Hypertherm®

powermax30®

Plasma arc cutting system

Service Manual – 805170
Revision 2

powermax30®

Service Manual

(P/N 805170)

Revision 2 – January, 2006

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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

Section 1

SAFETY

In this section:

RECOGNIZE SAFETY INFORMATION

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

FOLLOW SAFETY INSTRUCTIONS

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

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

DANGER WARNING CAUTION

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

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

CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire prevention

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

Explosion prevention

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

WARNING

Explosion Hazard
Argon-Hydrogen and Methane

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

WARNING

Hydrogen Detonation
with Aluminum Cutting

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

ELECTRIC SHOCK CAN KILL

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

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

Electric shock prevention

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

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

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

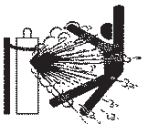
Work cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

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

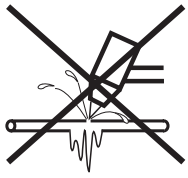
Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

- 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:

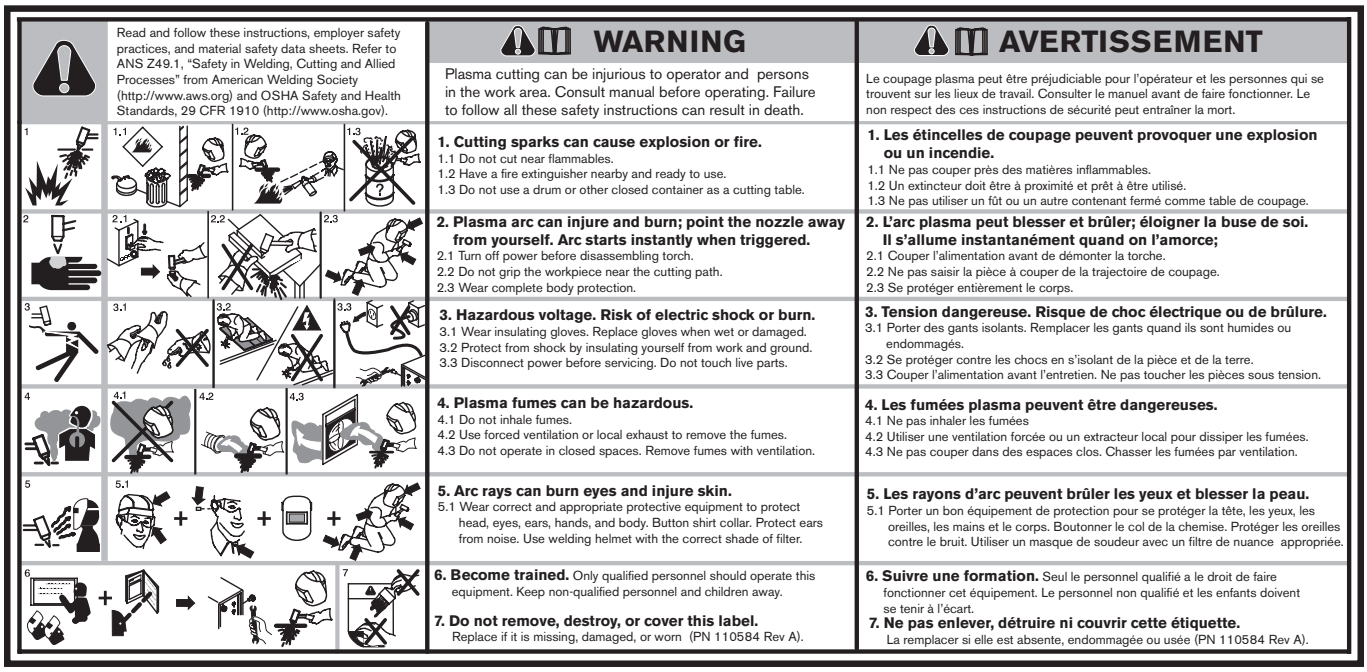
- Keep both the work cable and the torch lead to one side, away from your body.
- Route the torch leads as close as possible to the work cable.
- Do not wrap or drape the torch lead or work cable around your body.
- Keep as far away from the power supply as possible.

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. 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.

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Section 1a

SÉCURITÉ

Dans cette section :

IDENTIFIER LES CONSIGNES DE SÉCURITÉ

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

SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

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

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

DANGER AVERTISSEMENT PRÉCAUTION

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

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

LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

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

Prévention des explosions

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

AVERTISSEMENT

Risque d'explosion argon-hydrogène et méthane

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

AVERTISSEMENT

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

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

LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

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

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

Prévention des chocs électriques

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

- Porter des bottes et des gants isolants et garder le corps et les vêtements au sec.
- Ne pas se tenir, s'asseoir ou se coucher sur une surface mouillée, ni la toucher quand on utilise le système plasma.
- S'isoler de la surface de travail et du sol en utilisant des tapis isolants secs ou des couvertures assez grandes pour éviter tout contact physique avec le travail ou le sol. S'il s'avère nécessaire de travailler dans ou près d'un endroit humide, procéder avec une extrême prudence.
- Installer un sectionneur avec fusibles appropriés, à proximité de la source de courant. Ce dispositif permet à l'opérateur d'arrêter rapidement la source de courant en cas d'urgence.
- En cas d'utilisation d'une table à eau, s'assurer que cette dernière est correctement mise à la terre.
- Installer et mettre à la terre l'équipement selon les instructions du présent manuel et conformément aux codes électriques locaux et nationaux.
- Inspecter fréquemment le cordon d'alimentation primaire pour s'assurer qu'il n'est ni endommagé, ni fendu. Remplacer immédiatement un cordon endommagé. **Un câble dénudé peut tuer**.
- Inspecter et remplacer les câbles de la torche qui sont usés ou endommagés.
- Ne pas saisir la pièce à couper ni les chutes lors du coupage. Laisser la pièce à couper en place ou sur la table de travail, le câble de retour connecté lors du coupage.
- Avant de vérifier, de nettoyer ou de remplacer les pièces de la torche, couper l'alimentation ou débrancher la prise de courant.
- Ne jamais contourner ou court-circuiter les verrouillages de sécurité.
- Avant d'enlever le capot du système ou de la source de courant, couper l'alimentation électrique. Attendre ensuite 5 minutes pour que les condensateurs se déchargent.
- Ne jamais faire fonctionner le système plasma sans que les capots de la source de courant ne soient en place. Les raccords exposés de la source de courant sont extrêmement dangereux.
- Lors de l'installation des connexions, attacher tout d'abord la prise de terre appropriée.
- Chaque système plasma Hypertherm est conçu pour être utilisé uniquement avec des torches Hypertherm spécifiques. Ne pas utiliser des torches inappropriées qui pourraient surchauffer et présenter des risques pour la sécurité.

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.

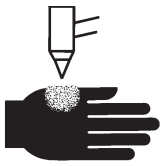
Le niveau de qualité de l'air dans tout lieu de travail dépend des variables propres au site comme :

- 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.

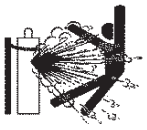
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

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

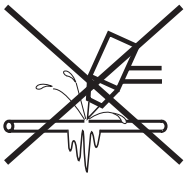
Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

- 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

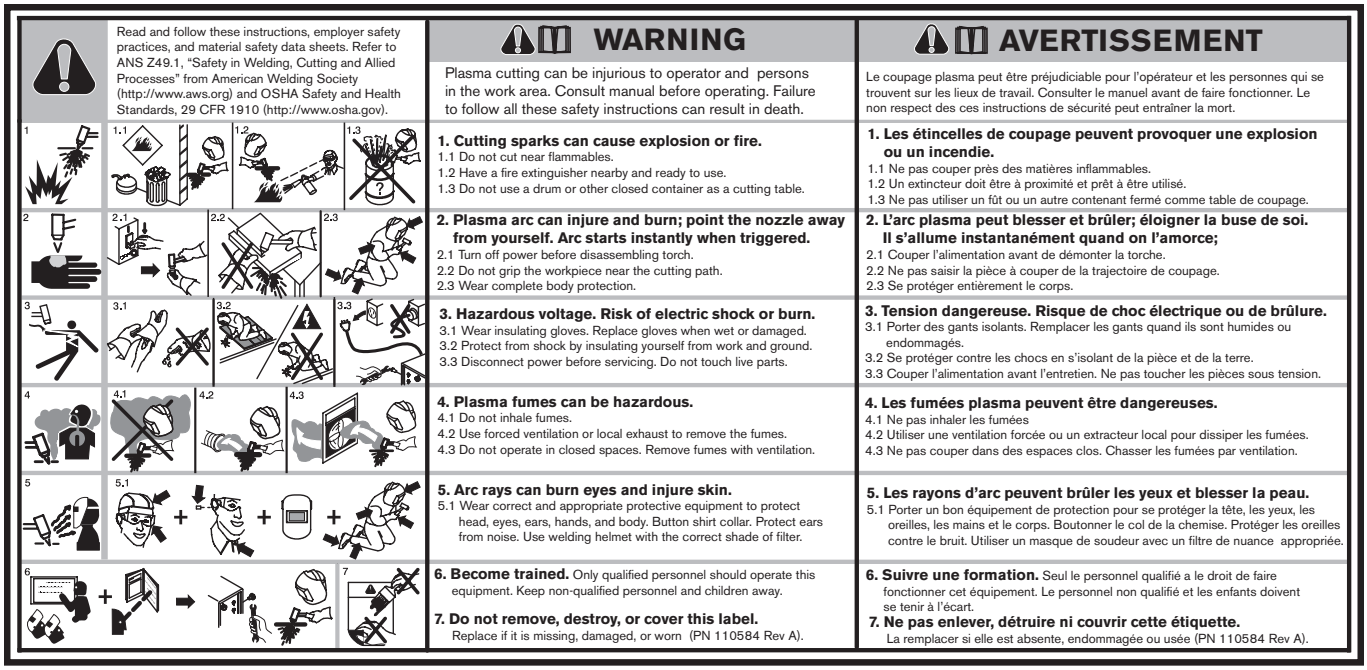
Les champs magnétiques produits par les courants à haute tension peuvent affecter le fonctionnement des prothèses auditives et des pacemakers. Les personnes portant ce type d'appareil doivent consulter un médecin avant de s'approcher d'un lieu où s'effectue le coupage ou le gougeage plasma.

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.



Read and follow these instructions, employer safety practices, and material safety data sheets. Refer to ANS Z49.1, "Safety in Welding, Cutting and Allied Processes" from American Welding Society (http://www.aws.org) and OSHA Safety and Health Standards, 29 CFR 1910 (http://www.osha.gov).

WARNING

Plasma cutting can be injurious to operator and persons in the work area. Consult manual before operating. Failure to follow all these safety instructions can result in death.

1. Cutting sparks can cause explosion or fire.
1.1 Do not cut near flammables.
1.2 Have a fire extinguisher nearby and ready to use.
1.3 Do not use a drum or other closed container as a cutting table.

2. Plasma arc can injure and burn; point the nozzle away from yourself. Arc starts instantly when triggered.
2.1 Turn off power before disassembling torch.
2.2 Do not grip the workpiece near the cutting path.
2.3 Wear complete body protection.

3. Hazardous voltage. Risk of electric shock or burn.
3.1 Wear insulating gloves. Replace gloves when wet or damaged.
3.2 Protect from shock by insulating yourself from work and ground.
3.3 Disconnect power before servicing. Do not touch live parts.

4. Plasma fumes can be hazardous.
4.1 Do not inhale fumes.
4.2 Use forced ventilation or local exhaust to remove the fumes.
4.3 Do not operate in closed spaces. Remove fumes with ventilation.

5. Arc rays can burn eyes and injure skin.
5.1 Wear correct and appropriate protective equipment to protect head, eyes, ears, hands, and body. Button shirt collar. Protect ears from noise. Use welding helmet with the correct shade of filter.

6. Become trained. Only qualified personnel should operate this equipment. Keep non-qualified personnel and children away.

7. Do not remove, destroy, or cover this label. Replace if it is missing, damaged, or worn (PN 110584 Rev A).

AVERTISSEMENT

Le coupage plasma peut être préjudiciable pour l'opérateur et les personnes qui se trouvent sur les lieux de travail. Consulter le manuel avant de faire fonctionner. Le non respect des ces instructions de sécurité peut entraîner la mort.

1. Les étincelles de coupage peuvent provoquer une explosion ou un incendie.
1.1 Ne pas couper près des matières inflammables.
1.2 Un extincteur doit être à proximité et prêt à être utilisé.
1.3 Ne pas utiliser un fût ou un autre contenant fermé comme table de coupage.

2. L'arc plasma peut blesser et brûler; éloigner la buse de soi. Il s'allume instantanément quand on l'amorce;
2.1 Couper l'alimentation avant de démonter la torche.
2.2 Ne pas saisir la pièce à couper de la trajectoire de coupage.
2.3 Se protéger entièrement le corps.

3. Tension dangereuse. Risque de choc électrique ou de brûlure.
3.1 Porter des gants isolants. Remplacer les gants quand ils sont humides ou endommagés.
3.2 Se protéger contre les chocs en s'isolant de la pièce et de la terre.
3.3 Couper l'alimentation avant l'entretien. Ne pas toucher les pièces sous tension.

4. Les fumées plasma peuvent être dangereuses.
4.1 Ne pas inhaler les fumées
4.2 Utiliser une ventilation forcée ou un extracteur local pour dissiper les fumées.
4.3 Ne pas couper dans des espaces clos. Chasser les fumées par ventilation.

5. Les rayons d'arc peuvent brûler les yeux et blesser la peau.
5.1 Porter un bon équipement de protection pour se protéger la tête, les yeux, les oreilles, les mains et le corps. Boutonner le col de la chemise. Protéger les oreilles contre le bruit. Utiliser un masque de soudeur avec un filtre de nuance appropriée.

6. Suivre une formation. Seul le personnel qualifié a le droit de faire fonctionner cet équipement. Le personnel non qualifié et les enfants doivent se tenir à l'écart.

7. Ne pas enlever, détruire ni couvrir cette étiquette. La remplacer si elle est absente, endommagée ou usée (PN 110584 Rev A).

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.

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.

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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:

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.

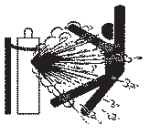
Mesa de trabajo Conecte la mesa de trabajo a una buena toma de tierra, de conformidad con los códigos eléctricos nacionales o locales apropiados.

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

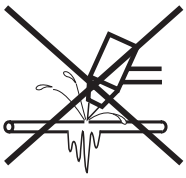
Los cilindros de gas contienen gas bajo alta presión. Un cilindro dañado puede explotar.

- 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

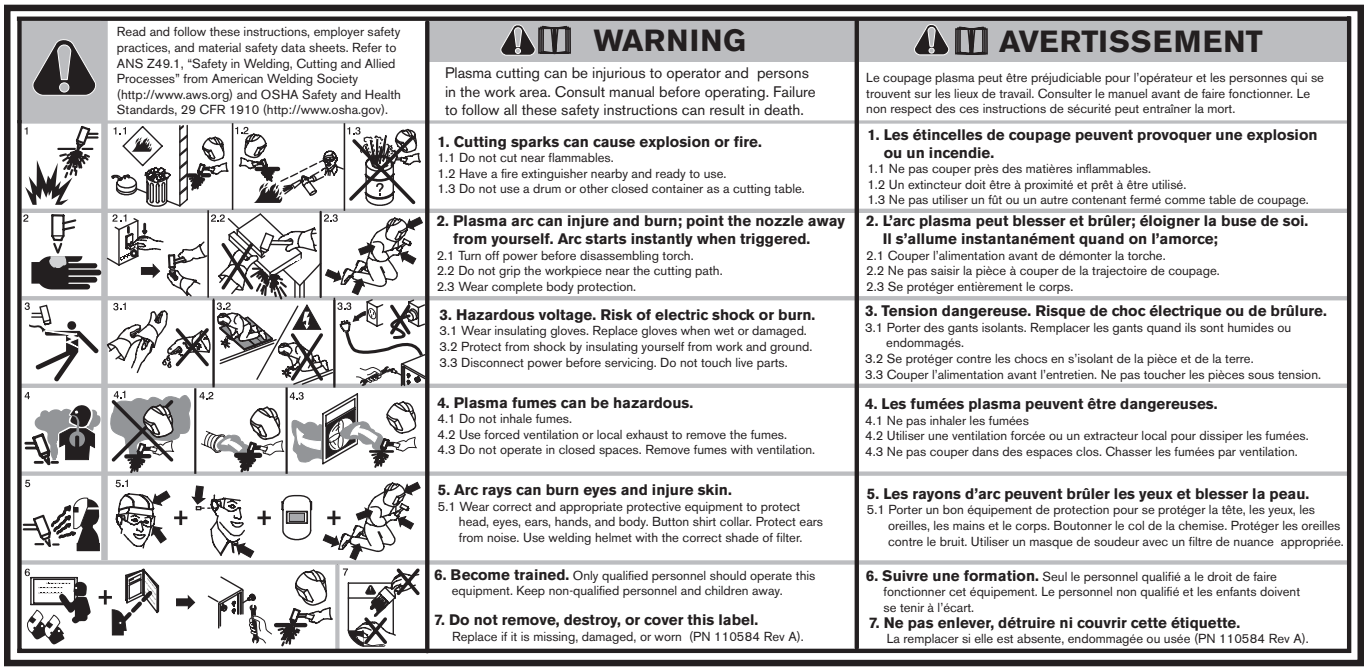
Los campos magnéticos producidos por las elevadas corrientes pueden afectar la operación de marcapasos y de audífonos. Las personas que lleven marcapasos y audífonos deberán consultar a un médico antes de acercarse a sitios donde se realizan operaciones de corte y ranurado por plasma.

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.



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.

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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

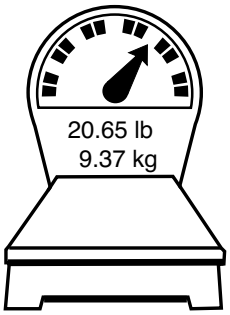
SPECIFICATIONS

In this section:

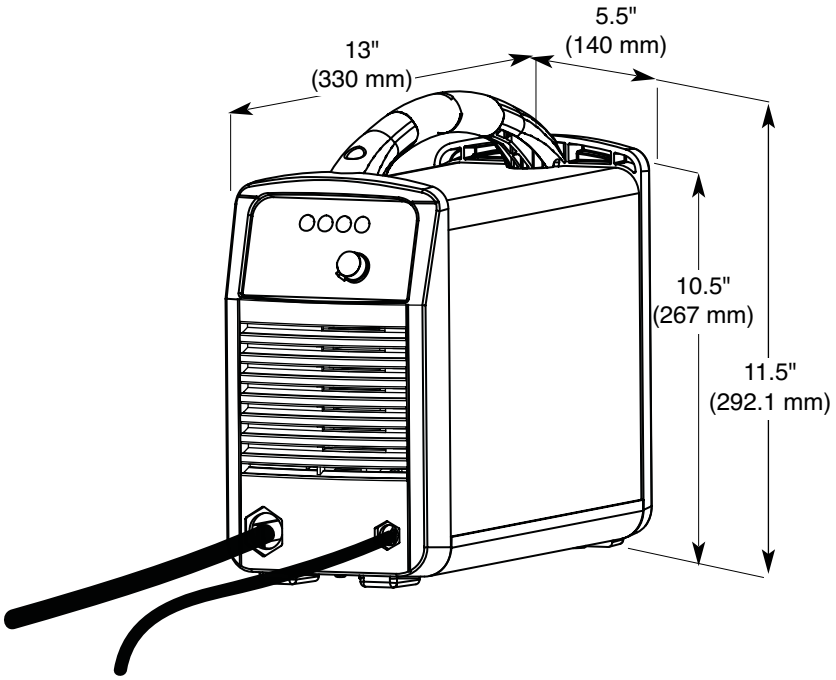
Power supply

Rated open circuit voltage (U_0)	240 VDC	
Rated output current (I_2)	15 A to 30 A	
Rated output voltage (U_2)	83 VDC	
Duty cycle at 40°C, U_1=120 VAC (See data plate on power supply for more information on duty cycle and for IEC ratings.)	35% (I_2 = 30 A, U_2 = 83 V) 60% (I_2 =2 3 A, U_2 = 83 V) 100% (I_2 = 18 A, U_2 = 83 V)	
Duty cycle at 40°C, U_1=200-240 VAC	50% (I_2 = 30 A, U_2 = 83 V) 75% (I_2 = 24 A, U_2 = 83 V) 100% (I_2 = 21 A, U_2 = 83 V)	
Operating temperature	14° to 104° F (-10° to 40°C)	
Storage temperature	-13° to 131° F (-25° to 55°C)	
Power factor (120 V — 240 V)	0.99 — 0.97	
Input voltage (U_1)/ Input current (I_1) at rated output ($U_{2\,MAX}$, $I_{2\,MAX}$)	120 V / 26 A 200-240 V / 15.5-13 A	
Gas type	Air	Nitrogen
Gas quality	Clean, dry, oil-free	99.995 % pure
Minimum required gas inlet flow and pressure	3.5 scfm @ 65 psi (99.1 l/min @ 5.5 bar)	
Recommended gas inlet flow and pressure	4.0 scfm @ 80 psi (113.3 l/min @ 5.5 bar)	

Dimensions and weight



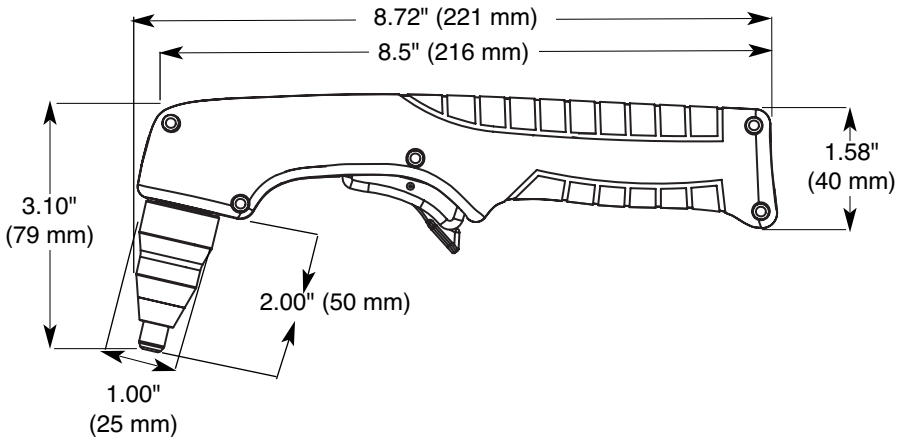
Weight includes the hand torch and 15 ft (4.57 m) lead.



T30v torch ratings

Recommended cutting capacity	1/4 inch (6 mm) at 30A (35 % duty cycle)
Maximum cutting capacity	3/8 inch (10 mm) at 30A (35 % duty cycle)
Severance cutting capacity	1/2 inch (12 mm) at 30A (35 % duty cycle)
Weight	2.1 lbs (1.0 kg)

Dimensions



Symbols and markings

S mark

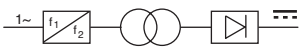
The S mark indicates that the power supply and torch are suitable for use in environments with increased hazard of electrical shock.

CE mark

The CE mark (CE) constitutes a manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of Hypertherm products with a CE mark 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 mark.

IEC symbols

The following symbols may appear on the power supply data plate, control labels, switches, and LEDs.

	Direct current (DC)		An inverter-based power source
	Alternating current (AC)		Volt/amp curve, "drooping" characteristic
	Plasma torch cutting		Power is ON (LED)
	AC input power connection		Low inlet gas pressure
	The terminal for the external protective (earth) conductor		Missing or loose consumables
I	Power is ON		Power supply is over heated
O	Power is OFF		

Section 3

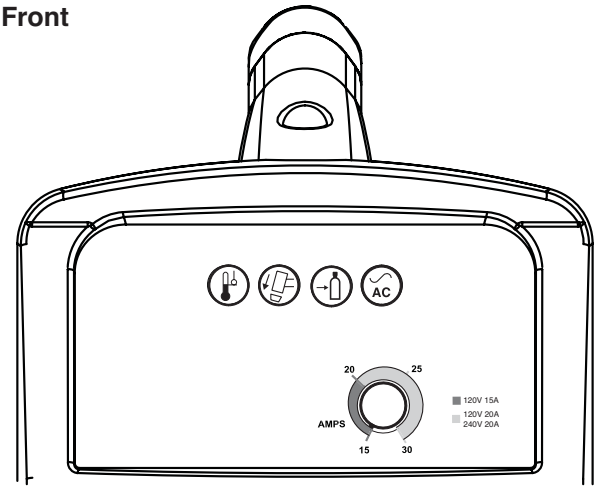
MAINTENANCE

In this section:

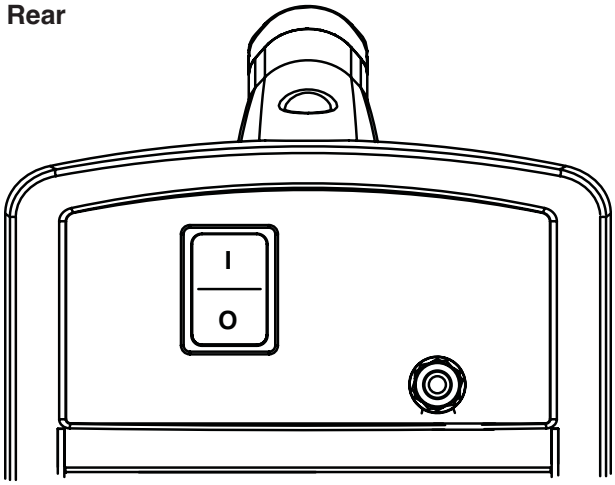
Controls and indicators

The Powermax30 has an ON/OFF rocker switch, an amperage adjustment knob and four indicator LEDs, which are described below.

Front



Rear



Front controls and LEDs

Power ON LED (green)
When illuminated, this LED indicates that the power switch has been set at I (ON) and that the safety interlocks are satisfied.

Gas pressure LED (yellow)
When illuminated, this LED indicates that the gas pressure is below 40 psi (2.8 bar). Correct this condition before continuing.

Torch cap LED (yellow)
When illuminated, this LED indicates that the consumables are loose, improperly installed, or missing.

Temperature LED (yellow)
When illuminated, this LED indicates that the power supply's temperature is outside the acceptable operating range.

Amperage adjustment knob
Use this knob to set the output current between 15 and 30 amps. For use on a 120 volt, 15 amp circuit, set it at 20 or below (indicated by the darker area around the knob).

Rear controls

ON (I)/OFF (O) power switch
Activates the power supply and its control circuits.

Some fault conditions will cause one or more of the LEDs to flash. For information on what these fault conditions are and how to clear them, see *Troubleshooting guide*, later in this section.

Theory of operation

General

Refer to the *Functional description* and *Sequence of operation* sections below, and to Section 5, *Wiring diagrams*.

Functional description

AC power enters the system through the power switch (S1) to the input diode bridges (D24, D30). The voltage from the diode bridge supplies the power factor correction (PFC) boost converter, which provides a nominal 375 VDC bus voltage. The bus voltage then supplies voltage and current to the inverter and the flyback circuit power supply (DC to DC converter) on the power board (PCB2). The power board provides noise suppression and spike protection. A “soft start” is implemented via the power board resistor and relay (K1).

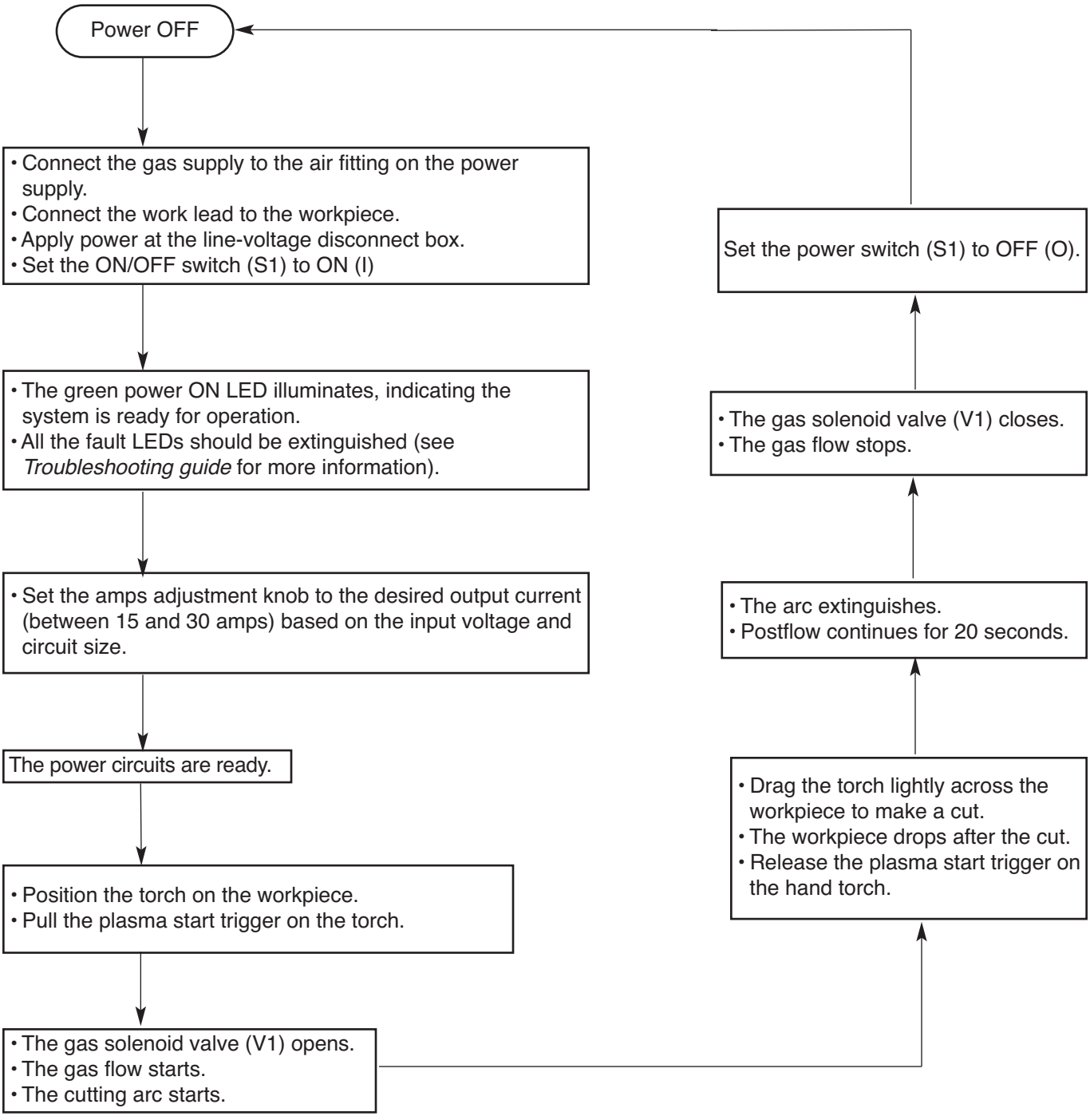
The PFC boost converter consists of an insulated gate bipolar transistor (IGBT Q1), choke, and control circuit. It provides a 375 VDC bus voltage when the input AC voltage is between 120 and 240 VAC.

The inverter consists of an IGBT (Q2), the power transformer, a current sense transformer, and sections of the power board. The inverter operates as a pulse-width, modulator-controlled bridge circuit that is rectified by the output diode (D27).

The output circuitry consists of 2 current sensors located on the power board, the pilot arc IGBT (inside the D27 module), and the output choke.

The control board’s microprocessor monitors and regulates the system’s operation and safety circuits. The amps adjustment knob is used to set the output current to the desired value between 15 and 30 amps. The system compares the set-point to the output current by monitoring the current sensor and adjusting the pulse-width output of the inverter IGBT (Q2).

Sequence of operation



Troubleshooting preparation

The complexity of the circuits requires that service technicians have a working knowledge of inverter power supply theory. In addition to being technically qualified, technicians must perform all testing with safety in mind.

If questions or problems arise during servicing, call the Hypertherm Technical Services team listed in the front of this manual.

Test equipment

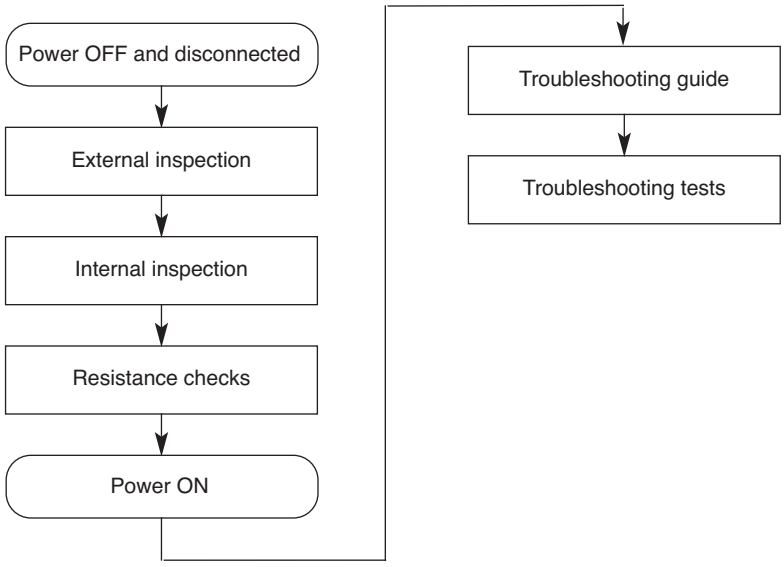
- Multimeter with a variety of jumper leads, including E-Z Hooks®.

Troubleshooting procedures and sequence

When performing the troubleshooting procedures,

- Read Section 1, *Safety*;
- Refer to Section 5 for the system's electrical schematic;
- Refer to Section 4 to locate power supply components and torch components.

After the problem has been located and repaired, refer to the *Sequence of operation* flow diagram in this section to test the power supply for proper operation.



External inspection

1. Inspect the exterior of the power supply for damage to the cover and external components, such as the power cord and plug.
2. Inspect the torch and the torch lead for damage.

	DANGER
	**ELECTRIC SHOCK CAN KILL** • **Turn off the power and remove the input power plug from its receptacle before removing the cover from the power supply. If the power supply is connected directly to a line disconnect box, switch the line disconnect to OFF (O). In the U.S., use a "lock-out / tag-out" procedure until the service or maintenance work is complete. In other countries, follow appropriate national or local safety procedures.** • **Do not touch live electrical parts! If power is required for servicing, use extreme caution when working near live electrical circuits. Dangerous voltages exist inside the power supply that can cause serious injury or death.** • **Do not attempt to repair the power board or control board. Do not cut away or remove any protective conformal coating from either board. To do so will risk a short circuit between the AC input circuit and the output circuit and may result in serious injury or death.**
	**HOT PARTS CAN CAUSE SEVERE BURNS** • **Allow the power supply to cool before servicing.**
	**MOVING BLADES CAN CAUSE INJURY** • **Keep hands away from moving parts.**
	**STATIC ELECTRICITY CAN DAMAGE CIRCUIT BOARDS** • **Put on a grounded wrist strap before handling PC boards.**

Internal inspection

1. Set the ON/OFF switch (S1) to O (OFF), unplug the power cord and disconnect the gas supply.

2. Use a #2 Phillips-head screwdriver to remove the 2 screws from the power supply's handle. Tip the endcaps back slightly so that you can get the edges of the handle out from underneath the endcaps. Remove the handle and then lift the cover off the power supply.

3. There is a Nomex® insulating barrier between the cover and the power board. Lift the barrier out of the power supply and set it aside. Be certain to replace the barrier when you are finished working on the power supply.

4. Inspect the inside of the power supply, especially on the side with the power board. Look for broken or loose wiring connections, burn and char marks, damaged components, and so on. Repair or replace as necessary.

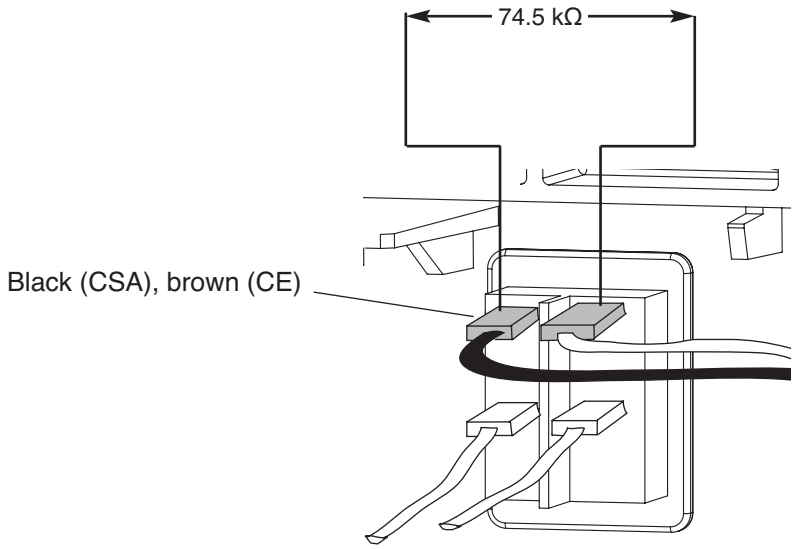
Initial resistance check

All resistance values must be taken with the power cord disconnected and all internal power supply wires attached. Perform the steps in *Internal inspection* before continuing in this section.

- If resistance values are not close (±25%) to the values given in this section, isolate the problem by removing wires attached to the resistance check points or component until the problem is found.
- After the problem has been located and repaired, refer to the *Sequence of operation* flow diagram in this section to test the power supply for proper operation.

1. With the power disconnected, set the ON/OFF switch (S1) to ON (I).

2. Check the resistance across the input leads.



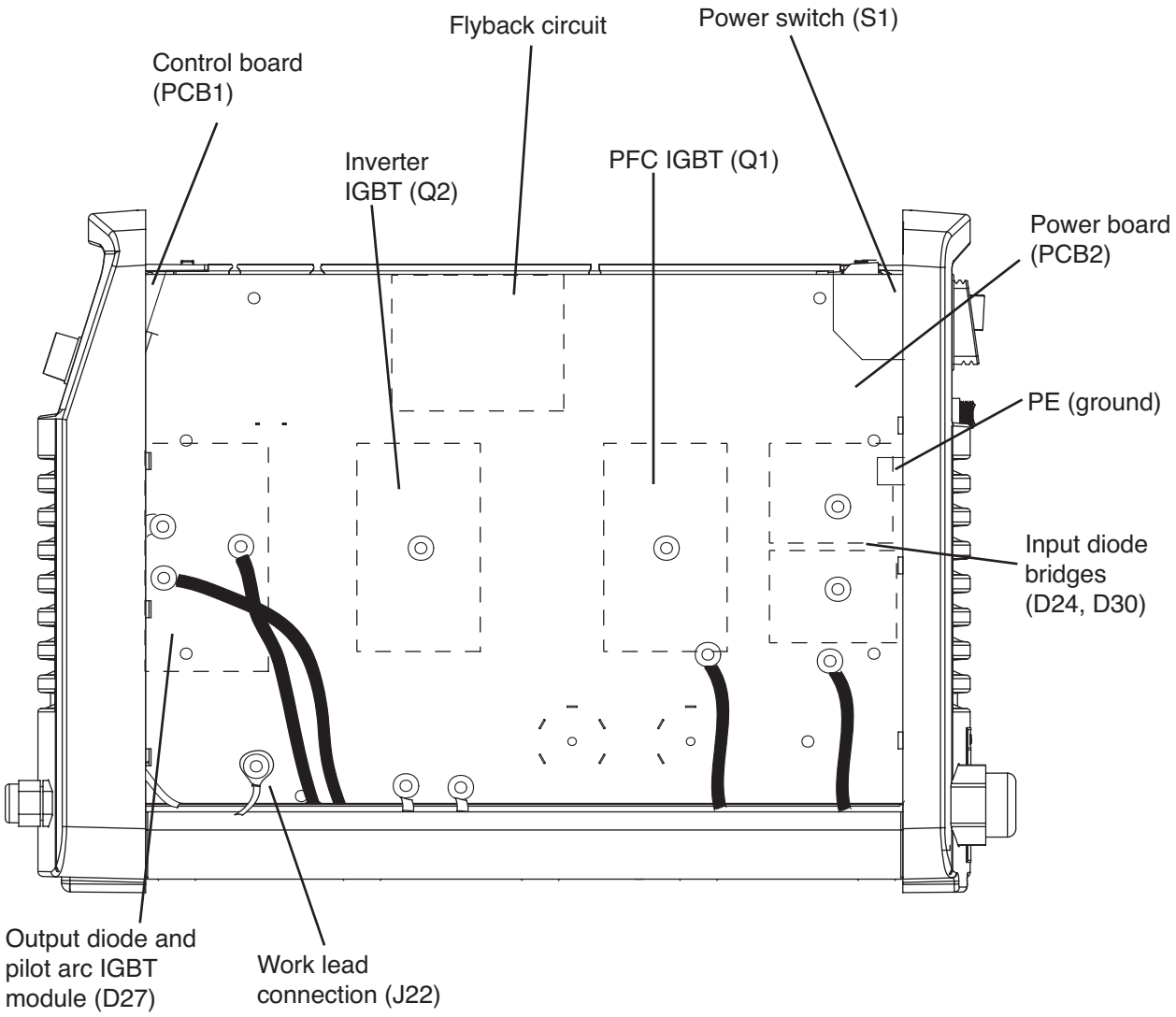
3. Check the resistance from the input leads to ground to verify that it reads as open.

Note: With the power disconnected and the ON/OFF switch (S1) set to OFF (O), all circuits should read as open.
The electrical value shown is ±25%.

If no problems were found during the visual inspection or the initial resistance check, and the power supply still does not operate correctly, see the *Troubleshooting guide*.

Note: The *Troubleshooting guide* provides most probable causes and solutions. Study the system wiring diagram and understand the theory of operation before troubleshooting. Before purchasing any major replacement component, verify the problem with Hypertherm Technical Service or the nearest Hypertherm repair facility.

Power supply overview

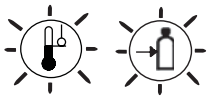
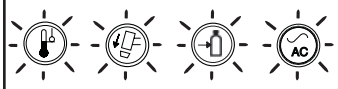


Troubleshooting guide

See *System tests*, later in this section, for detailed test procedures.

Problem	This may mean	Cause	Solution
The ON/OFF power switch is set to ON (I), but the power ON LED does not illuminate.	There is insufficient voltage to the control circuits or a short-circuited power component.	• The system has no incoming voltage or an improper incoming voltage. • The power board is faulty.	• Check to see that the system is plugged into an appropriately-sized circuit and that the circuit breaker has not been tripped. • Perform test 1 to check the incoming voltage and the power switch.
The power ON LED and the gas pressure LED illuminate. 	There is insufficient gas pressure to the machine.	• There is no gas attached to the system. • The gas supply line has a restriction or the air filter element is dirty. • The pressure switch is not reading at least 40 psi (2.8 bar) on the gas supply line.	• Ensure that the gas supply is connected correctly. • Check the gas supply line for restrictions or damage. • Check the air filter element and replace it if necessary. • Perform test 9 to verify that the pressure switch functions correctly.
The power ON LED and the temperature LED illuminate. 	The system has overheated.	• You have exceeded the duty cycle. (For more information about duty cycle, see *Section 4* of the *Powermax30 Operator Manual*.	• Check the area around the system to make sure that the air flow is not blocked. • If the duty cycle has been exceeded, let the system cool before using it again. • Perform test 8 to make sure the fan is operating correctly.
The power ON LED flashes. 	The incoming voltage is not correct.	• The incoming voltage is below 90 VAC or above 285 VAC.	• Perform test 1 to check the incoming line voltage.

Troubleshooting guide (continued)

Problem	This may mean	Cause	Solution
The power ON LED and the torch cap LED illuminate. 	The cap-sensing circuit is not satisfied.	• The consumables are loose, improperly installed, or missing. • The cap sensor switch is faulty.	• Correctly install the consumables. • Perform test 7 to test the cap sensor switch.
The power ON LED illuminates and the torch cap LED flashes. 	The consumables are stuck in an open or closed position, or the nozzle and electrode are not touching when the torch's trigger is pulled.	• The consumables are installed incorrectly, or they are worn. • The torch plunger is stuck. • The torch or lead has a broken wire.	• Check the consumables for wear and replace if necessary. Make sure that they are properly installed. • Perform test 5 and replace the torch head if necessary.
The gas pressure and temperature LEDs flash when the machine is powered ON. 	The system was powered on while the plasma start signal was being sent.	• The system was powered on while the torch trigger was being pulled. • The start circuit is stuck closed.	• Release the torch trigger and turn OFF the power supply and then turn it ON again to reset the unit. • Perform test 6 to test the start signal.
All four LEDs flash when the system is powered on. 	A major fault has occurred in the power supply.	• Any of the fan, solenoid valve, control board, or power board may be faulty.	• The error LED on the control board should be flashing. The number of times it flashes between pauses indicates which components to test. See *Control board LEDs* in this section.
The power ON LED illuminates and no fault LEDs illuminate, but no gas flows when the torch trigger is pulled. 	The start signal is not reaching the control board.	• The torch or torch lead may be damaged. • The power board may be faulty. • The control board may be faulty.	• Inspect the torch and torch lead for damage. • Verify that the control board start LED illuminates when the trigger is pulled. If it does not, perform test 6 to check the start signal from the power board.

Troubleshooting guide (continued)

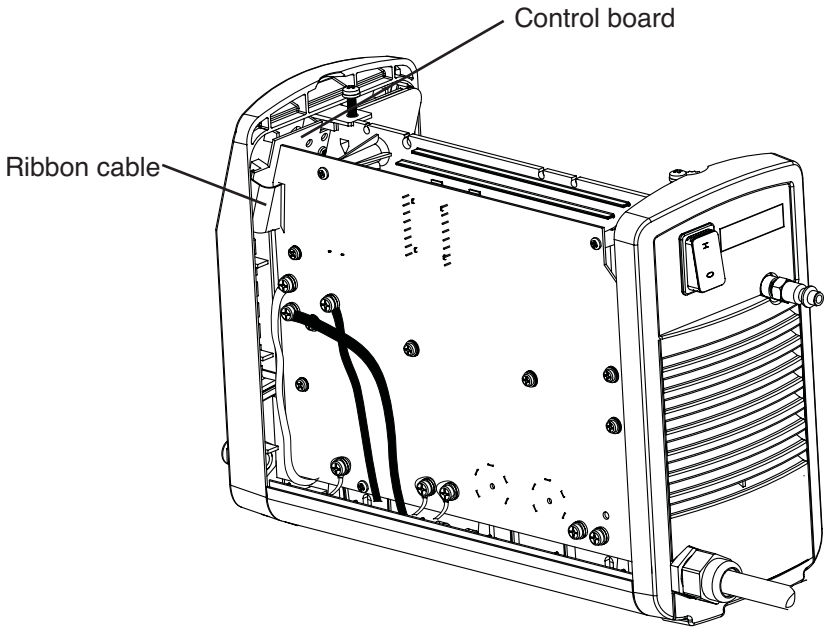
Problem	This may mean	Cause	Solution
Gas flows when the system is powered ON. 	The incoming gas pressure is too high.	• The gas pressure from the compressor or cylinder may be too high. • The gas solenoid valve may be faulty.	• Check the gas supply to make sure that it does not exceed 135 psi (9.3 bar). If necessary, reduce the pressure. • Perform test 4 to verify that the gas solenoid valve is functioning correctly.
When pulling the torch's trigger, gas flows from the torch, but the torch does not fire or fires only for a short period of time.	The consumables, torch, or torch lead are not functioning correctly, the gas pressure may be too low, or there is a voltage imbalance on the power board.	• The consumables may be worn or damaged. • The torch or torch lead may be damaged. • The gas pressure is too low or the gas supply is restricted. • The power board is faulty.	• Inspect the consumables, torch, and lead. Replace any damaged parts. • Verify that the gas supply is providing at least 65 psi (4.5 bar). Repair any restrictions in the supply line. • Perform test 3 to test the voltage balance on the power board.
Arc goes out while cutting or intermittently will not fire.	The arc lost contact with the workpiece.	• The work lead or work lead connection may be faulty.	• Check for loose connections at the work clamp and at the power supply. • Reposition the work lead on the workpiece. • Clean the cutting surface to ensure a better connection with the work lead.
When pulling the torch's trigger, the pilot arc starts but then extinguishes before the normal 5-second time-out period.	The consumables, torch, or torch lead are not functioning correctly, the gas pressure may be too low, the air quality may be poor, or there is a voltage imbalance on the power board.	• The consumables may be worn or damaged. • The torch or torch lead may be damaged. • The gas pressure is too low or the gas supply is restricted. • The air filter element is dirty. • The power board is faulty.	• Inspect the consumables, torch, and lead. Replace any damaged parts. • Verify that the gas supply is providing at least 65 psi (4.5 bar). Repair any restrictions in the supply line. • Perform test 3 to test the voltage balance on the power board.

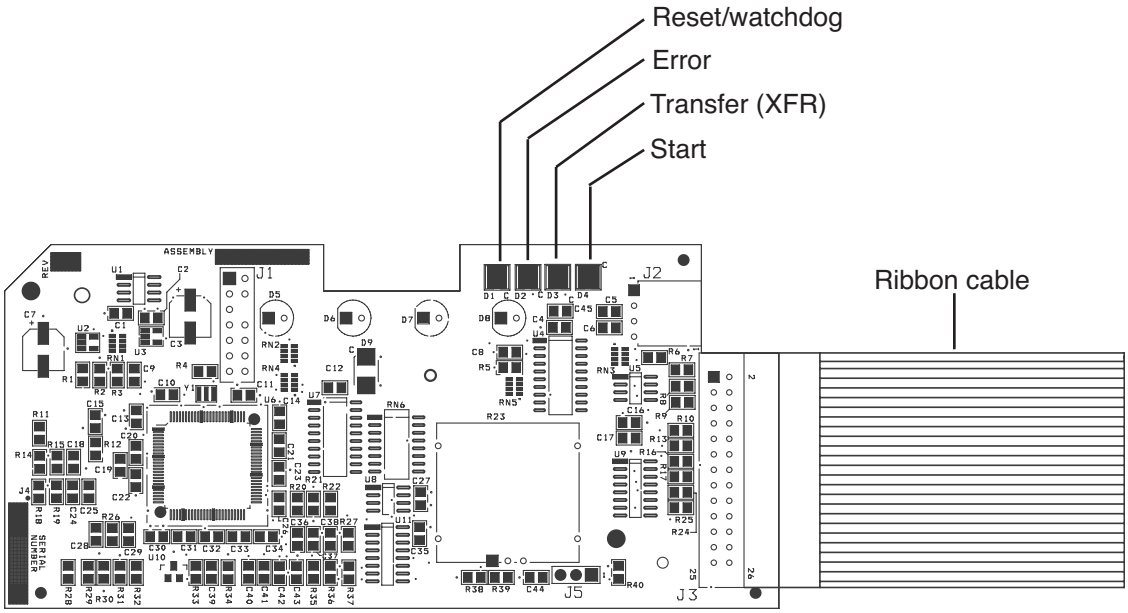
Troubleshooting guide (continued)

Problem	This may mean	Cause	Solution
The cut quality is poor or the cut does not sever the metal.	The consumables are worn, there is a poor work lead connection, the output from the power supply is too low, or the power board is producing low current.	• The consumables need to be replaced. • The work lead may be damaged or not properly connected to the work piece. • The amps adjustment knob may be set too low. • The power board may be faulty.	• Inspect the consumables and replace if necessary. • Inspect the work lead for damage. Reposition it and clean the work surface to ensure good contact. • Check the amps adjustment knob setting. If your input circuit is 120 V, 20 A; 120 V, 30 A; or 240 V, 20 A , turn the knob to the highest setting.
The pilot arc extinguishes when you move the plasma arc off the work piece while still pulling the torch's trigger.	The continuous pilot arc feature is not working.	The power board or the control board may be faulty.	• Perform tests 2 and 3 to verify that the power board is functioning properly. If the power board is faulty, replace it. Otherwise, replace the control board.

Control Board LEDs

The Powermax30 control board (PCB1) has 4 diagnostic LEDs.





The control board LEDs are:

- Start — The power supply has a start signal. This LED illuminates when the power supply receives a start signal and remains illuminated during normal operation.
- Transfer — This LED illuminates when there is proper arc transfer between the torch and the workpiece, and will flash during continuous pilot arc operation (such as when cutting expanded metal or moving the arc off the plate and then back on).
- Error — The Error LED illuminates when the gas pressure, torch cap, or temperature LEDs on the front of the power supply illuminate. If all 4 LEDs on the front of the power supply are flashing, the Error LED also flashes. The number of flashes between pauses indicates which component may have failed.
- Reset — This LED illuminates when a voltage reading is out of range or the Reset LED flashes.

During normal operation, the power ON LED on the front of the power supply and the Start and Transfer LEDs on the control board illuminate. When a problem occurs with the system, one or more of the fault LEDs on the front of the power supply and the Error LED or the Reset LED on the control board may illuminate or flash.

Use the control board Error and Reset LEDs to troubleshoot

The Error and Reset LEDs provide information to use when troubleshooting a system failure. If the LEDs on the front of the power supply are flashing, look at the Error LED on the control board to determine where the fault may be. Count the number of flashes and then look at the table on the following page to determine the corrective action.

Reset LED

When the control board's Reset LED illuminates, the voltages on the power board may be incorrect. Perform the following tests at J7 on the power board (see *Test 2 — power board voltage checks*, later in this section):

- Test pin 5 to ground for 3.3 VDC (±10%).
- Test pin 7 to ground for 5 VDC (±10%).
- Test pin 12 to ground for 2.2 VDC (±10%).

If the values you find are not within ±10% of the above values, detach the control board's ribbon cable and perform the tests again. If you find the correct values the second time, replace the control board. Otherwise, replace the power board.

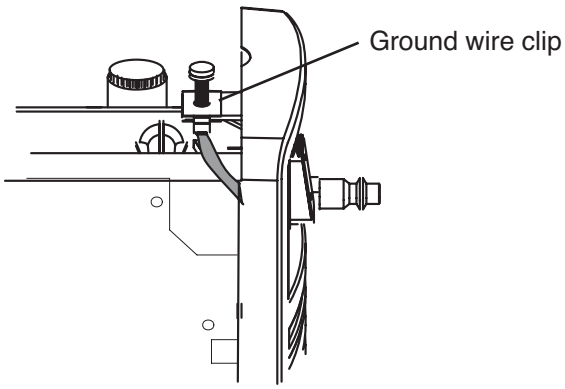
Error LED

The number of times the Error LED flashes indicates the problem detected. Each flash is a half-second long and each series of flashes is separated by a 2-second pause. See *System tests*, later in this section, for detailed test procedures.

Number of error LED flashes	Problem indicated	Solution
1	Faulty control board	Replace the control board.
2	Faulty power board	Replace the power board.
3	Either a faulty power board or a faulty control board	• Perform test 3. If any of the values are incorrect, replace the power board. • Perform test 2. If any of the values for pins 5, 7, or 12 are incorrect, remove the control board and test again. If the values are correct, replace the control board. • When performing test 2, if the values for pins 5, 7, and 12 are correct, but any other values are incorrect, replace the power board.
4	Faulty gas solenoid valve	Replace the gas solenoid valve.
5	Faulty fan	Replace the fan.

System tests

There is a ground clip near the top of the rear endcap that can be used as ground for any tests that require the multimeter to be attached to ground. There is also a ground on the heat sink with access through the power board as shown in test 1.



Test 1 – voltage input

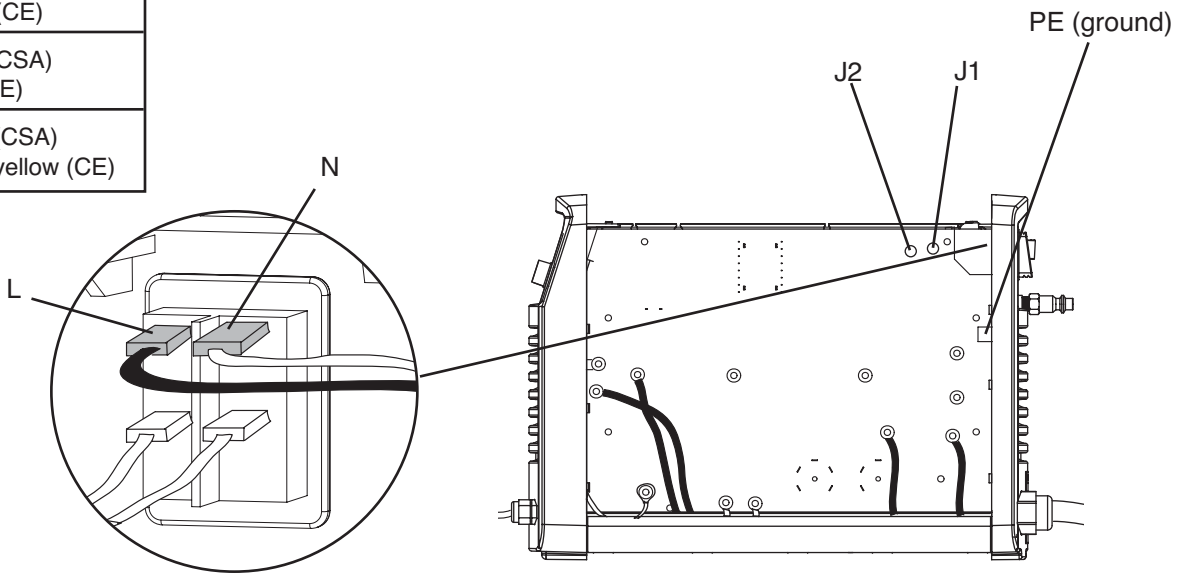
Check the incoming voltage and the line voltage to the top of the power switch (S1).

1. Disconnect the electrical power and set the ON/OFF switch to OFF (O).
2. Ease the ON/OFF switch's top 2 wires out from the tabs a little ways so that you can get your test leads on the tabs to check the AC voltage.
3. Once you have your test leads in place, reconnect the electrical power. Leave the ON/OFF switch set to OFF. The voltage should equal the line voltage of the incoming circuit, for example 120 V or 240 V
4. If the AC voltage is incorrect, check to see that you have power to the unit. If you do have power, check the power cord for damage.
5. If the power source and power cord are functioning correctly, disconnect the electrical power again and reconnect the wires.
6. Reconnect the electrical power. Then set the ON/OFF switch to ON (I), and measure the AC voltage from J1 to J2 (labeled "AC" on the power board). This value should be the same as the incoming line voltage. If it is not, check the ON/OFF switch.
7. If the AC LED is still illuminated, perform test 2 to determine whether the power board or the control board is faulty.

   Note: All values can be ±15%.

Single phase

L	Black (CSA) Brown (CE)
N	White (CSA) Blue (CE)
PE	Green (CSA) Green/yellow (CE)



Test 2 – power board voltage checks

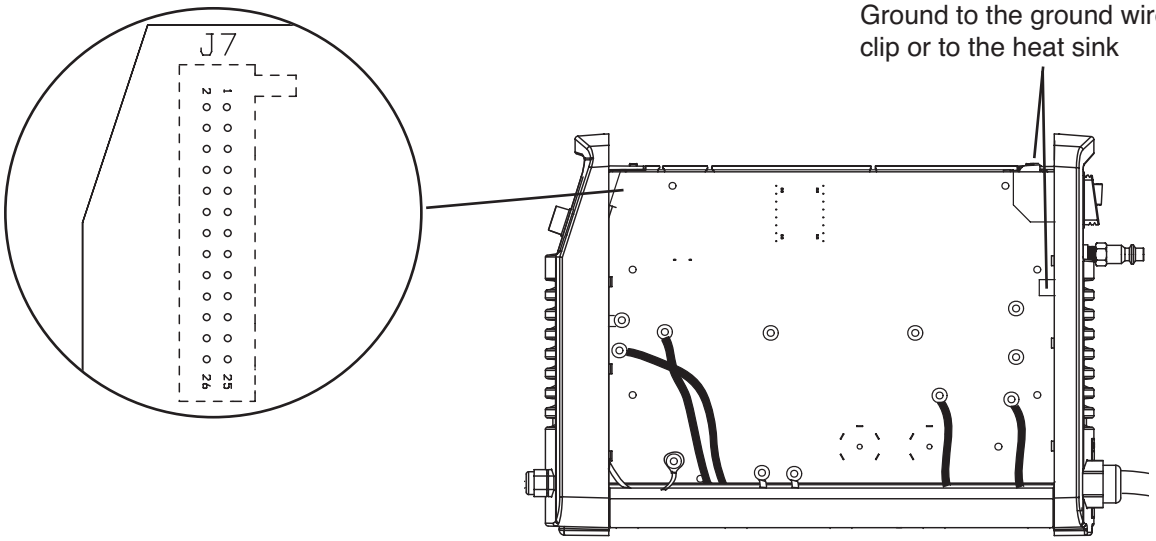
With the power ON, use a meter to verify the voltages at the J7 pins listed in the following table to be certain that the power board is functioning correctly. If any of the values are incorrect, replace the power board.

Note: All values can be ±10%.

Caution: **Do not use -VBUS as ground. Doing so could destroy the power supply. Instead ground to either the ground wire clip on the rear endcap or to the heat sink as shown below.**

J7 pin number to ground	Test	Expected value
19	VACR (rectified AC line voltage)	0.86 V @ 120 line voltage 1.87 V @ 230 line voltage
21	VBUS (DC bus voltage)	2.28 VDC @ 375 VBUS
18	IPFC (input current)	< 0.1 VDC
20	IFB (output current)	< 0.1 VDC
22	ITF (transfer current)	< 0.1 VDC
5	3.3 VDC	3.3 VDC ±5%
7	5 VDC	5 VDC ±5%
12	24 V sense pin	2.2 VDC
16	Start signal	3.2 VDC closed 0 VDC open

Note: To test the values at pin 16, you must have the torch and power supply positioned such that you can safely pull and release the torch's trigger.

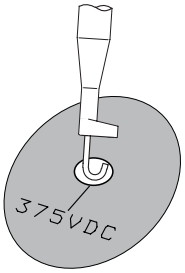


Test 3 — VBUS and voltage balance

Test the power board to ensure that the circuits are balanced.

> **Caution: Do not use a multimeter with test probes which can cause a short-circuit between the BUS and the heatsink. Use E-Z Hook® leads instead.**

1. Turn OFF the power.
2. Position the multimeter leads to measure the voltage from -VBUS to 375 VDC on the power board. Carefully connect the E-Z Hooks to the edges of the holes in the power board so that the hook makes contact with the ring on the back side of the power board.

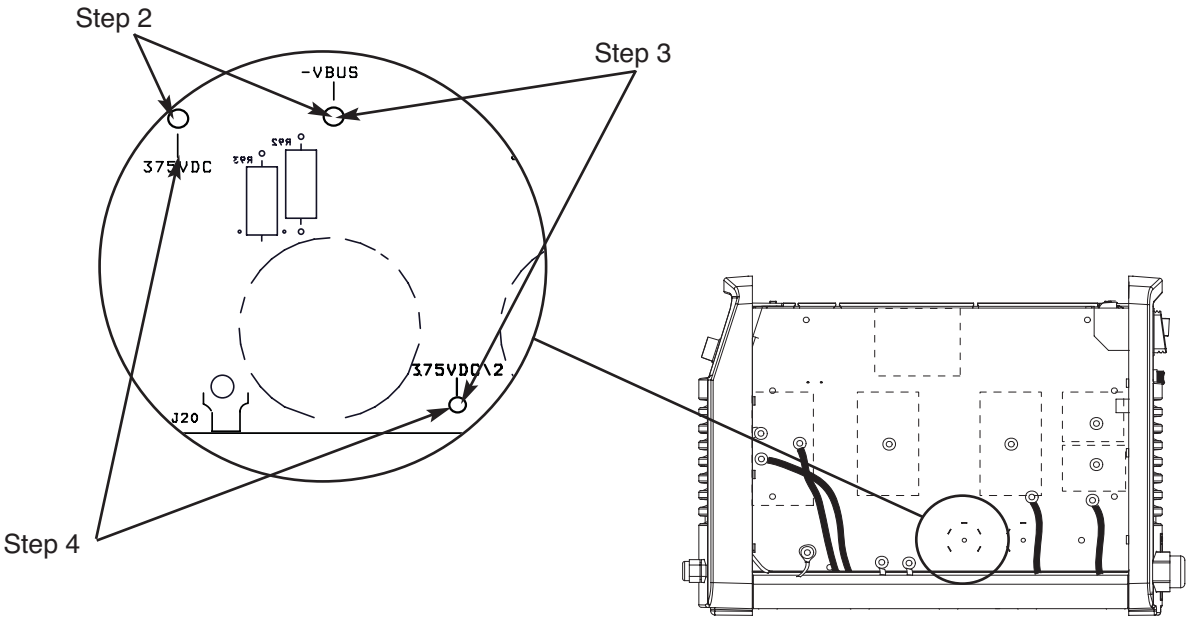


Note: All values can be ±10%.

Turn the power ON after you have connected the E-Z Hooks. The multimeter should read 375 VDC.

If you get a value other than 375 VDC, multiply the reading by 0.00601 to convert it to millivolts. Test pin 21 on J7. It should have the same value.

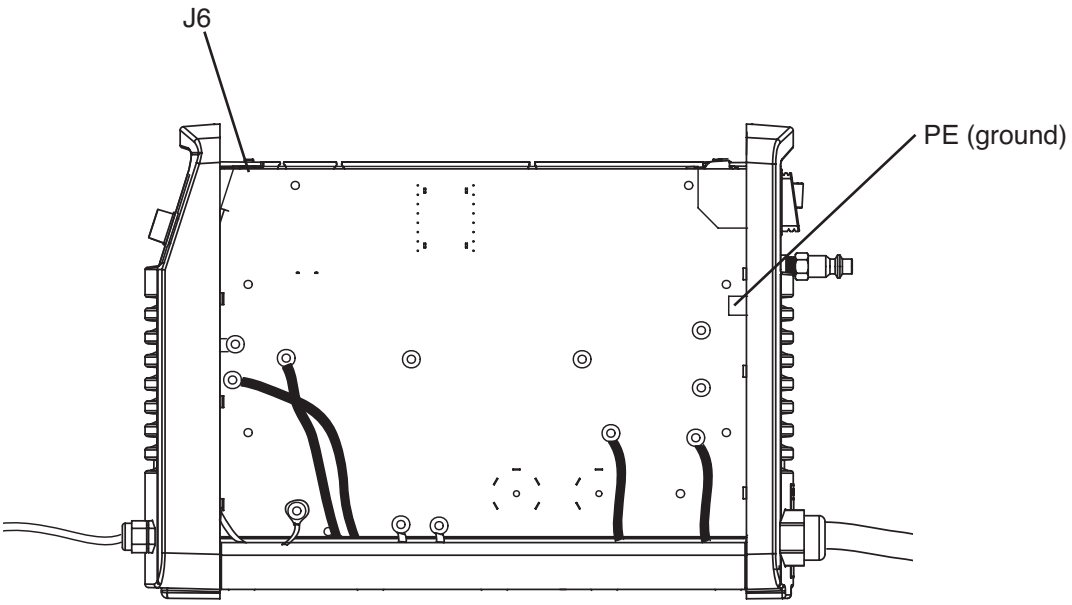
3. Turn the power OFF and move the E-Z Hooks to -VBUS and 375 VDC/2. Turn the power ON after you have connected the multimeter. This value should be 187.5 VDC or one-half of whatever value you found in step 2.
4. Turn the power OFF and move the E-Z Hooks to 375 VDC and 375 VDC/2. Turn the power ON after you have connected the multimeter. This value should be 187.5 VDC or one-half of whatever value you found in step 2.
5. The values found in steps 3 and 4 should be approximately equal. If they differ by more than 30 V, replace the power board.



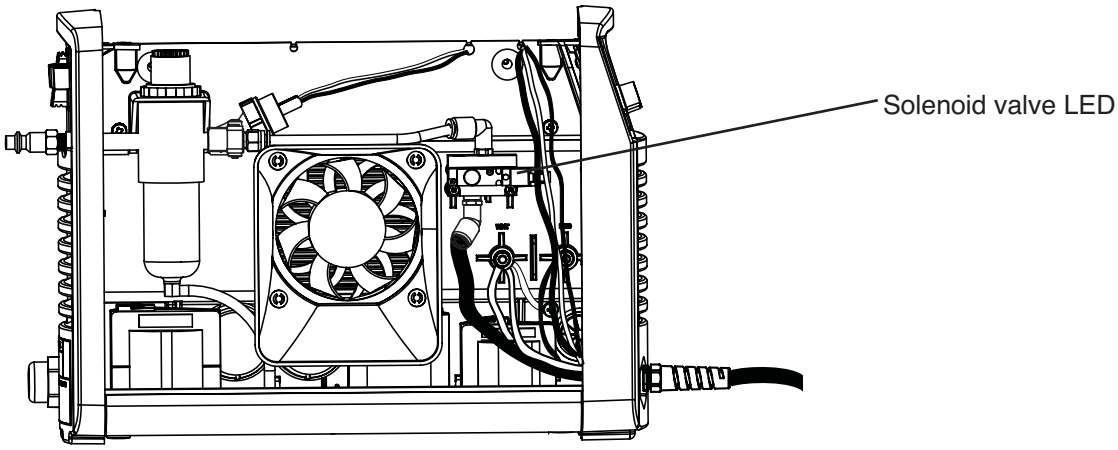
Test 4 – solenoid valve

If gas is not flowing properly, test the solenoid valve for proper operation.

1. Place a jumper from pin 4 of J6 on the power board to ground. You should hear the valve click.



2. There is an LED on the solenoid valve that illuminates red when the torch is fired. It stays illuminated until postflow stops. Fire the torch and watch for the LED to illuminate.
3. If you do not hear the valve click or the LED does not illuminate, replace the solenoid valve.



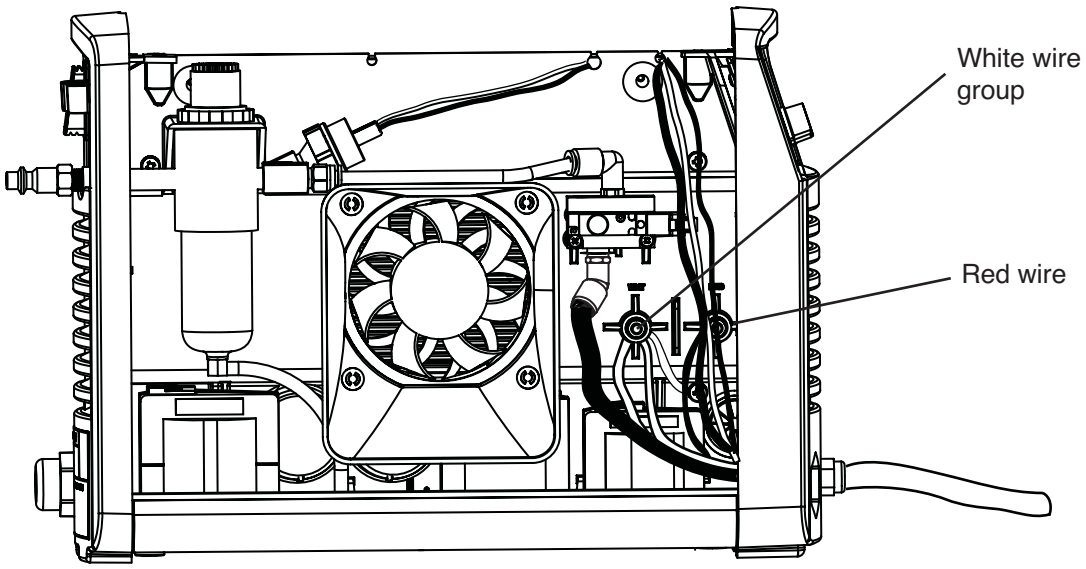
Test 5 – torch stuck open (TSO)

Before the torch's trigger is pulled and gas starts to flow, the nozzle and electrode should be closed. If not, the power supply will detect a TSO, or "torch stuck open," fault. Use the following test to determine if the torch is stuck open.

1. Set the ON/OFF switch to OFF (O).

2. Measure the resistance from the torch lead's white wire group and red wire to the positive and negative connections on the power supply. The resistance should read as closed.

3. If the resistance reads as open, then the nozzle and electrode are not touching, or one of the wires in the torch lead is broken. Make sure that the torch plunger moves freely in the torch head. If it does not, replace the torch head. If the torch parts are working properly, replace the torch lead.

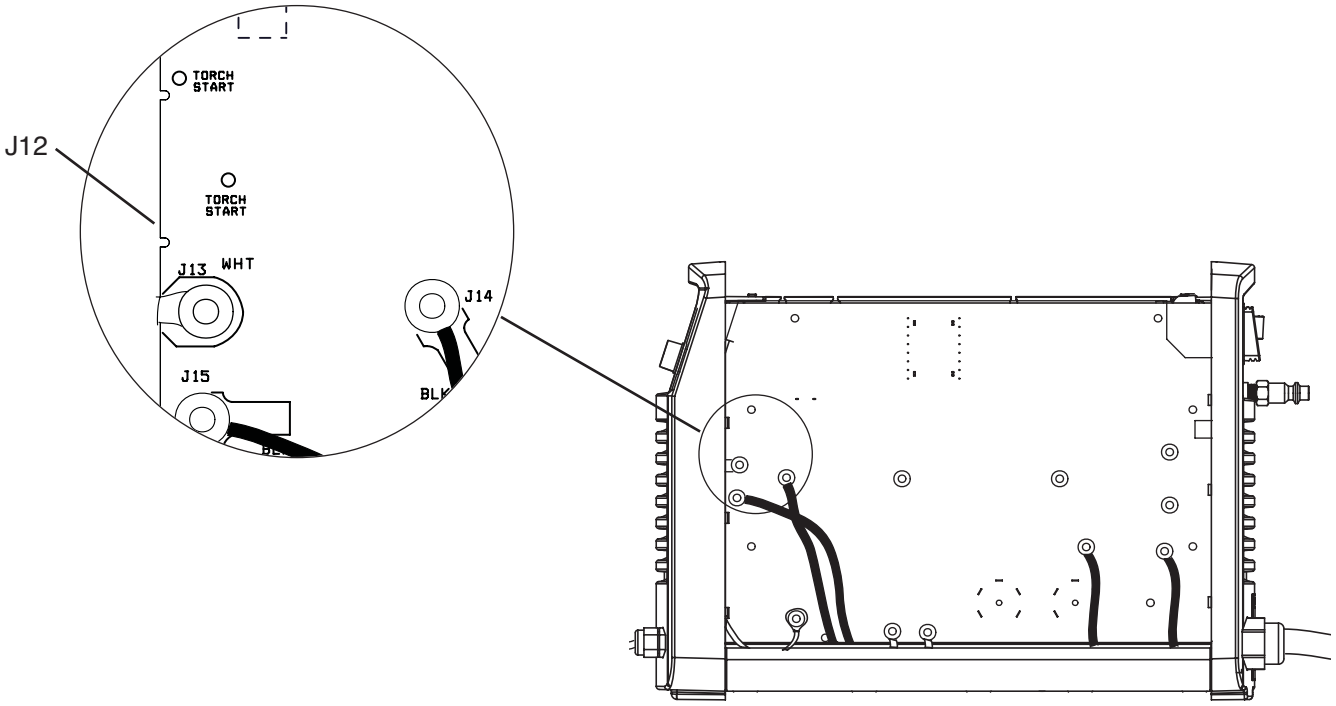


Test 6 — plasma start

Verify that the control board LED is receiving a valid start signal.

1. With the power ON, look at the Start LED on the control board. It should illuminate whenever the trigger is pulled.
2. Set the ON/OFF switch to OFF (O). Check the resistance at the 2 torch-start test points on the power board. With the trigger engaged, the resistance should be 10 Ω or less. With the trigger disengaged, the circuit should read as approximately 3 kΩ. If this test fails, check the torch's start switch and the torch wires.
3. Set the ON/OFF switch to ON (I). Measure pin 16 of J7 to ground (see *Test 2*, earlier in this section). It should measure as 0 VDC for an open circuit or 3.2 VDC for a closed circuit. If the values are not correct, replace the power board.

Caution: While testing, avoid any contact with the tip of the torch.



Test 7 — torch cap sensor

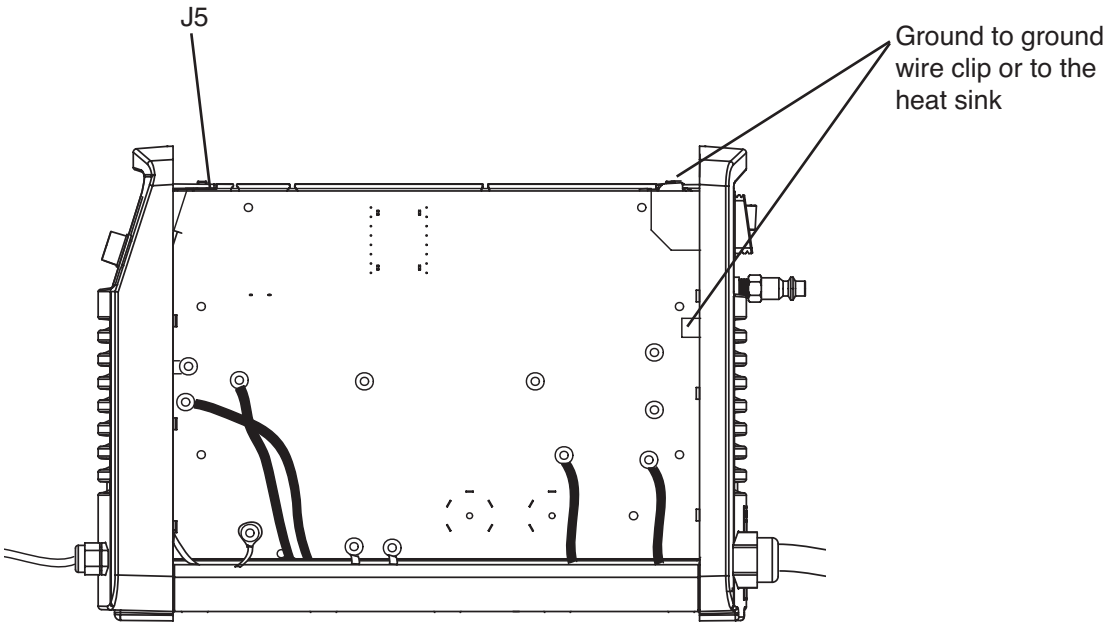
Test the cap sensor switch and torch leads.

1. Set the ON/OFF switch to OFF (O).
2. Gently pull the front endcap away from the power supply. Unplug J12 from the back side of the power board (just below the torch-start test points).
3. Measure the resistance from the orange wire to the blue wire. It should measure less than 10 Ω. If it reads as open, the cap sensor switch circuit is not satisfied.
4. If the torch plunger moves smoothly and the consumables are correctly installed, then either the cap sensor switch is faulty or the torch lead has a broken wire. Replace the faulty part.

Test 8 — fan

Test the fan for proper operation.

- Place a jumper from ground to pin 3 of J5. If the fan does not operate, replace the fan.



Test 9 — pressure switch

Test the pressure switch to ensure that the system is receiving the proper gas pressure.

1. Turn OFF the power.

2. Check the resistance between pins 1 and 2 of J4. It should read approximately 4.7 kΩ if there is no gas pressure. If the gas pressure is within system tolerances, the circuit should read as closed.

DANGER

ELECTRIC SHOCK CAN KILL

- **Use extreme caution when working near live electrical circuits. Dangerous voltages exist inside the power supply that can cause serious injury or death.**
- **See warnings on page 3-6 before proceeding.**

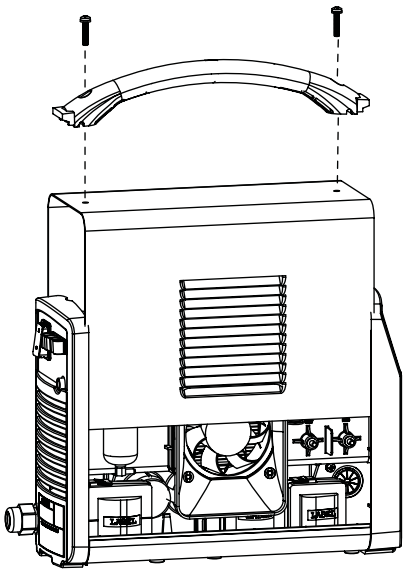
Component replacement

Remove an endcap

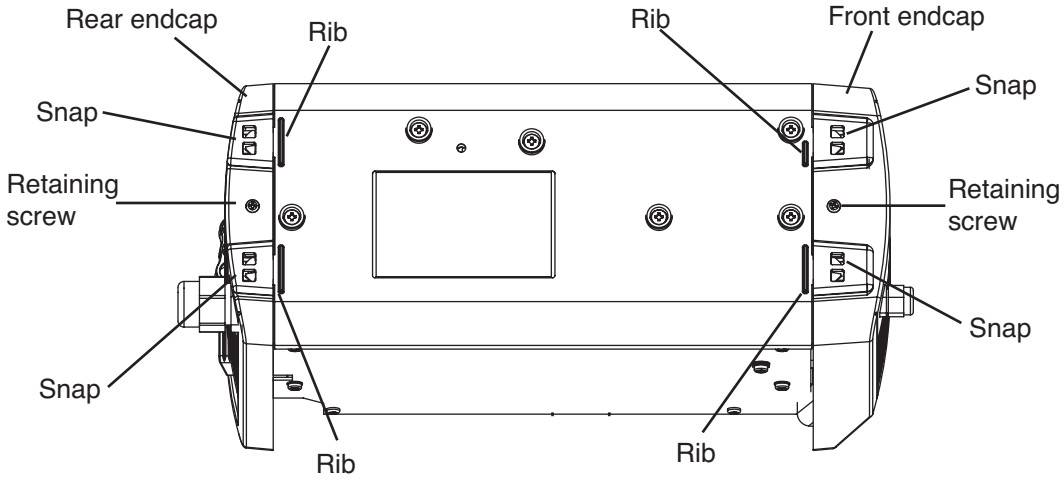
Endcaps can be removed to replace them. Also some repairs are easier to make with an endcap removed.

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the endcaps back slightly so that you can get the edges of the handle out from underneath the endcaps. Remove the handle and then lift the cover off the power supply.



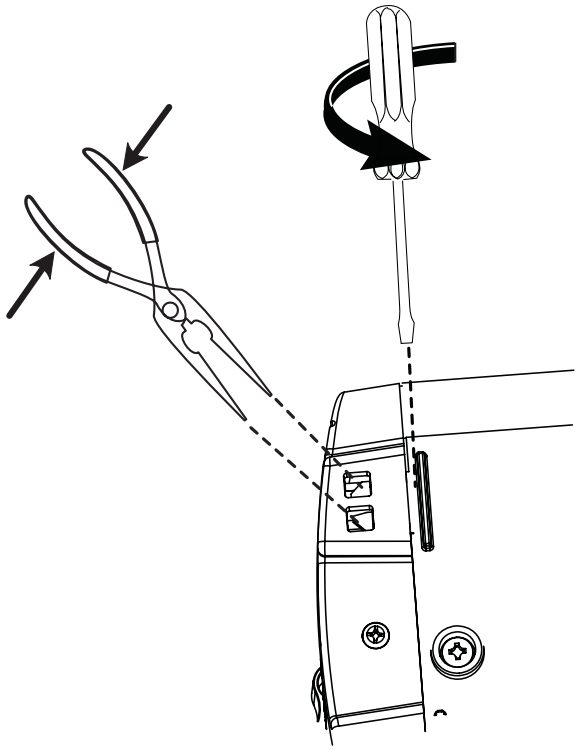
3. Lay the power supply on its side or hold it upside down. Each endcap has a retaining screw in the center. The raised feet on the bottom of the unit have holes to provide access to the snaps that hold the endcaps in place. Next to each foot is a raised rib.



4. Remove the retaining screw from the bottom of the endcap that you will remove.

5. There are snaps on both sides of each endcap that hold the endcaps in place. Insert needlenose pliers into the opening for one of the snaps and use the pliers to squeeze it together.

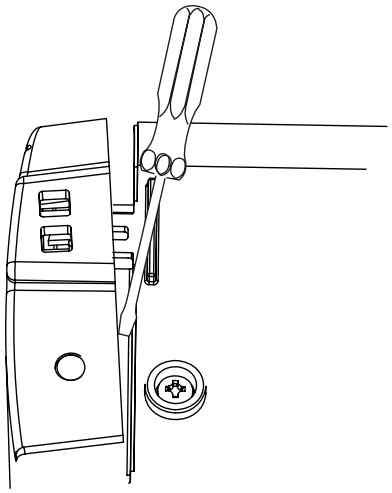
6. Place a flat-blade screwdriver against the raised rib next to the snap and gently turn the screwdriver to push the endcap away from the base.



7. Place another screwdriver or similar object into the opening between the endcap and the base to keep the first corner of the endcap from returning to its original position when you release the other corner.

8. Repeat steps 5 and 6 on the other corner of the endcap.

9. If you are completely removing the endcap to replace it, rather than removing it for better access to the interior of the power supply, you must also disconnect the torch lead, work lead, and ground clip from the front endcap or the power cord and gas supply connector from the rear endcap.



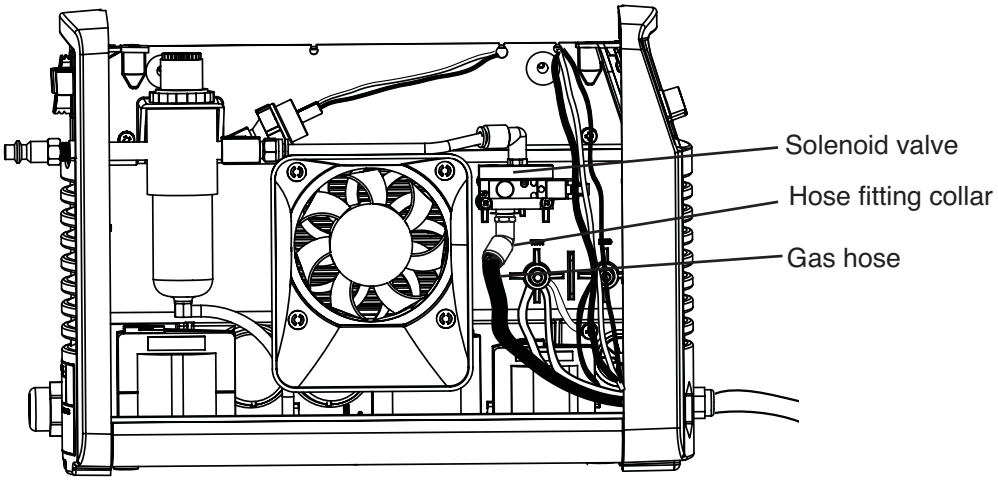
10. To replace the endcap, push it into the base to re-engage the snaps and then tighten the retaining screw. On the rear endcap, make sure that the hole in the ground clip is aligned with the screw holes in the endcap and the power supply before attempting to insert the retaining screw.

Replace the torch lead

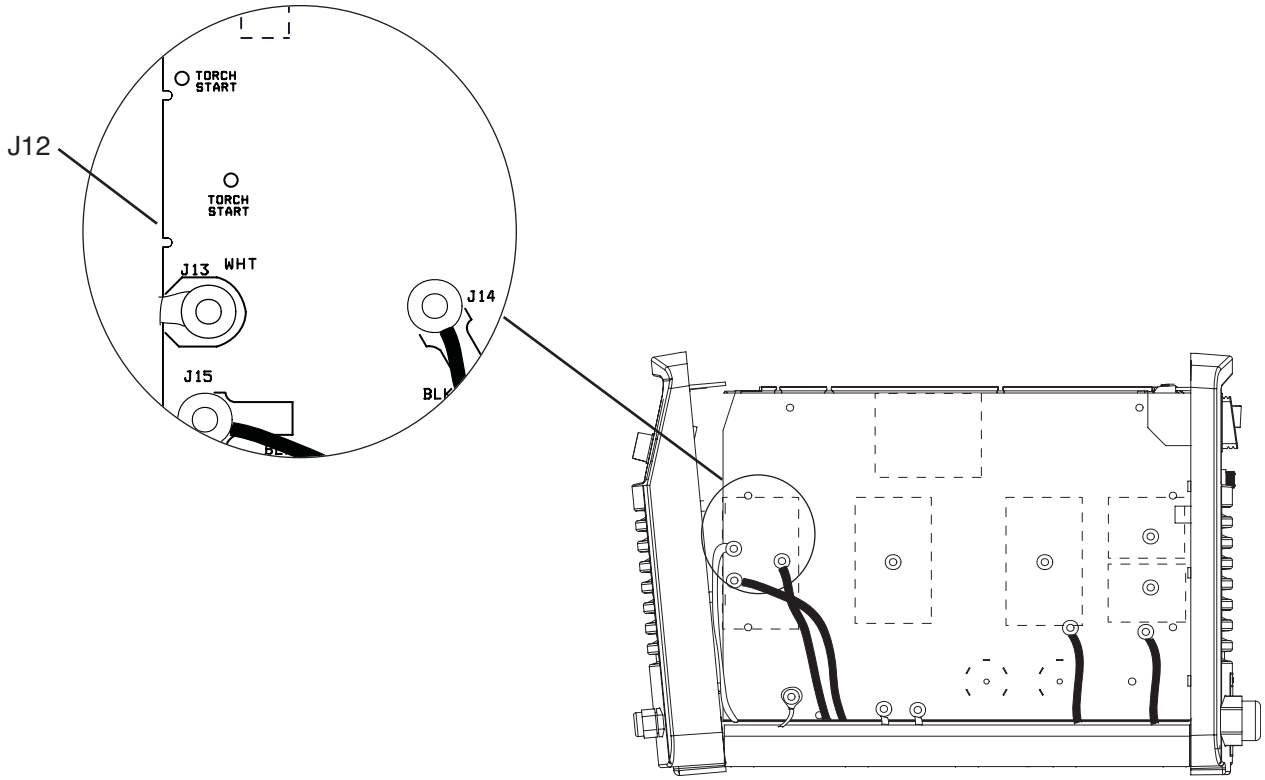
1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tilt the endcaps back slightly so that you can get the edges of the handle out from underneath the endcaps. Remove the handle and then lift the cover off the power supply. Remove the Nomex barrier that protects the power board.

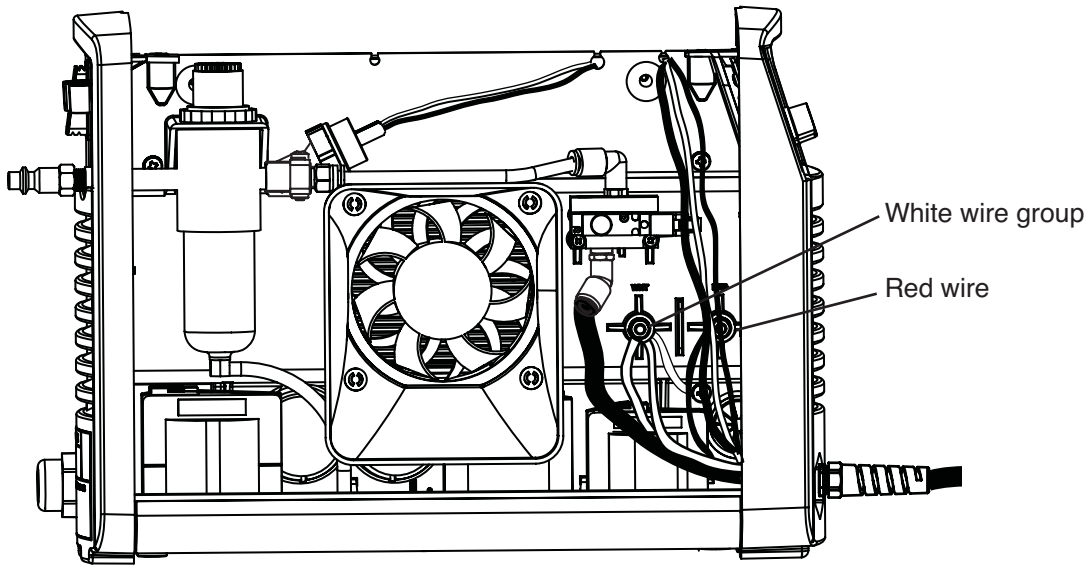
3. Compress the collar on the hose fitting and pull the hose from the fitting to remove the gas hose from the solenoid valve.



4. Carefully tilt the front endcap away from the power supply. The orange, blue, and purple wires from the torch lead are connected to the power board with a 3-pin connector at J12. Remove the connector by pulling it toward the front of the power supply.



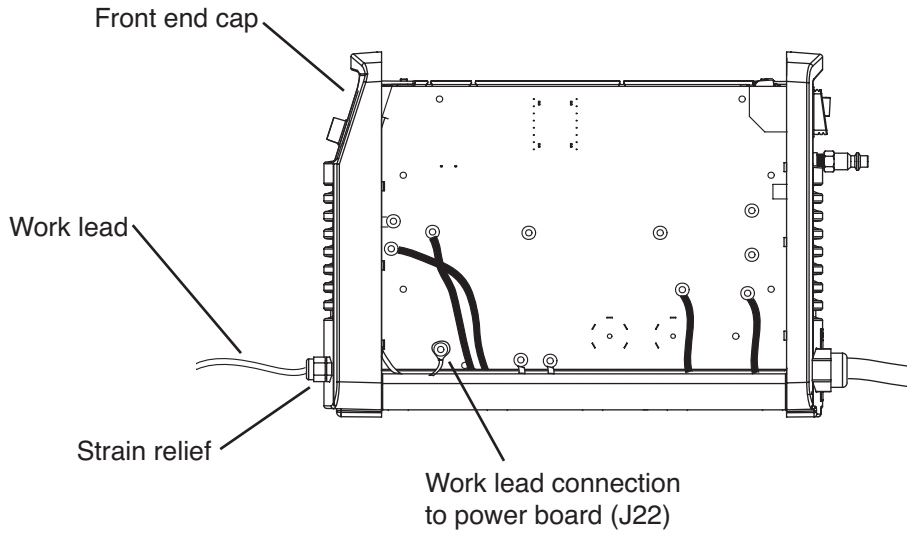
5. The white wire group and the red wire from the torch lead are secured to studs in the power supply's center panel on the fan side of the power supply. Use a 5/16-inch (8 mm) nut driver to remove the nuts from the studs and slide the ring terminals off the studs.



6. On the inside of the front endcap, unscrew the torch lead's strain relief retaining nut so that the torch lead moves freely. Remove the torch lead by pulling the wires and gas supply line through the hole in the endcap.
7. Route the wires and the gas supply line for the new torch lead through the hole in the endcap and then through the nut for the strain relief.
8. Tighten the torch lead's strain relief retaining nut onto the strain relief.
9. Push the torch's gas supply hose approximately .65 inch (16 mm) into the fitting on the bottom of the solenoid valve.
10. Slide the ring terminal for the white wire group over the left stud (labeled "WHT" on the center panel). Slide the ring terminal for the red wire onto the stud on the right (labeled "RED" on the center panel). Tighten the nut onto each stud.
11. Route the orange, blue, and purple wire group over the center panel with the wires resting in the notch in the panel. Press the connector into the slot on the power board.
12. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks.
13. Reposition the endcap. Make sure that the screw hole in the ground clip aligns with the screw holes in the endcap and the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
14. Reconnect the electrical power and the gas supply.

Replace the work lead

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply. Remove the Nomex barrier that protects the power board.
3. Remove and set aside the screw and washer from J22 on the power board (also labeled "WORK LEAD") that attaches the lead to the board.
4. Either remove the front endcap, or gently tilt it away from the power supply. Remove the strain relief's retaining nut. Pull the work lead through the hole in the endcap.



5. Route the connector end of the new work lead through the hole in the endcap and then through the retaining nut.

6. Tighten the nut onto the strain relief to hold it in place.

7. Attach the work lead to the power board at J22 using the screw and washer that you removed in step 3. The torque setting for this connection is 20 inch-pounds (23.04 kg cm).

8. Replace or realign the end cap.

9. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks.

10. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

11. Reconnect the electrical power and the gas supply.

Replace the power cord (CSA)

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply. Remove the Nomex barrier that protects the power board.

   The power cord has a black wire and a white wire that connect to the power switch, and a green ground wire that connects to the heatsink.

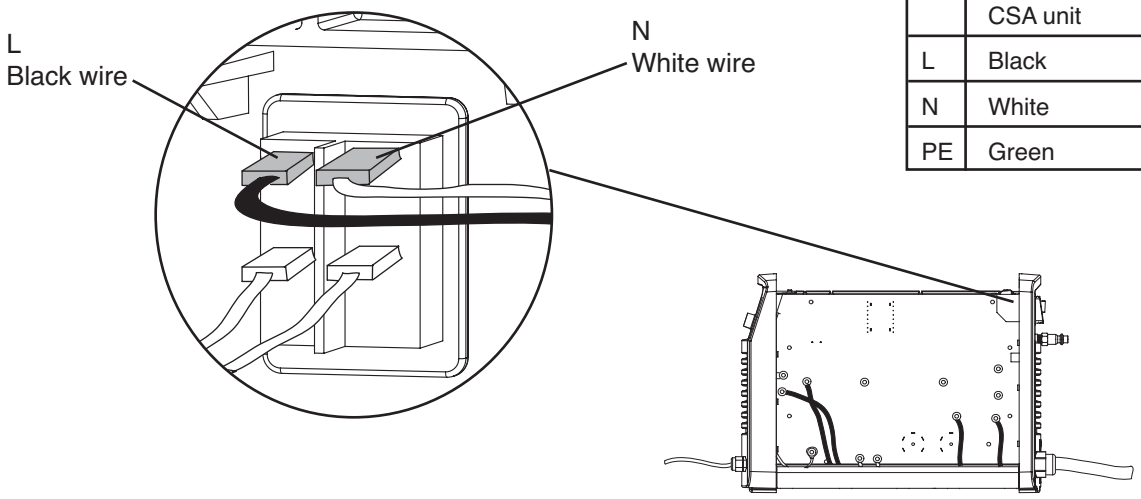
3. Remove the rear endcap or gently tilt it away from the power supply.

4. Carefully pull the connector for the white wire away from the power switch to disconnect it. You can use needlenose pliers or a straight screwdriver to ease it off, if necessary.

5. Remove the black wire the same way.

Single-phase

	CSA unit
L	Black
N	White
PE	Green



6. Remove the screw that holds the green wire to the heatsink. A notch in the power board provides access to the screw.

7. On the outside of the power supply, loosen the strain relief retention nut so that the wires move freely. If you will replace the strain relief, use an adjustable wrench to unscrew the nut on the inside of the power supply as well.

8. Pull the wires through the strain relief or through the hole in the endcap to remove the old power cord.
9. If you have a new strain relief, slide it onto the new power cord and route the wires for the new power cord through the hole in the endcap. If the old strain relief is still in place, route the wires through the strain relief.
10. Slide the strain relief's nut over the wires and screw it to the strain relief from the inside of the endcap.
11. Press the connector for the black wire onto the pin on the upper left side of the power switch.
12. Press the connector for the white wire onto the pin on the upper right side of the power switch.
13. Tighten the green ground wire to the heatsink with a torque setting of 15 inch-pounds (17.28 kg cm).
14. Position the wires in the wire chase up the side of the endcap and out of the way of the power board. Once the wires are in place, tighten the strain relief's retention nut.
15. Replace or reposition the endcap. Make sure that the screw hole in the ground clip aligns with the screw holes in the endcap and the power supply.
16. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
17. Reconnect the electrical power and the gas supply.

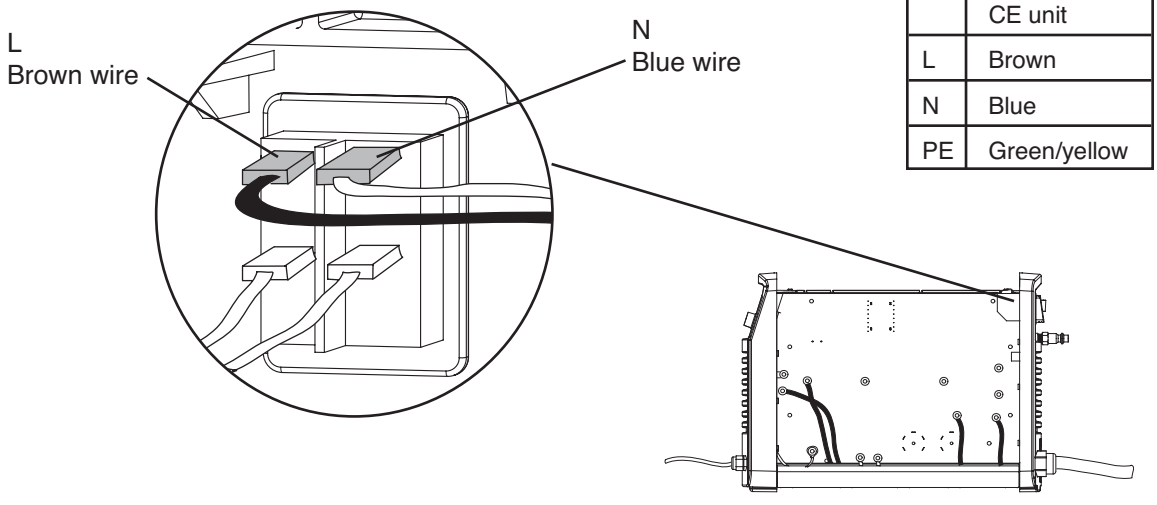
Replace the power cord (CE)

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply. Remove the Nomex barrier that protects the power board.

   The power cord has a brown wire and a blue wire that connect to the power switch and a green/yellow ground wire that connects to the heatsink.
3. Remove the rear endcap or gently tilt it away from the power supply.
4. Carefully pull the connector for the blue wire away from the power switch to disconnect it. You can use needlenose pliers or a straight screwdriver to ease it off, if necessary.
5. Remove the brown wire the same way.

Single phase

	CE unit
L	Brown
N	Blue
PE	Green/yellow



6. Remove the screw that holds the green/yellow ground wire to the heatsink. A notch in the power board provides access to the screw.

7. On the outside of the power supply, loosen the strain relief retention nut so that the wires move freely. If you are replacing the strain relief, use an adjustable wrench to unscrew the nut on the inside of the power supply as well.

8. Remove the plug from the old power cord.

9. From the inside of the power supply, pull the wires through the strain relief and the hole in the endcap to remove the old power cord.

10. Route the plug wires of the new power cord through the nut for the strain relief and then through the hole in the endcap. Do not remove the tubular ferrite bead from the power switch end of brown and blue wires.

11. If you have a new strain relief, slide it onto the new power cord. On the inside of the endcap, screw the nut onto the strain relief.

12. Press the connector for the brown wire onto the pin on the upper left side of the power switch.

13. Press the connector for the blue wire onto the pin on the upper right side of the power switch.

14. Tighten the green and yellow ground wire to the heatsink with a torque setting of 17.28 kg cm (15 inch-pounds).

15. Position the wires in the wire chase up the side of the endcap and out of the way of the power board.

16. Replace or reposition the endcap. Make sure that the screw hole in the ground clip aligns with the screw holes in the endcap and the power supply.

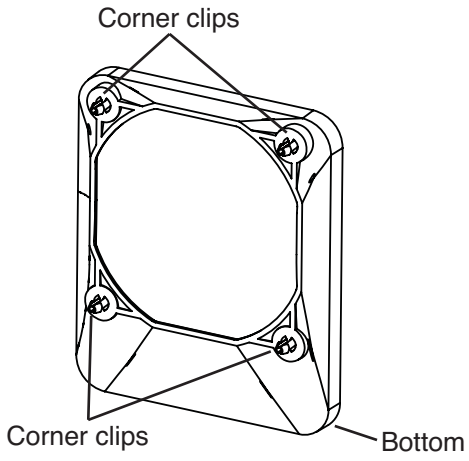
17. Tighten the strain relief retention nut on the outside of the endcap.

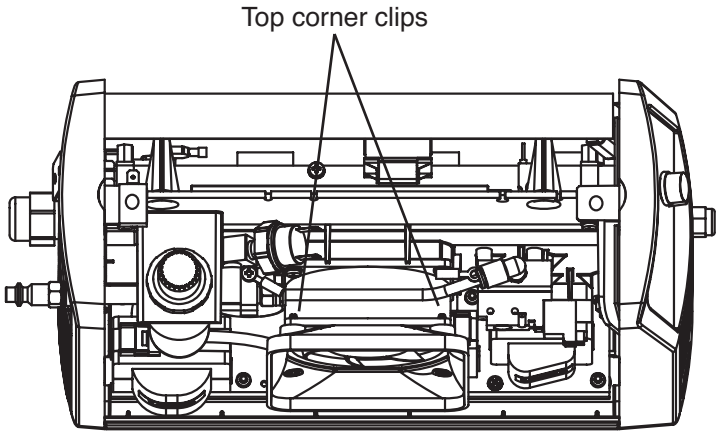
18. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

19. Reconnect the electrical power and the gas supply.

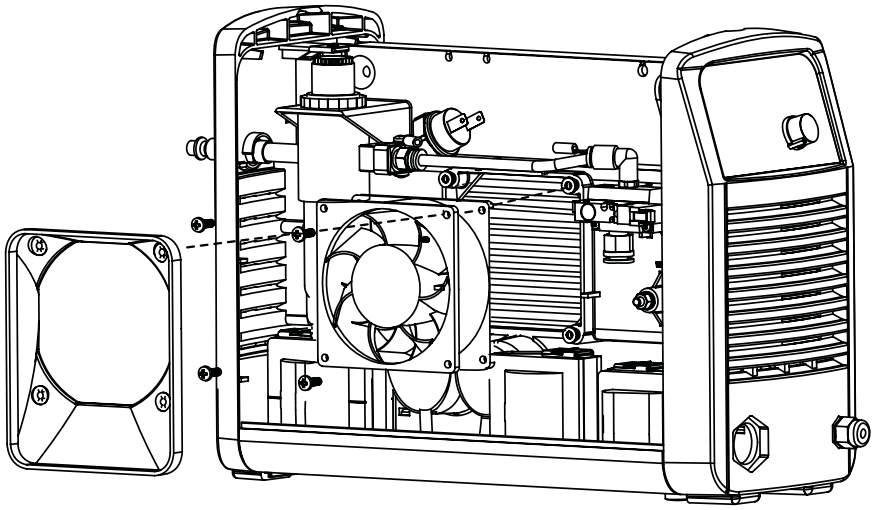
Replace the fan

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply.
3. Detach the connector from J5 on the power board. You may have to lift the top edge of the Nomex barrier to see the connector.
4. From the top of the power supply, use needlenose pliers to compress and release the 4 corner clips on the fan's plenum. After you release the top clips, you can tilt the plenum away from the power supply to reach the bottom 2 clips. Lift the plenum off the fan casing.





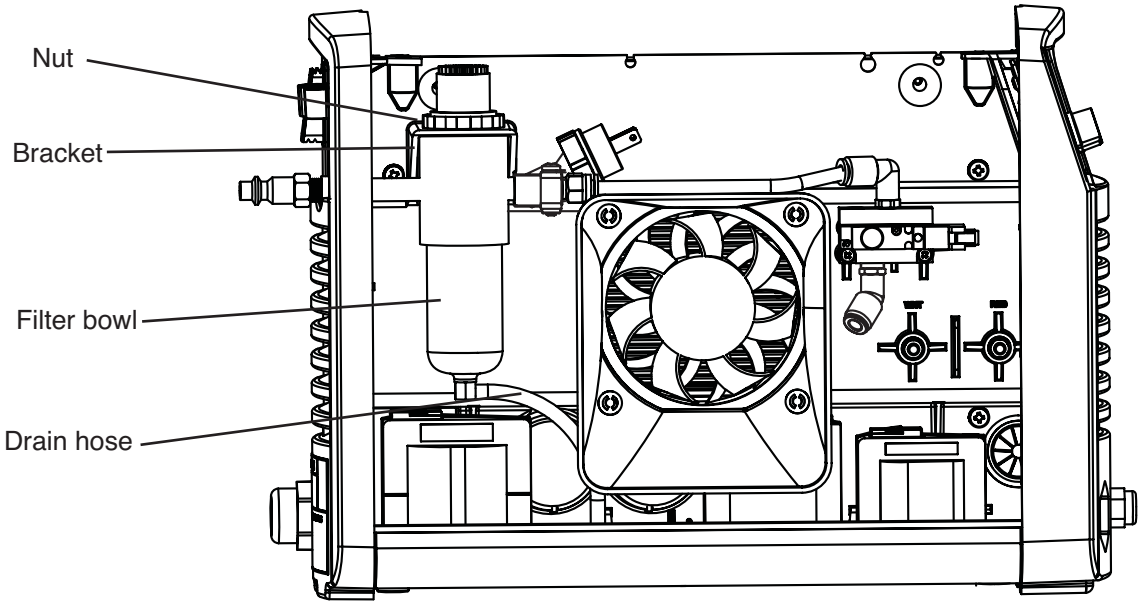
5. Insert a #1 Phillips screwdriver through the holes in the fan casing to remove the retaining screw from each corner of the fan.
6. Slide the old fan out from the power supply.
7. Slide the new fan into place.
8. Replace the 4 retaining screws.
9. Orient the fan plenum so that the wider end is at the bottom and snap it into place.



10. Attach the connector for the red and black wires on the left side of the fan to J5 on the power board.
11. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
12. Reconnect the electrical power and the gas supply.

Replace the air filter element

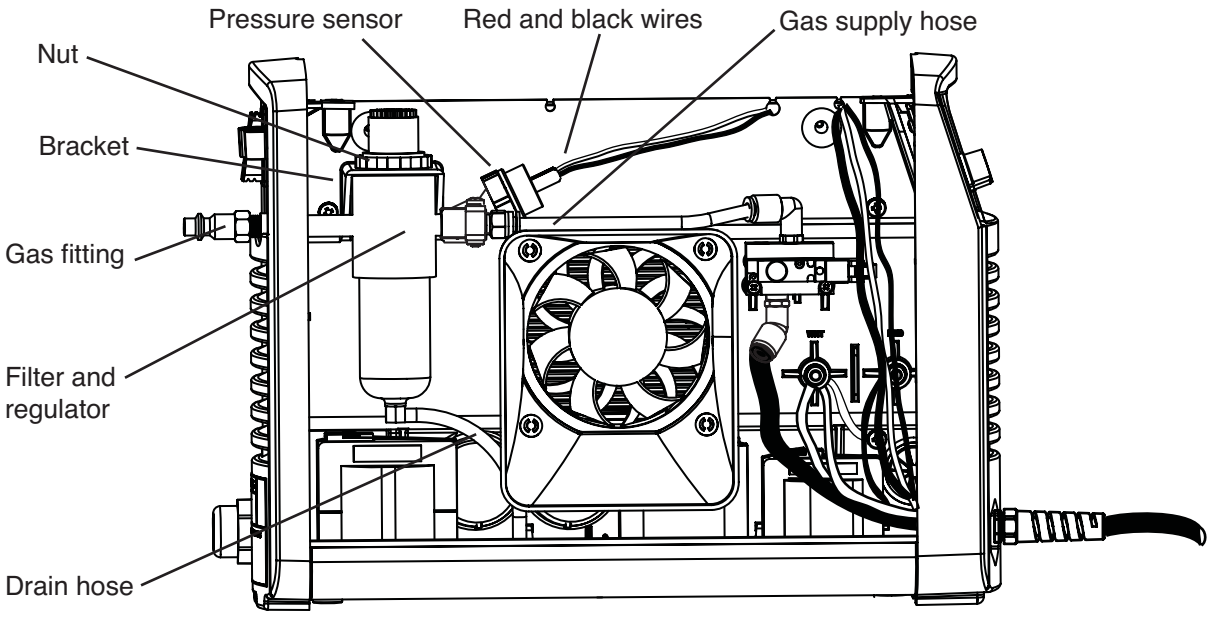
1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply.
3. Remove the drain hose from the hole in the bottom of the power supply's base.
4. Unscrew the nut that holds the air filter in the bracket. Tip the bottom of the air filter away from the power supply.
5. Unscrew the filter bowl from the body and remove it.



6. Unscrew the element from the filter body while being careful not to allow the element to rotate.
7. Screw the new element onto the filter body.
8. Reattach the filter bowl.
9. Reposition the air filter assembly in the bracket and replace its retainer nut.
10. Route the drain hose through the hole in the base of the power supply.
11. Reconnect the gas supply and check for leaks.
12. Being careful not to pinch any of the wires, slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
13. Reconnect the electrical power.

Replace the air filter and regulator

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply.
3. Remove the gas fitting from the rear of the power supply.
4. Remove the drain hose from the hole in the bottom of the power supply's base.
5. Disconnect the red and black wires from the pressure sensor.
6. Disconnect the gas supply hose from the filter.



7. Unscrew the nut that holds the air filter in the bracket. Tip the bottom of the air filter away from the power supply and slide the filter out of the bracket.
8. Position the new air filter in the bracket and replace the retainer nut.
9. Route the drain hose through the hole in the base of the power supply.
10. Press the black wire's connector onto the pin on the left side of the pressure sensor and the red wire's connector onto the pin on the right side of the pressure sensor.
11. Connect the gas supply hose to the new filter. If you are replacing the hose, cut the new hose to the same length as the old hose.
12. Reconnect the gas fitting, and then reconnect the gas supply to test it for leaks.
13. Being careful not to pinch any of the wires, slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
14. Reconnect the electrical power.

Replace the control board

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

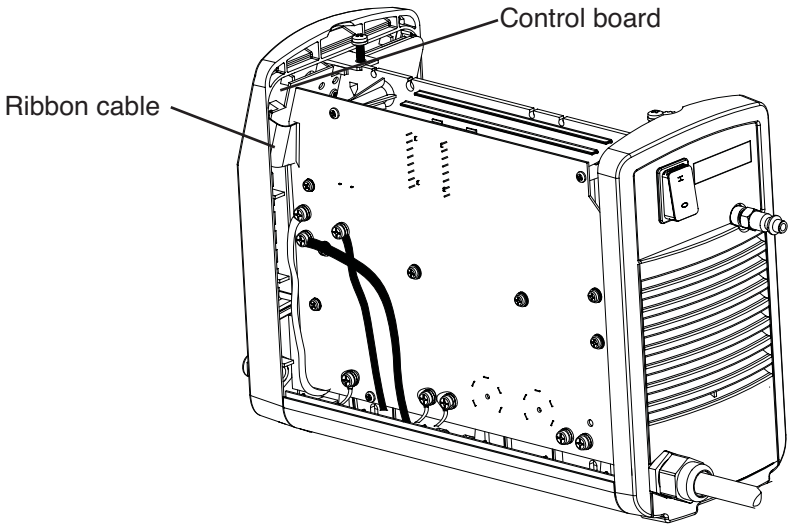
2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply. Remove the Nomex barrier that protects the power board.

3. Remove the front endcap, or gently tilt it away from the base.

4. Detach the ribbon cable from the power board.

Caution: 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.**



5. Test the new control board before installing it by attaching its ribbon cable to the power board. Reconnect the power, turn the system on, and verify that the Start LED on the control board is the only LED illuminated. Also, the fault LEDs on the front panel should be extinguished.

6. Disconnect electrical power and the ribbon cable again, and set aside the new control board.

7. Remove the 3 retaining screws from the old control board and lift it out of the power supply.

8. Screw the new control board into place with the 3 retaining screws and then attach the ribbon cable.

9. Reposition the front endcap. Make sure that the screw hole in the ground clip aligns with the screw holes in the endcap and the power supply.

10. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

11. Reconnect the electrical power and the gas supply.

Replace the power board

Before beginning this procedure, make sure you have the correct power board for your system. The replacement kit for a CSA power board is part number 228094. The replacement kit for a CE power board is part number 228102. Although there are some technical differences between the power board for CSA power supplies and the power board for CE power supplies, the procedure to replace the boards is the same.

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply. Remove the Nomex barrier that protects the power board.

Caution: 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.**

3. Detach the ribbon cable from the heatsink side of the power board. (See the illustration on the following page for the location of the ribbon cable and the components listed in the next steps.)

4. Remove the torch start and cap sensor connector at J12 on the heatsink side of the power board.

5. Remove the connectors at J4, J5, and J6 on the heatsink side of the power board.

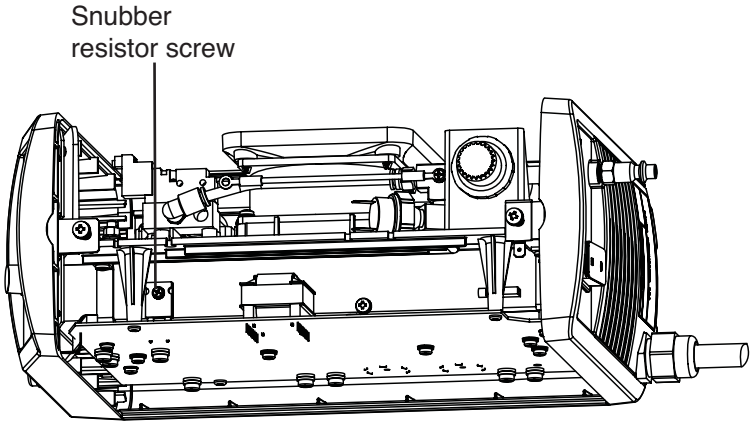
6. Remove the wires for the transformers and inductors at J13, J14, J15, J18, J19, J20, and J21**.**

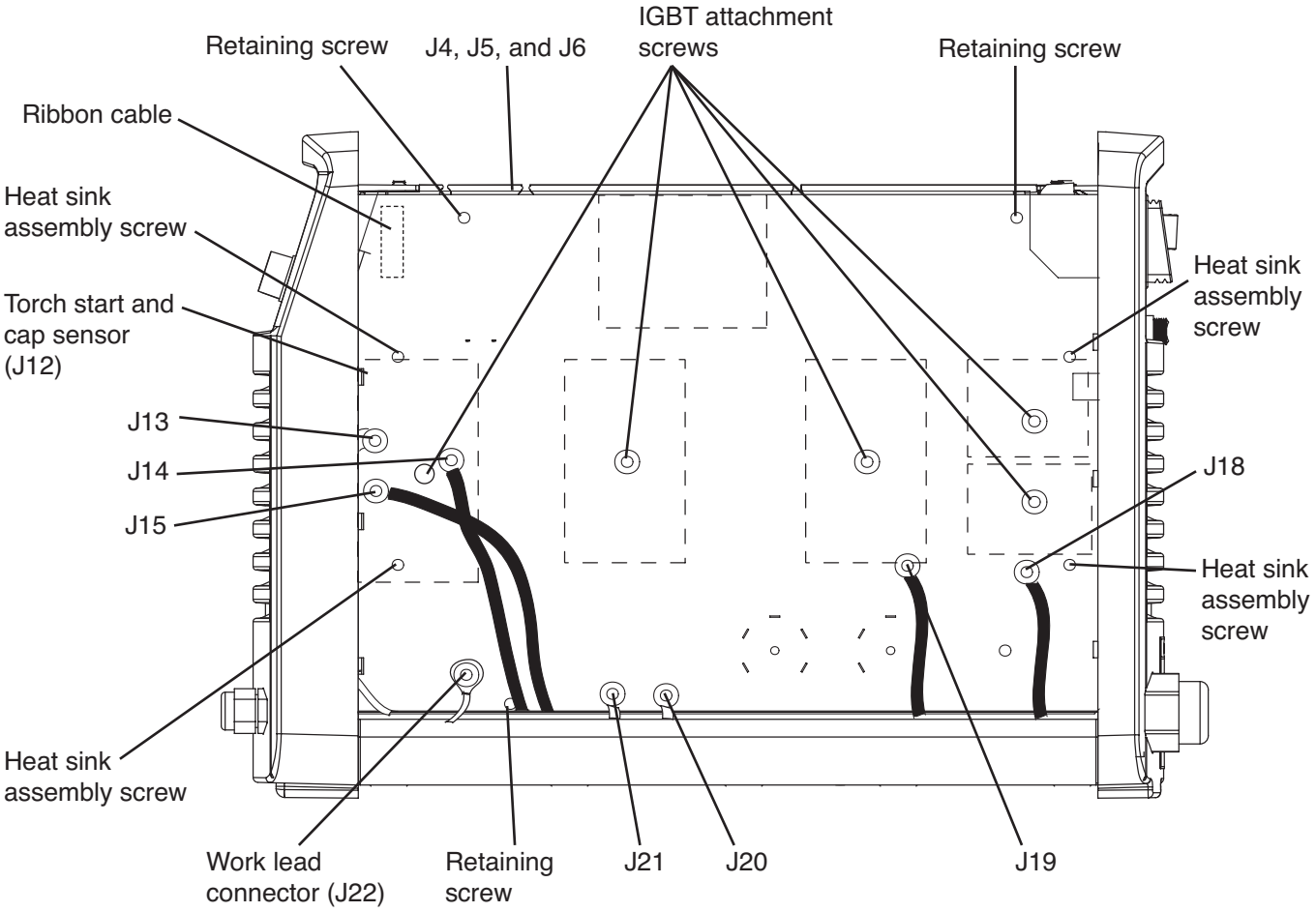
7. Remove the work lead ring terminal from J22.

8. Remove the 3 retaining screws and the 4 heatsink assembly screws.

9. Remove the 5 screws that attach the IGBTs to the heatsink. There are holes in the power board to provide access to them.

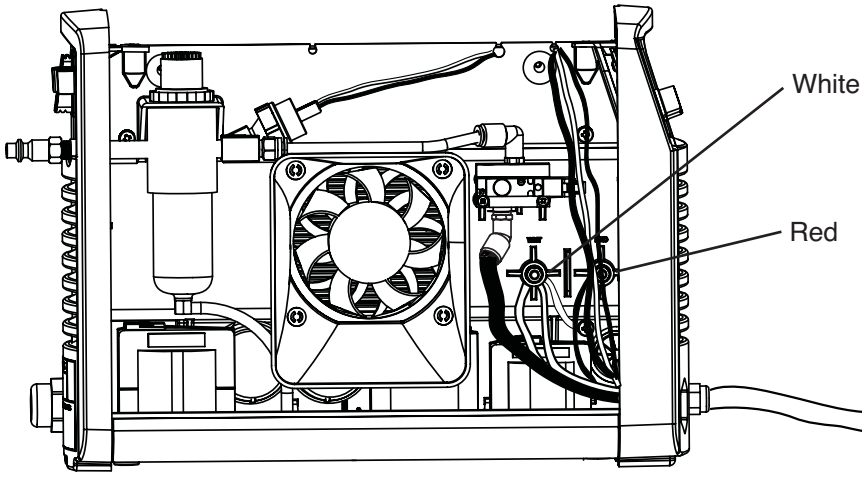
10. Remove the screw from the snubber resistor on the top of the heatsink.





11. Detach the bottom 2 wires (both are white) from the ON/OFF switch.

12. Lay the unit on its side (power board down) and use a 5/16-inch (8 mm) nut driver to remove the nuts that secure the red and the white wires that are routed underneath the board to the studs on the fan side of the unit. The studs are labeled “RED” and “WHT.”



13. Stand up the unit again. Tuck out of the way all the wires that you detached.

14. Pull the board straight out from the power supply.

15. Before installing a new power board, clean the heatsink with isopropyl alcohol. Gently scrub away any residual thermal compound, being careful not to scratch the heatsink. Wipe it with a clean cloth.

16. Spread a thin layer of thermal compound 2 mil thick (about the thickness of a sheet of paper) on all the IGBTs.

17. Spread a layer of thermal compound 2 mil thick on the snubber resistor, starting from the bottom and dragging toward the top (away from the prongs). It is important to avoid getting any compound on the prongs.

18. Push the red and white wires that are attached to the new power board through from the power board side of the power supply to the fan side of the power supply.

19. Line up the capacitors on the back of the power board with the holes in the power supply's center panel.

20. Push the power board straight in.

21. Reconnect the 2 white wires to the ON/OFF switch

22. Replace the 4 heatsink assembly screws and the 3 retaining screws. Torque these screws to 15 inch-pounds (17.28 kg cm).

23. Replace the screw you removed from the snubber resistor in step 10. Torque it to 7 inch-pounds (8.06 kg cm).

    Note: Torque settings greater than 7 inch-pounds (8.06 kg cm) may damage the resistor.

24. Replace the 5 screws that attach the IGBTs to the heatsink. The torque setting for these is 15 inch-pounds (17.28 kg cm).

25. Reconnect the wires to the transformers and inductors at J13, J14, J15, J18, J19, J20, and J21 and the work lead ring terminal at J22. Torque them to 20 inch-pounds (23.04 kg cm).

26. Replace the torch start and cap sensor connector at J12 and the connectors at J4, J5, and J6.

27. Reconnect the ribbon cable from the control board to the power board.

28. Attach the red and white wires to the studs on the fan side of the board.

29. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

30. Reconnect the electrical power and the gas supply.

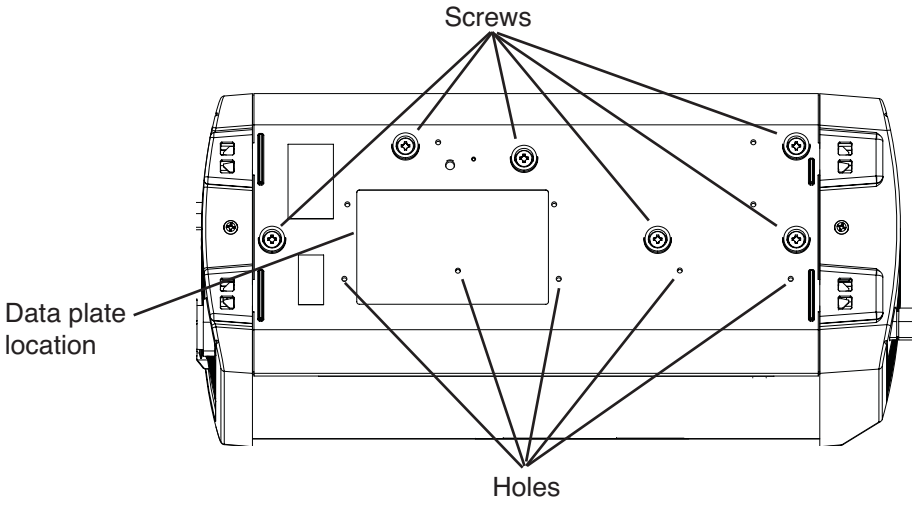
Replace the base

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Remove the 2 screws from the handle on the top of the power supply. Remove the handle and then lift the cover off the power supply. Remove the Nomex barrier that protects the power board.

3. Turn the power supply upside down and remove the 6 screws from the base.

4. Remove the endcaps and the Nomex barrier. See *Remove an endcap*, earlier in this section.



5. Carefully peel the data plate off the base. Set it aside. The data plate has your system's serial number on it, so do not lose it or tear it.

6. Place the wooden end of a swab, a stiff wire, or other similar item with a .092-inch (.23 cm) diameter in each of the 5 holes on the power board side of the base. Press each one until the clips release and you can pull the base away from the center panel.

7. Position the new base over the metal plate on the bottom of the power supply so that the screw holes align. Replace the 6 screws and press the data plate onto the new base.

8. Replace the endcaps. Make sure that the screw hole in the ground clip on the front endcap aligns with the screw holes in the endcap and the power supply.

9. Being careful not to pinch any of the wires, replace the Nomex barrier and slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

10. Reconnect the electrical power and the gas supply.

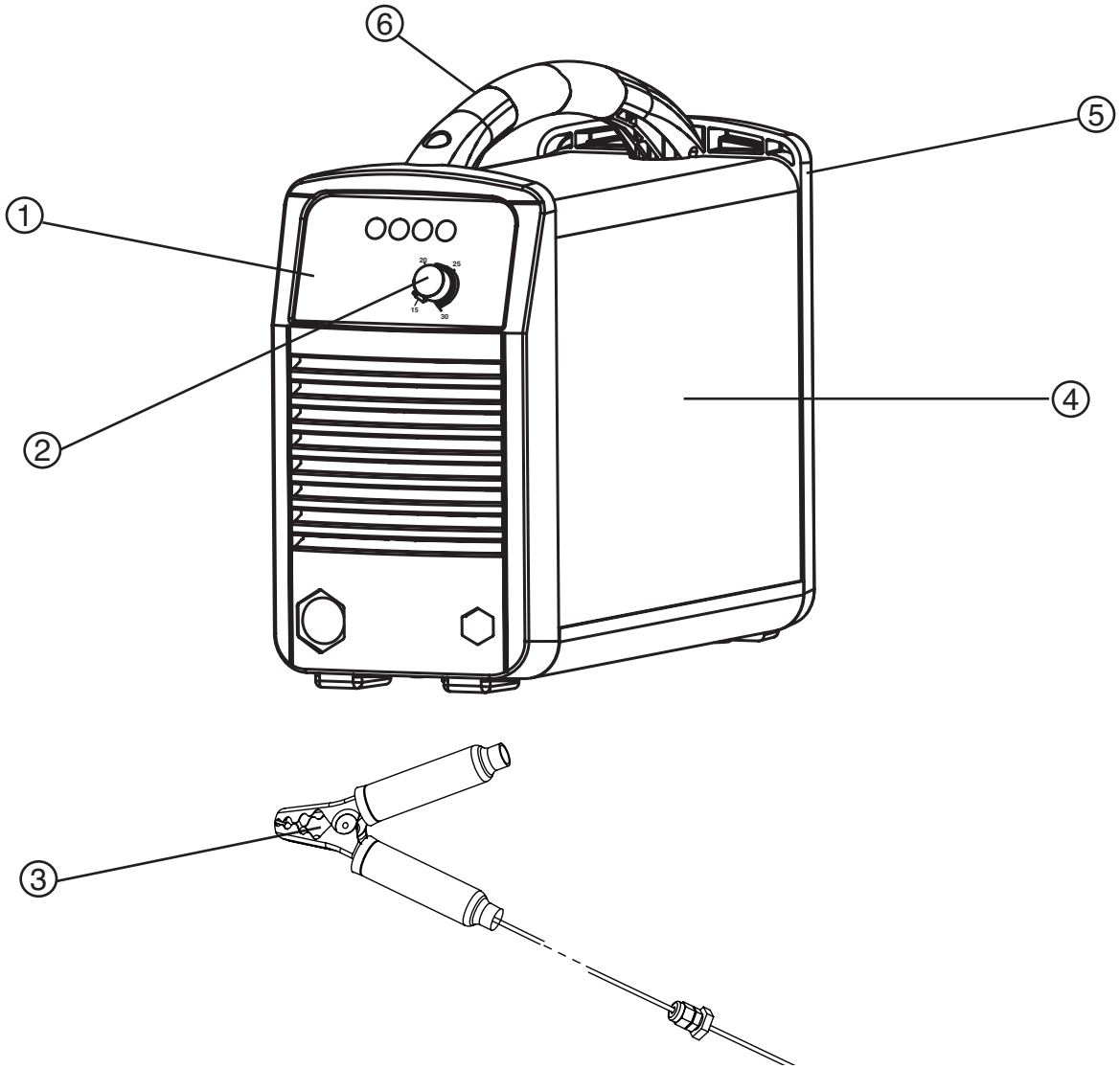
Section 4

PARTS

In this section:

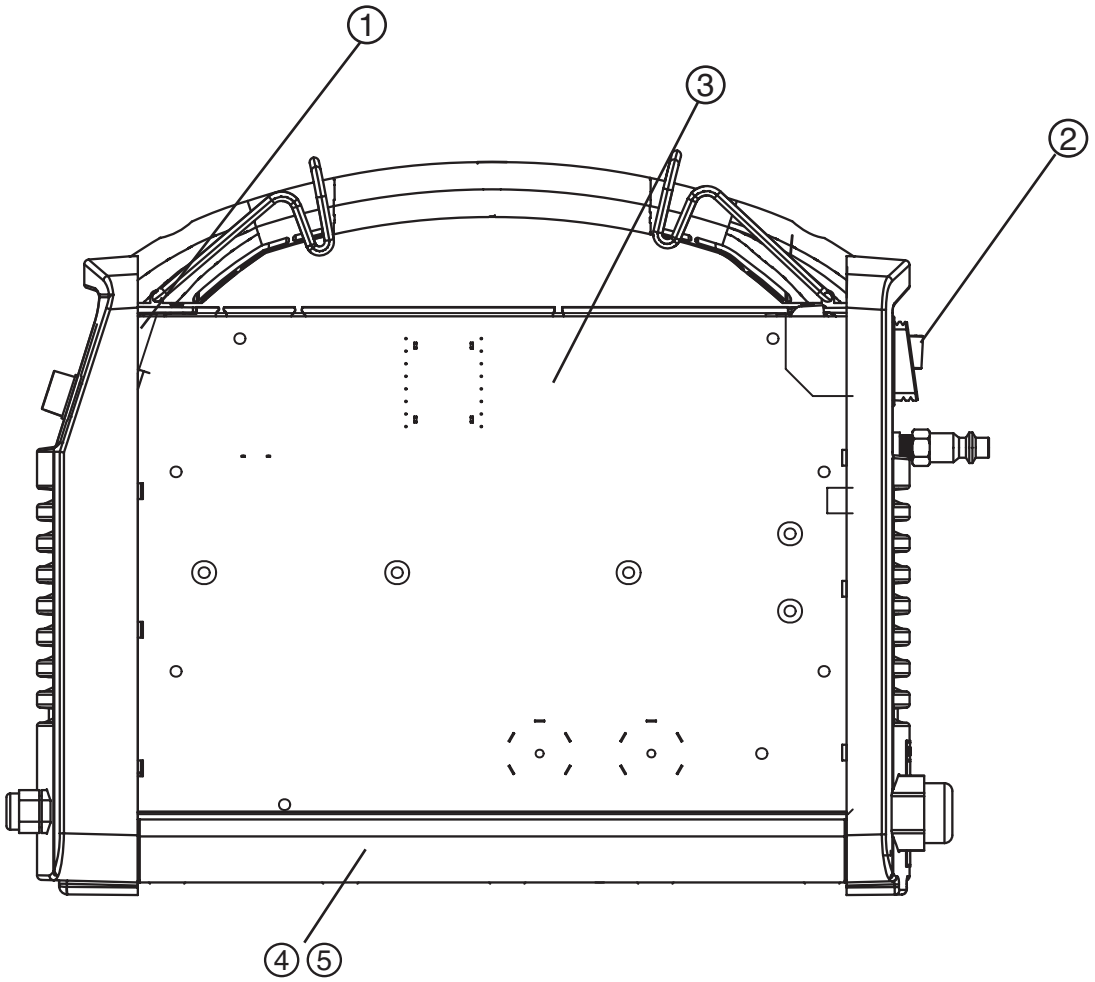
Power supply parts

Exterior



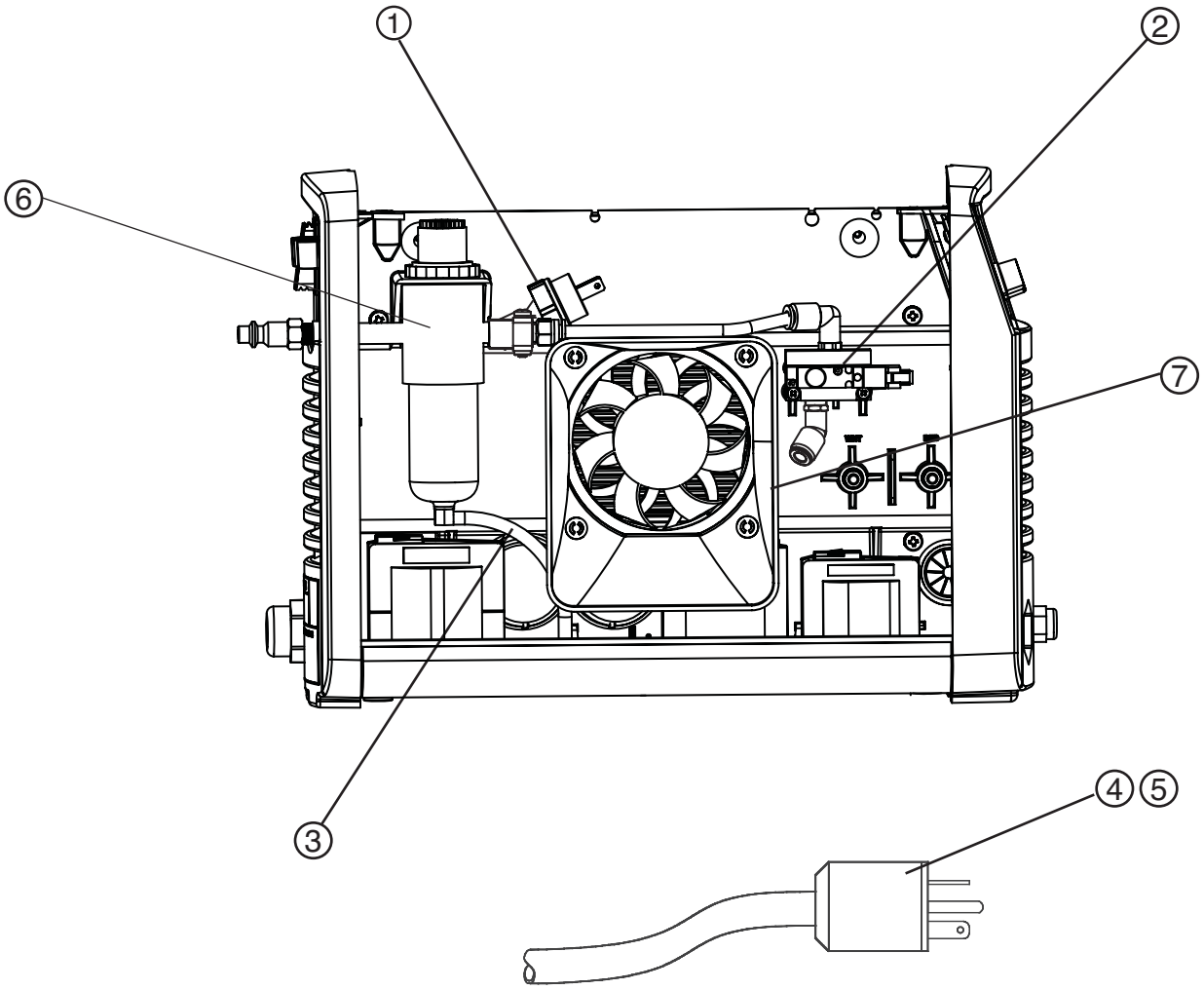
Item	Part number	Description	Qty.
	228098	Kit: Labels, domestic	1
	228097	Kit: Labels, CE	1
	228096	Kit: Screws	49
1	228101	Kit: Front panel	1
2	108616	Current adjustment knob	1
3	123868	Work lead assembly	1
4	229121	Kit: Power supply cover with labels, domestic	1
	229122	Kit: Power supply cover with labels, CE	1
5	228100	Kit: Rear panel	1
6	228099	Kit: Powermax30 handle	1

Interior, power board side



Item	Part number	Description	Designator	Qty.
1	228093	Kit: Control board	PCB1	1
2	005605	Power rocker switch		1
3	228094	Kit: Power board, CSA	PCB2	1
	228102	Kit: Power board, CE	PCB2	1
4	228139	Kit: Base		1
5	228105	Kit: Magnetic mounting base		1
	228104	Kit: Powermax30 insulator		1
	228103	Kit: Powermax30 wire group		1

Interior, fan side



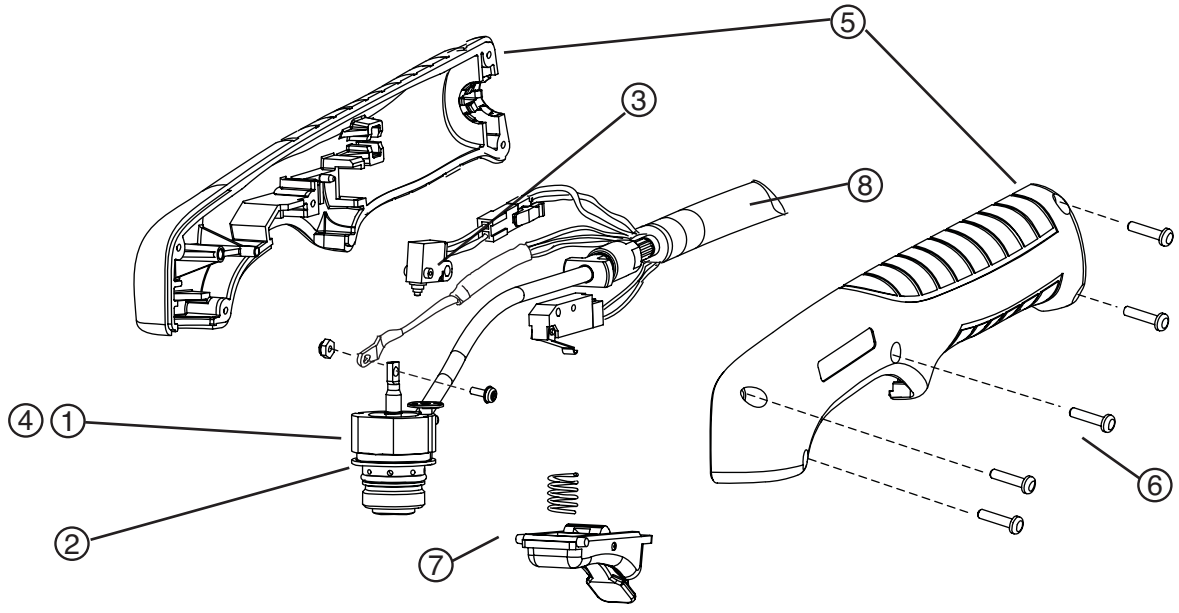
Item	Part number	Description	Designator	Qty.
1	005112	Kit: Pressure sensor		1
2	228108	Kit: Solenoid valve	V1	1
3	228095	Kit: Hoses		2
4	228142	Kit: CSA power cord, 1-phase, 8 ft		1
5	228140	Kit: CE power cord, 1-phase, 2.5 m		
6	228106	Kit: Filter regulator		1
	011106	Air filter element		1
7	228107	Kit: Fan	M1	1

T30v hand torch parts

Item	Part number	Description	Quantity
	088001*	T30v hand torch assembly with 15 ft (4.6 m) lead	
1	228112	Kit: T30v torch head replacement	1
2	058503	O-ring	1
3	228109	Kit: Cap-off sensor replacement	1
4	228110	Kit: T30v torch head repair kit	1
5	228111	Kit: T30v torch handle replacement	1
6	075714	Screws: #4 x 1/2 SLTD Torx PAN, S/B	5
7	002244	Safety trigger and spring replacement	1
8	228113	Kit: T30v 15 ft (4.6 m) torch lead replacement	1

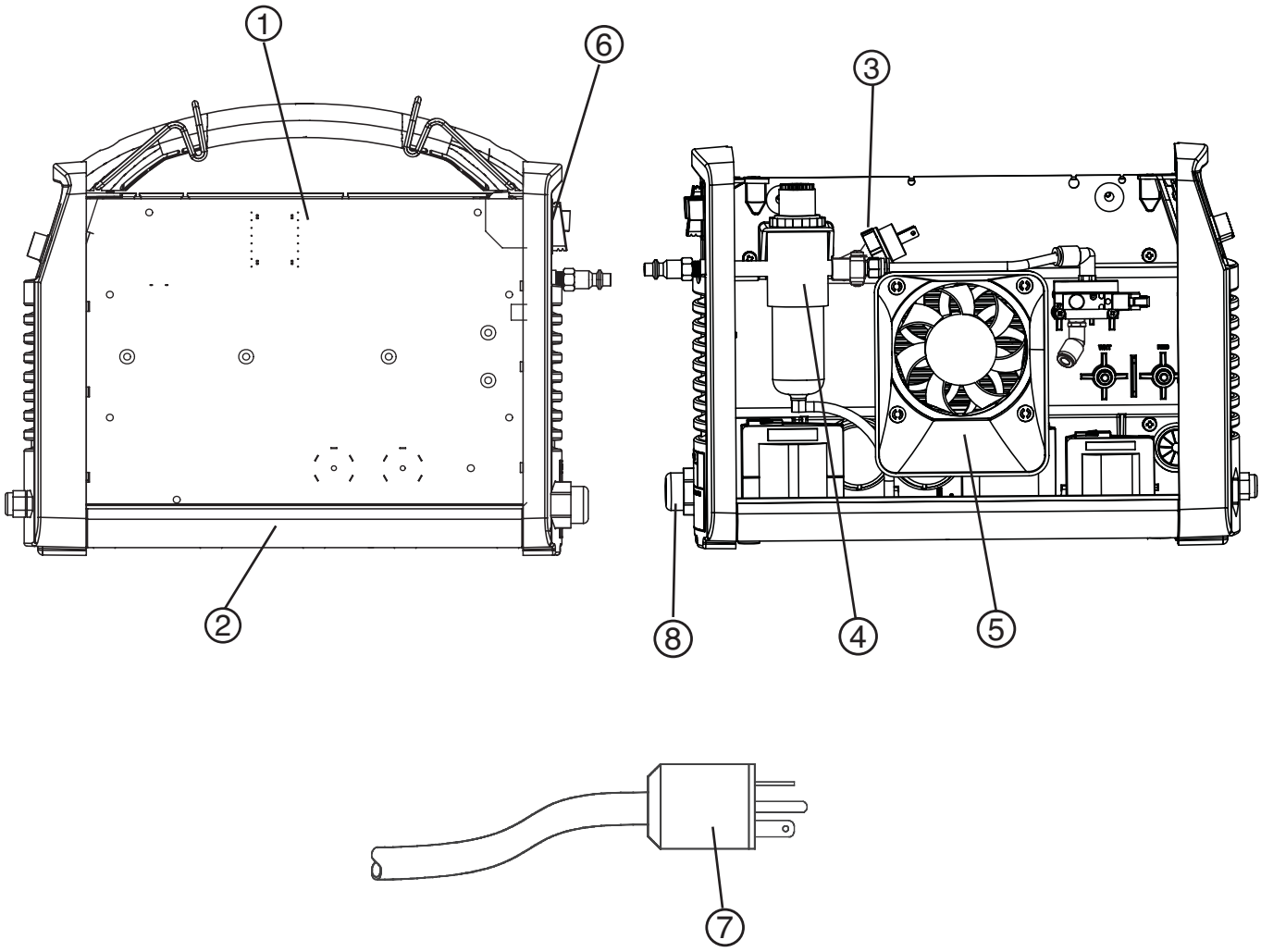
* Top assembly includes the following consumables:

220478	Electrode	1
220479	Swirl ring	1
220483	Retaining cap	1
220480	Nozzle	1



Safety-critical parts

Genuine Hypertherm parts are the factory-recommended 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. In addition, the parts listed below are considered safety-critical parts that must be replaced only with Hypertherm parts to maintain the warranty and all system certifications, including CE, CSA, GOST, and CCC certification.



Item	Part number	Description
1	228094	Kit: Power board (CSA) and subcomponents
	228102	Kit: Power board (CE) and subcomponents
2	228105	Kit: 30 A magnetics
3	005112	Filter/regulator pressure switch
4	228106	Kit: Filter/regulator
5	228107	Kit: Fan
6	005605	Rocker switch
7	228142	Kit: Power cord, 115 VAC (CSA)
	228140	Kit: Power cord, (CE)
8	228143	Kit: Strain relief

Recommended spare parts

Part number	Description	Page reference
108616	Amps adjustment knob	4-2
123868	Work cable with clamp, 15 ft (4.6 m)	4-2
228101	Kit: Front panel	4-2
228100	Kit: Rear panel	4-2
005605	Power rocker switch	4-3
228093	Kit: Control board	4-3
228094	Kit: Power board	4-3
228102	Kit: Power board, CE	4-3
228139	Kit: Base	4-3
228105	Kit: Magnetic mounting base	4-3
005112	Pressure sensor	4-4
228108	Kit: Solenoid valve	4-4
228106	Kit: Filter regulator	4-4
011106	Air filter element	4-4
228107	Kit: Fan	4-4
058503	Torch o-ring	4-5
228111	Kit: T30v torch handle replacement	4-5
075714	T30v torch handle screws (5 required)	4-5
002244	T30v torch trigger assembly with spring	4-5
027254	Replacement trigger spring, T30v	4-5
128642	Kit: Start switch replacement	4-5
228109	Kit: T30v torch cap sensor replacement	4-5
088001	T30v hand torch assembly with 15 ft (4.6 m) lead	4-5
228113	Kit: T30v 15 ft (4.6 m) torch lead replacement	4-5
027055	Silicone lubricant, 1/4 oz. tube	

Section 5

WIRING DIAGRAM

In this section:

MACHINE

REAR

16A/250V DPST

12AWG

POWER PWA

041950 (Top Level)

7.85"h x 11.20"w

2oz plated to 3oz

FACING COMPONENT SIDE of POWER BD

CONTROL PWA

041953 (Top Level) 4 LAYER

2.35"h x 5.00"w

MACHINE

FRONT

L

R

PRESSURE SW

005112

Low Press=OPEN

FAN

110CFM

24vi/0.50A

GAS SOL

24vi/0.13A

J1

J2

J4

J5

J6

+24

/FAN

/GAS

SSR

FAN

GAS

L9338MD

J7

EE PROM

26 POS RIBBON CABLE

/RESET or HDR FLT

ERROR CODE

XFR

START

SERIAL DATA

JTAG/EMULATION CONNECTOR

TEMP

CAPOFF "TSO"

GAS LOW

POWER ON "L/H LINE"

YEL

YEL

YEL

GRN

DSP 2801

4x25Mhz=100Mhz

0.78 x 0.78"

Stayout for

TEST CLIP

AMPS

MPX5700 BACK-UP PRESSURE SENSOR NOT USED

5.51"-7.85"

1.72" MAX

Height Zone

10 150J

6.8uf 300vac X2

CM Choke 16arms

CM Choke Installed on CE unit only

LAX100-NP

75k 2w

18 INVU

COM INVU

375VDC

TOP247

2.21M

18REG

-VBUS

E36/18/11

18PA

COMPA

18T

COMT

+24

+5

+3.3

Fsw = 66khz

UVLO = 110vdc (80vac)

OVLO = 495vdc

HCPL-7840

Vbus

Vacr

y=2.09"-5.51"

0.472" MAX

Height Zone

PFC IGBT MODULE

INVERTER IGBT MODULE

-Vbus

Fpfc=28khz

Iline Limit

37.5arms

Finv=42khz

600V

90A

0.33uF

630VDC

PFC DIODE

60A 600V

CLAMP DIODE

60A 600V

nc

375vdc

OUTPUT DIODE and

PILOT ARC IGBT MODULE

1200V

35A

3.3nF

1000VDC

15 ohm

50W TO247

MTG4

CONTROL to

CHASSIS GND

WHT WIRE

J12

J13

J14

J15

J16

RED

HEAT SINK

MTG3

LIFT to

Hipot

.01uF Y2

300vac

35A

1200V

INPUT BRIDGES

MTG6

MTG8

LIFT to

Hipot

4.7nF

300vac

Y2

y=0.00"-2.09"

1.00" MAX

Height Zone

OUTPUT CURRENT SENSOR

TRANSFER SENSOR

J17

WHT

12AWG UL1569 WHT

3.9uF

630VDC

2.7uF

630VDC

15

4W

27K

3W

2200uF

250VDC

LOW INDUCTANCE LAYOUT

INV IPRIM

20K

3W

0.01uF

300vac

Loutput 014309

L0=410uH

L30=270uH

Rdc20C=19mohm

CAP SW NC

BLUE

ORG

VIOLET

START

M5 in Plastic

WHITE

ELECTRODE

12AWG UL1569 RED

RED

NOZZLE

12AWG UL1015 BLK

WORK LEAD

MUELLER

J18

J19

J20

J21

J22

PE 98-264vac

47-63hz

CORD

STD Unit 14/3 SO Dia=0.53"

CE Unit H05VV-F3G2.5 Dia=0.39"

Lpfc 014307

L0=350uh

L60=185uh

Rdc20C=21.5mohm

11T

14T

POWER XFMR 014308

Twisted Leads

Lprim=0.75mH Rprim20C=4.8mohm

Rsec20C=10.5mohm

Lleak=0.5uH Typ

HYPERTHERM

Box 5010 Hanover, NH 03755-5010 (603) 643-3441

Description: ELEC SCHEM:PMX30 SYS

Drawn By: Date: 10-5-06

Approved By: Date: 10-6-06

Size: D | Drawing Number: 013-2-364 | File Name: 0130481 | Stock Number: 013364 | Rev: 4

Sheet 1 of 1