HySpeed® Plasma HSD130™

Local High Frequency (LHF)

Instruction Manual

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Hypertherm®

HySpeed HSD130
Local High Frequency (LHF)

Instruction Manual

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EMC Introduction

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

The limits required by EN60974-10 may not be adequate to completely eliminate interference when the affected equipment is in close proximity or has a high degree of sensitivity. In such cases it may be necessary to use other measures to further reduce interference.

This plasma equipment is designed for use only in an industrial environment.

Installation and use

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

Assessment of area

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

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

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

Methods of reducing emissions

Mains supply

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

Maintenance of cutting equipment

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

Cutting cables

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

Equipotential bonding

Bonding of all metallic components in the cutting installation and adjacent to it should be considered. However, metallic components bonded to the workpiece will increase the risk that the operator could

receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of workpiece

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

Note: the cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC/TS 62081 Arc Welding Equipment Installation and Use.

Screening and shielding

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

Warning

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

Warning

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

General

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

Certification test marks

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

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

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

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

Patent indemnity

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

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

Limitation of liability

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

Liability cap

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

Insurance

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

National and Local codes

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

Transfer of rights

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

Proper disposal of Hypertherm products

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

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

Register your product on-line at:

www.hypertherm.com/warranty.htm

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Section 1

SAFETY

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RECOGNIZE SAFETY INFORMATION

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

FOLLOW SAFETY INSTRUCTIONS

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

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

DANGER WARNING CAUTION

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

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

CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire prevention

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

Explosion prevention

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

WARNING

Explosion Hazard
Argon-Hydrogen and Methane

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

WARNING

Hydrogen Detonation
with Aluminum Cutting

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

ELECTRIC SHOCK CAN KILL

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

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

Electric shock prevention

All Hypertherm plasma systems use high voltage in the cutting process (200 to 400 VDC are common). Take the following precautions when operating this system:

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

STATIC ELECTRICITY CAN DAMAGE CIRCUIT BOARDS

Use proper precautions when handling printed circuit boards.

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

TOXIC FUMES CAN CAUSE INJURY OR DEATH

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

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

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

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

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

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

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

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

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

To reduce the risk of exposure to fumes:

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

A PLASMA ARC CAN CAUSE INJURY AND BURNS

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

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

ARC RAYS CAN BURN EYES AND SKIN

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

Arc current	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

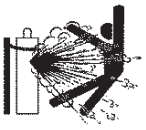
Work cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

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

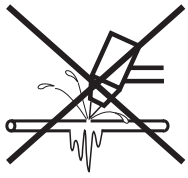
Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

- 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.

WARNING

Protect yourself and others. Read and understand this marking.

- Disconnect power source before servicing.
- Disconnect power source before disassembly of the torch.
- Use torches specified in the instruction manual.
- This plasma cutting machine must be connected to power source in accordance with applicable electrical codes.
- Plasma arc cutting can be injurious to operator and persons in the work area. Before operating, read and understand the manufacturer's instructions and know your employer's safety practices.

AVERTISSEMENT

Pour votre protection et celle des autres, lire et comprendre ces consignes.

- Couper l'alimentation avant d'effectuer le dépannâge.
- Couper l'alimentation avant de démonter la torche.
- Utiliser exclusivement les torches indiquées dans le manual d'instructions.
- Le raccordement au réseau de cette machine de coupage à arc-plasma doit-être comforme aux codes de l'électricité pertinents.
- Le coupage à arc-plasma comporte des risques pour l'utilisateur et les personnes se trouvant dans la zone de travail. Avant le coupage, lire et comprendre les instructions du fabricant. Appliquer également les consignes de sécurité de votre entreprise.

Electric shock can kill.

- Do not touch live electrical parts.
- Keep all panels and covers in place when the machine is connected to a power source.
- Insulate yourself from work and ground: wear insulating gloves, shoes and clothing.
- Keep gloves, shoes, clothing, work area, torch and this machinery dry.

Explosion will result if pressurized containers are cut.

Arc rays can injure eyes and burn skin.

- Wear correct eye and body protection.

Noise can damage hearing.

- Wear correct ear protection.

Fumes and gases can injure your health.

- Keep your head out of the fumes.
- Provide ventilation, exhaust at the arc, or both to keep the fumes and gases from your breathing zone and the general area.
- If ventilation is inadequate, use an approved respirator.

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the state of California to cause birth defects and, in some cases, cancer.

Heat, splatter and sparks cause fire and burns.

- Do not cut near combustible material.
- Do not cut containers that have held combustibles.
- Do not have on your person any combustibles such as a butane lighter or matches.

Pilot arc can cause burns.

- Keep the torch nozzle away from yourself and others when the switch is depressed.
- Wear correct eye and body protection.

DO NOT REMOVE THIS MARKING **NE PAS ENLEVER CET AVIS**

010298 Rev. B TLF

WARNING LABEL

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

1. Cutting sparks can cause explosion or fire.

1.1 Keep flammables away from cutting.

1.2 Keep a fire extinguisher nearby, and have a watchperson ready to use it.

1.3 Do not cut on any closed containers.

2. The plasma arc can cause injury and burns.

2.1 Turn off power before disassembling torch.

2.2 Do not hold the material near cutting path.

2.3 Wear complete body protection.

3. Electric shock from torch or wiring can kill. Protect yourself from electric shock.

3.1 Wear insulating gloves. Do not wear wet or damaged gloves.

3.2 Insulate yourself from work and ground.

3.3 Disconnect input plug or power before working on machine.

4. Breathing cutting fumes can be hazardous to your health.

4.1 Keep your head out of the fumes.

4.2 Use forced ventilation or local exhaust to remove the fumes.

4.3 Use ventilating fan to remove the fumes.

5. Arc rays can burn eyes and injure skin.

5.1 Wear hat and safety glasses. Use ear protection and button shirt collar. Use welding helmet with correct shade of filter. Wear complete body protection.

6. Become trained and read the instructions before working on the machine or cutting.

7. Do not remove or paint over (cover) warning labels.

Section 1a

SÉCURITÉ

Dans cette section :

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

IDENTIFIER LES CONSIGNES DE SÉCURITÉ

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

SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

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

- Les étiquettes de sécurité doivent rester lisibles. Remplacer immédiatement les étiquettes manquantes ou abîmées.
- Apprendre à faire fonctionner la machine et à utiliser correctement les commandes. Ne laisser personne utiliser la machine sans connaître son fonctionnement.
- Garder la machine en bon état. Des modifications non autorisées sur la machine peuvent engendrer des problèmes de sécurité et raccourcir la durée d'utilisation de l'équipement.

DANGER AVERTISSEMENT PRÉCAUTION

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

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

LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

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

Prévention des explosions

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

AVERTISSEMENT

Risque d'explosion argon-hydrogène et méthane

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

AVERTISSEMENT

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

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

LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

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

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

Prévention des chocs électriques

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

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

L'ÉLECTRICITÉ STATIQUE PEUT ENDOMMAGER LES CARTES DE CIRCUITS IMPRIMÉS

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

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

LES VAPEURS TOXIQUES PEUVENT PROVOQUER DES BLESSURES OU LA MORT

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

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

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

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

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

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

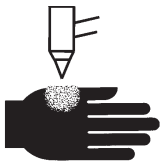
Le niveau de qualité de l'air dans tout lieu de travail dépend des variables propres au site comme :

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

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

Pour réduire le risque d'exposition aux vapeurs :

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



L'ARC PLASMA PEUT PROVOQUER DES BLESSURES OU DES BRÛLURES

Torches à allumage instantané

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

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

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

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

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

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

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.

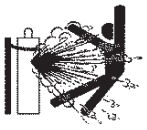
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

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

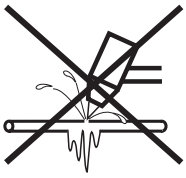
Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

- 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.

WARNING

Protect yourself and others. Read and understand this marking.

- Disconnect power source before servicing.
- Disconnect power source before disassembly of the torch.
- Use torches specified in the instruction manual.
- This plasma cutting machine must be connected to power source in accordance with applicable electrical codes.
- Plasma arc cutting can be injurious to operator and persons in the work area. Before operating, read and understand the manufacturer's instructions and know your employer's safety practices.

AVERTISSEMENT

Pour votre protection et celle des autres, lire et comprendre ces consignes.

- Couper l'alimentation avant d'effectuer le dépannâge.
- Couper l'alimentation avant de démonter la torche.
- Utiliser exclusivement les torches indiquées dans le manual d'instructions.
- Le raccordement au réseau de cette machine de coupage à arc-plasma doit-être comforme aux codes de l'électricité pertinents.
- Le coupage à arc-plasma comporte des risques pour l'utilisateur et les personnes se trouvant dans la zone de travail. Avant le coupage, lire et comprendre les instructions du fabricant. Appliquer également les consignes de sécurité de votre entreprise.

Electric shock can kill.

- Do not touch live electrical parts.
- Keep all panels and covers in place when the machine is connected to a power source.
- Insulate yourself from work and ground: wear insulating gloves, shoes and clothing.
- Keep gloves, shoes, clothing, work area, torch and this machinery dry.

Explosion will result if pressurized containers are cut.

Arc rays can injure eyes and burn skin.

- Wear correct eye and body protection.

Noise can damage hearing.

- Wear correct ear protection.

Fumes and gases can injure your health.

- Keep your head out of the fumes.
- Provide ventilation, exhaust at the arc, or both to keep the fumes and gases from your breathing zone and the general area.
- If ventilation is inadequate, use an approved respirator.

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the state of California to cause birth defects and, in some cases, cancer.

Heat, splatter and sparks cause fire and burns.

- Do not cut near combustible material.
- Do not cut containers that have held combustibles.
- Do not have on your person any combustibles such as a butane lighter or matches.

Pilot arc can cause burns.

- Keep the torch nozzle away from yourself and others when the switch is depressed.
- Wear correct eye and body protection.

DO NOT REMOVE THIS MARKING **NE PAS ENLEVER CET AVIS**

010298 Rev. B TLF

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.

Seccíon 1b

SEGURIDAD

En esta sección:

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RECONOCIMIENTO DE INFORMACIÓN DE SEGURIDAD

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

SIGA LAS INSTRUCCIONES DE SEGURIDAD

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

- Mantenga las etiquetas de seguridad de su máquina en buen estado. Reemplace las etiquetas que se pierdan o se dañen inmediatamente.
- Aprenda a utilizar la máquina y a utilizar los controles de la manera correcta. No permita que sea utilizada por alguien que no conozca su funcionamiento.
- Mantenga su máquina en buenas condiciones de funcionamiento. La realización de modificaciones no autorizadas a la máquina puede comprometer la seguridad y la vida útil de la máquina.

PELIGRO ADVERTENCIA PRECAUCIÓN

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

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

LOS CORTES PUEDEN PROVOCAR INCENDIOS O EXPLOSIONES

Prevención ante el fuego

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

Prevención ante explosiones

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

ADVERTENCIA

Peligro de explosión
Argón-Hidrógeno y metano

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

ADVERTENCIA

Detonación de hidrógeno con el corte de aluminio

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

EL CHOQUE ELÉCTRICO PUEDE PROVOCAR LA MUERTE

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

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

Prevención ante el electrochoque

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

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

ELECTRICIDAD ESTÁTICA PUEDE DAÑAR TABLILLAS DE CIRCUITO

Use precauciones adecuadas cuando maneje tablillas impresas de circuito

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

HUMOS TÓXICOS PUEDEN CAUSAR LESIONES O MUERTE

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

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

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

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

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

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

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

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

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

Para reducir el riesgo de exposición a humo:

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

EL ARCO DE PLASMA PUEDE CAUSAR LESIONES Y QUEMADURAS

Antorchas de encendido instantáneo

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

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

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

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

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

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

Corriente del arco	Número del cristal AWS (EE.UU.)	ISO 4850
Hasta 100A	No. 8	No. 11
100-200 A	No. 10	No. 11-12
200-400 A	No. 12	No. 13
Más de 400 A	No. 14	No. 14

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

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

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

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

SEGURIDAD DE TOMA A TIERRA

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

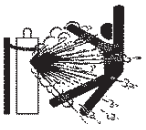
Mesa de trabajo Conecte la mesa de trabajo a una buena toma de tierra, de conformidad con los códigos eléctricos nacionales o locales apropiados.

Potencia primaria de entrada

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

SEGURIDAD DE LOS EQUIPOS DE GAS COMPRIMIDO

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



LOS CILINDROS DE GAS PUEDEN EXPLOTAR SI ESTÁN DAÑADOS

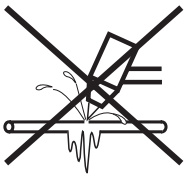
Los cilindros de gas contienen gas bajo alta presión. Un cilindro dañado puede explotar.

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

EL RUIDO PUEDE DETERIORAR LA AUDICIÓN

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

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



UN ARCO PLASMA PUEDE DAÑAR TUBOS CONGELADOS

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

OPERACIÓN DE MARCAPASOS Y DE AUDÍFONOS

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

Para reducir los peligros de los campos magnéticos:

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

Etiqueta de advertencia

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

WARNING

Protect yourself and others. Read and understand this marking.

- Disconnect power source before servicing.
- Disconnect power source before disassembly of the torch.
- Use torches specified in the instruction manual.
- This plasma cutting machine must be connected to power source in accordance with applicable electrical codes.
- Plasma arc cutting can be injurious to operator and persons in the work area. Before operating, read and understand the manufacturer's instructions and know your employer's safety practices.

AVERTISSEMENT

Pour votre protection et celle des autres, lire et comprendre ces consignes.

- Couper l'alimentation avant d'effectuer le dépannâge.
- Couper l'alimentation avant de démonter la torche.
- Utiliser exclusivement les torches indiquées dans le manual d'instructions.
- Le raccordement au réseau de cette machine de coupage à arc-plasma doit-être comforme aux codes de l'électricité pertinents.
- Le coupage à arc-plasma comporte des risques pour l'utilisateur et les personnes se trouvant dans la zone de travail. Avant le coupage, lire et comprendre les instructions du fabricant. Appliquer également les consignes de sécurité de votre entreprise.

Electric shock can kill.

- Do not touch live electrical parts.
- Keep all panels and covers in place when the machine is connected to a power source.
- Insulate yourself from work and ground: wear insulating gloves, shoes and clothing.
- Keep gloves, shoes, clothing, work area, torch and this machinery dry.

Explosion will result if pressurized containers are cut.

Arc rays can injure eyes and burn skin.

- Wear correct eye and body protection.

Noise can damage hearing.

- Wear correct ear protection.

Fumes and gases can injure your health.

- Keep your head out of the fumes.
- Provide ventilation, exhaust at the arc, or both to keep the fumes and gases from your breathing zone and the general area.
- If ventilation is inadequate, use an approved respirator.

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the state of California to cause birth defects and, in some cases, cancer.

Heat, splatter and sparks cause fire and burns.

- Do not cut near combustible material.
- Do not cut containers that have held combustibles.
- Do not have on your person any combustibles such as a butane lighter or matches.

Pilot arc can cause burns.

- Keep the torch nozzle away from yourself and others when the switch is depressed.
- Wear correct eye and body protection.

DO NOT REMOVE THIS MARKING **NE PAS ENLEVER CET AVIS**

010298 Rev. B TLF

Etiqueta de advertencia

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

1. Las chispas producidas por el corte pueden causar explosiones o incendios.

1.1 Mantenga los materiales inflamables lejos del lugar de corte.

1.2 Tenga a mano un extinguidor de incendios y asegúrese de que alguien esté preparado para utilizarlo.

1.3 No corte depósitos cerrados.

2. El arco de plasma puede causar quemaduras y lesiones.

2.1 Apague la fuente de energía antes de desarmar la antorcha.

2.2 No sostenga el material junto al trayecto de corte.

2.3 Proteja su cuerpo completamente.

3. Los electrochoques provocados por la antorcha o el cableado pueden ser fatales. Protéjase del electrochoque.

3.1 Colóquese guantes aislantes. No utilice guantes dañados o mojados.

3.2 Aíslese de la pieza de trabajo y de la tierra.

3.3 Antes de trabajar en una máquina, desconecte el enchufe de entrada o la potencia primaria.

4. La inhalación de los humos provenientes del área de corte puede ser nociva para la salud.

4.1 Mantenga la cabeza fuera de los gases tóxicos.

4.2 Utilice ventilación forzada o un sistema local de escape para eliminar los humos.

4.3 Utilice un ventilador para eliminar los humos.

5. Los rayos del arco pueden producir quemaduras en los ojos y en la piel.

5.1 Utilice un sombrero y gafas de seguridad. Utilice protección para los oídos y abróchese el botón del cuello de la camisa. Utilice un casco de soldar con el filtro de sombreado adecuado. Proteja su cuerpo completamente.

6. Antes de trabajar en la máquina o de proceder a cortar, capacítese y lea las instrucciones completamente.

7. No retire las etiquetas de advertencia ni las cubra con pintura.

Section 2

SPECIFICATIONS

In this section:

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- Power supply 2-2
- Ignition console 2-2
- Fuel-gas console 2-2
- Off-valve 2-2
- Torch 2-2
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System description

General

The HySpeed HSD130 plasma system is designed to cut a wide range of thicknesses of mild steel, stainless steel and aluminum.

Power supply

The power supply is a 130-amp, 150-VDC constant-current supply. It contains the circuitry to ignite a torch plus a heat exchanger and a pump to cool the torch. The power supply has a discrete machine interface to provide communication with a CNC controller.

Ignition console

The ignition console uses a spark-gap assembly. The ignition console converts 120 VAC control voltage from the power supply into high-frequency and high-voltage pulses (9-10 kV) to break over the torch electrode-nozzle gap. The high-voltage, high-frequency signal is coupled to the pilot arc lead.

Fuel-gas console (optional, see system diagram 2)

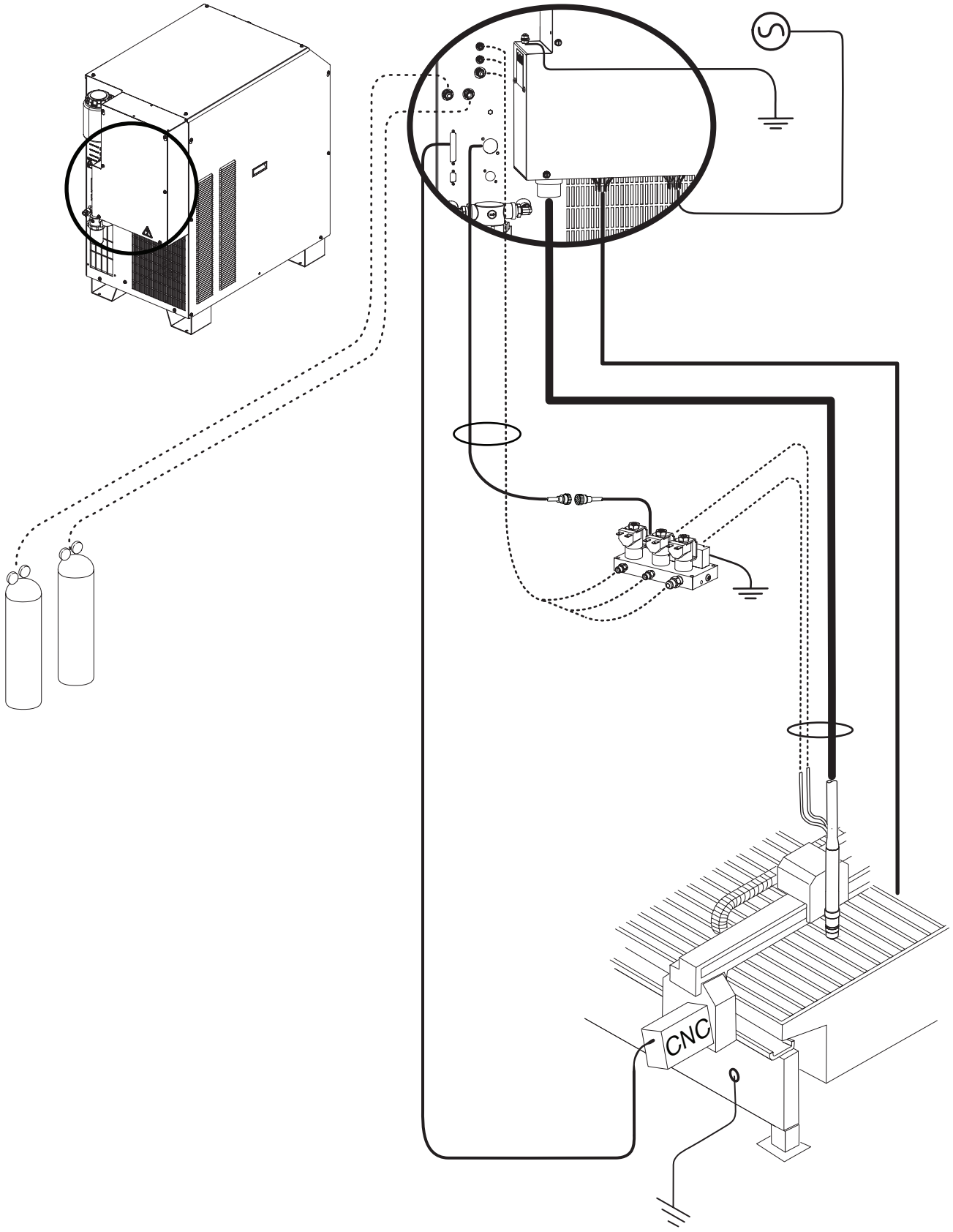
The fuel-gas console manages the selection and flow rate of incoming fuel-gases. The fuel-gas console includes a regulator, solenoid valves, check valves and a pressure transducer. The fuel-gas console also houses a relay PC board and a control PC board.

Off-valve

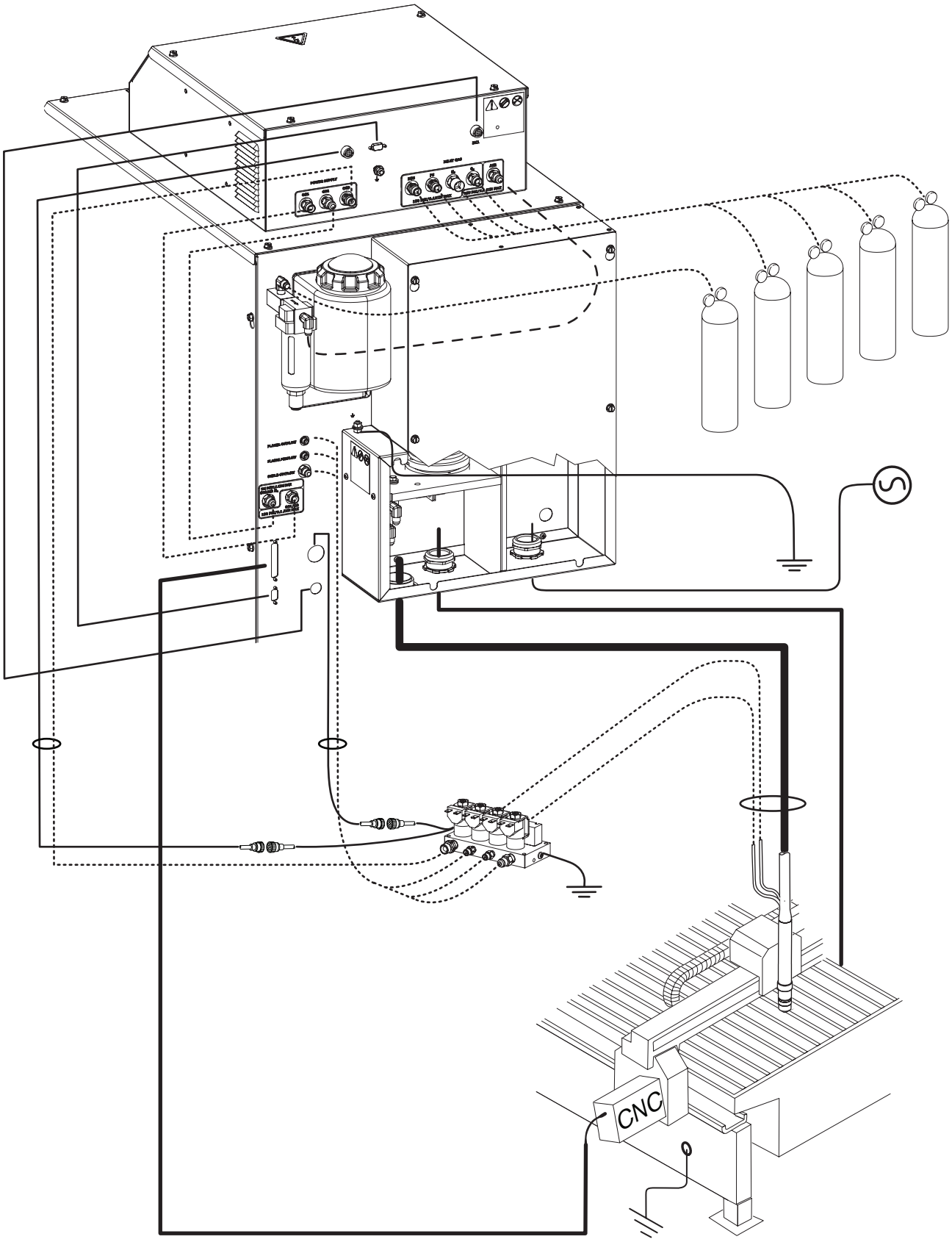
The off-valve consists of 3 solenoid valves, a manifold block and a wiring harness with connector. The assembly interfaces with the power supply.

Torch

The torch can cut 12 mm mild steel at up to 2032 mm/min (1/2 inch at up to 80 ipm). The recommended production cutting capability of the torch is 16 mm (5/8 inch). Maximum pierce capability is 25 mm (1 inch) for mild steel and 19 mm (3/4 inch) for stainless steel and aluminum. The maximum severance capability is 38 mm (1.5 inch) for mild steel and 25 mm (1 inch) for stainless steel and aluminum.



System diagram 1 – without a fuel-gas console



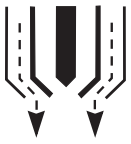
System diagram 2 – with a fuel-gas console

Specifications

System gas requirements

Gas quality and pressure requirements			
	Quality	**Pressure +/- 10%**	**Flow rate**
O_2 Oxygen	99.5% pure Clean, dry, oil-free	793 kPa / 7.93 bar 115 psi	4250 l/h 150 scfh
N_2 Nitrogen*	99.99% pure Clean, dry, oil-free	793 kPa / 7.93 bar 115 psi	8500 l/h 300 scfh
Air	Clean, dry, oil-free	655 kPa / 6.55 bar 95 psi	8500 l/h 300 scfh
H35 Argon-hydrogen*	99.995% pure (H35 = 65% Argon, 35% Hydrogen)	793 kPa / 7.93 bar 115 psi	4250 l/h 150 scfh
F5 Nitrogen-hydrogen*	99.98% pure (F5 = 95% Nitrogen, 5% Hydrogen)	793 kPa / 7.93 bar 115 psi	4250 l/h 150 scfh

* These gases are only needed for systems with a fuel-gas console.

	Mild steel		**Stainless steel**		**Aluminum**	
						
Gas types	Plasma	Shield	Plasma	Shield	Plasma	Shield
Cutting 45 A	Air	Air	Air / N_2 / F5	Air / N_2	Air	Air
Cutting 50 A	O_2	Air	N/A	N/A	N/A	N/A
Cutting 130 A	O_2 / Air	Air	Air / N_2 / H35	Air / N_2	Air / H35	Air / N_2

Noise levels

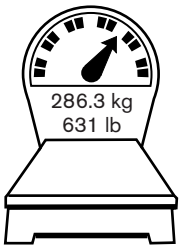
Measurements were made in a Hypertherm engineering laboratory, with other equipment operating nearby, in accordance with Hypertherm instruction ESI-034. These measurements only provide a general indication of the noise produced by the plasma system. Sound measurements should be taken after installation to determine the specific noise levels at the site. Measurements were taken at distances of 1 m, 2 m, 3 m, and 5 m (straight-line distance) from the center of the arc. An operator standing at the CNC controller would be approximately 1 m from the arc. All measurements were made with a Bruel & Kjaer sound meter mounted on a tripod at a height of 336.55 mm (13.25 inch) above the center of the arc.

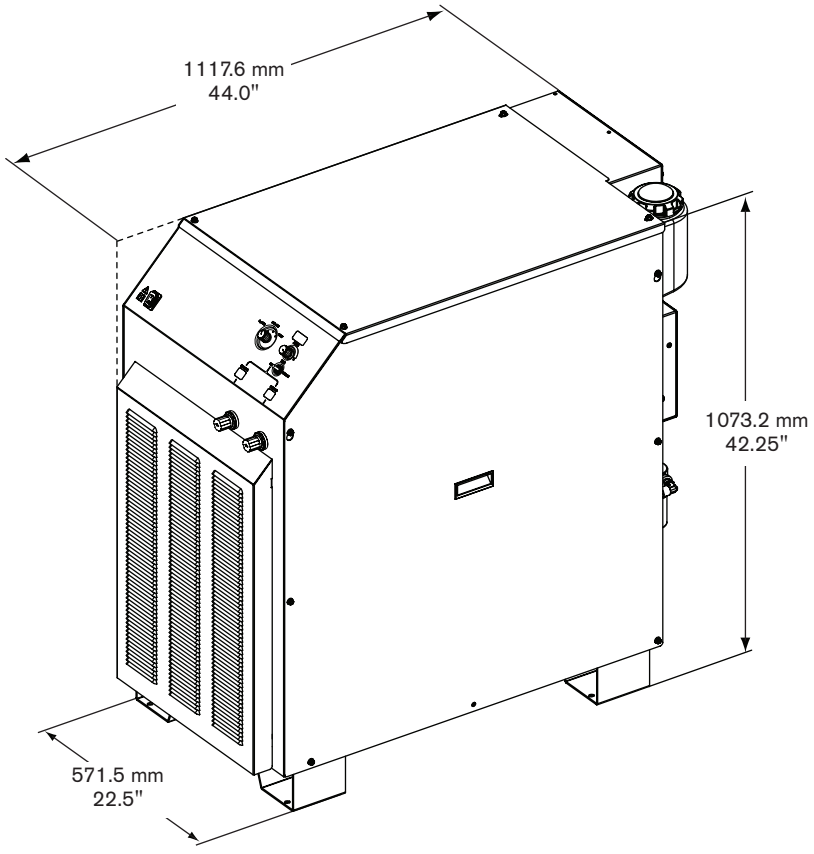
Distance from the center of the arc	Ambient room noise	Process 1 $H35/N_2$ 130 Amps	Process 2 Air/Air 130 Amps
1 m (3.3 ft)	80-84 dB	104-106 dB	106-108 dB
2 m (6.6 ft)	80-84 dB	97-99 dB	99-100 dB
3 m (9.9 ft)	80-84 dB	94-96 dB	96-97 dB
5 m (16.5 ft)	80-84 dB	93-97 dB	94-96 dB

Power supply

General	
Maximum OCV (U_0)	311 VDC
Maximum output current (I_2)	130 amps
Output voltage (U_2)	50 – 150 VDC
Duty cycle rating (X)	100% @ 19.5 kw, 40° C (104° F)
Ambient temperature	Power supplies will operate between -10° C and +40° C (+14° and 104° F)
Power factor(cosφ)	0.91 @ 130 ADC output
Cooling	Forced air (Class F)
Insulation	Class H
Input power (input voltage (U_1) X input current (I_1 X 1.73) (+/- 10%)	
200/208 VAC, 3-PH, 50/60 Hz, 62/60 amps	
220 VAC, 3-PH, 50/60 Hz, 56 amps	
240 VAC, 3-PH, 60 Hz, 52 amps	
380 VAC, 3-PH, 50/60 Hz, 33 amps	
400 VAC CE, 3-PH, 50/60 Hz, 32 amps	
440 VAC, 3-PH, 50/60 Hz, 28 amps	
480 VAC, 3-PH, 60 Hz, 26 amps	
600 VAC, 3-PH, 60 Hz, 21 amps	

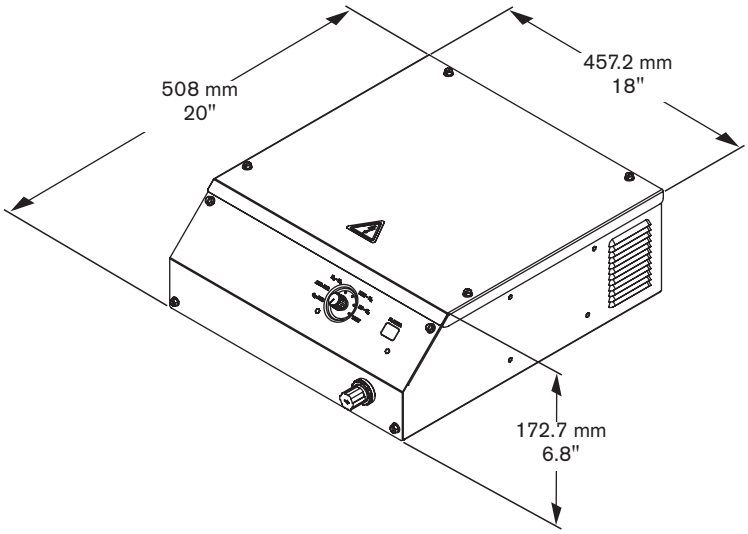
Part numbers
200/208 VAC – 078194
220 VAC – 078204
240 VAC – 078195
380 VAC – 078196
400 VAC – 078197
440 VAC – 078198
480 VAC – 078199
600 VAC – 078200

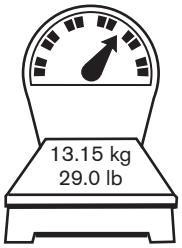


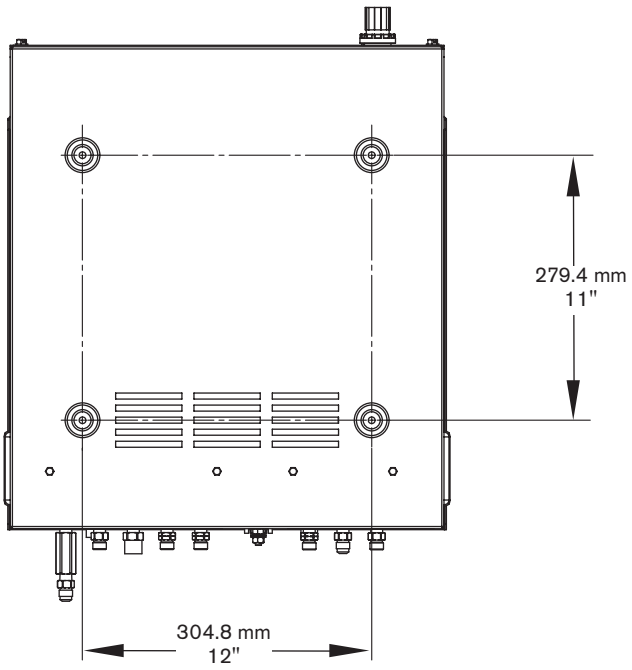


Fuel-gas console (optional) – 078201

- The fuel-gas console is mounted on the top of the power supply. Allow 1m (3 ft) on all sides of the console for servicing and ventilation.
- The maximum lead length, from the fuel-gas console to the off-valve, is 15 m (50 ft).

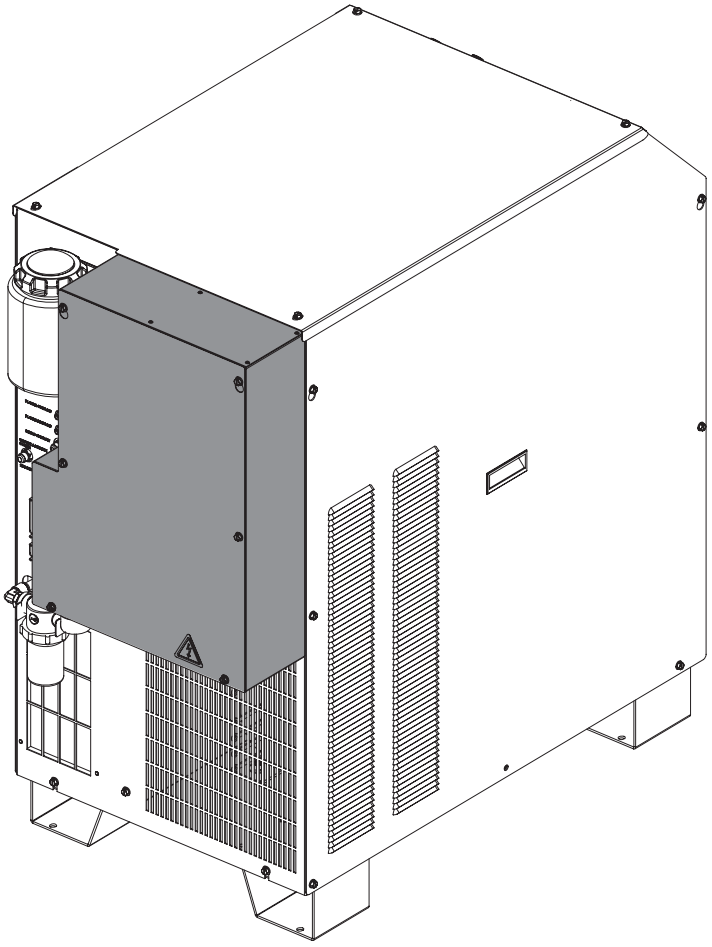






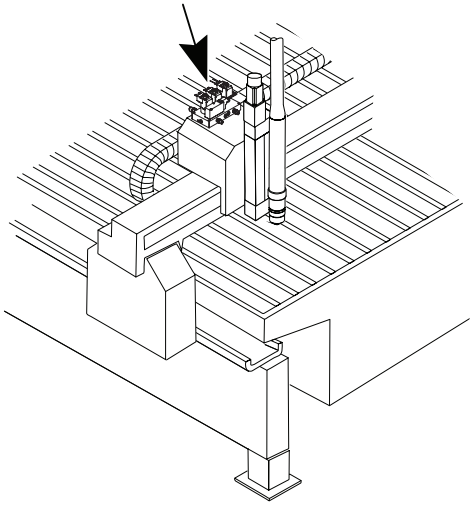
Ignition console

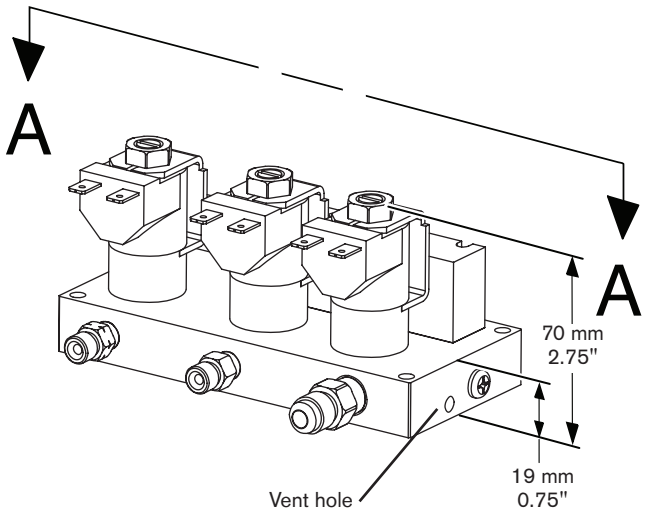
- The ignition console is mounted on the rear of the power supply. Allow room to remove the rear panel for servicing.
- The maximum torch-lead length, from the ignition console to the torch, is 15 m (50 ft).

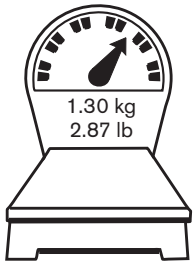


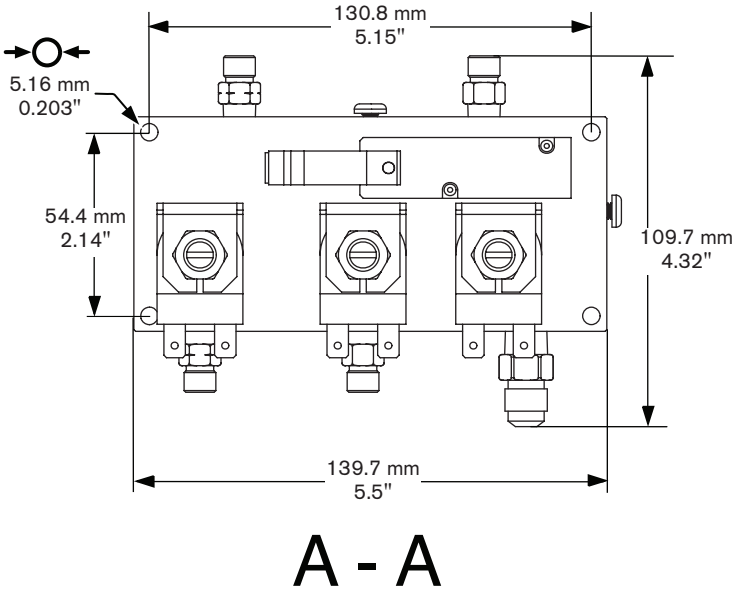
Standard off-valve – 229105

- Maximum cable length from the off-valve to the torch lifter is 1.8 m (6 ft).
- Mount the off-valve assembly on the torch carriage on large tables. On small tables it can be mounted on a bracket just above the bridge.
- The vent hole on the side of the manifold must be kept clear at all times.





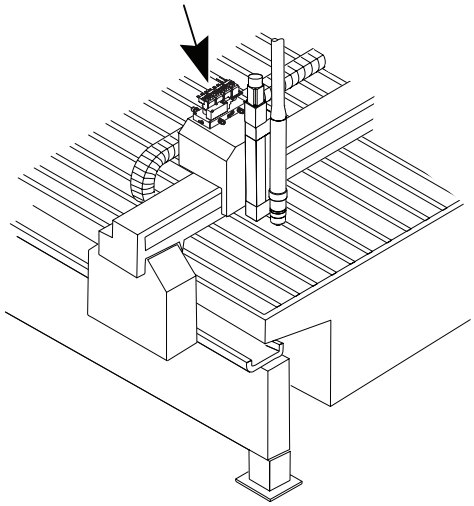


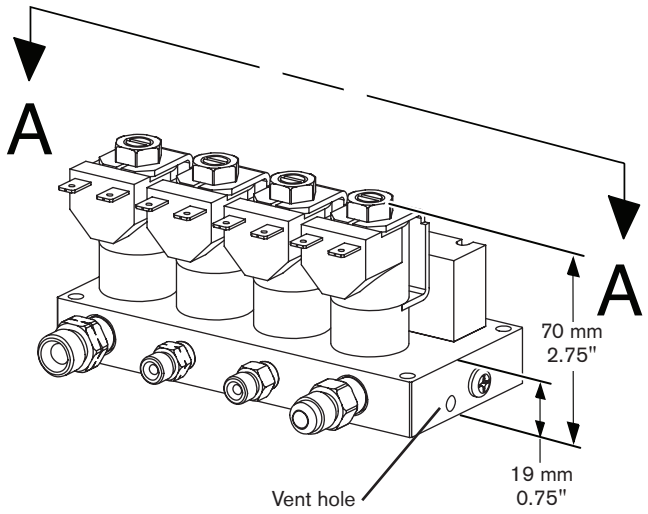


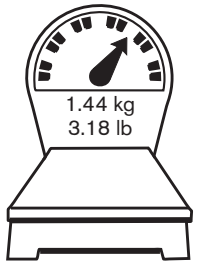
A - A

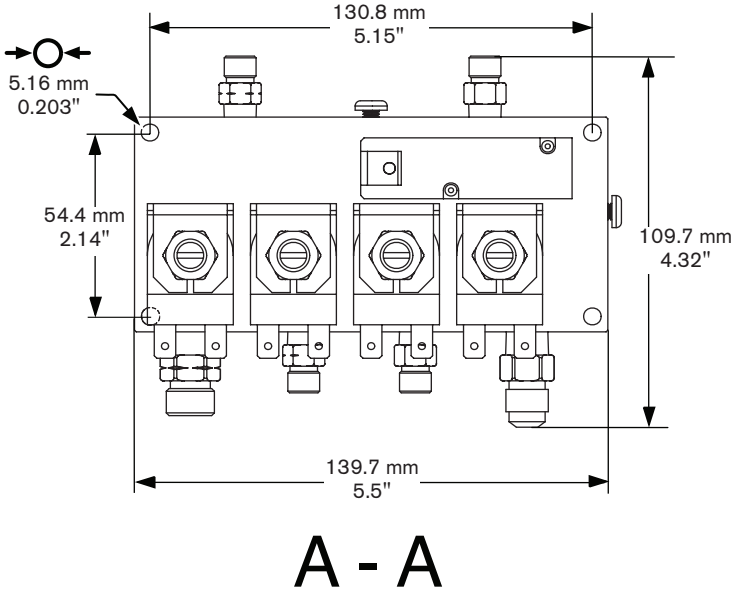
Fuel-gas off-valve – 229130

- Maximum cable length from the off-valve to the torch lifter is 1.8 m (6 ft).
- Mount the off-valve assembly on the torch carriage on larg tables. On small tables it can be mounted on a bracket just above the bridge.
- The vent hole on the side of the manifold must be kept clear at all times.









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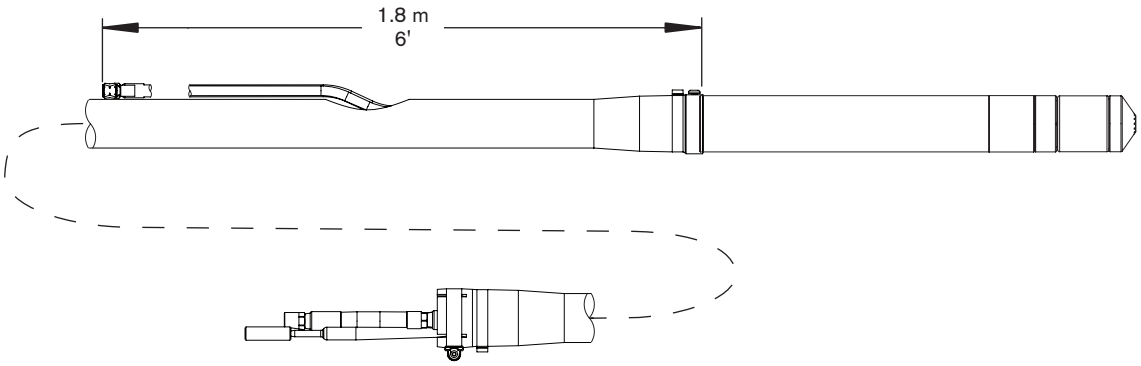
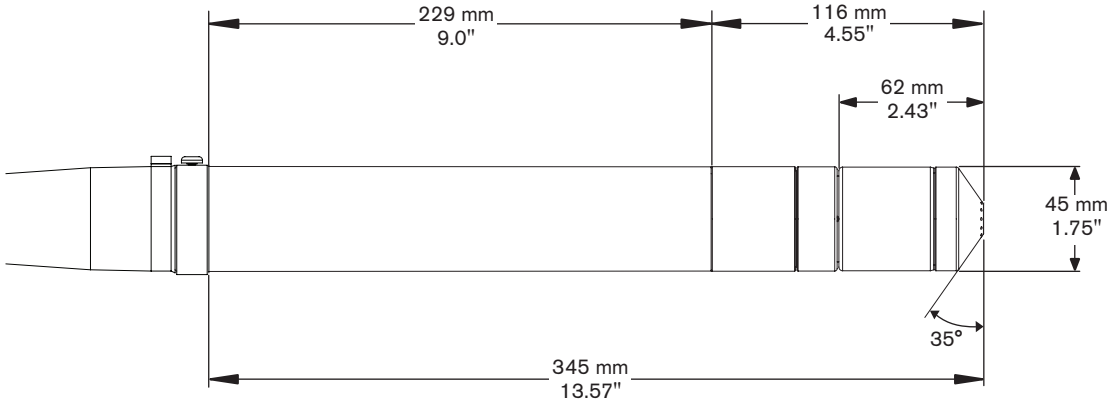
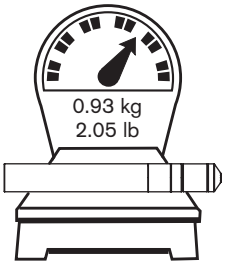
Torch – 228144 (includes mounting sleeve and consumables)

- The outside diameter of the torch mounting sleeve is 45 mm (1.75 inch).







Section 3

INSTALLATION

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Upon receipt

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

Claims

Claims for damage during shipment – If your unit was damaged during shipment, you must file a claim with the carrier. Hypertherm will furnish you with a copy of the bill of lading upon request. If you need additional assistance, call Customer Service listed in the front of this manual, or your authorized Hypertherm distributor.

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

Installation requirements

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

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

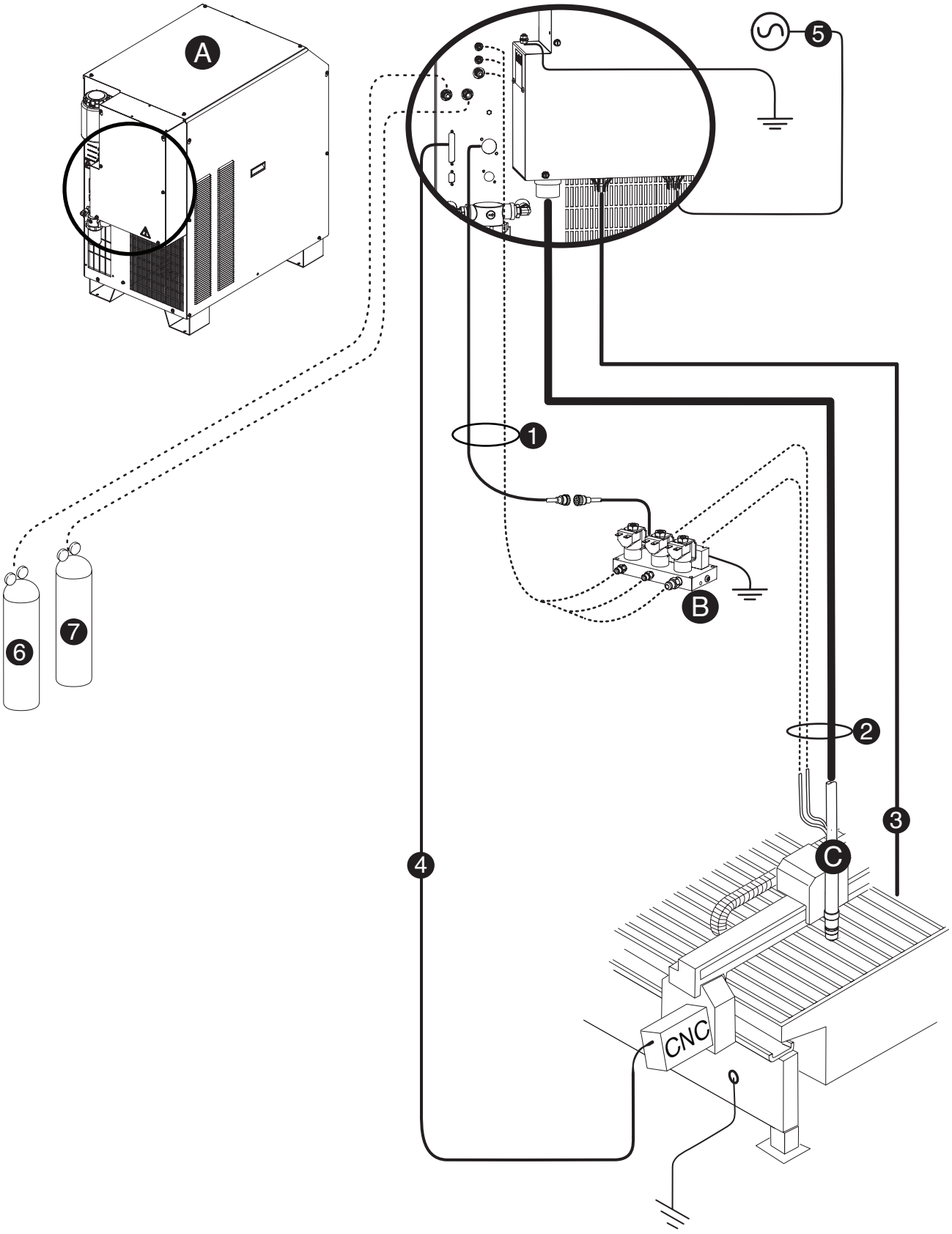
Placement of system components

- Place all system components in position prior to making electrical, gas and interface connections. Use the diagrams in this section for component placement guidelines.
- Ground all system components to earth. See *Recommended grounding and shielding practices* 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	kgf-cm	lbf-in	lbf-ft
Up to 10 mm (3/8")	8.6-9.8	75-85	6.25-7
12 mm (1/2")	41.5-55	360-480	30-40

Installation requirements – standard system



System diagram 2 – without a fuel gas console

System components

- Ⓐ Power supply
- Ⓑ Off-valve assembly
- Ⓒ Torch

Cables and hoses

- ❶ Cable and hose assembly from power supply to off-valve
- ❷ Torch lead assembly
- ❸ Work lead
- ❹ Power supply to CNC interface cable

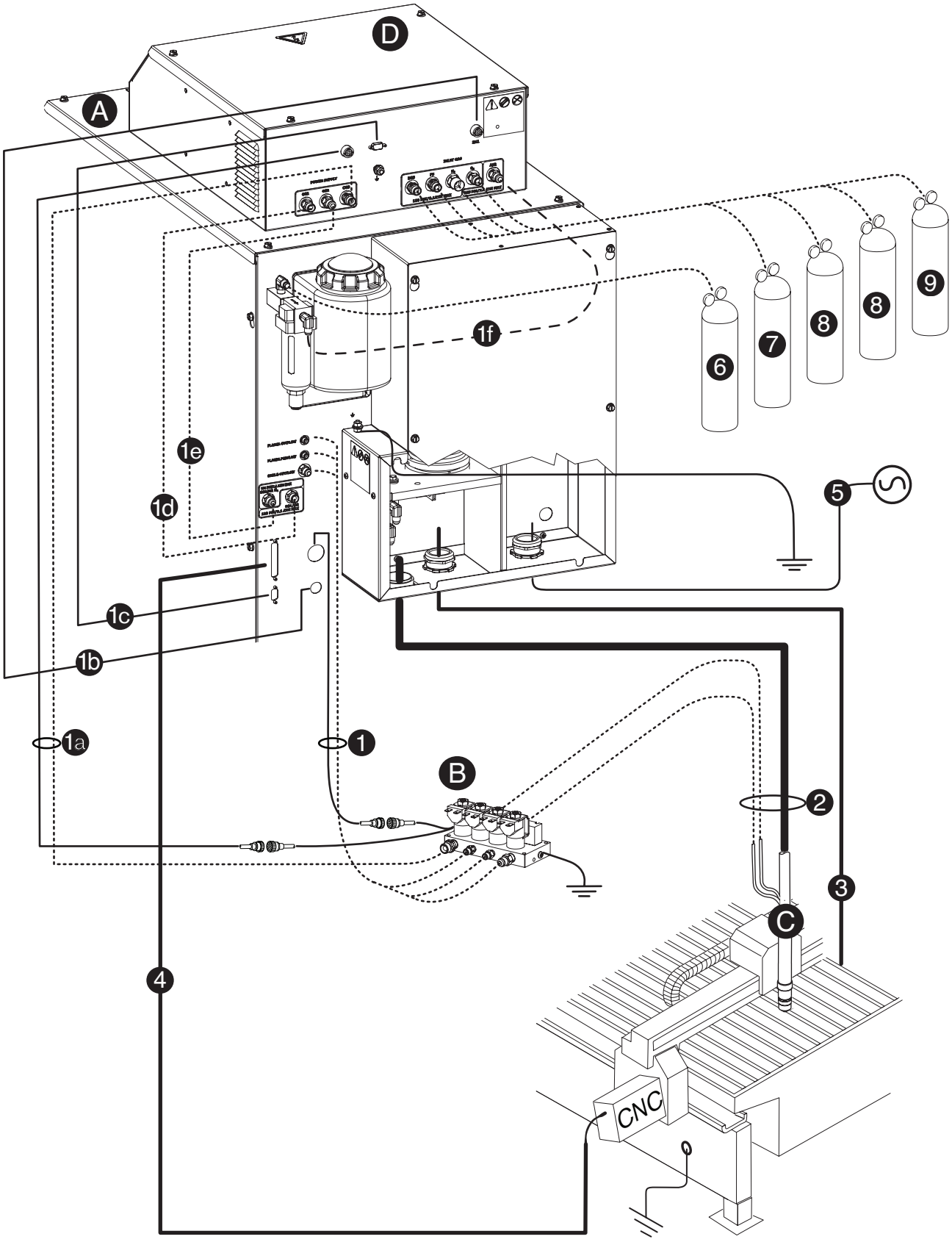
Customer-supplied power cable

- ❺ Main power cable

Supply gas hoses

- ❻ Air
- ❼ Oxygen

Installation requirements – system with optional fuel gas console



System diagram 2 – with a fuel gas console

System components

- A Power supply
- B Off-valve assembly
- C Torch
- D Fuel gas console

Cables and hoses

- 1 Cable and hose assembly from the power supply to the off-valve
- 1a Cable and hose assembly from the fuel gas console to the off-valve
- 1b Gas power cable
- 1c Gas control cable
- 1d Cut gas 1 hose
- 1e Cut gas 2 hose
- 1f Air hose from power supply air filter to the fuel-gas console
- 2 Torch lead assembly
- 3 Work lead
- 4 Power supply to CNC interface cable

Customer-supplied power cable

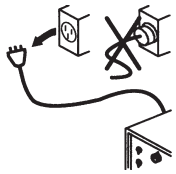
- 5 Main power cable

Supply gas hoses

- 6 Air
- 7 Oxygen
- 8 F5 or H35
- 9 Nitrogen

Recommended grounding and shielding practices


DANGER
ELECTRIC SHOCK CAN KILL



Disconnect electrical power before performing any maintenance. All work requiring the removal of the power supply cover must be performed by a qualified technician.

See *Section 1* of the plasma system instruction manual for more safety precautions.

Introduction

This document describes the grounding and shielding necessary to protect a plasma cutting system installation against radio frequency interference (RFI) and electromagnetic interference (EMI) noise. It addresses the 3 grounding systems described below. There is diagram on page 5 for reference.

Note: These procedures and practices are not known to succeed in every case to eliminate RFI/EMI noise issues. The practices listed here have been used on many installations with excellent results, and we recommend that these practices be a routine part of the installation process. The actual methods used to implement these practices may vary from system to system, but should remain as consistent as possible across the product line.

Types of grounding

A. The safety (PE) or service ground. This is the grounding system that applies to the incoming line voltage. It prevents a shock hazard to any personnel from any of the equipment, or the work table. It includes the service ground coming into the plasma power supply and other systems such as the CNC controller and the motor drivers, as well as the supplemental ground rod connected to the work table. In the plasma circuits, the ground is carried from the plasma power supply chassis to the chassis of each separate console through the interconnecting cables.

B. The DC power or cutting current ground. This is the grounding system that completes the path of the cutting current from the torch back to the power supply. It requires that the positive lead from the power supply be firmly connected to the work table ground bus with a properly sized cable. It also requires that the slats, on which the workpiece rests, make good contact with the table and the workpiece.

C. RFI and EMI grounding and shielding. This is the grounding system that limits the amount of electrical “noise” emitted by the plasma and motor drive systems. It also limits the amount of noise that is received by the CNC and other control and measurement circuits. This grounding/shielding process is the main target of this document.

Steps to take

1. Unless noted, use only 6 AWG (16 mm^2) welding cable (Hypertherm part no. 047040) for the EMI ground cables shown on the diagram (blue).

2. The cutting table is used for the common, or star, EMI ground point and should have threaded studs welded to the table with a copper bus bar mounted on them. A separate bus bar should be mounted on the gantry as close to each drive motor as possible. If there are drive motors at each end of the gantry, run a separate EMI ground cable from the far drive motor to the gantry bus bar. The gantry bus bar should have a separate, heavy EMI ground cable (4 AWG part no. 047031) to the table bus bar. The EMI ground cables for the torch lifter and the RHF console must each run separately to the table ground bus.

3. A ground rod that meets all applicable local and national electrical codes must be installed within 6 m (20 feet) of the table. This is a PE ground and should be connected to the ground bus on the cutting table with 6 AWG green/yellow grounding cable (Hypertherm part number 047121) or equivalent. All PE grounds are shown on the diagram in green.

4. For the most effective shielding, use the Hypertherm CNC interface cables for I/O signals, serial communication signals, power supply-to-power supply multi-drop connections, and interconnections between all parts of the Hypertherm system.

5. All hardware used in the ground system must be brass or copper. The only exception is that the studs welded to the table for mounting the ground bus can be steel. Under no circumstances should aluminum or steel hardware be used.

6. AC power, PE, and service grounds must be connected to all equipment according to local and national codes.

7. * The positive, negative, and pilot arc leads should be bundled together for as long a distance as possible. The torch lead, work lead, and the pilot arc (nozzle) leads may only be run parallel to other wires or cables if they are separated by at least 150 mm (6 in.). If possible, run power and signal cables in separate cable tracks.

8. * The ignition console should be mounted as close as possible to the torch, and must have a separate ground cable to the bus bar on the cutting table.

9. Each Hypertherm component, as well as any other CNC or motor-drive cabinet or enclosure, must have a separate ground cable to the common (star) point on the table. This includes the ignition console, even if it is bolted to the power supply or to the cutting machine.

10. The metal braided shield on the torch leads must be connected firmly to the ignition console and to the torch. It must be electrically insulated from any metal and from any contact with the floor or building.

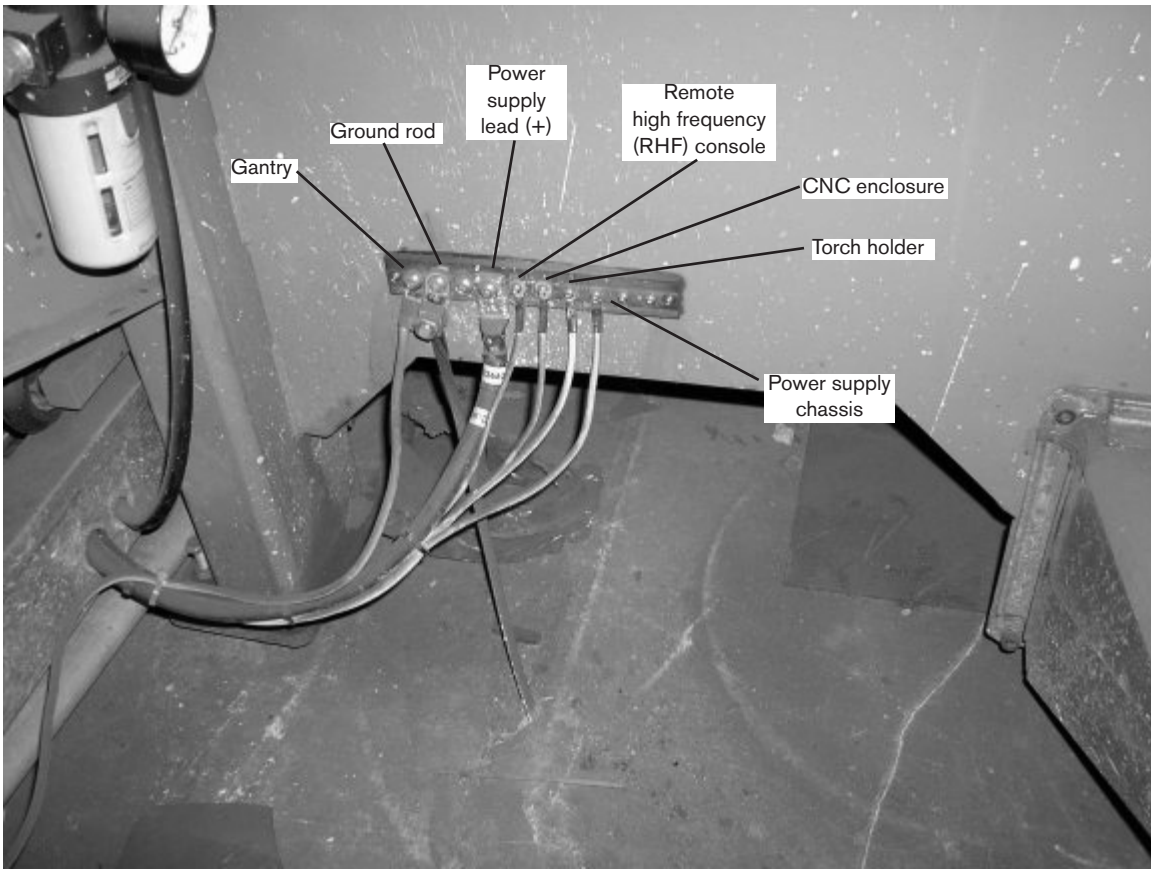
11. The torch holder and the torch breakaway mechanism – the part mounted to the lifter, not the part mounted on the torch – must be connected to the stationary part of the lifter with copper braid at least 12.7 mm (1/2 in.) wide. A separate cable must run from the lifter to the bus bar on the gantry. The valve assembly should also have a separate ground connection to the gantry bus bar.

* Applies to systems that use a remote high frequency (RHF) console

12. If the gantry runs on rails that are not welded to the table, then the rails need to be connected with a ground cable from each end of both rails to the table. These need not go to the common (star) point, but could take the shortest path to the table.

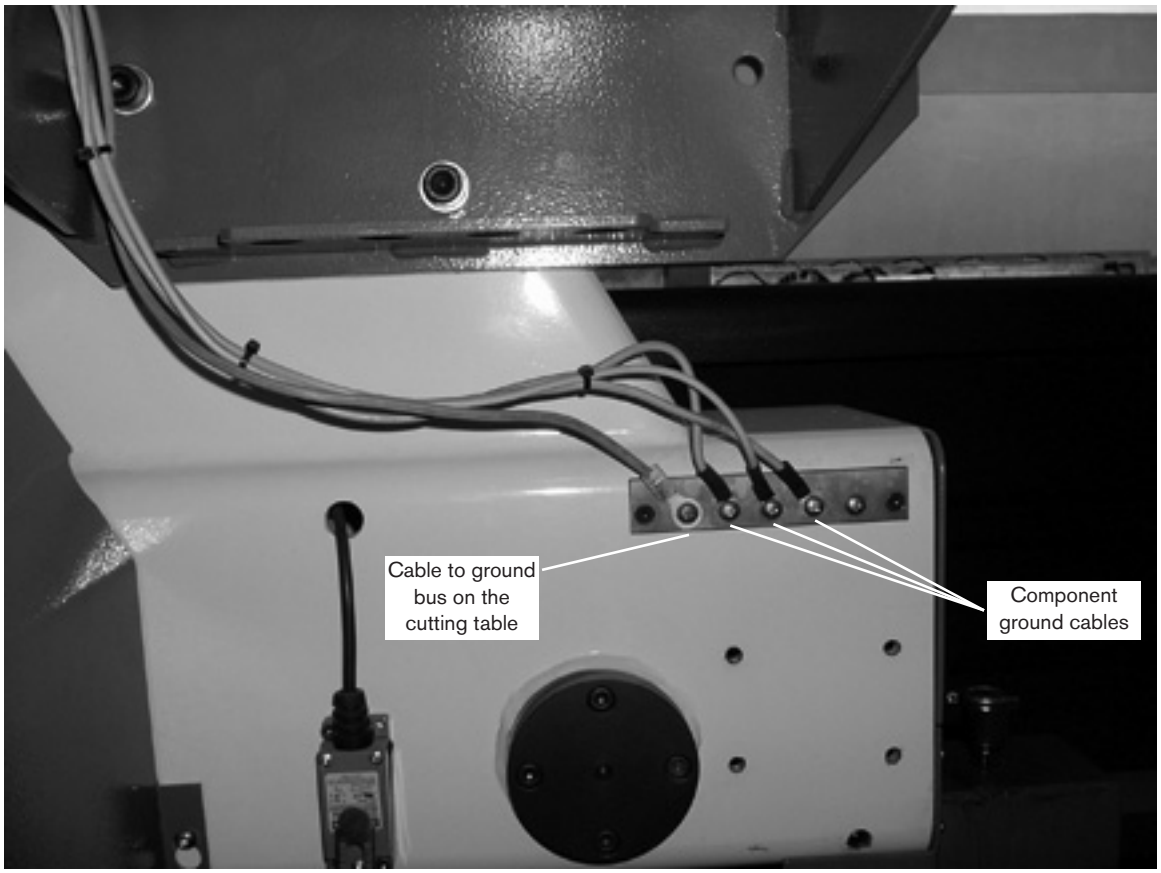
13. If the OEM is installing a voltage divider to process arc voltage for use in the control system, the voltage divider board should be mounted as close as possible to the point where the arc voltage is sampled. One acceptable location is inside the plasma power supply. If the Hypertherm voltage divider board is used, the output signal is isolated from all other circuits. The processed signal should be run in twisted, shielded cable (Belden type 1800F or equivalent). The cable used must have a braided shield, not a foil shield. The shield should be connected to the chassis of the power supply and left unconnected at the other end.

14. All other signals (analog, digital, serial, encoder) should run in twisted pairs inside a shielded cable. Connectors on these cables should have a metal housing and the shield, not the drain, should be connected to the metal housing of the connectors at each end of the cable. Never run the shield or the drain through the connector on any of the pins.



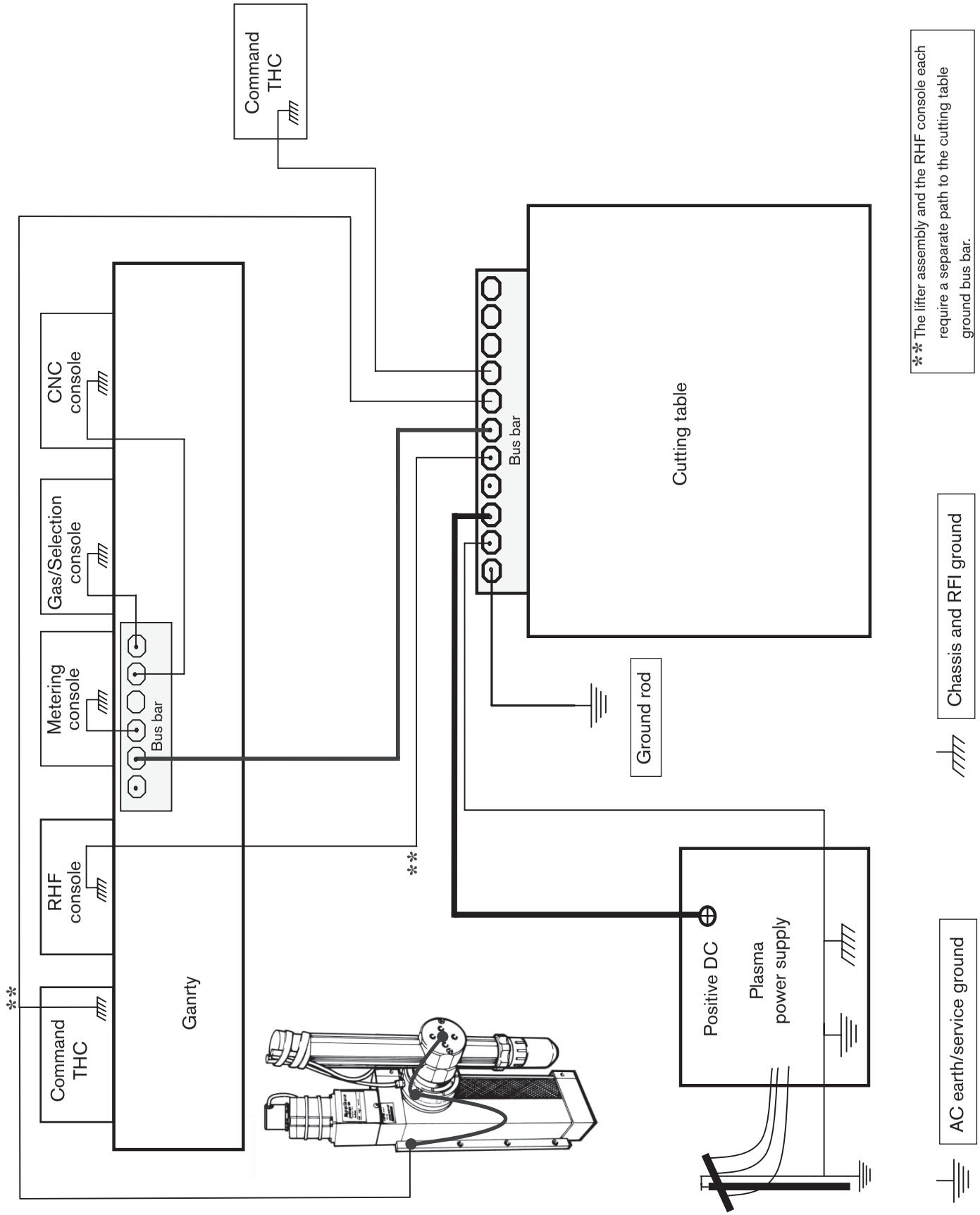
Example of a good cutting table ground bus. The picture above shows the connection from the gantry ground bus, the connection from the ground rod, the power supply positive lead, the RHF console*, the CNC enclosure, the torch holder, and the power supply chassis.

* Applies to systems that use a remote high frequency (RHF) console



Example of a good gantry ground bus. It is bolted to the gantry, close to the motor. All of the individual ground cables from the components mounted on the gantry go to the bus except those from the RHF console* and the torch holder. A single heavy cable then goes from the gantry ground bus to the ground bus bolted to the table.

* Applies to systems that use a remote high frequency (RHF) console



Grounding diagram (some systems will not include all the components shown)

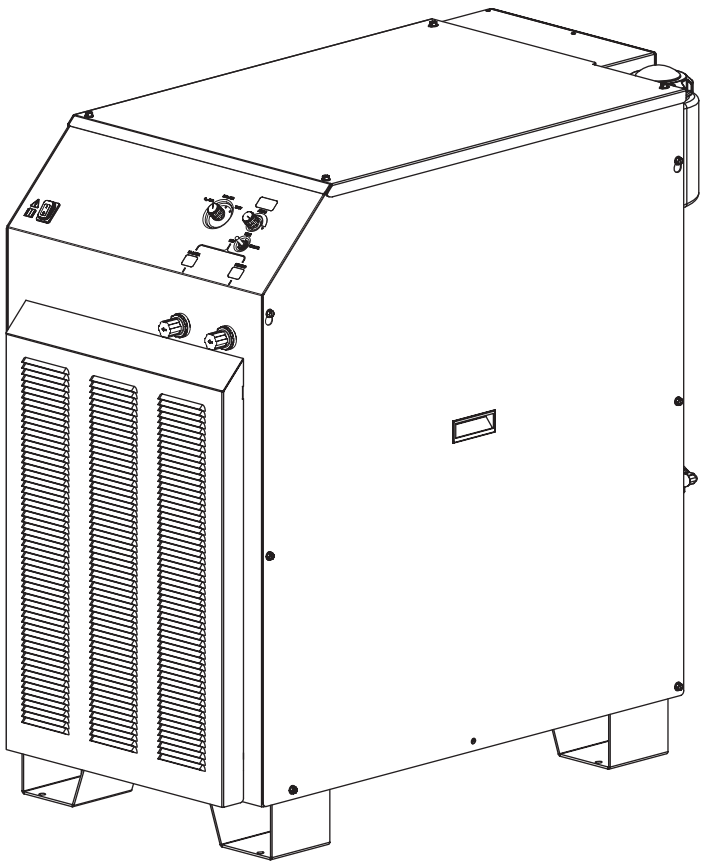
A Placement of the power supply

DANGER
ELECTRICAL SHOCK CAN KILL

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

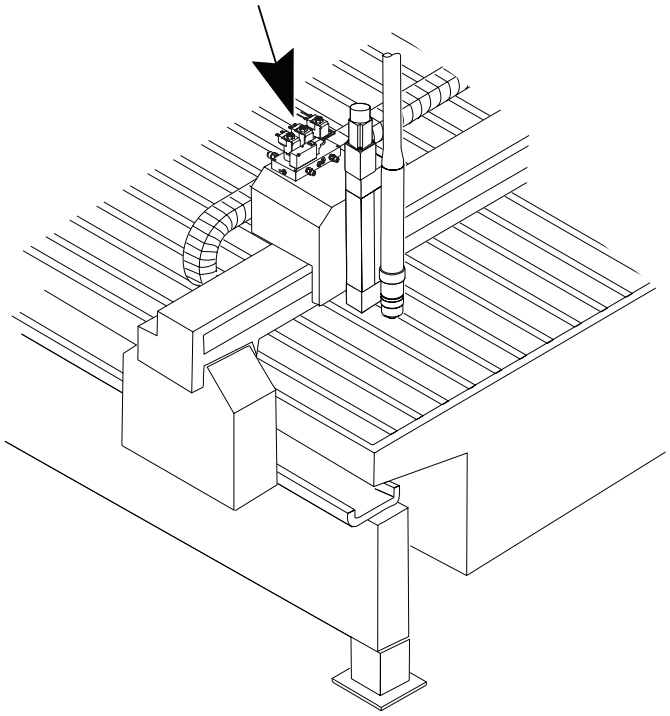
The power supply can be moved by forklift but the forks must be long enough to extend the entire length of the base. Take care when lifting so that the underside of the power supply is not damaged.

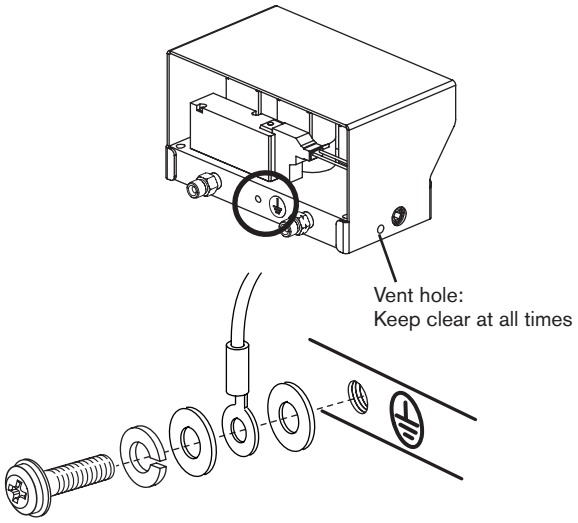
- Place the power supply in an area that is free of excessive moisture, has proper ventilation, and is relatively clean. Allow 1 m (3 ft) on all sides of the power supply for ventilation and servicing.
- Cooling air is drawn in through the front panel and is exhausted through the rear of the unit by a cooling fan. Do not place any filter device over the air intake locations, which reduces cooling efficiency and VOIDS THE WARRANTY.
- Do not place the power supply on an incline greater than 10° to prevent it from toppling.



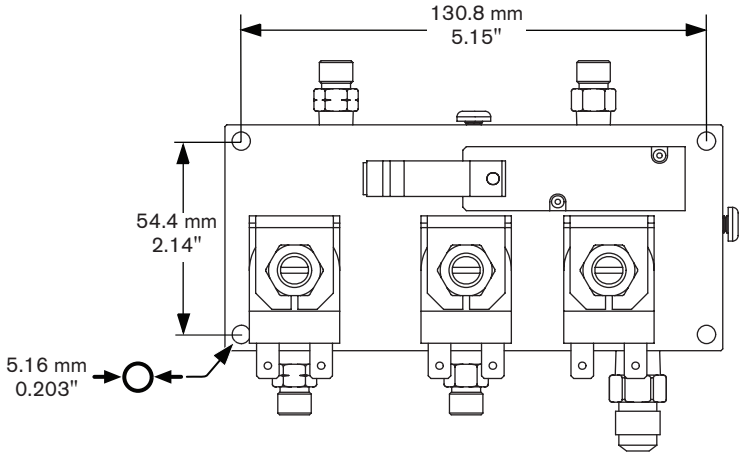
B Install the off-valve (standard and fuel-gas)

- Mount the off-valve assembly near the torch lifter. The maximum length of the gas hoses between the off-valve assembly and the torch is 1.8 m (6 ft).



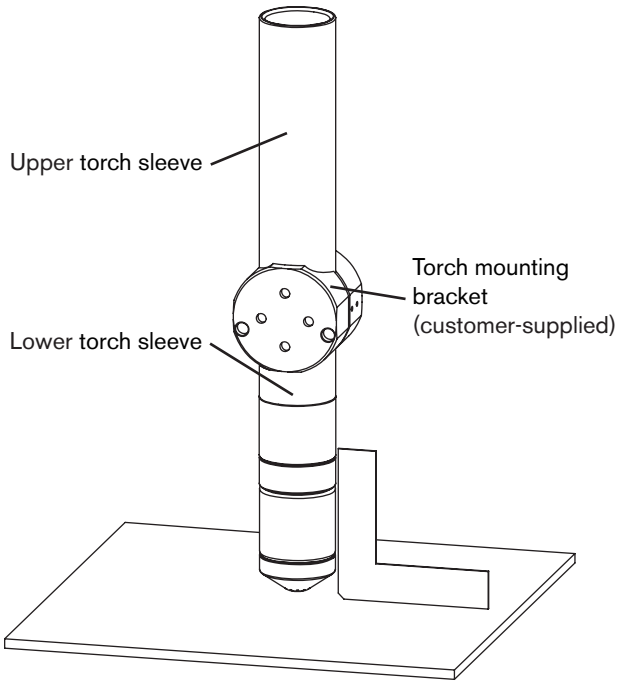


Off-valve grounding



C Torch mounting and alignment

Mounting the torch



Installation

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

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

Torch alignment

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

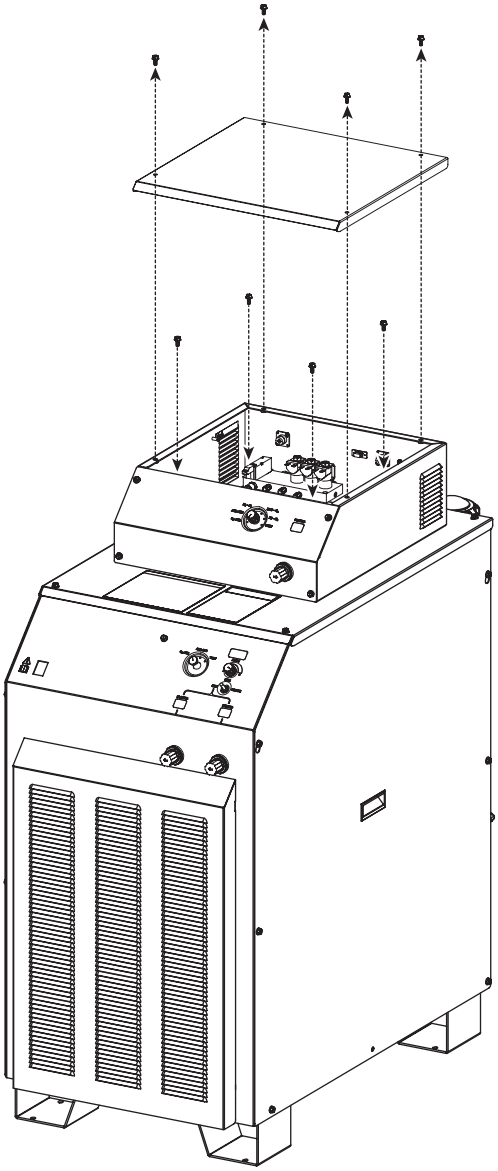
See also *Install consumables* in Section 4 to install consumables in the torch.

Torch lifter requirement

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

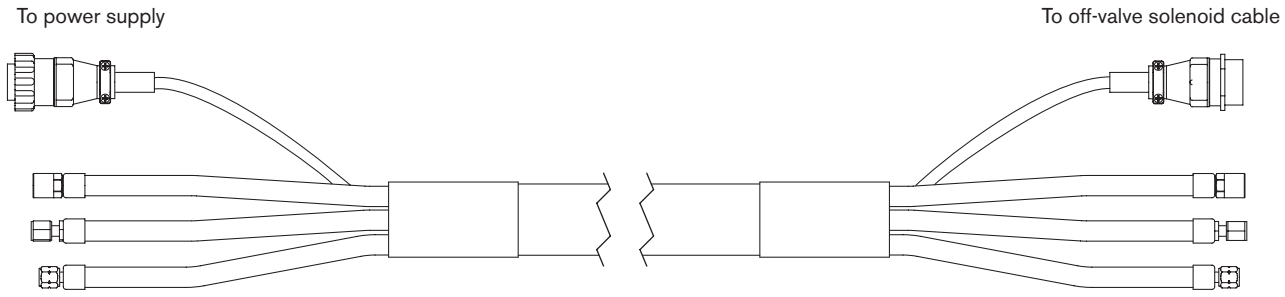
Install the fuel gas console (optional component)

- The fuel gas console is mounted on the top of the power supply. Allow 1 m (3 ft) on all sides of the console for servicing and ventilation.
- The maximum lead length, from the fuel gas console to the off-valve, is 15 m (50 ft).



❶ Cable and hose assembly from power supply to off-valve

Part no.	Length
228053	7.5 m (25 ft)
228054	15 m (50 ft)

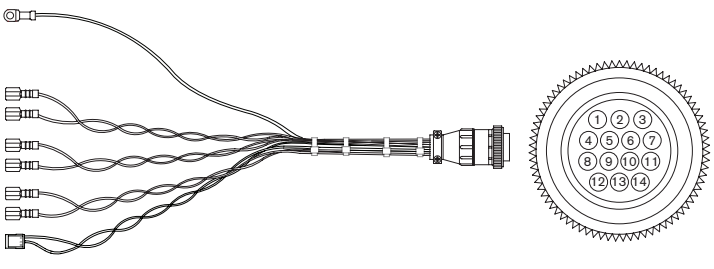


Power supply to off-valve cable

Cable signal list – power supply to off-valve cable

Power supply end		Off-valve end
Pin #	Description	Pin #
1	120 Vac Hot – Shield	1
2	120 Vac Return – Shield	2
3	120 Vac Hot – Plasma preflow	3
4	120 Vac Return – Plasma preflow	4
5	120 Vac Hot – Plasma cutflow	5
6	120 Vac Return – Plasma cutflow	6
7	120 Vac Hot – Plasma vent	7
8	120 Vac Return – Vent	8
9	Ground	9

Off-valve solenoid cable



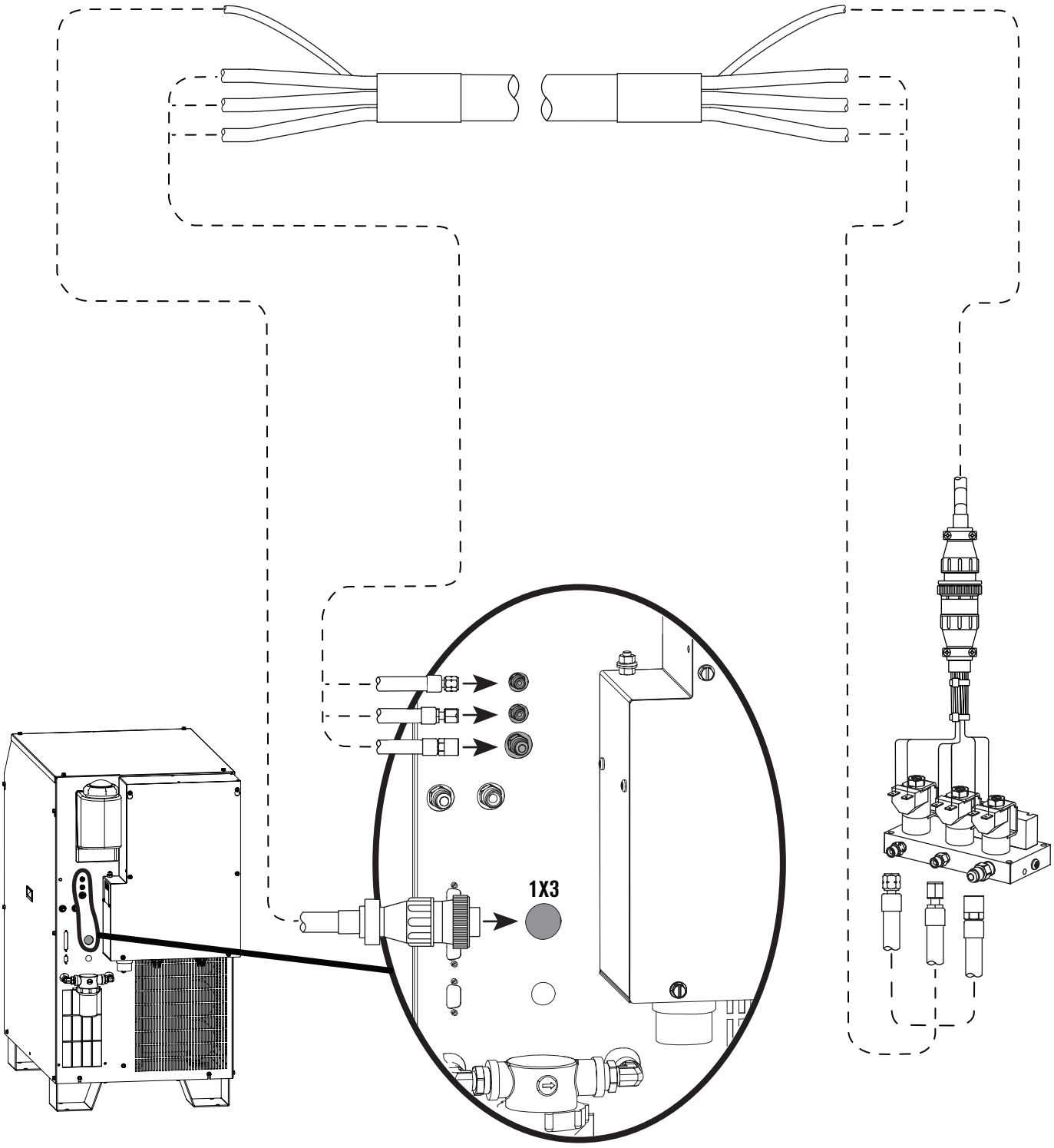
End B

End A (male/pins)

Cable signal list – off-valve solenoid cable to off-valve cable

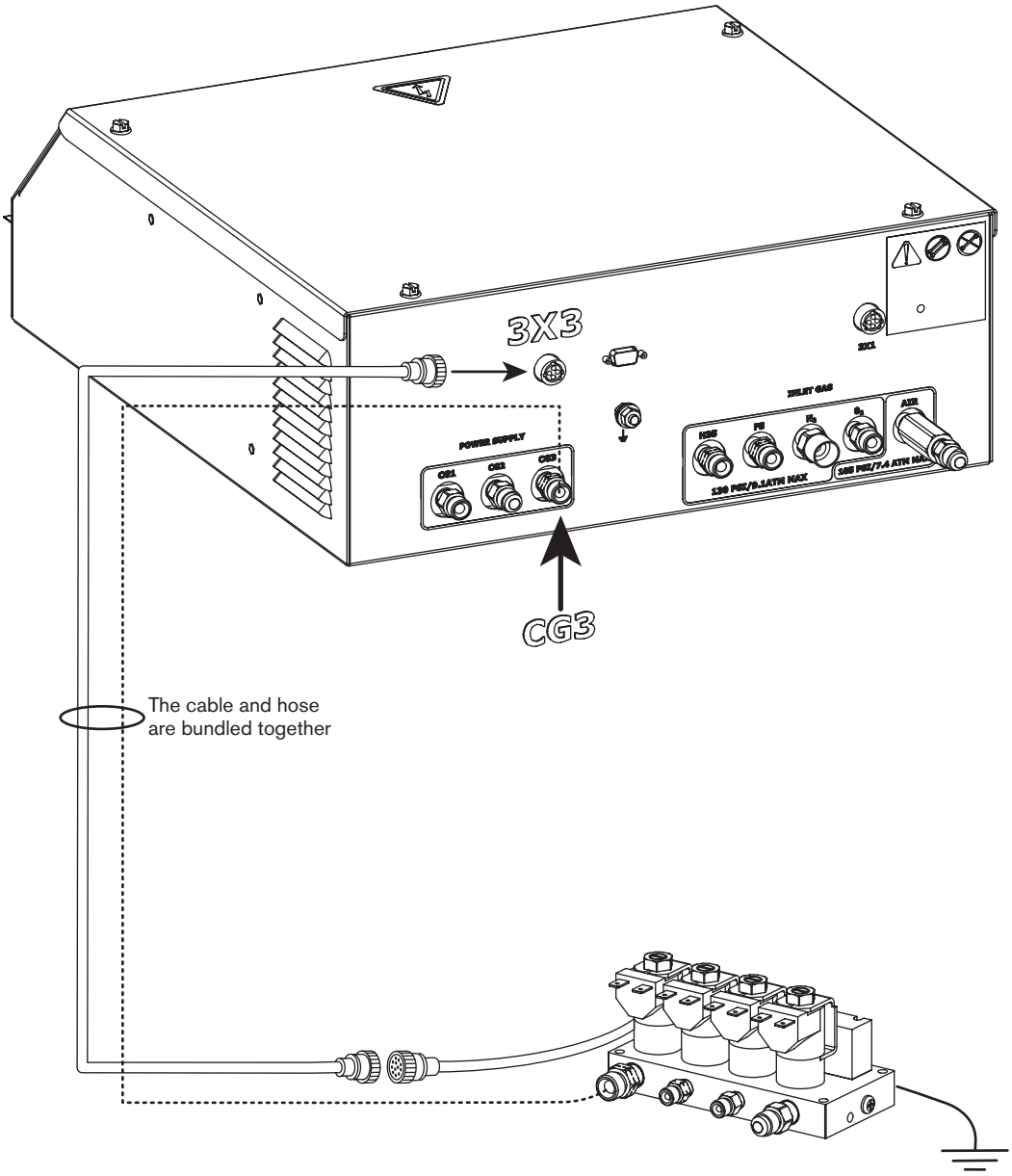
Function	End B	Color	End A
Shield	A	Blue	1
	C	Blue	2
Plasma	P	Red/Black	3
Preflow	P	Red	4
Plasma	P	Red/Black	5
Cutflow	C	Red	6
Vent	V	Red/Black	7
	V	Red	8
Not used			9
Not used			10
Ground	Ground	Green/Yellow	11
	Ground		12
	Ground		13
	Ground		14

Power supply to off-valve connections



❶a Fuel gas console to off-valve connections

Part no.	Length
228148	7.5 m (25 ft)
228149	15 m (50 ft)

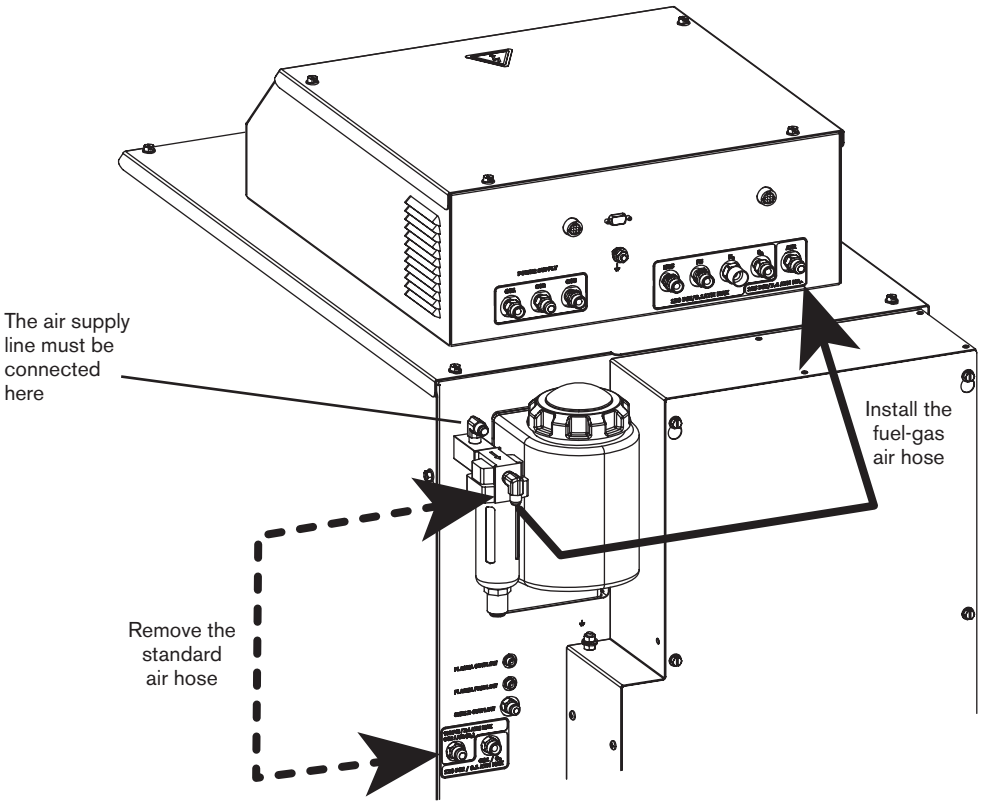


⓫b – ⓫f Fuel gas console to power supply connections

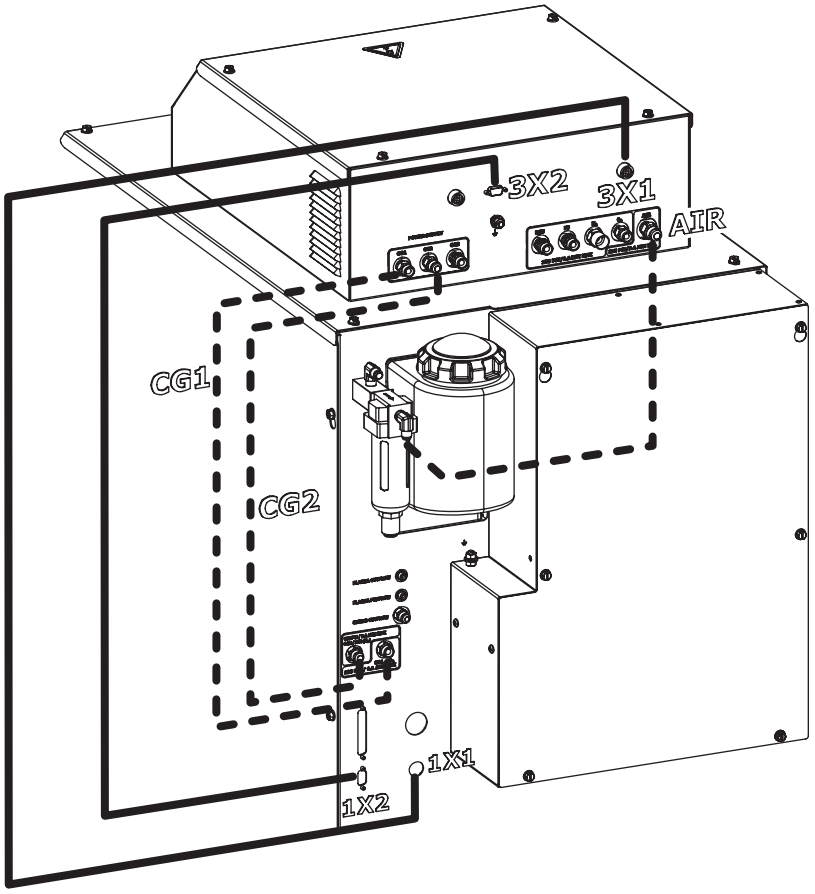
Before connections from the power supply to the fuel-gas console are made, the standard air hose must be removed from the power supply.

1. Remove and discard the standard air hose.

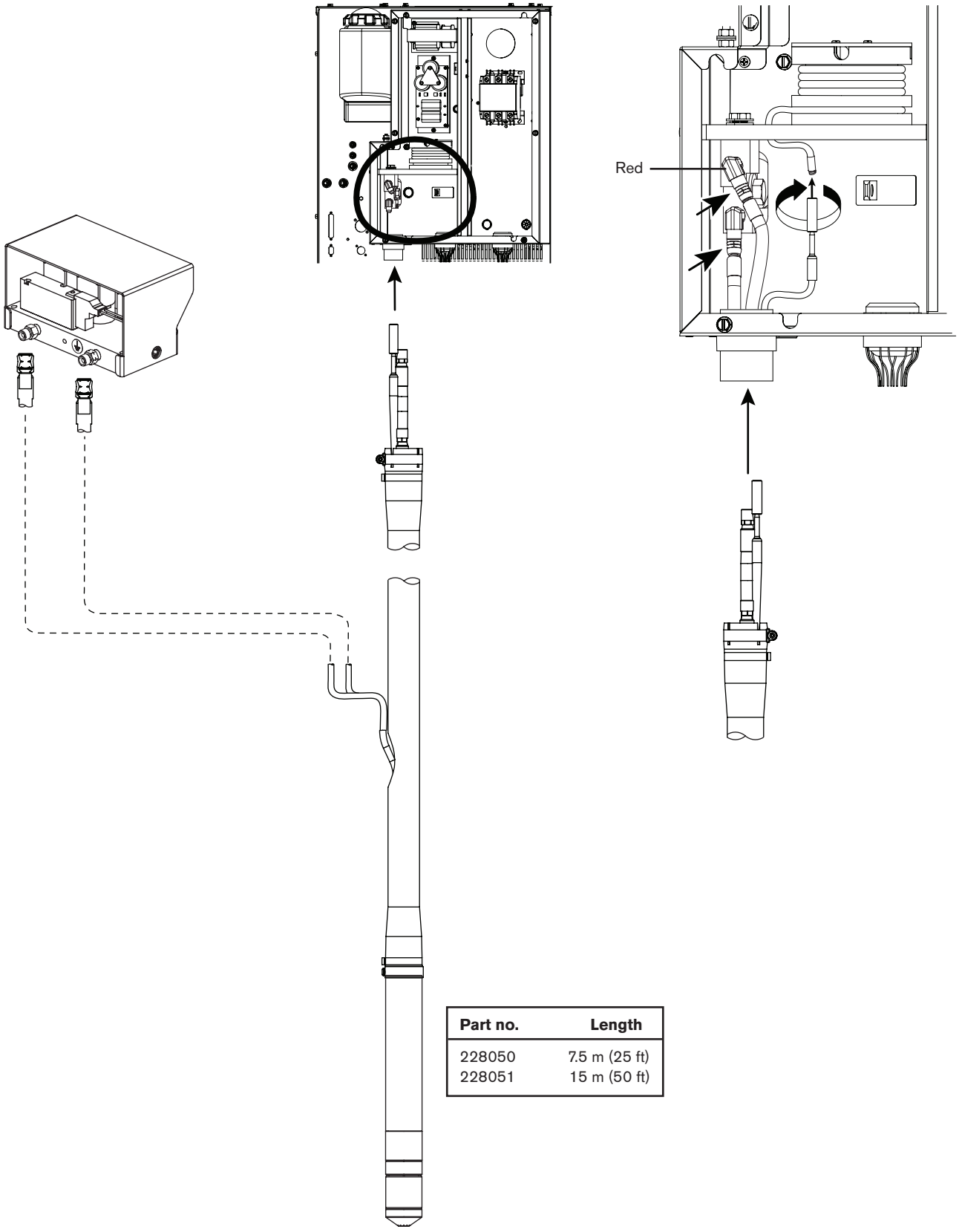
2. The air hose for the power supply to the fuel-gas console connection is supplied with the fuel-gas console. Connect the hose (024819) from the air filter on the power supply to the air inlet on the fuel-gas console.



Part no.	Description	Length
078203	**Fuel-gas console lead set**	
024819	Hose (black): CG1	1 m (3 ft)
024820	Hose (blue): CG2	1 m (3 ft)
123844	Cable: CAN Communication (3x2 to 1x2)	1.5 m (5 ft)
123684	Cable: Power (3x1 to 1x1)	1.5 m (5 ft)
024819	Hose: power supply air filter to fuel-gas console	1 m (3 ft)



❷ Torch lead assembly

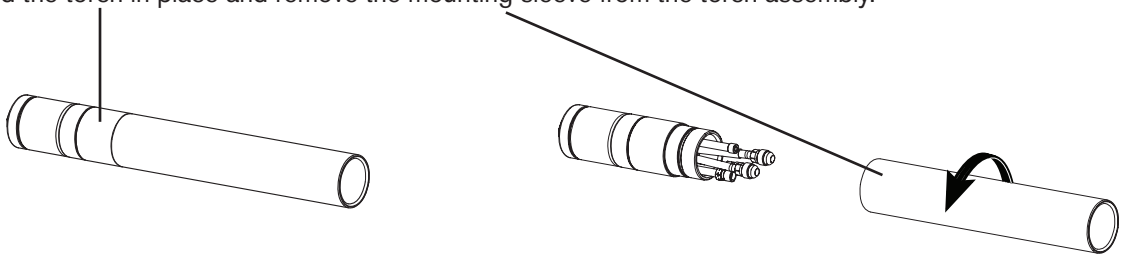


Part no.	Length
228050	7.5 m (25 ft)
228051	15 m (50 ft)

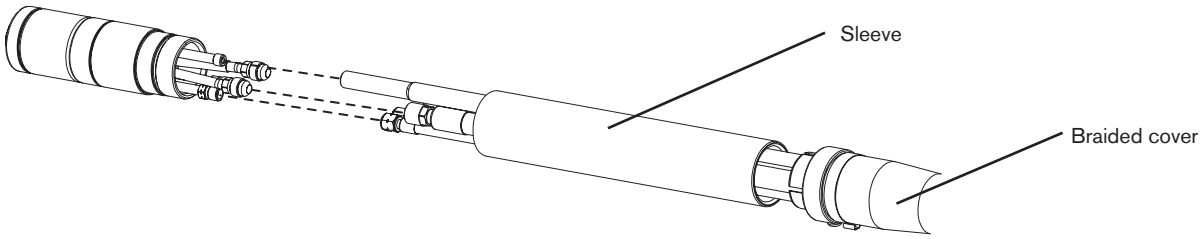
Connect the torch to the torch lead assembly

1. Route the leads through the cable track on the table. Leave 2 meters (6.5 ft.) of the leads loose at the torch end to install the torch.

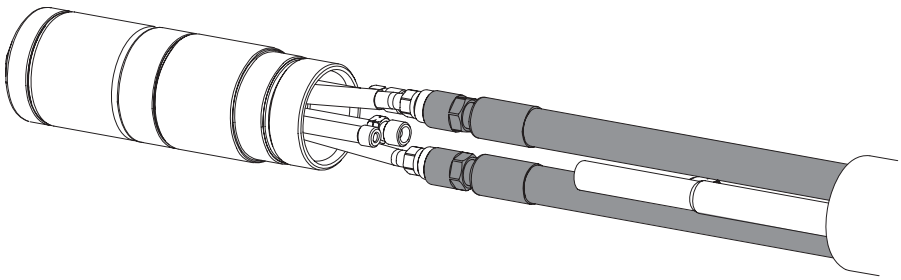
2. Hold the torch in place and remove the mounting sleeve from the torch assembly.



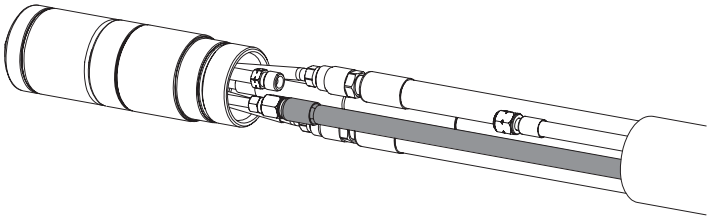
3. Push back the braided cover and slide the sleeve back over the leads. Align the torch connections with the hoses in the lead assembly. The hoses must not twist, and they are taped together to help prevent twisting.



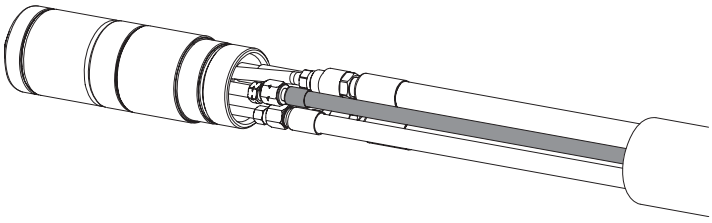
4. Connect the coolant hoses to the torch. Red connects to red. Use 2 wrenches to tighten gas and coolant fittings.



5. Connect the shield gas hose.

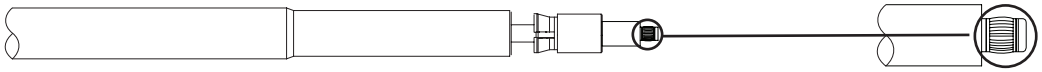


6. Connect the plasma gas hose. This connection has left-hand threads.

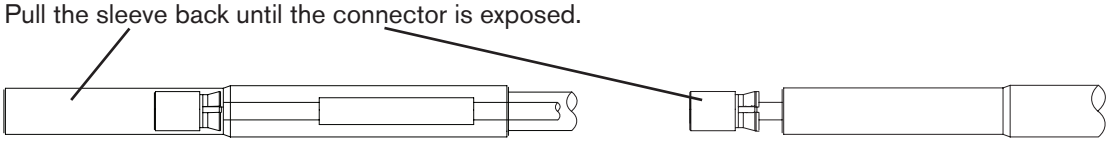


7. Connect the pilot arc lead.

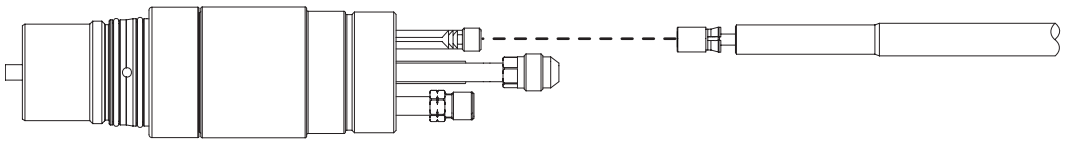
Note: Be careful not to damage or remove the small slotted metal band at the end of the pilot arc cable



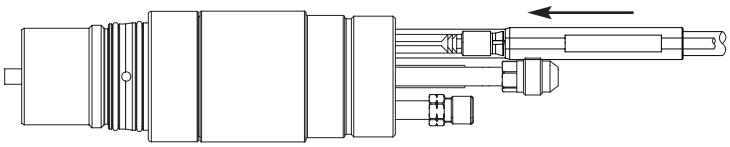
7a. Pull the sleeve back until the connector is exposed.



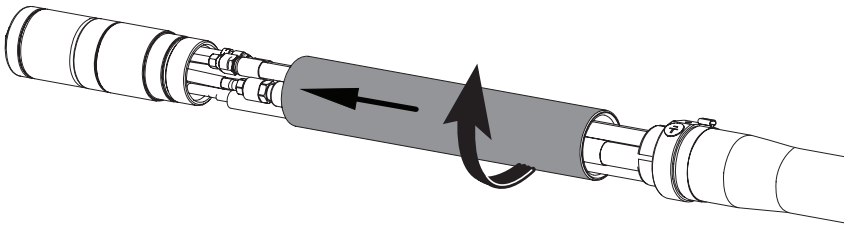
7b. Screw the connector onto the pilot arc connection from the torch. Tighten by hand until it is firmly seated.



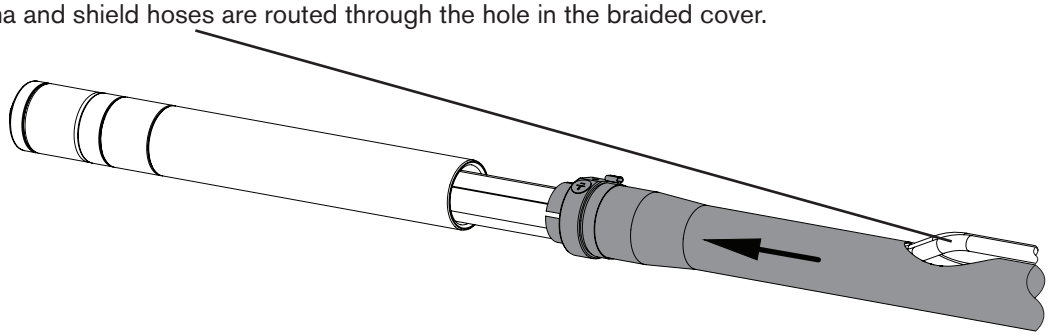
7c. Slide the sleeve forward until it clicks into place.



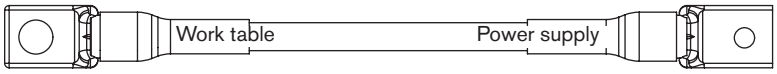
8. Slide the torch sleeve over the connections and screw it onto the torch body.



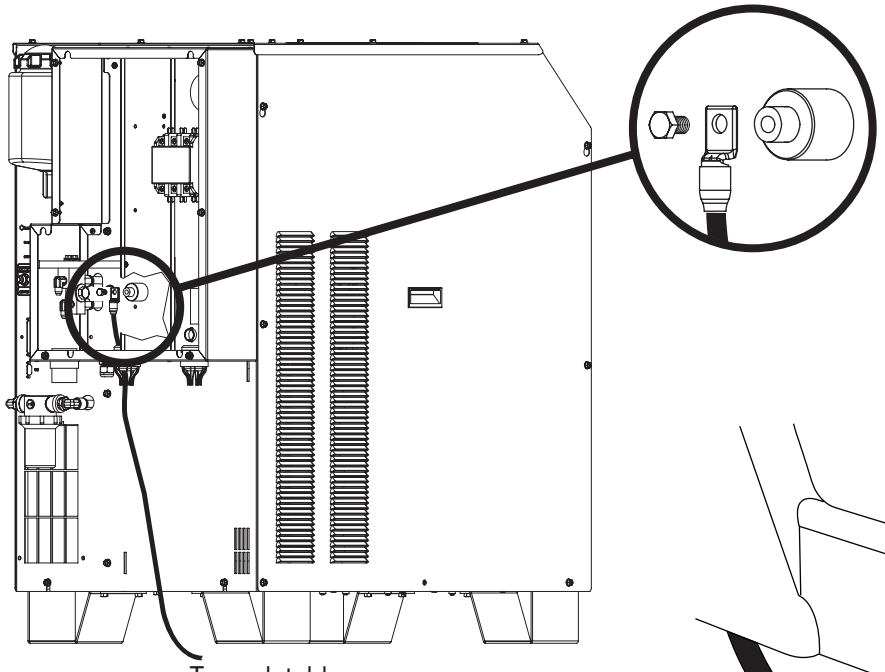
9 Slide the braided cover up to the torch sleeve. Push the brass collar into the torch sleeve. It is a snug fit. Make sure the plasma and shield hoses are routed through the hole in the braided cover.

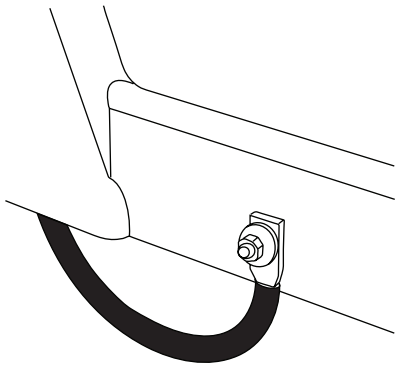


❸ Work lead



Part no.	Length
123662	7.5 m (25 ft)
123663	15 m (50 ft)

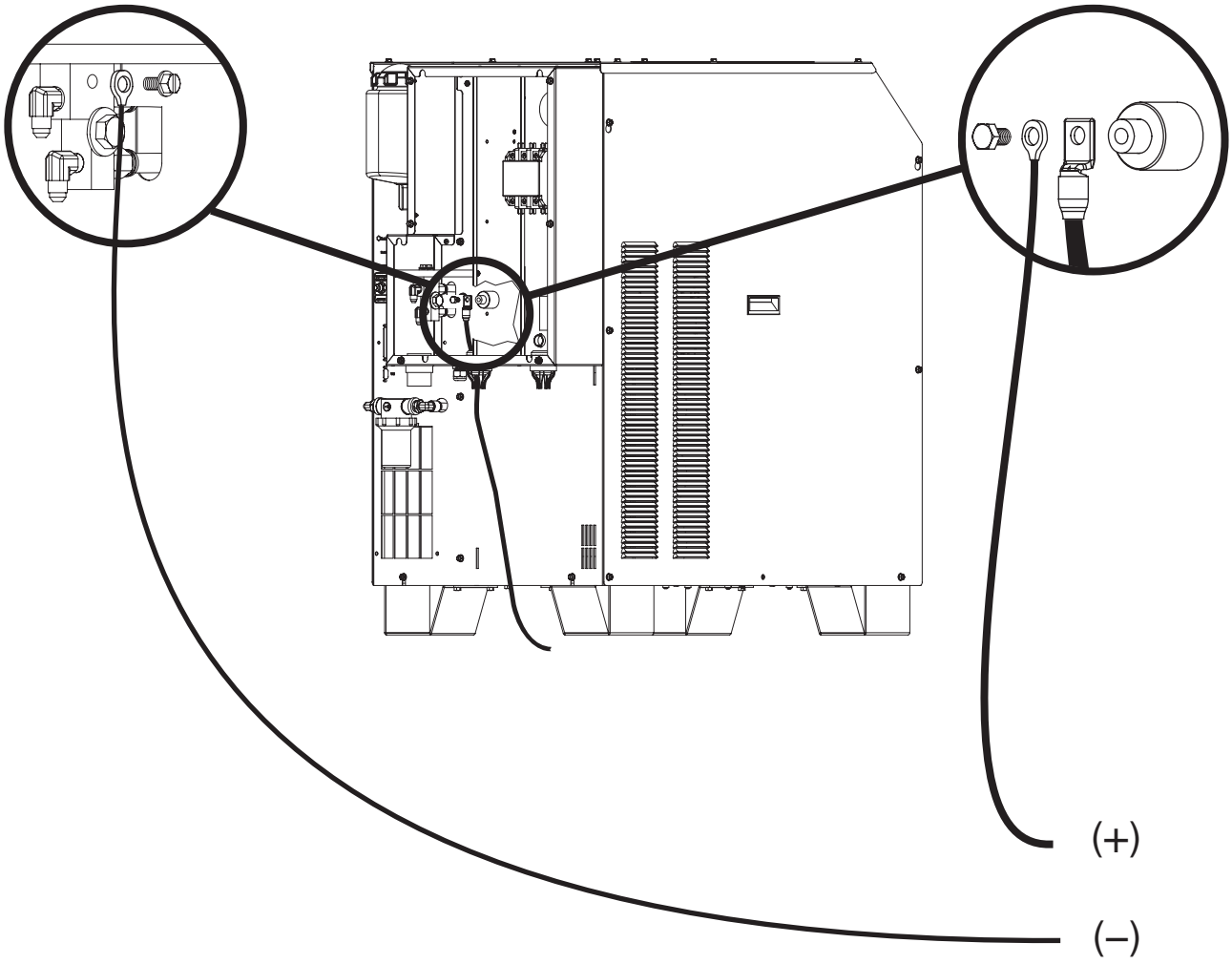




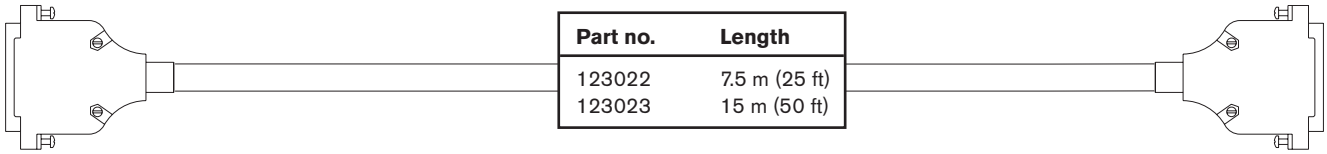
Lower frame of work table (typical)

Arc voltage connection

If a torch height control is installed, and undivided arc voltage (0 to 311 VDC) is needed, it can be accessed by making the connections shown in the figure on this page. The cables in the figure terminate at a voltage divider (supplied by the torch height control manufacturer).



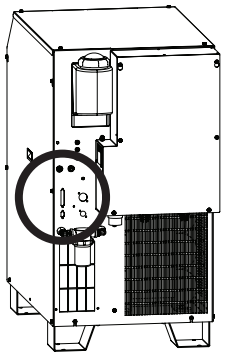
❹ Power supply to CNC interface cable

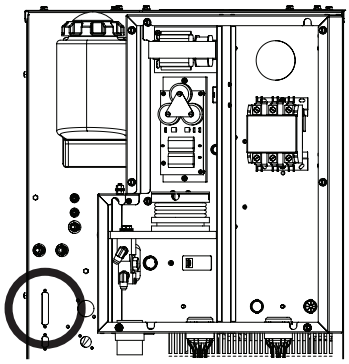


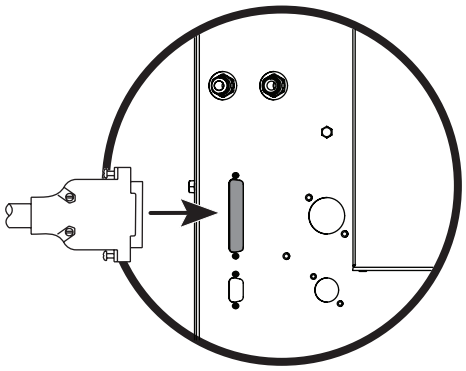
Part no.	Length
123022	7.5 m (25 ft)
123023	15 m (50 ft)

Power supply **CNC**

Wire color	Pin no.	Input/ Output	Signal name	Function	Input/ Output	Notes
Black Red	1 20	Input Input	None None	Not used Not used	Output Output	
Black Green	2 21	Output Output	None None	Not used Not used	Input Input	
Black Blue	3 22		None None	Not used Not used		
Black Yellow	4 23	Output Output	Motion E (-) Motion C (+)	Notifies the CNC that an arc transfer has occurred and to begin machine motion once the CNC's pierce delay has timed out.	Input Input	2
Black Brown	5 24	Output Output	None None	Not used Not used	Input Input	2
Black Orange	6 25	Output Output	Rampdown error E (-) Rampdown error C (+)	Notifies the CNC that a rampdown error has occurred	Input	2
Red White	7 26	Output Output	None None	Not used Not used	Input	2
Red Green	8 27	Output Output	None None	Not used Not used	Input Input	2
Red Blue	9 28	Output Output	None None	Not used Not used	Input Input	2
Red Yellow	10 29	Output Output	None None	Not used Not used	Input Input	2
Red Brown	11 30		None None	Not used Not used		
Red Orange	12 31	Input Input	Corner - Corner +	CNC Notifies the plasma system that a corner is approaching and to reduce cut current (Cut current is CNC selectable or defaults to 75%. of cut current)	Output Output	1
Green White	13 32	Input Input	Pierce - Pierce +	CNC Notifies the plasma system to maintain the shield preflow until the CNC releases the signal.	Output	1
Green Blue	14 33	Input Input	Hold - Hold +	Not required without Command THC. Command THC requires signal to preflow gases during IHS.	Output	1
Green Yellow	15 34	Input Input	Start - Start +	CNC initiates the plasma arc.	Output Output	1
Green Brown	16 35		None None	Not used Not used		
Green Orange	17 36		None Power ground	Not used Ground		
White Black	18 37		Power ground CNC +24 VDC	Ground Available 24 VDC (200 milliamps maximum) See notes		3
	19		CNC + 24 VDC	Not connected		







Notes to CNC interface cable run list

Note 1. Inputs are relay coils. They require 24 VDC at 8.3 mA, or dry-contact closure.

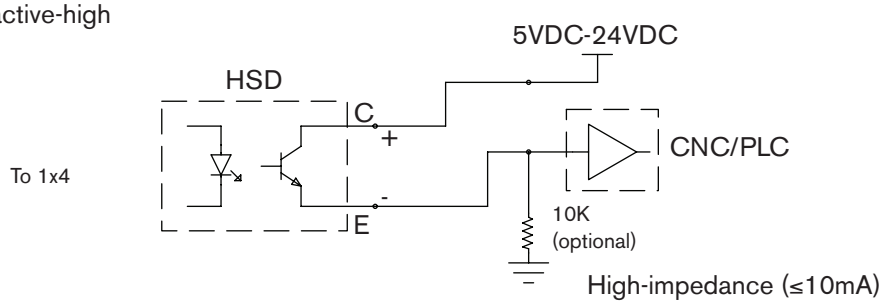
Note 2. Outputs are optically isolated, open-collector, transistors. The maximum rating is 24 VDC at 10 mA.

Note 3. CNC +24 VDC provides 24 VDC at 200 mA maximum. A jumper is required on J300 to use 24 V power.

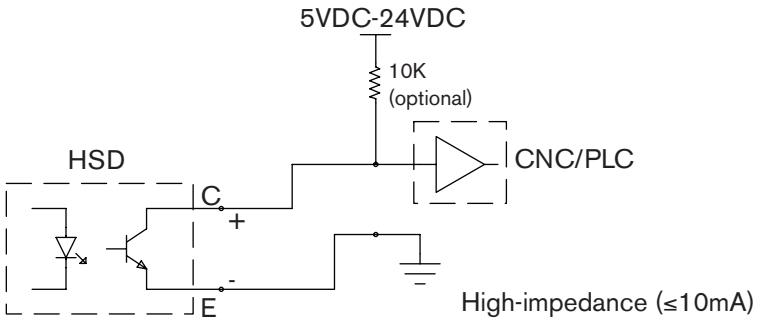
Caution: **The CNC cable must be constructed using cable with 360 degree shielding and metal housing connectors at each end. The shielding must be terminated to the metal housings at each end to ensure proper grounding and to provide the best shielding.**

Examples of output circuits

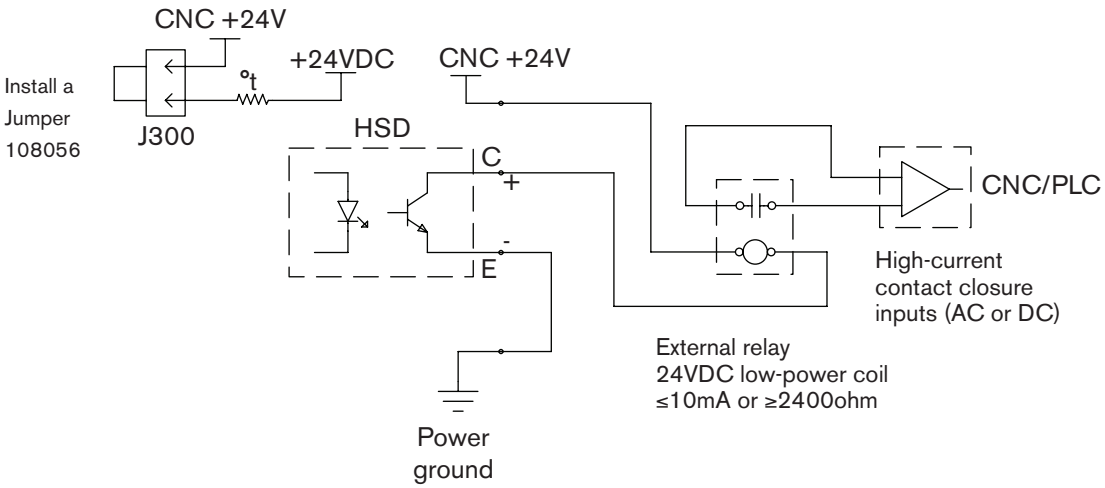
1. Logic interface, active-high



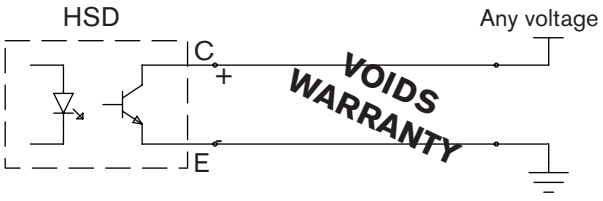
2. Logic interface, active-low



3. Relay interface

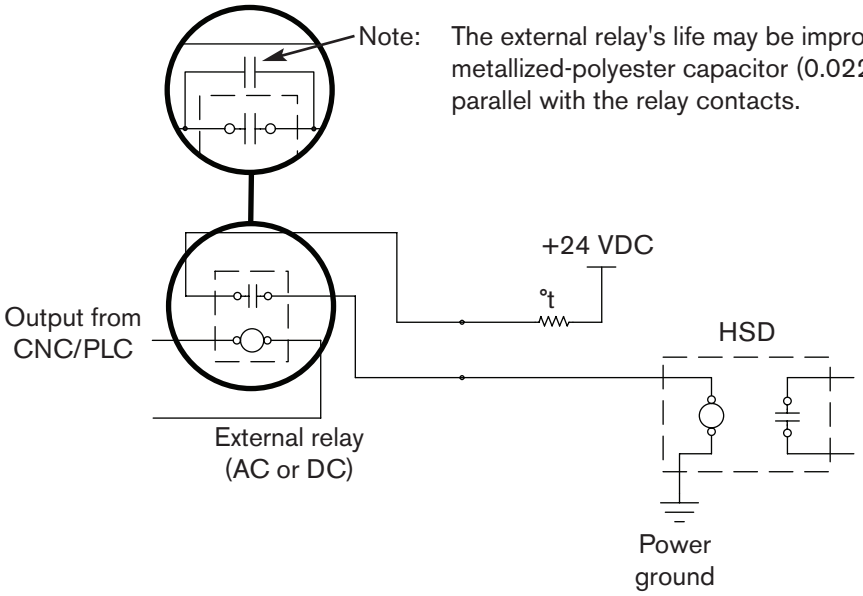


4. Do not use this configuration. Warranty will be void.

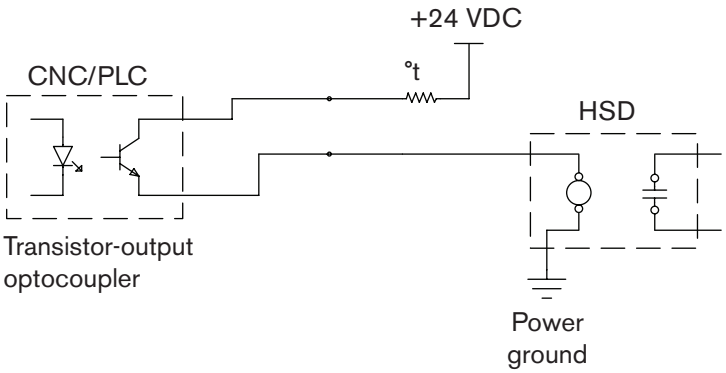


Examples of input circuits

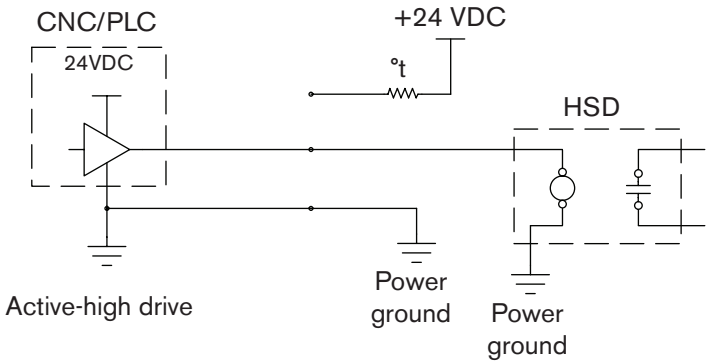
1. Relay interface



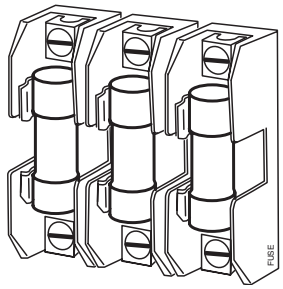
2. Optocoupler interface



3. Amplified-output interface



Power requirements



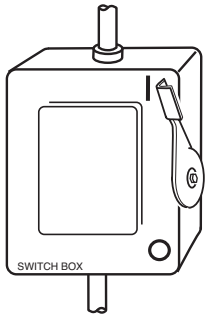
General

All switches, slow-blow fuses and power cables are customer-supplied and must be chosen as outlined by applicable national and 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 @ 19.5 kW output	Recommended slow-blow fuse size	Recommended cable size for 15 m (50 feet) maximum length Rated for 60° C
200/208 VAC	3	62/58 amps	85 amps	30 mm^2 (3 AWG)
220 VAC	3	56 amps	80 amps	30 mm^2 (3 AWG)
240 VAC	3	52 amps	65 amps	26 mm^2 (4 AWG)
400 VAC	3	32 amps	40 amps	10 mm^2 (8 AWG)
440 VAC	3	28 amps	35 amps	8 mm^2 (8 AWG)
480 VAC	3	26 amps	35 amps	8 mm^2 (8 AWG)
600 VAC	3	21 amps	30 amps	6 mm^2 (10 AWG)

Note: Cable AWG recommendations taken from table 310-16 of the National Electric Code handbook (USA).

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 national and local 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 “O” (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

Cable sizes vary based on the distance of the receptacle from the main box. Use a 4-conductor Type SO input power cable with a conductor temperature rating of 60° C (140° F). Installation must be performed by a licensed electrician.

Connect the power

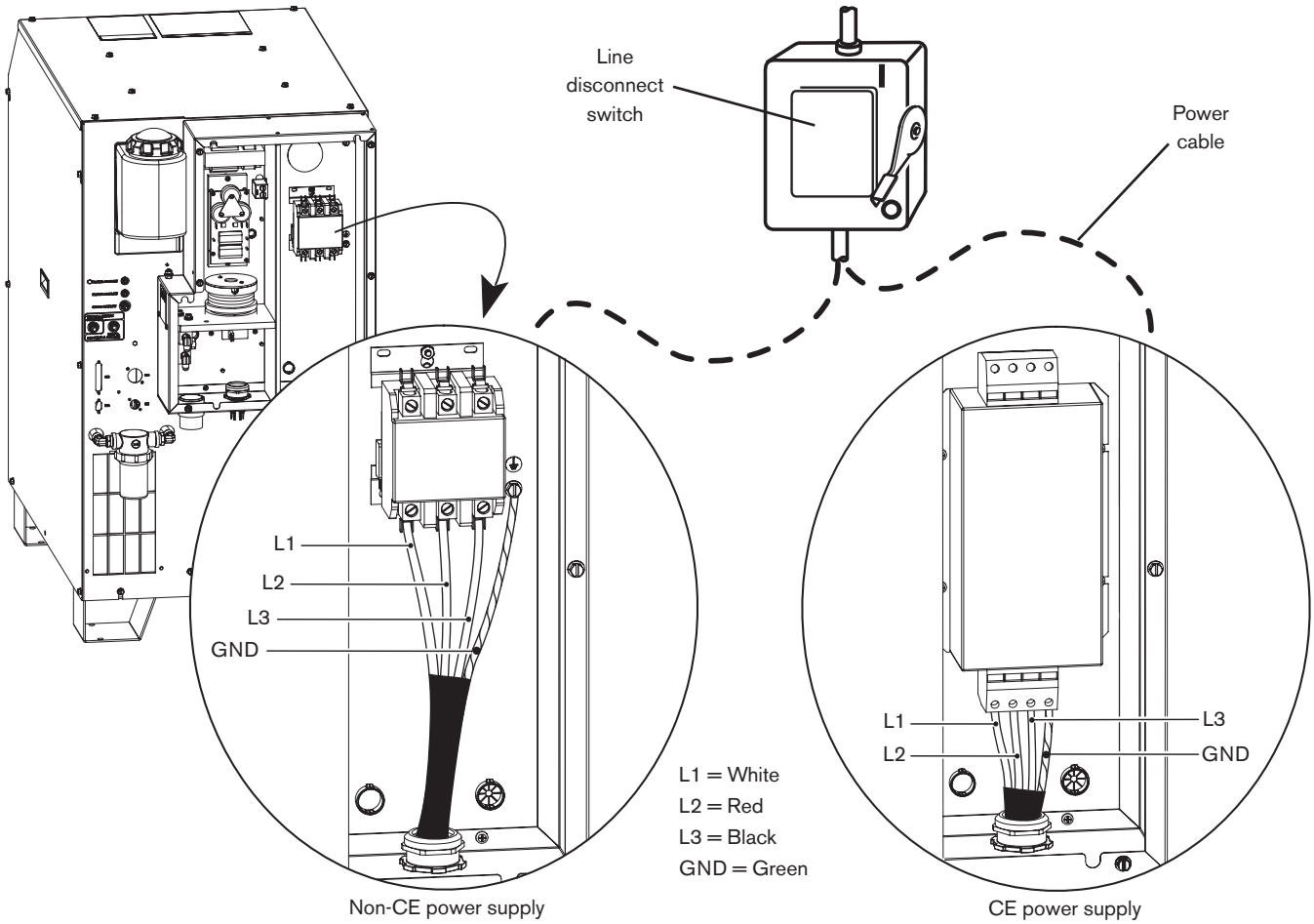
DANGER
ELECTRICAL SHOCK CAN KILL

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 and local safety procedures.

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 as shown below.
3. Connect the power leads to the terminals of 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 system.**
5. Connect the power cord leads to the line disconnect switch, following national or local electrical codes.

North American wire colors
U = Black
V = White
W = Red
(PE) Earth ground = Green/Yellow

European wire colors
U = Black
V = Blue
W = Brown
(PE) Earth ground = Green/Yellow



Torch coolant requirements

The power supply is shipped without any coolant in the tank. Hypertherm recommends a mixture of 30% propylene glycol, 69.9% deionized water, and 0.1% benzotriazole. This mixture resists freezing to -12° C (+10° F) and contains a corrosion inhibitor to protect copper surfaces in the coolant loop. This mixture is available in 1-gallon (3.8 liter) 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 Material Safety Data Sheets Appendix 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 Appendix* for data on safety, handling and storage of propylene glycol and benzotriazole.

DANGER

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, induce vomiting and call a physician immediately.

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

Always use purified water in the coolant mixture in order to prevent damage to the pump and corrosion in the torch coolant system.

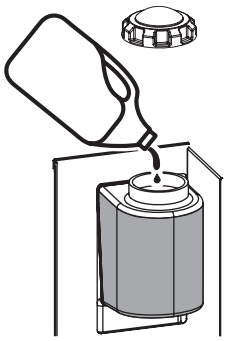
Water purity requirements

It is critical to maintain a low level of calcium carbonate in the coolant to avoid reduced performance of the torch or cooling system.

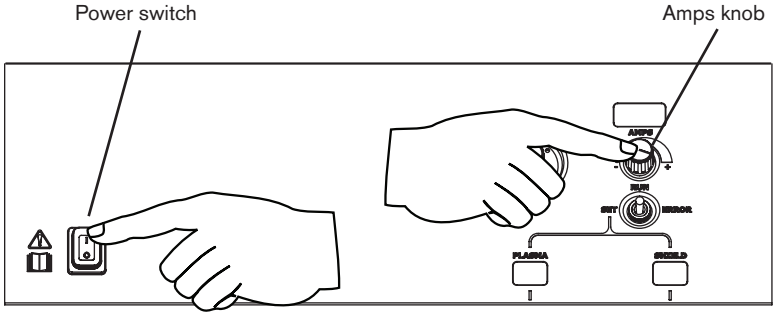
Fill the power supply with coolant

The system will take 11.4 – 15.1 liters (3 to 4 gallons) of coolant depending on the length of the torch leads and whether the system has a local or remote ignition console.

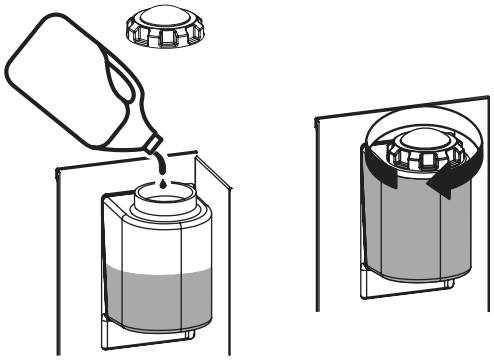
① Add coolant until the tank is full.



② Press and hold the Amps knob on the power supply control panel and turn ON the power to the power supply. This allows the user to override the 5-second pump time-out and fill the torch leads with coolant for the first time. Release the amps knob after 60 seconds. If the coolant flow switch is satisfied, the pump will continue to run and you are done. If the pump turns off, turn OFF the power to the power supply and repeat the process.



③ The level of coolant in the tank will have dropped. Add coolant until the tank is full and replace the filler cap.



Gas requirements

The customer must furnish all gases and gas-supply regulators for the system. Use high-quality, 2-stage pressure regulators located within 3 m (10 ft) of the power supply or optional fuel-gas console. See *Gas regulators* in this section for recommendations. See Section 2 for gas and flow specifications.

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

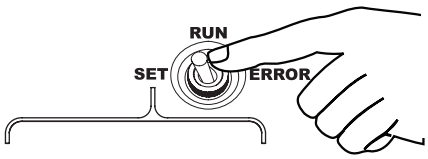
If the purity level of the gas is too low, or if there are leaks in the supply hoses or connections,

- **Cut speeds can decrease**
- **Cut quality can deteriorate**
- **Cutting thickness capability can decrease**
- **Parts life can shorten**

Setting the supply regulators

1. Make sure the power is OFF. Set the oxygen regulator pressure to 8.3 bar (120 psi). Set the air regulator pressure to 7.2 bar (95 psi). If an optional fuel-gas console is being used, set H35, F5, and N_2 pressures to 8.3 bar (120 psi).

2. Turn ON the power. 

3. After the purge cycle stops, move the selection switch to the SET position. 

4. Adjust all regulators while gas is flowing. Return to the supply regulators and adjust them to match the values in step 1.

5. Move the selection switch back to the RUN position (center).

Gas regulators

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

Supply gas plumbing

Rigid copper plumbing or suitable flexible hose may be used for all gas supplies. Do not use steel or aluminum pipe. After installation, pressurize the entire system and check for leaks.
Recommended hose diameters are 9.5 mm (3/8 in) for lengths < 23 m (75 ft) and 12.5 mm (1/2 in) for lengths > 23 m (75 ft).

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

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

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

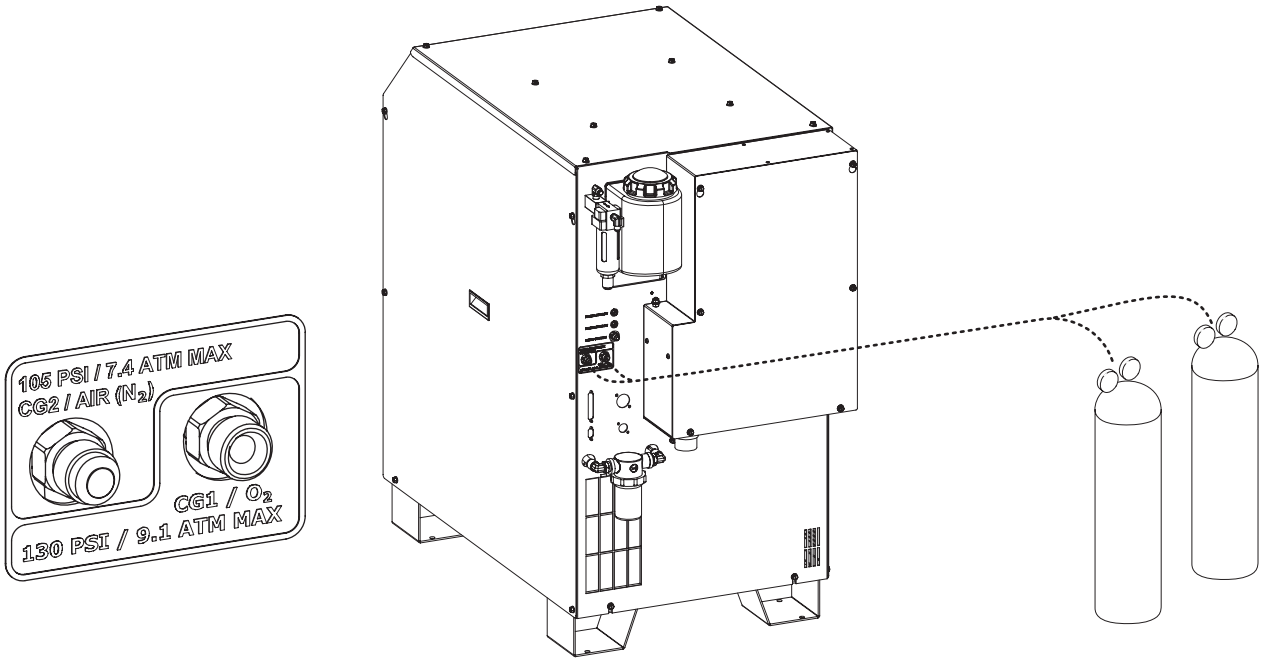
WARNING
CUTTING WITH OXYGEN CAN CAUSE FIRE OR EXPLOSION

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.
Flashback arrestors are required (unless not available for specific gases or required pressures) to prevent fire from propagating to the gas supply.

Connect the supply gases

Standard system

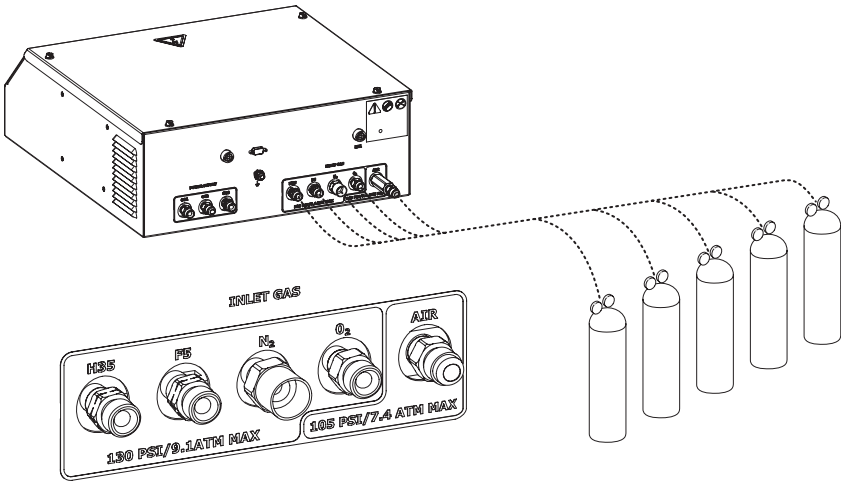
Connect the supply gases to the power supply.



Fuel-gas system

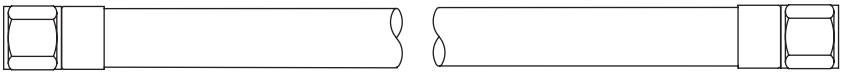
Connect the supply gases to the gas console. Torch leads must be purged between gas changes.

Fitting	Size
H35 / F5	9/16 – 18 LH, (fuel gas)"B"
N_2	5/8 – 18, RH, internal (inert gas) "B"
O_2	9/16 – 18, RH (oxygen) "B"
Air	9/16 – 18, JIC, #6



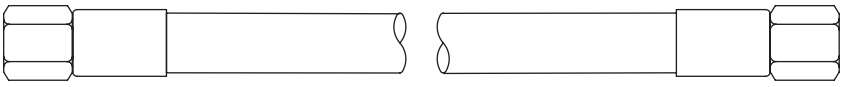
Supply gas hoses

❻ Air hose



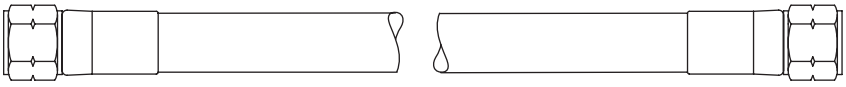
Part no.	Length
024659	7.5 m (25 ft)
024660	15 m (50 ft)

❼ Oxygen hose



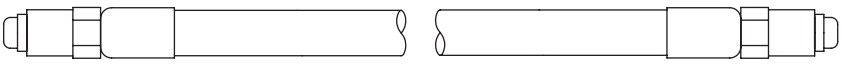
Part no.	Length
024205	7.5 m (25 ft)
024155	15 m (50 ft)

❽ F5 or H35 hose



Part no.	Length
024384	7.5 m (25 ft)
024656	15 m (50 ft)

❾ Nitrogen hose



Part no.	Length
024134	7.5 m (25 ft)
024112	15 m (50 ft)

Section 4

OPERATION

In this section:

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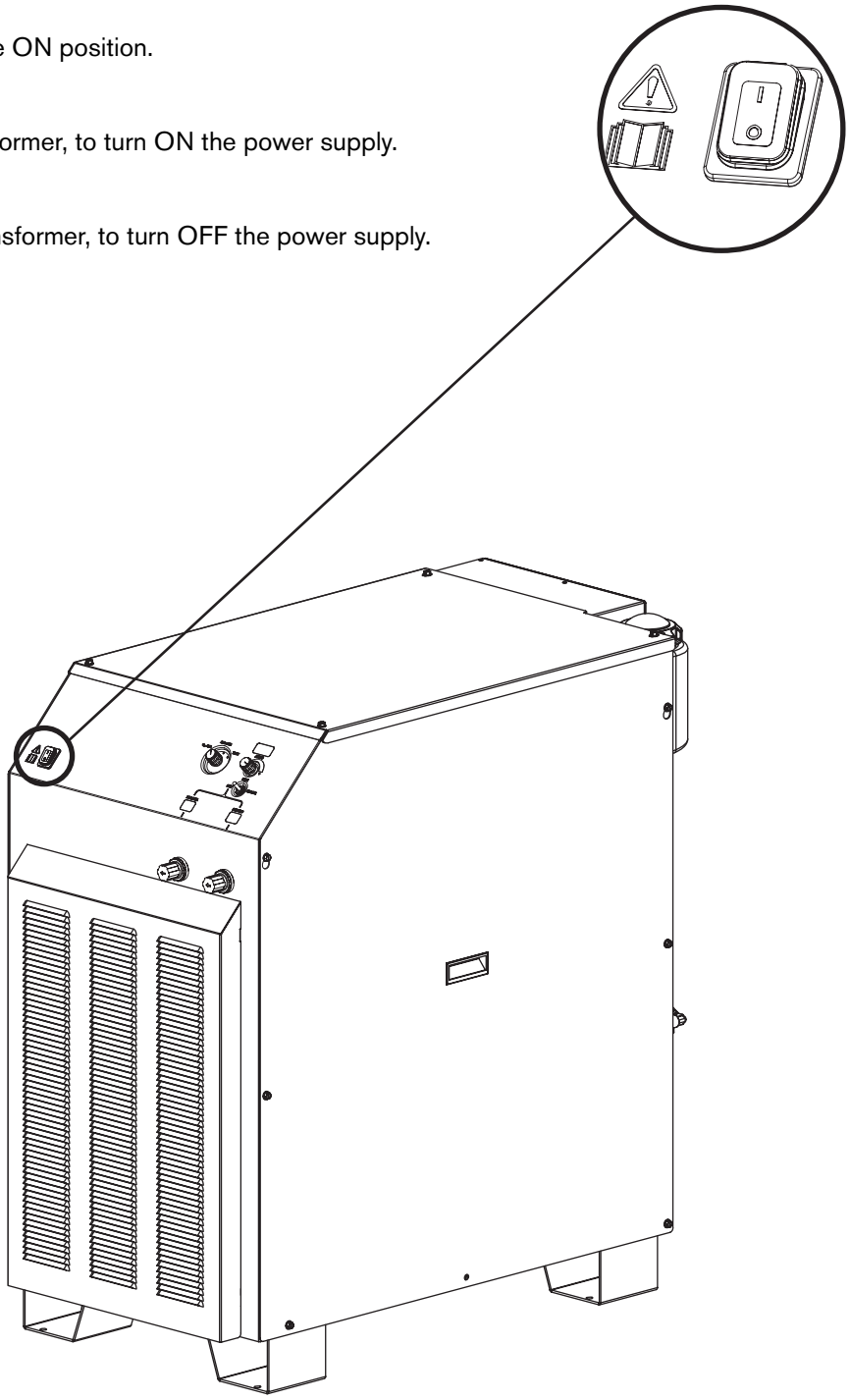
Controls and indicators

Main power switch

The switch illuminates when it is in the ON position.

On position (I)
AC power is sent to the control transformer, to turn ON the power supply.

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



Daily start-up

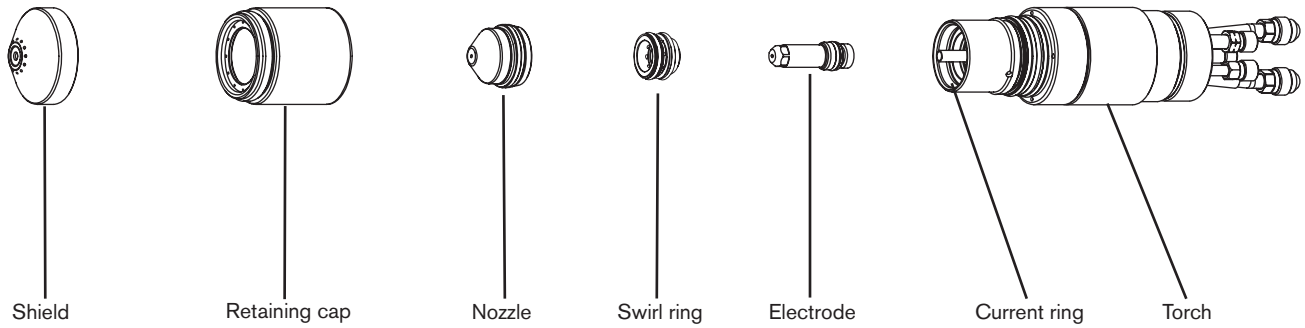
Prior to start-up, ensure that your cutting environment and that your clothing meet the safety requirements outlined in the *Safety* section of this manual.

Check the torch

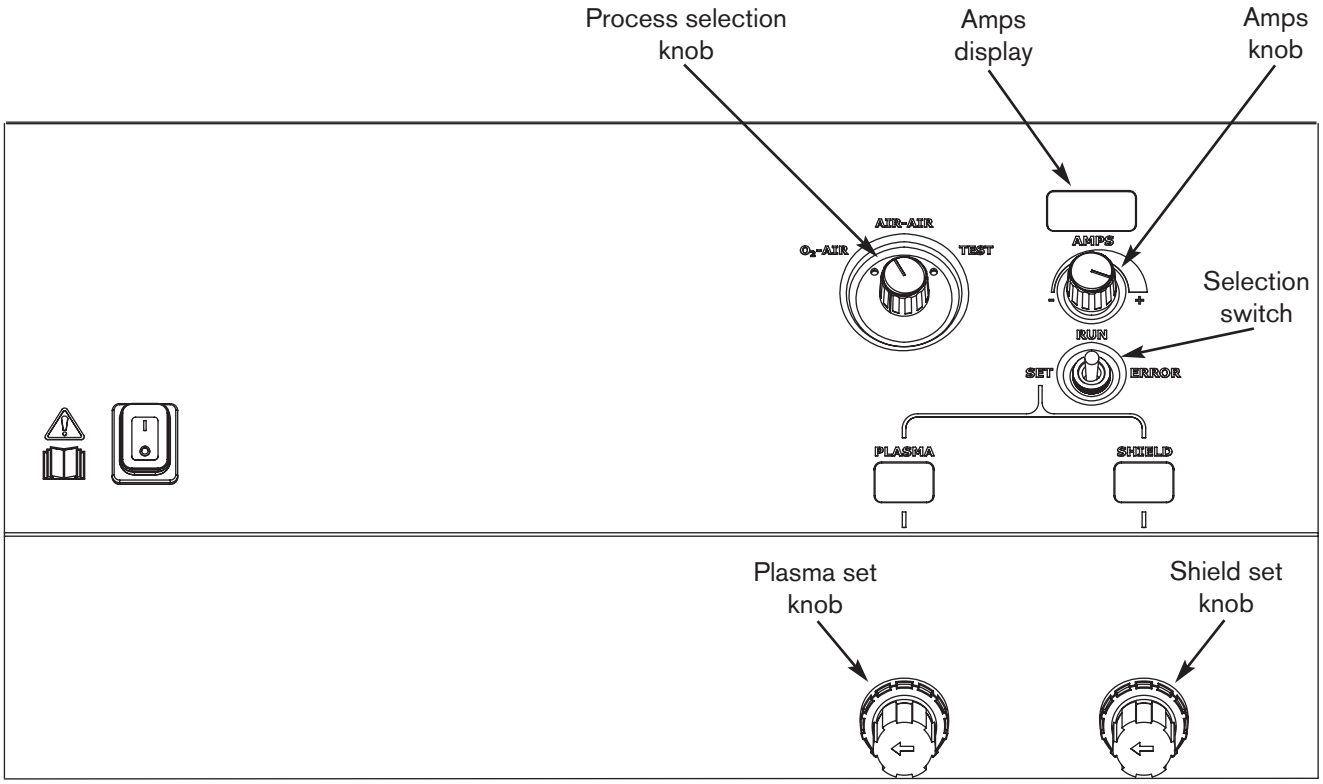
WARNING

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 OFF the main disconnect switch to the power supply.
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 consumable inspection tables.
   - Refer to *Consumable selection* to choose the correct consumables for your cutting needs.
3. Replace consumables. Refer to *Changing consumable parts* later in this section for details.
4. Ensure that the torch is perpendicular to the workpiece.



System operation



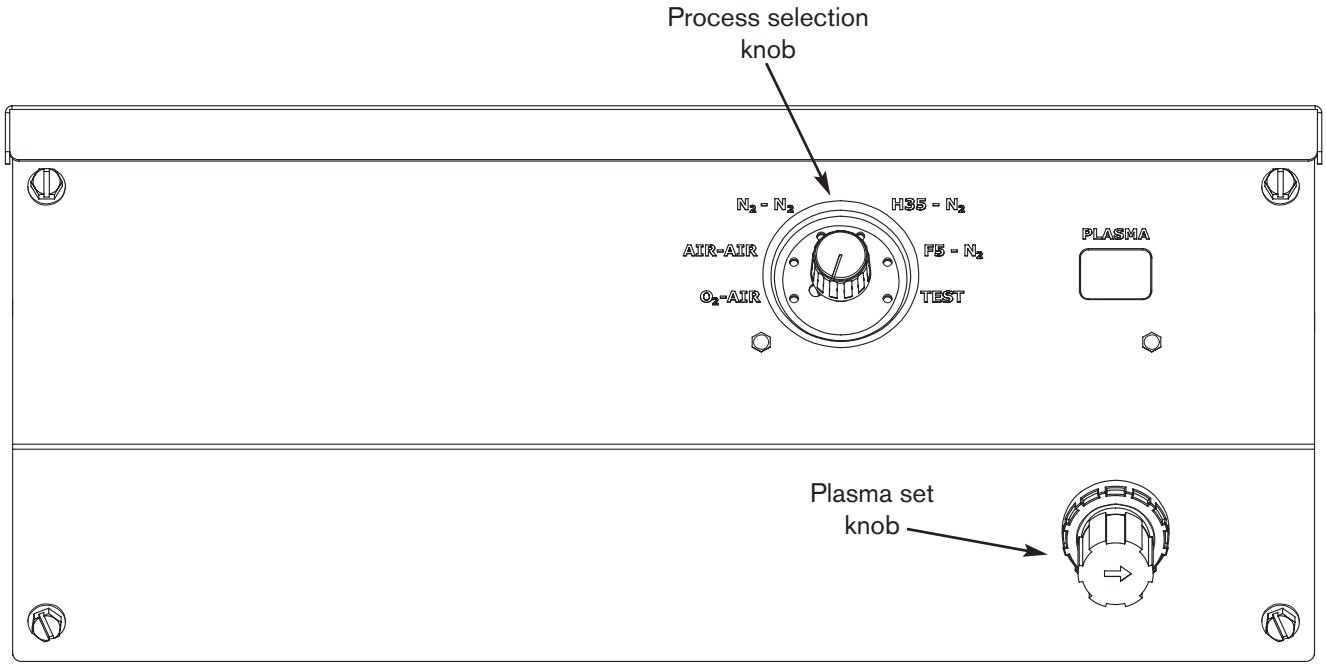
1. Turn ON the power with the selection switch in the RUN position.
2. Set the current using the AMPS knob.
3. Choose a process using the process selection knob.
4. Move the selection switch to the SET position.
5. Set the PLASMA and SHIELD gas pressures using the data in the cut chart for the desired process. Pull the knob towards you to unlock it and set the pressure. Push the knob towards the power supply until it clicks to lock it.

   Note: when the selection switch is in the set position, the amps display shows the incoming shield supply pressure.
6. Move the selection switch to the RUN position.

Amps display

- When the selection switch is in the run position, the display shows the current set point.
- During a cut the display shows the actual cutting current.
- Push the amps knob during a cut to display the output voltage of the power supply.

Fuel-gas console operation

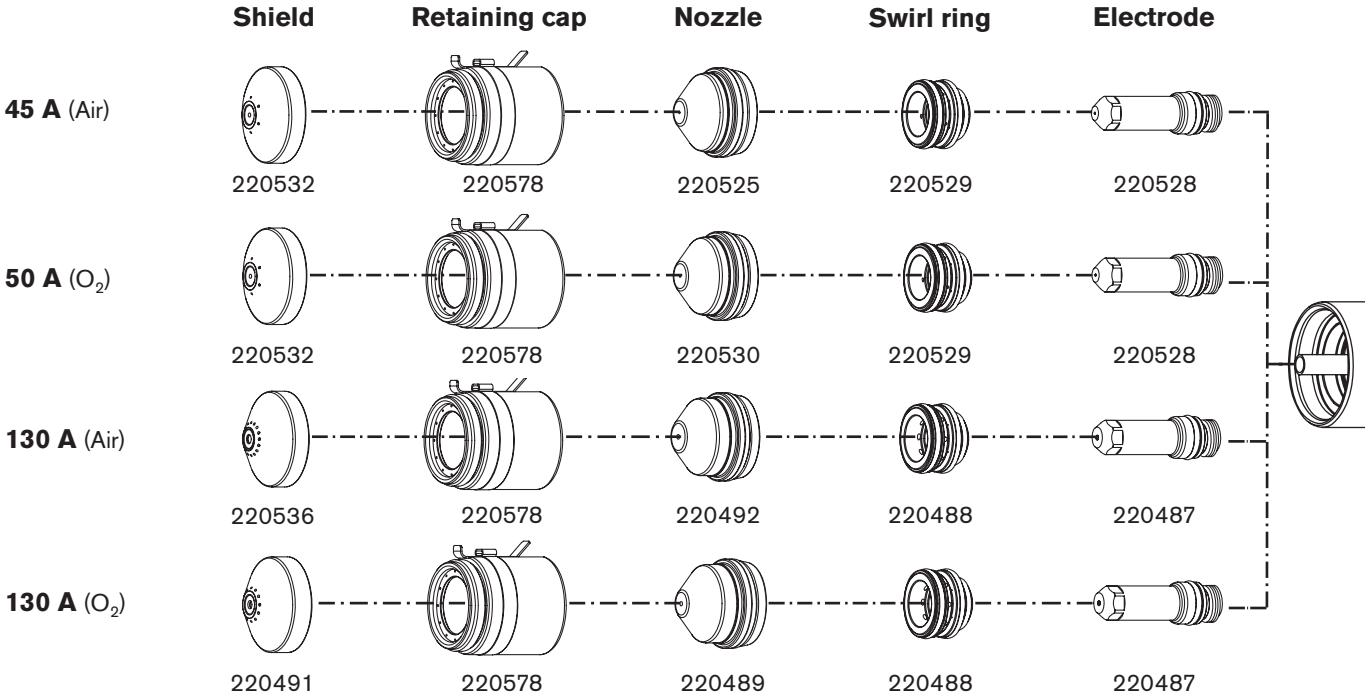


Note: The plasma set knob on the fuel-gas console is used when an H35 or F5 process is selected. The plasma set knob on the power supply is used (as described on the previous page) when an O_2, Air, or N_2 process has been selected.

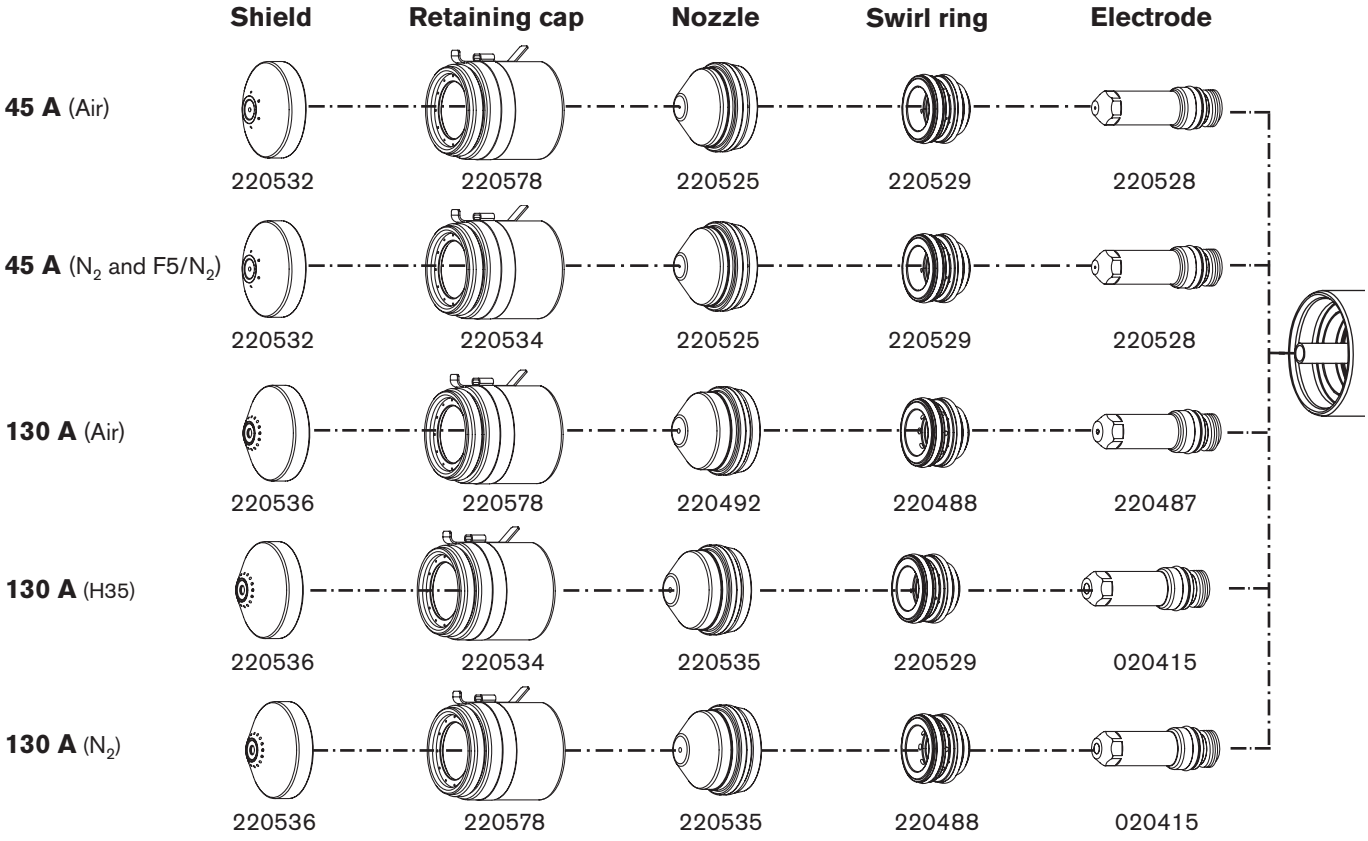
1. Turn ON the power with the selection switch in the RUN position.
2. Move the selection switch on the power supply to SET and choose the current using the AMPS knob.
3. Choose a process using the process selection knob on the fuel gas console.
4. Set the PLASMA gas pressure on the fuel gas console (H35/F5).
5. Set the SHIELD gas pressure on the power supply using the data in the cut chart for the desired process.
6. Move the selection switch on the power supply to the RUN position.

Consumable selection

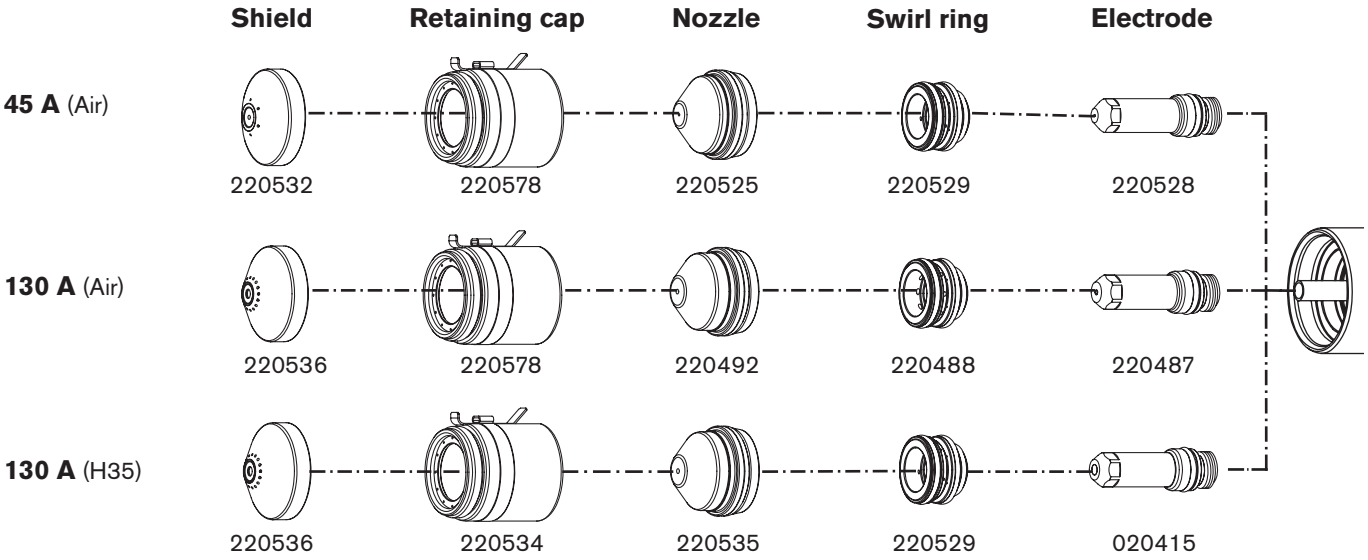
Mild steel



Stainless steel

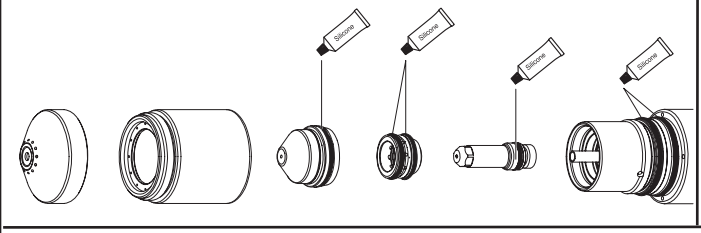


Aluminum

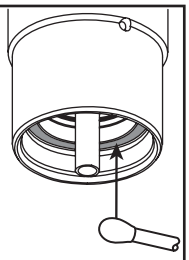

Shield
Retaining cap
Nozzle
Swirl ring
Electrode
45 A (Air)
220532
220578
220525
220529
220528
130 A (Air)
220536
220578
220492
220488
220487
130 A (H35)
220536
220534
220535
220529
020415

Install consumables

① Apply a thin film of silicone grease on all o-rings.



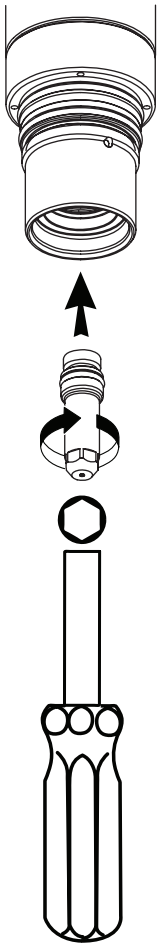
② Clean the nozzle mating surface with a cotton swab and water or 3% hydrogen peroxide.



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

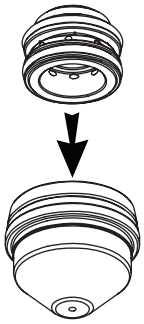
Use compressed air to clean out the inside of the torch every time consumables are changed.

③ Install the electrode

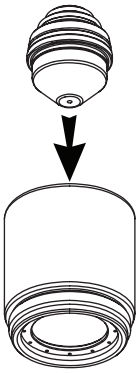


Tool part number
027102

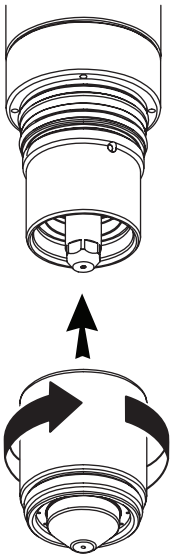
④ Install the swirl ring



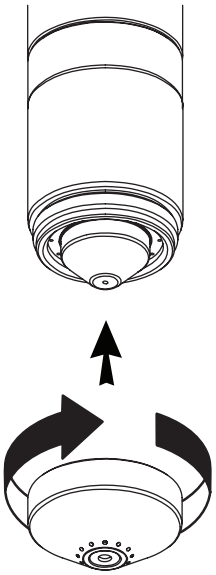
⑤ Install the nozzle and swirl ring



⑥ Install the retaining cap



⑦ Install the shield



Cut charts

The following *Cut charts* show the consumable parts, cutting speed, and the gas and torch settings required for each process.

The numbers shown in the *Cut charts* are recommended to provide high-quality cuts with minimal dross. Because of differences between installations and material composition, adjustments may be required to obtain desired results.

Estimated kerf width compensation

	Thickness (mm)						
Mild steel	**1.524**	**3.429**	**6.350**	**9.525**	**12.70**	**19.05**	**25.40**
130 O2/Air		1.549	1.778	1.981	2.235	2.336	3.073
130 Air/Air		1.346	1.574	1.879	2.082	2.717	3.251
50 O2/Air	1.041	1.168	1.473				
45 Air/Air	0.812	1.270	1.422				
Stainless steel							
130 Air/Air			1.651	1.930	2.133	2.768	
130 N2/N2			1.651	1.651	2.540	3.530	
130 H35/N2				2.870	2.768	2.590	2.946
45 Air/Air	0.812	1.117	1.270				
45 N2/N2	0.533	0.660	0.660				
45 F5/N2	0.609	0.635	0.812				
Aluminum							
130 Air/Air			2.082	1.930	2.159	2.692	2.819
130 H35/N2				2.235	2.184	2.006	1.168
45 Air/Air	1.168	1.193	1.219				

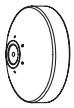
	Material thickness (inches)						
Mild steel	**0.06**	**0.135**	**0.25**	**0.375**	**0.5**	**0.75**	**1**
130 O2/Air		0.061	0.07	0.078	0.088	0.092	0.121
130 Air/Air		0.053	0.062	0.074	0.082	0.107	0.128
50 O2/Air	0.041	0.046	0.058				
45 Air/Air	0.032	0.050	0.056				
Stainless steel							
130 Air/Air			0.065	0.076	0.084	0.109	
130 N2/N2			0.065	0.065	0.100	0.139	
130 H35/N2				0.113	0.109	0.102	0.116
45 Air/Air	0.032	0.044	0.050				
45 N2/N2	0.021	0.026	0.026				
45 F5/N2	0.024	0.025	0.032				
Aluminum							
130 Air/Air			0.082	0.076	0.085	0.106	0.111
130 H35/N2				0.088	0.086	0.079	0.046
45 Air/Air	0.046	0.047	0.048				

Mild steel

Air Plasma / Air Shield

45 A Cutting

Flow Rates – lpm/scfh	
	Air
Preflow	113 / 240
Cutflow	122 / 258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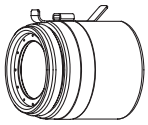
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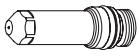
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Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	57	50	**0.5**	104	1.5	8930	3.0	200	0.0
				0.8	106	1.5	8400	3.0	200	0.0
				1.0	107	1.5	7750	3.0	200	0.1
				1.2	108	1.8	7250	3.6	200	0.1
				1.5	109	1.8	6500	3.6	200	0.2
				2.0	110	1.8	5800	3.6	200	0.2
				2.5	110	2.0	4700	4.0	200	0.2
				3.0*	110	2.0	3300	4.0	200	0.3
				4.0*	113	2.3	1950	4.6	200	0.4
				6.0*	115	2.5	1575	5.0	200	0.5

English

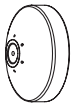
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
Air	Air	57	50	**.018**	104	.060	360	0.120	200	0.0
				.024	105	.060	345	0.120	200	0.0
				.030	106	.060	335	0.120	200	0.0
				.036	107	.060	315	0.120	200	0.1
				.048	108	.070	285	0.140	200	0.1
				.060	109	.070	255	0.140	200	0.2
				.075	110	.070	235	0.140	200	0.2
				.105	110	.080	170	0.160	200	0.2
				.135*	110	.080	90	0.160	200	0.3
				3/16*	113	.090	70	0.180	200	0.4
				1/4*	116	.100	60	0.200	200	0.5

Mild steel

O_2 Plasma / Air Shield

50 A Cutting

Flow Rates – lpm/scfh		
	O_2	Air
Preflow	0 / 0	69 / 146
Cutflow	29 / 62	73 / 155



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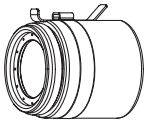

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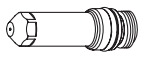


220528

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
O_2	Air	72	36	**0.5**	98	1.5	7550	3.0	200	0.0
				0.8	98	1.5	7050	3.0	200	0.0
				1.0	98	1.5	6775	3.0	200	0.1
				1.2	98	1.5	6600	3.0	200	0.1
				1.5	98	1.5	6150	3.0	200	0.1
				2.0	98	1.5	5400	3.0	200	0.1
				2.5	100	1.8	4300	3.6	200	0.2
				3.0*	102	1.8	3650	3.6	200	0.3
				4.0*	104	2.0	2800	4.0	200	0.4
				6.0*	108	2.5	1750	5.0	200	0.5

English

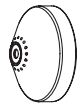
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
O_2	Air	72	36	**.018**	98	.060	300	0.120	200	0.0
				.024	98	.060	290	0.120	200	0.0
				.030	98	.060	280	0.120	200	0.0
				.036	98	.060	270	0.120	200	0.1
				.048	98	.060	260	0.120	200	0.1
				.060	98	.060	240	0.120	200	0.1
				.075	98	.060	220	0.120	200	0.1
				.105	100	.070	160	0.140	200	0.2
				.135*	103	.070	130	0.140	200	0.3
				3/16*	106	.090	85	0.180	200	0.4
				1/4*	108	.100	65	0.200	200	0.5

Mild steel

Air Plasma / Air Shield

130 A Cutting

Flow Rates – lpm/scfh	
	Air
Preflow	67 / 142
Cutflow	132 / 280



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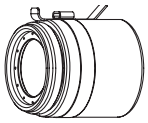

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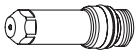


220487

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	72	35	**3**	136	3.1	6000	6.2	200	0.1
				4	13	3.1	4930	6.2	200	0.2
				6	138	3.6	3850	7.2	200	0.3
				10	142	4.1	2450	8.2	200	0.5
				12	144	4.1	2050	8.2	200	0.5
				15	150	4.6	1450	9.2	200	0.8
				20	153	4.6	810	10.5	230	1.2
				25	163	4.6	410	Edge Start		
				32	170	5.1	250			

English

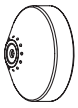
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
Air	Air	72	35	**0.1350**	136	.120	220	.240	200	0.1
				0.1875	136	.120	160	.240	200	0.2
				0.2500	138	.140	150	.280	200	0.3
				0.3750	142	.160	100	.320	200	0.5
				0.5000	144	.160	75	.320	200	0.5
				0.6250	150	.180	50	.360	200	0.8
				0.7500	153	.180	35	.420	230	1.2
				1	163	.180	15	Edge Start		
				1-1/4	170	.200	10			

Mild steel

O_2 Plasma / Air Shield

130 A Cutting

Flow Rates – lpm/scfh		
	O_2	Air
Preflow	0 / 0	90 / 190
Cutflow	48 / 102	92 / 195



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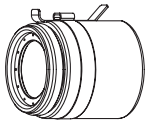

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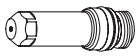


220487

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
O_2	Air	65	48	**3**	128	2.5	6500	5	200	0.1
				4	129	2.8	5420	5.6	200	0.2
				6	130	2.8	4000	5.6	200	0.3
				10	134	3.0	2650	6	200	0.3
				12	136	3.0	2200	6	200	0.5
				15	141	3.8	1650	7.6	200	0.7
			43	**20**	142	3.8	1130	7.6	200	1
				25	152	4.0	675	8	200	1.5
				32	155	4.5	480	Edge Start		
				38	160	4.5	305			

English

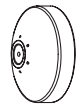
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
O_2	Air	65	48	**0.1350**	128	.100	240	0.2	200	0.1
				0.1875	129	.110	190	0.22	200	0.2
				0.2500	130	.110	150	0.22	200	0.3
				0.3750	134	.120	110	0.24	200	0.3
				0.5000	136	.120	80	0.24	200	0.5
				0.6250	141	.150	60	0.3	200	0.7
			43	**0.7500**	142	.150	50	0.3	200	1
				1	152	.160	25	0.32	200	1.5
				1-1/4	155	.180	20	Edge Start		
				1-1/2	160	.180	12			

Stainless steel

Air Plasma / Air Shield

45 A Cutting

Flow Rates – lpm/scfh	
	Air
Preflow	149 / 315
Cutflow	161 / 342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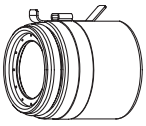
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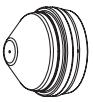
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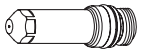
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Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	62	73	**0.5**	102	1.5	6800	3.0	200	0.0
				0.8	104	1.5	6100	3.0	200	0.0
				1.0	105	1.5	5600	3.0	200	0.1
				1.2	108	1.8	5100	3.6	200	0.1
				1.5	109	1.8	4500	3.6	200	0.2
				2.0	110	1.8	3650	3.6	200	0.2
				2.5	113	2.0	3000	4.0	200	0.2
				3.0*	117	2.0	2250	4.0	200	0.3
				4.0*	120	2.3	1500	4.6	200	0.4
				6.0*	122	2.5	1050	5.0	200	0.5

English

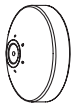
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
Air	Air	62	73	**.018**	102	.060	270	0.120	200	0.0
				.024	103	.060	260	0.120	200	0.0
				.030	104	.060	245	0.120	200	0.0
				.036	105	.060	230	0.120	200	0.1
				.048	108	.070	200	0.140	200	0.1
				.060	109	.070	175	0.140	200	0.2
				.075	110	.070	150	0.140	200	0.2
				.105	113	.080	110	0.160	200	0.2
				.135*	117	.080	70	0.160	200	0.3
				3/16*	120	.090	50	0.180	200	0.4
				1/4*	122	.100	40	0.200	200	0.5

Stainless steel

N_2 Plasma / N_2 Shield

45 A Cutting

Flow Rates – lpm/scfh	
	N_2
Preflow	74 / 157
Cutflow	91 / 192



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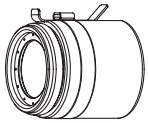

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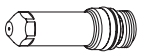


220528

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
N_2	N_2	73	25	**0.5**	106	1.5	7000	3.0	200	0.0
				0.8	107	1.5	6500	3.0	200	0.0
				1.0	107	1.5	5850	3.0	200	0.1
				1.2	109	1.8	5350	3.6	200	0.1
				1.5	112	1.8	4600	3.6	200	0.2
				2.0	114	1.8	3950	3.6	200	0.2
				2.5	118	2.0	3300	4.0	200	0.2
				3.0*	119	2.0	2450	4.0	200	0.3
				4.0*	121	2.3	1700	4.6	200	0.4
				6.0*	126	2.5	1125	5.0	200	0.5

English

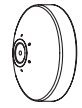
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
N_2	N_2	73	25	**.018**	106	.060	280	0.120	200	0.0
				.024	106	.060	270	0.120	200	0.0
				.030	107	.060	260	0.120	200	0.0
				.036	107	.060	240	0.120	200	0.1
				.048	109	.070	210	0.140	200	0.1
				.060	112	.070	180	0.140	200	0.2
				.075	114	.070	160	0.140	200	0.2
				.105	118	.080	120	0.160	200	0.2
				.135*	119	.080	75	0.160	200	0.3
				3/16*	121	.090	60	0.180	200	0.4
				1/4*	126	.100	40	0.200	200	0.5

Stainless steel

F5 Plasma / N_2 Shield

45 A Cutting

Flow Rates – lpm/scfh		
	F5	N_2
Preflow	0 / 0	162 / 344
Cutflow	32 / 67	147 / 311



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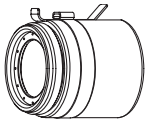

220534

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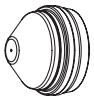
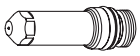


220525

220529



220528

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
F5	N_2	82	82	**0.5**	122	2.3	7000	4.6	200	0.0
				0.8	124	2.3	6500	4.6	200	0.0
				1.0	125	2.3	5875	4.6	200	0.1
				1.2	128	2.5	5360	5.0	200	0.1
				1.5	129	2.5	4650	5.0	200	0.2
				2.0	132	2.8	3200	5.6	200	0.2
				2.5	137	3.0	2975	6.0	200	0.2
				3.0*	138	3.0	2740	6.0	200	0.3
				4.0*	140	3.3	2350	6.6	200	0.4
				6.0*	148	3.6	1325	7.2	200	0.6

English

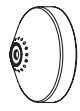
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
F5	N_2	82	82	**.018**	122	.090	280	0.180	200	0.0
				.024	123	.090	270	0.180	200	0.0
				.030	124	.090	260	0.180	200	0.0
				.036	125	.090	240	0.180	200	0.1
				.048	128	.100	210	0.200	200	0.1
				.060	129	.100	180	0.200	200	0.2
				.075	132	.110	130	0.220	200	0.2
				.105	137	.120	115	0.240	200	0.2
				.135*	138	.120	100	0.240	200	0.3
				3/16*	140	.130	80	0.260	200	0.4
				1/4*	148	.140	45	0.280	200	0.6

Stainless steel

Air Plasma / Air Shield

130 A Cutting

Flow Rates – lpm/scfh	
	Air
Preflow	67 / 142
Cutflow	132 / 280



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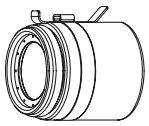
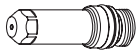


220578

220490 (no IHS tab)

220492

220488



220487

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	72	35	**6**	143	3.6	2600	7.2	200	0.3
				10	148	4.1	1700	8.2	200	0.5
				12	148	4.1	1380	8.2	200	0.8
				15	158	4.6	900	Edge Start		
				20	160	4.6	430			

English

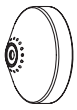
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
Air	Air	72	35	**1/4**	143	.140	100	.280	200	0.3
				3/8	148	.160	70	.320	200	0.5
				1/2	148	.160	50	.320	200	0.8
				5/8	158	.180	30	Edge Start		
				3/4	160	.180	20			

Stainless steel

N_2 Plasma / N_2 Shield

130 A Cutting

Flow Rates – lpm/scfh	
	N_2
Preflow	165 / 350
Cutflow	173 / 366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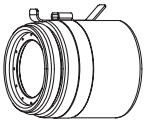
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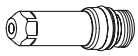
220535


220488


020415

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
N_2	N_2	46	71	**6**	130	3.0	2340	6.0	200	0.3
				10	132	3.6	1640	7.2	200	0.5
				12	141	3.6	1080	7.2	200	0.8
				15	144	3.8	700	Edge Start		
				20	153	4.3	300			

English

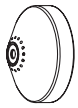
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
N_2	N_2	46	71	**1/4**	130	.120	90	.240	200	0.3
				3/8	132	.140	70	.280	200	0.5
				1/2	141	.140	35	.280	200	0.8
				5/8	144	.150	25	Edge Start		
				3/4	153	.170	15			

Stainless steel

H35 Plasma / N_2 Shield

130 A Cutting

Flow Rates – lpm/scfh		
	H35	N_2
Preflow	0 / 0	164 / 348
Cutflow	61 / 130	141 / 298



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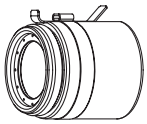

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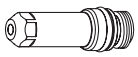
220529



020415

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
H35	N2	70	75	**10**	150	4.6	980	7.8	170	0.3
				12	154	4.6	820	7.8	170	0.5
				15	157	4.6	580	7.8	170	0.8
				20	162	4.6	360	7.8	170	1.3
				25	167	4.6	260	Edge Start		

English

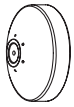
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
H35	N2	70	75	**3/8**	150	.180	40	.310	170	0.3
				1/2	154	.180	30	.310	170	0.5
				5/8	157	.180	20	.310	170	0.8
				3/4	162	.180	15	.310	170	1.3
				1	167	.180	10	Edge Start		

Aluminum

Air Plasma / Air Shield

45 A Cutting

Flow Rates – lpm/scfh	
	Air
Preflow	149 / 315
Cutflow	161 / 342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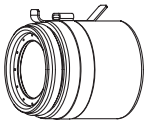
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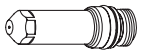
220525


220529


220528

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	62	73	**0.5**	113	1.5	7600	3.0	200	0.0
				0.8	116	1.5	6900	3.0	200	0.1
				1.0	117	1.8	6350	3.6	200	0.1
				1.2	118	1.8	5800	3.6	200	0.2
				1.5	119	1.8	5000	3.6	200	0.2
				2.0	120	2.0	3950	4.0	200	0.2
				2.5	120	2.0	2950	4.0	200	0.3
				3.0*	121	2.0	2400	4.0	200	0.3
				4.0*	122	2.3	1950	4.6	200	0.4
				6.0*	130	2.5	1150	5.0	200	0.5

English

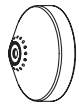
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
Air	Air	62	73	**0.016**	113	.060	310	0.120	200	0.0
				0.020	114	.060	300	0.120	200	0.0
				0.025	115	.060	290	0.120	200	0.0
				0.032	116	.060	270	0.120	200	0.1
				0.040	117	.070	250	0.140	200	0.1
				0.051	118	.070	220	0.140	200	0.2
				0.064	119	.070	185	0.140	200	0.2
				0.081	120	.080	150	0.160	200	0.2
				0.102	120	.080	110	0.160	200	0.3
				1/8*	121	.080	90	0.160	200	0.3
				3/16*	122	.090	65	0.180	200	0.4
				1/4*	130	.100	40	0.200	200	0.5

Aluminum

Air Plasma / Air Shield

130 A Cutting

Flow Rates – lpm/scfh	
	Air
Preflow	67 / 142
Cutflow	132 / 280



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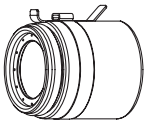

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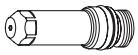
220492

220488



220487

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
Air	Air	72	35	**6**	147	2.8	2370	5.6	200	0.2
				10	148	3.0	1465	6.1	200	0.3
				12	152	3.0	1225	6.1	200	0.5
				15	162	3.3	1050	6.6	200	0.8
				20	166	3.6	725	7.8	220	1.3
				25	173	4.1	525	Edge Start		

English

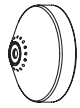
Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
Air	Air	72	35	**1/4**	147	.110	90	.220	200	0.2
				3/8	148	.120	60	.240	200	0.3
				1/2	152	.120	45	.240	200	0.5
				5/8	162	.130	40	.260	200	0.8
				3/4	166	.140	30	.310	220	1.3
				1	173	.160	20	Edge Start		

Aluminum

H35 Plasma / N_2 Shield

130 A Cutting

Flow Rates – lpm/scfh		
	H35	N_2
Preflow	0 / 0	164 / 348
Cutflow	61 / 130	141 / 298



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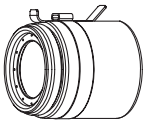

220534

220533 (no IHS tab)

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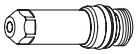
220529



020415

Metric

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**mm**	Volts	mm	mm/m	mm	factor %	seconds
H35	N2	70	75	**10**	150	4.6	1615	7.8	170	0.3
				12	151	4.6	1455	7.8	170	0.5
				15	152	4.6	1305	7.8	170	0.8
				20	155	4.6	940	7.8	170	1.3
				25	158	4.6	540	Edge Start		

English

Select Gases		Set Cutflow		**Material Thickness**	Arc Voltage	Torch-to-Work Distance	Cutting Speed	Initial Pierce Height		Pierce Delay Time
Plasma	Shield	Plasma	Shield	**in**	Volts	in	ipm	in	factor %	seconds
H35	N2	70	75	**3/8**	150	.180	65	.310	170	0.3
				1/2	151	.180	55	.310	170	0.5
				5/8	152	.180	50	.310	170	0.8
				3/4	155	.180	40	.310	170	1.3
				1	158	.180	20	Edge Start		

Changing consumable parts

WARNING

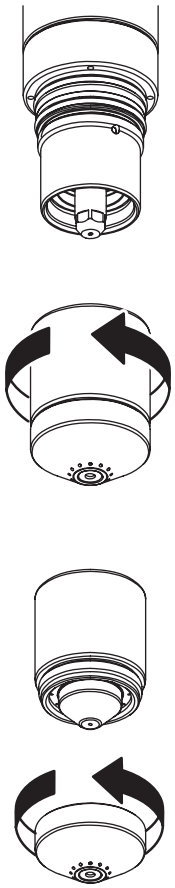
<u>Always</u> disconnect power to the power supply before inspecting or changing torch consumable parts.
Coolant will flow from the torch if there is power to the system.
Use gloves when removing consumables. The torch might be hot.

Remove consumables

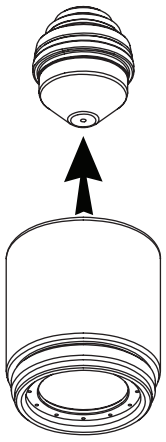
Check the consumable parts daily for wear before cutting. Before removing consumables, bring the torch to the edge of the cutting table, with the torch lifter raised to its highest point to prevent the consumables from dropping into the water of the water table.

1. Turn OFF all power to the system.

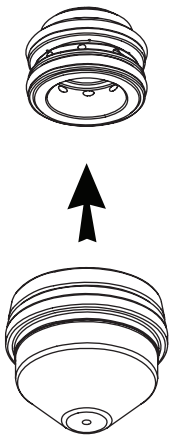
2. Remove the retaining cap and shield



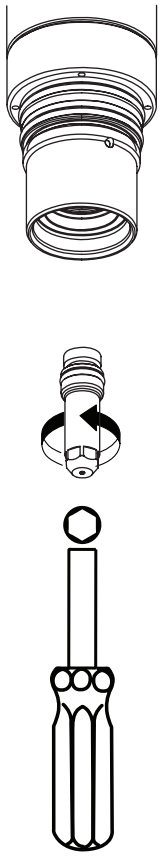
3. Remove the nozzle and swirl ring



4. Remove the swirl ring

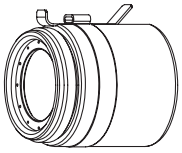
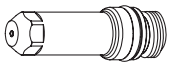


5. Remove the electrode



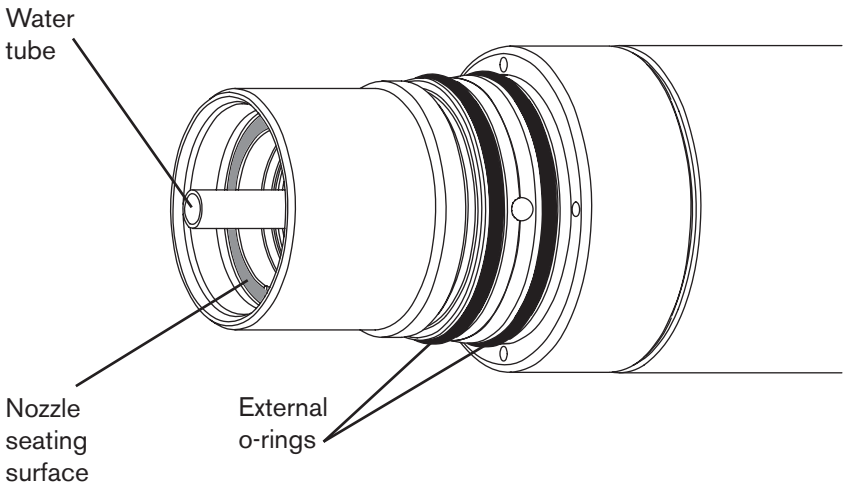
Tool part number
027102

Inspect consumables

Part	*Check for*	*Action*
Cap 	Erosion, missing material	Replace cap
	Cracks	Replace cap
	Burn marks	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 		
Center surface	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.

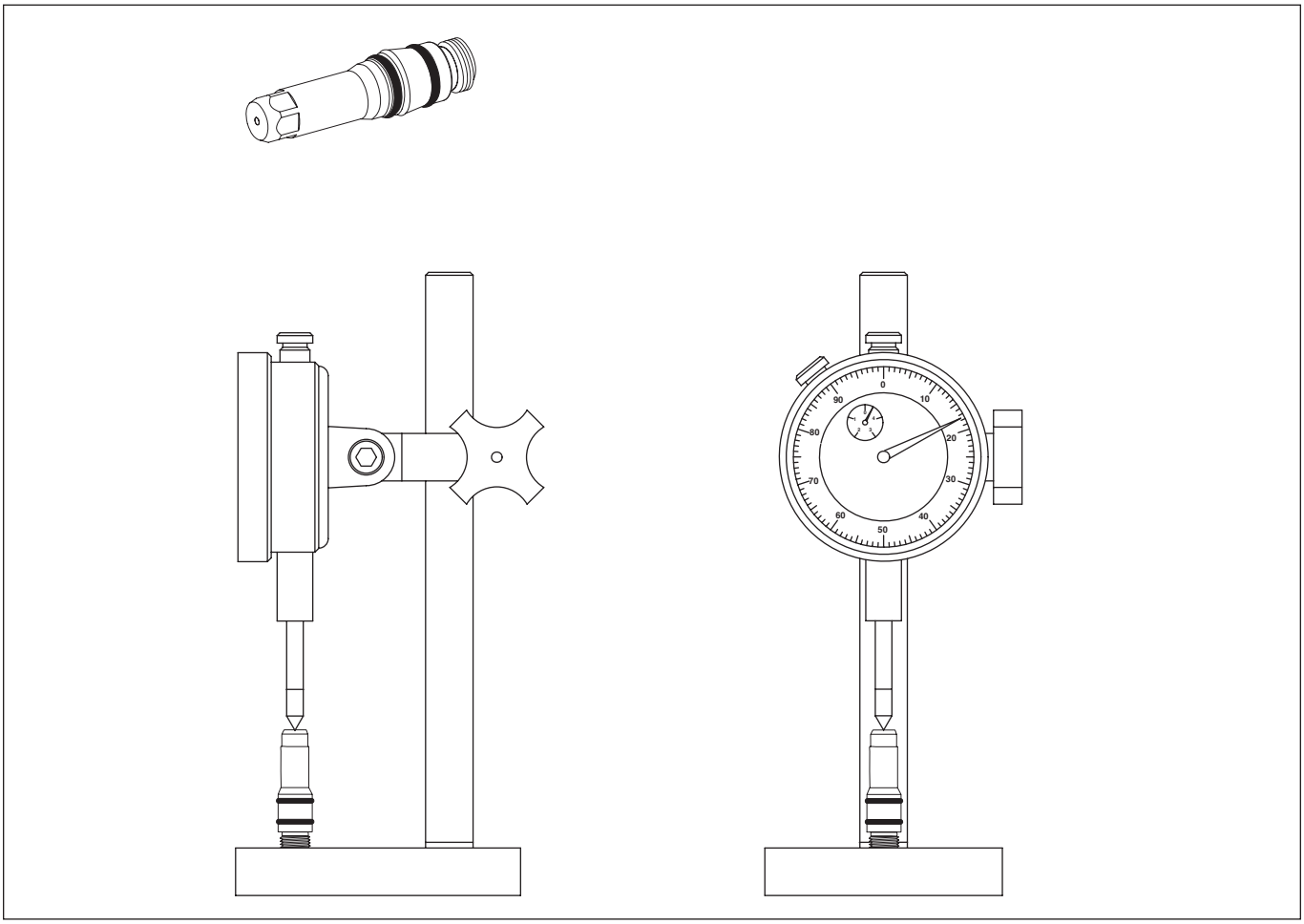
Inspect torch



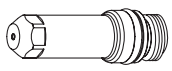
Inspect	*Check for*	*Action*
All surfaces	Dirt or debris	Clean surfaces
	Erosion, missing material	Replace torch
	Cracks	Replace torch
	Internal burn or arcing marks	Replace torch
Nozzle seating surface	1. Dirt or debris	Clean (use compressed air to remove debris)
	2. Pitted or missing material	Replace torch
Threads	Wear or damage	Replace torch
External o-rings	1. Damage	Replace o-ring
	2. Lubricant	Apply a thin film of silicone lubricant if dry
Water tube*	1. Pitted or missing material	Replace water tube*

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

Inspect electrode pit depth



Electrode pit depth gauge (004630)

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

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

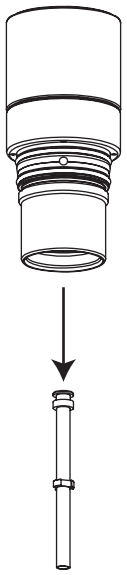
Replace torch water tube

WARNING

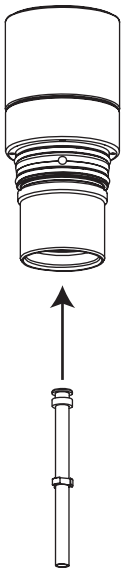
Always disconnect power to the power supply before inspecting or changing torch consumable parts.
Coolant will flow from the torch if there is power to the system.
Use gloves when removing consumables. The torch might be hot.

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

1. Turn OFF all power to the system.
2. Remove consumables from torch. See *Remove consumables* in this section.
3. Remove water tube



4. Install new water tube



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

Common cutting faults

- Torch pilot arc will initiate, but will not transfer. Causes can be:

  1. Work cable connection on the cutting table is not making good contact.
  2. Malfunction in the system. See Section 5.
  3. Torch-to-work distance is too high.

- The workpiece is not totally penetrated, and there is excessive sparking on top of the workpiece. Causes can be:

  1. Current is set too low (check *Cut chart* information).
  2. Cut speed is too high (check *Cut chart* information).
  3. Torch parts are worn (see *Changing consumable parts*).
  4. Metal being cut is too thick.

- Dross forms on the bottom of the cut. Causes can be:

  1. Cutting speed is not correct (check *Cut chart* information).
  2. Arc current is set too low (check *Cut chart* information).
  3. Torch parts are worn (see *Changing consumable parts*).

- Cut angle is not square. Causes can be:

  1. Wrong direction of machine travel.
     High-quality side is on the right with respect to the forward motion of the torch.
  2. Torch-to-work distance is not correct (check *Cut chart* information).
  3. Cutting speed is not correct (check *Cut chart* information).
  4. Arc current is not correct (check *Cut chart* information).
  5. Damaged consumable parts (see *Changing consumable parts*).

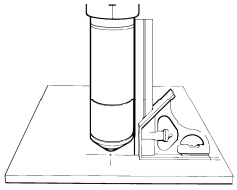
- Short consumable life. Causes can be:

  1. Arc current, arc voltage, travel speed, motion delay, gas flow rates, or initial torch height not set as specified in the *Cut charts*.
  2. Attempting to cut highly magnetic metal plate, such as armor plate with a high nickel content, will shorten consumable life. Long consumable life is difficult to achieve when cutting plate that is magnetized or becomes magnetized easily.
  3. Beginning or ending the cut off the plate surface. **To achieve consumable long life, all cuts must begin and end on the plate surface**.

How to optimize cut quality

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

Tips for table and torch



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

Plasma set-up tips

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

Purge the gas lines before cutting.

Maximize the life of consumable parts

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

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

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

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

Additional factors of cut quality

Cut angle

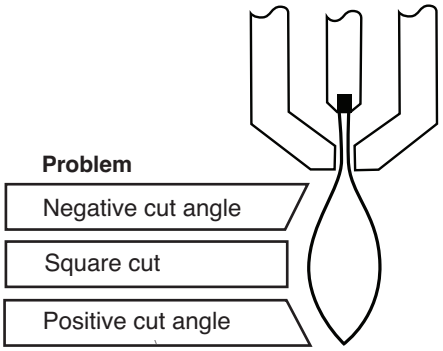
A cut part whose 4 sides average less than 4° of cut angle is considered acceptable.

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

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

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

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



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.

Section 5

MAINTENANCE

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Introduction

Hypertherm assumes that the service personnel that troubleshoots and tests the plasma systems 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.

WARNING
Shock Hazard

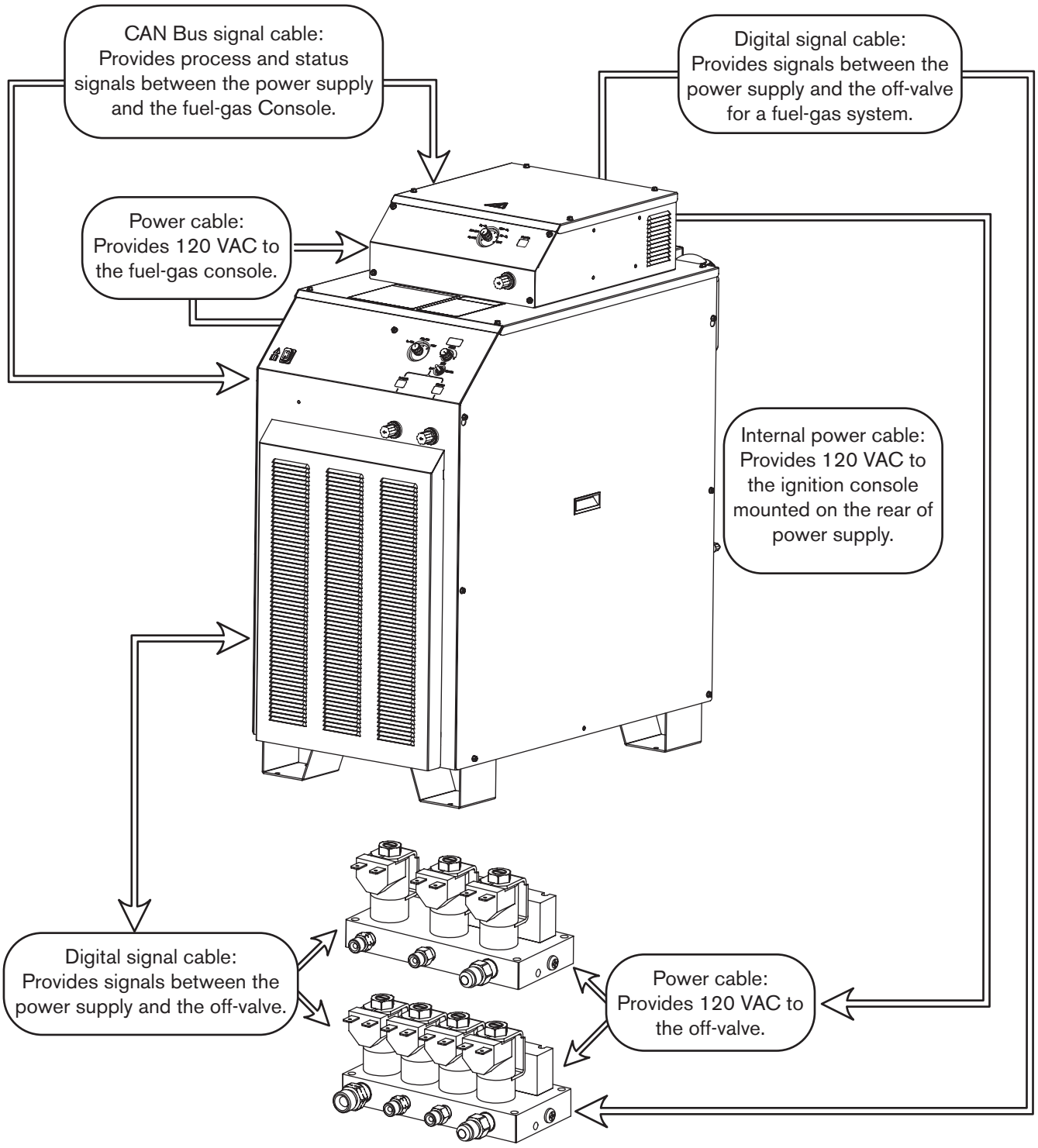
Use extreme caution when working near the chopper components. The large blue capacitors store high voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the choppers, and the heatsinks. Discharging any capacitor with a screwdriver or other implement may result in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

Routine maintenance

For a complete list of routine maintenance recommendations, see the *Preventative Maintenance Schedule,* 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.

System description

Control and signal cables



Sequence of operation

1. Power-up – The system verifies that all of these signals are off at power-up
   - Coolant flow off
   - Chopper current off
   - Transfer off
   - Phase Loss off
   - Chopper 1 over-temp off
   - Magnetics over-temp off
   - Coolant over-temp off
   - Plasma start off

2. Purge – Air or O_2 gas flows through torch for 24 seconds
   - Coolant flow on
   - Contactor closes and the chopper performs a chopper test and a current sensor test
   - Plasma start off
   - Contactor opens when the purge cycle ends
   - Gas pressure OK

3. Idle
   - Gas pressure OK
   - Coolant flow on
   - Chopper current off
   - Line voltage OK

4. Preflow – Gas flows for 1.25 seconds

5. Pilot arc – Current flows between electrode and nozzle
   - Chopper, main contactor, and pilot arc relay are on
   - High frequency present
   - Chopper current sensor = pilot arc current

6. Transfer – Pilot arc current sensed on the worklead

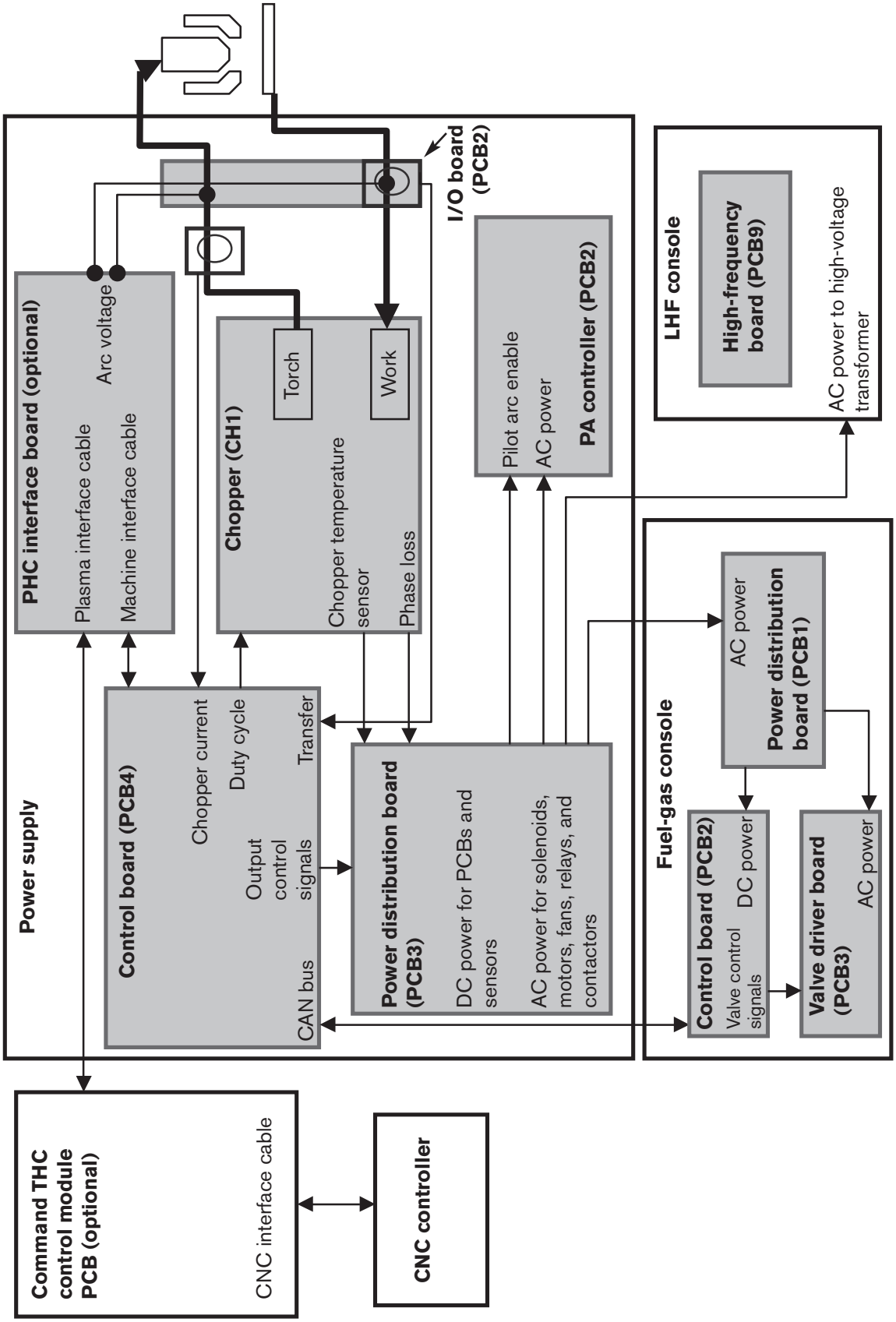
7. Ramp-up – Chopper current increases to set-point and the gas switches to cutflow
   - Coolant flow on
   - Gas pressure OK
   - Phase loss on
   - Line voltage OK

8. Steady state – normal operating parameters
   - Coolant flow on
   - Gas pressure OK
   - Phase loss on
   - Chopper over-temp off
   - Magnetics over-temp off
   - Coolant over-temp off

9. Ramp-down – Current and gas flow decrease after plasma start has been removed
   - Cutflow gas off

10. Auto Off – 10-second postflow
    - Main contactor off
    - Chopper off

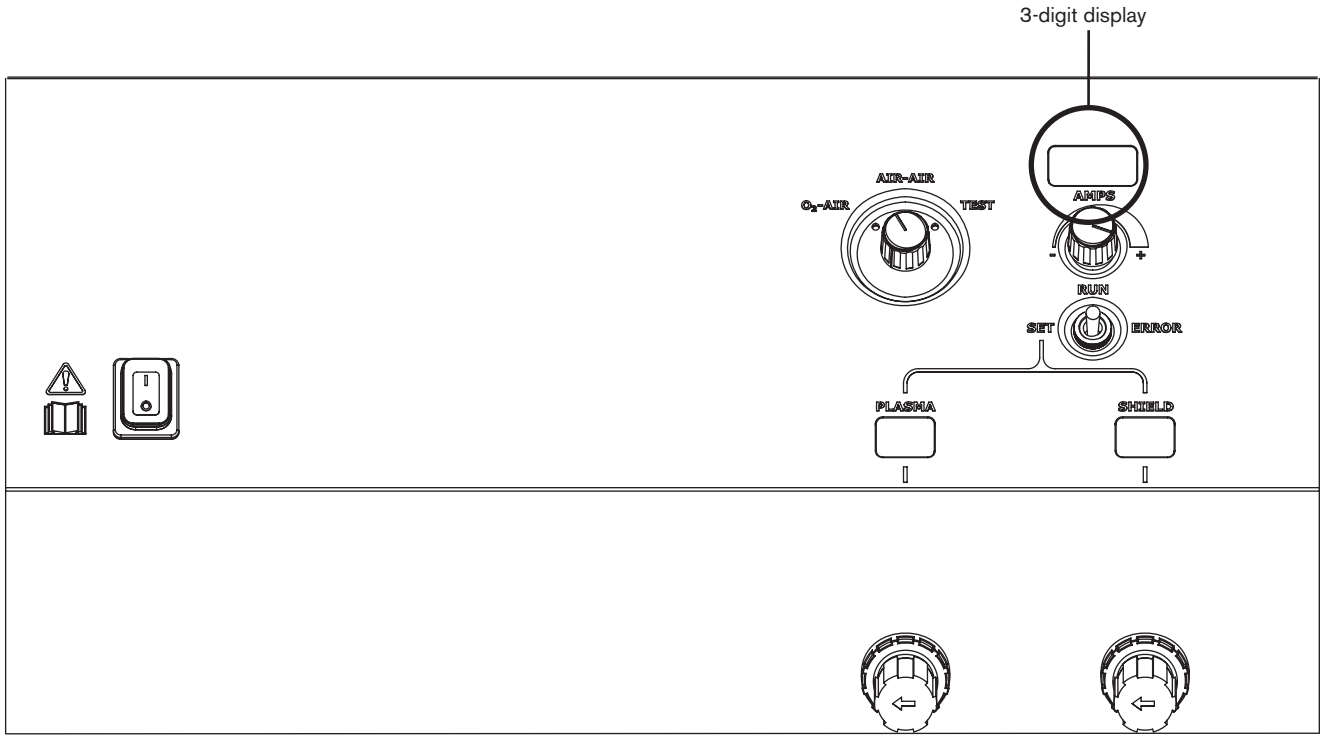
PCB block diagram



Error codes

HySpeed plasma system error codes

Set the selection switch on the power supply to ERROR. The power supply states are shown in the 3-digit LED display on the power supply. The state ID numbers are 2 digits with a dash in front of them and error codes have 3 digits. When the selection switch is set to ERROR, the state ID number will be displayed for 2 seconds. An error code number will then be displayed for 2 seconds. The display will continue to cycle through both numbers until the selection switch is moved.



Error code troubleshooting (1 of 8)

Error code number	Name	Description	Corrective action
000	No error	System is ready to run.	None needed.
012 **fuel-gas console only**	Test in progress	One of the gas tests is running.	The test will run for about 3 minutes.
014 **fuel-gas console only**	Plasma-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the plasma gas channel.	Check the plasma gas lines for leaks.
015 **fuel-gas console only**	Preflow-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the preflow gas channel.	Check the preflow gas lines for leaks.
016 **fuel-gas console only**	Shield-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the shield gas channel.	Check the shield gas lines for leaks.
017 **fuel-gas console only**	Fuel-gas channel failure	A gas leak of more than 0.7 bar (10 psi) in the shield gas channel.	Check the fuel plasma line for leaks.
020	No pilot arc	No current detected from chopper at ignition and before 1-sec timeout.	1. Verify that the consumable parts are in good condition. 2. Verify proper pre-flow and cut-flow settings. 3. **Fuel-gas only**: Perform leak test. 4. Verify spark across spark gap. 5. Inspect CON1 for excessive wear. 6. Perform torch lead test (see *Maintenance* section). 7. Perform start circuit test (see *Maintenance* section). 8. Perform chopper test (see *Maintenance* section).
021	No arc transfer	No current detected on work lead 500 milli-seconds after pilot arc current was established.	1. Verify proper pierce height. 2. Verify proper gas settings. 3. Inspect work lead for damage or loose connections. 4. Verify the condition of the current transfer sensor on the I/O PCB.
024	Lost current	Lost current from chopper after transfer.	1. Verify that the consumable parts are in good condition. 2. Verify proper gas settings. 3. Verify pierce delay time. 4. Verify that the arc did not lose contact with plate while cutting (hole cutting, scrap cutting, etc). 5. Perform chopper test (see *Maintenance* section).

Error code troubleshooting (2 of 8)

Error code number	Name	Description	Corrective action
026	Lost transfer	After transfer lost the transfer signal. The signal is < 3.5 amps.	1. Verify that the consumable parts are in good condition. 2. Verify proper gas settings. 3. Verify pierce delay time. 4. Verify that the arc did not lose contact with plate while cutting (hole cutting, scrap cutting, etc). 5. Inspect work lead for damage or loose connections. 6. Try connecting work lead directly to the plate. 7. Perform chopper test (see *Maintenance* section).
027	Lost phase	Phase imbalance to chopper after contactor engaged or while cutting.	1. Verify phase-to-phase voltage to power supply. 2. Disconnect power to power supply, remove cover on contactor, and inspect contacts for excessive wear. 3. Inspect the power cord, contactor, and input to chopper for loose connections. 4. Inspect the phase-loss fuses on the power distribution board (PCB3). Replace board if fuses are blown. 5. Perform phase-loss test (see *Maintenance* section).
031	Start loss	Start signal was received and then lost before an arc was established.	1. If a mechanical relay is being used to provide the HSD with a start signal, this relay is either bouncing when activated or the contacts are faulty. Replace the relay. 2. Inspect interface cable for damage; faulty crimps, or poor electrical connections. 3. If interface cable is good and a relay is not driving the start input, the CNC is dropping the start signal before a steady state arc has been established.
032	Hold timeout	Hold signal was active for longer than 60 seconds.	1. Check the interface cable for damage. The hold wires may be short-circuiting inside. 2. The CNC is maintaining this input, it could be waiting for an IHS complete input from another torch. 3. If CNC interface cable is good and it is a one-torch system, change PCB4.
035	Low preflow pressure	Preflow gas pressure under lower limit of 0.4 bar (5 psi).	1. Put the selection switch in the SET position. The 3-digit LED shows the preflow supply pressure. The pressure reading should be between 6.2 bar and 8.3 bar (90 psi and 120 psi). 2. Verify that the Burkart valve is functioning properly.
042	Nitrogen gas purge error	Low or no nitrogen pressure during purge. Purge occurs when switching from a fuel gas process to an oxygen or air process.	1.Verify that the nitrogen supply is turned on, and inspect gas supply pressure and volume of gas remaining in supply tanks. 2. Verify that the gas regulator is set to 7.2 bar (105 psi). See *Setting the supply regulators* (*Installation* section).

Error code troubleshooting (3 of 8)

Error code number	Name	Description	Corrective action
043	High preflow pressure	Gas pressure is above the upper limit of 6.8 bar (99 psi)	1. Verify gas supply pressure settings. 2. Verify gas regulator settings on gas console with cut chart. 3. See *Setting the supply regulators* (*Installation* section). 4. Solenoid at off-valve is not opening. Verify power to valves, disconnect plasma and shield hoses exiting off-valve. If pressures decrease, a valve is not functioning or no power to the valve.
044	Low plasma gas pressure	Gas pressure is below the lower limit of 3.5 bar (50 psi)	1. Inspect gas supply pressure and volume of gas remaining in supply tanks. 2. Verify gas regulator settings on the front panel of the power supply with cut chart. 3. See *Setting the supply regulators* (*Installation* section). 4. **Fuel-gas only** – Perform leak test procedure (*Maintenance* section).
045	High plasma gas pressure	Gas pressure above the upper limit of 6.8 bar (99 psi)	1. Verify gas supply pressure settings. 2. Verify plasma gas regulator settings on the front panel of the power supply with cut chart. 3. See *Setting the supply regulators* (*Installation* section). 4. Solenoid at off-valve is not opening. Verify power to valves, disconnect plasma and shield hoses exiting off-valve. If pressures decrease, a valve is not functioning or no power to the valve.
046	Low line voltage	Line voltage is close to or below the lower limit of 102 VAC (120 VAC –15%). The normal lower limit for operation is 108 VAC (120 VAC –10%).	1. Verify input-line voltage. Voltage needs to be within 10 % of nominal (120 VAC). 2. Verify fuses on PCB3. 3. Verify 120 VAC voltage on plug J3.4, pins 3 and 4 on PCB3. 4. If AC voltage on J3.4, pins 3 and 4, is greater than 108 VAC, replace PCB3.
047	High line voltage	Line voltage is close to or above the upper limit of 138 VAC (120 VAC +15%). The normal upper limit for operation is 132 VAC (120 VAC +10%).	1. Verify input-line voltage. Voltage needs to be within 10 % of nominal (120 VAC). 2. Verify fuses on PCB3. 3. Verify 120 VAC voltage on plug J3.4, pins 3 and 4 on PCB3. 4. If AC voltage on J3.4, pins 3 and 4, is less than 132 VAC, replace PCB3.

Error code troubleshooting (4 of 8)

Error code number	Name	Description	Corrective action
050	Start signal is on at power-up	Plasma start signal input is active during power-up of the power supply.	1. Stop or clear the cutting program. The plasma start signal to the plasma was not dropped after the last cut. 2. Verify that the CNC interface cable is not damaged. 3. Remove CNC interface cable from PCB4 and look for an open circuit between pins 15 and 34. 4. If the circuit is closed either the CNC is issuing a plasma start or the CNC interface cable is damaged. 5. If circuit is open, and D44 is illuminated with the CNC Interface cable removed from PCB4, replace PCB4.
053	Low shield pressure	Shield pressure is below lower limit of 0.14 bar (2 psi).	1. Verify gas supply pressure and that a sufficient volume of gas remains in your supply. 2. Verify gas regulator settings on the front panel with cut chart. 3. See *Setting the supply regulators* (*Installation* section). 4. **Fuel-gas only** – Perform leak test procedure (*Maintenance* section).
054	High shield pressure	Shield gas pressure is above upper limit of 6.8 bar (99 psi).	1. Verify gas supply regulator settings. See *Setting the supply regulators* (Installation section). 2. Verify pressure settings on the front panel with cut chart. 3. Solenoid at off-valve is not opening. Verify power to valves, disconnect plasma and shield hoses exiting off-valve. If pressures decrease, a valve is not functioning or no power to the valve.
061	No plasma gas type	Plasma gas has not been selected	1. If you have a base system (no fuel-gas console), replace the control board (PCB4) 2. If the system has a fuel gas console, replace the fuel-gas console control board (PCB2)
062	No shield gas type	Plasma gas has not been selected	1. If you have a base system (no fuel-gas console), replace the control board (PCB4) 2. If the system has a fuel gas console, replace the fuel-gas console control board (PCB2)
063	Low preflow inlet pressure	Inlet pressure is < 4.1 bar (60 psi).	1. Verify Air or nitrogen gas supply pressure and that a sufficient volume of gas remains in your supply. 2. Verify that the Burkart valve is functioning properly. 3. Put the selection switch in the SET position. The 3-digit LED shows the supply pressure. The pressure reading should be between 6.2 bar and 8.3 bar (90 psi and 120 psi).

Error code troubleshooting (5 of 8)

Error code number	Name	Description	Corrective action
065	Chopper over temp	The chopper has overheated. The temperature is > 85° C (185° F).	1. Verify that both chopper fans are operating properly. Spinning fan blades should be difficult to see. 2. Blow dust out of the system, especially from fans and the chopper's heat sink. 3. Verify that the voltage on the back side of J3.19, pins 1 and 2 on PCB3, is less than or equal to 2.9 VDC. 4. If the voltage is low, verify correct wiring between chopper temp sensor and J3.19 pins 1 and 2. 5. If wiring is good and over temp error does not clear after 30 minutes, replace chopper. 6. If voltage is higher than 2.9 VDC and over temp LED does not clear after 30 minutes, replace PCB3.
067	Magnetics over temp	The power transformer or inductors have overheated. The temperature is > 150° C (302° F).	1. Verify that the large fan is operating properly. Spinning fan blades should be difficult to see. 2. Blow dust out of system, especially from fans and large power transformer. 3. Verify that the voltage on the back side of J3.20 pins 3 and 4, is equal to or less than 3.2 VDC. 4. If voltage is low, inspect wiring between the transformer's temp sensor and J3.20 pins 3 and 4. Look for short circuits to wires or ground. 5. If wiring is good, the transformer has overheated. 6. If voltage is higher than 3.2 V and over temp error does not clear after 30 minutes, replace PCB3.
071	Coolant over temp	Torch coolant has overheated. The temperature is > 70° C (158° F).	1. Verify that all fans in the coolant heat exchanger are running. 2. Blow dust out of the system, especially from the heat exchanger. 3. Verify that the voltage on the back side of J3.20 pins 1 and 2, is equal to or lower than 2.8 VDC. 4. If voltage is low, inspect wiring between coolant sensor and J3.20, pins 1 and 2, for short circuits to wires or ground. 5. If wiring is good, the coolant has overheated; let system stand for 30 minutes to cool. 6. If voltage is higher than 2.8 VDC and the over temp error does not clear after 30 minutes, replace the temperature switch.
075	Low current on CS2	A Current < 10 Amps has been detected on chopper channel 2 by current sensor 2 during the chopper test at power-up.	1. Measure voltage across the current sensor (CS2). a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.

Error code troubleshooting (6 of 8)

Error code number	Name	Description	Corrective action
093	No coolant flow	Coolant flow signal was lost or was never satisfied. Coolant flow is < 2 lpm (0.6 gpm)	1. If this is a new system, follow start procedure. 2. Verify that the coolant filter is in good condition. 3. Perform coolant flow test procedure (*Maintenance* section). 4. Verify that the CNC drives the plasma start signal for at least 10 seconds to allow the timed-out pump to turn on again.
098	Phase-loss at power-up	Voltage detected on the phase-loss circuit during the chopper test at power-up.	1. Verify phase-to-phase voltage to the power supply. 2. Verify that the fuses on PCB3 (F5, F6, and F7) are good. 3. Verify the voltage from F5 to F6, F5 to F7, and F6 to F7. All 3 readings should be about 311 VAC. If the voltage readings are correct, U5 should be active and J8, pins 1 and 2 should be closed. If these conditions are not met, replace PCB3.
099	Chopper over temp at power-up	Chopper is indicating an over temp at power-up.	1. Verify that the temperature sensor for the chopper has not been jumped out or the wires to the temp switch shorted out in the harness. 2. If no jumper is present, the chopper is overheated and needs time to cool to 83° C (181.4° F).
101	Magnetics over temp at power-up	The main transformer or inductors are indicating an over temp at power-up.	1. Verify that the transformer temperature sensor for the chopper has not been jumped out or the wires to the temperature sensor are not shorted out in the harness. 2. If not, the main transformer is overheated and needs time to cool to 150° C (302° F).
102	Output current at power-up	Chopper current signal from CS1 is active (greater than 5 amps) at power-up.	1. Verify proper electrical connections to chopper current sensor (CS1) and to J4.2 on PCB4. 2. Verify that the contactor is not stuck in the closed (on) position.
103	High current on CS1	A Current > 35 Amps has been detected on chopper channel "A" by current sensor 1 during the chopper test at power-up.	1. Verify that there is not a short circuit between the negative lead and the work lead. 2. Measure voltage across the current sensor (CS1) a) Red to black = +15 VDC, green to black = –15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.

Error code troubleshooting (7 of 8)

Error code number	Name	Description	Corrective action
105	Low current on CS1	A Current < 10 Amps has been detected on chopper channel 1 by current sensor 1 during the chopper test at power-up.	1. Measure voltage across the current sensor (CS1). a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
107	High current on CS2	A Current > 35 Amps has been detected on channel 2 by current sensor 2 during the chopper test at power-up.	1. Verify that there is not a short circuit between the negative lead and the work lead. 2. Measure voltage across the current sensor (CS2). a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
108	Transfer at power-up	The system has detected current on the work lead > 3.5 amps during power-up.	1. Disconnect J6.6 on the I/O PCB (PCB6). If the problem is resolved, replace PCB6.
109	Coolant flow at power-up	Coolant flow is > 2 lpm (0.6 gpm) when the pump is off.	1. The coolant flow sensor was bypassed or the flow switch is faulty. Replace the flow switch.
111	Coolant over temp at power-up	Coolant is indicating an over temp at power-up.	1. Verify that the coolant temperature sensor has not been jumped out or the wires to the sensor are not shorted out in the harness.). 2. If not, the coolant temperature is over the set point and needs time to cool to 70° C (158° F).
116	Watchdog interlock	An error occurred with the CAN communication system.	1. Verify that the power supply to gas console control cable is not damaged and is properly connected to PCB4 and to the back of the gas console. 2. Verify that the power supply to gas console power cable is not damaged and is properly connected inside the power supply and to the back of the gas console. 3. Use the CAN bus tester to verify CAN bus communications.

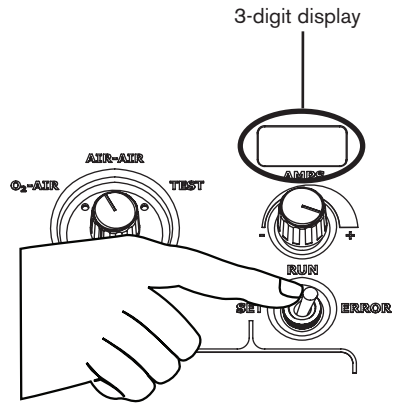
Error code troubleshooting (8 of 8)

Error code number	Name	Description	Corrective action
134	Chopper overcurrent	Chopper channel 1 current feedback has exceeded 90 amps.	1. Verify that the wiring between CS1 and PCB4 is correct and not damaged. 2. Measure voltage across the current sensor. a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on the current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
139	Purge time-out error	The purge cycle did not complete within 3 minutes.	This is a warning for a possible gas restriction in the leads. Verify that there are no restrictions in the plasma and shield hoses.
151	Software failure	The software has detected an incorrect state or condition.	1. Replace the power supply control board (PCB4).
152	Internal flash error	Communication problem to the flash chip on the power supply control board.	1. Replace the power supply control board (PCB4).
153	PS EEPROM error	EEPROM memory on power supply control board is not working.	1. Replace the power supply control board (PCB4).
154	Chopper overcurrent	Chopper channel 2 current feedback has exceeded 90 amps.	1. Verify that the wiring between CS2 and PCB4 is correct and not damaged. 2. Measure voltage across the current sensor. a) Red to black = +15 VDC, green to black = -15 VDC, white to black = 0 VDC at idle and varies with current output (4 VDC = 100 amps). b) If possible, take a voltage reading on the current sensor while trying to cut. Ratio is 4 VDC = 100 amps. c) If the current sensor voltage is approximately 6.4 VDC or greater at idle, replace the current sensor.
157	Output current at power-up	Chopper current signal from CS2 is active (greater than 5 amps) at power-up.	1. Verify proper electrical connections to chopper current sensor (CS1) and to J4.2 on PCB4. 2. Verify proper electrical connections to chopper current sensor (CS2) and to J4.2 on PCB4.

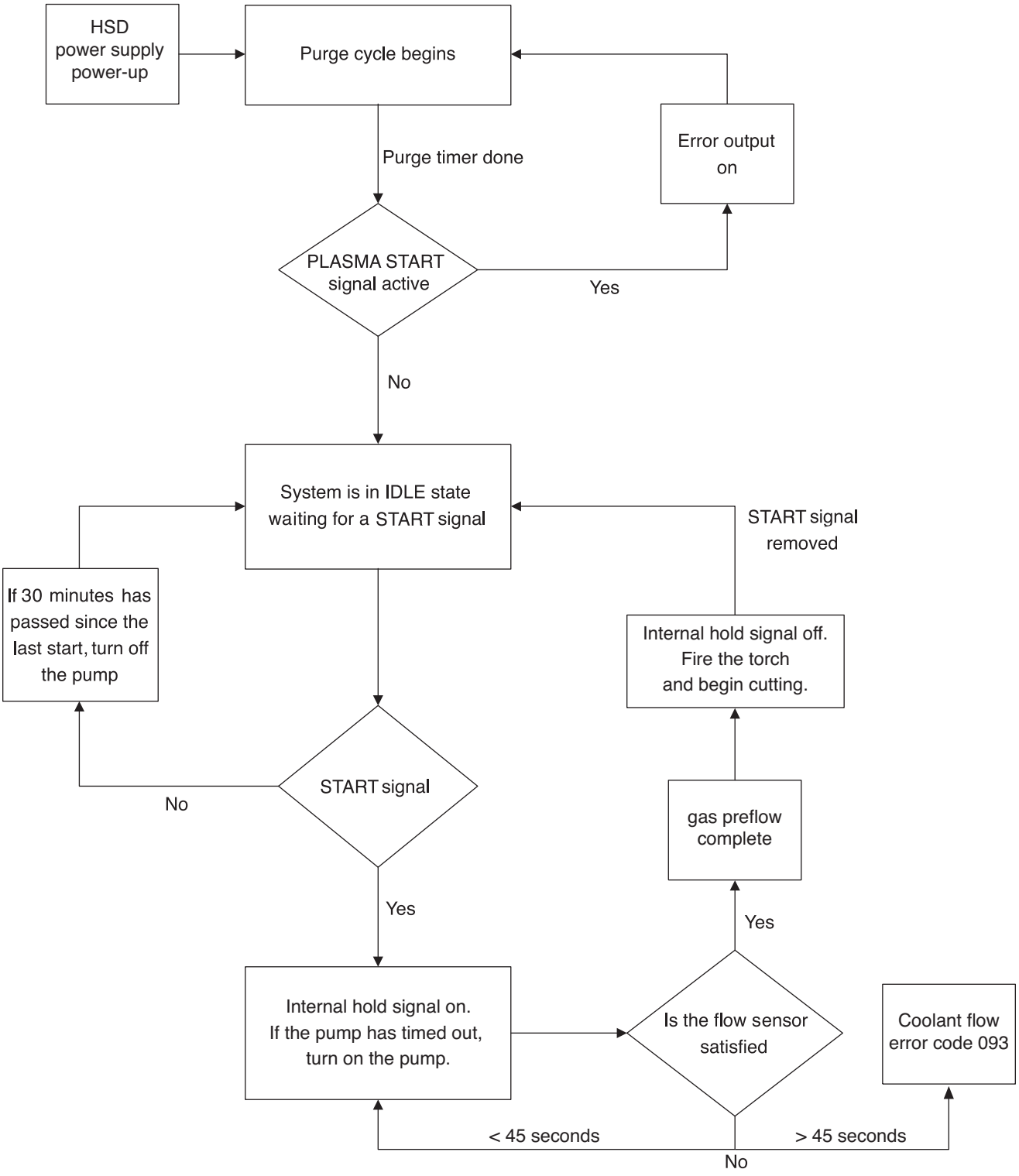
Power supply states

Set the selection switch on the power supply to ERROR. The power supply states are shown in the 3-digit LED display on the power supply. The state ID numbers are 2 digits with a dash in front of them and error codes are 3 digits. When the selection switch is set to ERROR, the state ID number will be displayed for 2 seconds. An error code number will then be displayed for 2 seconds. The display will continue to cycle through both numbers until the selection switch is moved.

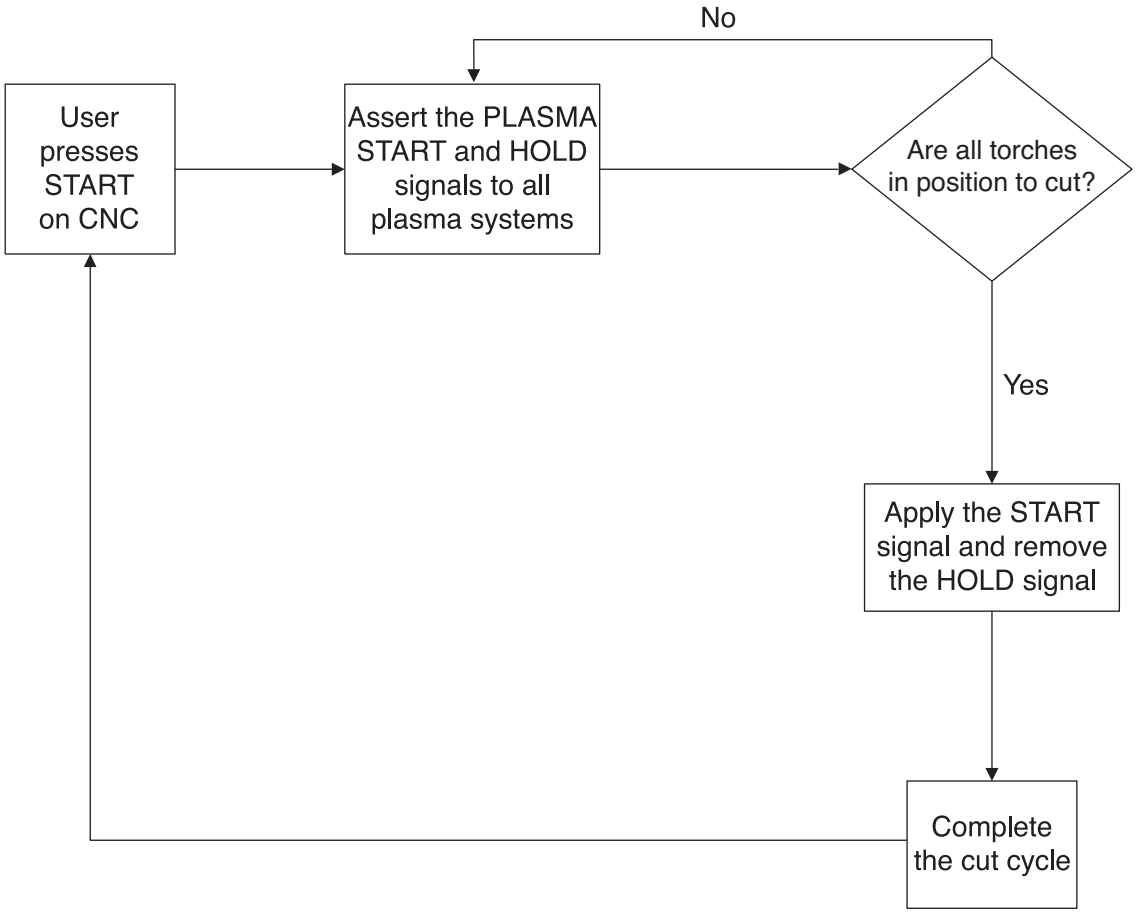
State ID	Name
-00	Idle
-02	Purge
-03	Idle 2
-04	Preflow
-05	Pilot arc
-06	Transfer
-07	Ramp-up
-08	Steady state
-09	Ramp-down
-10	Final ramp-down
-11	Auto off
-12	Test cutflow
-14	Shutdown
-15	Reset
-16	Maintenance
-22	Manual pump control
-26	System test state



Plasma system operation with pump timeout



CNC operation with pump timeout



Initial checks

Before troubleshooting, do a visual check that proper voltages are present at the power source, transformers and power distribution board.

DANGER

SHOCK HAZARD: Always use extreme caution when servicing a power supply when it is 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 OFF the main disconnect switch.

2. Remove the power supply's top panel and 2 side panels.

3. Inspect interior of power supply 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, connect power to the power supply, and turn the main disconnect switch ON.

5. Measure the voltage between the W, V and U terminals of TB1 located on the right side of the power supply. See *Power measurement* later in this section. 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.

Automated diagnostic tests

Move the process selection knob on the power supply to the TEST position while the machine is idle and the system will run the following tests automatically:

1. The system tests the chopper. The Amps display will show the open circuit voltage (OCV). A normal reading is approximately 300 VDC.

2. The plasma select valve (SV1) turns on for 3 seconds.

3. The shield off-valve (SV2) turns on for 3 seconds.

4. The preflow off-valve (SV3) turns on for 3 seconds.

5. The plasma off-valve (SV4) turns on for 3 seconds.

6. The vent off-valve (SV5) turns on for 3 seconds.

7. **(Fuel Gas Console Only)** The off-valve closes and the inlet valves open until the system is pressurized, and then they close. The system should maintain pressure. If a leak is detected, the HSD130 will display an error code. Put the toggle switch in the Error position to monitor for errors.

8. **(Fuel Gas Console Only)** The inlet valve closes and the off-valve opens until the pressure in the system is released and then it closes. The system looks for an increase in pressure. The test ensures that the valves are closing properly and are not allowing gas to leak through. Put the toggle switch in the Error position to monitor for errors.

The following error codes may be seen during automated tests 7 and 8:

Error 012 – Test in progress – Wait for test completion.

Error 014 – Test failed – Plasma gas channel

Error 015 – Test failed – Preflow gas channel

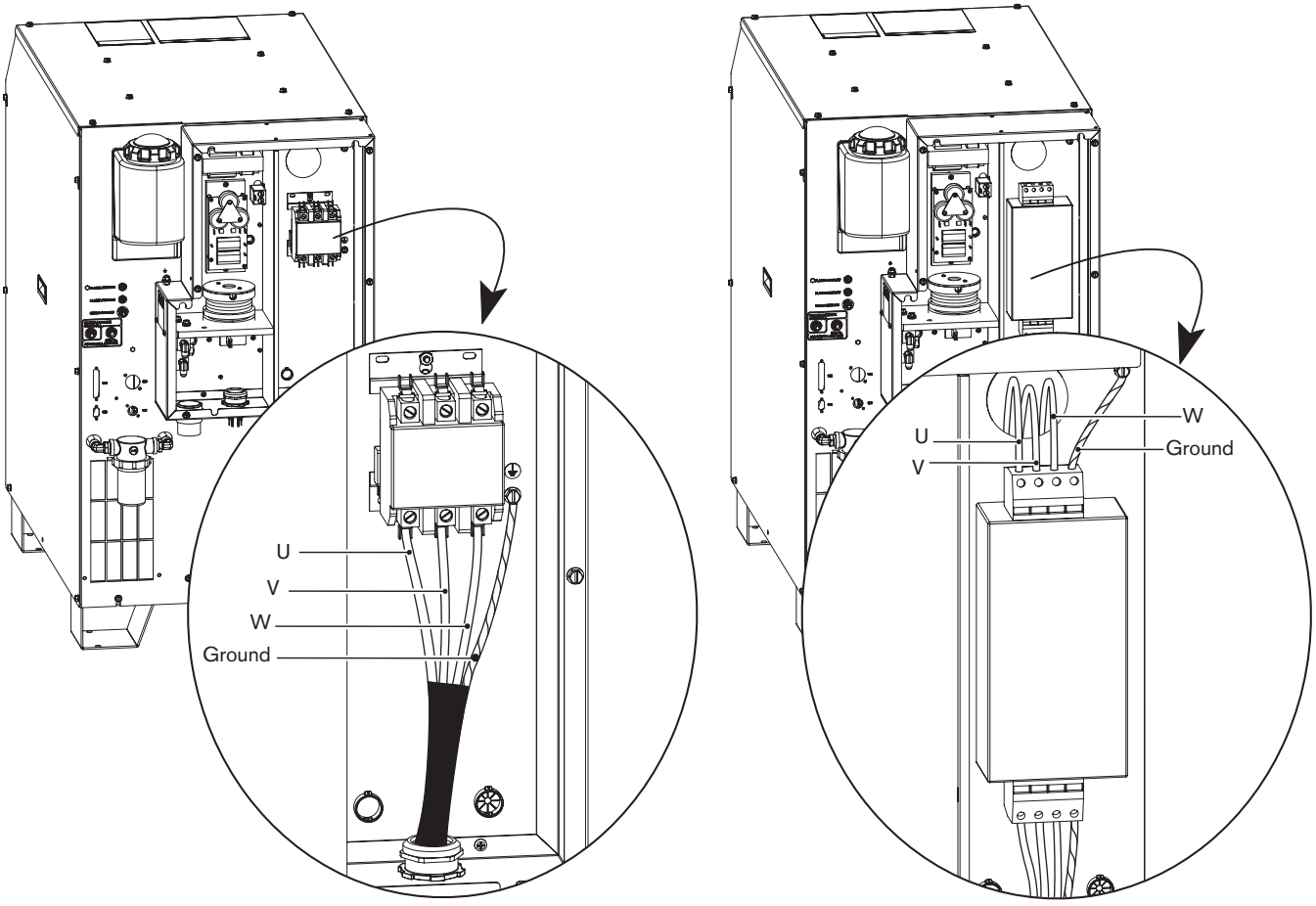
Error 016 – Test failed – Shield channel

Note: When the process selection knob is in the TEST position the display will alternate between “-26” (test position) and “012” (test in progress). If the error code changes from “012” to “000”, the system passed all tests.

Power measurement

DANGER

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

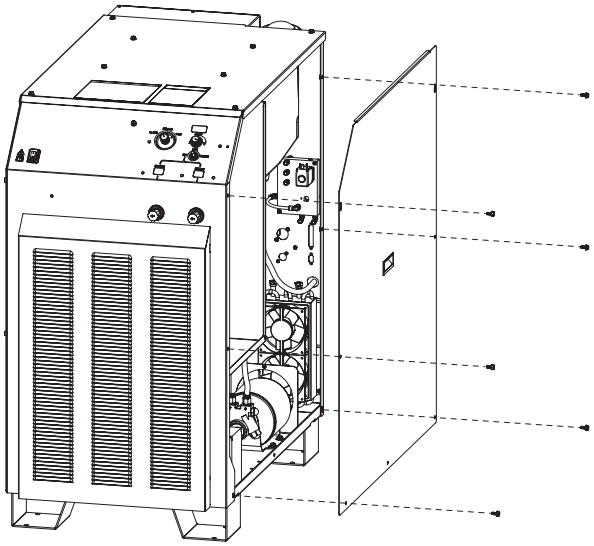


Note: Check lines in the following order:
U to V
U to W
V to W
Check each line to ground. If one line is 10% or higher than the other two, put that leg on U.

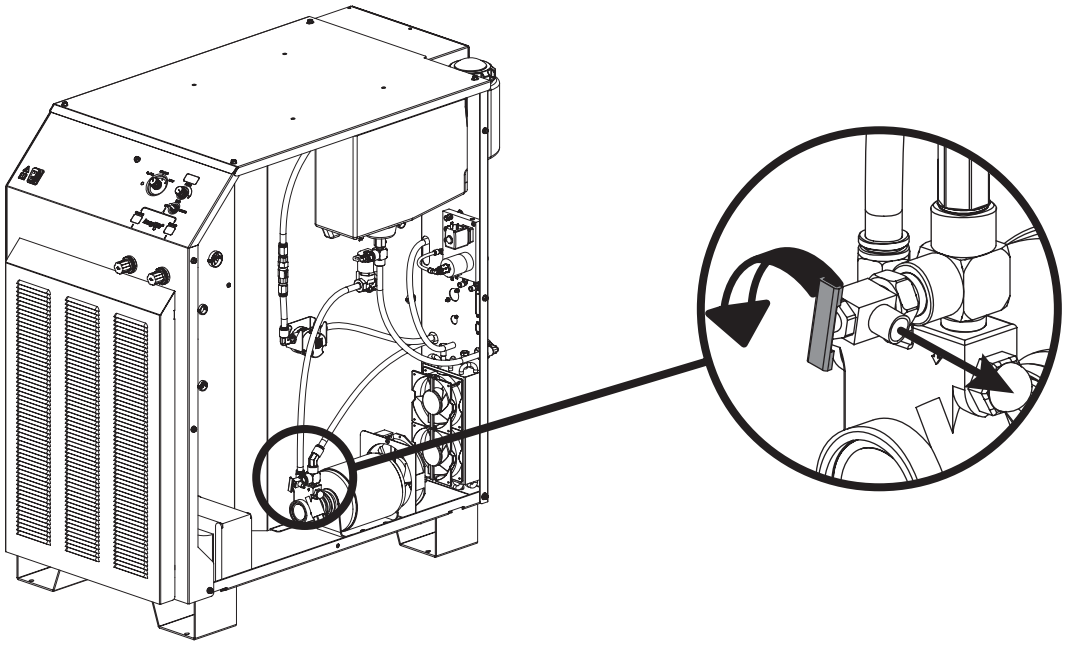
Power supply coolant system servicing

Draining the coolant system

1. Turn OFF the power, and remove the right-side panel from the power supply.



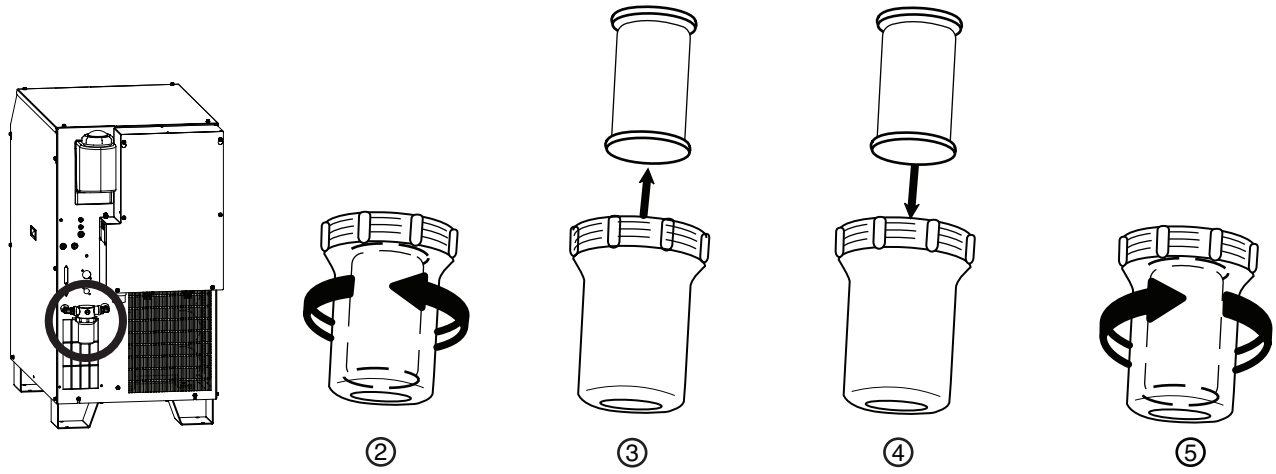
2. Locate the coolant drain valve and use a 20 liter (5 gallon) container to catch the coolant. Coolant will flow as soon as the drain is opened. Close the drain valve when the coolant stops flowing. Always dispose of coolant according to local and national codes.



Caution: Coolant will flow from the filter when its housing is removed. Drain coolant before replacing the filter.

Coolant system filter replacement

1. Make sure that the coolant has been drained and then turn OFF all power to the system.
2. Remove housing.
3. Remove and discard the filter element.
4. Install the new filter element 027664.
5. Re-install housing.
6. Refill the power supply with coolant.



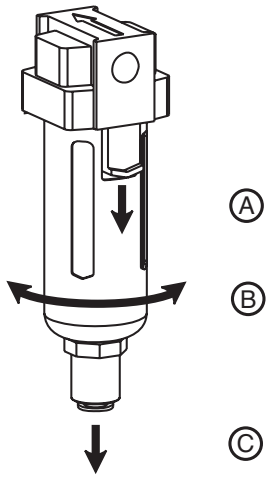
Air filter element replacement

1. Disconnect the electrical power and the gas supply. Remove the filter bowl and the old filter element.

   a. Pull down and hold the black release tab. (If you do not see the tab, check the back of the filter bowl.)

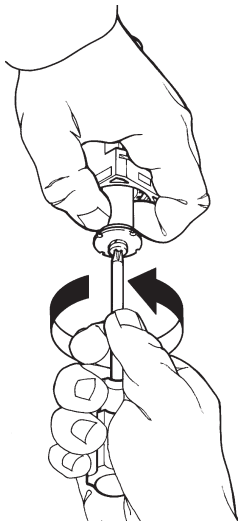
   b. Rotate the filter bowl in either direction until it releases.

   c. Pull the filter bowl down to remove it. The bowl has an o-ring around the top. Do not discard the o-ring. If the o-ring needs to be replaced, use part number 011105.



Use a screwdriver to remove the filter element from the filter housing. Then install the new filter element.

Note: Do not allow the filter element to turn when loosening the screw.

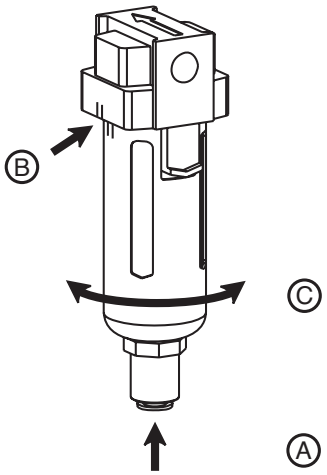


Re-install the filter bowl.

a. Hold down the black tab and slide the filter bowl over the new filter element.

b. Align the marks on filter bowl and the filter body.

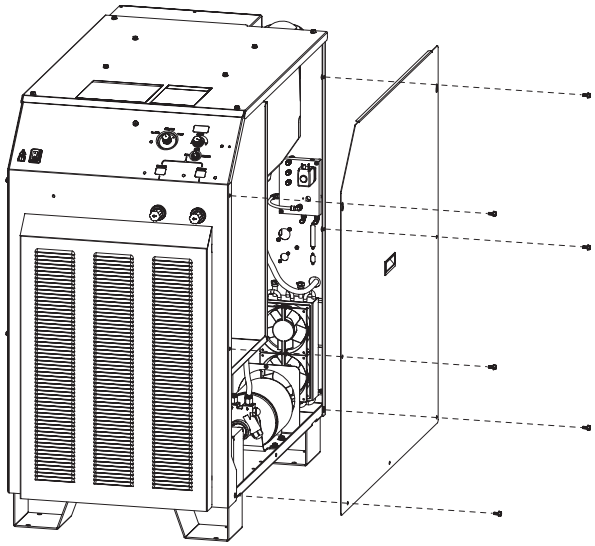
c. Rotate the filter bowl until it locks in place.



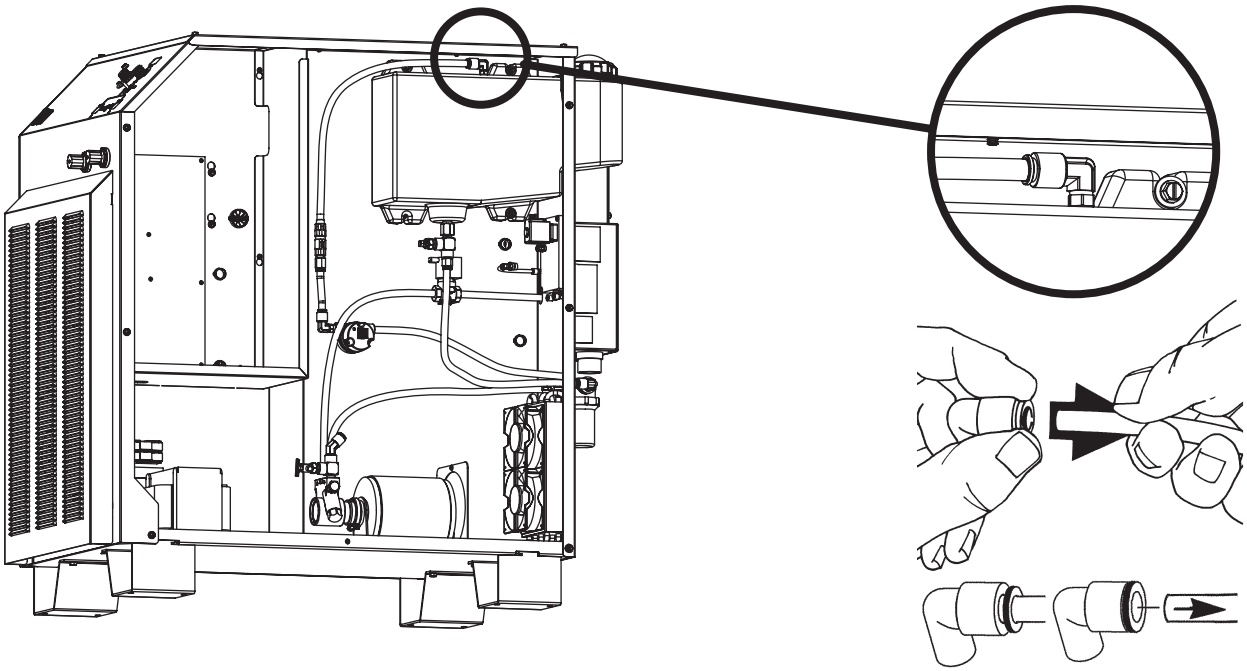
Coolant flow test procedure

The control board (PCB4) receives a contact closure signal from the flow switch when the flow rate is 2.3 lpm (0.6 gpm) or greater. Normal flow is 4.5 lpm (1.2 gpm), but this will vary depending on lead lengths and whether the power is 50 Hz or 60 Hz. PCB4 will allow the system to operate if the coolant flow is 2.3 lpm (0.6 gpm) or greater. If the system shows a coolant flow error (093) the system will need to be turned OFF and then ON again and the following test needs to be performed to determine if the problem is coolant flow or the flow switch.

1. Turn OFF the power, and remove the right-side panel from the power supply.



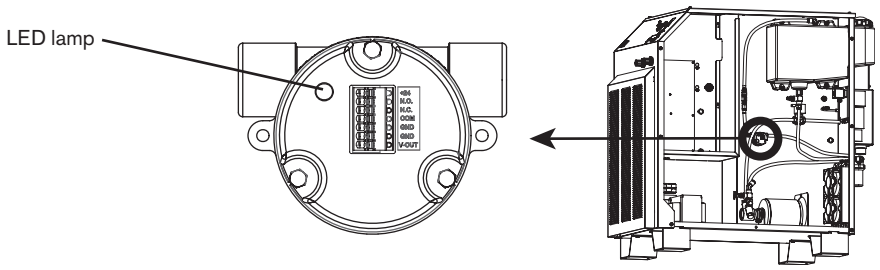
2. Remove the return hose at the top of the coolant tank. Apply gentle pressure to the hose while pulling back on the collar of the elbow fitting. This will release the coolant hose. No tools required. Put the end of the return hose into a 20 liter (5 gallon) container.



3. Turn ON the power and have another person push and hold the current knob, to override the flow time-out error. Allow the coolant to flow for 45 seconds, and turn OFF the power.

4. Measure the amount of coolant in the container. It should be about 4 liters (1 gallon). If there is less than 3 liters (3/4 gallon) there may be a restriction in the coolant system or a problem with the pump.

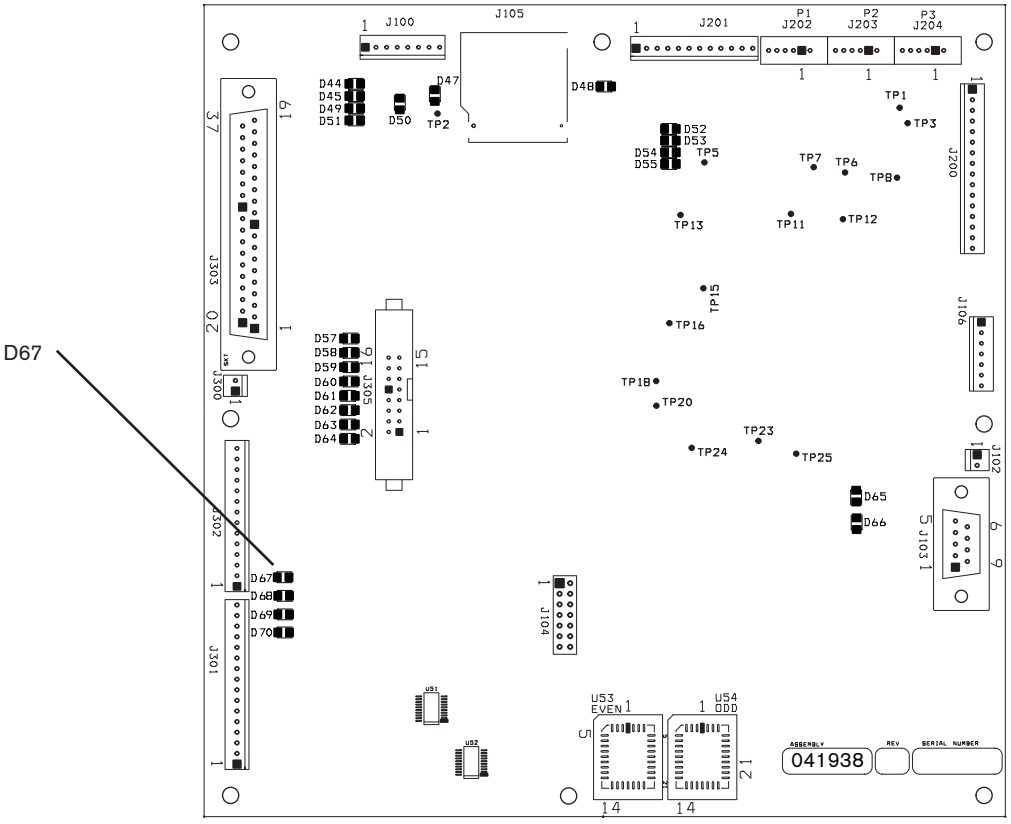
5. If the flow is 2.3 lpm (0.6 gpm) or higher, check the flow switch for contact closure at J11 (blue and white wires). The wires should be shorted. The LED lamp on the flow switch should be illuminated when the pump is running and the flow is > 2.3 lpm (0.6 gpm).



Testing the flow switch

6. Reconnect the return hose to the coolant tank and turn ON the power. Have another person push and hold the current knob to override the flow time-out error.

7. If the LED lamp on the flow switch is illuminated, D67 on the control board (PCB4) should also be illuminated.

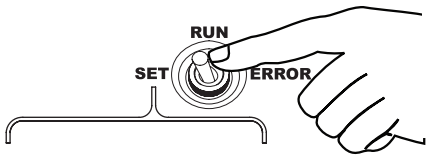


Gas leak test procedure (standard system)

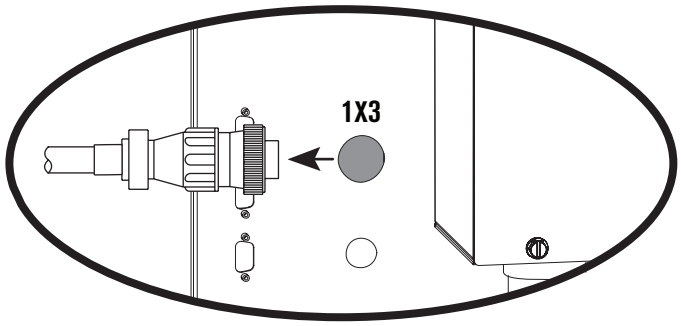
The fuel-gas system has 2 automated leak test modes. See *Automated diagnostic tests* in this section.

Leak test for a standard system (no fuel-gas console)

1. Turn ON the power to the system.
2. After the initial gas purge, move the process selection switch to SET.

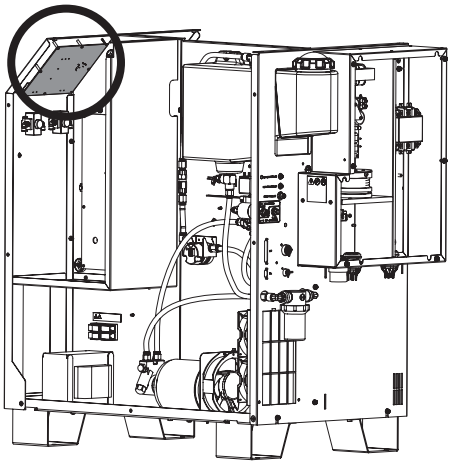


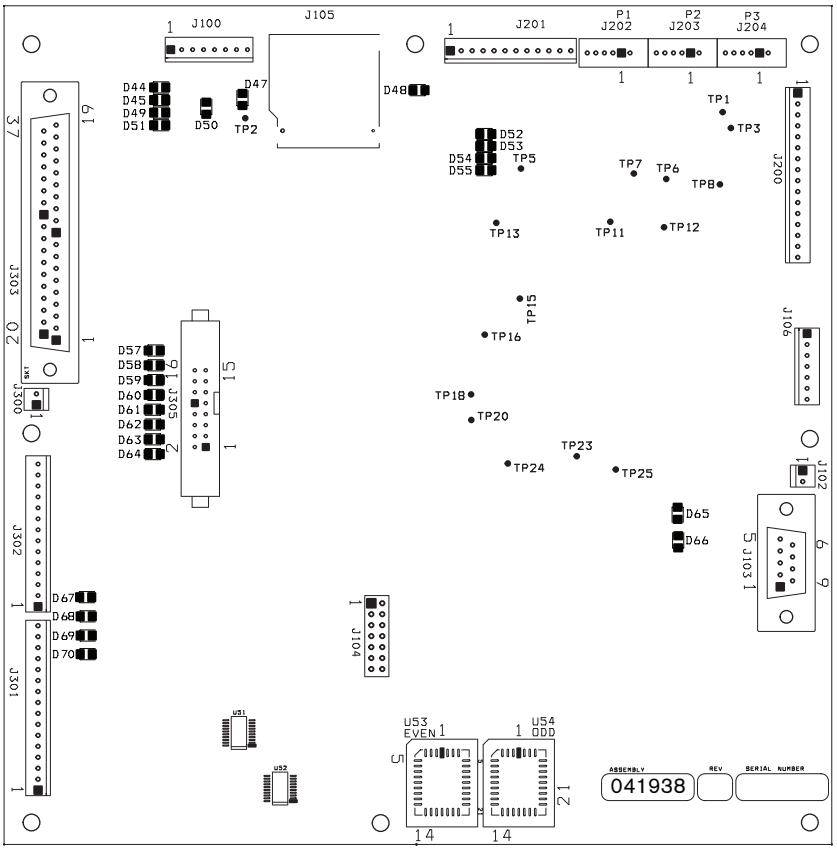
3. Adjust the air supply regulator to 5.5 bar (80 psi).
4. Adjust the O_2 supply regulator to 5.5 bar (80 psi).
5. Move the process selection switch to RUN.
6. Disconnect the off-valve cable (1x3) from the rear panel of the power supply.



7. Move the process selection switch to SET.
8. Turn off the oxygen and the air at the supply.
9. Monitor the plasma pressure and the shield pressure displays for 10 minutes. The pressure should not decrease more than 0.7 bar (10 psi) in 10 minutes.
10. When the test is complete, reconnect the 1x3 cable, move the process selection switch to RUN, and reset the incoming gas supply pressures.

PCB4: Power supply control board



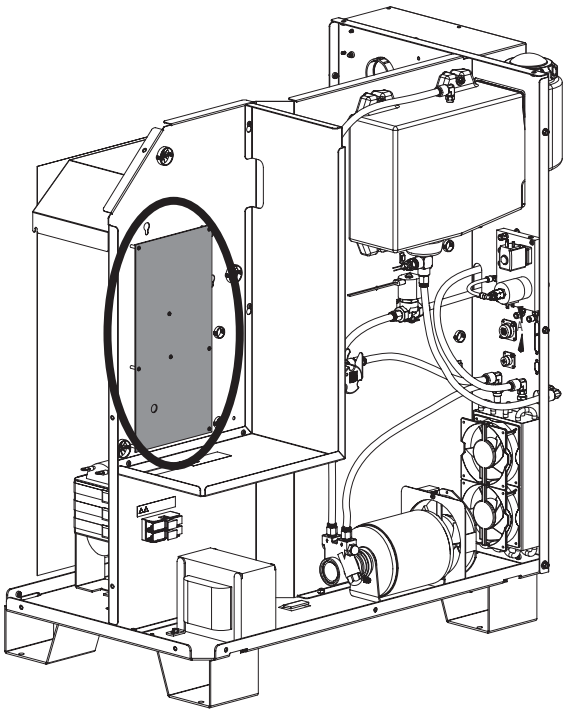


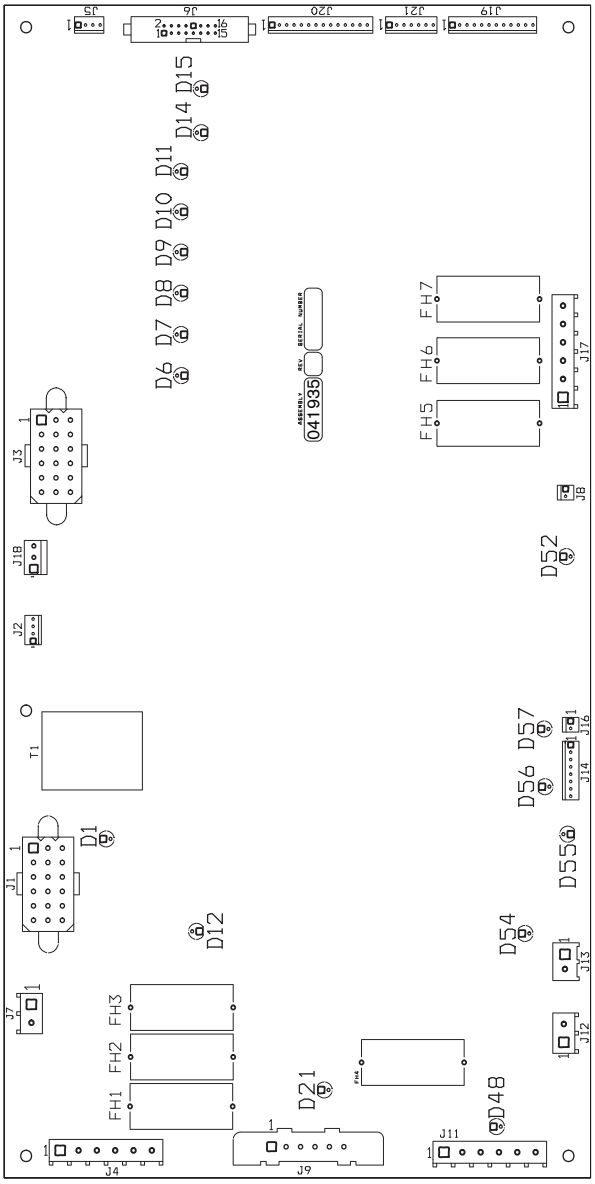
Control PCB4 firmware list	
Item	Part number
U53	081118 EVEN
U54	081118 ODD

PCB4 LED list

LED	Description	Color	LED	Description	Color
D44	Plasma start input	Green	D59	Hold output	Green
D45	Corner current input	Green	D60	Pilot arc enable output	Green
D47	+ 5 VDC	Green	D61	High-frequency enable	Green
D48	Coolant temperature	Green	D62	Pump enable	Green
D49	Hold ignition input	Green	D63	Contactor enable	Green
D50	+ 3.3 VDC	Green	D64	SVA drive	Green
D51	Pierce complete input	Green	D65	CAN transmit	Green
D52	Chopper temperature	Green	D66	CAN receive	Green
D53	Magnetics temperature	Green	D67	Flow switch	Green
D54	Chopper temperature 2	Green	D68	Work lead (transfer)	Green
D55	Magnetics temperature 2	Green	D69	Phase loss	Green
D57	Motion output	Green	D70	Overpressure (not used)	Green
D58	Ramp-down error output	Green			

PCB3: Power supply power distribution board





Note: FH1, FH2, and FH3 are 6 Amp slow-blow fuses
FH5, FH6, and FH7 are 3 Amp fast-blow fuses

PCB3 LED list

LED	Output	Color	LED	Output	Color
D1	120 VAC	Green	D15	Main contactor	Red
D6	Vent solenoid (SV5)	Red	D21	24 VAC	Green
D7	Plasma cutflow solenoid (SV4)	Red	D48	240 VAC	Green
D8	Plasma preflow solenoid (SV3)	Red	D52	+ 24 VDC	Red
D9	Shield off-valve solenoid (SV2)	Red	D54	Pump on	Green
D10	Plasma select solenoid (SV1)	Red	D55	+ 5 VDC	Red
D11	Shield select solenoid (SV0)	Red	D56	– 15 VDC	Red
D12	Power switch closed	Green	D57	+ 15 VDC	Red
D14	High-voltage transformer	Red			

PCB2: Start-circuit

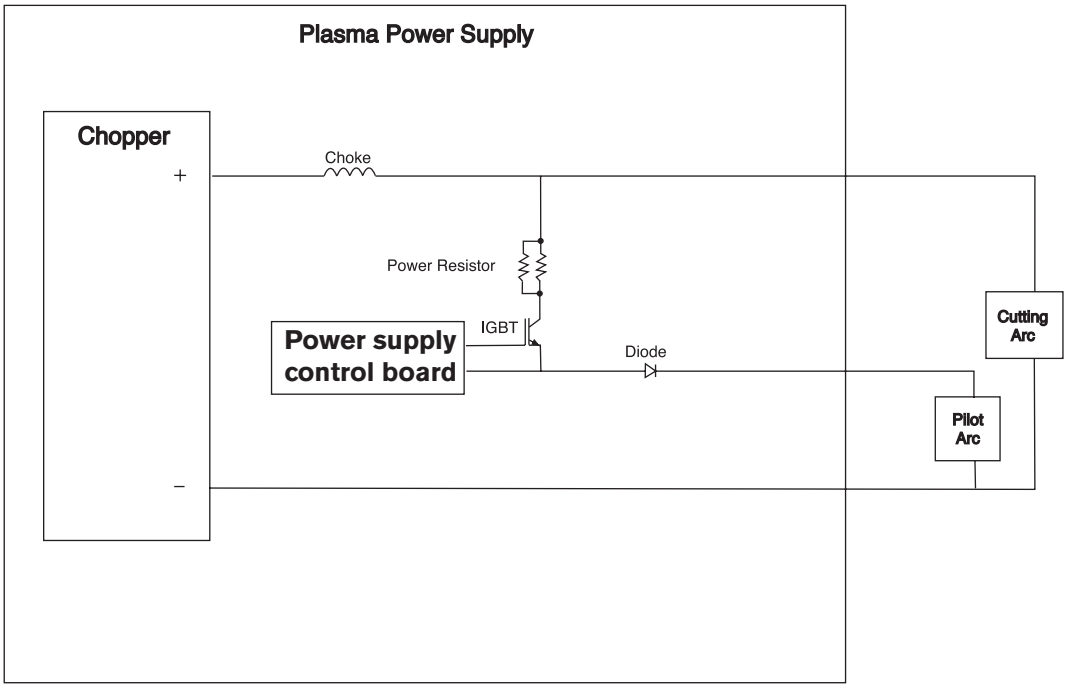
Operation

The start circuit is a high-speed switch that quickly transfers the pilot arc current from the pilot arc lead to the work lead. 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 resistance to the pilot arc lead to aid in transferring the arc to the workpiece. See schematic below.

Start circuit functional schematic



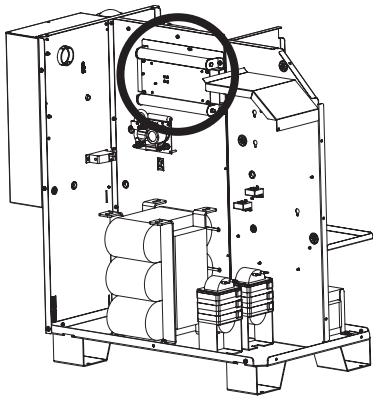
Start-circuit troubleshooting

DANGER

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

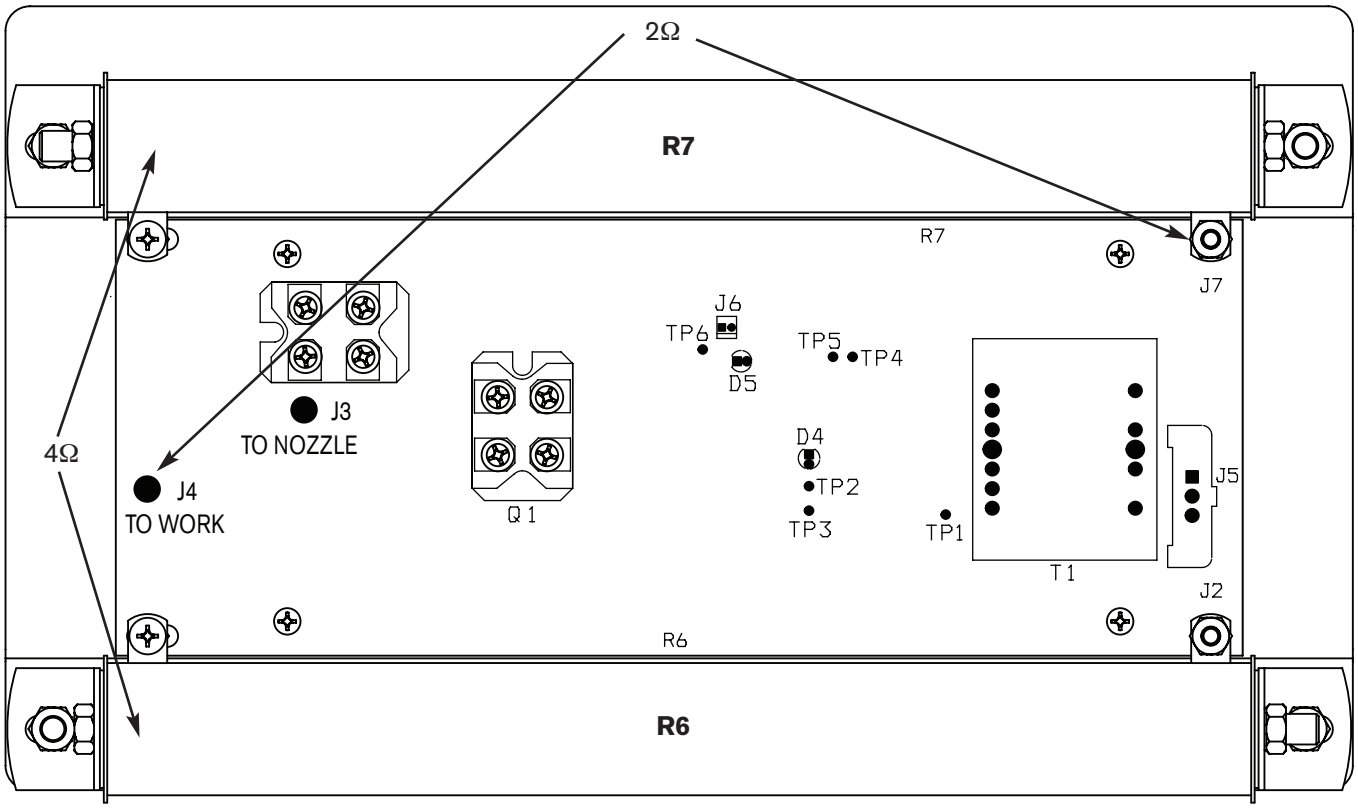
D4 should always be illuminated.

D5 illuminates as soon as the torch fires and will extinguish as soon as the arc transfers to the workpiece. If arc transfer is immediate, the LED may not illuminate.



If there is no arc at the torch or if the arc will not transfer:

1. Turn OFF all power to the system.
2. Remove wires from J4 (TO WORK) and J3 (TO NOZZLE) studs on the board.
3. Verify a resistance of 2 Ω between J4 and J7. If the resistance value is not correct, replace PCB2.
   Note: Resistance value may slowly increase to the correct value due to the capacitance in the circuit.
4. Verify a resistance of 4 Ω across R7 and R6.
   - The work lead should not have any cuts or breaks. verify a resistance of 1Ω or less. The work lead connection to the cutting table should be clean and have good contact to the table.
   - Verify that D4 is illuminated. If it is not illuminated the board may need to be replaced or the board may not be receiving power.
   - Fire the torch in the air and verify that D5 is illuminated. If it is not illuminated, but a pilot arc is established, PCB2 may need to be replaced.
5. Place a 10 AWG (6 mm²) jumper across J3 and J4. Perform a test cut. The nozzle will wear out after just a few starts. If the arc transfers, replace PCB2.



PCB2

Pilot arc current levels

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

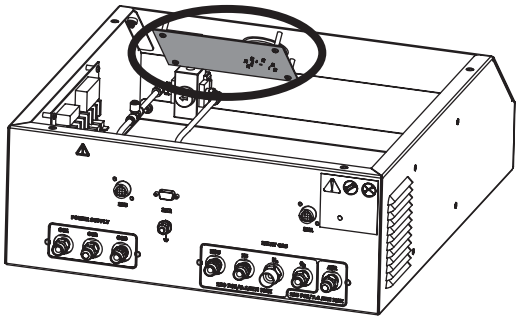
Pilot arc current

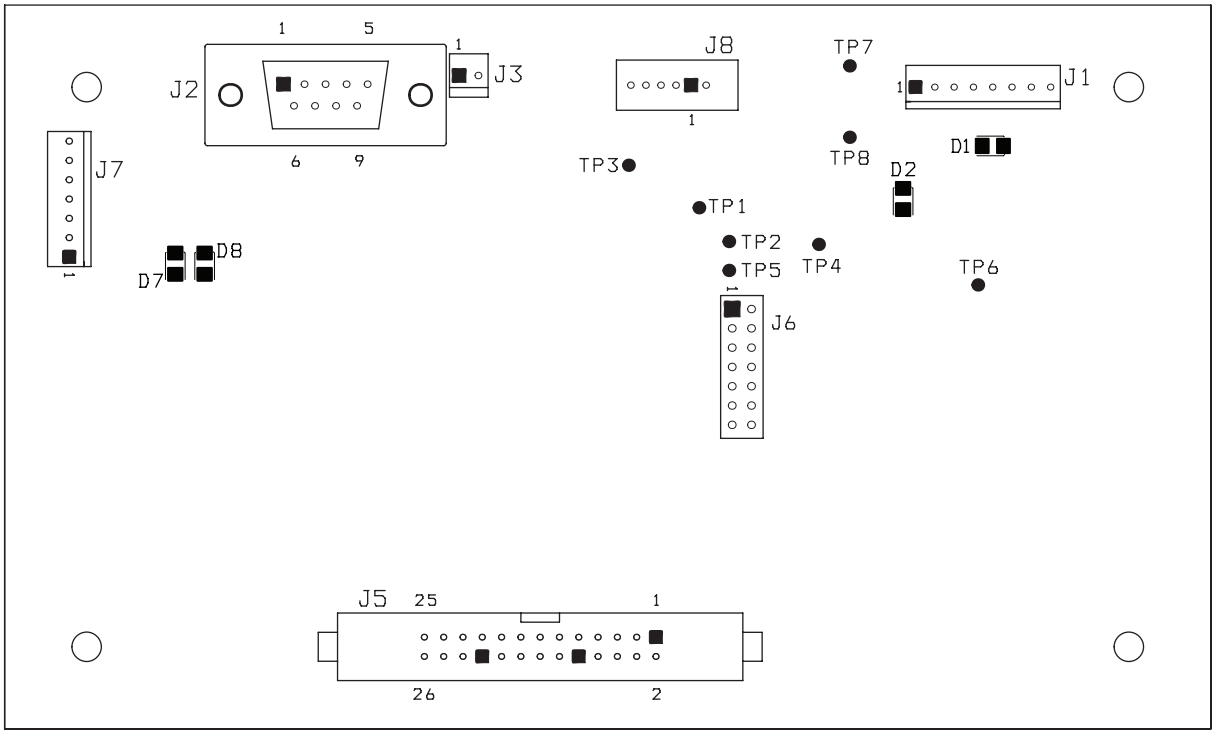
Plasma gas	45 Amps	50 Amps	130 Amps
O_2	30	20	30
N_2	30	20	35
H35	30	20	35
F5	30	20	35
Air	30	20	35

Transfer current

Transfer is determined by CS1 on PCB6. Transfer occurs when current on the work lead is > 3.5 Amps.

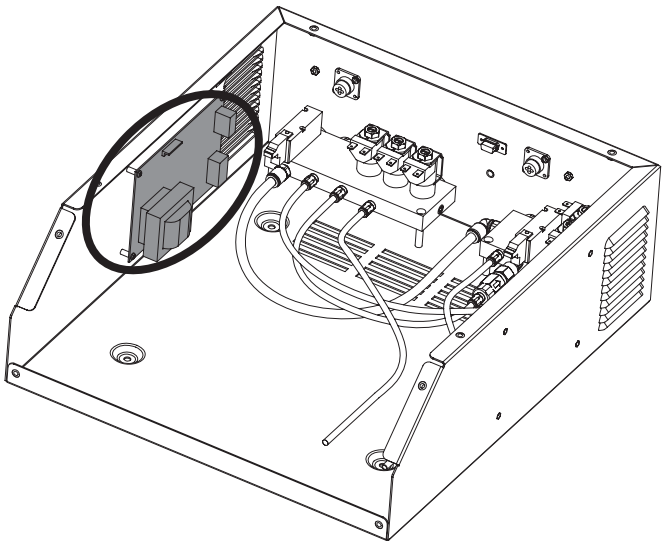
PCB2: Fuel-gas console control board

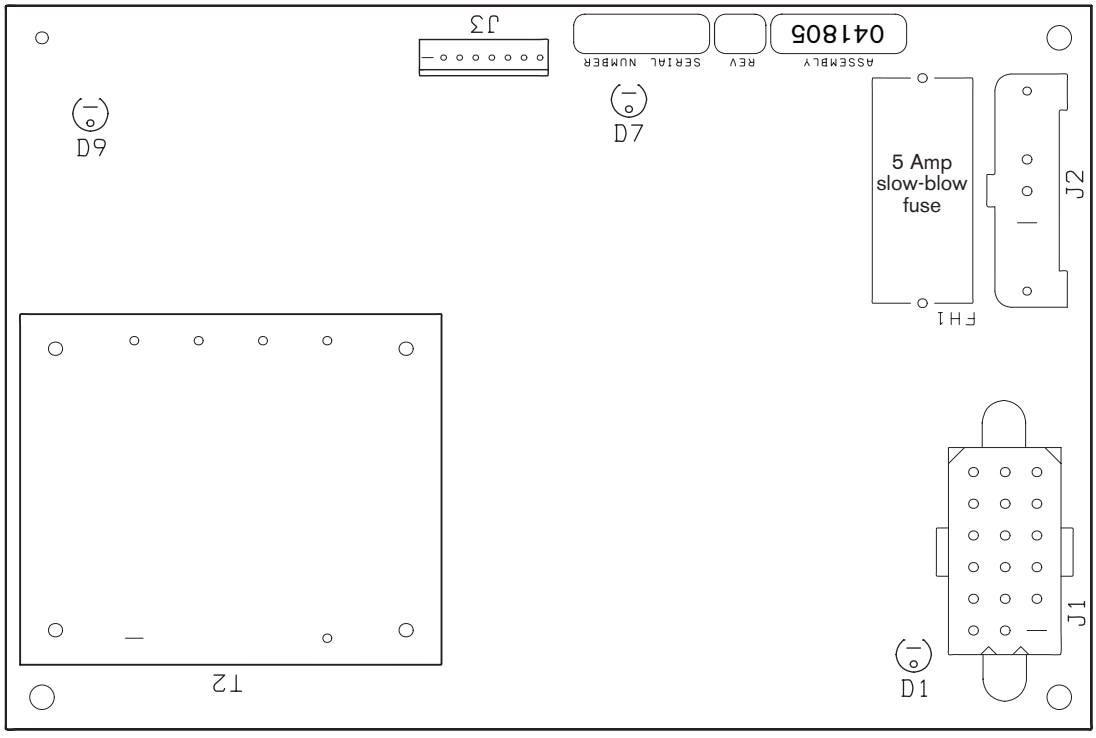




Gas console control board LED list		
LED	Signal name	Color
D1	+ 5 VDC	Green
D2	+ 3.3 VDC	Green
D7	CAN transmit	Green
D8	CAN receive	Green

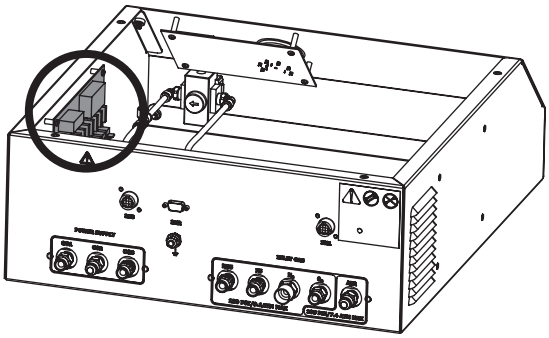
PCB1: Fuel-gas console power distribution board

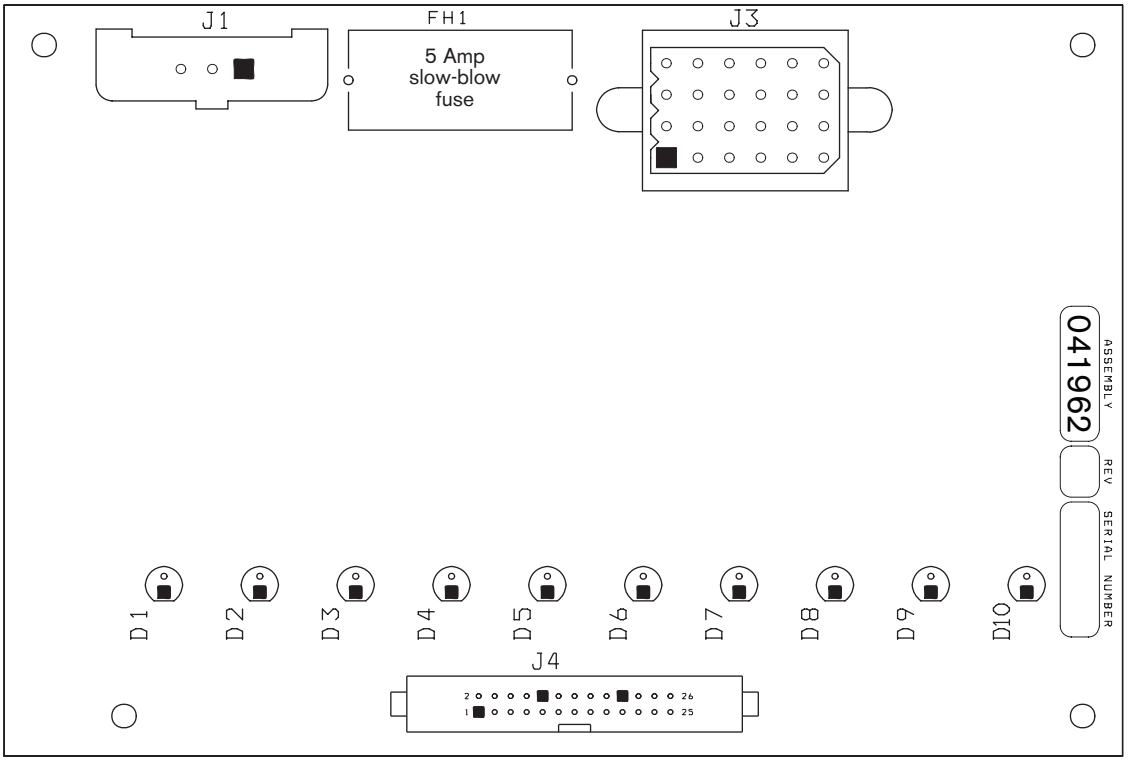




Gas console power distribution board LED list		
LED	Signal name	Color
D1	120 VAC	Green
D7	+ 5 VDC	Red
D9	+ 24 VDC	Red

PCB3: Fuel-gas console AC valve-driver board





Gas console AC valve driver board LED list

LED	Signal name	Color
D1	SV0	Red
D2	SV1	Red
D3	SV2	Red
D4	SV3	Red
D5	SV4	Red
D6	SV5	Red
D7	SV6	Red
D8	SV7	Red
D9	SV8	Red
D10	SV9	Red

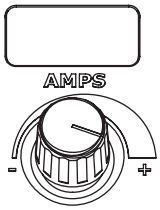
Chopper tests

WARNING

SHOCK HAZARD: Use extreme care when working near the chopper modules. Each large electrolytic capacitor (blue-cased cylinder) stores 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.

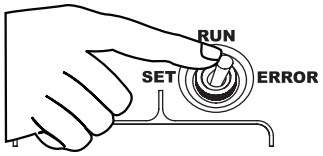
Test 1 – automatic chopper and current sensor tests during power-up

Turn ON the system. When the preflow starts, the contactor will close and the system will automatically test the chopper and current sensors. The system closes the contactor and turns chopper channel 1 on at 90% duty cycle. The chopper will charge the surge capacitor on the I/O board (PCB 6). The current that charges the capacitor should be between 10 amps and 35 amps. Error code 105 will show in the AMPS display if the current is < 10 amps or there is no feedback on current sensor 1 (CS1). Error code 103 will show in the AMPS display if the current is > 35 amps.



If Channel 1 passes the test, the system will repeat the test for channel 2 and current sensor 2. Error code 075 will show in the AMPS display if the current is < 10 amps. Error code 107 will show in the AMPS display if the current is > 35 amps.

Place the toggle switch in the ERROR position if the system completes the power-up sequence. If the system shows a status of -03 the test has passed. The chopper and current sensors are OK.



Troubleshooting low-current error codes 75 and 105

1. Verify that the current sensor (CS1 or CS2) and the cables are not damaged.
2. Exchange CS1 and CS2 to see if the error code switches channels. Replace the faulty sensor if the channel switches.
3. Measure the resistance between J6.2 and J6.3 on PCB6 with a meter. The value should be increasing as the capacitor charges. Replace PCB6 if a constant value is seen.
4. Check for loose wires or opens from chopper to PCB6.
5. Check for 220 VAC to 1A, 1B, and 1C on the chopper when the contactor closes.

Troubleshooting high-current error codes 103 and 107

1. Verify that the current sensor (CS1 or CS2) and the cables are not damaged.

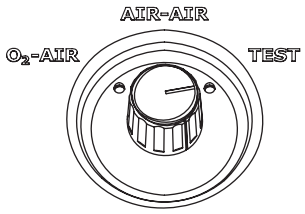
2. Exchange CS1 and CS2 to see if error the code switches channels. Replace the faulty sensor if the channel switches.

3. Look at the surge capacitor to ensure that it is not short circuited. Replace PCB6 if it is open.

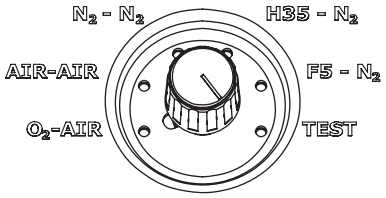
4. Check for short circuits from work to negative. Resistance should be about 100K ohm from negative to work. Resistance will vary if you have a voltage divider for a height control system.

Test 2 – using the TEST position on the process selection knob.

1. Turn the process selection knob to TEST.

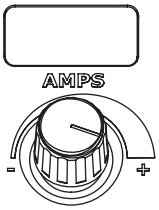


Power supply selection knob



Fuel-gas console selection knob

2. The contactor will close and the open circuit voltage (OCV) for the chopper will show in the AMPS display.



3. The OCV is 311 VDC. The AMPS display will show approximately 280 VDC for OCV based on where the measurement is taken.

   Note: At any time while the system is cutting you can push in on AMPS knob to display the actual voltage while cutting. The refresh rate is slow but you can compare the value to the height control set point.

Test 3 – using a meter to measure open circuit voltage (OCV)

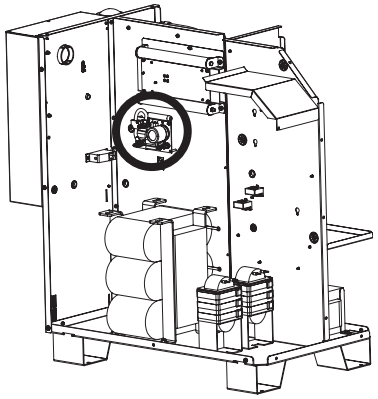
DANGER

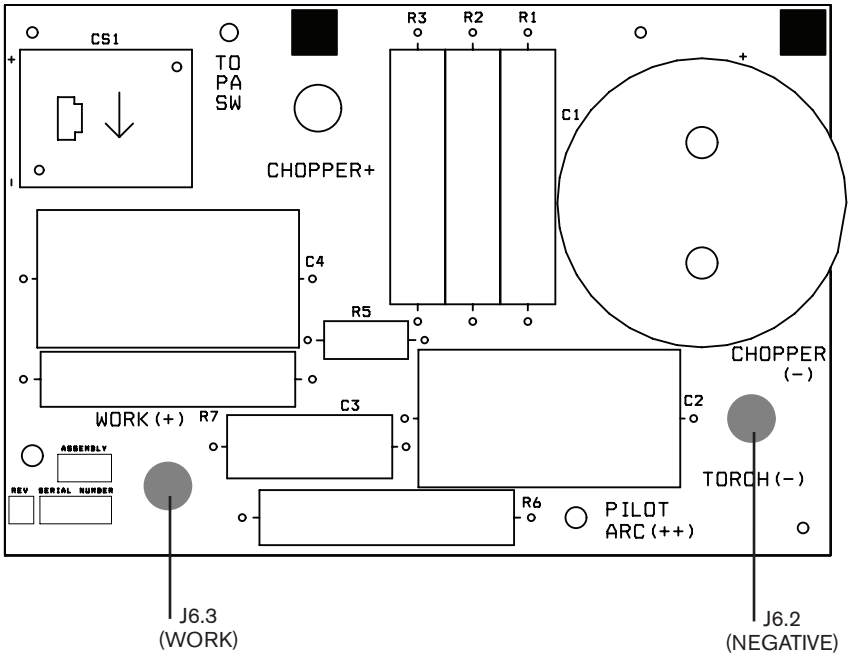
SHOCK HAZARD: The system will close the contactor and feed voltage to the I/O board (PCB6) with no input from the technician. Lethal voltages greater than 300 VDC will be present at times during power-up.

1. It is best to use clip-on test leads to keep your hands and the meter outside the power supply. Connect the meter to J6.3 (WORK) and J6.2 (NEGATIVE) on the I/O board (PCB 6).

2. Turn ON the system.

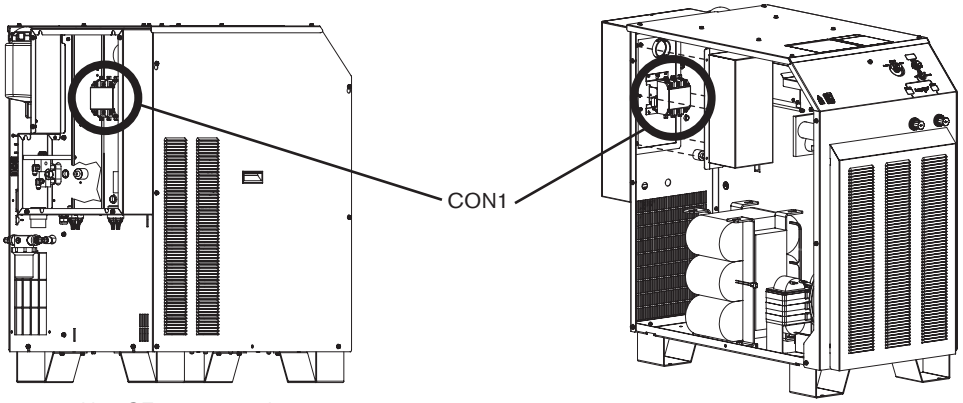
3. The automatic chopper test will begin when the purge cycle starts. You will hear the main contactor close and 0 to 5 seconds later the meter should show 311 VDC. This is the OCV for channel 1. The voltage will start to decrease to 0 VDC and will then spike back up to 311 VDC again. The second reading represents the OCV for channel 2.





Phase-loss detection test

1. Turn OFF all power to the system and remove the cover from CON1. On non-CE units the contactor is located on the back of the power supply. On CE units the contactor is located inside the power supply on the left side.



Non-CE power supply

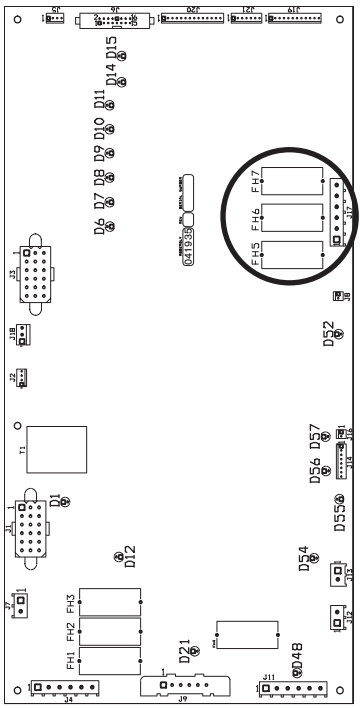
CE power supply

2. Inspect the condition of the 3 contacts for excessive wear. If one or more of the contacts are worn excessively, replace CON1 and restart the system. If the error remains, perform the following steps.

OK

Excessive wear

3. Test the fuses F5, F6, and F7 on the power distribution board (PCB3). If any of the fuses are blown, replace PCB3.



4. Remove J3.8 from PCB3 and place a jumper wire between pins 1 and 2 on the cable connector.

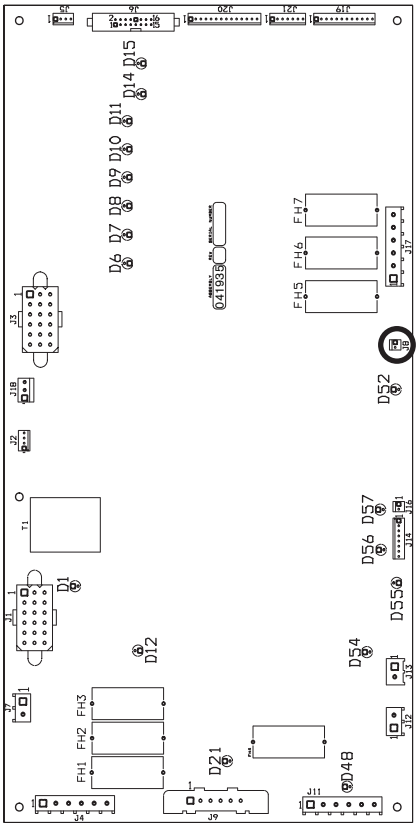
   a. Make a test cut. If the phase-loss error continues, verify wiring between the connectors J3.8 on PCB3 and J4.301 on the power supply control board (PCB4) by verifying the continuity between

      – J3.8 pin1 to J4.301 pin13

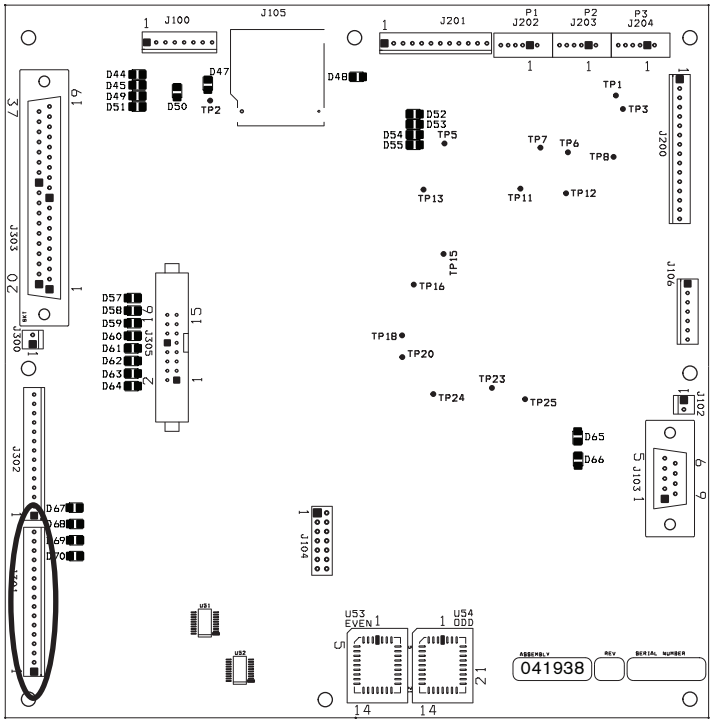
      – J3.8 pin2 to J4.301 pin14.

   b. If the wiring is OK, replace PCB4. If any wiring is damaged, repair or replace damaged wires.

   c. If the phase-loss error goes away while the jumper is on J3.8, make another cut and measure the phase-to-phase voltage across the fuses F5, F6, and F7. The voltage should be 220 VAC +/–15%. If one of the 3 voltage readings is less than 187 VAC, check the contacts to the contactor, and check for loose connections between the power cord, contactor, power transformer, and the chopper.



Power distribution board (PCB3)



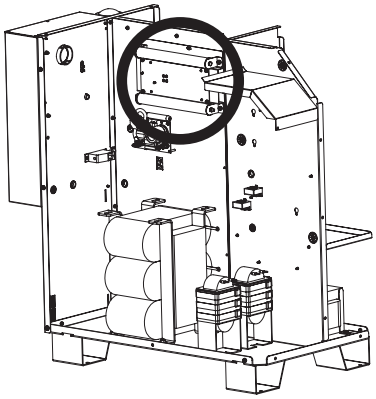
Power supply control board (PCB4)

DANGER

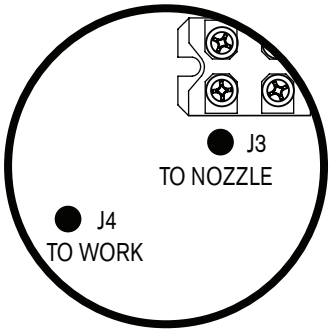
SHOCK HAZARD: Always use extremecaution when servicing a power supply when it is plugged in and the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death.

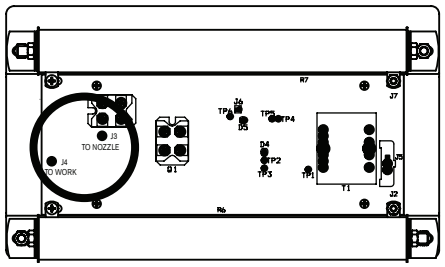
Torch lead test

1. Turn OFF all power to the system.
2. Locate the pilot arc controller.



3. Install a temporary jumper wire between J4 (work) and J3 (nozzle) on the start circuit PCB1.





4. Measure the ohm value between the nozzle and the plate. The reading should be < 3 ohms. A measurement > 3 ohms indicates a faulty connection between the torch and ignition console, or between the ignition console and the power supply.

5. Verify that the pilot arc wire on the torch lead is not damaged. If it is damaged, replace the lead. If it is not damaged, replace the torch head.

Preventive maintenance

Introduction

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

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

Preventive maintenance protocol

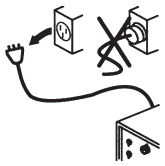
The following protocol covers the basic elements of all Hypertherm HySpeed plasma systems.

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

The power supply

DANGER

ELECTRIC SHOCK CAN KILL



Turn off all electrical power before removing the power supply cover 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. With power to the power supply turned off, remove all side panels. Use compressed air to blow out any accumulation of dust and particulates.

2. Inspect wiring harnesses and connections for wear, damage or loose connections. If you see any discoloration that might indicate overheating, contact Hypertherm Technical Service.

3. Inspect the main contactor for excessive pitting on the contacts, characterized by a blackened, rough surface on any of the contacts. If this condition exists, replacement is recommended.

Cooling system

4. Inspect the coolant-circulating system's filter element at the rear of the power supply. If the filter is a brownish color, replace it. Consult the *Parts List* in this manual for part numbers.

5. Perform a coolant flow test as described in this manual, then check for coolant leaks. Primary locations to inspect are these:

   A. The back of the power supply;

   B. At the ignition console; and

   C. At the torch main body.

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

Torch main body

6. Verify that the water tube is straight and has no pitting on the end.

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

8. Inspect the torch insulator for cracks. Replace the torch if you find cracks.

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

10. Check that the retaining or shield cap is tightened securely to the torch main body.

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

12. Check that all connections between the torch and torch leads are tight, but do not overtighten. See torque specs in the *Installation* section of this manual.

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

Gas flows

13. Check each gas line from the gas supply, as follows:

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

    B. Pressurize the O_2 gas line to 8.3 bar (120 psi) and the air gas line to 7.2 bar (105 psi).

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

    D. Repeat for each line from a gas supply source. If any pressure continues to drop, find the leak within the system.

14. If the gas line pressures hold steady, perform a system gas leak test as specified in this manual.

15. Check for hose restrictions, as follows:

    A. Check all hoses to verify that they have no kinks or sharp bends, which can restrict gas flow.

    B. If the cutting table uses a power track system to support leads from the power supply to the gas console or torch, check the position of the leads in the power track to ensure the leads do not twist or kink, causing a possible restriction.

Cable connections

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

Ignition console

17. Open the cover and use compressed air to blow out any accumulation of dust and particulates. If moisture is present, dry the inside of the console with a cloth and try to identify the source of the moisture.

18. Inspect the spark gap assembly. Ensure that the wiring connections to the spark gap assembly are secure.

19. Inspect the torch leads. Ensure that they are fastened tightly to the outside of the ignition console.

System grounding

20. Verify that all components of the system are individually grounded to a driven earth ground, as described in the *Installation* and *Grounding* sections of this manual.

    A. All metal enclosures, such as the power supply, ignition console and 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.

21. Check the work lead (+) connection, particularly where the work lead (+) connects to the cutting table. This must be a good, clean connection because a poor connection may cause arc-transfer problems.

22. Complete the Preventive Maintenance worksheet on the next page, for future reference.

Preventive Maintenance Master Schedule

Daily:

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

Weekly:

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

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

Bi-Annually:

Year	1st Service	2nd Service

- Replace service parts per the Service Part Replacement Schedule.

Annually:

Year									

- Replace service parts per the Service Part Replacement Schedule.

Preventive Maintenance Protocol Checklist

Customer: _____
Location: _____
Contact: _____
Date: _____

Hypertherm system: _____
System serial #: _____
System arc hours: _____
(if equipped with an hour meter)

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

Power supply

☐*P* ☐*NP* 1. Inspect for particulates and blow out
☐*P* ☐*NP* 2. Inspect wiring harnesses
☐*P* ☐*NP* 3. Inspect main contactor

Coolant system

☐*P* ☐*NP* 4. Inspect filter element
☐*P* ☐*NP* 5. Perform coolant flow test
A. Coolant flow checked at _____ gallons per minute (_____ l/min)

Torch main body

☐*P* ☐*NP* 6. Inspect water tube
☐*P* ☐*NP* 7. Clean threads on torch front end
☐*P* ☐*NP* 8. Inspect Vespel torch insulator
☐*P* ☐*NP* 9. Inspect torch and consumable o-rings
☐*P* ☐*NP* 10. Verify proper fit of retaining or shield cap
☐*P* ☐*NP* 11. Inspect hose fittings
☐*P* ☐*NP* 12. Inspect torch-to-torch-lead connections

Gas flows

☐*P* ☐*NP* 13. Inspect plumbing from gas supply
☐*P* ☐*NP* A. Oxygen
☐*P* ☐*NP* B. Nitrogen
☐*P* ☐*NP* C. Air
☐*P* ☐*NP* D. Nitrogen-Hydrogen
☐*P* ☐*NP* E. Argon-Hydrogen
☐*P* ☐*NP* F. Inspect compressed air filter system

Gas flows (cont.)

☐*P* ☐*NP* 14. Perform gas leak test
A. Oxygen pressure drop at _____ psi in 10 minutes (_____ bar)
B. Air pressure drop at _____ psi in 10 minutes (_____ bar)
☐*P* ☐*NP* 15. Inspect for hose restrictions
☐*P* ☐*NP* A. Off-valve to torch body
☐*P* ☐*NP* B. Hoses in power track

Cable connections

☐*P* ☐*NP* 16. Inspect cables
☐*P* ☐*NP* A. Height control
☐*P* ☐*NP* B. Control cable from off-valve to power supply

Ignition console

☐*P* ☐*NP* 17. Inspect for moisture, dust and particulates
☐*P* ☐*NP* 18. Inspect spark gap subassembly
☐*P* ☐*NP* 19. Inspect torch leads

System grounding

☐*P* ☐*NP* 20. Inspect for proper system component grounding
☐*P* ☐*NP* 21. Inspect connection from cutting table to workpiece (+) lead

General comments and recommendations:

_____
_____
_____
_____
_____

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

HSD130 Service Parts Replacement Schedule

Annual Kit 228167

Timeline	Component	Part Number	Quantity
6 months or 300 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
1 Year or 600 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
1.5 Years or 900 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
2 Years or 1200 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Coolant Pump	229126	1
	Torch leads	System Dependent	1
2.5 Years or 1500 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
3 Years or 1800 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Off-valve Assembly	System Dependent	1
	Cooling Fan	127039	System Dependent
	Cooling Fan	027079	1
3.5 Years or 2100 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
4 Years or 2400 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Coolant Pump	229126	1
	Torch Leads	System Dependent	1
	Coolant Pump Motor	128385	1
4.5 Years or 2700 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
5 Years or 3000 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	High Voltage Transformer	129854	1
	Power Distribution Board	041935	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
6.0 Years or 3600 arc hrs.	Coolant Filter Element	027664	1
	Coolant Solution 70/30	028872	4
	Main Contactor	003139	1
	Torch Main Body	220474	1
	Air filter	011093	1
	Coolant Pump	229126	1
	Torch Leads	System Dependent	1
	Off-valve Assembly	System Dependent	1
	Cooling Fan 6"	127039	System Dependent
	Cooling Fan 10"	027079	1
6.5 Years or 3900 arc hrs.	Repeat schedule starting at 6 months or 300 arc hrs.		

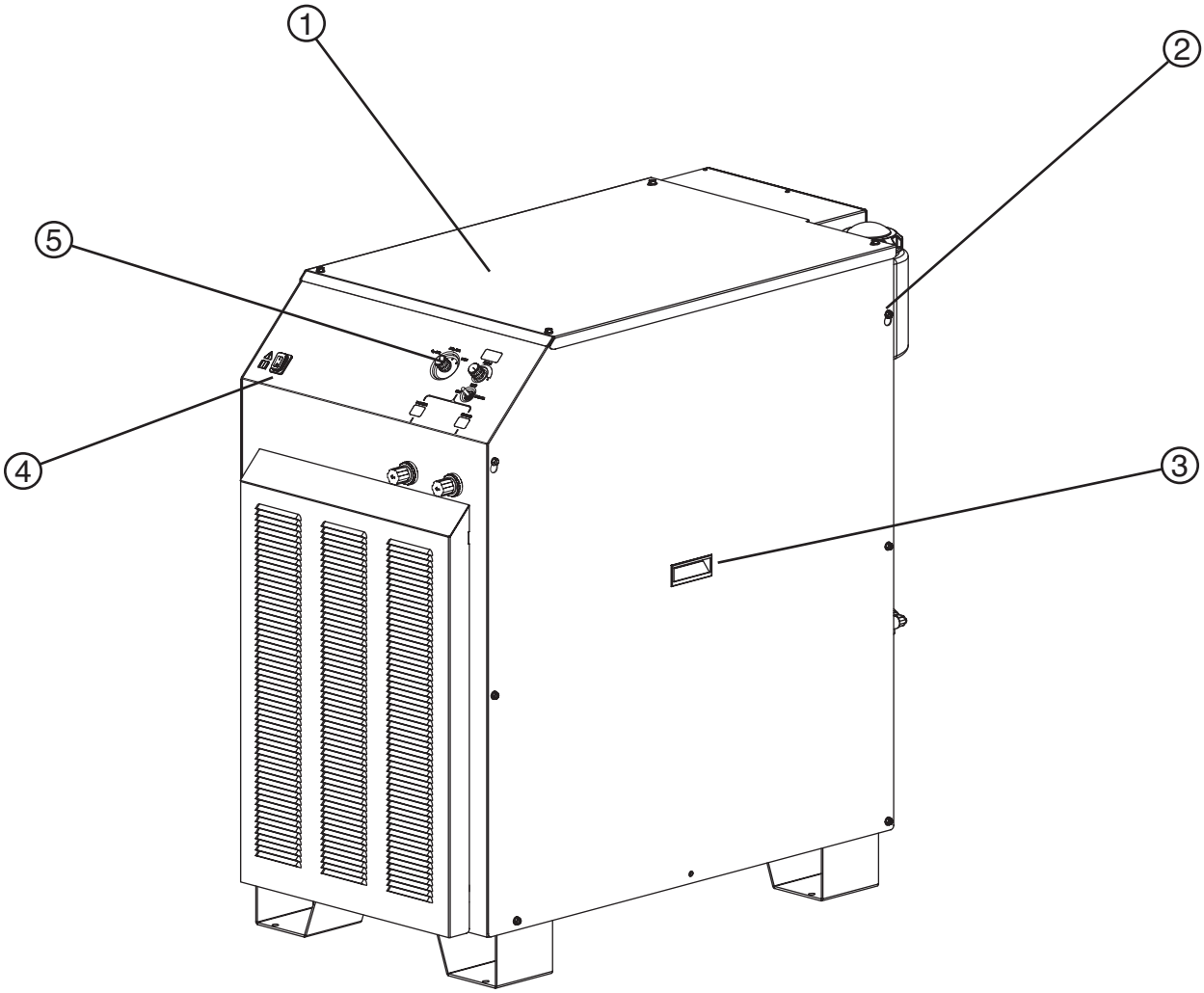
Section 6

PARTS LIST

In this section:

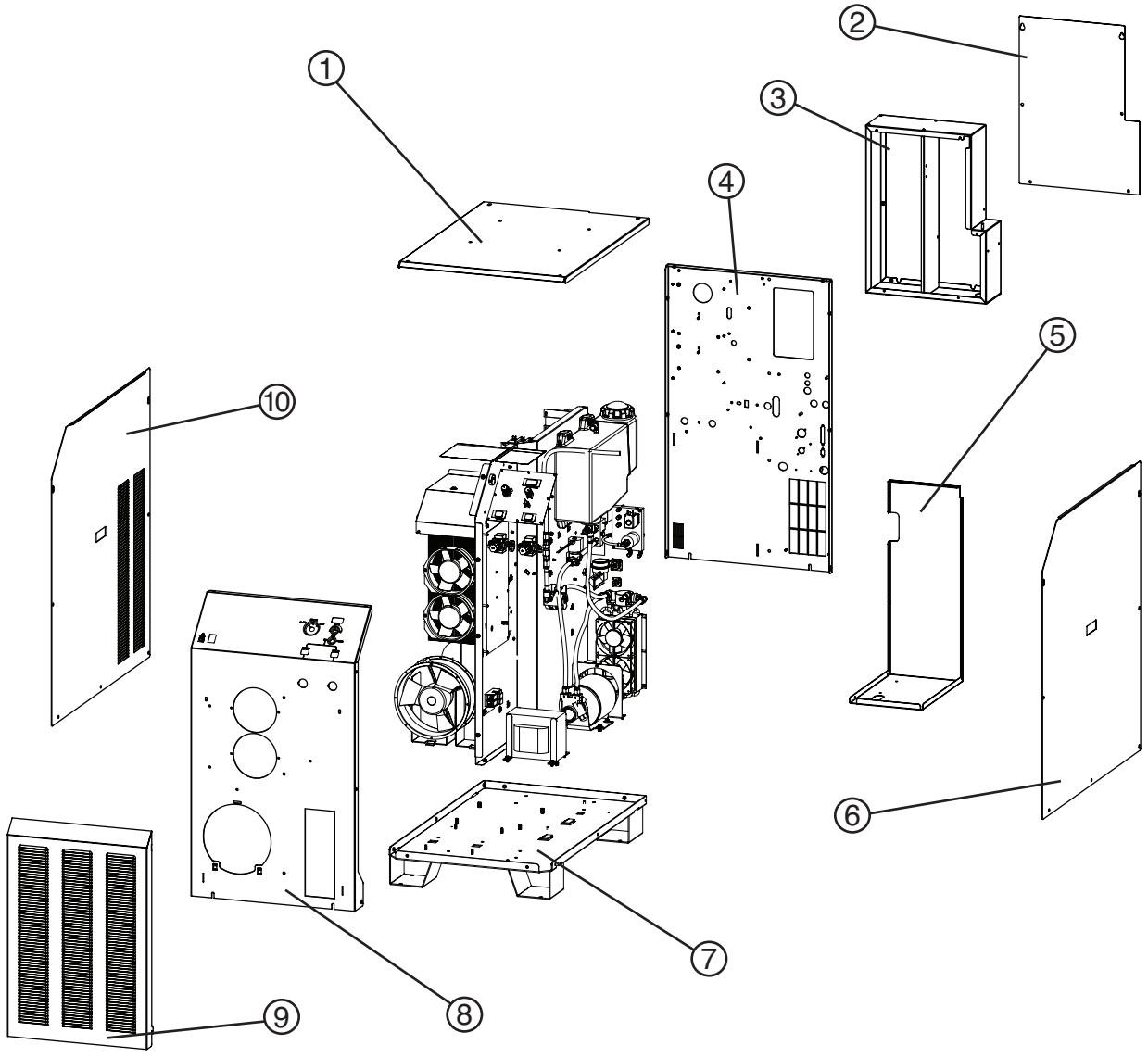
Power supply 6-2
Ignition console 6-8
Fuel-gas console 6-9
Off-valve (standard) 6-10
Off-valve (fuel-gas) 6-10
HySpeed torch 6-11
    Torch assembly 6-11
    Torch leads 6-11
Mild steel consumable parts kit 6-12
Stainless steel / Aluminum consumable parts kit 6-13
Recommended spare parts 6-14

Power supply



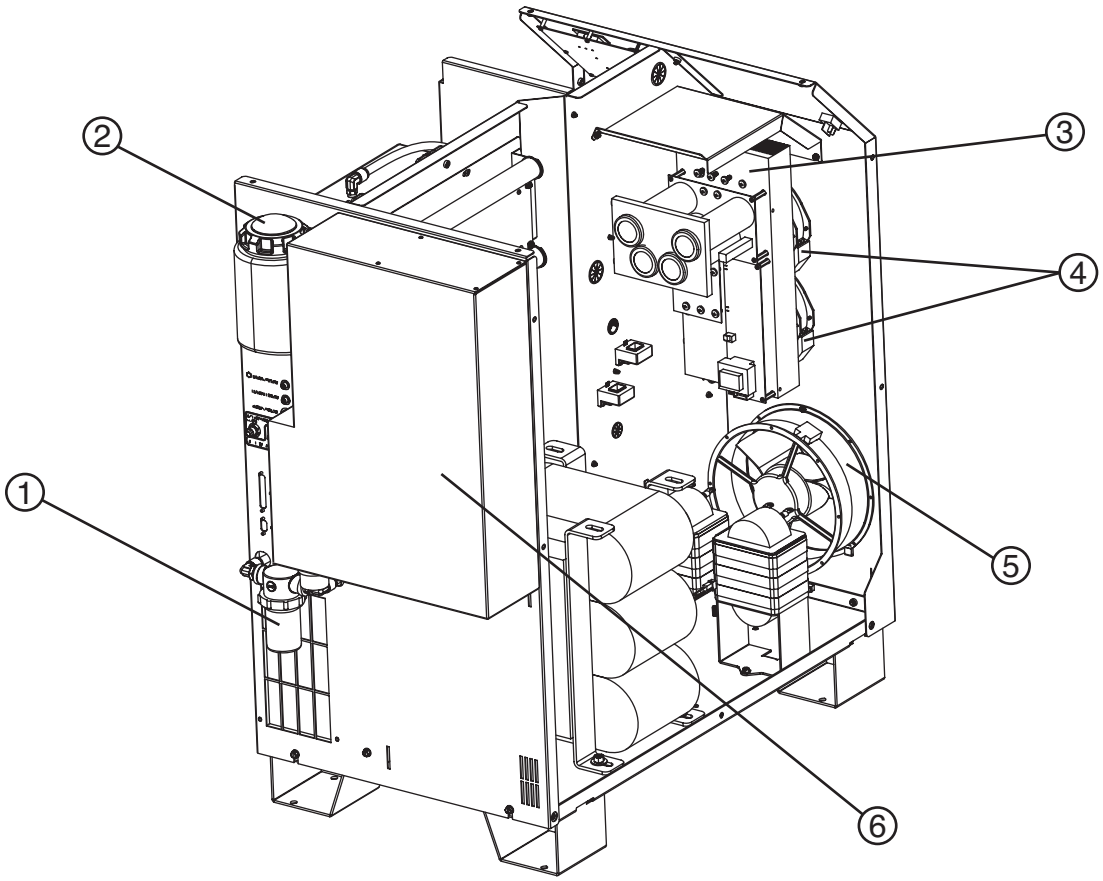
Item	Part number	Description	Designator	Qty.
1	078194	HySpeed (HSD) Plasma power supply: 200/208 volt		
	078204	HySpeed (HSD) Plasma power supply: 220 volt		
	078195	HySpeed (HSD) Plasma power supply: 240 volt		
	078196	HySpeed (HSD) Plasma power supply: 380 volt		
	078197	HySpeed (HSD) Plasma power supply: 400 volt		
	078198	HySpeed (HSD) Plasma power supply: 440 volt		
	078199	HySpeed (HSD) Plasma power supply: 480 volt		
	078200	HySpeed (HSD) Plasma power supply: 600 volt		
2	075241	Sheet metal screw		1
3	027967	Handle		2
4	005262	Power switch: green illuminated		1
5	108590	knob		2
	108591	Knob cover		2

Power supply



Item	Part number	Description	Qty.
1	001963	Cover: power supply	1
2	001965	Cover: LHF rear box	1
3	001964	Enclosure: LHF rear box	1
4	001960	Panel: power supply rear	1
5	001966	Enclosure: power supply PCB	1
6	001962	Panel: power supply left side	1
7	001810	Base: power supply	1
8	001957	Panel: power supply front	1
9	001958	Panel: fan cover	1
10	001961	Panel: power supply right side	1

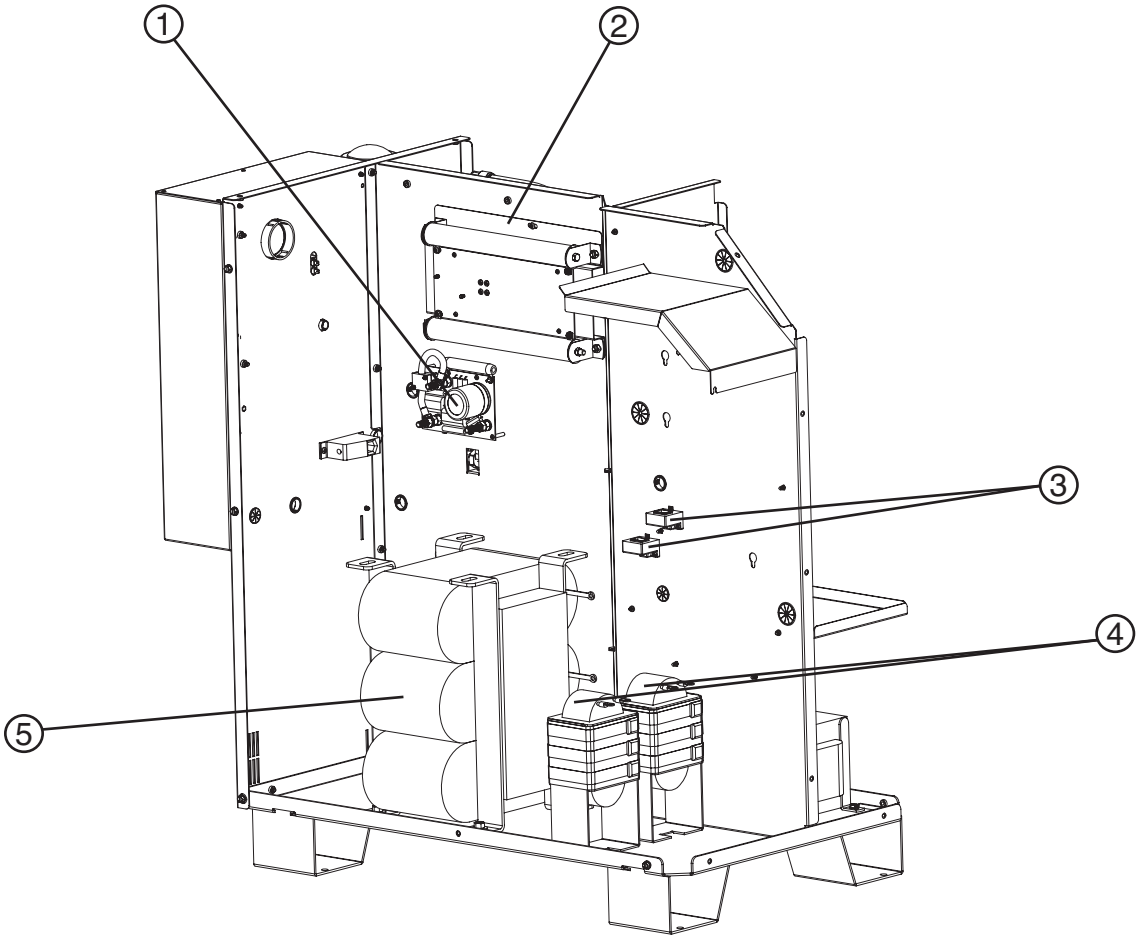
Power supply



Item	Part number	Description	Designator	Qty.
1	027634	Filter assembly		1
	027664	Filter element		1
2	127014	Cap: coolant reservoir		1
3	229107	Chopper assembly	CH1	1
4	127039	6" fan :230 CFM, 115 VAC 50-60 HZ		2
5	027079	10" fan :450-550 CFM, 120 VAC 50-60 HZ		1
6	109638*	EMI filter (not shown)		1

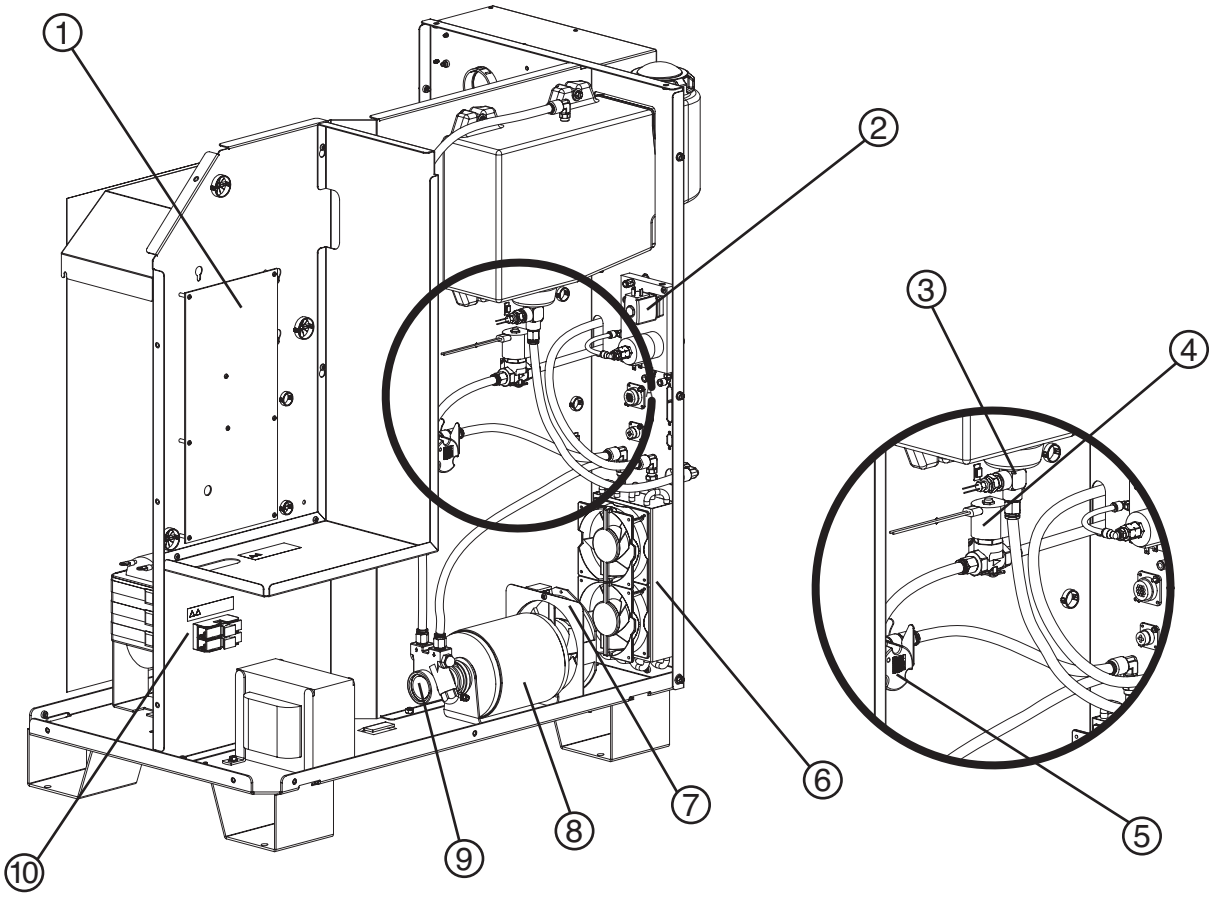
*400 volt power supplies

Power supply



Item	Part number	Description	Designator	Qty.
1	041932	PCB: I/O	PCB6	1
2	229106	Pilot arc start circuit assembly	PCB2	1
3	109004	Current sensor: hall 100 amp, 4 volt	CS1, CS2	2
4	014310	Inductor: 65A 1Mh	L1/L2	2
5	014283	Main transformer: 200V, 50-60 Hz	T1	1
	014284	Main transformer: 220V, 50 Hz	T1	1
	014282	Main transformer: 240V, 60 Hz	T1	1
	014303	Main transformer: 380V, 50-60 Hz	T1	1
	014283	Main transformer: 400V, 50-60 Hz	T1	1
	014284	Main transformer: 440V, 50 Hz	T1	1
	014282	Main transformer: 480V, 60 Hz	T1	1
	014281	Main transformer: 600V, 60 Hz	T1	1

Power supply



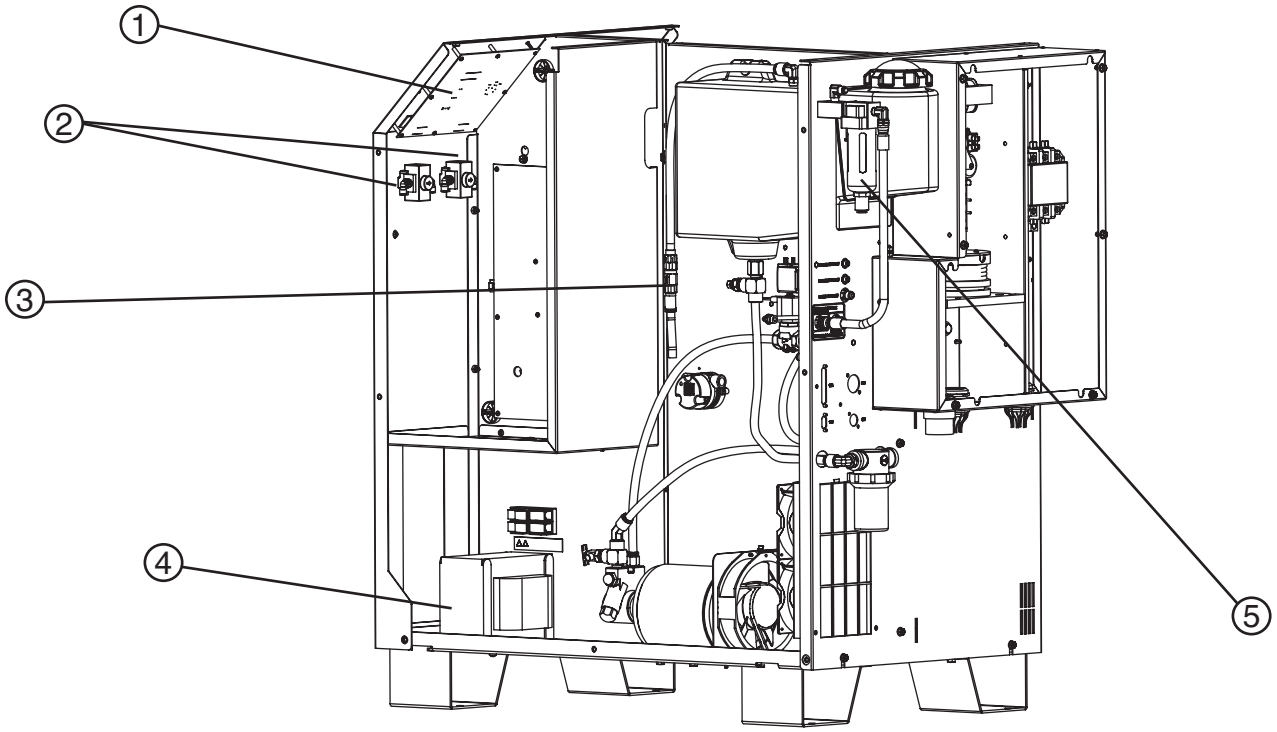
Item	Part number	Description	Designator	Qty.
1	041935	Power distribution PCB	PCB3	1
2	229102	Gas manifold		1
3	109393	Temperature switch		1
4	006046	Solenoid valve	CLT SOL	1
5	229119	Flow switch	FLS	1
6	027978	Heat exchanger assembly		1
7	127039*	6" fan :230 CFM, 115 VAC 50-60 HZ		1
8	128385	Motor assembly: 1/3HP 240 V 50-60 HZ		1
9	229126	Pump		1
10	008709**	Fuse: 20 amp, 500 volt	F1, F2	2
	008551***	Fuse: 7.5 amp, 600 volt	F1, F2	2

*200, 220, 380, 400 and 440, volt power supplies

**200, 220 and 240 volt power supplies

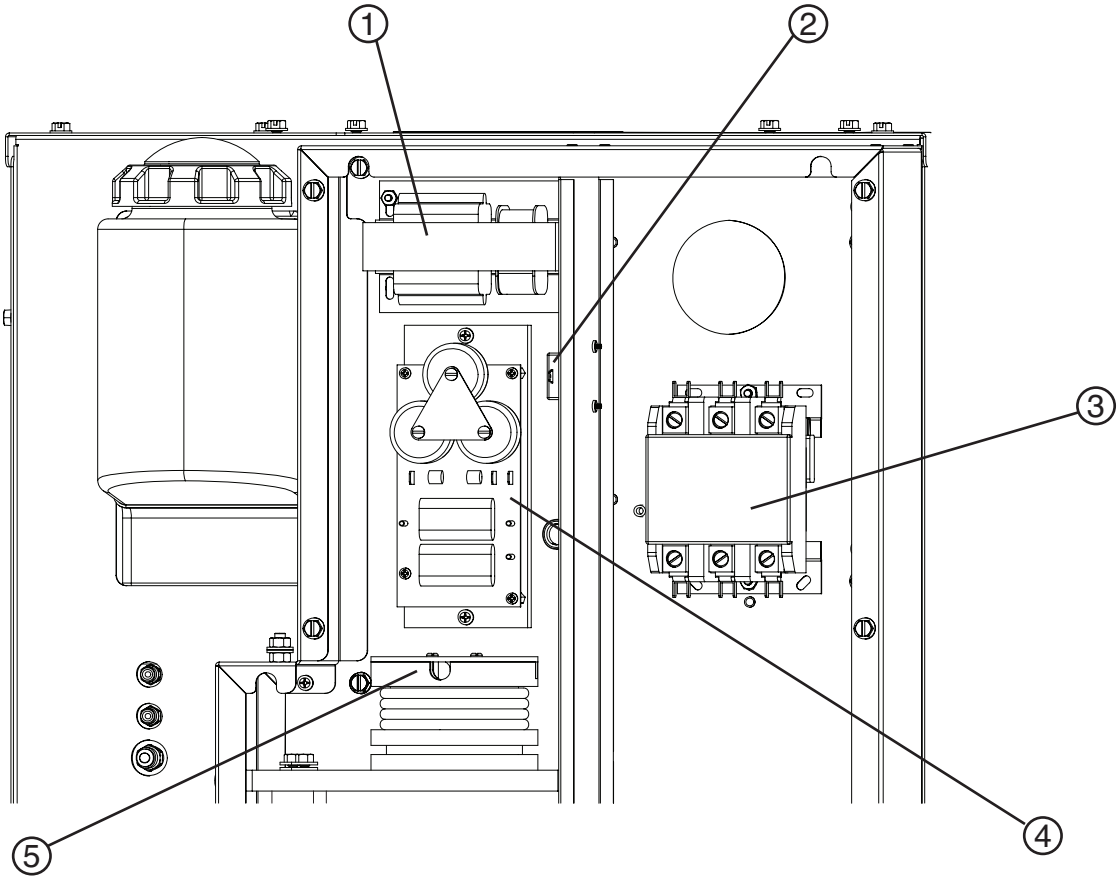
***380, 400, 440, 480 and 600 volt power supplies

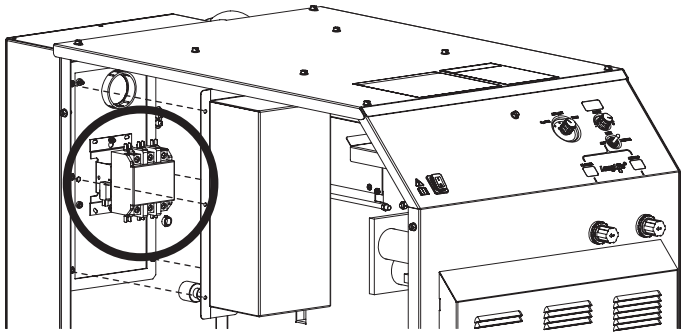
Power supply



Item	Part number	Description	Designator	Qty.
1	041938	Control PCB	PCB4	1
2	011101	Regulator		2
3	006075	Check valve		1
4	129786	Control transformer: 200 V power supply	T2	1
	229117	Control transformer: 220 V power supply	T2	1
	129966	Control transformer: 240 V power supply	T2	1
	229094	Control transformer: 380 V power supply	T2	1
	129787	Control transformer: 400 V power supply	T2	1
	229013	Control transformer: 440 V power supply	T2	1
	129967	Control transformer: 480 V power supply	T2	1
	129989	Control transformer: 600 V power supply	T2	1
5	011093	Filter element		1
	011105	O-ring: filter bowl		1

LHF Ignition console

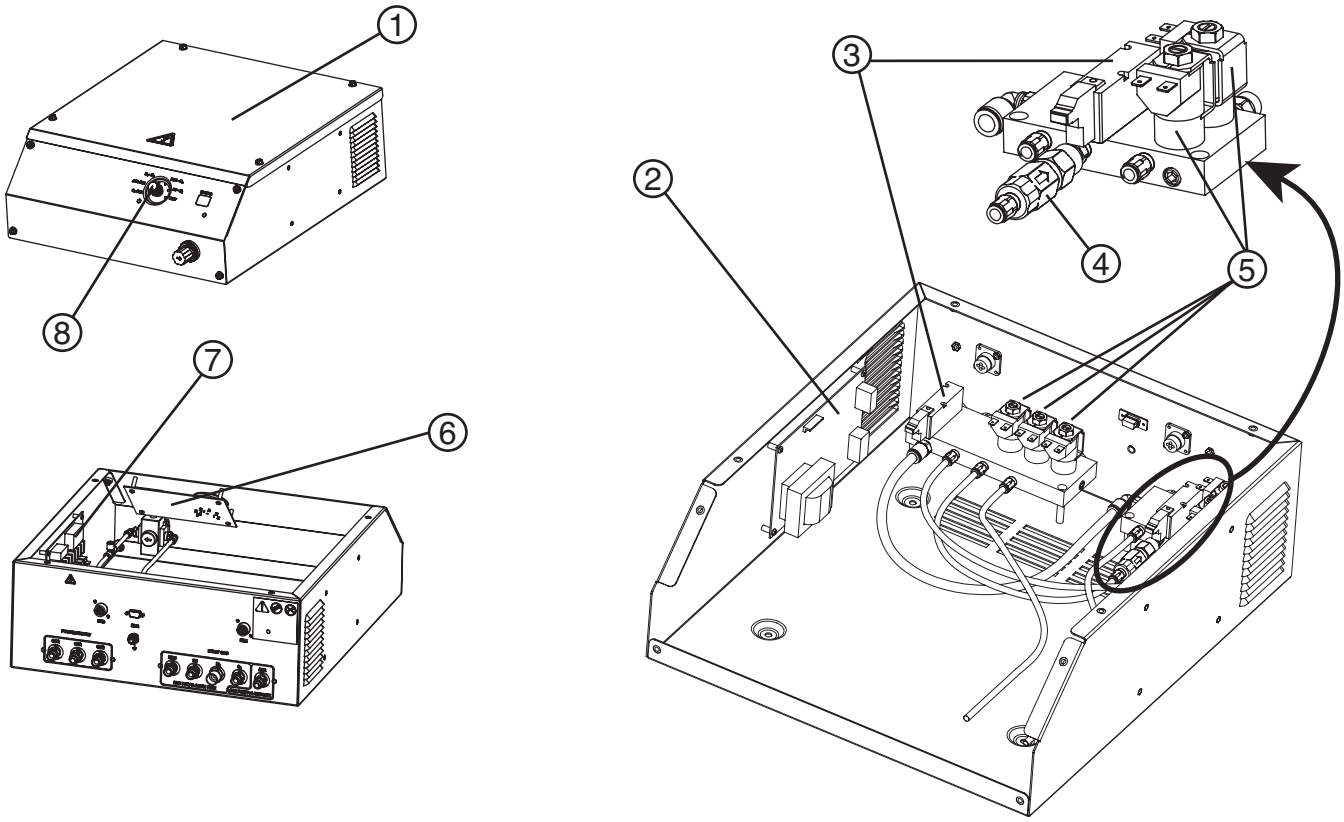




Contactor location for CE power supplies

Item	Part number	Description	Designator	Qty.
1	129854	Transformer	T1	1
2	109636	EMI filter		1
3	003139	Contactor: 90 A, 3 phase, 120 VAC	CON1	1
4	041817	HFHV Ignition PCB	PCB9	1
5	129831	Coil assembly	T2	1

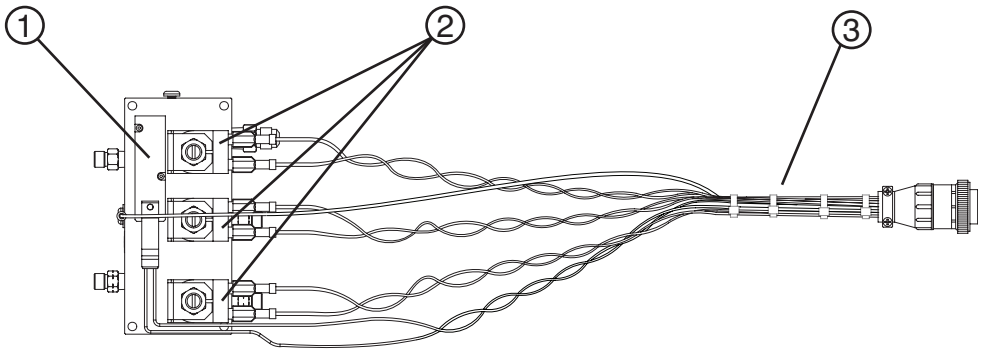
Fuel-gas console



Item	Part number	Description	Designator	Qty.
1	**078201**	**Fuel-gas console**		**1**
	001970	Cover: fuel-gas console		1
	001971	Front panel: fuel-gas console		1
2	041805	Power distribution PCB	PCB1	1
3	006135	Solenoid valve	SV0 and SV7	2
4	006075	Check valve		1
5	006109	Solenoid valve	SV1-SV5	5
	006112	Replacement solenoid coil		5
6	041971	Control PCB	PCB2	1
7	041962	Valve driver PCB	PCB3	1
8	108590	knob		2
	108591	Knob cover		2

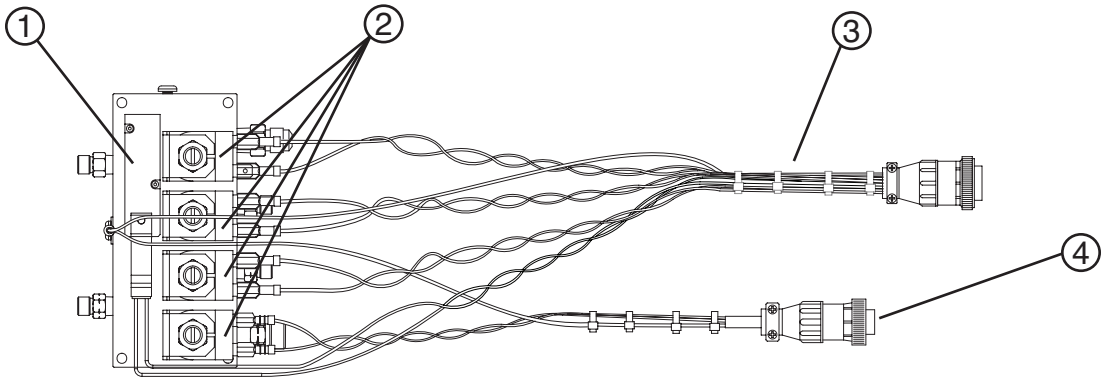
Off-valve (standard)

Item	Part number	Description	Designator	Qty.
	229105	**Off valve assembly** (includes cable)		**1**
1	006135	Solenoid valve	SV2	1
2	006109	Solenoid valve	SV3-SV5	3
	006112	Replacement solenoid coil		3
3	123870	Off-valve cable		1



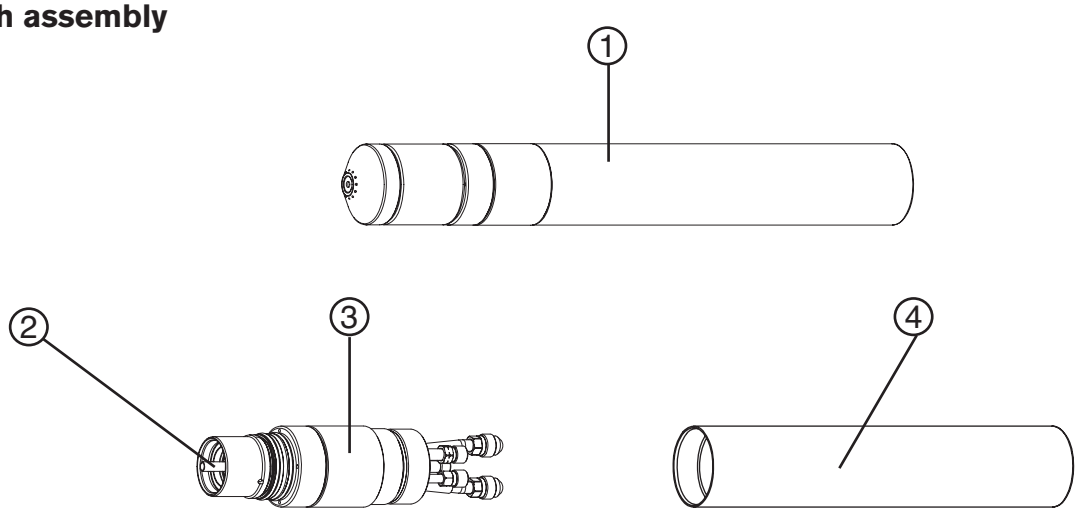
Off-valve (fuel-gas)

Item	Part number	Description	Designator	Qty.
	229130	**Off valve assembly**		**1**
1	006135	Solenoid valve	SV2	1
2	006109	Solenoid valve	SV3-SV6	4
	006112	Replacement solenoid coil		4
3	123870	Off-valve cable		1
4	123912	Off-valve cable (fuel-gas)		1



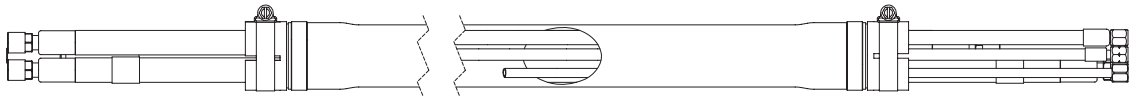
HySpeed torch

Torch assembly



Item	Part number	Description
1	**228144**	**HSD machine torch assembly**
2	220521	Water tube
3	220474	Torch main body
4	220473	Torch mounting sleeve

Torch leads



Part number	Description
228050	7.5 m (25 ft)
228051	15 m (50 ft)

Mild steel consumable parts kit – 228146

Note: See *Consumable selection* or *Cut charts* for specific applications

Part number	Description	Qty.
004630	Electrode gauge assembly	1
044026	O-ring: 1.239" X .070"	2
027055	Lubricant: silicone 1/4-oz tube	2
027102	Tool: electrode removal / replacement	1
220487	Electrode	3
220488	Swirl ring	1
220489	Nozzle	3
220490	Retaining cap	1
220491	Shield	1
220492	Nozzle	3
220525	Nozzle	2
220528	Electrode	2
220529	Swirl ring	1
220530	Nozzle	2
220532	Shield	1
220578	Retaining cap with IHS tab	1
220340	Water tube with o-ring	1

Stainless steel / Aluminum consumable parts kit – 228156

Note: See *Consumable selection* or *Cut charts* for specific applications

Part number	Description	Qty.
044026	O-ring: 1.239" X .070"	2
027055	Lubricant: silicone 1/4-oz tube	2
027102	Tool: electrode removal / replacement	1
020415	Electrode	3
220488	Swirl ring	1
220490	Retaining cap: clockwise	1
220491	Shield	1
220492	Nozzle	2
220525	Nozzle	2
220528	Electrode	2
220529	Swirl ring	1
220532	Shield	1
220533	Retaining cap: counter-clockwise	1
220534	Retaining cap: counter-clockwise with IHS tab	1
220535	Nozzle	3
220536	Shield	1
220578	Retaining cap: clockwise with IHS tab	1
220340	Water tube with o-ring	1

Recommended spare parts

Power supply

Part number	Description	Designator	Qty.
005262	Power switch: green illuminated		1
011093	Filter element		1
229107	Chopper assembly	CH1	1
127039	6" fan :230 CFM, 115 VAC 50-60 HZ		1
027079	10" fan :450-550 CFM, 120 VAC 50-60 HZ		1
041932	PCB: I/O	PCB6	1
229106	Pilot arc start circuit assembly	PCB2	1
109004	Current sensor: hall 100 amp, 4 volt	CS1, CS2	1
008709*	Fuse: 20 amp, 500 volt	F1, F2	2
008551**	Fuse: 7.5 amp, 600 volt	F1, F2	2
041935	Power distribution PCB	PCB3	1
041938	Control PCB	PCB4	1
229119	Flow switch	FLS	1
006075	Check valve		1
006046	Solenoid valve	CLT SOL	1
229126	Coolant pump		1
128385	Kit: motor, 1/3HP 240 V 50-60 HZ		1
041817	HFHV Ignition PCB	PCB9	1
129854	Transformer	T1	1

*200, 220 and 240 volt power supplies
**380, 400, 440, 480 and 600 volt power supplies

Fuel-gas console (optional)

Part number	Description	Designator	Qty.
041805	Power distribution PCB	PCB1	1
041962	Valve driver PCB	PCB3	1
041971	Control PCB	PCB2	1
006135	Solenoid valve	SV0 and SV7	1
006109	Solenoid valve	SV1-SV5	2

Off-valve (standard)

Part number	Description	Designator	Qty.
006135	Solenoid valve	SV2	1
006109	Solenoid valve	SV3-SV5	1

Off-valve (fuel-gas)

Part number	Description	Designator	Qty.
006135	Solenoid valve	SV2	1
006109	Solenoid valve	SV3-SV5	1

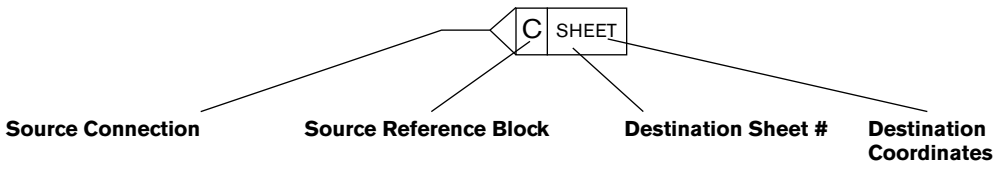
Section 7

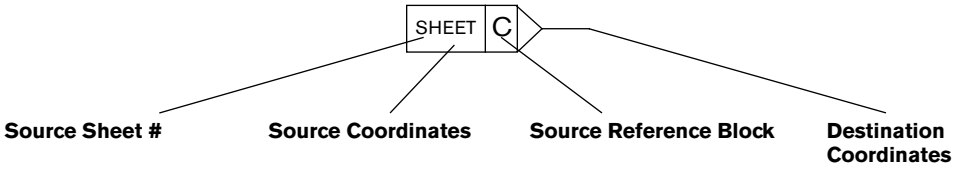
WIRING DIAGRAMS

Introduction

This section contains the wiring diagrams for the 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:

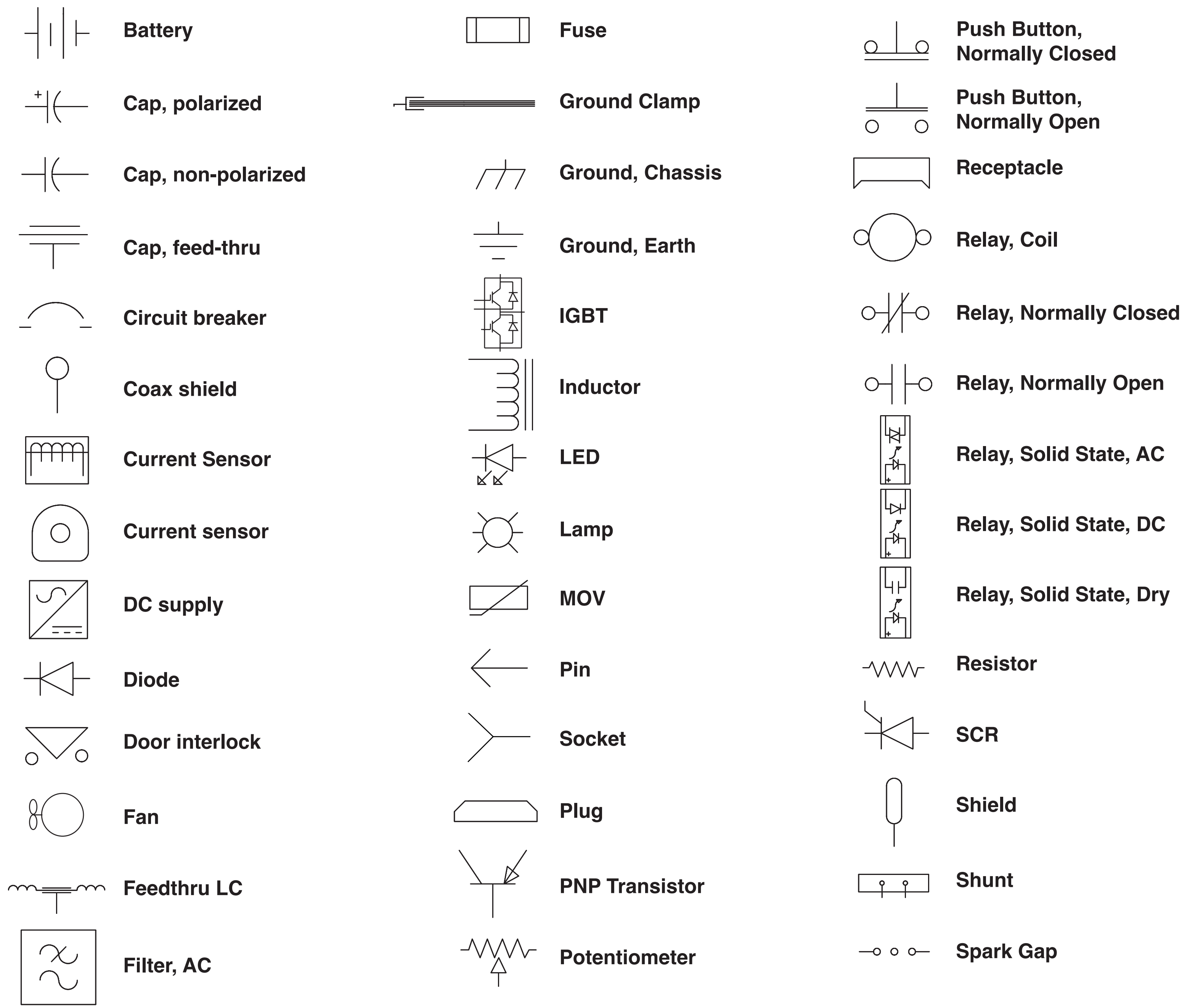


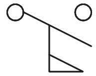


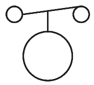
Destination and **Source Coordinates** refer to letters A-D on the Y-axis of each sheet and numbers 1-4 on the X-axis of each sheet. Lining up the coordinates will bring you to the source or destination blocks (similar to a road map).

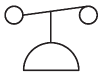
Wiring diagram symbols

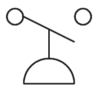
Wiring diagram symbols and their identification precede the system wiring diagrams in this section.


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
Lamp
MOV
Pin
Socket
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

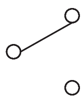

Switch, Flow

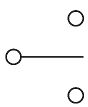

Switch, Level, Normally Closed

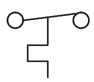

Switch, Pressure, Normally Closed

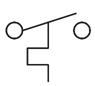

Switch, Pressure, Normally Open

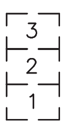

Switch, 1 Pole, 1 Throw


Switch, 1 Pole, 2 Throw

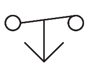

Switch, 1 Pole, 1 Throw, Center Off

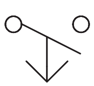

Switch, Temperature, Normally Closed

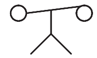

Switch, Temperature, Normally Open

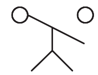


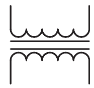
Terminal Block

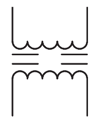

Time Delay Closed, NC/Off


Time Delay Open, NO/Off

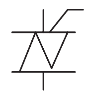

Time Delay Open, NC/On


Time Delay Closed, NO/Off


Transformer


Transformer, Air Core


Transformer Coil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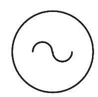
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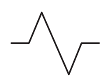
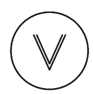

Valve, Solenoid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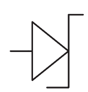
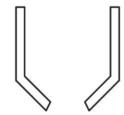
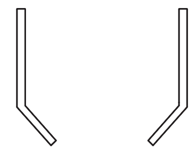

Zener Diode

Torch Symbols


Electrode


Nozzle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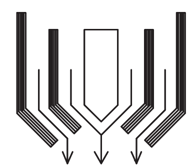
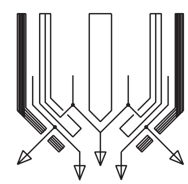
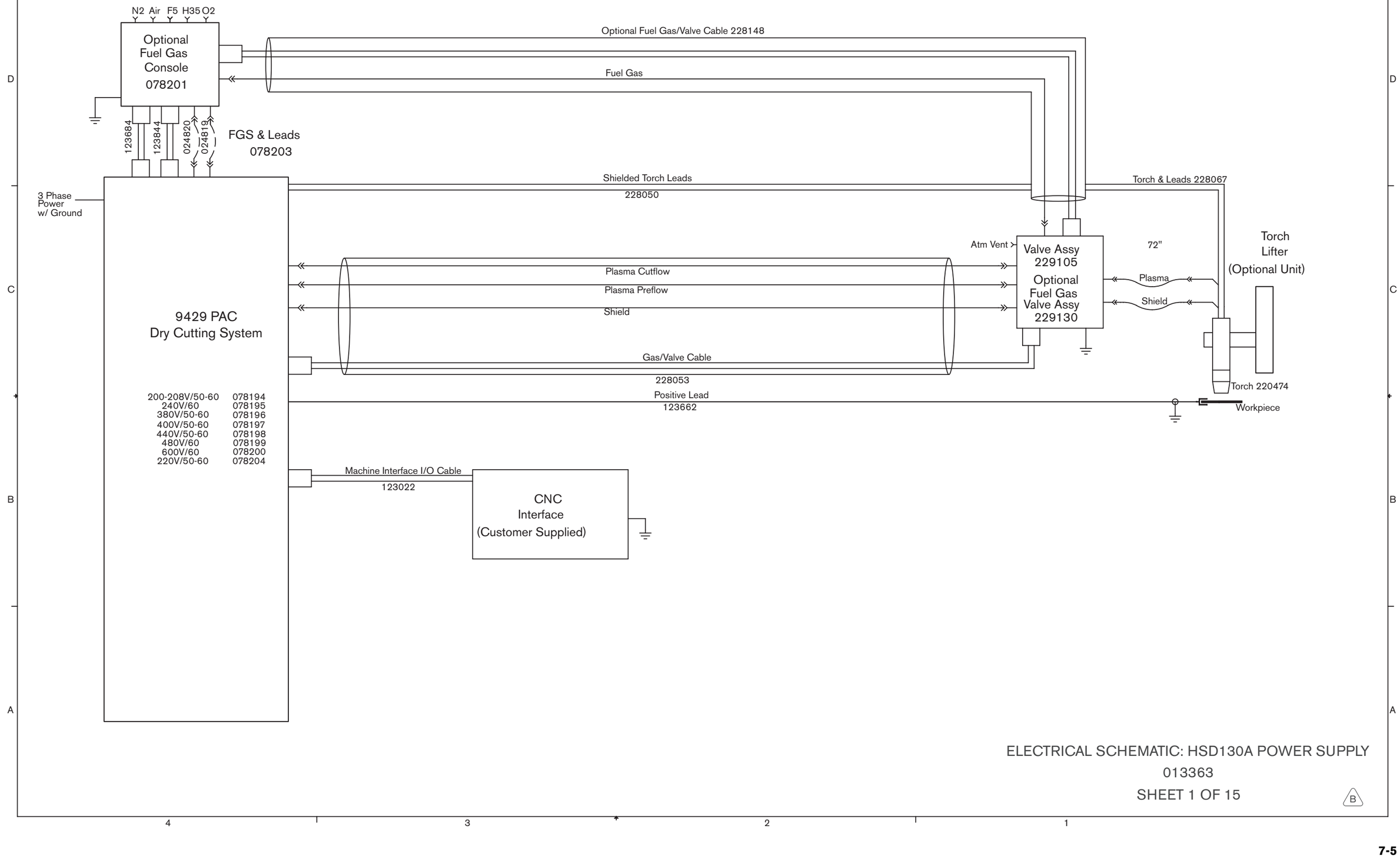

Torch


Torch, HyDefinition™

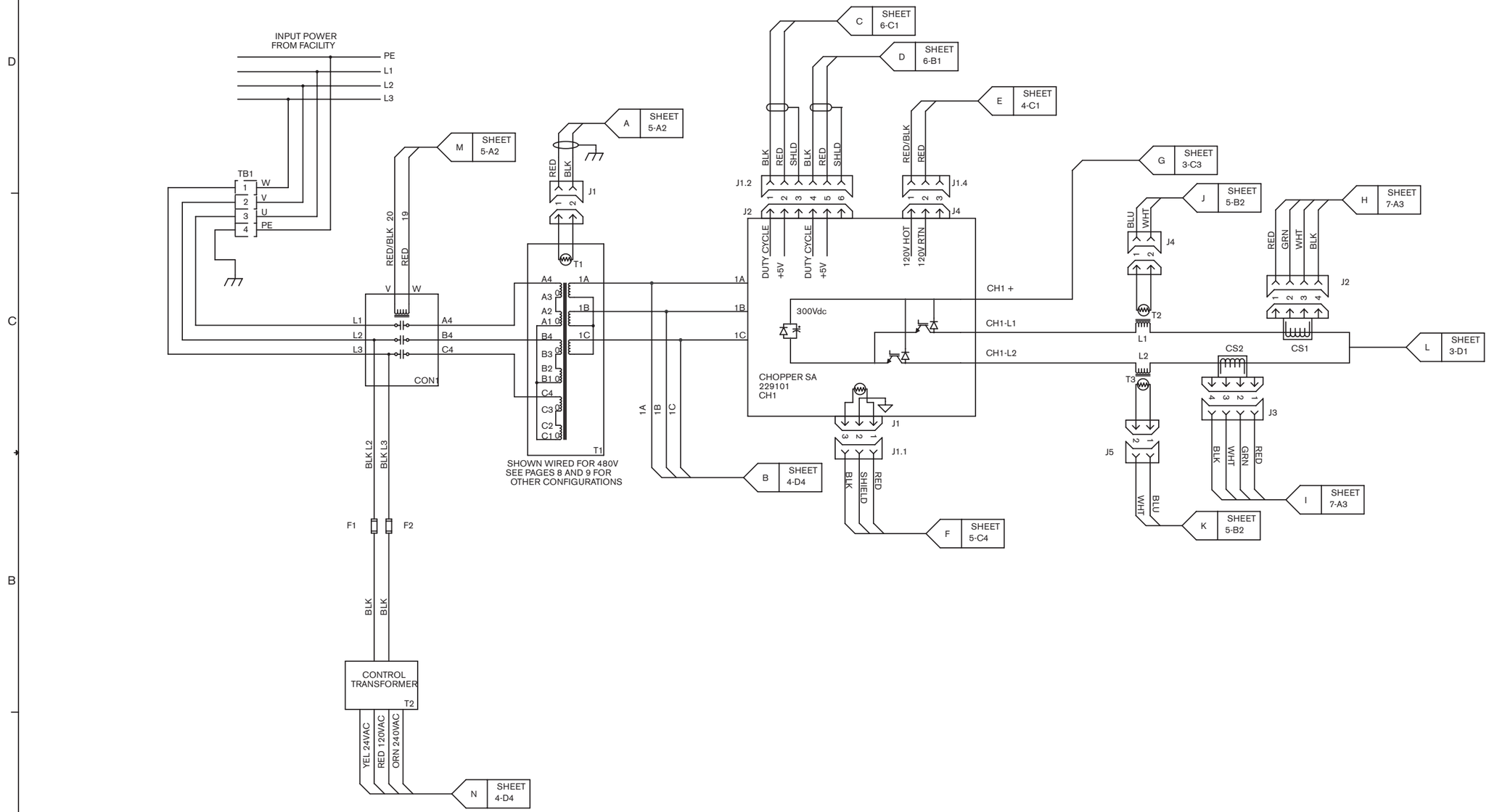


ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 1 OF 15

B

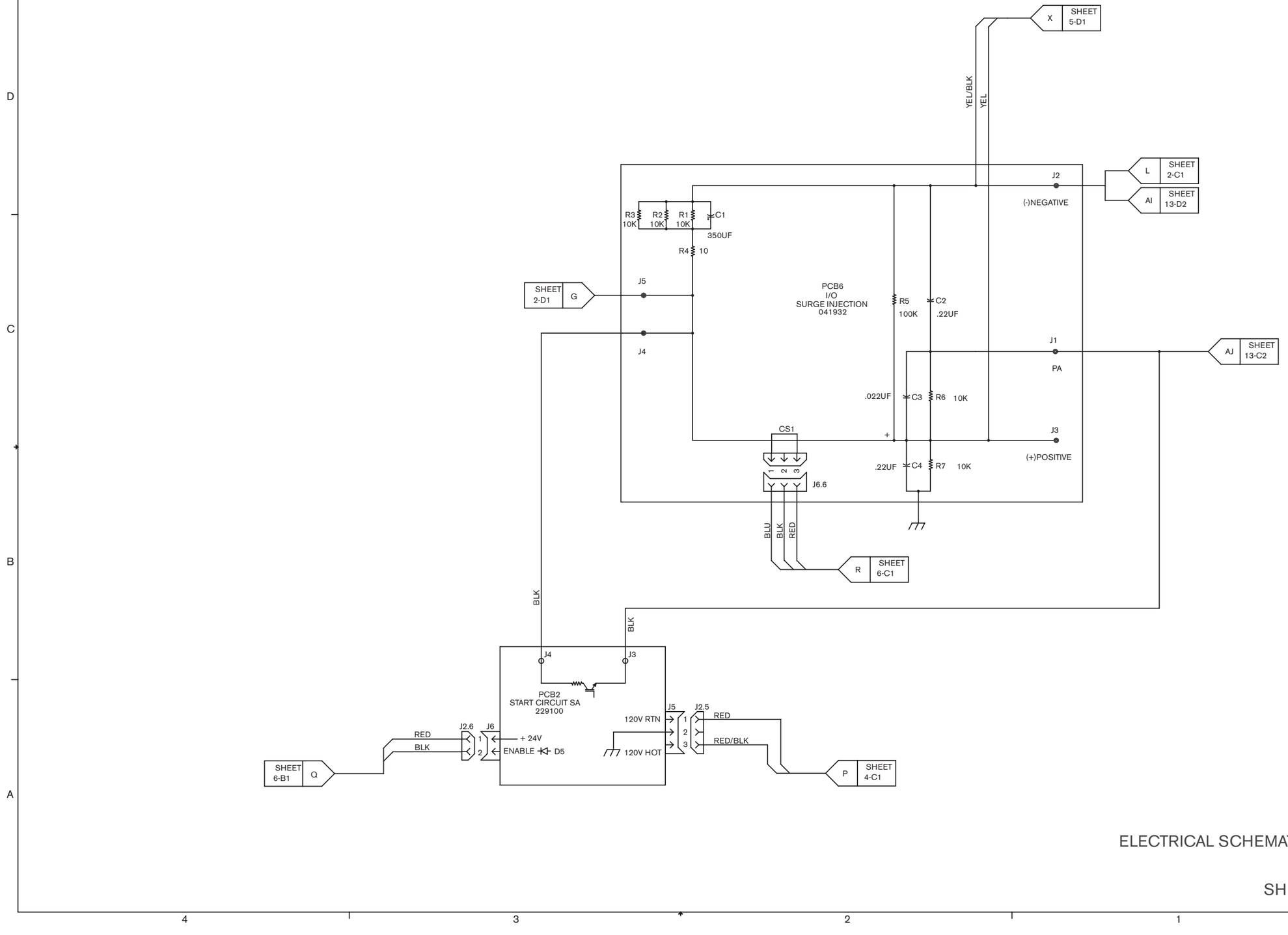


ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 2 OF 15

B



ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

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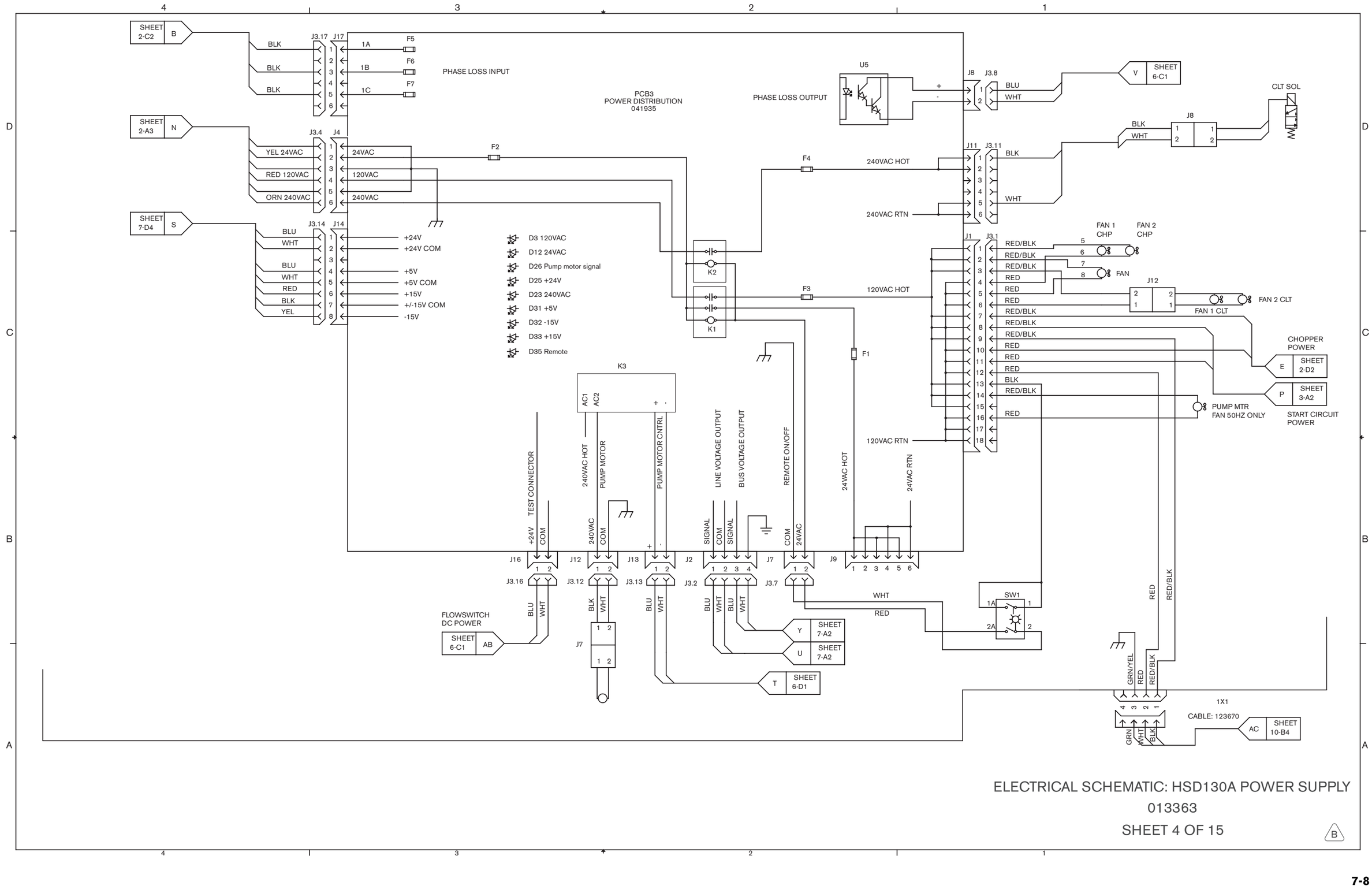
SHEET 3 OF 15

B



ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

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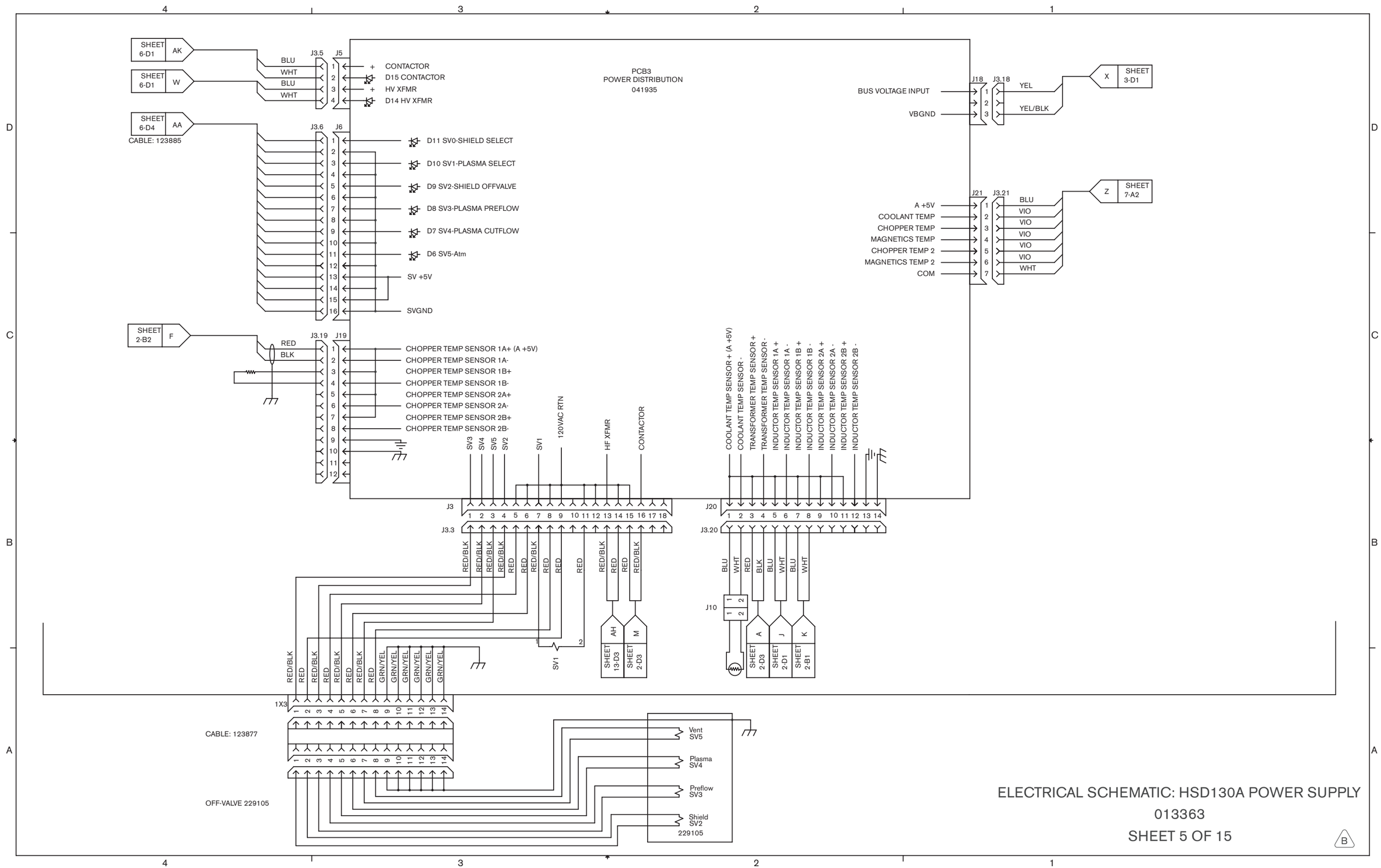
SHEET 4 OF 15

B


PCB3
POWER DISTRIBUTION
041935
SHEET 6-D1 AK
SHEET 6-D1 W
BLU
WHT
BLU
WHT
J3.5
J5
+ CONTACTOR
D15 CONTACTOR
+ HV XFMR
D14 HV XFMR
SHEET 6-D4 AA
CABLE: 123885
J3.6
J6
D11 SV0-SHIELD SELECT
D10 SV1-PLASMA SELECT
D9 SV2-SHIELD OFFVALVE
D8 SV3-PLASMA PREFLOW
D7 SV4-PLASMA CUTFLOW
D6 SV5-Atm
SV +5V
SVGND
SHEET 2-B2 F
RED
BLK
J3.19
J19
CHOPPER TEMP SENSOR 1A+ (A +5V)
CHOPPER TEMP SENSOR 1A-
CHOPPER TEMP SENSOR 1B+
CHOPPER TEMP SENSOR 1B-
CHOPPER TEMP SENSOR 2A+
CHOPPER TEMP SENSOR 2A-
CHOPPER TEMP SENSOR 2B+
CHOPPER TEMP SENSOR 2B-
BUS VOLTAGE INPUT
VBGND
J18
J3.18
YEL
YEL/BLK
X
SHEET 3-D1
A +5V
COOLANT TEMP
CHOPPER TEMP
MAGNETICS TEMP
CHOPPER TEMP 2
MAGNETICS TEMP 2
COM
J21
J3.21
BLU
VIO
VIO
VIO
VIO
VIO
WHT
Z
SHEET 7-A2
SV3
SV4
SV5
SV2
SV1
120VAC RTN
HF XFMR
CONTACTOR
COOLANT TEMP SENSOR + (A +5V)
COOLANT TEMP SENSOR -
TRANSFORMER TEMP SENSOR +
TRANSFORMER TEMP SENSOR -
INDUCTOR TEMP SENSOR 1A +
INDUCTOR TEMP SENSOR 1A -
INDUCTOR TEMP SENSOR 1B +
INDUCTOR TEMP SENSOR 1B -
INDUCTOR TEMP SENSOR 2A +
INDUCTOR TEMP SENSOR 2A -
INDUCTOR TEMP SENSOR 2B +
INDUCTOR TEMP SENSOR 2B -
J3
J3.3
J20
J3.20
RED/BLK
RED
GRN/YEL
BLU
WHT
J10
AH
M
A
J
K
SHEET 13-D3
SHEET 2-D3
SHEET 2-D1
SHEET 2-B1
SV1
1X3
CABLE: 123877
OFF-VALVE 229105
Vent SV5
Plasma SV4
Preflow SV3
Shield SV2
229105
ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY
013363
SHEET 5 OF 15
B

PCB4
POWER SUPPLY CONTROL
041938

SHEET 5-D4 AA
CABLE: 123885

J4.305 J305

1 SOLENOID VALVE 0
2 SOLENOID VALVE 1
3 SOLENOID VALVE 2
4 SOLENOID VALVE 3
5 SOLENOID VALVE 4
6 SOLENOID VALVE 5
7
8
9
10
11
12
13
14
15 +5V
16

D48 COOLANT TEMP
D52 CHOPPER TEMP
D53 MAGNETICS TEMP
D54 CHOPPER TEMP 2
D55 MAGNETICS TEMP 2
D67 FLOWSWITCH
D68 WORK LEAD
D69 PHASE LOSS
D70 OVERPRESSURE
D57 MOTION
D58 RD ERROR

D59 HOLD OUTPUT
D60 PILOT ARC
D61 HF
D62 PUMP
D63 CONTACTOR
D64 SVA
D44 PLASMA START INPUT
D45 CNC CORNER CURRENT INPUT
D49 HOLD IGNITION INPUT
D51 CNC PIERCE COMPLETE INPUT

J301 J4.301

+24V 1 BLU → AK SHEET 5-D4
CONTACTOR 2 WHT
3 BLU → T SHEET 4-A2
PUMP 4 WHT
HF 5 BLU → W SHEET 5-D4
6 WHT
7
+12V 8 RED → R SHEET 3-B2
WORK LEAD 9 BLU
BLK
FLOWSWITCH 10 BLU → J11.3 → FLS
PHASE LOSS 11 WHT
12 BLU
13 WHT → V SHEET 4-D1
OVERPRESSURE 14
15
16

J13
BLU WHT → AB SHEET 4-A3

J302 J4.302

+5V 1 RED → C SHEET 2-D2
PWM DRV A 2 BLK
3
PWM DRV B 4
5
6 RED → D SHEET 2-D2
PWM DRV C 7 BLK
8 SHIELD
PWM DRV D 9
10 RED → Q SHEET 3-A4
+24V 11 BLK
PA-E 12 RED → VA
13 BLK
SVA 14 CLEAR

CNC INTERFACE

CNC +24V
+24V
MOTION-E
MOTION-C
RDERR-E
RDERR-C
CORNER CURRENT-
CORNER CURRENT+
PIERCE-
PIERCE+
HOLD-
HOLD+
START-
START+
PWR GND
CNC +24V

J300 1 2
J303 1 20 2 21 3 22 4 23 5 24 6 25 7 26 8 27 9 28 10 29 11 30 12 31 13 32 14 33 15 34 16 35 17 36 18 37 19

123887

1X4 1 20 2 21 3 22 4 23 5 24 6 25 7 26 8 27 9 28 10 29 11 30 12 31 13 32 14 33 15 34 16 35 17 36 18 37 19

ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY
013363
SHEET 6 OF 15
B

PCB4
POWER SUPPLY CONTROL
041938

SHEET 4-D4 S

J4.100 J100

BLU 1 +24V
WHT 2 PWR GND
BLU 3 +5V
WHT 4 GND
RED 5 +15V
BLK 6 COM
YEL 7 -15V
8

0

J104

1 TMS
2 TRST\
3 TDI
4 COM
5 +5V
6
7 TDO
8
9 TCK
10
11
12
13 EMU0
14 EMU1

JTAG

TP3 TP1 TP12 TP8 TP13 TP5

1/2 1/2 1/2 1/2 1 1

CHOPPER SENSOR A
CHOPPER SENSOR B
CHOPPER SENSOR C
CHOPPER SENSOR D
BUS VOLTAGE INPUT
LINE VOLTAGE INPUT

TP11 TP7

1/3 1/3

MFG TEST

TP6

1/3

SD CARD

J105

FLASHCS\ 1
SPISIMO 2
+3.3V 3
SPICLK 4
SPISOMI 5
6
7
8
9
FLASHCD\ 10
FLASHWP\ 11
12
13
COM 14
15

J106

COM 1
TX+ 2
TX- 3
RX+ 4
RX- 5
6
7

J204 J4.204

+15V 1
COM 2
PRESS C 3
4

P3

CABLE: 123878

+15V COM PRESS A

+15V COM PRESS B

CANL CANH CAN GND CAN +24V

121

+15V -15V COM

+5V COOLANT TEMP
CHOPPER TEMP
MAGNETICS TEMP
CHOPPER TEMP 2
MAGNETICS TEMP 2
COM

J101 J103 J200 J201 J202 J203

J4.101 J4.200 J4.201 J4.202 J4.203

SHIELD
BLK RED BLK RED

CABLE: 123886

RED GRN WHT BLK

RED GRN WHT BLK

BLU WHT BLU WHT

BLU VIO VIO VIO VIO VIO WHT

P1

CABLE: 123878

P2

CABLE: 123878

SHEET 11-B4 AG

SHIELD
BLK
RED
BLK
RED

CABLE: 123844

1X2

SHIELD
BLK
RED
BLK
RED

H SHEET 2-C1

I SHEET 2-B1

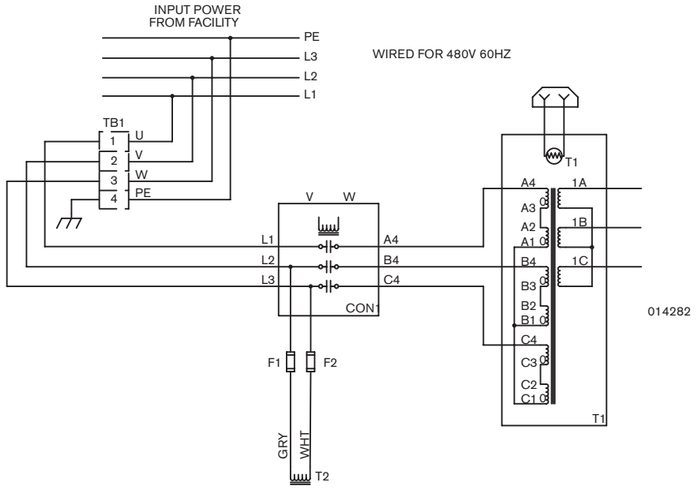
Y SHEET 4-A2

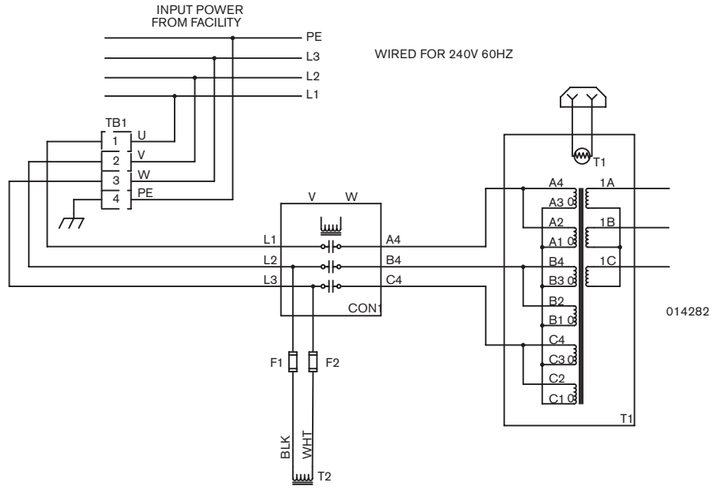
U SHEET 4-A2

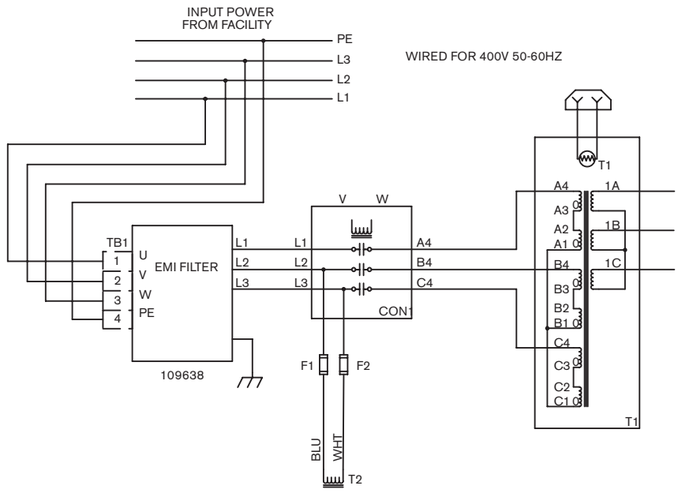
Z SHEET 5-D1

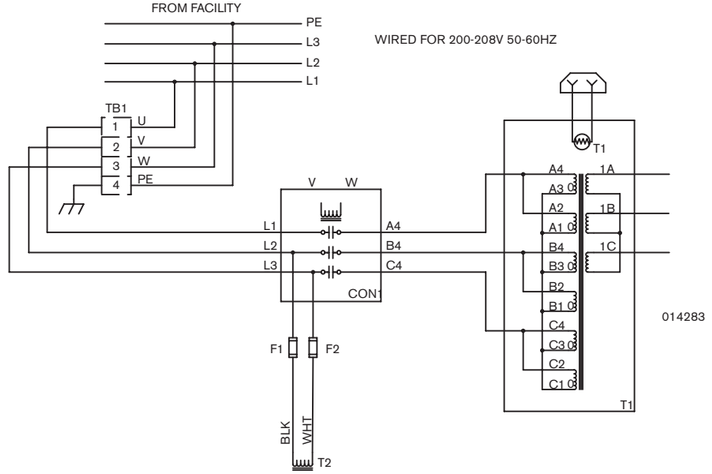
ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY
013363
SHEET 7 OF 15

B







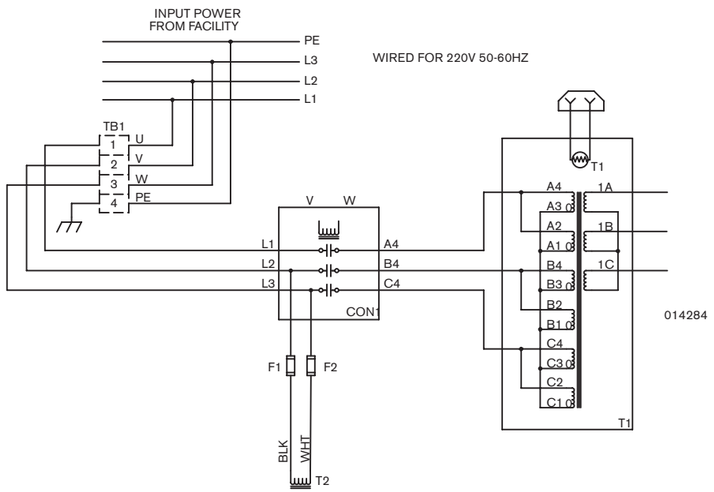


ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

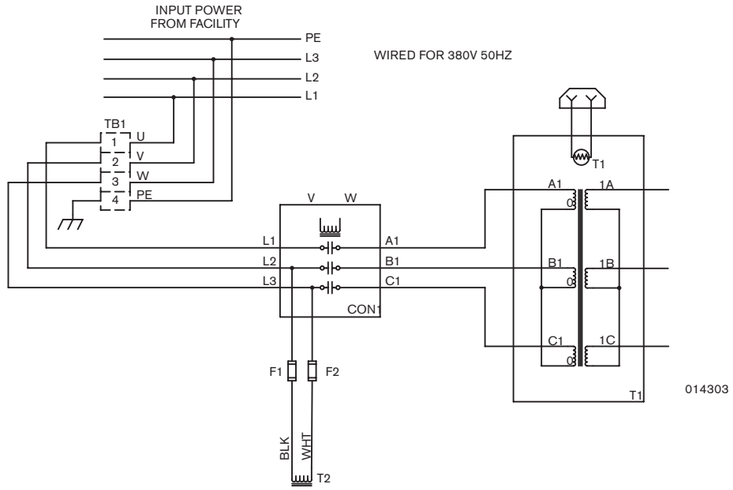
SHEET 8 OF 15

B



WIRED FOR 220V 50-60HZ

014284



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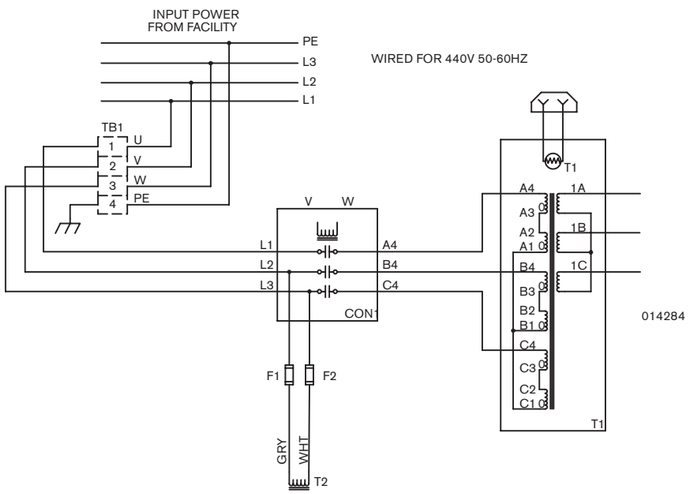
014303



WIRED FOR 440V 50-60HZ

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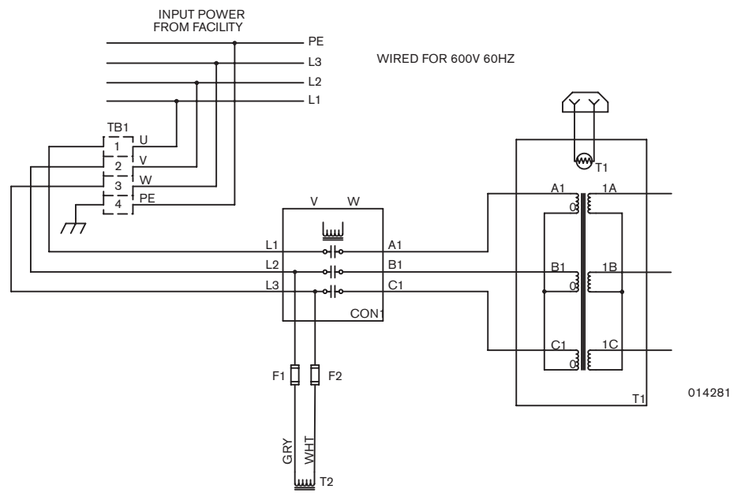


WIRED FOR 600V 60HZ

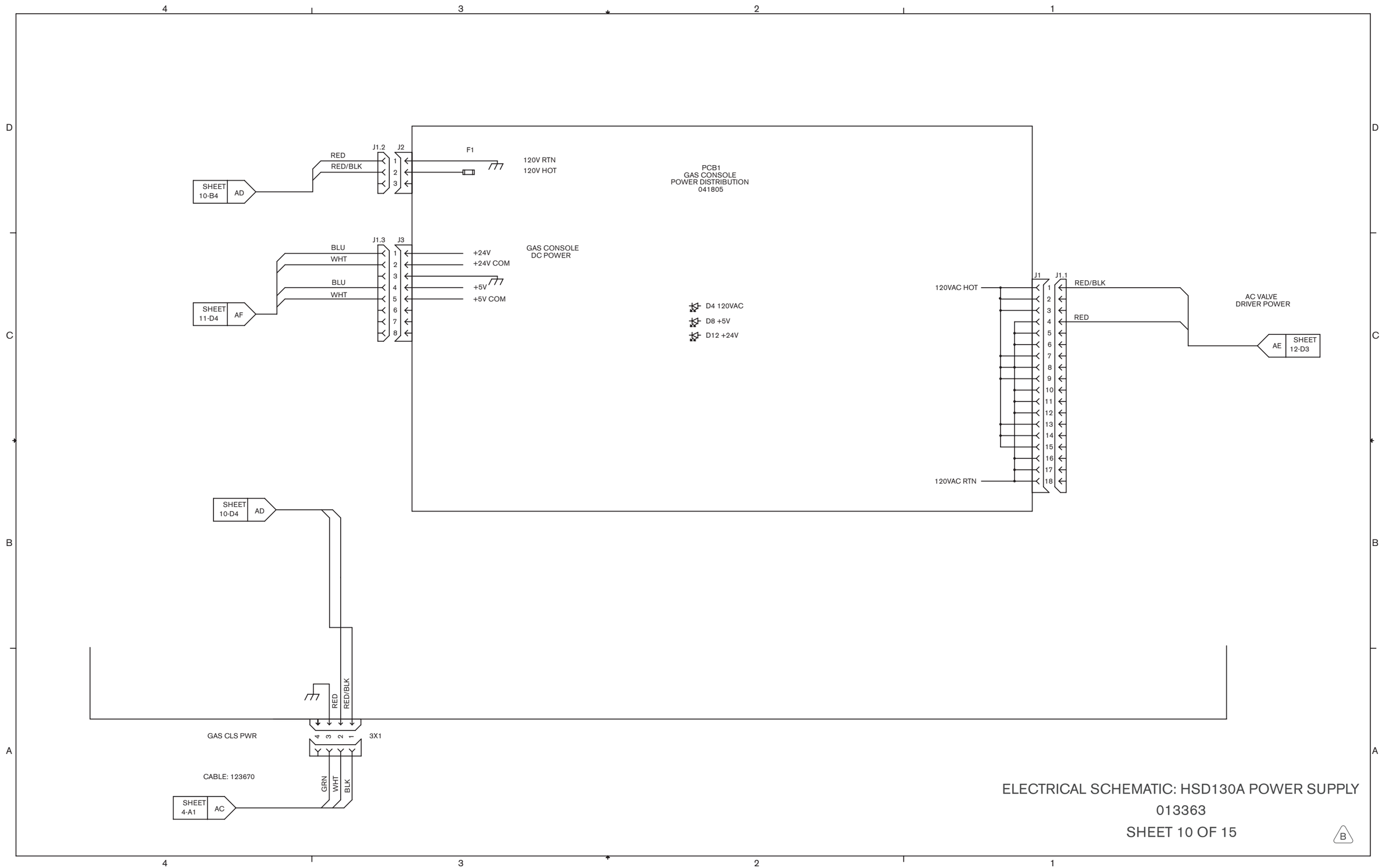
014281

ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 9 OF 15

B

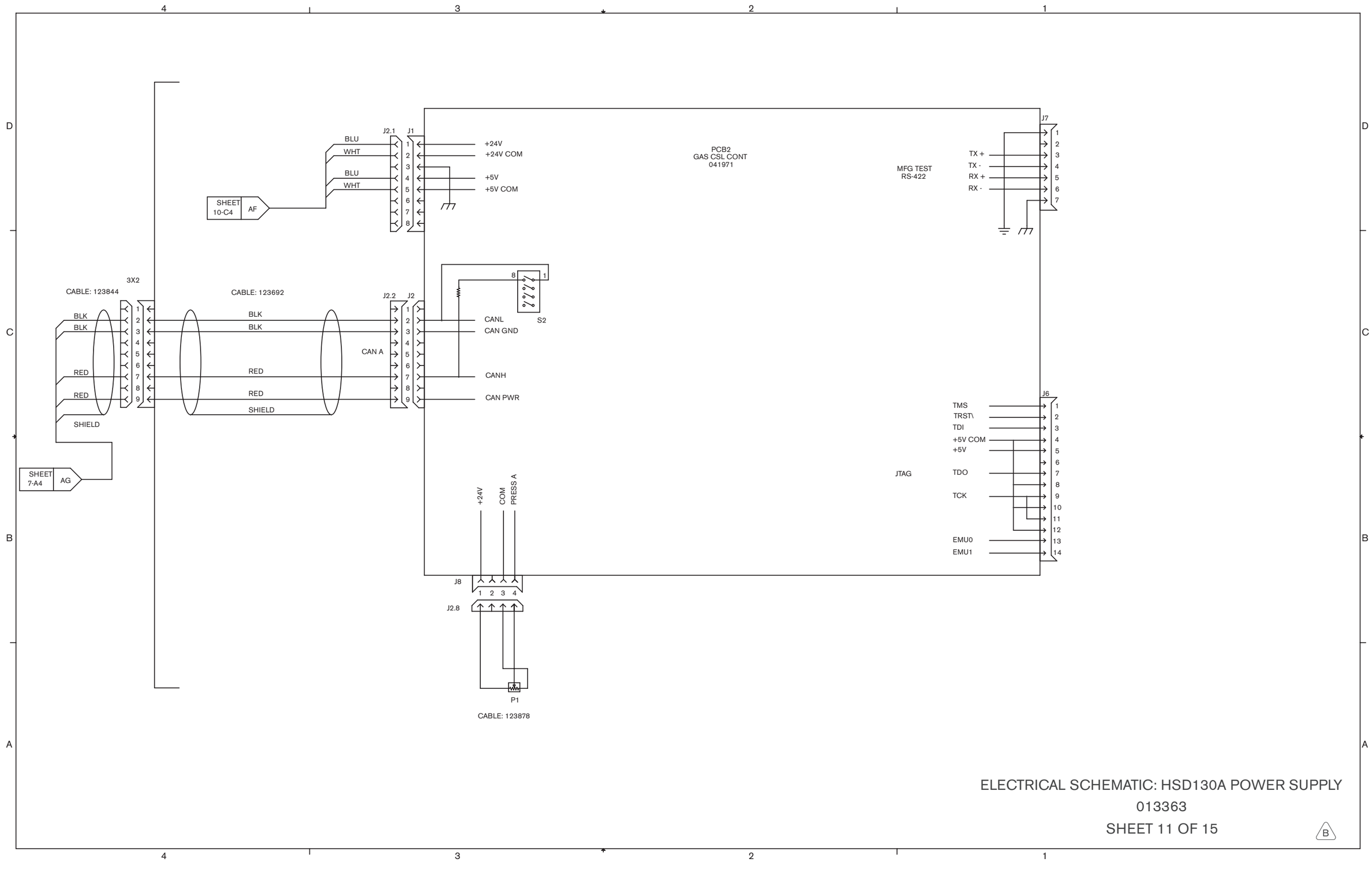


ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 10 OF 15

B



ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

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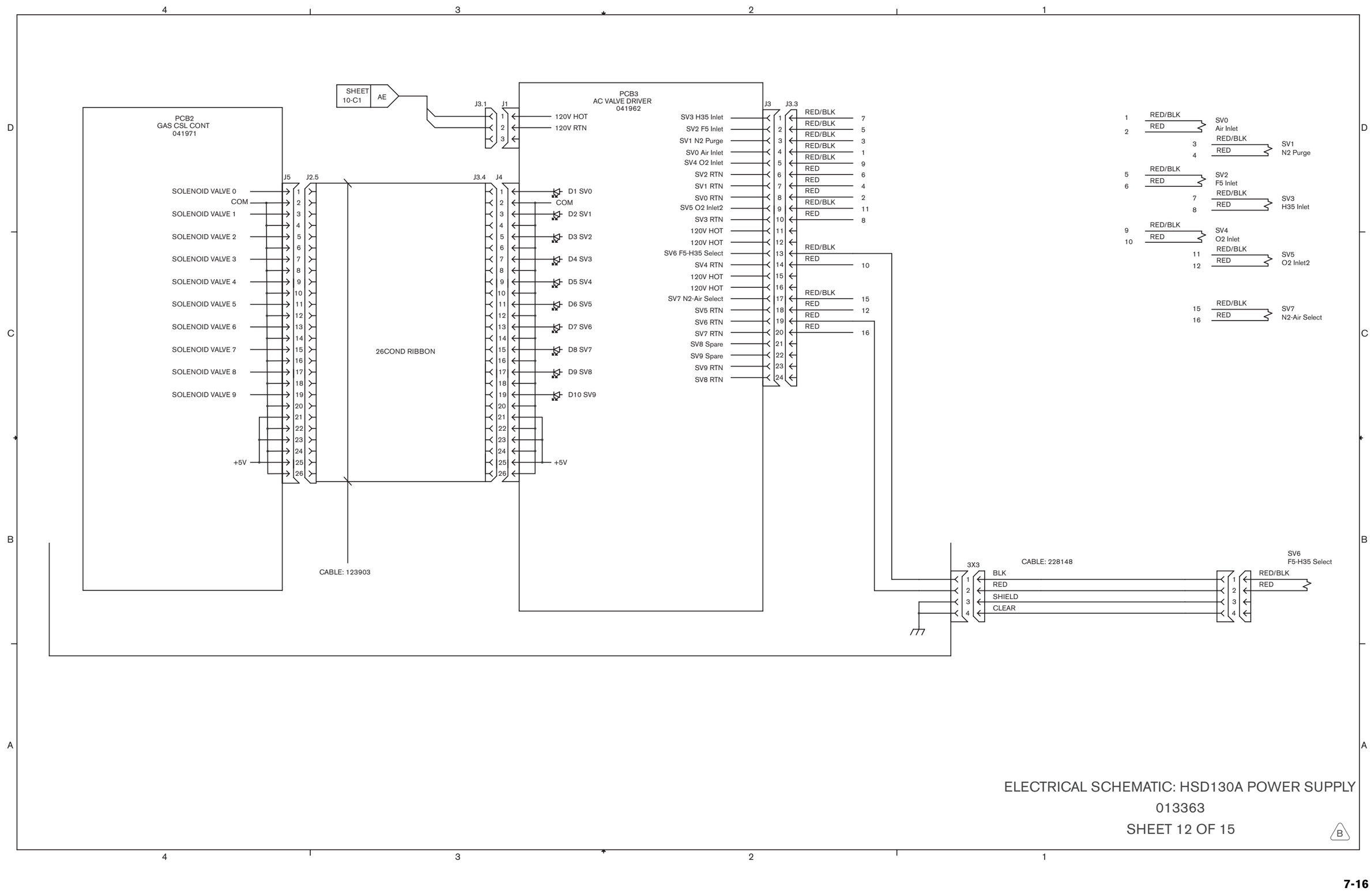
SHEET 11 OF 15

B



ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

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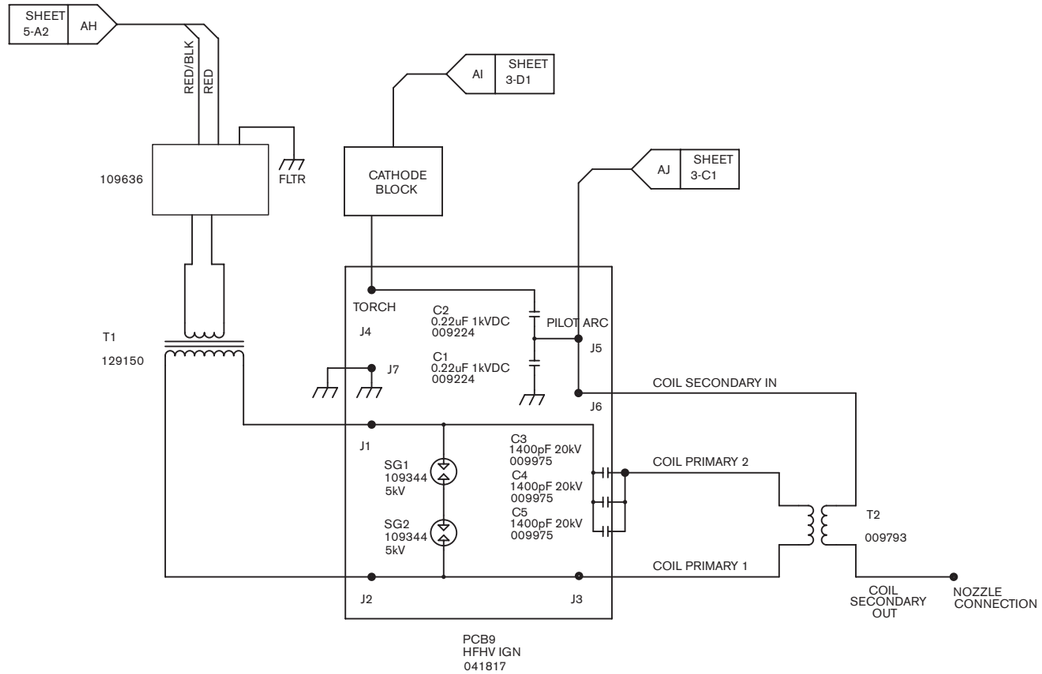
SHEET 12 OF 15

B



ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

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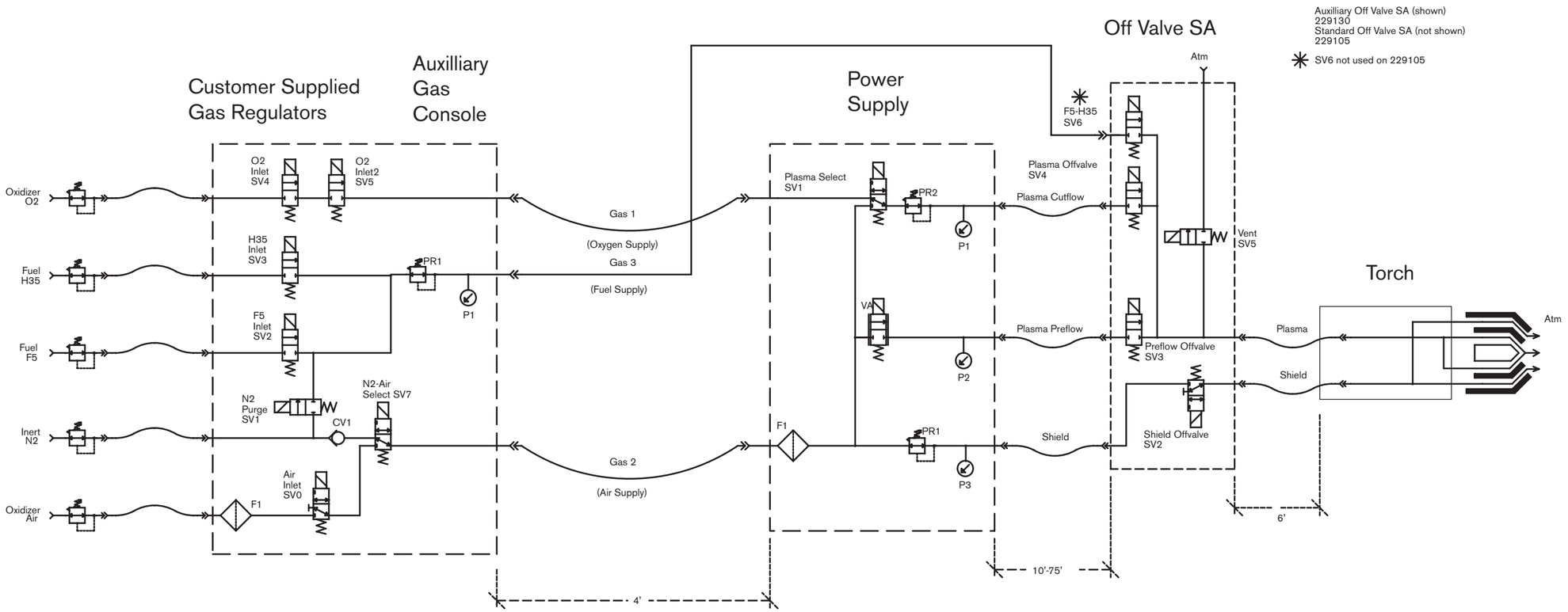
SHEET 13 OF 15

B

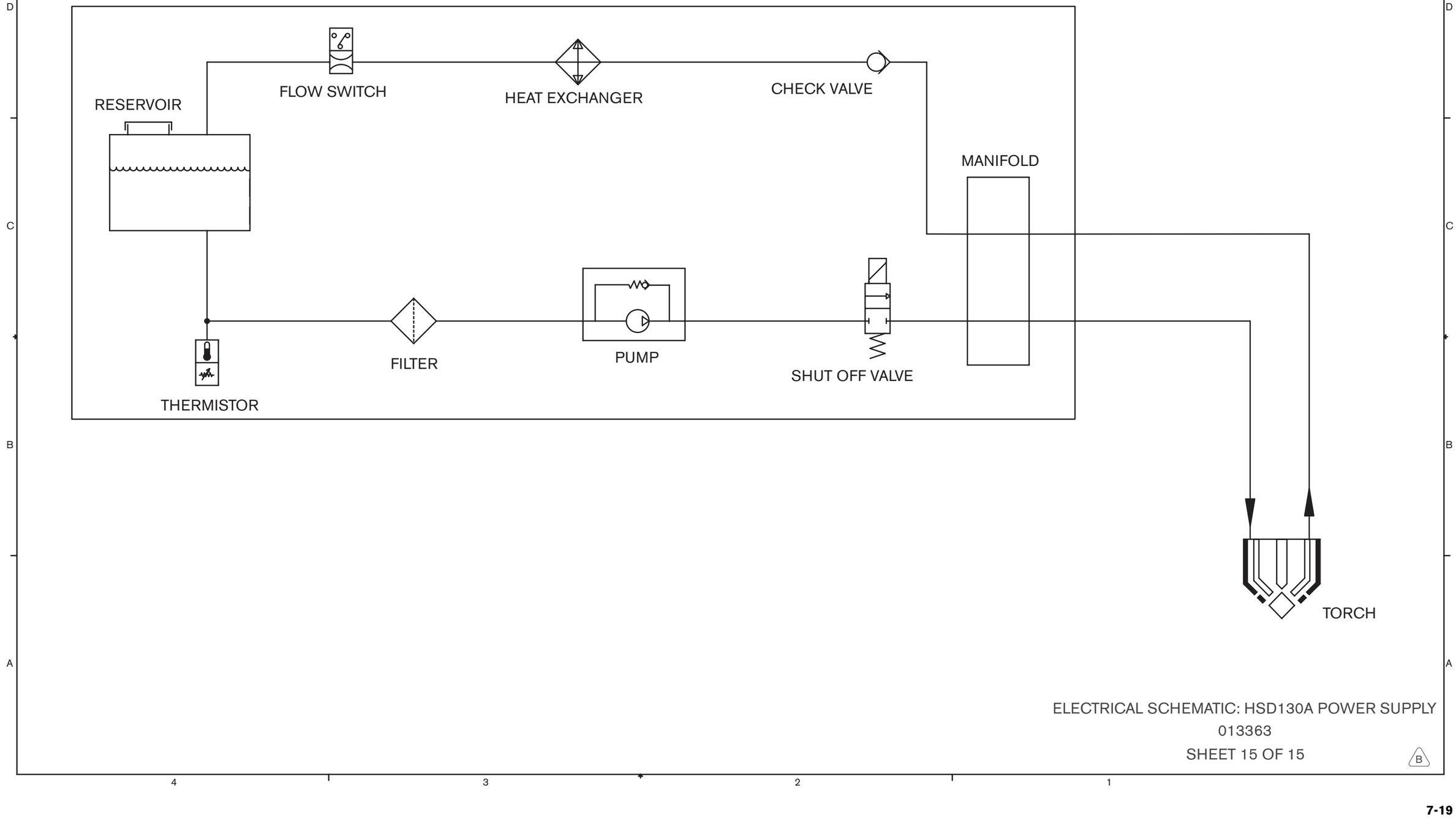


ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY

013363

SHEET 14 OF 15

B



ELECTRICAL SCHEMATIC: HSD130A POWER SUPPLY
013363
SHEET 15 OF 15
B

Appendix A

HYPERTHERM TORCH COOLANT SAFETY DATA

In this section:

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

MATERIAL SAFETY DATA SHEET

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	Hypertherm Torch Coolant

Latest Revision Date	09-02-2004

ISSUE DATE	03-10-2005

EMERGENCY TELEPHONE NUMBERS

DISTRIBUTOR:

Hypertherm, Inc.
Etna Road
Hanover, N.H. 03755

Transportation: **(800) 424-9300 ***
Product Information: **(603) 643-3441**

SECTION 2 – COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Component	CAS No.	% by wt.	EXPOSURE LIMITS OSHA PEL	EXPOSURE LIMITS ACGIH TLV	R Phrases
Benzotriazole	95-14-7	<1,0	N.E.	N.E.	R22,36/37/38
Propylene Glycol	57-55-6	<50,0	N.E.	N.E.	R36/37/38

SECTION 3 – HAZARDS IDENTIFICATION

Emergency Overview	Causes eye irritation. May be harmful if swallowed. May cause skin irritation

Potential Health Effects	
Ingestion	Oral LD 50 (rat) as reported for 100% Benzotriazole is 560 mg./Kg.
Inhalation	Mists are harmful.
eye contact	Causes eye irritation.
skin contact	Can cause skin irritaion.

SECTION 4 – FIRST AID MEASURES

Ingestion	Never give anything by mouth to an unconscious person. Give several glasses of water. If vomiting is not spontaneous, induce vomiting. Keep airway clear. Get medical attention.
Inhalation	If affected, remove from exposure. Restore breathing. Keep warm and quiet. Get medical attention.
Eye Contact	Immediately flush eye with cool running water. Remove contact lenses if applicable. Continue flushing with water for at least 15 minutes. Get immediate medical attention.
Skin Contact	Wash with soap and water. If irritation develops or persists, get medical attention.
Note to Physician	Treatment based on judgment of the physician in response to reactions of the patient.

SECTION 5 – FIRE FIGHTING MEASURES

Flash Point / Method	None to boiling.	Flammable limits	Not Established
Extinguishing media	Product is an aqueous solution. Use Carbon Dioxide, Dry Chemical, Foam.		
special fire fighting procedures	Full protective equipment including self-contained breathing apparatus should be used. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Get medical attention.		
Fire and explosion hazards	Water base solution.		

SECTION 6 – ACCIDENTAL RELEASE MEASURES

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

SECTION 7 – HANDLING AND STORAGE

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

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

Hygienic practices	Normal procedures for good hygiene.
Engineering controls	Good general ventilation. Eye wash station in immediate area of use. **M.E.L./O.E.S** Nil. **U.K HSE EH:40** Not listed

Personal protective equipment

X	**Respirator**	If exposed to mists.
X	**goggles / face shield**	Recommended
	APRON	
X	**Gloves**	Recommended; PVC, Neoprene or Nitrile acceptable
	Boots	

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Clear Pink/Red Liquid	Boiling point	100EC
ODOR	None	freezing point	Not established
pH of Concentrate	5,5-7,0	vapor pressure	Not applicable
Specific gravity	1,0	vapor density	Not applicable
solubility in water	Complete	evaporation rate	Not determined

SECTION 10 – STABILITY AND REACTIVITY

Chemical Stability		**Stable**	X		**Unstable**	
Conditions to avoid	None					
Incompatibility	None Known					
Hazardous products of decomposition	BY FIRE: Carbon Dioxide, Carbon Monoxide Nitrogen Oxides					
Polymerization		**Will not occur**	X		**May occur**	
Conditions to avoid	Not applicable					

SECTION 11 – TOXICOLOGICAL INFORMATION

Carcinogenicity

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

Other effects

Acute	Not determined
Chronic	Not determined

SECTION 12 – ECOLOGICAL INFORMATION

Biodegradability		**Considered biodegradable**			**Not biodegradable**		
BOD / COD Value	Not established						
Ecotoxicity	As reported for 100% Benzotriazole: Bluegill Sunfish (96 hr. Tlm):28mg/l; Minnow (96hr. Tlm):28mg/l; Trout (96 hr. LC 50): 39mg/l; Algae(96hr. EC 50): 15.4mg/l; Daphina magna (48 hr. LC 50): 141.6mg/l						

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste disposal method	Waste material must be disposed of in accordance with national/local legislative requirements.							
RCRA Classification	Non Hazardous							
Recycle container		**Yes**	X		**CODE**	2 – HDPE		**No**

SECTION 14 – TRANSPORT INFORMATION

DOT Classification		**Hazardous**			**Not Hazardous**	X
Description	Not applicable					

SECTION 15 – REGULATORY INFORMATION

REGULATORY STATUS: Benzotriazole

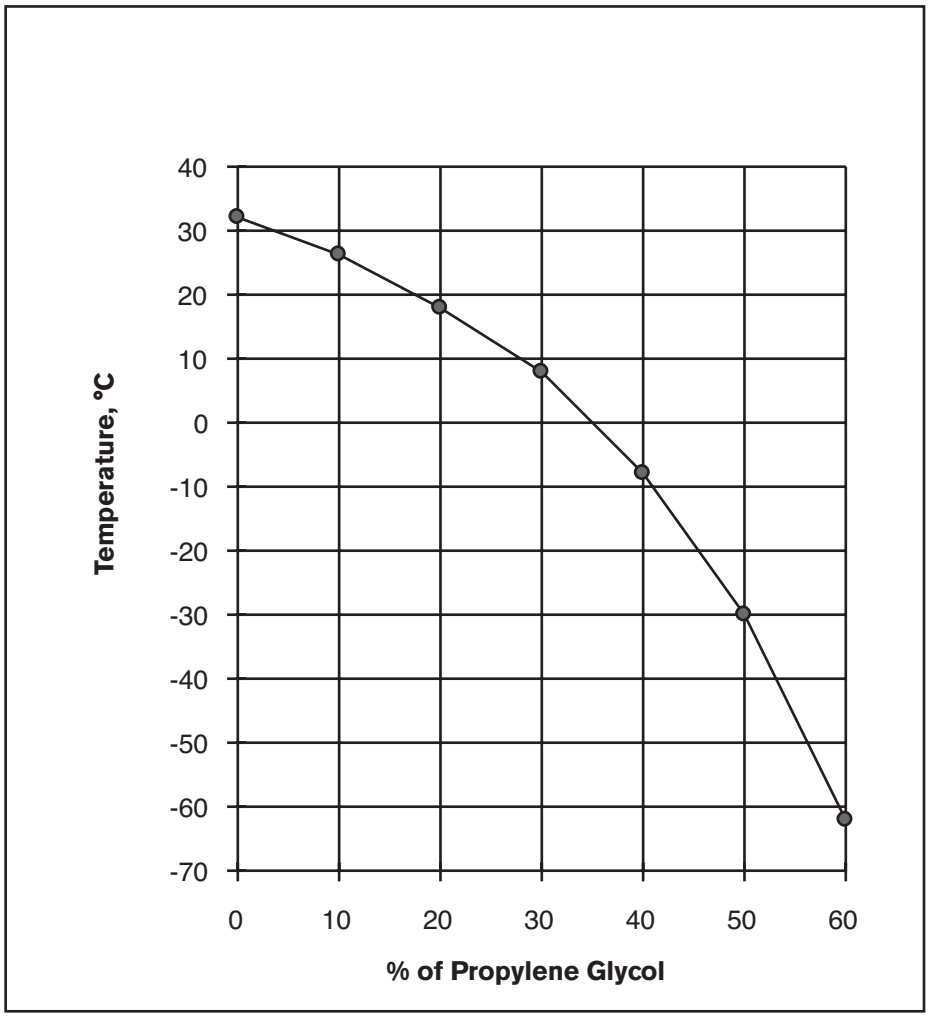
1.	Labeling Information	Irritant
2.	R Phrases	R 36/37/38, 22
3.	S Phrases	S 24/25, 26
4.	EI NECS No.	Not listed
5.	EC annex 1 Classification	Nil.
6.	German WGK	–

SECTION 16 – OTHER INFORMATION

NFPA Classification

1	**BLUE**	Health hazard
0	**RED**	Flammability
0	**YELLOW**	reactivity
–	**WHITE**	Special hazard

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



Freezing Point of Propylene Glycol Solution