

MAX20®

**(200/220/240V, 1-Ph,
50/60 Hz)**

Plasma Arc Cutting System

***Instruction Manual
801310 – Revision 4***



EN50199
EN60974-1

Hypertherm®
*The world leader in
plasma cutting technology*

MAX20

(200/220/240 Volt, 1-Ph, 50/60 Hz)

Instruction Manual

(P/N 801310)

Revision 4 – November 2001

**Hypertherm, Inc.
Hanover, NH USA**
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EMC INTRODUCTION

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

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

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

INSTALLATION AND USE

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

ASSESSMENT OF AREA

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

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

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

METHODS OF REDUCING EMISSIONS

Mains Supply

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

Maintenance of Cutting Equipment

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

Cutting Cables

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

Equipotential Bonding

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

Earthing of Workpiece

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

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

Screening and Shielding

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

WARRANTY

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 G3 Series power supplies, which shall be within a period of three (3) years from the date of delivery to you, and (ii) with respect to the torch and leads within a period of one (1) year from its date of delivery to you. This warranty shall not apply to any Product which has been incorrectly installed, modified, or otherwise damaged. Hypertherm, at its sole option, shall repair, replace, or adjust, free of charge, any defective Products covered by this warranty which shall be returned with Hypertherm's prior authorization (which shall not be unreasonably withheld), properly packed, to Hypertherm's place of business in Hanover, New Hampshire, or to an authorized Hypertherm repair facility, all costs, insurance and freight prepaid. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph or with Hypertherm's prior written consent. **The warranty above is exclusive and is in lieu of all other warranties, express, implied, statutory, or otherwise with respect to the Products or as to the results which may be obtained therefrom, and all implied warranties or conditions of quality or of merchantability or fitness for a particular purpose or against infringement. The foregoing shall constitute the sole and exclusive remedy for any breach by Hypertherm of its warranty.** Distributors/OEMs may offer different or additional warranties, but Distributors/OEMs are not authorized to give any additional warranty protection to you or make any representation to you purporting to be binding upon Hypertherm.

PATENT INDEMNITY

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

Hypertherm, infringes any patent of any third party. You shall notify Hypertherm promptly upon learning of any action or threatened action in connection with any such alleged infringement, and Hypertherm's obligation to indemnify shall be conditioned upon Hypertherm's sole control of, and the indemnified party's cooperation and assistance in, the defense of the claim.

LIMITATION OF LIABILITY

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

LIABILITY CAP

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

INSURANCE

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

NATIONAL AND LOCAL CODES

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

TRANSFER OF RIGHTS

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

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Section 1

SAFETY

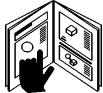
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RECOGNIZE SAFETY INFORMATION

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



FOLLOW SAFETY INSTRUCTIONS

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

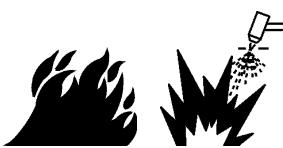
- Keep the safety labels on your machine in good condition. Replace missing or damaged labels immediately.
- Learn how to operate the machine and how to use the controls properly. Do not let anyone operate it without instruction.

- Keep your machine in proper working condition. Unauthorized modifications to the machine may affect safety and machine service life.

DANGER WARNING CAUTION

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

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



CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire Prevention

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

Explosion Prevention

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



WARNING

Explosion Hazard
Argon-Hydrogen and Methane

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



WARNING

Hydrogen Detonation with Aluminum Cutting

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



ELECTRIC SHOCK CAN KILL

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

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

Electric Shock Prevention

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

- Wear insulated gloves and boots, and keep your body and clothing dry.
- Do not stand, sit or lie on – or touch – any wet surface when using the plasma system.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must work in or near a damp area, use extreme caution.
- Provide a disconnect switch close to the power supply with properly sized fuses. This switch allows the operator to turn off the power supply quickly in an emergency situation.
- When using a water table, be sure that it is correctly connected to earth ground.

- Install and ground this equipment according to the instruction manual and in accordance with national and local codes.
- Inspect the input power cord frequently for damage or cracking of the cover. Replace a damaged power cord immediately. **Bare wiring can kill.**
- Inspect and replace any worn or damaged torch leads.
- Do not pick up the workpiece, including the waste cutoff, while you cut. Leave the workpiece in place or on the workbench with the work cable attached during the cutting process.
- Before checking, cleaning or changing torch parts, disconnect the main power or unplug the power supply.
- Never bypass or shortcut the safety interlocks.
- Before removing any power supply or system enclosure cover, disconnect electrical input power. Wait 5 minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply covers are in place. Exposed power supply connections present a severe electrical hazard.
- When making input connections, attach proper grounding conductor first.
- Each Hypertherm plasma system is designed to be used only with specific Hypertherm torches. Do not substitute other torches which could overheat and present a safety hazard.



CUTTING CAN PRODUCE TOXIC FUMES

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

- Keep the cutting area well ventilated or use an approved air-supplied respirator.
- Do not cut in locations near degreasing, cleaning or spraying operations. The vapors from certain chlorinated solvents decompose to form phosgene gas when exposed to ultraviolet radiation.
- Do not cut metal coated or containing toxic materials, such as zinc (galvanized), lead, cadmium or

beryllium, unless the area is well ventilated and the operator wears an air-supplied respirator. The coatings and any metals containing these elements can produce toxic fumes when cut.

- Never cut containers with potentially toxic materials inside – they must be emptied and properly cleaned first.
- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer.



A PLASMA ARC CAN CAUSE INJURY AND BURNS

Instant-On Torches

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

The plasma arc will cut quickly through gloves and skin.

- Keep away from the torch tip.
- Do not hold metal near the cutting path.
- Never point the torch toward yourself or others.



ARC RAYS CAN BURN EYES AND SKIN

Eye Protection Plasma arc rays produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.

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

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



| Lens Shade | |
|------------|-----------|
| AWS (USA) | ISO 4850 |
| No. 8 | No. 11 |
| No. 10 | No. 11-12 |
| No. 12 | No. 13 |
| 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.

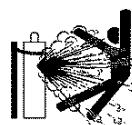
Work Table Connect the work table to an earth ground, in accordance with appropriate national or local electrical codes.

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.

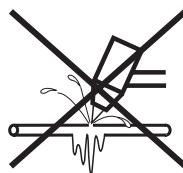
- Handle and use compressed gas cylinders in accordance with applicable national or local codes.
- Never use a cylinder that is not upright and secured in place.
- Keep the protective cap in place over valve except when the cylinder is in use or connected for use.
- Never allow electrical contact between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

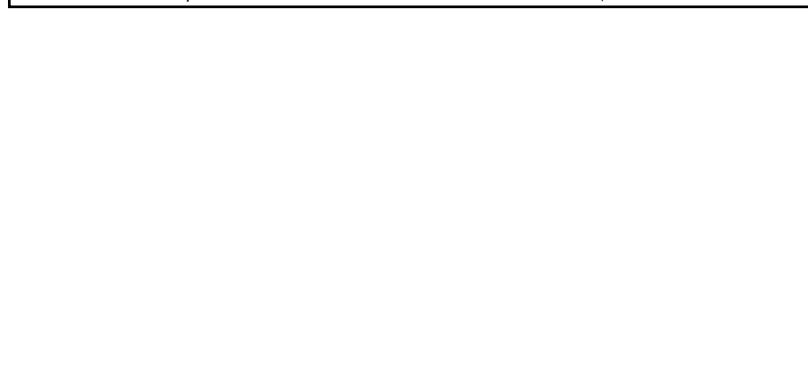
1. ANSI Standard Z49.1, *Safety in Welding and Cutting*, American Welding Society, 550 LeJeune Road P.O. Box 351020, Miami, FL 33135
2. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*, American National Standards Institute 1430 Broadway, New York, NY 10018
3. ANSI Standard 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

SAFETY

WARNING LABEL

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



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

Section 1

SÉCURITÉ

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SÉCURITÉ



IDENTIFIER LES CONSIGNES DE SÉCURITÉ

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



SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

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

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

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

DANGER AVERTISSEMENT PRÉCAUTION

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

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



LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

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

Prévention des explosions

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



AVERTISSEMENT

Risque d'explosion
argon-hydrogène et méthane

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



AVERTISSEMENT

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

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



LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

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

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

Prévention des chocs électriques

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

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

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



LE COUPAGE PEUT PRODUIRE DES VAPEURS TOXIQUES

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

- Conserver le poste de coupage bien aéré ou utiliser un masque respiratoire homologué.
- Ne pas procéder au coupage près d'endroits où s'effectuent le dégraissage, le nettoyage ou la vaporisation. Certains solvants chlorés se décomposent sous l'effet des rayons ultraviolets et forment du phosgène.
- Ne pas couper des métaux peints ou contenant des matières toxiques comme le zinc (galvanisé), le plomb, le cadmium ou le beryllium, à moins que la zone de travail

soit très bien ventilée et que l'opérateur porte un masque respiratoire. Les revêtements et métaux contenant ces matières peuvent produire des vapeurs toxiques lors du coupage.

- Ne jamais couper de récipients pouvant contenir des matières inflammables avant de les avoir vidés et nettoyés correctement.
- Quand on utilise ce produit pour le soudage ou le coupage, il dégage des fumées et des gaz qui contiennent des produits chimiques qui, selon l'État de Californie, provoquent des anomalies congénitales et, dans certains cas, le cancer.

SÉCURITÉ



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



| Puissance des verres teintés | AWS (É.-U.) | ISO 4850 |
|------------------------------|-------------|----------|
| Jusqu'à 100 A | Nº 8 | Nº 11 |
| 100-200 A | Nº 10 | Nº 11-12 |
| 200-400 A | Nº 12 | Nº 13 |
| Plus de 400 A | Nº 14 | Nº 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 crissipin, chaussures et casque de sécurité.
- Vêtements ignifugés couvrant toutes les parties exposées du corps.
- Pantalon sans revers pour éviter que des étincelles ou des scories puissent s'y loger.
- Avant le coupage, retirer de ses poches tout objet combustible comme les briquets au butane ou les allumettes.

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

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



MISE À LA MASSE ET À LA TERRE

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

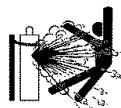
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

Alimentation

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

SÉCURITÉ 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.

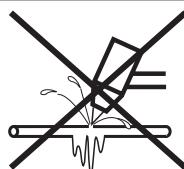


PACEMAKERS ET PROTHÈSES AUDITIVES

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.



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.

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.



- Les étincelles produites par le coupage peuvent provoquer une explosion ou un incendie.
 - Pendant le coupage, éloigner toute matière inflammable.
 - Conserver un extincteur à proximité et s'assurer qu'une personne soit prête à l'utiliser.
 - Ne jamais couper de récipients fermés.
 - L'arc plasma peut provoquer des blessures et des brûlures.
- 1.1 Couper l'alimentation avant de démonter la torche.
- 2.1 Ne pas tenir la surface à couper près de la trajectoire de coupe.
- 2.2 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.

Section 2**SPECIFICATIONS**

In this section:

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| Product Specifications | 2-3 |
| MAX20 CE Power Supply | 2-3 |
| PAC110 Torch..... | 2-3 |
| IEC Symbols Used..... | 2-4 |

General

- Hypertherm's MAX20 CE air plasma cutting system is designed for hand cutting of most metals up to 6 mm (1/4 inch) in thickness.
- The MAX20 provides continuously variable current output from 10 to 20 amps to provide excellent cutting performance on all thicknesses within its range.
- The MAX20 power supply uses 200/220/240-volt, single-phase, 50/60 hertz power and incorporates advanced transistor technology. It offers the following benefits:
 - It weighs only 20 kg (44 pounds), offering maximum portability.
 - The pilot arc ignition pierces coated, painted or rusted metals.
 - The solid-state design allows a steady cutting arc between the torch and the workpiece.
 - The transistorized design performs best while lightly dragging the torch nozzle on the workpiece. This makes the torch extremely easy to use.
 - The continuous pilot arc makes it easy to cut grate material or other perforated metals. The pilot arc transfers to the workpiece when the torch is within 3 mm (1/8 inch) of the cutting surface.
 - The nearly ripple-free output provides a smooth cutting arc, ensuring high-quality cuts across a wide variety of materials and thicknesses.
- The MAX20 uses compressed air as the plasma gas. A cylinder of compressed air or an air compressor may be used. The air supply must be free of moisture, oil or other contaminants. An air pressure regulator and air filter are provided. The air pressure regulator is preset to deliver the correct air flow and pressure.
- The variable amperage output (**OUTPUT POWER**) potentiometer mounted on the front panel adjusts the cutting current of the torch and varies the AC line draw of the system to conform with the fuse size at the primary power line.

Product Specifications

MAX20 CE Power Supply

The MAX20 CE (070049) is a constant current chopper power supply providing continuously variable amperage from 10 amps to 20 amps. It conforms to the following specifications:

| | |
|--------------------------------|---|
| Rated OCV (U_0) | 240 VDC at rated input voltage |
| Output Current (I_2) | 10 amps minimum to 20 amps maximum |
| Output Voltage (U_2) | 84 VDC @ 10 amps; 88 VDC @ 20 amps |
| Duty Cycle Rating (X) | 25% duty cycle (20 amps, 88 VDC); 100% duty cycle 10 amps.) |
| Input Voltage (V_1) | 200-220-240V, 1PH, 50/60 Hz, jumper selectable |
| Input Current (I_1) | 13.0 amps @ 1.8 kw out (200-volt input) 11.8 amps @ 1.8 kw out (220-volt input) 10.8 amps @ 1.8 kw out (240-volt input) |

Dimensions

| | |
|--------------|------------------------|
| Width | 200 mm (8 inches) |
| Height | 298 mm (11.75 inches) |
| Length | 432 mm (17 inches) |
| Weight | 20 kg (44 U.S. pounds) |

Gas Supply

| | |
|----------------------------|--|
| Type | Air |
| Quality | Clean, Dry, Oil-Free |
| Air Flow | 127 liters/minute (4.5 scfm) |
| Air Pressure Setting | 4.1 bar (60 psi) for 4.5 meter (15-foot) lead set 4.5 bar (65 psi) for 7.5 meter (25-foot) lead set |
| Air Requirements | 4.8-8.6 bar (70-125 psi) |

PAC110 Torch

The PAC110 torch conforms to the following specifications:

| | |
|--|------------------------------|
| Maximum cutting thickness range | Up to 6 mm (1/4 inch) |
| Maximum current at 50% duty cycle | 20 Amps |
| Maximum current at 100% duty cycle | 10 Amps |
| Gas Flow | 127 liters/minute (4.5 scfm) |
| Weight | 1.4 kg (3 U.S. pounds) |

SPECIFICATIONS

IEC Symbols Used

| | |
|--|---|
| | Direct Current (DC). |
| | Alternating current (AC). |
| | Plasma cutting torch. |
| | AC input power connection. |
| | The terminal for the external protective (earthed) conductor. |
| | A chopper-based power source. |
| | Anode (+) work clamp. |
| | Temperature switch. |
| | Pressure switch. |
| | Plasma torch in the TEST position (cooling and cutting gas exiting nozzle). |
| | The power is on. |
| | The power is off. |
| | Volt/amp curve. |

Section 3**SETUP**

In this section:

| | |
|--|-----|
| Upon Receipt | 3-2 |
| Primary Connection | 3-2 |
| Line Voltage and Frequency Selection | 3-5 |
| Grounding | 3-6 |
| Air Supply | 3-6 |

Upon Receipt

1. Remove the unit and save the carton. The carton is reusable and provides an impact-resistant box for transporting or storing the unit.

The carton should include:

- MAX20 CE Power Supply
 - PAC110 Torch and Leads 4.5 meter (15 ft.) or 7.5 meter (25 ft.)
 - Spare Parts Kit
 - Instruction Manual
2. Verify that all components are present. Alert your distributor if any parts are missing.
 3. Inspect the power supply for any physical damage that may have occurred during shipping. If there is evidence of damage, see the *Claims* section for instructions.

Before operating the MAX20, read the *Safety* and *Operation* sections of this manual.

Primary Connections

To make or change the primary (line) power cord connection:

1. Use rugged line cordage certified by your local or national electrical codes and sized for 16-amp service. For example, in Europe use IEC “harmonized” line cordage sized at 1.5mm² such as HO5VVF3G.150 (vinyl cordage) or H05RRF3G1.50 (rubber cordage). In North America, use 3-conductor UL/CSA certified cordage for rugged service such as Belden #19354 (type SJT-3, 300 V-60°C, 14 AWG-IEC), or Belden #8479 (type SJ-3, 300 V-60°C, 14 AWG). The International and North American color codes are shown below:

| Conductors | North American | International |
|------------|----------------|---------------|
| Line | Black | Brown |
| Neutral | White | Blue |
| Ground | Green | Green/yellow |

2. If the unit has a cord attached, unplug the unit and move the I/O switch to the O (off) position.



WARNING

The aluminum heatsink (the U-shaped piece of aluminum) is electrically live when the plasma is on. In case of an electronic failure of the chopper circuit, the heatsink may be live when the power is on.

SHOCK HAZARD: The large electrolytic capacitor (blue-cased cylinder located behind the front panel) stores large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the PC board, and on certain areas of the PC board. Discharge time to 40 volts is 90 seconds. Never discharge the capacitor with a screwdriver or other implement...explosion, property damage and/or personal injury will result. Wait at least five minutes after turning the power supply off before touching the PC board or the capacitor.

3. Wait five minutes to allow the capacitor to discharge. Remove the cover.
4. Loosen the cable grip with a wrench and remove the old cord.
5. Carefully strip back the outer jacket of the new cord 5 cm (2 inches) and strip back the individual wires 10 mm (3/8 inch).
6. For best results, crimp wire-tip ferrules onto the bare wires. Select the correct ferrule according to the following table. Otherwise, twist the bare copper wires of each conductor into a tight bundle.

| | 14 AWG (1.95mm ²)-N. American | 15mm ² -International |
|---------|---|----------------------------------|
| Ferrule | H2.5/15 (blue cap, 15 mm long) | H1.5/14 (red cap, 14 mm long) |

7. Feed the cord through the cable grip, insert twisted or ferruled wires to the terminal block (1TB) and tighten the retaining screws with a screwdriver as follows:

| Wire | Terminal |
|----------------------|----------|
| Brown (black) | ~ |
| Blue (white) | ~N. |
| Green/yellow (green) | () |

See Figure 3-1. In situations where there is no neutral conductor, either phase may be connected to the terminal marked ~N.

SETUP

8. Use a wrench to tighten the strain relief. The IEC cord should be able to withstand a 60-newton (30 lb. force) pull without movement of the cord. The North American cord should be able to withstand a 220-newton (50 lb. force) pull without movement of the cord.
9. If necessary, attach a plug (16-amp) which is certified by your local or national electric code. Follow the manufacturer's instructions.
10. Replace the cover and plug the unit in.

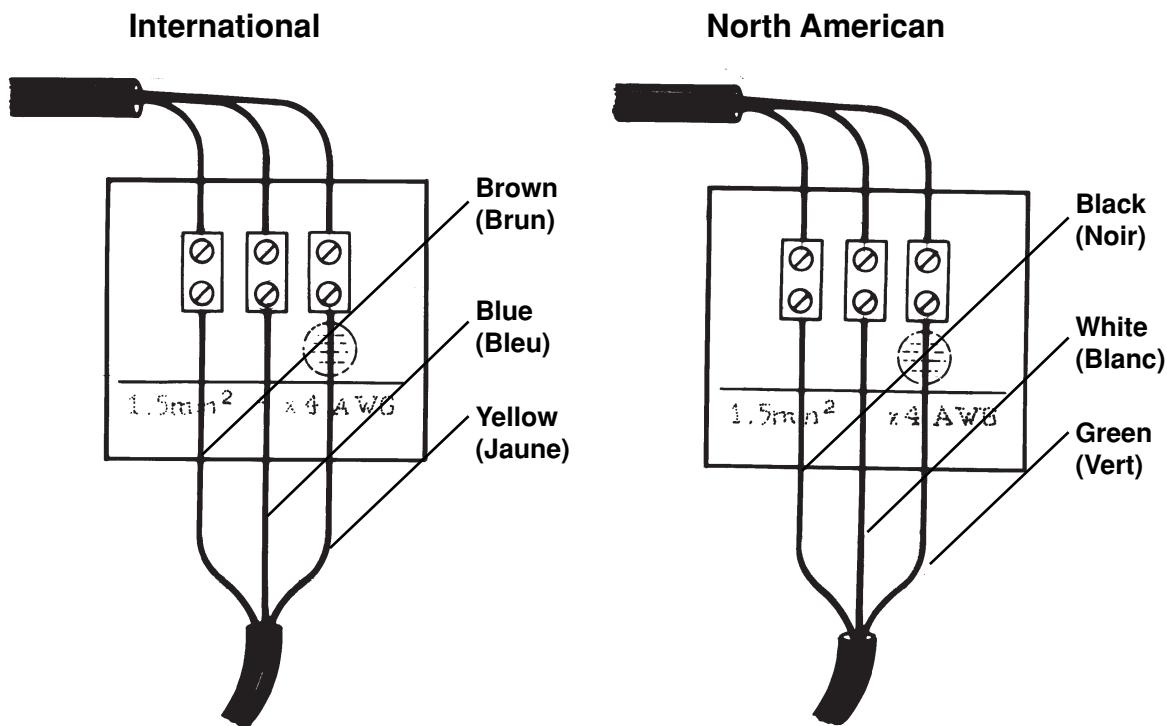
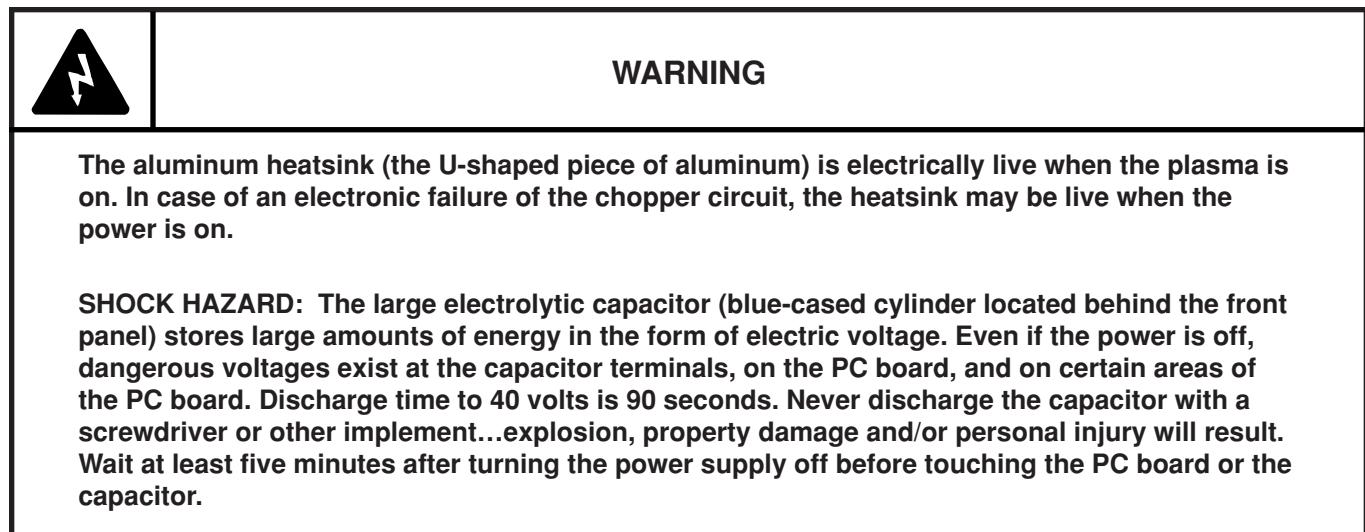


Figure 3-1 Primary Connections

Line Voltage and Frequency Selection

Select the correct primary line voltage (U1) and frequency (Hz) by moving the “link” wires at the voltage/frequency selection terminal block as follows:

1. Move the I/O switch to the O (off) position. Unplug the unit.



2. Wait five minutes to allow the capacitor to discharge. Remove the cover.
3. Use a screwdriver to remove the cover plate over the terminal block (2TB).
4. Use a screwdriver to move the voltage (U1) wire to the position indicating the primary line voltage. See Figure 3-2.
5. Use a screwdriver to move the frequency (Hz) link to the position indicating the primary line frequency.
6. Replace the link cover plate.
7. Replace the power supply cover and plug the unit back in.

When using the unit in the shop, use the 200, 220 or 240-volt incoming line in accordance with the following schedule:

| Fuse Size | Duty Cycle |
|-----------|---|
| 16 Amps | Operates within duty cycle rating at full output. |
| 10 Amps | Operates at 60% duty cycle at 13 amps. Operates at 100% duty cycle at 10 amps. |

SETUP

When operating in the field, check the fuse or circuit breaker size on the incoming line before cutting and adjust the system accordingly. If an extension cord is necessary, use one that is properly rated. Reducing the current enables you to cut with a longer extension cord.

For safety and performance, always minimize the length of the extension cord.

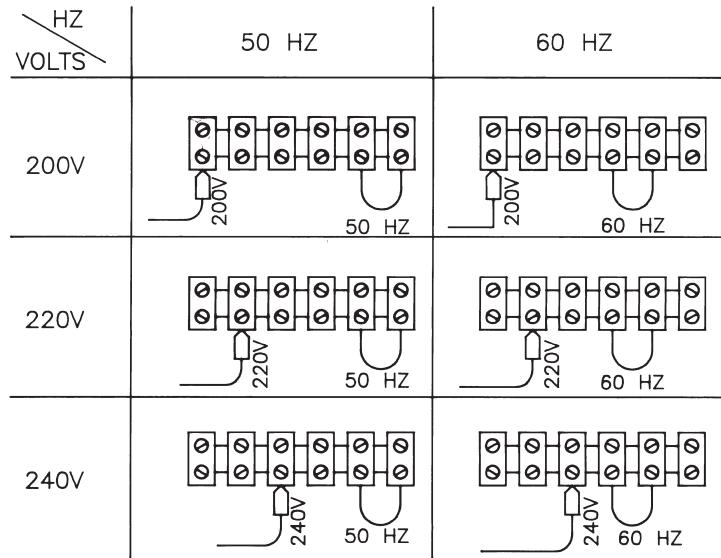


Figure 3-2 Linkboard Connections

Grounding

The power supply must be properly grounded through the power cable according to your local electric power company requirements. The 200/220/240 VAC MAX20 cabinet is electrically conductive and can present a shock hazard if it is not properly grounded through the wall outlet. The service must be of the 3-wire type with a green/yellow wire protective "Earth Ground." It must comply with local electrical requirements. See *Grounding* in the *Safety* section.

DO NOT USE A 2-WIRE SERVICE!

The work clamp must make good metal-to-metal contact on the workpiece. Do not attach the work clamp to the portion of the workpiece being cut away. (See Fig. 3-3 for proper connection.)

Air Supply

The air supply must provide 127 liters/minute (4.5 scfm) at a pressure greater than 4.1 bar (60 psi) for a minimum of a 35% duty cycle.

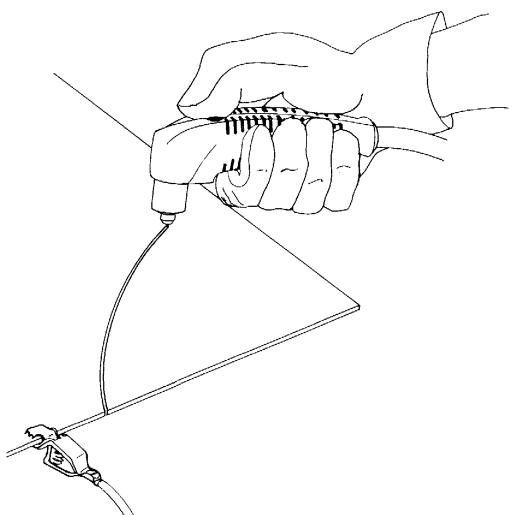


Figure 3-3 Proper Work Clamp Connection

The air supply must be clean, dry and free of oil or dirt. Air pressure greater than 4.1 bar (60 psi) within a range of 4.8 - 8.6 bar (70-125 psi) should be applied to the air filter unit located on the back panel of the unit. **Pressure must not exceed 8.6 bar (125 psi)**. The air pressure regulator is preset at the factory and regulated to 4.1 bar (60 psi) pressure when the gas flow is on.* To adjust the pressure regulator, refer to the adjustment procedure in *Troubleshooting*.

*The pressure is set to 4.5 bar (65 ± 2 psi) when a 7.5 meter (25-foot) lead is used.

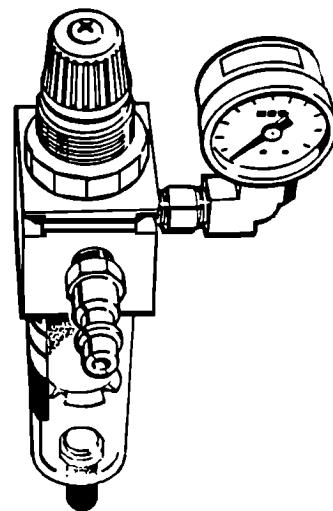


Figure 3-4 Air Supply

Section 4**OPERATION***In this section:*

| | |
|-------------------------------------|------|
| Front Panel Controls | 4-2 |
| Operating Instructions..... | 4-3 |
| Operating Tips | 4-4 |
| Changing Consumable Parts | 4-4 |
| Adjusting Output Power | 4-5 |
| Cutting..... | 4-6 |
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Front Panel Controls

- **ON (1)/OFF (0) power switch**

Applies input power to the power supply.

- **POWER ON LED**

Illuminates when the main power is on.

- **TEMP/PRESSURE LED**

Remains extinguished when the temperature and pressure are within operating limits. It illuminates if:

- The incoming air pressure is too low.

- The duty cycle rating of the system has been exceeded and the thermal overload circuit has opened and disabled the power supply. The thermal overload switch remains open to allow the power supply to cool down.

- **OUTPUT POWER adjustment knob**

Adjusts both the output cutting current and the AC line draw from your 200, 220 or 240-volt AC power supply.

The table above the adjustment knob lists the information you need to adjust the power to avoid blowing the circuit breaker. The label also tells you the approximate amount of time that you will be able to cut (duty cycle) before the MAX20 overheats.

Before using your MAX20, you need to know the amperage of your 200, 220 or 240-volt AC circuit service and the rating of your circuit breaker (see page 3-5). You can then adjust the OUTPUT POWER setting to the maximum indicated on the label and cut for the time indicated without blowing the breaker. For cutting instructions, see *Operating Tips*.

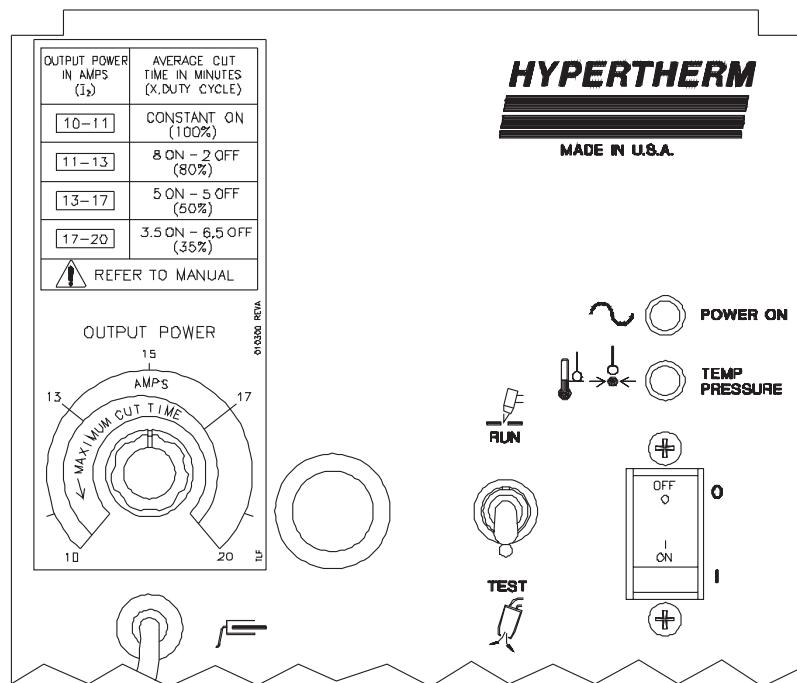


Figure 4-1 Front Panel Controls

- **RUN/TEST** switch

Permits you to see if the pressure is set correctly at 4.1 bar (60 psi – 65 psi) if you use a 7.5 meter (25 ft.) lead. To adjust the pressure, follow the adjustment procedure described in *Troubleshooting*. If the gauge reads 5 psi more or less than the recommended pressure, an adjustment may be needed.

Operating Instructions

1. Ensure that the work environment and your clothing meet the safety requirements outlined in the *Safety* section.
2. Place the power supply in an area where the air flow is not blocked or impeded.
3. Plug the unit into a 200, 220 or 240-volt, 50/60 Hz, grounded outlet. Be sure that the line voltage and frequency are correct for the links selected in the MAX20.
4. Using a quick connect air fitting, attach the compressed air to the male fitting on the air filter.
5. Check the filter bowl for water. If necessary, empty it by loosening the brass knob at the bottom of the bowl. Retighten the knob when the bowl is empty.
6. Move the power I/O switch to the **I** position. The **POWER ON** LED should illuminate indicating the unit is “on.” The **TEMP/PRESSURE** LED should remain extinguished indicating the temperature and air pressure are within the range of operation.
7. Place the **RUN/TEST** switch in the **TEST** position. Check the air pressure setting to ensure the pressure is set correctly.
8. Attach the work clamp securely to the workpiece. Do not attach the clamp to the section of the workpiece that will fall away.
9. Place the **RUN/TEST** switch in the **RUN** position. The pilot arc starts immediately (no preflow) when the torch switch is pressed.



WARNING

The pilot arc starts immediately (no preflow) when the torch switch is pressed.

10. The unit is now ready to operate. When you are ready to cut, place the torch on the workpiece. Push the start button on top of the torch handle.
11. The arc transfers from the torch to the workpiece. Move the torch in the desired direction, at a speed which gives good cut quality.
12. When the cut is finished, release the torch button to stop the arc.

Operating Tips

Changing Consumable Parts



WARNING

Always unplug the power supply before inspecting or changing the torch parts.

Inspect the nozzle for damage or wear. If the hole in the nozzle is worn or oval shaped, it is time to change it. Inspect the electrode. If the center of the electrode has a pit more than 2.0 mm (1/16") deep, replace it.

Changing the consumable parts requires no tools. Unscrew the retaining cap and the remaining parts will come apart easily. When you unscrew the retaining cap, you'll hear a click. This click is a microswitch disabling the torch so that the torch cannot accidentally be activated. Replace the parts as illustrated in Figure 4-2. Each part fits in only one direction, so you cannot put the parts in backwards. Also, the torch will not fire if the parts are improperly assembled.

When the nozzle, electrode and swirl ring are properly in place, replace the retaining cap. When the retaining cap is tightened, the microswitch will click, indicating that the torch is operable again.

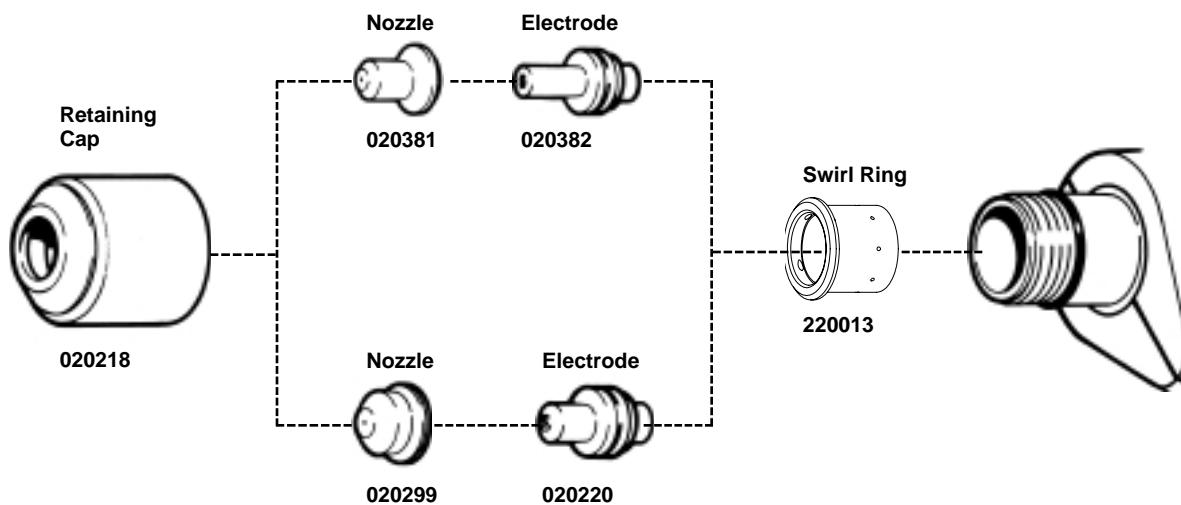


Figure 4-2 Consumable Parts

Adjusting the Output Power

Hypertherm recommends that you use a 16-amp service and the proper breaker for your service, and that you cut at the lowest power setting which will give you good cut quality.

For this example, assume that you have a 10-amp service and circuit breaker. You will be able to cut with the OUTPUT POWER setting in the following ranges:

- Blue range (10-11 amp output)
- Light green range (11-13 amp output)
- Green range (13-17 amp output)

In these ranges, you will be able to cut for up to five minutes at a time without concern that you will blow your circuit breaker. If you want to cut longer than five minutes, adjust the OUTPUT POWER into the light green or blue ranges. In the light green range (11-13 amps), you will be able to cut continuously for eight minutes. In the blue range (10-11 amps), you will be able to cut continuously. Pick the lowest range you can without sacrificing cut quality.

If you need more cut power, adjust the OUTPUT POWER setting into the red range (17-20 amps). You need a 16-amp service and breaker to be able to cut for 3-1/2 minutes continuously. You can cut with the setting in the red range (17-20 amps) for short periods of time (under a minute usually), but you will blow your circuit breaker during longer cuts.

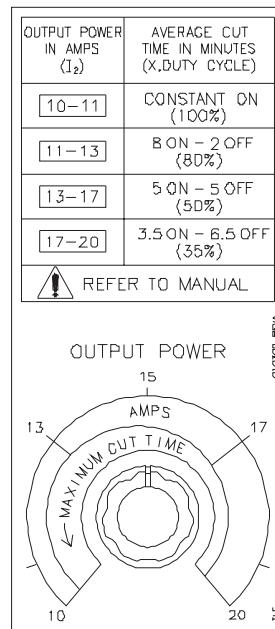


Figure 4-3 Output Power Adjustment

Cutting

- Do not fire the pilot arc into the air needlessly – doing so causes a drastic reduction of the nozzle and electrode life.
- Start cutting from the edge of the workpiece (Fig. 4-4) unless you must pierce. For tips on piercing, see *Piercing*.

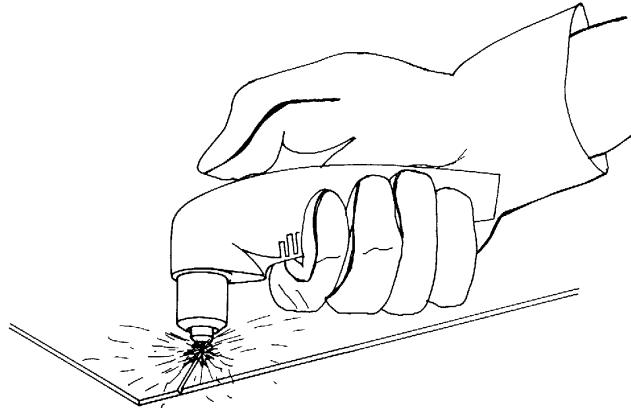


Figure 4-4 Starting a Cut

- When cutting, make sure that the sparks are coming out of the bottom of the workpiece. If sparks are spraying on top of the workpiece, you are moving the torch too fast, or you do not have sufficient power to fully penetrate the workpiece.
- Hold the torch lightly on the metal or just off the metal. Holding the torch firmly to the workpiece causes the nozzle to stick and makes smooth cutting difficult. The arc transfers once the torch is within 3 mm (1/8 inch) of the workpiece.
- To cut perfect circles for spin fittings, use a template or a radius cutter attachment (Fig. 4-5).
- Pull the torch through the cut. Pulling it is easier than pushing it.

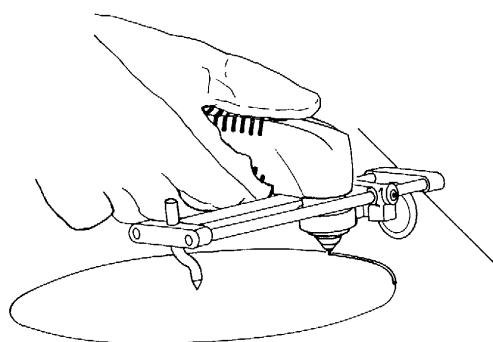


Figure 4-5 Cutting a Circle

- Hold the torch nozzle at a vertical position and watch the arc as it cuts along the line (Fig. 4-6). By lightly dragging the nozzle on the workpiece, you can maintain a steady cut. For straight-line cuts, use any straight edge as a guide.
- When cutting thin material, reduce the amps until you get the best quality cut.

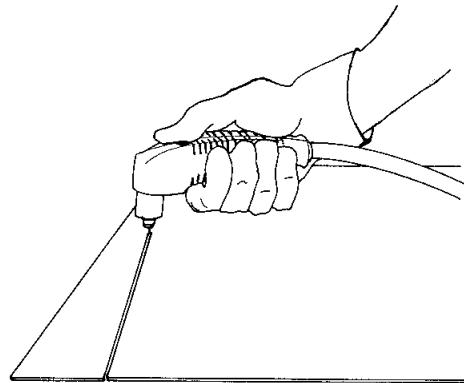


Figure 4-6 Dragging the Torch

Piercing

- Hold the torch so that the nozzle is approximately 1.5 mm (1/16 inch) away from the workpiece before pushing the start button. This method maximizes the life of the nozzle.
- Hold the torch at an angle to the workpiece away from yourself, then slowly roll it to a vertical position. (This is particularly important when cutting thicker material.) Make sure that the torch is pointed away from you and the people around you to avoid any danger from sparks and hot metal.
- Start the cut at an angle rather than in an upright position. This method permits the hot metal to escape to one side rather than splashing back against the nozzle, protecting the operator from the sparks and extending the nozzle life (Fig. 4-7).
- When the pierce is complete, proceed with the cut.

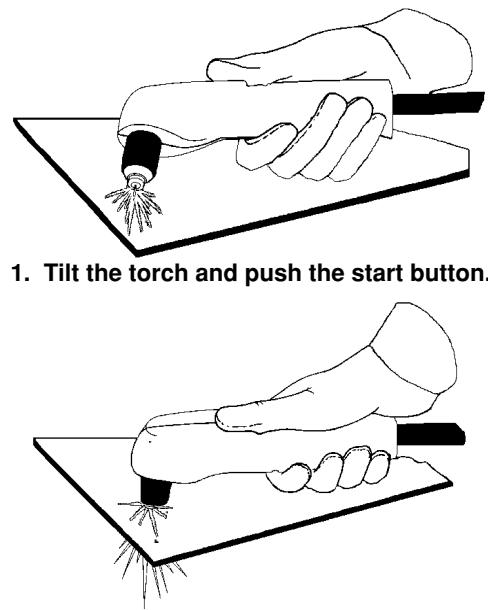


Figure 4-7 Piercing

Common Cutting Faults

- The workpiece is not totally penetrated. Causes can be:
 - The current is too low.
 - The cut speed is too high.
 - The torch parts are worn.
 - The metal being cut is too thick.
- Dross forms on the bottom of the cut. Causes can be:
 - The cutting speed is too slow.
 - The torch parts are worn.

Duty Cycle

The duty cycle (X), or the amount of time the pilot or plasma arc can remain “on” in minutes within a 10-minute period, is affected by many factors. When the current is set at 20 amps, the MAX20 has a 35% duty cycle. During normal operation, the plasma arc can remain on 3-1/2 minutes out of every 10 minutes without causing the temperature sensors to disable the unit. The duty cycle increases to 60% when the current is set at 13 amps, and 100% at 10 amps. The duty cycle for different amperages are listed on the front panel as shown:

| OUTPUT POWER IN AMPS (I ₂) | AVERAGE CUT TIME IN MINUTES (X ₁ DUTY CYCLE) |
|--|---|
| 10 – 11 | CONSTANT ON (100%) |
| 11 – 13 | 8 ON – 2 OFF (80%) |
| 13 – 17 | 5 ON – 5 OFF (50%) |
| 17 – 20 | 3.5 ON – 6.5 OFF (35%) |

Figure 4-8 Duty Cycle

The duty cycle is reduced if:

- The work clamp is not connected to the workpiece. This causes the power supply heatsink to overheat rapidly causing the temperature sensor on the heatsink to shut the machine off.
- The pilot arc is fired when the nozzle is more than 3 mm (1/8) inch from the workpiece.
- The work clamp is not making good electrical contact to the workpiece due to paint, rust, etc.

Gas Pressure

Compressed air must be available at a flow rate of 127 liters /minute (4.5 scfm) and a minimum pressure of 4.1 bar (60 psi). If the pressure is below 2.8 bar (40 psi), the torch goes out.

Do not exceed 8.6 bar (125 psi). The plastic filter bowl is rated for 10.3 bar (150 psi) and may explode if this pressure is exceeded. See the warning label on the filter bowl for other safety warnings.

Torch Heat

After several minutes of running, the torch retaining cap may become hot. To cool it, put the **RUN/TEST** switch in the **TEST** position.

Claims and Technical Questions

Claims for damage during shipment – If your unit was damaged during shipment, you must file a claim with the carrier. Hypertherm will furnish you with a copy of the bill of lading upon request.

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

1. Read the *Troubleshooting* section of this manual. You may find the problem is quite easy to fix, such as a loose connection.
2. If you are unable to solve the problem, call your distributor. He will be able to help you, or refer you to an authorized Hypertherm repair facility.
3. If you need additional assistance, call Customer Service at 1-800-643-0030 or Technical Service at 1-800-643-9878.

Section 5**MAINTENANCE***In this section:*

| | |
|--|-----|
| Troubleshooting | 5-2 |
| Problems: Causes and Solutions | 5-3 |
| System Illustrations | 5-7 |
| Torch Repair | 5-9 |
| Repair Kit & Customer-Supplied Tools | 5-9 |
| Remove the Defective Torch | 5-9 |
| Install the New Torch | 5-9 |



WARNING

The aluminum heatsink (the U-shaped piece of aluminum) is electrically live when the plasma is on. In case of an electronic failure of the chopper circuit, the heatsink may be live when the power is on.

SHOCK HAZARD: The large electrolytic capacitor (blue-cased cylinder located behind the front panel) stores large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the PC board, and on certain areas of the PC board. Discharge time to 40 volts is 90 seconds. Never discharge the capacitor with a screwdriver or other implement...explosion, property damage and/or personal injury will result. Wait at least five minutes after turning the power supply off before touching the PC board or the capacitor.

Troubleshooting

Problem

1. The machine is switched on, but the green POWER ON LED does not light up.

2. The machine is switched on, but the TEMP/PRESSURE LED illuminates.

3. The circuit breaker on the incoming 200, 220 or 240V line fails occasionally when the unit is turned on.

4. The circuit breaker on the incoming 200, 220 or 240V line fails during cutting.

Cause / Solution

1.1 Power is not present in the power line, or the primary fuse is not operative.

Turn the power on. Check the line fuse; replace if defective.

1.2 The resistors on 2PCB have failed.

Replace 2PCB.

2.1 The air pressure is low.

Check the air filter for blockage. (Remove the air supply before changing the filter element.)

Increase the air pressure to the unit. Verify that the air supply can provide 127 liters/minute (4.5 scfm). Check the lines for blockage.

2.2 The unit is still overheated. The unit cools down faster with the fan on.

Turn the unit on. Let it cool for 7 minutes before operating the torch.

2.3 The 1FU fuse on the circuit board may be blown.

Check the fuse. Replace if defective.

2.4 The thermal overload switches are defective.

Call the Hypertherm Service Department.

3.1 There is a “weak” circuit breaker.

Replace the breaker.

3.2 The 2PCB/3CR circuit failed.

Check 3CR and 2PCB and replace them if necessary.

4.1 The power supply has exceeded the capacity of the breaker.

Decrease the cutting current by reducing the amperage setting on the front panel, or decrease the time of the cut.

Reduce the length of the extension cord, or increase the gauge of the extension cord.

4.2 Other equipment is being operated on the same circuit.

Do not operate any other equipment on the same circuit as the MAX20.

Troubleshooting (continued)

Problem

5. The POWER switch will not stay in the I (on) position.

Cause / Solution

- 5.1 **The retaining cap is not screwed on correctly.**

Gently tighten the cap.

- 5.2 **The consumables are not installed correctly.**

Check the consumables for correct installation. (See Figure 4-2.)

- 5.3 **The cap sensing circuit is inoperative, but the unit still won't turn on.**

Check the continuity between the blue wires from the torch cable.

Call Hypertherm Technical Service at 1-800-643-9878.

6. There is a very loud buzzing in the power supply during cutting.

7. There is no plasma arc, or the arc fails during cutting and does not re-ignite.

- 6.1 **Relay 1CR may have filings or dirt in it.**

Clean out the relay with compressed air.

- 6.2 **The air pressure is low.**

Increase the air pressure. Ensure that the air supply can provide 127 liters/minute (4.5 scfm).

- 7.1 **There is scale build-up on the consumable parts.**

Change the parts, or lightly scour away oxides using steel wool.

- 7.2 **The consumable parts may be worn out.**

Check the consumables, and replace if necessary. See Figure 4-2 for correct installation.

- 7.3 **The retaining cap has been overtightened.**

Loosen the retaining cap.

- 7.4 **The system has overheated.**

Check the TEMP/PRESSURE LED on the front panel. If it is illuminated, wait for the unit to cool down.

- 7.5 **There is insufficient air pressure.**

Check the TEMP/PRESSURE LED on the front panel. If it is illuminated, check the gauge on the back of the unit. Increase the air pressure to the unit.

Check the air filter. If it is clogged, remove the air supply and change the filter element.

Troubleshooting (continued)

Problem

Cause / Solution

- 7.6 The wire leads inside the torch are broken.**
Replace the torch assembly.
- 7.7 There is low primary line voltage.**
Check the incoming primary service. If you are using an extension cord, ensure that the gauge of the cord meets specifications. If possible, avoid using an extension cord and plug the unit directly into the wall.
- 7.8 Relay 2CR has failed. The chopper fails to receive a signal from the relay.**
Replace 2CR.
- 7.9 Relay 1CR has failed.**
Replace 1CR.
- 7.10 1SOL has failed, and the pilot arc does not ignite.**
Replace 1SOL.
- 7.11 The circuit fuse failed.**
Replace 1FU.
- If all the above checks are satisfactory, the chopper may have failed. In this event, the chopper module needs to be replaced. Contact your field service representative or the factory for proper instructions.
- 8. The arc blows out, but re-ignites when the torch button is depressed.**
- 8.1 There are faulty consumable parts.**
Inspect and change the consumable parts if necessary.
- 8.2 There is low incoming line voltage, improperly sized or too lengthy an extension cord, or too many other users on the same power circuit.**
Check the incoming line voltage and, where possible, gain access to proper line voltage. Or, reduce the power output to 14 amps and try again.
- 8.3 The air pressure is incorrect.**
Adjust the air pressure using the following procedure:
1. Apply air supply at 5.2 – 8.6 bar (75-125 psi) with at least 127 liters/minute (4.5 scfm) flow capacity.
 2. Using a Philips screwdriver, unlock the screw at the top of the air pressure regulator cap.

Troubleshooting (continued)**Problem****Cause / Solution**

3. Adjust the air pressure downward ("relieve the regulator") by turning the knob in the direction shown on the regulator cap ("—" is counterclockwise). Adjust the pressure below 2.8 bar (40 psi) using the gauge on the back of the unit.
4. Slowly increase the air pressure by turning the knob clockwise until 4.1 bar (60 psi, or 4.5 bar (65 psi) if you are using a 7.5 meter (25-foot) lead is reached. **STOP!** DO NOT BACK OFF ADJUSTMENT. IF YOU DO, YOU MUST RETURN TO STEP 4.
5. Using the Philips screwdriver, and being careful not to change the pressure adjustment, lock the screw at the top of the air regulator cap.
6. Replace the cover before plugging the unit back in. Typically, when the unit is operated in TEST mode, the no-flow (static) pressure is 4.1 – 4.5 bar (60-65 psi) and the pressure with flow (dynamic) is 3.8 bar (55 psi). If consistent pressure cannot be maintained, the pressure gauge is probably faulty and/or the pressure regulator may be faulty.

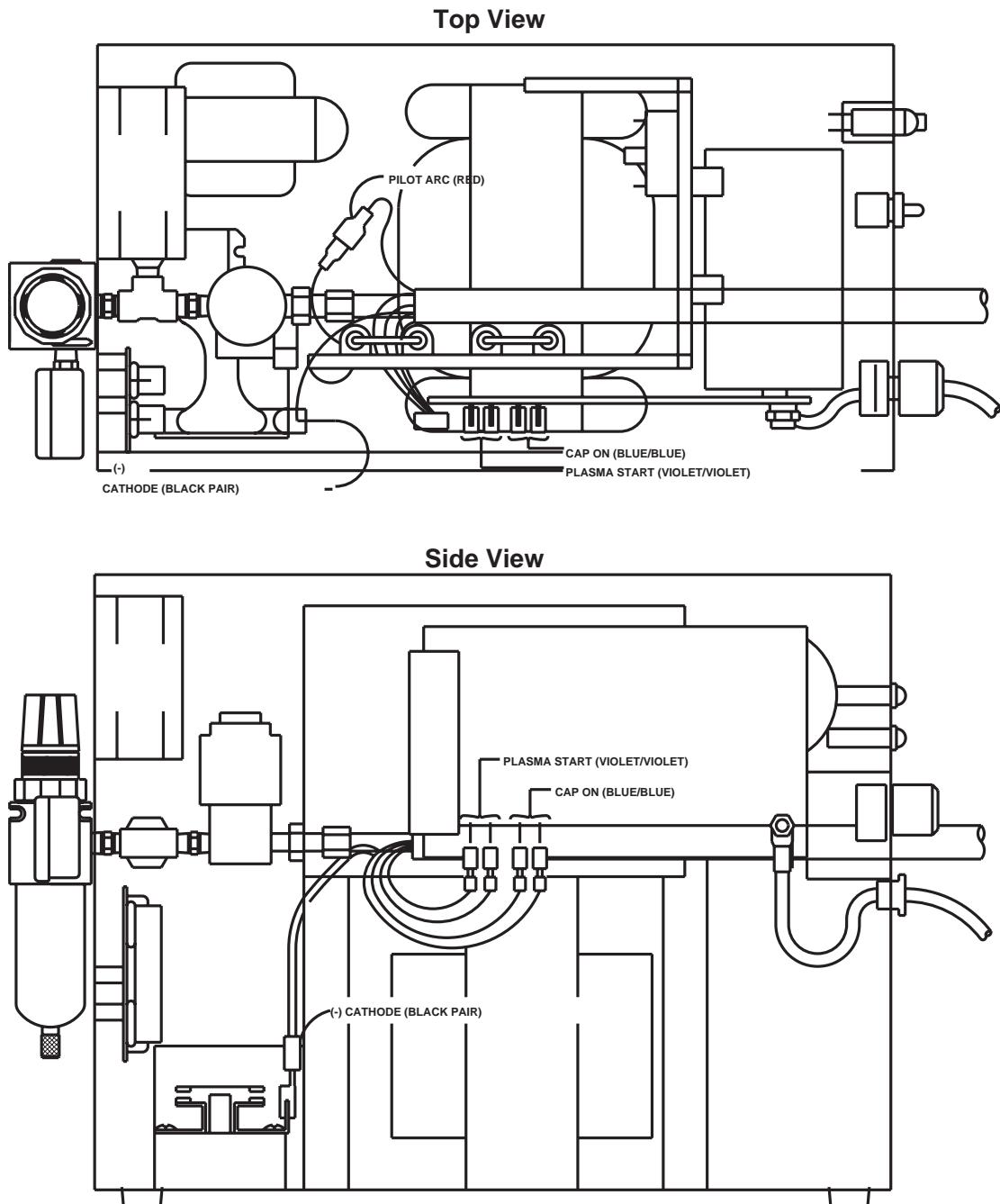


Figure 5-1 Torch Lead Connections

MAINTENANCE

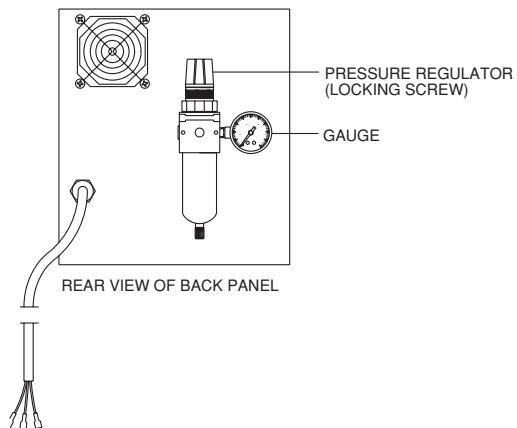
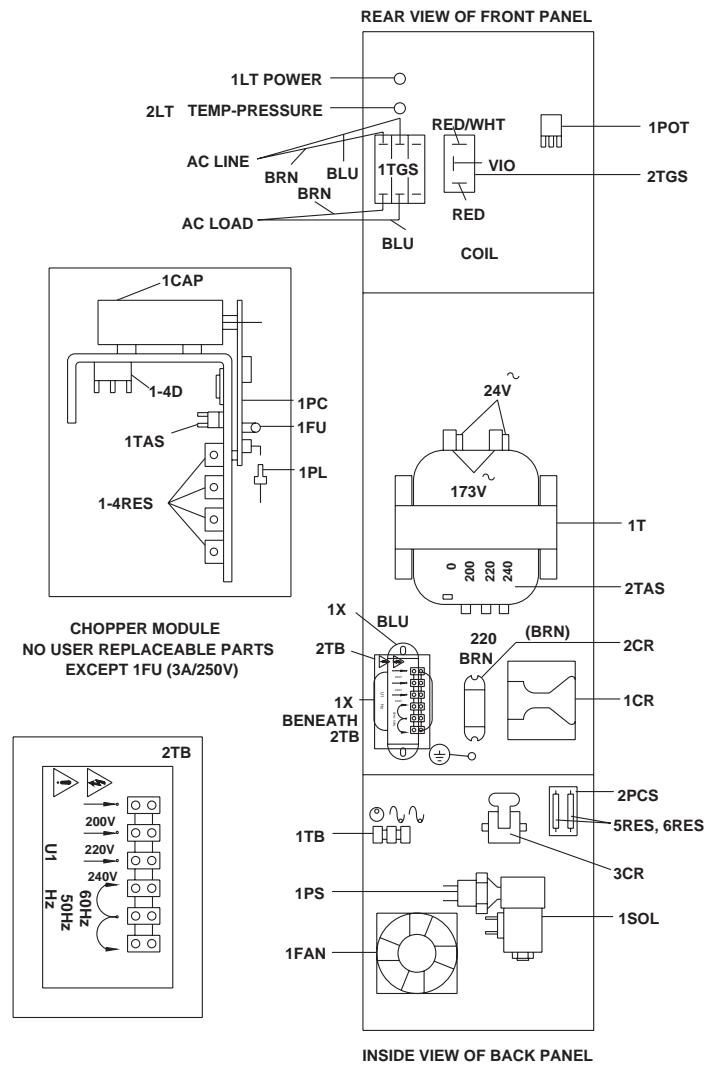


Figure 5-2 Component Locator

Torch Repair

Repair Kit and Customer-Supplied Tools

The PAC110/100 torch can be repaired in the field by removing the torch main body from the torch assembly and replacing it with a torch repair kit. The repair kit, part # 028482, includes:

- Torch main body assembly, part # 020588
- Tyrap (1), # 074005

To perform the repair, you need the following customer-supplied tools:

- #1 Phillip's-head screwdriver
- 7/16" open-end wrench
- Wire cutters
- Sta-kon crimping tool

Remove the Defective Torch

To disassemble and repair the torch, refer to Figure 5-3 and perform the following procedure:

1. Remove the five screws which secure the handle halves together.
2. Remove the torch main body and torch switch from the handle halves.
3. Disconnect the Tyrap.
4. Cut the two black wires connecting the torch lead to the plunger. Cut the wires at the butt splice.
5. Cut the two blue wires connecting the torch lead to the microswitch. Cut the wires at the butt splices.
6. Cut the red wire connecting the torch lead to the pilot arc lead. Cut the wire at the butt splice.
7. Disconnect the torch main body and torch lead gas fitting using the 7/16" open-end wrench.

Install the New Torch

To install the new torch, reverse the removal procedure:

1. While holding the torch main body to keep the wires from twisting, connect the body assembly and the torch lead gas fitting using the 7/16" open-end wrench.
2. Connect the red wire from the torch lead to the butt splice connecting the red wire to the pilot arc fitting using the Sta-kon crimping tool.
3. Connect the two blue wires from the torch lead to the butt splices connecting the white wires to the microswitch using the Sta-kon crimping tool.

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4. Connect the two black wires from the torch lead to the butt splice connecting the black plunger wire to the torch main body using the Sta-kon crimping tool.
5. Connect the Tyrap as shown.
6. Install the torch main body assembly and torch switch into one of the handle halves. While positioning the handle halves together, **be careful not to pinch any wires. Be especially careful around the torch switch retainers.**
7. Replace the five screws to secure the handle halves together. If the seams do not fit together tightly, remove the screws and check for pinched wires.

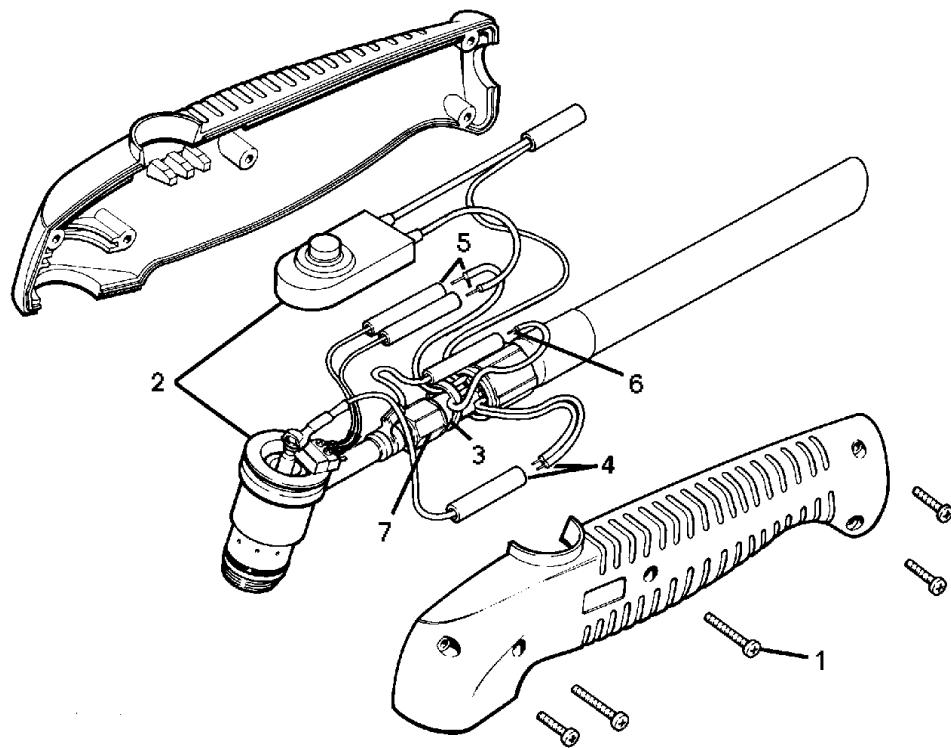


Figure 5-3 PAC100/110 Torch Repair Kit Installation

Section 6**PARTS LIST**

In this section:

| | |
|---------------------------------------|-----|
| PAC110 Torch Assembly and Leads | 6-2 |
| MAX20 CE Power Supply | 6-3 |
| System Descriptions | 6-3 |
| MAX20 CE Parts | 6-3 |

PARTS LIST

PAC110 Torch Assembly and Leads

| <u>Part Number</u> | <u>Description</u> |
|--------------------|---|
| 070003 | PAC110 Torch Assembly w/4.5 meter (15 ft. lead) |
| 070014 | PAC110 Torch Assembly w/7.5 meter (25 ft. lead) |
| 020218 | Retaining Cap |
| 220013 | Swirl Ring |
| 020382 | Electrode, Extended |
| 020220 | Electrode |
| 020381 | Nozzle, Extended |
| 020299 | Nozzle |
| 026016 | O-Ring |
| 028349 | Spare Parts Kit |
| 220013 | Swirl Ring (1) |
| 020382 | Electrode, Extended (3) |
| 020381 | Nozzle, Extended (5) |
| 026016 | O-Ring (2) |

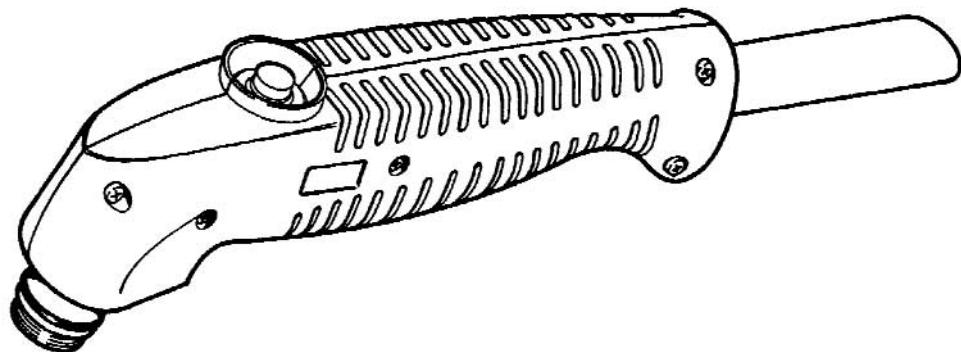


Figure 6-1 PAC110 Torch

MAX20 CE Power Supply – (070049)

System Descriptions

- 070045 MAX20 CE System, PAC110 Torch, 200/220/240-Volt, 1 PH, 50/60 Hz, 4.5 meter (15-ft) Torch Leads, 3 meter (9-ft) Primary Cable
- 070046 MAX20 CE System, PAC110 Torch, 200/220/240-volt, 1 PH, 50/60 Hz, 7.5 meter (25-ft) Torch Leads, 3 meter (9-ft) Primary Cable

MAX20 CE Parts

Indicated below are the MAX20 CE components and subassemblies (see Figure 6-2).

| <u>Item</u> | <u>Qty</u> | <u>Part Number</u> | <u>Description</u> |
|-------------|------------|--------------------|--|
| 1 | 1 | 129045 | Cover, SA MAX20 CE |
| 1 | 1 | 001562 | Cover, MAX20 CE |
| 2 | 1 | 001197 | Handle, 20/42R |
| 3 | 1 | 029515 | Gas supply, subassembly, MAX20E |
| 4 | 1 | 011039 | Filter, regulator, 5 Micron, 120 psi |
| | 1 | 011054* | Filter element (used with 011039) |
| 5 | 1 | 022019 | Gauge, pressure, 0-100 psig, 1-1/2" |
| 6 | 1 | 027106 | Finger guard for 027103, 027116 |
| 7 | 1 | 008513 | Hole plug |
| 8 | 1 | 027116 | Fan, TX, 220/230 VAC 50/60 Hz 34 SCFH |
| 9 | 1 | 008412 | Cord grip, 14-3 cord |
| 10 | 3 | 074123 | Wire tip, 14 AWG x .323 insulated |
| 11 | 1 | 023293 | Line cord, 20A, 220-240 |
| 12 | 2 | 074015 | Terminal, 16-14 .250 QC , insulated, female |
| 13 | 1 | 074067 | Terminal, 22-18, .25 MAL QC insulated |
| 14 | 2 | 008408 | Standoff, 6-32 x 5/8" |
| 15 | 1 | 008411 | Terminal block, 6-pos |
| 16 | 1 | 002196 | Linkboard, 20A, 200-220-240V |
| 17 | 2 | 004454 | Spacer, 8-32 x 3.20" AL HX |
| 18 | 1 | 004309 | Link, 20A, 220-240V, 50/60 Hz |
| 19 | 1 | 029516 | Linkboard subassembly, 20A, 200-220-240V, 50-60 Hz |
| 20 | 2 | 027038 | Nut, pem KFS2-632 |
| 21 | 1 | 002172 | Shield, safety, linkboard, 20A |
| 22 | 1 | 014086 | Inductor, 6 MHY, 20A CLS H UL/CSA- 1X |
| 23 | 4 | 008379 | Bumper, rubber molded in washer |
| 24 | 1 | 003079 | Relay, solder tab, DPDT 24 VAC |
| 25 | 4 | 001219 | Shield, 3-term 20A 200/220/240 |
| 26 | 1 | 008413 | Terminal strip, 3-pos |
| 27 | 2 | 009476 | Resistor, 1 ohm, 20W, 5% |
| 28 | 2 | 008398 | Standoff, 6-32 x 1/2", nylon |
| | 1 | 129043 | Relay SA, soft start MAX20 CE |
| 29 | 1 | 041141 | PC board assembly, In-rush, 20A, 220V |
| 30 | 1 | 041140 | PC board only, in-rush 20A, 220V |
| 31 | 1 | 003084 | Relay, 30A, SPST 220-240VAC, 50-60 Hz |
| 32 | 1 | 005044 | Switch, toggle SPDT SC TM MNT ON/ON |

PARTS LIST

MAX20 CE Parts (continued)

| Item | Qty | Part Number | Description |
|-------------|------------|--------------------|--|
| 33 | 1 | 005112 | Switch, pressure 39 psi, .013 BAF |
| 34 | 1 | 015540 | Tee, 1/8 |
| 35 | 2 | 015517 | Nipple, 1/8 x CL, hex |
| 36 | 1 | 006055 | Valve, solenoid, 24VAC, 70 psi |
| 37 | 1 | 015151 | Adapter, st, 1/8 NPT x 3/16 tube |
| | 1 | 129110 | Switch SA, MAX20 CE |
| 38 | 1 | 003180 | Circuit breaker, 3P 240V/Rocker QDisc |
| 38A | 2 | 009951 | Capacitor, .01 μ f 500 VAC ceramic |
| 38B | 1 | 009966 | Capacitor, .1 μ f 300 X1-type metallized paper |
| 39 | 1 | 004293 | Plate, antirotation |
| 40 | 1 | 008246 | Bushing, 1.000 hole x 3/4" ID |
| 41 | 1 | 001600 | Base, MAX20 CE |
| 42 | 1 | 009382 | Light, pilot green LED 24 VAC .187 QDisc |
| 43 | 1 | 009375 | Light, pilot yellow LED 24 VAC .187 QDisc |
| 44 | 1 | 008381 | Strain relief, Anode Lead |
| 45 | 1 | 008965 | Knob, .850 diameter BLK/NAT 1/4" SFT |
| 46 | 1 | 008382 | Clamp, anode lead, copper, 40A |
| 47 | 1 | 023269 | Lead, anode, 4.5 meter (15 Ft.) |
| 48 | 1 | 014196 | Transformer, CE 3KVA 50 Hz, 200-220-240/50 |
| 49 | 1 | 129112 | Chopper SA, 20A 250 OCV, MAX20 CE |
| 50 | 1 | 004291 | Spacer, chopper SA, MAX20 |
| 51 | 1 | 003078 | Relay, 30A No mag blowout AC TM |

* Filter element 011054 can also be obtained by contacting the local Hypertherm distributor.

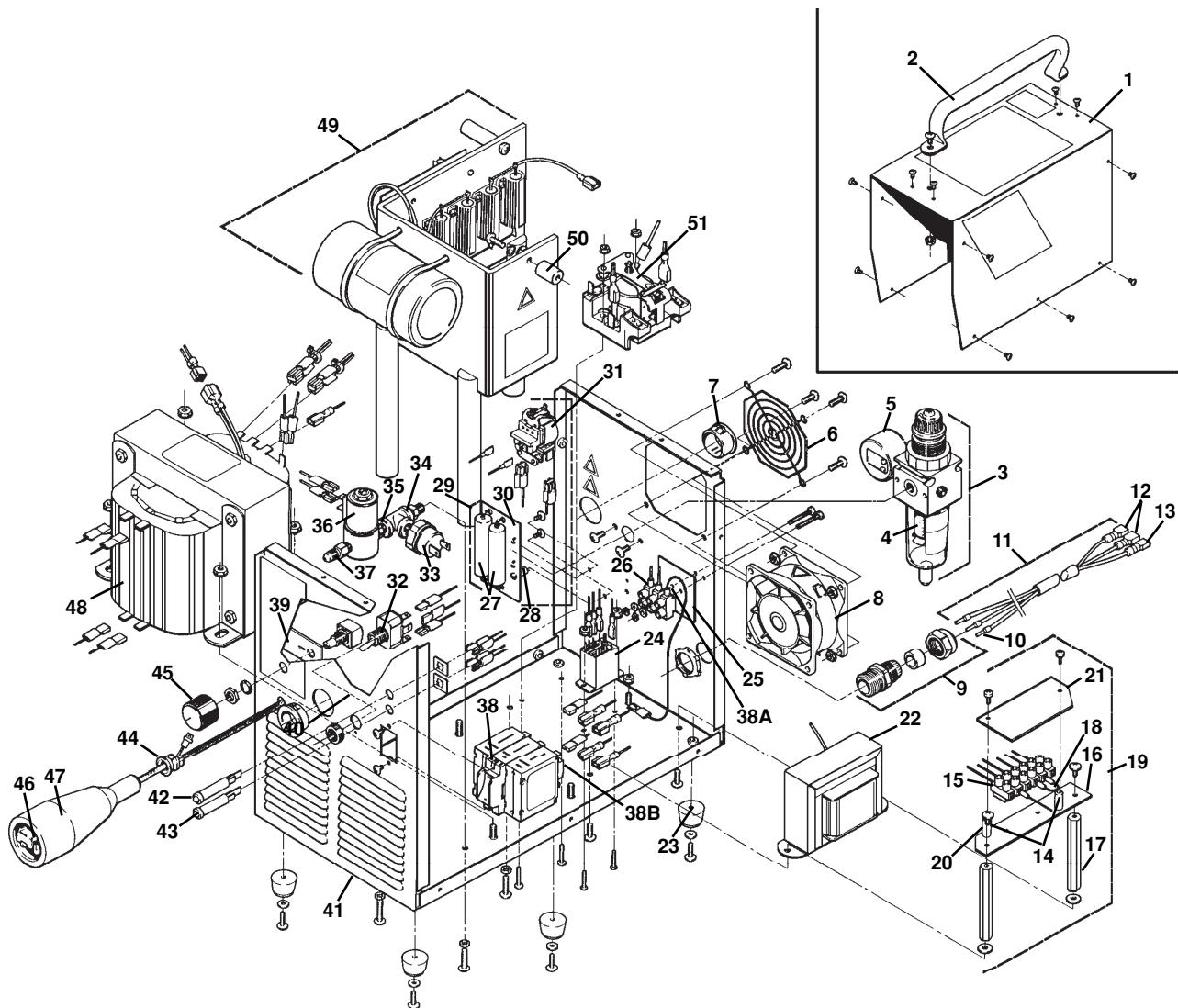


Figure 6-2 MAX20 – Exploded View

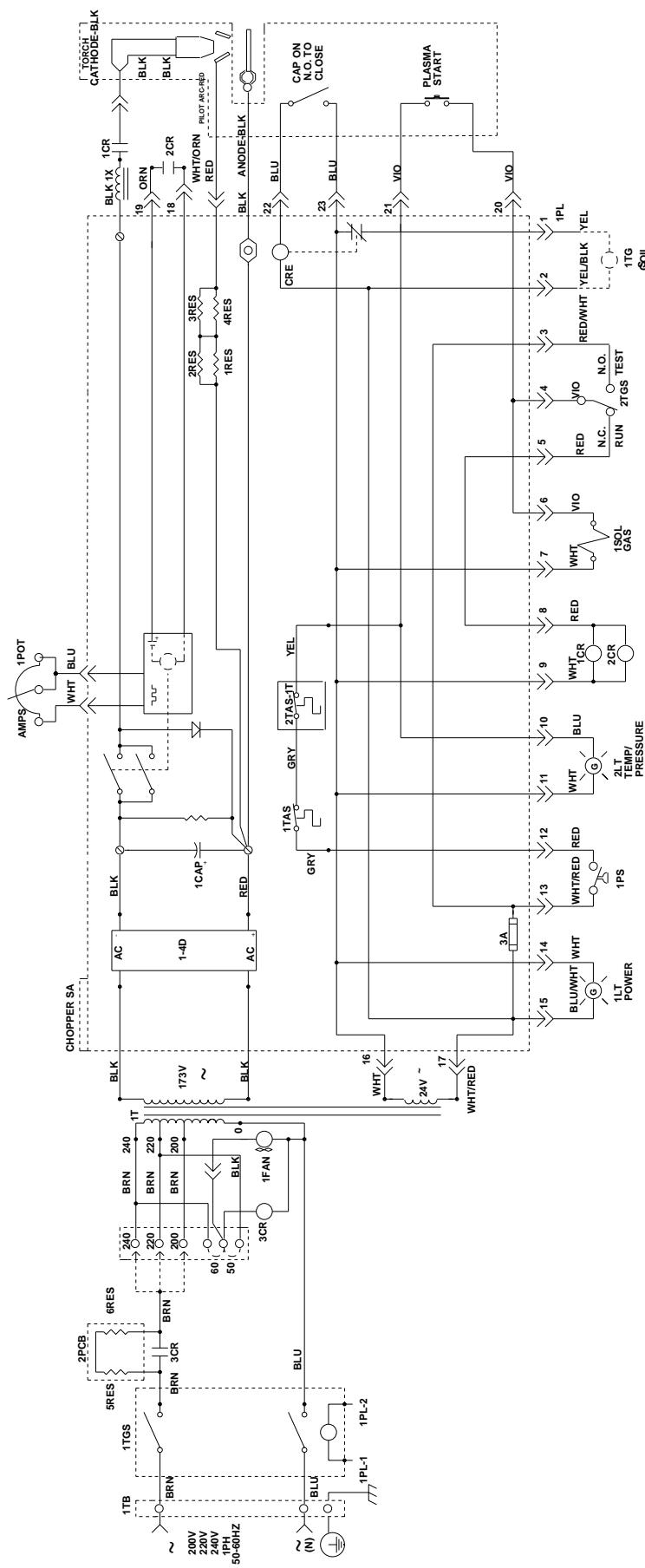
PARTS LIST

Section 7**WIRING DIAGRAMS**

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|----------------------|-----|
| Wiring Diagram | 7-3 |
|----------------------|-----|

WIRING DIAGRAMS



WIRING DIAGRAMS
