MAX100D®

380-415V CE

Plasma Arc Cutting System

Instruction Manual
802750 – Revision 0

CE

EN50199
EN50192

Hypertherm®

The world leader in plasma cutting technology

MAX100D
380-415V CE

Instruction Manual

IM-275

(P/N 802750)

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EMC INTRODUCTION

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

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

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

INSTALLATION AND USE

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

ASSESSMENT OF AREA

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

a. Other supply cables, control cables, signalling and telephone cables; above, below and adjacent to the cutting equipment.

b. Radio and television transmitters and receivers.

c. Computer and other control equipment.

d. Safety critical equipment, for example guarding of industrial equipment.

e. Health of the people around, for example the use of pacemakers and hearing aids.

f. Equipment used for calibration or measurement.

g. Immunity of other equipment in the environment. User shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures.

h. Time of day that cutting or other activities are to be carried out.

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

METHODS OF REDUCING EMISSIONS

Mains Supply

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

Maintenance of Cutting Equipment

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

Cutting Cables

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

Equipotential Bonding

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

Earthing of Workpiece

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

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

Screening and Shielding

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

WARNING

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

WARNING

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

GENERAL

Hypertherm, Inc. warrants that its Products shall be free from defects in materials and workmanship, if Hypertherm is notified of a defect (i) with respect to the power supply within a period of two (2) years from the date of its delivery to you, with the exception of G3 Series power supplies, which shall be within a period of three (3) years from the date of delivery to you, and (ii) with respect to the torch and leads within a period of one (1) year from its date of delivery to you. This warranty shall not apply to any Product which has been incorrectly installed, modified, or otherwise damaged. Hypertherm, at its sole option, shall repair, replace, or adjust, free of charge, any defective Products covered by this warranty which shall be returned with Hypertherm's prior authorization (which shall not be unreasonably withheld), properly packed, to Hypertherm's place of business in Hanover, New Hampshire, or to an authorized Hypertherm repair facility, all costs, insurance and freight prepaid. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph or with Hypertherm's prior written consent. **The warranty above is exclusive and is in lieu of all other warranties, express, implied, statutory, or otherwise with respect to the Products or as to the results which may be obtained therefrom, and all implied warranties or conditions of quality or of merchantability or fitness for a particular purpose or against infringement. The foregoing shall constitute the sole and exclusive remedy for any breach by Hypertherm of its warranty**. Distributors/OEMs may offer different or additional warranties, but Distributors/OEMs are not authorized to give any additional warranty protection to you or make any representation to you purporting to be binding upon Hypertherm.

PATENT INDEMNITY

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

LIMITATION OF LIABILITY

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

LIABILITY CAP

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

INSURANCE

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

NATIONAL AND LOCAL CODES

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

TRANSFER OF RIGHTS

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

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Section 1

SAFETY

In this section:

RECOGNIZE SAFETY INFORMATION

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

FOLLOW SAFETY INSTRUCTIONS

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

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

DANGER WARNING CAUTION

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

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

CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire Prevention

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

Explosion Prevention

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

WARNING

Explosion Hazard
Argon-Hydrogen and Methane

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

WARNING

Hydrogen Detonation with Aluminum Cutting

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


ELECTRIC SHOCK CAN KILL

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

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

Electric Shock Prevention

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

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

CUTTING CAN PRODUCE TOXIC FUMES

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

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

A PLASMA ARC CAN CAUSE INJURY AND BURNS

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

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

ARC RAYS CAN BURN EYES AND SKIN

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

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

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

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

GROUNDING SAFETY

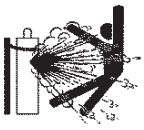
Work Cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

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

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

COMPRESSED GAS EQUIPMENT SAFETY

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



GAS CYLINDERS CAN EXPLODE IF DAMAGED

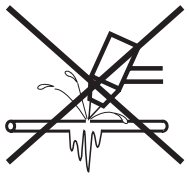
Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

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

NOISE CAN DAMAGE HEARING

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

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



A PLASMA ARC CAN DAMAGE FROZEN PIPES

Frozen pipes may be damaged or can burst if you attempt to thaw them with a plasma torch.

PACEMAKER AND HEARING AID OPERATION

Pacemaker and hearing aid operation can be affected by magnetic fields from high currents.
Pacemaker and hearing aid wearers should consult a doctor before going near any plasma arc cutting and gouging operations.

To reduce magnetic field hazards:

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

ADDITIONAL SAFETY INFORMATION

1. ANSI Standard Z49.1, *Safety in Welding and Cutting,* American Welding Society, 550 LeJeune Road P.O. Box 351020, Miami, FL 33135
2. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes,* American National Standards Institute 1430 Broadway, New York, NY 10018
3. ANSI Standard Z87.1, *Safe Practices for Occupation and Educational Eye and Face Protection,* American National Standards Institute, 1430 Broadway, New York, NY 10018
4. AWS F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances,* American Welding Society 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
5. AWS F5.2, *Recommended Safe Practices for Plasma Arc Cutting,* American Welding Society 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
6. CGA Pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders,* Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202
7. CSA Standard W117.2, *Code for Safety in Welding and Cutting,* Canadian Standards Association Standard Sales 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3, Canada
8. NFPA Standard 51B, *Cutting and Welding Processes,* National Fire Protection Association 470 Atlantic Avenue, Boston, MA 02210
9. NFPA Standard 70–1978, *National Electrical Code,* National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210
10. OSHA, *Safety and Health Standards,* 29FR 1910 U.S. Government Printing Office, Washington, D.C. 20402

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Section 1a

SÉCURITÉ

Dans cette section :

IDENTIFIER LES CONSIGNES DE SÉCURITÉ

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

SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

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

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

DANGER AVERTISSEMENT PRÉCAUTION

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

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

LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

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

Prévention des explosions

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

AVERTISSEMENT

Risque d'explosion argon-hydrogène et méthane

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

AVERTISSEMENT

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

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


LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

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

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

Prévention des chocs électriques

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

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

LE COUPAGE PEUT PRODUIRE DES VAPEURS TOXIQUES

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

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

L'ARC PLASMA PEUT PROVOQUER DES BLESSURES OU DES BRÛLURES

Torches à allumage instantané

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

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

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

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

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

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

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

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

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

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

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

MISE À LA MASSE ET À LA TERRE

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

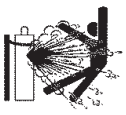
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

Alimentation

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

SÉCURITÉ DES BOUTEILLES DE GAZ COMPRIMÉ

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



LES BOUTEILLES DE GAZ COMPRIMÉ PEUVENT EXPLOSER EN CAS DE DOMMAGES

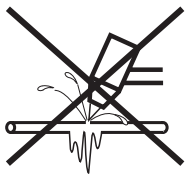
Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

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

LE BRUIT PEUT PROVOQUER DES PROBLÈMES AUDITIFS

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

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



UN ARC PLASMA PEUT ENDOMMAGER LES TUYAUX GELÉS

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

PACEMAKERS ET PROTHÈSES AUDITIVES

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

Pour réduire les risques associés aux champs magnétiques :

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

Hypertherm

Section 2

SPECIFICATIONS

In this section:

General

Hypertherm's MAX100D is a dual-gas system designed for cutting most metals from gauge to 32 mm thick. In addition to hand cutting, it can be used with a machine torch and a THC-2 Torch Height Control system for high-speed mechanized cutting.

The MAX100D provides continuously variable current output from 30 to 100 Amps for optimum performance on all thicknesses of metal up to 32 mm thick. This allows the operator wide variations in cutting speeds on the same thickness of metal. Two nozzle sizes (60-Amp and 100-Amp) provide high-quality cuts throughout its range of cut thicknesses.

The system can also provide a continuous pilot arc which allows high-quality cutting of perforated or expanded metal without any appreciable deterioration in parts life. This feature is only available for use with the 60-Amp nozzle.

The unique MAX100D power supply design uses transistor technology to produce a very smooth constant current DC output.

Air can be used as the primary plasma gas, providing low operating costs combined with high-speed performance. Cylinder air or shop air is acceptable as long as it is free of moisture, oil, and particulate matter contamination. For better cut quality on metals such as stainless steel, aluminum, and other non-ferrous materials, use either nitrogen, argon/hydrogen (Hypertherm recommends a mixture of 35% hydrogen and 65% argon), or a mixture of argon/hydrogen and nitrogen as the plasma gas. Air, nitrogen, and carbon dioxide are the shield gases that can be used.

In addition to cutting, the MAX100D can be used for plasma arc gouging. Both mechanized and hand gouging capabilities are provided. Air and H35 are the plasma gases for the gouging application. When H35 is used as the plasma gas, high gouging efficiency is achieved. Air gouging has lower efficiency but is economical on gas consumption.

Product Specifications

MAX100D Power Supply

The MAX100D is a constant current, secondary converter chopper power supply providing continuously variable amperage from 30 Amps to 100 Amps. It conforms to the following specifications:

Maximum OCV (U_0) .....280 VDC

Output Current (I_2).....30-100 A

Output Voltage (U_2) .....90-150 VDC

Duty Cycle Rating (X) .....800% @ 15 KW, 40° C (104° F)

Ambient Temperatures/Duty Cycle.....Power supplies will operate between +14° and 104° F (-10° and +40° C). Power supplies operated in an ambient temperature above 86° F (30° C) may show some decrease in duty cycle.

Input Power (Input Voltage (U_1) x Input Current (I_1)**:**
#059199 .....380/415V, CE/LVD, 3PH, 50/60 Hz, 28/26 Amps

Dimensions and Weight:
Width .....673 mm
Height.....1092 mm
Depth.....806 mm
Weight .....205 kg

Gas Requirements:
Plasma Gas Types .....Air, Nitrogen (N_2), Argon/Hydrogen (H35 = 35% hydrogen and 65% argon), Argon/Hydrogen-Nitrogen mixture.
Shield Gas Types .....Air, Carbon Dioxide (CO_2), Nitrogen (N_2)
Gas Quality ..... Clean, dry, oil-free
Plasma Gas Flow .....58 l/min
Shield Gas Flow .....208 l/min
Plasma Gas Inlet Pressure .....5.4 bar to 8.5 bar dynamic (flowing) pressure.
Shield Gas Inlet Pressure .....5.4 bar to 8.5 bar dynamic (flowing) pressure.

Plasma Gas and Shield Gas Pressures in
Test and Operate modes.....See *Cut / Gouging Chart* data in **Section 4**

MAX100D Machine Torch

Maximum mechanized cutting.....16 mm

Maximum current at 80% duty cycle .....100 Amps

Maximum temperature at torch head .....149° C

Gouging capability (metal removal rate):
H35 as plasma gas .....6.8 kg/hour
Air as plasma gas.....3.6 kg/hour

Gas Flow .....208 l/min at 4.1 bar with 100 amp consumables

Weight .....0.79 kg

WARNING

The voltage between the tip of the torch and the workpiece will exceed 113 VDC if shielded consumable parts are not installed in the hand torches. The hand torches must be operated with shielded parts to maintain the S mark and CE low voltage compliance for hand held applications. This requirement does not apply to machine torch applications.

PAC160 Hand Torch

Maximum cutting thickness range.....32 mm

Maximum current at 80% duty cycle .....100 Amps

Maximum temperature at torch head .....149° C

Gas Flow .....208 l/min at 4.1 bar with 100 amp consumables

Weight .....0.68 kg

PAC160E Hand Torch

Maximum cutting thickness range.....32 mm

Maximum current at 80% duty cycle .....100 Amps

Maximum temperature at torch head .....149° C

Maximum temperature at torch handle .....60° C with hand heat shield

Gouging capability (metal removal rate):
H35 as plasma gas .....6.8 kg/hour
Air as plasma gas.....3.6 kg/hour

Gas Flow .....208 l/min at 4.1 bar with 100 amp consumables

Weight .....1.14 kg with hand heat shield

Dual Gas Mixer – Optional

The MAX100D gas mixer is used to provide an H35 - Nitrogen gas mixture for high-quality stainless-steel cutting (See *Cut / Gouging Chart* data in **Section 4**)

Plasma inlet pressure (dynamic) .....6.8 bar

Plasma outlet pressure (dynamic).....4.1 bar

Percentage of mixture .....0 to 100%

Plasma flow rate.....35 l/min

Dimensions and Weight:
Width .....292 mm
Height.....371 mm
Depth.....102 mm
Weight .....7.3 kg

THC-2 – Optional

See IM20 (#800200) for details and instructions for the THC-2 Torch Height Control system.

Hypertherm

Section 3

SETUP

In this section:

Upon Receipt

Verify that all components listed below are present. Alert your distributor if any parts are missing. All communications regarding this equipment must include the model number and serial number (located on the back of the MAX100D).

PAC160 System – Hand Torch Configuration:

- MAX100D power supply with 7.6 meter work cable (ground) and clamp
- PAC160 hand torch with torch lead assembly
- Consumable spare parts kit (#028649)

PAC160E System – Extended Hand Torch Configuration:

- MAX100D power supply with 7.6 meter work cable (ground) and clamp
- PAC160E hand torch with torch lead assembly
- Consumable spare parts kit (#028665)
- Hand heat shield (#020711)

MAX100D System – Machine Torch Configuration:

- MAX100D power supply with 7.6 meter work cable (ground) and clamp
- MAX100D machine torch and torch lead assembly
- Consumable spare parts kit (#028650)

- Dual Gas Mixer – optional (#059123)
- THC-2 Torch Height Control – optional (#052002)

Note: For detailed part number information, see the *Parts List* (**Section 6**).

Claims and Technical Questions

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

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

1. Read *Troubleshooting* in the **Maintenance** section (**Section 5**) of this manual. You may find the problem is quite easy to fix, such a loose connection.

2. If you are unable to solve the problem, call your distributor. He will be able to help you, or refer you to an authorized Hypertherm repair facility.

3. If you need additional assistance, contact the nearest Hypertherm Technical Service Department listed at the front of this manual.

Introduction

The following requirements must be fulfilled prior to the installation of the MAX100D plasma cutting system. Please read these requirements carefully. Their purpose is to aid you in the installation of your plasma cutting system and to allow maximum performance.

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

For installation, operation or service questions or problems, contact the nearest Hypertherm Technical Service Department listed at the front of this manual.

Gas Supply Requirements

Two different sources of air can be used to supply the MAX100D. The setting should be flowing (dynamic):

Cylinder Compressed Air

The cylinder air supply must be clean, dry and oil-free. The cylinder regulator must be used only for compressed air and must be capable of delivering at least **208 liters/minute** of air at **5.4 bar** to **8.5 bar** output pressure.

> **Caution:** **Do not exceed 8.5 bar delivery pressure to the system. Exceeding this pressure will cause shortened torch parts life.**
>
> **Pressures in excess of 8.5 bar can also damage the pressure gauge that is located on top of the MAX100D filter. If delivery pressure is greater than 8.5 bar, turn regulator on top of the MAX100D filter counterclockwise to decrease the pressure to the system.**

Shop Compressed Air

Shop compressed air must be clean, dry and oil-free if used to supply the MAX100D. Poor quality air reduces cut speeds, produces poor cut quality, and reduces parts life. Shop air must be available at a minimum dynamic pressure of **5.4 bar** and must be routed through the regulator and filter supplied with the system. The regulator and filter are mounted at the top rear of the MAX100D power supply.

If the shop air is not clean, refer to Appendix A for recommended filter specifications. These filters are available from any industrial supplier.

> **Caution:** **Do not exceed 8.5 bar delivery to the system. Exceeding this pressure will cause shortened torch parts life.**

Note: Whether you use a compressed air cylinder or shop compressed air:

- Use an inert gas hose to connect the gas supply to the input connection on the air regulator mounted at the rear of the power supply.
- Use a filter to maintain a high air purity level. All moisture, oil and other contaminants must be removed.

Plasma and Shield Gases

When nitrogen, argon/hydrogen, or an argon/hydrogen-nitrogen mixture is used as the plasma gas, and nitrogen or carbon dioxide is used as the shield gas, they must be supplied to the MAX100D at 99.995% purity. The source can be compressed gas cylinders or liquid containers. The gas supply source must be capable of delivering a minimum of **208 liters/minute** at a delivery pressure of **5.4 bar**. Refer to the *Cut / Gouging Charts* in **Section 4** for detailed information.

Hoses

To obtain the proper plasma and shield gas flow rates and pressures, use hose that meets the following specifications:

I.D.: **9.5 mm minimum**
Length: **30 m maximum**

Purity

If the purity level of the plasma gas is too low, cut speeds decrease, cut quality deteriorates, cutting thickness capability decreases, and parts life shortens.

Note: These conditions also occur if there are leaks in the gas supply hoses or connections.

Grounding Requirements

The plasma system must be properly grounded to ensure personal safety, and to reduce emission of radio frequency interference.

- Connect the work table to a high-quality earth ground within 6 m of the table. A suitable ground consists of a solid copper rod of at least 13 mm diameter driven to a depth of at least 2.5 m into the earth below the permanent moisture level.
- For more information, refer to applicable national and local electrical codes.

Power Requirements

Line Disconnect Switch

- Use a primary line disconnect switch for each power supply. This disconnect switch allows you to turn the power supply off quickly in an emergency situation. The switch should be located on a wall near the power supply, and be easily accessible to the operator. The interrupt level of the switch must be equal to or exceed the continuous rating of the fuses. The line disconnect fuses should be sized according to the table below:

Input Voltage	Rated Input Current	Time Lag type gG Fuse Size	Recommended Power Cord Gauge Size (mm^2)			
			to 25 m	25-50 m	50-75 m	75-100 m
380 VAC	28 A	40 A	4 mm^2	6 mm^2	10 mm^2	16 mm^2
415 VAC	26 A	40 A	4 mm^2	6 mm^2	10 mm^2	16 mm^2

Power Cables

- Power cables are supplied by the customer.
- Cable sizes vary based on the distance of the receptacle from the main box – see table above. In Europe, use a 4-conductor Harmonized (“HAR”) type cord. 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 i in the front part of this manual for further power (supply) cable shielding recommendations.
- To connect power cable to power supply, see *Power Cable Connection* later in this section.

Power Supply Placement

- Place the power supply in an area that is free of excessive moisture, is relatively clean, and has proper ventilation so that air flow is not blocked in any way. (Cooling air is drawn in through the front panel grating, and is exhausted through the rear of the unit by a cooling fan.)
- Do not place any filter device over the air intake locations. This reduces cooling efficiency and VOIDS THE WARRANTY..

Power Supply Electrical Connections

380/415V Linkboard Configurations

The 380/415-volt power supply is shipped from the factory linked for 380-volt operation. The links must be moved for 415-volt operation. See Figure 3-1.

WARNING

Danger: High Voltage. Line voltage may be present on this linkboard. Disconnect input power before servicing.

1. Remove the left-side cover of the power supply, and locate the linkboard on the inside front wall.
2. Ensure that the linkboard is configured for the proper line voltage.

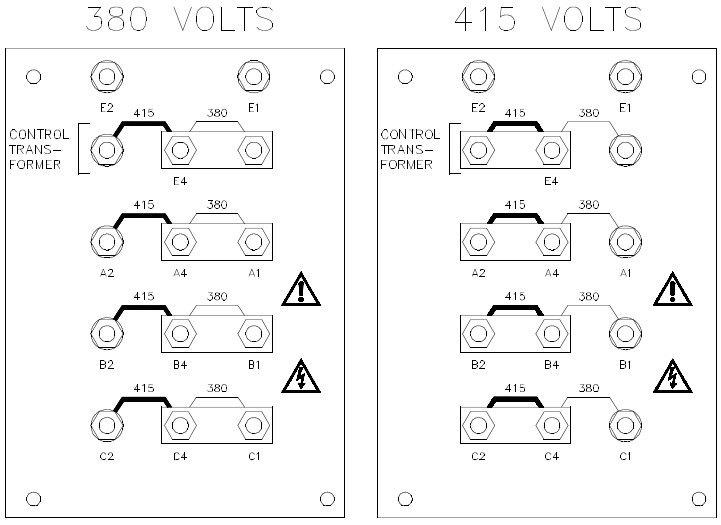


Figure 3-1 Dual Voltage 380/415-Volt Linkboard

Power Cable Connection

Power Cable to MAX100D Power Supply

1. Locate the EMI filter box on the rear of the power supply.
2. Unscrew the filter cover screws and remove the cover for access to the input voltage connections.
3. Insert the power cable through the strain relief.
4. Connect leads L1 to U, L2 to V, and L3 to W terminals of the filter (see Fig. 3-2). Ensure that all connections are tight to avoid excessive heating.
5. Connect the ground lead to rear terminal of filter marked. ⏚

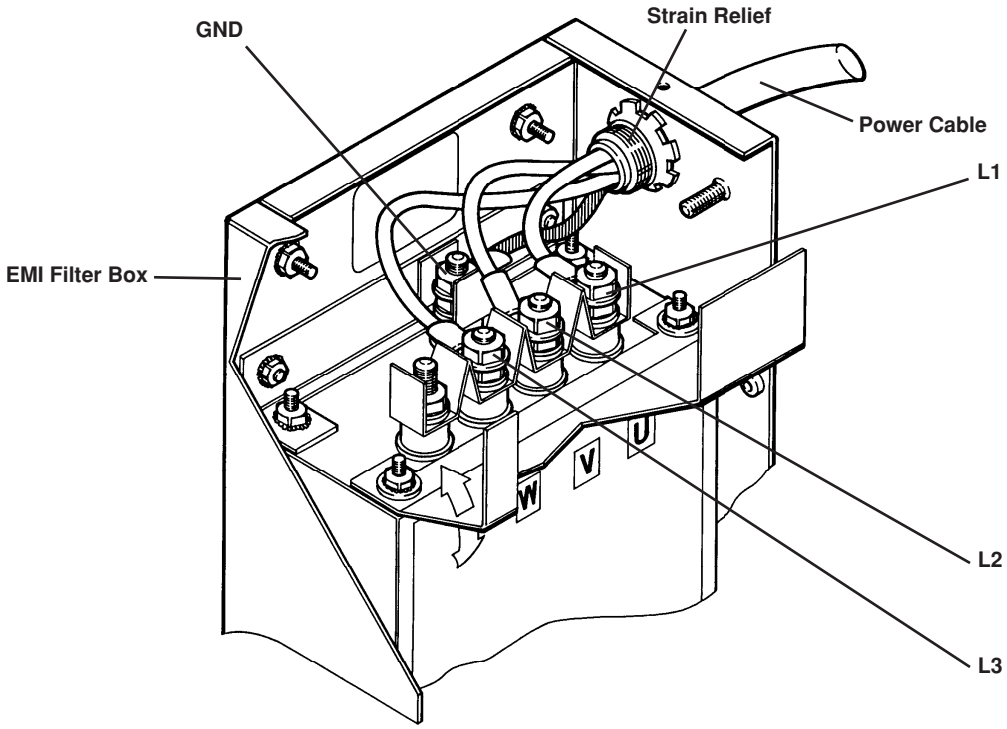


Figure 3-2 MAX100D Primary Power Connections

WARNING

There is line voltage at the filter even if the I (ON) pushbutton on the MAX100D power supply has not been pressed. 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. In the U.S., use a "lock-out / tag out" procedure until the service or maintenance work is complete. In other countries, follow appropriate national or local safety procedures.

Power Cable Connection (Continued)

Power Cable from MAX100D Power Supply to Power Source

1. **Be certain that the line disconnect switch is in the OFF position.**
2. Connect the power cord leads to the line disconnect switch. Follow applicable national or local electrical codes.
3. **Be certain that the line disconnect switch remains in the OFF position during the rest of the setup of the MAX100D system.**

Remote Start/Stop Switch (Optional)

To connect the remote start/stop switch:

1. Pass the remote start/stop switch cable assembly through the strain relief at the rear of the MAX100D.
2. Connect wires 33 and 34 to TB1-5 and TB1-6 for machine “start.” (See Figure 6-5 for location of TB1, and Figure 3-3 for detail of TB1.)
3. Connect wires 37 and 38 to TB1-7 and TB1-8 for “auxiliary 24-volt AC input.”

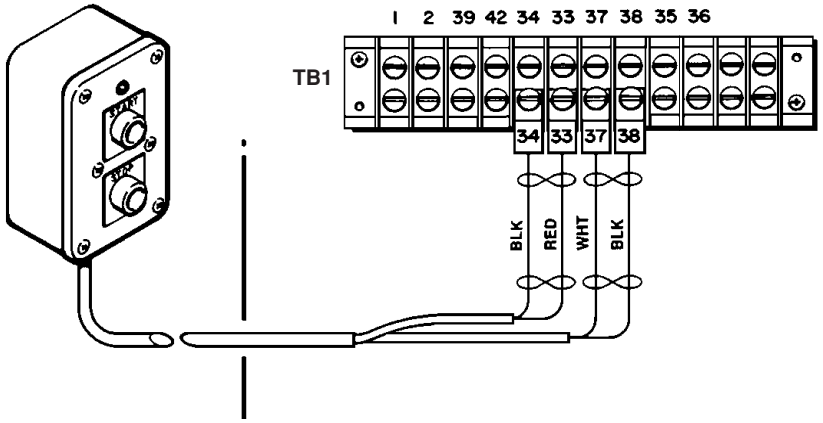


Figure 3-3 Remote Start/Stop Switch Connections

Machine Computer Interface (Optional)

The customer must supply 2-pair twisted 22 AWG (American Wire Gauge) cable (or equivalent).

Refer to TB1 on page 7-2 in the *Wiring Diagrams* for machine interface connections.

Power Supply Gas Connections

Plasma Gas Connections

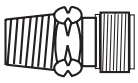
1. When using **nitrogen** or **argon**/**hydrogen** as the plasma gas, connect hose from source to the connector on the rear of the plasma gas console located on the top of the power supply labeled **PLASMA GAS**. (Fig. 3-4)

2. When using **air** as the plasma gas, connect hose from **SOURCE SUPPLY** to the connector located on the left of the regulator on the rear of the power supply. (Fig. 3-6) Remove **TEE PLUG** on right side of regulator, and connect 0.5 m hose (#024373) from the tee to the **PLASMA GAS** inlet on the plasma gas console. (Fig. 3-6, 3-4)

3. ***If you are not cutting with an H35-N_2 mixture, skip this step (3).***

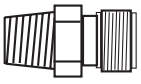
   When using a **nitrogen** and **argon**/**hydrogen** mixture as the plasma gas, the optional Dual Gas Mixer must be used. The mixer is secured to the rear and top of the Plasma Gas Console with four 8-32 screws.

#015230



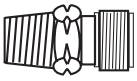
- Attach the left-handed adapter (#015230) included in the Dual Gas Mixer hose package (#028721) to the argon/hydrogen (H35) tank. Find the red 7.6 meter left-hand threaded hose (#024384) from the package and connect the hose from the argon/hydrogen tank to **INLET1** of the Dual Gas Mixer.

#015009



- Attach the right-handed adapter (#015009) included in the Dual Gas Mixer hose package (#028721) to the nitrogen tank. Find the blue 7.6 meter right-hand threaded hose (#024205) from the package and connect the hose from the nitrogen tank to **INLET2** of the Dual Gas Mixer.

#015230
(remove from hose)



- Find the 610 mm red hose (#024374) from the hose package and remove the left-hand connector (#015230). Attach this connector to the **PLASMA GAS** inlet on the rear of the Gas Console. Connect the hose from the Dual Gas Mixer **OUTLET** to the **PLASMA GAS** inlet at the rear of the plasma gas console.

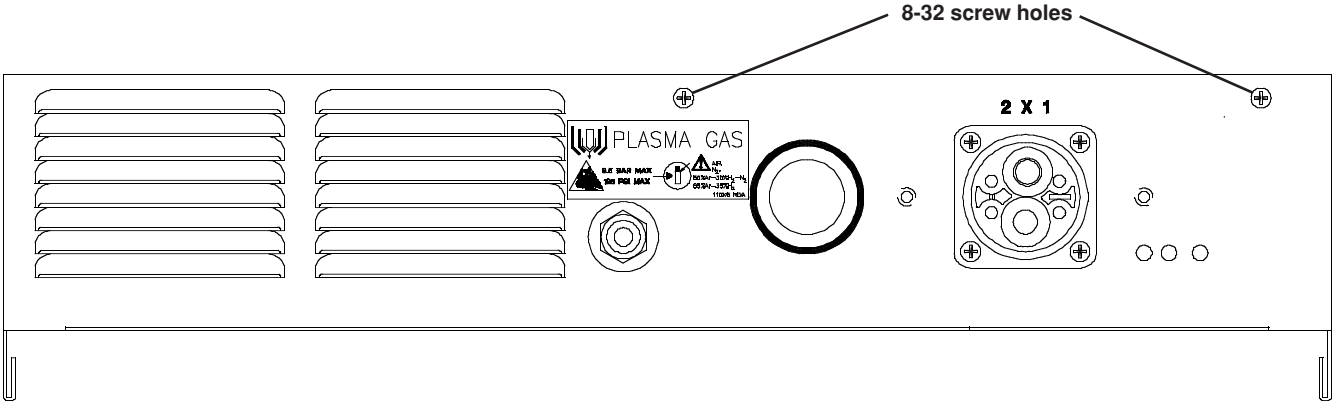


Figure 3-4 Plasma Gas Console Connections and Torch Connection

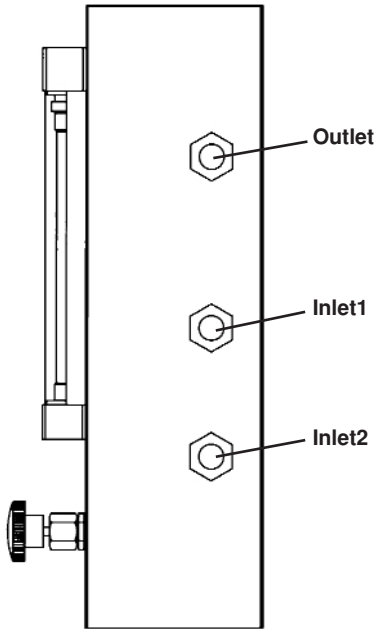


Figure 3-5 Dual Gas Mixer Connections

Shield Gas Connections

1. When using **air, nitrogen** or **carbon dioxide** as the shield gas, connect hose from **SOURCE SUPPLY** to the connector on the left of the regulator on the rear of the power supply. (Fig. 3-6)

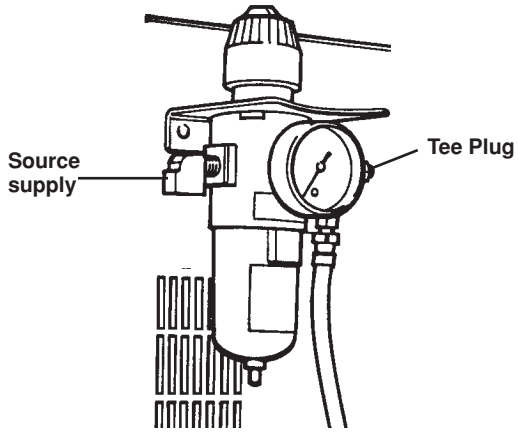


Figure 3-6 Shield Gas Power Supply Connections and Air Plasma Gas Connection

Connecting the Torch

Torch Leads to Power Supply

1. Align the **TORCH CONNECTOR Key Plug** with the **2X1 RECEPTACLE Key Slot** (on the plasma gas console) and push in until the pins seat. (Figure 3-7)

2. Turn the connector **Securing Ring** 1/4 turn counterclockwise to ensure that the securing ring threads and the receptacle threads are aligned prior to tightening.

> **Caution: The connector securing ring and 2X1 receptacle are fine-threaded. Thread damage could occur if cross-threaded.**

3. Turn the connector securing ring clockwise to tighten.

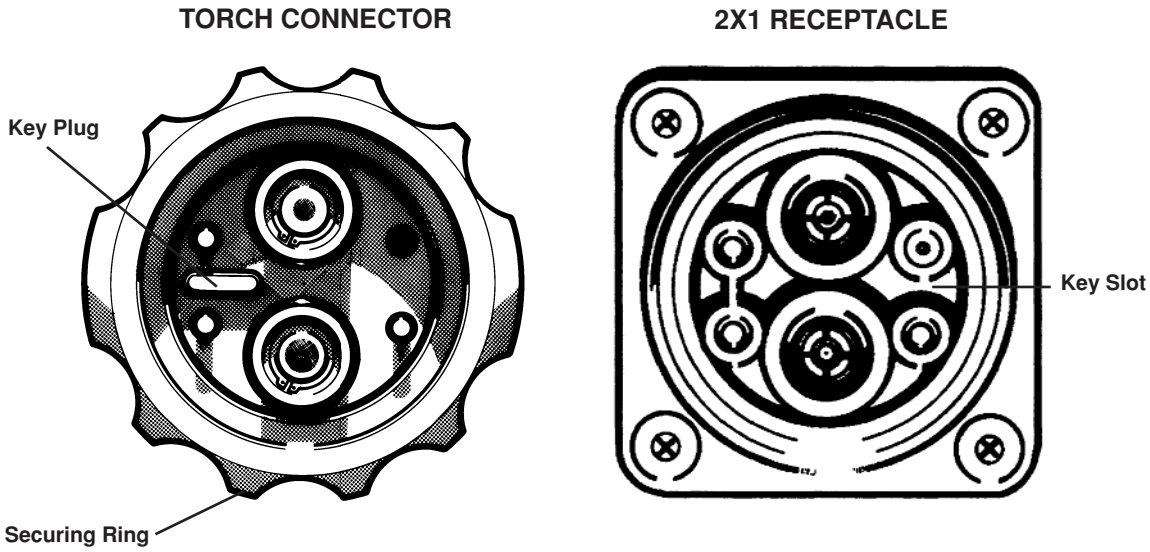


Figure 3-7 Quick Disconnect Alignment

Hypertherm

Section 4

OPERATION

In this section:

Description of Controls and Indicators

Plasma Gas Console Panel (Figure 4-1)

- **GOUGING / CUTTING Application Switch**
  Changes pilot arc current for gouging or cutting operations.

- **PLASMA Gas Adjustment Valve**
  Adjusts plasma gas pressure in TEST position.

- **PLASMA Gas Pressure Gauge**
  Indicates dynamic (flowing) plasma gas pressure.

MAX100D Control Panel (Figure 4-2)

- **Green I (ON) button**
  Activates the power supply and its control circuits.

- **Red O (OFF) button**
  Shuts the power supply down.

- **White POWER ON light**
  Illuminates after the I (ON) button is released to indicate that all control circuits are activated, safety interlocks are satisfied, and the system is ready for operation.

- **Green GAS PRESSURE light**
  Illuminates after the I (ON) button is released to indicate that the gas pressure is adequate. If power supply shuts down and light is not illuminated when the I (ON) button is pushed, then the gas pressure is inadequate.

- **Yellow OVER-TEMPERATURE light**
  Normally not illuminated. If power supply shuts down and light is illuminated when the I (ON) button is pushed, then the power transformer and/or the chopper has overheated.

- **AMPS output adjustment knob**
  Adjusts output current between 30 and 100 amps. (Increase the amperage to cut thicker material.)

- **PLATE – EXPANDED/NORMAL switch**
  In EXPANDED (up) position, a continuous pilot arc remains on. This setting is recommended for cutting expanded plate. Never exceed 40 amps while in this position.

  Use in NORMAL (down) position when cutting normal plate.

Description of Controls and Indicators (cont.)

- **GAS TEST/RUN switch**
  In **TEST** position, gases flow so that adjustments to both shield and plasma gas pressures can be made. **RUN** position is used after gases have been set in **TEST** position, and cut is about to be made.

- **SHIELD Gas Adjustment Valve**
  Adjusts shield gas pressure in **TEST** position.

- **SHIELD Gas Pressure Gauge**
  Indicates dynamic (flowing) plasma gas pressure.

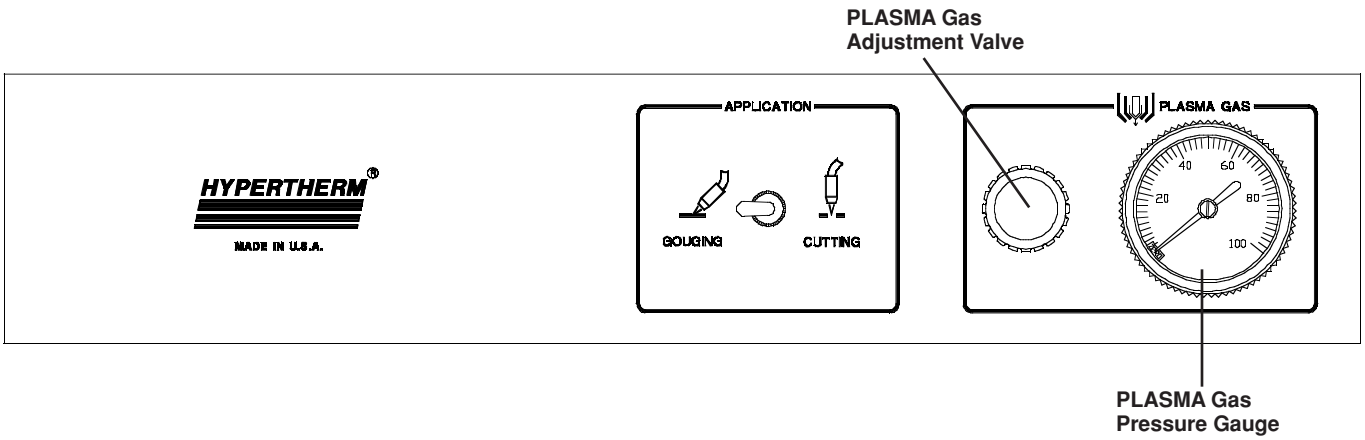


Figure 4-1 Plasma Gas Console Panel

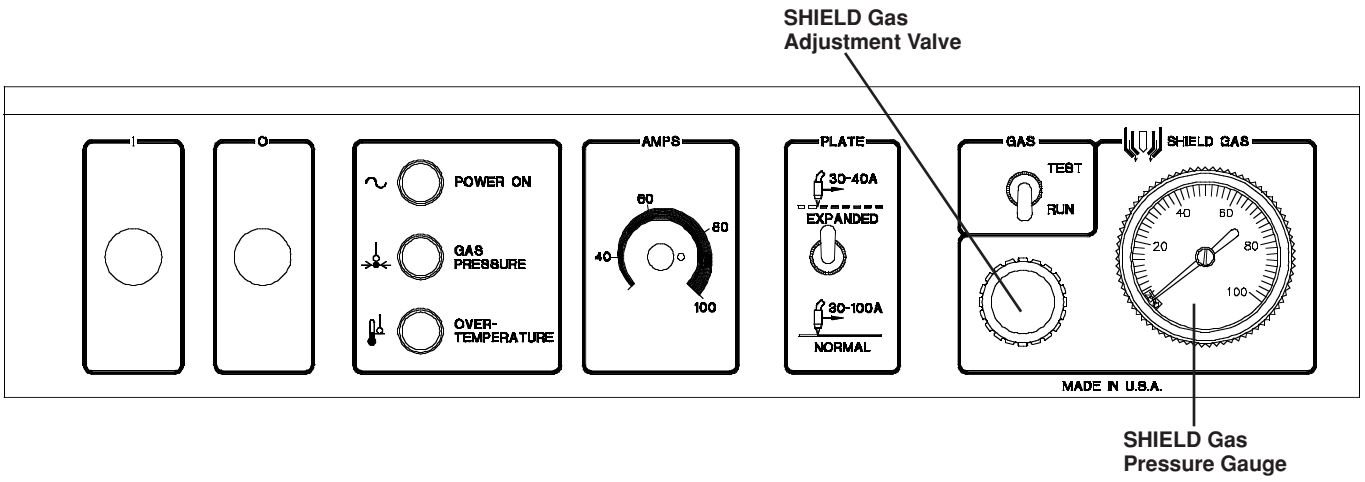


Figure 4-2 MAX100D Control Panel

Description of Controls and Indicators (cont.)

Dual Gas Mixer (Figure 4-3)

Note: If you are <u>not</u> cutting with an H35-N_2 mixture, skip this page.

- **GAS1 Adjustment Valve**
  Adjusts plasma flow for gas component #1 that is plugged into **INLET1**.
- **GAS1 Flowmeter**
  Indicates flow rate of gas component #1 that is sent to the Plasma Gas Console.
- **GAS1 Pressure Gauge**
  Indicates plasma **GAS1** inlet pressure.
- **GAS2 Adjustment Valve**
  Adjusts plasma flow for gas component #2 that is plugged into **INLET2**.
- **GAS2 Flowmeter**
  Indicates flow rate of gas component #2 that is sent to the Plasma Gas Console.
- **GAS2 Pressure Gauge**
  Indicates plasma **GAS2** inlet pressure.
- **OUTLET Pressure Gauge**
  Indicates plasma gas mixture outlet pressure.

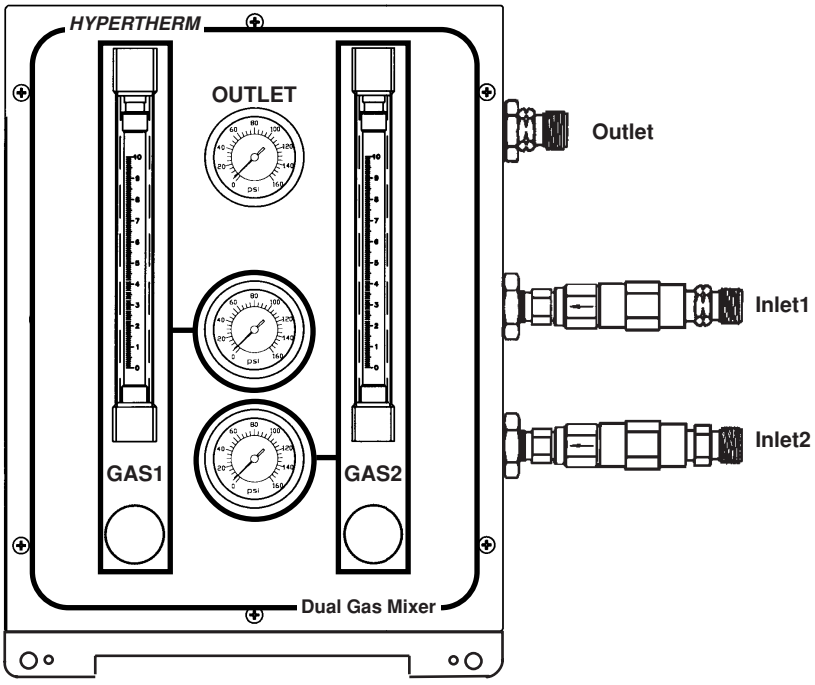


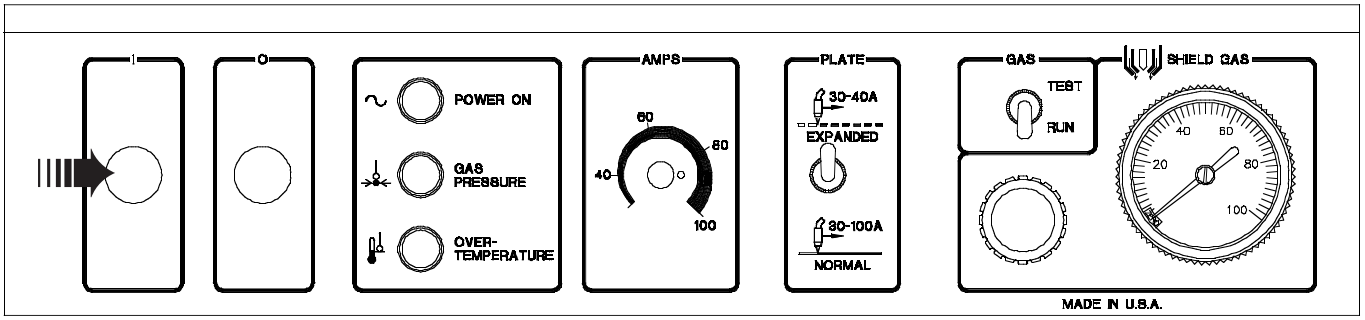
Figure 4-3 Gas Mixer

Operating Instructions

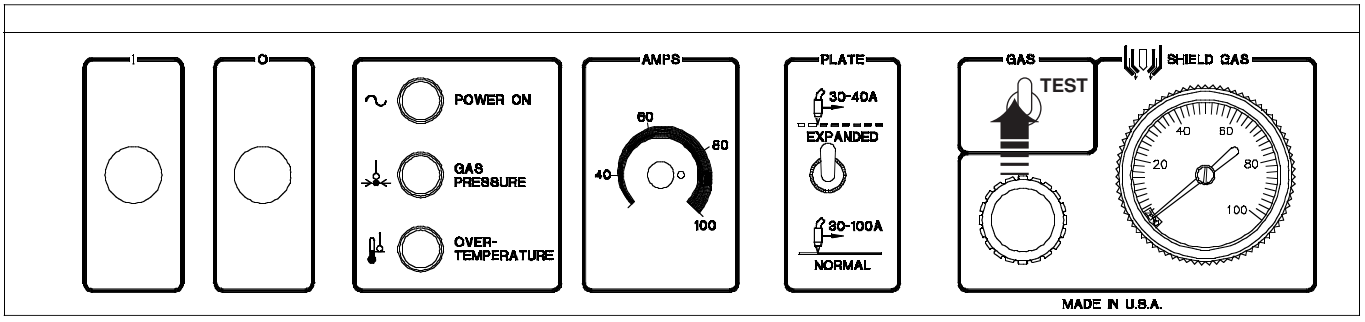
WARNING

Before operating this system, you must read the *Safety* section of this manual thoroughly!

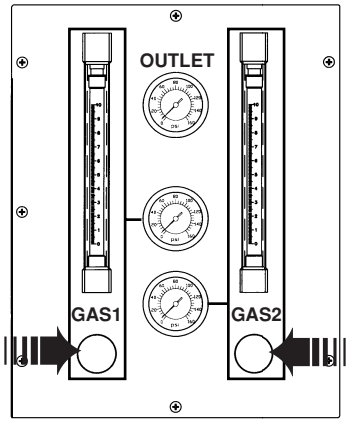
1. Ensure that the work environment and your clothing meet the safety requirements outlined in the *Safety* section.
2. Follow the system installation instructions in the *Setup* section.
3. Be sure that the correct consumable parts are in the MAX100D torch. See *Cut / Gouging Charts* later in this section for correct consumables.
4. Turn on the facility gas supply. Adjust incoming plasma and shield gas pressures to a minimum of **5.4 bar**.
5. Apply 3-phase power to the MAX100D.
6. Press the green **I (ON)** button to power up the system. Hold it down until the white **POWER ON** light and the green **GAS PRESSURE** light both illuminate.



7. Place the GAS TEST/RUN switch in the **TEST** position. Gases will flow through the system.



8. ***If you are <u>not</u> cutting with an H35-N_2 mixture, skip this step (8).***



8.1. At the Plasma Gas Console Panel, choose **CUTTING**.

8.2. Fully open **PLASMA** Gas Adjustment Valve on the Plasma Gas Console Panel.

8.3. Be certain that incoming flowing (dynamic) pressures to the Dual Gas Mixer are equal.

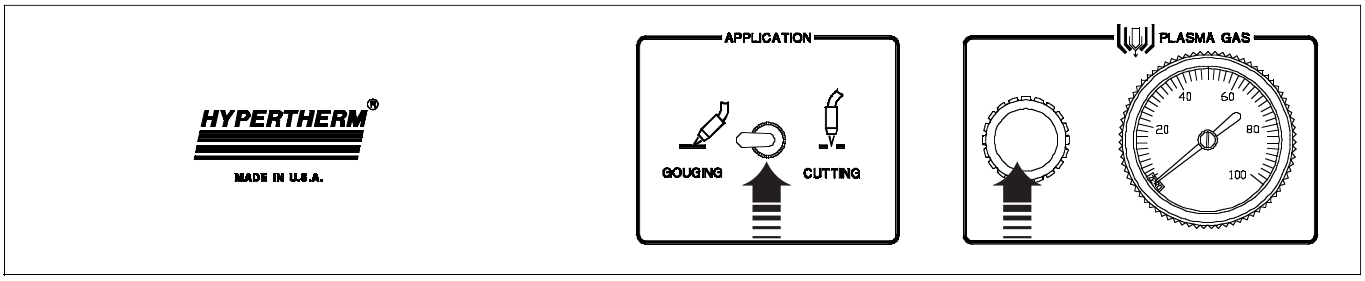
8.4. Adjust the H35 (**GAS1**) and N_2 (**GAS2**) mixture % at the Dual Gas Mixer by referring to **Plasma Gas Mix H35 GAS1** and **N_2 Gas2** in the *Cut / Gouging Charts* (pg.4-32 for 100 amp cutting).

Note: When adjusting the H35-N_2 mixture at the Dual Gas Mixer, be careful not to let the mixer **OUTLET** pressure go below **20 psi** (**1.4 bar**). (A pressure switch inside the power supply will shut down the system if the incoming pressure drops below 20 psi (1.4 bar).)

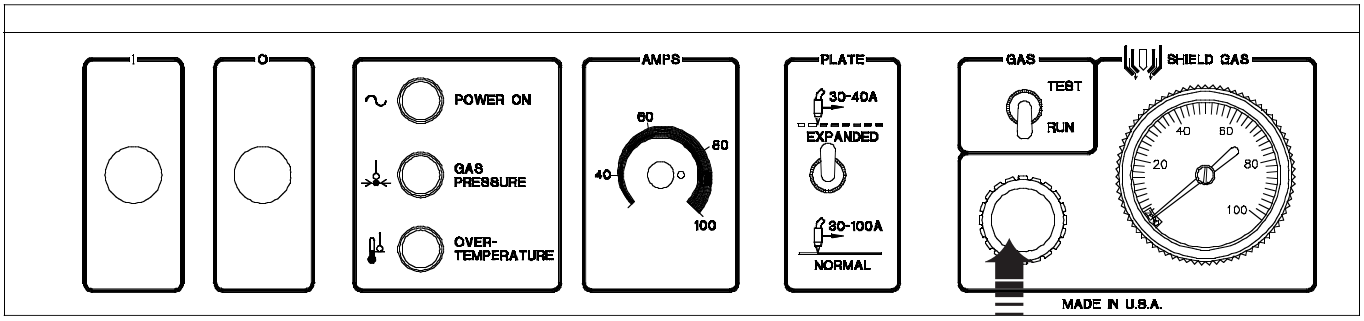
8.5. **Go to step 10**.

9. At the Plasma Gas Console Panel, choose **CUTTING** or **GOUGING** application, and then, with the **PLASMA** Gas Adjustment Valve, set the plasma gas pressure for the particular metal you are cutting. Refer to the **Plasma Gas Pressure** in **TEST** position in the *Cut / Gouging Charts* later in this section.

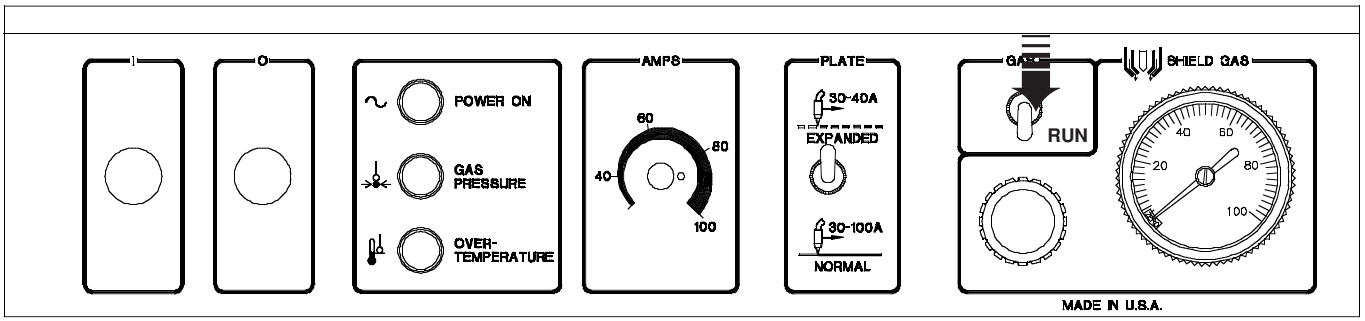
Note: Plasma gas pressure in **RUN** position is always higher than the set **TEST** pressure. No adjustment is necessary for **RUN** position.



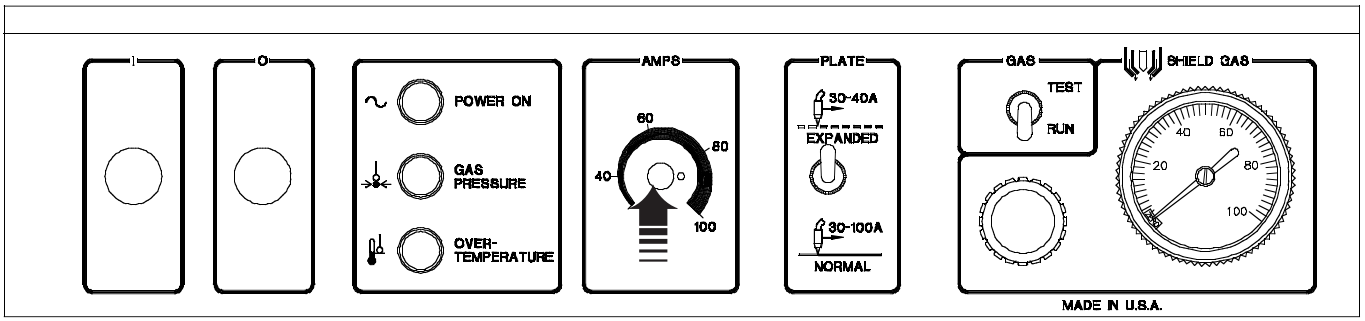
10. Using the **SHIELD** Gas Adjustment Valve on the MAX100D Control Panel, set the shield gas pressure according to the **Shield Gas Pressure** in the *Cut / Gouging Charts* later in this section.



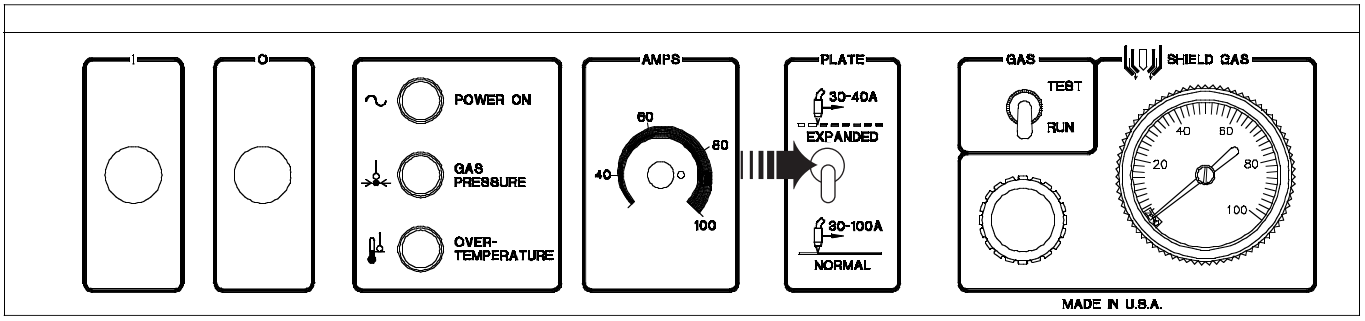
11. After gases have been set, switch to the **RUN** position. Gases will stop flowing through the system.



12. Adjust the **AMPS** potentiometer to the desired current. Refer to the **Arc Current Setting** in the *Cut / Gouging Charts* later in this section



13. Place the **PLATE** EXPANDED/NORMAL switch in the **NORMAL** position.
    Note: If you are cutting metal grate, place the **PLATE** EXPANDED/NORMAL switch in the **EXPANDED** position.



14. If you are using a torch height control system, adjust the **Arc Voltage Setting** on the torch height control according to the specifications in the *Cut / Gouging Charts* later in this section.

15. Adjust the work clamp to the work table or workpiece. Do not attach the work clamp to the portion of the workpiece that will fall away. See Figure 4-4.

16. Position the torch the appropriate distance from the workpiece. Refer to the **Torch-to-work Distance** in the *Cut / Gouging Charts* later in this section.

17. Set the machine travel speed. Refer to **Travel Speed** in the *Cut / Gouging Charts* later in this section.

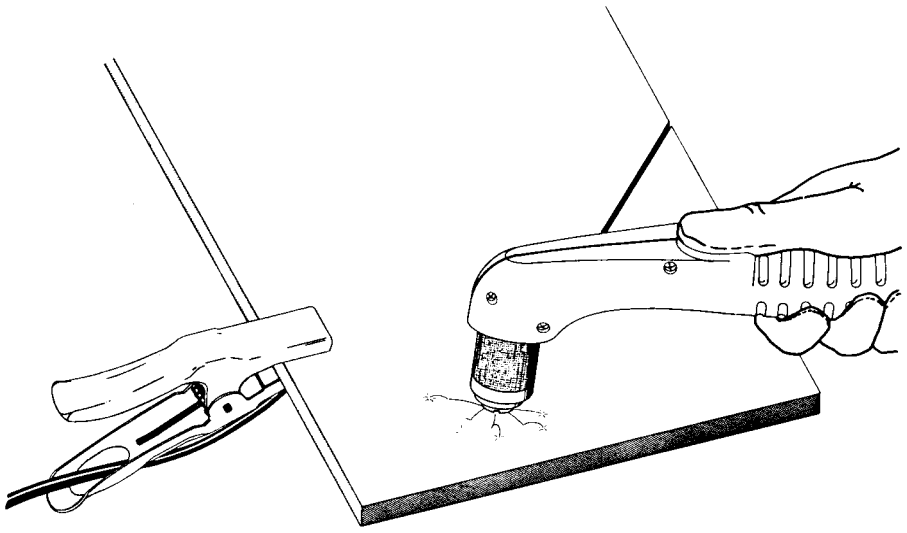


Figure 4-4 Proper Work Clamp Connection

18. **Hand Torch:** Press the torch start button and hold it down.
    Machine Torch: Press the START button.

    After a two-second delay, the pilot arc will activate, and transfer will occur if the **Torch-to-work Distance** is set properly.

Notes:

Hand Torch: The arc will extinguish if the torch switch is released or if no material remains under the arc.
Machine Torch: The arc will extinguish if the STOP button is pressed or if no material remains under the arc.

Postflow of gas will continue for ten seconds after arc is extinguished.

Operating Tips

Changing Consumable Parts

WARNING

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

The consumable parts in the torch need to be inspected periodically for signs of wear. A good rule of thumb is to check the parts after every 100 starts (pierces, edge starts, parts cut, etc.).

To remove the consumables (Fig. 4-5):

1. **Machine torch.** Bring the torch to the edge of the machine with the lifter raised to its highest point. Hold your hand under the retaining cap – the nozzle and swirl ring may fall when you remove the retaining cap. Unscrew and remove the **retaining cap**. If the **nozzle** and **swirl ring** remain inside the cap, take them out and set them aside.

   Hand torch. Unscrew and remove the **retaining cap**. The **nozzle** and **swirl ring** will come out; set them aside.

2. Inspect the retaining cap. It should be undamaged.

3. Check the **shield** for external signs of wear. The shield should be clean and clear of metal debris. (Debris will cause arcing.) The gas holes along the edge of the shield should not be blocked with debris. The center hole should not have any nicks or gouges, and should show no signs of arcing activity.

4. Unscrew the shield. Inspect the gas holes from the inside. The holes should be clear of metal or other debris. If the gas holes are blocked by debris, try to open them by pushing a pin through each one **from the outside of the shield to the inside**. If the shield is still good, screw it back on to the retaining cap. If it is damaged, replace it with a new one.

5. Inspect the **O-rings** on the **torch**. They should be lubricated and undamaged. If they are dry, lubricate them with a thin film of the lubricant provided in the spare parts kit. If they are damaged, replace them.

6. Inspect the **nozzle** for damage or signs of wear. The inside of the nozzle should be clean and bright, with no deposits from the electrode. You can clean the inside of the nozzle with steel wool, but be sure to remove any remnants of the steel wool afterward. The hole in the nozzle should not be worn or oval-shaped. If the nozzle is damaged, replace it with a new one.

7. Inspect the **swirl ring**. It should be clean, and the holes along the side should not be plugged. If the swirl ring is damaged, replace it with a new one.

8. Remove the **electrode** with the wrench supplied in the spare parts kit. Inspect it. If the center of the electrode has a pit more than 1 mm deep, replace it. If the electrode is still good, inspect its O-ring; it should be lubricated and undamaged. If the O-ring is dry, lubricate it with a thin film of the lubricant supplied in the consumable parts kit. If it is damaged, replace it.

9. Inspect the inside of the **torch** body. It should be clean and undamaged.

10. Replace the electrode and tighten it with the wrench. **Do not overtighten it.**

11. Install the swirl ring on the electrode with the word “front” facing away from the torch body – it won't fit in properly if it is installed in the wrong direction. Place the nozzle on top of the swirl ring. Be certain that the nozzle is inserted far enough into the torch so that the O-ring is not visible, and is not pinched.

12. Replace the retaining cap and shield. Make sure that it is tightened snugly; if it is loose, it can affect the cut (or gouge) quality.

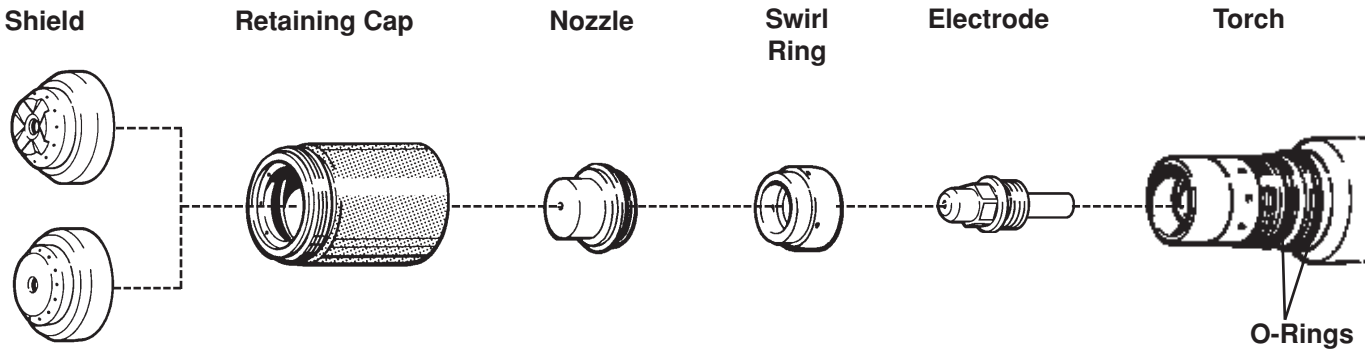


Figure 4-5 Consumable Parts

Cutting with Hand Torch

- Set **APPLICATION** switch to **CUTTING**.
- Do not fire the pilot arc into the air needlessly – doing so causes a drastic reduction of the nozzle and electrode life.
- Start cutting from the edge of the workpiece (Fig. 4-6) unless you must pierce. For tips on piercing, see *Piercing* later in this section.
- When cutting, make sure that the sparks are coming out of the bottom of the workpiece. If they are spraying on top of the workpiece, you are moving the torch too fast, or you do not have sufficient power to fully penetrate the workpiece.
- Hold the torch lightly on the metal or just off the metal. Holding the torch firmly to the workpiece causes the nozzle to stick and makes smooth cutting difficult. The arc transfers once the torch is within 3 mmof the workpiece.
- To cut circles use a template or a radius cutter attachment (Fig. 4-7).
- Pull the torch through the cut. Pulling it is easier than pushing it.
- Hold the torch nozzle (tip) at a vertical position and watch the arc as it cuts along the line (Fig. 4-8). By lightly dragging the nozzle on the workpiece, you can maintain a steady cut. For straight-line cuts, use a straight edge as a guide.

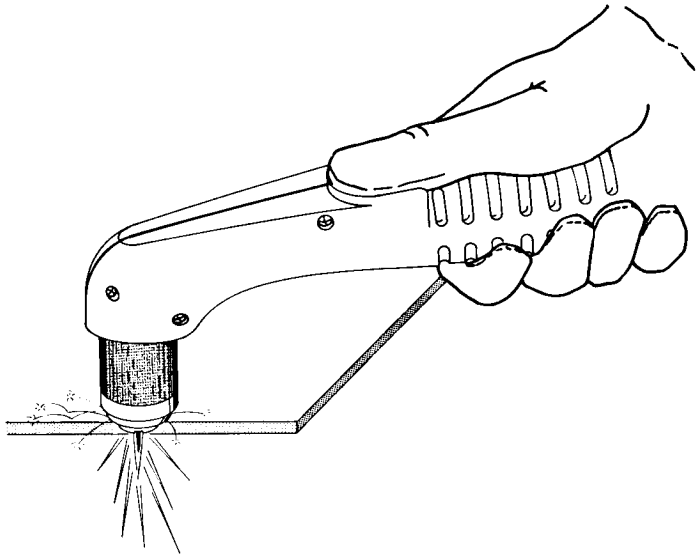


Figure 4-6 Starting a Cut

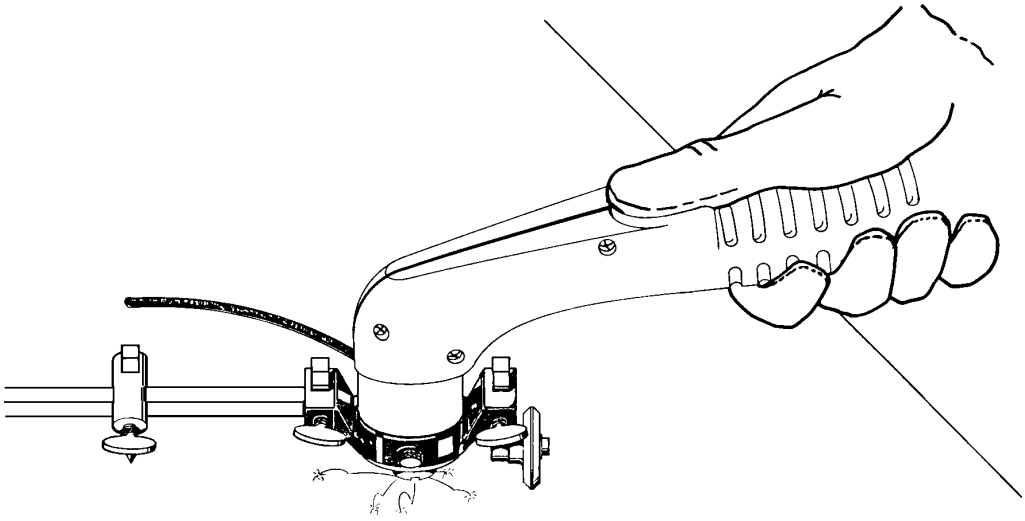


Figure 4-7 Cutting a Circle

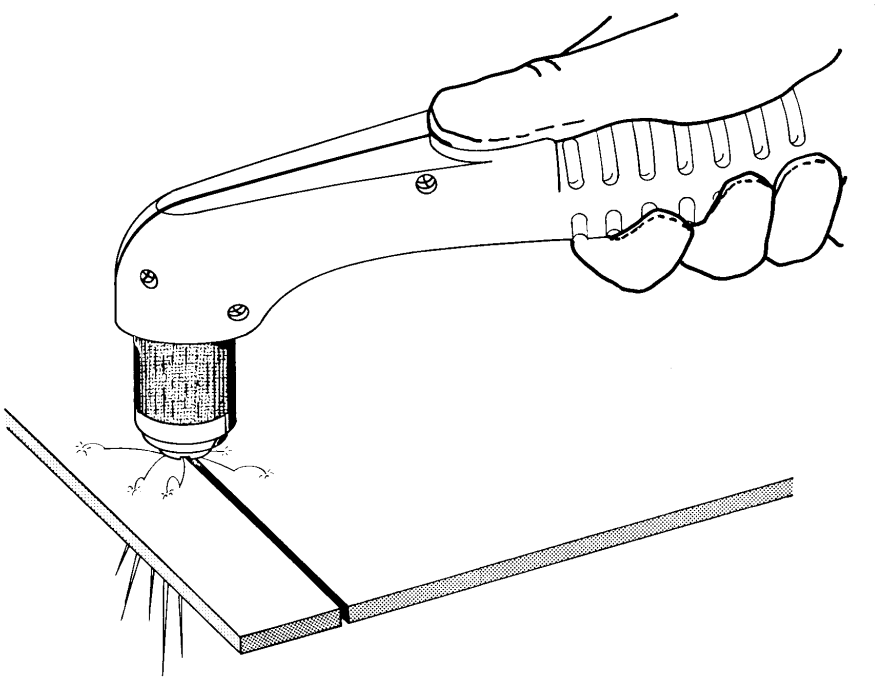
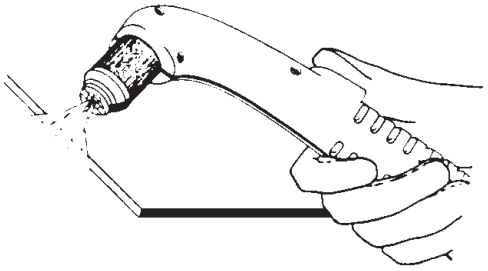


Figure 4-8 Dragging the Torch

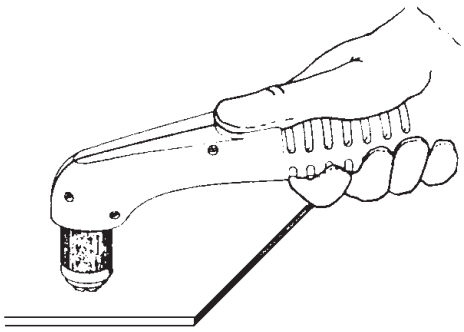
Piercing with Hand Torch

Note: **Consumable life will be shortened when piercing metal greater than 15 mm thick.**

- Hold the torch so that the nozzle is approximately 1.5 mm away from the workpiece before pressing the start button. This method maximizes the life of the nozzle.
- Hold the torch at an angle to the workpiece away from yourself, then slowly roll it to a vertical position. (This is particularly important when cutting thicker material.) Make sure that the torch is pointed away from you and the people around you to avoid any danger from sparks and hot metal.
- Start the cut at an angle rather than in an upright position. This method permits the hot metal to escape to one side rather than splashing back against the nozzle, protecting the operator from the sparks and extending the torch nozzle life (Fig. 4-9).
- When the pierce is complete, proceed with the cut.



1. Tilt the torch and push the start button.



2. Rotate the torch to an upright position.

Figure 4-9 Piercing

Gouging with Hand Torch

The MAX100D can be used for gouging mild steel, stainless steel, or aluminum by using the gouging consumables (See *Cut / Gouging Charts* later in this section). Use the following guidelines to assist you with the gouging process:

- Set **APPLICATION** switch to **GOUGING**.
- When gouging, it is absolutely necessary to wear full protection – a welding helmet with at least a #6 glass, welding gloves and a welding jacket. The arc is fully exposed and will cause serious burns if skin is not covered.
- An optional hand heat shield (#020711) is available and should be used for hand gouging. The hand heat shield guards the hand and the plastic torch handle from excessive heat.
- Install the gouging consumables just as you would install the standard cutting consumables.
- Adjust the gas pressures according to *Cut / Gouging Chart* data.
- Tilt the torch approximately 40-45° from the surface to be gouged and feed into the gouge. Try not to allow the shield to come in contact with the plate since this can cause premature wear. Multiple passes or “weaving” may be necessary to gouge wider and deeper sections. (See Fig. 4-10.)

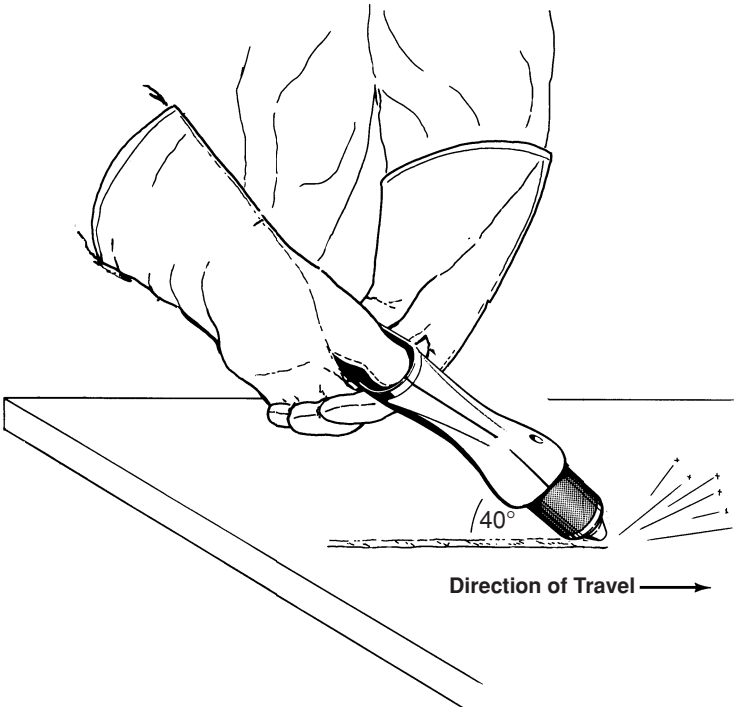


Figure 4-10 Gouging

Common Cutting Faults

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

Duty Cycle

The duty cycle, or the amount of time the pilot or plasma arc can remain “on” in minutes within a 10-minute period, is affected by many factors. When the current is set at 100 amps, the MAX100D has an 80% duty cycle. During normal operation, the plasma arc can remain on 8 minutes out of every 10 minutes without causing the temperature sensors to disable the unit. The duty cycle increases to 100% when the current is set at or below 80 amps.

The duty cycle is reduced if:

- The input line voltage is less than nominal, due to a long power cord, poor utility supply, etc.
- You are cutting material greater than 25 mm thick.
- The work clamp is not making a good electrical contact with the workpiece due to paint, rust, etc.

Gas Pressure

The plasma gas, compressed air or nitrogen, must be available at a flow rate of **208 liters/minute** and a minimum pressure of 5.4 bar. If the pressure is below **4.1 bar**, the torch will extinguish.

Cut / Gouging Charts

The cut and gouging chart information on the following pages will enable you to successfully cut or gouge using the MAX100D system.

Caution: Before cutting, check all settings and adjustments. Also, check for damaged torch parts and worn consumable parts.

Note: If the metal thickness that you are cutting is not listed in the cut charts, make an appropriate interpolation for **Arc Voltage**, **Travel Speed** and **Approx. Motion Delay Time**.

WARNING

The voltage between the tip of the torch and the workpiece may exceed 113 VDC if shielded consumable parts are not installed in the torch. Cut charts that specify non-shielded consumables are for machine torch applications only. The PAC160 hand torch must be operated with shielded parts to maintain the S mark and CE low voltage compliance.

Cut / Gouging Index

CUT / GOUGING INDEX					
	Metal	**Current**	**Plasma Gas**	**Shield Gas**	**Page**
 CUTTING	**Mild Steel**	**100 Amp**	Air	Air	**4-22**
		100 Amp	N_2	Air	4-23
		100 Amp	N_2	CO_2	4-24
		100 Amp**	Air	Air	4-25
		60 Amp	Air	Air	**4-26**
		60 Amp	N_2	Air	4-27
		60 Amp	N_2	CO_2	4-28
		60 Amp†	Air	Air	4-29
	Stainless	**100 Amp**	N_2	Air	**4-30**
		100 Amp	N_2	CO_2	4-31
		100 Amp*	H35-N_2	N_2	4-32
		100 Amp	H35	N_2	4-33
		100 Amp**	N_2	Air	4-34
		60 Amp	N_2	Air	**4-35**
		60 Amp	N_2	CO_2	4-36
		60 Amp†	N_2	Air	4-37
		30/40 Amp	Air	Air	**4-38**
	Aluminum	**100 Amp**	Air	Air	**4-39**
		100 Amp	N_2	Air	4-40
		100 Amp	N_2	CO_2	4-41
		100 Amp	H35	Air	4-42
		100 Amp	H35	N_2	4-43
		100 Amp**	Air	Air	4-44
		60 Amp	Air	Air	**4-45**
		60 Amp	N_2	Air	4-46
		60 Amp	N_2	CO_2	4-47
		60 Amp†	Air	Air	4-48
 GOUGING	**Mild Steel**	100 Amp	Air	Air	**4-49**
		100 Amp	H35	Air	4-50
	Stainless	100 Amp	H35	Air	**4-51**
		100 Amp	H35	N_2	4-52
	Aluminum	100 Amp	H35	Air	**4-53**
		100 Amp	H35	N_2	4-54

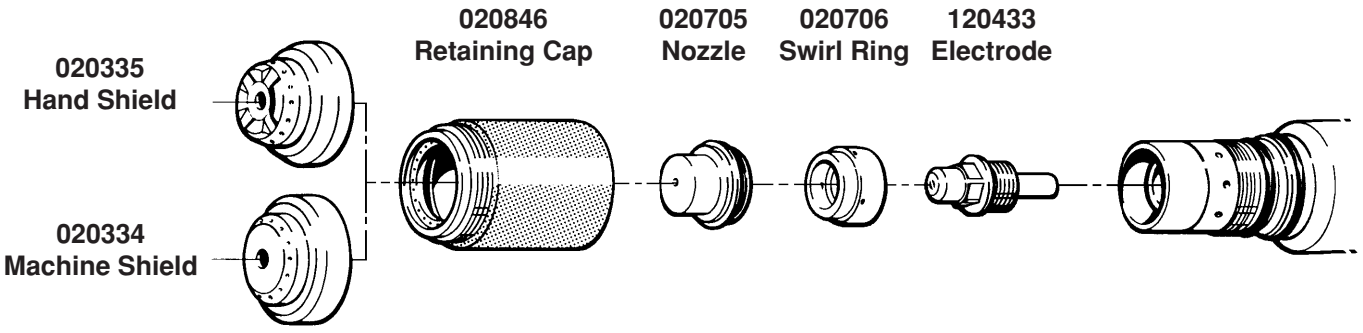
* Dual Gas Mixer required
** Extended Consumables Cut Chart
† Unshielded Consumable Parts

MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriding can occur.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**4.8†**	**4**	**3**	**100**	135	**80**	3048	0.8	**6.9†**	**6.9**
10						140		2032	1.0		
12						145		1143	1.2		
15						150		762	1.5		
19*						155		432			
25*						165		279			
32*						170		152			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

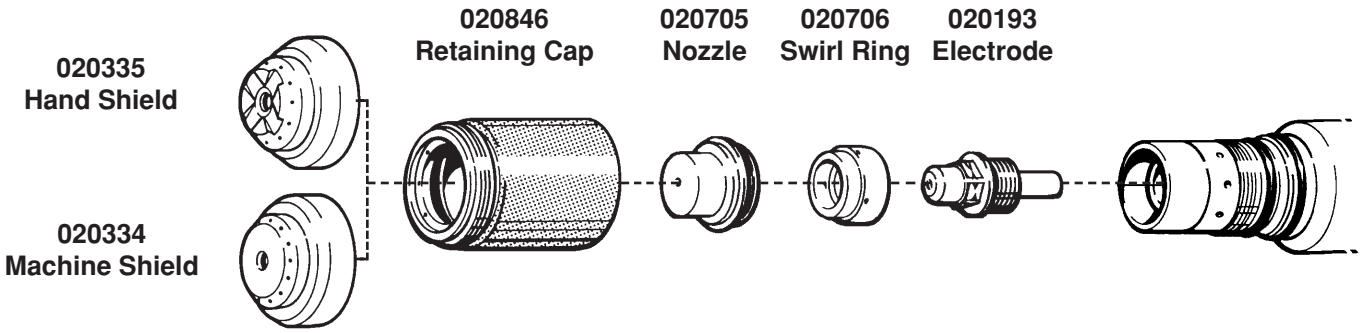
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination is used when cut edge quality and surface nitriding are less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bari)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**5.5†**	**4**	**3**	**100**	140	**80**	1651	1.,0	**6.9†**	**6.9**
9						145		1270	1.0		
12						150		1016	1.5		
15						155		508	1.5		
19*						165		254			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

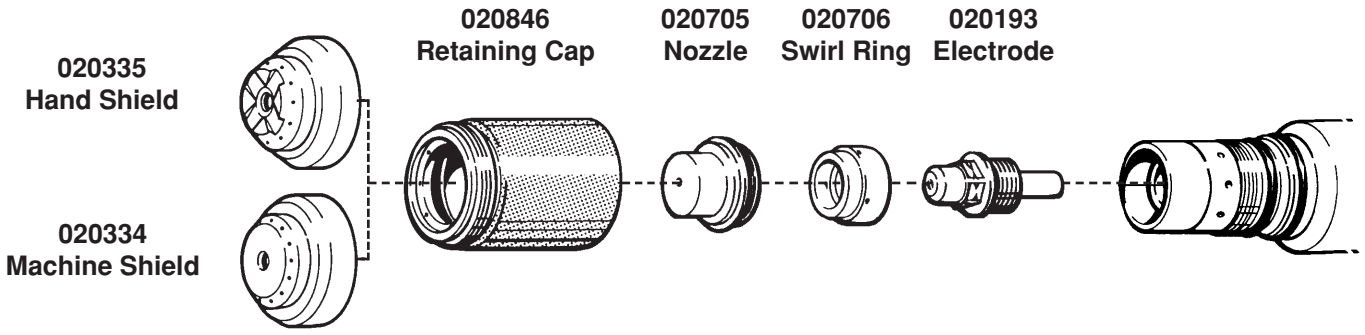
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **CO_2**
Current Setting: **100 Amp**

This gas combination is used when cut edge quality and surface nitriding are less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (CO_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (CO_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**5.9†**	**4**	**3**	**100**	140	**80**	2159	1.0	**6.9†**	**6.9**
9						145		1270	1.0		
12						145		1016	1.2		
15						150		762	1.5		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

1 bar = 6.895 KPa

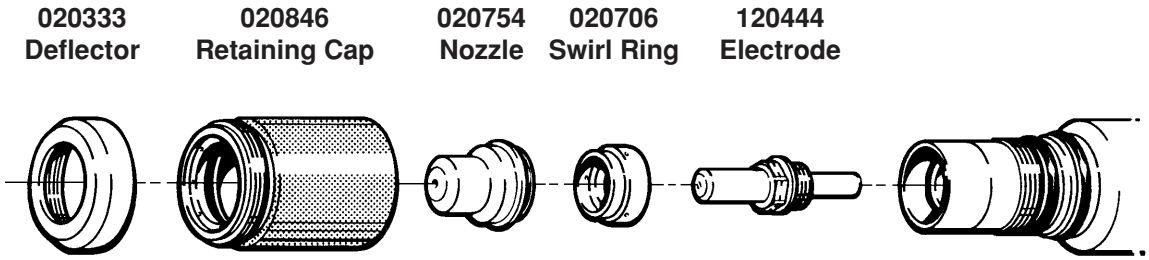
MAX100D Machine/PAC160 Hand Torch

Extended Consumables

Mild Steel Cutting

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriding can occur. The extended consumables allow the user greater accessibility for some cutting applications.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
3	**3.4**	**5.5†**	**4**	**3**	**100**	120	**80**	4572	0.5	**6.9†**	**6.9**
6						120		3175	0.8		
10						125		2286	1.0		
12						135		1270	1.2		
15						135		889	1.5		
19*						145		559			
25*						150		356			
32*						150		254			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

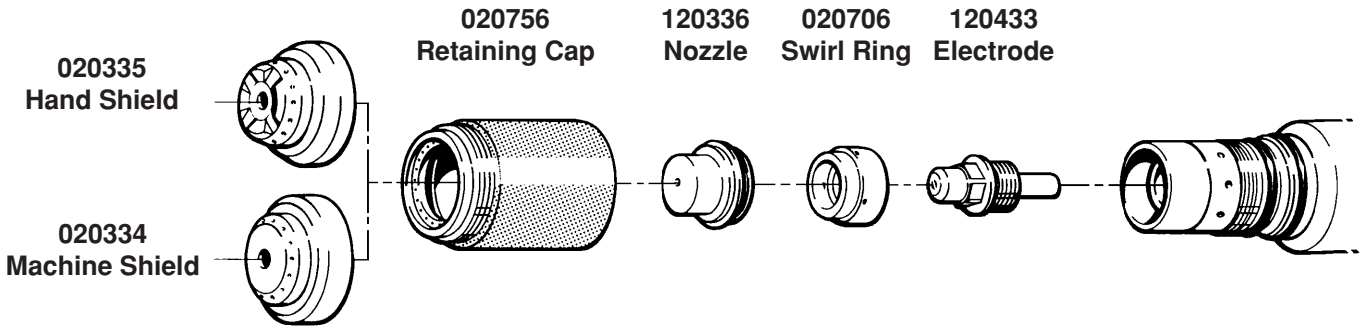
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriding can occur.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1	**3.4**	**5.2†**	**4**	**1.5**	**60**	120	**100**	7620	0.5	**6.9†**	**6.9**
1.3						120		7620	0.5		
1.5						125		7620	0.5		
2						130		6096	0.5		
2.5						130		5080	0.5		
3						130		4445	0.5		
3.5						130		4318	0.6		
6						135		1397	0.8		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

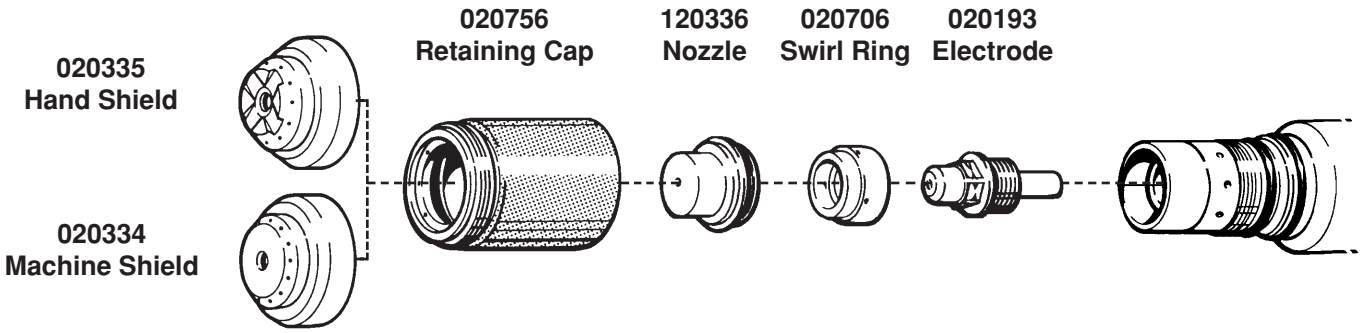
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination is used when cut edge quality and surface nitriding are less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1	**3.4**	**5.2†**	**4**	**1.5**	**60**	125	**100**	7620	0.5	**6.9†**	**6.9**
1.3						125		7620	0.5		
1.5						125		7620	0.5		
2						130		5334	0.5		
2.5						130		3556	0.5		
3						135		3048	0.5		
3.5						135		2159	0.6		
6						145		762	0.8		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

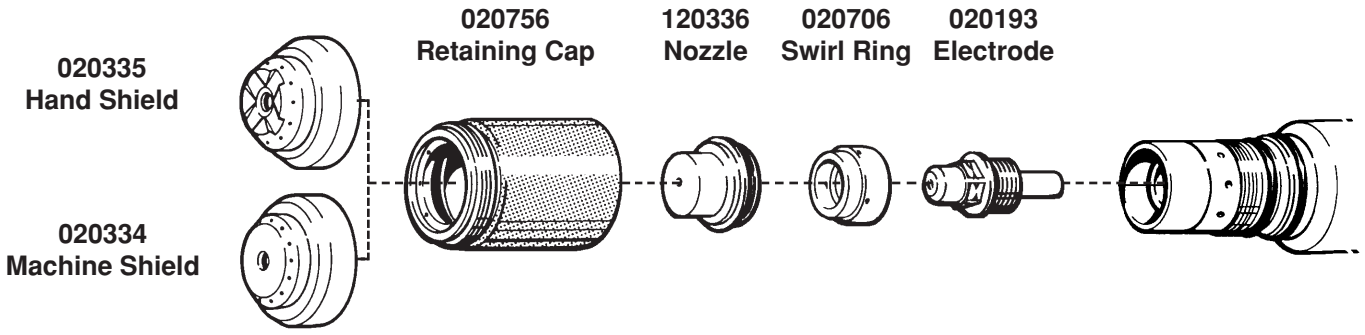
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **CO_2**
Current Setting: **60 Amp**

This gas combination is used when cut edge quality and surface nitriding are less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (CO_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (CO_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1	**3.4**	**5.2†**	**4**	**1.5**	**60**	125	**100**	7620	0.5	**6.9†**	**6.9**
1.3						125		7620	0.5		
1.5						125		7620	0.5		
2						130		5334	0.5		
2.5						130		4064	0.5		
3						135		3048	0.8		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

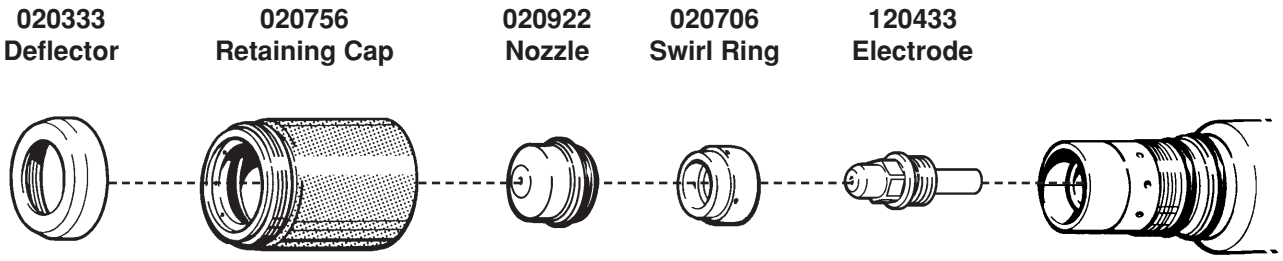
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting – Unshielded Parts

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriding can occur.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1	**2.8**	**5.5†**	**4**	**3**	**60**	110	**100**	10160	0.2	**6.9†**	**6.9**
1.3						115		8636	0.2		
1.5						120		7620	0.2		
2						120		6096	0.5		
2.5						125		5080	0.5		
3						125		3810	0.8		
3.4						125		3556	1.0		
6						130		1651	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

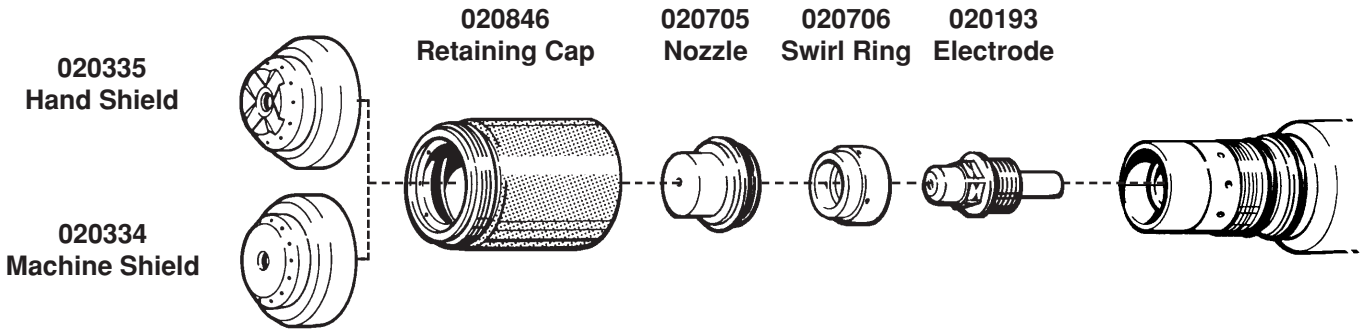
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Stainless Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination is used when cut edge quality, surface nitriding and surface oxidation of alloying elements are less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.5	**3.4**	**5.5†**	**4**	**3**	**100**	130	**80**	5588	0.2	**6.9†**	**6.9**
2.5						140		4191	0.5		
4						145		1778	0.8		
6						150		1397	0.8		
9						150		1016	1.0		
12						155		762	1.2		
15						155		559			
19*						155		559			
25*						165		279			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

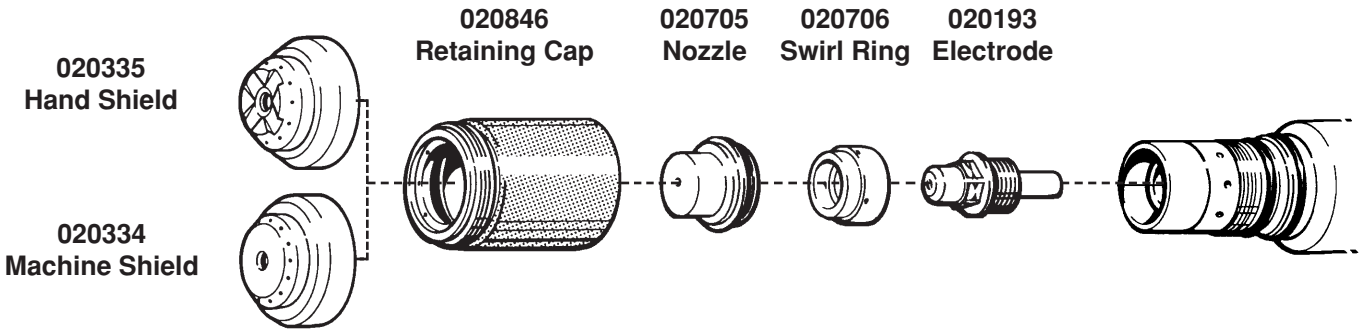
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Stainless Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **CO_2**
Current Setting: **100 Amp**

This gas combination is used when surface nitriding and surface oxidation of alloying elements is less important. Electrode life is extended when using this gas combination.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (CO_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (CO_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.5	**3.4**	**5.9†**	**4**	**3**	**100**	125	**80**	5588	0.2	**6.9†**	**6.9**
2.5						140		4318	0.5		
4						145		1778	1.0		
6						150		1397	1.0		
9						150		1016	1.0		
12						155		762	1.5		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

1 bar = 6.895 KPa

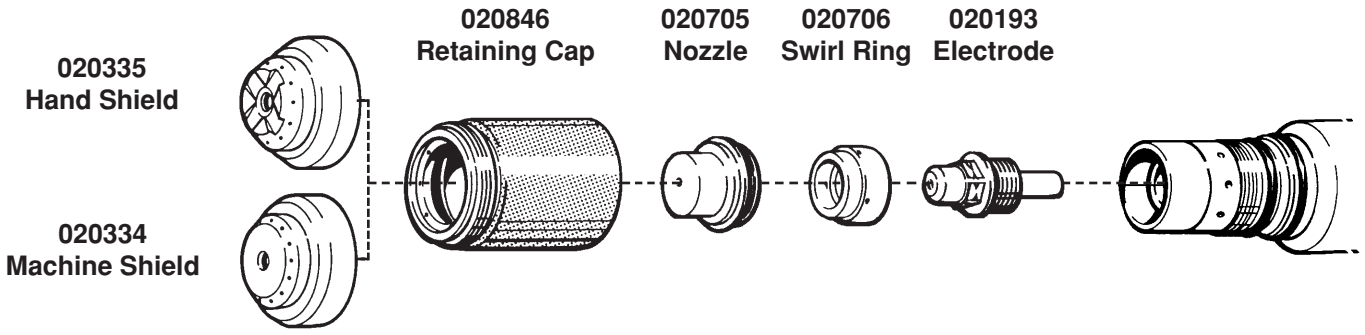
MAX100D Machine/PAC160 Hand Torch

Stainless Steel Cutting

Plasma Gas: **H35-N_2**
Shield Gas: **N_2**
Current Setting: **100 Amp**

Dual Gas Mixer (#059123) required

This gas combination is used when good surface quality and long consumable life are desired.



Material Thickness	Plasma Gas Mix		Shield Gas (N_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Dual Gas Mixer (H35&N_2) Inlet Pressures	Shield Gas (N_2) Inlet Pressure
	H35	N_2									
(mm)	GAS1*	GAS1*	(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
3	10	90	**4**	**3**	**100**	150	**80**	3429	0.5	**6.9**	**6.9**
4	20	80				150		2540	0.5		
6	60	40				150		1651	1.0		
9	80	20				155		1016	1.5		
12	90	10				155		762	1.5		
15	90	10				160		762	2.0		

Note: • To get good cut quality, dynamic (flowing) input pressure to Dual Gas Mixer should be equal (6.9 bar).
• When cutting stainless steel with the H35-N_2 mixture, dross may form on the bottom of the cut if the N_2 flow rate is too low.
• When the Dual Gas Mixer is properly set, the plasma gas pressure gauge on the gas console should read approximately 3.8 bar.

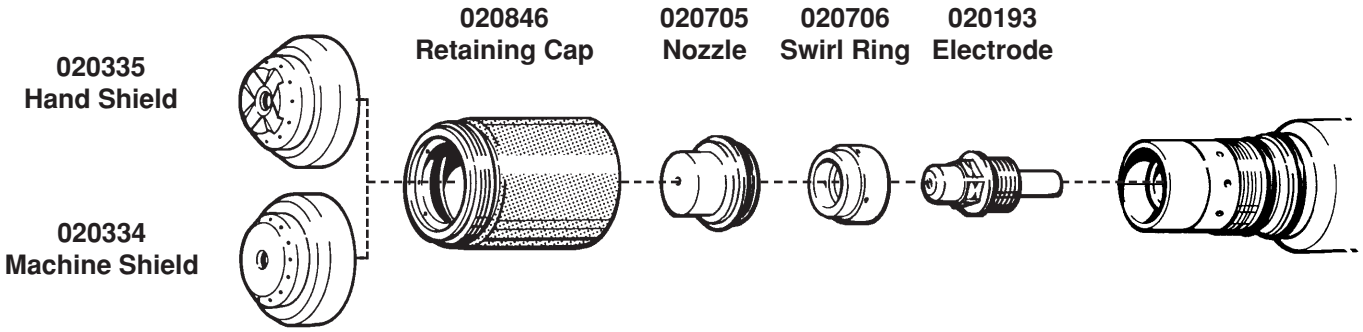
* Align flowmeter scale with middle of flowmeter float ball when setting mix ratios.
* Full scale = 100. Flow rate at full scale (100) of the flow meter is about 35.4 liters/minute.

1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Stainless Steel Cutting

Plasma Gas: **H35**
Shield Gas: **N_2**
Current Setting: **100 Amp**



Material Thickness	Plasma Gas Pressure H35		Shield Gas (N_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (N_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
9	**3.4**	**5.2†**	**4**	**3**	**100**	155	**80**	1016	1.5	**6.9†**	**6.9**
12						155		762	1.5		
15						160		762	2.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

1 bar = 6.895 KPa

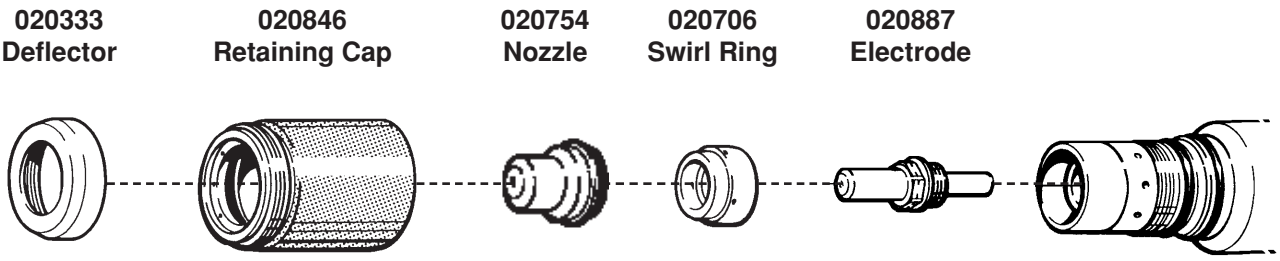
MAX100D Machine/PAC160 Hand Torch

Extended Consumables

Stainless Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination is used when cut edge quality, surface nitriding and surface oxidation of alloying elements are less important. Electrode life is increased when this combination is used. The extended consumables allow the user greater accessibility for some cutting applications.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
2.5	**3.4**	**5.5†**	**4**	**3**	**100**	130	**80**	4445	0.5	**6.9†**	**6.9**
3						130		4064	0.5		
4						135		2032	0.8		
6						135		1524	0.8		
9						140		1016	1.0		
12						145		889	1.2		
15						150		457	1.5		
19*						155		381			
25*						160		254			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

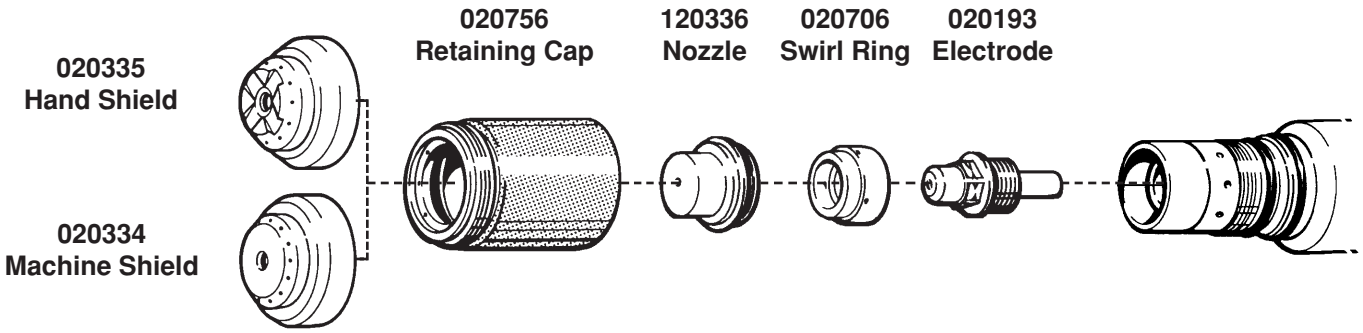
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Stainless Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination is used when cut edge quality, surface nitriding and surface oxidation of alloying elements are less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1	**3.4**	**5.2†**	**4**	**1.5**	**60**	125	**100**	7620	0.5	**6.9†**	**6.9**
1.5						125		7620	0.5		
2						130		6096	0.5		
2.5						130		4572	0.5		
3						140		3810	1.0		
4						145		1651	1.0		
6						150		1143	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

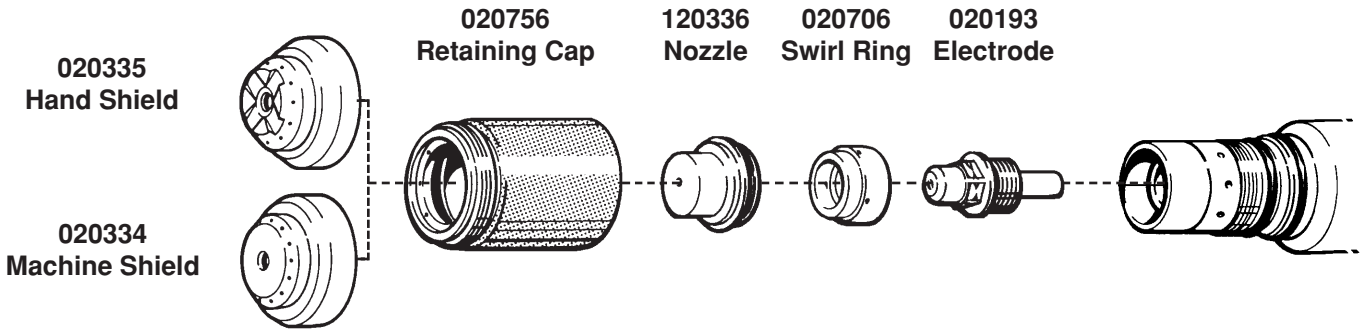
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Stainless Steel Cutting

Plasma Gas: **N_2**
Shield Gas: **CO_2**
Current Setting: **60 Amp**

This gas combination is used when surface nitriding and surface oxidation of alloying elements is less important. Electrode life is extended when using this gas combination.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (CO_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (CO_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1	**3.4**	**5.2†**	**4**	**1.5**	**60**	125	**100**	9144	0.5	**6.9†**	**6.9**
1.5						125		9144	0.5		
2						130		6096	0.5		
2.5						130		3810	0.8		
3						135		3048	1.0		
4						140		1397	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

1 bar = 6.895 KPa

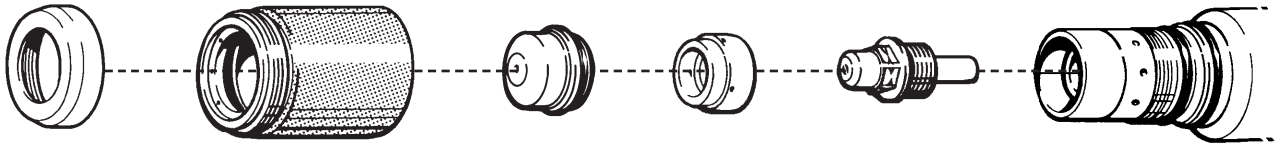
MAX100D Machine Torch

Stainless Steel Cutting – Unshielded Parts

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination is used when cut edge quality, surface nitriding and surface oxidation of alloying elements are less important. Electrode life is extended when this combination is used.

020333 Deflector **020756 Retaining Cap** **020922 Nozzle** **020706 Swirl Ring** **020193 Electrode**



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.3	**2.8**	**5.5†**	**4**	**3**	**60**	120	**100**	9144	0.2	**6.9†**	**6.9**
1.5						120		7620	0.2		
2						125		6096	0.5		
2.5						125		4572	0.5		
3						135		3556	1.0		
4						140		1524	1.0		
6						145		1016	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

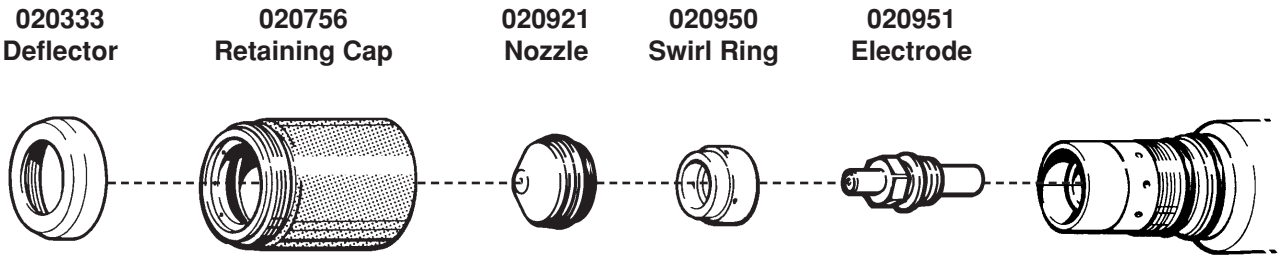
1 bar = 6.895 KPa

MAX100D Machine Torch

Stainless Steel Cutting*

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **30/40 Amp**

This gas combination is used when cut edge quality, surface nitriding and surface oxidation of alloying elements are less important.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
0.5	**2.8**	**4†**	**4**	**0.5**	30**	**65-75*** **	**100**	6350	0	**6.9†**	**6.9**
0.6					30**			5842	0		
0.7					30**			5588	0		
0.9					30**			5080	0		
1.2					40			3810	0.1		
1.5					40			3048	0.1		

* Some stainless steel plate comes with a plastic film attached to it. Because of the close torch-to-work distance required for 30/40 amp cutting, this film must be removed before cutting begins.

** Turn **AMPS** knob totally counterclockwise for 30 Amp setting

*** To maintain the 0.5 mm Torch-to-work Distance as the electrode wears, increase arc voltage in this range to avoid having the torch dive into the plate.

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

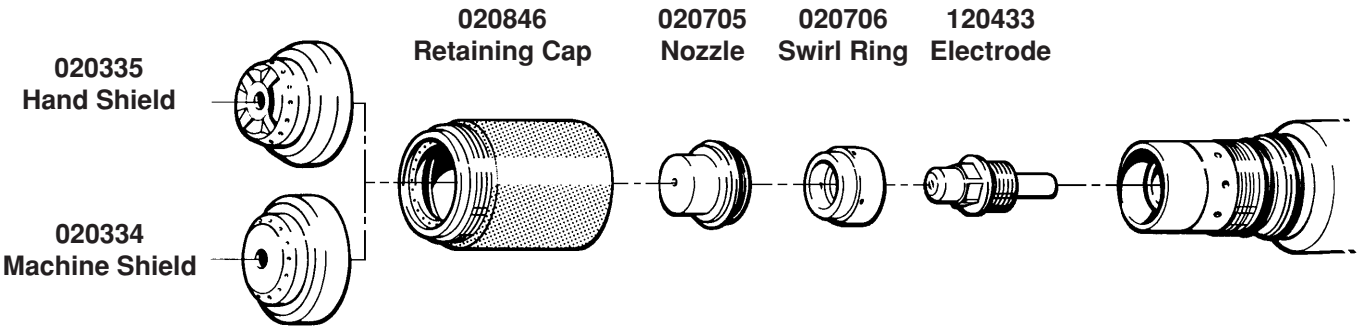
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination gives good cut speed, low dross levels and is very economical.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**5.2†**	**4**	**3**	**100**	140	**80**	2413	0.8	**6.9†**	**6.9**
9						140		1778	1.0		
12						145		1397	1.2		
15						150		1143	1.5		
19*						155		838			
25*						160		559			
32*						170		279			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

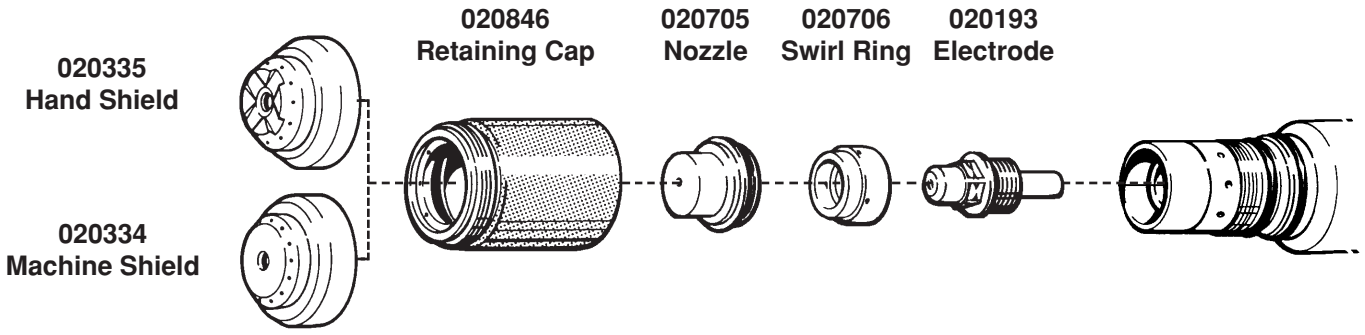
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**5.9†**	**4**	**3**	**100**	145	**80**	2413	1.0	**6.9†**	**6.9**
9						150		1778	1.0		
12						155		1397	1.5		
15						155		1143	1.5		
19*						160		889			
25*						165		559			
32*						175		279			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

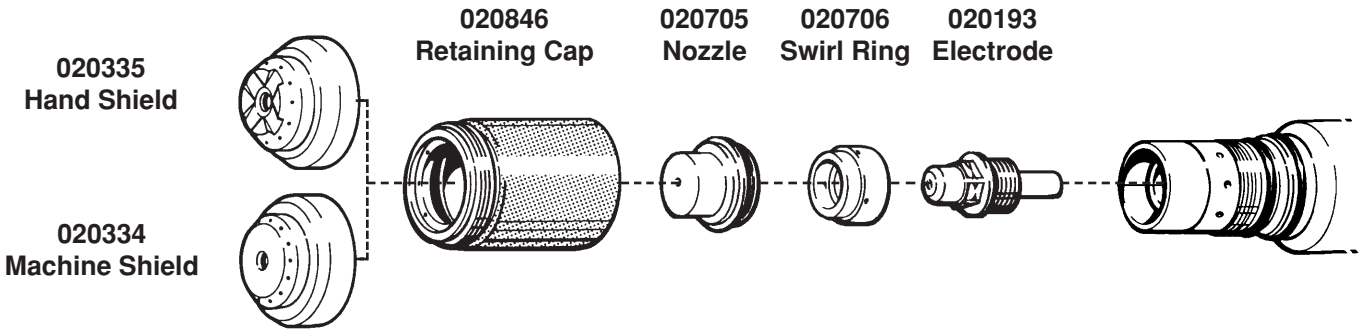
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **N_2**
Shield Gas: **CO_2**
Current Setting: **100 Amp**

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (CO_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (CO_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**5.9†**	**4**	**3**	**100**	145	**80**	2413	0.8	**6.9†**	**6.9**
9						145		1778	1.0		
12						150		1397	1.2		
15						155		1143	1.5		
19*						160		889			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

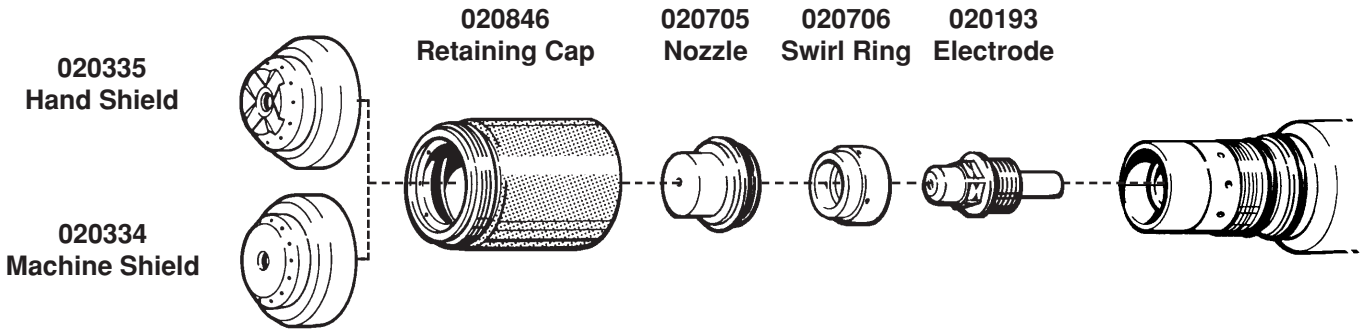
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **H35**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination (Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas) gives maximum thickness cutting capability, good cut quality and weldability. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure H35		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**5.5†**	**4**	**3**	**100**	130	**80**	2413	0.8	**6.9†**	**6.9**
9						130		1778	1.0		
12						135		1397	1.2		
15						135		1143	1.5		
19*						140		889			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

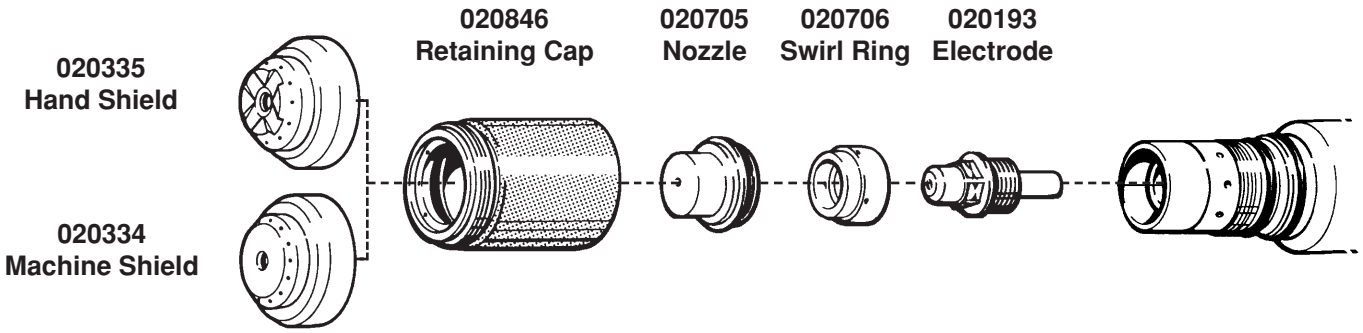
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **H35**
Shield Gas: **N_2**
Current Setting: **100 Amp**

This gas combination (Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas) gives maximum thickness cutting capability, excellent cut quality and excellent weldability. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure H35		Shield Gas (N_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (N_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
6	**3.4**	**5.5†**	**4**	**3**	**100**	130	**80**	2413	0.8	**6.9†**	**6.9**
9						135		1778	1.0		
12						135		1397	1.2		
15						140		1143	1.5		
19*						145		889			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

1 bar = 6.895 KPa

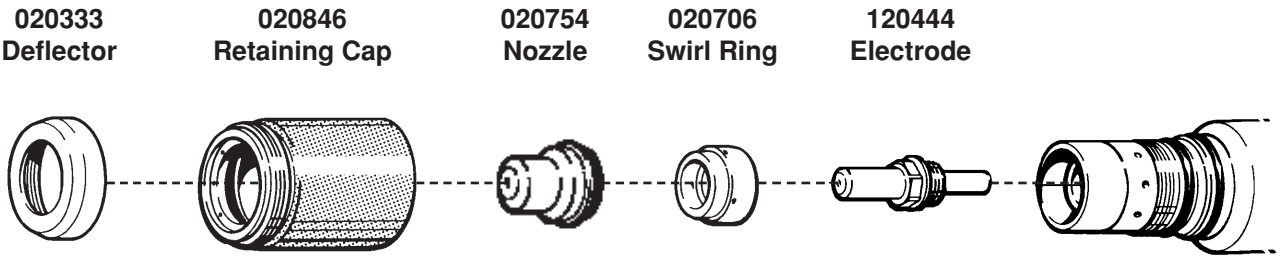
MAX100D Machine Torch

Extended Consumables

Aluminum Cutting

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **100 Amp**

This gas combination gives good cut speed, low dross levels and is very economical. The extended consumables allow the user greater accessibility for some cutting applications.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.5	**3.4**	**5.5†**	**4**	**3**	**100**	130	**80**	4445	0.2	**6.9†**	**6.9**
2						130		4064	0.2		
2.5						130		3683	0.5		
3						130		3683	0.5		
3						135		3429	0.5		
4						135		3175	0.8		
6						135		2921	0.8		
9						140		2286	1.0		
12						140		1524	1.2		
15						145		1143	1.5		
19*						145		762			
25*						155		508			
32*						160		304			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended

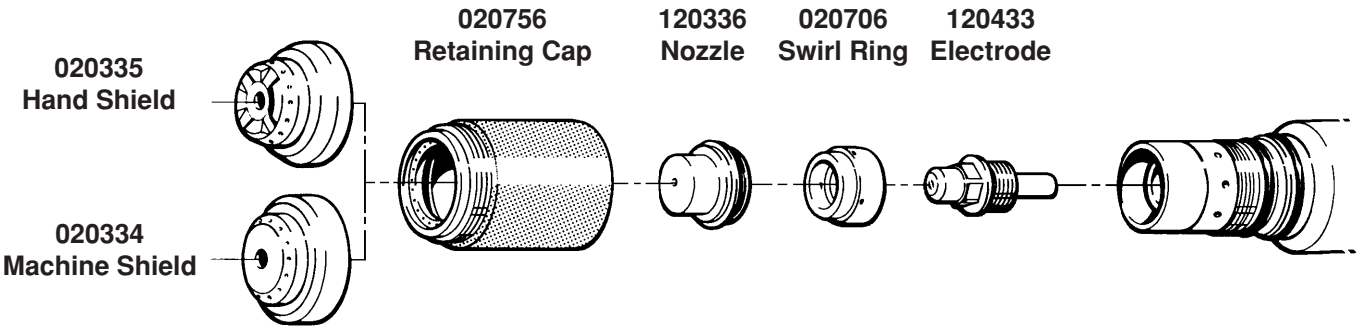
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination gives good cut speed, low dross levels and is very economical.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.3	**3.4**	**5.5†**	**4**	**1.5**	**60**	120	**100**	7620	0.5	**6.9†**	**6.9**
1.5						125		6096	0.5		
2						125		5080	0.5		
2.5						130		4064	0.5		
3						130		3048	0.8		
6						135		2286	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

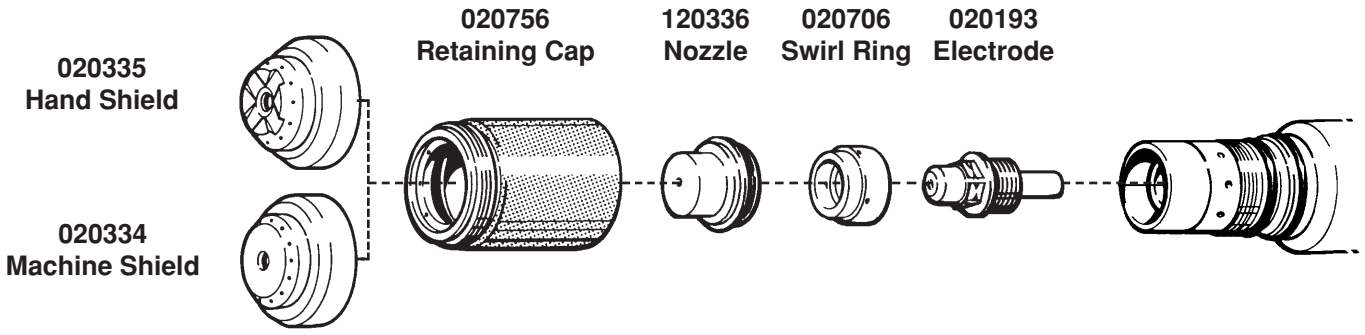
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **N_2**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.3	**3.4**	**5.9†**	**4**	**1.5**	**60**	125	**100**	6096	0.5	**6.9†**	**6.9**
1.5						125		4572	0.5		
2						135		4064	0.5		
2.5						140		3302	0.5		
3						145		2159	0.8		
6						155		1016	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

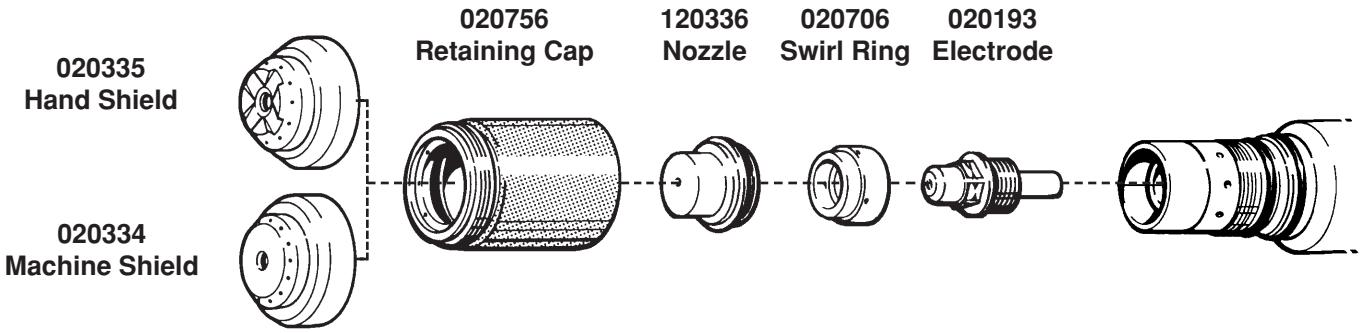
1 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

Aluminum Cutting

Plasma Gas: **N_2**
Shield Gas: **CO_2**
Current Setting: **60 Amp**

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



Material Thickness	Plasma Gas Pressure Nitrogen		Shield Gas (CO_2) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (N_2) Inlet Pressure	Shield Gas (CO_2) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.3	**3.4**	**5.9†**	**4**	**1.5**	**60**	125	**100**	6096	0.5	**6.9†**	**6.9**
1.5						125		4572	0.5		
2						135		4064	0.5		
2.5						140		3302	0.5		
3						145		2159	0.8		
6						155		1016	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

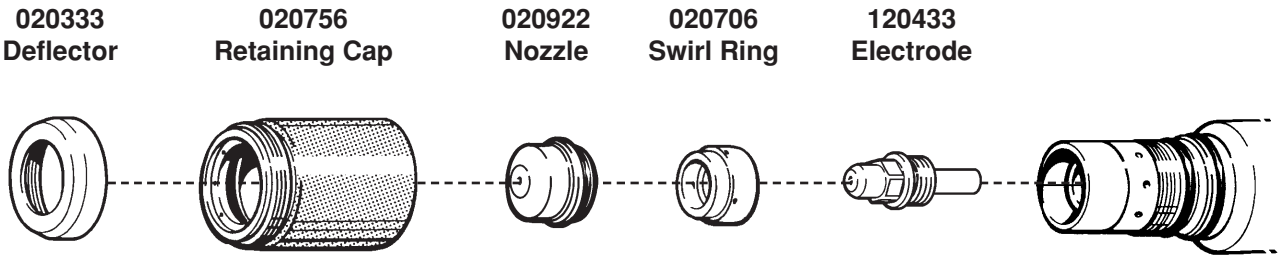
1 bar = 6.895 KPa

MAX100D Machine Torch

Aluminum Cutting – Unshielded Parts

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **60 Amp**

This gas combination gives good cut speed, low dross levels and is very economical.



Material Thickness	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Arc Voltage Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)									
(mm)			(bar)	(mm)	(amps)	(volts)	(%)	(mm/min)	(sec)	(bar)	(bar)
1.3	**2.8**	**5.5†**	**4**	**3**	**60**	115	**100**	7620	0.2	**6.9†**	**6.9**
1.5						120		6096	0.2		
2						120		5080	0.5		
2.5						125		4064	0.5		
3						125		3048	0.8		
6						130		2286	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

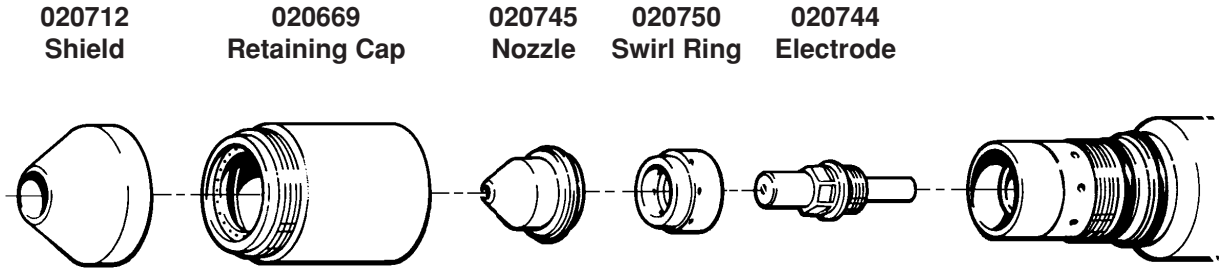
1 bar = 6.895 KPa

MAX100D Machine/PAC160E Hand Torch

Mild Steel Gouging

Plasma Gas: **Air**
Shield Gas: **Air**
Current Setting: **100 Amp**

This combination is very economical on gas.



Torch-to-work Angle of inclination	Plasma Gas Pressure Air		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (Air) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)								
Θ (Degrees)			(bar)	(mm)	(amps)	(%)	(mm/min)	(sec)	(bar)	(bar)
40°	3.4	3.7†	4	1.5	100	80	381	1.0	6.9†	6.9

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

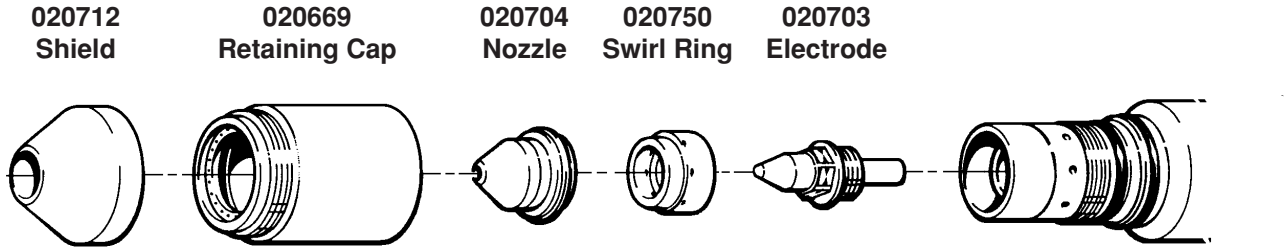
1 bar = 6.895 KPa

MAX100D Machine/PAC160E Hand Torch

Mild Steel Gouging

Plasma Gas: **H35**
Shield Gas: **Air**
Current Setting: **100 Amp**

Hypertherm recommends a plasma gas mixture of 35% hydrogen, and 65% argon. This gas combination is highly efficient and yields long consumable life.



Torch-to-work Angle of inclination	Plasma Gas Pressure H35		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)								
Θ (Degrees)			(bar)	(mm)	(amps)	(%)	(mm/min)	(sec)	(bar)	(bar)
40°	3.4	3.7†	4	3	100	80	508	1.0	6.9†	6.9

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

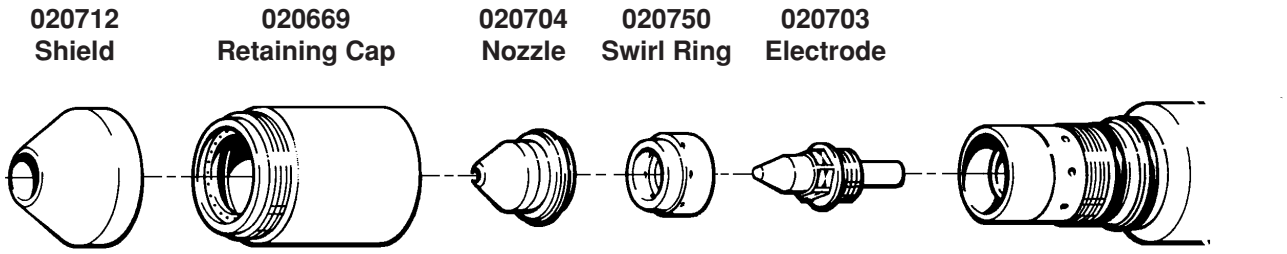
1 bar = 6.895 KPa

MAX100D Machine/PAC160E Hand Torch

Stainless Steel Gouging

Plasma Gas: **H35**
Shield Gas: **Air**
Current Setting: **100 Amp**

Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas. This gas combination is highly efficient and yields long consumable life.



Torch-to-work Angle of inclination	Plasma Gas Pressure H35		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)								
Θ (Degrees)			(bar)	(mm)	(amps)	(%)	(mm/min)	(sec)	(bar)	(bar)
40°	3.4	3.7†	4	3	100	80	508	1.0	6.9†	6.9

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

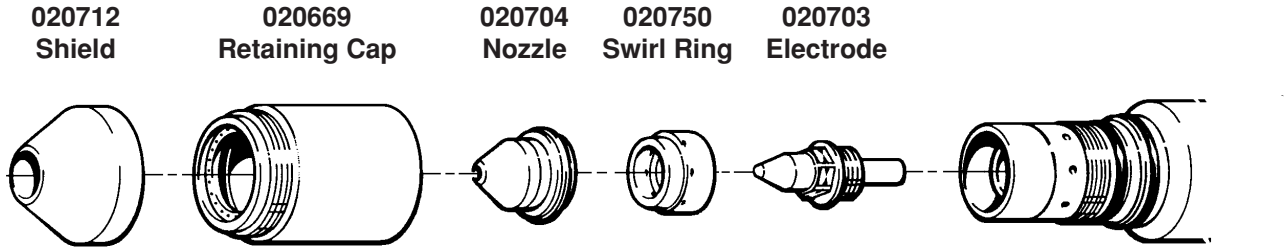
1 bar = 6.895 KPa

MAX100D Machine/PAC160E Hand Torch

Stainless Steel Gouging

Plasma Gas: **H35**
Shield Gas: **N_2**
Current Setting: **100 Amp**

Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas. This gas combination is highly efficient, yields long consumable life, and leaves a superior work surface.



Torch-to-work Angle of inclination	Plasma Gas Pressure H35		Shield Gas (N_2) Pressure	Torch-to-work Distance	Arc Current Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (N_2) Inlet Pressure
	TEST (bar)	RUN (bar)								
Θ (Degrees)			(bar)	(mm)	(amps)	(%)	(mm/min)	(sec)	(bar)	(bar)
40°	3.4	3.7†	4	3	100	80	508	1.0	6.9†	6.9

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

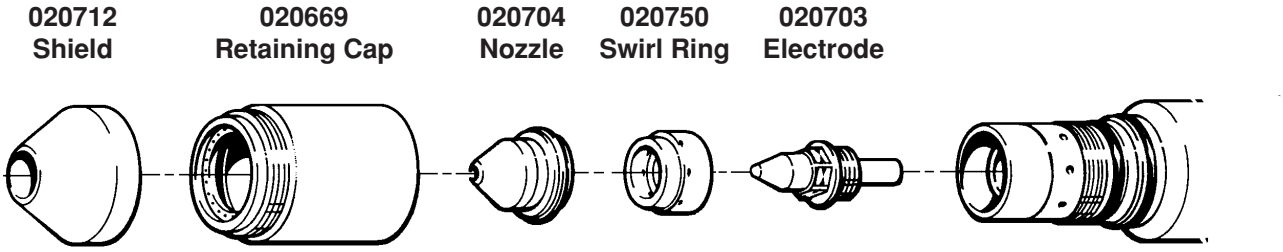
1 bar = 6.895 KPa

MAX100D Machine/PAC160E Hand Torch

Aluminum Gouging

Plasma Gas: **H35**
Shield Gas: **Air**
Current Setting: **100 Amp**

Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas. This gas combination is highly efficient and yields long consumable life.



Torch-to-work Angle of inclination	Plasma Gas Pressure H35		Shield Gas (Air) Pressure	Torch-to-work Distance	Arc Current Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (Air) Inlet Pressure
	TEST (bar)	RUN (bar)								
Θ (Degrees)			(bar)	(mm)	(amps)	(%)	(mm/min)	(sec)	(bar)	(bar)
40°	3.4	3.7†	4	3	100	80	508	1.0	6.9†	6.9

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

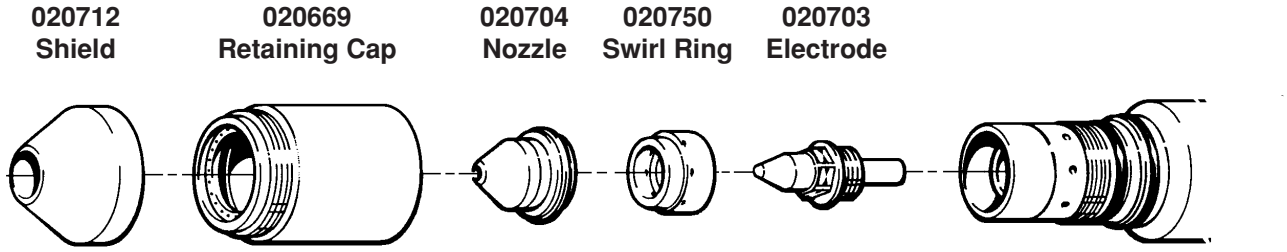
1 bar = 6.895 KPa

MAX100D Machine/PAC160E Hand Torch

Aluminum Gouging

Plasma Gas: **H35**
Shield Gas: **N_2**
Current Setting: **100 Amp**

Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas. This gas combination is highly efficient, yields long consumable life, and leaves a superior work surface.



Torch-to-work Angle of inclination	Plasma Gas Pressure H35		Shield Gas (N_2) Pressure	Torch-to-work Distance	Arc Current Setting	Duty Cycle	Travel Speed	Approx. Motion Delay Time	Plasma Gas (H35) Inlet Pressure	Shield Gas (N_2) Inlet Pressure
	TEST (bar)	RUN (bar)								
Θ (Degrees)			(bar)	(mm)	(amps)	(%)	(mm/min)	(sec)	(bar)	(bar)
40°	3.4	3.7†	4	3	100	80	508	1.0	6.9†	6.9

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure

1 bar = 6.895 KPa

Hypertherm

Section 5

MAINTENANCE

In this section:

Introduction

The MAX100D, 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 **Sections 3** and **4** are followed.

If a problem does arise, this section will familiarize qualified service personnel with the proper operation of the MAX100D system, and will provide guides to troubleshoot problems that may occur during operation. The intent of this section is to isolate problems at a modular level. PC board component level troubleshooting is not addressed.

This section begins with a detailed sequence of events flowchart, an initial checks procedure, a troubleshooting guide, test procedures and instructions to remove and replace the torch and torch leads.

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

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

For service questions or problems, contact the nearest Hypertherm Technical Service Department listed at 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

Hypertherm systems are designed to require little regular maintenance under normal use and conditions. The routine maintenance suggestions in this section will allow the operator to keep the system in peak operating condition.

Torch and Torch Leads

Inspect the torch and torch leads on a regular basis:

- Always inspect the torch's consumable parts and main body before cutting. Worn or damaged parts can cause gas leaks which can cause cut quality to deteriorate. Inspect consumables for indications of arcing, overheating or pitting, and replace any parts that appear worn or damaged. See *Changing Consumable Parts* in **Section 4.**
- The torch leads should be checked occasionally for cracking or other damage.

Power Supply

Inspect the power supply on a regular basis:

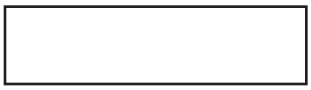
- Check the exterior for any damage that might affect safe operation of the power supply.
- Remove the power supply cover and inspect the interior. Check wiring harnesses and connections for wear or damage. Check for loose connections and areas of discoloration which may indicate overheating.
- Clean the power supply periodically: use compressed air to blow dust and dirt that may have accumulated inside the unit. In an excessively dirty environment, do this weekly.

Sequence of Events

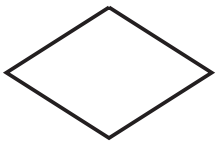
On the following pages is a detailed flow chart outlining the sequence of events during proper MAX100D operation with a hand or machine torch. Shaded boxes represent action taken by the operator.

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

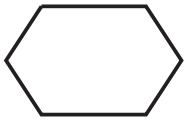
Terminus The terminus is used to indicate the beginning or ending point of a flowchart.



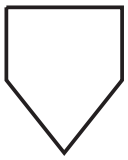
Task/Process Box The process or task box is used to indicate any process or task other than an input/output operation or a decision.



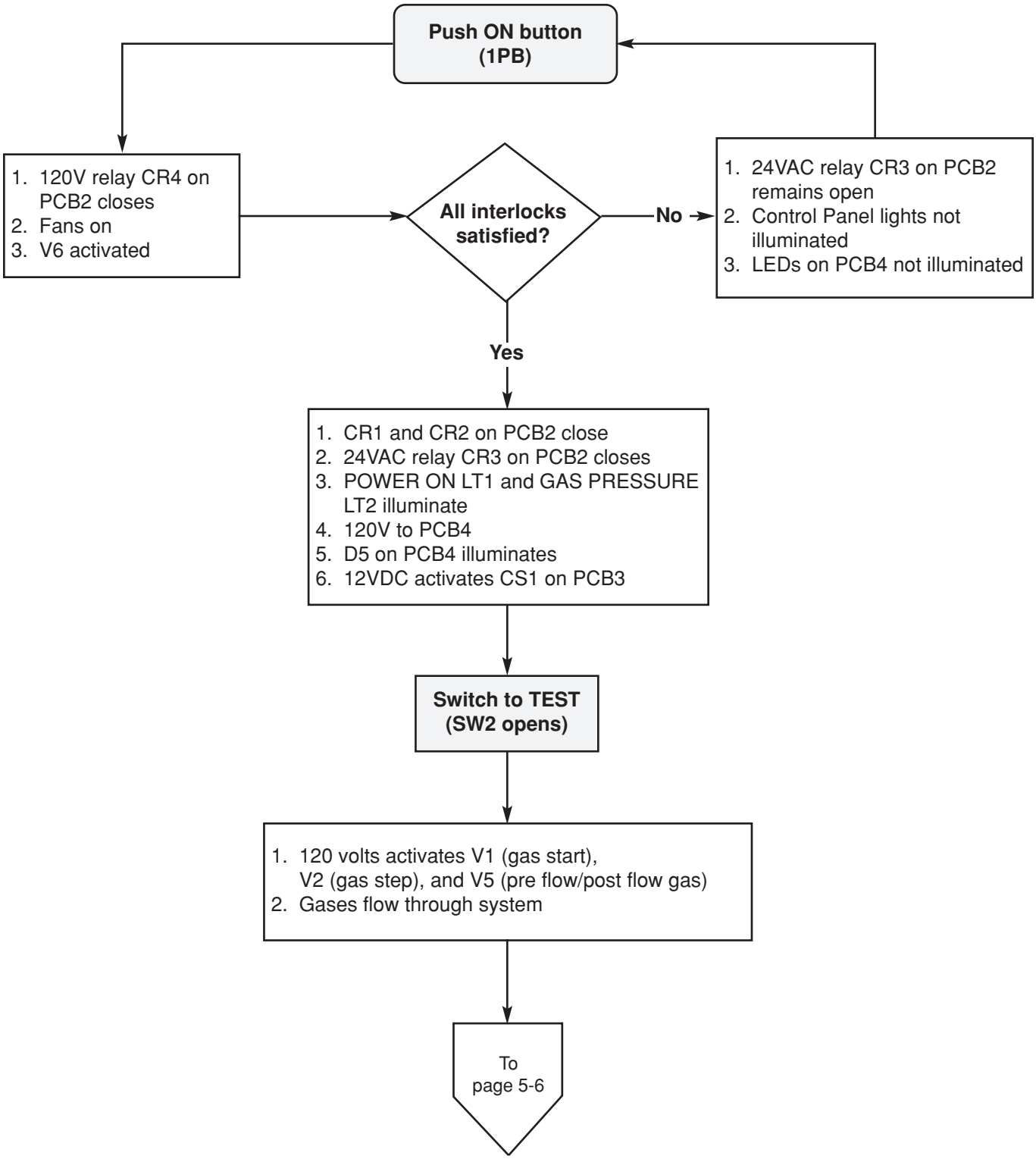
Decision Diamond The decision diamond is used to indicate a decision or branching point.

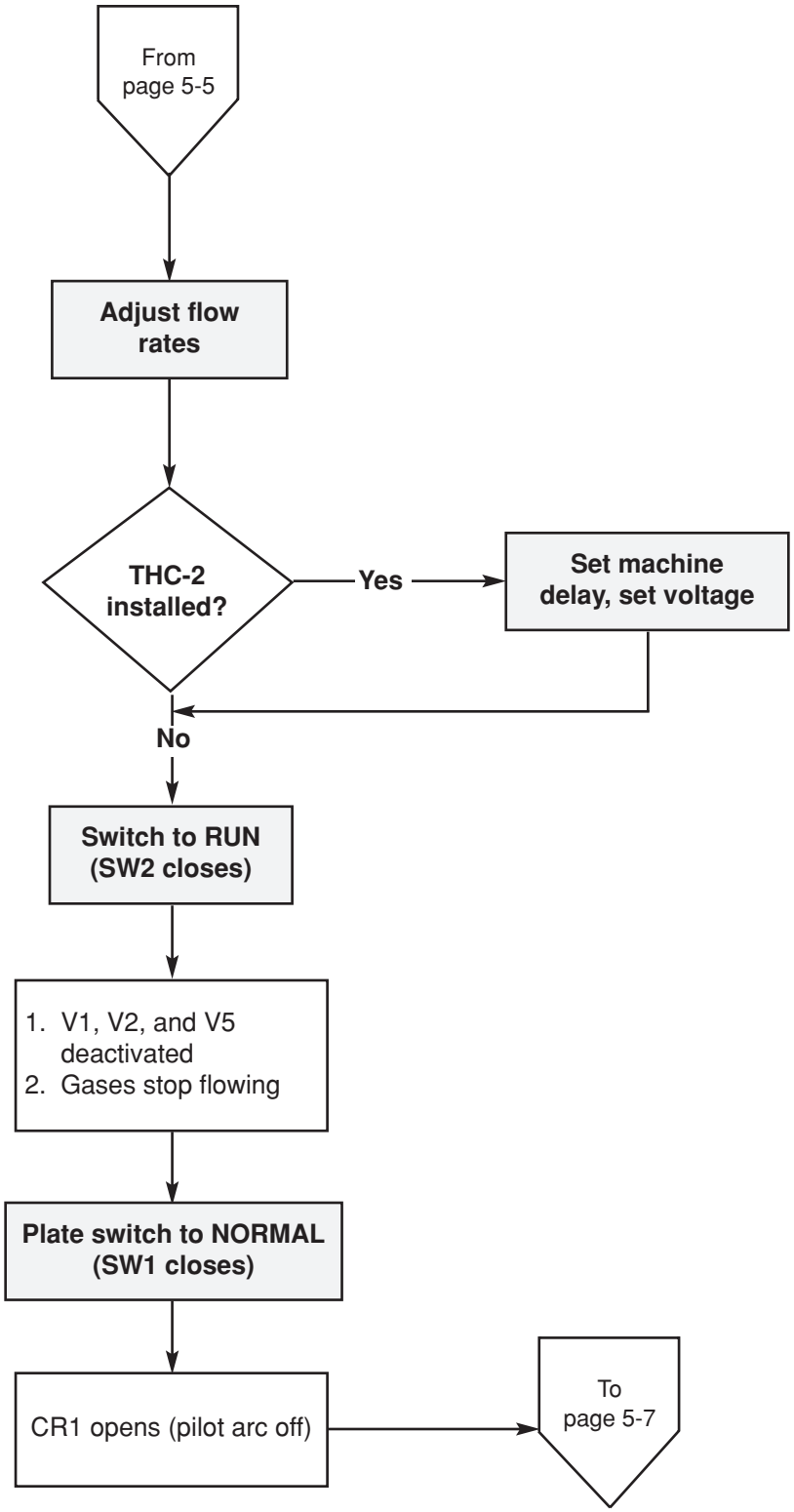


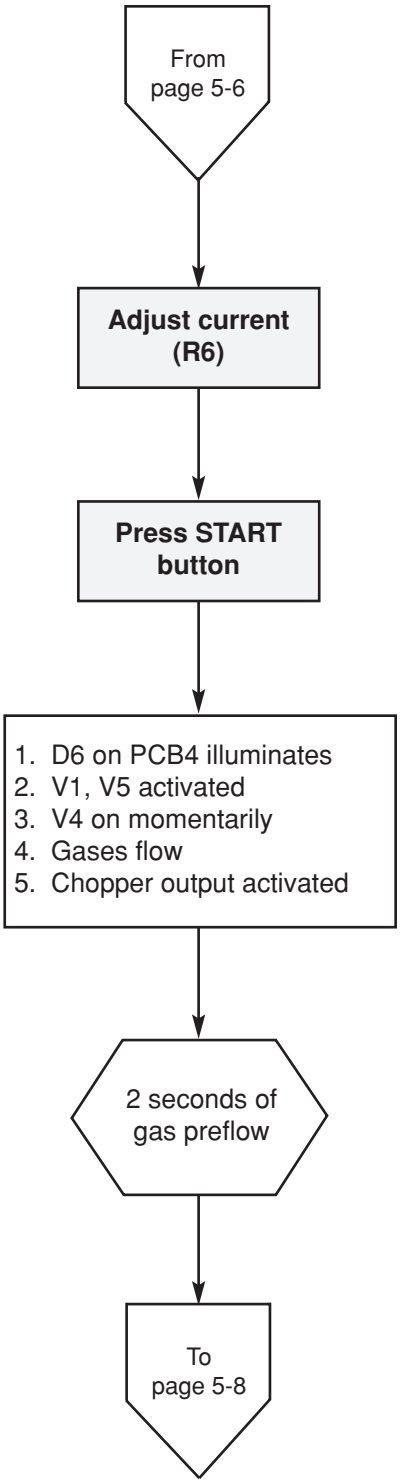
Preparation The preparation symbol is used to indicate an instruction modification.

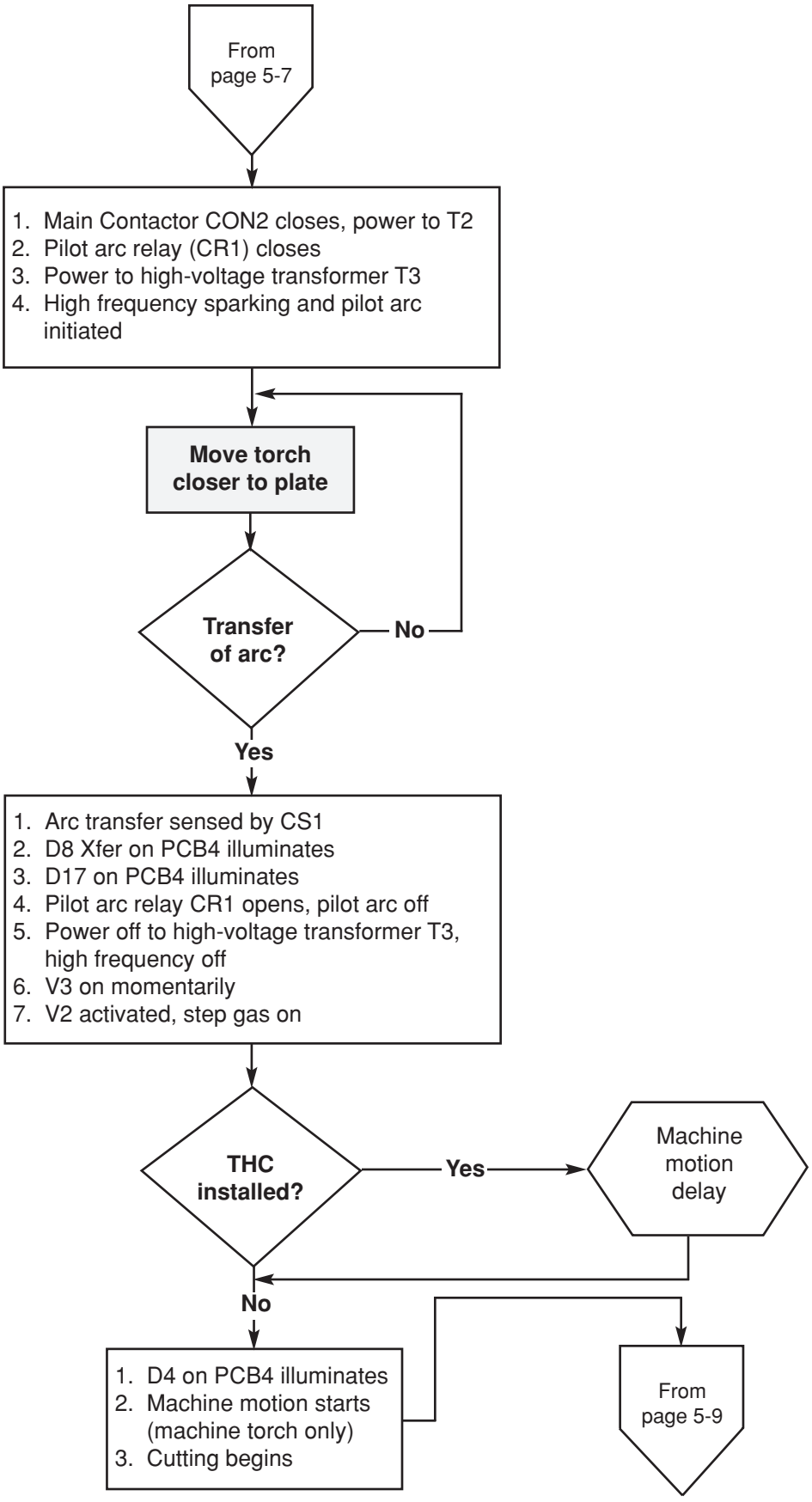


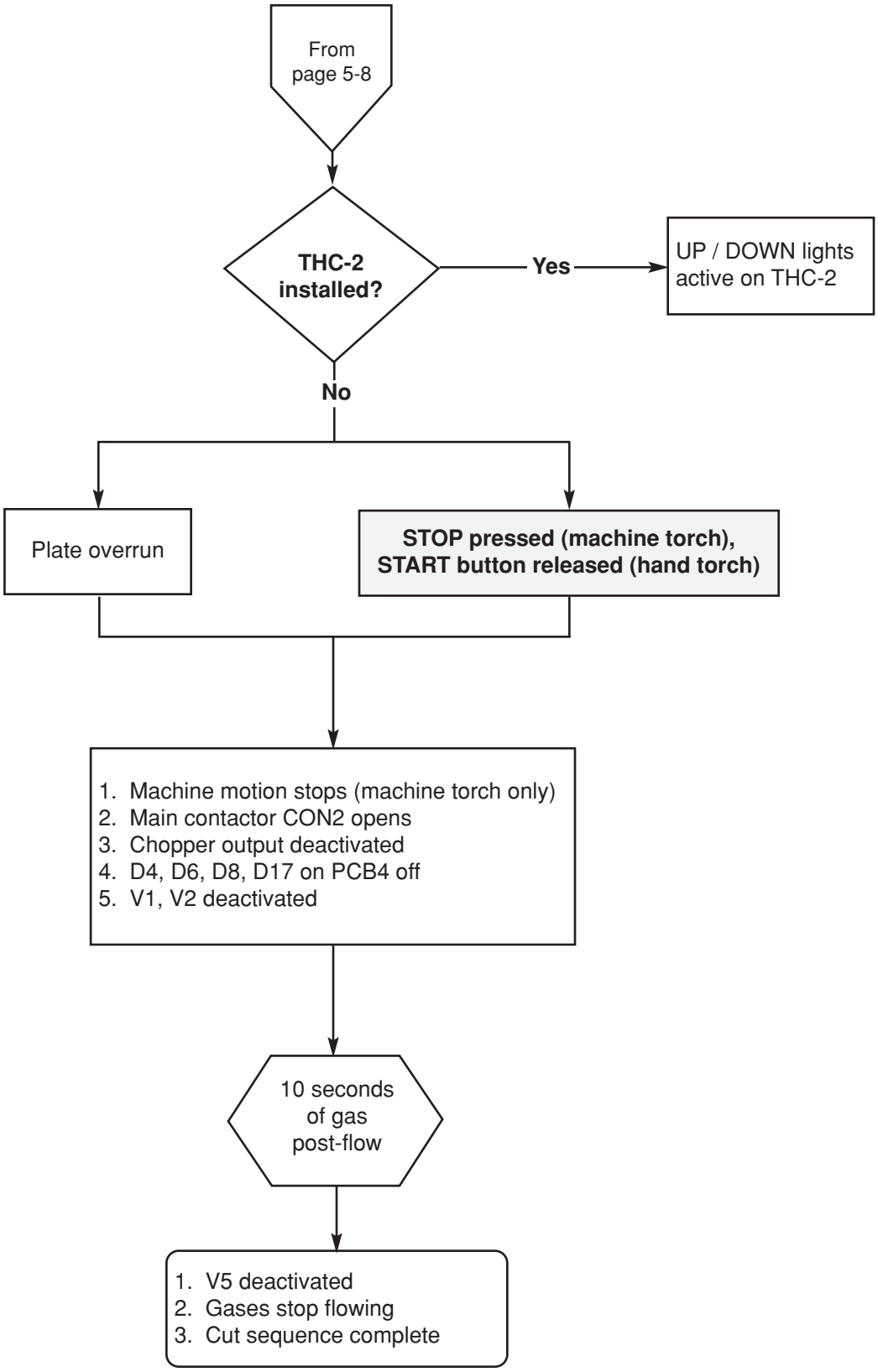
Off-page Connector The off-page connector is used to indicate exit or entry from another page to the flowchart.


Push ON button (1PB)
1. 120V relay CR4 on PCB2 closes
2. Fans on
3. V6 activated
All interlocks satisfied?
No
1. 24VAC relay CR3 on PCB2 remains open
2. Control Panel lights not illuminated
3. LEDs on PCB4 not illuminated
Yes
1. CR1 and CR2 on PCB2 close
2. 24VAC relay CR3 on PCB2 closes
3. POWER ON LT1 and GAS PRESSURE LT2 illuminate
4. 120V to PCB4
5. D5 on PCB4 illuminates
6. 12VDC activates CS1 on PCB3
Switch to TEST (SW2 opens)
1. 120 volts activates V1 (gas start), V2 (gas step), and V5 (pre flow/post flow gas)
2. Gases flow through system
To page 5-6


From
page 5-5
Adjust flow
rates
THC-2
installed?
Yes
Set machine
delay, set voltage
No
Switch to RUN
(SW2 closes)
1. V1, V2, and V5
deactivated
2. Gases stop flowing
Plate switch to NORMAL
(SW1 closes)
CR1 opens (pilot arc off)
To
page 5-7


From
page 5-6
Adjust current
(R6)
Press START
button
1. D6 on PCB4 illuminates
2. V1, V5 activated
3. V4 on momentarily
4. Gases flow
5. Chopper output activated
2 seconds of
gas preflow
To
page 5-8


From page 5-7
1. Main Contactor CON2 closes, power to T2
2. Pilot arc relay (CR1) closes
3. Power to high-voltage transformer T3
4. High frequency sparking and pilot arc initiated
Move torch closer to plate
Transfer of arc?
No
Yes
1. Arc transfer sensed by CS1
2. D8 Xfer on PCB4 illuminates
3. D17 on PCB4 illuminates
4. Pilot arc relay CR1 opens, pilot arc off
5. Power off to high-voltage transformer T3, high frequency off
6. V3 on momentarily
7. V2 activated, step gas on
THC installed?
Yes
Machine motion delay
No
1. D4 on PCB4 illuminates
2. Machine motion starts (machine torch only)
3. Cutting begins
From page 5-9


From page 5-8
THC-2 installed?
Yes
UP / DOWN lights active on THC-2
No
Plate overrun
STOP pressed (machine torch), START button released (hand torch)
1. Machine motion stops (machine torch only)
2. Main contactor CON2 opens
3. Chopper output deactivated
4. D4, D6, D8, D17 on PCB4 off
5. V1, V2 deactivated
10 seconds of gas post-flow
1. V5 deactivated
2. Gases stop flowing
3. Cut sequence complete

Initial Checks

Before tracking down specific problems, it is good practice to do a visual check, and verify proper voltages are present at the power source, transformer and power distribution board.

WARNING

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

1. Disconnect line power by turning main disconnect switch off.

2. Using a Phillips head screwdriver, remove top plate, two side plates, front plate, and rear plate.

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 (**6**) to identify parts and part numbers.

4. If no damage is apparent, apply power by turning on the main disconnect switch.

5. Measure the voltage between the U, V and W terminals on the EMI filter located on the rear of the MAX100D power supply. Refer to Figure 5-1. The voltage between any two of the three terminals should be equal to the supply voltage (380 or 415 VAC). If there is a problem at this point, disconnect main power and check connections, power cable, and fuses at line disconnect switch. Repair and/or replace defective component(s) if necessary.

(continued on page 5-12)

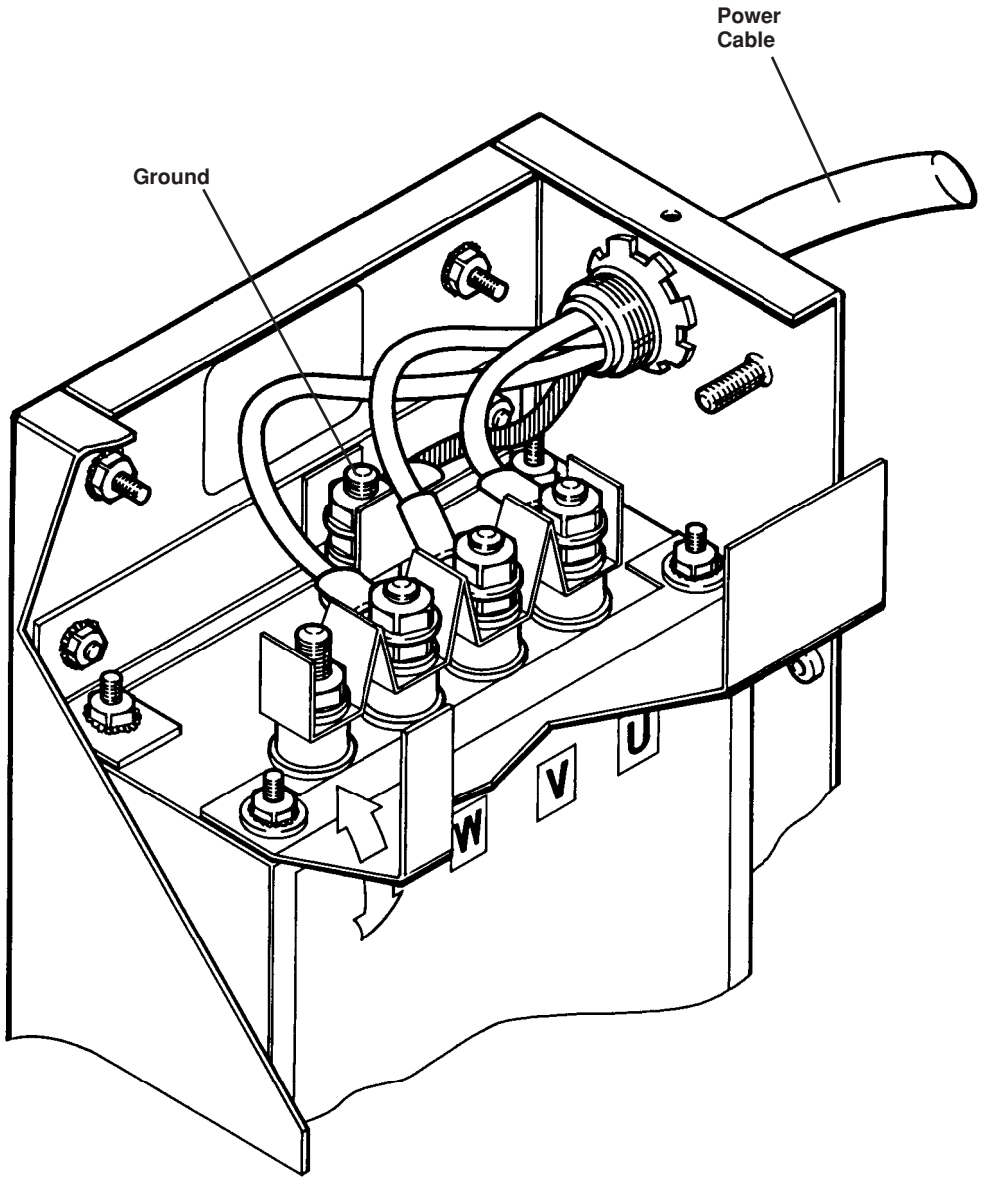


Figure 5-1 Primary Power Measurement Location – MAX100D

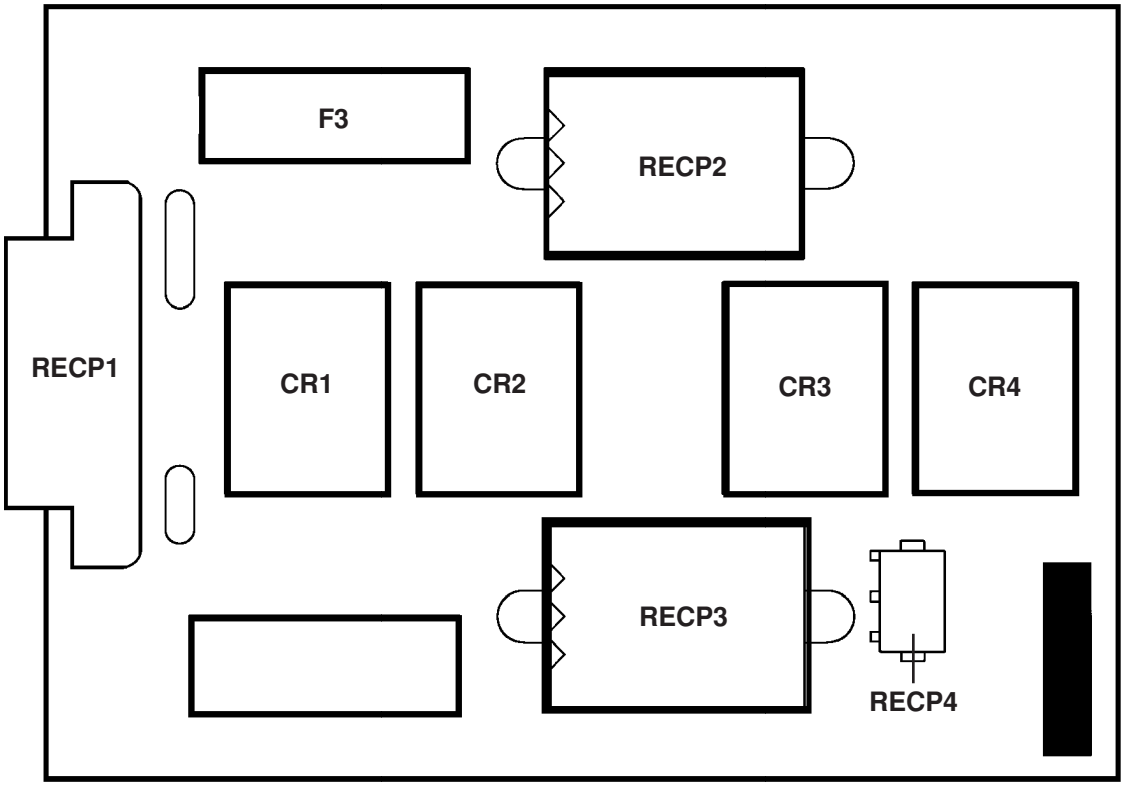


Figure 5-2 Power Distribution Board PCB2

6. Measure voltage at power distribution board PCB2. See Figure 5-2 for detail of PCB2. Look on the board for fuses **F3** and **F4**. Measurements between each fuse and chassis ground are as follows:

   F3: 115 VAC
   F4: 24 VAC

   If voltages are not present, or incorrect at one or more of these points, disconnect power and troubleshoot PCB2 fuses and associated pins, connectors and wiring between power distribution board connector RECP1 and transformer secondary T1. See Figure 6-5 for location of T1.

   Also, check main power fuses F1 and F2 (located in Figure 6-1), and associated wiring and connections between T1 and L1 and L2.

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

Troubleshooting

The troubleshooting section is presented by following normal operational sequence. Shaded boxes with operator action correspond to action outlined in Sequence of Events. 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 nearest Hypertherm Technical Services Department listed at the front of this manual.

Push ON button (PB1)

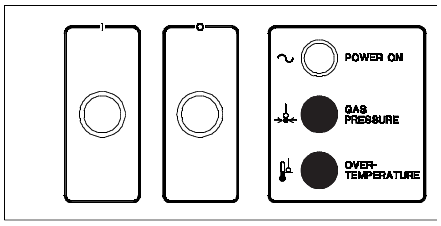
Problem	*Possible Causes* and Solutions
1. The fans are not operating and the POWER ON indicator does not illuminate.	**1.1.** *The green I (ON) PB1 pushbutton is defective.* Check switch. The ON switch is normally open
	1.2. *The red O (OFF) PB2 pushbutton is defective.* Check switch. The OFF switch is normally closed.
	1.3. *Associated wiring not making good contact.* Check wiring and repair or replace, if necessary.
2. POWER ON indicator illuminates, but the fans are not operating.	**2.1.** *CR4 on the Power Distribution Board is defective.* Check that CR4 switches when ON pushbutton is pressed. See Figure 5-2 for location of CR4. If CR4 is defective, replace PCB2.
	2.2. *Terminals to fans are not seated together securely and/or not getting 120VAC from Power Distribution Board.* Check terminals and associated wiring for good continuity. Check for 120VAC at terminals.
	2.3. *PL2 and RECP2 on Power Distribution Board (see Figure 5-2 for location of RECP2) 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 fans are operating, but the POWER ON indicator does not illuminate.

Note: Indicator On = ◯
Indicator Off = ●

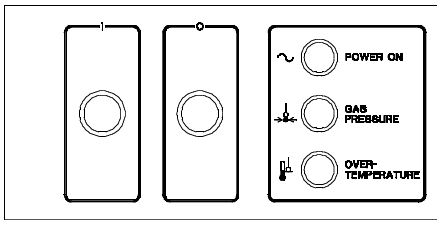


3.1. *The I (ON) PB1 pushbutton was not held down for a long enough time.*
Press and hold the I (ON) button for a minimum of 5 seconds. If the POWER ON indicator will not illuminate after holding down the I (ON) button for 5 seconds, check the safety "interlock" indicators while holding down the I (ON) button. Refer to the control panel indicator conditions and possible causes and solutions listed opposite.

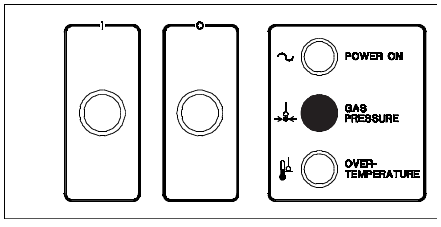
3.2.1. *Gas is not on or is set too low.*
Control panel indicator GAS PRESSURE will not illuminate if the pressure to the MAX100D is set too low. Be certain that the plasma supply gas is on and is set to a minimum of **6.2 bar.**

3.2.2. *There is a gas leak somewhere in the system.*
Be certain that there is no hissing sound coming from the torch, or anywhere between the torch and the gas supply.

3.2.3. *Pressure switch PS1 not functioning.*
PS1 is normally open, and closes when gas pressure of **2.7 bar** or greater is sensed. It is powered by 24VAC from the Power Distribution Board. After PS1 is closed, 24VAC illuminates the GAS PRESSURE indicator. Use wiring diagram in **Section 7** to troubleshoot.



3.3. *Main Transformer T2 and/or chopper has overheated.*
Temperature switch TS1 will open when the transformer overheats. Temperature switch TS2 will open when the chopper overheats. If transformer T2 or chopper are excessively hot, leave the MAX100D off with fans running for 1 hour to cool down. If transformer and chopper are <u>not</u> hot, take TS1 connector apart and check for continuity. TS1 and TS2 are normally closed. Also, check TS2 for continuity. Check pins, connectors and associated wiring from TS1 and TS2 to PL3 of power distribution board PCB2.



3.4. *There are problems with the gas pressure <u>and</u> the transformer or chopper.*
See 3.2. to 3.3. above

Switch to TEST

Problem	*Possible Causes* and Solutions
4. Gas flow is weak, or not flowing.	**4.1.** *TEST/RUN switch no functioning.* SW2 is open in the TEST position. Make a continuity check.
	4.2. *Plasma Gas or Shield Gas adjustment valves are closed.* Open plasma gas valve on plasma gas console and shield gas valve on front control panel.
	4.3. *Valves V5, or V2 not getting 120VAC from Control Board PCB4.* Check for 120VAC at V5 and V2 after switch is in TEST position. If V5 and/or V2 are not getting 120VAC from PCB4, check to see if PCB4 is functioning. Repair and/or replace defective component(s).
	4.4. *Gas line(s) from valves to adjustment valves to torch are blocked or leaking.* Check hoses and repair or replace if necessary.

Adjust flow rates

Problem	*Possible Causes* and Solutions
5. Flow rates cannot be adjusted to specifications suggested in Cut / Gouging charts.	**5.1.** *Source gas pressures not on or set too low.* Set incoming pressure to a minimum of 6.2 bar at 59 liters/minute for plasma gas, and 6.2 bar at 208 liters/minute for shield gas.
	5.2. *Gas line(s) from valves to adjustment valves to torch are blocked or leaking.* Check hoses and repair or replace if necessary.

Switch to RUN

Problem	*Possible Causes* and Solutions
6. Gas continues to flow.	**6.1.** *TEST/RUN switch not functioning.* SW2 is closed in RUN position. Make a continuity check.
	6.2. *Solenoid valves V2 and V5 not getting 0VAC from Control Board PCB4.* Disconnect terminals to V2 and V5, and check for 0VAC from Control Board PCB4 after SW2 is in the RUN position. If there is 120VAC replace Control Board PCB4.
	6.3. *Solenoid valves V2 and V5 not functioning.* If valves are getting 0VAC from PCB4, verify that valves are opening correctly. If not, replace them.

Press START button

Problem	*Possible Causes* and Solutions
7. 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 (.5 mm per gap) the electrodes, if necessary. Ensure that the electrode surfaces between the gaps are flat. If surfaces are rounded, replace and regap.
	7.2. *High voltage transformer T3 is overheating.* Check T3 for leaking or overheating. Replace, if necessary.
	7.3. *High voltage transformer T3 not getting 120VAC from Control Board PCB4.* Check pins, connectors and associated wiring from T3 to PCB4.
	7.4. *T3 or capacitor pair C6, C7 in spark gap assembly defective.* Shut down system and remove capacitors C6 and C7. Restart system and see if a faint spark is now observed across the gaps. If a spark is not observed at the gaps, replace T3. If there is a spark, replace capacitor pair C6, C7. Always replace the capacitors in pairs.

Problem	*Possible Causes* and Solutions
	7.5. *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.
	7.6. Pilot arc relay CR1 is not functioning or not getting 120VAC from the Control Board PCB4. See if the CR1 relay contacts close after the START command is given. If CR1 does not close check to see if CR1 is getting 120VAC from PCB4. If it is, replace CR1. If there is no 120VAC from PCB4, replace Control Board PCB4.
8. There is high frequency, but there is no pilot arc.	**8.1.** *Torch parts are worn.* Check consumable parts and replace, if necessary. See *Changing Consumable Parts* in **Section 4**.
	8.2. *Torch leads are loose or worn.* Replace torch leads as required.
	8.3. *Pilot arc relay CR1 not functioning.* See solution 7.6.
	8.4. *Main contactor CON2 or PCB4 is defective.* Check to see if CON2 is getting 24VAC after START command is given. If there is no 24VAC, check pins, connections, and associated wiring from CON2 to PCB4. If wiring is O.K., replace PCB4. If there is 24VAC at CON2 after START command is given, measure for 200 VAC between terminals A, B and C of main transformer T2. If there is no voltage between these points, replace CON2.
	8.5. *Surge injection circuit is defective.* Check capacitor C3 and resistor R3. Replace as required.
	8.6. *Chopper defective or not functioning.* See *Chopper Module Test Procedure* later in this section to troubleshoot.

Move torch close to plate

Problem	*Possible Causes* and Solutions
9. Arc not transferring to workpiece.	**9.1.** *The work clamp is not connected or it is broken.* Connect or repair the work clamp.
	9.2. *The PLATE switch is in the EXPANDED position.* Verify that PLATE is in the NORMAL position.
	9.3. *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 / Gouging Charts* in **Section 4**.
	9.4. *Transfer of arc not sensed by MAX100D.* See *Arc Transfer Test Procedure* later in this section.
	9.5. *Chopper defective or not functioning.* See *Chopper Module Test Procedure* later in this section.
10. The unit stops cutting during cut, or cuts poorly.	**10.1.** *There is insufficient gas pressure.* Check gas inlet pressure specifications under *Cut / Gouging Charts* in **Section 4.** Check plasma and shield gas pressures in TEST and RUN positions as specified under *Cut / Gouging Charts* in **Section 4.**
	10.2. *Torch is getting insufficient current.* Check the arc current setting for the type and thickness of metal you are cutting from the *Cut / Gouging Charts* in **Section 4.**
	10.3. *Torch consumable parts are worn.* Check consumables and replace if necessary. See Changing Consumable Parts in **Section 4.**
	10.4. *The PLATE switch is in the EXPANDED position.* When cutting most metals, place the PLATE switch in the NORMAL position. Switch to EXPANDED position only when cutting metal grate (see *Description of Controls* and *Operating Instructions* in Section 4).

Problem	*Possible Causes* and Solutions
	10.5. *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 (**3.2**).
	10.6. *Chopper defective or not functioning.* See *Chopper Module Test Procedure* later in this section.

Plate overrun **or** **STOP pressed (machine torch), START button released (hand torch)**

Problem	*Possible Causes* and Solutions
11. Machine motion continues (machine torch only).	**11.1.** *Defective or miswired machine START switch.* Check switch and wiring diagrams for correct hookup of PLASMA START and MACHINE START.
	11.2. *Arc transfer signal not changing.* Check to see if D8 on Control Board PCB4 remains illuminated after torch moves away from plate. See Figure 5-7 for location of D8. • If D8 remains illuminated, check to see if CS1 is sending a 0 volt signal to PCB4. If there is 0 volts at PCB4, replace sensor CS1. If voltage at PCB4 is greater than 0 volts, replace Control Board PCB4. • If D8 is extinguished, replace Control Board PCB4.
12. Gas continues to flow after 10 seconds.	**12.1.** *Gas TEST/RUN switch is in the TEST position.* Be certain that Gas switch is in the RUN position when cutting.
13. No post-flow of gas.	**13.1.** *Defective Control Board PCB4.* See step 4.3. If valves are working in TEST mode, but not in post-flow mode, replace Control Board PCB4.
	13.2. *Defective valves.* See solution 4.4.
14. Short torch consumables life.	**14.1.** *Plate is in the Expanded position.* See solution 10.4.
	14.2. *Pilot arc relay CR1 not opening after transfer of arc.* Check to see if contacts on relay CR1 are stuck shut. Replace if necessary. If relay is OK, check to see if CR1 is receiving 120VAC fromthe Control Board PCB4 after transfer of arc. If Control Board PCB4 continues to send 120VAC to CR1 after arc transfer, replace Control Board PCB4.

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, contact the nearest Hypertherm Technical Service Department listed at the front of this manual.

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) on the I/O board and the signal is sent to the Control Board PCB4. To check for proper functioning of the arc transfer sensing system, perform the following procedure:

1. Observe D8 on PCB4 (see Figure 5-6) and see if it illuminates after main contactor closes (see sequence flowchart earlier in this section). If it does not illuminate, continue to next step. If it does illuminate, return to *Troubleshooting* section.

2. Disconnect connector from CS1 (see Figure 6-3 for location of CS1) and check for +12VDC. If there is +12VDC, go to step 5.

3. If there is no +12VDC, power down and check connectors, pins and associated wiring between PL4 and PL6 (connected to S2 on Control Board PCB4). Repair and/or replace defective component(s) if necessary.

4. If wiring is OK, replace Control Board PCB4.

5. If there is +12VDC at CS1, reconnect PL4 and take voltage between pins 13&14 of PL6 on Control Board PCB4 after arc is established. This should read 0 volts.

   If there is no 0 volts, replace CS1.

Test Procedures (cont.)

Chopper Module Test Procedure

Note: Take voltages with a digital multimeter capable of storing min. and max. readings.

WARNING

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

1. Turn all power to the MAX100D OFF.
   Disconnect terminals labeled 21&22 from their mating receptacles to disable the high frequency transformer. Terminals 21&22 are located near the high voltage transformer T3. See Fig. 6-2 for location of T3.

2. Remove large fuse F5. Check to see if fuse is open. See Fig. 6-3 for location of F5.

3. Place the positive lead to the **+** side of the bridge and the negative lead to the **–** side of the bridge. See Fig. 5-3. Note that actual connection points are hidden by cap support bracket in Fig. 5-3.

4. Turn power to the MAX100 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 F5 was blown, replace the chopper module.
   If there is no +280 VDC input, check input to bridge for shorts. Also, check contactor (CON2), connections and associated wiring to the contactor. Repair and/or replace defective component(s) if necessary.

5. If voltage from above step is +280 VDC and F5 is not blown, check output of chopper by putting the positive lead of the voltmeter at point (+) WORK and placing the negative lead on point (-) TORCH. See Fig. 5-3.

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

7. If the chopper does not output +280 VDC, check to see if LED1 logic power light is illuminated. If LED1 is not illuminated, 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 illuminated and LED3 is red when enabled (fault condition), then make sure that JP9 is seated properly.

Test Procedures (cont.)

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 from the control board PCB4 as an analog level from 0 to +12 VDC, which varies the duty cycle and subsequent output current of the chopper. This analog signal is on pins 10&11 of S3 on PCB4.

   To determine if there is a problem with the chopper module or with control board PCB4, proceed as follows:

   - Ensure that high frequency is still disabled (see step 1).
   - Disconnect PL7 from S3 on PCB4.
   - Place voltmeter across output of chopper and press the START command.
   - If the voltmeter reads +280 VDC, then there is a problem with PCB4.
   - If the voltmeter reads 0 volts, then replace chopper module.

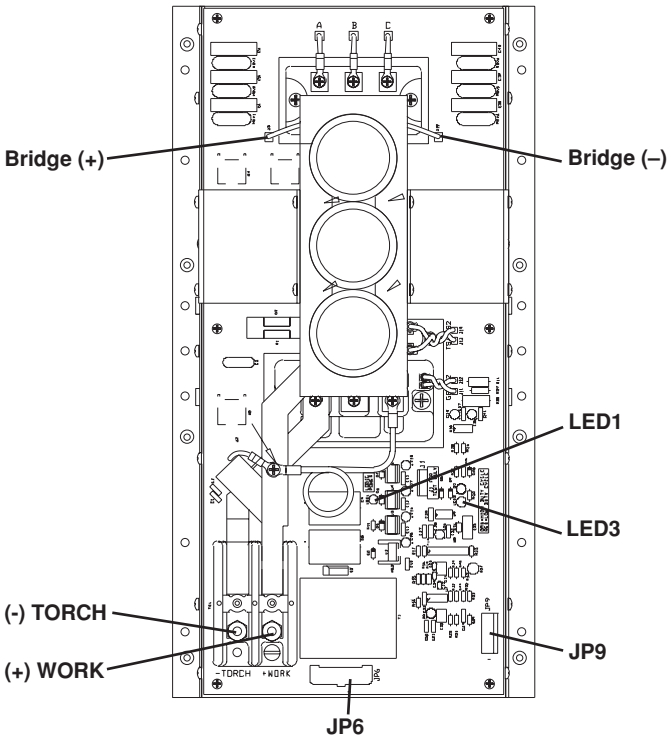


Figure 5-3 Chopper Module – Front View

Disassembly of Hand Torch

To remove and replace the hand torch main body from the lead, perform the following procedure and see Figure 5-4.

Removal

1. Remove the 5 **screws** and separate the two **handle** halves.
2. Remove the torch **switch** from the handle **switch holder** and allow it to hang freely.
3. For the **shield** gas lead, use a 3/8" open-end wrench to hold the torch main body fitting and a 1/2" open-end wrench to loosen the torch lead fitting.
4. For the **plasma** gas lead, use a 5/16" open-end wrench to hold the torch main body fitting and a 7/16" open-end wrench to loosen the torch lead fitting.
5. For the **cap-on** gas lead, use a 5/16" open-end wrench to hold the torch main body fitting, and a 3/8" open-end wrench to loosen the torch lead fitting.
6. Remove the torch **main body**.

Replacement

Reverse the above steps to replace the new torch body onto the torch leads.

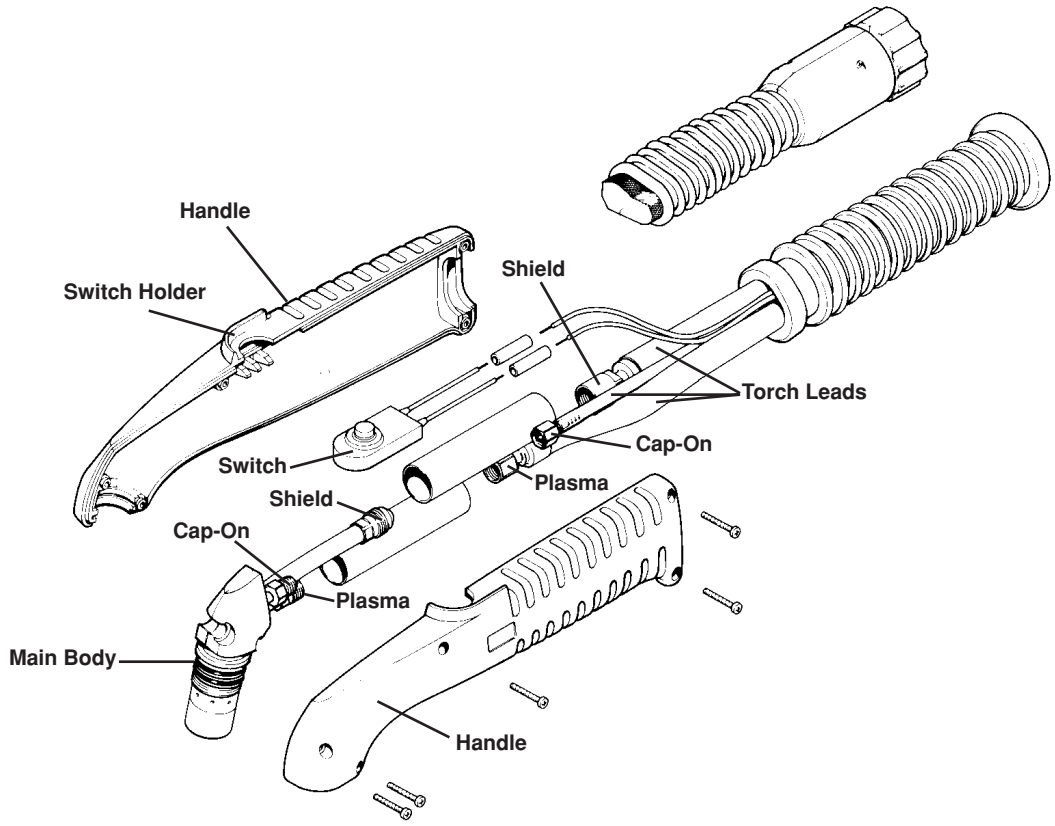


Figure 5-4 PAC160 or PAC160E Hand Torch Assembly

Disassembly of Machine Torch

Refer to Figure 5-5 and follow the instructions below.

Removal

1. Unscrew the torch **sleeve** from the torch **main body** and slide it over the torch **leads**.

2. For the **shield** gas lead, use a 3/8" open-end wrench to hold the torch main body fitting and a 1/2" open-end wrench to loosen the torch lead fitting.

3. For the **plasma** gas lead, use a 5/16" open-end wrench to hold the torch main body fitting and a 7/16" open-end wrench to loosen the torch lead fitting.

4. For the **cap-on** gas lead, use a 5/16" open-end wrench to hold the torch main body fitting, and a 3/8" open-end wrench to loosen the torch lead fitting.

5. Remove the torch **main body**.

Replacement

Reverse the above steps to replace the new torch body onto the torch leads.

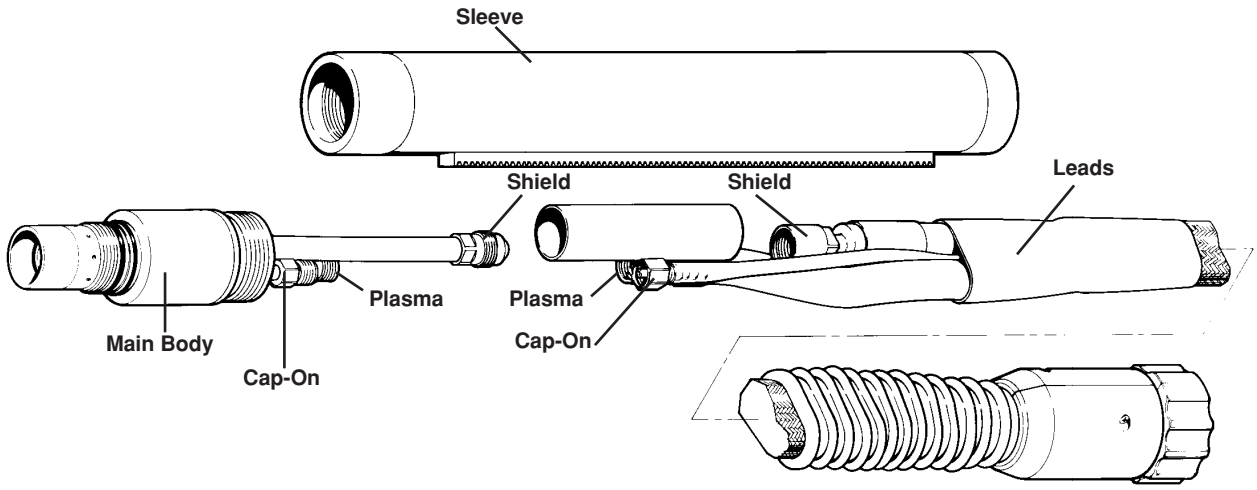


Figure 5-5 Machine Torch Assembly

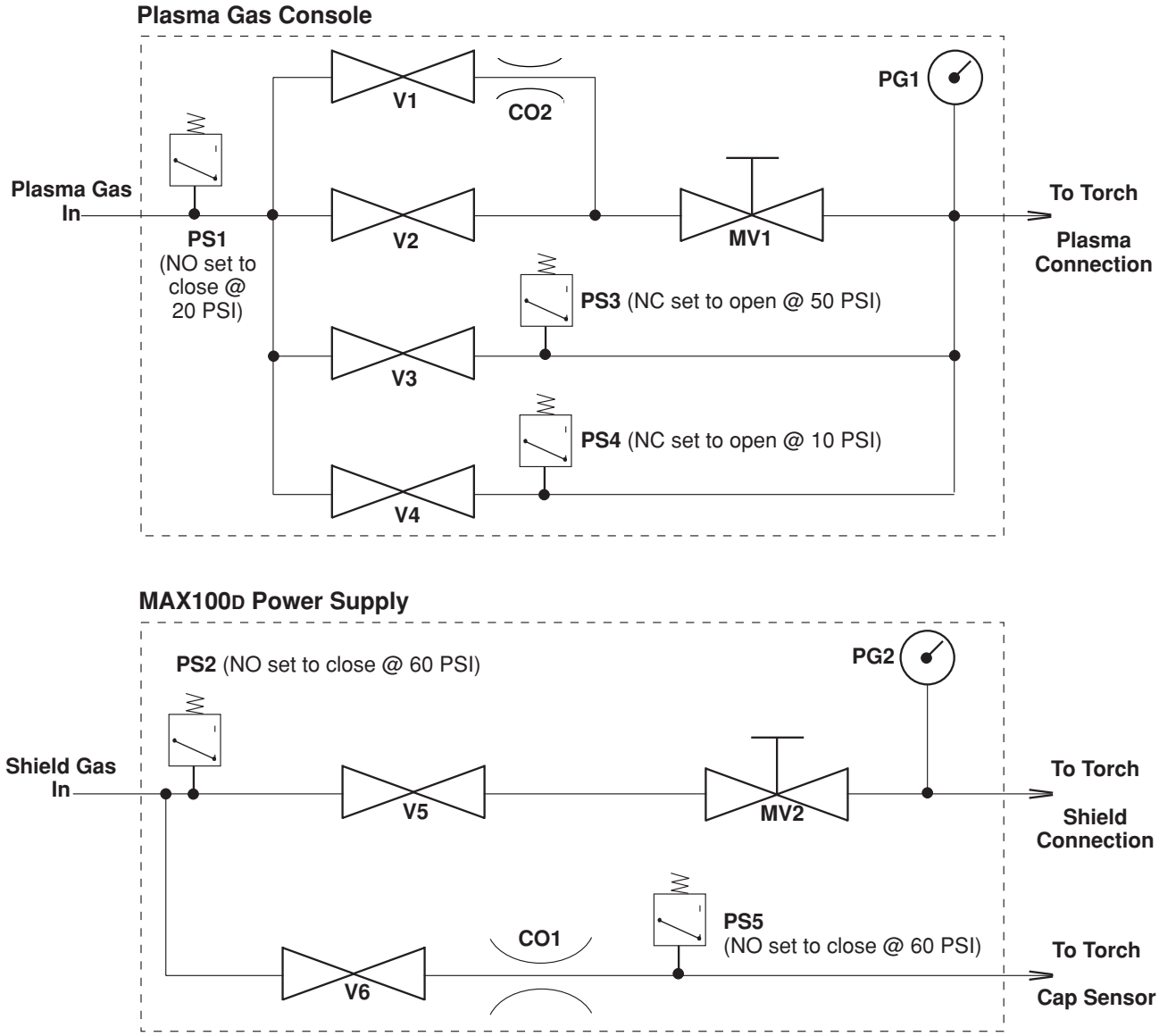


Figure 5-6 MAX100D System Plasma and Shield Gas Flow Schematic

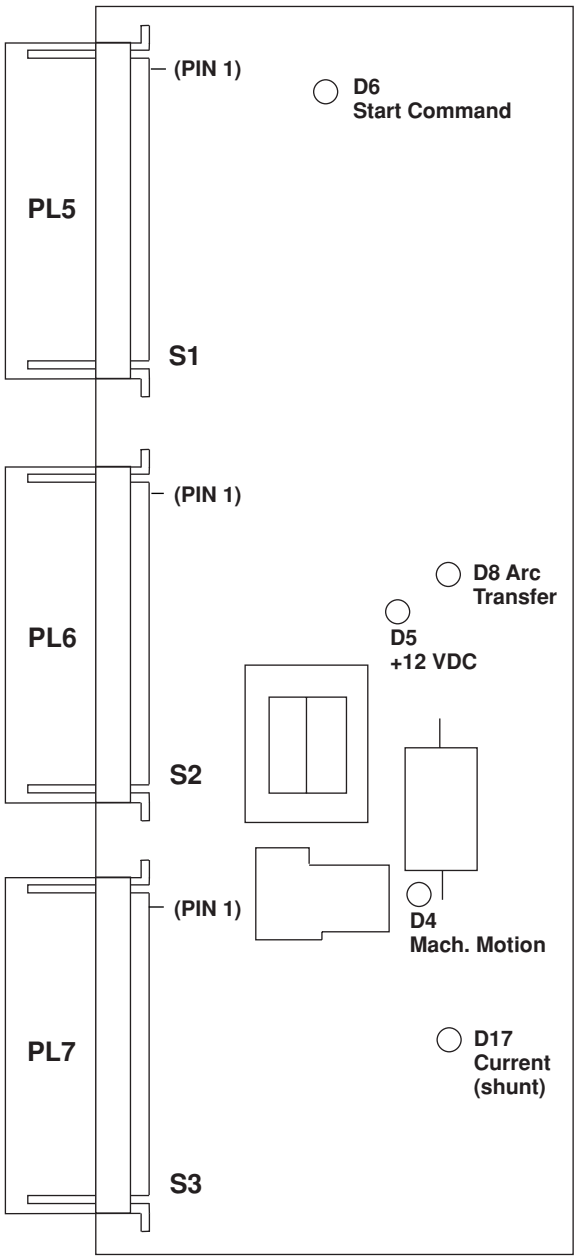


Figure 5-7 PCB4 Control Board

Hypertherm

Section 6

PARTS LIST

In this section:

Introduction

In this section is a parts list breakdown with accompanying drawings for the MAX100D plasma torch system.

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

Item	Part Number	Description	Designator	Qty.
	129153	**Cont Pnl SA: MAX100D-CE/LVD**		1
1	001611	Pnl: MAX100D-CE/LVD Cont		1
12	005092	PB Sw: Grn NO Full Gd	**PB1**	1
14	008328	Knob: .930 Dia 1/4 SFT Blk/Nat		

Item: Refers to item call out on opposing page.
Number (Ex. 1) refers to numbered call out ① on opposing page.

Part Number: Refers to Hypertherm part numbers.
Bold part numbers (Ex. **129153**) signify parent or subassemblies that contain additional items.

Normal-style part numbers (Ex. 001611) signify items under parent or subassembly.

Description: Describes the item.
Bold descriptions not indented (Ex. **Cont Pnl SA: MAX100D**) signify parent assemblies that contain additional items.

Normal-style part numbers that are indented (Ex. Pnl: MAX100D CE/LVD Cont) signify items under parent or subassembly.

Normal-style part numbers that are not indented (Ex. Knob: .930 Dia 1/4 SFT Blk/Nat) represent subassemblies that are not under the 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.

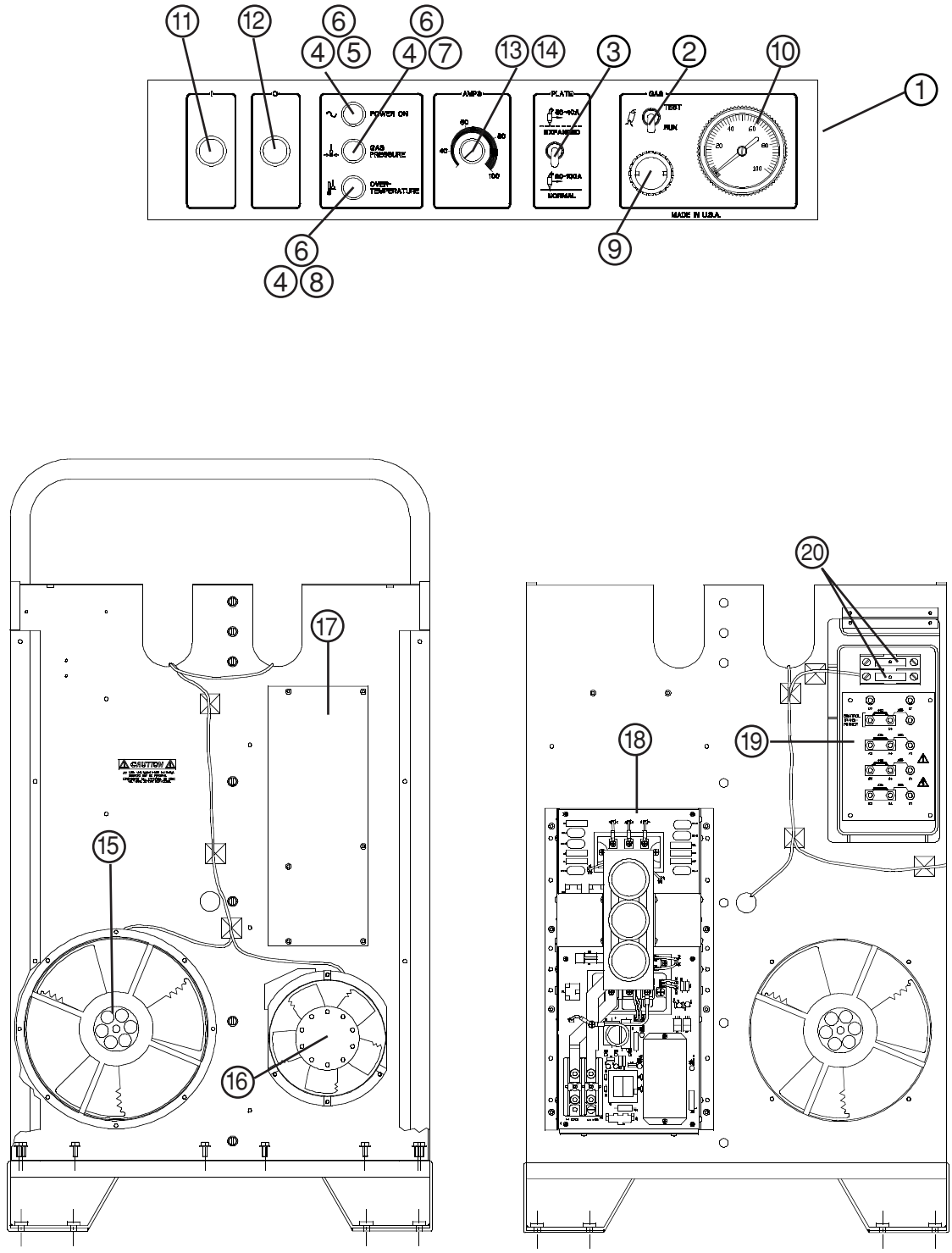
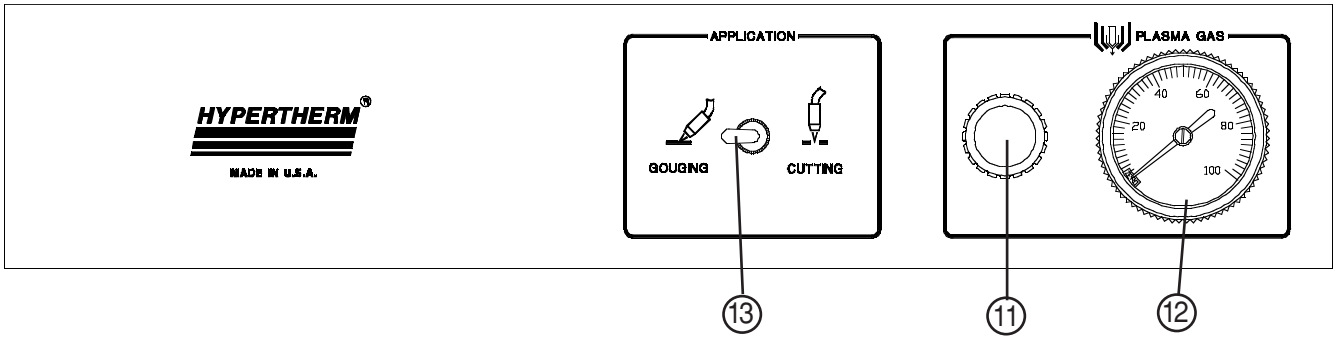


Figure 6-1 MAX100D: Front Panel Outside, Front Panel Inside, and Control Panel

MAX100D: Front Panel Outside, Front Panel Inside and Control Panel

Item	Part Number	Description	Designator	Qty.
	129153	**Cont Pnl SA: MAX100D-CE/LVD**		1
1	001611	Pnl: MAX100D-CE/LVD Cont		1
2	005105	Tgl Sw: 3PDT	**SW2**	1
3	005041	Tgl Sw: DP Maint ON/ON	**SW1**	1
4	005088	Lamp Hldr: Use T3-1/4 LTBULB		3
5	005089	Lens: Wht For 005088		1
6	005168	Lightbulb: 28VDC 40ma T3-1/4	**LT1, LT2, LT3**	3
7	005177	Lens: Green for 005088		1
8	005197	Lens: Amber for 005088		1
9	006002	Meter Valve: 1/4 FPT .125 Orf		1
10	022008	Gauge, Press 2 1/2" Dia. 1-100		1
11	005121	PB Sw: Grn NO Full Gd	**PB1**	1
12	005122	PB Sw: Red NC	**PB2**	1
13	009483	Pot: 1K-Ohm 1W 10%	**R6**	1
14	008328	Knob: .930 Dia 1/4 SFT Blk/Nat		1
15	027079	Fan 450-550 CFM 120VAC 50/60 Hz	**M1**	1
16	027080	Fan 225 CFM 120VAC 50/60 Hz	**M2**	1
17	**041313**	**PC BD Assy Ctrl MAX100D**	**PCB4**	1
18	**129118**	**CH130-CE/LVD Chopper SA**		1
	005199	Temperature Switch 82°C	**TS2**	1
19	**129075**	**Linkboard SA: 100/D-CE/LVD 380-415**		1
20	008997	Fuse: 2A 500V 10mmX38mm Gl Slo	**F1, F2**	2
	001574	Panel:MAX100-CE/LVD Front		1



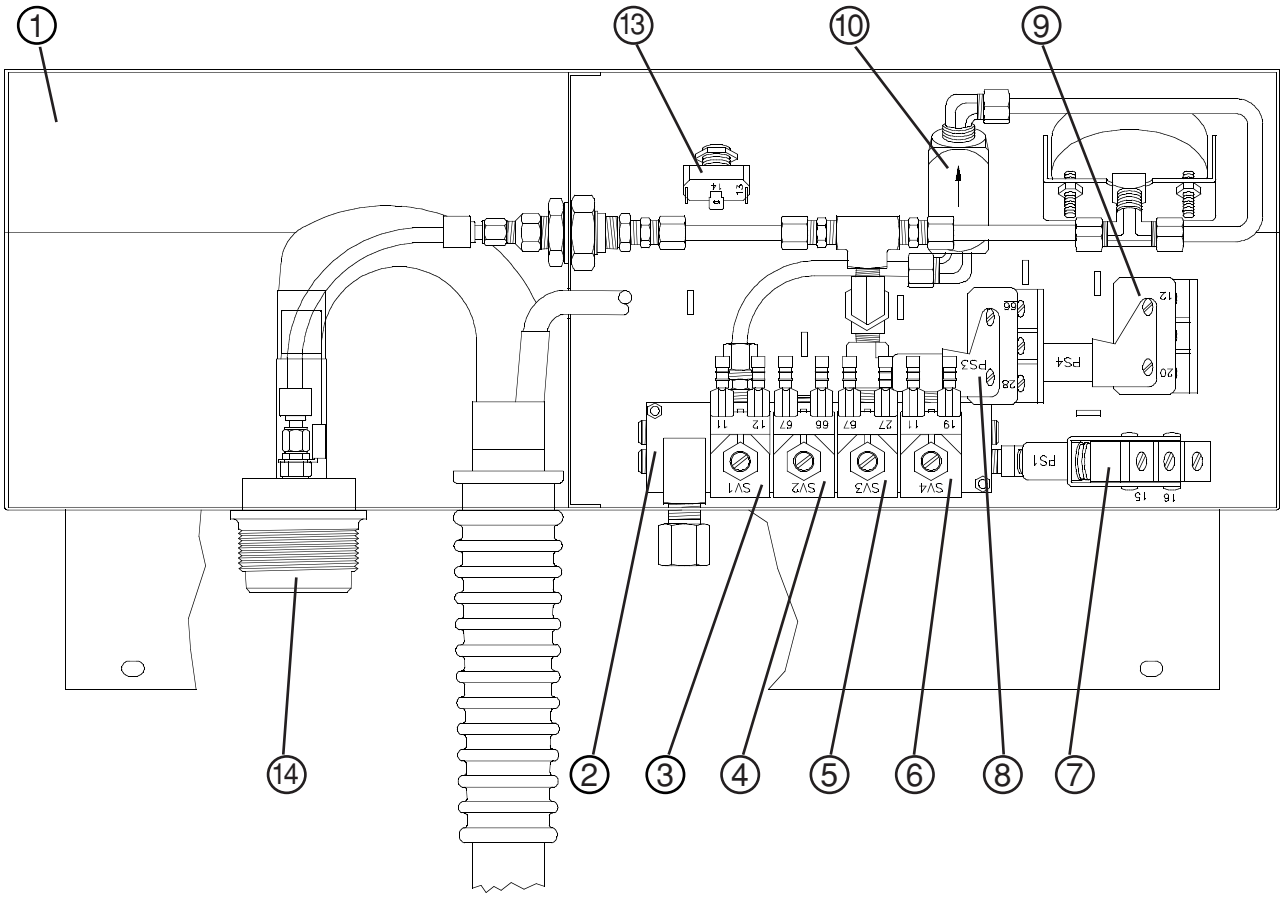


Figure 6-2 MAX100D: Plasma Gas Console

MAX100D: Plasma Gas Console

Item	Part Number	Description	Designator	Qty.
	129163	**MAX100D Gas Cont SA**		1
1	001612	Gas Console Enclosure		1
	029793	**Manf SA: MAX100D Gas Cont**		1
2	004566	Manf: MAX100D Plasma Gas		1
3	006093	Sol Valve: 150# Manif Mnt 120V NC	**V1**	1
4	006093	Sol Valve: 150# Manif Mnt 120V NC	**V2**	1
5	006093	Sol Valve: 150# Manif Mnt 120V NC	**V3**	1
6	006093	Sol Valve: 150# Manif Mnt 120V NC	**V4**	1
7	005093	Press Sw: 0-90 psi 1/8 NPT	**PS1**	1
8	005093	Press Sw: 0-90 psi 1/8 NPT	**PS3**	1
9	005093	Press Sw: 0-90 psi 1/8 NPT	**PS4**	1
10	006002	Meter Valve:1/4 FPT .125 Orifice	**MV1**	1
11	004117	Cap: Ndl Valve		4
12	022008	Pressure Gauge:100#/Bar 2.5" 1/8CBM	**PG1**	1
13	005044	Tgl Sw: SPDT Maint ON/ON	**10TGS**	1
14	**028559**	**Rcpt Assy: MAX100D Qdisc**		1

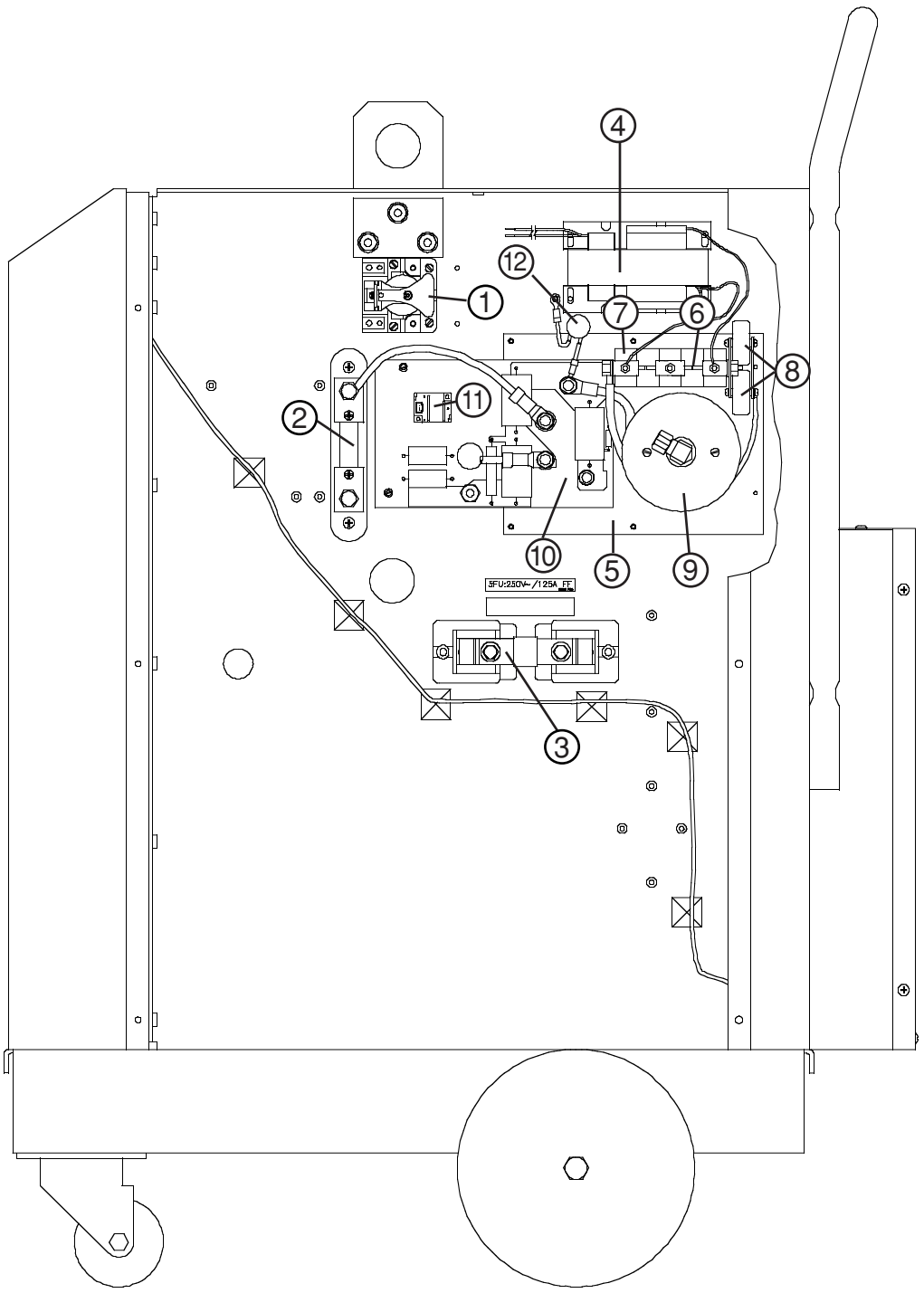


Figure 6-3 MAX100D: Right Center Wall

MAX100D: Right Center Wall

Item	Part Number	Description	Designator	Qty.
1	003021	Relay: 120VAC SPST NO	**CR1**	1
2	007022	Shunt: 100A 100 mv	**1MSH**	1
3	008317	Fuse: 125A 250V Semicond	**F5**	1
4	014021	Transformer, 5000VAC, 20ma	**T3**	1
5	**029190**	**Hi Freq/IO Panel SA, MAX100**	**PCB3**	1
	009350	**Spark Gap Assy: 40-20/2000/HD**	**SG1**	1
6	004061	Electrd:Spk Gap 1/8 x 1.6		3
7	004140	Base:40/80/100/200/HD Spk Gap		1
8	009280	Cap: .022uF 15kV	**C6,C7**	2
9	**009371**	**Coil Assy:80-100A HF**	**T4**	1
10	**041120**	**PC BD Assy I/O MAX100**		1
11	**029202**	**Current Sensor SA, MAX100**	**CS1**	1
12	129164	Capacitor SA:MAX100/D-CE/LVD Filter		1
	001578	Cover: MAX100-CE/LVD Side		1
	001575	Cover: MAX100-CE/LVD Top		1

MAX100D: Base Plate Components

Item	Part Number	Description	Designator	Qty.
1	014043	Inductor, 4mh, 100ADC, MAX100	**L1**	1
2	014065	Transformer 15kW 220-380-415/3/50	**T2**	1

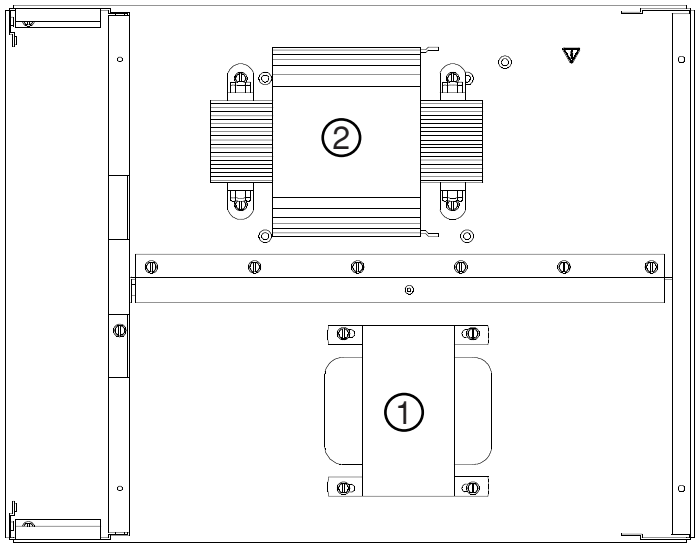


Figure 6-4 MAX100D: Base Plate Components

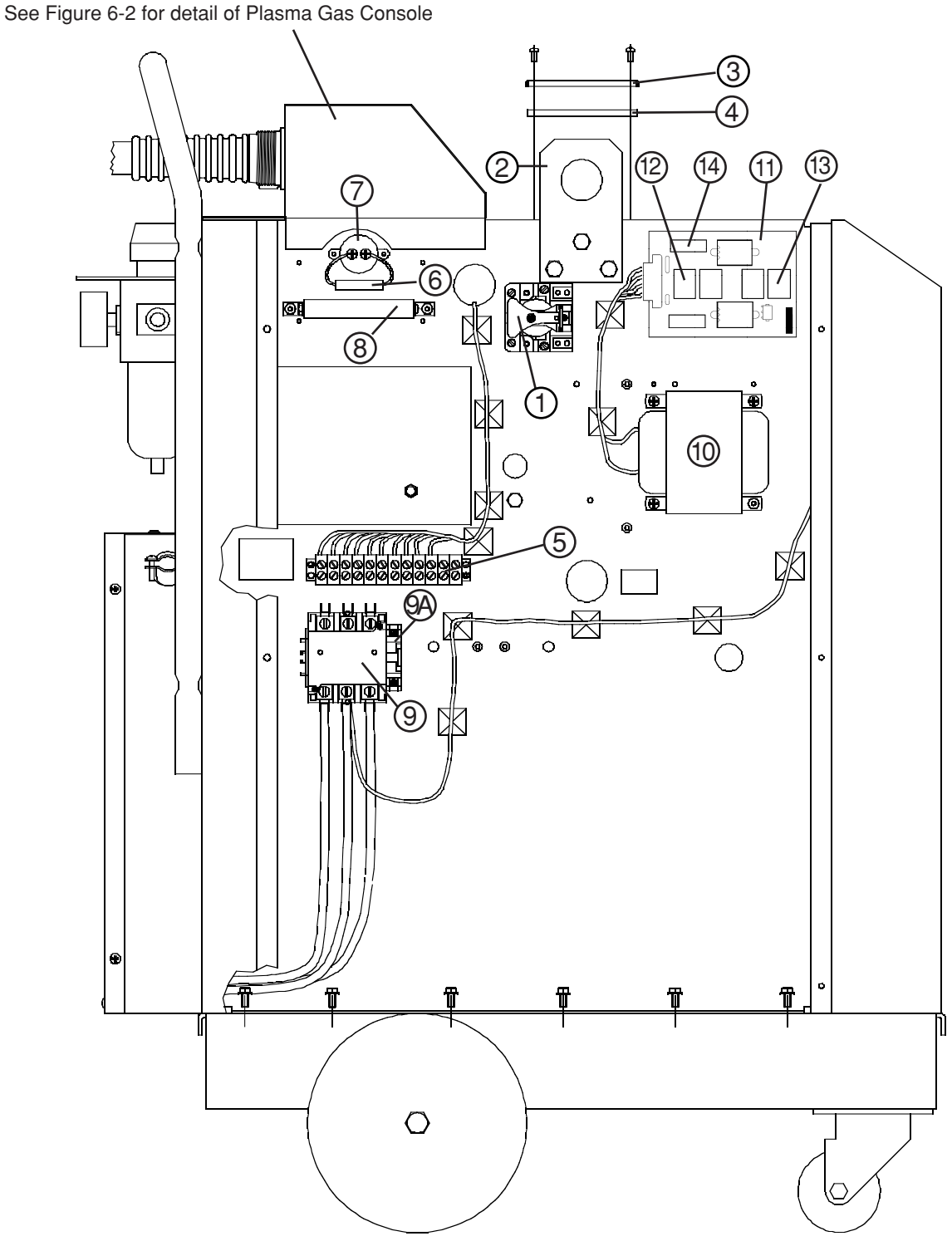


Figure 6-5 MAX100D: Left Center Wall

MAX100D: Left Center Wall

Item	Part Number	Description	Designator	Qty.
1	003021	Relay: 120VAC SPST NO	**CR3**	1
2	004261	Lifting Eye: 80/100 Pwr Unit		1
3	001601	Plate: MAX100-CE/LVD Lifting Eye		1
4	001602	Gasket: MAX100-CE/LVD Lifting Eye		1
5	008079	Term Bd: 12-Term	**TB1**	1
6	009015	Res: 10K ohm 10W 5% VIT	**R4**	1
7	009296	Cap: 100uF 350WV +50-10%	**C3**	1
8	009622	Res: 10 ohm, 50W 5% W/L Brk	**R3**	1
9	003153	Contactor, MAX100 60A 3P, 24VAC	**CON2**	1
9A	003154	Cont: MAX100 NO Aux		1
10	014028	Transformer, 40/100 220-380-415V	**T1**	1
11	**041530**	**PC Bd Assy Power Dist. MAX100-CE/LVD**	**PCB2**	1
12	003173	Relay: 24VAC 7A DPDT Mini	**CR1,CR2,CR3**	3
13	003174	Relay: 115VAC 7A DPDT Mini	**CR4**	1
14	108000	Fuse: 2A 250V 6.3mmX32mm	**F3,F4**	2
	001578	Cover: MAX100-CE/LVD Side		1

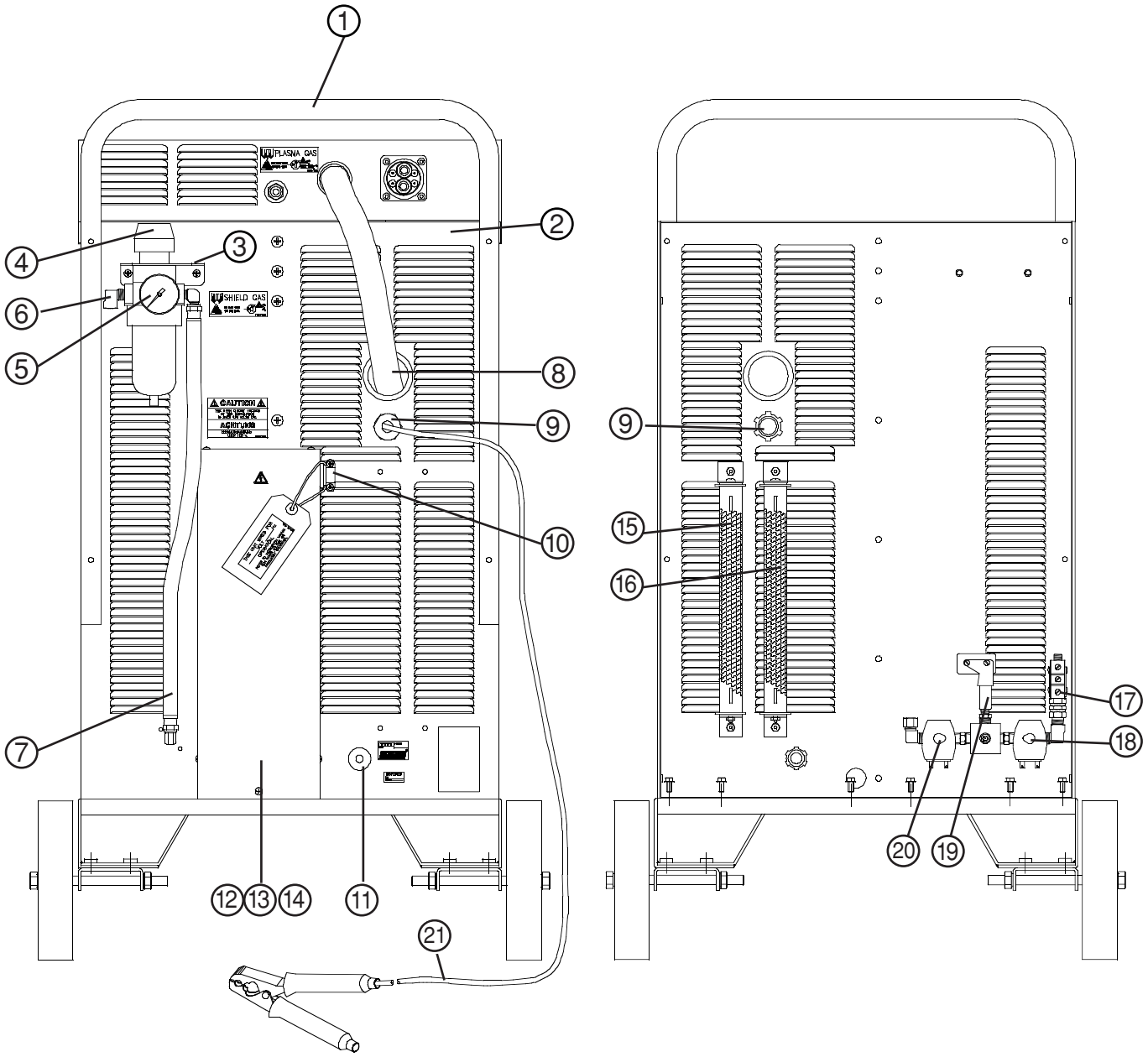


Figure 6-6 MAX100D: Rear Panel Outside, Rear Panel Inside

MAX100D: Rear Panel Outside, Rear Panel Inside

Item	Part Number	Description	Designator	Qty.
1	001182	Handle: MAX80/MAX100		1
2	001577	Panel: MAX100-CE/LVD Rear		1
	029772	**Air Regulator SA: MAX100D**		1
3	004264	Bracket: 80/100/200 Air Regulator		1
4	011025	Filter Regulator: 0-120 psi 1/4NPT Air		1
5	011027	Gauge,0-120 psig for 011025		1
6	015532	Street Elbow, 1/4", 90°		1
7	**024162**	**Hose Assy #6 x 19 1/2" Air Reg**		1
8	**028559**	**Rcpt Assy: MAX100D Qdisc**		1
9	008415	Strain Relief: 3/4 NPT x .310-.560		1
10	008944	Strain Relief: 3/4 NPT .530 X .750		1
11	008070	Strain Relief: 1/2 NPT x .312-.375		1
12	001549	Enclosure:MAX100-CE Filter		1
13	001556	Cover:MAX100-CE Filter Enclosure		1
14	**129024**	**Line Filter SA:MAX100-CE**		1
15	009625	Resistor: 2.0 ohm, 395W	**R2**	1
16	009625	Resistor: 2.0 ohm, 395W	**R1**	1
	029771	**Gas Sply SA: MAX100D**		
17	005093	Press Sw: 0-90 PSI 1/8 NPT	**PS2**	1
18	006014	Sol Valve: 90# 1/4 FPT 120V NC	**V6**	1
19	005093	Press Sw: 0-90 PSI 1/8 NPT	**PS5**	1
20	006014	Sol Valve: 90# 1/4 FPT 120V NC	**V5**	1
21	**023209**	**Cable, Ground #4 W/Clamp 25'**		1

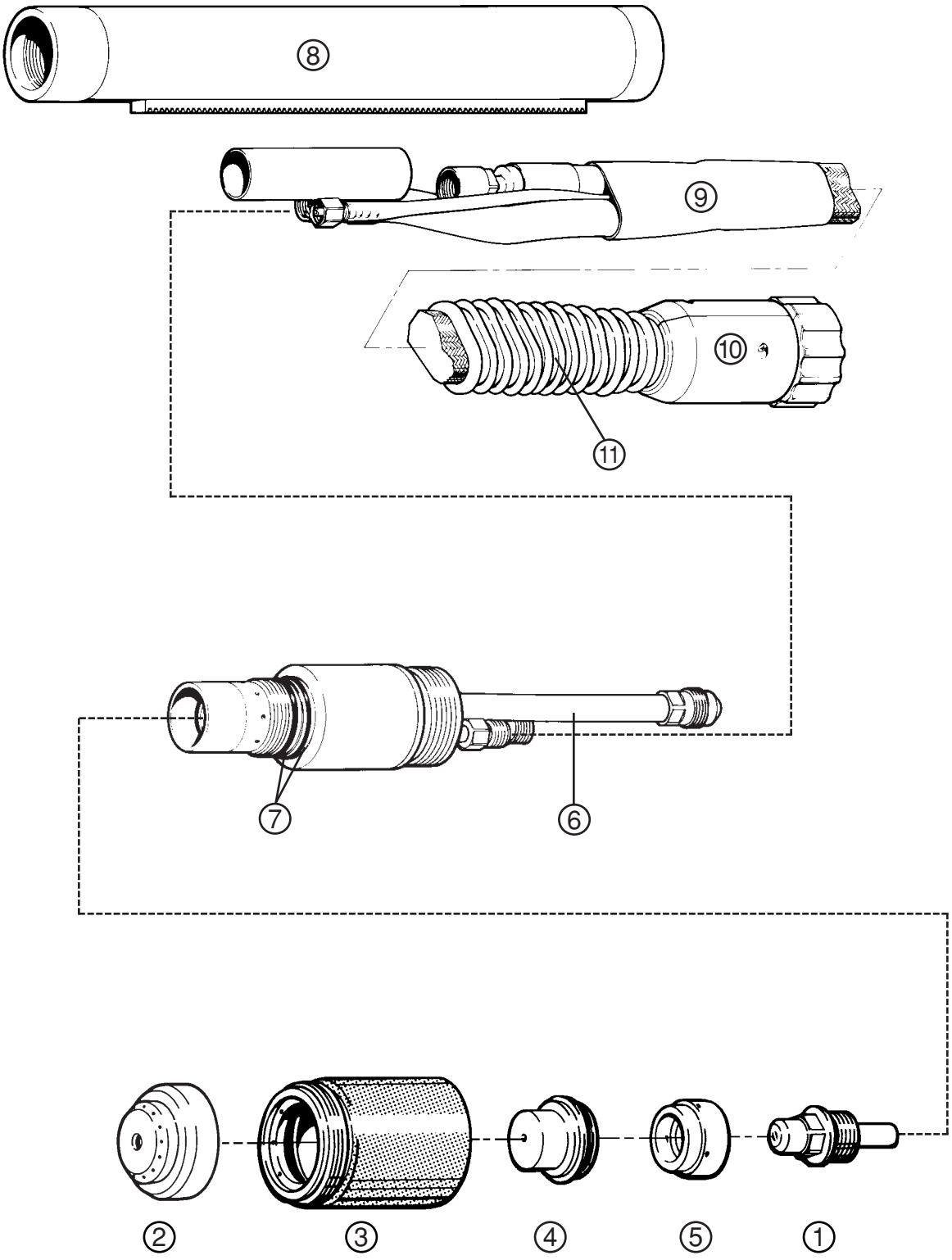


Figure 6-7 Machine Torch Assembly

MAX100D Machine Torch Assembly

Item	Part Number	Description	Qty.
	059115	**MAX100D Machine Torch Assy 25'**	
	059116	**MAX100D Machine Torch Assy 50'**	
	059117	**MAX100D Machine Torch Assy 75'**	
	028596	**MAX100D Machine Torch Assy**	1
1	**120433**	**Electrode: PAC130/160/MAX100/D Air**	1
2	**020334**	**Shield: MAX80/100/C/D 100A**	1
3	**020846**	**Shield Cap: PAC160/100D 100A, Cutting**	1
4	**020705**	**Nozzle: PAC160/MAX100D 100A Cut**	1
5	**020706**	**Swirl Ring: PAC160/MAX100D Cut**	1
6	**020713**	**MAX100D Machine Torch Main Body**	1
7	058019	O-Ring: Viton .801 x .070	1
8	**020243**	**Torch Pos Sleeve MAX100**	1
9	**028555**	**Leads: MAX100D Machine Torch 25'**	1
10	**028910**	**Plug Assy:PAC160 Mach Qdisc**	1
11	002190	Boot: 80A/100A QDisc PL	1
9	**028556**	**Leads: MAX100D Machine Torch 50'**	1
10	**028910**	**Plug Assy:PAC160 Mach Qdisc**	1
11	002190	Boot: 80A/100A QDisc PL	1
9	**028557**	**Leads: MAX100D Machine Torch 75'**	1
10	**028910**	**Plug Assy:PAC160 Mach Qdisc**	1
11	002190	Boot: 80A/100A QDisc PL	1

MAX100D International Machine Torch Assembly

Item	Part Number	Description	Designator	Qty.
	059163	**MAX100D Intl. Machine Torch Assy 25'**		
	059164	**MAX100D Intl. Machine Torch Assy 50'**		
	059165	**MAX100D Intl. Machine Torch Assy 75'**		
	028752	**MAX100D Intl. Machine Torch Assy**		1
1	**120433**	**Electrode: PAC130/160/MAX100/D Air**		1
2	**020334**	**Shield: MAX80/100/C/D 100A**		1
3	**020846**	**Shield Cap: PAC160/100D 100A, Cutting**		1
4	**020705**	**Nozzle: PAC160/MAX100D 100A Cut**		1
5	**020706**	**Swirl Ring: PAC160/MAX100D Cut**		1
6	**020713**	**MAX100D Machine Torch Main Body**		1
7	058019	O-Ring: Viton .801 x .070		1
8*	**020245**	**Torch Mntg Sleeve MAX100 Intl.**		1
9	**028555**	**Leads: MAX100D Machine Torch 25'**		1
10	**028910**	**Plug Assy:PAC160 Mach Qdisc**		1
11	002190	Boot: 80A/100A QDisc PL		1
9	**028556**	**Leads: MAX100D Machine Torch 50'**		1
10	**028910**	**Plug Assy:PAC160 Mach Qdisc**		1
11	002190	Boot: 80A/100A QDisc PL		1
9	**028557**	**Leads: MAX100D Machine Torch 75'**		1
10	**028910**	**Plug Assy:PAC160 Mach Qdisc**		1
11	002190	Boot: 80A/100A QDisc PL		1

* No rack with 020245 sleeve

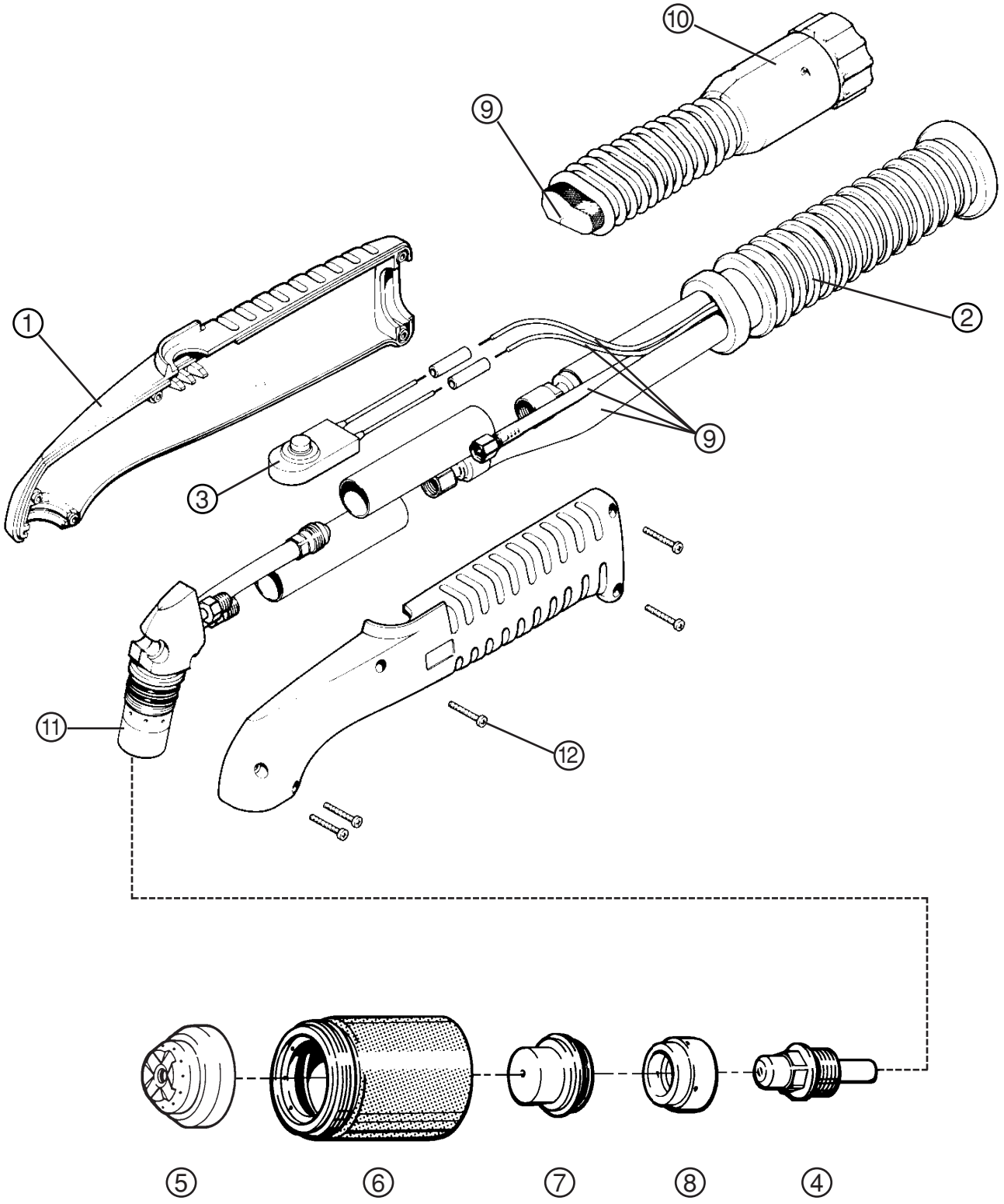


Figure 6-8 PAC160 Hand Torch Assembly

PAC160 Hand Torch Assembly

Item	Part Number	Description	Qty.
	059124	**PAC160 Torch Assy 25'**	
	059125	**PAC160 Torch Assy 50'**	
	059126	**PAC160 Torch Assy 75'**	
1	001214	Handle: PAC130/PAC140 Tch	1
2	001217	Boot: PAC130 Tch	1
3	005094	PB Switch: Tch	1
4	**120433**	**Electrode: PAC130/160/MAX100/D Air**	1
5	**020335**	**Shield: MAX80/100/C/D 100A**	1
6	**020846**	**Shield Cap: PAC160/100D 100A, Cutting**	1
7	**020705**	**Nozzle: PAC160/MAX100D 100A Cut**	1
8	**020706**	**Swirl Ring: PAC160/MAX100D Cut**	1
9	**029730**	**Leads: PAC160/160E Torch 25'**	1
10	028558	PL Assy: PAC160/100D QDisc	1
9	**029731**	**Leads: PAC160/160E Torch 50'**	1
10	028558	PL Assy: PAC160/100D QDisc	1
9	**029732**	**Leads: PAC160/160E Torch 75'**	1
10	028558	PL Assy: PAC160/100D QDisc	1
11	**020761**	**PAC160 Tch Main Body**	1
12	075365	P/S, #6 x 3/4, PH, Rnd, S/B	5

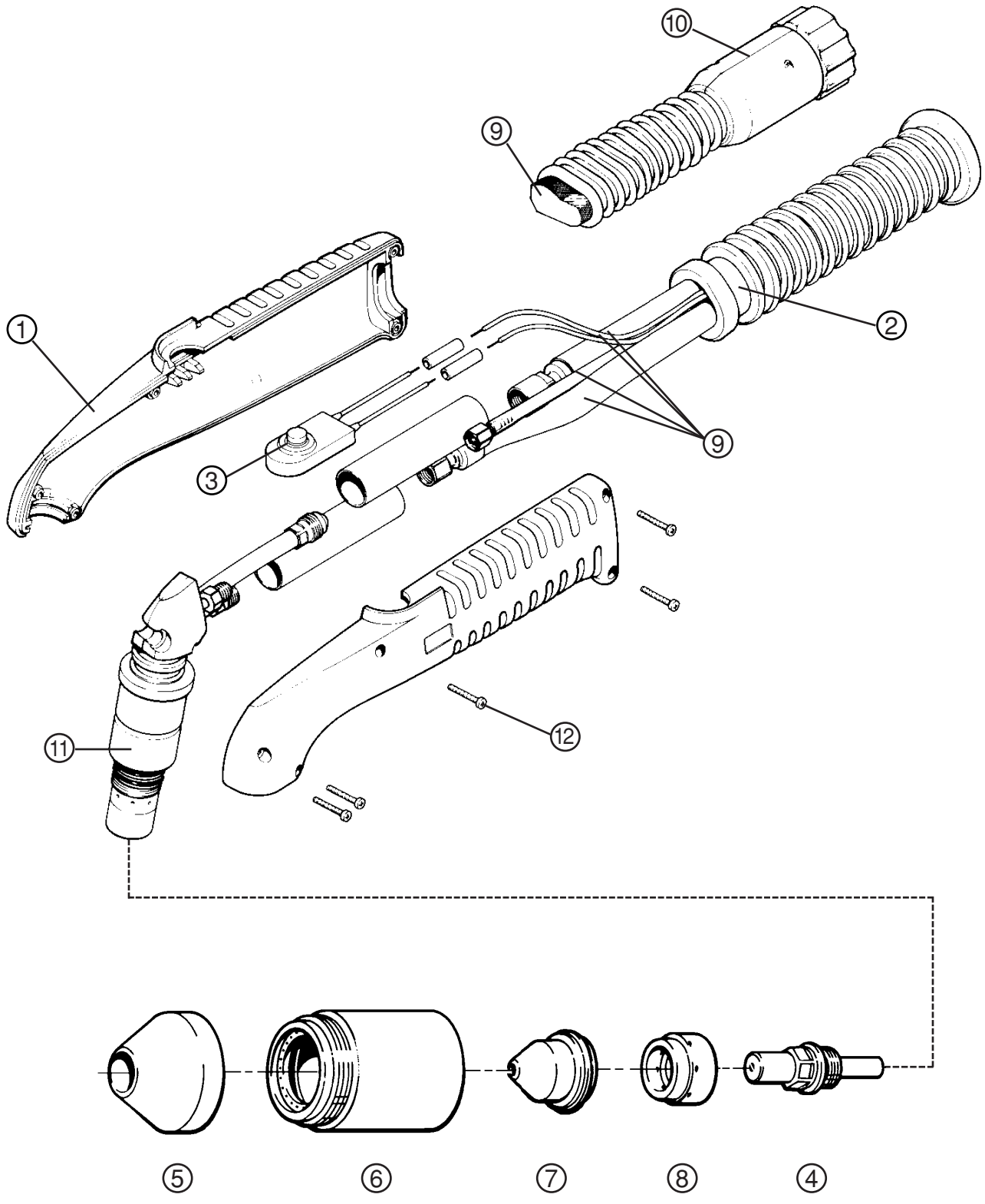


Figure 6-9 PAC160 Hand Torch Assembly

PAC160E Gouging Torch Assembly

Item	Part Number	Description	Qty.
	059112	**PAC160E Torch Assy 25'**	
	059113	**PAC160E Torch Assy 50'**	
	059114	**PAC160E Torch Assy 75'**	
1	001214	Handle: PAC130/PAC140 Tch	1
2	001217	Boot: PAC130 Tch	1
3	005094	PB Switch: Tch	1
4	**020703**	**Electrode: PAC160E H35 Gouge**	1
5	**020712**	**Shield: PAC160E Gouge**	1
6	**020699**	**Shield Cap: PAC160/100D 100A, Gouging**	1
7	**020704**	**Nozzle: PAC160E H35 Gouge**	1
8	**020750**	**Swirl Ring: PAC160/MAX100D Cut**	1
9	**029730**	**Leads: PAC160/160E Torch 25'**	1
10	028558	PL Assy: PAC160/100D QDisc	1
9	**029731**	**Leads: PAC160/160E Torch 50'**	1
10	028558	PL Assy: PAC160/100D QDisc	1
9	**029732**	**Leads: PAC160/160E Torch 75'**	1
10	028558	PL Assy: PAC160/100D QDisc	1
11	**020693**	**PAC160E Ext Tch Main Body**	1
12	075365	P/S, #6 x 3/4, PH, Rnd, S/B	5
	020711	Hand Heat Shield	1

MAX100D Lead Assemblies

MAX100D Machine Torch Lead Assemblies	
Part Number	**Description**
028555	Leads: MAX100D Machine Torch 25'
028556	Leads: MAX100D Machine Torch 50'
028557	Leads: MAX100D Machine Torch 75'

PAC160/160E Hand Torch Lead Assemblies	
Part Number	**Description**
029730	Leads: PAC160/160E Torch 25'
029731	Leads: PAC160/160E Torch 50'
029732	Leads: PAC160/160E Torch 75'

MAX100D Consumable Parts Kits

Machine Torch Consumable Parts (#028650)

Item	Part Number	Description	Qty.
1	**120433**	**Electrode, PAC130/160/MAX100/D Air**	10
2	**020193**	**Electrode, PAC130/160/MAX100/D N2, H35**	5
3	**020334**	**Shield: MAX80/100/C/D 100A**	4
4	**020846**	**Shield Cap: PAC160/100D 100A, Cutting**	1
5	**020756**	**Shield Cap: PAC160/MAX100D 60A**	1
6	**020705**	**Nozzle: PAC160/MAX100D 100A Cut**	5
6	**120336**	**Nozzle: MAX100D 60A Shield**	5
7	**020706**	**Swirl Ring: PAC160/MAX100D Cut**	2
8	058019	O-Ring: Viton .801 x .070	2
	027055	Lubricant, Silicon, 1/4 Oz Tube	1
	027322	Wrench: 3/8 Hex Electrode	1
	001067	Box: Gray Plastic	1

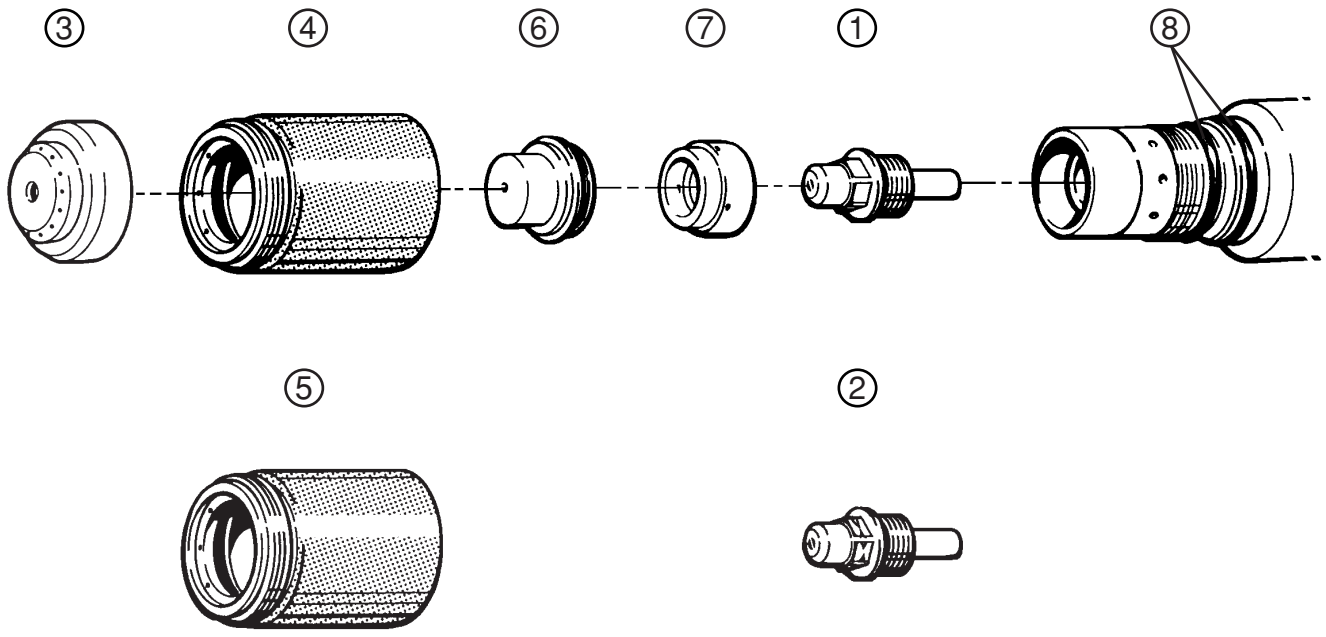


Figure 6-10 Machine Torch Consumable Parts

MAX100D Consumable Parts Kits (cont.)

PAC160 Hand Torch Consumable Parts (#028649)

Item	Part Number	Description	Qty.
1	**120433**	**Electrode, PAC130/160/MAX100/D Air**	10
2	**020193**	**Electrode, PAC130/160/MAX100/D N2, H35**	5
3	**020335**	**Shield: PAC130/160 100A**	2
4	**020846**	**Shield Cap: PAC160/100D 100A, Cutting**	1
5	**020756**	**Shield Cap: PAC160/MAX100D 60A**	1
6	**020705**	**Nozzle: PAC160/MAX100D 100A Cut**	5
6	**120336**	**Nozzle: MAX100D 60A Shield**	5
7	**020706**	**Swirl Ring: PAC160/MAX100D Cut**	2
8	058019	O-Ring: Viton .801 x .070	2
	027055	Lubricant, Silicon, 1/4 Oz Tube	1
	027322	Wrench: 3/8 Hex Electrode	1
	001067	Box: Gray Plastic	1

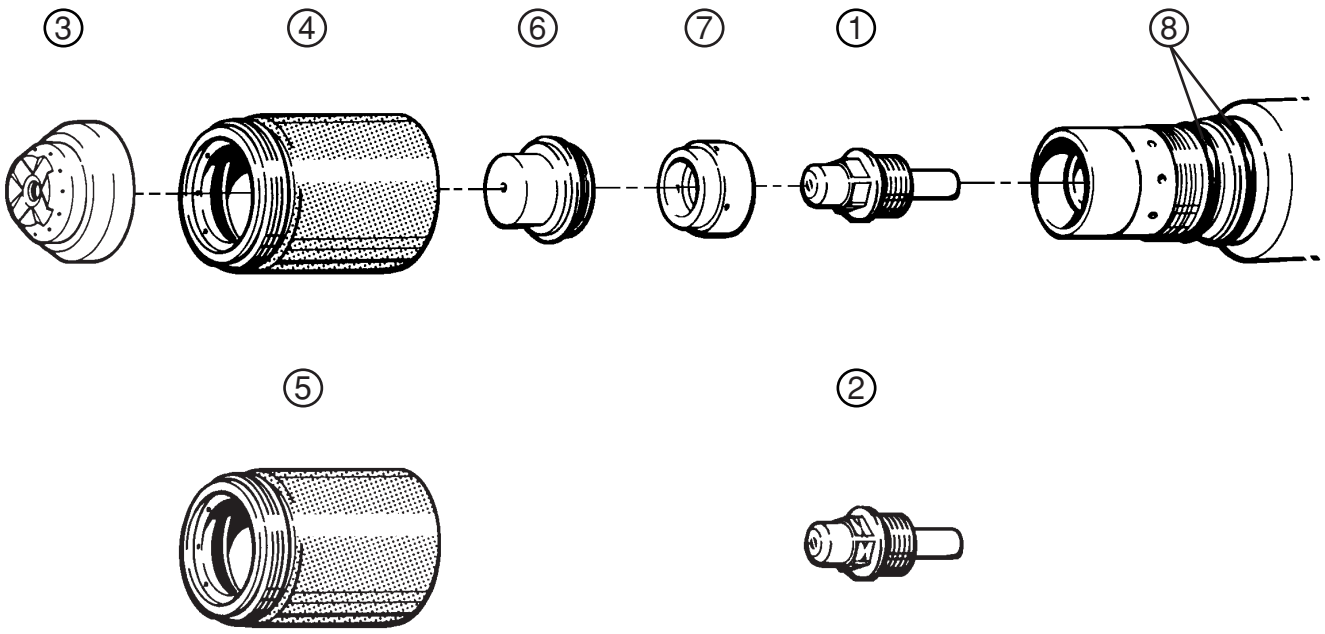


Figure 6-11 PAC160 Hand Torch Consumable Parts

MAX100D Consumable Parts Kits (cont.)

PAC160E Gouging Torch Consumable Parts (#028665)

Item	Part Number	Description	Qty.
1	**020744**	**Electrode, PAC160E Air Gouge**	10
2	**020703**	**Electrode, PAC160E H35 Gouge**	5
3	**020712**	**Shield: PAC160E Gouge**	2
4	**020699**	**Shield Cap: PAC160/100D 100A, Gouging**	1
5	**020745**	**Nozzle: PAC160E Air Gouge**	5
6	**020704**	**Nozzle: PAC160E H35 Gouge**	5
7	**020750**	**Swirl Ring: PAC160E Gouge**	2
8	058019	O-Ring: Viton .801 x .070	2
	027055	Lubricant, Silicon, 1/4 Oz Tube	1
	027322	Wrench: 3/8 Hex Electrode	1
	001067	Box: Gray Plastic	1

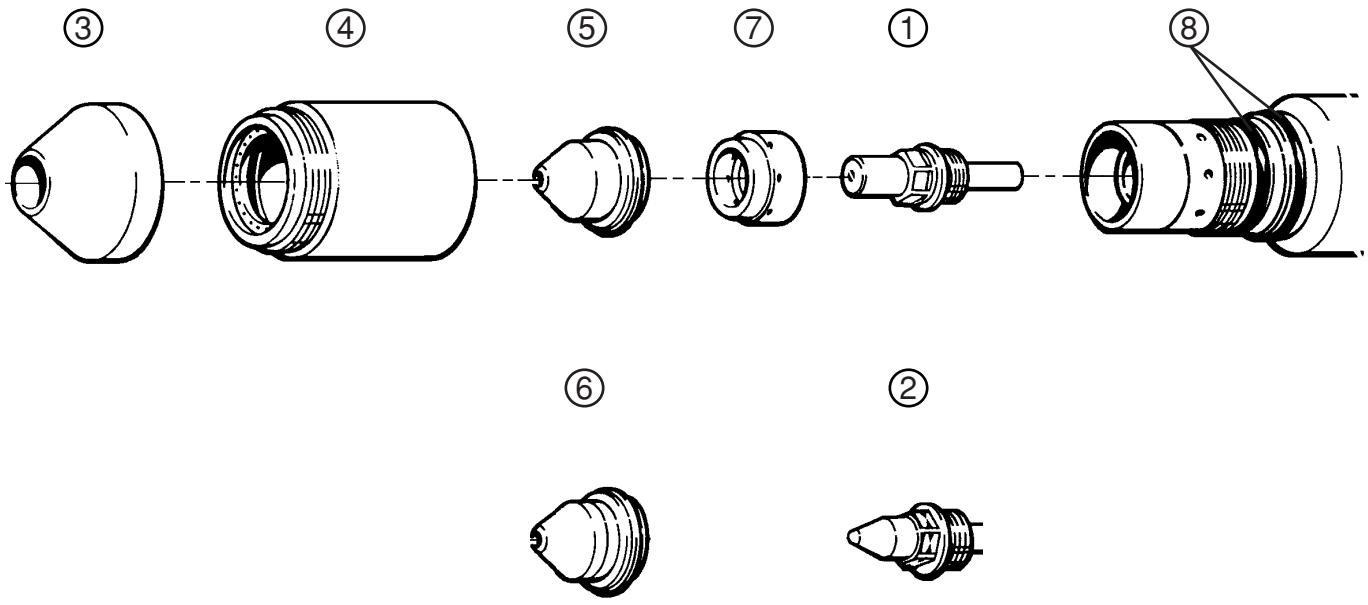


Figure 6-12 PAC160E Gouging Torch Consumable Parts

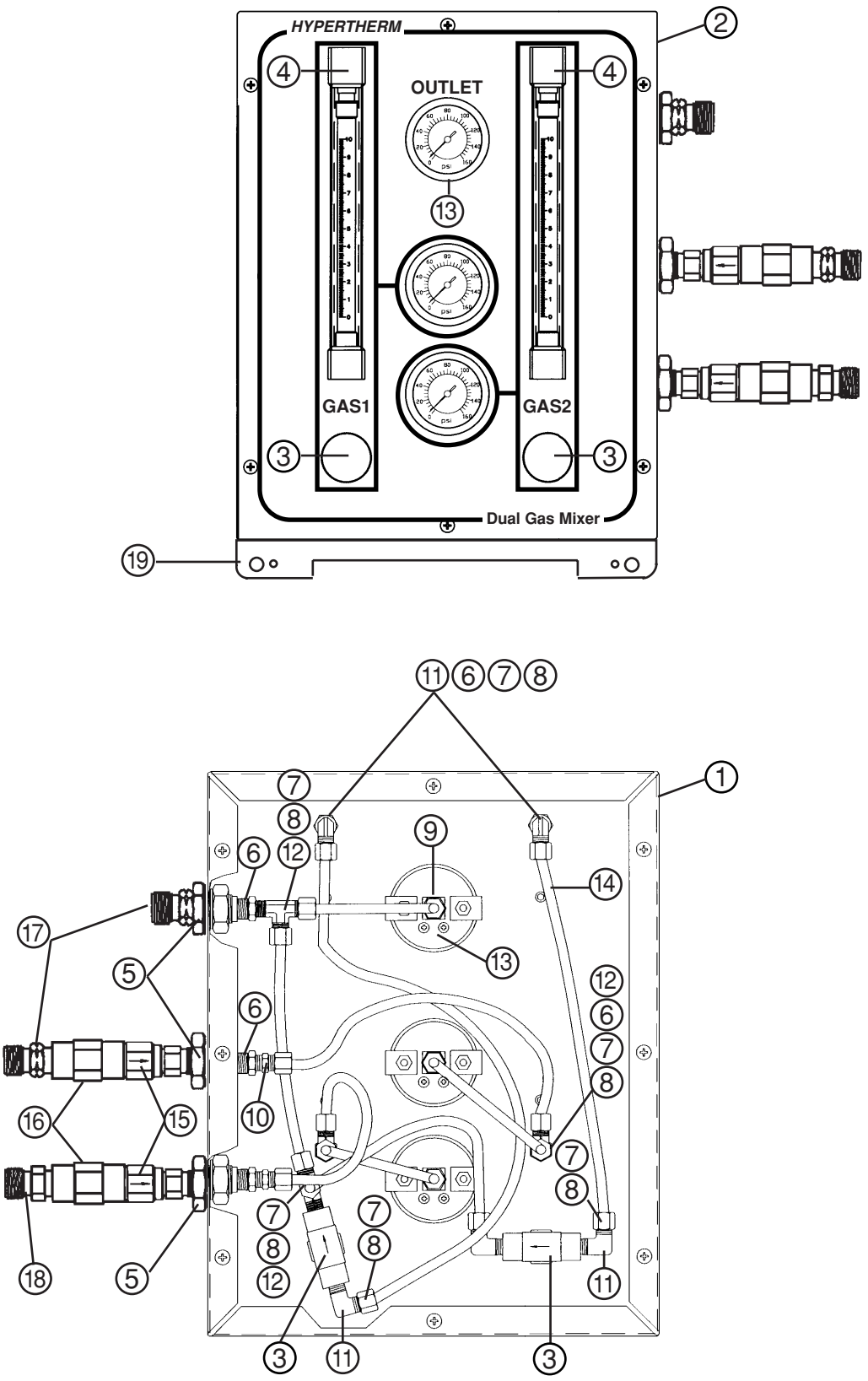


Figure 6-13 Dual Gas Mixer

Dual Gas Mixer

Item	Part Number	Description	Designation	Qty.
	059123	**MAX100D Dual Gas Mixer**		
1	001408	Encl: Dual Gas Mixer		1
2	001410	Panel: Dual Gas Mixer Front		1
3	006062	Motor Valve: 1/8 FPT .062 Orf		2
4	011051	Flowmeter: 27SCFH NO Valve		2
5	015001	Adapter, Bulkhead, 1/4 NPTF		3
6	015570	Reducer Bushing 1/4 x 1/8		7
7	015608	Sleeve, Delrin 1/4"		18
8	015609	Insert, Brass (1/4 OD)		18
9	015610	Connector Female 1/4		3
10	015611	Connector Male 1/4 Tube x 1/8		2
11	015612	Elbow, Male 1/4 Tube x 1/8 NPT		5
12	015613	Male Running Tee		4
13	022020	Gauge: Pressure, 160 PSI/BAR		3
14	046077	Tubing, 1/4 OD x .040 Blu Nyl		6 ft
15	006074	Check Valve, 1/4 NPT		2
16	015551	Coupling:1/4 Brass		2
17	015230	Adapter:1/4NPT X LH'B' Brass		2
18	015009	Adapter:1/4NPT X RH'B' Male Brass		1
19	001409	Panel:Dual Gas Mixer Rear		1

Hose Package for Dual Gas Mixer

Part Number	Description	Qty.
028721	**Hose Package: MAX100D Dual Gas Mixer**	
015230	Adapter: 1/4NPT x LH 'B'	1
015009	Adapter: 1/4NPT x RH 'B'	1
024205	**Hose Assy: 3/8 Blue RH 25 ft**	**1**
024373	**Hose Assy: 3/8 Blue RH 1.5 ft**	**1**
024374	**Hose Assy: 3/8 Red LH 2 ft**	**1**
024384	**Hose Assy: 3/8 Red LH 25 ft**	**1**

Recommended Spare Parts

Part Number	Description	Designator	Page Number Showing Item
022008	Gauge, 0-100 psig	PG1,2	6-4,6-6
011025	Filter Regulator: 0-120 psi 1/4NPT Air		6-12
011031	Replacement filter		
005168	LTBULB:28VDC 40ma T3-1/4	LT1,LT2,LT3	6-4
005121	PB Sw: Grn NO Full Gd	PB1	6-4
005122	PB Sw: Red NC	PB2	6-4
005093	Press Sw: 0-90 psi 1/8 NPT	PS1,2,3,4,5	6-6,6-12
006093	Sol Valve:150#	V1,2,3,4	6-6
006014	Sol Valve:90#	V5,6	6-12
003021	Relay: 120VAC SPST NO	CR1,CR2	6-8,6-10
003066	Contactor, MAX100 60A	CON2	6-10
003054	Sw:MAX40/100/HT40C Aux Contactor		6-10
008997	Fuse: 2A 500V 10mmX38mm Slo	F1,F2	6-4
005102	Thermostat, 75°C	TS1	
014021	Transformer, 5000VAC, 20ma	T3	6-8
027079	Fan 450-550 CFM 120VAC 50/60 Hz	M1	6-4
027080	Fan 225 CFM 120VAC 50/60 Hz	M2	6-4
041313	PC BD Assy Ctrl MAX100D	PCB4	6-4
129118	CH130 Chopper Module		6-4
041530	PC Bd Assy Power Dist. MAX100	PCB2	6-10
020761	PAC160 Torch Main Body		6-16
020693	PAC160E Torch Main Body		6-18
020713	MAX100D Machine Torch Main Body		6-14

Hypertherm

Section 7

WIRING DIAGRAMS

In this section:

380-415/3PH/50HZ
SHOWN WIRED FOR 415

PE L3 L2 L1

MAIN CON2

U(A) V(B) W(C) (N)

L1 L2

F1 F2

LB1

T2

110VA 110VB 110VC

1 TURN

CH130 CHOPPER SA
129118

TS2

JP6 PL9 JP9 PL8

RED 75

T1

415 VAC
380 VAC
115 VAC
24 VAC

WHT BRN BLK GRY

1 RED 2 RED 3 YEL 4 YEL

PL1

24VAC

PB1 PB2 LT2: PS1/GAS LT3: TS1/TEMP LT1: POWER ON

PS2 PS5 TS1

PL3

RECP1 RECP3 RECP2

F3 F4 MOV6 MOV5

CR1 CR2 CR3 CR4 REC4

PCB2
Power Distribution

Spare

PB1 PB2 V6 M1 M2

SW1 SW2 CR1

HM1 VJ5 CON2

R6

PL6 PL5 PL7

S2 S1 S3

PCB4
Control

120 VAC Supply
Cont. PA
Gas Test
Pilot Arc Relay
Current Sense
HV Transformer
Pre/Post Flow Gas Valve
Step Gas Valve
DC ON Light
Main Contactor
Plasma Start
24 VAC Supply
Gas START
Gouge/Cut
CURRENT CONTROL
CH1 Duty Cycle
Shunt
Mach Motion

PCB3
HF & I/O

PCB6
I/O MAX100

(-) Negative
(+) PILOT ARC
(++) 42
(+) Positive

F5 L1 1MSH CS1 PL4

C1 C2 C3 C4 C5 C6 C7
R1 R2 R3 R4
CR1 CR3

T4 .015 .015 SG1

T3

280 VDC

QDC 2X1

Ain 33 RED
34 R/B
Bin
AO BO

RED BLK BLU
42 WHT 39 BLU 41 WHT 42 RED

RED
RED/BLK
RED 16
WHT 15
RED 28
R/B
SW2 R/B 27
RED
RED 20
RED
R/B 19
RED/BLK
BLK
RED
RED/BLK

PL 10 RECP 10

ORG 10 TGS — CLOSED FOR GOUGING, OPEN FOR CUTTING
GRN/BLK
RED/BLK PS1
RED 380V UNITS ONLY
GRN/WHT 28 PS3
WHT/BLK 66
GRN V3
WHT 67 V2
BLK/WHT PS4
RED/WHT
ORG/BLK V4
BLU/BLK V1
BLK GND
BLU/WHT 33 → TORCH LEAD
BLU 34 → TORCH START

GAS CONSOLE

25:1 Volt Divider
THC-2 Option Only
P/N 041007

39 BLU
42 WHT
33 RED
34 R/B
WHT
RED
R/B
RED
YEL
Y/B
BLK

TB1

39	Negative VDC
42	Positive VDC
70	25:1 Neg VDC
33	Plasma Start
34	Plasma Start
37	24 VAC Neutral
38	24 VAC Hot
1	120 VAC Hot
2	120 VAC Neut
35	Machine MOTION
36	Machine MOTION
GND	

LEGEND

PB1 - POWER ON SWITCH
PB2 - POWER OFF SWITCH
PS1 - PLASMA GAS PRESSURE SWITCH
PS2 - SHIELD GAS PRESSURE SWITCH
PS3 - LINE CHARGE AT TRANSFER PRESSURE SWITCH
PS4 - LINE CHARGE AT START PRESSURE SWITCH
PS5 - CAP SENSOR PRESSURE SWITCH
TS1 - T2 TRANSFORMER TEMPERATURE SWITCH
LT1 - POWER ON/READY LIGHT
LT2 - DC POWER LIGHT
M1 - 1 FAN
M2 - 2 FAN
SW1 - CONTINUOUS PILOT SWITCH
SW2 - RUN/TEST SELECTION SWITCH
10TGS - CUT/GOUGE SELECTION SWITCH
R6 - CURRENT CONTROL POT
V1 - PLASMA MAIN FLOW SOL. VALVE
V2 - PLASMA STEP FLOW SOL. VALVE
V3 - LINE CHARGE AT TRANSFER SOL. VALVE
V4 - LINE CHARGE AT START SOL. VALVE
V5 - SHIELD SOL. VALVE
V6 - CAP SENSOR SOL. VALVE

MATERIAL

DRAWN BY	MWW	DATE 10-15-96
CHECKED BY		DATE
APP. BY	WVB	DATE 12-4-96

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: 2 PL DECIMALS ±.015 3 PL DECIMALS ±.005 FRACTIONS ±1/64 BREAK SHARP CORNERS WITH CHAMFER OR RADIUS .015 MAX.

HYPERTHERM, INC.
Hypertherm, Incorporated
Box-5010 Hanover, NH 03755-5010 603/643-3441

DESCRIPTION: MAX100D-CE/LVD SYSTEM SCH

STOCK NO.	DRAWING NO.	FILE NAME
N/A	013-4-305	013305D

SCALE N/A MODEL SHEET 1 OF 1

Hypertherm

Appendix A

AIR FILTERS

Air Filters

Gas purity is critical for maximizing consumable parts life, as well as for producing the highest quality cutting which Hypertherm plasma equipment can achieve. Plasma air must be clean, dry and oil-free, and air must be delivered at the pressure and flow rate specified for each plasma system. If the air supply contains moisture, oil or dirt particles, cut quality will be lowered and consumable parts life will be shortened, which increase production costs.

To optimize both consumables life and cut quality, Hypertherm recommends a three-stage filtering process for compressor air for removing contaminants from the air supply.

1. The first stage of filtering should remove at least 99% of all particles and liquids 5 microns and larger in size.

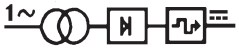
2. The second stage should be a coalescing-type filter to remove oil. This filter should remove 99.99% of particles 0.025 micron and larger in size.

3. The third and final stage of filtration should be an activated carbon adsorbent filter that removes 99.999% of oil or hydrocarbons that have not been trapped by the previous stages.

Appendix B

IEC SYMBOLS USED

IEC Symbols Used

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

Appendix C

AERATION MANIFOLD FOR PLASMA CUTTING ALUMINUM

Aeration Manifold for Plasma Cutting Aluminum

Introduction

When plasma arc cutting aluminum at the water table surface or below water, free hydrogen gas may be generated by the cutting process. The high temperature of the plasma process causes disassociation of oxygen and hydrogen from the water in the water table. The hot aluminum, which has a high affinity for oxygen, then combines with the oxygen leaving free hydrogen.

An effective means of avoiding free hydrogen buildup is to install an aeration manifold on the floor of the water table to replenish the oxygen content of the water.

Making an Aeration Manifold – Figure c-1

Make an **Aeration Manifold** with two-inch (50 mm) PVC tubing with one-inch (25 mm) **Distribution Lines** connected to it. Drill 1/8 inch (3 mm) holes every six inches (150 mm) in the distribution lines. Cap the ends of the distribution lines and install the lines so that oxygen is delivered to all parts of the cutting area.

Connect the manifold to a shop air line. Set a pressure regulator to obtain a steady stream of bubbles.

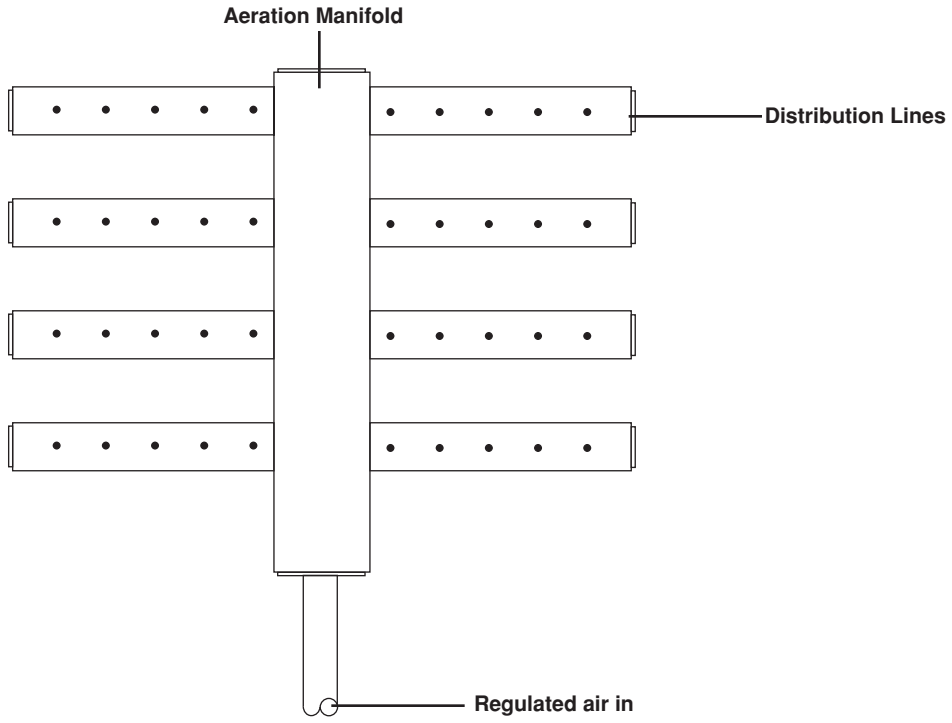


Figure c-1 Aeration Manifold