MAX100D ®

Plasma Arc Cutting System

Instruction Manual
801720 - Rev. 8

HYPERTHERM®

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Plasma Arc Cutting System

Instruction Manual
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WARRANTY

ATTENTION

Genuine Hypertherm parts are the factory-recommended replacement parts for your Hypertherm system. Use of other than genuine Hypertherm parts may be cause for invalidation of the Hypertherm warranty.

WARRANTY

GENERAL

HYPERTHERM, Inc. warrants that Products shall be free from defects in materials and workmanship, under proper and normal use for which such Equipment is recommended, for a period of two (2) years, except only with respect to the Torch, for which the warranty period shall be one (1) year, from the date of its delivery to you.

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Section 1 SAFETY

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Before using this plasma arc system. . . .

Each person who will operate this equipment, perform service or maintenance, or supervise its use must read the safety instructions and warnings in this manual and the labels on the equipment.

About Notes, Cautions and Warnings

Notes: Throughout this manual, useful information for operating the plasma system is presented in "notes", such as shown in this paragraph.

Cautions: Information in bold type and surrounded by a box describes a situation that may cause damage to the plasma system.

WARNINGS

Warnings describe situations that present a physical danger to the operator, and advice to avoid or correct the situation. Each type of warning includes applicable danger symbols, such as a hand burn, electrical shock, fire, explosion, etc.

WARNING — Instant-On Torches

Instant-on torches produce a plasma arc immediately after the torch switch is pushed.

Always hold a hand torch away from your body as a precaution against accidental torch firing. Be aware of this hazard, which has potential for serious bodily injury.

WARNING — Electric Shock

- **Never touch the torch body, workpiece or the water in a water table when operating the plasma system.**
- **When using a water table, be sure that it is correctly connected to earth ground.**
- **Operating the plasma system completes an electrical circuit between the torch and the workpiece and anything touching the workpiece. The workpiece is part of the electrical circuit.**

Eye Protection

- Wear dark safety glasses or goggles with side shields, or a welding helmet, in accordance with applicable national or local codes, to protect eyes against the plasma 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

- Replace the glasses, goggles or helmet when the lens becomes pitted or broken.
- Warn other people in the area not to look directly at the arc unless they are wearing glasses, goggles or a helmet.
- Prepare the cutting area in a manner that reduces the reflection and transmission of ultraviolet light:
  - Paint walls and other surfaces with dark colors to reduce reflection.
  - Install protective screens or curtains to reduce ultraviolet transmission.

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 which covers all exposed areas.
  - Cuffless trousers to prevent entry of sparks and slag.

Toxic Fume Prevention

- Keep the cutting area well ventilated.
- Remove all chlorinated solvents from the cutting area before cutting. Certain chlorinated solvents decompose when exposed to ultraviolet radiation to form phosgene gas.
- Wear proper breathing mask and use proper ventilation when cutting galvanized metal.
- Do not cut containers with toxic materials inside. Clean containers that have held toxic materials thoroughly before cutting.

WARNING — Toxic Fumes

Do not cut metal or painted metals containing zinc, lead, cadmium or beryllium unless the operator, or anyone else subjected to the fumes, wears respiratory equipment or an air-supplied helmet.

Fire Prevention

- Make fire extinguishers available in the cutting area.
- Remove combustible material from the immediate cutting area to a distance of at least 35 feet (10 m).
- Quench freshly cut metal or allow metal to cool before handling it or bringing it into contact with combustible materials.
- Never use a plasma system to cut containers with potentially flammable materials inside. Such containers must be thoroughly cleaned prior to cutting.
- Ventilate potentially flammable atmospheres before cutting with a plasma system. When cutting with oxygen as the plasma gas, an exhaust ventilation system is required.
- Never operate the plasma system in an atmosphere which contains heavy concentrations of dust, flammable gas or combustible liquid vapors unless properly vented.

Electric Shock Prevention

All Hypertherm plasma systems use high voltage (up to 280 VDC) to initiate the plasma arc. Take the following precautions when operating the plasma system:

- Wear insulated gloves and boots, and keep body and clothing dry.
- Do not stand, sit or lie on—or touch—any wet surface when using the plasma system.
- Maintain proper insulation against electrical shock. If you must work in or near a damp area, use extreme caution.
- Provide a wall-mounted disconnect switch with properly sized fuses close to the power supply. This switch allows the operator to turn the power supply off quickly in an emergency situation.
- Conform to all local electrical codes for primary wiring sizes and types.
- Inspect the primary power cord frequently for damage or cracking of the cover. Bare wiring can kill. Do not use a system with a damaged power cord. Replace a damaged power cord immediately.
- Inspect the torch leads. Replace if frayed or damaged.
- 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.

Electric Shock Prevention (continued)

- Before changing the torch parts, disconnect the main power or unplug the power supply. After changing torch parts and replacing the retaining cap, plug in the power supply again.
- Never bypass or shortcut the safety interlocks.
- Before removing a power supply cover for maintenance, disconnect the main power at the wall disconnect switch or unplug the power supply. To avoid exposure to severe electrical hazard, wait five minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply unit covers are in place. Exposed power supply connections present a severe electrical hazard.

Explosion Prevention

WARNING — Compressed Gas

The plasma system uses compressed gas. Observe proper precautions when handling and using compressed gas equipment and cylinders.

- Do not use the plasma system if explosive dust or vapors may be present.
- Do not cut pressurized cylinders or any closed container.

WARNING — Hydrogen Explosion Hazard

If your system uses hydrogen, remember that this is a flammable gas that presents an explosion hazard. Keep flames away from cylinders containing hydrogen mixtures and hoses that carry hydrogen mixtures. Also, keep flames and sparks away from the torch when using argon-hydrogen as the plasma gas.

Compressed Gas Cylinders

Handle and use compressed gas cylinders in accordance with safety standards published by the U.S. Compressed Gas Association (CGA), American Welding Society (AWS), Canadian Standards Association (CSA) or applicable national or local codes.

- Never use a cylinder that leaks or is physically damaged.
- Never use a cylinder that is not upright and secured in place.
- Never move or transport a cylinder without its protective valve cover in place.
- Never use a gas cylinder or its contents for any purpose other than that for which it is intended.
- Never lubricate cylinder valves with oil or grease.
- Never allow electrical contact between the plasma arc and a cylinder.
- Never expose cylinders to excessive heat, sparks, slag or open flame.
- Never use hammers, wrenches or other tools to open stuck cylinder valves.

Pressure Regulators

- Be certain that all pressure regulators are in proper working condition.
- Never use a regulator for any gas other than that for which it is intended.
- Never use a regulator that leaks, creeps excessively or is physically damaged in any way.
- Never attempt to lubricate a regulator with oil or grease.

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.

Installing an aeration manifold on the floor of the water table is an effective way to eliminate the possibility of hydrogen detonation when cutting aluminum. Refer to the Appendix section of this manual for instructions on how to fabricate an aeration manifold.

Hoses

- Label and color-code all gas hoses in order to clearly identify the type of gas in each hose. Consult applicable national or local codes.
- Never use the oxygen hose for any gas other than oxygen.
- Examine hoses at regular intervals for leaks, wear, loose connections or other hazard.
- Replace hose that is damaged in any way.

Hoses (continued)

- Keep hose lengths to a minimum to prevent damage, reduce pressure drop and to prevent possible flow restrictions.
- Prevent kinking by laying out hoses as straight as possible between termination points.
- Coil any excess hose and place it out of the way to prevent damage and to eliminate the danger of tripping.

Noise Protection

The plasma cutting process can generate high levels of noise. Depending on the arc current, material being cut, acoustics and size of the cutting room, distance from the torch and other factors, acceptable noise levels as defined by national or local codes may be exceeded by your plasma system.

- Always wear proper ear protection when cutting or gouging with the plasma system.

Grounding

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 properly connect the power cord ground wire. Conform to Canadian Standards Association (CSA) standards by placing the power cord 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.

Work Cable

- Attach the work cable securely to the workpiece or the work table by making 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 a high-quality earth ground, in accordance with the U.S. National Electrical Code, Article 250, Section H, Grounding Electrode System, or other appropriate national or local codes.

Safety Reminders

- Never bypass or shortcut the safety interlocks on any of the plasma system units.
- Except in Hypertherm's largest mechanized systems, all Hypertherm torches are designed with a safety interlock that prevents firing of the plasma arc when the retaining cap is loosened.
- 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 potentially dangerous situation to the operator and any personnel in the area. Hypertherm's warranty does not cover problems caused by the use of torches not made by Hypertherm.
- Use only consumable parts and replacement parts made by Hypertherm. Hypertherm's warranty does not cover problems caused by the use of parts not made by Hypertherm.
- Never operate the plasma system with any of its covers not in place. This would be hazardous to the operator and other people in the area, and prevents the proper cooling of the equipment.

Electronic Health Support Equipment

Plasma arc cutting and gouging systems create electric and magnetic fields that may interfere with the correct operation of electronic health support equipment, such as pacemakers or hearing aids. Any person who wears a pacemaker or hearing aid should consult a doctor before operating or being near any plasma system when it is in use. To minimize exposure to EMF:

- Keep both the work cable and the torch lead on one side of your body. Keep your body from coming in between the torch lead and the work cable.
- Route torch leads as close as possible to work cable.
- Do not wrap the torch lead or work cable around your body.
- Stay as far away from the power supply as possible.

Section 1a SÉCURITÉ

Cette section comprend :

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Protection de la peau 1a-2
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Prévention des incendies 1a-2
Prévention des chocs électriques 1a-2
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Avant d'utiliser ce système de coupage plasma...

Chaque personne qui utilise, répare ou entretient l'appareil ou en surveille l'emploi, doit lire les consignes de sécurité et les avertissements donnés dans ce manuel et sur les étiquettes du matériel.

Au sujet des rubriques Notes, Attention et Avertissements

Notes : Sous cette rubrique, on donne des conseils pratiques pour utiliser le système plasma.

Attention : Les informations en caractères gras et encadrées décrivent une situation qui risquerait d'endommager le système plasma.

AVERTISSEMENTS

Un avertissement décrit des situations qui présentent un danger physique pour l'opérateur, et donne des conseils pour éviter ou rectifier ce problème. Chaque type d'avertissement est accompagné d'un symbole de danger correspondant, comme une brûlure aux mains, un feu, une explosion, un choc électrique, etc.

AVERTISSEMENT — Torches à allumage instantané

Les torches à allumage instantané produisent un arc plasma immédiatement après avoir appuyé sur le bouton d'allumage de la torche.

Par précaution, maintenez toujours la torche éloignée de votre corps en cas d'un allumage accidentel. Prenez garde à ce danger qui risque de provoquer des blessures graves.

AVERTISSEMENT — Chocs électriques

- **Ne jamais toucher le corps de la torche, la pièce à couper ou l'eau de la table à eau quand on utilise le système plasma.**
- **Quand on utilise une table à eau, s'assurer qu'elle est bien mise à la terre.**
- **Quand on utilise le système plasma, on établit un circuit électrique entre la torche et la pièce à couper et avec tout ce qui touche la pièce. La pièce à couper fait partie intégrante du circuit électrique.**

Protection des yeux

- Porter des lunettes de sécurité à verres teintés ou des lunettes-masque munies d'écrans latéraux ou encore un masque à serre-tête, conformément aux codes nationaux ou locaux applicables, pour se protéger contre les rayons ultraviolets et infrarouges de l'arc.

Courant de l'arc	Pouvoir obscurcissant des verres 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

- Remplacer les lunettes, les lunettes-masque ou le masque à serre-tête quand les verres sont rayés ou cassés.
- Avertir les autres personnes se trouvant sur les lieux de travail de ne pas regarder directement l'arc, à moins qu'elles ne portent des lunettes, des lunettes-masque ou un masque à serre-tête.
- Préparer le poste de coupage de façon à réduire la réflexion et la transmission des rayons ultraviolets :
  - Peindre les murs et autres surfaces de couleur foncée pour réduire la réflexion.
  - Installer des écrans ou des rideaux protecteurs pour réduire la transmission des rayons ultraviolets.

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 du corps exposées.
  - Pantalon sans revers pour éviter que des étincelles ou des scories puissent s'y loger.

Prévention des vapeurs toxiques

- Tenir le poste de coupage bien aéré.
- Avant le coupage, enlever tous les solvants chlorés du poste de coupage. Certains solvants chlorés se décomposent sous l'effet des rayons ultraviolets et forment du phosgène.
- Porter un masque respiratoire approprié lors du coupage de métaux galvanisés, et s'assurer que la ventilation est efficace.
- Ne pas couper des réservoirs contenant des matières toxiques. Avant le coupage, nettoyer soigneusement les réservoirs qui ont contenu des matières toxiques.

AVERTISSEMENT — Vapeurs toxiques

Ne pas couper des métaux (peints ou non) qui contiennent du zinc, du plomb, du cadmium ou du béryllium, à moins que l'utilisateur et toute personne exposée aux vapeurs ne portent un appareil respiratoire ou un masque à adduction d'air.

Prévention des incendies

- S'assurer qu'il y a des extincteurs au poste de coupage.
- Éloigner les matières inflammables d'au moins 10 m du poste de coupage.
- Tremper le métal que l'on vient de couper ou le laisser refroidir avant de le manipuler ou de le mettre en contact avec des matériaux inflammables.
- Ne jamais utiliser un système plasma pour couper des réservoirs contenant des matières potentiellement inflammables. De tels récipients doivent être soigneusement nettoyés avant le coupage.
- Aérer toute atmosphère potentiellement inflammable avant de couper avec un système plasma. Quand on utilise l'oxygène comme gaz plasma, il faut utiliser un système de ventilation par aspiration.
- Ne jamais faire fonctionner le système plasma dans une atmosphère qui contient une forte concentration de poussière, de gaz inflammable ou de vapeurs de liquides inflammables, à moins que l'on utilise une bonne ventilation.

Prévention des chocs électriques

Tous les systèmes de coupage Hypertherm utilisent une haute tension (jusqu'à 280 V c.c.) pour amorcer l'arc plasma. On doit prendre les précautions suivantes quand on utilise le système plasma :

- Porter des gants et des bottes isolants et garder le corps et les vêtements au sec.
- Ne pas se tenir, s'asseoir, se coucher sur une surface mouillée, ni la toucher, quand on utilise le système plasma.
- Bien s'isoler contre les chocs électriques. Agir avec la plus grande prudence quand l'on doit travailler près ou à l'intérieur d'une zone humide.
- Installer un sectionneur mural 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.
- Se conformer aux codes électriques de la région au point de vue des types et des grosseurs du câblage primaire.
- Inspecter fréquemment le cordon d'alimentation primaire pour s'assurer qu'il n'est ni endommagé ni fissuré. Un câble dénudé peut tuer. Ne pas utiliser le système si le cordon d'alimentation est endommagé. Si tel est le cas, remplacer immédiatement le cordon.
- Inspecter les câbles ou tuyaux de la torche. Les remplacer s'ils sont effilochés 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.

Prévention des chocs électriques (suite)

- Avant de remplacer les pièces de la torche, couper l'alimentation ou débrancher la source de courant. Après avoir remplacé les pièces de la torche et remis en place la buse de protection, rebrancher la source de courant.
- Ne jamais contourner ou court-circuiter les verrouillages de sécurité.
- Avant d'enlever le capot de la source de courant pour effectuer l'entretien, couper l'alimentation au sectionneur mural ou débrancher. Attendre cinq minutes pour que les condensateurs se déchargent ; sinon on s'expose à des chocs importants.
- Ne jamais faire fonctionner le système plasma sans que le capot de la source de courant soit en place. Les raccords exposés de la source de courant sont extrêmement dangereux.

Prévention des explosions

AVERTISSEMENT — Gaz comprimé

Le système plasma utilise du gaz comprimé. Prendre les précautions nécessaires quand on manutentionne et utilise des appareils et des bouteilles à gaz comprimé.

- Ne pas couper en présence de poussière ou de vapeurs explosives.
- Ne pas couper des bouteilles sous pression ni des réservoirs fermés.

AVERTISSEMENT — Risque d'explosion de l'hydrogène

Si le système utilise de l'hydrogène, se rappeler que c'est un gaz inflammable qui présente un danger d'explosion. Tenir toute flamme éloignée des bouteilles et des tuyaux contenant des mélanges d'hydrogène. Tenir également la torche plasma éloignée de toute flamme ou étincelle lorsque le gaz plasma est constitué d'un mélange argon-hydrogène.

Bouteilles de gaz comprimé

Manipuler et utiliser les bouteilles de gaz comprimé conformément aux normes de sécurité publiées par la Compressed Gas Association (CGA), l'American Welding Society (AWS), l'Association canadienne de normalisation (ACNOR/CSA) ou les codes nationaux ou locaux.

- Ne jamais utiliser une bouteille qui fuit ou est endommagée.
- Ne jamais utiliser une bouteille qui n'est pas placée à la verticale et bien assujettie.
- Ne jamais déplacer ou transporter une bouteille si son chapeau n'est pas en place.
- Ne jamais utiliser une bouteille de gaz ou son contenu à des fins autres que celles pour lesquelles elle est conçue.
- Ne jamais lubrifier le robinet des bouteilles avec de l'huile ou de la graisse.
- 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.

Détendeurs

- S'assurer que tous les détendeurs sont en état de marche.
- Ne jamais utiliser un détendeur avec un gaz autre que celui pour lequel il a été conçu.
- Ne jamais utiliser un détendeur qui fuit, présente une dérive excessive ou est endommagé.
- Ne jamais lubrifier un détendeur en utilisant de l'huile ou de la graisse.

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

Quand on coupe 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 détoner lors du coupage plasma.

On peut éliminer la possibilité de détonation de l'hydrogène lors du coupage plasma de l'aluminium si l'on place un collecteur d'aération au fond de la table à eau. Voir l'annexe de ce manuel qui donne des directives pour fabriquer un collecteur d'aération.

Tuyaux

- Étiqueter et coder tous les tuyaux de gaz avec des couleurs différentes pour chaque type de gaz. Consulter les codes nationaux ou locaux applicables.
- Ne jamais utiliser un tuyau à oxygène pour un autre gaz.
- Examiner les tuyaux à intervalles réguliers pour vérifier s'ils présentent des fuites, s'ils sont usés ou si leurs raccords sont desserrés et s'ils présentent d'autres dangers.
- Remplacer un tuyau s'il est endommagé de quelque façon que ce soit.

Tuyaux (suite)

- N'utiliser que la longueur de tuyau nécessaire pour éviter les dégâts, réduire la chute de pression et éviter de réduire le débit.
- Empêcher la formation de coudes brusques en posant les tuyaux le plus possible en ligne droite entre les points de raccordement.
- Enrouler le tuyau en trop et le ranger pour ne pas l'endommager et pour éviter qu'il ne fasse trébucher.

Protection contre le bruit

Le coupage plasma peut être très bruyant. Selon le courant de l'arc, le matériau coupé, l'acoustique et la grandeur de la salle de coupage, l'éloignement de la torche et autres facteurs, votre système plasma peut dépasser les niveaux de bruit fixés par les codes nationaux et locaux.

- Porter en permanence un protecteur anti-bruit convenable quand on coupe ou gouge avec le système plasma.

Mise à la masse et à la terre

Alimentation

- S'assurer que le fil de terre du cordon d'alimentation est connecté à la terre dans le coffret du sectionneur.
- S'il faut 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. Respecter les normes de l'Association canadienne de normalisation (ACNOR/CSA) en plaçant le fil de terre du cordon d'alimentation sur le plot de mise à la terre. Placer ensuite 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.

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 à couper qui doit se détacher.

Table de travail

- Raccorder la table de travail à une terre de bonne qualité, conformément au National Electrical Code (É.-U.), Article 250, Section H, «Grounding Electrode System», ou aux codes de sécurité nationaux ou locaux appropriés.

Rappels de sécurité

- Ne jamais contourner ou court-circuiter les verrouillages de sécurité des systèmes plasma.
- Exception faite des plus gros systèmes mécanisés d'Hypertherm, toutes les torches Hypertherm sont conçues avec un verrouillage de sécurité qui empêche d'amorcer l'arc plasma quand la buse de protection est desserrée.
- Chaque système plasma Hypertherm n'est conçu que pour être utilisé avec les torches Hypertherm particulières. Ne pas les remplacer par d'autres torches qui pourraient surchauffer et présenter un danger pour l'opérateur et le personnel sur les lieux. La garantie d'Hypertherm ne couvre pas les dégâts causés par l'utilisation d'autres torches que celles d'Hypertherm.
- N'utiliser que les pièces consommables ou de rechange d'Hypertherm. La garantie d'Hypertherm ne couvre pas les problèmes causés par l'utilisation d'autres pièces que celles d'Hypertherm.
- Ne jamais faire fonctionner le système de coupage plasma si les capots ne sont pas en place, car cela mettrait en danger l'opérateur et les autres personnes présentes, en plus de compromettre le refroidissement des pièces.

Prothèses électroniques

Les systèmes de coupage et de gougeage plasma produisent des champs électriques et magnétiques qui peuvent créer des problèmes de fonctionnement pour les prothèses électroniques, comme les stimulateurs cardiaques et les appareils auditifs. Les personnes qui portent de telles prothèses doivent consulter un médecin avant de faire fonctionner un système plasma ou de s'en approcher, quand celui-ci est en marche. Pour réduire l'exposition aux champs électromagnétiques :

- Garder le câble de retour et le faisceau de la torche d'un côté du corps. Ne pas se tenir entre le faisceau de la torche et le câble de retour.
- Faire passer le faisceau de la torche le plus près possible du câble de retour.
- Ne pas entourer le faisceau de la torche ou le câble de retour autour du corps.
- Se tenir le plus loin possible de la source de courant.

Section 2 SPECIFICATIONS

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- MAX100D Power Supply 2-3
- MAX100D Machine Torch 2-4
- PAC160 Hand Torch 2-4
- PAC160E Hand Torch 2-5
- Dual Gas Mixer 2-5
- THC-2 2-5

SPECIFICATIONS

GENERAL

Hypertherm's MAX100D is a dual-gas system designed for cutting most metals from gauge to 1-1/4 inch thick (32 mm). In addition to hand cutting, it can be used with a machine torch and a THC-2 Torch Height Control system (Instruction manual IM-20) 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 1-1/4 inch thick (32 mm). 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 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.

An EMI filter, standard with the 380/415V CE power supplies, meets the CE requirements for filtering incoming power - standard EN50199. Refer to Appendix D to connect incoming power to the filter and to find filter part number information.

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) ..... 80%@ 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):

#059175 ..... 200V, 3PH, 50/60 Hz, 60 Amps
#059122 ..... 208V, 3PH, 60 Hz, 55 Amps
#059118 ..... 240/480V, 3PH, 60 Hz, 50/25 Amps
#059120 ..... 220/380/415V, 3PH, 50/60 Hz, 53/31/28 Amps
#059121 ..... 600V, 3PH, 60 Hz, 17 Amps

Dimensions and Weight:

Width ..... 26-1/2" (673 mm)
Height ..... 43" (1092 mm)
Depth ..... 31-3/4" (806 mm)
Weight ..... 435 pounds (197 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 ..... 124 scfh (58 l/min)
Shield Gas Flow ..... 440 scfh (208 l/min)
Plasma Gas Inlet Pressure ..... 80 psi (5.4 bar) to 125 psi (8.5 bar) dynamic (flowing) pressure.

Gas Requirements (cont.):

Shield Gas Inlet Pressure ..... 80 psi (5.4 bar) to 125 psi (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 (#059115 - with 25' leads)

For machine torch with other lead lengths, see **Parts List**

Maximum mechanized cutting ..... 5/8 inch (16 mm)
Maximum current at 80% duty cycle ..... 100 Amps
Maximum temperature at torch head ..... 300°F (149°C)

Gouging capability (metal removal rate):
H35 as plasma gas ..... 15 pounds (6.8 kg)/hour
Air as plasma gas ..... 8 pounds (3.6 kg)/hour

Gas Flow ..... 440 scfh (208 l/min) at 60 psi (4.1 bar) with 100 amp consumables
Weight ..... 1-3/4 pounds (.79 kg)

PAC160 Hand Torch (#059124 - with 25' leads)

For PAC160 with other lead lengths, see **Parts List**

Maximum cutting thickness range ..... 1-1/4 inch (32 mm)
Maximum current at 80% duty cycle ..... 100 Amps
Maximum temperature at torch head ..... 300°F (149°C)

Gas Flow ..... 440 scfh (208 l/min) at 60 psi (4.1 bar) with 100 amp consumables
Weight ..... 1-1/2 pounds (.68 kg)

PAC160E Hand Torch (#059112 - with 25' leads)

For PAC160E with other lead lengths, see **Parts List**

Maximum cutting thickness range	1-1/4 inch (32 mm)
Maximum current at 80% duty cycle	100 Amps
Maximum temperature at torch head	300° F (149° C)
Maximum temperature at torch handle	140° F (60° C) with hand heat shield (#020711)

Gouging capability (metal removal rate):

H35 as plasma gas	15 pounds (6.8 kg)/hour
Air as plasma gas	8 pounds (3.6 kg)/hour

Gas Flow	440 scfh (208 l/min) at 60 psi (4.1 bar) with 100 amp consumables
Weight	2-1/2 pounds (1.14 kg) with hand heat shield

Dual Gas Mixer (#059123) - 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)	100 psi (6.8 bar)
Plasma outlet pressure (dynamic)	60 psi (4.1 bar)
Percentage of mixture	0 to 100%
Plasma flow rate	75 scfh (35 l/min)

Dimensions and Weight:

Width	11-1/2" (292 mm)
Height	14-5/8" (371 mm)
Depth	4" (102 mm)
Weight	16 pounds (7.3 kg)

THC-2 (#052002) - Optional

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

Section 3 SETUP

In this section:

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  Cylinder Compressed Air 3-4
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SETUP

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 25-foot 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 25-foot 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 25-foot 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 system part number information, see the *Parts List* (**Section 6**).

CLAIMS & 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.

SETUP

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 **440 scfh (208liters/minute)** of air at **80 psi (5.4 bar)** to **125 psi (8.5 bar)** output pressure.

> **CAUTION: Do not exceed 125 psi (8.5 bar) delivery pressure to the system. Exceeding this pressure will cause shortened torch parts life.**
>
> **Pressures in excess of 125 psi (8.5 bar) can also damage the pressure gauge that is located on top of the MAX100D filter. If delivery pressure is greater than 125 psi (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 **80 psi (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 125 psi (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 **440 scfh (208 liters/minute)** at a delivery pressure of **80 psi (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.: **3/8" (9.5 mm) minimum**
Length: **100 ft (30 meters) 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 20 feet (6 m) of the table. A suitable ground consists of a solid copper rod of at least 1/2-inch (13 mm) diameter driven to a depth of at least 8 feet (2.5 m) into the earth below the permanent moisture level.
- For more information, refer to applicable national and local electrical codes.

SETUP

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 switch should be sized according to the table below::

Input Voltage	Phase	Input Current @ 15 kW Output	Recommended Slow-Blow Fuse Size	Recommended Cable Size
200 VAC	3	60 amps	80 amps	4
208 VAC	3	55 amps	70 amps	4
220 VAC	3	53 amps	60 amps	4
240 VAC	3	50 amps	60 amps	4
380 VAC	3	31 amps	40 amps	8
415 VAC	3	28 amps	40 amps	10
480 VAC	3	25 amps	30 amps	10
600 VAC	3	17 amps	25 amps	10

Power Cables

- Power cables are supplied by the customer.
- Cable sizes vary based on the distance of the receptacle from the main box. Final specification and installation of the power cord should be made by a licensed electrician and according to applicable national or local codes.
- 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

240/480V Linkboard Configurations

The 240/480-volt power supply is shipped from the factory linked for 480-volt operation. The links must be moved for 240-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.

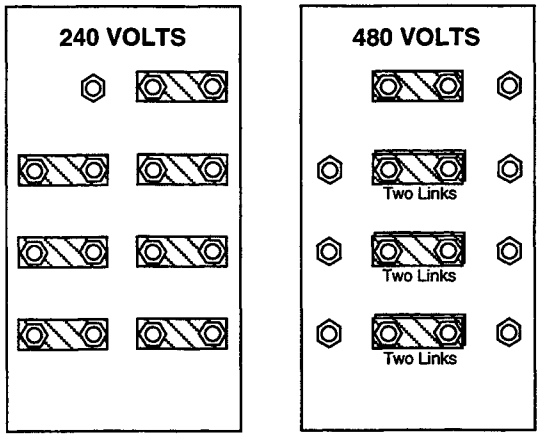


Figure 3-1 Dual Voltage 240/480-Volt Linkboard

Power Cable Connection

Power Cable to MAX100D Power Supply

1. Route the **Power Cable** through the strain relief on the rear of the MAX100D power supply.

2. Connect the three hot lines of the power cable to **L1**, **L2** & **L3** on the **CON1** contactor located in the rear, lower left hand side of the MAX100D. The **Ground** lead must be connected to the ground stud provided on the case of the machine near the contactors. (See Figure 3-2)

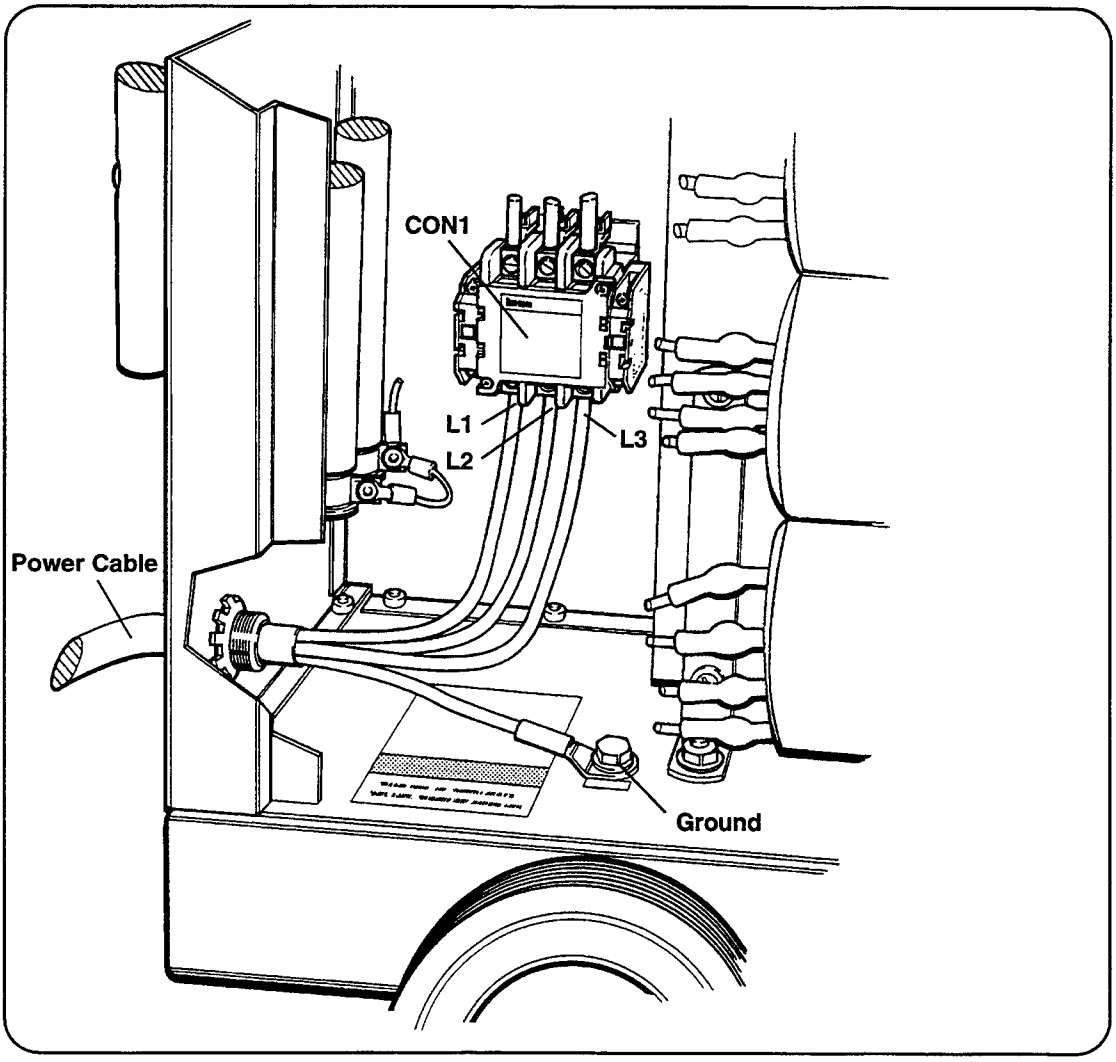


Figure 3-2 MAX100D Primary Power Connections

Power Cable Connection (Cont.)

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 6-4 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."

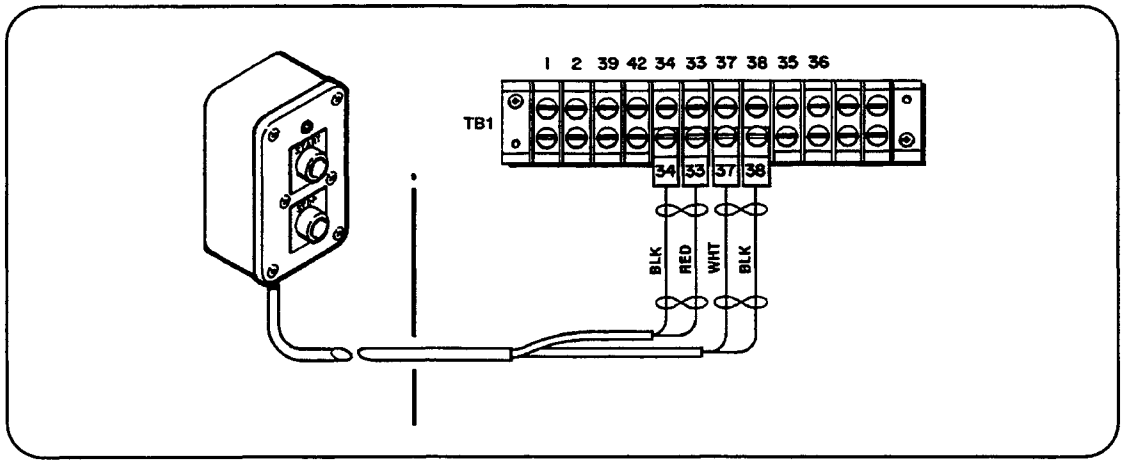


Figure 3-3 Remote Start/Stop Switch Connections

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 hosing 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 hosing 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 1.5-foot (0.5 m) hose(#024373) from the tee to the **PLASMA GAS** inlet on the plasma gas console. (Fig. 3-6, 3-4)

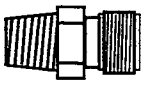
3. ***If you are not cutting with an H35-N_2 mixture, skip this step (3).***

   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 25-foot (7.6 m) 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 25-foot (7.6 m) 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 24-inch (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.

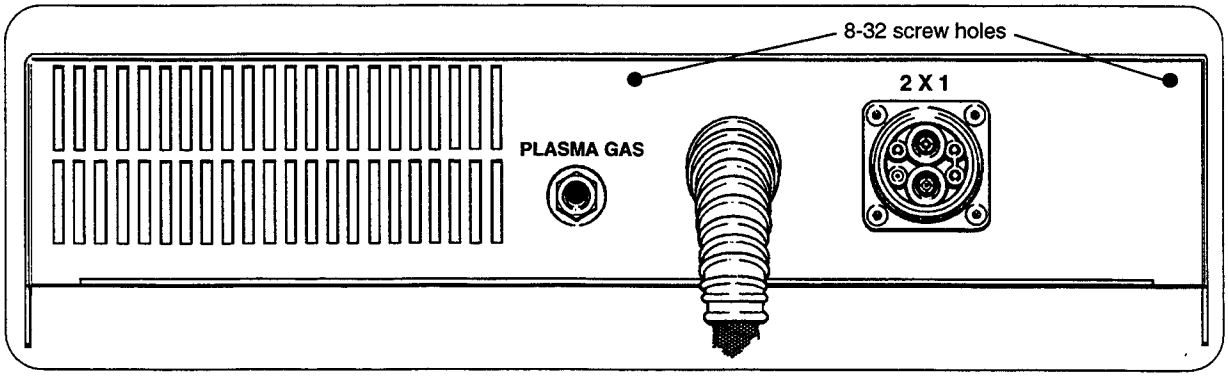


Figure 3-4 Plasma Gas Console Connections and Torch Connection

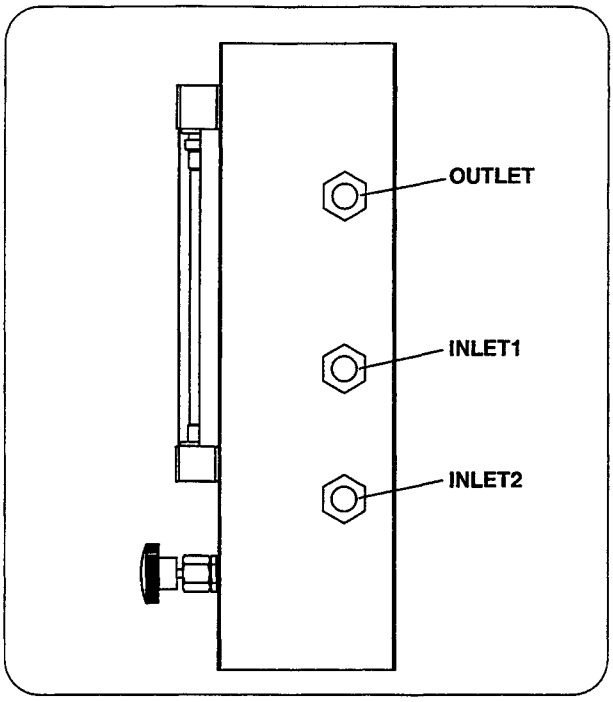


Figure 3-5 Dual Gas Mixer Connections

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)

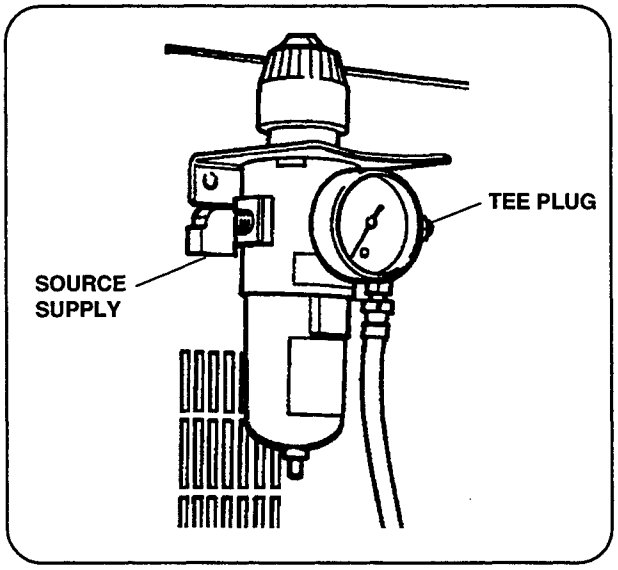


Figure 3-6 Shield Gas Power Supply Connections and Air Plasma Gas Connection

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.

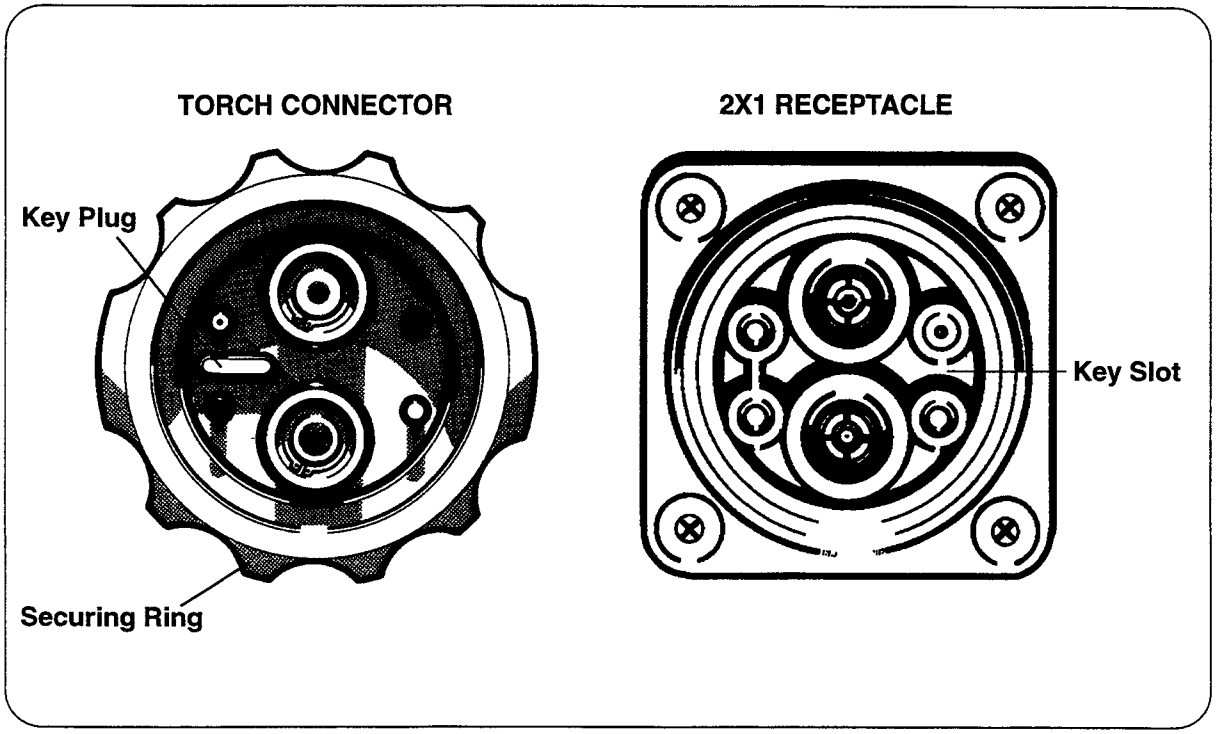


Figure 3-7 Quick Disconnect Alignment

Section 4 OPERATION

In this section:

Description of Controls and Indicators 4-2
- Plasma Gas Console Panel 4-2
- MAX100D Control Panel 4-2
- Dual Gas Mixer 4-4

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Operating Tips 4-10
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OPERATION

DESCRIPTION OF CONTROLS

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 mode.

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

MAX100D Control Panel (Figure 4-2)

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

- **Red OFF button**
  Shuts the power supply down.

- **White READY light**
  Indicates that all control circuits are activated, safety interlocks are satisfied, and the system is ready for operation.

- **Red DC POWER light**
  Indicates that DC power is present at the torch.

- **AMPS output adjustment knob**
  Adjusts output current between 30 and 100 amps. (Increasing the amperage increases the thickness that can be cut.)

- **PLATE TYPE - EXPANDED/NORMAL switch**
  In **EXPANDED** mode, 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 mode when cutting most (normal) metal plate.

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

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

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

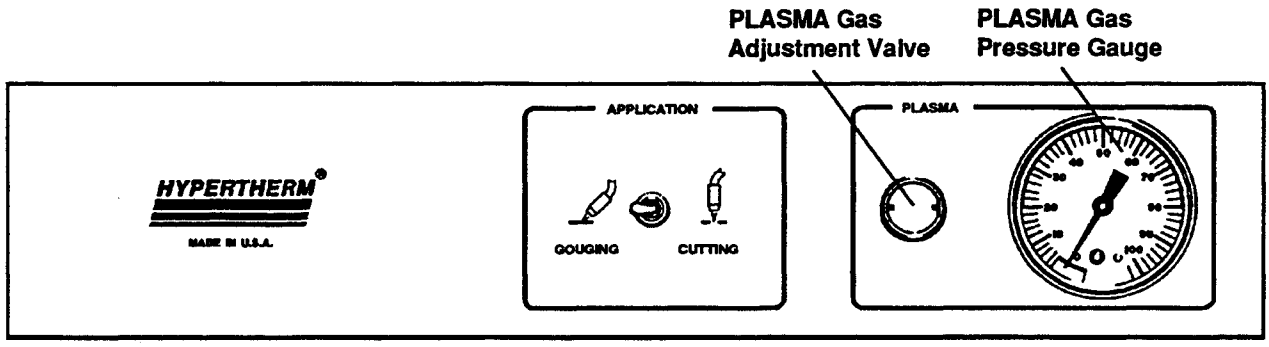


Figure 4-1 Plasma Gas Console Panel

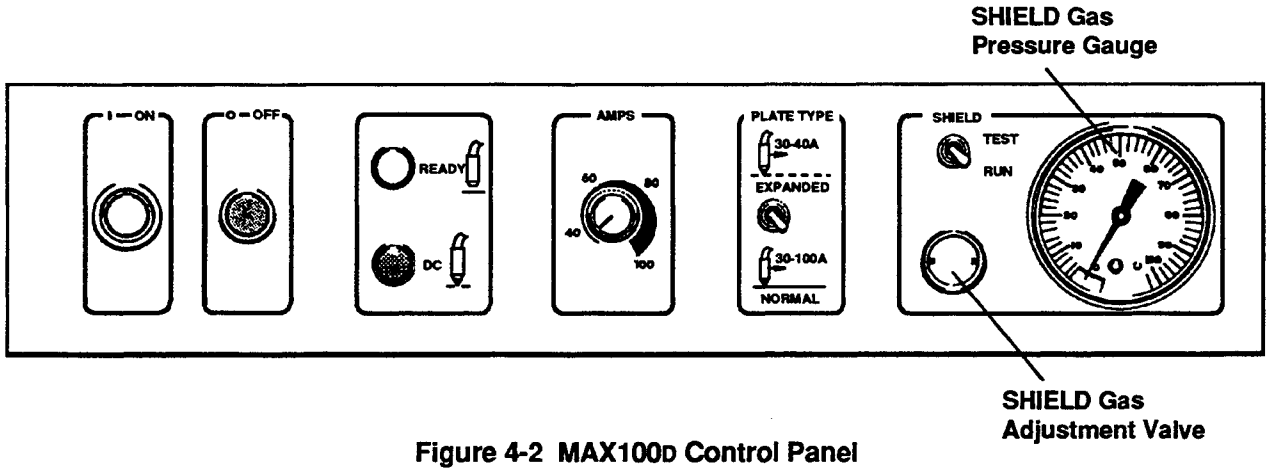


Figure 4-2 MAX100D Control Panel

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.

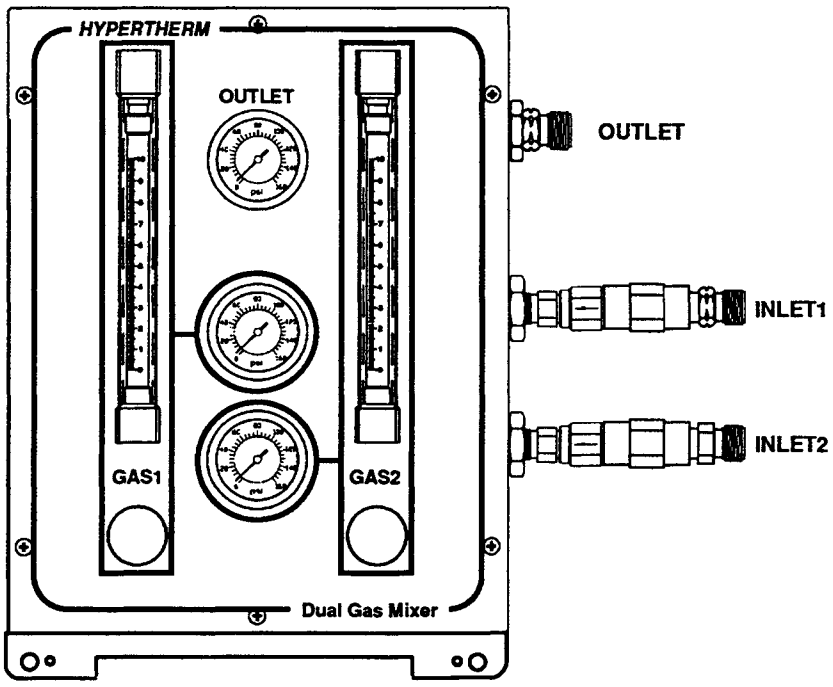


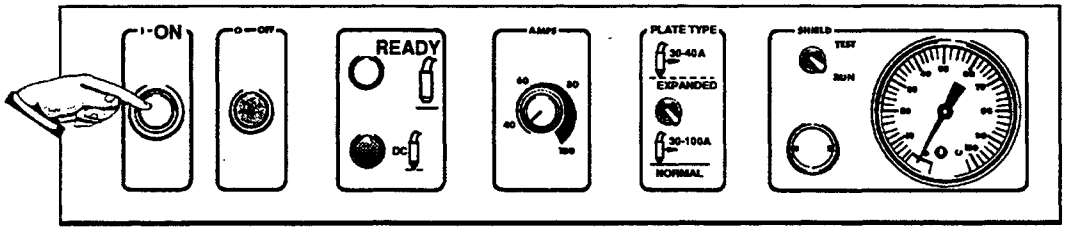
Figure 4-3 Gas Mixer

OPERATING INSTRUCTIONS

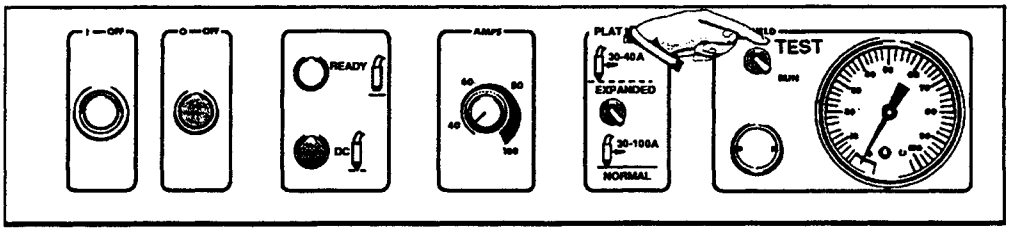
WARNING

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

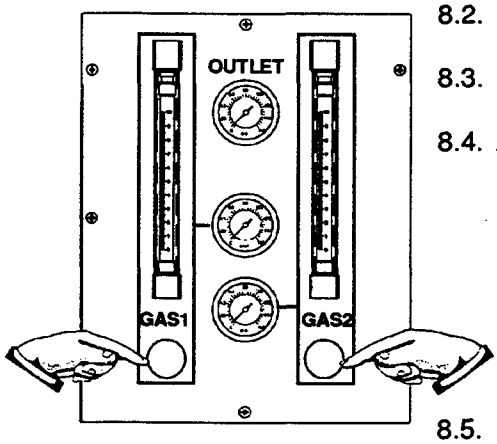
1. Ensure that the work environment and your clothing meet the safety requirements outlined in the *Safety* section.
2. Follow the system installation instructions in the *Setup* section.
3. Be sure that the correct parts are in the MAX100D torch. See *Cut / Gouging Charts* later in this section.
4. Turn on the facility gas supply. Adjust incoming plasma and shield gas pressures to a minimum of **80 psi (5.4 bar)**.
5. Apply three-phase power to the MAX100D.
6. Press the green **ON** button to power up the system. Hold it down until the white **READY** button lights up.



7. Place the 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).***

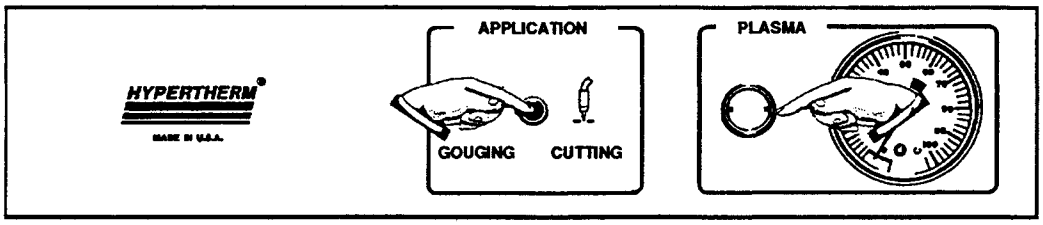


8.1. At the Plasma Gas Console Panel, choose **CUTTING**.
8.2. Fully open **PLASMA** Gas Adjustment Valve on the Plasma Gas Console Panel.
8.3. Be certain that incoming flowing (dynamic) pressures to the Dual Gas Mixer are equal.
8.4. Adjust the H35 (**GAS1**) and N_2 (**GAS2**) mixture % at the Dual 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).

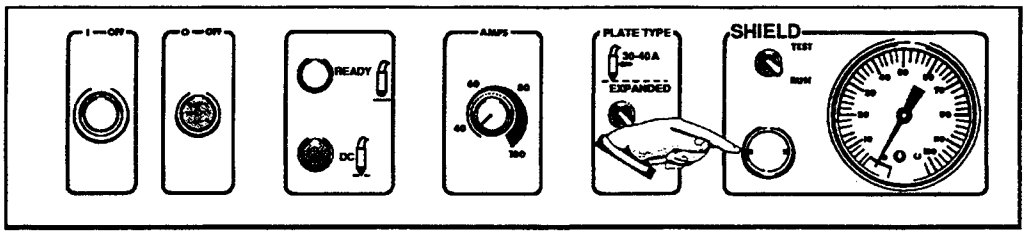
Note: When adjusting the H35-N_2 mixture at the Dual Gas Mixer, be careful not to let the mixer **OUTLET** pressure go below **20 psi (1.4 bar)**. (A pressure switch inside the power supply will shut down the system if the incoming pressure drops below 20 psi (1.4 bar).)

8.5. **Go to step 10.**

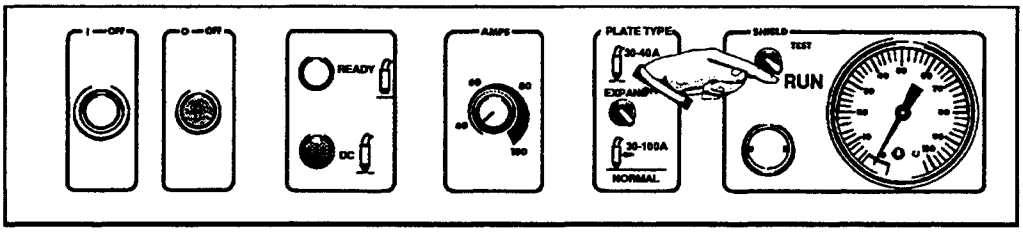
9. At the Plasma Gas Console Panel, choose **CUTTING** or **GOUGING** application, and then, with the **PLASMA** Gas Adjustment Valve, set the plasma gas pressure for the particular metal you are cutting. Refer to the **Plasma Gas Pressure** in **TEST** mode in the *Cut / Gouging Charts* later in this section.
Note: Plasma gas pressure in **RUN** mode is always higher than the set **TEST** pressure. No adjustment is necessary for **RUN** mode.



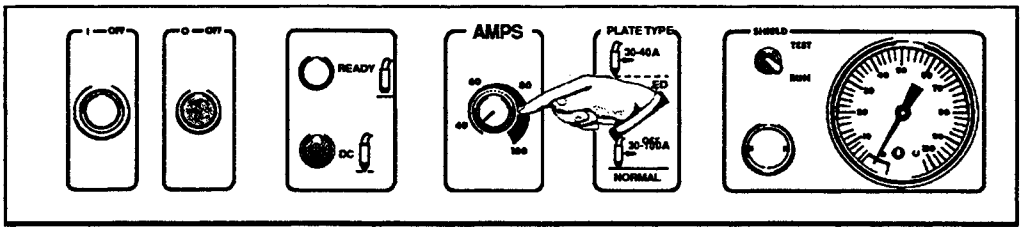
10. Using the **SHIELD** Gas Adjustment Valve on the MAX100D Control Panel, set the shield gas pressure according to the **Shield Gas Pressure** in the *Cut / Gouging Charts* later in this section.



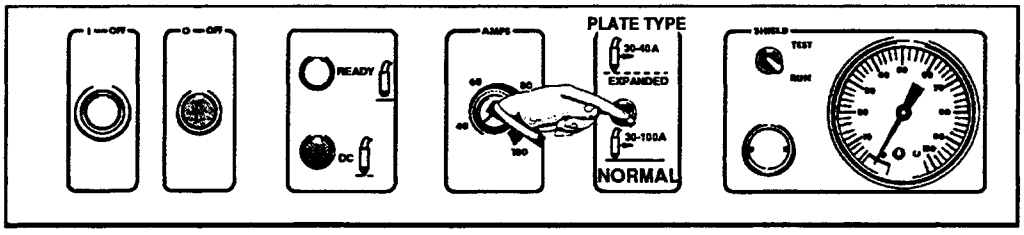
11. After gases have been set, switch to the **RUN** position. Gases will stop flowing through the system.



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

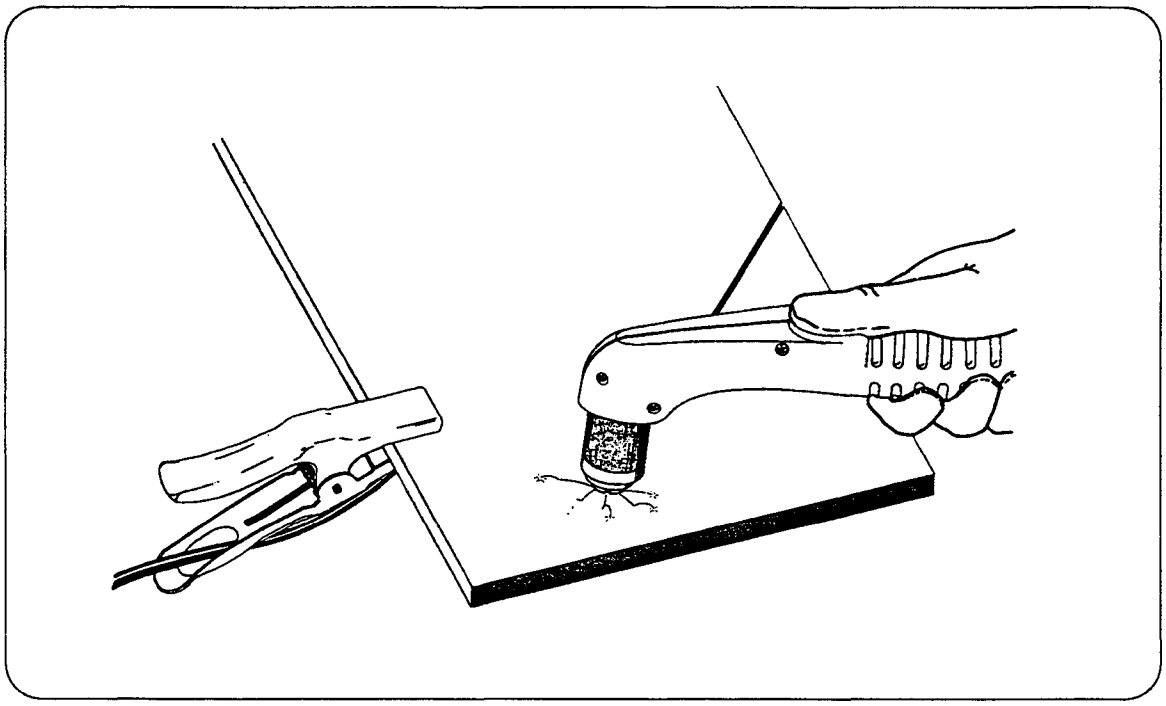


Figure 4-4 Proper Work Clamp Connection

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.

OPERATION

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 (See Figure 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 .040 inch (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. Make sure that it is tightened snugly; if it is loose, it can affect the cut (or gouge) quality.

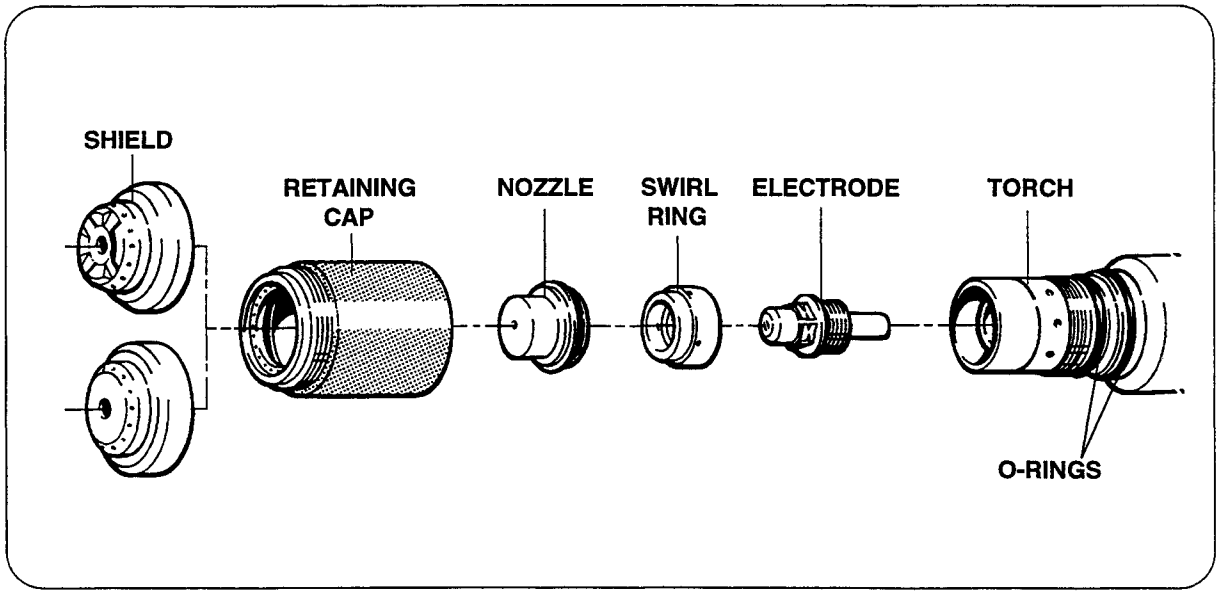


Figure 4-5 Consumable Parts

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 1/8 inch (3 mm) of the workpiece.
- To cut perfect circles for spin fittings, 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 any straight edge as a guide.

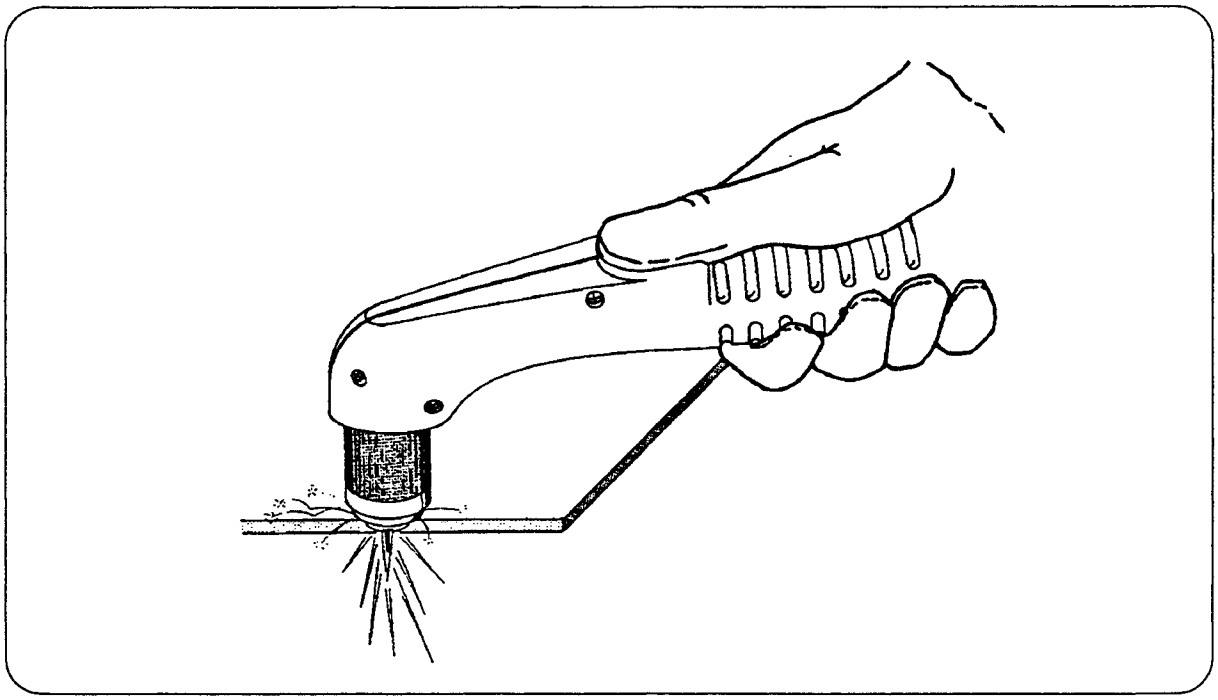


Figure 4-6 Starting a Cut

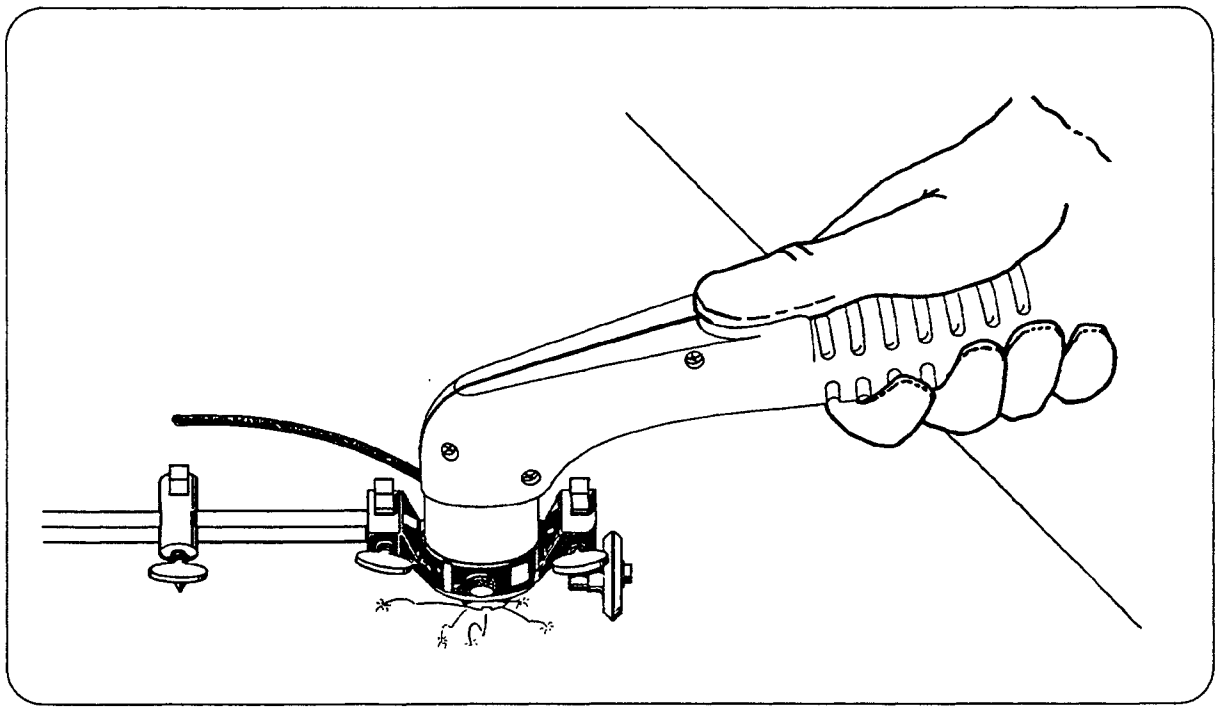


Figure 4-7 Cutting a Circle

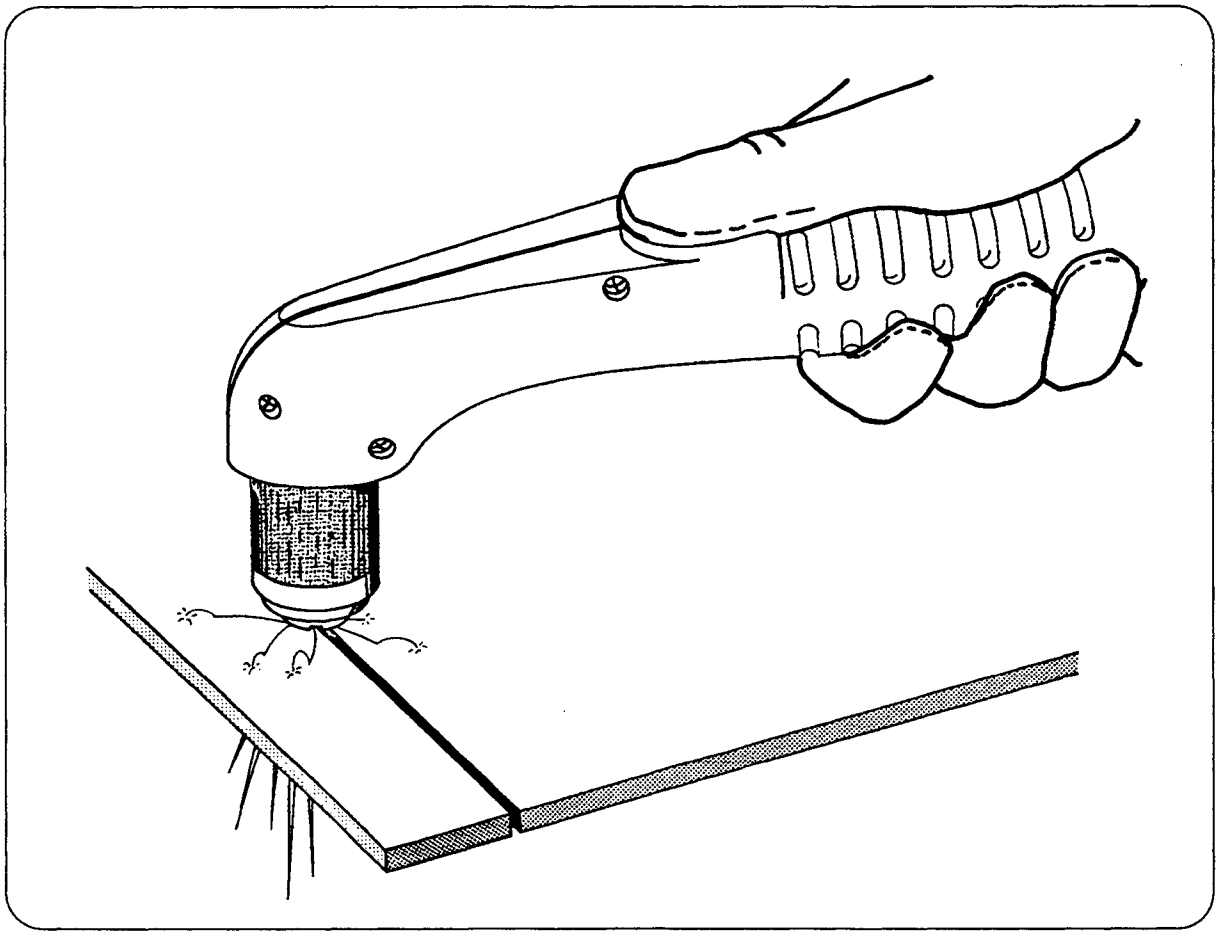


Figure 4-8 Dragging the Torch

Piercing with Hand Torch

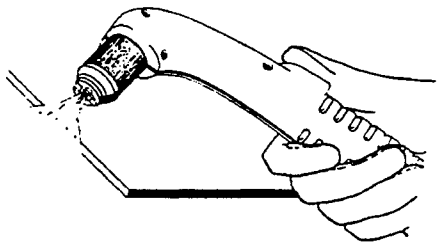
Note: **Consumable life will be shortened when piercing metal greater than 5/8" (15 mm) thick.**

- Hold the torch so that the nozzle is approximately 1/16 inch (1.5 mm) away from the workpiece before pressing the start button. This method maximizes the life of the nozzle.

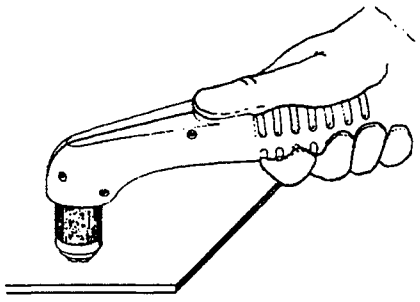
- Hold the torch at an angle to the workpiece away from yourself, then slowly roll it to a vertical position. (This is particularly important when cutting thicker material.) Make sure that the torch is pointed away from you and the people around you to avoid any danger from sparks and hot metal.

- 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° 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 Figure 4-10.)

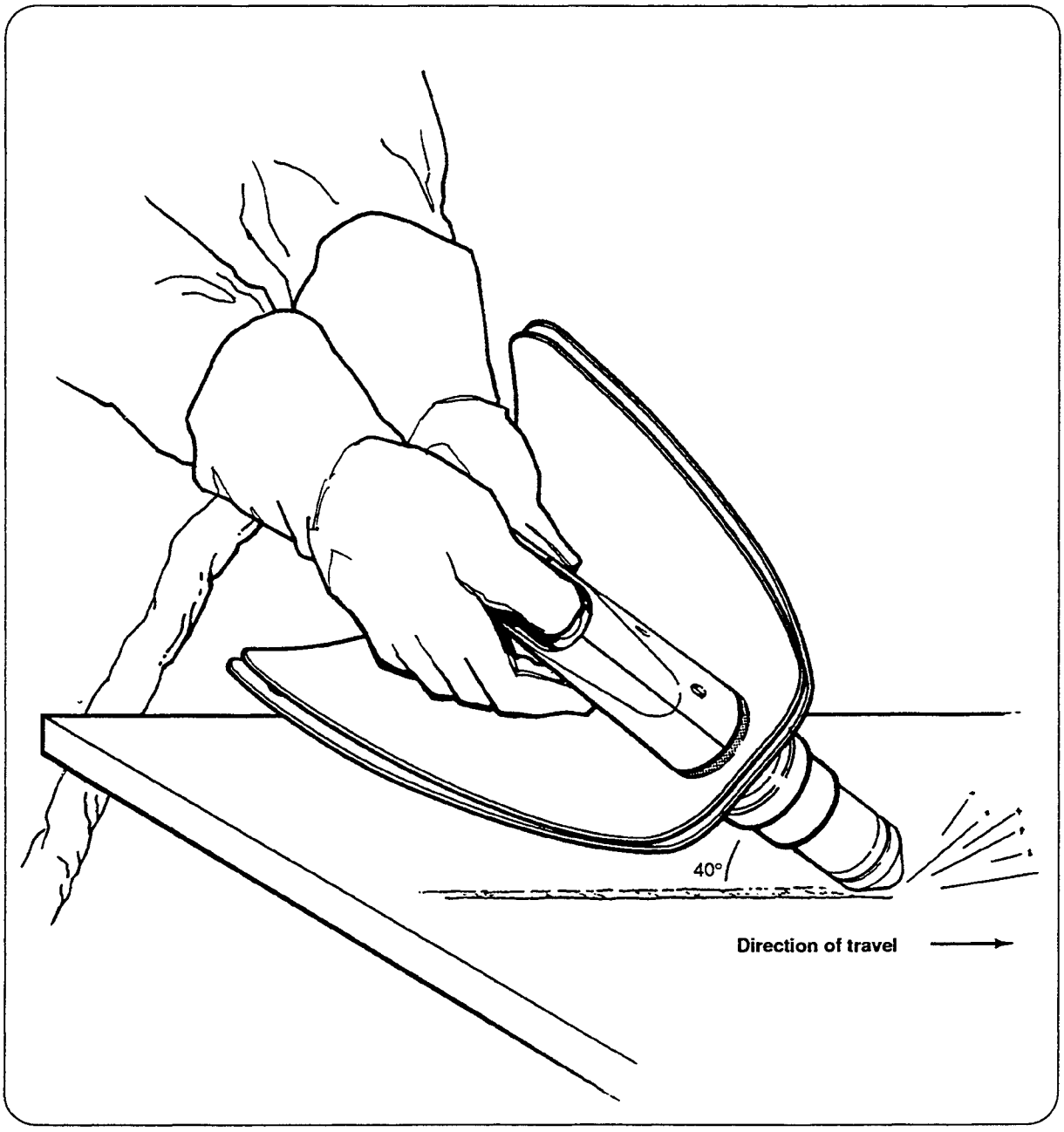


Figure 4-10 Gouging

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 one inch (25 mm) thick.
- The work clamp is not making a good electrical contact to the workpiece due to paint, rust, etc.

Gas Pressure

The plasma gas, compressed air or nitrogen, must be available at a flow rate of 440 scfh (208 liters/minute) and a minimum pressure of 80 psi (5.4 bar). If the pressure is below 60 psi (4.1 bar), the torch will go out.

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.**

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**	N2	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

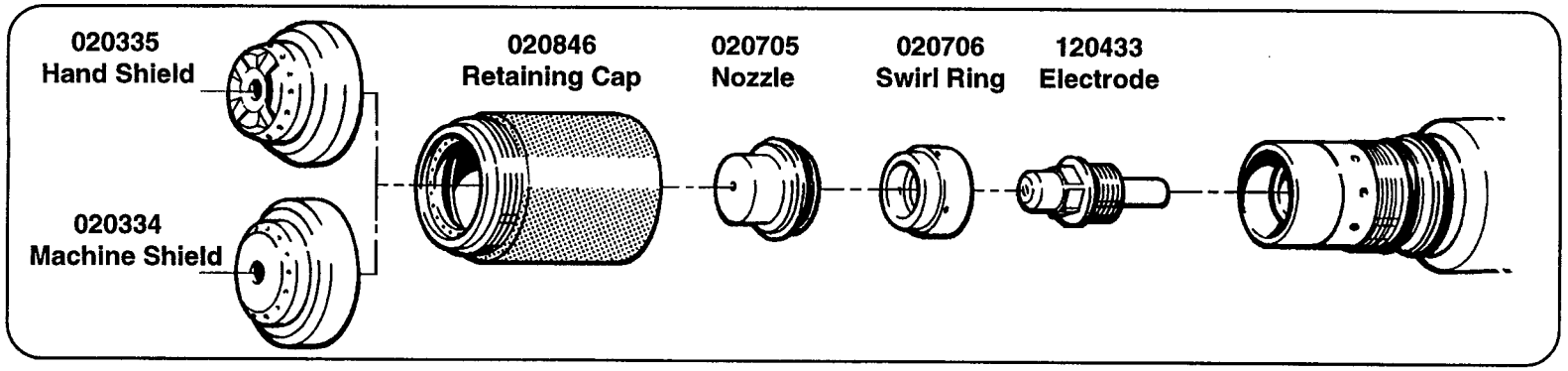
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (Inches)	(mm)	Plasma Gas Pressure Air TEST (psi)	Plasma Gas Pressure Air RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
1/4	6	50	70†	60	1/8	3	100	135	80	120	3048	0.8	100†	100
3/8	10							140		80	2032	1.0		
1/2	12							145		45	1143	1.2		
5/8	15							150		30	762	1.5		
3/4*	19*							155		17	432			
1*	25*							165		11	279			
1-1/4*	32*							170		6	152			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

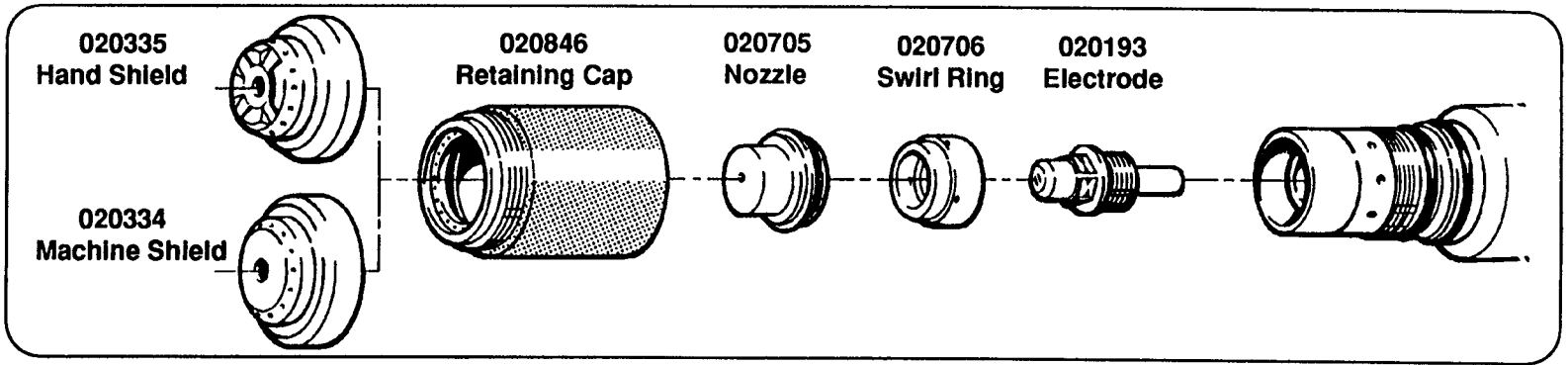
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (Inches)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
1/4	6	50	80†	60	1/8	3	100	140	80	65	1651	1.0	100†	100
3/8	9							145		50	1270	1.0		
1/2	12							150		40	1016	1.5		
5/8	15							155		20	508	1.5		
3/4*	19*							165		10	254			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

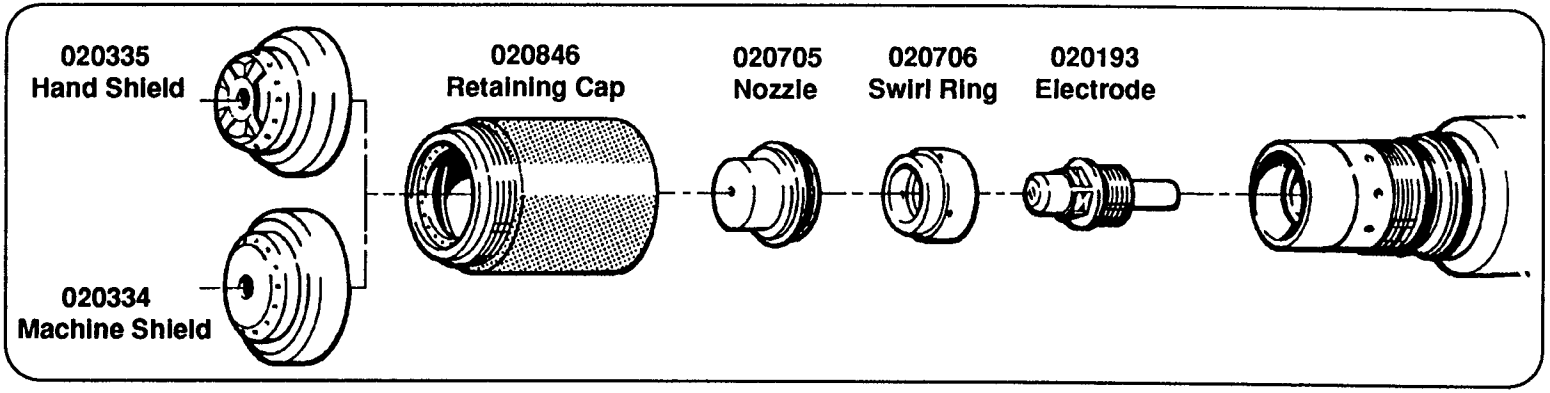
MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

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

CUTTING

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 (Inches)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (CO_2) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (CO_2) Inlet Pressure (psi)
1/4	6	50	85†	60	1/8	3	100	140	80	85	2159	1.0	100†	100
3/8	9							145		50	1270	1.0		
1/2	12							145		40	1016	1.2		
5/8	15							150		30	762	1.5		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

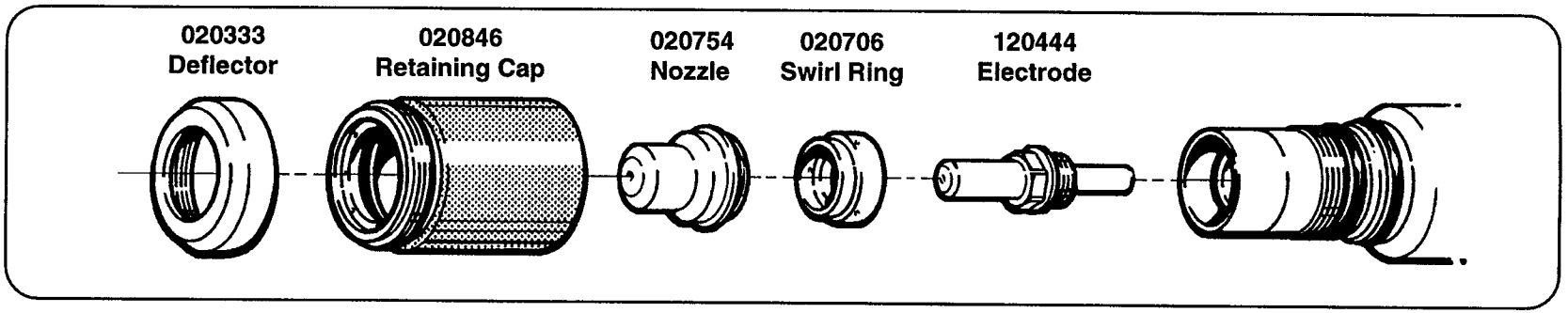
Extended Consumables

Mild Steel Cutting

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

CUTTING

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 (Inches)	(mm)	Plasma Gas Pressure Air TEST (psi)	Plasma Gas Pressure Air RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
1/8	3	50	80†	60	1/8	3	100	120	80	180	4572	0.5	100†	100
1/4	6							120		125	3175	0.8		
3/8	10							125		90	2286	1.0		
1/2	12							135		50	1270	1.2		
5/8	15							135		35	889	1.5		
3/4*	19*							145		22	559			
1*	25*							150		14	356			
1-1/4*	32*							150		10	254			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

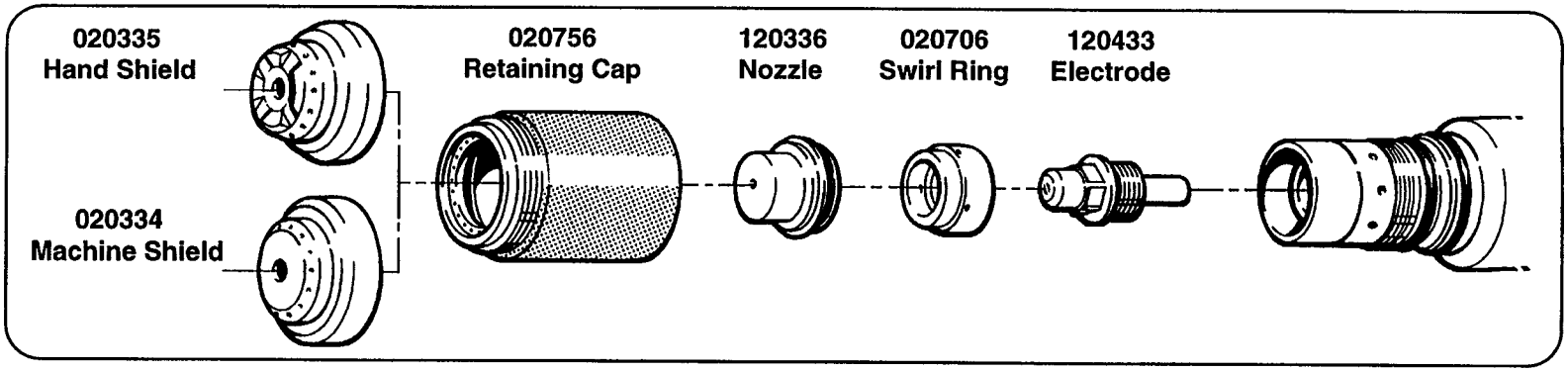
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Air TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
20/.036	1	50	75†	60	1/16	1.5	60	120	100	300	7620	0.5	100†	100
18/.050	1.3							120		300	7620	0.5		
16/.060	1.5							125		300	7620	0.5		
14/.075	2							130		240	6096	0.5		
12/.105	2.5							130		200	5080	0.5		
/.125	3							130		175	4445	0.5		
10/.135	3.5							130		170	4318	0.6		
/.250	6							135		55	1397	0.8		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

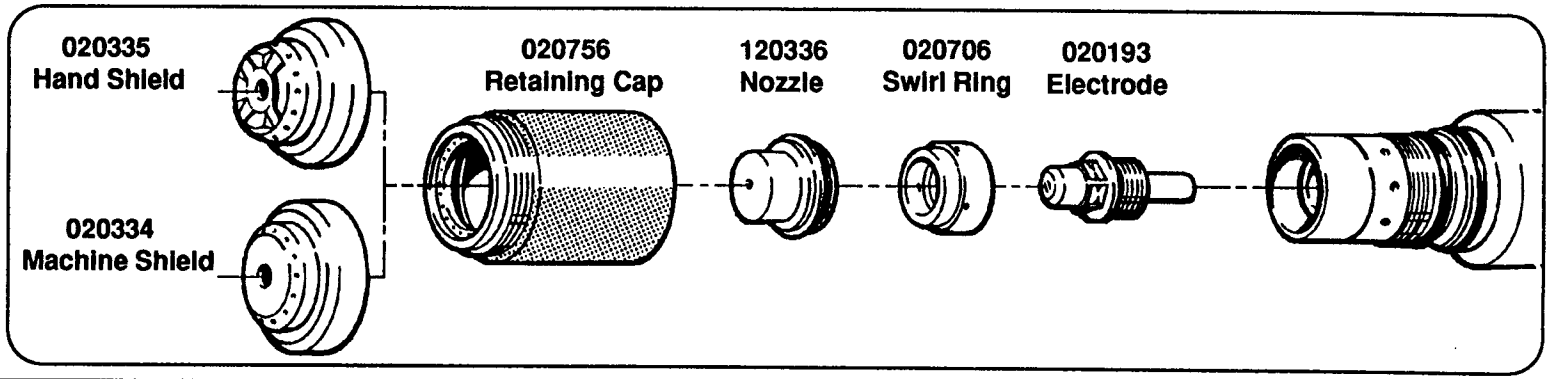
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
20/.036	1	50	75†	60	1/16	1.5	60	125	100	300	7620	0.5	100†	100
18/.050	1.3							125		300	7620	0.5		
16/.060	1.5							125		300	7620	0.5		
14/.075	2							130		210	5334	0.5		
12/.105	2.5							130		140	3556	0.5		
/.125	3							135		120	3048	0.5		
10/.135	3.5							135		85	2159	0.6		
.250	6							145		30	762	0.8		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

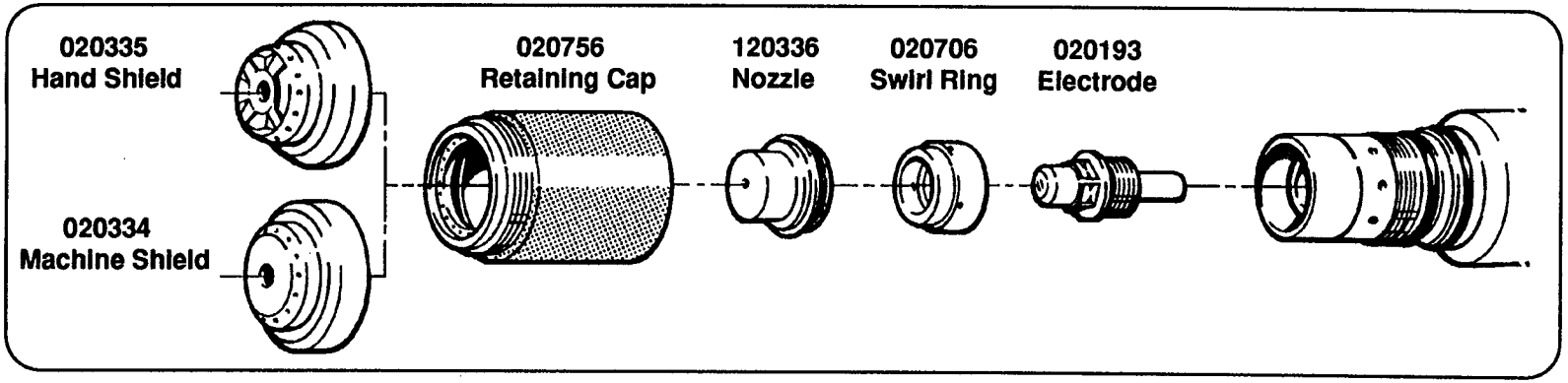
MAX100D Machine/PAC160 Hand Torch

Mild Steel Cutting

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

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (CO_2) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (CO_2) Inlet Pressure (psi)
20/.036	1	50	75†	60	1/16	1.5	60	125	100	300	7620	0.5	100†	100
18/.050	1.3							125		300	7620	0.5		
16/.060	1.5							125		300	7620	0.5		
14/.075	2							130		210	5334	0.5		
12/.105	2.5							130		160	4064	0.5		
/.125	3							135		120	3048	0.8		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

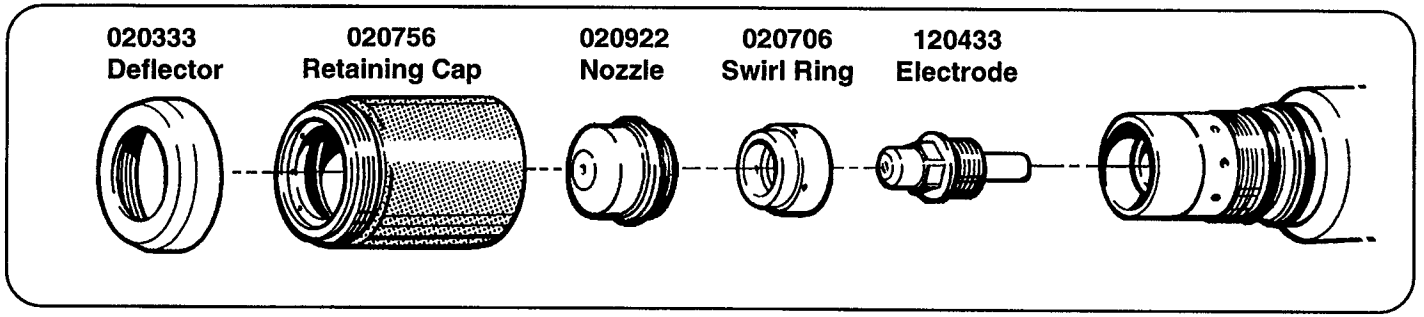
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Air TEST (psi)	Plasma Gas Pressure Air RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
20/.036	1	40	80†	60	1/8	3	60	110	100	400	10160	0.2	100†	100
18/.050								115		340	8636	0.2		
16/.060	1.5							120		300	7620	0.2		
14/.075	2							120		240	6096	0.5		
12/.105	2.5							125		200	5080	0.5		
/.125	3							125		150	3810	0.8		
10/.135								125		140	3556	1.0		
/.250	6							130		65	1651	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

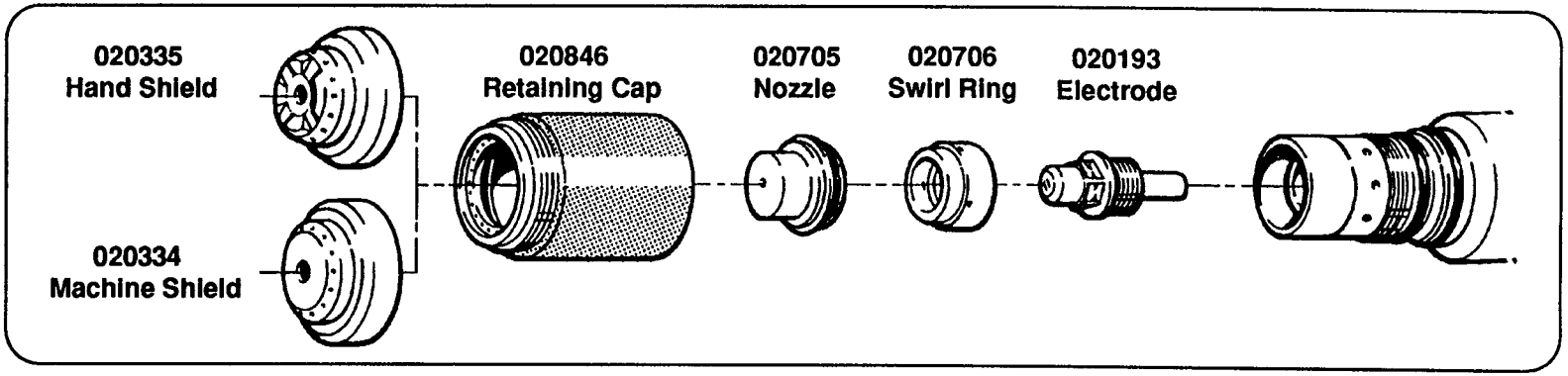
MAX100D Machine/PAC160 Hand Torch

Stainless Steel Cutting

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

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
16/.060	1.5	50	80†	60	1/8	3	100	130	80	220	5588	0.2	100†	100
12/.105	2.5							140		165	4191	0.5		
/.188	4							145		70	1778	0.8		
/.250	6							150		55	1397	0.8		
/.375	9							150		40	1016	1.0		
/.500	12							155		30	762	1.2		
/.625	15							155		22	559			
/.750*	19*							155		22	559			
/1.00*	25*							165		11	279			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

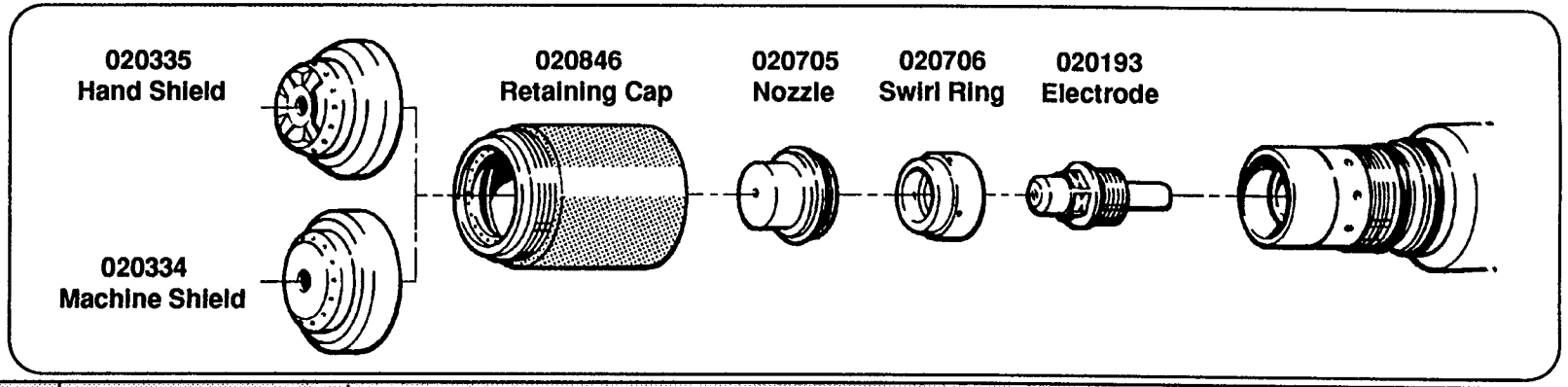
MAX100D Machine/PAC160 Hand Torch

CUTTING

Stainless Steel Cutting

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

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (CO_2) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (CO_2) Inlet Pressure (psi)
16/.060	1.5	50	85†	60	1/8	3	100	125	80	220	5588	0.2	100†	100
12/.105	2.5							140		170	4318	0.5		
/.188	4							145		70	1778	1.0		
/.250	6							150		55	1397	1.0		
/.375	9							150		40	1016	1.0		
/.500	12							155		30	762	1.5		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

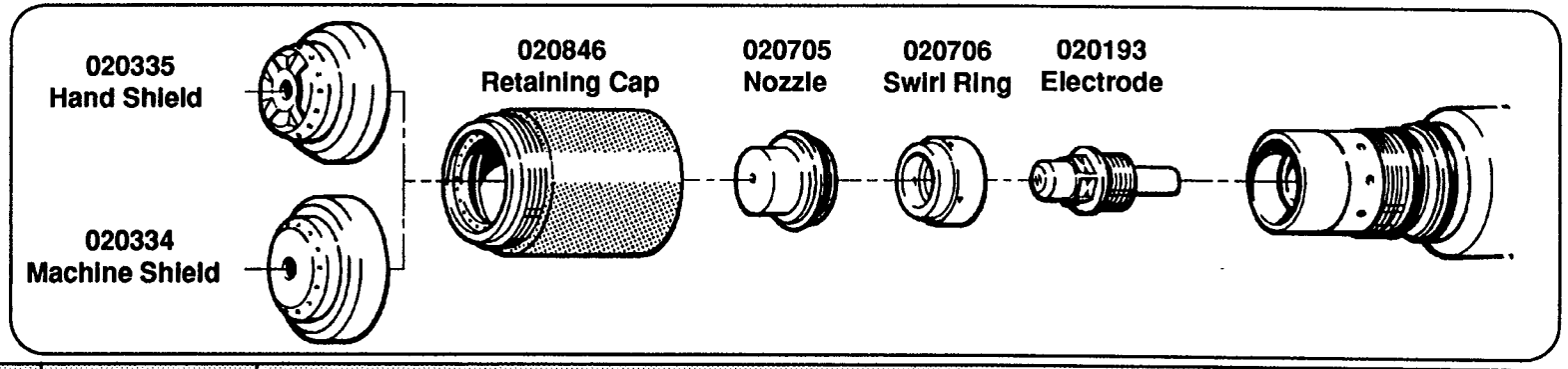
MAX100D Machine/PAC160 Hand Torch

CUTTING

Stainless Steel Cutting

Plasma Gas: **H35-N_2**
Shield Gas: **N_2**
Current Setting: **100 Amps**
Dual Gas Mixer (#059123) required

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



Material Thickness (in.)	(mm)	Plasma Gas Mix H35 GAS1*	N_2 GAS2*	Shield Gas (N_2) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Dual Gas Mixer (H35&N_2) Inlet Pressures (psi)	Shield Gas (N_2) Inlet Pressure (psi)
1/8	3	10	90	**60**	**1/8**	**3**	**100**	150	**80**	135	3429	0.5	**100**	**100**
.188	4	20	80					150		100	2540	0.5		
1/4	6	60	40					150		65	1651	1.0		
3/8	9	80	20					155		40	1016	1.5		
1/2	12	90	10					155		30	762	1.5		
5/8	15	90	10					160		30	762	2.0		

Note:
- To get good cut quality, dynamic (flowing) input pressure to Dual Gas Mixer should be equal (100 psi).
- 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 55 psi.

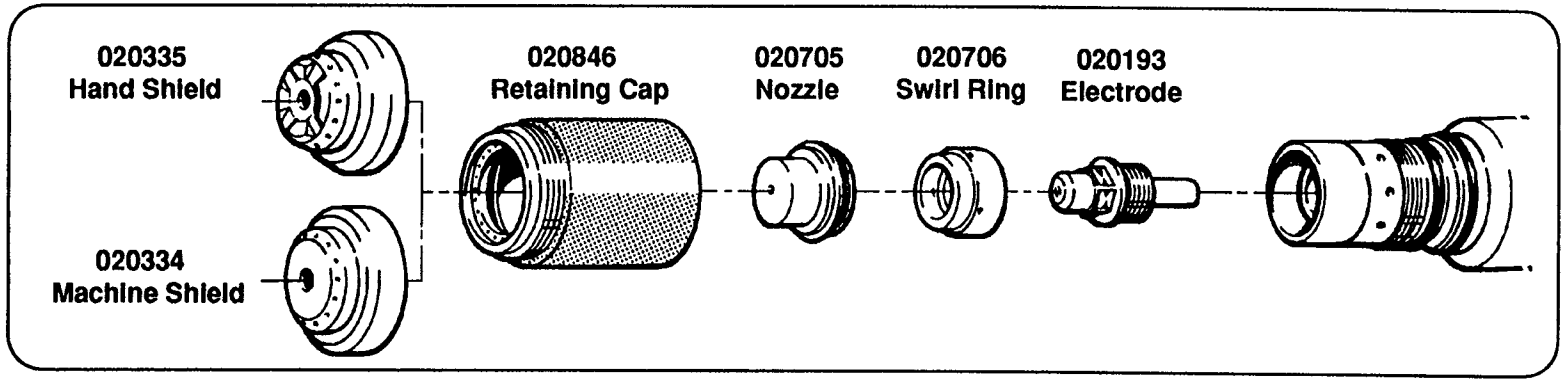
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Align flowmeter scale with middle of flowmeter float ball when setting mix ratios.
* Full scale = 100. Flow rate at full scale (100) of the flow meter is about 75 scfh (2123 liters/hour).

MAX100D Machine/PAC160 Hand Torch

CUTTING

Stainless Steel Cutting

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



Material Thickness (In)	(mm)	Plasma Gas Pressure H35 TEST (psi)	RUN (psi)	Shield Gas (N_2) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (N_2) Inlet Pressure (psi)
3/8	9	50	75†	60	1/8	3	100	155	80	40	1016	1.5	100†	100
1/2	12							155		30	762	1.5		
5/8	15							160		30	762	2.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

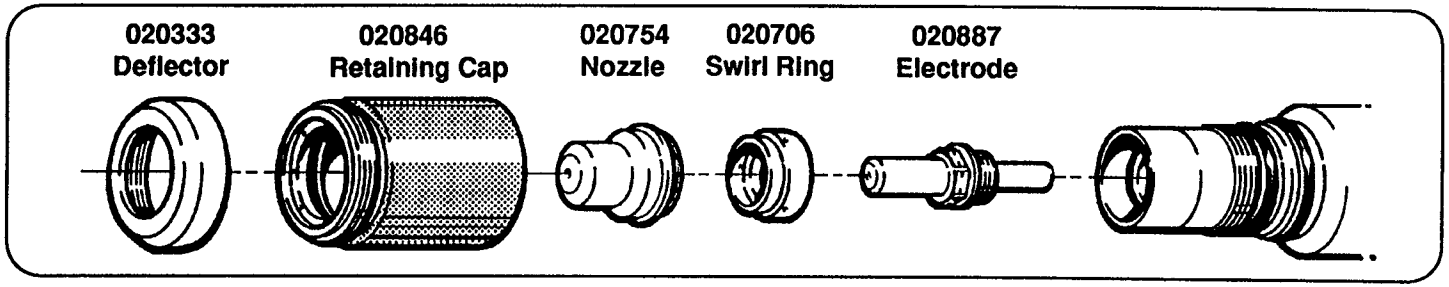
MAX100D Machine/PAC160 Hand Torch

CUTTING

Extended Consumables
Stainless Steel Cutting

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

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
12/.105	2.5	50	80†	60	1/8	3	100	130	80	175	4445	0.5	100†	100
10/.135	3							130		160	4064	0.5		
/.188	4							135		80	2032	0.8		
/.250	6							135		60	1524	0.8		
/.375	9							140		40	1016	1.0		
/.500	12							145		35	889	1.2		
/.625	15							150		18	457	1.5		
/.750*	19*							155		15	381			
/1.00*	25*							160		10	254			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

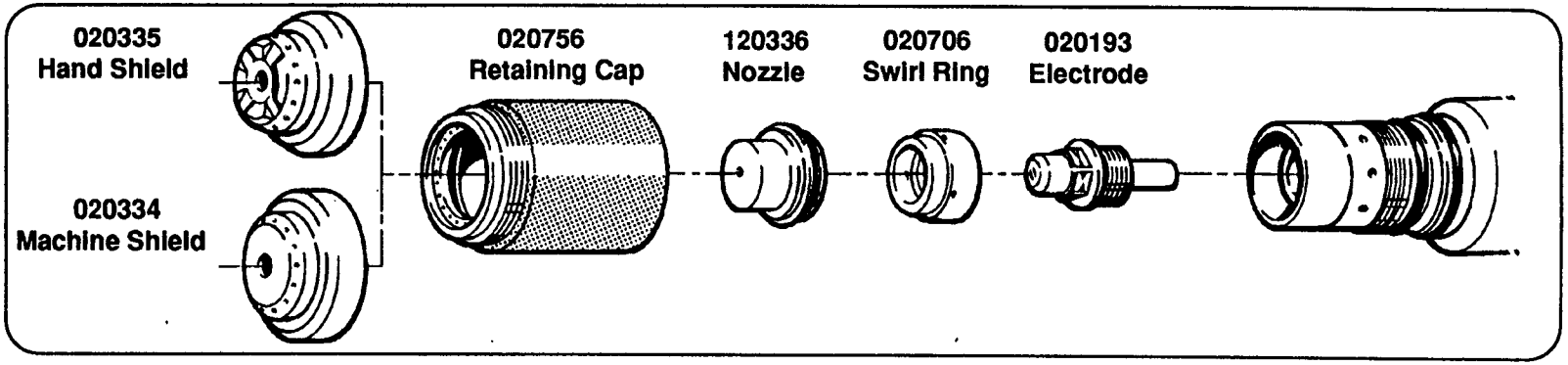
MAX100D Machine/PAC160 Hand Torch

CUTTING

Stainless Steel Cutting

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

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
20/.036	1	50	75†	60	1/16	1.5	60	125	100	300	7620	0.5	100†	100
16/.060	1.5							125		300	7620	0.5		
14/.075	2							130		240	6096	0.5		
12/.105	2.5							130		180	4572	0.5		
/.125	3							140		150	3810	1.0		
/.188	4							145		65	1651	1.0		
/.250	6							150		45	1143	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

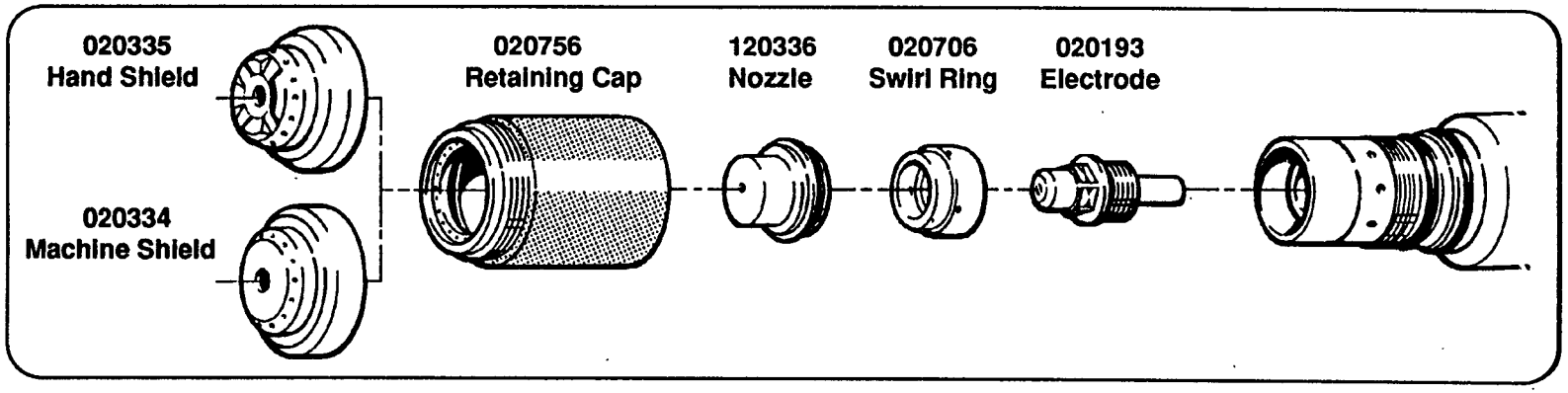
MAX100D Machine/PAC160 Hand Torch

CUTTING

Stainless Steel Cutting

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

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (CO_2) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (CO_2) Inlet Pressure (psi)
20/.036	1	50	75†	60	1/16	1.5	60	125	100	360	9144	0.5	100†	100
16/.060	1.5							125		360	9144	0.5		
14/.075	2							130		240	6096	0.5		
12/.105	2.5							130		150	3810	0.8		
/.125	3							135		120	3048	1.0		
/.188	4							140		55	1397	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

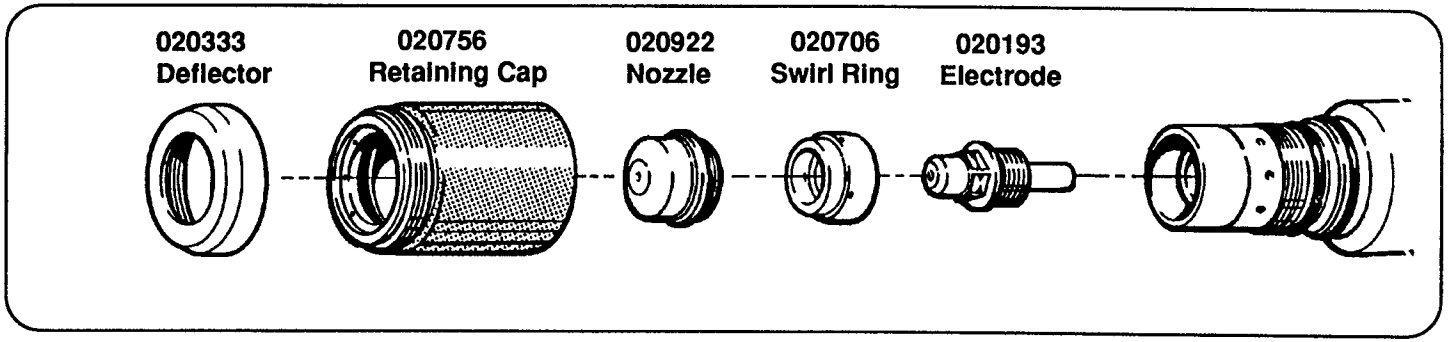
MAX100D Machine/PAC160 Hand Torch

CUTTING

Stainless Steel Cutting - Unshielded Parts

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

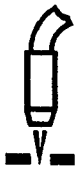
This gas combination is used when cut edge quality, surface nitriding and surface oxidation of alloying elements are less important. Electrode life is extended when this combination is used.



Material Thickness (GA/In)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
18/.050		40	80†	60	1/8	3	60	120	100	360	9144	0.2	100†	100
16/.060	1.5							120		300	7620	0.2		
14/.075	2							125		240	6096	0.5		
12/.105	2.5							125		180	4572	0.5		
/.125	3							135		140	3556	1.0		
/.188	4							140		60	1524	1.0		
/.250	6							145		40	1016	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

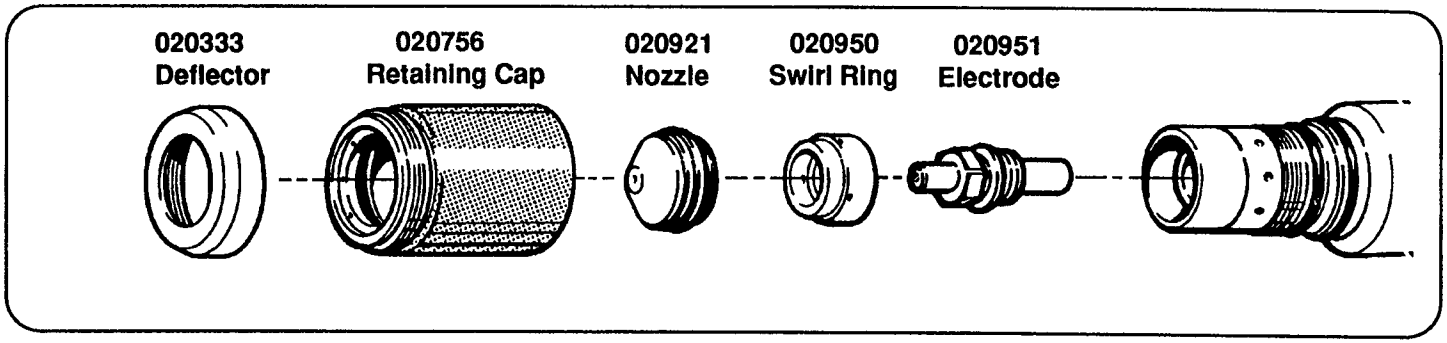


CUTTING

Stainless Steel Cutting*

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

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



Material Thickness (GA/in)	(mm)	Plasma Gas Pressure Air TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
26/.018	0.5	40	60†	60	.020	0.5	30**	65-75***	100	250	6350	0	100†	100
24/.024	0.6						30**			230	5842	0		
22/.030	0.7						30**			220	5588	0		
20/.036	0.9						30**			200	5080	0		
18/.048	1.2						40			150	3810	0.1		
16/.060	1.5						40			120	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.

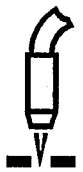
** Turn **AMPS** knob totally counterclockwise for 30 Amp setting

*** To maintain the .020 (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 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

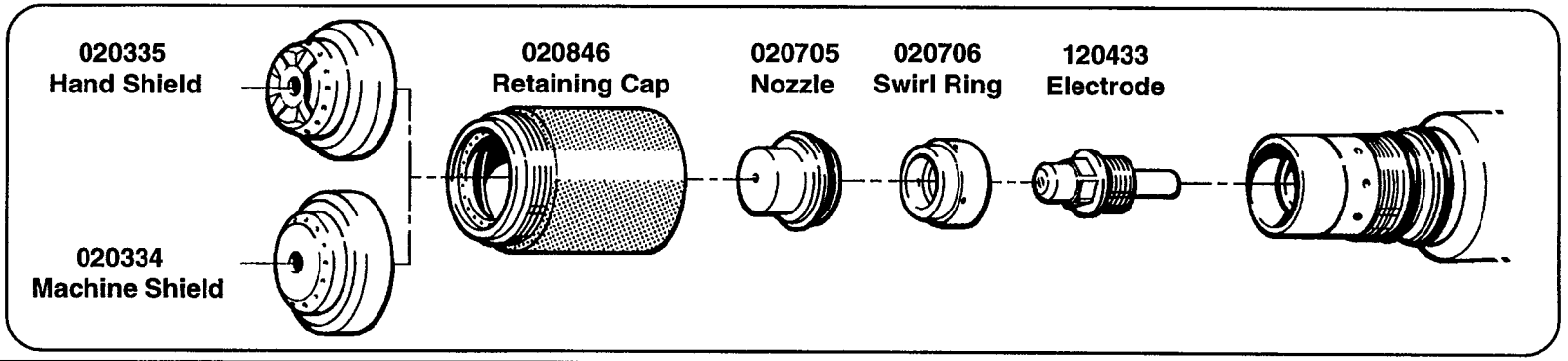


CUTTING

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 (inches)	(mm)	Plasma Gas Pressure Air TEST (psi)	Plasma Gas Pressure Air RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
1/4	6	50	75†	60	1/8	3	100	140	80	95	2413	0.8	100†	100
3/8	9							140		70	1778	1.0		
1/2	12							145		55	1397	1.2		
5/8	15							150		45	1143	1.5		
3/4*	19*							155		33	838			
1*	25*							160		22	559			
1-1/4*	32*							170		11	279			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

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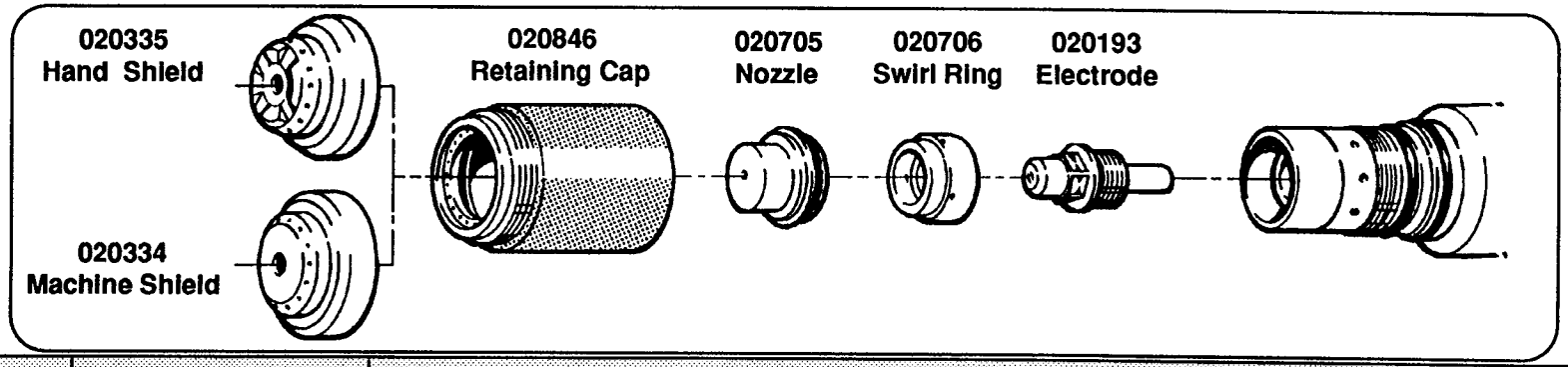
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (Inches)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
1/4	6	50	86†	60	1/8	3	100	145	80	95	2413	1.0	100†	100
3/8	9							150		70	1778	1.0		
1/2	12							155		55	1397	1.5		
5/8	15							155		45	1143	1.5		
3/4*	19*							160		35	889			
1*	25*							165		22	559			
1-1/4*	32*							175		11	279			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

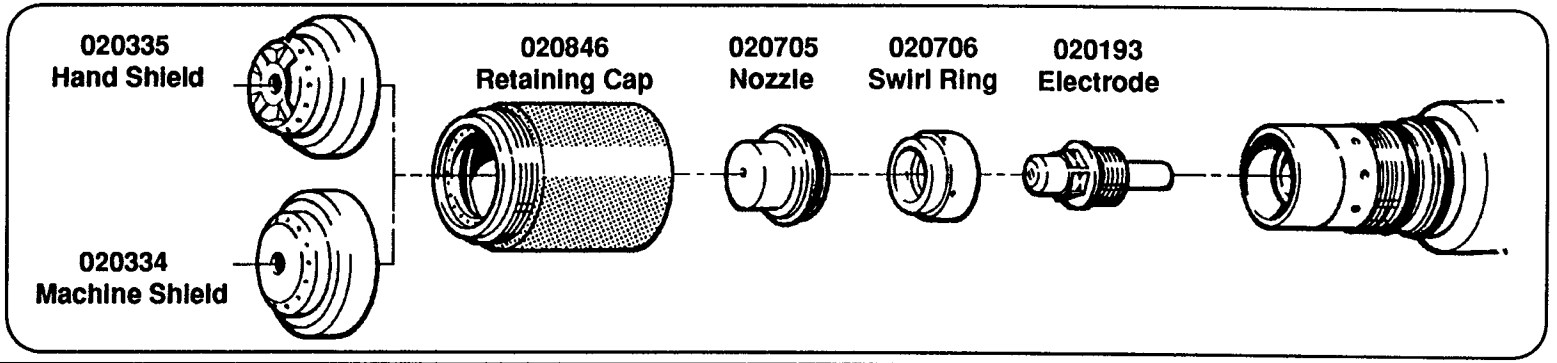
MAX100D Machine/PAC160 Hand Torch

CUTTING

Aluminum Cutting

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

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



Material Thickness (inches)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (CO_2) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (CO_2) Inlet Pressure (psi)
1/4	6	50	85†	60	1/8	3	100	145	80	95	2413	0.8	100†	100
3/8	9							145		70	1778	1.0		
1/2	12							150		55	1397	1.2		
5/8	15							155		45	1143	1.5		
3/4*	19*							160		35	889			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

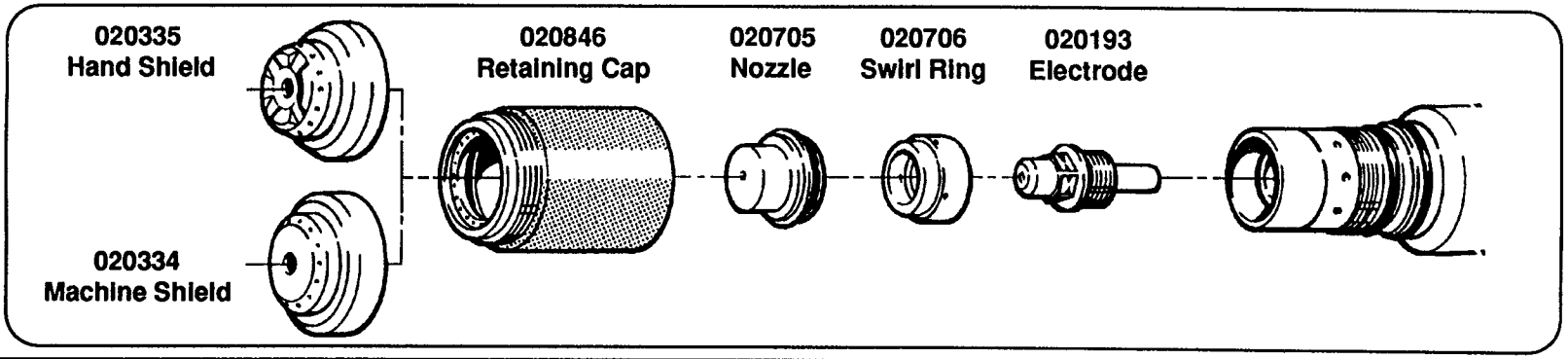
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (inches)	(mm)	Plasma Gas Pressure H35 TEST (psi)	Plasma Gas Pressure H35 RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
1/4	6	50	80†	60	1/8	3	100	130	80	95	2413	0.8	100†	100
3/8	9							130		70	1778	1.0		
1/2	12							135		55	1397	1.2		
5/8	15							135		45	1143	1.5		
3/4*	19*							140		35	889			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

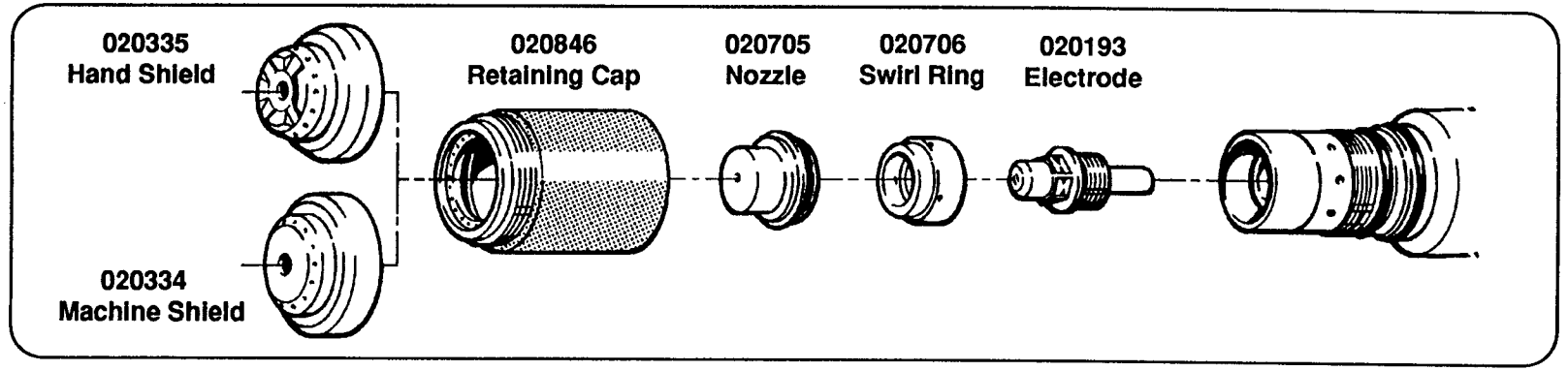
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (Inches)	(mm)	Plasma Gas Pressure H35 TEST (psi)	Plasma Gas Pressure H35 RUN (psi)	Shield Gas (N_2) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (N_2) Inlet Pressure (psi)
1/4	6	50	80†	60	1/8	3	100	130	80	95	2413	0.8	100†	100
3/8	9							135		70	1778	1.0		
1/2	12							135		55	1397	1.2		
5/8	15							140		45	1143	1.5		
3/4*	19*							145		35	889			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

MAX100D Machine/PAC160 Hand Torch

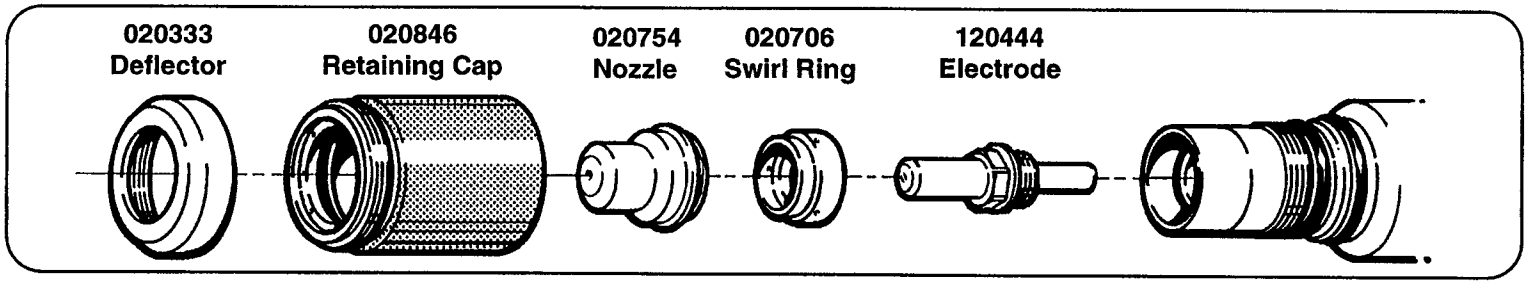
Extended Consumables

Aluminum Cutting

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

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Air TEST (psi)	Plasma Gas Pressure Air RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
16/.060	1.5	**50**	**80†**	**60**	**1/8**	**3**	**100**	130	**80**	175	4445	0.2	**100†**	**100**
14/.075	2							130		160	4064	0.2		
12/.105	2.5							130		145	3683	0.5		
/.125	3							130		145	3683	0.5		
10/.135	3							135		135	3429	0.5		
/.188	4							135		125	3175	0.8		
/.250	6							135		115	2921	0.8		
/.375	9							140		90	2286	1.0		
/.500	12							140		60	1524	1.2		
/.625	15							145		45	1143	1.5		
/.750*	19*							145		30	762			
/1.00*	25*							155		20	508			
/1.25*	32*							160		12	304			

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
* Piercing not recommended
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

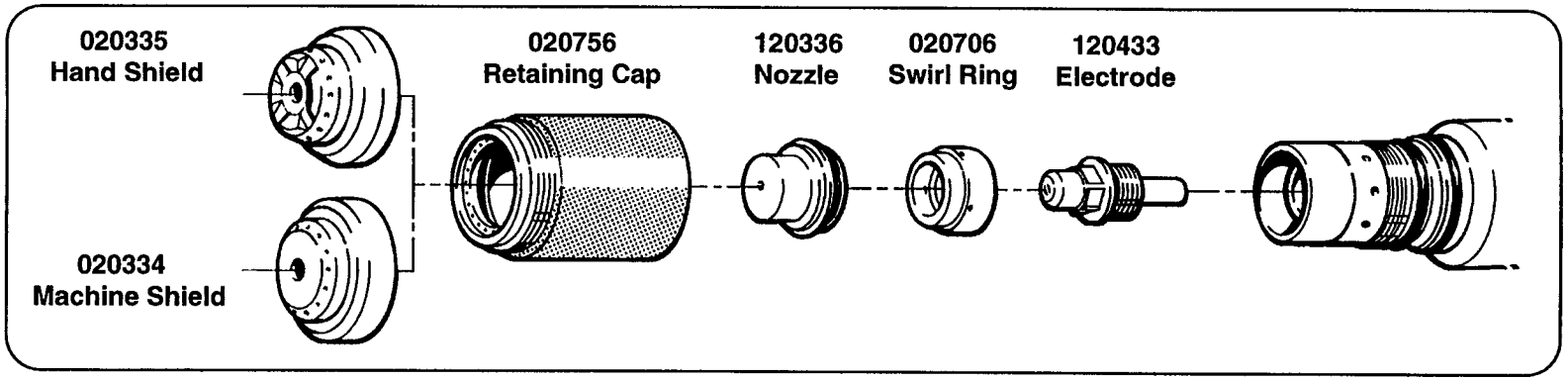
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Air TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
18/.050	1.3	50	80†	60	1/16	1.5	60	120	100	300	7620	0.5	100†	100
16/.060	1.5							125		240	6096	0.5		
14/.075	2							125		200	5080	0.5		
12/.105	2.5							130		160	4064	0.5		
/.125	3							130		120	3048	0.8		
/.250	6							135		90	2286	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

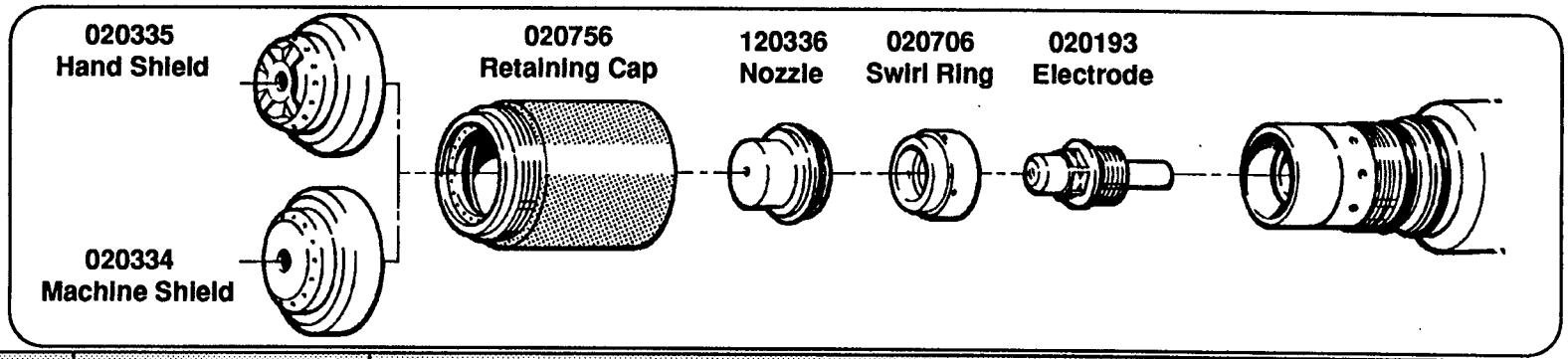
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
18/.050	1.3	50	85†	60	1/16	1.5	60	125	100	240	6096	0.5	100†	100
16/.060	1.5							125		180	4572	0.5		
14/.075	2							135		160	4064	0.5		
12/.105	2.5							140		130	3302	0.5		
/.125	3							145		85	2159	0.8		
/.250	6							155		40	1016	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

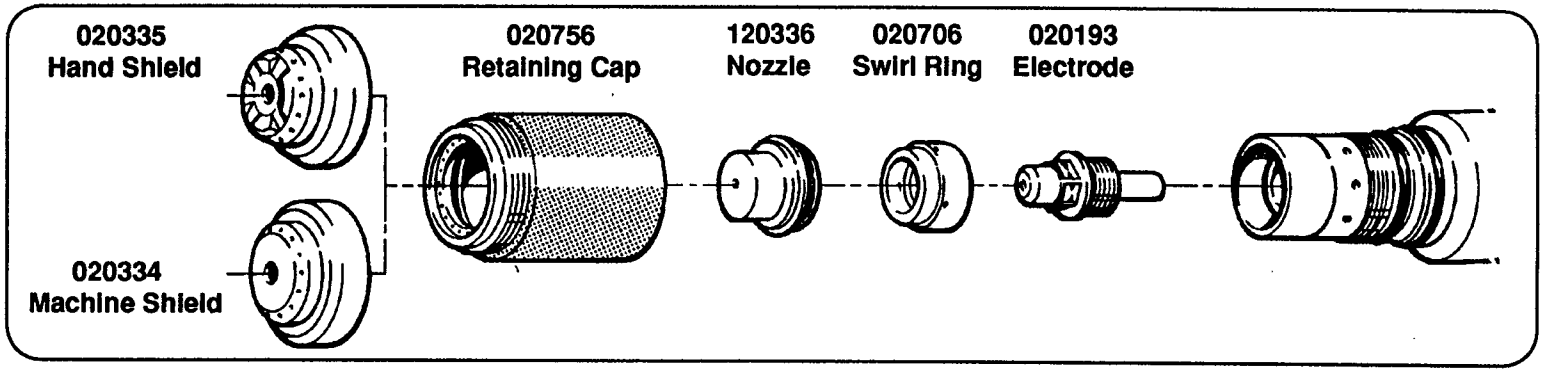
MAX100D Machine/PAC160 Hand Torch

CUTTING

Aluminum Cutting

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

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



Material Thickness (GA/in)	(mm)	Plasma Gas Pressure Nitrogen TEST (psi)	RUN (psi)	Shield Gas (CO_2) Pressure (psi)	Torch-to-work Distance (inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (N_2) Inlet Pressure (psi)	Shield Gas (CO_2) Inlet Pressure (psi)
18/.050	1.3	50	85†	60	1/16	1.5	60	125	100	240	6096	0.5	100†	100
16/.060	1.5							125		180	4572	0.5		
14/.075	2							135		160	4064	0.5		
12/.105	2.5							140		130	3302	0.5		
/.125	3							145		85	2159	0.8		
/.250	6							155		40	1016	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

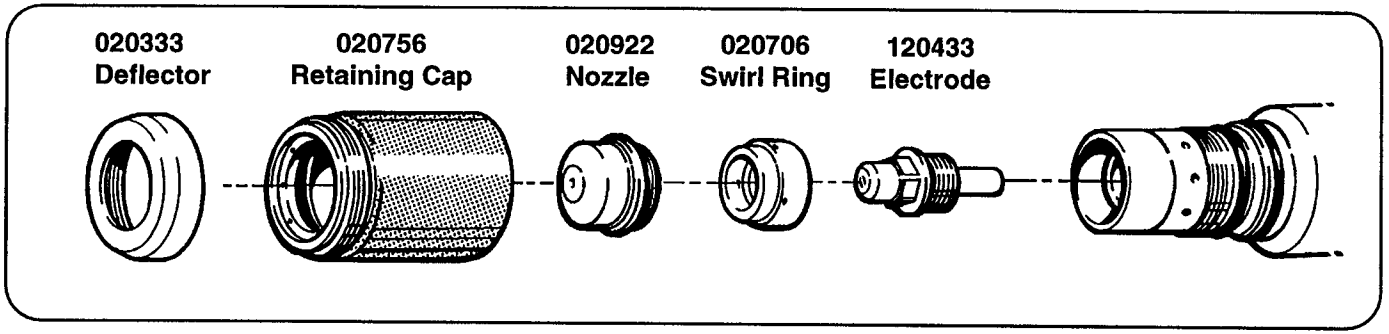
MAX100D Machine/PAC160 Hand Torch

CUTTING

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 (GA/in)	(mm)	Plasma Gas Pressure Air TEST (psi)	Plasma Gas Pressure Air RUN (psi)	Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Arc Voltage Setting (volts)	Duty Cycle (%)	Travel Speed (ipm)	Travel Speed (mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
18/.050		40	80†	60	1/8	3	60	115	100	300	7620	0.2	100†	100
16/.060	1.5							120		240	6096	0.2		
14/.075	2							120		200	5080	0.5		
12/.105	2.5							125		160	4064	0.5		
/.125	3							125		120	3048	0.8		
/.250	6							130		90	2286	1.0		

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

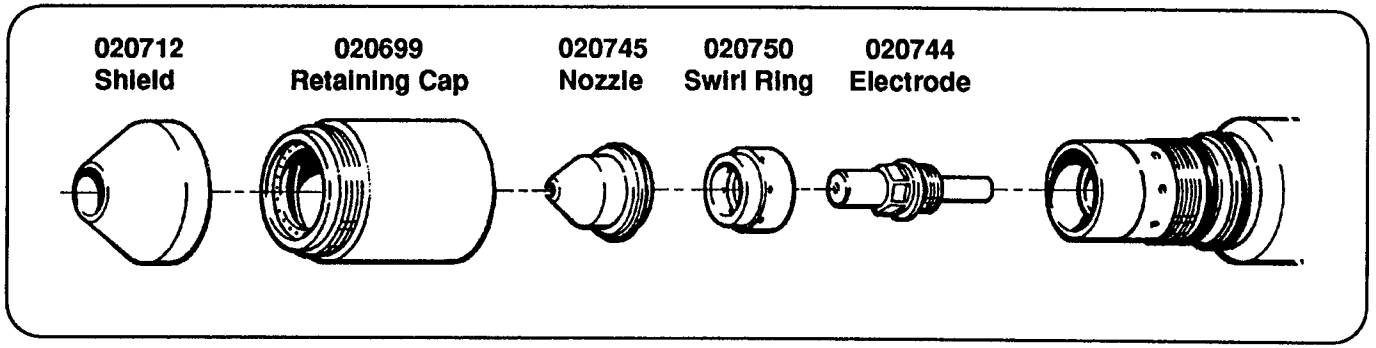
MAX100D Machine/PAC160E Hand Torch

Mild Steel Gouging

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

GOUGING

This combination is very economical on gas.



Torch-to-work Angle of Inclination θ (Degrees)	Plasma Gas Pressure Air		Shield Gas (Air) Pressure (psi)	Torch-to-work Distance		Arc Current Setting (amps)	Duty Cycle (%)	Travel Speed		Approx. Motion Delay Time (sec)	Plasma Gas (Air) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
	TEST (psi)	RUN (psi)		(Inches)	(mm)			(ipm)	(mm/min)			
40°	50	54†	60	1/16	1.5	100	80	15	381	1.0	100†	100

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

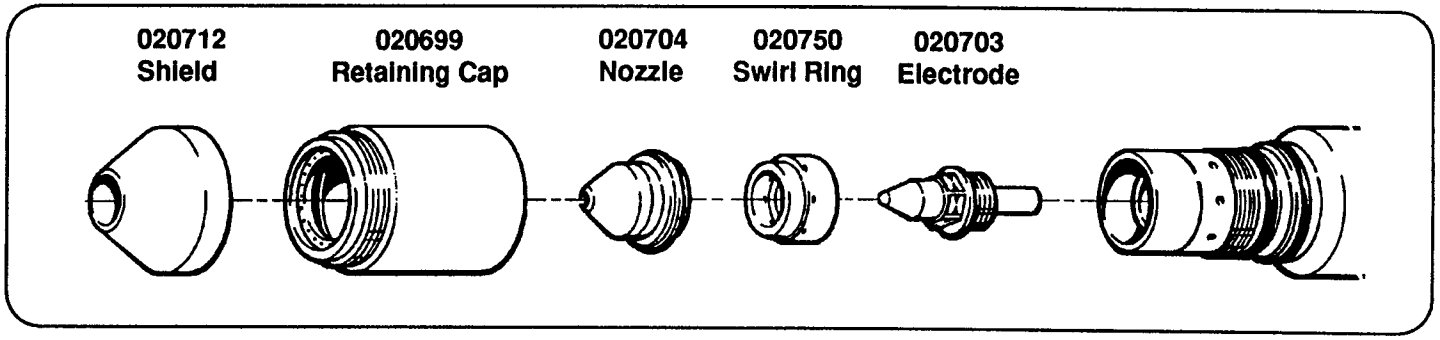
MAX100D Machine/PAC160E Hand Torch

Mild Steel Gouging

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

GOUGING

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 θ (Degrees)	Plasma Gas Pressure H35		Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
	TEST (psi)	RUN (psi)										
40°	50	54†	60	1/8	3	100	80	20	508	1.0	100†	100

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

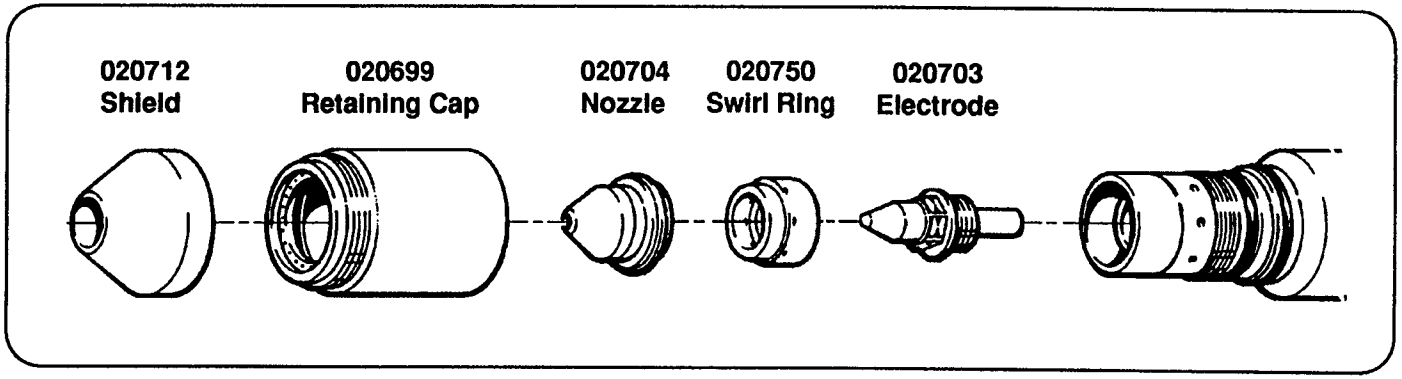
MAX100D Machine/PAC160E Hand Torch

Stainless Steel Gouging

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

GOUGING

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 θ (Degrees)	Plasma Gas Pressure H35		Shield Gas (Air) Pressure (psi)	Torch-to-work Distance		Arc Current Setting (amps)	Duty Cycle (%)	Travel Speed		Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
	TEST (psi)	RUN (psi)		(Inches)	(mm)			(ipm)	(mm/min)			
40°	50	54†	60	1/8	3	100	80	20	508	1.0	100†	100

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

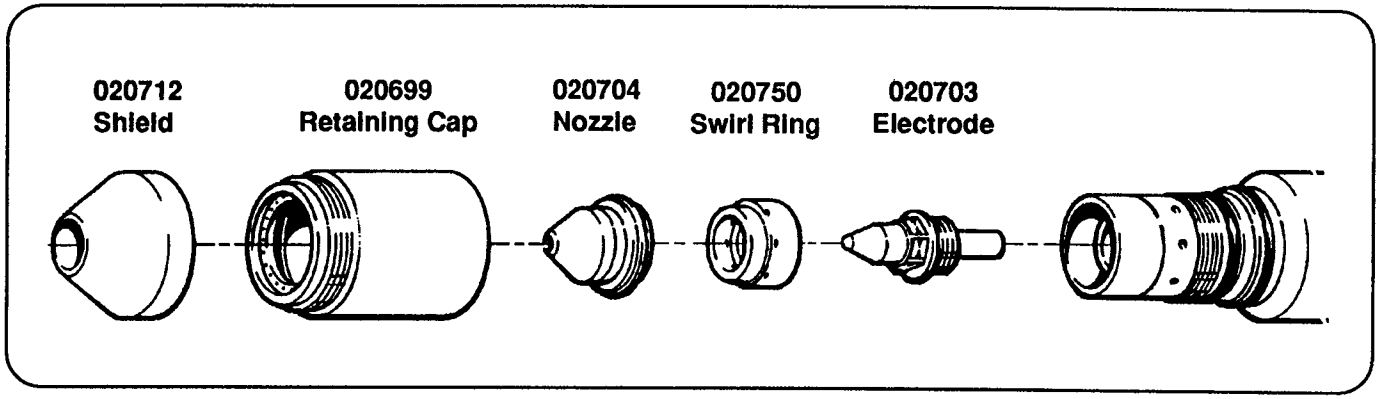
MAX100D Machine/PAC160E Hand Torch

Stainless Steel Gouging

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

GOUGING

**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 θ (Degrees)	Plasma Gas Pressure H35		Shield Gas (N_2) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (N_2) Inlet Pressure (psi)
	TEST (psi)	RUN (psi)										
40°	50	54†	60	1/8	3	100	80	20	508	1.0	100†	100

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

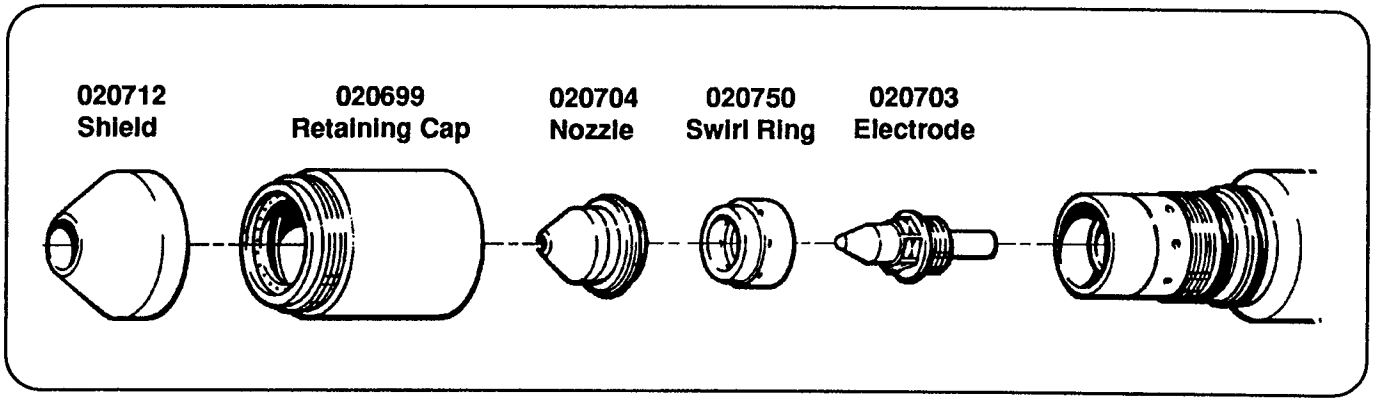
MAX100D Machine/PAC160E Hand Torch

Aluminum Gouging

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

GOUGING

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 θ (Degrees)	Plasma Gas Pressure H35		Shield Gas (Air) Pressure (psi)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (amps)	Duty Cycle (%)	Travel Speed (ipm)	(mm/min)	Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (Air) Inlet Pressure (psi)
	TEST (psi)	RUN (psi)										
40°	50	54†	60	1/8	3	100	80	20	508	1.0	100†	100

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

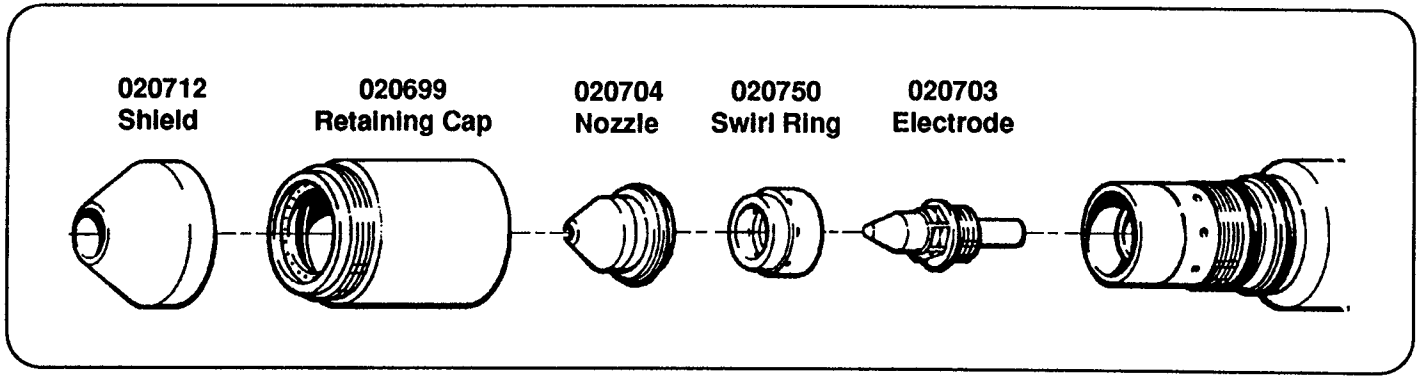
MAX100D Machine/PAC160E Hand Torch

Aluminum Gouging

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

GOUGING

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 θ (Degrees)	Plasma Gas Pressure H35		Shield Gas (N_2) Pressure (psi)	Torch-to-work Distance		Arc Current Setting (amps)	Duty Cycle (%)	Travel Speed		Approx. Motion Delay Time (sec)	Plasma Gas (H35) Inlet Pressure (psi)	Shield Gas (N_2) Inlet Pressure (psi)
	TEST (psi)	RUN (psi)		(Inches)	(mm)			(ipm)	(mm/min)			
40°	50	54†	60	1/8	3	100	80	20	508	1.0	100†	100

† If RUN pressure is higher than recommended, lower Plasma Gas Inlet Pressure
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

Section 5 MAINTENANCE

In this section:

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Routine Maintenance 5-3
  Torch and Torch Leads 5-3
  Power Supply 5-3
Sequence of Events 5-4
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MAINTENANCE

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.

MAINTENANCE

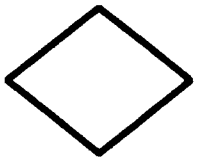
SEQUENCE OF EVENTS

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.

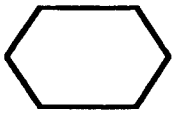
The following symbols used in the flowchart are ANSI standard flowcharting symbols. Their names and definitions are as follows:

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

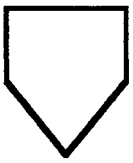
Task/Process Box The process or task box is used to indicate any process or task other than an input/output operation or a decision.



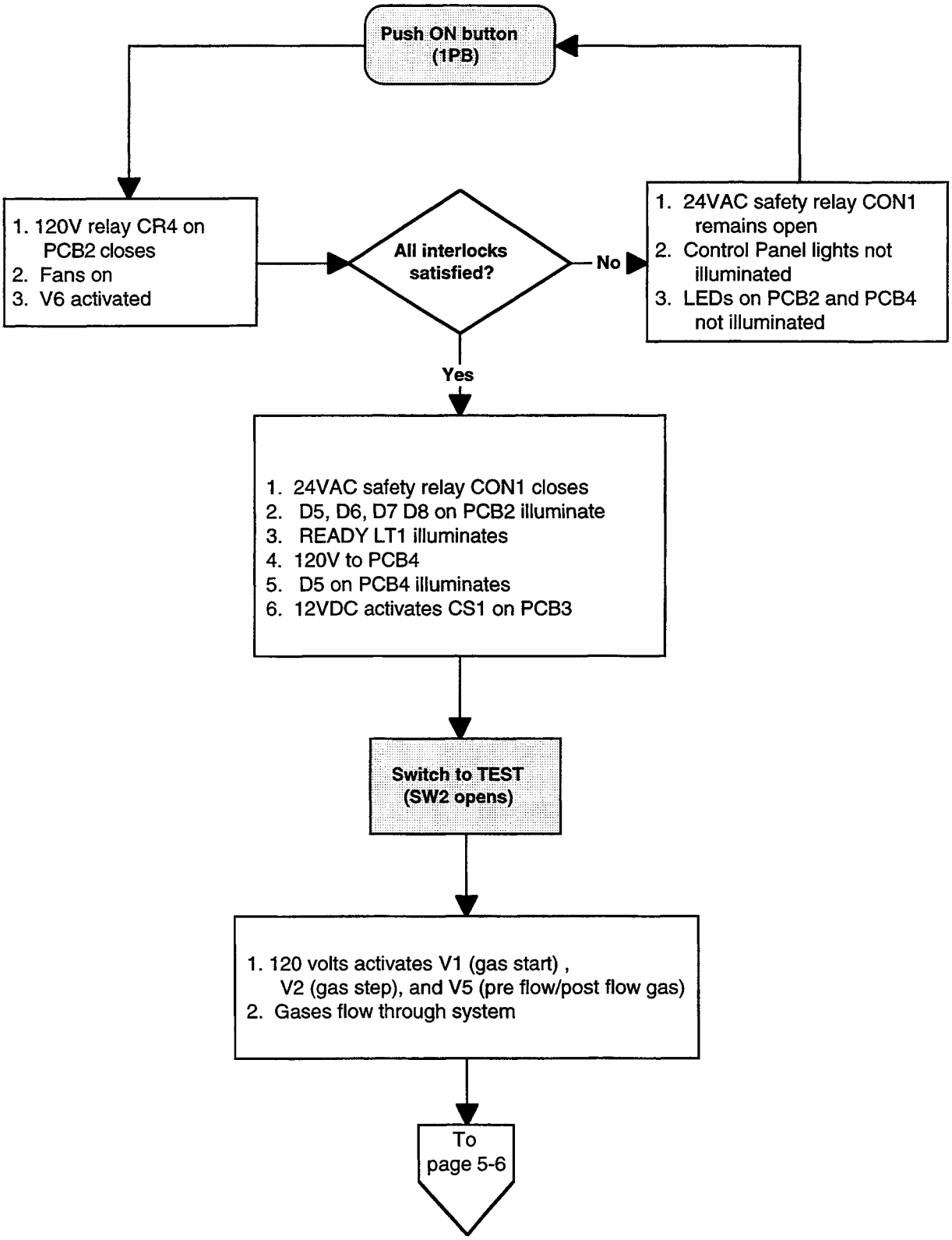
Decision Diamond The decision diamond is used to indicate a decision or branching point.

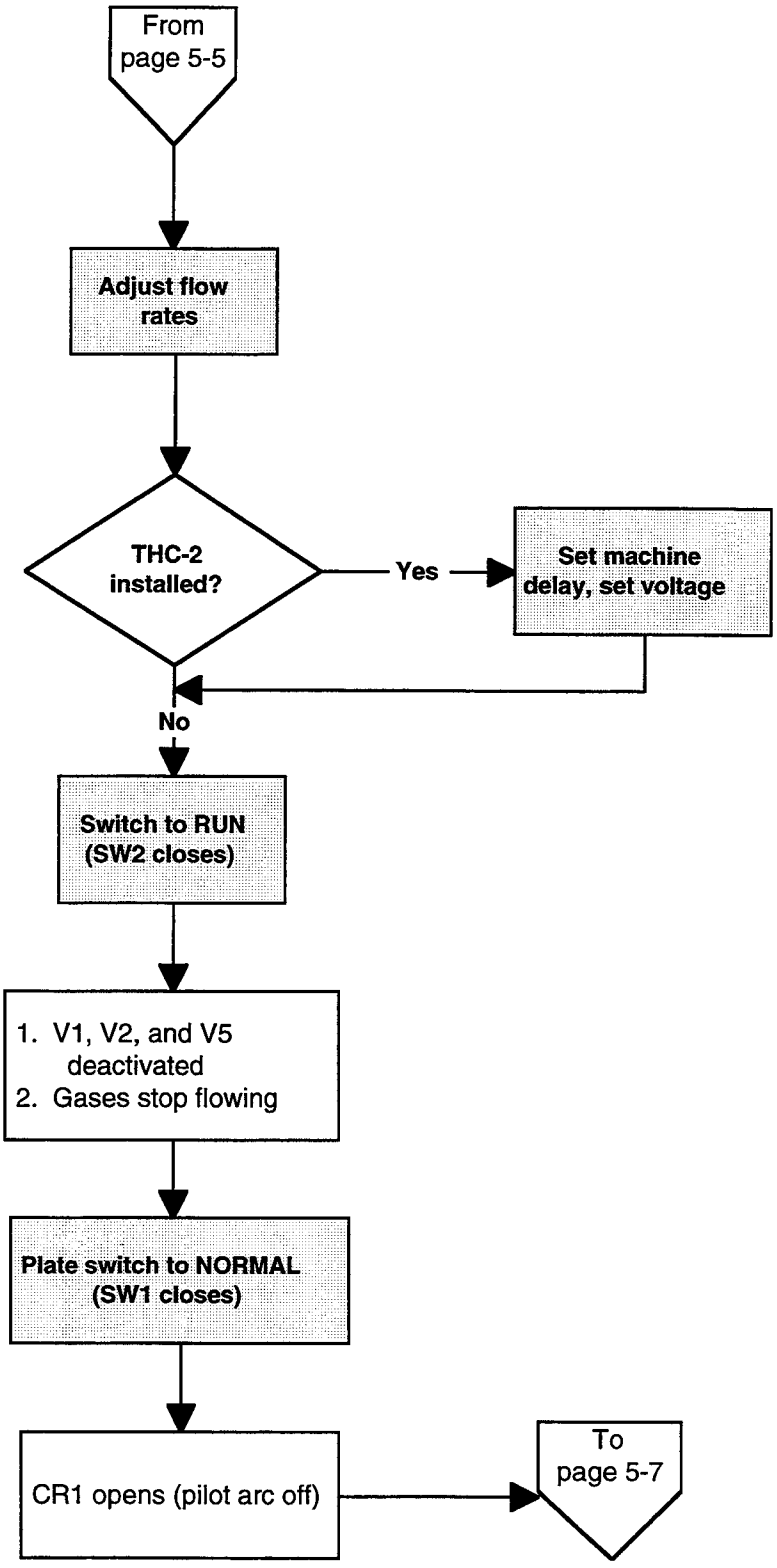


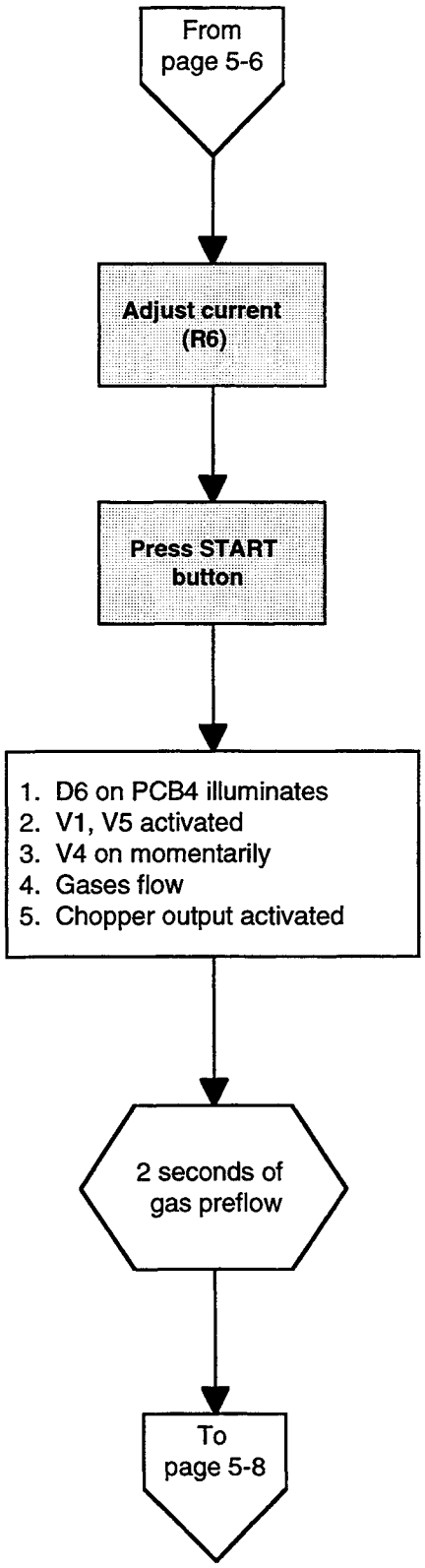
Preparation The preparation symbol is used to indicate an instruction modification.

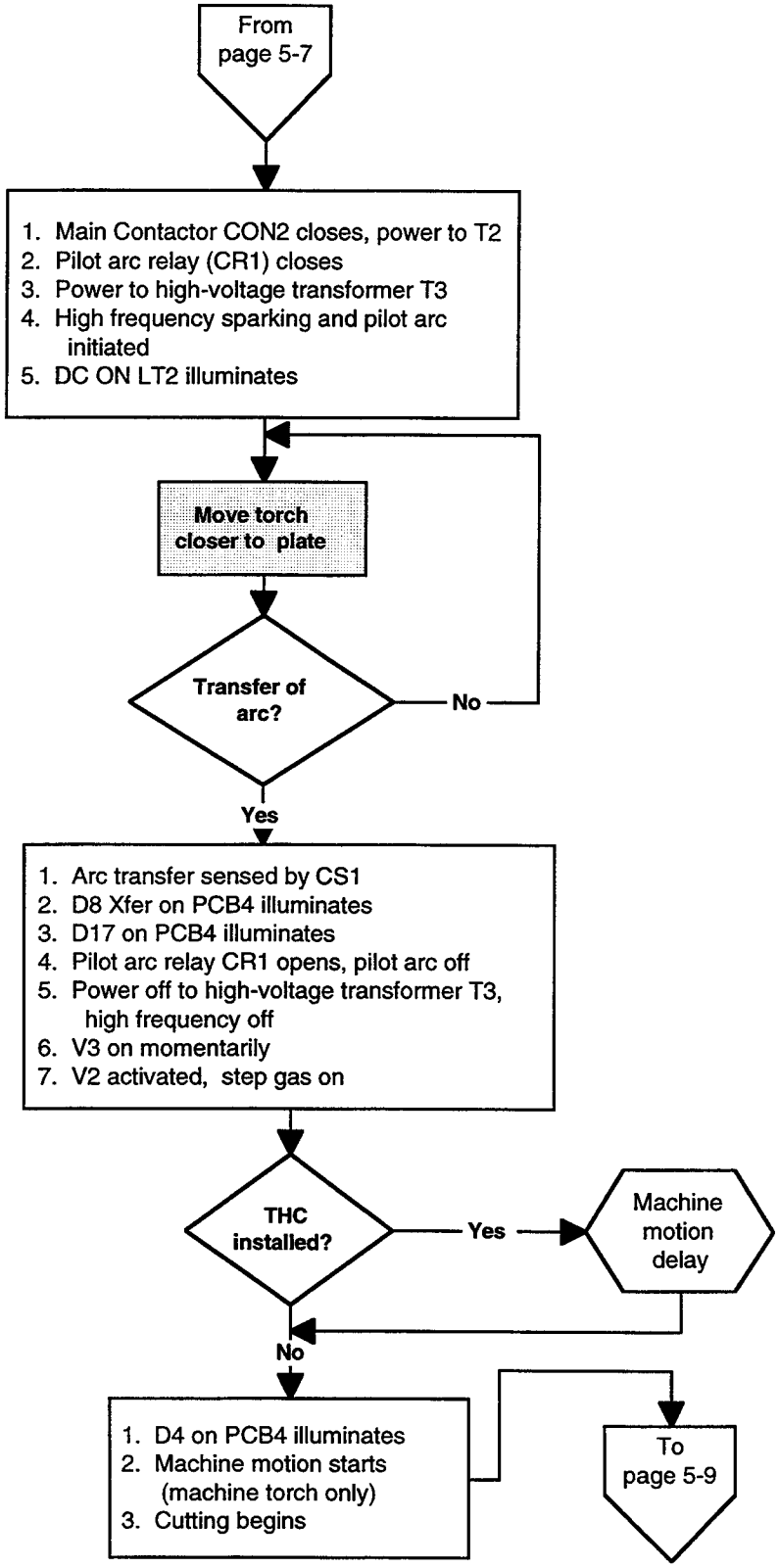


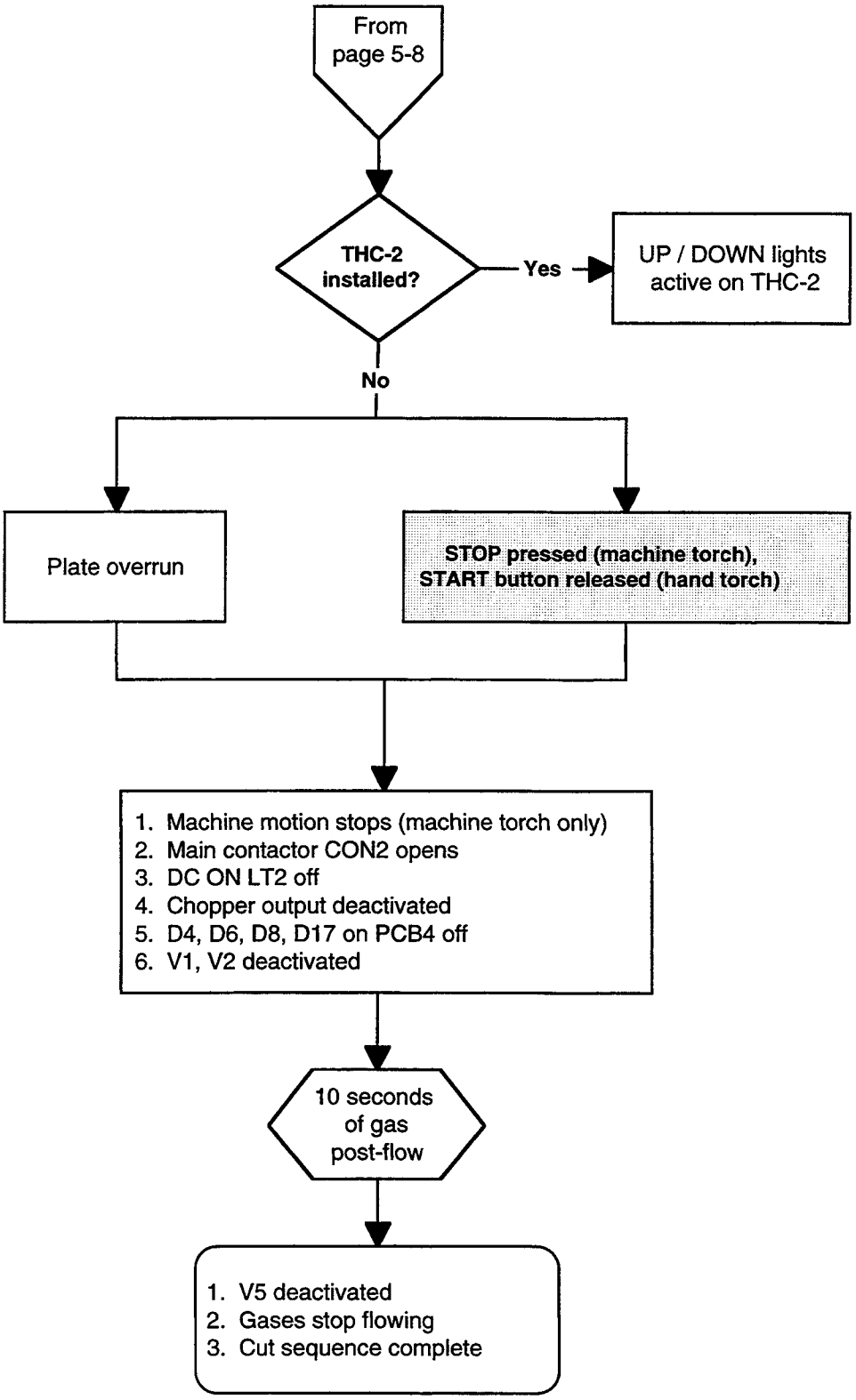
Off-page Connector The off-page connector is used to to indicate exit or entry from another page to the flowchart.


Push ON button (1PB)
1. 120V relay CR4 on PCB2 closes
2. Fans on
3. V6 activated
All interlocks satisfied?
No
1. 24VAC safety relay CON1 remains open
2. Control Panel lights not illuminated
3. LEDs on PCB2 and PCB4 not illuminated
Yes
1. 24VAC safety relay CON1 closes
2. D5, D6, D7 D8 on PCB2 illuminate
3. READY LT1 illuminates
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
5. DC ON LT2 illuminates
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
To 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. DC ON LT2 off
4. Chopper output deactivated
5. D4, D6, D8, D17 on PCB4 off
6. V1, V2 deactivated
10 seconds of gas post-flow
1. V5 deactivated
2. Gases stop flowing
3. Cut sequence complete

MAINTENANCE

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 **Section 6** - *Parts List* 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 at the input to CON1 between L1, L2 and L3. Refer to Figure 5-1. The voltage between any two of the three points at CON1 should be equal to the supply voltage (208, 220, 240, 380, 415, 480, or 600VAC). 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.

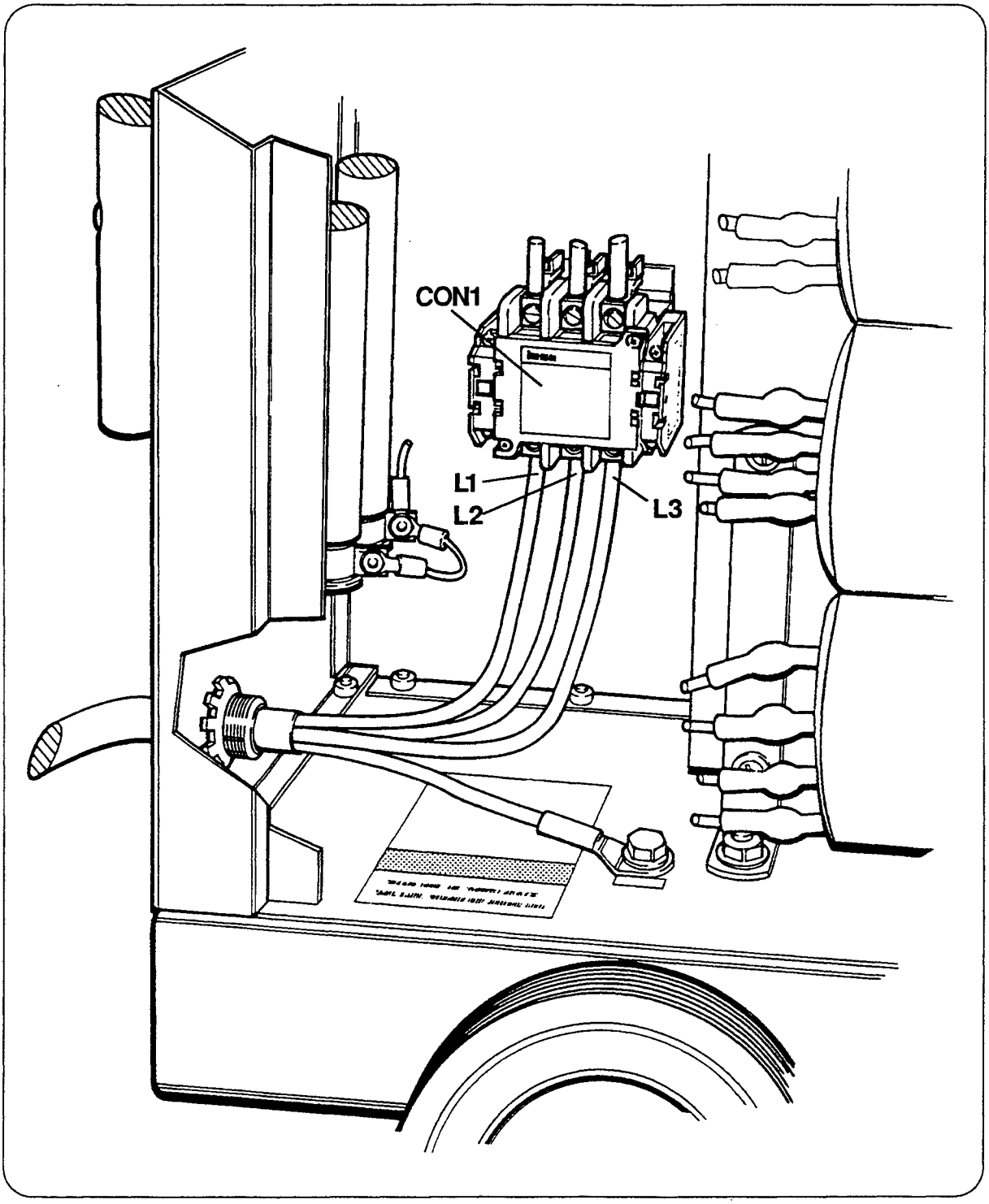


Figure 5-1 Primary Power Measurement Location - MAX100D

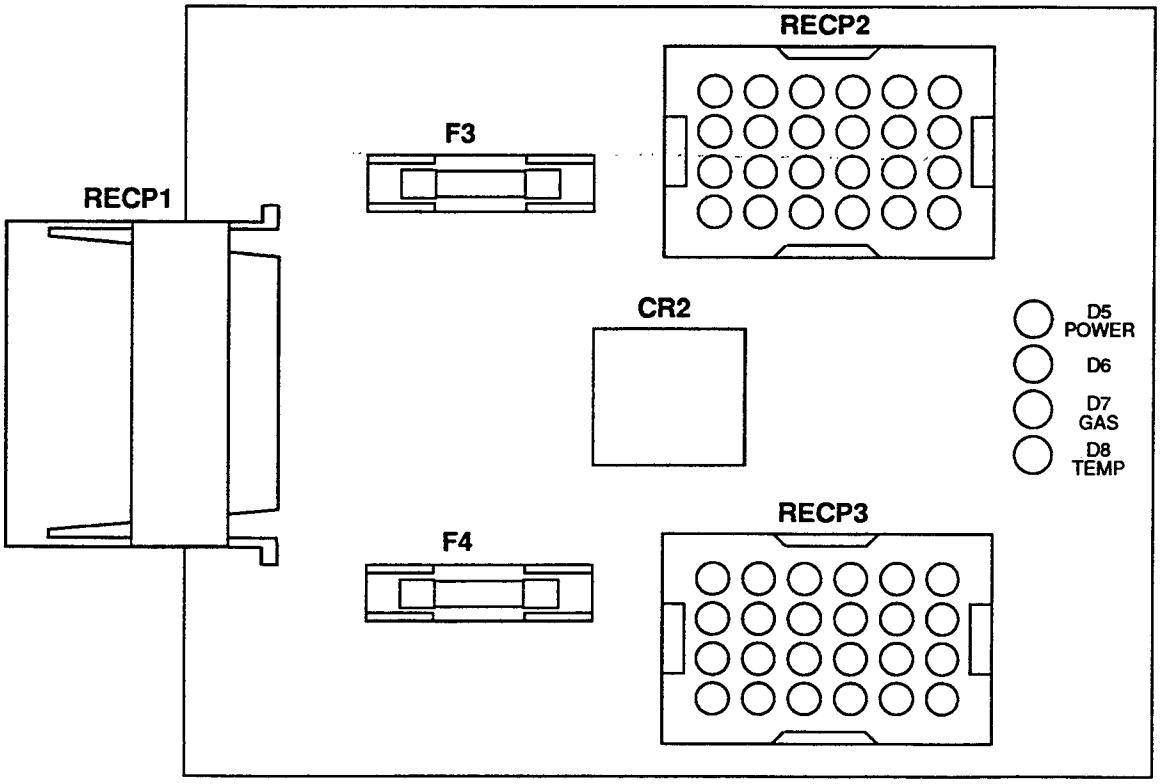


Figure 5-2 Power Distribution Board PCB2

6. Measure voltage at power distribution board PCB2. See Figure 6-4 for location of PCB2, and 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: 120 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 6-4 for location of T1.

   Also, check main power fuses F1 and F2 (located in Figure 6-4), 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 green ON indicator does not illuminate.	**1.1.** *The green ON(1) PB1 pushbutton is defective.* Check switch. The ON switch is normally open. **1.2.** *The red OFF(0) PB2 pushbutton is defective.* Check switch. The POWER OFF switch is normally closed. **1.3.** *Associated wiring not making good contact.* Check wiring and repair or replace, if necessary.
2. The ON indicator illuminates, but the fans are not operating.	**2.1.** *CR2 on the Power Distribution Board is defective.* Check that CR2 switches when ON pushbutton is pressed. See Figure 5-2 for location of CR2. If CR2 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.

Problem	Possible Causes and Solutions
	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.
3. The fans are operating, but the white READY indicator does not illuminate.	**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.
	3.2. *Safety relay CON1 is defective* Check that CON1 switches after ON pushbutton is pressed. If CON1 is defective, replace it.
	3.3. *Unit did not pass one or more of the safety "interlocks"* Remove the left cover to the power supply and observe the four LEDs on the power distribution board. Press and hold PB1 again to observe which LED is extinguished. The top most LED that is extinguished is the first problem that must be corrected. The following is a guide to troubleshooting the cause of extinguished LEDs:
D5 POWER extinguished:	**3.3.1.** *No jumper between pins 15 and 16 of PL3.* Check for continuity between pins 15 and 16. Repair and/or replace defective component(s), if necessary.
D6 extinguished:	**3.3.2.** *No jumper between pins 19 and 20 of PL3.* Check for continuity between pins 19 and 20. Repair and/or replace defective component(s), if necessary.
D7 GAS extinguished:	**3.3.3.1.** *Gas is not on, or is too low.* D7 will not illuminate if the pressure to the MAX100d is set too low. Be certain that the supply gases are on and set to a dynamic (flowing) minimum of **100 psi** (6.9 bar).
	3.3.3.2. *There is a gas leak somewhere in the MAX100D system.* Be certain that there is no hissing sound coming from the torch, or anywhere between the torch and the gas supplies.
	3.3.3.3. *One or more of the pressure switches is defective* 24VAC activates PS1, PS2 and PS5. 120VAC activates PS3 and PS4. Use wiring diagrams in **Section 7** to troubleshoot.

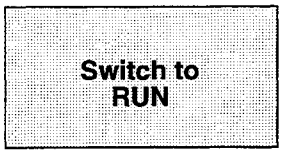
D8 TEMP extinguished	**3.3.4.** *Main transformer T2 is overheating.* This LED will illuminate when the main transformer (T2) is operating in a normal temperature range (under 165° C). Temperature switch TS1 will open and turn off LED when the transformer overheats. If transformer T2 is excessively hot, turn the MAX100D off for one hour to cool down. If transformer is not hot, take TS1 connector apart and check for continuity. TS1 is normally closed. Check pins, connectors and associated wiring from TS1 to RECP3 of PCB2.

Switch to TEST

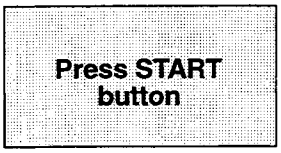
Problem	Possible Causes and Solutions
4. Gas flow is weak, or not flowing	**4.1.** *TEST/RUN switch not functioning* SW2 is open in the TEST position. Make a continuity check. **4.2.** *Plasma Gas or Shield Gas adjustment valves are closed* Open plasma gas valve on plasma gas console and shield gas valve 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 100 psi (6.9 bar) at 125 scfh (59 liters/minute) for plasma gas, and 100 psi (6.9 bar) at 440 scfh (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.

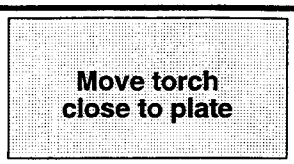


Problem	Possible Causes and Solutions
6. Gas continues to flow	**6.1.** *TEST/RUN switch not functioning* SW2 is closed in RUN position. Make a continuity check. **6.2.** *Solenoid valves V2 and V5 not getting 0VAC from Control Board PCB4.* Disconnect terminals to V2 and V5, and check for 0VAC from Control 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.



Problem	Possible Causes and Solutions
7. DC indicator is illuminated, but there is no high frequency and no pilot arc.	**7.1.** *There is no spark between the spark gap electrodes.* Clean (with emery cloth), align, and/or regap (.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. **DC indicator is illuminated, and 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.



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).

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 (**3.3**).

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 solution 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 from the 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 6-2 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

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. 6-3 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 MAX100D 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 contactors (CON1 and CON2), connections and associated wiring to the contactors. 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 on. If LED1 is not on, check if 120V is going to JP6. If there is no 120V at JP6, check wiring back to power distribution board. Repair or replace defective component(s), if necessary.

TEST PROCEDURES (Cont.)

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

8. If chopper still does not output 280V after completing step 7, there may be a problem with the control signal or the chopper module. The chopper drive signal comes 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.

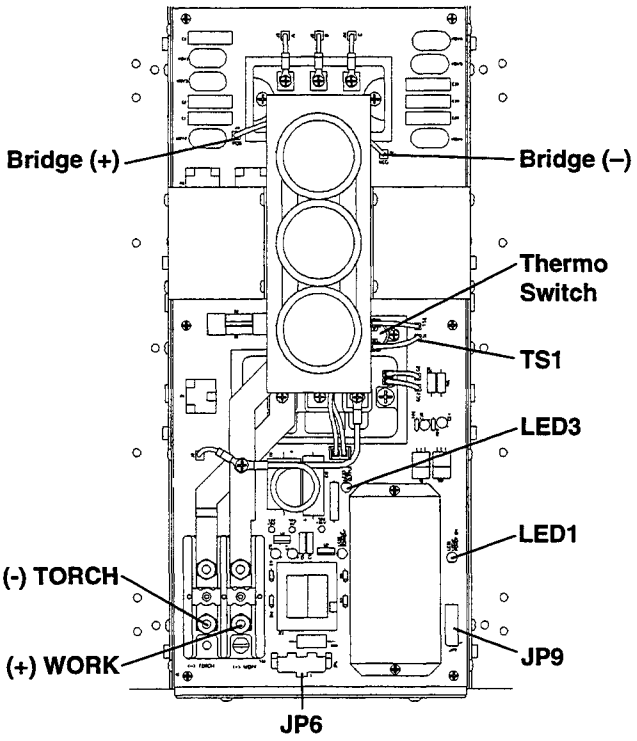


Figure 5-3 Chopper Module - Front View

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.

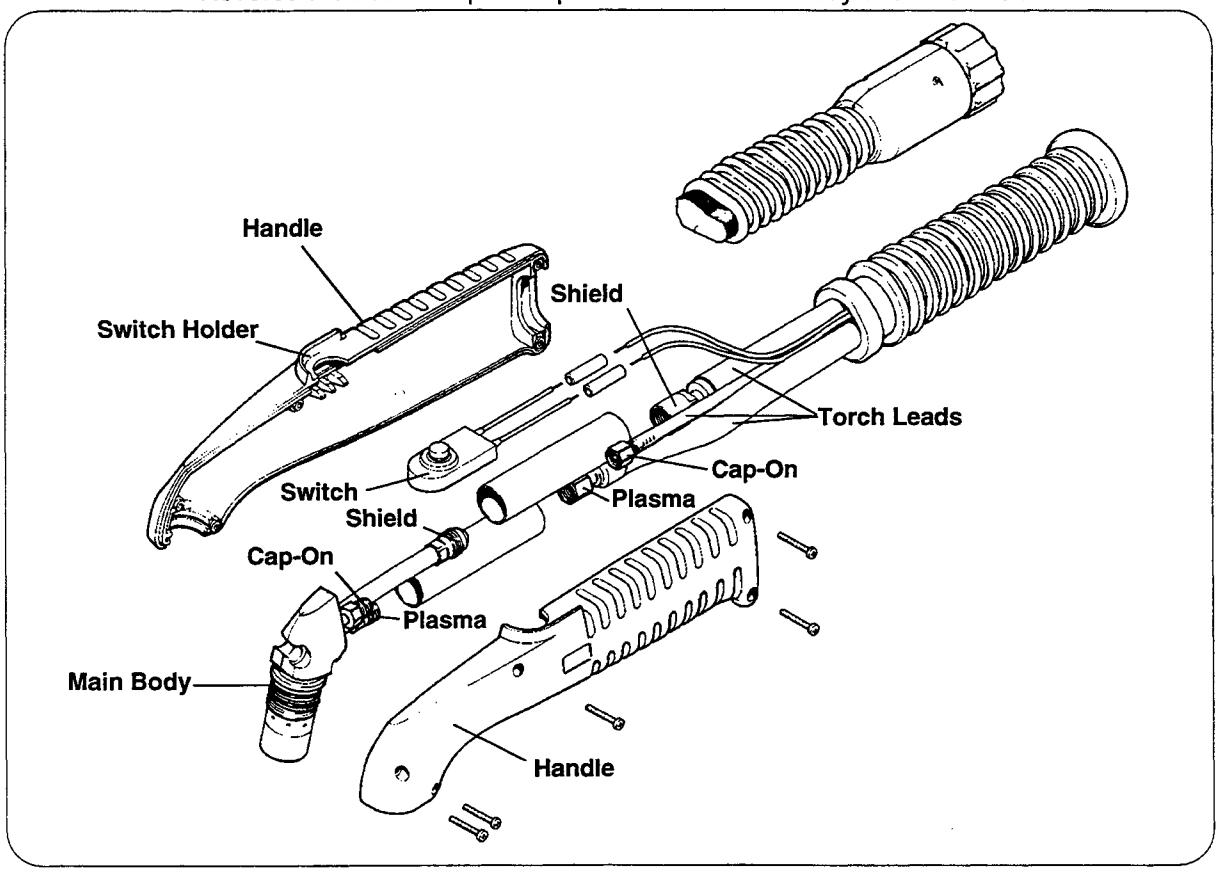


Figure 5-4 PAC160 or PAC160E Hand Torch Assembly

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.

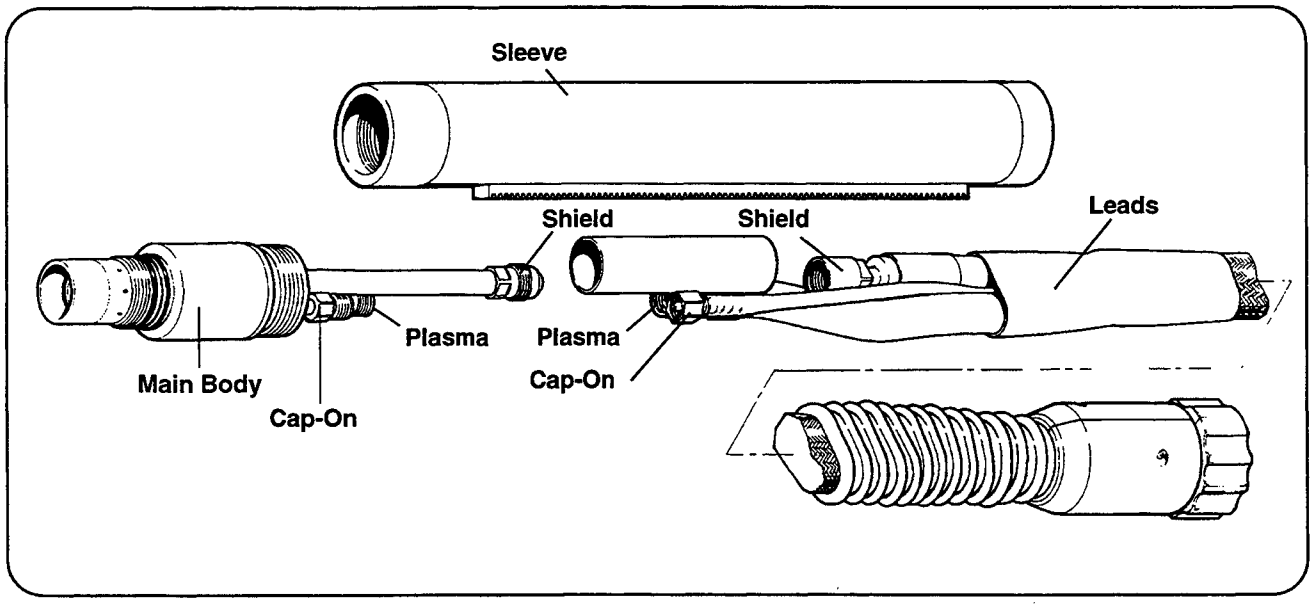


Figure 5-5 Machine Torch Assembly

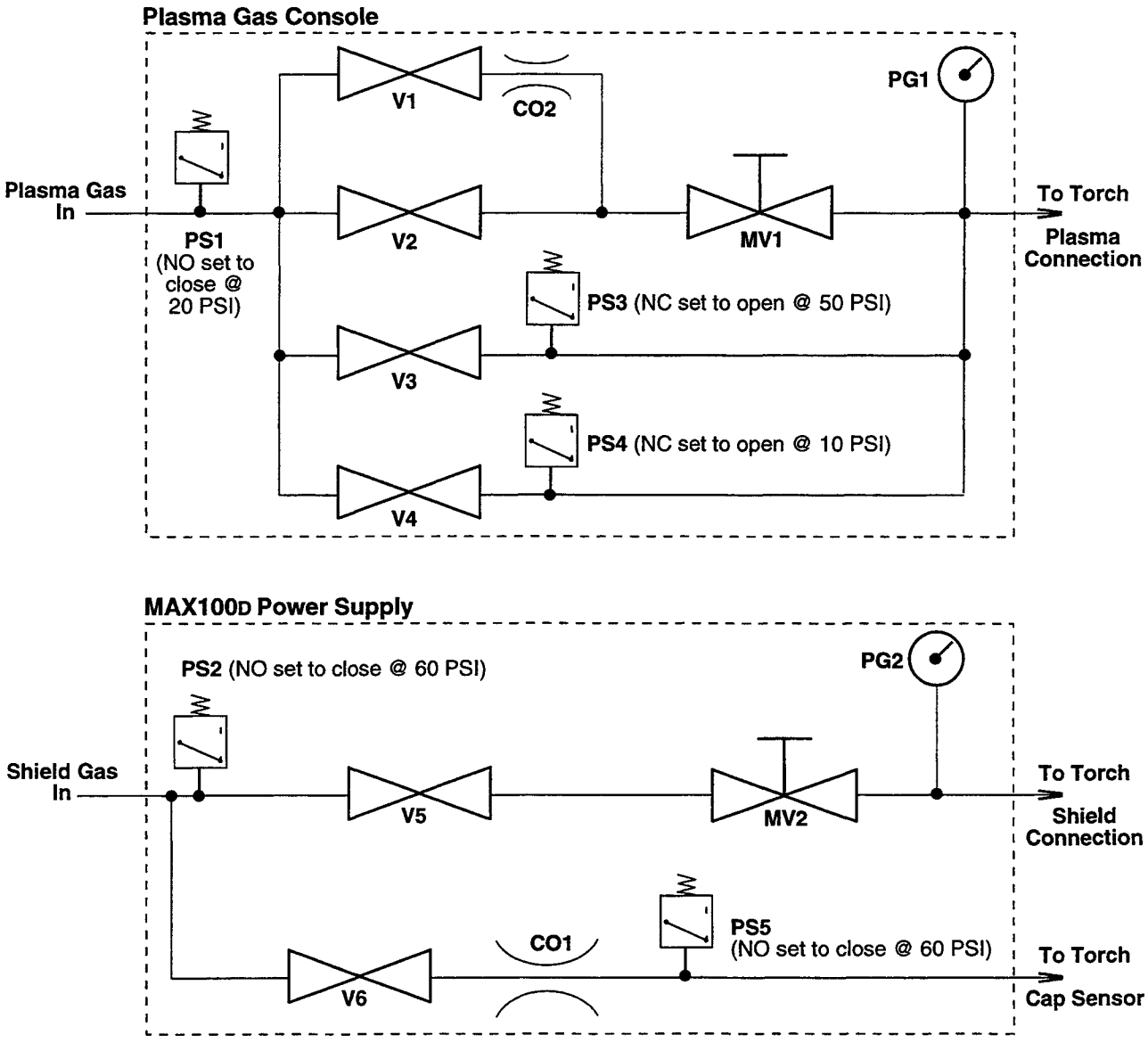


Figure 5-6 MAX100D System Plasma and Shield Gas Flow Schematic

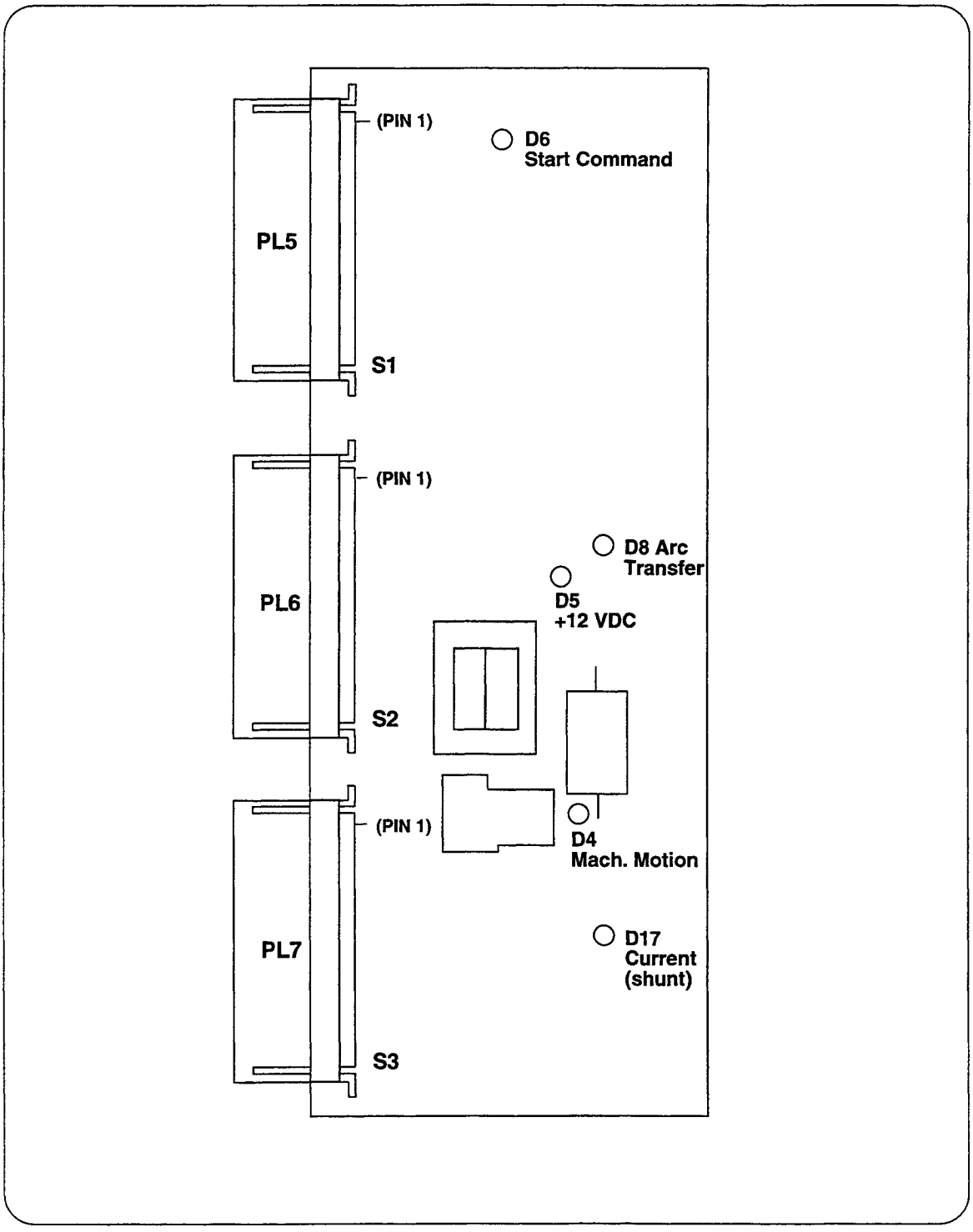


Figure 5-7 PCB4 Control Board

Section 6 PARTS LIST

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Hose Package for Dual Gas Mixer 6-25

PARTS LIST

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.
	029769	**Cont Pnl SA: MAX100D**		1
1	001411	Pnl: MAX100D Cont		1
	029192	**Harness SA MAX100 Rev1 230-460**		1
10	005092	PB Sw: Grn NO Full Gd	**PB1**	1
13	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. **029769**) signify parent or subassemblies that contain additional items.

Normal-style part numbers (Ex. 001411) 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 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)

Note: When referencing components to the wiring diagrams, designations may appear to be repeated. Ex: C1 appears in the wiring diagrams in three separate locations. Sections of the power supply are outlined with a dotted box and a label. Within different sections, the same designation may appear. Be certain to check the dotted box label when looking for or cross-referencing MAX100D parts.

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

MAX100D SYSTEMS


CUTTING


GOUGING

MACHINE TORCH SYSTEMS				
Voltage	Power Supply	with 25' Leads	with 50' Leads	with 75' Leads
208V,3Ø,60 Hz	**059122**	**059127**	**059128**	**059129**
240/480V,3Ø,60 Hz	**059118**	**059136**	**059137**	**059138**
220/380/415V,3Ø,50/60 Hz	**059120**	**059145***	**059146***	**059147***
600V,3Ø,60 Hz	**059121**	**059154**	**059155**	**059156**

* Machine torch comes with metric torch mounting sleeve (020245)


CUTTING

PAC160 HAND TORCH SYSTEMS				
Voltage	Power Supply	with 25' Leads	with 50' Leads	with 75' Leads
208V,3Ø,60 Hz	**059122**	**059130**	**059131**	**059132**
240/480V,3Ø,60 Hz	**059118**	**059139**	**059140**	**059141**
220/380/415V,3Ø,50/60 Hz	**059120**	**059148**	**059149**	**059150**
600V,3Ø,60 Hz	**059121**	**059157**	**059158**	**059159**


GOUGING

PAC160E GOUGING TORCH SYSTEMS				
Voltage	Power Supply	with 25' Leads	with 50' Leads	with 75' Leads
208V,3Ø,60 Hz	**059122**	**059133**	**059134**	**059135**
240/480V,3Ø,60 Hz	**059118**	**059142**	**059143**	**059144**
220/380/415V,3Ø,50/60 Hz	**059120**	**059151**	**059152**	**059153**
600V,3Ø,60 Hz	**059121**	**059160**	**059161**	**059162**

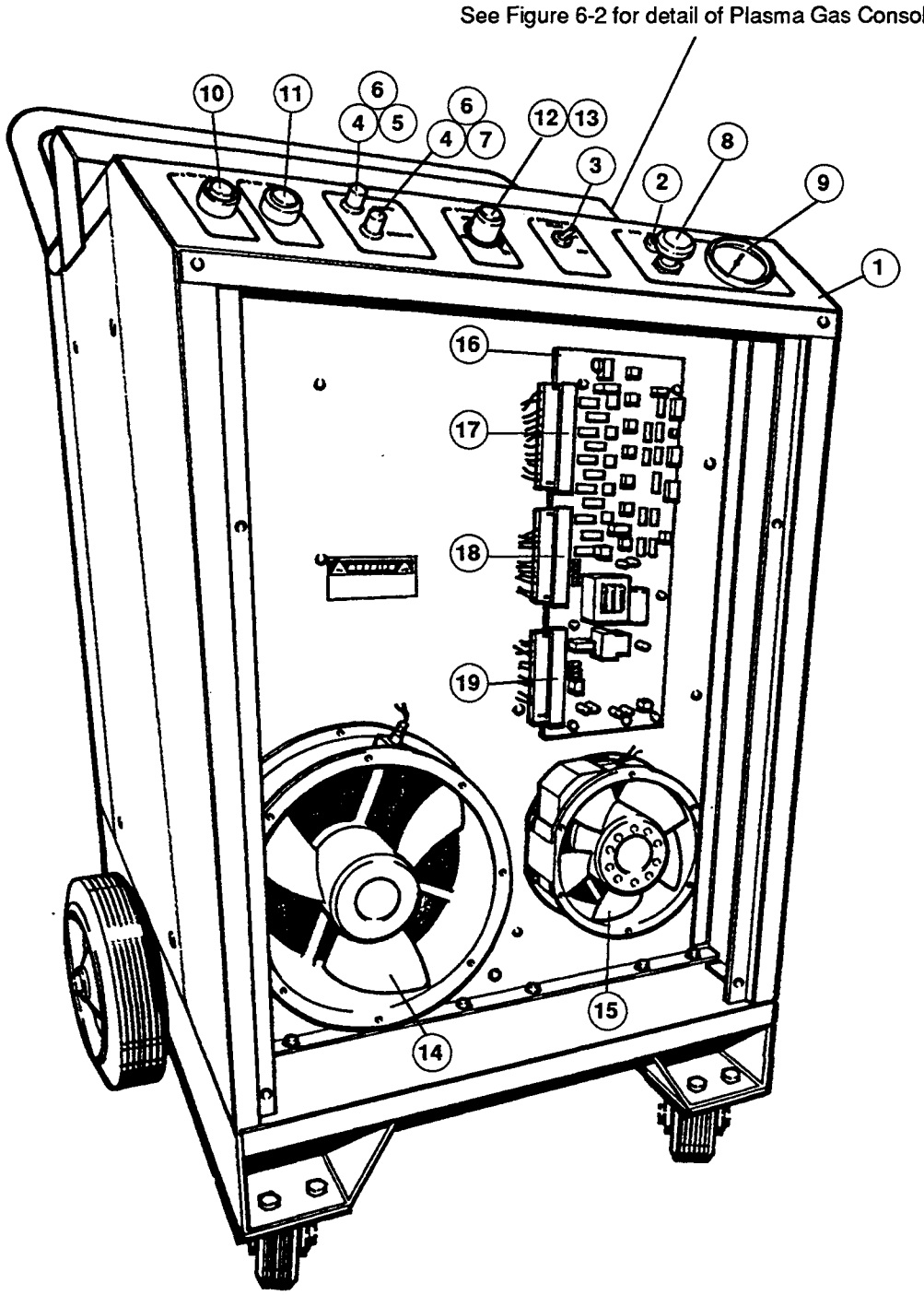


Figure 6-1 MAX100D: Front Panel and Control Panel

MAX100D: Front Panel and Control Panel

Item	Part Number	Description	Designator	Qty.
	029769	**Cont Pnl SA: MAX100D**		1
1	001411	Pnl: MAX100D Cont		1
2	005105	Tgl Sw: DP Maint ON/ON	**SW2**	1
3	005041	Tgl Sw: DP Maint ON/ON	**SW1**	1
4	005088	Lamp Hldr: Use T3-1/4 LTBULB		2
5	005089	Lens: Wht For 005088		1
6	005168	LTBULB: 28VDC 40ma T3-1/4	**LT1, LT2**	2
7	005091	Lens: Red for 005088		1
8	006002	Mtr Valve: 1/4 FPT .125 Orf	**MV2**	1
9	022008	Gauge, Press 2 1/2" Dia. 1-100	**PG2**	1
10	005121	PB Sw: Grn NO Full Gd	**PB1**	1
11	005122	PB Sw: Red NC	**PB2**	1
	029779	**Harness SA MAX 100D**		1
	029192*	**Harness SA MAX100 Rev1 230-460**		1
12	009483	Pot: 1K-Ohm 1W 10% 1T Cerm	**R6**	1
13	008328	Knob: .930 Dia 1/4 SFT Blk/Nat		1
14	027079	Fan 450-550 CFM 120VAC 50/60 Hz	**M1**	1
15	027080	Fan 225 CFM 120VAC 50/60 Hz	**M2**	1
16	**041313**	**PCB Assy: MAX100D Cont**	**PCB4**	1
17	008242	Pin HDR: 16-Posn Rtang PCB Mt	**S1**	1
18	008242	Pin HDR: 16-Posn Rtang PCB Mt	**S2**	1
19	008242	Pin HDR: 16-Posn Rtang PCB Mt	**S3**	1

* Used only on 240/480V pwr spply (#059118)

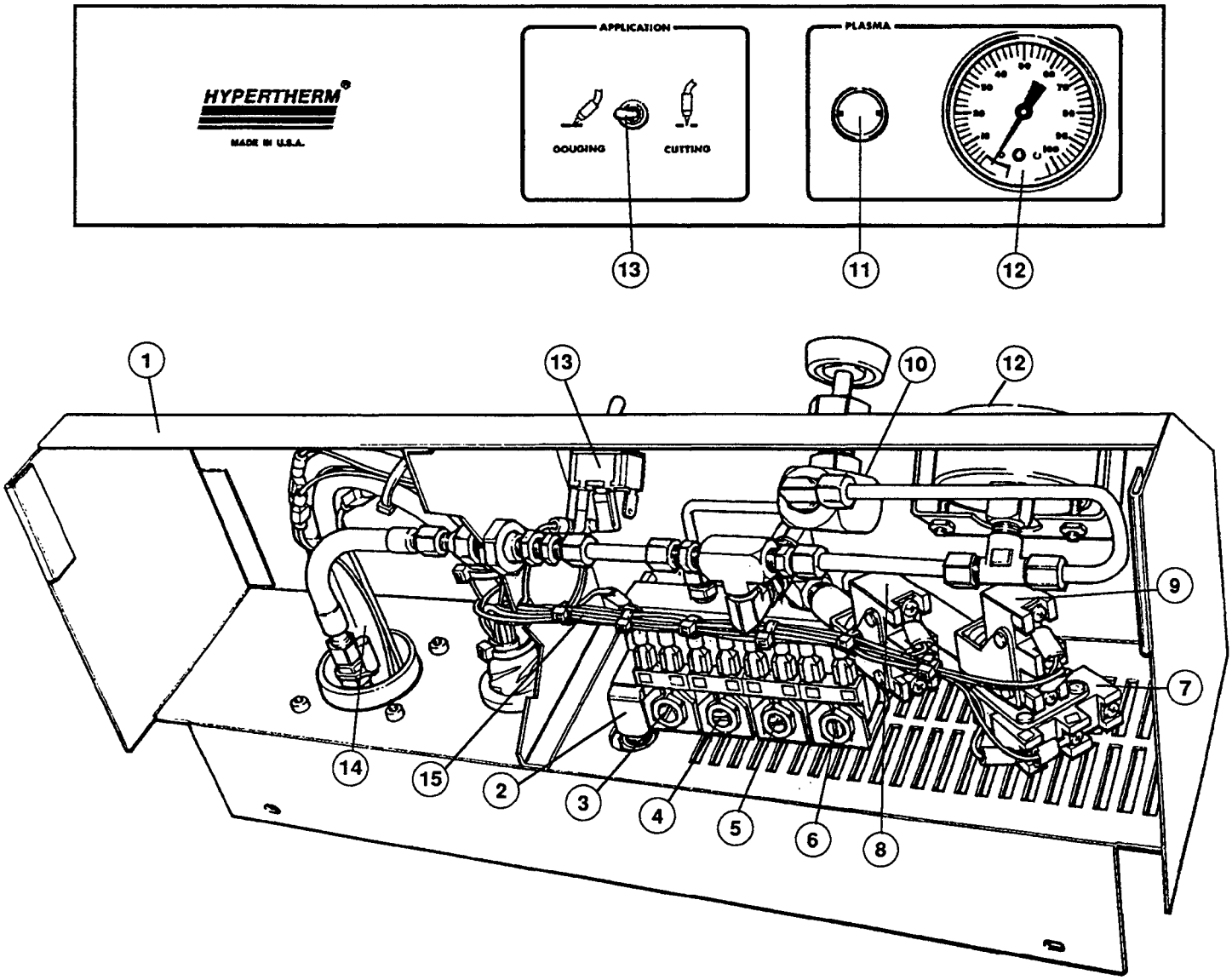


Figure 6-2 MAX100D: Plasma Gas Console

MAX100D: Plasma Gas Console

Item	Part Number	Description	Designator	Qty.
	029766	**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# Manifold Mount 120V NC	**V1**	1
4	006093	Sol Valve: 150# Manifold Mount 120V NC	**V2**	1
5	006093	Sol Valve: 150# Manifold Mount 120V NC	**V3**	1
6	006093	Sol Valve: 150# Manifold Mount 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
15	**023653**	**Harn: MAX100D Gas Csl**		1

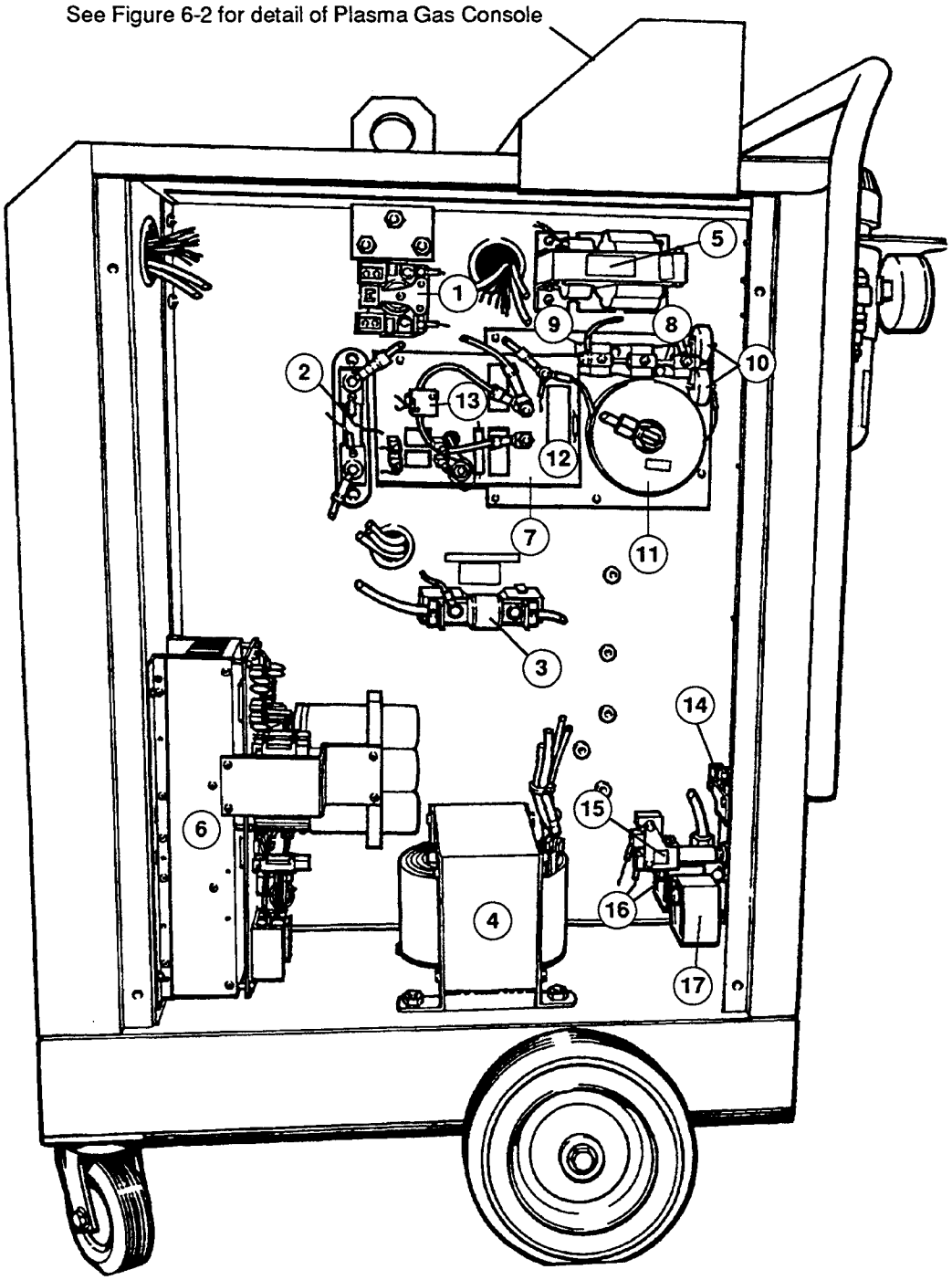


Figure 6-3 MAX100D: Right Side

MAX100D: Right Side

Item	Part Number	Description	Designator	Qty.
1	003021	Relay: 120VAC SPST	**CR1**	1
2	007022	Shunt: 100A 100 mv	**1MSH**	1
3	008317	Fuse: 125A 250V Semicond	**F5**	1
4	014043	Inductor, 4mh, 100ADC, MAX100	**L1**	1
5	014021	Transformer, 5000VAC, 20ma	**T3**	1
6	**029922**	**CH130 Chopper SA**	**CH1**	1
	029770	**MAX100D Subassemblies**		1
7	**029190**	**Hi Freq/IO Panel SA, MAX100**	**PCB3**	1
	009350	**Spark Gap Assy: 40-20**	**SG1**	1
8	004061	Electrd:Spk Gap 1/8 x 1.6		3
9	004140	Base:40/80/100/200/HD Spk Gap		1
10	009280	Cap: .022uF 15kV		2
11	**009371**	**Coil Assy:80-100A HF**	**T4**	1
12	**041120**	**PC BD Assy I/O MAX100**	**PCB6**	1
13	**029202**	**Current Sensor SA, MAX100**	**CS1**	1
	029771	**Gas Sply SA: MAX100D**		1
14	005093	Press Sw: 0-90 PSI 1/8 NPT	**PS2**	1
15	005093	Press Sw: 0-90 PSI 1/8 NPT	**PS5**	1
16	006014	Sol Valve: 90# 1/4 FPT 120V NC	**V5**	1
17	006014	Sol Valve: 90# 1/4 FPT 120V NC	**V6**	1

See Figure 6-2 for detail of Plasma Gas Console

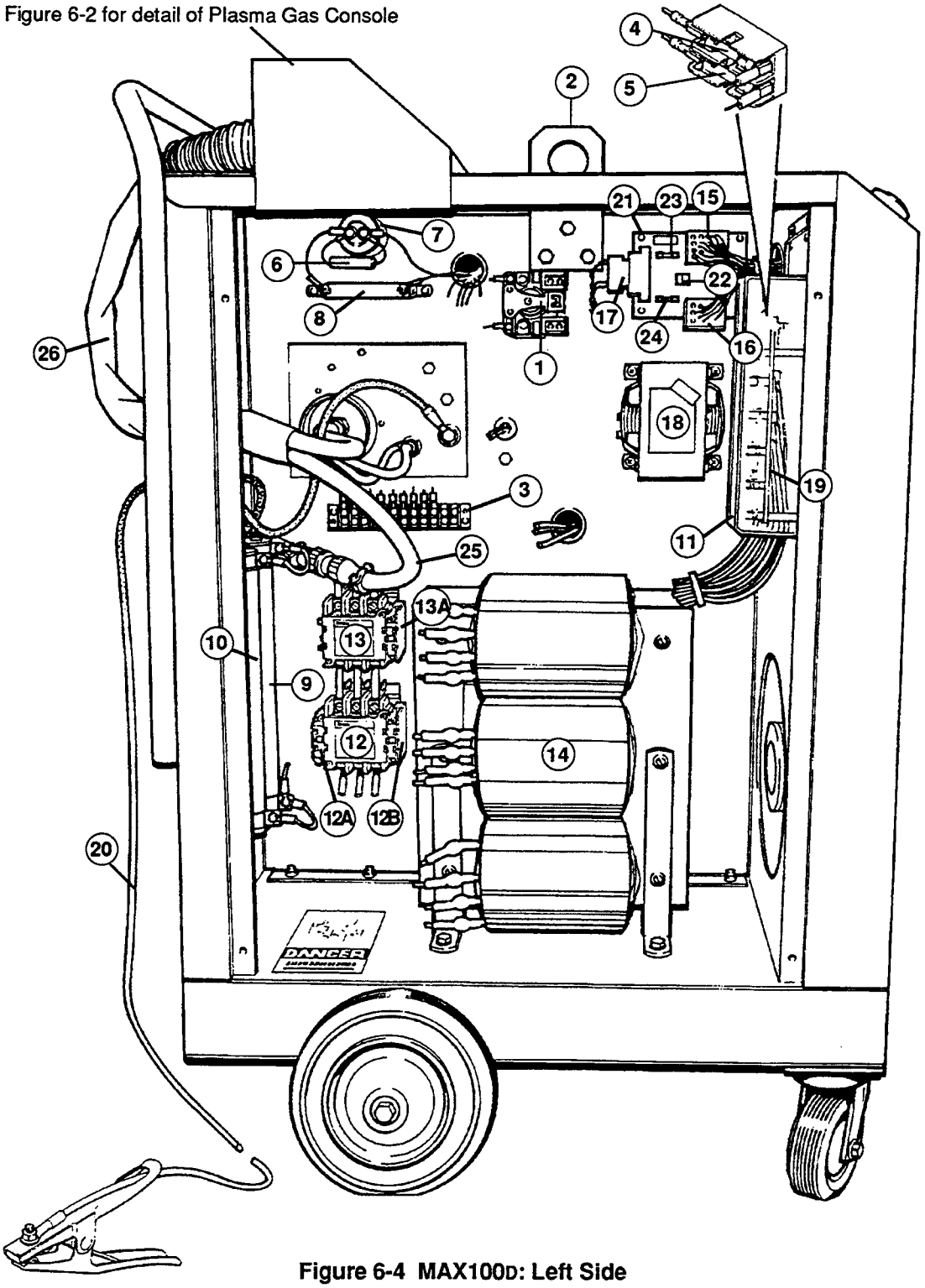


Figure 6-4 MAX100D: Left Side

MAX100D: Left Side

Item	Part Number	Description	Designator	Qty.
1	003021	Relay: 120VAC SPST NO	CR3	1
2	004261	Lifting Eye: 80/100 Pwr Unit		1
3	008079	Term Bd: 12-Term	TB1	1
4	008239	Fuse: 2A 500V 13/32 x 1-1/2 Slo	F1	1
5	008239	Fuse: 2A 500V 13/32 x 1-1/2 Slo	F2	1
6	009015	Res: 10K ohm 10W 5% VIT	R4	1
7	009296	Cap: 100uF 350WV +50-10%	C8	1
8	009622	Res: 10 ohm, 50W 5% W/L Brk	R3	1
9	009625	Res: 2.0 ohm, 395W	R1	1
10	009625	Res: 2.0 ohm, 395W	R2	1
11	002153	Shld: MAX100 Lnkboard		1
12	003153†	Contactor, MAX100 60A 3P, 24VAC	CON1	1
12A	003154	Cont: MAX100 NO Aux	1AUX	1
12B	003154	Cont: MAX100 NO Aux	2AUX	1
13	003153†	Contactor, MAX100 60A 3P, 24VAC	CON2	1
13A	003154	Cont: MAX100 NO Aux		1
14	014068*	Transformer 15kW 240-480/3/60	T2	1
14	014066**	Transformer 15kW 208/3/60	T2	1
14	014065***	Transformer 15kW 220, 380-415/50	T2	1
14	014067****	Transformer 15kW 600/3/60	T2	1
14	014069*****	Transformer 15kW 200/3/50	T2	1
	029779	**Harness SA MAX100D**		1
15	008323	Rcpt Hsg: 24-Posn Metri Freehng	PL2	1
16	008323	Rcpt Hsg: 24-Posn Metri Freehng	PL3	1
	029192*	**Harness SA MAX100 Rev1 230-460**		1
15	008323	Rcpt Hsg: 24-Posn Metri Freehng	PL2	1
16	008323	Rcpt Hsg: 24-Posn Metri Freehng	PL3	1
	029214*	**Xfmr SA, MAX100 240/480V**		1
17	008235	Plug Hsg: 6-Posn INLN Freehng	PL1	1
18	014023*	Transformer, Control, 230-460	T1	1
	029511**	**Xfmr SA, MAX100 208V**		1
17	008235	Plug Hsg: 6-Posn INLN Freehng	PL1	1
18	014023**	Transformer, Control, 600/60	T1	1
	029218***	**Xfmr SA, MAX100 380-415V**		1
17	008235	Plug Hsg: 6-Posn INLN Freehng	PL1	1
18	014028***	Transformer, Control, 220-380-415/50	T1	1
	029217****	**Xfmr SA, MAX100 600V**		1
17	008235	Plug Hsg: 6-Posn INLN Freehng	PL1	1
18	014039*****	Transformer, Control, 600/60	T1	1
	029958*****	**Xfmr SA, MAX100/100D 200V**		1
17	008235	Plug Hsg: 6-Posn INLN Freehng	PL1	1
18	014049*******	Transformer, Control, 200	T1	1
	029215*	**Linkboard SA, MAX100 240/480**		1
19	004244*	Linkboard:100/200/1070 240/480V		1
20	023209	Cable, Ground #4 W/Clamp 25'		1
21	**041116**	**PC Bd Assy Power Dist. MAX100**	PCB2	1
22	003067	Rly: GP PCB Mtg Scaled	CR2	1
23	008259	Fuse: 3A 250V 1/4 x 1-1/4 Slo	F3	1
24	008322	Fuse: 8A 250V 1/4 x 1-1/4 Slo	F4	1
25	**029761**	**Harness:Max100D Gas Csl**		1
26	**028559**	**Rcpt Assy:MAX100D Qdisc**		1

* Used only on 240/480V pwr spply (#059118) **Used only on 208V pwr spply (#059122)
*** Used only on 220/380/415V pwr spply (#059120) ****Used only on 600V pwr spply (#059121)
*****Used only on 200V pwr spply (#059175)
† For MAX100D serial #s before 71-000212, order **003157** to replace 60A contactor. **003157** contains one 003153 contactor and two 003154 aux. contactors. The old 003054 aux. contactors will not mount on the new 003153 contactors.

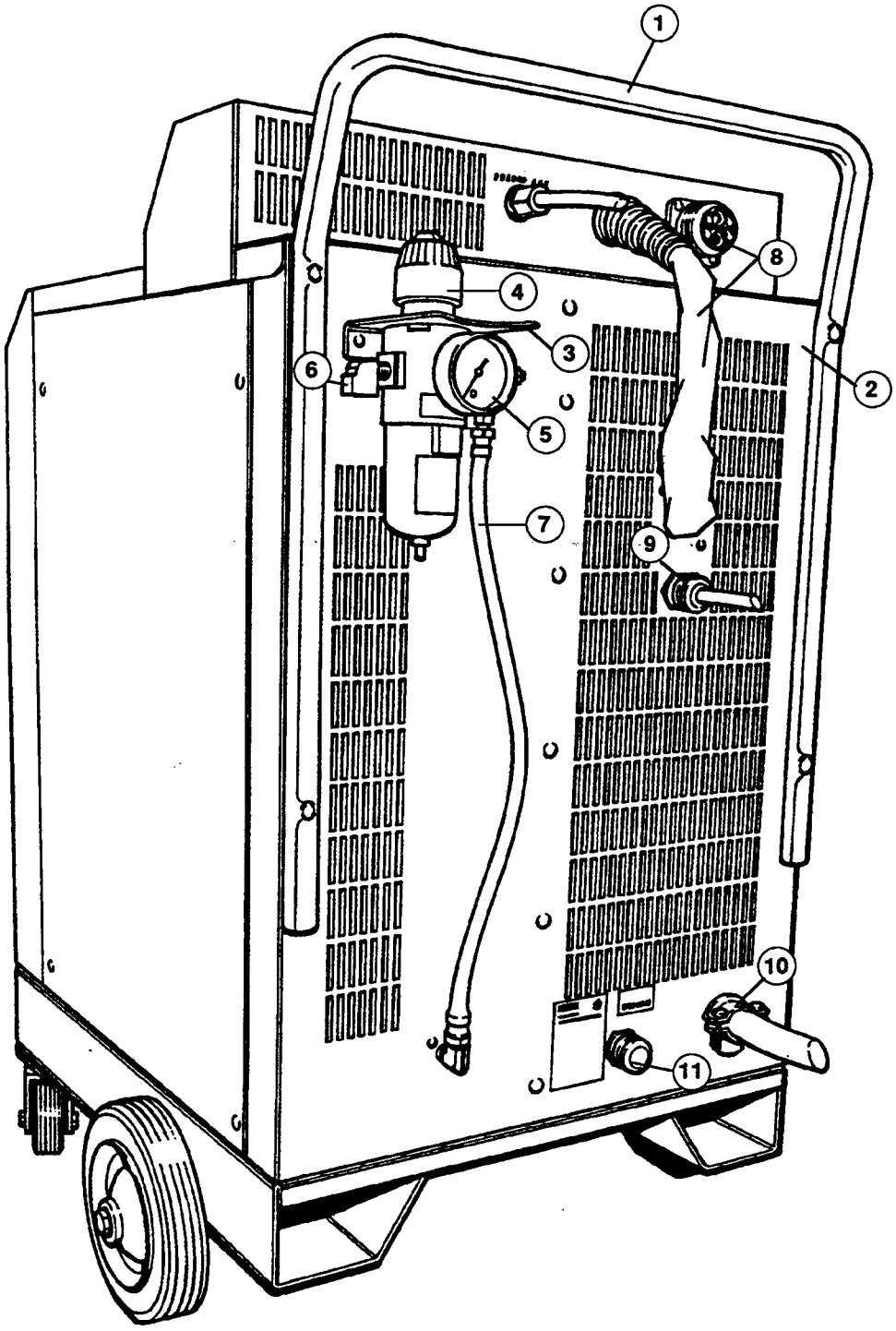


Figure 6-5 MAX100D: Rear Panel

MAX100D : Rear Panel

Item	Part Number	Description	Designator	Qty.
1	001182	Handle: MAX80/MAX100		1
2	001306	Panel: MAX80/MAX100		1
	029772	**Air Regulator SA: MAX100D**		1
3	004264	Bracket: 80/100/200 Air Regulator		1
4	011025	Filter Regulator		1
5	011027	Gauge, High Pressure for 011025		1
6	015532	Street Elbow, 1/4		1
7	**024162**	**Hose Assy, #6 X 19-1/2" Air Regulator**		1
8	**028559**	**Rcpt Assy:MAX100D Qdisc**		1
9	008415	Strainrlf: 3/4 NPT x .310-.560		1
10	008318	Cord Grip: 1-1/4NPT .850-1.320 2SC		1
11	008070	Strainrlf: 1/2 NPT x .312-.375		1

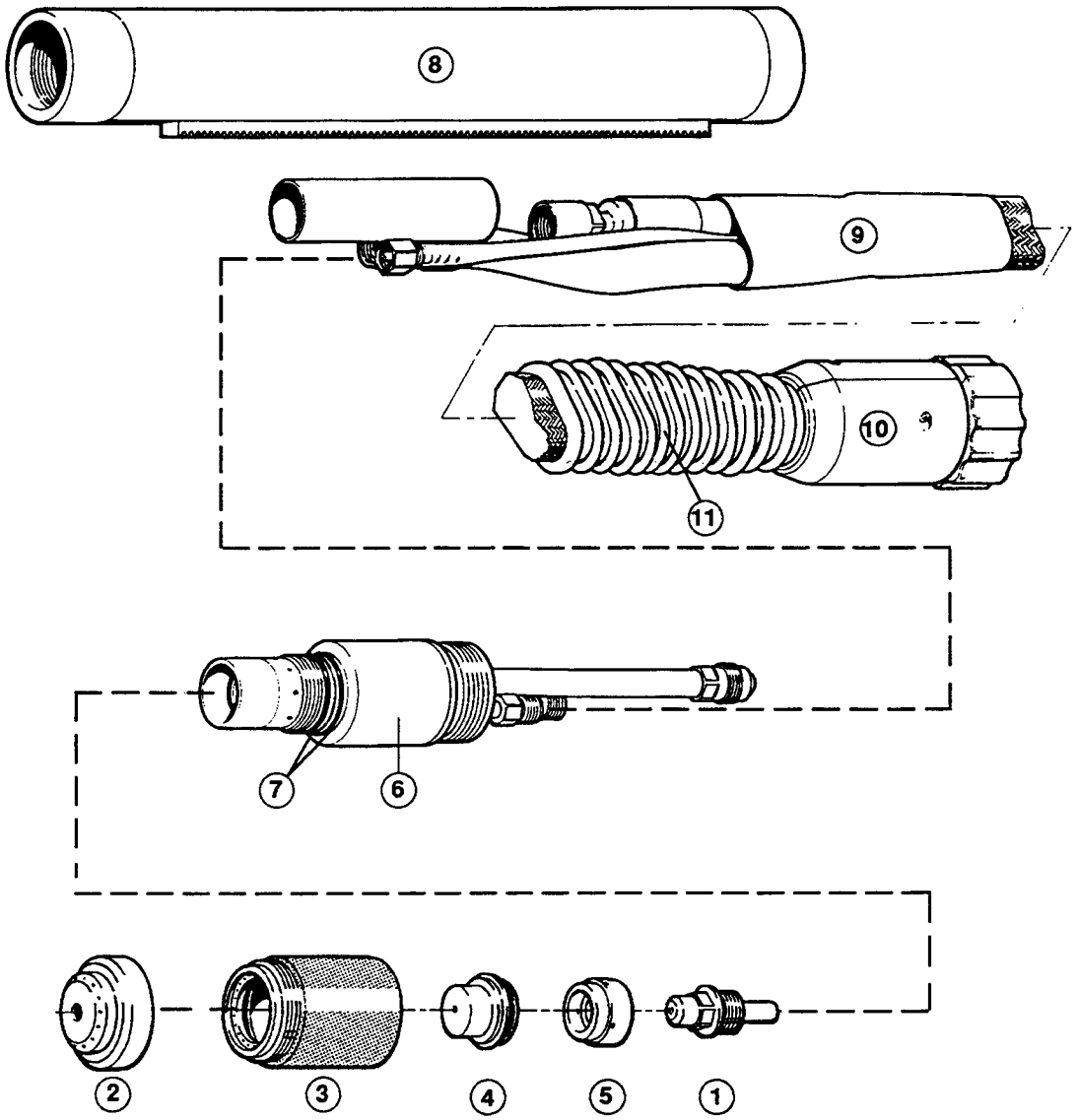


Figure 6-6 Machine Torch Assembly

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	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

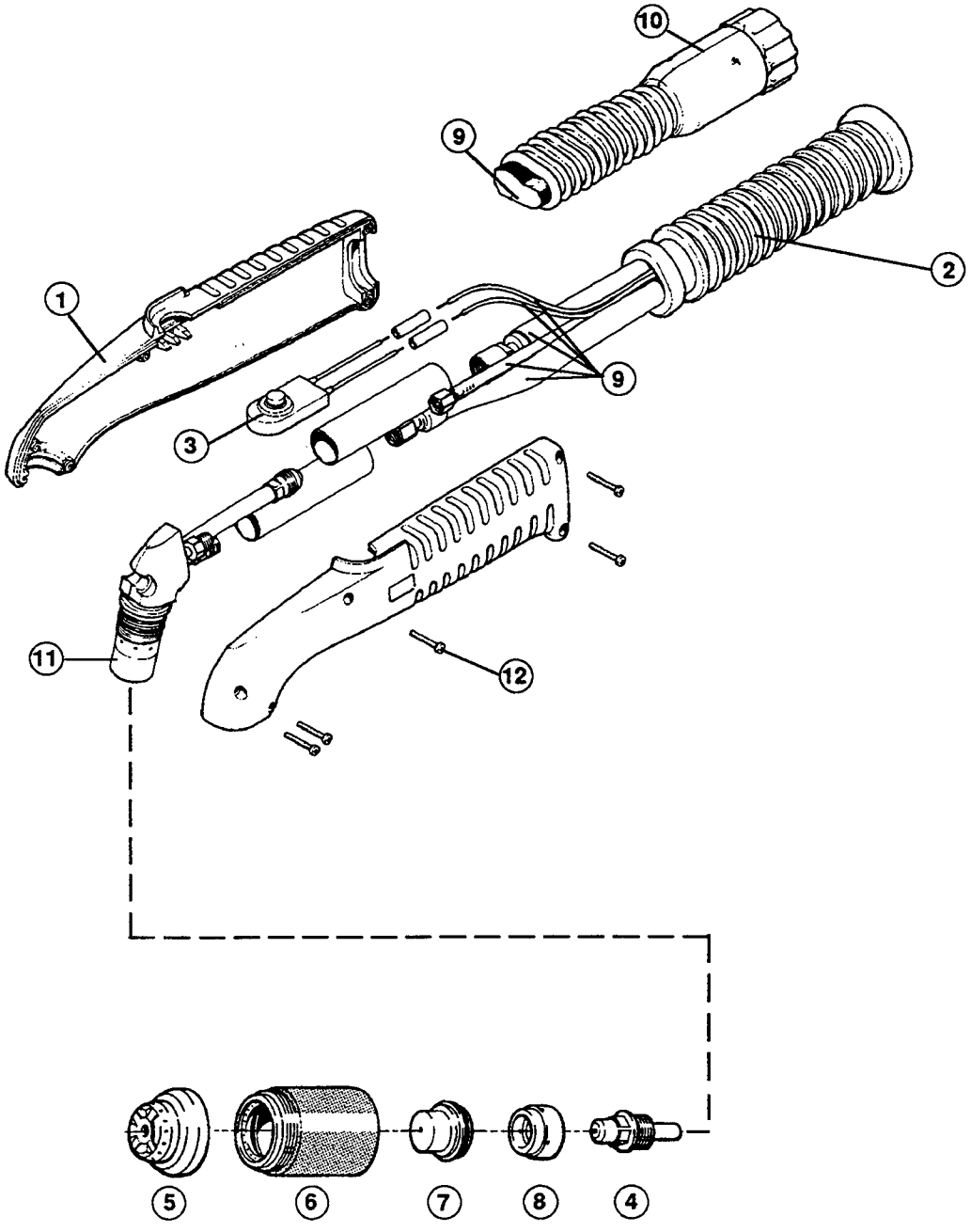


Figure 6-7 PAC160 Hand Torch Assembly

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

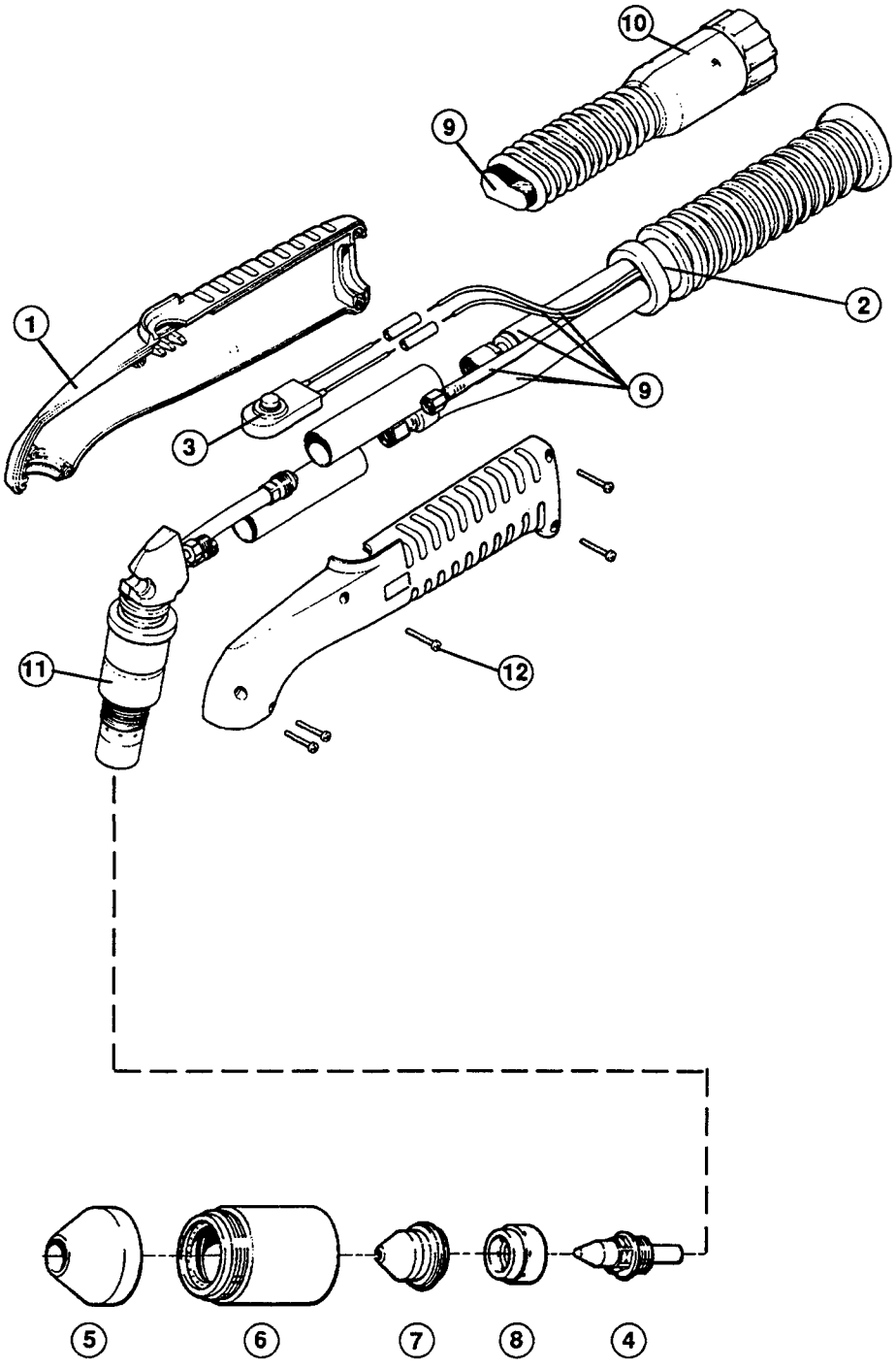


Figure 6-8 PAC 160E Gouging Torch Assembly

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

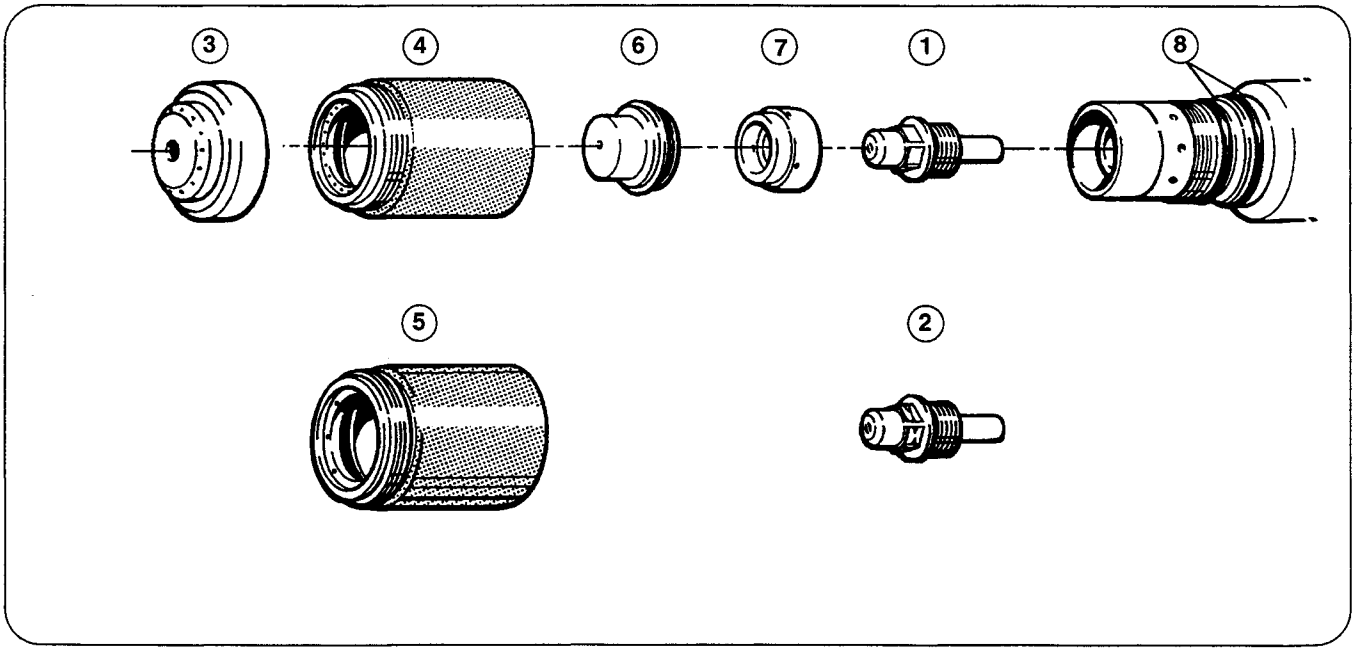


Figure 6-9 Machine Torch Consumable Parts

PARTS LIST

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

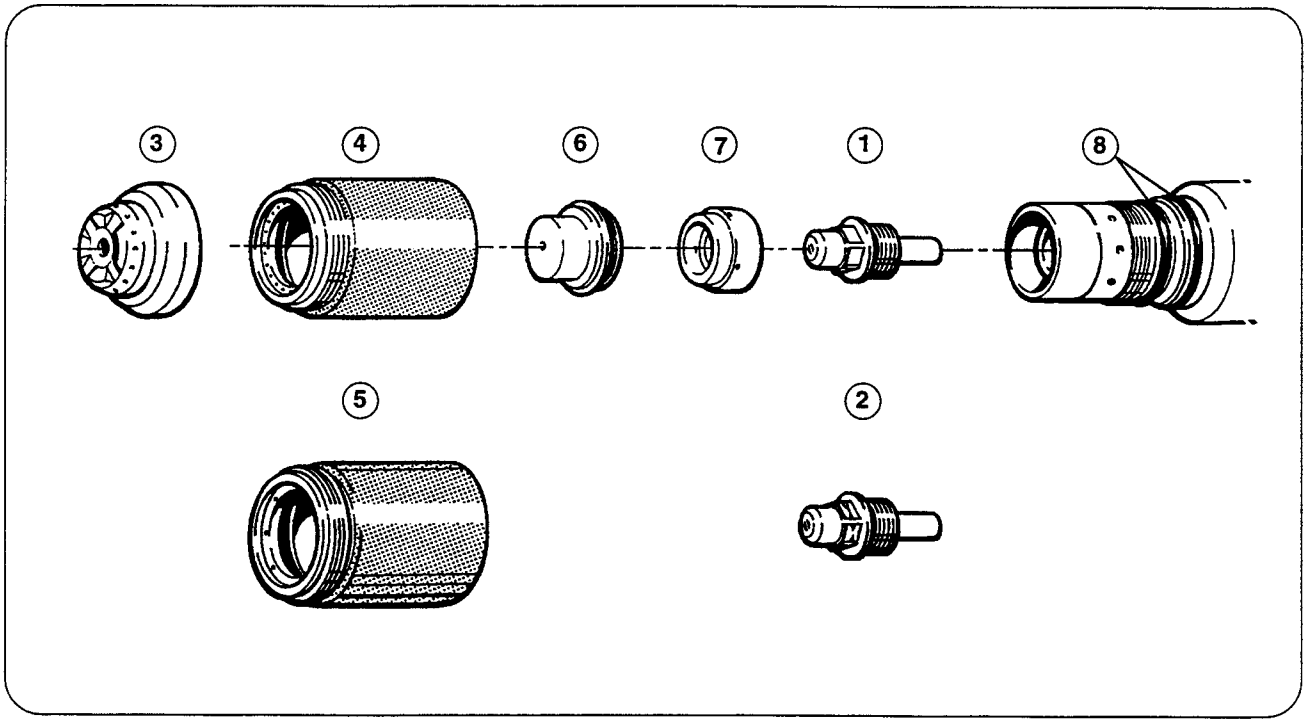


Figure 6-10 PAC160 Hand Torch Consumable Parts

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

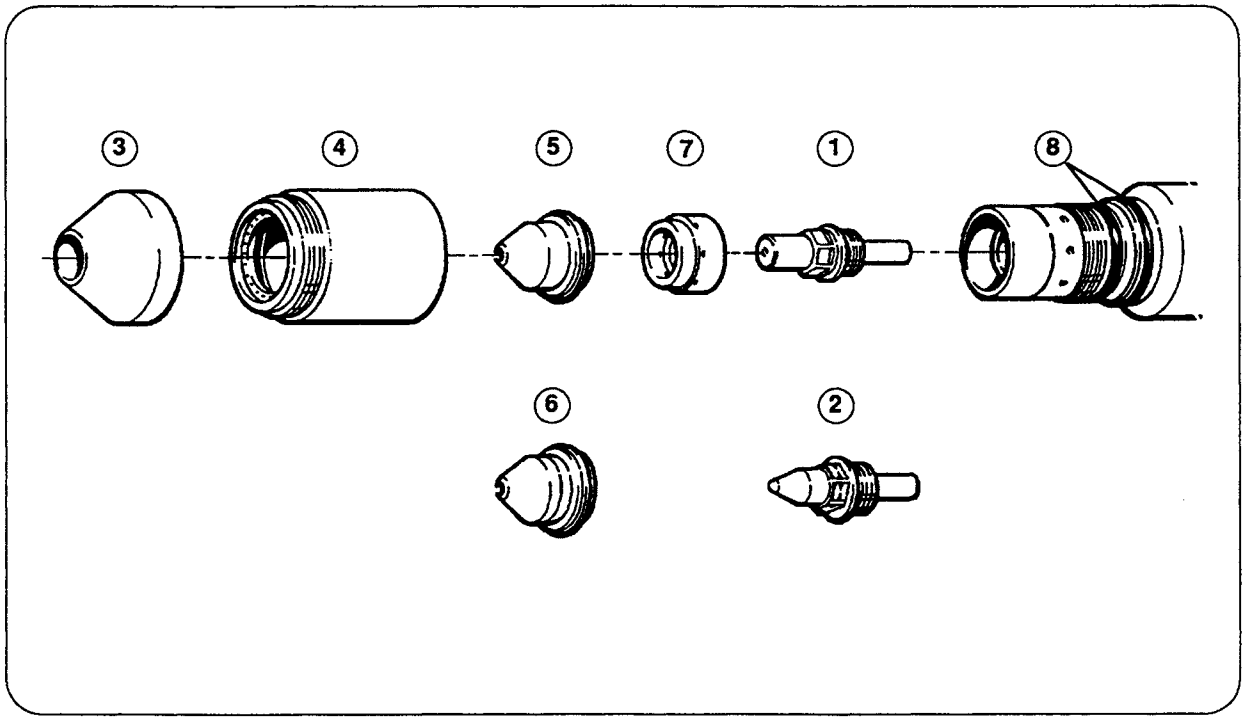


Figure 6-11 PAC160E Gouging Torch Consumable Parts

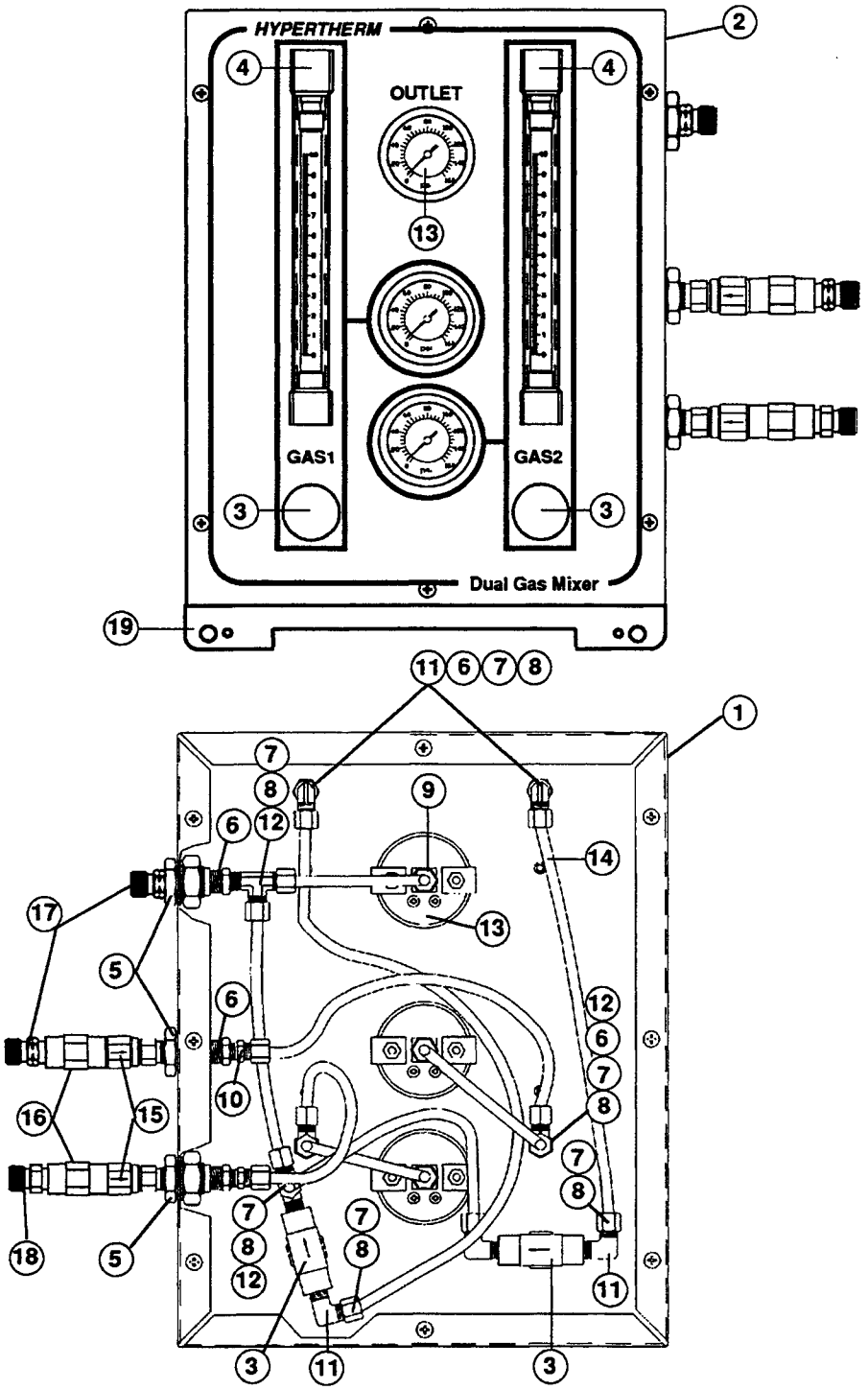


Figure 6-12 Dual Gas Mixer

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

PARTS LIST

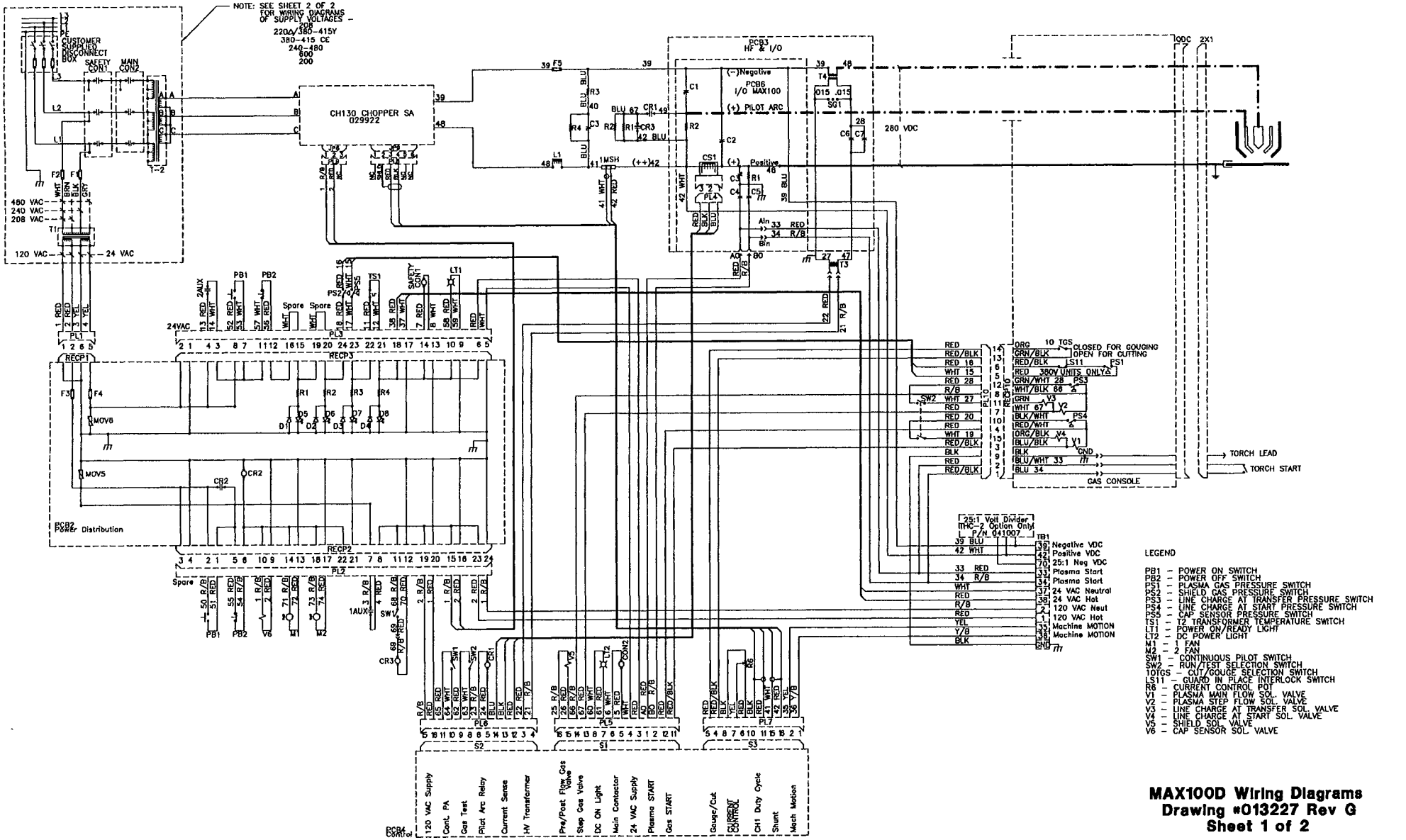
RECOMMENDED SPARE PARTS

Part Number	Description	Designator	Page Number Showing Item
022008	Gauge, 0-100 psig	PG1,2	6-4,-6
011025	Filter Regulator: 0-120 psi 1/4NPT Air		6-12
011031	Replacement filter		
005168	LTBULB:28VDC 40ma T3-1/4	LT1,LT2	6-4
005092	PB Sw: Grn NO Full Gd	PB1	6-4
005095	PB Sw: Red NC	PB2	6-4
005093	Press Sw: 0-90 psi 1/8 NPT	PS1,3,4,2	6-6,-8
003021	Relay: 120VAC SPST NO	CR1	6-8
003066	Contactor, MAX100 60A	CON1,CON2	6-10
003054	Sw:MAX40/100/HT40C Aux Contactor	1AUX,2AUX	6-10
008239	Fuse: 2A 500V 13/32 x 1-1/2 Slo	F1,F2	6-10
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
041114	PC BD Assy Ctrl MAX100	PCB4	6-4
029922	CH130 Chopper Module	PCB5	6-8
041116	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
029730	Leads: PAC160/160E Torch QDisc 25'		6-16,-18
028555	Leads: MAX100D Machine Torch QDisc 25'		6-14

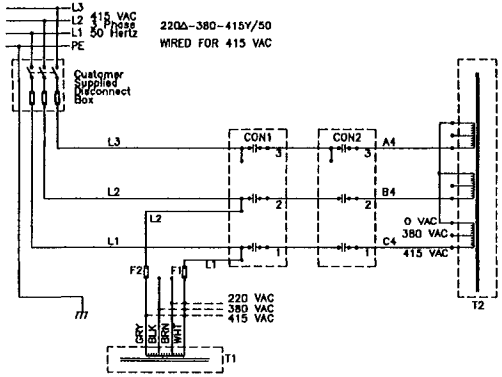
Section 7 WIRING DIAGRAMS

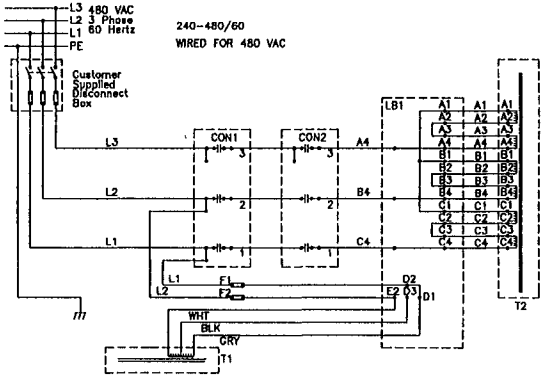
In this section:

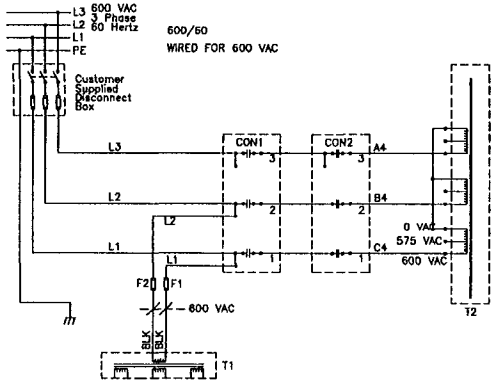
MAX100D Wiring Diagrams 7-2

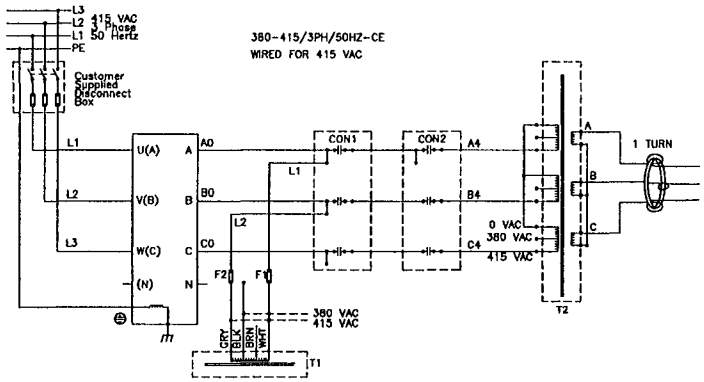


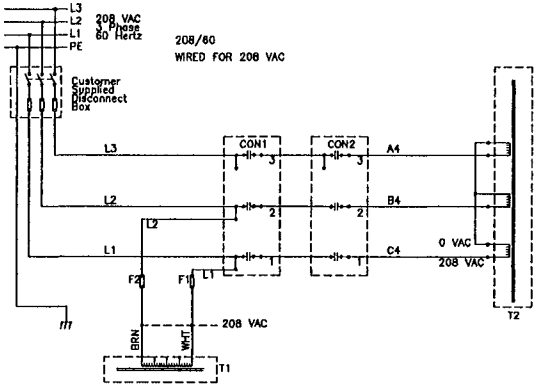
MAX100D Wiring Diagrams
Drawing #013227 Rev G
Sheet 1 of 2

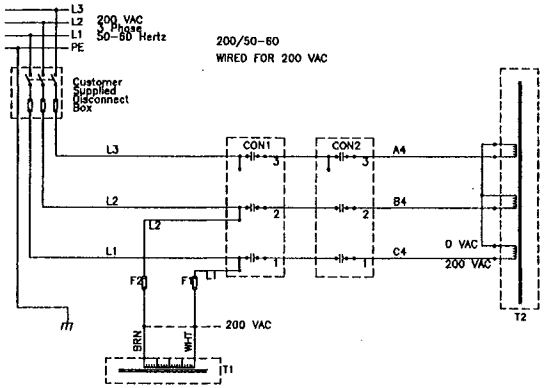




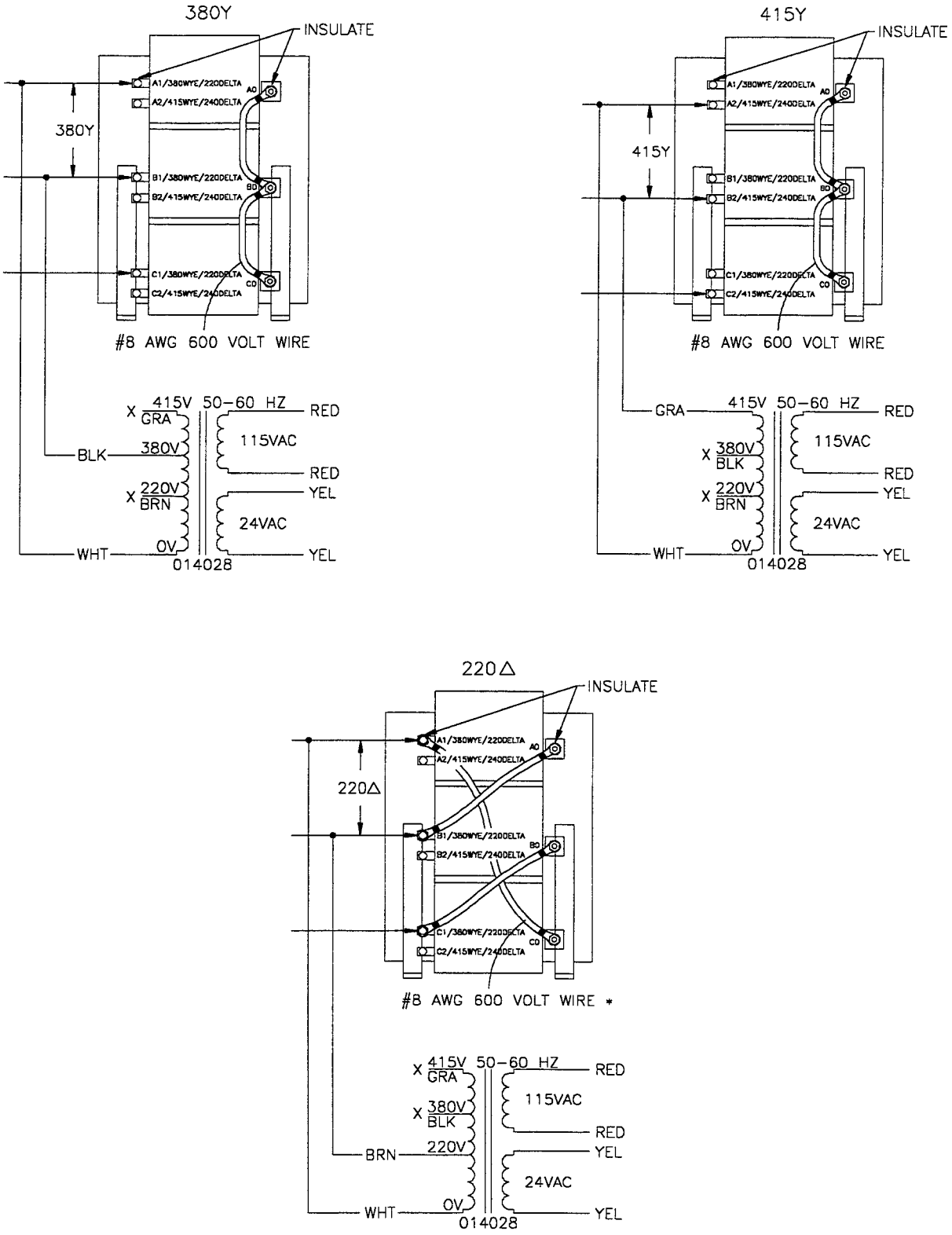








MAX100D Wiring Diagrams
Drawing #013227 Rev G
Sheet 2 of 2



Transformer Wiring - 220Δ/380Y/415Y

APPENDIX A

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.

IEC SYMBOLS USED

Direct Current (DC).

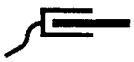
Alternating current (AC).

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).

I

The power is on.

O

The power is off.

Volt/amp curve.

APPENDIX C

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.

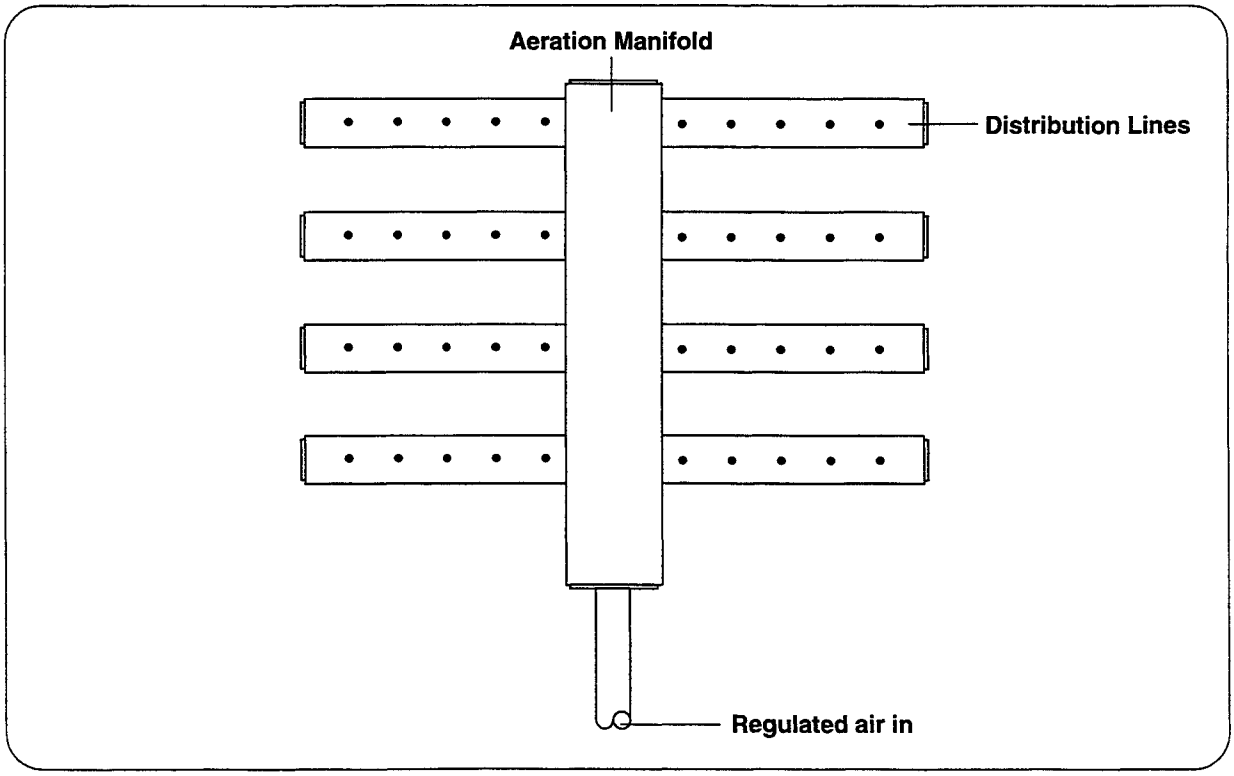


Figure c-1 Aeration Manifold

APPENDIX D

STANDARDS INDEX

For further information concerning safety practices to be exercised with plasma arc cutting equipment, please refer to the following publications:

1. ANSI Standard Z49.1, *Safety in Welding and Cutting*, obtainable from the American Welding Society, 550 LeJeune Road, P.O. Box 351020, Miami, FL 33135.

2. NIOSH, *Safety and Health in Arc Welding and Gas Welding and Cutting*, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

3. OSHA, *Safety and Health Standards*, 29FR 1910, obtainable from the U.S. Government Printing Office, Washington, D.C. 20402.

4. ANSI Standard Z87.1, *Safe Practices for Occupation and Educational Eye and Face Protection*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

5. ANSI Standard Z41.1, *Standard for Men's Safety-Toe Footwear*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

6. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

7. AWS Standard A6.0, *Welding and Cutting Containers Which Have Held Combustibles*, obtainable from the American Welding Society, 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135.

8. NFPA Standard 51, *Oxygen — Fuel Gas Systems for Welding and Cutting*, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

9. NFPA Standard 70-1978, *National Electrical Code*, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

10. NFPA Standard 51B, *Cutting and Welding Processes*, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

11. CGA Pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders*, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

12. CSA Standard W117.2, *Code for Safety in Welding and Cutting*, obtainable from the Canadian Standards Association Standard Sales, 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3, Canada.

13. NWSA booklet, *Welding Safety Bibliography*, obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103.

14. American Welding Society Standard AWS F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances*, obtainable from the American Welding Society, 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135.

15. ANSI Standard Z88.2, *Practices for Respiratory Protection*, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

16. Canadian Electrical Code Part 1, *Safety Standards for Electrical Installations*, obtainable from the Canadian Standards Association, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W1R3.