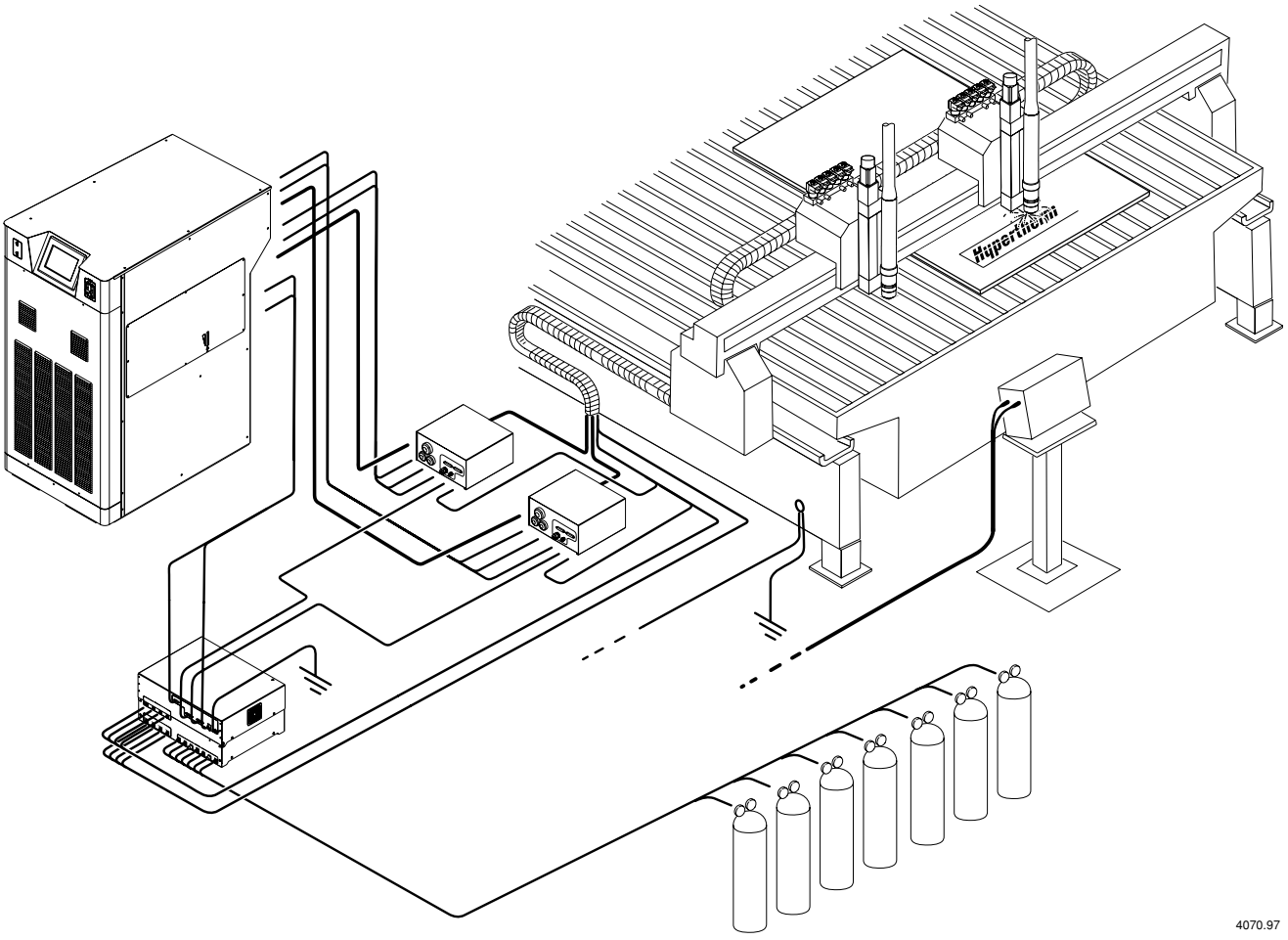
HyDefinition®
HD4070

Plasma Arc Cutting / Marking System

Instruction Manual
803760 – Revision 8



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Hypertherm®

The world leader in plasma cutting technology™

Changed Page	Description of Change	IM376 Rev 7 to 8 2/22/05
5.19, 5.46, 6.7, 6.21 and 013339 schematic (sheet 3 of 5)	The part number for the THC power source has been changed from 041509 to 229069. All 5 sheets of the 013339 schematic changed to revision "G".	

Changed Page	Description	IM376 Rev 6 to 7 12/22/04
General	Coolant system upgrade. Changes pump, motor and some hoses in the coolant loop.	
vi and 5.1	Strainer removed from "Coolant System Filter and Strainer" description (5-7). There is no strainer in the new pump.	
vii and 5.1	Removed schedule from "Preventive Maintenance schedule" (5-49). New preventive maintenance information added.	
3.3, 3A.24, 3B.22, 5.4	Caution box updated. Hypertherm coolant should still be used, but the catastrophic damage statement has been removed.	
5.45	Added dipswitch settings and art next to figure of PCB 041511.	
5.49-5.56	New preventive maintenance information added. Preventive maintenance protocal, master schedule, protocal checklist and parts replacement schedule.	
6.3 and 6.4	Removed old pump from art. Art change only.	
6.8	Art updated to show new pump. Part numbers changed. Item number 9 changed from 024749 (Hose Assembly) to 229036 (Motor). Item number 10 changed from 128906 (Kit: Pump Upgrade) to 128714 (Kit: Low profile filter). Item number 11 and 12 (024724 and 024606) no longer used. Added Motor and Pump numbers for item numbers 11 and 12. Description changed for item number 9 from "Filter Assembly: 25 Micron" to " FIlter Housing.	
6.16	Added pump part number under Cooling system.	
6.22	Added pump and motor part numbers.	
Wiring diagrams Section 7	013334 diagram went to Rev "D". 013339 Diagrams went to Rev "F".	

General	Coolant pump changed. The coolant system must use Hypertherm coolant. If the system is run with water as coolant catostrphic pump failure will occur.
Cover and title page	Changed Revision and date
vi	Water removed from cooler description. Was "water cooler" now "cooler"
3.3, 3A.24, 3B.22, 5.4	Caution added.
3.4	Information changed and added under "Water Purity Requirements"
3A.24, 3B.22	Note under "Fill the Power Supply With Coolant" changed.
4.17-4.22	Added decimal equivalents for gauge thicknesses.
4.31	Water removed from bullet connector description. Was "water in bullet connector" and "water return bullet connector" now "coolant in bullet connector" and "coolant return bullet connector""
5.2	Changed text in warning box
5.7	Pump strainer cleaning deleted. The new pump has no strainer.
6.8	Art updated to show new pump. Part numbers changed. Item number 9 changed from 129619 (Pump-Motor Assembly) to 229036 (Motor Sub-Assembly). Item number 10 changed from 129738 (Pump Sub-Assembly) to 128906 (Kit: Pump Upgrade).
Wiring diagrams Section 7	Flowswitch diagram (013339, sheet 2 of 5) corrected . Revision of all 5 sheets went to "D" in Rev 5.
Wiring diagrams Section 7	013339 Diagrams went to Rev "E".

Changed Page	Description	Rev 3 to 4

11/12/02

4.1	Updated TOC to reflect insertion of "How to optimize cut quality".
4.14 & 6.13	Added note: "Sets can also be used for marking mild steel" to consumable table.
4.16	Added note under marking cutchart explaining the use and constraints of using cutting consumables for marking applications.
4.34-4.38	Updated "Cutting Techniques" to new boiler plate "How to optimize cut quality".
5.15	Note at top of table changed. Error codes # 5 & 6 added. They replace #s 46 & 47, which had the over/under percentages at 10%. When #s 5 & 6 were added this was corrected to 15% .
5.16	Note at top of table changed. #s 46 & 47 removed. Replaced by #s 5 & 6. Error codes 80-85 added. Changed 6 seconds to 12 in error code #93.
5.17	Error code #s 131 & 132 were listed on this page in error and were removed. #s 116 & 117 were added. Text for #117 is exactly the same as 132. Only the code # was changed.
5.18	Error code # 131Text corrected, was watchdog time-out, now THC control failure.
5.20	Pin designators for PC-104 DC power added.
5.30	Changed 10 K° to 1K° in last bullet point on page.
6.4	Item # 5 - part number 014239 was incorrect. Part # corrected and part #s for all other voltages added.
6.6	Added designators.
6.8	Item # 6 - hose length changed to 20 inches. Item # 11 - part number changed to 024724 from 027724. Hose length changed to 14 inches.
Appendix e	Changed name of appendix to "Command THC and CNC software - Supplimental information" Changed main TOC to agree. Added information on mulit-port serial communication. Added pages e-9 & e-10 with information on breakout board dip switch configurations and cabling between systems.

2.3, 3A.25, 3B.2, 3B.3, 3B.21, 3B.23, 4.8, 4.9, 5.5	Additional torch receptacle plug information added. Notes, art & warning
2.5	Added note stating that CO2 is not used at this time, no need to install line.
2.12, 3A.2, 3A.12, 3A.13, 3A.15-18, 3A.25, 3B.2&3, 3B.16, 5.41, 5.43, 6.17	Changed art to show new encoder on THC lifter. New part numbers on page 6.17. 128726 - encoder replacement kit. 128727 - motor/encoder replacement kit.
5.1	Updated TOC.
5.30	Gas console relay boards (PCB1 & PCB3) description lists are now on one page.
5.31-5.34	Added LED sequences for PCB1 & 3 for cutting and marking.
5.35	Added Setting regulator pressure.
6.2	003138 circuit breaker replaced with 2 different types. 003209 - 7.5Amp for 400/440/480&600V units. 003210 - 15Amp for 200/220&240V units

Changed Page	Description	Rev 1 to 2

12/17/01

2.12	Changed dimension from 2.4" to 2.8". 2 rail lifter change.
3.6 & .12, 3A.2 &. 23, 3B.2,.12 & .21, 5.3	Updated art to show off-valve cover
4.14 & 6.13	Added CCW consumables for 200A M.S.
5.35	Text changed to match figure change in Rev1 (P2 Jumper for 265V is now for 211V block position changed from 265V to 211V)
5.37&5.39	Updated art to show 2 rail lifter.
6.8	Added Lo-Profile Filter art. P/Ns 128714 & 027927 and Pump sub-assembly, P/N 129738. Rearranged order of part #s.
6.11	Gas console art updated. Shows valves in the current orientation.
6.17	Lifter assembly P/N (128050) changed to 2 rail version 128606. Driving block P/N (027552) changed to 027903. Rail and block bearing P/N (027551) changed to 027904. Lead screw assembly P/N (129266) changed to 129699. AddedP/N 128607- band seal kit.
6.18	P/N (075508) changed to 075583.
6.19	Cable P/N 123596 given an item # (3a).

Changed Page	Description	IM376 Rev 0 to 1

4/26/01

Cover	Added HyDefinition to title
2.5	H35 percentages corrected to H35 = 35% Hydrogren, 65% Argon
2.11	Updated dimension from 2.25" to 3.5" and metric equivalent
iv &3.1	Correction to table of contents: 3-19 canged to 3-20, 3-20 to 3-21
3.3	Caution box text realigned
3.14	Note added under power requirements table (Pg still says 0 not 1.1)
3A.3	Cables and hoses header changed from German to English
Section 4	Cutcharts added: 30A S.S. & AL, 70A S.S. & AL, 100A S.S. & AL
4.5	Note added "The screen displays the choices..."
4.19	English cutchart: ipm & mmm were reversed
5.15 & 5.16	Notes added to top of error code tables 1 & 2
5.25 & 26	PC-104 art and test procedure removed. Incomplete procedure and parts. Pg #'s after bumped up
5.35	P2 Jumper for 265V is now for 211V block position changed from 265V to 211V
6.12	Added part #'s 058224, 044030 & 128654. Renumbered parts, updated art

HD4070

Instruction Manual

(P/N 803760)

Revision 8 – February, 2005

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EMC INTRODUCTION

Hypertherm's CE-marked equipment is built in compliance with standard EN50199. The equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

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

This plasma equipment 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.

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.

Hypertherm

Section 1

SAFETY

In this section:

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.

CUTTING CAN PRODUCE TOXIC FUMES

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

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

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

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

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

GROUNDING SAFETY

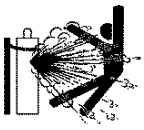
Work Cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

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

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

COMPRESSED GAS EQUIPMENT SAFETY

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



GAS CYLINDERS CAN EXPLODE IF DAMAGED

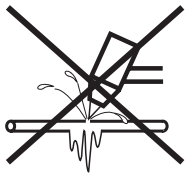
Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

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

NOISE CAN DAMAGE HEARING

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

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



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. 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.

Hypertherm

Section 1a

SÉCURITÉ

Dans cette section :

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 fendu. 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.

LE COUPAGE PEUT PRODUIRE DES VAPEURS TOXIQUES

Le coupage peut produire des vapeurs et des gaz toxiques qui réduisent le niveau d'oxygène dans l'air et peuvent provoquer des blessures, voire la mort.

- Conserver le poste de coupage bien aéré ou utiliser un masque respiratoire homologué.
- Ne pas procéder au coupage près d'endroits où s'effectuent le dégraissage, le nettoyage ou la vaporisation. Certains solvants chlorés se décomposent sous l'effet des rayons ultraviolets et forment du phosgène.
- Ne pas couper des métaux peints ou contenant des matières toxiques comme le zinc (galvanisé), le plomb, le cadmium ou le béryllium, à moins que la zone de travail soit très bien ventilée et que l'opérateur porte un masque respiratoire. Les revêtements et métaux contenant ces matières peuvent produire des vapeurs toxiques lors du coupage.
- Ne jamais couper de récipients pouvant contenir des matières inflammables avant de les avoir vidés et nettoyés correctement.
- Quand on utilise ce produit pour le soudage ou le coupage, il dégage des fumées et des gaz qui contiennent des produits chimiques qui, selon l'État de Californie, provoquent des anomalies congénitales et, dans certains cas, le cancer.

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.

Courant de l'arc	Puissance des verres teintés AWS (É.-U.)	ISO 4850
Jusqu'à 100 A	N° 8	N° 11
100-200 A	N° 10	N° 11-12
200-400 A	N° 12	N° 13
Plus de 400 A	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 ignifuges 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.

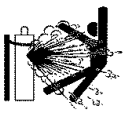
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

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 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

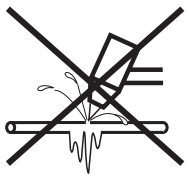
Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

- 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. 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.

Hypertherm

Section 2

SPECIFICATIONS

In this section:

System Description

General

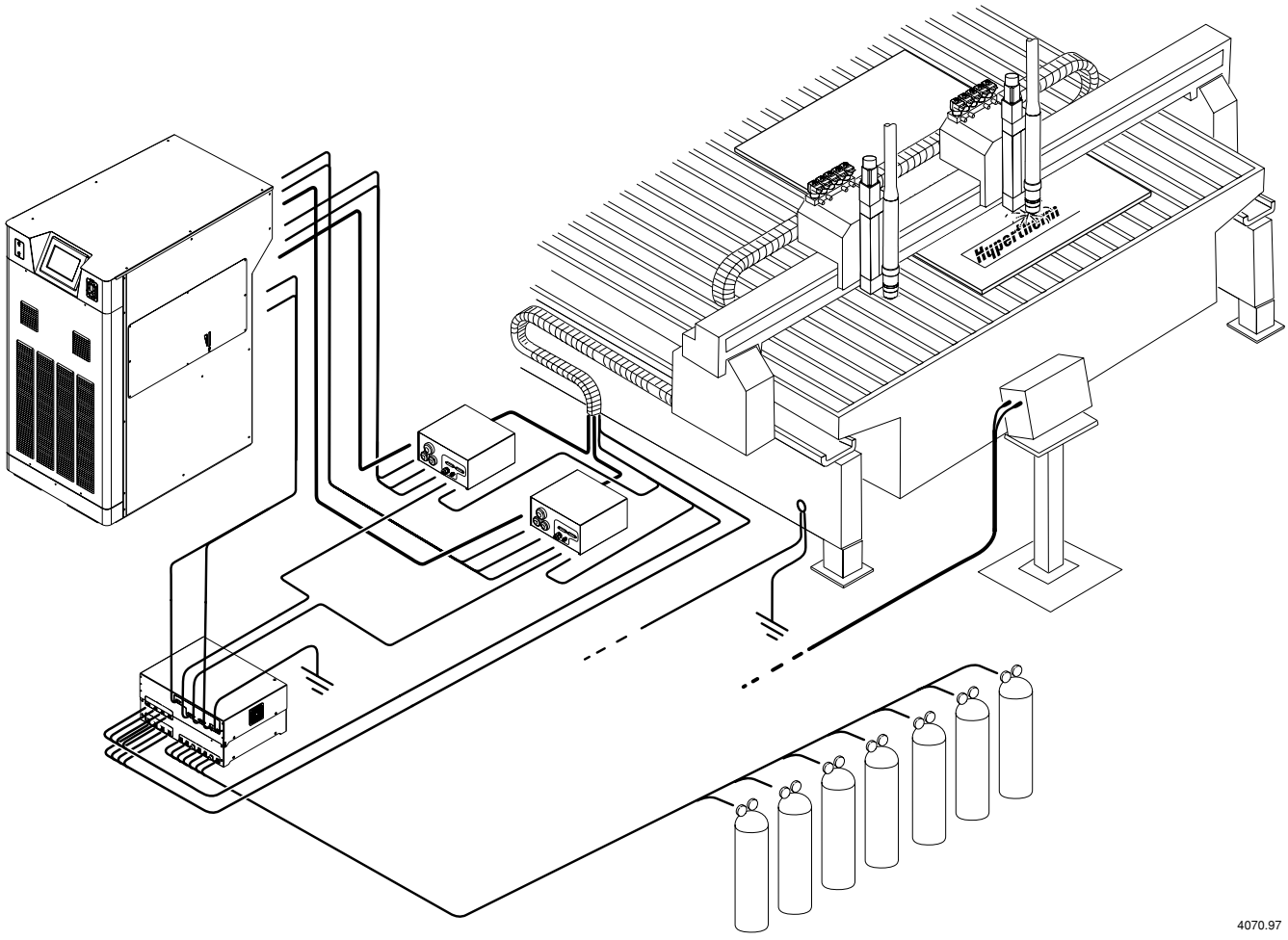
The HD4070 is a fully automated 200-amp plasma cutting system that requires minimal input and adjustment by the operator. Using the HD4070 display touch screen (or CNC), the operator enters the material and thickness to be cut. The HD4070 system automatically selects and adjusts the power and gas required 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 1/2" mild steel at up to 90 ipm (12 mm at up to 2515 mm/min).

Machine torch

The machine torch can cut 1/2" mild steel at 90 ipm (12 mm at up to 2515 mm/min). The maximum production cutting capability of the torch is 3/4 inch (19 mm) HyDefinition and 1 inch (25 mm) conventional cutting. **To achieve consumable long life, all cuts must begin and end on the plate surface.**



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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 Command THC Option** - The Hypertherm Integrated Command THC 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 Command THC 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 Command THC 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 with out 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

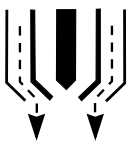
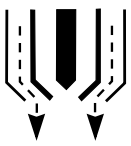
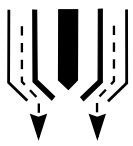
Warning: The HD4070 system can only support one touch screen display, either local or remote. Installing displays at both locations on one system may cause malfunctions or damage.

Specifications

System gas requirements

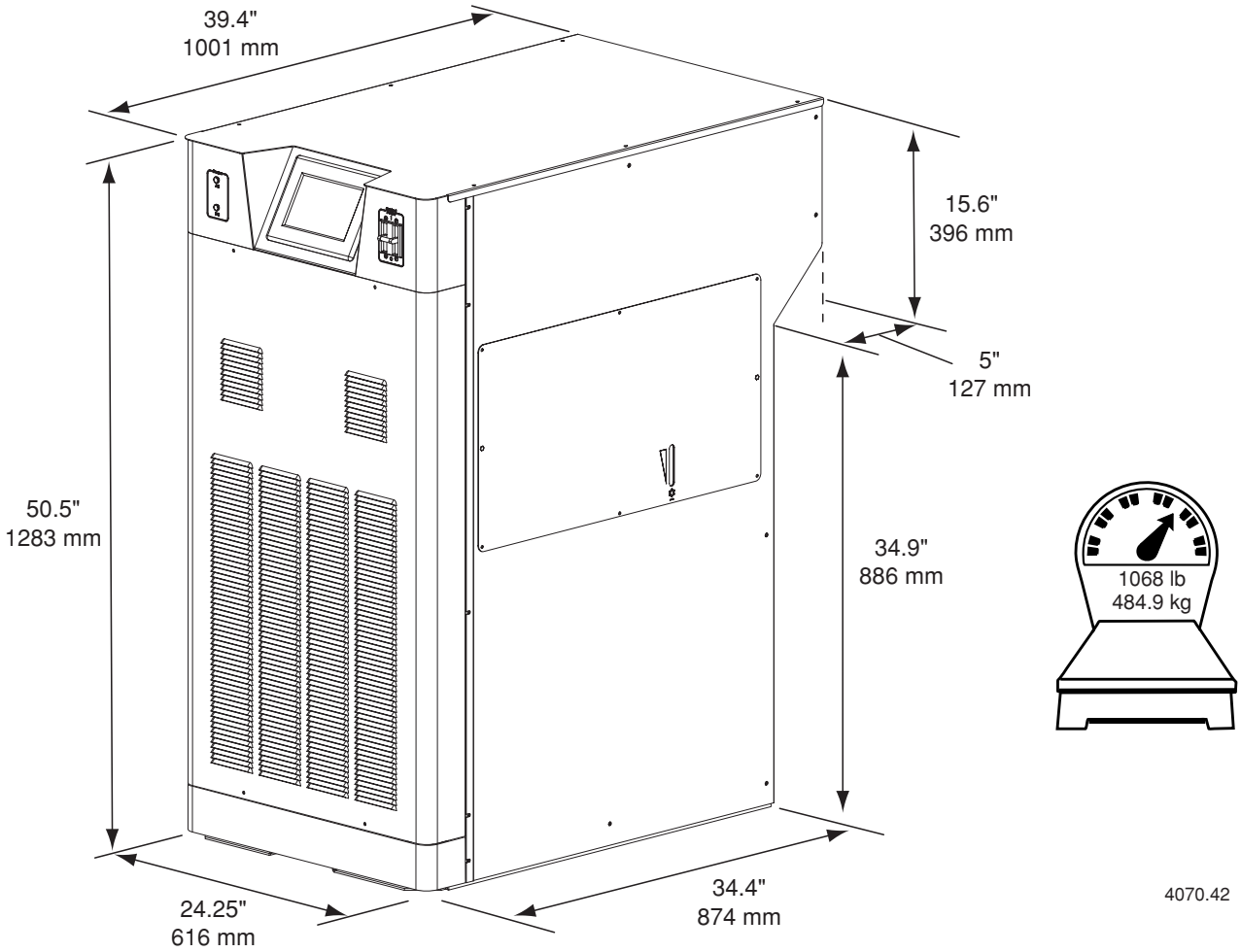
Gas Quality and Pressure Requirements			
	Quality	**Pressure + 5%**	**Flow Rate**
O_2 Oxygen	99.5% pure (liquid gas recommended) Clean, dry, oil-free	120 psi 8.3 bar / 827 kPa	133 scfh (3780 l/h)
N_2 Nitrogen	99.99% pure (liquid gas recommended) Clean, dry, oil-free	120 psi 8.3 bar / 827 kPa	142 scfh 4020 l/h
Air	Clean, dry, oil-free	120 psi 8.3 bar / 827 kPa	140 scfh 3960 l/h
CH_4 Methane	93% pure	120 psi 8.3 bar / 827 kPa	188 scfh 5340 l/h
H5 Argon-Hydrogen	99.995% pure (liquid gas recommended) (H5=5% Hydrogen, 95% Argon)	120 psi 8.3 bar / 827 kPa	122 scfh 3420 l/h
H35 Argon-Hydrogen	99.995% pure (liquid gas recommended) (H35=35% Hydrogen, 65% Argon)	120 psi 8.3 bar / 827 kPa	146 scfh 4140 l/h
*CO_2 Carbon-Dioxide	99.5% pure	120 psi 8.3 bar / 827 kPa	113 scfh 3180 l/h

*CO_2 is not currently used on the HD4070 and there is no need to install the gas line.

	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	O_2	O_2 & N_2	Air	Air	Air	Air
Cutting 70 A	O_2	O_2 & N_2	H35 & N_2	N_2	Air	CH_4 & Air
Cutting 100 A to 200 A	O_2	O_2 & N_2	H35 & N_2	N_2	H35 & N_2	N_2

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, 104°F (40°C)
Ambient Temperature/Duty Cycle	Power supplies will operate between +14° and 104°F (-10°C and +40°C)
Power Factor(cosφ)	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, 3ph, 50-60 Hz, 125A	
220 VAC, 3ph, 50-60 Hz, 113A	
240 VAC, 3ph, 60 Hz, 103A	
400 VAC CE, 3ph, 50-60 Hz, 62A	
440 VAC, 3ph, 50-60 Hz, 56A	
480 VAC, 3ph, 60 Hz, 52A	
600 VAC, 3ph, 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

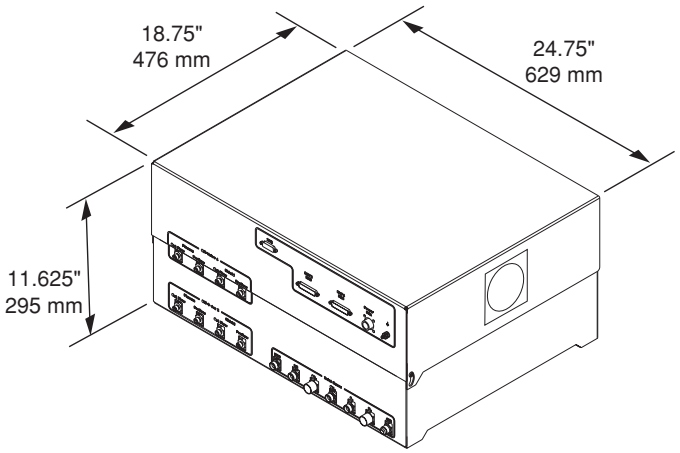
Gas console assembly - 078085

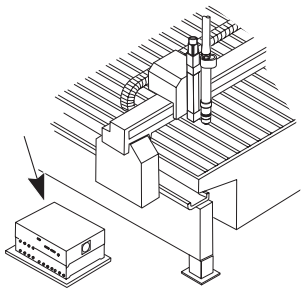
Position the gas console near the cutting table. Allow room to open the top for servicing.

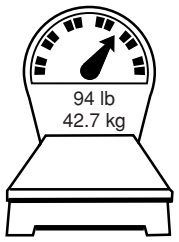
Venting air is drawn in through fans on both sides and is exhausted through the front of the unit.

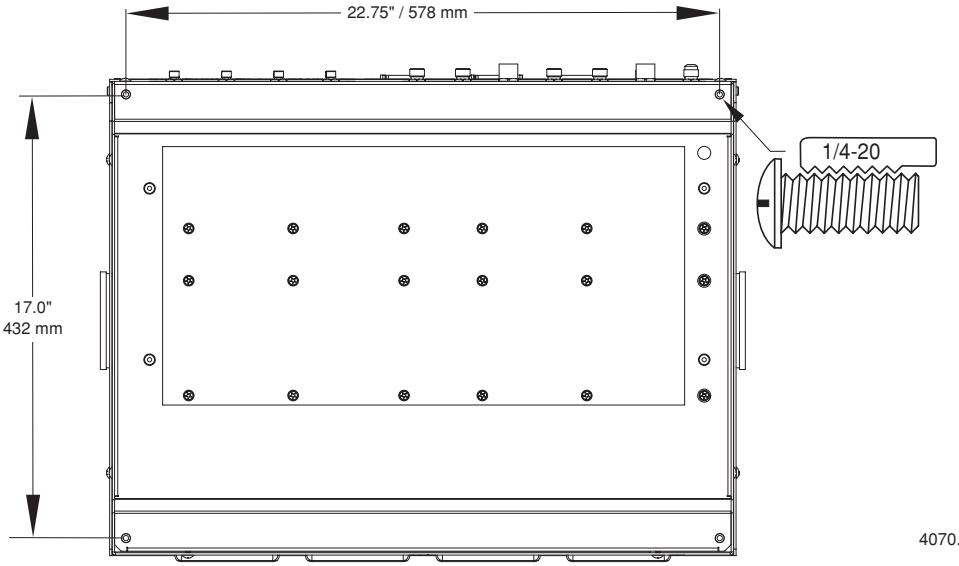
Maximum distance from the power supply should not exceed 150 feet (46 m).

Maximum distance to the off-valve assembly should not exceed 100 feet (30.5 m).



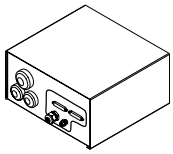




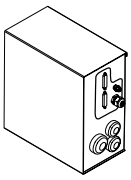


Ignition console assembly - 078088

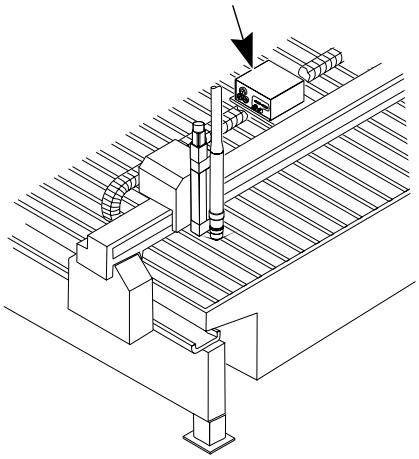
- Mount the ignition console up to 15 feet (4.5 m) from the torch lifter station. Allow room to remove the top for servicing.
- The ignition console may be mounted in the horizontal or the vertical position as shown below.

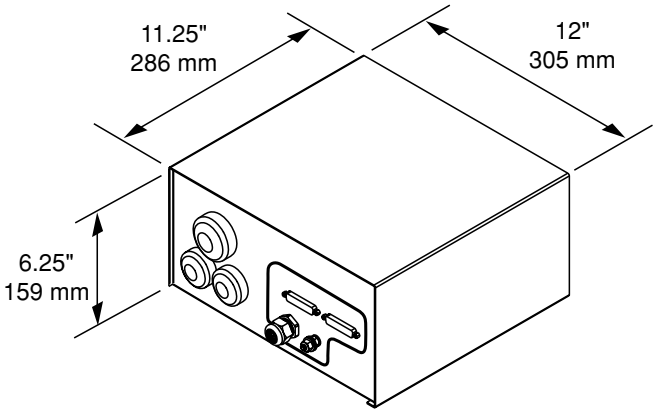


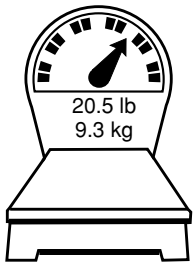
Horizontal Mounting

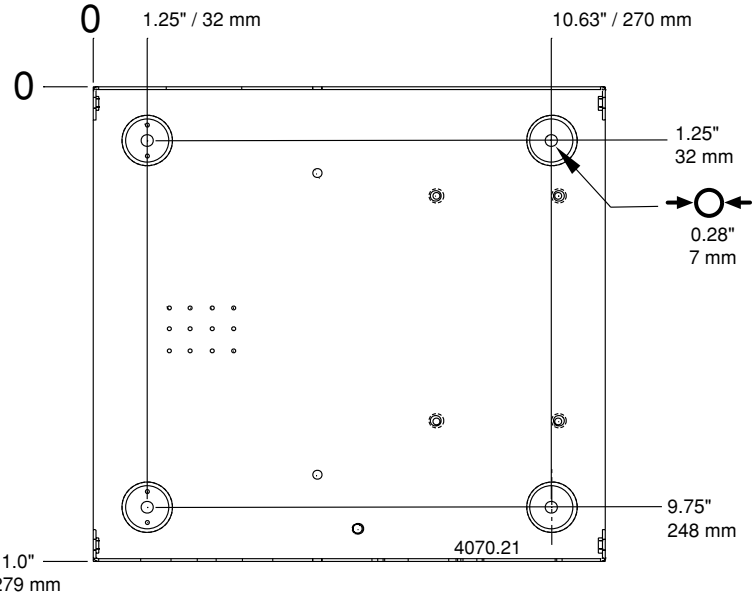


Vertical Mounting









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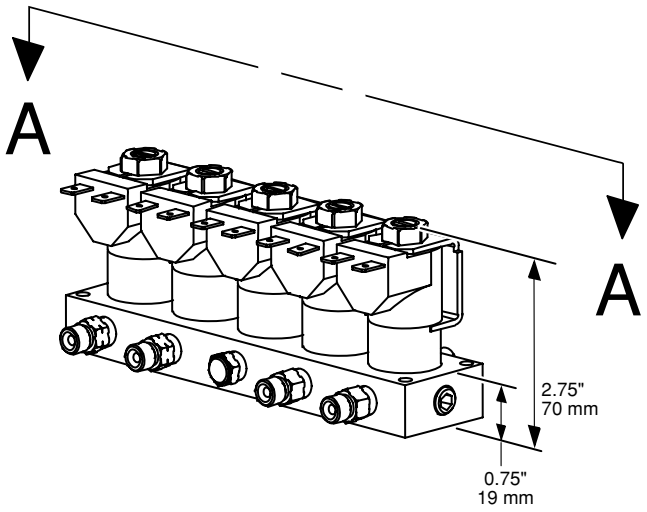
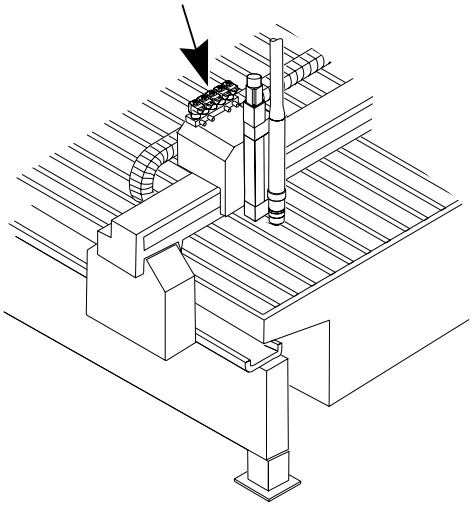
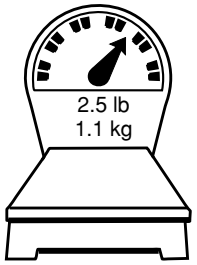
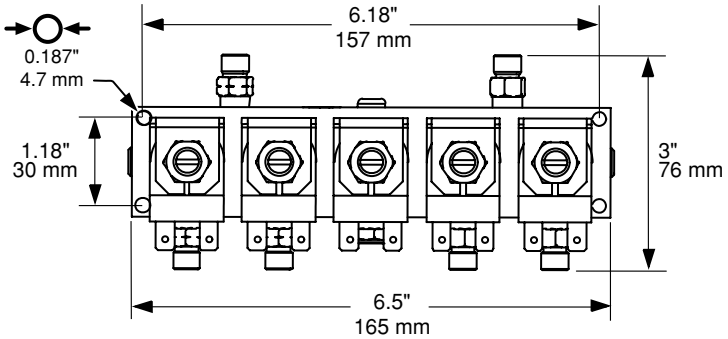
Off-valve assembly - 129563

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









A - A

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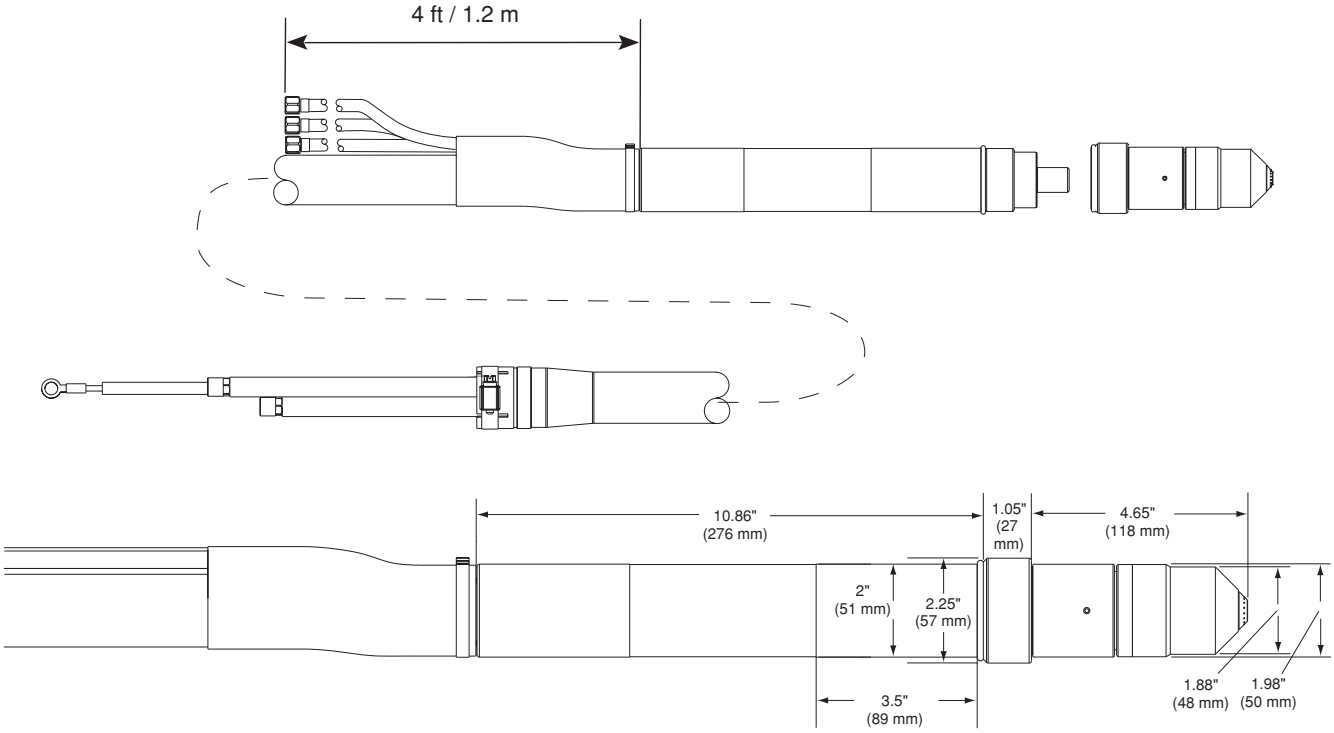
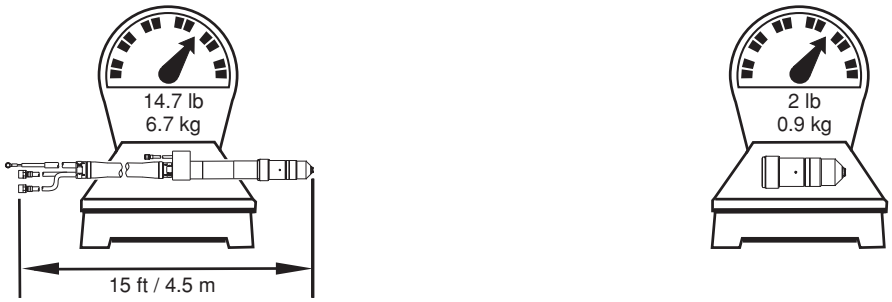
Torch Specifications





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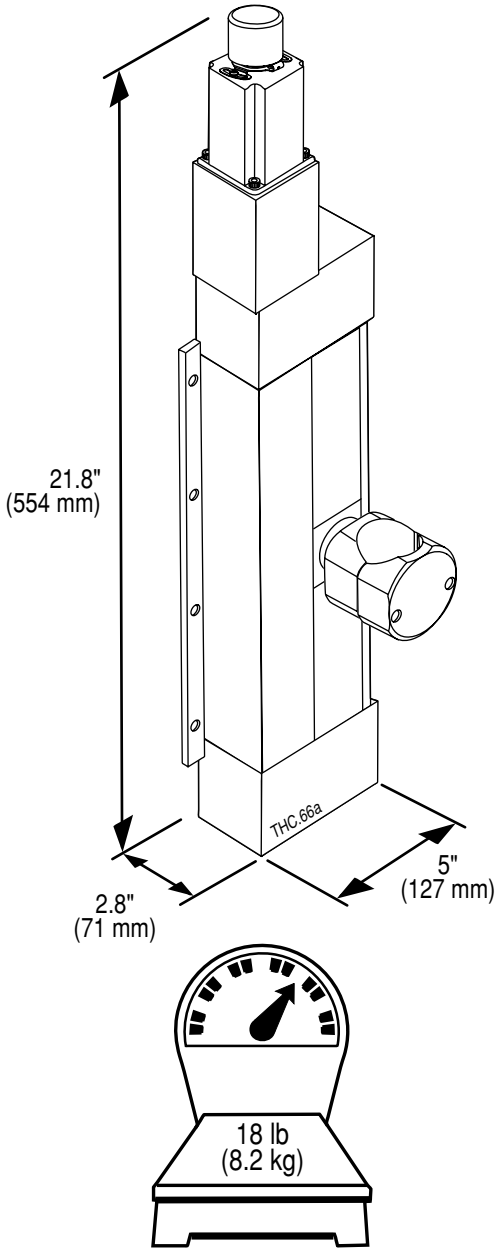
X-Y Lifter Assembly

Electrical

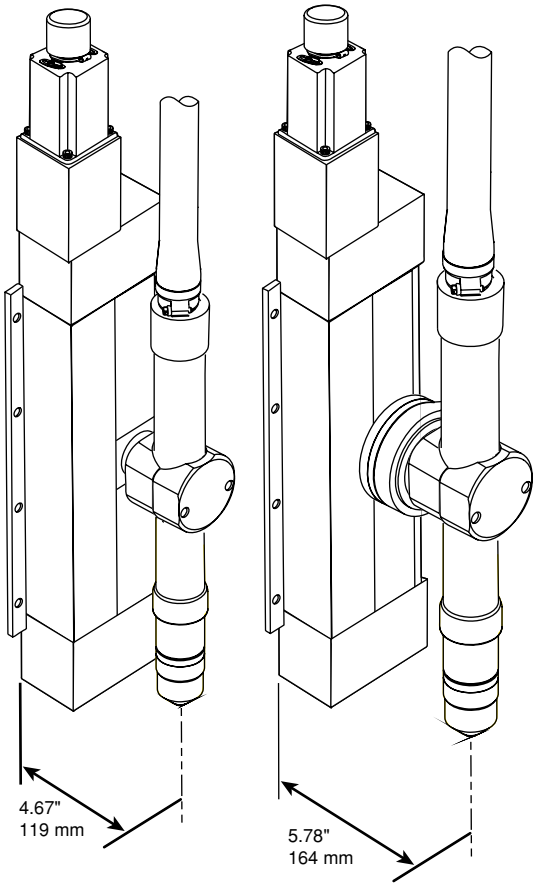
Motor .....+ 2.48 VDC, 2-phase (3.3 amp per ph.)
Limit switches .....+ 24 VDC

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 .....200 inches (508 cm) per minute
Maximum Z Axis Stroke .....8 inches (203 mm)



Torch Mounting Dimensions



Without Breakaway With Breakaway

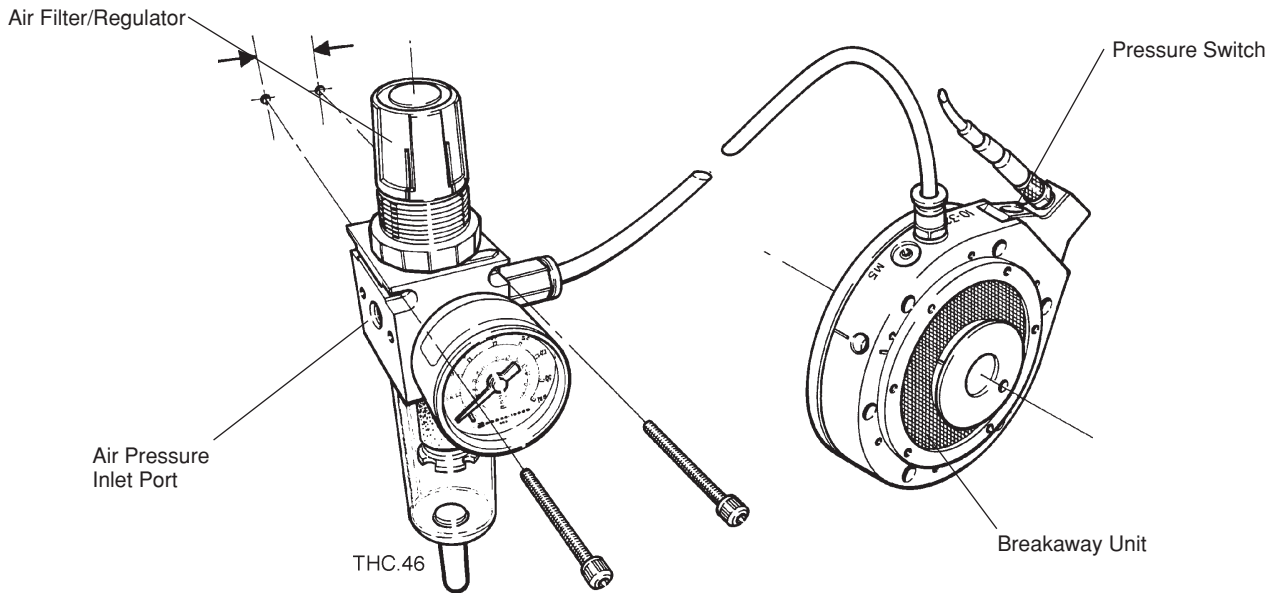
Torch Breakaway Kit - 128281

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

Breakaway Control Function
Shop air pressure.....100 psi (6.9 bar) maximum

Size
Breakaway width.....3.8 inches (97 mm)
Breakaway height (thickness).....2.25 inches (57 mm)
Air filter/regulator height.....7.06 inches (179 mm)
Air filter/regulator width.....1.56 inches (40 mm)
Air filter/regulator depth (from gauge to back).....3.125 inches (79 mm)

Weight
Breakaway unit.....1.9 pounds (0.86 kg)
Air filter/regulator.....1.0 pounds (0.45 kg)



X-Y Lifter Breakaway Option

Section 3

INSTALLATION

In this section:

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 10 ft (3 m) 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 too high in the case of methane) 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 +10° F (-12° C) 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.

WARNING

COOLANT CAN BE IRRITATING TO SKIN AND EYES AND HARMFUL OR FATAL IF SWALLOWED

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

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.

Caution: 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.

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 µS/cm at 77° F (25 °C)**	**Resistivity MΩ/cm at 77° F (25 °C)**	**Dissolved Solids (ppm of NaCl)**	**Grains per Gallon (gpg of $CaCO_2$)**
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

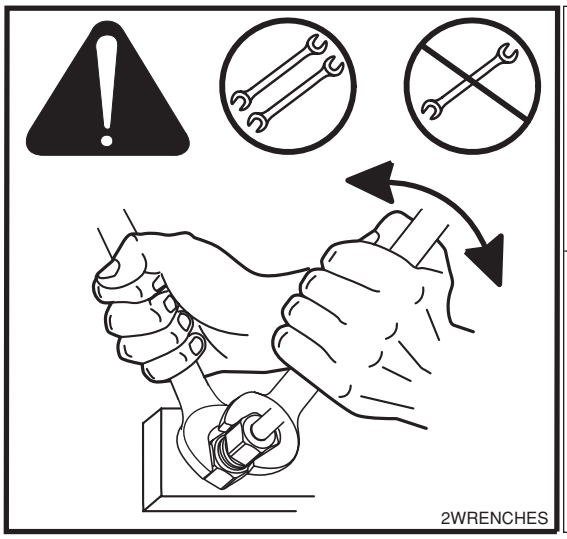
Acceptable noise levels as defined by national or local codes may be exceeded by this plasma system. Always wear proper ear protection when cutting or gouging. See also Noise Protection in the Safety section of this manual.

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 8 inches (203 mm) of vertical travel. The unit should have the capability of maintaining a constant speed of up to 200 ipm (5080 mm/min) with positive braking. A unit which drifts through the stop point is not acceptable.

Placement of System Components

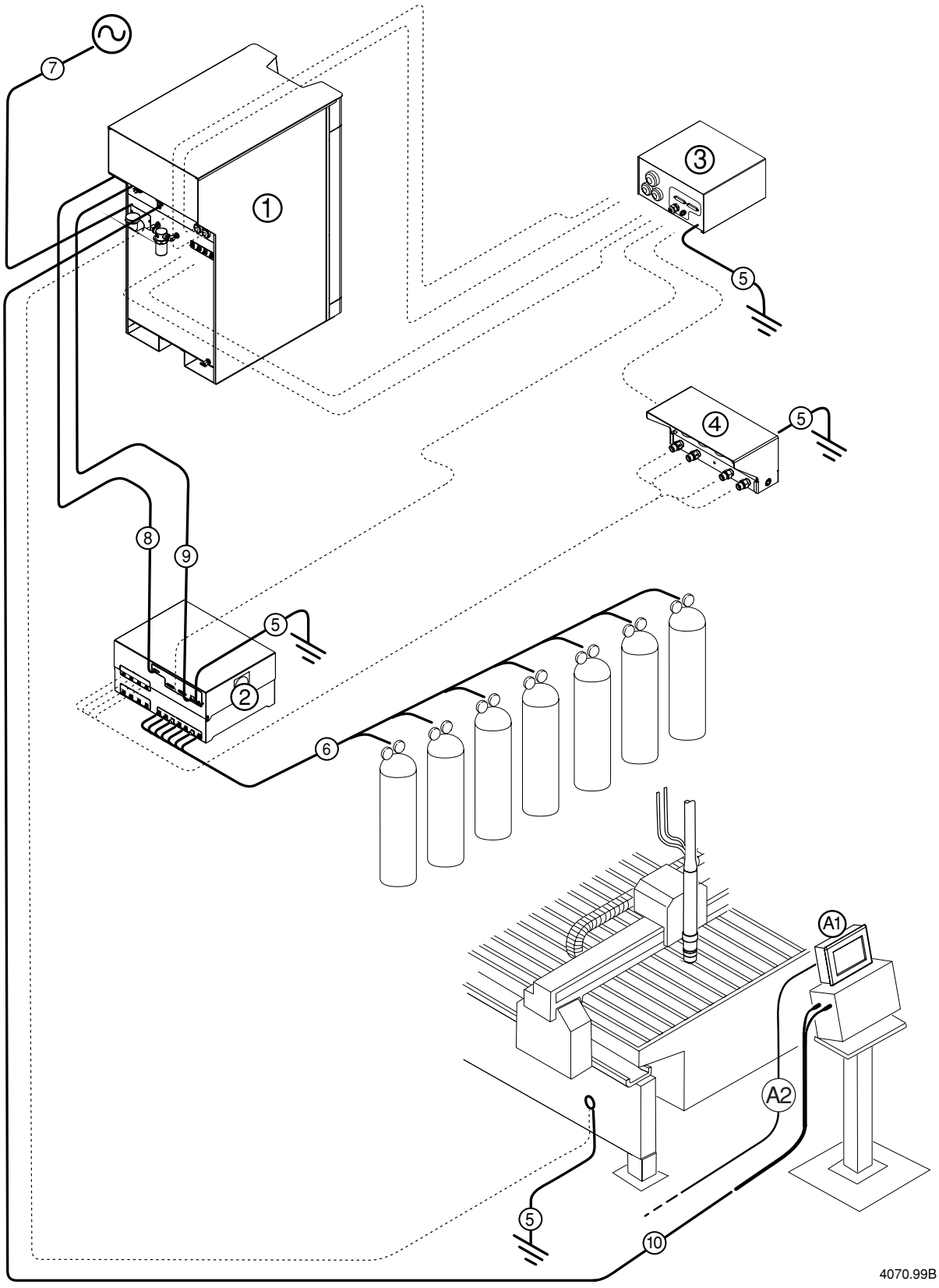
- Place all system components in position prior to making electrical, gas and interface connections. Use the diagram on the following page for component placement guidelines.
- Ground all system components to earth. See *Grounding Requirements* in this section for details.
- To prevent leaks in the system,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



Torque Specifications

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

HD4070 Installation – Basic Requirements



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

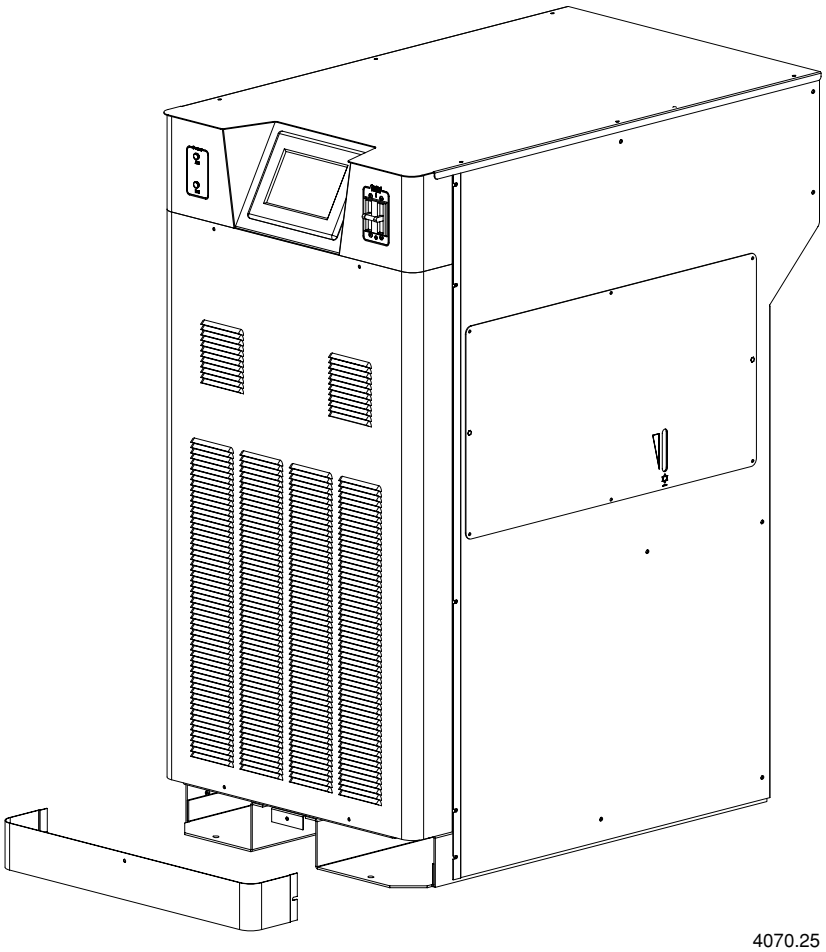
① Placement of the Power Supply

WARNING
ELECTRICAL SHOCK CAN KILL

Remove all electrical connections to power supply before moving or positioning. Transporting unit can cause personal injury and equipment damage.

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.



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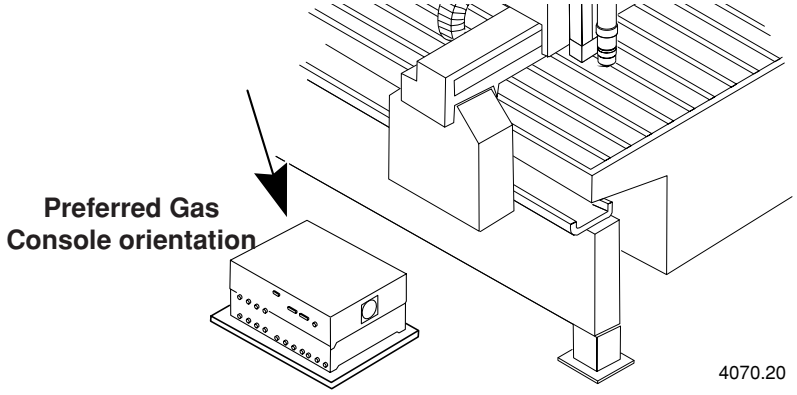
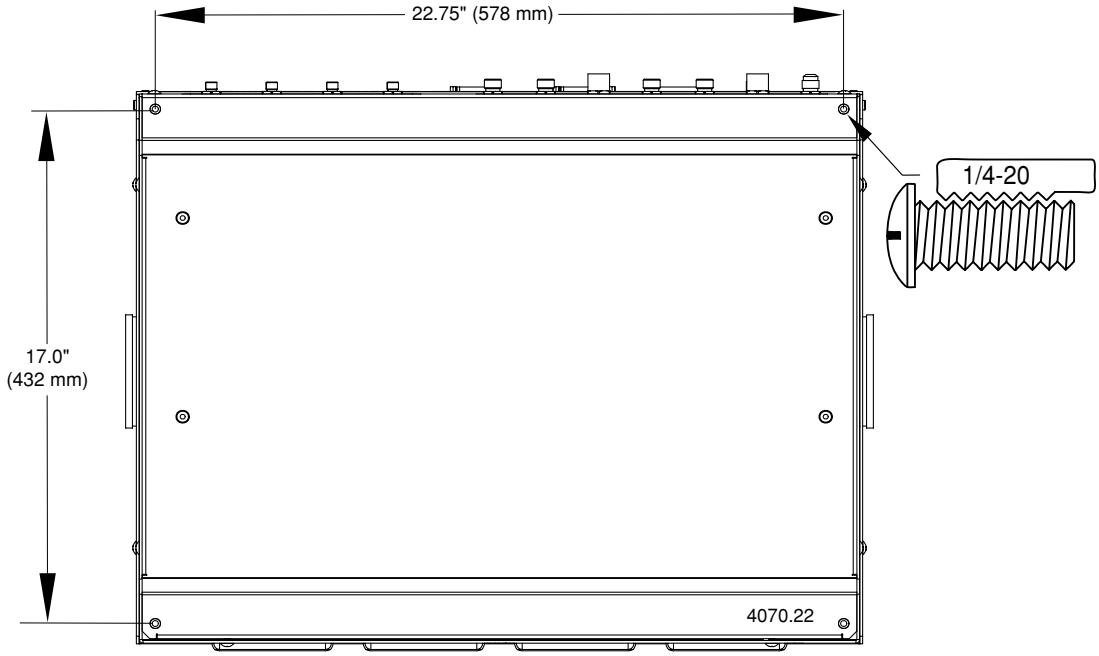
② Placement of the Gas Console Assembly

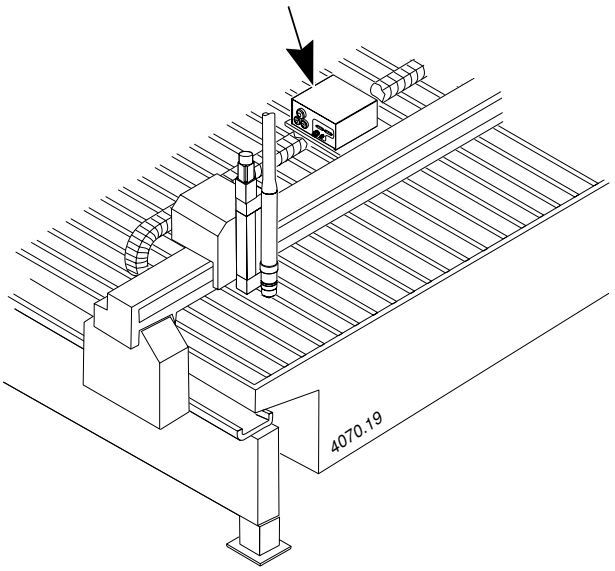
- Position the gas console near the cutting table. Allow room to open the hinged top for servicing. Preferred orientation is shown in the figure below. The maximum length of cables between the power supply and gas console is 150 feet (45 m). The maximum length of cables and hoses between the gas console and the ignition console and off-valve assembly is 100 feet (30 m).
- 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.



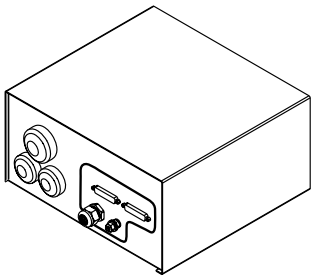


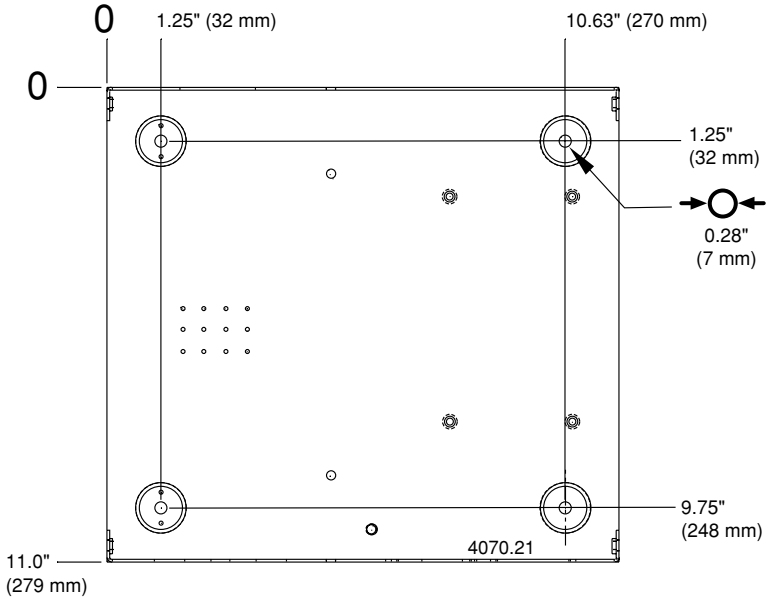
③ Mount the Ignition Console Assembly

- 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 15 feet (4.5 m).
- 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.

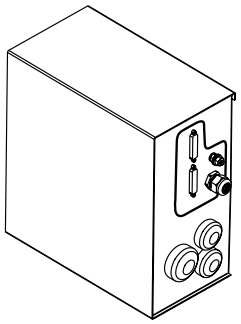


Horizontal Mounting



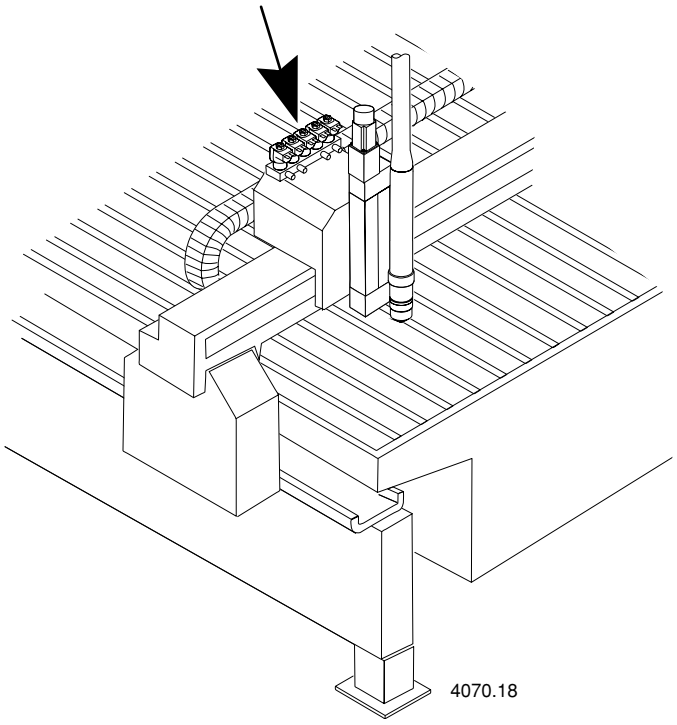


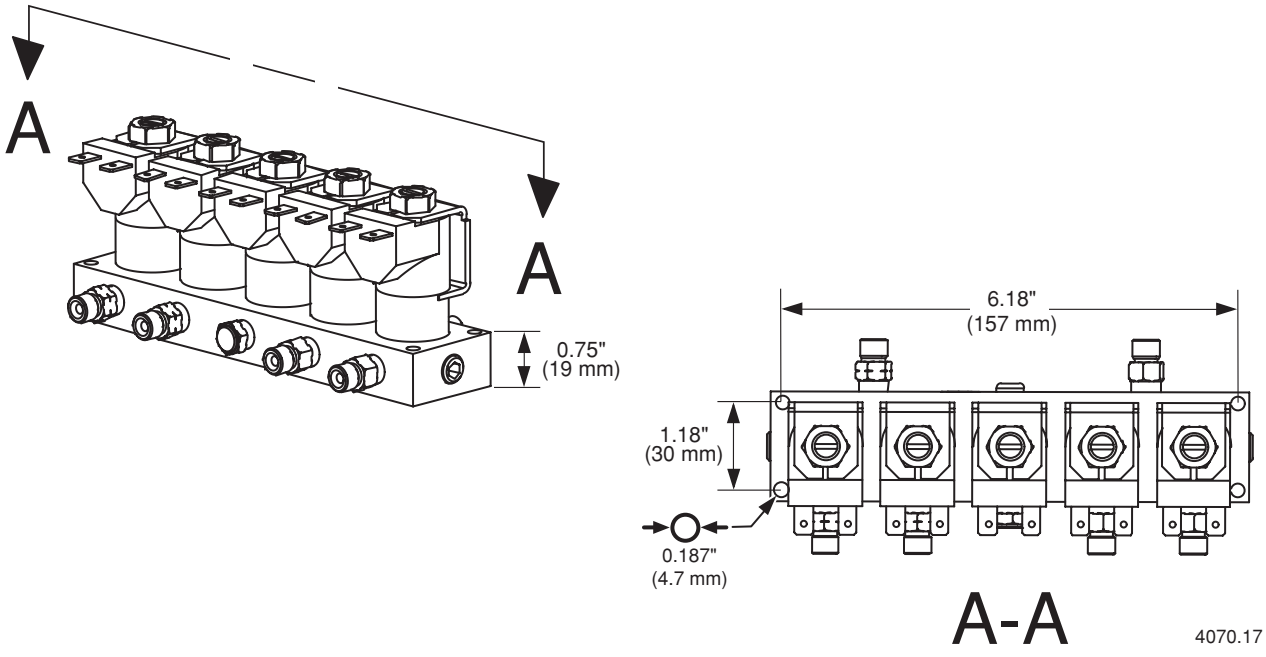
Vertical Mounting



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 4 feet (1.2 m).
- 2-Torch systems: 2 off-valve assemblies are required for a 2-torch system.

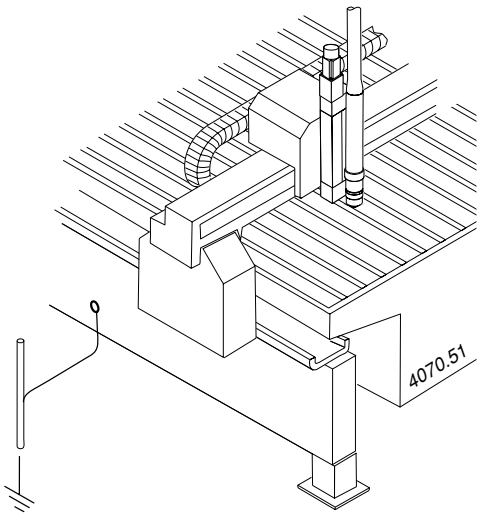




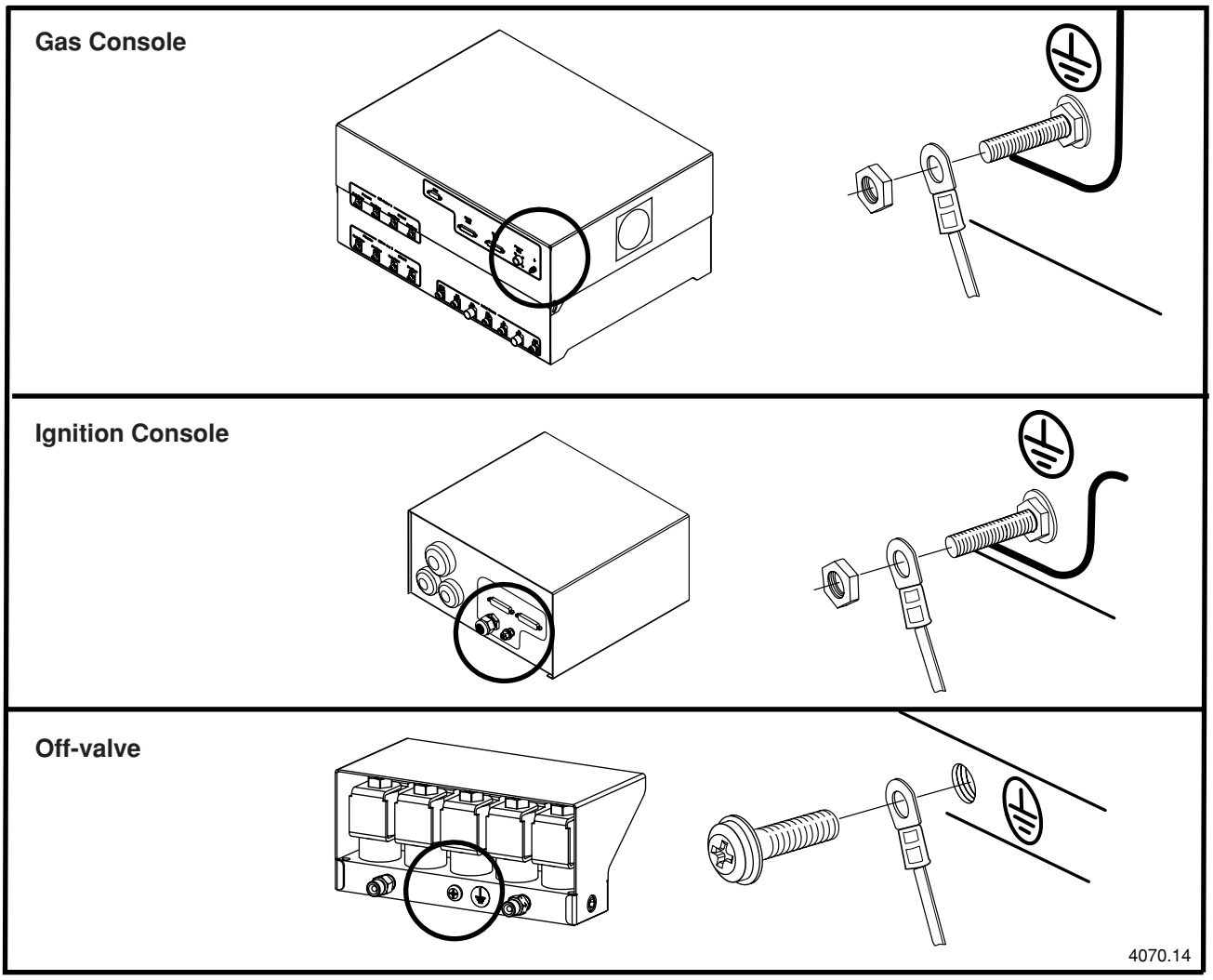
⑤ Grounding Requirements

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 20 feet (6 m) from the table. A suitable ground consists of a solid copper rod of at least 1/2" (13 mm) diameter driven to a depth of at least 8 feet (2.5 m) 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 (10mm^2) 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 3/8 inch (9.5mm) for lengths < 75 feet (23m) and 1/2 inch (12.5mm) for lengths > 75 feet (23m).

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

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.

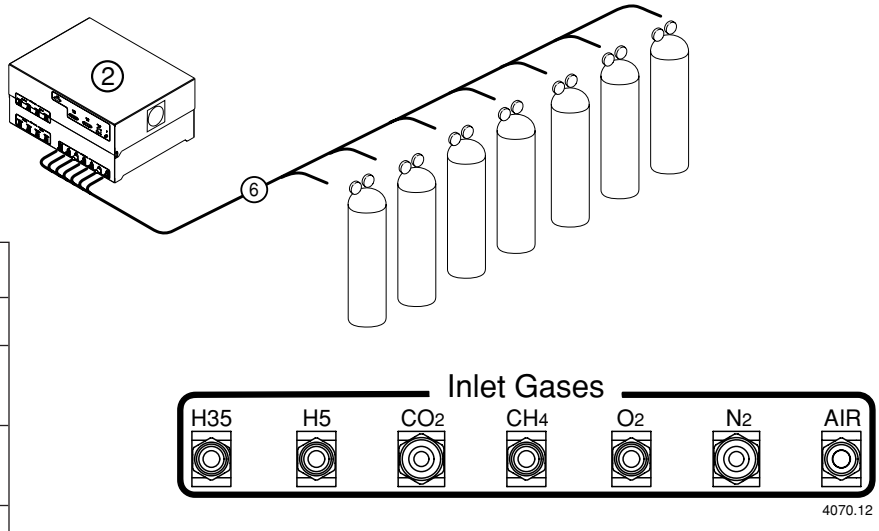
Note: When cutting with oxygen as the plasma gas, nitrogen must also be connected to the gas console to achieve the proper oxygen-nitrogen mixtures in the preflow and cutflow conditions.

WARNING
CUTTING WITH OXYGEN CAN CAUSE FIRE OR EXPLOSION

Cutting with oxygen as the plasma gas can cause a potential fire hazard due to the oxygen-enriched atmosphere that it creates. As a precaution, Hypertherm recommends that an exhaust ventilation system be installed when cutting with oxygen.

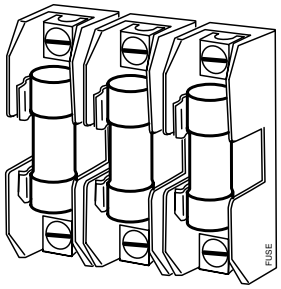
Connect the Supply Gases

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



Fitting	Size
Air	9/16 – 18 #6
O_2	9/16 – 18, RH (oxygen) “B”
CO_2 & N_2	5/8 – 18, RH, internal (Inert Gas) “B”
H35, H5 & CH_4	9/16 – 18 LH, (Fuel Gas)”B”

⑦ Power Requirements



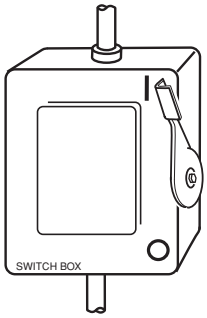
General

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.

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 140°F (60°C). Installation must be performed by a licensed electrician.

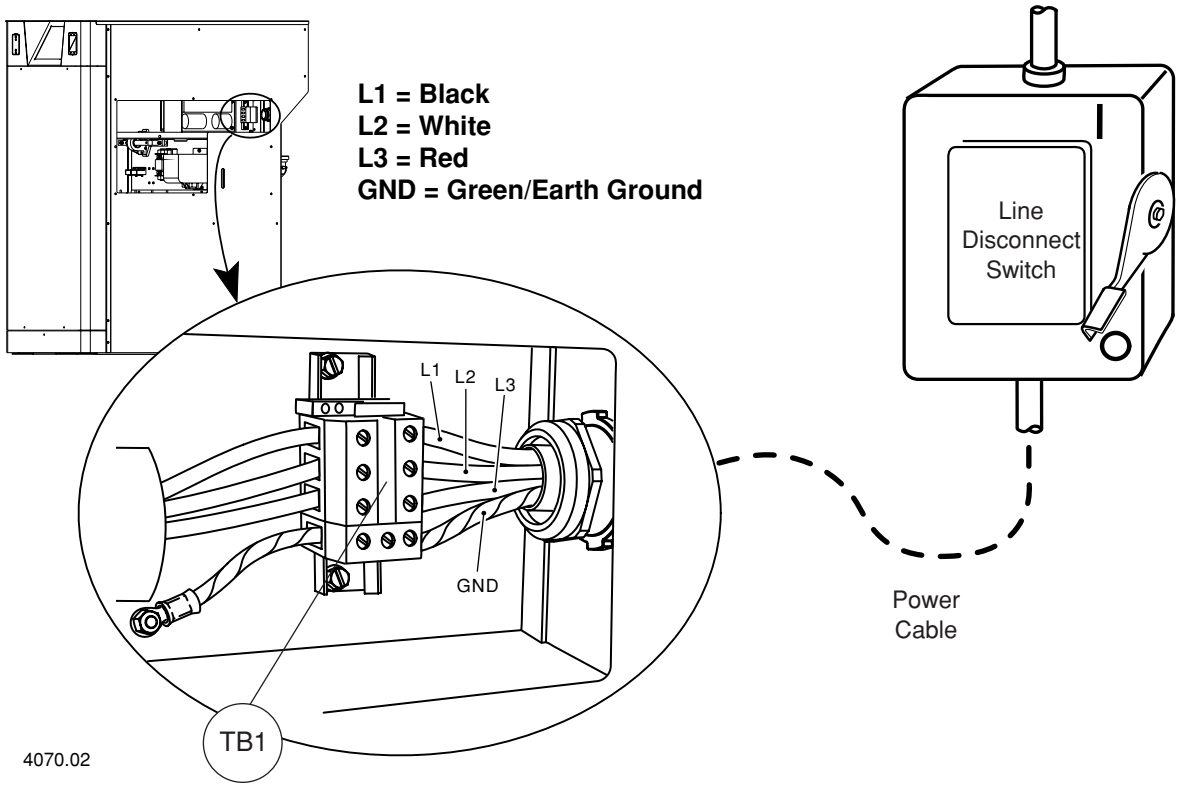
Connect the Power

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.

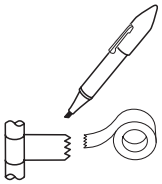
1. Insert the power cable through the strain relief at the rear of the power supply.
2. Connect the ground lead (PE) to the GND terminal of TB1 as shown below.
3. Connect the power leads to the terminals of TB1 as shown below.
4. **Check that the line disconnect switch is in the OFF position and remains 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.

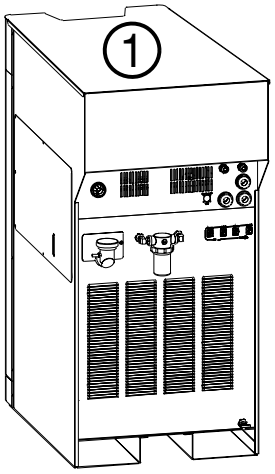


Install the Power Supply to Gas Console and CNC Cables

Installation Note

Mark the identification number on the ends of each cable.





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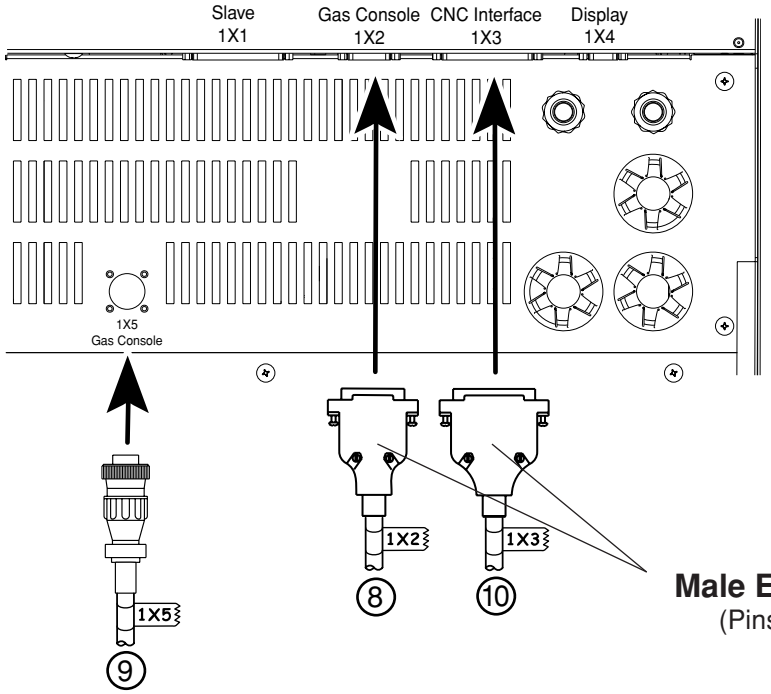
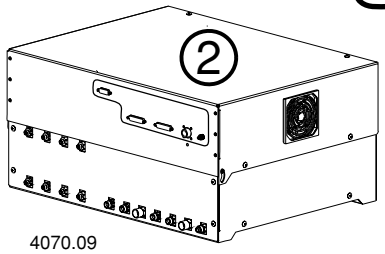


Male Ends
(Pins)



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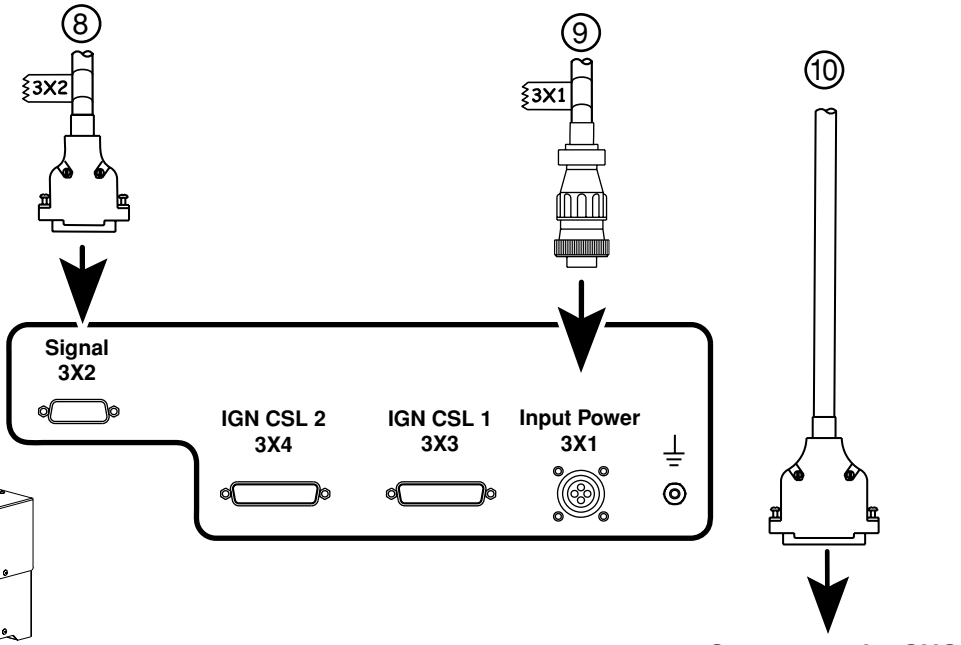
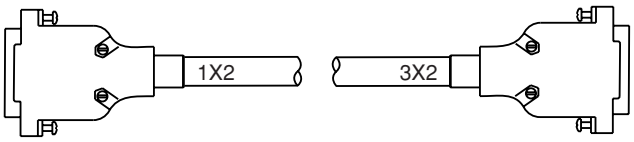


Connect to the CNC

⑧ Signal Cable – Power Supply to Gas Console

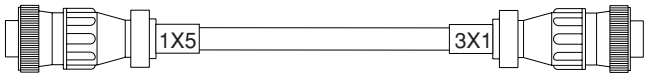


Part No.	Length	Part No.	Length
123428	10 ft (3 m)	123433	50 ft (15 m)
123429	20 ft (6 m)	123434	75 ft (23 m)
123430	25 ft (7.5 m)	123435	100 ft (30.5 m)
123431	30 ft (9 m)	123436	150 ft (46 m)
123432	40 ft (12 m)		

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

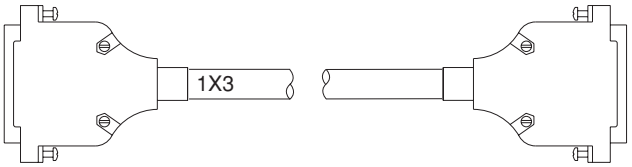


Part No.	Length	Part No.	Length
123419	10 ft (3 m)	123424	50 ft (15 m)
123420	20 ft (6 m)	123425	75 ft (23 m)
123421	25 ft (7.5 m)	123426	100 ft (30.5 m)
123422	30 ft (9 m)	123427	150 ft (46 m)
123423	40 ft (12 m)		

RUN LIST – Power Supply to Gas Console Power Cable

SIGNAL	1X5	COLOR	3X1
120 VAC HOT 120 VAC Return	1 2	Black White	1 2
Positive Earth (Ground) Not Applicable	3 4	Green N/A	3 4

⑩ CNC Interface Cable - Power Supply to CNC



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

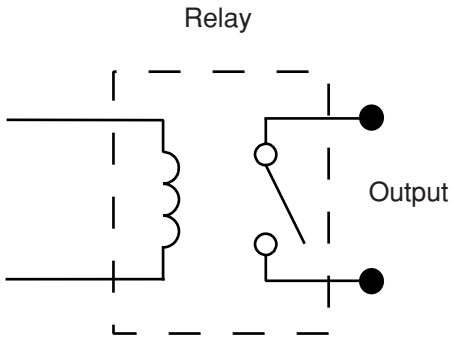
Twisted Wire Pairs

Signal Name	Power Supply End	Color	CNC-End	Function	Input/ Output	Notes
	NC	Blue	NC	Not connected		*
Interlock - Interlock +	19 37	White Black	19 37	Allows installation of an emergency stop switch (normally closed). If CNC interlock is not used, install a jumper wire to close.	Input Input	
Motion Motion	18 36	White Orange	18 36	Verifies 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 Output	1
Transfer Transfer	17 35	Green Brown	17 35	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 Output	1
Ground Ground Ground	16 34 15	Green Yellow Green	16 34 15			
Machine Cable Installed + Machine Cable Installed -	33 14	Blue Green	33 14	Verifies that the CNC machine cable has been installed.	Input Input	3
System Error + System Error -	32 13	White Green	32 13	Notifies the CNC motion controls that a plasma system error has occurred Actual error can be queried from serial interface.	Output Output	2
Spare Output 1 + Spare Output 1 -	31 12	Orange Red	31 12	Spare output	Output Output	2
Spare Input 1 + Spare Input 1 -	30 11	Brown Red	30 11	Spare input	Input Input	3
Spare Input 2 + Spare Input 2 -	29 10	Yellow Red	29 10	Spare input	Input Input	3
Retract Complete + Retract Complete -	28 9	Blue Red	28 9	Verifies to the CNC that the torch has retracted.	Output Output	2
Spare Output 2 + Spare Output 2 -	27 8	Green Red	27 8	Spare output	Output Output	2
Spare Output 3 + Spare Output 3 -	26 7	White Red	26 7	Spare output	Output Output	2
Ready to Fire + Ready to Fire -	25 6	Orange Black	25 6	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 Output	2
Plasma Sync + Plasma Sync -	24 5	Brown Black	24 5	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 Input	3
Corner Hold + Corner Hold -	23 4	Yellow Black	23 4	On systems with a command THC installed, When this signal is active it override the arc voltage control and hold the torch height constant.	Input Input	3
System Start + System Start -	22 3	Blue Black	22 3	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 Input	3
CNC TX + CNC TX -	21 2	Green Black	21 2	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 Input	3
CNC RX + CNC RX -	20 1	Red Black	20 1	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 Output	

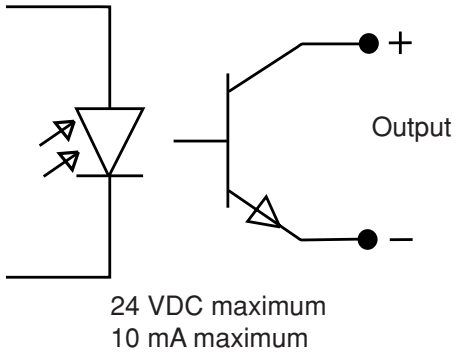
*See notes on next page

Notes: to CNC interface cable run list

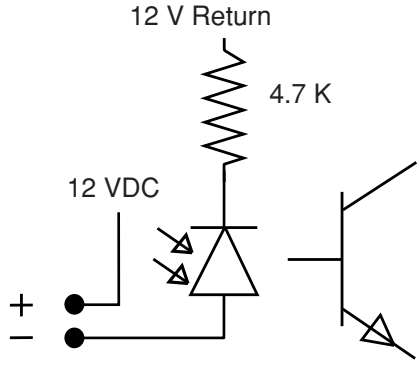
Note 1. Motion and Transfer Outputs.
Relay Contact Closure.



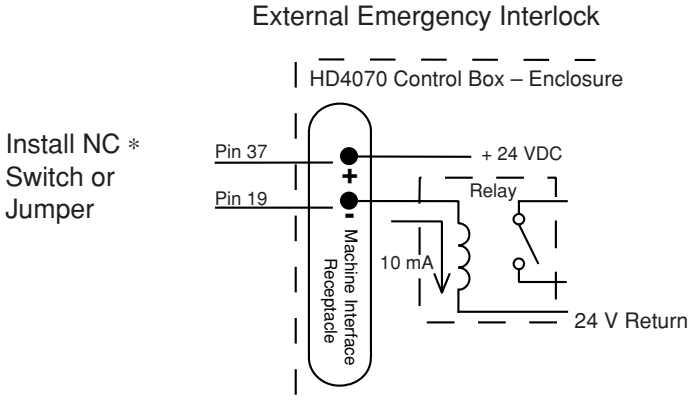
Note 2. HD4070 outputs are optically coupled transistors with maximum ratings of 24 VDC and 10 mA.



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.



* Normally closed

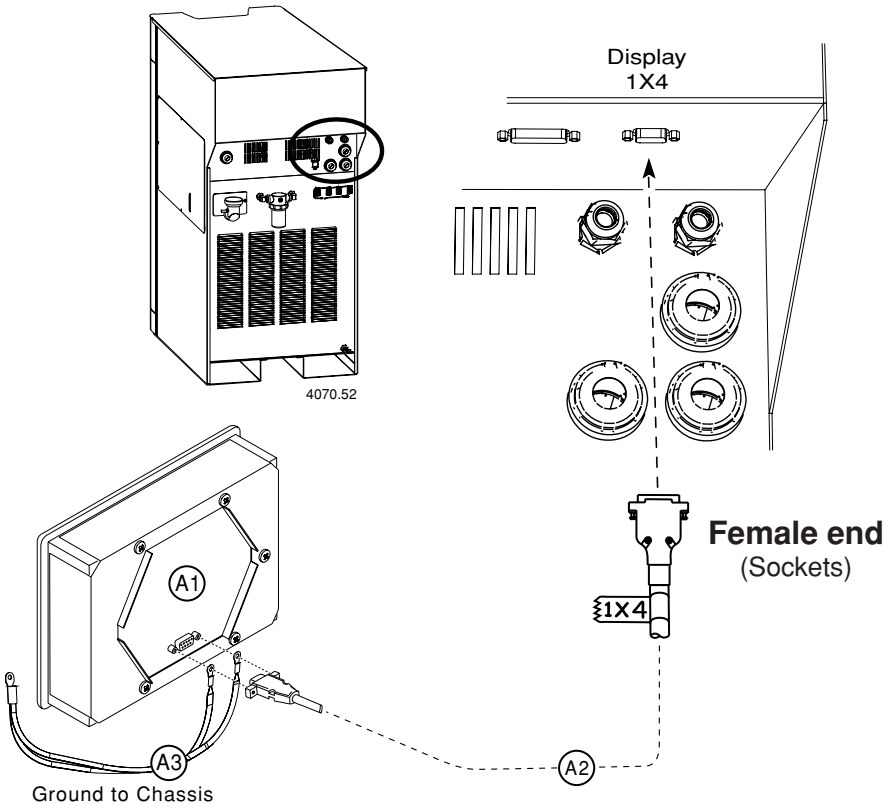
Install the Remote Display Cable

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.

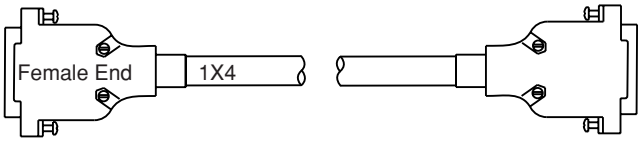
2 – Instructions to install the remote display are included with the applicable remote display kit.



(A1) Remote Display

(A2) Signal Cable – Power Supply to Remote Display

(A3) Ground Wire



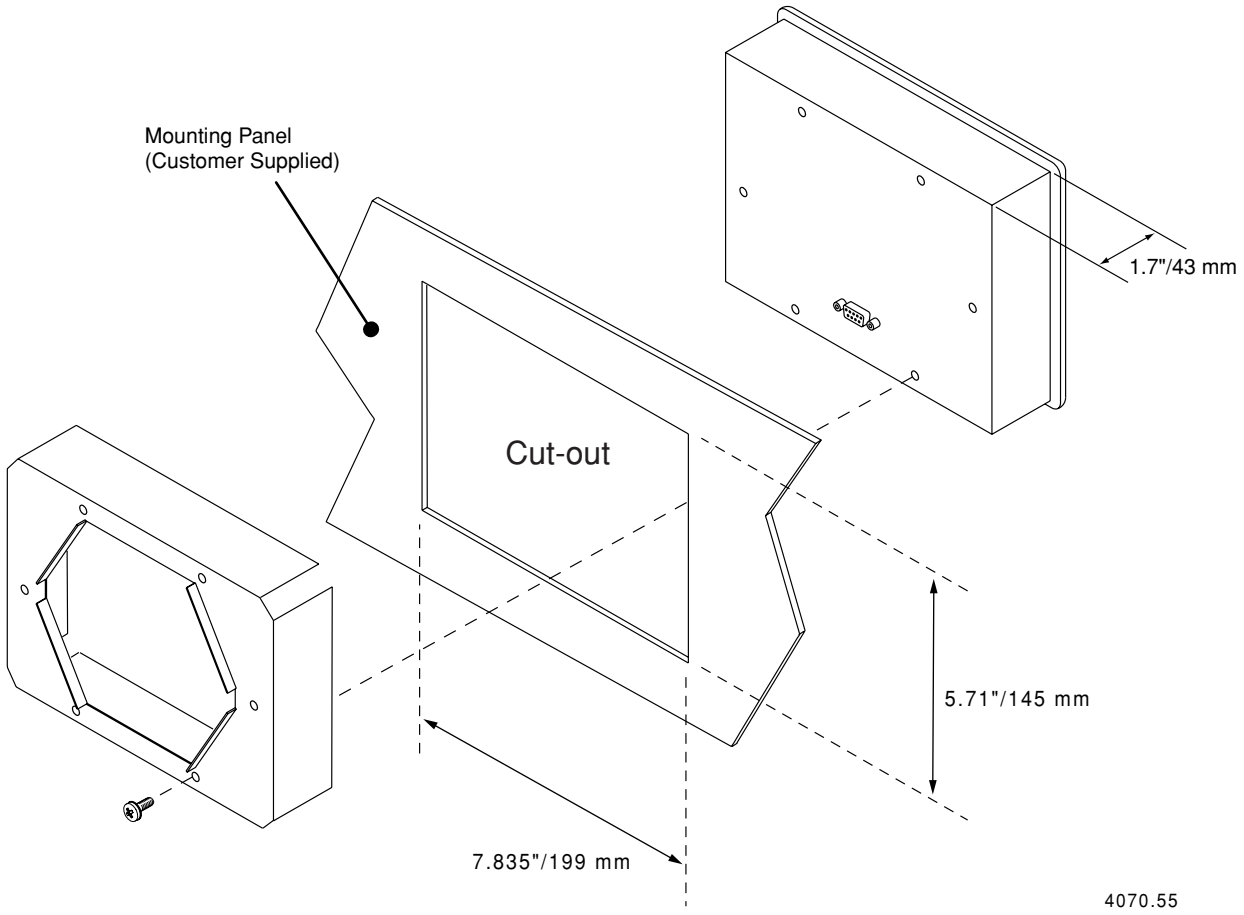
Part No.	Length	Part No.	Length
123476	6 ft (2 m)	123485	40 ft (12 m)
123481	10 ft (3 m)	123019	50 ft (15 m)
123482	20 ft (6 m)	123487	75 ft (23 m)
123018	25 ft (7.5 m)	123488	100 ft (30.5 m)
123484	30 ft (9 m)	123489	150 ft (46 m)

RUN LIST – Power Supply to Remote Display Cable

1X4	COLOR	Display
5	Black	5
9	Red	9
8	N/C*	8
7	N/C	7
4	N/C	4
3	White	3
6	Black	6
2	Green	2
1	Black	1

* Not connected

⑪ Display Mounting Dimensions



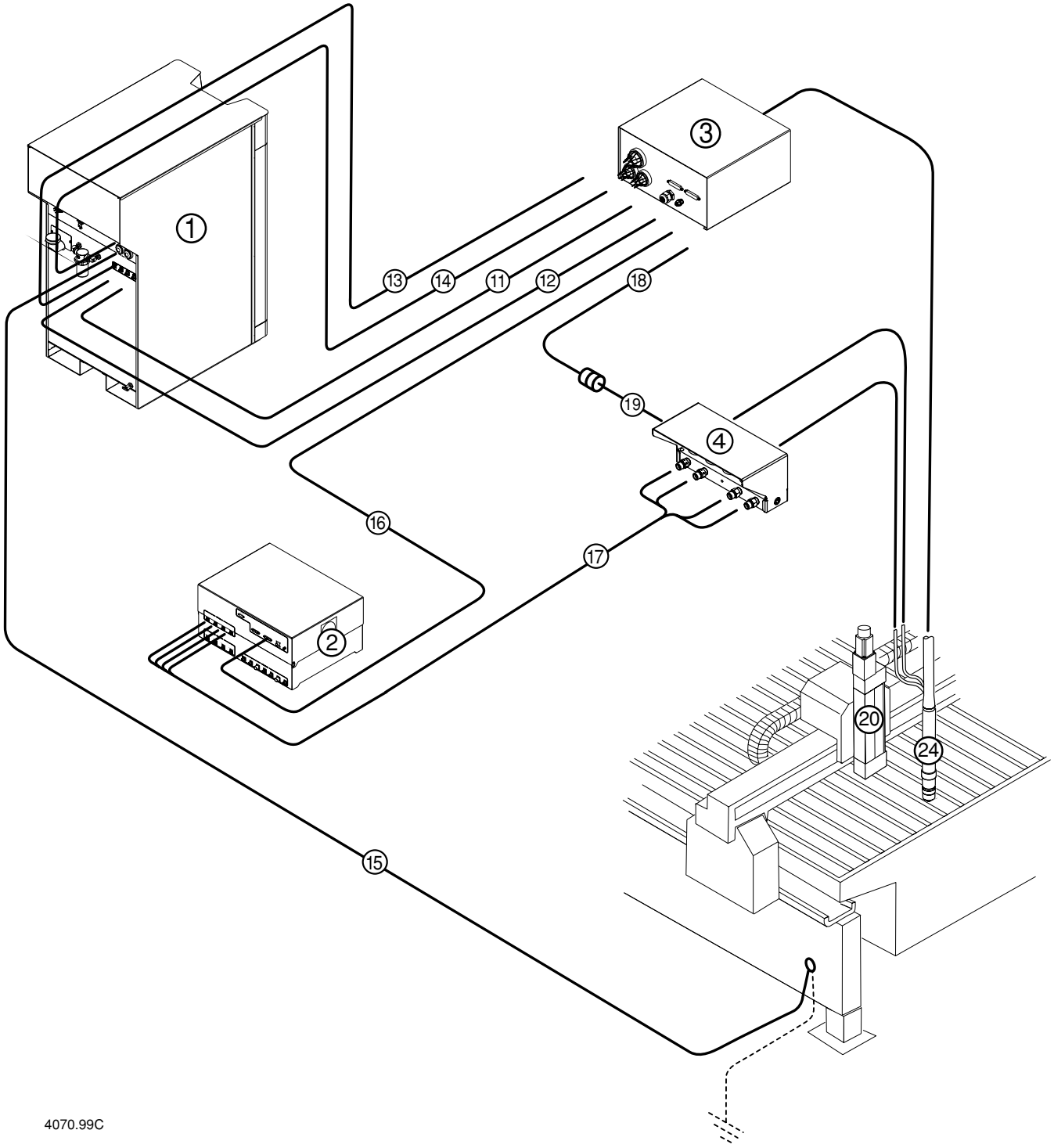
Hypertherm

Section 3A

1-TORCH INSTALLATION

In this section:

HD4070 1-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 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.

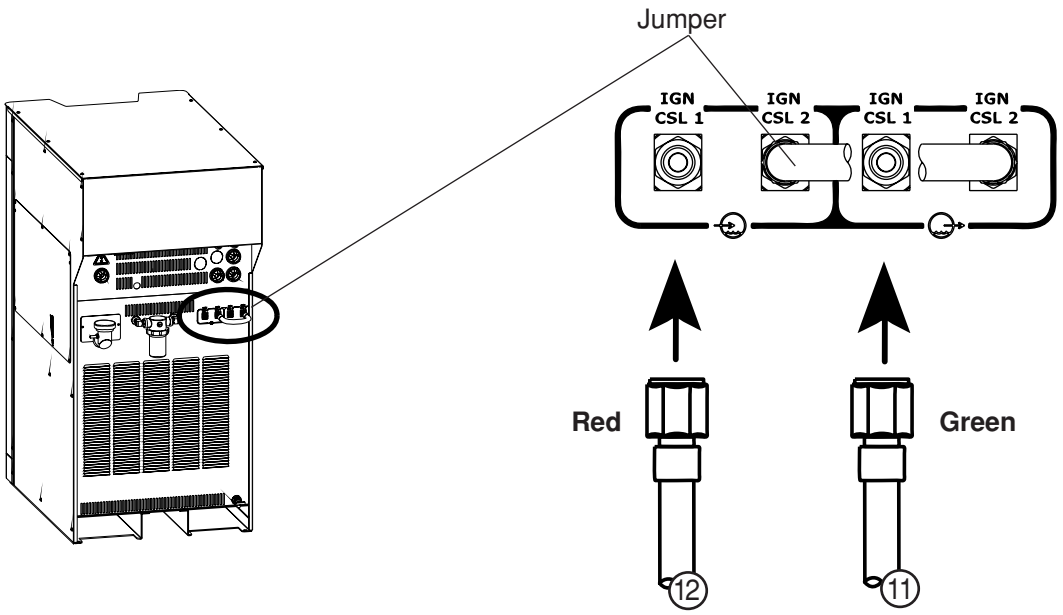
⑲ Off-valve assembly cable; see page 3A-10.

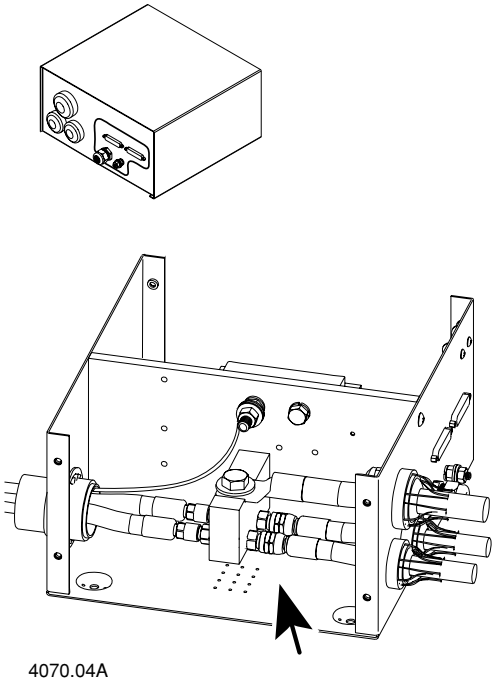
⑳ - ㉓ Integrated Command THC option; see page 3A-18.

㉔ Torch and lead assembly; see page 3A-21.

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.





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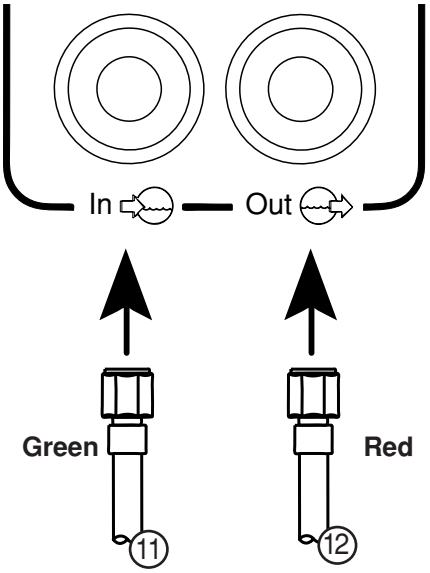


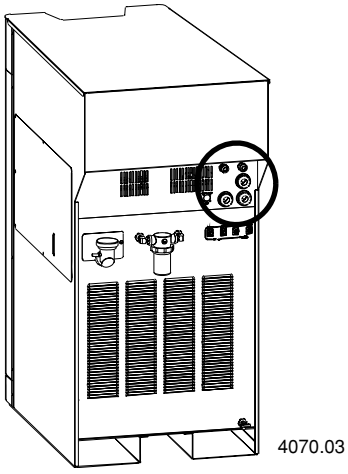
⑪ Coolant Hose Assembly – Green Supply

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

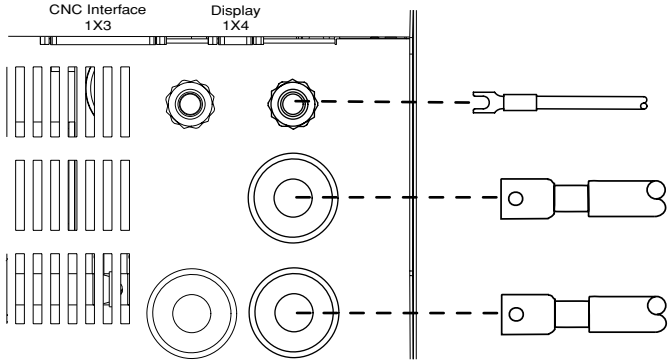
⑫ Coolant Hose Assembly – Red Return

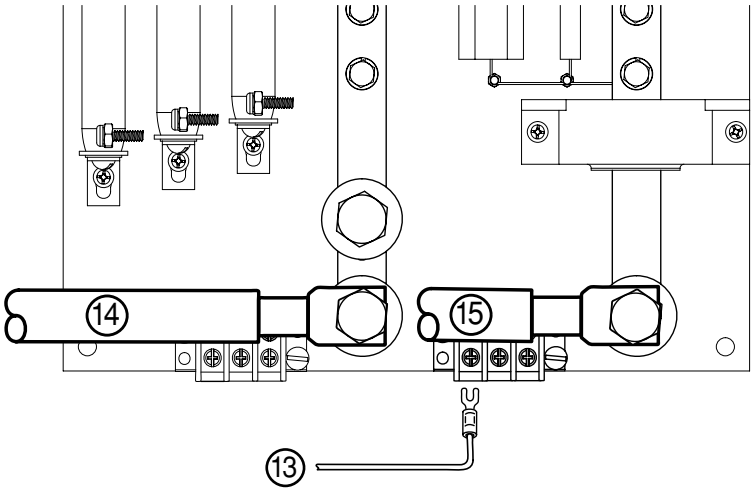
Part No.	Length	Part No.	Length
024566	10 ft (3 m)	024268	50 ft (15 m)
024567	20 ft (6 m)	024269	75 ft (23 m)
024267	25 ft (7.5 m)	024270	100 ft (30.5 m)
024504	30 ft (9 m)	024460	150 ft (46 m)
024568	40 ft (12 m)		

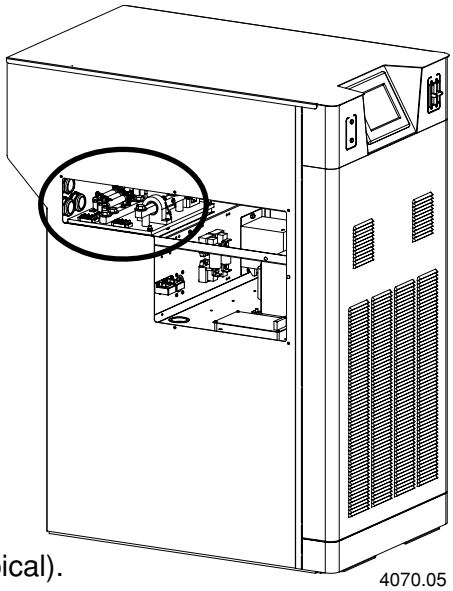
Install the Power Supply to Ignition Console Leads
install the Work Lead



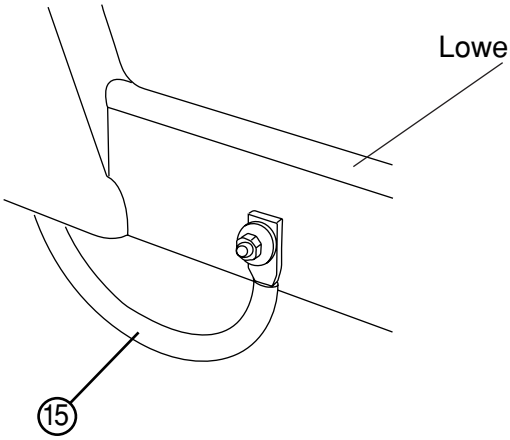
4070.03

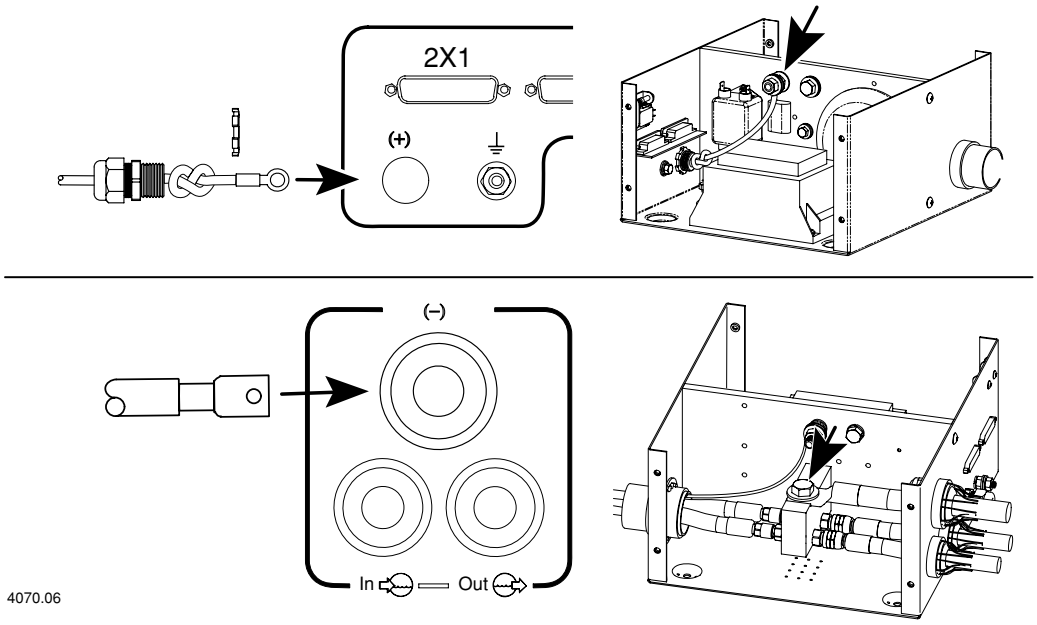




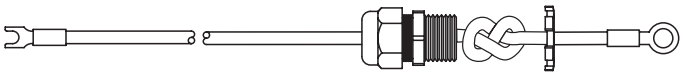


4070.05





⑬ Pilot Arc Lead



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

⑭ Negative Lead

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

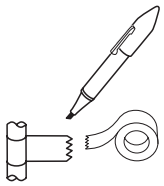
⑮ Work Lead

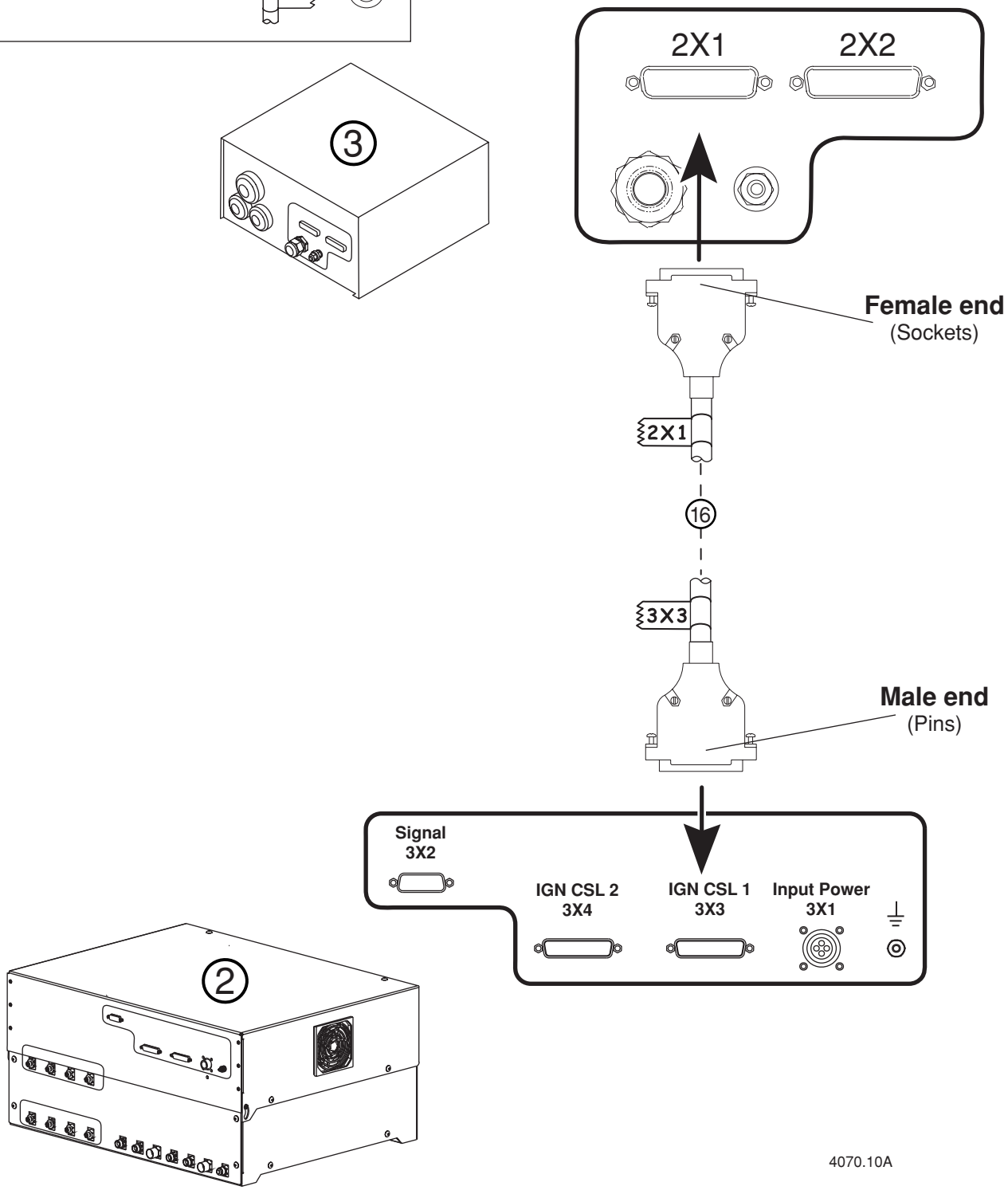
Part No.	Length	Part No.	Length
123418	10 ft (3 m)	023079	50 ft (15 m)
023136	20 ft (6 m)	023124	75 ft (23 m)
023078	25 ft (7.5 m)	023080	100 ft (30.5 m)
023101	30 ft (9 m)	023081	150 ft (46 m)
023135	40 ft (12 m)		

Install the Gas Console to Ignition Console Cable

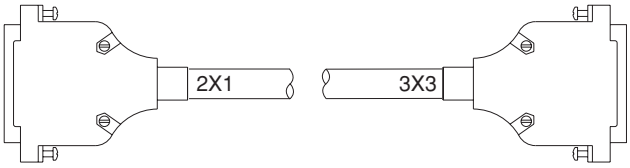
Installation Note

Mark the identification number on the ends of the cable.





⑯ Cable – Gas Console to Ignition Console



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

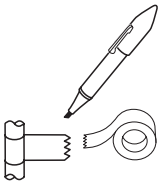
CABLE RUN LIST

SignalName	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

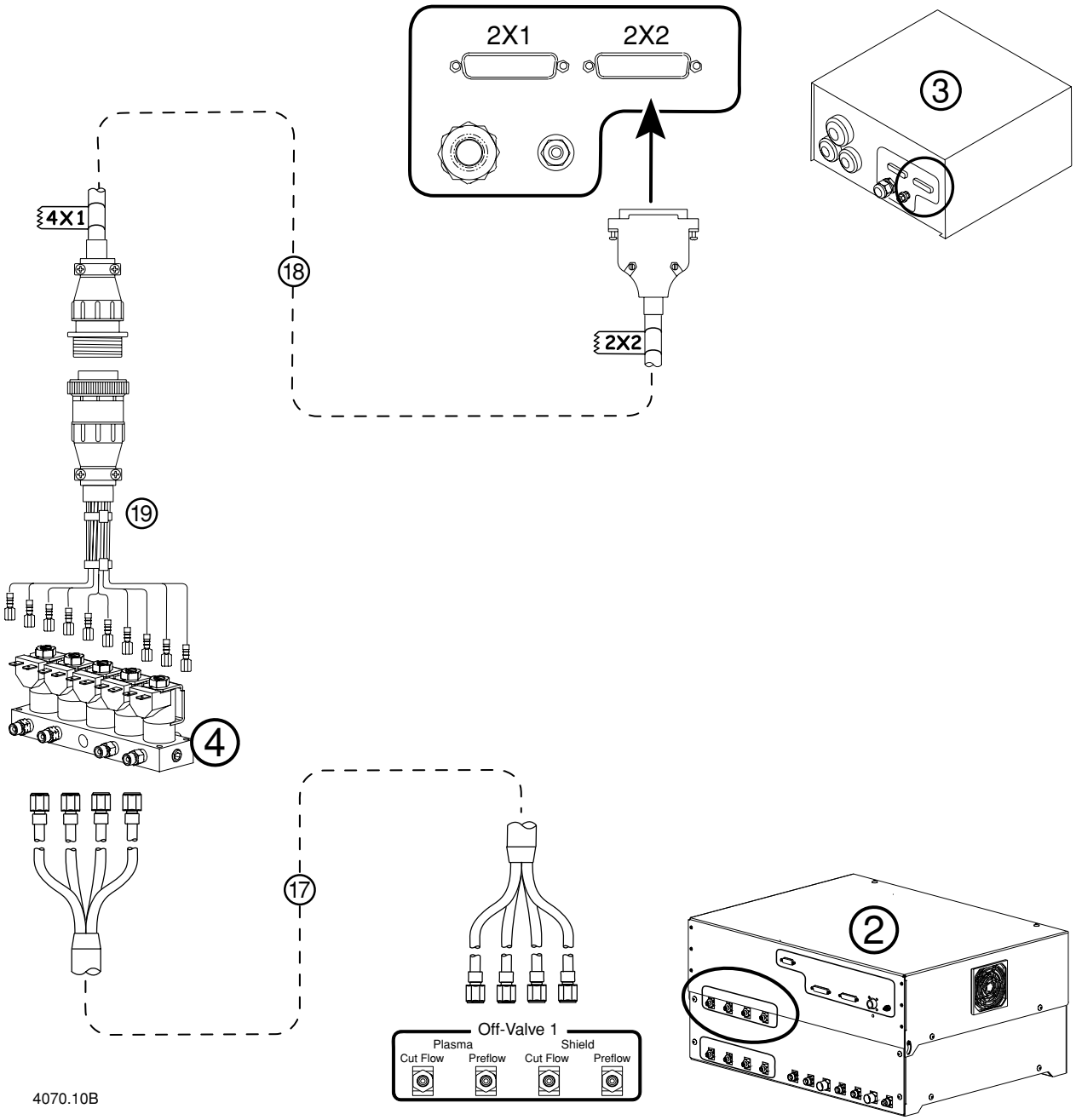
Install the Ignition Console to Off-Valve Cable and Gas Hose Assembly

Installation Note

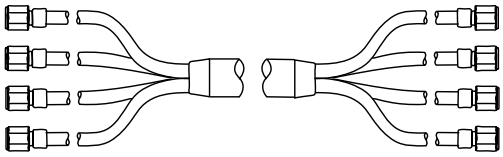
Mark the identification number on the ends of cable 18.



Make sure there are no leaks at connections.

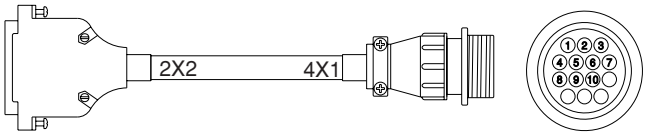


⑰ Hoses – Gas Console to Off-Valve



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

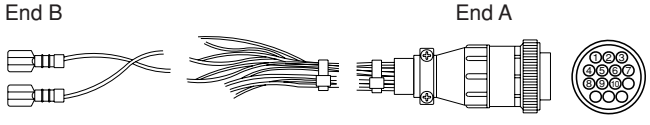
⑱ Cable – Ignition Console to Off-Valve



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

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



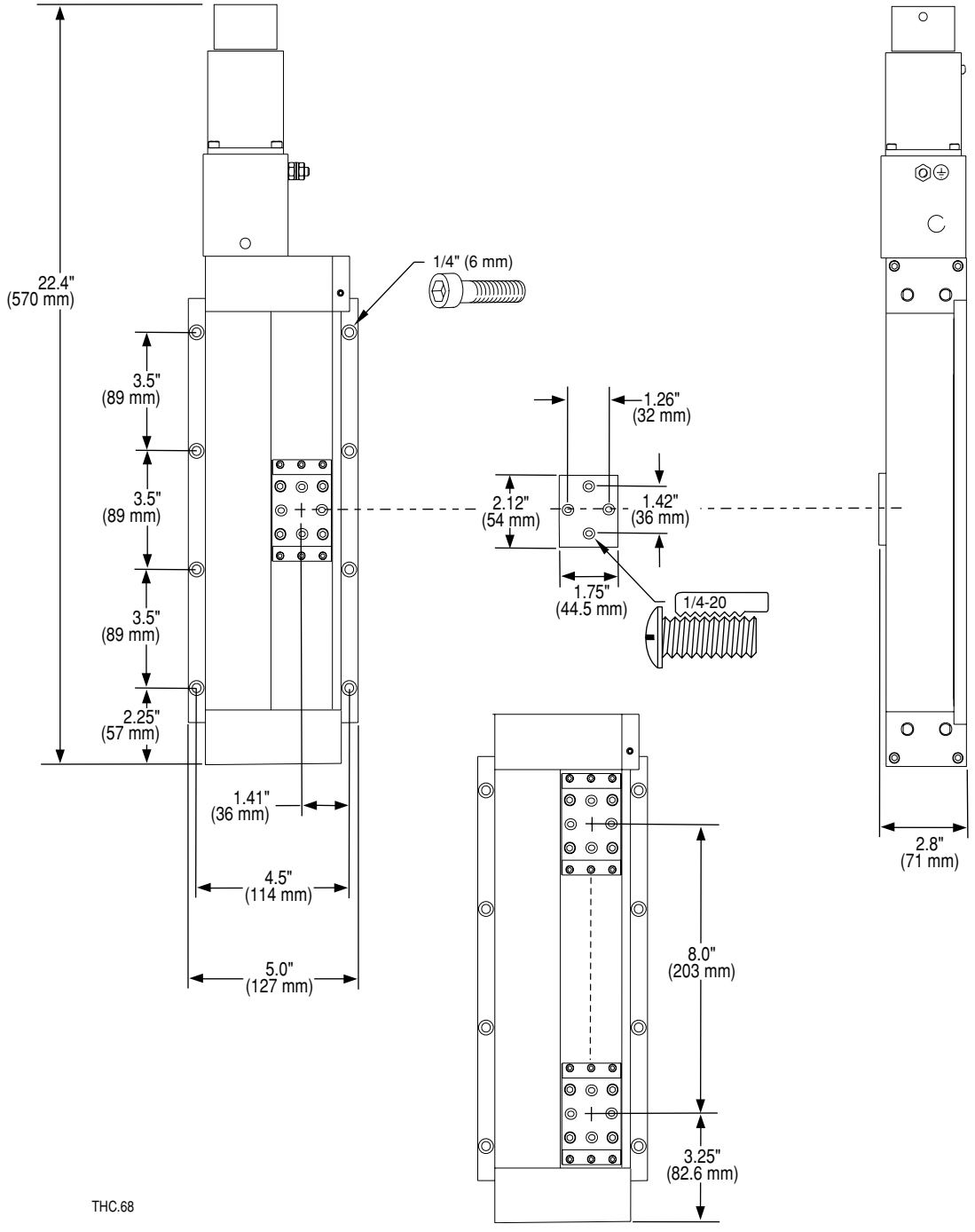
Part No.	Length	Part No.	Length
123540	1.5 ft (0.5 m)		

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

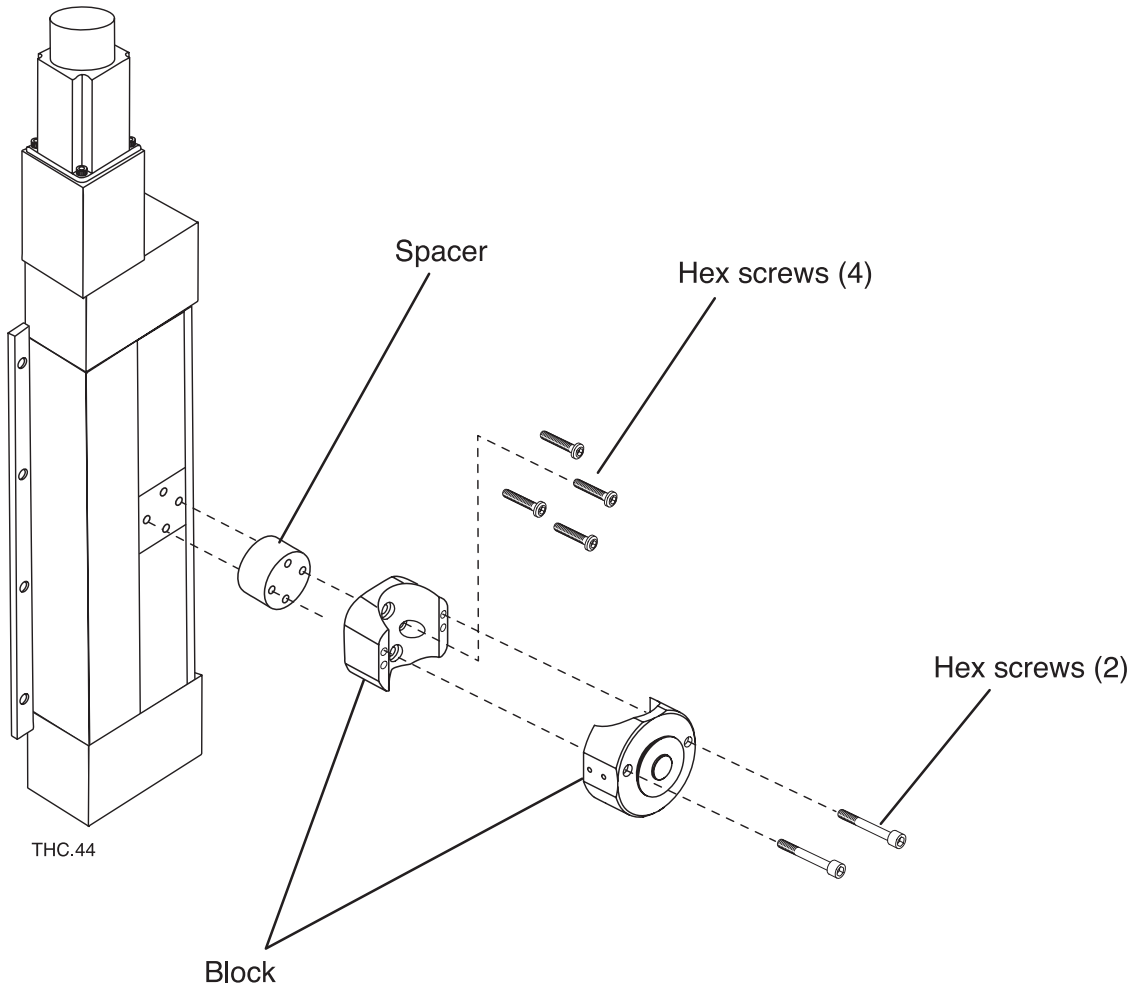
- Mount the X-Y lifter assembly on the cutting table.



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)

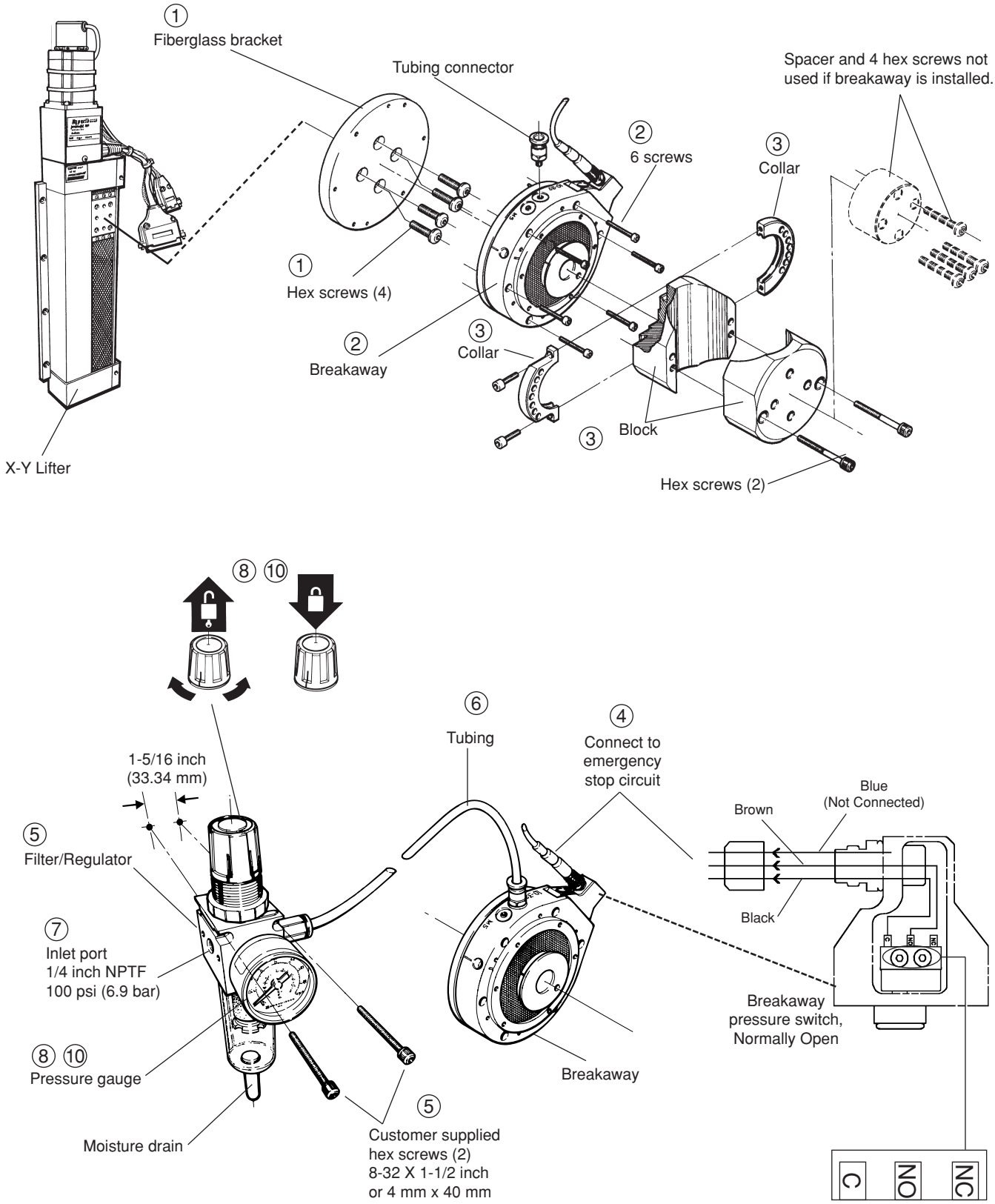
If not installing breakaway kit, go to page 3A-16

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 100 psi (6.9 bar) (recommended maximum pressure).
8. Adjust the regulator to indicate 30 psi (2 bar) (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 150 psi (10.2 bar). Typically, the maximum inlet pressure should be set at 100 psi (6.9 bar).
- 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.

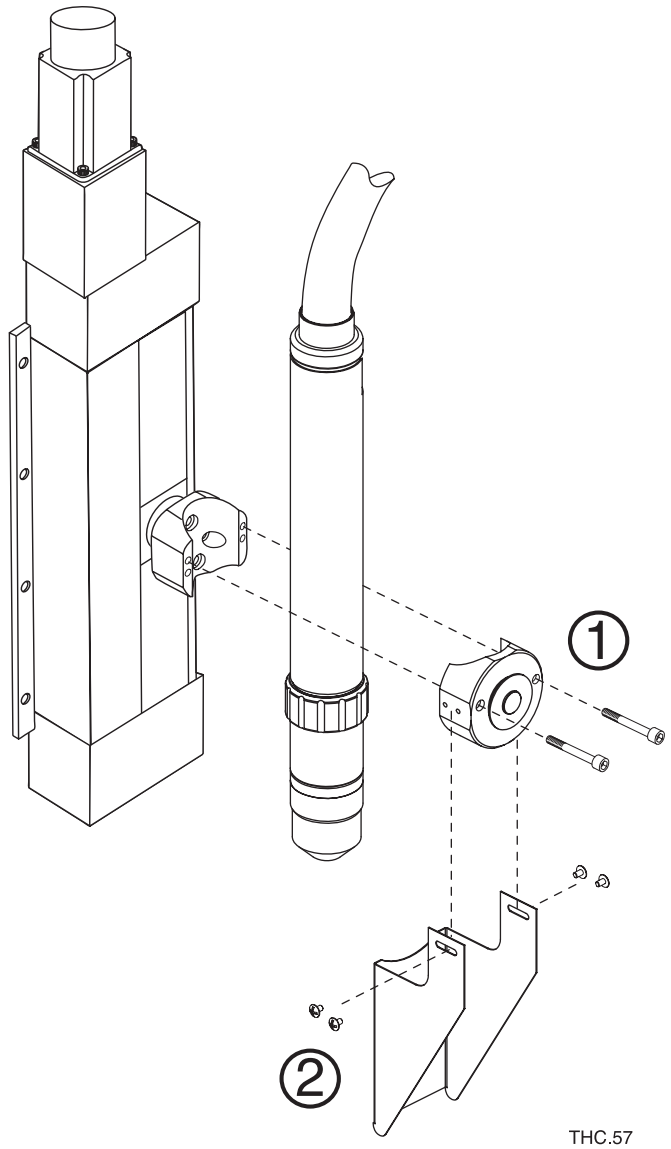


X-Y Lifter Assembly Optional Torch Breakaway Kit Mounting Details

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.

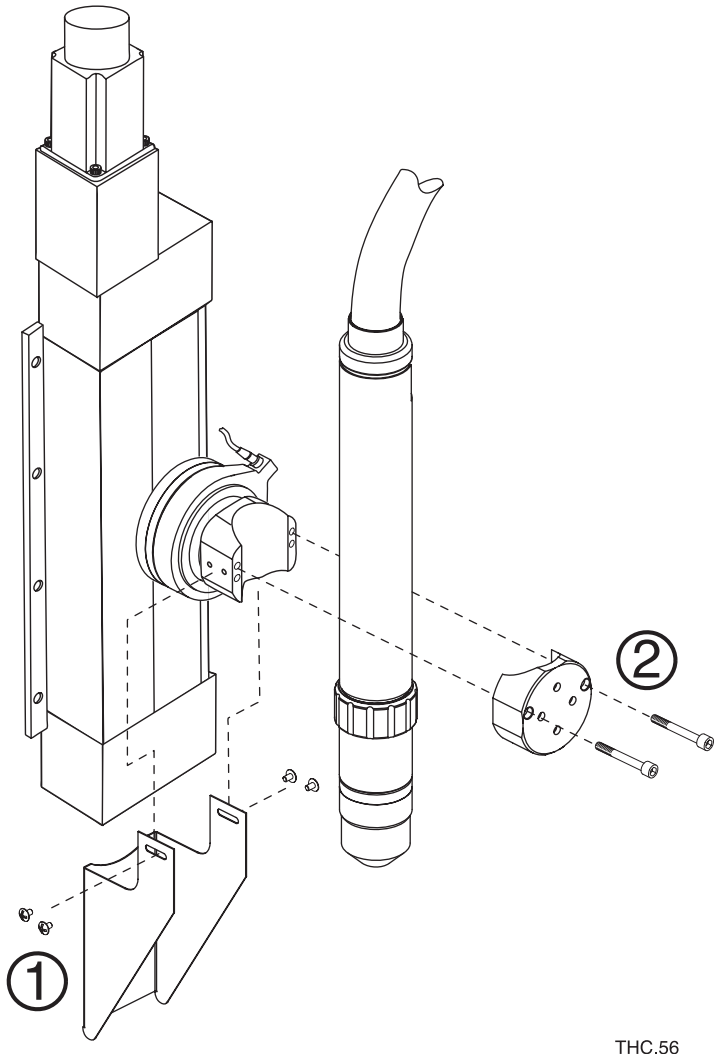


Torch Installed without Torch Breakaway Option

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.

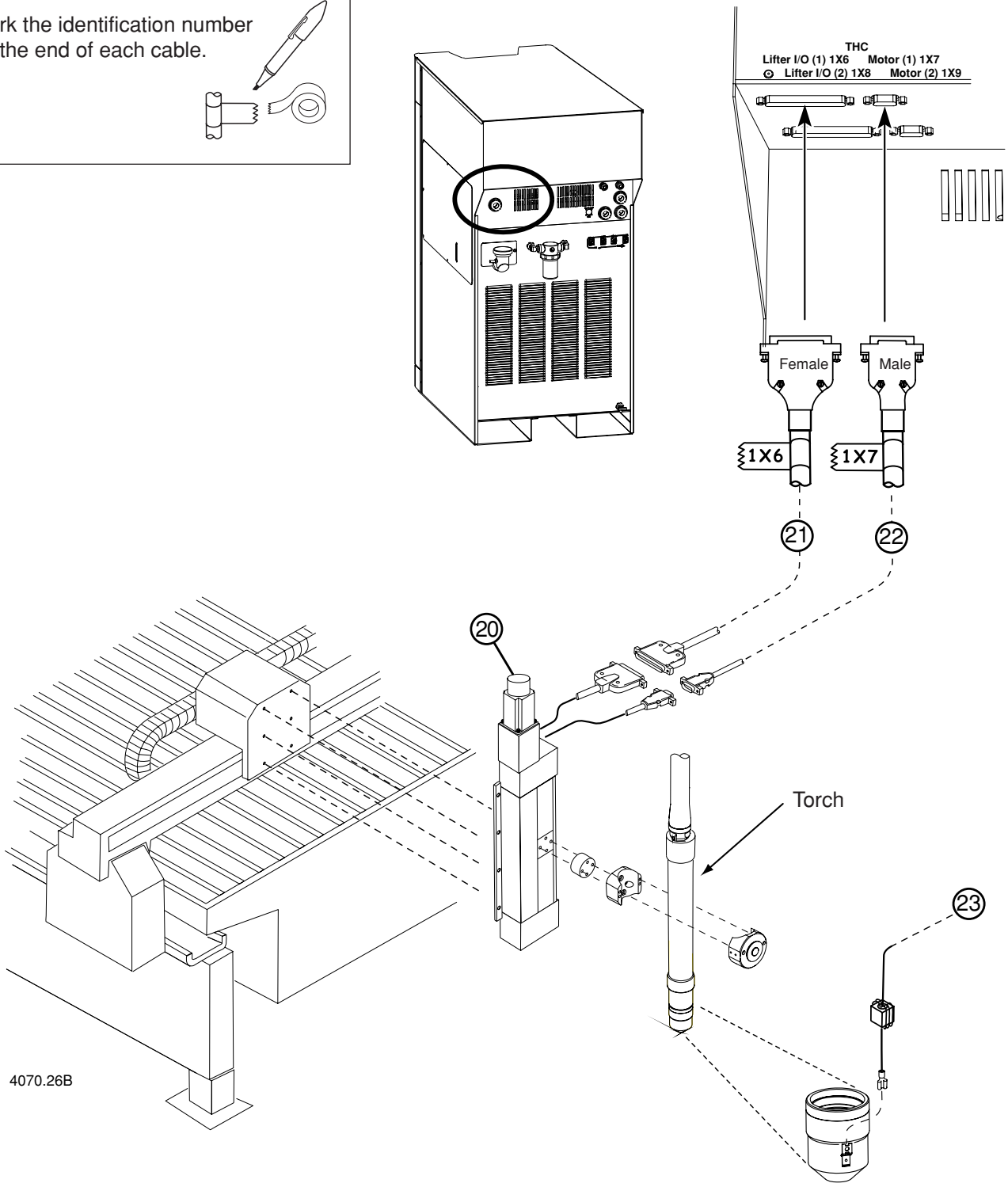


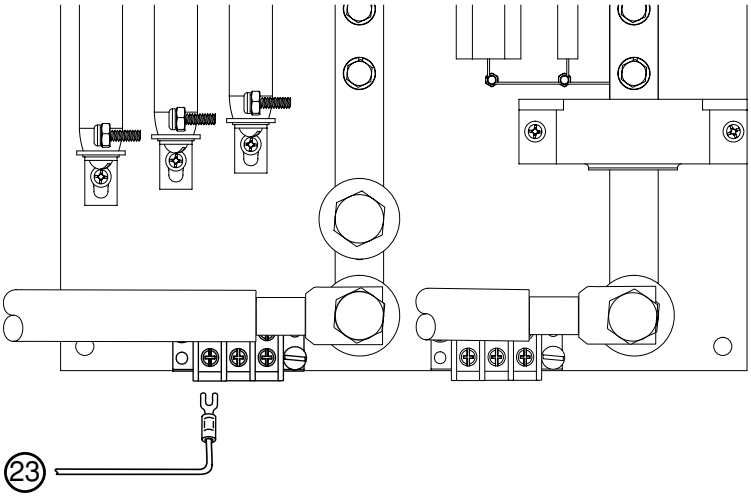
Torch Installed with Torch Breakaway Option

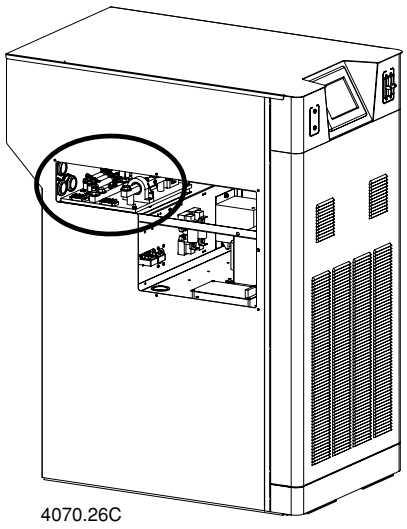
Integrated Command THC Option – Cable Installation

Installation Note

Mark the identification number on the end of each cable.

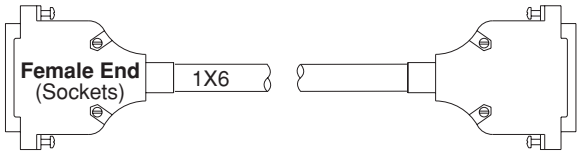






(21) Cable – Lifter Interface

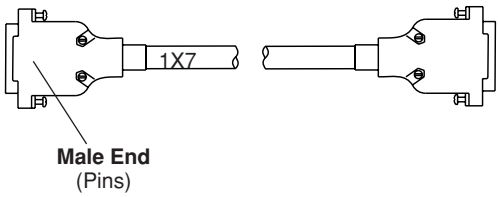
See next page for signal information



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

(22) Cable – Motor Drive

See next page for signal information



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

(23) Ohmic Contact Wire

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

Lifter Interface Cable Signals

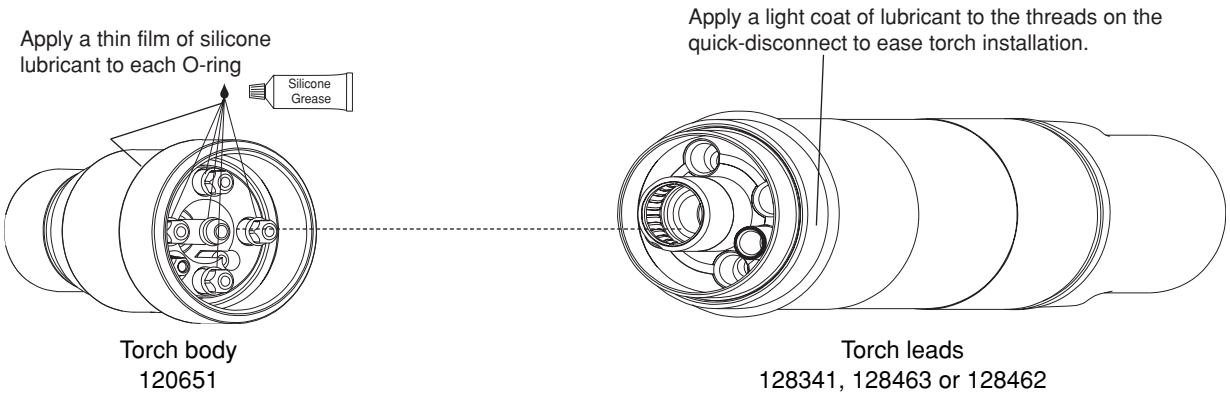
Power Supply Pin number	Signal Name	Wire Color	Function	
1 Input	Encoder Power -	Black	Encoder power	
20	Encoder Power (5V)+	Red		
2 Input	Encoder B -	Black	A quad B position signal.	
21	Encoder B +	Green		
3 Input	Encoder A -	Black	A quad B position signal.	
22	Encoder A +	Blue		
5 Input	Drive ID2 -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

Motor Drive Cable Signal

Power Supply Pin Number	Signal Name	Wire Color	Function
5 Output	Motor Phase A +	Red	Powers lifter motor, phase A+.
9	Motor Phase A +	Red	
4 Output	Motor Phase A -	Black	Powers lifter motor, phase A-.
8	Motor Phase A -	Black	
3			Not connected
7 Output	Motor Phase B +	Red	Powers lifter motor, phase B+.
2	Motor Phase B +	Red	
6 Output	Motor Phase B -	Black	Powers lifter motor, phase B-.
1	Motor Phase B -	Black	

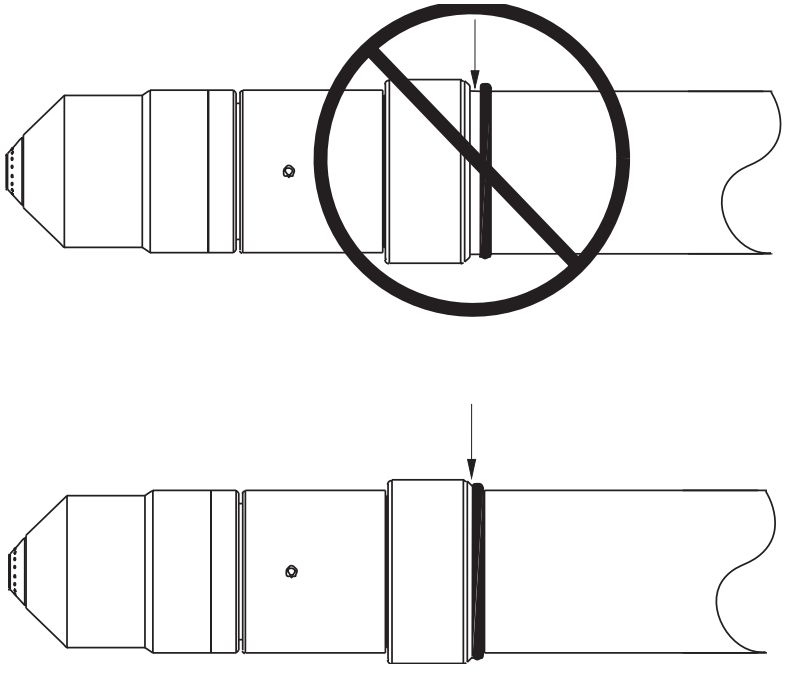
Torch Connections

Connecting the Torch to Torch Leads



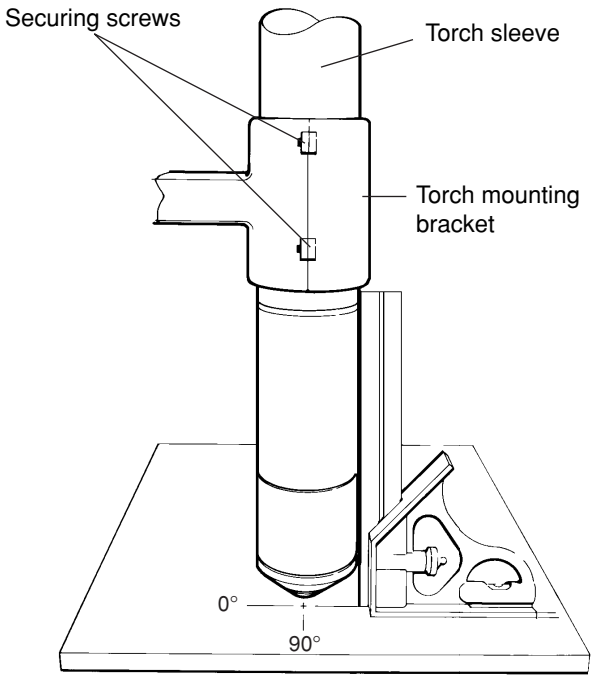
Installation Note

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 Note

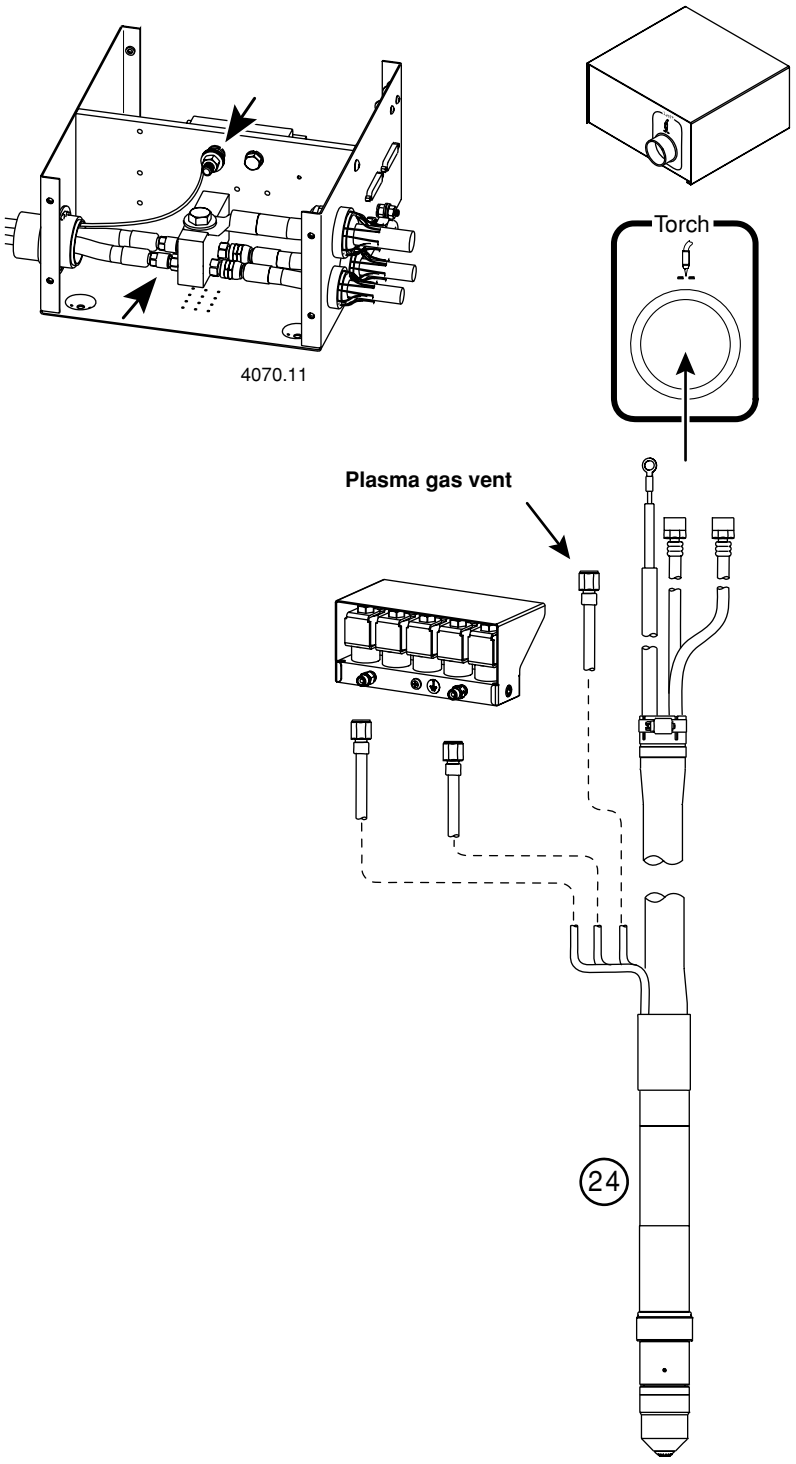
1. Install the torch (with torch leads attached) in the torch mounting bracket.
2. Position the torch until the torch body extends all the way through the bracket, so that the bracket is now around the torch sleeve and not touching the torch body. Position the torch approximately 0.25" (6 mm) from the workpiece.
3. Tighten the securing screws.

Torch Alignment

To align the torch at right angles to the workpiece, use a square at 0° and 90°. See figure above.

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

Install the Torch and Lead Assembly



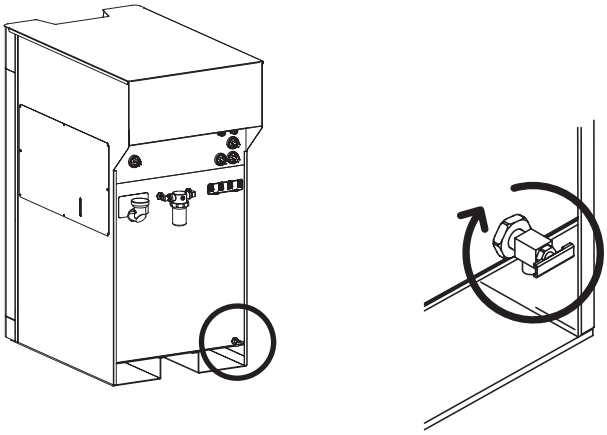
24 Torch and Lead Assembly

Part No.	Length
128500	6 ft (2 m)
128501	10 ft (3 m)
128502	15 ft (4.5 m)

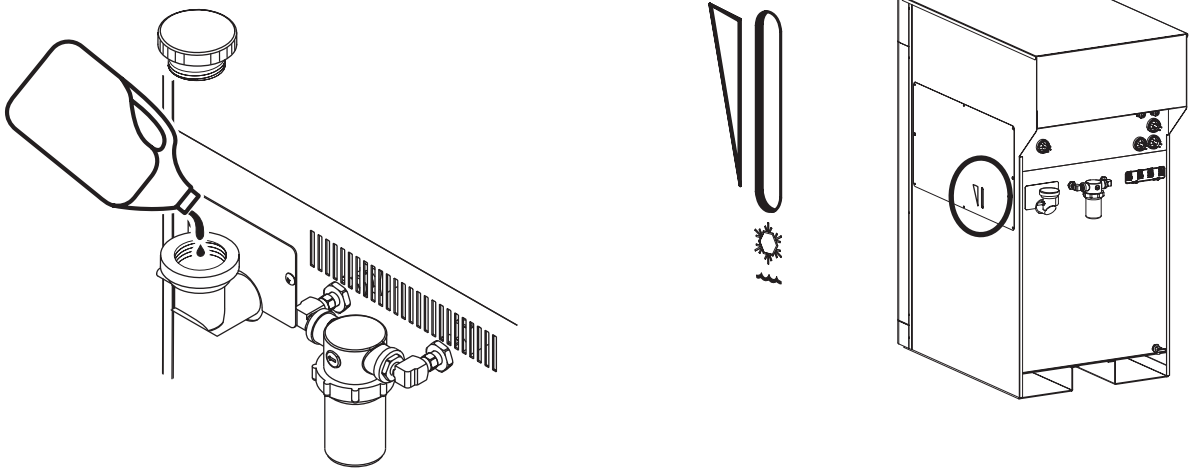
Fill the Power Supply with Coolant

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

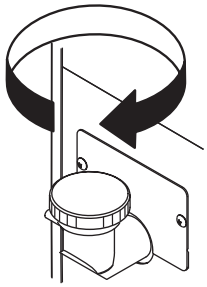
① Check that the drain valve is closed.



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

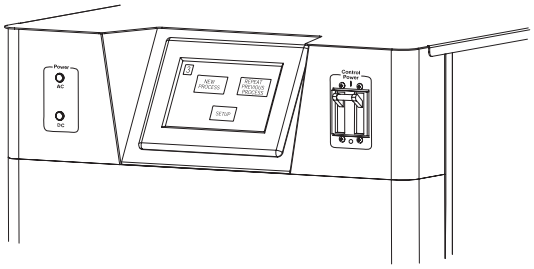


③ Replace the filler cap.

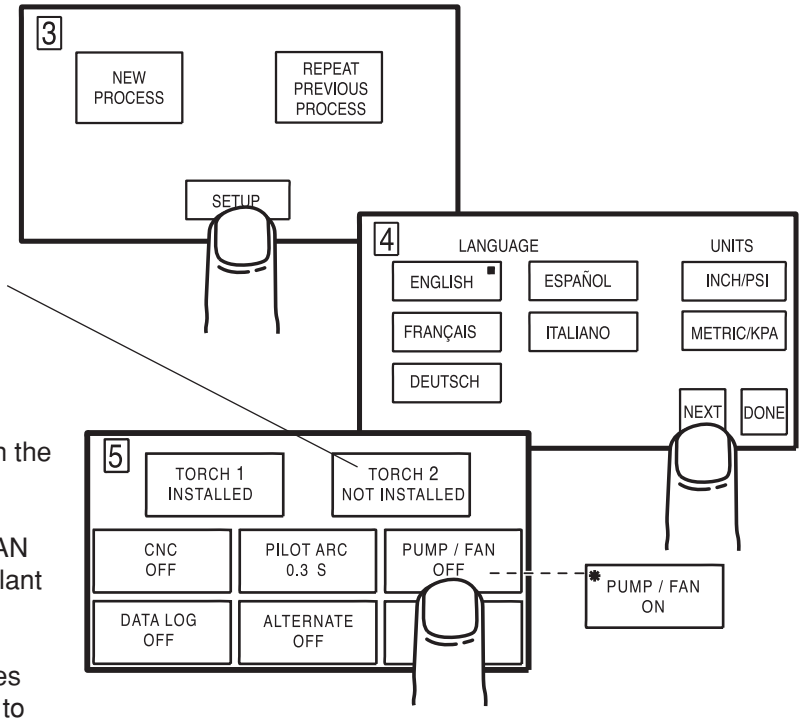


4070.40A

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.

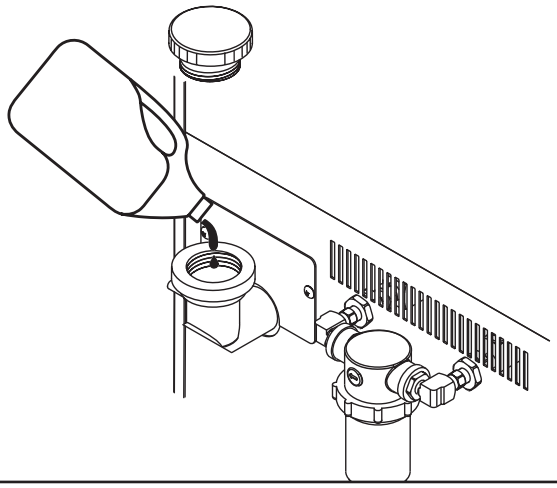
An asterisk will appear in the PUMP FAN button when power supply detects coolant flow.

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".



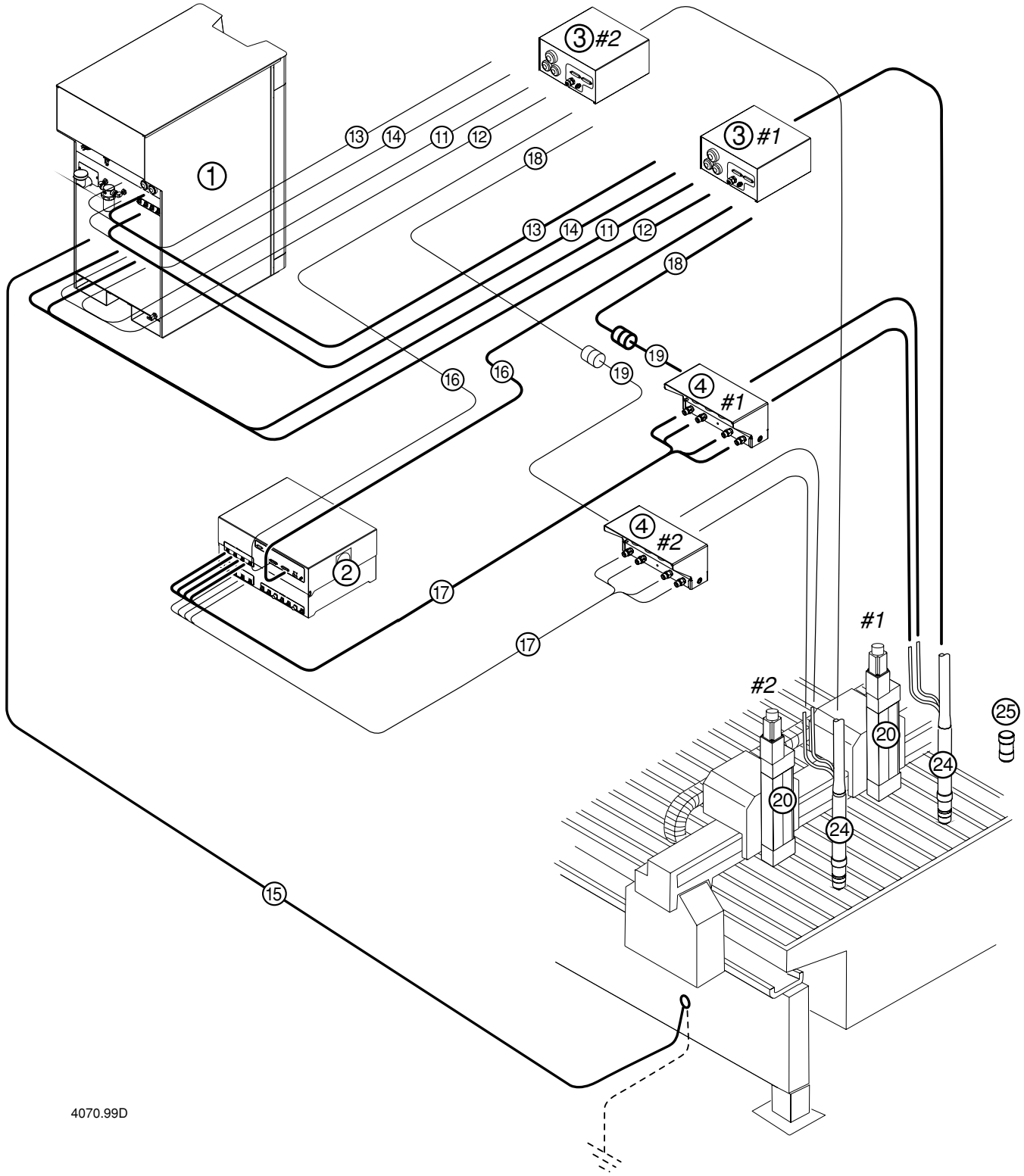
Hypertherm

Section 3B

2- TORCH INSTALLATION

In this section:

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 Torch and lead assembly; see page 3B-19.

㉕ Torch receptacle plug: used when a two torch system is being run in single torch mode. See page 3B-21

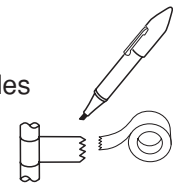
Install the Coolant Hoses

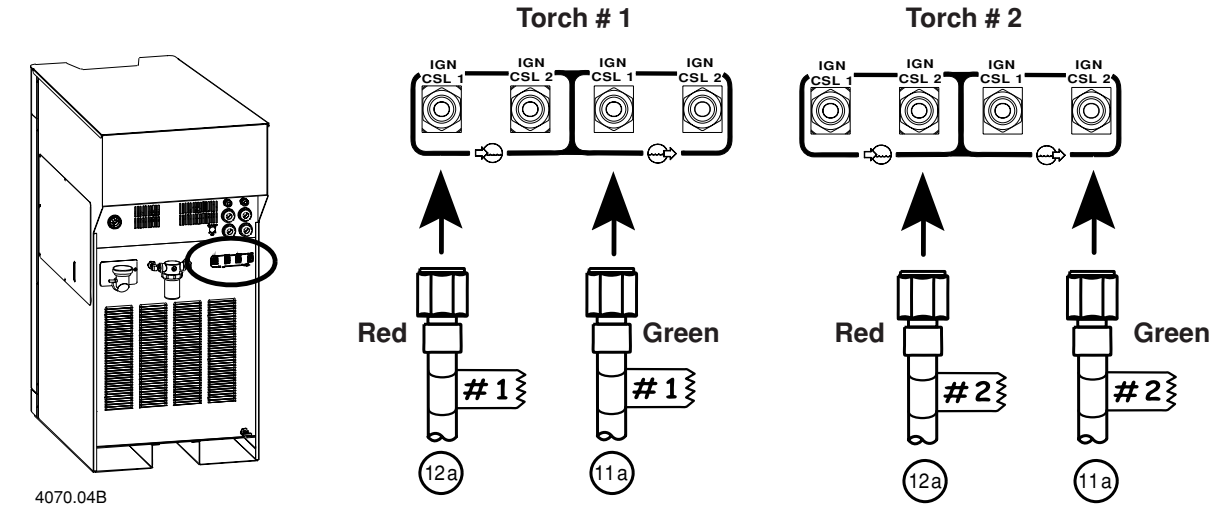
WARNING

Crossed return hoses can cause catastrophic torch failure

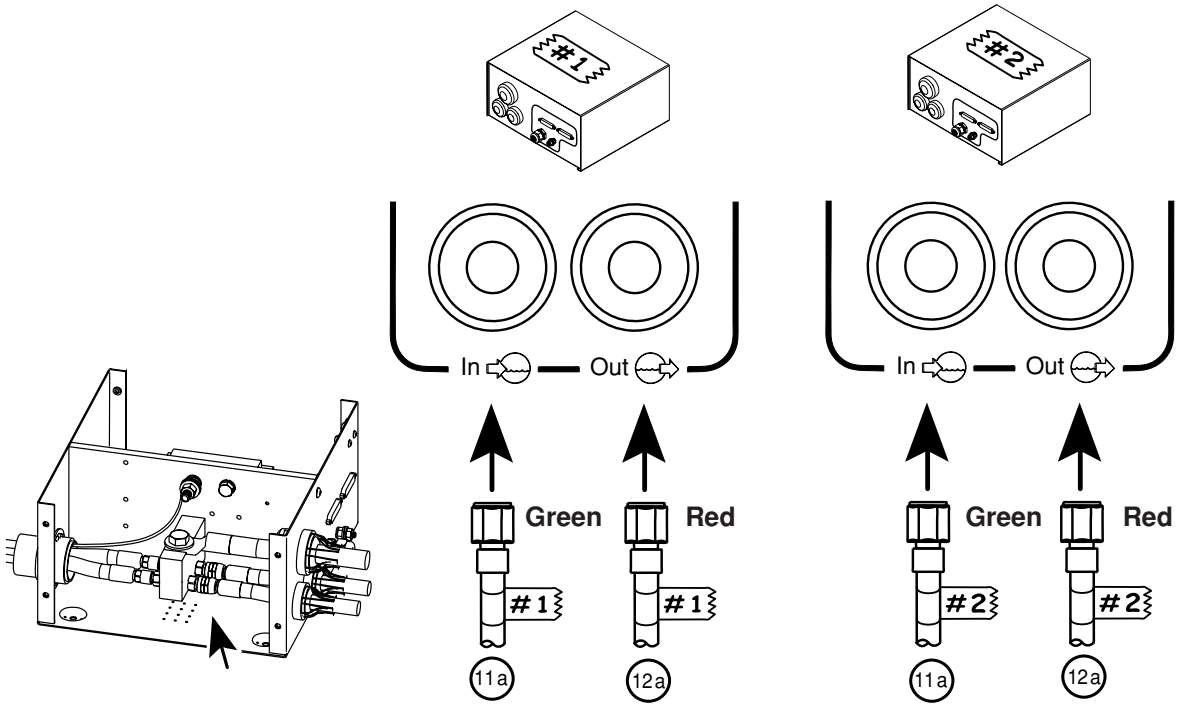
Installation Note

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	10 ft (3 m)	024263	50 ft (15 m)
024564	20 ft (6 m)	024264	75 ft (23 m)
024291	25 ft (7.5 m)	024265	100 ft (30.5 m)
024503	30 ft (9 m)	024459	150 ft (46 m)
024565	40 ft (12 m)		

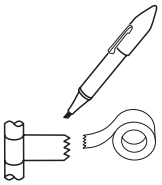
⑫ Coolant Hose Assembly - Red Return

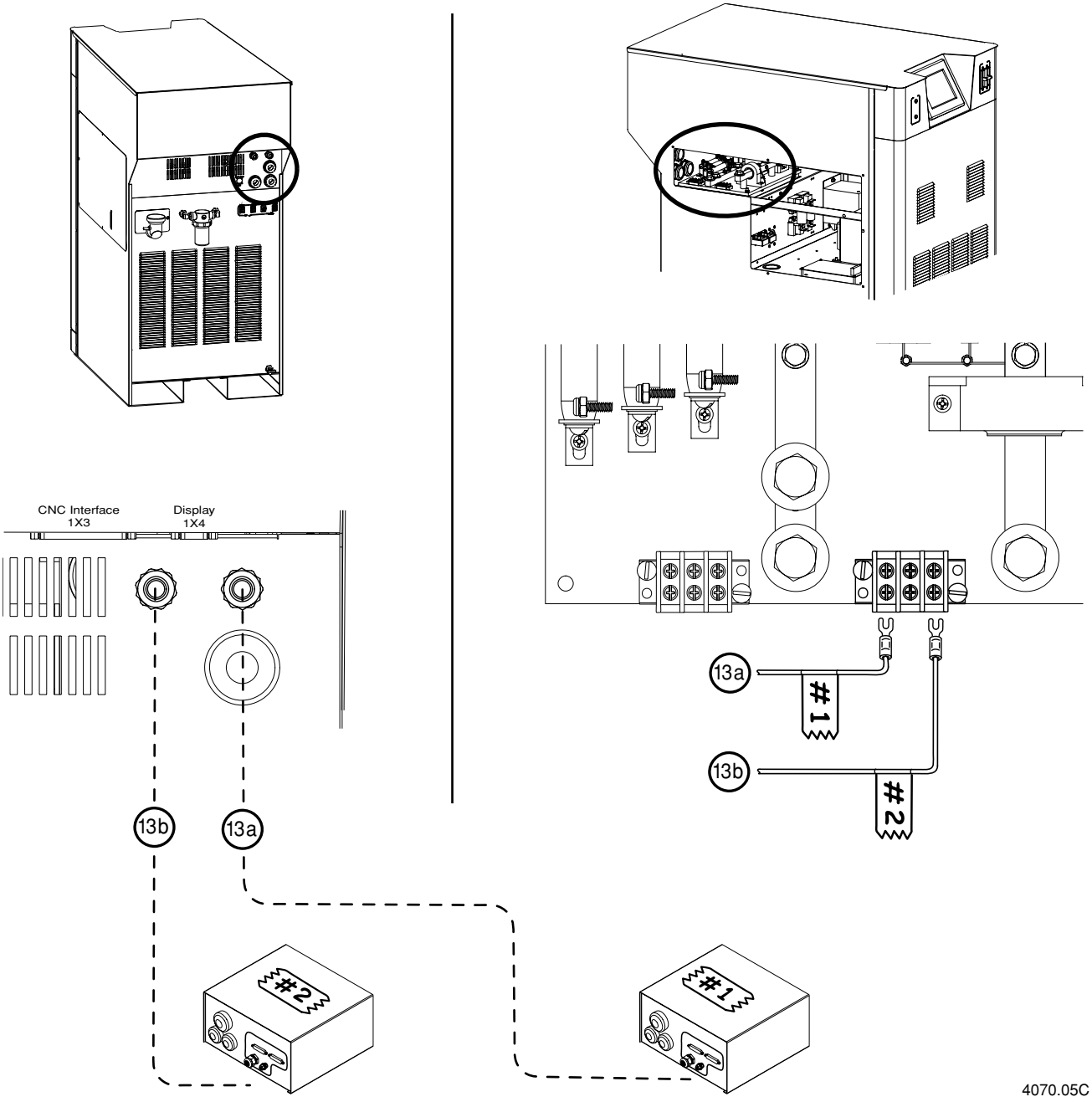
Part No.	Length	Part No.	Length
024566	10 ft (3 m)	024268	50 ft (15 m)
024567	20 ft (6 m)	024269	75 ft (23 m)
024267	25 ft (7.5 m)	024270	100 ft (30.5 m)
024504	30 ft (9 m)	024460	150 ft (46 m)
024568	40 ft (12 m)		

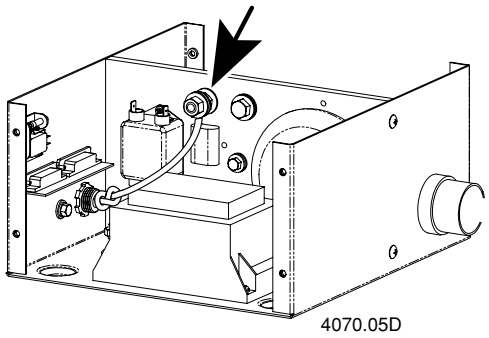
Install the Pilot Arc Leads

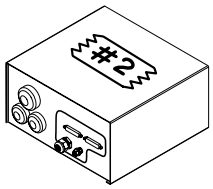
Installation Note

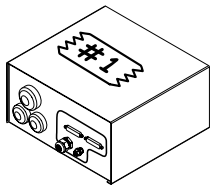
Mark the pilot arc leads for torch number 1 and torch number 2.

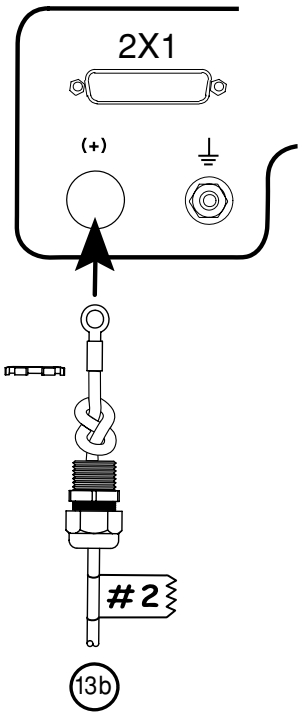


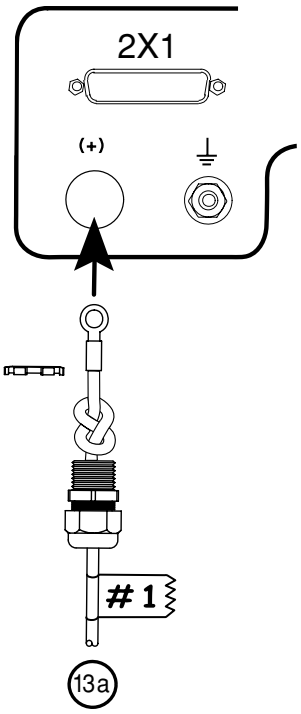




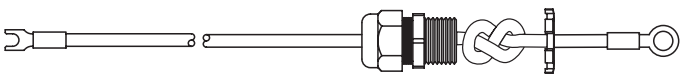






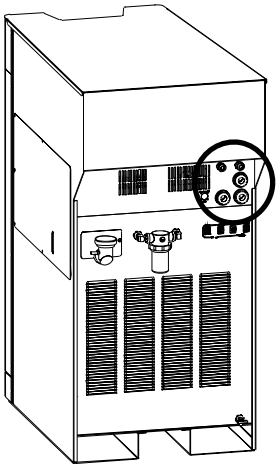


⑬ Pilot Arc Lead



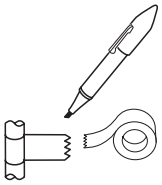
Part No.	Length	Part No.	Length
123409	10 ft (3 m)	123414	50 ft (15 m)
123410	20 ft (6 m)	123415	75 ft (23 m)
123411	25 ft (7.5 m)	123416	100 ft (30.5 m)
123412	30 ft (9 m)	123417	150 ft (46 m)
123413	40 ft (12 m)		

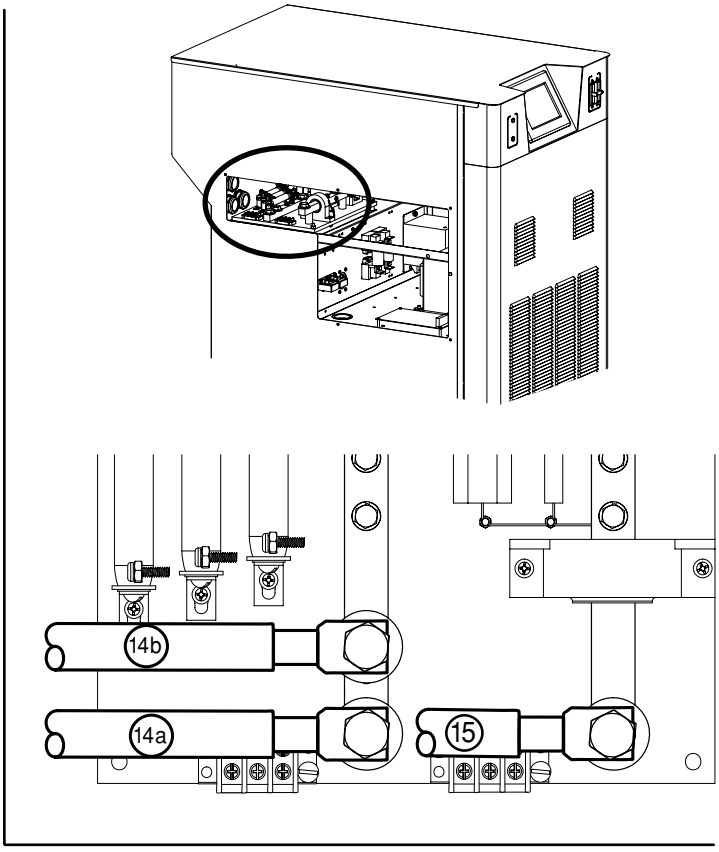
Install the Negative and Work Lead

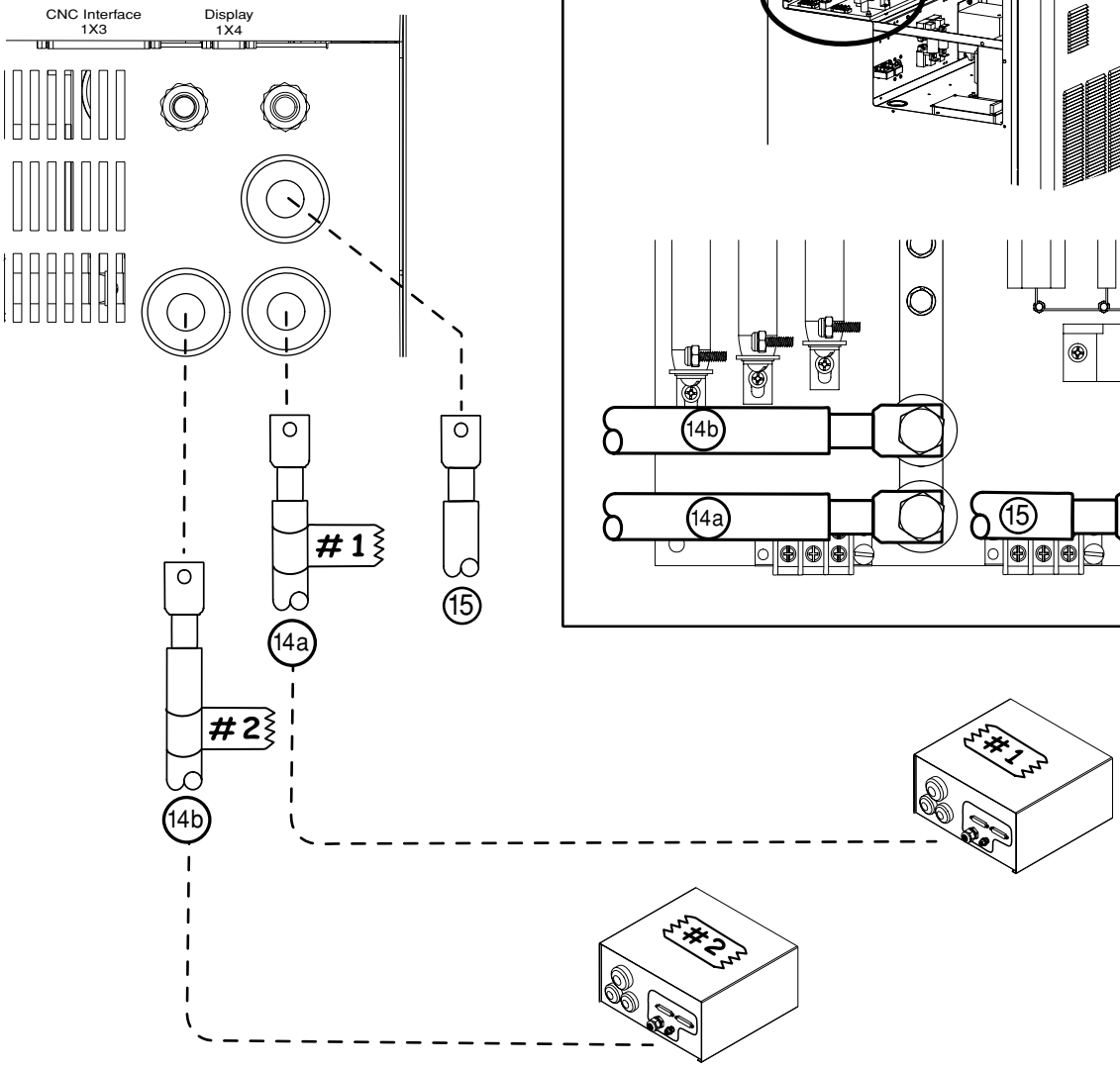


Installation Note

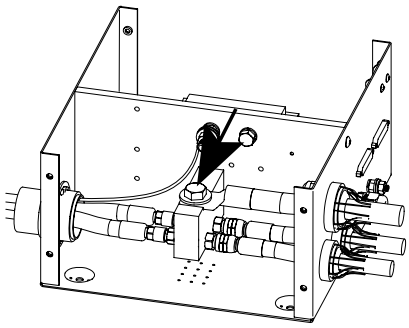
Mark negative and work leads for torch number 1 and torch number 2.

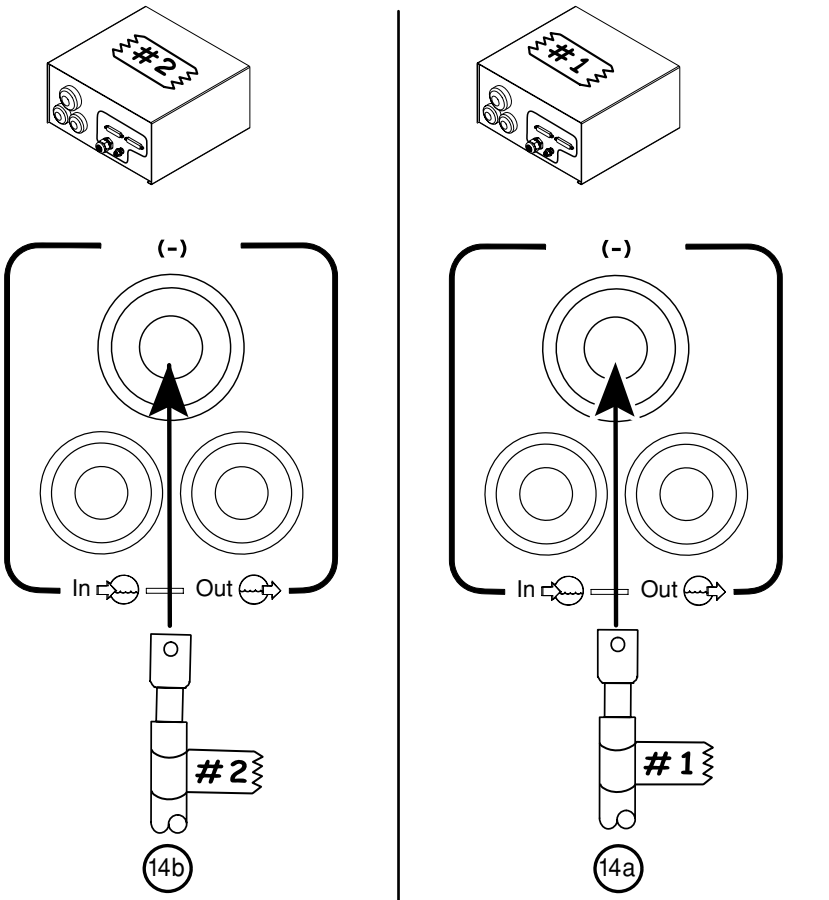






4070.05B





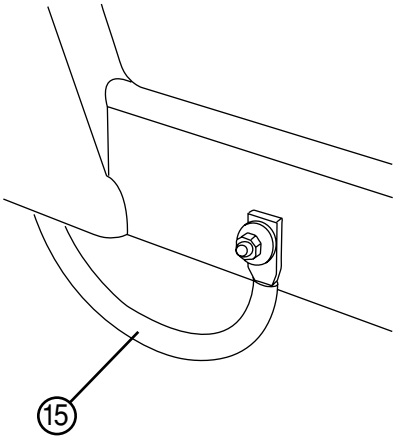
4070.05E

⑭ Negative Lead

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

⑮ Work Lead

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

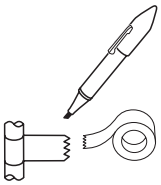


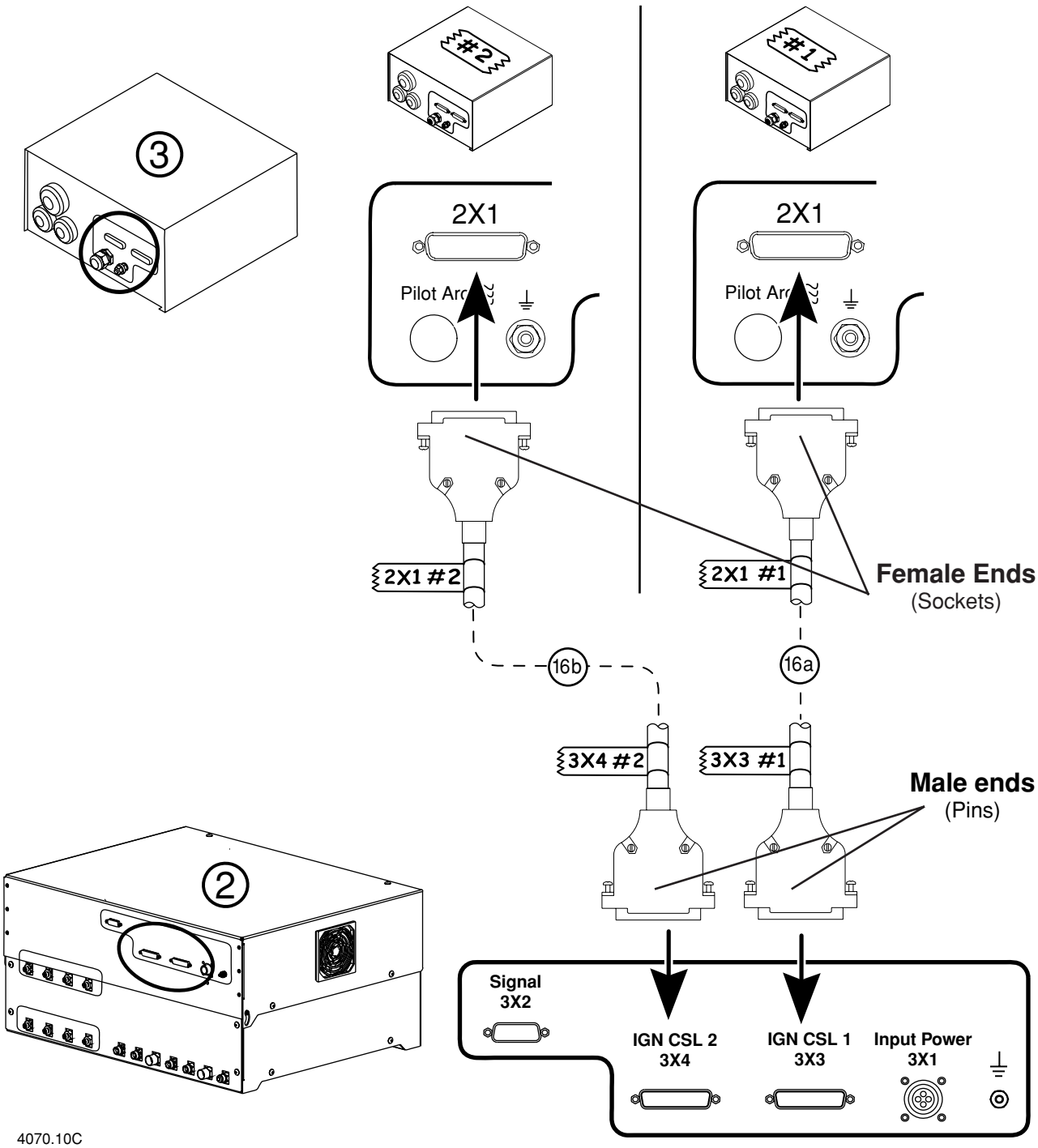
Lower frame of work table (typical).

Install the Gas Console to Ignition Console Cable

Installation Note

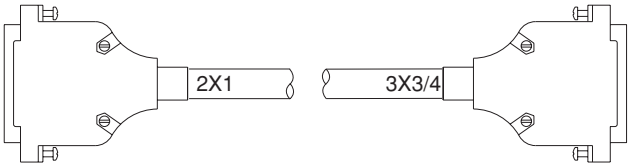
Mark the cable identification number and torch number on the ends of each cable.





4070.10C

⑯ Cable – Gas Console to Ignition Console



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

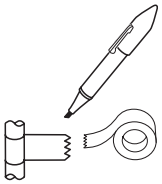
CABLE RUN LIST

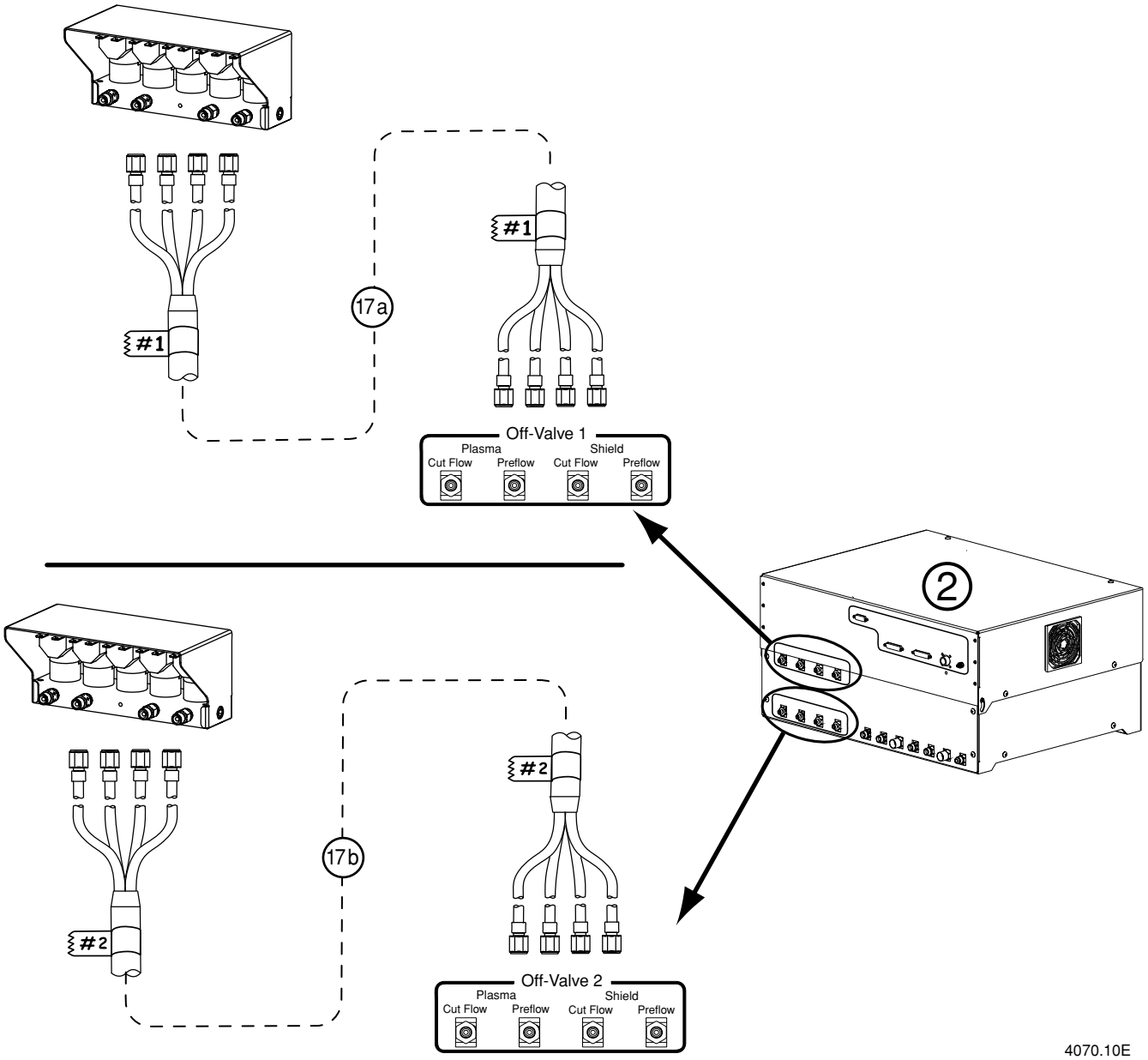
Signal Name	2X1	COLOR	3X3/4	Function	Input/Output
Not Used	13	Grey	13		
Not Used	25	Brown	25		
Not Used	12	Red	12		
Not Used	24	Yellow	24		
Not Used	11	Red	11		
Not Used	23	Blue	23		
Not Used	10	Red	10		
Not Used	22	Green	22		
Not Used	9	Red	9		
Not Used	21	White	21		
Not Used	8	Red	8		
Not Used	20	Orange	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

Install the Gas Hose Assembly

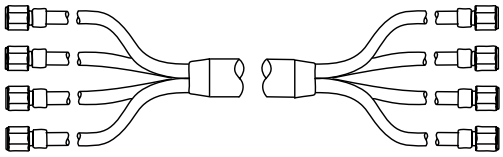
Installation Note

Mark the torch number on the ends of each gas hose assembly.
Make sure there are no leaks at connections.





⑰ Hoses - Gas Console to Off-Valve

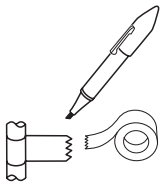


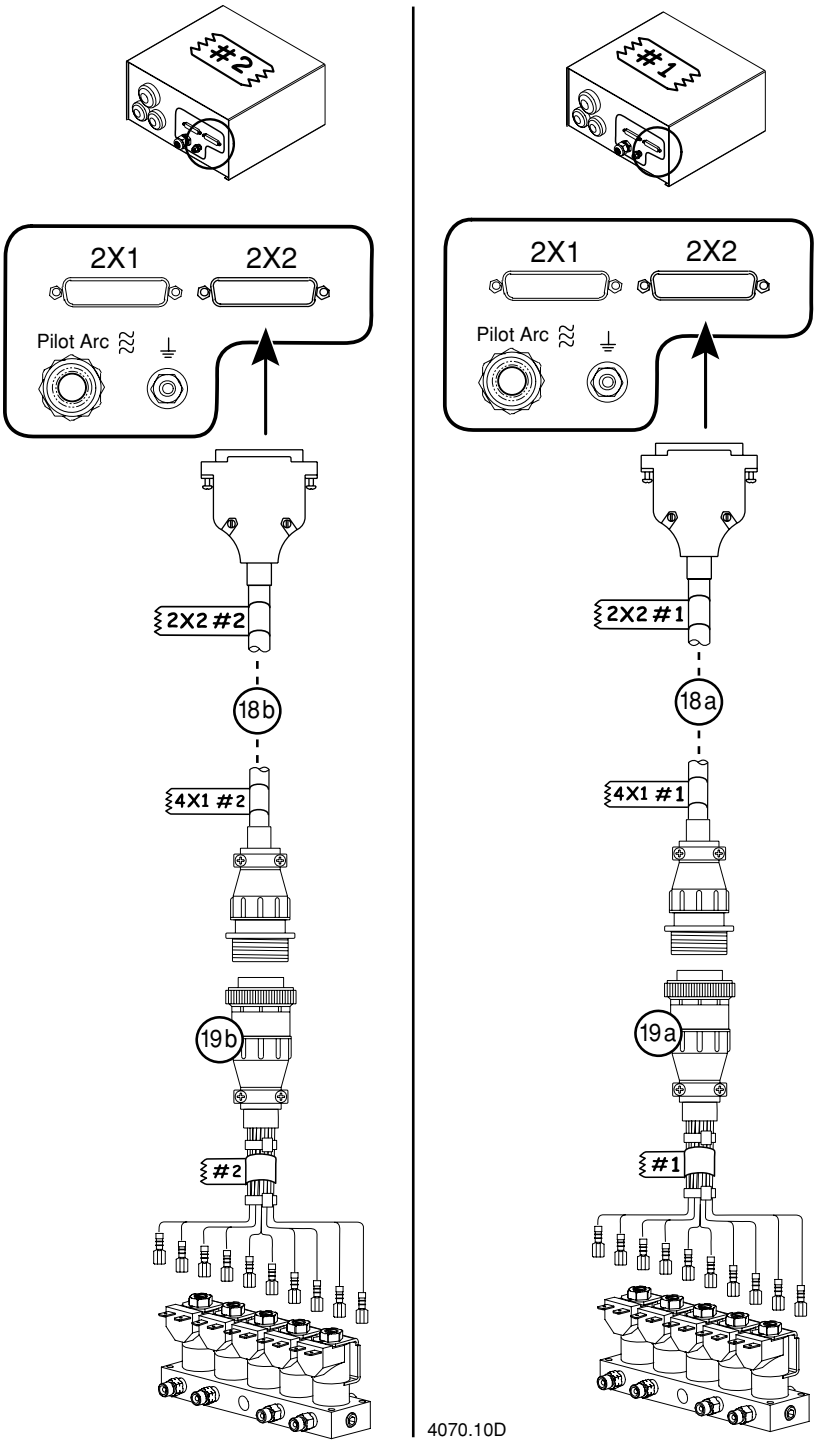
Part No.	Length	Part No.	Length
128445	15 ft (4.6 m)	128450	40 ft (12 m)
128446	20 ft (6 m)	128558	50 ft (15 m)
128447	25 ft (7.5 m)	128559	60 ft (18 m)
128448	30 ft (9 m)	128550	75 ft (23 m)
128449	35 ft (10.5 m)	128551	100 ft (30.5 m)

Install the Ignition Console to Off-Valve Cables

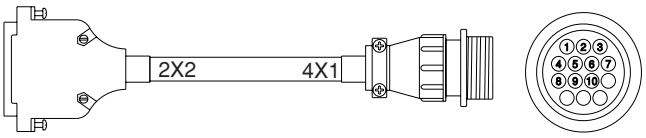
Installation Note

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





⑱ Cable - Ignition Console to Off-Valve

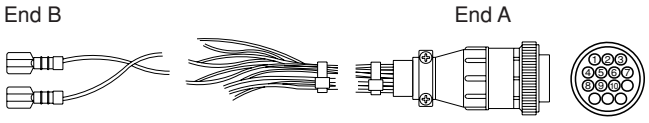


Part No.	Length	Part No.	Length
123451	6 ft (1.8 m)	123453	15 ft (4.6 m)
123452	10 ft (3 m)		

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	1.5 ft (0.5 m)		

CABLE RUN LIST

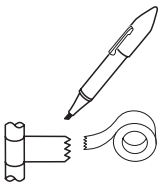
FUNCTION	END B	COLOR	END A
SHIELD	S	Red/Black	1
PREFLOW	P	Red	2
SHIELD	S	Red/Black	3
CUTFLOW	C	Red	4
PLASMA	P	Red/Black	5
PREFLOW	P	Red	6
PLASMA	P	Red/Black	7
CUTFLOW	C	Red	8
VENT	V	Red/Black	9
	V	Red	10

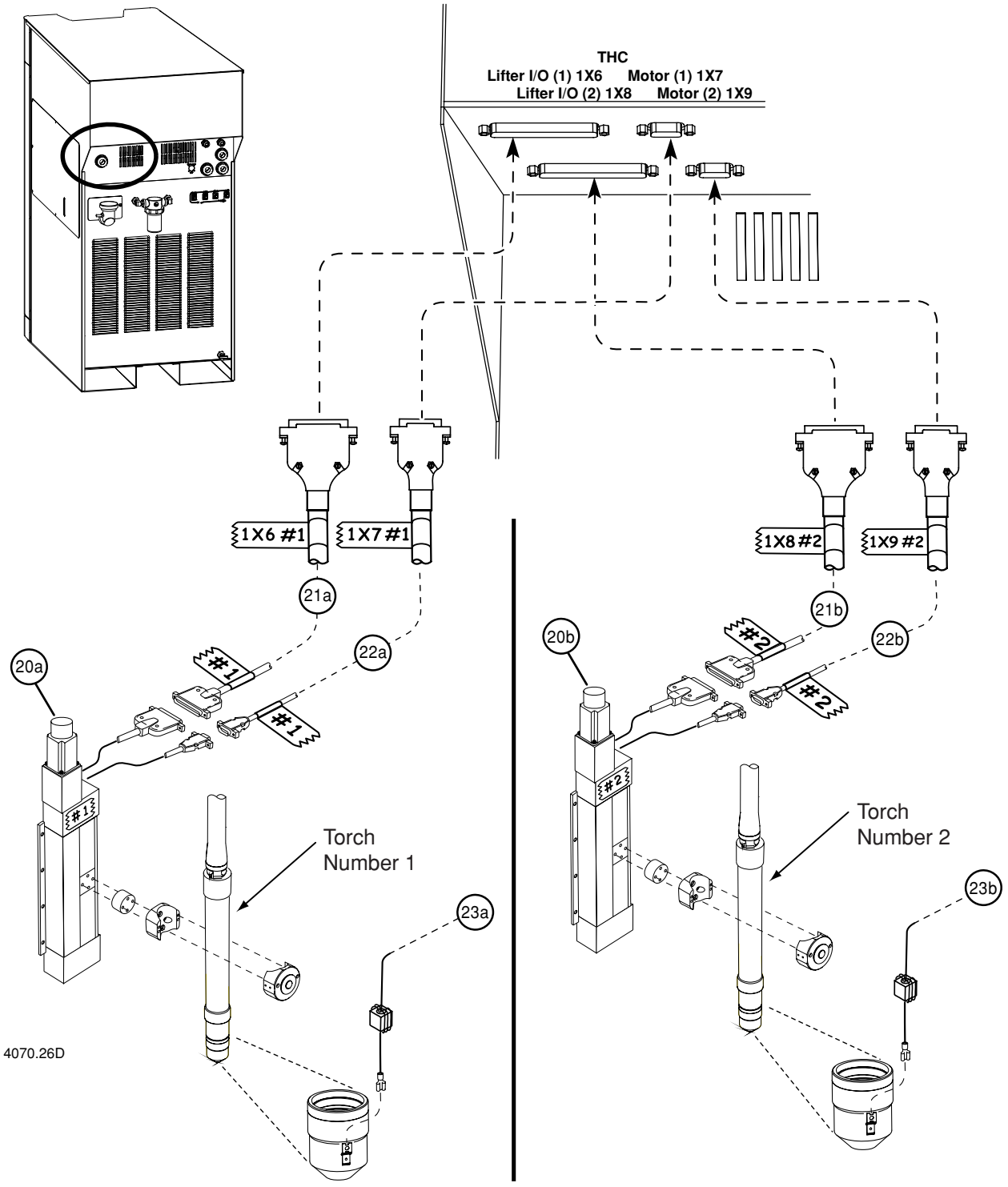
Install the Integrated Command THC Option

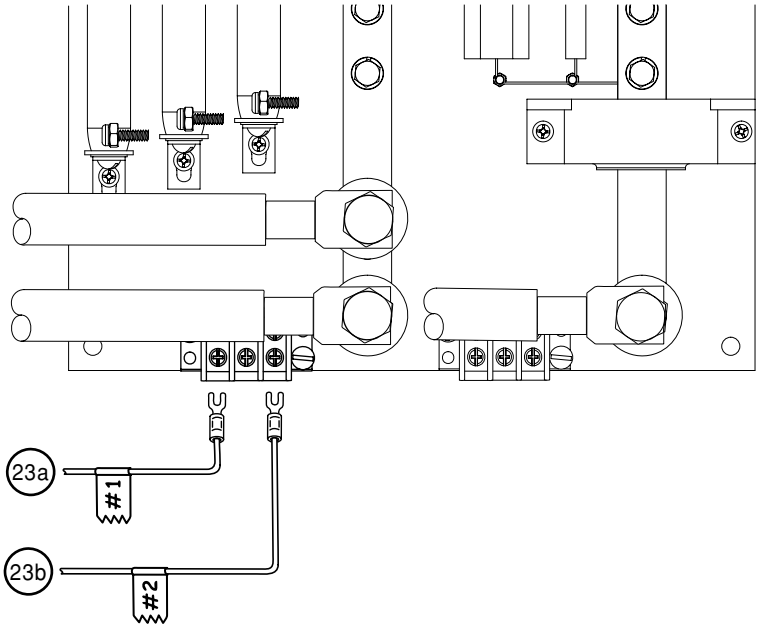
See section 3A for instructions to mount X-Y lifter, torch mounting block and torch breakaway options.

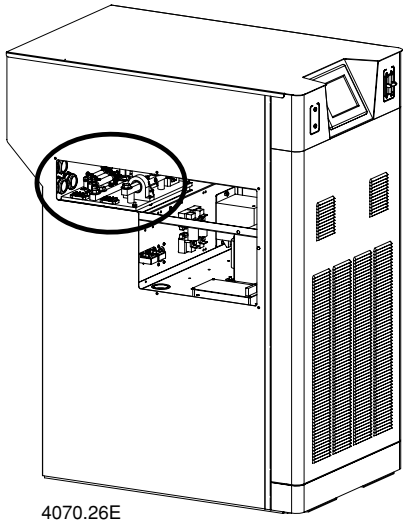
Installation Note

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



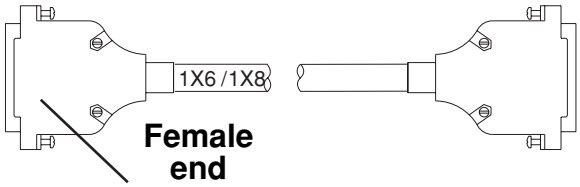





4070.26E

(21) Cable – Lifter Interface

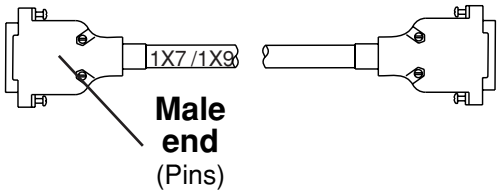
See next page for signal information



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

(22) Cable – Motor Drive

See next page for signal information



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

(23) Ohmic Contact Wire

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

Lifter Interface Cable Signals

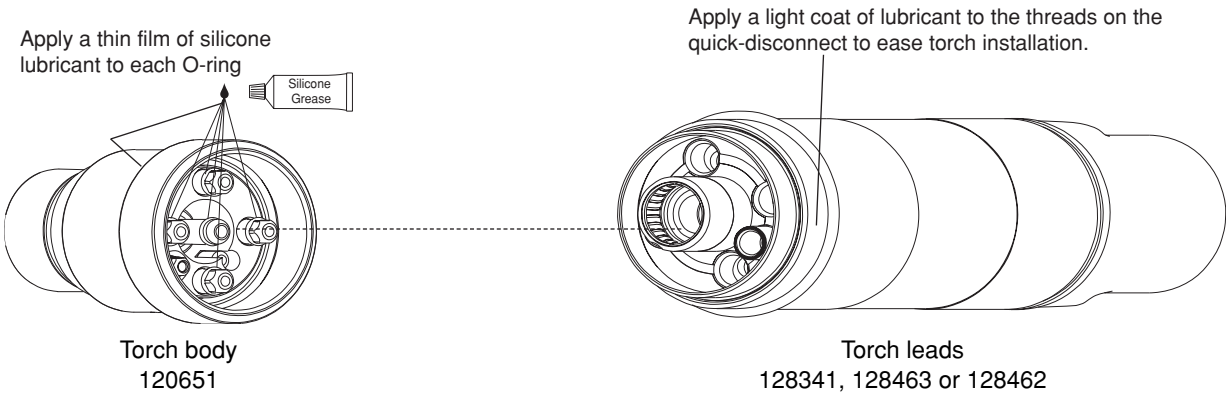
Power Supply Pin number	Signal Name	Wire Color	Function
1 Input	Encoder Power -	Black	Encoder power
20	Encoder Power (5V)+	Red	
2 Input	Encoder B -	Black	A quad B position signal.
21	Encoder B +	Green	
3 Input	Encoder A -	Black	A quad B position signal.
22	Encoder A +	Blue	
5 Input	Drive ID2 -	Black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

Motor Drive Cable Signal

Power Supply Pin Number	Signal Name	Wire Color	Function
5 Output	Motor Phase A +	Red	Powers lifter motor, phase A+.
9	Motor Phase A +	Red	
4 Output	Motor Phase A -	Black	Powers lifter motor, phase A-.
8	Motor Phase A -	Black	
3			Not connected
7 Output	Motor Phase B +	Red	Powers lifter motor, phase B+.
2	Motor Phase B +	Red	
6 Output	Motor Phase B -	Black	Powers lifter motor, phase B-.
1	Motor Phase B -	Black	

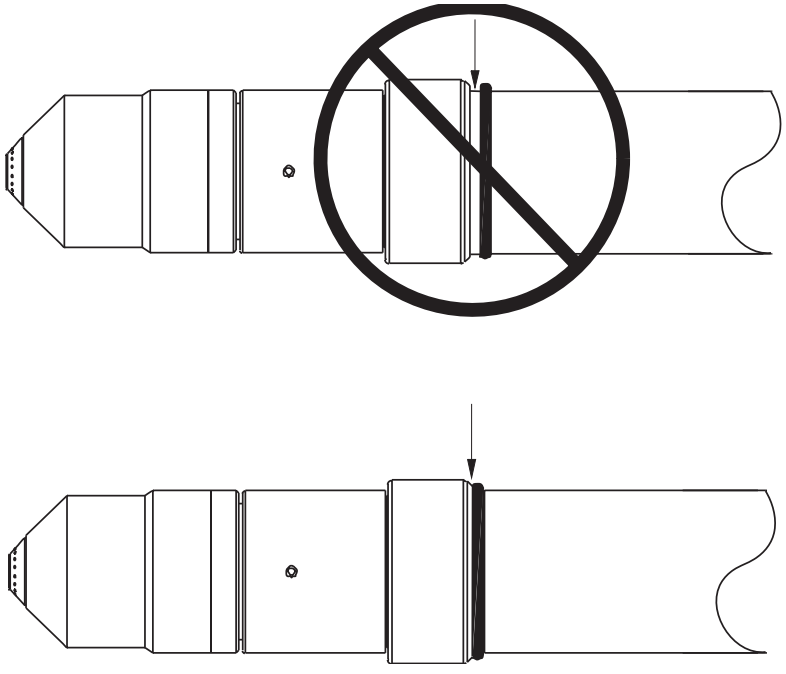
Torch Connections

Connecting the Torch to Torch Leads



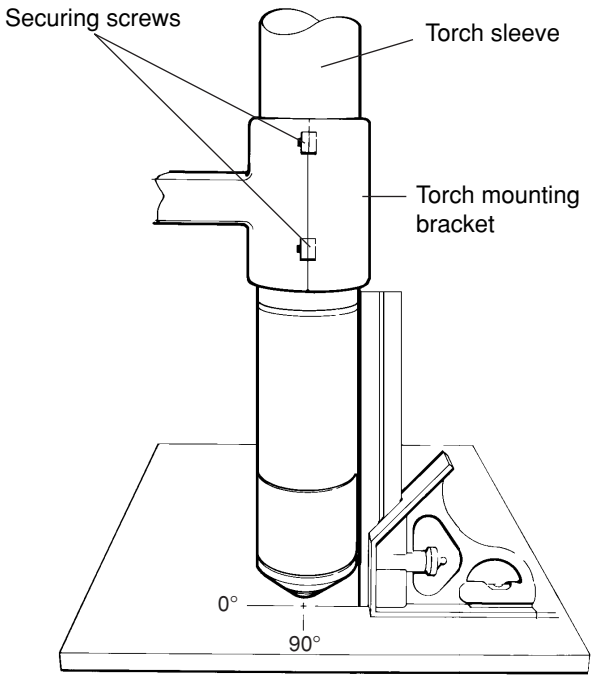
Installation Note

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 Note

1. Install the torch (with torch leads attached) in the torch mounting bracket.
2. Position the torch until the torch body extends all the way through the bracket, so that the bracket is now around the torch sleeve and not touching the torch body. Position the torch approximately 0.25" (6 mm) from the workpiece.
3. Tighten the securing screws.

Torch Alignment

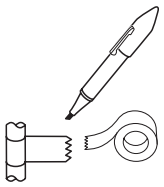
To align the torch at right angles to the workpiece, use a square at 0° and 90°. See figure above.

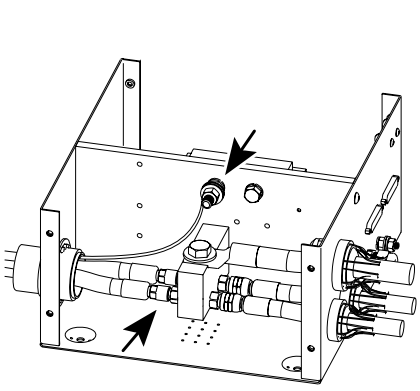
See also *Changing Consumables* in Section 4 to install consumables in the torch.

Install the Torch and Lead Assembly

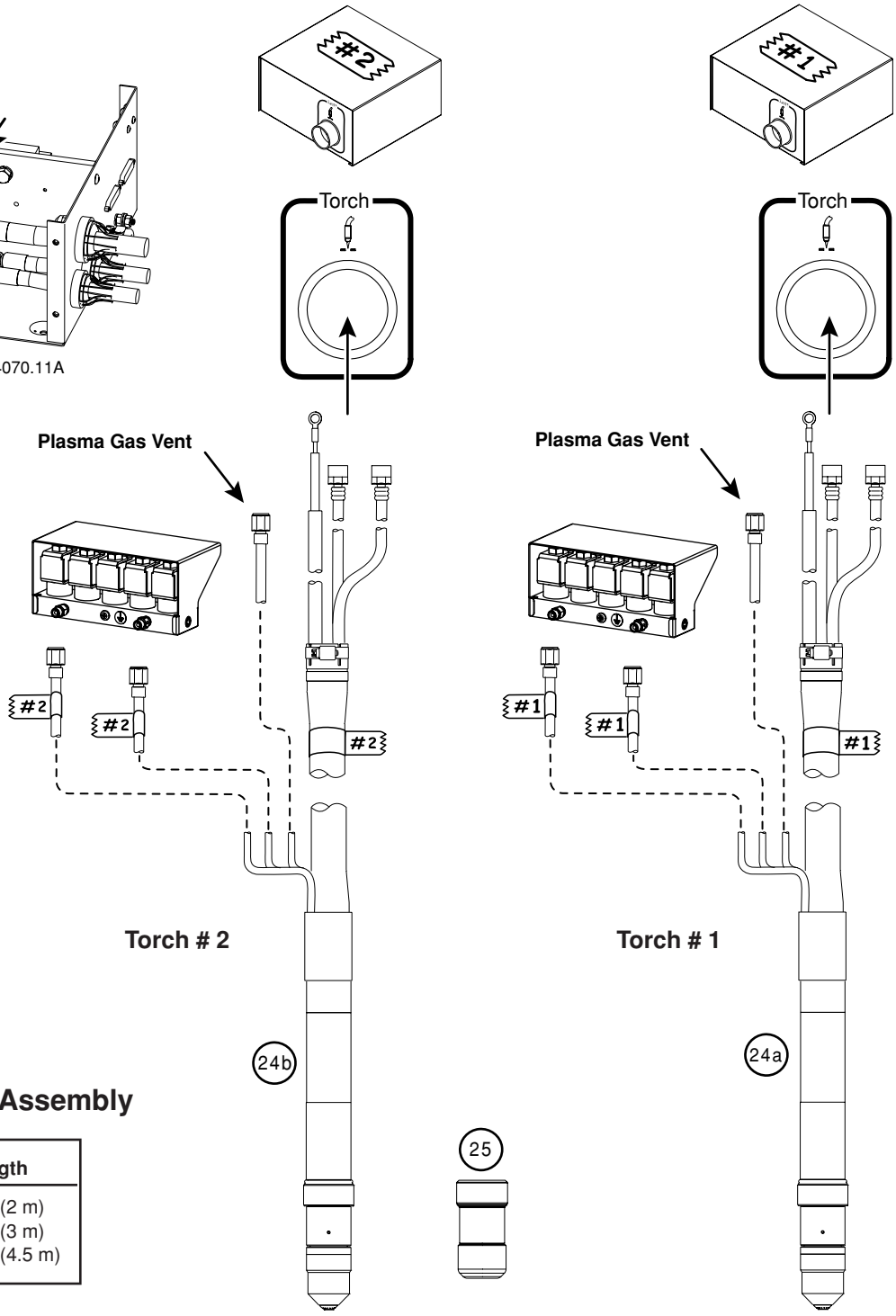
Installation Note

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





4070.11A



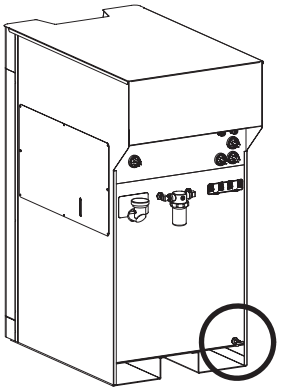
㉔ Torch and Lead Assembly

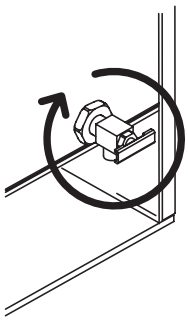
Part No.	Length
128500	6 ft (2 m)
128501	10 ft (3 m)
128502	15 ft (4.5 m)

Fill the Power Supply with Coolant

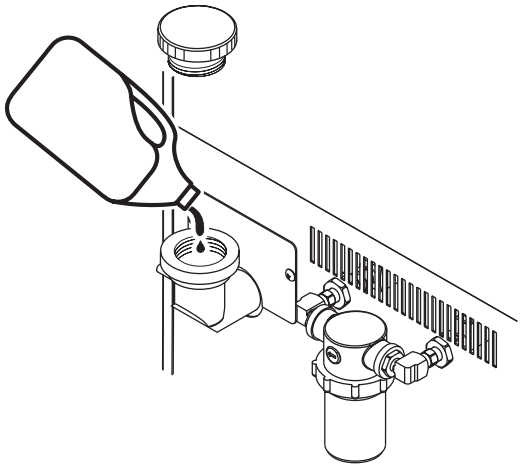
	Caution
	Use Hypertherm coolant (028872) to reduce the risk of damage from freezing and to prevent long-term corrosion.

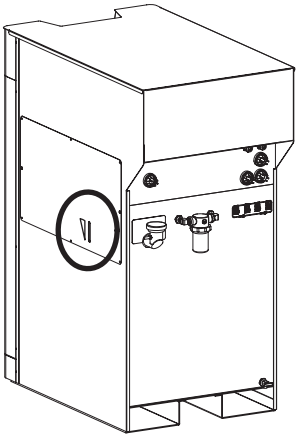
① Check that the drain valve is closed.



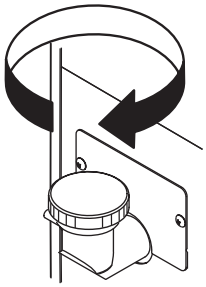


② Add coolant to the power supply until the sight gauge indicates full.



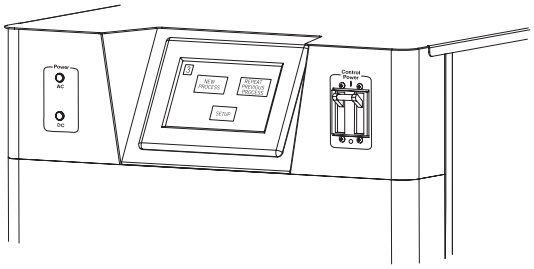


③ Replace the filler cap.



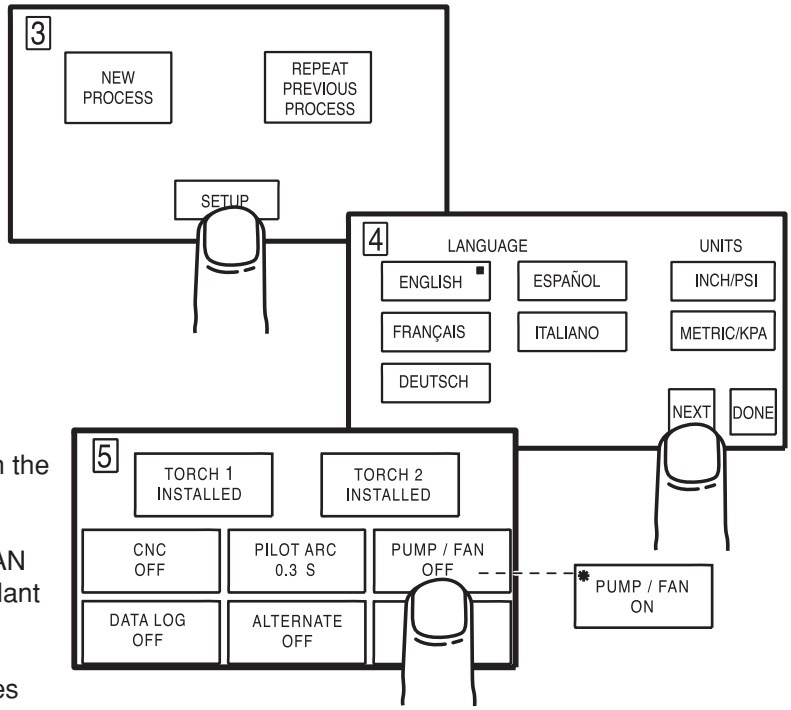
4070.40A

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.

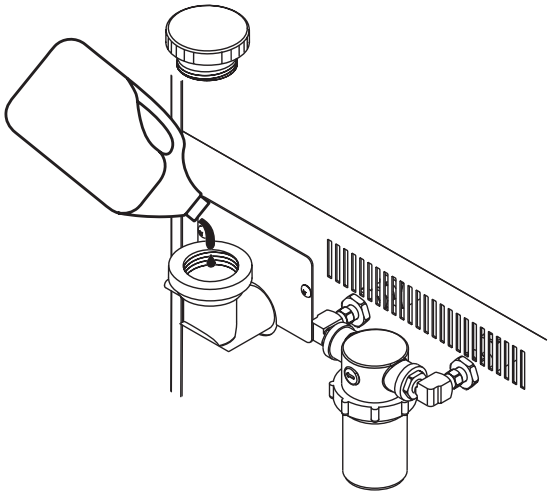
An asterisk will appear in the PUMP FAN button when power supply detects coolant flow.

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:

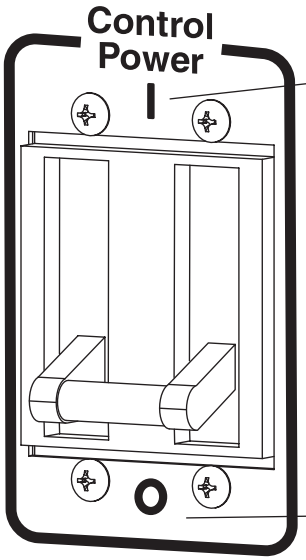
Power Supply Controls and Indicators

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.

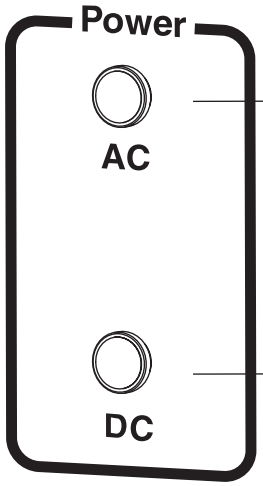
Power Switch



On Position (I)
In this position, AC power is sent to the control transformer, to turn on the power supply.

Off Position (O)
In this position, AC power is cut off to the control transformer, to turn off the power supply.

Power Indicators



4070.27

AC Green Indicator:
Indicator illuminates when power switch is in the on position and power up is complete.

DC White Indicator:
Indicator illuminates when main contactor closes, indicating DC power is being supplied to the torch.

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.

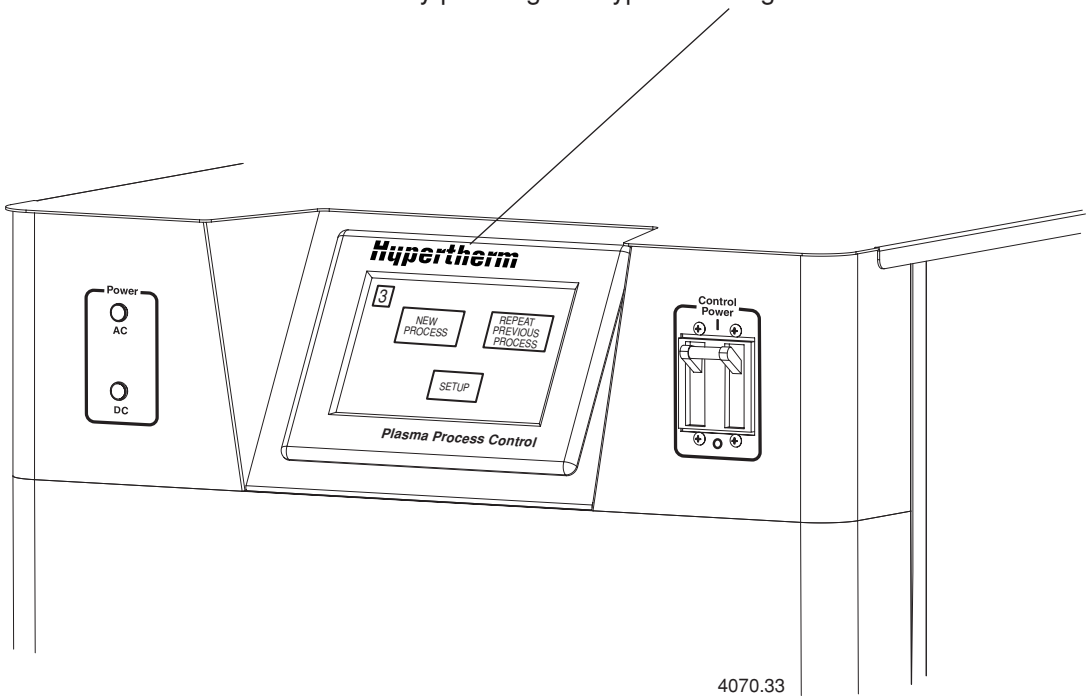
There are a total of 17 screens, 1-11 and 13-18. Screen 1(initiating) and 2 (power-up) only appear briefly at start-up and are not discussed further in this manual. There is no screen 12.

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.

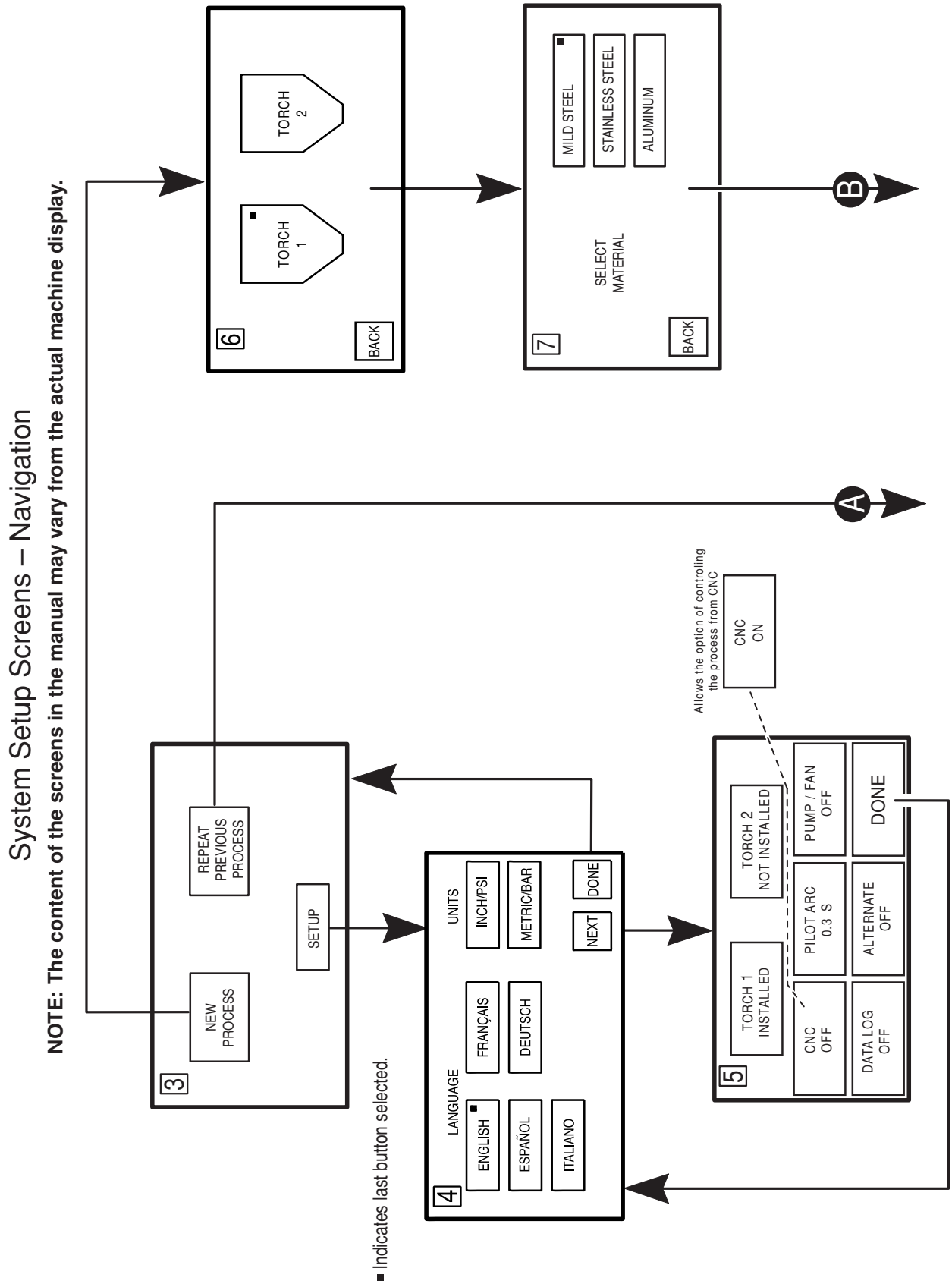
Setup Screens – Screens 3 through 11 are for system setup. The system is ready for input when Screen 3 appears.

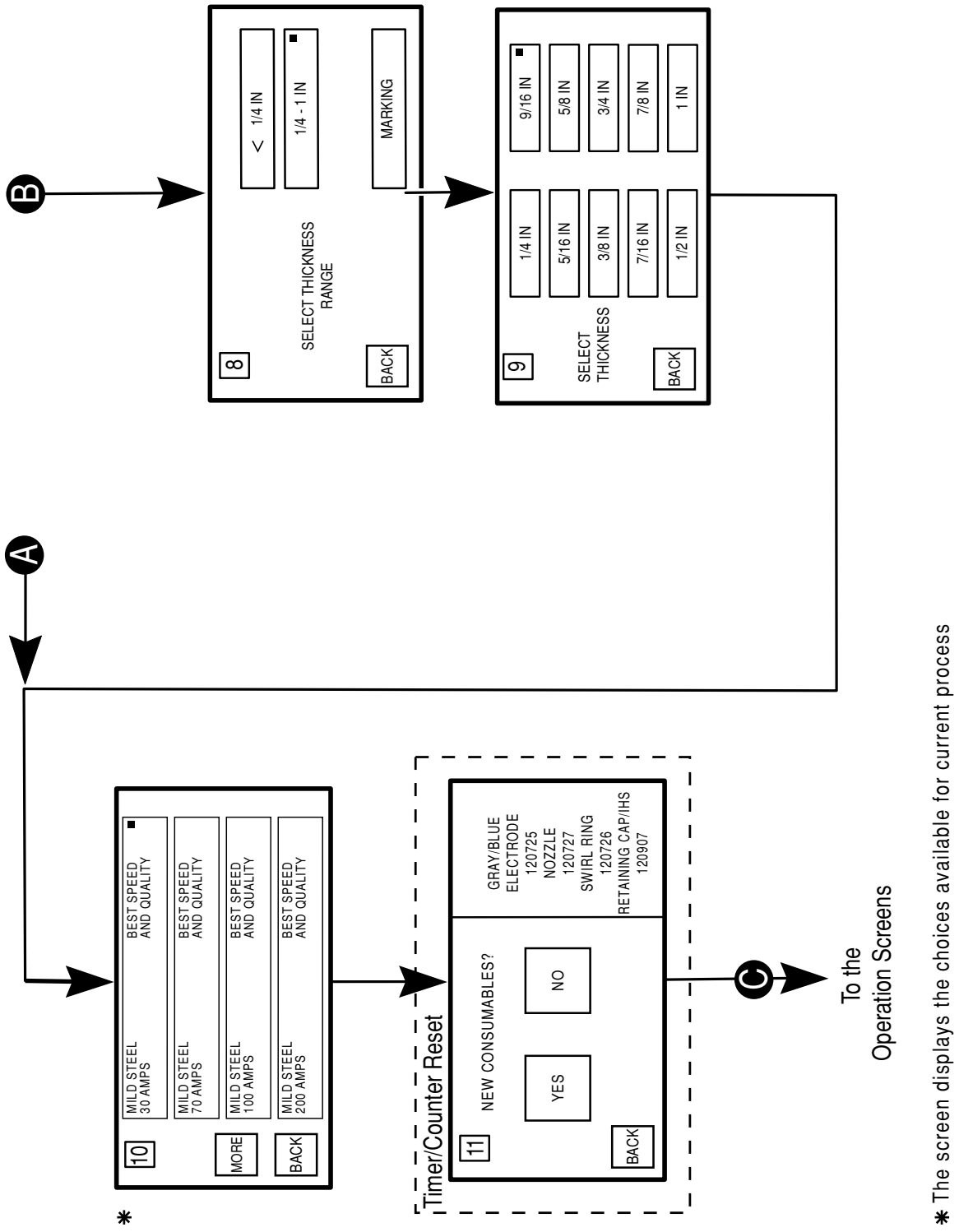
Operation Screens – Screens 13 through 16 are for system operation. Screen 13 is the primary operating screen and is visible during cutting operations. When an error occurs that freezes the system software, a RESET button appears in place of NEW PROCESS. Pushing RESET clears the error without having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

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



Warning: 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.

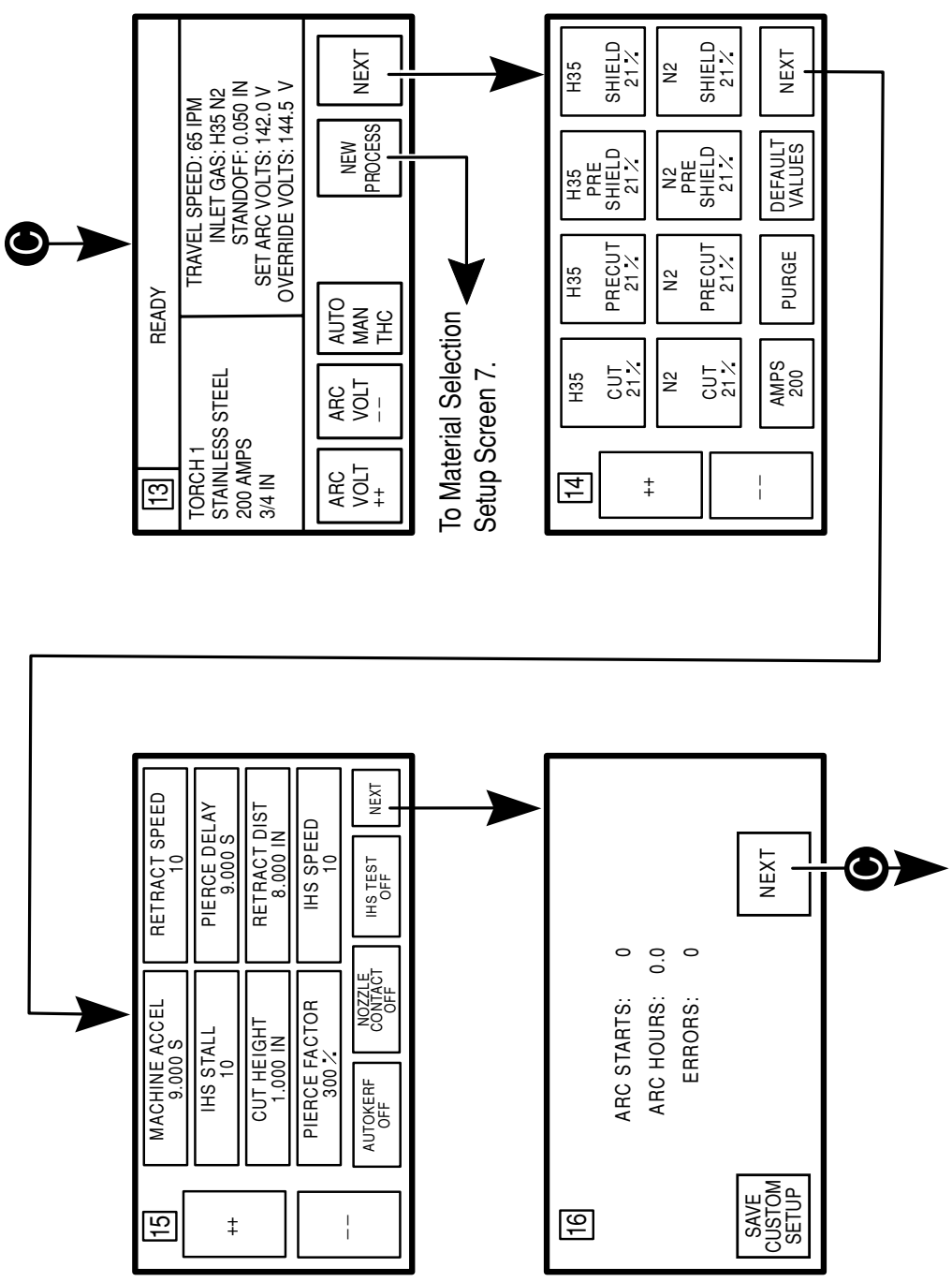

System Setup Screens – Navigation
NOTE: The content of the screens in the manual may vary from the actual machine display.
3
NEW PROCESS
REPEAT PREVIOUS PROCESS
SETUP
4
LANGUAGE
ENGLISH
ESPAÑOL
ITALIANO
FRANÇAIS
DEUTSCH
UNITS
INCH/PSI
METRIC/BAR
NEXT
DONE
5
TORCH 1 INSTALLED
TORCH 2 NOT INSTALLED
CNC OFF
PILOT ARC 0.3 S
PUMP / FAN OFF
DATA LOG OFF
ALTERNATE OFF
DONE
Allows the option of controling the process from CNC
CNC ON
6
TORCH 1
TORCH 2
BACK
7
SELECT MATERIAL
MILD STEEL
STAINLESS STEEL
ALUMINUM
BACK
A
B
■ Indicates last button selected.



* 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.



1

Daily Start-up

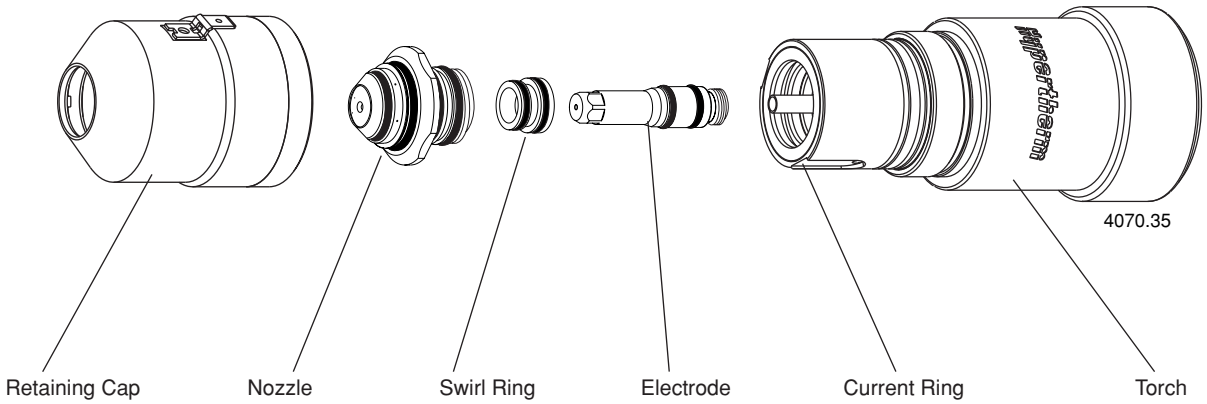
Prior to start-up, ensure that your cutting environment and that your clothing meet the safety requirements outlined in the *Safety* section of this manual.

① Check Torch

WARNING

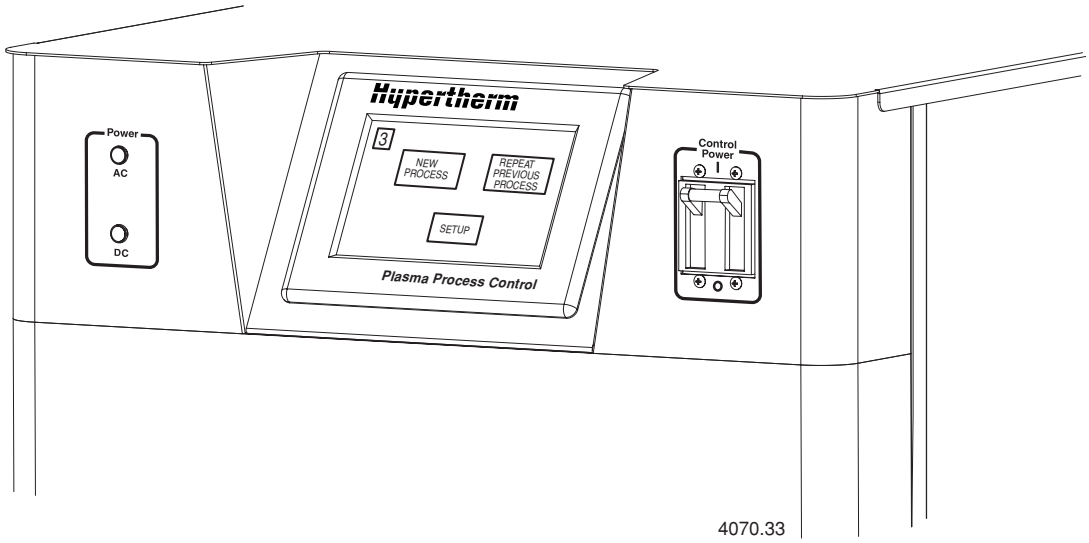
Before operating this system, you must read the Safety section thoroughly! Turn OFF the power supply's main disconnect switch before proceeding with the following steps.

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

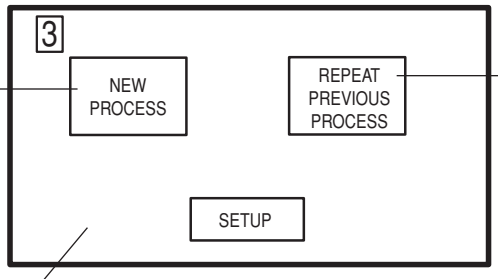
1. Move the power switch to the ON position.
2. Check that the green AC indicator is illuminated.



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

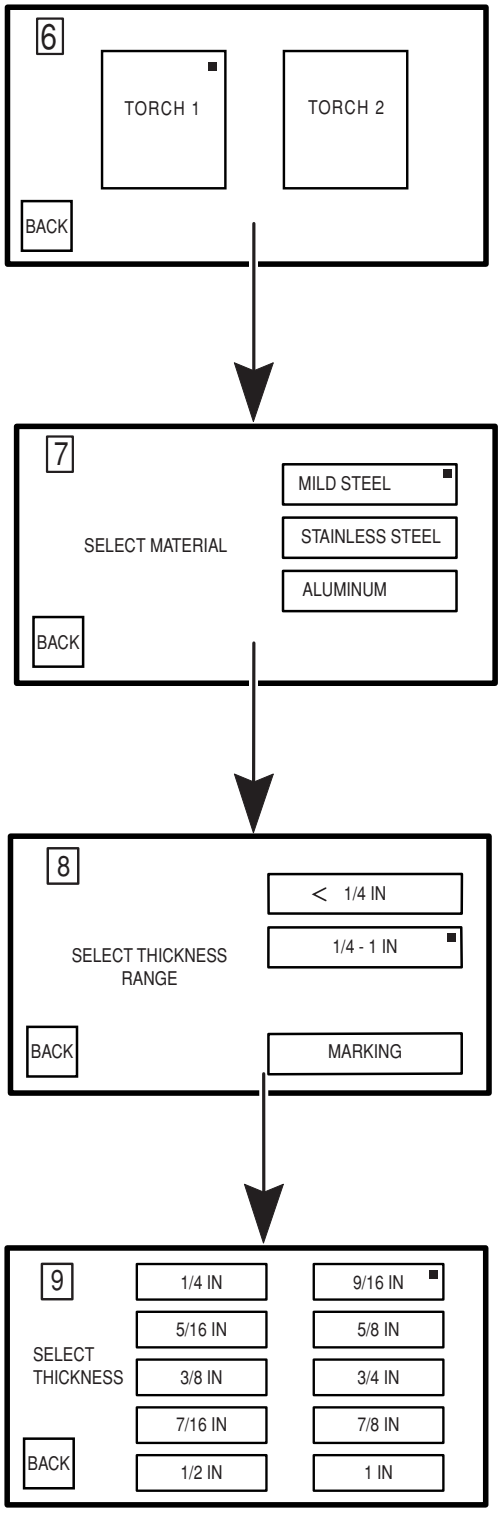


Press to select :
1. Torch 1 or torch 2 – Screen 6
2. Material to cut – Screen 7
3. Material thickness – Screen 8 & 9

Press to return to the last cutting process that was used. The display will advance to screen 10.

Press to change:
1. Language and units of measure – Screen 4
2. CNC control (ON or OFF) – Screen 5
3. Torch status to installed or uninstalled – Screen 5
4. Turn ON or OFF data logging – Screen 5

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.

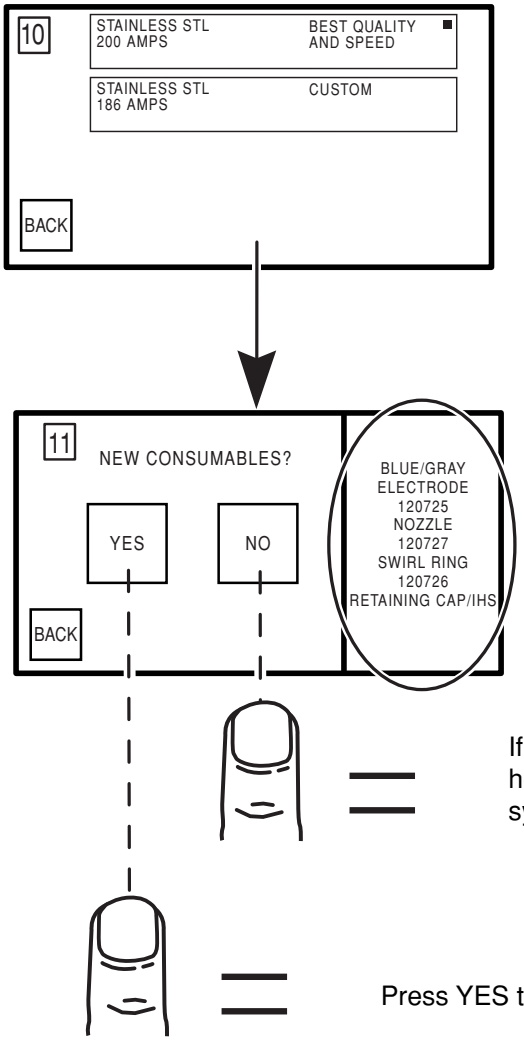
Select material thickness range.

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. Color code indicates O-ring colors for process.

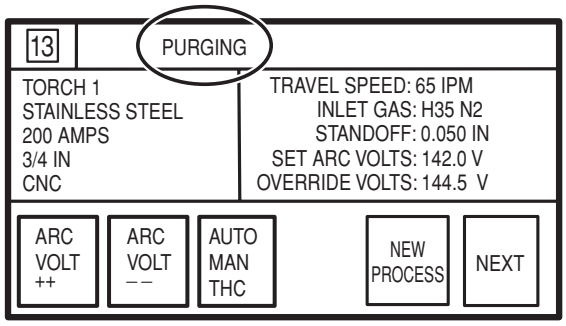
If you press NO, the system will add arc starts, arc hours and number of errors to the stored totals in the system's counter/timer (shown on screen 16).

Press YES to zero the system counter/timer.

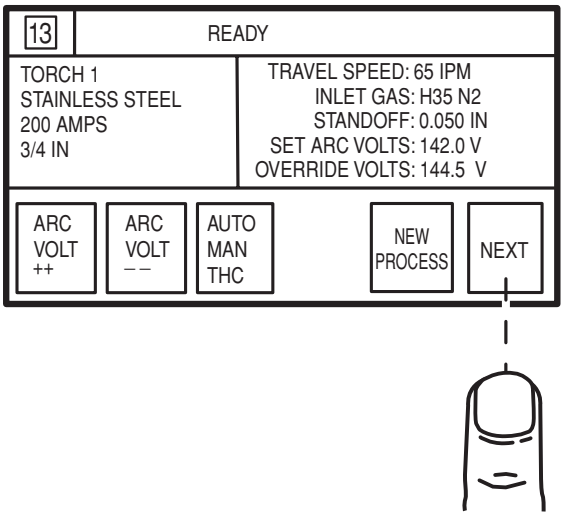
■ Indicates last button selected.

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

④ System Operation Screens



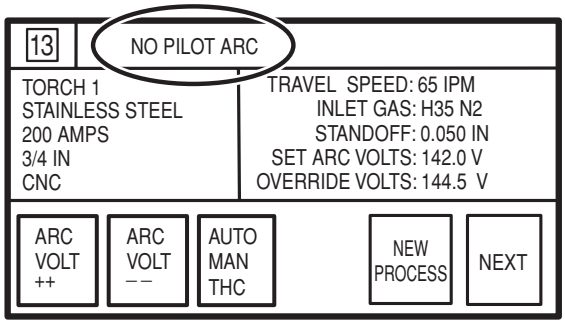
When screen 13 first appears, the system will purge all gas lines.



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.

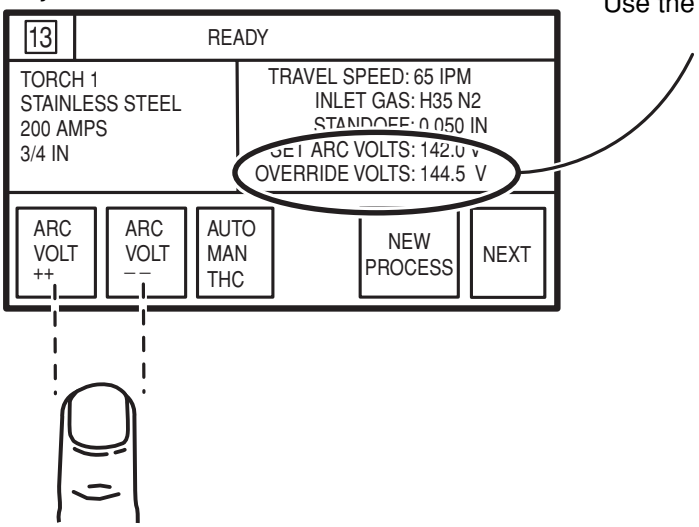


Error codes are displayed at the top of the screen. The system will clear some error codes and will then return to the READY state. When an error occurs that freezes the system software, a RESET button appears in place of NEW PROCESS. Pushing RESET clears the error without having to turn the power off.

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

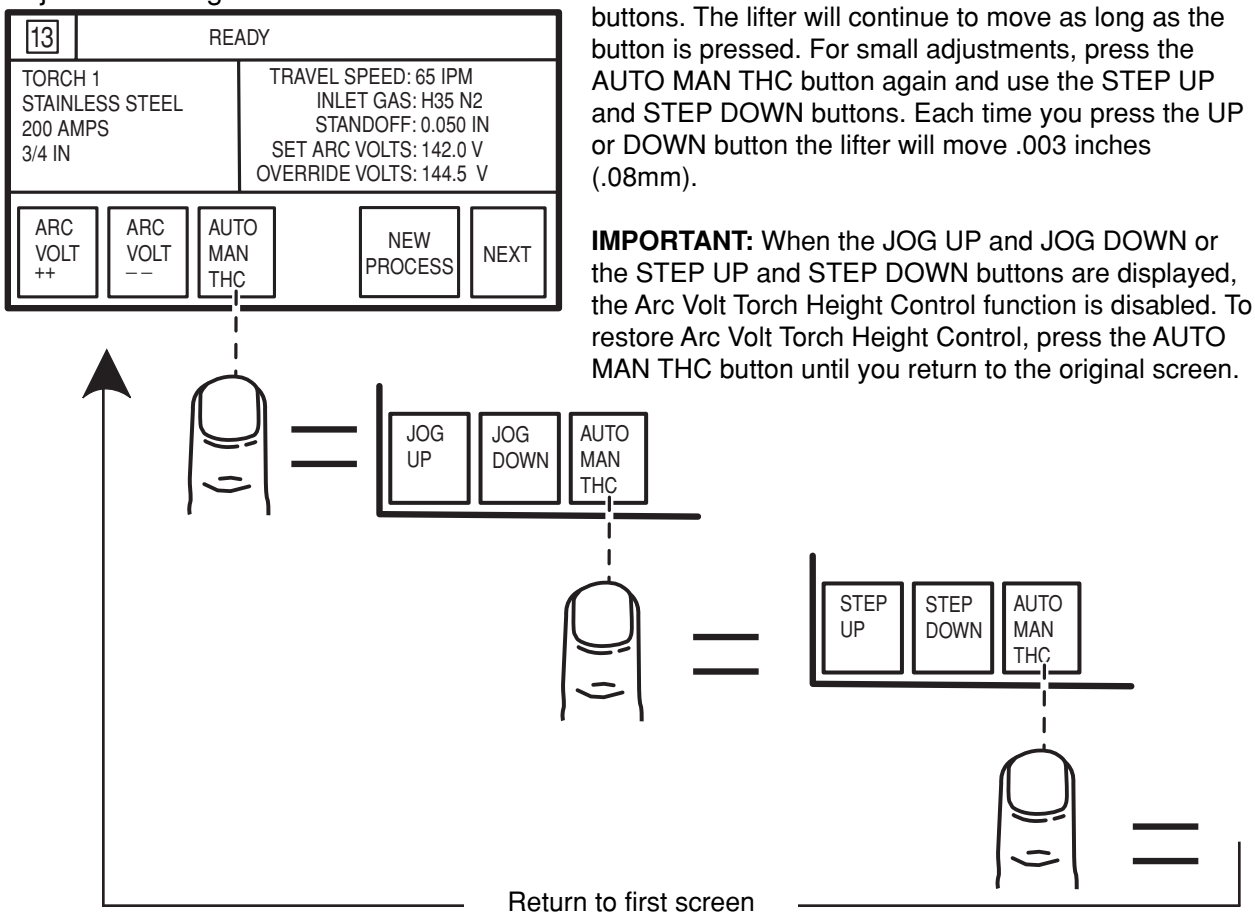
④ System Operation Screens – continued

Adjust arc volts



Use the ARC VOLT buttons to adjust the arc volts.

Adjust torch height

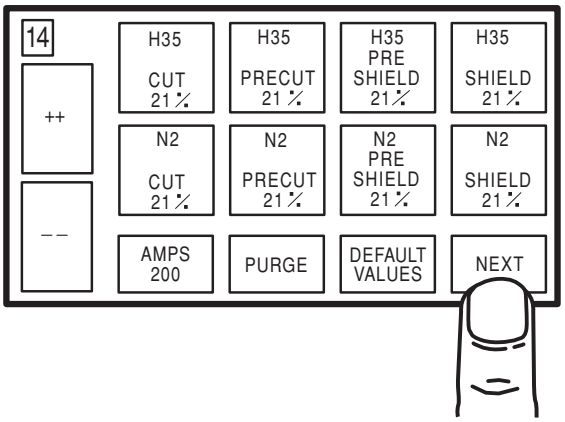


The lifter can be manually moved up or down in two ways. For large adjustments, press the AUTO MAN THC button and then use the JOG UP and JOG DOWN buttons. The lifter will continue to move as long as the button is pressed. For small adjustments, press the AUTO MAN THC button again and use the STEP UP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

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.

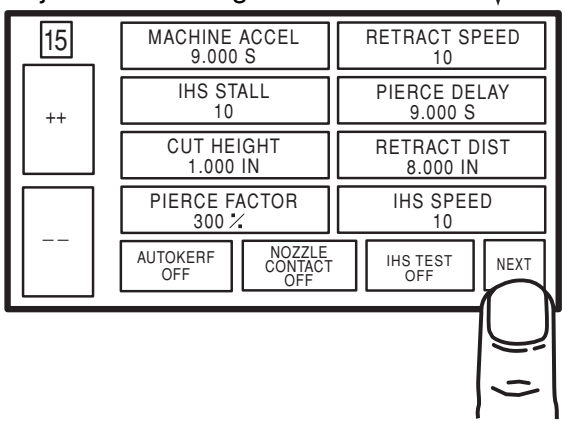
④ System Operation Screens – continued

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

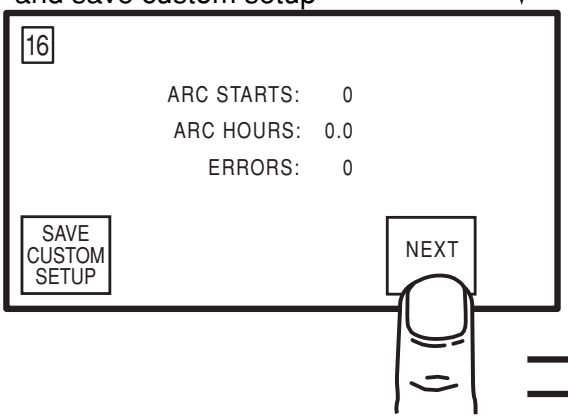


Note: If the THC option is not installed only the pierce delay button will be active.

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

Auto kerf and nozzle contact functions may be turned ON or OFF from this screen.

View timer/counter totals and save custom setup



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

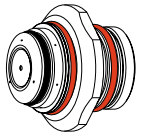
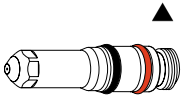
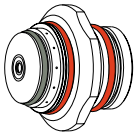
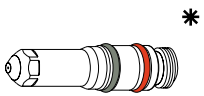
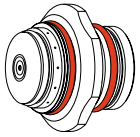
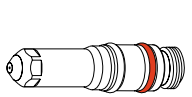
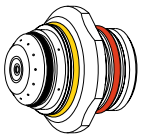
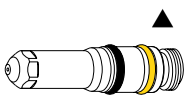
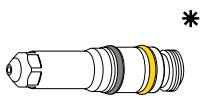
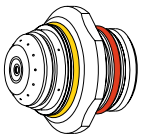
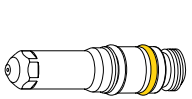
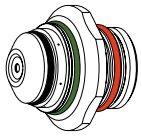
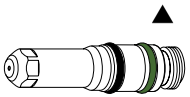
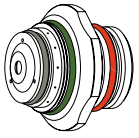
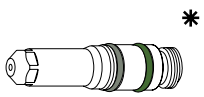
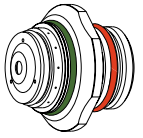
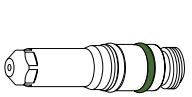
Press SAVE CUSTOM SETUP to save an adjusted cutting process. The custom setup is saved for the material being cut and can be selected for future cutting operations from the process selection screen 10. CUSTOM SETUP saves the following adjusted values: gas flows, pierce delay, cut height, pierce factor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

Display will return to screen 13.

Consumables Selection

▲ = Sets can also be used for marking mild steel

✱ = Sets not included in parts kit

	Mild Steel			Stainless Steel			Aluminum		
30/45 Amp			 ▲			 ✱			 ✱
	120678	120677	120676	120706	120705	120704	120741	120740	120739
70 Amp			 ▲			 ✱			 ✱
	120685	120684	120683	120713	120712	120711	120748	120747	120746
100 Amp			 ▲			 ✱			 ✱
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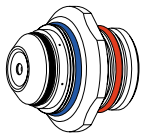
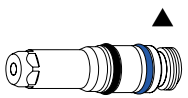
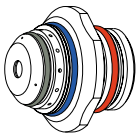
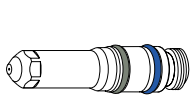
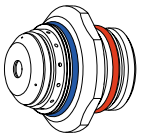
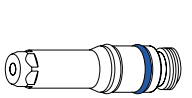
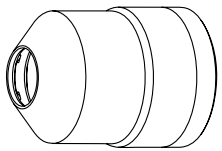
200 Amp			 ▲						
	120692 220081(ccw)	120691 220080(ccw)	120690	120727	120726	120725	120762	120761	120760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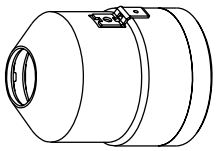
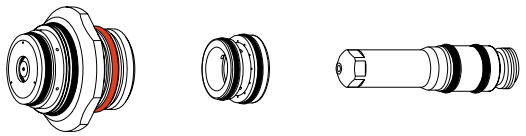

120907

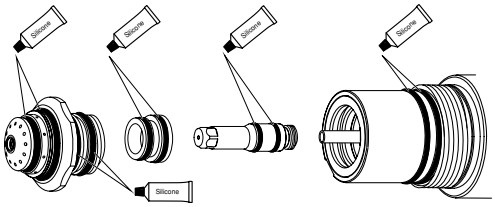
Note: If using the Integrated Command THC with ohmic contact, use retaining cap with IHS tab **120907**

Marking Process - All Materials

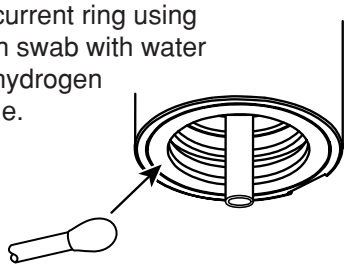

120671 120670 120669

Install Consumables

① Apply a thin coat of silicone grease on all O-rings.

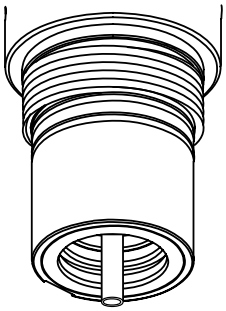


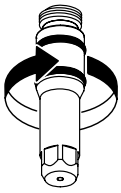
② Clean current ring using a cotton swab with water or 3% hydrogen peroxide.



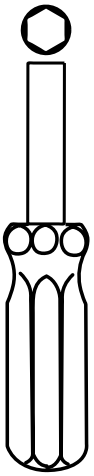
Do not overtighten parts! Only tighten until mating parts are seated.

③ Install electrode

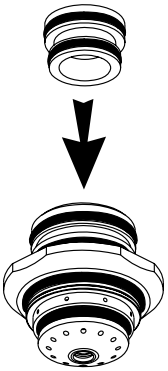




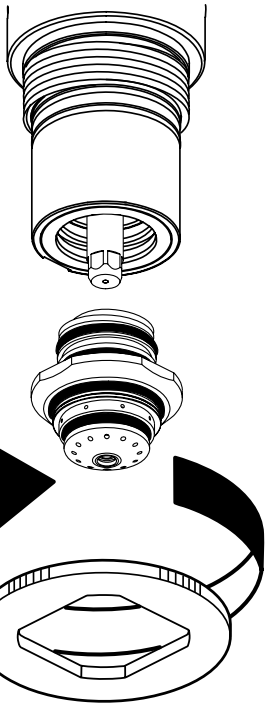
Tool Part No.
027102



④ Insert swirl ring

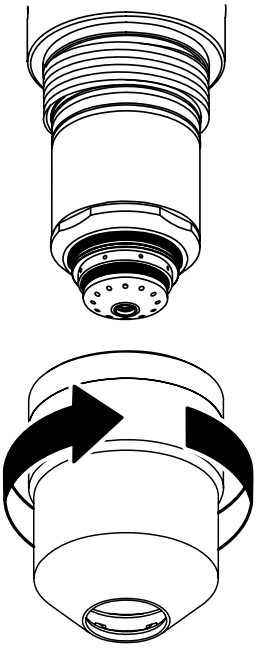


⑤ Install nozzle



Tool Part No.
004663

⑥ Install retaining cap



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.

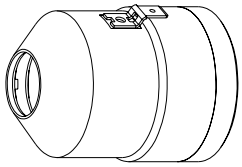
If the Hypertherm Integrated Command THC option is installed, the HD4070 system will also automatically adjust torch settings required for the specific process, including arc volts, torch standoff, initial pierce height and pierce time delay.

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.

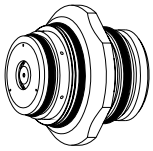
Marking

N_2 or H5 Plasma / N_2 Shield

O-Ring Colors: Black/Black (see page 4-14)

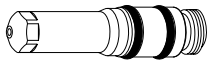


120907



120671

120670



120669

Material	Test Preflow Rate (%)				Test Cutflow Rate (%)				Marking Amps	Arc Voltage	Torch-to-work distance		Cutting Speed	
	Plasma		Shield		Plasma		Shield							
	Gas	Rate	Gas	Rate	Gas	Rate	Gas	Rate			in	mm	ipm	mm/m
Mild Steel	N_2	25	N_2	80	N_2	20	N_2	80	7	153	.09	2.3	250	6350
Stainless Steel	H5	50	N_2	80	H5	40	N_2	80	7	84	.09	2.3	120	3050
Aluminum	H5	50	N_2	80	H5	20	N_2	80	10	80	.09	2.3	175	4450

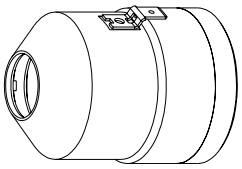
Note: Any of the mild steel consumable sets can also be used for marking. The mild steel consumables will not have the same performance characteristics as the dedicated marking consumables and may not be suitable for all applications. The settings in the table above are for all marking uses.

Mild Steel

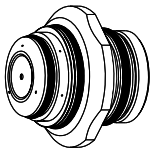
O_2 Plasma / O_2-N_2 Shield

30A Cutting

O-Ring Color: Black/Red (see page 4-14)

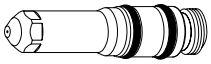


120907



120678

120677



120676

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness gauge/inch**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			in	mm	ipm	mm/m	%	
10	16	10	60	40	0	10	0	**26/.018**	114	.05	1.25	215	5500	170	0
								24/.024	114			200	5100		0
								22/.030	115			170	4350		0
								20/.036	116			155	3950		0
								18/.048	117			110	2800		0
10	16	10	60	28	0	10	0	**16/.060**	119			85	2150		.1
								14/.075	120			60	1500		.3
								12/.105	122			50	1200		.4
								10/.135	123			40	1000		.5
								3/16	128			30	800		.6
								1/4	128	.06	1.5	25	600		.8

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			mm	in	mm/m	ipm	%	
10	16	10	60	40	0	10	0	**1**	117	1.25	.05	3356	140	170	0
10	16	10	60	28	0	10	0	**2**	120			1524	60		.3
								3	122			1270	50		.4
								4	124			940	37		.5
								5	128			737	29		.7
								6	128	1.5	.06	635	25		.8

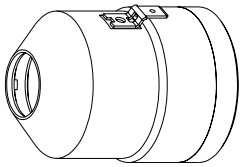
Pierce height = Torch-to-work distance X Pierce height factor

Stainless Steel

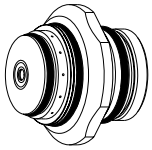
N_2 Plasma / N_2 Shield

45A Cutting

O-Ring Color: Gray/Red (see page 4-14)

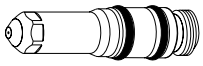


120907



120706

120705



120704

Test Preflow Rate (%)		Test Cutflow Rate (%)		**Material Thickness gauge/inch**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma	Shield	Plasma	Shield								
N_2	N_2	N_2	N_2			in	mm	ipm	mm/m	%	
30	75	40	75	**20/.038**	110	.1	2.5	220	5588	180	0.0
				18/.050				210	5334		0.1
				16/.063				180	4572		0.2
				14/.078				155	3937		0.2

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)		Test Cutflow Rate (%)		**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma	Shield	Plasma	Shield								
N_2	N_2	N_2	N_2			mm	in	mm/m	ipm	%	
30	75	40	75	**1**	110	2.5	.1	5461	215	180	0.0
				2				3937	155		0.2

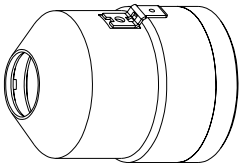
Pierce height = Torch-to-work distance X Pierce height factor

Aluminum

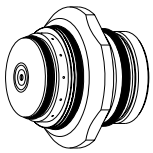
Air Plasma / Air Shield

30A Cutting

O-Ring Color: White/Red (see page 4-14)

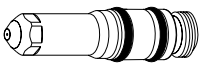


120907



120741

120740



120739

Test Preflow Rate (%)		Test Cutflow Rate (%)		**Material Thickness gauge/Inch**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma	Shield	Plasma	Shield								
Air	Air	Air	Air			in	mm	ipm	mm/m	%	
30	50	30	50	**18/.048**	112	.04	1	71	1800	150	0
				16/.06				47	1200		.1

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)		Test Cutflow Rate (%)		**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma	Shield	Plasma	Shield								
Air	Air	Air	Air			mm	in	mm/m	ipm	%	
30	50	30	50	**1**	112	1	.04	2030	80	150	0

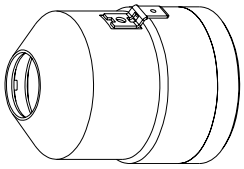
Pierce height = Torch-to-work distance X Pierce height factor

Mild Steel

O_2 Plasma / O_2-N_2 Shield

70A Cutting

O-Ring Color: Black/Yellow (see page 4-14)



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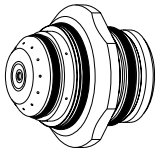
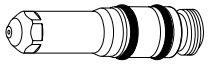


120685

120684



120683

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness gauge/ inch**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			in	mm	ipm	mm/m	%	
10	38	80	30	40	0	30	10	**16/.060**	108	.04	1	280	7100	200	.1
								14/.075	108			230	5800		
								12/.105	112			80	2000		.2
								10/.135	116			70	1800		.3
								3/16	118			55	1400		.5
								1/4	126	.06	1.5	35	875	250	.75
								5/16	132	.08	2.0	27.5	700		1
								3/8	137	.10	2.0	20	500		

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			mm	in	mm/m	ipm	%	
10	38	80	30	40	0	30	10	**2**	108	1	.04	5700	225	200	.1
								3	112			1900	75		.1
								4	117			1500	60		.2
								5	119			1000	40		.3
								6	125	1.5	.06	900	36	250	.5
								8	132	2.0	.08	700	28		.8
								10	138	2.5	.10	450	18		1

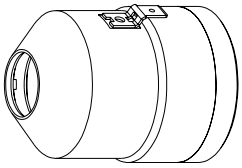
Pierce height = Torch-to-work distance X Pierce height factor

Stainless Steel

H35-N_2 Plasma / N_2 Shield

70A Cutting

O-Ring Color: Gray/Yellow (see page 4-14)



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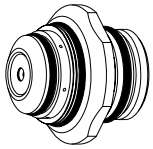
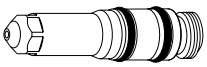


120713

120712



120711

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness gauge/ inch**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			in	mm	ipm	mm/m	%	
0	30	0	75	0	30	0	75	**16/.063**	123	.06	1.5	380	9652	200	0
								14/.078				350	8890		
								12/.109	148	.20	5.0	140	3556	100	.2
								10/.141				130	3302		
12	17	0	65	12	17	0	45	**3/16**	141	.12	3.0	80	2032	200	.3
								1/4	144			50	1270		.4
								5/16	145			45	1143		.5
								3/8	146			40	1016		.6

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			mm	in	mm/m	ipm	%	
0	30	0	75	0	30	0	75	**2**	123.0	1.5	.06	8890	350	200	0
								3	148.0	5.0	.20	3429	135	100	.2
								4				3048	120		
12	17	0	65	12	17	0	45	**5**	141.5	3.0	.12	1879	74	200	.4
								6	143.5			1270	50		
								8	145.0			1143	45		.6

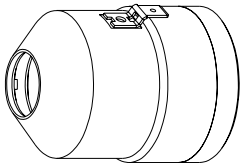
Pierce height = Torch-to-work distance X Pierce height factor

Aluminum

Air Plasma / CH_4 Shield

70A Cutting

O-Ring Color: White/Yellow (see page 4-14)



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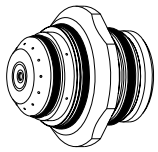
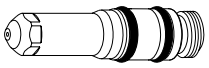


120748

120747



120746

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness gauge/inch**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
CH_4	Air	CH_4	Air	CH_4	Air	CH_4	Air			in	mm	ipm	mm/m	%	
0	50	0	60	0	37	10	0	**18/.048**	162.5	.12	3	130	3302	170	.1
						20		**16/.06**	160			125	3175		.2
								14/.075	165			115	2921		.2
							30	**12/.105**	174	.19	4.8	95	2413	110	.3
								1/8	174.5			90	2286		.4
								10/.135	175			85	2159		.4
								3/16	176			60	1524		.5
								1/4	176			45	1143		.5
								5/16	177			40	1016		.6
								3/8	178			35	889		.6

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
CH_4	Air	CH_4	Air	CH_4	Air	CH_4	Air			mm	in	mm/m	ipm	%	
0	50	0	60	0	37	20	0	**2**	165	3.0	.12	2921	115	170	.2
							30	**3**	174	4.8	.19	2337	92	110	.4
								4	175			1905	75		.4
								5	176			1448	57		.5
								6	176			1143	45		.5
								8	177			1016	40		.6

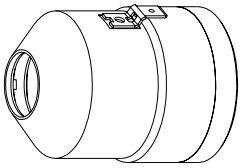
Pierce height = Torch-to-work distance X Pierce height factor

Mild Steel

O_2 Plasma / O_2-N_2 Shield

100A Cutting

O-Ring Color: Black/Green (see page 4-14)



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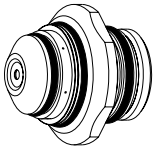
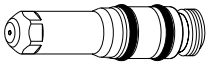


120660

120655



120654

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (inch)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			in	mm	ipm	mm/m	%	
15	40	40	10	37	0	40	10	**1/4**	128	.08	2.0	145	3700	200	.3
		35	10	45		35	10	**5/16**	129	.09	2.25	110	2800		.4
		12	33	45		12	33	**3/8**	130	.10	2.5	95	2400		.5
		35	10	50		35	10	**7/16**	135	.12	3.0	80	2000		.6
		35	10	50		35	10	**1/2**	141	.14	3.5	65	1700		.7

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			mm	in	mm/m	ipm	%	
15	40	40	10	37	0	40	10	**6**	128	2.0	.08	3700	145	200	.3
		35		45		35		**8**	132	2.25	.09	2800	110		.4
								10	136	2.5	.10	2500	100		.5
				50				**12**	140	3.5	.14	1850	73		.7

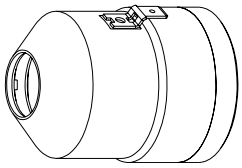
Pierce height = Torch-to-work distance X Pierce height factor

Stainless Steel

H35-N_2 Plasma / N_2 Shield

100A Cutting

O-Ring Color: Gray/Green (see page 4-14)



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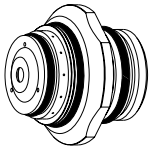
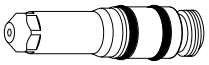


120720

120719



120718

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (inch)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			in	mm	ipm	mm/m	%	
17	20	0	75	17	20	0	45	**1/4**	123	.10	2.5	65	1651	200	.6
								5/16				60	1524		
								3/8				55	1397		
					16		60	**7/16**	126	.11	2.8	48	1219	210	.7
					13		75	**1/2**	128	.12	3.0	40	1016	220	.8

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			mm	in	mm/m	ipm	%	
17	20	0	75	17	20	0	45	**6**	123	.10	2.5	1651	65	200	.6
								8				1524	60		
								10				1397	55		
					13		75	**12**	128	.12	3.0	1016	40	220	.8

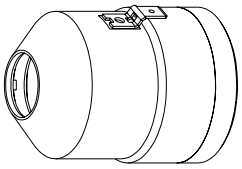
Pierce height = Torch-to-work distance X Pierce height factor

Aluminum

H35-N_2 Plasma / N_2 Shield

100A Cutting

O-Ring Color: White/Green (see page 4-14)



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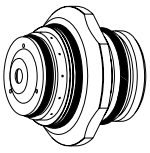
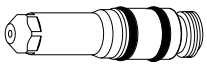


120755

120754



120753

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (inch)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			in	mm	ipm	mm/m	%	
17	20	0	75	17	20	0	75	**1/4**	136.5	.16	4.1	65	1651	170	.6
							30	**3/8**	136.0	.17	4.3	55	1397	160	.7
								1/2	142.0	.18	4.6	40	1016	150	.8

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			mm	in	mm/m	ipm	%	
17	20	0	75	17	20	0	75	**6**	136.5	.16	4.1	1651	65	170	.6
							45	**8**	136.0	.17	4.3	1524	60	160	
								10	137.0			1346	53		.7
							30	**12**	142.0	.18	4.6	1016	40	150	.8

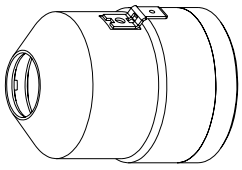
Pierce height = Torch-to-work distance X Pierce height factor

Mild Steel

O_2 Plasma / O_2-N_2 Shield

200A Cutting

O-Ring Color: Black/Blue (see page 4-14)



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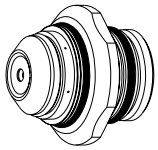
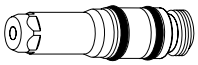


120692

120691



120690

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness (inch)	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			in	mm	ipm	mm/m	%	
5	45	13	60	71	0	15	57	**3/8**	142.0	.16	4.0	130	3302	200	.30
								7/16	143.0			110	2794		.40
								1/2	144.5			90	2286		.50
								9/16	144.0			84	2134		.50
								5/8	144.0			77	1956		.60
								3/4	144.0			65	1651		.75
								7/8	149.0	.18	4.5	50	1270		.90
								1	153.5	.20	5.0	35	889		1.0

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				Material Thickness (mm)	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
O_2	N_2	O_2	N_2	O_2	N_2	O_2	N_2			mm	in	mm/m	ipm	%	
5	45	13	60	71	0	15	57	**10**	142.0	4	.16	3175	125	200	.3
								12	144.0			2515	99		.5
								15	144.0			2057	81		.6
								20	144.0			1651	65		.8
								25	153.5	5	.20	889	35		1

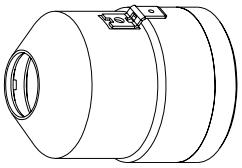
Pierce height = Torch-to-work distance X Pierce height factor

Stainless Steel

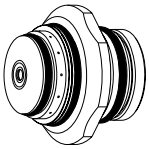
H35-N_2 Plasma / N_2 Shield

200A Cutting

O-Ring Color: Gray/Blue (see page 4-14)



120907



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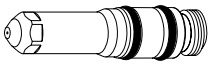
120726



120725

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (inch)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			in	mm	ipm	mm/m	%	
31	0	0	80	31	45	0	80	**3/8**	160	.16	4.0	80	2032	150	.5
								7/16	161			78	1981		.6
								1/2	162			75	1905		.6
								9/16	163	.17		70	1778		.7
								5/8	164	.18	4.5	62	1575		.8
								3/4	166	.20	5.0	50	1270		1

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			mm	in	mm/m	ipm	%	
31	0	0	80	31	45	0	80	**10**	160.0	4.0	.16	2032	80	150	.5
								12	161.5	4.0	.16	1905	75		.6
								15	163.5	4.5	.18	1651	65		.8
								20	166.5	5.0	.20	1270	50		1

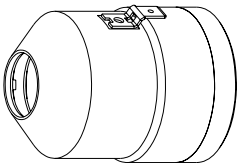
Pierce height = Torch-to-work distance X Pierce height factor

Aluminum

H35-N_2 Plasma / N_2 Shield

200A Cutting

O-Ring Color: White/Blue (see page 4-14)



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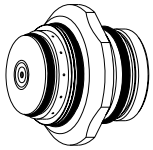

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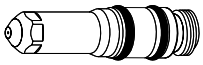
120761



120760

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (inch)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			in	mm	ipm	mm/m	%	
31	0	0	70	31	45	0	70	**3/8**	153.5	.25	6.25	120	3048	150	.5
								1/2	154.5			100	2540		.6
			50				50	**5/8**	159.5			80	2032		.8
								3/4	163.5			60	1524		1

Pierce height = Torch-to-work distance X Pierce height factor

Test Preflow Rate (%)				Test Cutflow Rate (%)				**Material Thickness (mm)**	Arc Voltage	Torch-to-work distance		Cutting Speed		Pierce Height Factor	Pierce Delay Time
Plasma		Shield		Plasma		Shield									
H35	N_2	H35	N_2	H35	N_2	H35	N_2			mm	in	mm/m	ipm	%	
31	0	0	70	31	45	0	70	**10**	153.5	6.25	.25	2997	118	150	.5
								12	154.5			2667	105		.6
								15	158.0			2159	85		.8
			50				50	**20**	164.0			1524	60		1

Pierce height = Torch-to-work distance X Pierce height factor

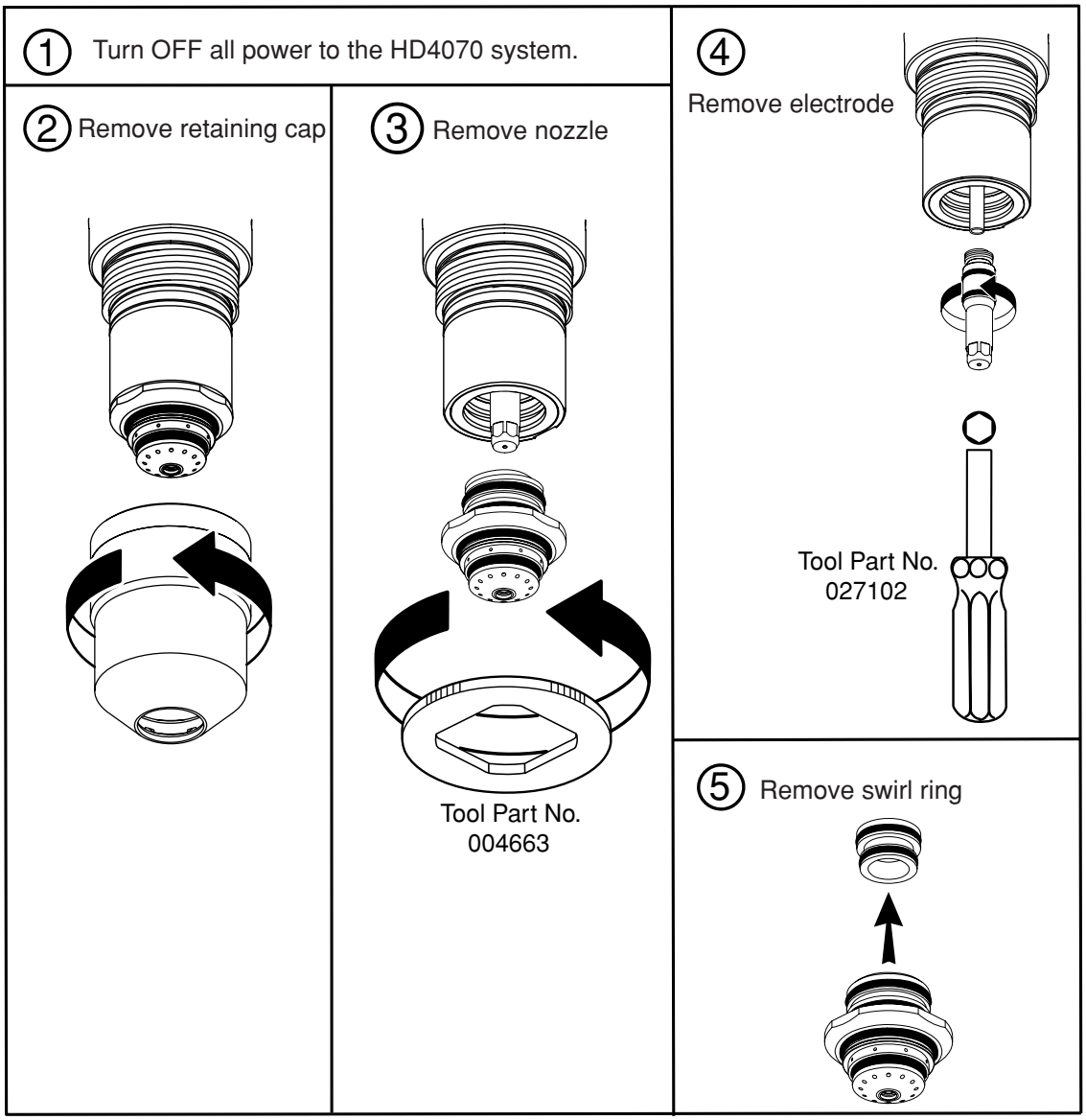
Changing Consumable Parts

WARNING

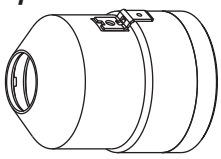
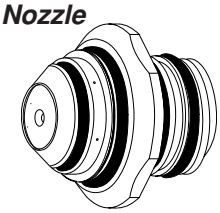
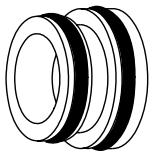
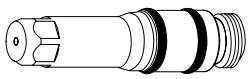
The HD4070 power supply is designed to go into an idle mode if the retaining cap is removed. However, DO NOT CHANGE CONSUMABLE PARTS WHILE IN THE IDLE MODE! Always disconnect power to the power supply before inspecting or changing torch consumable parts.

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.

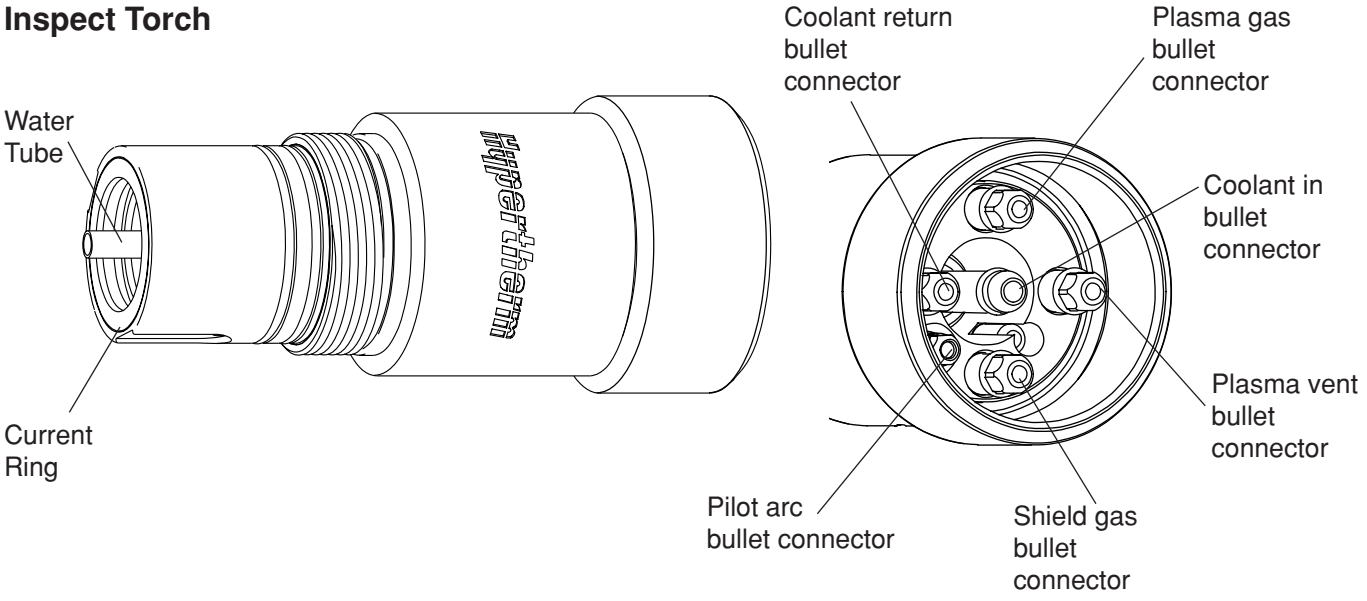


Inspect Consumables

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

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

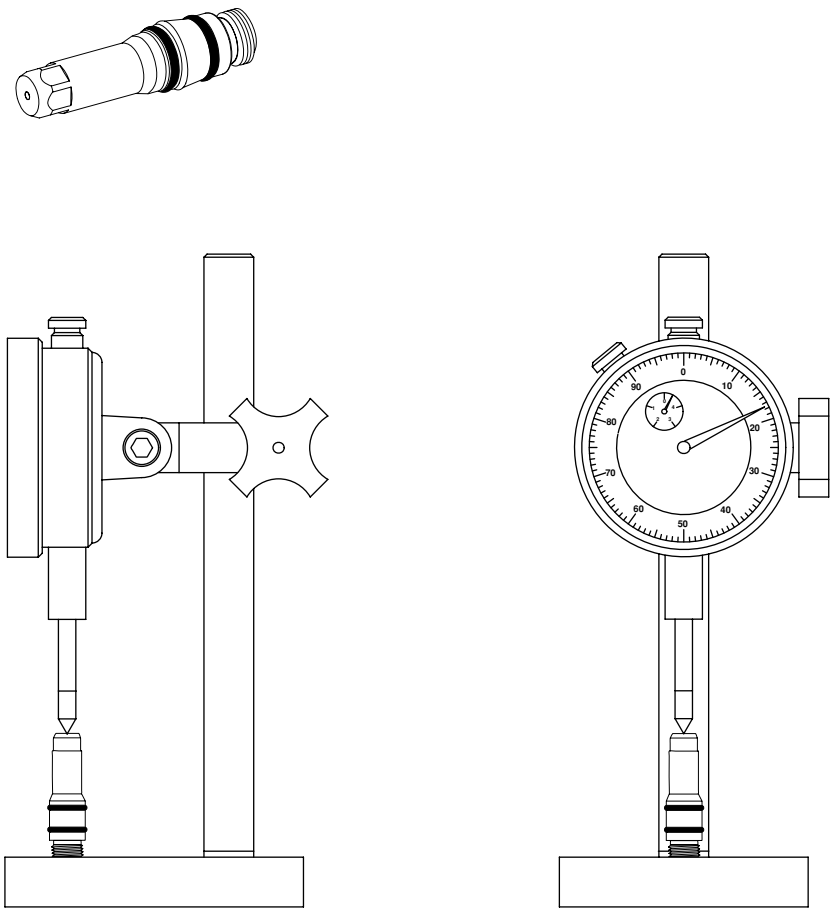
Inspect Torch



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

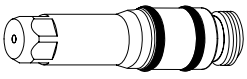
*Note: See *Replace Torch Water Tube* later in this section.

Inspect Electrode Pit Depth



Electrode Pit Depth Gauge (004147)

004147

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

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

Replace Torch Water Tube

Below are some problems and causes that you may find with a defective or improperly installed water tube.

Problem	Cause
Short electrode life	Water tube not screwed in tightly
Flow switch interlock shutting down the system	Water flow restricted because water tube is loose
Humming or rattling sound coming from the torch	Water tube bent or loose

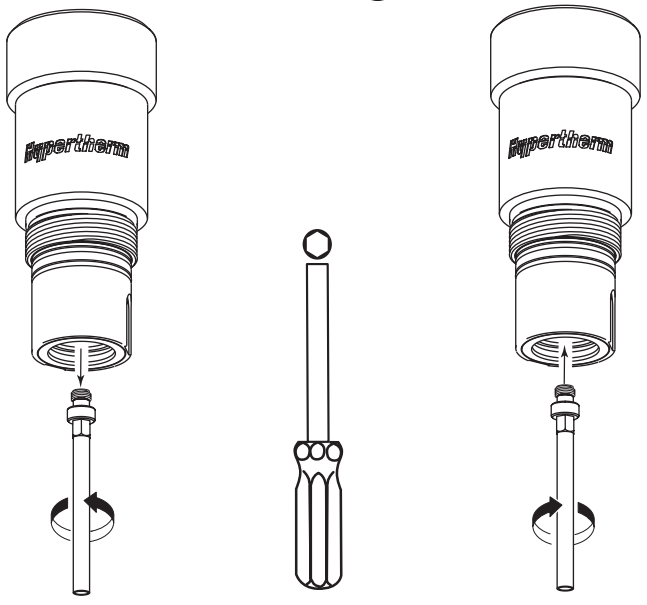
WARNING

The HD4070 power supply 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.

1. Turn OFF all power to the HD4070 system.
2. Remove consumables from torch. See page 4-23

Do not overtighten parts! Only tighten until mating parts are seated.

3. Remove water tube
4. Install new water tube
5. Replace consumables see page- 4-15



Hypertherm
027347 Tool

4070.37

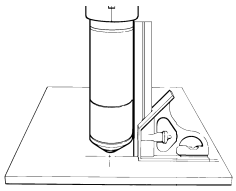
Common Cutting Faults

- 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 HD4070 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

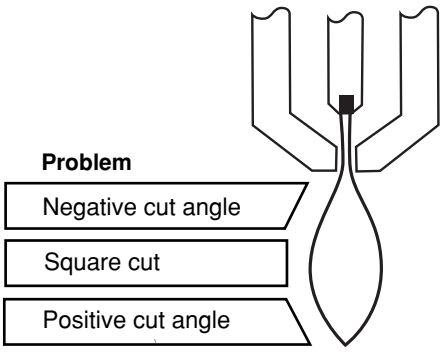
A cut part whose 4 sides average less than 4° of cut angle is considered acceptable.

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.



Problem	Cause	Solution
Negative cut angle	The torch is too low.	Increase arc voltage to raise the torch.
Square cut		
Positive cut angle	The torch is too high.	Decrease arc voltage to lower the torch.

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 O_2 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.

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 N_2 in the O_2-N_2 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 O_2 in the O_2-N_2 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.

When piercing maximum thicknesses, the ring of dross that forms during the pierce may become 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.

- In some Hypertherm systems, the shield gas pressure automatically increases during pierce delay.

- If the above steps do not solve the problem, increasing the setting of the shield gas pressure may help blow the molten metal away during piercing.
  Trade-off: This may reduce starting reliability.

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.

Hypertherm

Section 5

MAINTENANCE

In this section:

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

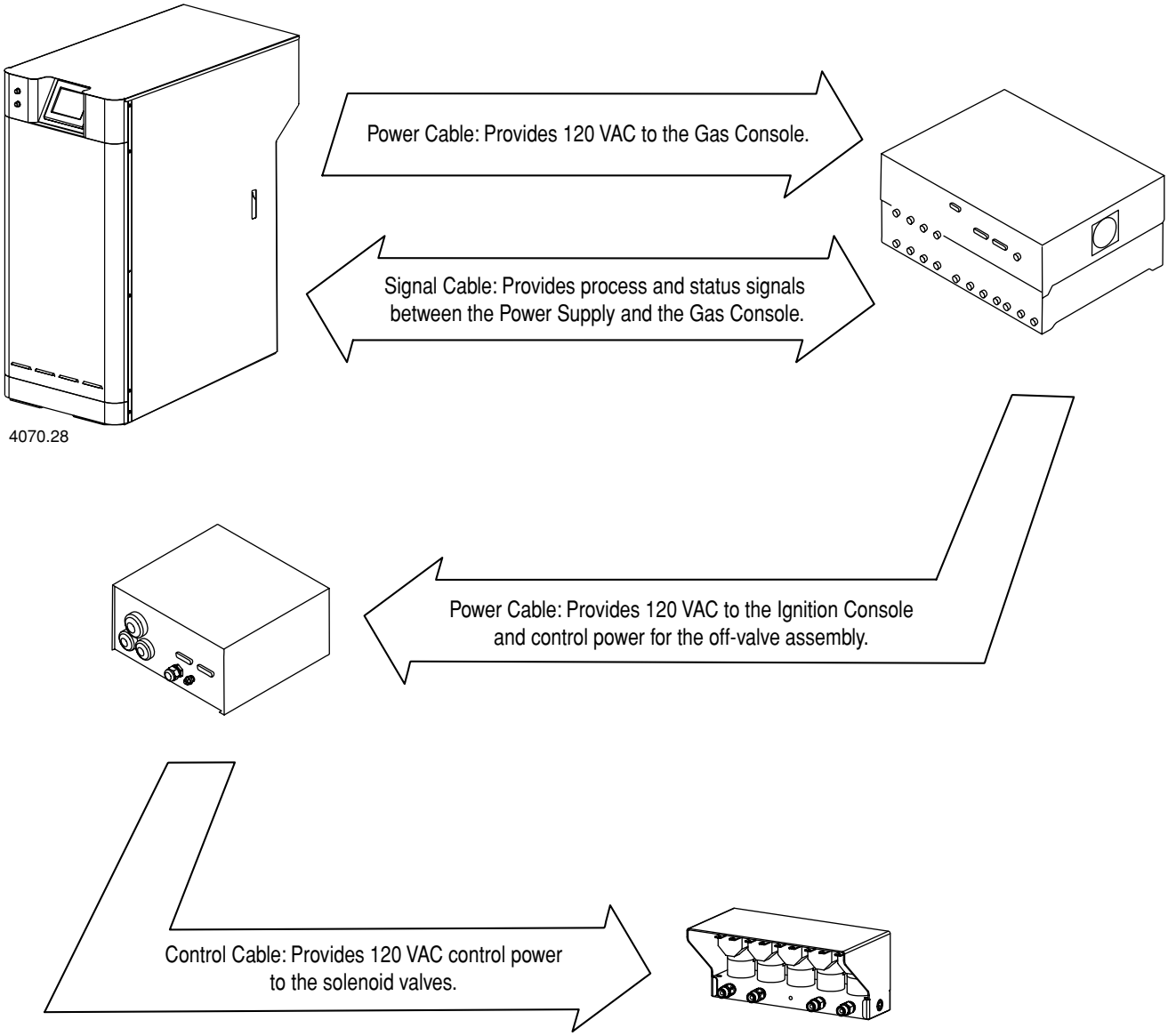
Use extreme care when working near the chopper modules. The large blue capacitors store high voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper and the heatsinks. Discharging any capacitor with a screwdriver or other implement may result in an explosion,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

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

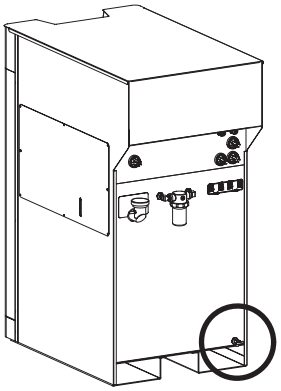
Control and Signal Cables

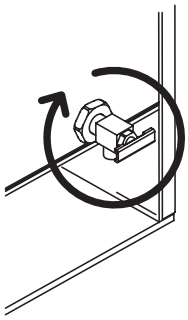


Power Supply Coolant System Servicing

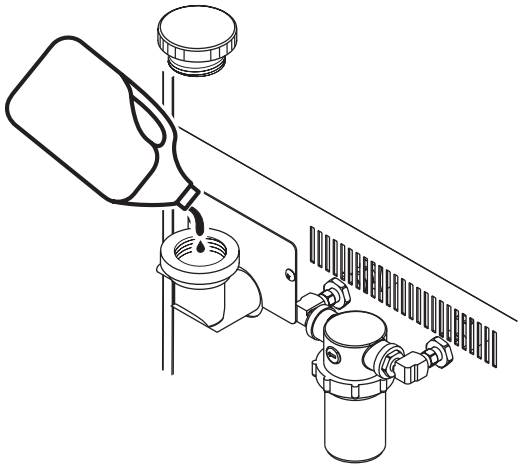
	Caution
	Use Hypertherm coolant (028872) to reduce the risk of damage from freezing and to prevent long-term corrosion.

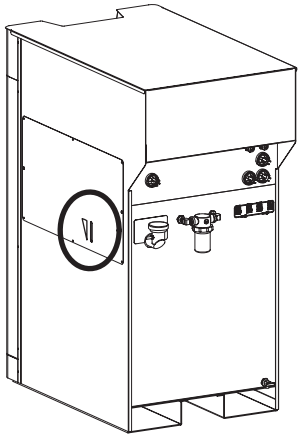
① Check that the drain valve is closed.



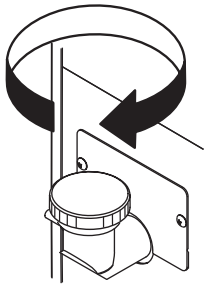


② Add coolant to the power supply until the sight gage indicates full.



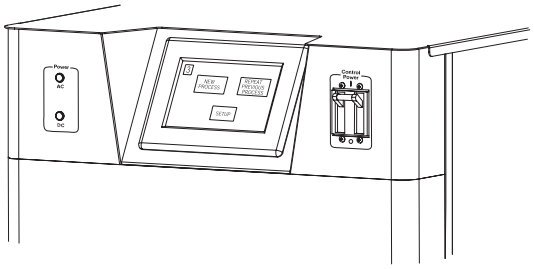


③ Replace the filter cap.

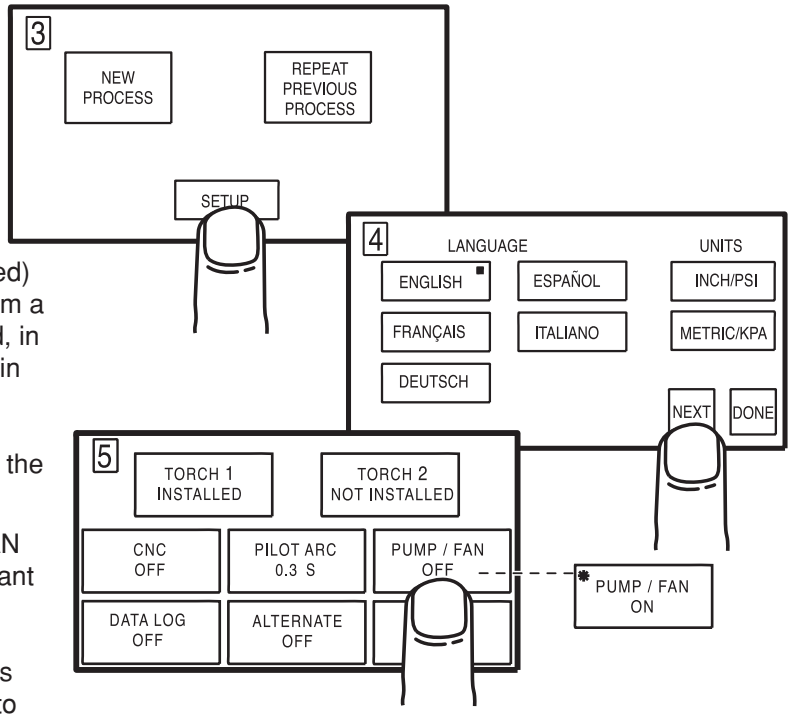


4070.40A

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.

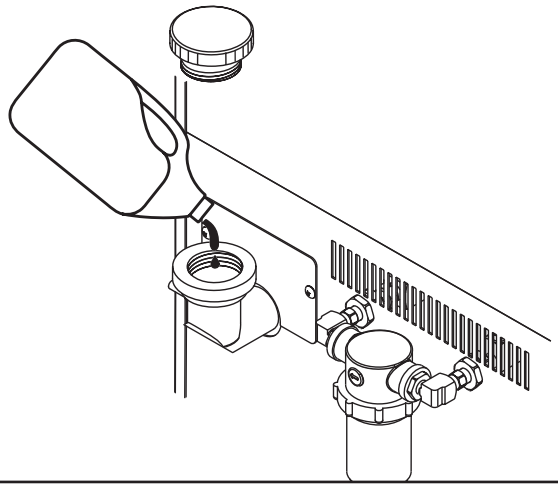
An asterisk will appear in the PUMP FAN button when power supply detects coolant flow.

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

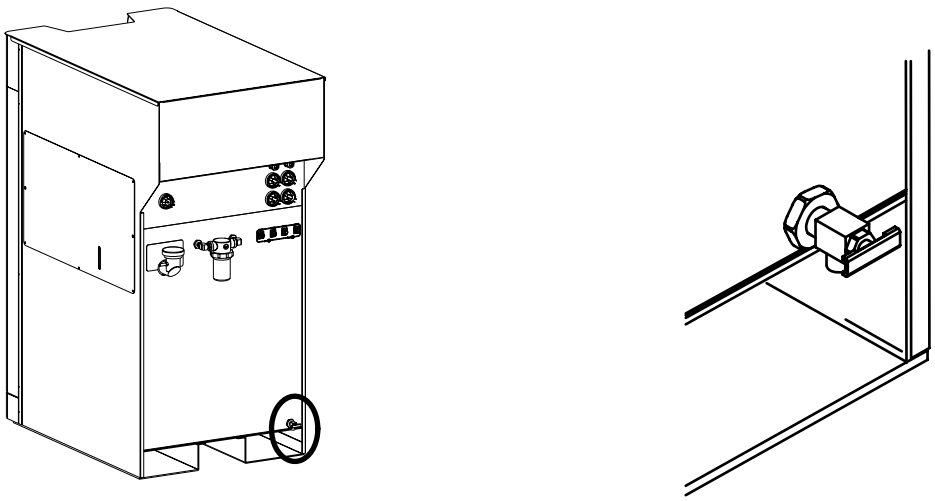
If the torch needs to be changed or transported, follow this procedure for draining the torch coolant from the torch and torch leads. Coolant should be drained from the system every 6 months. See *Preventative Maintenance Schedule* at the back of this section.

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 80-120 psi (5.5-8.3 bar) 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.

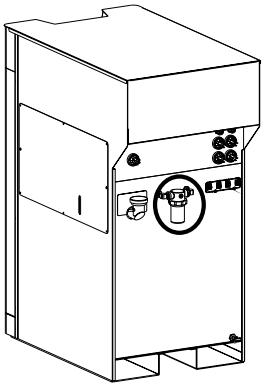


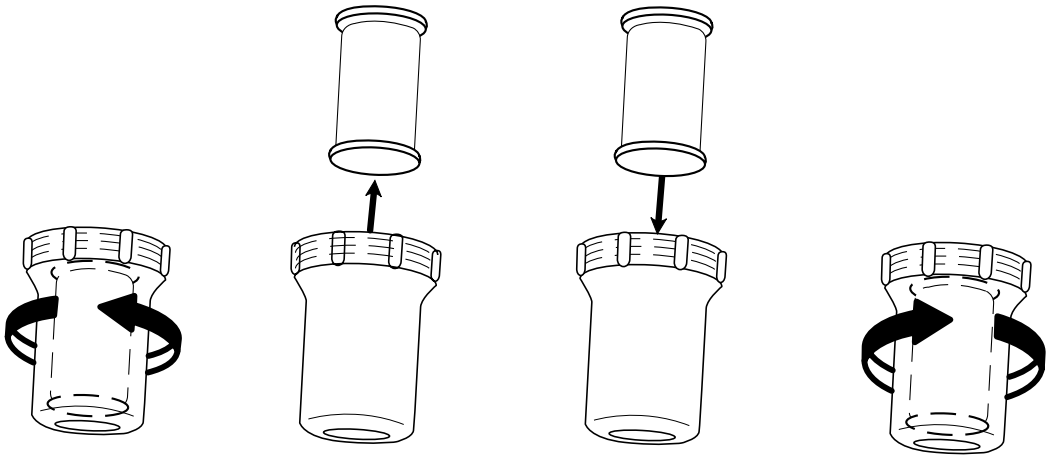
Coolant Drain Location

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 1-gallon (4-liter) 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.

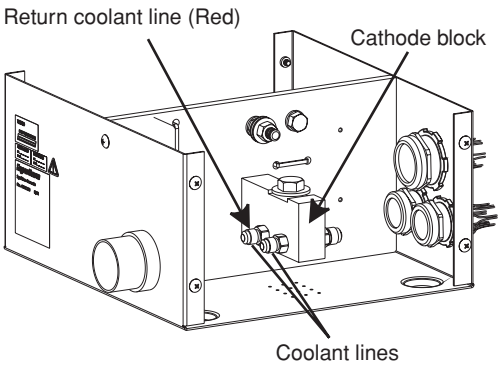
8. The gallon container should be filled within the 60 seconds. If the flow is greater than 1 gallon/minute, and the machine is still not powering up, the flow switch is the cause of the problem. Replace flow switch. If the container is not full, you have a flow restriction problem. Reinstall the coolant 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.

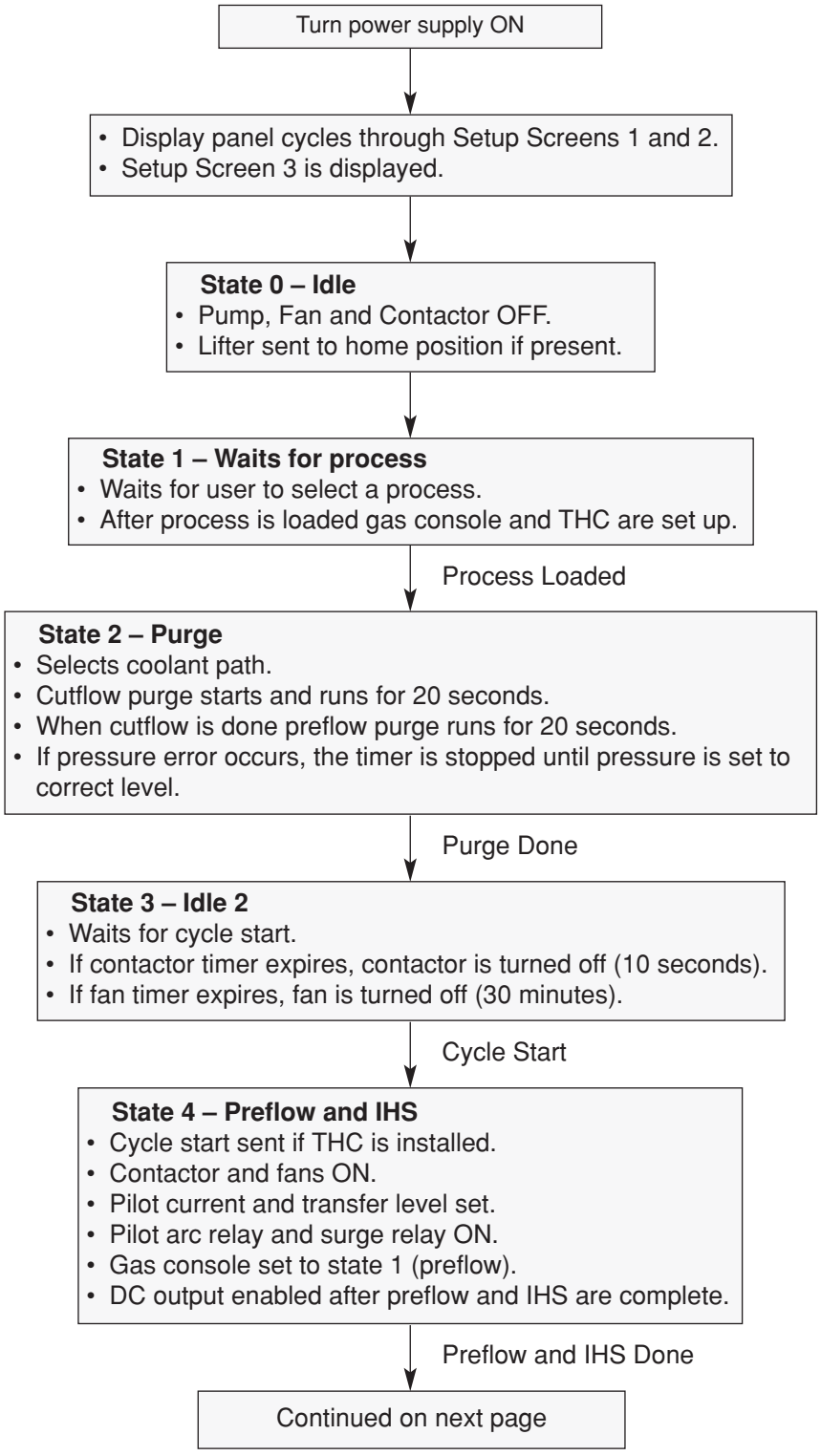
10. To check the return flow from the torch, replace all consumables and remove the return coolant hose within the torch lead from the cathode block located in the ignition console (See figure below) and repeat step 7. This tests the flow from the pump to the torch and out through the torch lead. If 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.

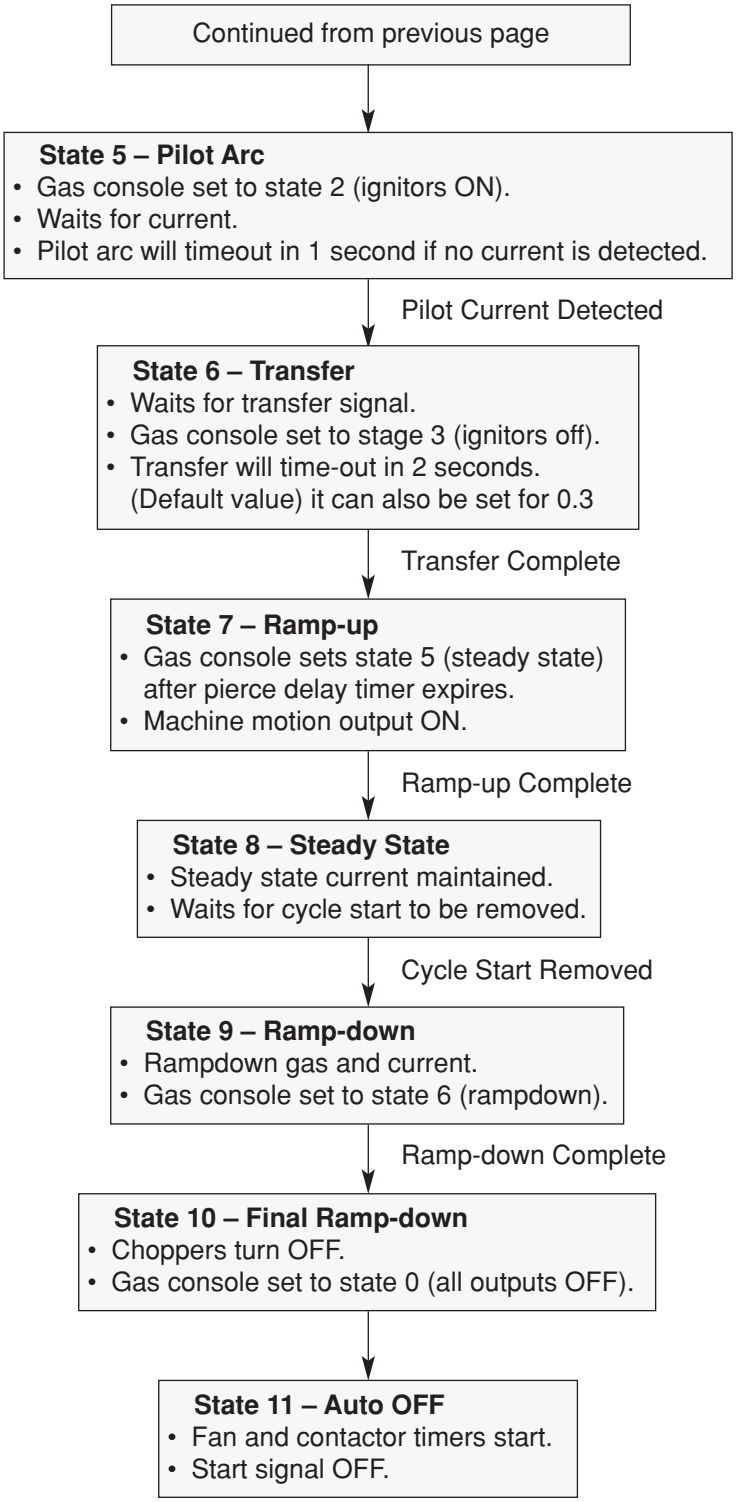
Ignition Console



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.

WARNING

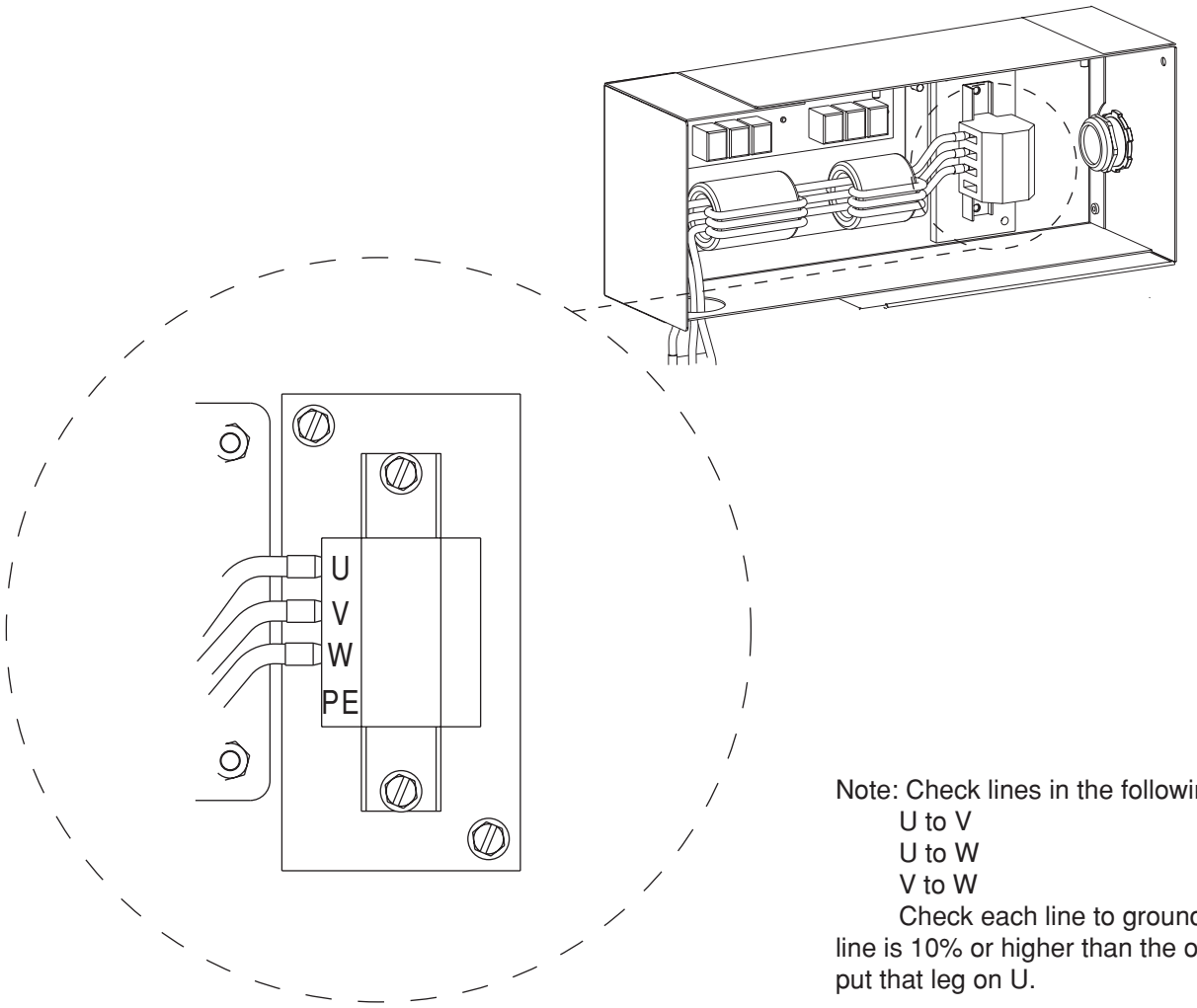
SHOCK HAZARD: Always use caution when servicing a power supply when plugged in and the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.

1. Disconnect line power by turning 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.

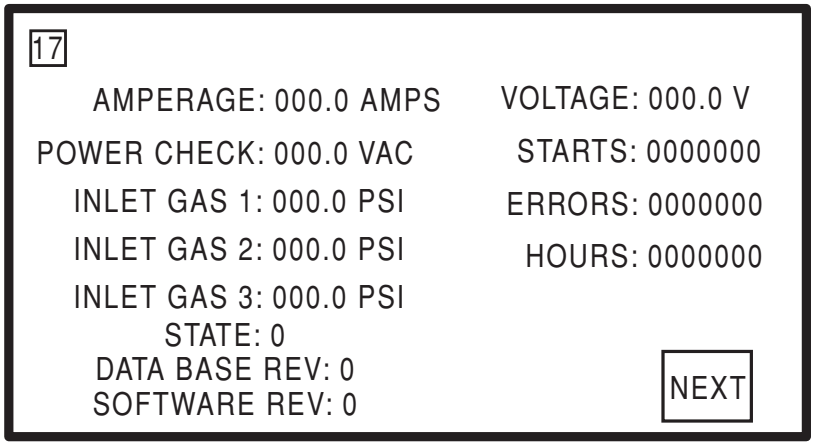


Note: Check lines in the following order:
U to V
U to W
V to W
Check each line to ground. If one line is 10% or higher than the other two, put that leg on U.

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.

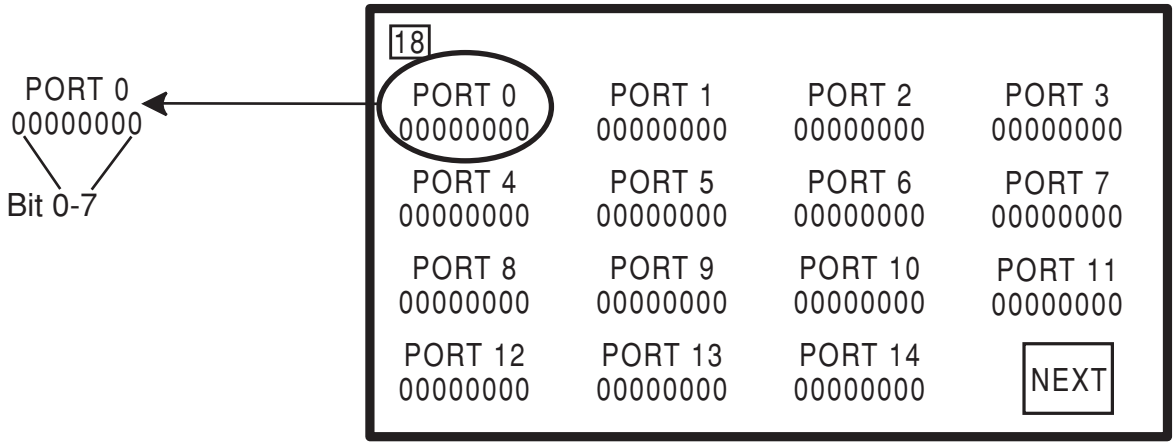
Service Display Screens



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

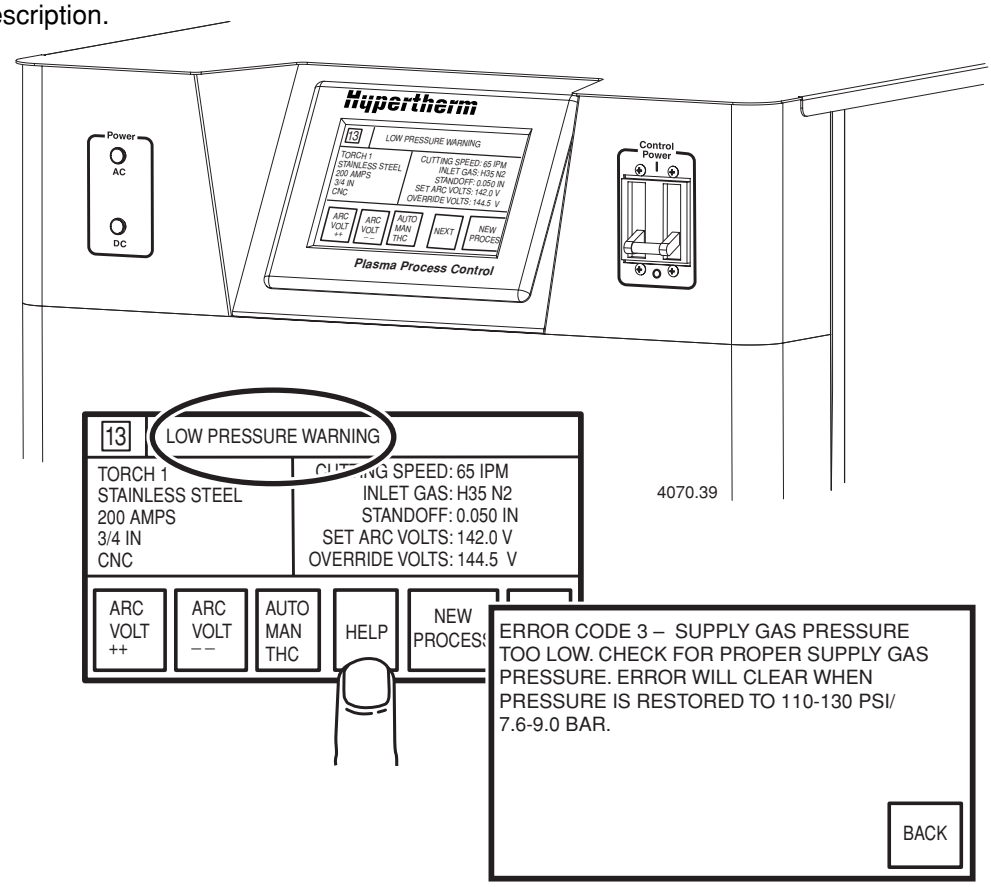


Screen 18 is display only.
Input/Output status: See table in Appendix D for details.

Error Codes

HD4070 Error Codes

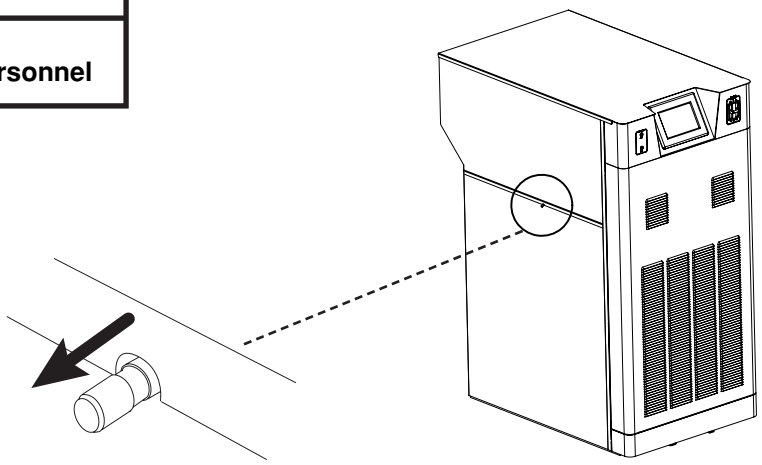
Error codes are displayed at the top of screen 13. The system will clear some error codes and will then return to the READY state. Other error codes require the operator to turn off the power supply, perform corrective maintenance and then turn ON the power supply again. Press the HELP button to view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



WARNING
ELECTRIC SHOCK CAN KILL

All work must be performed by qualified personnel

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 sytem 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 maintenence section.
81	CONTROL SYSTEM FAILURE	File corrupted, Faulty cable or Hard disk failure.	Run PC-104 test. See maintenence section.
82	CONTROL SYSTEM FAILURE	File corrupted, Faulty cable or Hard disk failure.	Run PC-104 test. See maintenence section.
83	CONTROL SYSTEM FAILURE	File corrupted, Faulty cable or Hard disk failure.	Run PC-104 test. See maintenence 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.

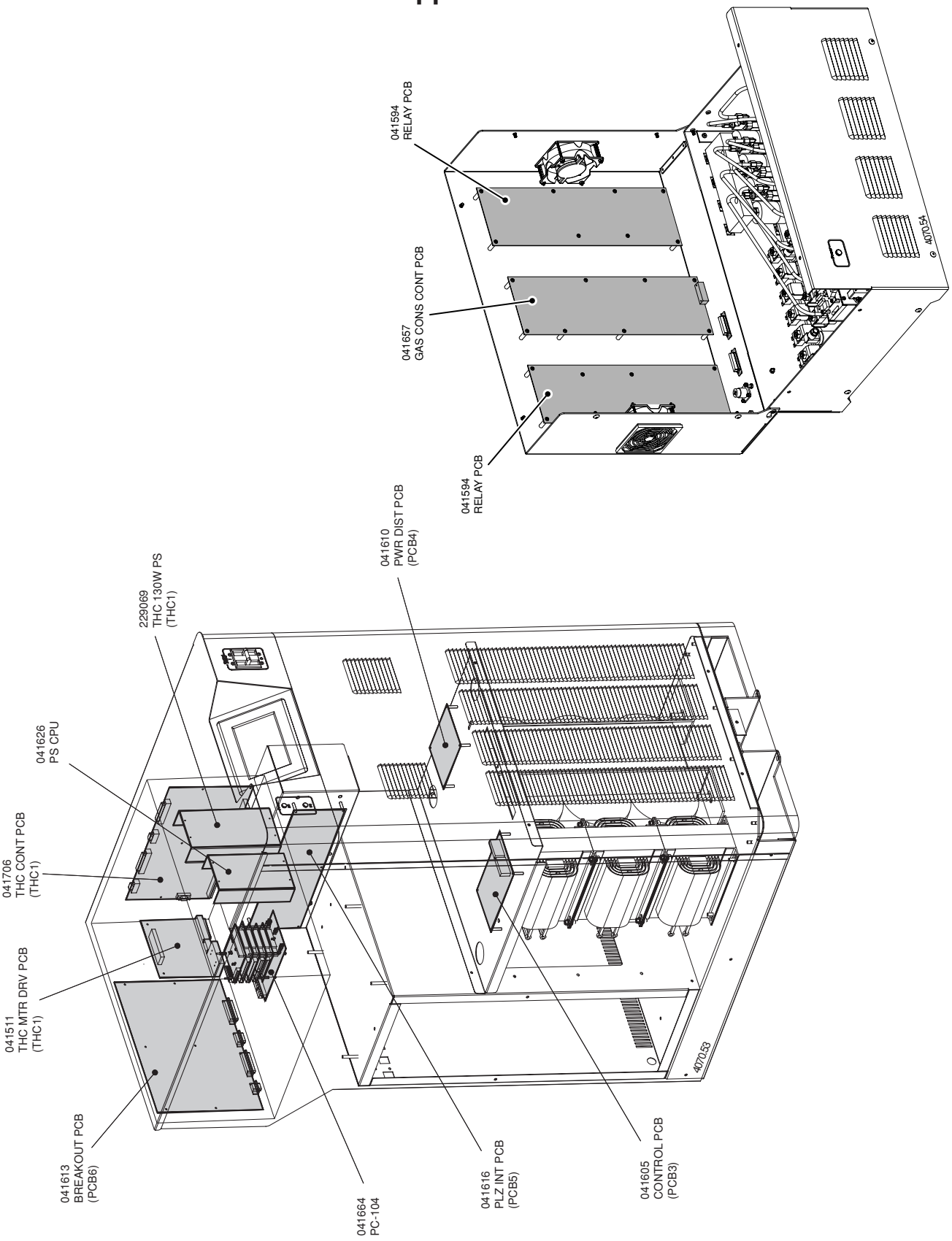
Error Code Troubleshooting (3 of 4)

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.

Error Code Troubleshooting (4 of 4)

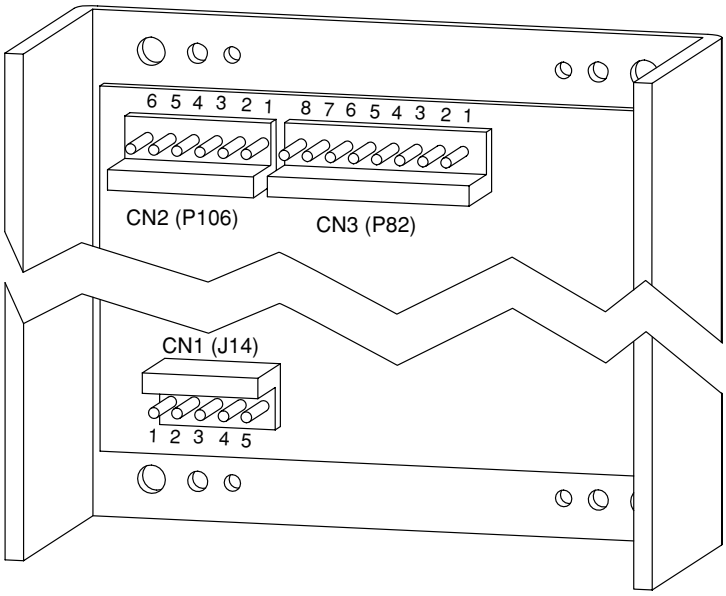
ID #	Error Code or Message	Description	Corrective action
123	MV 1 ERROR	Motor valve #1 did not move when commanded.	(1) Check all cables from relay PCB to Motor valves. (2) Check LED for relay PCB#1, Shown later in this section. (3) Check relay PCB#1 incoming signal. (4) Check relay PCB#1 output signal. (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, 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



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



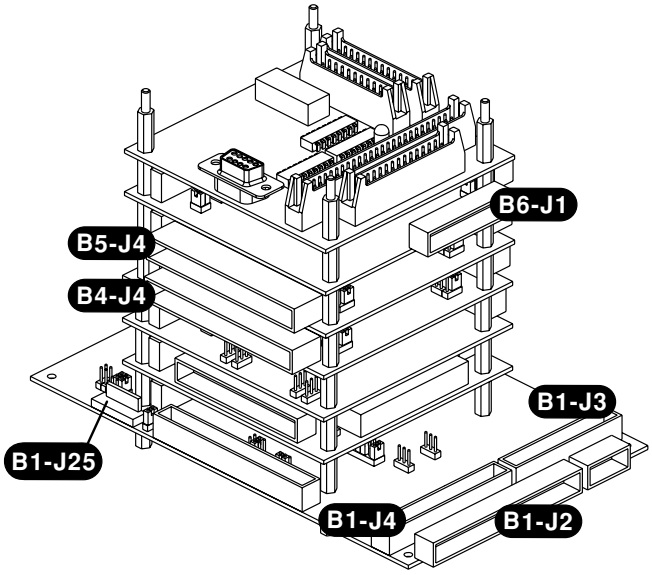
PC-104 Test Procedure

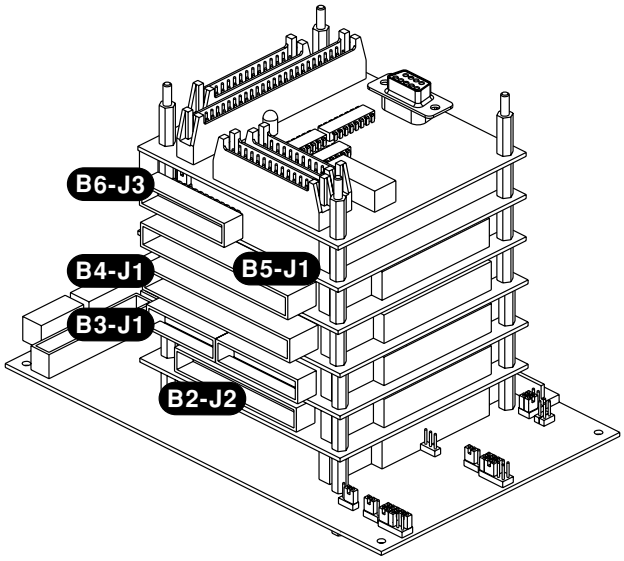
1. Turn main power OFF.
2. Remove connectors from PC-104 stack in the following order:
   – Board 1 J4 - Remove for access. Reconnect after all other connections are made.
   – B1, J2
   – B3, J1
   – B4, J1 and J4
   – B5, J1 and J4
   – B6, J1 and J3
3. Make the following connections, using cables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

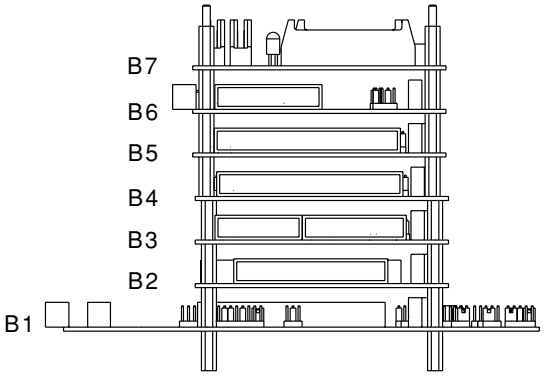
Each test can take 2 minutes. LED (D1) will be green if all tests pass. It will be red if there is a failure. Certain communication failures can cause the process to freeze. If a test is taking longer than 2 minutes, re-start the power supply.

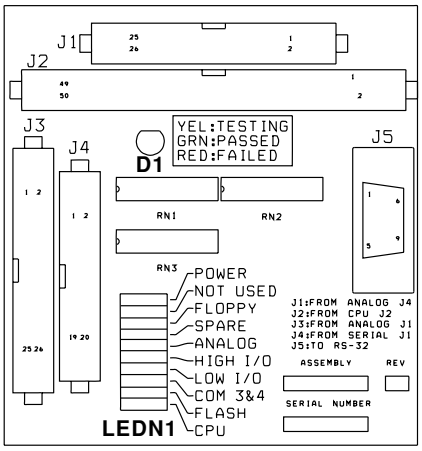
Kit (P/N 128648) Contents

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



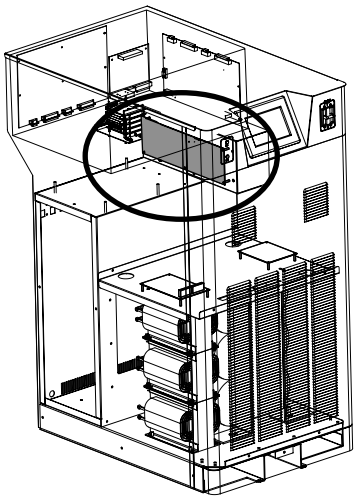


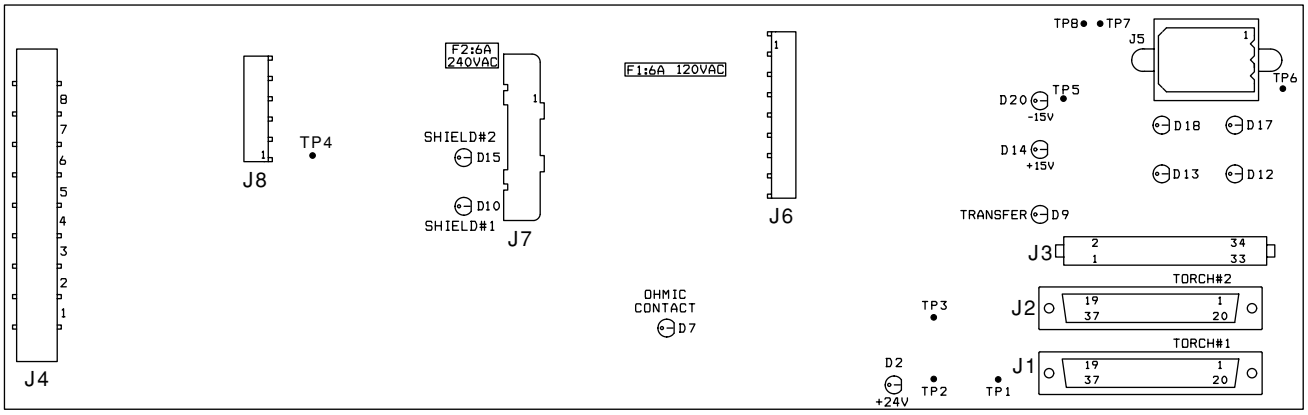




Test Board: B7

Plasma Interface Board PCB5- Status Indicators

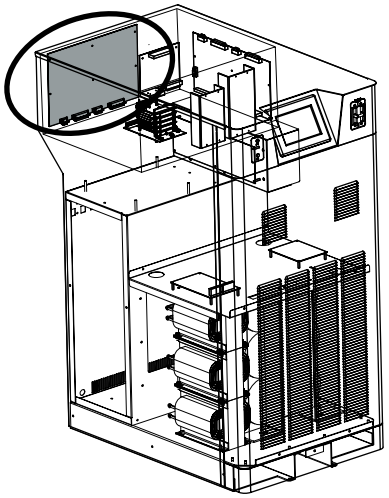


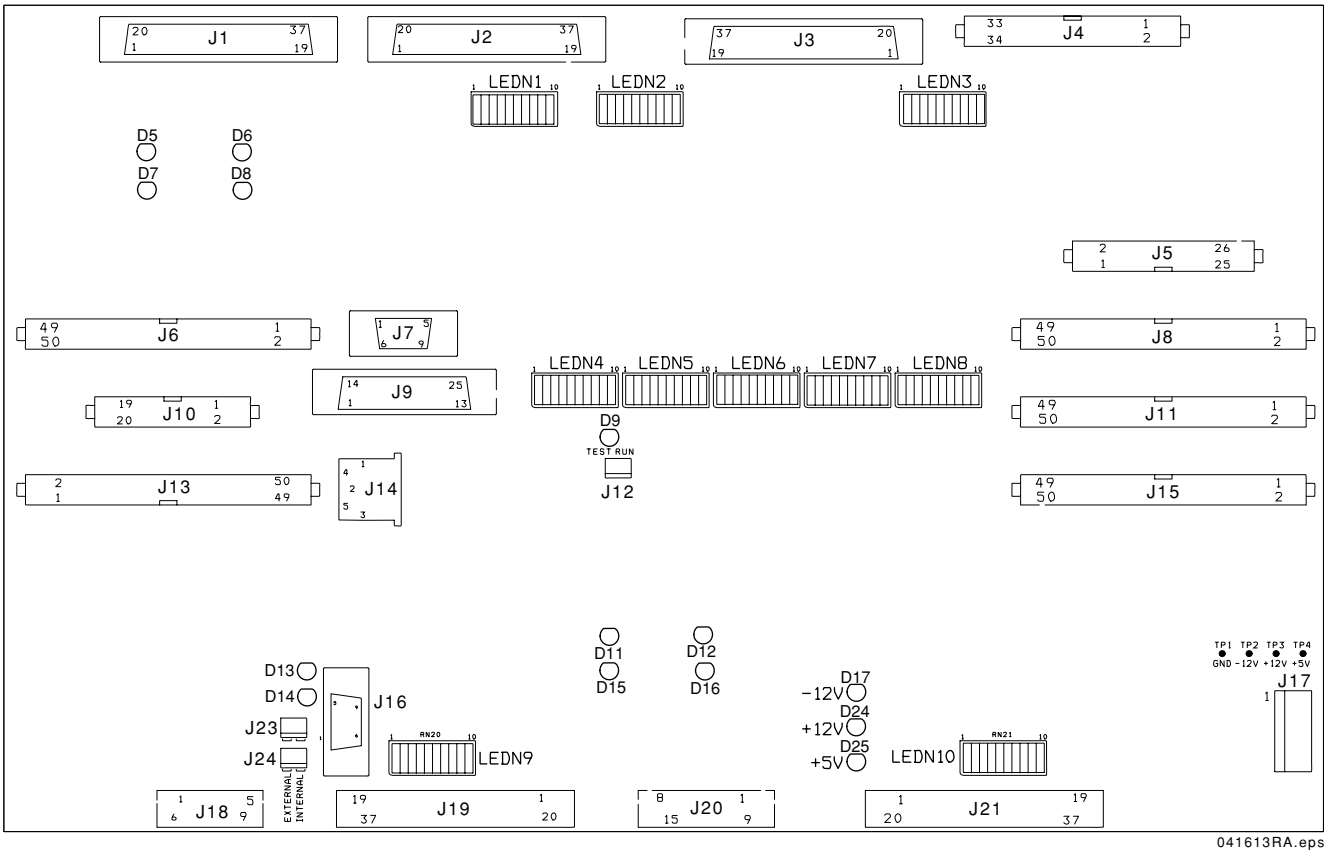


Plasma Interface PC Board LED List

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





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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 with-in 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

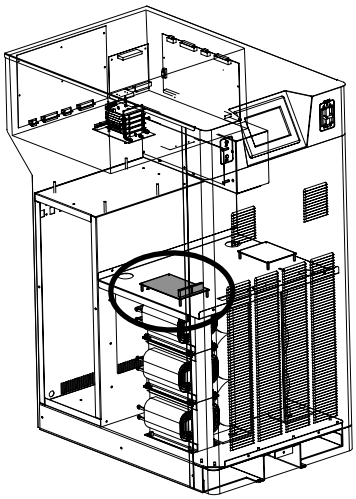
LEDN7	Signal Name	Function
LEDN7-1	CNC motion	Sends start signal to THC
LEDN7-2	Slave 80 Amp select	—
LEDN7-3	Slave 40 Amp select	—
LEDN7-4	Slave 20 Amp select	—
LEDN7-5	Slave 10 Amp select	—
LEDN7-6	Slave 1/10th current	—
LEDN7-7	Slave fan control	—
LEDN7-8	Slave contactor control	—
LEDN7-9	Slave DC 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	—

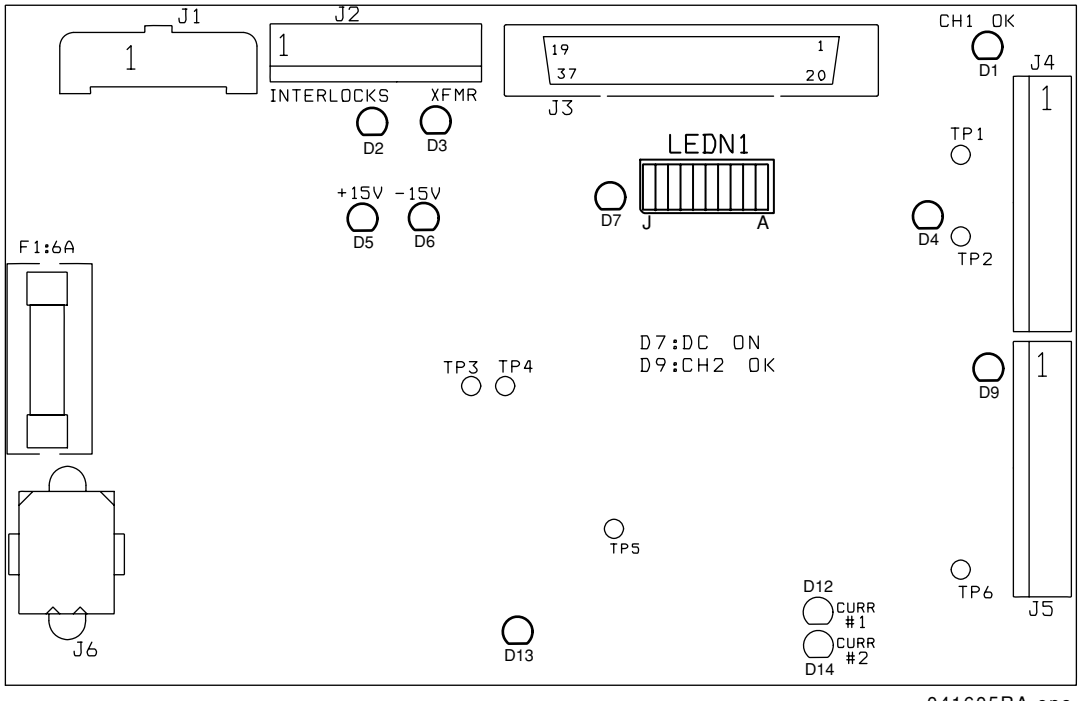
LEDN10	Signal Name	Function
LEDN10-1	Not Used	—
LEDN10-2	Slave input power active	—
LEDN10-3	Slave missing phase detect	—
LEDN10-4	Slave chopper #1 temp OK	—
LEDN10-5	Slave chopper #2 temp OK	—
LEDN10-6	Slave temp/airflow OK	—
LEDN10-7	Slave output current OK	—
LEDN10-8	Slave door interlock	—
LEDN10-9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

Control Board PCB3- Status Indicators



Control PC Board LED List

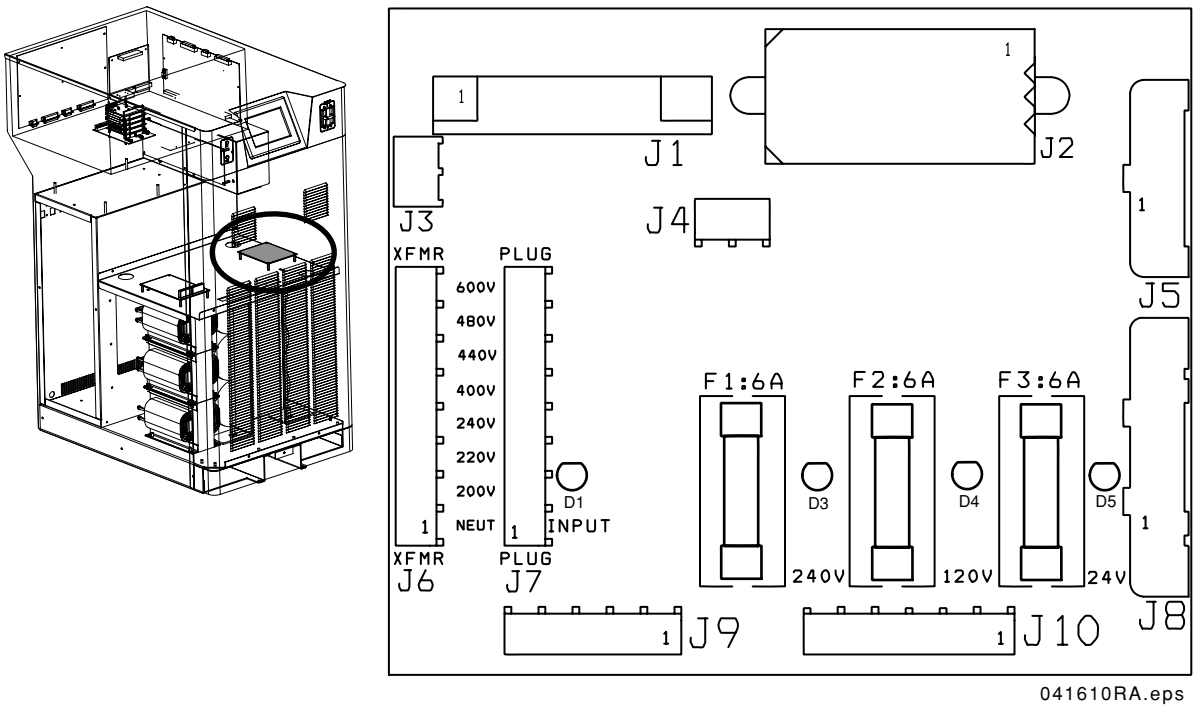
LED	Signal Description/ Function
D1	Chopper #1 Temp OK
D2	Interlocks OK, panels in place
D3	Transformer Temp OK
D5	Power indicator, +15 Volts
D6	Power indicator, -15 Volts
D7	DC Output ON, signals choppers to turn on
D9	Chopper #2 Temp OK
D12	Current #1, current detected from chopper #1
D14	Current #2,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



Control PC Board LEDN List

LEDN1	Signal Name	Function
LEDN1-A	160 Amp Select	Used, in combination, to set power level
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	

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.

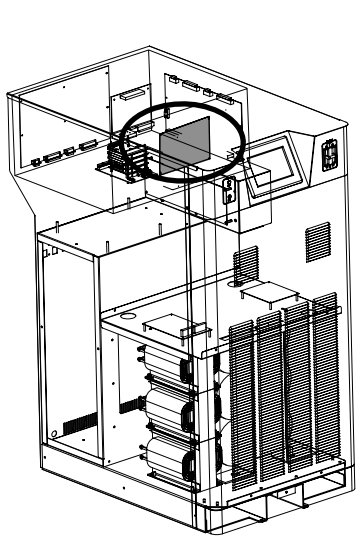
To measure voltages at the power distribution board, find fuses F1, F2 and F3. When the power supply is energized, take measurements from the top of each fuse to chassis ground, and then from the bottom of each fuse to chassis ground. Measurements should be as follows:

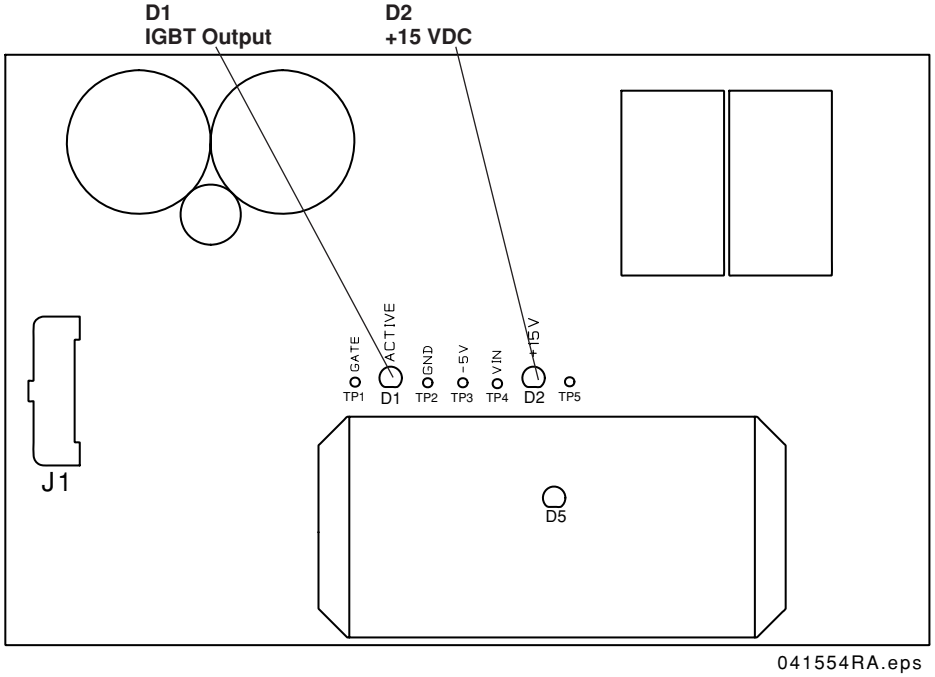
F1: 240 VAC
F2: 120 VAC
F3: 24 VAC

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





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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.

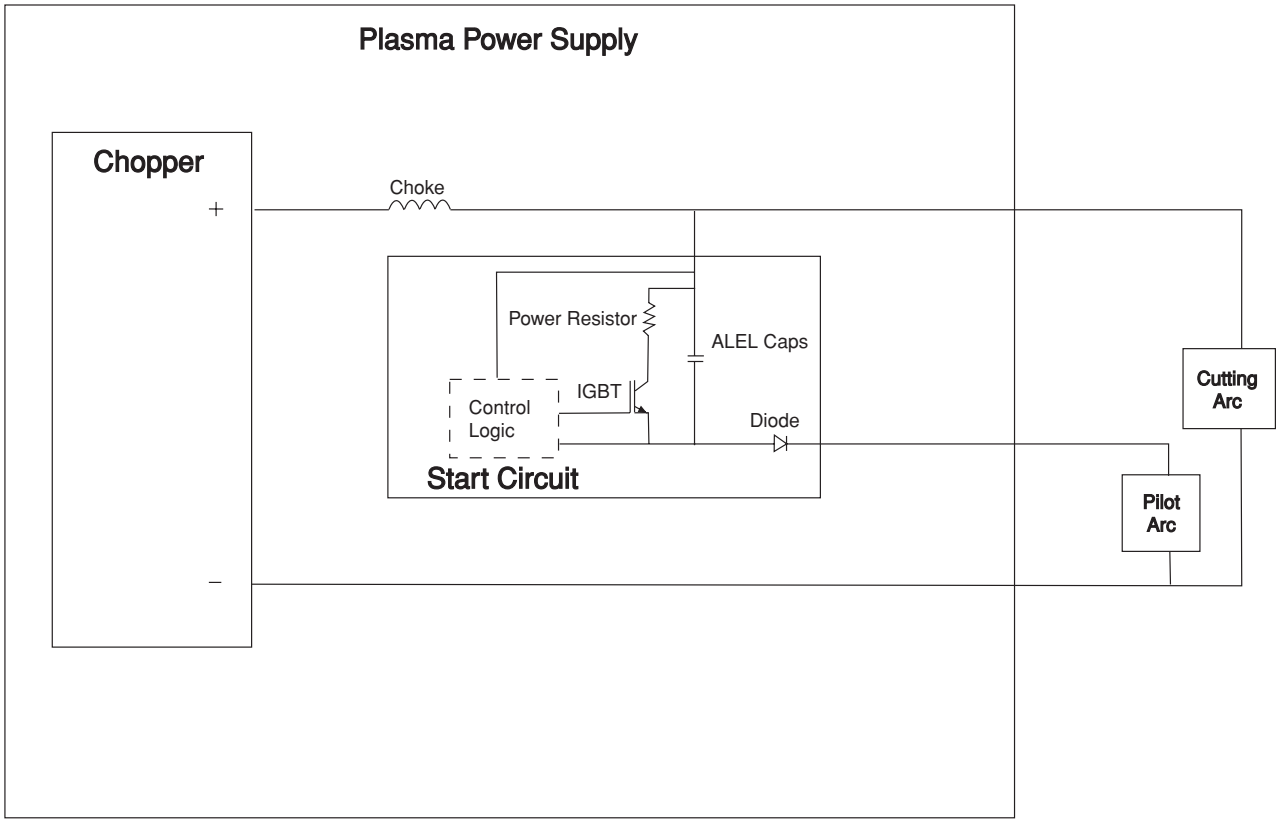
2. After initial pilot arc current is established, the start circuit introduces impedance to the pilot arc load to aid in transferring the arc to the workpiece. See schematic on following page.

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-amp Process	20 amps
70-amp Process	20 amps
100-amp Process	30 amps
200-amp Process	40 amps

Start Circuit Functional Schematic



Start Circuit Troubleshooting

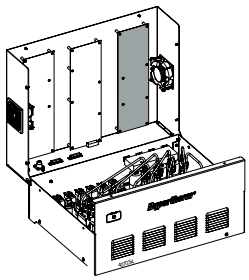
WARNING

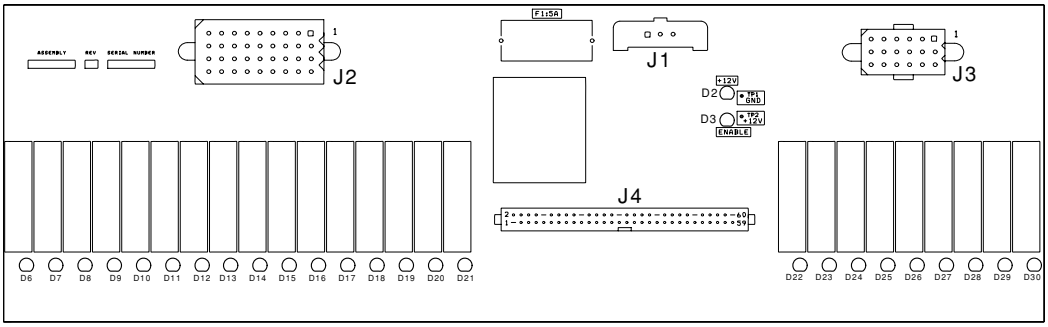
SHOCK HAZARD: Always use caution when servicing a power supply when plugged in and the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.

- 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

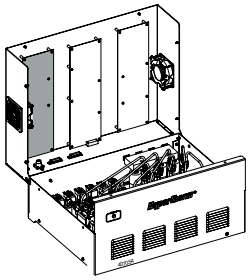
PCB1

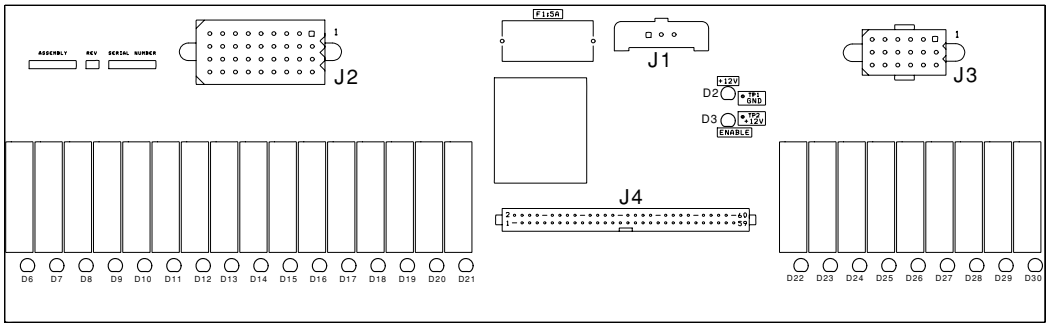




LED	Signal Name	Function	LED	Signal Name	Function
D2	+12 VDC	Power indicator	D18	SV2	H5 in
D6	SV11	Plasma operate	D19	SV1	H35 in
D7	SV13	Air Plasma operate	D20	SV3	CO2 in
D8	SV15	N2 Plasma preflow	D21	SV5 & SV10	O2 in
D9	SV17	Shield operate	D22	MV2 Close	Plasma operate - N2 / Air
D10	SV18	N2 Shield operate	D23	MV2 Open	Plasma operate - N2 / Air
D11	SV16	Air Plasma preflow	D24	MV1 Open	Plasma operate
D12	SV14	Plasma preflow	D25	MV1 Close	Plasma operate
D13	SV12	N2 Plasma operate	D26	SV23, 24, 25, 26	Torch select
D14	SV8	H35 and H5, Double fault protection	D27	SV21	N2 Shield preflow
			D28	SV20	Shield preflow
D15	SV7	Air in	D29	SV19	Air Shield operate
D16	SV6	N2 in	D30	SV22	Air Shield preflow
D17	SV4 & SV9	CH4 in			

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

PCB1 and PCB3 LED Sequences – O_2 Cutting

O_2 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

N_2 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

O_2 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

N_2 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

O_2 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	–	–

O_2 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

N_2 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/N_2 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

N_2 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

N_2 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	–	–

N_2 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	–	–

N_2 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/N_2 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

N_2 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	–	–

N_2 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 – N_2/N_2 Marking

N_2 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

N_2 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

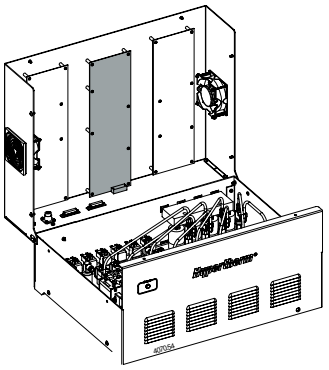
N_2 Plasma Cutflow

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	–	–

N_2 Shield Cutflow

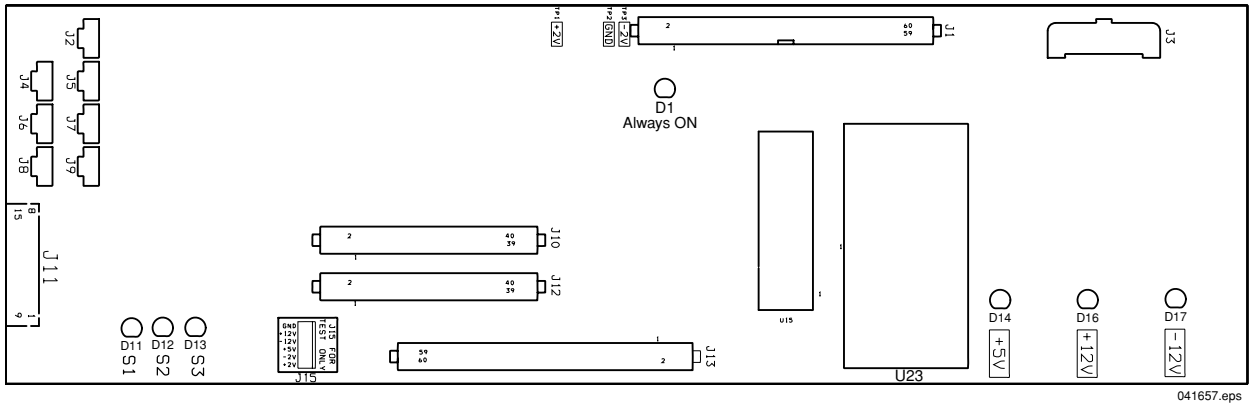
PCB 1		PCB 3	
LED	Action	LED	Action
D16	SV6	D7	MV6 Open
D18	SV18	D13	MV6 Close
D26	SV25: Torch 2 Select	D29	SV30: Torch 1 Active
–	–	D26	SV35: Torch 2 Active

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



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 4 feet (1.2 meters) 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 120 psi (8.3 bar). 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

SHOCK HAZARD: Use extreme care when working near the chopper modules. The large electrolytic capacitor(s) (blue-cased cylinder(s)) store large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper, and the diode heatsinks. Never discharge any capacitor with a screwdriver or other implement...explosion, property damage and/or personal injury will result.

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 & F2. Check to see if either fuse is open.

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.

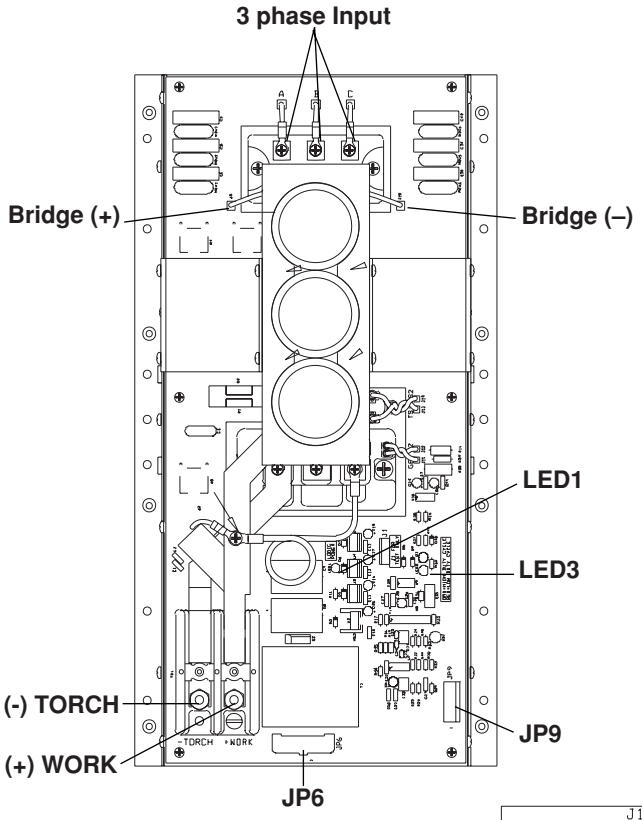
5. If voltage from above step is +311 VDC and corresponding fuse is not blown, check output of choppers.

   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.

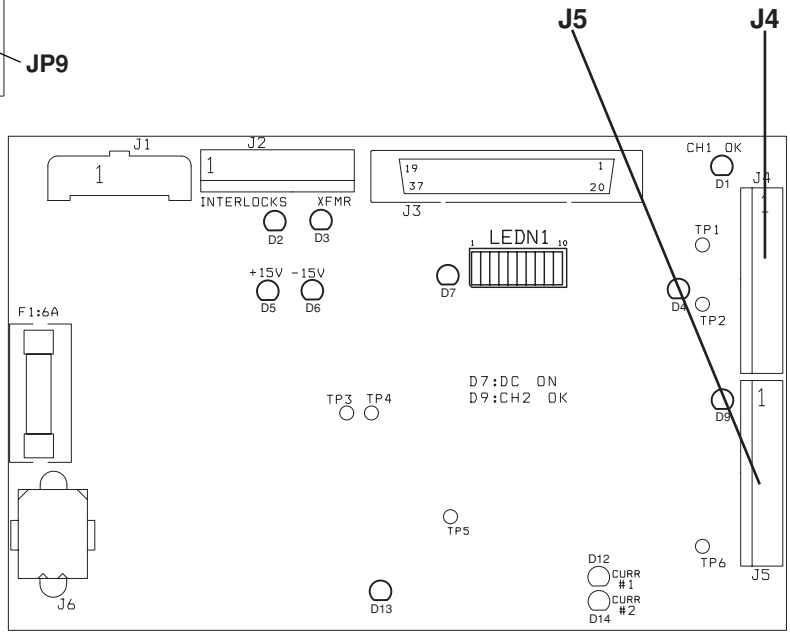
   CH2: To check the output of CH2, repeat the above procedure for CH1 but put the positive lead of the DVM at wire #8 and the negative lead at wire #6.

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.



Chopper Module – front view



Control board – PCB3

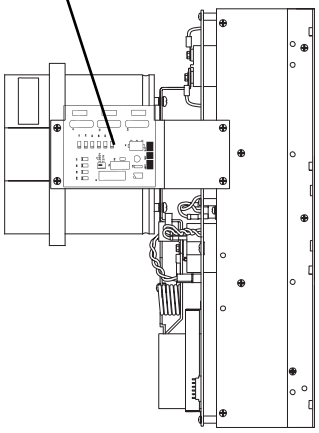
Phase Loss Detection Board PCB1 Status Indicators and Operation

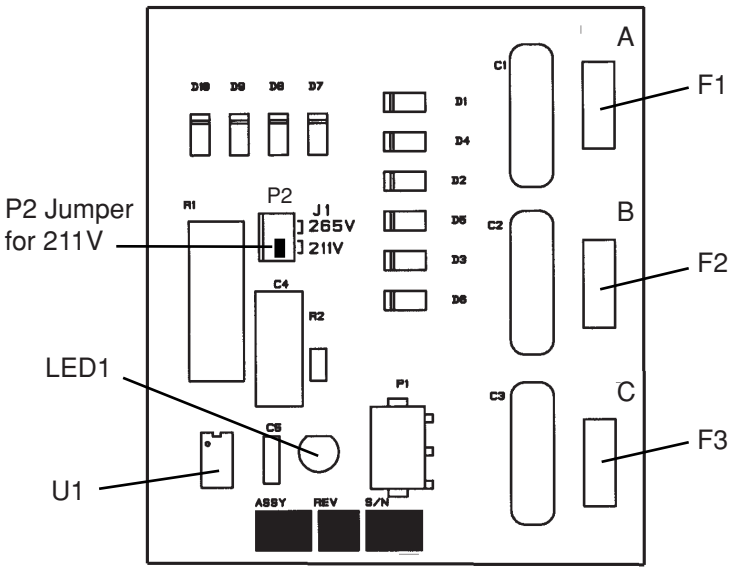
Operation

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 U_1 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 open, 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.



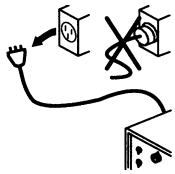


THC Routine Maintenance

Every 3 months complete the following:


WARNING

ELECTRIC SHOCK CAN KILL



Turn off all electrical power before removing the power supply cover. Press the power supply OFF (0) pushbutton switch and set the line disconnect switch to OFF. In the U.S., use a "lock-out and tag-out" procedure until the service or maintenance is complete. In other countries, follow appropriate local or national safety procedures.

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

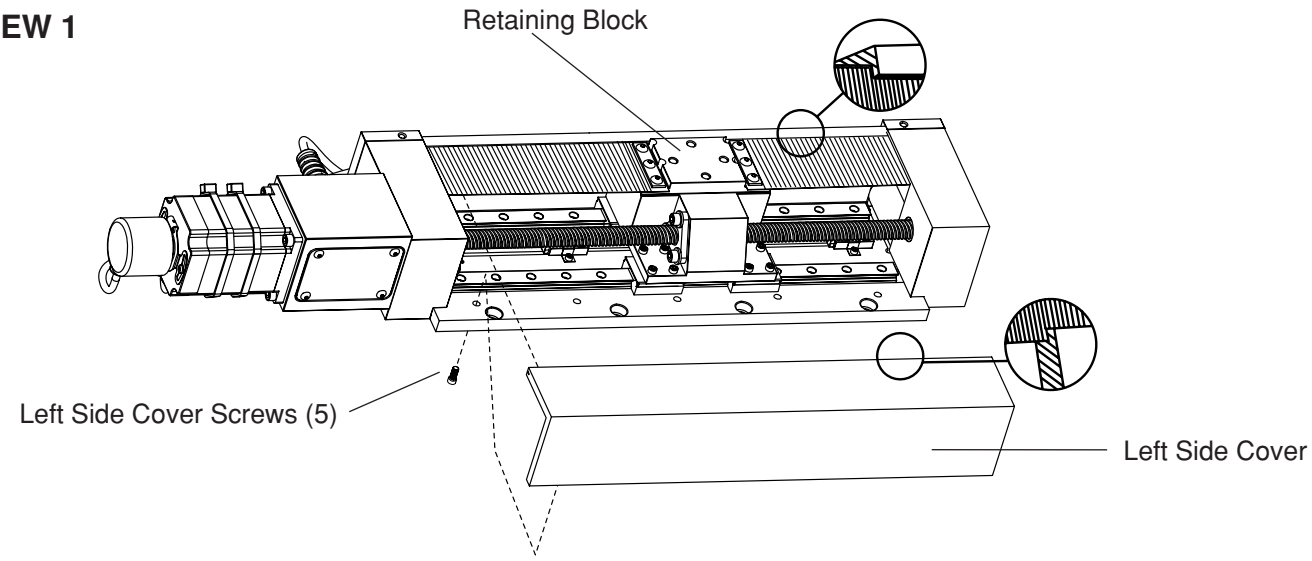
The sealing band keeps foreign matter out of the lifter assembly. Replace the band if it is torn or worn by installing a Band Seal Kit. The kit contains a new band, screws and retainers.

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.

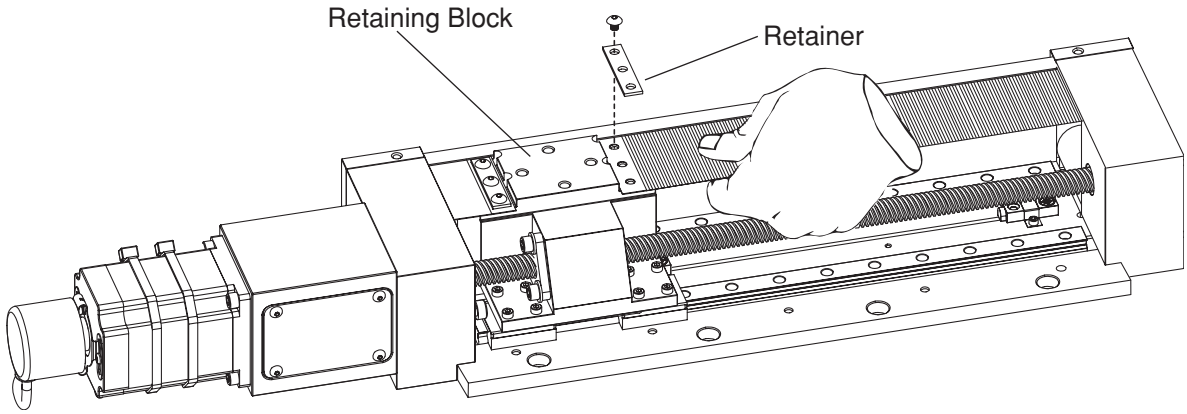
Sealing Band – Remove (Figure 5-1)

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).

VIEW 1



VIEW 2



VIEW 3

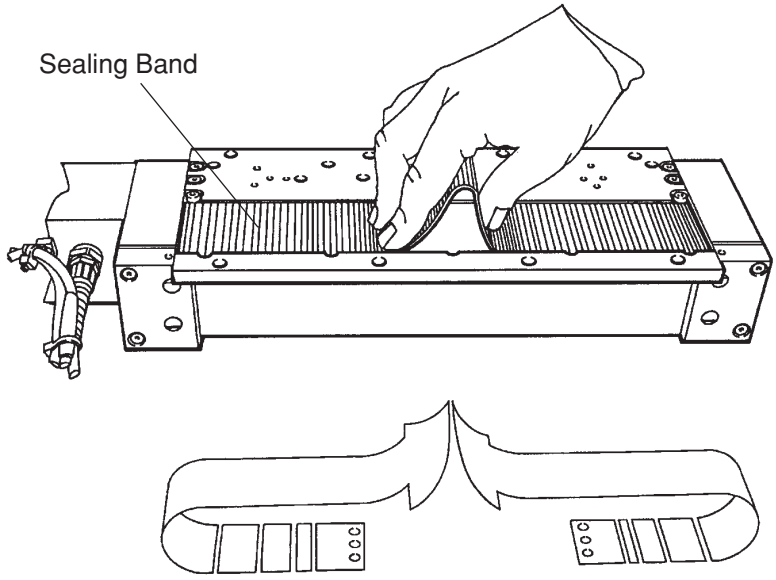


Figure 5-1 Sealing Band – Remove

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

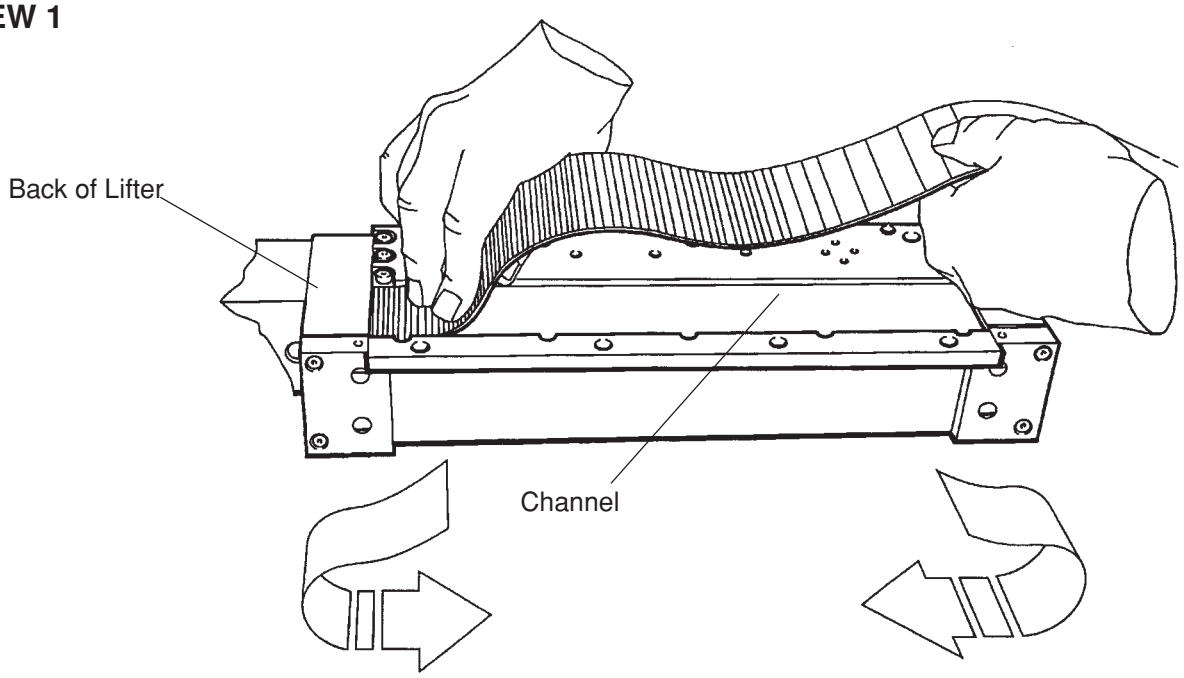
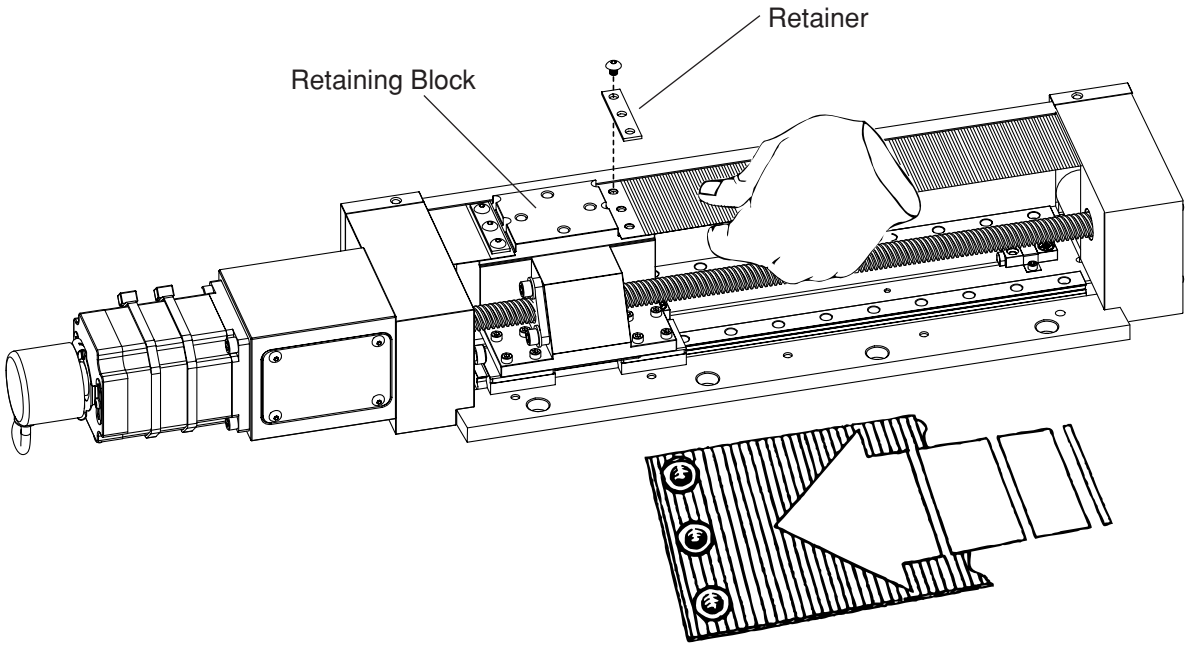


Figure 5-2 Sealing Band - Install (1 of 2)

VIEW 2



VIEW 3

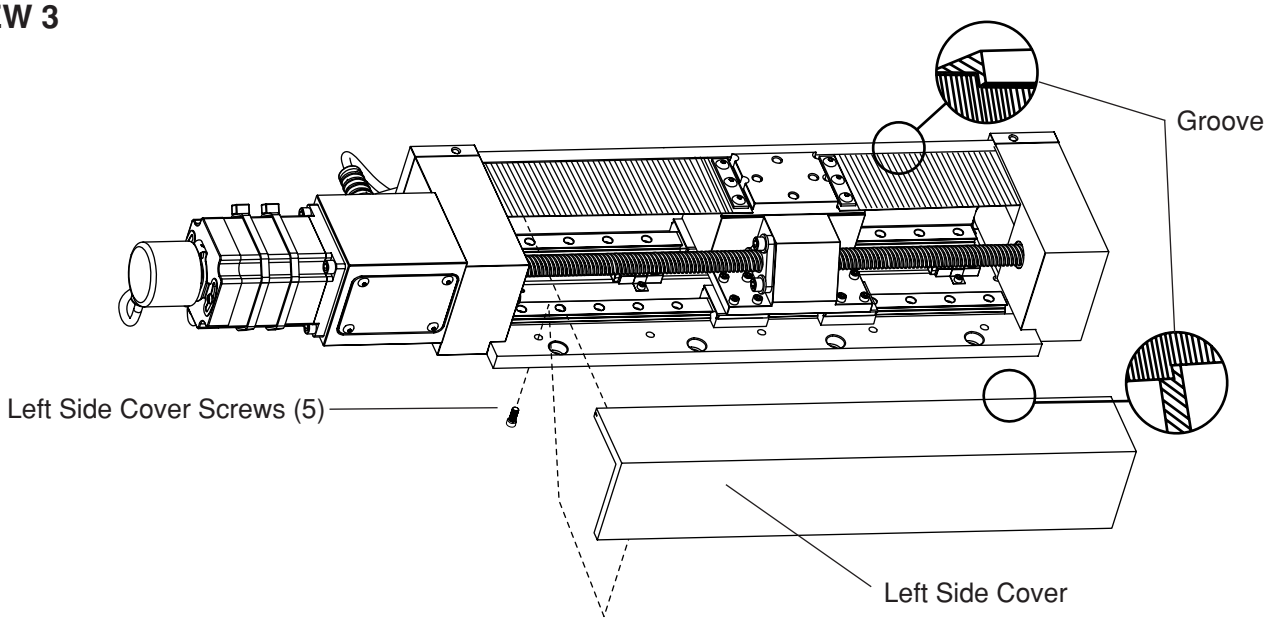
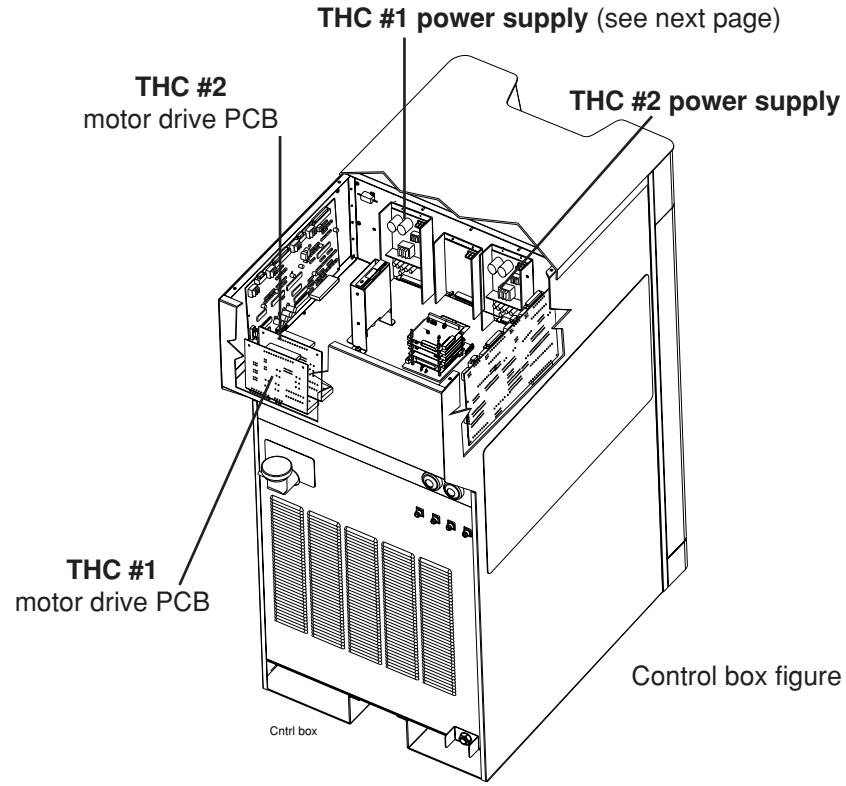


Figure 5-2 Sealing Band - Install (2 of 2)

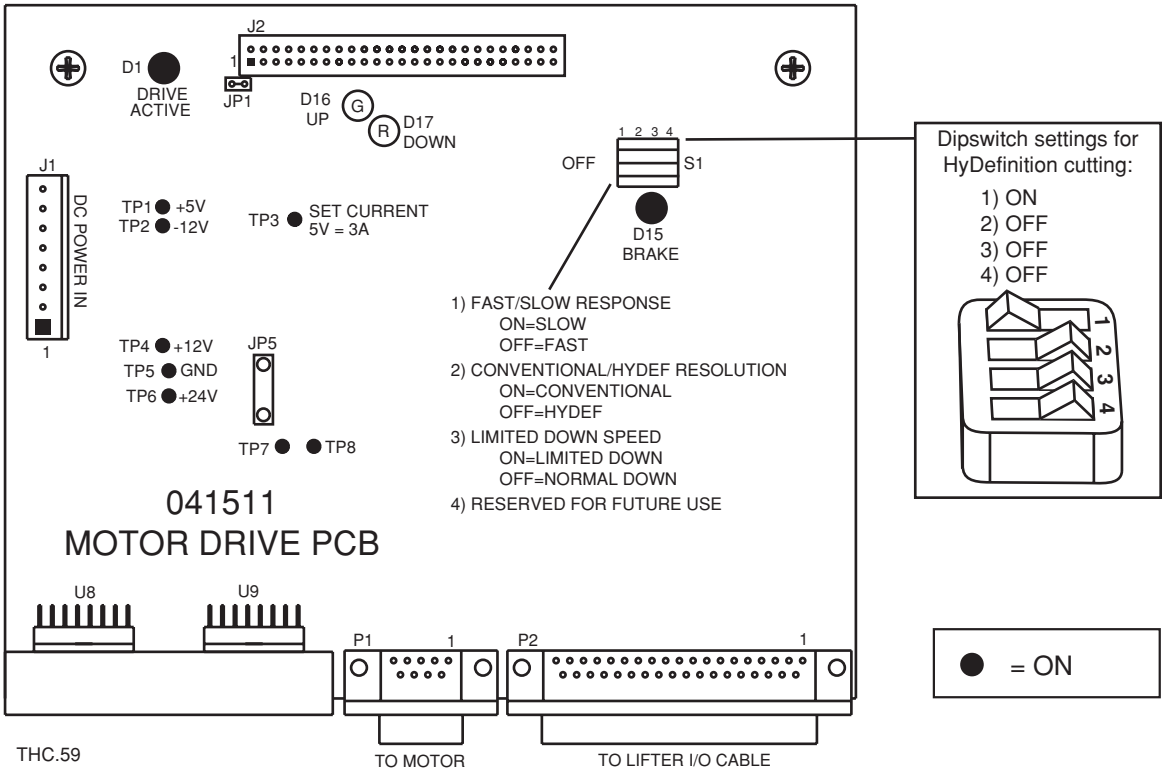
THC Motor Drive Board

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

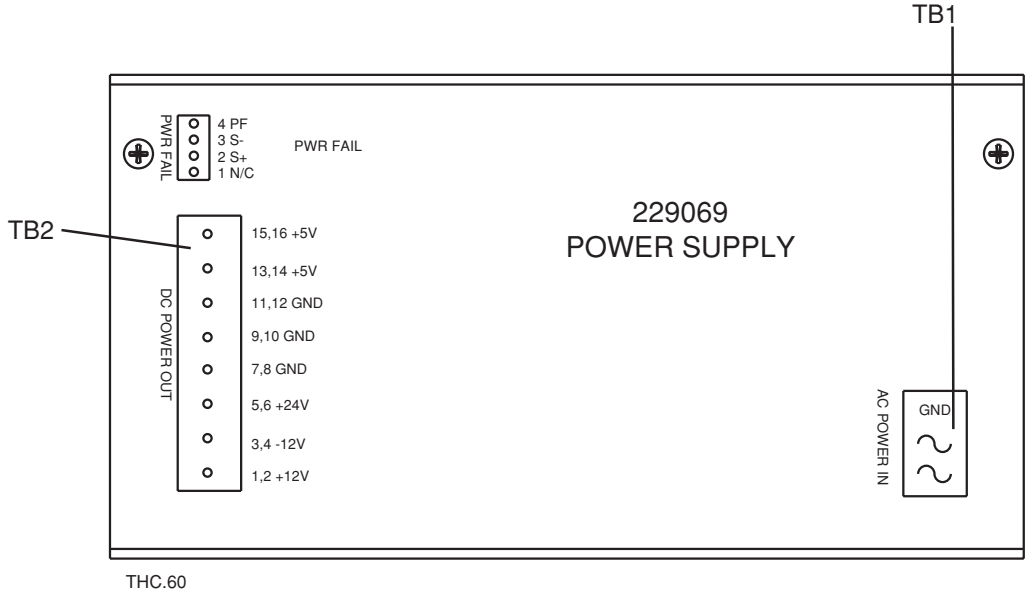


Control box figure



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

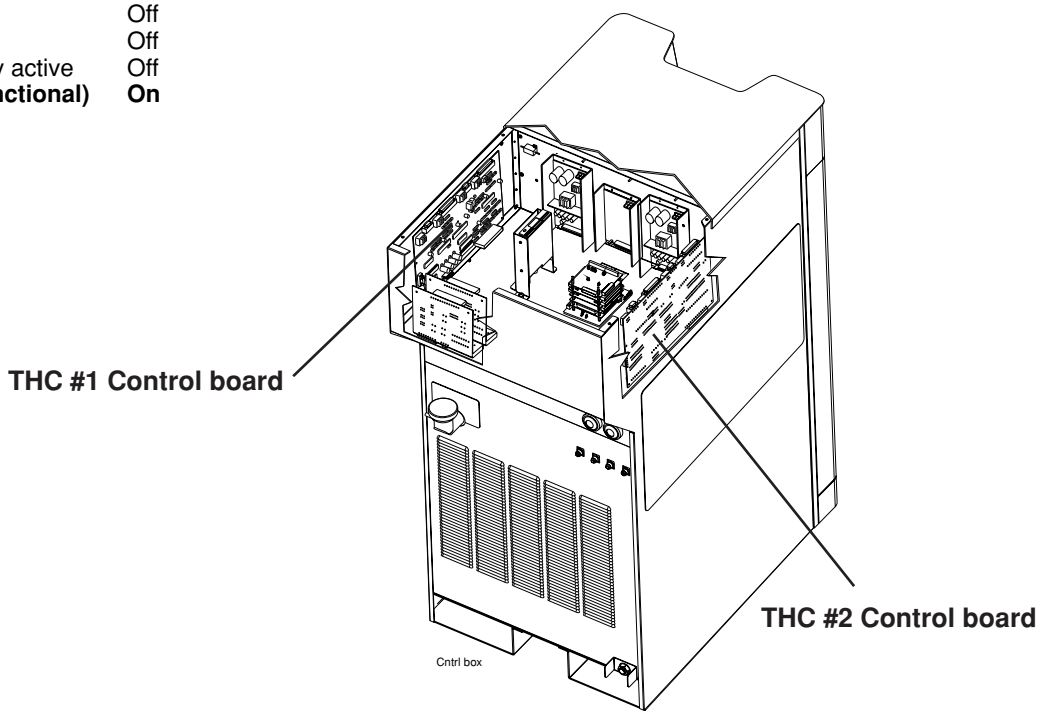
DC Power	Wire Color	Wire Connection Points/LEDs and Test Points Power Supply PCB DC Power Out	Motor Drive PCB DC Power In	Control PCB DC Power In
+ 12 VDC	Blue	TB2-1		J8-3/D43 & TP6
Common	White	TB2-3		J8-4/D42 & TP5
+ 12 VDC	Blue	TB2-2	J1-3/TP4	
Common	White	TB2-4	J1-4/TP2	
+ 24 VDC	Blue	TB2-5		J8-5/D41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

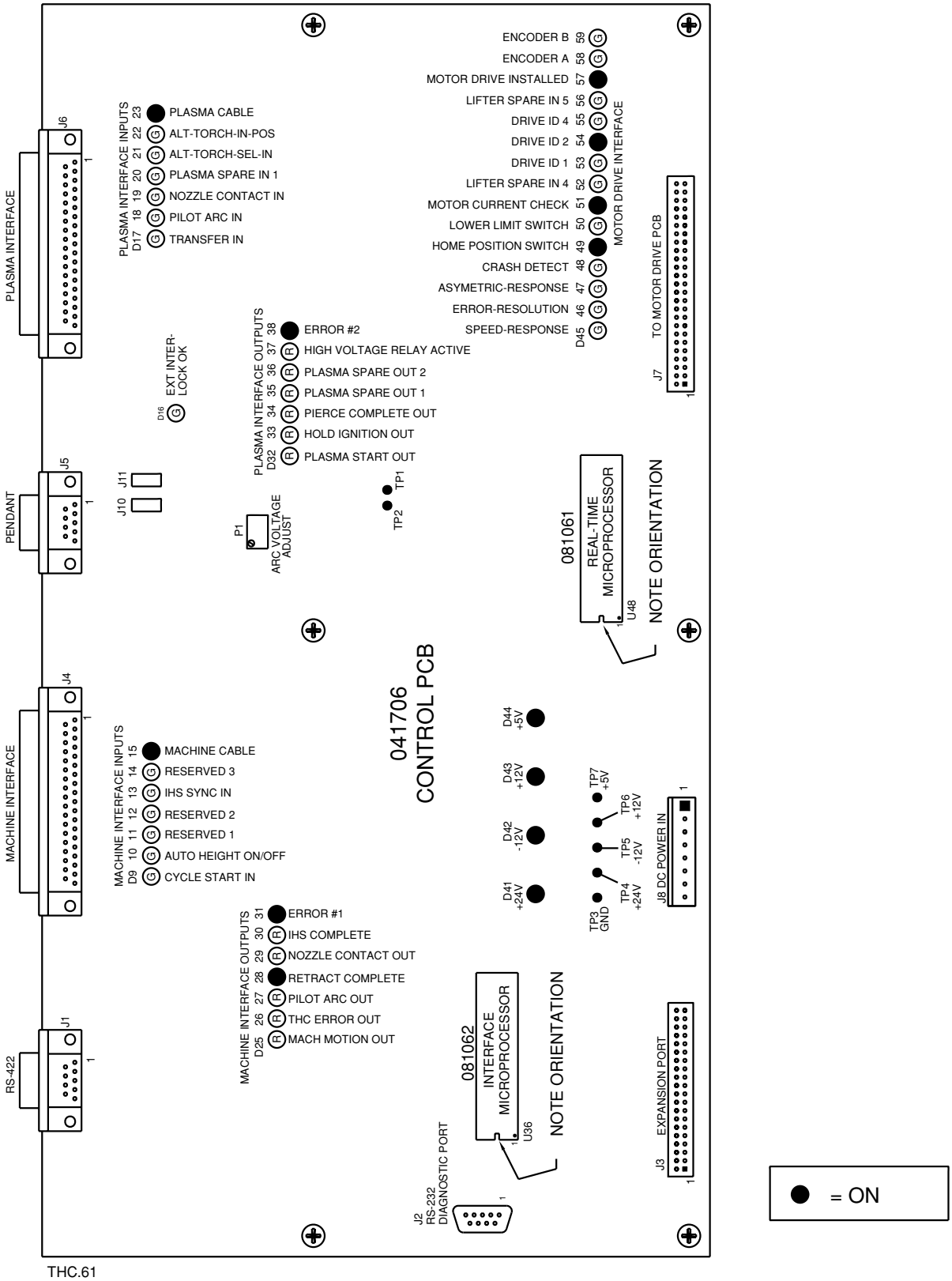
THC Control Board – status lights during normal power-up.

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

LED Signal Function	Status
D9 - cycle start input	Off
D10 - auto height on/off	Off
D11 - spare input	Off
D12 - spare input	Off
D13 - IHS sync input	Off
D14 - spare input	Off
D15 - machine cable	**On**
D17 - transfer input	Off
D18 - pilot arc input	Off
D19 - nozzle contact	Off
D20 - spare input	Off
D21 - torch 1 select	Off
D22 - torch 2 select	Off
D23 - plasma cable	**On**
D25 - machine motion output	Off
D26 - THC error out	Off, (On if there is error)
D27 - pilot arc output	Off
D**28 - retract complete**	**On**
D29 - spare out	Off
D30 - IHS complete	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**

LED Signal Function	Status
D41 - +24v	**On**
D42 - -12v	**On**
D43 - +12v	**On**
D44 - +5v	**On**
D45 - response switch 1 (user-definable response)	Off
D46 - response switch 2 (user-definable response)	Off
D47 - response switch 3 (user-definable response)	Off
D48 - crash detect (Future use)	Off
D49 - home position	On momentarily, then Off
D50 - lower limit switch	Off
D51 - motor current check	**On**
D52 - response sw4	Off
D53 - drive ID 1	Off
D54 - drive ID 2	**On**
D55 - drive ID 4	Off
D56 - spare input	Off
D57 - motor drive installed	**On**
D58 - encoder A	On or Off
D59 - encoder B	On or Off




041706
CONTROL PCB
PLASMA INTERFACE
J6
PLASMA INTERFACE INPUTS
D17 18 19 20 21 22 23
PLASMA CABLE
ALT-TORCH-IN-POS
ALT-TORCH-SEL-IN
PLASMA SPARE IN 1
NOZZLE CONTACT IN
PILOT ARC IN
TRANSFER IN
ENCODER B 59
ENCODER A 58
MOTOR DRIVE INSTALLED 57
LIFTER SPARE IN 5 56
DRIVE ID 4 55
DRIVE ID 2 54
DRIVE ID 1 53
LIFTER SPARE IN 4 52
MOTOR CURRENT CHECK 51
LOWER LIMIT SWITCH 50
HOME POSITION SWITCH 49
CRASH DETECT 48
ASYMETRIC-RESPONSE 47
ERROR-RESOLUTION 46
SPEED-RESPONSE D45
MOTOR DRIVE INTERFACE
J7 TO MOTOR DRIVE PCB
PENDANT
J5
J10 J11
D16 EXT INTER-LOCK OK
PLASMA INTERFACE OUTPUTS
D32 33 34 35 36 37 38
ERROR #2
HIGH VOLTAGE RELAY ACTIVE
PLASMA SPARE OUT 2
PLASMA SPARE OUT 1
PIERCE COMPLETE OUT
HOLD IGNITION OUT
PLASMA START OUT
TP1
TP2
P1
ARC VOLTAGE ADJUST
081061
REAL-TIME MICROPROCESSOR
U48
NOTE ORIENTATION
MACHINE INTERFACE
J4
MACHINE INTERFACE INPUTS
D9 10 11 12 13 14 15
MACHINE CABLE
RESERVED 3
IHS SYNC IN
RESERVED 2
RESERVED 1
AUTO HEIGHT ON/OFF
CYCLE START IN
D44 +5V
D43 +12V
D42 -12V
D41 +24V
TP7 +5V
TP6 +12V
TP5 -12V
TP4 +24V
TP3 GND
J8 DC POWER IN
MACHINE INTERFACE OUTPUTS
D25 26 27 28 29 30 31
ERROR #1
IHS COMPLETE
NOZZLE CONTACT OUT
RETRACT COMPLETE
PILOT ARC OUT
THC ERROR OUT
MACH MOTION OUT
RS-422
J1
081062
INTERFACE MICROPROCESSOR
U36
NOTE ORIENTATION
J2
RS-232
DIAGNOSTIC PORT
J3 EXPANSION PORT
= ON

THC.61

Preventive Maintenance

Introduction

Deteriorating consumable parts life is frequently one of the first symptoms to indicate that something is wrong with a plasma system. Reduced parts life dramatically increases operating costs for two reasons: first, and perhaps most obvious, shorter consumable life means that the end user will have to use more consumables to cut the same amount of metal. The second, and even more important factor, is that shorter consumable life means that the end user must shut down his cutting operation to change consumables more often. In an average cutting operation, labor and overhead can account for over 80% of the cost of cutting, so improved productivity, in the form of less downtime, can reduce cutting costs dramatically.

Proper maintenance often eliminates the problems that lead to shortened consumables life. Since the basic premise behind the purchase of a Hypertherm plasma system is reduced cutting costs and increased productivity, maintaining a system in proper operating condition is a key to ensuring customer satisfaction.

The Preventive Maintenance Protocol is intended to be simple to follow. After you have performed it a few times, you should expect to take approximately 3 hours to complete it for each individual plasma system involved.

Hypertherm wants to meet or exceed our customers' expectations. We hope that this booklet will help you meet or exceed those customers' expectations.

Preventive maintenance protocol

The following protocol covers the basic elements of a Hypertherm mechanized plasma system. These basic elements apply broadly to all our mechanized systems, although certain specific components, such as the high-frequency console or the coolant system, are not present in all mechanized systems. The protocol may therefore vary slightly from a MAX100 to an HT2000, for example, and as we move through the protocol, we have tried to note where certain steps would not be necessary for certain systems.

It is important to have available for reference a copy of the appropriate manual for the Hypertherm system to be maintained.

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

The power supply

When performing preventive maintenance in any plasma system power supply, it is critical to turn off power to the power supply at the source. Extreme electrical hazard is present in the power supply and at the torch. Please consult the manual for a complete list of safety precautions.

1. With power to the power supply off, remove all side panels and inspect for accumulated dust. Using compressed air, blow out the inside of the power supply to remove dust and particulates.

2. Inspect wiring harnesses and connections for any wear or damage. Check for loose connections and look for any discoloration that might indicate overheating. If this condition is observed, 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 should be recommended.

4. If the plasma system has an air filter in the front panel of the power supply, inspect the air filter and recommend replacement if dirty.

5. Inspect the pilot arc relay (CR1) for excessive pitting on the contacts, characterized by a roughened, black surface. Recommend replacement if necessary.

Coolant system

6. If the plasma equipment in question has a built-in coolant system, inspect the filter element of the coolant system which is located at the rear of the power supply. If the filter has begun to turn a brownish color, replacement should be recommended. For HyDefinition systems, a de-ionizing filter should be used. Refer to the manual for proper part numbers. If the system is a MAX200 or HT2000, a particle filter should be used.

7. Perform a coolant flow test on the system. For MAX200, HT2000, HD1070 and HD3070 systems, flow should be at least 0.75 gpm (2.8 l/min) on the return line. When testing systems with external water chillers, the required coolant flow varies according to different size pumps. Refer to appropriate manuals.

   Check for coolant leaks. Primary locations to inspect are: 1) the back of the power supply; 2) at the high-frequency console, if applicable; and, 3) at the torch main body. Check the holding tank for dirt and particulates. Verify that proper Hypertherm coolant is being used.

Torch main body

8. If the torch contains a water tube for electrode cooling, check the water tube to ensure that it is straight and has no pitting on the end.

9. Check the current ring inside the torch main body. The current ring should be smooth and not pitted. If slight pitting is seen, contact Hypertherm Technical Service to assess the likelihood that the torch could be repaired. If no pitting is observed, clean the current ring with a clean cotton swab and clean water. Do not use alcohol. Pitting on the current ring generally indicates improper maintenance (i.e. lack of regular cleaning).

10. Clean all threads on the front end of the torch head with clean water and a cotton swab, pipe cleaner or clean cloth. Do not use alcohol. Damage to the threads usually results from not properly cleaning the torch and retaining cap threads, so that dirt and particulates accumulate in the threads.

11. Inspect the torch insulator for cracks. Replacement of the torch should be recommended if cracks are found.

12. Inspect all o-rings on the torch body and consumables. Make sure that the correct amount of lubricant is being applied to these o-rings. Too much lubricant may obstruct gas flows.

13. Ensure that the retaining or shield cap is tightened securely to the torch main body.

14. Check all hose fittings at the rear of the torch for wear. Damage to the fitting threads may indicate that overtightening has occurred.

15. Ensure that all connections between the torch and torch leads are tight, but do not overtighten.

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

Gas flows

16. Check the plumbing from the gas supply source, as follows:

    A. Remove and plug the oxygen inlet gas fitting at the gas console.

    B. Pressurize the gas system at the source to 8.3 bar (120 psi).

    C. Close the gas supply valve at the source. Watch for a pressure drop. If the supply line from the source is a hose, there may be a 0.3 to 0.5 bar (5 to 7 psi) drop due to stretch.

    D. If the pressure continues to drop, find the leaks in the system.

E. Perform the same protocol for the nitrogen gas supply system, except that the gas system should be pressurized at the source to 10.3 bar (150 psi), 8.3 bar (120 psi) for the HD3070 and HD4070.

F. Perform the same protocol for the air, carbon dioxide or argon-hydrogen and methane supplies (as applicable) except that the gas system should be pressurized at the source to 6.2 bar (90 psi), 8.3 bar (120 psi) for the HD3070 and HD4070.

G. If the system is operating on compressed air, verify that a filtering system is in place to ensure that no oil or moisture is allowed to enter the plasma system. Inspect all filters and oil separators and recommend replacement if dirty.

17. Perform a system gas leak test, as follows:

A. Place the gas console in the Test Preflow mode.

Adjust gas flows to appropriate settings as outlined in the *Operation* section of the instruction manual.

B. Locate the off-valve solenoid and disconnect the control cable from the solenoid. The digital pressure indicator should slowly drop to zero. If it does not, a leak may be indicated.

C. Close the shut-off valves for the oxygen and nitrogen supply at the source.

D. The pressure gauges on the gas console should maintain their pressure. If either nitrogen or oxygen pressures drop more than 0.1 bar (2 psi) in 10 minutes, there is an unacceptable leak.

E. If a leak is indicated, check all gas connections, using a soapy water solution.

18. Check for hose restrictions, as follows:

A. Check the 3 hoses connected to the motor valve. Make sure that they are not bent, causing a possible restriction.

B. Check the gas hoses from the gas console to the motor valve, looking for any sharp bends that may cause restrictions.

C. Check the off-valve hose from the off-valve to the torch main body. Make sure that the hose is not bent, causing a restriction.

D. 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

19. Cables should be checked for chafing or unusual wear. If the outside insulation has been cut, check the wires inside for damage:

A. For Initial Height Sensing (IHS) option, check the cables from the inductive probes to the IHS console.

B. Check the control cable from the off-valve to the motor valve console.

C. Check the cable from the motor valve console to the power supply.

D. Check control cables from the high-frequency console and the gas console to the power supply.

High-frequency console (if applicable)

20. Open the cover and inspect the interior for condensation or the accumulation of dust and particulates. If dust and particulates are present, blow out the unit with compressed air. If moisture is present, dry the inside of the console with a cloth and contact Hypertherm Technical Service for recommended action.

21. Inspect the spark gap subassembly. Inspect the 3 electrodes. Verify that the electrodes are 0.508 mm (0.020") apart and that they are clean and the ends are flat. File the electrodes clean with a diamond file if necessary. Ensure that the wiring connections to the spark gap subassembly are secure. Check that the console doors are properly closed.

22. Inspect the torch leads. Ensure that they are fastened tightly to the outside of the high-frequency console.

System grounding

23. Verify that all components of the system are individually grounded to a driven earth ground, as described in the instruction manual.

    A. All metal enclosures, such as the power supply, high-frequency console and gas console, should be connected individually to a ground point. These connections should be made with 10 mm^2 (#8 AWG) wire (USA), or equivalent-size wire.

24. Check the connection from the cutting table to the workpiece (+) lead. Particularly inspect where the positive (+) lead connects to the cutting table to ensure that it is a good, clean connection. A poor connection may cause arc transfer problems.

Preventive Maintenance Master Schedule

Daily:

- Verify proper inlet gas pressure.
- Verify proper gas flow settings. – Mandatory at every consumable change.
- Verify proper coolant pressures and temperatures. – Water chillers only.
- 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.

Monthly:

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec

- Complete systems check per the preventive maintenance protocol.

Bi-Annually:

Year	1st Service	2nd Service

- Complete systems check per the preventive maintenance protocol.
- Replace service parts per the service part replacement schedule.

Annually:

Year									

- Complete systems check per the preventive maintenance protocol.
- 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 air filter on front of system
- ☐*P* ☐*NP* 5. Inspect pilot arc relay

Coolant system

- ☐*P* ☐*NP* 6. Inspect filter element
- ☐*P* ☐*NP* 7. Perform coolant flow test
  - A. Coolant flow checked at _____ gallons per minute (_____ l/min)

Torch main body

- ☐*P* ☐*NP* 8. Inspect water tube
- ☐*P* ☐*NP* 9. Inspect current ring
- ☐*P* ☐*NP* 10. Clean threads on torch front end
- ☐*P* ☐*NP* 11. Inspect Vespel torch insulator
- ☐*P* ☐*NP* 12. Inspect torch and consumable o-rings
- ☐*P* ☐*NP* 13. Verify proper fit of retaining or shield cap
- ☐*P* ☐*NP* 14. Inspect hose fittings
- ☐*P* ☐*NP* 15. Inspect torch-to-torch-lead connections

Gas flows

- ☐*P* ☐*NP* 16. Inspect plumbing from gas supply
  - ☐*P* ☐*NP* A. Oxygen
  - ☐*P* ☐*NP* B. Nitrogen
  - ☐*P* ☐*NP* C. Air
  - ☐*P* ☐*NP* D. CO_2
  - ☐*P* ☐*NP* E. Argon-Hydrogen
  - ☐*P* ☐*NP* F. Methane
  - ☐*P* ☐*NP* G. Inspect compressed air filter system

Gas flows (cont.)

- ☐*P* ☐*NP* 17. 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* 18. Inspect for hose restrictions
  - ☐*P* ☐*NP* A. Motor valve hoses
  - ☐*P* ☐*NP* B. Gas console to motor valve
  - ☐*P* ☐*NP* C. Off-valve to torch body
  - ☐*P* ☐*NP* D. Hoses in power track

Cable connections

- ☐*P* ☐*NP* 19. Inspect cables
  - ☐*P* ☐*NP* A. From IHS probes to IHS console
  - ☐*P* ☐*NP* B. Control cable from off-valve to motor valve console
  - ☐*P* ☐*NP* C. From motor valve console to power supply
  - ☐*P* ☐*NP* D. From high-frequency console and gas console to power supply

High-frequency console

- ☐*P* ☐*NP* 20. Inspect for moisture, dust and particulates
- ☐*P* ☐*NP* 21. Inspect spark gap subassembly
  - ☐*P* ☐*NP* A. Electrode gap range _____ to _____
- ☐*P* ☐*NP* 22. Inspect torch leads

System grounding

- ☐*P* ☐*NP* 23. Inspect for proper system component grounding
- ☐*P* ☐*NP* 24. Inspect connection from cutting table to workpiece (+) lead

General comments and recommendations:

_____

_____

_____

_____

_____

Preventive maintenance performed by: _____ **Date:** _____

HD4070 Service Part 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	128564	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	120651	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	128564	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	120651	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	128564	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	120651	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	128564	1
	O-ring	058224	1
	O-ring	044028	2
	O-ring	044030	1

Continued on next page

HD4070 Service Part Replacement Schedule

Timeline	Component	Part number	Qty.
4 Years or 2400 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Main contactor	003201	1
	Torch main body	120651	1
	Pilot arc relay	003149	1
	Coolant pump	System dependent	1
	Torch leads	System dependent	1
4.5 Years or 2700 arc hrs.	Coolant filter element	027664	1
	Coolant solution 70/30	028872	4
	Torch bullet kit	128564	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	120651	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	128564	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	120651	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.		

Hypertherm

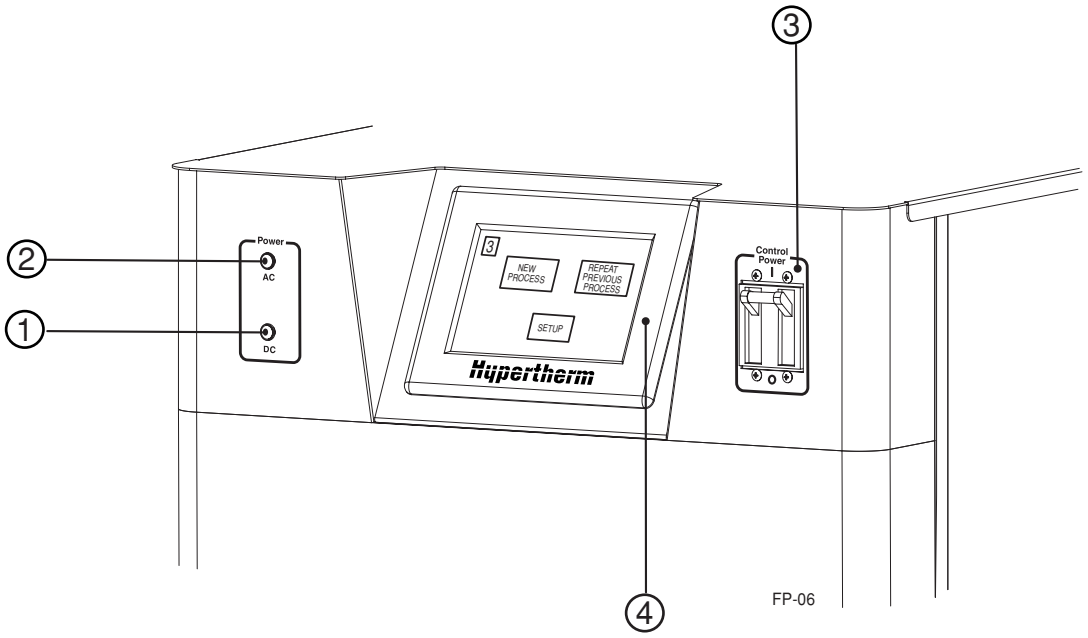
Section 6

PARTS LIST

In this section:

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)	CB1	1
	003210	Circuit Breaker: 15 Amp (200/220/240V units)		1
4	129659*	Touch Screen Display		1
	128535-128543**	Remote Cable Kits		1
	128526-128534***	Remote Display Kits		1

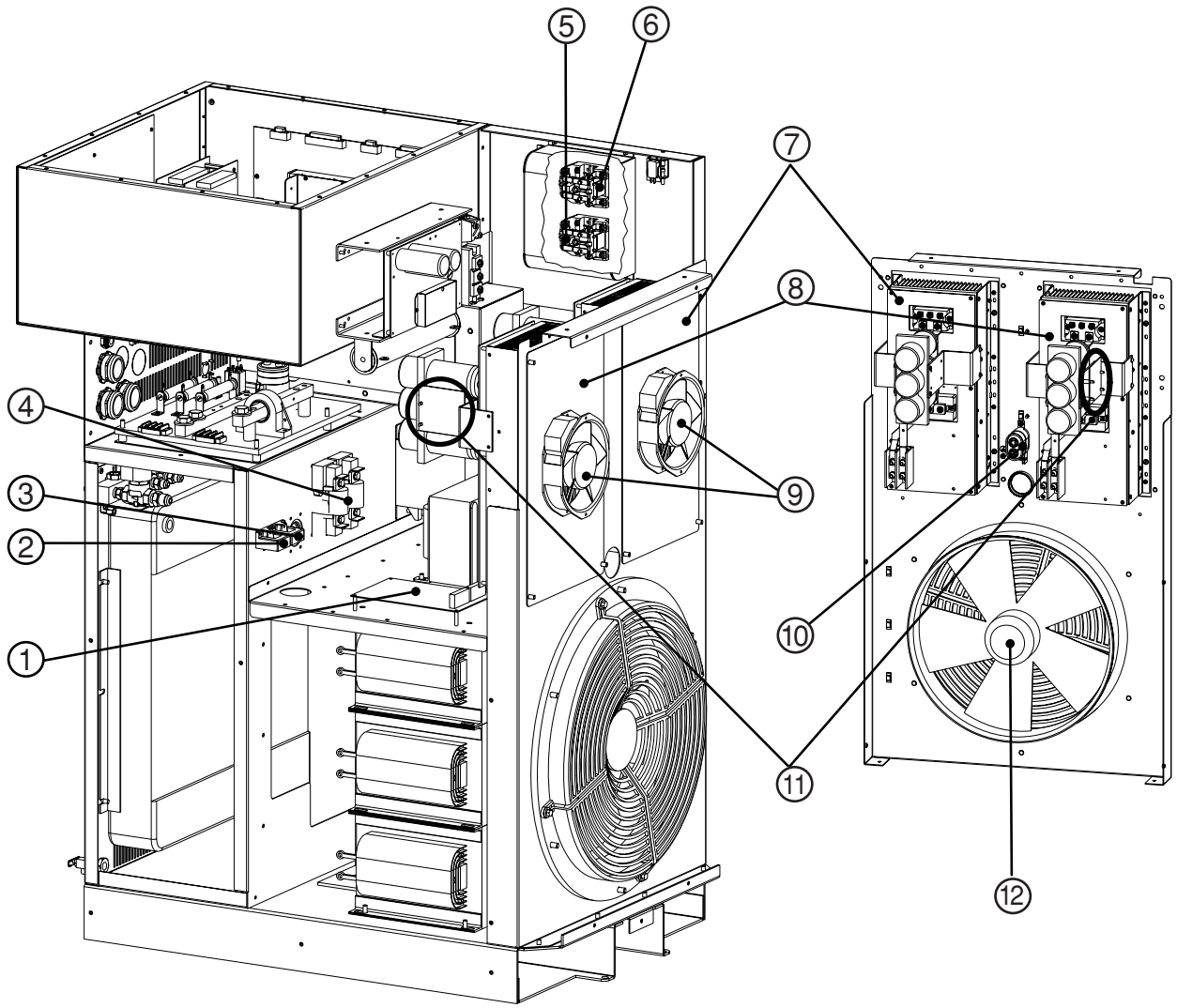
* Replacement part number if your power supply came with a display installed.
** For removal of installed display and installation at a remote location.
*** For display installation at a remote location if your power supply came with no display installed. Display provided in kit.

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

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

Power Supply

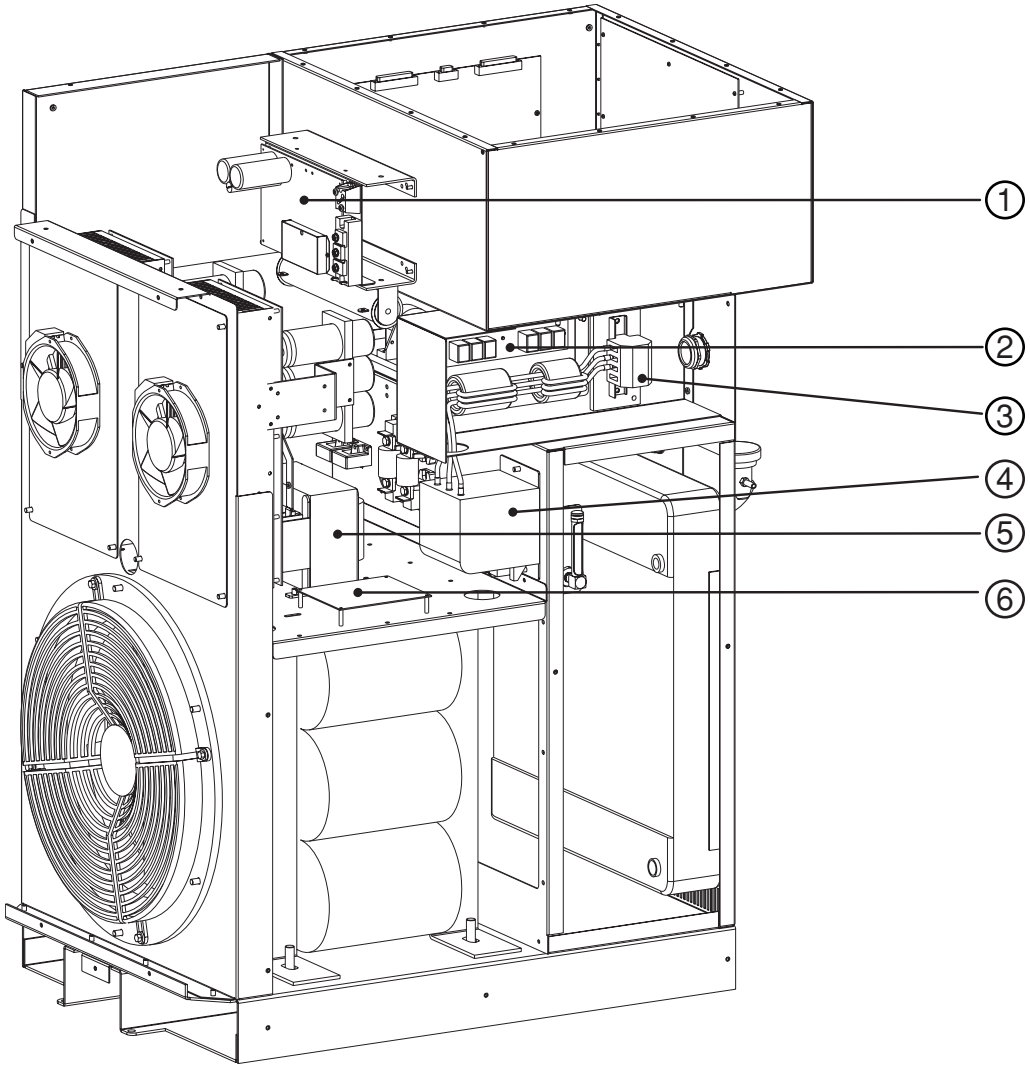
Left Side Interior



Item	Part Number	Description	Designator	Qty.
1	041605	Control Board	PCB3	1
	108075	Fuse: 6A 250V		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

Power Supply

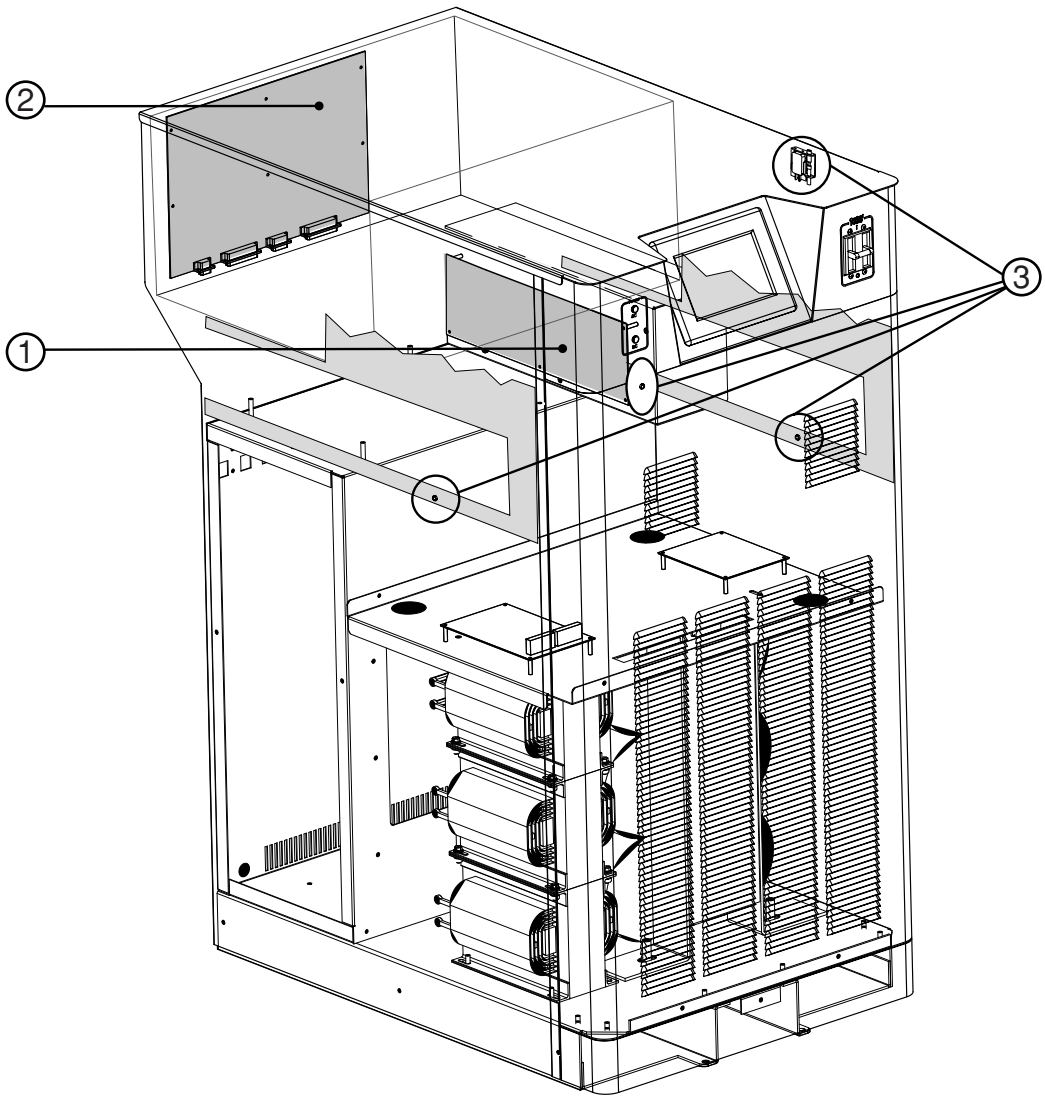
Right Side Interior



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

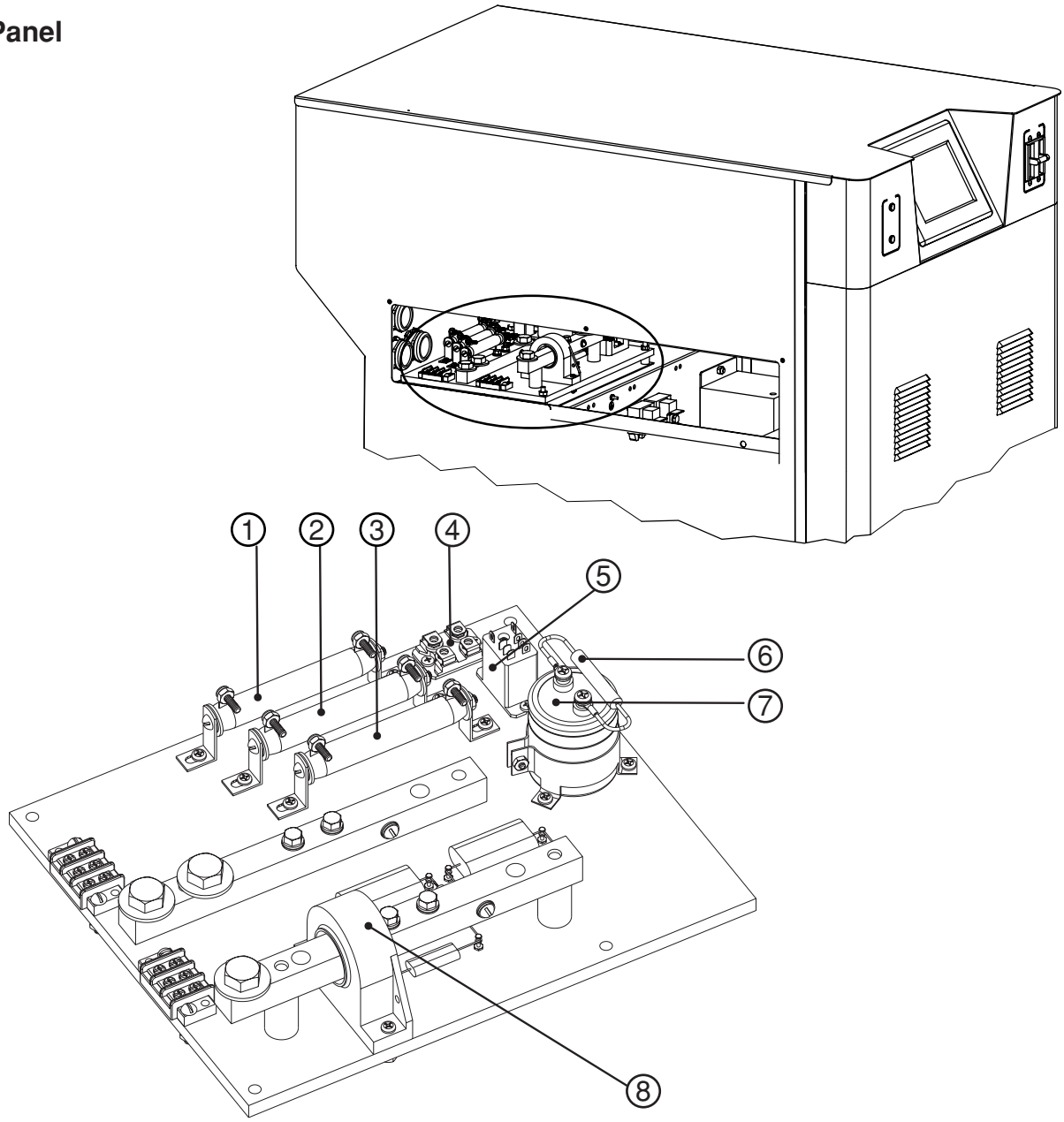
PC Boards and Interlock Switches



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

Power Supply

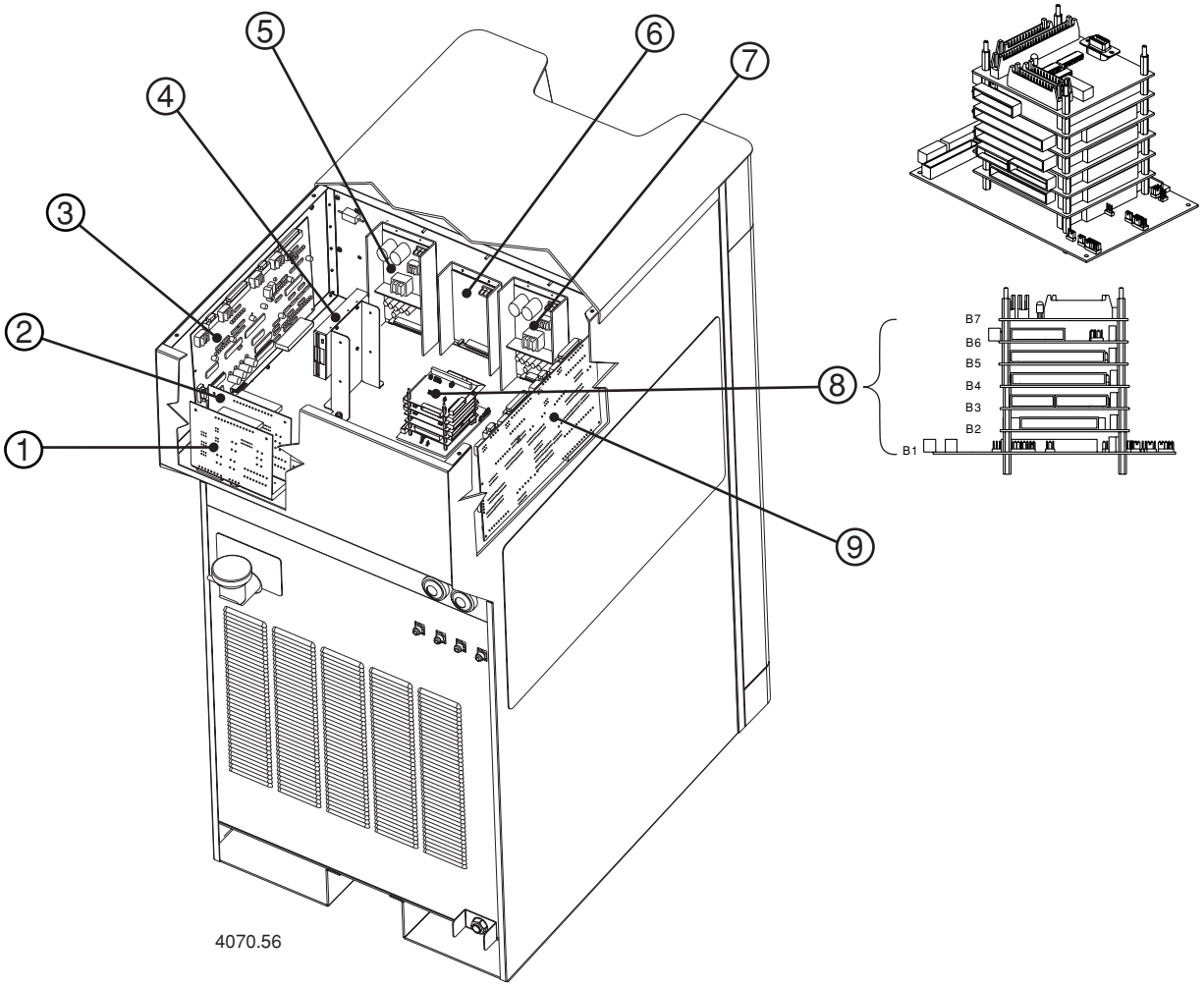
I/O Panel



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: 350µf 450WV	R-1	1
8	109201	Current Sensor: Hall 500A = 4V	C-1	1

Power Supply

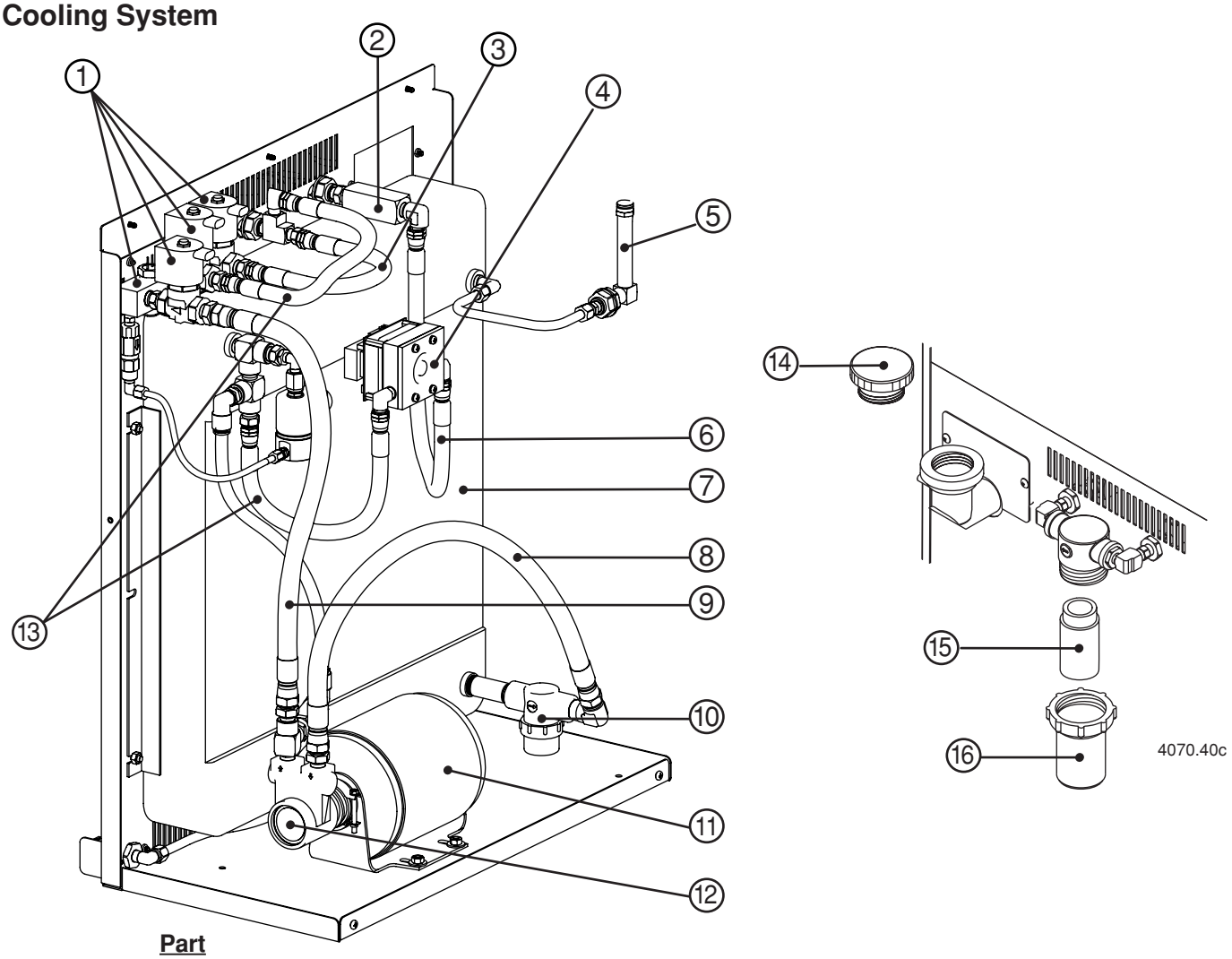
Control Box: Shown with parts for 2-THC option



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	041509	THC Power Supply	THC1	1
6	041626	Power Supply CPU		1
7	229069	THC Power Supply	THC2	1
8	**041664**	**PC-104**		
	041620	Board 1: HD4070 CPU		1
	041625	Board 2: 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

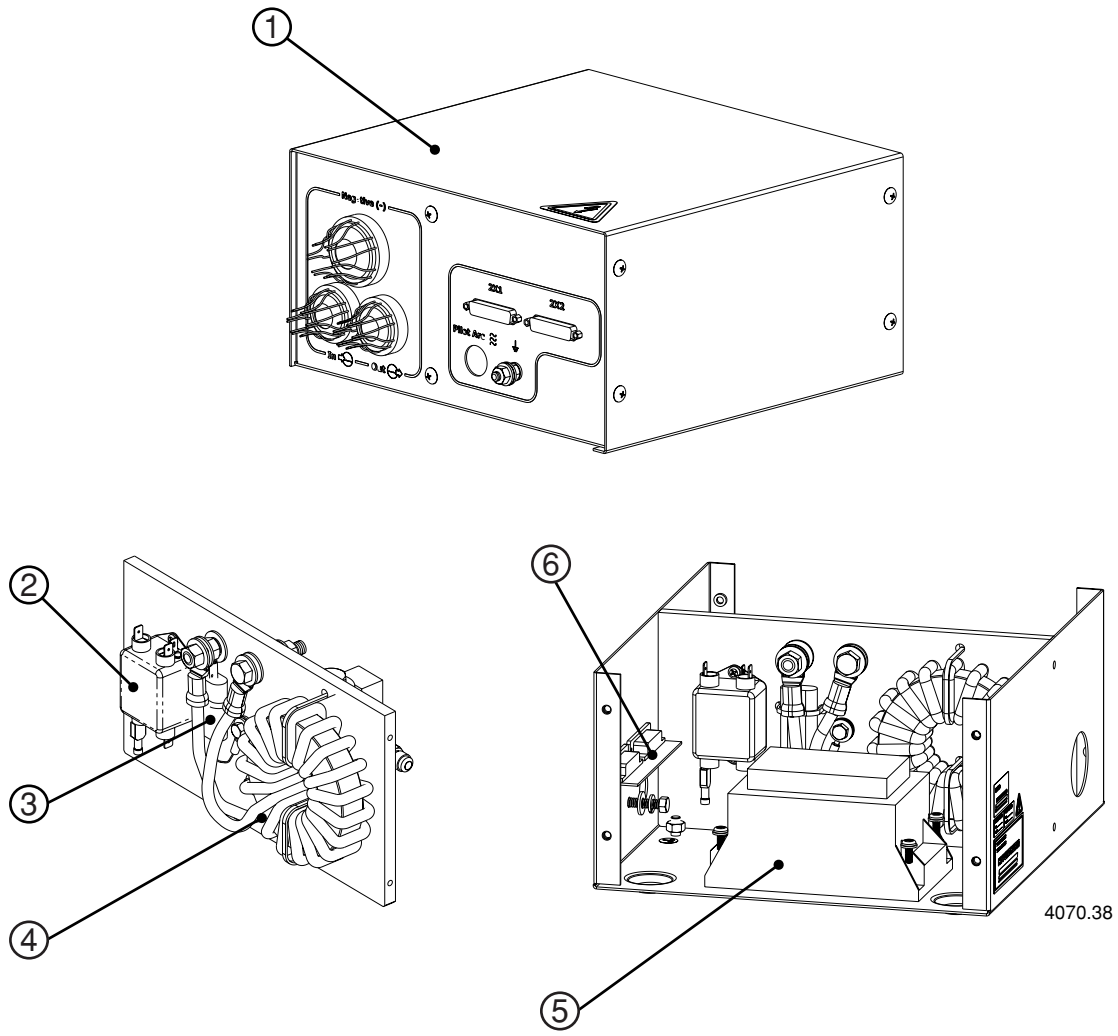
Power Supply

Cooling System



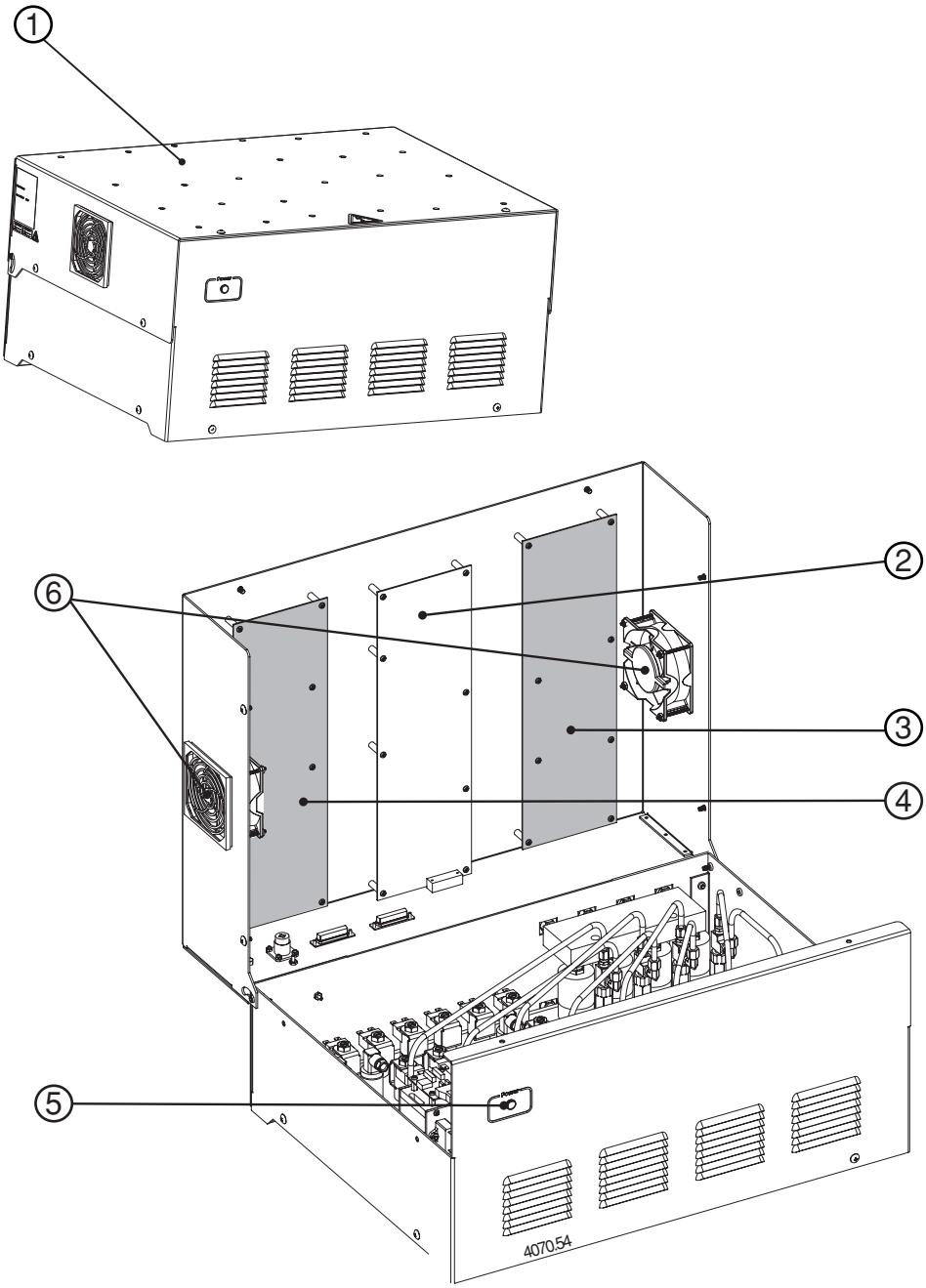
Item	Part Number	Description	Designator	Qty.
1	129485	Solenoid Valve SA W/ Temp Switch	TMP1 SV1, SV2, SV3	1
2	006113	Check Valve: 3/8 FTP	CHV5	1
3	024538	Hose assembly: 3/8, Blue, 10 Inches		1
4	129620	Flow Switch Assembly	FS1	1
5	011084	Sight Glass 1/4 NPT		1
6	024090	Hose assembly: 3/8, Blue, 20 Inches		1
7	027632	Radiator		1
8	024601	Hose assembly: 1/2, Black, 23 Inches		1
9	024749	Hose assembly: 1/2, Blue, 25 Inches		
10	128714	Kit: Low Profile Filter		1
	027927	Filter Element		1
11	229036	Motor		1
12	031138	Pump		1
	128968	Kit: Coolant System Upgrade		1
13	024606	Hose assembly: 3/8, Blue, 12 Inches		2
14	004598	Coolant Reservoir Cap		1
15	027664	Filter Element		1
16	027634	Filter Housing		1

Ignition Console



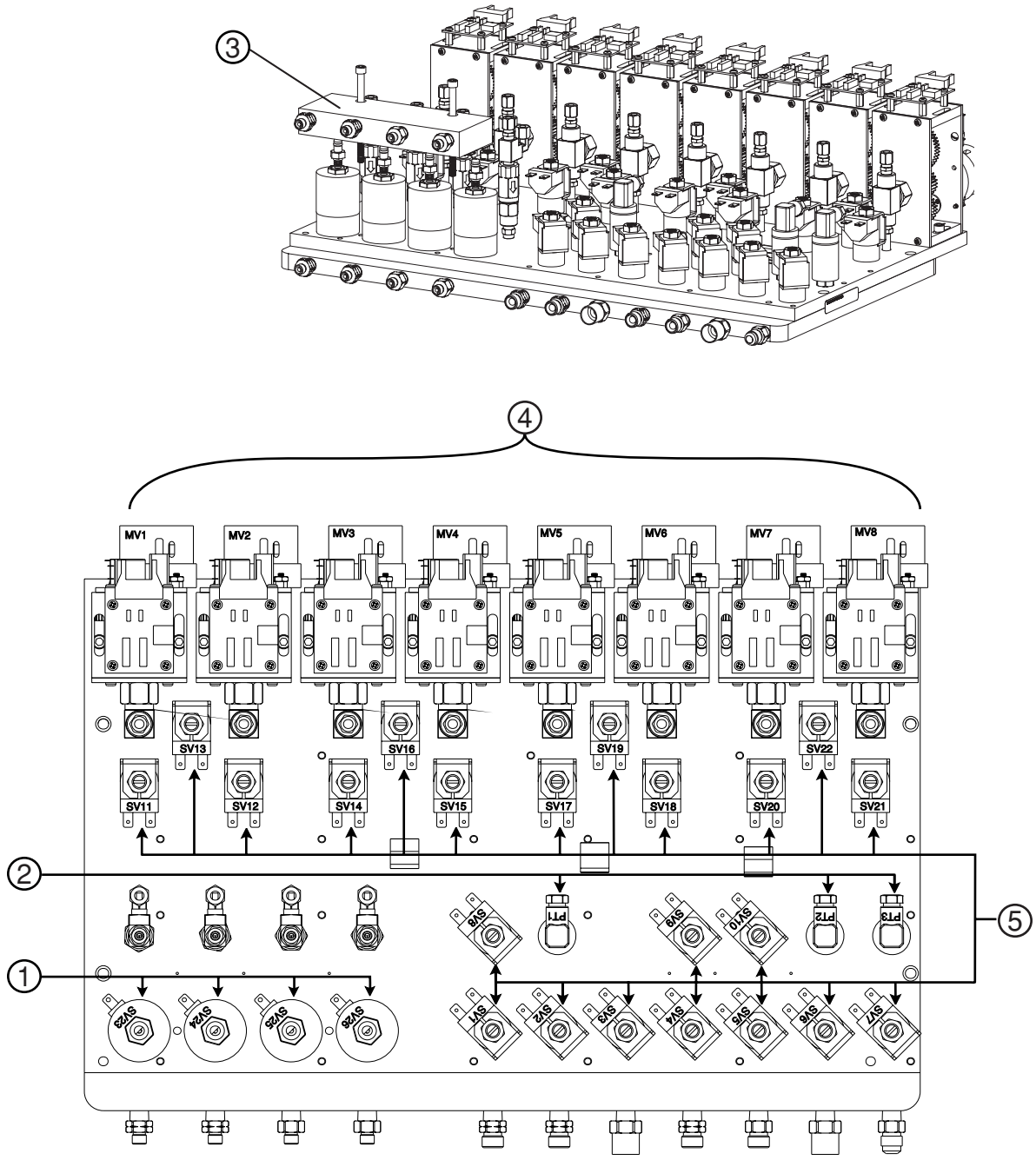
Item	Part Number	Description	Designator	Qty.
1	0**78088**	**Ignition Console**		
2	009040	Filter: 3A, 3W	**FL1**	1
3	128510	Kit: Filter Capacitor Replacement	**C1**	1
4	129616	Inductor: Ignition Console	**L2**	1
5	027648	Ignition Module		1
6	041619	PCB Assembly: Ignition Console Interface		1

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

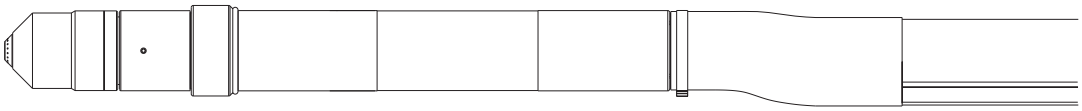
Gas Console – 2 of 2



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

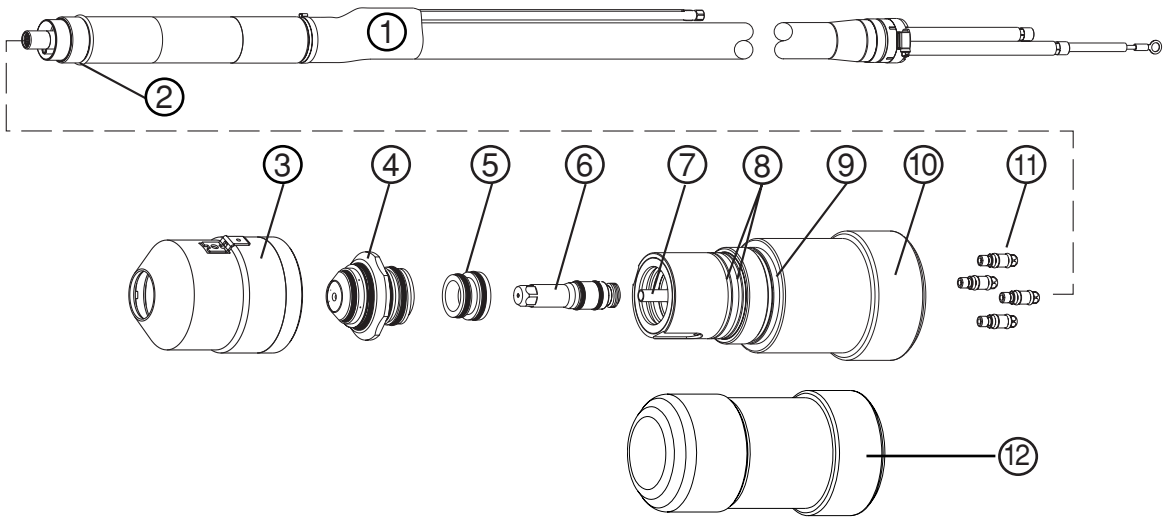
HD4070 Torch

Entire torch assemblies including leads, torch and consumables



Part Number	Description
128500	**Torch with 6' (2 m) Leads**
128501	**Torch with 10' (3 m) Leads**
128502	**Torch with 15' (4.5 m) Leads**

Lead assemblies, torch and consumables

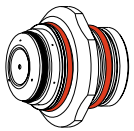
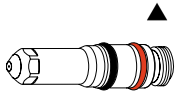
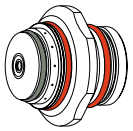
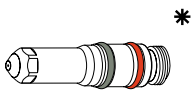
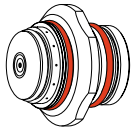
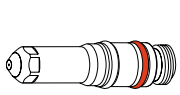
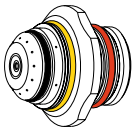
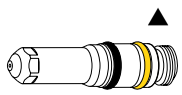
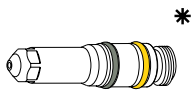
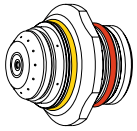
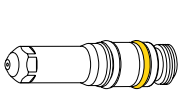
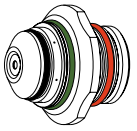
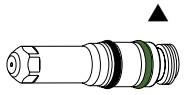
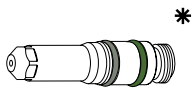
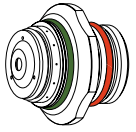
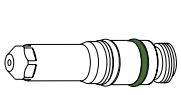


Item	Part Number	Description
1	**128462**	**Torch Adapter with 6 ft (2 m) Lead**
1	**128463**	**Torch Adapter with 10 ft (3 m) Lead**
1	**128341**	**Torch Adapter with 15 ft (4.5 m) Lead**
2	058224	O-ring (part of torch adapter with lead assembly
3	120907	Retaining Cap with IHS tab
4	120692	Nozzle
5	120691	Swirl Ring
6	120690	Electrode
7	120025	Water Tube (Part of 120651 Torch Body Assembly)
8	044028	O-rings (Part of 120651 Torch Body Assembly)
9	044030	O-ring (Part of 120651 Torch Body Assembly)
10	120651	Torch Body
11	128654	Bullet Connector Replacement Kit
12	129671	Torch Receptacle Plug

Consumable Configurations

▲ = Sets can also be used for marking mild steel

✱ = Sets not included in parts kit

	Mild Steel			Stainless Steel			Aluminum		
30/45 Amp			 ▲			 ✱			 ✱
	120678	120677	120676	120706	120705	120704	120741	120740	120739
70 Amp			 ▲			 ✱			 ✱
	120685	120684	120683	120713	120712	120711	120748	120747	120746
100 Amp			 ▲			 ✱			 ✱
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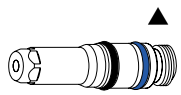
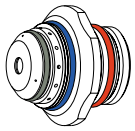
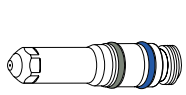
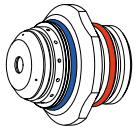
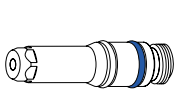
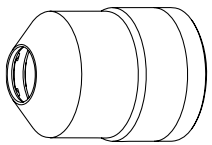
200 Amp			 ▲						
	120692 220081(ccw)	120691 220080(ccw)	120690	120727	120726	120725	120762	120761	120760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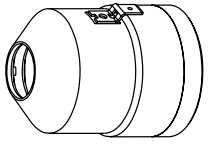
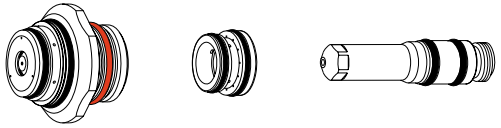

120907

Note: If using the Integrated Command THC with ohmic contact, use retaining cap with IHS tab **120907**

Marking Process - All Materials

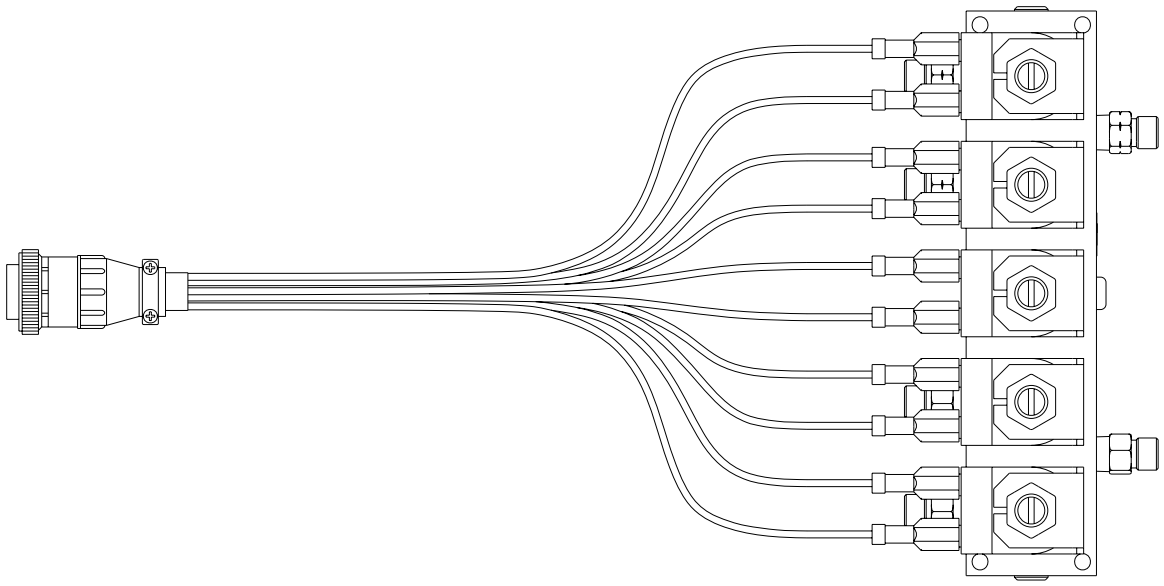

120671 120670 120669

Consumable Parts Kit

Part Number	Description	Qty.
128520	**Consumable Parts Kit**	
001067	Box: Gray Plastic	1
004663	Nozzle Wrench	1
027102	Electrode Wrench	1
027347	Water Tube Replacement 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
120690	Electrode: 200A Mild Steel, Blue/Black O-rings	3
120691	Swirl Ring: 200A Mild Steel, Blue/Black O-rings, CW	1
120692	Nozzle Assembly: 200A Mild Steel, Blue/Black O-rings, CW	3
120725	Electrode: 200A Stainless Steel, Blue/Grey O-rings	1
120726	Swirl Ring: 200A Stainless Steel, Blue/Grey O-rings, CW	1
120727	Nozzle Assembly: 200A Stainless Steel, Blue/Grey O-rings, CW	1
120760	Electrode: 200A Aluminum, Blue/White O-rings	1
120761	Swirl Ring: 200A Aluminum, Blue/White O-rings, CW	1
120762	Nozzle Assembly: 200A Aluminum, Blue/White O-rings, CW	1
120654	Electrode:100A Mild Steel, Green/Black O-rings	2
120655	Swirl Ring: 100A Mild Steel, Green/Black O-rings, CW	1
120660	Nozzle Assembly: 100A Mild Steel, Green/Black O-rings, CW	2
120683	Electrode: 70A Mild Steel, Yellow/Black O-rings	1
120684	Swirl Ring: 70A Mild Steel, Yellow/Black O-rings, CW	1
120685	Nozzle Assembly: 70A Mild Steel, Yellow/Black O-rings, CW	1
120676	Electrode: 30A Mild Steel, Red/Black O-rings	1
120677	Swirl Ring: 30A Mild Steel, Red/Black O-rings, CW	1
120678	Nozzle Assembly: 30A Mild Steel, Red/Black O-rings, CW	1
120669	Electrode: Marking, Black/Black O-rings	1
120670	Swirl Ring: Marking, Black/Black O-rings	1
120671	Nozzle Assembly: Marking, Black/Black O-rings	1
004630	Electrode pit depth gauge	1
110359	Consumable selection pocket card	1

See *Consumable Configurations* on page 6-13 for graphics and proper combinations of consumables.

Off-Valve Assembly – 129563



Recommended Spare Parts

Power supply

Part Number	Description	Designator	Qty.
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

Part Number	Description	Designator	Qty.
128510	Kit: Filter Capacitor Replacement		1
027648	Ignition Module		1

Recommended Spare Parts (continued)

Gas console

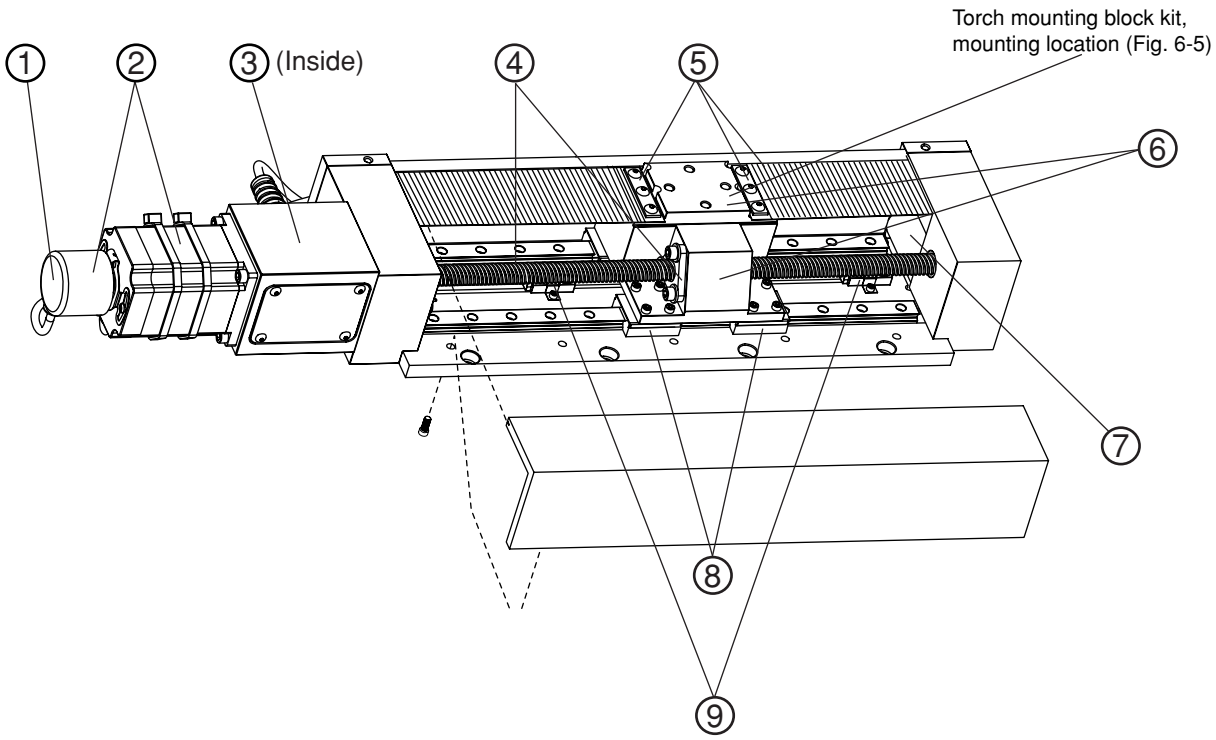
Part Number	Description	Designator	Qty.
041657	Control Board	PCB2	1
041594	Relay Board	PCB1	1

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
031138	Pump		1

Integrated Command THC

X-Y Lifter Assembly

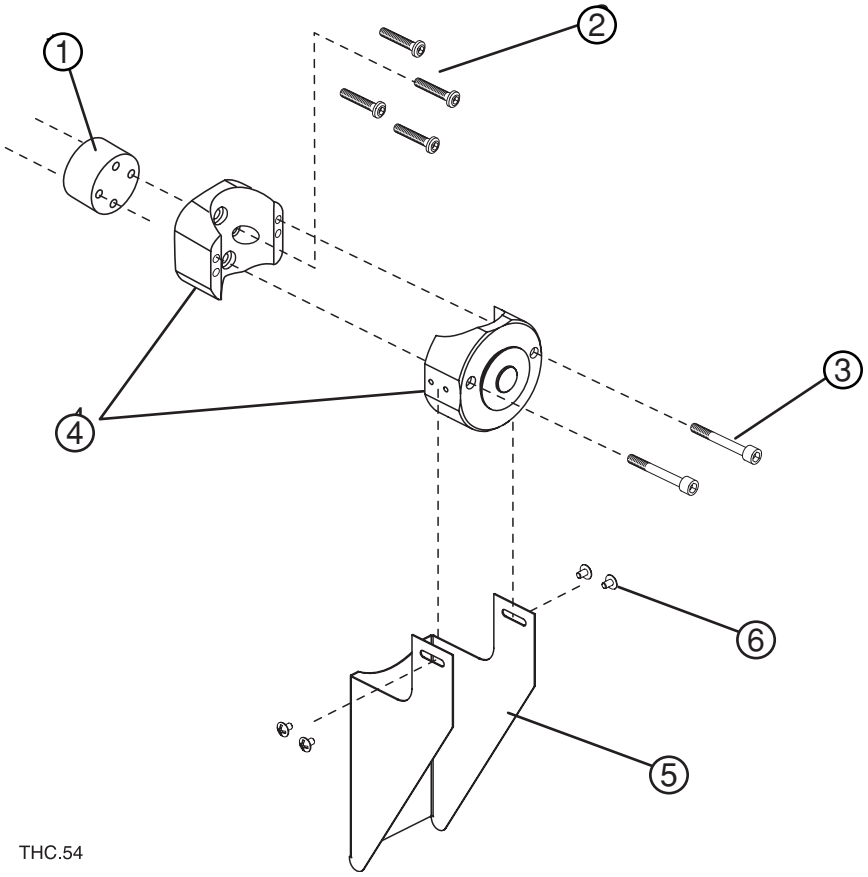


X-Y lifter assembly - 2 rail

Index No.	Part No.	Description	Quantity
	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 Command THC

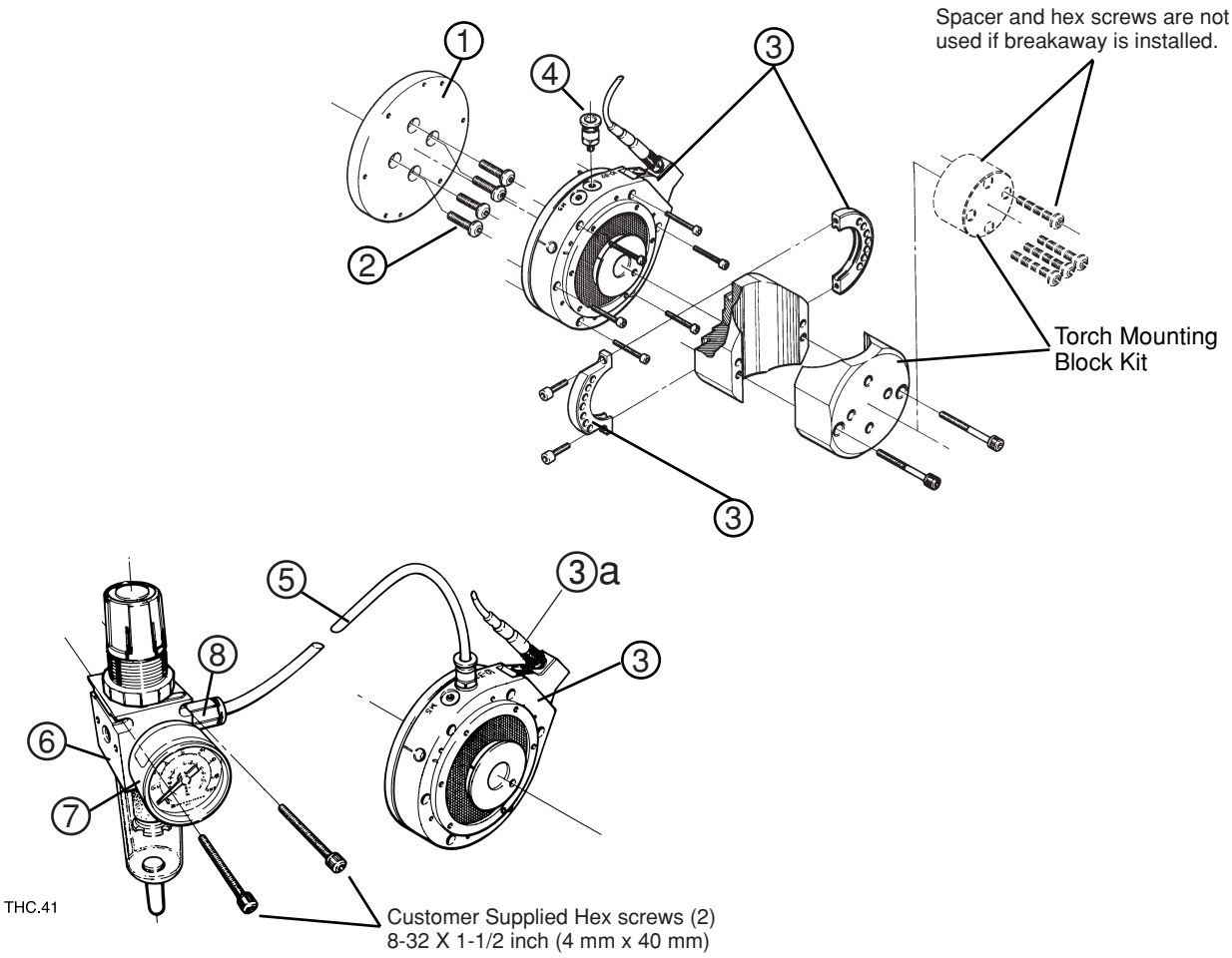
X-Y Lifter Torch Mounting Block Kit



Item	Part No.	Description	Qty.
	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

Integrated Command THC

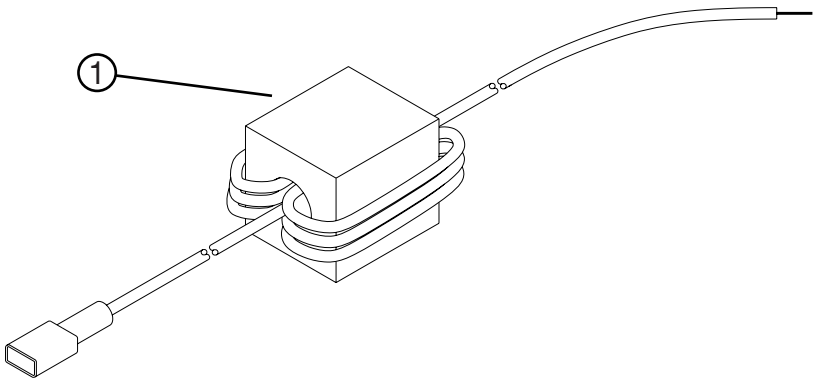
X-Y Lifter Breakaway Kit – optional



Item	Part No.	Description	Qty.
	128281	**Kit, X-Y Lifter Torch Breakaway**	**1**
1	004774	Bracket, Breakaway X-Y Fiberglass	1
		Screw	6
2	075509	Socket Cap, 1/4-20 X 1/2 Inch Hex BTN S/Z	4
3	027574	Breakaway, Command THC	1
		Screw	2
		Collar	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	Tubing, 1/4 inch O.D. Synflex	10 ft. (3m)
	129361	Regulator/Filter Assembly	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 Command THC

Ohmic Contact Wire



Item	Part Number	Description	Length	Quantity
1	123542	Wire, Ohmic Contact	10 ft./3 m	1
	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./45.6 m	

HD4070 - Least Replacement Units	
Part Number	Descriptions
120651	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	Capasitor: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
041664	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

027664	Filter Element
006113	Check Valve :3/8 FTP
129489	flow switch SA
011084	Sight Glass
027632	Radiator
031138	Coolant system pump
229036	Pump motor
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 Capasitor Replacement
129616	Inductor
027648	Igniotion 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: PS 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: PS 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)

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: PS 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: PS 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: PS 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	
128430	6 ft. (1.8 m)
128431	10 ft. (3 m)
128342	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)

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)

Hypertherm

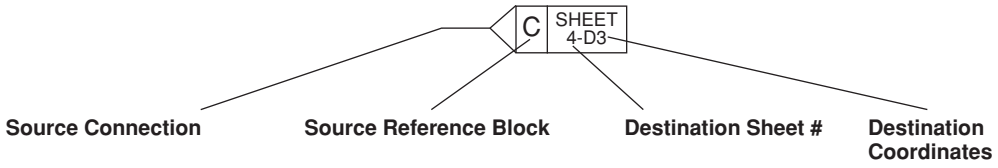
Section 7

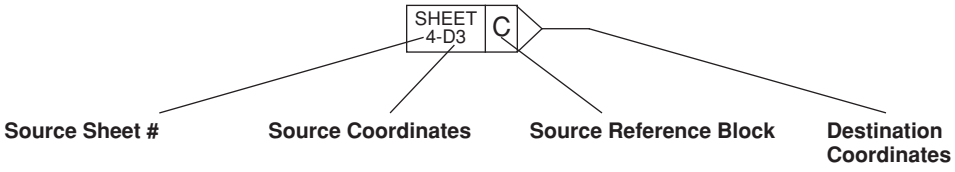
WIRING DIAGRAMS

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:

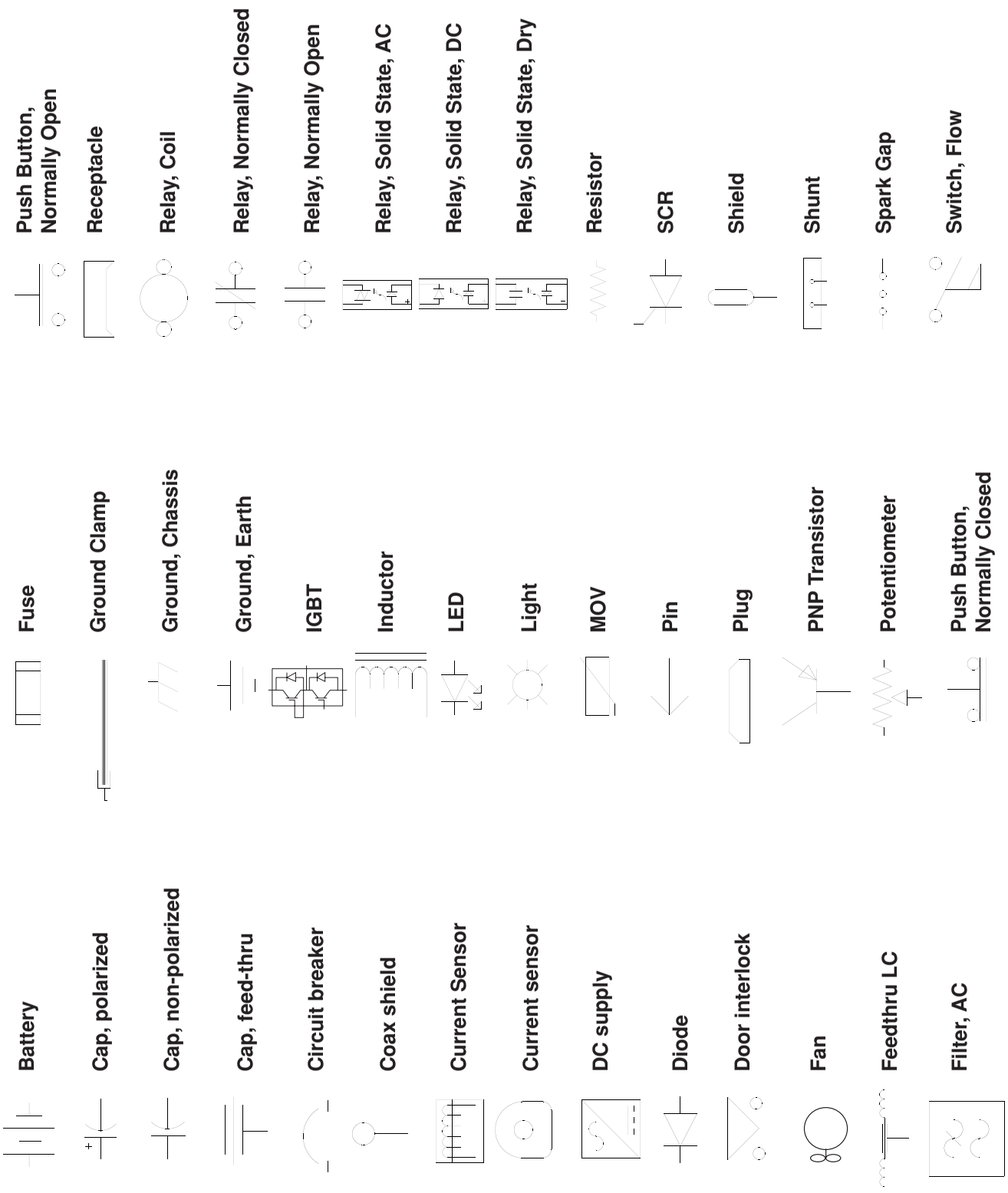




Destination and **Source Coordinates** refer to letters A-D on the Y-axis of each sheet and numbers 1-4 on the X-axis of each sheet. Lining up the coordinates will bring you to the source or destination blocks (similar to a road map).

Wiring Diagram Symbols

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


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

Torch Symbols

Electrode

Nozzle

Shield

Torch

Torch, HyDefinition™

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

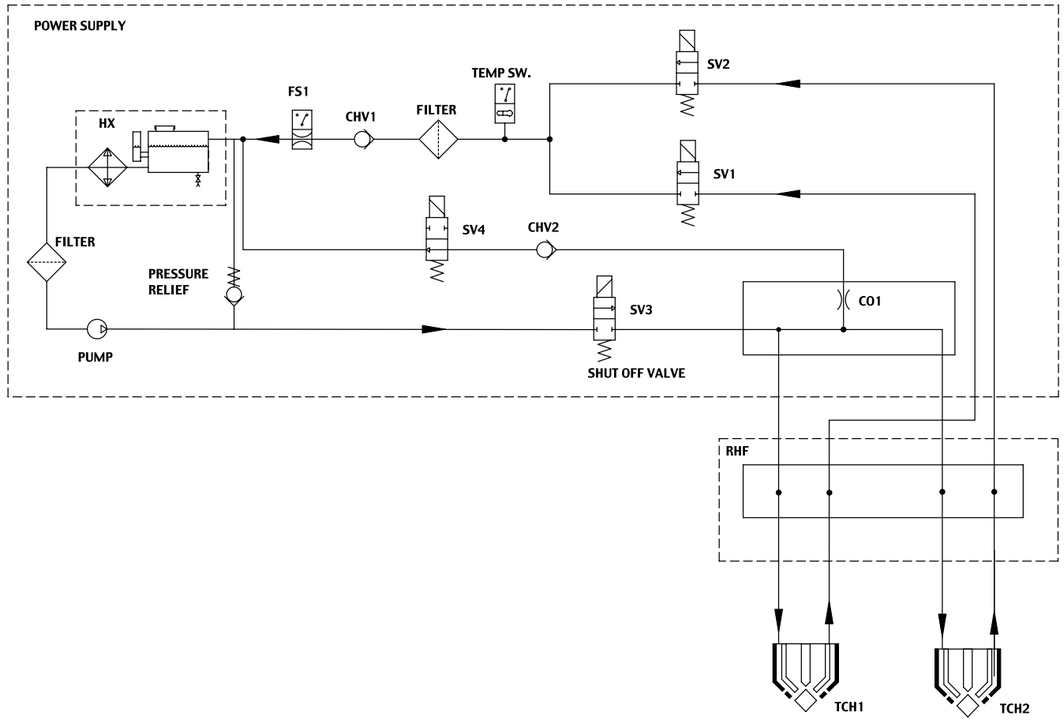
Triac

VAC Source

Valve, Solenoid

Voltage Source

Zener Diode

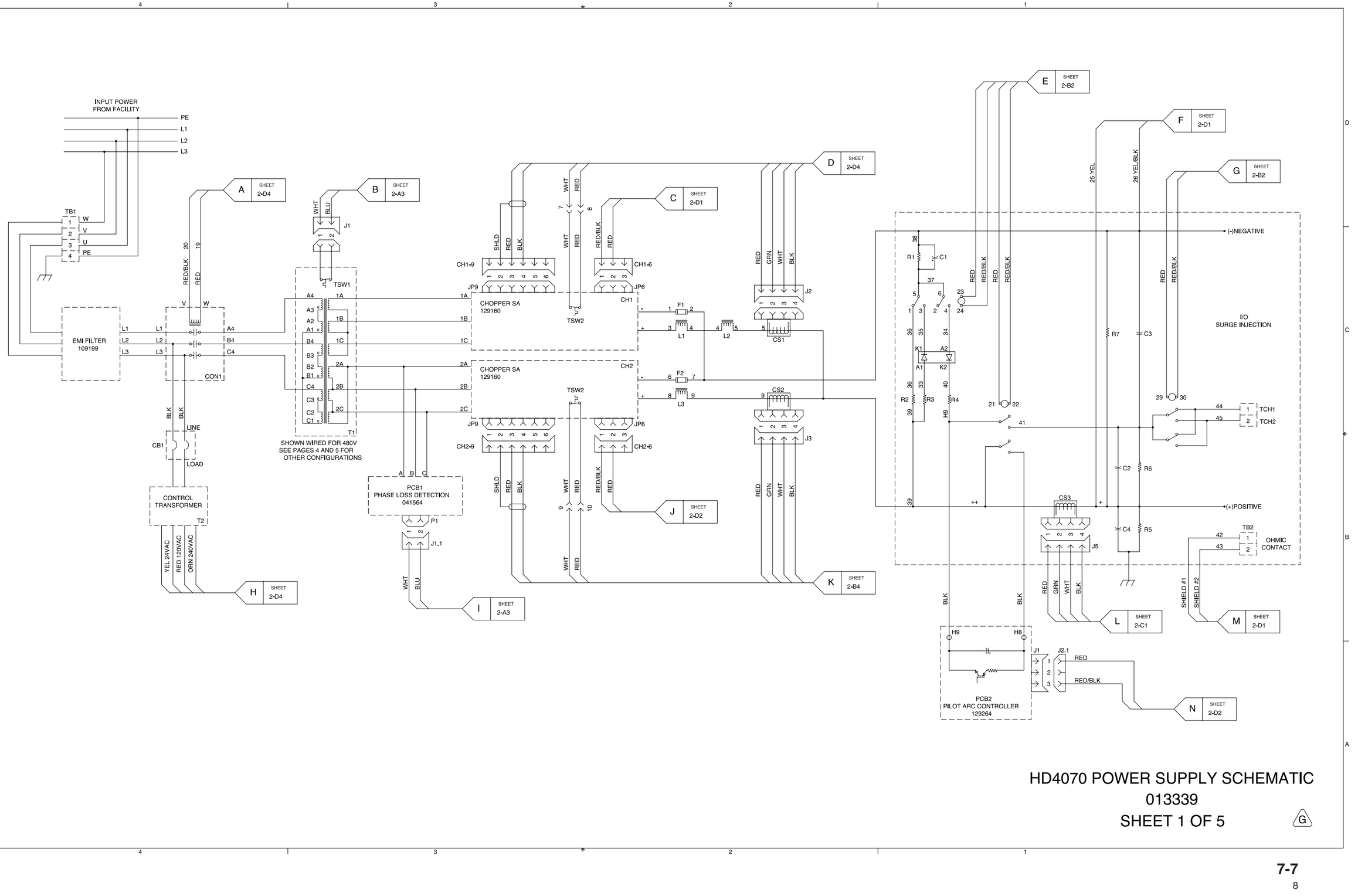


HD4070 COOLING SYSTEM SCHEMATIC

013334

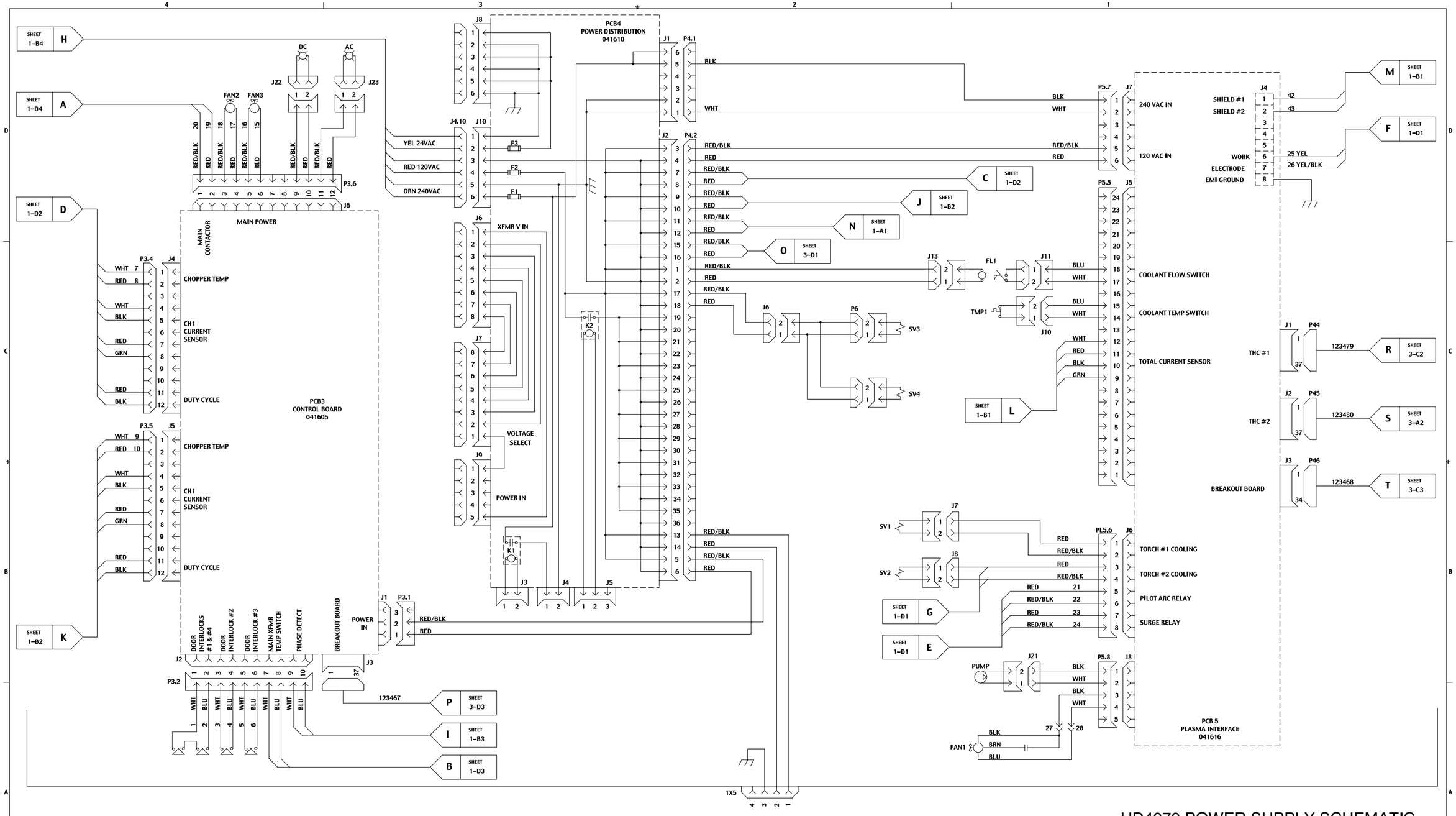
SHEET 1 OF 1

D

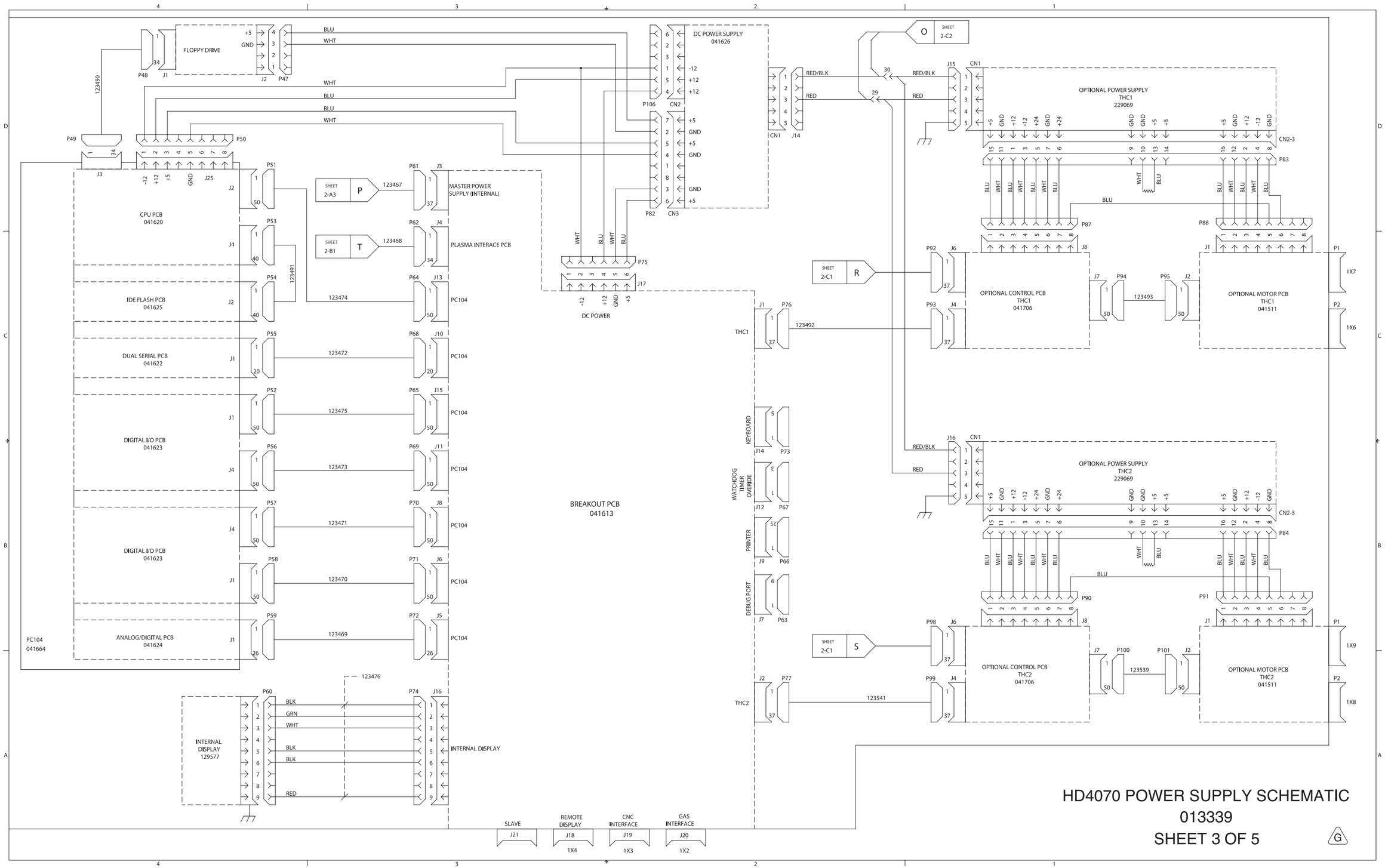


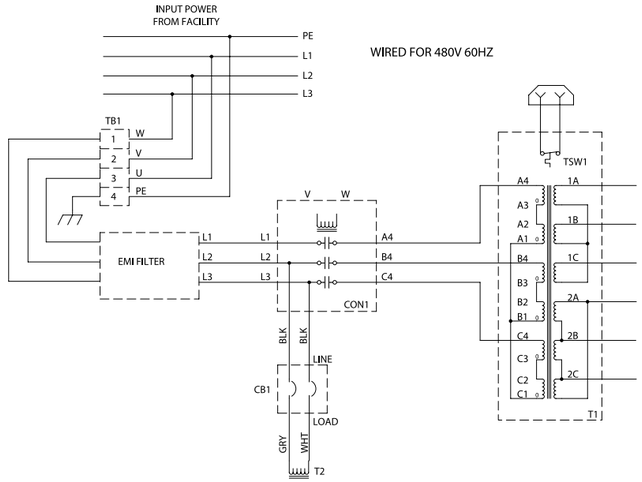
HD4070 POWER SUPPLY SCHEMATIC
013339
SHEET 1 OF 5

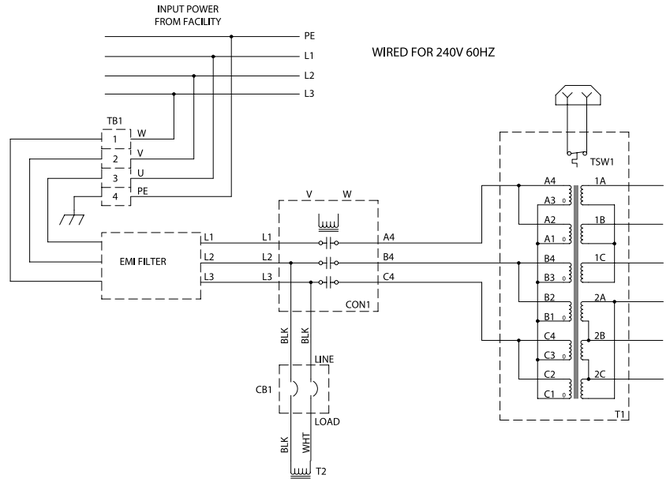
G

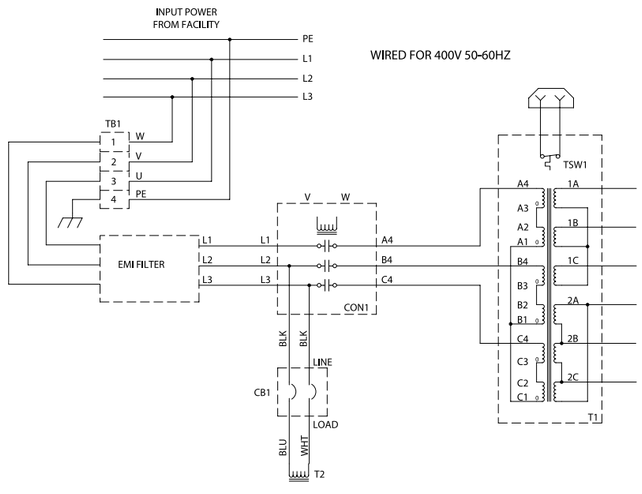


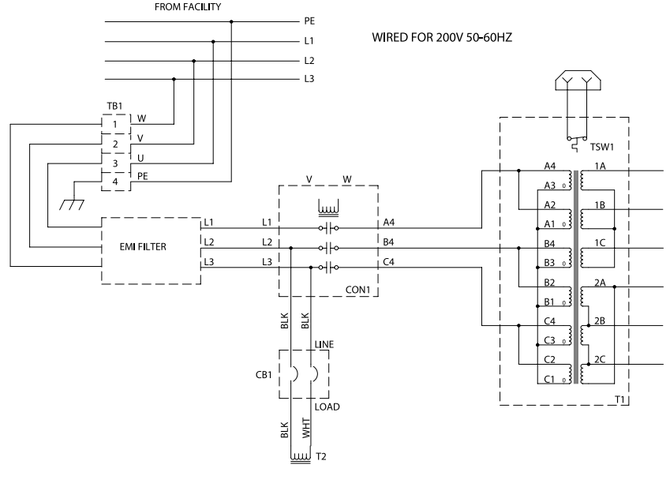
HD4070 POWER SUPPLY SCHEMATIC
013339
SHEET 2 OF 5


FLOPPY DRIVE
P48 J1
J2 P47
123490
DC POWER SUPPLY
041626
P106 CN2
P82 CN3
CN1 J14
P49 P50
J3 J25
CPU PCB
041620
J2 P51
J4 P53
IDE FLASH PCB
041625
J2 P54
123491
DUAL SERIAL PCB
041622
J1 P55
DIGITAL I/O PCB
041623
J1 P52
J4 P56
DIGITAL I/O PCB
041623
J4 P57
J1 P58
ANALOG/DIGITAL PCB
041624
J1 P59
PC104
041664
SHEET 2-A3 P 123467
SHEET 2-B1 T 123468
123474
123472
123475
123473
123471
123470
123469
MASTER POWER SUPPLY (INTERNAL)
PLASMA INTERACE PCB
PC104
P61 J3
P62 J4
P64 J13
P68 J10
P65 J15
P69 J11
P70 J8
P71 J6
P72 J5
P75 J17
DC POWER
BREAKOUT PCB
041613
123476
INTERNAL DISPLAY
129577
P60
P74 J16
BLK
GRN
WHT
BLK
BLK
RED
INTERNAL DISPLAY
SLAVE J21
REMOTE DISPLAY J18 1X4
CNC INTERFACE J19 1X3
GAS INTERFACE J20 1X2
THC1
J1 P76
123492
KEYBOARD J14 P73
WATCHDOG TIMER OVERIDE J12 P67
PRINTER J9 P66
DEBUG PORT J7 P63
THC2
J2 P77
123541
SHEET 2-C2 O
RED/BLK
RED
J15 CN1
OPTIONAL POWER SUPPLY
THC1
229069
CN2-3
P83
P87
P88
SHEET 2-C1 R
P92 J6
P93 J4
OPTIONAL CONTROL PCB
THC1
041706
J8
J7 P94
123493
P95 J2
OPTIONAL MOTOR PCB
THC1
041511
J1 P1
1X7
P2
1X6
J16 CN1
OPTIONAL POWER SUPPLY
THC2
229069
P84
P90
P91
SHEET 2-C1 S
P98 J6
P99 J4
OPTIONAL CONTROL PCB
THC2
041706
J7 P100
123539
P101 J2
OPTIONAL MOTOR PCB
THC2
041511
J1 P1
1X9
P2
1X8
HD4070 POWER SUPPLY SCHEMATIC
013339
SHEET 3 OF 5
G



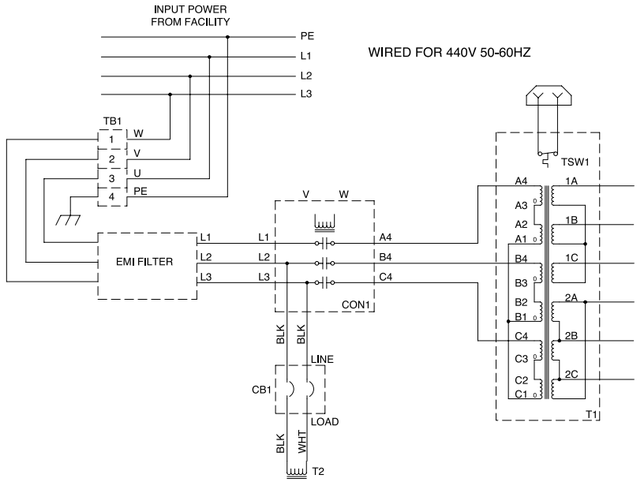


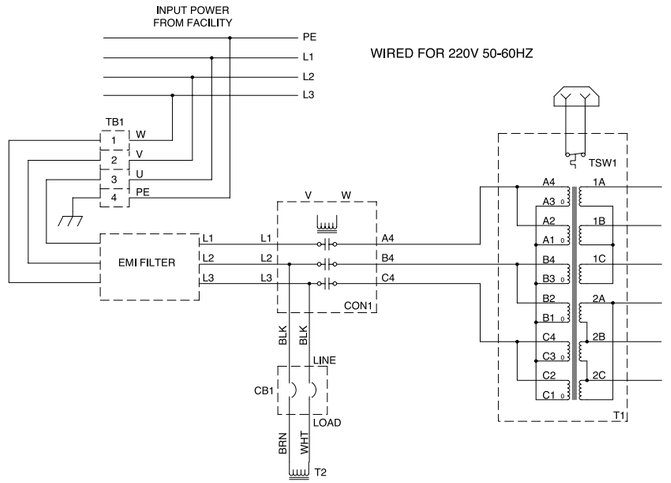


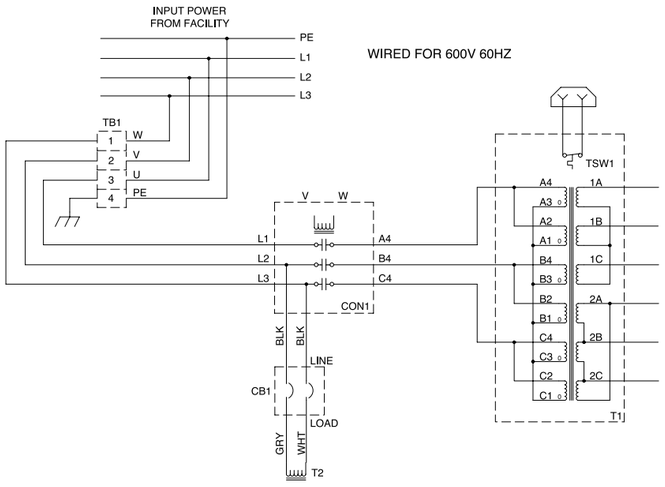


HD4070 POWER SUPPLY SCHEMATIC
013339
SHEET 4 OF 5

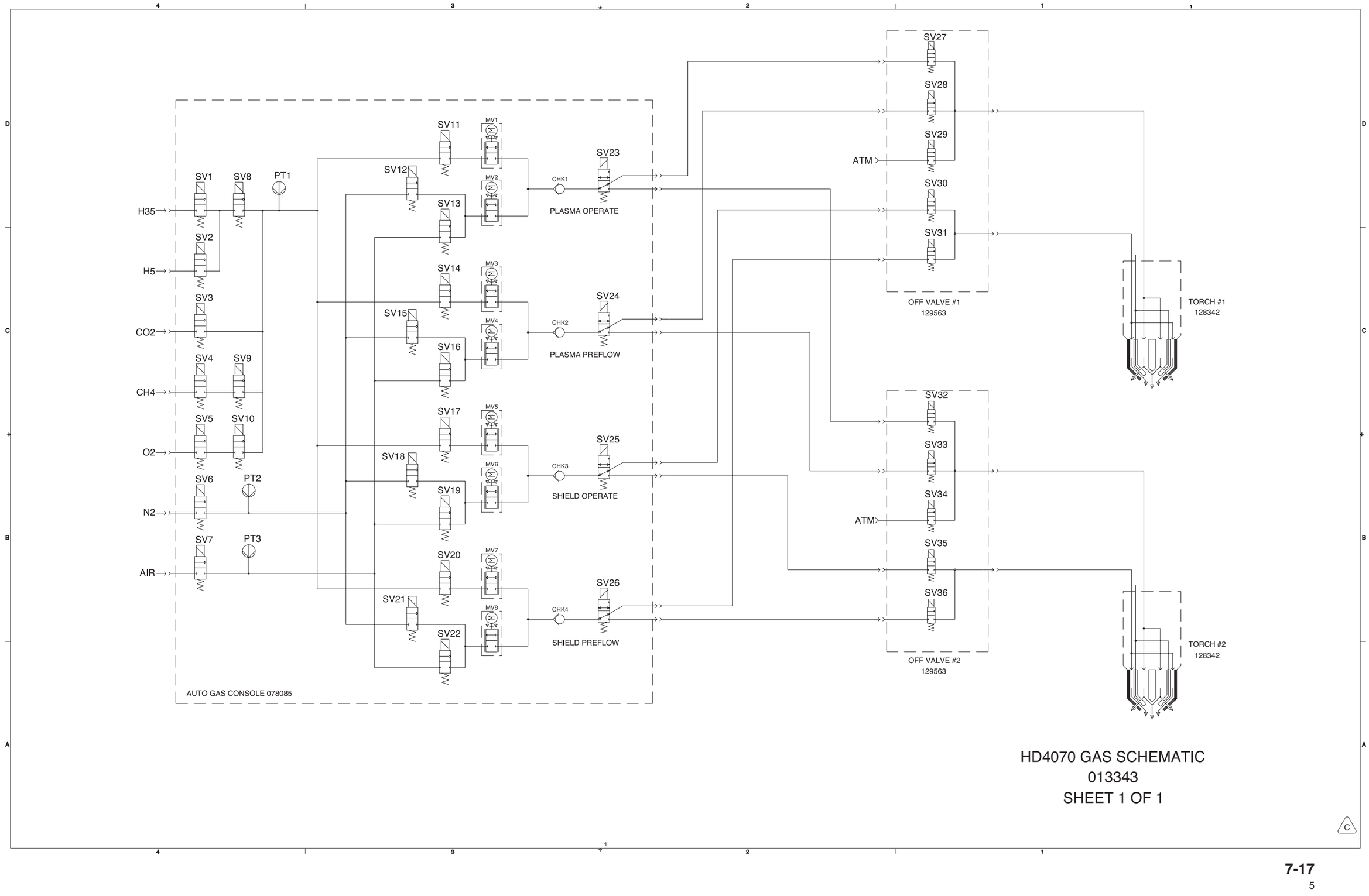
G







HD4070 POWER SUPPLY SCHEMATIC
013339
SHEET 5 OF 5



HD4070 GAS SCHEMATIC
013343
SHEET 1 OF 1

041594 PCB
PCB 1

P2-1 J2

1 SV1 2: RED/BLK; RED
3 SV2 4: RED; RED/BLK
5 SV3 6: RED/BLK; RED
18 SV9 17 / 8 SV4 7: RED; RED/BLK
19 SV10 20 / 9 SV5 10: RED/BLK; RED
12 SV6 11: RED; RED/BLK
RED/BLK; RED/BLK; RED; RED
13 SV7 14: RED/BLK; RED
16 SV8 15: RED; RED/BLK
21 SV11 22: RED/BLK; RED
24 SV12 23: RED; RED/BLK
25 SV13 26: RED/BLK; RED
28 SV14 27: RED; RED/BLK
29 SV15 30: RED/BLK; RED
32 SV16 31: RED; RED/BLK
33 SV17 34: RED/BLK; RED
36 SV18 35: RED; RED/BLK

1 OUTPUT 3
2
3
4 OUTPUT 4
5 OUTPUT 2
6
7
8 OUTPUT 5
9 OUTPUT 1
10
11
12 OUTPUT 6
13
14 120VAC
15
16 OUTPUT 7
17
18
19
20 OUTPUT 8
21 OUTPUT 16
22
23
24 OUTPUT 9
25 OUTPUT 15
26
27
28 OUTPUT 10
29 OUTPUT 14
30
31
32 OUTPUT 11
33 OUTPUT 13
34
35 120VAC RTN
36 OUTPUT 12

SHEET 3-A4 B
SHEET 2-B3 C

3X1
1 RED/BLK
2 RED
3
4

P1-1 J1
1
2
3

P3-1 J3

37 SV19 38: RED/BLK; RED
39 SV20 40: RED; RED/BLK
42 SV21 41: RED/BLK; RED
43 SV22 44: RED; RED/BLK
51 SV26 52 / 49 SV25 50 / 47 SV24 48 / 45 SV23 46: RED/BLK; RED
BLU; RED
BLK; RED; BLU; BLK

1 OUTPUT 18
2
3 OUTPUT 19
4
5
6 OUTPUT 20
7 OUTPUT 17
8
9 OUTPUT 21
10
11
12 OUTPUT 22 CLOSE VALVE
13
14
15 OUTPUT 23 OPEN VALVE
16 OUTPUT 25 CLOSE VALVE
17 120VAC RTN
18 OUTPUT 24 OPEN VALVE

SHEET 4-A1 D
SHEET 4-A1 E

OUTPUT ENABLE
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
OUT 12
OUT 13
OUT 14
OUT 15
OUT 16
OUT 17
OUT 18
OUT 19
OUT 20
OUT 21
OUT 22
OUT 23
OUT 24
OUT 25
GND
CABLE CHK

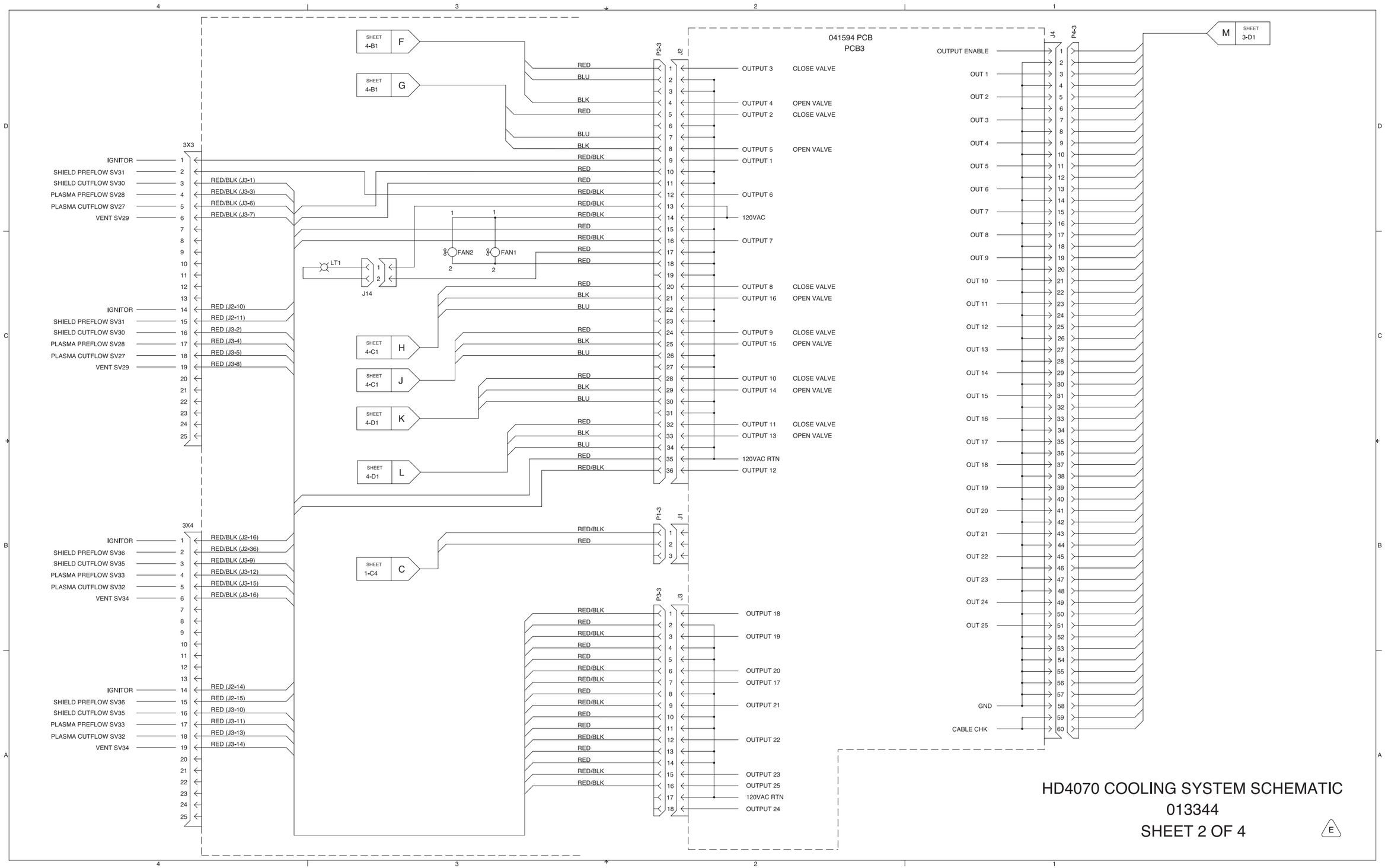
J4 P4-1

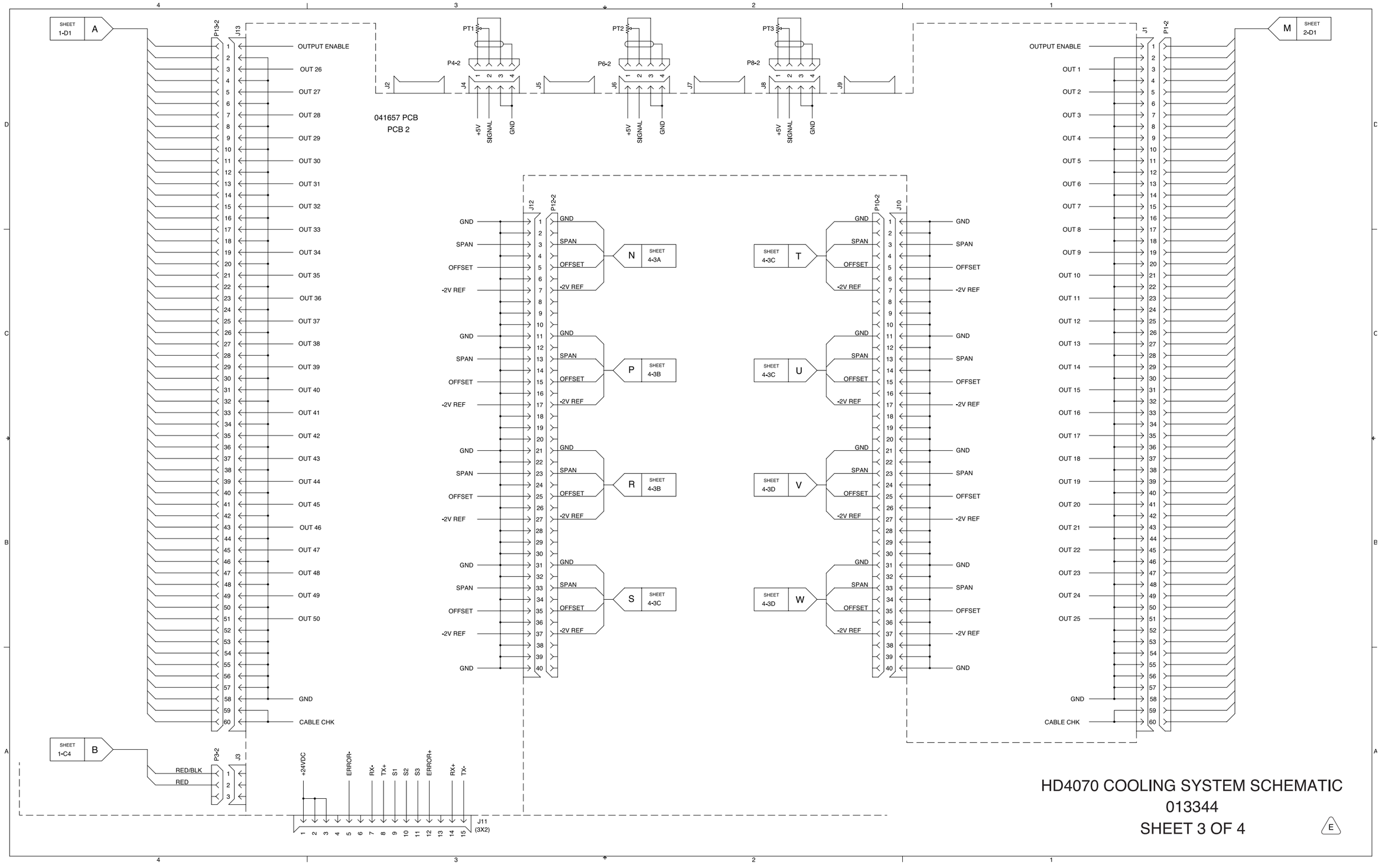
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

A SHEET 3-D4

HD4070 COOLING SYSTEM SCHEMATIC
013344
SHEET 1 OF 4

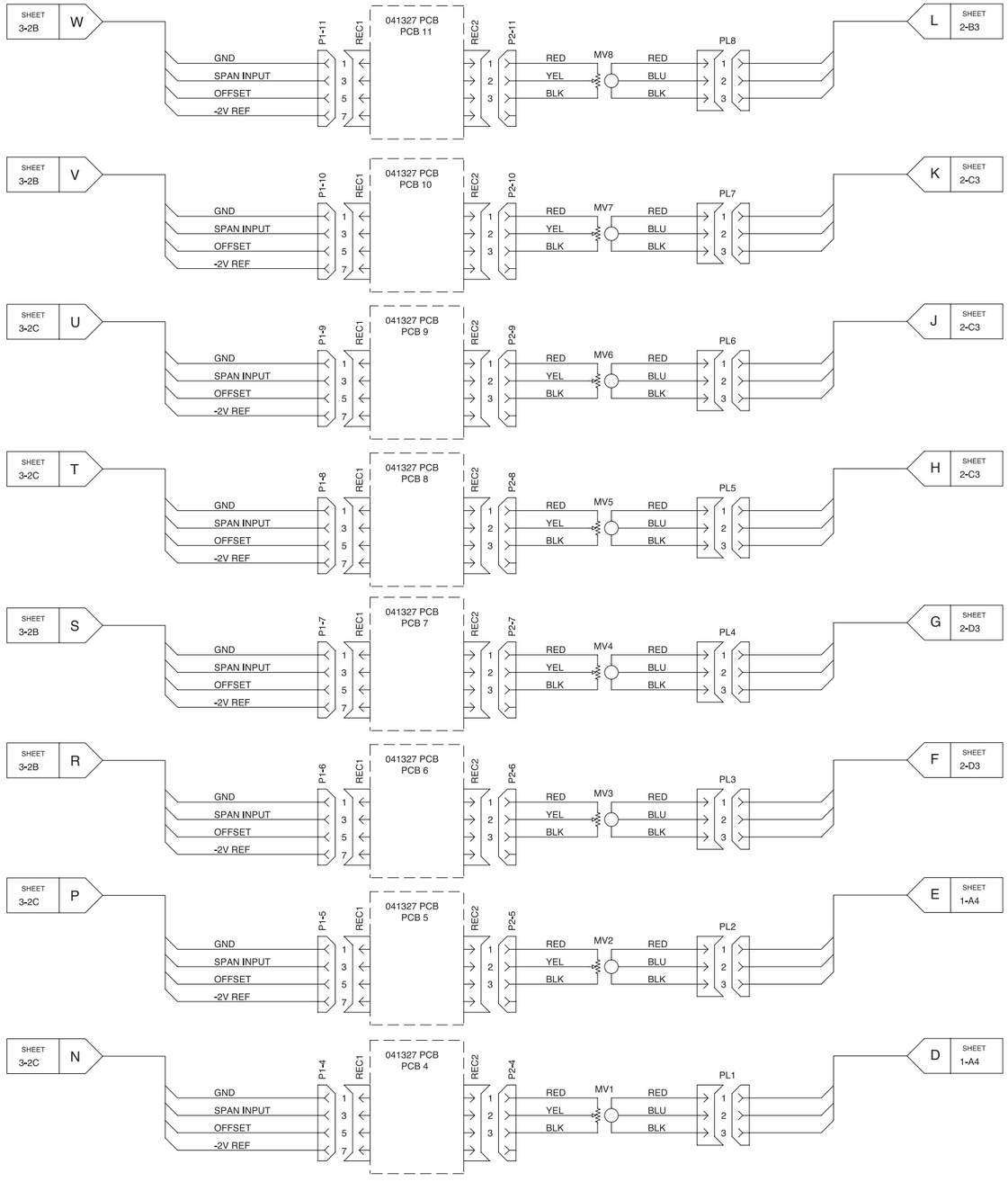
E


041594 PCB
PCB3
3X3
IGNITOR
SHIELD PREFLOW SV31
SHIELD CUTFLOW SV30
PLASMA PREFLOW SV28
PLASMA CUTFLOW SV27
VENT SV29
RED/BLK (J3-1)
RED/BLK (J3-3)
RED/BLK (J3-6)
RED/BLK (J3-7)
RED (J2-10)
RED (J2-11)
RED (J3-2)
RED (J3-4)
RED (J3-5)
RED (J3-8)
3X4
SHIELD PREFLOW SV36
SHIELD CUTFLOW SV35
PLASMA PREFLOW SV33
PLASMA CUTFLOW SV32
VENT SV34
RED/BLK (J2-16)
RED/BLK (J2-36)
RED/BLK (J3-9)
RED/BLK (J3-12)
RED/BLK (J3-15)
RED/BLK (J3-16)
RED (J2-14)
RED (J2-15)
RED (J3-10)
RED (J3-11)
RED (J3-13)
RED (J3-14)
LT1
J14
FAN2
FAN1
SHEET 4-B1 F
SHEET 4-B1 G
SHEET 4-C1 H
SHEET 4-C1 J
SHEET 4-D1 K
SHEET 4-D1 L
SHEET 1-C4 C
P2-3
J2
P1-3
J1
P3-3
J3
OUTPUT 3 CLOSE VALVE
OUTPUT 4 OPEN VALVE
OUTPUT 2 CLOSE VALVE
OUTPUT 5 OPEN VALVE
OUTPUT 1
OUTPUT 6
120VAC
OUTPUT 7
OUTPUT 8 CLOSE VALVE
OUTPUT 16 OPEN VALVE
OUTPUT 9 CLOSE VALVE
OUTPUT 15 OPEN VALVE
OUTPUT 10 CLOSE VALVE
OUTPUT 14 OPEN VALVE
OUTPUT 11 CLOSE VALVE
OUTPUT 13 OPEN VALVE
120VAC RTN
OUTPUT 12
OUTPUT 18
OUTPUT 19
OUTPUT 20
OUTPUT 17
OUTPUT 21
OUTPUT 22
OUTPUT 23
OUTPUT 25
120VAC RTN
OUTPUT 24
J4
P4-3
SHEET 3-D1 M
OUTPUT ENABLE
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
OUT 12
OUT 13
OUT 14
OUT 15
OUT 16
OUT 17
OUT 18
OUT 19
OUT 20
OUT 21
OUT 22
OUT 23
OUT 24
OUT 25
GND
CABLE CHK
HD4070 COOLING SYSTEM SCHEMATIC
013344
SHEET 2 OF 4
E



HD4070 COOLING SYSTEM SCHEMATIC
013344
SHEET 3 OF 4

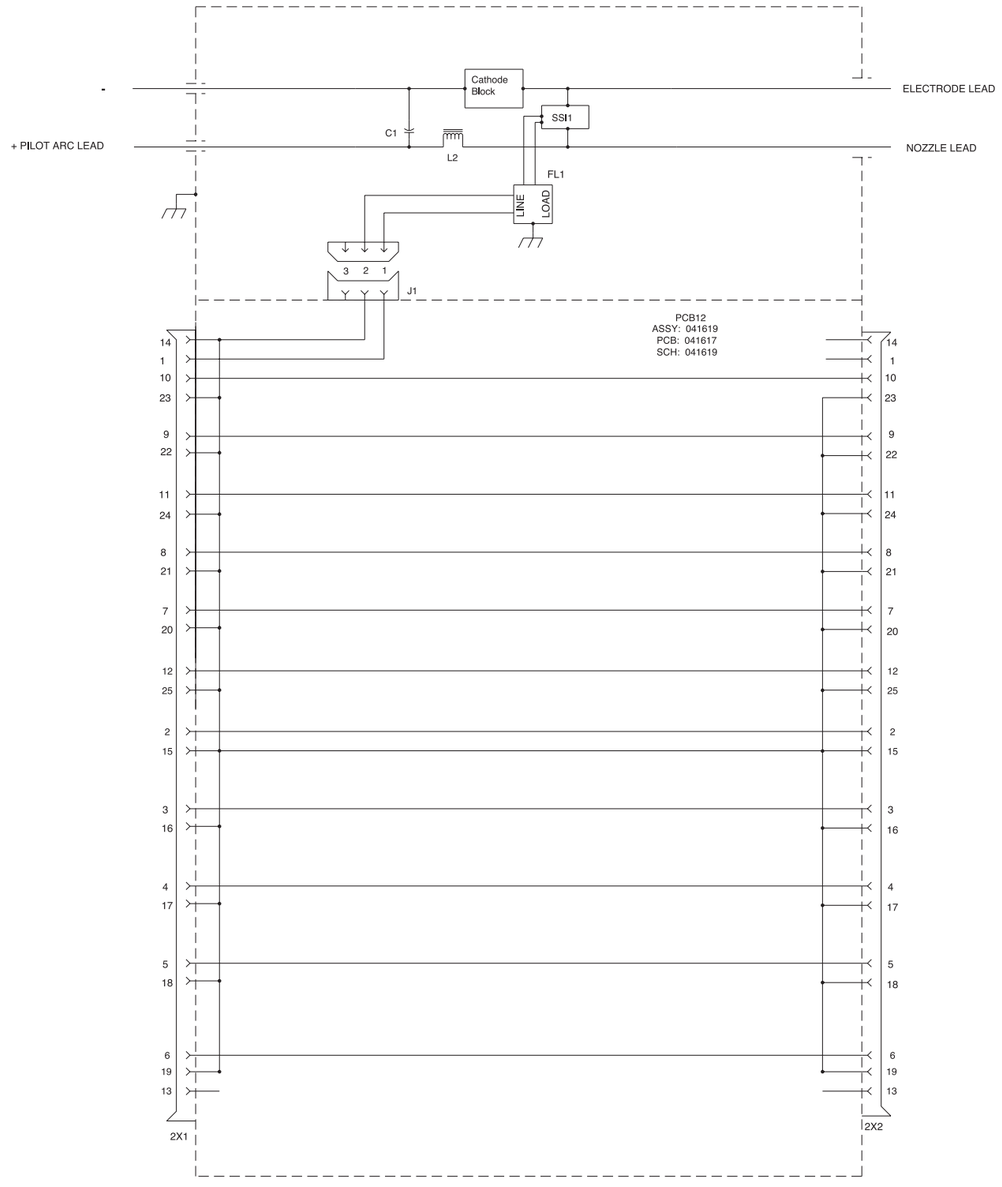
E



HD4070 COOLING SYSTEM SCHEMATIC
013344
SHEET 4 OF 4

E

IGNITION CONSOLE
078088



HD4070 IGNITION CONSOLE SCHEMATIC
013345
SHEET 1 OF 1

A

NOTES:

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

POWER SUPPLY

ASSEMBLY PART NUMBER

078135	200V, NO THC, NO DISPLAY
078136	200V, 1 THC, NO DISPLAY
078137	200V, 2 THC, NO DISPLAY
078138	200V, 0 THC, WITH DISPLAY
078139	200V, 1 THC, WITH DISPLAY
078140	200V, 2 THC, WITH DISPLAY
078141	220V, NO THC, NO DISPLAY
078142	220V, 1 THC, NO DISPLAY
078143	220V, 2 THC, NO DISPLAY
078144	220V, 0 THC, WITH DISPLAY
078145	220V, 1 THC, WITH DISPLAY
078146	220V, 2 THC, WITH DISPLAY
078134	240V, NO THC, NO DISPLAY
078147	240V, 1 THC, NO DISPLAY
078148	240V, 2 THC, NO DISPLAY
078149	240V, 0 THC, WITH DISPLAY
078150	240V, 1 THC, WITH DISPLAY
078151	240V, 2 THC, WITH DISPLAY
078089	400V, NO THC, NO DISPLAY
078090	400V, 1 THC, NO DISPLAY
078091	400V, 2 THC, NO DISPLAY
078092	400V, 0 THC, WITH DISPLAY
078093	400V, 1 THC, WITH DISPLAY
078094	400V, 2 THC, WITH DISPLAY
078095	440V, NO THC, NO DISPLAY
078096	440V, 1 THC, NO DISPLAY
078097	440V, 2 THC, NO DISPLAY
078098	440V, 0 THC, WITH DISPLAY
078099	440V, 1 THC, WITH DISPLAY
078100	440V, 2 THC, WITH DISPLAY
078087	480V, NO THC, NO DISPLAY
078101	480V, 1 THC, NO DISPLAY
078102	480V, 2 THC, NO DISPLAY
078103	480V, 0 THC, WITH DISPLAY
078104	480V, 1 THC, WITH DISPLAY
078105	480V, 2 THC, WITH DISPLAY
078106	600V, NO THC, NO DISPLAY
078107	600V, 1 THC, NO DISPLAY
078108	600V, 2 THC, NO DISPLAY
078109	600V, 0 THC, WITH DISPLAY
078110	600V, 1 THC, WITH DISPLAY
078111	600V, 2 THC, WITH DISPLAY

ELECTRICAL SCHEMATIC NUMBER
013339

COOLING SYSTEM SCHEMATIC NUMBER
013334

1X6 — LIFTER INTERFACE 123022 — THC LIFTER #1
ASSEMBLY PART NUMBER 128433

1X7 — MOTOR DRIVE 123020

OHMIC CONTACT 123542

PILOT ARC 123409
NEGATIVE LEAD 023382
024290
024266

IGNITION CONSOLE #1

ASSEMBLY PART NUMBER
078088

ELECTRICAL SCHEMATIC NUMBER
013345

123446 — 2X1

PART OF TORCH/LEADS

123451 — 2X2 — 4X1

TORCH/LEADS #1

ASSEMBLY PART NUMBER
128342

GAS SCHEMATIC NUMBER
013343

OFF VALVE #1

ASSEMBLY PART NUMBER
129563

ELECTRICAL SCHEMATIC NUMBER
013347

GAS SCHEMATIC NUMBER
013343

PART OF TORCH/LEADS

3X3

123428 — 1X2 — 3X2

GAS CONSOLE

ASSEMBLY PART NUMBER
078085

ELECTRICAL SCHEMATIC NUMBER
013344

GAS SCHEMATIC NUMBER
013343

HOSE PACKAGE
128445

123419 — 1X5 — 3X1

3X4

OFF VALVE #2

ASSEMBLY PART NUMBER
129563

ELECTRICAL SCHEMATIC NUMBER
013347

GAS SCHEMATIC NUMBER
013343

HOSE PACKAGE
128445

PART OF TORCH/LEADS

IGNITION CONSOLE #2

ASSEMBLY PART NUMBER
078088

ELECTRICAL SCHEMATIC NUMBER
013345

123446 — 2X1

123451 — 2X2 — 4X1

PART OF TORCH/LEADS

TORCH/LEADS #2

ASSEMBLY PART NUMBER
128342

GAS SCHEMATIC NUMBER
013343

PILOT ARC 123409
NEGATIVE LEAD 023382
024290
024266

OHMIC CONTACT 123542

1X8 — LIFTER INTERFACE 123022 — THC LIFTER #2
ASSEMBLY PART NUMBER 128433

1X9 — MOTOR DRIVE 123020

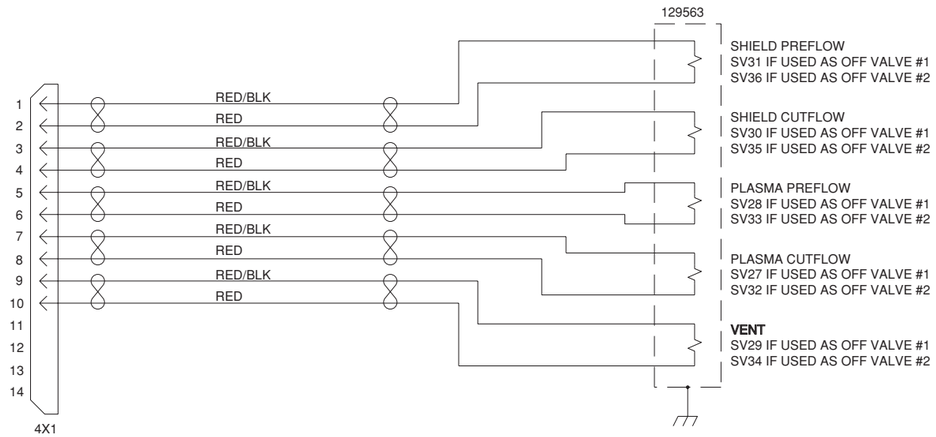
1X4 — 123018 — REMOTE DISPLAY

1X3 — 123437 — CNC INTERFACE

HD4070 BLOCK DIAGRAM
013346
SHEET 1 OF 1

1

A



HD4070 OFF VALVE
013347
SHEET 1 OF 1

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).

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 20 ft (6 m) 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.

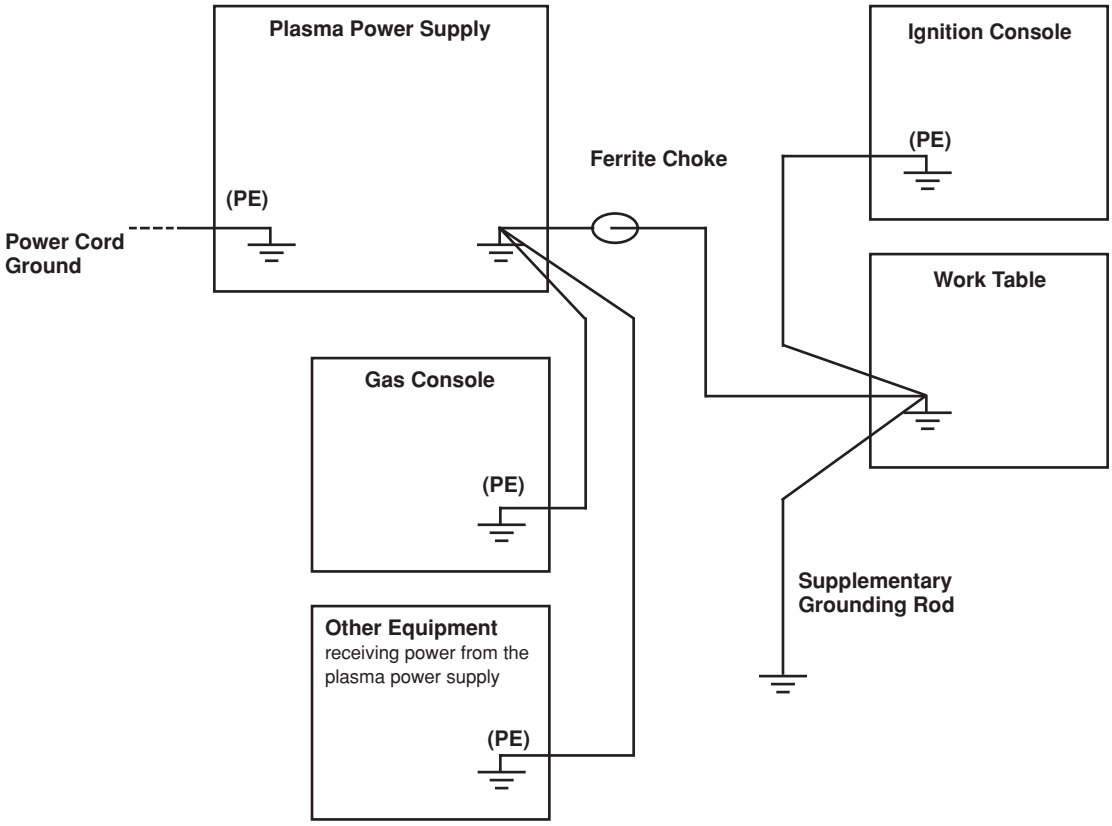


Figure a-1 Recommended Ground Connection Configuration

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

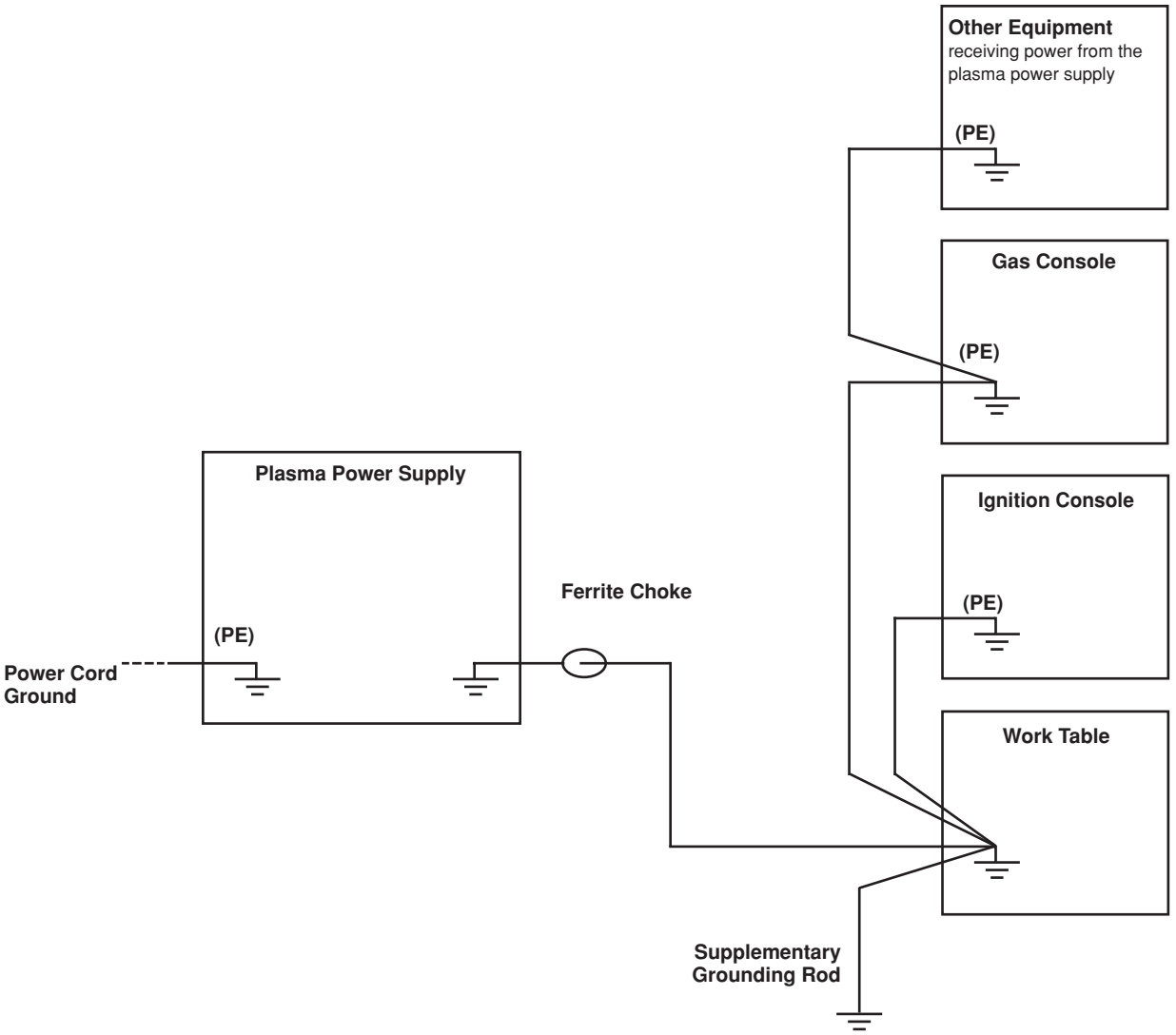


Figure a-2 Alternate Ground Connection Configuration

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.

Hypertherm

Appendix B

PROPYLENE GLYCOL SAFETY DATA
BENZOTRIAZOLE SAFETY DATA

In this appendix:

MATERIAL SAFETY DATA SHEET

SECTION 1 -- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	HYPERTHERM TORCH COOLANT

PRODUCT CODE	

ISSUE DATE	11-22-96

EMERGENCY TELEPHONE NUMBERS

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

SECTION 2 -- COMPOSITION / INFORMATION ON INGREDIENTS

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

SECTION 3 -- HAZARDS IDENTIFICATION

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

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

SECTION 4 -- FIRST AID MEASURES

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

SECTION 5 -- FIRE FIGHTING MEASURES

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

SECTION 6 -- ACCIDENTAL RELEASE MEASURES

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

SECTION 7 -- HANDLING AND STORAGE

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

SECTION 8 -- EXPOSURE CONTROLS / PERSONAL PROTECTION

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

PERSONAL PROTECTIVE EQUIPMENT

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

SECTION 9 -- PHYSICAL AND CHEMICAL PROPERTIES

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

SECTION 10 -- STABILITY AND REACTIVITY

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

SECTION 11 -- TOXICOLOGICAL INFORMATION

CARCINOGENICITY

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

OTHER EFFECTS

ACUTE	Not determined
CHRONIC	Not determined

SECTION 12 -- ECOLOGICAL INFORMATION

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

SECTION 13 -- DISPOSAL CONSIDERATIONS

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

SECTION 14 -- TRANSPORT INFORMATION

DOT CLASSIFICATION		HAZARDOUS			NOT HAZARDOUS	X
DESCRIPTION	Not applicable					

SECTION 15 -- REGULATORY INFORMATION

USA REGULATORY STATUS

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

SECTION 16 -- OTHER INFORMATION

NFPA CLASSIFICATION

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

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

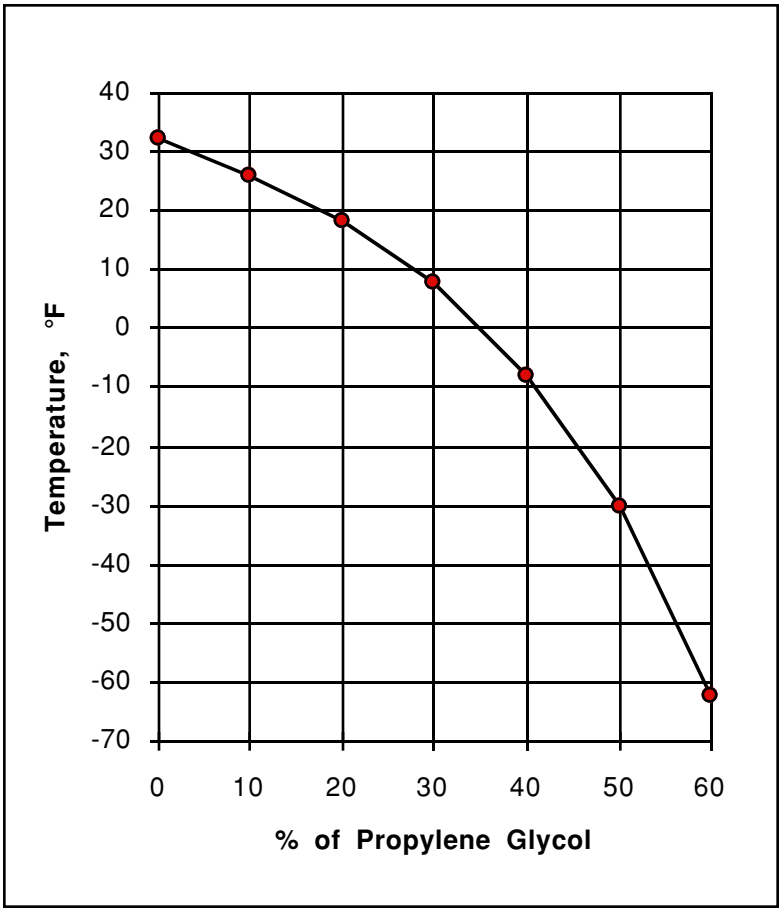


Figure b-1 Freezing Point of Propylene Glycol Solution

SECTION I

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

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

SECTION II INGREDIENTS

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

SECTION III PHYSICAL DATA

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

08/28/95

SECTION IV FIRE AND EXPLOSION HAZARD DATA

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

EXTINGUISHING MEDIA: Carbon Dioxide, Dry Chemical, Foam

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

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

SECTION V HEALTH HAZARD DATA

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

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

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

TOXICITY DATA:

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

SECTION VI REACTIVITY DATA

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

SECTION VII SPILL OR LEAK PROCEDURES

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

SECTION VIII SPECIAL PROTECTIVE INFORMATION

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

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

SECTION IX SPECIAL PRECAUTIONS

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

SECTION X REGULATORY STATUS

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

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

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

The information contained herein is based on the data available to us and is believed to be correct as of the date prepared; however, PMC SPECIALTIES GROUP, INC. makes no warranty, expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof.

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Appendix C

GAS REGULATORS

In this appendix:

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

Part Number	Description	Qty.
128544	**Kit: Oxygen, 2-Stage ***	**1**
128545	**Kit: Inert Gas, 2-Stage**	**1**
128546	**Kit: Hydrogen (H5, H35 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

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Appendix D

SERVICE SCREEN (#18) STATUS TABLE

In this appendix:

Input / Output (Screen 18)

Port 0	Base Addr 224H	Output
Bit 0	Select 160 amp	Pin 47
Bit 1	Select 80 amp	Pin 45
Bit 2	Select 40 amp	Pin 43
Bit 3	Select 20 amp	Pin 41
Bit 4	Select 10 amp	Pin 39
Bit 5	Select 1_10 current/ cable checkCout	Pin 37
Bit 6	Fan control	Pin 35
Bit 7	Contactor control	Pin 33

Port 1	Base Addr 225H	Input
Bit 0	Input power active	Pin 31
Bit 1	Missing phase detect	Pin 29
Bit 2	Chopper #1 temp OK	Pin 27
Bit 3	Chopper #2 temp OK	Pin 25
Bit 4	Temp_Airflow_OK	Pin 23
Bit 5	Output current OK	Pin 21
Bit 6	Slave input power active	Pin 19
Bit 7	Slave missing phase detect	Pin 17

Port 2	Base Addr 226H	Output
Bit 0	DC output On/Off	Pin 15
Bit 1	Slave 160 amp select	Pin 13
Bit 2	Slave 80 amp select	Pin 11
Bit 3	Slave 40 amp select	Pin 9
Bit 4	Slave 20 amp select	Pin 7
Bit 5	Slave 10 amp select	Pin 5
Bit 6	Slave 1_10 current	Pin 3
Bit 7	Slave fan control	Pin 1

Port 3	Base Addr 220H	Input
Bit 0	Slave Chopper #1 temp OK	Pin 47
Bit 1	Slave Chopper #2 temp OK	Pin 45
Bit 2	Slave_Temp_Airflow_OK	Pin 43
Bit 3	Slave current OK	Pin 41
Bit 4	Spare input	Pin 39
Bit 5	Transfer sense	Pin 37
Bit 6	Coolant flow switch	Pin 35
Bit 7	Coolant temp switch	Pin 33

Port 4	Base Addr 221H	Output
Bit 0	Slave contactor control	Pin 31
Bit 1	Slave DC output On/Off	Pin 29
Bit 2	Pump control	Pin 27
Bit 3	Torch #1 coolant	Pin 25
Bit 4	Torch #2 coolant	Pin 23
Bit 5	Spare out	Pin 21
Bit 6	Transfer 1	Pin 19
Bit 7	Spare_out2	Pin 17

Port 5	Base Addr 222H	Input
Bit 0	Plasma interface spare input	Pin 15
Bit 1	Master_door_interlock	Pin 13
Bit 2	Cable_checkA_in	Pin 11
Bit 3	Slave_door_interlock	Pin 9
Bit 4	Cable_checkC_in	Pin 7
Bit 5	Gas_error	Pin 5
Bit 6	Spare_in4	Pin 3
Bit 7	Spare_in19	Pin 1

Port 6	Base Addr 50H	Ouput
Bit 0	Spare_out14	Pin 47
Bit 1	Spare_out15	Pin 45
Bit 2	Spare_out16	Pin 43
Bit 3	Spare_out17	Pin 41
Bit 4	Spare_out7	Pin 39
Bit 5	Spare_out8	Pin 37
Bit 6	Spare_out20	Pin 35
Bit 7	Spare_out21	Pin 33

Port 7	Base Addr 51H	Input
Bit 0	Spare_in1	Pin 31
Bit 1	Spare_in2	Pin 29
Bit 2	Spare_in3	Pin 27
Bit 3	Spare_in6	Pin 25
Bit 4	Spare_in7	Pin 23
Bit 5	Spare_in8	Pin 21
Bit 6	Spare_in9	Pin 19
Bit 7	Spare_in10	Pin 17

Port 8	Base Addr 52H	Input
Bit 0	Spare_in11	Pin 15
Bit 1	Spare_in12	Pin 13
Bit 2	Spare_in13	Pin 11
Bit 3	Spare_in14	Pin 9
Bit 4	Spare_in15	Pin 7
Bit 5	Spare_in16	Pin 5
Bit 6	Spare_in17	Pin 3
Bit 7	Spare_in18	Pin 1

Port 9	Base Addr 200H	Output
Bit 0	Transfer 2	Pin 47
Bit 1	Transfer 3	Pin 45
Bit 2	Select 5 amp	Pin 43
Bit 3	Select 2 amp	Pin 41
Bit 4	Watchdog_out	Pin 39
Bit 5	Slave 5 amp select	Pin 37
Bit 6	Slave 2 amp select	Pin 35
Bit 7	Cable_checkB_out	Pin 33

Port 10	Base Addr 201H	Output
Bit 0	Pilot arc relay	Pin 31
Bit 1	Surge injection select	Pin 29
Bit 2	Spare_out13	Pin 27
Bit 3	THC1 cycle start	Pin 25
Bit 4	THC2 cycle start	Pin 23
Bit 5	Analog6_check_out	Pin 21
Bit 6	Cable_checkA_out	Pin 19
Bit 7	Spare_out18	Pin 17

Port 11	Base Addr 202H	Output
Bit 0	Gas_state1	Pin 15
Bit 1	Gas_state2	Pin 13
Bit 2	Gas_state3	Pin 11
Bit 3	Spare_out19	Pin 9
Bit 4	CNC_transfer	Pin 7
Bit 5	CNC_motion	Pin 5
Bit 6	THC1_corner_hold	Pin 3
Bit 7	THC2_corner_hold	Pin 1

Port 12	Base Addr 204H	Input
Bit 0	THC1 Retract complete	Pin 47
Bit 1	THC1 Cable install	Pin 45
Bit 2	THC1 Discrete error	Pin 43
Bit 3	THC2 Retract complete	Pin 41
Bit 4	THC2 Cable installed	Pin 39
Bit 5	THC2 Discrete error	Pin 37
Bit 6	THC2 IHS complete	Pin 35
Bit 7	CNC system start	Pin 33

Port 13	Base Addr 205H	Input
Bit 0	CNC corner hold	Pin 31
Bit 1	CNC plasma sync	Pin 29
Bit 2	CNC emergency stop	Pin 27
Bit 3	CNC machine cable installed	Pin 25
Bit 4	CNC spare input	Pin 23
Bit 5	Watchdog_interlock	Pin 21
Bit 6	THC1 IHS complete	Pin 19
Bit 7	Cable_checkB_in	Pin 17

Port 14	Base Addr 206H	Output
Bit 0	CNC ready to fire	Pin 15
Bit 1	CNC arc transfer	Pin 13
Bit 2	CNC machine motion	Pin 11
Bit 3	CNC retract complete	Pin 9
Bit 4	CNC spare output	Pin 7
Bit 5	CNC system error	Pin 5
Bit 6	Serial Select1	Pin 3
Bit 7	Serial Select2	Pin 1

	Serial Channels	Addr
Com 1	Debug port	03F8H
Com 2	Display serial	02F8H
Com 3	CNC Serial	03E8H
Com 4	THC1/THC2 switched serial	02E8H

100H	Analog Inputs	Input
Channel	Total current	Pin 1
Channel	Power Check	Pin 2
Channel	Not used	Pin 3
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

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Appendix E

COMMAND THC AND CNC SOFTWARE – SUPPLEMENTAL INFORMATION

In this appendix:

Command THC 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

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.

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

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

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)

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

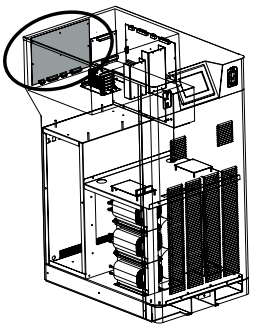
PS_ERROR – PS has an internal software or configuration error
Response Data – (error code)

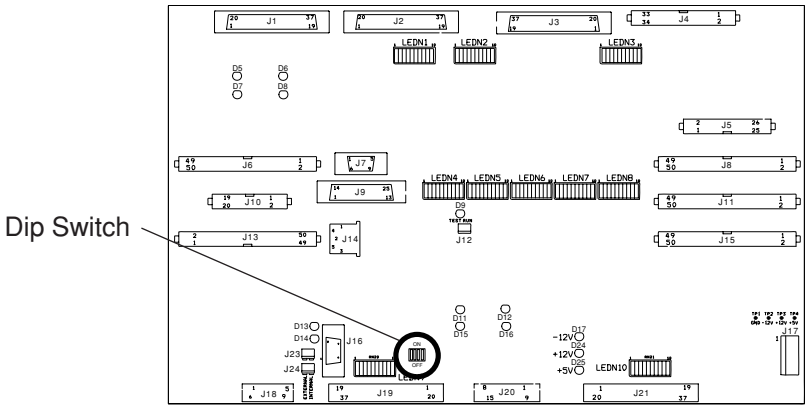
Suggestions for CNC Serial Expansion to Multiple Plasma Systems

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.

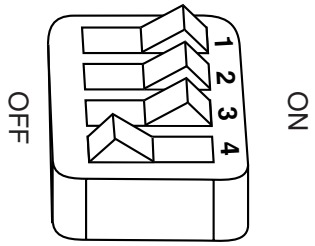
Breakout Board Dip Switch Configurations





Single machine configuration

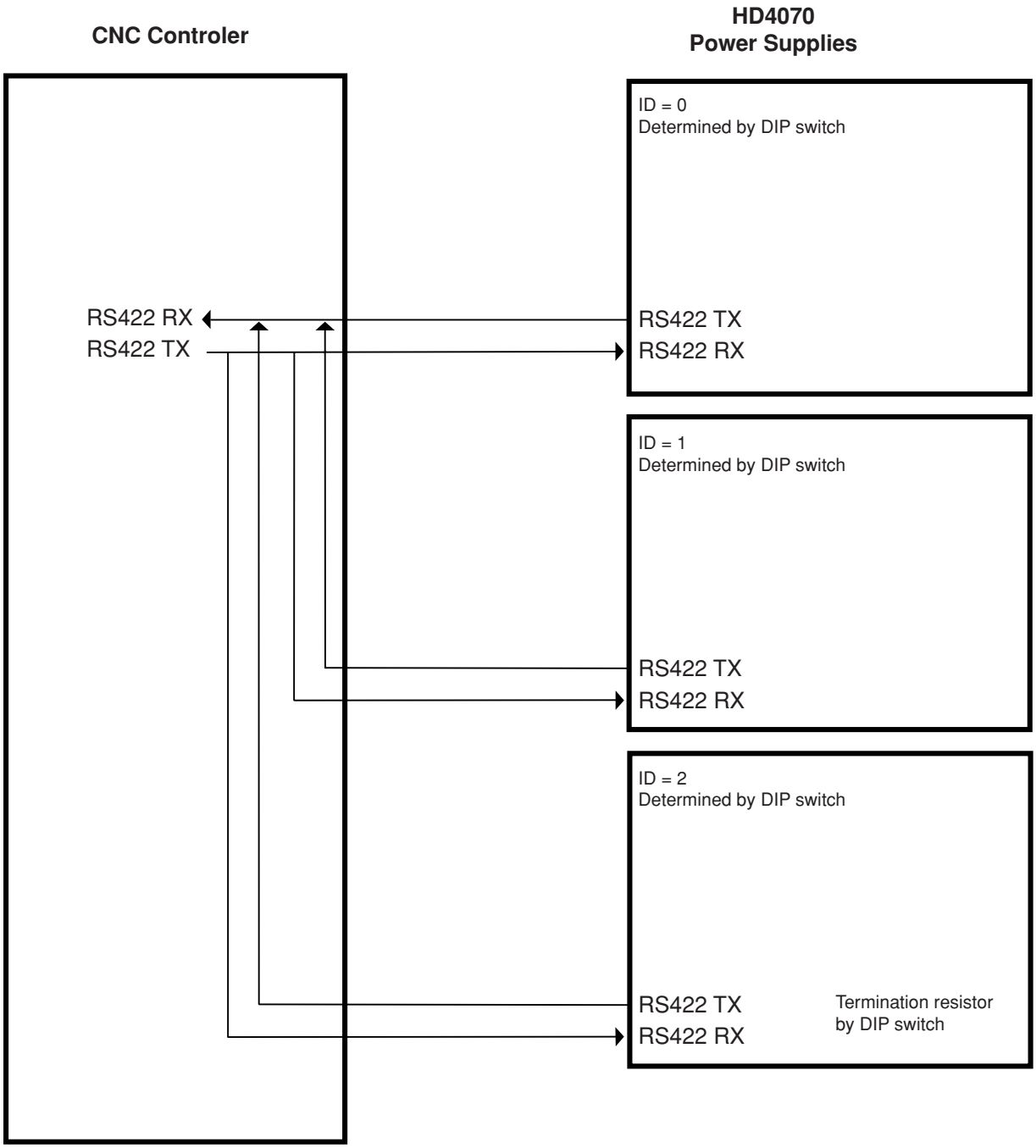
Switch number 4 must be in the ON position in a single system configuration. Switch 1, 2 and 3 are OFF.



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

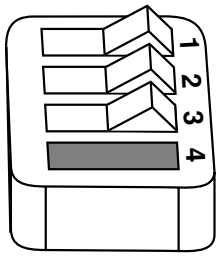


Dip Switch Configurations for Multiple Machines

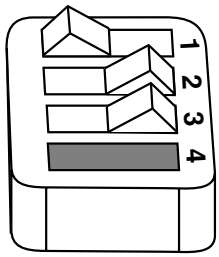
CAUTION

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.

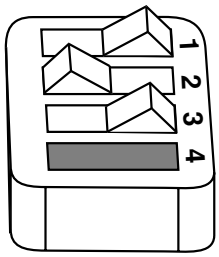
1st in a series - ID = 0



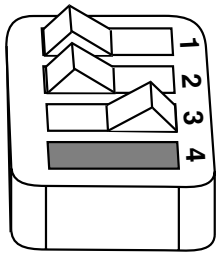
2nd in series - ID = 1



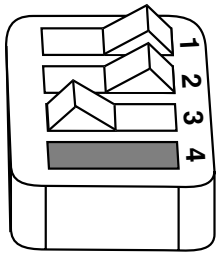
3rd in series - ID = 2



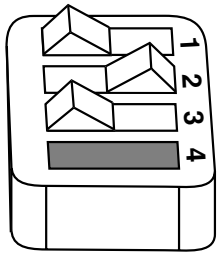
4th in series - ID = 3



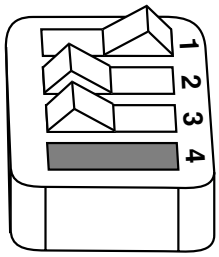
5th in series - ID = 4



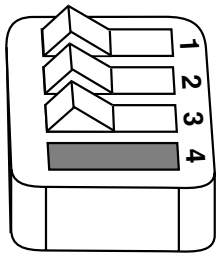
6th in series - ID = 5



7th in series - ID = 6

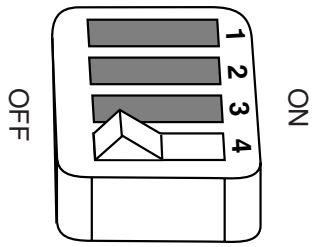


8th in series - ID = 7

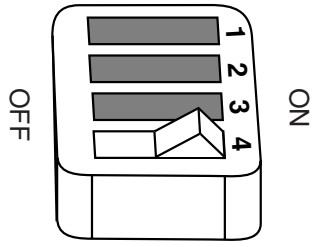


Switch number 4 positions

Last in series



All others



Hypertherm

Appendix F

PC-104 STACK: JUMPER POSITIONS

In this appendix:

PC104 Stack: Jumper Positions

CPU Board (B1)

Jumper Block	Position	Jumper
J9	1,2	open
	3,4	open
	5,6	open
	7,8	jumper
	9,10	open
	11,12	jumper
	13,14	jumper
	15,16	open
	17,18	jumper
J8	1,2	jumper
	3	open
J11	1,2	open
	3,4	jumper
	5,6	open
J14	1,2	jumper
J27	all open	
J28	all open	
J23	1,2	open
	3	open
J24	1,2	jumper
	3	open
J22	all open	
J16	all open	
J30	1	open
	2,3	jumper
J32	1,2	open
	3,4	open
	6,8	jumper
	5,7	jumper
	9,10	jumper

Jumper Block	Position	Jumper
J26	1,2	jumper
	3	open
J29	1	open
	2,3	jumper
J31	1,3	jumper
	2,4	open
	5,6	jumper
	7,9	jumper
	8,10	jumper
J5	all open	
J6	all open	

Flash Memory Board (B2)

Jumper Block	Position	Jumper
J1	all open	

Dual Serial Board (B3)

Jumper Block	Position	Jumper
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)

Jumper Block	Position	Jumper
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
SW1	1 2,3,4 5 6,7,8	OFF ON OFF ON

48 Channel Digital I/O #2 (B5)

Jumper Block	Position	Jumper
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
SW1	1 2,3,4 5 6,7,8	OFF ON ON ON

Analog Board (B6)

Jumper Block	Position	Jumper
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	