reasonably foreseeable. Since actual use and handling are beyond our control, no warranty, express or implied, is made and no liability is assumed by Hypertherm in connection with the use of this information.

MATERIAL SAFETY DATA SHEET COBRATEC® 99 Powder

SECTION I

MANUFACTURER:	PMC SPECIALTIES GROUP, INC.
ADDRESS:	501 Murray Road Cincinnati, OH 45217
EMERGENCY TELEPHONE:	(513) 242-3300
FOR TRANSPORTATION EMERGENCY:	(800) 424-9300
CHEMICAL NAME AND SYNONYMS:	1-H Benzotriazole, Benzotriazole
TRADE NAMES AND SYNONYMS:	COBRATEC® 99 Powder
CHEMICAL FAMILY:	Triazole
FORMULA:	$C_6H_5N_3$
DOT SHIPPING DESCRIPTION:	Not Regulated (Benzotriazole)
PRODUCT NUMBER:	X18BT5585

NFPA BASED RATINGS: Health: 1, Flammability: 1, Reactivity: 0
HMIS RATINGS: Health: 2, Flammability: 0, Reactivity: 0, PPE: E
WHMIS CLASSIFICATION: D-2-(B)

SECTION II INGREDIENTS

Material	CAS No.	Wt. %	Exposure Limits
Benzotriazole	95-14-7	>99	None Established

SECTION III PHYSICAL DATA

BOILING POINT:	>350° C
FREEZING POINT:	94-99° C
SPECIFIC GRAVITY:	1.36 (solid)
VAPOR PRESSURE AT 20° C:	0.04 mm Hg
VAPOR DENSITY (air=1):	4.1 (calculated)
SOLUBILITY IN WATER % BY WT at 20° C:	2.0
% VOLATILES BY VOLUME:	None
EVAPORATION RATE (Butyl Acetate = 1):	Non-volatile
APPEARANCE AND ODOR:	Off white powder. Slight characteristic odor.

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:	340° F. (CC)
AUTOIGNITION TEMPERATURE:	Not Available
FLAMMABLE LIMITS IN AIR:	LOWER: Dust MEC. 0.03 oz/(cu. ft.)
	UPPER: Not Available

EXTINGUISHING MEDIA: Carbon Dioxide, Dry Chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES: Full protective equipment including self-contained breathing apparatus should be used. Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat. During emergency conditions, overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Get medical attention.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Airborne dust is rated a severe explosion hazard at a minimum concentration of 0.03 ounce per cubic feet (30 grams per cubic meter).

SECTION V HEALTH HAZARD DATA

OSHA AIR CONTAMINANTS: Due to its dusting nature during handling, exposure to dust must comply with OSHA's particulate not otherwise regulated limits for total and respirable dust.

EFFECTS OF OVEREXPOSURE: Contact with the eyes is likely to cause severe irritation. Detailed information about the effects of overexposure in the human being is unavailable. Experience thus far has not provided any example of obvious overexposure with resultant symptoms. Animal studies have indicated an effect on the central nervous system. An NCI bioassay showed no convincing evidence of carcinogenicity (NCI-CG-TR-88). Bacterial mutagenicity data exists. Experts consider the data inconclusive. (Environmental Mutagenesis, Vol. 7, Suppl. 5: 1-248 (1985) and references in RTECS #DM1225000).

EMERGENCY AND FIRST AID PROCEDURES: IF INHALED: If affected, remove from exposure. Restore breathing. Keep warm and quiet. IF ON SKIN: Wash affected area thoroughly with soap and water. IF IN EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention. IF SWALLOWED: Never give anything by mouth to an unconscious person. Give several glasses of water. If vomiting is not spontaneous, induce vomiting. Keep airway clear. Get medical attention.

TOXICITY DATA:

Oral LD_{50} (rat)	560 mg/Kg
Primary skin Irritation (rabbit)	Not a primary skin irritant
Dermal LD_{50}	>2000 mg/Kg
Eye irritation (rabbit)	caused severe eye irritation
Bluegill Sunfish (96 hr. Tlm)	28 mg/l
Minnow (96 hr. Tlm)	28 mg/l
Trout (96 hr. LC_{50})	39 mg/l
Algae (96 hr. EC_{50})	15.4 mg/l
Daphnia magna (48 hr. LC_{50})	141.6 mg/l

SECTION VI REACTIVITY DATA

STABILITY: Stable
INCOMPATIBILITY: Oxidizing Agents
HAZARDOUS DECOMPOSITION PRODUCTS: BY FIRE: Carbon Dioxide, Carbon Monoxide Nitrogen oxides, HCN in reducing atmospheres
HAZARDOUS POLYMERIZATION: Will Not occur

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED: If local high concentration of airborne dust occurs, dampen spill with water and ventilate to disperse dust laden air. Sweep up spill and reclaim or place in a covered waste disposal container.
WASTE DISPOSAL METHOD: Sanitary landfill or incinerate in approved facilities in accordance with local, state, and federal regulations. Do not heat or incinerate in closed containers.

SECTION VIII SPECIAL PROTECTIVE INFORMATION

RESPIRATORY PROTECTION: If personal exposure cannot be controlled below applicable exposure limits by ventilation, wear respiratory devices approved by NIOSH/MSHA for protection against organic vapors, dusts, and mists.

VENTILATION: Local exhaust recommended for dust control.
PROTECTIVE GLOVES: Recommended to avoid skin contact, Rubber, Vinyl
EYE PROTECTION: Use safety goggles where airborne dust is a problem.
OTHER PROTECTIVE EQUIPMENT: Safety shower, eye wash

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Store in a cool, dry area. Keep containers tightly closed when not in use. Avoid creating airborne dust concentrations which could constitute a potential dust explosion hazard. Avoid contact with skin, eyes, and clothing. Avoid inhalation of dust and vapor. DO NOT TAKE INTERNALLY. Clean up spills immediately.

SECTION X REGULATORY STATUS

Benzotriazole (CAS No. 95-14-7) is contained on the following chemical lists:

1. TSCA Section 8(a)/40CFR 712 Preliminary Assessment Information Rule
2. TSCA Section 8(d) Health and Safety Data Rule
3. NTP Testing Program
4. Massachusetts Substance List
5. Canadian Domestic Substance List
6. WHMIS Ingredient Disclosure List
7. TSCA Inventory List

PREPARED: August 28, 1995
SUPERSEDES: May 25, 1994

Appendix D TIMER-COUNTER

In this appendix:

APPENDIX D

INTRODUCTION

This appendix will enable a technician to install the optional timer-counter to the HD-3070 plasma cutting system. The timer-counter consists of the timer-counter and control cable.

WARNING - HIGH VOLTAGE!

Power supply must be disconnected before installation.

INSTALLATION

1. Mount the timer-counter for easy access, refer to Figure d-1 for dimensions. For fixed mounting of the timer-counter, four mounting holes are located on the bottom.

2. Interface the timer-counter to the power supply with the current setpoint cable by referring to Section 3, *Installation*, page 3-23 and Figure 3-19 and the current setpoint cable lengths and wire run list on Figure 3-20.

OPERATION

Controls and Indicators (Figure d-2)

Each LCD unit is self-powered by a three-volt lithium battery. When the battery weakens (three to five years) the unit will operate erratically. Replace the faulty LCD unit.

- **STARTS** LCD Counter (w/Reset)
  Indicates the number of arc starts.

- **ARC TIME** LCD Elasped Time Meter
  Indicates the cumlative time that the arc is on hours.

- **ERRORS** LCD Counter (w/Reset)
  Indicates the number of arc errors that have occured. Any of the following four error codes will cause the error counter to increment. Refer to Section 5, *Maintenance* for more information on the error codes.

  Lost Transferred Current During Ramp Up
  Arc was extinguished after the current transferred to the workpiece, but before steady-state operation.

  Lost Set Transferred Current
  Arc was lost during steady-state operation.

  Over Voltage During Steady-State Operation
  During steady-state operation the measured arc voltage exceeded the programmed maximum allowable arc voltage for the set current.

  Lost Current During Ramp Down
  Arc was lost during current ramp down, but before the programmed ramp down time had elapsed.

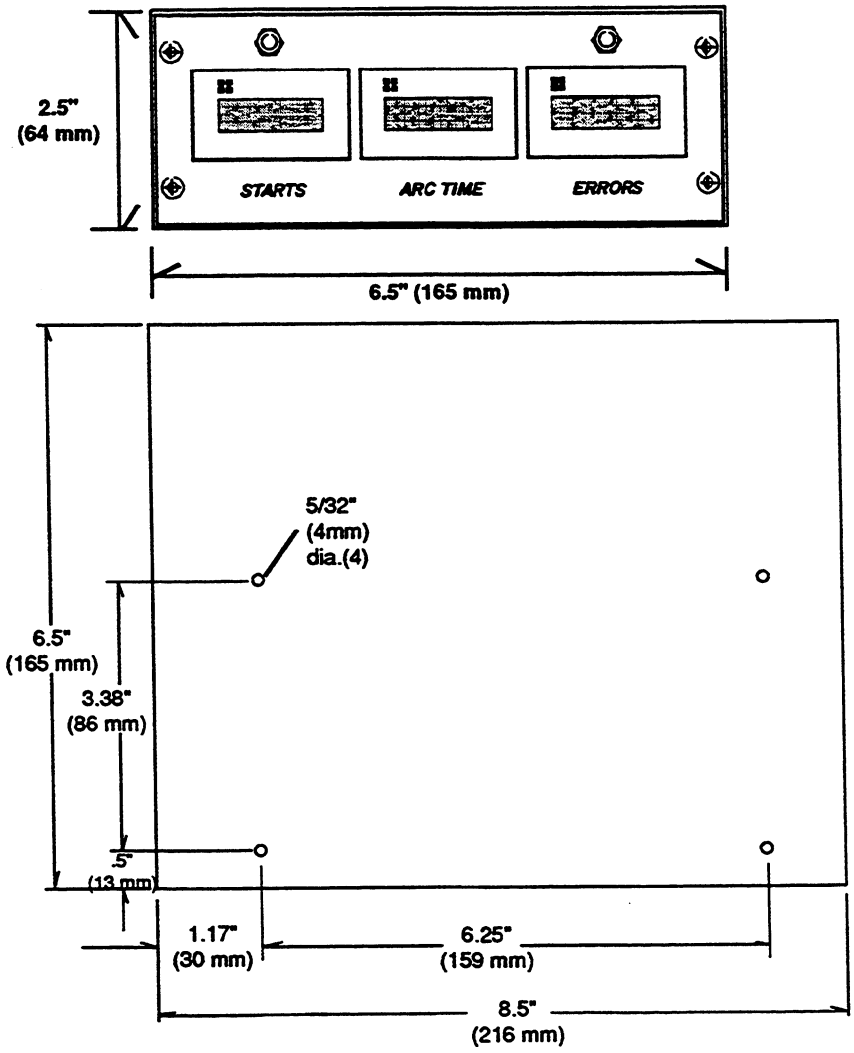


Figure d-1 Timer-Counter Dimensions and Mounting Holes

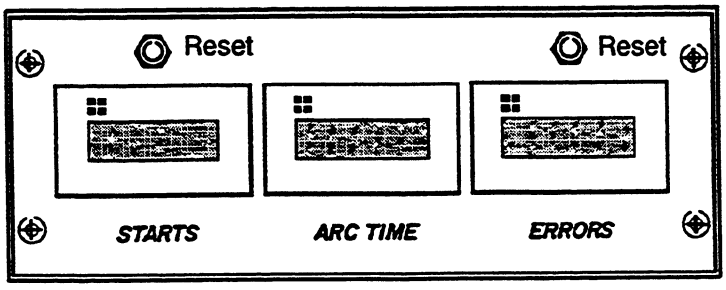


Figure d-2 Timer-Counter Controls and Indicators

APPENDIX D

TIMER-COUNTER INTERNAL WIRING

Refer to Figure d-3 for the timer-counter wiring between receptacle 5X1 and the ERROR counter, ARC TIME elasped time meter and STARTS counter.

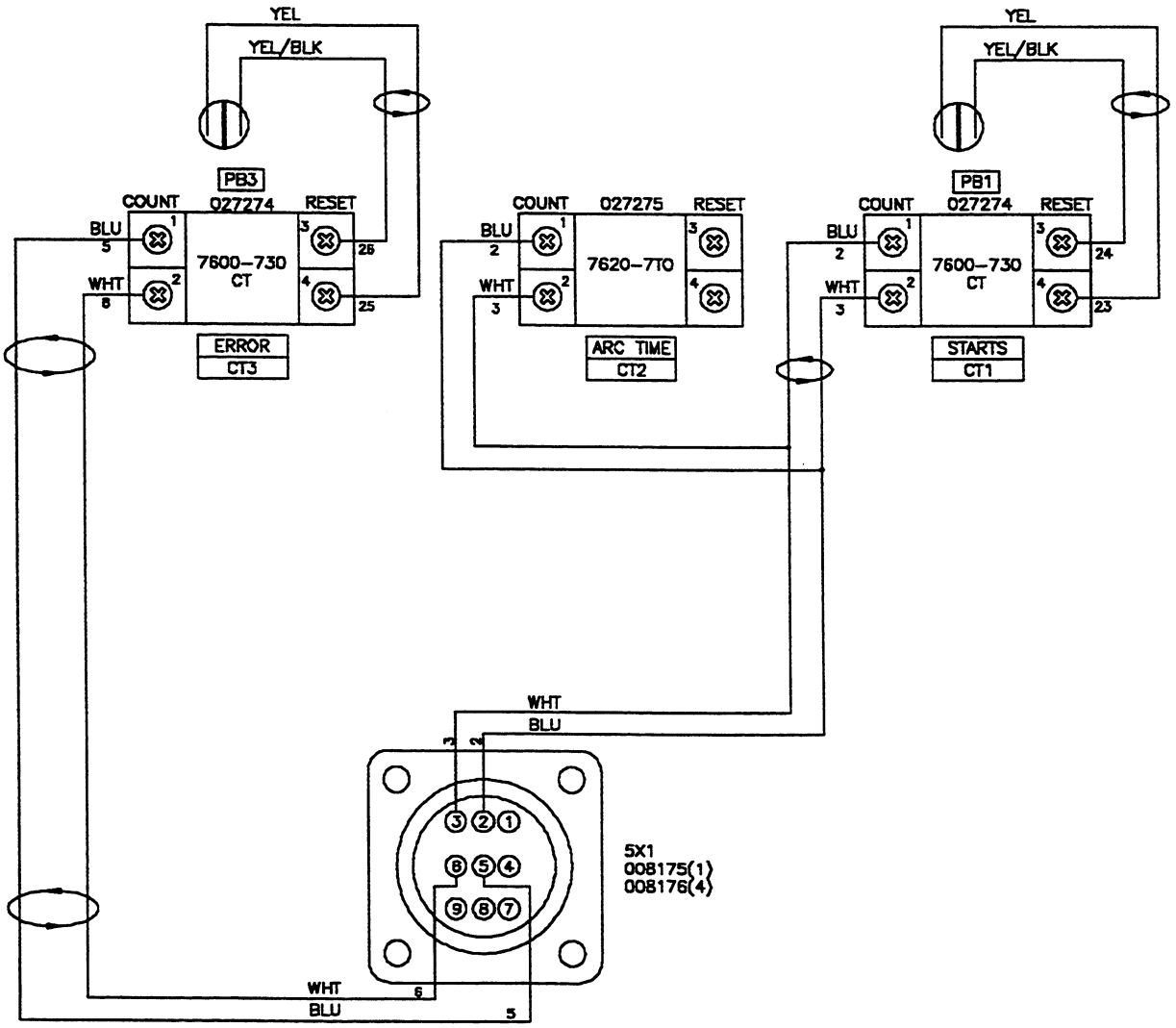


Figure d-3 Timer-Counter Internal Wiring

PARTS LIST

Item	Part Number	Description	Designator	Qty.
	078049	**Assembly, timer-counter**		**1**
1	001391	Panel, front		1
2	027274	Counter, self powered LCD	CT3	1
3	027275	Meter, elapsed time, self powered LCD	CT2	1
4	027274	Counter, self powered LCD	CT1	1
5	005161	Switch, pushbutton, SPDT	PB3	1
6	005161	Switch, pushbutton, SPDT	PB1	1
7	001513	Panel, rear		1
8	008175	Receptacle, CPC 13-9 standard sex	5X1	1
8	008176	Pin, 24-20 AWG TYPE III + CRP		4
	001068	Enclosure, timer-counter (not shown)		1

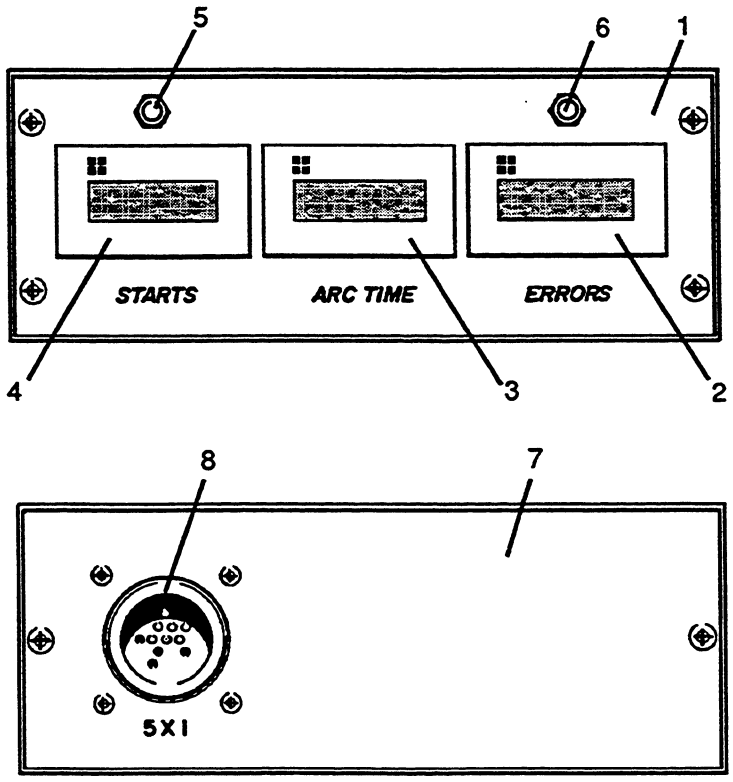


Figure d-4 Timer-Counter Component Locations

Appendix E REMOTE CURRENT CONTROL (RCC)

In this appendix:

APPENDIX E

INTRODUCTION

This appendix will enable a technician to install the optional remote current control (RCC) to the HD-3070 plasma cutting system. The RCC has two basic components: the remote current control box (078050) and the current setpoint cable. The RCC is interfaced with the power supply with the current setpoint cable.

WARNING - HIGH VOLTAGE!

Power supply must be disconnected before installation.

INSTALLATION

1. Mount the RCC for easy access. For fixed mounting of the RCC, refer to Figure e-1.

2. Interface the RCC to the power supply with the current setpoint cable by referring to Section 3, *Installation*, page 3-23 and Figure 3-19 and the current setpoint cable lengths and wire run list in Figure 3-22.

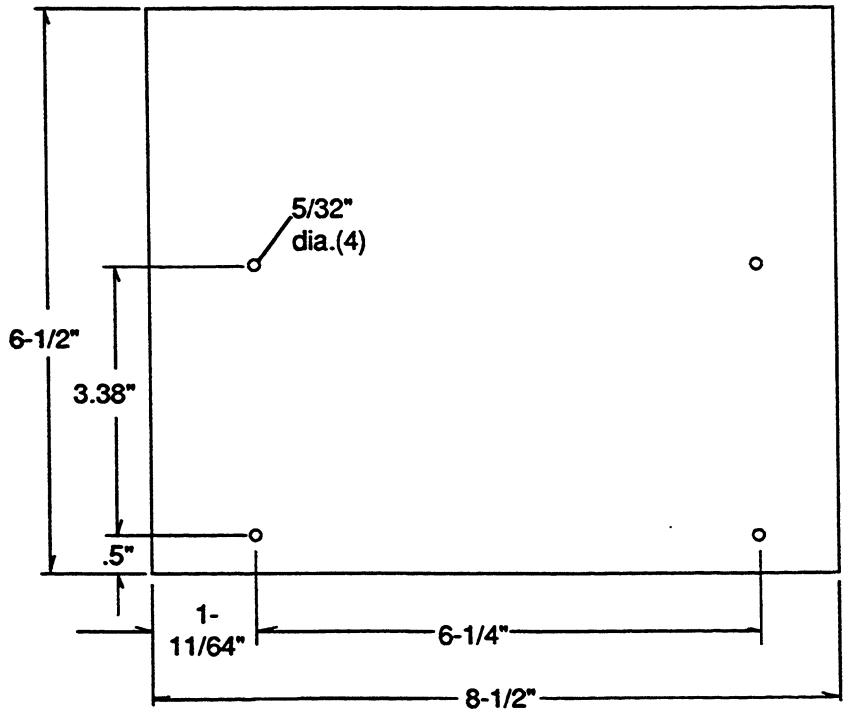
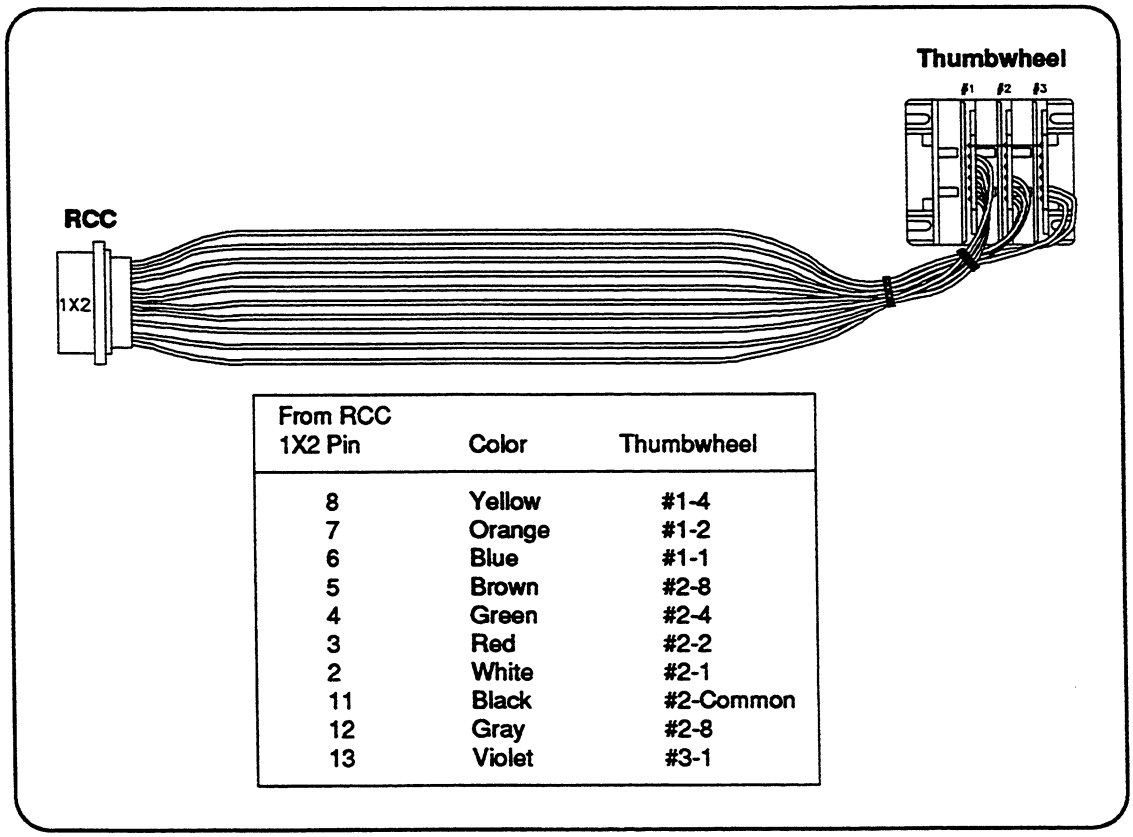


Figure e-1 RCC Mounting Dimensions

RCC 1X2 TO THUMBWHEEL SWITCH WIRING INTERFACE

Refer to Figure e-2 for wiring interface data between receptacle 1X2 and the thumbwheel switch.



From RCC 1X2 Pin	Color	Thumbwheel
8	Yellow	#1-4
7	Orange	#1-2
6	Blue	#1-1
5	Brown	#2-8
4	Green	#2-4
3	Red	#2-2
2	White	#2-1
11	Black	#2-Common
12	Gray	#2-8
13	Violet	#3-1

Figure e-2 RCC 1X2 to Thumbwheel Switch Wiring Interface

OPERATION

Set the desired current using the thumbwheel switch on the RCC. Refer to Section 4, *Operation*, for the Cut Chart data for current settings on the type and thickness of materials to be cut.

APPENDIX E

PARTS LIST

Item	Part Number	Description	Designator	Qty.
	078050	Remote Current Control, HD-3070		1
1	001514	Panel, RCC Front		1
2	005182	Switch, thumbwheel, 3-position BCD		1
3	001515	Panel, RCC Rear		1
4	008186	Socket, 24-20 AWG Type III + CRP		9
4	008208	Recptacle shell, CPC 23-37 reverse sex		1
	001068	Enclosure, RCC (not shown)		1

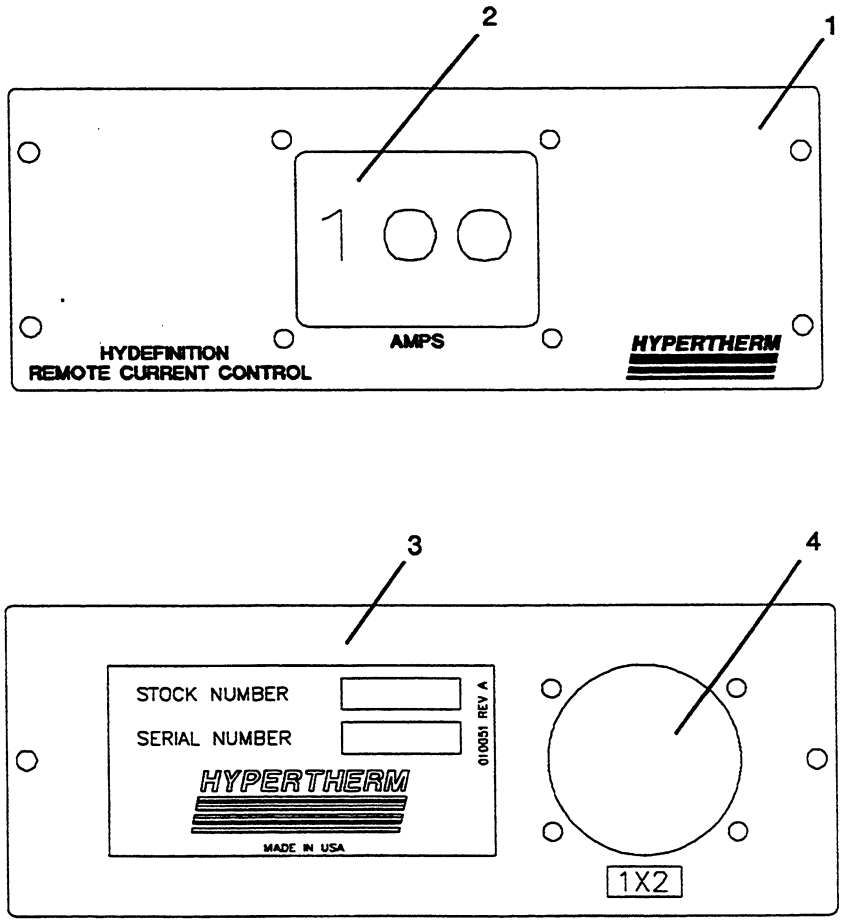


Figure e-3 RCC Component Locations

Appendix F ELECTROMAGNETIC COMPATIBILITY (EMC)

In this appendix:

APPENDIX F

EMC INTRODUCTION

This plasma cutting equipment has been built in compliance with standard EN50199. To ensure that the equipment works in a compatible manner with other radio and electronic systems, the equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN50199 may not be adequate to completely eliminate interference when the affected equipment is in close proximity or has a high degree of sensitivity. In such cases it may be necessary to use other measures to further reduce interference.

This plasma equipment should be used only in an industrial environment. It may be difficult to ensure electromagnetic compatability in a domestic environment.

INSTALLATION AND USE

The user is responsible for installing and using the plasma equipment according to the manufacturers instructions.If electromagnetic disturbances are detected then it shall be the responsibility of the user to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the cutting circuit, see *Earthing of Workpiece*. In other cases it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

ASSESSMENT OF AREA

Before installing the equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

a. Other supply cables, control cables, signalling and telephone cables; above, below and adjacent to the cutting equipment.
b. Radio and television transmitters and receivers.
c. Computer and other control equipment.
d. Safety critical equipment, for example guarding of industrial equipment.
e. Health of the people around, for example the use of pacemakers and hearing aids.
f. Equipment used for calibration or measurement.
g. Immunity of other equipment in the environment. User shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures.
h. Time of day that cutting or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

METHODS OF REDUCING EMISSIONS

Mains Supply

Cutting equipment should be connected to the mains supply according to the manufacturers recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed cutting equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the cutting mains supply so that good electrical contact is maintained between the conduit and the cutting power source enclosure

Maintenance of Cutting Equipment

The cutting equipment should be routinely maintained according to the manufacturers recommendations. All access and service doors and covers should be closed and properly fastened when the cutting equipment is in operation. The cutting equipment should not be modified in any way except for those changes and adjustments covered in the manufacturers instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Cutting Cables

The cutting cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential Bonding

Bonding of all metallic components in the cutting installation and adjacent to it should be considered. However, metallic components bonded to the workpiece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of Workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example, ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitances selected according to national regulations.

Note. The cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC TC26 (sec)94 and IEC TC26/108A/CD Arc Welding Equipment Installation and Use.

Screening and Shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire plasma cutting installation may be considered for special applications.

APPENDIX F

GENERAL

This appendix will enable a qualified electrician to install the power cable to the EMI filter on all CE 220/380/415 volt power supplies (078027).

POWER CABLE

The power cable is **customer supplied.** Refer to *Power Cable* on page 3-4 for cable information. Final specification and installation of the power cable should be made by a licensed electrician and according to national and local codes. Also, refer to *Mains Supply* on page f-2 for further power cable shielding recommendations.

Install Ring Terminals on to Power Cable Leads

1. Obtain four ring terminals that can be crimped on to the power cable leads. Terminal specifications are as follows:

   - Ring inner diameter 7.143 mm
   - Current rating of 60 amps or higher.

2. Crimp ring terminals on to leads.

WARNING - HIGH VOLTAGE!

Ensure ring terminals are securely crimped on to leads to reduce chance of arcing and shorting.

CONNECT POWER CABLE

Connect the power cable to the EMI filter first and then connect it to the line disconnect switch.

Power Supply

1. Locate the EMI filter at the lower right rear of the power supply (see Figure f-1).
2. Remove two screws to remove cover to access input voltage stud connections.
3. Remove nuts and and top washers from studs.
4. Insert the power cable through the strain relief.
5. Connect the leads to the **U**, **V**, and **W** studs and secure using nuts and washers. Ensure that all electrical connections are tight to avoid excessive heating.
6. Connect the **ground lead** to the stud directly in front of ground symbol.

APPENDIX F

Line Disconnect Switch

Connecting the power cable to the disconnect switch must conform to national and local electrical codes. This work should be performed only by qualified, licensed personnel.

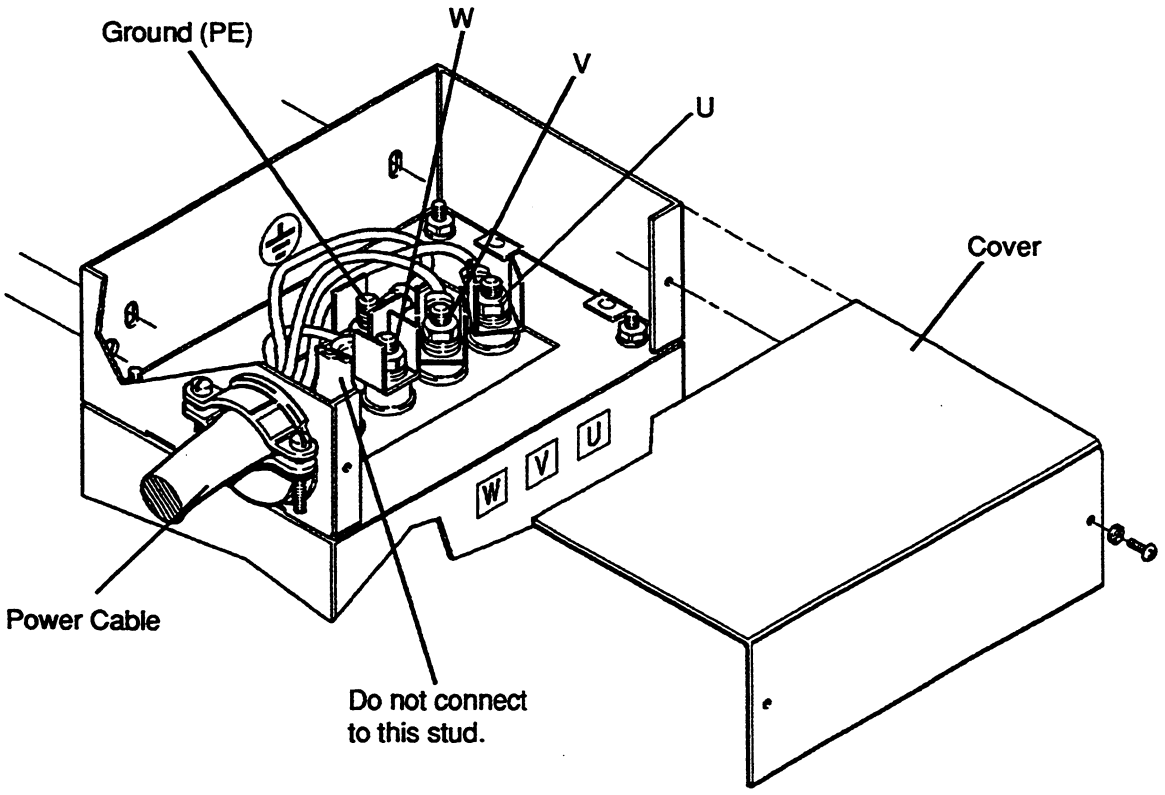


Figure f-1 Power Cable Connections to EMI Filter

EMI FILTER PARTS LIST

Item	Part Number	Description	Designator	Qty.
1	109036	Filter, 60A 2-stage AYT6C Elek		1
2	001526	Cap, end		2
3	001554	Cover, end cap		2
4	008318	Relief, strain		1

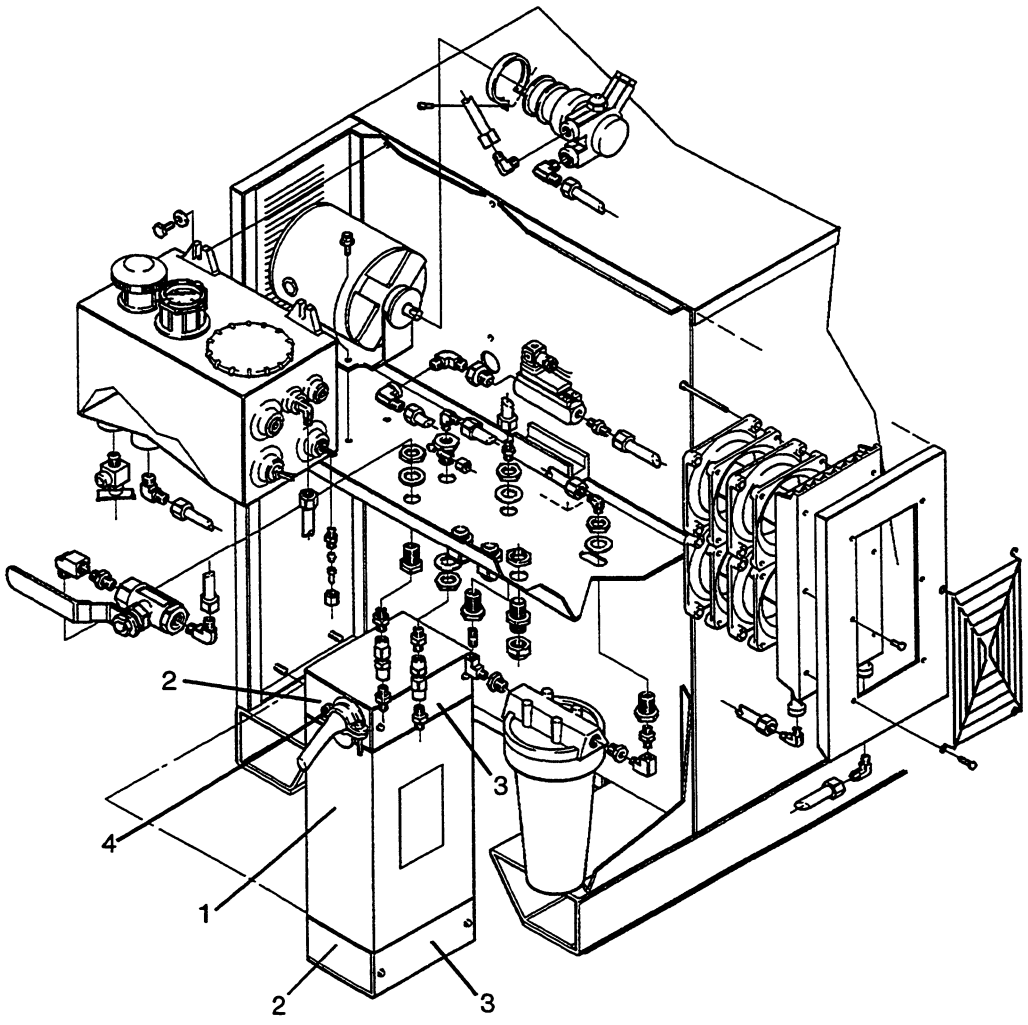
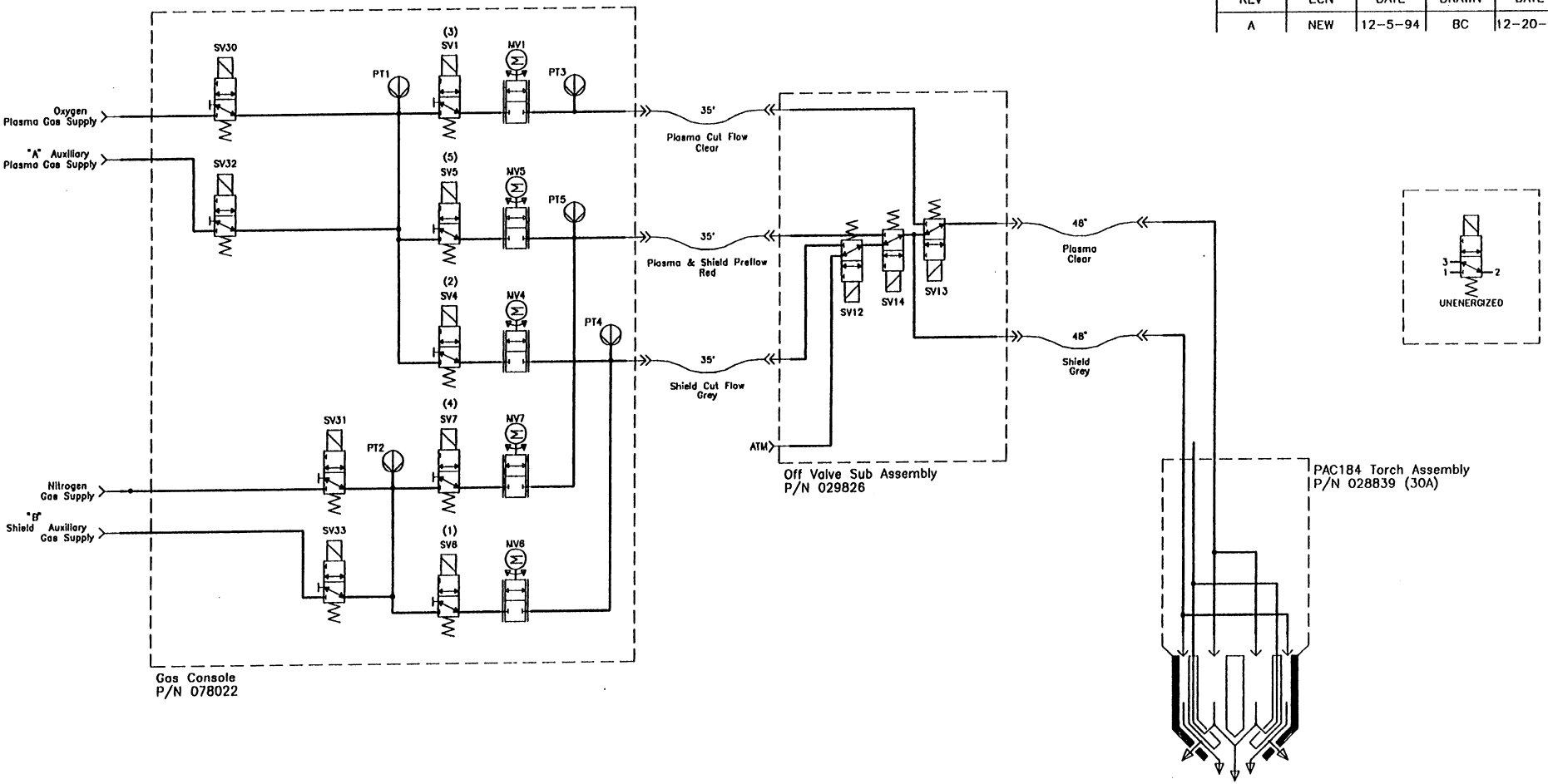


Figure f-2 EMI Filter Location

DIAGRAMS

In this section:

REVISIONS					
REV	ECN	DATE	DRAWN	DATE	APPROVED
A	NEW	12-5-94	BC	12-20-94	ZPL



SV1	Solenoid Valve, Plasma Operate
SV13	Solenoid Valve, Plasma Preflow/Operate
SV30	Solenoid Valve, Plasma O2
SV31	Solenoid Valve, Shield N2
SV4	Solenoid Valve, Shield O2 Operate
SV6	Solenoid Valve, Shield N2 Operate
SV12	Solenoid Valve, Shield Vent
SV5	Solenoid Valve, O2 Preflow
SV7	Solenoid Valve, N2 Preflow
SV14	Solenoid Valve, Shield Preflow/Operate
SV32	Solenoid Valve, Plasma Aux.
SV33	Solenoid Valve, Shield Aux.

PT1	Pressure Transducer, Oxygen Inlet
PT2	Pressure Transducer, Nitrogen Inlet
PT3	Pressure Transducer, Plasma Gas Operating
PT4	Pressure Transducer, Shield Gas Operating
PT5	Pressure Transducer, Preflow
MV1	Metering Valve, Plasma Gas Operating
MV4	Metering Valve, Shield O2 Operating
MV5	Metering Valve, O2 Preflow
MV6	Metering Valve, Shield N2 Operating
MV7	Metering Valve, N2 Preflow

MATERIAL

DRAWN BY	BC	DATE 12-5-94
CHECKED BY	NPL	DATE 12-20-94
APP. BY	ZPL	DATE 12-20-94

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
2 PL DECIMALS ±.015
3 PL DECIMALS ±.005
FRACTIONS ±1/64
BREAK SHARP CORNERS WITH CHAMFER OR RADIUS .015 MAX.

HYPERTHERM, INC.
Hypertherm, Incorporated
Box 5010 Hanover, NH 03755-5010 603/643-3441

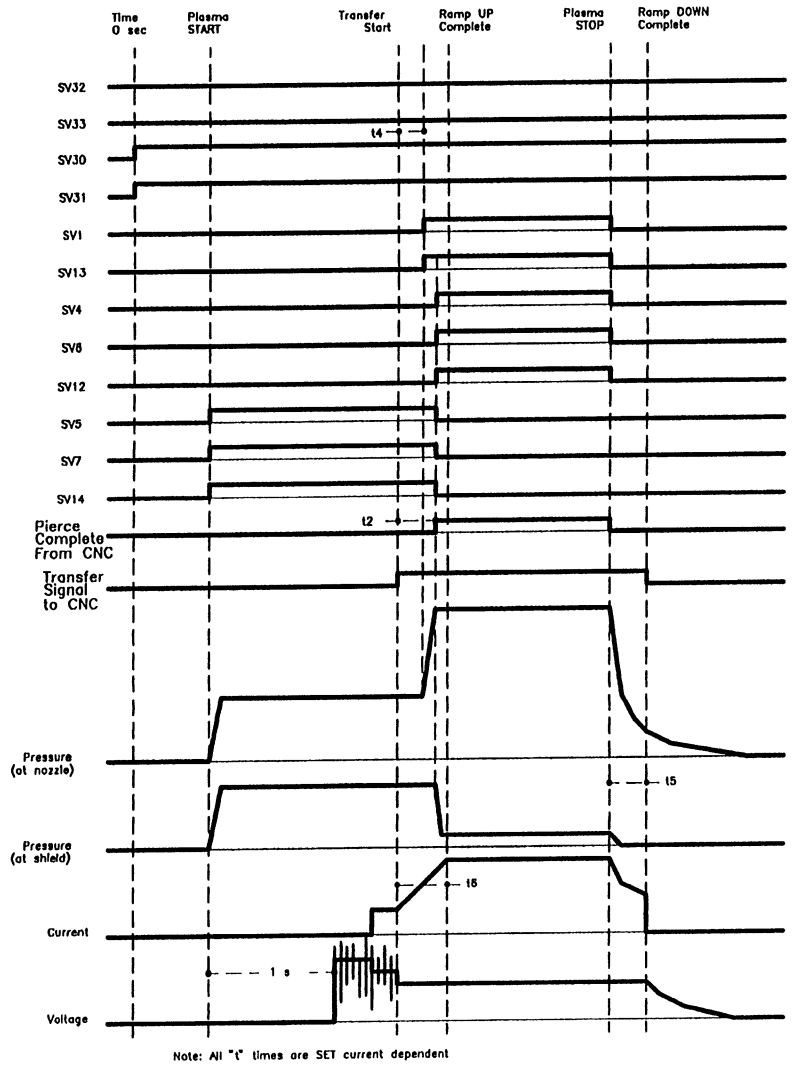
DESCRIPTION: HD3070 GAS SCHEMATIC AUTO (A)

STOCK NO.	DRAWING NO.	FILE NAME
013268	013-2-268	013268B1

SCALE	MODEL	SHEET
NONE	HD3070	1 OF 3

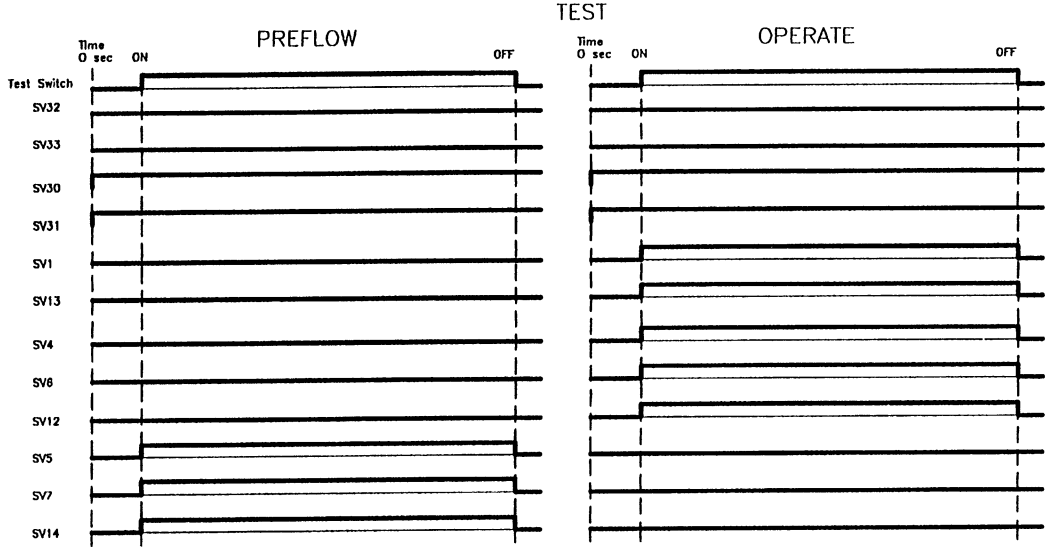
TIMING DIAGRAM
(PRIMARY GAS)

RUN



Note: All "t" times are SET current dependent

TEST



T_2 = CNC DEFINED PIERCE COMPLETE

T_4 = TRANSFER TO PLASMA GAS RAMP-UP.

T_5 = TORCH RAMP-DOWN (GAS AND CURRENT.)

T_6 = RAMP-UP OF CURRENT FROM PILOT TO OPERATE CURRENT.

SV30	Solenoid Valve, Plasma O2
SV31	Solenoid Valve, Shield N2
SV1	Solenoid Valve, Plasma Operate
SV13	Solenoid Valve, Plasma Preflow/Operate
SV4	Solenoid Valve, Shield O2 Operate
SV6	Solenoid Valve, Shield N2 Operate
SV12	Solenoid Valve, Shield Vent
SV5	Solenoid Valve, O2 Preflow
SV7	Solenoid Valve, N2 Preflow
SV14	Solenoid Valve, Shield Preflow/Operate
SV32	Solenoid Valve, Plasma Aux.
SV33	Solenoid Valve, Shield Aux.

MATERIAL	DRAWN BY BC	DATE 12-5-94
	CHECKED BY NPL	DATE 12-20-94
	APP. BY ZPL	DATE 12-20-94

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
2 PL DECIMALS ±.015
3 PL DECIMALS ±.005
FRACTIONS ±1/64
BREAK SHARP CORNERS WITH CHAMFER OR RADIUS .015 MAX.

HYPERTHERM, INC.
Hypertherm, Incorporated
Box-A10 Hanover, NH 03755 603/643-3441

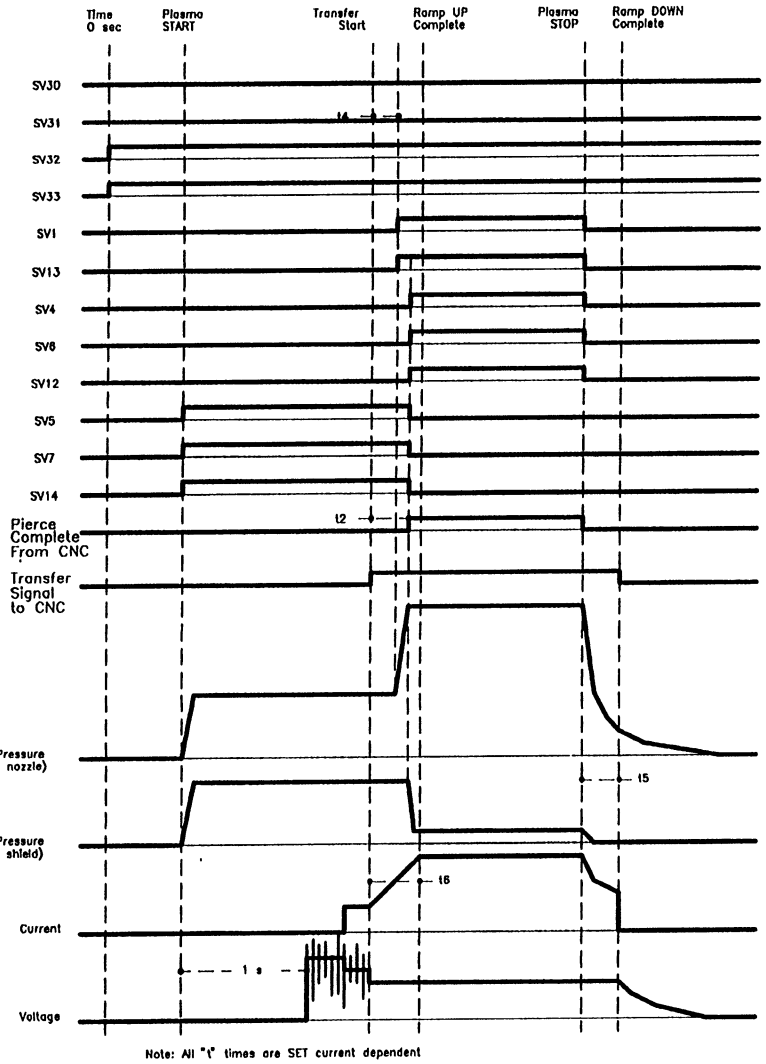
DESCRIPTION: HD3070 GAS SCHEMATIC AUTO

STOCK NO.	DRAWING NO.	FILE NAME
013268	013-2-268	013268B2

SCALE	MODEL	SHEET
NONE	HD3070	2 OF 3

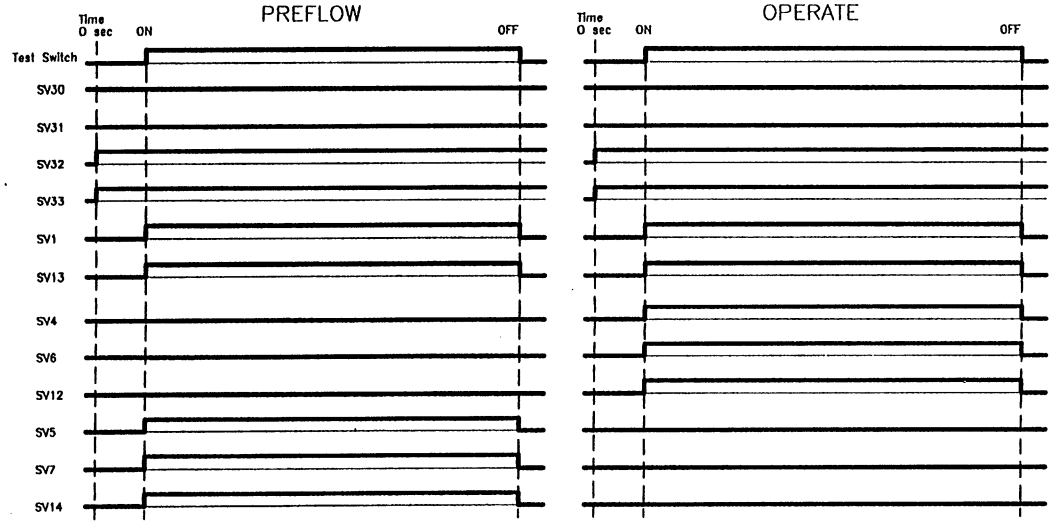
TIMING DIAGRAM
(AUX. GAS)

RUN



Note: All "t" times are SET current dependent

TEST



T_2 = CNC DEFINED PIERCE COMPLETE

T_4 = TRANSFER TO PLASMA GAS RAMP-UP.

T_5 = TORCH RAMP-DOWN (GAS AND CURRENT.)

T_6 = RAMP-UP OF CURRENT FROM PILOT TO OPERATE CURRENT.

SV30	Solenoid Valve, Plasma O2
SV31	Solenoid Valve, Shield N2
SV1	Solenoid Valve, Plasma Operate
SV13	Solenoid Valve, Plasma Preflow/Operate
SV4	Solenoid Valve, Shield O2 Operate
SV6	Solenoid Valve, Shield N2 Operate
SV12	Solenoid Valve, Shield Vent
SV5	Solenoid Valve, O2 Preflow
SV7	Solenoid Valve, N2 Preflow
SV14	Solenoid Valve, Shield Preflow/Operate
SV32	Solenoid Valve, Plasma Aux.
SV33	Solenoid Valve, Shield Aux.

MATERIAL

DRAWN BY	BC	DATE 12-5-94
CHECKED BY	NPL	DATE 12-20-94
APP. BY	ZPL	DATE 12-20-94

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
2 PL DECIMALS ±.015
3 PL DECIMALS ±.005
FRACTIONS ±1/64
BREAK SHARP CORNERS WITH CHAMFER OR RADIUS .015 MAX.

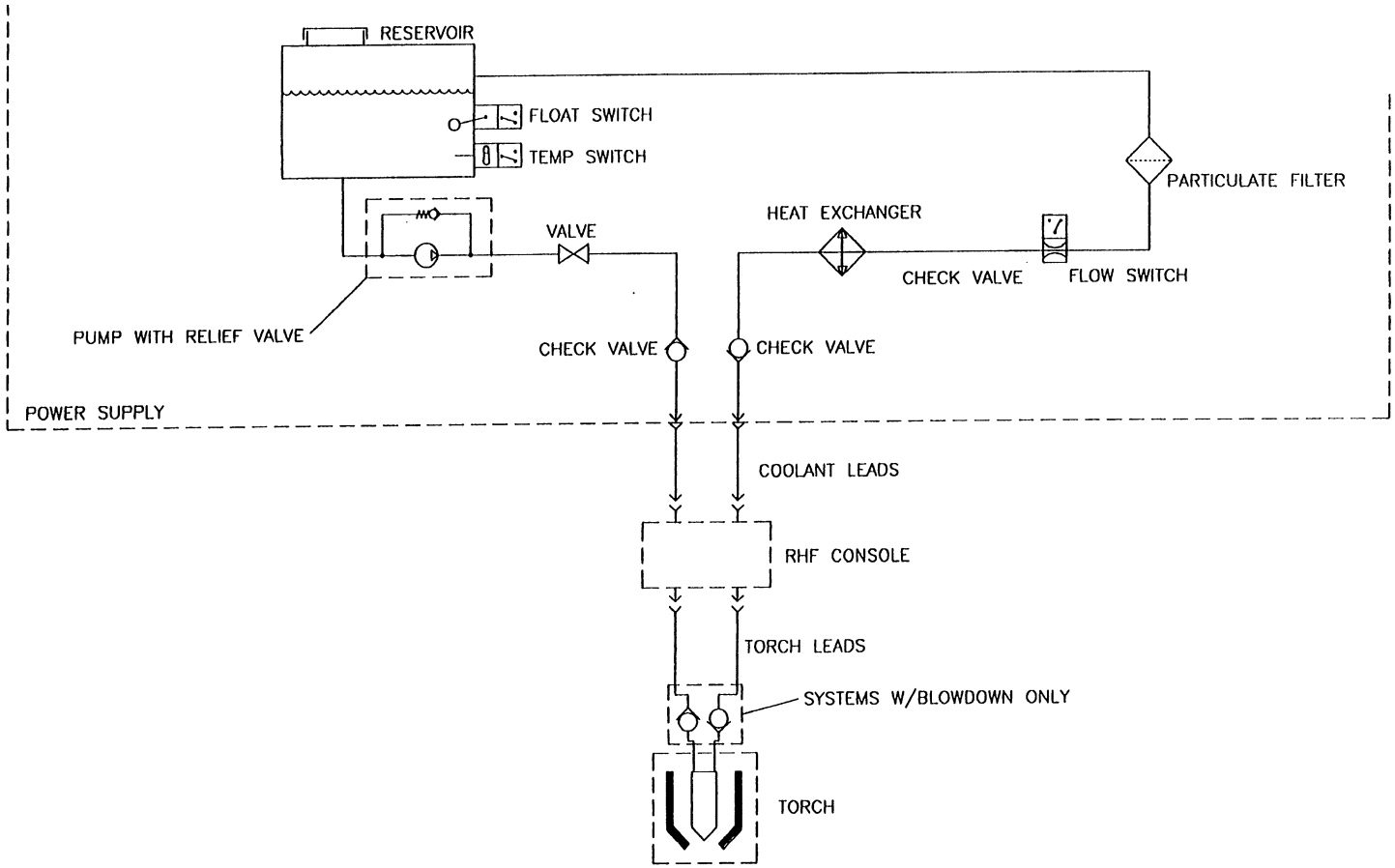
HYPERTHERM, INC.
Hypertherm, Incorporated
Box-A10 Hanover, NH 03755 603/643-3441

DESCRIPTION: HD3070 GAS SCHEMATIC AUTO (A)

STOCK NO.	DRAWING NO.	FILE NAME
013268	013-2-268	013268B3

SCALE	MODEL	SHEET
NONE	HD3070	3 OF 3

REVISIONS					
REV	ECN	DATE	DRAWN	DATE	APPROVED
A	8376	6-23-97	BC	7-2-97	EBH



MATERIAL

THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES WITHOUT PERMISSION FROM HYPERTHERM, INC.

DRAWN BY	BC	DATE 6-23-97
CHECKED BY		DATE
APP. BY	EBH	DATE 7-2-97

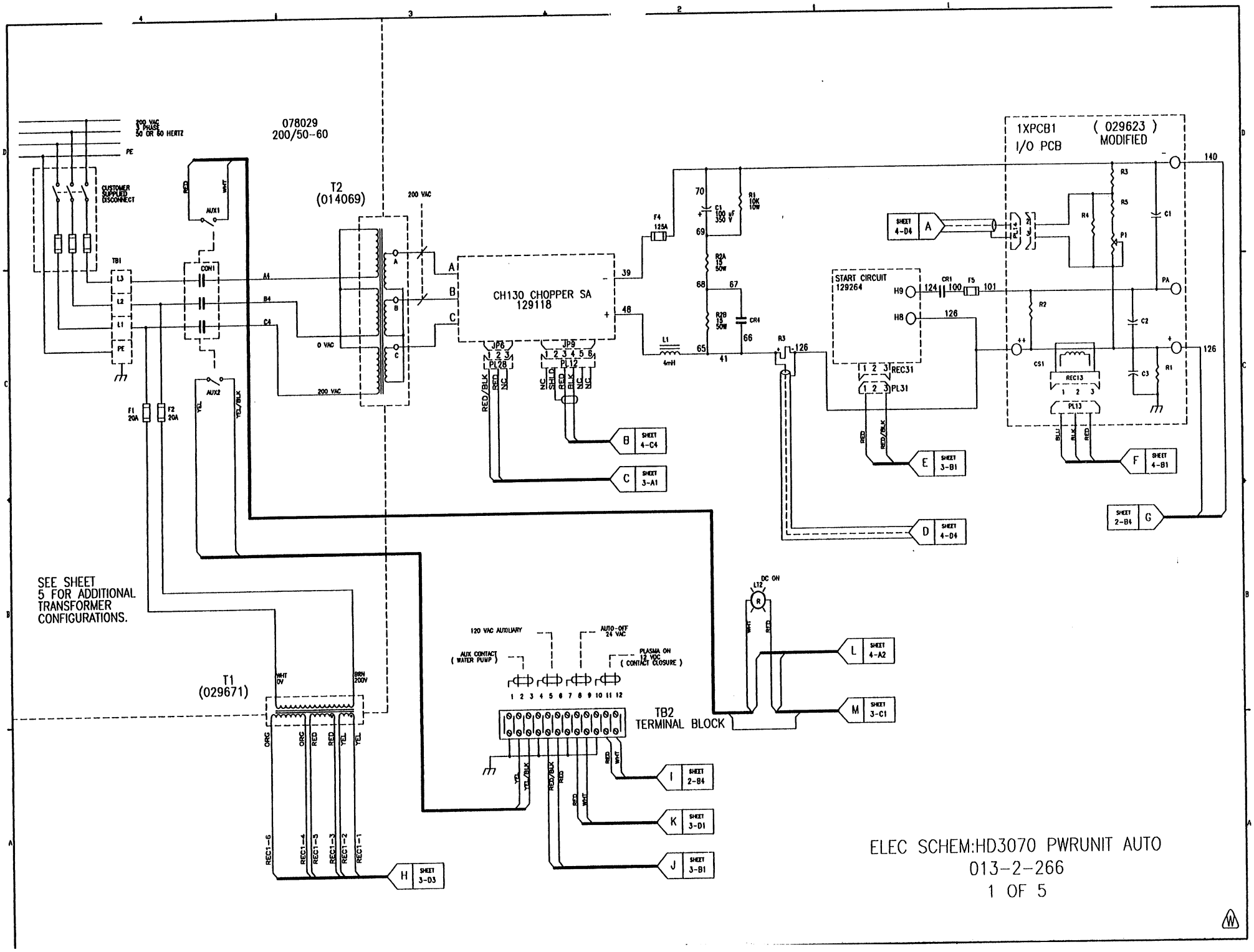
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
2 PL DECIMAL ±.01
3 PL DECIMAL ±.005
FRACTIONS ±1/64
ANGULAR ±.5°
PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015

HYPERTHERM, INC.
Hypertherm, Incorporated
Box-5010 Hanover, NH 03755-5010 603/643-3441

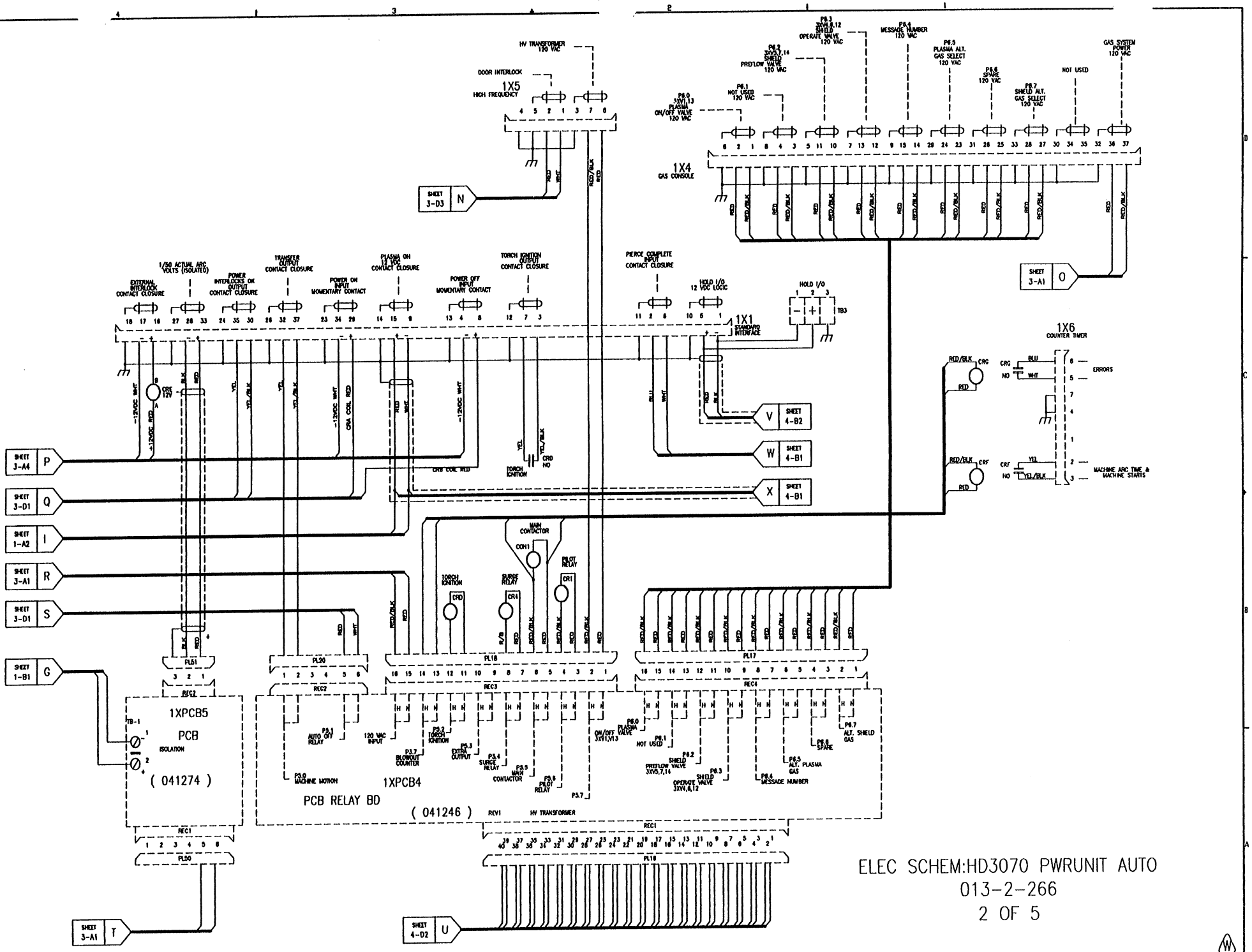
DESCRIPTION
COOLANT SA:HD3070 (A)

STOCK NO.	DRAWING NO.	FILE NAME
129255	129-2-255	129255B

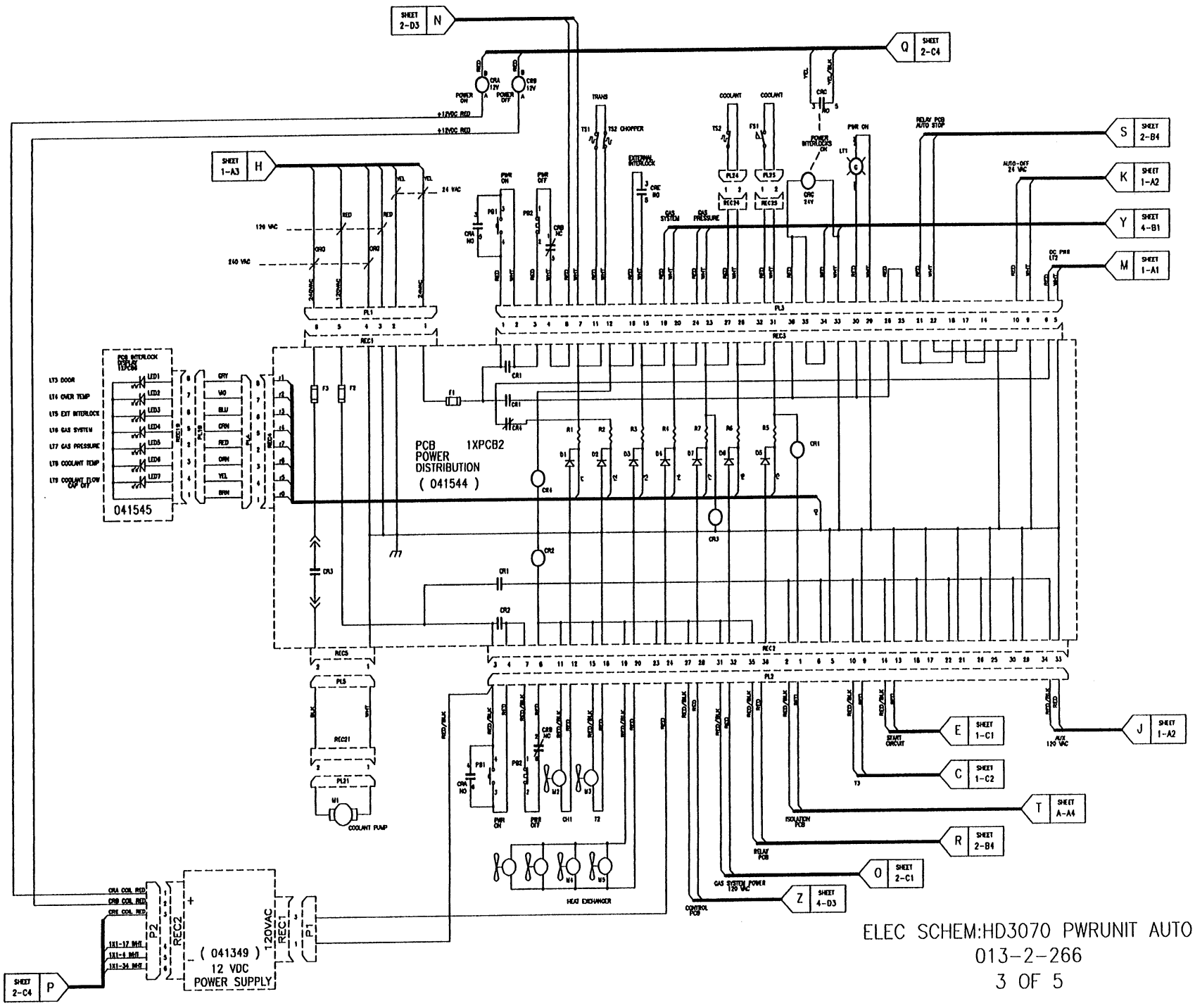
SCALE	MODEL	SHEET
N/A		1 OF 1

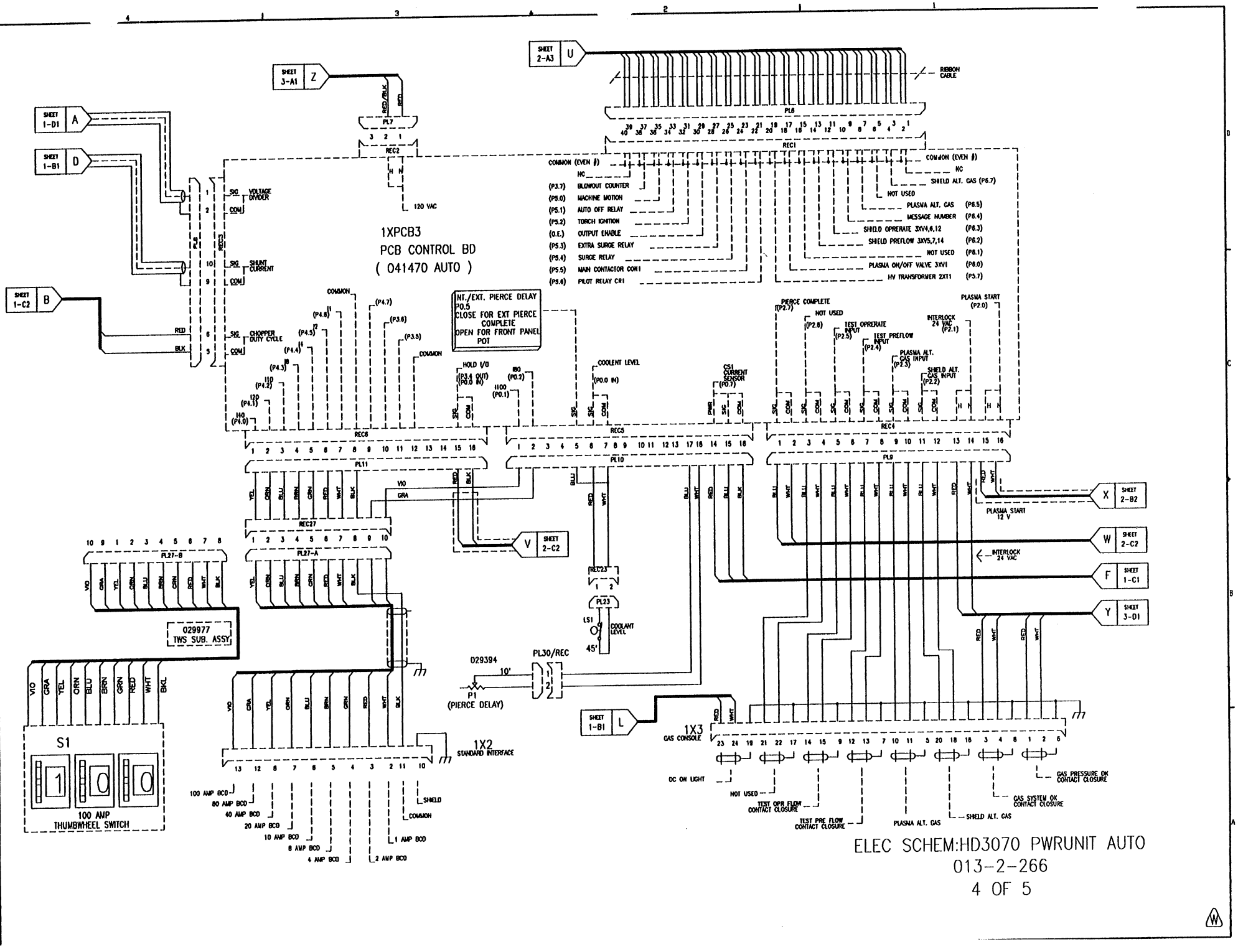


ELEC SCHEM:HD3070 PWRUNIT AUTO
013-2-266
1 OF 5

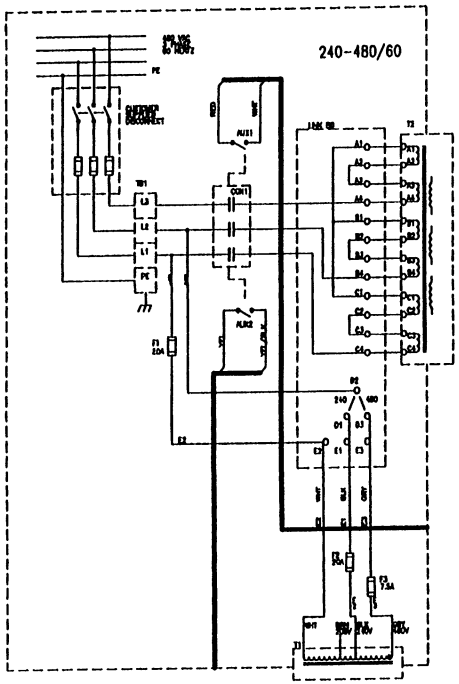


ELEC SCHEM:HD3070 PWRUNIT AUTO
013-2-266
2 OF 5

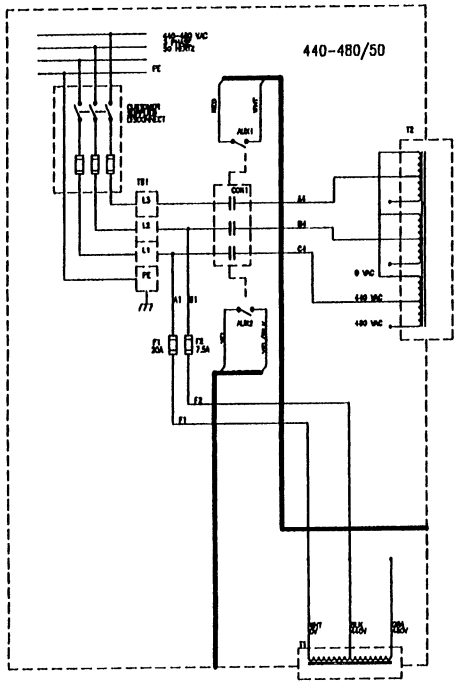

PCB 1XPCB2
POWER
DISTRIBUTION
(041544)
041545
(041349)
12 VDC
POWER SUPPLY
120VAC
ELEC SCHEM:HD3070 PWRUNIT AUTO
013-2-266
3 OF 5


1XPCB3
PCB CONTROL BD
(041470 AUTO)
INT./EXT. PIERCE DELAY
P0.5
CLOSE FOR EXT PIERCE
COMPLETE
OPEN FOR FRONT PANEL
POT
029977
TWS SUB. ASSY
S1
100 AMP
THUMBWHEEL SWITCH
029394
P1
(PIERCE DELAY)
1X2
STANDARD INTERFACE
1X3
GAS CONSOLE
ELEC SCHEM:HD3070 PWRUNIT AUTO
013-2-266
4 OF 5

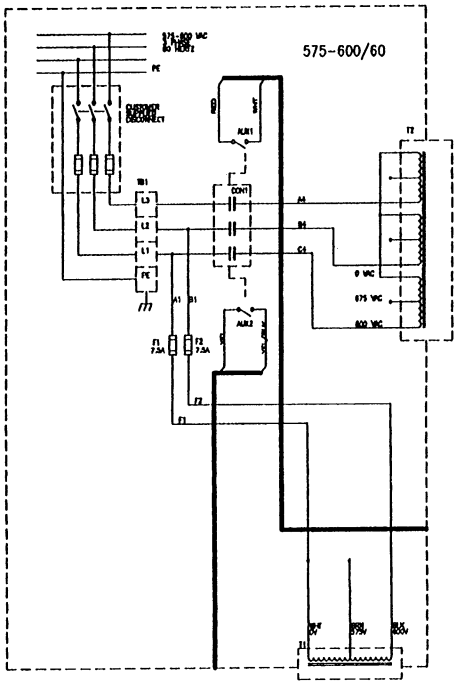
078020



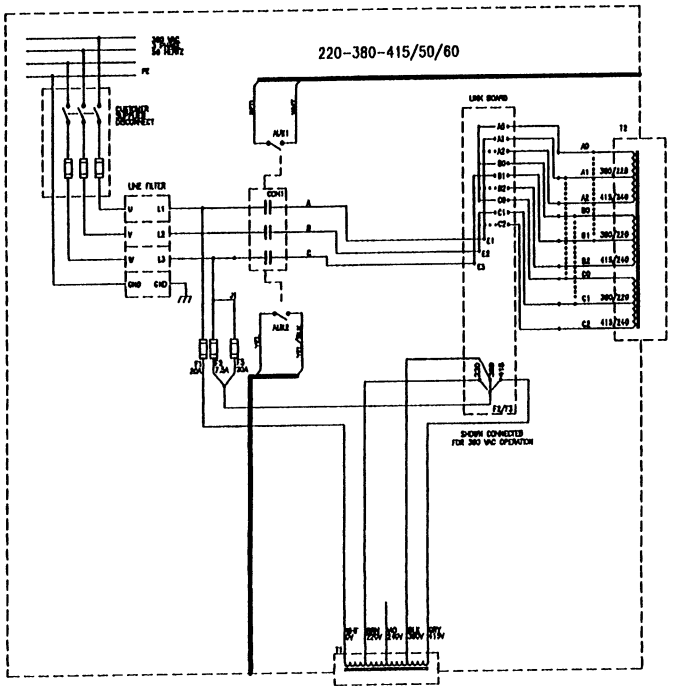
078055



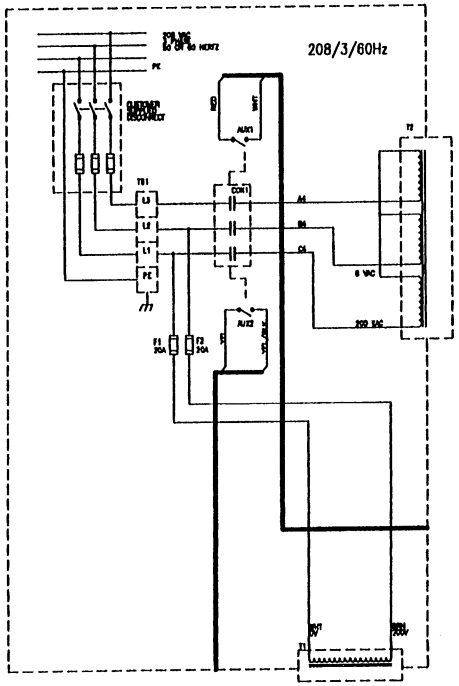
078028



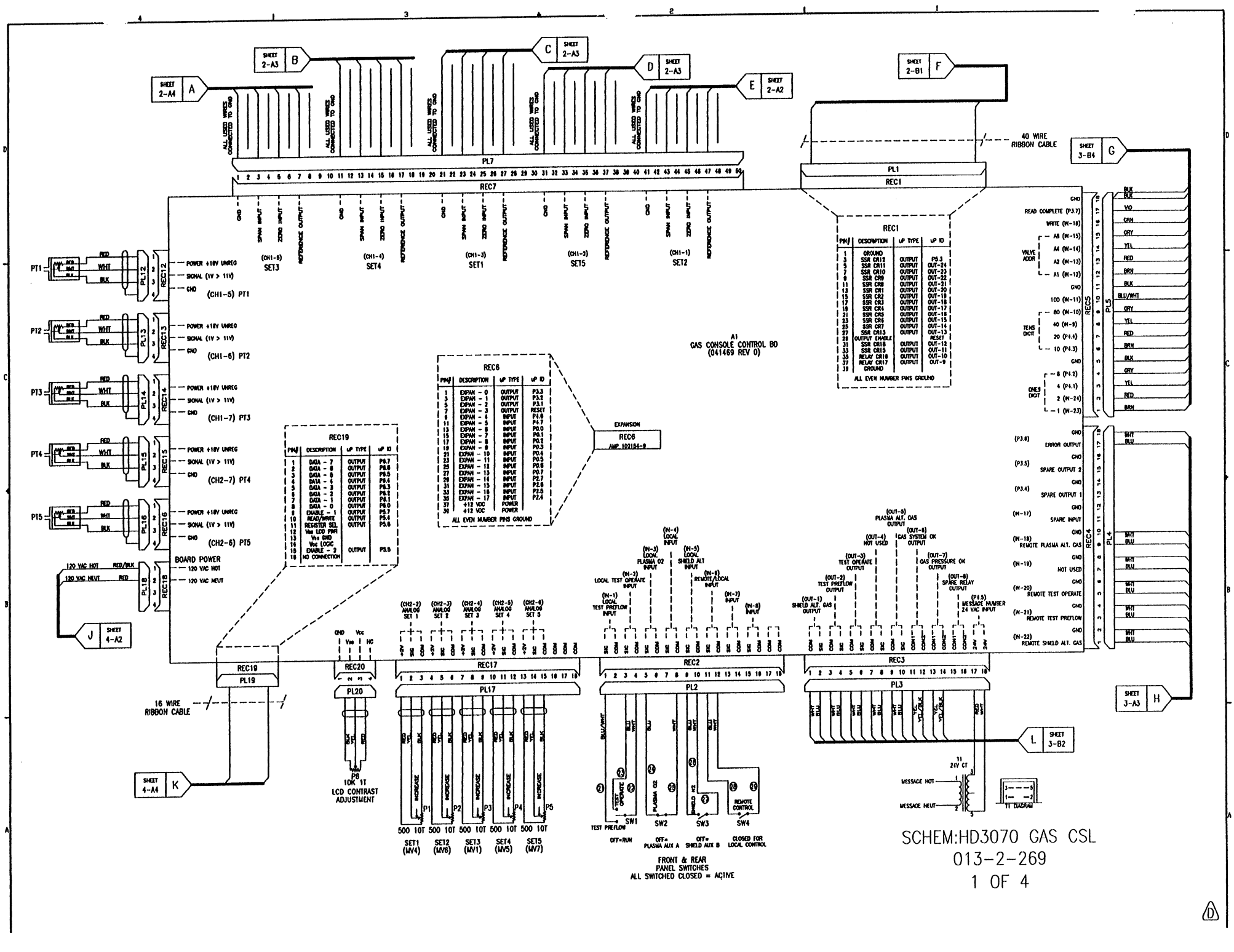
078027

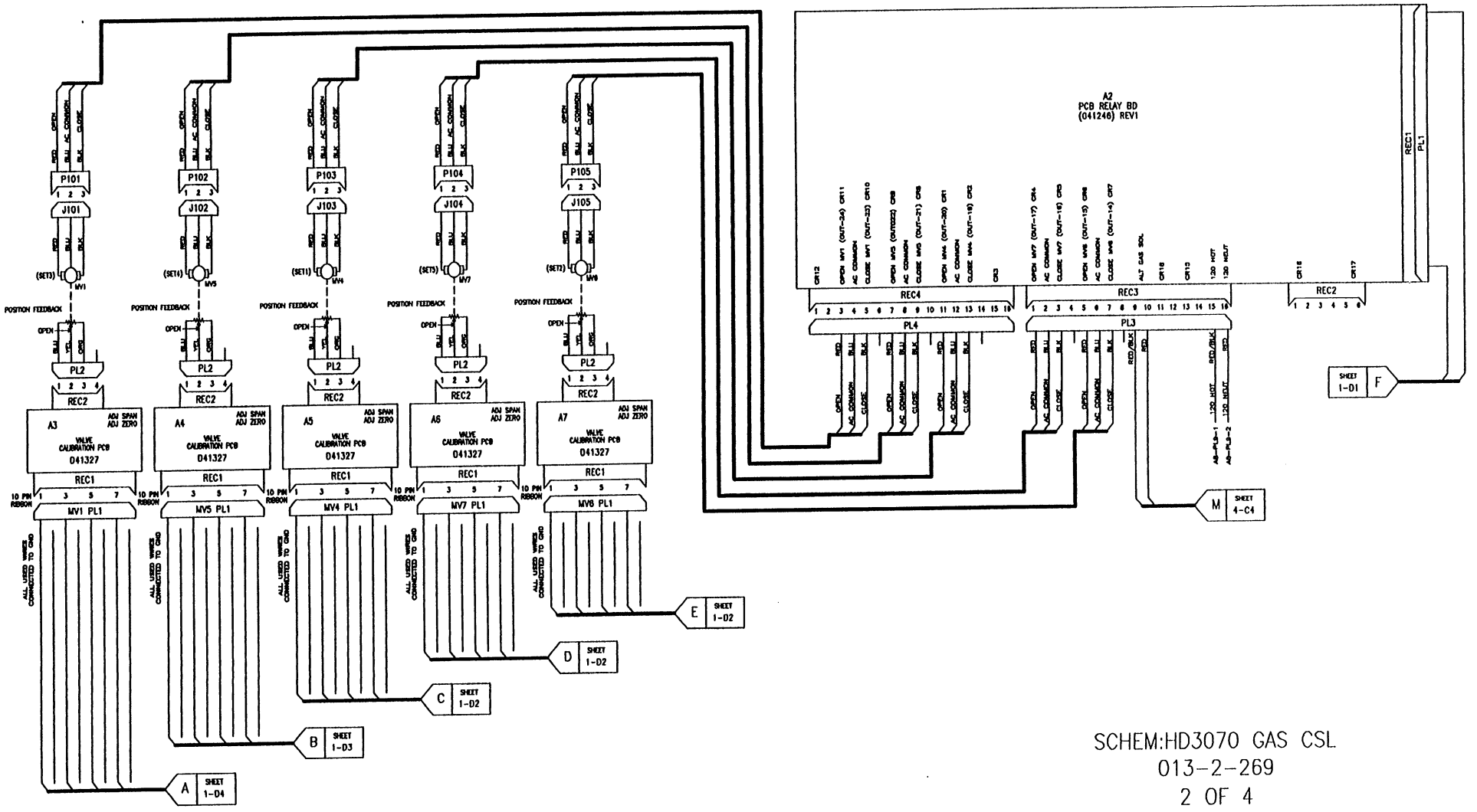


078026

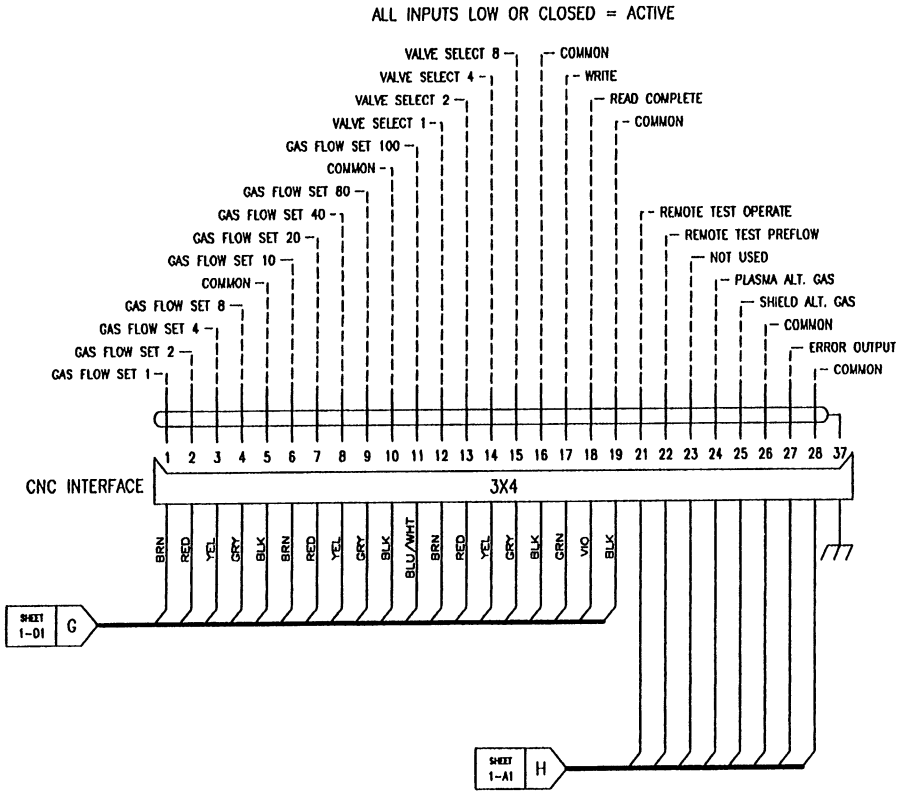


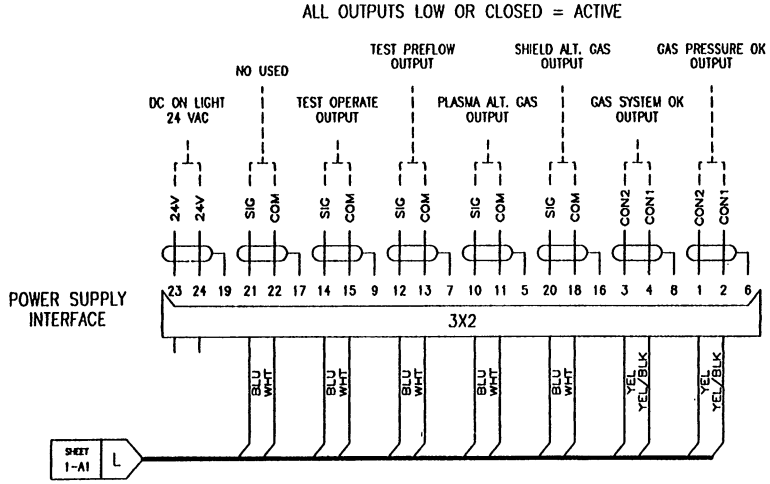
ELEC SCHEM:HD3070 PWRUNIT AUTO
013-2-266
5 OF 5


A1
GAS CONSOLE CONTROL BD
(041469 REV 0)
SCHEM:HD3070 GAS CSL
013-2-269
1 OF 4
FRONT & REAR
PANEL SWITCHES
ALL SWITCHED CLOSED = ACTIVE
40 WIRE
RIBBON CABLE
16 WIRE
RIBBON CABLE
BOARD POWER
LCD CONTRAST
ADJUSTMENT
EXPANSION
REC6
AMP 102184-9
ALL EVEN NUMBER PINS GROUND
TEST PREFLOW
OFF=RUN
OFF=
PLASMA AUX A
OFF=
SHIELD AUX B
CLOSED FOR
LOCAL CONTROL
SET1 (MV4)
SET2 (MV6)
SET3 (MV1)
SET4 (MV5)
SET5 (MV7)

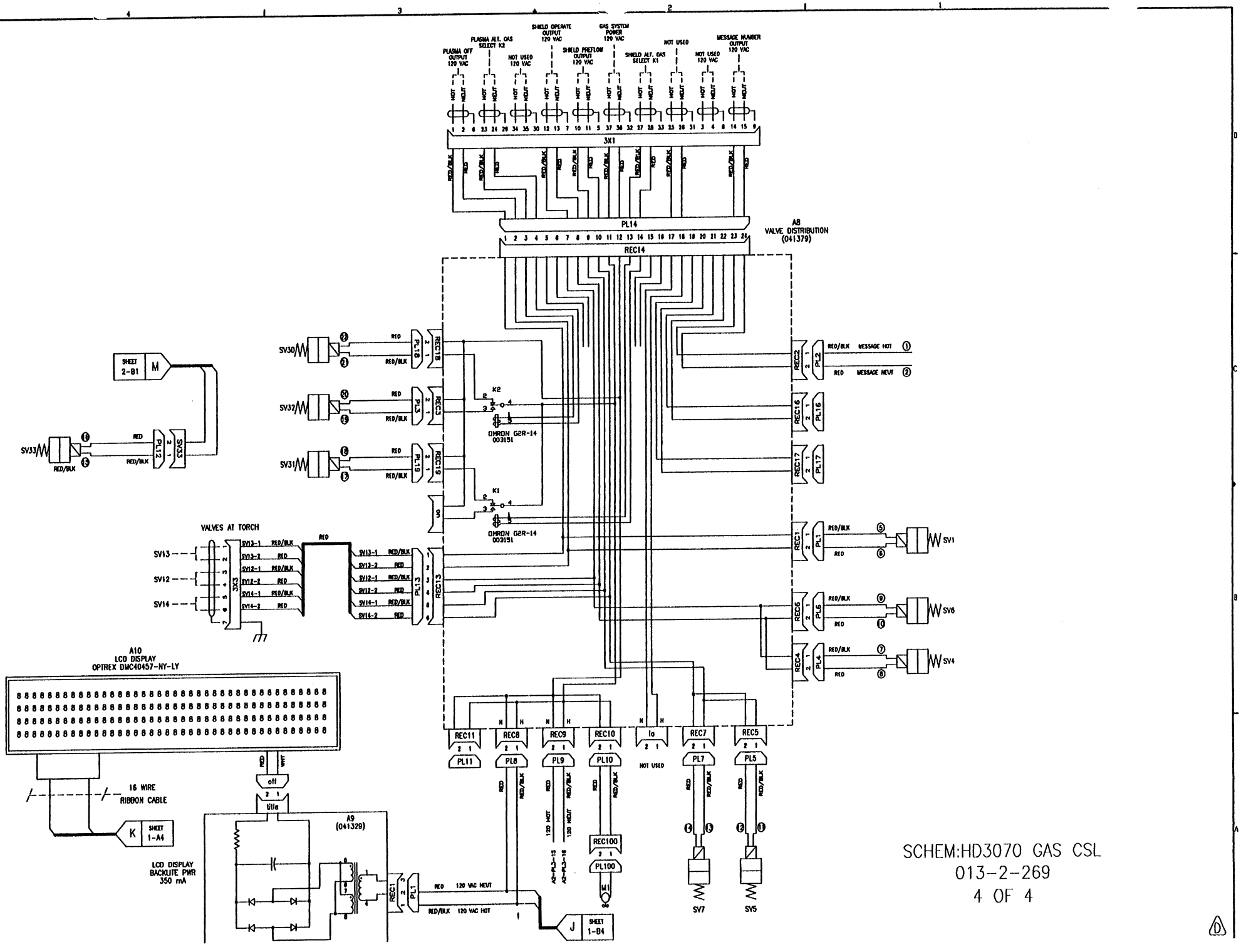


SCHEM:HD3070 GAS CSL
013-2-269
2 OF 4





SCHEM:HD3070 GAS CSL
013-2-269
3 OF 4



SCHEM:HD3070 GAS CSL
013-2-269
4 OF 4