MAX200®

Plasma Arc Cutting System

Service Manual
801620 – Revision 15

CE

EN50199
EN50192
EN60974-1

Hypertherm®

The world leader in plasma cutting technology

MAX200

Plasma Arc Cutting System

Service Manual
(P/N 801620)

for Serial Numbers
beginning with
200-003200

Revision 15 – April, 2008

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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 cutting 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 (nozzle for laser heads) 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.

Attention

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.

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, and with respect to torch lifter assemblies within a period of one (1) year from its date of delivery to you, and with respect to laser heads 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. For more information, visit www.hypertherm.com/weee.
- In other countries, check national and local laws.

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

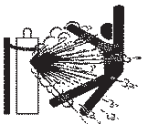
Work cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

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

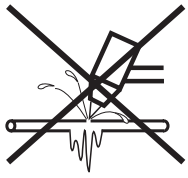
Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

- 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.

WARNING

Protect yourself and others. Read and understand this marking.

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

AVERTISSEMENT

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

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

Electric shock can kill.

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

Explosion will result if pressurized containers are cut.

Arc rays can injure eyes and burn skin.

- Wear correct eye and body protection.

Noise can damage hearing.

- Wear correct ear protection.

Fumes and gases can injure your health.

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

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

Heat, splatter and sparks cause fire and burns.

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

Pilot arc can cause burns.

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

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

010298 Rev. B TLF

WARNING LABEL

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

1. Cutting sparks can cause explosion or fire.

1.1 Keep flammables away from cutting.

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

1.3 Do not cut on any closed containers.

2. The plasma arc can cause injury and burns.

2.1 Turn off power before disassembling torch.

2.2 Do not hold the material near cutting path.

2.3 Wear complete body protection.

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

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

3.2 Insulate yourself from work and ground.

3.3 Disconnect input plug or power before working on machine.

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

4.1 Keep your head out of the fumes.

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

4.3 Use ventilating fan to remove the fumes.

5. Arc rays can burn eyes and injure skin.

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

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

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

Section 1a

SÉCURITÉ

Dans cette section :

IDENTIFIER LES CONSIGNES DE SÉCURITÉ

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

SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

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

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

DANGER AVERTISSEMENT PRÉCAUTION

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

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

LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

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

Prévention des explosions

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

AVERTISSEMENT

Risque d'explosion argon-hydrogène et méthane

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

AVERTISSEMENT

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

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

LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

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

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

Prévention des chocs électriques

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

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

L'ÉLECTRICITÉ STATIQUE PEUT ENDOMMAGER LES CARTES DE CIRCUITS IMPRIMÉS

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

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

LES VAPEURS TOXIQUES PEUVENT PROVOQUER DES BLESSURES OU LA MORT

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

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

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

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

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

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

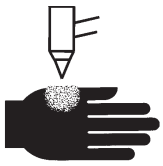
Le niveau de qualité de l'air dans tout lieu de travail dépend des variables propres au site comme :

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

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

Pour réduire le risque d'exposition aux vapeurs :

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



L'ARC PLASMA PEUT PROVOQUER DES BLESSURES OU DES BRÛLURES

Torches à allumage instantané

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

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

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

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

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

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

Courant de l'arc	Puissance des verres teintés AWS (É.-U.)	ISO 4850
Jusqu'à 100 A	N° 8	N° 11
100-200 A	N° 10	N° 11-12
200-400 A	N° 12	N° 13
Plus de 400 A	N° 14	N° 14

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

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

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

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

MISE À LA MASSE ET À LA TERRE

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

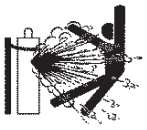
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

Alimentation

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

SÉCURITÉ DES BOUTEILLES DE GAZ COMPRIMÉ

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



LES BOUTEILLES DE GAZ COMPRIMÉ PEUVENT EXPLOSER EN CAS DE DOMMAGES

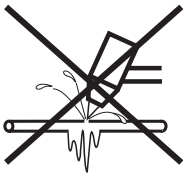
Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

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

LE BRUIT PEUT PROVOQUER DES PROBLÈMES AUDITIFS

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

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



UN ARC PLASMA PEUT ENDOMMAGER LES TUYAUX GELÉS

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

PACEMAKERS ET PROTHÈSES AUDITIVES

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

Pour réduire les risques associés aux champs magnétiques :

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

Étiquette de sécurité

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

WARNING

Protect yourself and others. Read and understand this marking.

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

AVERTISSEMENT

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

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

Electric shock can kill.

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

Explosion will result if pressurized containers are cut.

Arc rays can injure eyes and burn skin.

- Wear correct eye and body protection.

Noise can damage hearing.

- Wear correct ear protection.

Fumes and gases can injure your health.

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

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

Heat, splatter and sparks cause fire and burns.

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

Pilot arc can cause burns.

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

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

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Étiquette de sécurité

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

1. Les étincelles produites par le coupage peuvent provoquer une explosion ou un incendie.

1.1 Pendant le coupage, éloigner toute matière inflammable.

1.2 Conserver un extincteur à proximité et s'assurer qu'une personne soit prête à l'utiliser.

1.3 Ne jamais couper de récipients fermés.

2. L'arc plasma peut provoquer des blessures et des brûlures.

2.1 Couper l'alimentation avant de démonter la torche.

2.2 Ne pas tenir la surface à couper près de la trajectoire de coupe.

2.3 Porter des vêtements de protection couvrant tout le corps.

3. Un choc électrique causé par la torche ou les câbles peut être fatal. Se protéger contre les risques de chocs électriques.

3.1 Porter des gants isolants. Ne pas porter de gants mouillés ou abîmés.

3.2 S'isoler de la surface de travail et du sol.

3.3 Débrancher la prise ou la source de courant avant de manipuler l'équipement.

4. L'inhalation des vapeurs produites par le coupage peut être dangereuse pour la santé.

4.1 Garder le visage à l'écart des vapeurs.

4.2 Utiliser un système de ventilation par aspiration ou d'échappement localisé pour dissiper les vapeurs.

4.3 Utiliser un ventilateur pour dissiper les vapeurs.

5. Les rayons de l'arc peuvent brûler les yeux et provoquer des lésions de la peau.

5.1 Porter un casque et des lunettes de sécurité. Se protéger les oreilles et porter une chemise dont le col peut être déboutonné. Porter un casque de soudure dont la protection filtrante est suffisante. Porter des vêtements protecteurs couvrant la totalité du corps.

6. Se former à la technique du coupage et lire les instructions avant de manipuler l'équipement ou de procéder au coupage.

7. Ne pas retirer ou peindre (recouvrir) les étiquettes de sécurité.

Seccíon 1b

SEGURIDAD

En esta sección:

RECONOCIMIENTO DE INFORMACIÓN DE SEGURIDAD

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

SIGA LAS INSTRUCCIONES DE SEGURIDAD

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

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

PELIGRO ADVERTENCIA PRECAUCIÓN

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

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

LOS CORTES PUEDEN PROVOCAR INCENDIOS O EXPLOSIONES

Prevención ante el fuego

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

Prevención ante explosiones

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

ADVERTENCIA

Peligro de explosión
Argón-Hidrógeno y metano

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

ADVERTENCIA

Detonación de hidrógeno con el corte de aluminio

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

EL CHOQUE ELÉCTRICO PUEDE PROVOCAR LA MUERTE

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

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

Prevención ante el electrochoque

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

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

ELECTRICIDAD ESTÁTICA PUEDE DAÑAR TABLILLAS DE CIRCUITO

Use precauciones adecuadas cuando maneje tablillas impresas de circuito

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

HUMOS TÓXICOS PUEDEN CAUSAR LESIONES O MUERTE

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

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

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

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

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

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

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

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

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

Para reducir el riesgo de exposición a humo:

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

EL ARCO DE PLASMA PUEDE CAUSAR LESIONES Y QUEMADURAS

Antorchas de encendido instantáneo

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

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

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

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

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

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

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

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

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

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

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

SEGURIDAD DE TOMA A TIERRA

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

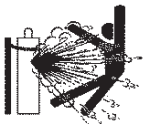
Mesa de trabajo Conecte la mesa de trabajo a una buena toma de tierra, de conformidad con los códigos eléctricos nacionales o locales apropiados.

Potencia primaria de entrada

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

SEGURIDAD DE LOS EQUIPOS DE GAS COMPRIMIDO

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



LOS CILINDROS DE GAS PUEDEN EXPLOTAR SI ESTÁN DAÑADOS

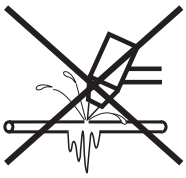
Los cilindros de gas contienen gas bajo alta presión. Un cilindro dañado puede explotar.

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

EL RUIDO PUEDE DETERIORAR LA AUDICIÓN

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

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



UN ARCO PLASMA PUEDE DAÑAR TUBOS CONGELADOS

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

OPERACIÓN DE MARCAPASOS Y DE AUDÍFONOS

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

Para reducir los peligros de los campos magnéticos:

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

Etiqueta de advertencia

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

WARNING

Protect yourself and others. Read and understand this marking.

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

AVERTISSEMENT

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

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

Electric shock can kill.

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

Explosion will result if pressurized containers are cut.

Arc rays can injure eyes and burn skin.

- Wear correct eye and body protection.

Noise can damage hearing.

- Wear correct ear protection.

Fumes and gases can injure your health.

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

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

Heat, splatter and sparks cause fire and burns.

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

Pilot arc can cause burns.

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

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

010298 Rev. B — TLF

Etiqueta de advertencia

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

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

1.1 Mantenga los materiales inflamables lejos del lugar de corte.

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

1.3 No corte depósitos cerrados.

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

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

2.2 No sostenga el material junto al trayecto de corte.

2.3 Proteja su cuerpo completamente.

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

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

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

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

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

4.1 Mantenga la cabeza fuera de los gases tóxicos.

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

4.3 Utilice un ventilador para eliminar los humos.

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

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

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

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

Section 2

SPECIFICATIONS

In this section:

General

MAX200s are normally shipped from the factory configured for mild steel cutting with air supplied to both the plasma and shield gas inlets from a single pressure/filter regulator. The regulator ensures that the correct air pressure is supplied to the system at the proper quality.

For better cut quality on metals such as stainless steel, aluminum, and other non-ferrous materials, either nitrogen or argon/hydrogen (Hypertherm recommends a mixture of 35% hydrogen and 65% argon) can be used as the plasma gas. When cutting mild steel, oxygen can also be used as the plasma gas. Shield gases other than air which can be used are nitrogen and carbon dioxide.

The machine-torch systems have several optional units available to control arc current and, for units with the THC option, arc voltage. These units are the switch remote V/C control, the digital remote V/C control, and the programmable remote V/C control. Other optional units unique to the machine torch systems are the initial height sensing (IHS) unit and the water muffler.

An EMI filter, standard with all 400V CE power supplies (073200 and 073213), meets the CE requirement for filtering incoming power. Refer to Appendix A to connect incoming power to the filter and for part numbers specific to the CE power supplies.

Product Specifications

MAX200 Power Supplies

The MAX200 is a constant current, secondary converter chopper power supply providing continuously variable amperage from 40 amps to 200 amps. It conforms to the following specifications:

Maximum OCV (U_0) .....280 VDC
Output Current (I_2).....40-200 amps
Output Voltage (U_2) .....150 VDC
Duty Cycle Rating (X) .....100% up to 30kW

Input Power: (Input Voltage (U_1) x Input Current (I_1):
073002*.....240/480 VAC, 3Ø, 60 Hz, 90/45 amps
073020**

073003*.....600 VAC, 3Ø, 60Hz, 36 amps
073021**

073004*.....208 VAC, 3Ø, 60Hz, 104 amps
073022**

073005* .....220/380/415 VAC, 3Ø, 50 Hz, 98/57/52 amps
073023**

073026* .....200 VAC, 3Ø, 50 Hz, 108 amps
073024**

073036* .....500 VAC, 3Ø, 50 Hz, 43 amps
073039**

Dimensions:

Width .....28-1/4" (71 cm)
Height .....35-1/2" (90 cm) w/o casters
43" (109 cm) w/casters
Depth .....41-1/4" (104 cm) w/o handle
50" (127 cm) w/handle
Weight .....780 pounds (351 kg)

Cooling .....Forced Air (Class F)

Torch Coolant Tank Capacity .....2.9 gallons (11 liters)

Torch Coolant Requirements and Coolant Safety Data .....See Appendix B

* MAX200 Power Supply – Machine Torch w/o THC Configuration
** MAX200 Power Supply – Machine Torch w/THC Configuration

Gas Requirements:

Gas Type/Quality	Air (compressed)/clean, dry, oil-free Oxygen (O_2)/99.5% (liquid) Nitrogen (N_2)/99.995% (liquid) Carbon Dioxide (CO_2)/99.5% (compressed or liquid) Argon/Hydrogen (H35 = 35% Hydrogen/65% Argon)
Plasma Gases	Air, O_2, N_2, H35
Shield Gases	Air, CO_2, N_2
Plasma Gas Flow	66 scfh (Air), 60 scfh (N_2), 70 scfh (H35), 72 scfh (O_2)
Shield Gas Flow	220 scfh (CO_2), 280 scfh (Air), 290 scfh (N_2)
Plasma Gas Inlet Pressure	90/120 psi (6.2/8.3 bar) (flowing)
Shield Gas Inlet Pressure	90 psi (6.2 bar) (flowing)
Plasma Gas Pressure (Test/Run)	See *Cut Charts* in **Operation** section of IM87 (#800870) or IM98 (#800980)
Shield Gas Pressure	70 psi (4.8 bar)

MAX200 CE Power Supplies

The specifications specific to the 400V CE power supplies (073200 and 073213) are listed below. These CE power supplies conform to all other CE power supply specifications as listed above. Refer to Appendix A for EMC requirements, power cable connections, and parts information specific to the MAX200 CE power supplies.

Input Power (Input Voltage (U_1) x Input Current (I_1)):

# 073200 (without THC)	400 VAC, 3Ø, 50 Hz, 56 amps
# 073213 (with THC)	400 VAC, 3Ø, 50 Hz, 56 amps

Dimensions:

Height	40-3/4" (104 cm) w/o casters 48-1/4" (122 cm) w/casters
Weight	800 pounds (363 kg)

PAC200T (90° & 65°) Cutting/PAC200E (65°) Gouging/MAX200 Rev 1 (90°) Hand Torches

Maximum cutting thickness	2 inches (50 mm)
Maximum current at 100% duty cycle	200 amps
Plasma Gas Flow	66 scfh (Air), 60 scfh (N_2), 70 scfh (H35), 72 scfh (O_2)
Shield Gas Flow	220 scfh (CO_2), 280 scfh (Air), 290 scfh (N_2)
Water Coolant Flow Rate	0.8 gpm (3.0 l/min)
Weight	3 lbs (1.4 kg - MAX200 Rev 1 90°) 2-1/2 lbs. (1.1 kg – PAC200T/E)

MAX200 Machine Torch

Maximum cutting thickness	2 inches (50 mm)
Maximum current at 100% duty cycle	200 amps
Plasma Gas Flow	66 scfh (Air), 60 scfh (N_2), 70 scfh (H35), 72 scfh (O_2)
Shield Gas Flow	220 scfh (CO_2), 280 scfh (Air), 290 scfh (N_2)
Water Coolant Flow Rate	0.8 gpm (3.0 l/min)
Weight	2-1/2 lbs. (1.1 kg)

Switch Remote (SR) V/C Control

Controls	Start button: Activates IHS (if on) and initializes pilot arc. Stop button: Deactivates main contactor in power supply. IHS On/Off switch: Turns IHS system on or off. Auto Height On/Off switch: Activates THC in power supply. Voltage adjust pot: Adjusts arc cutting voltage and displays value on LEDs. Current adjust pot: Adjusts arc cutting current and displays value on LEDs.
Control Range	Current: 40 to 200 Amps Voltage: 100 to 200 Volts
Control Resolution	Current: 20 Amps Voltage: 5 Volts

Dimensions:

Width	11-1/2" (29 cm)
Height	5" (13 cm)
Depth	13-1/4" (34 cm)
Weight	6 pounds (2.7 kg)

Digital Remote (DR) V/C Control – Optional

Controls ..... Voltage adjust pot:
Adjusts arc cutting voltage and displays value on LEDs.
Current adjust pot:
Adjusts arc cutting current and displays value on LEDs.

Dimensions:
Width ..... 11-1/2" (29 cm)
Height ..... 3" (7.6 cm)
Depth ..... 13-3/8" (34 cm)
Weight ..... 5 pounds-5 oz. (2.4 kg)

Programmable Remote (PR) V/C Control – Optional

Controls ..... None. Controlled through guidance machinery computer.

Dimensions:
Width ..... 11-1/2" (29 cm)
Height ..... 3" (7.6 cm)
Depth ..... 12-1/2" (31.8 cm)
Weight ..... 5 pounds-5 oz. (2.4 kg)

Initial Height Sensing – Optional

Input Power ..... 120 VAC from power supply
Air Pressure ..... 20 psi (1.4 bar) regulated shop air input to solenoid.

Dimensions:
Width ..... 9" (23 cm)
Height ..... 4-1/2" (11 cm)
Depth ..... 11-1/2" (29 cm)
Weight ..... 13 pounds (6 kg)

Water Muffler – Optional

Refer to Water Muffler Instruction Manual (P/N 802050). Must use optional 1.75" diameter torch to install Water Muffler.

Section 3

MAINTENANCE

In this section:

Introduction

The MAX200, and all Hypertherm plasma systems, undergo rigorous testing prior to shipment and should require little maintenance if proper setup and operation procedures as outlined in instruction manuals #800870 (MAX200 Hand Torch) and #800980 (MAX200 Machine Torch) are followed.

If a problem does arise, this section will familiarize qualified service personnel with the proper operation of the MAX200 system, and will provide guides to troubleshoot problems that may occur during operation. Isolation of a problem at a modular level is the intent of this section. PC board component-level troubleshooting is not addressed unless the component is easily isolated and easily replaced.

After a routine maintenance section, a general theory of operation for the chopper power supply and high frequency circuits followed by a detailed sequence of events flowchart are presented so that service personnel can gain knowledge of proper MAX200 operation. An initial checks procedure is then given, followed by a troubleshooting guide and test procedures to aid in servicing the MAX200 system. Finally, procedures to remove, and replace the torch and torch leads are given.

It is assumed that the service personnel performing the troubleshooting testing are high-level electronic service technicians that have worked with high voltage electro-mechanical systems. Knowledge of final isolation troubleshooting techniques is also assumed.

In addition to being technically qualified, maintenance personnel must perform all testing with safety in mind. Refer to the *Safety* section for operating precautions and warning formats.

If you need additional assistance or need to order parts, call our Customer Service or Technical Service Group at the phone numbers listed in the front of this manual.

WARNING

SHOCK HAZARD: The large electrolytic capacitor(s) (blue-cased cylinder(s)) store large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper, and the diode heatsinks. Never discharge the capacitor(s) 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 chopper or the capacitor(s).

Routine Maintenance

The MAX200 system is designed to require very little regular maintenance under normal use. The following torch, torch leads, torch coolant and power supply routine maintenance checks are suggested to keep your system in top running condition:

Torch and Torch Leads

Always inspect the torch consumable parts and torch main body prior to cutting. Worn or damaged parts can cause gas and water leaks which can affect the cut quality. Check for pitting and burn marks on the consumable parts and replace, if necessary. See Changing Consumable Parts in Section 4 of the MAX200 Instruction Manual (#800870 – Hand Torch, or #800980 – Machine Torch).

The torch leads should be checked occasionally for cracking and damage.

Torch Coolant

A standard mixture of propylene glycol (30%), deionized water (69.9%) and benzotriazole (0.1 %) is recomended. Refer to Appendix B for Torch Coolant Requirements and the Material Safety Data Sheets on propylene glycol and benzotriazolefor data on safety, handling, and storage.

Power Supply

Inspect the power supply on a routine basis.

- Check the exterior for any damage. If there is damage, ensure it does not affect safe operation of the power supply.
- Remove covers and inspect the interior. Check wiring harnesses and connections for wear and damage. Check for loose connections and look for areas of discoloration due to overheating.
- At the rear of the power supply, inspect the particle filter element of the water/coolant subassembly. In the event that the filter becomes excessively dirty, torch coolant flow can slow down causing the flow switch to open (turn off) and make the coolant flow interlock status LED illuminate. The filter turns to a browish color when dirty. Replace the filter element (027005) when it starts to change color.
- Every 2 weeks, inspect the air filter in the front panel of the power supply by removing the access cover and lifting the filter out. Replace filter (027441) when dirty.
- Every 6 months, flush the power supply of its torch coolant and replace with new coolant (028872).

Theory of Operation: “Chopper” Power Supply

Introduction

The MAX200 plasma unit uses a “chopper” control circuit to stabilize the DC output current of the system. The chopper is a switching circuit that is AC activated and outputs a square wave with the peak value being equal to its DC input (283 VDC in the case of the MAX200).

Circuit Description

The following is a description of the operation of the chopper section of the MAX200 power supply. See wiring diagram 013-4-179 as well as component figures in the *Parts List* section for reference.

“Snubber” Section

The “snubber” section supplies 283VDC to the chopper PCBs.

Incoming AC voltage enters dual snubber PCBs (PCB1, PCB3) and becomes rectified to DC through diodes D1-D6. Varistors MOV1, MOV2, and MOV3 limit transient voltage spikes. Capacitors C1-C6 are charged to 283VDC. Bleeder resistors R7 and R8 allow capacitors C1-C6 to discharge when the unit is not in use.

Chopper Section

Chopper modules PCB2 and PCB4 are powered by 14VAC from T3 and T4. Current control, which controls pulse duration (duty cycle) of the choppers is selected from Voltage/Current (V/C) Remote or thumbwheel switch. This information is on pins 5 and 6 of REC1 on the chopper PCBs. A longer pulse duration yields a higher output current, and a shorter pulse duration yields a lower output current. The chopper module generates a square wave of output current at the input DC voltage (283V) at an operating frequency of16KHZ.

The output of the chopper goes to the surge injection circuit (R4, C7), filter inductors (L1, L2), chopper module diode, torch electrode, transferred arc sensor (CS1), and shunt resistors (R1, R2, R3). Fuses F3 and F4 protect each chopper from exceeding 125 amps of output.

Surge Injection Circuit

Surge injection circuit capacitor C7 charges to the open circuit voltage of the chopper module (283VDC). When the arc is transferred from the electrode to the workpiece (see **THEORY OF OPERATION: HIGH FREQUENCY** later in this section for more information on arc transfer), C7 discharges through the 5Ω R4 and on to the torch electrode. Current provided by C7 maintains the cutting arc, while the chopper module and rectifier circuit responds to the current load of the cutting arc. Filter inductors (L1 and L2) and the chopper module diode begin to function once the arc is established.

Filter Inductor and Chopper Module Diode Circuit

During the off interval of the chopper module output cycle, the magnetic fields of L1 and L2 will collapse, and their polarity will reverse (looking at page 1 of wiring schematic inductors L1 and L2 will now be negative on their left side). This action of the inductor will forward bias the chopper output diode causing current flow to pass through it from bottom to top. L1 and L2 then maintain the cutting arc current flow during the “off” chopper cycle.

Current Sensor Circuit

The current sensor coil CS1 is a magnetic device that produces a voltage when current is sensed from the cable passing through it. The cable is directly attached to the workpiece, and the sensing of current will occur when the arc is transferred. This type of sensing phenomena is known as the Hall effect. This voltage is transmitted from pin 3 on PL12, to pin 14 of REC2 on the Control PCB (PCB7).

Shunt Circuit

R1 and R2 are shunt resistors for choppers CH1 and CH2, respectively. R3 carries the sum of the currents flowing to R1 and R2. The voltage taken across R1 and R2 is sent to Control PCB7. This shunt voltage will be compared with the current control voltage. Any difference between the two voltages is sensed, and the output control signal to the chopper module is adjusted to correct any error.

Theory of Operation: High Frequency

Introduction

The MAX200 power supply uses a high frequency transformer to initiate a pilot arc between the nozzle and the electrode to start the plasma torch. When the torch is sufficiently close to the workpiece, the arc will “transfer” to the workpiece. Once the arc has been transferred, relays open to disable the high frequency transformer and the pilot arc.

Circuit Description

The following is a description of the operation of the high frequency section of the MAX200 power supply. See wiring diagram 013-4-179 as well as component placement figures in the Parts List section for reference.

High Frequency Generation Circuit

A high voltage is necessary to activate the high frequency generation. 120 VAC is sent through REC26 to a high voltage transformer T5. T5 steps up the 120 VAC to 5000VAC. This voltage charges C7 and C8. Once voltage across the caps gets sufficiently high, the space between the sparkgaps (SG1) breaks down, causing a virtual short circuit which creates a damped oscillating LC circuit between C7, C8 and the high frequency coil T6. The frequency of this oscillating circuit is determined by the equation $F = 1/(2\pi \times \sqrt{(LC)})$.

As C7 and C8 discharge, the decaying voltage across the spark gap causes the gap to once again become “open”. The capacitors charge again, and the process repeats.

It is important that the proper spark gap be maintained. The MAX200 requires a spark gap setting of .020". If the gaps are too wide, they will not break down at all because there will not be enough voltage available to jump the air space between the gaps. If the gaps are too close together, an almost continuous series of pulses is produced, but the amplitude and duration of each pulse may not be large enough to initiate the pilot arc.

Once there is ionized plasma flow between nozzle and electrode, the current present at the electrode will jump the gap to the nozzle, completing the circuit through the parallel pilot arc resistors R6. The pilot arc is now initialized.

Pilot Arc Circuit

The current level for the pilot arc is determined by the parallel resistors R6. When the torch is sufficiently close to the workpiece, the arc is transferred to the workpiece. Once the transferred arc is established, relay CR1 opens, stopping the pilot arc. The controls for shutting off the pilot arc and the high frequency generator come from Control PCB7.

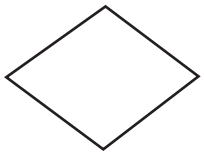
Sequence of Events

On the following pages is a detailed flow chart outlining the sequence of events during proper MAX200 operation with a hand or machine torch. Shaded boxes represent action taken by the operator.

The following symbols used in the flowchart are ANSI standard flowcharting symbols. Their names and definitions are as follows:

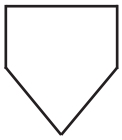
Terminus The terminus is used to indicate the beginning or ending point of a flowchart.

Task/Process Box The process or task box is used to indicate any process or task other than an input/output operation or a decision.

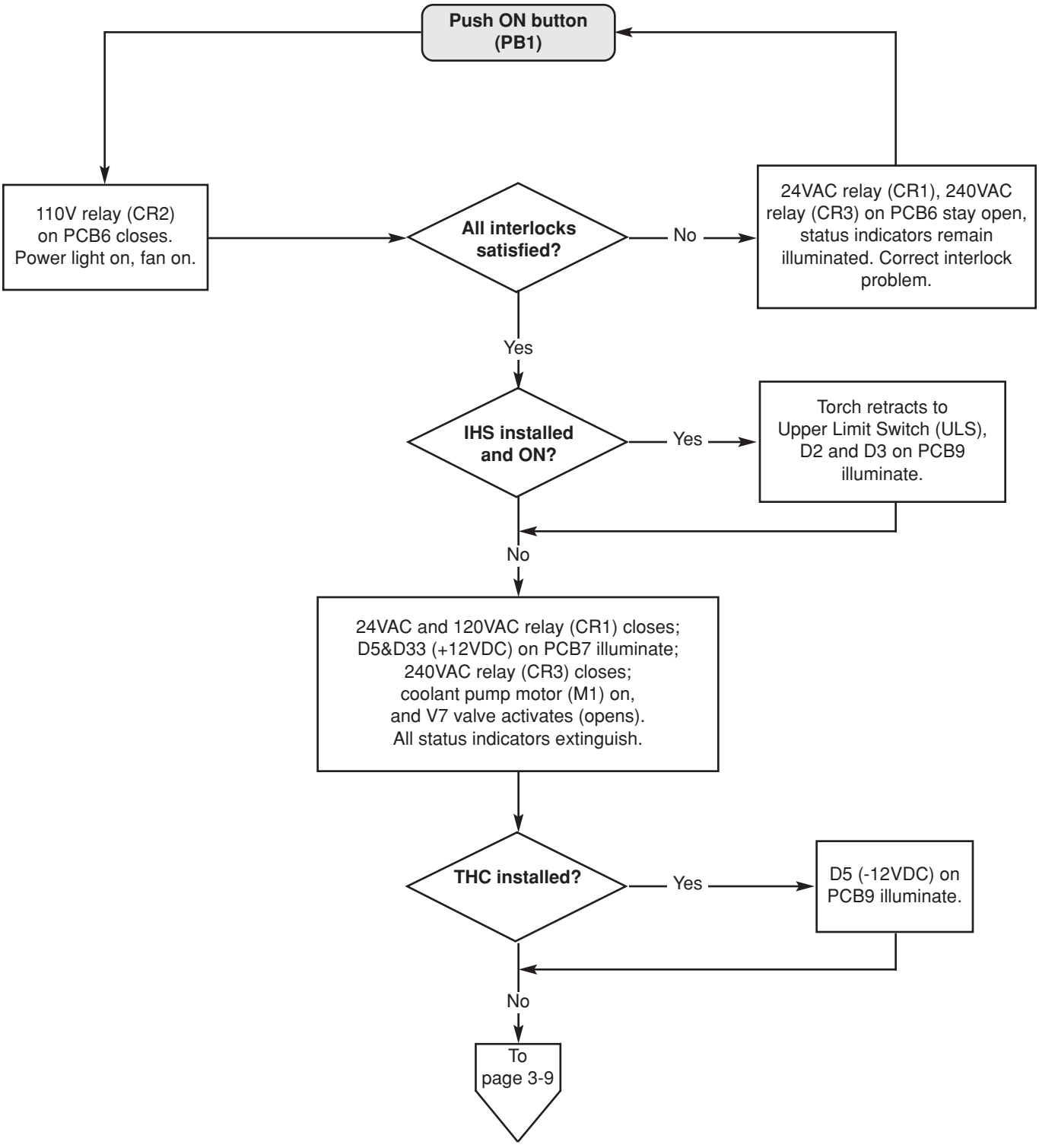


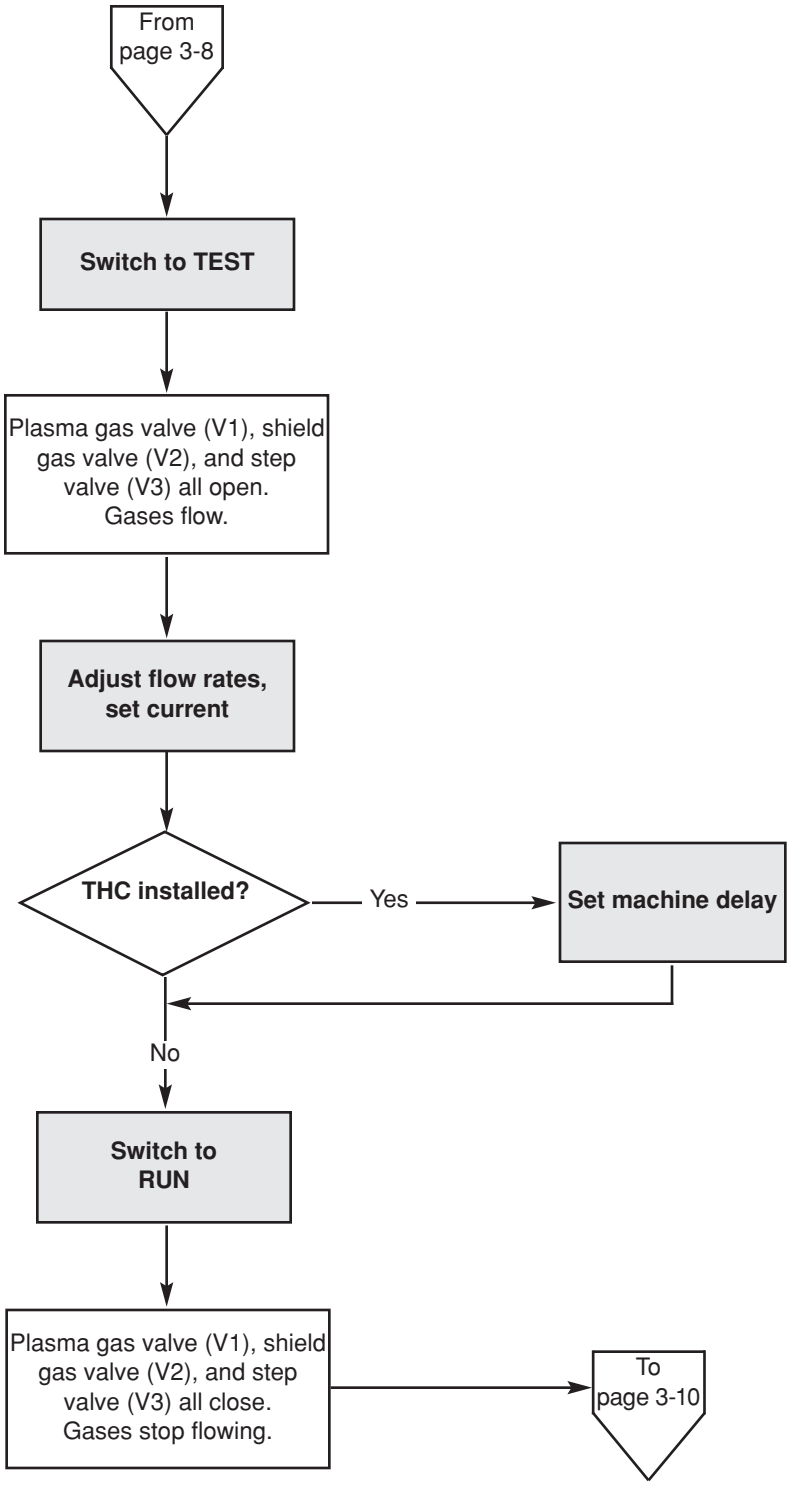
Decision Diamond The decision diamond is used to indicate a decision or branching point.

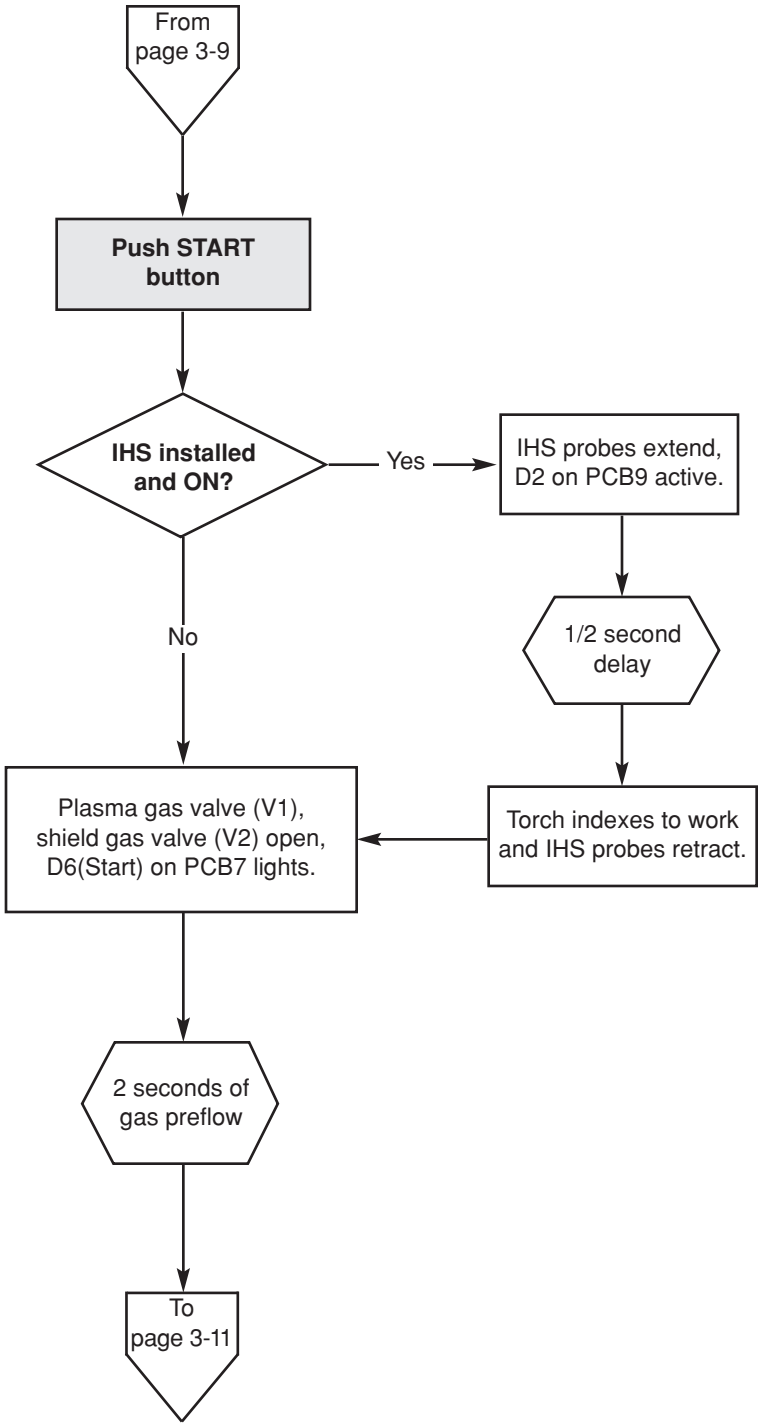
Preparation The preparation symbol is used to indicate an instruction modification.

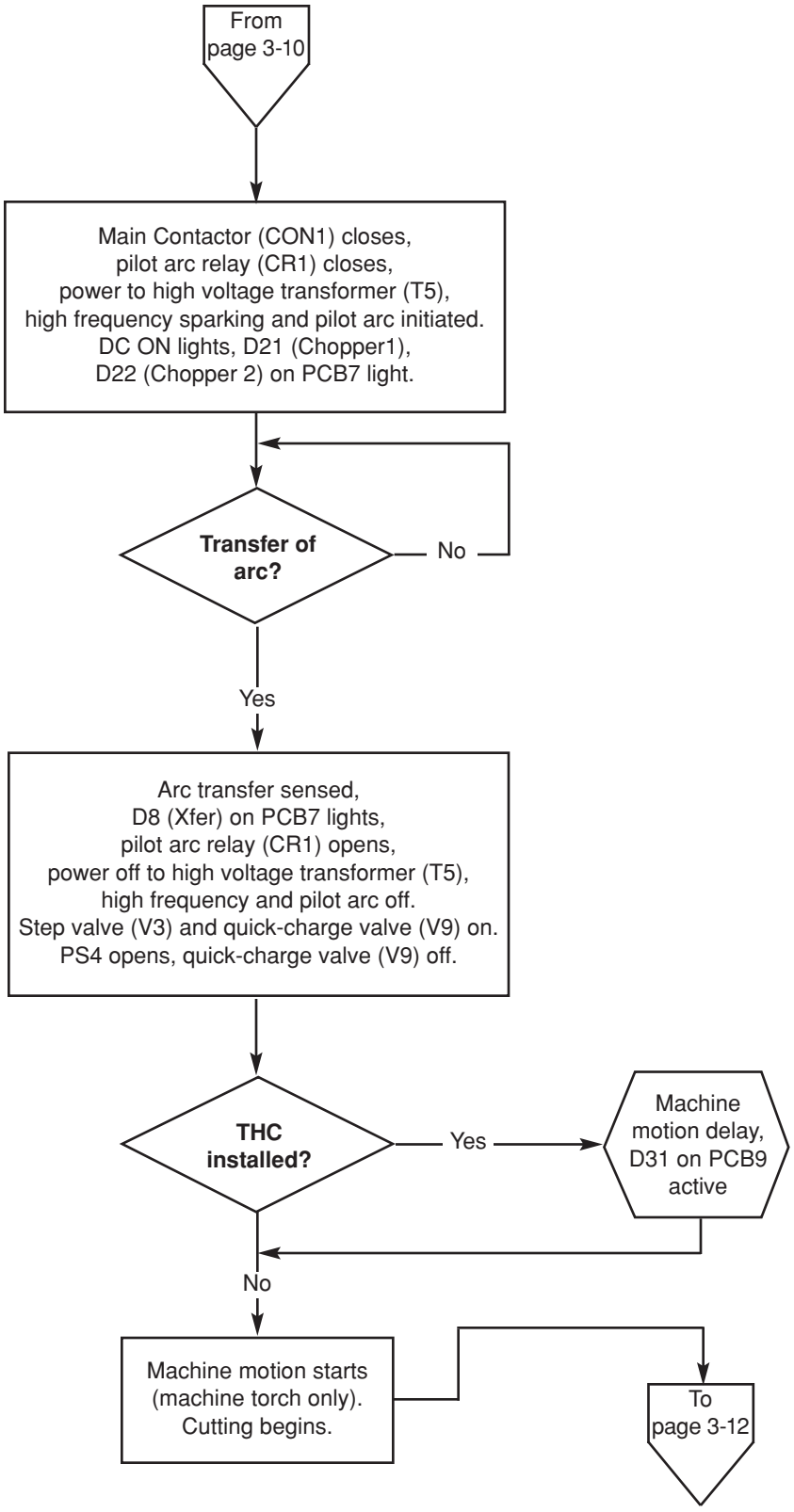


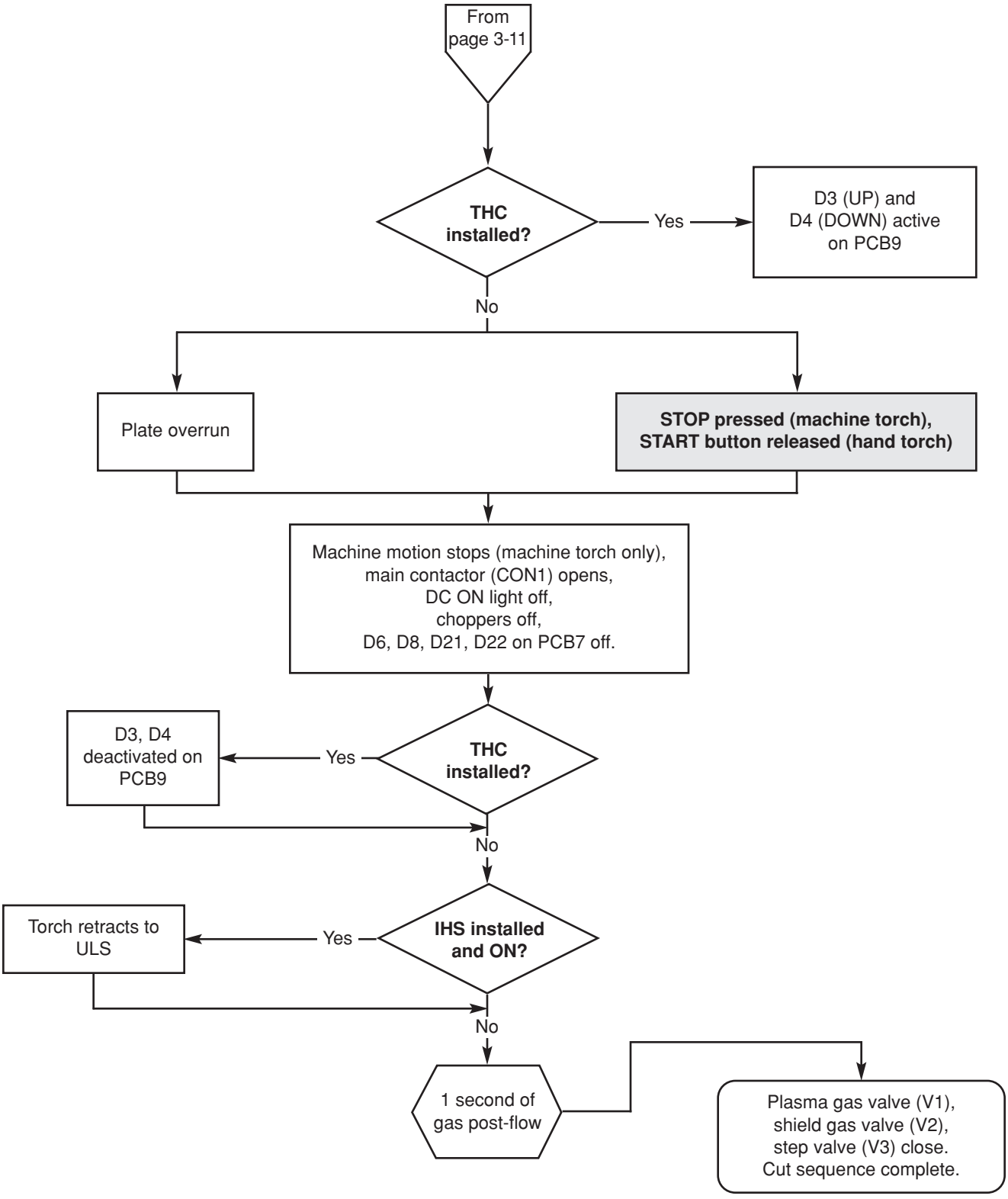
Off-page Connector The off-page connector is used to indicate exit or entry from another page to the flowchart.


Push ON button (PB1)
110V relay (CR2) on PCB6 closes. Power light on, fan on.
All interlocks satisfied?
No
24VAC relay (CR1), 240VAC relay (CR3) on PCB6 stay open, status indicators remain illuminated. Correct interlock problem.
Yes
IHS installed and ON?
Yes
Torch retracts to Upper Limit Switch (ULS), D2 and D3 on PCB9 illuminate.
No
24VAC and 120VAC relay (CR1) closes; D5&D33 (+12VDC) on PCB7 illuminate; 240VAC relay (CR3) closes; coolant pump motor (M1) on, and V7 valve activates (opens). All status indicators extinguish.
THC installed?
Yes
D5 (-12VDC) on PCB9 illuminate.
No
To page 3-9


From page 3-8
Switch to TEST
Plasma gas valve (V1), shield gas valve (V2), and step valve (V3) all open. Gases flow.
Adjust flow rates, set current
THC installed?
Yes
Set machine delay
No
Switch to RUN
Plasma gas valve (V1), shield gas valve (V2), and step valve (V3) all close. Gases stop flowing.
To page 3-10


From page 3-9
Push START button
IHS installed and ON?
Yes
IHS probes extend, D2 on PCB9 active.
1/2 second delay
No
Plasma gas valve (V1), shield gas valve (V2) open, D6(Start) on PCB7 lights.
Torch indexes to work and IHS probes retract.
2 seconds of gas preflow
To page 3-11


From page 3-10
Main Contactor (CON1) closes, pilot arc relay (CR1) closes, power to high voltage transformer (T5), high frequency sparking and pilot arc initiated. DC ON lights, D21 (Chopper1), D22 (Chopper 2) on PCB7 light.
Transfer of arc?
No
Yes
Arc transfer sensed, D8 (Xfer) on PCB7 lights, pilot arc relay (CR1) opens, power off to high voltage transformer (T5), high frequency and pilot arc off. Step valve (V3) and quick-charge valve (V9) on. PS4 opens, quick-charge valve (V9) off.
THC installed?
Yes
Machine motion delay, D31 on PCB9 active
No
Machine motion starts (machine torch only). Cutting begins.
To page 3-12


From page 3-11
THC installed?
Yes
D3 (UP) and D4 (DOWN) active on PCB9
No
Plate overrun
STOP pressed (machine torch), START button released (hand torch)
Machine motion stops (machine torch only), main contactor (CON1) opens, DC ON light off, choppers off, D6, D8, D21, D22 on PCB7 off.
D3, D4 deactivated on PCB9
Yes
THC installed?
No
Torch retracts to ULS
Yes
IHS installed and ON?
No
1 second of gas post-flow
Plasma gas valve (V1), shield gas valve (V2), step valve (V3) close. Cut sequence complete.

Initial Checks

Before trouble-shooting specific problems, it is good practice to do a visual check, and verify that voltages are present at the power source, transformer and power distribution board.

WARNING

SHOCK HAZARD: High voltages inside the power supply can kill! Always use caution when servicing a power supply that is plugged in and has an access panel removed.

1. Disconnect line power by turning main disconnect switch off and unplugging the power supply unit.

2. Using a Phillips head screwdriver, remove top access panel, 2 side access panels, and front and rear access panels.

3. Inspect interior of unit for discoloration on PC boards, or other apparent damage. If a component or module is obviously defective upon visual inspection, remove and replace it before doing any testing. Refer to the *Parts List* section to identify parts and part numbers.

4. If no damage is apparent, plug in the power supply unit, and apply power by turning on the main disconnect switch.

5. For a 200, 208, 240, 480, or 600-volt power supply, measure the voltage at TB1 between L1 (U), L2 (V) and L3 (W). See Figure 3-1, item 5. Refer to wiring diagram supplied with manual, if required. The voltage between any 2 of the 3 points at TB1 should be equal to the supply voltage (200, 208, 240, 480, or 600 VAC). If there is a problem at this point, disconnect main power and check connections, power cable, and fuses or circuit breaker at line disconnect switch. Repair or replace any defective components.

   For a 400-volt CE power supply, measure the voltage between the U, V and W studs on the EMI filter. Refer to Appendix A. Also refer to wiring diagram supplied with manual, if required. The voltage between any 2 of the 3 studs should be equal to the supply voltage (400 VAC). If there is a problem at this point, disconnect main power and check connections, power cable, and fuses or circuit breaker at line disconnect switch. Repair or replace any defective components.

(continued on page 3-15)

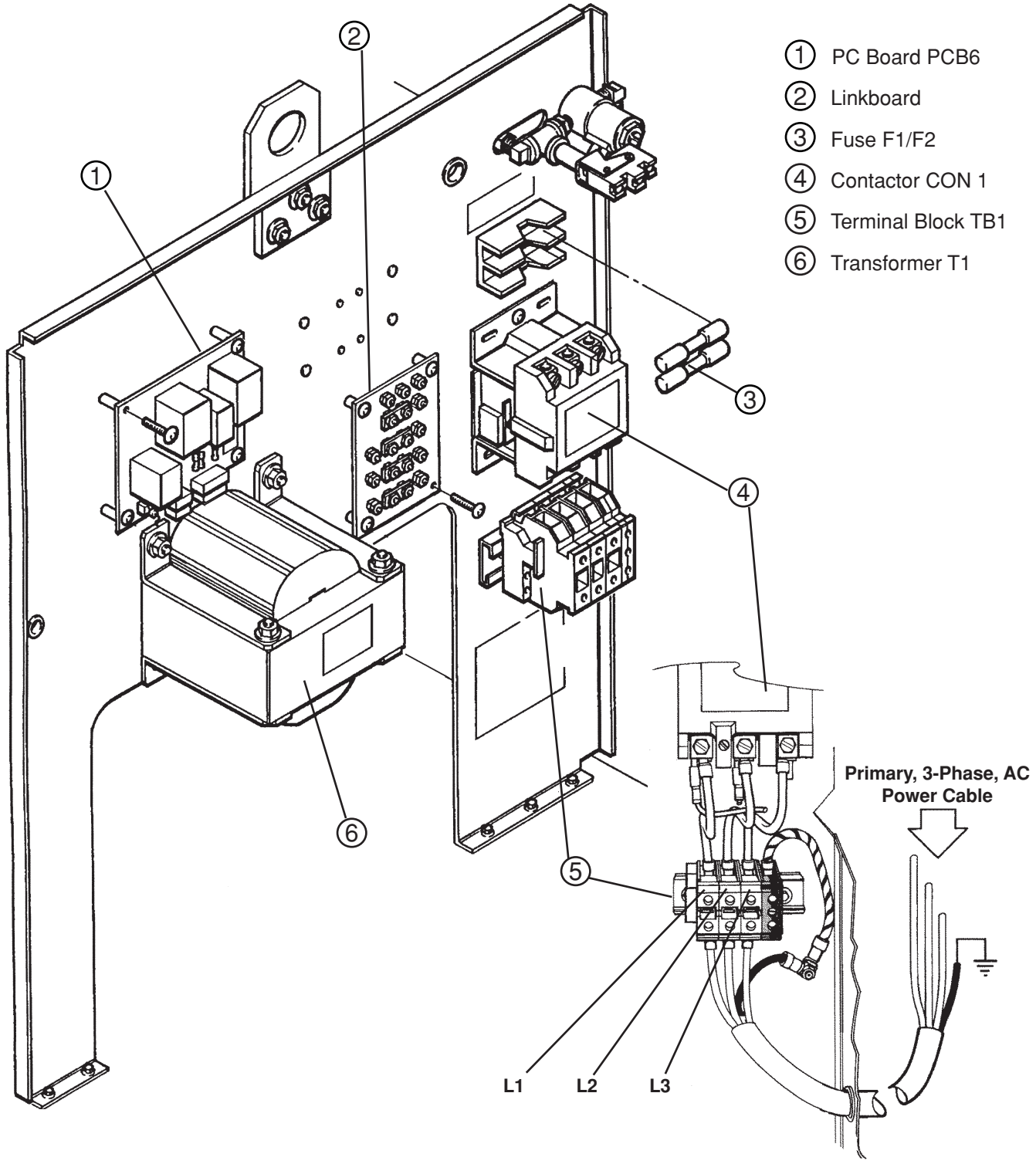


Figure 3-1 MAX200 Initial Checks

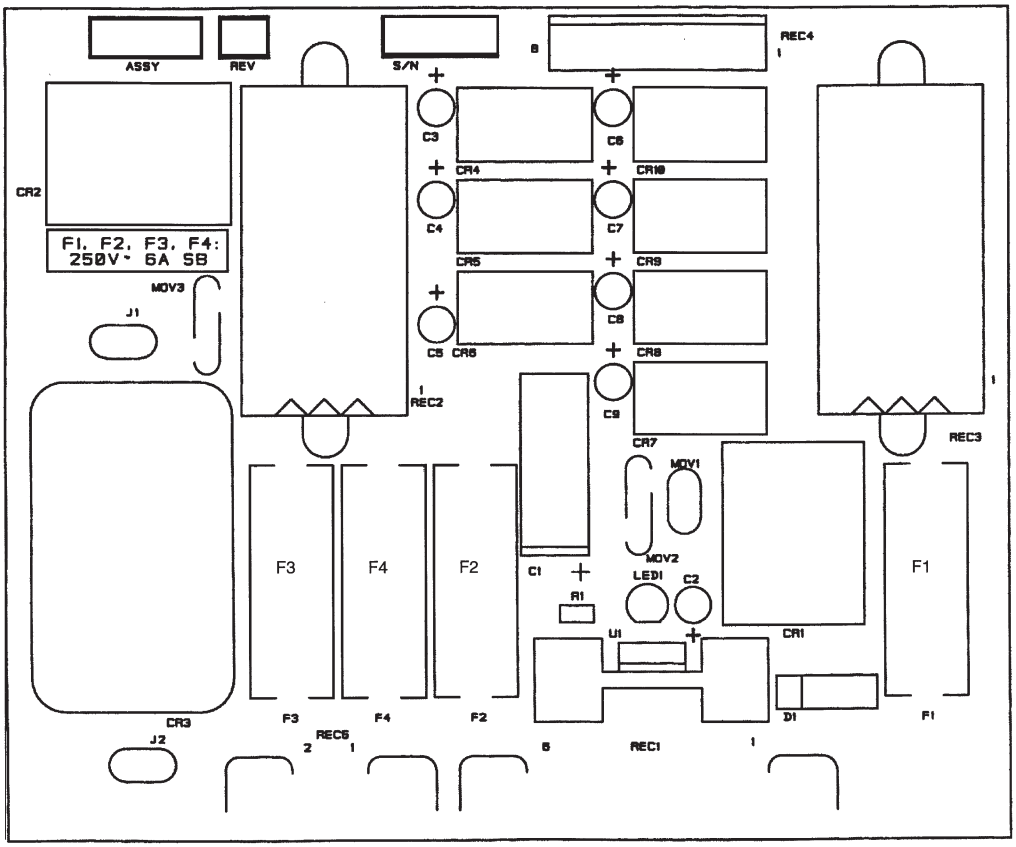


Figure 3-2 Power Distribution PCB6

6. Measure voltage at power distribution board PCB6 (Figure 3-1, item 1). Look on the board for fuses F1 through F4 (Figure 3-2). Measurements between each fuse and chassis ground should be as follows:

   F1: 24VAC
   F2: 120VAC
   F3: 240VAC
   F4: 120VAC

   If voltages are not present, or incorrect at 1 or more of these points, disconnect power and troubleshoot PCB6 fuses and associated pins, connectors and wiring between power distribution board connector REC1 and transformer secondary T1 (Figure 3-1, item 6).

   Also, check main power fuses F1 and F2 (Figure 3-1, item 3) and associated wiring and connections between T1 and L1 and L2.

   Repair or replace any defective components.

Troubleshooting

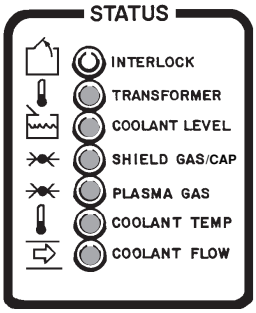
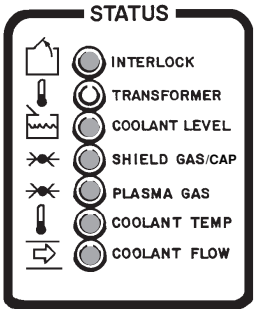
The troubleshooting section is presented by following normal operational sequence.

Before troubleshooting for specific problems, be sure that unit passes *Initial Checks* as outlined earlier in this section.

WARNING

SHOCK HAZARD: Always use caution when servicing a power supply when the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death. If questions or problems arise during servicing, call the Hypertherm Technical Services Department at 1-800-643-0030.

Problem	Possible Causes and Solutions
1. The green POWER ON pushbutton switch PB1 is pressed, but the fans are not operating and the green POWER ON indicator does not illuminate.	**1.1.** *The green POWER ON(I) PB1 pushbutton is defective.* Check that switch is operating correctly, and that good contact is being made. The POWER ON switch is normally open. **1.2.** *The red POWER OFF(O) PB2 pushbutton is defective.* Check that switch is operating correctly, and that good contact is being made. The POWER OFF switch is normally closed. **1.3.** *Associated wiring not making good contact.* Check wiring and repair or replace, if necessary.
2. The green POWER ON pushbutton switch PB1 is pressed, the POWER ON indicator illuminates, but the fans are not running.	**2.1.** *CR2 on the Power Distribution Board is defective.* Check that CR2 switches when POWER ON pushbutton is pressed. See Figure 3-2 for location of CR2. If CR2 is defective, desolder CR2 and replace. **2.2.** *PL31 and REC31 located near the fans (see Figure 4-1 for location of fans) are not seated together securely and/or not getting 120VAC from Power Distribution Board.* • Check pins, connectors and associated wiring for good continuity. • Check for 120VAC at PL31. **2.3.** *PL2 and REC2 on Power Distribution Board (see Figure 3-2 for location of REC2) are not seated well.* Check pins, connectors and associated wiring for good continuity. Repair or replace, if necessary.

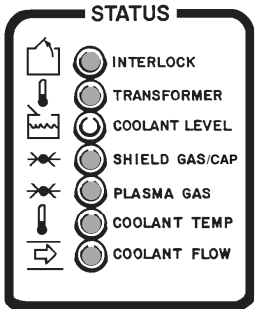
Problem	Possible Causes and Solutions
3. The green POWER ON pushbutton switch PB1 is pressed, the fans are operating, but the green POWER ON indicator does not illuminate.	**3.1.** *Pushbutton PB1 was not held down long enough.* Press and hold PB1 for a minimum of five seconds. **3.2.** *Relay CR1 on the Power Distribution Board is defective.* Check that CR1 switches when POWER ON pushbutton is pressed. See Figure 3-2 for location of CR1. If CR1 is defective, desolder CR1 and replace. **3.3.** *One or more of the STATUS LEDs remains illuminated, indicating a fault condition.* The following is a guide to troubleshooting the cause of unlit STATUS indicators:
3a. INTERLOCK LED illuminated: 	**3a.1.** *No jumper between terminals 34 and 35 of TB4.* If your unit does not have a Remote High Frequency Console, this LED will be satisfied if there is a jumper between terminals 34 and 35 of TB4. See Figure 4-10 for location of TB4. If the jumper <u>is</u> there: • Using the 013-2-179 wiring diagram, check pins, connectors and associated wiring from REC3 on the Power Distribution Board (PCB6) to terminals 34 and 35 of TB4. Repair and/or replace defective component(s) if necessary.
3b. TRANSFORMER LED illuminated: 	**3b.1.** *Main transformer T2 or one of the choppers is overheating.* This LED will extinguish when the main transformer (T2) is operating in a normal temperature range (under 165° C) and choppers CH1 and CH2 are also operating in the normal temperature range (under 82° C). See Figure 4-3 for location of T2 and connector to TS1. Chopper temperature switches TSW1 and TSW2 are located on choppers CH1 and CH2 respectively. See Figures 4-7, 4-8 and 4-9.

Problem

Possible Causes and Solutions

- Check temperature switches (normally closed).
- Check pins, connectors and associated wiring to temperature switches.
- Leave the fans running, and try restarting the unit after one hour. If LED still illuminates, one of the choppers or the main transformer may need to be replaced.

3c. COOLANT LEVEL LED illuminated:

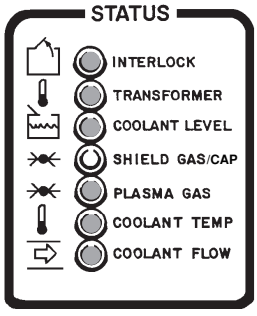


3c.1. *Coolant level is low.*
This LED will extinguish when a proper coolant level in the coolant reservoir is maintained. Level switch LS1 is located in the coolant reservoir, and will open when it senses that coolant level is too low. See Figure 4-13 for location of coolant reservoir and LS1.

- Check coolant level.
- If coolant level is adequate, disconnect PL23 (located near reservoir) and check to see if LS1 switch is closed.
- Check connections and associated wiring from PL23 to REC3 of PCB6. See Figure 4-6 for location of PCB6, and Figure 3-2 for location of REC3.

Repair and/or replace defective component(s) if necessary.

3d. SHIELD GAS/CAP LED illuminated:



3d.1. *Shield gas pressure too low.*
This LED will extinguish when shield gas pressure of 70 psi or greater is sensed by PS2. See Figure 4-6 for location of PS2, and Figure 3-14 for gas interconnect diagram.

- Check to see that shield gas supply is set to specifications according to the *Cut Chart* tables in **Section 4** of MAX200 Instruction Manual (#800870 Hand Torch; #800980 Machine Torch).
- Verify that all shield gas connections are secure, and that there are no leaks in the hosing. See Figure 4-10 for location of Shield Gas Supply bulkhead.

Problem

Possible Causes and Solutions

- Verify that the torch cap is on tight, and that no hissing from gas leakage is heard.

- Check for damage to O-rings in the torch main body. See Figure 3-3 for location of torch main body and O-rings for hand torch, and Figure 3-6 for machine torch.

3d.2. *Pressure switch PS2 not functioning.*
PS2 is normally open, and closes when shield gas pressure is 70 psi or greater. After PS2 is closed, the SHIELD GAS/CAP LEDextinguishes.

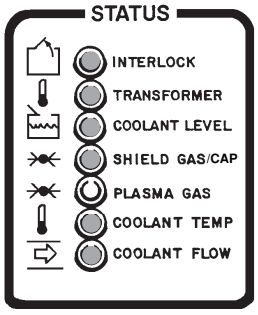
- Using the 013-2-179 wiring diagram, check pins, connectors and associated wiring from REC3 on the Power Distribution Board to PS2.

3d.3. *Solenoid valve V4 not functioning.*
V4 is normally closed and opens when 24VAC is applied. See Figure 4-6 for location of V4.

- Using the 013-2-179 wiring diagram, check pins, connectors and associated wiring from REC3 on the Power Distribution Board to V4.

Repair and/or replace defective component(s) if necessary.

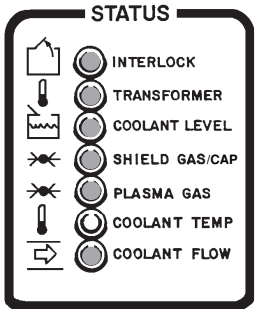
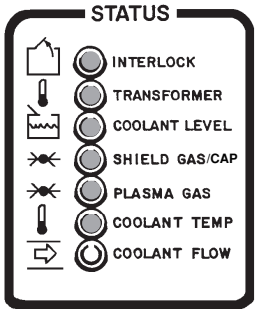
3e. PLASMA GAS LED illuminated:



3e.1. *Plasma gas pressure too low.*
This LED will extinguish when PS1 senses plasma gas pressure of 60 psi or greater. Refer to Figure 4-4 for location of PS1, and Figure 3-14 for gas interconnect diagram.

- Verify that plasma gas supply is set to specifications in *Cut Chart Tables* in Section 4 of MAX200 Instruction Manual (#800870 or #800980).

- Verify that all Plasma Gas connections are secure, and that there are no leaks in the hosing. See Figure 4-10 for location of plasma gas supply bulkhead.

Problem	Possible Causes and Solutions
	3e.2. *Pressure switch PS1 not functioning.* This switch is normally open, and closes when plasma gas pressure is at or above 60 psi. After PS1 is closed, the 12 VDC extinguishes the PLASMA GAS LED. • Using the 013-2-179 wiring diagram, check pins, connectors and associated wiring from REC3 on the Power Distribution Board to PS1. Repair and/or replace defective component(s) if necessary.
3f. COOLANT TEMP LED illuminated: 	**3f.1.** *Coolant too hot.* This LED will extinguish when temperature switch TS2 senses that the temperature of coolant in the coolant reservoir is under 160°F. See Figure 4-13 for location of TS2 and the coolant reservoir. • Check to see if water coolant is above 160°C. • Disconnect PL24 (located in the rear of the power supply near the coolant reservoir), and check to see if TS2 is open. TS2 is normally closed, and is opened when a temperature above 160°F is reached. • Using the 013-2-179 wiring diagram, check pins, wires and connections from PL24 to REC3 of PCB6. See Figure 4-6 for location of PCB6. See Figure 3-2 for location of REC3. Repair and/or replace defective component(s) if necessary.
3g. COOLANT FLOW LED illuminated: 	**3g.1.** *Coolant flow too slow.* This LED will extinguish when FS1 senses a coolant flow of at least .5gpm to the torch. See Figure 4-13 for location of flow switch FS1, motor M1, pump P1 and filter element. **3g.2.** *Motor M1 not functioning.* • Check to see if 240VAC is available at PL21. PL21 is located near the pump. Note: The 240VAC relay (CR3) on PCB6 will not close until the first five interlocks (STATUS indicators) are satisfied.

Problem	Possible Causes and Solutions
	• Using the 013-2-179 wiring diagram, check pins, connections and associated wiring from PL21 to REC5 of PCB6. See Figure 4-4 for location of PCB6. See Figure 3-2 for location of REC5. If 240VAC is not available at REC5, CR3 may be defective. Replace PCB6 if CR3 is defective.
	3g.3. *Flowwitch FS1 not functioning.* FS1 is a normally open switch that is closed when a flow greater than .5gpm is sensed. When FS1 is closed, the COOLANT FLOW LED extinguishes.
	• Check coolant hoses and connections for leaks.
	Repair and/or replace defective component(s) if necessary.
4. All status indicators extinguished, switch to TEST, but no gas flow.	**4.1.** *Volume of hosing from supply gas to power supply is too small in diameter.* Increase I.D. of supply hose.
	4.2. *Valves V1, V2, and V3 not getting 120VAC from Control Board PCB7.*
	• On PCB7, check to see if D5 and D33 are illuminated. See Figure 3-16 for location of D5 and D33. If these LEDs are not illuminated check pins, connectors and associated wiring from REC2 of Power Distribution Board to REC2 and REC4 of Control Board.
	• If D5 and D33 are lit, disconnect receptacles 28 and 29 from V1 and V3, and check for 120VAC from Control Board PCB7 after S1 is in the TEST position. See Figure 4-4 for location of V1 and V3.
	• If there is no 120VAC use 013-4-179 wiring diagram and check pins, connections and associated wiring from V1 and V3 to REC1 of PCB7. If wiring is O.K., replace Control Board PCB7.

Problem	Possible Causes and Solutions
5. All status indicators extinguished, switch to TEST, plasma gas flow present, but no shield gas flow.	**5.1.** *V6 is closed.* Open V6 (shield gas knob). See Figure 3-14 for gas interconnect diagram. **5.2.** *V2 not opening.* Disconnect PL30 from REC30 and check for 120VAC from Control Board PCB7. See Figure 4-1 for location of V2. If there <u>is</u> 120VAC at V2, replace V2. If there is <u>no</u> 120VAC at V2, use 013-2-179 wiring diagram to check pins, connections and associated wiring from V2 to REC2 of Control Board PCB7. If wiring is O.K., replace PCB7.
6. All status indicators extinguished, switch from TEST to RUN, but gases continue to flow.	**6.1.** *S1 (TEST/RUN) switch is defective.* Do a continuity check to verify that S1 is functioning properly. **6.2.** *V1, V2 or V3 not closing.* Using the 013-2-179 wiring diagram, verify that 120VAC is <u>not</u> at V1, V2 and V3 when S1 is in the RUN position. See Figures 4-3 and 4-4 for location of V1 and V3, and Figure 4-1 for location of V2. If there is 120VAC at any one of these valves while in the RUN position, replace PCB7. If 120VAC is not at the valves, troubleshoot each valve to determine which one is stuck open. Repair and/or replace defective valve(s).
7. The green POWER ON indicator is illuminated, the START command is given and DC ON indicator is illuminated but there is no high frequency and no pilot arc.	**7.1.** *There is no spark between the spark gap electrodes.* Clean (with emery cloth), align, and/or regap (.020" per gap) the electrodes, if necessary. Ensure that the electrode surfaces between the gaps are flat. If surfaces are rounded, replace and regap. See Figure 4-11 for part number information. • Visually inspect the high voltage transformer T5 for leaking oil or overheating. See Figure 4-10 for location of T5. Replace T5 if leaking or overheating.

Problem	Possible Causes and Solutions
	• Disconnect PL26 from REC26 and check for 120VAC at PL26 after START command is given. REC26 is located near T5 (high-voltage transformer). (See Figure 4-10 for location of T5) • If there is no 120VAC at PL26, use 013-2-179 wiring diagram and check pins, connectors and associated wiring from PL26 to REC2 of Control Board PCB7. If connections are O.K., replace PCB7. • If there is 120VAC at PL26 , shut down system and remove capacitors C7 and C8. (See Figure 4-11 for location of C7 and C8) Restart system and see if a faint spark is now observed across the gaps. • If a spark is not observed at the gaps, replace T5. If there is a spark, shut down system, and replace capacitors C7 and C8. **(Always replace the capacitors in pairs).** **7.2.** *There is no high frequency at the torch.* Check for a shorted torch, a damaged pilot arc lead, or loose lead connections. Replace the torch or pilot arc lead or tighten the lead connections.
8. The green POWER ON indicator is illuminated, the torch START command is given and the DC ON indicator illuminates, and there is high frequency, but there is no pilot arc.	**8.1.** *Pilot arc relay CR1 is not getting 120VAC from the Control Board PCB7.* See if the CR1 relay contacts close after the START command is given. See Figure 4-10 for location of CR1. If CR1 does not close: • With an AC voltmeter between wires 62 and 63, see if 120VAC is coming from PCB7 after START command is given. • If there is no 120VAC, check connectors, terminals, pins, and associated wiring to REC2 of PCB7. • If wiring is O.K., replace PCB7. **8.2.** *Pilot arc relay CR1 is defective.* If there is 120VAC at wires 62 and 63 (see above steps), and CR1 does not close, replace CR1.

Problem	Possible Causes and Solutions
	8.3. *Main contactor (CON1) or PCB7 is defective.* • With an AC voltmeter, see if contactor CON1 is getting 24VAC between pins 66&67 after START command is given. If there is no 24VAC, check pins, connectors and associated wiring from CON1 to pins 5&6 of REC1 of PCB7. • If wiring is O.K., replace PCB7. • If CON1 is getting 24VAC from the Control Board as described above, measure the voltage between all terminals 1A, 1B and 1C of main transformer T2. after the START command is given. See Figure 4-3 for location of T2. The voltage between any two of the three points should be equal to 200VAC. • Measure the voltage between all terminals 2A, 2B and 2C of main transformer T2 after the START command is given. The voltage between any two of the three points should be equal to 200VAC. If there is no voltage at <u>any</u> of the above points, replace CON1. If there is voltage at some but not all of the above points, check wiring and connections to and from T2. If wiring checks out OK, replace T2. **8.4.** *Choppers 1 and/or 2 defective or not functioning.* See *Chopper Module Test Procedure* later in this section to troubleshoot.

9. The green POWER ON indicator is illuminated, and the START command has been given, but the DC ON indicator does not illuminate.	**9.1.** *The torch start button is defective (on hand-torch system). The interface between the machine START button and the MAX200 power supply is wrong or defective (on machine-torch system).*
	Check to see if D6 on PCB7 (see Figure 3-16) illuminates when START command is given. If D6 does not illuminate, use 013-2-179 wiring diagram and check wiring from:
	• **On Hand-Torch system:** Torch start button (normally open) to terminals 177 & 178 of TB2 of power supply.
	  • TB2 to I/O PCB5 to TB3 to REC3 of PCB6.
	  • REC3 of PCB6 to REC1 of PCB7.

Problem	Possible Causes and Solutions

	• **On Machine-Torch system:** Cutting machine switch (normally open) to terminals 82&83 of TB3 of power supply.
	  • TB3 to REC3 of PCB6 .
	  • REC3 of PCB6 to REC1 of PCB7.
	
	Repair and/or replace defective component(s), if necessary.

	9.2. *Control Board PCB7 or LT2 bulb is defective.* Check to see if D5 and D33 on PCB7 are illuminated (see Figure 3-16). If these indicators are illuminated and wiring checkout as described above is O.K., LT2 may not be getting 24VAC from Control Board. Proceed as follows (see Figure 4-2 for location of LT2): • Monitor between points 64&65 with an AC volt meter. (64&65 are terminal points to the LT2 bulb) • Press START. Voltage between these points should read 24VAC. If there is no 24VAC, use the 013-2-179 wiring diagram and check wires and conncectors from LT2 to REC1 of PCB7. Repair and/or replace defective component(s), if necessary. If wiring is OK, replace PCB7. • If there is 24VAC between points 64&65 after START is pressed, replace bulb LT2.
10. The unit stops cutting during cut, or cuts poorly.	**10.1.** *The work clamp is not connected or it is broken.* Connect or repair the work clamp. **10.2.** *Arc not transferring to workpiece.* Check work clamp and cable connecting clamp to workpiece. Good contact must be made in order for the arc to transfer to the workpiece. **10.3.** *There is insufficient air or gas pressure.* Check gas inlet pressure specifications under *Cut Charts* in **Operation** section of MAX200 Instruction Manual (#800870 or #800980). Check plasma and shield gas pressures in TEST and RUN modes as specified under *Cut Charts* in **Operation** section of MAX200 Instruction Manual (#800870 or #800980).

Problem	Possible Causes and Solutions
	10.4. *Torch is getting insufficient current.* Check the arc current setting for the type and thickness of metal you are cutting from the *Cut Charts* in the **Operation** section of MAX200 Instruction Manual (#800870 or #800980).
	10.5. *Torch Height Control receiving incorrect voltage for correct standoff distance* (for machine torches with THC). • Check the arc voltage setting for the type and thickness of metal you are cutting from the *Cut Charts* in the **Operation** section of MAX200 Instruction Manual (#800870 or #800980). • Check cable from power supply to remote V/C control. See Parts List section for information on the remote V/C cables.
	10.6. *The power supply has overheated.* Shut down system and wait for unit to cool down. If unit will not restart, see interlock troubleshooting guide earlier in this section.
	10.7. *Transfer of arc is not sensed.* See *Arc Transfer Test Procedure* later in this section to troubleshoot.
	10.8. *Choppers 1 and/or 2 defective or not functioning.* See *Chopper Module Test Procedure* later in this section to troubleshoot.
11. No Initial Height Sensing (machine-torch systems with IHS option)	**11.1.** *Torch lifter motor defective.* Replace torch lifter motor, if necessary.
	11.2. *THC board not being activated.* Check to see if D5 on PCB9 illuminates after the STATUS indicators all extinguish. See Figure 3-15 for location of D5. If D5 is notilluminated, then PCB9 may not be getting 120VAC from Power Distribution Board PCB6. Using 013-2-179 wiring diagram, check pins, connectors and associated wiring from REC5 of PCB9 to REC2 of PCB6. Repair and/or replace defective component(s), if necessary.

Problem **Possible Causes and Solutions**

11.3. *IHS system not getting start command from Control Board PCB7, or CR1 on PCB9 is defective.*

- After START command is given, look to see if D2 on PCB9 illuminates. See Figure 3-15 for location of D2. If D2 illuminates, 120VAC should be sent to the IHS system and be present at terminals 2 & 3 of 1TB of IHS module. See Figure 5-4.

  If there is no 120VAC at the terminals after the START command is given, check pins, connectors, cables and associated wiring from Initial Height Sensor to REC4 of PCB9.

  Repair or replace defective component(s), if necessary. If wiring is O.K., replace CR1 on PCB9.

  If there is 120VAC at terminals 2 & 3 of 1TB of IHS, there may be a problem with the IHS or its hookup.

  - Verify that air to IHS is on and pressure is 20 psi.
  - Verify that 1SOL activates when 120VAC is applied. See Figure 4-23 for location of 1SOL.
  - Verify that cables from IHS sensors are mated securely in their receptacles.

- If D2 on PCB9 does not illuminate after START command is given, check pins, connectors, machine interface cable and wires from machine to MAX200 power supply. See Figure 3-10 in **Setup** section of instruction manual #800980 for machine interface cable detail.

Repair, replace or reconnect, if necessary.

- If wiring is correct, check pin 9 of REC2 of PCB9 for 0 volts after START command is given. If 0 volts is not at pin 9, replace Control PCB7.

Problem	Possible Causes and Solutions
12. IHS in use – no auto retract after cut (machine-torch systems with IHS option).	**12.1.** *No upper limit switch, defective upper limit switch, or switch improperly installed / adjusted.* See *Install the Upper Limit Switch and Cable* under *Install the MAX200 with IHS Option* in **Setup** section of instruction manual #800980 for details. See also specifications on purchased upper limit switch.
13. No torch UP (machine-torch systems with THC option)	**13.1.** *Torch lifter motor defective.* Replace torch lifter motor, if necessary. **13.2.** *Machine interface connections incorrect and/or external AC or DC source not functioning or interfaced incorrectly.* See Figure 3-10 in **Setup** section of instruction manual #800980 for detail and specifications for machine interface. **13.3.** *THC board not being activated.* Check to see if D5 on PCB9 illuminates after the STATUS indicators all extinguish. See Figure 3-15 for location of D5. If D5 is notilluminated, then PCB9 may not be getting 120VAC from Power Distribution Board PCB6. Check pins, connectors and associated wiring from REC5 of PCB9 to REC2 of PCB6. Repair and/or replace defective component(s), if necessary. **13.4.** *CR2 relay on PCB9 defective.* See if D3 illuminates during cut sequence. If D3 illuminates and there is no torch motion up and wiring to machine is O.K., replace CR2. **13.5.** *Problem with the volt division circuit.* See *Voltage Divider Test Procedure* later in this section. **13.6.** *THC PCB10 defective.* See if D3 illuminates during cut sequence. If D3 does not illuminate, and voltage division and CR2 are O.K., replace PCB10.

Problem	Possible Causes and Solutions
14. No torch DOWN (machine-torch systems with THC option)	**14.1.** *Torch lifter motor defective.* Replace torch lifter motor, if necessary.
	14.2. *Machine interface connections incorrect and/or external AC or DC source not functioning or interfaced incorrectly.* See Figure 3-10 in **Setup** section of instruction manual #800980 for detail and specifications for machine interface.
	14.3. *THC board not being activated.* Check to see if D5 on PCB9 illuminates after the STATUS indicators all extinguish. See Figure 3-15 for location of D5. If D5 is not illuminated, then PCB9 may not be getting 120VAC from Power Distribution Board PCB6. Check pins, connectors and associated wiring from REC5 of PCB9 to REC2 of PCB6. Repair and/or replace defective component(s), if necessary.
	14.4. *CR3 relay on PCB9 defective.* See if D4 illuminates during cut sequence. If D4 illuminates and there is no torch motion down and wiring to machine is O.K., replace CR3.
	14.5. *Problem with the volt division circuit.* See *Voltage Divider Test Procedure* later in this section.
	14.6. *THC PCB10 defective.* See if D4 illuminates during cut sequence. If D4 does not illuminate, and voltage division and CR3 are O.K., replace PCB10.

Test Procedures

WARNING

SHOCK HAZARD: Always use caution when servicing a power supply when the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death. If questions or problems arise during servicing, call the Hypertherm Technical Services Department at 1-800-643-0030.

Arc Transfer Test Procedure

The “transfer” of arc refers to the arc being made between the electrode of the torch and the workpiece. The pilot arc is made between the torch electrode and the torch nozzle and precedes transfer in normal operation. When transfer is made, it is sensed by a Hall effect device (CS1) and the signal is sent to the Control Board PCB7. To check for proper functioning of the arc transfer sensing system, perform the following procedure:

1. Observe D8 on PCB7 (see Figure 3-16) and see if it lights after main contactor closes (see sequence flowchart earlier in this section). If it does not light, continue to next step. If it does light, return to *Troubleshooting* section.

2. Disconnect PL12 from CS1 (see Figure 4-12 for location of CS1) and check for +12VDC between pins 1&2. If there is +12VDC, go to step 5.

3. If there is no +12VDC, power down and check connectors, pins and associated wiring between PL12 and REC2 of PCB7.

   Repair and/or replace defective component(s) if necessary.

4. If wiring is O.K., replace PCB7.

5. If there is +12VDC between pins 1&2 of PL12, reconnect PL12 to CS1 and take voltage between pins 13&14 of REC2 on PCB7 after arc is established. This should read 0 volts.

   If there is no 0 volts, replace CS1.

Test Procedures (Cont.)

Chopper Module Test Procedure

The chopper module operation is described earlier in this section under *Theory of Operation: "Chopper" Power Supply.* In order to troubleshoot the chopper section for proper functioning, perform the following procedure:

WARNING

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

1. Turn all power to the MAX200 OFF. Disconnect PL26 from REC26 to disable high frequency transformer T5. See Figure 4-10 for location of T5.

2. Remove large fuses F3 and F4. Check to see if fuse(s) is (are) open.

3. Place the positive lead to the **+** side of the bridge and the negative lead to the **–** side of the bridge. See Figure on page 3-32. Note that actual connection points are hidden by cap support bracket.

4. Turn power to the MAX200 ON, and start system up. After the START command has been given, check voltage. The input to the chopper at these points should be about +280 VDC.

   If the input is OK and corresponding fuse F3 or F4 was blown, replace the chopper module.

   If there is no +280 VDC input, check input to bridge for shorts. Also, check contactor (CON1), connections and associated wiring to the contactor. Repair and/or replace defective component(s) if necessary.

5. If voltage from step 4 is +280 VDC and corresponding fuse is not blown, check the CH1 chopper output at TB1 by putting the positive lead of the voltmeter at the (+) WORK terminal (#48A output cable) and negative lead at the (-) TORCH (#39A output cable). (Check the CH2 output using the same procedure used checkout CH1. See Figure on page 3-32

6. Turn the system on and press the START command. After the START command has been given, check the voltage. If the output from each chopper at these points is +280 VDC, then choppers are OK.

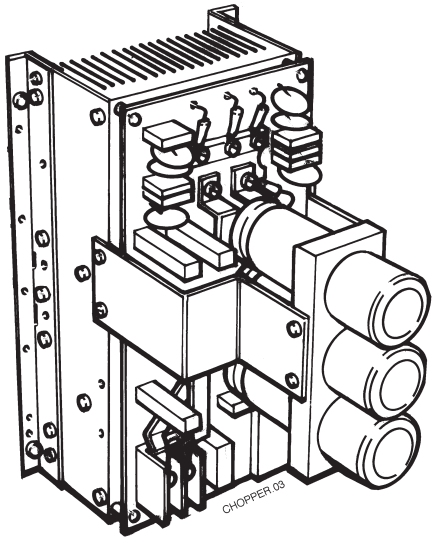
7. If the chopper does not output +280 VDC, check to see if LED1 logic power light is on. If LED1 is not on, check if 120V is going to JP6. If there is no 120V at JP6, check wiring back to power distribution board. Repair or replace defective component(s), if necessary.

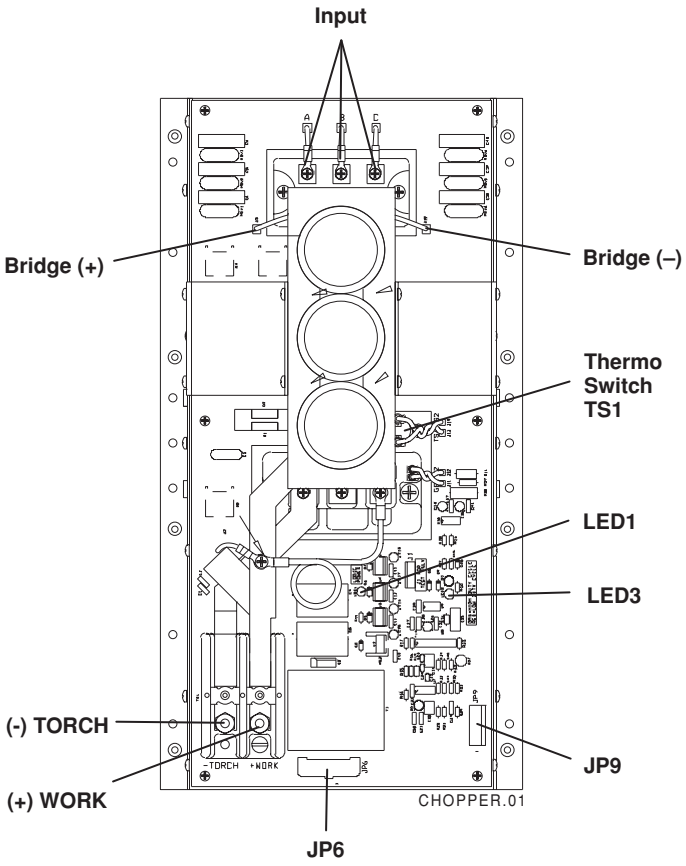
   Also check to see if LED3 is turning green when enabled (normal condition). If LED1 is on and LED3 is red when enabled (fault condition), then make sure that JP9 is seated properly. If JP9 is connected, disconnect one side of the thermo switch wire (TS1) and try again. If voltage comes up and LED3 turns green, the unit is either too hot or thermo switch is shorted. Allow unit to cool and repeat test. If LED3 still turns green, replace chopper module.

8. If chopper still does not output 280V after completing step 7, there may be a problem with the control signal or the chopper module. The chopper drive signal comes through control board PCB7 as an analog level from 0 to +8 VDC, which varies the duty cycle and subsequent output current of the chopper. These analog signals are on pins 3 & 4 REC3 of PCB7 for CH1, and 5 & 6 REC3 for CH2.

   To determine if there is a problem with the chopper modules or with control board PCB7, proceed as follows:

   - Ensure that high frequency is still disabled (see step 1).
   - Disconnect PL7 from REC3 on PCB7.
   - Place voltmeter across output terminals of chopper (positve lead to (+) WORK and negative lead to (-) TORCH) and press the START command.
   - If the voltmeter reads +280 VDC, replace control board PCB7.
   - If the voltmeter reads 0 volts, replace corresponding chopper module CH1 or CH2.





Test Procedures (Cont.)

Voltage Divider Test Procedure (Machine-Torch Systems)

The voltage between the electrode and the workpiece during arc transfer is divided down by 100 in the MAX200 and sent to the THC board PCB9. Adjustments to the torch height are made by the THC board so that consistent distance can be maintained between the torch and the workpiece.

In order to see if the voltage dividing is being done properly, perform the following procedure:

1. Press the OFF button on the MAX200 Power Supply.

2. Place a DC voltmeter between the positive and negative terminals on the I/O PC board (PCB5). See Figure 4-12 for location of PCB5. The positive and negative terminals have cables marked 45 (-) and 42 (+) attached to them.

3. Press the ON button of the MAX200.

4. After all STATUS indicators light, press START.

5. When the arc transfers, record the voltage off of the meter.

6. Remove voltmeter from the positive and negative terminals.

7. Place voltmeter across pins 3(+)&4(-) of REC5 on PCB9. See Figure 3-15 for location of REC5 on PCB9.

8. Depress the START button again to start a second cut.

9. When the arc is transferred, record the voltage off of the meter. It should read 1/100th of the first reading. Example: -130VDC at positive and negative terminals should read -1.3VDC between pins 3&4.

   If the second reading is not 1/100th of the first reading, check pins, connectors and associated wiring between REC1 of PCB5 and REC2 of PCB7.

MAX200 Rev 1 90° Hand Torch Removal and Replacement

To remove and replace the hand torch main body from the torch lead, perform the following procedure and see Figure 3-3.

Removal

1. Remove the nine (9) screws securing the two handle halves and separate.

2. Remove the torch switch from the handle switch holder and allow to hang freely.

3. On the larger leads, use a 3/8" open-end wrench to hold the torch body fittings and a 1/2" open-end wrench to turn the torch lead fittings.

   On the smaller leads, use a 5/16" open-end wrench to hold the torch body fittings and a 7/16" open-end wrench to turn the torch lead fittings.

   Turn the torch lead fittings counterclockwise (ccw) to loosen the connections. Note that the red lead fitting is reverse threaded and must be turned in the opposite direction (clockwise).

4. Remove the torch main body.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Use the size wrenches called out in the *Removal* procedure above. Note that the red lead fitting is reverse threaded and must be turned in the opposite direction (counterclockwise).

2. Ensure the lead insulator is positioned over the pilot/shield gas lead fitting.

3. Insert the torch main body into one of the handle halves and then align the body and handle slots.

4. Insert the torch switch into the handle switch holder.

5. Insert the top rib of the boot into the handle just above the screw holes.

6. Align both halves of the handle, press together, and secure with the nine (9) screws.

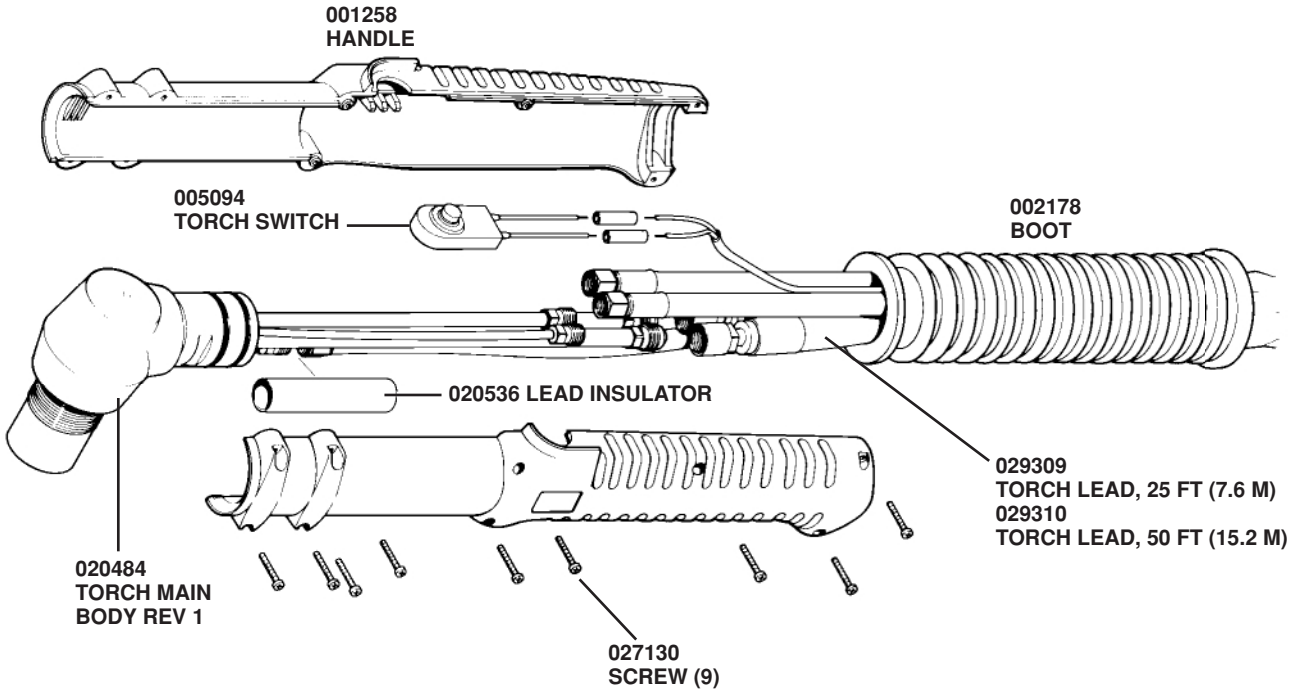


Figure 3-3 MAX200 Rev 1 90° Hand Torch Assembly

MAX200 Rev 1 90° Hand Torch Lead Set and Individual Leads Removal and Replacement

Torch Lead Set

To remove and replace the torch lead set, perform the following procedure and see Figure 3-4.

Removal

1. Disconnect torch start switch leads from terminal block TB2.
2. Disconnect the cap sensor hose (gray) from the adapter.
3. Disconnect the plasma gas hose (red) from the adapter. This connection is lefthand threaded and must be turned in a clockwise (cw) direction to loosen.
4. Disconnect the pilot shield gas hose (blue) from the A.C.T. coil adapter.
5. Disconnect the torch coolant supply hose (blue w/green band) from the bulkhead adapter.
6. Disconnect the torch coolant return hose (blue w/red band) from the bulkhead adapter.
7. Disconnect the torch from the torch lead as described in the *Removal and Replacement of Hand Torch* procedure on page 3-34.

Replacement

1. Connect the torch lead to the power supply by reversing directions in steps 1-6 of the above *Removal* procedure.
2. Connect the torch lead to the torch by referring to the *Replacement* (of Hand Torch) procedure on page 3-34).

Individual Torch Leads

To remove and replace individual leads from the torch lead set, perform the following procedure and see Figure 3-5.

Removal

1. Disconnect the torch lead from the power supply as described above under *Removal.*
2. Remove the torch from the torch lead as described in the *Removal and Replacement of Hand Torch* procedure on page 3-34.
3. Lay the torch lead on the floor and stretch it out completely.
4. Cut away the heat shrink (8) and any tape underneath at both ends of the torch lead.

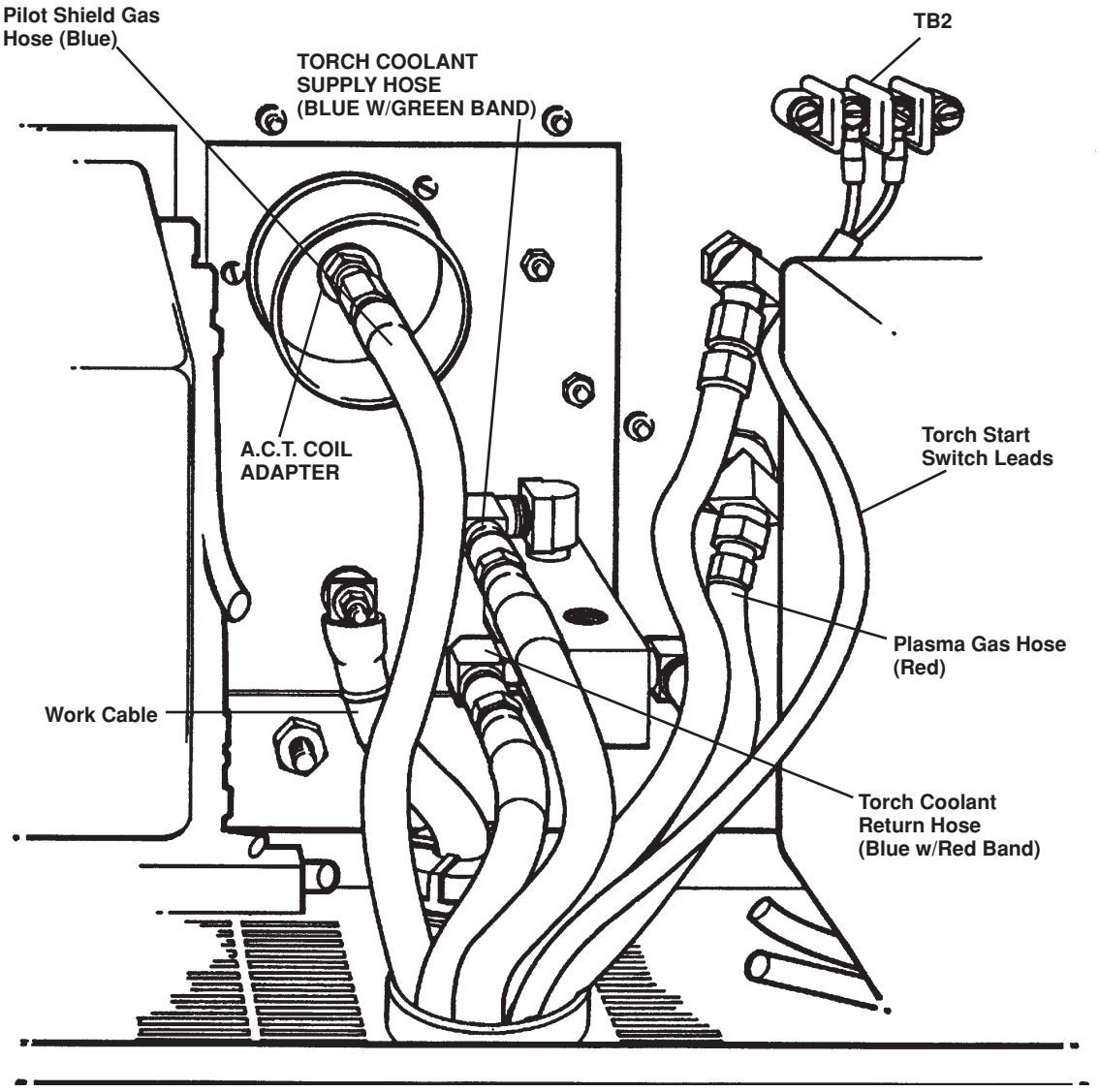


Figure 3-4 MAX200 Rev 1 90° Hand Torch Lead Set Connections to Power Supply

5. Holding one end of the the torch lead, pull the sheath (9) off of the torch lead.
6. Cut the tape (every 18 inches) that holds the torch leads together.
7. Remove the lead (1-6) requiring repair or replacement.

Replacement

1. Replace the repaired or replacement lead with the other leads.
2. Ensure the lead lengths (1-6) at both ends are in accordance with those called out in Figure 3-5.
3. Tape the leads together every 18 inches.
4. Slide the sheath (9) over the torch lead ends and pull the sheath until it approximates the length requirements called out in Figure 3-5.
5. Tape both ends of the sheath to the torch lead.
6. Slide the shrink tubing (8) over each end of the sheath. Heat the shrink tubing until it tightly bonds around the sheath and torch lead.
7. Connect the torch lead to the power supply.
8. Connect the torch lead to the torch.

MAX200 Rev 1 90° Hand Torch Lead Set Assemblies

Item	Part Number	Description	Qty
	029309	**Hand Torch Lead, 25 Ft.**	1
1	023326	Lead Pilot, Shield Gas, 25 Ft. (blue)	1
2	024194	Lead, Plasma Gas, 25 Ft. (red)	1
3	024192	Lead, Cap Sensor, 25 Ft. (gray)	1
4	023013	Cable, Water Cooled, 25 Ft. (blue- red band)	1
5	023013	Cable, Water Cooled, 25 Ft. (blue- green band)	1
	029310	**Hand Torch Lead, 50 Ft.**	1
1	023327	Lead Pilot, Shield Gas, 50 Ft. (blue)	1
2	024195	Lead, Plasma Gas, 50 Ft. (red)	1
3	024193	Lead, Cap Sensor, 50 Ft. (gray)	1
4	023199	Cable, Water Cooled, 50 Ft. (blue- red band)	1
5	023199	Cable, Water Cooled, 50 Ft. (blue- green band)	1

The following parts are common to both hand torch lead assemblies:

6	047032	Cable, Switch, 51 Ft.	1
7	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
8	046026	Tubing, 1-1/2" ID Shrink Black	2
9	024197	Sheath, 25 Ft.	1
		or	
9	024198	Sheath, 50 Ft.	1

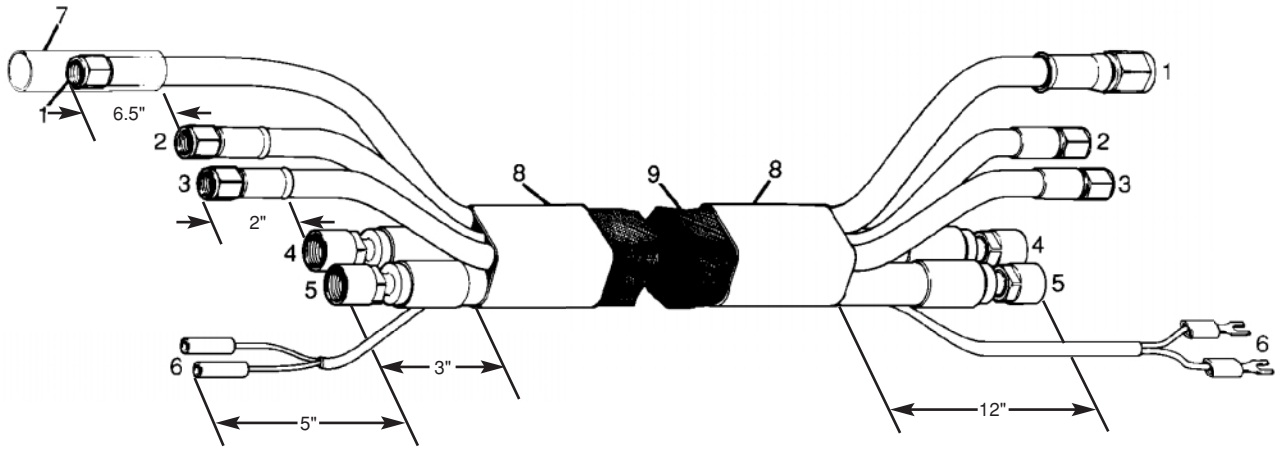


Figure 3-5 MAX200 Rev 1 90° Hand Torch Lead Set Assembly

MAX200 Machine Torch Removal and Replacement

To remove and replace the torch main body from the torch lead, perform the following procedure and see Figure 3-6.

Removal

1. Unscrew the insulating sleeve from the torch main body and slide the sleeve out of the way in order to expose the torch lead fittings.

2. On the larger leads, use a 3/8" open-end wrench to hold the torch body fittings and a 1/2" open-end wrench to turn the torch lead fittings.

   On the smaller leads, use a 5/16" open-end wrench to hold the torch body fittings and a 7/16" open-end wrench to turn the torch lead fittings.

   Turn the torch lead fittings counterclockwise (ccw) to loosen the connections. Note that the red lead fitting is reverse threaded and must be turned in the opposite direction (clockwise).

3. Remove the torch main body.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Use the size wrenches called out in the *Removal* procedure above. Note that the red lead fitting is reverse threaded and must be turned in the opposite direction (counterclockwise).

2. Ensure the lead insulator is positioned over the pilot/shield gas lead fitting.

3. Slide the insulating sleeve to the torch main body and screw together.

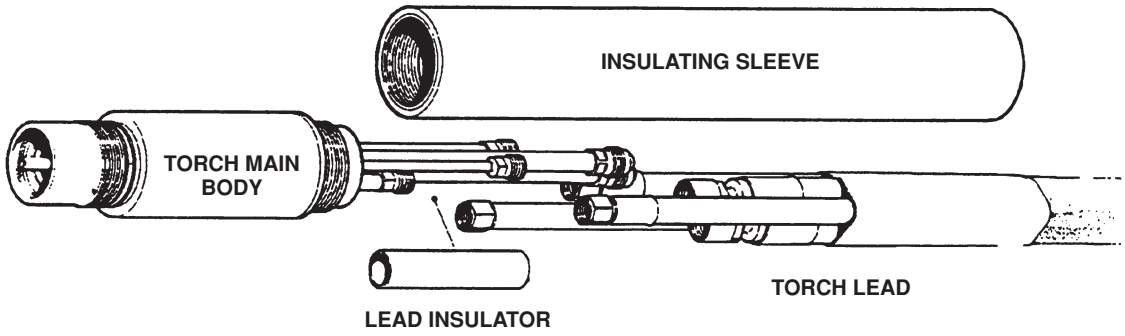


Figure 3-6 MAX200 Machine Torch Assembly

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MAX200 Machine Torch Lead Set and Individual Leads Removal and Replacement

Torch Lead Set

To remove and replace the torch lead set, perform the following procedures. Refer to Figure 3-7.

Removal

1. Disconnect the cap sensor hose (gray) from the adapter.
2. Disconnect the plasma gas hose (red) from the adapter. This connection is lefthand threaded and must be turned in a clockwise (cw) direction to loosen.
3. Disconnect the pilot shield gas hose (blue) from the A.C.T. coil adapter.
4. Disconnect torch coolant supply hose (blue w/green band) and torch coolant return hose (blue w/red band) from the bulkhead adapter.
5. Disconnect the torch from the torch lead as described in the *Removal and Replacement of Machine Torch* procedure on page 3-40.

Replacement

1. Connect the torch lead to the power supply by reversing directions in steps 1-5 of the above *Removal* procedure.
2. Connect the torch lead to the torch by referring to the *Replacement* (of Machine Torch) procedure on page 3-40.

Note: When using the MAX200 machine torch with extended torch leads (100, 125 or 150 feet) be aware that the **40A consumable parts cannot be used.** There is also a slight chance that the following conditions could occur during cutting with extended torch leads over 75 feet:

- High ambient operating temperature or high volume production cutting may increase the heat load on the torch cooling system enough to cause the system to shutdown. If this occurs, allow the system to cool down. Reduce the ambient temperature, if possible or the cutting “arc on” time.
- The gas pressure response time will increase at the torch at preflow, plasma on and plasma off. This may reduce consumable life. The user may have to increase the lead in of the cut and/or increase the time between successive cuts.
- There may be a slight incidence of the torch misfiring due to the high frequency energy from the start circuit being dissipated.

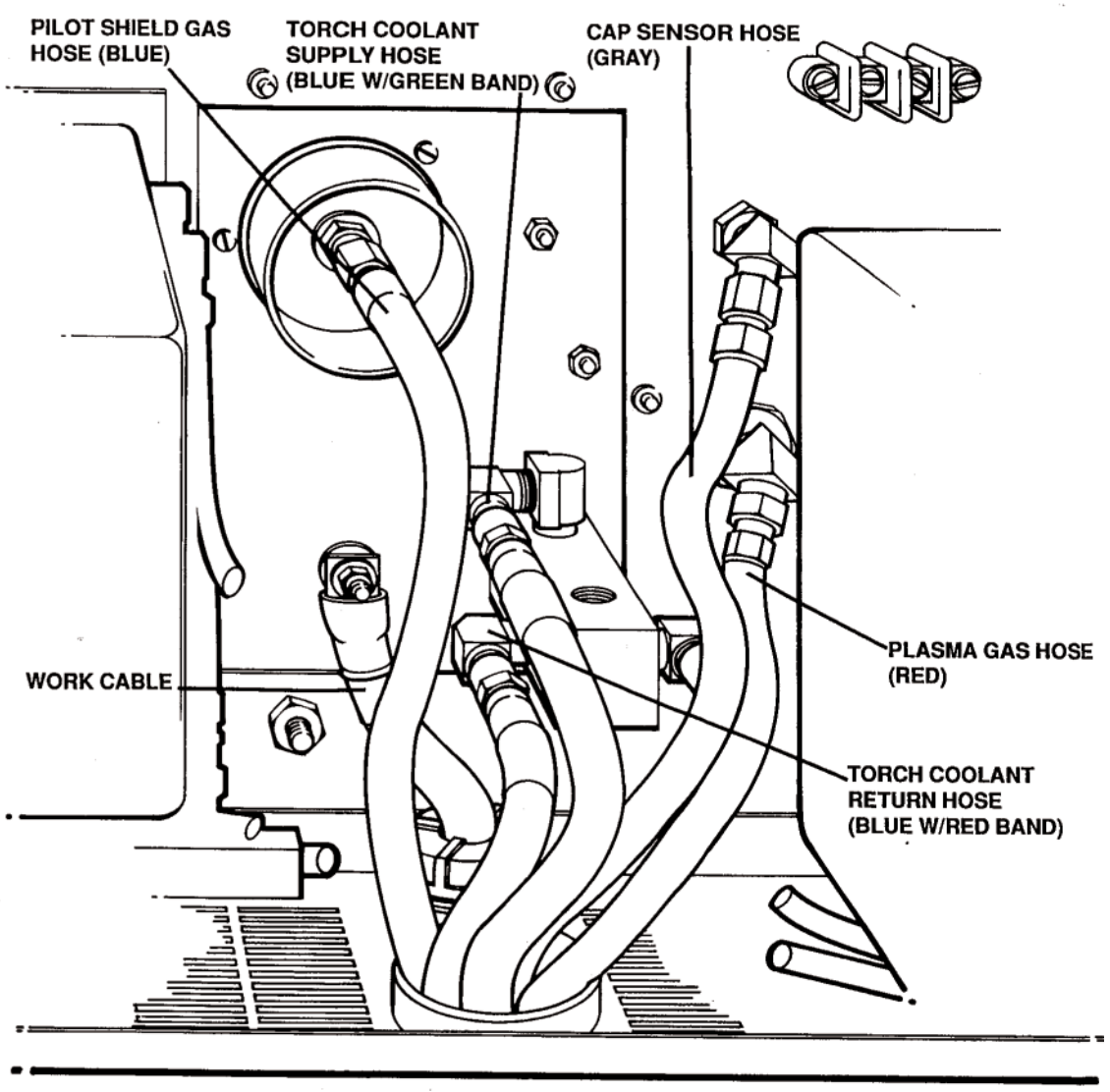


Figure 3-7 MAX200 Machine Torch Lead Connections to Power Supply

Individual Torch Leads

To remove and replace individual torch leads, perform the following procedure and see Figure 3-8. Refer to Section 4, Parts List, pages 4-44 to 4-48 for machine torch lead assemby part numbers for different lead lengths and other torch lead parts.

Removal

1. Disconnect the torch lead from the power supply as described in *Removal* under *Removal and Replacement of Machine Torch Lead Set* on page 3-41.
2. Disconnect the torch from the torch lead as described in the *Removal and Replacement of Machine Torch* procedure on page 3-40.
3. Lay the torch lead on the floor and stretch it out completely.
4. Cut away the heat shrink (7) and any tape underneath at both ends.
5. Remove the hose clamp (11), shield collar (10), and compression ring (9) from the torch lead at the other end. Cut away any tape under the compression ring.
6. Holding one end of the the torch lead, pull the shield braid (8) off of the torch lead.
7. Cut the tape (every 18 inches) that holds the torch leads together.
8. Remove the lead (1-5) requiring repair or replacement.

Replacement

1. Replace the repaired or replacement lead(s) with the other leads.
2. Ensure the lead lengths (1-5) at both ends are in accordance with those called out in Figure 3-8.
3. Tape the leads together every 18 inches.
4. Slide the shield braid (8) over the torch lead ends and pull the sheath until it approximates the length requirements called out in Figure 3-8.
5. Tape both ends of the shield braid to the torch lead.
6. Slide the heat shrink (7) over torch end of the shield braid. Heat the heat shrink until it tightly bonds around the shield braid and torch lead.
7. Replace the compression ring (9), shield collar (10), and hose clamp (11) over the power supply end of the shield braid. Tighten the hose clamp.
8. Connect the torch lead to the power supply.
9. Connect the torch lead to the torch.

Item	Description	Qty
1	Lead Pilot, Shield Gas (blue)	1
2	Lead, Plasma Gas (red)	1
3	Lead, Cap Sensor (gray)	1
4	Cable, Water Cooled (blue- red band)	1
5	Cable, Water Cooled (blue- green band)	1
6	Lead Insulator, 9/16" ID x 2-1/2"	1
7	Tubing, 1-1/2" ID Shrink Black	1
8	2" ID Tinned Braid	1
9	Ring Compress, Shield Torch Lead	1
10	Collar, Shield Torch Leads	1
11	Clamp, Hose, 1-5/16 - 2-1/4	1

Note: Refer to Section 4, Parts List, pages 4-44 to 4-48 for machine torch lead assembly part numbers for different lead lengths and other torch lead parts.

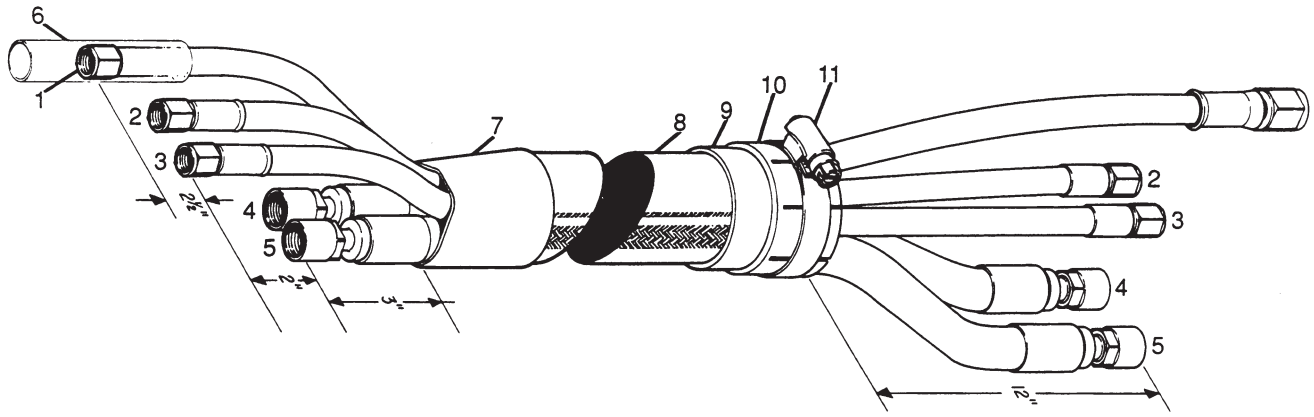


Figure 3-8 MAX200 Machine Torch Lead Set Assembly

PAC200T/E Torches Removal and Replacement

WARNING

Press the OFF (O) pushbutton switch on the power supply and place the wall mounted disconnect box switch to OFF before working on the torch or torch leads!

Removal

1. Remove the six (6) **Screws** securing the two **Handle** halves and separate.
2. Remove the torch **Switch** and **Safety Trigger** from the handle. Take care not to lose the **Trigger Spring**.
3. On the two largest leads, use a 3/8" open-end wrench to hold the torch body fittings and a 1/2" open-end wrench to turn the torch lead fittings.

   On the two next smaller leads, use a 5/16" open-end wrench to hold the torch body fittings and a 7/16" open-end wrench to turn the torch lead fittings.
   Note that the red lead fitting is reverse threaded and must be turned in the opposite direction (clockwise) to loosen.

   On the smallest lead (grey), use a 5/16" wrench to loosen.
4. Remove the **Torch Main Body**.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Use the size wrenches called out in the *Removal* procedure above. Note that the red lead fitting is reverse threaded and must be turned in the opposite direction (ccw).
2. Ensure the **Lead Insulator** is positioned over the shield gas (grey w/ blue band) lead fitting.
3. Insert the torch main body into one of the handle halves and then align the body and handle slots.
4. Insert the torch **Switch, Safety Trigger** and **Trigger Spring** into the handle half that it was removed from.
5. Insert the top rib of the **Boot** into the handle just above the screw holes.
6. Align both halves of the handle, press together, and secure with the six (6) screws.

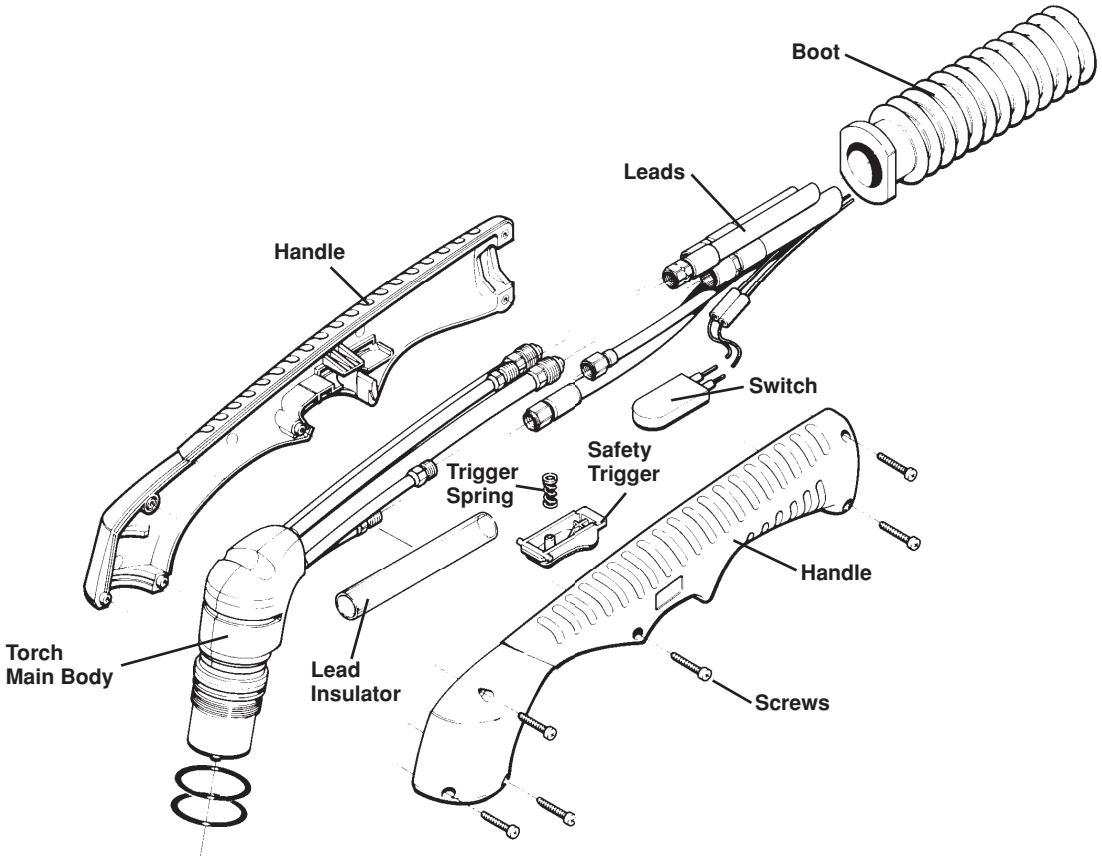


Figure 3-9 PAC200T Torch Assembly

PAC200T/E Torch Lead Assembly Removal and Replacement

Note: To change length of torch lead assemblies, see *Increase or Decrease PAC200 Torch Lead Length* on page 3-50.

WARNING

Press the OFF (O) pushbutton switch on the power supply and place the wall mounted disconnect box switch to OFF before working on the torch or torch leads!

Removal

To disconnect the PAC200T/E torch lead assembly from the MAX200, proceed as follows (see Figure 3-10):

1. Disconnect the torch **COOLANT RETURN** lead (red w/red band for 25' leads; blue w/red band for extended leads) from the bulkhead adapter.
2. Disconnect the torch **COOLANT SUPPLY** lead (blue w/green band) from the bulkhead adapter.
3. Disconnect the **SHIELD GAS** lead (grey w/blue band for 25" leads; blue for extended leads) from the high-frequency coil.
4. Disconnect the **PLASMA GAS** lead (red) from adapter 2. This connection is left hand-threaded; it loosens in a clockwise (cw) direction.
5. Disconnect the **CAP SENSE** lead (grey) from adapter 1.
6. Disconnect the shielded **PLASMA START SWITCH LEADS** (red and black) from terminal block **TB2**.

Note: The 90° hand torch lead assemblies are not interchangeable with the PAC200T/E lead assembly.

Replacement

1. Connect the torch lead assembly to the power supply by reversing the above procedure.
2. Connect the torch lead assembly to the torch by referring to the *Removal and Replacement of PAC200T/E Torches* procedure on page 3-46.

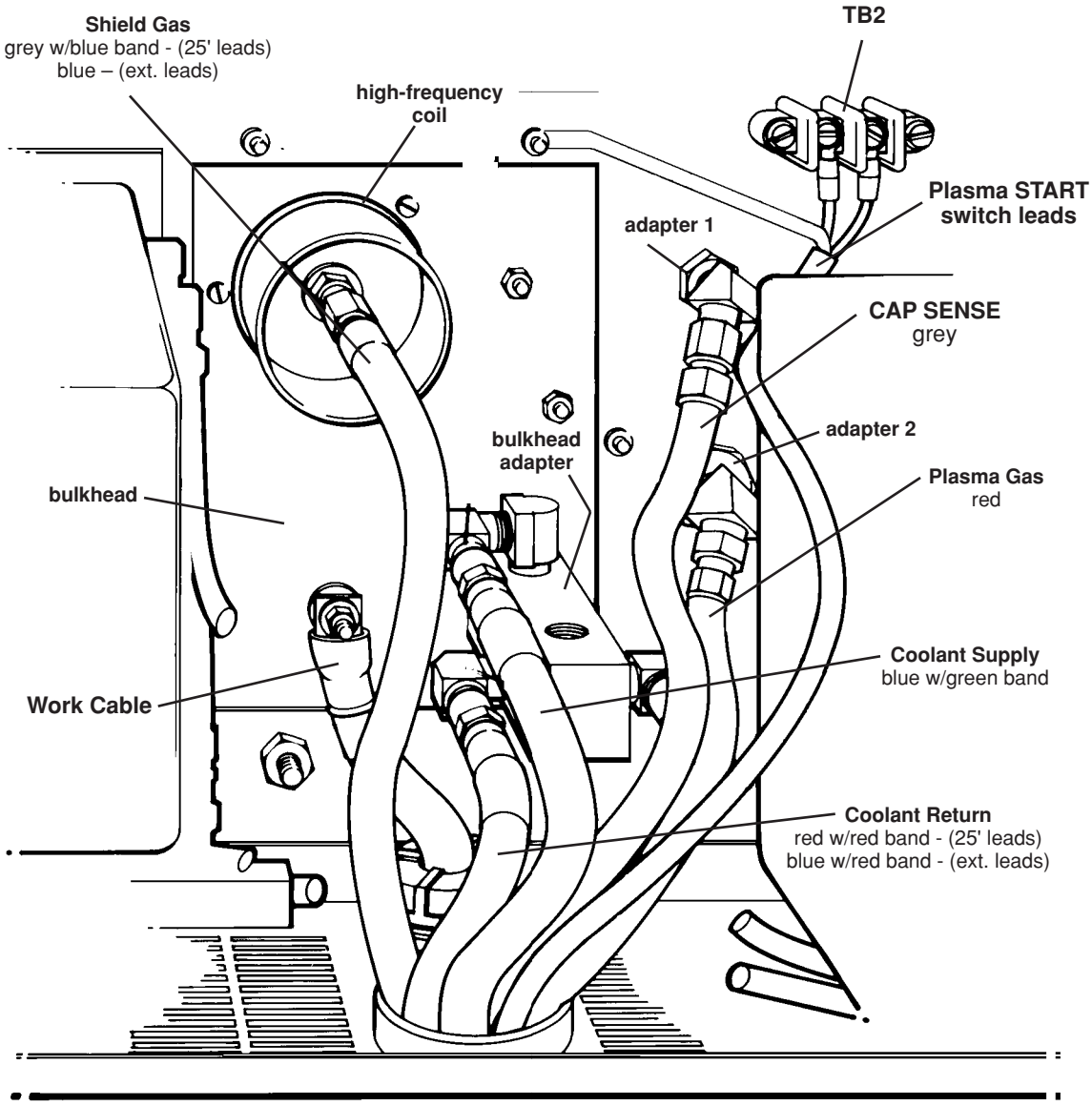


Figure 3-10 PAC200T/E Torch Lead Set Connections to Power Supply

Increase or Decrease PAC200T/E Torch Lead Length

In order to increase or decrease the torch lead length between 50 and 150 ft at 25-foot increments, look at the torch lead part numbers on pg. 4-82 to determine the leads that you need. The center section leads (029593) and the torch-to-extension-box leads (029866) come with the male adapters (015036, 015049, and 015208) necessary to mate leads to the next section – see Figure 3-12. After ordering the correct leads, follow the general procedures below and refer to Figure 3-11.

Note: If you have the PAC200T/E 25-foot leads (029865) that come with the 25-foot MAX200 system and you want to lengthen the leads, you cannot use these 25-foot leads with any of the extended leads sets. You must use the 029866 25-foot leads. See pg. 4-82.

1. Remove the eight (8) screws from the extension box halves and separate.
2. Slide the three lead insulators away from the pilot/shield lead and the two coolant hose connections.
3. Loosen connections using 1/2" wrenches on the coolant hose fittings, and 7/16" wrenches on all other fittings.
4. Add or remove lead sections as required. Match color-coded leads when connecting. Note that the red plasma gas leads are all left-hand threaded.
5. After making the connections, slide the lead insulators over the connection joints.
6. Using tyraps, secure the two coolant hoses together. Also secure the other leads and torch switch leads together. Do this on both sides of the connections.
7. Position the two coolant hoses and other leads into one of the box halves. Coolant hoses go to narrow side of the divider, other leads go to the wider side.
8. Position each boot into the box half, so that the top rib fits over the lip just above the screw holes.
9. Align both halves of the box, press together, and secure with the eight (8) screws.
10. Route the torch leads prior to connecting the torch and power supply.
11. Connect extension leads to power supply. See page 3-48.
12. Connect leads to torch. See page 3-46.
13. After installing the torch to the torch leads, check coolant level in the tank prior to startup. More coolant may be required if lead lengths were increased.
14. If you have increased torch lead length from 50 feet or under to 75 feet or over, see *Adjusting Plasma Gas* on page 3-53.

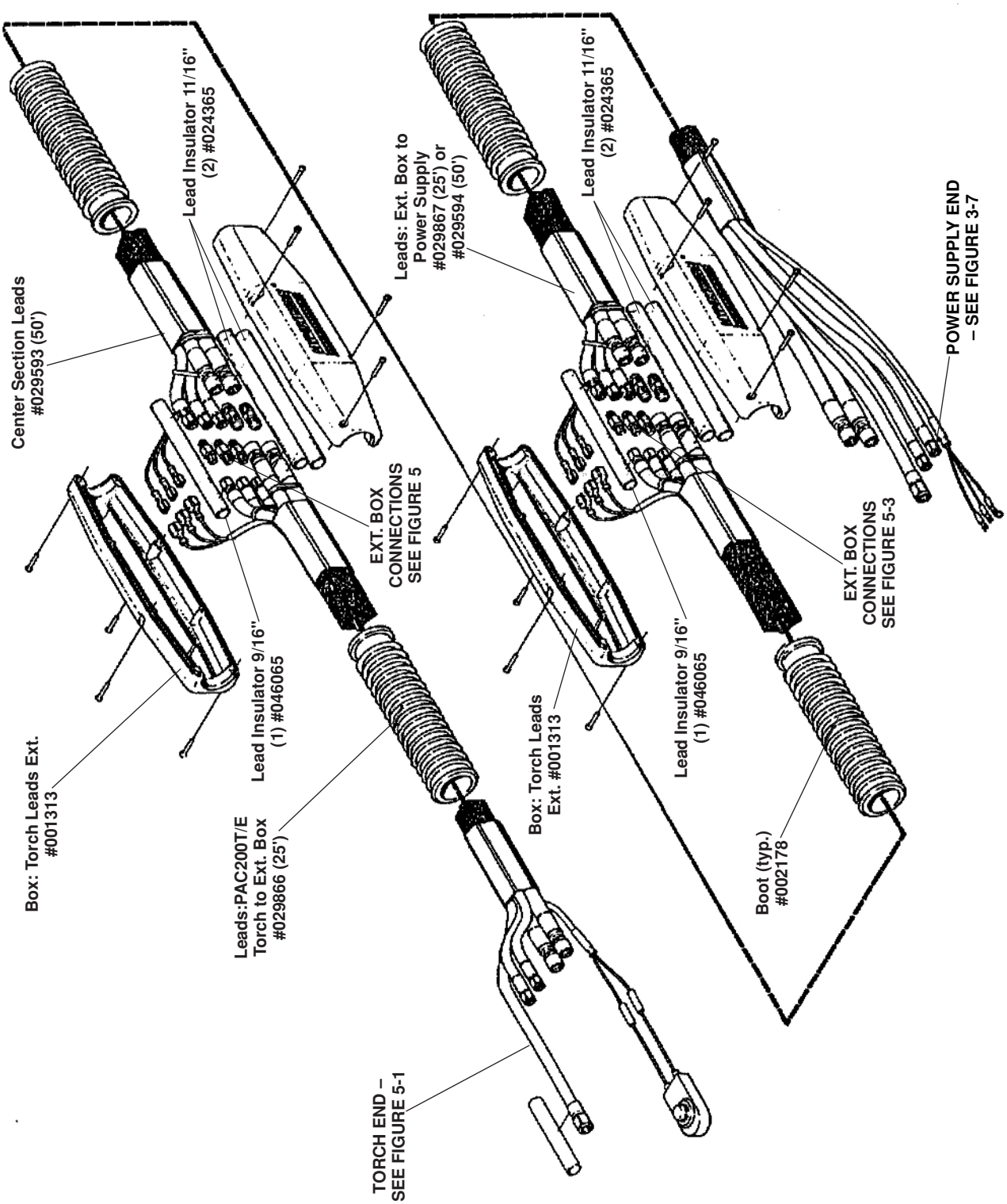


Figure 5-2 Extended Torch Lead Interconnections

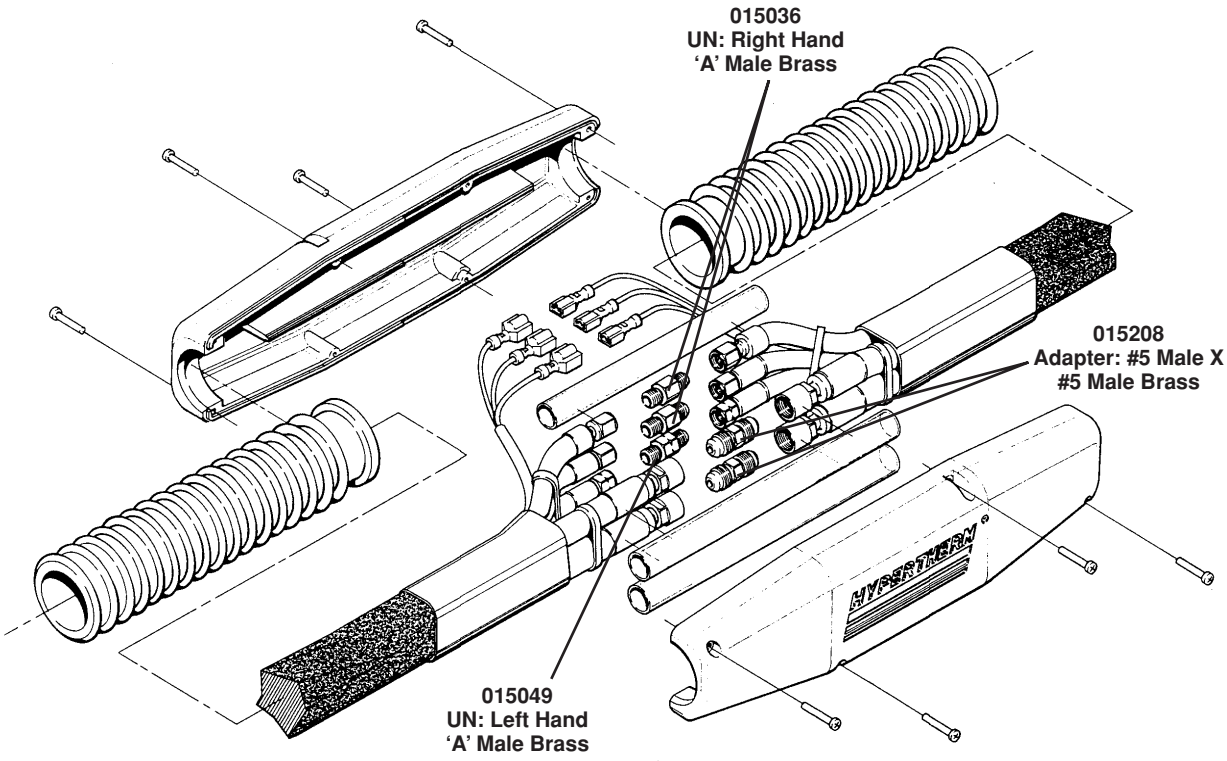


Figure 3-12 Extension Connectors

Adjusting Plasma Gas

If you have increased torch lead length from 50 feet or under to 75 feet or over, the plasma gas pressure must be re-adjusted to accommodate the extra torch lead length:

1. At the front panel of the MAX200 power supply while in TEST mode, adjust the PLASMA gas valve control by increasing the TEST pressure approximately **5 psi per 50 ft of lead length (beyond 50 ft)** from what is called out in the Cut Charts.
   See note on page 4-17 in IM87.

	WARNING
Use extreme caution when making the following adjustment:	

2. If the plasma gas RUN pressure does not quickly reach the value stated in the Cut Charts **after arc transfer**, you may need to adjust PS4. Remove the right side panel of the power supply. On the floor of the power supply, locate pressure switch PS4 by referring to Figure 3-13 and adjust by turning the PS4 Adjustment screw in a clockwise direction.

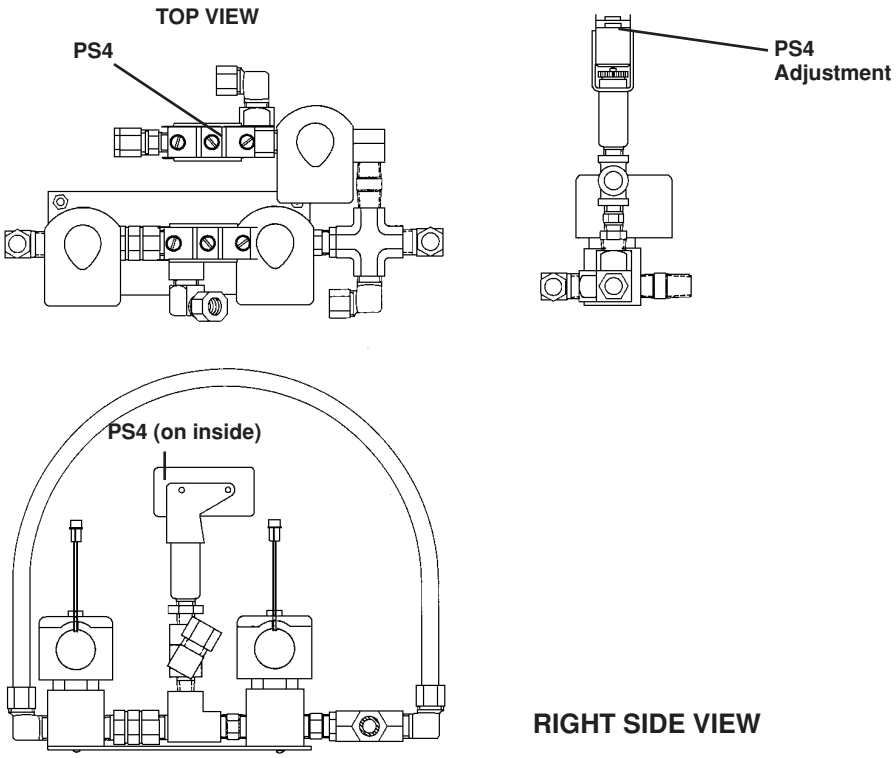


Figure 3-13 Pressure Switch PS4 and Adjustment Location

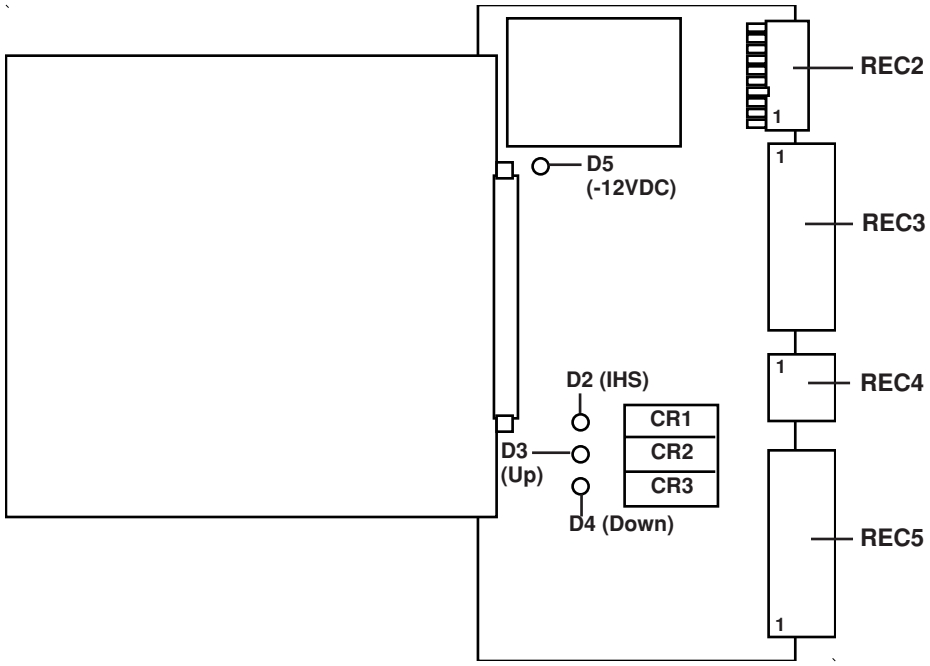


Figure 3-14 PCB9 THC Mother Board

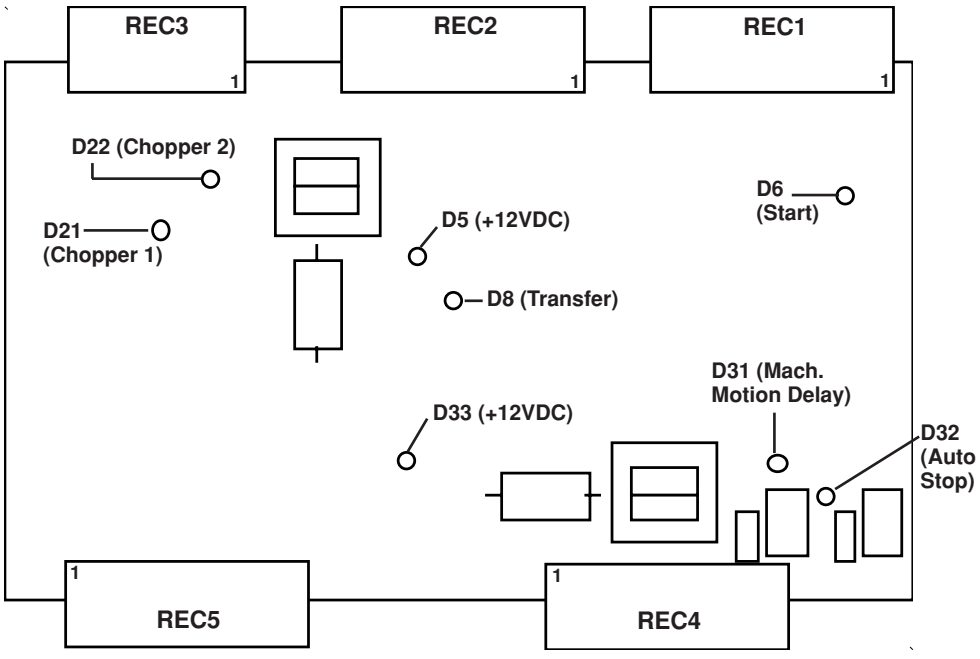


Figure 3-15 PCB7 Control Board

In this section:

Introduction

In this section is a parts list breakdown with accompanying drawings for the MAX200 machine and hand-torch systems.

Internal power supply cabling and hosing are not shown in the drawings. Part numbers for this hosing with connection point referencing are on page 4-58.

The format to list and call out Hypertherm parts is as follows:

Item	Part Number	Description	Designator	Qty.
	029319	**Contr Pnl SA, MAX200 Thumb/Pot**		**1**
7	006027	Valve, needle, 1/4 NPTF	**V5**	1
	029360	**Thumbwheel/Pot Panel SA MAX200**		**1**
25	075165	Hexnut, 6-32, WXF .250, .093, S/Z		4
	029383	**Thumbwheel switch SA**		**1**
27	008186	Socket, 20-24 AWG Type III+		7
38	005121	Pushbutton, 2 NO Green Illumin	**PB1**	1

Item: Refers to item call out on opposing or current page.
Number (Ex. 7) refers to numbered call out on opposing or current page.

Part Number: Refers to Hypertherm part numbers.
Bold part numbers (Ex. **029319**) signify parent or subassemblies that contain additional items.

Normal-style part numbers (Ex. 006027) signify items under parent or subassembly.

Description: Describes the item.
Bold descriptions not indented (Ex. **Contr Pnl SA, MAX200 Thumb/Pot**) signify parent assemblies that contain additional items.

Normal-style part numbers that are indented (Ex. Valve, needle, 1/4 NPTF) signify items under parent or subassembly. In this example, parent is **Contr Pnl SA, MAX200 Thumb/Pot**.

Bold descriptions that are indented (Ex. **Thumbwheel/Pot Panel SA MAX200**) represent subassemblies that are under a parent assembly.

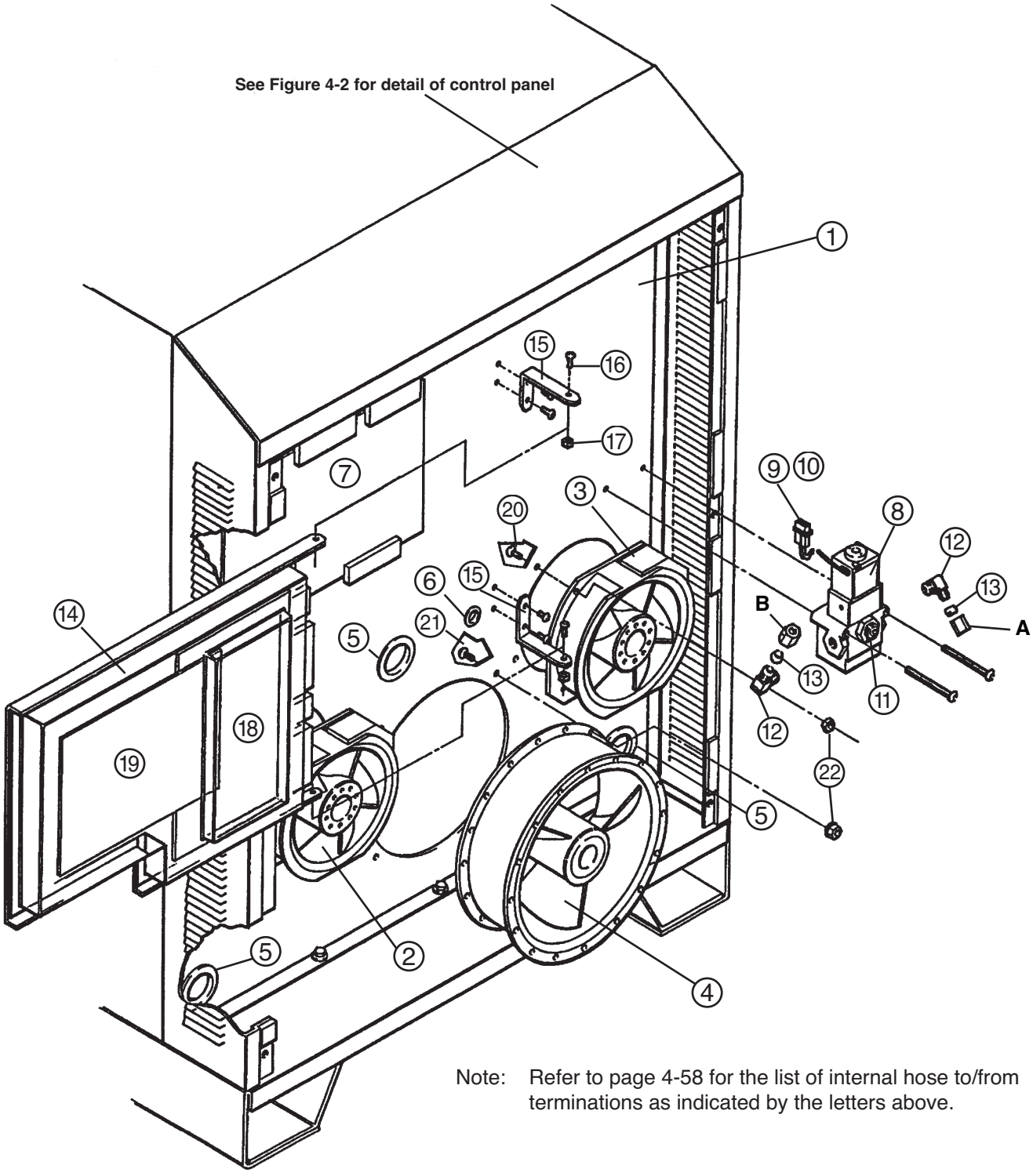
In this example, parent assembly is **Contr Pnl SA, MAX200 Thumb/Pot** and subassembly **Thumbwheel/Pot Panel SA MAX200** contains additional items.

Normal-style part numbers that are not indented (Ex. Pushbutton, 2 NO Green Illumin) represent items not under parent assembly.

Designator: Represents a cross reference to wiring diagrams or pneumatic diagrams. (Ex. **PB1** refers to pushbutton PB1 shown in wiring diagrams)

Qty.: Refers to the number of items in the parent or subassembly.

Note: Items that appear on exploded views as single letters and do not appear on opposing pages, represent hosing or tubing connection points. A complete hosing run list with part numbers and lengths appears on page 4-58.



Note: Refer to page 4-58 for the list of internal hose to/from terminations as indicated by the letters above.

Figure 4-1 Power Supply – Front Wall, Outside

Front Wall Outside – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	001233	Panel, MAX200 Front		1
2	027080	Fan 225 CFM 120VAC 50/60Hz	**M3**	1
3	027080	Fan 225 CFM 120VAC 50/60Hz	**M2**	1
4	027079	Fan 450-550 CFM 120VAC 50/60Hz	**M4**	1
5	008509	Bushing 1.75 MTG X 1.37 ID		3
6	008245	Bushing, 7/8" Hole X 11/16" ID		1
7	**041143**	**PC BD Assy Control MAX200**	**PCB7**	**1**
	029315	**Shield Gas SA, MAX200**		
8	006032	Valve, Sol, Shield Gas	**V2**	1
9	008503	Cap, Comm Mnl 2 Circuit		1
10	008504	Pin, Comm Mnl 24-18 AWG		2
11	015563	Plug, 3/8		1
12	015132	Fitting 90, 3/8 Tube X 1/4 NPT		2
13	015133	Ferrule, 3/8 OD Tube Delrin		2
	***029303**	**THC SA, MAX200**		
14	001297	Cov: MAX200 THC Dust		1
15	004338	Hinge - THC Pan, MAX200		2
16	075092	M/S, 10-32 X 1/2, PH, Pan, S/Z		6
17	075160	Kepnut, 10-32, S/Z		2
18	**041151**	**PC BD Assy THC Mother**	**PCB9**	**1**
19	**041186**	**PC BD SA - THC, MAX200**	**PCB10**	**1**
20	075078	M/S, 8-32 X 5/8, PH, Pan, S/Z		8
21	075073	M/S, 8-32 X 1/2, PH, Pan, S/Z		4
22	075159	Kepnut, 8-32, S/Z		12
	**001566	Panel, MAX200 front filter		1
	**001567	Cover, MAX200 front filter panel		1
	**027441	Filter, 24 X 24 X 2 fiberglass air		1

* THC SA available only on MAX200 power supplies 073020, 073021, 073022, 073023, 073024 and 073213 (CE).

** Items not shown in Figure 4-1.

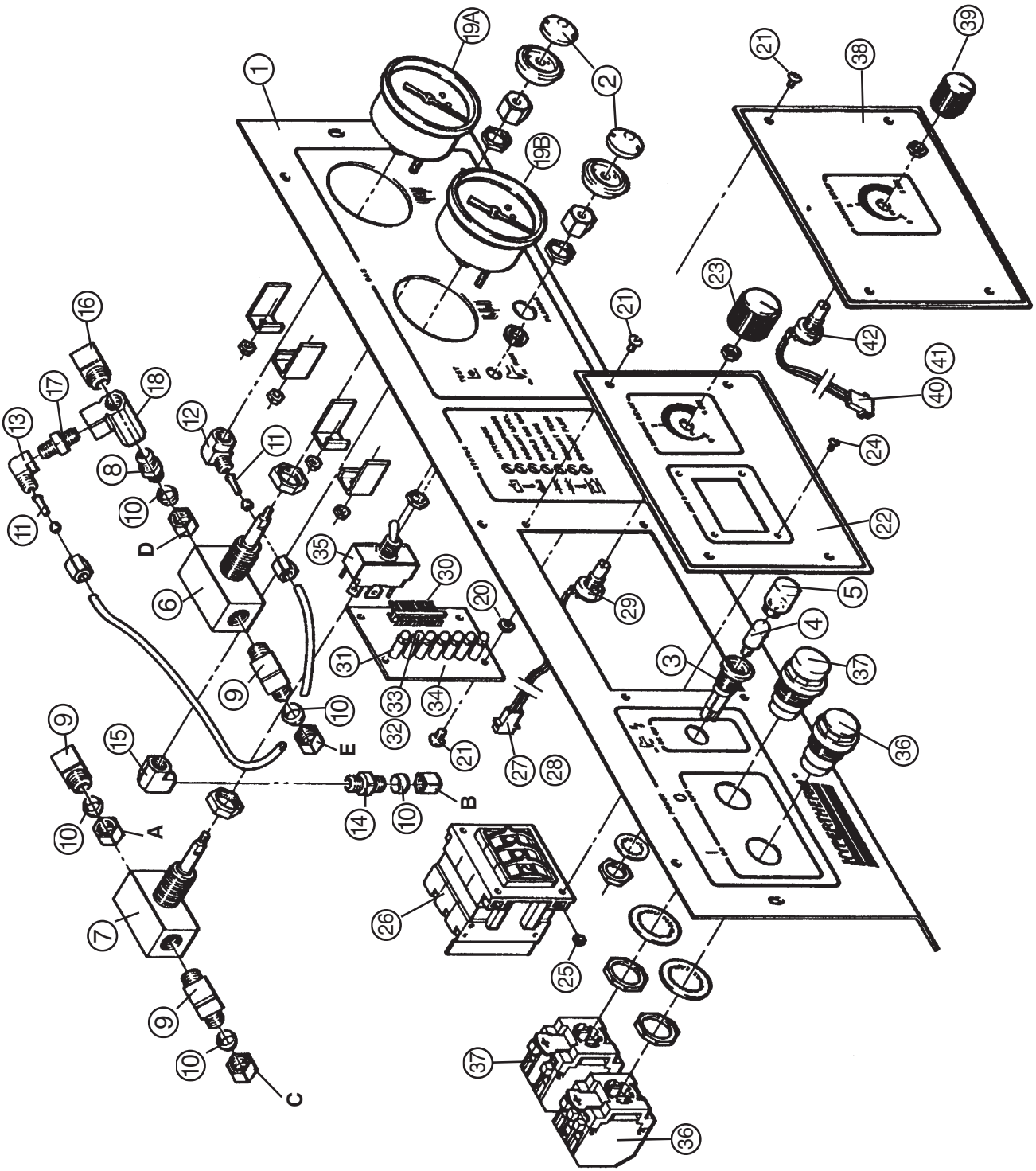


Figure 4-2 Power Supply – Control Panel SA, Front

Note: Refer to page 4-58 for the list of internal hose to/from terminationsas indicated by the letters above.

Control Panel SA – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	029319	**Contr Pnl SA, MAX200 Thumb/Pot**		**1**
1	001222	Pnl :Max200 Cont		1
2	004117	Cap, valve, flow control		2
3	005151	Lamp holder		1
4	005187	Bulb, 28 VDC	**LT2**	1
5	005089	Lens, white for 005088		1
6	006002	Valve, needle 1/4 NPT .125 Ori	**V6**	1
7	006027	Valve, needle, 1/4 NPTF	**V5**	1
8	015131	Fitting, 3/8 tube X 1/4 NPT		1
9	015132	Fitting 90, 3/8 tube X 1/4 NPT		3
10	015133	Ferrule, 3/8 OD tube delrin		5
11	015135	Insert, 1/8 OD brass		2
12	015136	Fitting 90 1/8 tube X 1/8 NPTF		1
13	015141	Fitting 90, 1/8 tube X 1/8 NPT		1
14	015196	Fitting, 3/8 tube X 1/8 NPT		1
15	015520	Elbow, 1/8		1
16	015532	Street elbow 1/4		1
17	015570	Reducer bushing 1/4 X 1/8		1
18	015593	Street tee 1/4		1
19A	022008	Gauge, Press 2 1/2" Dia 1-100	**PG2**	1
19B	022008	Gauge, Press 2 1/2" Dia 1-100	**PG1**	1
20	075198	Flwshr, #6, .156, .375, .045, S/Z		4
21	075250	M/S, 6-32X1/4, PH, TRS, S/B		8
	***029360**	**Thumbwheel/Pot Panel SA MAX200**		**1**
22	001246	Panel, MAX200 Thumbwheel/Mach		1
23	008328	Knob, .930 Dia. Blk/Nat 1/4"		1
24	075394	Sktcap, 6-32X3/8, HX, Btn, S/B		4
25	075165	Hexnut, 6-32, WXF .250, .093, S/Z		4
	029383	**Thumbwheel switch SA**		**1**
26	005123	Thumbwheel switch		1
	008186	Socket, 20-24 AWG Type III+		7
	008233	Plug, In-line, 16 pos		1
	029394	**Pot SA, MAX200 Machine Delay**		**1**
27	008492	Pin, gold		2
28	008503	Cap, comm mnl 2 circuit		1
29	009604	Res: Var, 100K, 1 Turn		1
	041536	**PC BD Assy Intlk Display**	**PCB9**	**1**
30	008516	Post Header, 8-pin RA MTA-156		1
31	008517	Standoff, .19 OD .12 ID .50 LG		7
32	009063	Diode, Ind LED Amber		7
33	009705	Clip & Retain ring, T1-3/4 LED		7
34	041148	PC BD only Intlck Dsply 200/1070		1
35	005041	Switch, Tog 2Pl Maint On/On	**S1**	1
36	005121	Pushbutton, 2 NO Green Illumin	**PB1**	1
37	005122	Pushbutton, 2 NC Red Extended	**PB2**	1
	****001250**	**Pnl: MAX200 THC Fr**		**1**
38	001247	Pnl: MAX200 Mach. Delay		1
39	008164	Knob		1
40	008492	Pin, Gold		2
41	008503	Cap, comm mnl 2 circ		1
42	009604	Res: Var, 100K, 1 Turn		1

* Power Supplies without THC – 073002, 073003, 073004, 073005, 073026 and 073200 (CE)

** Power Supplies with THC – 073020, 073021, 073022, 073023, 073024 and 073213 (CE)

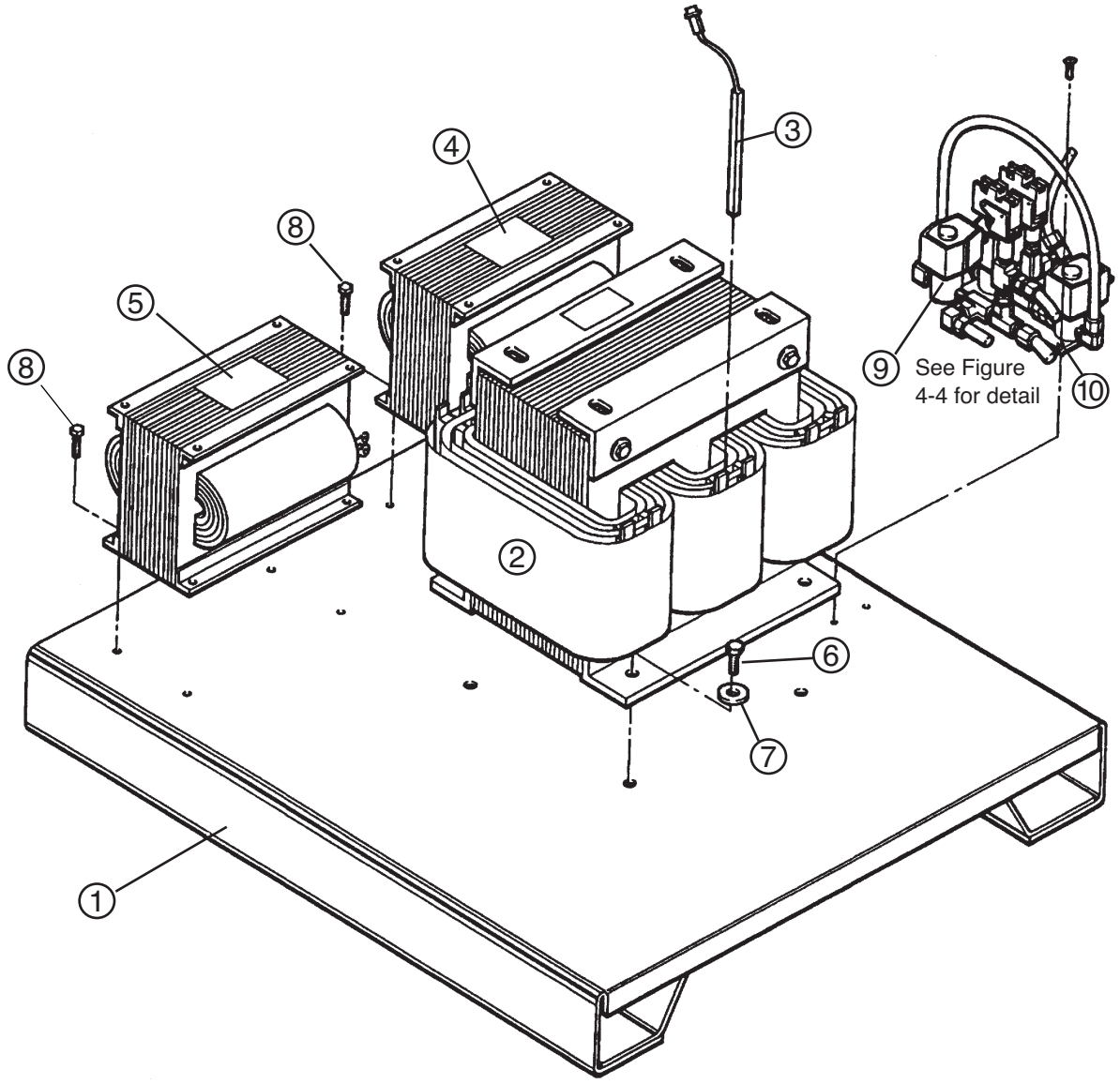


Figure 4-3 Power Supply – Base Plate with Components

Base Plate – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
1	001229	Base, MAX200		1
2	014078	Transf'mer 30KW 240-480, 3 PH, 60	**T2**	1
2	*014097	Transf'mer 30KW 208V, 3 PH, 60	**T2**	1
2	**014088	Transf"mer 30KW 220/380/400/415V, 3 PH, 50	**T2**	1
2	***014111	Transf'mer 30KW 200V, 3 PH, 50	**T2**	1
2	****014082	Transf'mer 30KW 600V, 3 PH, 60	**T2**	1
3	005102	Thermostat, 160°C, 6 Amp	**TS1**	1
4	014080	Inductor, 4mh 100A	**L1**	1
5	014080	Inductor, 4mh 100A	**L2**	1
6	075241	M/S, 1/4-20 X1/2,SL, IHW, S/Z		4
7	075199	Flwshr, 1/2, .532, 1.06, .099, S/Z		4
8	075242	M/S, 1/4-20 X 3/4, SL, IHW, S/Z		8
9	**•029314**	**Plasma Gas SA, MAX200**		**1**
10	004336	Panel, MAX200 Plasma Gas MTG.		1

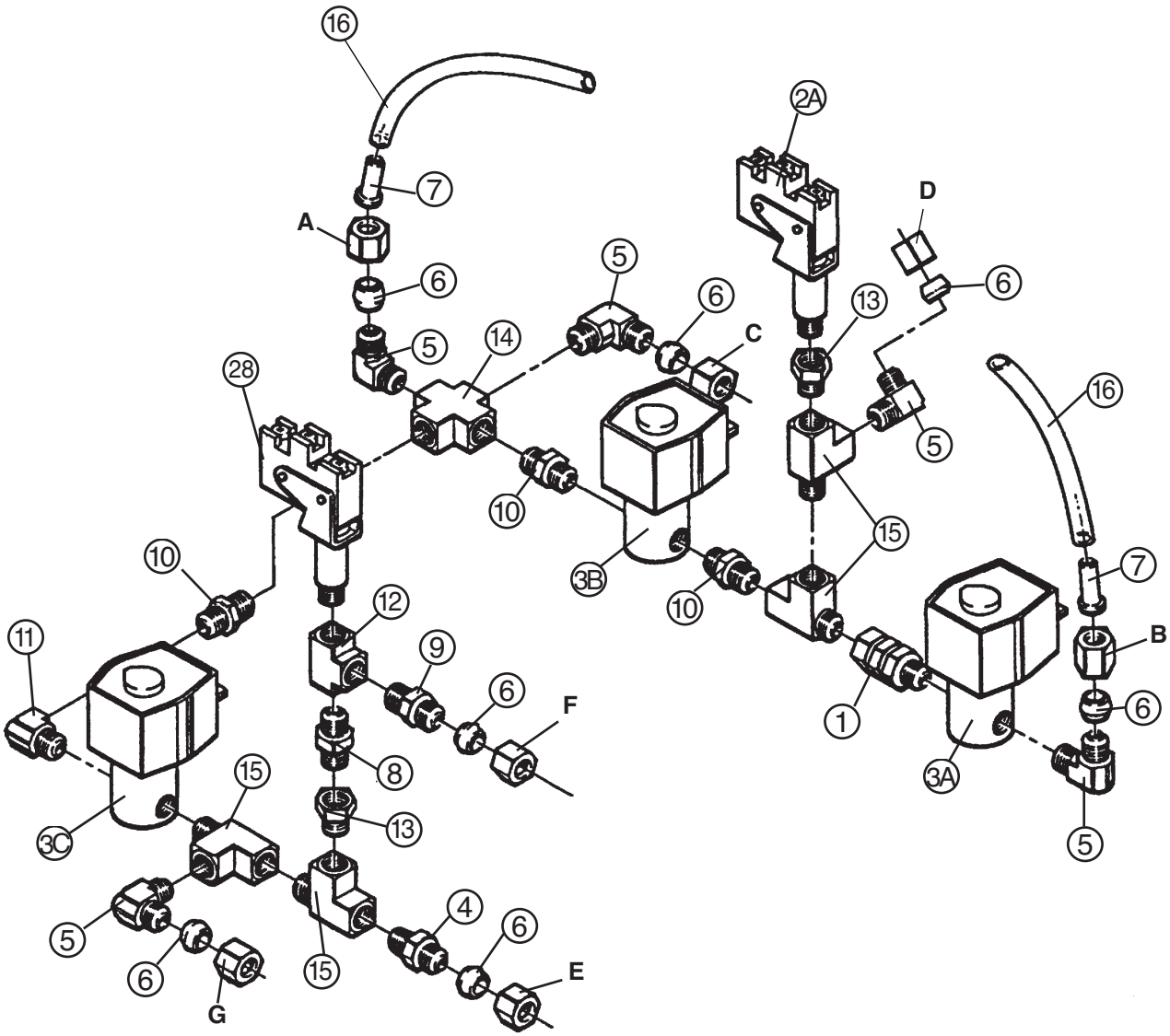
* Used on 208 volt power supplies 073004 (w/o THC) and 073022 (w/ THC)

** Used on 220/380/415 volt power supplies 073005 (w/o THC) and 073023 (w/ THC) and 400 volt CE power supplies 073200 (w/o THC) and 073213 (w/ THC)

*** Used on 200 volt power supply 073026 (w/o THC) and 073024 (w/THC)

**** Used on 600 volt power supplies 073003 (w/o THC) and 073021 (w/THC)

• See page 4-11 for subassembly breakdown



Note: Refer to page 4-58 for the list of internal hose to/from terminations as indicated by the letters above.

Figure 4-4 Power Supply – Plasma Gas SA

Plasma Gas SA – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	029314	**Plasma Gas SA, MAX200**		**1**
1	004342	Flow restrictor, .020 1/4 NPT		1
2A	005235	Switch, Pressure 0-90 PSI	**PS1**	1
2B	005239	Switch, Pressure 0-90 PSI	**PS4**	1
3A	006014	Valve, Sol 90#, 1/4 NPTF Water	**V1**	1
3B	006014	Valve, Sol 90#, 1/4 NPTF Water	**V3**	1
3C	006014	Valve, Sol 90#, 1/4 NPTF Water	**V9**	1
4	015131	Fitting, 3/8 tube x 1/4 NPT		1
5	015132	Fitting 90, 3/8 tube x 1/4 NPT		5
6	015133	Ferrule, 3/8 OD Tube Delrin		7
7	015134	Insert, 3/8 OD x .062 w Brass		2
8	015165	Orifice, .032 ID x 1/8 NPT		1
9	015196	Fitting, 3/8 Tube x 1/8 NPT		1
10	015510	Nipple 1/4 x Cl, Hex		3
11	015532	Street elbow 1/4		1
12	015540	Tee 1/8		1
13	015570	Reducer Bushing 1/4 x 1/8		2
14	015592	Cross 1/4		1
15	015593	Street Tee 1/4		4
16	046067	Tubing, 3/8 OD Blu Air Brake		*21 ft

* Note: Length of tubing includes interconnections not shown in this drawing.
For a complete listing of internal hosing and hosing lengths, see *MAX200 Power Supply Internal Hosing* later in this section.

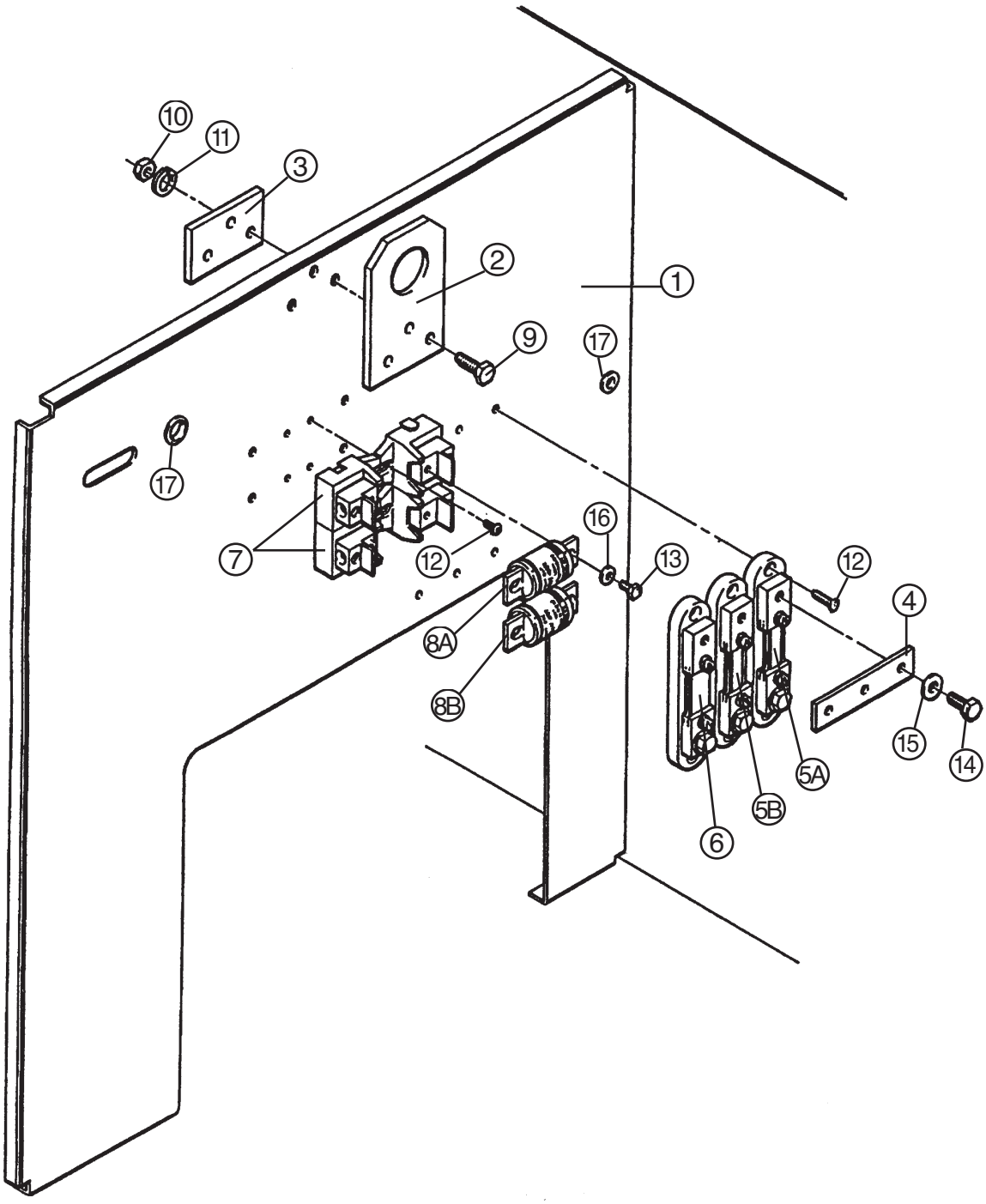
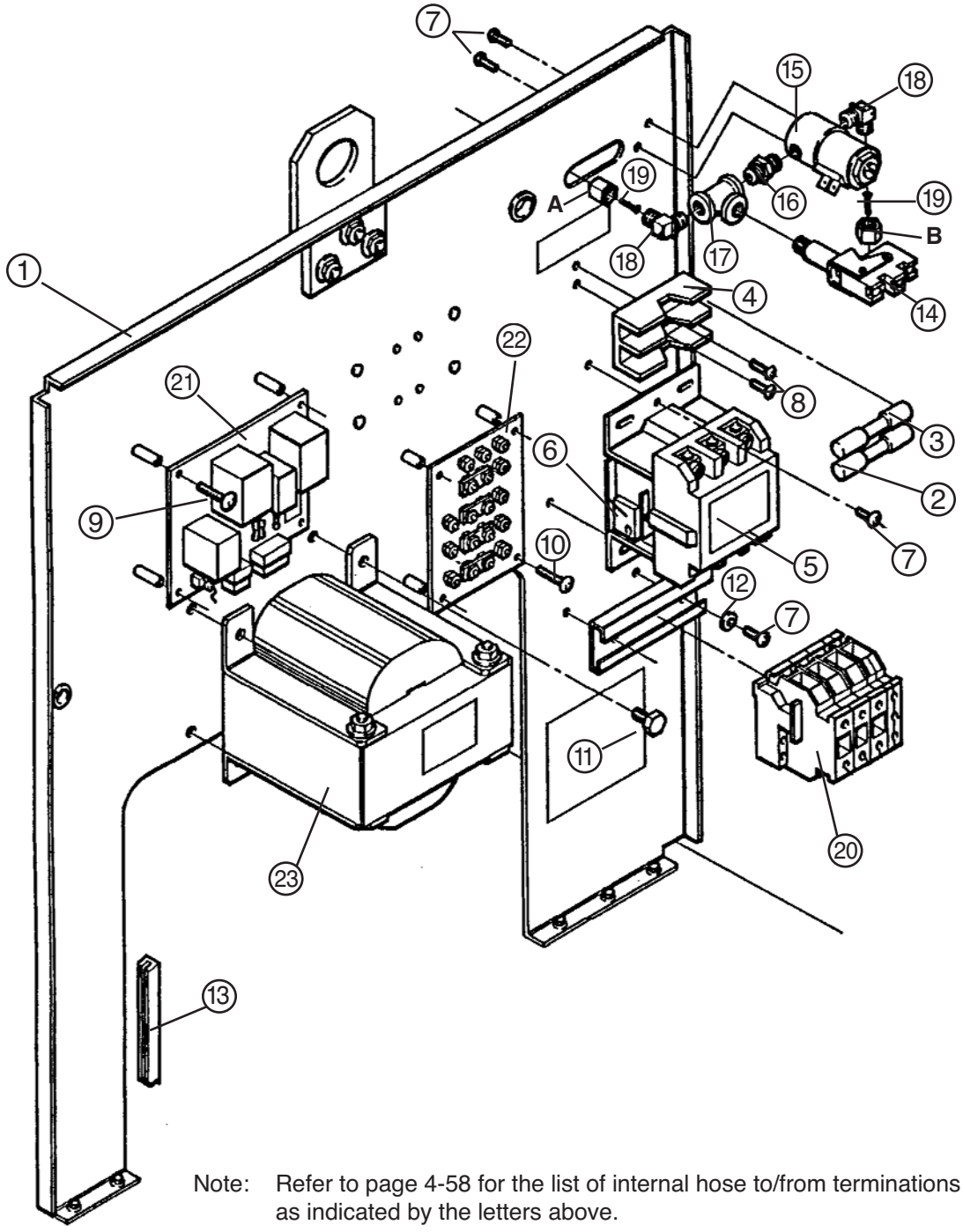


Figure 4-5 Power Supply – Center Wall Left Side

Center Wall Left Side – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
1	001230	Panel, MAX200 Center		1
2	004261	Bar, Lift, MAX100 & 80		1
3	004262	Plate, Lift, MAX100 & 80		1
4	004334	Busbar, MAX200 Shunt		1
5A	007022	Shunt, 100A, 100mv	**R2**	1
5B	007022	Shunt, 100A, 100mv	**R1**	1
6	007024	Shunt, 200A, 100mv	**R3**	1
7	008945	Fuseholder, 100A		2
8A	008317	Fuse, Semiconductor 125A, 250V	**F3**	1
8B	008317	Fuse, Semiconductor 125A, 250V	**F4**	1
9	075137	Hhdcap, 3/8-16 X 1 1/4, Hex, S/Z		3
10	075166	Hexnut, 3/8-16, S/Z		3
11	075194	Lkwshr, 3/8, Splitlock		3
12	075092	M/S, 10-32 X 1/2, PH, Pan		10
13	075241	M/S, 1/4-20 X 1/2, SL, IHW		4
14	075136	Hhdcap, 3/8-16 X 3/4, Hex, S/Z		3
15	075216	Flwshr, 5/16		3
16	075192	Lkwshr, 1/4, Splitlock		4
17	008245	Bushing, 7/8" hole X 11/16" ID		2



Note: Refer to page 4-58 for the list of internal hose to/from terminations as indicated by the letters above.

Figure 4-6 Power Supply – Center Wall Right Side

Center Wall Right Side – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
1	001230	Panel, MAX200 Center		1
2	*008551	Fuse, 7.5 Amp, 600V	**F1**	1
2	**008709	Fuse, 20Amp, 500V	**F1**	1
3	*008551	Fuse, 7.5 Amp, 600V	**F2**	1
3	**008709	Fuse, 20Amp, 500V	**F2**	1
4	008301	Fuseholder, 2 Pole, 30 amp		1
5	003092	Contactor, 90A 3 Pole 24VAC	**CON1**	1
6	003093	Switch, aux contactor	**SW2**	1
7	075237	M/S, 10-32 X 3/8, PH, TRS, SSB		7
8	075062	M/S, 6-32 X 1/2, SL, Pan, S/Z		2
9	075055	M/S, 6-32 X 5/8, PH, Rnd, S/Z		4
10	075056	M/S, 6-32 X 1, PH, Rnd, S/Z		4
11	075241	M/S, 1/4-20 X 1/2, SL, IHW, S/Z		2
	075160	Kepnut, 1/4-20, S/Z		2
12	075200	Flwshr, #10, .250, .562, .047, S/Z		2
13	008603	Grommet Strip		18"
	029315	**Shield Gas SA, MAX200 (see page 4-23 for more part numbers)**		
14	005233	Switch, Pressure 0-90 PSI	**PS2**	1
15	006037	Valve, Sol 24VAC 50/60 Hz 60 psi	**V4**	1
16	015165	Orifice, .032 ID X 1/8 NPT		1
17	015540	Tee 1/8		1
18	015141	Fitting 90, 1/8 Tube X 1/8 NPT		2
19	015135	Insert, 1/8 OD Brass		2
20	**029316**	**Incoming Power TB1 SA, MAX200**	**TB1**	**1**
21	**041534**	**PC BD Assy Pwr Dist**	**PCB6**	**1**
22	***029359	**Linkboard SA, MAX200 240-480V**		**1**
23	**029318**	**Cont Xf'mer SA 240-480V, 3/60 Hz**	**T1**	**1**
	029441	**Cont Xf'mer SA 208V, 3/60 Hz**	**T1**	**1**
	029362	**Cont Xf'mer SA 220/380/400/415V, 3/50 Hz**	**T1**	**1**
	029404	**Cont Xf'mer SA 600V, 3/60 Hz**	**T1**	**1**

* Used when incoming power is 380V, 400V, 415V or 480V
** Used when incoming power is 208V, 220V or 240V
*** Used when incoming power is 240 or 480V

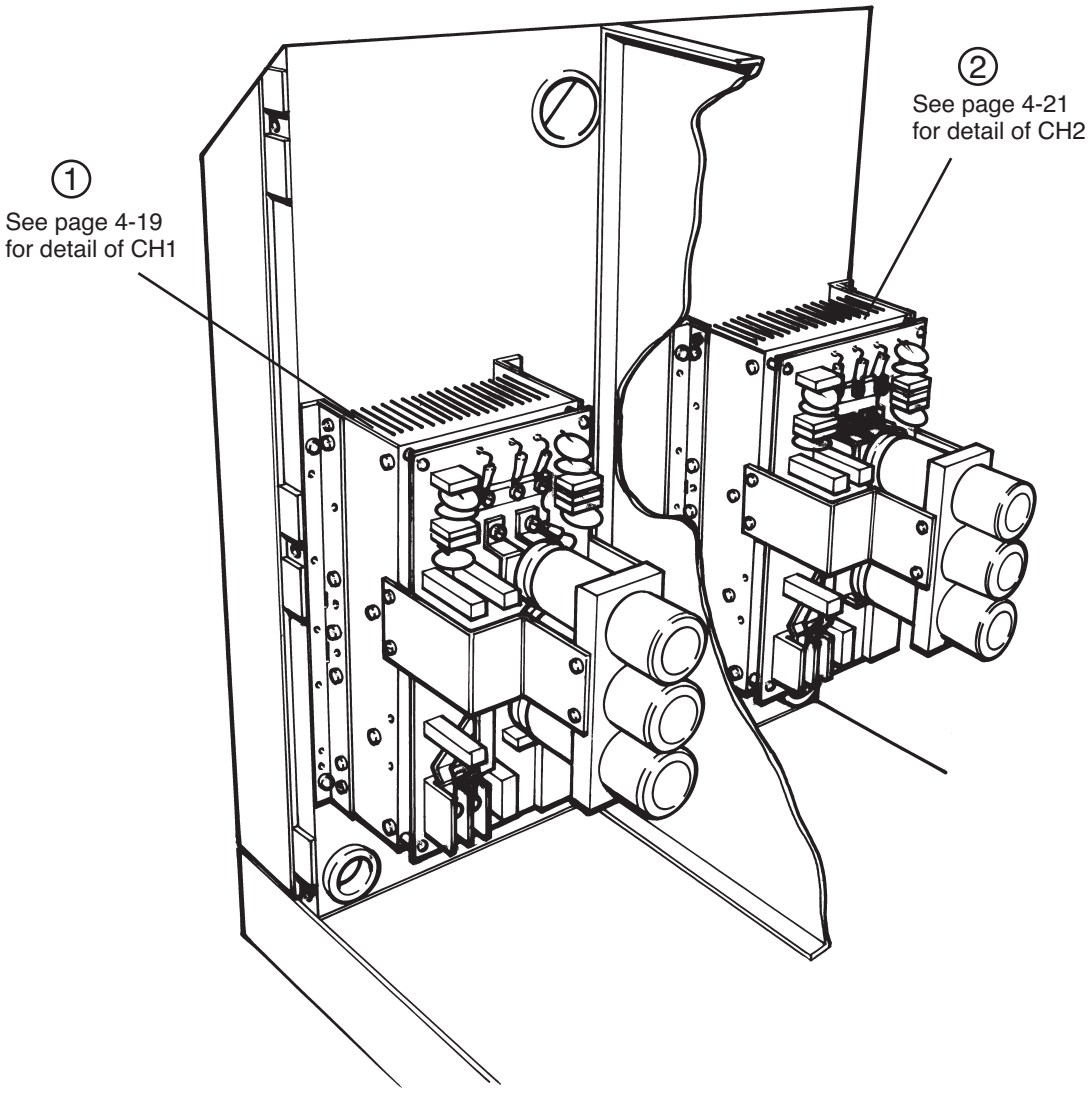


Figure 4-7 Power Supply – Front Wall, Inside

Front Wall Inside – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
1	*128789	Kit: chopper, 15KW	CH1	1
	005199	Switch, temperature 82° C	TSW1	1
2	**128789	Kit: chopper, 15KW	CH2	1
	005199	Switch, temperature 82° C	TSW2	1

* For detail of CH1 parts list, see page 4-19

** For detail of CH2 parts list, see page 4-21

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Chopper SA Front Wall Inside Left – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	128789	**Kit: chopper, 15KW**	**CH1**	**1**
1	005199	Switch, temperature 82° C	TSW1	1

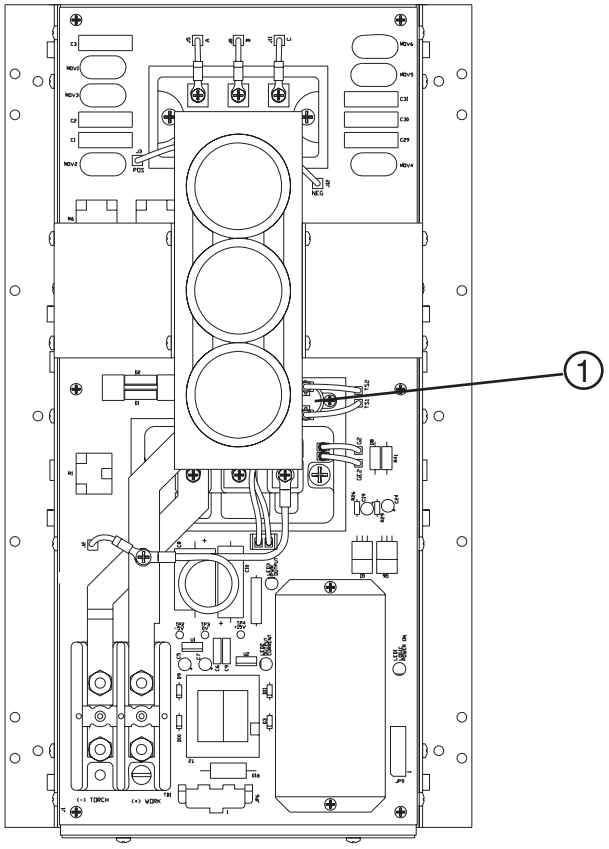

Figure 4-8 Power Supply – Chopper SA, Front Wall – Inside Left

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Chopper SA Front Wall Inside Right – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	128789	**Kit: chopper, 15KW**	**CH2**	**1**
1	005199	Switch, temperature 82° C	TSW1	1

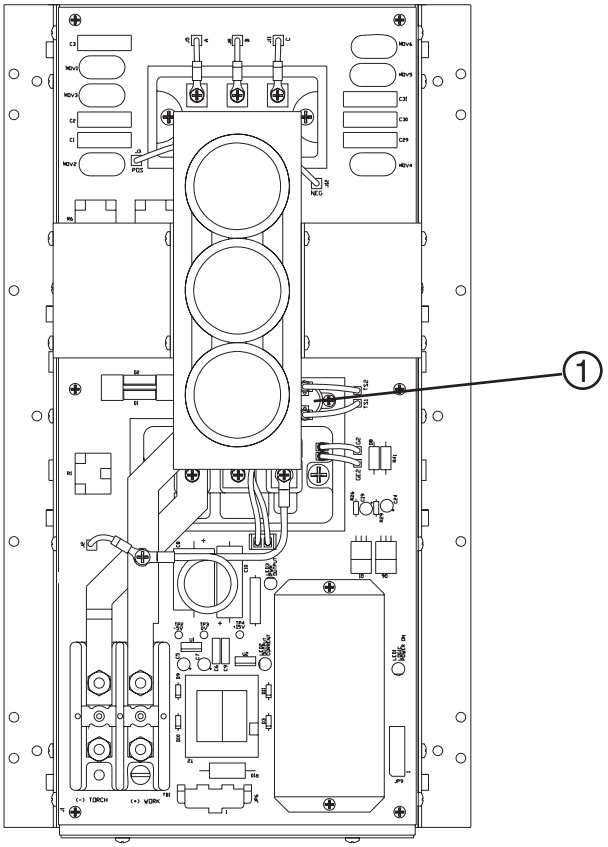
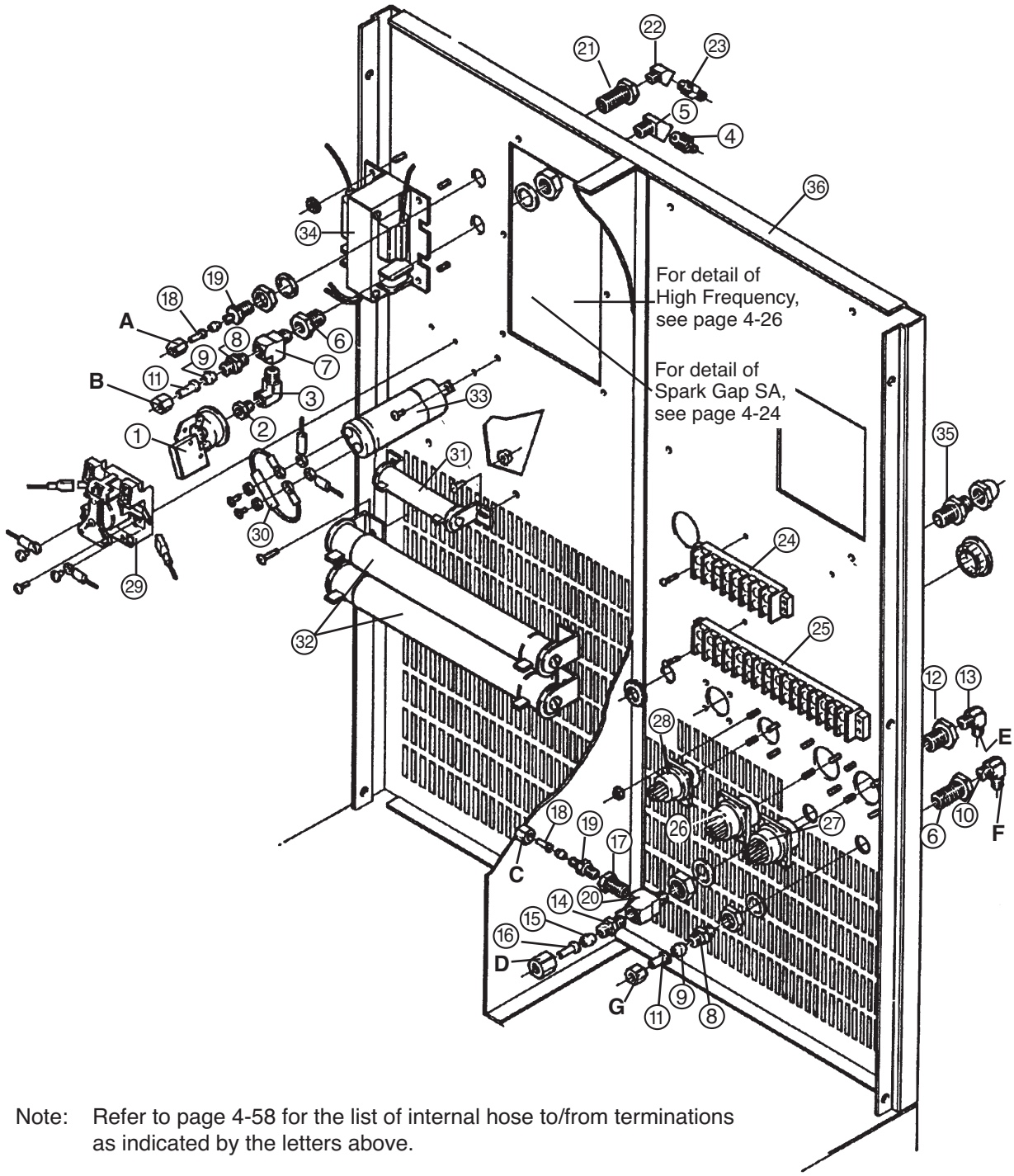


Figure 4-9 Power Supply – Chopper SA, Front Wall – Inside Right



Note: Refer to page 4-58 for the list of internal hose to/from terminations as indicated by the letters above.

Figure 4-10 Power Supply -- Rear Wall, Inside

Rear Wall Inside – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	029314	**Plasma Gas Valve SA**		
1	005228	Switch, 0-15 PSI Press	**PS3**	1
2	015570	Reducer bushing 1/4 X 1/8		1
3	015605	Elbow, 1/4" Long Street		1
4	015047	Adapt, 1/4 MNPT X Acc "A"/LH		1
5	015602	Street elbow 45 deg 1/4 NPT		1
6	015001	Adapter, Bulkhead, 1/4 NPTF		2
7	015593	Street Tee 1/4		1
8	015131	Fitting, 3/8 Tube X 1/4 NPT		2
9	015133	Ferrule, 3/8 OD Tube Delrin		2
10	015015	Adapter 90, 1/4 NPT X #6		1
11	015134	Insert, 3/8 OD X .062 w Brass		2
	029315	**Shield Gas SA, MAX200 (see page 4-15 for more part numbers)**		
12	015001	Adapter, Bulkhead, 1/4 NPTF		1
13	015015	Adapter 90, 1/4 NPT X #6		1
14	015131	Fitting, 3/8 Tube X 1/4 NPT		1
15	015133	Ferrule, 3/8 OD tube Delrin		1
16	015134	Insert, 3/8 OD X .062 w Brass		1
17	015570	Reducer Bushing 1/4 X 1/8		1
18	015135	Insert, 1/8 OD Brass		2
19	015137	Fitting, 1/8 Tube X 1/8 NPT		2
20	015593	Street Tee 1/4		1
21	015050	Adapter, Bulkhead, 1/8 X 1-1/2		1
22	015601	Street elbow 45 deg 1/8 NPT		1
23	015116	Adapter, 1/8 NPT X Oxy "A"		1
	029358	**Harness SA MAX200**		
24	008073	Terminal Strip (8)	**TB4**	1
25	008134	Terminal Strip (16)	**TB3**	1
26	008447	Receptacle, 23-37, Std sex	**1X1**	1
27	008208	Receptacle, 23-37, Rev sex	**1X2**	1
28	008201	Receptacle, shell size 17-14	**1X3**	1
29	003021	Relay, 120VAC NO SPST	**CR1**	1
30	009015	Res: 10K Ohm, 10W	**R5**	1
31	009438	Res: 5 Ohm, 50W	**R4**	1
32	009684	Res: 4 Ohm 420W	**R6**	2
33	009506	Cap: 250μF, 350VDC	**C9**	1
34	**029317**	**HV Transformer SA**	**T5**	**1**
35	008212	Strain Relief, 1/2 X .125-.375		1
36	001234	Panel, MAX200 Rear		1

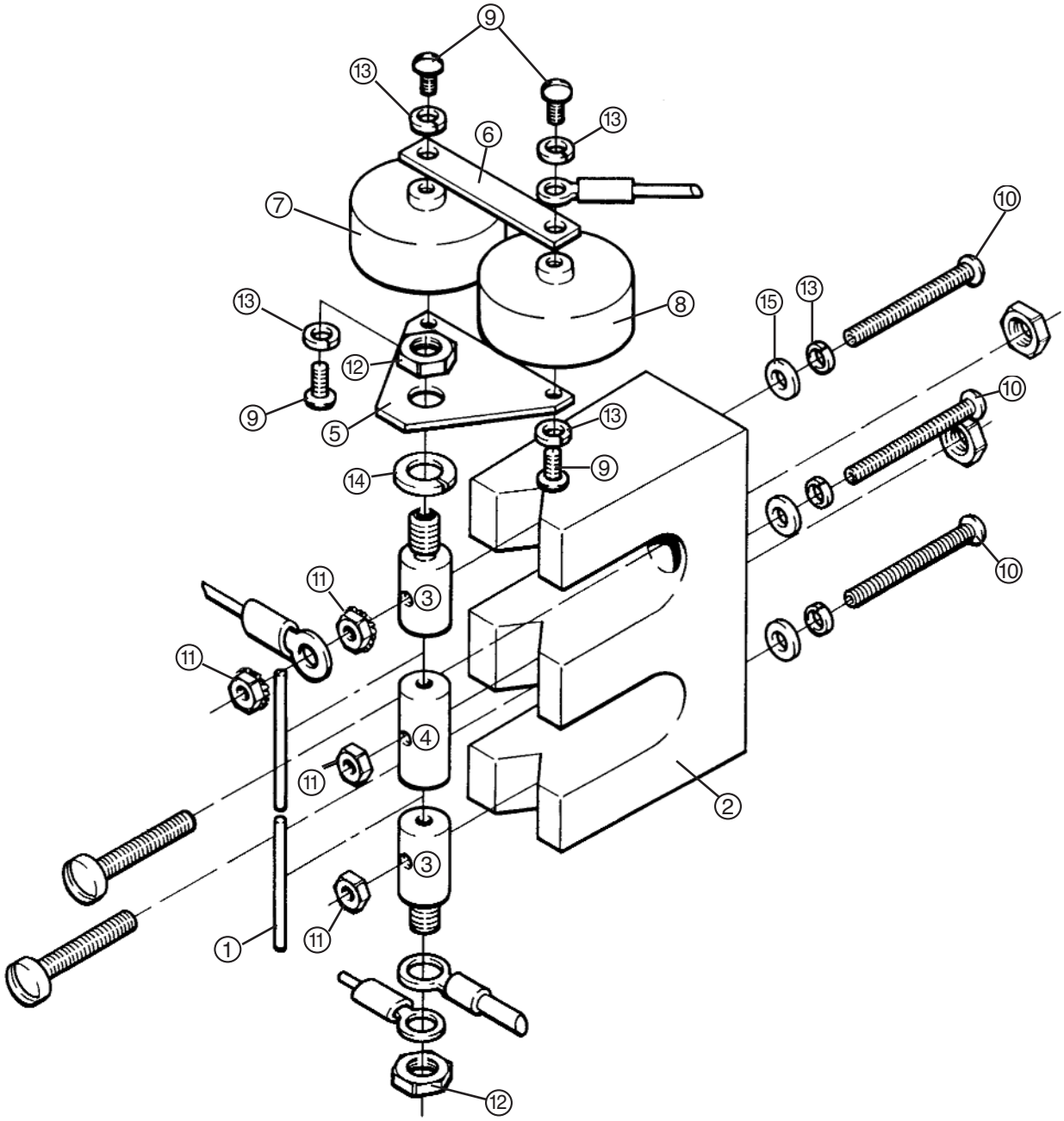


Figure 4-11 Power Supply – Spark Gap Assembly

Spark Gap Assembly – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	009350	**Spark Gap Assembly**	**SG1**	**1**
1	*004061	Electrode, Spark Gap 1/8 X 1.6		3
2	004140	Block, Spark Gap		1
3	004141	Tungsten Mount End		2
4	004142	Tungsten Mount Center		1
5	004143	Plate, Capacitor Mtg		1
6	004144	Bar, Capacitor Mtg		1
7	009280	Cap: .022μF 15KV	**C7**	1
8	009280	Cap: .022μF 15KV	**C8**	1
9	075034	M/S, 8-32 X 1/4, SL, Rnd, Brs		4
10	075036	M/S, 8-32 X 3/4, SL, Rnd, Brs		3
11	075147	Hexnut, 8-32, Brs		3
12	075152	Hexnut, 5/16-18, Finish Brs		1
13	075191	Lkwshr, #8, Splitlock, Brz		7
14	075193	Lkwshr, 5/16, Splitlock, Brz		1
15	075213	Flwshr, #8, .202,.436, .037, Brs		3

* Two of three electrodes shown

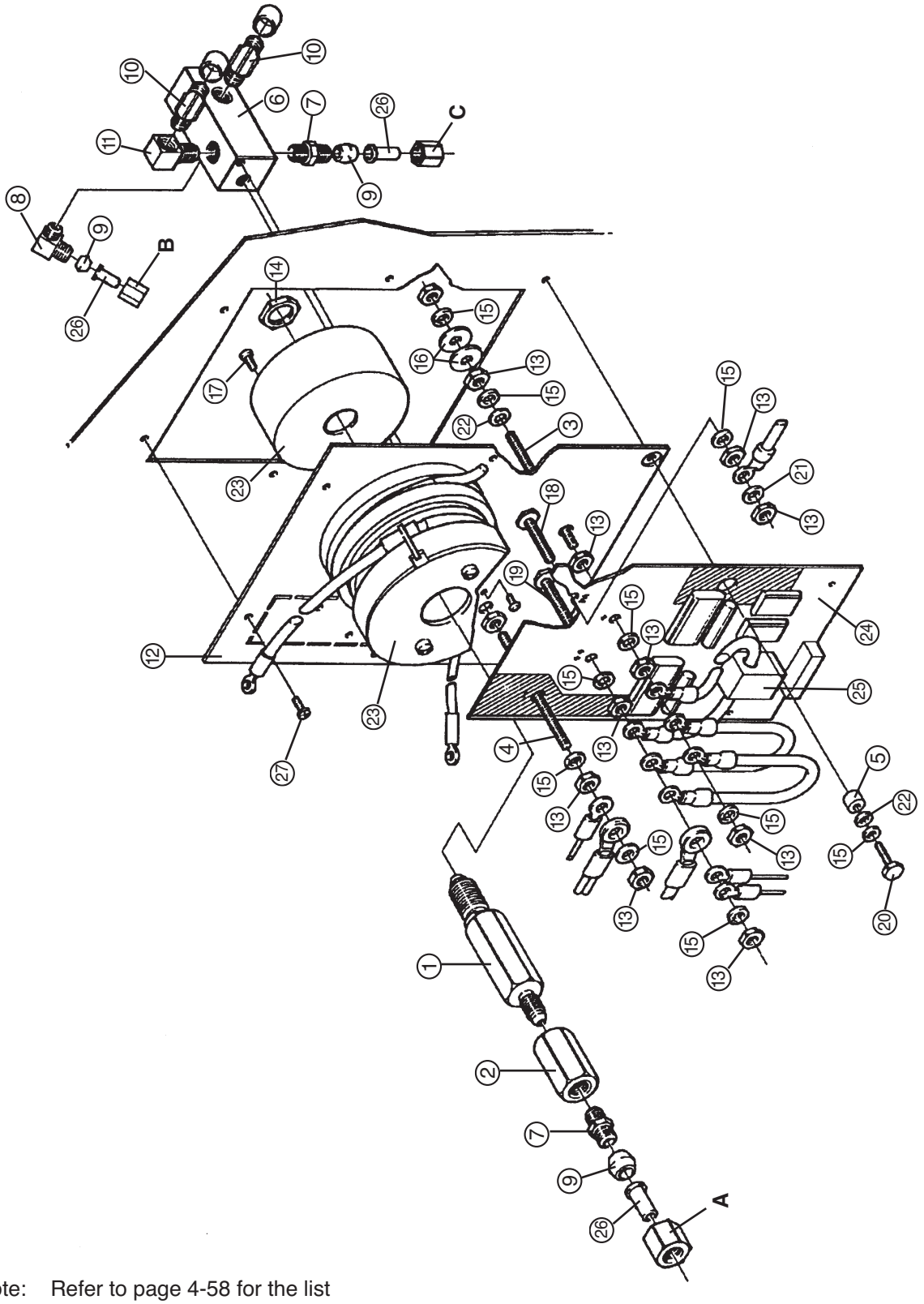


Figure 4-12 Power Supply – High Frequency & I/O PCB Assembly

Note: Refer to page 4-58 for the list of internal hose to/from terminations as indicated by the letters above.

High Frequency and I/O PCB – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	029312	**HF & I/O PCB SA MAX200**		1
1	004136	Connector, cathode		1
2	004259	Adapter, Cathode Connector		1
3	004311	Standoff, MAX200 Anode		1
4	004312	Standoff, MAX200 Cathode		1
5	004313	Spacer, .42ID X .750 X .50 lg		1
6	004314	Block, MAX200 Cathode		1
7	015131	Fitting, 3/8 Tube X 1/4 NPT		2
8	015132	Fitting, 90, 3/8 Tube X 1/4 NPT		1
9	015133	Ferrule, 3/8 OD Tube Delrin		3
10	015157	Adapter, 90 1/4 NPT X #5		2
11	015532	Street Elbow 1/4		1
12	041152	Panel, MAX200 Output		1
13	075153	Hexnut, 3/8-16, Finish, Brs		10
14	075156	Hexnut, 1/2-20, Finish/Jam, Brs		1
15	075194	Lkwshr, 3/8, Splitlock, Brz		9
16	075217	Flwshr, 3/8, .390,.875,.063, Brs		2
17	075335	M/S, 8-32 X 1/2, SL, Bin, Nyl		3
18	075347	Bolt, 5/16 X 11/4, Hex, Brz		1
19	075229	Bolt, 3/8-16 X 1 1/2, FTH, Hex, Brs		1
20	075351	Bolt, 3/8-16 X 1, Hex, Brs		1
21	075360	Flwshr, 5/16, .328,.520,.032, Brs		1
22	075361	Flwshr, 3/8, .394, .625, .032, Brs		2
23	**009349**	**Assembly, Coil, High Frequency**	**T6**	**1**
24	**041145**	**PC BD Assy MAX200 I/O**	**PCB5**	**1**
25	**029202**	**Current Sensor SA**	**CS1**	**1**
26	015134	Insert, 3/8 OD X .062 Brass		3
27	075072	M/S, 8-32 X 1/2		6

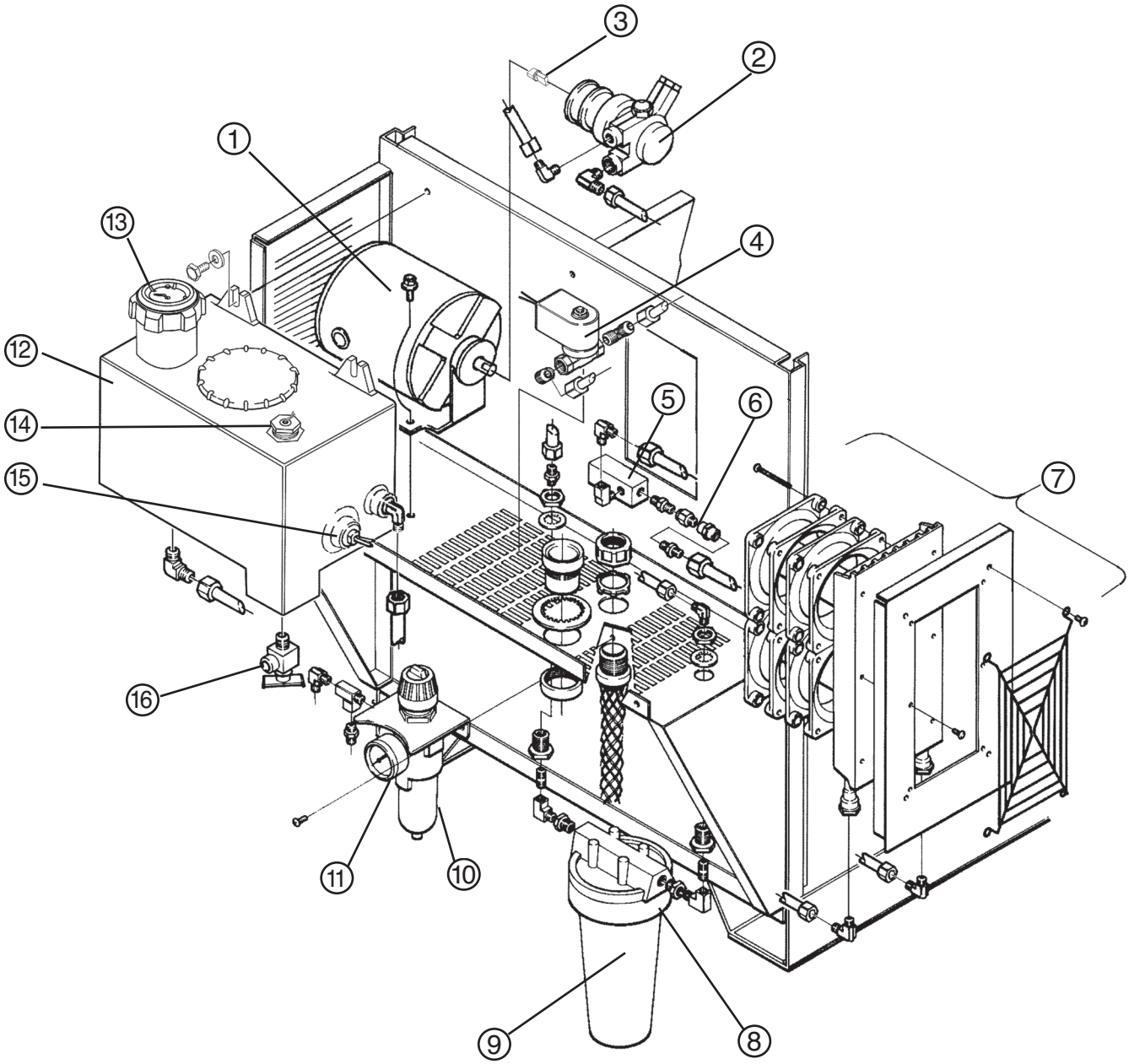


Figure 4-13 Power Supply – Rear Wall, Outside

Rear Wall Outside – MAX200 Power Supply

Item	Part Number	Description	Designator	Qty.
	129252	**Pump Motor Subassembly**		**1**
1	128385	Kit, Replacement Motor, 1/3 HP	M1	1
2	128384	Kit, Replacement Pump, 70 GPH		1
3	031122	Drive Coupling, Pump to motor		1
	129383	**Valve Subassembly (w/ elec connectors)**		**1**
4	006046	Valve, Sol 240V 3/8 NPT NC	V7	1
	029361	**Flowswitch Subassembly (w/ elec connector)**		**1**
5	005119	Flowswitch, 0.5 GPM	FS1	1
6	006053	Valve, Check 1/3 PSI, 1/4 NPTM		1
7	027978	Heat Exchanger, Water/Air	MX1	1
8	027139	Filter Housing, 10" X 3/8 NPT		1
9	027005	Filter, Element		1
10	011025	Filter Regulator		1
11	011027	Gauge, High Press (for 011025)		1
12	002304	Reservoir, coolant		1
13	022036	Gauge, liquid level		1
14	129618	Level Switch Subassembly, 1/2 NPT	LS1	1
15	029323	Temp Switch Subassembly, 162 Deg F	TS2	1
16	006099	Bib drain valve 1/4 NPT		1
	*128410	Kit: coolant resevoir upgrade		1

* For older systems. Item numbers 12 through 16 can not be used if the tank has been upgraded with the 128410 kit.

Recommended Spare Parts

Power Supply

Part Number	Description	Designator
005041	Switch, tog 2pl Maint ON/ON	S1
005121	Pushbutton, green, illmn.	PB1
005122	Pushbutton, red, extended	PB2
005151	Holder, lamp	-
005168	Bulb, 28 VDC	-
005091	Lens, white	-
009604	Resistor, variable, 100 K, 1 turn	R9
027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M2
027079	Fan, 450-550 CFM, 120 VAC, 50/60 Hz	M4
027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M3
*041151	PCB, THC motherboard	PCB9
*041186	PCB, SA-THC	PCB10
041143	PCB, Control	PCB7
005102	Thermostat, 160°C, 6 Amp	TS1
006014	Valve, solenoid	V1
005093	Switch, pressure, 0-90 psi	PS1
129118	CH130 Chopper SA CE/LVD	CH1/CH2
041534	PCB, power distribution	PCB6
**008551	Fuse, 7.5 Amp, 600VAC	F1, F2
***008709	Fuse, 20 Amp, 500VAC	F1, F2
008317	Fuse, semiconductor, 125 Amp, 250 V	F3, F4
003021	Relay, 120 VAC	CR1
005130	Switch, pressure, SPDT, 0-15 psi	PS3
029317	Transformer, High Voltage SA	T5
029202	Sensor, current	CS1
027005	Filter, coolant	-
011025	Filter/regulator	FR1
011031	Filter Element (used with 011025)	-
011027	Gauge, high pressure	-
128384	Kit: coolant Pump with clamp	-
029323	Switch, water temperature, 162°F	TS2
029326	Switch, level	LS1
029361	Switch, flow, 0.5 gpm	FS1
006053	Valve, check 1/3 psi, 1/4 NPTH	
028872	Coolant, propylene glycol 30%/ deionized water 70% (standard mixture)	
028873	Coolant, propylene glycol 100%	

* Power Supplies with THC
** Used when incoming power is 380V, 415V, 400V or 480V
*** Used when incoming power is 208V, 220V, or 240V

Recommended Spare Parts (cont.)

MAX200 Rev 1 90° Hand Torch and Torch Leads

Part Number	Description
020484	Torch Main Body
029309	Hand torch lead, 25 ft.
029310	Hand torch lead, 50 ft.

MAX200 Machine Torch and Torch Leads

Part Number	Description
120584	Torch Main Body
028383	Shielded torch lead, 25 ft.
028384	Shielded torch lead, 50 ft.

PAC200T (90°) Cutting Torch and Torch Lead

Part Number	Description
120045	Torch Main Body
029865	Leads SA, PAC200T/E, 25 ft. (torch to power supply)

PAC200T (65°) Gouging Torch and Torch Lead

Part Number	Description
020908	Torch Main Body
029865	Leads SA, PAC200T/E, 25 ft. (torch to power supply)

PAC200T (65°) Cutting Torch and Torch Lead

Part Number	Description
020907	Torch Main Body
029865	Leads SA, PAC200T/E, 25 ft. (torch to power supply)

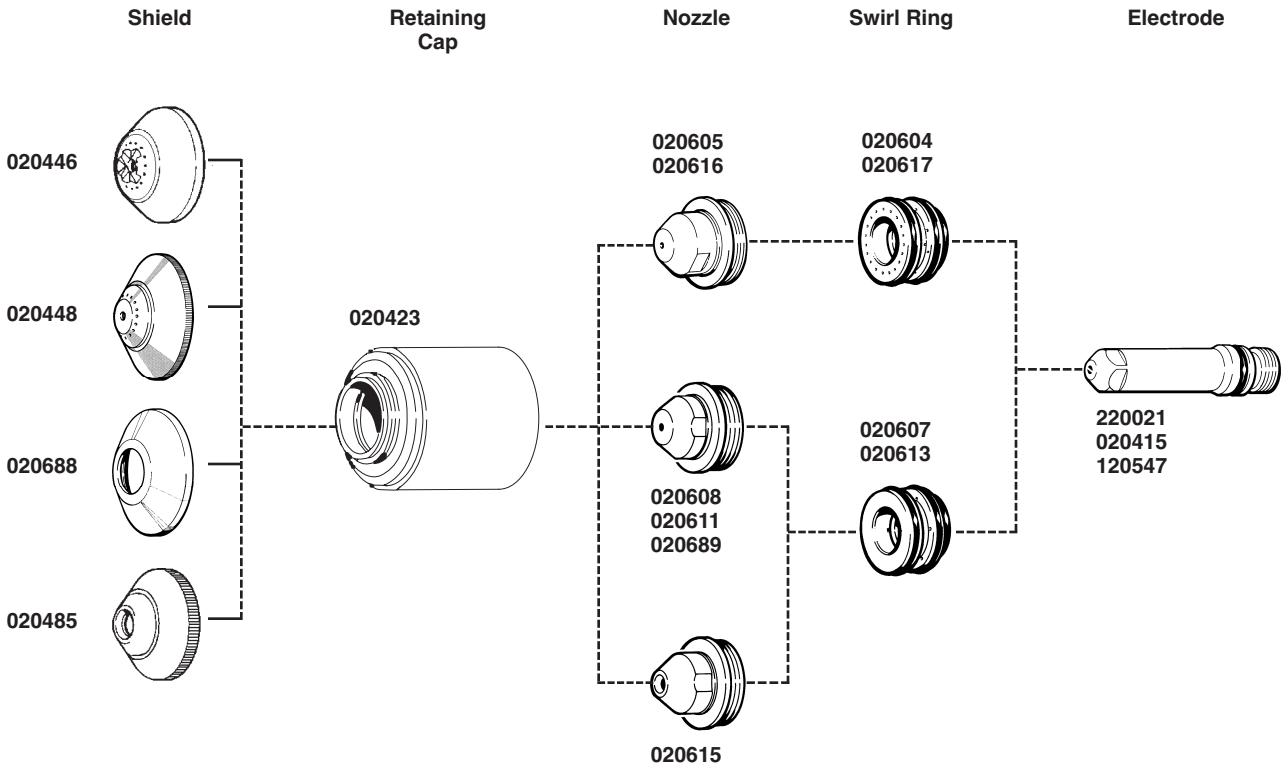


Figure 4-14 MAX200 Rev 1 Hand Torch Consumable Parts

MAX200 Rev 1 Hand Torch Consumables (See Figure 4-14)

		Part Numbers				
Plasma Gas/ Shield Gas	**Nozzle Type (Amps)**	**Shield**	**Retaining Cap**	**Nozzle**	**Swirl Ring**	**Electrode**
Air/Air	**200**	020446	020423	020608	020607	220021
	100	020448	020423	020611	020607	120547
	40	020688	020423	020689	020613	220021
	200 gouging	020485	020423	020615	020607	220021
O_2/Air	**200**	020446	020423	020605	020604	220021
	100	020448	020423	020616	020617	120547
H35/N_2	**200**	020602	020423	020608	020607	020415
	100	020448	020423	020611	020607	020415
	200 gouging	020485	020423	020615	020607	020415
N_2/CO_2	**200**	020446	020423	020608	020607	020415
N_2/Air	**200**	020446	020423	020608	020607	020415

MAX200 Rev 1 Hand Torch Consumable Parts Kit (028414)

Part Number	Description	Qty.
001067	Enclosure, Consumable Parts Kit	1
015015	Adapter 90, 1/4 NPT x #6	1
015193	Cap, #6 JIC	1
220021	Electrode, Air/Oxygen	5
020415	Electrode, Nitrogen	5
020423	Cap, Shield	1
020446	Shield	1
020604	Swirl Ring, Oxygen	1
020605	Nozzle, Shield Oxygen, .082	5
020607	Swirl Ring, Air/ N_2	1
020608	Nozzle, Shield 200 Amp., .086	5
027055	Lubricant, Silicon, 1/4 Oz. Tube	1
027194	Wrench, Nozzle, 3/4"	1
044027	O-Ring	2
027347	Tool:Wtr Tube Replacement	1

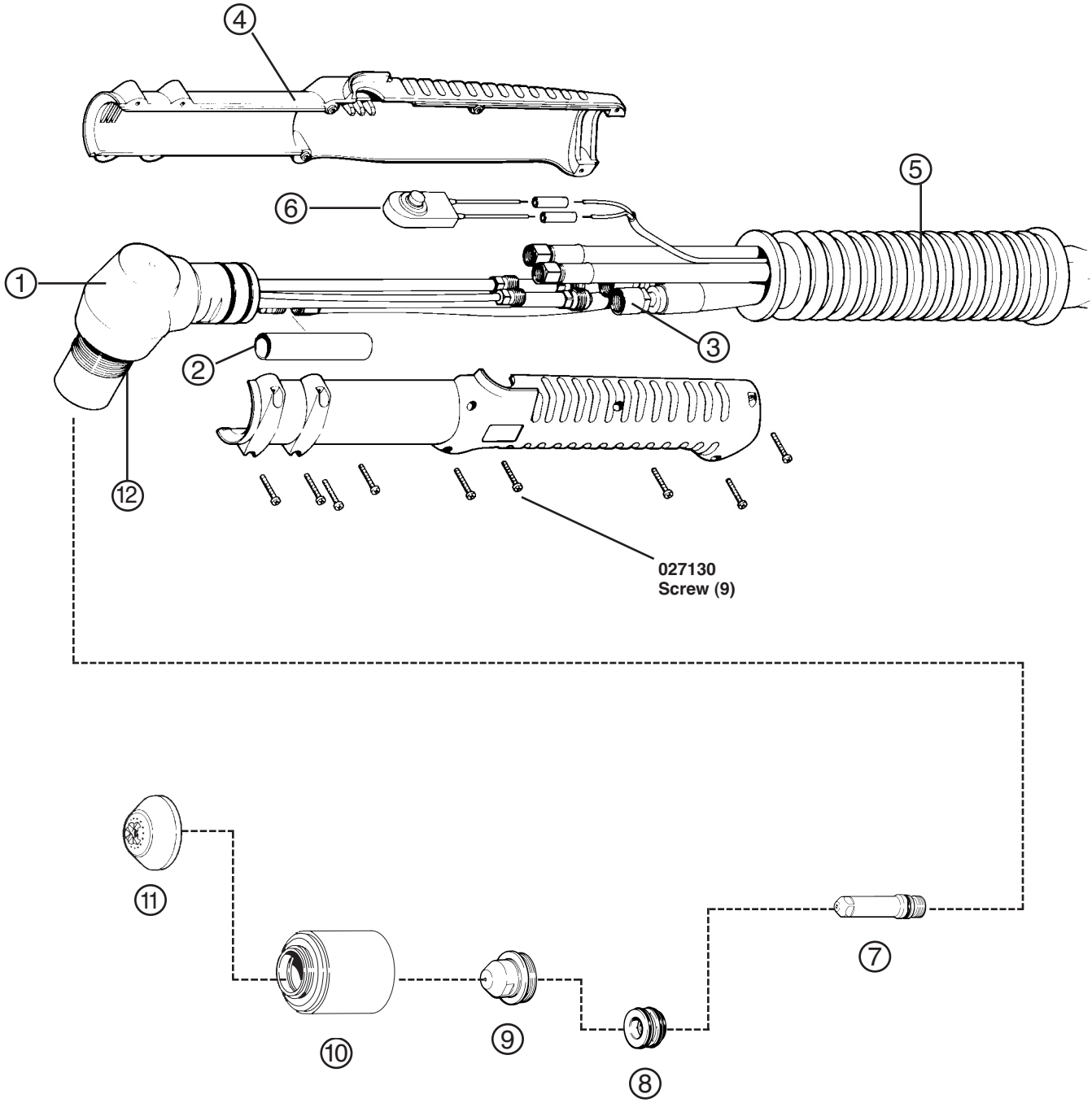


Figure 4-15 MAX200 Rev 1 Hand Torch Assembly

MAX200 Rev 1 Hand Torch Assembly

The following is a listing of the MAX200 Rev 1 90° Hand Torch with 25 foot and 50 foot leads. Refer to Figure 4-15.

Item	Part Number	Description	Qty.
	073189	**MAX200 90 Deg. Hand Torch 25'**	**1**
1	**020484**	**MAX200 90 Deg Hnd Tch Main Body**	**1**
3	***029309**	**Leads SA MAX200 Hand Torch 25'**	**1**
	073190	**MAX200 90 Deg. Hand Torch 50'**	**1**
1	**020484**	**MAX200 90 Deg Hnd Tch Main Body**	**1**
3	***029310**	**Leads SA MAX200 Hand Torch 50'**	**1**

The following items are common to the MAX200 Rev 1 Hand Torch assemby:

2	020536	Lead Insulator 9/16 X 2.5 Tef	1
4	001258	Handle, MAX200 Hand Torch	1
5	002178	Boot, MAX200 Torch	1
6	005094	Switch, PB, Torch	1
7	220021	Electrode, MAX200 Air O/2	1
8	020607	Swirl Ring, MAX200 Air/N2/H35	1
9	020608	Nozzle, MX200 200A .086 Air/N2/H35	1
10	020423	Cap, Nozzle Retaining, MAX200	1
11	020446	Shield, MAX200 Hnd 200A	1
12	044027	O-ring, Buna-N	1

* Lead subassemblies are broken down on page 4-36.

MAX200 Rev 1 Hand Torch Lead Assembly Parts

Item	Part Number	Description	Qty
	029309	**Hand Torch Lead, 25 Ft.**	1
1	023326	Lead Pilot, Shield Gas, 25 Ft. (blue)	1
2	024194	Lead, Plasma Gas, 25 Ft. (red)	1
3	024192	Lead, Cap Sensor, 25 Ft. (gray)	1
4	023013	Cable, Water Cooled, 25 Ft. (blue- red band)	1
5	023013	Cable, Water Cooled, 25 Ft. (blue- green band)	1
6	047032	Cable, Switch, 26 Ft.	1
7	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
8	046026	Tubing, 1-1/2" ID Shrink Black	2
9	024197	Sheath, 25 Ft.	1
	029310	**Hand Torch Lead, 50 Ft.**	1
1	023327	Lead Pilot, Shield Gas, 50 Ft. (blue)	1
2	024195	Lead, Plasma Gas, 50 Ft. (red)	1
3	024193	Lead, Cap Sensor, 50 Ft. (gray)	1
4	023199	Cable, Water Cooled, 50 Ft. (blue- red band)	1
5	023199	Cable, Water Cooled, 50 Ft. (blue- green band)	1
6	047032	Cable, Switch, 51 Ft.	1
7	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
8	046026	Tubing, 1-1/2" ID Shrink Black	2
9	024198	Sheath, 50 Ft.	1

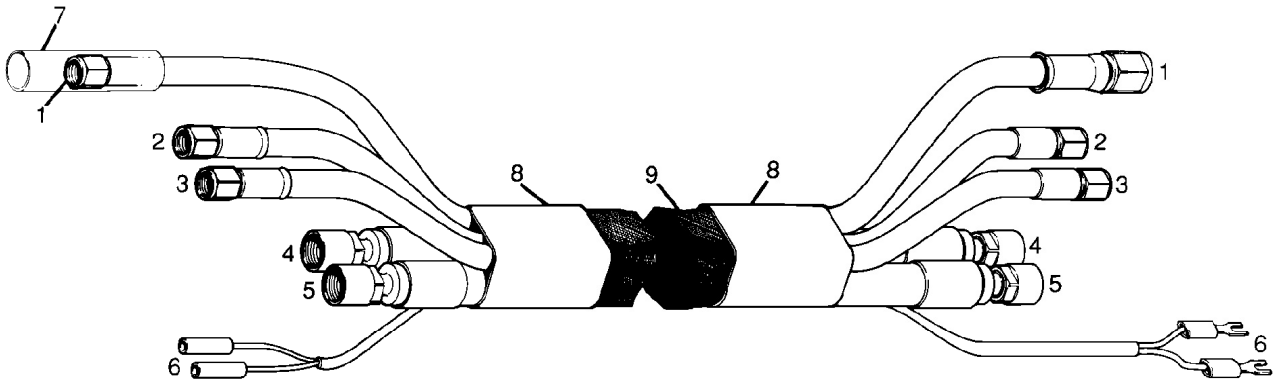


Figure 4-16 Hand Torch Lead Assemblies

MAX200 Rev 1 Hand Torch Lead Extensions

Part No.	Description	Length
028496	Lead Extensions, Hand Torch	100 ft
028497	Lead Extensions, Hand Torch	150 ft

For more detailed information on hand-torch lead extensions and their installation, please refer to instruction manual IM-140 (P/N 801400).

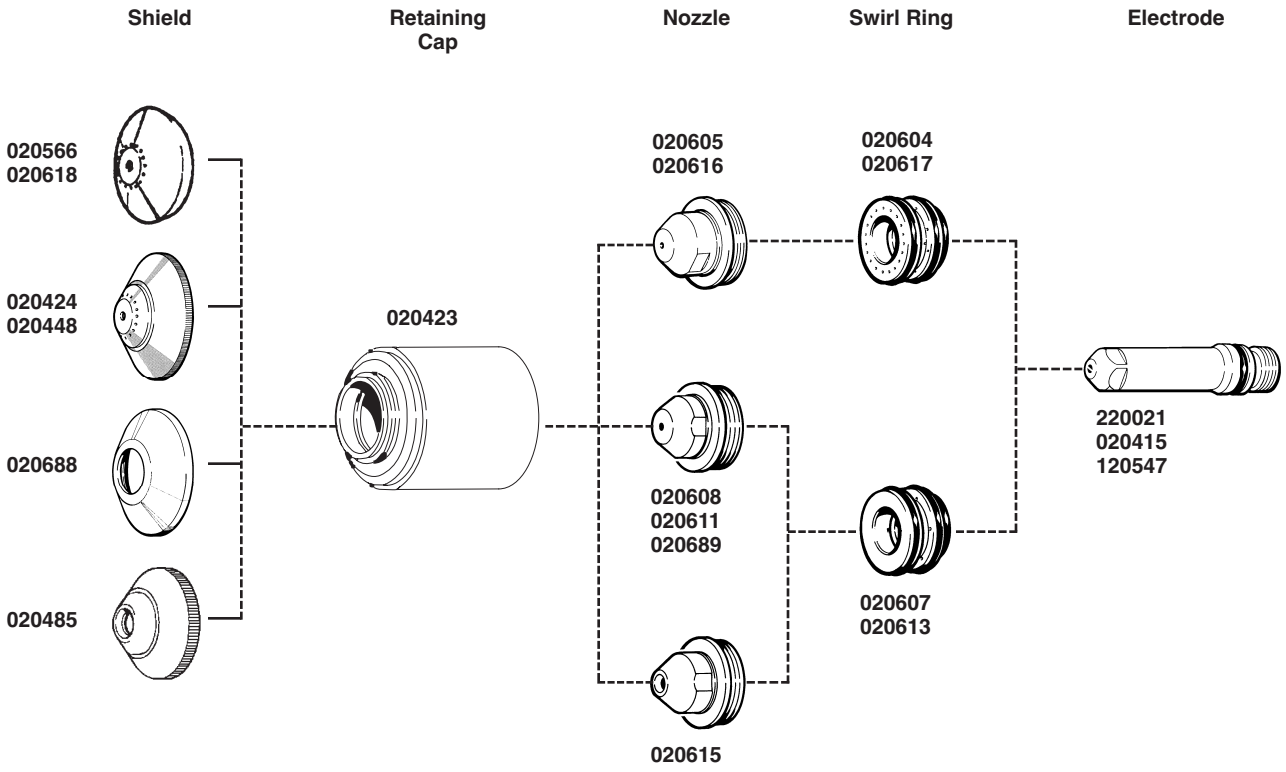


Figure 4-17 MAX200 Machine Torch Consumable Parts

MAX200 Machine Torch Consumables (See Figure 4-17)

		Part Numbers				
Plasma Gas/ Shield Gas	**Nozzle Type (Amps)**	**Shield**	**Retaining Cap**	**Nozzle**	**Swirl Ring**	**Electrode**
Air/Air	**200** **100** **40** **200 gouging**	020424 020448 020688 020485	020423 020423 020423 020423	020608 020611 020689 020615	020607 020607 020613 020607	220021 120547 220021 220021
O_2/Air	**200** **100**	020424 020448	020423 020423	020605 020616	020604 020617	220021 120547
H35/N_2	**200** **100** **200 gouging**	020602 020448 020485	020423 020423 020423	020608 020611 020615	020607 020607 020607	020415 020415 020415
N_2/CO_2	**200**	020424	020423	020608	020607	020415
N_2/Air	**200**	020424	020423	020608	020607	020415
		Consumables Used with MAX200 Water-Muffler				
Air/Air	**200** **100**	020566 020618	020423 020423	020608 020611	020607 020607	220021 120547
O_2/Air	**200** **100**	020566 020618	020423 020423	020605 020616	020604 020617	220021 120547
N_2/CO_2	**200**	020566	020423	020608	020607	020415
N_2/Air	**200**	020566	020423	020608	020607	020415

MAX200 Machine Torch Consumable Parts Kits

Part #	Description	Quantity
028392	**Kit, Consum Parts, MAX200 Mach**	**1**
001067	Enclosure, Consumable Parts Kit	1
015015	Adapter 90, 1/4 NPT x #6	1
015193	Cap, #6 JIC	1
220021	Electrode, Air/Oxygen	5
020415	Electrode, Nitrogen/H35	5
020423	Cap, Shield	1
020424	Shield, Machine 200A	1
020448	Shield, Machine 100A	1
020605	Nozzle, Shield Oxygen, .082	5
020607	Swirl Ring, Air/ Nitrogen	1
020608	Nozzle, Shield 200A, .086	5
020604	Swirl Ring, Oxygen	1
020611	Nozzle, Shield 100A, .059	3
020616	Nozzle, 100A, .055, Oxygen	3
020617	Swirl Ring, 100A, Oxygen	1
027055	Lubricant, Silicon, 1/4 Oz. Tube	1
027194	Wrench, Nozzle, 3/4"	1
044027	O-Ring	2
027347	Tool:Wtr Tube Replacement	1
020963	Tube, Water	1
120547	Electrod, 100A Air/Oxygen	3

Part #	Description	Quantity
028429	**Kit Cons Parts MAX200 Mch Intl**	**1**
001067	Enclosure, Consumable Parts Kit	1
015015	Adapter 90, 1/4 NPT x #6	1
220021	Electrode, Air/Oxygen	5
020415	Electrode, Nitrogen/H35	5
020423	Cap, Shield	1
020424	Shield, Machine 200A	1
020448	Shield, Machine 100A	1
020688	Shield, 40A	1
020605	Nozzle, Shield Oxygen, .082	5
020607	Swirl Ring, Air/ Nitrogen	1
020608	Nozzle, Shield 200A, .086	5
020604	Swirl Ring, Oxygen	1
020611	Nozzle, Shield 100A, .059	3
020689	Nozzle, 40A	5
020613	Swirl Ring, 40A	1
027055	Lubricant, Silicon, 1/4 Oz. Tube	1
027194	Wrench, Nozzle, 3/4"	1
044027	O-Ring	2
027347	Tool:Wtr Tube Replacement	1
120547	Electrod, 100A Air/Oxygen	3

MAX200 Machine Torch Assembly with 1.75" diameter Torch Body and 2" diameter Sleeve (Standard)

Item	Part Number	Description	Qty.
	128380	**MAX200 Machine Torch Assembly**	**1**
1	120894	Sleeve, Insul, MAX200 Mach, 2.0" diameter	1
2	**120584**	**MAX200 Machine Torch Main Body**	**1**
3	020536	Lead insulator 9/16 X 2.5 Tef	1
4	044027	O-ring, Buna-N	1

The following consumables are part of the MAX200 Machine Torch Assembly.
See Figure 4-17 for details.

020424	Shield, MAX200 Mch 200A	1
020423	Cap, Nozzle Retaining, MAX200	1
020608	Nozzle MX200 200A .086 Air/N2/H35	1
020607	Swirl ring, MAX200 Air/N2/H35	1
220021	Electrode, MAX200 Air O/2	1

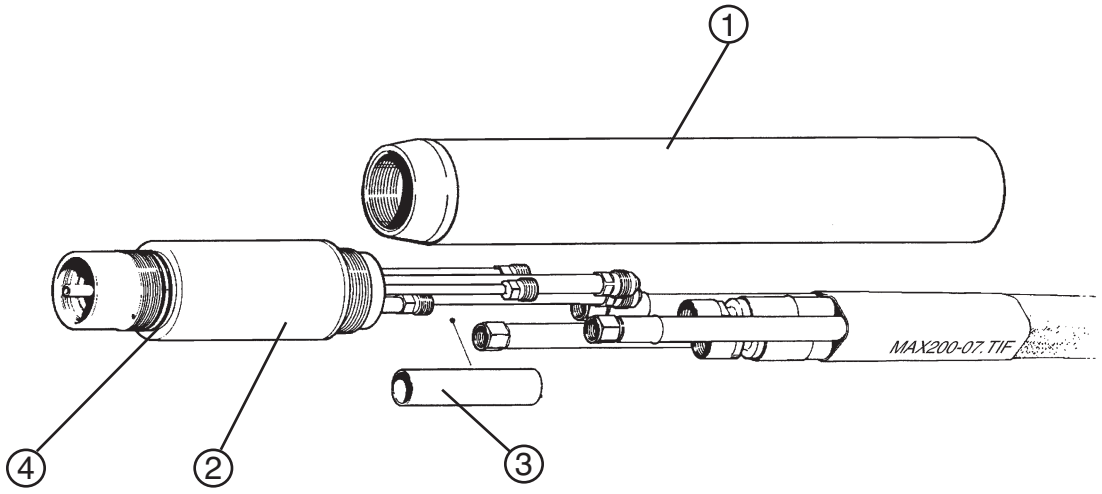


Figure 4-18 MAX200 Machine Torch Assembly

MAX200 Machine Torch Assembly with 2" Stainless Steel Torch Body and 2" diameter Sleeve (Optional)

Item	Part Number	Description	Qty.
	128365	**MAX200 Machine Torch Assembly**	**1**
1	020041	Sleeve, Insul, MAX200 Mach, 2.0" diameter	1
2	**120356**	**MAX200 Machine Torch Main Body**	**1**
3	020536	Lead insulator 9/16 X 2.5 Tef	1
4	044027	O-ring, Buna-N	1

The following consumables are part of the MAX200 Machine Torch Assembly.
See Figure 4-17 for details.

020424	Shield, MAX200 Mch 200A	1
020423	Cap, Nozzle Retaining, MAX200	1
020608	Nozzle MX200 200A .086 Air/N2/H35	1
020607	Swirl ring, MAX200 Air/N2/H35	1
220021	Electrode, MAX200 Air O/2	1

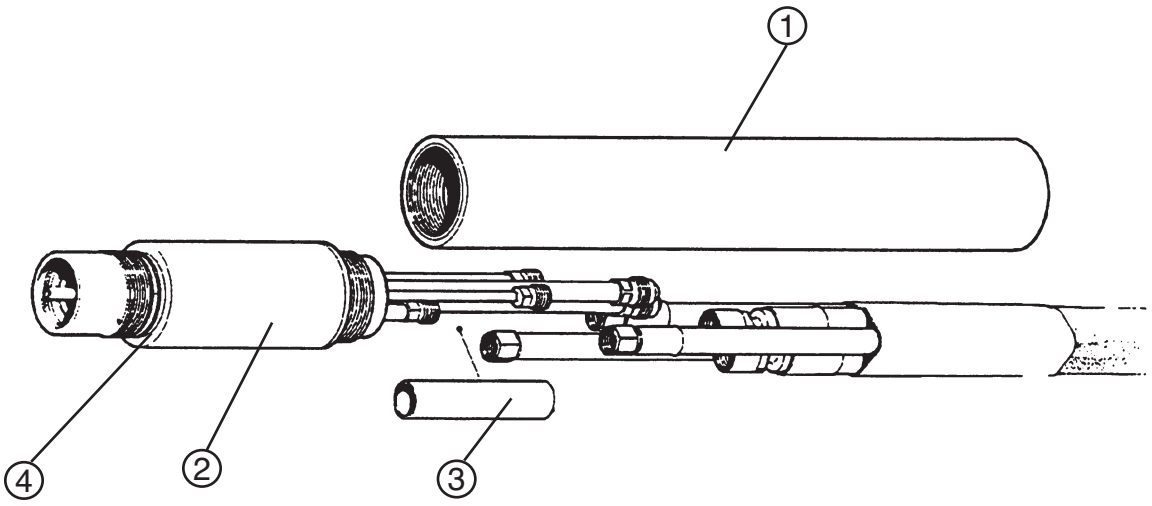


Figure 4-18a MAX200 Machine Torch Assembly (Optional)

MAX200 Machine Torch Assembly with 1.75" diameter Torch Body and 1.75" diameter Sleeve (Optional)

Item	Part Number	Description	Qty.
	128364	**MAX200 Machine Torch Assembly**	**1**
1	020431	Sleeve, Insul, MAX200 Mach, 1.75" diameter	1
2	**120584**	**MAX200 Machine Torch Main Body**	**1**
3	020536	Lead insulator 9/16 X 2.5 Tef	1
4	044027	O-ring, Buna-N	1

The following consumables are part of the MAX200 Machine Torch Assembly.
See Figure 4-17 for details.

020424	Shield, MAX200 Mch 200A	1
020423	Cap, Nozzle Retaining, MAX200	1
020608	Nozzle MX200 200A .086 Air/N2/H35	1
020607	Swirl ring, MAX200 Air/N2/H35	1
220021	Electrode, MAX200 Air O/2	1

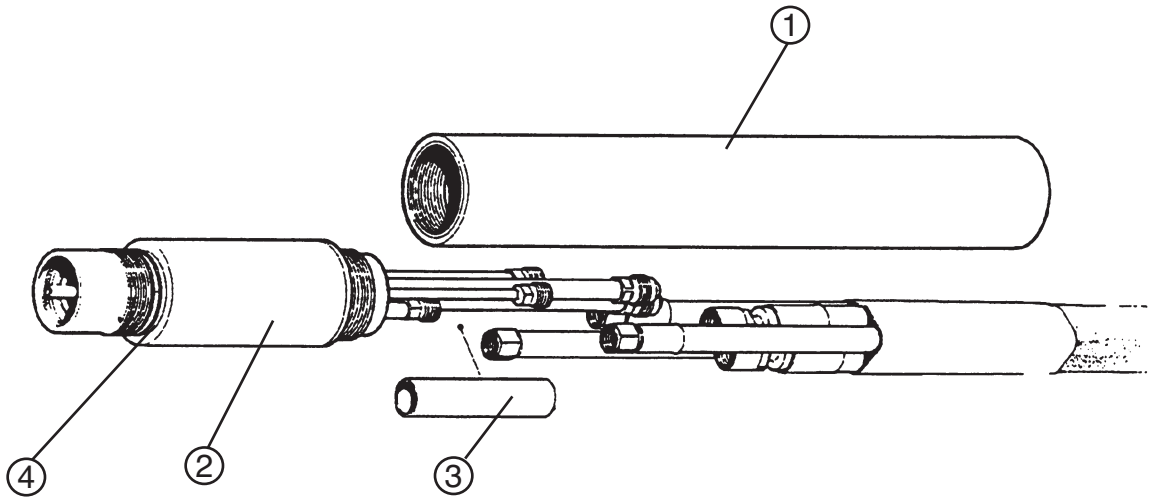


Figure 4-18b MAX200 Machine Torch Assembly (Optional)

Machine Torch Lead Assemblies

See Figure 4-19

Item	Part Number	Description	Qty.
	028454	**Shield Torch Lead, 10 Ft.**	1
1	023429	Lead Pilot, Shield Gas, 10 Ft. (blue)	1
2	024216	Lead, Plasma Gas, 10 Ft. (red)	1
3	024221	Lead, Cap Sensor, 10 Ft. (gray)	1
4	023032	Cable, Water Cooled, 10 Ft. (blue- red band)	1
5	023032	Cable, Water Cooled, 10 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028455	**Shield Torch Lead, 15 Ft.**	1
1	023430	Lead Pilot, Shield Gas, 15 Ft. (blue)	1
2	024217	Lead, Plasma Gas, 15 Ft. (red)	1
3	024222	Lead, Cap Sensor, 15 Ft. (gray)	1
4	023034	Cable, Water Cooled, 15 Ft. (blue- red band)	1
5	023034	Cable, Water Cooled, 15 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028456	**Shield Torch Lead, 20 Ft.**	1
1	023431	Lead Pilot, Shield Gas, 20 Ft. (blue)	1
2	024228	Lead, Plasma Gas, 20 Ft. (red)	1
3	024223	Lead, Cap Sensor, 20 Ft. (gray)	1
4	023012	Cable, Water Cooled, 20 Ft. (blue- red band)	1
5	023012	Cable, Water Cooled, 20 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (cont.)

See Figure 4-19

Item	Part Number	Description	Qty.
	028383	**Shield Torch Lead, 25 Ft.**	1
1	023326	Lead Pilot, Shield Gas, 25 Ft. (blue)	1
2	024194	Lead, Plasma Gas, 25 Ft. (red)	1
3	024192	Lead, Cap Sensor, 25 Ft. (gray)	1
4	023013	Cable, Water Cooled, 25 Ft. (blue- red band)	1
5	023013	Cable, Water Cooled, 25 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028457	**Shield Torch Lead, 30 Ft.**	1
1	023432	Lead Pilot, Shield Gas, 30 Ft. (blue)	1
2	024229	Lead, Plasma Gas, 30 Ft. (red)	1
3	024224	Lead, Cap Sensor, 30 Ft. (gray)	1
4	023014	Cable, Water Cooled, 30 Ft. (blue- red band)	1
5	023014	Cable, Water Cooled, 30 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028458	**Shield Torch Lead, 35 Ft.**	1
1	023433	Lead Pilot, Shield Gas, 35 Ft. (blue)	1
2	024218	Lead, Plasma Gas, 35 Ft. (red)	1
3	024225	Lead, Cap Sensor, 35 Ft. (gray)	1
4	023015	Cable, Water Cooled, 35 Ft. (blue- red band)	1
5	023015	Cable, Water Cooled, 35 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (cont.)

See Figure 4-19

Item	Part Number	Description	Qty.
	028459	**Shield Torch Lead, 40 Ft.**	1
1	023434	Lead Pilot, Shield Gas, 40 Ft. (blue)	1
2	024230	Lead, Plasma Gas, 40 Ft. (red)	1
3	024226	Lead, Cap Sensor, 40 Ft. (gray)	1
4	023016	Cable, Water Cooled, 40 Ft. (blue- red band)	1
5	023016	Cable, Water Cooled, 40 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028460	**Shield Torch Lead, 45 Ft.**	1
1	023435	Lead Pilot, Shield Gas, 45 Ft. (blue)	1
2	024231	Lead, Plasma Gas, 45 Ft. (red)	1
3	024227	Lead, Cap Sensor, 45 Ft. (gray)	1
4	023387	Cable, Water Cooled, 45 Ft. (blue- red band)	1
5	023387	Cable, Water Cooled, 45 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028384	**Shield Torch Lead, 50 Ft.**	1
1	023327	Lead Pilot, Shield Gas, 50 Ft. (blue)	1
2	024194	Lead, Plasma Gas, 50 Ft. (red)	1
3	024193	Lead, Cap Sensor, 50 Ft. (gray)	1
4	023199	Cable, Water Cooled, 50 Ft. (blue- red band)	1
5	023199	Cable, Water Cooled, 50 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (cont.)

See Figure 4-19

Item	Part Number	Description	Qty.
	028773	**Shield Torch Lead, 60 Ft.**	1
1	023515	Lead Pilot, Shield Gas, 60 Ft. (blue)	1
2	024260	Lead, Plasma Gas, 60 Ft. (red)	1
3	024259	Lead, Cap Sensor, 60 Ft. (gray)	1
4	023052	Cable, Water Cooled, 60 Ft. (blue- red band)	1
5	023052	Cable, Water Cooled, 60 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028599	**Shield Torch Lead, 75 Ft.**	1
1	023622	Lead Pilot, Shield Gas, 75 Ft. (blue)	1
2	024319	Lead, Plasma Gas, 75 Ft. (red)	1
3	024318	Lead, Cap Sensor, 75 Ft. (gray)	1
4	023262	Cable, Water Cooled, 75 Ft. (blue- red band)	1
5	023262	Cable, Water Cooled, 75 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Note: Hypertherm does not recommend using torch leads longer than 75 Feet. 100 Ft, 125 Ft. and 150 Ft. leads will cause problems with starting.

	028781	**Shield Torch Lead, 100 Ft.**	1
1	023808	Lead Pilot, Shield Gas, 100 Ft. (blue)	1
2	024416	Lead, Plasma Gas, 100 Ft. (red)	1
3	024413	Lead, Cap Sensor, 100 Ft. (gray)	1
4	023805	Cable, Water Cooled, 100 Ft. (blue- red band)	1
5	023805	Cable, Water Cooled, 100 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (cont.)

Note: Hypertherm does not recommend using torch leads longer than 75 Feet. 100 Ft, 125 Ft. and 150 Ft. leads will cause problems with starting.

Item	Part Number	Description	Qty.
	028782	**Shield Torch Lead, 125 Ft.**	1
1	023809	Lead Pilot, Shield Gas, 125 Ft. (blue)	1
2	024417	Lead, Plasma Gas, 125 Ft. (red)	1
3	024414	Lead, Cap Sensor, 125 Ft. (gray)	1
4	023806	Cable, Water Cooled, 125 Ft. (blue- red band)	1
5	023806	Cable, Water Cooled, 125 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028783	**Shield Torch Lead, 150 Ft.**	1
1	023810	Lead Pilot, Shield Gas, 150 Ft. (blue)	1
2	024418	Lead, Plasma Gas, 150 Ft. (red)	1
3	024415	Lead, Cap Sensor, 150 Ft. (gray)	1
4	023807	Cable, Water Cooled, 150 Ft. (blue- red band)	1
5	023807	Cable, Water Cooled, 150 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046114	1.5" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

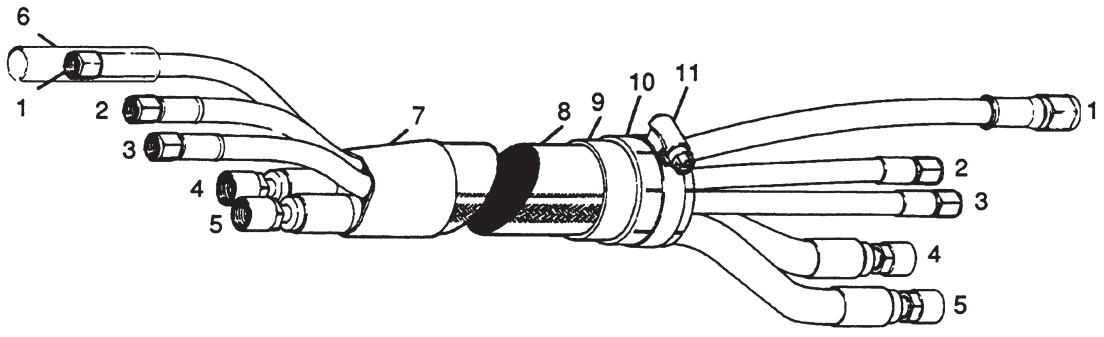


Figure 4-19 Machine Torch Lead Assemblies

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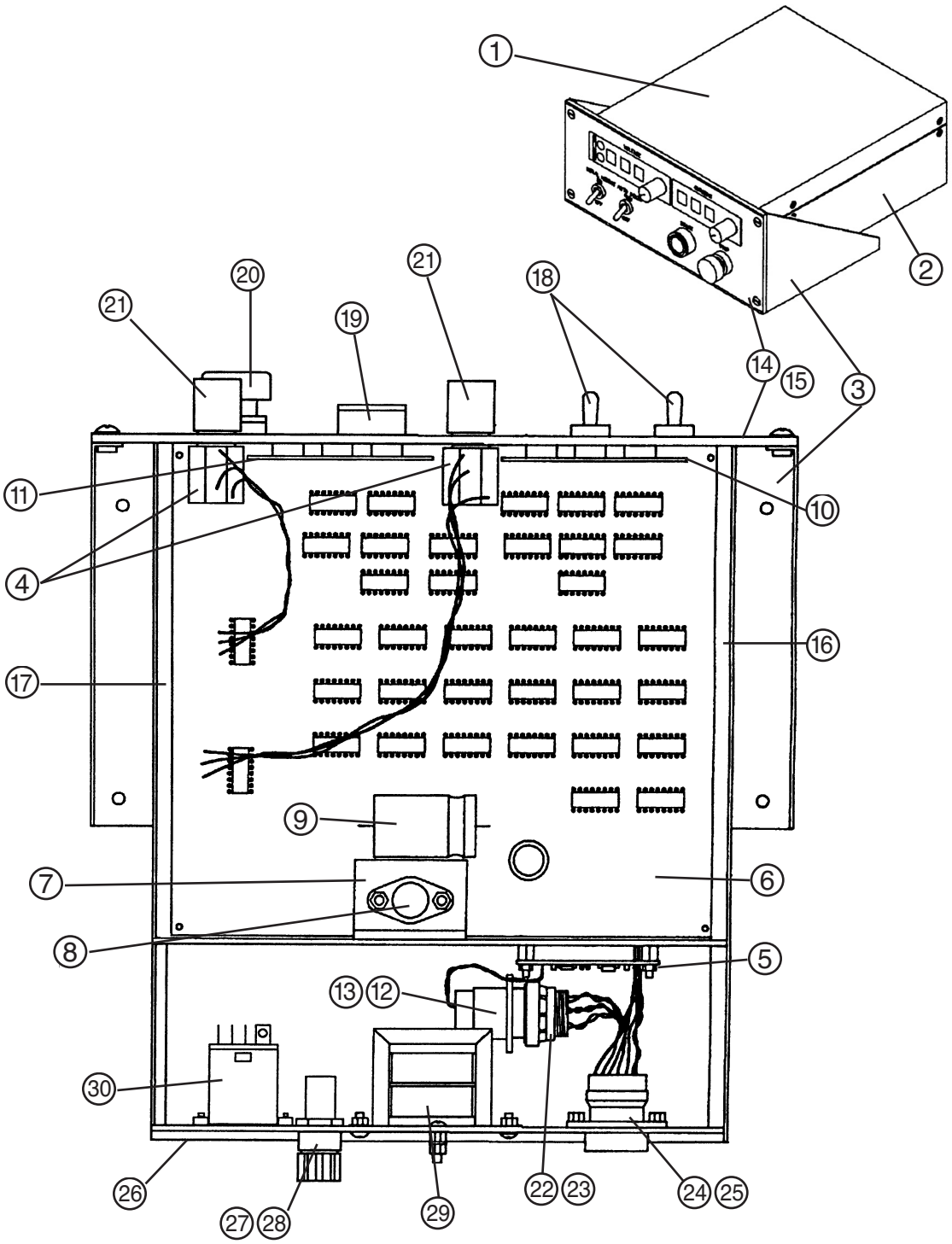


Figure 4-20 Switch Remote (SR) V/C Control Station

Switch Remote (SR) V/C Control

Item	Part Number	Description	Figure 5-1 Designator	Qty.
	073001	**Control Station, SW Rem V/C MAX200**		**1**
1	002107	Cov: DR/PR V/C Top		1
2	002125	Cov: SR V/C Bot		1
3	004123	Bracket, Mtg, SR V/C HT400		1
	029302	**Filter PNL-PCB SA DR/SR V/C**		**1**
4	009871	Potentiometer, 500 Ohm 10 Turn	**Vols, Amps**	2
5	**041070**	**PC BD Assy Opto-Iso HT400**	**PCB2**	**1**
	008097	Terminal, PC HHS 2022C		4
6	**041187**	**PC BD Assy Dig/Sta V/C MAX200**	**PCB1**	**1**
7	004116	Heatsink, DR/PR SR V/C HT400		1
8	042059	IC, LM340AK-5.0		1
9	009274	Capacitor, 2600 UF 15VDC		1
10	**041076**	**PC BD Assy Rem Volt Disp**		**1**
11	**041077**	**PC BD Assy Rem Curr Disp**		**1**
12	008175	Receptacle, Shell 13-9 Size	**RECP1**	1
13	008176	Pin, 20-24 AWG Type III+		6
	074016	Term 22-18 .250 FEM QC Insul		2
	074038	Term 22-18 FEM QC Insul		11
	074041	Term 22-18 #6 Ring Uninsul		1
	074067	Term 22-18 .25 MAL QC Insul		2
	002179	**Encl:MAX200 SR V/C**		**1**
14	001243	Pl: MAX200 SR Fr		1
15	001141	Flg: HT400 SR V/C Mdl Fr		1
16	001137	FR: HT400 DR/PR/ST V/C Mdl LS		1
17	001138	FR: HT400 DR/PR/ST V/C Mdl RS		1
18	005044	Switch, Tog 1Pl Maint On/On	**S1, S2**	2
19	005082	Switch, PB, Green, Full Guard	**PB1**	1
20	005083	Switch, PB, Red, Mushroom Head	**PB2**	1
21	008164	Knob		2
	029304	**Harness, SA MAX200, SR V/C**		**1**
22	008185	Plug, Shell 13-9 Size	**PL1**	1
23	008186	Socket, 20-24 AWG Type III+		6
24	008193	Receptacle, Shell 17-16 Size	**RECP2**	1
25	008176	Pin, 20-24 AWG Type III+		14
	074016	Term, 22-18 .250 FEM QC Insul		2
	074027	Term, 22-16 #6 LCK Fork Insul		4
	074038	Term, 22-18 FEM QC Insul		11
	074041	Term 22-18 #6 Ring Uninsul		1
	074053	Term 22-18 FEM QC Inusl		4
	074067	Term 22-18 .25 MAL QC Insul		2
	029301	**Rear Panel SA, MAX200**		**1**
26	002127	Pnl: MAX200 SR V/C Rear		1
27	008069	Fuse, 3/8 Amp 313, 375	**F1**	1
28	008165	Fuseholder, Rem V/C HT400		1
29	014012	Transf'mer, DR/PR/SR V/C HT400	**T1**	1
30	003096	Relay: 24VAC DPDT Bifurcated Cont	**CR1**	1

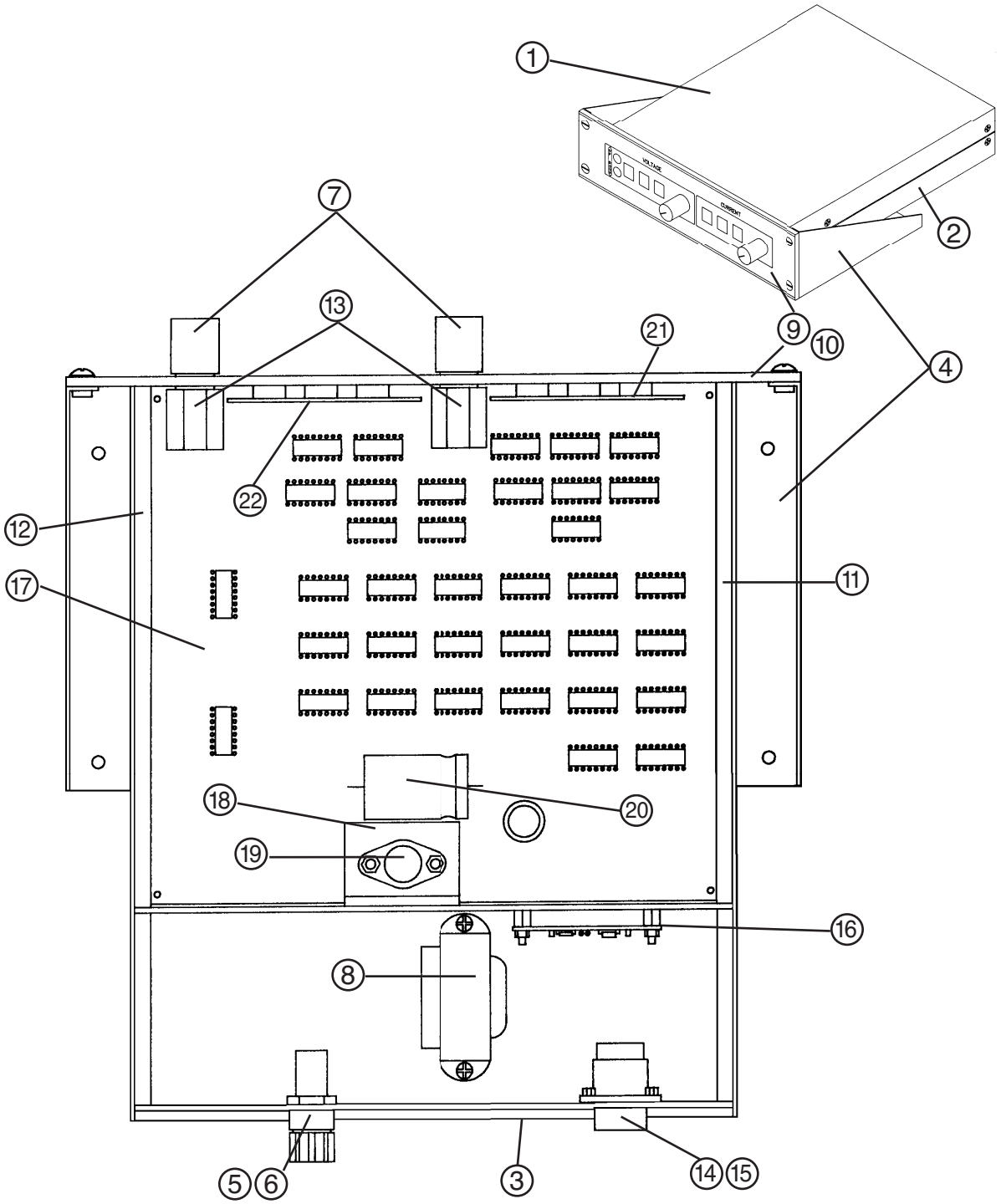


Figure 4-21 Digital Remote (DR) V/C Control

Digital Remote (DR) V/C Control

Item	Part Number	Description	Figure 5-2 Designator	Qty.
	073007	**Control Station, Digital Remote V/C**	**1**	
1	002107	Cov: DR/PR V/C Top		1
2	002106	Cov: DR/PR V/C Bottom		1
3	002119	Panel, Rear, DR V/C		1
4	004119	Bracket, Mtg, DR/PR V/C		1
5	008069	Fuse, 3/8 Amp 313, 375	**1FU**	1
6	008165	Fuseholder, REM V/C		1
7	008164	Knob		2
8	014012	Transf'mer, DR/PR/SR V/C	**1TRANS**	1
	002118	**Encl, Assy DR V/C**		**1**
9	001133	Pl: HT400 DR V/C MDL FR		1
10	001131	Flg: HT400 DR/PR V/C MDL Fr		1
11	001137	FR: HT400 DR/PR/ST V/C Mdl LS		1
12	001138	FR: HT400 DR/PR/ST V/C Mdl RS		1
	029302	**Filter PNL-PCB SA DR/SR V/C**	**029302**	**1**
13	009871	Potentiometer, 500 Ohm 10 turn	**Volt Set,Curr Set**	2
14	008175	Receptacle, Shell Size 13-9	**7RECP**	1
15	008176	Pin, 20-24 AWG Type III+		6
	074016	Term 22-18 .250 FEM QC Insul		2
	074038	Term 22-18 FEM QC Insul		11
	074041	Term 22-18 #6 Ring Uninsul		1
	074067	Term 22-18 .25 MAL QC Insul		2
16	**041070**	**PC BD Assy Opto-Iso**	**2PC**	**1**
	008097	Terminal, PC HHS 2022C		4
17	**041187**	**PC BD Assy Dig/Sta V/C MAX200**	**1PC**	**1**
18	004116	Heatsink, DR/PR SR V/C		1
19	042059	IC, LM340AK-5.0		1
20	009274	Capacitor, 2600 UF 15VDC		1
	008097	Terminal, PC HHS 2022C		11
	008098	Terminal, PC CAM		9
21	**041076**	**PC BD Assy Rem Volt Disp**		**1**
22	**041077**	**PC BD Assy Rem Curr Disp**		**1**

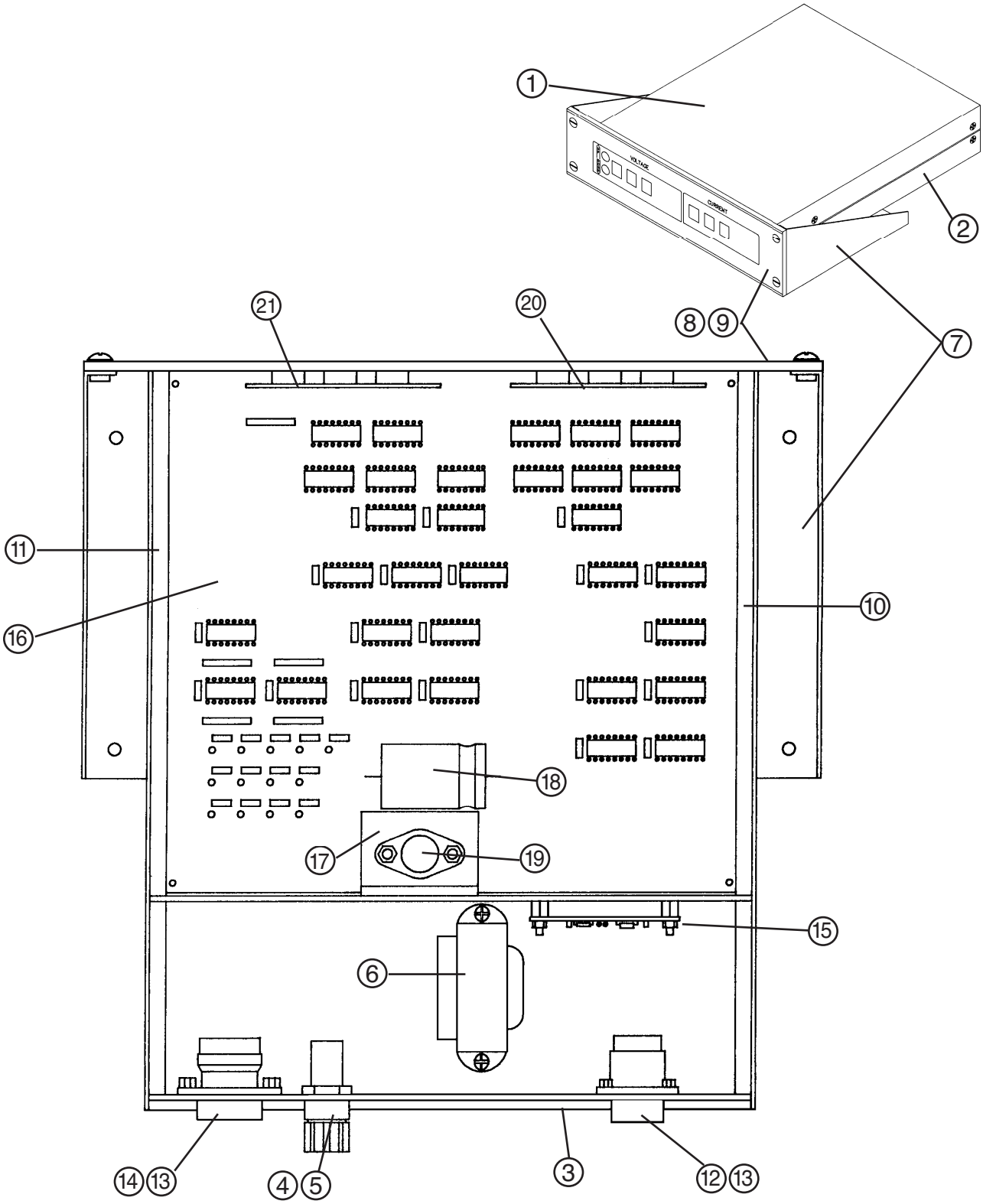


Figure 4-22 Programmable (PR)V/C Control

Programmable Remote (PR) V/C Control

Item	Part Number	Description	Figure 5-3 Designator	Qty.
	055004	**Control, Programmable V/C**		**1**
1	002107	Cov: DR/PR V/C Top		1
2	002106	Cov: DR/PR V/C Bottom		1
3	002123	Panel, Rear, PR V/C		1
4	008069	Fuse, 3/8 Amp 313, 375	**1FU**	1
5	008165	Fuseholder, REM V/C		1
6	014012	Transf'mer, DR/PR/SR V/C		1
7	004119	Bracket, Mtg, DR/PR V/C		1
	002122	**Encl Assy, PR V/C**		**1**
8	001139	PL: HT400 PR V/C MDL FR		1
9	001131	Flg: HT400 DR/PR V/C MDL Fr		1
10	001137	FR: HT400 DR/PR/ST V/C Mdl LS		1
11	001138	FR: HT400 DR/PR/ST V/C Mdl RS		1
	029089	**Filter PNL-PCB SA PR V/C**	**029089**	**1**
12	008175	Receptacle, Shell 13-9 Size	**7RECP**	1
13	008176	Pin, 20-24 AWG Type III+		22
14	008193	Recp, CPC 17-16 Standard Sex	**6RECP**	1
	074016	Term 22-18 .250 FEM QC Insul		2
	074038	Term 22-18 FEM QC Insul		5
	074041	Term 22-18 #6 Ring Uninsul		4
	074067	Term 22-18 .25 MAL QC Insul		2
15	**041070**	**PC BD Assy Opto-Iso**	**2PC**	**1**
	008097	Terminal, PC HHS 2022C		4
16	**041085**	**PC BD Assy, PR V/C**	**041085**	**1**
17	004116	Heatsink, DR/PR SR V/C		1
18	009274	Capacitor, 2600 UF 15VDC		1
19	042059	IC, LM340AK-5.0		1
	008097	Terminal, PC HHS 2022C		18
	008098	Terminal, PC CAM		7
20	**041076**	**PC BD Assy, Rem Volt Disp**		**1**
21	**041077**	**PC BD Assy, Rem Curr Disp**		**1**

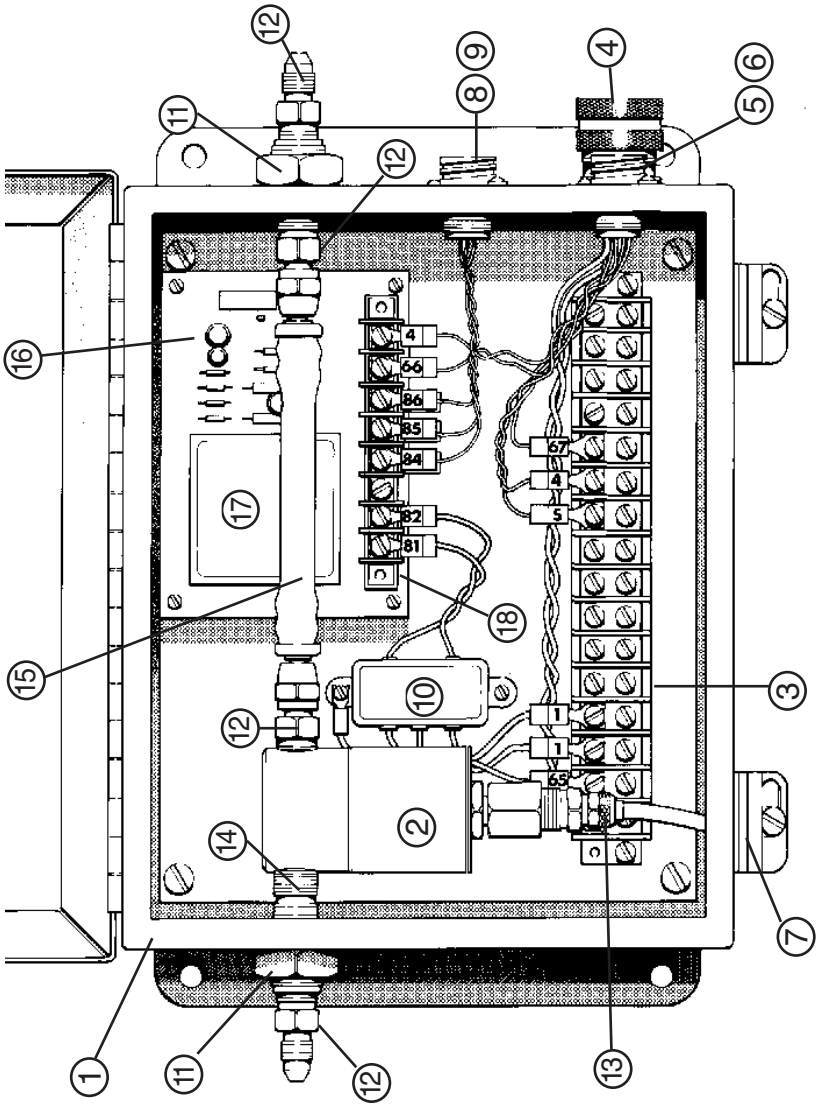


Figure 4-23 Inductive IHS Control Module

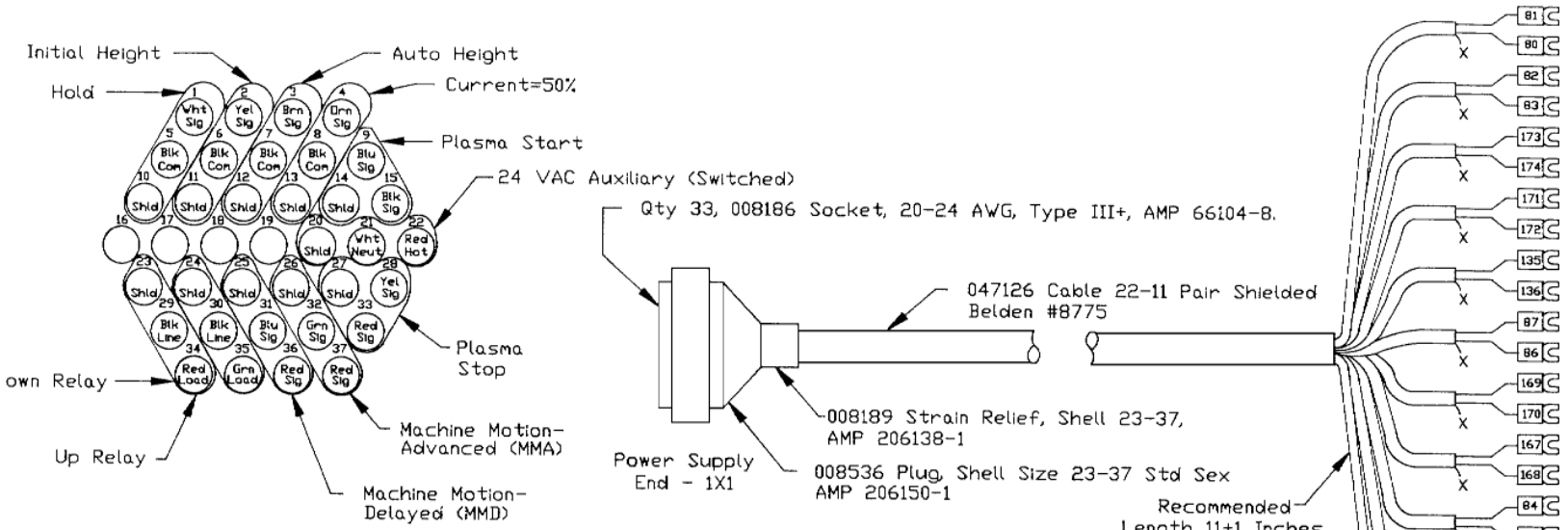
Inductive IHS Control Module

Item	Part Number	Description	Designator	Qty.
	053016	**Control Module, IND IHS, HT400**		
1	002095	Encl., Control Module UW-IHS		1
2	006021	Valve, SOL 75# 1/4 NPTF	**1SOL**	1
3	008073	Terminal Strip (16)	**1TB**	1
4	008071	Strain Relief, 1/2 X .375-.500		1
5	008175	Receptacle, Shell Size 13-9	**14RECP**	1
6	008176	Pin, 20-24 AWG Type III+		7
7	008177	Grommet, HHS 91107		1
8	008186	Socket, 20-24 AWG Type III+		8
9	008210	Receptacle, 11-4	**15RECP,16RECP**	2
10	009041	Filter, AC, 1 Amp 1B3	**009041**	1
11	015001	Adapter, Bulkhead, 1/4 NPTF		2
12	015005	Adapter, 1/4 NPT x #4		4
	015259	Swivel, #4		1
13	015100	Adapter, 1/4 NPT x 1/4 Poly		1
14	015502	Nipple, 1/4 x CL		1
15	**024038**	**Hose Assy, #4 x 7"**		**1**
16	**041043**	**PC BD Assy UW-IHS**	**041043**	**1**
17	041023	Power Source, IHS		1
18	008094	Terminal Strip (8)	**2TB**	1

MAX200 Power Supply Internal Hosing

To identify hosing, find lettered item where one of the ends of the hosing terminates from the exploded views, and find the same lettered item and page number under the column **From Item on Page** or **To Item on Page** in chart below.

From Item on Page		To Item on Page		Part No.	Description	Length
A	4-10	**B**	4-10	046067	Tubing, 3/8 OD Blu Air Brake	22"
C	4-10	**A**	4-6	046067	" " "	42"
D	4-10	**G**	4-22	046067	" " "	24"
E	4-10	**B**	4-22	046067	" " "	80"
F	4-10	**B**	4-6	046067	" " "	40"
G	4-10	**C**	4-6	046067	" " "	40"
D	4-22	**A**	4-4	046067	" " "	46"
B	4-4	**E**	4-6	046067	" " "	15"
A	4-14	**A**	4-22	046048	Tubing, 1/8 OD Blk Air Brake	22"
C	4-22	**B**	4-14	046048	" " "	22"
B	4-26	**A**	4-28	046047	Tubing, 3/8 OD Blk Air Brake	12.75"
C	4-26	**C**	4-28	046047	" " "	9.5"
D	4-6	**A**	4-22	046047	" " "	96"
B	4-28	**D**	4-28	046047	" " "	7.75"
E	4-28	**F**	4-28	046047	" " "	9.5"
J	4-28	**K**	4-28	046047	" " "	11.75"
L	4-28	**M**	4-28	046047	" " "	10"
N	4-28	**E**	4-22	046016	Hose, 3/8 ID Blk	13"
P	4-28	**F**	4-22	046016	" " "	19.5"



Legend – Power Supply End – 1X1		
SCKT	COLOR	FUNCTION
1	Wht	Hold Sig
2	Yel	Initial Height – Sig
3	Brn	Auto Height – Sig
4	Orn	Current 50% – Sig
5	Blk	Hold – Common
6	Blk	Initial Height – Common
7	Blk	Auto Height – Common
8	Blk	Current 50% – Common
9	Blu	Plasma Start – Sig
10	Shield	Hold – Shield
11	Shield	Initial Height – Shld
12	Shield	Auto Height – Shld
13	Shield	Current 50% – Shld
14	Shield	Plasma Start – Shld
15	Blk	Plasma Start – Sig

Legend – Power Supply End – 1X1		
SCKT	COLOR	FUNCTION
20	Shield	24VAC Aux.., Shld
21	Wht	24VAC Aux., Neutral
22	Red	24VAC Aux., Hot
23	Shield	Down Relay, Shield
24	Shield	Up Relay, Shield
25	Shield	Mach. Motion Delayed, Shld
26	Shield	Mach. Motion Advanced, Shld
27	Shield	Plasma Stop – Shld
28	Yel	Plasma Stop – Sig
29	Blk	Down Relay, Line
30	Blk	Up Relay, Line
31	Blu	Mach. Motion Delayed, Sig
32	Grn	Mach. Motion Advanced, Sig
33	Red	Plasma Stop – Sig
34	Red	Down Relay, Load
35	Grn	Up Relay, Load
36	Red	Mach. Motion Delayed, Sig
37	Red	Mach. Motion Advanced, Sig

Part No.	Length
023334	25 ft (7.6m)
023335	50 ft (15m)
023336	75 ft (23m)
023337	100 ft (30m)
023338	150 ft (46m)
023339	200 ft (61m)

Figure 4-24 MAX200 Machine Interface Cable Diagram – 1 of 2

Lug		Color	Description and Comments
81 80		Red Yel	Plasma Emergency Stop (24VAC) – 1X1 pins 28, 33; cable lugs 80, 81. Open to stop. To use, remove jumper on TB3-80 and 81 in power supply.
82 83		Blu Blk	Plasma Start (24VAC) – 1X1 pins 9, 15; cable lugs 82, 83. Close to start; Open to stop.
173 174	Sig. Com.	Yel Blk	* Initial Height (12VDC) – 1X1 pins 2, 6; cable lugs 173, 174. Close for no IHS; Open for IHS.
171 172	Sig. Com.	Brn Blk	* Auto Height (!2VDC) – 1X1 pins 3, 7; cable lugs 171, 172. Close for no Auto Height; Open for Auto Height.
135 136	Sig. Com.	Orn Blk	* Current 50% (12VDC) – 1X1 pins 4, 8; cable lugs 135, 136. Reduces current to 50% of preset for cornering, etc. Close for 50% current; Open for 100% current.
87 86	Sig. Com	Wht Blk	* Hold (12VDC) – 1X1 pins 1, 5; cable lugs 86, 87. Synchronizes starting of two or more systems. Close for no start; Open for start.
169 170	Load Line	Red Blk	* Relay Down (Solid state relay (dry contacts), rated to switch 24 to 240VAC, 1 amp. DC relay optional.) – 1X1 pins 29, 34; cable lugs 169, 170.
167 168	Load Line	Grn Blk	* Relay Up (Solid state relay (dry contacts), rated to switch 24 to 240VAC, 1 amp. DC relay optional.) – 1X1 pins 30, 35; cable lugs 167, 168.
84 85		Red Blu	** Machine Motion – Delayed – 1X1 pins 31, 36; cable lugs 84, 85. Contact closes after arc transfer and time delay (set on power supply front panel). Relay (dry contacts).
79 78		Red Grn	*** Machine Motion – Advanced – 1X1 pins 32, 37; cable lugs 79, 78. Contact closes approximately three seconds before arc fires. Relay (dry contacts).
77 76	Hot Neut	Red Wht	Auxiliary 24VAC, 1 amp. – 1X1 pins 21, 22; cable lugs 77, 76.

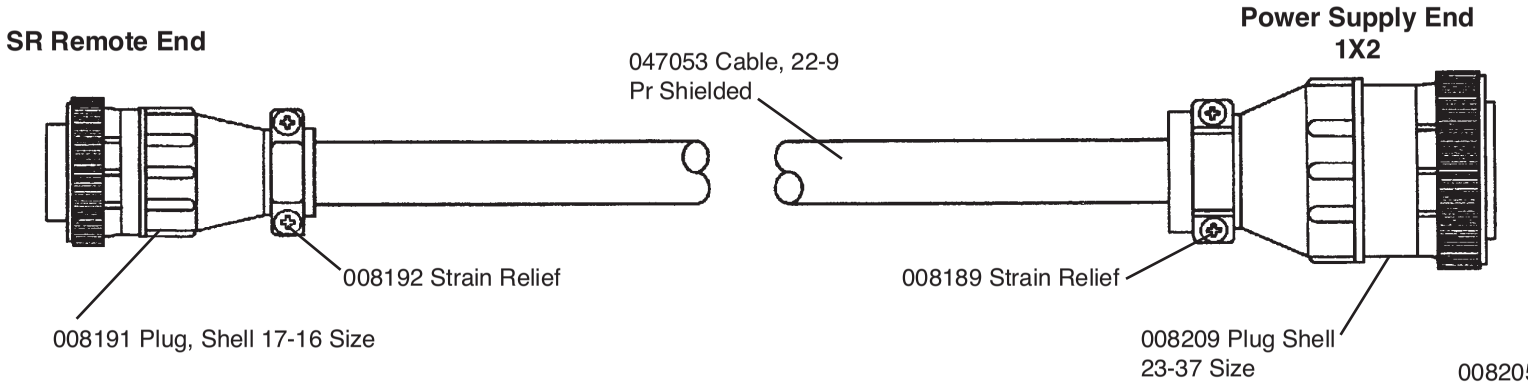
Notes: 1X1 designates connector on rear of power supply. Lug numbers designate wire numbers on end of Interface cable.

* These functions are available only on MAX200s equipped with Torch Height Control option.

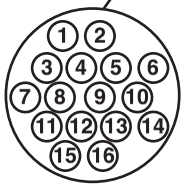
** Note that resistor R150 and capacitor C78 are connected in series across the contacts. In some cases one lead of R150 must be cut from the control PC board as the R-C circuit may provide enough current flow to maintain machine motion input to cutting machine.

*** Note that resistor R155 and capacitor C79 are connected in series across the contacts. In some cases one lead of R155 must be cut from the control PC board as the R-C circuit may provide enough current flow to maintain machine motion input to cutting machine.

Figure 4-24 Machine Interface Cable Diagram – 2 of 2



008186 Socket (14)

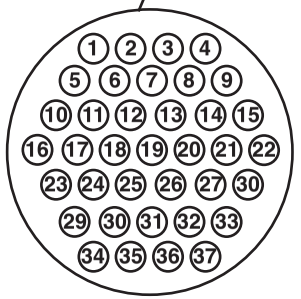


Legend – Switch Remote End		
SCKT	COLOR	FUNCTION
1	Yel	IH Signal
2	Blu	Plasma Start Signal
3	Blk	IH Common
4	Blk	Plasma Start Common
5	Blk	Auto Height Common
6	Brn	Auto Height Signal
7	Red	SOD Data
8	Blk	SOD Common
9	Grn	SID Data
10	Blk	SID Common
11	Orn	24VAC Aux. Hot
12	Blk	24VAC Aux. Neut.
15	Blk	120VAC Hot
16	Wht	120VAC Neut.

Note: Shields cut on P8 end

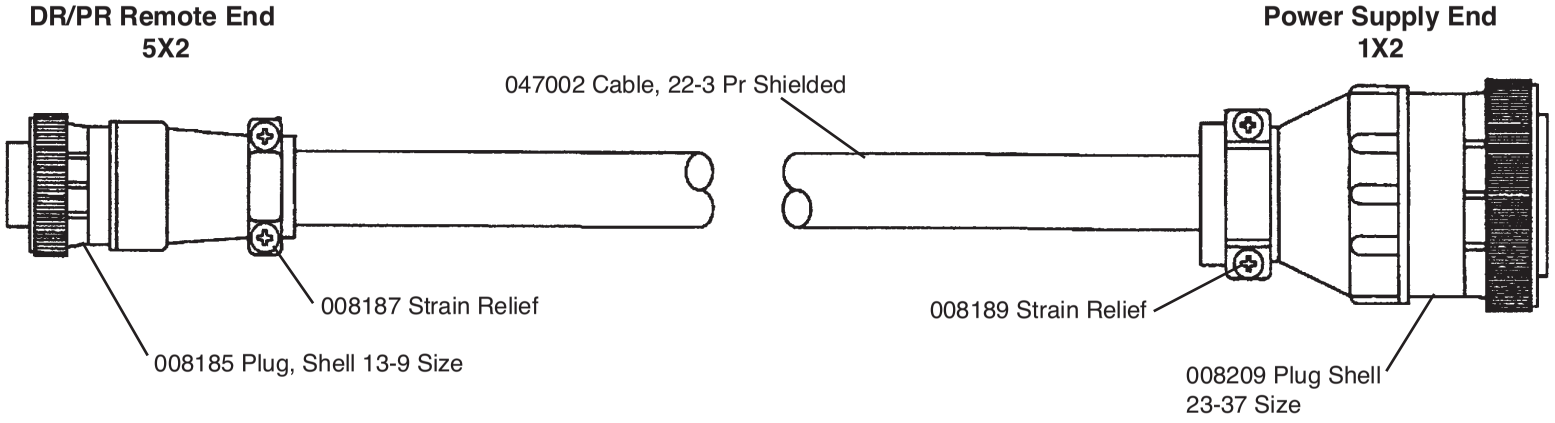
Legend – Power Supply End – 1X2		
PIN	COLOR	FUNCTION
1	Blu	Plasma Start Signal
2	Yel	IH Signal
3	Brn	Auto Height Signal
4	Grn	SID Signal
5	Blk	Plasma Start Common
6	Blk	IH Common
7	Blk	Auto Height Common
8	Blk	SID Data Common
9	Red	SOD Data Signal
10		Shield Plasma Start
11		Shield Initial Height
12		Shield Auto Height
13		Shield (SID)
14		Shield (SOD)
15	Blk	SOD Common
19		Shield Unused R/W/Shield
20		Shield Unused R/G/Shield
23	Blk	24VAC Aux. Neut.
24		24VAC Aux. Shield
29	Orn	24VAC Aux. Hot
31		120VAC Shield
35	Wht	120VAC Neut.
36	Blk	120VAC Hot

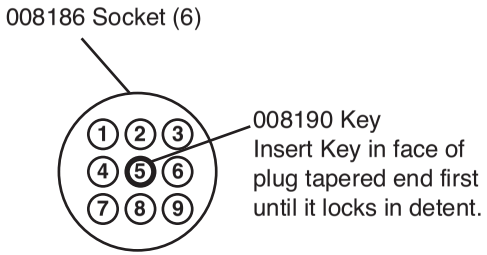
008176 Pin (21)



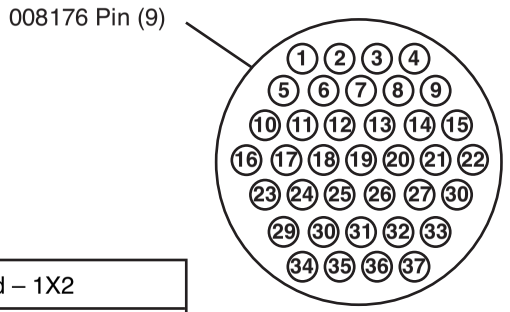
Part No.	Length
023319	25 ft (7.6m)
023328	50 ft (15m)
023329	75 ft (23m)
023330	100 ft (30.5m)
023331	150 ft (46m)
023332	200 ft (61m)

Figure 4-25 Remote V/C Cable – Power Supply to Switch Remote (SR) V/C





Note: Shields cut on remote end



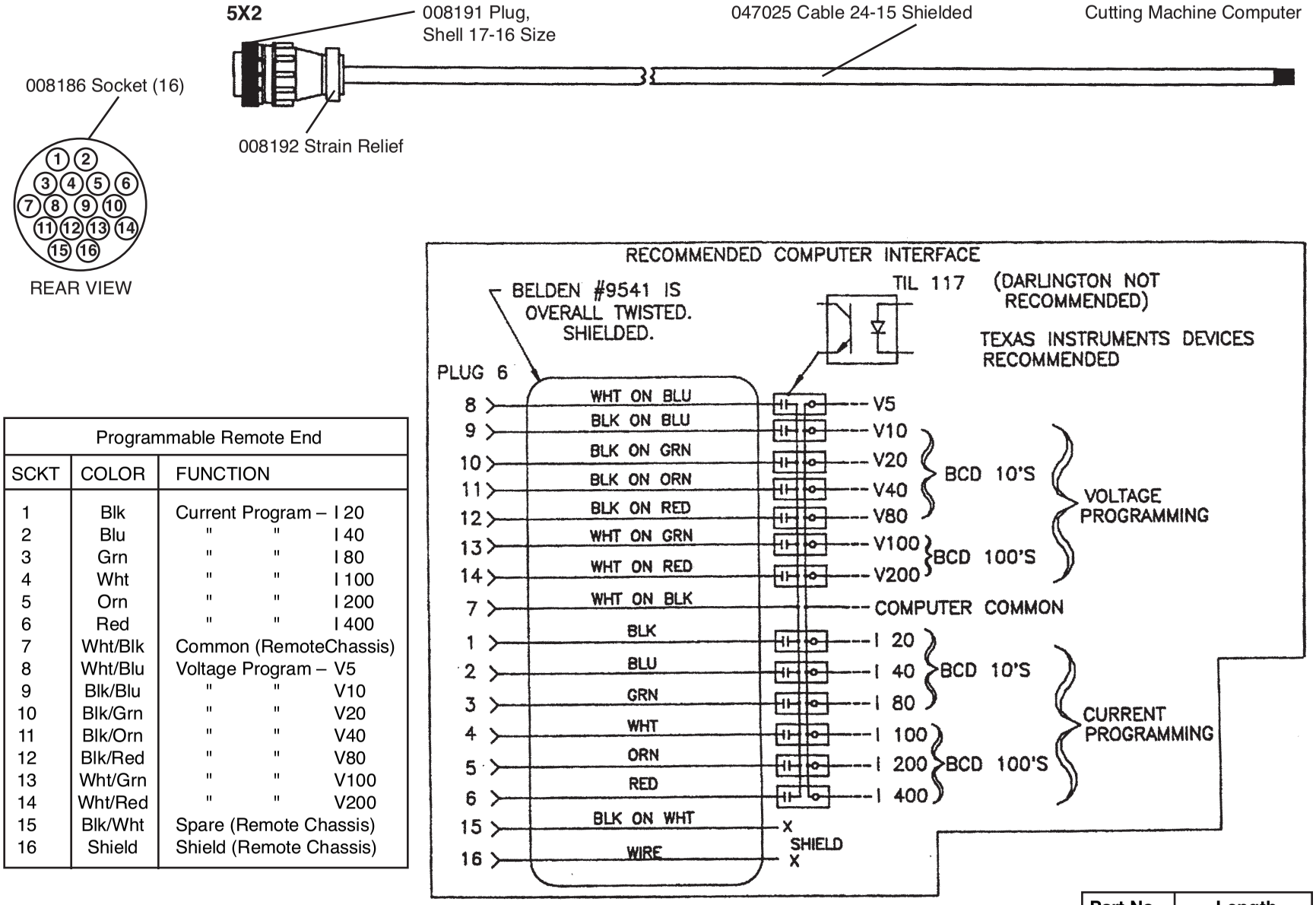
Legend-DR/PR Remote End		
SCKT	COLOR	FUNCTION
1	Grn	SID Data
2	Blk	SID Common
3	Red	SOD Data
5		Key
6	Blk	SOD Common
7	Wht	AC Power
8	Blk	AC Power

Legend – Power Supply End – 1X2		
PIN	COLOR	FUNCTION
4	Grn	SID Data
8	Blk	SID Common
9	Red	SOD Data
13		Shield-Grn/Blk
14		Shield-Red/Blk
15	Blk	SOD Common
31		Shield (AC PWR) Wht/Blk
35	Wht	AC Power
36	Blk	AC Power

Indicates Pairs

Part No.	Length
023346	25 ft (7.6 m)
023347	50 ft (15 m)
023348	75 ft (23 m)
023349	100 ft (30.5 m)
023742	125 ft (38.1 m)
023350	150 ft (46 m)
023351	200 ft (61 m)
023813	250 ft (76 m)
023577	275 ft (83.6 m)
023818	300 ft (91.5 m)

Figure 4-26 Remote V/C Cable – Power Supply to Digital (DR) or Programmable (PR) V/C



Programmable Remote End		
SCKT	COLOR	FUNCTION
1	Blk	Current Program – I 20
2	Blu	" " I 40
3	Grn	" " I 80
4	Wht	" " I 100
5	Orn	" " I 200
6	Red	" " I 400
7	Wht/Blk	Common (RemoteChassis)
8	Wht/Blu	Voltage Program – V5
9	Blk/Blu	" " V10
10	Blk/Grn	" " V20
11	Blk/Orn	" " V40
12	Blk/Red	" " V80
13	Wht/Grn	" " V100
14	Wht/Red	" " V200
15	Blk/Wht	Spare (Remote Chassis)
16	Shield	Shield (Remote Chassis)

Part No.	Length
023099	25 ft (7.6m)
023100	50 ft (15m)

Figure 4-27 Computer Cable – Programmable Remote (PR) V/C to Computer Interface

Inductive IHS Torch Mounting Assembly

Parent Item numbers (028390 and 028720) includes items listed below, as well as IHS Control Module 053016 listed on pages 4-54 and 4-55.

Item	Part Number	Description	Qty.
	028720	**Inductive IHS,2" - used with standard & stainless steel torch**	
	029044	**Torch MTG SA, Induct IHS MAX200**	
1	004082	Bracket, IND Sensor, UW-IHS	1
2	004083	Bracket, MTG Torch, UW-IHS MAX200	1
3	015005	Adapter, 1/4 NPT x #4	1
4	027024	Cylinder, IND Sensor, UW-IHS	1
5	**005074**	**Inductive Sensor Assembly**	**2**

Item	Part Number	Description	Qty.
	028390	**Inductive IHS, 1-3/4" - used with optional torch**	
	029334	**Torch MTG SA, Induct IHS MAX200**	
1	004082	Bracket, IND Sensor, UW-IHS	1
2	004349	Bracket, MTG Torch, UW-IHS MAX200	1
3	015005	Adapter, 1/4 NPT x #4	1
4	027024	Cylinder, IND Sensor, UW-IHS	1
5	**005074**	**Inductive Sensor Assembly**	**2**

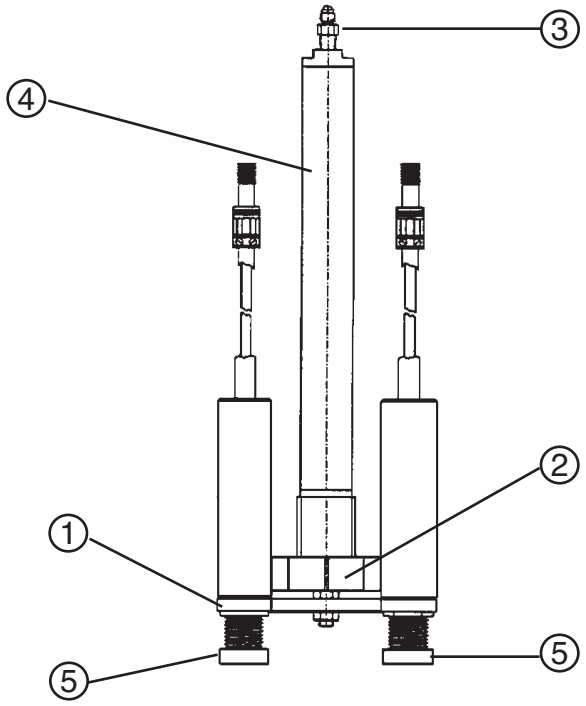
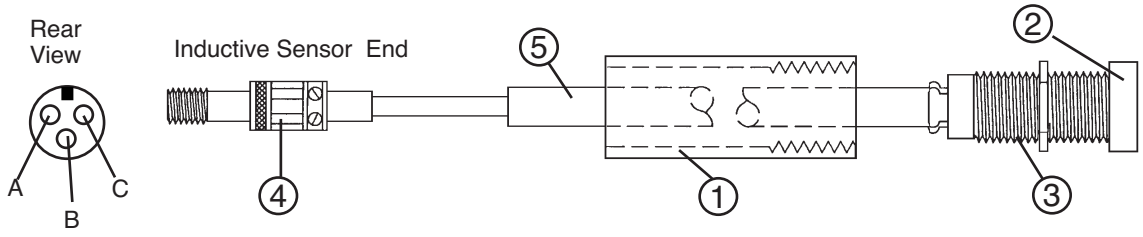


Figure 4-28 Inductive IHS Torch Mounting Assembly

Item	Part Number	Description	Qty.
1	004085	Nut, Ins, Ind Sensor	2
2	005078	Cap, Sensor, UW-IHS	2
3	005085	Sensor, Inductive	2
4	008145	Plug, 3 Pin M Ind Sensor UW-IHS	2
5	004656	Heat shrink	1



Legend-Inductive Sensor End		
PIN	COLOR	FUNCTION
A	Brn	Power (+15 VDC)
B	Blu	Common
C	Blk	Signal

Part No.
005074

Figure 4-29 Inductive Sensor Assembly

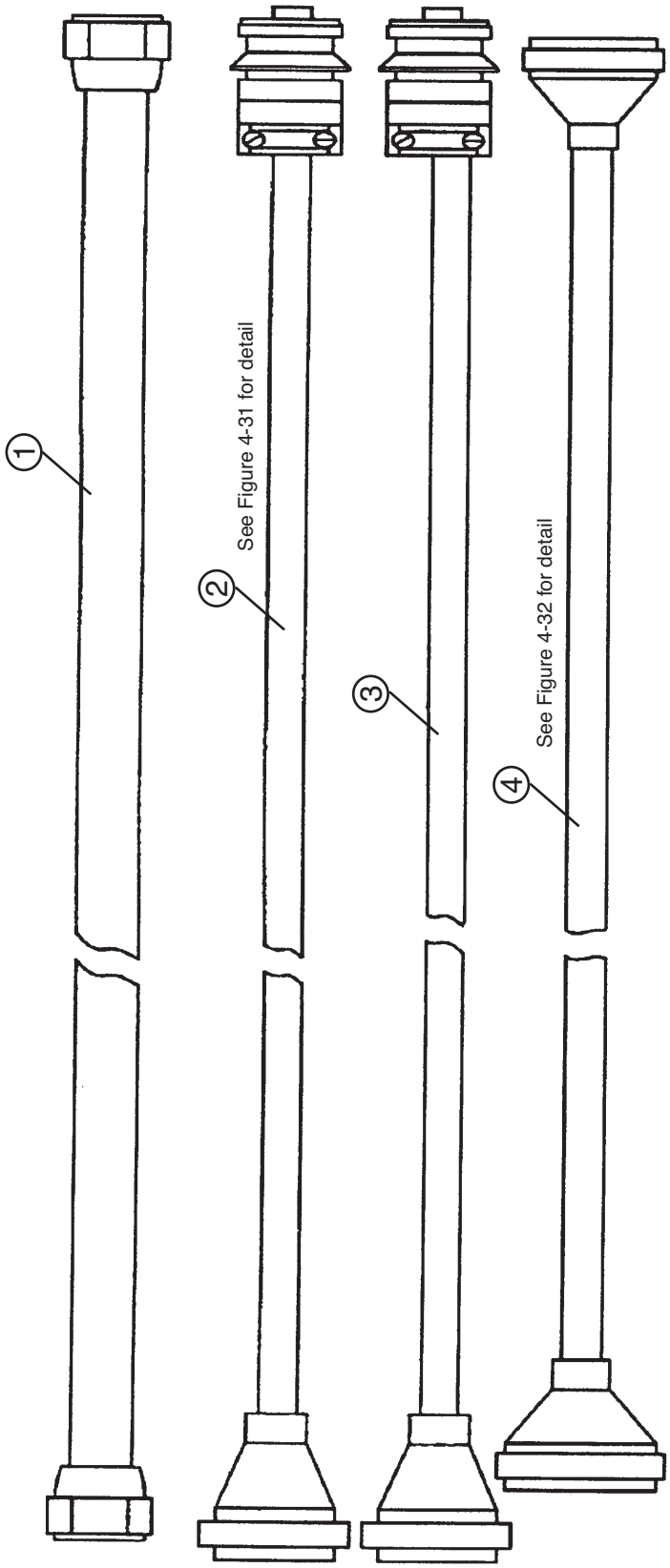
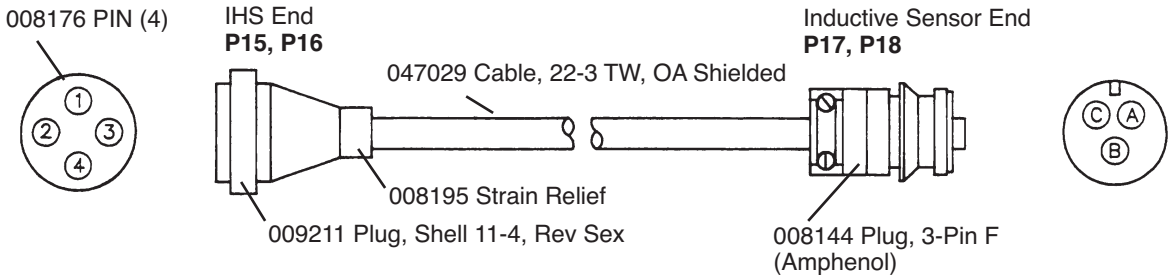


Figure 4-30 Lead sets for IHS System

Interconnecting Leads for Inductive IHS System

Item	028244 (25 ft)	028245 (50 ft)	028282 (75 ft)	028246 (100 ft)	028247 (150 ft)	028356 (200 ft)
1	024144	024144	024144	024144	024144	024144
2	023115	023115	023115	023115	023115	023115
3	023115	023115	023115	023115	023115	023115
4	023111	023112	023155	023113	023114	023284



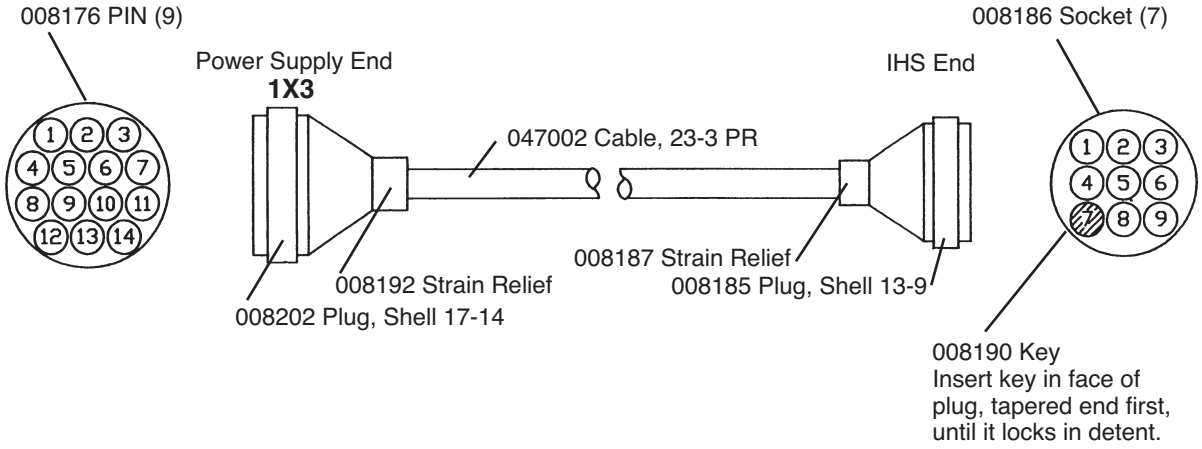
Legend IHS End (P15, P16)		
PIN	COLOR	FUNCTION
1	Clear	Signal
2	Black	Common
3	Braid	Shield
4	Red	Power (+15 VDC)

Legend Inductive Sensor End (P17, P18)		
PIN	COLOR	FUNCTION
A	Red	Power (+15 VDC)
B	Black	Common
C	Clear	Signal

Note: Cut Shield Sensor End

Part No.	Length
023115	40 ft

Figure 4-31 Cable IHS (P15-16)/Sensor (P17-18)



Legend – Power Supply End		
PIN	COLOR	FUNCTION
1	Red	IHS Complete Sig.
2	Grn	Upper Limit Sw Sig
4	Blk	IHS Complete Com
5	Blk	Upper Limit Sw Com
7	Drain	Shield-Wht/Blk
8	Drain	Shield-Red/Blk
9	Drain	Shield-Grn./Blk
11	Blk	AC Power
14	Wht	AC Power

Legend – IHS End		
PIN	COLOR	FUNCTION
1	Red	IHS Complete Sig.
2	Grn	Upper Limit Sw Sig
3	Blk	Upper Limit Sw Com
4	Blk	IHS Complete Com
5	Drain	Shield-Grn/Blk
7		Key
8	Wht	AC Power
9	Blk	AC Power

Indicates Pairs

Indicates Pairs w/Drain

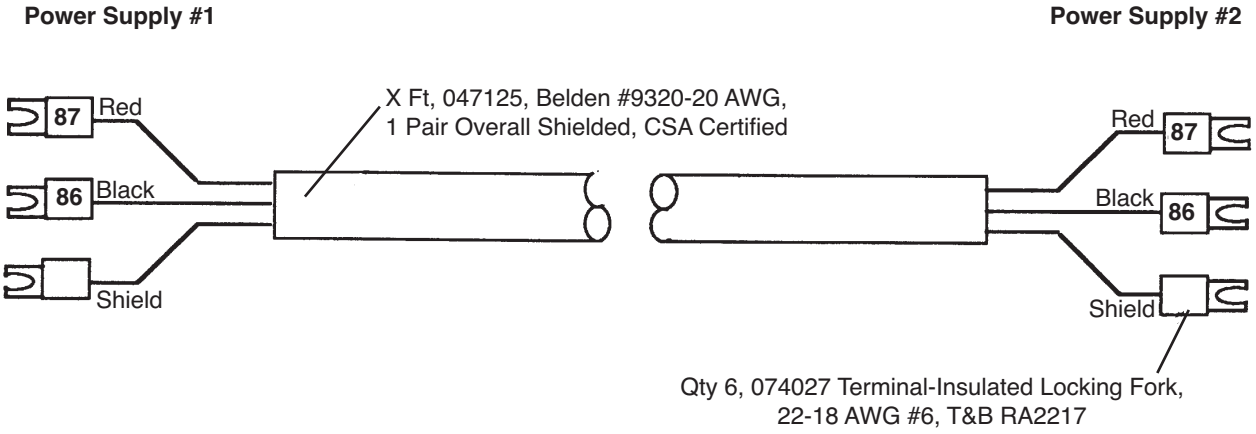
Note: On IHS End, cut Red/Black Shield & White/Black Shield Wires

Part No.	Length
023111	**25 ft (7.6m)**
023112	**50 ft (15m)**
023155	**75 ft (23m)**
023113	**100 ft (30.5m)**
023114	**150 ft (46m)**
023284	**200 ft (61m)**

Figure 4-32 HS Interface Cable – Power Supply to IHS

IHS Fittings Kit

Part Number	Description	Qty.
028243	**Kit, Fittings, IHS, HT400**	
008144	Plug, 3 Pin F Ind Sensr UW-IHS	2
008176	Pin, 20-24 AWG Type III+	17
008185	Plug, Shell 13-9 Size	1
008186	Socket, Amp, 24-20 AWG	6
008187	Strain Relief W/008185	1
008190	Key, Plug	1
008192	Strain Relief W/008191, 196, 202	1
008195	Strain Relief W/008194	2
008202	Plug, Shell Size 17-14	1
008211	Plug, 11-4, Rev Sex	2
015259	Swivel, #4	2
015140	Ferrule	2



Legend-Power Supply #1 End		
Wire #	Color	Function
86 87	Black Red Shield	Hold Signal Hold Common Hold Shield

Legend-Power Supply #2 End		
Wire #	Color	Function
86 87	Black Red Shield	Hold Signal Hold Common Hold Shield

Part No.	Length
023340	**15 ft (4.5m)**
023341	**25 ft (7.6m)**
023342	**50 ft (15m)**
023343	**100 ft (30.5m)**
023344	**150 ft (46m)**

Figure 4-33 Hold Cable – Power Supply #1 to Power Supply #2

PAC200T/E Hand Torch Systems

CUTTING

PAC200T (90°) Hand Torch Cutting Systems

PAC200T (90°) HAND TORCH CUTTING SYSTEMS						
PAC200T Torch w/	200VAC	208VAC	380/415VAC	240/480VAC	500VAC	600VAC
25' Leads	073163	073139	073151	073115	073175	073127
50' Leads	073164	073140	073152	073116	073176	073128
75' Leads	073165	073141	073153	073117	073177	073129
100' Leads	073166	073142	073154	073118	073178	073130
125' Leads	073167	073143	073155	073119	073179	073131
150' Leads	073168	073144	073156	073120	073180	073132

GOUGING

MAX200E Hand Torch Gouging Systems*

MAX200E (65°) HAND TORCH GOUGING SYSTEMS						
PAC200E Torch w/	200VAC	208VAC	380/415VAC	240/480VAC	500VAC	600VAC
25' Leads	073169	073145	073157	073121	073181	073133
50' Leads	073170	073146	073158	073122	073182	073134
75' Leads	073171	073147	073159	073123	073183	073135
100' Leads	073172	073148	073160	073124	073184	073136
125' Leads	073173	073149	073161	073125	073185	073137
150' Leads	073174	073150	073162	073126	073186	073138

* Heat shield (020881) included in MAX200E systems

PAC200T/E Trigger Torch Consumables – Figures 4-34, 4-35

Note: See page 4-74 for consumable part kits.

	Metal	Amps	Plasma Gas/ Shield Gas	Shield	Retaining Cap	Nozzle	Swirl Ring	Electrode
 CUTTING	**Mild Steel**	**200**	Air / Air	020918	020915	020608	020607	220021
		100	Air / Air	020919	020915	020611	020607	120547
		40	Air / Air	020917	020915	020689	020613	220021
		200	O_2 / Air	020918	020915	020605	020604	220021
		100	O_2 / Air	020919	020915	020616	020617	120547
		200	N_2 / CO_2	020918	020915	020608	020607	020415
	Stainless Steel	**200**	Air / Air	020918	020915	020608	020607	220021
		100	Air / Air	020919	020915	020611	020607	220021
		40	Air / Air	020917	020915	020689	020613	220021
		200	N_2 / Air	020918	020915	020608	020607	020415
		200	N_2 / CO_2	020918	020915	020608	020607	020415
		200	H35 / N_2	020920	020915	020608	020607	020415
		100	H35 / N_2	020919	020915	020611	020607	020415
	Aluminum	**200**	Air / Air	020918	020915	020608	020607	220021
		100	Air / Air	020919	020915	020611	020607	220021
		40	Air / Air	020917	020915	020689	020613	220021
		200	N_2 / Air	020918	020915	020608	020607	020415
		200	N_2 / CO_2	020918	020915	020608	020607	020415
		200	H35 / N_2	020918	020915	020608	020607	020415
		100	H35 / N_2	020919	020915	020611	020607	020415
 GOUGING	**Mild Steel**	**200**	Air / Air	020891	020882	020615	020607	220021
		200	H35/Air	020891	020882	020934	020607	020933
	Stainless Steel	**200**	H35 / N2	020891	020882	020934	020607	020933
	Aluminum	**200**	H35 / N2	020891	020882	020934	020607	020933

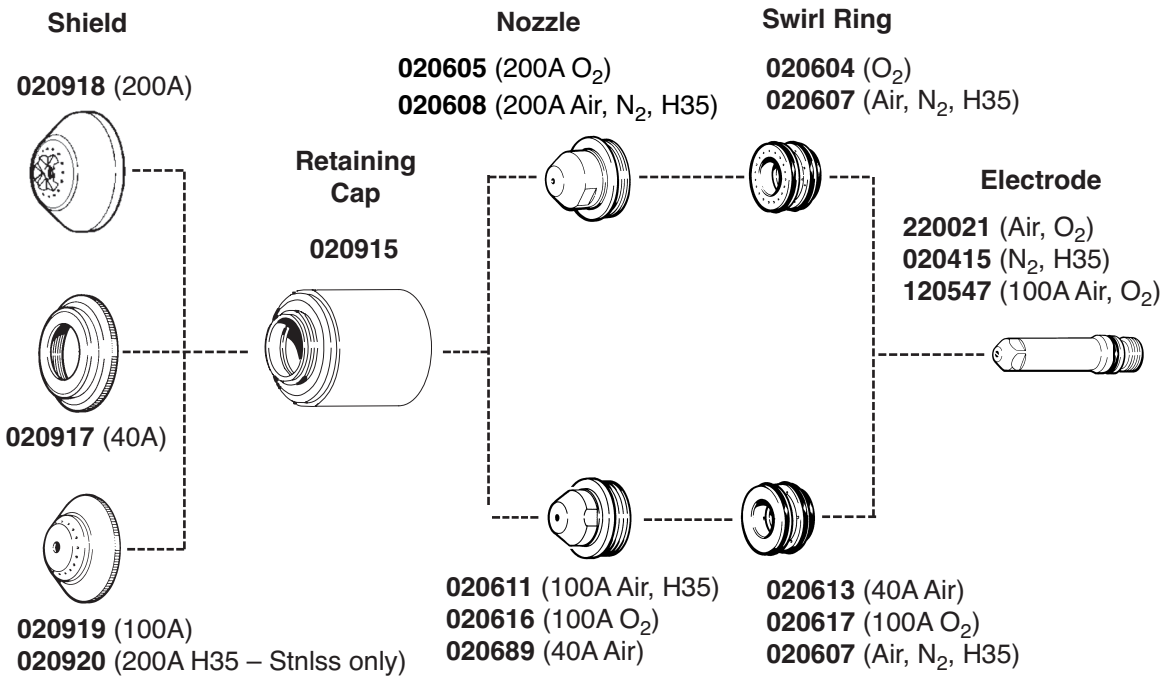


Figure 4-34 PAC200T (Cutting) Trigger Torch Consumable Parts

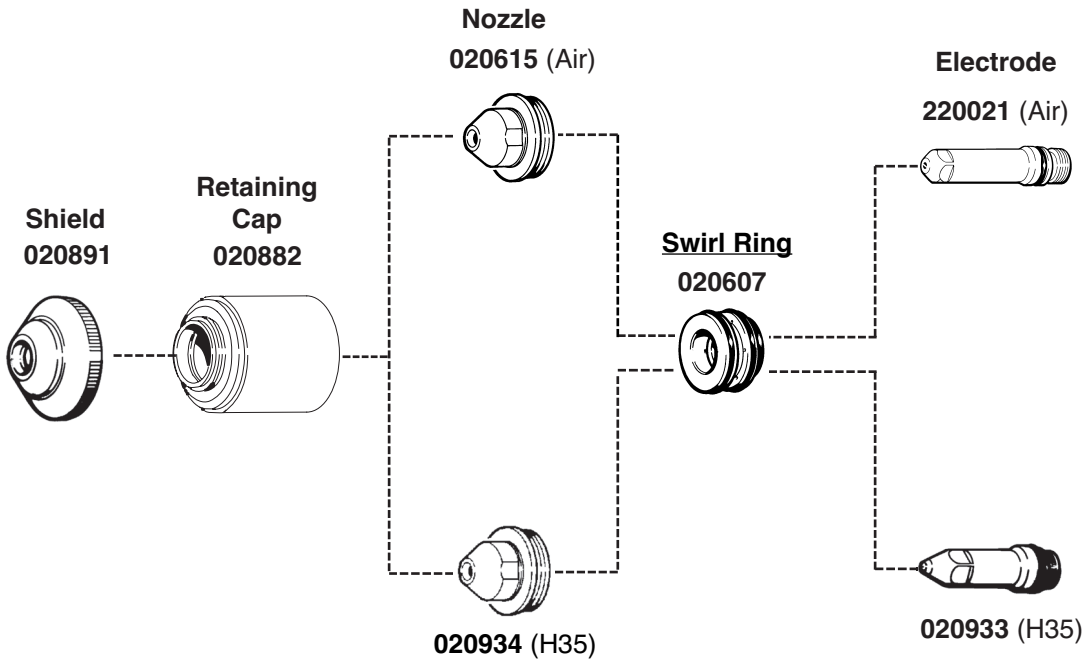


Figure 4-35 PAC200E (Gouging) Trigger Torch Consumable Parts

PAC200T Cutting Torch Consumable Parts Kit 028750

Part Number	Description	Qty.
028750	**Parts Kit: PAC200T**	
001067	Box:Gray Plastic	1
015015	Adapter:1/4NPT X #6 Male 90 Brass	1
015193	Cap:#6 Brass	1
220021	Electrode:MAX200 Air/Oxy	5
020415	Electrode:MAX200 N2/H35	5
020918	Shield:PAC200T Hand Torch 200A	5
020604	Swirl Ring:MAX200 Oxy	1
020605	Nozzle:MAX200 .082 200A Oxy	5
020607	Swirl Ring:MAX200 Air/N2/H35	1
020608	Nozzle:MX200 .086 200A Air/N2	5
027055	Lubricant:Silicone 1/4-Oz Tube	1
027194	Nozzle Wrench:MAX200/HT2000	1
044027	O-Ring:BUNA 70DURO 1.301X.070	2
027347	Tool:Water Tube Replacement	1

PAC200E Gouging Torch Consumable Parts Kit 028751

Part Number	Description	Qty.
028751	**Parts Kit: PAC200E**	
001067	Box:Gray Plastic	1
015015	Adapter:1/4NPT X #6 Male 90 Brass	1
015193	Cap:#6 Brass	1
020607	Swirl Ring:MAX200 Air/N2/H35	1
020891	Shield:PAC200E Torch	1
020918	Shield:PAC200T 200A	1
020933	Electrode:PAC200E Torch	5
220021	Electrode:MAX200 Air/Oxy	5
020934	Nozzle:PAC200E Torch N2/H35	5
020615	Nozzle:MAX200 Air/H35 Gouging	5
020608	Nozzle:MAX200 .086 200A Air/N2/H35	5
027055	Lubricant:Silicone 1/4-Oz Tube	1
027194	Nozzle Wrench:MAX200/HT2000	1
044027	O-Ring:BUNA 70DURO 1.301X.070	2
027347	Tool:Water Tube Replacement	1
027524	Nozzle Wrench: 1" open end	1

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PAC200T (90°) Cutting Torch Assembly

Item	Part Number	Description	Qty.
	073190	**PAC200T (90°) Cutting Torch Assembly**	1
1	002244	Safety Trigger: PAC120/200T/E Tch	1
2	001412	Handle: PAC200T/E 90 Deg Hand Torch	1
3	001217	Boot: PAC200T/E Torch	1
4	**120045**	**PAC200T Torch Main Body**	1
	020963	Water Tube:PAC200T Electd Cool	1
5	044027	O-Ring:Buna 1.301X.070	2
6	027254	Spring, Trigger, PAC120/200T/E Torch	1
7	075365	P/S, #6X3/4, PH, Pan	6
8	**029865**	**Leads SA:PAC200T/E Torch/PS 25 ft**	**1**
	220021	Electrode: MAX200 Air/Oxygen	1
	020607	Swirl Ring: MAX200 Air/N2/H35	1
	020608	Nozzle: MAX200 .086 200A Air/N2/H35	1
	020915	Shield Cap: PAC200T Cutting Torch	1
	020918	Shield: PAC200T 200A	1

PAC200T (90°) Cutting Torch Assembly 25 Ft

Item	Part Number	Description	Qty.
	073189	**PAC200T Cutting Torch Assembly 25 ft**	1
1	002244	Safety Trigger: PAC120/200T/E Tch	1
2	001412	Handle: PAC200T/E 90 Deg Hand Torch	1
3	001217	Boot: PAC200T/E Torch	1
4	**120045**	**PAC200T Torch Main Body**	1
	020963	Water Tube:PAC200T Electd Cool	1
5	044027	O-Ring:Buna 1.301X.070	2
6	027254	Spring, Trigger, PAC120/200T/E Torch	1
7	075365	P/S, #6X3/4, PH, Pan	6
8	**029865**	**Leads SA:PAC200T/E Torch/PS 25 ft**	**1**
	220021	Electrode: MAX200 Air/Oxygen	1
	020607	Swirl Ring: MAX200 Air/N2/H35	1
	020608	Nozzle: MAX200 .086 200A Air/N2/H35	1
	020915	Shield Cap: PAC200T Cutting Torch	1
	020918	Shield: PAC200T 200A	1

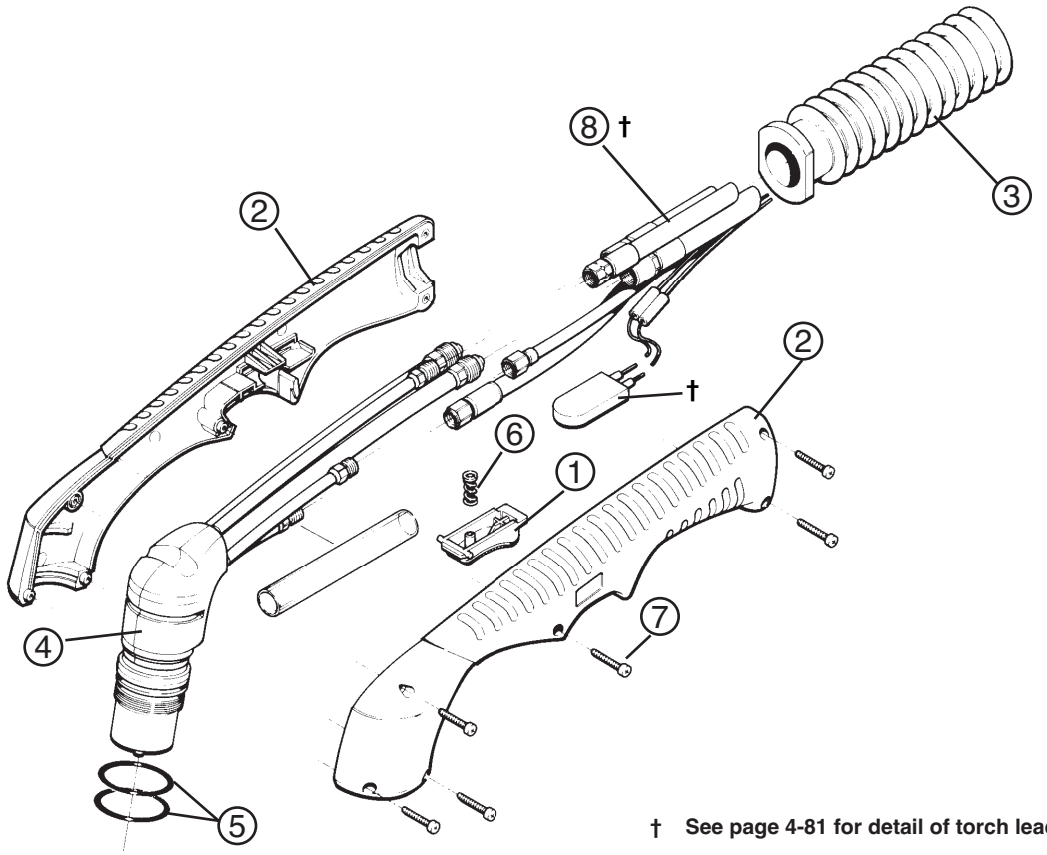


Figure 4-36 PAC200T (Cutting) Torch Assembly

PAC200T (65°) Cutting Torch Assembly

Item	Part Number	Description	Qty.
	073187	**PAC200T (65°) Cutting Torch Assembly***	1
1	002244	Safety Trigger: PAC120/200T/E Tch	1
2	001440	Handle: PAC200T/E 65 Deg Hand Torch	1
3	001217	Boot: PAC200T/E Torch	1
4	**020907**	**PAC200T (65°) Torch Main Body**	1
	020963	Water Tube:PAC200T Electd Cool	1
5	044027	O-Ring:Buna 1.301X.070	2
6	027254	Spring, Trigger, PAC120/200T/E Torch	1
7	075365	P/S, #6X3/4, PH, Pan	6
8	**029865**	**Leads SA:PAC200T/E Torch/PS 25 ft**	**1**
	220021	Electrode: MAX200 Air/Oxygen	1
	020607	Swirl Ring: MAX200 Air/N2/H35	1
	020608	Nozzle: MAX200 .086 200A Air/N2/H35	1
	020915	Shield Cap: PAC200T Cutting Torch	1
	020918	Shield: PAC200T 200A	1

PAC200T (65°) Cutting Torch Assembly 25 Ft

Item	Part Number	Description	Qty.
	073110	**PAC200T (65°) Cutting Torch Assembly 25 ft**	1
1	002244	Safety Trigger: PAC120/200T/E Tch	1
2	001440	Handle: PAC200T/E 65 Deg Hand Torch	1
3	001217	Boot: PAC200T/E Torch	1
4	**020907**	**PAC200T (65°) Torch Main Body**	1
	020963	Water Tube:PAC200T Electd Cool	1
5	044027	O-Ring:Buna 1.301X.070	2
6	027254	Spring, Trigger, PAC120/200T/E Torch	1
7	075365	P/S, #6X3/4, PH, Pan	6
8	**029865**	**Leads SA:PAC200T/E Torch/PS 25 ft**	**1**
	220021	Electrode: MAX200 Air/Oxygen	1
	020607	Swirl Ring: MAX200 Air/N2/H35	1
	020608	Nozzle: MAX200 .086 200A Air/N2/H35	1
	020915	Shield Cap: PAC200T Cutting Torch	1
	020918	Shield: PAC200T 200A	1

* See Figure 4-36.

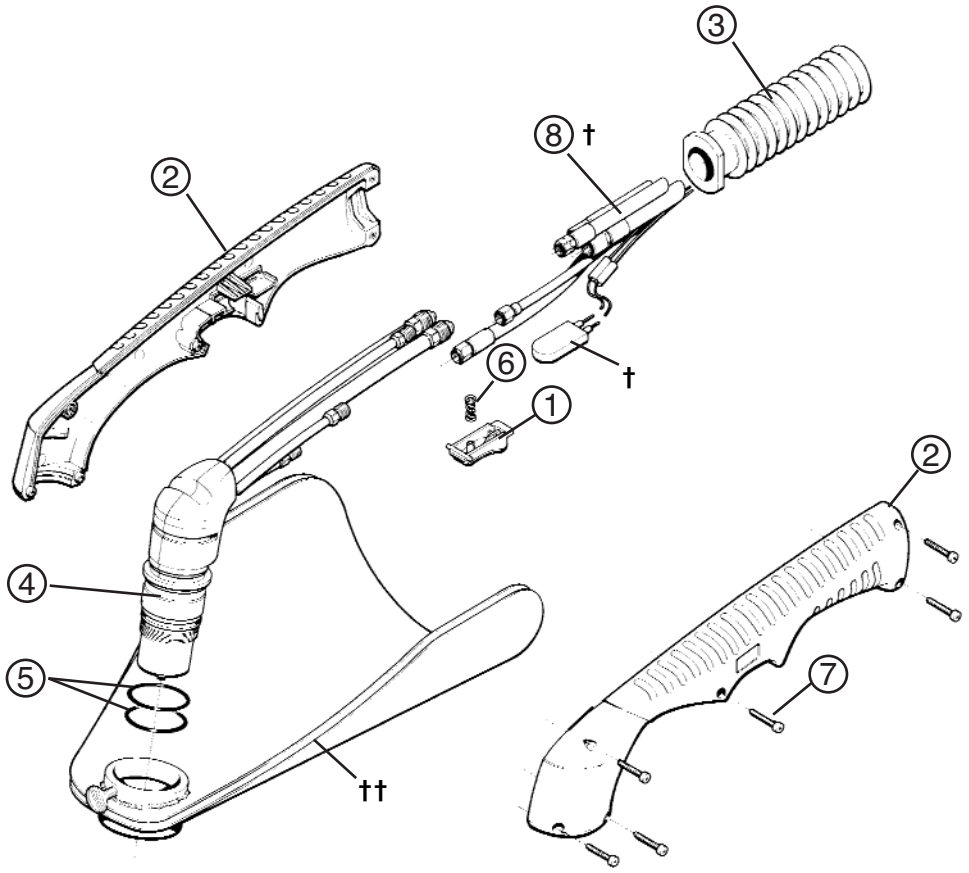
PAC200E Gouging Torch Assembly

Item	Part Number	Description	Qty.
	073188	**PAC200E Gouging Torch Assembly***	1
1	002244	Safety Trigger: PAC120/200T/E Tch	1
2	001440	Handle: PAC200T/E 65 Deg Hand Torch	1
3	001217	Boot: PAC200T/E Torch	1
4	**020908**	**PAC200E Torch Main Body**	1
	020913	Water Tube:PAC200E Electd Cool	1
5	044027	O-Ring:Buna 1.301X.070	2
6	027254	Spring, Trigger, PAC120/200T/E Torch	1
7	075365	P/S, #6X3/4, PH, Pan	6
8	**029865**	**Leads SA:PAC200T/E Torch/PS 25 ft**	**1**
	020933	Electrode: PAC200E	1
	020607	Swirl Ring: MAX200 Air/N2/H35	1
	020934	Nozzle: PAC200E N2	1
	020882	Shield Cap: PAC200E Torch	1
	020891	Shield: PAC200E Torch	1

PAC200E Gouging Torch Assembly 25 Ft

Item	Part Number	Description	Qty.
	073111	**PAC200E Gouging Torch Assembly 25 ft**	1
1	002244	Safety Trigger: PAC120/200T/E Tch	1
2	001440	Handle: PAC200T/E 65 Deg Hand Torch	1
3	001217	Boot: PAC200T/E Torch	1
4	**020908**	**PAC200E Torch Main Body**	1
	020913	Water Tube:PAC200E Electd Cool	1
5	044027	O-Ring:Buna 1.301X.070	2
6	027254	Spring, Trigger, PAC120/200T/E Torch	1
7	075365	P/S, #6X3/4, PH, Pan	6
8	**029865**	**Leads SA:PAC200T/E Torch/PS 25 ft**	**1**
	020933	Electrode: PAC200E	1
	020607	Swirl Ring: MAX200 Air/N2/H35	1
	020934	Nozzle: PAC200E N2	1
	020882	Shield Cap: PAC200E Torch	1
	020891	Shield: PAC200E Torch	1

* See Figure 4-37.



† See page 4-81 for detail of torch leads.
†† Heat Shield 020881 not included in PAC200E Torch Assembly. Order separately.

Figure 4-37 PAC200E (Gouging) Torch Assembly

Trigger Torch 25 – Foot Lead Assembly (Torch to Power Supply)*

Item	Part Number	Description	Qty.
	029865	**Leads SA:PAC200T/E Trch/PS 25 ft**	1
1	024375	Hose:200T/E Cap Sensor Trch/PS	1
2	024194	Hose Assy:3/16 Red LH	1
3	023714	Cable: 200T/E Water Cooled Blue	1
4	023716	Cable: 200T/E Water Cooled Red	1
5	023715	Cable: 200T/E Shield Gas	1
6	047203	Cable, 16-1 Pair	1
7	005094	Push Button Switch: Torch	1
8	024197	Sheath: MAX200 Hand Torch Leads 25'	1
9	046065	Tube 9/16 ID X .03 WL Nat Tef	.333 ft

* Note: If leads longer than 25 feet are needed, use extended leads (see page 4-82).

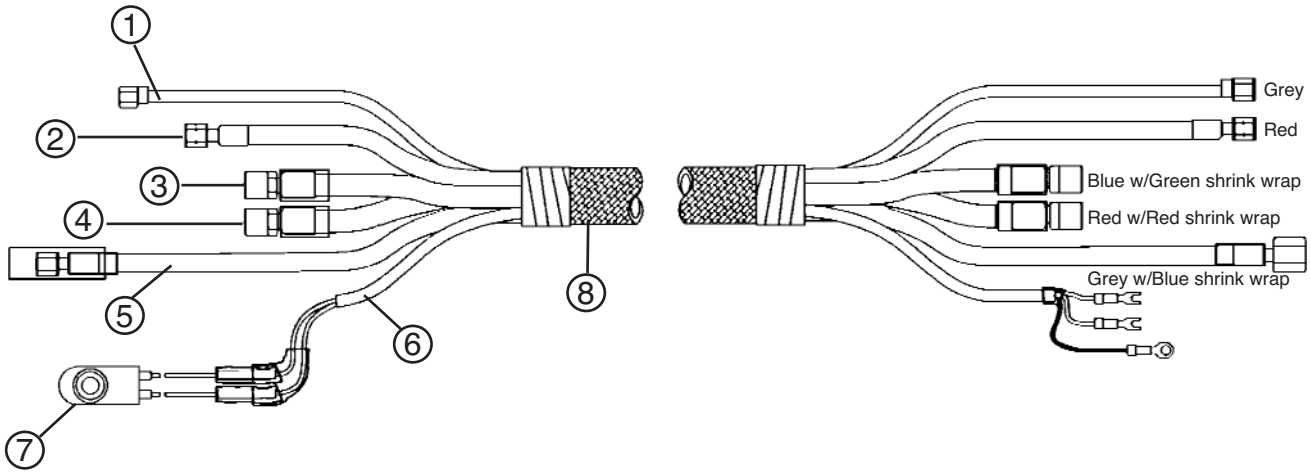


Figure 4-38 PAC200T/E Trigger Torch Lead Assemblies

Extended Leads

Part Number	Description	Qty.	Length
028715	**PAC200T/E Torch Leads Ext 50'**	**1**	**50 ft**
*029866	Leads SA:PAC200T/E Torch-XBT 25'	1	
029867	Leads SA:PAC200T/E XBT-PS 25'	1	
001313	Box:Torch Leads Ext (one half)	1 pair	
075365	Screws	8	
028716	**PAC200T/E Torch Leads Ext 75'**	**1**	**75 ft**
*029866	Leads SA:PAC200T/E Torch-XBT 25'	1	
029594	Leads MAX200 Hand Torch XT 50' PS End	1	
001313	Box:Torch Leads Ext	1 pair	
075365	Screws	8	
028717	**PAC200T/E Torch Leads Ext 100'**	**1**	**100 ft**
*029866	Leads SA:PAC200T/E Torch-XBT 25'	1	
029593	Leads MAX200 Hand Torch XT 50' CTRSC	1	
029867	Leads SA:PAC200T/E XBT-PS 25'	1	
001313	Box:Torch Leads Ext	2 pair	
075365	Screws	8	
028718	**PAC200T/E Torch Leads Ext 125'**	**1**	**125 ft**
*029866	Leads SA:PAC200T/E TCH-XBT 25'	1	
029593	Leads MAX200 Hand Torch XT 50' CTRSC	1	
029594	Leads MAX200 Hand Torch XT 50' PS End	1	
001313	Box:Torch Leads Ext	2 pair	
075365	Screws	8	
028719	**PAC200T/E Torch Leads Ext 150'**	**1**	**150 ft**
*029866	Leads SA:PAC200T/E Torch-XBT 25'	1	
029593	Leads MAX200 Hand Torch XT 50' CTRSC	2	
029867	Leads SA:PAC200T/E XBT-PS 25'	1	
001313	Box:Torch Leads Ext	3 pair	
075365	Screws	8	

* See page 4-83 for detail.

Trigger Torch 25 – Foot Lead Assembly (Torch to Extension Box)

Item	Part Number	Description	Qty.
	029866	**Leads SA:PAC200T/E Torch-Ext. Box 25'**	1
1	024376	Hose:200T/E Cap Sensor Torch/Box	1
2	024379	Hose Assy:3/16 Red LH'A' 25'1"	1
3	023714	Cable: 200T/E Water Cooled Blue	1
4	023716	Cable: 200T/E Water Cooled Red	1
5	023717	Cable: 200T/E Shield Gas Torch/Box	1
6	047203	Cable, 16-1 Pair	1
7	005094	Push Button Switch: Torch	1
8	024197	Sheath: MAX200 Hand Torch Leads 25'	1
9	015036	UN: Right Hand 'A' Male Brass	2
10	015049	UN: AC'A' Male Brass	1
11	015208	Adapter: #5 Male X #5 Male Brass	2
12	074067	Term 22-18 .25 Male QC Insul	3
13	046065	Tube 9/16 ID X .03 WL Nat Tef	.333 ft

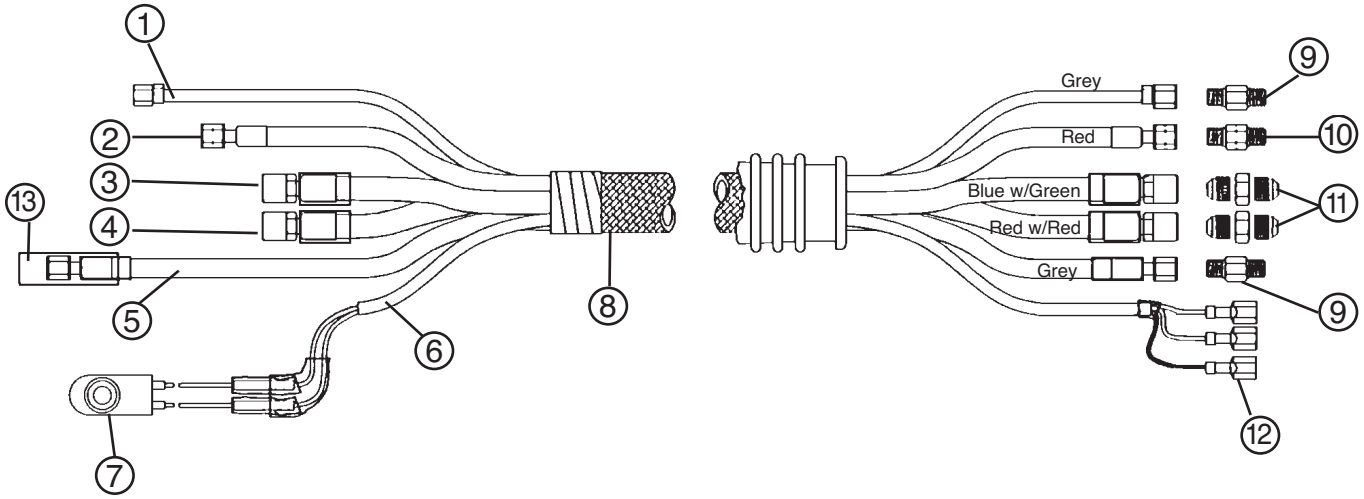


Figure 4-39 #029866 – Leads SA:PAC200T/E Torch to Extension Box – 25'

Appendix A

TORCH COOLANT MATERIAL SAFETY DATA SHEETS

In this section:

Torch Coolant Requirements

The power supply is shipped without any coolant in the tank. A standard mixture of propylene glycol (30%), deionized water (69.5%) and .5% benzotriazole is recommended. This mixture resists freezing to +10° F (-12° C) and contains a corrosion inhibitor (benzotriazole) to protect copper surfaces in the coolant loop. This mixture is available in one-gallon containers by ordering 028872. 100% propylene glycol is available by ordering 028873.

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

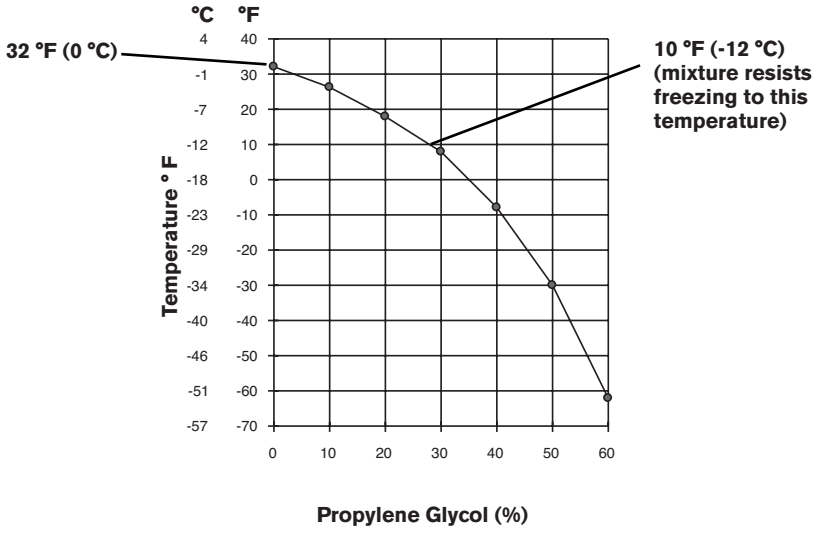
Observe the warning and cautions below. Refer to the Material Safety Data Sheets in this Appendix for data on safety, handling, and storage of propylene glycol and benzotriazole.

WARNING

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

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

Always use purified water in the coolant mixture in order to prevent corrosion in the torch coolant system. The hardness of purified water should be between .206 and 8.5 ppm. If using a conductivity meter to measure water purity, the recommended level is between .5 and 18 µSiemens/cm at 77° F (25° C).



MATERIAL SAFETY DATA SHEET

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	Hypertherm Torch Coolant

Latest Revision Date	09-02-2004

ISSUE DATE	03-10-2005

EMERGENCY TELEPHONE NUMBERS

Product Information: (603) 643-3441

DISTRIBUTOR: **Hypertherm, Inc.**
Etna Road
Hanover, N.H. 03755

SECTION 2 – COMPOSITION / INFORMATION ON INGREDIENTS

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

SECTION 3 – HAZARDS IDENTIFICATION

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

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

SECTION 4 – FIRST AID MEASURES

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

SECTION 5 – FIRE FIGHTING MEASURES

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

SECTION 6 – ACCIDENTAL RELEASE MEASURES

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

SECTION 7 – HANDLING AND STORAGE

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

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

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

Personal protective equipment

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

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

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

SECTION 10 – STABILITY AND REACTIVITY

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

SECTION 11 – TOXICOLOGICAL INFORMATION

Carcinogenicity

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

Other effects

Acute	Not determined
Chronic	Not determined

SECTION 12 – ECOLOGICAL INFORMATION

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

SECTION 13 – DISPOSAL CONSIDERATIONS

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

SECTION 14 – TRANSPORT INFORMATION

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

SECTION 15 – REGULATORY INFORMATION

REGULATORY STATUS: Benzotriazole

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

SECTION 16 – OTHER INFORMATION

NFPA Classification

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

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

Appendix B

ELECTROMAGNETIC COMPABILITY (EMC)

In this section:

General

This appendix will enable a qualified electrician to install the power cable to the EMI filter on 400V CE power supplies 073200 (without THC) and 073213 (with THC) for machine or hand torch systems.

Power Cable

The power cable is **customer supplied**. See *Power Cable* on pages 3-6 in IM-87 or page 3-8 in IM-98 for recommended cable sizes. Final specification and installation of the power cord should be made by a licensed electrician and according to applicable national or local codes. See also *Mains Supply* on page a-2 for further power (supply) cable shielding recommendations.

Connect power cable

Connect one end of the power cable to the EMI filter first and then connect the other end to the line disconnect switch.

Power Supply

1. Locate the EMI filter on the top rear of the power supply (see Figure a-1).

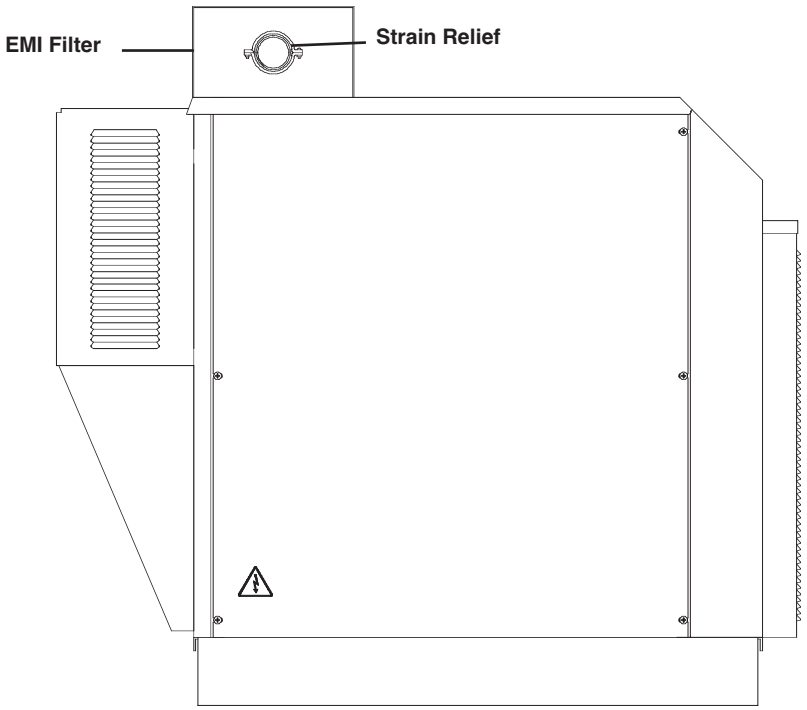


Figure a-1 MAX200 Power Supply with EMI Filter – Side View

2. Unscrew the four filter cover screws and remove cover to access input voltage connections at TB1 (see Figure a-2).

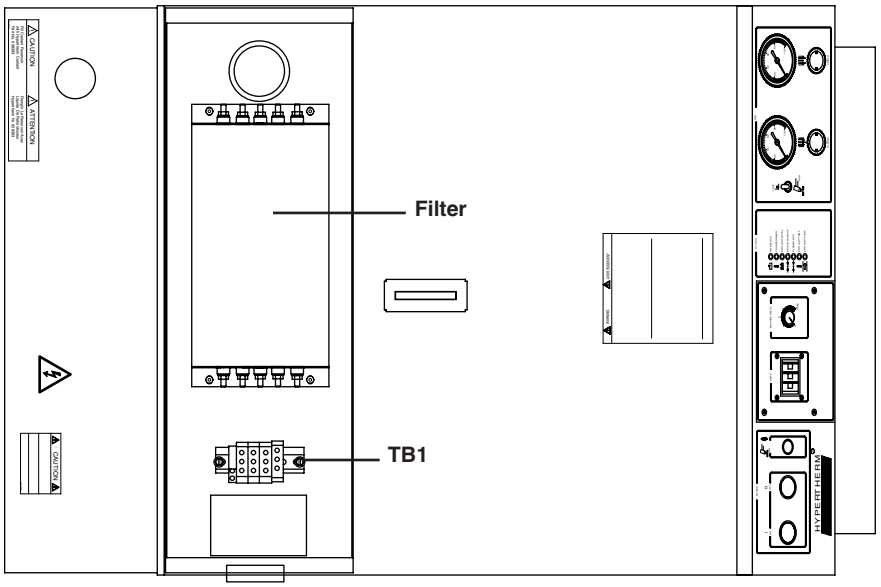


Figure a-2 MAX200 Power Supply with EMI Filter Cover Off – Top View

3. Insert the power cable through the strain relief (see Figure a-1).

4. Connect leads L1 to U, L2 to V, and L3 to W terminals of TB1 (see Figure a-3). Ensure that all connections are tight to avoid excessive heating.

5. Connect the ground lead to terminal marked PE at TB1 (see Figure a-3).

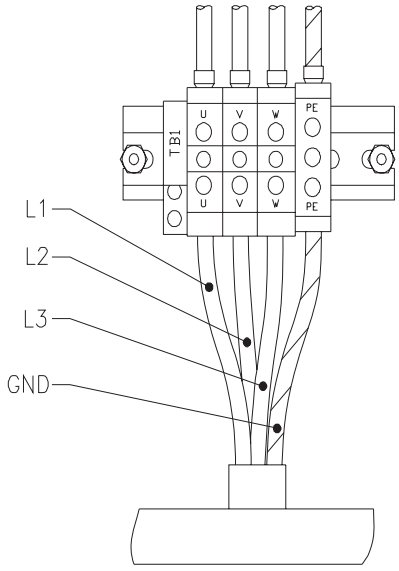


Figure a-3 Power Cable Connections to TB1

WARNING

As a common safety practice, ALWAYS verify that the line disconnect switch is in the OFF position before installing, disconnecting or servicing in this area.

Line Disconnect Switch

Connecting the power cable to the line disconnect switch must conform to national or local electrical codes. This work should be performed only by qualified, licensed personnel. See *Power Requirements* and *Line Disconnect Switch* on page 3-6 in IM-87 and page 3-8 in IM-98.

EMI Filter Parts List

Item	Part Number	Description	Qty.
	001557	Cover: 200/2000-CE Electronic Filter Enclosure	1
1	001558	Enclosure: 200/2000-CE Electronic Filter	1
2	001559	Cover: 200/2000-CE Top	1
3	008489	Bushing: 1.97 ID X 2.5 Hole Black-Snap	1
4	008610	Strain Relief: 1-1/2NPT 1.5ID 2-Screw	1
5	029316	TB1 Input-Power SA: 200/2000/4X00/HD	1
6	109036	Filter: 60A 440VAC 3PH 2-Stage Electronic	1
7	109040	Filter Mounting Bracket for 109036	1

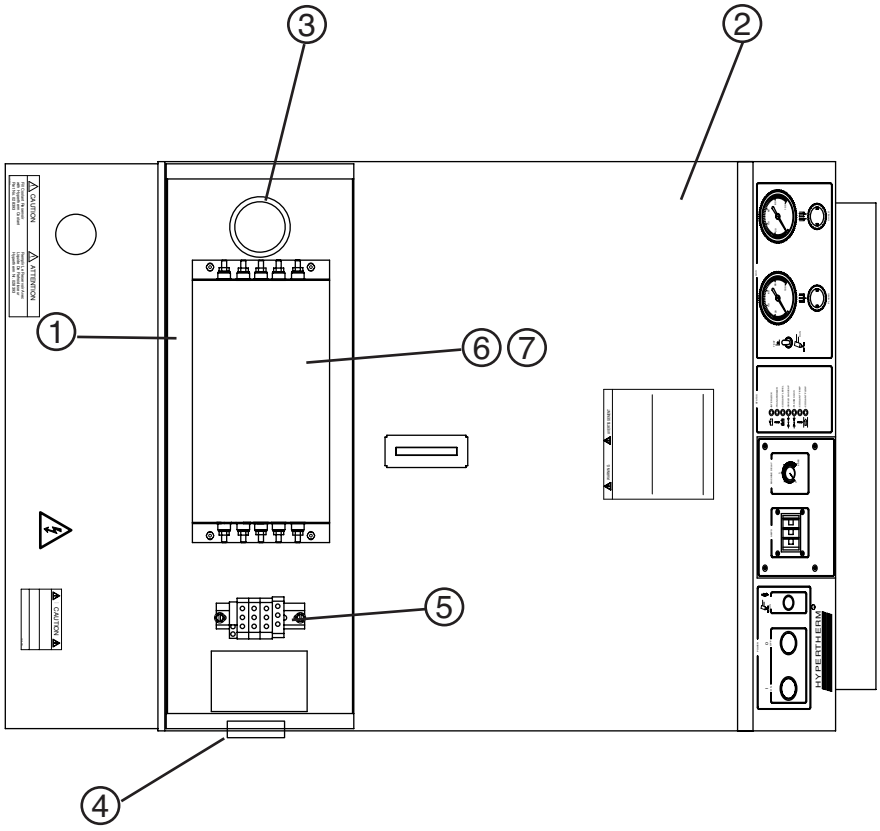
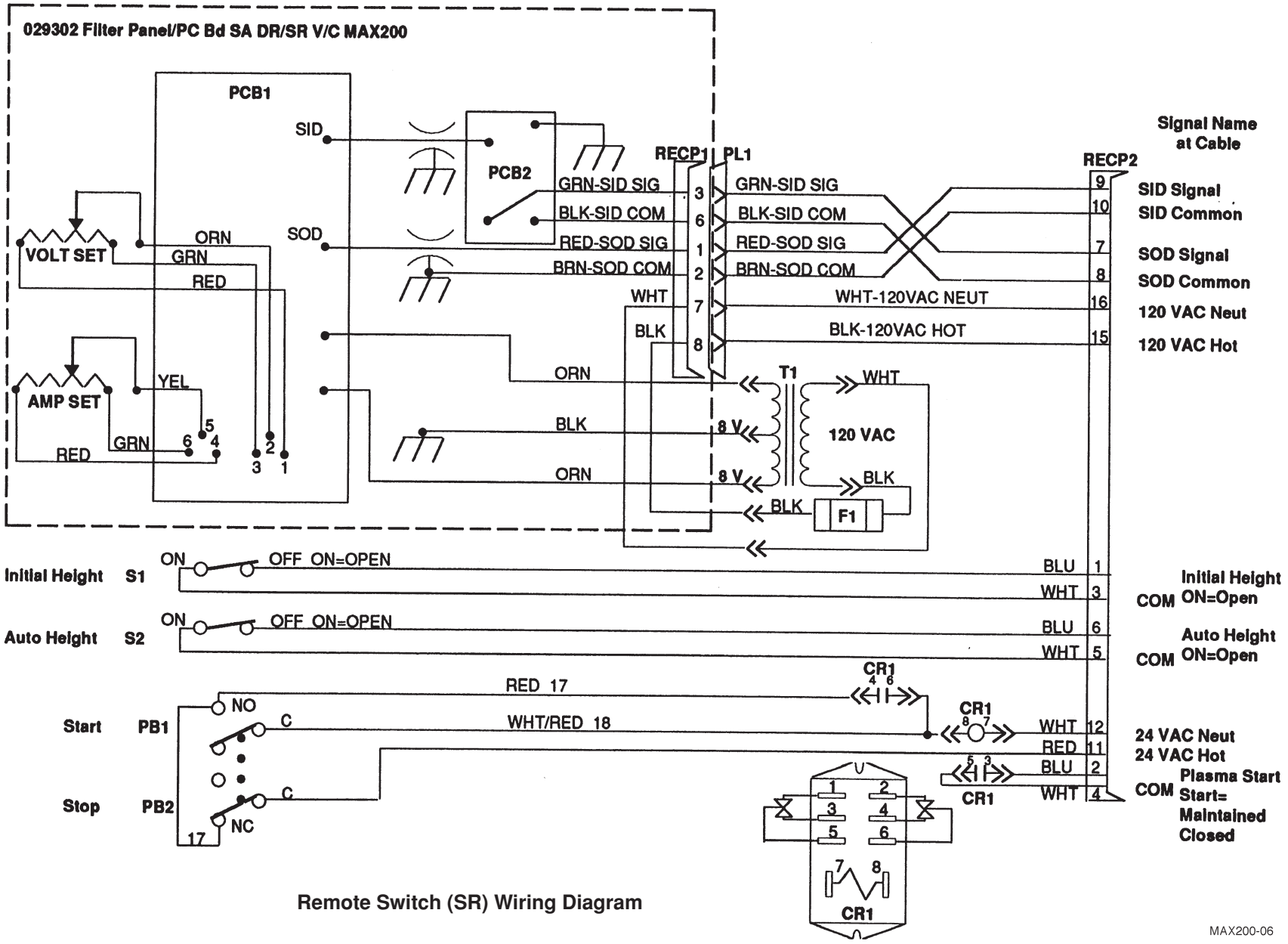


Figure a-4 MAX200 EMI Filter Parts

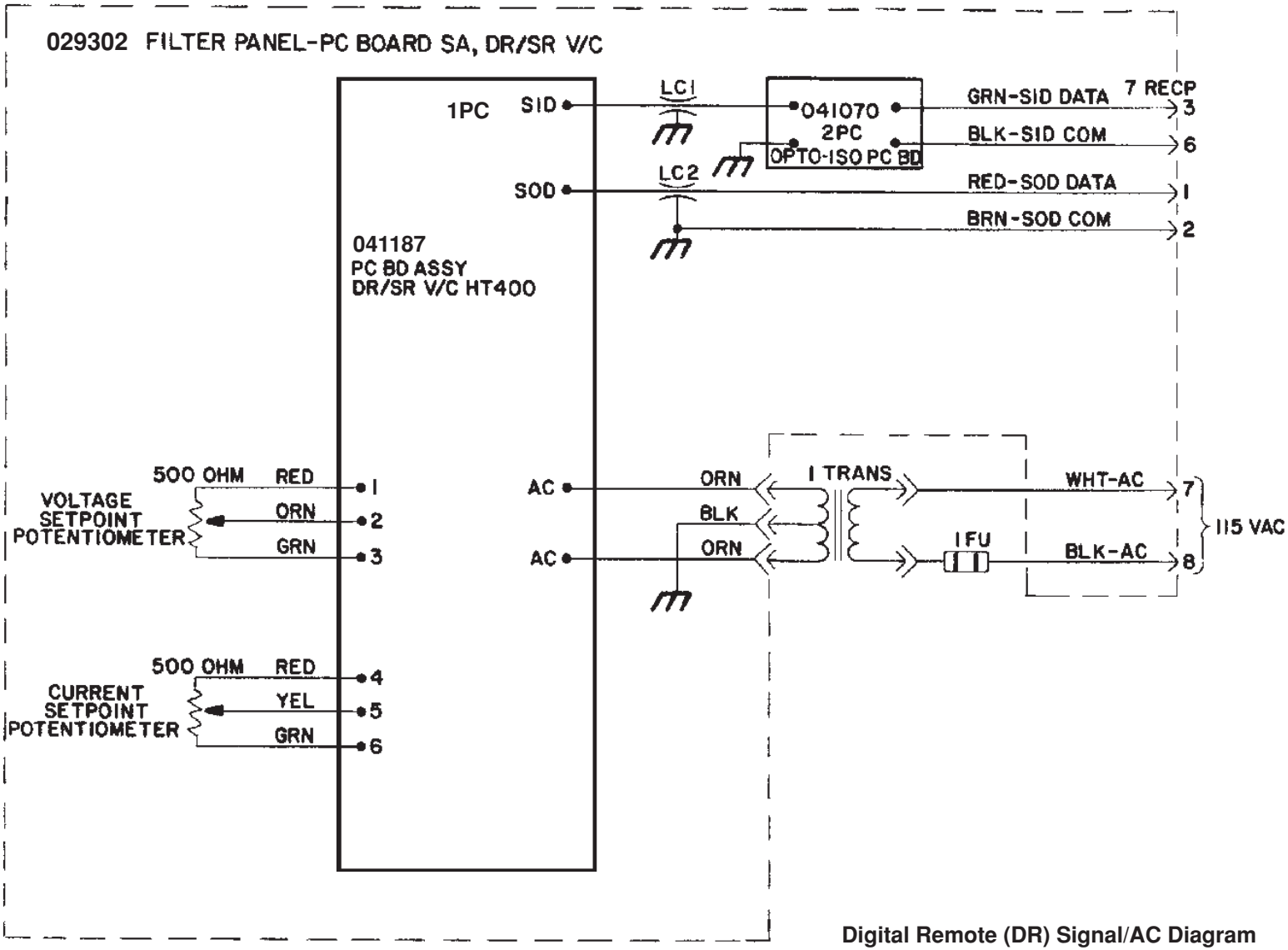
Appendix C

DIAGRAMS

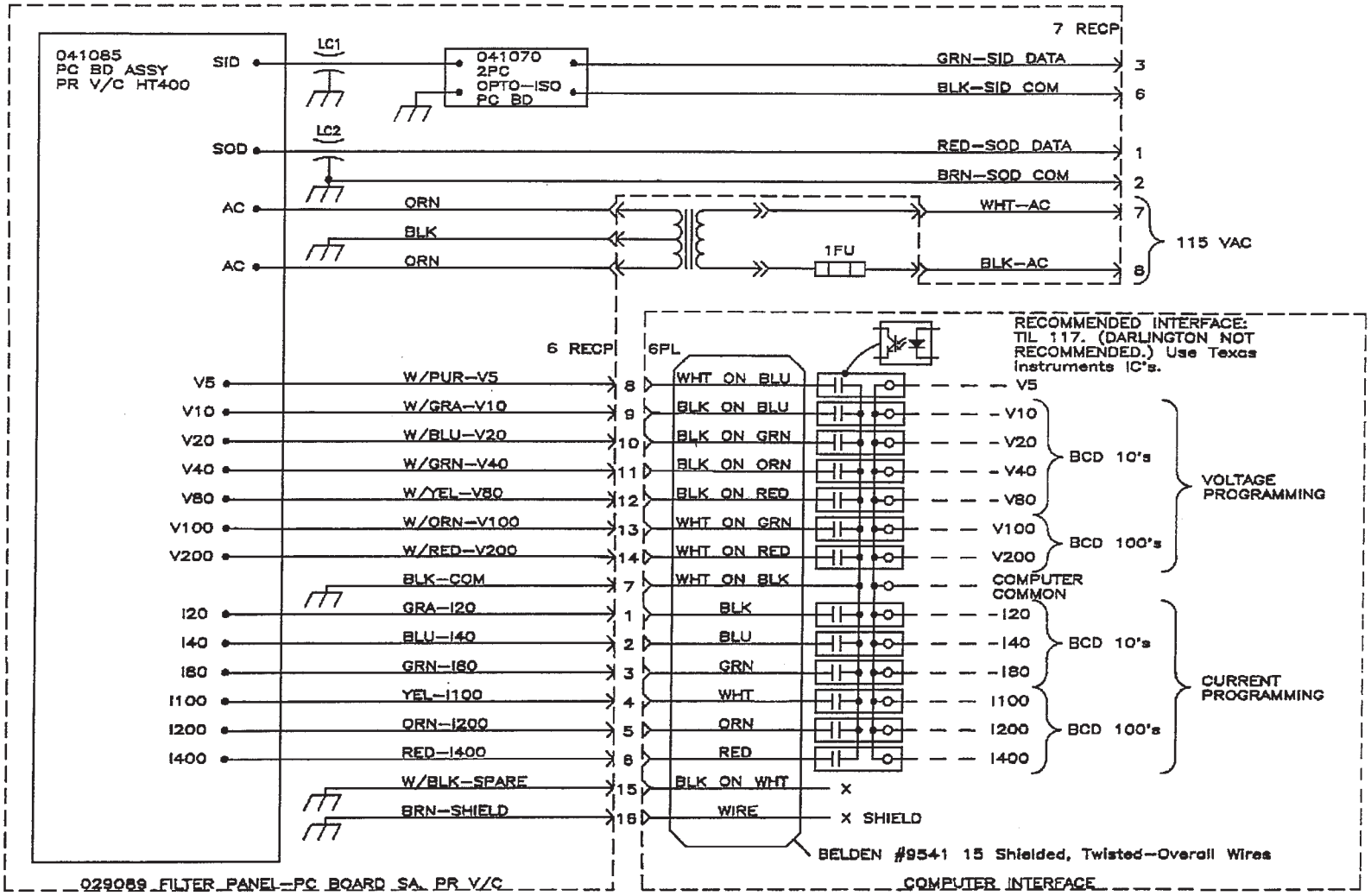
In this section:



Remote Switch (SR) Wiring Diagram

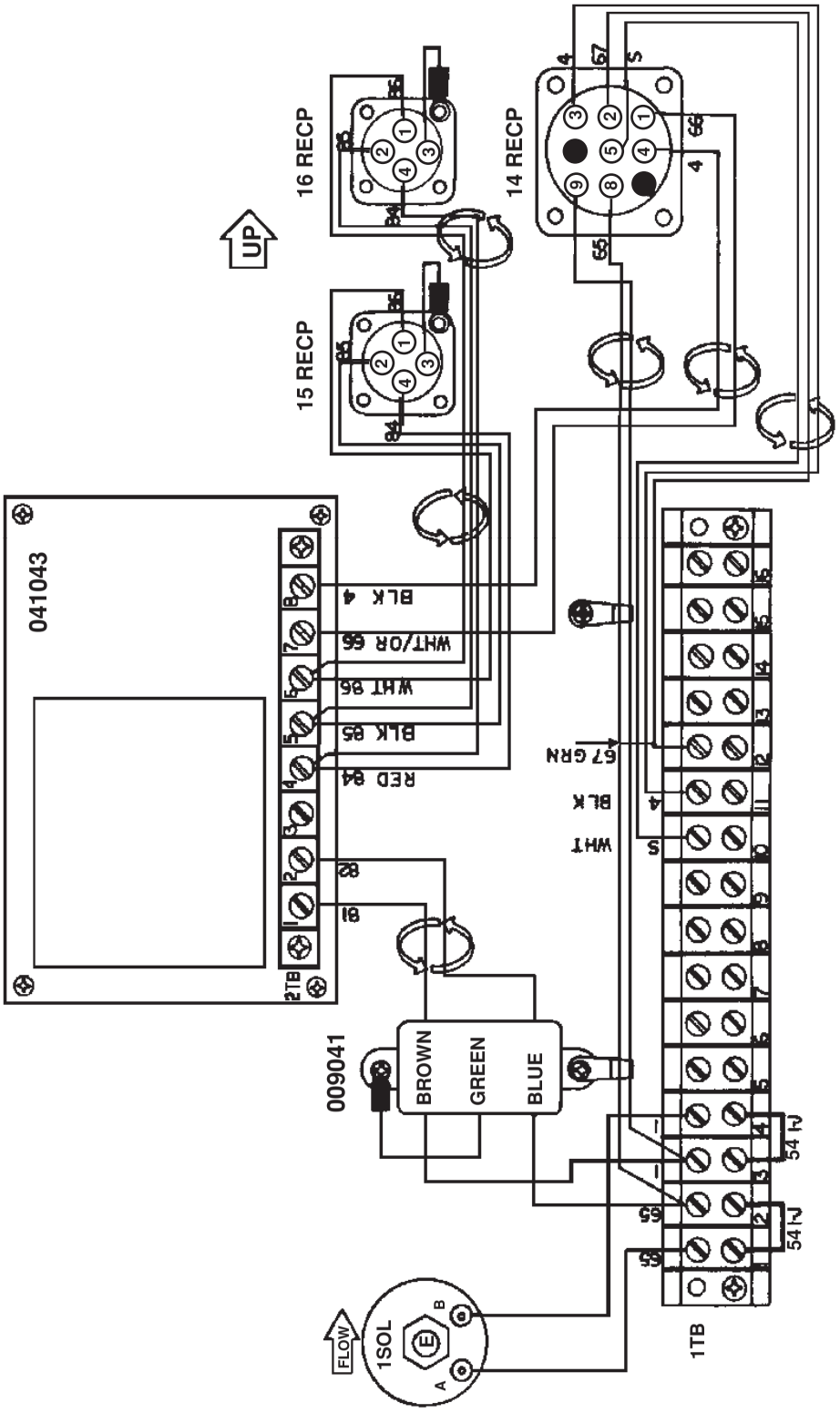


Digital Remote (DR) Signal/AC Diagram

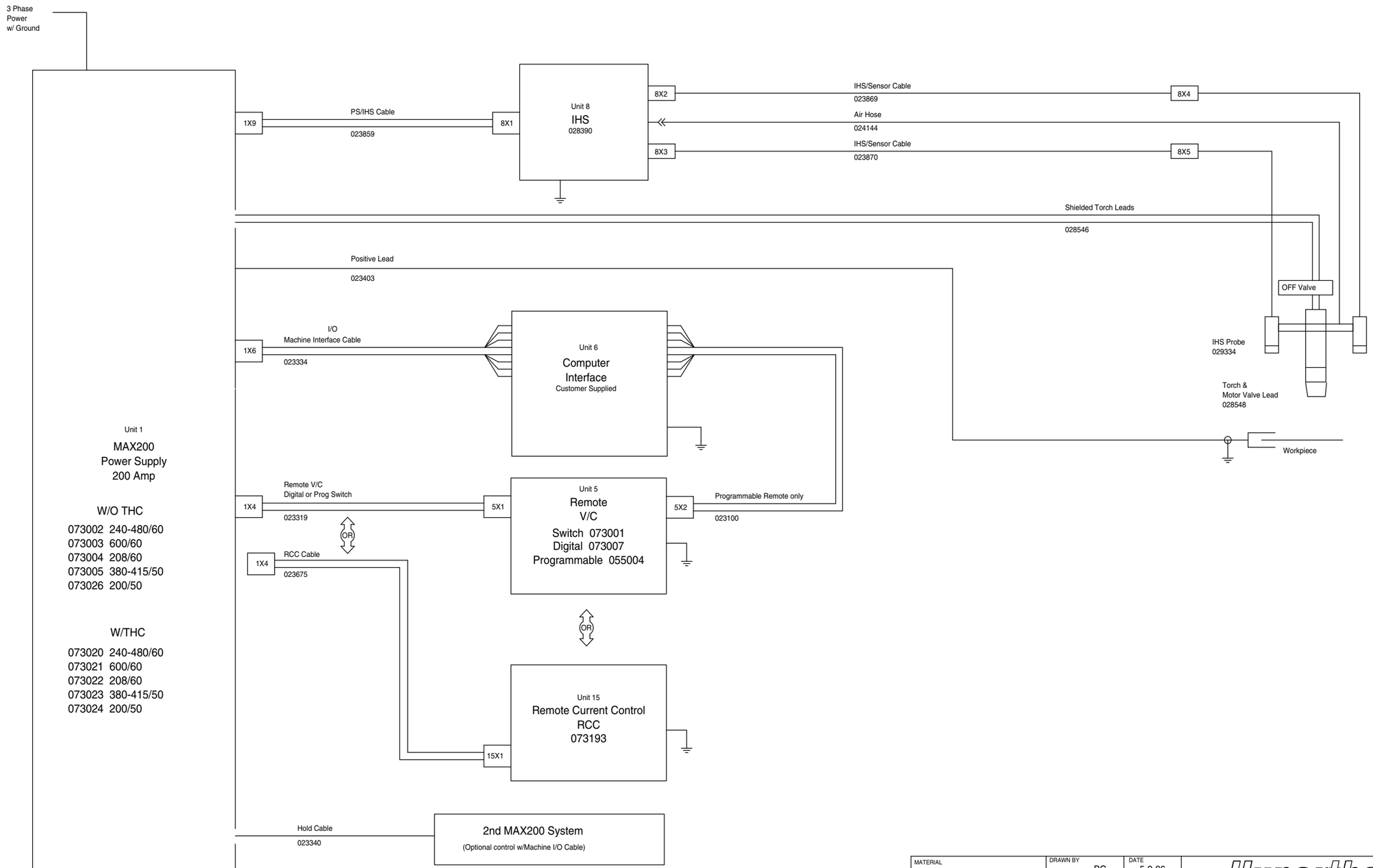


Drwg 13-2-056

Programmable Remote (PR) Signal/AC Diagram



Initial Height Sensing (IHS) Wiring Diagram



MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	
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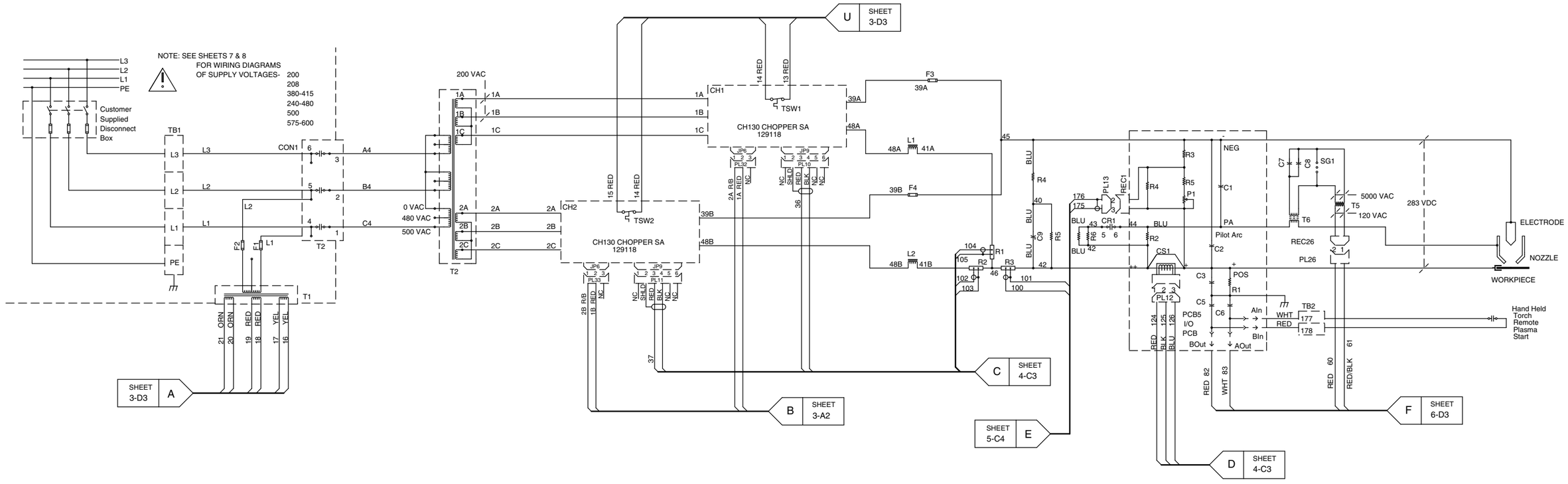
	ITEM NO.: 013179	DRAWING NO.: 013-2-179	FILE NAME: 013179B1
	SCALE: N/A	MODEL: MAX200	SHEET: 1 OF 9



MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
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A — SHEET 2-B4

U — SHEET 2-D2

G — SHEET 4-D3

H — SHEET 4-B3

J — SHEET 6-C4

K — SHEET 6-C2

L — SHEET 5-C4

M — SHEET 4-B4

B — SHEET 2-B2

24 VAC
115 VAC
240 VAC

ORN 20 · RED 18 · ORN 21 · RED 19 · YEL 17 · YEL 16

PB1 · PB2 · Remote Machine STOP

TS1 · LS1 · PS2 · PS1 · TS2 · FS1 · PS3 · LT1 · V4

PL1 · PL3 · REC1 · REC3

F1 F2 F3 F4 · H1 H2 H3 H4 · MOV1 MOV2 MOV3

D8 · U1 · R1 R2 R3 · C8 C9 · D9

J1 J2 · CR1 CR2 CR3

CR4 CR5 CR6 CR7 CR8 CR9 CR10

POWER DISTRIBUTION
PCB ASSY: 041534

REC4 PL1.4

REC5 · REC2 · PL19 · PL2

V7 · M1 · PL21

PB1 · PB2 · M2 · M4 · M3 · PL31 · REC31 · HX1 · M5 M6 M7 M8

PCB: 041535
ASSY: 041536

023354

REC1 · REC2

LED7 LED6 LED5 LED4 LED3 LED2 LED1

RN2A RN2B RN2E RN2F RN2G RN2H RN1A RN1B RN1C RN1D RN1F RN1E RN1H RN1G

U2A U2C U2D U1A U1B U1C U1D

D7 D6 D5 D4 D3 D2 D1

Hypertherm
Box-5010 Hanover, NH 03755-5010 603/643-3441

MATERIAL	DRAWN BY: BC	DATE: 5-9-96
	CHECKED BY	DATE
	APP. BY	DATE

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DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
2 PL DECIMAL ±.01
3 PL DECIMAL ±.005
FRACTIONS ±1/64
ANGULAR ±.5°
PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015.

DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)

ITEM NO.	DRAWING NO.	FILE NAME
013179	013-2-179	013179B3

SCALE	MODEL	SHEET
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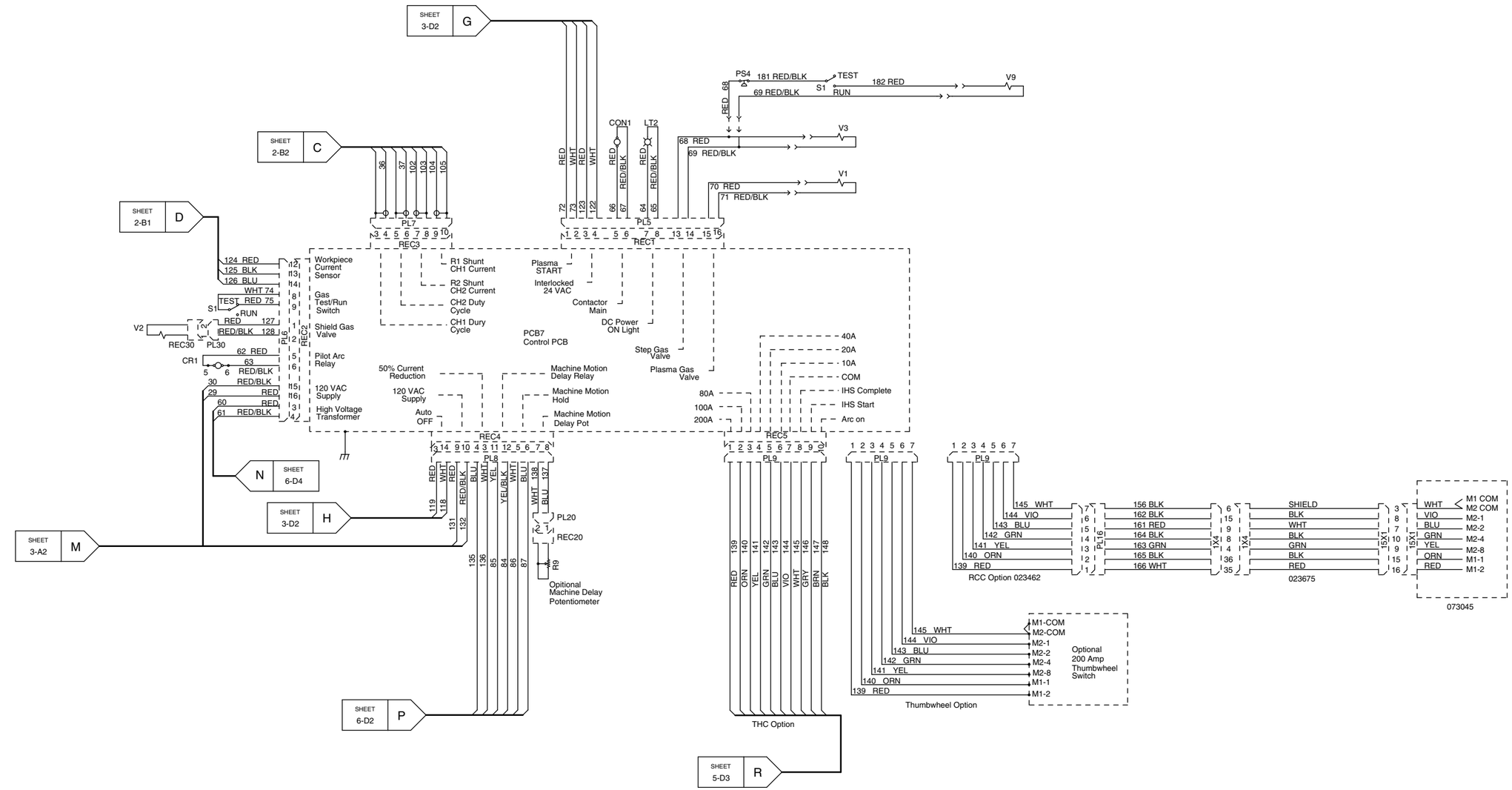

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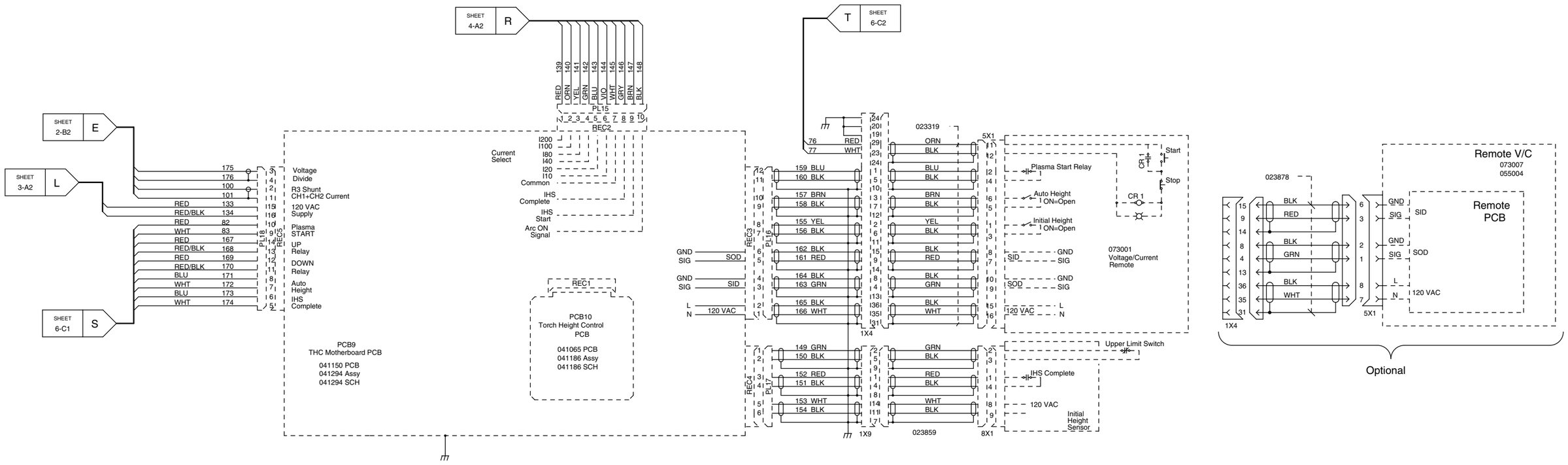

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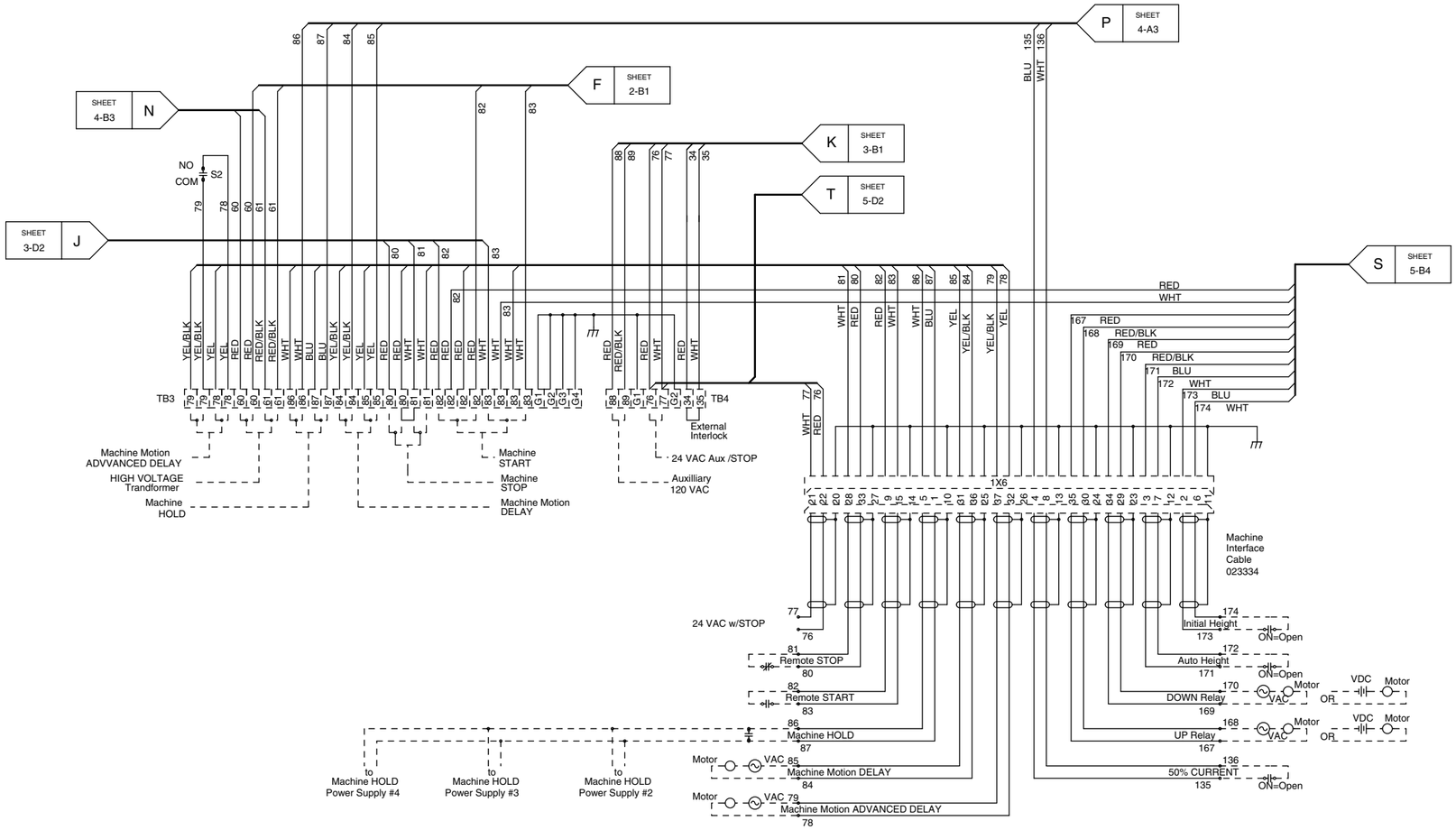

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	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)

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DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
2 PL DECIMAL ±.01
3 PL DECIMAL ±.005
FRACTIONS ±1/64
ANGULAR ±.5=
PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015.

ITEM NO.	DRAWING NO.	FILE NAME
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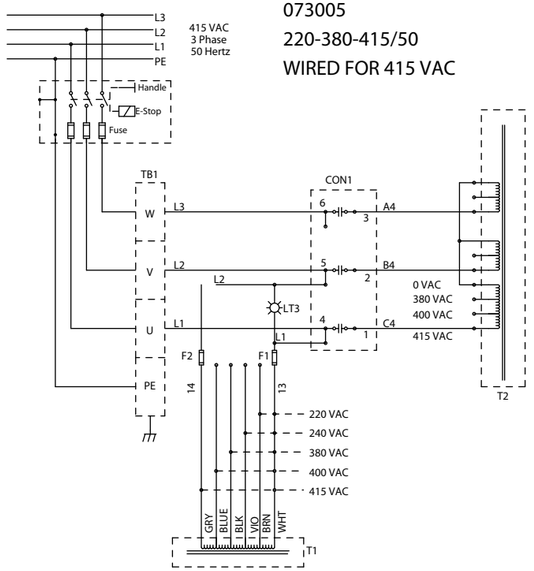
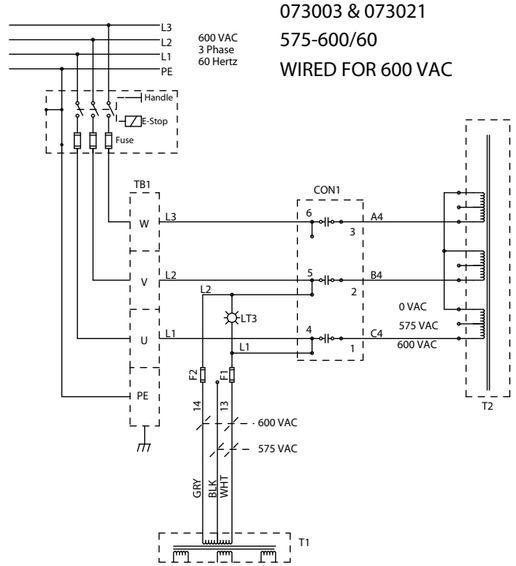
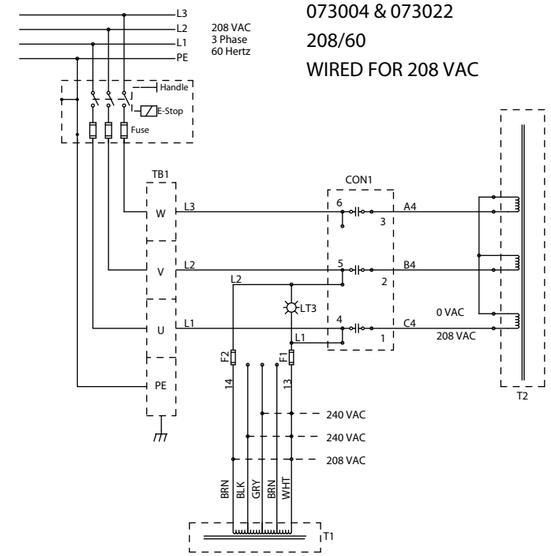
SCALE	MODEL	SHEET
N/A	MAX200	6 OF 9



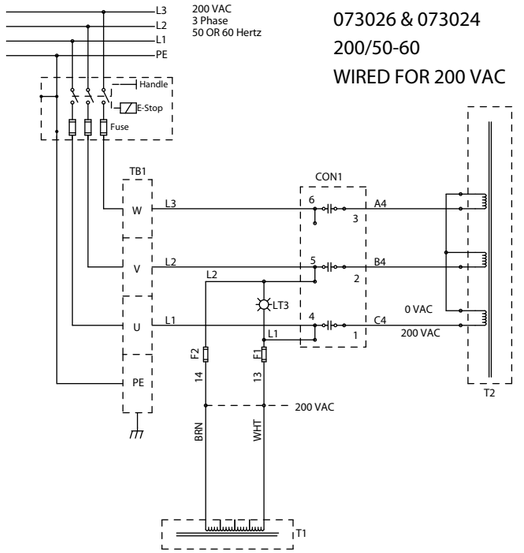
073005
220-380-415/50
WIRED FOR 415 VAC



073003 & 073021
575-600/60
WIRED FOR 600 VAC



073004 & 073022
208/60
WIRED FOR 208 VAC



073026 & 073024
200/50-60
WIRED FOR 200 VAC

MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 V
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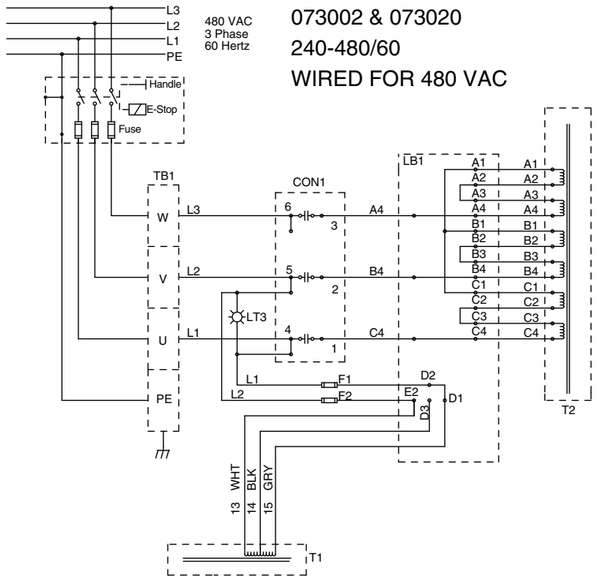
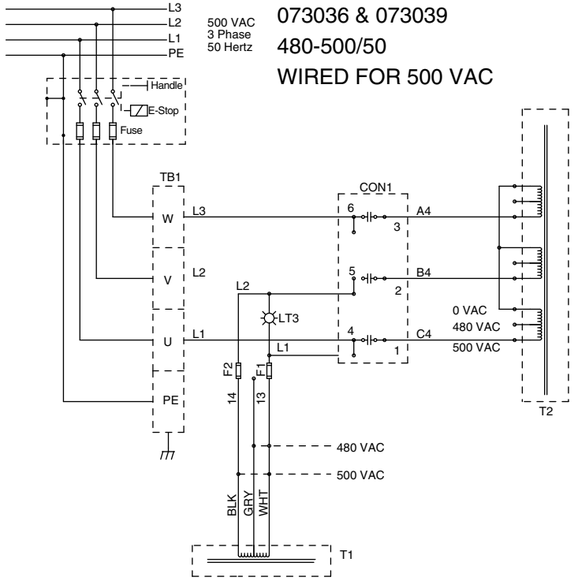
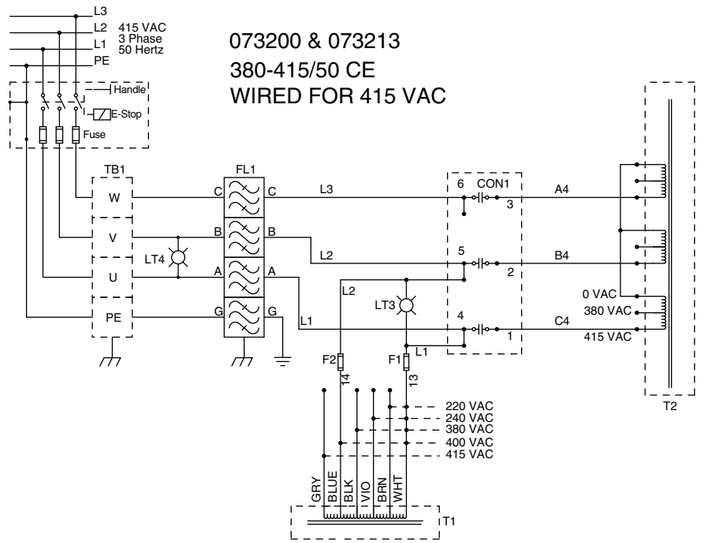
			SCALE: N/A | MODEL: MAX200 | SHEET: 7 OF 9



073002 & 073020
240-480/60
WIRED FOR 480 VAC



073036 & 073039
480-500/50
WIRED FOR 500 VAC



073200 & 073213
380-415/50 CE
WIRED FOR 415 VAC

MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm Box-5010 Hanover, NH 03755-5010 603/643-3441
	CHECKED BY	DATE	
	APP. BY	DATE	
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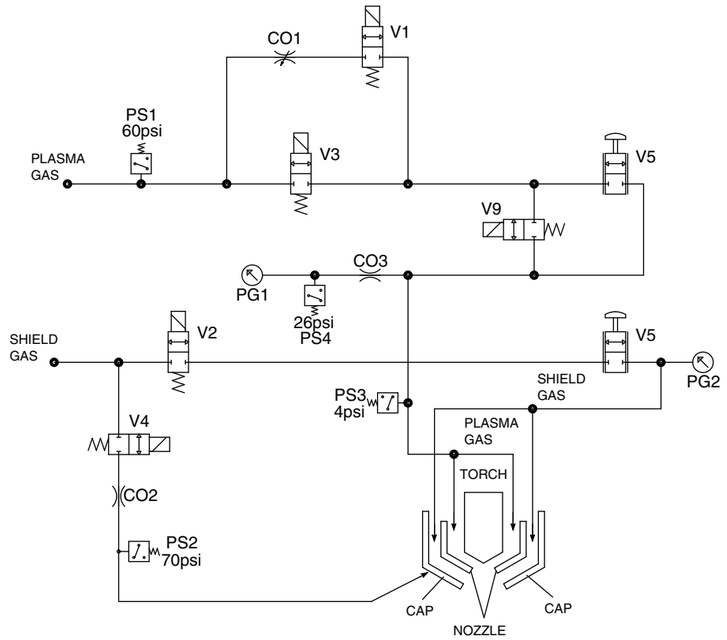
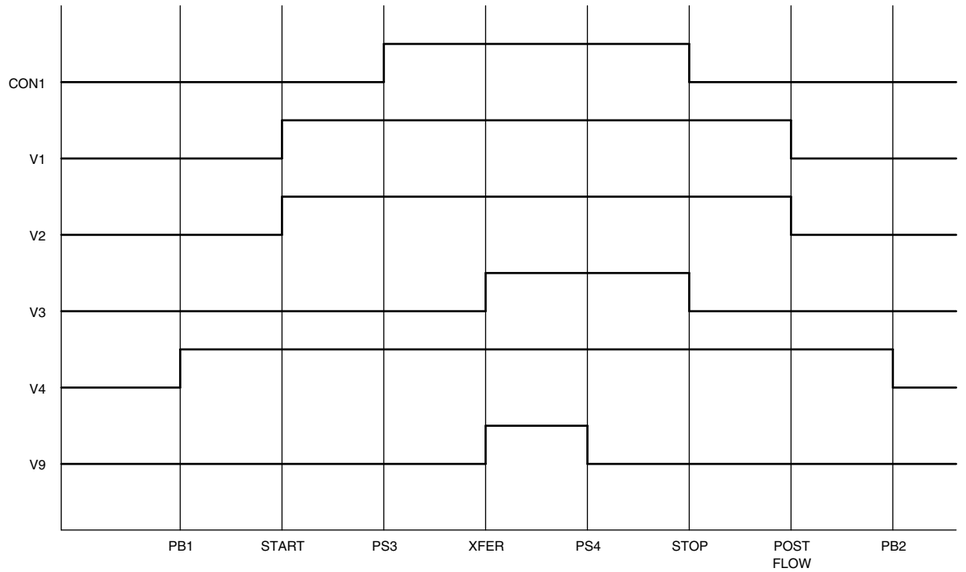


GAS FLOW DIAGRAM



TIMING CHART MAX200

MAX200 TIMING CHART	
CON1	MAIN CONTACTOR
V1	PLASMA PRE/POST FLOW SOLENOID VALVE
V2	SHIELD GAS SOLENOID
V3	PLASMA STEP GAS SOLENOID VALVE
V4	CAP-ON-SENSE SOLENOID VALVE
V9	PLASMA CHARGING VALVE
PB1	POWER ON SWITCH
PB2	POWER OFF SWITCH
PS3	PLASMA GAS OUTLET PRESSURE SWITCH. N.O. SWITCH THAT CLOSES WHEN THE PLASMA GAS PRESSURE EXCEEDS 3 psi
PS4	QUICK CHARGE PRESSURE SWITCH. N.C. SWITCH THAT OPENS WHEN PLASMA GAS REACHES 26 psi
START	PLASMA START SIGNAL FROM CNC
STOP	PLASMA STOP SIGNAL FROM CNC
XFER	ARC TRANSFER
POST-FLOW	1 SECOND GAS FLOW AT END OF CYCLE

NOTES:
1. IN TEST MODE, V1, V2, AND V3 ARE THE ONLY VALVES THAT ARE ACTIVE.
2. WHEN V1 BECOMES ACTIVE AFTER START, 10 TO 15 psi WILL BE REGISTERED AT PG1.
3. THE HV TRANSFORMER IS ACTIVATED 2 SECONDS AFTER THE PLASMA START SIGNAL. IT WILL STAY ACTIVE FOR 5 SECONDS OR UNTIL THE ARC TRANSFERS TO THE WORK PIECE, WHICH EVER HAPPENS FIRST.

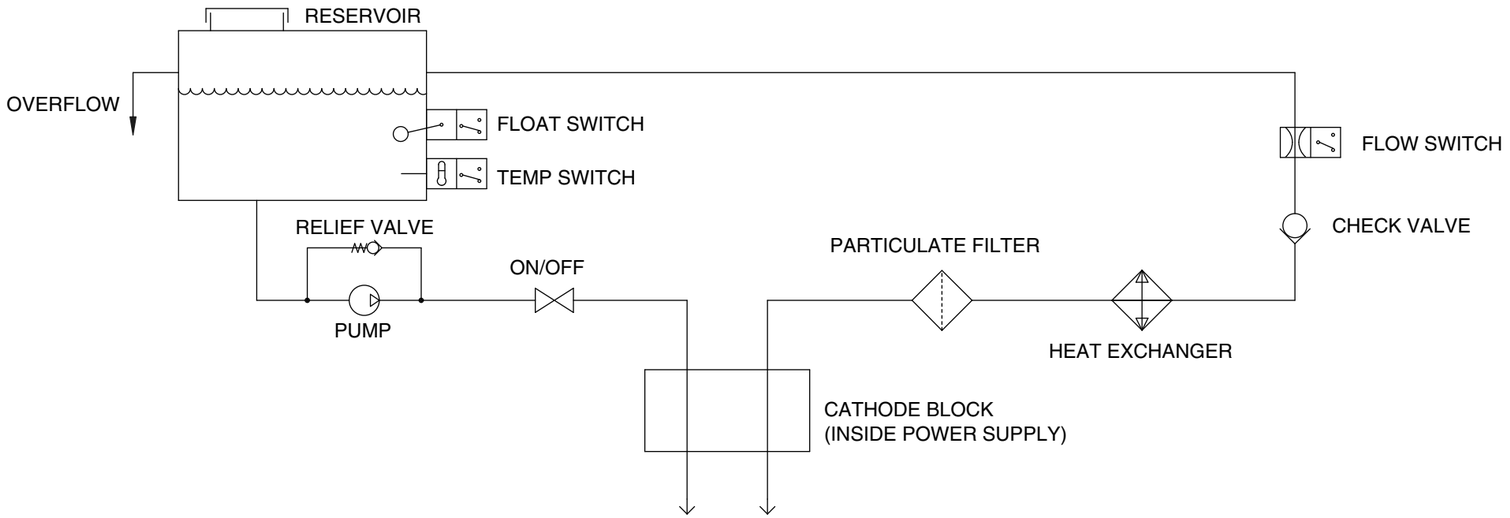
GAS SYSTEM DESIGNATOR

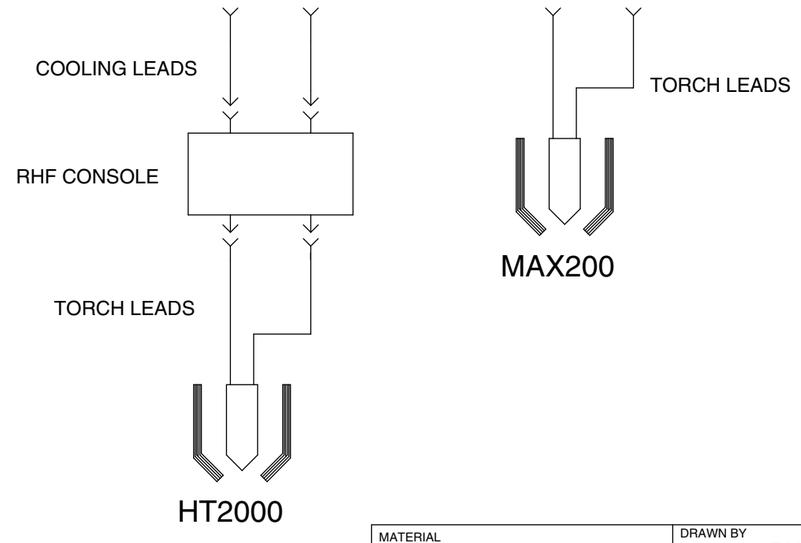
MATERIAL	DRAWN BY: BC	DATE: 5-9-96
	CHECKED BY	DATE
	APP. BY	DATE

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
2 PL DECIMAL ±.01
3 PL DECIMAL ±.005
FRACTIONS ±1/64
ANGULAR ±.5=
PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015.

Hypertherm
Box-5010 Hanover, NH 03755-5010 603/643-3441

DESCRIPTION: ELEC/GAS SCHEM: MAX200			V
ITEM NO.: 013179	DRAWING NO.: 013-2-179	FILE NAME: 013179B9	
SCALE: N/A	MODEL: MAX200	SHEET: 9 OF 9	





MATERIAL	DRAWN BY: BMD	DATE: 8-13-90	Hypertherm Box-5010 Hanover, NH 03755-5010 603/643-3441
	CHECKED BY: MER	DATE: 10-10-91	
	APP. BY: WVB	DATE:	DESCRIPTION: RSVR SA:MAX200/HT2000 PWR SPLY (X)
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES WITHOUT PERMISSION FROM HYPERTHERM, INC.	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: 2 PL DECIMAL ±.01 3 PL DECIMAL ±.005 FRACTIONS ±1/64 ANGULAR ±.5∞ PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015.		ITEM NO.: 029313 · DRAWING NO.: 029-2-313 · FILE NAME: 029313B4 SCALE: N/A · MODEL: · SHEET:

Changed Page	Description of change for revision 15 (date of change - 4/2008)
Revision change pages	Added changes for revisions 14 and 15. Pages moved to the end of the manual.
i - x	Updated EMC and Warranty information to the latest version. Updated table of contents to reflect changes for the new revision.
Section 1, 1a, and 1b	Updated section 1 and 1a with the latest safety sections. Added the Spanish safety section (1b).
4-7	Changed part numbers for items 3, 4, and 24. 005088 to 005151, 005168 to 005187, and 075104 to 075394 respectively.
4-13	Changed part number for item 7 from 008316 to 008945.
4-15	Added a note to "shield gas SA" to see page 4-23. Removed components for "Incoming power TB1 SA" (029316) and made 02916 item number20. Renumbered item numbers 24 through 26. They are now item numbers 21 through 23.
4-17 through 4-19	Changed the part number for the chopper SA from 129118 to 129789.
4-23	Added a note to "shield gas SA" to see page 4-15.
4-25	Removed "HF & I/O PCB SA (029312) and item numbers 16 and 17.
4-29	Changed heat exchanger part number from 027136 to 027978. Added part number 128410 (coolant reservoir upgrade kit), and a note for older systems.
4-30	Changed the part number for the lamp holder from 005088 to 005151.Changed the part number for the coolant filter from 027137 to 027005. Changed coolant pump SA (029325) to a kit number (128384).
4-29	Corrected the part number for item 14 (from 029618 to 129618)
4-31	Corrected the part number for the torch main body. It was 020584 and changed to 120584.
4-35	Replaced obsolete part numbers for 90° hand torches with 25 foot (073008 to 073189) and 50 foot leads (073009 to 073190).
4-36	Changed the part number for the 25 foot water cooled cable from 023324 to 023013. Changed the part number for the 50 foot water cooled cable from 023325 to 023199.
4-44 through 4-48	Changed the part number and description for item number 8 from 046061 (2 inch ID tinned braid) to 046114 (1.5 inch ID tinned braid).
4-51 and 4-53	Changed the part number for item number 4 from 009336 to 009871 (same change for item number 13 on page 4-53).Changed the part number for item number 26 from 002176 to 002127.
4-57 and 4-69	Changed the part number for "swivel #4" (below item number 12) from 015006 to 015259. Also added ferrule (015140) on page 4-69.
4-63	Removed part number 023098 (10 foot [3m]).
4-65	Removed part numbers 027109 and 046023, and added the part number for the heat shrink that is used now, 004656.
4-82	Added part number for screws 075365 (qty 8).
Ap-c	Schematics 013179 and 029313 changed from 8.5 x 11" to 11 x 17 fold outs.

Changed Page	Description of change for revision 14 (date of change - 2/2000)
3-32	Revised chopper figure to new configuration.
4-1	General correction; PAC200E Gouging.
4-11	Revised item 2A and 2B part numbers.
4-15	Revised item 14 part number.
4-23	Revised item 1 part number.
4-45 and 4-46	Note added about extended leads over 75' causing start problems.

PAGE	SUBJECT
Cover	New Revision
Title Page	New Revision
i	Added plumbing/electrical code statement to warranty page
1- 1 thru 6	New safety section
1a- 1 thru 6	New French safety section
3- 3	Revised coolant mixture
4- 28/29	New Coolant tank
4- 31	Corrected Machine torch P/N 020584
4- 41	New 2 inch sleeve P/N 120894
5	Deleted section 5. Diagrams included in appendix C.
6	Deleted section 6. Standards included in section 1.
Appendix C	Revised 013179 sheet 3
Appendix C	Revised 013179 sheet 7
Appendix C	Revised 013179 sheet 8

Changed Page	Description	IM162 Revision 12 1/99
Cover	New Revision	
Title Page	New Revision	
2- 2	Reduced General description text	
2- 3	Added 073036 & 073039 power supply	
2- 4	General correction	
2- 5	Removed Rev 1 reference to machine torch	
2- 6	Revised water muffler option description	
3- 1	Removed Rev 1 reference to machine torch	
3- 2	Removed phone number references	
3- 40	Removed P/N reference	
3- 41	Shifted text to improve usability	
3- 42	Removed Rev 1 reference to machine torch	
3- 43	Removed Rev 1 reference to machine torch	
3- 44	Shifted text to improve usability	
3- 45	Removed Rev 1 reference to machine torch	
4- 1	Removed Rev 1 reference to machine torch	
4- 19	General correction	
4- 21	General correction	
4- 23	Corrected item 32 P/N	
4- 28/29	Revised coolant pump and motor listing	
4- 31	Removed Rev 1 reference to machine torch	
4- 32/33	Added 120667 electrode	
4- 35	Added 120667 electrode	
4- 36/37	Added Rev 1 reference to hand torch	
4- 38 thru 40	Added 120667 electrode	
4- 41,41a,41b	Added new machine torch and optional torches	
4- 62	Added new HIS for the optional 2" torch	
4- 63	Shifted text to improve usability	
4- 70 thru 72	Added 120667 electrode	
4- 74	Added 120667 electrode	
4- 75	General clarification	
4- 76	Added 120667 electrode	
4- 78	General clarification	
b- 1	Spelling correction	
Diagrams	Spelling correction	

Cover	New Revision
Title Page	New Revision
3- 13	Revise warning
3- 14	Revise Figure 3-1
3- 15	New power distribution board PCB6
3- 54 & 55	Delete Figure 3-14 (data included in Diagrams)
4- 28	Revise Figure 4-13, New Solenoid valve subassembly
4- 29	New Solenoid valve subassembly
4- 71	Revise Figure 4-34 to include 020917 shield
Appendix B	New Coolant MSDS
DIAGRAMS	013179, Add sheet 9
DIAGRAMS	Add 029313 Coolant Diagram

4-	32	Added new Electrode
4-	33	Added new Electrode and revised Kit contents
4-	38	Added new Electrode
4-	39	Added new Electrode
4-	40	Added new Electrode and revised Kit contents
4-	70	Added new Electrode
4-	71	Added new Electrode
4-	72	Revised Kit contents

Cover	Uprevved manual due to LVD compliance
Title Page	Uprevved manual due to LVD compliance
0.01	Changed reference from 220-380-415V CE to 400V CE
0.03	updated table of contents
0.04	updated table of contents
0.05	updated table of contents
0.06	updated table of contents
1.01	New Safety section
1.02	New Safety section
1.03	New Safety section
1.04	New Safety section
1a.01	New French Safety section
1a.02	New French Safety section
1a.03	New French Safety section
1a.04	New French Safety section
2.02	Changed reference from 220-380-415V CE to 400V CE
2.04	Changed reference from 220-380-415V CE to 400V CE
3.03	Power Supply - Changed word extinguish after LED to illuminate
3.08	Updated flowchart
3.13	Changed reference from 220-380-415V CE to 400V CE
3.15	New power distribution PCB6 illustration
3.17	New STATUS logic
3.18	New STATUS logic
3.19	New STATUS logic
3.20	New STATUS logic
3.21	New STATUS logic
3.22 - 3.29	Incorporated words illuminate and extinguish into text
4.07	Changed part nos. of items 4 &5
4.09	Changed reference from 220-380-415V to 220-380-400-415V
4.15	Changed reference from 220-380-415V to 220-380-400-415V
4.17	Changed part nos. of items 1 & 2. Added temp switches.
4.19	Changed part no. of chopper. Added temp sw.
4.21	Changed part no. of chopper. Added temp sw.
4.29	New coolant reservoir part no.; added part nos. for gauge, drain valve.
4.30	Changed part nos. in Recommended Spare Parts
a.03	Changed reference from 220-380-415V CE to 400V CE
b.02	Changed warning on propylene glycol to not induce vomiting.
8 sheets	MAX200 wiring diagram format change 013-2-179 Rev K