

HyPerformance™ **HD4070®**

Instruction Manual
804900 – Revision 1

Hypertherm®

HyPerformance HD4070

Instruction Manual

(P/N 804900)

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**Hypertherm, Inc.
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EMC Introduction

Hypertherm's CE-marked equipment is built in compliance with standard EN60974-10. The equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN60974-10 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 is designed for use only in an industrial environment.

Installation and use

The user is responsible for installing and using the plasma equipment according to the manufacturer's 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 must be connected to the mains supply according to the manufacturer's 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 must be routinely maintained according to the manufacturer's 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 manufacturer's 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/TS 62081 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.

Warning

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

Warning

You are responsible for the safe use of the Product. Hypertherm does not and cannot make any guarantee or warranty regarding the safe use of the Product in your environment.

General

Hypertherm, Inc. warrants that its Products shall be free from defects in materials and workmanship, if Hypertherm is notified of a defect (i) with respect to the power supply within a period of two (2) years from the date of its delivery to you, with the exception of Powermax Series power supplies, which shall be within a period of three (3) years from the date of delivery to you, and (ii) with respect to the torch and leads within a period of one (1) year from its date of delivery to you. This warranty shall not apply to any Product which has been incorrectly installed, modified, or otherwise damaged. Hypertherm, at its sole option, shall repair, replace, or adjust, free of charge, any defective Products covered by this warranty which shall be returned with Hypertherm's prior authorization (which shall not be unreasonably withheld), properly packed, to Hypertherm's place of business in Hanover, New Hampshire, or to an authorized Hypertherm repair facility, all costs, insurance and freight prepaid. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph or with Hypertherm's prior written consent. **The warranty above is exclusive and is in lieu of all other warranties, express, implied, statutory, or otherwise with respect to the Products or as to the results which may be obtained therefrom, and all implied warranties or conditions of quality or of merchantability or fitness for a particular purpose or against infringement. The foregoing shall constitute the sole and exclusive remedy for any breach by Hypertherm of its warranty.** Distributors/OEMs may offer different or additional warranties, but Distributors/OEMs are not authorized to give any additional warranty protection to you or make any representation to you purporting to be binding upon Hypertherm.

Certification test marks

Certified products are identified by one or more certification test marks from accredited testing laboratories. The certification test marks are located on or near the data plate. Each certification test mark means that the product and its safety-critical components conform to the relevant national safety standards as reviewed by that testing laboratory. Hypertherm places a certification test mark on its products only after that product is manufactured with safety-critical components that have been authorized by the accredited testing laboratory.

Once the product has left the Hypertherm factory, the certification test marks are invalidated if any of the following occurs:

- The product is significantly modified in a manner that creates a hazard or non-conformance.
- Safety-critical components are replaced with unauthorized spare parts.
- Any unauthorized assembly or accessory that uses or generates a hazardous voltage is added.
- There is any tampering with a safety circuit or other feature that is designed into the product as part of the certification.

CE marking constitutes a manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of Hypertherm products with a CE Marking located on or near the data plate have been tested for compliance with the European Low Voltage Directive and the European EMC Directive. EMC filters needed to comply with the European EMC Directive are incorporated within versions of the power supply with a CE Marking.

Patent indemnity

Except only in cases of products not manufactured by Hypertherm or manufactured by a person other than Hypertherm not in strict conformity with Hypertherm's specifications and in cases of designs, processes, formulae, or combinations not developed or purported to be developed by Hypertherm, Hypertherm will defend or settle, at its own expense, any suit or proceeding brought against you alleging that the use of the Hypertherm product, alone and not in combination with any other product not supplied by Hypertherm, infringes any patent of any third party. You shall notify Hypertherm promptly upon learning of any action or threatened

action in connection with any such alleged infringement, and Hypertherm's obligation to indemnify shall be conditioned upon Hypertherm's sole control of, and the indemnified party's cooperation and assistance in, the defense of the claim.

Limitation of liability

In no event shall Hypertherm be liable to any person or entity for any incidental, consequential, indirect, or punitive damages (including but not limited to lost profits) regardless of whether such liability is based on breach of contract, tort, strict liability, breach of warranties, failure of essential purpose or otherwise and even if advised of the possibility of such damages.

Liability cap

In no event shall Hypertherm's liability, whether such liability is based on breach of contract, tort, strict liability, breach of warranties, failure of essential purpose or otherwise, for any claim action suit or proceeding arising out of or relating to the use of the Products exceed in the aggregate the amount paid for the Products that gave rise to such claim.

Insurance

At all times you will have and maintain insurance in such quantities and types, and with coverage sufficient and appropriate to defend and to hold Hypertherm harmless in the event of any cause of action arising from the use of the Products.

National and Local codes

National and Local codes governing plumbing and electrical installation shall take precedent over any instructions contained in this manual. **In no event** shall Hypertherm be liable for injury to persons or property damage by reason of any code violation or poor work practices.

Transfer of rights

You may transfer any remaining rights you may have hereunder only in connection with the sale of all or substantially all of your assets or capital stock to a successor in interest who agrees to be bound by all of the terms and conditions of this Warranty.

Proper disposal of Hypertherm products

Hypertherm plasma cutting systems, like all electronic products, may contain materials or components, such as printed circuit boards, that cannot be discarded with ordinary waste. It is your responsibility to dispose of any Hypertherm product or component part in an environmentally acceptable manner according to national and local codes.

- In the United States, check all federal, state, and local laws.
- In the European Union, check the EU directives, national, and local laws.
- In other countries, check national and local laws.

Register your product on-line at:

www.hypertherm.com/warranty.htm

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SAFETY

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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 in the cutting process (200 to 400 VDC are common). 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 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.



STATIC ELECTRICITY CAN DAMAGE CIRCUIT BOARDS

Use proper precautions when handling printed circuit boards.

- Store PC boards in anti-static containers.
- Wear a grounded wrist strap when handling PC boards.



TOXIC FUMES CAN CAUSE INJURY OR DEATH

The plasma arc by itself is the heat source used for cutting. Accordingly, although the plasma arc has not been identified as a source of toxic fumes, the material being cut can be a source of toxic fumes or gases that deplete oxygen.

Fumes produced vary depending on the metal that is cut. Metals that may release toxic fumes include, but are not limited to, stainless steel, carbon steel, zinc (galvanized), and copper.

In some cases, the metal may be coated with a substance that could release toxic fumes. Toxic coatings include, but are not limited to, lead (in some paints), cadmium (in some paints and fillers), and beryllium.

Gases produced by plasma cutting vary based on the material to be cut and the method of cutting, but may include ozone, oxides of nitrogen, hexavalent chromium, hydrogen, and other substances if such are contained in or released by the material being cut.

Caution should be taken to minimize exposure to fumes produced by any industrial process. Depending upon the chemical composition and concentration of the fumes (as well as other factors, such as ventilation), there may be a risk of physical illness, such as birth defects or cancer.

It is the responsibility of the equipment and site owner to test the air quality in the area where the equipment is used and to ensure that the air quality in the workplace meets all local and national standards and regulations.

The air quality level in any relevant workplace depends on site-specific variables such as:

- Table design (wet, dry, underwater).
- Material composition, surface finish, and composition of coatings.
- Volume of material removed.
- Duration of cutting or gouging.
- Size, air volume, ventilation and filtration of the work area.
- Personal protective equipment.
- Number of welding and cutting systems in operation.
- Other site processes that may produce fumes.

If the workplace must conform to national or local regulations, only monitoring or testing done at the site can determine whether the site is above or below allowable levels.

To reduce the risk of exposure to fumes:

- Remove all coatings and solvents from the metal before cutting.
- Use local exhaust ventilation to remove fumes from the air.
- Do not inhale fumes. Wear an air-supplied respirator when cutting any metal coated with, containing, or suspected to contain toxic elements.
- Assure that those using welding or cutting equipment, as well as air-supplied respiration devices, are qualified and trained in the proper use of such equipment.
- Never cut containers with potentially toxic materials inside. Empty and properly clean the container first.
- Monitor or test the air quality at the site as needed.
- Consult with a local expert to implement a site plan to ensure safe air quality.



A 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, and a welding helmet) with appropriate lens shading to protect your eyes from the arc's ultraviolet and infrared rays.

Arc current

Up to 100 A
100-200 A
200-400 A
Over 400 A



Lens shade

AWS (USA)

No. 8
No. 10
No. 12
No. 14

ISO 4850

No. 11
No. 11-12
No. 13
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.

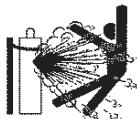
Input power

- 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.

SAFETY

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.

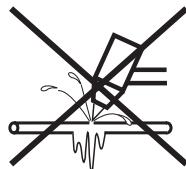
- Handle and use compressed gas cylinders in accordance with applicable national or local codes.
- Never use a cylinder that is not upright and secured in place.
- Keep the protective cap in place over valve except when the cylinder is in use or connected for use.
- Never allow electrical contact between 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.



A PLASMA ARC CAN DAMAGE FROZEN PIPES

Frozen pipes may be damaged or can burst if you attempt to thaw them with a plasma torch.



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

WARNING LABEL

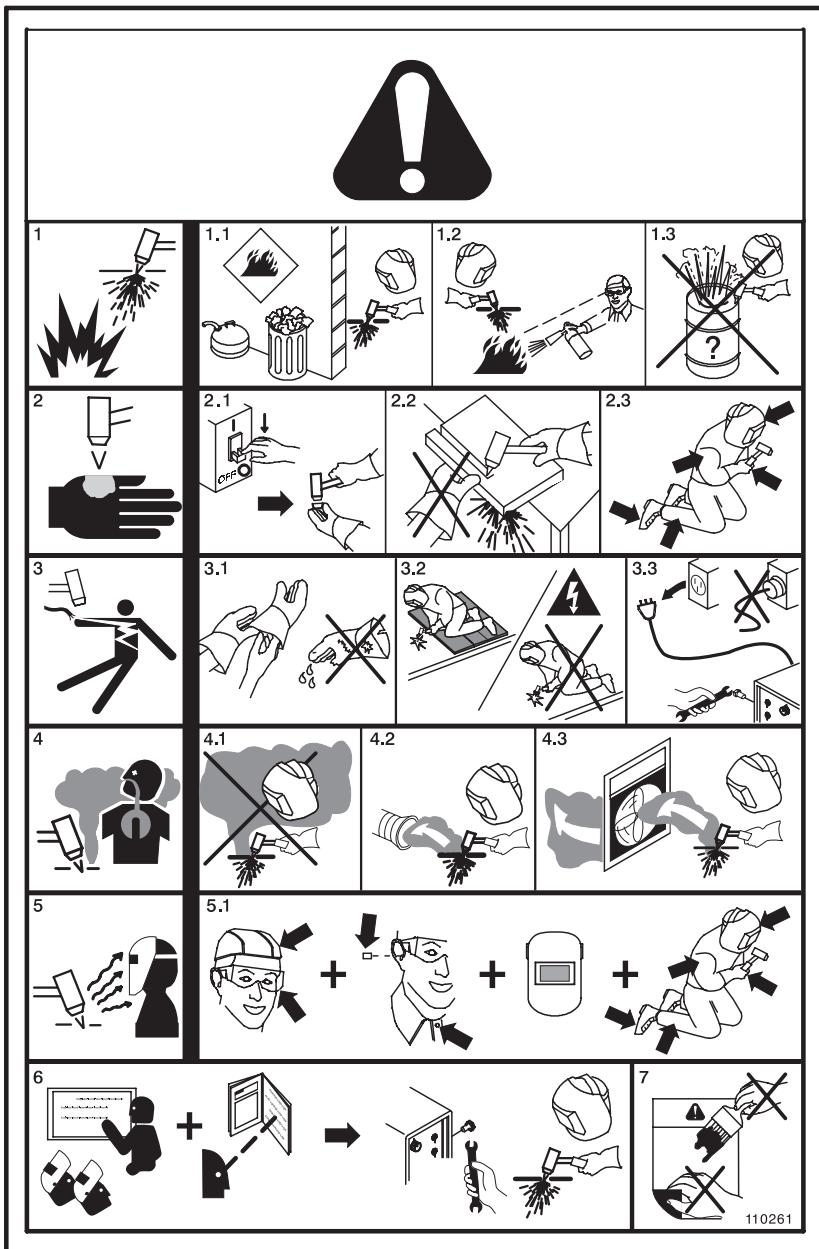
This warning label is affixed to some power supplies. It is important that the operator and maintenance technician understand the intent of these warning symbols as described.

 WARNING	 AVERTISSEMENT
<p>Protect yourself and others. Read and understand this marking.</p> <ul style="list-style-type: none"> • Disconnect power source before servicing. • Disconnect power source before disassembly of the torch. • Use torches specified in the instruction manual. • This plasma cutting machine must be connected to power source in accordance with applicable electrical codes. • Plasma arc cutting can be injurious to operator and persons in the work area. Before operating, read and understand the manufacturer's instructions and know your employer's safety practices. 	<p>Pour votre protection et celle des autres, lire et comprendre ces consignes.</p> <ul style="list-style-type: none"> • Couper l'alimentation avant d'effectuer le dépannage. • Couper l'alimentation avant de démonter la torche. • Utiliser exclusivement les torches indiquées dans le manuel d'instructions. • Le raccordement au réseau de cette machine de coupe à arc-plasma doit-être conforme aux codes de l'électricité pertinents. • Le coupage à arc-plasma comporte des risques pour l'utilisateur et les personnes se trouvant dans la zone de travail. Avant le coupage, lire et comprendre les instructions du fabricant. Appliquer également les consignes de sécurité de votre entreprise.
<p>Electric shock can kill.</p> <ul style="list-style-type: none"> • Do not touch live electrical parts. • Keep all panels and covers in place when the machine is connected to a power source. • Insulate yourself from work and ground: wear insulating gloves, shoes and clothing. • Keep gloves, shoes, clothing, work area, torch and this machinery dry. 	<p>Fumes and gases can injure your health.</p> <ul style="list-style-type: none"> • Keep your head out of the fumes. • Provide ventilation, exhaust at the arc, or both to keep the fumes and gases from your breathing zone and the general area. • If ventilation is inadequate, use an approved respirator.
<p>Explosion will result if pressurized containers are cut.</p>	<p>WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the state of California to cause birth defects and, in some cases, cancer.</p>
<p>Arc rays can injure eyes and burn skin.</p> <ul style="list-style-type: none"> • Wear correct eye and body protection. 	<p>Heat, splatter and sparks cause fire and burns.</p> <ul style="list-style-type: none"> • Do not cut near combustible material. • Do not cut containers that have held combustibles. • Do not have on your person any combustibles such as a butane lighter or matches.
<p>Noise can damage hearing.</p> <ul style="list-style-type: none"> • Wear correct ear protection. 	<p>Pilot arc can cause burns.</p> <ul style="list-style-type: none"> • Keep the torch nozzle away from yourself and others when the switch is depressed. • Wear correct eye and body protection.
DO NOT REMOVE THIS MARKING <small>010298 Rev. B</small>	
NE PAS ENLEVER CET AVIS <small>TLF</small>	

SAFETY

WARNING LABEL

This warning label is affixed to some power supplies. It is important that the operator and maintenance technician understand the intent of these warning symbols as described. The numbered text corresponds to the numbered boxes on the label.



1. Cutting sparks can cause explosion or fire.
 - 1.1 Keep flammables away from cutting.
 - 1.2 Keep a fire extinguisher nearby, and have a watchperson ready to use it.
 - 1.3 Do not cut on any closed containers.
2. The plasma arc can cause injury and burns.
 - 2.1 Turn off power before disassembling torch.
 - 2.2 Do not hold the material near cutting path.
 - 2.3 Wear complete body protection.
3. Electric shock from torch or wiring can kill. Protect yourself from electric shock.
 - 3.1 Wear insulating gloves. Do not wear wet or damaged gloves.
 - 3.2 Insulate yourself from work and ground.
 - 3.3 Disconnect input plug or power before working on machine.
4. Breathing cutting fumes can be hazardous to your health.
 - 4.1 Keep your head out of the fumes.
 - 4.2 Use forced ventilation or local exhaust to remove the fumes.
 - 4.3 Use ventilating fan to remove the fumes.
5. Arc rays can burn eyes and injure skin.
 - 5.1 Wear hat and safety glasses. Use ear protection and button shirt collar. Use welding helmet with correct shade of filter. Wear complete body protection.
6. Become trained and read the instructions before working on the machine or cutting.
7. Do not remove or paint over (cover) warning labels.

Section 1a

SÉCURITÉ

Dans cette section :

Identifier les consignes de sécurité.....	1a-2
Suivre les instructions de sécurité	1a-2
Le coupage peut provoquer un incendie ou une explosion	1a-2
Les chocs électriques peuvent être fatals.....	1a-3
L'électricité statique peut endommager les cartes de circuits imprimés	1a-3
Les vapeurs toxiques peuvent provoquer des blessures ou la mort.....	1a-4
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Les rayons de l'arc peuvent brûler les yeux et la peau.....	1a-5
Mise à la masse et à la terre.....	1a-5
Sécurité des bouteilles de gaz comprimé	1a-6
Les bouteilles de gaz comprimé peuvent exploser en cas de dommages	1a-6
Le bruit peut provoquer des problèmes auditifs.....	1a-6
Pacemakers et prothèses auditives.....	1a-6
Un arc plasma peut endommager les tuyaux gelés.....	1a-6
Étiquettes de sécurité	1a-7



IDENTIFIER LES CONSIGNES DE SÉCURITÉ

Les symboles indiqués dans cette section sont utilisés pour identifier les risques éventuels. Si vous trouvez un symbole de sécurité, que ce soit dans ce manuel ou sur l'équipement, soyez conscient des risques de blessures et suivez les instructions correspondantes afin d'éviter ces risques.



SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

Lire attentivement toutes les consignes de sécurité dans le présent manuel et sur les étiquettes de sécurité se trouvant sur la machine.

- Les étiquettes de sécurité doivent rester lisibles. Remplacer immédiatement les étiquettes manquantes ou abîmées.
- Apprendre à faire fonctionner la machine et à utiliser correctement les commandes. Ne laisser personne utiliser la machine sans connaître son fonctionnement.

- Garder la machine en bon état. Des modifications non autorisées sur la machine peuvent engendrer des problèmes de sécurité et raccourcir la durée d'utilisation de l'équipement.

DANGER AVERTISSEMENT PRÉCAUTION

Les signaux DANGER ou AVERTISSEMENT sont utilisés avec un symbole de sécurité, DANGER correspondant aux risques les plus sérieux.

- Les étiquettes de sécurité DANGER et AVERTISSEMENT sont situées sur la machine pour signaler certains dangers spécifiques.
- Les messages d'AVERTISSEMENT précèdent les instructions d'utilisation expliquées dans ce manuel et signalent les risques de blessures ou de mort au cas où ces instructions ne seraient pas suivies correctement.
- Les messages de PRÉCAUTION précèdent les instructions d'utilisation contenues dans ce manuel et signalent que le matériel risque d'être endommagé si les instructions ne sont pas suivies correctement.



LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

- Avant de commencer, s'assurer que la zone de coupage ne présente aucun danger. Conserver un extincteur à proximité.
- Éloigner toute matière inflammable à une distance d'au moins 10 m du poste de coupage.
- Tremper le métal chaud ou le laisser refroidir avant de le manipuler ou avant de le mettre en contact avec des matériaux combustibles.
- Ne jamais couper des récipients pouvant contenir des matières inflammables avant de les avoir vidés et nettoyés correctement.
- Aérer toute atmosphère potentiellement inflammable avant d'utiliser un système plasma.
- Lors de l'utilisation d'oxygène comme gaz plasma, un système de ventilation par aspiration est nécessaire.

Prévention des explosions

- Ne pas couper en présence de poussière ou de vapeurs.
- Ne pas couper de bouteilles, de tuyaux ou autres récipients fermés et pressurisés.
- Ne pas couper de récipients contenant des matières combustibles.



AVERTISSEMENT

Risque d'explosion
argon-hydrogène et méthane

L'hydrogène et le méthane sont des gaz inflammables et potentiellement explosifs. Conserver à l'écart de toute flamme les bouteilles et tuyaux contenant des mélanges à base d'hydrogène ou de méthane. Maintenir toute flamme et étincelle à l'écart de la torche lors de l'utilisation d'un plasma d'argon-hydrogène ou de méthane.



AVERTISSEMENT

Détonation de l'hydrogène lors du coupage de l'aluminium

- Lors du coupage de l'aluminium sous l'eau, ou si l'eau touche la partie inférieure de la pièce d'aluminium, de l'hydrogène libre peut s'accumuler sous la pièce à couper et détonner lors du coupage plasma.
- Installer un collecteur d'aération au fond de la table à eau afin d'éliminer les risques de détonation de l'hydrogène. Se référer à l'annexe du manuel pour plus de renseignements sur les collecteurs d'aération.



LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

Toucher une pièce électrique sous tension peut provoquer un choc électrique fatal ou des brûlures graves.

- La mise en fonctionnement du système plasma ferme un circuit électrique entre la torche et la pièce à couper. La pièce à couper et tout autre élément en contact avec cette pièce font partie du circuit électrique.
- Ne jamais toucher le corps de la torche, la pièce à couper ou l'eau de la table à eau pendant le fonctionnement du système plasma.

Prévention des chocs électriques

Tous les systèmes plasma Hypertherm utilisent des hautes tensions pour le coupage (souvent de 200 à 400 V). On doit prendre les précautions suivantes quand on utilise le système plasma :

- Porter des bottes et des gants isolants et garder le corps et les vêtements au sec.
- Ne pas se tenir, s'asseoir ou se coucher sur une surface mouillée, ni la toucher quand on utilise le système plasma.
- S'isoler de la surface de travail et du sol en utilisant des tapis isolants secs ou des couvertures assez grandes pour éviter tout contact physique avec le travail ou le sol. S'il s'avère nécessaire de travailler dans ou près d'un endroit humide, procéder avec une extrême prudence.
- Installer un sectionneur avec fusibles appropriés, à proximité de la source de courant. Ce dispositif permet à l'opérateur d'arrêter rapidement la source de courant en cas d'urgence.
- En cas d'utilisation d'une table à eau, s'assurer que cette dernière est correctement mise à la terre.

- Installer et mettre à la terre l'équipement selon les instructions du présent manuel et conformément aux codes électriques locaux et nationaux.
- Inspecter fréquemment le cordon d'alimentation primaire pour s'assurer qu'il n'est ni endommagé, ni fenu. Remplacer immédiatement un cordon endommagé. **Un câble dénudé peut tuer.**
- Inspecter et remplacer les câbles de la torche qui sont usés ou endommagés.
- Ne pas saisir la pièce à couper ni les chutes lors du coupage. Laisser la pièce à couper en place ou sur la table de travail, le câble de retour connecté lors du coupage.
- Avant de vérifier, de nettoyer ou de remplacer les pièces de la torche, couper l'alimentation ou débrancher la prise de courant.
- Ne jamais contourner ou court-circuiter les verrouillages de sécurité.
- Avant d'enlever le capot du système ou de la source de courant, couper l'alimentation électrique. Attendre ensuite 5 minutes pour que les condensateurs se déchargent.
- Ne jamais faire fonctionner le système plasma sans que les capots de la source de courant ne soient en place. Les raccords exposés de la source de courant sont extrêmement dangereux.
- Lors de l'installation des connexions, attacher tout d'abord la prise de terre appropriée.
- Chaque système plasma Hypertherm est conçu pour être utilisé uniquement avec des torches Hypertherm spécifiques. Ne pas utiliser des torches inappropriées qui pourraient surchauffer et présenter des risques pour la sécurité.



L'ÉLECTRICITÉ STATIQUE PEUT ENDOMMAGER LES CARTES DE CIRCUITS IMPRIMÉS

On doit prendre les précautions qui s'imposent quand on manipule les circuits imprimés.

- On doit ranger les cartes de circuits imprimés dans des contenants antistatiques.
- On doit porter un bracelet antistatique quand on manipule les cartes de circuits imprimés.



LES VAPEURS TOXIQUES PEUVENT PROVOQUER DES BLESSURES OU LA MORT

L'arc plasma est lui-même la source de chaleur utilisée pour le coupage. Par conséquent, bien que l'arc plasma n'ait pas été reconnu comme une source de vapeurs toxiques, le matériau coupé peut être une source de vapeurs ou de gaz toxiques qui épuisent l'oxygène.

Les vapeurs produites varient selon le métal coupé. Les métaux qui peuvent dégager des vapeurs toxiques comprennent, entre autres, l'acier inoxydable, l'acier au carbone, le zinc (galvanisé) et le cuivre.

Dans certains cas, le métal peut être revêtu d'une substance susceptible de dégager des vapeurs toxiques. Les revêtements toxiques comprennent entre autres, le plomb (dans certaines peintures), le cadmium (dans certaines peintures et enduits) et le beryllium.

Les gaz produits par le coupage plasma varient selon le matériau à couper et la méthode de coupage, mais ils peuvent comprendre l'ozone, les oxydes d'azote, le chrome hexavalent, l'hydrogène et autres substances présentes dans le matériau coupé ou en émanant.

On doit prendre les précautions qui s'imposent pour réduire au minimum l'exposition aux vapeurs produites par tout processus industriel. Selon la composition chimique et la concentration des vapeurs (ainsi que d'autres facteurs comme la ventilation), il peut y avoir un risque de maladie physique, comme des malformations ou le cancer.

Il incombe au propriétaire du matériel et du site de vérifier la qualité de l'air dans le secteur où l'on utilise le matériel et de s'assurer que la qualité de l'air sur les lieux de travail répond aux normes et réglementation locales et nationales.

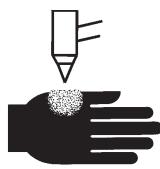
Le niveau de qualité de l'air dans tout lieu de travail dépend des variables propres au site comme :

- Type de table (humide, sèche, sous l'eau).
- Composition du matériau, fini de la surface et composition des revêtements.
- Volume de matériau enlevé.
- Durée du coupage ou du gougeage.
- Dimensions, volume d'air, ventilation et filtration de la zone de travail.
- Équipement de protection individuelle.
- Nombre de systèmes de soudage et de coupage en fonctionnement.
- Autres procédés du site qui peuvent produire des vapeurs.

Si les lieux de travail doivent être conformes aux règlements nationaux ou locaux, seuls les contrôles ou les essais effectués au site peuvent déterminer si celui-ci se situe au-dessus ou au-dessous des niveaux admissibles.

Pour réduire le risque d'exposition aux vapeurs :

- Éliminer tout revêtement et solvant du métal avant le coupage.
- Utiliser la ventilation d'extraction locale pour éliminer les vapeurs de l'air.
- Ne pas inhale les vapeurs. Porter un respirateur à adduction d'air quand on coupe des métaux revêtus d'éléments toxiques ou qui en contiennent ou sont susceptibles d'en contenir.
- S'assurer que les personnes qui utilisent un matériel de soudage ou de coupage ainsi que les dispositifs de respiration par adduction d'air sont qualifiés et ont reçu la formation sur la bonne utilisation d'un tel matériel.
- Ne jamais couper les contenants dans lesquels il peut y avoir des matériaux toxiques. En premier lieu, vider et nettoyer correctement le contenant.
- Contrôler ou éprouver la qualité de l'air au site selon les besoins.
- Consulter un expert local pour mettre en œuvre un plan du site afin d'assurer une qualité de l'air sûre.



L'ARC PLASMA PEUT PROVOQUER DES BLESSURES OU DES BRÛLURES

Torches à allumage instantané

L'arc plasma s'allume immédiatement après que la torche soit mise en marche.

L'arc plasma coupe facilement les gants et la peau.

- Rester éloigné de l'extrémité de la torche.
- Ne pas tenir de métal près de la trajectoire de coupe.
- Ne jamais pointer la torche vers soi ou d'autres personnes.



LES RAYONS DE L'ARC PEUVENT BRÛLER LES YEUX ET LA PEAU

Protection des yeux Les rayons de l'arc plasma produisent de puissants rayons visibles ou invisibles (ultraviolets et infrarouges) qui peuvent brûler les yeux et la peau.

- Utiliser des lunettes de sécurité conformément aux codes locaux ou nationaux en vigueur.
- Porter des lunettes de protection (lunettes ou masque muni d'écrans latéraux et encore masque de soudure) avec des verres teintés appropriés pour protéger les yeux des rayons ultraviolets et infrarouges de l'arc.

Puissance des verres teintés

Courant de l'arc

Jusqu'à 100 A
100-200 A
200-400 A
Plus de 400 A



AWS (É.-U.)	ISO 4850
N° 8	N° 11
N° 10	N° 11-12
N° 12	N° 13
N° 14	N° 14

Protection de la peau Porter des vêtements de sécurité pour se protéger contre les brûlures que peuvent causer les rayons ultraviolets, les étincelles et le métal brûlant :

- Gants à crispin, chaussures et casque de sécurité.
- Vêtements ignifugés couvrant toutes les parties exposées du corps.
- Pantalon sans revers pour éviter que des étincelles ou des scories puissent s'y loger.
- Avant le coupage, retirer de ses poches tout objet combustible comme les briquets au butane ou les allumettes.

Zone de coupage Préparer la zone de coupage afin de réduire la réverbération et la transmission de la lumière ultraviolette :

- Peindre les murs et autres surfaces de couleur sombre pour réduire la réflexion de la lumière.
- Utiliser des écrans et autres dispositifs de protection afin de protéger les autres personnes de la lumière et de la réverbération.
- Prévenir les autres personnes de ne pas regarder l'arc. Utiliser des affiches ou des panneaux.



MISE À LA MASSE ET À LA TERRE

Câble de retour Bien fixer le câble de retour (ou de masse) à la pièce à couper ou à la table de travail de façon à assurer un bon contact métal-métal. Ne pas fixer le câble de retour à la partie de la pièce qui doit se détacher.

Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

Alimentation

- S'assurer que le fil de terre du cordon d'alimentation est connecté à la terre dans le coffret du sectionneur.
- S'il est nécessaire de brancher le cordon d'alimentation à la source de courant lors de l'installation du système, s'assurer que le fil de terre est correctement branché.
- Placer tout d'abord le fil de terre du cordon d'alimentation sur le plot de mise à la terre puis placer les autres fils de terre par-dessus. Bien serrer l'écrou de retenue.
- S'assurer que toutes les connexions sont bien serrées pour éviter la surchauffe.

SÉCURITÉ

SÉCURITÉ DES BOUTEILLES DE GAZ COMPRIMÉ

- Ne jamais lubrifier les robinets des bouteilles ou les régulateurs avec de l'huile ou de la graisse.
- Utiliser uniquement les bouteilles, régulateurs, tuyaux et accessoires appropriés et conçus pour chaque application spécifique.
- Entretenir l'équipement et les pièces d'équipement à gaz comprimé afin de les garder en bon état.
- Étiqueter et coder avec des couleurs tous les tuyaux de gaz afin d'identifier le type de gaz contenu dans chaque tuyau. Se référer aux codes locaux ou nationaux en vigueur.



LES BOUTEILLES DE GAZ COMPRIMÉ PEUVENT EXPLOSER EN CAS DE DOMMAGES

Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

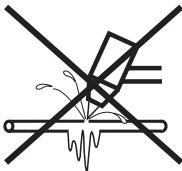
- Manipuler et utiliser les bouteilles de gaz comprimé conformément aux codes locaux ou nationaux.
- Ne jamais utiliser une bouteille qui n'est pas placée à la verticale et bien assujettie.
- Le capuchon de protection doit être placé sur le robinet sauf si la bouteille est en cours d'utilisation ou connectée pour utilisation.
- Éviter à tout prix le contact électrique entre l'arc plasma et une bouteille.
- Ne jamais exposer des bouteilles à une chaleur excessive, aux étincelles, aux scories ou aux flammes nues.
- Ne jamais utiliser des marteaux, des clés ou d'autres outils pour débloquer le robinet des bouteilles.



LE BRUIT PEUT PROVOQUER DES PROBLÈMES AUDITIFS

Une exposition prolongée au bruit du coupage ou du gougeage peut provoquer des problèmes auditifs.

- Utiliser un casque de protection homologué lors de l'utilisation du système plasma.
- Prévenir les personnes aux alentours des risques encourus en cas d'exposition au bruit.



UN ARC PLASMA PEUT ENDOMMAGER LES TUYAUX GELÉS

Les tuyaux gelés peuvent être endommagés ou éclater si l'on essaie de les dégeler avec une torche plasma.



PACEMAKERS ET PROTHÈSES AUDITIVES

Les champs magnétiques produits par les courants à haute tension peuvent affecter le fonctionnement des prothèses auditives et des pacemakers. Les personnes portant ce type d'appareil doivent consulter un médecin avant de s'approcher d'un lieu où s'effectue le coupage ou le gougeage plasma.

Pour réduire les risques associés aux champs magnétiques :

- Garder loin de soi et du même côté du corps le câble de retour et le faisceau de la torche.
- Faire passer le faisceau de la torche le plus près possible du câble de retour.
- Ne pas s'enrouler le faisceau de la torche ou le câble de retour autour du corps.
- Se tenir le plus loin possible de la source de courant.

Étiquette de sécurité

Cette étiquette est affichée sur la source de courant. Il est important que l'utilisateur et le technicien de maintenance comprennent la signification des symboles de sécurité.

 WARNING	 AVERTISSEMENT
<p>Protect yourself and others. Read and understand this marking.</p> <ul style="list-style-type: none"> • Disconnect power source before servicing. • Disconnect power source before disassembly of the torch. • Use torches specified in the instruction manual. • This plasma cutting machine must be connected to power source in accordance with applicable electrical codes. • Plasma arc cutting can be injurious to operator and persons in the work area. Before operating, read and understand the manufacturer's instructions and know your employer's safety practices. 	<p>Pour votre protection et celle des autres, lire et comprendre ces consignes.</p> <ul style="list-style-type: none"> • Couper l'alimentation avant d'effectuer le dépannage. • Couper l'alimentation avant de démonter la torche. • Utiliser exclusivement les torches indiquées dans le manuel d'instructions. • Le raccordement au réseau de cette machine de coupe à arc-plasma doit-être conforme aux codes de l'électricité pertinents. • Le coupage à arc-plasma comporte des risques pour l'utilisateur et les personnes se trouvant dans la zone de travail. Avant le coupage, lire et comprendre les instructions du fabricant. Appliquer également les consignes de sécurité de votre entreprise.
<p>Electric shock can kill.</p> <ul style="list-style-type: none"> • Do not touch live electrical parts. • Keep all panels and covers in place when the machine is connected to a power source. • Insulate yourself from work and ground: wear insulating gloves, shoes and clothing. • Keep gloves, shoes, clothing, work area, torch and this machinery dry. 	<p>Fumes and gases can injure your health.</p> <ul style="list-style-type: none"> • Keep your head out of the fumes. • Provide ventilation, exhaust at the arc, or both to keep the fumes and gases from your breathing zone and the general area. • If ventilation is inadequate, use an approved respirator.
<p>Explosion will result if pressurized containers are cut.</p>	<p>WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the state of California to cause birth defects and, in some cases, cancer.</p>
<p>Arc rays can injure eyes and burn skin.</p> <ul style="list-style-type: none"> • Wear correct eye and body protection. 	<p>Heat, splatter and sparks cause fire and burns.</p> <ul style="list-style-type: none"> • Do not cut near combustible material. • Do not cut containers that have held combustibles. • Do not have on your person any combustibles such as a butane lighter or matches.
<p>Noise can damage hearing.</p> <ul style="list-style-type: none"> • Wear correct ear protection. 	<p>Pilot arc can cause burns.</p> <ul style="list-style-type: none"> • Keep the torch nozzle away from yourself and others when the switch is depressed. • Wear correct eye and body protection.
DO NOT REMOVE THIS MARKING <small>010298 Rev. B</small>	
NE PAS ENLEVER CET AVIS <small>TLF</small>	

SÉCURITÉ

Étiquette de sécurité

Cette étiquette est affichée sur la source de courant. Il est important que l'utilisateur et le technicien de maintenance comprennent la signification des symboles de sécurité. Les numéros de la liste correspondent aux numéros des images.



1. Les étincelles produites par le coupage peuvent provoquer une explosion ou un incendie.
 - 1.1 Pendant le coupage, éloigner toute matière inflammable.
 - 1.2 Conserver un extincteur à proximité et s'assurer qu'une personne soit prête à l'utiliser.
 - 1.3 Ne jamais couper de récipients fermés.
2. L'arc plasma peut provoquer des blessures et des brûlures.
 - 2.1 Couper l'alimentation avant de démonter la torche.
 - 2.2 Ne pas tenir la surface à couper près de la trajectoire de coupe.
 - 2.3 Porter des vêtements de protection couvrant tout le corps.
3. Un choc électrique causé par la torche ou les câbles peut être fatal. Se protéger contre les risques de chocs électriques.
 - 3.1 Porter des gants isolants. Ne pas porter de gants mouillés ou abîmés.
 - 3.2 S'isoler de la surface de travail et du sol.
 - 3.3 Débrancher la prise ou la source de courant avant de manipuler l'équipement.
4. L'inhalation des vapeurs produites par le coupage peut être dangereuse pour la santé.
 - 4.1 Garder le visage à l'écart des vapeurs.
 - 4.2 Utiliser un système de ventilation par aspiration ou d'échappement localisé pour dissiper les vapeurs.
 - 4.3 Utiliser un ventilateur pour dissiper les vapeurs.
5. Les rayons de l'arc peuvent brûler les yeux et provoquer des lésions de la peau.
 - 5.1 Porter un casque et des lunettes de sécurité. Se protéger les oreilles et porter une chemise dont le col peut être déboutonné. Porter un casque de soudure dont la protection filtrante est suffisante. Porter des vêtements protecteurs couvrant la totalité du corps.
6. Se former à la technique du coupage et lire les instructions avant de manipuler l'équipement ou de procéder au coupage.
7. Ne pas retirer ou peindre (recouvrir) les étiquettes de sécurité.

Sección 1b

SEGURIDAD

En esta sección:

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Siga las instrucciones de seguridad	1b-2
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El choque eléctrico puede provocar la muerte	1b-3
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RECONOCIMIENTO DE INFORMACIÓN DE SEGURIDAD

Los símbolos que se muestran en esta sección se utilizan para identificar los posibles peligros. Cuando vea un símbolo de seguridad en este manual o en su máquina, recuerde que existe la posibilidad de que se produzcan lesiones personales y siga las instrucciones correspondientes para evitar el peligro.



SIGA LAS INSTRUCCIONES DE SEGURIDAD

Lea atentamente todos los mensajes de seguridad de este manual y las etiquetas de seguridad en su máquina.

- Mantenga las etiquetas de seguridad de su máquina en buen estado. Reemplace las etiquetas que se pierdan o se dañen inmediatamente.
- Aprenda a utilizar la máquina y a utilizar los controles de la manera correcta. No permita que sea utilizada por alguien que no conozca su funcionamiento.

- Mantenga su máquina en buenas condiciones de funcionamiento. La realización de modificaciones no autorizadas a la máquina puede comprometer la seguridad y la vida útil de la máquina.

PELIGRO ADVERTENCIA PRECAUCIÓN

Las palabras PELIGRO y ADVERTENCIA se utilizan conjuntamente con un símbolo de seguridad. La palabra PELIGRO se utiliza para identificar los mayores peligros.

- Encontrará etiquetas de seguridad con las inscripciones PELIGRO y ADVERTENCIA en su máquina, junto a peligros específicos.
- En este manual, la palabra ADVERTENCIA va seguida de instrucciones que, si no se siguen correctamente, pueden provocar lesiones e inclusive la muerte.
- En este manual, la palabra PRECAUCIÓN va seguida de instrucciones que, si no se siguen correctamente, pueden provocar daños en el equipo.



LOS CORTES PUEDEN PROVOCAR INCENDIOS O EXPLOSIONES

Prevención ante el fuego

- Asegúrese de que el área sea segura antes de proceder a cortar. Tenga a mano un extinguidor de incendios.
- Retire todos los materiales inflamables, colocándolos a por lo menos 10 metros del área de corte.
- Remoje los metales calientes o permita que se enfrién antes de que entren en contacto con materiales combustibles.
- Nunca corte depósitos que contengan materiales inflamables – primero es necesario vaciarlos y limpiarlos debidamente.
- Antes de realizar cortes en atmósferas potencialmente inflamables, asegúrese de ventilar bien.
- Al realizar cortes utilizando oxígeno como gas plasma, se requiere tener un sistema de ventilación de escape.

Prevención ante explosiones

- No corte en atmósferas que contengan polvo o vapores explosivos.
- No corte depósitos o tubos a presión ni cualquier depósito cerrado.
- No corte depósitos que hayan contenido materiales combustibles.



ADVERTENCIA

Peligro de explosión
Argón-Hidrógeno y metano

El hidrógeno y el metano son gases inflamables que suponen un peligro de explosión. Mantenga el fuego lejos de los cilindros y las mangueras que contengan mezclas de hidrógeno o metano. Mantenga la llama y las chispas lejos de la antorcha al utilizar metano o argón-hidrógeno como plasma.



ADVERTENCIA

Detonación de hidrógeno con
el corte de aluminio

- Al cortar aluminio bajo agua o con agua en contacto con el lado inferior del aluminio, puede acumularse gas hidrógeno bajo la pieza a cortar y detonar durante la operación de corte por plasma.
- Instale un múltiple de aireación en el fondo de la mesa de agua para eliminar la posibilidad de la detonación del hidrógeno. Consulte la sección del apéndice de este manual para conocer detalles acerca del múltiple de aireación.



EL CHOQUE ELÉCTRICO PUEDE PROVOCAR LA MUERTE

El contacto directo con piezas eléctricas conectadas puede provocar un electrochoque fatal o quemaduras graves.

- Al hacer funcionar el sistema de plasma, se completa un circuito eléctrico entre la antorcha y la pieza a cortar. La pieza a cortar es una parte del circuito eléctrico, como también cualquier cosa que se encuentre en contacto con ella.
- Nunca toque el cuerpo de la antorcha, la pieza a cortar o el agua en una mesa de agua cuando el sistema de plasma se encuentre en funcionamiento.

Prevención ante el electrochoque

Todos los sistemas por plasma de Hypertherm usan alto voltaje en el proceso de corte (son comunes los voltajes CD de 200 a 400). Tome las siguientes precauciones cuando se utiliza el equipo de plasma:

- Use guantes y botas aislantes y mantenga el cuerpo y la ropa secos.
- No se siente, se pare o se ponga sobre cualquier superficie húmeda cuando esté trabajando con el equipo.
- Aíslase eléctricamente de la pieza a cortar y de la tierra utilizando alfombrillas o cubiertas de aislamiento secas lo suficientemente grandes como para impedir todo contacto físico con la pieza a cortar o con la tierra. Si su única opción es trabajar en una área húmeda o cerca de ella, sea muy cauteloso.
- Instale un interruptor de corriente adecuado en cuanto a fusibles, en una pared cercana a la fuente de energía. Este interruptor permitirá al operador desconectar rápidamente la fuente de energía en caso de emergencia.
- Al utilizar una mesa de agua, asegúrese de que ésta se encuentre correctamente conectada a la toma a tierra.
- Instale este equipo y conéctelo a tierra según el manual de instrucciones y de conformidad con los códigos locales y nacionales.
- Inspeccione el cordón de alimentación primaria con frecuencia para asegurarse de que no esté dañado ni agrietado. Si el cordón de alimentación primaria está dañado, reemplácelo inmediatamente. **Un cable pelado puede provocar la muerte.**
- Inspeccione las mangueras de la antorcha y reemplácelas cuando se encuentren dañadas.
- No toque la pieza ni los recortes cuando se está cortando. Deje la pieza en su lugar o sobre la mesa de trabajo con el cable de trabajo conectado en todo momento.
- Antes de inspeccionar, limpiar o cambiar las piezas de la antorcha, desconecte la potencia primaria o desenchufe la fuente de energía.
- Nunca evite o descuide los bloqueos de seguridad.
- Antes de retirar la cubierta de una fuente de energía o del gabinete de un sistema, desconecte la potencia primaria de entrada. Espere 5 minutos después de desconectar la potencia primaria para permitir la descarga de los condensadores.
- Nunca opere el sistema de plasma sin que las tapas de la fuente de energía estén en su lugar. Las conexiones expuestas de la fuente de energía presentan un serio riesgo eléctrico.
- Al hacer conexiones de entrada, conecte el conductor de conexión a tierra en primer lugar.
- Cada sistema de plasma Hypertherm está diseñado para ser utilizado sólo con antorchas Hypertherm específicas. No utilice antorchas diferentes, que podrían recalentarse y ser peligrosas.



ELECTRICIDAD ESTÁTICA PUEDE DAÑAR TABLILLAS DE CIRCUITO

Use precauciones adecuadas cuando maneje tablillas impresas de circuito

- Almacene las tablillas PC en recipientes antiestáticos.
- Use la defensa de muñeca conectada a tierra cuando maneje tablillas PC.



HUMOS TÓXICOS PUEDEN CAUSAR LESIONES O MUERTE

El arco plasma es por si solo la fuente de calor que se usa para cortar. Según esto, aunque el arco de plasma no ha sido identificado como la fuente de humo tóxico, el material que se corta puede ser la fuente de humo o gases tóxicos que vacían el oxígeno.

El humo producido varía según el metal que está cortándose. Metales que pueden liberar humo tóxico incluyen, pero no están limitados a, acero inoxidable, acero al carbón, cinc (galvanizado), y cobre.

En algunos casos, el metal puede estar recubierto con una sustancia que podría liberar humos tóxicos. Los recubrimientos tóxicos incluyen, pero no están limitados a, plomo (en algunas pinturas), cadmio (en algunas pinturas y rellenos), y berilio.

Los gases producidos por el corte por plasma varían basándose en el material a cortarse y el método de cortar, pero pueden incluir ozono, óxidos de nitrógeno, cromo hexavalente, hidrógeno, y otras substancias, si están contenidas dentro o liberadas por el material que se corta.

Se debe tener cuidado de minimizar la exposición del humo producido por cualquier proceso industrial. Según la composición química y la concentración del humo (al igual que otros factores, tales como ventilación), puede haber el riesgo de enfermedad física, tal como defectos de natividad o cáncer.

Es la responsabilidad del dueño del equipo y instalación el comprobar la calidad de aire en el lugar donde se está usando el equipo para garantizar que la calidad del aire en el lugar de trabajo cumpla con todas las normas y reglamentos locales y nacionales.

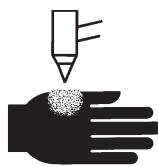
El nivel de la calidad del aire en cualquier lugar de trabajo relevante depende en variables específicas al sitio tales como:

- Diseño de mesa (mojada, seca, bajo agua).
- La composición del material, el acabado de la superficie, y la composición de los recubrimientos.
- Volumen que se quita del material.
- La duración del corte o ranura.
- Tamaño, volumen del aire, ventilación y filtración del lugar de trabajo.
- Equipo de protección personal.
- Número de sistemas de soldar y cortar en la operación.
- Otros procesos del lugar que pueden producir humo.

Si el lugar de trabajo debe cumplir reglamentos nacionales o locales, solamente el monitoreo o las pruebas que se hacen en el lugar pueden determinar si el sitio está encima o debajo de los niveles permitidos.

Para reducir el riesgo de exposición a humo:

- Quite todos los recubrimientos y solventes del metal antes de cortar.
- Use ventilación extractora local para quitar humo del aire.
- No inhale el humo. Use un respirador con fuente propia de aire cuando corte cualquier metal recubierto con, o sospechado de contener, elementos tóxicos.
- Garantice que aquéllos usando equipo de soldar o cortar, al igual que aparatos de respiración con aire propio de aire, estén capacitados y entrenados en el uso apropiado de tal equipo.
- Nunca corte recipientes con materiales potencialmente tóxicos adentro. Primero, vacíe y limpie el recipiente adecuadamente.
- Monitoree o compruebe la calidad del aire en el sitio como fuera necesario.
- Consulte con un experto local para realizar un plan al sitio para garantizar la calidad de aire seguro.



EL ARCO DE PLASMA PUEDE CAUSAR LESIONES Y QUEMADURAS

Antorchas de encendido instantáneo

El arco de plasma se enciende inmediatamente después de activarse el interruptor de la antorcha.

El arco de plasma puede cortar a través de guantes y de la piel con rapidez.

- Manténgase alejado de la punta de la antorcha.
- No sostenga el metal junto al trayecto de corte.
- Nunca apunte la antorcha hacia Ud. mismo o hacia otras personas.



LOS RAYOS DEL ARCO PUEDEN PRODUCIR QUEMADURAS EN LOS OJOS Y EN LA PIEL

Protección para los ojos Los rayos del arco de plasma producen rayos intensos visibles e invisibles (ultravioleta e infrarrojo) que pueden quemar los ojos y la piel.

- Utilice protección para los ojos de conformidad con los códigos locales o nacionales aplicables.
- Colóquese protectores para los ojos (gafas o anteojos protectores con protectores laterales, y bien un casco de soldar) con lentes con sombreado adecuado para proteger sus ojos de los rayos ultravioleta e infrarrojos del arco.

Número del cristal

Corriente del arco



AWS (EE.UU.)	ISO 4850
No. 8	No. 11
No. 10	No. 11-12
No. 12	No. 13
No. 14	No. 14

Protección para la piel Vista ropa de protección para proteger la piel contra quemaduras causadas por la radiación ultravioleta de alta intensidad, por las chispas y por el metal caliente:

- Guantes largos, zapatos de seguridad y gorro.
- Roipa de combustión retardada y que cubra todas las partes expuestas.
- Pantalones sin dobladillos para impedir que recojan chispas y escorias.
- Retire todo material combustible de los bolsillos, como encendedores a butano e inclusive cerillas, antes de comenzar a cortar.

Área de corte Prepare el área de corte para reducir la reflexión y la transmisión de la luz ultravioleta:

- Pinte las paredes y demás superficies con colores oscuros para reducir la reflexión.
- Utilice pantallas o barreras protectoras para proteger a los demás de los destellos.
- Advierta a los demás que no debe mirarse el arco. Utilice carteles o letreros.



SEGURIDAD DE TOMA A TIERRA

Cable de trabajo La pinza del cable de trabajo debe estar bien sujetada a la pieza y hacer un buen contacto de metal a metal con ella o bien con la mesa de trabajo. No conecte el cable con la parte que va a quedar separada por el corte.

Mesa de trabajo Conecte la mesa de trabajo a una buena toma de tierra, de conformidad con los códigos eléctricos nacionales o locales apropiados.

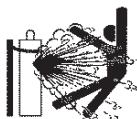
Potencia primaria de entrada

- Asegúrese de que el alambre de toma a tierra del cordón de alimentación está conectado al terminal de tierra en la caja del interruptor de corriente.
- Si la instalación del sistema de plasma supone la conexión del cordón de alimentación primaria a la fuente de energía, asegúrese de conectar correctamente el alambre de toma a tierra del cordón de alimentación primaria.
- Coloque en primer lugar el alambre de toma a tierra del cordón de alimentación primaria en el espárrago luego coloque cualquier otro alambre de tierra sobre el conductor de tierra del cable. Ajuste firmemente la tuerca de retención.
- Asegúrese de que todas las conexiones eléctricas están firmemente realizadas para evitar sobrecalentamientos.

SEGURIDAD

SEGURIDAD DE LOS EQUIPOS DE GAS COMPRIMIDO

- Nunca lubrique reguladores o válvulas de cilindros con aceite o grasa.
- Utilice solamente cilindros, reguladores, mangueras y conectores de gas correctos que hayan sido diseñados para la aplicación específica.
- Mantenga todo el equipo de gas comprimido y las piezas relacionadas en buen estado.
- Coloque etiquetas y códigos de color en todas las mangueras de gas para identificar el tipo de gas que conduce cada una. Consulte los códigos locales o nacionales aplicables.



LOS CILINDROS DE GAS PUEDEN EXPLOTAR SI ESTÁN DAÑADOS

Los cilindros de gas contienen gas bajo alta presión. Un cilindro dañado puede explotar.

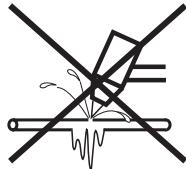
- Manipule y utilice los cilindros de gas comprimido de acuerdo con los códigos locales o nacionales aplicables.
- No use nunca un cilindro que no esté de pie y bien sujetado.
- Mantenga la tapa de protección en su lugar encima de la válvula, excepto cuando el cilindro se encuentre en uso o conectado para ser utilizado.
- No permita nunca el contacto eléctrico entre el arco de plasma y un cilindro.
- No exponga nunca los cilindros a calor excesivo, chispas, escorias o llamas.
- No emplee nunca martillos, llaves u otro tipo de herramientas para abrir de golpe la válvula del cilindro.



EL RUIDO PUEDE DETERIORAR LA AUDICIÓN

La exposición prolongada al ruido propio de las operaciones de corte y ranurado puede dañar la audición.

- Utilice un método de protección de los oídos aprobado al utilizar el sistema de plasma.
- Advierta a las demás personas que se encuentren en las cercanías acerca del peligro que supone el ruido excesivo.



UN ARCO PLASMA PUEDE DAÑAR TUBOS CONGELADOS

Se puede hacer daño a los tubos congelados, o se los puede reventar, si uno trata de descongelarlos con una antorcha por plasma.



OPERACIÓN DE MARCAPASOS Y DE AUDÍFONOS

Los campos magnéticos producidos por las elevadas corrientes pueden afectar la operación de marcapasos y de audífonos. Las personas que lleven marcapasos y audífonos deberán consultar a un médico antes de acercarse a sitios donde se realizan operaciones de corte y ranurado por plasma.

Para reducir los peligros de los campos magnéticos:

- Mantenga el cable de trabajo y la manguera de la antorcha a un lado, lejos del cuerpo.
- Dirija la manguera antorcha lo más cerca posible del cable de trabajo.
- No envuelva el cable de trabajo ni la manguera de la antorcha en su cuerpo.
- Manténgase tan lejos de la fuente de energía como sea posible.

Etiqueta de advertencia

Esta etiqueta de advertencia se encuentra adherida a la fuente de energía. Es importante que el operador y el técnico de mantenimiento comprendan el sentido de estos símbolos de advertencia según se describen. El texto numerado corresponde a los cuadros numerados de la etiqueta.



Etiqueta de advertencia

Esta etiqueta de advertencia se encuentra adherida a la fuente de energía. Es importante que el operador y el técnico de mantenimiento comprendan el sentido de estos símbolos de advertencia según se describen. El texto numerado corresponde a los cuadros numerados de la etiqueta.



1. Las chispas producidas por el corte pueden causar explosiones o incendios.
- 1.1 Mantenga los materiales inflamables lejos del lugar de corte.
- 1.2 Tenga a mano un extinguidor de incendios y asegúrese de que alguien esté preparado para utilizarlo.
- 1.3 No corte depósitos cerrados.
2. El arco de plasma puede causar quemaduras y lesiones.
- 2.1 Apague la fuente de energía antes de desarmar la antorcha.
- 2.2 No sostenga el material junto al trayecto de corte.
- 2.3 Proteja su cuerpo completamente.
3. Los electrochoques provocados por la antorcha o el cableado pueden ser fatales. Protéjase del electrochoque.
- 3.1 Colóquese guantes aislantes. No utilice guantes dañados o mojados.
- 3.2 Aíslese de la pieza de trabajo y de la tierra.
- 3.3 Antes de trabajar en una máquina, desconecte el enchufe de entrada o la potencia primaria.
4. La inhalación de los humos provenientes del área de corte puede ser nociva para la salud.
- 4.1 Mantenga la cabeza fuera de los gases tóxicos.
- 4.2 Utilice ventilación forzada o un sistema local de escape para eliminar los humos.
- 4.3 Utilice un ventilador para eliminar los humos.
5. Los rayos del arco pueden producir quemaduras en los ojos y en la piel.
- 5.1 Utilice un sombrero y gafas de seguridad. Utilice protección para los oídos y abróchese el botón del cuello de la camisa. Utilice un casco de soldar con el filtro de sombreado adecuado. Proteja su cuerpo completamente.
6. Antes de trabajar en la máquina o de proceder a cortar, capacítense y lea las instrucciones completamente.
7. No retire las etiquetas de advertencia ni las cubra con pintura.

Section 2**SPECIFICATIONS**

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System description

General

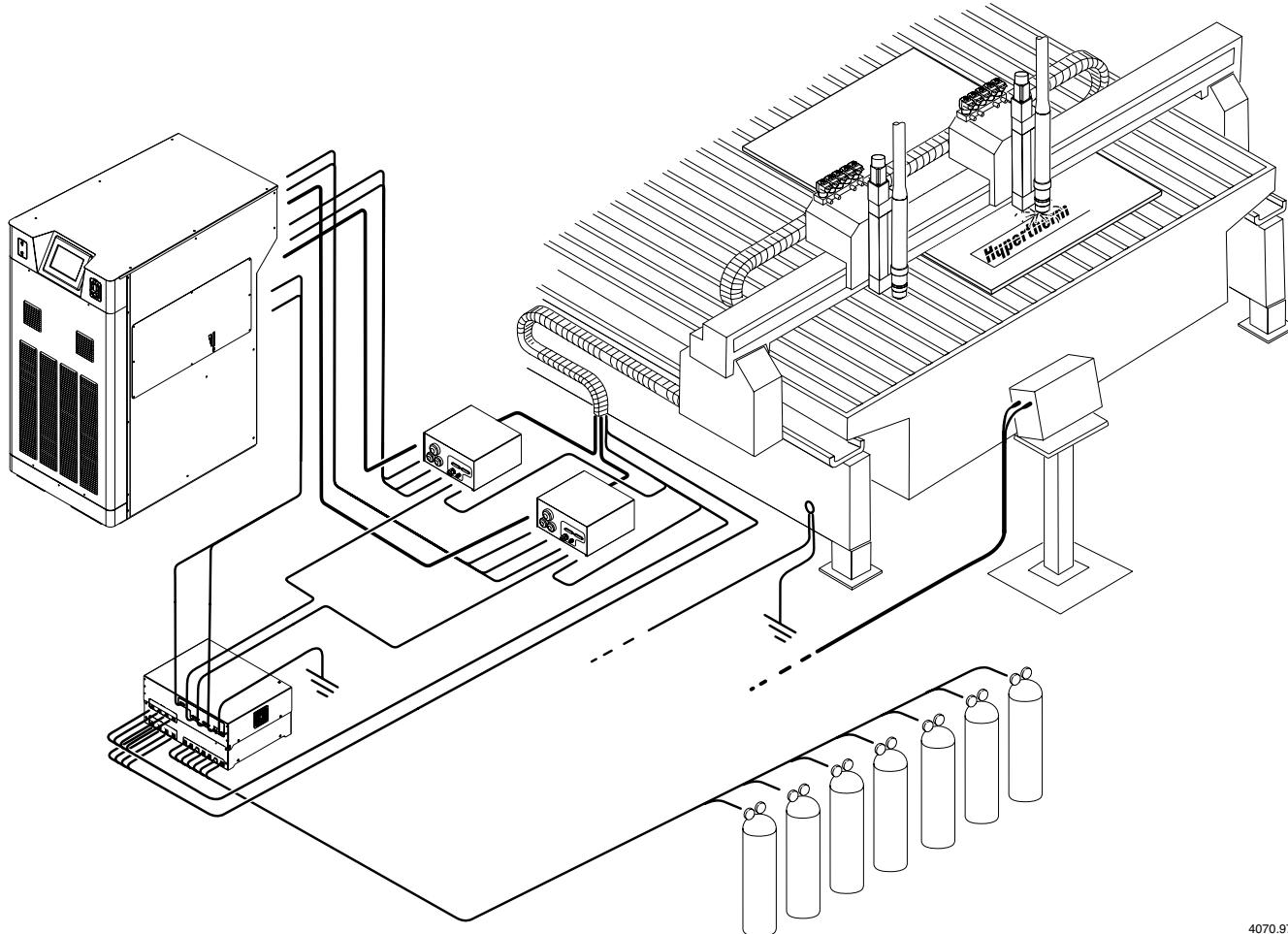
The HD4070 is a fully automated 200-amp plasma cutting system that requires minimal input and adjustment by the operator. Using the HD4070 display touch screen (or CNC), the operator enters the material and thickness to be cut. The HD4070 system automatically selects and adjusts the power and gas required to optimize cutting, including amperage, gas and gas flow rate.

Power supply

The power supply houses two 100-amp, 15 kHz choppers to produce up to 200A of constant current DC output. The HD4070 power supply provides the energy to cut 12 mm mild steel at up to 3050 mm/min (1/2 inch at up to 115 ipm).

Machine torch

The machine torch can cut 12 mm mild steel at up to 3050 mm/min (1/2 inch at up to 115 ipm). The maximum production cutting capability of the torch is 19 mm (3/4 inch) HyDefinition and 25 mm (1 inch) conventional cutting.
To achieve maximum consumable life, all cuts must begin and end on the plate surface.



4070.97

Off-valve assembly

The off-valve assembly consists of 5 solenoid valves, a manifold block and a wiring harness with connector. The assembly interfaces with the machine torch, the ignition console and the gas console.

Gas console

The gas console manages all incoming gasses for selection and flow rate and is controlled by the HD4070 power supply. The gas console includes motor valves, solenoid valves, check valves and pressure transducers, all mounted on a single manifold assembly. The manifold significantly reduces gas leaks by eliminating the use of flexible hose. The gas console also houses 2 relay PC boards and a control PC board.

Ignition console

The ignition console generates a high-voltage, high-frequency signal and couples it to the cathode lead and pilot arc lead. The ignition console is fully electronic, eliminating the use of a spark gap assembly.

Options

- **2-torch option** – The HD4070 plasma cutting system has the ability to support 2 torches operated from a single power supply and gas console. When one torch is selected for cutting, the second torch is in the off-mode. This allows operators to configure the system for 2 different processes (i.e. 100-amp consumables installed in one torch and 200-amp consumables installed in the second torch), and to select one torch or the other from the HD4070 display (or CNC).

Note: A torch receptacle plug must be used if a two torch system is running in single torch mode. Single torch mode is when a table is loaded with plate material and one torch is doing all the cutting or marking. Dual torch mode is when one torch is performing one operation and the second torch is performing another operation on the same plate material.

- **Integrated CommandTHC option** – The Hypertherm Integrated CommandTHC takes full advantage of the HD4070's automated capabilities. When the operator enters the material and thickness to be cut, using the HD4070 display touch screen (or CNC), the Integrated CommandTHC automatically adjusts the torch settings required for the specific process, including arc volts, torch-to-work distance, initial pierce height and pierce time delay, using the plasma arc voltage to control the torch-to-work distance during cutting. IHS is accomplished by ohmic contact sensing or by limited force stall detection. HD4070 power supplies that are equipped with the Integrated CommandTHC option include the THC motor drive board, the THC control PC board and THC power supply required for torch lifter operation and control.
- **X-Y lifter assembly** (page 2-12) The torch lifter station, under control of the THC control module, positions a torch head vertically above the workpiece. Its maximum stroke is 8 inches (200 mm) between the home and lower-limit switches. It is driven by a stepper motor attached to a leadscrew. An encoder is provided for stall IHS sensing, and to detect gross errors during normal operation. A lower limit switch detects maximum travel in the downward direction. A home switch is provided to detect when the lifter is in the uppermost position. A power-off brake is energized after power-up, and allows controlled motion of the torch. It is powered on during "Maintenance Mode" to prevent the torch from being accidentally moved. An optional torch breakaway kit is available.
- **Torch breakaway kit** (optional page 2-13) The torch breakaway (collision sensor) provides a level of protection for the torch, lifter and X-Y table. Air pressure locks the torch to the THC lifter assembly. The air pressure can be adjusted to change the force required to trip the breakaway. Upon side impact, the breakaway releases from the lock position and allows the torch to float. See page 2-12 for torch mounting dimensions with and without the breakaway.

Options – continued

- **Touch screen display option** – The HD4070 display is a touch screen that provides all system control functions and plasma process information at a single location. The torch consumables that are required for the selected process are also listed. The power supply may be ordered in three configurations.

- No display
- Display installed in power supply
- Display for installation at a remote location

Caution: The HD4070 system can only support one touch screen display, either local or remote. Installing displays at both locations on one system may cause malfunctions or damage.



Specifications

System gas requirements

Gas quality and pressure requirements				
	Quality	Grade*	Pressure +/- 10%	Flow rate
O ₂ Oxygen	99.5% pure Clean, dry, oil-free	G	827 kPa / 8.3 bar 120 psi	3780 l/h 133 scfh
N ₂ Nitrogen	99.99% pure Clean, dry, oil-free	E	827 kPa / 8.3 bar 120 psi	4020 l/h 142 scfh
Air	Clean, dry, oil-free	K	827 kPa / 8.3 bar 120 psi	3960 l/h 140 scfh
H35 Argon-hydrogen	99.995% pure (H35 = 65% Argon, 35% Hydrogen)	Ar = A H ₂ = A	827 kPa / 8.3 bar 120 psi	4140 l/h 146 scfh
F5 Nitrogen-hydrogen	99.98% pure (F5 = 95% Nitrogen, 5% Hydrogen)	N ₂ = E H ₂ = A	827 kPa / 8.3 bar 120 psi	4250 l/h 150 scfh
H5 Argon-hydrogen	99.995% pure (H5 = 5% Hydrogen, 95% Argon)	Ar = A H ₂ = A	827 kPa / 8.3 bar 120 psi	3420 l/h 122 scfh

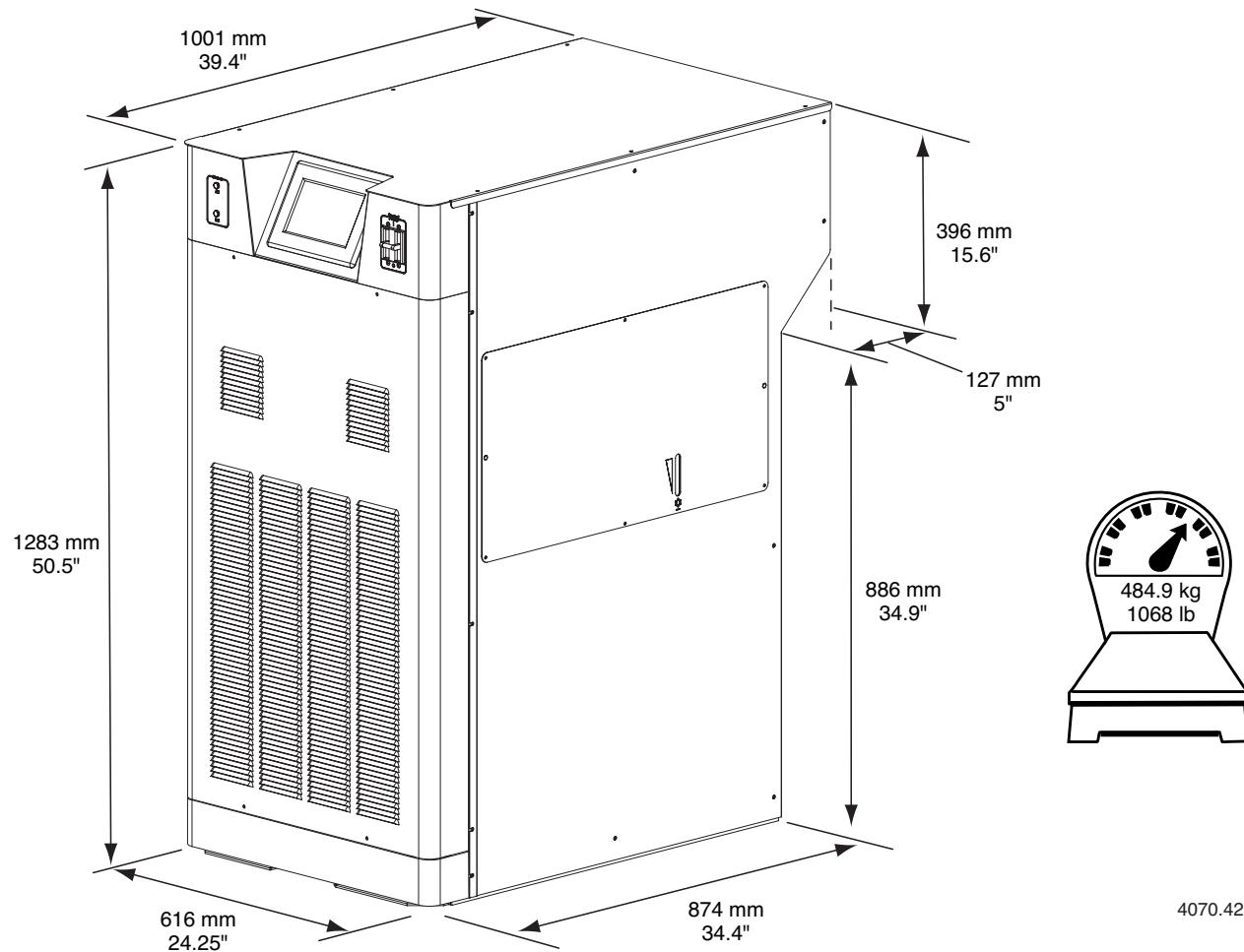
* This information can be found in the *Handbook of Compressed Gases*, 3rd edition, Compressed Gas Association, Van Nostrand Reinhold.

	Mild Steel		Stainless Steel		Aluminum	
Gas types	Plasma	Shield	Plasma	Shield	Plasma	Shield
Marking	N ₂	N ₂	H5	N ₂	H5	N ₂
Cutting 30 A / 45 A	O ₂	O ₂	F5	N ₂	Air	Air
Cutting 80 A	O ₂	O ₂ & N ₂	F5	N ₂	N/A	N/A
Cutting 130 A to 200 A	O ₂	O ₂ & N ₂	H35 & N ₂	N ₂	H35 & N ₂	N ₂

SPECIFICATIONS

Power supply

General	
Maximum OCV (U_0)	311 VDC
Maximum output current (I_2)	200 amps
Output voltage (U_2)	85 – 200 VDC
Duty cycle rating (X)	100% @ 40 kW, 40°C (104°F)
Ambient temperature/Duty cycle	Power supplies will operate between -10°C and +40°C (+14° and 104°F)
Power factor($\cos\phi$)	0.98 @ 200A DC output
Cooling	Forced air (Class F)
Input power (Input voltage (U_1) X Input current (I_1 X 1.73)	
200 VAC, 3-PH, 50-60 Hz, 125A	
220 VAC, 3-PH, 50-60 Hz, 113A	
240 VAC, 3-PH, 60 Hz, 103A	
400 VAC CE, 3-PH, 50-60 Hz, 62A	
440 VAC, 3-PH, 50-60 Hz, 56A	
480 VAC, 3-PH, 60 Hz, 52A	
600 VAC, 3-PH, 60 Hz, 41A	

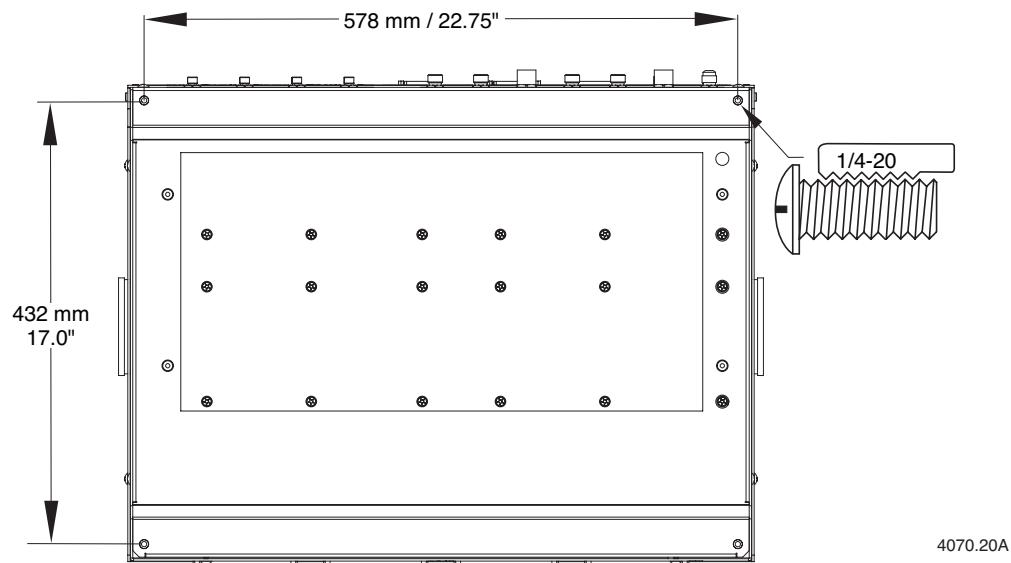
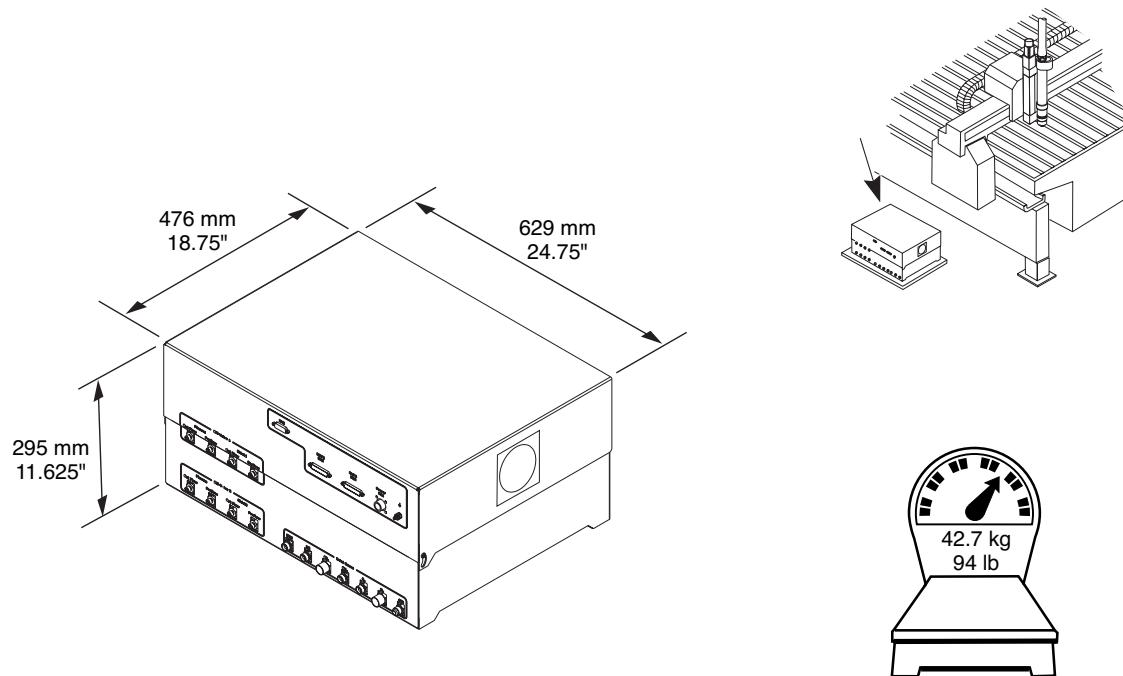


Power supply part number	Voltage							Options		
	480V	240V	400V	200V	440V	220V	600V	Display	1 THC	2 THC
	60 HZ	60 HZ	50-60 HZ	50-60 HZ	50-60 HZ	50-60 HZ	60 HZ			
078087	X	-	-	-	-	-	-	n	n	n
078101	X	-	-	-	-	-	-	n	X	n
078102	X	-	-	-	-	-	-	n	n	X
078103	X	-	-	-	-	-	-	X	n	n
078104	X	-	-	-	-	-	-	X	X	n
078105	X	-	-	-	-	-	-	X	n	X
078134	-	X	-	-	-	-	-	n	n	n
078147	-	X	-	-	-	-	-	n	X	n
078148	-	X	-	-	-	-	-	n	n	X
078149	-	X	-	-	-	-	-	X	n	n
078150	-	X	-	-	-	-	-	X	X	n
078151	-	X	-	-	-	-	-	X	n	X
078089	-	-	X	-	-	-	-	n	n	n
078090	-	-	X	-	-	-	-	n	X	n
078091	-	-	X	-	-	-	-	n	n	X
078092	-	-	X	-	-	-	-	X	n	n
078093	-	-	X	-	-	-	-	X	X	n
078094	-	-	X	-	-	-	-	X	n	X
078135	-	-	-	X	-	-	-	n	n	n
078136	-	-	-	X	-	-	-	n	X	n
078137	-	-	-	X	-	-	-	n	n	X
078138	-	-	-	X	-	-	-	X	n	n
078139	-	-	-	X	-	-	-	X	X	n
078140	-	-	-	X	-	-	-	X	n	X
078095	-	-	-	-	X	-	-	n	n	n
078096	-	-	-	-	X	-	-	n	X	n
078097	-	-	-	-	X	-	-	n	n	X
078098	-	-	-	-	X	-	-	X	n	n
078099	-	-	-	-	X	-	-	X	X	n
078100	-	-	-	-	X	-	-	X	n	X
078141	-	-	-	-	-	X	-	n	n	n
078142	-	-	-	-	-	X	-	n	X	n
078143	-	-	-	-	-	X	-	n	n	X
078144	-	-	-	-	-	X	-	X	n	n
078145	-	-	-	-	-	X	-	X	X	n
078146	-	-	-	-	-	X	-	X	n	X
078106	-	-	-	-	-	-	X	n	n	n
078107	-	-	-	-	-	-	X	n	X	n
078108	-	-	-	-	-	-	X	n	n	X
078109	-	-	-	-	-	-	X	X	n	n
078110	-	-	-	-	-	-	X	X	X	n
078111	-	-	-	-	-	-	X	X	n	X

SPECIFICATIONS

Gas console assembly – 078085

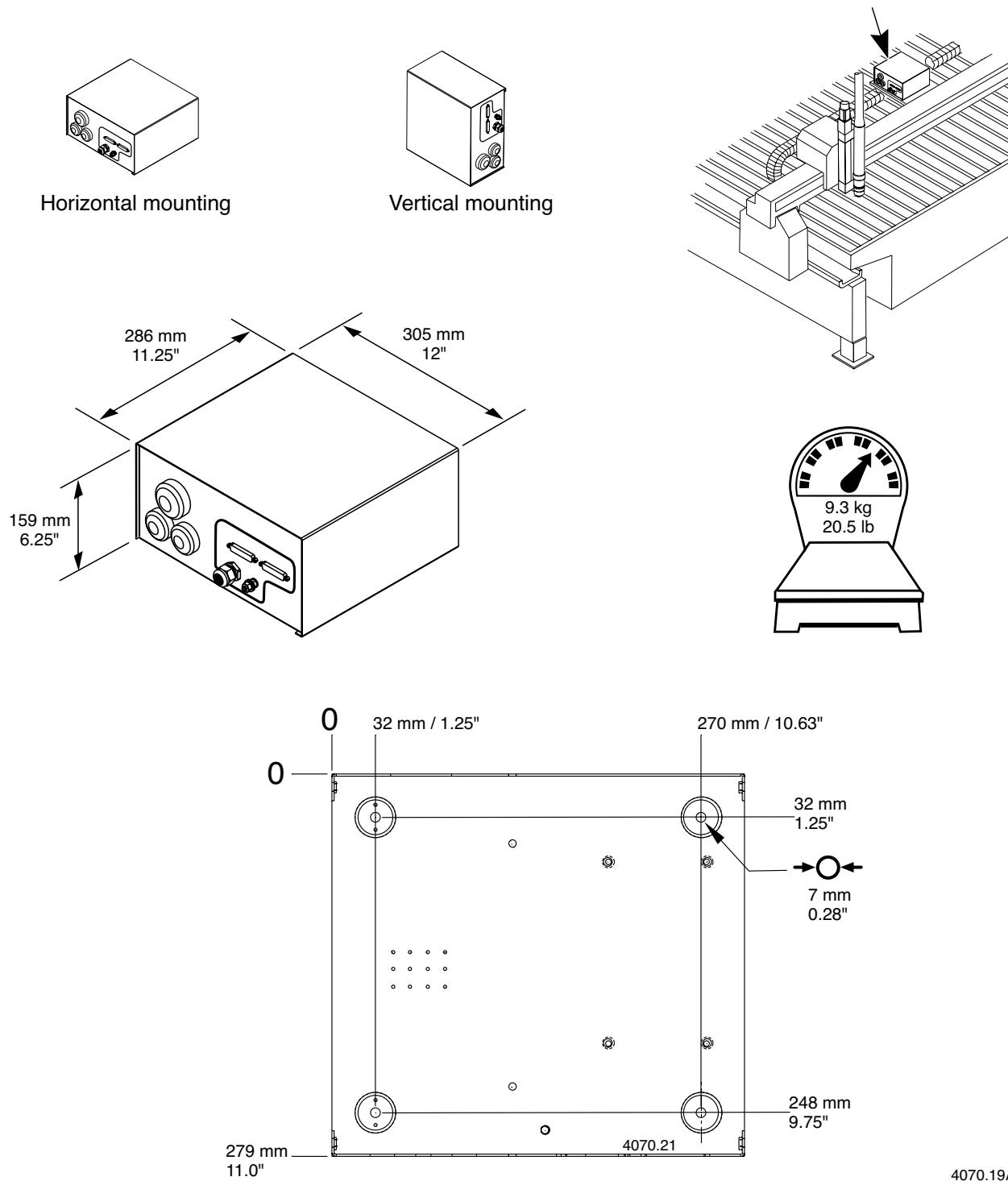
- Position the gas console near the cutting table. Allow room to open the top for servicing.
- Venting air is drawn in through fans on both sides and is exhausted through the front of the unit.
- Maximum distance from the power supply should not exceed 46 m (150 feet).
- Maximum distance to the off-valve assembly should not exceed 30.5 m (100 feet).



4070.20A

Ignition console assembly – 078088

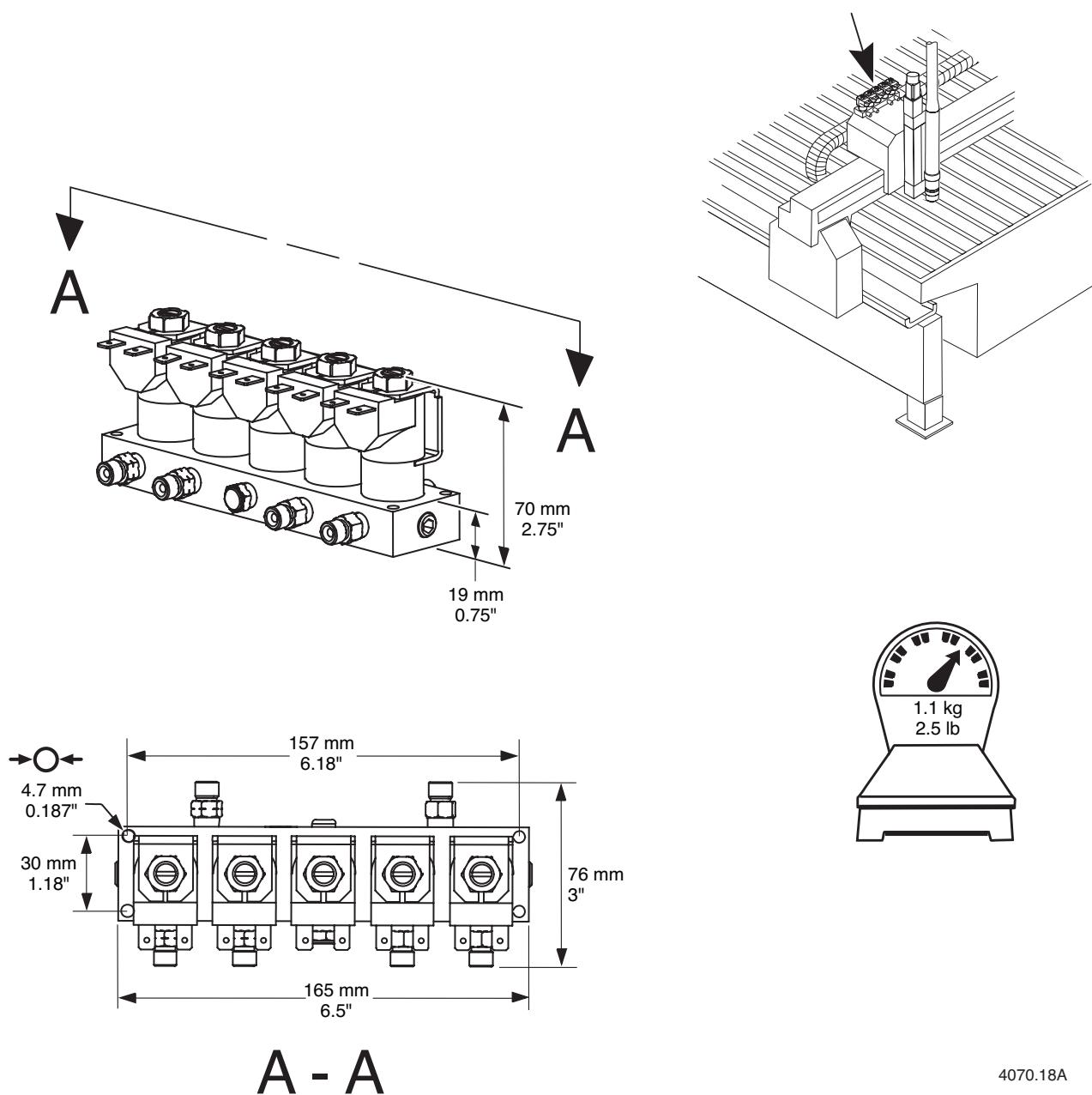
- Mount the ignition console up to 4.5 m (15 feet) from the torch lifter station. Allow room to remove the top for servicing.
- The ignition console may be mounted in the horizontal or the vertical position as shown below.



SPECIFICATIONS

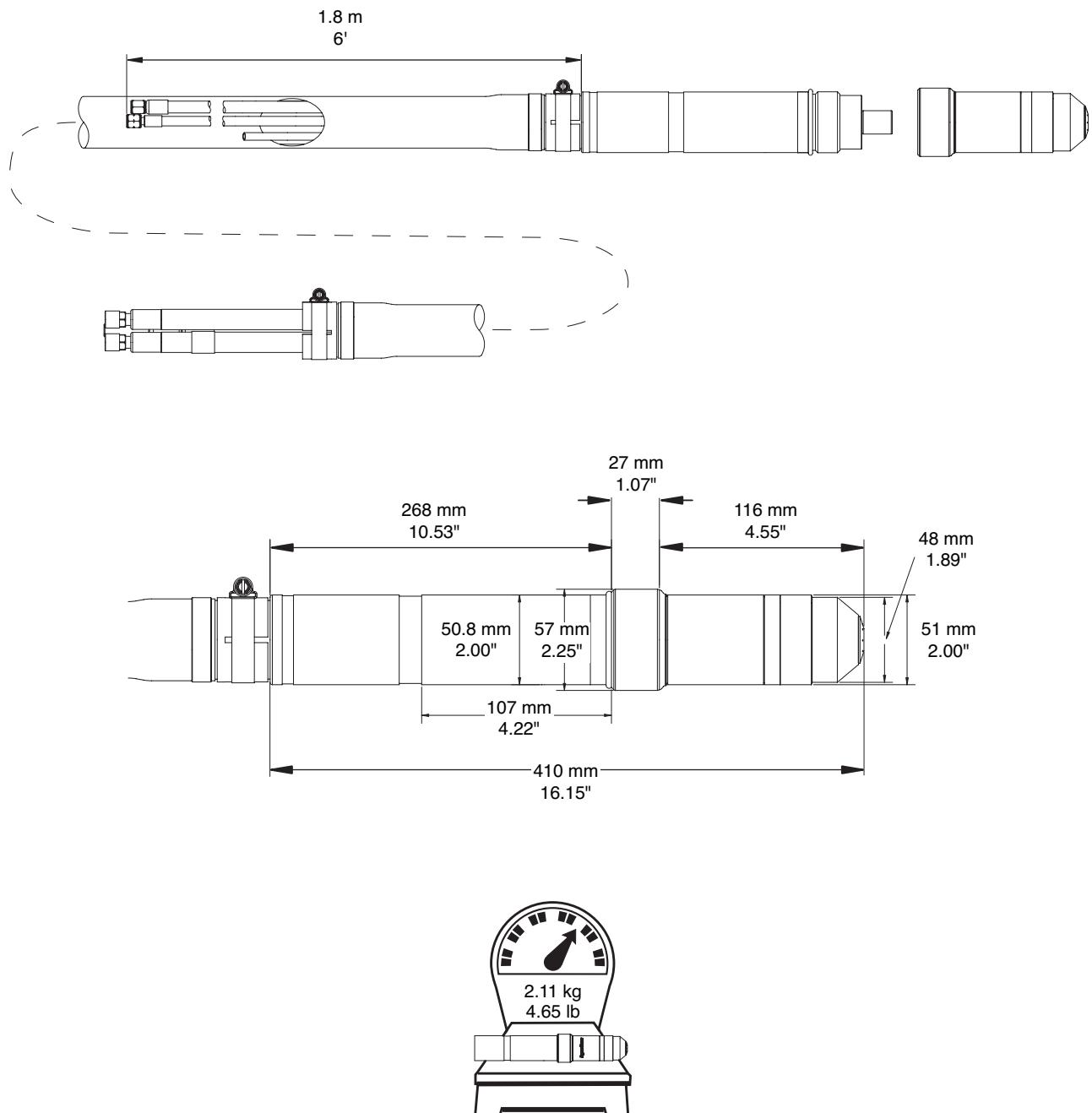
Off-valve assembly – 129563

- Mount the off-valve assembly up to 1.5 m (4 feet) from the torch lifter station.



Torch specifications – 228048

- The outside diameter of the torch mounting sleeve is 50.8 mm (2.0 in.).



SPECIFICATIONS

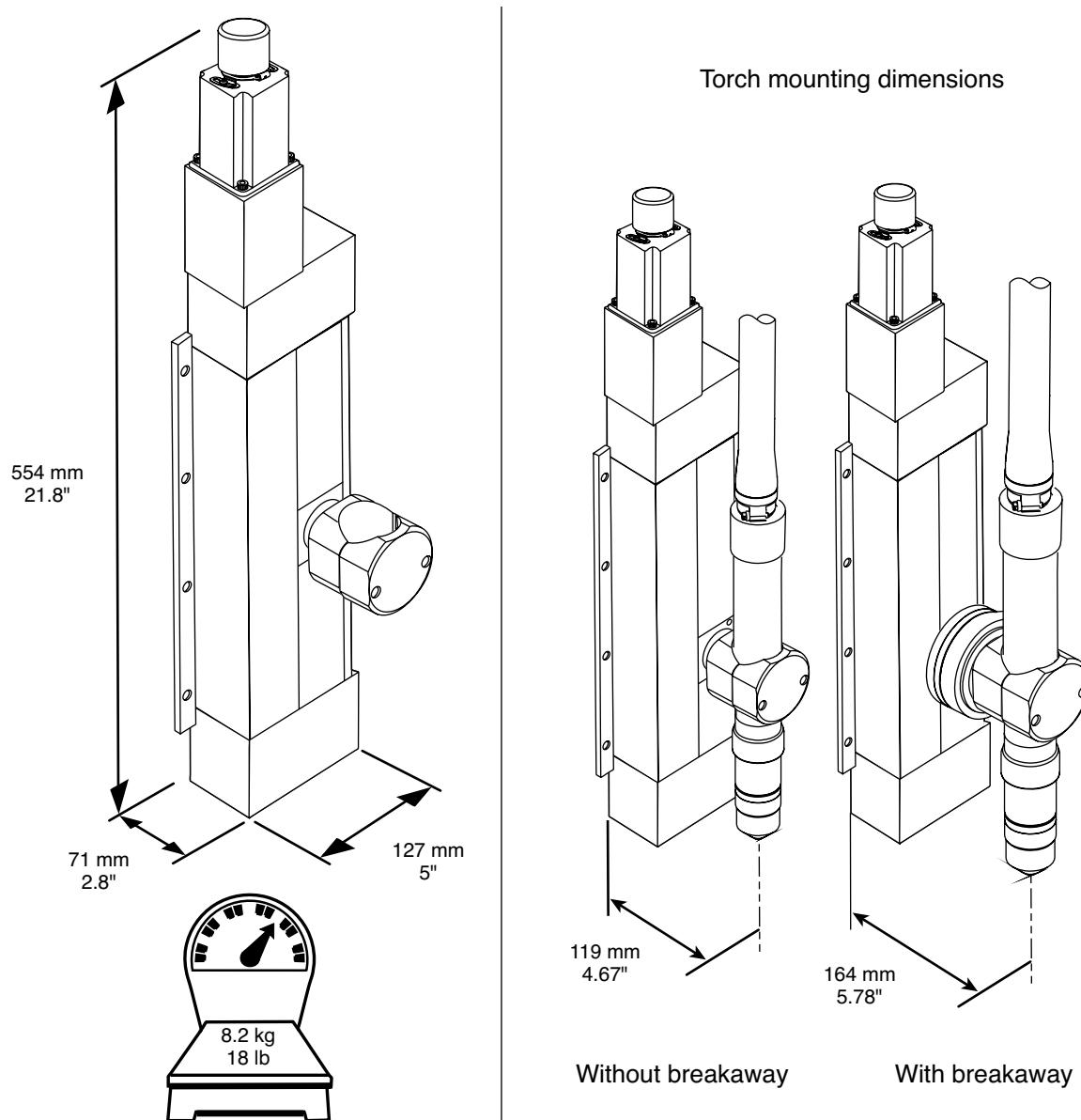
X-Y lifter assembly – 128606

Electrical

Motor + 2.48 VDC, 2-phase (3.3 amp per ph.)
Limit switches + 24 VDC

Lifter control function

Motor Stepper
Motor drive Stepper, chopped constant current
Lifter feedback Encoder
Lifter limit switches Home switch and lower limit switch
Maximum Z axis speed 508 cm (200 inches) per minute
Maximum Z axis stroke 203 mm (8 inches)



Note: The bracket should be as low on the torch sleeve as possible, without touching the quick disconnect, to minimize vibration at the tip of the torch.

Torch breakaway kit – 128281**Electrical**

Pressure switch.....CNC emergency stop circuit voltage

Breakaway control function

Shop air pressure.....6.9 bar (100 psi) maximum

Size

Breakaway width97 mm (3.8 inches)

Breakaway height (thickness)57 mm (2.25 inches)

Air filter / regulator height179 mm (7.06 inches)

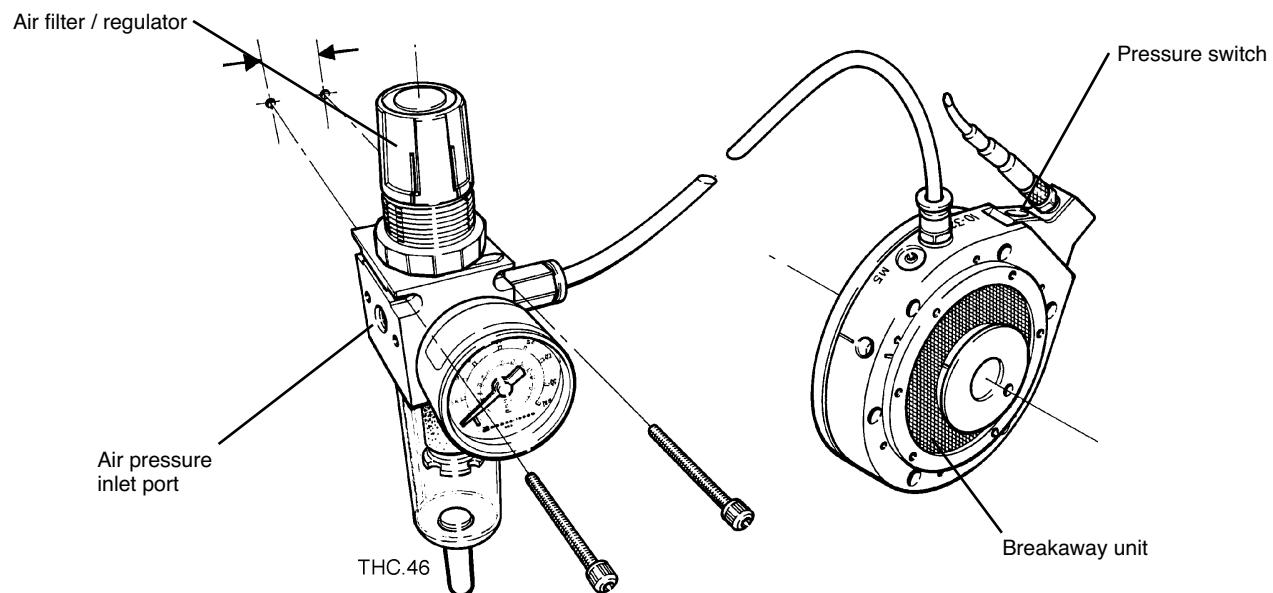
Air filter / regulator width40 mm (1.56 inches)

Air filter / regulator depth (from gauge to back).....79 mm (3.125 inches)

Weight

Breakaway unit.....0.86 kg (1.9 pounds)

Air filter / regulator.....0.45 kg (1.0 pounds)

**X-Y lifter breakaway option**

Section 3**INSTALLATION***In this section:*

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Upon receipt

- Verify that all system components on your order have been received. Contact your supplier if any items are missing.
- Inspect the system components for any physical damage that may have occurred during shipping. If there is evidence of damage, refer to Claims. All communications regarding claims must include the model number and serial number located on the back of the power supply.

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, contact your supplier. If you need additional assistance, call Customer Service listed in the front of this manual, or your authorized Hypertherm distributor.

Installation requirements

All installation and service of the electrical and plumbing systems must conform to national or local electrical and plumbing codes. This work should be performed only by qualified, licensed personnel.

Direct any technical questions to the nearest Hypertherm Technical Service Department listed in the front of this manual, or your authorized Hypertherm distributor.

Gas requirements

The customer furnishes all gases and gas-supply regulators for the system. Use a high-quality, 2-stage pressure regulator located within 3 m (10 ft.) of the gas console. See Appendix C for gas regulator recommendations. Refer to Section 2 for gas and flow specifications.

Caution: **Gas supply pressures not within the specifications in Section 2 can cause poor cut quality, poor consumable life and operational problems.**



If the purity level of the gas is too low or if there are leaks in the supply hoses or connections,

- **cut speeds can decrease**
- **cut quality can deteriorate**
- **cutting thickness capability can decrease**
- **parts life can shorten**

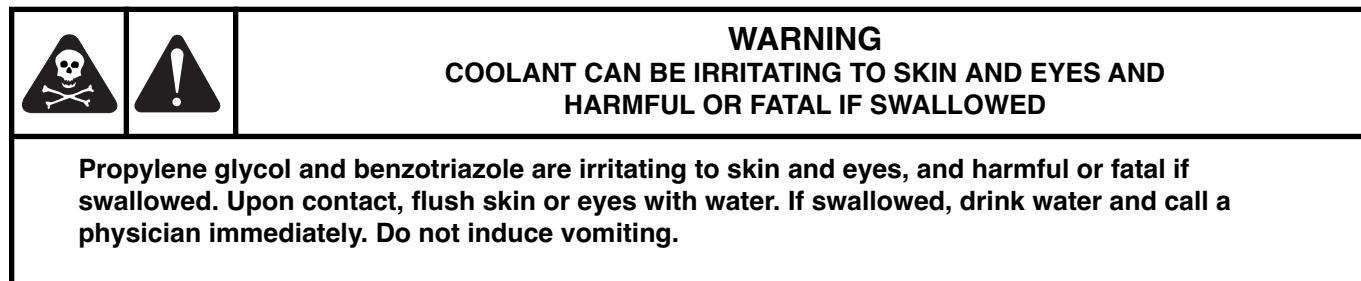
Torch coolant requirements

The power supply is shipped without any coolant in the tank. Hypertherm recommends a mixture of 30% propylene glycol, 69.9% deionized water, and 0.1% benzotriazole. This mixture resists freezing to -12° C (+10° F) and contains a corrosion inhibitor to protect copper surfaces in the coolant loop. This mixture is available in 1-gallon containers by ordering 028872. 100% propylene glycol is available by ordering 028873.

Caution: For operating temperatures colder than the temperature stated above, the percentage of propylene glycol must be increased. Failure to do so could result in a cracked torch head, hoses or other damage to the torch coolant system due to freezing.

See Appendix B to determine if a stronger propylene glycol:purified water solution is needed for your particular application.

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



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

Always use purified water in the coolant mixture in order to prevent corrosion in the torch coolant system. See *Water purity requirements*.

Caution: Use Hypertherm coolant (028872) to reduce the risk of damage from freezing and to prevent long-term corrosion.

INSTALLATION

Water purity requirements for coolant mixture

Maintaining a low level of calcium carbonate is critical for proper performance of the torch and components in the cooling system. Water purity should meet the requirements defined in the table below. When mixing Hypertherm coolant (P/N 028873 – 100% propylene glycol) with water to create the appropriate coolant mixture.

Note: If water purity exceeds maximum levels, mineral deposits may occur throughout the system.
If water purity is below minimum levels, soluble materials may leach into the coolant.

Water purity	Water purity			
	Conductivity $\mu\text{S}/\text{cm}$ at 77° F (25 °C)	Resistivity $\text{M}\Omega/\text{cm}$ at 77° F (25 °C)	Dissolved solids (ppm of NaCl)	Grains per gallon (gpg of CaCO ₃)
Pure water (reference only)	0.055	18.3	0	0
Maximum purity	0.5	2	0.206	0.010
Minimum purity	18	0.054	8.5	0.43
Max. potable water (reference only)	1000	0.001	495	25

Noise levels

Acceptable noise levels as defined by national or local codes may be exceeded by this plasma system. Always wear proper ear protection when cutting or gouging. See also *Noise protection* in the Safety section of this manual.

Torch lifter requirement

The HD4070 system requires a high-quality, motorized torch lifter with sufficient travel to cover all cutting thickness requirements. The lifter must provide 203 mm (8 inches) of vertical travel. The unit should have the capability of maintaining a constant speed of up to 5080 mm/min (200 ipm) with positive braking. A unit which drifts through the stop point is not acceptable.

Placement of system components

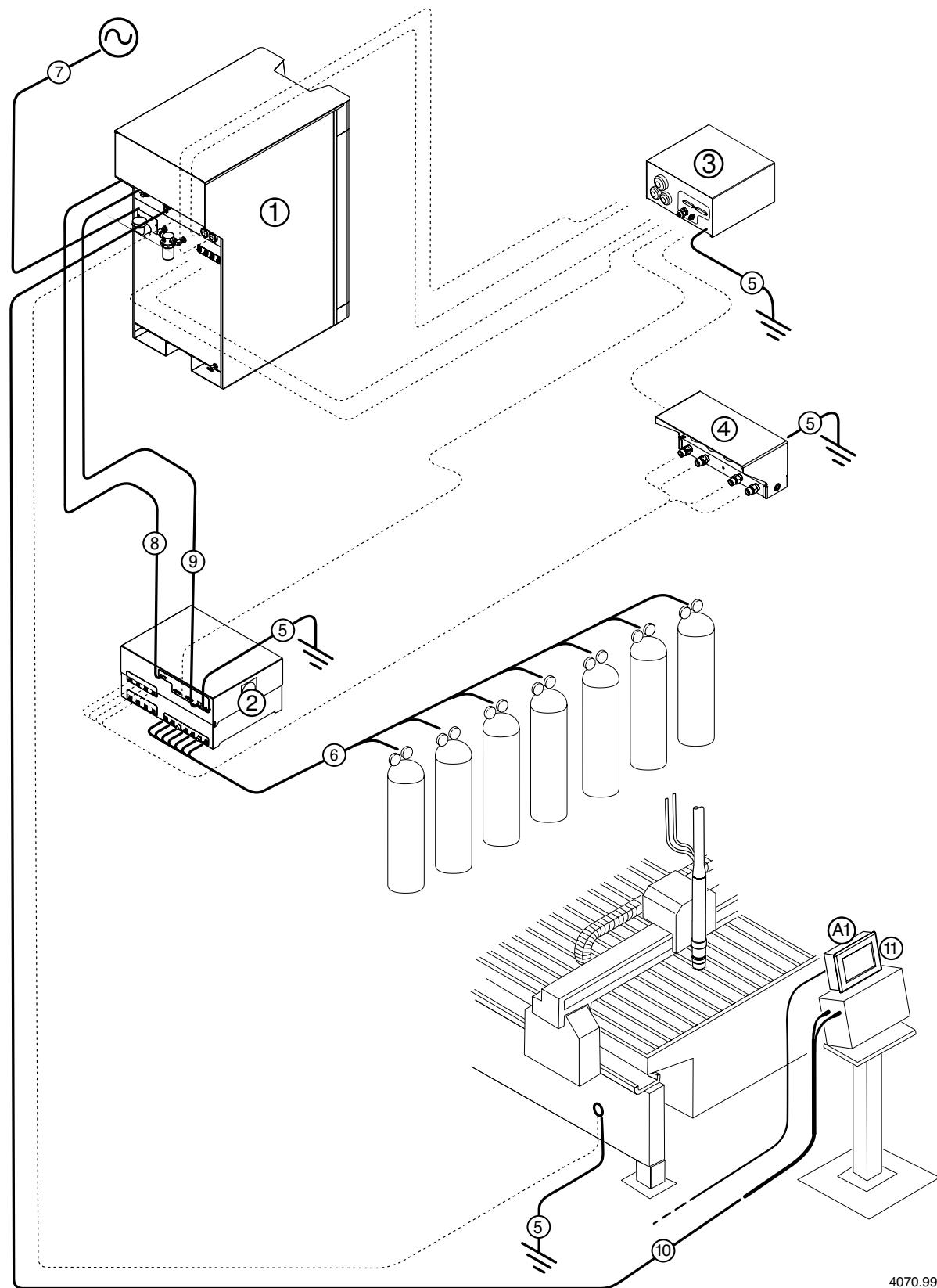
- Place all system components in position prior to making electrical, gas and interface connections. Use the diagram on the following page for component placement guidelines.
- Ground all system components to earth. See *Grounding requirements* in this section for details.
- To prevent leaks in the system, tighten all gas and water connections as shown below:



Torque specifications

Gas or water hose size	Ibf-in	Ibf-ft	kgf-cm
Up to 10 mm (3/8")	75-85	6.25-7	8.6-9.8
12 mm (1/2")	360-480	30-40	41.5-55

HD4070 installation – basic requirements



4070.99B

Place system components

- ① Power supply; see page 3-8.
- ② Gas console; see page 3-9.
- ③ Ignition console; see page 3-10.
- ④ Off-valve assembly; see page 3-11.

Customer-supplied cables and hoses

- ⑤ Grounding cable; see page 3-12.
- ⑥ Gas supply plumbing; see page 3-13.
- ⑦ Power cable; see page 3-14/15.

Install cables and hoses

- ⑧ Gas console signal cable; see page 3-17.
- ⑨ Gas console power cable; see page 3-17.
- ⑩ CNC interface cable; see page 3-18.

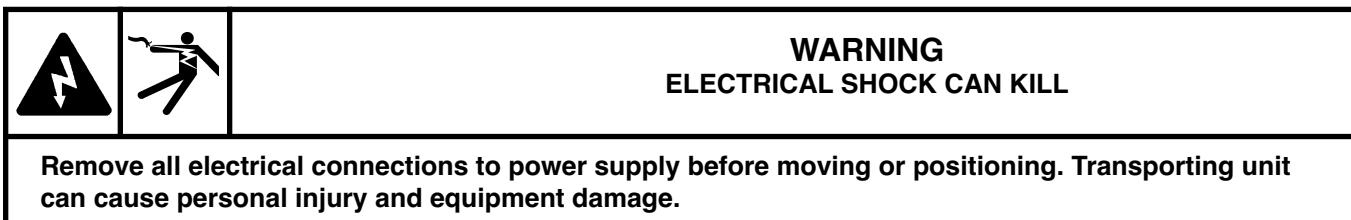
Remote display option:

- A1 Remote display; see page 3-20.
- A2 Remote display cable; see page 3-20.
- A3 Ground wire; see page 3-20.
- 11 Display mounting dimensions; see page 3-21.

Note: Instructions for installing the torch and remaining leads and hoses are provided in the sections listed below.

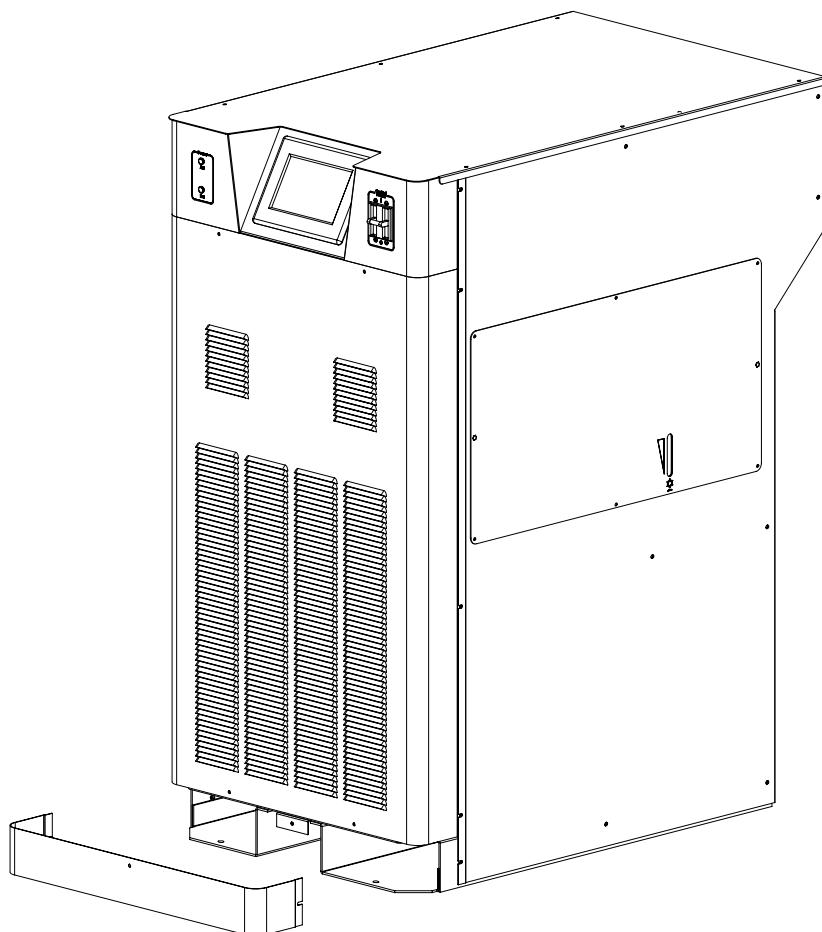
- 1-Torch systems – Section 3A
- 2-Torch systems – Section 3B

① Placement of the power supply



The power supply can be moved by forklift but the forks must be long enough to extend the entire length of the base. Take care when lifting so that the underside of the power supply is not damaged.

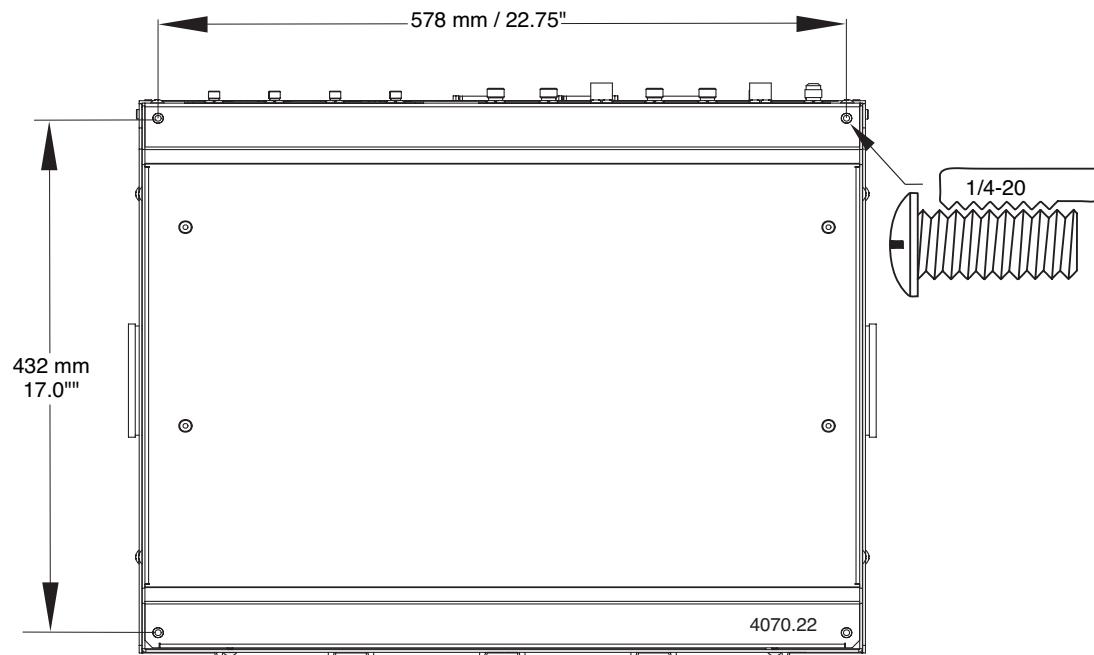
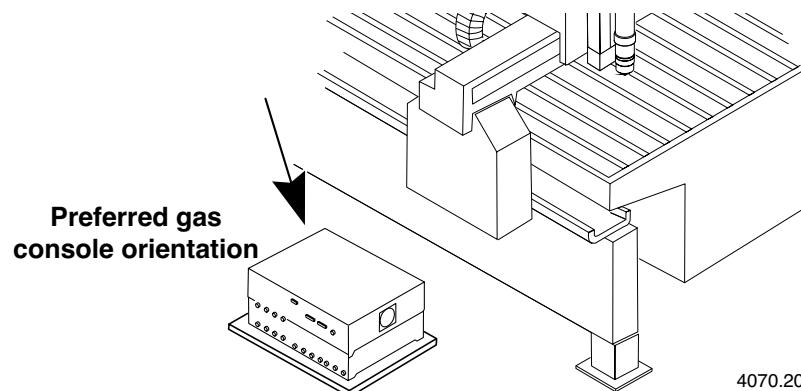
- Place the power supply in an area that is free of excessive moisture, has proper ventilation, and is relatively clean. Allow room at the sides and rear of the power supply for servicing.
- Cooling air is drawn in through the front panel grating and is exhausted through the rear of the unit by a cooling fan. Do not place any filter device over the air intake locations, which reduces cooling efficiency and **VOIDS THE WARRANTY**.



4070.25

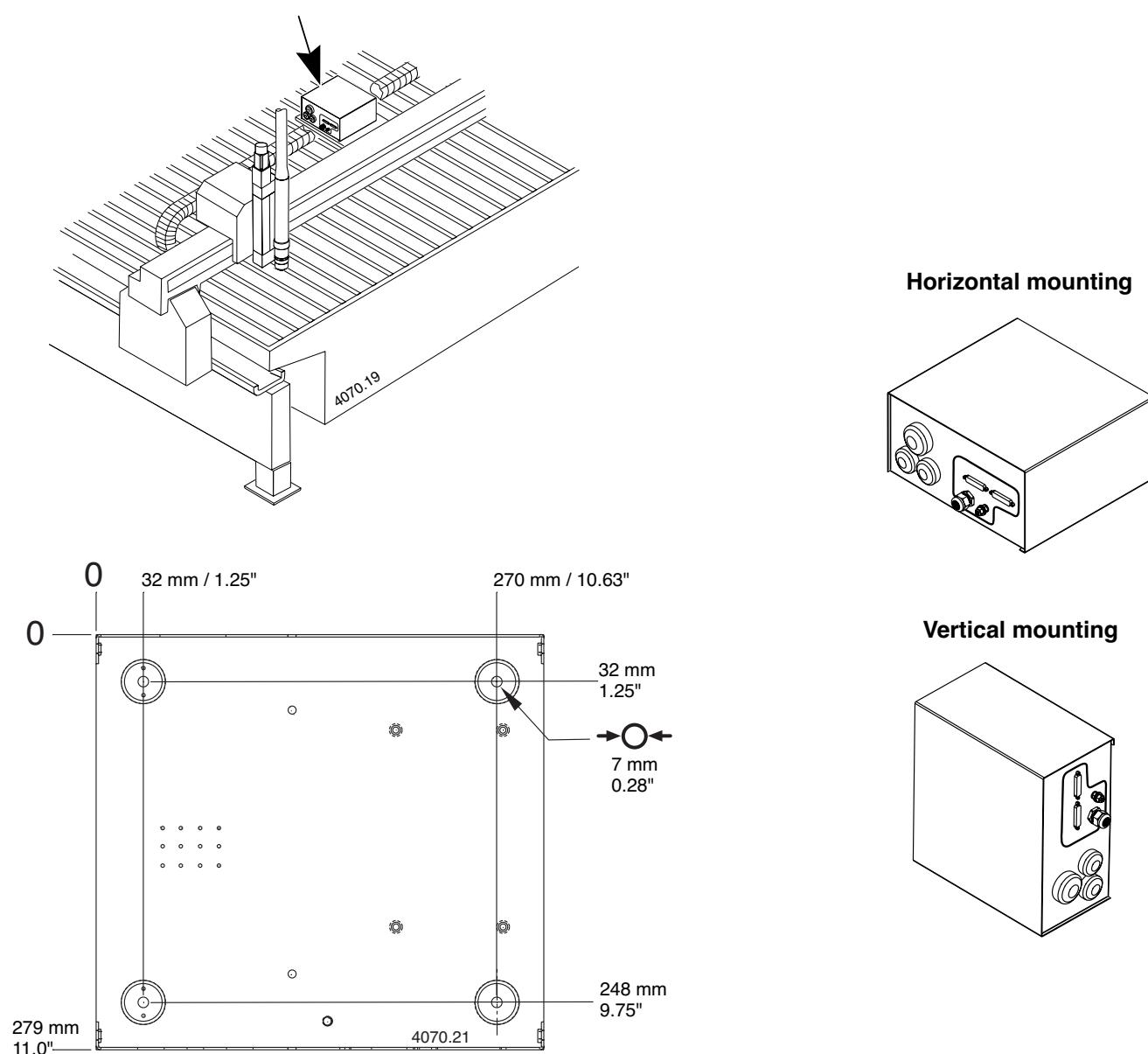
② Placement of the gas console assembly

- Position the gas console near the cutting table. Allow room to open the hinged top for servicing. Preferred orientation is shown in the figure below. The maximum length of cables between the power supply and gas console is 45 m (150 feet). The maximum length of cables and hoses between the gas console and the ignition console and off-valve assembly is 30 m (100 feet).
- Venting air is drawn in through fans on both sides and is exhausted through the front of the unit. The fans cool the console and purge the enclosure of any gas build-up.



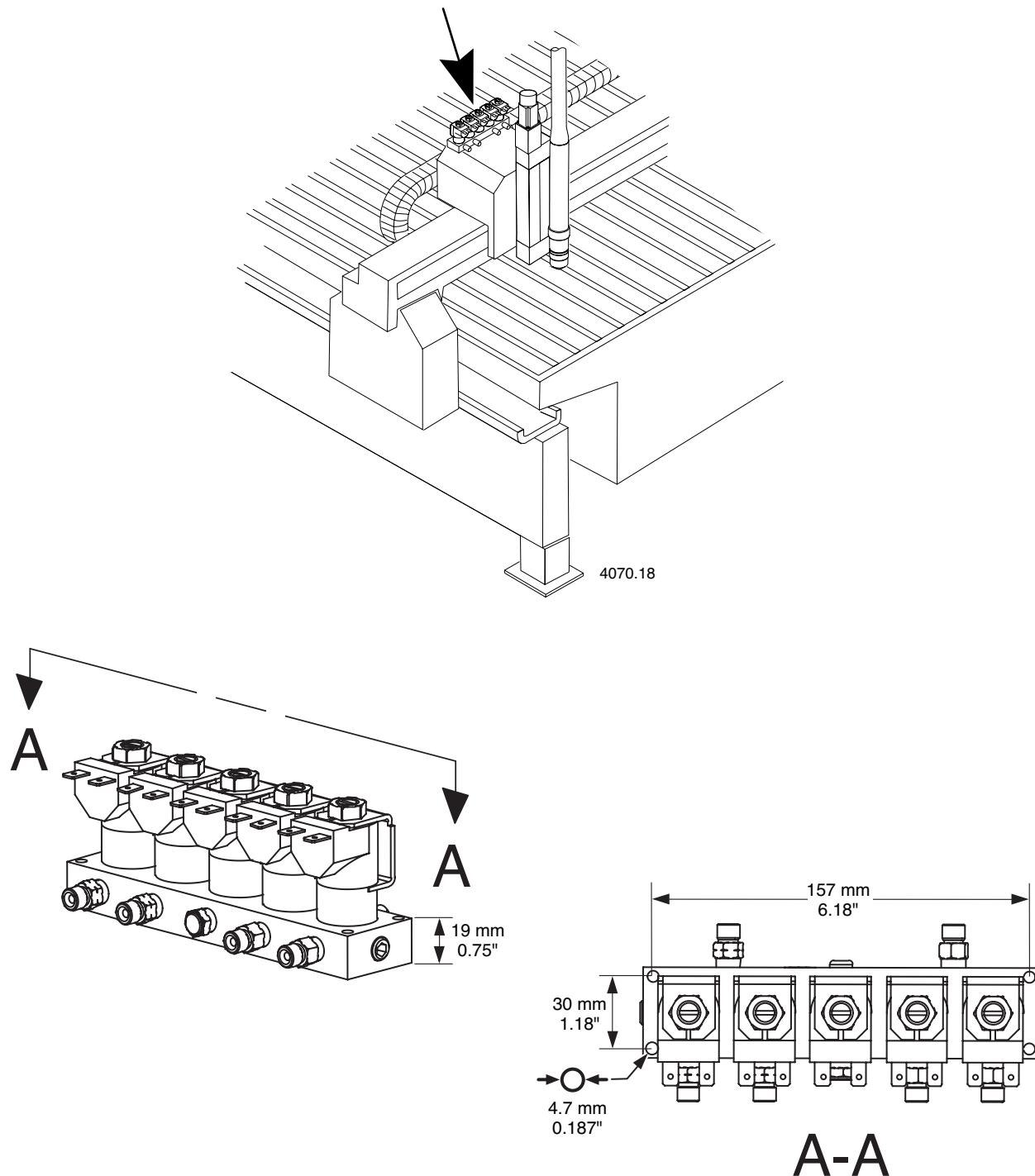
③ Mount the ignition console assembly

- Mount the ignition console on the gantry (bridge). Allow room to remove the top for servicing. Maximum length of the leads between the ignition console and the torch is 4.5 m (15 feet).
- Mount the ignition console horizontally, or in the vertical position as shown below.
- 2-torch systems: 2 ignition consoles are required for a 2-torch system.



④ Install the off-valve assembly

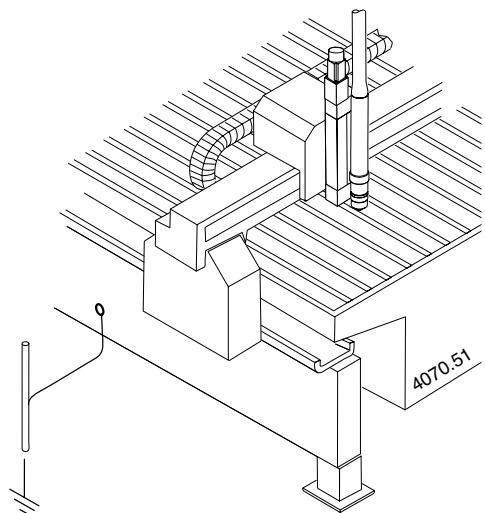
- Mount the off-valve assembly near the torch lifter station. The maximum length of the gas hoses between the off-valve assembly and the torch is 1.8 m (6 feet).
- 2-torch systems: 2 off-valve assemblies are required for a 2-torch system.



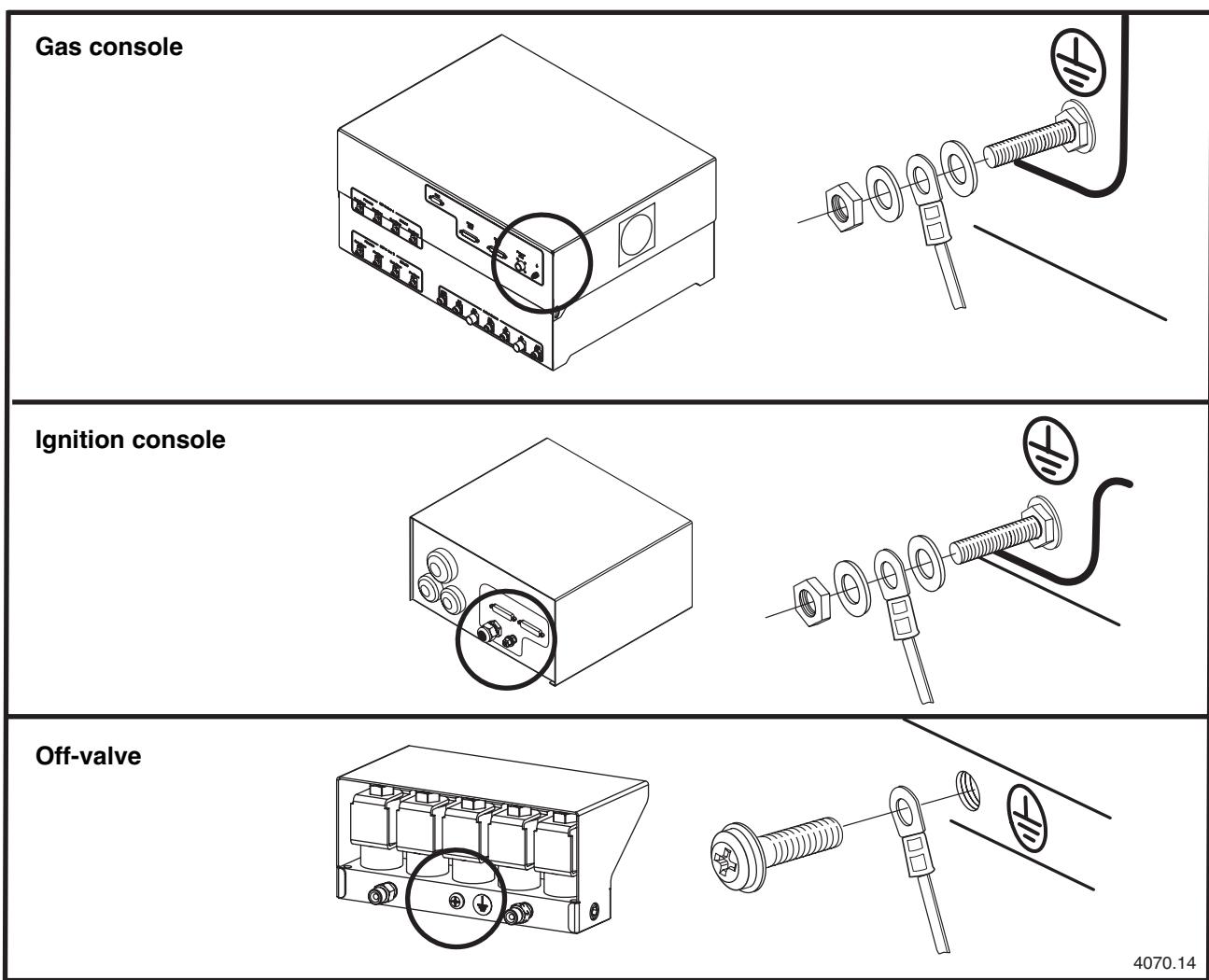
⑤ Grounding requirements

Proper grounding is essential for personal safety and to prevent emission of high-frequency interference. See *Grounding Safety* in Section 1 and Appendix A for system grounding requirements.

Connect the worktable to a high-quality earth ground, not more than 6 m (20 feet) from the table. A suitable ground consists of a solid copper rod of at least 13 mm (1/2 inch) diameter driven to a depth of at least 2.5 m (8 feet) into the earth, below the permanent moisture level. Ensure that all grounding connections are tight to avoid excessive heating. Consult national or local electrical codes for compliance and additional information.



Connect all HD4070 system components to earth ground. Use a minimum of 8 AWG (10 mm²) wire connected from each component to the work table ground.



⑥ Supply gas plumbing

Rigid copper plumbing or suitable flexible hose may be used for all gas supplies. Do not use steel or aluminum pipe.

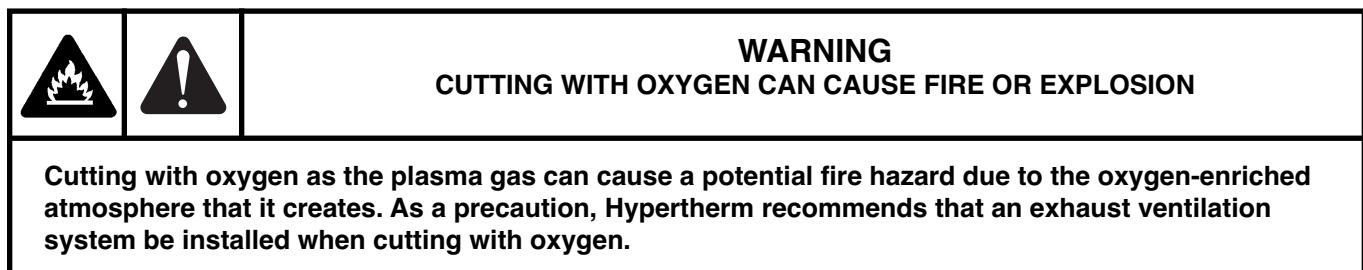
After installation, pressurize the entire system and check for leaks.

Recommended hose diameters are 9.5 mm (3/8 inch) for lengths < 23 m (75 feet) and 12.5 mm (1/2 inch) for lengths > 23 m (75 feet).

For flexible-hose systems, use a hose designed for inert gas to carry air, nitrogen, or argon-hydrogen.

Caution: When configuring the gas console to the supply gases, make sure that all hoses, hose connections and fittings are acceptable for use with oxygen, argon-hydrogen and methane. Installation must be made in accordance with local or national codes.

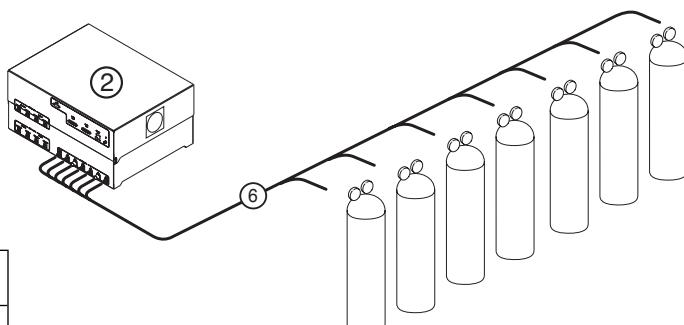
Note: When cutting with oxygen as the plasma gas, nitrogen must also be connected to the gas console to achieve the proper oxygen-nitrogen mixtures in the preflow and cutflow conditions.



Connect the supply gases

Connect the supply gases to the HD4070 gas console. Torch leads must be purged between gas changes.

Fitting	Size
H35, H5 & F5	9/16 – 18 LH, (Fuel Gas)"B"
O ₂	9/16 – 18, RH (oxygen) "B"
N ₂	5/8 – 18, RH, internal (Inert Gas) "B"
Air	9/16 – 18 #6



⑦ Power requirements

General

All switches, slow-blow fuses and power cables are customer supplied and must be chosen as outlined by applicable national or local electrical codes. Installation must be performed by a licensed electrician. Use a separate primary line disconnect switch for the power supply.

Note: The main feed protection device (Circuit Breaker or Fuse) must be sized to handle all branch feed loads for both inrush and steady state current. The power supply must be wired into one of the branch feed circuits. The power supply has a steady state current listed in the table below and has an inrush current of 10 times the rated input current that can last up to 0.20 seconds or 10 line cycles.

Input voltage	Phase	Rated input current @ 40 kW output	Recommended slow-burn fuse size	Cable size (AWG)
200 VAC	3	125 amps	150 amps	(*See note below)
220 VAC	3	113 amps	150 amps	2 AWG
240 VAC	3	103 amps	125 amps	4 AWG
400 VAC	3	62 amps	80 amps	6 AWG
440 VAC	3	56 amps	70 amps	6 AWG
480 VAC	3	52 amps	70 amps	6 AWG
600 VAC	3	41 amps	50 amps	8 AWG

* Note: Use 2 AWG wire rated for 90° C (194° F) rather than an equivalent larger diameter cable (1AWG) rated for 60° C (140° F)

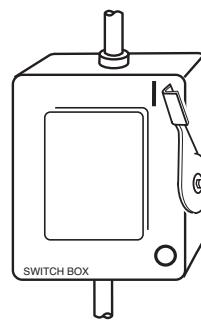
Line disconnect switch

The line disconnect switch serves as the supply-voltage disconnecting (isolating) device. Install this switch near the power supply for easy access by the operator.

Installation must be performed by a licensed electrician and according to applicable local or national codes.

The switch should:

- isolate the electrical equipment and disconnect all live conductors from the supply voltage when in the “OFF” position
- have one “OFF” and one “ON” position clearly marked with “0” (OFF) and “I” (ON)
- have an external operating handle capable of being locked in the “OFF” position
- contain a power operated mechanism that serves as an emergency stop
- have slow-blow fuses installed for the proper breaking capacity (see table above)



Power cable

Wire sizes vary based on the distance of the receptacle from the main box. The wire sizes listed in the table above were taken from the National Electric Code 1990 handbook, table 310.16 (USA). Use a 4-conductor Type SO input power cable with a conductor temperature rating of 60°C (140°F). Installation must be performed by a licensed electrician.

Connect the power

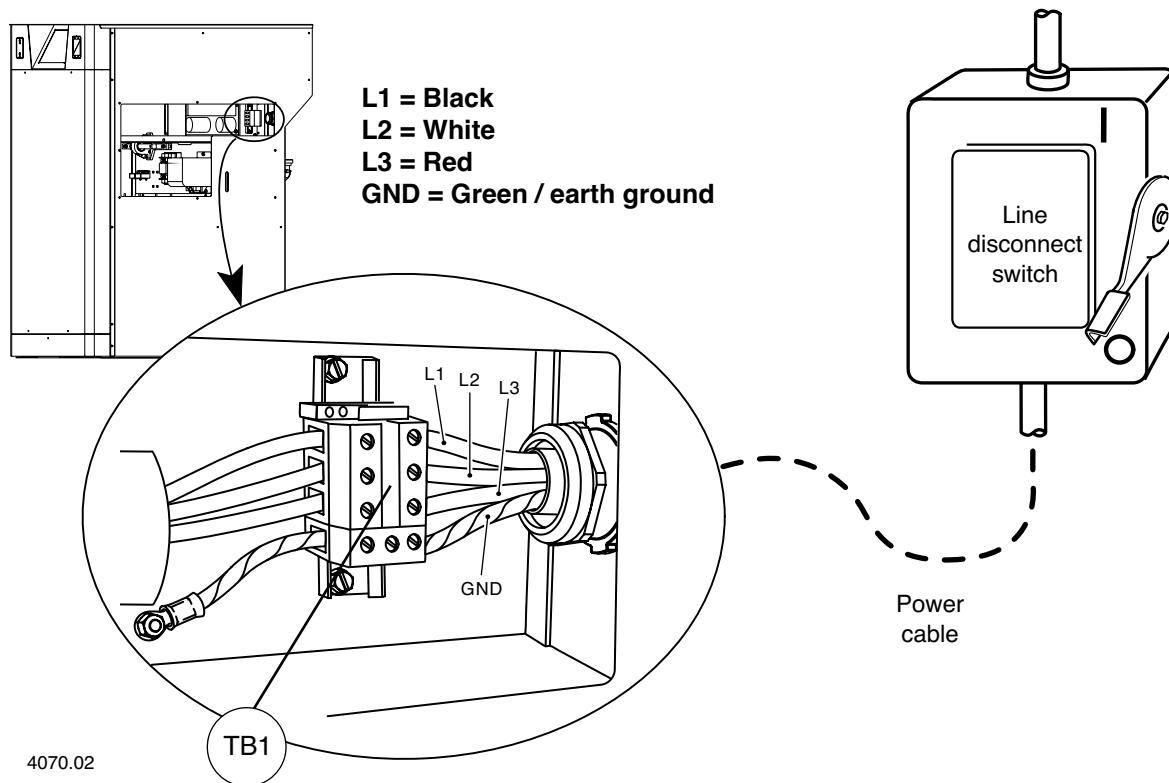


WARNING
ELECTRICAL SHOCK CAN KILL

The line disconnect switch must be in the OFF position before making the power cable connections. In the U.S., use a "lock-out/tag-out" procedure until installation is complete. In other countries, follow appropriate national or local safety procedures.

Note: Connect main power cable last if installing THC cables, for ease of installation.

1. Insert the power cable through the strain relief at the rear of the power supply.
2. Connect the ground lead (PE) to the GND terminal of TB1 as shown below.
3. Connect the power leads to the terminals of TB1 as shown below.
4. **Check that the line disconnect switch is in the OFF position and remains in the OFF position for the remainder of the installation of the HD4070 system.**
5. Connect the power cord leads to the line disconnect switch following national or local electrical codes.

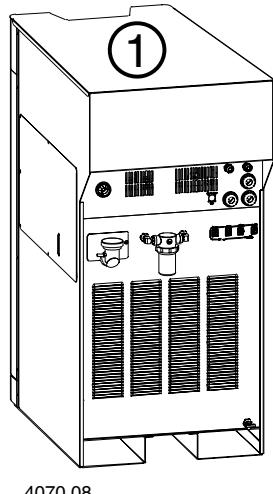
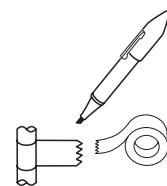


INSTALLATION

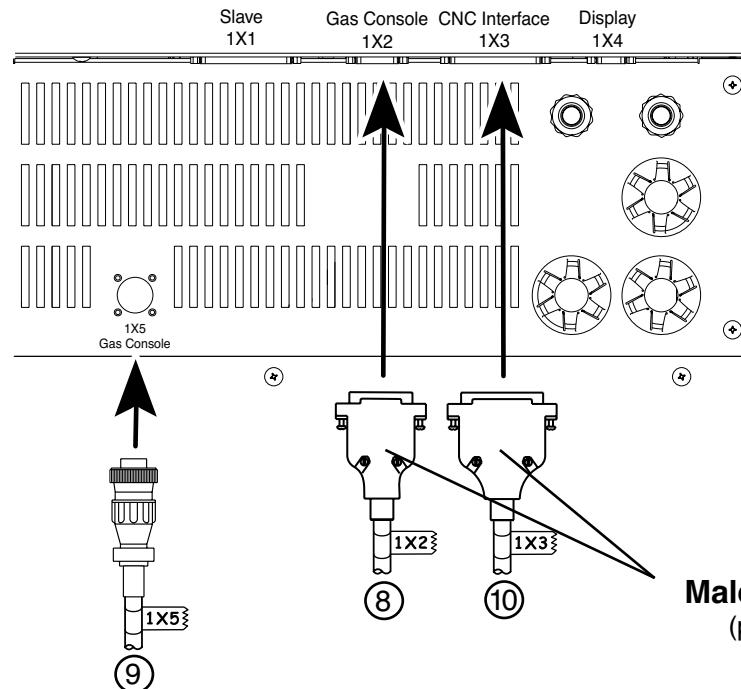
Install the power supply to gas console and CNC cables

Installation note

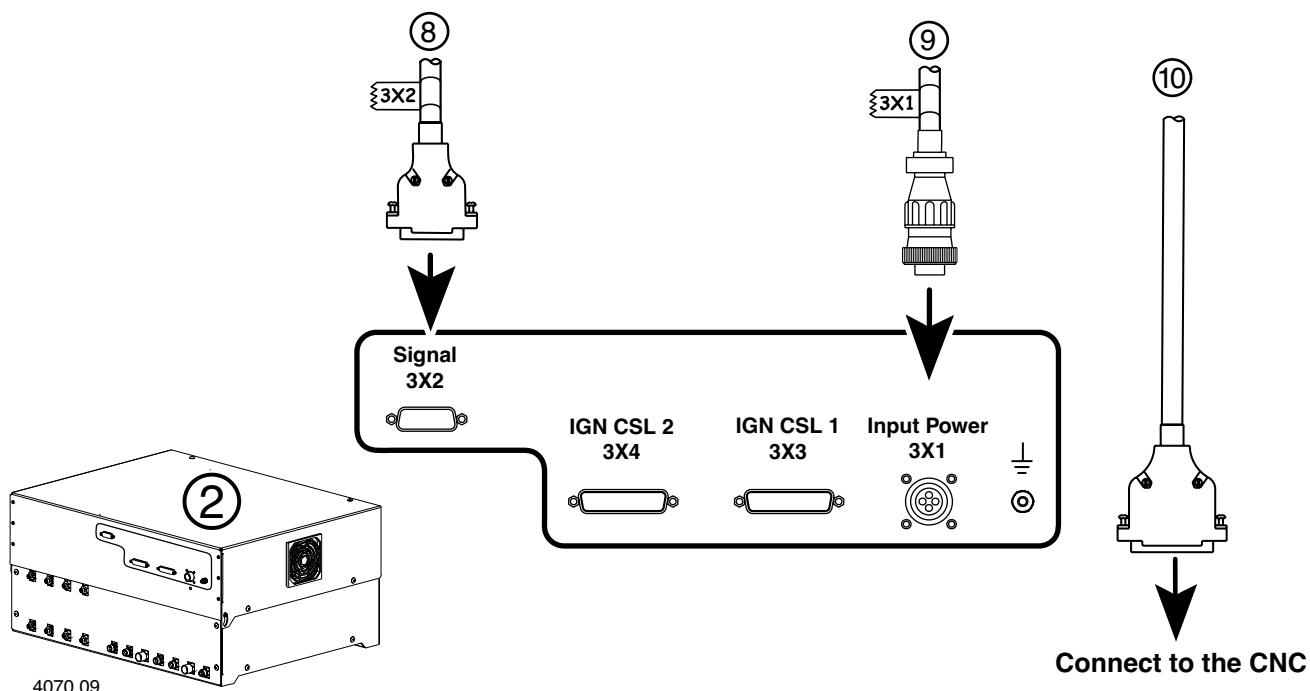
Mark the identification number on the ends of each cable.



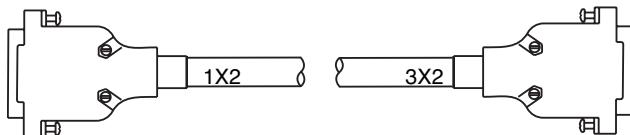
4070.08



Male ends
(pins)



⑧ Signal cable – power supply to gas console



Part no.	Length	Part no.	Length
123428	3 m (10 ft)	123433	15 m (50 ft)
123429	6 m (20 ft)	123434	23 m (75 ft)
123430	7.5 m (25 ft)	123435	30.5 m (100 ft)
123431	9 m (30 ft)	123436	46 m (150 ft)
123432	12 m (40 ft)		

RUN LIST – Power Supply to Gas Console Signal Cable					
Signal name	1X2	Color	3X2	Function	Input/Output
	NC	White	NC	Not connected	
TX + TX -	8 15	Red Orange	8 15	RS-422 Serial transmitter RS-422 Serial transmitter	Output Output
RX - RX +	7 14	Black Brown	7 14	RS-422 Serial receiver RS-422 Serial receiver	Input Input
	6 13	Black Yellow	6 13		
Error - Error +	5 12	Black Blue	5 12	Tells you that an error has occurred	Output Output
	4	Black	4		
S3	11 3	Green Black	11 3	Used to select state 3	Input Input
S2	10 2	White Black	10 2	Used to select state 3	Input Input
S1	9 1	Red Black	9 1	Used to select state 3	Input Input

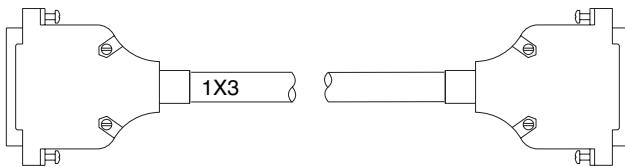
⑨ Power cable – power supply to gas console



Part no.	Length	Part no.	Length	RUN LIST – Power Supply to Gas Console Power Cable			
				Signal	1X5	Color	3X1
123419	3 m (10 ft)	123424	15 m (50 ft)	120 VAC HOT	1	Black	1
123420	6 m (20 ft)	123425	23 m (75 ft)	120 VAC Return	2	White	2
123421	7.5 m (25 ft)	123426	30.5 m (100 ft)	Positive earth (ground)	3	Green	3
123422	9 m (30 ft)	123427	46 m (150 ft)	Not applicable	4	N/A	4
123423	12 m (40 ft)						

INSTALLATION

⑩ CNC interface cable – power supply to CNC



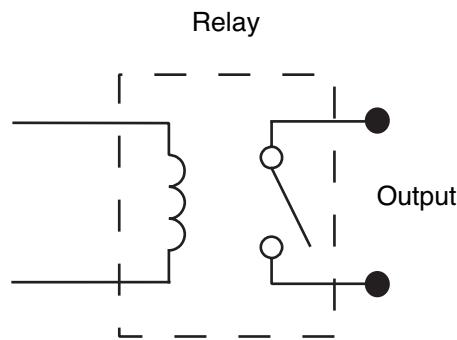
Part no.	Length	Part no.	Length
123437	3 m (10 ft)	123442	15 m (50 ft)
123438	6 m (20 ft)	123443	23 m (75 ft)
123439	7.5 m (25 ft)	123444	30.5 m (100 ft)
123440	9 m (30 ft)	123445	46 m (150 ft)
123441	12 m (40 ft)		

Twisted Wire Pairs	Signal name	Power supply end	Color	CNC-end	Function	Input/Output	Notes
		NC	Blue	NC	Not connected		*
<input type="checkbox"/>	Interlock -	19	White	19	Allows installation of an emergency stop switch (normally closed). If CNC interlock is not used, install a jumper wire to close.	Input	
<input type="checkbox"/>	Interlock +	37	Black	37		Input	
<input type="checkbox"/>	Motion Motion	18	White	18	Vерifies to CNC that a pierce delay is complete and notifies CNC to start movement of the cutting machine. For multiple plasma systems on the same cutting machine, this signal should be logically ANDed from all connected plasma systems.	Output	1
<input type="checkbox"/>	Motion Motion	36	Orange	36		Output	
<input type="checkbox"/>	Transfer Transfer	17	Green	17	Notifies the CNC that a successful arc transfer has occurred. This signal is similar to motion, but does not include the programmed pierce delay time.	Output	1
<input type="checkbox"/>	Transfer Transfer	35	Brown	35		Output	
<input type="checkbox"/>	Ground Ground	16	Green	16			
<input type="checkbox"/>	Ground Ground	34	Yellow	34			
<input type="checkbox"/>	Ground Ground	15	Green	15			
<input type="checkbox"/>	Machine Cable Installed +	33	Blue	33	Vерifies that the CNC machine cable has been installed.	Input	3
<input type="checkbox"/>	Machine Cable Installed -	14	Green	14		Input	
<input type="checkbox"/>	System Error +	32	White	32	Notifies the CNC motion controls that a plasma system error has occurred Actual error can be queried from serial interface.	Output	2
<input type="checkbox"/>	System Error -	13	Green	13		Output	
<input type="checkbox"/>	Spare Output 1 +	31	Orange	31	Spare output	Output	2
<input type="checkbox"/>	Spare Output 1 -	12	Red	12		Output	
<input type="checkbox"/>	Spare Input 1 +	30	Brown	30	Spare input	Input	3
<input type="checkbox"/>	Spare Input 1 -	11	Red	11		Input	
<input type="checkbox"/>	Spare Input 2 +	29	Yellow	29	Spare input	Input	3
<input type="checkbox"/>	Spare Input 2 -	10	Red	10		Input	
<input type="checkbox"/>	Retract Complete +	28	Blue	28	Vерifies to the CNC that the torch has retracted.	Output	2
<input type="checkbox"/>	Retract Complete -	9	Red	9		Output	
<input type="checkbox"/>	Spare Output 2 +	27	Green	27	Spare output	Output	2
<input type="checkbox"/>	Spare Output 2 -	8	Red	8		Output	
<input type="checkbox"/>	Spare Output 3 +	26	White	26	Spare output	Output	2
<input type="checkbox"/>	Spare Output 3 -	7	Red	7		Output	
<input type="checkbox"/>	Ready to Fire +	25	Orange	25	This signal is used in multiple plasma systems. It notifies the CNC that the THC completed the IHS cycle and preflow is complete, indicating that the torch is ready to fire. This signal and the CNC Plasma Sync signal are used together. For multiple plasma systems on the same cutting machine this signal should be logically ANDed to indicate that all machines are ready.	Output	2
<input type="checkbox"/>	Ready to Fire -	6	Black	6		Output	
<input type="checkbox"/>	Plasma Sync +	24	Brown	24	This signal is used in multiple plasma systems. It delays torch firing, but allows the preflow gases to flow. This signal and the ready-to-fire signal are used together. For multiple plasma systems on the same cutting machine, this signal should be removed simultaneously to all connected plasma systems so all torches will fire simultaneously.	Input	3
<input type="checkbox"/>	Plasma Sync -	5	Black	5		Input	
<input type="checkbox"/>	Corner Hold +	23	Yellow	23	On systems with a command THC installed, When this signal is active it overrides the arc voltage control and hold the torch height constant.	Input	3
<input type="checkbox"/>	Corner Hold -	4	Black	4		Input	
<input type="checkbox"/>	System Start +	22	Blue	22	Initiates the start of a programmed plasma system cut cycle. This signal must be maintained for the duration of the cut. For multiple plasma systems on the same cutting machine, this signal should be activated simultaneously to all machines.	Input	3
<input type="checkbox"/>	System Start -	3	Black	3		Input	
<input type="checkbox"/>	CNC TX +	21	Green	21	RS - 422 serial transmitter. Transmits data from CNC to plasma system. Used to set up plasma process information and query for plasma status information. See serial command list for full description.	Input	3
<input type="checkbox"/>	CNC TX -	2	Black	2		Input	
<input type="checkbox"/>	CNC RX +	20	Red	20	RS - 422 serial receiver. Receives data from plasma system to CNC controls. Used to report plasma system status and error information in response to commands from the CNC controller. See serial command list for full description.	Output	
<input type="checkbox"/>	CNC RX -	1	Black	1		Output	

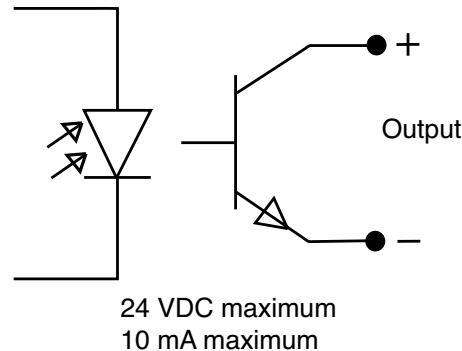
*See notes on next page

Notes: to CNC interface cable run list

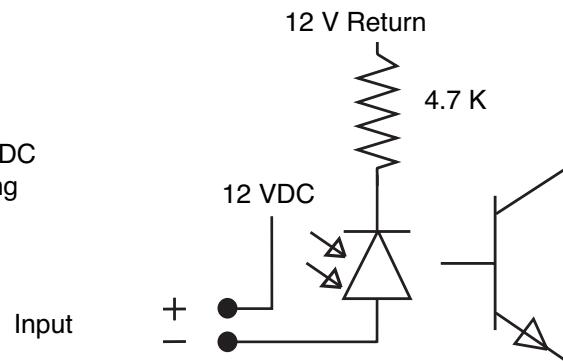
- Note 1. Motion and Transfer Outputs.
Relay Contact Closure.



- Note 2. HD4070 outputs are optically coupled transistors with maximum ratings of 24 VDC and 10 mA.



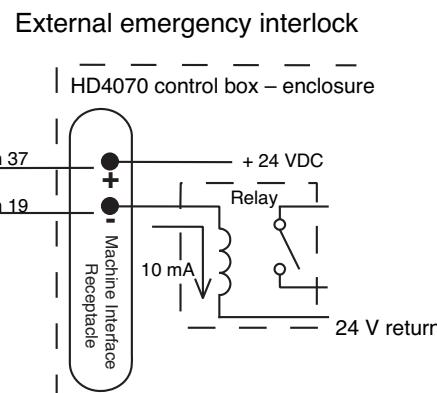
- Note 3. HD4070 inputs are optically isolated 12 VDC signals. Signals are made active by sinking 3 mA per input.



- Note 4. Emergency interlock contact closure.

Install NC *
switch or
jumper

* Normally closed



INSTALLATION

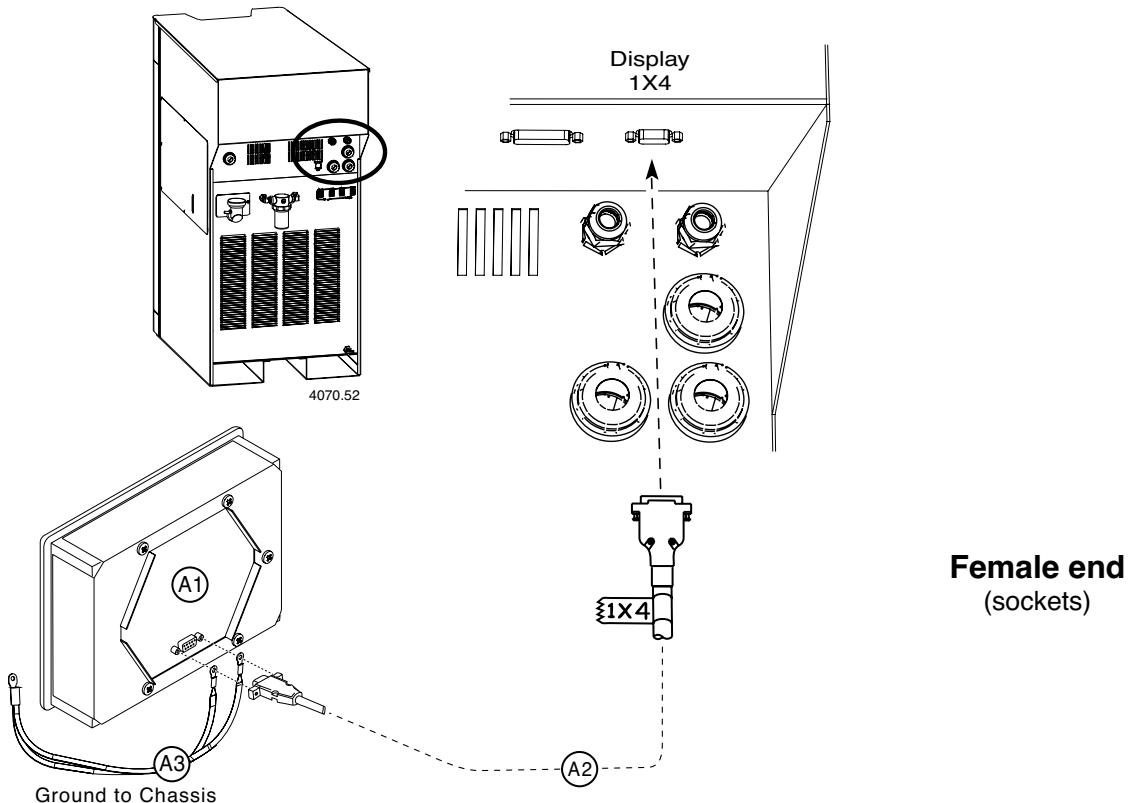
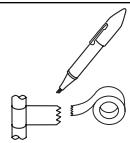
Install the remote display cable



Caution: The HD4070 system can only support one touch screen display, either local or remote. Installing displays at both locations on one system may cause malfunctions or damage.

Installation note

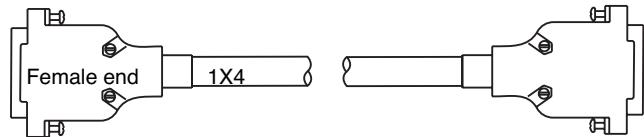
1. Mark the identification number on the end of the cable.
2. Instructions to install the remote display are included with the applicable remote display kit.



A1 Remote display

A2 Signal cable – power supply to remote display

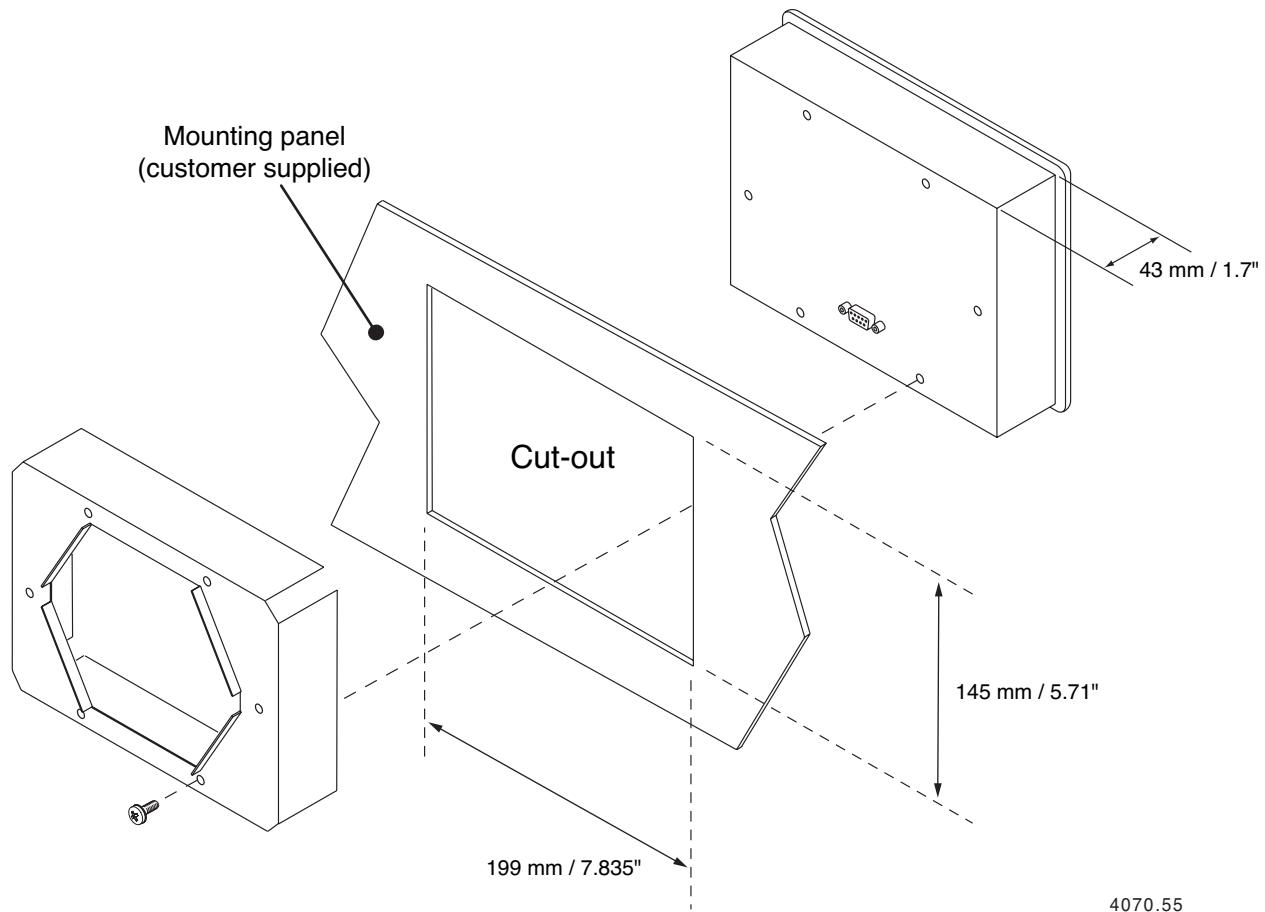
A3 Ground wire



RUN LIST – Power Supply to Remote Display Cable

Part no.	Length	Part no.	Length	1X4	Color	Display
123476	2 m (6 ft)	123485	12 m (40 ft)	5	Black	5
123481	3 m (10 ft)	123019	15 m (50 ft)	9	Red	9
123482	6 m (20 ft)	123487	23 m (75 ft)	8	N/C*	8
123018	7.5 m (25 ft)	123488	30.5 m (100 ft)	7	N/C	7
123484	9 m (30 ft)	123489	46 m (150 ft)	4	N/C	4
* Not connected						

⑪ Display mounting dimensions



4070.55

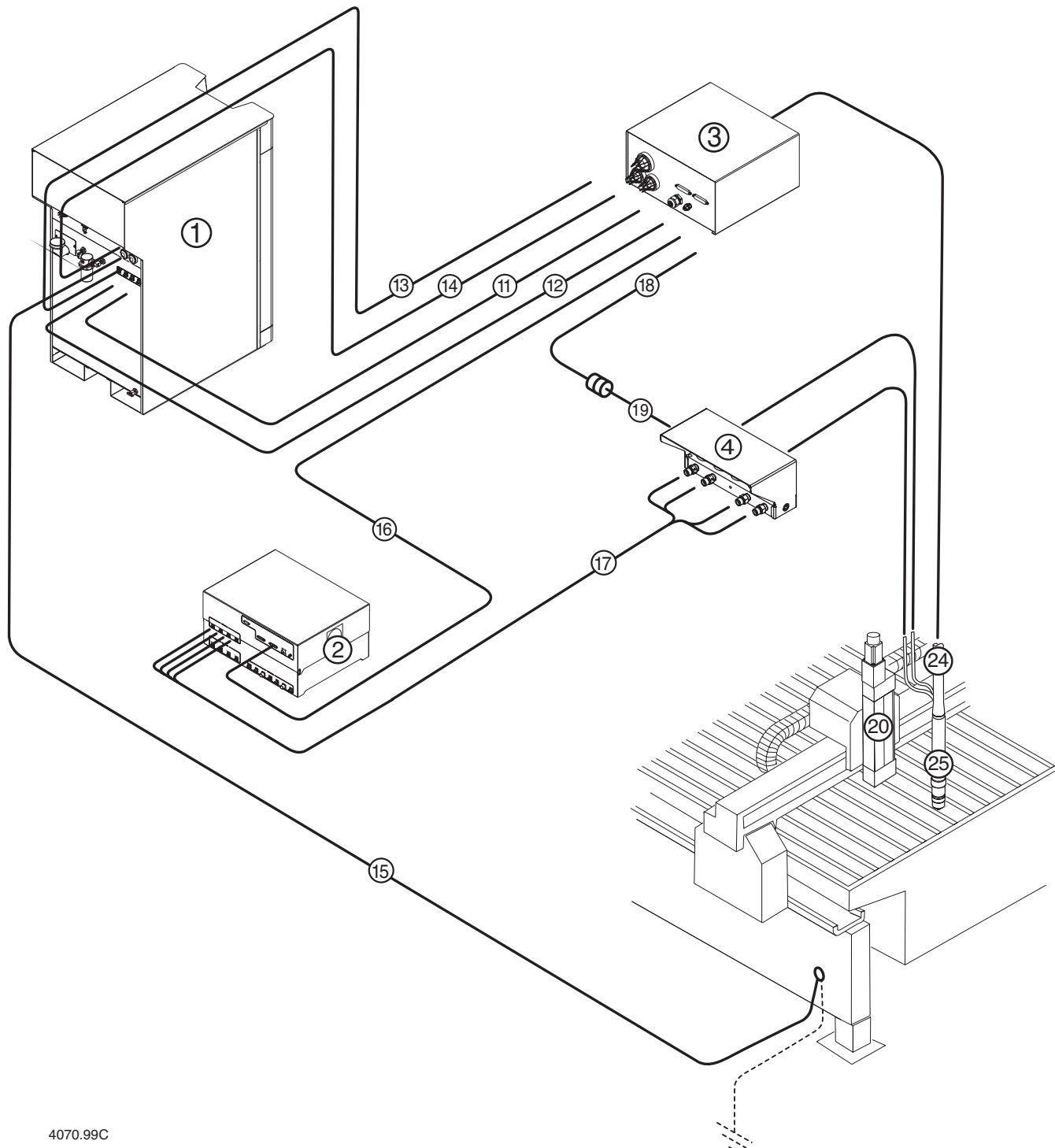
Section 3A**1-TORCH INSTALLATION**

In this section:

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Torch and lead assembly	3A-25
Fill the power supply with coolant	3A-26

1-TORCH INSTALLATION

HD4070 1-torch installation



4070.99C

System components

See section 3 for installation details.

- (1) Power supply
- (2) Gas console
- (3) Ignition console
- (4) Off-valve assembly

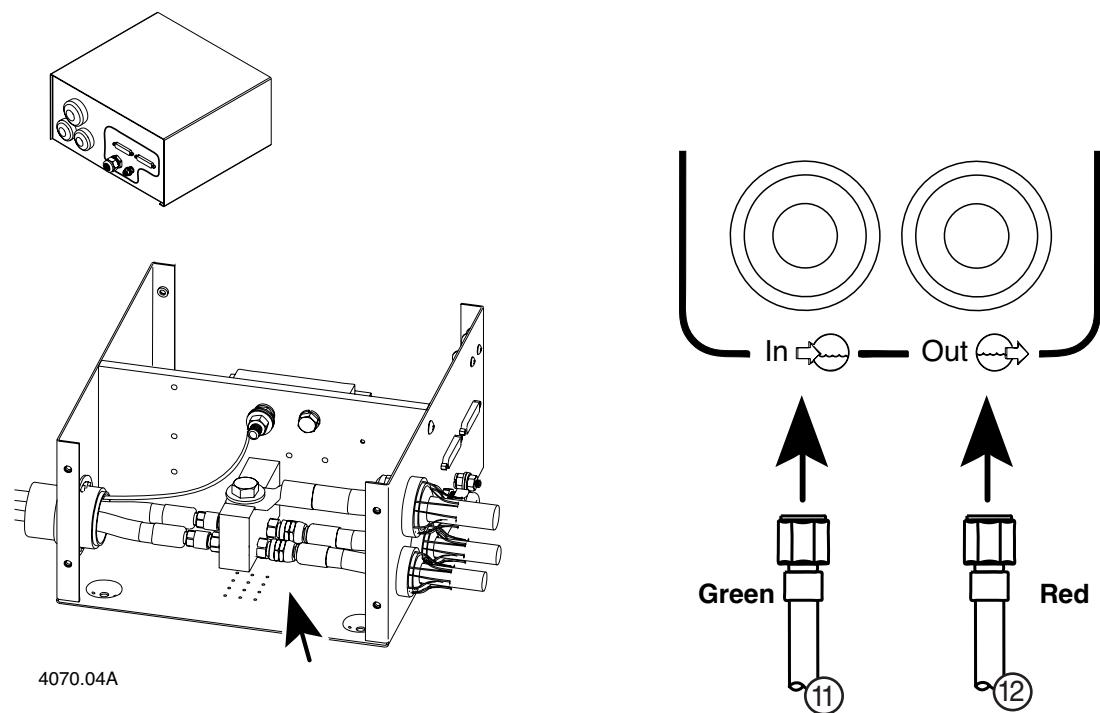
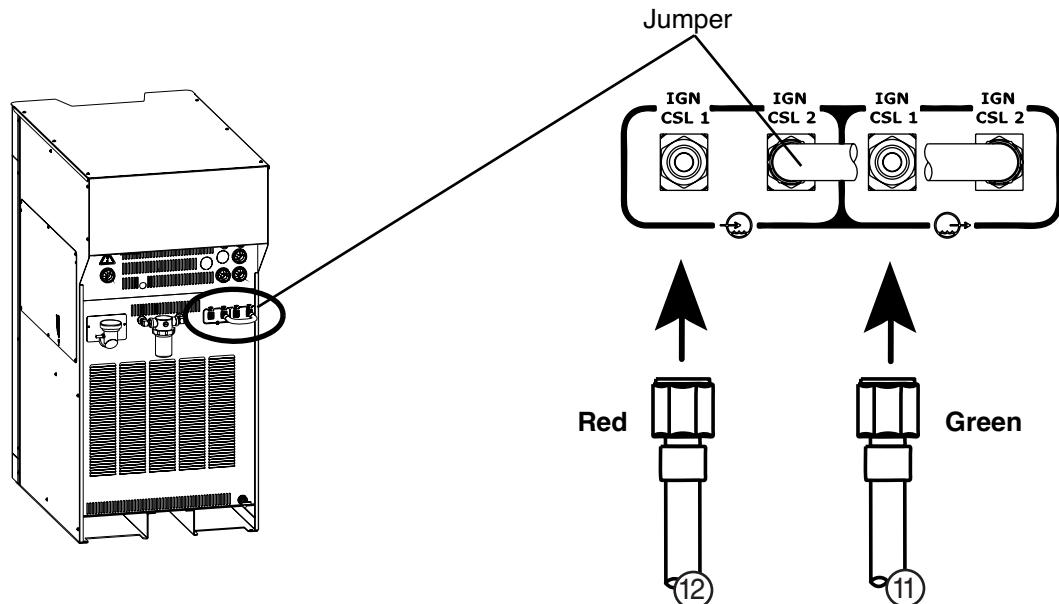
Cables and hoses

- (11) Coolant hose assembly; see page 3A-4.
- (12) Coolant hose assembly; see page 3A-4.
- (13) Pilot arc lead; see page 3A-6.
- (14) Negative lead; see page 3A-6.
- (15) Work lead; see page 3A-6.
- (16) Gas console cable; see page 3A-8.
- (17) Gas hose assembly; see page 3A-10.
- (18) Ignition console cable; see page 3A-10.
- (19) Off-valve assembly cable; see page 3A-10.
- (20) - (23) Integrated Command THC option; see page 3A-18.
- (24) Lead assemblies; see page 3A-21.
- (25) Torch assembly; see page 3A-23.

1-TORCH INSTALLATION

Install the coolant hoses

Important: A jumper hose is installed in power supplies configured for 1 torch and must be in place when system is run with one torch. Coolant will flow out if the jumper hose is not in place.

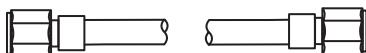


⑪ Coolant hose assembly – green supply



Part no.	Length	Part no.	Length
024563	3 m (10 ft)	024263	15 m (50 ft)
024564	6 m (20 ft)	024264	23 m (75 ft)
024291	7.5 m (25 ft)	024265	30.5 m (100 ft)
024503	9 m (30 ft)	024459	46 m (150 ft)
024565	12 m (40 ft)		

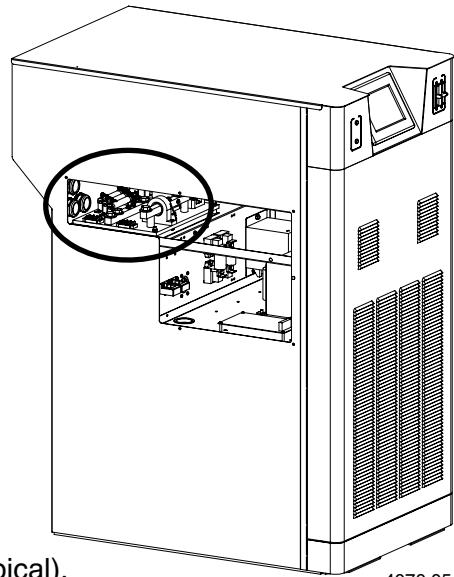
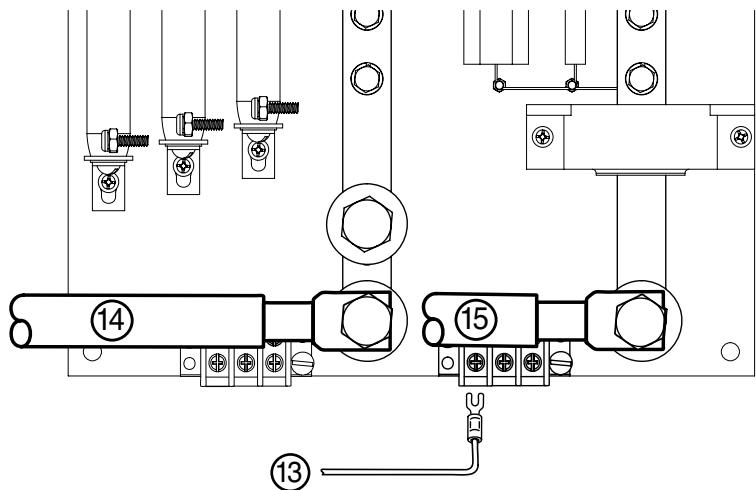
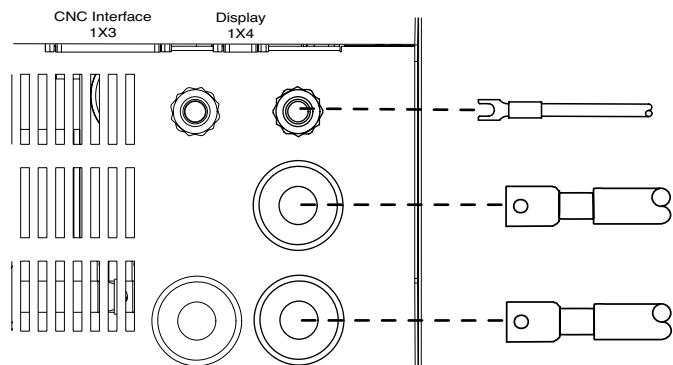
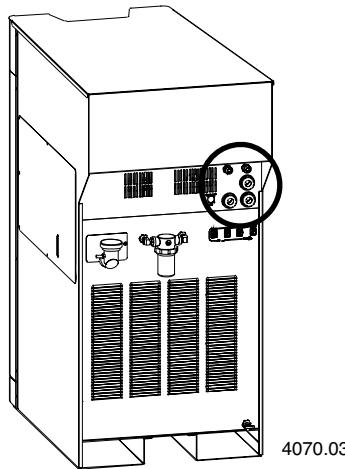
⑫ Coolant hose assembly – red return



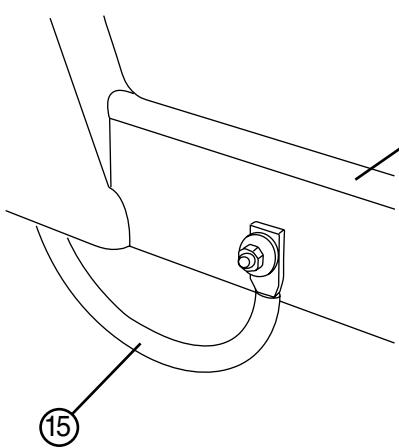
Part no.	Length	Part no.	Length
024566	3 m (10 ft)	024268	15 m (50 ft)
024567	6 m (20 ft)	024269	23 m (75 ft)
024267	7.5 m (25 ft)	024270	30.5 m (100 ft)
024504	9 m (30 ft)	024460	46 m (150 ft)
024568	12 m (40 ft)		

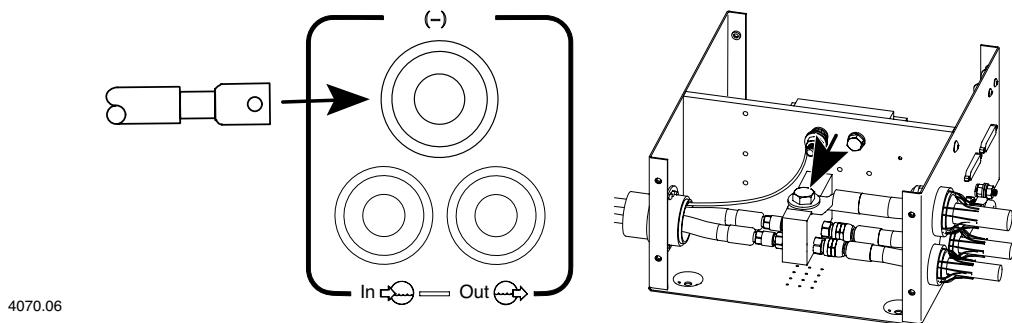
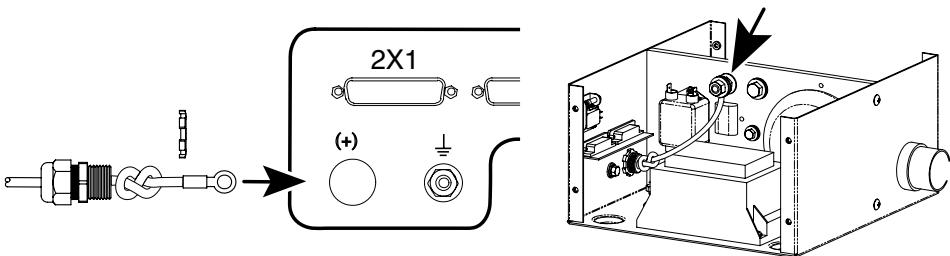
1-TORCH INSTALLATION

Install the power supply to ignition console leads and the work lead

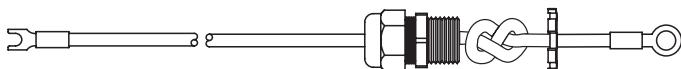


Lower frame of work table (typical).





⑬ Pilot arc lead



Part no.	Length	Part no.	Length
123409	3 m (10 ft)	123414	15 m (50 ft)
123410	6 m (20 ft)	123415	23 m (75 ft)
123411	7.5 m (25 ft)	123416	30.5 m (100 ft)
123412	9 m (30 ft)	123417	46 m (150 ft)
123413	12 m (40 ft)		

⑭ Negative lead



Part no.	Length	Part no.	Length
123418	3 m (10 ft)	023079	15 m (50 ft)
023136	6 m (20 ft)	023124	23 m (75 ft)
023078	7.5 m (25 ft)	023080	30.5 m (100 ft)
023101	9 m (30 ft)	023081	46 m (150 ft)
023135	12 m (40 ft)		

⑮ Work lead



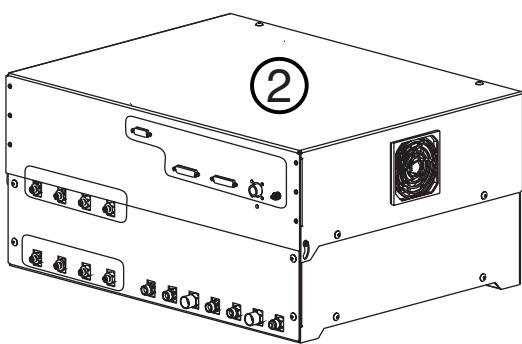
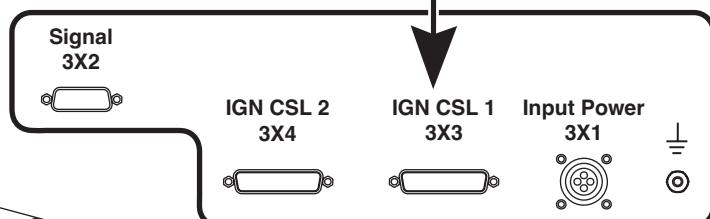
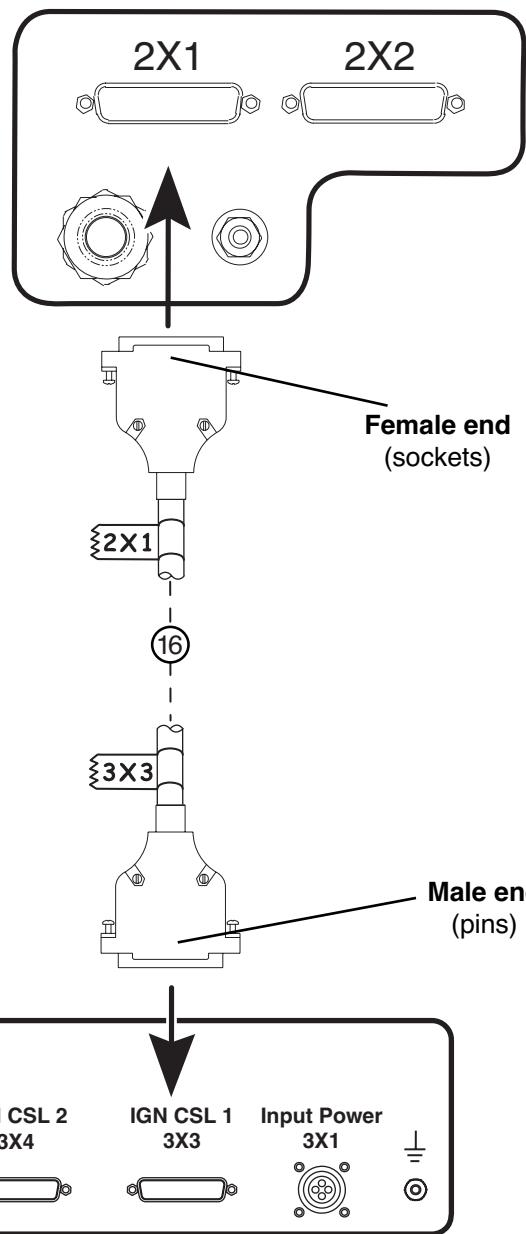
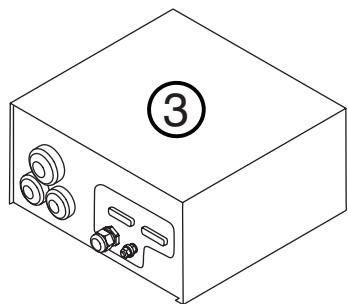
Part no.	Length	Part no.	Length
123418	3 m (10 ft)	023079	15 m (50 ft)
023136	6 m (20 ft)	023124	23 m (75 ft)
023078	7.5 m (25 ft)	023080	30.5 m (100 ft)
023101	9 m (30 ft)	023081	46 m (150 ft)
023135	12 m (40 ft)		

1-TORCH INSTALLATION

Install the gas console to ignition console cable

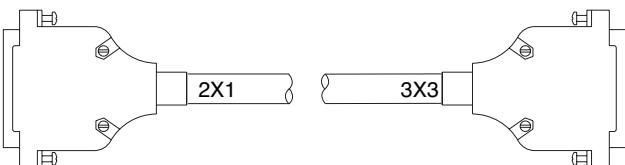
Installation note

Mark the identification number on the ends of the cable.



4070.10A

⑯ **Cable – gas console to ignition console**



Part no.	Length	Part no.	Length
123446	3 m (10 ft)	123512	15m (50 ft)
123447	6 m (20 ft)	123559	18m (60 ft)
123448	7.5 m (25 ft)	123513	23m (75 ft)
123449	9 m (30 ft)	123514	30.5m (100 ft)
123450	12 m (40 ft)		

CABLE RUN LIST					
Signal name	2X1	Color	3X3	Function	Input/ Output
Not used	13	Grey	13		
Not used	25	Brown	25		
Not used	12	Red	12		
Not used	24	Yellow	24		
Not used	11	Red	11		
Not used	23	Blue	23		
Not used	10	Red	10		
Not used	22	Green	22		
Not used	9	Red	9		
Not used	21	White	21		
Not used	8	Red	8		
Not used	20	Orange	20		
Not used	7	Black	7		
Vent-120 VAC return	19	Brown	19	Energizes the vent solenoid	Output
Vent-120 VAC	6	Black	6		Output
Plasma cutflow-120 VAC return	18	Yellow	18	Energizes the plasma cutflow solenoid	Output
Plasma cutflow-120 VAC	5	Black	5		Output
Plasma preflow-120 VAC return	17	Blue	17	Energizes the plasma preflow solenoid	Output
Plasma preflow-120 VAC	4	Black	4		Output
Shield cutflow-120 VAC return	16	Green	16	Energizes the shield cutflow solenoid	Output
Shield cutflow-120 VAC	3	Black	3		Output
Shield preflow-120 VAC return	15	White	15	Energizes the shield preflow solenoid	Output
Shield preflow-120 VAC	2	Black	2		Output
Ignitor-120 VAC return	14	Red	14	Energizes the ignitor	Output
Ignitor-120 VAC	1	Black	1		Output

1-TORCH INSTALLATION

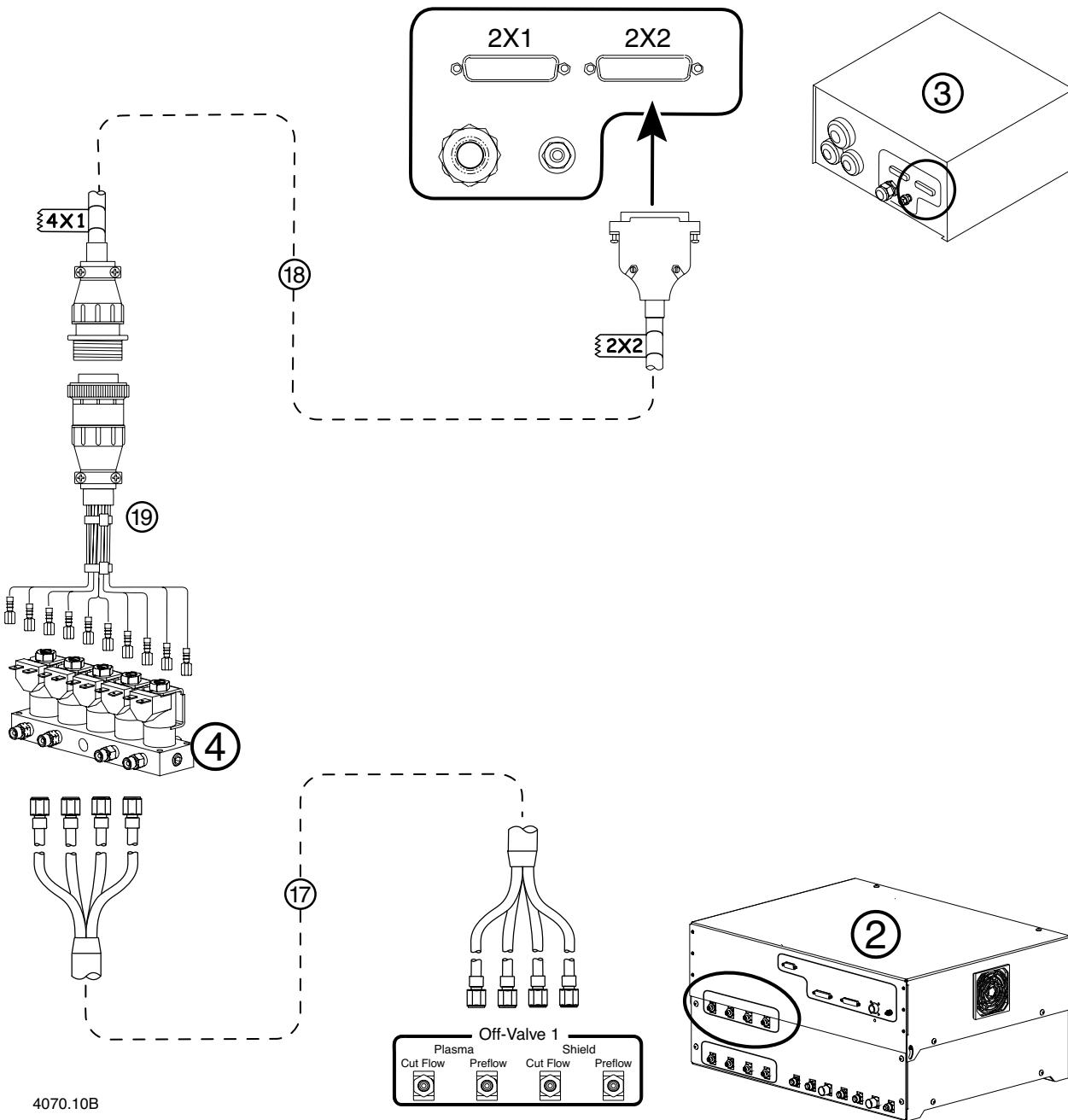
Install the ignition console to off-valve cable and gas hose assembly

Installation note

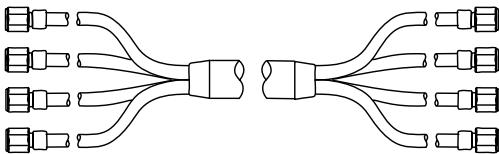
Mark the identification number on the ends of cable 18.



Make sure there are no leaks at connections.

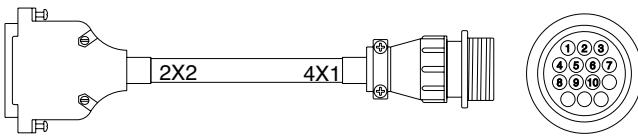


(17) Hoses – gas console to off-valve



Part no.	Length	Part no.	Length
128445	4.6 m (15 ft)	128450	12 m (40 ft)
128446	6 m (20 ft)	128558	15 m (50 ft)
128447	7.5 m (25 ft)	128559	18 m (60 ft)
128448	9 m (30 ft)	128550	23 m (75 ft)
128449	10.5 m (35 ft)	128551	30.5 m (100 ft)

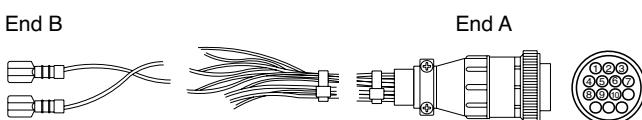
(18) Cable – ignition console to off-valve



Part no.	Length	Part no.	Length
123451	1.8 m (6 ft)	123453	4.6 m (15 ft)
123452	3 m (10 ft)		

CABLE RUN LIST			
Function	2X2	Color	4X1
Shield	2	Red	1
Preflow	15	White	2
Shield	3	Green	3
Cutflow	16	White	4
Plasma	4	Orange	5
Preflow	17	White	6
Plasma	5	Blank	7
Cutflow	18	White	8
Vent	6	Yellow	9
	19	White	10

(19) Cable – off-valve



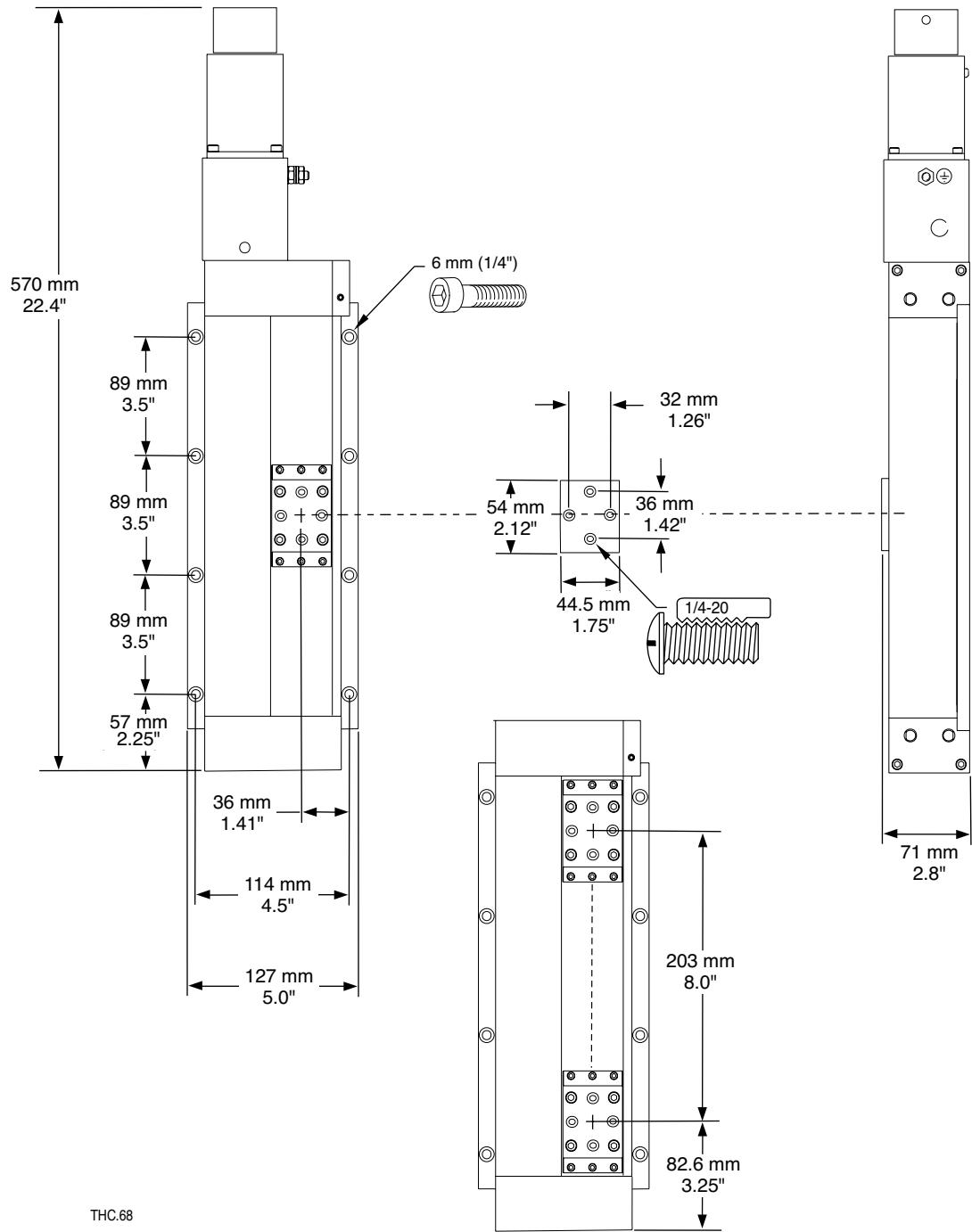
Part no.	Length	Part no.	Length
123540	0.5 m (1.5 ft)		

CABLE RUN LIST			
Function	End B	Color	End A
Shield	S	Red/Black	1
Preflow	P	Red	2
Shield	S	Red/Black	3
Cutflow	C	Red	4
Plasma	P	Red/Black	5
Preflow	P	Red	6
Plasma	P	Red/Black	7
Cutflow	C	Red	8
Vent	V	Red/Black	9
	V	Red	10

THC and torch installation

X-Y lifter assembly

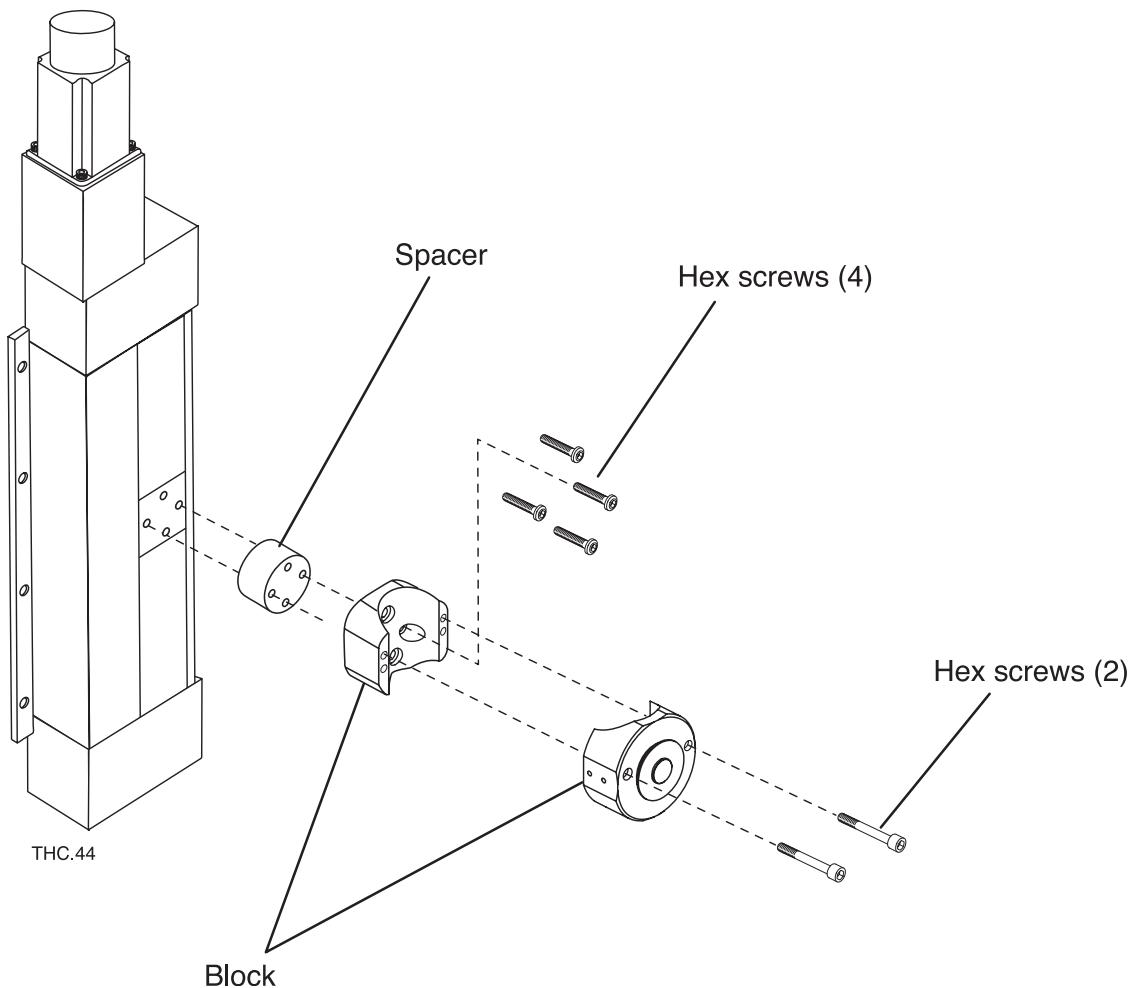
- Mount the X-Y lifter assembly on the cutting table.



X-Y lifter assembly mounting

Torch mounting block kit

- Mount the torch mounting block kit to the X-Y lifter assembly.
Refer to Section 6, *Parts List* for a complete list of available kits.

**X-Y lifter assembly torch mounting block**

Torch breakaway kit (optional)

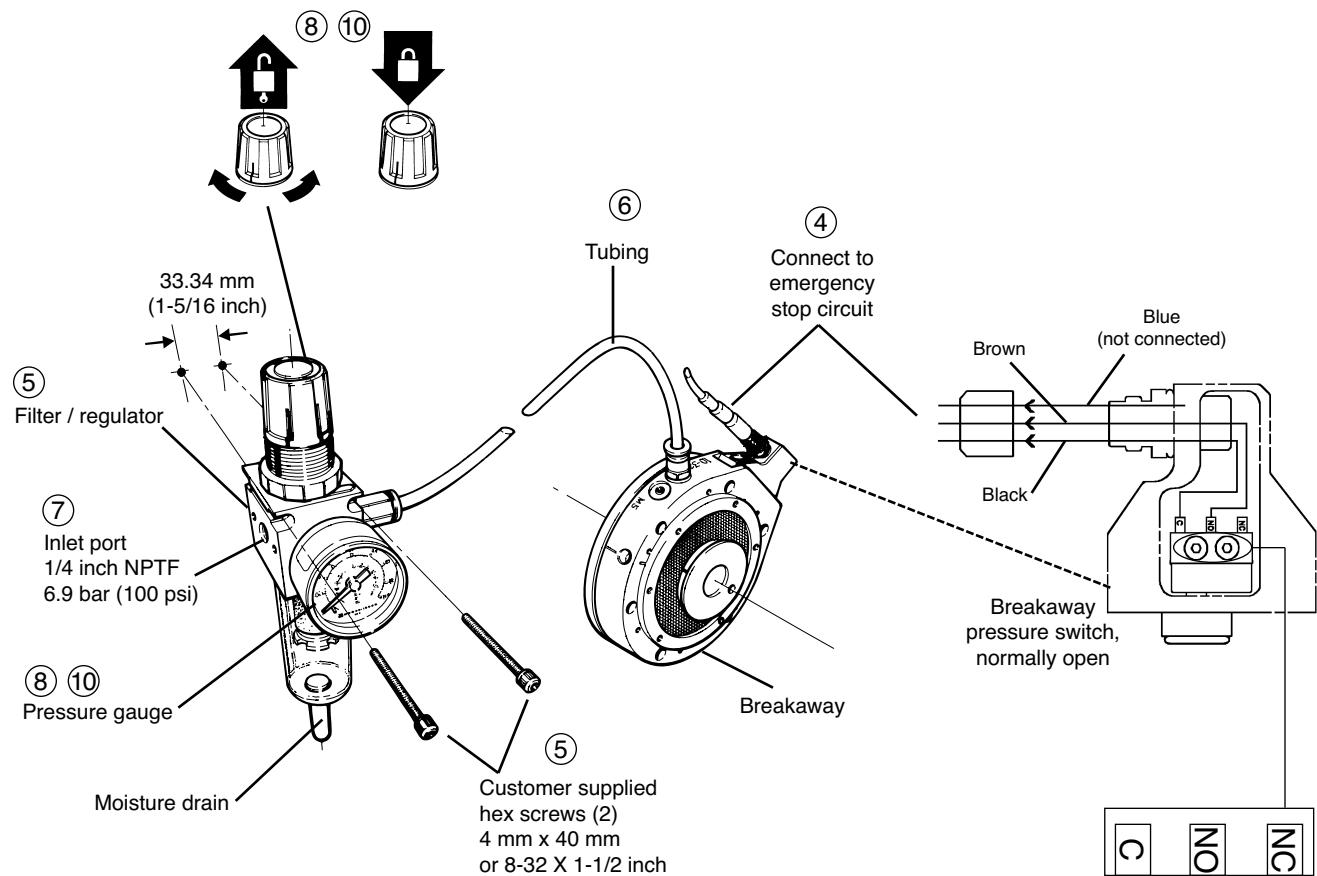
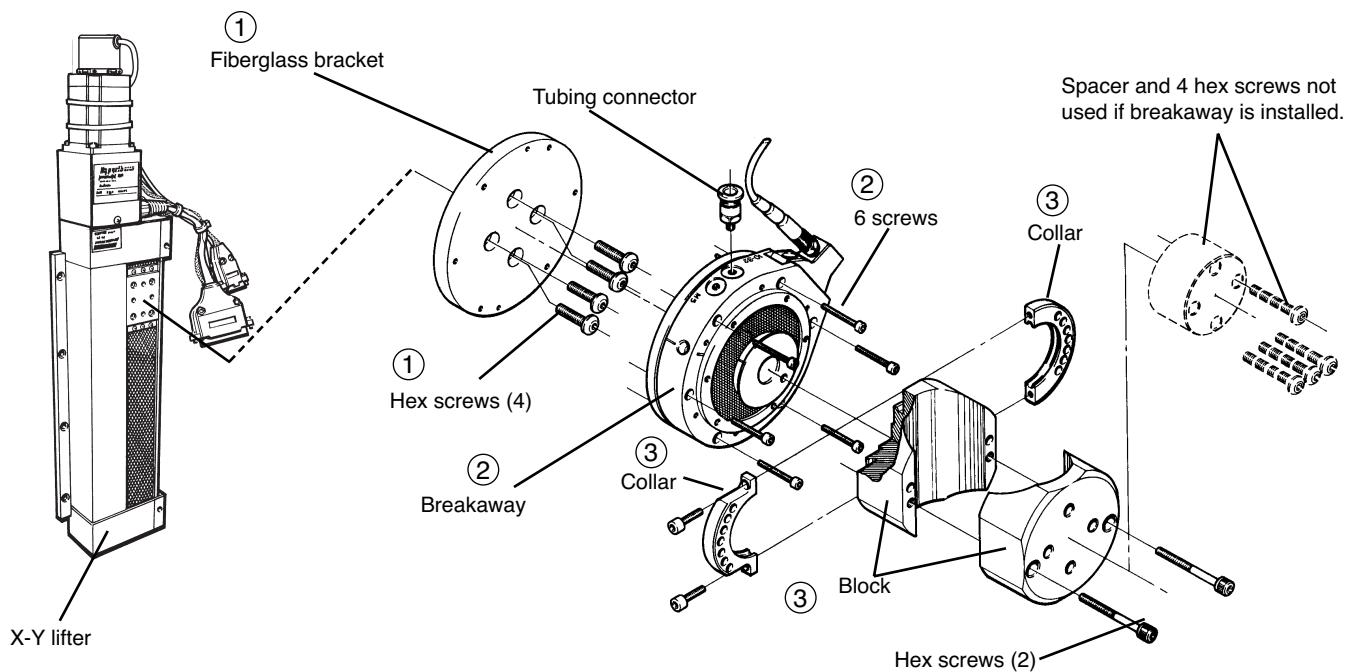
If not installing breakaway kit, go to page 3A-16

Install the torch breakaway kit as follows. Refer to figure on next page.

1. Mount the fiberglass bracket to the X-Y lifter with 4 hex screws.
2. Mount the breakaway to fiberglass bracket with 6 screws.
3. Attach the torch mounting block to the breakaway with the collar and 2 screws.
4. Connect the electrical output of the breakaway to the emergency stop circuit at CNC.
5. Mount the filter-regulator.
6. Connect tubing between regulator and breakaway.
7. Install air supply to the regulator inlet port at 6.9 bar (100 psi) (recommended maximum pressure).
8. Adjust the regulator to indicate 2 bar (30 psi) (recommended starting pressure) on the gauge.
9. By hand, force the breakaway to trip to simulate a crash.
Manually reposition breakaway to the lock position.
10. Adjust air pressure until the desired trip force is achieved.
11. Enable the emergency stop circuit at CNC after the breakaway is installed.

Notes:

- Installing the torch breakaway kit to the X-Y lifter assembly also requires using parts of the torch mounting block kit of the proper diameter. Refer to Section 6, *Part List* for details.
- The maximum pressure regulator inlet pressure is 10.2 bar (150 psi). Typically, the maximum inlet pressure should be set at 6.9 bar (100 psi).
- The routing of the leads, stall force, IHS speed, and acceleration/deceleration movements can affect the pressure setting required to achieve reliable operation.
- If air pressure is removed (for example, overnight), the breakaway must be manually repositioned when air is applied. The breakaway will not rest in its position after air pressure is lost.

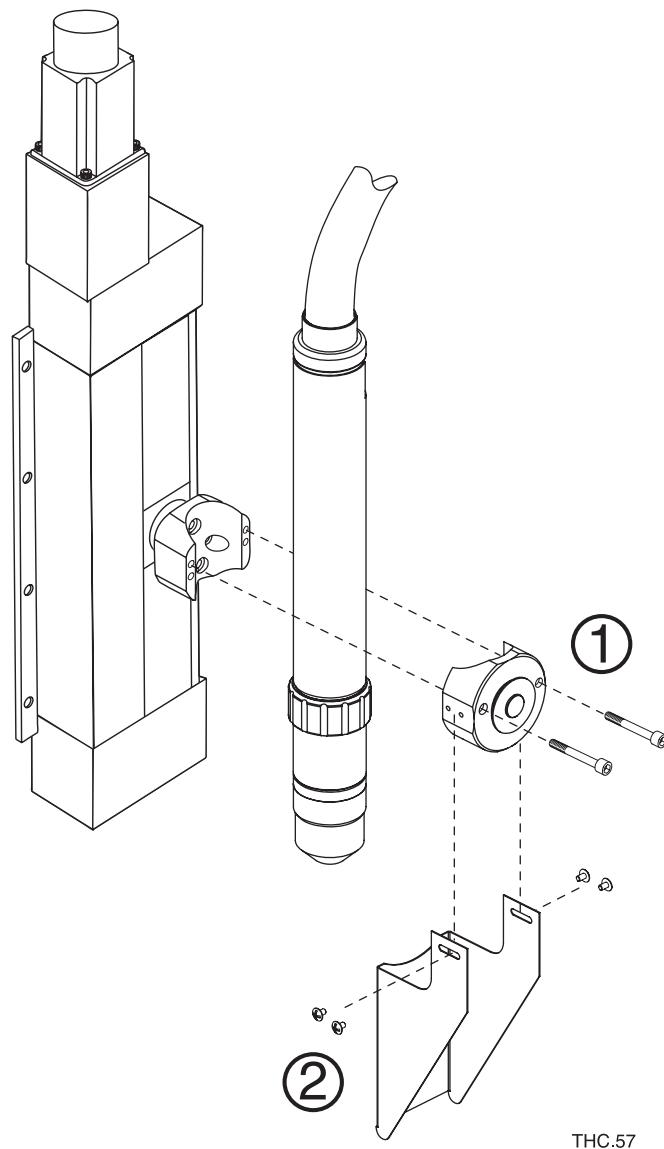


X-Y lifter assembly optional torch breakaway kit mounting details

1-TORCH INSTALLATION

Install the torch (without torch breakaway)

- ① Mount the torch to the lifter with the mounting block and 2 screws. See figure below.
- ② Install the shield to the mounting block with 4 screws.

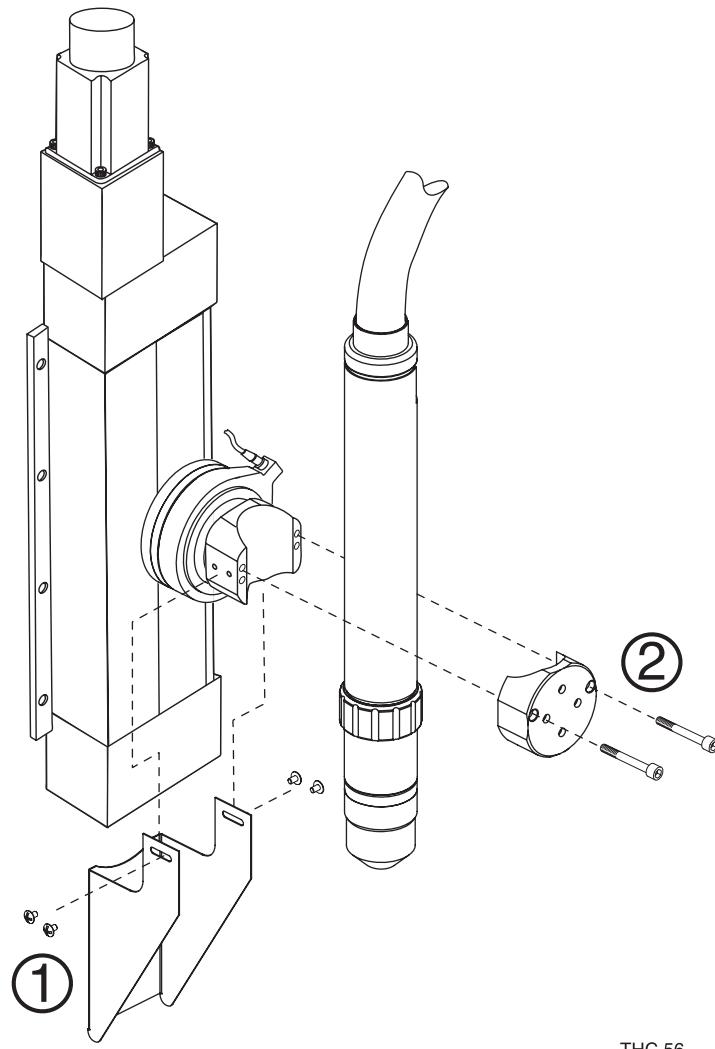


THC.57

Torch installed without torch breakaway option

Install the torch (with torch breakaway)

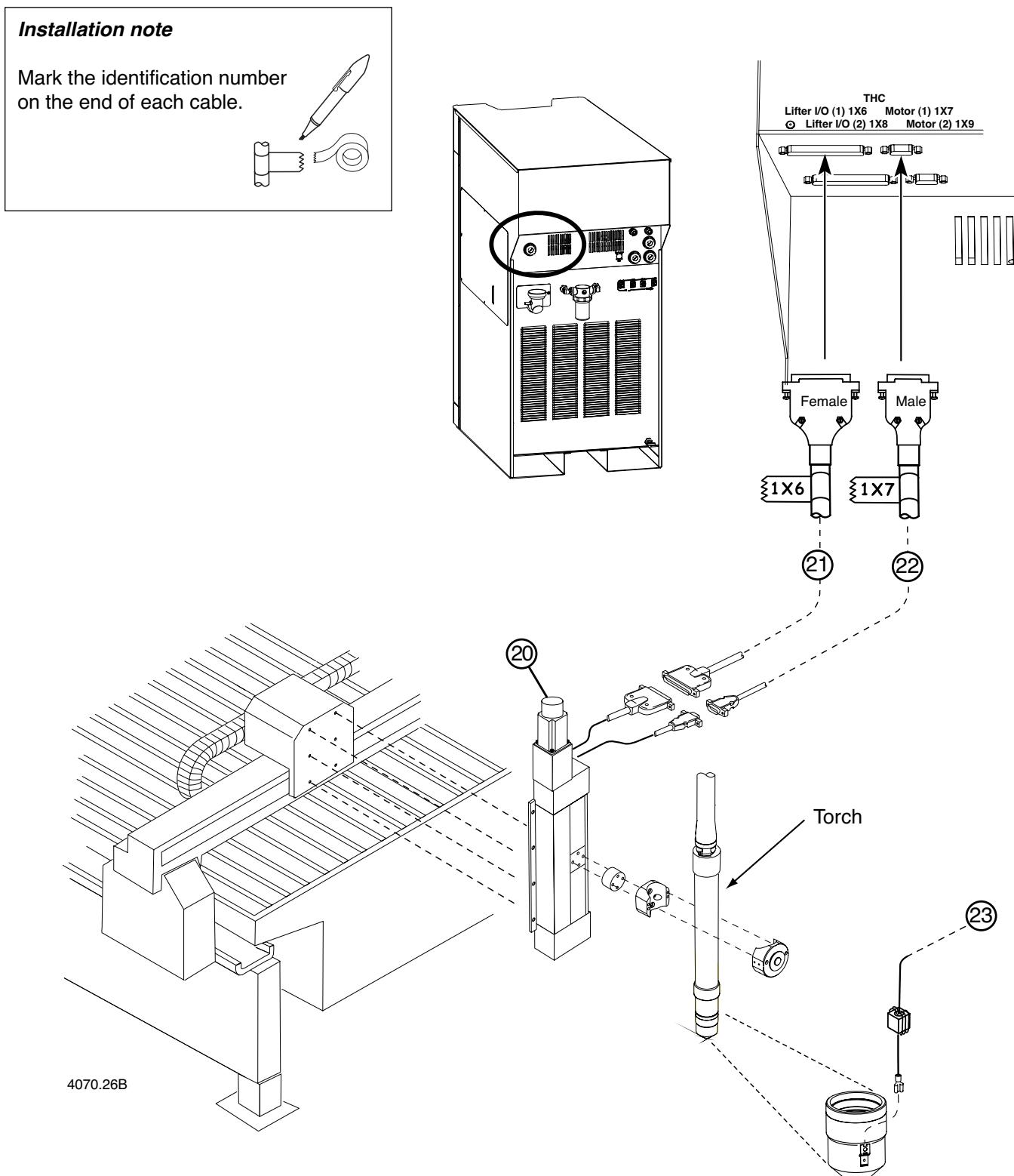
- ① Install the shield to the mounting block with 4 screws. See figure below.
- ② Mount the torch to the lifter with the mounting block and 2 screws.

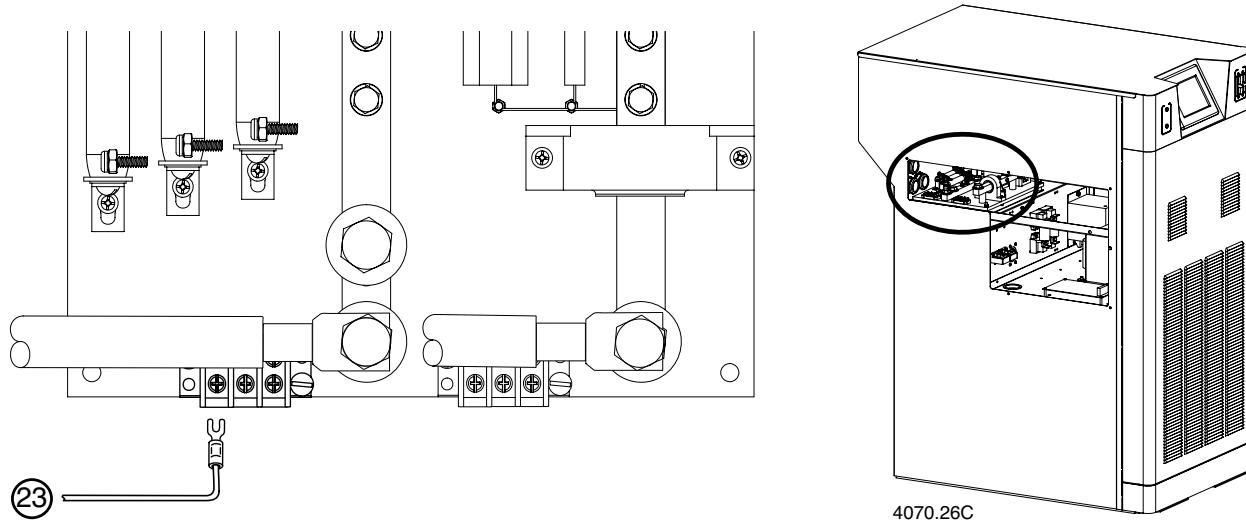


THC.56

Torch installed with torch breakaway option

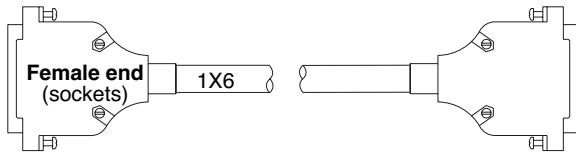
Integrated CommandTHC option – cable installation





②1 Cable – lifter interface

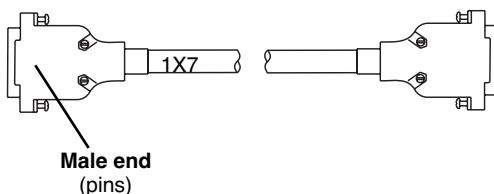
See next page for signal information



Part no.	Length	Part no.	Length
123209	1.5 m (5 ft.)	123215	12.2 m (40 ft.)
123210	3 m (10 ft.)	123216	13.7 m (45 ft.)
123211	4.6 m (15 ft.)	123023	15.2 m (50 ft.)
123212	6.1 m (20 ft.)	123217	23 m (75 ft.)
123022	7.6 m (25 ft.)	123218	30.5 m (100 ft.)
123213	9.1 m (30 ft.)	123219	38 m (125 ft.)
123214	10.6 m (35 ft.)	123220	45.6 m (150 ft.)

②2 Cable – motor drive

See next page for signal information



Part no.	Length	Part no.	Length
123197	1.5 m (5 ft.)	123203	12.2 m (40 ft.)
123198	3 m (10 ft.)	123204	13.7 m (45 ft.)
123199	4.6 m (15 ft.)	123021	15.2 m (50 ft.)
123200	6.1 m (20 ft.)	123205	23 m (75 ft.)
123020	7.6 m (25 ft.)	123206	30.5 m (100 ft.)
123201	9.1 m (30 ft.)	123207	38 m (125 ft.)
123202	10.6 m (35 ft.)	123208	45.6 m (150 ft.)

②3 Ohmic contact wire



Part no.	Length	Part no.	Length
123542	3 m (10 ft.)	123546	12.2 m (40 ft.)
123543	6.1 m (20 ft.)	123547	15.2 m (50 ft.)
123544	7.6 m (25 ft.)	123548	23 m (75 ft.)
123545	9.1 m (30 ft.)	123549	30.5 m (100 ft.)
		123550	45.6 m (150 ft.)

1-TORCH INSTALLATION

Lifter interface cable signals

Power supply pin number	Signal name	Wire color	Function
1 Input 20	Encoder Power - Encoder Power (5V)+	Black Red	Encoder power
2 Input 21	Encoder B - Encoder B +	Black Green	A quad B position signal.
3 Input 22	Encoder A - Encoder A +	Black Blue	A quad B position signal.
5 Input 24	Drive ID2 - Drive ID2 +	Black Brown	Lifter ID Most Significant Bit (Binary 3)
6 Input 25	Drive ID1 - Drive ID1 +	Black Orange	Lifter ID (Binary 2)
7 Input 26	Drive ID0 - Drive ID0 +	Red White	Lifter ID Least Significant Bit (Binary 1)
8 Output 27	Lifter Up - Lifter Up +	Red Green	Active when lifter is moving up.
9 Input 28 Input 10 Output	Lower Limit Switch Com. Lower Limit Switch Lower Limit Switch 24V	Red Blue Red	Limit switch common. A switch closure at input indicates torch is at bottom of travel or zero travel position. Limit switch power.
11 Output 29 Output 30 Output	Home Switch Home Switch Common Home Switch 24V	Red Yellow Brown	A switch closure at input indicates torch is at top of travel or maximum travel position. Home switch common. Home switch power.
16 Output 35	Lifter Down - Lifter Down +	Green Brown	Active when lifter is moving down.
17 Output 36	Lifter Brake Out - Lifter Brake Out +	Green Orange	Powers electro-mechanical brake on lifter.
4 Input 23	Lifter Spare In 5 - Lifter Spare In 5 +	Black Yellow	Spare
12 Output 31	Crash Detect - Crash Detect +	Red Orange	Spare
13 Output 32	Lifter Spare 3 - Lifter Spare 3 +	Green White	Spare
14 Output 33	Reserved	Green	Spare
15 Output 34	Reserved	Blue	Spare
18	Lifter Spare 1 - Lifter Spare 1 +	Green Yellow	Spare
37	24 VDC Common	White	Available 24 VDC, 500 mA maximum.
19	24 VDC +	Black	
	Reserved	N/C	Spare

Lifter jumper connection ID Code

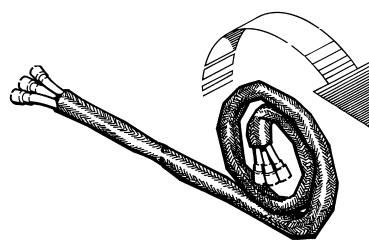
Motor drive cable signals

Power supply pin number	Signal name	Wire color	Function
5 Output 9	Motor Phase A + Motor Phase A +	Red Red	Powers lifter motor, phase A+.
4 Output 8	Motor Phase A - Motor Phase A -	Black Black	Powers lifter motor, phase A-.
3			Not connected
7 Output 2	Motor Phase B + Motor Phase B +	Red Red	Powers lifter motor, phase B+.
6 Output 1	Motor Phase B - Motor Phase B -	Black Black	Powers lifter motor, phase B-.

Torch connections

Connect the torch to the torch lead assembly

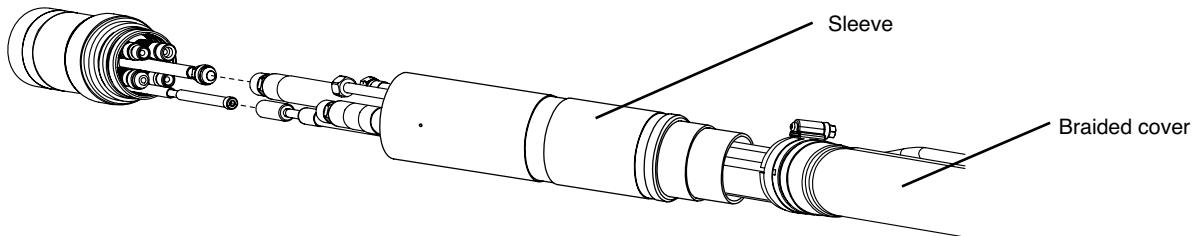
1. Uncoil the first 2 meters (6.5 feet) of leads on a flat surface.



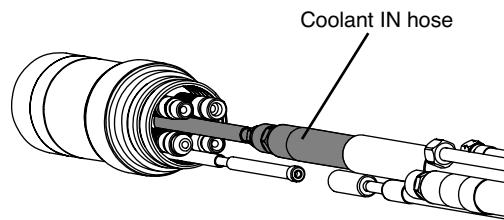
2. Hold the torch assembly in place with the spanner wrench (104269) and remove the mounting sleeve from the torch assembly. *Note: the plastic insulator must be in place to prevent internal short circuits.



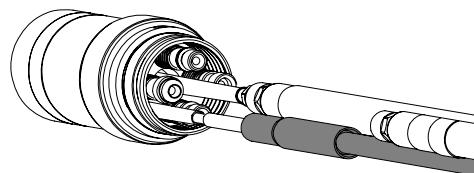
3. Push back the braided cover and slide the sleeve over leads. Align the torch with the hoses in the lead assembly. The hoses must not be twisted. They are taped together to help prevent twisting.



4. Connect the coolant IN hose to the torch.

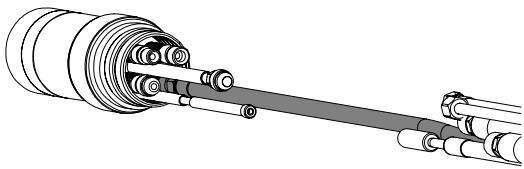


5. Connect the pilot arc lead.

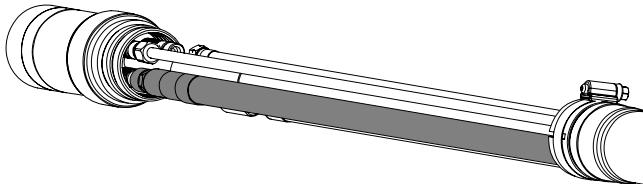


1-TORCH INSTALLATION

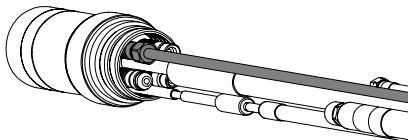
6. Connect the plasma vent hose.



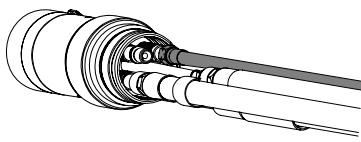
7. Connect the coolant return hose (red).



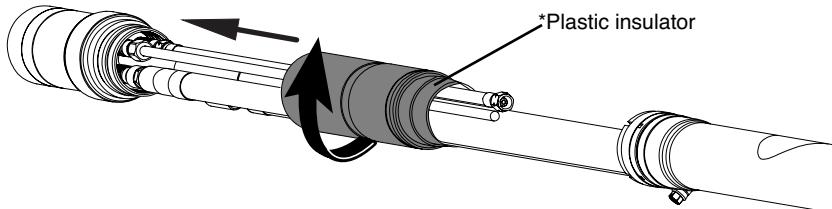
8. Connect the plasma gas hose.



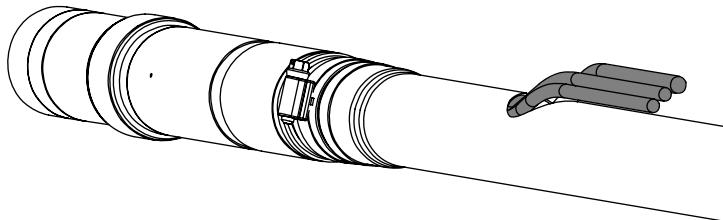
9. Connect the shield gas hose.



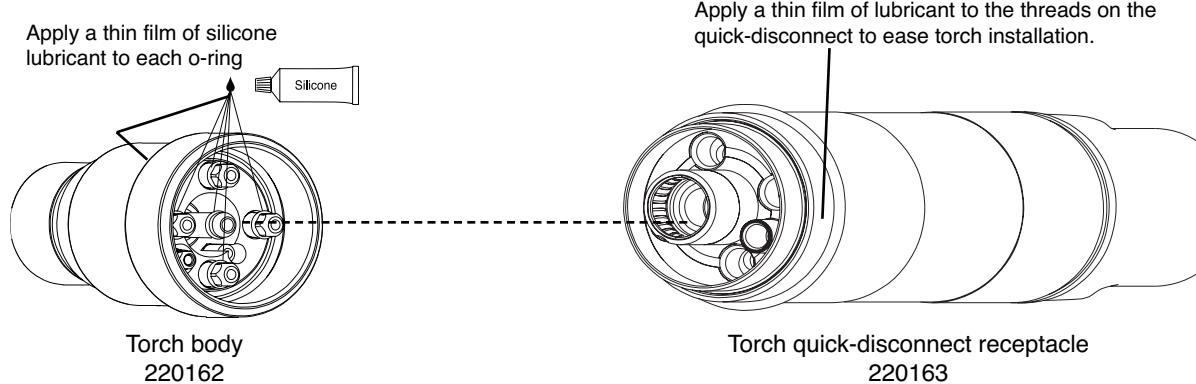
10. Position the plastic insulator so that it covers the coolant IN hose (green) connection. Wrap the bundle of hoses with electrical tape to prevent the insulator from moving. Slide the torch sleeve over connections and screw it onto the torch body. *Note: the plastic insulator must be in place to prevent internal short circuits.



11. Slide braiding up to the torch sleeve. Make sure that the plasma, shield and vent hoses are routed through the hole in the braiding. Loosen the hose clamp on the braiding, slide braiding and clamp over the sleeve and tighten the clamp.

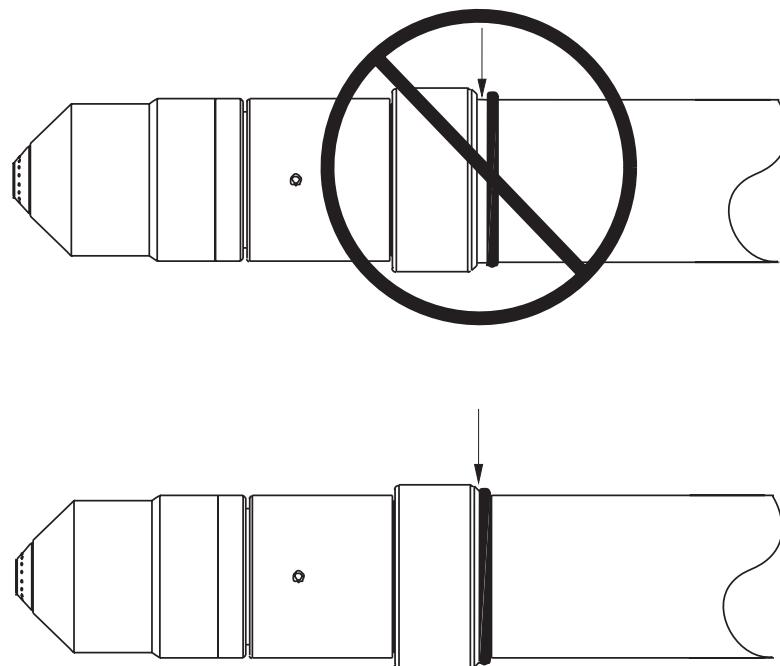


Connect the torch to the quick-disconnect



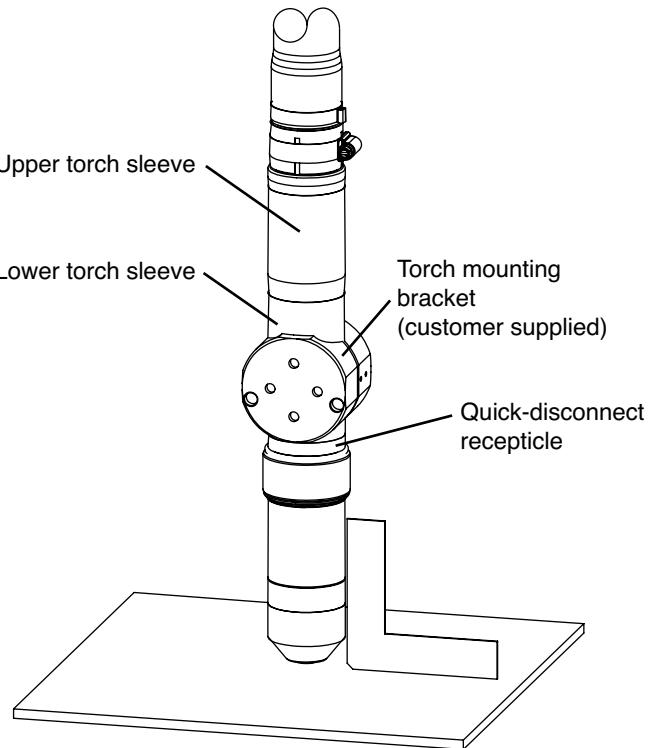
Installation note

Align the torch body to the torch leads and secure by screwing completely together. Be certain that there is no space between the torch body and the o-ring on the torch leads. See also *Ignition console connections* earlier in this section for torch lead connections to ignition console.



Torch mounting and alignment

Mounting the torch



Installation

1. Install the torch (with torch leads attached) in the torch mounting bracket.
2. Position the torch below the mounting bracket, so that the bracket is around the lower portion of the torch sleeve but not touching the torch quick disconnect.
3. Tighten the securing screws.

Note: The bracket should be as low on the torch sleeve as possible to minimize vibration at the tip of the torch.

Torch alignment

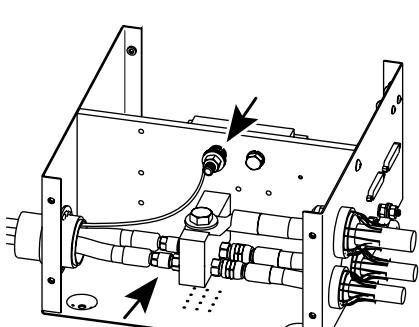
To align the torch at right angles to the workpiece, use a square. See figure above.

See also *Changing consumables* in Section 4 to install consumables in the torch.

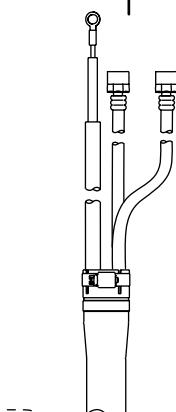
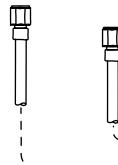
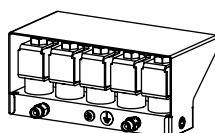
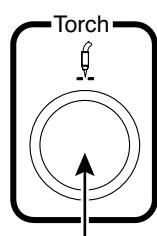
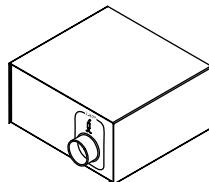
Torch lifter requirement

The system requires a high-quality, motorized torch lifter with sufficient travel to cover all cutting thickness requirements. The lifter must provide 203 mm (8 in.) of vertical travel. The unit should have the capability of maintaining a constant speed of up to 5080 mm/min (200 ipm) with positive braking. A unit which drifts through the stop point is not acceptable.

Install the torch and lead assembly

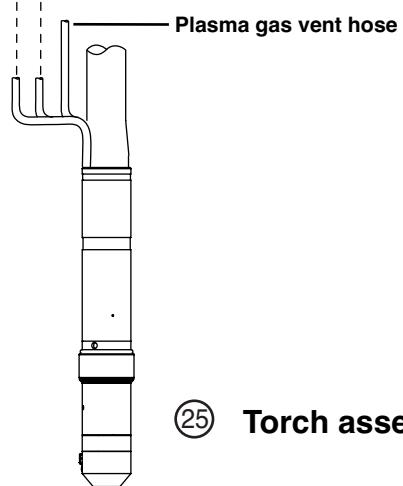


4070_11



(24) Lead assemblies

Part no.	Length
128890	1.8 m (6 ft)
128891	3.0 m (10 ft)
128892	4.5 m (15 ft)



(25) Torch assembly – 228048



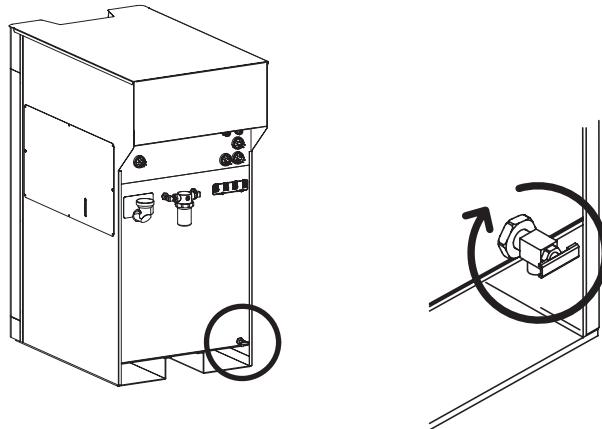
Caution: Locate the exposed end of the plasma gas vent hose away from sparks caused by piercing to avoid ignition and possible damage to the torch leads

Fill the power supply with coolant

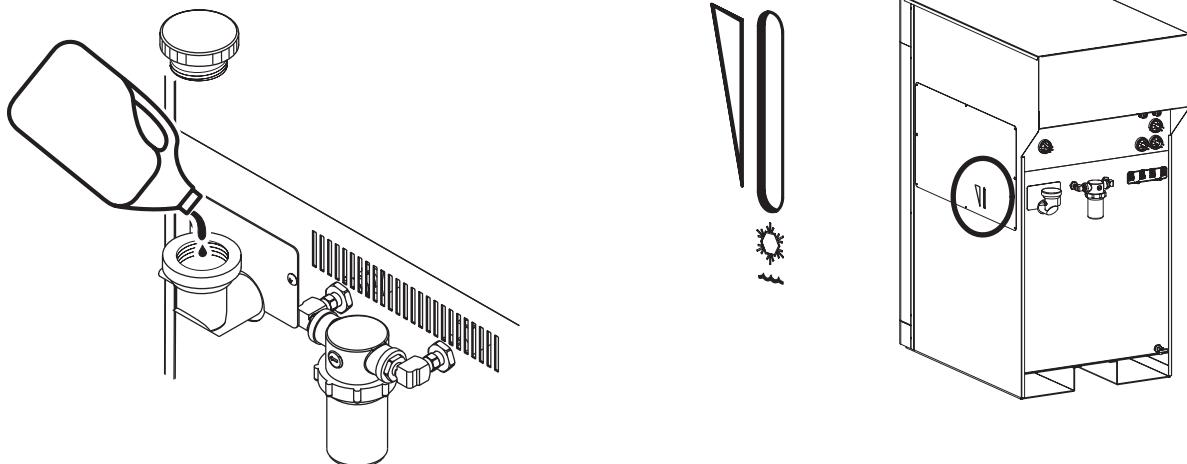


Caution: Use Hypertherm coolant (028872) to reduce the risk of damage from freezing and to prevent long-term corrosion.

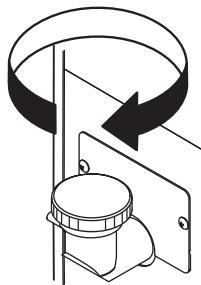
- ① Check that the drain valve is closed.



- ② Add coolant to the power supply until the sight gauge indicates full.

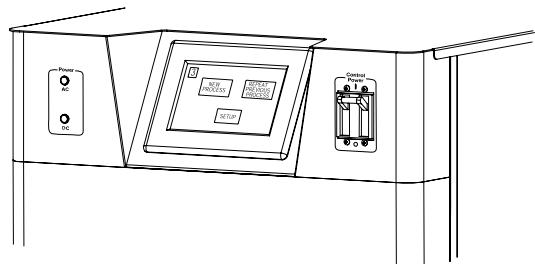


- ③ Replace the filler cap.



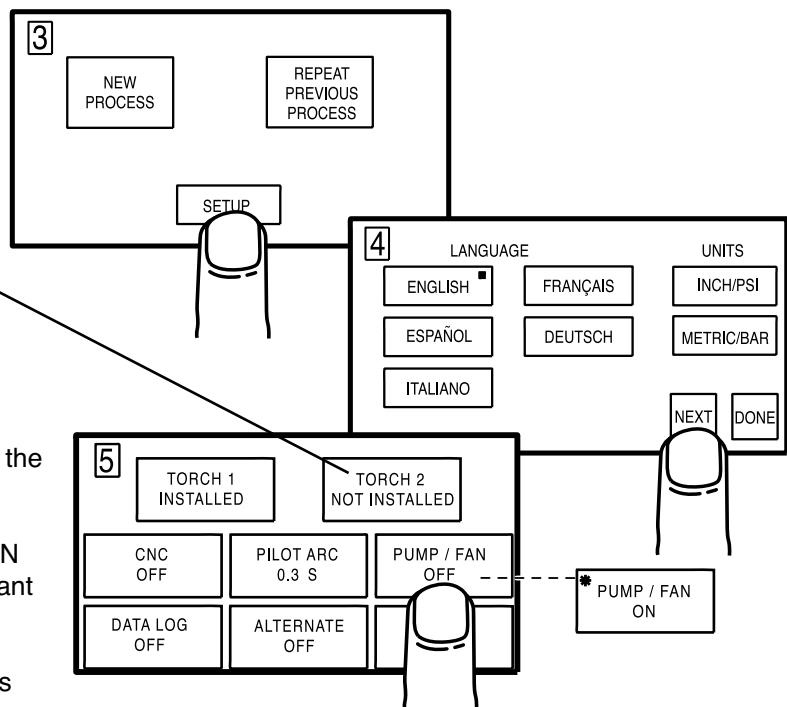
4070.40A

- ④ Turn the power supply ON.



- ⑤ Navigate to set-up screen 5.

Note: Torch 2 must be turned off
(Not installed) in a 1 torch system.



- ⑥ Press the PUMP FAN button to turn on the coolant pump.

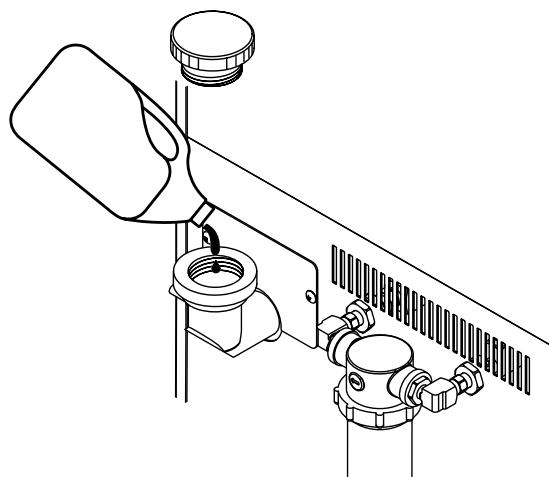
An asterisk will appear in the PUMP FAN button when power supply detects coolant flow.

- ⑦ Allow the pump to operate for 5 minutes and then press the PUMP FAN button to turn the coolant pump off.

- ⑧ Turn the power supply OFF.

- ⑨ Check all coolant hose connections for leaks.

- ⑩ Add coolant until the sight gauge indicates "full."



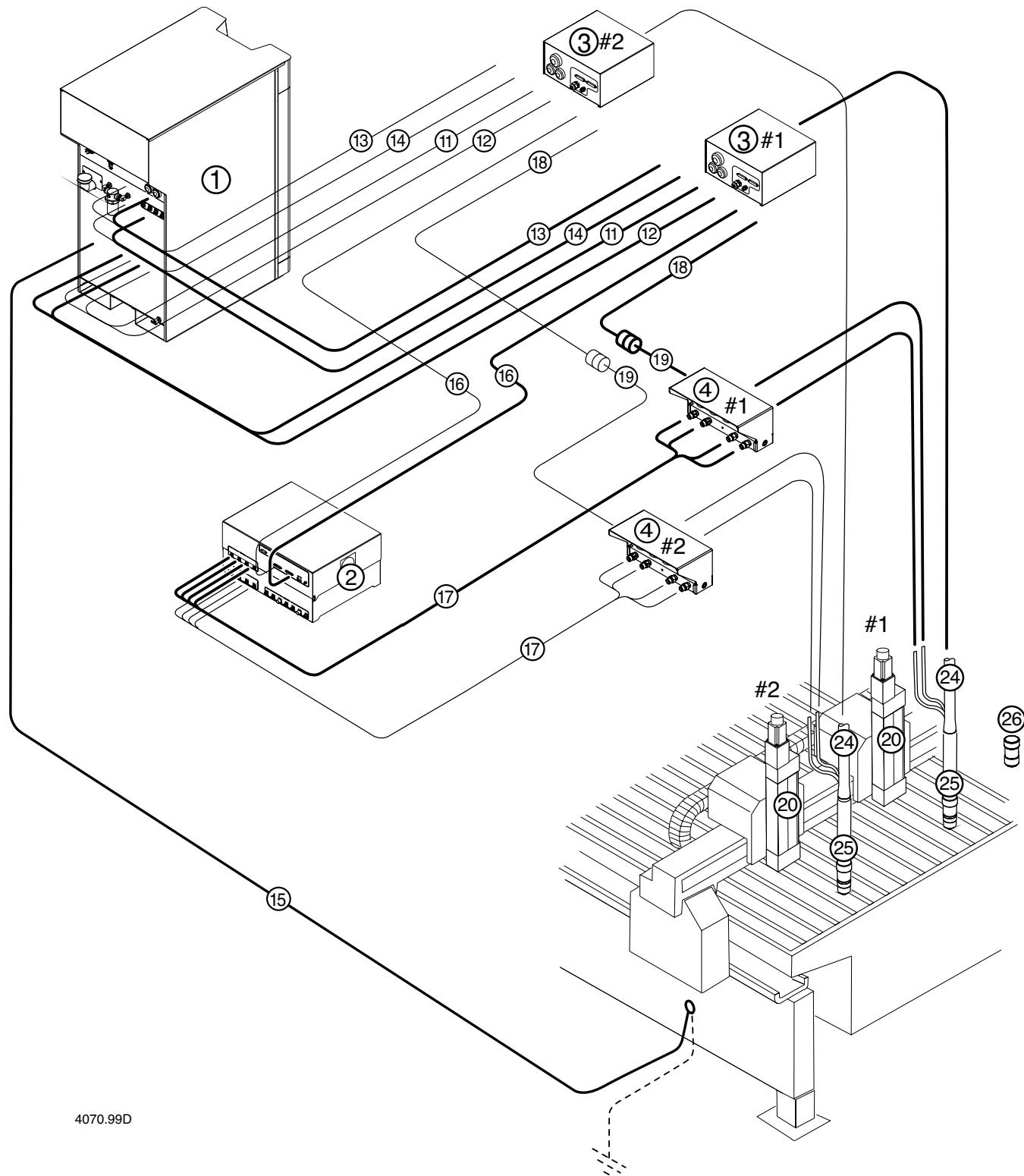
Section 3B**2-TORCH INSTALLATION**

In this section:

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Cables and hoses	3B-3
Install the coolant hoses	3B-4
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Coolant hose assembly – red return	3B-5
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Pilot arc lead	3B-7
Install the negative and work leads	3B-8
Negative lead	3B-9
Work lead	3B-9
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Cable – gas console to ignition console	3B-11
Install the gas hose assembly	3B-12
Hoses – gas console to off-valve	3B-13
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2-TORCH INSTALLATION

HD4070 2-torch installation



System components

See section 3 for installation details.

- (1) Power supply
- (2) Gas console
- (3) Ignition console
- (4) Off-valve assembly

Cables and hoses

- (11) Coolant hose assembly; see page 3B-4.
- (12) Coolant hose assembly; see page 3B-4.
- (13) Pilot arc lead; see page 3B-6.
- (14) Negative lead; see page 3B-8.
- (15) Work lead, see page 3B-8.
- (16) Gas console cable; see page 3B-10.
- (17) Gas hose assembly; see page 3B-12.
- (18) Ignition console cable; see page 3B-14.
- (19) Off-valve assembly cable; see page 3B-14.
- (20) - (23) Integrated Command THC option; see page 3B-16.
- (24) Lead assemblies; see page 3B-23.
- (25) Torch assembly; see page 3B-23.
- (26) Torch receptacle plug: used when a 2-torch system is being run in single torch mode. See page 3B-23

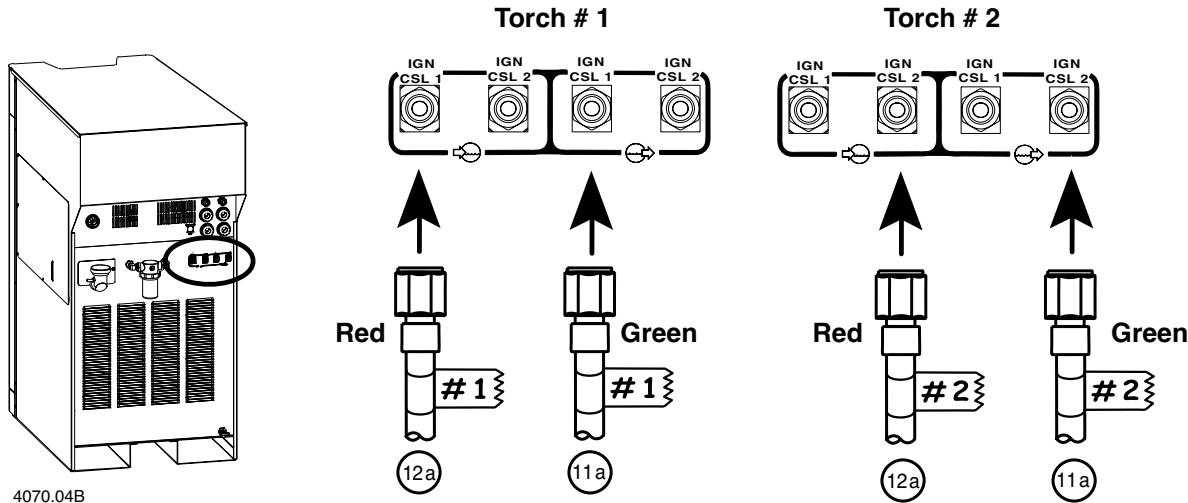
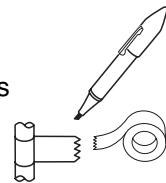
2-TORCH INSTALLATION

Install the coolant hoses

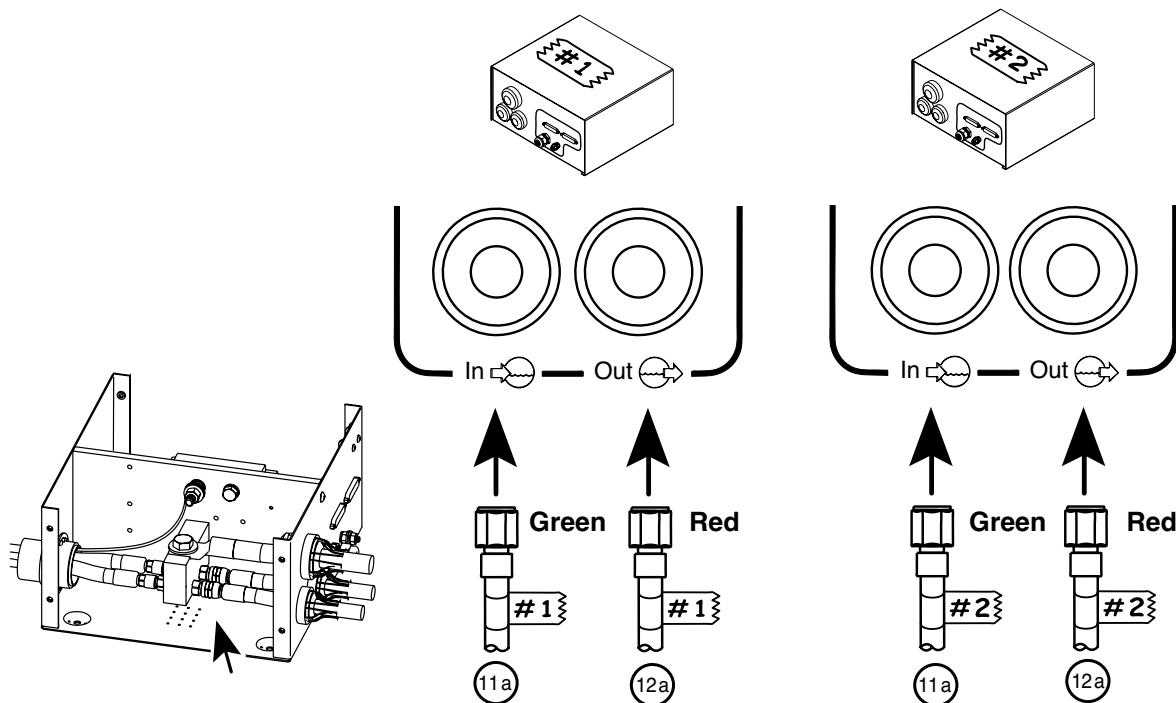


Installation note

Mark hoses and ignition consoles for torch number 1 and torch number 2.



Important: A jumper hose must be in place when system is run with 1 torch. Coolant will flow out if jumper hose is not in place. See page 3A-4 for jumper hose position.

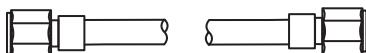


⑪ Coolant hose assembly – green supply



Part no.	Length	Part no.	Length
024563	3 m (10 ft)	024263	15 m (50 ft)
024564	6 m (20 ft)	024264	23 m (75 ft)
024291	7.5 m (25 ft)	024265	30.5 m (100 ft)
024503	9 m (30 ft)	024459	46 m (150 ft)
024565	12 m (40 ft)		

⑫ Coolant hose assembly – red return



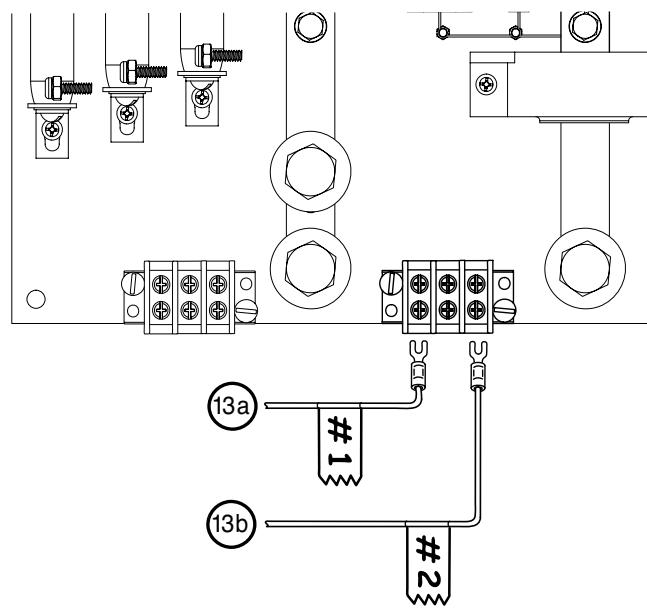
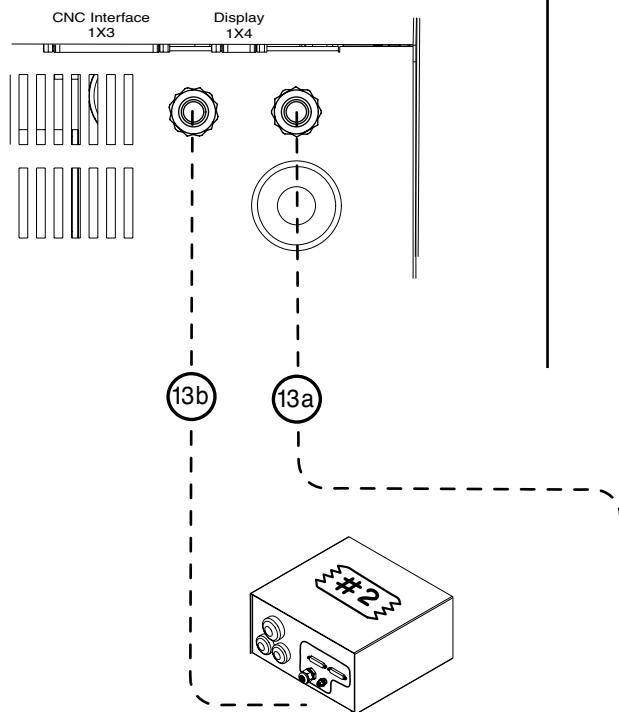
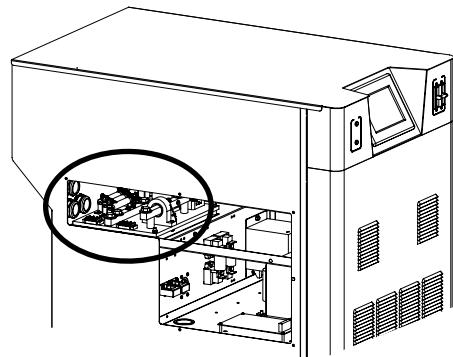
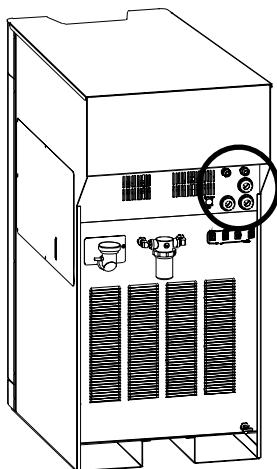
Part no.	Length	Part no.	Length
024566	3 m (10 ft)	024268	15 m (50 ft)
024567	6 m (20 ft)	024269	23 m (75 ft)
024267	7.5 m (25 ft)	024270	30.5 m (100 ft)
024504	9 m (30 ft)	024460	46 m (150 ft)
024568	12 m (40 ft)		

2-TORCH INSTALLATION

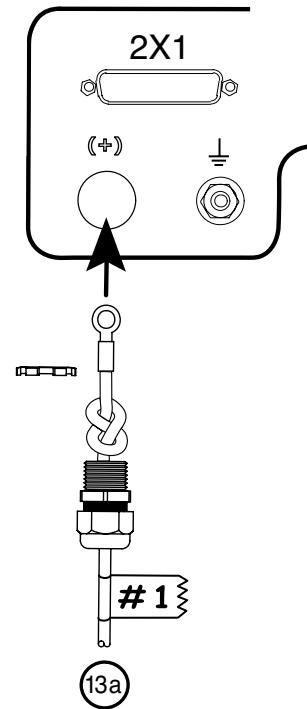
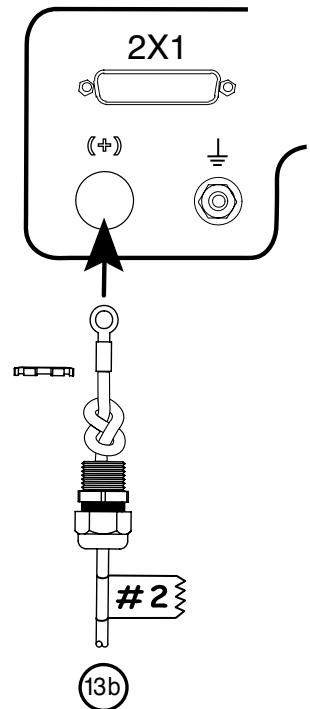
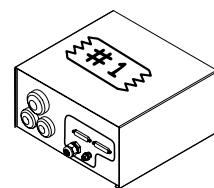
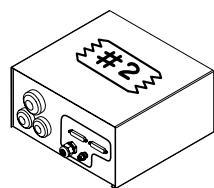
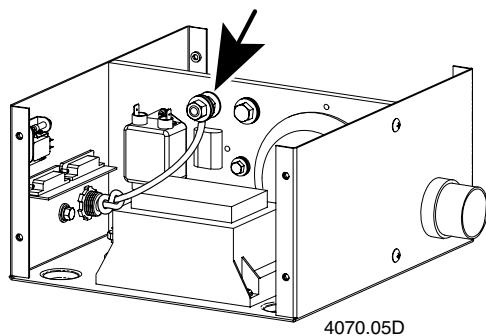
Install the pilot arc leads

Installation note

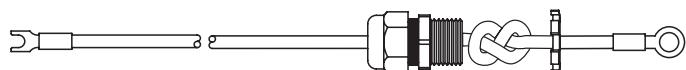
Mark the pilot arc leads for torch number 1 and torch number 2.



4070.05C



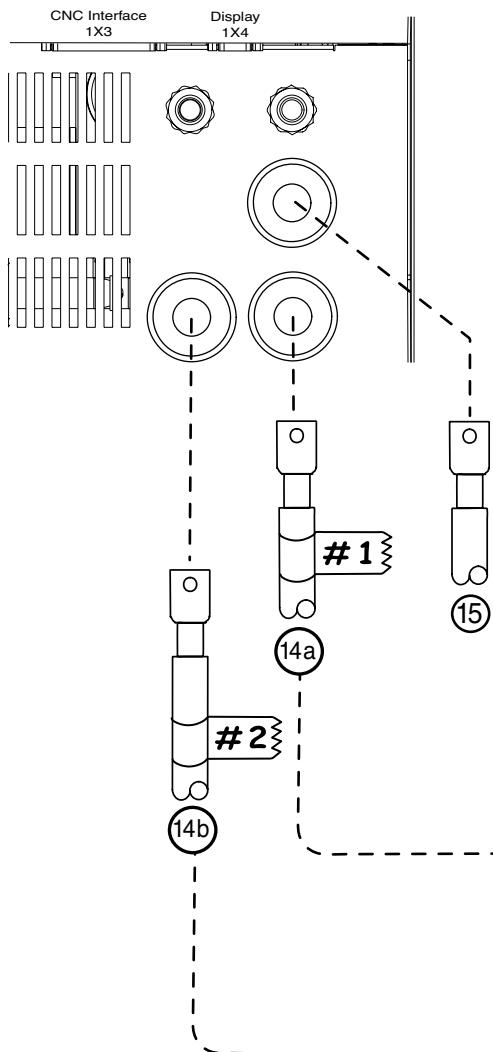
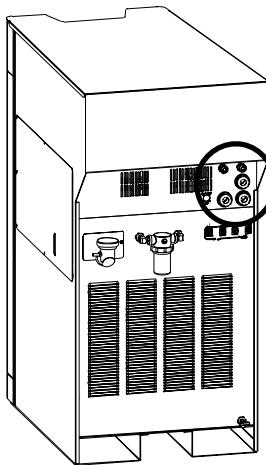
⑬ Pilot arc lead



Part no.	Length	Part no.	Length
123409	3 m (10 ft)	123414	15 m (50 ft)
123410	6 m (20 ft)	123415	23 m (75 ft)
123411	7.5 m (25 ft)	123416	30.5 m (100 ft)
123412	9 m (30 ft)	123417	46 m (150 ft)
123413	12 m (40 ft)		

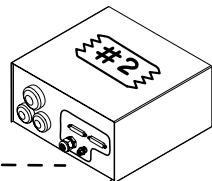
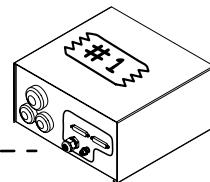
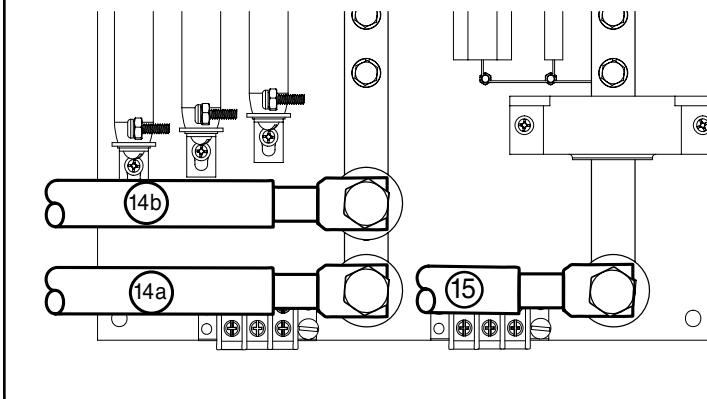
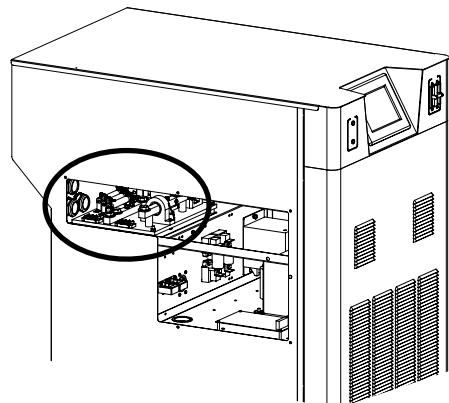
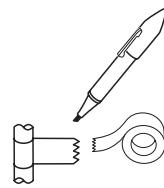
2-TORCH INSTALLATION

Install the negative and work lead

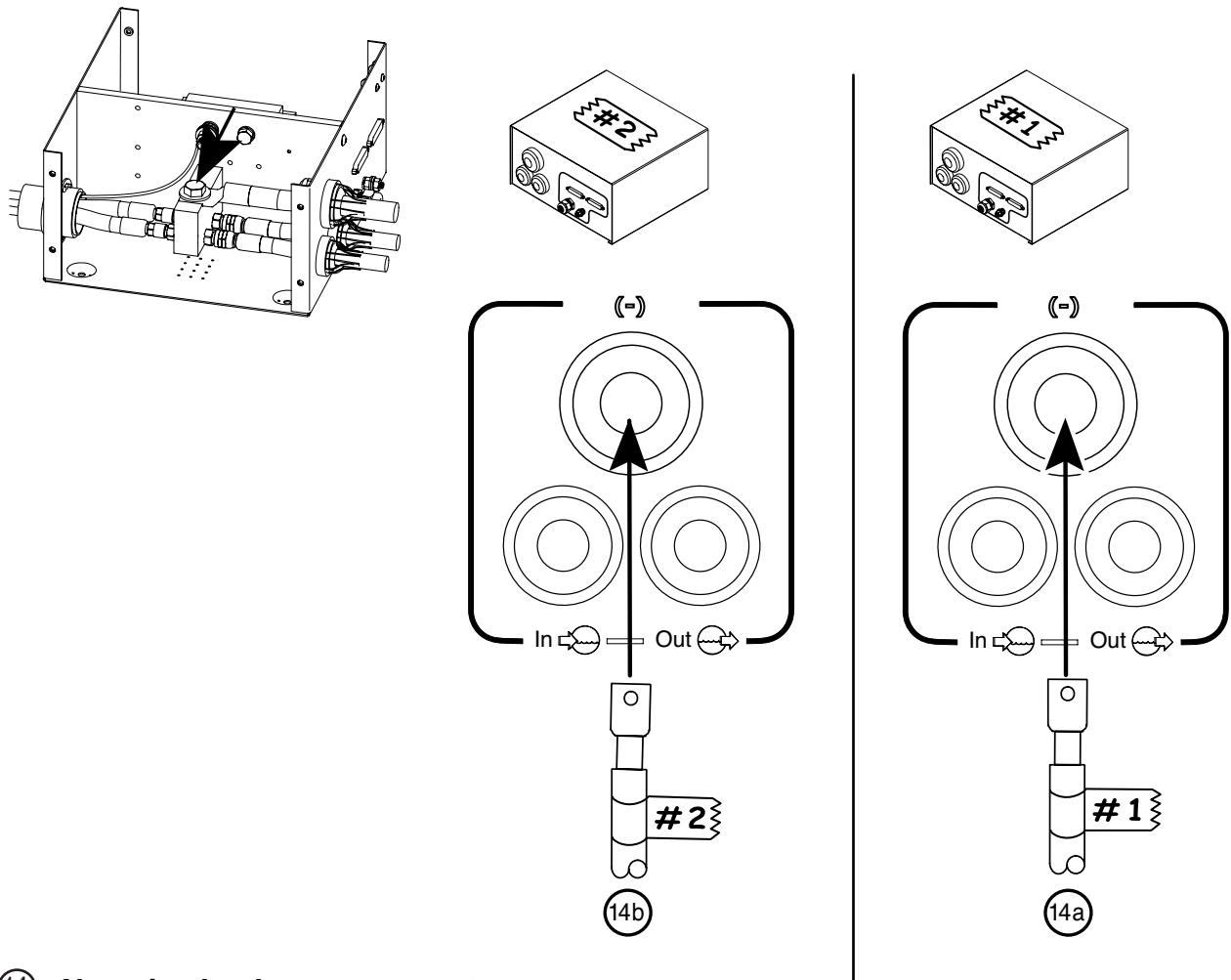


Installation note

Mark negative and work leads for torch number 1 and torch number 2.



4070.05B



(14) Negative lead

4070.05E

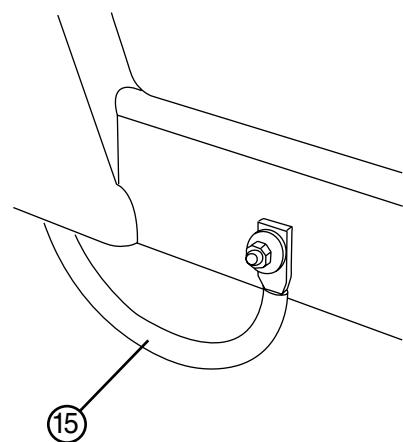


Part no.	Length	Part no.	Length
123418	3 m (10 ft)	023079	15 m (50 ft)
023136	6 m (20 ft)	023124	23 m (75 ft)
023078	7.5 m (25 ft)	023080	30.5 m (100 ft)
023101	9 m (30 ft)	023081	46 m (150 ft)
023135	12 m (40 ft)		

(15) Work lead



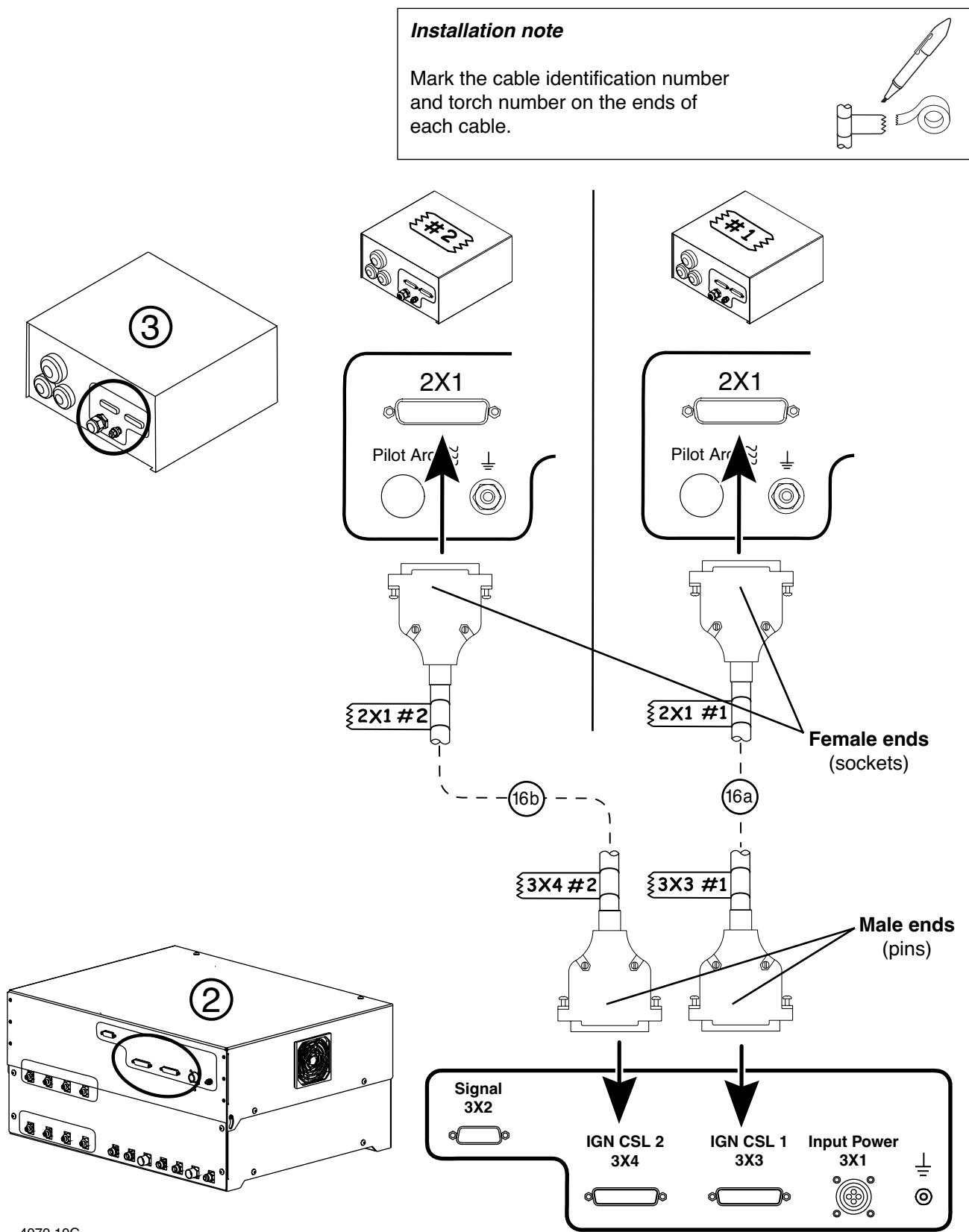
Part no.	Length	Part no.	Length
123418	3 m (10 ft)	023079	15 m (50 ft)
023136	6 m (20 ft)	023124	23 m (75 ft)
023078	7.5 m (25 ft)	023080	30.5 m (100 ft)
023101	9 m (30 ft)	023081	46 m (150 ft)
023135	12 m (40 ft)		



Lower frame of work table (typical).

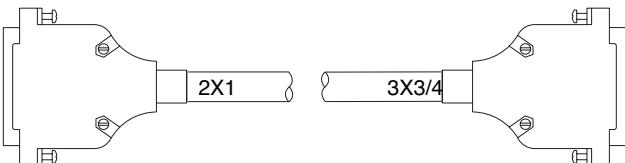
2-TORCH INSTALLATION

Install the gas console to ignition console cable



4070.10C

(16) Cable – gas console to ignition console



Part no.	Length	Part no.	Length
123446	3 m (10 ft)	123512	15 m (50 ft)
123447	6 m (20 ft)	123559	18 m (60 ft)
123448	7.5 m (25 ft)	123513	23 m (75 ft)
123449	9 m (30 ft)	123514	30.5 m (100 ft)
123450	12 m (40 ft)		

CABLE RUN LIST					
Signal name	2X1	Color	3X3/4	Function	Input/Output
Not used	13	Grey	13		
Not used	25	Brown	25		
Not used	12	Red	12		
Not used	24	Yellow	24		
Not used	11	Red	11		
Not used	23	Blue	23		
Not used	10	Red	10		
Not used	22	Green	22		
Not used	9	Red	9		
Not used	21	White	21		
Not used	8	Red	8		
Not used	20	Orange	20		
Not used	7	Black	7		
Vent-120 VAC return	19	Brown	19	Energizes the vent solenoid	Output
Vent-120 VAC	6	Black	6		Output
Plasma cutflow-120 VAC return	18	Yellow	18	Energizes the plasma cutflow solenoid	Output
Plasma cutflow-120 VAC	5	Black	5		Output
Plasma preflow-120 VAC return	17	Blue	17	Energizes the plasma preflow solenoid	Output
Plasma preflow-120 VAC	4	Black	4		Output
Shield cutflow-120 VAC return	16	Green	16	Energizes the shield cutflow solenoid	Output
Shield cutflow-120 VAC	3	Black	3		Output
Shield preflow-120 VAC return	15	White	15	Energizes the shield preflow solenoid	Output
Shield preflow-120 VAC	2	Black	2		Output
Ignitor-120 VAC return	14	Red	14	Energizes the ignitor	Output
Ignitor-120 VAC	1	Black	1		Output

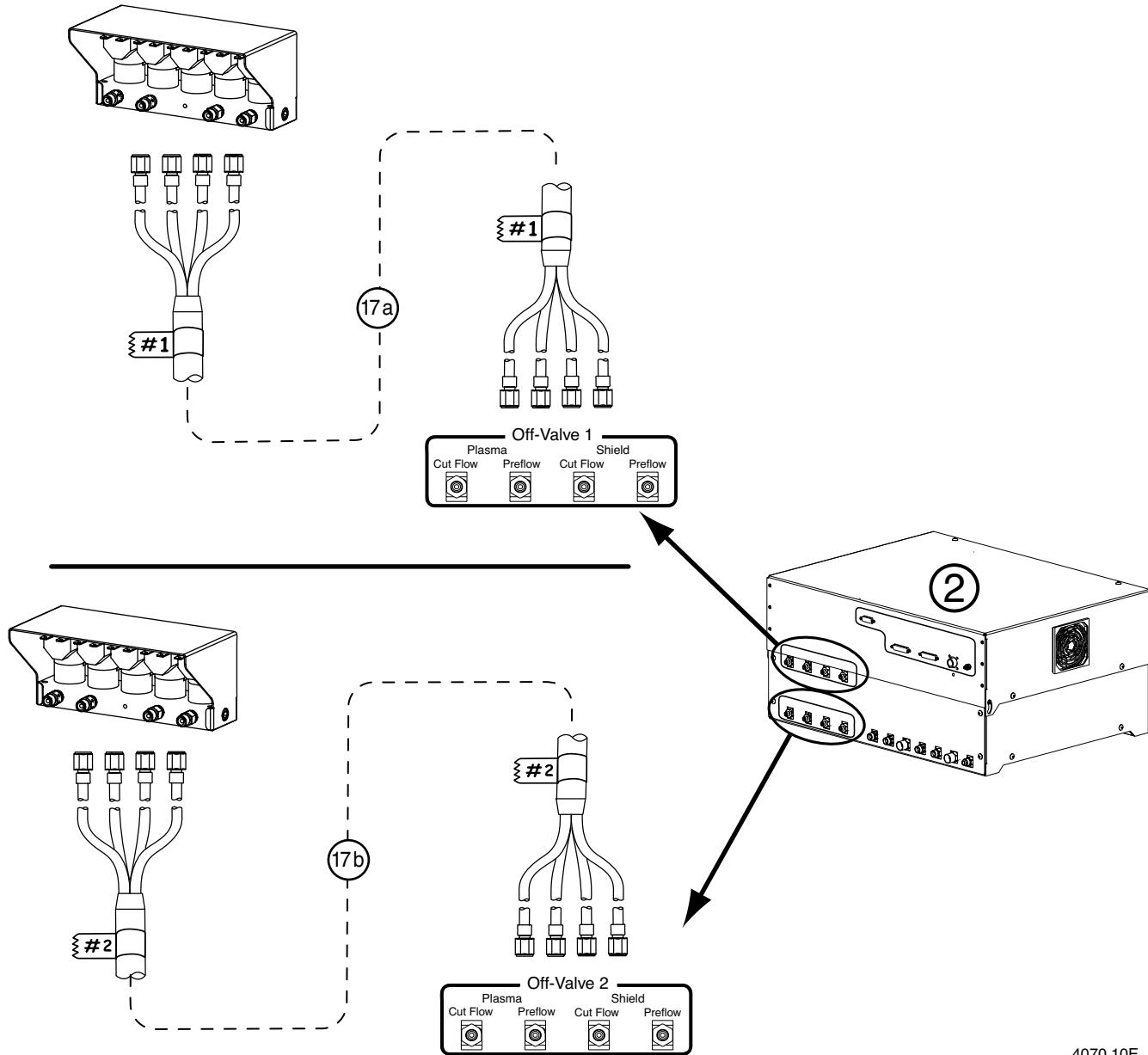
2-TORCH INSTALLATION

Install the gas hose assembly

Installation note

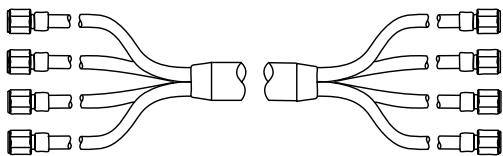
Mark the torch number on the ends of each gas hose assembly.

Make sure there are no leaks at connections.



4070.10E

(17) Hoses – gas console to off-valve



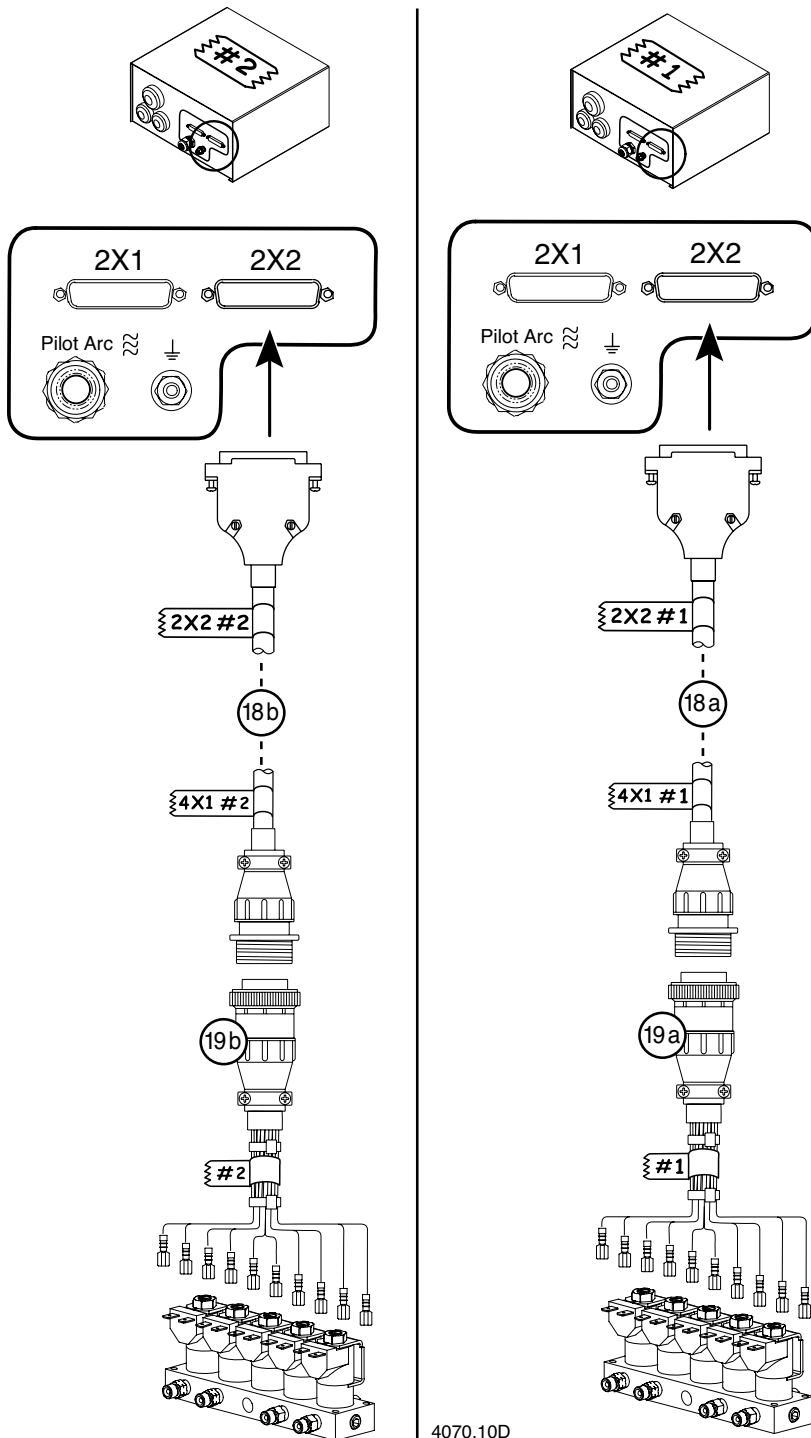
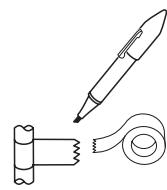
Part no.	Length	Part no.	Length
128445	4.6 m (15 ft)	128450	12 m (40 ft)
128446	6 m (20 ft)	128558	15 m (50 ft)
128447	7.5 m (25 ft)	128559	18 m (60 ft)
128448	9 m (30 ft)	128550	23 m (75 ft)
128449	10.5 m (35 ft)	128551	30.5 m (100 ft)

2-TORCH INSTALLATION

Install the ignition console to off-valve cables

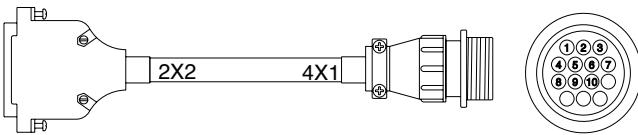
Installation note

Mark the cable identification number and torch number on the ends of each cable.



4070.10D

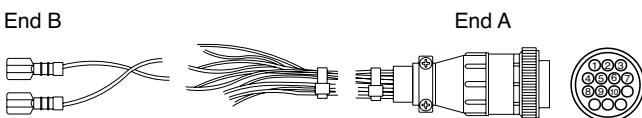
(18) Cable – ignition console to off-valve



Part no.	Length	Part no.	Length
123451	1.8 m (6 ft)	123453	4.6 m (15 ft)
123452	3 m (10 ft)		

CABLE RUN LIST			
Function	2X2	Color	4X1
Shield	2	Red	1
Preflow	15	White	2
Shield	3	Green	3
Cutflow	16	White	4
Plasma	4	Orange	5
Preflow	17	White	6
Plasma	5	Blank	7
Cutflow	18	White	8
VENT	6	Yellow	9
	19	White	10

(19) Cable – off-valve



Part no.	Length
123540	0.5 m (1.5 ft)

CABLE RUN LIST			
Function	End B	Color	End A
Shield	S	Red/Black	1
Preflow	P	Red	2
Shield	S	Red/Black	3
Cutflow	C	Red	4
Plasma	P	Red/Black	5
Preflow	P	Red	6
Plasma	P	Red/Black	7
Cutflow	C	Red	8
Vent	V	Red/Black	9
	V	Red	10

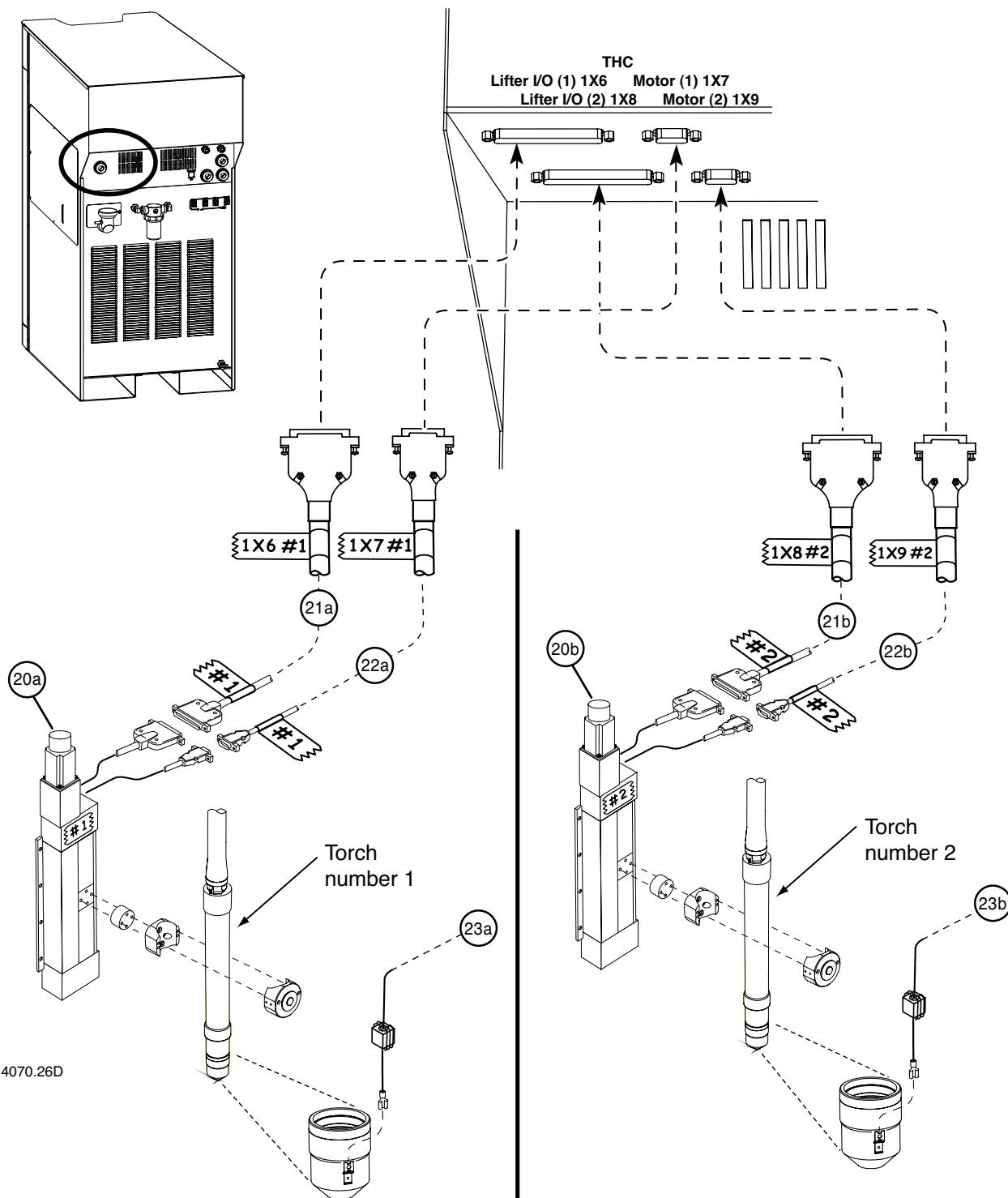
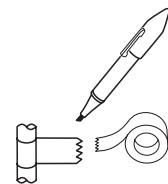
2-TORCH INSTALLATION

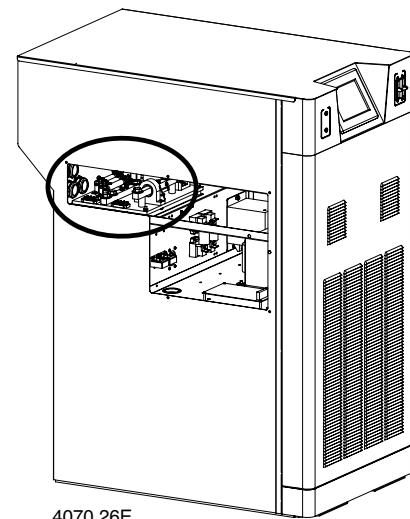
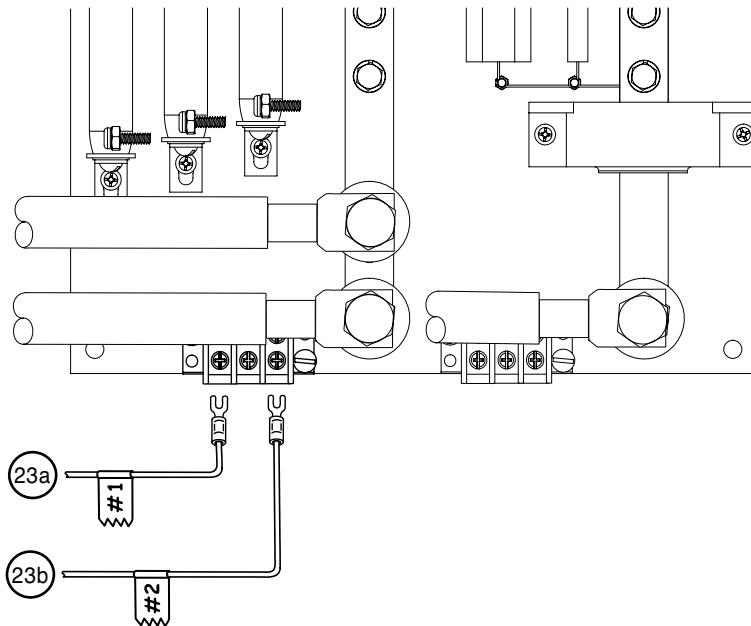
Install the integrated CommandTHC option

See section 3A for instructions to mount X-Y lifter, torch mounting block and torch breakaway options.

Installation note

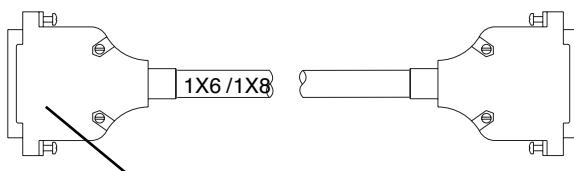
Mark the identification number and torch number on the ends of each cable.





(21) Cable – lifter interface

See next page for signal information

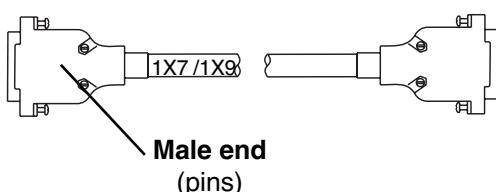


**Female end
(sockets)**

Part no.	Length	Part no.	Length
123209	1.5 m (5 ft.)	123215	12.2 m (40 ft.)
123210	3 m (10 ft.)	123216	13.7 m (45 ft.)
123211	4.6 m (15 ft.)	123023	15.2 m (50 ft.)
123212	6.1 m (20 ft.)	123217	23 m (75 ft.)
123022	7.6 m (25 ft.)	123218	30.5 m (100 ft.)
123213	9.1 m (30 ft.)	123219	38 m (125 ft.)
123214	10.6 m (35 ft.)	123220	45.6 m (150 ft.)

(22) Cable – motor drive

See next page for signal information



**Male end
(pins)**

Part no.	Length	Part no.	Length
123197	1.5 m (5 ft.)	123203	12.2 m (40 ft.)
123198	3 m (10 ft.)	123204	13.7 m (45 ft.)
123199	4.6 m (15 ft.)	123021	15.2 m (50 ft.)
123200	6.1 m (20 ft.)	123205	23 m (75 ft.)
123020	7.6 m (25 ft.)	123206	30.5 m (100 ft.)
123201	9.1 m (30 ft.)	123207	38 m (125 ft.)
123202	10.6 m (35 ft.)	123208	45.6 m (150 ft.)

(23) Ohmic contact wire



Part no.	Length	Part no.	Length
123542	3 m (10 ft.)	123546	12.2 m (40 ft.)
123543	6.1 m (20 ft.)	123547	15.2 m (50 ft.)
123544	7.6 m (25 ft.)	123548	23 m (75 ft.)
123545	9.1 m (30 ft.)	123549	30.5 m (100 ft.)
		123550	45.6 m (150 ft.)

2-TORCH INSTALLATION

Lifter interface cable signals

Power supply pin number	Signal name	Wire color	Function
1 Input 20	Encoder Power - Encoder Power (5V)+	Black Red	Encoder power
2 Input 21	Encoder B - Encoder B +	Black Green	A quad B position signal.
3 Input 22	Encoder A - Encoder A +	Black Blue	A quad B position signal.
5 Input 24	Drive ID2 - Drive ID2 +	Black Brown	Lifter ID Most Significant Bit (Binary 3)
6 Input 25	Drive ID1 - Drive ID1 +	Black Orange	Lifter ID (Binary 2)
7 Input 26	Drive ID0 - Drive ID0 +	Red White	Lifter ID Least Significant Bit (Binary 1)
8 Output 27	Lifter Up - Lifter Up +	Red Green	Active when lifter is moving up.
9 Input 28 Input 10 Output	Lower Limit Switch Com. Lower Limit Switch Lower Limit Switch 24V	Red Blue Red	Limit switch common. A switch closure at input indicates torch is at bottom of travel or zero travel position. Limit switch power.
11 Output 29 Output 30 Output	Home Switch Home Switch Common Home Switch 24V	Red Yellow Brown	A switch closure at input indicates torch is at top of travel or maximum travel position. Home switch common. Home switch power.
16 Output 35	Lifter Down - Lifter Down +	Green Brown	Active when lifter is moving down.
17 Output 36	Lifter Brake Out - Lifter Brake Out +	Green Orange	Powers electro-mechanical brake on lifter.
4 Input 23	Lifter Spare In 5 - Lifter Spare In 5 +	Black Yellow	Spare
12 Output 31	Crash Detect - Crash Detect +	Red Orange	Spare
13 Output 32	Lifter Spare 3 - Lifter Spare 3 +	Green White	Spare
14 Output 33	Reserved	Green	Spare
15 Output 34	Reserved	Blue	Spare
18	Lifter Spare 1 - Lifter Spare 1 +	Green Yellow	Spare
37	24 VDC Common	White	Available 24 VDC, 500 mA maximum.
19	24 VDC +	Black	
	Reserved	N/C	Spare

Lifter jumper connection ID Code

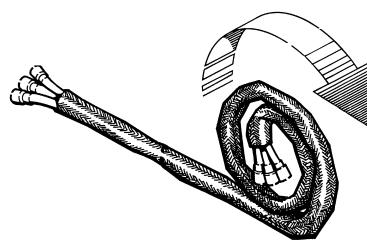
Motor drive cable signal

Power supply pin number	Signal name	Wire color	Function
5 Output 9	Motor Phase A + Motor Phase A +	Red Red	Powers lifter motor, phase A+.
4 Output 8	Motor Phase A - Motor Phase A -	Black Black	Powers lifter motor, phase A-.
3			Not connected
7 Output 2	Motor Phase B + Motor Phase B +	Red Red	Powers lifter motor, phase B+.
6 Output 1	Motor Phase B - Motor Phase B -	Black Black	Powers lifter motor, phase B-.

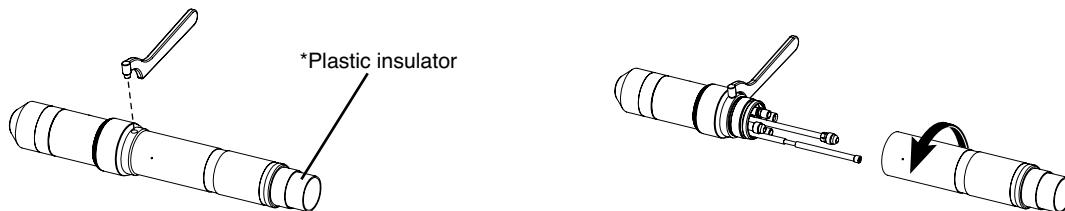
Torch connections

Connect the torch to the torch lead assembly

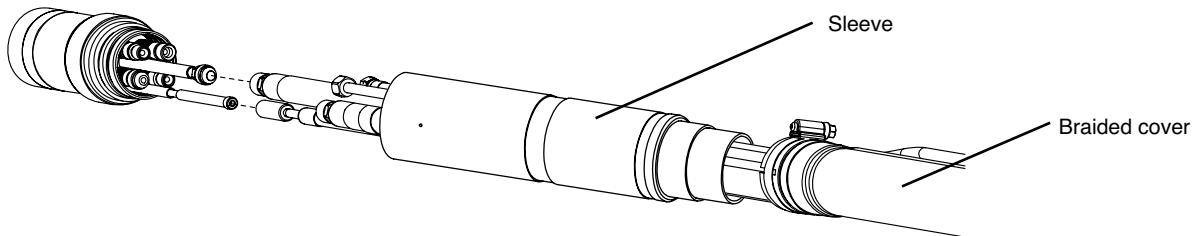
1. Uncoil the first 2 meters (6.5 feet) of leads on a flat surface.



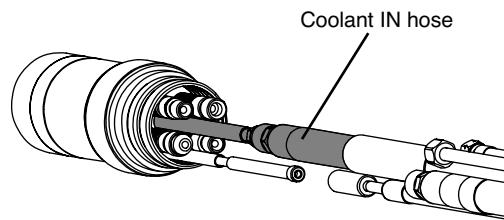
2. Hold the torch assembly in place with the spanner wrench (104269) and remove the mounting sleeve from the torch assembly. *Note: the plastic insulator must be in place to prevent internal short circuits.



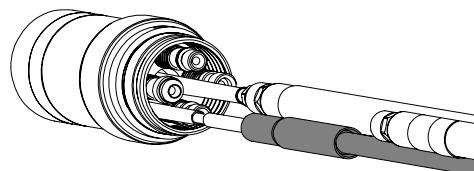
3. Push back the braided cover and slide the sleeve over leads. Align the torch with the hoses in the lead assembly. The hoses must not be twisted. They are taped together to help prevent twisting.



4. Connect the coolant IN hose to the torch.

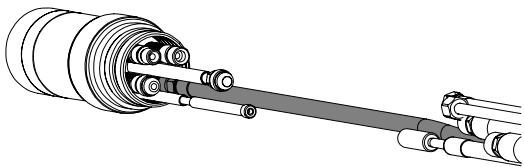


5. Connect the pilot arc lead.

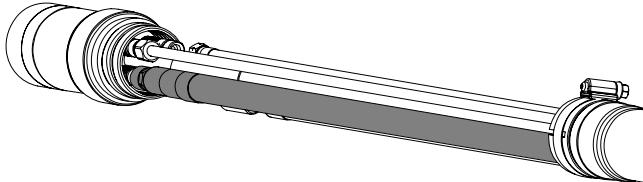


2-TORCH INSTALLATION

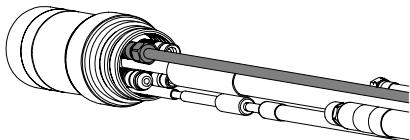
6. Connect the plasma vent hose.



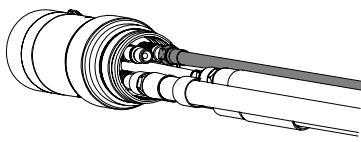
7. Connect the coolant return hose (red).



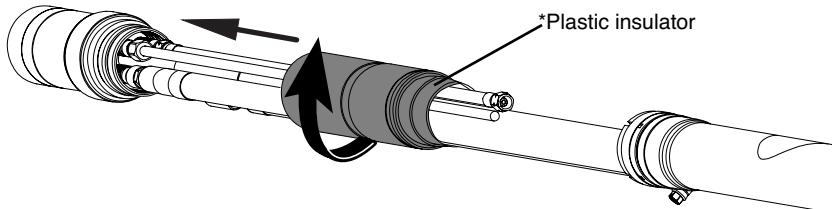
8. Connect the plasma gas hose.



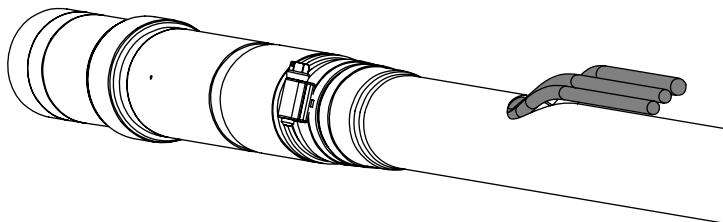
9. Connect the shield gas hose.



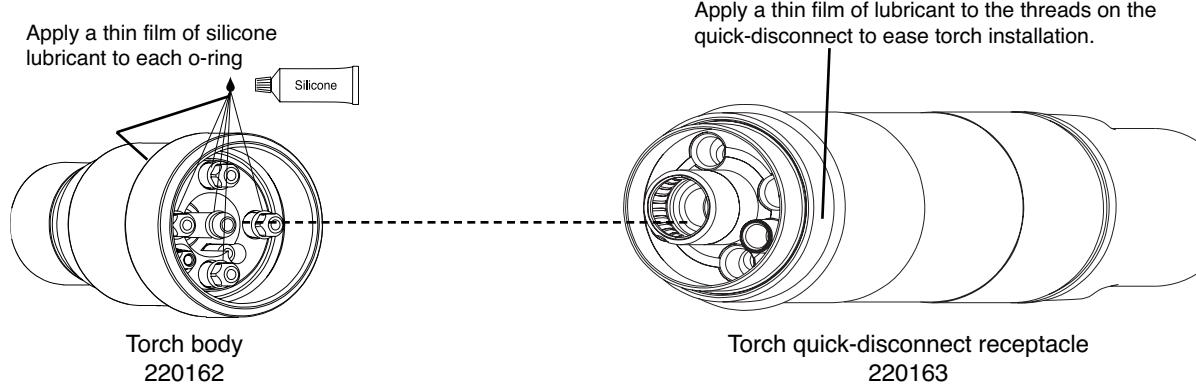
10. Position the plastic insulator so that it covers the coolant IN hose (green) connection. Wrap the bundle of hoses with electrical tape to prevent the insulator from moving. Slide the torch sleeve over connections and screw it onto the torch body. *Note: the plastic insulator must be in place to prevent internal short circuits.



11. Slide braiding up to the torch sleeve. Make sure that the plasma, shield and vent hoses are routed through the hole in the braiding. Loosen the hose clamp on the braiding, slide braiding and clamp over the sleeve and tighten the clamp.

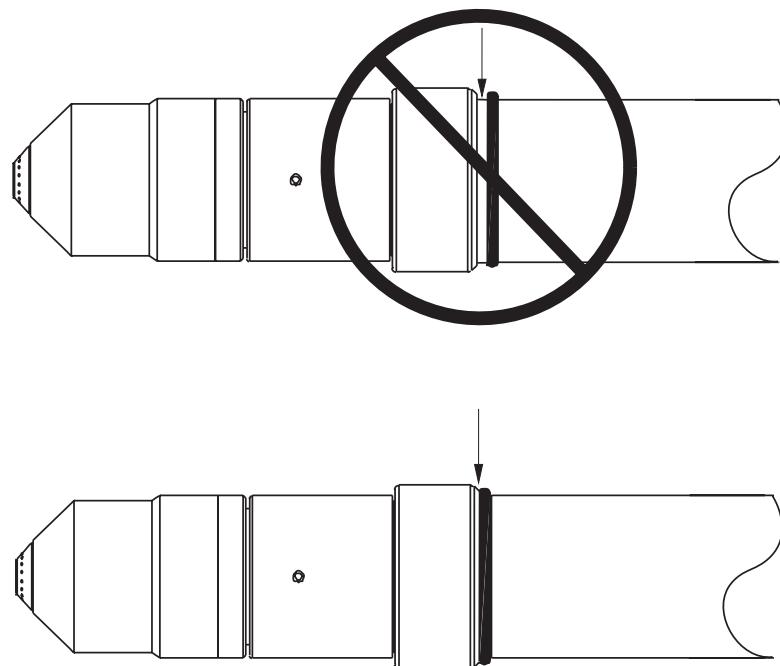


Connect the torch to the quick-disconnect



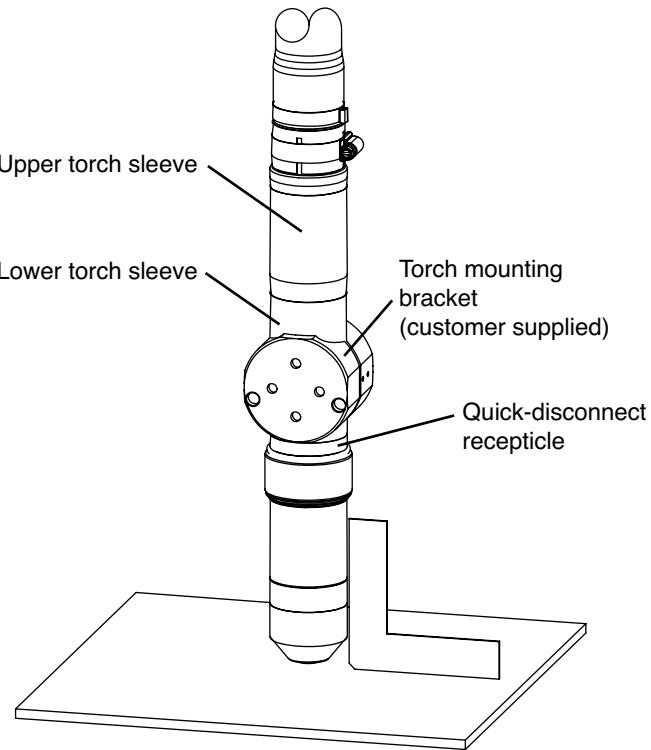
Installation note

Align the torch body to the torch leads and secure by screwing completely together. Be certain that there is no space between the torch body and the o-ring on the torch leads. See also *Ignition console connections* earlier in this section for torch lead connections to ignition console.



Torch mounting and alignment

Mounting the torch



Installation

1. Install the torch (with torch leads attached) in the torch mounting bracket.
2. Position the torch below the mounting bracket, so that the bracket is around the lower portion of the torch sleeve but not touching the torch quick disconnect.
3. Tighten the securing screws.

Note: The bracket should be as low on the torch sleeve as possible to minimize vibration at the tip of the torch.

Torch alignment

To align the torch at right angles to the workpiece, use a square. See figure above.

See also *Changing consumables* in Section 4 to install consumables in the torch.

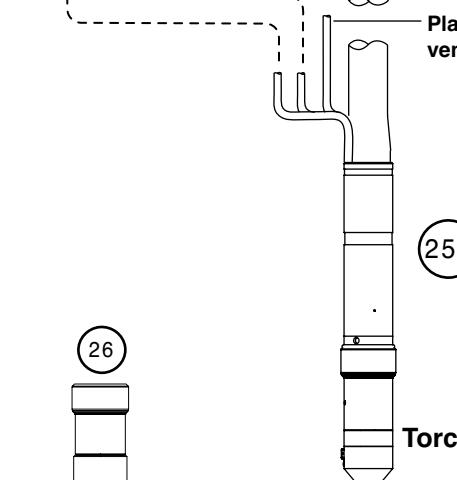
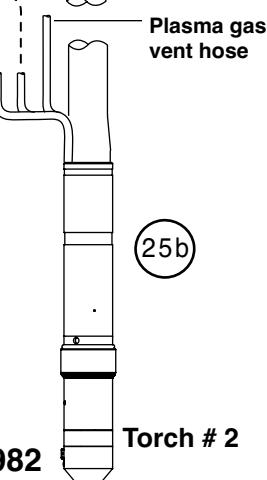
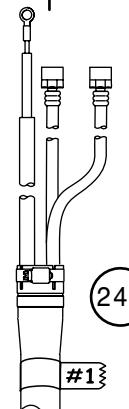
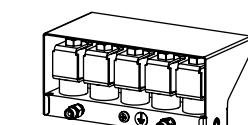
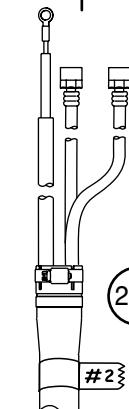
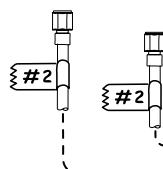
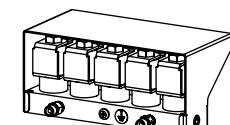
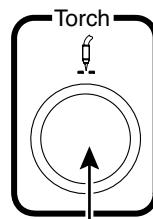
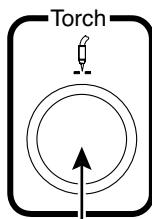
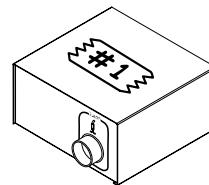
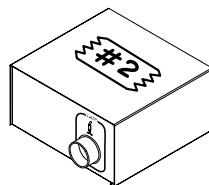
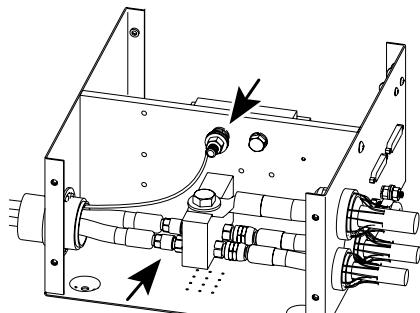
Torch lifter requirement

The system requires a high-quality, motorized torch lifter with sufficient travel to cover all cutting thickness requirements. The lifter must provide 203 mm (8 in.) of vertical travel. The unit should have the capability of maintaining a constant speed of up to 5080 mm/min (200 ipm) with positive braking. A unit which drifts through the stop point is not acceptable.

Install the torch and lead assembly

Installation note

Mark the torch number on the ends of each gas hose and torch lead.



② Lead assemblies

Part no.	Length
128890	1.8 m (6 ft)
128891	3.0 m (10 ft)
128892	4.5 m (15 ft)

③ Torch assembly – 228048

④ Torch receptacle plug – 129982



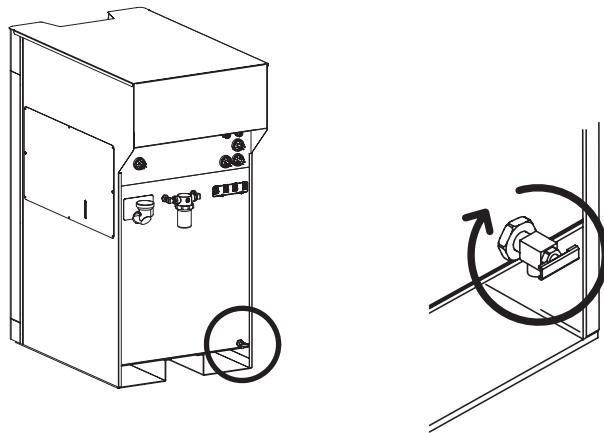
Caution: Locate the exposed end of the plasma gas vent hose away from sparks caused by piercing to avoid ignition and possible damage to the torch leads

Fill the power supply with coolant

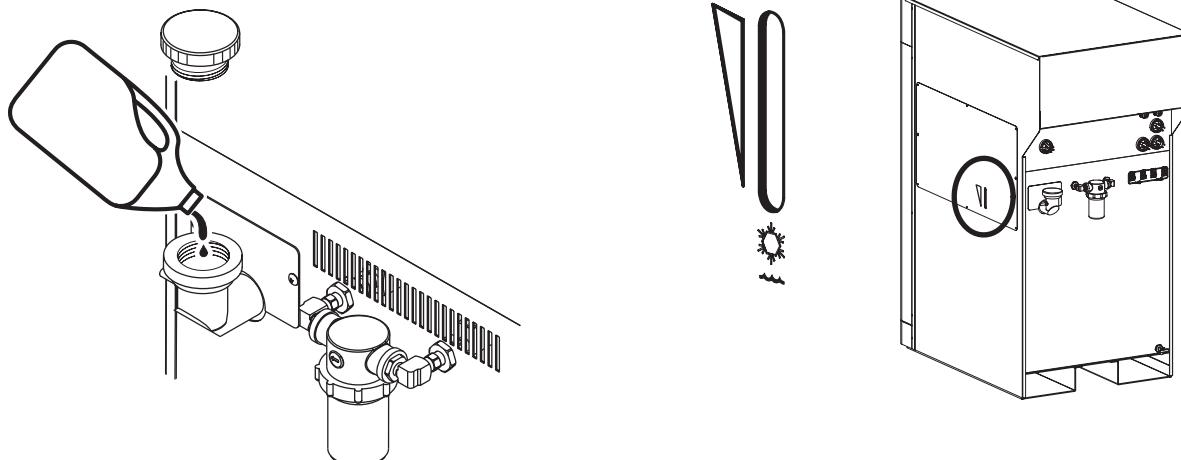


Caution: Use Hypertherm coolant (028872) to reduce the risk of damage from freezing and to prevent long-term corrosion.

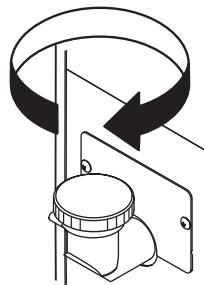
- ① Check that the drain valve is closed.



- ② Add coolant to the power supply until the sight gauge indicates full.

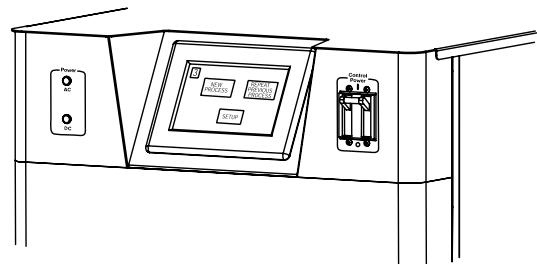


- ③ Replace the filler cap.

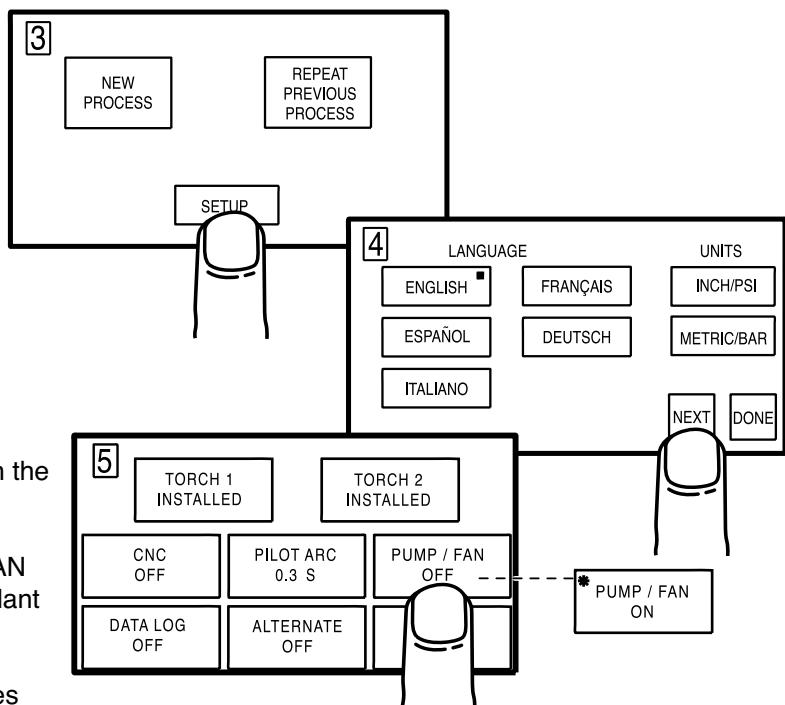


4070.40A

- ④ Turn the power supply ON.



- ⑤ Navigate to set-up screen 5.



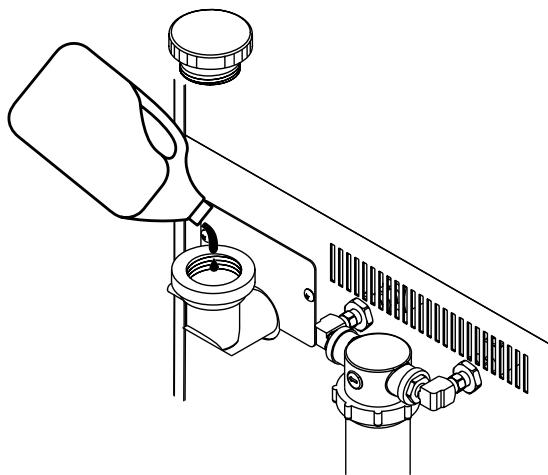
Note: If the system is being used in single torch mode, a torch receptacle plug must be installed in the torch that is not being used.

- ⑥ Press the PUMP FAN button to turn on the coolant pump.

An asterisk will appear in the PUMP FAN button when power supply detects coolant flow.

- ⑦ Allow the pump to operate for 5 minutes and then press the PUMP FAN button to turn the coolant pump off.

- ⑧ Turn the power supply OFF.
⑨ Check all coolant hose connections for leaks.
⑩ Add coolant until the sight gauge indicates "full."



Section 4**OPERATION**

In this section:

Power supply controls and indicators	4-2
General	4-2
Power switch	4-2
Power indicators	4-2
Power supply display	4-3
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System operation screens – Navigation	4-6
Daily start-up.....	4-7
Check torch	4-7
Turn power supply ON	4-8
System setup screens.....	4-8
System operation screens.....	4-11
Consumables selection.....	4-14
Install consumables	4-16
Cut charts	4-17
Estimated kerf width compensation	4-17
Changing consumable parts	4-30
Remove consumables.....	4-30
Inspect consumables	4-31
Inspect torch.....	4-32
Inspect electrode pit depth	4-33
Replace torch water tube	4-34
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Tips for table and torch.....	4-36
Plasma set-up tips.....	4-36
Maximize the life of consumable parts	4-36
Additional factors of cut quality	4-37
Additional improvements	4-38

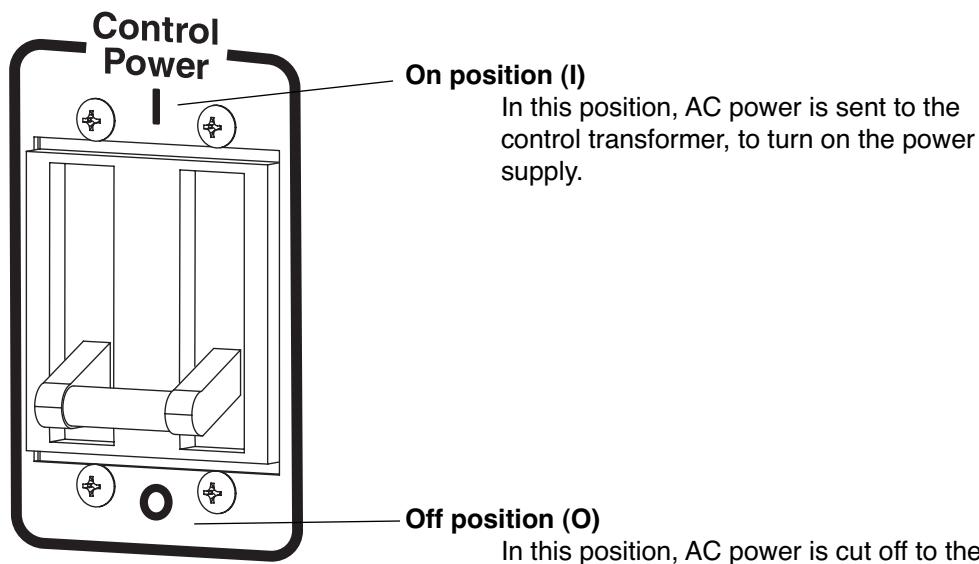
Power supply controls and indicators

General

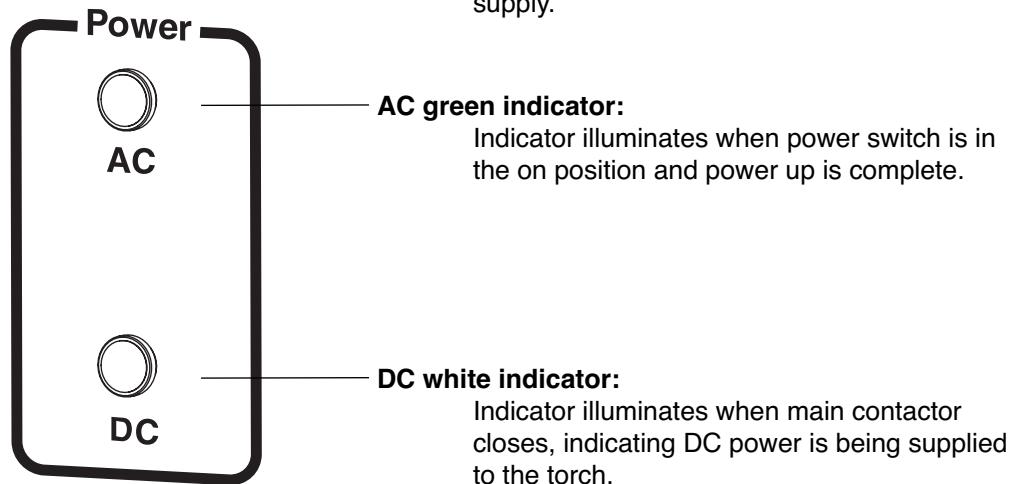
The HD4070 is a fully automated system that requires minimal input and adjustment by the operator. Using the HD4070 display touch screen (or CNC), the operator enters the material and thickness to be cut. The HD4070 system automatically selects and adjusts the power and gas required to optimize cutting, including amperage, gas and gas flow rate. The torch consumables that are required for the selected process are also listed on the HD4070 display.

If the Hypertherm Integrated Command THC option is installed, the HD4070 system will automatically adjust torch settings required for the specific process, including arc volts, torch-to-work, initial pierce height and pierce time delay.

Power switch



Power indicators



4070.27

Power supply display

The HD4070 display is a touch screen interface, providing all system control functions at a single location. The display may be installed in the power supply or mounted at a remote location.

There are a total of 17 screens, 1-11 and 13-18. Screen 1 (initiating) and 2 (power-up) only appear briefly at start-up and are not discussed further in this manual. There is no screen 12.

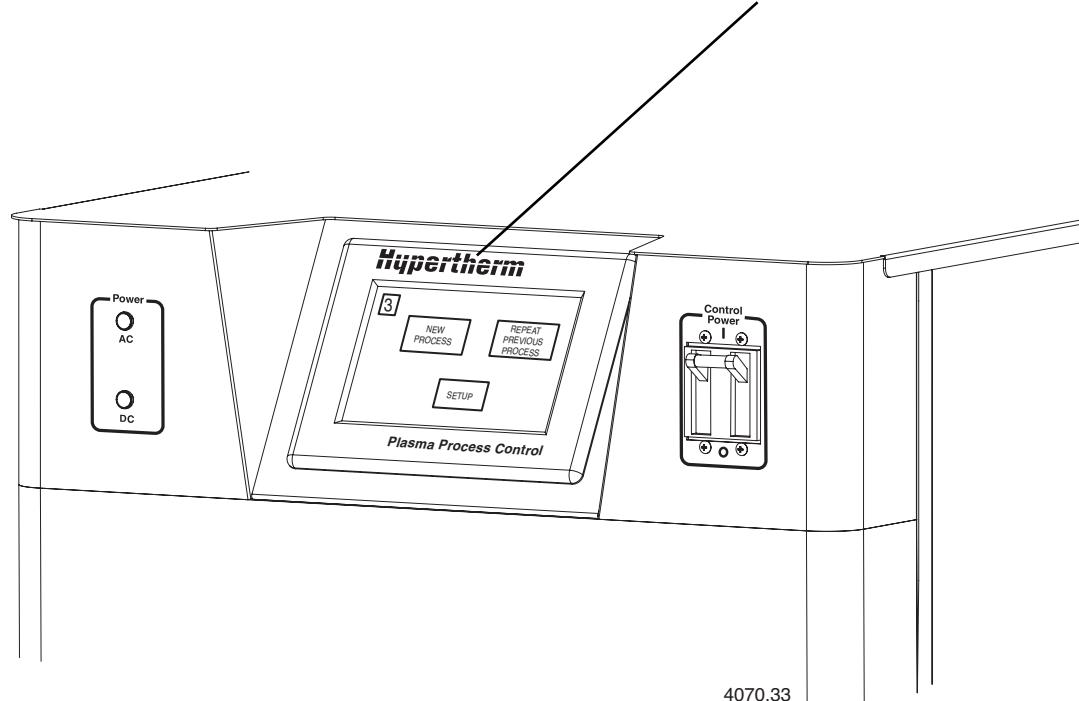
Screen navigation – The following pages describe how to navigate through the screens.

Note: The content of the screens in the manual may vary from the actual machine display.

Setup screens – Screens 3 through 11 are for system setup. The system is ready for input when Screen 3 appears.

Operation screens – Screens 13 through 16 are for system operation. Screen 13 is the primary operating screen and is visible during cutting operations. When an error occurs that freezes the system software, a RESET button appears in place of NEW PROCESS. Pushing RESET clears the error without having to turn the power off.

Service screens – Screens 17 and 18 are for troubleshooting only. You cannot make adjustments. See *Section 5* page 13 for details. Access the service screens by pressing the Hypertherm logo on screens 13 - 16.

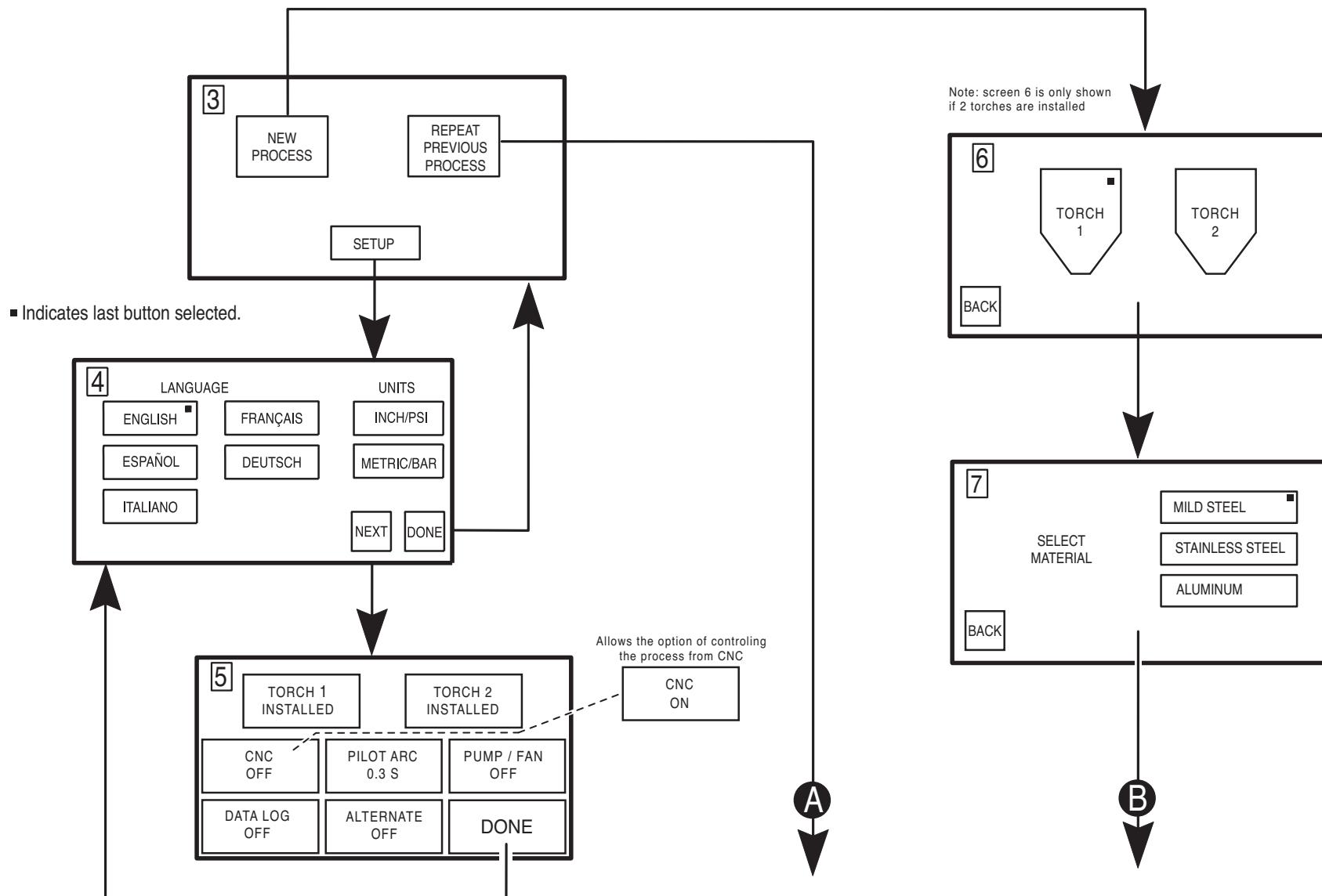


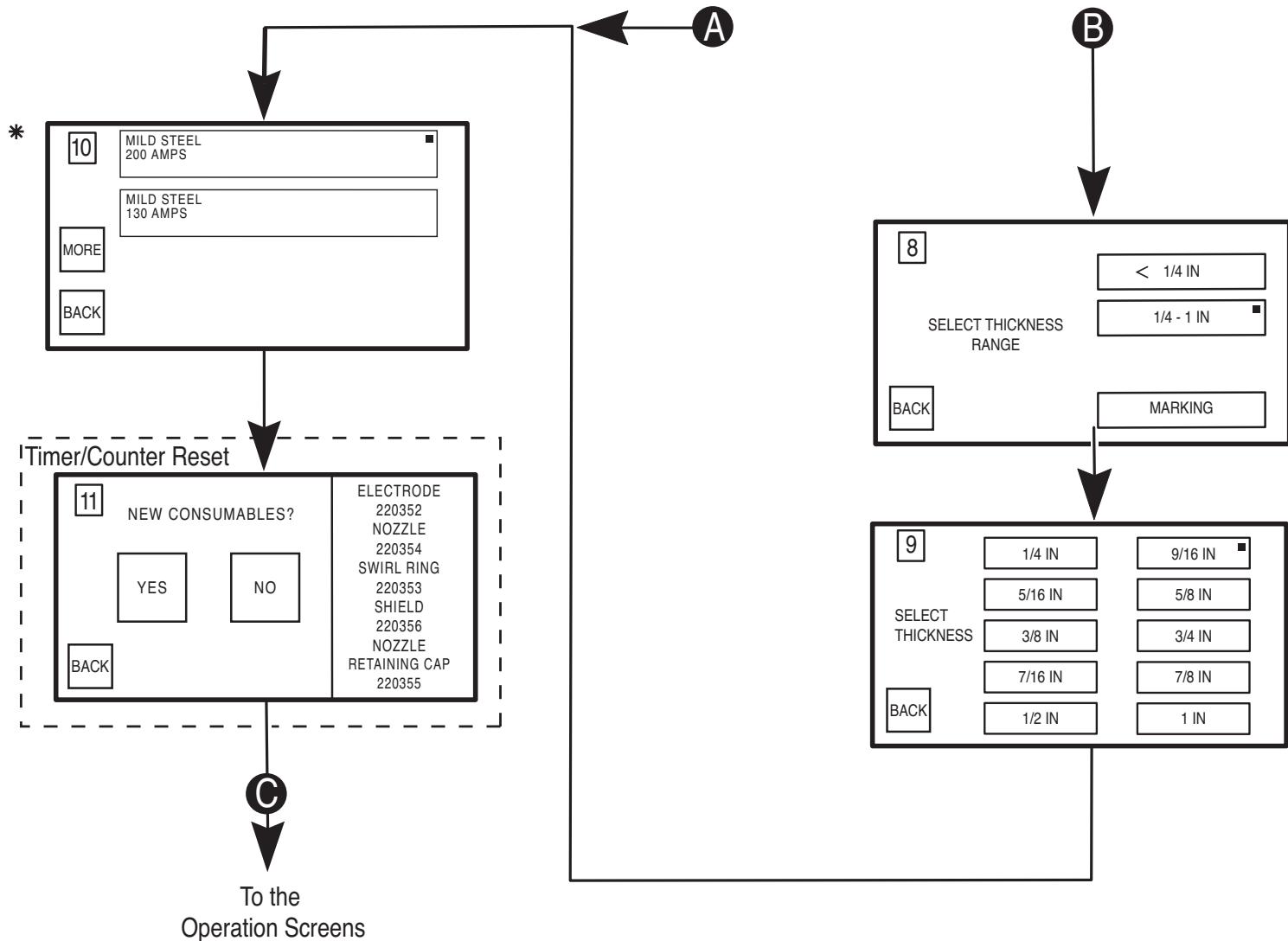
Caution: The HD4070 system can only support one touch screen display, either local or remote. The installation of two displays on one system may cause malfunctions or damage.



System setup screens – Navigation

Note: The content of the screens in the manual may vary from the actual machine display.

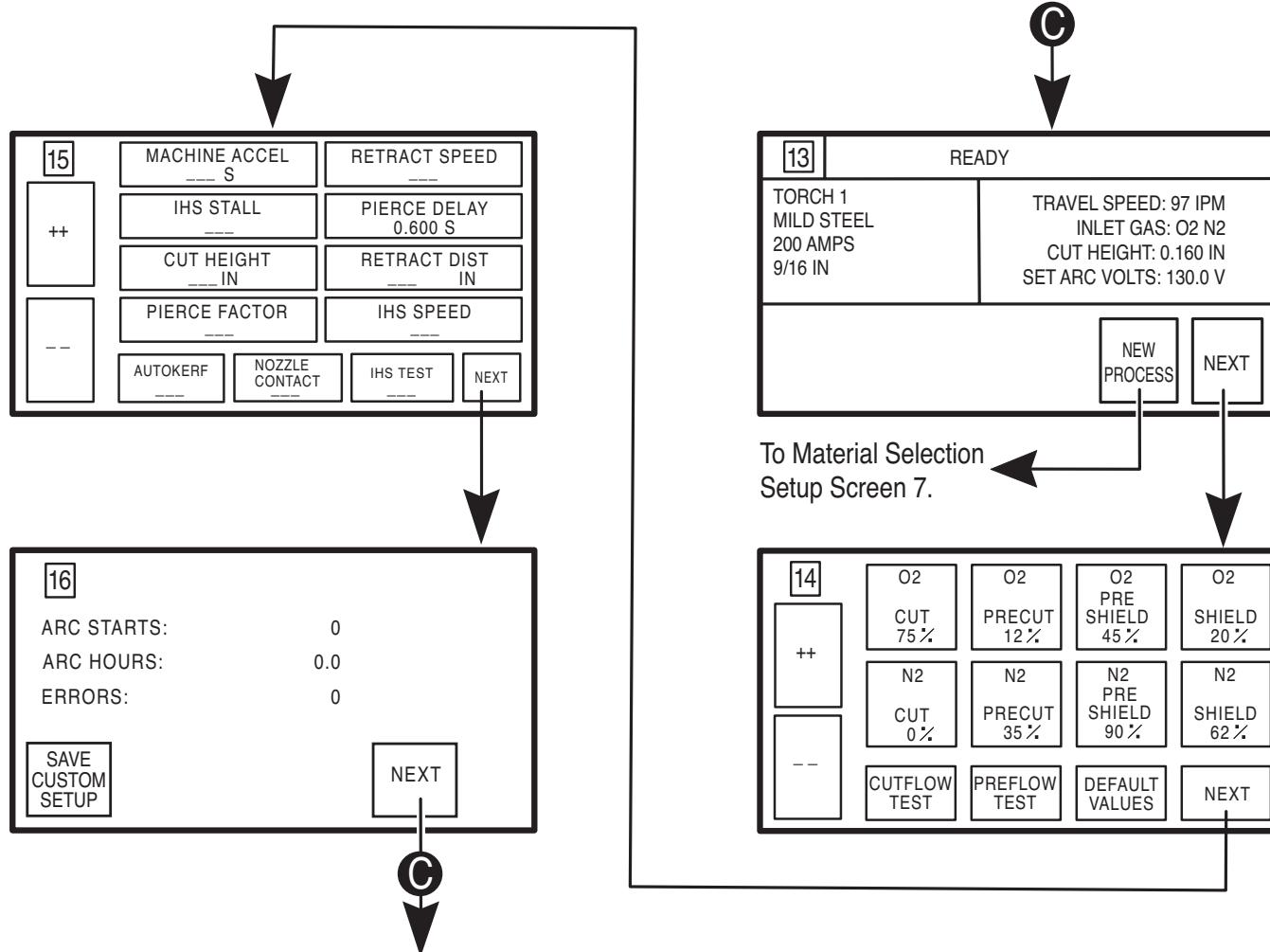




* The screen displays the choices available for current process

System operation screens – Navigation

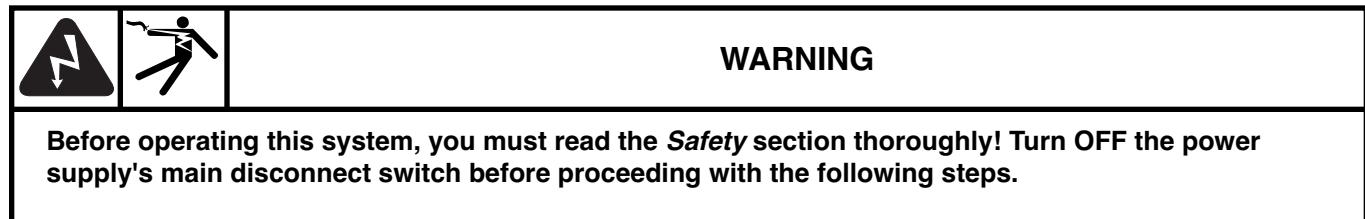
Note: The content of the screens in the manual may vary from the actual machine display.



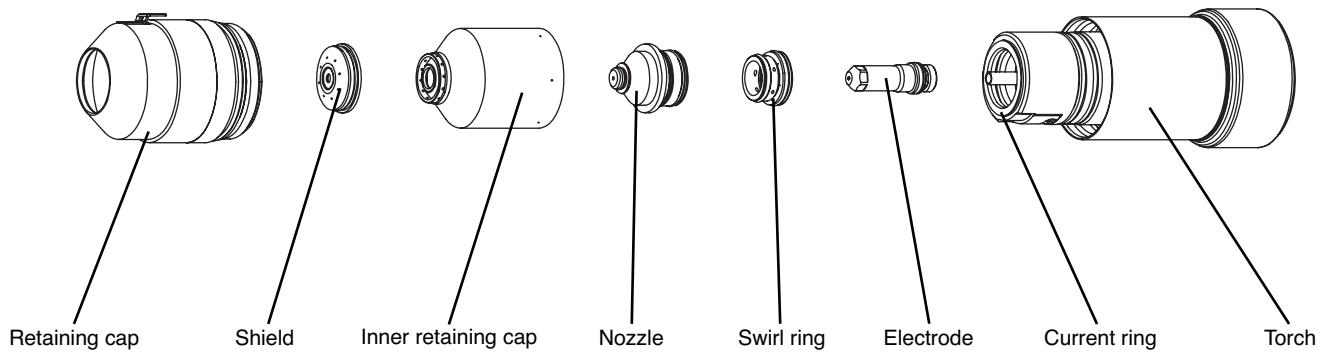
Daily start-up

Prior to start-up, ensure that your cutting environment and clothing meet the safety requirements outlined in the *Safety* section of this manual.

① Check torch

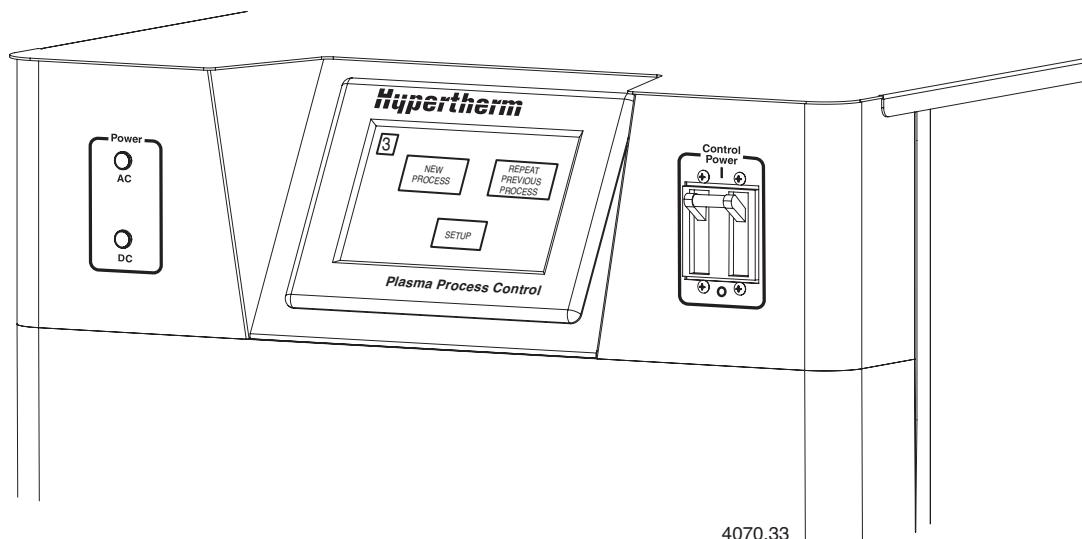


1. Turn main disconnect switch to the power supply OFF.
2. Remove the consumables from the torch and check for worn or damaged parts. **Always place the consumables on a clean, dry, oil-free surface after removing. Dirty consumables can cause the torch to malfunction.**
 - Refer to *Changing consumable parts* later in this section for details and for parts inspection tables.
 - Refer to the *Cut charts* to choose the correct consumables for your cutting needs.
3. Replace consumable parts. Refer to *Changing consumable parts* later in this section for details.
4. Ensure that the torch is perpendicular to the workpiece.



② Turn power supply ON

1. Move the power switch to the ON position.
2. Check that the green AC indicator is illuminated.



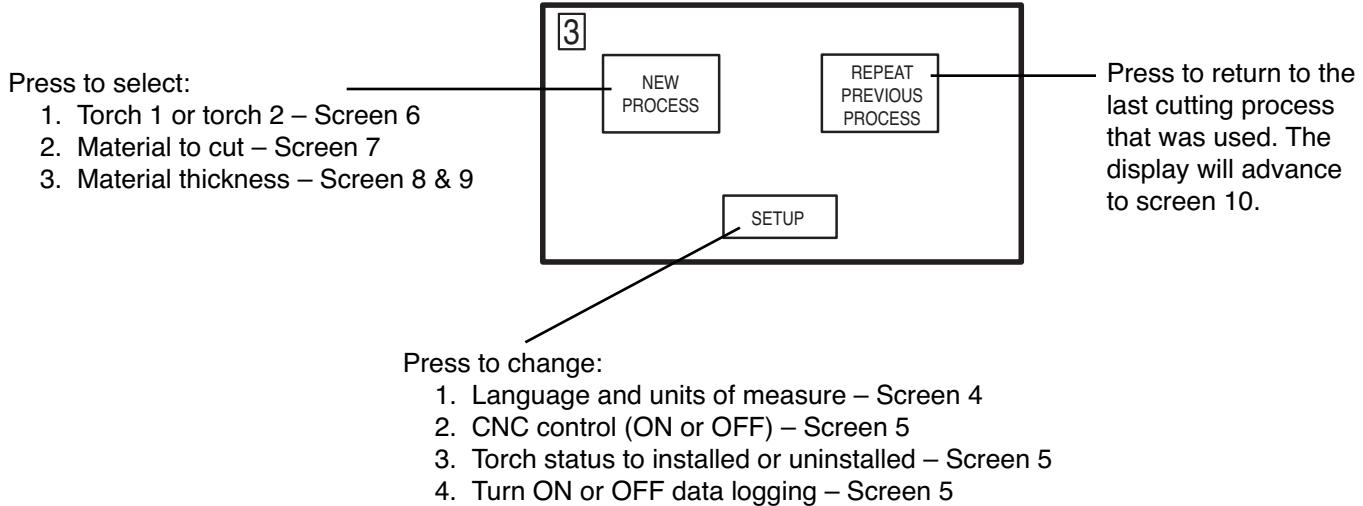
4070.33



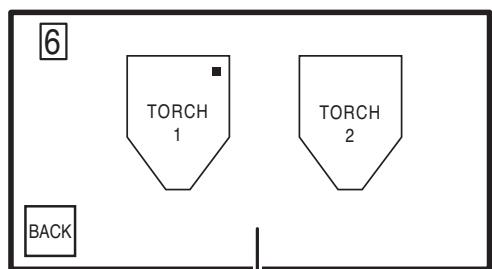
WARNING

DO NOT touch an idle torch! Always disconnect power to the power supply before changing a torch or inspecting or changing torch consumable parts.

③ System setup screens

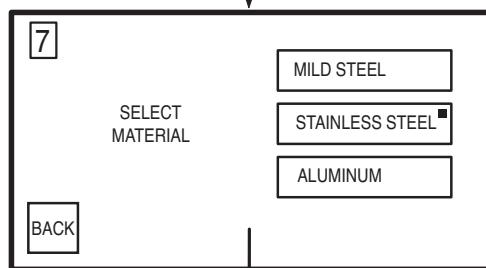


③ System setup screens – continued

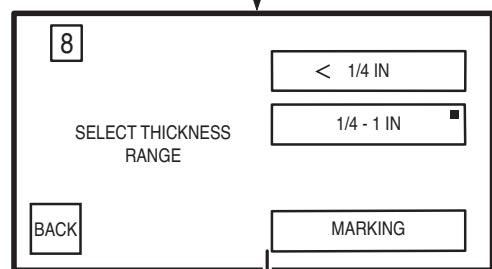


Select which torch is to be used. This screen will be bypassed if the 2-torch option is not installed.

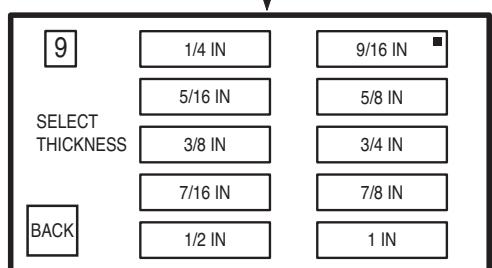
Note: When a two torch system is in single torch mode. A torch receptacle plug must be installed in the torch that is not being used.



Select the material to be cut.



Select material thickness range.

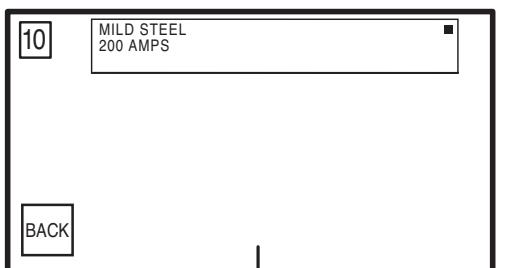


Select material thickness.

After pressing the desired thickness,
the display will advance to screen 10.

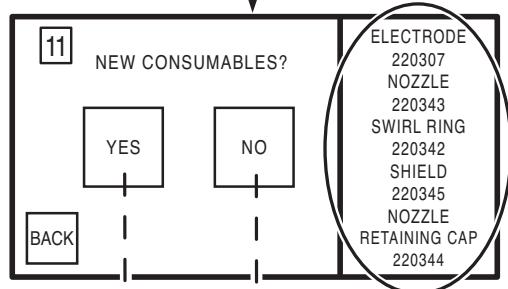
■ Indicates last button selected.

③ System setup screens – continued



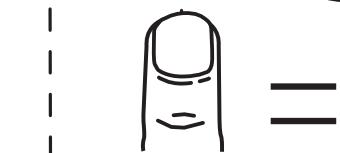
Select cutting process to be used.

A custom setting must be saved before it will be displayed.



The consumables required for the process are shown for reference.

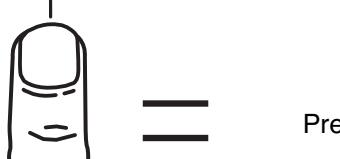
If you press NO, the system will add arc starts, arc hours and number of errors to the stored totals in the system's counter/timer (shown on screen 16).



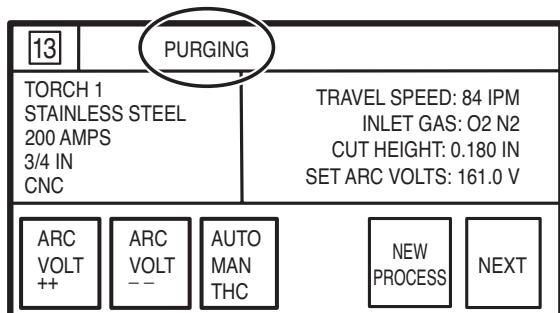
Press YES to zero the system counter/timer.

- Indicates last button selected.

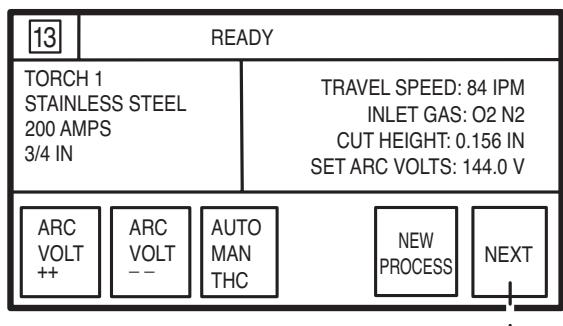
After pressing YES or NO, the display will advance to screen 13.



④ System operation screens



When screen 13 first appears, the system will purge all gas lines.

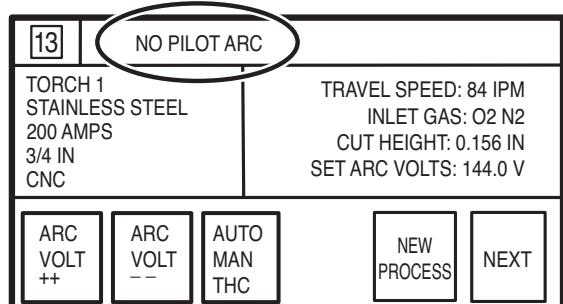


After the gases are purged, the screen will display READY indicating that the power supply is ready to receive the start signal from the CNC.

Screen 13 provides process information so that the operator can view what parameters are being used.



= Display will advance to screen 14.

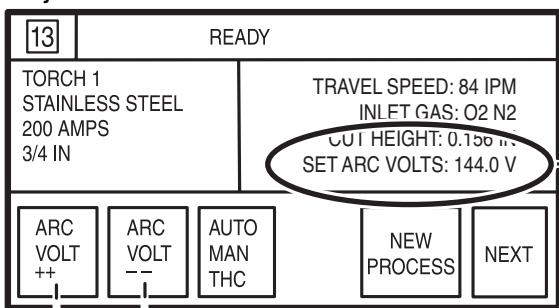


Error codes are displayed at the top of the screen. The system will clear some error codes and will then return to the READY state. When an error occurs that freezes the system software, a RESET button appears in place of NEW PROCESS. Pushing RESET clears the error without having to turn the power off.

See *Maintenance Section 5* for a complete list of error codes and corrective actions.

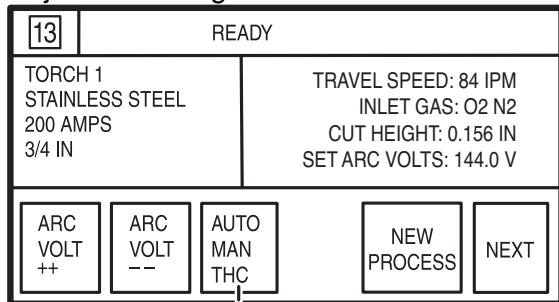
④ System operation screens – continued

Adjust arc volts



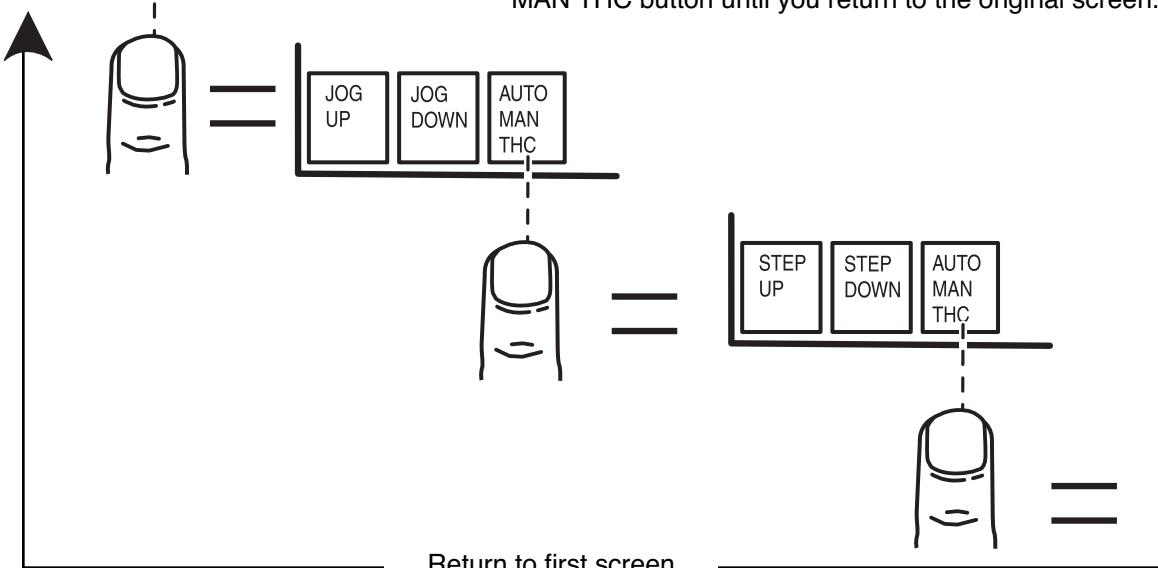
Use the ARC VOLT buttons to adjust the arc volts.

Adjust torch height



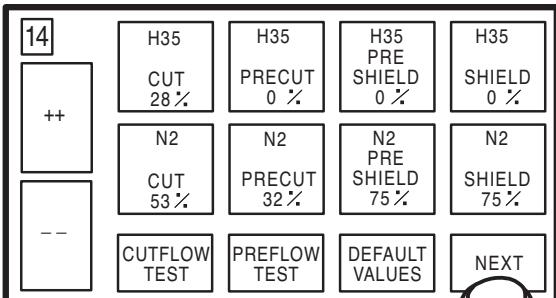
The lifter can be manually moved up or down in two ways. For large adjustments, press the AUTO MAN THC button and then use the JOG UP and JOG DOWN buttons. The lifter will continue to move as long as the button is pressed. For small adjustments, press the AUTO MAN THC button again and use the STEP UP and STEP DOWN buttons. Each time you press the UP or DOWN button the lifter will move .08 mm (.003 inches).

IMPORTANT: When the JOG UP and JOG DOWN or the STEP UP and STEP DOWN buttons are displayed, the Arc Volt Torch Height Control function is disabled. To restore Arc Volt Torch Height Control, press the AUTO MAN THC button until you return to the original screen.



④ System operation screens – continued

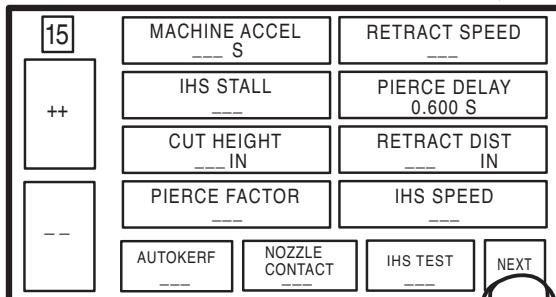
Adjust gas flows



First select the gas flow that you want to adjust. Then use the ++ or -- buttons to increase or decrease the flow value. Press the DEFAULT VALUES button to return all gas flows to the preset values.



Adjust THC settings

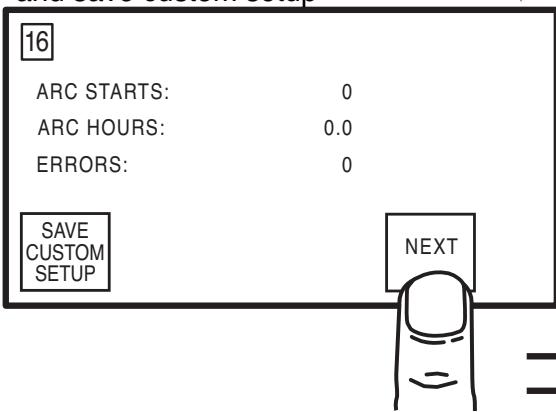


Note: If the THC option is not installed only the pierce delay button will be active.

First select the THC setting that you want to adjust. Then use the ++ or -- buttons to increase or decrease the selected THC setting.



View timer/counter totals and save custom setup



The system's counter/timer may be reset to zero from screen 11.

Press SAVE CUSTOM SETUP to save an adjusted cutting process. The custom setup is saved for the material being cut and can be selected for future cutting operations from the process selection screen 10. CUSTOM SETUP saves the following adjusted values: gas flows, pierce delay, cut height, pierce factor and arc volts. One custom setup can be saved for each process.



Display will return to screen 13.

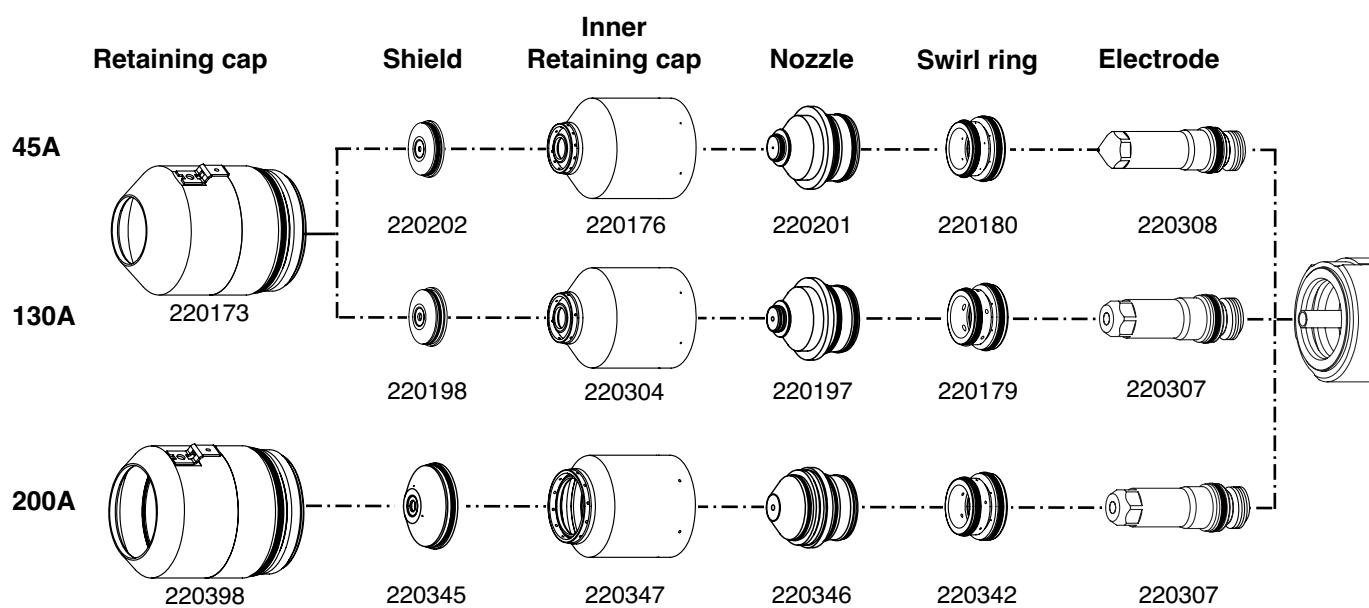
Consumable selection

Mild steel

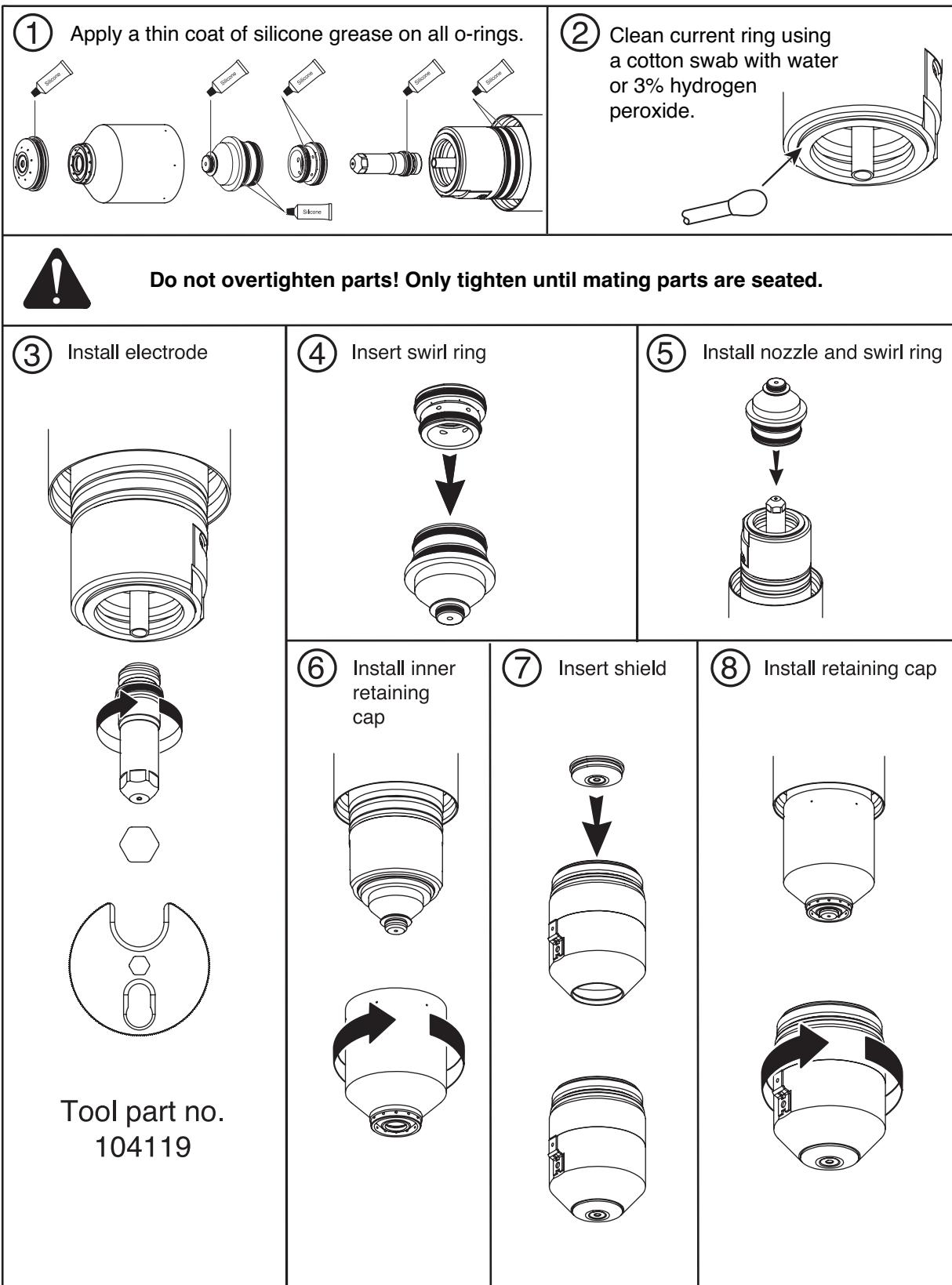
	Retaining cap	Shield	Inner Retaining cap	Nozzle	Swirl ring	Electrode
30A						
	220194	220313	220193	220180	220192	
80A	220173					
	220189	220176	220188	220179	220187	
130A						
	220183	220176	220182	220179	220181	
200A	220398					
	220356	220355	220354	220353	220352	

Stainless steel

	Retaining cap	Shield	Inner Retaining cap	Nozzle	Swirl ring	Electrode
45A						
	220202	220304	220201	220180	220308	
80A	220173					
	220338	220304	220337	220179	220339	
130A						
	220198	220304	220197	220179	220307	
200A	220398					
	220345	220344	220343	220342	220307	

Aluminum

Install consumables



Cut charts

The following cut charts show the consumable parts, cutting speed and the gas and torch settings required for the specific process.

The HD4070 system will automatically select and adjust the power and gas (including amperage, gas type and gas flow rate) required for the material and thickness to be cut.

If the Hypertherm Integrated Command THC option is installed, the HD4070 system will also automatically adjust torch settings required for the specific process, including arc volts, torch standoff, initial pierce height and pierce time delay.

The numbers shown in the cut charts are the HD4070's default values and should provide high quality cuts with minimal dross. Because of differences between installations and material composition, adjustments may be required to obtain desirable results.

Estimated kerf width compensation

The widths in the chart below are for reference. Differences between installations and material composition may cause actual results to vary from those shown in the table.

Metric

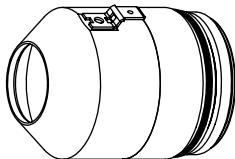
Process	Thickness (mm)								
	1.5	3	6	10	12	20	25	32	38
MS									
200A O2-N2				2.18	2.26	2.95			
130A O2-N2			1.80	2.03	2.11	2.64	3.43		
80A O2-N2		1.37	1.73	1.91					
30A O2-N2	1.35	1.45							
SS									
200A H35-N2				3.68	3.81	3.94			
130A H35-N2				2.72	2.77	2.90			
80A F5-N2			1.19						
45A F5-N2	0.58	0.38	0.53						
AL									
200A H35-N2				2.67	2.92	3.30			
130A H35-N2				2.72	2.77	2.90			
45A Air-Air	1.07	1.09	1.25						

English

Process	Thickness (in)								
	0.060"	0.135"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
MS									
200A O2-N2				0.086	0.089	0.116			
130A O2-N2			0.071	0.080	0.083	0.104	0.135		
80A O2-N2		0.054	0.068	0.075					
30A O2-N2	0.053	0.057							
SS									
200A H35-N2				0.145	0.150	0.155			
130A H35-N2				0.107	0.109	0.114			
80A F5-N2			0.047						
45A F5-N2	0.023	0.015	0.021						
AL									
200A H35-N2				0.105	0.115	0.130			
130A H35-N2				0.107	0.109	0.114			
45A Air-Air	0.042	0.043	0.049						

Marking

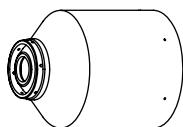
N₂ or H5 Plasma / N₂ Shield



220173



220202



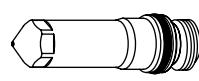
220304



220201



220180



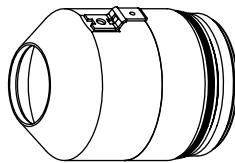
220308

Metric

Material	Test Preflow Rate (%)				Test Cutflow Rate (%)				Marking Current	Arc Voltage	Torch-to-Work Distance	Cutting Speed				
	Plasma		Shield		Plasma		Shield									
	Gas	Rate	Gas	Rate	Gas	Rate	Gas	Rate								
Mild Steel	N2	15	N2	40	N2	15	N2	40	7	153.0	2.2	6250				
Stainless Steel	H5	50	N2	80	H5	40	N2	80	7	84.0		3000				
Aluminum	H5	50	N2	80	H5	20	N2	80	10	78.0		4375				

English

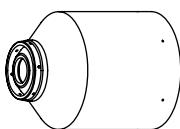
Material	Test Preflow Rate (%)				Test Cutflow Rate (%)				Marking Current	Arc Voltage	Torch-to-Work Distance	Cutting Speed				
	Plasma		Shield		Plasma		Shield									
	Gas	Rate	Gas	Rate	Gas	Rate	Gas	Rate								
Mild Steel	N2	15	N2	40	N2	15	N2	40	7	153.0	0.090	250				
Stainless Steel	H5	50	N2	80	H5	40	N2	80	7	84.0		120				
Aluminum	H5	50	N2	80	H5	20	N2	80	10	78.0		175				

Mild steel**O₂ Plasma / O₂-N₂ Shield****30A Cutting**

220173



220194



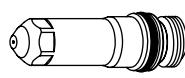
220313



220193



220180



220192

Pierce height = torch-to-work distance X pierce height factor**Metric**

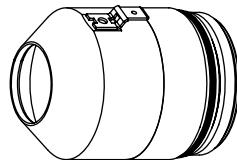
Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
O2	N2	O2	N2	O2	N2	O2	N2												
10	13	16	0	32	0	16	0	1	110	1.2	3550	180	0.3						
		23						2	120		1475		0.4						
								3	124		1150		0.5						
		12	34			10		4		1.5	900		0.7						
								5			775		0.9						
								6			650		1.0						

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness gauge/inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
O2	N2	O2	N2	O2	N2	O2	N2												
10	13	16	0	32	0	16	0	26.018	110	0.050	215	180	0.1						
		24.024						24.024	110		200		0.2						
		22.030						22.030	110		170								
		20.036						20.036	110		155								
		18.048						18.048	114		110		0.3						
		16.060						16.060	117		85								
		14.075						14.075	120	0.060	60	180	0.4						
		12.105						12.105	122		50								
		10.135						10.135	124		40		0.5						
		3/16						3/16	127		30		0.7						
		1/4						1/4	127		25		1.0						

OPERATION

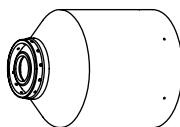
Mild steel
O₂ Plasma / O₂-N₂ Shield
80A Cutting



220173



220189



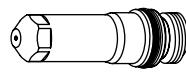
220176



220188



220179



220187

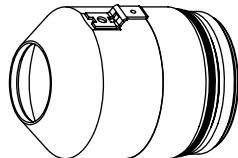
Pierce height = torch-to-work distance X pierce height factor

Metric

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
O2	N2	O2	N2	O2	N2	O2	N2												
10	24	15	52	34	0	11	48	2	112	2.5	9650	150	0.1						
								3	117		6050		0.2						
								4	119	2.0	4225	200	0.3						
								5	120		3600		0.4						
								6	121		3000		0.5						
								8	123		2000		0.6						
								10	124		1775		0.7						
								11	34		1400		0.8						
								12	126		250		0.9						

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness gauge/inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
O2	N2	O2	N2	O2	N2	O2	N2												
10	24	15	52	34	0	11	48	14/.075	112	0.100	400	150	0.1						
								12/.105	115		290		0.2						
								10/.135	117		180		0.3						
								3/16	119	0.080	155	200	0.4						
								1/4	121		110		0.5						
								5/16	123		92		0.6						
								3/8	124		75		0.7						
								7/16	125		62		0.8						
								1/2	126		50		0.9						

Mild steel**O₂ Plasma / O₂-N₂ Shield****130A Cutting**

220173

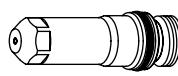
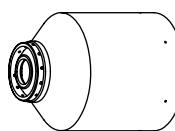
220183

220176

220182

220179

220181

**Pierce height = torch-to-work distance X pierce height factor****Metric**

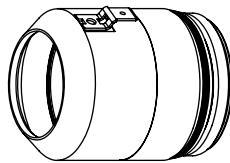
Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay				
Plasma	Shield	Plasma	Shield	O2	N2	O2	N2										
O2	N2	O2	N2	O2	N2	O2	N2	18	55	3	124	2.5	6400	200	0.1		
12	35	19	58	70	0	18	55			4	126	2.7	5425		0.2		
										5	127		4700				
										6	127		3975				
										8	129	3.0	3325		0.3		
										10	130		2650				
						16	48			12	132	3.2	2175		0.5		
										15	135	3.7	1650		0.7		
										20	140		1025		1.0		
40	90																

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness gauge/inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay				
Plasma	Shield	Plasma	Shield	O2	N2	O2	N2										
O2	N2	O2	N2	O2	N2	O2	N2	18	55	10/.135	124	0.100	240	200	0.1		
12	35	19	58	70	0					3/16	126	0.110	190		0.2		
										1/4	127		150				
										5/16	129	0.120	130		0.3		
										3/8	130		110				
										7/16	131	0.130	95		0.4		
										1/2	132		80		0.5		
										9/16	134	0.150	70		0.6		
										5/8	135		60		0.7		
										3/4	140		45		1.0		
40	90																

OPERATION

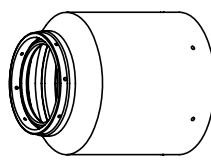
Mild steel
O₂ Plasma / O₂-N₂ Shield
200A Cutting



220398



220356



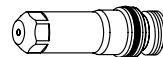
220355



220354



220353



220352

Pierce height = torch-to-work distance X pierce height factor

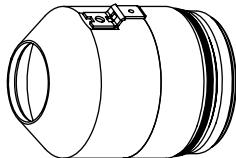
Metric

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
O2	N2	O2	N2	O2	N2	O2	N2												
12	35	45	90	75	0	20	62	8	126	3.3	4250	200	0.3						
								10	127		3450		0.3						
								12	128		3050		0.5						
								15	132	4.0	2275		0.6						
								20	135		1575		0.8						
								25	141	5.0	1175		1.0						

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
O2	N2	O2	N2	O2	N2	O2	N2												
12	35	45	90	75	0	20	62	5/16	126	0.130	170	200	0.3						
								3/8	127		140		0.3						
								7/16	127		127		0.4						
								1/2	128		115		0.5						
								9/16	130	0.160	97		0.6						
								5/8	132		80		0.6						
								3/4	135		65		0.7						
								7/8	138	0.200	55		0.8						
								1	141		45		1.0						

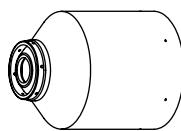
Stainless steel
F5 Plasma / N₂ Shield
45A Cutting



220173



220202



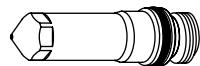
220304



220201



220180



220308

Pierce height = torch-to-work distance X pierce height factor

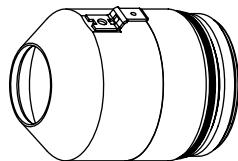
Metric

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
F5	N2	F5	N2	F5	N2	F5	N2												
17	0	0	48	16	0	0	64	1	104	2.5	5650	150	0.2						
								2	107		3125								
								3	109		1975								
								4	109		1400								
								5	109		1125		0.3						
								6	110		825		190						
			28					12	2.0	0.4									

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness gauge/inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
F5	N2	F5	N2	F5	N2	F5	N2												
17	0	0	48	16	0	0	64	20/.038	104	0.100	240	150	0.2						
								18/.050			190								
								16/.063			150								
								14/.078			130								
								12/.109			90								
								10/.141			65								
								3/16	109		45		190						
			28					1/4	110		30		0.4						

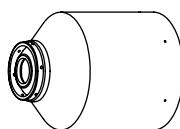
Stainless steel
F5 Plasma / N₂ Shield
80A Cutting



220173



220338



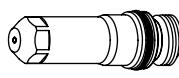
220304



220337



220179



220339

Pierce height = torch-to-work distance X pierce height factor

Metric

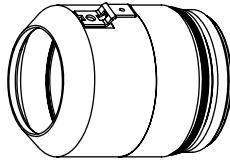
Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
F5	N2	F5	N2	F5	N2	F5	N2												
28	0	0	62	43	0	0	87	4	108	3.0	2150	150	0.2						
								5	110	2.7	1675		0.3						
								6	113	2.5	1200		0.4						
								8	117	3.0	875		0.5						
								10	120		550								

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness gauge/inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
F5	N2	F5	N2	F5	N2	F5	N2												
28	0	0	62	43	0	0	87	10/141	108	0.120	105	150	0.2						
								3/16	110	0.110	60		0.3						
								1/4	113	0.100	45		0.4						
								5/16	118	0.120	35		0.5						
								3/8	120		25								

Stainless steel

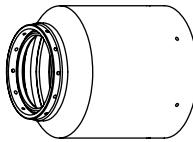
H35-N₂ Plasma / N₂ Shield
130A Cutting



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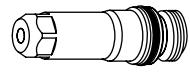
220304



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220307

Pierce height = torch-to-work distance X pierce height factor

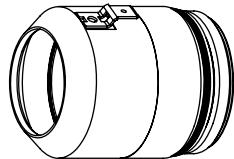
Metric

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay					
Plasma	Shield	Plasma	Shield	mm	mm/m	%	seconds											
H35	N2	H35	N2	H35	N2	H35	N2	90	151	3.0	1750	200	0.3					
0	31	0	90	25	43	0												
						6												
						8												
						10												
						12	155		3.5	750								
						15	162		3.7	625								
						20	168		4.2	375	180	0.5						
						20	173		4.2	375	180	0.8						

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay		
Plasma	Shield	Plasma	Shield	in	ipm	%	seconds								
H35	N2	H35	N2	H35	N2	H35	N2	90	151	0.120	70	200	0.3		
0	31	0	90	25	43	0			5/16			60			
									3/8			50			
									7/16			40			
									1/2	159		30			
									9/16	162		28			
									5/8	165		25			
									3/4	168		15	180	0.4	
									75	173	0.140	180	1.3	0.5	
									1/2	168	0.150	25			
									9/16	173	0.170	15	180	0.7	
									5/8	173	180	1.3	0.8		
									3/4	173	15				

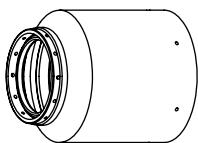
Stainless steel
H35-N₂ Plasma / N₂ Shield
200A Cutting



220398



220345



220344



220343



220342



220307

Pierce height = torch-to-work distance X pierce height factor

Metric

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
H35	N2	H35	N2	H35	N2	H35	N2												
0	32	0	75	28	53	0	75	10	157	4.0	1875	200	0.5						
								12	158		1750		0.6						
								15	163	4.5	1500	150	0.8						
								20	168	5.0	1125		1.0						

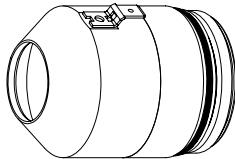
English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
H35	N2	H35	N2	H35	N2	H35	N2												
0	32	0	75	28	53	0	75	3/8	157	0.160	75	200	0.5						
								7/16	157		73		0.6						
								1/2	158		70								
								9/16	161	0.180	65	150	0.7						
								5/8	163		60		0.8						
								3/4	168		45		1.0						

Aluminum

Air Plasma / Air Shield

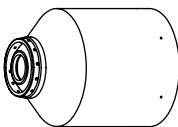
45A Cutting



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220202



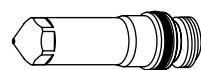
220176



220201



220180



220308

Pierce height = torch-to-work distance X pierce height factor**Metric**

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
	Air		Air		Air		Air												
0	15	0	52	0	14	0	38	52	108	2.5	6700	150	0.2						
											3925								
											3175								
								38	96	1.7	2525		0.3						
											2100		0.5						
											1675								
											0.6								

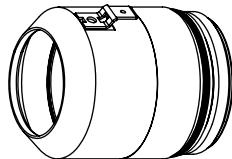
English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness gauge/inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
	Air		Air		Air		Air												
0	15	0	52	0	14	0	38	52	108	0.100	220	150	0.2						
											170								
											160								
								38	96	0.070	140		0.3						
											110		0.4						
											90								
											60		0.6						

OPERATION

Aluminum

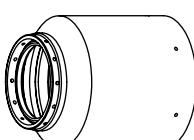
H35-N₂ Plasma / N₂ Shield
130A Cutting



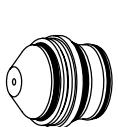
220173



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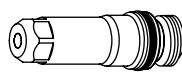
220304



220197



220179



220307

Pierce height = torch-to-work distance X pierce height factor

Metric

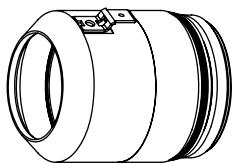
Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
H35	N2	H35	N2	H35	N2	H35	N2												
0	31	0	80	25	43	0	65	6	156	3.5	2125	200	0.3						
								8	158		1875		0.5						
								10	159		1625		0.8						
								12	160	3.0	1375		1.3						
								15	162		1125								
								20	164		875								

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
H35	N2	H35	N2	H35	N2	H35	N2												
0	31	0	80	25	43	0	65	1/4	156	0.140	85	200	0.3						
								5/16	158		75		0.4						
								3/8	159		65		0.5						
								7/16	159	0.130	60		0.7						
								1/2	160		55		0.8						
								9/16	161		52		1.3						
								5/8	162	0.120	45								
								3/4	164		35								

AluminumH35-N₂ Plasma / N₂ Shield

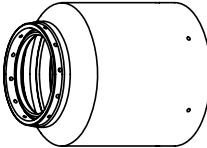
200A Cutting



220398



220345



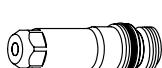
220347



220346



220342



220307

Pierce height = torch-to-work distance X pierce height factor**Metric**

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness millimeters	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
H35	N2	H35	N2	H35	N2	H35	N2												
0	32	0	70	31	45	0	70	10	6.2	153	2950	150	0.5						
								12		154	2625		0.6						
								15		157	2125		0.8						
								35		20	1500		1.0						
								35		161									

English

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness inch	Arc Voltage	Torch-to-Work distance	Cutting Speed	Pierce Height Factor	Pierce Delay						
Plasma		Shield		Plasma		Shield													
H35	N2	H35	N2	H35	N2	H35	N2												
0	32	0	70	31	45	0	70	3/8	0.250	153	120	150	0.5						
								7/16		153	110		0.6						
								1/2		154	100		0.7						
								9/16		156	90		0.8						
								5/8		158	80		1.0						
								3/4		161	60								

Changing consumable parts

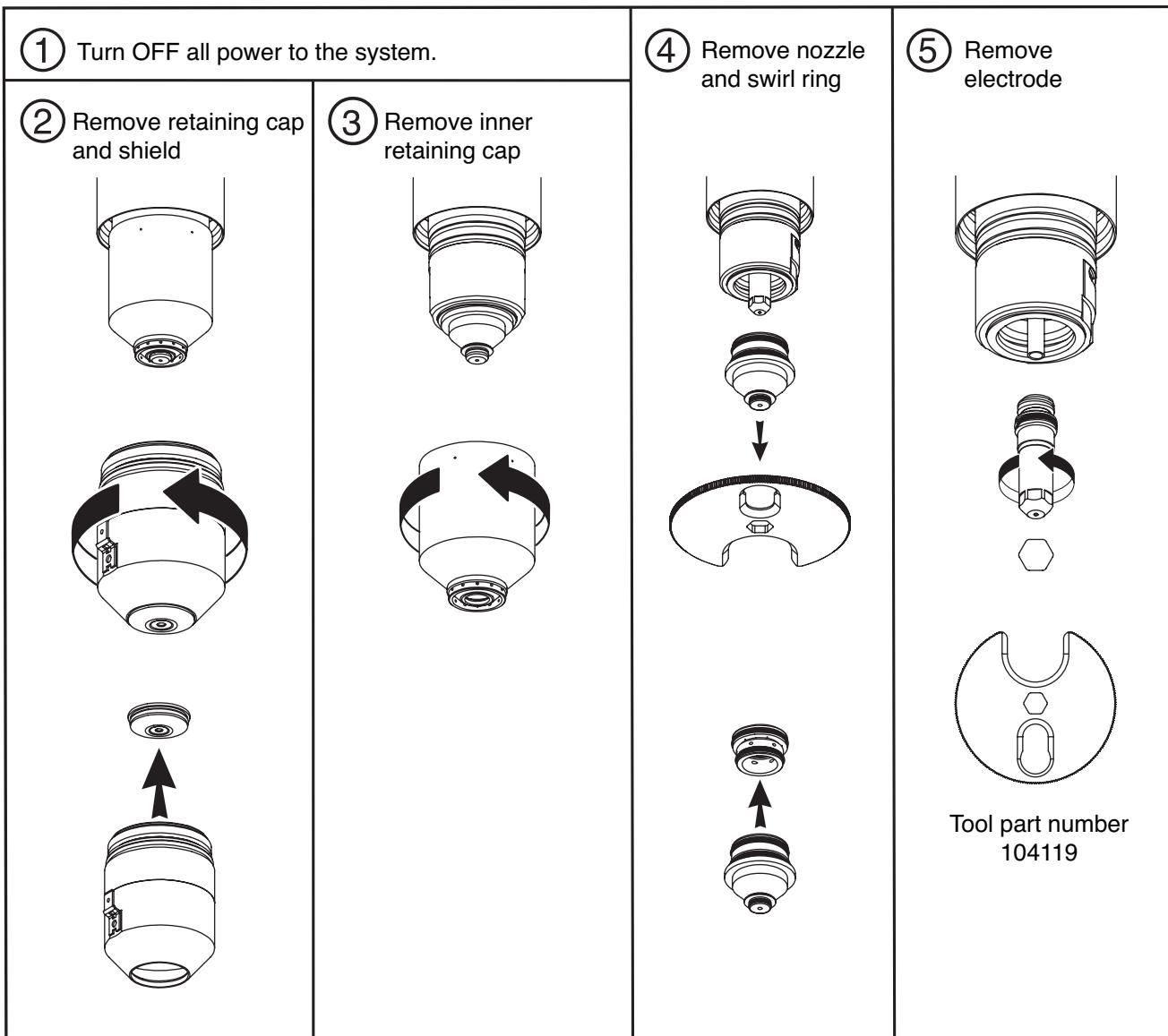


WARNING

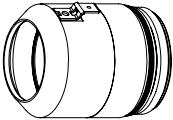
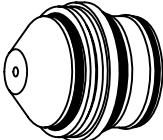
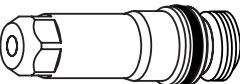
The system is designed to go into an idle mode if the retaining cap is removed. However, DO NOT CHANGE CONSUMABLE PARTS WHILE IN THE IDLE MODE! Always disconnect power to the power supply before inspecting or changing torch consumable parts. Use gloves when removing consumables. The torch might be hot.

Remove consumables

Check the consumable parts daily for wear before cutting. Before removing consumables, bring the torch to the edge of the cutting table, with the torch lifter raised to its highest point to prevent the consumables from dropping into the water of the water table.



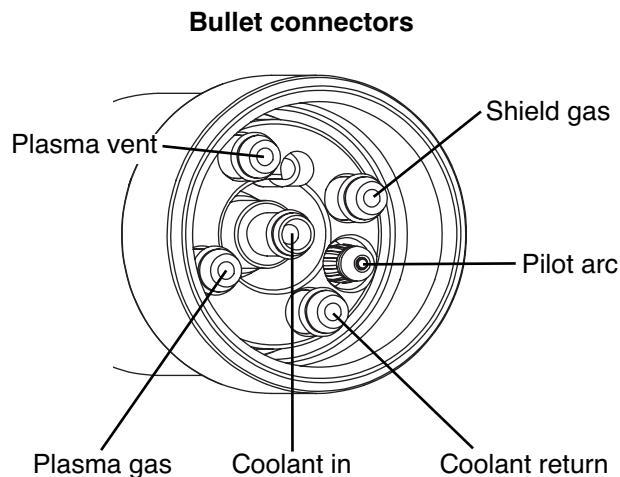
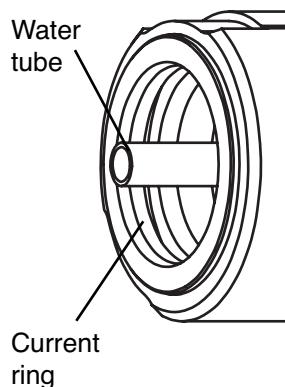
Inspect Consumables

Part	Check for	Action
Retaining cap 	Erosion, missing material Cracks Burns	Replace cap Replace cap Replace cap
Nozzle 	Erosion or missing material Blocked gas holes	Replace nozzle* Replace nozzle*
Center hole	1. Must be round 2. Signs of arcing	Replace nozzle if hole is no longer round* Replace nozzle*
O-rings	1. Damage 2. Lubricant	Replace nozzle* Apply a thin film of silicone lubricant if dry
Swirl ring 	Damage Dirt or debris	Replace swirl ring Clean and check for damage, and replace swirl ring if damaged
Gas holes	Blocked holes	Replace swirl ring
O-rings	1. Damage 2. Lubricant	Replace swirl ring Apply a thin film of silicone lubricant if dry
Electrode 	Wear	See <i>Inspect Electrode Pit Depth</i> later in this section
O-rings	1. Damage 2. Lubricant	Replace electrode* Apply a thin film of silicone lubricant if dry

*Note: Always replace the nozzle and electrode as a set.

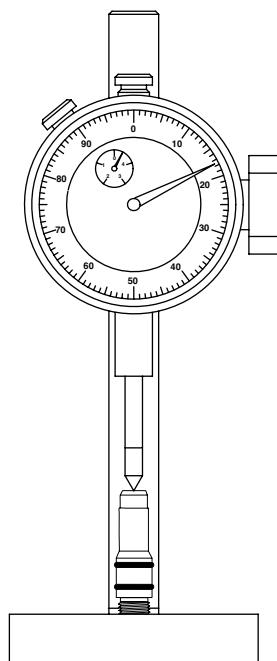
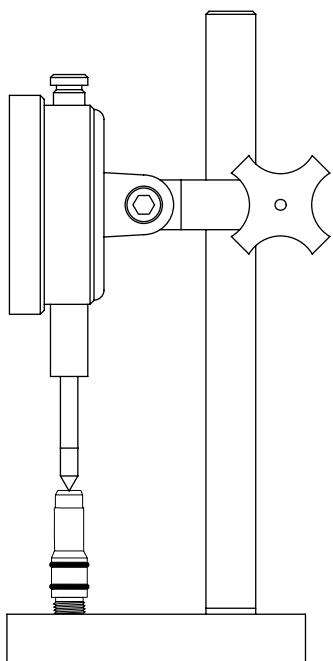
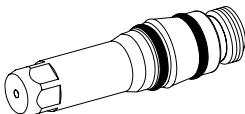
OPERATION

Inspect torch



Inspect	Check for	Action
All surfaces	Dirt or debris Erosion, missing material Cracks Internal burn or arcing marks	Clean surfaces Replace torch Replace torch Replace torch
Current ring	1. Dirt or debris 2. Pitted or missing material	Clean Replace torch
Threads	Wear or damage	Replace torch
Bullet connectors	Damage	Replace torch
O-rings	1. Damage 2. Lubricant	Replace o-ring Apply a thin film of silicone lubricant if dry
External o-rings	1. Damage 2. Lubricant	Replace o-ring Apply a thin film of silicone lubricant if dry
Water tube*	1. Tightness 2. Pitted or missing material	Tighten or replace tube* Replace tube*

*Note: See *Replace torch water tube* later in this section.

Inspect electrode pit depth

Electrode pit depth gauge (004630)

Part	Check for	Action
Electrode		
Center surface	Wear	Replace electrode if pit is deeper than 1 mm (0.040 inch)*

*Note: Always replace the nozzle and electrode as a set.

Replace torch water tube



WARNING

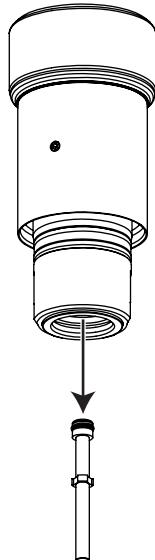
The system is designed to go into an idle mode if the retaining cap is removed. However, DO NOT REMOVE CONSUMABLE PARTS WHILE IN THE IDLE MODE! Always disconnect power to the power supply before removing torch consumable parts.

Note: The water tube may seem loose when correctly inserted, but any side-to-side looseness will disappear after the electrode is installed.

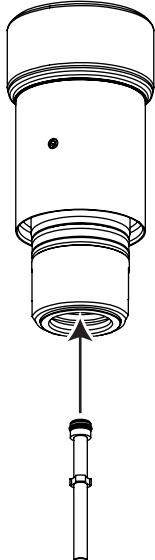
- ① Turn OFF all power to the system.

- ② Remove consumables from torch. See *Remove consumables* in this section.

- ③ Remove water tube



- ④ Install new water tube



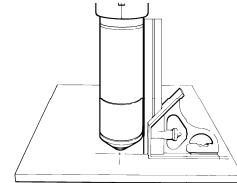
- ⑤ Replace consumables. See *Install consumables* in this section.

Common cutting faults

- Torch pilot arc will initiate, but will not transfer. Causes can be:
 1. Work cable connection on the cutting table is not making good contact.
 2. Malfunction in the system. See Section 5.
 3. Torch-to-work distance is too high.
- The workpiece is not totally penetrated, and there is excessive sparking on top of the workpiece. Causes can be:
 1. Current is set too low (check *Cut chart* information).
 2. Cut speed is too high (check *Cut chart* information).
 3. Torch parts are worn (see *Changing consumable parts*).
 4. Metal being cut is too thick.
- Dross forms on the bottom of the cut. Causes can be:
 1. Cutting speed is not correct (check *Cut chart* information).
 2. Arc current is set too low (check *Cut chart* information).
 3. Torch parts are worn (see *Changing consumable parts*).
- Cut angle is not square. Causes can be:
 1. Wrong direction of machine travel.
High quality side is on the right with respect to the forward motion of the torch.
 2. Torch-to-work distance is not correct (check *Cut chart* information).
 3. Cutting speed is not correct (check *Cut chart* information).
 4. Arc current is not correct (check *Cut chart* information).
 5. Damaged consumable parts (see *Changing consumable parts*).
- Short consumable life. Causes can be:
 1. Arc current, arc voltage, travel speed, motion delay, gas flow rates, or initial torch height not set as specified in the *Cut charts*.
 2. Attempting to cut highly magnetic metal plate, such as armor plate with a high nickel content, will shorten consumable life. Long consumable life is difficult to achieve when cutting plate that is magnetized or becomes magnetized easily.
 3. Beginning or ending the cut off the plate surface. **To achieve consumable long life, all cuts must begin and end on the plate surface.**

How to optimize cut quality

The following tips and procedures will help produce square, straight, smooth and dross-free cuts.



Tips for table and torch

- Use a square to align the torch at right angles to the workpiece.
- The torch may travel more smoothly if you clean, check and “tune” the rails and drive system on the cutting table. Unsteady machine motion can cause a regular, wavy pattern on the cut surface.
- The torch must not touch the workpiece during cutting. Contact can damage the shield and nozzle, and affect the cut surface.

Plasma set-up tips

Follow carefully each step in the *Daily start-up* procedure described earlier in this section.

Purge the gas lines before cutting.

Maximize the life of consumable parts

Hypertherm's LongLife® process automatically "ramps up" the gas and current flows at the start and ramps them down at the end of each cut, to minimize erosion of the electrode's center surface. The LongLife process also requires that cuts start and stop on the workpiece.

- The torch should never fire into the air.
 - Starting the cut at the edge of the workpiece is acceptable, as long as the arc is not fired in the air.
 - To start with a pierce, use a pierce height that is 1.5 to 2 times the torch-to-work distance. See cut charts.
- Each cut should end with the arc still attached to the workpiece, to avoid arc blow-outs (ramp-down errors).
 - When cutting drop parts (small parts that drop down after being cut from the workpiece), check that the arc stays attached to the edge of the workpiece, for proper ramp-down.
- If arc blow-outs occur, try one or more of the following:
 - Reduce the cutting speed during the final part of the cut.
 - Stop the arc before the part is completely cut, to allow completion of the cut during the ramp-down.
 - Program the path of the torch into the scrap area for ramp-down.

Note: Use a "chain cut" if possible, so the path of the torch can lead directly from one cut part into the next, without stopping and starting the arc. However, do not allow the path to lead off the workpiece and back on, and remember that a chain cut of long duration will cause electrode wear.

Note: It may be difficult to achieve the full benefits of the LongLife process in some conditions.

Additional factors of cut quality

Cut angle

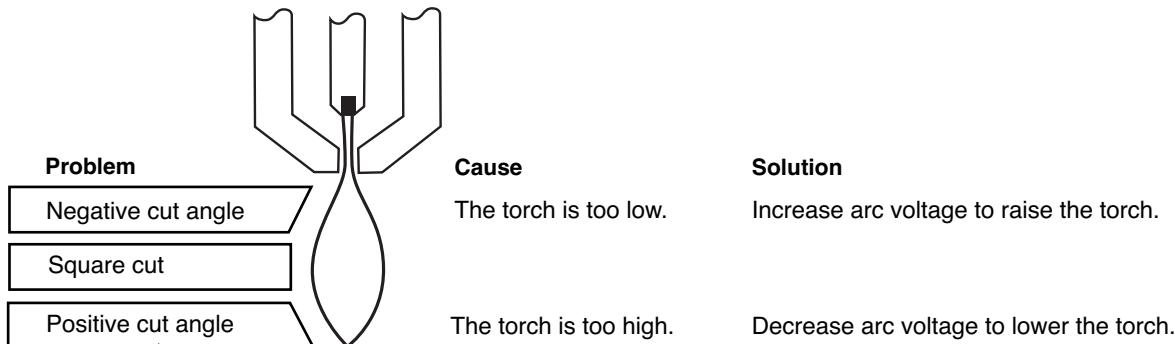
A cut part whose 4 sides average less than 4° of cut angle is considered acceptable.

Note: The squarest cut angle will be on the right side with respect to the forward motion of the torch.

Note: To determine whether a cut-angle problem is being caused by the plasma system or the drive system, make a test cut and measure the angle of each side. Next, rotate the torch 90° in its holder and repeat the process. If the angles are the same in both tests, the problem is in the drive system.

If a cut-angle problem persists after “mechanical causes” have been eliminated (See *Tips for table and torch*, previous page), check the torch-to-work distance, especially if cut angles are all positive or all negative.

- A positive cut angle results when more material is removed from the top of the cut than from the bottom.
- A negative cut angle results when more material is removed from the bottom of the cut.



Dross

Low-speed dross forms when the torch's cutting speed is too slow and the arc shoots ahead. It forms as a heavy, bubbly deposit at the bottom of the cut and can be removed easily. Increase the speed to reduce the dross.

High-speed dross forms when the cutting speed is too fast and the arc lags behind. It forms as a thin, linear bead of solid metal attached very close to the cut. It is welded to the bottom of the cut and is difficult to remove. To reduce high-speed dross:

- Decrease the cutting speed.
- Decrease arc voltage, to decrease the torch-to-work distance.
- Increase O₂ in the shield gas to increase the range of dross-free cutting speeds. (Only HyDefinition and HT4400 systems can accommodate mixed-gas shield gases.)

Notes: Dross is more likely to form on warm or hot metal than on cool metal. For example, the first cut in a series of cuts will likely produce the least dross. As the workpiece heats up, more dross may form on subsequent cuts.

Dross is more likely to form on mild steel than on stainless steel or aluminum.

Worn or damaged consumables may produce intermittent dross.

OPERATION

Straightness of the cut surface



A typical plasma cut surface is slightly concave.

The cut surface may become more concave, or convex. Correct torch height is required to keep the cut surface acceptably close to straight.



A strongly concave cut surface occurs when the torch-to-work distance is too low. Increase the arc voltage to increase the torch-to-work distance and straighten the cut surface.



A convex cut surface occurs when the torch-to-work distance is too great or the cutting current is too high. First, reduce the arc voltage, then reduce the cutting current. If there is overlap between different cutting currents for that thickness, try the consumables designed for the lower current.

Additional improvements

Some of these improvements involve trade-offs, as described.

Smoothness of cut surface (surface finish)

- (HyDefinition and HT4400 only) On mild steel, a higher concentration of N₂ in the O₂-N₂ shield mixture may produce a smoother cut surface.
Trade-off: This may produce more dross.
- (HyDefinition and HT4400 only) On mild steel, a higher concentration of O₂ in the O₂-N₂ shield mixture may increase the cutting speed and produce less dross.
Trade-off: This may produce a rougher cut surface.

Piercing

- The pierce delay must be sufficiently long that the arc can pierce the material before the torch moves, but not so long that the arc “wanders” while trying to find the edge of a large hole.
- A higher shield gas preflow may help blow the molten metal away during piercing.
Trade-off: This may reduce starting reliability.

Note: When piercing at maximum thicknesses, the ring of dross that forms during the pierce may be high enough to contact the torch when the torch begins to move after the pierce is complete. A “flying pierce,” which makes the pierce while the torch is moving, may eliminate the torch vibration that follows contact between the torch and the ring of dross.

How to increase cutting speed

- Decrease the torch-to-work distance.
Trade-off: This will increase the negative cut angle

Note: The torch must not touch the workpiece while piercing or cutting.

MAINTENANCE

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Introduction

Hypertherm assumes that the service personnel performing the troubleshooting testing are high-level electronic service technicians who 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 our Customer Service or Technical Service departments listed in the front of this manual.

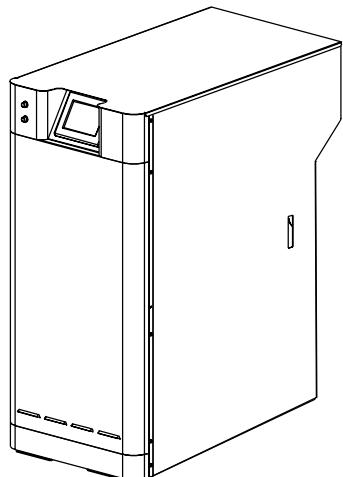
		WARNING SHOCK HAZARD
<p>Use extreme care when working near the chopper modules. The large blue capacitors store high voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper and the heatsinks. Discharging any capacitor with a screwdriver or other implement may result in an explosion, property damage or personal injury. Wait at least 5 minutes after turning the power supply off before touching the chopper or the capacitors.</p>		

Routine maintenance

For a complete list of routine maintenance recommendations, see the *Preventative Maintenance Schedule* sheet located at the end of this section. Contact the Technical Services department listed at the front of this manual with any questions regarding the maintenance schedule or procedures.

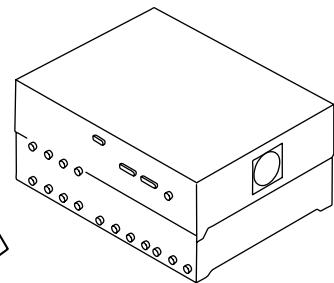
HD4070 system description

Control and signal cables

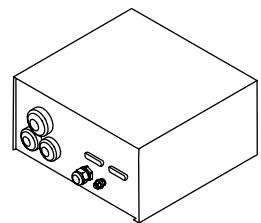


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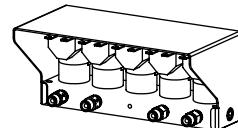
Power Cable: Provides 120 VAC to the Gas Console.



Signal Cable: Provides process and status signals between the Power Supply and the Gas Console.



Power Cable: Provides 120 VAC to the Ignition Console and control power for the off-valve assembly.



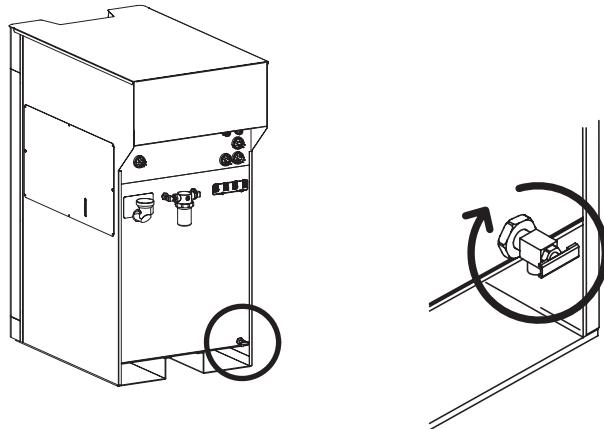
Control Cable: Provides 120 VAC control power to the solenoid valves.

Power supply coolant system servicing

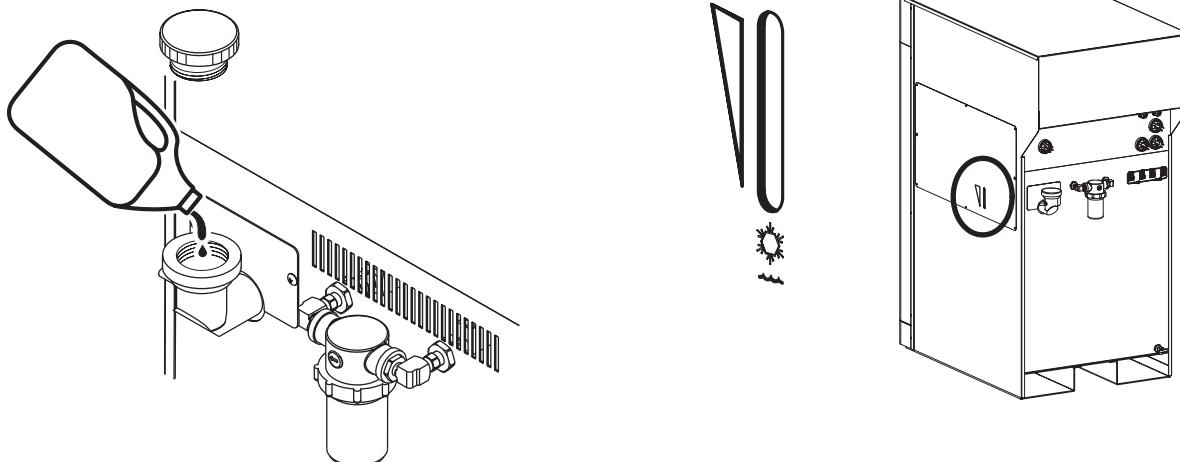


Caution: Use Hypertherm coolant (P/N 028872) only or catastrophic damage to pump will occur. For requirements see pg. 3-3, *Installation* section.

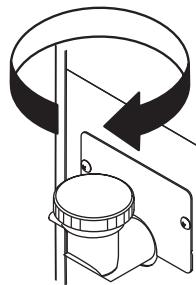
- ① Check that the drain valve is closed.



- ② Add coolant to the power supply until the sight gauge indicates full.

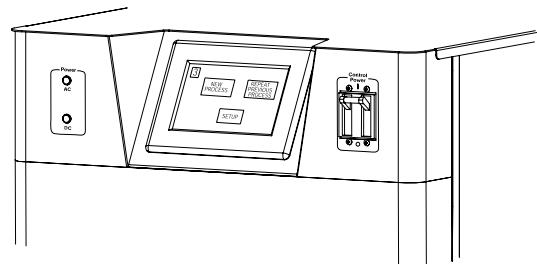


- ③ Replace the filler cap.

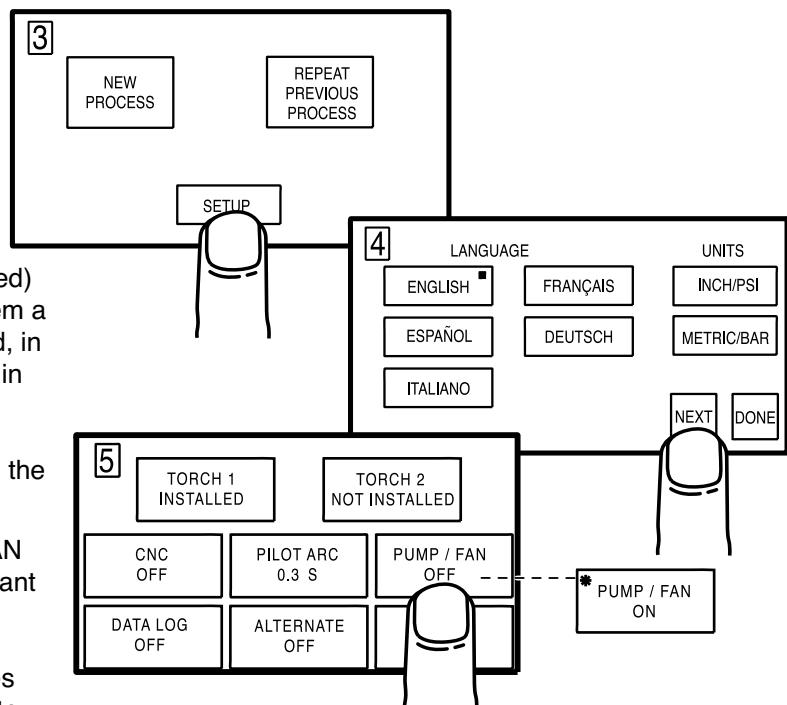


4070.40A

- ④ Turn the power supply ON.



- ⑤ Navigate to set-up screen 5.



Note: Torch 2 must be turned off (Not installed) on a 1 torch system. In a 2 torch system a torch receptacle plug must be installed, in the torch that is not being used, when in single torch mode.

- ⑥ Press the PUMP FAN button to turn on the coolant pump.

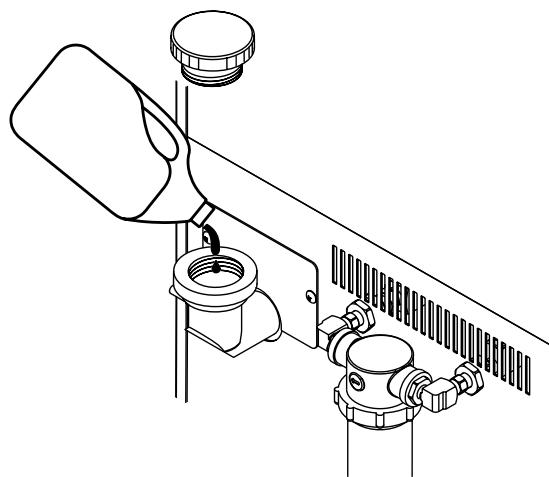
An asterisk will appear in the PUMP FAN button when power supply detects coolant flow.

- ⑦ Allow the pump to operate for 5 minutes and then press the PUMP FAN button to turn the coolant pump off.

- ⑧ Turn the power supply OFF.

- ⑨ Check all coolant hose connections for leaks.

- ⑩ Add coolant until the sight gauge indicates "full."



Torch coolant draining

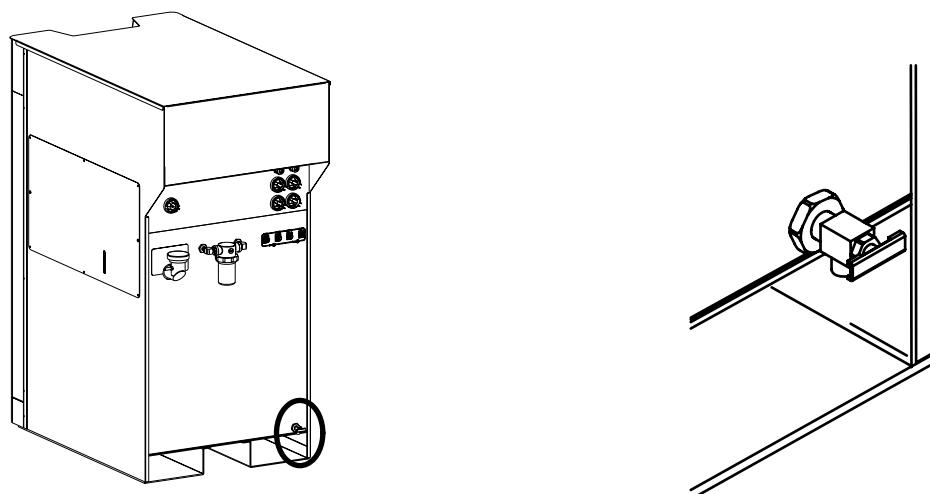
If the torch needs to be changed or transported, follow this procedure for draining the torch coolant from the torch and torch leads. Coolant should be drained from the system every 6 months. See *Preventative Maintenance Schedule* at the back of this section.

1. Disconnect all power to the HD4070 system.
2. Disconnect the torch leads from the ignition console and valve cluster.
3. Ensure that the consumables are installed in the torch.
4. Position the torch lead fittings over a drain or other suitable device to collect coolant.
5. Blow clean, dry, oil-free air at 5.5-8.3 bar (80-120 psi) into the hose with the green band.
Coolant will flow out of hose with the red band.

Power supply coolant draining

If the power supply needs to be transported, follow this procedure to drain the coolant from the system. Coolant should be drained from the system every 6 months. See *Preventative Maintenance Schedule* at the back of this section.

1. Disconnect all power to the HD4070 system.
2. Disconnect and drain the coolant from the hoses going between the water cooler and the ignition console.
3. Place a suitable receptacle under the coolant system's drain petcock. See figure below.
4. Turn petcock counterclockwise to drain coolant.

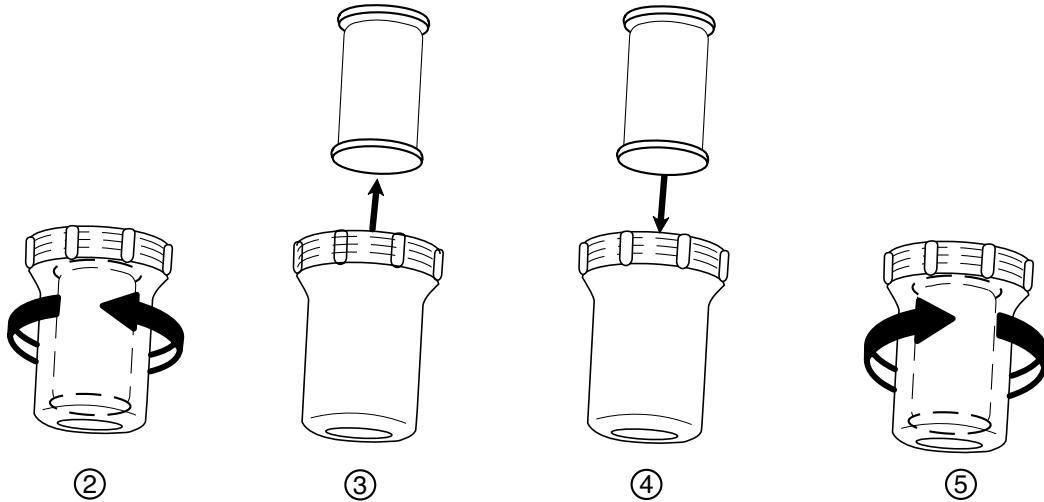
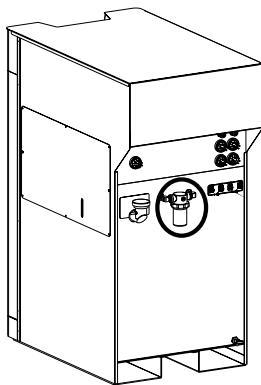


Coolant drain location

Coolant system filter

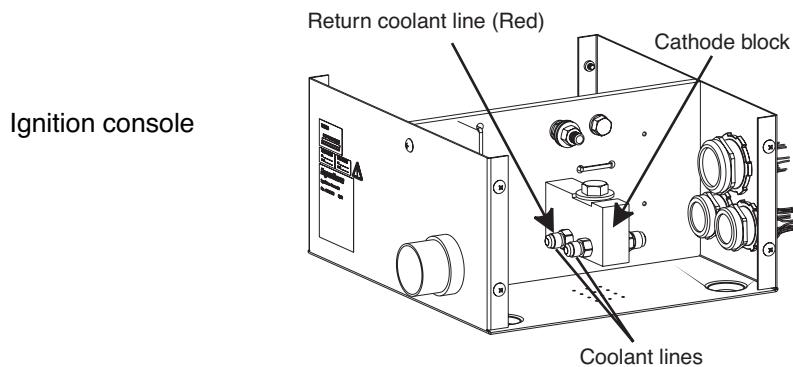
Filter replacement

1. Disconnect all power to the HD4070 system.
2. Remove cover.
3. Remove and discard filter element.
4. Install new filter element 027664.
5. Re-install cover.

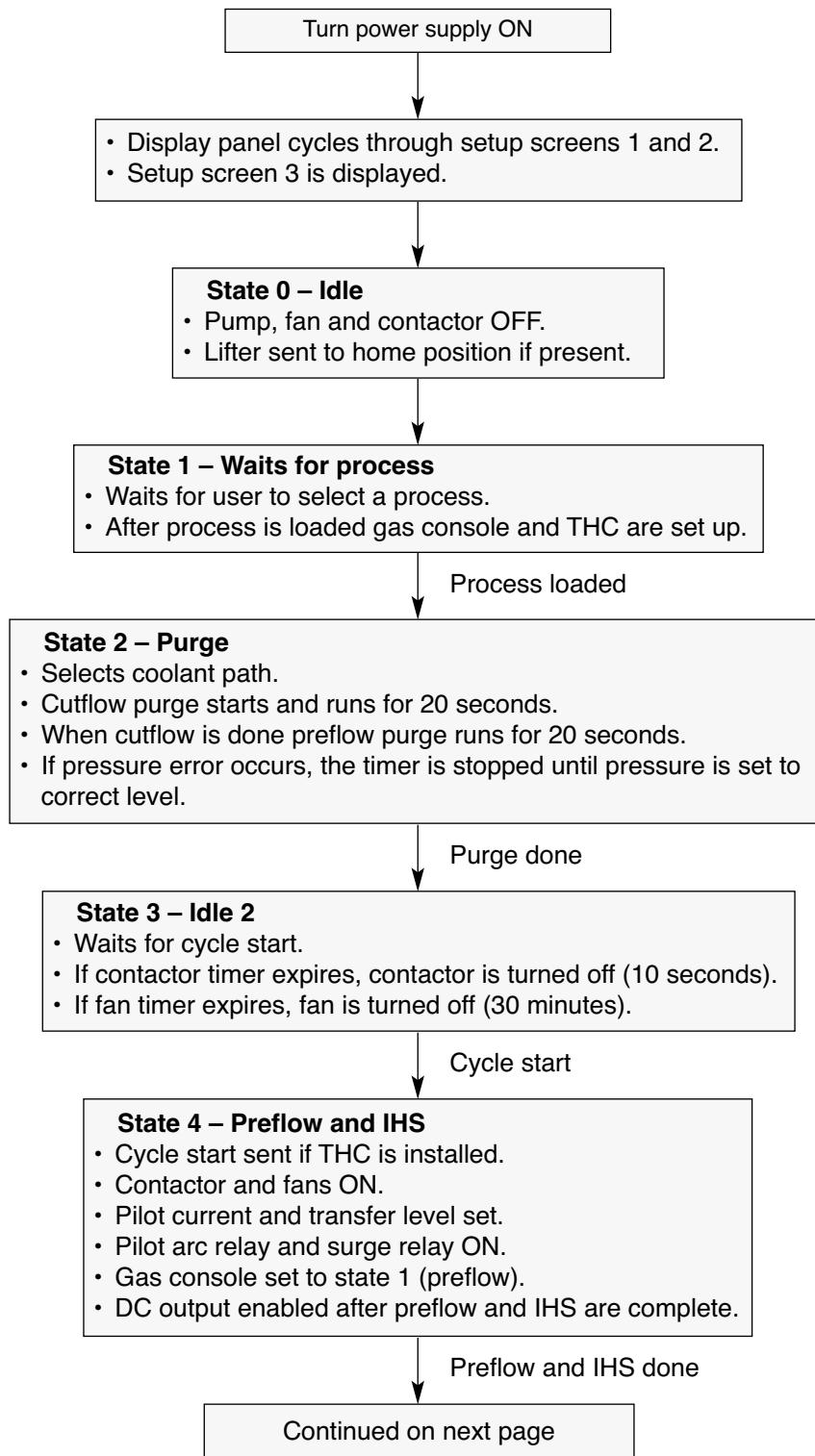


Coolant flow test procedure

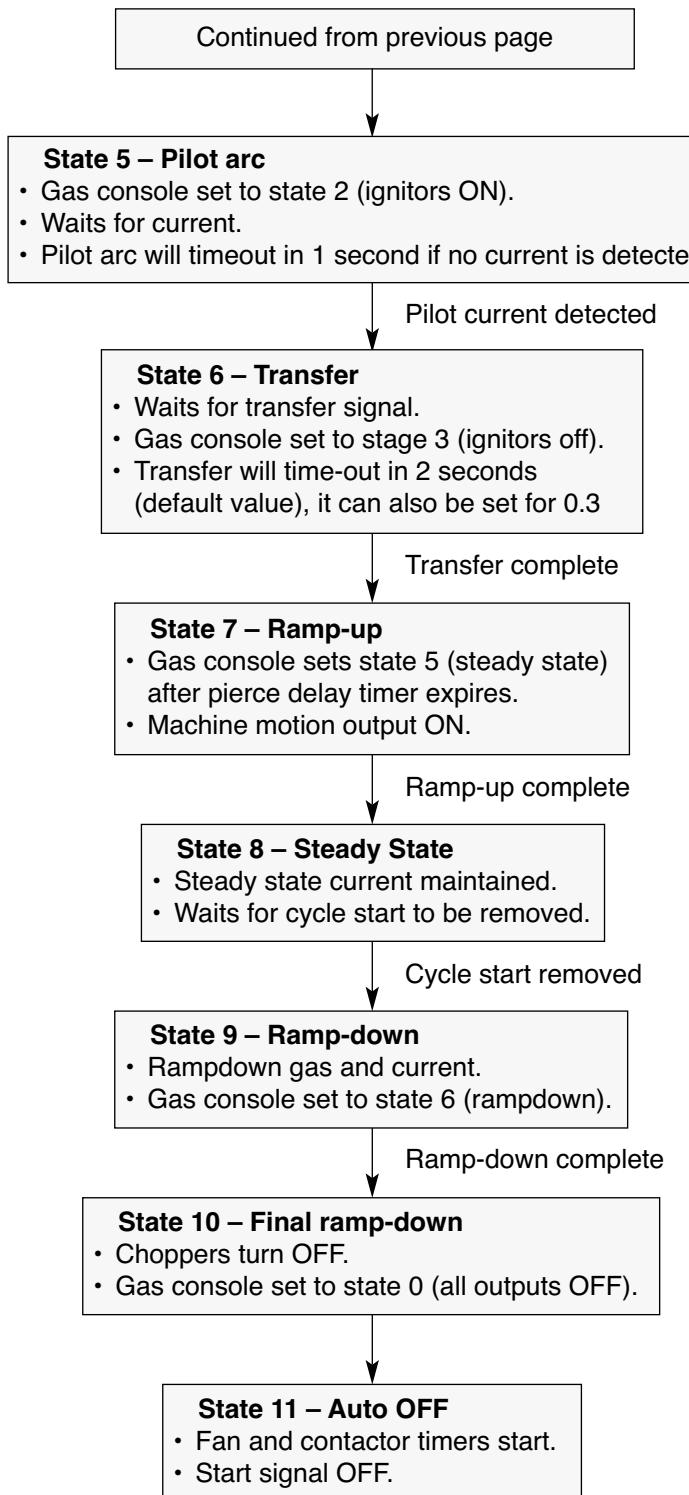
1. Turn HD4070 main power OFF.
2. Remove the return coolant hose (red) from the back of the power supply for the torch you want to check.
See page 3A-4 or 3B-4 for hose location.
3. Place the return coolant hose inside a 4-liter (1-gallon) container.
4. Turn HD4070 main power ON.
5. After system initializes, press the set up button on the touch screen (Screen #3). Navigate to screen #5.
6. In a two torch system make sure the button for the torch you want to test says INSTALLED on screen #5 and the button for the other torch says NOT INSTALLED.
7. Depress the "PUMP FAN OFF" button on the touch screen (Screen #5) and allow the pump to run for 60 seconds.
8. The container should be filled within the 60 seconds. If the flow is greater than 4 liter/min (1 gallon/min), and the machine is still not powering up, the flow switch is the cause of the problem. Replace flow switch. If the container is not full, you have a flow restriction problem. Reinstall the coolant line (from step 2) and repeat step 7 at various locations in the system, (torch, ignition console, etc.), to isolate the flow restriction.
9. To check coolant flow to the torch, remove all consumables from the torch and repeat steps 1-7.
This test checks the coolant flow from the coolant pump to the torch.
10. To check the return flow from the torch, replace all consumables and remove the return coolant hose within the torch lead from the cathode block located in the ignition console (see figure below) and repeat step 7. This tests the flow from the pump to the torch and out through the torch lead. If the flow is low, the problem is either the torch or the return line in the torch lead. To isolate the problem, swap the two coolant lines in the torch lead at the cathode block in the ignition console (see figure below). Rerun the test with the consumables removed from the torch. If the flow is low, the problem is the return coolant line in the torch lead (the entire torch lead assembly will need to be replaced). If the flow is good, the problem is in the torch head.
11. If the torch is suspected to have a restriction, perform the same test as in step 10, but reinstall the consumables in the torch. Allow the coolant to run through the system for 5 minutes. This configuration supplies coolant through the torch in the reverse direction. This creates a higher chamber pressure in the torch and may remove particles lodged in the torch.



HD4070 process sequence

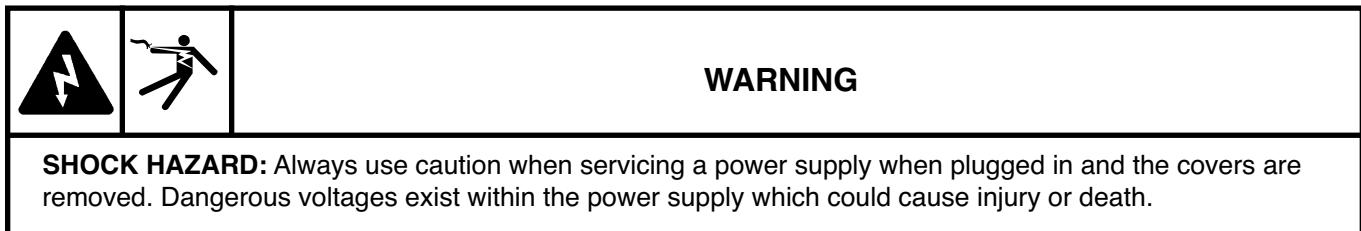


HD4070 process sequence – continued



Initial checks

Before tracking down specific problems, do a visual check and verify proper voltages are present at the power source, transformers and power distribution board.

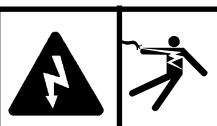
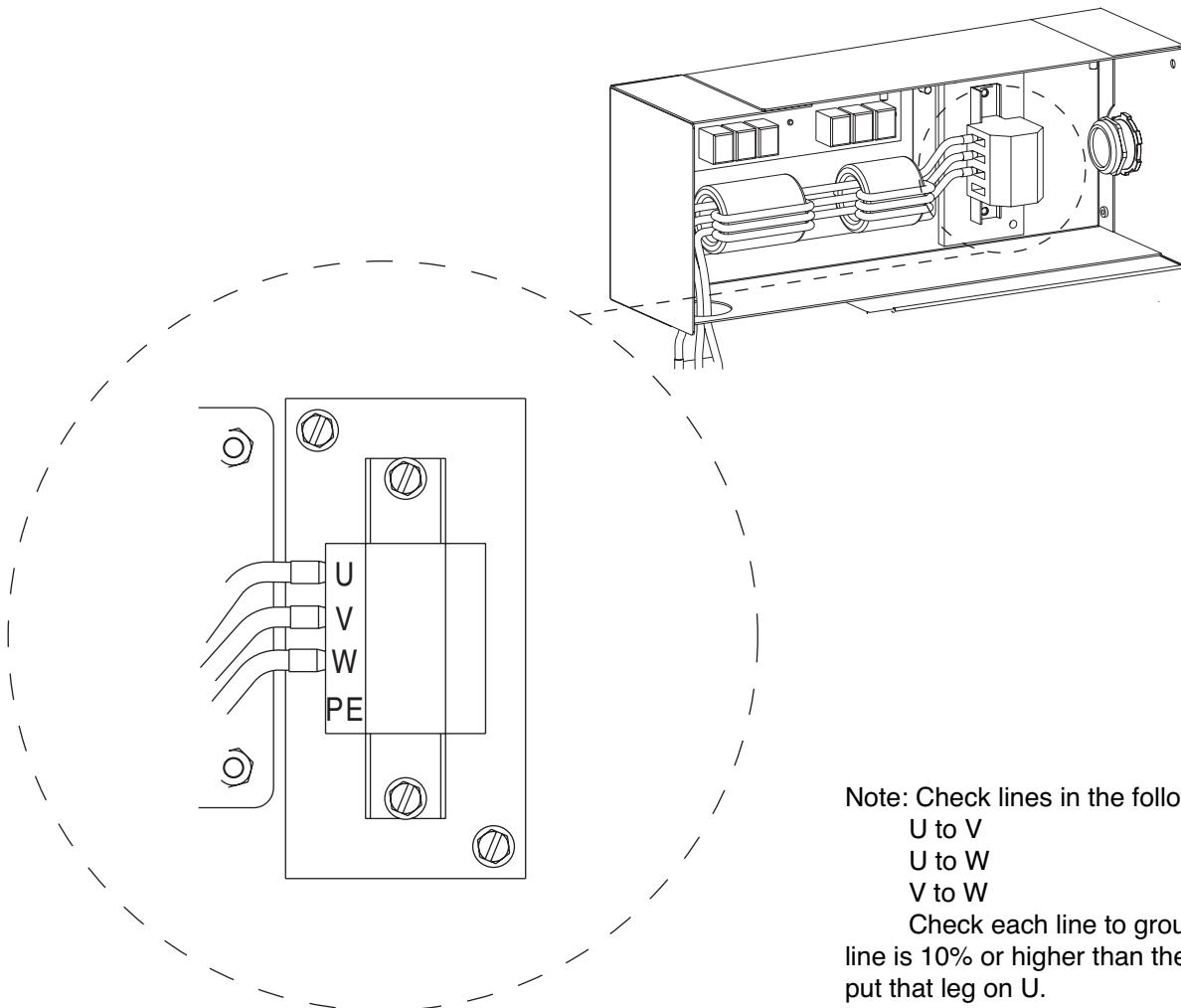


1. Disconnect line power by turning main disconnect switch OFF.
2. Remove top panel, two side panels, front panel and rear panel of power unit.
3. Inspect interior of power unit for discoloration on PC boards, or other apparent damage. If a component or module is obviously defective, remove and replace it before doing any testing. Refer to the *Parts List* section to identify parts and part numbers.
4. If no damage is apparent, plug in the power supply unit, and apply power by turning the main disconnect switch ON.

(Continued on next page)

Power measurement

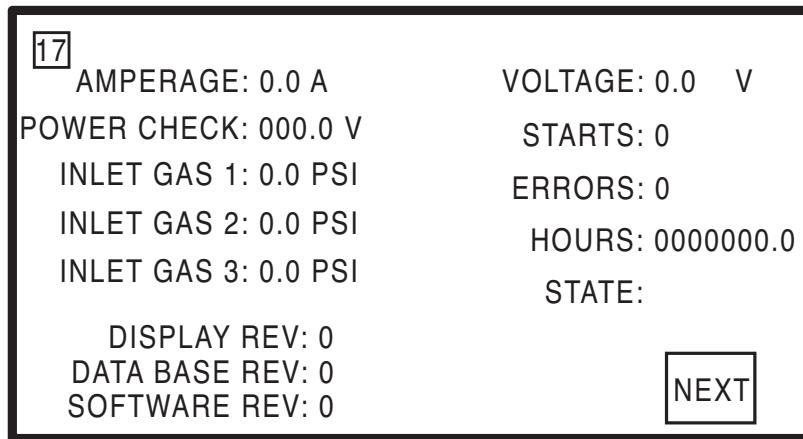
5. Measure the voltage between the W, V and U terminals of TB1 located on the right side of the power supply. See figure above. Also refer to the wiring diagram in Section 7, if required. The voltage between any 2 of the 3 terminals should be equal to the supply voltage. If there is a problem at this point, disconnect main power and check connections, power cable, and fuses at line disconnect switch. Repair or replace any defective component.



WARNING

There is line voltage at the contactor after the line disconnect switch is ON, even if the the circuit breaker on the power supply is OFF. Use extreme care when measuring primary power in these areas. Voltages present at the terminal block and contactors can cause injury or death.

Service display screens



Screen 17 is display only. No adjustments can be made.

Amperage – Actual arc current

Power check – Actual measure of 120VAC from control transformer

Inlet gas 1 – Inlet gas pressure (not checked in idle state)

Inlet gas 2 – Inlet gas pressure (not checked in idle state)

Inlet gas 3 – Inlet gas pressure (not checked in idle state)

State – State of power supply

State 0 = Initialization

State 1 = Waiting for user to select process

State 2 = Purge

State 3 = Idle (waiting for start)

State 4 = Preflow and IHS, if THC is present

State 5 = Pilot arc

State 6 = Arc transfer

State 7 = Ramp-up

State 8 = Steady (run) state

State 9 = Ramp-down

State 10 = Final ramp-down

State 11 = Auto OFF

State 14 = Shut-down

Screen 18 displays a table of port status:

PORT 0 00000000	PORT 1 00000000	PORT 2 00000000	PORT 3 00000000
PORT 4 00000000	PORT 5 00000000	PORT 6 00000000	PORT 7 00000000
PORT 8 00000000	PORT 9 00000000	PORT 10 00000000	PORT 11 00000000
PORT 12 00000000	PORT 13 00000000	PORT 14 00000000	<input type="button" value="NEXT"/>

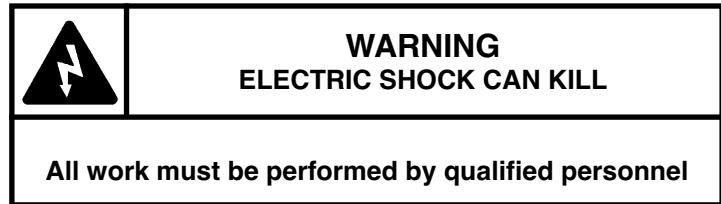
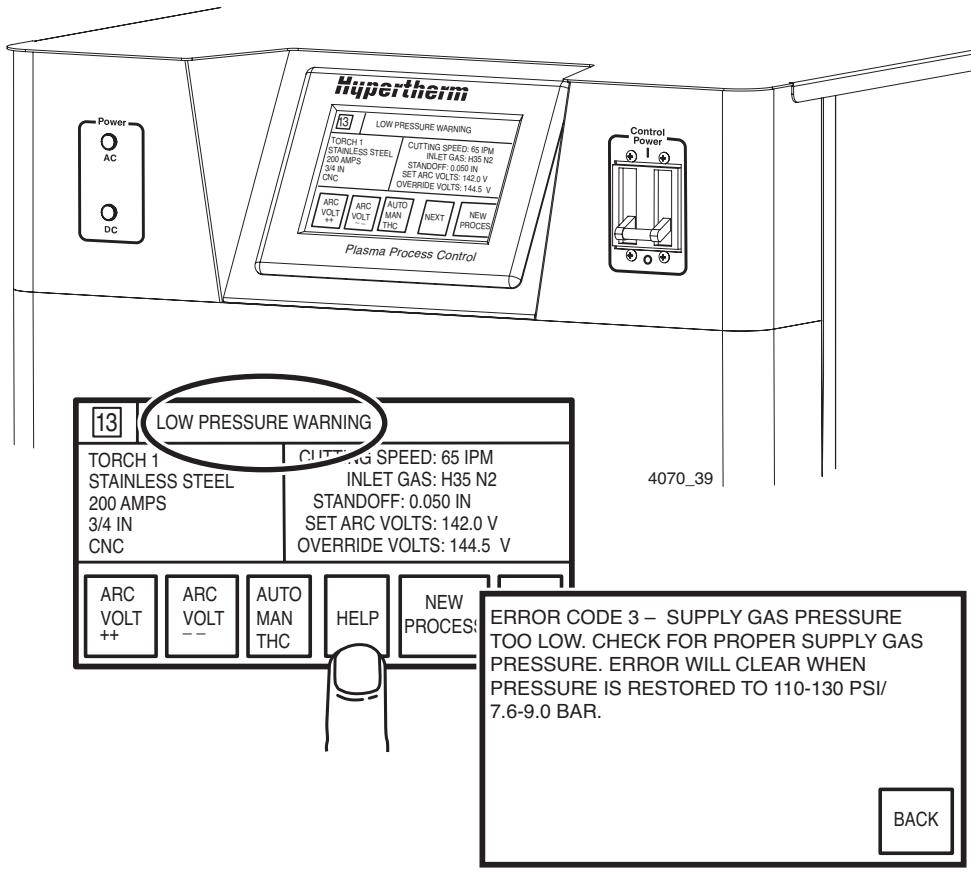
Screen 18 is display only.

Input/Output status: See table in Appendix D for details.

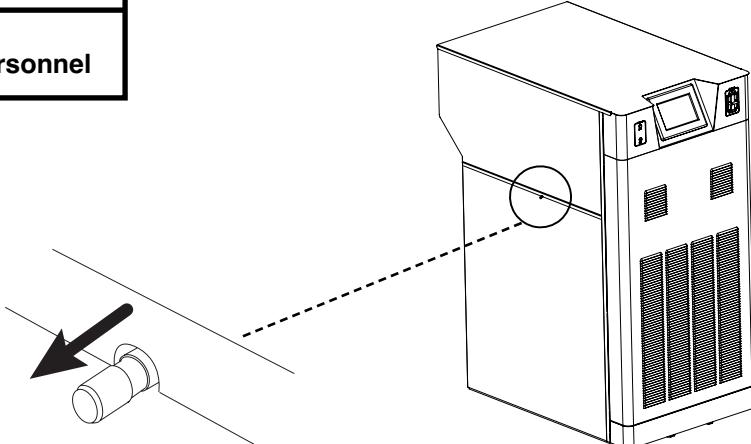
Error codes

HD4070 error codes

Error codes are displayed at the top of screen 13. The system will clear some error codes and will then return to the READY state. Other error codes require the operator to turn off the power supply, perform corrective maintenance and then turn ON the power supply again. Press the HELP button to view error code number and general description.



When troubleshooting the system with the power supply access panels removed, pull the associated door interlock switch plunger out to disable the door interlock error.



ID #'s 0-50: The system does not shut down when a warning message is displayed. To clear the message, adjustments may have to be made.

ID #	Error Code or Message	Description	Corrective action
3	LOW PRESSURE WARNING	Supply gas pressure is 10psi (.34 Bar) under required specification. System will continue to run.	Adjust supply gas pressure
4	HIGH PRESSURE WARNING	Supply gas pressure is 10psi (.34 Bar) over required specification. System will continue to run.	Adjust supply gas pressure
5	LOW VOLTAGE WARNING	Input power is 15% under required specification.	Check for correct input power to power supply
6	HIGH VOLTAGE WARNING	Input power is 15% over required specification.	Check for correct input power to power supply
9	FLOW-SWITCH IS TESTED FOR OFF CONDITION	Refer to error code #109.	Refer to error code #109.
20	NO PILOT ARC	Incorrect current setting, consumables, or gas preflow settings. Disconnected or defective cables. Shorted consumables or torch head. Disconnected or defective pilot arc relay, pilot arc controller or ignition console. Faulty SSR on relay board, located in gas console.	(1) Verify current setting, consumables, or gas preflow settings. (2) Verify that torch head or consumables are not shorted. (3) Make sure pins, sockets and plugs are properly seated.
21	NO ARC TRANSFER	No current was detected by current sensor within 2 seconds of issuing plasma start.	(1) Verify Proper initial height. (2) Verify all cables and wires for continuity, including work cable and torch leads. (3) Properly seat pins, sockets and plugs. (4) Replace faulty current sensor, plasma interface or breakout board.
22	PLASMA SYNC TIMEOUT	Plasma sync input from CNC controller has remained active and has delayed ignition for over one minute.	Check CNC interface wiring and software.
23	LOST ARC BEFORE TRANSFER	Lost current from chopper 1 and/or 2 before arc transfer.	Position torch 4" to 8" above plate and perform chopper current test (See pg. In the instruction manual).
24	LOST CURRENT	Loss of current from Chopper 1 or 2 after transfer was established. Signal comes from control PCB.	(1) Perform chopper current test. (2) Verify that work cable is in good condition and properly connected. (3) Check for defective torch leads.
26	LOST TRANSFER	Arc extinguished or current not sensed after transfer was established.	(1) Verify initial pierce height. (2) Check rampdown programming for errors. (3) Check for defective torch leads. (4) Verify that work cable is in good condition and properly connected.
27	LOST PHASE	System has detected a loss or drop of voltage on the incoming AC power.	Check contact points in main contactor and/or incoming power.
36	THC AT LOWER LIMIT	The Command THC uses proximity switches to detect upper and lower limits of travel. During initial height sensing (IHS), the torch did not reach the work piece and retracted to home position. During cutting the torch hits the lower limit.	To verify proper operating proximity or switches, the torch must have full range of travel. (1) Reposition torch so it contacts the workpiece during IHS. (2) Check lower limit switch by changing THC to manual mode from operating screen 13. Jog torch to lower limit position to activate switch. On THC control PCB: LED- D50 should be on. Jog torch up to deactivate switch. D50 should go off. If test fails, check lower limit switch and cable and Replace if required.
37	THC AT HOME LIMIT	During IHS the torch retracted or did not move from home limit.	(1) Reposition torch in holder. (2) Try a lower IHS speed or a higher stall force. (3) Check the home limit switch by changing THC to manual mode from operating screen 13. Jog torch to home limit position to activate switch. On THC control PCB: LED- D49 should be on. Jog torch down to deactivate switch. D49 should go off. (4) If test fails, check home limit switch and cable and Replace if required.
38	THC MOTION FAILURE	Torch did not reach home position during full retract. Encoder failed during a cut.	(1) Verify that torch lifter motion is not blocked. (2) Test limit switch by following step 3 above. (3) Check limit switch and cable, replace if required. (4) Check for an encoder problem by changing THC to manual mode. Jog torch up. On THC control PCB, lights D58 and D59 should blink alternately. If test fails, check lower and home limit switches and replace if required. (5) Check continuity of cable from lifter to control module.
39	NOZZLE CONTACT AT HOME	Ohmic contact wire shorted to ground.	(1) Verify that Ohmic contact wire is not shorted to ground. (2) Verify all cables and wires for continuity. (3) Replace faulty plasma interface or THC control board.
40	THC START AT INIT	THC start signal is ON during power up.	Check for shorting of THC ribbon cables.
41	THC MOTOR CURRENT FAULT	Cable not installed, External interlock not satisfied, Torch lifter motion restricted, Motor drive PCB failure or Lifter motor failure.	(1) Check for cable installation and good connections. On THC control PCB, Motor drive interface, D51 should be on. (2) On THC control PCB, Ext interlock Ok, D16 should be ON, if not, jumper machine interface cable at CNC, pins 19 and 37, on plug J6. (3) Verify that torch lifter motion is not restricted. (4) Replace lifter motor or motor drive PCB.
44	LOW GAS PRESSURE	Gas pressure dropped below 105psi (7.2Bar). Interlock is tripped, the current process is stopped and the arc is not allowed to fire.	Adjust supply gas pressure to specification. Check for pressure drop between gas console and supply regulator. Recommend regulators be within 10 feet/3meters of gas console.

Error code troubleshooting – 2 of 4

ID #'s 51-64: User must clear the error. Adjustments or changes must be made before cutting can continue.
 ID #'s 65 & >: The error shuts the system off. The system needs to be reset or the power cycled before cutting can continue.

ID #	Error Code or Message	Description	Corrective action
45	HIGH GAS PRESSURE	Gas pressure over 135psi (7.2Bar) detected. Interlock is tripped, the current process is stopped and the arc is not allowed to fire.	Adjust supply gas pressure to specification. Recommend regulators be within 10 feet/3meters of gas console.
50	CYCLE START AT INIT	System was powered up while start command was coming from CNC.	Remove start signal. System will wait for next start command.
51	PILOT ARC OVERTEMP	Repeated, long pilot arcs have exceeded the thermal capacity of the pilot arc controller.	Wait one minute for pilot arc controller to cool down.
52	NO PROCESS LOADED	The CNC has not selected a process.	Verify serial communication is working properly and select a process.
65	CHOPPER 1 OVERTEMP	Fans not working or vents are obstructed.	Make sure fans are operating and that the power supply vents are not obstructed.
66	CHOPPER 2 OVERTEMP	Fans not working or vents are obstructed.	Make sure fans are operating and that the power supply vents are not obstructed.
67	TRANSFORMER OVERTEMP	Fans not working or vents are obstructed.	Make sure fans are operating and that the power supply vents are not obstructed.
71	COOLANT OVERTEMP	Coolant temperature too high	(1) Check fan for operation. (2) Check coolant level. (3) Check for vent obstructions. (4) Remove air from coolant loop, by following coolant servicing at the beginning of this section.
80	CONTROL SYSTEM FAILURE	File corrupted, Faulty cable or Hard disk failure.	Run PC-104 test. See maintenance section.
81	CONTROL SYSTEM FAILURE	File corrupted, Faulty cable or Hard disk failure.	Run PC-104 test. See maintenance section.
82	CONTROL SYSTEM FAILURE	File corrupted, Faulty cable or Hard disk failure.	Run PC-104 test. See maintenance section.
83	CONTROL SYSTEM FAILURE	File corrupted, Faulty cable or Hard disk failure.	Run PC-104 test. See maintenance section.
84	CABLE TO GAS CONSOLE NOT DETECTED	The cable is missing or not properly connected.	Check cable connections.
85	HARDDRIVE FAILURE	File corrupted, Faulty cable or Hard disk failure.	Not customer serviceable
86	HARDDRIVE FAILURE	File corrupted, Faulty cable or Hard disk failure.	Not customer serviceable
87	NO INPUT POWER DETECTED	Faulty control or breakout board.	(1) Verify all cables and wires for continuity. (2) Properly seat pins, sockets and plugs. (3) Replace faulty control or breakout board.
88	CNC CABLE MISSING	Cable not connected or damaged.	Check power supply to CNC cable and connections.
89	FAIL TO OPEN FILE	File corrupted or hard disk failure.	Cycle power to clear error.
90	PROCESS INVALID FAIL	File containing process information is corrupt and not valid.	Reload the process file.
91	FAIL TO READ FILE	File corrupted or hard disk failure.	Cycle power to clear error.
92	FAIL TO WRITE FILE	File corrupted or hard disk failure.	Cycle power to clear error.
93	NO COOLANT FLOW	During normal operation, the system checks for coolant flow. After the coolant pump has been turned on and the active torch has been selected, this error is activated if the flow sensor does not indicate coolant flow within a 12 second delay.	(1) Check that the torch head is installed. For two torch systems, check that either the inactive torch or a dummy head is installed. (2) Check that the coolant tank has enough coolant. (3) Check that the air has been purged from the coolant lines. See Cooling System Servicing in the front of this section. (4) make sure that the coolant lines are not obstructed or kinked. (5) Make sure that the proper coolant select solenoid is energized. The torch #1 cooling solenoid is energized from 120Vac output from the plasma interface board connector J6 pins 1 & 2. Torch #1 output is indicated on the breakout board by LEDN 8-8. The torch #2 cooling solenoid is energized from 120Vac output from the plasma interface board connector J6 pins 3 & 4. Torch #2 output is indicated on the breakout board by LEDN 8-7. If the breakout board LEDN 8-8 is on (indicating coolant flow), check for continuity across the coolant flow sensor output connections. If there is continuity across the sensor output connections, replace the sensor. If LED D17 is ON and there is no continuity across the sensor output connections, troubleshoot the plasm
94	DOOR INTERLOCK	Power supply access panel removed or loose.	Check that all panels are properly installed.
97	NO TORCH INTERFACE	THC#1 or THC#2 were not selected during set up.	Select one on the set up screen.
98	PHASE LOST AT INITIALIZATION	Phase loss sensor indicating that voltage is present at the chopper input before the main contactor has been closed.	(1) Check that main contactor is open (2) Check phase loss sensor board. (3) Check power supply control board. (See electrical PC boards and power supplies in this section)
99	CHOPPER 1 OVERTEMP	Cable or sensor failure	(1) Make sure fans are working. (2) Blow out power supply.
100	CHOPPER 2 OVERTEMP	Cable or sensor failure	(1) Make sure fans are working. (2) Blow out power supply.
101	TRANSFORMER OVERTEMP	Cable or sensor failure	(1) Make sure fans are working. (2) Blow out power supply.

Error code troubleshooting – 3 of 4**MAINTENANCE**

ID #	Error Code or Message	Description	Corrective action
102	CURRENT BEFORE IGNITION	Current detected from choppers before ignition.	(1) Verify wiring from control PCB to choppers. (2) Check LED - D7 on control board, it should be off.
108	TRANSFER BEFORE IGNITION	Current detected at sensor before start signal	(1) Check wires between sensor and control board. (2) Replace sensor
109	COOLANT FLOW SENSOR FAIL	When the power supply is turned on, the system checks operation of the coolant flow sensor. This error is activated if the flow sensor detects coolant flow before the coolant pump has been turned on.	(1) If the plasma interface board LED D17 is ON (indicating coolant flow), check for continuity across coolant flow sensor output connections. If there is continuity across the sensor output connections, replace the sensor. If LED D17 is ON and there is no continuity across the sensor output connections, troubleshoot the plasma interface board. (2) If the plasma interface board LED D17 is OFF (indicating no coolant flow), check that the breakout board LEDN 3-5 is ON (indicating coolant flow). If LEDN 3-5 is ON, with no coolant flow, trouble shoot the breakout board. (3) If the breakout board LEDN 3-5 is OFF (indicating no coolant flow), check output signal from breakout board J-11, Pin 35, to B4-J4, pin 35, on PC-104. (4) Use the PC-104 test software and test board to verify the proper operation of PC-104 board B4.
111	COOLANT OVERTEMP	Coolant temperature sensor indicates high coolant temperature before the coolant pump has been turned on.	Trouble shoot coolant temperature switch.
112	CABLE CHECK A FAIL	When the power supply is turned on, the system checks ribbon cable connections between the PC-104 and the breakout board and for the proper operation of the PC-104 digital I/O boards. A digital output from the PC-104 is connected through one ribbon cable to the breakout board and is returned through a second cable to an analog input on the PC-104. This error is activated if the test circuit has open continuity or if the PC-104 digital I/O boards do not operate properly.	(1) Check that ribbon cable is properly installed from PC-104 connector B5-J1 to breakout board connector J8. (2) Check that ribbon cable is properly installed from PC-104 connector B4-J1 to breakout board connector J11. (3) Use an Ohm meter to check crimp terminations and individual connections on each of the ribbon cables. (4) Verify continuity between the breakout board connectors J8-19 and J5-11. If no continuity, replace breakout board. (5) Use the PC-104 test software and test board to verify the proper operation of PC-104 boards B4 and B5.
113	CABLE CHECK B FAIL	When the power supply is turned on, the system checks ribbon cable connections between the PC-104 and the breakout board and for the proper operation of the PC-104 digital I/O boards. A digital output from the PC-104 is connected through one ribbon cable to the breakout board and is returned through a second cable to an analog input on the PC-104. This error is activated if the test circuit has open continuity or if the PC-104 digital I/O boards do not operate properly.	(1) Check that ribbon cable is properly installed from PC-104 connector B5-J1 to breakout board connector J8. (2) Check that ribbon cable is properly installed from PC-104 connector B5-J4 to breakout board connector J6. (3) Use an Ohm meter to check crimp terminations and individual connections on each of the ribbon cables. (4) Verify continuity between the breakout board connectors J8-33 and J6-17. If no continuity, replace breakout board. (5) Use the PC-104 test software and test board to verify the proper operation of PC-104 board B5.
114	CABLE CHECK C FAIL	When the power supply is turned on, the system checks ribbon cable connections between the PC-104 and the breakout board and for the proper operation of the PC-104 digital I/O boards. A digital output from the PC-104 is connected through one ribbon cable to the breakout board and is returned through a second cable to an analog input on the PC-104. This error is activated if the test circuit has open continuity or if the PC-104 digital I/O boards do not operate properly.	(1) Check that ribbon cable is properly installed from PC-104 connector B4-J4 to breakout board connector J15. (2) Check that ribbon cable is properly installed from PC-104 connector B4-J1 to breakout board connector J11. (3) Use an Ohm meter to check crimp terminations and individual connections on each of the ribbon cables. (4) Verify continuity between the breakout board connectors J15-37 and J11-7. If no continuity, replace breakout board. (5) Use the PC-104 test software and test board to verify proper operation of PC-104 board B4.
115	ANALOG TEST FAIL	When the power supply is turned on, the system checks ribbon cable connections between the PC-104 and the breakout board and for the proper operation of the PC-104 board B6. A digital output from the PC-104 is connected through one ribbon cable to the breakout board and is returned through a second cable to an analog input on the PC-104. This error is activated if the test circuit has open continuity or if the PC-104 board B6 does not operate properly.	(1) Check that ribbon cable is properly installed from PC-104 connector B5-J1 to breakout board connector J5. (2) Check that ribbon cable is properly installed from PC-104 connector B6-J1 to breakout board connector J5. (3) Use an Ohm meter to check crimp terminations and individual connections on each of the ribbon cables. (4) Verify continuity between the breakout board connectors J8-19 and J5-11. If no continuity, replace breakout board. (5) Use the PC-104 test software and test board to verify proper operation of PC-104 boards B5 and B6.
116	WATCHDOG TIMEOUT	watchdog on breakout board (PCB6)not satisfied.	Check external interlocks.
117	THC CONTROL FAIL	Indicates a failure on the THC control board.	Replace board.
118	THC LIFTER NOT DETECTED	Cable not connected or damaged.	(1) Install cable. (2) Check cables and connections
120	THC PLASMA CABLE NOT DETECTED	Cable not connected or damaged.	(1) Install cable. (2) Check cables and connections
121	THC COMM FAIL	Plasma system is unable to communicate with the THC.	(1) No power to THC, check power supply. (2) Check cables and connections.
122	GAS COMM FAIL	Gas control cable disconnected, Gas console power cable disconnected. Gas console control board failure, PC104 dual serial board failure or Breakout board failure.	(1) Make sure cables are present and properly connected. (2) Verify that gas console has power. (3) Look for activity on the indicator LED's on the breakout board.

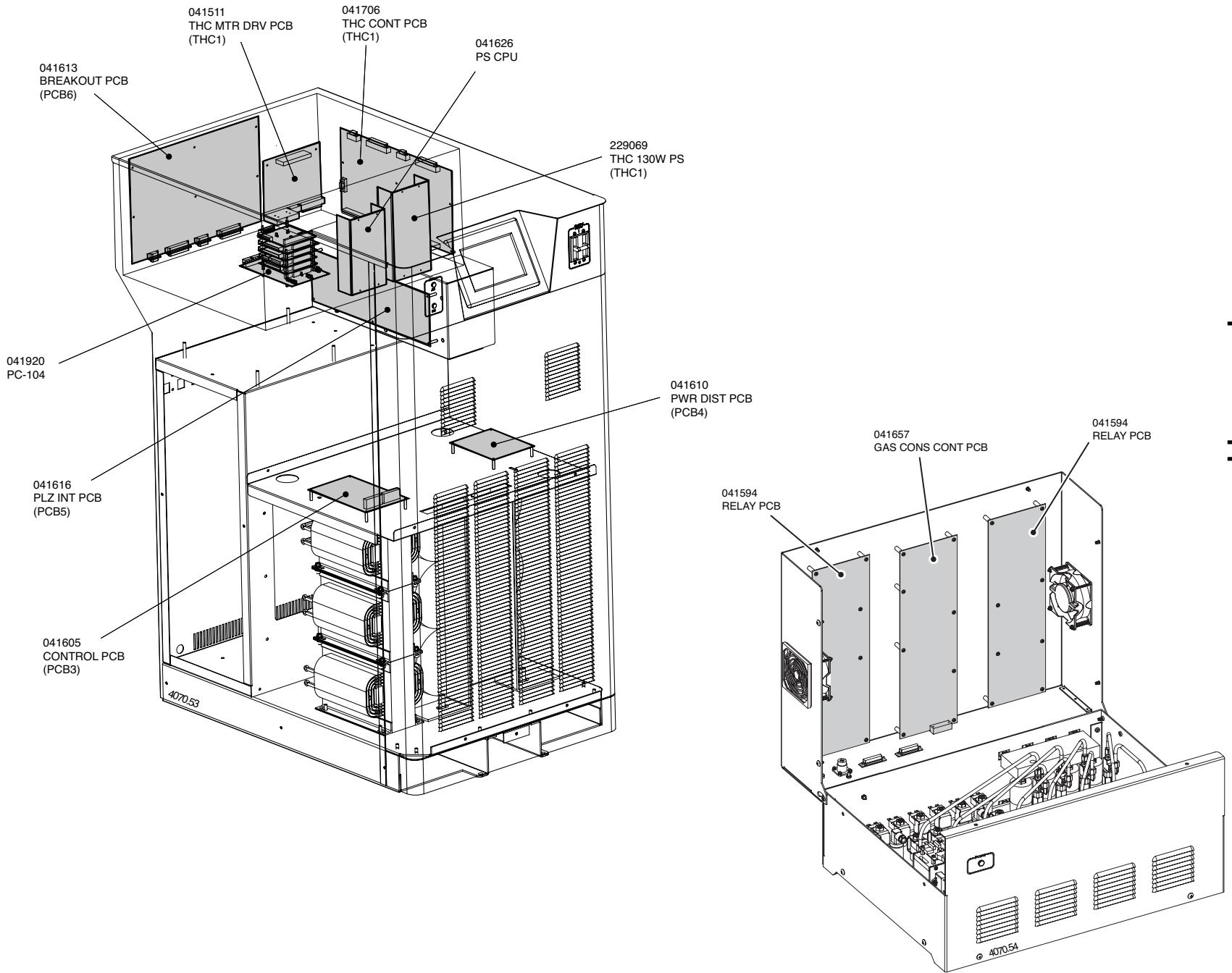
MAINTENANCE

Error code troubleshooting – 4 of 4

ID #	Error Code or Message	Description	Corrective action
123	MV 1 ERROR	Motor valve #1 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#1, Shown later in this section. (3) Check relay PCB#1 incoming signal. (4) Check relay PCB#1 output signal. (5) Switch cables to a working MV; If MV works, replace malfunctioning MV. If MV does not work, replace or repair cables. (6) Broken wire or cable. P1-4, P12-2, P2-4, PL1 and P3-1 not seated properly. Pin or socket not seated in plug housing properly. Faulty SSR on relay board. Loss of signal from control board to relay board.
124	MV 2 ERROR	Motor valve #2 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#1, Shown later in this section. (3) Check relay PCB#1 incoming signal. (4) Check relay PCB#1 output signal. (5) Switch cables to a working MV; If MV works, replace malfunctioning MV. If MV does not work, replace or repair cables. (6) Broken wire or cable. P1-5, P12-2, P2-5, PL2 and P3-1 not seated properly. Pin or socket not seated in plug housing properly. Faulty SSR on relay board. Loss of signal from control board to relay board.
125	MV 3 ERROR	Motor valve #3 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#2, Shown later in this section. (3) Check relay PCB#2 incoming signal. (4) Check relay PCB#2 output signal. (5) Switch cables to a working MV; If MV works, replace malfunctioning MV. If MV does not work, replace or repair cables. (6) Broken wire or cable. P1-6, P12-2, P2-6, PL3 and P2-3 not seated properly. Pin or socket not seated in plug housing properly. Faulty SSR on relay board. Loss of signal from control board to relay board.
126	MV 4 ERROR	Motor valve #4 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#2, Shown later in this section. (3) Check relay PCB#2 incoming signal. (4) Check relay PCB#2 output signal. (5) Switch cables to a working MV; If MV works, replace malfunctioning MV. If MV does not work, replace or repair cables. (6) Broken wire or cable. P1-7, P12-2, P2-7, PL4 and P2-3 not seated properly. Pin or socket not seated in plug housing properly. Faulty SSR on relay board. Loss of signal from control board to relay board.
127	MV 5 ERROR	Motor valve #5 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#2, Shown later in this section. (3) Check relay PCB#2 incoming signal. (4) Check relay PCB#2 output signal. (5) Switch cables to a working MV; If MV works, replace malfunctioning MV. If MV does not work, replace or repair cables. (6) Broken wire or cable. P1-8, P10-2, P2-8, PL5 and P2-3 not seated properly. Pin or socket not seated in plug housing properly. Faulty SSR on relay board. Loss of signal from control board to relay board.
128	MV 6 ERROR	Motor valve #6 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#2, Shown later in this section. (3) Check relay PCB#2 incoming signal. (4) Check relay PCB#2 output signal. (5) Switch cables to a working MV; If MV works, replace malfunctioning MV. If MV does not work, replace or repair cables. (6) Broken wire or cable. P1-9, P10-2, P2-9, PL6 and P2-3 not seated properly. Pin or socket not seated in plug housing properly. Faulty SSR on relay board. Loss of signal from control board to relay board.
129	MV 7 ERROR	Motor valve #7 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#2, Shown later in this section. (3) Check relay PCB#2 incoming signal. (4) Check relay PCB#2 output signal. (5) Switch cables to a working MV; If MV works, replace malfunctioning MV. If MV does not work, replace or repair cables. (6) Broken wire or cable. P1-10, P10-2, P2-10, PL7 and P2-3 not seated properly. Pin or socket not seated in plug housing properly. Faulty SSR on relay board. Loss of signal from control board to relay board.
130	MV 8 ERROR	Motor valve #8 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#2, Shown later in this section. (3) Check relay PCB#2 incoming signal.
131	THC CONTROL FAIL	Indicates a failure on the THC control board.	Replace board.
132	THC CONTROL FAIL	Indicates a failure on the THC control board.	Replace board.
150	INTERLOCK (E-STOP)	External emergency stop activated on cutting apparatus.	Reset e-stop at cutting machine.
151	SOFTWARE FAIL	This is a catch all message indicating that the software has unexpectedly failed to perform a routine operation.	Cycle power and try and continue operation.

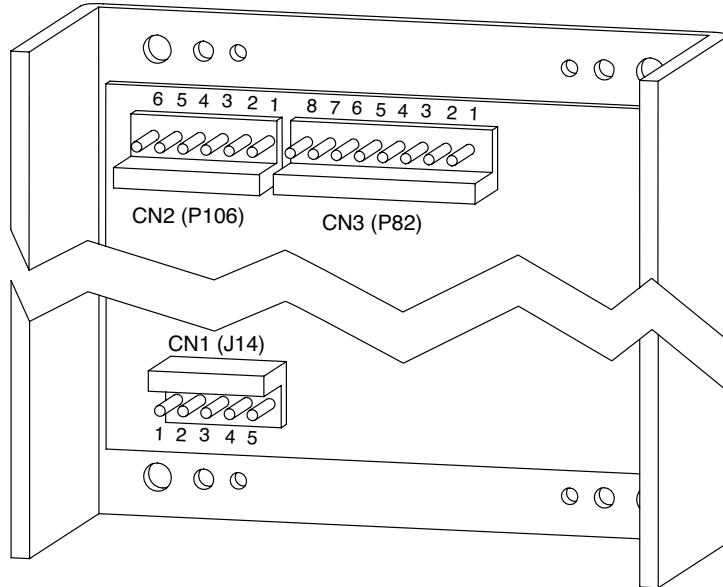
Electrical PC boards and power supplies

MAINTENANCE



PC-104 DC power: pin designators

Designator	Pin number	Function
CN2 (P106)	1	-12 VDC
	2	Blank
	3	Blank
	4	+12 VDC
	5	+12 VDC
	6	Blank
CN3 (P82)	1	Blank
	2	Common
	3	Common
	4	Common
	5	+5 VDC
	6	+5 VDC
	7	+5 VDC
	8	Blank
CN1 (J14)	1	240 VAC
	2	Blank
	3	Common
	4	Blank
	5	Ground



PC-104 test procedure

Note: Kit 128648 is required to perform this test.

Kit (P/N 128648) contents

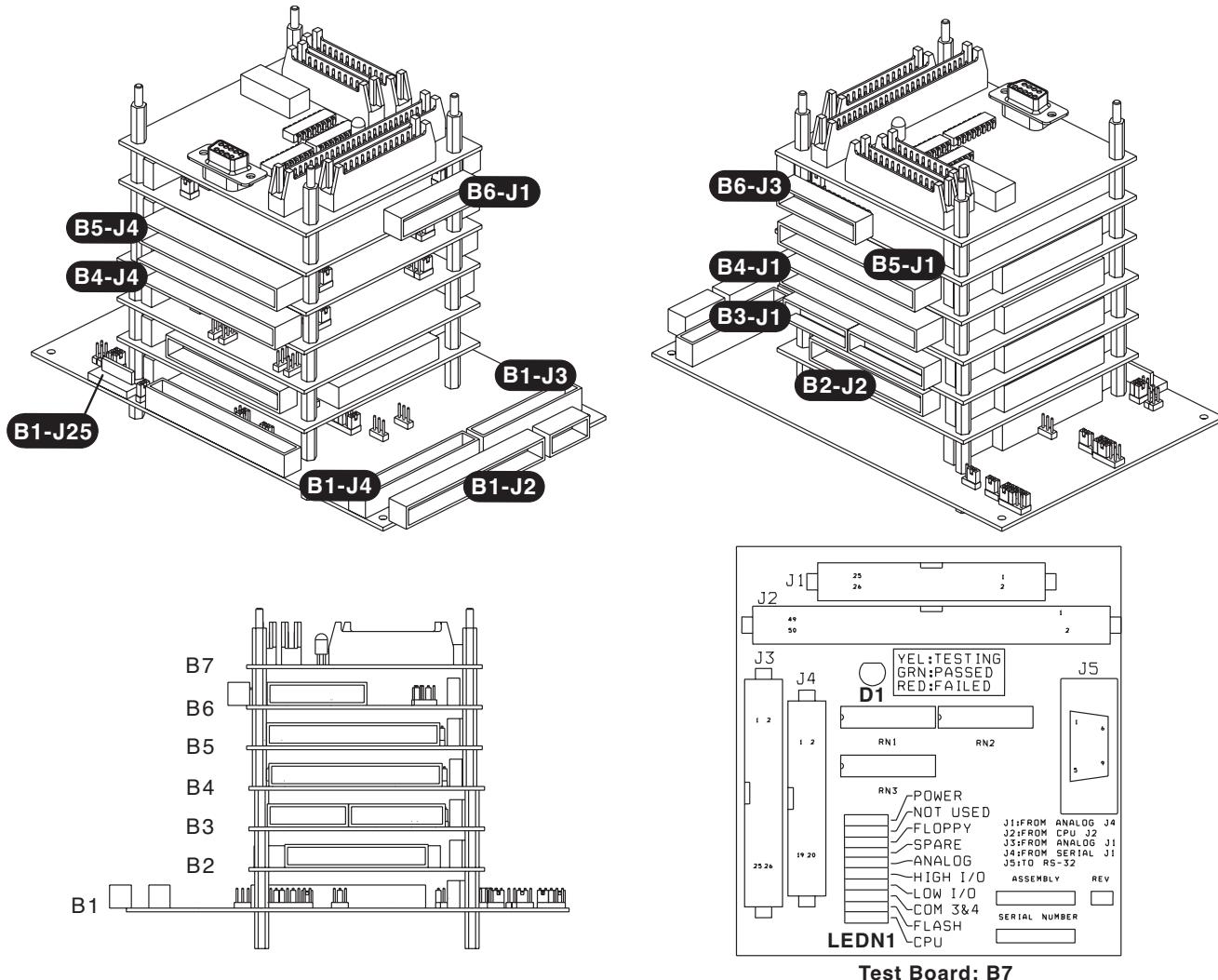
Part number	Description	Qty
081084	Disk: HD4070 firmware	1
123644	Ribbon Cable: 50/C (B4J4)	1
123643	Ribbon Cable: 50/C (B5J4)	1
123642	Ribbon Cable: 50/C (B7J2)	1
123641	Ribbon Cable: 20/C (B7J4)	1
123618	Ribbon Cable: 26/C (B7J3)	1
123617	Ribbon Cable: 50/C (B7J1)	1

1. Turn main power OFF.
2. Remove connectors from PC-104 stack in the following order:
 - Board 1 J4 – Remove for access. Reconnect after all other connections are made.
 - B1, J2
 - B3, J1
 - B4, J1 and J4
 - B5, J1 and J4
 - B6, J1 and J3
3. Make the following connections, using cables provided in kit 128648.
 - B3, J1 to B7, J4
 - B4, J1 to B4, J4
 - B5, J1 to B5, J4
 - B7, J3 to B6, J1

- B6, J3 to B7, J1
- B1, J2 to B7, J2
- Reconnect ribbon cable to B1, J4

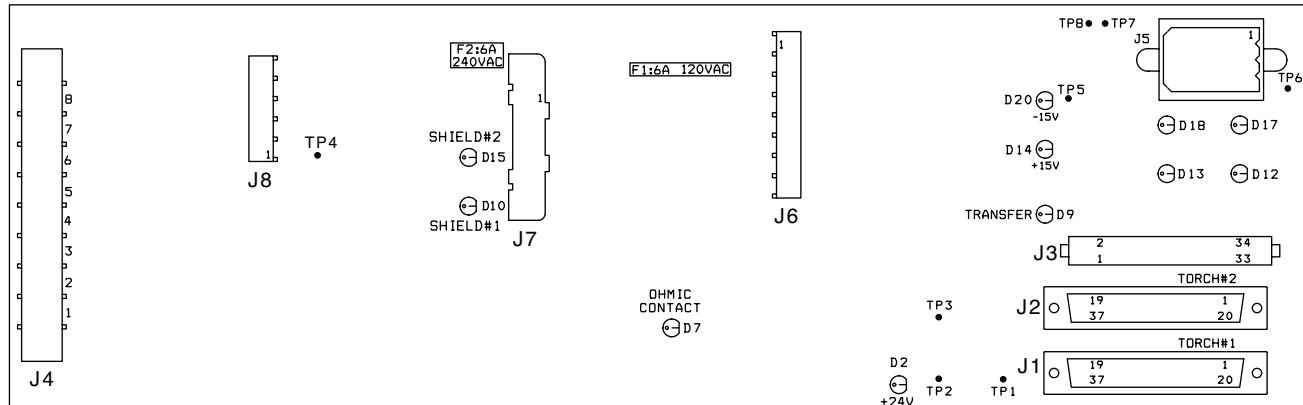
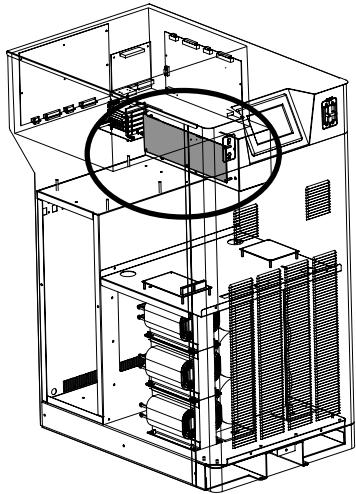
4. Insert disk (part # 081084) into drive.
5. Turn main power switch ON. Start-up will take approximately 30 seconds. After start-up LED (D1) will be yellow and all lamps on LEDN1 will be extinguished.
6. As each board is tested the corresponding LEDN lamp will illuminate. Each lamp will be extinguished if the test is successful. It will remain illuminated if there is a failure. The testing sequence is: CPU, COMM 3&4, FLOPPY, FLASH, LOW I/O, HIGH I/O, ANALOG.

Each test can take 2 minutes. LED (D1) will be green if all tests pass. It will be red if there is a failure. Certain communication failures can cause the process to freeze. If a test is taking longer than 2 minutes, re-start the power supply.



MAINTENANCE

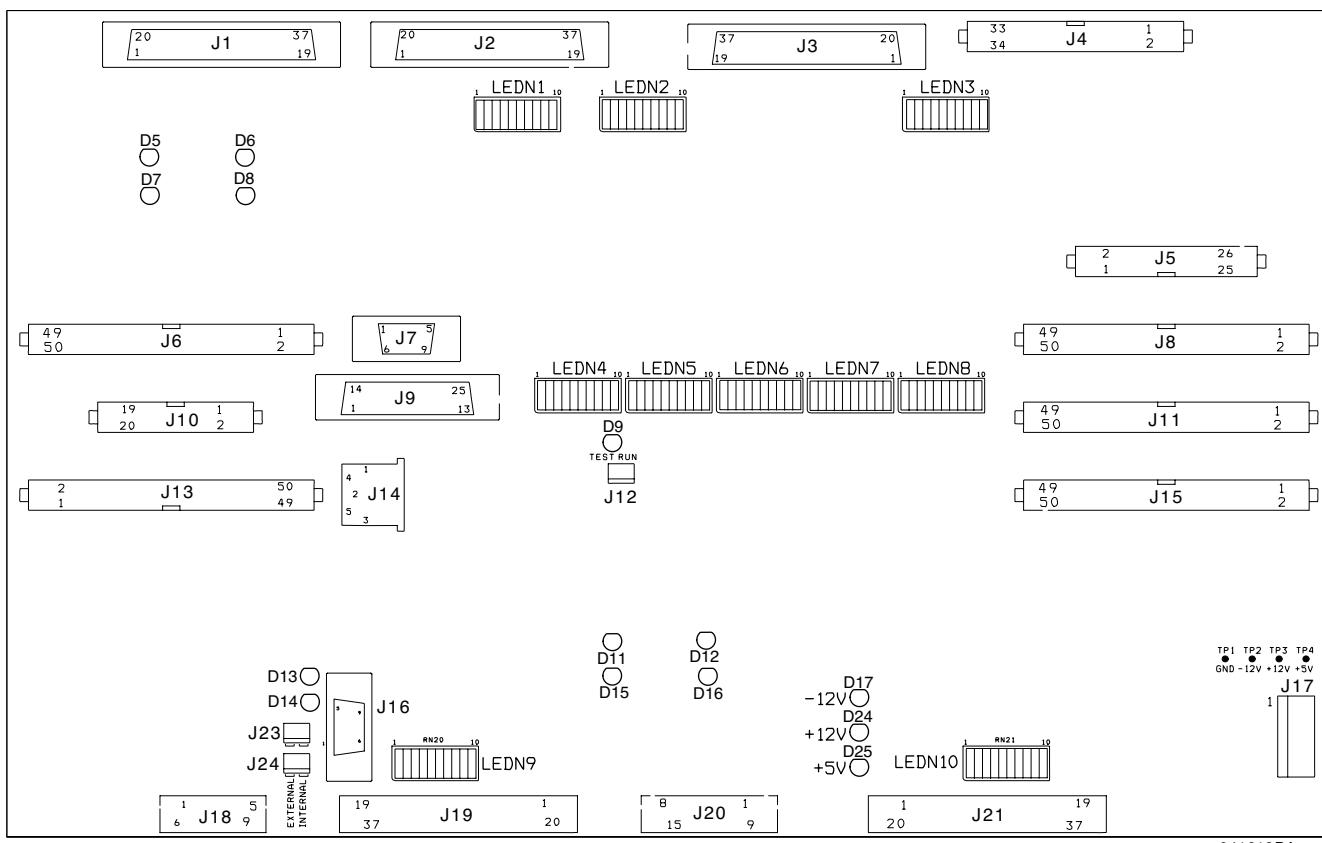
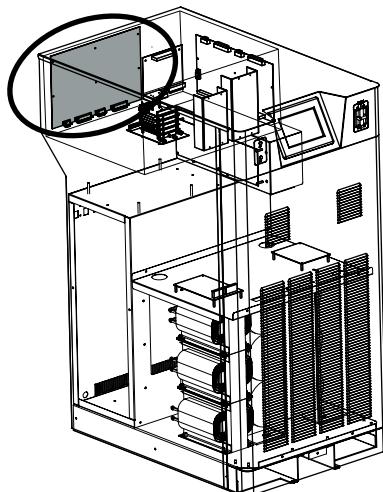
Plasma interface board PCB5 status indicators



Plasma interface PC board LED list

LED	Signal name	Function
D2	+24 Volts	Power indicator, Always ON
D7	Ohmic Contact	Illuminates when torch is in contact with plate
D9	Transfer	Illuminates when arc transfers to plate
D10	Shield #1	Relay for THC #1. ON when circuit is closed
D12	Cooling Temp OK	Coolant temperature at acceptable level, always ON
D13	Spare Input	Not used
D14	+15 Volts	Power indicator, Always ON
D15	Shield #2	Relay for THC #2. ON when circuit is closed
D17	Cooling Flow OK	Sensor detecting good coolant flow
D18	Spare Output	Not used
D20	-15 Volts	Power indicator

Breakout board PCB6 status indicators



041613RA.eps

MAINTENANCE

Breakout board LED list

LED	Signal name	Function
D5	THC1 Tx	Transmits information to THC1
D6	THC2 Tx	Transmits information to THC2
D7	THC1 Rx	Receives information from THC1
D8	THC2 Rx	Receives information from THC2
D9	Watchdog	Illuminated when no errors are detected
D11	CNC Tx	Transmits information to CNC
D12	Gas Tx	Transmits information to gas console
D13	Display Tx	Transmits information to touch screen display
D14	Display Rx	Receives information from touch screen display
D15	CNC Rx	Receives information from CNC
D16	Gas Rx	Receives information from gas console
D17	-12 VDC	Power indicator
D24	+12 VDC	Power indicator
D25	+5 VDC	Power indicator

Breakout board LEDN list

LEDN1	Signal name	Function
LEDN1-1	Not Used	—
LEDN1-2	THC1 cable installed	Checks for cable installation
LEDN1-3	THC1 IHS complete	Contact with work-piece detected
LEDN1-4	THC1 retract complete	THC1 is at home position
LEDN1-5	THC1 discrete error	Indicates THC error
LEDN1-6	THC2 cable installed	Checks for cable installation
LEDN1-7	THC2 IHS complete	Contact with work-piece detected
LEDN1-8	THC2 retract complete	THC2 is at home position
LEDN1-9	THC2 discrete error	Indicates THC error
LEDN1-10	Not Used	—

LEDN2	Signal name	Function
LEDN2-1	Not Used	—
LEDN2-2	Master door interlock	All interlocks are engaged
LEDN2-3	Output current OK	Power supply control has detected current from chopper
LEDN2-4	Temp / Airflow OK	Transformer temperature is within normal operating range
LEDN2-5	Chopper #2 Temp OK	Chopper 2 temperature is within normal operating range
LEDN2-6	Chopper #1 Temp OK	Chopper 1 temperature is within normal operating range
LEDN2-7	Missing phase detect	Indicates proper 3-phase line voltage
LEDN2-8	Input power active	Indicates proper logic power on power supply control board
LEDN2-9	Not Used	—
LEDN2-10	Not Used	—

Breakout board LEDN list – continued

LEDN3	Signal name	Function
LEDN3-1	Not Used	—
LEDN3-2	Plasma int spare input 2	—
LEDN3-3	Coolant temp switch	Coolant temperature is with-in normal operating range
LEDN3-4	Coolant flow switch	Coolant flow is with-in normal operating range
LEDN3-5	Transfer sense	Arc transfer detected
LEDN3-6	Plasma int spare input 1	—
LEDN3-7	Not Used	—
LEDN3-8	Not Used	—
LEDN3-9	Not Used	—
LEDN3-10	Not Used	—

LEDN4	Signal name	Function
LEDN4-1	Slave 5 Amp select	—
LEDN4-2	CNC system error	Indicates plasma system has an error or warning condition
LEDN4-3	CNC spare output 1	—
LEDN4-4	CNC retract complete	Torch has retracted to programmed position
LEDN4-5	Slave 2.5 Amp select	—
LEDN4-6	CNC spare output 2	—
LEDN4-7	5 Amp select	Power supply set for 5 Amp output
LEDN4-8	CNC spare output 3	—
LEDN4-9	2.5 Amp select	Power supply set for 2.5 Amp output
LEDN4-10	CNC ready to fire	Torch has finished pre-flow and IHS (if THC is in use)

LEDN5	Signal name	Function
LEDN5-1	THC 1 corner hold	THC 1 motion is stopped
LEDN5-2	THC 2 corner hold	THC 2 motion is stopped
LEDN5-3	Not Used	—
LEDN5-4	Not Used	—
LEDN5-5	Not Used	—
LEDN5-6	Gas state #3	Used in combination to select gas system state
LEDN5-7	Gas state #2	
LEDN5-8	Gas state #1	
LEDN5-9	Slave 160 Amp select	—
LEDN5-10	Not Used	—

LEDN6	Signal name	Function
LEDN6-1	THC 1 cycle start	THC start signal
LEDN6-2	DC output ON /OFF	Turns ON choppers
LEDN6-3	Contactor control	Turns ON contactor
LEDN6-4	Fan control	Turns ON chopper fans
LEDN6-5	1/10th current	Sets power supply to 1/10 of selected current (used for marking)
LEDN6-6	10 Amp select	Power supply set to 10 Amp output
LEDN6-7	20 Amp select	Power supply set to 20 Amp output
LEDN6-8	40 Amp select	Power supply set to 40 Amp output
LEDN6-9	80 Amp select	Power supply set to 80 Amp output
LEDN6-10	160 Amp select	Power supply set to 160 Amp output

MAINTENANCE

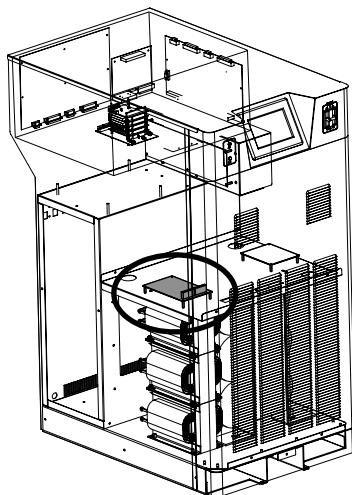
LEDN7	Signal name	Function
LEDN7-1	CNC motion	Sends start signal to THC
LEDN7-2	Slave 80 Amp select	—
LEDN7-3	Slave 40 Amp select	—
LEDN7-4	Slave 20 Amp select	—
LEDN7-5	Slave 10 Amp select	—
LEDN7-6	Slave 1/10th current	—
LEDN7-7	Slave fan control	—
LEDN7-8	Slave contactor control	—
LEDN7-9	Slave DC output ON/OFF	—
LEDN7-10	CNC transfer	Indicates arc has transferred to work-piece

LEDN8	Signal name	Function
LEDN8-1	THC2 cycle start	Gives signal for THC to start
LEDN8-2	Pilot arc relay	Turns pilot arc relay ON
LEDN8-3	Transfer 3	Sets various transfer levels, depending on process selected
LEDN8-4	Transfer 2	
LEDN8-5	Transfer 1	
LEDN8-6	Plasma int spare out	—
LEDN8-7	Torch #2 cooling select	Torch #2 cooling solenoid turns ON
LEDN8-8	Torch #1 cooling select	Torch #1 cooling solenoid turns ON
LEDN8-9	Pump/fan control	Large fan in power supply turns ON
LEDN8-10	Surge injection select	Selects different surge levels (normal/marking)

LEDN9	Signal name	Function
LEDN9-1	Not Used	—
LEDN9-2	Not Used	—
LEDN9-3	CNC machine cable installed	Detects CNC cable. Jumper required from CNC
LEDN9-4	CNC spare input 1	—
LEDN9-5	CNC spare input 2	—
LEDN9-6	CNC plasma sync	Keeps plasma system in pre-flow (used for synchronizing multiple systems)
LEDN9-7	CNC corner hold	THC motion stopped (at corner)
LEDN9-8	CNC system start	Cycle start (plasma start)
LEDN9-9	Gas error	Error detected in gas system
LEDN9-10	Not Used	—

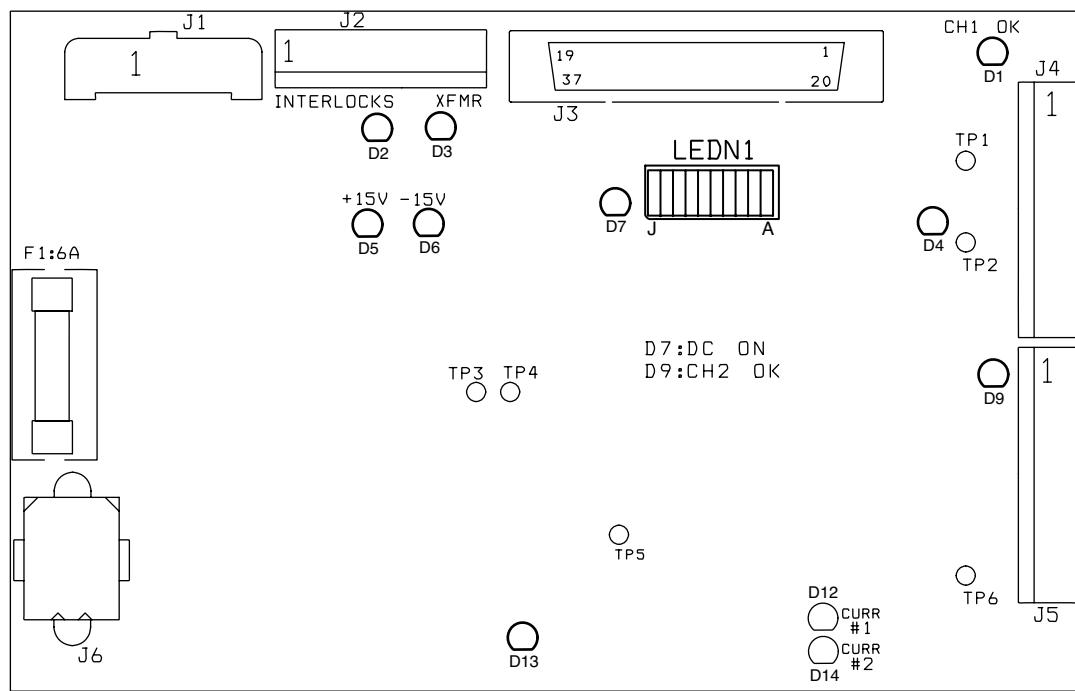
LEDN10	Signal name	Function
LEDN10-1	Not Used	—
LEDN10-2	Slave input power active	—
LEDN10-3	Slave missing phase detect	—
LEDN10-4	Slave chopper #1 temp OK	—
LEDN10-5	Slave chopper #2 temp OK	—
LEDN10-6	Slave temp/airflow OK	—
LEDN10-7	Slave output current OK	—
LEDN10-8	Slave door interlock	—
LEDN10-9	Not Used	—
LEDN10-10	Not Used	—

Control board PCB3 status indicators



Control PC board LED list

LED	Signal description/ Function
D1	Chopper #1 Temp OK
D2	Interlocks OK, panels in place
D3	Transformer Temp OK
D5	Power indicator, +15 Volts
D6	Power indicator, -15 Volts
D7	DC Output ON, signals choppers to turn on
D9	Chopper #2 Temp OK
D12	Current #1, current detected from chopper #1
D14	Current #2, current detected from chopper #2

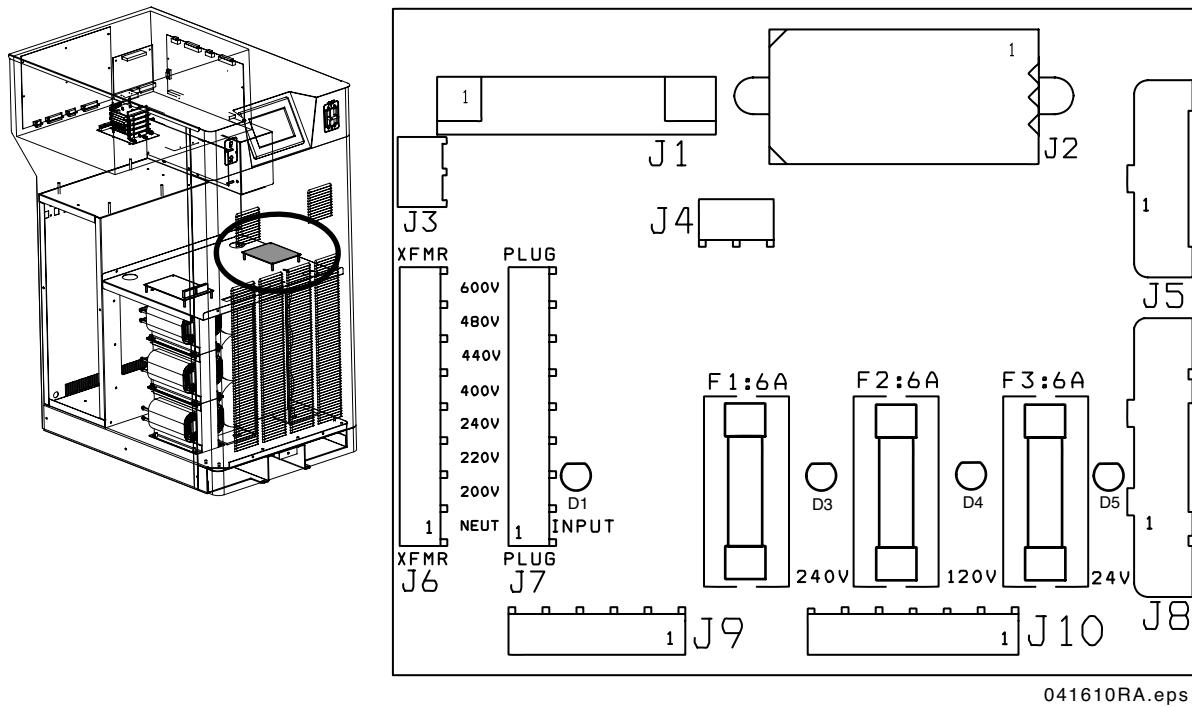


Control PC board LEDN1 list

LEDN1	Signal name	Function
LEDN1-A	160 Amp Select	
LEDN1-B	80 Amp Select	
LEDN1-C	40 Amp Select	
LEDN1-D	20 Amp Select	
LEDN1-E	10 Amp Select	
LEDN1-F	5 Amp Select	
LEDN1-G	2.5 Amp Select	
LEDN1-H	1/10 Current, divides current by 10. Used at low amperage to disable one chopper for better function	
LEDN1-I	Chopper fans ON	
LEDN1-J	Contactor	

A brace on the left side of the table groups the first seven items (A-G) under the heading "Used, in combination, to set power level".

Power distribution board PCB4 status indicators



Power distribution PC board LED list

LED	Signal description/ Function
D3	240 VAC Out Power indicator
D4	120 VAC Out Power indicator
D5	24 VAC Out Power indicator

Notes: When circuit breaker CB1 is switched ON, LEDs D3-D5 will illuminate and stay illuminated.

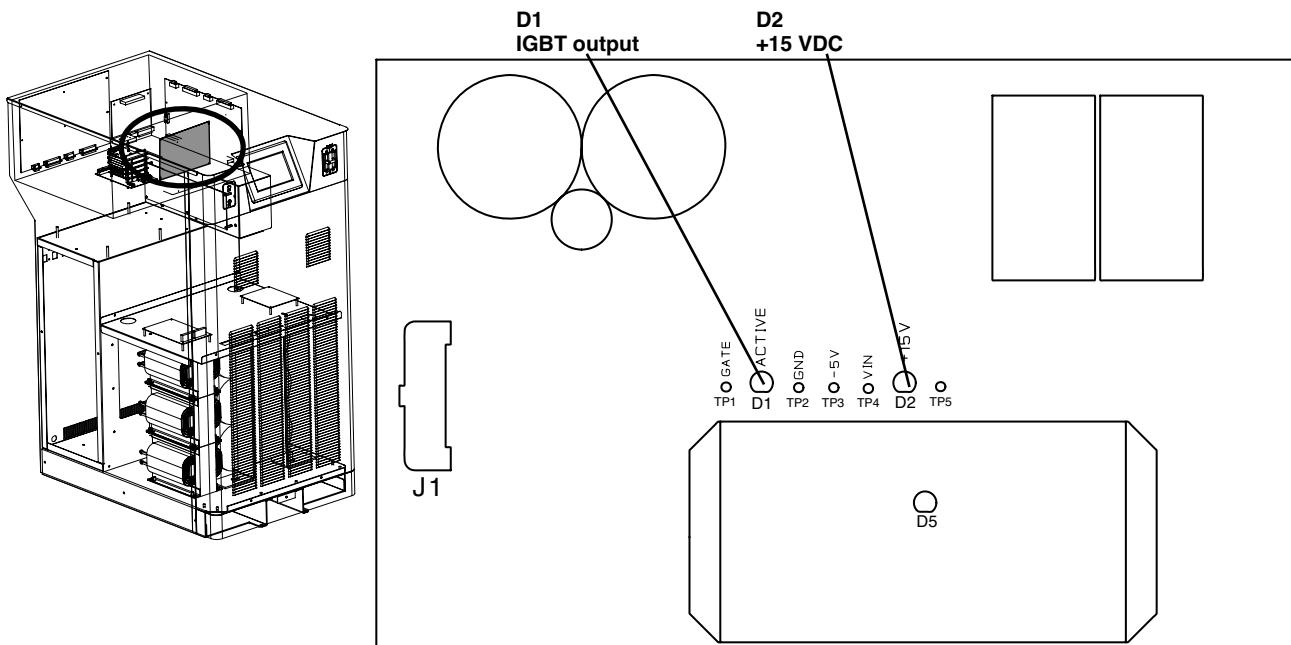
To measure voltages at the power distribution board, find fuses F1, F2 and F3. When the power supply is energized, take measurements from the top of each fuse to chassis ground, and then from the bottom of each fuse to chassis ground. Measurements should be as follows:

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

If voltages are not present, or incorrect at one or more of these points, disconnect power and troubleshoot fuses and associated pins, connectors and wiring between power distribution board connector J10 and control transformer secondary T1.

Also, check wiring and connections between T1, CB1 and CON1.

Start-circuit assembly board PCB2



Pilot arc control PC board LED list

LED	Signal description/ Function
D1	Pilot Arc Active
D2	+15 Volts power indicator

Operation

The start circuit is a high-speed switch that quickly transfers the pilot arc current from the pilot arc load to the work load. The start circuit performs 2 functions:

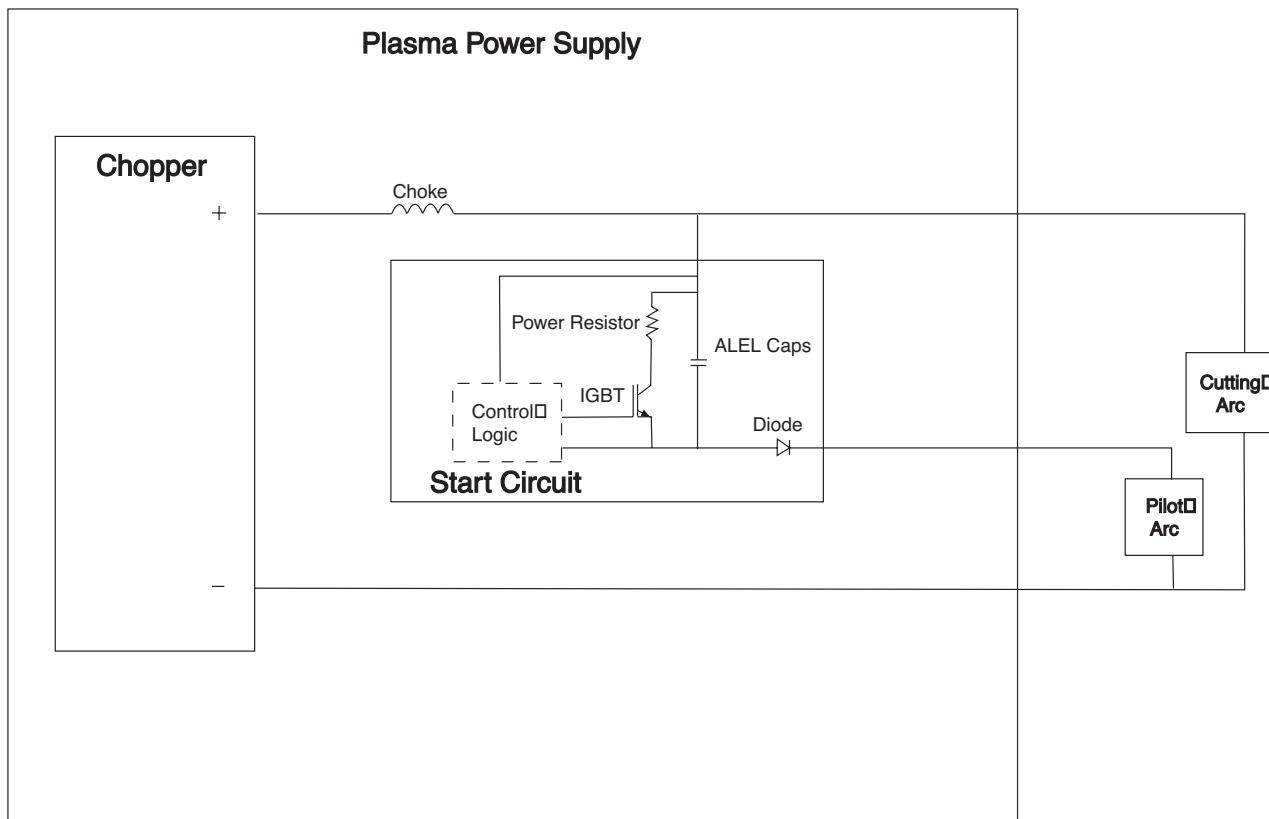
1. It allows the initial pilot arc current to flow through the pilot arc lead quickly, with little impedance.
2. After initial pilot arc current is established, the start circuit introduces impedance to the pilot arc load to aid in transferring the arc to the workpiece. See schematic on following page.

Pilot arc current levels

The pilot arc current level will change depending on the chosen process and arc current level. See table below.

Process	Pilot arc current
Marking	10 amps
30/45-amp process	20 amps
80-amp process	20 amps – Mild steel 25 amps – Stainless steel
130-amp process	30 amps – Mild steel 35 amps – Stainless steel and Aluminum
200-amp process	40 amps

Start-circuit functional schematic

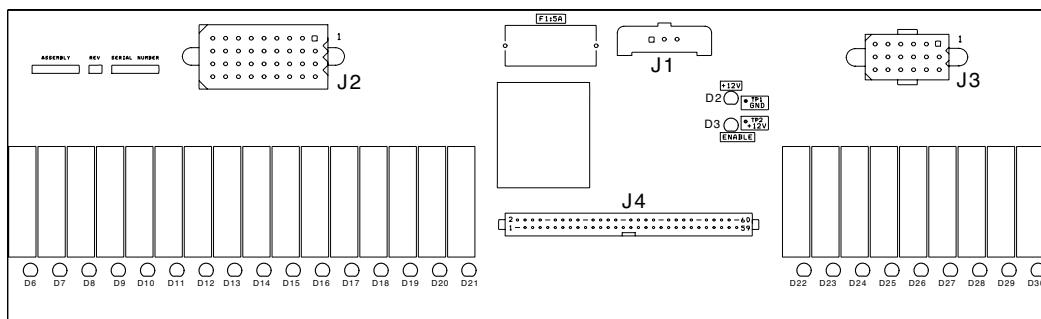
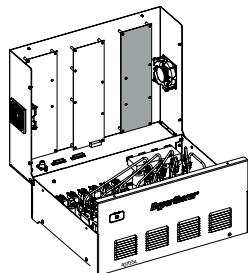


Start-circuit troubleshooting

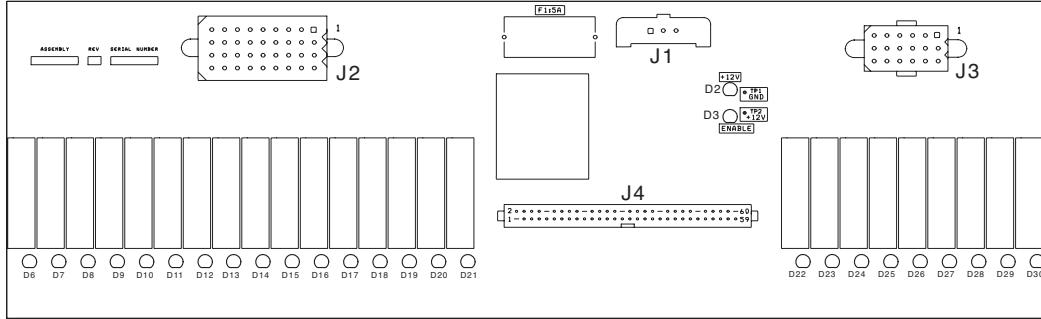
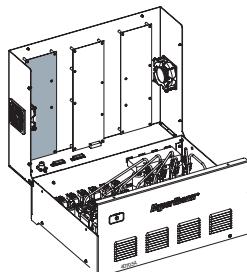
		WARNING
SHOCK HAZARD: Always use caution when servicing a power supply when plugged in and the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.		

- D2 should always be ON.
- D1 illuminates as soon as the torch fires and then will extinguish as soon as the arc transfers to the plate. If arc transfer is immediate, the LED will not illuminate.
- If there is no arc at the torch or if the arc will not transfer:
 - Turn the power to the system OFF and check for a resistance of 15 kΩ from H8 to H1.
 - Check for a resistance of 5.5 kΩ across H10 and H4. Refer to wiring diagrams. Note that the resistances will slowly increase to the above values due to capacitance in the circuit.
 - Check the junction of the D12 diode.
 - Work cable connection on the cutting table is not making good contact.
 - Check D2. It should be illuminated.
 - Fire the torch in the air and check to be sure that D1 illuminates.
 - Check the resistance across the R3 resistor. It should be 1 kΩ.

Gas console relay boards PCB1 and PCB3 – LED description lists

PCB1

LED	Signal name	Function	LED	Signal name	Function
D2	+12 VDC	Power indicator	D18	SV2	H5 in
D6	SV11	Plasma operate	D19	SV1	H35 in
D7	SV13	Air Plasma operate	D20	SV3	CO ₂ in
D8	SV15	N ₂ Plasma preflow	D21	SV5 & SV10	O ₂ in
D9	SV17	Shield operate	D22	MV2 Close	Plasma operate – N ₂ / Air
D10	SV18	N ₂ Shield operate	D23	MV2 Open	Plasma operate – N ₂ / Air
D11	SV16	Air Plasma preflow	D24	MV1 Open	Plasma operate
D12	SV14	Plasma preflow	D25	MV1 Close	Plasma operate
D13	SV12	N ₂ Plasma operate	D26	SV23, 24, 25, 26	Torch select
D14	SV8	H35 and H5, Double fault protection	D27	SV21	N ₂ Shield preflow
D15	SV7	Air in	D28	SV20	Shield preflow
D16	SV6	N ₂ in	D29	SV19	Air Shield operate
D17	SV4 & SV9	CH4 / F5 in	D30	SV22	Air Shield preflow

PCB3

LED	Signal name	Function	LED	Signal name	Function
D2	+12 VDC	Power indicator	D18	MV3 Open	Plasma Preflow
D6	MV5 Open	Shield Operate	D19	MV3 Close	Plasma Preflow
D7	MV6 Open	Shield Operate – N ₂ /Air	D20	MV4 Close	Plasma Preflow – N ₂ /Air
D8	MV7 Open	Shield Preflow	D21	Ignitor	Tch #1
D9	MV8 Open	Shield Preflow – N ₂ /Air	D22	SV34	Vent – Tch #2
D10	SV36	Shield Preflow Tch #2	D23	Not used	
D11	MV8 Close	Shield Preflow – N ₂ /Air	D24	SV32	Plasma Cutflow – Tch#2
D12	MV7 Close	Shield Preflow	D25	SV33	Plasma Preflow – Tch#2
D13	MV6 Close	Shield Operate – N ₂ /Air	D26	SV35	Shield Cutflow – Tch#2
D14	MV5 Close	Shield Operate	D27	SV27	Plasma Cutflow – Tch#1
D15	Ignitor	Tch #2	D28	SV28	Plasma Preflow – Tch#1
D16	SV31	Shield Preflow Tch #1	D29	SV30	Shield Cutflow – Tch#1
D17	MV4 Open	Plasma Preflow – N ₂ /Air	D30	SV29	Vent – Tch#1

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PCB1 and PCB3 LED sequences – O₂ cutting

O₂ Plasma Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D21	SV5 & SV10	D18	MV3 Open
D12	SV14	D19	MV3 Close
D26	SV24: Torch 2 Select	D28	SV28: Torch 1 Active
–	–	D25	SV33: Torch 2 Active

N₂ Plasma Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D17	MV4 Open
D8	SV15	D20	MV4 Close
D26	SV24: Torch 2 Select	D28	SV28: Torch 1 Active
–	–	D25	SV33: Torch 2 Active

O₂ Shield Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D21	SV5 & SV10	D8	MV7 Open
D28	SV20	D12	MV7 Close
D26	SV26: Torch 2 Select	D16	SV31: Torch 1 Active
–	–	D10	SV36: Torch 2 Active

N₂ Shield Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D9	MV8 Open
D27	SV21	D11	MV8 Close
D26	SV26: Torch 2 Select	D16	SV31: Torch 1 Active
–	–	D10	SV36: Torch 2 Active

O₂ Plasma Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D21	SV5 & SV10	D27	SV27: Torch 1 Active
D6	SV11	D24	SV32: Torch 2 Active
D26	SV23: Torch 2 Select	–	–
D24	MV1 Open	–	–
D25	MV1 Close	–	–

O₂ Shield Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D21	SV5 & SV10	D6	MV5 Open
D9	SV17	D14	MV5 Close
D26	SV25: Torch 2 Select	D29	SV30: Torch 1 Active
–	–	D26	SV35: Torch 2 Active

N₂ Shield Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D7	MV6 Open
D10	SV18	D13	MV6 Close
D26	SV25: Torch 2 Select	D29	SV30: Torch 1 Active
–	–	D26	SV35: Torch 2 Active

PCB1 and PCB3 LED sequences – H35/N₂ cutting**H35 Plasma Preflow**

PCB 1		PCB 3	
LED	Action	LED	Action
D19	SV1	D18	MV3 Open
D14	SV8	D19	MV3 Close
D12	SV14	D28	SV28: Torch 1 Active
D26	SV24: Torch 2 Select	D25	SV33: Torch 2 Active

N₂ Plasma Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D17	MV4 Open
D8	SV15	D20	MV4 Close
D26	SV24: Torch 2 Select	D28	SV28: Torch 1 Active
–	–	D25	SV33: Torch 2 Active

N₂ Shield Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D9	MV8 Open
D27	SV21	D11	MV8 Close
D26	SV26: Torch 2 Select	D10	SV36: Torch 2 Active
–	–	D16	SV31: Torch 1 Active

H35 Plasma Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D19	SV1	D27	SV27: Torch 1 Active
D14	SV8	D24	SV32: Torch 2 Active
D6	SV11	–	–
D24	MV1 Open	–	–
D25	MV1 Close	–	–
D26	SV23: Torch 2 Select	–	–

N₂ Plasma Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D27	SV27: Torch 1 Active
D13	SV12	D24	SV32: Torch 2 Active
D22	MV2 Open	–	–
D23	MV2 Close	–	–
D26	SV23: Torch 2 Select	–	–

N₂ Shield Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D7	MV6 Open
D10	SV18	D13	MV6 Close
D26	SV25: Torch 2 Select	D29	SV30: Torch 1 Active
–	–	D26	SV35: Torch 2 Active

PCB1 and PCB3 LED sequences – H5/N₂ marking

H5 Plasma Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D18	SV2	D18	MV3 Open
D14	SV8	D19	MV3 Close
D12	SV14	D28	SV28: Torch 1 Active
D26	SV24: Torch 2 Select	D25	SV33: Torch 2 Active

N₂ Shield Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D9	MV8 Open
D27	SV21	D11	MV8 Close
D26	SV26: Torch 2 Select	D16	SV31: Torch 1 Active
–	–	D10	SV36: Torch 2 Active

H5 Plasma Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D18	SV2	D27	SV27: Torch 1 Active
D14	SV8	D24	SV32: Torch 2 Active
D6	SV11	–	–
D24	MV1 Open	–	–
D25	MV1 Close	–	–
D26	SV23: Torch 2 Select	–	–

N₂ Shield Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D7	MV6 Open
D10	SV18	D13	MV6 Close
D26	SV25: Torch 2 Select	D29	SV30: Torch 1 Active
–	–	D26	SV35: Torch 2 Active

PCB1 and PCB3 LED sequences – N₂/N₂ marking

N₂ Plasma Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D17	MV4 Open
D8	SV15	D20	MV4 Close
D26	SV24: Torch 2 Select	D28	SV28: Torch 1 Active
–	–	D25	SV33: Torch 2 Active

N₂ Shield Preflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D9	MV8 Open
D27	SV21	D11	MV8 Close
D26	SV26: Torch 2 Select	D16	SV31: Torch 1 Active
–	–	D10	SV36: Torch 2 Active

N₂ Plasma Cutflow

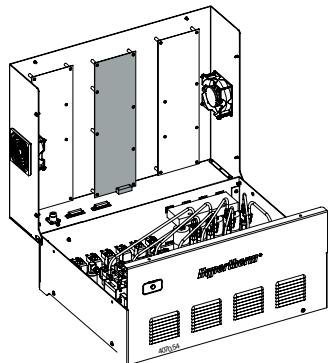
PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D27	SV27: Torch 1 Active
D13	SV12	D24	SV32: Torch 2 Active
D22	MV2 Open	–	–
D23	MV2 Close	–	–
D26	SV23: Torch 2 Select	–	–

N₂ Shield Cutflow

PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D7	MV6 Open
D18	SV18	D13	MV6 Close
D26	SV25: Torch 2 Select	D29	SV30: Torch 1 Active
–	–	D26	SV35: Torch 2 Active

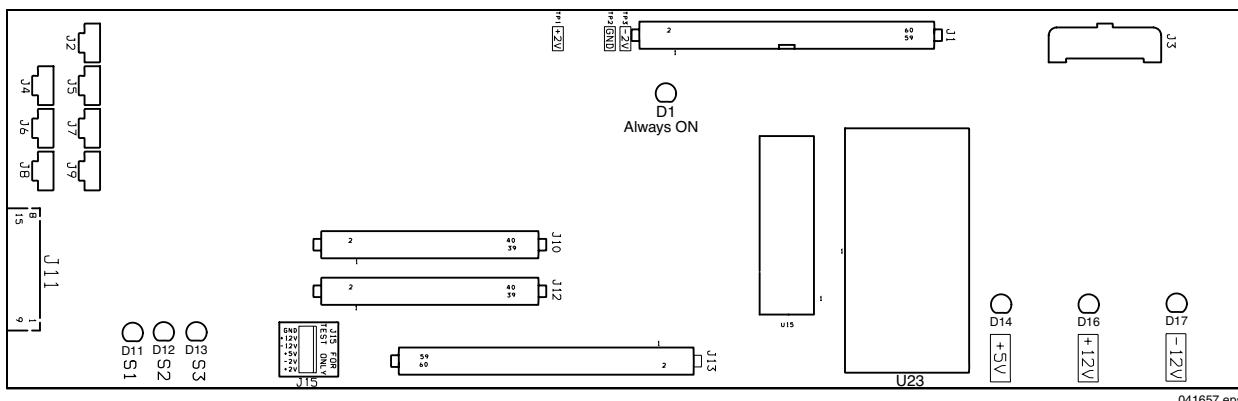
MAINTENANCE

Gas console control board PCB2



U23 LCD display shows the following:

- Revision number
- Inlet gas pressures
- Current operating state number
- Error messages
- Motor valve position
- Control voltage



041657.eps

Gas console control PC board LED list

LED	Signal name	Function
D11	S1	Used, in combination with S2 and S3 to set state of gas console. See chart below.
D12	S2	See above
D13	S3	See above
D14	+ 5 VDC	Power indicator
D16	+ 12 VDC	Power indicator
D17	- 12 VDC	Power indicator

Gas state chart: LED indicators (1 = ON, 0 = OFF)

LED	D11(S1)	D12(S2)	D13(S3)	State #	Description
	0	0	0	0	All outputs OFF
	0	0	1	1	Preflow
	0	1	0	2	Ignition
	0	1	1	3	Spare (not used)
	1	0	0	4	Pierce complete
	1	0	1	5	Steady state
	1	1	0	6	Rampdown
	1	1	1	7	Spare (not used)

Leak test procedure

1. Locate the off-valve assembly. It will be within 1.8 meters (6 feet) of the torch receptacle. See *Installation* section page 3-11.
2. Disconnect the power cable to the off-valve assembly. See *Installation* section page 3A-10 or 3B-14.
3. Turn the power supply ON.
4. After the system initializes, it will attempt to purge gas through the torch. No gas will flow through the torch, because the off-valve has been disconnected, but the system will complete the purge cycle. The gas lines are now pressurized.
5. After the purge cycle finishes, locate the supply gas valves for the chosen process and turn them OFF.
6. Monitor the gauges on the pressure regulators for a minimum of 20 minutes.
7. The gas pressures may drop initially but should stabilize within 5 minutes. If one or both pressures continue to drop, there is a leak in the system.
8. To find the leak, repeat steps 1 through 5. Then spray all gas fittings in the system with soapy water. Look for bubbles around fittings.
9. After the leak has been isolated and repaired, repeat steps 1 through 5 to ensure that there are no other leaks in the system.

Setting regulator pressure

1. Turn power supply ON
2. Press set-up on touch screen. Press “NEXT” on screen 4.
3. Press “ALTERNATE” so it reads ON. Press “DONE” twice.
4. Choose a process and navigate to screen 14.
5. After the purge cycle is complete, press “PREFLOW TEST” to turn preflow gas ON.
6. Press Hypertherm logo to get to service screen (#17)
7. Set the shield gas regulator, at the source, so the pressure on the service screen reads 8.3 bar (120 psi). Press “NEXT” twice to return to screen 14.
8. Press “PREFLOW TEST” to turn the gas flow OFF.
9. Repeat steps 5 through 8 for “CUTFLOW TEST” to set plasma gas pressure.

The shield and plasma gases are now properly set.

Chopper module test procedure

		WARNING
<p>Use extreme care when working near the chopper modules. The large blue capacitors store high voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper and the heatsinks. Discharging any capacitor with a screwdriver or other implement may result in an explosion, property damage or personal injury. Wait at least 5 minutes after turning the power supply off before touching the chopper or the capacitors.</p>		

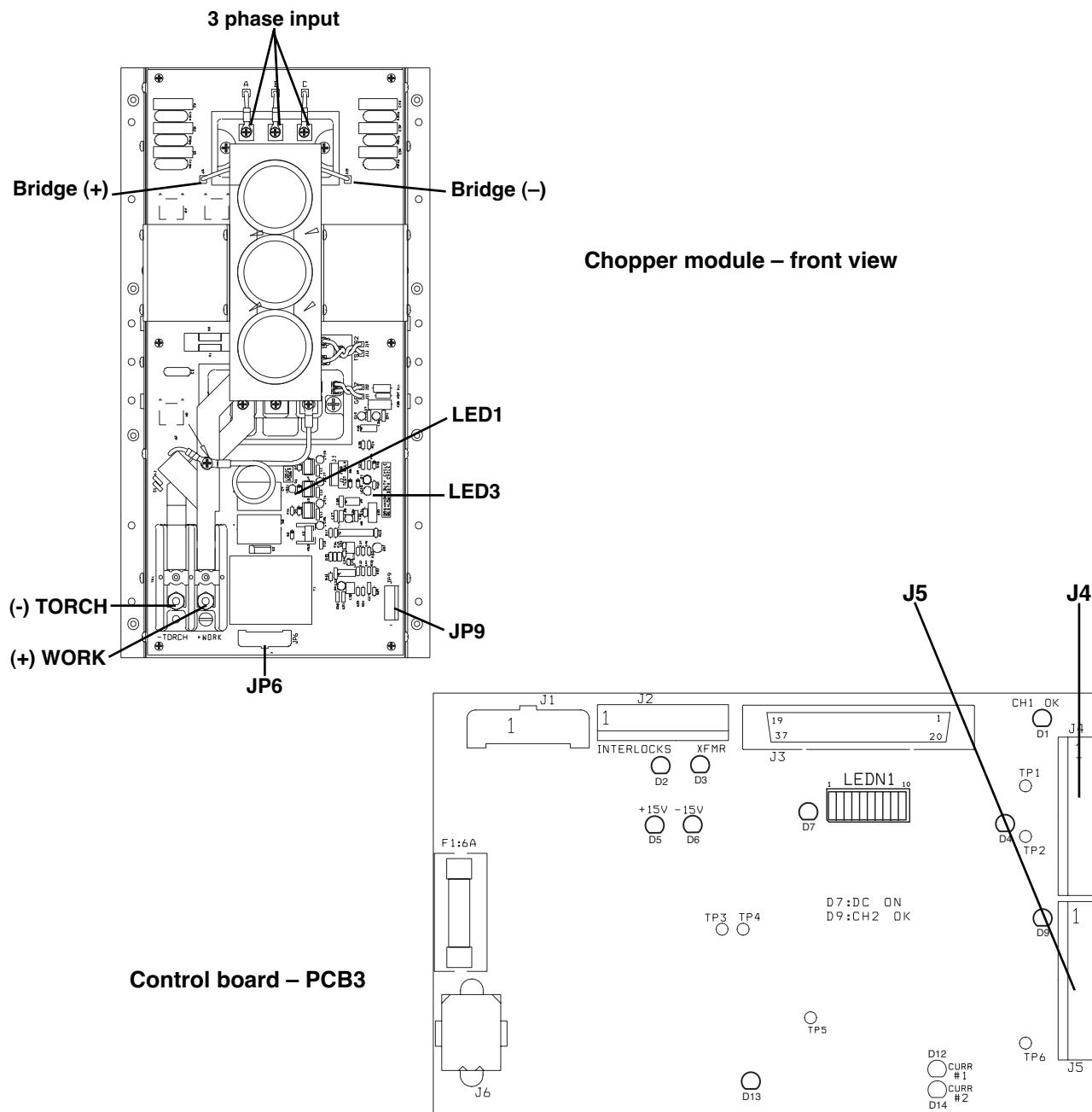
Note: Read voltages with a digital multimeter (DVM) capable of storing minimum and maximum readings.

1. Turn all power to the HD4070 system OFF.
Disconnect two terminals on line filter FL1, in the ignition console, to disable the solid-state ignition SSI1.
See page 6-9 in *Parts List* section for location of FL1.
2. Remove large fuses F1 and F2. Check to see if either fuse is blown.
3. Place the positive lead of the DVM to the + side of the bridge and the negative lead to the – side of the bridge.
See figure on next page. Note that actual connection points are hidden by capacitor support bracket in figure.
4. Turn power to the HD4070 ON, and start up system. After the START command has been given, check voltage.
The input to the chopper at these points should be about +311 VDC. If the input is OK and corresponding fuse F1 or F2 is blown, replace the chopper module. If there is no +311 VDC input, check the 3-phase AC input to the chopper. Also, check main contactor (CON1) contacts, connections and associated wiring to the contactor.
Repair or replace any defective components. To check AC voltage to chopper, perform the same test again with DVM in AC mode. Check voltage across A&B, B&C: Voltage should be 220 VAC.
5. If voltage from above step is +311 VDC and corresponding fuse is not blown, check output of choppers.

- CH1:
- Place the positive lead of the DVM at point (+) WORK on the chopper module (wire #3) and negative lead at point (-) TORCH (wire #1). See the figure on following page.
 - Turn the system on and give the START command. After the START command has been given, check the voltage. If the output from these points is +311 VDC, chopper is OK.
 - An alternate method of testing is to keep fuses F1-F4 in place and take voltage as above. A low voltage reading with this method could mean a shorted torch.

- CH2: To check the output of CH2, repeat the above procedure for CH1 but put the positive lead of the DVM at wire #8 and the negative lead at wire #6.

6. If a chopper does not output +311 VDC, check to see if LED1 logic power light is illuminated. If LED1 is extinguished, check if 120V is going to JP6. If there is no 120V at JP6, check wiring back to power distribution board. Repair or replace any defective components. Also check to see if LED3 is turning green when start command is given (normal condition). If LED1 is illuminated and LED3 is red when start signal is given (fault condition), then make sure that JP9 is seated properly. Check wiring from JP9 to control board. Replace control board if necessary.
7. If a chopper still does not output +311 VDC after completing these instructions through step 6, there may be a problem with the control signal or the chopper module. The chopper drive signal comes through the control board PCB3 as an analog level from 0 to +3.5 VDC, which varies the duty cycle and subsequent output current of the chopper. These analog signals are on PCB3, J4, pins 11&12 for CH1 and J5, pins 11&12 for CH2.



Phase-loss detection board PCB1 status indicators and operation

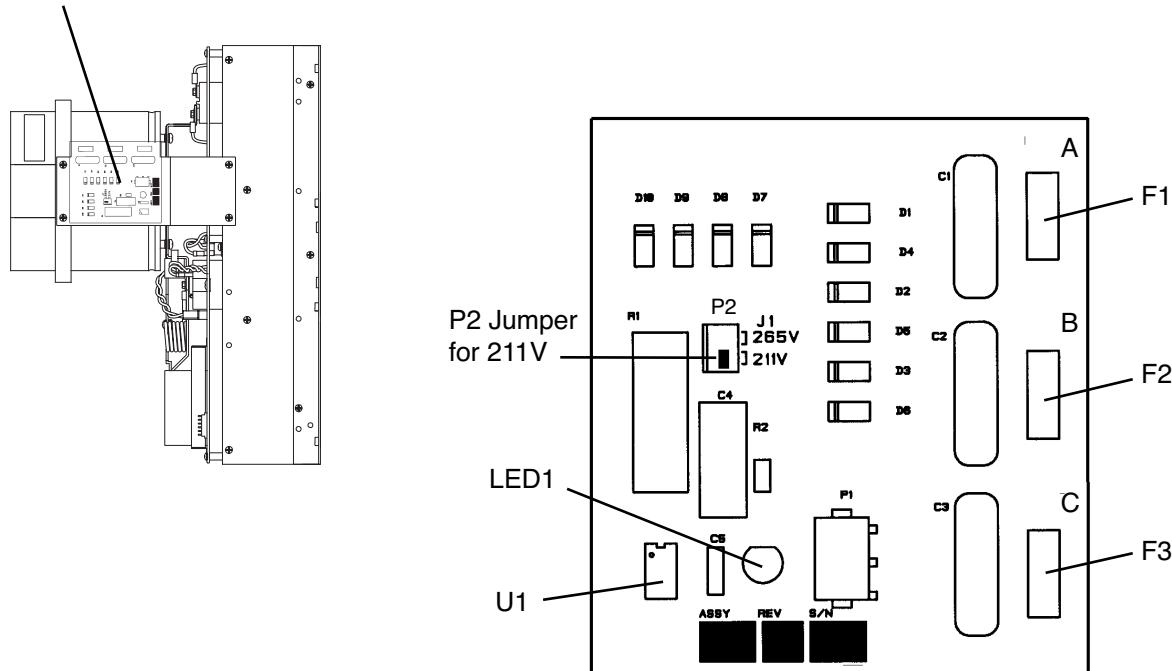
Operation

The phase-loss detection circuit checks the incoming voltage and verifies that the voltages between the 3-wire inputs are within +/- 15% of each other.

- After contactor CON1 closes, opto-coupler U₁ on PCB1 is activated, shorting pins 1&2 of PL1 together and illuminating LED1.
- If LED1 does not illuminate:
 - Verify that voltages across points A B and C, phase-to-phase are approximately 255 VAC. If voltages are not within +/- 15%, LED1 will not illuminate. Check the incoming line voltage and the contacts on CON1.
 - Check PCB1 fuses F1-F3. If any of the fuses are blown, then PCB1 is faulty.
 - Check jumper on P2 and verify that the jumper is set for 211V.

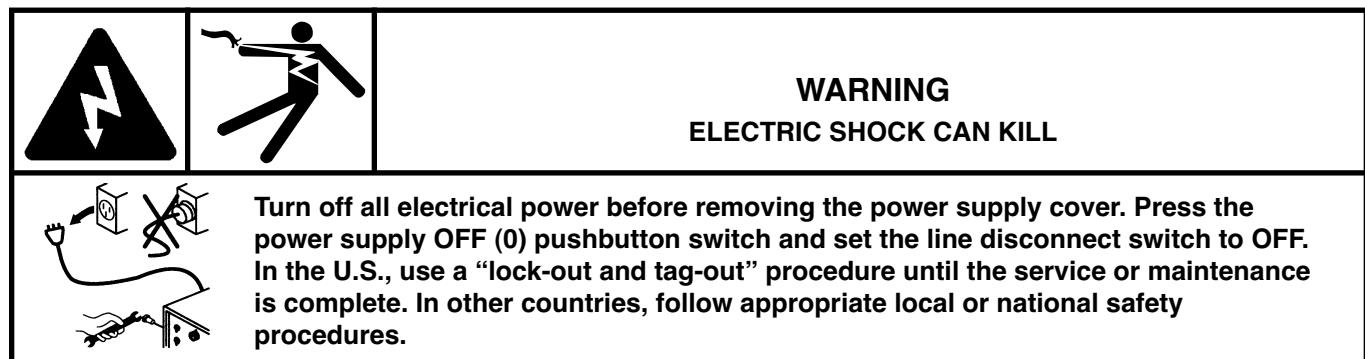
Phase-loss board PCB1 location on chopper CH2

See page 6-3 for location of CH2.



THC routine maintenance

Every 3 months complete the following:



1. Check the THC lifter assembly and associated cables for wear and damage.
2. Check the inside of the control box and for dirt. Use compressed air to clean the units. If the work environment is extremely dirty, clean the units more often.
3. Check the lifter assembly sealing band for tears and fraying.
4. Replace or repair damaged parts.

Note: Do not grease or lubricate any part of the X-Y lifter assembly.

X-Y lifter sealing band – replacement

The sealing band keeps foreign matter out of the lifter assembly. Replace the band if it is torn or worn by installing a Band Seal Kit. The kit contains a new band, screws and retainers.

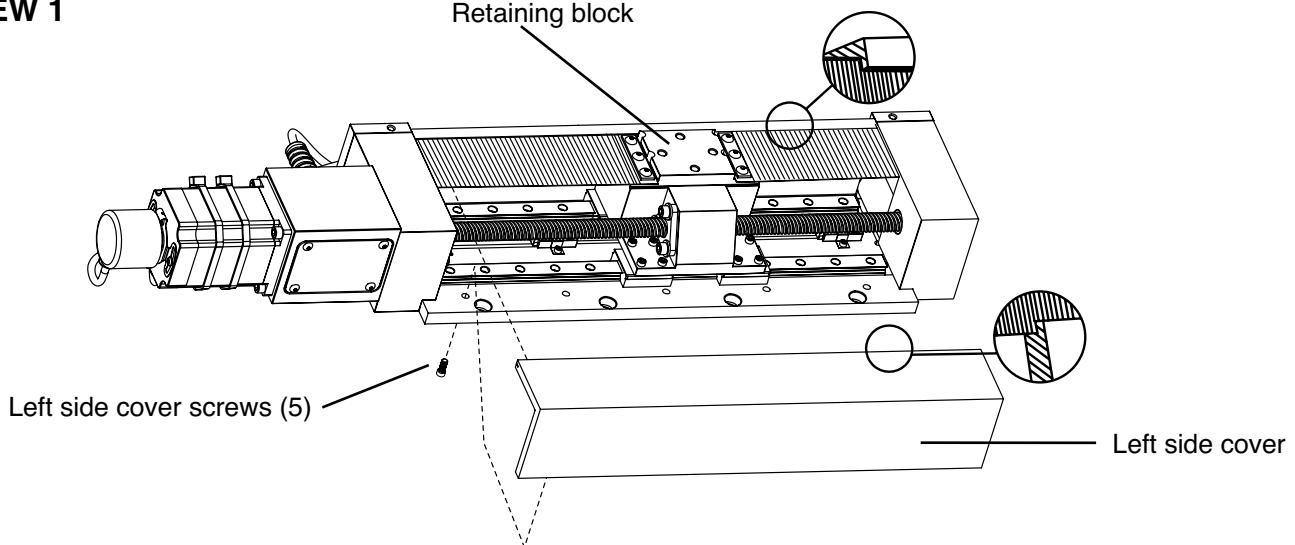
Caution: Turn off all power to the plasma system and THC before working on the THC lifter. The THC system can be damaged if disconnected with power applied.

Sealing band – remove (figure 5-1)

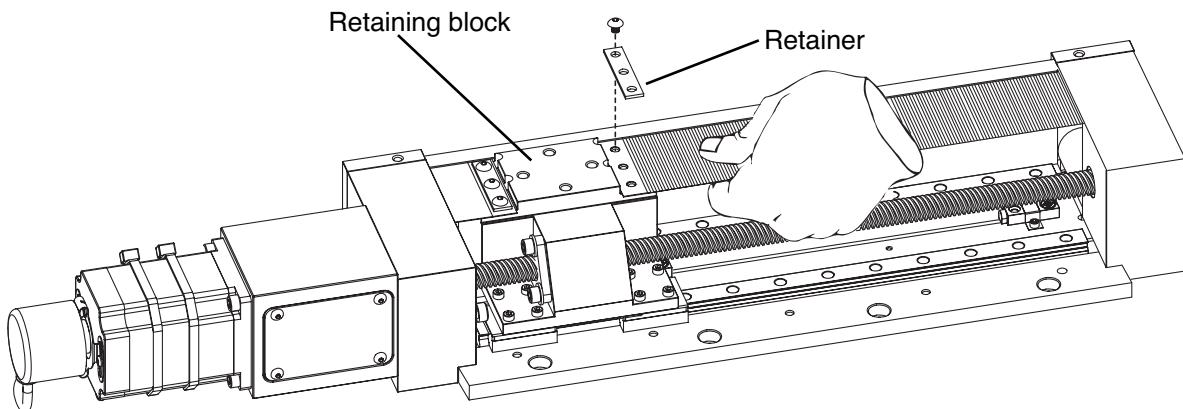
1. Turn off all power to the plasma system and THC.
2. Remove the lifter from the cutting machine.
3. Remove the torch mounting block or breakaway mounting bracket from the lifter retaining block (view 1).
4. Remove the left side cover (view 1).
5. Remove the 2 retainers that secure the band to the retaining block (view 2).
6. Remove the band from the rear of the lifter (view 3).

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VIEW 1



VIEW 2



VIEW 3

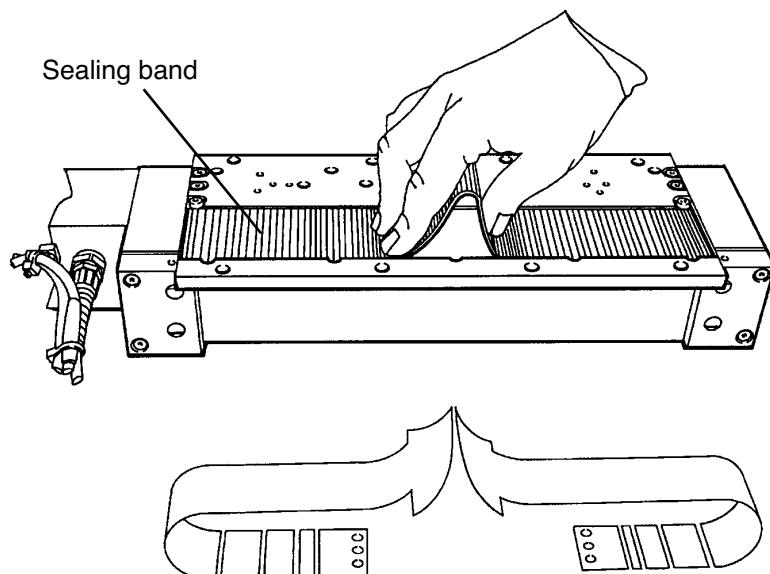


Figure 5-1 Sealing band – remove

Sealing band – install (figure 5-2)

1. Install the new band from the back of the lifter (view 1).
2. Route the band through the top and bottom slots. Make sure the band sits in the channel (view 1).
3. Secure the ends of the band to the retaining block with retainers and hex screws.
Make sure the band is in the groove (views 2 and 3).
4. Install the lifter left side cover. Make sure the band is in the groove (view 3).
5. Install the torch mounting block or breakaway bracket as described in Section 3, *Setup*.

VIEW 1

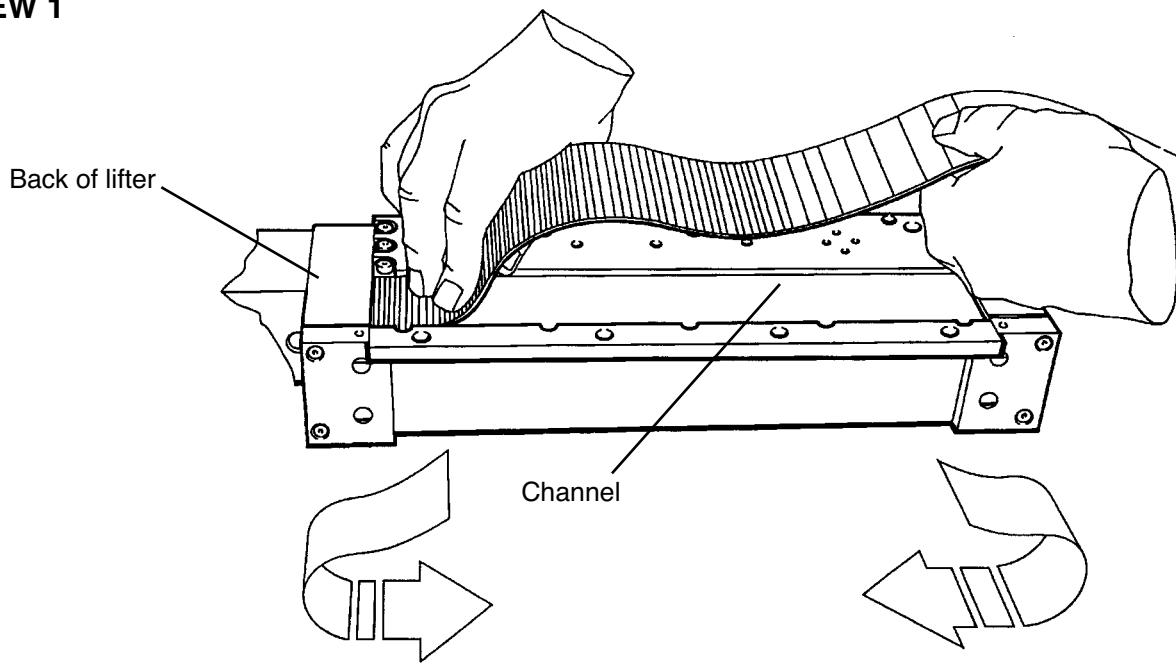
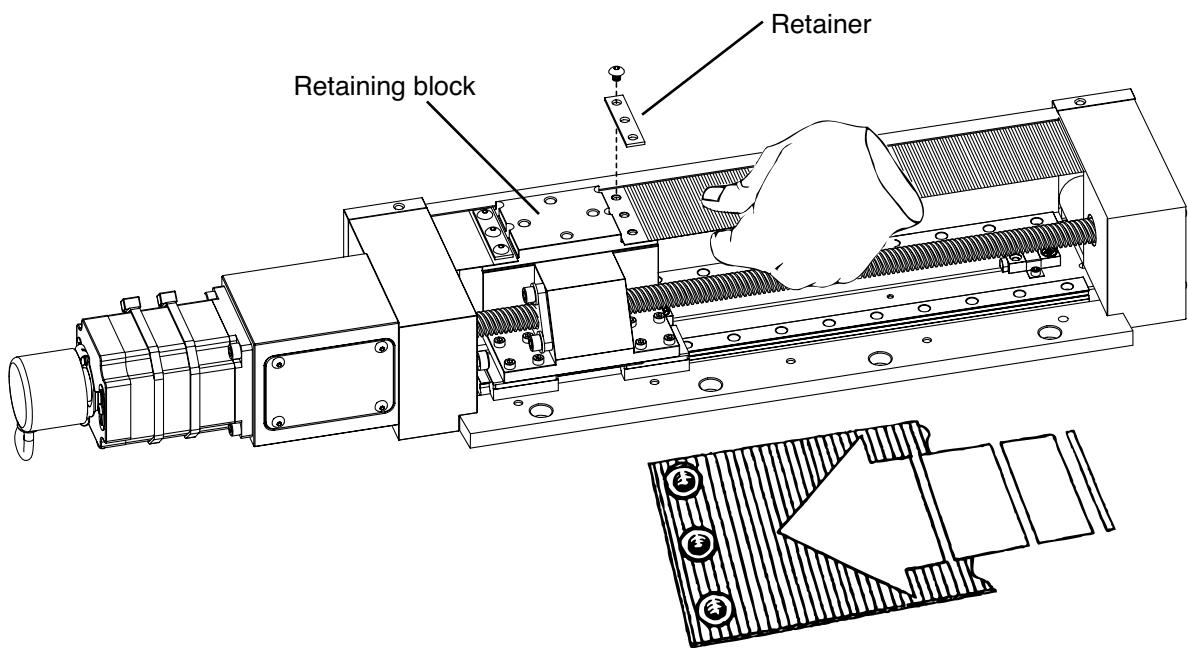


Figure 5-2 Sealing band – install (1 of 2)

MAINTENANCE

VIEW 2



VIEW 3

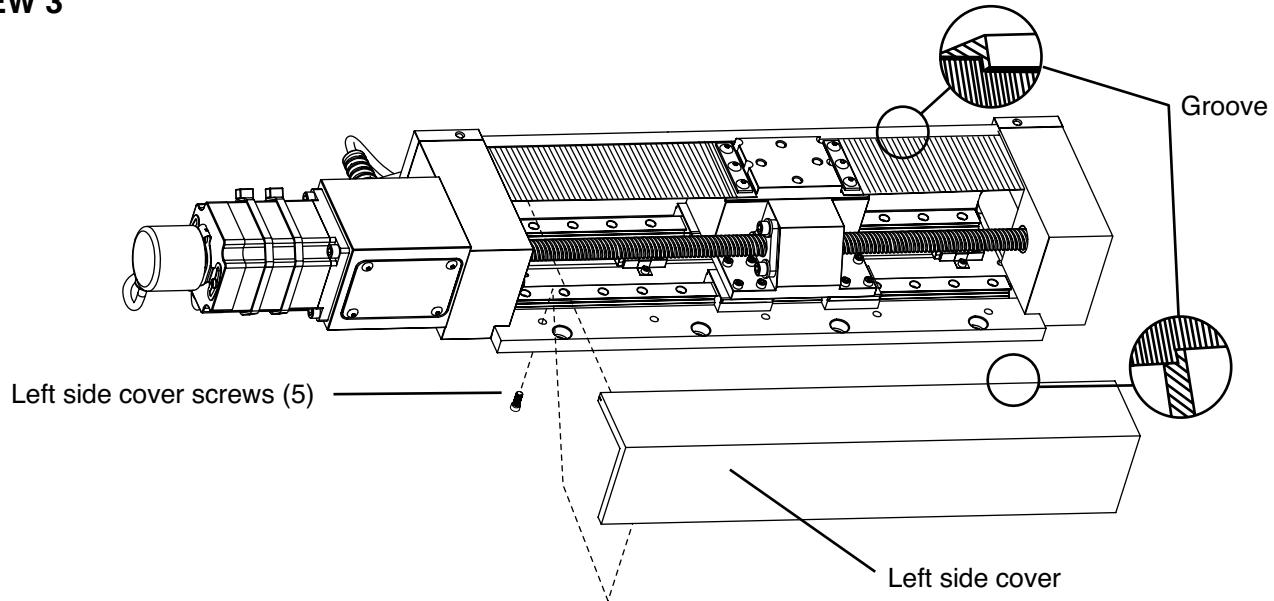


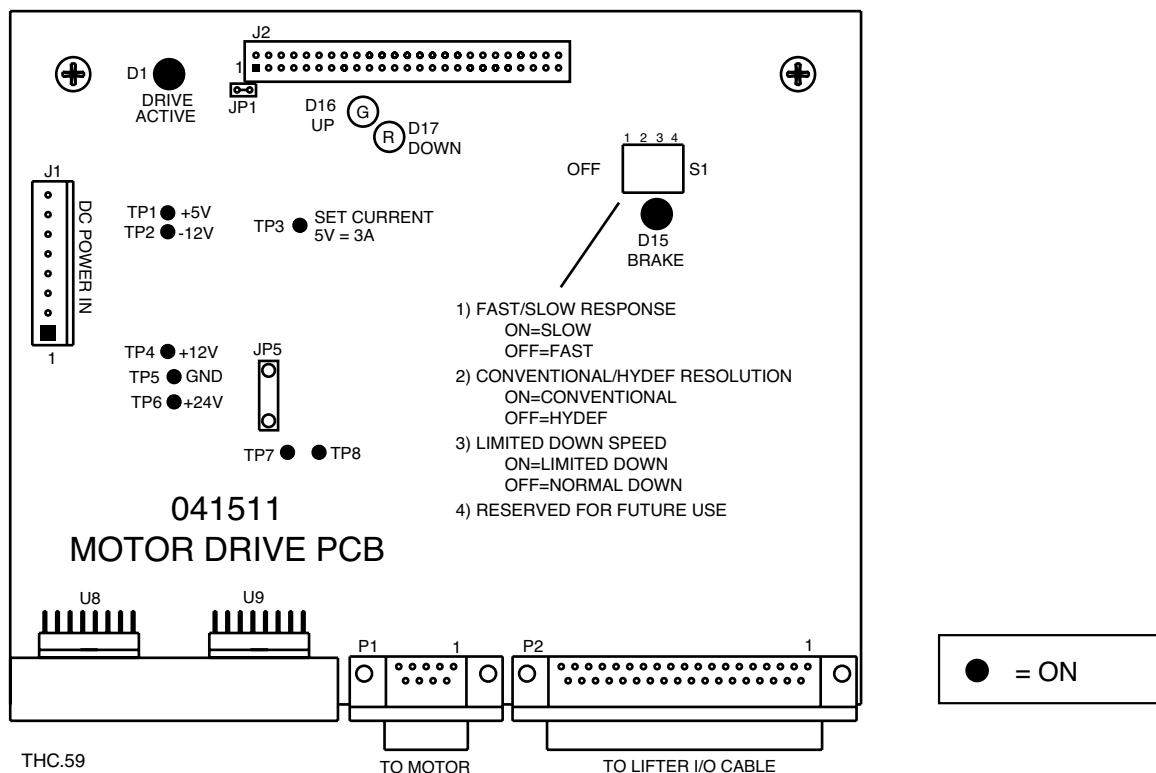
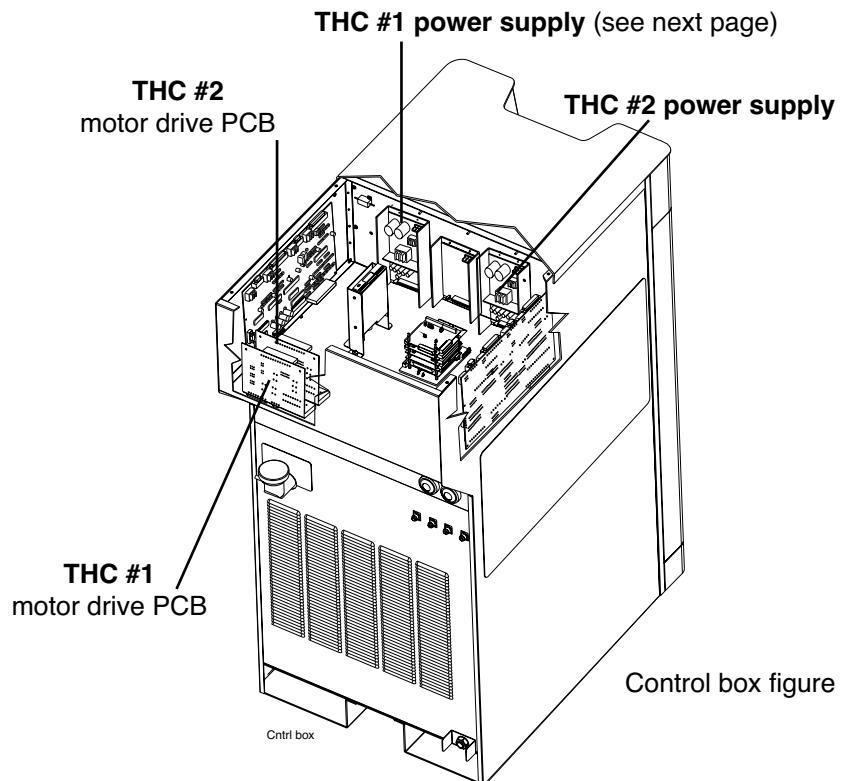
Figure 5-2 Sealing band – install (2 of 2)

THC motor drive board

Status Lights During Normal Power-up.

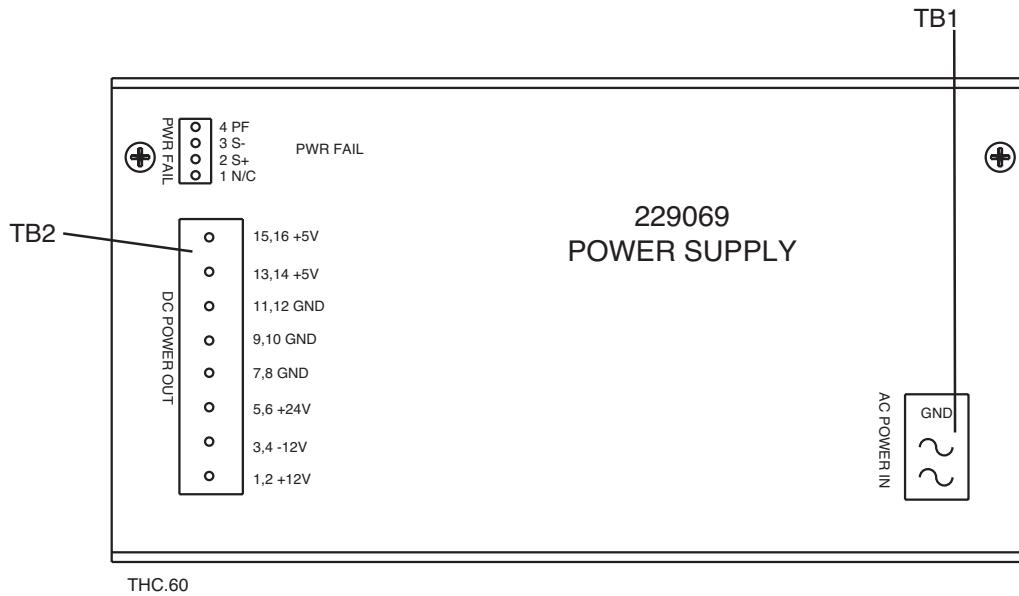
The following LEDs are located on the motor drive PCB inside the control box.

LED	Signal function	Function
D1	Drive active	On
D15	Brake released	On
D16	Up	Off
D17	Down	Off



THC Power Supply

The following connections are located on the power supply board located inside the control box. See figure and table below. See control box figure on previous page for location.



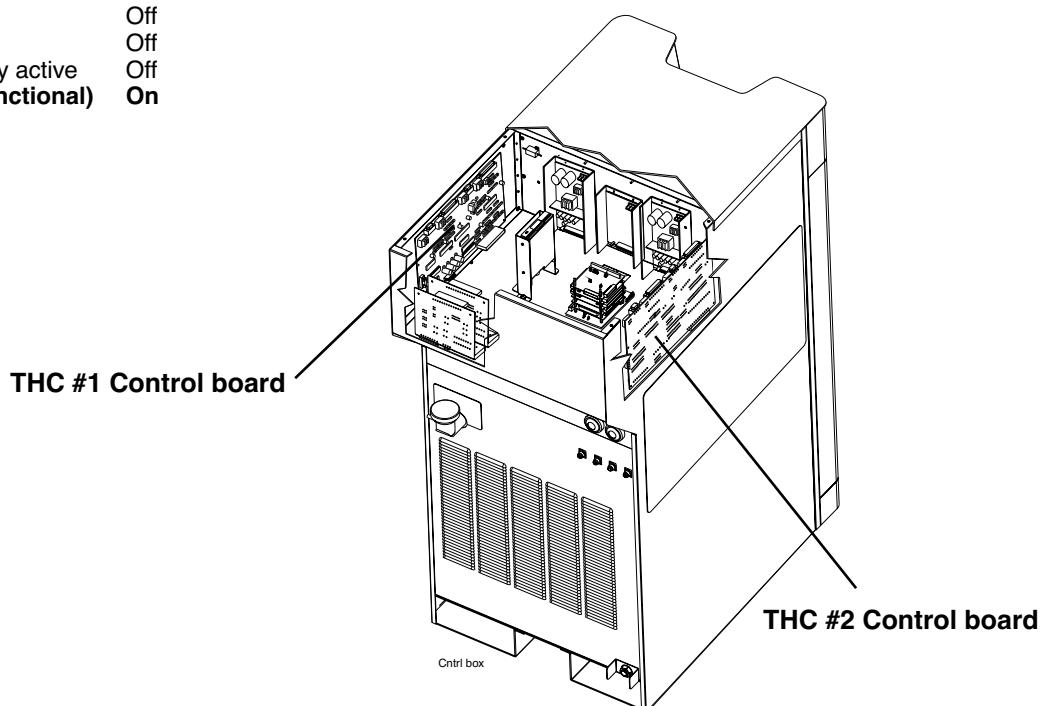
DC Power, LEDs and Test Points

DC Power	Wire Color	Wire Connection Points/LEDs and Test Points		
		Power Supply PCB DC Power Out	Motor Drive PCB DC Power In	Control PCB DC Power In
+ 12 VDC Common	Blue White	TB2-1 TB2-3		J8-3/D43 & TP6 J8-4/D42 & TP5
+ 12 VDC Common	Blue White	TB2-2 TB2-4	J1-3/TP4 J1-4/TP2	
+ 24 VDC Ground	Blue White	TB2-5 TB2-7		J8-5/D41 & TP4 J8-6/TP3 Ground
+ 24 VDC + 24 VDC Ground	Blue Blue White	TB2-6 TB2-8	J1-5/TP6 J1-6/TP5 Ground	J8-7 J8-8
Ground + 5 VDC	White Blue	TB2-11 TB2-15		J8-2 Ground J8-1/D44 & TP7
Ground + 5 VDC	White Blue	TB2-12 TB2-16	J1-2 Ground J1-1/TP1	
+ 5 VDC Ground	Blue White	TB2-13 TB2-10		Resistor 1 mounted on heatsink

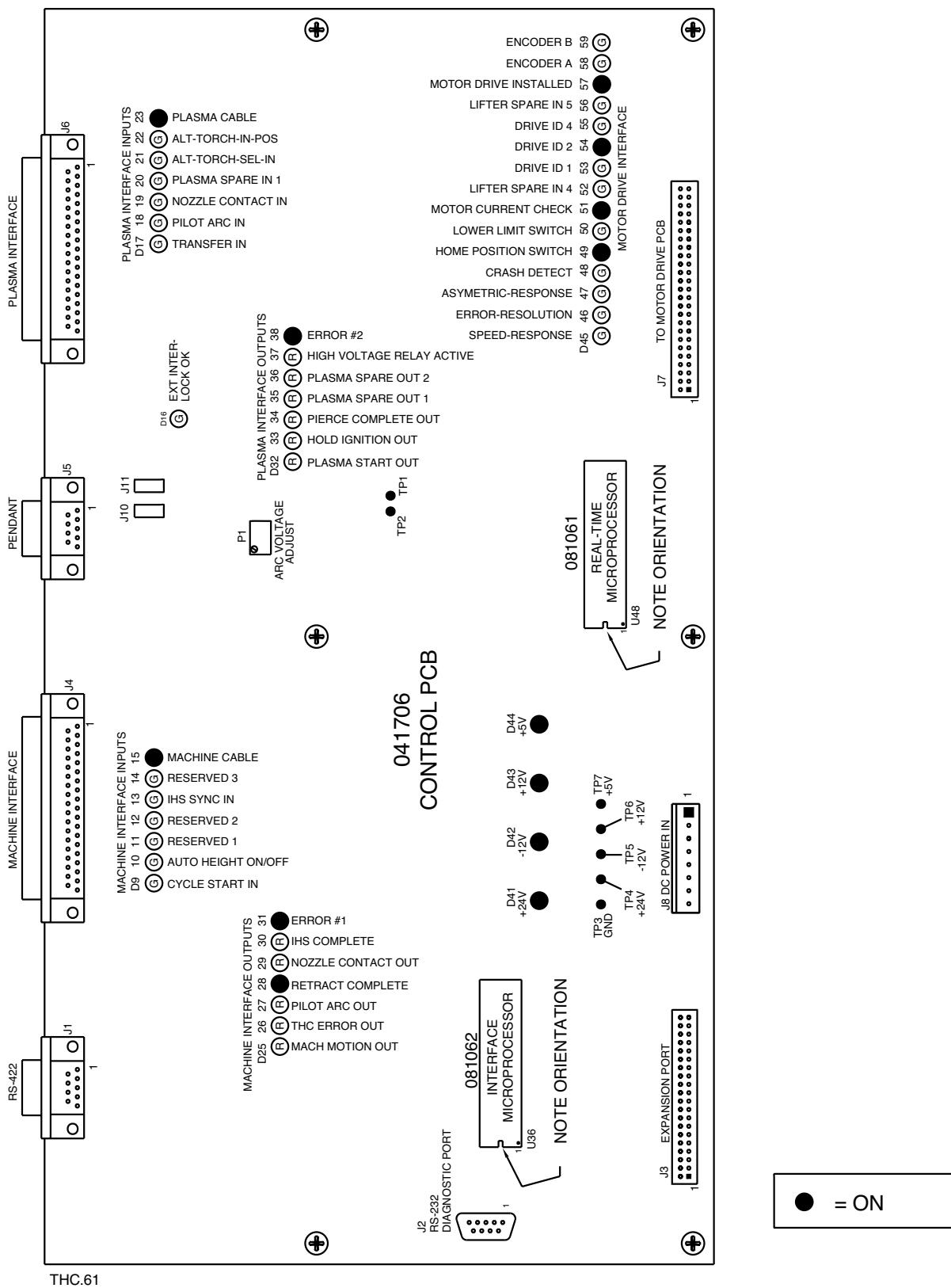
THC control board – status lights during normal power-up.

The following LEDs are located on the control board inside the control box. See figure below for location.

LED	Signal function	Status	LED	Signal function	Status
D9 – cycle start input	Off		D41 – +24v	On	
D10 – auto height on/off	Off		D42 – -12v	On	
D11 – spare input	Off		D43 – +12v	On	
D12 – spare input	Off		D44 – +5v	On	
D13 – IHS sync input	Off				
D14 – spare input	Off		D45 – response switch 1 (user-definable response)	Off	
D15 – machine cable	On		D46 – response switch 2 (user-definable response)	Off	
D17 – transfer input	Off		D47 – response switch 3 (user-definable response)	Off	
D18 – pilot arc input	Off		D48 – crash detect (future use)	Off	
D19 – nozzle contact	Off		D49 – home position		On momentarily, then Off
D20 – spare input	Off		D50 – lower limit switch	Off	
D21 – torch 1 select	Off		D51 – motor current check	On	
D22 – torch 2 select	Off		D52 – response sw4	Off	
D23 – plasma cable	On		D53 – drive ID 1	Off	
D25 – machine motion output	Off		D54 – drive ID 2	On	
D26 – THC error out	Off, (On if there is error)		D55 – drive ID 4	Off	
D27 – pilot arc output	Off		D56 – spare input	Off	
D28 – retract complete	On		D57 – motor drive installed	On	
D29 – spare out	Off		D58 – encoder A	On or Off	
D30 – IHS complete	Off		D59 – encoder B	On or Off	
D31 – error #1 (Not functional)	On				
D32 – plasma start output	Off				
D33 – hold ignition output	Off				
D34 – pierce complete out	Off				
D35 – spare out	Off				
D36 – spare out	Off				
D37 – high voltage relay active	Off				
D38 – error #2 (Not functional)	On				



MAINTENANCE



Preventive maintenance

Introduction

Deteriorating consumable parts life is one of the first indications that something is wrong with a plasma system. Reduced parts life increases operating costs in two ways: the operator must use more electrodes and nozzles to cut the same amount of metal, and the work of cutting must stop more often to change consumables.

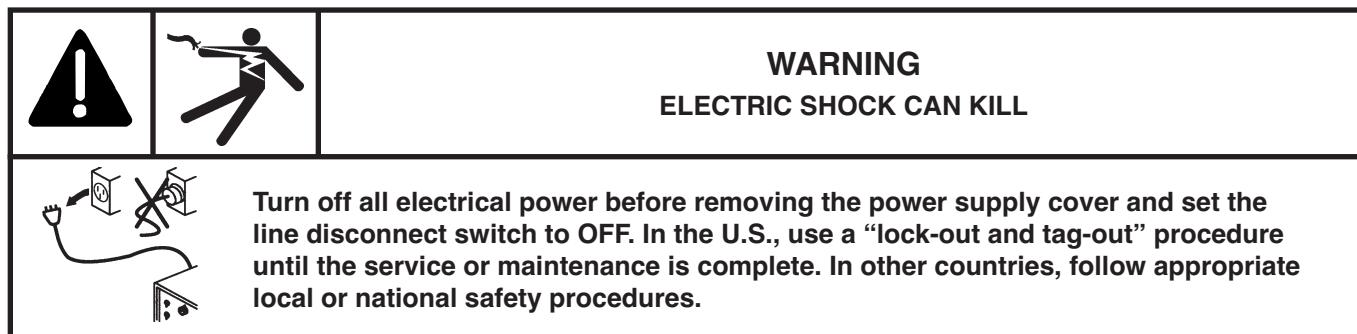
Proper maintenance often eliminates the problems that shorten the life of consumable parts. Since labor and overhead can account for 80% of the cost of cutting, improved productivity can reduce cutting costs dramatically.

Preventive maintenance protocol

The following protocol covers the basic elements of all Hypertherm HyPerformance plasma systems.

If inspection suggests that a component is worn and might require replacement, and you would like confirmation of your decision, please contact Hypertherm's Technical Service department.

The power supply



1. With power to the power supply turned off, remove all side panels. Use compressed air to blow out any accumulation of dust and particulates.
2. Inspect wiring harnesses and connections for wear, damage or loose connections. If you see any discoloration that might indicate overheating, contact Hypertherm Technical Service.
3. Inspect the main contactor for excessive pitting on the contacts, characterized by a blackened, rough surface on any of the contacts. If this condition exists, replacement is recommended.
4. Inspect the pilot arc relay (CR1) for excessive pitting on the contacts, characterized by a roughened, black surface. Replace if necessary.

Cooling system

5. Inspect the coolant-circulating system's filter element at the rear of the power supply. If the filter is a brownish color, replace it. Consult the *Parts List* in this manual for part numbers.
6. Perform a coolant flow test as described in this manual, then check for coolant leaks. Primary locations to inspect are these:
 - A. The back of the power supply;
 - B. At the ignition console, and;
 - C. At the torch main body.

Also, check the coolant tank for dirt and particulates. Verify that proper Hypertherm coolant is being used. Proper Hypertherm coolant (028872) is a red liquid.

Torch main body

7. Verify that the water tube is straight and has no pitting on the end.
8. Inspect the current ring inside the torch main body. The current ring should be smooth and not pitted. If no pitting is observed, clean the current ring with a clean cotton swab and hydrogen peroxide. Do not use alcohol. Pitting on the current ring generally indicates improper maintenance (i.e. lack of regular cleaning).
9. Clean all threads on the front end of the torch head with hydrogen peroxide and a cotton swab, pipe cleaner or clean cloth. Do not use alcohol. Damage to the threads usually results from not cleaning the torch and retaining cap threads properly, so that dirt and particulates accumulate in the threads.
10. Inspect the torch insulator for cracks. Replace the torch if you find cracks.
11. Inspect all o-rings on the torch body and consumables. Make sure that the correct amount of lubricant – a thin film – is applied to these o-rings. Too much lubricant may obstruct gas flows.
12. Check that the retaining or shield cap is tightened securely to the torch main body.
13. Inspect all hose fittings at the rear of the torch for wear. Damage to the fitting threads may indicate that overtightening has occurred.
14. Check that all connections between the torch and torch leads are tight, but do not overtighten. See torque specs in the *Installation* section of this manual.

When removing consumables, always place them on a clean, dry, oil-free surface, since dirty consumables may cause the torch to malfunction.

Gas flows

15. Check each gas line from the gas supply, as follows:
 - A. Remove and plug the inlet gas fitting at the gas console.
 - B. Pressurize the gas line to 8 bar (115 psi).
 - C. Close the gas supply valve at the source. Watch for a pressure drop. If the gas supply line is a hose, there may be a 0.3 to 0.5 bar (5 to 7 psi) drop due to hose-stretch.
 - D. Repeat for each line from a gas supply source. If any pressure continues to drop, find the leak within the system.

16. If the gas line pressures hold steady, perform a system gas leak test as specified in this manual.
17. Check for hose restrictions, as follows:
 - A. Check all hoses to verify that they have no kinks or sharp bends, which can restrict gas flow.
 - B. If the cutting table uses a power track system to support leads from the power supply to the gas console or torch, check the position of the leads in the power track to ensure the leads do not twist or kink, causing a possible restriction.

Cable connections

18. All cables should be checked for chafing or unusual wear. If the outside insulation has been cut or otherwise damaged, replace the cable.

Ignition console

19. Open the cover and use compressed air to blow out any accumulation of dust and particulates. If moisture is present, dry the inside of the console with a cloth and try to identify the source of the moisture.
20. Inspect the spark gap assembly. Ensure that the wiring connections to the spark gap assembly are secure. Check that the console doors close properly.
21. Inspect the torch leads. Ensure that they are fastened tightly to the outside of the ignition console.

System grounding

22. Verify that all components of the system are individually grounded to a driven earth ground, as described in the *Installation* and *Grounding* sections of this manual.
 - A. All metal enclosures, such as the power supply, ignition console and selection console, should be connected individually to a ground point. These connections should be made with 10 mm² (#8 AWG) wire (USA), or equivalent-size wire.
23. Check the work lead (+) connection, particularly where the work lead (+) connects to the cutting table. This must be a good, clean connection because a poor connection may cause arc-transfer problems.
24. Complete the Preventive Maintenance worksheet on the next page, for future reference.

MAINTENANCE

Preventive Maintenance Master Schedule

Daily:

- Verify proper inlet gas pressure.
- Verify proper gas flow settings. – Mandatory at every consumable change.
- Inspect torch and replace consumables as needed.

Weekly:

Week	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1												
2												
3												
4												
5												

- Clean power supply with dry, oil free compressed air or vacuum.
- Verify cooling fans are working properly.
- Clean torch threads and current ring.
- Verify proper coolant level.

Bi-Annually:

Year	1 st Service	2 nd Service

- Replace service parts per the Service Part Replacement Schedule.

Annually:

Year									

- Replace service parts per the Service Part Replacement Schedule.

Preventive Maintenance Protocol Checklist

Customer: _____

Location: _____

Contact: _____

Date: _____

Hypertherm system: _____

System serial #: _____

System arc hours: _____

(if equipped with an hour meter)

Comments *P* – Performed *NP* – Not present on system

Power supply

- P* *NP* 1. Inspect for particulates and blow out
- P* *NP* 2. Inspect wiring harnesses
- P* *NP* 3. Inspect main contactor
- P* *NP* 4. Inspect pilot arc relay

Coolant system

- P* *NP* 5. Inspect filter element
- P* *NP* 6. Perform coolant flow test
 - A. Coolant flow checked at _____ gallons per minute (_____ l/min)

Torch main body

- P* *NP* 7. Inspect water tube
- P* *NP* 8. Inspect current ring
- P* *NP* 9. Clean threads on torch front end
- P* *NP* 10. Inspect Vespel torch insulator
- P* *NP* 11. Inspect torch and consumable o-rings
- P* *NP* 12. Verify proper fit of retaining or shield cap
- P* *NP* 13. Inspect hose fittings
- P* *NP* 14. Inspect torch-to-torch-lead connections

Gas flows

- P* *NP* 15. Inspect plumbing from gas supply
 - A. Oxygen
 - B. Nitrogen
 - C. Air
 - D. Nitrogen-Hydrogen
 - E. Argon-Hydrogen
 - F. Inspect compressed air filter system

Gas flows (cont.)

- P* *NP* 16. Perform gas leak test
 - A. Oxygen pressure drop at _____ psi in 10 minutes (_____ bar)
 - B. Nitrogen pressure drop at _____ psi in 10 minutes (_____ bar)
- P* *NP* 17. Inspect for hose restrictions
 - A. Metering console hoses
 - B. Selection console to Metering console
 - C. Metering console to torch
 - D. Hoses in power track

Cable connections

- P* *NP* 18. Inspect cables
 - A. CommandTHC
 - B. Control cable from metering console to selection console
 - C. From Metering console to power supply
 - D. From ignition console and selection console to power supply

Ignition console

- P* *NP* 19. Inspect for moisture, dust and particulates
- P* *NP* 20. Inspect spark gap subassembly
- P* *NP* 21. Inspect torch leads

System grounding

- P* *NP* 22. Inspect for proper system component grounding
- P* *NP* 23. Inspect connection from cutting table to workpiece (+) lead

General comments and recommendations:

Preventive maintenance performed by: _____ Date: _____

HPR HD4070 Parts Replacement Schedule

Timeline	Component	Part number	Qty.
6 months or 300 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch bullet kit	128654	1
	O-ring	058224	1
	O-ring	044028	2
	O-ring	044030	1
1 Year or 600 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch main body	220162	1
	Main contactor	003201	1
	Pilot arc relay	003149	1
1.5 Years or 900 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch bullet kit	128654	1
	O-ring	058224	1
	O-ring	044028	2
	O-ring	044030	1
2 Years or 1200 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Main contactor	003201	1
	Pilot arc relay	003149	1
	Torch main body	220162	1
	Coolant pump	System dependent	1
	Torch leads	System dependent	1
2.5 Years or 1500 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch bullet kit	128654	1
	O-ring	058224	1
	O-ring	044028	2
	O-ring	044030	1
3 Years or 1800 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch main body	220162	1
	Off-valve assembly	129563	1
	Cooling fan	027080	2
	Cooling fan	129634	1
3.5 Years or 2100 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch bullet kit	128654	1
	O-ring	058224	1
	O-ring	044028	2
	O-ring	044030	1
4 Years or 2400 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Main contactor	003201	1
	Torch main body	220162	1
	Pilot arc relay	003149	1
	Coolant pump	System dependent	1
	Torch leads	System dependent	1

HPR HD4070 Parts Replacement Schedule

Timeline	Component	Part number	Qty.
4.5 Years or 2700 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch bullet kit	128654	1
	O-ring	058224	1
	O-ring	044028	2
	O-ring	044030	1
5 Years or 3000 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch main body	220162	1
	Power distribution board	041610	1
	Pilot arc lead	System dependent	1
	Gas leads	System dependent	1
5.5 Years or 3300 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch bullet kit	128654	1
	O-ring	058224	1
	O-ring	044028	2
	O-ring	044030	1
6.0 Years or 3600 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Main contactor	003201	1
	Torch main body	220162	1
	Pilot arc relay	003149	1
	Coolant pump	System dependent	1
	Torch leads	System dependent	1
	Off-valve assembly	129563	1
	Cooling fan	027080	2
	Cooling fan	129634	1
6.5 Years or 3900 arc hrs.	Repeat schedule starting at 6 months or 300 arc hrs.		

Section 6**PARTS LIST**

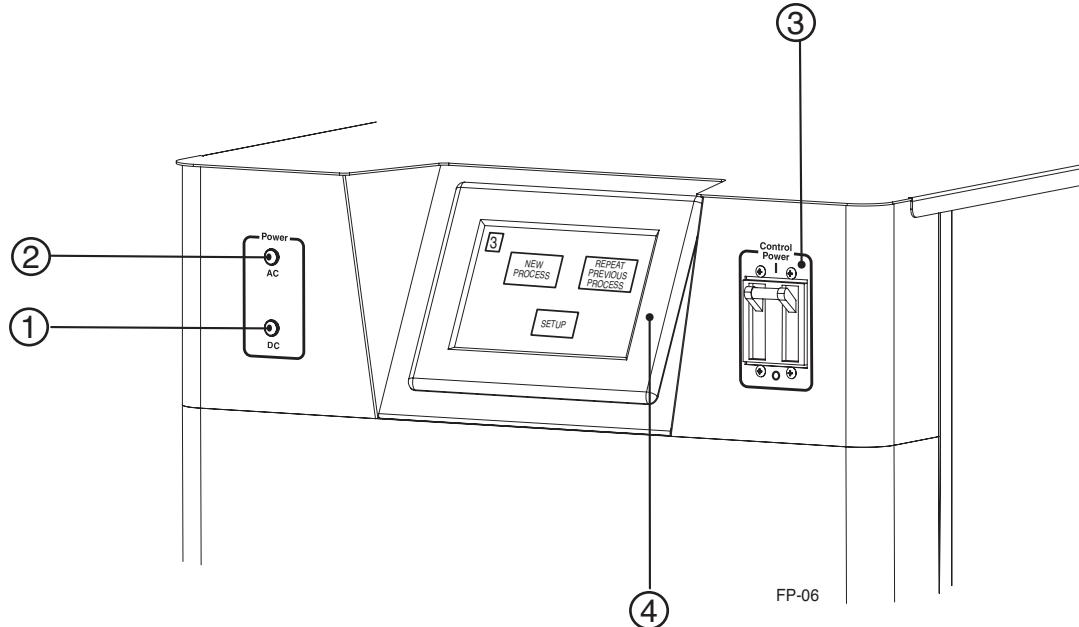
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PARTS LIST

Power supply

Front panel outside



Warning: The HD4070 system can only support 1 touch screen display, either local or remote. The installation of 2 displays on 1 system may cause malfunctions or damage.

Item	Part number	Description	Designator	Qty.
1	129632	White DC Power Light		1
2	129633	Green AC Power Light		1
3	003209	Circuit Breaker: 7.5 Amp (400/440/480 & 600V units)		1
	003210	Circuit Breaker: 15 Amp (200/220/240V units)	CB1	1
4	229098*	Touch Screen Display		1
	128535-128543**	Remote Cable Kits		1
	128526-128534***	Remote Display Kits		1

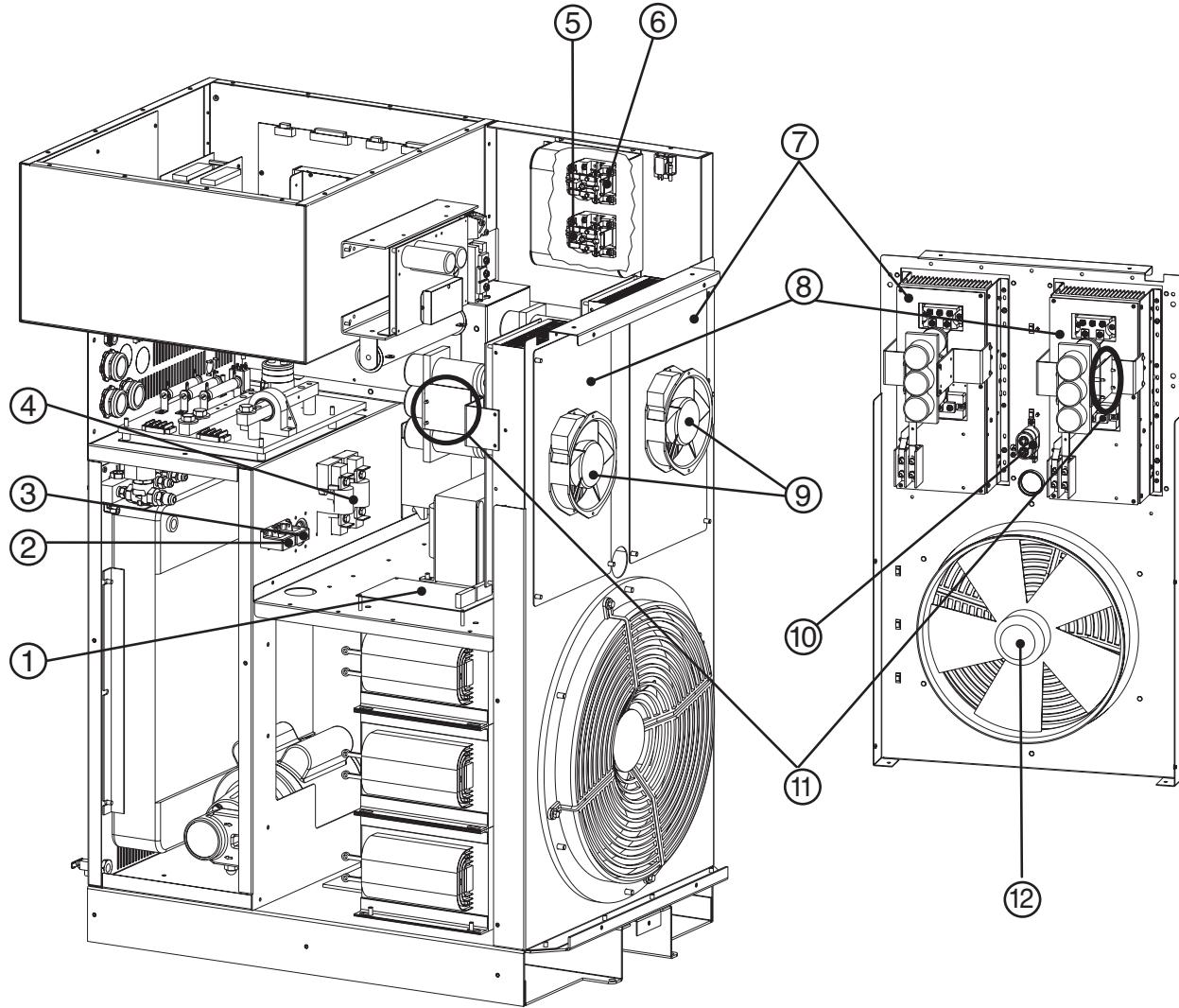
* Replacement part number if your power supply came with a display installed.

** For removal of installed display and installation at a remote location.

*** For display installation at a remote location if your power supply came with no display installed.
Display provided in kit.

Kit no.	Cable no.	Length**
128535	123481	3 m (10 ft)
128536	123482	6 m (20 ft)
128537	123018	7.5 m (25 ft)
128538	123484	9 m (30 ft)
128539	123485	12 m (40 ft)
128540	123019	15 m (50 ft)
128541	123487	23 m (75 ft)
128542	123488	30.5 m (100 ft)
128543	123489	46 m (150 ft)

Kit No.	Cable No.	Length***
128526	123481	3 m (10 ft)
128527	123482	6 m (20 ft)
128528	123018	7.5 m (25 ft)
128529	123484	9 m (30 ft)
128530	123485	12 m (40 ft)
128531	123019	15 m (50 ft)
128532	123487	23 m (75 ft)
128533	123488	30.5 m (100 ft)
128534	123489	46 m (150 ft)

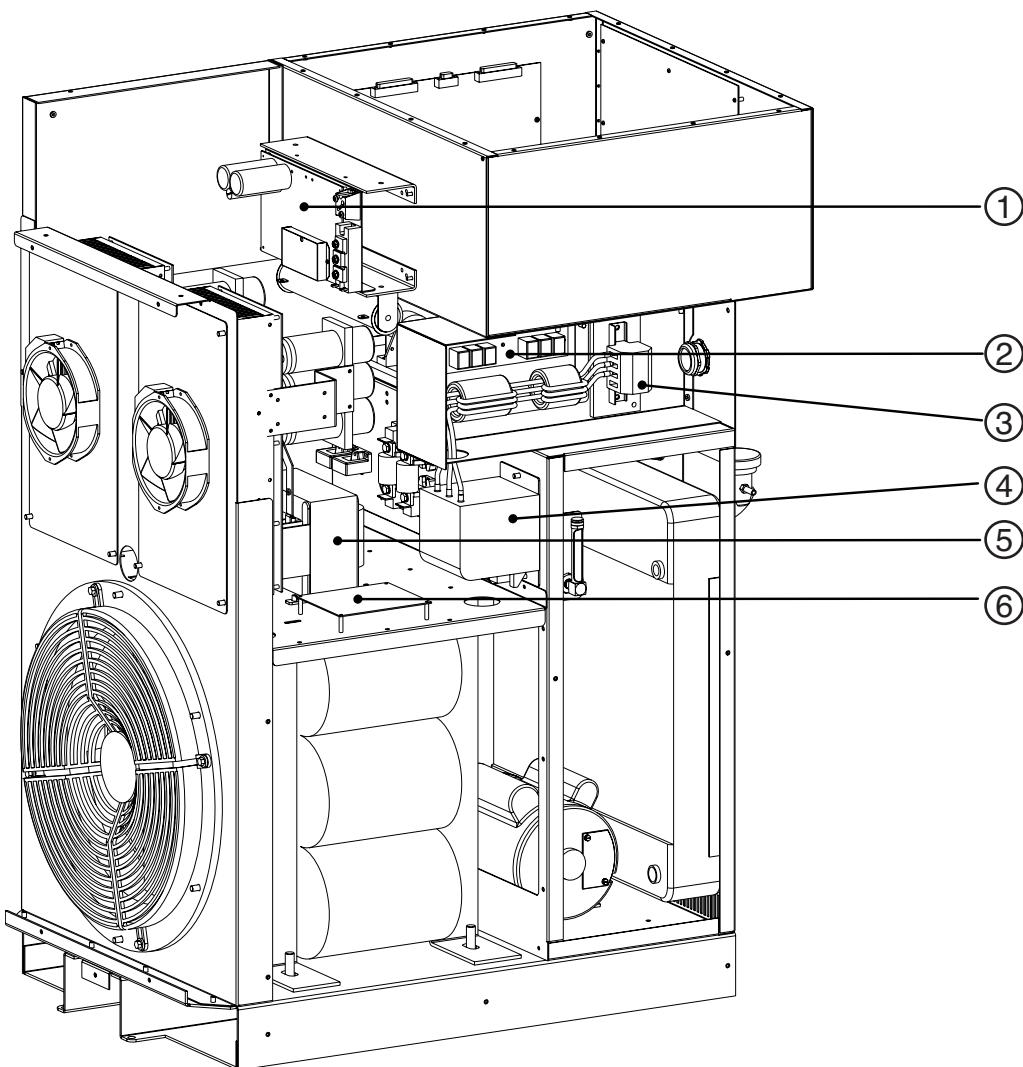
Power supply**Left side interior**

Item	Part number	Description	Designator	Qty.
1	041605 108075	Control Board Fuse: 6A 250V	PCB3	1 1
2	109004	Current Sensor	CS2	1
3	109004	Current Sensor	CS1	1
4	008317	125Amp Fuse	F1,F2	2
5	003149	Relay 120VAC		1
6	003149	Relay 120VAC		1
7	129568	20kW Chopper with Fan	CH1	1
8	129568	20kW Chopper with Fan	CH2	1
9	027080	Chopper Fan	FAN1, FAN2	2
10	109207	Fan Run Capacitor		1
11	041564	Phase Loss Detection PCB	PCB1	1
12	129634	Main Fan: 2910CFM 240V 240W		1

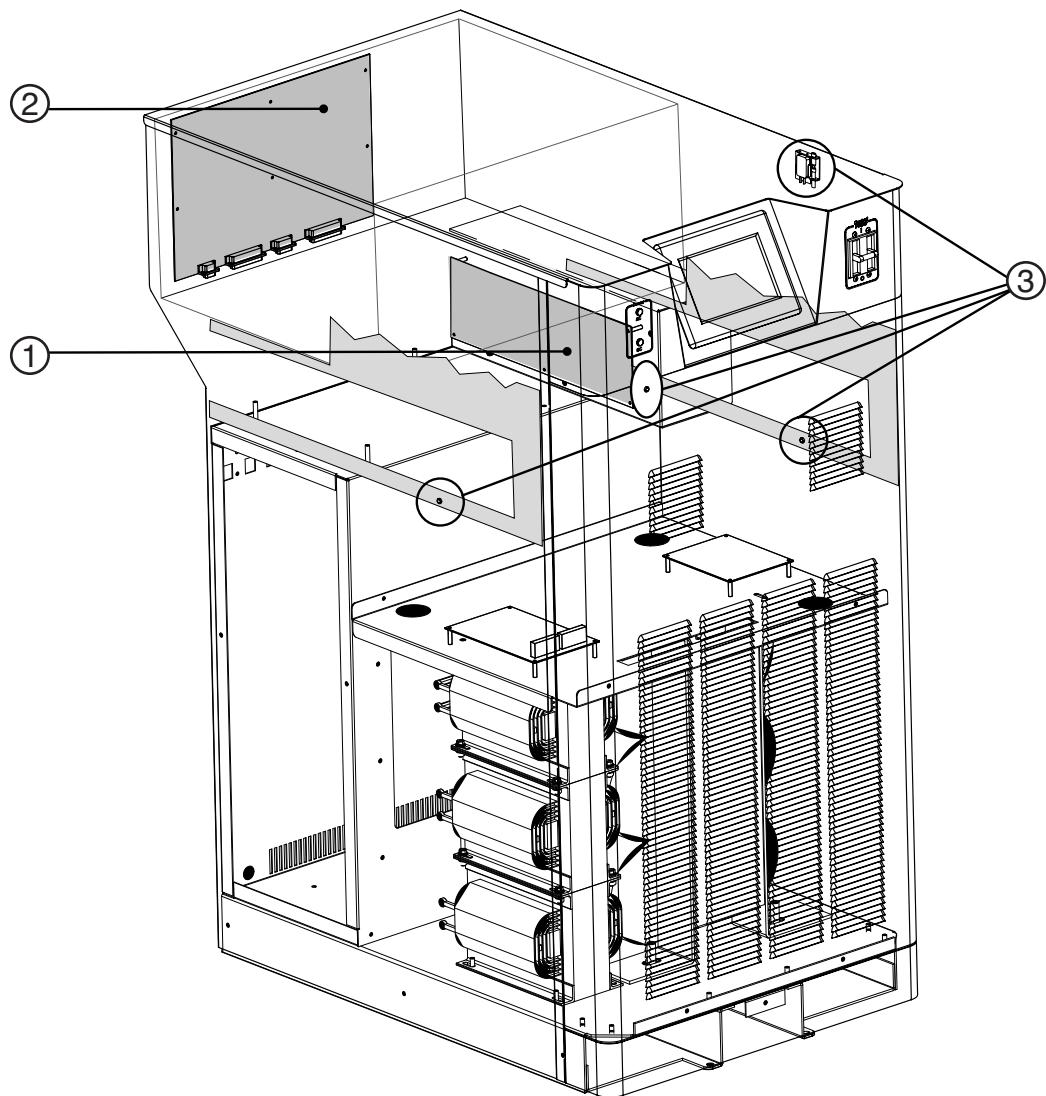
PARTS LIST

Power supply

Right side interior



Item	Part number	Description	Designator	Qty.
1	129264	Start Circuit Board Assembly	PCB2	1
2	129631	Power Input Filter	EMI Filter	1
3	029316	Input Power Block	TB1	1
4	003201	Main Contactor	CON1	1
5	129624	Control Transformer: 200 Volt	T2	1
	129626	Control Transformer: 220 Volt	T2	1
	129622	Control Transformer: 240 Volt	T2	1
	129623	Control Transformer: 400 Volt	T2	1
	129625	Control Transformer: 440 Volt	T2	1
	129621	Control Transformer: 480 Volt	T2	1
	129627	Control Transformer: 600 Volt	T2	1
6	041610	Power Distribution Board	PCB4	1
	108075	Fuse: 6A 250V		3

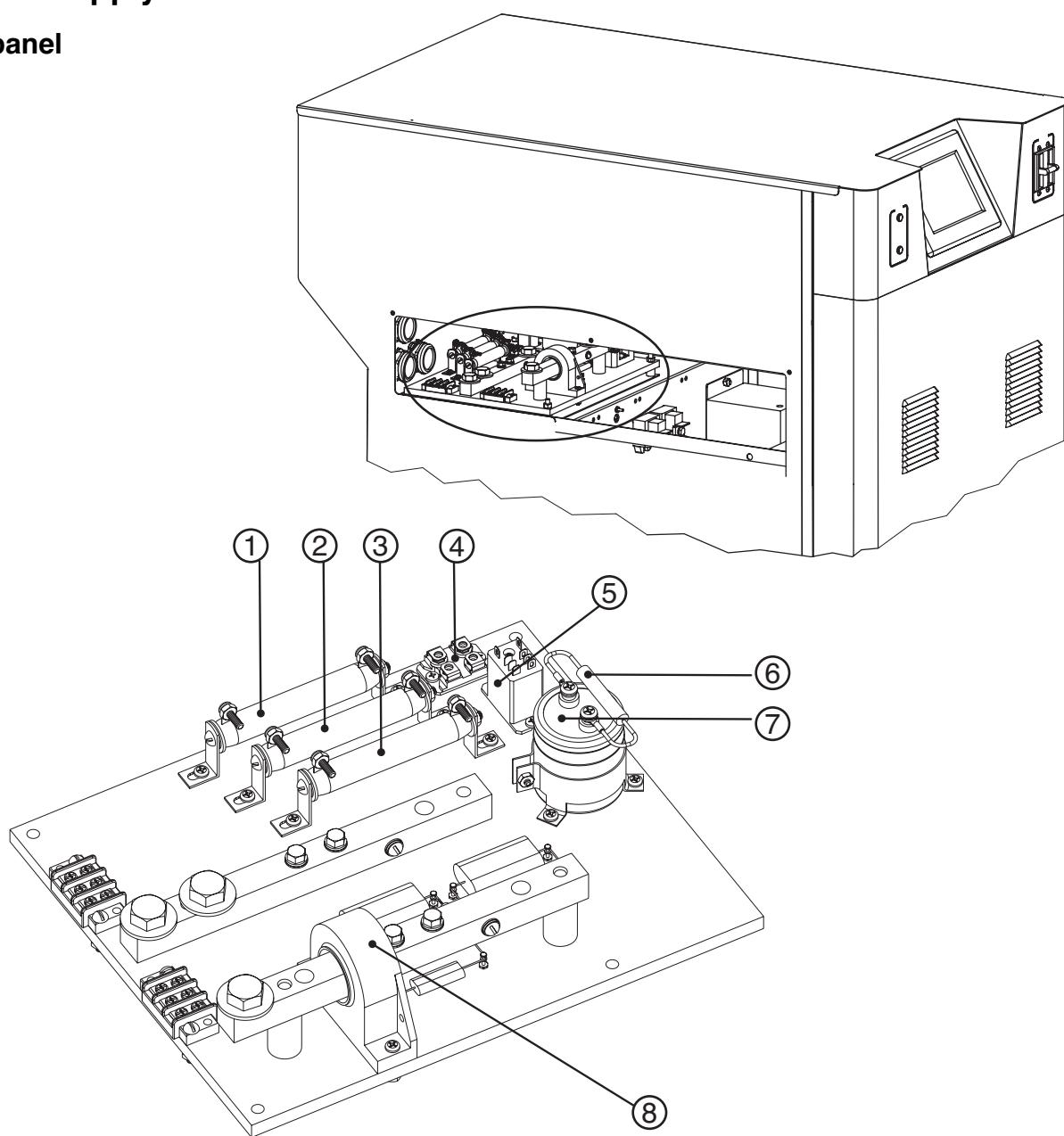
Power supply**PC boards and interlock switches**

<u>Item</u>	<u>Part number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	041616	Plasma Interface Board	PCB5	1
	108075	Fuse: 6A 250V		2
2	041613	Breakout Board	PCB6	1
3	005100	Door Limit Switch		4

PARTS LIST

Power supply

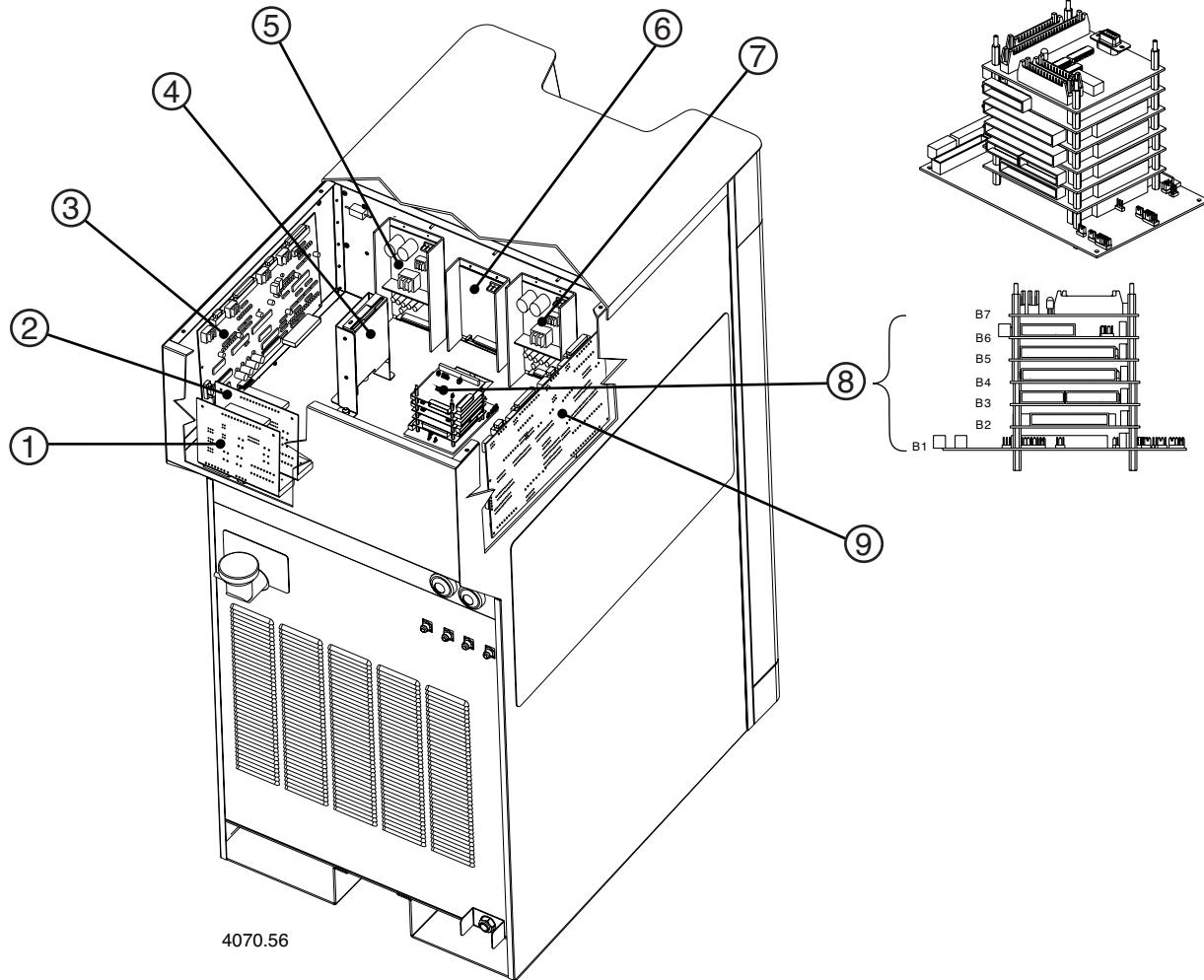
I/O panel



Item	Part number	Description	Designator	Qty.
1	009622	Resistor: 10-OHM 50W	R-4	1
2	009827	Resistor: 100-OHM 50W	R-3	1
3	109205	Resistor: 20-OHM 50W	R-2	1
4	109204	Diode:600V 30A Dual		1
5	003142	Relay:120VAC		1
6	009015	Resistor: 10K-OHM 10W		1
7	009912	Capacitor: 350 μ f 450WV	R-1	1
8	109201	Current Sensor: Hall 500A = 4V	C-1	1

Power supply

Control box: shown with parts for 2-THC option

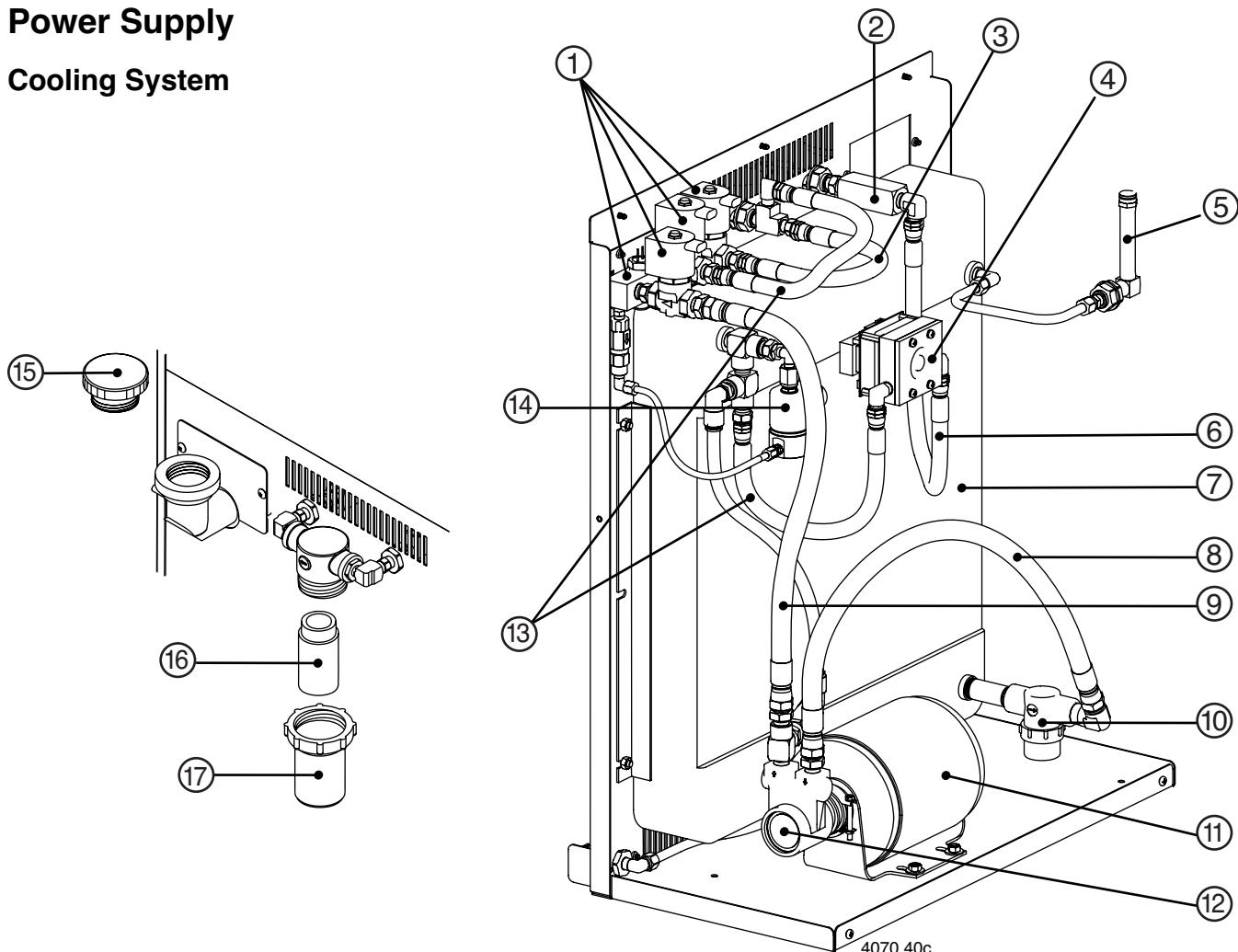


Item	Part number	Description	Designator	Qty.
1	041511	THC Motor Drive PCB	THC1	1
2	041511	THC Motor Drive PCB	THC2	1
3	128407	THC Control Board Replacement Kit	THC1	1
4	027647	Floppy Drive		1
5	229069	THC Power Supply	THC1	1
6	041626	Power Supply CPU		1
7	041509	THC Power Supply	THC2	1
8	041920	HPR: PC-104		
	041620	Board 1: HD4070 CPU		1
	041921	Board 2: HPR, HD4070 IDE Flash		1
	041622	Board 3: HD4070 Dual Serial		1
	041623	Board 4: HD4070 48ChanDigital I/O		2
	041623	Board 5: HD4070 48ChanDigital I/O		1
	041624	Board 6: HD4070 Anlg/Digital		1
	041687	Board 7: PC-104 Test		1
9	128407	THC Control Board Replacement Kit	THC2	1

PARTS LIST

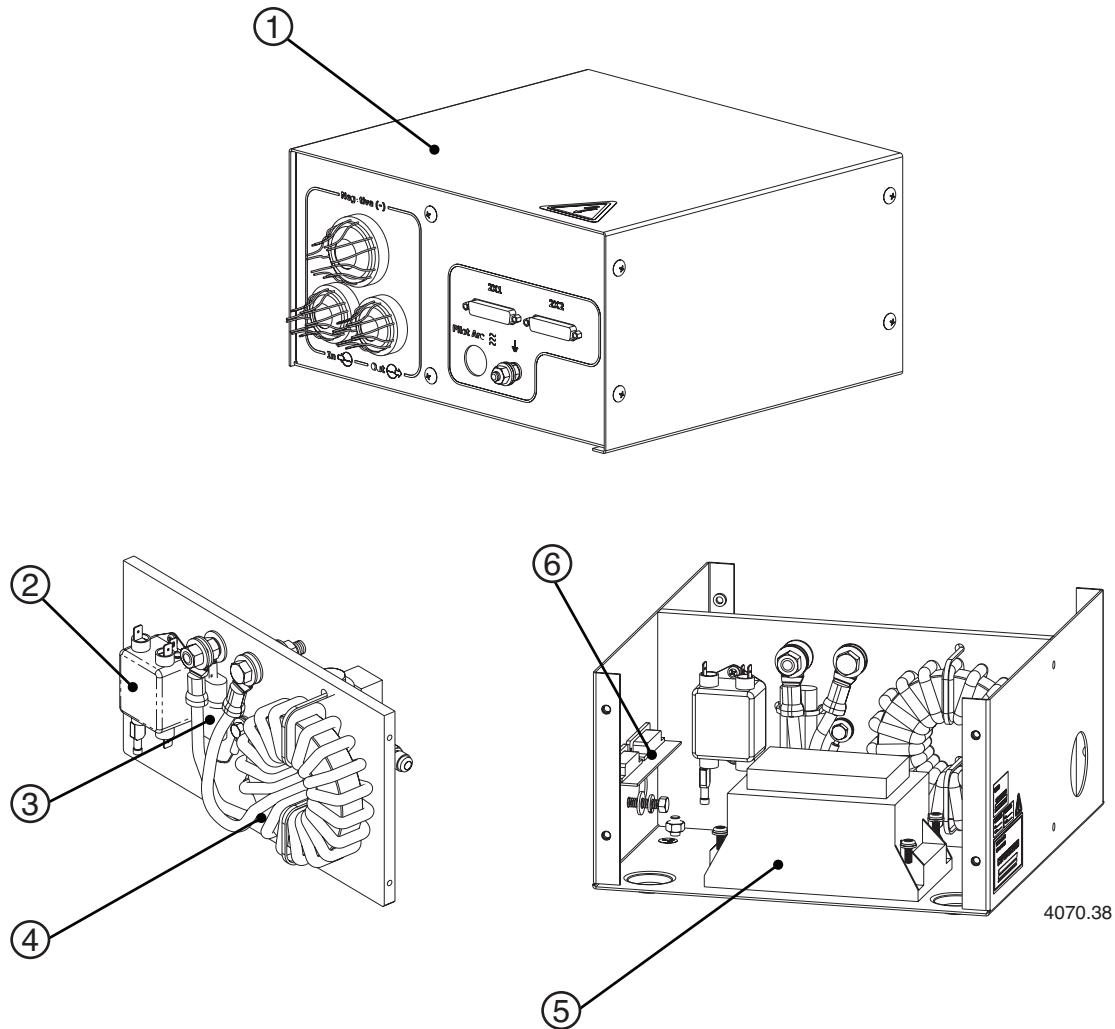
Power Supply

Cooling System



<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
1	129485	Solenoid Valve SA W/ Temp Switch	TMP1 SV1, SV2, SV3	1
2	006113	Check Valve: 3/8 FTP	CHV5	1
3	024538	Hose assembly: 3/8, Blue, 10 Inches		1
4	129620	Flow Switch Assembly	FS1	1
5	011084	Sight Glass 1/4 NPT		1
6	024090	Hose assembly: 3/8, Blue, 20 Inches		1
7	027632	Radiator		1
8	024601	Hose assembly: 1/2, Black, 23 Inches		1
9	024749	Hose assembly: 1/2, Blue, 25 Inches		1
10	128714	Kit: Low Profile Filter		1
	027927	Filter Element		1
11	031113	Motor		1
12	031138	Pump		1
	128968	Kit: Coolant System Upgrade		1
13	024606	Hose assembly: 3/8, Blue, 12 Inches		2
14	128936	Kit: Coolant By-Pass		1
15	004598	Coolant Reservoir Cap		1
16	027664	Filter Element		1
17	027634	Filter Housing		1

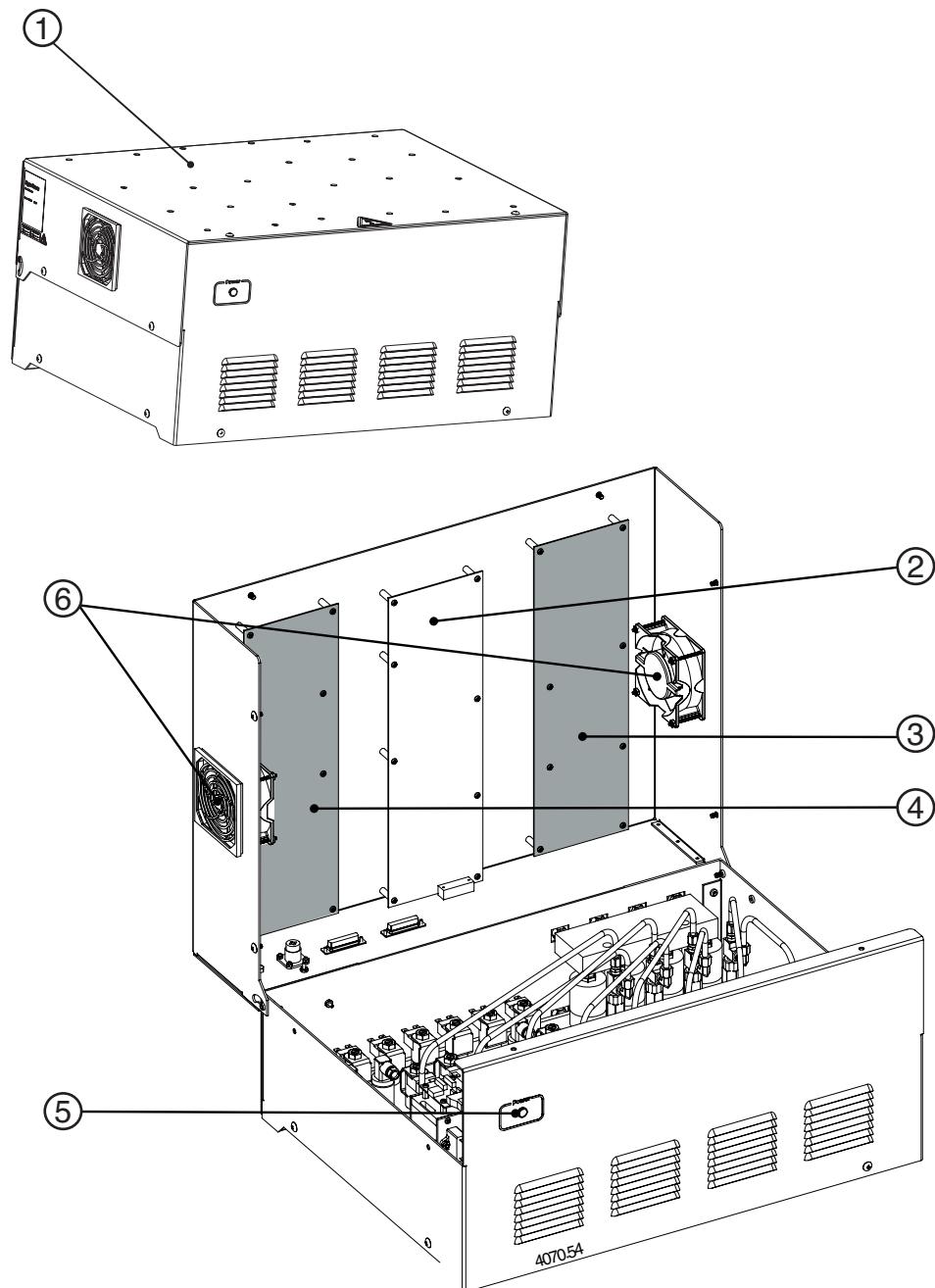
Ignition console



Item	<u>Part number</u>	Description	Designator	Qty.
1	078088	Ignition Console		
2	009040	Filter: 3A, 3W	FL1	1
3	128510	Kit: Filter Capacitor Replacement	C1	1
4	129616	Inductor: Ignition Console	L2	1
5	027648	Ignition Module		1
6	041619	PCB Assembly: Ignition Console Interface		1

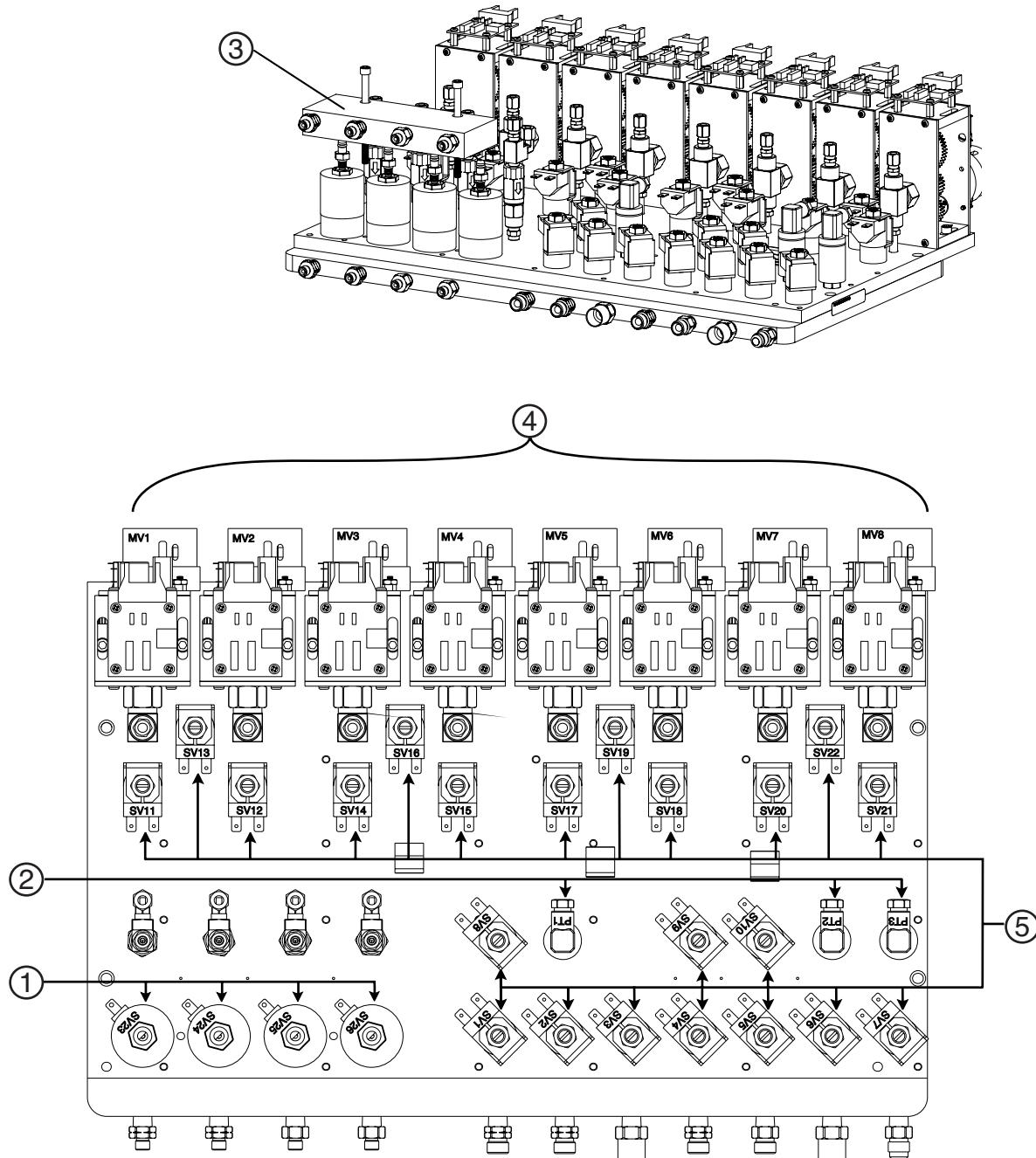
PARTS LIST

Gas console – 1 of 2



Item	Part number	Description	Designator	Qty.
1	078085	Gas Console		
2	041657	Control Board	PCB2	1
3	041594	Relay Board	PCB1	1
4	041594	Relay Board	PCB3	1
5	129633	Green Power Light		1
6	129629	Ventilation Fan		2

Gas console – 2 of 2

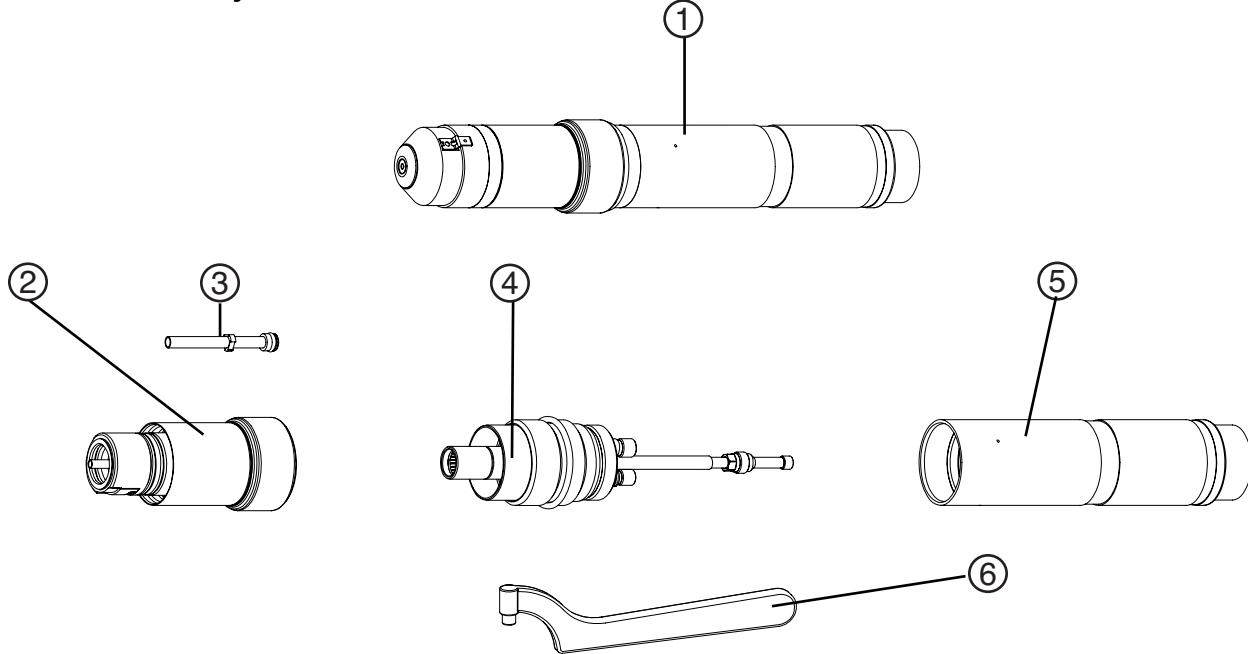


Item	Part number	Description	Designator	Qty.
1	006117	Output Solenoid Valves	SV23,24,25,26	4
2	129496	Pressure Transducers	PT1,2,3	3
3	004867	Output manifold		1
4	129546	Motor Valve Subassemblies	MV1,2,3,4,5,6,7,8,	8
5	006109	Small Solenoid Valves	SV1 Thru SV22	22

PARTS LIST

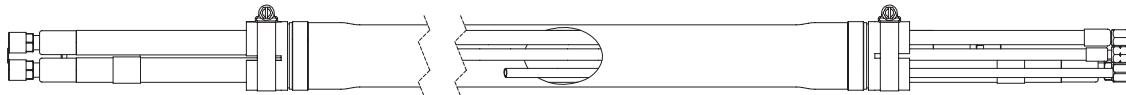
HyPerformance torch

Torch assembly



<u>Item</u>	<u>Part Number</u>	<u>Description</u>
1	228048	HPR machine torch with extended sleeve
2	220162	Quick-disconnect torch
3	220340	Water tube
4	220163	Quick-disconnect receptacle
5	220516	Torch mounting sleeve: HPR extended
6	104269 128879 128880	2" spanner wrench Torch kit: bullet plugs, o-rings, water tube and seal Quick disconnect kit: o-ring and connector

Torch leads



<u>Part number</u>	<u>Description</u>
128890	1.8 m (6')
128891	3.0 m (10')
128892	4.5 m (15') leads

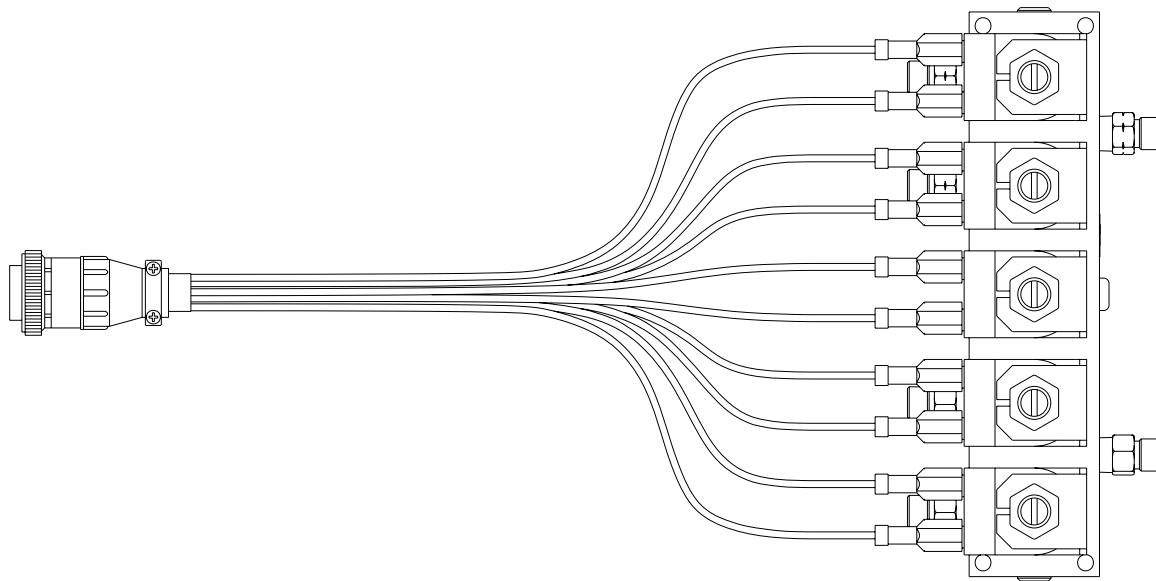
Consumable parts kit

Part number	Description	Qty.
128946	Consumable Parts Kit	
001579	Box: Gray Plastic	2
104119	HPR Consumable Tool	1
120025	Water Tube	1
026009	O-ring, .208 x .070	5
044028	O-ring, 1.364 x .070	2
027012	Lubricant: Silicon 2-Oz Tube	1
220173	Shield Retaining Cap with IHS Tab	1
220176	Nozzle Retaining Cap	2
220179	Swirl Ring: 130 Amp Mild Steel	1
220180	Swirl Ring: 30 Amp Mild Steel	1
220181	Electrode: 130 Amp Mild Steel	2
220182	Nozzle: 130 Amp Mild Steel	2
220183	Shield: 130 Amp Mild Steel	1
220187	Electrode: 80 Amp Mild Steel	1
220188	Nozzle: 80 Amp Mild Steel	1
220189	Shield: 80 Amp Mild Steel	1
220192	Electrode: 30 Amp Mild Steel	1
220193	Nozzle: 30 Amp Mild Steel	1
220194	Shield: 30 Amp Mild Steel	1
220197	Nozzle: 130 Amp Stainless Steel	1
220198	Shield: 130 Amp Stainless Steel	1
220201	Nozzle: 45 Amp Stainless Steel	1
220202	Shield: 45 Amp Stainless Steel	1
220304	Nozzle Retaining Cap (CCW)	1
220307	Electrode: 130 Amp Stainless Steel	4
220308	Electrode: 45 Amp Stainless Steel	1
220313	Nozzle Retaining Cap: 30 Amp	1
220337	Nozzle: 80 Amp Stainless Steel	1
220338	Shield: 80 Amp Stainless Steel	1
220339	Electrode: 80 Amp Stainless Steel	1
220340	Water tube: HPR	1
220352	Electrode: 200 Amp Mild Steel	3
220353	Swirl Ring: 200 Amp Mild Steel (CW)	1
220354	Nozzle: 200 Amp Mild Steel	3
220355	Nozzle Retaining Cap: 200 Amp Mild Steel (CW)	1
220356	Shield: 200 Amp Mild Steel	1
220398	Shield Retaining Cap: 200 Amp with IHS Tab	1
220342	Swirl Ring: 200 Amp Stainless Steel	1
220343	Nozzle: 200 Amp Stainless Steel	2
220344	Nozzle Retaining Cap: 200 Amp Stainless Steel	1
220345	Shield: 200 Amp Stainless Steel	1
220346	Nozzle: 200 Amp Aluminum	1
220347	Nozzle: 200 Amp Aluminum	1
004630	Electrode Pit Depth Gauge	1

See *Consumable selection* in the *Operation* section for graphics and proper combinations of consumables.

PARTS LIST

Off-valve assembly – 129563



Recommended spare parts

Power supply

<u>Part number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
129632	White DC Power Light		1
129633	Green AC Power Light		1
027080	Chopper Fan	FAN1, FAN2	1
129568	20kW Chopper with Fan	CH1, CH2	1
008317	125A Fuse	F1, F2	2
041610	Power Distribution Board	PCB4	1
108075	Fuse: 6A 250V		3
041605	Control Board	PCB3	1
108075	Fuse: 6A 250V		1
003138	Circuit Breaker: 3-Phase	CB1	1

Ignition console

<u>Part number</u>	<u>Description</u>	<u>Designator</u>	<u>Qty.</u>
128510	Kit: Filter Capacitor Replacement		1
027648	Ignition Module		1

Recommended spare parts (continued)**Gas console**

Part number	Description	Designator	Qty.
041657	Control Board	PCB2	1
041594	Relay Board	PCB1	1

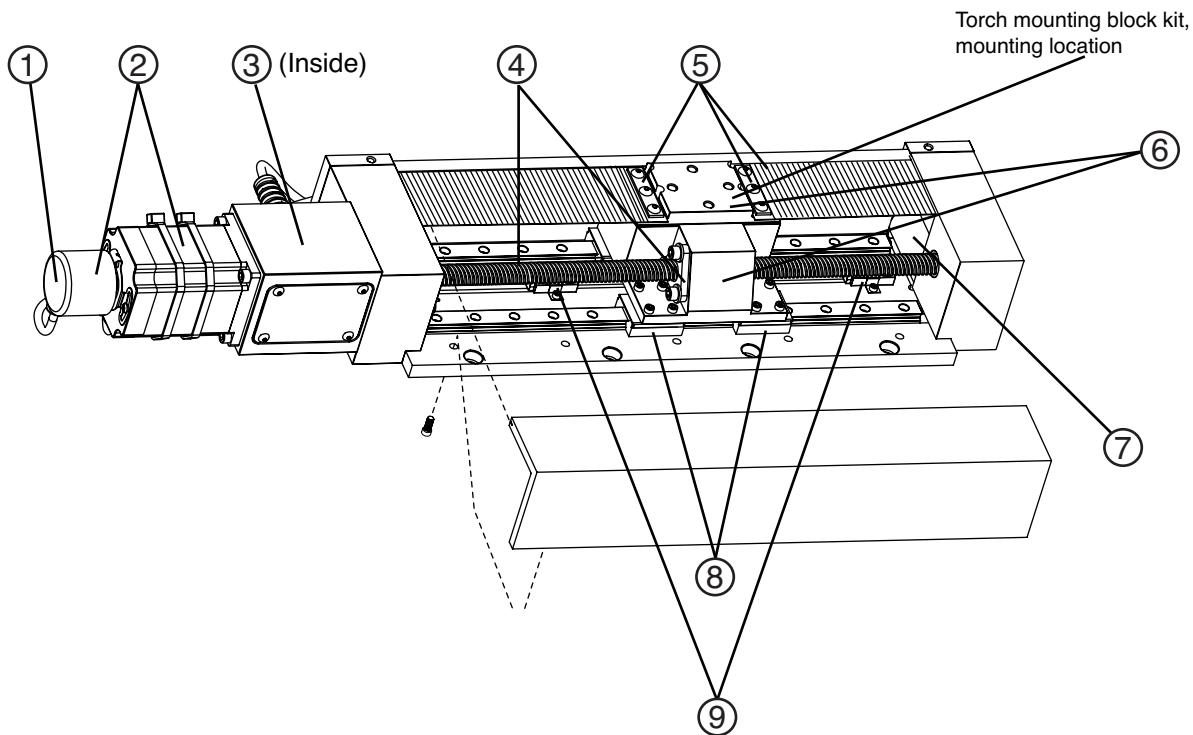
Cooling system

Part number	Description	Designator	Qty.
129485	Solenoid Valve SA with Temp Switch	TMP1 SV1, SV2, SV3	1
027664	Filter Element		1
129489	Flow Switch Assembly	FS1	1

PARTS LIST

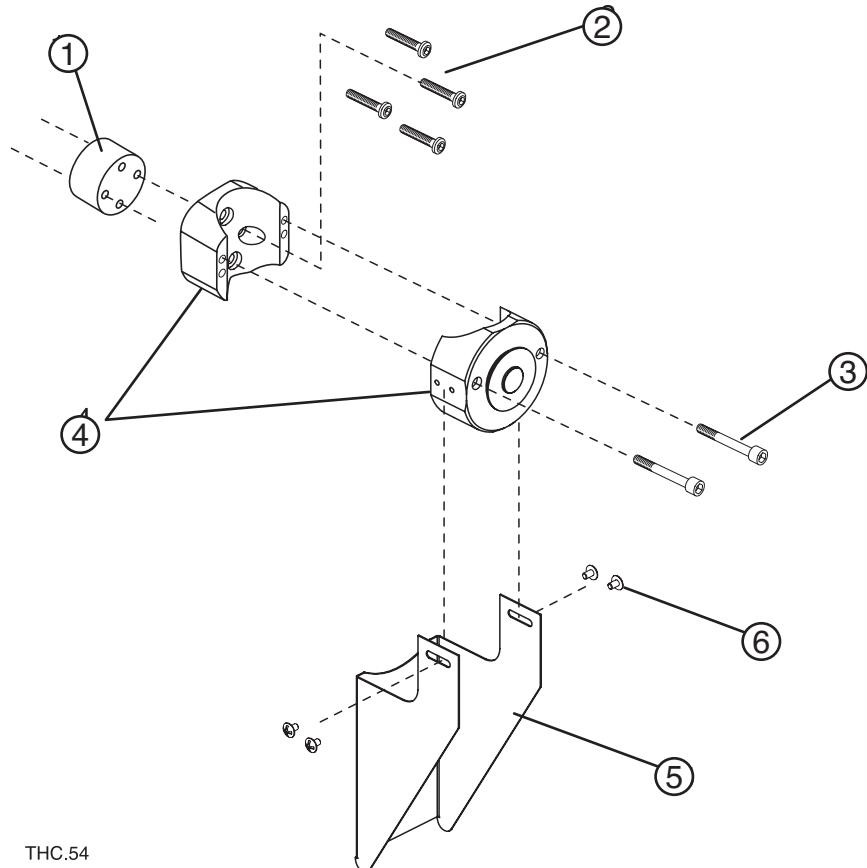
Integrated CommandTHC

X-Y lifter assembly



X-Y lifter assembly - 2 rail

<u>Index no.</u>	<u>Part no.</u>	<u>Description</u>	<u>Quantity</u>
	128606	X-Y lifter assembly	1
1	128726	Encoder replacement kit	1
2	128727	Motor/Encoder replacement kit	1
3	027550	Brake, power off	1
4	129699	Assembly, leadscrew standard	1
5	128607	Band seal kit	1
6	027903	Block, driving	1
7	128190	Band roller kit	4 per lifter
8	027904	Rail and block, bearing	4
9	005195	Limit switch	2

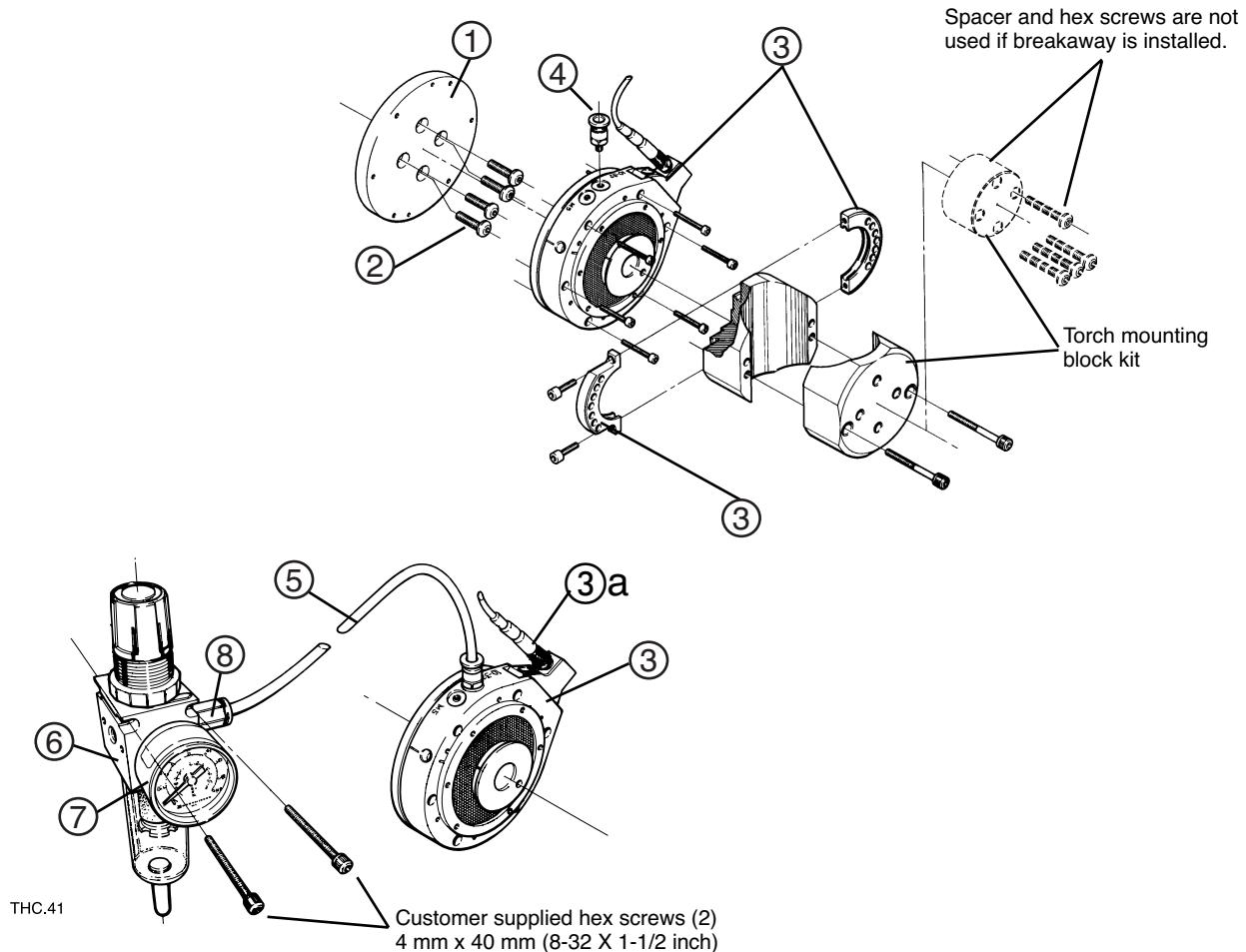
Integrated CommandTHC**X-Y lifter torch mounting block kit**

Item	Part no.	Description	Qty.
1	128279	Kit, Torch Mounting Block, 2-Inch Diameter Torch	1
1	004775	Spacer, Command THC Mounting Block	1
2	075127	Socket Cap, 1/4-20 X 1-1/2 Inch Hex BTN S/Z	4
3	075583	Socket Cap, 1/4-20 X 1-3/4 inch hex SST	2
4	120597	Block, 2-inch Torch Mounting (Kit 128279)	1
5	002303	Shield	1
6	075071	Screw, 8-32 X 1/4 Inch	4

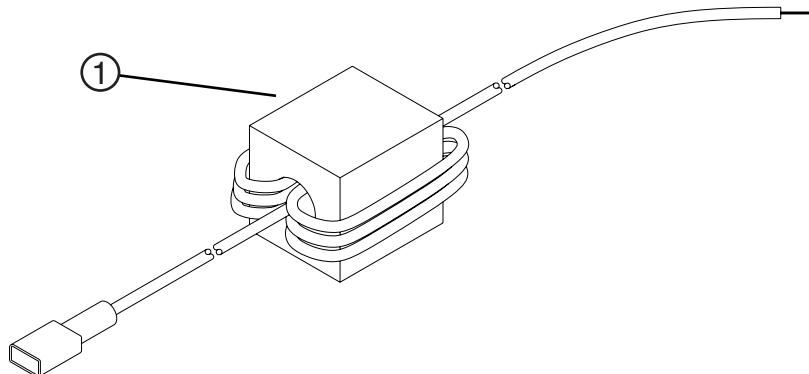
PARTS LIST

Integrated CommandTHC

X-Y lifter breakaway kit – optional



Item	Part no.	Description	Qty.
1	128281 004774	Kit, X-Y Lifter Torch Breakaway Bracket, Breakaway X-Y Fiberglass Screw	1 1 6
2	075509	Socket Cap, 1/4-20 X 1/2 Inch Hex BTN S/Z	4
3	027574	Breakaway, Command THC Screw Collar	1 2 1
3a	123596	Cable: CMD THC Lift Torch Break	1
4	015317	Connector, Male 10-32 X 1/4 Inch, Push In Tubing	1
5	046078 129361	Tubing, 1/4 inch O.D. Synflex Regulator/Filter Assembly	(3 m) 10 ft. 1
6	011039	Filter/Regulator	1
7	011038	Gauge, Pressure 150 PSI (10.2 Bar) Maximum	1
8	015285	Adapter, 1/8 Inch NTP X 1/4 Inch Push In Tubing	1

Integrated CommandTHC**Ohmic contact wire**

<u>Item</u>	<u>Part number</u>	<u>Description</u>	<u>Length</u>	<u>Quantity</u>
1	123542	Wire, Ohmic Contact	3 m/10 ft.	1
	123543		6.1 m/20 ft.	
	123544		7.6 m/25 ft.	
	123545		9.1 m/30 ft.	
	123546		12.2 m/40 ft.	
	123547		15.2 m/50 ft.	
	123548		23 m/75 ft.	
	123549		30.5 m/100 ft.	
	123550		45.6 m/150 ft.	

PARTS LIST

HD4070 – Least Replacement Units	
Part number	Descriptions
	Torch
220162	Torch head with no consumables
	Power supply
129568	20 kW chopper with fan
027080	Chopper cooling fan
041564	Phase-loss Detection PCB
129264	Pilot arc controller board (Start Circuit Board Assembly)
129566	System I/O board / surge injection
041594	I/O PCB SA
109201	Current Sensor Hall 500A:4V
009015	Resistor: 10K-OHM 10W
003142	Relay: 120VAC
009912	Capacitor:35OUF 450WV
109205	Resistor: 20-OHM 50W
009622	Resistor: 10-OHM 50W
009827	Resistor: 100-OHM 50W
109204	Diode: 600V 3A Dual
129631	Input power EMI filter SA: HD4070 PWR SPLY
029316	TB1 INP-PWRSA: 200/2000/4X00/HD
129634	EBM main fan
041610	Power distribution board
108075	Fuse for power distribution board
003201	Main contactor
041613	Breakout board
041507	THC control board
229069	THC power supply
009858	Load resistor for THC power supply
041511	THC mortor drive board
041626	PC-104 power supply
041920	PC-104 stack
027647	Floppy drive
041605	Control PCB
108075	Fuse on control board
129633	P. S. Indicator light, Green
129632	P. S. Indicator light, White
003138	P. S. main current breaker
129621	Control transformer SA: HD4070, 480 V / 60 Hz
129622	Control transformer SA: HD4070, 240 V / 60 Hz
129623	Control transformer SA: HD4070, 400 V / 50-60 Hz
129624	Control transformer SA: HD4070, 200 V /50- 60 Hz
129625	Control transformer SA: HD4070, 440 V / 60 Hz
129626	Control transformer SA: HD4070, 220 V / 50-60 Hz
129627	Control transformer SA: HD4070, 600 V / 60 Hz
008317	125 amp fuse
109004	Hall effect sensor: 100A
041616	Plasma interface board
109201	Hall effect sensor: 500A
129485	Coolant flow subassembly with temp switch
004598	Coolant filler cap
027634	Filter assembly
128909	Kit: HPR HD4070 upgrade

027664	Filter element
006113	Check valve :3/8 FTP
129489	Flow switch SA
011084	Sight glass
027632	Radiator
129619	Pump motor assembly
078085	Gas console
129633	Green power light
129629	Gas vent fan
129496	Pressure transducer
129546	Motor valve subassembly
041657	Gas console control board
041594	Gas console relay board
129629	Ventilation fan
004867	Output manifold
006117	Output solenoid valves
006109	Small solenoid valves
129563	Off-valve assembly
078088	Ignition console
009040	Filter
128510	Kit: Filter capacitor replacement
129616	Inductor
027648	Ignition module
041619	Ignition console interface PCB
Interconnecting cables / hoses	
Power supply to ignition console hose/lead group	
128412	10 ft. (3 m)
128413	20 ft. (6.1 m)
128414	25 ft. (7.6 m)
128415	30 ft. (9.1 m)
128416	40 ft. (12.2 m)
128417	50 ft. (15.2 m)
128418	75 ft. (23 m)
128419	100 ft. (30.5 m)
128420	150 ft. (45.7 m)
Coolant hose assembly: power supply to RHF – supply (green)	
024563	10 ft. (3 m)
024290	15 ft. (4.6 m)
024564	20 ft. (6.1 m)
024291	25 ft. (7.6 m)
024503	30 ft. (9.1 m)
024565	40 ft. (12.2 m)
024263	50 ft. (15.2 m)
024264	75 ft. (23 m)
024265	100 ft. (30.5 m)
024459	150 ft. (45.7 m)
Coolant hose assembly: power supply to RHF – return (red)	
024566	10 ft. (3 m)
024266	15 ft. (4.6 m)
024567	20 ft. (6.1 m)
024267	25 ft. (7.6 m)
024504	30 ft. (9.1 m)
024568	40 ft. (12.2 m)

PARTS LIST

024268	50 ft. (15.2 m)
024269	75 ft. (23 m)
024270	100 ft. (30.5 m)
024460	150 ft. (45.7 m)
Pilot arc lead assembly: power supply to RHF	
123409	10 ft. (3 m)
123410	20 ft. (6.1 m)
123411	25 ft. (7.6 m)
123412	30 ft. (9.1 m)
123413	40 ft. (12.2 m)
123414	50 ft. (15.2 m)
123415	75 ft. (23 m)
123416	100 ft. (30.5 m)
123417	150 ft. (45.7 m)
Neg lead: power supply to RHF	
123418	10 ft. (3 m)
023382	15 ft. (4.6 m)
023136	20 ft. (6.1 m)
023078	25 ft. (7.6 m)
023101	30 ft. (9.1 m)
023135	40 ft. (12.2 m)
023079	50 ft. (15.2 m)
023124	75 ft. (23 m)
023080	100 ft. (30.5 m)
023081	150 ft. (45.7 m)
Pos lead: ground (work) lead	
123418	10 ft. (3 m)
023382	15 ft. (4.6 m)
023136	20 ft. (6.1 m)
023078	25 ft. (7.6 m)
023101	30 ft. (9.1 m)
023135	40 ft. (12.2 m)
023079	50 ft. (15.2 m)
023124	75 ft. (23 m)
023080	100 ft. (30.5 m)
023081	150 ft. (45.7 m)
Power supply to gas console cable group	
128421	10 ft. (3 m)
128422	20 ft. (6.1 m)
128423	25 ft. (7.6 m)
128424	30 ft. (9.1 m)
128425	40 ft. (12.2 m)
128426	50 ft. (15.2 m)
128427	75 ft. (23 m)
128428	100 ft. (30.5 m)
128429	150 ft. (45.7 m)
Signal cable: power supply to gas console	
123428	10 ft. (3 m)
123429	20 ft. (6.1 m)
123430	25 ft. (7.6 m)
123431	30 ft. (9.1 m)
123432	40 ft. (12.2 m)
123433	50 ft. (15.2 m)

123434	75 ft. (23 m)
123435	100 ft. (30.5 m)
123436	150 ft. (45.7 m)

POWER CABLE: PS TO GAS CONSOLE

123419	10 ft. (3 m)
123420	20 ft. (6.1 m)
123421	25 ft. (7.6 m)
123422	30 ft. (9.1 m)
123423	40 ft. (12.2 m)
123424	50 ft. (15.2 m)
123425	75 ft. (23 m)
123426	100 ft. (30.5 m)
123427	150 ft. (45.7 m)

CNC INTERFACE CABLE

123437	10 ft. (3 m)
123438	20 ft. (6.1 m)
123439	25 ft. (7.6 m)
123440	30 ft. (9.1 m)
123441	40 ft. (12.2 m)
123442	50 ft. (15.2 m)
123443	75 ft. (23 m)
123444	100 ft. (30.5 m)
123445	150 ft. (45.7 m)

Gas Hoses - Gas Console to Off-Valve

128445	15 ft. (4.6 m)
128446	20 ft. (6.1 m)
128447	25 ft. (7.6 m)
128448	30 ft. (9.1 m)
128449	35 ft. (10.7 m)
128450	40 ft. (12.2 m)
128550	75 ft. (23 m)
128551	100 ft. (30.5 m)

SIGNAL CABLE: GAS CNSL TO RHF CONSOLE

123446	10 ft. (3 m)
123447	20 ft. (6.1 m)
123448	25 ft. (7.6 m)
123449	30 ft. (9.1 m)
123450	40 ft. (12.2 m)

SIGNAL CABLE: RHF CONSOLE TO OFF VALVE

123451	6 ft. (1.8 m)
123452	10 ft. (3 m)
123453	15 ft. (4.6 m)

TORCH LEADS

128890	6 ft. (1.8 m)
128891	10 ft. (3 m)
128892	15 ft. (4.6 m)

THC TO Power Supply Cable Group

128452	10 ft. (3 m)
128453	20 ft. (6.1 m)
128454	25 ft. (7.6 m)
128455	30 ft. (9.1 m)
128456	40 ft. (12.2 m)
128457	50 ft. (15.2 m)
128458	75 ft. (23 m)

PARTS LIST

128459	100 ft. (30.5 m)
128460	150 ft. (45.7 m)
THC lifter I/O cable	
123209	5 ft. (1.5 m)
123210	10 ft. (3 m)
123211	15 ft. (4.6 m)
123212	20 ft. (6.1 m)
123022	25 ft. (7.6 m)
123213	30 ft. (9.1 m)
123214	35 ft (10.7 m)
123215	40 ft. (12.2 m)
123216	45 ft. (13.7 m)
123023	50 ft. (15.2 m)
123217	75 ft. (23 m)
123218	100 ft. (30.5 m)
123219	125 ft. (38.1 m)
123220	150 ft. (45.7 m)
THC motor drive cable	
123197	5 ft. (1.5 m)
123198	10 ft. (3 m)
123199	15 ft. (4.6 m)
123200	20 ft. (6.1 m)
123020	25 ft. (7.6 m)
123201	30 ft. (9.1 m)
123202	35 ft (10.7 m)
123203	40 ft. (12.2 m)
123204	45 ft. (13.7 m)
123021	50 ft. (15.2 m)
123205	75 ft. (23 m)
123206	100 ft. (30.5 m)
123207	125 ft. (38.1 m)
123208	150 ft. (45.7 m)
THC ohmic contact cable	
123542	10 ft. (3 m)
123543	20 ft. (6.1 m)
123544	25 ft. (7.6 m)
123545	30 ft. (9.1 m)
123546	40 ft. (12.2 m)
123547	50 ft. (15.2 m)
123548	75 ft. (23 m)
123549	100 ft. (30.5 m)
123550	150 ft. (45.7 m)

Supply gas regulator kits	
128544	2-stage oxygen
128545	2-stage nitrogen
128546	2-stage hydrogen (H5, H35 and methane)
128547	2-stage air
128458	1-stage (for use with cryogenic liquid nitrogen or oxygen)
Supply gas hoses	
Oxygen – 3/8" blue RH "B"	
024204	15 ft. (4.6 m)
024205	25 ft (7.6 m)
024155	50 ft (15.2 m)
024398	75 ft (23 m)
Nitrogen – 3/8" black RH "B"	
024203	15 ft. (4.6 m)
024134	25 ft (7.6 m)
024112	50 ft (15.2 m)
024148	75 ft (23 m)
Hydrogen (H5, H35 or methane) – 3/8" red LH "B"	
024655	15 ft. (4.6 m)
024384	25 ft (7.6 m)
024656	50 ft (15.2 m)
024657	75 ft (23 m)
Air – 3/8" black #6	
024658	15 ft. (4.6 m)
024659	25 ft (7.6 m)
024660	50 ft (15.2 m)
024661	75 ft (23 m)

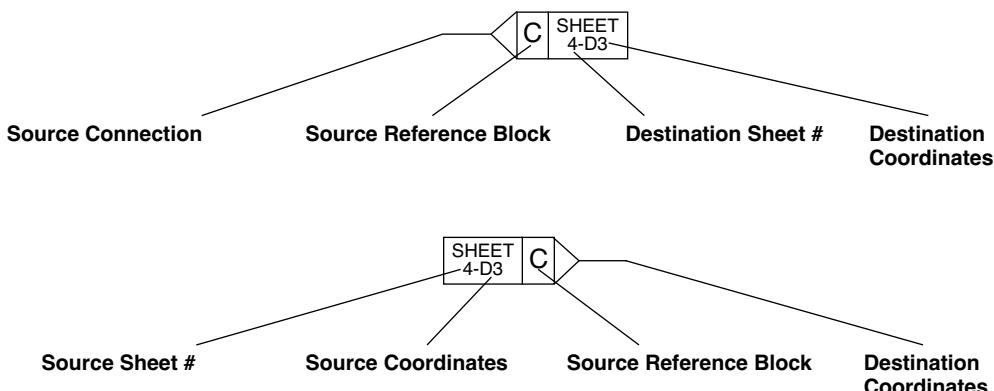
Section 7

WIRING DIAGRAMS

Introduction

This section contains the wiring diagrams for the HD4070 system. When tracing a signal path or referencing with the **Parts List** or **Troubleshooting** sections, please be aware of the following format to assist you in understanding the wiring diagrams' organization:

- Sheet numbers are located in the lower right-hand corner.
- Page-to-page referencing is done in the following manner:



Destination and **Source Coordinates** refer to letters A-D on the Y-axis of each sheet and numbers 1-4 on the X-axis of each sheet. Lining up the coordinates will bring you to the source or destination blocks (similar to a road map).

Wiring diagram symbols

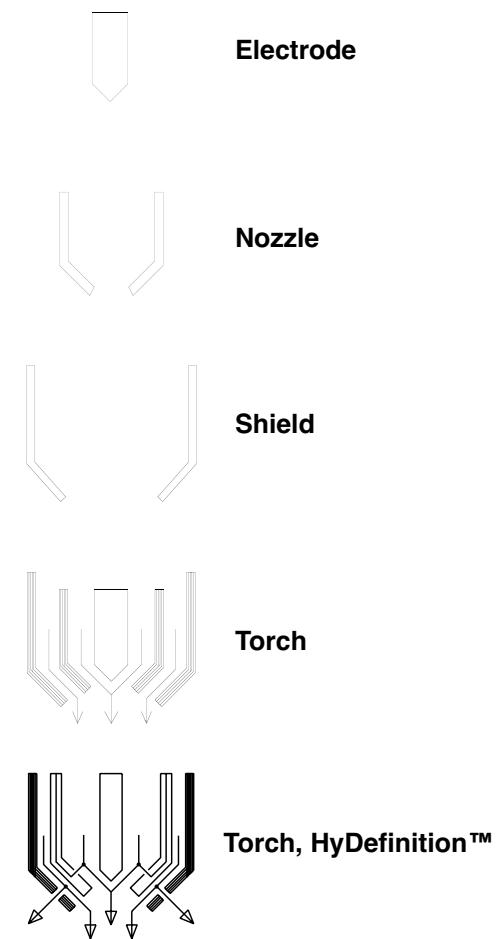
Wiring diagram symbols and their identification precede the system wiring diagrams in this section.

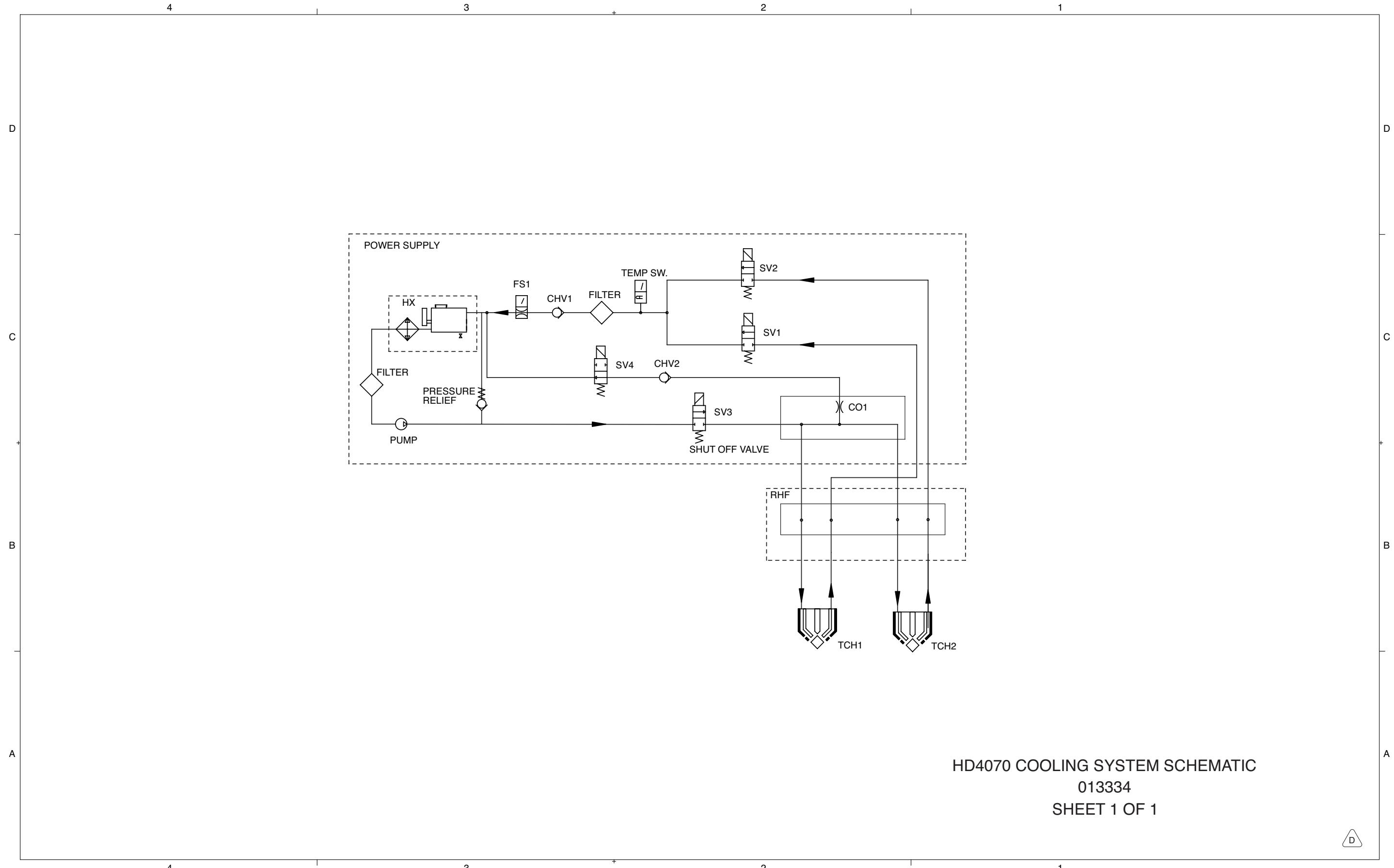
	Battery		Fuse		Push Button, Normally Open
	Cap, polarized		Ground Clamp		Receptacle
	Cap, non-polarized		Ground, Chassis		Relay, Coil
	Cap, feed-thru		Ground, Earth		Relay, Normally Closed
	Circuit breaker		IGBT		Relay, Normally Open
	Coax shield		Inductor		Relay, Solid State, AC
	Current Sensor		LED		Relay, Solid State, DC
	Current sensor		Light		Relay, Solid State, Dry
	DC supply		MOV		Resistor
	Diode		Pin		SCR
	Door interlock		Plug		Shield
	Fan		PNP Transistor		Shunt
	Feedthru LC		Potentiometer		Spark Gap
	Filter, AC		Push Button, Normally Closed		Switch, Flow

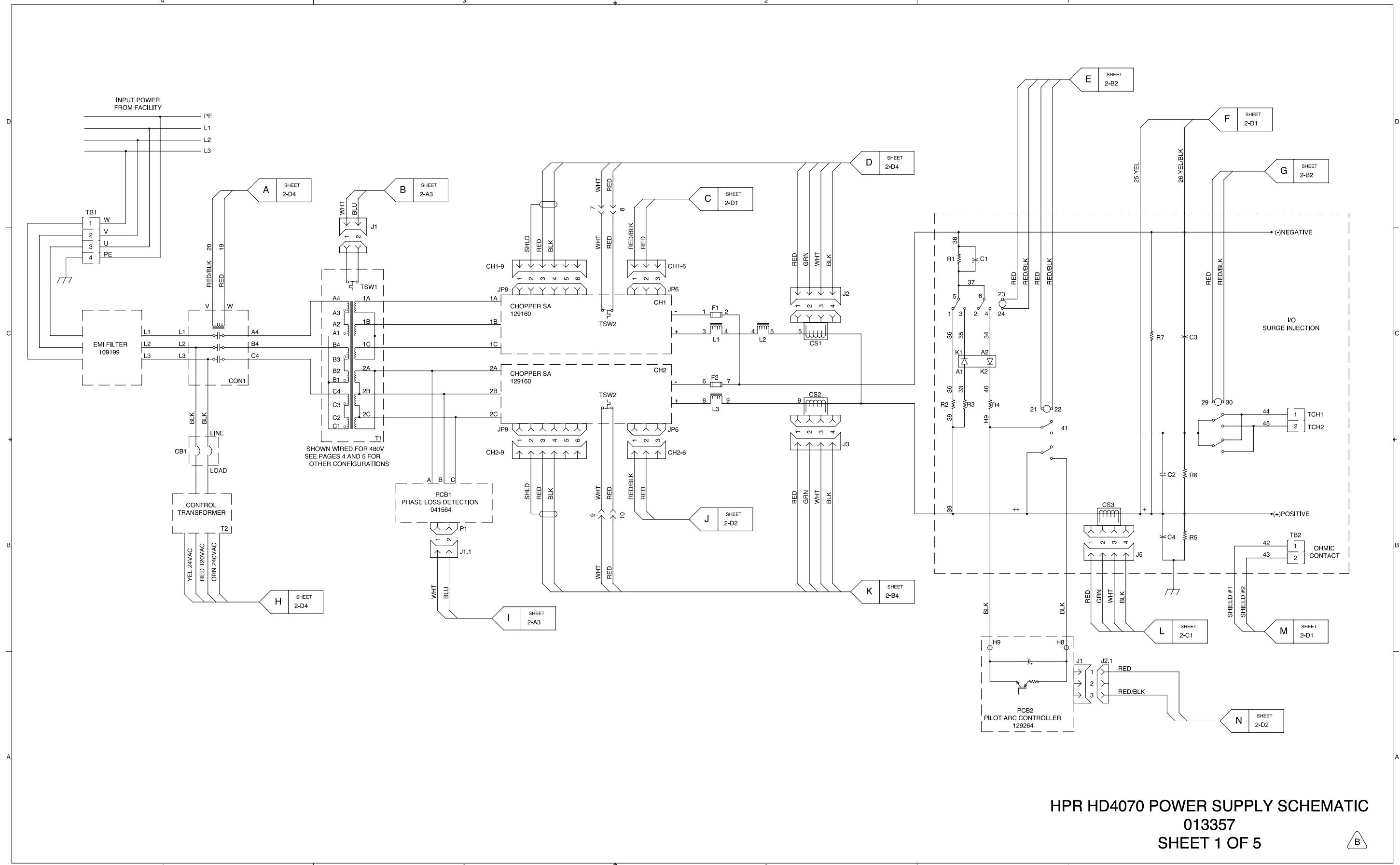
	Switch, Level, Normally Closed
	Switch, Pressure, Normally Closed
	Switch, Pressure, Normally Open
	Switch, 1 Pole, 1 Throw
	Switch, 1 Pole, 2 Throw
	Switch, 1 Pole, 1 Throw, Center Off
	Switch, Temperature, Normally Closed
	Switch, Temperature, Normally Open
	Terminal Block
	Time Delay Closed, NC/Off
	Time Delay Open, NO/Off
	Time Delay Open, NC/On

	Time Delay Closed, NO/Off
	Transformer
	Transformer, Air Core
	Transformer Coil
	Triac
	VAC Source
	Valve, Solenoid
	Voltage Source
	Zener Diode

Torch Symbols

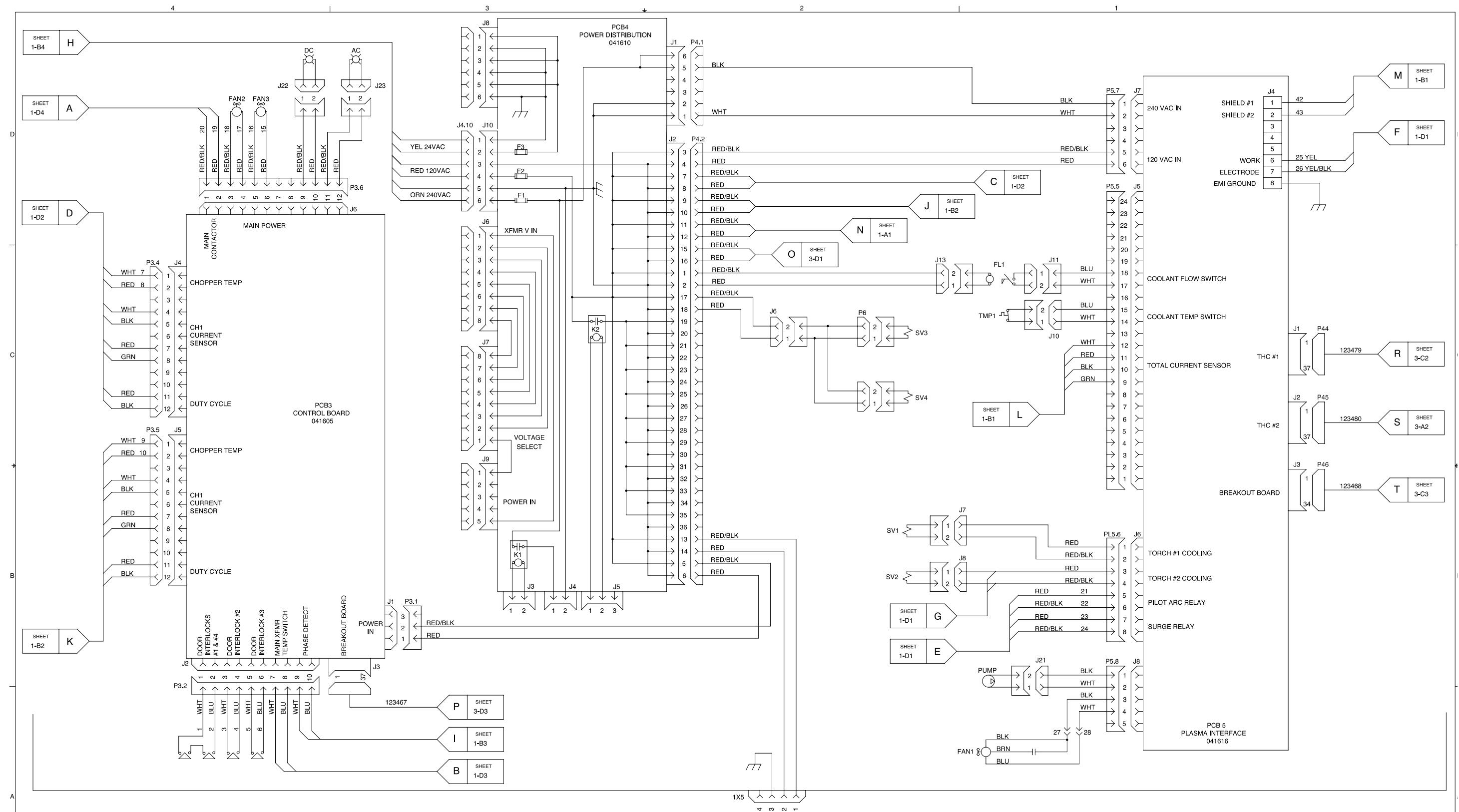






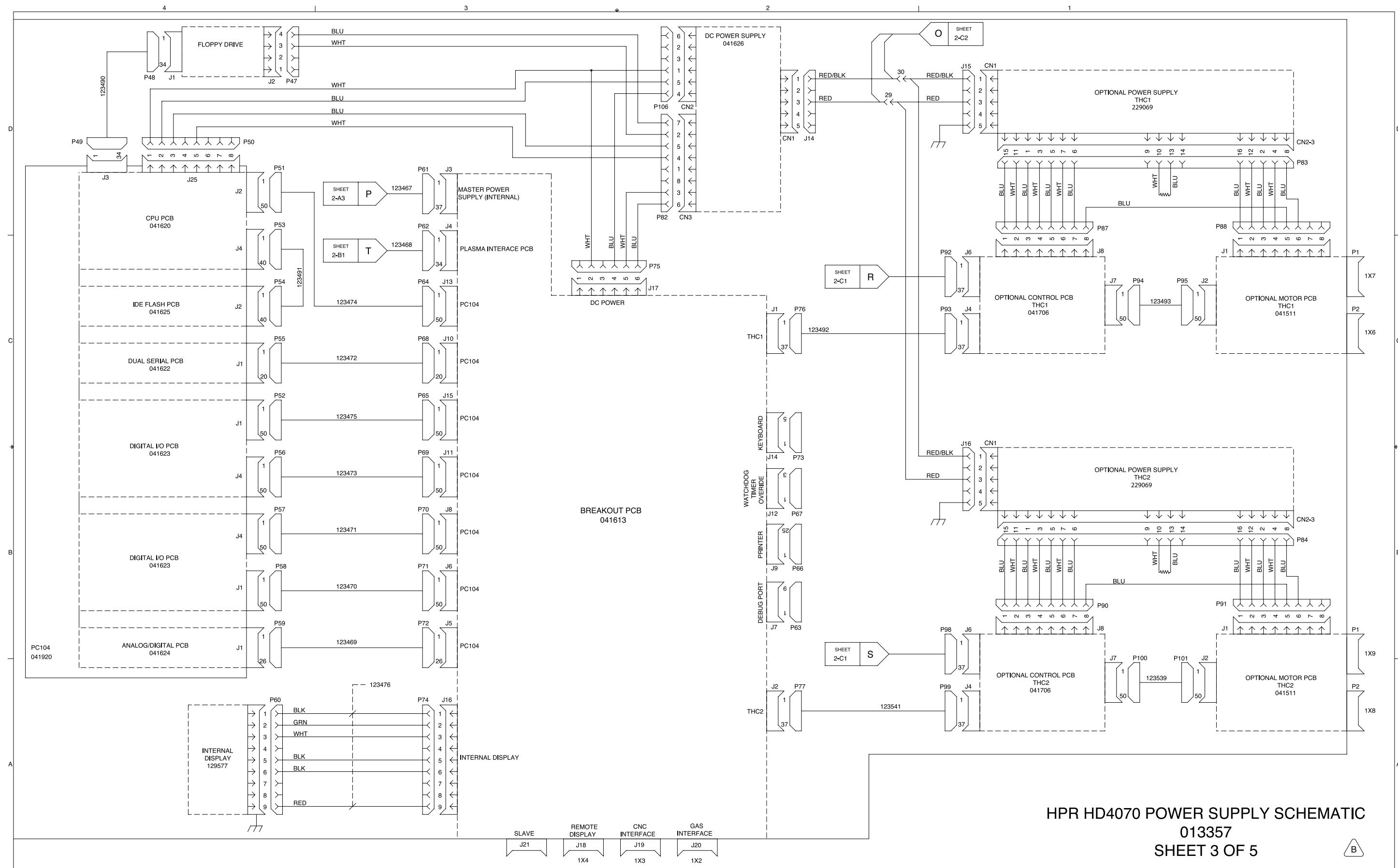
HPR HD4070 POWER SUPPLY SCHEMATIC
013357
SHEET 1 OF 5

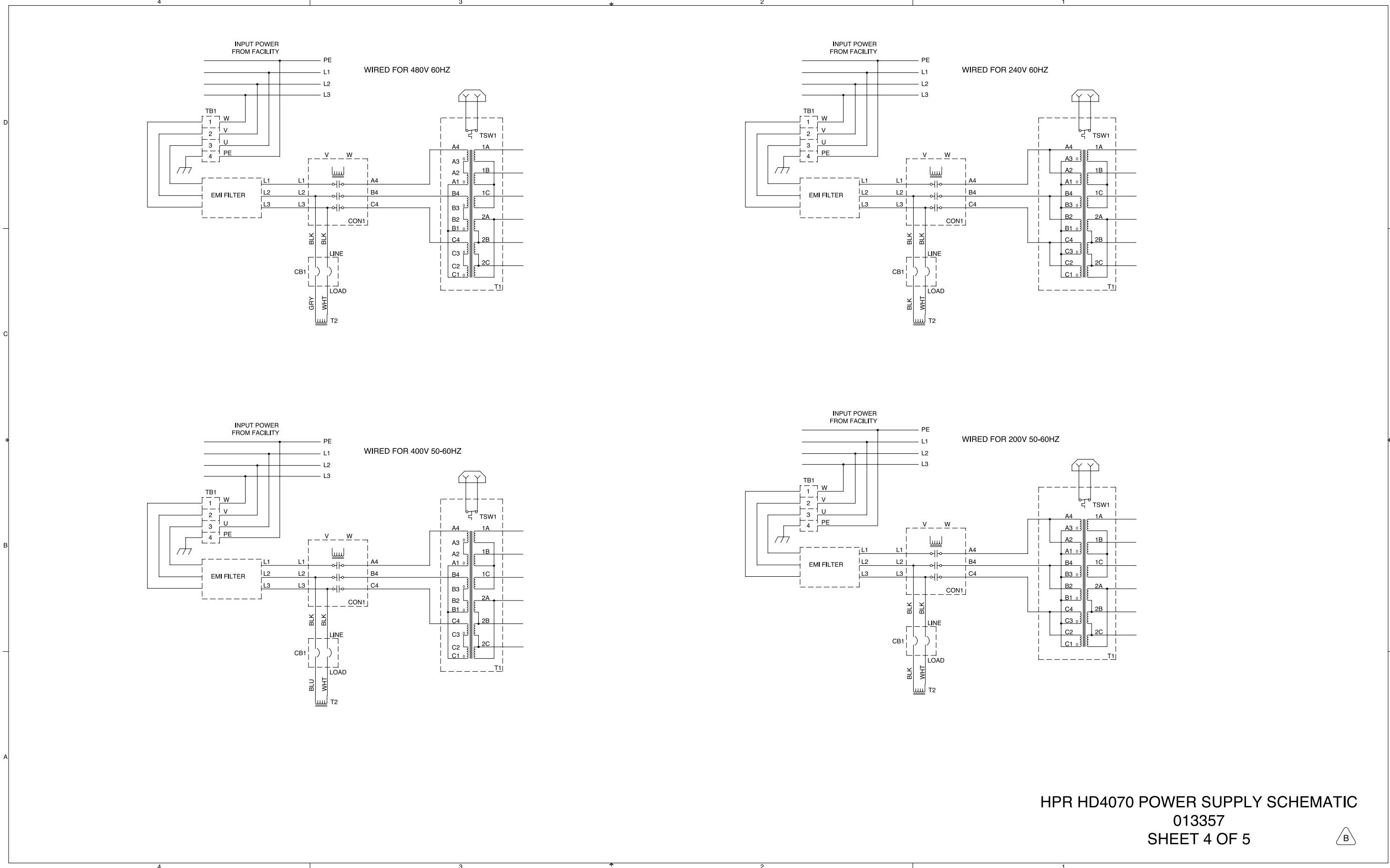


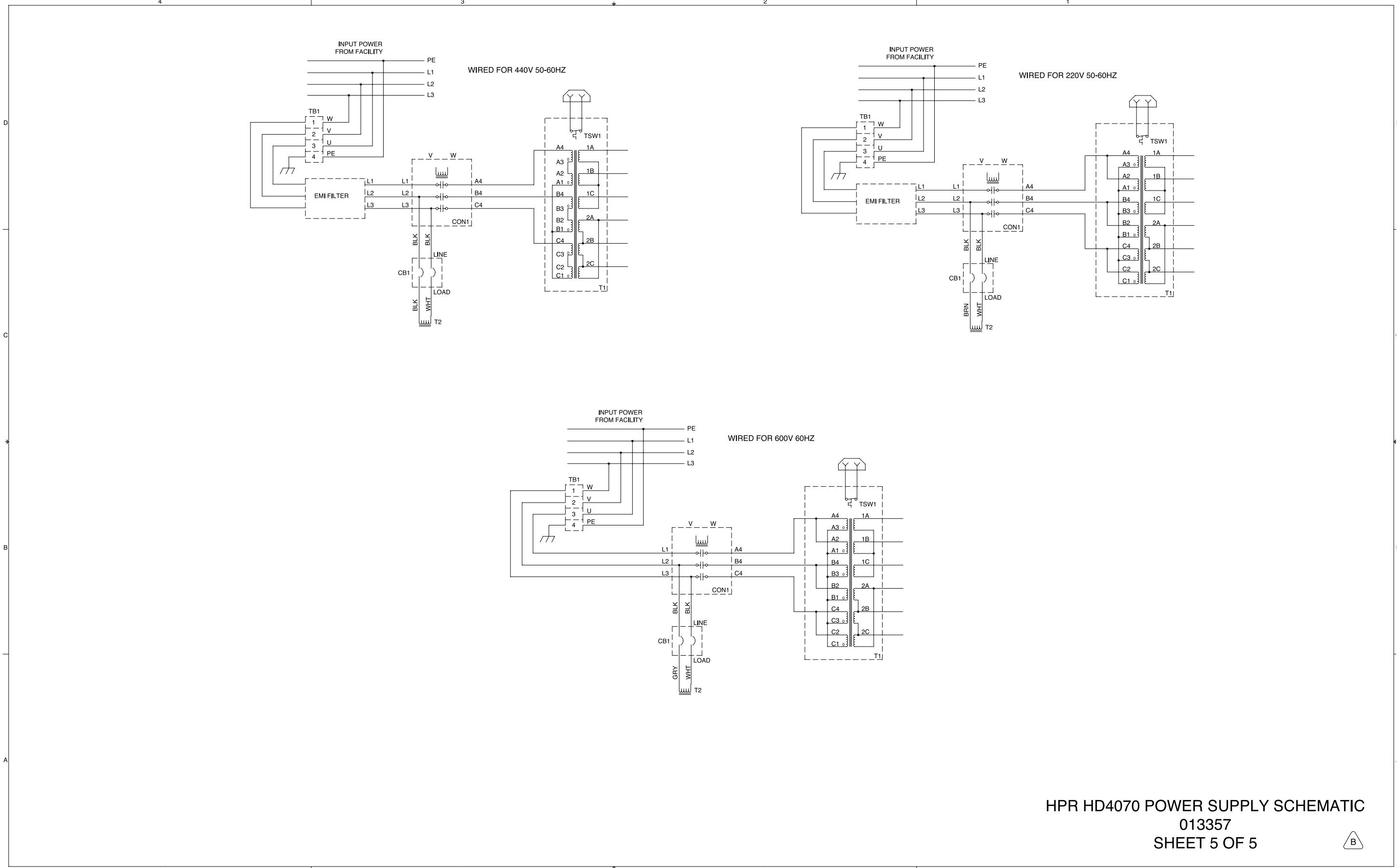


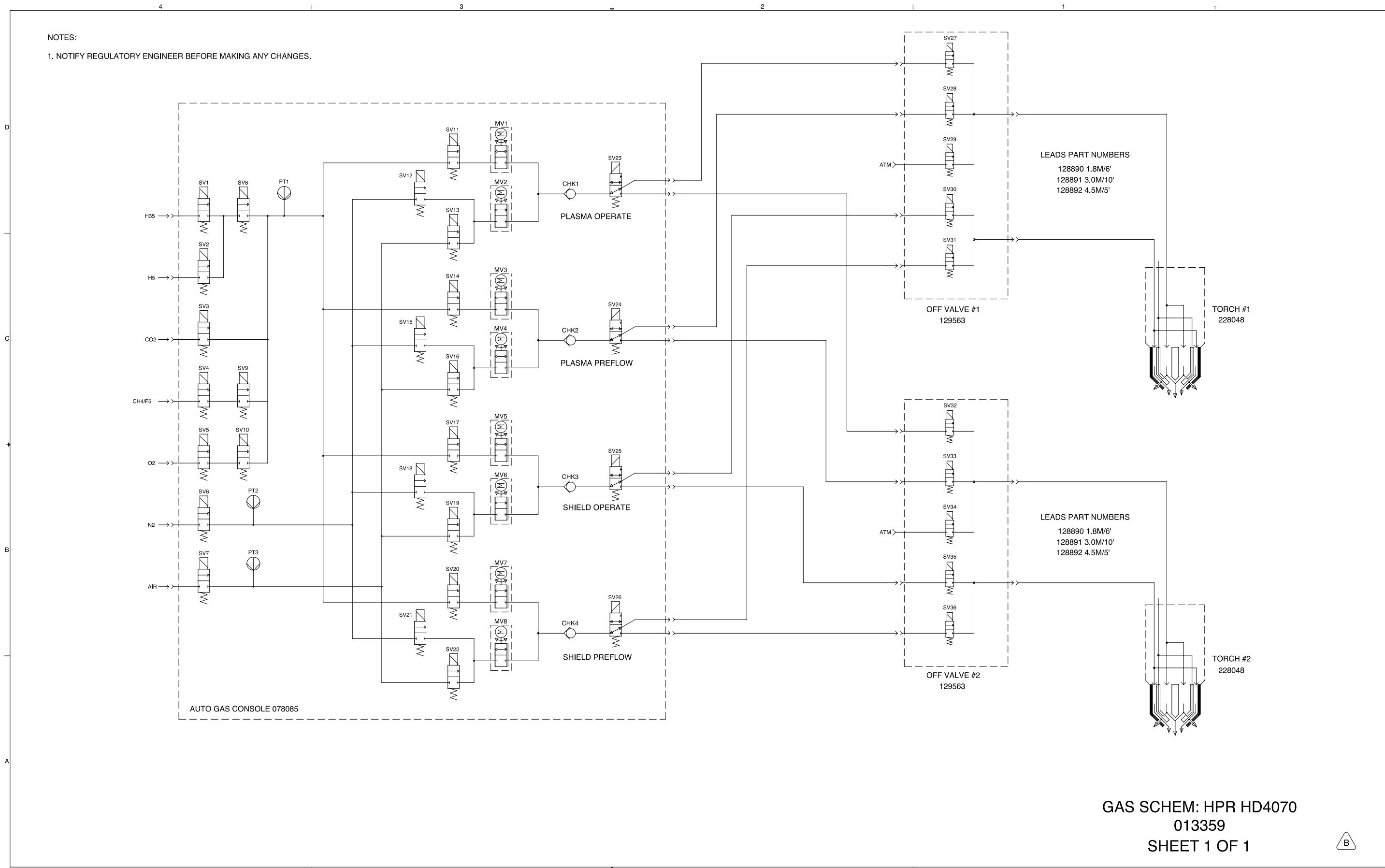
HPR HD4070 POWER SUPPLY SCHEMATIC
013357
SHEET 2 OF 5

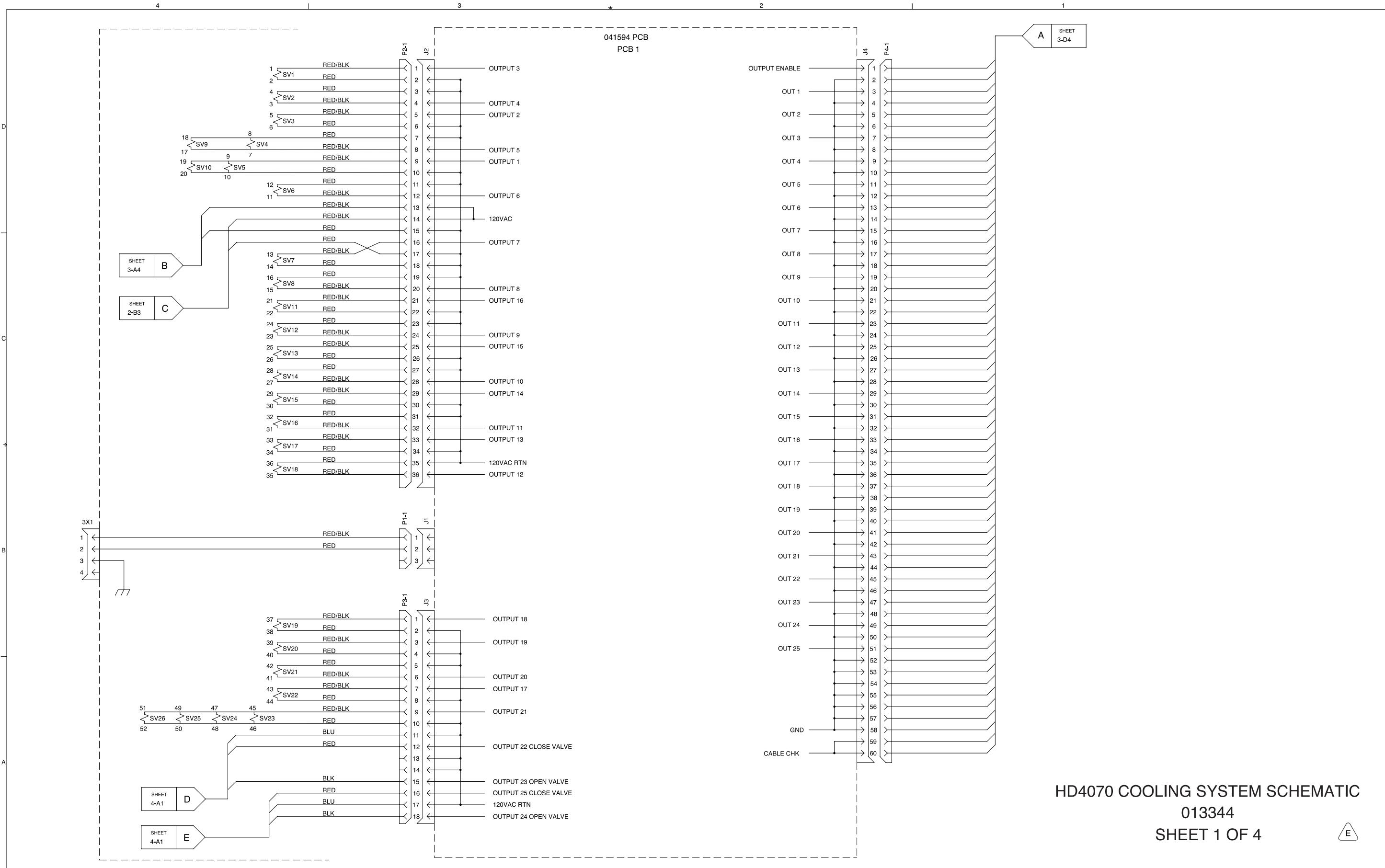


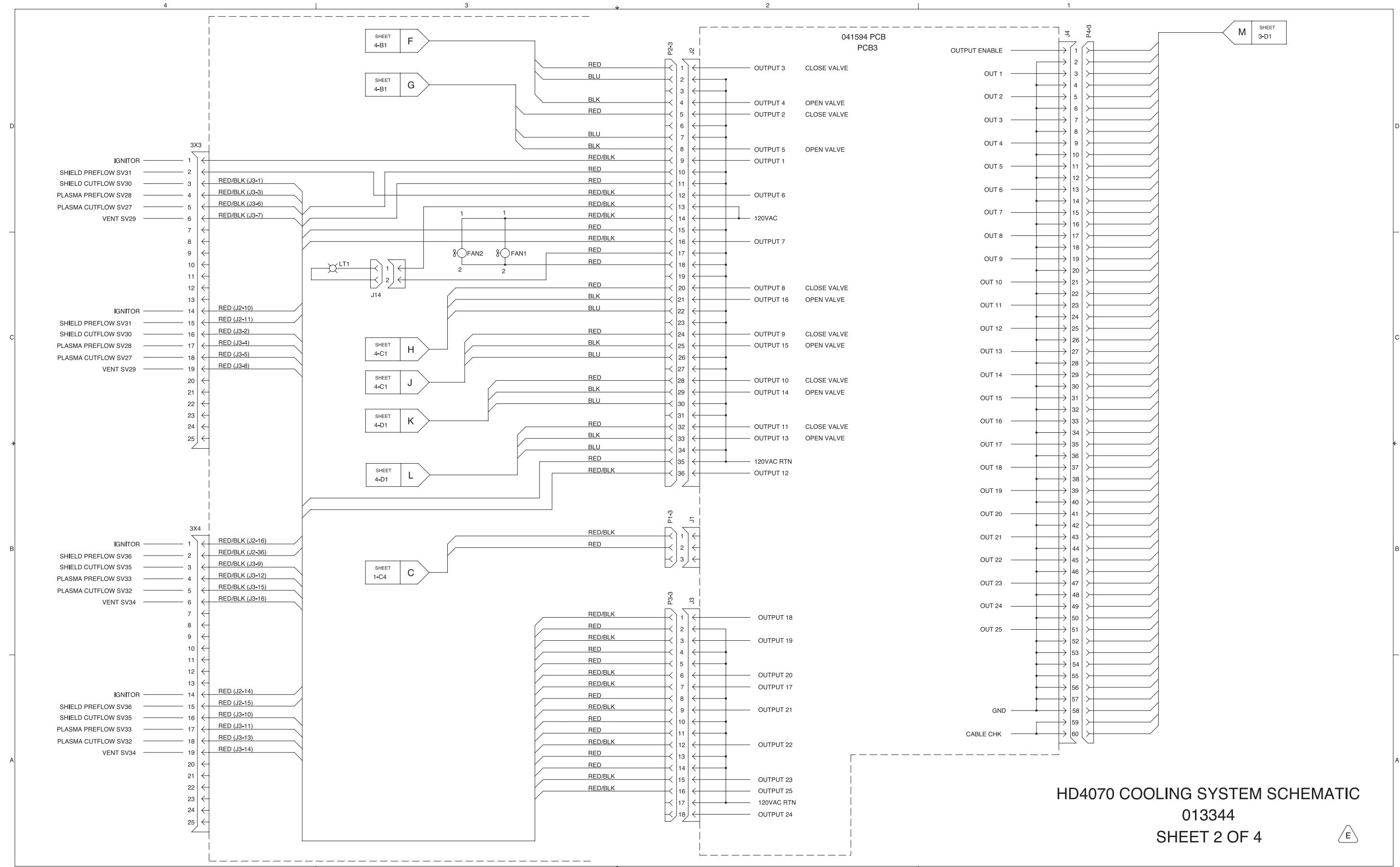


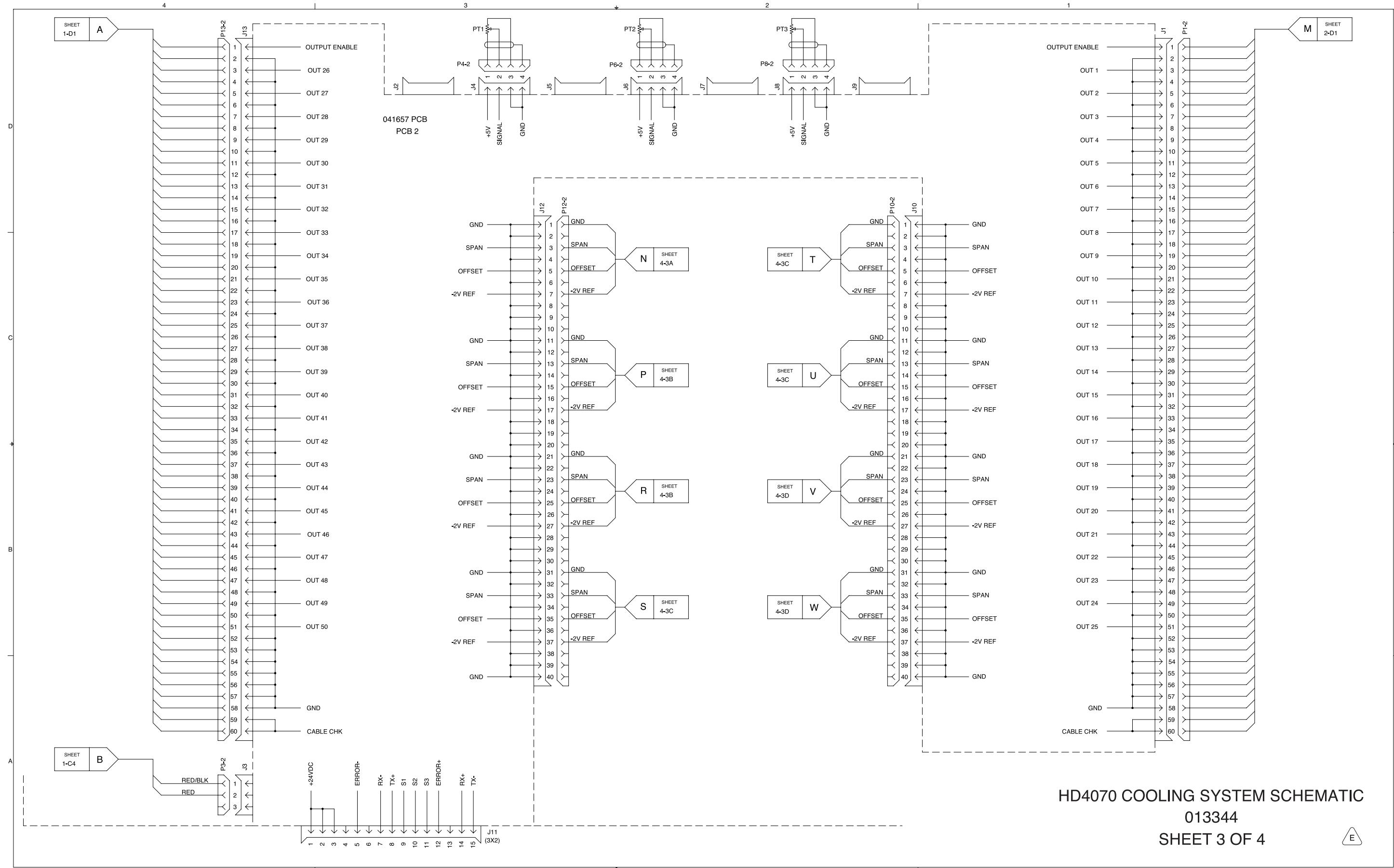


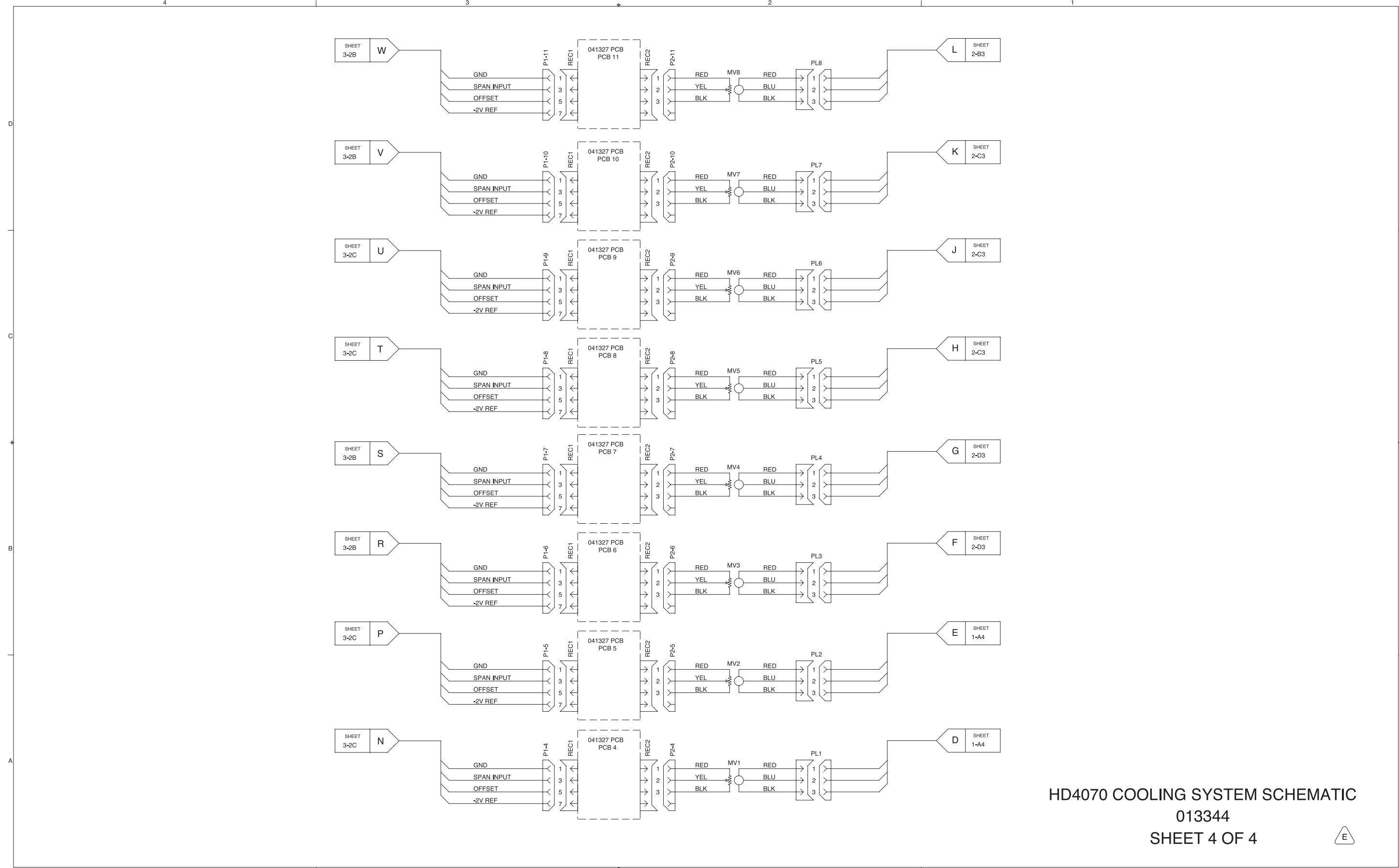










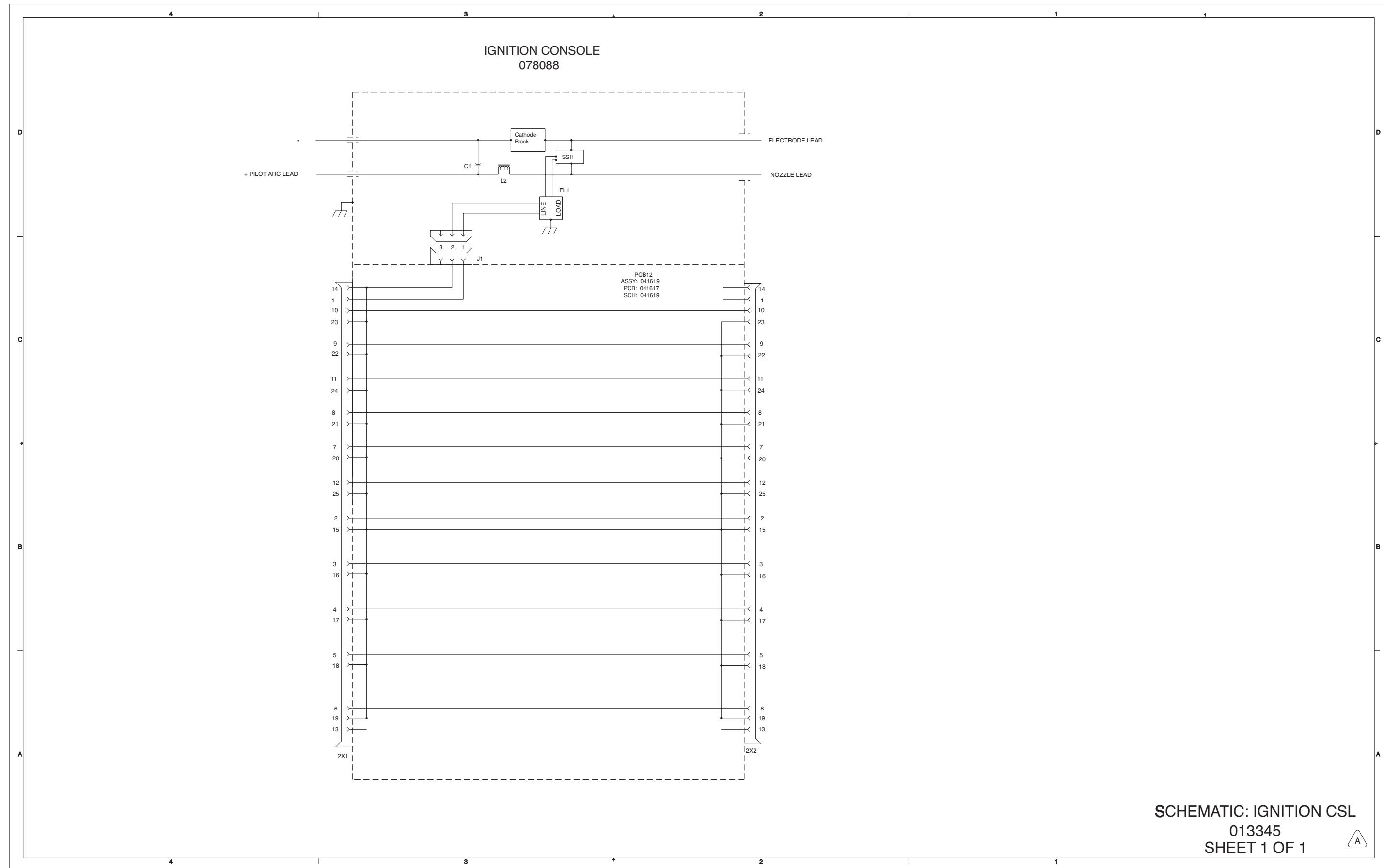


HD4070 COOLING SYSTEM SCHEMATIC

013344

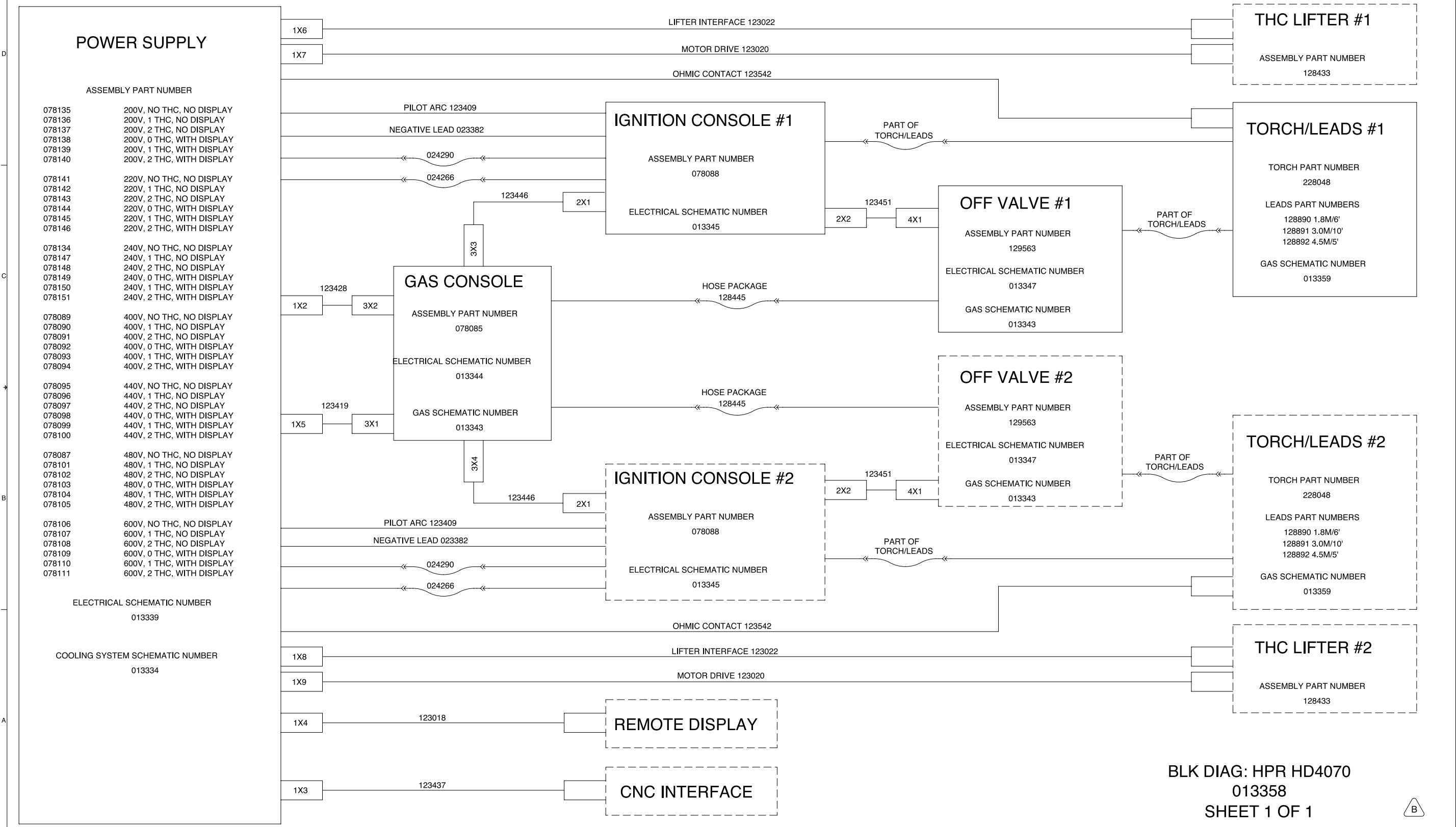
SHEET 4 OF 4

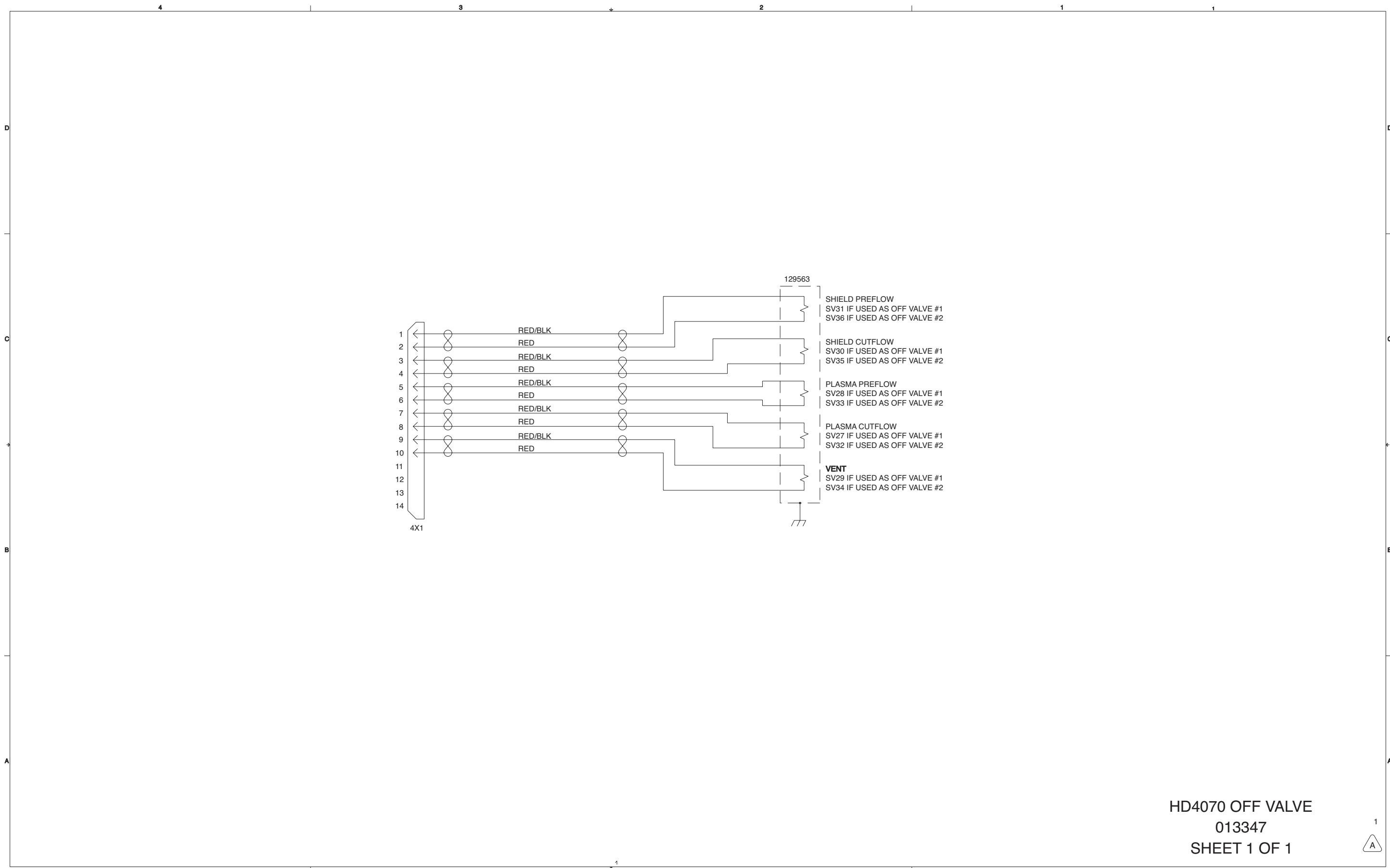




NOTES:

1. CABLES AND HOSES ARE AVAILABLE IN MULTIPLE LENGTHS. NUMBERS SHOWN ARE OF SOURCE DRAWING.





Appendix A

SYSTEM GROUNDING

System grounding requirements

The plasma system must be grounded for safety reasons and to suppress EMI:

- *Safety* The entire system—power supply, accessory enclosures, and worktable—must be grounded to protect it and the operator from a ground fault. The protective earth (PE) ground connections must be installed by a licensed electrician and conform to national or local codes.
- *EMI Suppression* If allowed by national or local codes, the ground system can also be used to suppress EMI (electromagnetic interference). Below is a guide to configure the plasma system for minimal EMI. See Electromagnetic Compatibility in this manual for additional information.

Suggested ground cable routing

Power supply

Connect the power supply to the PE ground terminal, using a properly sized color-coded conductor. This PE ground is connected to the service ground through the line disconnect switch. See the Installation section for further information on the power cord and the line disconnect switch.

Equipment grounding

All accessory modules that receive power from the plasma power supply must also use the power supply's ground—either by connection to the PE terminal of the power supply, or by direct connection to the equipment ground conductor. Each module should have only one connection to ground to avoid ground loops and stray currents. If any enclosure is grounded to the work table, the work table must be grounded to the power supply.

Effective grounding for EMI reduction is highly dependent upon the installation configuration. Two acceptable configurations are shown in Figures a-1 and a-2.

The ignition console should be installed near the work table, and grounded directly to it. Other modules should be installed near the power supply, and grounded directly to it (Figure a-1).

APPENDIX A – SYSTEM GROUNDING

All modules may also be installed near the work table, and grounded directly to it (Figure a-2). Do not ground the ignition console directly to the power supply.

The customer must furnish all conductors for equipment grounding. Grounding conductors may be purchased through Hypertherm in any length specified by the customer (Part No. 047058). The conductor may also be purchased locally, using a minimum 8 AWG UL Type MTW cable (USA specification) or the appropriate cable specified by national and local codes.

Consult the appropriate manufacturer's instructions to ground equipment that does not receive power from the power supply.

Work table grounding

If a supplementary ground rod is installed near the worktable to reduce EMI, it must be connected directly to the PE ground of the building structure, connected to the service ground; or to earth, providing the resistance between the ground rod and the service ground meets national or local codes. Place the supplementary ground rod within 6 m (20 ft) of the worktable according to national or local codes.

If any module is grounded to the work table, the work table must be grounded to the power supply, or the configuration must be changed to comply with applicable national and local electrical codes.

A ferrite choke can be placed in the conductor between the work table ground rod and the PE ground, with a number of turns through the choke to isolate the safety ground (at 60 Hz) from any electromagnetic interference (frequencies above 150 KHz). The more turns the better. A suitable ferrite choke can be made by wrapping 10 turns or more of the ground lead through Magnetics part number 77109-A7, Fair-Rite part number 59-77011101, or other equivalent ferrite choke. Locate the choke as close as possible to the plasma power supply.

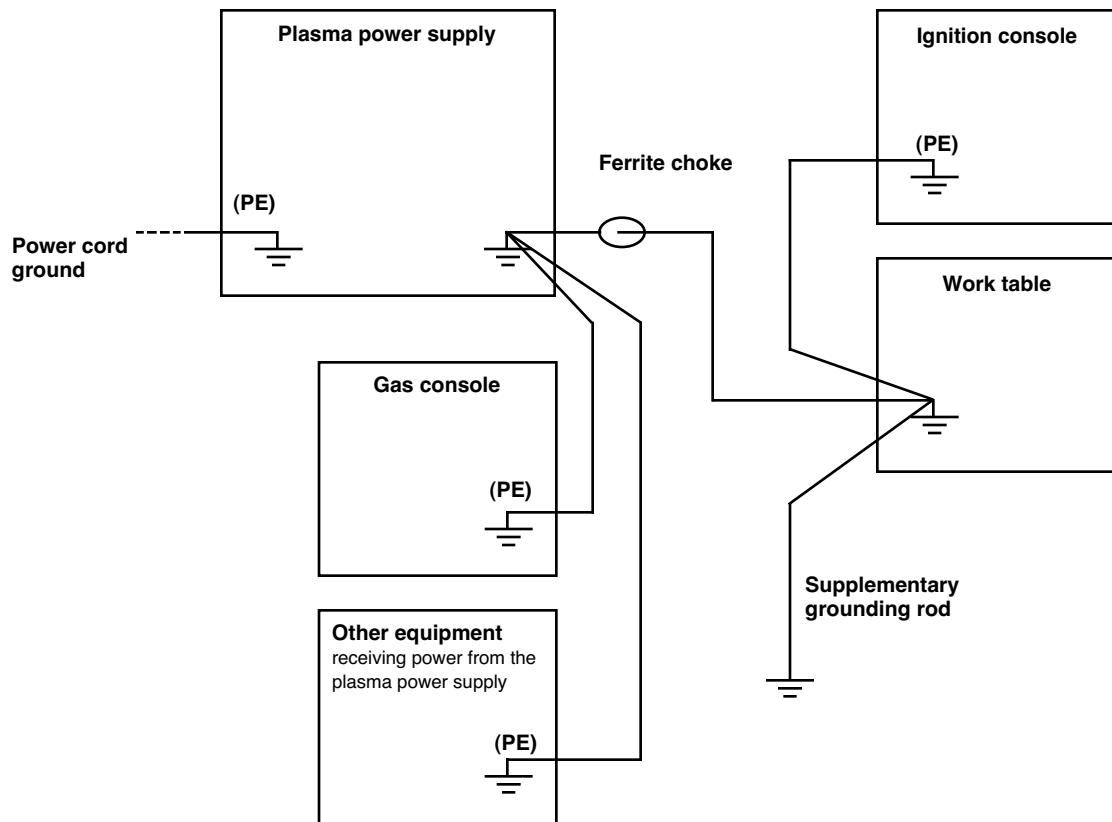


Figure a-1 Recommended ground connection configuration

Note: Configuration may vary for each installation and may require a different ground scheme.

APPENDIX A – SYSTEM GROUNDING

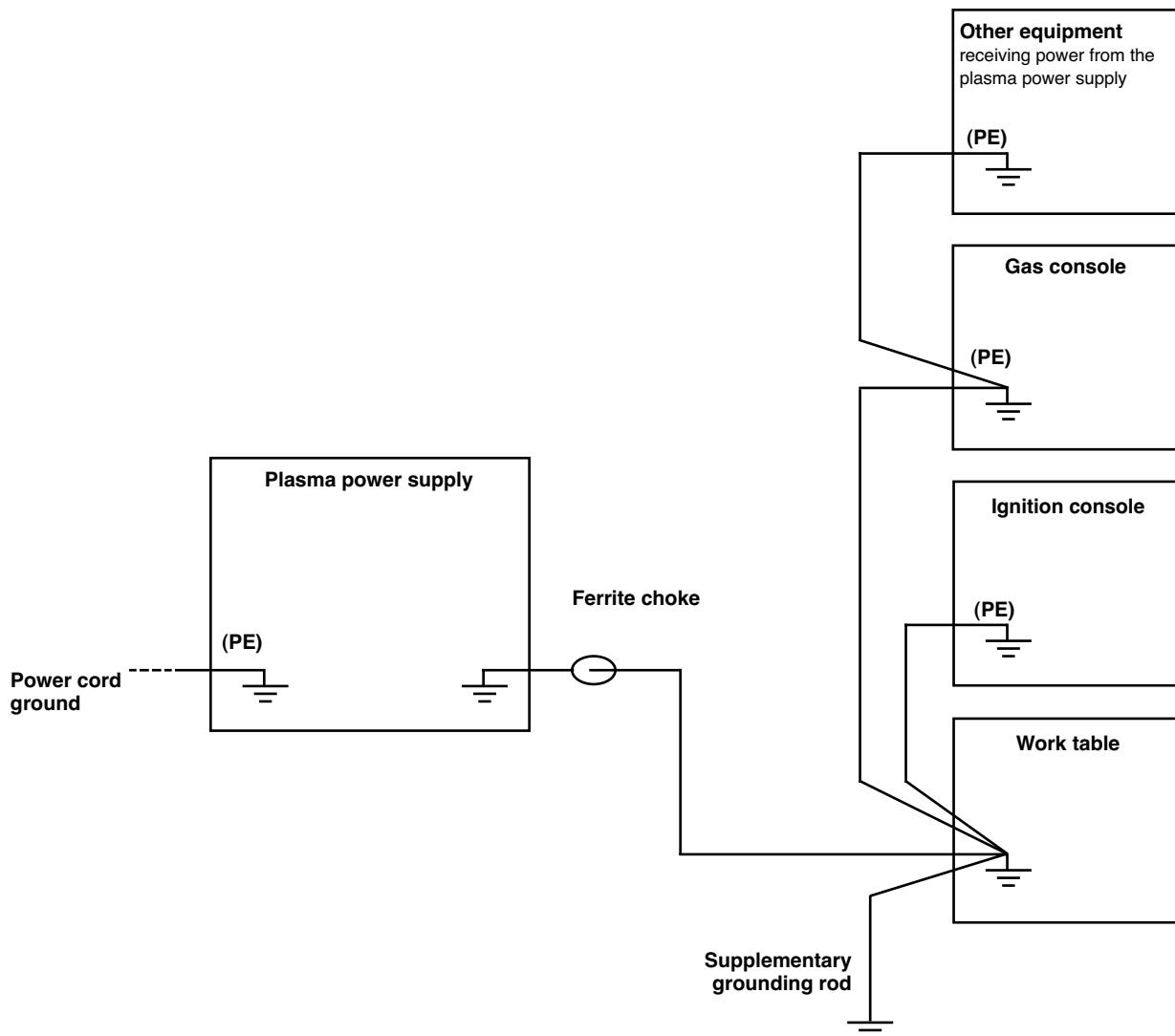


Figure a-2 Alternate ground connection configuration

The preferred cable routing for this configuration is as shown, but it is acceptable to “daisy-chain” the grounds for the gas console and other equipment to the ignition console. The ignition console should NOT be daisy-chained through the other components to the work table.

Appendix B

BENZOTRIAZOLE / PROPYLENE GLYCOL SAFETY DATA

In this appendix:

Benzotriazole / Propylene Glycol Safety Data

Section 1 Chemical Product and Company Identification	b-2
Section 2 Composition / Information on Ingredients	b-2
Section 3 Hazards Identification	b-2
Section 4 First Aid Measures	b-3
Section 5 Fire Fighting Measures	b-3
Section 6 Accidental Release Measures	b-3
Section 7 Handling and Storage	b-3
Section 8 Exposure Controls / Personal Protection	b-4
Section 9 Physical and Chemical Properties	b-4
Section 10 Stability and Reactivity	b-4
Section 11 Toxicological Information	b-4
Section 12 Ecological Information	b-5
Section 13 Disposal Considerations	b-5
Section 14 Transport Information	b-5
Section 15 Regulatory Information	b-5
Section 16 Other Information	b-5
Freezing point of Propylene Glycol solution	b-6

MATERIAL SAFETY DATA SHEET

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	Hypertherm Torch Coolant

Latest Revision Date	09-02-2004
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ISSUE DATE	03-10-2005
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DISTRIBUTOR: Hypertherm, Inc.
STREET ADDRESS: Etna Road
CITY, STATE, ZIP: Hanover, N.H. 03755

EMERGENCY TELEPHONE NUMBERS

Transportation: (800) 424-9300 *
*For spill, leak, fire or transport accident emergencies.
Product Information: (603) 643-3441

SECTION 2 – COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENT	CAS No.	% by wt.	EXPOSURE LIMITS		
			OSHA PEL	ACGIH TLV	R PHRASES
Benzotriazole	95-14-7	<1.0	N.E.	N.E.	R22,36/37/38
Propylene Glycol	57-55-6	<50.0	N.E.	N.E.	R36/37/38

SECTION 3 – HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	Causes eye irritation. May be harmful if swallowed. May cause skin irritation
--------------------	---

POTENTIAL HEALTH EFFECTS	
INGESTION	Oral LD 50 (rat) as reported for 100% Benzotriazole is 560 mg./Kg.
INHALATION	Mists are harmful.
EYE CONTACT	Causes eye irritation.
SKIN CONTACT	Can cause skin irritation.

SECTION 4 – FIRST AID MEASURES

INGESTION	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.
INHALATION	If affected, remove from exposure. Restore breathing. Keep warm and quiet. Get medical attention.
EYE CONTACT	Immediately flush eye with cool running water. Remove contact lenses if applicable. Continue flushing with water for at least 15 minutes. Get immediate 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 to boiling.	FLAMMABLE LIMITS	Not Established
EXTINGUISHING MEDIA	Product is an aqueous solution. Use Carbon Dioxide, Dry Chemical, Foam.		
SPECIAL FIRE FIGHTING PROCEDURES	Full protective equipment including self-contained breathing apparatus should be used. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Get medical attention.		
FIRE AND EXPLOSION HAZARDS	Water base solution.		

SECTION 6 – ACCIDENTAL RELEASE MEASURES

RESPONSE TO SPILLS	Small spills: Mop up residues and place in a covered waste disposal container. Large spills: Dike or dam spill. Pump to containers or soak up on inert absorbent. Place in covered waste disposal container.
--------------------	---

SECTION 7 – HANDLING AND STORAGE

HANDLING PRECAUTIONS	Keep container in upright position. Avoid breathing or creating airborne mists. Avoid contact with skin eyes, and clothing. Avoid inhalation of vapor or mists. DO NOT TAKE INTERNALLY. Clean up spills immediately.
STORAGE PRECAUTIONS	Store in a cool dry place. Keep from freezing. Keep containers tightly closed when not in use.

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

HYGIENIC PRACTICES	Normal procedures for good hygiene.		
ENGINEERING CONTROLS	Good general ventilation. Eye wash station in immediate area of use. M.E.L/O.E.S Nil. U.K HSE EH:40 Not listed		

PERSONAL PROTECTIVE EQUIPMENT

X	RESPIRATOR	If exposed to mists.
X	GOGGLES / FACE SHIELD	Recommended
	APRON	
X	GLOVES	Recommended; PVC, Neoprene or Nitrile acceptable
	BOOTS	

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Clear Pink/Red Liquid	BOILING POINT	100EC
ODOR	None	FREEZING POINT	Not established
pH of Concentrate	5.5-7.0	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	None				
INCOMPATIBILITY	None Known				
HAZARDOUS PRODUCTS OF DECOMPOSITION	BY FIRE: Carbon Dioxide, Carbon Monoxide Nitrogen Oxides				
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	NOT BIODEGRADABLE
BOD / COD VALUE	Not established	
ECOTOXICITY	As reported for 100% Benzotriazole: Bluegill Sunfish (96 hr. Tlm):28mg/l; Minnow (96hr. Tlm):28mg/l; Trout (96 hr. LC 50): 39mg/l; Algae(96hr. EC 50): 15.4mg/l; Daphnia magna (48 hr. LC 50): 141.6mg/l	

SECTION 13 – DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD	Waste material must be disposed of in accordance with national/local legislative requirements.				
RCRA CLASSIFICATION	Non Hazardous				
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

REGULATORY STATUS: Benzotriazole

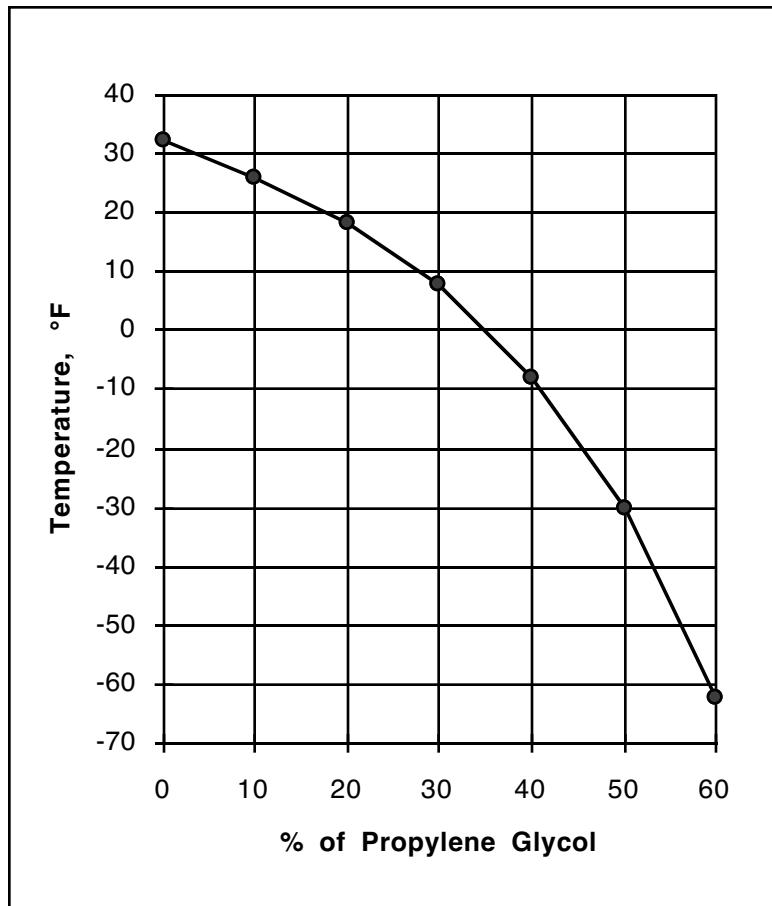
1.	Labeling Information	Irritant
2.	R Phrases	R 36/37/38, 22
3.	S Phrases	S 24/25, 26
4.	EI NECS No.	Not listed
5.	EC annex 1 Classification	Nil.
6.	German WGK	—

SECTION 16 – OTHER INFORMATION

NFPA CLASSIFICATION

1	BLUE	HEALTH HAZARD
0	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, Inc., in connection with the use of this information.



Freezing Point of Propylene Glycol Solution

Appendix C

GAS REGULATORS

In this appendix:

Gas regulators	c-2
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Gas regulators

Low-quality gas regulators do not provide consistent supply pressures and can result in poor cut quality and system operation problems. Use a high-quality, 1-stage, gas regulator to maintain consistent gas supply pressure, if using liquid cryogenic or bulk storage. Use a high-quality, 2-stage, gas regulator to maintain consistent gas supply pressure from high pressure gas cylinders.

The high-quality gas regulators listed below are available from Hypertherm and meet U.S. Compressed Gas Association (CGA) specifications. In other countries, select gas regulators that conform to national or local codes.

2-stage regulator



Single stage regulator



<u>Part number</u>	<u>Description</u>	<u>Qty.</u>
128544	Kit: Oxygen, 2-Stage *	1
128545	Kit: Inert Gas, 2-Stage	1
128546	Kit: Hydrogen (H ₂ , H ₃₅ and Methane) 2-Stage	1
128547	Kit: Air, 2 Stage	1
128548	Kit: 1 Stage (For use with cryogenic liquid Nitrogen or Oxygen)	1
022037	Oxygen, 2-Stage	1
022038	Inert Gas, 2-Stage	1
022039	Hydrogen/Methane, 2-Stage	3
022040	Air, 2-Stage	1
022041	Line Regulator, 1-Stage	1

* Kits include appropriate fittings

Appendix D**SERVICE SCREEN (#18) STATUS TABLE**

In this appendix:

Input / Output status table.....d-2

APPENDIX D – SERVICE SCREEN STATUS TABLE

Input / Output (Screen 18)

Port 0	Base Addr 224H	Output	Port 1	Base Addr 225H	Input	Port 2	Base Addr 226H	Output
Bit 0	Select 160 amp	Pin 47	Bit 0	Input power active	Pin 31	Bit 0	DC output On/Off	Pin 15
Bit 1	Select 80 amp	Pin 45	Bit 1	Missing phase detect	Pin 29	Bit 1	Slave 160 amp select	Pin 13
Bit 2	Select 40 amp	Pin 43	Bit 2	Chopper #1 temp OK	Pin 27	Bit 2	Slave 80 amp select	Pin 11
Bit 3	Select 20 amp	Pin 41	Bit 3	Chopper #2 temp OK	Pin 25	Bit 3	Slave 40 amp select	Pin 9
Bit 4	Select 10 amp	Pin 39	Bit 4	Temp_Airflow_OK	Pin 23	Bit 4	Slave 20 amp select	Pin 7
Bit 5	Select 1_10 current/ cable checkCout	Pin 37	Bit 5	Output current OK	Pin 21	Bit 5	Slave 10 amp select	Pin 5
Bit 6	Fan control	Pin 35	Bit 6	Slave input power active	Pin 19	Bit 6	Slave 1_10 current	Pin 3
Bit 7	Contactor control	Pin 33	Bit 7	Slave missing phase detect	Pin 17	Bit 7	Slave fan control	Pin 1
Port 3	Base Addr 220H	Input	Port 4	Base Addr 221H	Output	Port 5	Base Addr 222H	Input
Bit 0	Slave Chopper #1 temp OK	Pin 47	Bit 0	Slave contactor control	Pin 31	Bit 0	Plasma interface spare input	Pin 15
Bit 1	Slave Chopper #2 temp OK	Pin 45	Bit 1	Slave DC output On/Off	Pin 29	Bit 1	Master_door_interlock	Pin 13
Bit 2	Slave_Temp_Airflow_OK	Pin 43	Bit 2	Pump control	Pin 27	Bit 2	Cable_checkA_in	Pin 11
Bit 3	Slave current OK	Pin 41	Bit 3	Torch #1 coolant	Pin 25	Bit 3	Slave_door_interlock	Pin 9
Bit 4	Spare input	Pin 39	Bit 4	Torch #2 coolant	Pin 23	Bit 4	Cable_checkC_in	Pin 7
Bit 5	Transfer sense	Pin 37	Bit 5	Spare out	Pin 21	Bit 5	Gas_error	Pin 5
Bit 6	Coolant flow switch	Pin 35	Bit 6	Transfer 1	Pin 19	Bit 6	Spare_in4	Pin 3
Bit 7	Coolant temp switch	Pin 33	Bit 7	Spare_out2	Pin 17	Bit 7	Spare_in19	Pin 1
Port 6	Base Addr 50H	Output	Port 7	Base Addr 51H	Input	Port 8	Base Addr 52H	Input
Bit 0	Spare_out14	Pin 47	Bit 0	Spare_in1	Pin 31	Bit 0	Spare_in11	Pin 15
Bit 1	Spare_out15	Pin 45	Bit 1	Spare_in2	Pin 29	Bit 1	Spare_in12	Pin 13
Bit 2	Spare_out16	Pin 43	Bit 2	Spare_in3	Pin 27	Bit 2	Spare_in13	Pin 11
Bit 3	Spare_out17	Pin 41	Bit 3	Spare_in6	Pin 25	Bit 3	Spare_in14	Pin 9
Bit 4	Spare_out7	Pin 39	Bit 4	Spare_in7	Pin 23	Bit 4	Spare_in15	Pin 7
Bit 5	Spare_out8	Pin 37	Bit 5	Spare_in8	Pin 21	Bit 5	Spare_in16	Pin 5
Bit 6	Spare_out20	Pin 35	Bit 6	Spare_in9	Pin 19	Bit 6	Spare_in17	Pin 3
Bit 7	Spare_out21	Pin 33	Bit 7	Spare_in10	Pin 17	Bit 7	Spare_in18	Pin 1
Port 9	Base Addr 200H	Output	Port 10	Base Addr 201H	Output	Port 11	Base Addr 202H	Output
Bit 0	Transfer 2	Pin 47	Bit 0	Pilot arc relay	Pin 31	Bit 0	Gas_state1	Pin 15
Bit 1	Transfer 3	Pin 45	Bit 1	Surge injection select	Pin 29	Bit 1	Gas_state2	Pin 13
Bit 2	Select 5 amp	Pin 43	Bit 2	Spare_out13	Pin 27	Bit 2	Gas_state3	Pin 11
Bit 3	Select 2 amp	Pin 41	Bit 3	THC1 cycle start	Pin 25	Bit 3	Spare_out19	Pin 9
Bit 4	Watchdog_out	Pin 39	Bit 4	THC2 cycle start	Pin 23	Bit 4	CNC_transfer	Pin 7
Bit 5	Slave 5 amp select	Pin 37	Bit 5	Analog6_check_out	Pin 21	Bit 5	CNC_motion	Pin 5
Bit 6	Slave 2 amp select	Pin 35	Bit 6	Cable_checkA_out	Pin 19	Bit 6	THC1_corner_hold	Pin 3
Bit 7	Cable_checkB_out	Pin 33	Bit 7	Spare_out18	Pin 17	Bit 7	THC2_corner_hold	Pin 1
Port 12	Base Addr 204H	Input	Port 13	Base Addr 205H	Input	Port 14	Base Addr 206H	Output
Bit 0	THC1 Retract complete	Pin 47	Bit 0	CNC corner hold	Pin 31	Bit 0	CNC ready to fire	Pin 15
Bit 1	THC1 Cable install	Pin 45	Bit 1	CNC plasma sync	Pin 29	Bit 1	CNC arc transfer	Pin 13
Bit 2	THC1 Discrete error	Pin 43	Bit 2	CNC emergency stop	Pin 27	Bit 2	CNC machine motion	Pin 11
Bit 3	THC2 Retract complete	Pin 41	Bit 3	CNC machine cable installed	Pin 25	Bit 3	CNC retract complete	Pin 9
Bit 4	THC2 Cable installed	Pin 39	Bit 4	CNC spare input	Pin 23	Bit 4	CNC spare output	Pin 7
Bit 5	THC2 Discrete error	Pin 37	Bit 5	Watchdog_interlock	Pin 21	Bit 5	CNC system error	Pin 5
Bit 6	THC2 IHS complete	Pin 35	Bit 6	THC1_IHS complete	Pin 19	Bit 6	Serial Select1	Pin 3
Bit 7	CNC system start	Pin 33	Bit 7	Cable_checkB_in	Pin 17	Bit 7	Serial Select2	Pin 1
Serial Channels	Addr		100H	Analog Inputs	Input			
Com 1 Debug port	03F8H		Channel	Total current	Pin 1			
Com 2 Display serial	02F8H		Channel	Power Check	Pin 2			
Com 3 CNC Serial	03E8H		Channel	Not used	Pin 3			
Com 4 THC1/THC2 switched serial	02E8H		Channel	Not used	Pin 4			
			Channel	Not used	Pin 7			
			Channel	Not used	Pin 8			
			Channel	Analog6_check_in	Pin 11			
			Channel	Not used	Pin 12			

Appendix E**COMMAND THC AND CNC SOFTWARE – SUPPLEMENTAL INFORMATION**

In this appendix:

CommandTHC serial protocol	e-2
CNC serial interface.....	e-4

CommandTHC serial protocol

Commands can be sent over a serial link to control the function of the torch height control. The interface is 4 wire RS422 on the **Machine Interface Cable** (pins (1) RX-, (20) RX+, (2) TX-, (21) TX+). The serial frame runs at **19200 baud**, 8 data bits, 1 stop bit, and no parity. All bytes in a serial message are ASCII characters. A message consists of a start of message character (>, 0x3E), 2 byte message ID (**all message ID's should be capitalized**), variable length data, **2 byte checksum**, and end of message character (<, 0x3C). For example: to put the THC into remote mode >RM1D0<. ‘RM’ is the message ID, ‘1’ is the data field, and 0xD0 is the checksum (2 hex digits sent as 2 ASCII characters). The response to an accepted command is (^, 0x5E) and the response to an invalid command is (#, 0x23).

Some of the commands can be queried by using (?, 0x3F) as the data. For example: to query the actual arc voltage >AV?D6<. The response to this query would be >AV100058<, which represents an actual arc voltage of 100.0 volts with a checksum of 0x58.

Errors can be retrieved over the serial link. There is a discrete output on the machine interface cable (THC Error pins 14,33) which indicates an error has occurred. Using the command >CL8F< errors can be cleared and retrieved. A typical response might be >ERR-Motor Current Fault46< or if there is no error (^, 0x5E) is returned.

Command listing:

Command	ID	Data	Query	Notes
Pierce Delay	PD	0 – 9000 (0 to 9.000 seconds)	yes	Delay before motion output
Pierce Height Factor	PH	50 – 300 (50% to 300%)	yes	Used to set pierce height
Preflow During IHS	PF	0,1 (0 = off, 1 = on)	yes	Improves cycle time
IHS Stall Current	SC	1 – 10 (1 = least force)	yes	Used to set stall force
IHS Speed	IV	1 – 10 (1= slowest)	yes	Used to set IHS speed
IHS Test	IH	0,1 (0 = run, 1 = test)	no	Perform IHS test
Nozzle Contact Active	NC	0,1 (0 = off, 1 = on)	yes	Enable nozzle contact IHS
Machine Acceleration	MA	0 – 9000 (0 to 9.000 seconds)	yes	Delay voltage control
Maintenance Mode	MT	No data	no	Maintenance mode
Auto Kerf	AK	0,1 (0 = off, 1 = on)	yes	Disable voltage control in kerf
Actual Arc Voltage	AV	? (query only)	yes	Returned value is 1/10 volts
Automatic Voltage Control	AA	0,1 (0 = manual, 1 = auto)	yes	Voltage control or manual
Retract	RE	0,1 (0 = full, 1 = partial)	yes	Full or partial retract
Retract Distance	RH	0 – 8000 (0 to 8.000 inches)	yes	Must be in partial retract
Remote Mode	RM	0,1 (0 = off, 1 = on)	yes	Must be ON to use serial link
IO Rev	RI	? (query only)	yes	IO revision
RT Rev	RR	? (query only)	yes	Real Time revision
Homing Speed	HS	1 – 10 (1 = slowest)	yes	Home speed
Unit Conversion	UN	0,1 (0 = inches, 1 = metric)	yes	Units
Lifter Test	LT	No data	no	Perform lifter test
Cut Height	CH	0 – 1000 (0 to 1.000 inches)	yes	Used to set cut height
Arc Voltage Set-point	VS	500 – 3000 (50.0 to 300.0 volts)	yes	Used to set voltage control
Step Up	S+	No data	no	Move up fixed increment
Step Down	S-	No data	no	Move down fixed increment
Jog Up	J+	No data	no	Continuous movement up
Jog Down	J-	No data	no	Continuous movement down
Clear Error	CL	No data	no	Clear error, send error string
Flush Buffers	FL	No data	no	Reset RX and TX buffers
Error code	EC	? (query only)	yes	Send error code number

APPENDIX E – COMMAND THC AND CNC SOFTWARE – SUPPLEMENTAL INFORMATION

Application notes:

1. To do manual movements Jog up, down and Step up, down the THC must be in manual mode (Automatic Voltage Control = 0).
2. When the THC receives a Jog up or down command, it will move the torch up/down for 50 milliseconds. If a new command is not received after this time the motion will stop. To achieve continuous movement the Jog command must be repeatedly sent faster than once every 50 milliseconds.
3. The Error code command will ONLY retrieve an error code, it will not clear an error. To clear an error the CL (Clear error command must be sent).
4. The revision commands (RR and RI) return the decimal representations of the revisions that are stored (as ASCII characters) in the firmware.
5. Setting the Retract distance (RH) only applies when the THC is in partial retract (Retract = 1).
6. To force the lifter station to go home send the following series of commands : RE1, RE0 (partial retract, then full retract this will force a homing sequence).

Error codes:

Code	Error string
0	“ERR-Torch is in LOWER LIMIT”
1	“ERR-Torch is in HOME LIMIT”
2	“ERR-EEPROM checksum Error”
3	“ERR-Lifter NOT Installed”
4	“ERR-Motion FAIL”
5	“ERR-Watch Dog Timeout FAIL”
6	“ERR-InterProcessor Comm Fail”
7	“ERR-Nozzle Contact at Home”
8	“ERR-Cycle Start ON at INIT”
9	“ERR-Motor Current Fault”
10	“ERR-Machine Cable Missing”
11	“ERR-Plasma Cable Missing”
12	“ERR-Robotic Limit FAIL”
13	“ERR-DIAG FAIL REPOWER THC”
14	“ERR-IOP CHECKSUM FAIL”
15	“ERR-RTP CHECKSUM FAIL”
16	“ERR-NO ERROR”

CNC serial interface

The table below is intended to give you an idea of what commands and status information can be transferred over the serial link. This information is not sufficient to develop software from. If you are planning to develop software to interface to the HD4070 then contact Hypertherm engineering directly to get the most up-to-date and detailed information. Hypertherm has already developed a low level DLL (dynamic linked library) that will provide the basic plasma system interface to any PC based controller.

Guidelines

1. The plasma system is always “in charge of” the serial link: the plasma system (PS) software can decide at any time to ignore input from the remote user interface (CNC) and take commands from its local console instead.
2. The CNC initiates all message exchanges: the CNC sends a command or query message to the PS and the PS returns a response message. The CNC’s wait for a response may time out, in which case the CNC can re-send the message.
3. All messages are framed with a start-of-message/end-of-message character pair.
4. Only ASCII bytes will be transmitted. All messages include a two byte checksum.
5. No text for display will be transmitted. Error messages and process descriptions will be enumerated in a file shared between the PS and CNC software.

Message Format

The generic message format will be:

- start-of-message character (1 byte);
- message identifier (3 bytes);
- data (variable length);
- checksum (2 bytes);
- end-of-message character (1 byte).

Commands from CNC to PS

HELLO – ask PS to indicate that it is responding to serial messages.

Response Data – hardware identification string, e.g. “HD4070”

VERSION – get current PS version information.

Response Data – (code version) (database version) blank delimited

GET_STATE – get the state of the PS

Response Data – number representing the machine state.

LAST_ERROR – get most recent error code

Response Data – error code from Chris’s list of triaged warning/error conditions

REMOTE_MODE – request a change to remote mode

Response Data – (none) – respond with actual mode achieved.

GET_STD_PROCS, GET_CUST_PROCS – request for all [standard |custom] processes for specified material and thickness.

APPENDIX E – COMMAND THC AND CNC SOFTWARE – SUPPLEMENTAL INFORMATION

Comment – Not while cutting.

Command Data – (material) (thickness), blank delimited, e.g. “3 23” requests material 3, thickness 23

Response Data – process description(s) separated by linefeeds (see process description below)

GET_ACTIVE_PROC – request for process currently active on power supply.

Comment – Not while cutting.

Response Data – process description (see process description below) if there is no active process, the Response Data will have a process number of zero

READ_CTR1, READ_CTR2 – read counter/timer number 1 or 2

Comment – Only the counter for the active torch can be read while cutting.

Response Data – six fields of counter/timer data (see Counter_Timer_Text below) blank delimited

ZERO_CTR1, ZERO_CTR2 – clear specified counter/timer to zero

Comment – Will have no effect if cutting, due to EMI/disk-access concerns.

Response Data – (none)

LOAD_STD_PROC, LOAD_CUST_PROC – load specified process

Comment – Will be ignored if cutting.

Command Data – (material) (process number) blank delimited

Response Data – (process number loaded) Process number zero is reserved to indicate an error.

GET_DFLT_PROC – get the process number of the default process

Comment – Not while cutting due to EMI/disk-access concerns.

Response Data – (material) (process number) (0=standard or 1=custom) blank delimited e.g., “3 33 1” means the default process is material=3, proc_number=33, custom

SAVE_PROC – save current settings to custom database; make this the active process

Comment – Not while cutting.

Response Data – (proc_number loaded) or zero on error

GET_CONFIG – request description of current hardware configuration

Command Data – (none)

Response Data – (torches installed)(THC installed)(slave installed) as for SET_CONFIG command data

SET_CONFIG – send description of current hardware configuration to PS setup mode

Comments – Configuration cannot be changed while cutting.

The present HD4070 does not allow a slave configuration.

Command Data – (torches installed)(THC installed)(slave installed)

as a single three-digit decimal number, i.e., no spaces

torches installed: 0=neither, 1=first, 2=second, 3=both

THC installed: 0=neither, 1=first, 2=second, 3=both

slave installed: 0=no, 1=yes

e.g., “110” means Torch #1 with a THC is installed

Response Data – (none)

GET_TORCH – determine currently selected torch

Response Data – (number of active torch)

number: 0=neither torch, 1=first torch, 2=second torch

SET_TORCH1, SET_TORCH2 – select specified torch

Comment – Power supply will not allow a torch change while cutting.

Response Data – (number of torch selected)

number: 0=neither torch, 1=first torch, 2=second torch

APPENDIX E – COMMAND THC AND CNC SOFTWARE – SUPPLEMENTAL INFORMATION

THC_MANUAL, THC_AUTO – put THC for current torch into manual or automatic mode
Comment – On power-up, the power supply puts the THC into AUTO mode.

After power-up, the THC mode changes only by operator command.

The THC does not automatically return to AUTO mode when a cut is started.

Response Data – THC configuration. Response is either THC_MANUAL or THC_AUTO.

THC_SLEW_UP, THC_SLEW_DOWN – start slew on active THC

Comment – Hardware protection exists and may terminate a slew command prematurely.

Response Data – THC configuration

THC_SLEW_STOP – stop THC slew

Response Data – THC configuration

THC_JOG_UP – move THC up (away from workpiece) a fixed increment

Response Data – THC configuration

THC_JOG_DOWN – move THC down (toward workpiece) a fixed increment

Comment – Hardware protection may void this command.

Response Data – THC configuration

READ_PLASMA_AMPS – get actual arc current

Response Data – arc current in amps. arc current is zero when the torch is not cutting

READ_PLASMA_VOLTS – get actual arc voltage

Response Data – arc voltage in tenths of volts

arc voltage is zero when the torch is not cutting

arc voltage is zero if there is no THC installed on the active torch

SET_CUTSPEED – set the RECOMMENDED cut speed, useful for customization

Command Data – new recommended cut speed in inches per minute

Response Data – recommended cut speed in inches per minute

GET_INLET_GAS_n, (n=1,2,3) – get type and inlet pressure of specified gas

Response Data – (gas type) (gas pressure in psig) blank delimited

gas type is an enumeration from CNCdatadefs.h; it could be NO_GAS

gas pressure is the manifold supply pressure; it could be zero

GET_GAS_FLOW_XX_n, (XX=PreCut, CuT, PreShield, SHield), (n=1,2) – get gas flow-rate of specified gas

Response Data – gas flow-rate as a percent of full, e.g. “50” means half-flow

GET_GAS_TYPE_XX_n, (XX=PreCut, CuT, PreShield, SHield), (n=1,2) – get type (eg oxygen) of specified gas

Response Data – enumerated gas type

SET_GAS_FLOW_XX_n, (XX=PreCut, CuT, PreShield, SHield), (n=1,2) – set gas flow-rate of specified gas

Comment – receipt of this command will terminate any gas-flow tests in progress

Command Data – gas flow-rate as a percent of full, e.g. “50” means half-flow

Response Data – gas flow-rate as a percent of full, e.g. “50” means half-flow

SET_NOMINAL_AMPS – change arc current Set-point

Command Data – desired arc current Set-point

Response Data – actual arc current Set-point in amps

SET_NOMINAL_VOLTS – change arc voltage

APPENDIX E – COMMAND THC AND CNC SOFTWARE – SUPPLEMENTAL INFORMATION

Command Data – desired arc voltage

Response Data – achieved arc voltage in tenths of volts
if no THC installed, arc voltage will always be zero

SET_THC_PARAMS – set all THC parameters. Not while cutting.

Command Data – THC parameters as blank-delimited integers

pierce height factor, percent

pierce delay, tenths of seconds

IHS speed, 1 to 10 (arbitrary scale)

IHS stall force, 1 to 10 (arbitrary scale)

retract speed, 1 to 10 (arbitrary scale)

retract height, thousandths of an inch

nozzle contact, 0=off, 1=on

cut height, thousandths of an inch

autokerf, 0=off, 1=on

machine accel delay, thousandths of a second (0-9000 = 0 to 9.000 seconds)

Response Data – THC configuration

GET_THC_PARAMS – get all THC parameters

Response Data – THC parameters actually set, in SET_THC_PARAMS format

a pierce height (the first parameter) of zero indicates that the parameter list is invalid

THC_IHS_TEST_START – initiate a test of the IHS setting: THC moves toward workpiece until contact is sensed

Response Data – (none)

THC_IHS_TEST_STOP – stop the test

Response Data – (none)

GAS_CUTFLOW_TEST_START – initiate a test of the cutflow gasses

Response Data – (none)

GAS_CUTFLOW_TEST_STOP – stop the test

Response Data – (none)

GAS_PREFLOW_TEST_START – initiate a test of the preflow gasses

Response Data – (none)

GAS_PREFLOW_TEST_STOP – stop the test

Response Data – (none)

Plasma System Responses

BAD_CHECKSUM – checksum received doesn't match computed checksum

Response Data – (none)

BAD_COMMAND – unknown or illegal command

Response Data – (none)

CUTTING – PS is cutting and will ignore the command from CNC

Response Data – (none)

LOCAL_MODE – PS is in local mode, will not process commands from CNC

Response Data – (none)

APPENDIX E – COMMAND THC AND CNC SOFTWARE – SUPPLEMENTAL INFORMATION

LOCAL_CHANGES – PS may have changed parameters or database locally since last CNC query
Response Data – (none)

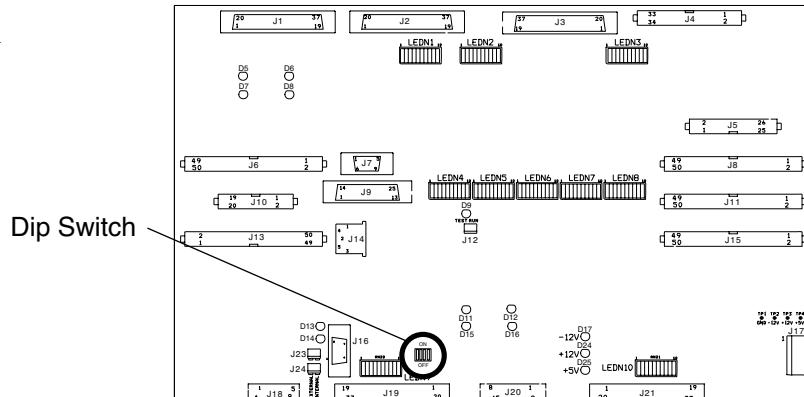
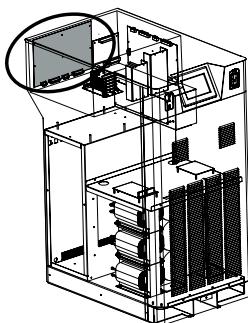
PS_ERROR – PS has an internal software or configuration error
Response Data – (error code)

Suggestions for CNC serial expansion to multiple plasma systems

The following are suggestions to allow a single CNC system to interface to multiple HD4070 plasma systems using the serial interface. Contact Hypertherm Engineering for more information.

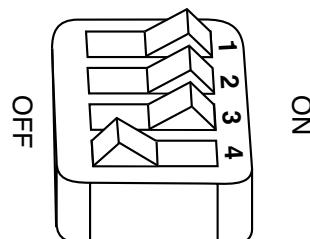
1. If the CNC controller is a PC based controller then possibly the simplest way would be to add an expansion I/O board with the correct number of RS422 serial ports. These expansion boards are available from a wide variety of vendors. Obviously the software must be developed to support the dedicated port for each plasma system.
2. If the CNC controller is limited to a single serial port then it may be possible to externally add a software controlled serial switch. This type of device intercepts control codes over the serial link that are used to switch the serial connection to any one of several available channels. Once again the CNC software must be developed to support this type of device. Devices of this type are available from BLACK BOX INC. and their telephone number is (877) 877-2269.
3. If the CNC controller has an ethernet connection then it is possible to use an ethernet to serial converter such as those sold by LANTRONIX INC. (949) 453-3990. These devices have a settable IP address and can be used to provide independent serial interfaces to each plasma system. Once again the CNC software must be designed to support this approach.

Breakout board Dip Switch configurations



Single machine configuration

Switch number 4 must be in the ON position in a single system configuration. Switch 1, 2 and 3 are OFF.



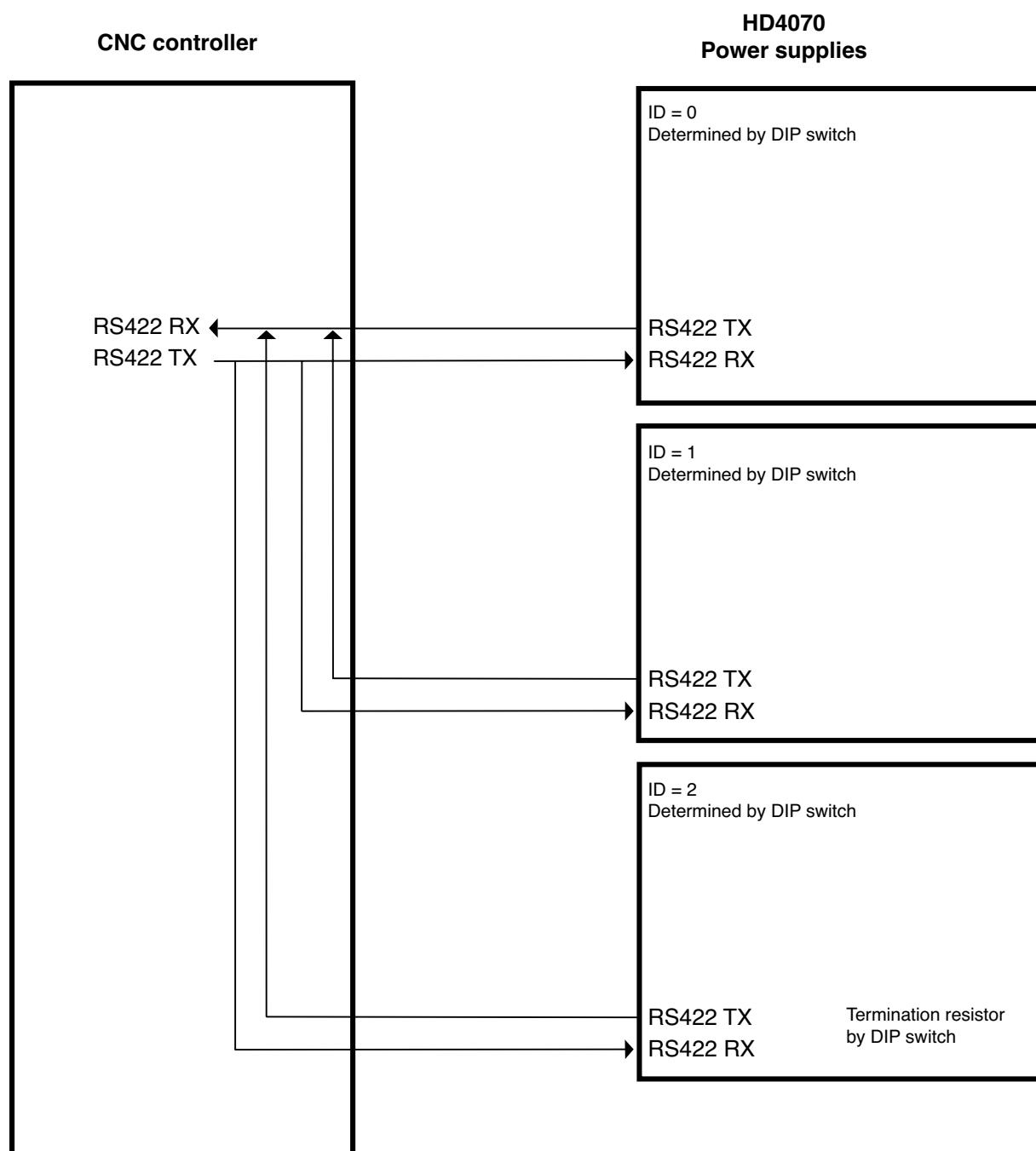
Multiple machine configuration

Up to 8 systems can be linked in series.

Each power supply is given an ID number by setting the dip switches as shown on the next page.

The series must be terminated by setting the number 4 switch on the last machine in the series to the ON position.

RS-422 multidrop interface to multiple HD4070 systems

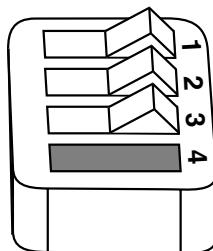


Dip Switch configurations for multiple machines

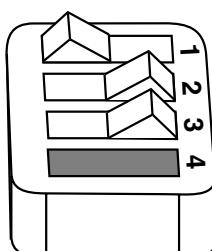


Caution: Damage to the break-out PCB can occur if any machine has switch number 4 in the ON position except the last machine in a series or a single machine system.

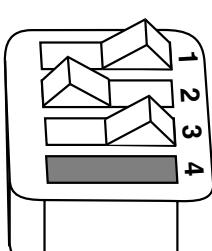
1st in a series - ID = 0



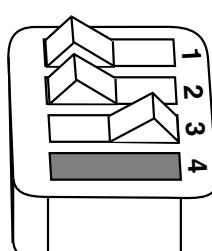
2nd in series - ID = 1



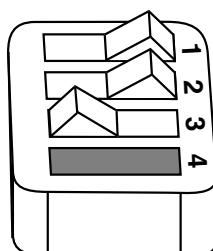
3rd in series - ID = 2



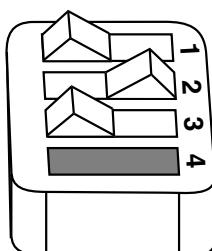
4th in series - ID = 3



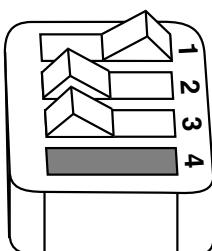
5th in series - ID = 4



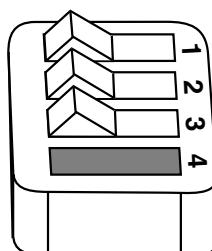
6th in series - ID = 5



7th in series - ID = 6

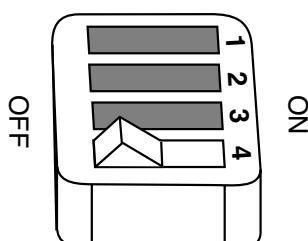


8th in series - ID = 7

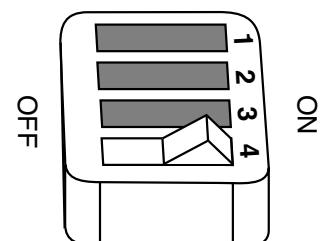


Switch number 4 positions

Last in series



All others



Appendix F

PC-104 STACK: JUMPER POSITIONS

In this appendix:

PC-104 stack: jumper positions	f-2
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APPENDIX F – PC-104 STACK: JUMPER POSITIONS

PC104 stack: jumper positions

CPU board (B1)

<u>Jumper block</u>	<u>Position</u>	<u>Jumper</u>	<u>Jumper block</u>	<u>Position</u>	<u>Jumper</u>
J9	1,2 3,4 5,6 7,8 9,10 11,12 13,14 15,16 17,18	open open open jumper open jumper jumper open jumper	J26	1,2 3	jumper open
J8	1,2 3	jumper open	J29	1 2,3	open jumper
J11	1,2 3,4 5,6	open jumper open	J31	1,3 2,4 5,6 7,9 8,10	jumper open jumper jumper jumper
J14	1,2	jumper	J5	all open	
J27	all open		J6	all open	
J28	all open				
J23	1,2 3	open open			
J24	1,2 3	jumper open			
J22	all open				
J16	all open				
J30	1 2,3	open jumper			
J32	1,2 3,4 6,8 5,7 9,10	open open jumper jumper jumper			

Flash memory board (B2)

<u>Jumper block</u>	<u>Position</u>	<u>Jumper</u>
J1	all open	

Dual serial board (B3)

<u>Jumper block</u>	<u>Position</u>	<u>Jumper</u>
J1	1,2	jumper
J2	all open	
J3	all open	
J5	all open	
J6	all open	
J7	1,2 3,4 5,6 7,9 8,10	open open open jumper jumper
J8	1,2	jumper
J9	1,2 3,4	open jumper

48 channel digital I/O #1 (B4)

<u>Jumper block</u>	<u>Position</u>	<u>Jumper</u>
JP1	1,2 3	jumper open
JP2	1,2 3,4 5,6	open jumper open
JP3	1,2 3	jumper open
JP4	1,2 3,4 5,6	open jumper open
JP5	13,14 all others	jumper open
SW1	1 2,3,4 5 6,7,8	OFF ON OFF ON

APPENDIX F – PC-104 STACK: JUMPER POSITIONS

48 channel digital I/O #2 (B5)

<u>Jumper block</u>	<u>Position</u>	<u>Jumper</u>
JP1	1,2 3	jumper open
JP2	1,2 3,4 5,6	open jumper open
JP3	1,2 3	jumper open
JP4	1,2 3,4 5,6	open jumper open
JP5	13,14 all others open	jumper all others open
SW1	1 2,3,4 5 6,7,8	OFF ON ON ON

Analog board (B6)

<u>Jumper block</u>	<u>Position</u>	<u>Jumper</u>
J2	1,2	jumper
J4	1 2,3	open jumper
J5	1 2,3	open jumper
J6	1,2 3,4 5,6 7,8	open jumper open jumper
J8	1,2 3,4	jumper jumper
J7	all open	