# MAX100®

## Plasma Arc Cutting System

***Instruction Manual***
***800690 – Revision 14***

Hypertherm®
*The world leader in plasma cutting technology*

# MAX100®

## Plasma Arc Cutting System

## Instruction Manual
## IM-69
## (P/N 800690)

**Revision 14 March, 1999**

**HYPERTHERM, Inc.**
**P.O. Box 5010**
**Hanover, New Hampshire 03755-5010**
**Tel.: (603) 643-3441**
**Fax: (603) 643-5352**
**http://www.hypertherm.com**
**email:info@hypertherm.com**

## *Hypertherm Offices Worldwide*:


**Hypertherm, Inc.**
Etna Road, P.O. Box 5010
Hanover, NH 03755 USA
Tel.: (603) 643-3441 (Main Office)
Fax: (603) 643-5352 (All Departments)
Tel.: (800) 643-9878 (Technical Service)
Tel.: (800) 737-2978 (Customer Service)

**Hypertherm Plasmatechnik GmbH**
Technologiepark Hanau
Rodenbacher Chaussee 6
D–63457 Hanau-Wolfgang, Germany
Tel.: 49 6181 58 2100
Fax: 49 6181 58 2134

**European Technical Support Organization (ETSO)**
Technologiepark Hanau
Rodenbacher Chaussee 6
D–63457 Hanau-Wolfgang, Germany
Tel.: 49 6181 58 2100
Fax: 49 6181 58 2134

**Hypertherm Singapore Pte Ltd**
No. 19 Kaki Bukit Road 2
K.B. Warehouse Complex
Singapore 417847, Republic of Singapore
Tel.: 65 841 2489
Fax: 65 841 2490

**Hypertherm U.K.**
9 Berkeley Court • Manor Park
Runcorn, Cheshire, England WA7 1TQ
Tel.: 44 1928 579 074
Fax: 44 1928 579 604

**France**
10, Allée de l'Isara
F-95000 Cergy-Pontoise, France
Tel.: 33 1 34 24 03 05
Fax: 33 1 34 25 09 64

**Italy**
Via Torino 2
20123 Milan, Italy
Tel.: 39 02 725 46 312
Fax: 39 02 725 46 400

**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 workman ship, 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.

HYPERTHERM, at its sole option, shall repair, replace, or adjust, free of charge, any Products covered by this warranty which shall be returned with HYPERTHERM's prior authorization (which shall not be unreasonably withheld), properly packed, to HYPERTHERM's place of business in Hanover, New Hampshire, all costs, insurance and freight prepaid, and which examination proves not to be free from defects in materials and workmanship. HYPERTHERM shall not be liable for any repairs, replacements, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph or with HYPERTHERM's written consent. This warranty shall not apply to any Product which has been mishandled, incorrectly installed, modified or assembled by you or any other person. HYPERTHERM shall be liable for breach of this warranty only if it receives written notice of such breach within the applicable warranty period specified herein above. THE FOREGOING SHALL CONSTITUTE THE SOLE REMEDY TO DISTRIBUTORS OR THEIR CUSTOMERS FOR ANY BREACH BY HYPERTHERM OF ITS WARRANTY.

## PATENT INDEMNITY

Except only in cases of Products not manufactured by HYPERTHERM or manufactured by a person other than HYPERTHERM not in strict conformity with HYPERTHERM's specifications, and in cases of designs, processes, formulae or combinations not developed or purported to be developed by HYPERTHERM, HYPERTHERM agrees to indemnify, protect and hold harmless Distributors and their customers against any and all liability or claims in any manner imposed upon or accruing against Distributors and their customers because of the use in or about the construction or operation of Equipment or any design, system, formula, combination, article or material which infringes or alleges to infringe on any patent or other right. Distributors shall notify HYPERTHERM promptly upon learning of any action or threatened action in connection with any such alleged infringement, and each party may appoint its own counsel for any such action or threatened action.

## DISCLAIMER OF OTHER WARRANTIES

HYPERTHERM MAKES NO WARRANTIES REGARDING PRODUCTS MANUFACTURED BY IT OR OTHERS (INCLUDING WITHOUT IMPLIED LIMITATION WARRANTIES AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), EITHER EXPRESS OR IMPLIED, EXCEPT AS PROVIDED HEREIN. This warranty is in lieu of any and all warranties, express or implied, by law or otherwise; and Distributors are not authorized to give any other warranty purporting to be binding upon HYPERTHERM upon resale of Products to their customers. IN NO EVENT shall HYPERTHERM be liable for incidental or consequential damages or injury to the person or property of anyone by reason of any defect in any Equipment sold hereunder.

# TABLE OF CONTENTS

# TABLE OF CONTENTS

# TABLE OF CONTENTS

# TABLE OF CONTENTS

## Illustrations

# Section 1 SAFETY

In this section:



***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.
- Keep distance between the work cable and the workpiece as short as possible to eliminate loop areas.
- 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 source as possible.

# Section 1a SÉCURITÉ

Cette section comprend :



***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



In this section:

# GENERAL

Hypertherm's MAX100 plasma cutting system is designed for cutting most metals from gauge to 1-1/4 inch (32 mm) thick. 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 MAX100 provides continuously variable current output from 30 to 100 amps for optimum performance on all thicknesses of metal up to 1-1/4 inch (32 mm) thick. This allows the operator wide variations in cutting speeds on the same thickness of metal. Three nozzle sizes (40-amp, 80-amp and 100-amp) are provided to produce high quality cuts throughout its range of cut thicknesses.

The system provides a continuous pilot arc which allows high quality cutting of perforated or expanded metal without any appreciable deterioration in parts life. This feature is only available for use with the small nozzle up to 40 amps of output.

Cut quality is superior and torch parts life is several times longer than any other air plasma cutting system. The unique MAX100 power supply design uses transistor technology to produce a very smooth constant current DC output.

Air is used as the primary plasma gas, providing low operating costs combined with high-speed performance. Cylinder air or shop air can be used 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, nitrogen can be used as the plasma gas. (A nitrogen electrode is the only part change required to switch from air to nitrogen.) A regulator and air filter are provided to ensure that the correct pressure and air flow are supplied to the system at the proper quality.

# PRODUCT SPECIFICATIONS

## MAX100 Power Supply

The MAX100 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 ..... 280 VDC

Output Current ..... 30-100 Amps

Output Voltage ..... 150 VDC

Duty Cycle Rating ..... 80% at 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:**

**# 059200** ..... 200V, 3PH, 50-60 Hz
**# 059025** ..... 208V, 3PH, 60 Hz
**# 059001** ..... 240/480V, 3PH, 60 Hz
**# 059011** ..... 220/380/415V, 3PH, 50 Hz
**# 059010** ..... 600V, 3PH, 60 Hz
**# 059080** ..... 500V, 3PH, 50Hz

**Dimensions and Weight:**

Width ..... 26-1/2" (673 mm)
Height ..... 43" (1092 mm)
Depth ..... 31-3/4" (806 mm)
Weight ..... 420 pounds (190 kg)

**Gas Requirements:**

Gas Type ..... Air, Nitrogen

Gas Quality ..... Clean, dry, oil-free

Gas Flow ..... 440 scfh (208 liters/minute)

Gas Inlet Pressure ..... 70 psi (4.8 bar) to 125 psi (8.5 bar)

Gas Pressure Setting ..... 60 psi (4.1 bar) to 75 psi (5.1 bar) dynamic (flowing)

SPECS

## PAC130 Torch

| | |
|---|---|
| Maximum cutting thickness range | 1-1/4 inch (32 mm) |
| Maximum current at 80% duty cycle | 100 Amps |
| Gas Flow | 440 scfh (208 liters/minute) at 60 psi (4.1 bar) |
| Weight | 1 pound 3 ounces (.462 kg) |

## MAX100 90° Torch

| | |
|---|---|
| Maximum cutting thickness range | 1-1/4 inch (32 mm) |
| Maximum current at 80% duty cycle | 100 Amps |
| Gas Flow | 440 scfh (208 liters/minute) at 60 psi (4.1 bar) |
| Weight | 1 pound 3 ounces (.462 kg) |

## MAX100 Machine Torch

| | |
|---|---|
| Maximum mechanized cutting | 5/8 inch (16 mm) |
| Maximum current at 80% duty cycle | 100 Amps |
| Gas Flow | 440 scfh (208 liters/minute) at 60 psi (4.1 bar) |
| Weight | 1 pound 7 ounces (.604 kg) |

## THC-2 - Optional

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

# Section 3 SETUP

In this section:

## UPON RECEIPT

Verify that all components listed below are present. Alert your distributor if any parts are missing. All communications regarding this equipment must include the model number and serial number (located on the back of the MAX100).

**PAC130 System with Hand Torch:**

- MAX100 power supply with work cable (ground) and clamp
- PAC130 hand torch with torch lead assembly
- Consumable parts kit

**MAX100 Machine Torch System - Machine Torch Configuration:**

- MAX100 power supply with work cable (ground) and clamp
- MAX100 machine torch and torch lead assembly
- Consumable parts kit

- THC-2 Torch Height Control - optional
- Remote Start/Stop Switch - optional

Note: For detailed 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 MAX100 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 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.



## 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.

## 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 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 to the following requirements:

| Three-Phase Input Voltage | Input Current @ 15 kW Output | Recommended Slow-Blow Fuse Size | Recommended Power Cord Gauge Size |
|---|---|---|---|
| 200 VAC | 60 amps | 70 amps | 4 AWG |
| 208 VAC | 55 amps | 70 amps | 4 AWG |
| 220 VAC | 53 amps | 60 amps | 4 AWG |
| 240 VAC | 50 amps | 60 amps | 4 AWG |
| 380 VAC | 30 amps | 40 amps | 8 AWG |
| 415 VAC | 28 amps | 40 amps | 10 AWG |
| 480 VAC | 25 amps | 30 amps | 10 AWG |
| 500 VAC | 21.7 amps | 25 amps | 10 AWG |
| 600 VAC | 20 amps | 25 amps | 10 AWG |



## Power Cables

- Power cables are supplied by the customer.
- Use AWG cable sizes as outlined by applicable local electrical codes. Cable sizes vary based on the distance of the receptacle from the main box.
- The wire sizes listed above were taken from the National Electric Code 1990 handbook, table 310.16. **Use a 4-conductor Type SO** input power cable with a conductor temperature rating of 60°C (140°F).
- To connect power cable to power supply, see *Power Cable Connection* later in this section.

# GAS SUPPLY REQUIREMENTS

The MAX100 uses air or nitrogen as the operating gas.

The gas source must be capable of delivering at least **440 scfh** (208 liters/minute) of gas at **90 psi** (6.2 bar) output pressure.

**Do not exceed 120 psi (8.3 bar) delivery pressure to the system. Exceeding this pressure will cause shortened torch parts life.**

### Hoses

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

I.D.: **3/8" (9.5 mm) minimum**
Length: **100 ft (30 m) maximum**

Two different sources of air can be used to supply the MAX100: cylinder compressed air or shop compressed air:

## Cylinder Compressed Air

The cylinder air supply must be clean, dry and oil-free.

| | |
|---|---|
| **CAUTION:** | **Do not use the regulator supplied on the MAX100 system if compressed air cylinders are used; the pressure could exceed the capability of the regulator. See *Power Supply Gas Connections* later in this section for hookup to the MAX100.** |



## Shop Compressed Air

Shop compressed air must be clean, dry, and oil-free if used to supply the MAX100. Poor quality air reduces cut speeds, produces poor cut quality, and reduces parts life. See *Power Supply Gas Connections* later in this section for hookup to the MAX100.

If the shop air is not clean, refer to *Additional Filtration* later in this section, and Appendix A for recommended filter specifications. These filters are available from any industrial supplier.

## Nitrogen

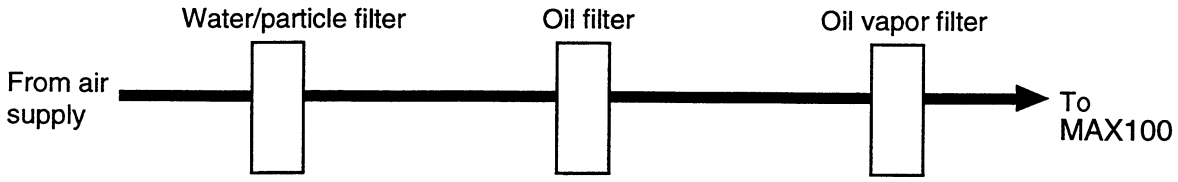
To use nitrogen as the operationg gas, it must be supplied to the MAX100 at 99.995% purity. The source can be compressed gas cylinders or liquid containers. If the purity level of the nitrogen is too low, cut speeds decrease, cut quality deteriorates, cutting thickness capability decreases, and parts life shortens.

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

To connect nitrogen supply to MAX100, see *Power Supply Gas Connections* later in this section.

## Additional Filtration

Use a 3-stage coalescing filtration system as shown below when site conditions introduce moisture, oil or other contaminants into the air line. See Appendix A for recommended filter specifications.




# 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.

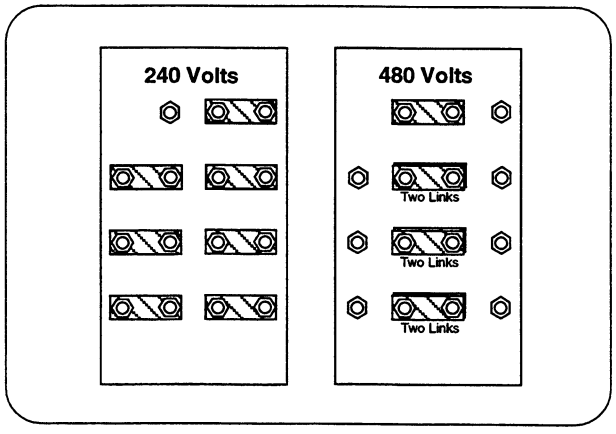



**Figure 3-1 Dual Voltage 240/480-Volt Linkboard**

## Power Cable Connection

### *Power Cable to MAX100 Power Supply*

1. Route the **POWER CABLE** through the strain relief on the rear of the MAX100 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 MAX100. The **GROUND** lead must be connected to the ground stud provided on the case of the machine near the contactors (see Fig. 3-2).

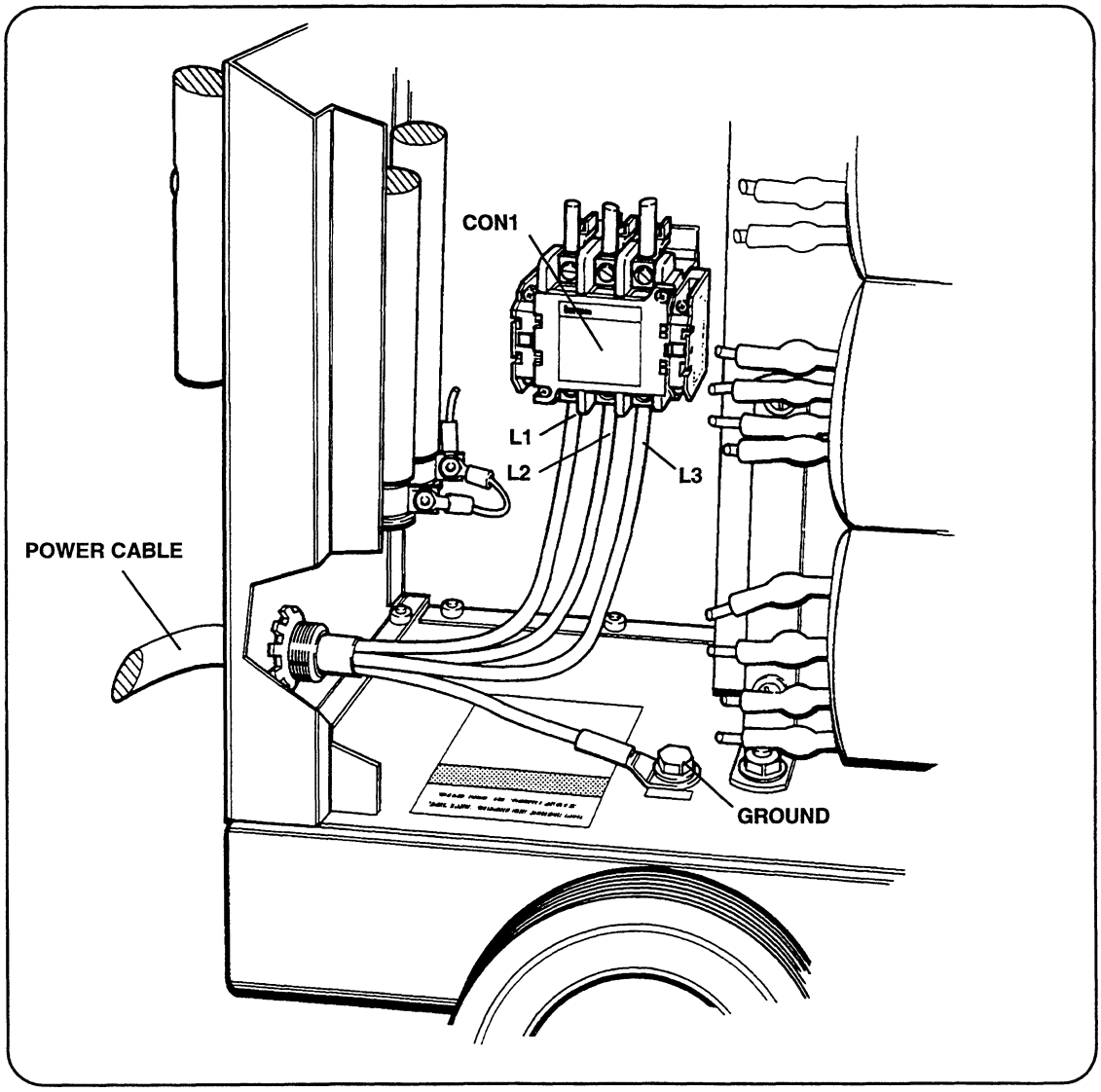



**Figure 3-2 MAX100 Primary Power Connections**

## Power Cable Connection (Continued)

***Power Cable from MAX100 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 MAX100 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 MAX100.

2. Connect wires 33 and 34 to TB1-5 and TB1-6 for machine "start." (See Fig. 6-3 for location of TB1, and Fig. 3-3 for detail of TB1.)

3. Connect wires 37 and 38 to TB1-7 and TB1-8 for "auxiliary 24-volt AC input."

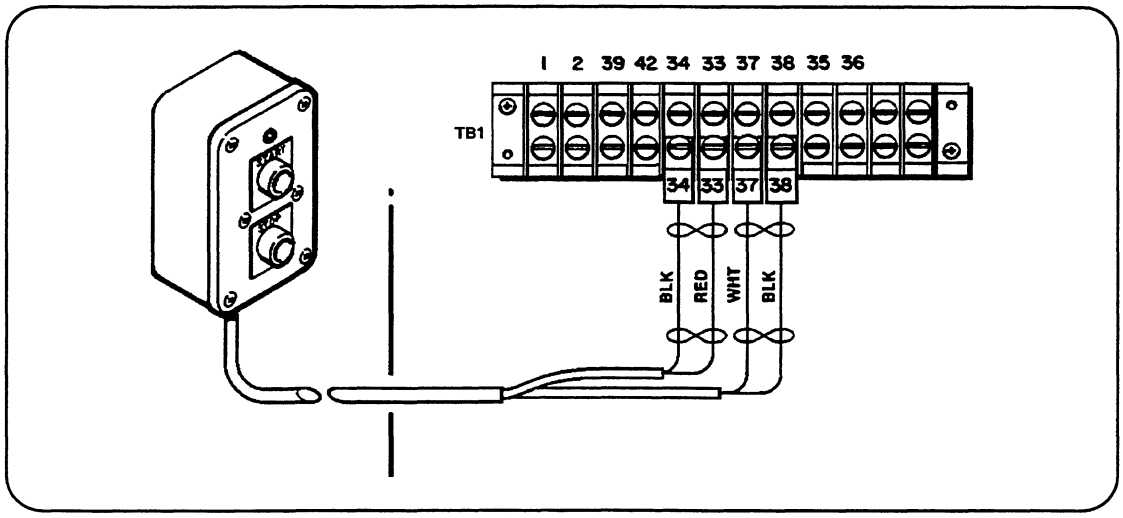



**Figure 3-3 Remote Start/Stop Switch Connections**

## Machine Computer Interface (Optional)

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

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

## POWER SUPPLY GAS CONNECTIONS

**When using compressed air cylinders, remove the hose from the MAX100 regulator and feed the OUTPUT OF AIR CYLINDER REGULATOR directly into the air input at the bottom rear of the MAX100 power supply.** (Fig. 3-4)

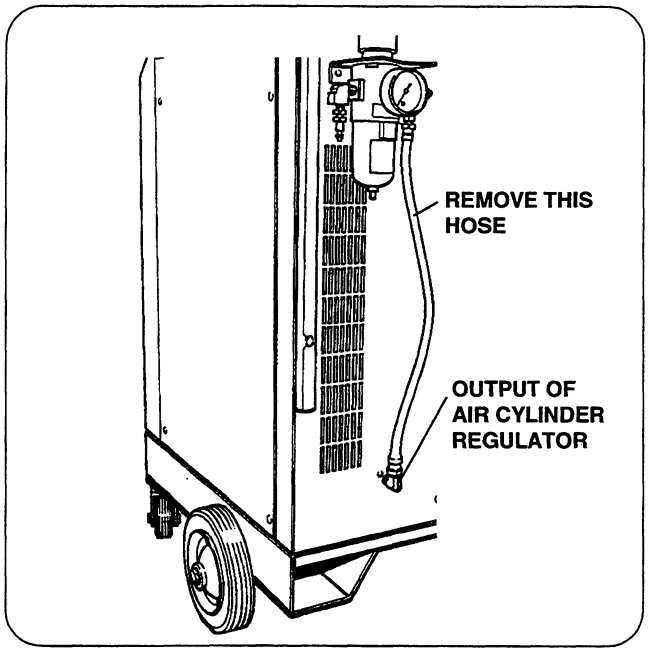



**Figure 3-4 Gas Connection for Air Cylinder**

When using **air** or **nitrogen** as the operating gas, and source pressure **does not** exceed **120 psi** (8.3 bar), connect hose from **SOURCE SUPPLY** to the connector located on the left of the regulator on the rear of the power supply. (Fig. 3-5)

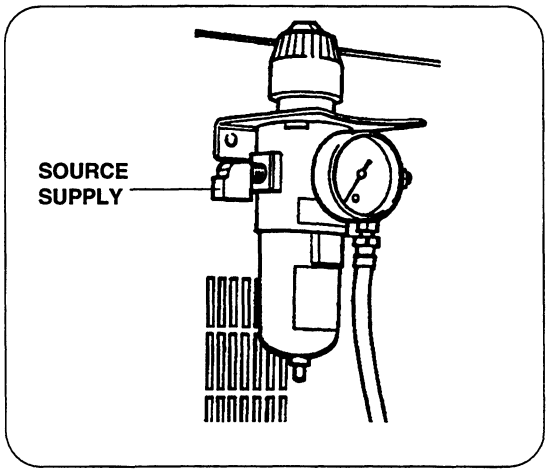



**Figure 3-5 Gas Connection for Shop Air or Nitrogen**

# CONNECTING THE TORCH

There are 2 configurations of power supplies to accommodate 2 configurations of torch / torch lead assemblies:

## Quick Disconnect Torch Leads to Power Supply

1. Align the **TORCH CONNECTOR KEY PLUG** with the **RECEPTACLE KEY SLOT** (on the back of the power supply) and push it in until the pins seat. (Fig. 3-6)

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 receptacle are fine-threaded. Thread damage could occur if cross-threaded. |
|---|---|

3. Turn the connector securing ring clockwise to tighten.



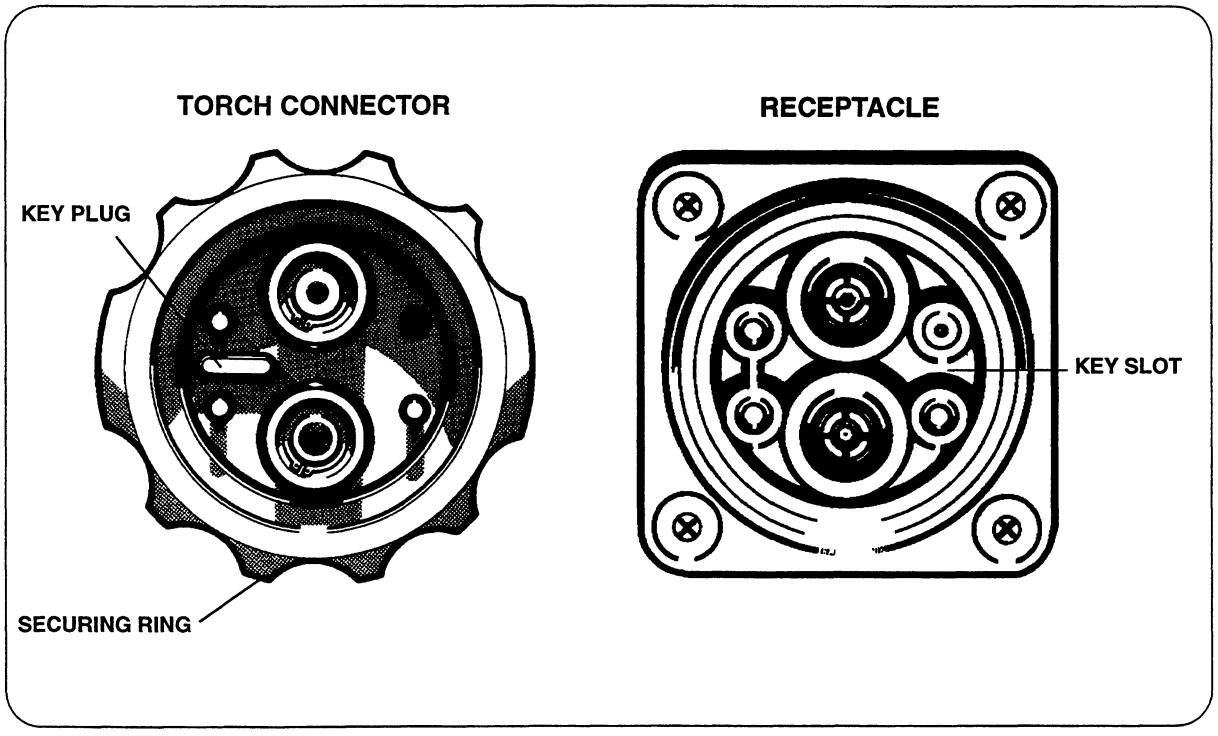



**Figure 3-6 Quick Disconnect Alignment**

## Torch Leads without Quick Disconnect to Power Supply

For torches not equipped with the quick disconnect torch leads:

1. Unscrew and remove the left-side cover of the power supply.
2. Connect the torch **CATHODE LEAD** (larger diameter lead) to the center of the coil assembly. (Fig. 3-7)
3. Connect the **PILOT ARC LEAD** (smaller diameter lead) to the other fitting located on the lower left of the ground cable connection. (Fig. 3-7)
4. Connect the cable terminals labeled **33** and **34** to TB1-5 and TB1-6. (Fig. 3-7)
5. Replace left-side cover of the power supply.



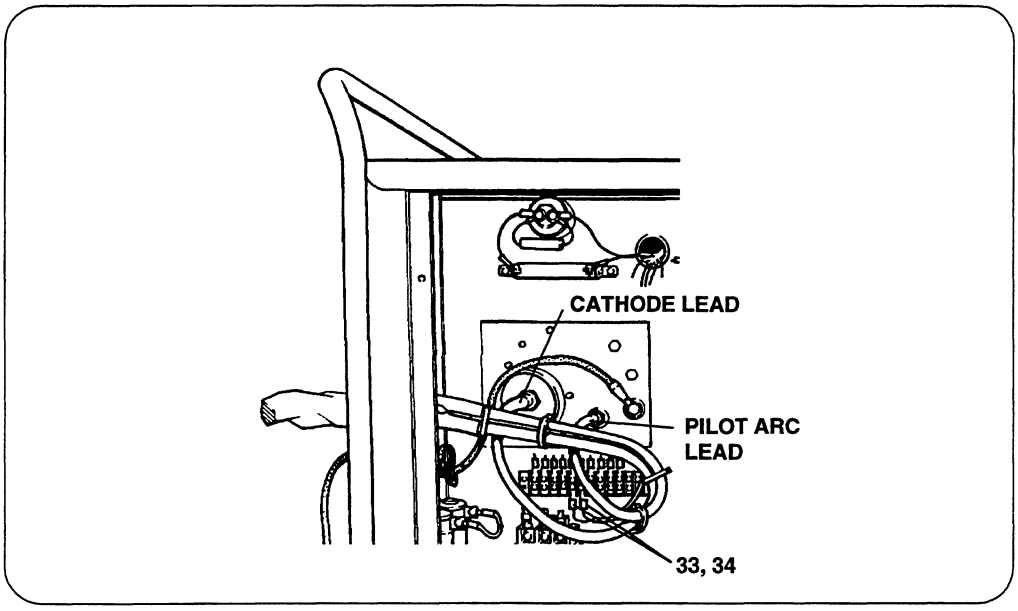



**Figure 3-7 Torch Lead Connections to Inside of Power Supply**

# Section 4 OPERATION

In this section:

# DESCRIPTION OF CONTROLS

## MAX100 Control Panel (Figure 4-1)

- **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 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 normal plate.

- **GAS TEST/RUN switch**
  In TEST mode, plasma gas flows so that adjustments to the pressure can be made. RUN mode is used after gas has been set in TEST mode, and cut is about to be made.

- **GAS Adjustment Valve**
  Adjusts dynamic (flowing) plasma gas.

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

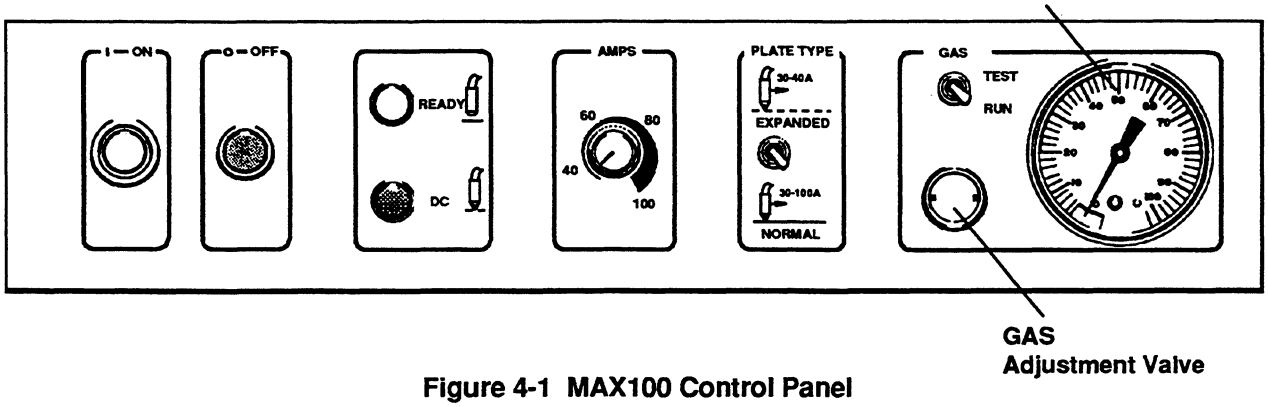



**Figure 4-1 MAX100 Control Panel**

# 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.

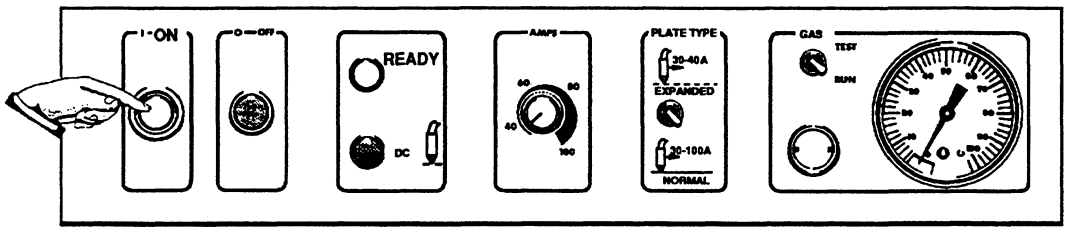
2. Follow the system installation instructions in the *Setup* section.

3. Be sure that the correct parts are in the MAX100 torch. See *Cut Charts* later in this section for correct consumables.

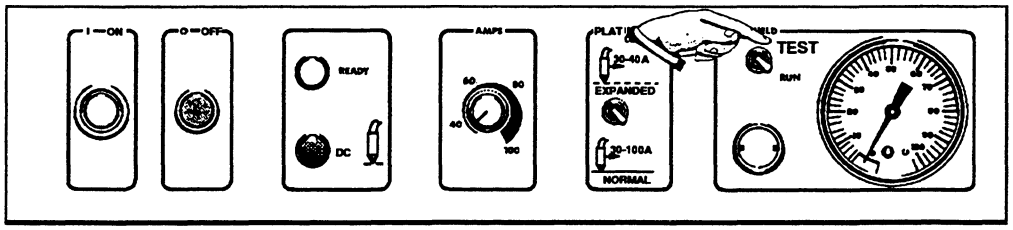
4. Turn on the facility gas supply. Adjust incoming plasma gas pressure to a minimum of **90 psi (6.2 bar)**.

5. Apply three-phase power to the MAX100.

6. Press the green **ON** button to power up the system. Hold it down until the white **READY** button lights up.

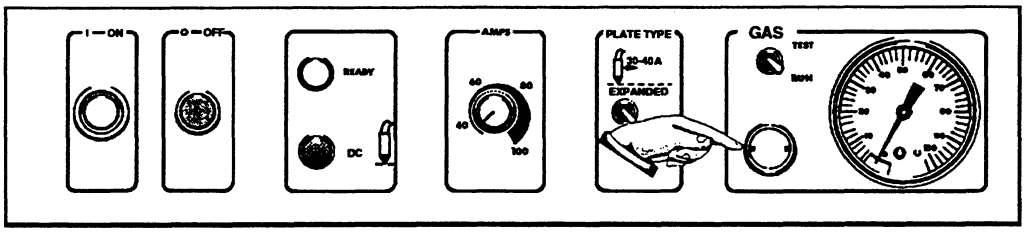



7. Place the TEST/RUN switch in the **TEST** position. Plasma Gas will flow through the system.

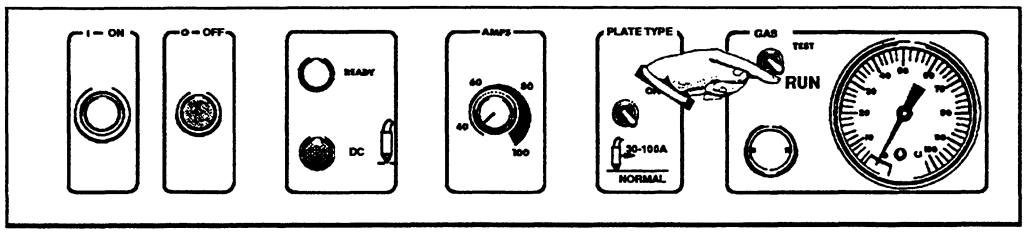



OPERATION

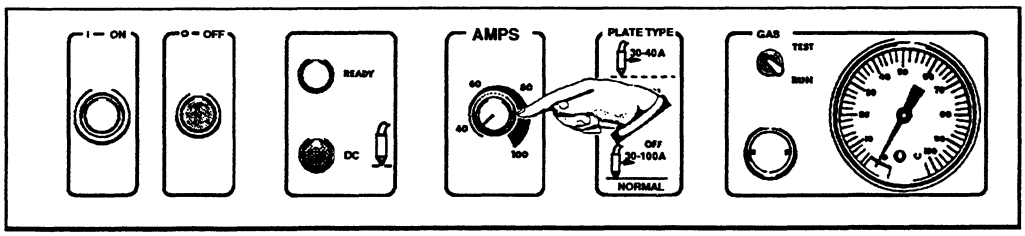
8. With the GAS Adjustment Valve, set the plasma gas pressure for the particular metal you are cutting. Refer to the **Plasma Gas Pressure** in **TEST** mode in the *Cut Charts* later in this section.



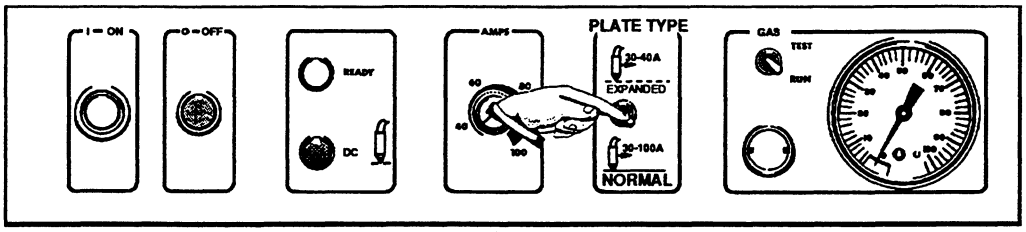

9. After gas has been set, switch to the **RUN** position. Gas will stop flowing through the system.




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



11. Place the **PLATE TYPE** switch in the **NORMAL** (down) position.
    Note: If you are cutting metal grate, place the **PLATE TYPE** switch in the **EXPANDED** (up) position.




12. 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 Charts* later in this section.

13. 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 4-2.

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

15. Cut at the speed specified under **Travel Speed** in the *Cut Charts* later in this section for the material and thickness being cut. Be sure to follow the proper **Pierce Time** outlined in the charts. For machine-torch systems, program cutting machine accordingly.

16. **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.

OPERATION

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.

**WARNING**

**All input power to the power supply is not turned off until the wall disconnect switch is turned off.**

**WARNING**

**Never remove the power supply cover before disconnecting main power.**



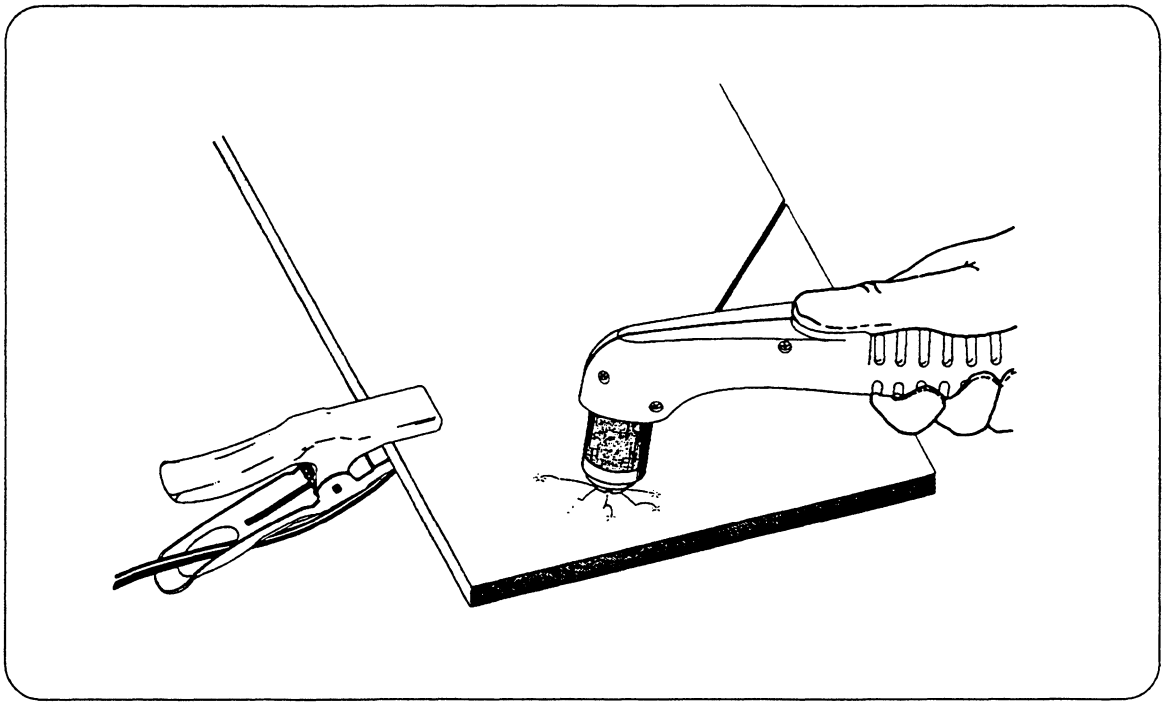


**Figure 4-2 Proper Work Clamp Connection**

# 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 4-3):

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 and screw it back on to the retaining cap.

5. Inspect the **O-ring** on the **torch**. It should be lubricated and undamaged. If it is dry, lubricate it with a thin film of the lubricant provided in the spare parts kit. If it is damaged, replace it.

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 spare 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.

12. Replace the retaining cap. Make sure that it is tightened snugly; if it is loose, it can affect cut quality.

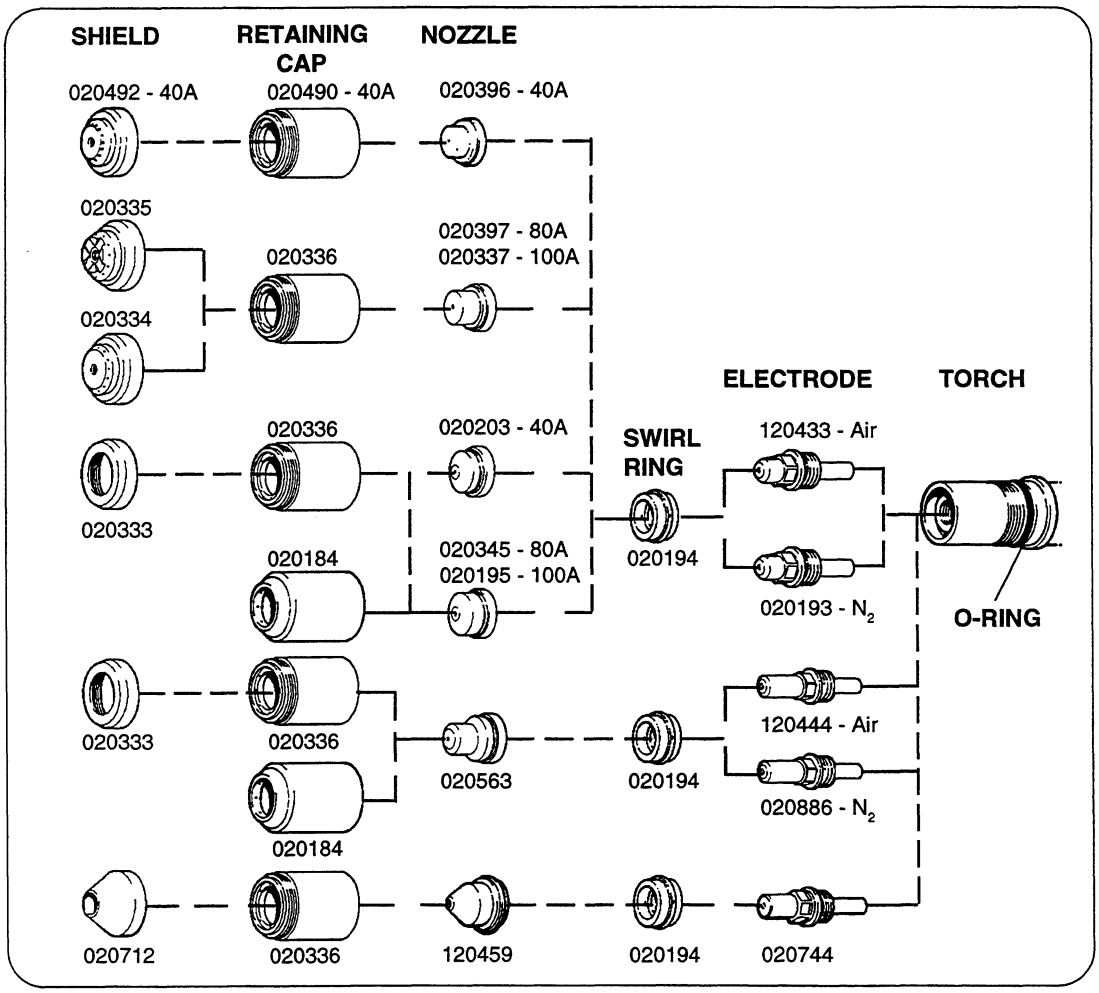



**Figure 4-3 Consumable Parts**

## Cutting with Hand Torch

- Do not fire the pilot arc into the air needlessly—doing so causes a drastic reduction of the nozzle and electrode life.

- Start cutting from the edge of the workpiece (Fig. 4-4) unless you must pierce. For tips on piercing, see *Piercing* later in this section .

- When cutting, make sure that the sparks are coming out of the bottom of the workpiece. If they are spraying on top of the workpiece, you are moving the torch too fast, or you do not have sufficient power to fully penetrate the workpiece.

- Hold the torch lightly on the metal or just off the metal. Holding the torch firmly to the workpiece causes the nozzle to stick and makes smooth cutting difficult. The arc transfers once the torch is within 3 mm (1/8 inch) of the workpiece.

- To cut circles, use a template or a radius cutter attachment (Fig. 4-5).

- 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. 4-6). By lightly dragging the nozzle on the workpiece, you can maintain a steady cut. For straight-line cuts, use any straight edge as a guide.



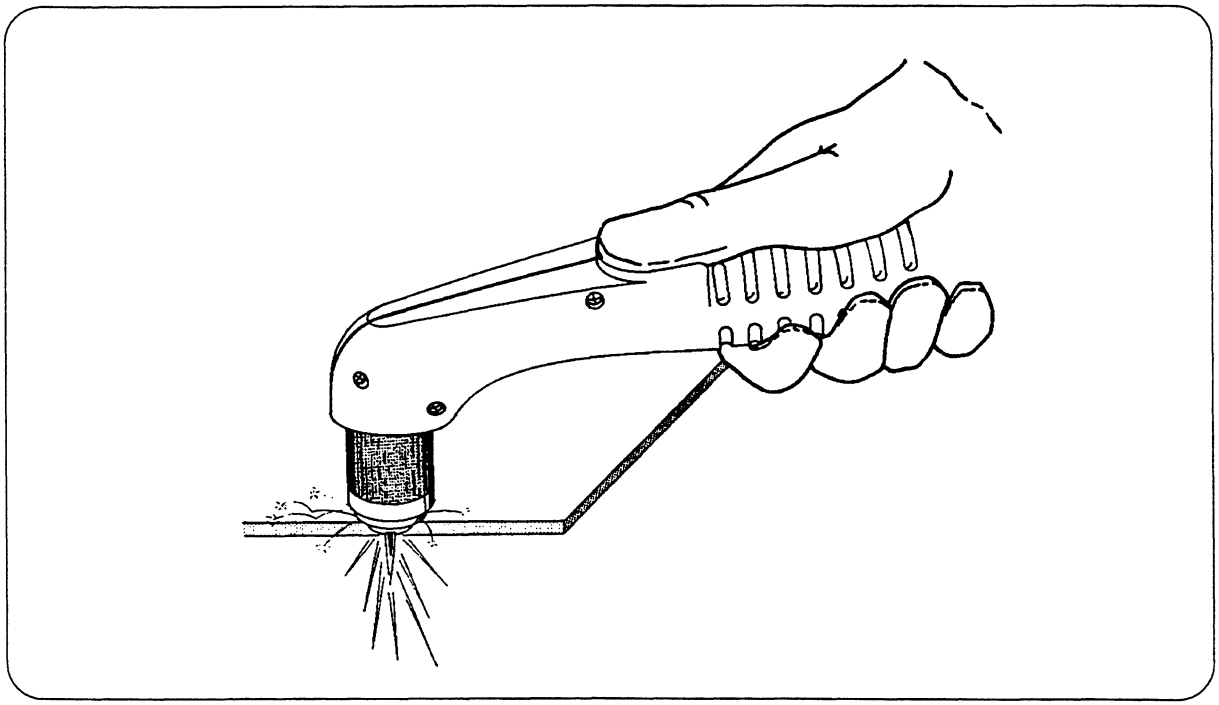


**Figure 4-4 Starting a Cut**

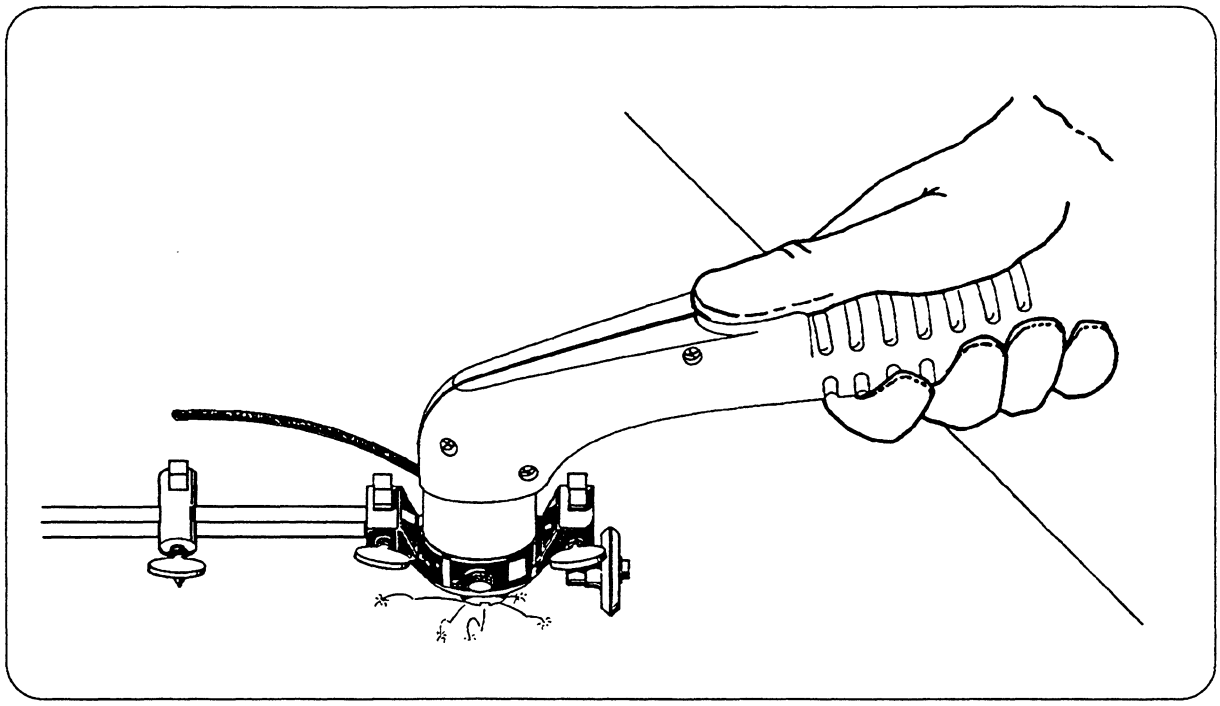


**Figure 4-5 Cutting a Circle**

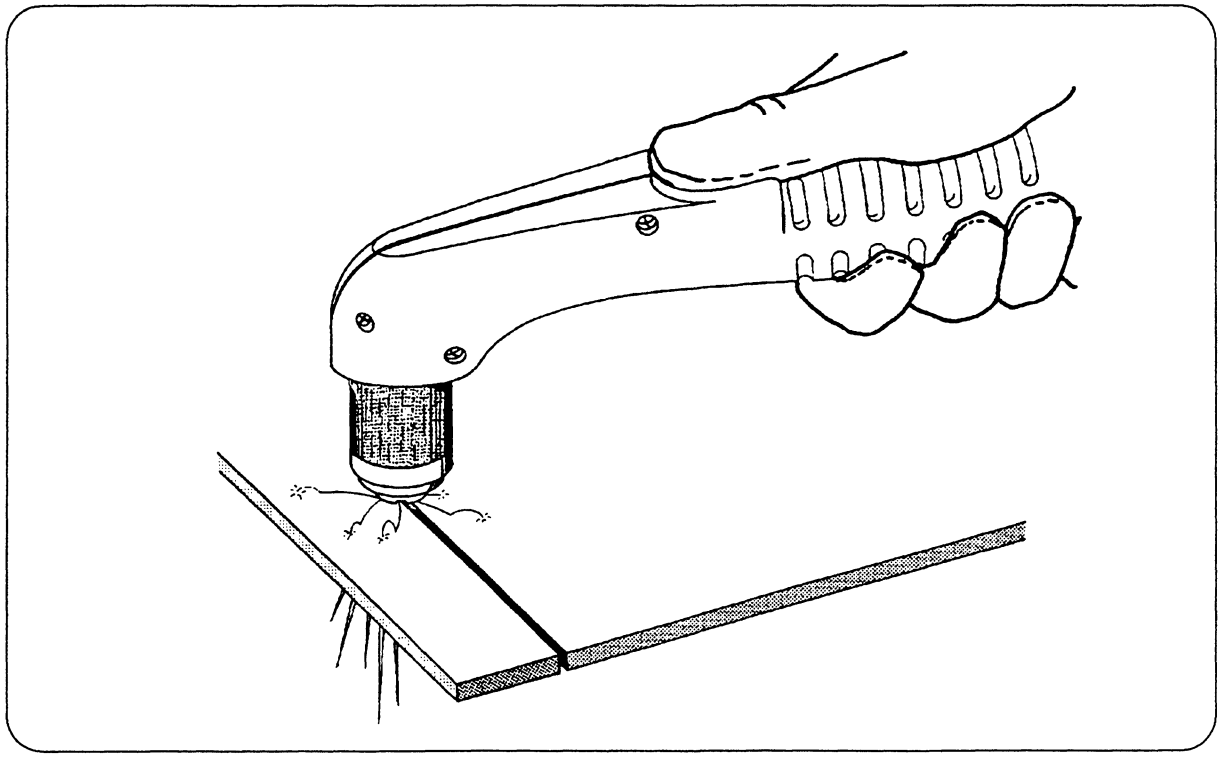


**Figure 4-6 Dragging the Torch**

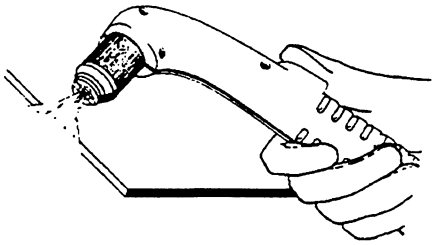
## Piercing with Hand Torch

- 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.

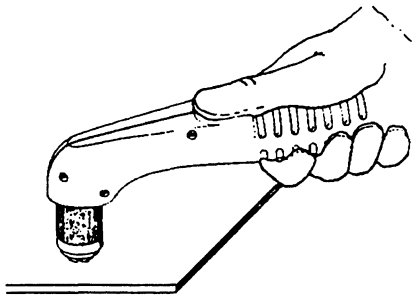
- Hold the torch at an angle to the workpiece away from yourself, then slowly roll it to a vertical position. (This is particularly important when cutting thicker material.) Make sure that the torch is pointed away from you and the people around you to avoid any danger from sparks and hot metal.

- 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. 4-7).

- 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 4-7 Piercing**

## Gouging with Hand Torch

The MAX100 can be used for gouging mild steel by using the optional gouging nozzle and shield. Use the following guidelines to assist you with the gouging process:

- When gouging, it is absolutely necessary to wear full protection - a welding helmet with at least a #8 glass, welding gloves and a welding jacket. The arc is fully exposed and will cause serious burns if skin is not covered.
- Install the gouging nozzle just as you would install the standard cutting nozzle.
- Adjust the air pressure to 50 psi (3.5 bar) (with air flowing at the torch). Note that this is slightly lower than the cutting pressure.
- Tilt the torch approximately 40-45° from the surface to be gouged and feed into the gouge. Try not to allow the shield to come in contact with the plate since this can cause premature wear. Multiple passes or "wearing" may be necessary to gouge wider and deeper sections. (See Figure 4-8. See also data in *Cut Charts* for mild steel gouging.)

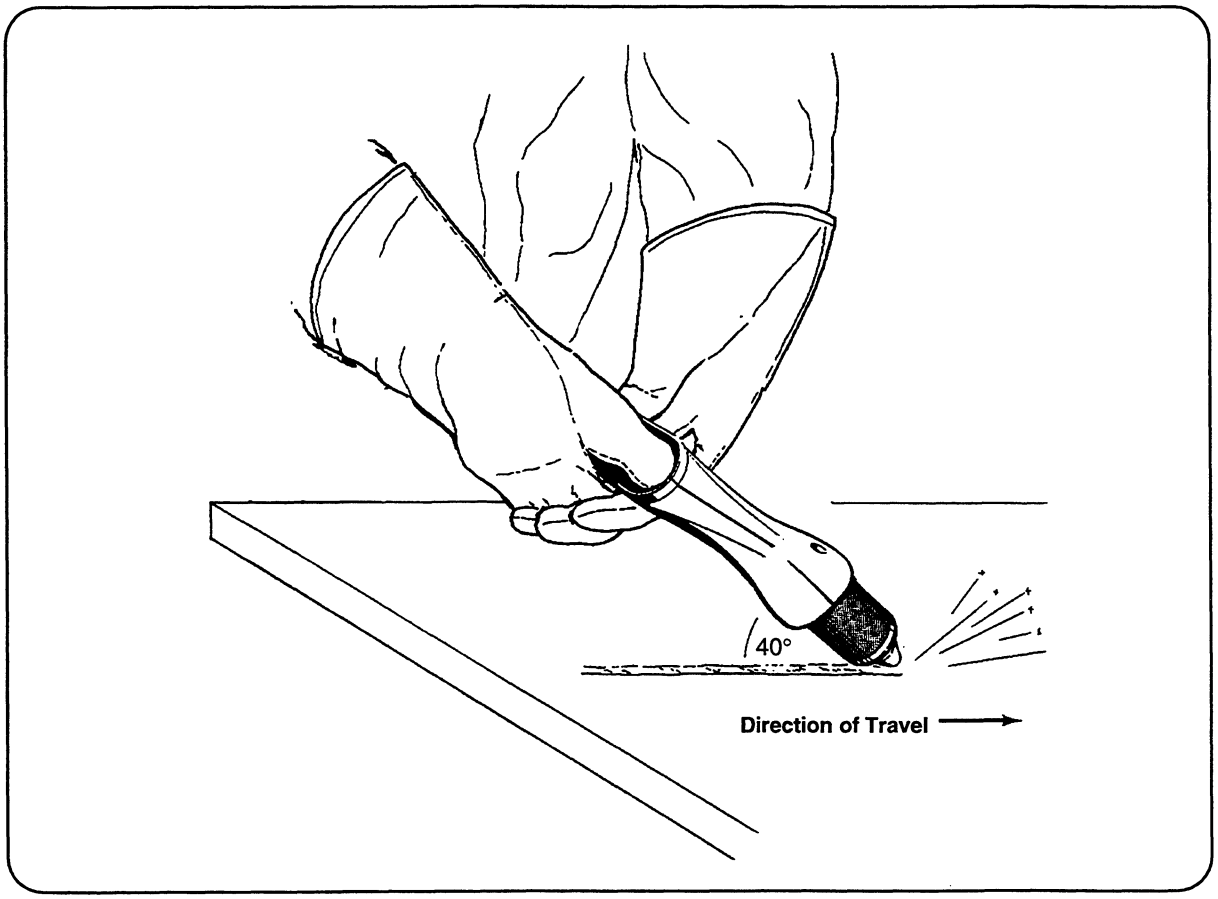



**Figure 4-8 Gouging**

## 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 MAX100 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 thick.
- The work clamp is not making 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 **70 psi** (4.8 bar). If the pressure is below **40 psi** (2.7 bar), the torch will go out.

# CUT CHARTS

The cut chart information on the following pages will enable you to successfully cut or gouge using the MAX100 system.

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

**CUT CHART INDEX**

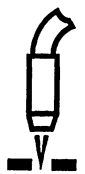


OPERATION

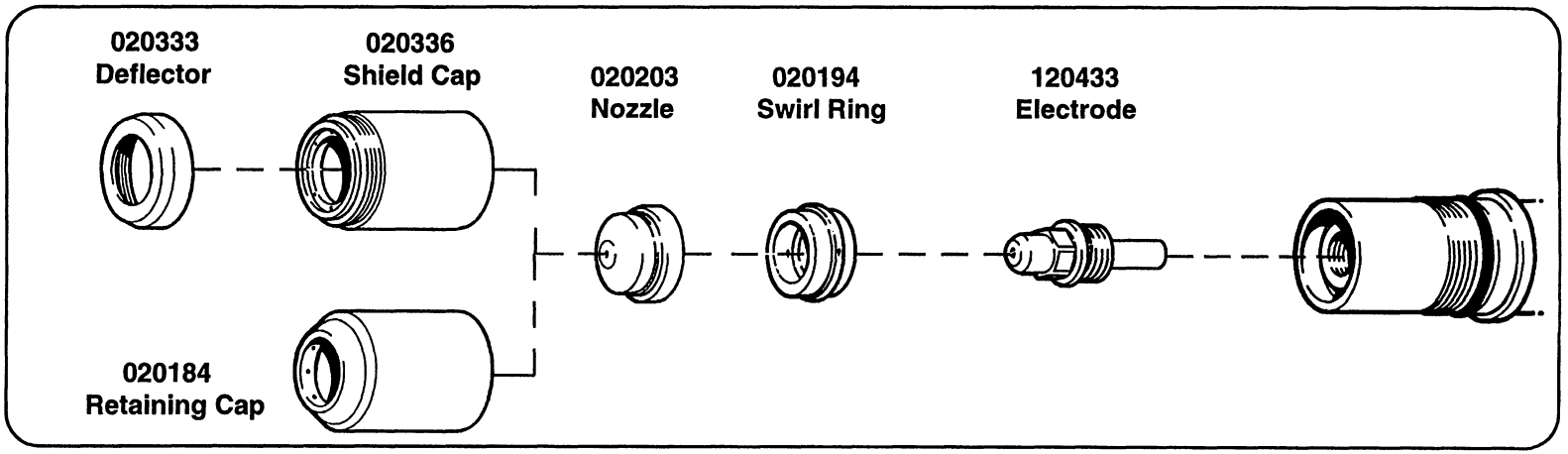
# MAX100 Machine/PAC130 Hand Torch

## Mild Steel Cutting

Plasma Gas: **Air**
Current Setting: **40 Amps**
Consumables: **Non-Shielded**



**CUTTING**




| Material Thickness (inches) | (GA) (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Expanded Metal Travel Speed (ipm) | (mm/min) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (28 GA) | **65*/4.5** | 5/64 | 2 | **40** | 90 | **100** | 340 | 8640 | | 240 | 6100 | **90-120/6.2-8.3** |
| | (26 GA) | | 5/64 | 2 | | 90 | | 320 | 8130 | | 225 | 5720 | |
| | (24 GA) | | 5/64 | 2 | | 95 | | 285 | 7200 | | 200 | 5080 | |
| .035 | 1 | | 5/64 | 2 | | 100 | | 235 | 5970 | | 165 | 4190 | |
| | (18 GA) | | 5/64 | 2 | | 100 | | 170 | 4320 | | 120 | 3050 | |
| 1/16 | 1.5 | | 5/64 | 2 | | 105 | | 150 | 3800 | 0.50 | 105 | 2670 | |
| .075 | 2 | | 5/64 | 2 | | 105 | | 130 | 3300 | 0.50 | 90 | 2290 | |
| 1/8 | 3 | | 5/64 | 2 | | 105 | | 85 | 2160 | 1.00 | 60 | 1520 | |
| .158 | 4 | | 1/8 | 3 | | 110 | | 60 | 1520 | 1.50 | 40 | 1020 | |
| .197 | 5 | | 1/8 | 3 | | 120 | | 45 | 1140 | 1.50 | 30 | 760 | |
| 1/4 | 6 | | 1/8 | 3 | | 120 | | 30 | 760 | 1.75 | | | |
| 3/8 | 10 | | 1/8 | 3 | | 125 | | 08 | 200 | 2.00 | | | |

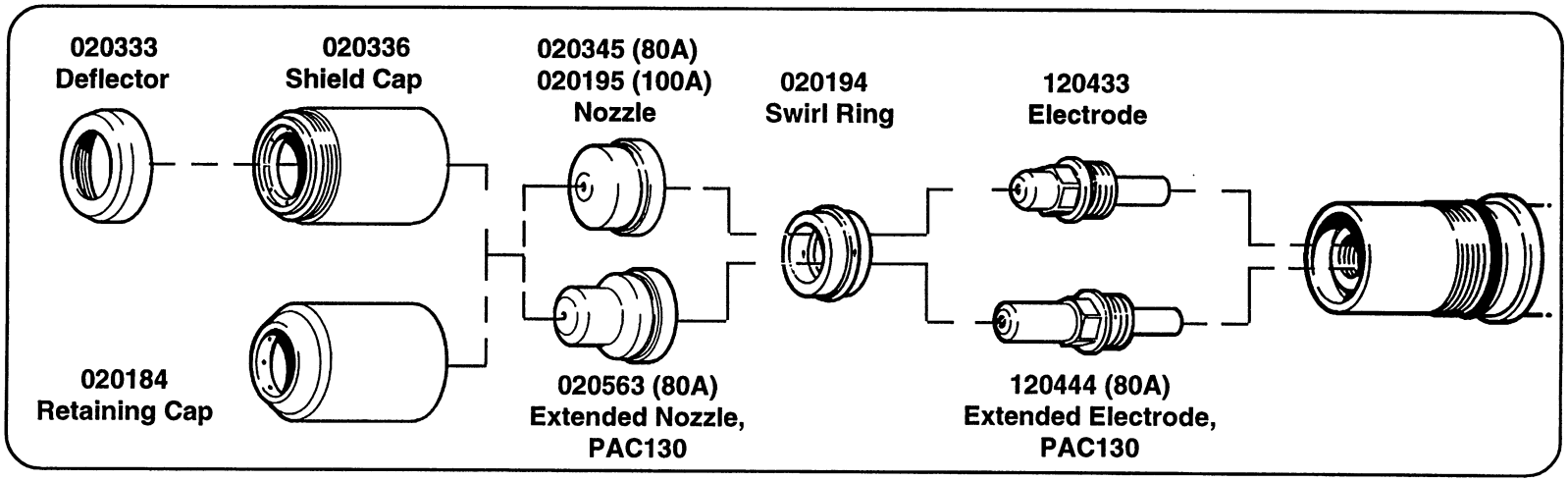
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

CUTTING

## Mild Steel Cutting

Plasma Gas: **Air**
Current Setting: **80 Amp / 100 Amp**
Consumables: **Non-Shielded**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/8 | 3 | **65*/4.5** | 1/8 | 3 | 80 | 100 | 100 | 200 | 5080 | 0.50 | **90-120/6.2-8.3** |
| 3/16 | 5 | | 1/8 | 3 | 80 | 110 | 100 | 120 | 3050 | 0.50 | |
| 1/4 | 6 | | 5/32 | 4 | 80 | 120 | 100 | 95 | 2400 | 0.75 | |
| 3/8 | 10 | | 5/32 | 4 | 100 | 115 | 80 | 55 | 1400 | 1.00 | |
| 1/2 | 13 | | 5/32 | 4 | 100 | 125 | 80 | 40 | 1000 | 1.25 | |
| 5/8 | 16 | | 3/16 | 5 | 100 | 130 | 80 | 25 | 750 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 140 | 80 | 20 | 500 | | |
| 7/8 | 22 | | 1/4 | 6 | 100 | 145 | 80 | 15 | 380 | | |
| 1 | 25 | | 1/4 | 6 | 100 | 150 | 80 | 10 | 250 | | |
| 1-1/4 | 32 | | 1/4 | 6 | 100 | 160 | 80 | 05 | 130 | | |

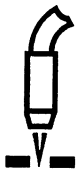
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa

* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

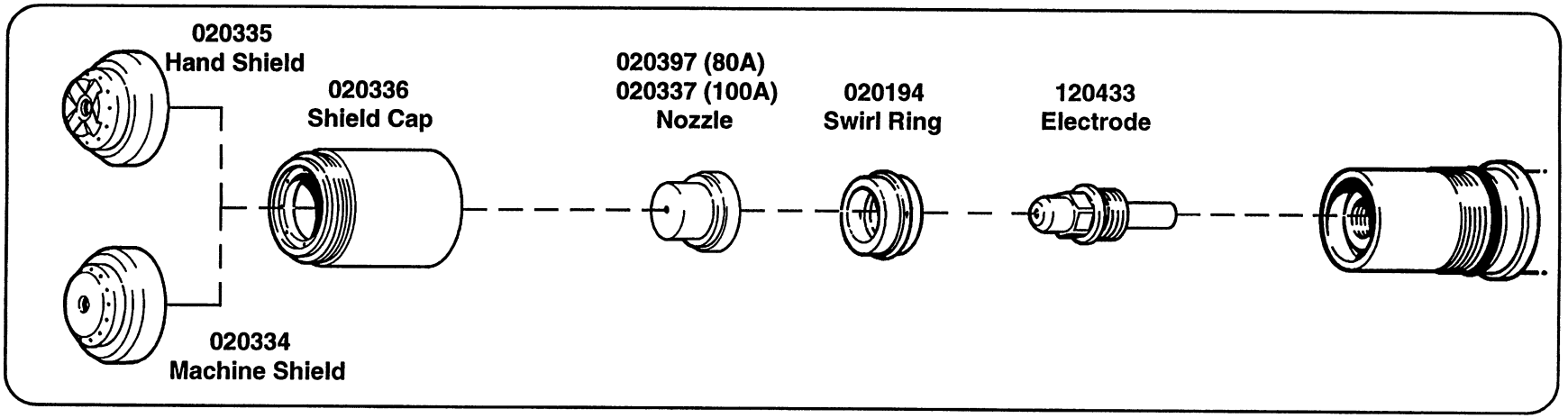
# MAX100 Machine/PAC130 Hand Torch

## Mild Steel Cutting

Plasma Gas: **Air**
Current Setting: **80 Amps / 100 Amps**
Consumables: **Shielded**



**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4 | 6 | **60*/4** | 1/8 | 3 | 80 | 130 | 100 | 90 | 2290 | 0.75 | **90-120/6.2-8.3** |
| 3/8 | 10 | | 1/8 | 3 | 100 | 125 | 80 | 50 | 1270 | 1.00 | |
| 1/2 | 13 | | 1/8 | 3 | 100 | 130 | 80 | 35 | 890 | 1.25 | |
| 5/8 | 15 | | 5/32 | 4 | 100 | 140 | 80 | 25 | 640 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 150 | 80 | 15 | 380 | | |
| 1 | 25 | | 1/4 | 6 | 100 | 160 | 80 | 10 | 250 | | |

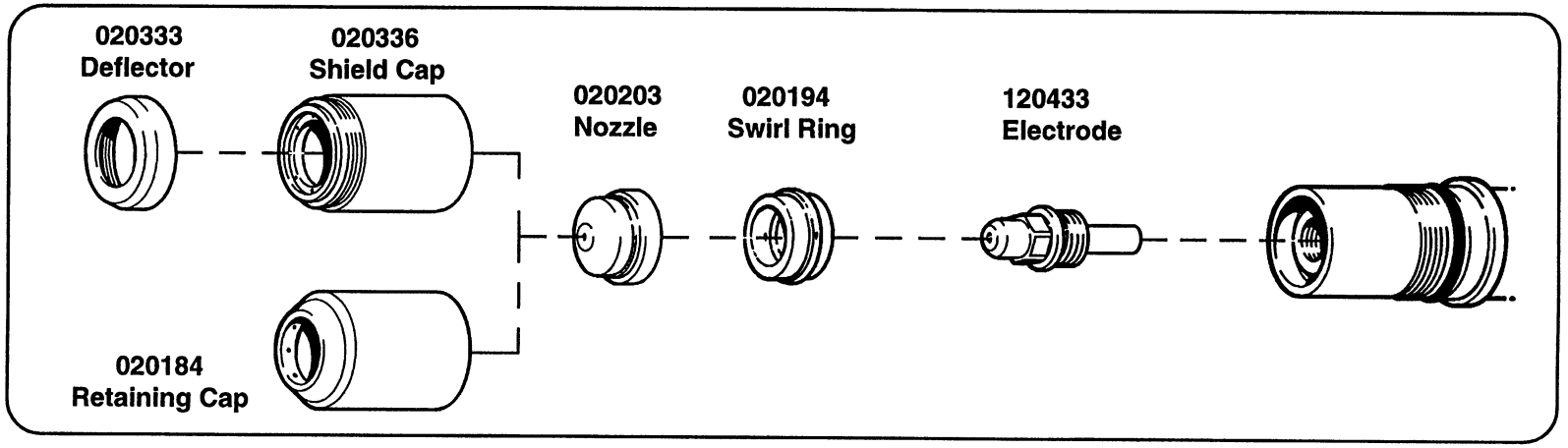
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Aluminum Cutting

Plasma Gas: **Air**
Current Setting: **40 Amp**
Consumables: **Non-Shielded**

**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Expanded Metal Travel Speed (ipm) | (mm/min) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/32 | .8 | **65*/4.5** | 5/64 | 2 | **40** | 90 | **100** | 240 | 6100 | 0.50 | 165 | 4190 | **90-120/6.2-8.3** |
| 1/16 | 1.5 | | 5/64 | 2 | | 100 | | 150 | 3800 | 0.75 | 105 | 2670 | |
| 3/32 | 2.4 | | 5/64 | 2 | | 100 | | 110 | 2790 | 1.00 | 75 | 1910 | |
| 1/8 | 3 | | 5/64 | 2 | | 105 | | 85 | 2160 | 1.00 | 60 | 1520 | |
| 1/4 | 6 | | 1/8 | 3 | | 120 | | 30 | 760 | 1.25 | | | |
| 3/8 | 10 | | 1/8 | 3 | | 125 | | 08 | 200 | 1.50 | | | |

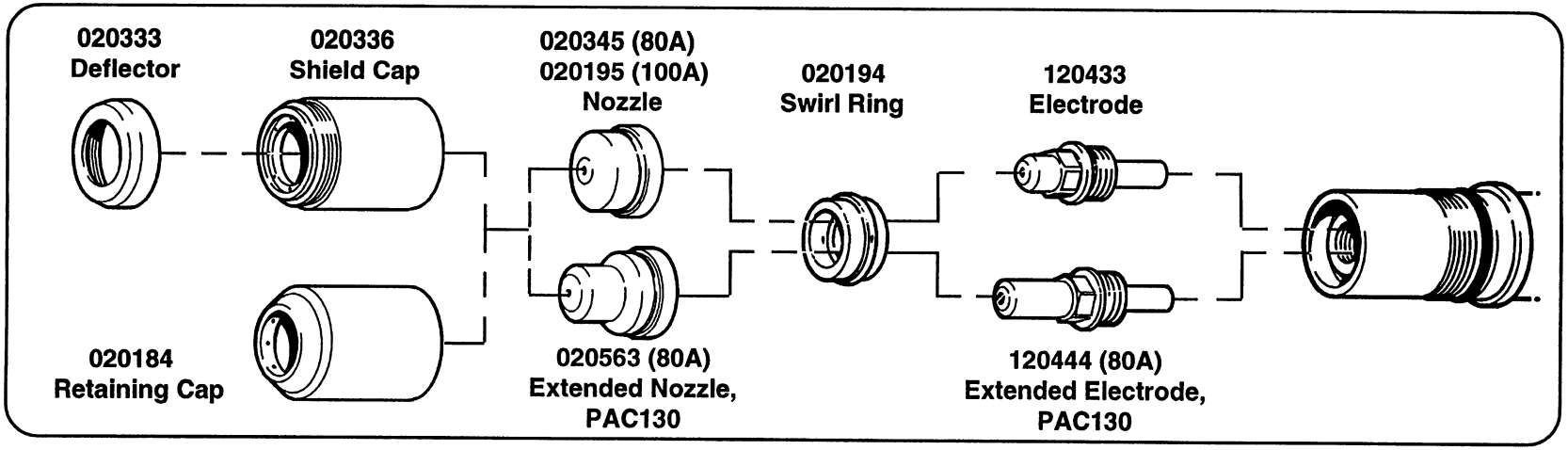
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Aluminum Cutting

Plasma Gas: **Air**
Current Setting: **80 Amp / 100 Amp**
Consumables: **Non-Shielded**

**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure In TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/8 | 3 | **65*/4.5** | 1/8 | 3 | 80 | 110 | 100 | 170 | 4320 | 0.50 | **90-120/6.2-8.3** |
| 1/4 | 6 | | 5/32 | 4 | 80 | 125 | 100 | 60 | 1500 | 0.75 | |
| 3/8 | 10 | | 5/32 | 4 | 100 | 120 | 80 | 40 | 1020 | 1.00 | |
| 1/2 | 13 | | 5/32 | 4 | 100 | 130 | 80 | 30 | 760 | 1.25 | |
| 5/8 | 15 | | 3/16 | 5 | 100 | 135 | 80 | 15 | 380 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 145 | 80 | 10 | 250 | | |
| 1 | 25 | | 1/4 | 6 | 100 | 155 | 80 | 05 | 125 | | |

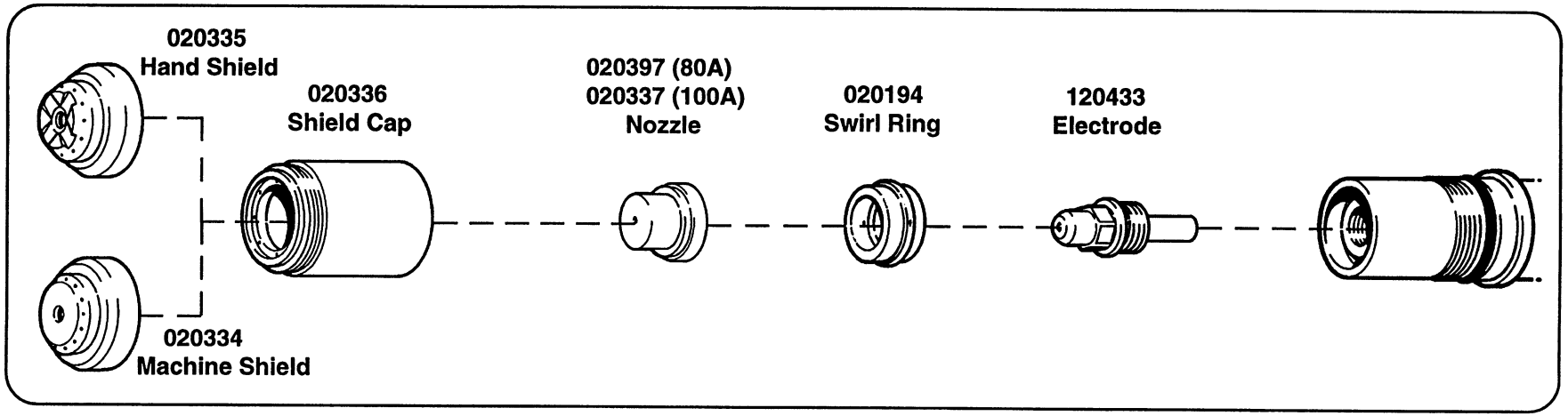
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Aluminum Cutting

Plasma Gas: **Air**
Current Setting: **80 Amp / 100 Amp**
Consumables: **Shielded**

**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure In TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4 | 6 | **60*/4** | 1/8 | 3 | 80 | 130 | 100 | 55 | 1400 | 0.75 | **90-120/6.2-8.3** |
| 3/8 | 10 | | 1/8 | 3 | 100 | 130 | 80 | 35 | 890 | 1.00 | |
| 1/2 | 13 | | 5/32 | 4 | 100 | 140 | 80 | 25 | 640 | 1.25 | |
| 5/8 | 15 | | 5/32 | 4 | 100 | 145 | 80 | 15 | 380 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 155 | 80 | 10 | 250 | | |

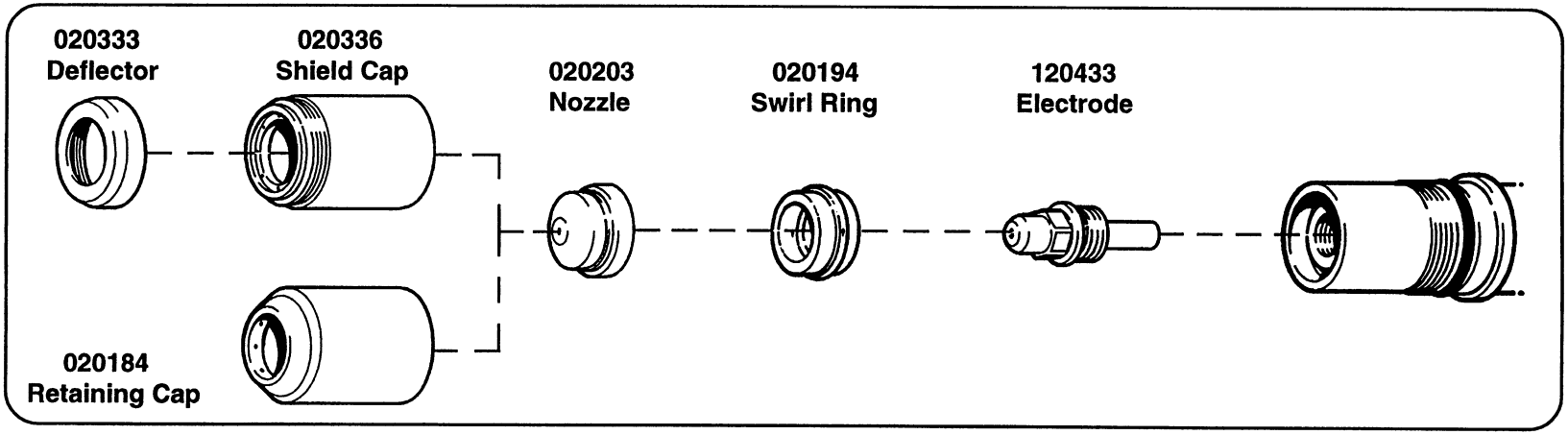
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Stainless Steel Cutting

Plasma Gas: **Air**
Current Setting: **40 Amp**
Consumables: **Non-Shielded**

**CUTTING**




| Material Thickness (inches) | (GA) (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Expanded Metal Travel Speed (ipm) | (mm/min) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (28 GA) | **65*/4.5** | 5/64 | 2 | **40** | 100 | **100** | 290 | 7400 | | 200 | 5080 | **90-120/6.2-8.3** |
| | (26 GA) | | 5/64 | 2 | | 100 | | 270 | 6860 | | 190 | 4830 | |
| | (24 GA) | | 5/64 | 2 | | 105 | | 240 | 6100 | | 170 | 4320 | |
| 1/32 | .8 | | 5/64 | 2 | | 105 | | 200 | 5080 | | 140 | 3560 | |
| | (18 GA) | | 5/64 | 2 | | 110 | | 145 | 3680 | | 100 | 2540 | |
| 1/16 | 1.5 | | 5/64 | 2 | | 110 | | 130 | 3300 | 0.50 | 90 | 2290 | |
| 1/8 | 3 | | 5/64 | 2 | | 120 | | 75 | 1910 | 1.00 | 50 | 1270 | |
| 1/4 | 6 | | 1/8 | 3 | | 130 | | 30 | 760 | 1.75 | | | |
| 3/8 | 10 | | 1/8 | 3 | | 135 | | 8 | 200 | 2.00 | | | |

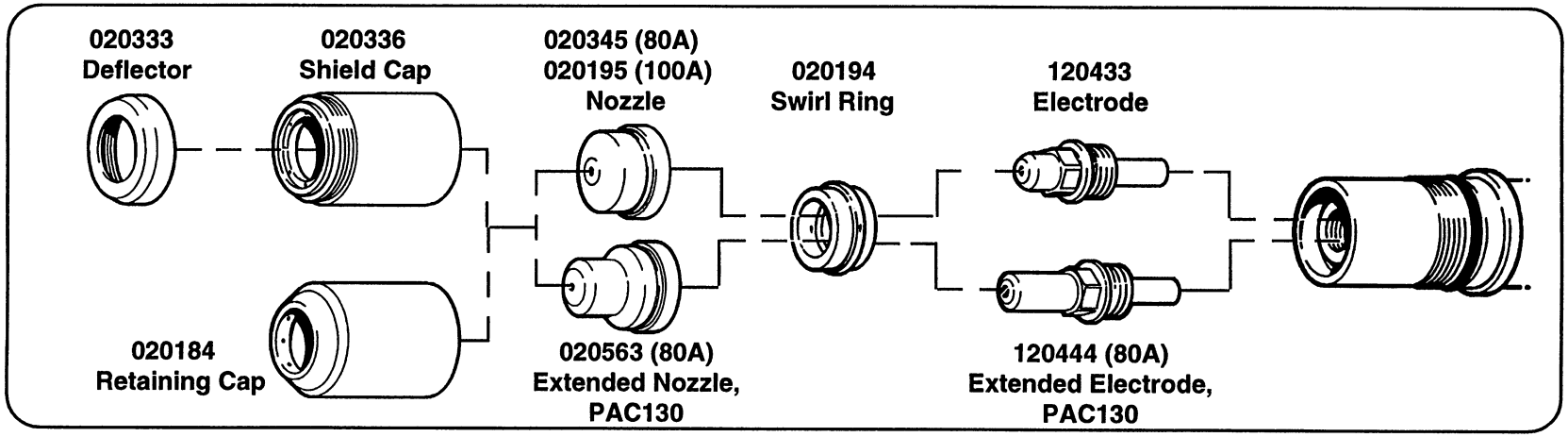
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Stainless Steel Cutting

Plasma Gas: **Air**
Current Setting: **80 Amp / 100 Amp**
Consumables: **Non-Shielded**

**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/8 | 3 | **65*/4.5** | 1/8 | 3 | 80 | 125 | 100 | 170 | 4320 | 0.50 | **90-120/6.2-8.3** |
| 1/4 | 6 | | 5/32 | 4 | 80 | 125 | 100 | 80 | 2000 | 0.75 | |
| 3/8 | 10 | | 5/32 | 4 | 100 | 130 | 80 | 45 | 1140 | 1.00 | |
| 1/2 | 13 | | 5/32 | 4 | 100 | 135 | 80 | 30 | 760 | 1.25 | |
| 5/8 | 15 | | 3/16 | 5 | 100 | 135 | 80 | 25 | 640 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 140 | 80 | 15 | 380 | | |
| 1 | 25 | | 1/4 | 6 | 100 | 145 | 80 | 10 | 250 | | |

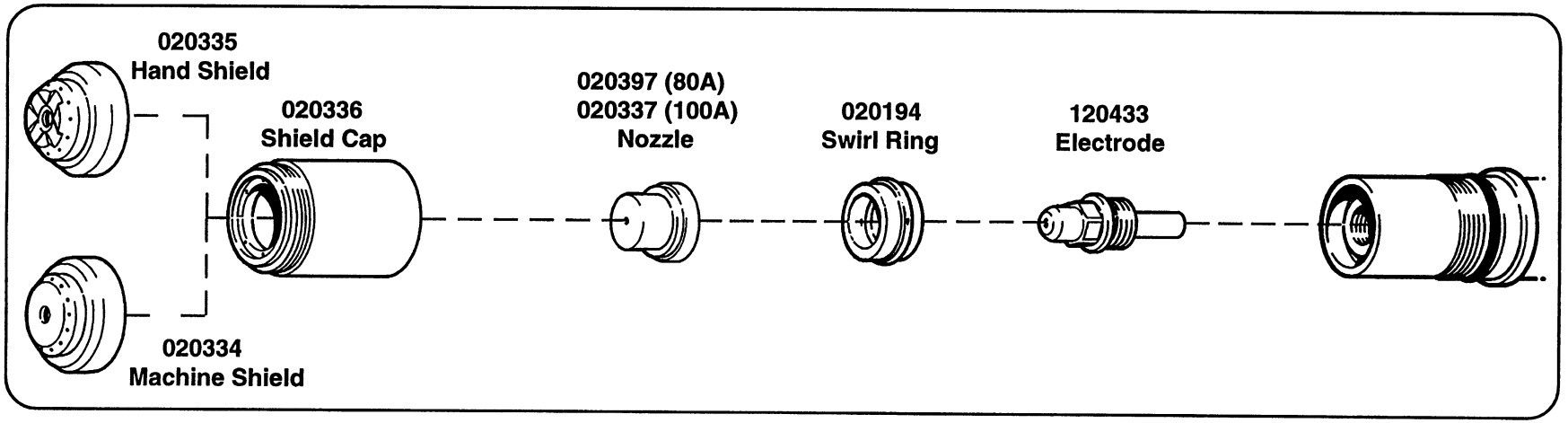
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Stainless Steel Cutting

Plasma Gas: **Air**
Current Setting: **80 Amp / 100 Amp**
Consumables: **Shielded**

**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4 | 6 | **60*/4** | 1/8 | 3 | 80 | 130 | 100 | 75 | 1910 | 0.75 | **90-120/6.2-8.3** |
| 3/8 | 10 | | 1/8 | 3 | 100 | 135 | 80 | 40 | 1020 | 1.00 | |
| 1/2 | 13 | | 1/8 | 3 | 100 | 140 | 80 | 30 | 760 | 1.25 | |
| 5/8 | 15 | | 5/32 | 4 | 100 | 140 | 80 | 20 | 510 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 145 | 80 | 15 | 380 | | |
| 1 | 25 | | 1/4 | 6 | 100 | 150 | 80 | 8 | 200 | | |

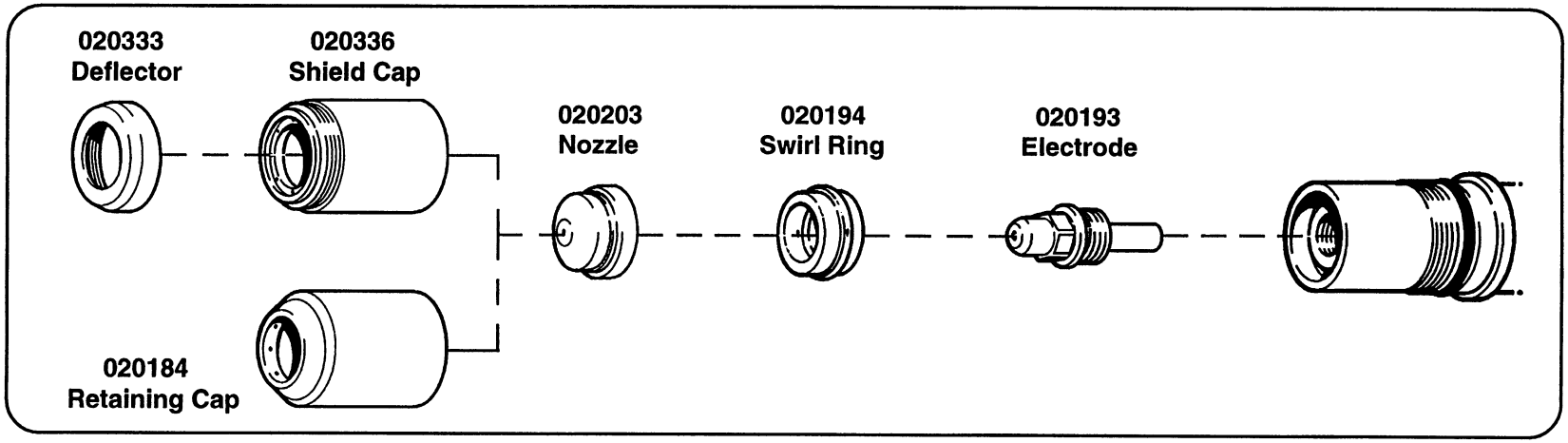
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Stainless Steel Cutting

Plasma Gas: **Nitrogen**
Current Setting: **40 Amp**
Consumables: **Non-Shielded**

**CUTTING**




| Material Thickness (inches) | (GA) (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (28 GA) | **65*/4.5** | 5/64 | 2 | **40** | 105 | **100** | 260 | 6600 | | **90-120/6.2-8.3** |
| | (26 GA) | | 5/64 | 2 | | 105 | | 240 | 6100 | | |
| | (24 GA) | | 5/64 | 2 | | 110 | | 215 | 5460 | | |
| 1/32 | 1 | | 5/64 | 2 | | 110 | | 180 | 4570 | | |
| | (18 GA) | | 5/64 | 2 | | 115 | | 130 | 3300 | | |
| 1/16 | 1.5 | | 5/64 | 2 | | 115 | | 120 | 3050 | 0.50 | |
| 1/8 | 3 | | 5/64 | 2 | | 125 | | 65 | 1650 | 1.00 | |
| 1/4 | 6 | | 1/8 | 3 | | 135 | | 25 | 640 | 1.75 | |

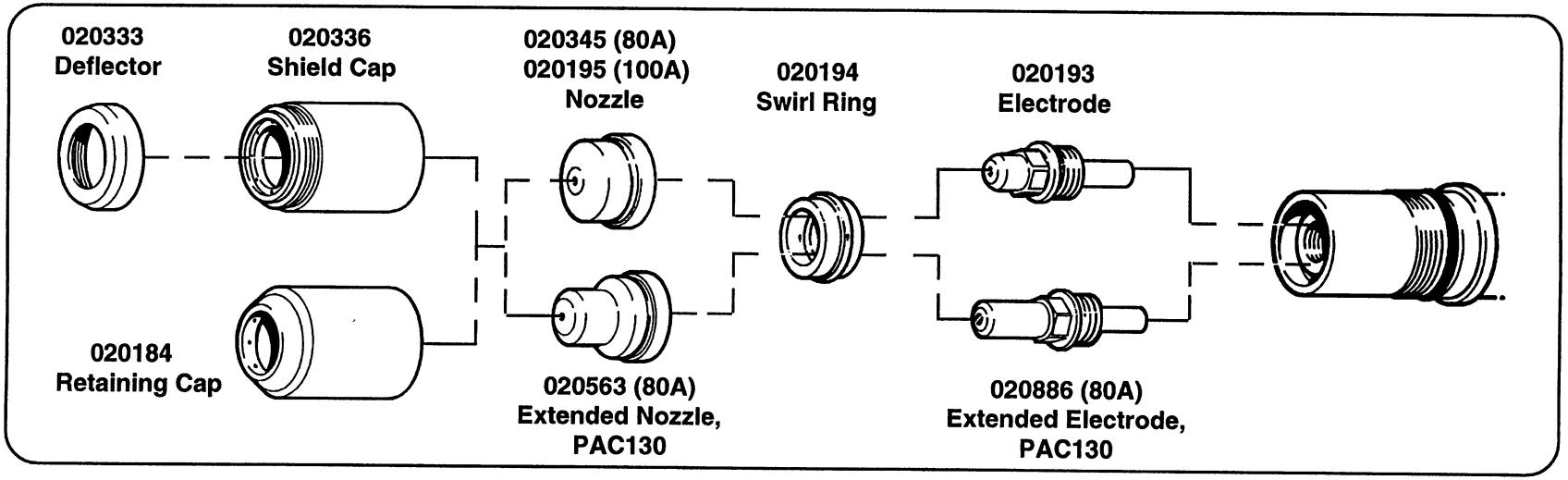
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Stainless Steel Cutting

Plasma Gas: **Nitrogen**
Current Setting: **80 Amp / 100 Amp**
Consumables: **Non-Shielded**

**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/8 | 3 | **65*/4.5** | 1/8 | 3 | 80 | 130 | 100 | 150 | 3810 | 0.50 | **90-120/6.2-8.3** |
| 1/4 | 6 | | 5/32 | 4 | 80 | 130 | 100 | 70 | 1780 | 0.75 | |
| 3/8 | 10 | | 5/32 | 4 | 100 | 135 | 80 | 40 | 1020 | 1.00 | |
| 1/2 | 13 | | 5/32 | 4 | 100 | 140 | 80 | 25 | 640 | 1.25 | |
| 5/8 | 15 | | 3/16 | 5 | 100 | 140 | 80 | 20 | 510 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 145 | 80 | 12 | 310 | | |

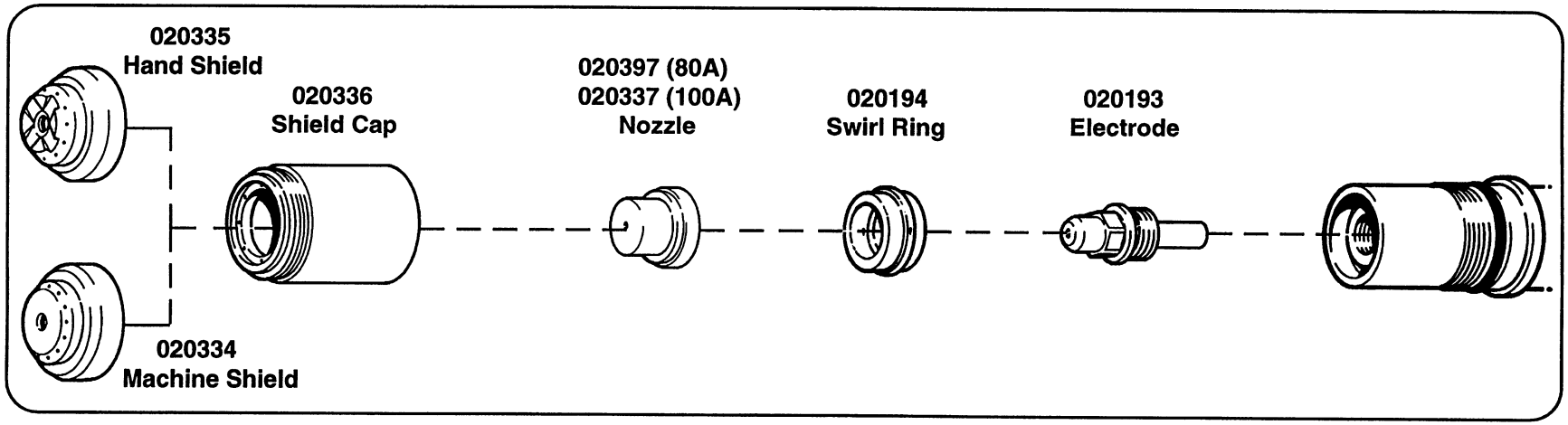
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# MAX100 Machine/PAC130 Hand Torch

## Stainless Steel Cutting

Plasma Gas: **Nitrogen**
Current Setting: **80 Amp / 100 Amp**
Consumables: **Shielded**

**CUTTING**




| Material Thickness (inches) | (mm) | Plasma Gas Pressure In TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Arc Voltage Setting (volts) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Pierce Time (sec) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4 | 6 | **60*/4** | 1/8 | 3 | 80 | 135 | 100 | 65 | 1650 | 0.75 | **90-120/6.2-8.3** |
| 3/8 | 10 | | 1/8 | 3 | 100 | 140 | 80 | 35 | 890 | 1.00 | |
| 1/2 | 13 | | 1/8 | 3 | 100 | 145 | 80 | 25 | 640 | 1.25 | |
| 5/8 | 15 | | 5/32 | 4 | 100 | 145 | 80 | 15 | 380 | 1.50 | |
| 3/4 | 19 | | 3/16 | 5 | 100 | 150 | 80 | 12 | 310 | | |

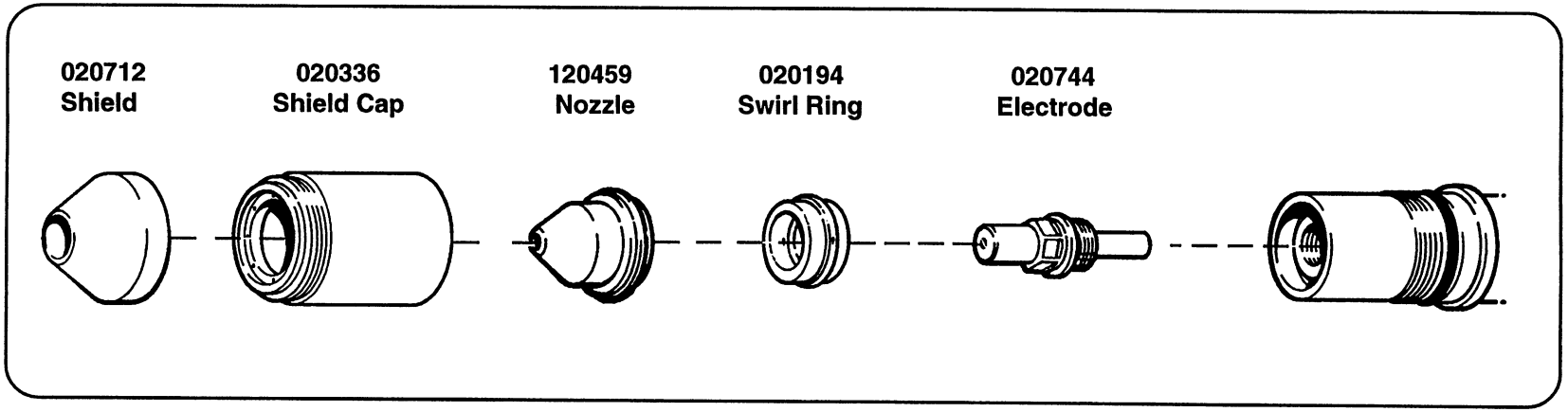
1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# PAC130 Hand Torch

## Mild Steel Gouging

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

**GOUGING**




| Torch-to-work Angle of inclination Θ (Degrees) | Plasma Gas Pressure in TEST (psi/bar) | Torch-to-work Distance (inches) | (mm) | Arc Current Setting (amps) | Duty Cycle (%) | Normal Plate Travel Speed (ipm) | (mm/min) | Plasma Gas (Air) Inlet Pressure (psi/bar) |
|---|---|---|---|---|---|---|---|---|
| 40-45° | 50*/3.4 | 1/16 | 1.5 | 100 | 80 | 15 | 380 | 90-120/6.2-8.3 |

1 inch = 25.4 mm; 1 psi = .0689 bar = 6.895 KPa
* Plasma Gas Pressure setting is for **25-ft.** (7.6 m) leads. Add **5 psi** (.34 bar) for **50-ft** (15 m) leads. Add **10 psi** (.7 bar) for **75-ft.** (23 m) leads.

# Section 5 MAINTENANCE

In this section:

# INTRODUCTION

The MAX100, 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 MAX100 system, and will provide guides to troubleshoot problems that may occur during operation. The intent of this section is to isolate a problem 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, maintenance personnel must perform all testing with safety in mind. Read and 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.

MAINTENANCE

**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 maintenance under normal use and conditions. The routine maintenance suggestions in this section will allow the operator to keep the system in peak operating condition.

## Torch and Torch Leads

Inspect the torch and torch leads on a regular basis:

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

- The torch leads should be checked occasionally for cracking or other damage.

## Power Supply

Inspect the power supply on a regular basis:

- Check the exterior for any damage that might affect safe operation of the power supply.

- Remove the power supply cover and inspect the interior. Check wiring harnesses and connections for wear or damage. Check for loose connections and areas of discoloration which may indicate overheating.

- Clean the power supply periodically: use compressed air to blow dust and dirt that may have accumulated inside the unit. In an excessively dirty environment, do this weekly.

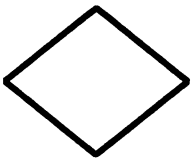
# SEQUENCE OF EVENTS

On the following pages is a detailed flow chart outlining the sequence of events during proper MAX100 operation with a hand or machine torch. Shaded boxes represent action taken by the operator.

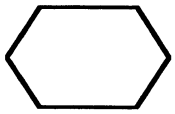
The following symbols used in the flowchart are ANSI standard flowcharting symbols. Their names and definitions are as follows:

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

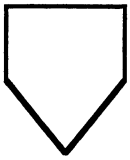
**Task/Process Box** The process or task box is used to indicate any process or task other than an input/output operation or a decision.



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

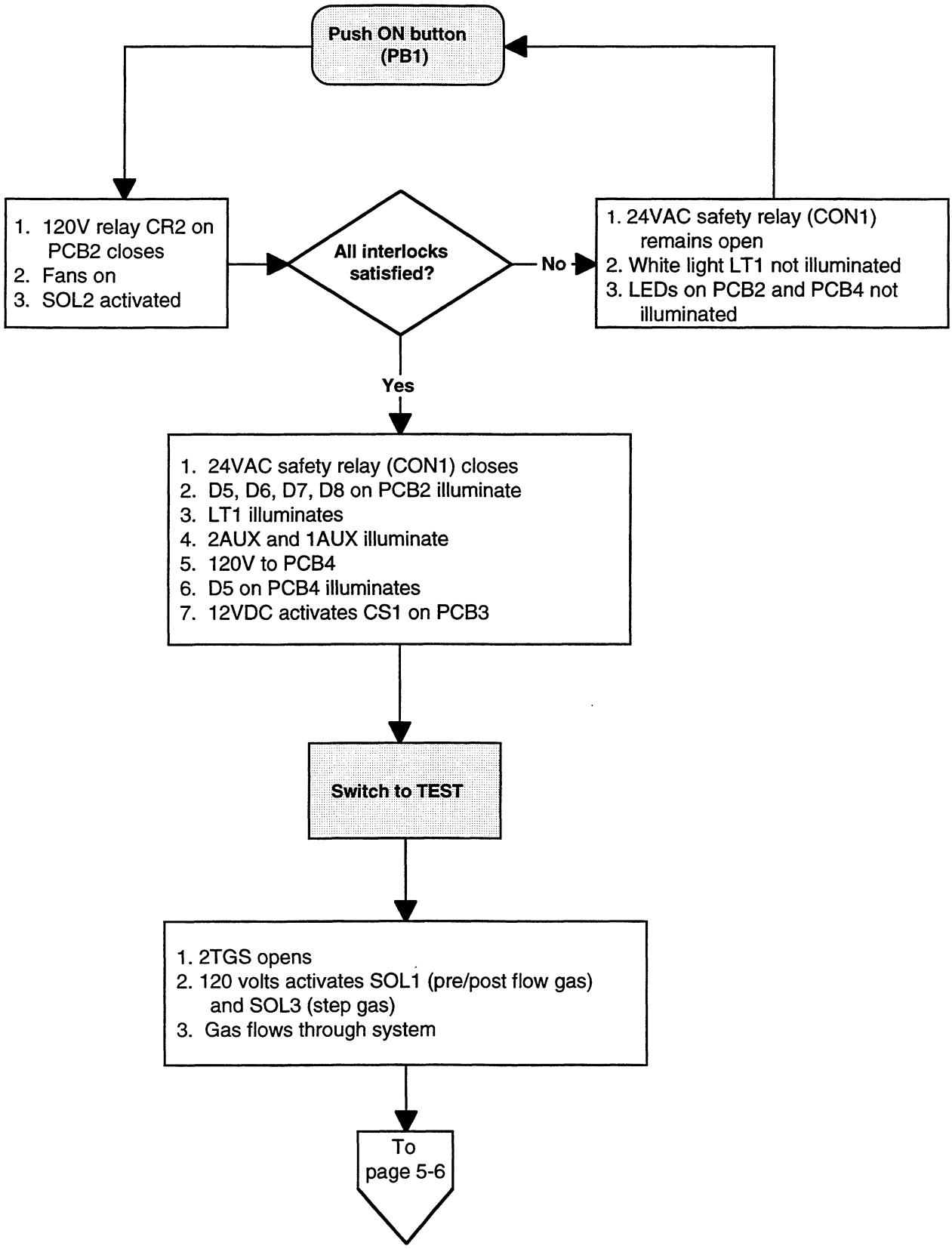


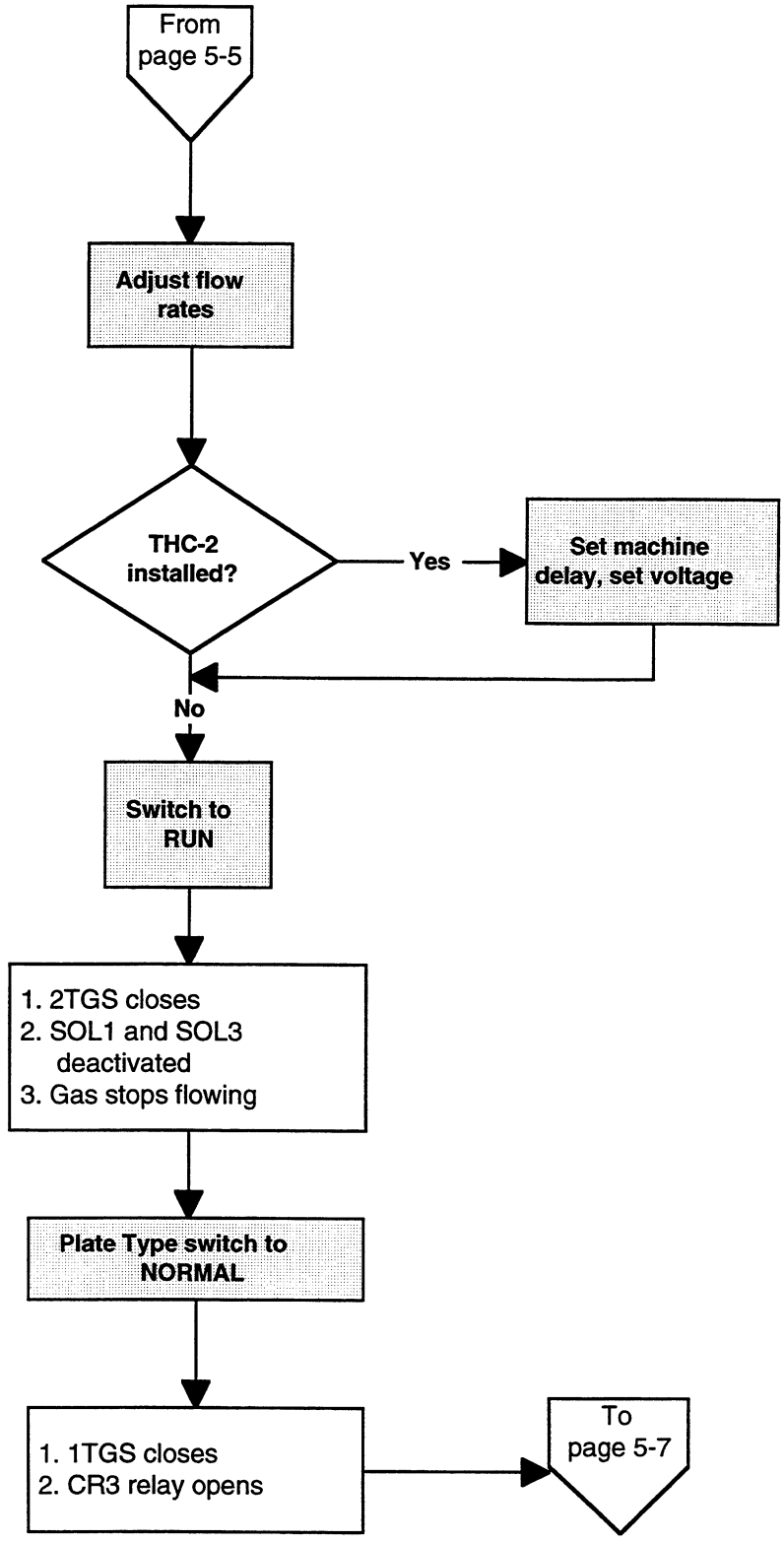
**Preparation** The preparation symbol is used to indicate an instruction modification.

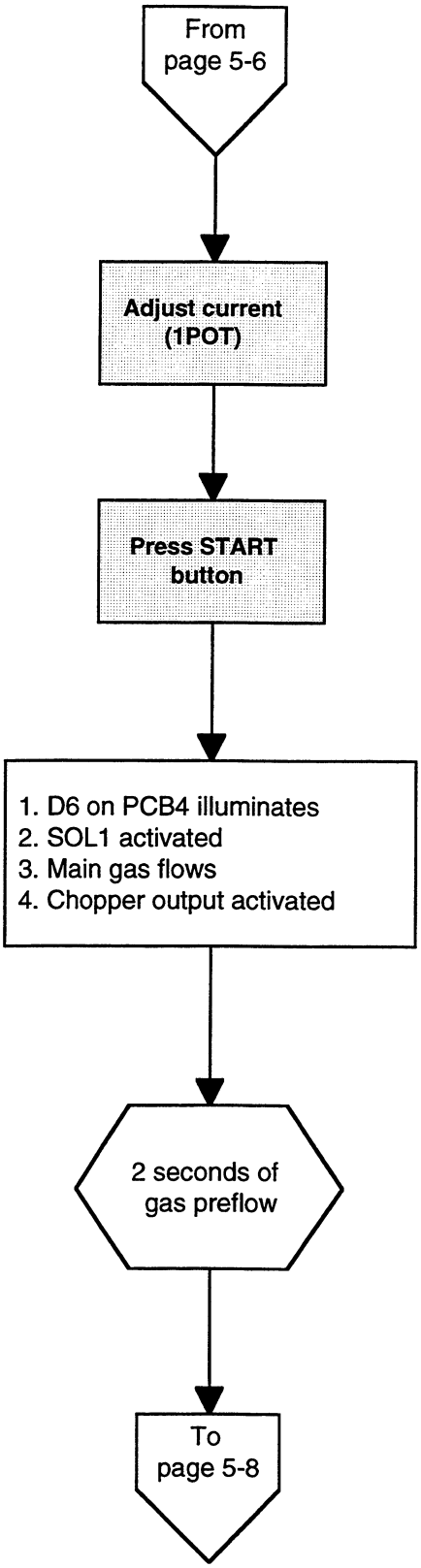


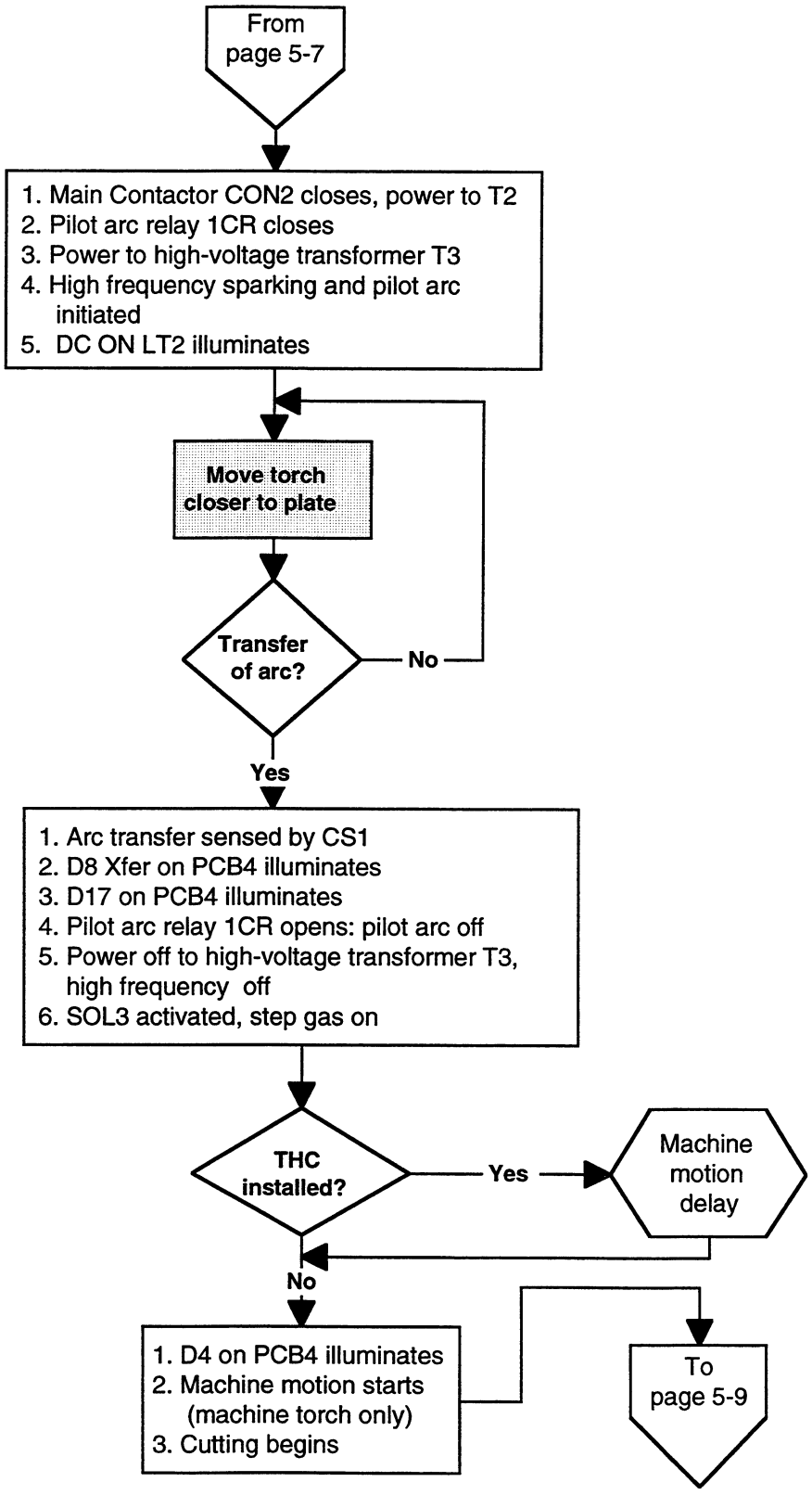
**Off-page Connector** The off-page connector is used to indicate exit or entry from another page to the flowchart.

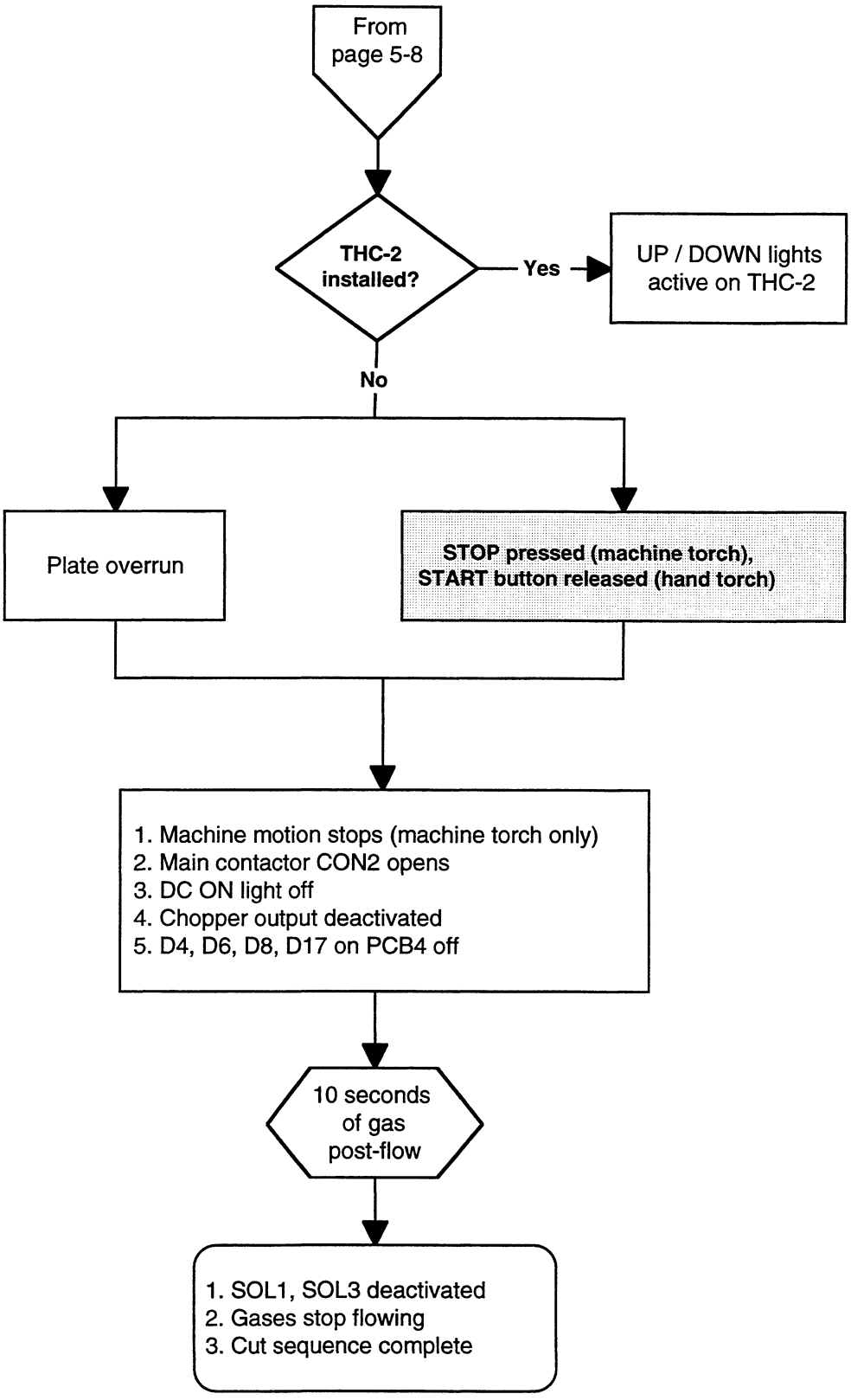
MAINTENANCE


Push ON button (PB1)
1. 120V relay CR2 on PCB2 closes
2. Fans on
3. SOL2 activated
All interlocks satisfied?
No
1. 24VAC safety relay (CON1) remains open
2. White light LT1 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. LT1 illuminates
4. 2AUX and 1AUX illuminate
5. 120V to PCB4
6. D5 on PCB4 illuminates
7. 12VDC activates CS1 on PCB3
Switch to TEST
1. 2TGS opens
2. 120 volts activates SOL1 (pre/post flow gas) and SOL3 (step gas)
3. Gas flows 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
1. 2TGS closes
2. SOL1 and SOL3 deactivated
3. Gas stops flowing
Plate Type switch to NORMAL
1. 1TGS closes
2. CR3 relay opens
To page 5-7


From
page 5-6
Adjust current
(1POT)
Press START
button
1. D6 on PCB4 illuminates
2. SOL1 activated
3. Main gas flows
4. 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 1CR 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 1CR opens: pilot arc off
5. Power off to high-voltage transformer T3, high frequency off
6. SOL3 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 light off
4. Chopper output deactivated
5. D4, D6, D8, D17 on PCB4 off
10 seconds of gas post-flow
1. SOL1, SOL3 deactivated
2. Gases stop flowing
3. Cut sequence complete

## INITIAL CHECKS

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

**WARNING**

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

1. Disconnect line power by turning main disconnect switch off.
2. Using a Phillips head screwdriver, remove top plate, two side plates, front plate and rear plate.
3. Inspect interior of unit for discoloration on pc boards, or other apparent damage. If a component or module is obviously defective upon visual inspection, remove and replace it before doing any testing. Refer to the **Parts List** section (**6**) to identify parts and part numbers.
4. If no damage is apparent, apply power by turning on the main disconnect switch.
5. Measure the voltage at **CON1** between **L1, L2** and **L3**. See Figure 5-1 for location of CON1 . The voltage between any two of the three points at CON1 should be equal to your 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.

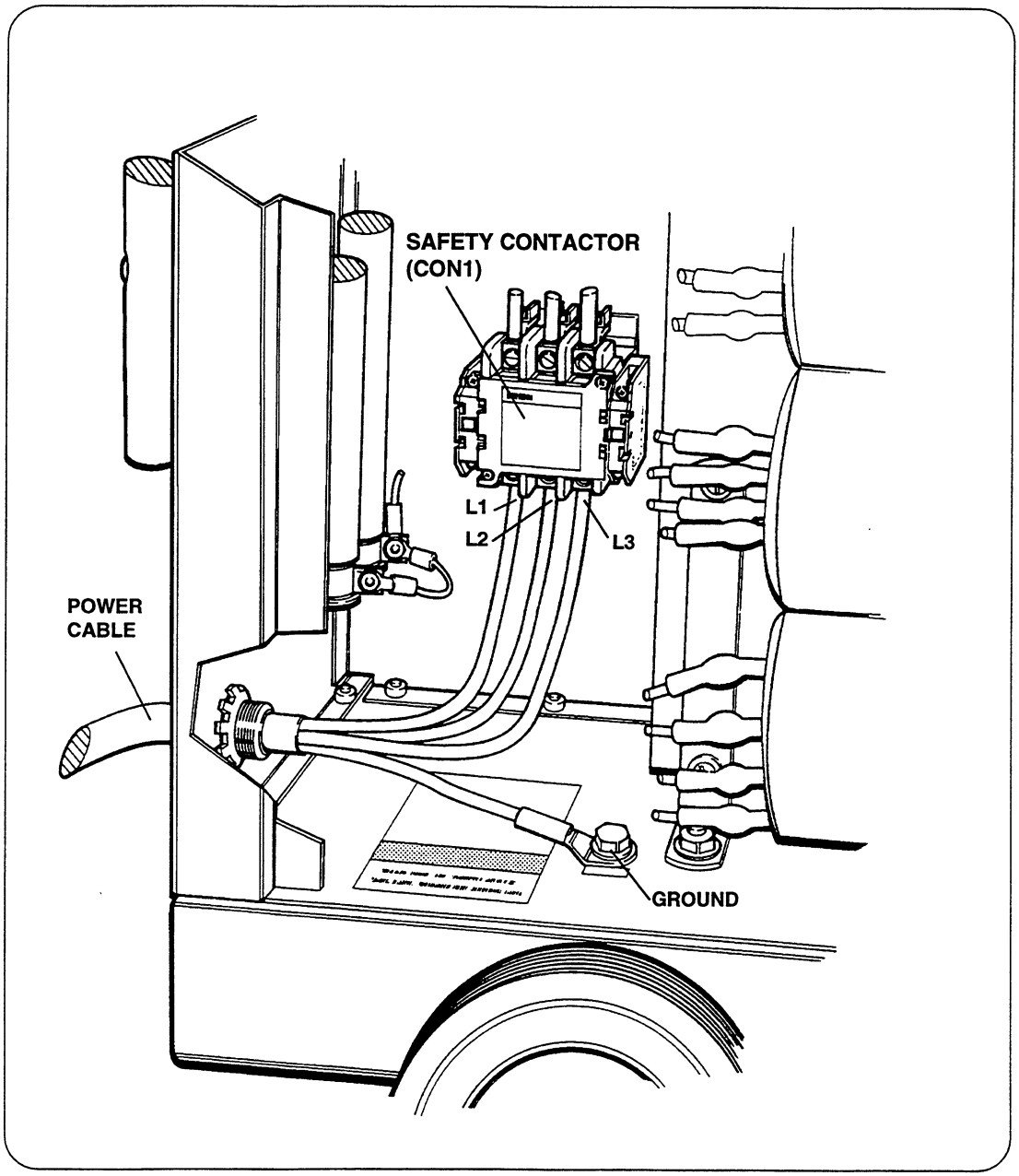



**Figure 5-1 Primary Power Measurement Location - MAX100**

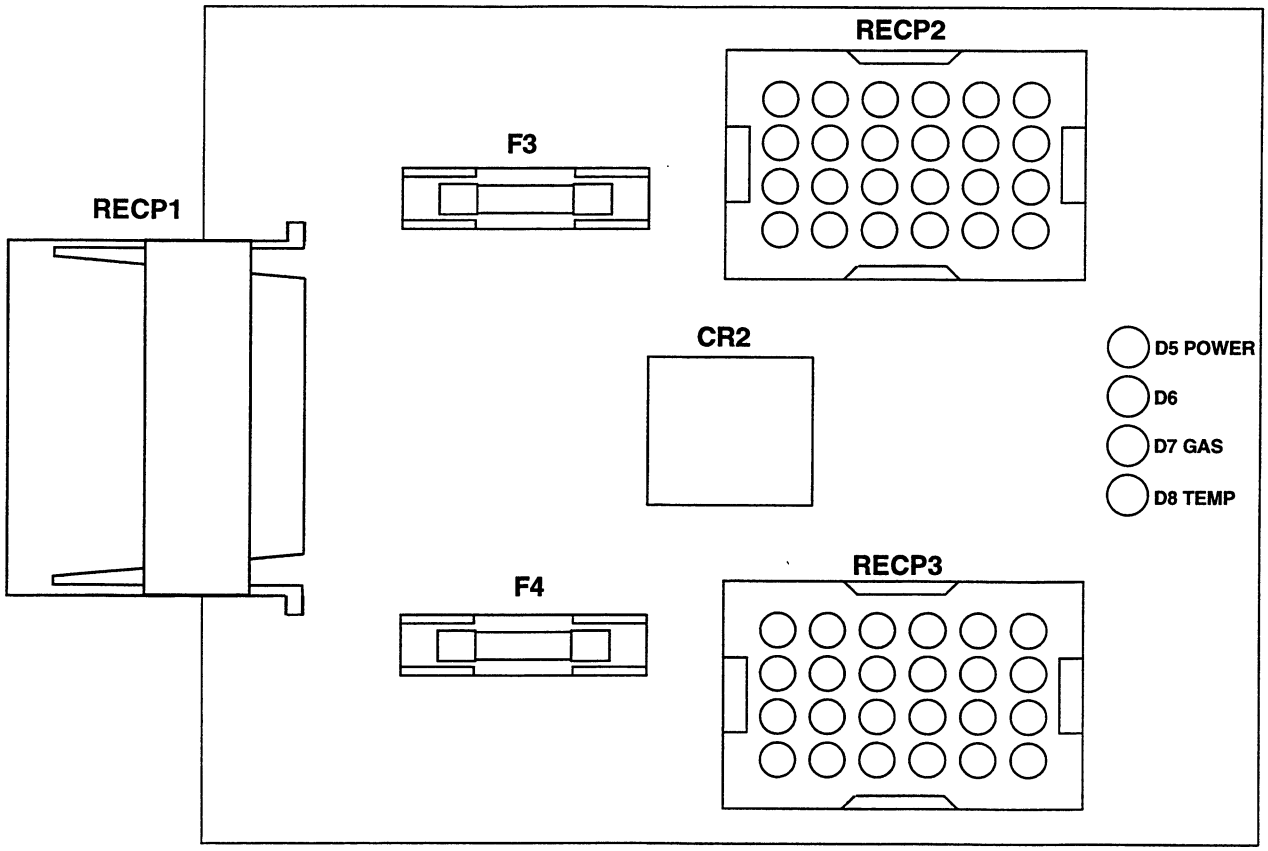



**Figure 5-2 Power Distribution Board PCB2**

6. Measure voltage at Power Distribution Board PCB2. Refer to Figure 5-2 for detail of PCB2. Look on the board for fuses **F3** and **F4**. Measurements between each fuse and chassis ground should be as follows:

   F3: 115 VAC
   F4: 24 VAC

   If voltages are not present, or incorrect at one or more of these points, disconnect power and troubleshoot PCB2 fuses and associated pins, connectors and wiring between power distribution board connector RECP1 and transformer secondary T1. See Figure 6-3 for location of T1.

   Also, check main power fuses F1 and F2 (located in Figure 6-3), 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 ON indicator does not illuminate.** | **1.1.** *The green ON (1) PB1 pushbutton is defective.* Check switch. The ON switch is normally open.<br><br>**1.2.** *The red OFF (0) PB2 pushbutton is defective.* Check switch. The OFF switch is normally closed.<br><br>**1.3.** *Associated wiring not making good contact.* Check wiring and repair or replace, if necessary. |
| 2. **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.<br><br>**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.** *Pushbutton PB1 was not held down long enough.* Press and hold PB1 for a minimum of 5 seconds.<br><br>**3.2.** *Safety relay CON1 is defective.* Check that CON1 switches after ON pushbutton is pressed. If CON1 is defective, replace it.<br><br>**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 not illuminated. The topmost LED that is not illuminated is the first problem that must be corrected. The following is a guide to troubleshooting the cause of extinguished LEDs. See Figure 5-2 for reference. |
| **3a. D5 POWER LED not illuminated:** | **3a.1.** *No jumper between pins 15 and 16 of PL3.* Check for continuity between pins 15 and 16 of PL3. Repair and/or replace defective component(s). |
| **3b. D6 LED not illuminated:** | **3b.1.** *No jumper between pins 19 and 20 of PL3* Check for continuity between pins 19 and 20 of PL3. Repair and/or replace defective component(s). |
| **3c. D7 GAS LED not illuminated:** | **3c.1.** *Gas is not on or is set too low.* Be certain that the plasma supply gas is on and is set at a minimum of **90 psi (6.2 bar)**.<br><br>**3c.2.** *There is a gas leak somewhere in the system.* Be certain that there is no hissing sound coming from the torch, or anywhere between the torch and the gas supply.<br><br>**3c.3.** *Pressure switch PS1 not functioning.* PS1 is normally open, and closes when gas pressure of **40 psi (2.7 bar)** or greater is sensed. It is powered by 24VAC from the Power Distribution Board. After PS1 is closed, 24VAC illuminates the D7 GAS LED. Use wiring diagram in **Section 7** to troubleshoot. |

| Problem | Possible Causes and Solutions |
|---|---|
| **3d. D8 TEMP LED not illuminated.** | **3d.1.** *Main Transformer T2 is overheating*<br>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 D8 LED when the transformer overheats.<br>If transformer T2 is excessively hot, turn the MAX100 off for one hour to cool down.<br>If transformer is <u>not</u> hot, take TS1 connector apart and check for continuity. TS1 is normally closed.<br>Check pins, connectors and associated wiring from TS1 to PL3 of power distribution board PCB2. |

**Switch to TEST**

| Problem | Possible Causes and Solutions |
|---|---|
| **4. Gas flow is weak, or not flowing.** | **4.1.** *TEST/RUN switch not functioning*<br>2TGS is open in TEST mode. Make a continuity check.<br><br>**4.2.** *GAS adjustment valve is closed*<br>Open gas valve on front panel.<br><br>**4.3.** *Solenoid valves SOL1 and/or SOL3 not getting 120VAC from Control Board PCB4.*<br>On PCB4, check to see if D5 is illuminated. See Figure 5-6 for location of D5. If LED is not illuminated, check pins, connectors and associated wiring from PL2 of Power Distribution Board to PL5 and S1 of Control Board PCB4.<br>If D5 is illuminated, disconnect receptacles from SOL1 and SOL3, and check for 120VAC from Control Board PCB4 after 2TGS is in the TEST position. See Figure 6-2 for location of SOL1 and SOL3.<br>If there is <u>no</u> 120VAC use wiring diagram and check pins, connections and associated wiring from SOL1 and SOL3 to PCB4. If wiring is O.K., replace Control Board PCB4.<br><br>**4.4.** *Solenoid valves SOL1 and/or SOL3 not functioning*<br>If valves are getting 120VAC from PCB4, verify that valves are opening. If not, replace them. |

| Problem | Possible Causes and Solutions |
|---|---|
| | **4.5.** *Gas line(s) from solenoid valves to gas adjustment valve to torch are blocked or leaking.*<br>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 Charts** | **5.1.** *Source gas pressure not on or set too low*<br>Set incoming pressure to a minimum of **90 psi (6.2 bar)** at **440 scfh (208 liters/minute).**<br><br>**5.2.** *Gas line(s) from solenoid valves to gas adjustment valve to torch are blocked or leaking*<br>Check hoses and repair or replace if necessary. |

**Switch to RUN**

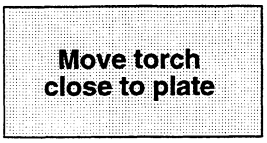
| Problem | Possible Causes and Solutions |
|---|---|
| 6. **Gas continues to flow** | **6.1.** *TEST/RUN switch not functioning*<br>2TGS is closed in RUN mode. Make a continuity check.<br><br>**6.2.** *Solenoid valves SOL1 and/or SOL3 not getting 0VAC from Control Board PCB4.*<br>Disconnect receptacles from SOL1 and SOL3, and check for 0VAC from Control Board PCB4 after 2TGS is in the RUN position. See Figure 6-2 for location of SOL1 and SOL3. If there is 120VAC replace Control Board PCB4.<br><br>**6.3.** *Solenoid valves SOL1 and/or SOL3 not functioning*<br>If valves are getting 0VAC from PCB4, verify that valves are opening correctly. If not, replace them. |

**Press START button**

| Problem | Possible Causes and Solutions |
|---|---|
| **7. 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*<br>Clean (with emery cloth), align, and/or regap (.020" (0.5 mm) per gap) the electrodes, if necessary. Ensure that the electrode surfaces between the gaps are flat. If surfaces are rounded, replace and regap. See Figure 6-2 for location of spark gap assembly SG1.<br><br>**7.2.** *High voltage transformer T3 is overheating*<br>Check T3 for leaking or overheating. Replace, if necessary.<br><br>**7.3.** *High voltage transformer T3 not getting 120VAC from Control Board PCB4*<br>Check pins, connectors and associated wiring from T3 to PCB4.<br><br>**7.4.** *T3 or capacitor pair 4CAP, 5CAP in spark gap assembly defective*<br>Shut down system and remove capacitors 4CAP, 5CAP (see Figure 6-2 for location). 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 4CAP, 5CAP. Always replace the capacitors in pairs.<br><br>**7.5.** *There is no high frequency at the torch*<br>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.<br><br>**7.6.** *Pilot arc relay CR1 is not functioning or not getting 120VAC from the Control Board PCB4*<br>See if the CR1 relay contacts close after the START command is given. If CR1 does <u>not</u> close, check to see if CR1 is getting 120VAC from PCB4. If it is, replace CR1. If there is no 120VAC from pins 5&6 of S2 of PCB4, replace Control Board PCB4. |
| **8. There is high frequency, but there is no pilot arc.** | **8.1.** *Torch parts are worn*<br>Check consumable parts and replace, if necessary. See *Changing Consumable Parts* in **Section 4**. |

MAINTENANCE

| Problem | Possible Causes and Solutions |
|---|---|
| | **8.2.** *Torch leads are loose or worn*<br>Replace torch leads as required.<br><br>**8.3.** *Pilot arc relay CR1 not functioning*<br>See solution 7.6.<br><br>**8.4.** *Main contactor CON2 or PCB4 is defective*<br>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.<br>If there is 24VAC at CON2 after START command is given, measure for 200VAC between terminals A, B and C of main transformer T2. If there is no voltage between these points, replace CON2.<br><br>**8.5.** Surge injection circuit is defective.<br>Check capacitor C3 and resistor R3. Replace as required. See Figure 6-3 for location of C3 and R3.<br><br>**8.6.** *Chopper defective or not functioning.*<br>See *Chopper Module Test Procedure* later in this section to troubleshoot. |
| **9. The DC indicator does not illuminate.** | **9.1.** *The torch start button is defective (on hand-torch system)*<br>*The interface between the machine START button and the MAX100 power supply is wrong or defective (on machine-torch system)*<br>Check to see if D6 on PCB4 illuminates when START command is given. If D6 does not illuminate, use wiring diagram and check wiring from:<br>• **On Hand-Torch system:** Torch start button (normally open) to TB1 to I/O PCB3 to S1 of PCB4.<br>• **On Machine-Torch system:** Cutting machine switch (normally open) to TB1 to I/O PCB3 to S1 of PCB4.<br>Repair and/or replace defective component(s), if necessary.<br><br>**9.2.** *Control Board PCB4 or LT2 bulb is defective.*<br>Monitor across terminals of LT2 with an AC voltmeter. Press START. Voltage between these points should read 24VAC. If there is no 24VAC, use the wiring diagram and check wires and connectors from LT2 to PCB4. Repair and/or replace defective component(s), if necessary. If wiring is OK, replace PCB4.<br>If there is 24VAC at LT2 after START is pressed, replace bulb LT2. |




| Problem | Possible Causes and Solutions |
|---|---|
| **10. Arc not transferring to workpiece** | **10.1.** *The work clamp is not connected or it is broken.* Connect or repair the work clamp.<br><br>**10.2.** *Torch Height Control receiving incorrect voltage for correct standoff distance (for machine torches with THC)* Check the arc voltage setting for the type and thickness of metal you are cutting from the *Cut Charts* in **Section 4**.<br><br>**10.3.** *Transfer of arc not sensed by MAX100* See *Arc Transfer Test Procedure* later in this section.<br><br>**10.4.** *Chopper defective or not functioning* See *Chopper Module Test Procedure* later in this section. |
| **11. The unit stops cutting during cut, or cuts poorly.** | **11.1.** *There is insufficient air or gas pressure* Check that gas inlet pressure is at least **90 psi (6.2 bar)**. Check plasma gas pressures in TEST mode as specified under *Cut Charts* in the **Section 4**.<br><br>**11.2.** *Torch is getting insufficient current* Check the arc current setting for the type and thickness of metal you are cutting from the *Cut Charts* in **Section 4**.<br><br>**11.3.** *Torch consumable parts are worn* Check consumables and replace if necessary. See *Changing Consumable Parts* in **Section 4.**<br><br>**11.4.** *Plate Type switch is in the Expanded position* When cutting most metals, place the Plate Type switch in the Normal position. Switch to Expanded position only when cutting metal grate (see *Description of Controls* and *Operating Instructions* in **Section 4**).<br><br>**11.5.** *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 troubleshooting section **(3a-3d)**.<br><br>**11.6.** *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 |
|---|---|
| **12. DC light (LT2) remains on. / Machine motion continues (machine torch only)** | **12.1.** *Defective or miswired machine START switch*<br>Check switch and wiring diagrams for correct hookup of PLASMA START and MACHINE START.<br><br>**12.2.** *Arc transfer signal not changing*<br>Check to see if D8 on Control Board PCB4 remains illuminated after torch moves away from plate. See Figure 5-6 for location of D8.<br>• If D8 remains illuminated, check to see if Hall effect sensor CS1 is sending a 0 volt signal to pin 14 of S2 of PCB4. If there is 0 volts at pin 14, replace sensor CS1. See Figure 6-2 for location of CS1. If voltage at pin 14 is greater than 0 volts, replace Control Board PCB4.<br>• If D8 is extinguised, replace Control Board PCB4. |
| **13. Gas continues to flow after 10 seconds** | **13.1.** *Gas TEST/RUN switch is in the TEST position*<br>Be certain that Gas switch is in the RUN position when cutting. |
| **14. No post-flow of gas** | **14.1.** *Defective Control Board PCB4*<br>See step 4.3. If valves are working in TEST mode, but not in post-flow mode, replace Control Board PCB4.<br><br>**14.2.** *Defective valves*<br>See step 4.4. |
| **15. Short torch consumables life** | **15.1.** *Plate Type is in the Expanded position*<br>Plate Type switch should be in the Expanded position only when cutting metal grate (expanded metal).<br><br>**15.2.** *Pilot arc relay CR1 not opening after transfer of arc*<br>Check to see if contacts on relay CR1 are stuck shut. Replace if necessary.<br><br>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. |

**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 PL4 (small 3-pin connector) from CS1 (see Figure 6-2 for location of CS1) and check for +12VDC between pins 2&3. 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 O.K., replace Control Board PCB4.

5. If there is +12VDC between pins 2&3 of PL4, 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 (#029202).

## TEST PROCEDURES (Cont.)

### Chopper Module Test Procedure

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

**WARNING**

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

1. Turn all power to the MAX100 OFF.
   Disconnect terminals labeled 21&22 from their mating receptacles to disable the high frequency transformer. Terminals 21&22 are located near the high voltage transformer T3. See Fig. 6-2 for location of T3.

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

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

4. Turn power to the MAX100 ON, and start system up. After the START command has been given, check voltage. The input to the chopper at these points should be about +280 VDC. If the input is OK and F5 was blown, replace the chopper module.
   If there is no +280 VDC input, check input to bridge for shorts. Also, check 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 illuminated. If LED1 is extinguished, 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.

MAINTENANCE

Also check to see if LED3 is turning green when enabled (normal condition). If LED1 is illuminated and LED3 is red when enabled (fault condition), then make sure that JP9 is seated properly. 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.

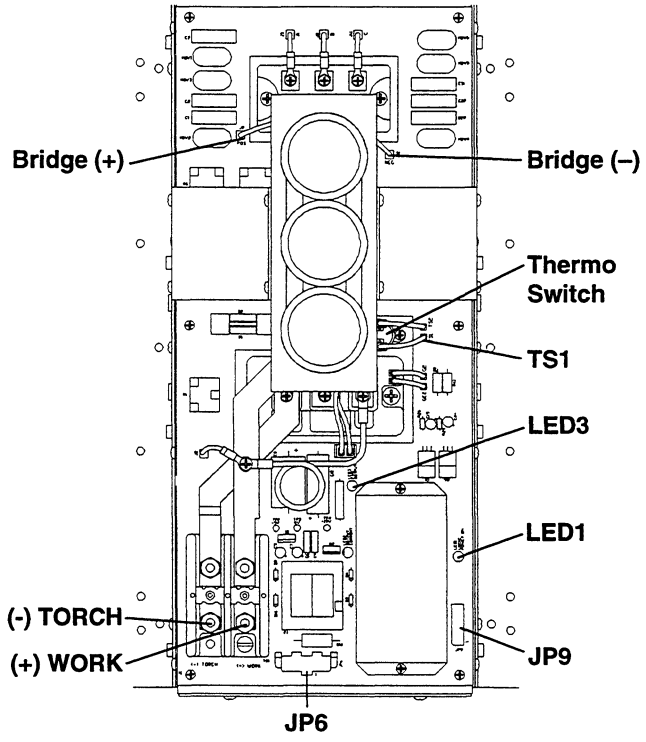



**Figure 5-3 Chopper Module - Front View**

# DISASSEMBLY OF HAND TORCH

To remove and replace the hand torch main body from the torch 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 to hang freely.
3. On the larger lead, use a 3/8" open-end wrench to hold the torch body fitting and a 1/2" open-end wrench to loosen the torch lead fitting.

   On the smaller lead, use a 5/16" open-end wrench to hold the torch body fitting and a 7/16" open-end wrench to loosen the torch lead fitting.
4. Remove the torch **main body.**

## Replacement

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

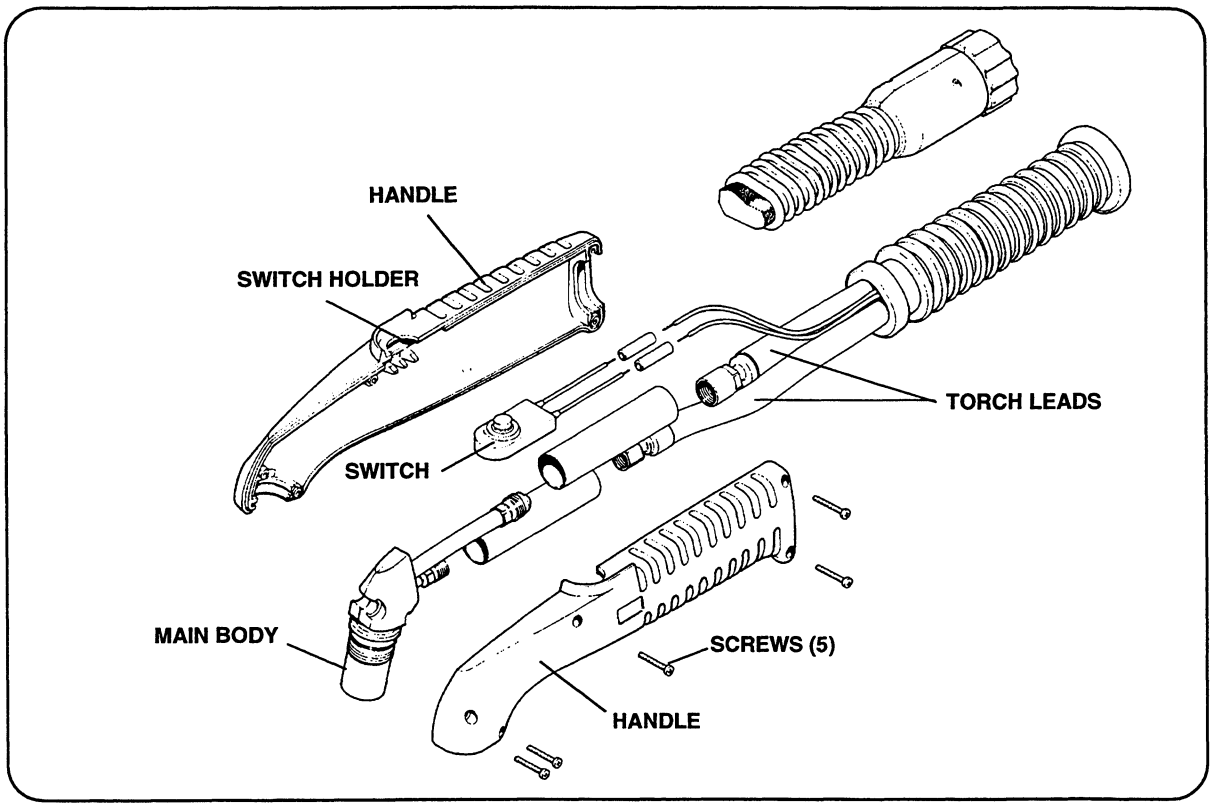



**Figure 5-4 PAC130 Hand Torch Assembly**

MAINTENANCE

## 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. On the larger 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.

   On the smaller 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.

3. Remove the torch **main body**.

### Replacement

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

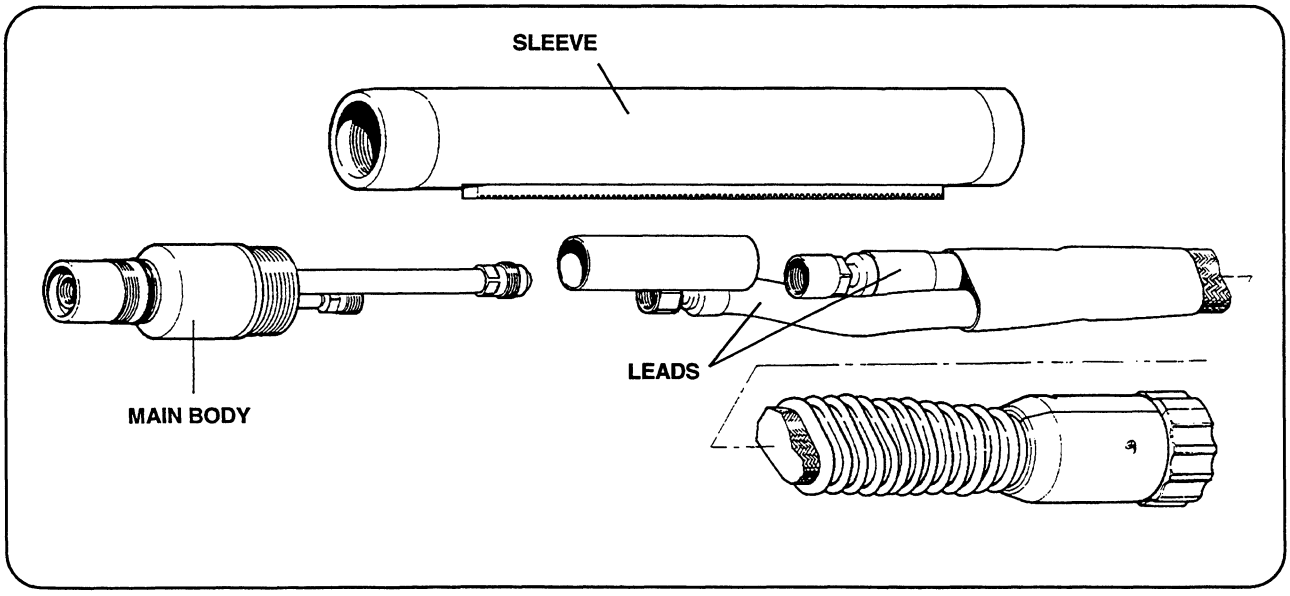



**Figure 5-5 MAX100 Machine Torch**

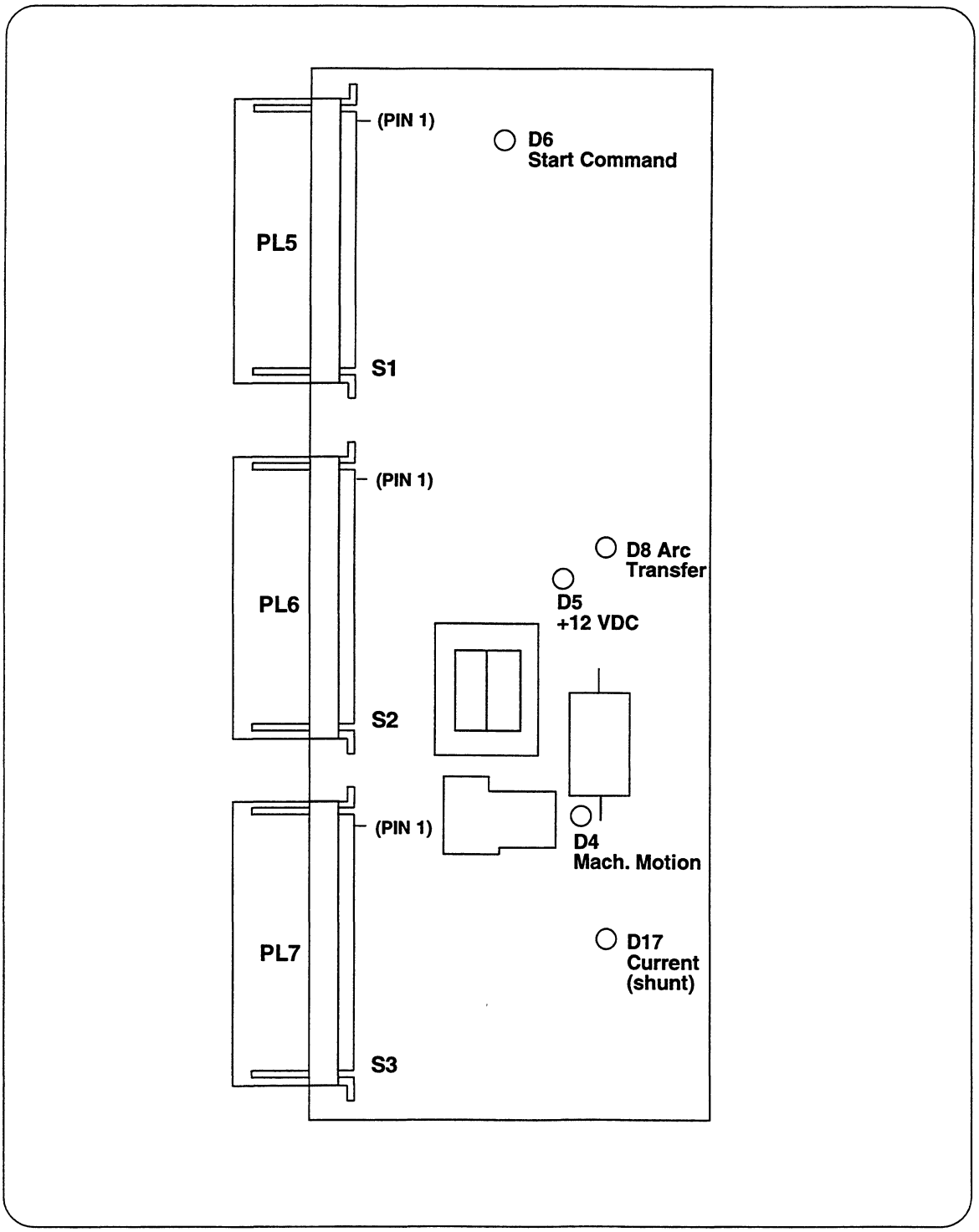



Figure 5-6 PCB4 Control Board

# Section 6 PARTS LIST

In this section:

# INTRODUCTION

In this section is a parts list breakdown with accompanying drawings for the MAX100 plasma torch system.

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

| Item | Part Number | Description | Designator | Qty. |
|---|---|---|---|---|
| | **029188** | **Cont Pnl SA: MAX100** | | 1 |
| 1 | 001181 | Pnl: MAX100 Cont | | 1 |
| | **029192** | **Harness MAX100** | | 1 |
| 10 | 005092 | PB Sw: Grn NO Full Gd | **PB1** | 1 |
| 16 | 008328 | Knob: .930 Dia 1/4 SFT Blk/Nat | | |

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

**Part Number:** Refers to Hypertherm part numbers.
**Bold** part numbers (Ex. **029188**) signify parent or subassemblies that contain additional items.

Normal-style part numbers (Ex. 001181) signify single items.

**Description:** Describes the item.
**Bold** descriptions not indented (Ex. **Cont Pnl SA: MAX100**) signify parent assemblies that contain additional items.

Normal-style part numbers that are indented (Ex. Pnl: MAX100 Cont) signify items under parent or subassembly.

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

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

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

# MAX100 SYSTEMS

| MAX100 / MACHINE TORCH SYSTEMS<br>with 10.75" (273 mm) Mounting Sleeve and Remote Switch | | | | |
|---|---|---|---|---|
| Voltage | w/ 25' (7.6 m) Leads | w/ 35' (10.7 m) Leads | w/ 50' (15.2 m) Leads | w/ 75' (23 m) Leads |
| 208V,3Ø,60 Hz | 059028 | —— | 059029 | 059039 |
| 240/480V,3Ø,60 Hz | 059006 | 059168 | 059007 | 059036 |
| 380/415V,3Ø,50 Hz | 059018 | 059169 | 059019 | 059038 |
| 500V,3Ø,50 Hz | 059084 | —— | 059085 | 059086 |
| 600V,3Ø,60 Hz | 059014 | —— | 059015 | 059037 |

| MAX100 / MACHINE TORCH SYSTEMS<br>with 8.5" (216 mm) Mounting Sleeve and Remote Switch | | | |
|---|---|---|---|
| Voltage | w/ 25' (7.6 m) Leads | w/ 35' (10.7 m) Leads | w/ 50' (15.2 m) Leads |
| 208V,3Ø,60 Hz | 059244 | —— | 059245 |
| 240/480V,3Ø,60 Hz | 059241 | 059242 | 059243 |
| 600V,3Ø,60 Hz | 059246 | —— | 059247 |

| MAX100 / MACHINE TORCH SYSTEMS<br>with 8.5" (216 mm) Mounting Sleeve, without Remote Switch | | | |
|---|---|---|---|
| Voltage | w/ 25' (7.6 m) Leads | w/ 35' (10.7 m) Leads | w/ 50' (15.2 m) Leads |
| 208V,3Ø,60 Hz | 059250 | —— | 059251 |
| 240/480V,3Ø,60 Hz | 059248 | 059249 | —— |
| 600V,3Ø,60 Hz | 059252 | —— | 059253 |

| MAX100 / PAC130 HAND TORCH SYSTEMS | | | |
|---|---|---|---|
| Voltage | w/ 25' (7.6 m) Leads | w/ 50' (15.2 m) Leads | w/ 75' (23 m) Leads |
| 208V,3Ø,60 Hz | 059026 | 059027 | 059035 |
| 240/480V,3Ø,60 Hz | 059004 | 059005 | 059032 |
| 380/415V,3Ø,50 Hz | 059016 | 059017 | 059034 |
| 500V,3Ø,50 Hz | 059081 | 059082 | 059083 |
| 600V,3Ø,60 Hz | 059012 | 059013 | 059033 |

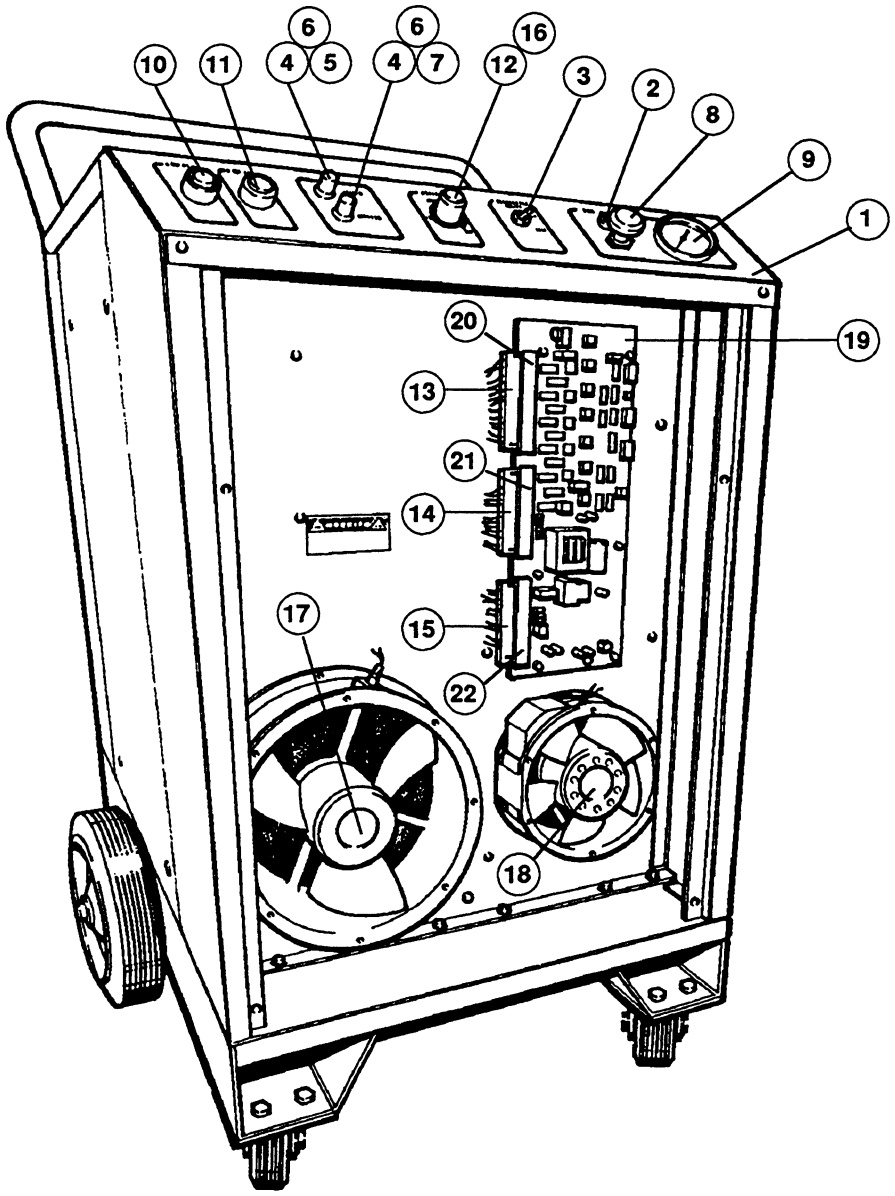



**Figure 6-1 MAX100: Front Panel and Control Panel**

## MAX100: Front Panel and Control Panel

| Item | Part Number | Description | Designator | Qty. |
|---|---|---|---|---|
| | **029188** | **Cont Pnl SA: MAX100** | | 1 |
| 1 | 001181 | Pnl: MAX100 Cont | | 1 |
| 2 | 005044 | Tgl Sw: SPDT 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 | **LT1** | 1 |
| 6 | 005168 | LTBULB: 28VDC 40ma T3-1/4 | | 2 |
| 7 | 005091 | Lens: Red for 005088 | **LT2** | 1 |
| 8 | 006033 | NDL Valve: 1/4 NPT .170 Orf | | 1 |
| 9 | 022008 | Gauge, Press 2 1/2" Dia. 1-100 | | 1 |
| 10 | 005121 | PB Sw: Grn NO Full Gd | **PB1** | 1 |
| 11 | 005122 | PB Sw: Red NC | **PB2** | 1 |
| | **029192** | **Harness MAX100** | | 1 |
| 12 | 009483 | Pot: 1K-Ohm 1W 10% 1T Cerm | **R6** | 1 |
| 13 | 008233 | Plug Hsg: 16-Posn Inln Freehng | **PL5** | 1 |
| 14 | 008233 | Plug Hsg: 16-Posn Inln Freehng | **PL6** | 1 |
| 15 | 008233 | Plug Hsg: 16-Posn Inln Freehng | **PL7** | 1 |
| 16 | 008328 | Knob: .930 Dia 1/4 SFT Blk/Nat | | 1 |
| 17 | 027079 | Fan 450-550 CFM 120VAC 50/60 Hz | **FAN1** | 1 |
| 18 | 027080 | Fan 225 CFM 120VAC 50/60 Hz | **FAN2** | 1 |
| 19 | **041114** | **PC BD Assy Ctrl MAX100** | **PCB4** | 1 |
| 20 | 008242 | Pin HDR: 16-Posn Rtang PCB Mt | **S1** | 1 |
| 21 | 008242 | Pin HDR: 16-Posn Rtang PCB Mt | **S2** | 1 |
| 22 | 008242 | Pin HDR: 16-Posn Rtang PCB Mt | **S3** | 1 |

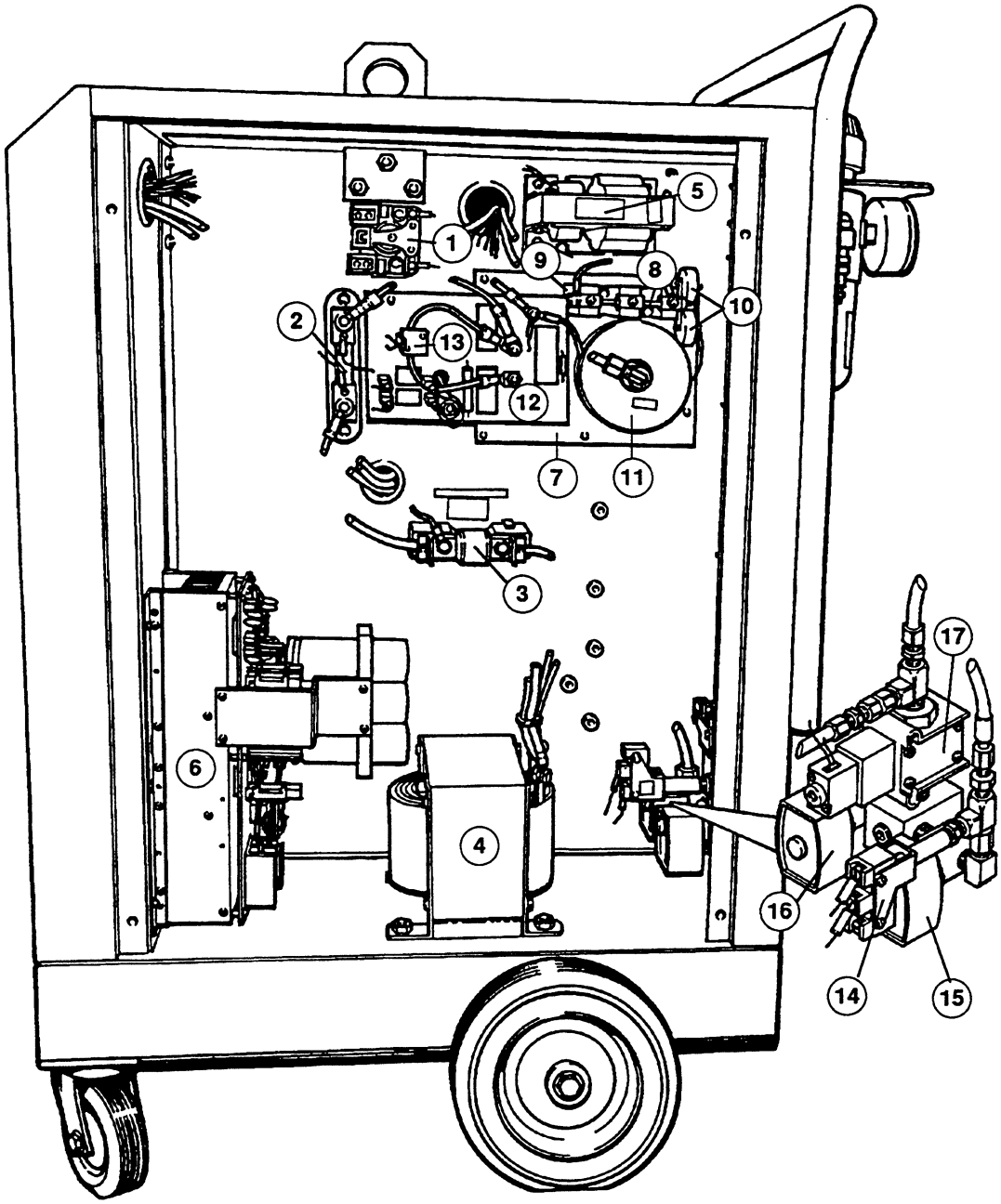



Figure 6-2 MAX100: Right Side

## MAX100: Right Side

| Item | Part Number | Description | Designator | Qty. |
|---|---|---|---|---|
| 1 | 003021 | Relay: 120VAC SPST NO | **CR1** | 1 |
| 2 | 007022 | Shunt: 100A 100 mv | **1MSH** | 1 |
| 3 | 008317 | Fuse: 125A 250V Semicond | **F5** | 1 |
| 4 | 014043 | Inductor, 4mh, 100ADC, MAX100 | **L1** | 1 |
| 5 | 014021 | Transformer, 5000VAC, 20ma | **T3** | 1 |
| 6 | **029922** | **CH130 Chopper SA** | | 1 |
| | 041353 | PCB Assy CH100/130 Chopper | **PCB5** | 1 |
| | **029597** | **MAX100/80 Subassemblies** | | 1 |
| 7 | **029190** | **Hi Freq/IO Panel SA, MAX100** | **PCB3** | 1 |
| | **009350** | **Spark Gap Assy: 40-20/2000/HD** | **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 | **4CAP,5CAP** | 2 |
| 11 | **009371** | **Coil Assy:80-100A HF** | **T4** | 1 |
| 12 | **041120** | **PC BD Assy I/O MAX100** | | 1 |
| 13 | **029202** | **Current Sensor SA, MAX100** | **CS1** | 1 |
| | **029191** | **Gas Sply SA: MAX100** | | 1 |
| 14 | 005093 | Press Sw: 0-90 PSI 1/8 NPT | **PS1** | 1 |
| 15 | 006014 | Sol Valve: 90# 1/4 FPT 120V NC | **SOL2** | 1 |
| 16 | 006014 | Sol Valve: 90# 1/4 FPT 120V NC | **SOL1** | 1 |
| 17 | 006032 | Sol Valve: 150# 1/4 FPT 120V NC | **SOL3** | 1 |

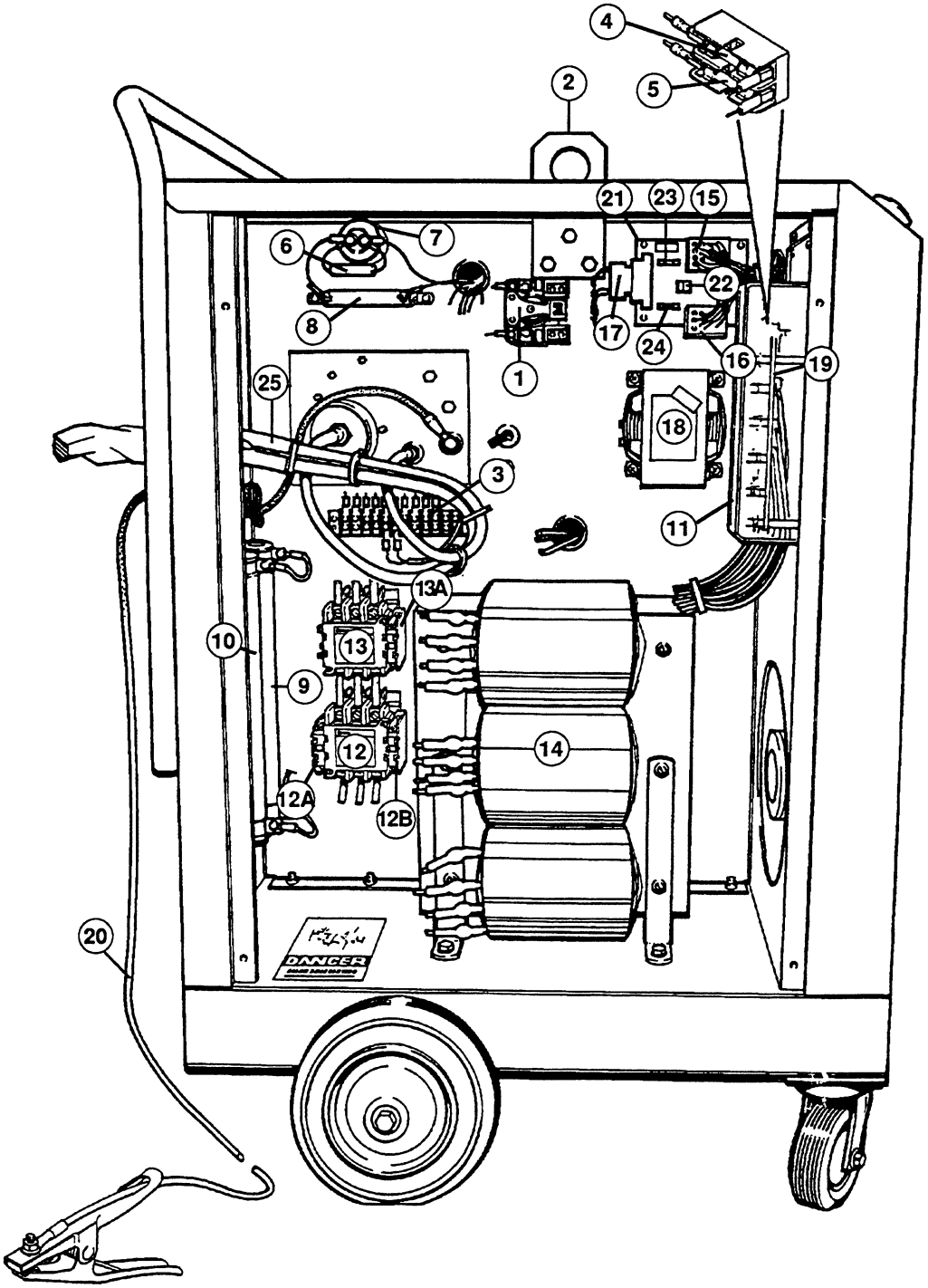



Figure 6-3 MAX100: Left Side

# MAX100: 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% | C3 | 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, 380-415/3/50 | T2 | 1 |
| 14 | 014067**** | Transformer 15kW 600/3/60 | T2 | 1 |
| 14 | 014123****** | Transformer 15kW 500/3/50 | T2 | 1 |
| 14 | 014069******* | Transformer 15kW 200/3/50 | T2 | 1 |
| | **029192** | **Harness SA MAX100** | | 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, 40/80/100 230-460V | T1 | 1 |
| | **029511**** | **Xfmr SA, MAX100 208V** | | 1 |
| 17 | 008235 | Plug Hsg: 6-Posn INLN Freehng | PL1 | 1 |
| 18 | 014023***** | Transformer, 40/80/100 230-460V | T1 | 1 |
| | **029218***** | **Xfmr SA, MAX100 380-415V** | | 1 |
| 17 | 008235 | Plug Hsg: 6-Posn INLN Freehng | PL1 | 1 |
| 18 | 014028*** | Transformer, 40/100 220-380-415V | T1 | 1 |
| | **029217****** | **Xfmr SA, MAX100 600V** | | 1 |
| 17 | 008235 | Plug Hsg: 6-Posn INLN Freehng | PL1 | 1 |
| 18 | 014039**** | Transformer, 40/100 600V | T1 | 1 |
| | **029430******* | **Xfmr SA, MAX100 500V** | | 1 |
| 17 | 008235 | Plug Hsg: 6-Posn INLN Freehng | PL1 | 1 |
| 18 | 014124****** | Transformer, 500V | T1 | 1 |
| | **029958******** | **Xfmr SA, MAX100 200V** | | 1 |
| 17 | 008235 | Plug Hsg: 6-Posn INLN Freehng | PL1 | 1 |
| 18 | 014049******** | Transformer, 200V | 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 | **028519** | **Rcpt Assy:80A/100A Qdisc** | | 1 |

* Used only on 240/480V pwr spply (#059001) **Used only on 208V pwr spply (#059025)
*** Used only on 220/380/415V pwr spply (#059011) ****Used only on 600V pwr spply (#059010)
***** Used on 240/480V pwr spply (#059001) and 208V pwr spply (#059025)
****** Used on 500V pwr spply (#059080) ******* Used on 200V pwr spply (#059200)

† For MAX100 serial #s before 70-006003, 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.

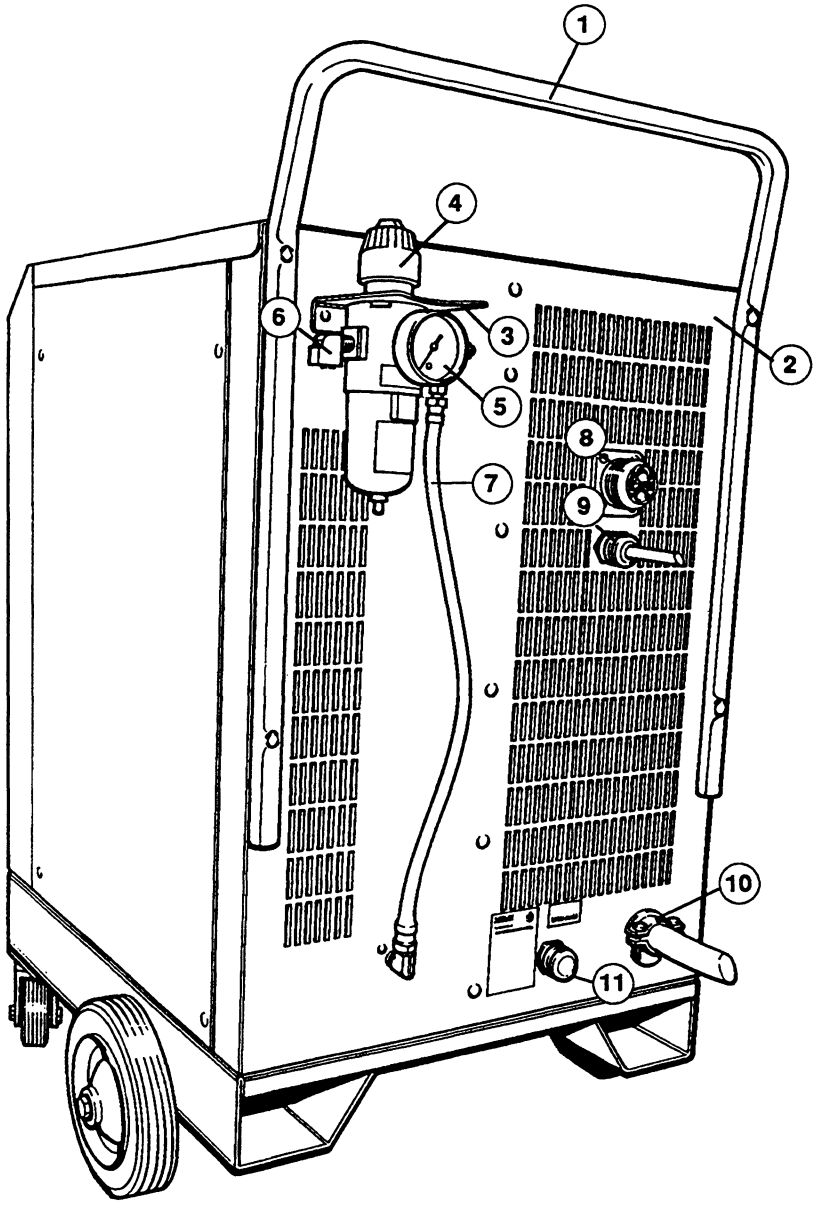



**Figure 6-4 MAX100: Rear Panel**

## MAX100 : Rear Panel

| Item | Part Number | Description | Designator | Qty. |
|---|---|---|---|---|
| 1 | 001182 | Handle: MAX80/MAX100 | | 1 |
| 2 | 001306 | Panel: MAX80/MAX100 Rear | | 1 |
| | **029203** | **Air Regulator SA: MAX100** | | 1 |
| 3 | 004264 | Bracket: 80/100/200 Air Regulator | | 1 |
| 4 | 011025 | Filter Regulator: 0-120 psi 1/4NPT Air | | 1 |
| 5 | 011027 | Gauge,0-120 psig for 011025 | | 1 |
| 6 | 015015 | Adapter 1/4NPT x #6 Male 90 Brs | | 1 |
| 7 | **024162** | **Hose Assy #6 x 19 1/2" Air Reg** | | 1 |
| 8 | **028519** | **Rcpt Assy:80A/100A 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 |

# MAX100 TORCH ASSEMBLIES WITH LEADS

| **MACHINE TORCHES** with 10.75" (273 mm) Sleeve * | | | |
|---|---|---|---|
| Lead Configuration | w/ 25' (7.6 m) Leads | w/ 50' (15.2 m) Leads | w/ 75' (23 m) Leads |
| With Quick Connect (QC) | 059096 | 059097 | 059098 |
| Without Quick Connect | 059008 | 059009 | 059031 |

| **MACHINE TORCHES** with 8.5" (216 mm) Sleeve * | | | |
|---|---|---|---|
| Lead Configuration | w/ 25' (7.6 m) Leads | w/ 35' (10.7 m) Leads | w/ 50' (15.2 m) Leads |
| With Quick Connect (QC) | 059238 | 059239 | 059240 |

| **PAC130 HAND TORCHES** ** | | | |
|---|---|---|---|
| Lead Configuration | with 25' (7.6 m) Leads | with 50' (15.2 m) Leads | with 75' (23 m) Leads |
| With Quick Connect | 059093 | 059094 | 059095 |
| Without Quick Connect | 059076 | 059077 | 059079 |

| **90° HAND TORCHES** | | | |
|---|---|---|---|
| Lead Configuration | with 25' (7.6 m) Leads | with 50' (15.2 m) Leads | with 75' (23 m) Leads |
| With Quick Connect | 059109 | 059110 | 059111 |
| Without Quick Connect | 059069 | 059070 | 059071 |

* See page 6-13 for breakdown of machine torch with QC.

** See page 6-15 for breakdown of PAC130 hand torch with QC.

## MACHINE TORCH

| Item | Part Number | Description | Qty. |
|---|---|---|---|
| | **059096** | **MAX100 Mach Torch Assy 25' QC** | |
| | **059238** | **MAX100 Mach Torch Assy 25' QC with 8.5" Torch Sleeve** | |
| | **059167** | **MAX100 International Mach Torch Assy 35' QC** | |
| | **059239** | **MAX100 Mach Torch Assy 35' QC with 8.5" Torch Sleeve** | |
| | **059097** | **MAX100 Mach Torch Assy 50' QC** | |
| | **059240** | **MAX100 Mach Torch Assy 50' QC with 8.5" Torch Sleeve** | |
| | **059098** | **MAX100 Mach Torch Assy 75' QC** | |
| 1 | 020243 | Torch Pos Sleeve MAX100 - 10.75" | 1 |
| 1 | 020244* | Torch Pos Sleeve MAX100 - 8.5" | 1 |
| 1 | 020245** | Torch Pos Sleeve International MAX100 | 1 |
| 2 | **020201** | **MAX100 180 Deg Torch Main Body** | 1 |
| 3 | 020334 | Shld:MAX80/100/C/D 100A | 1 |
| 4 | 020336 | Cap, Shld 80A/100A MAX100/100C | 1 |
| 5 | 020337 | Nozzle, Shld 100A MAX100/PAC130 | 1 |
| 6 | 020194 | Swirl Ring, MAX100/PAC130 | 1 |
| 7 | 120433 | Electrode:PAC130/160/MAX100/D Air | 1 |
| 8 | **028524** | **Leads:80A/100A Mch QDisc 25'** | 1 |
| 8 | **028527** | **Leads:80A/100A Mch QDisc 35'** | 1 |
| 8 | **028525** | **Leads:80A/100A Mch QDisc 50'** | 1 |
| 8 | **028526** | **Leads:80A/100A Mch QDisc 75'** | 1 |
| 9 | **028909** | **Plug Assy:80A/100A Mach Qdisc.** | 1 |

* Used only on 059238, 059239 and 059240 torch assemblies
** Used only on 059167 torch assembly

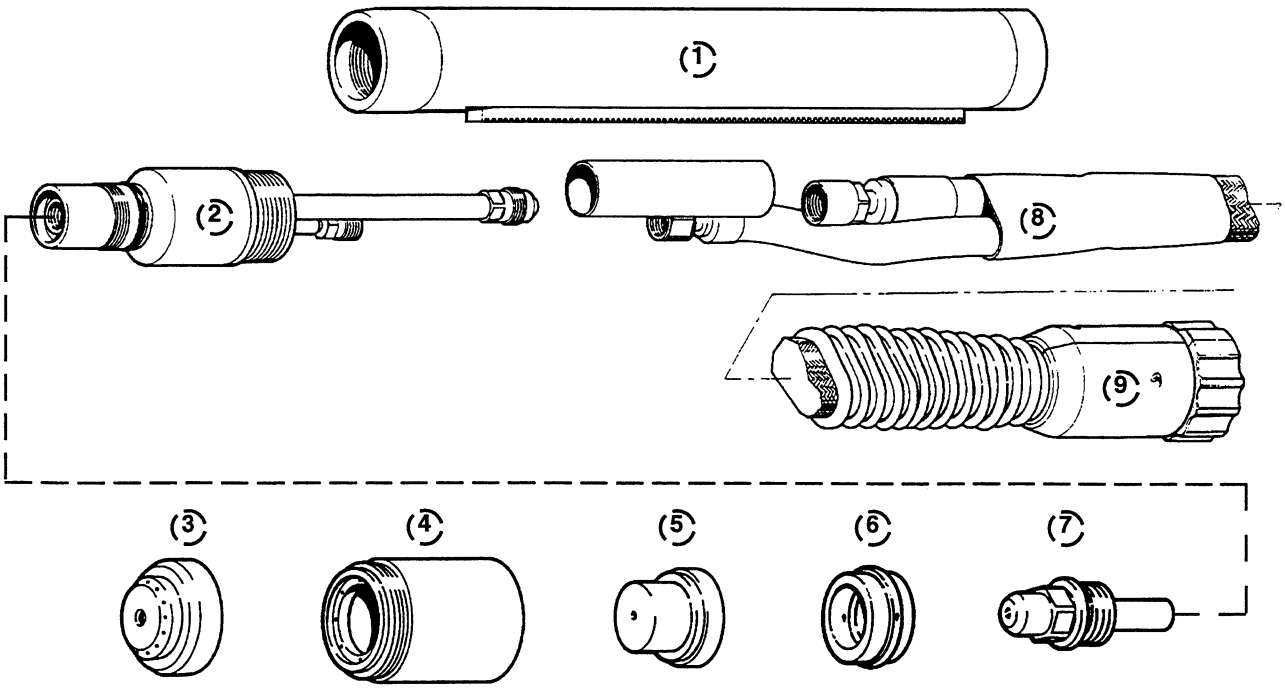



**Figure 6-5 MAX100 Machine Torch**

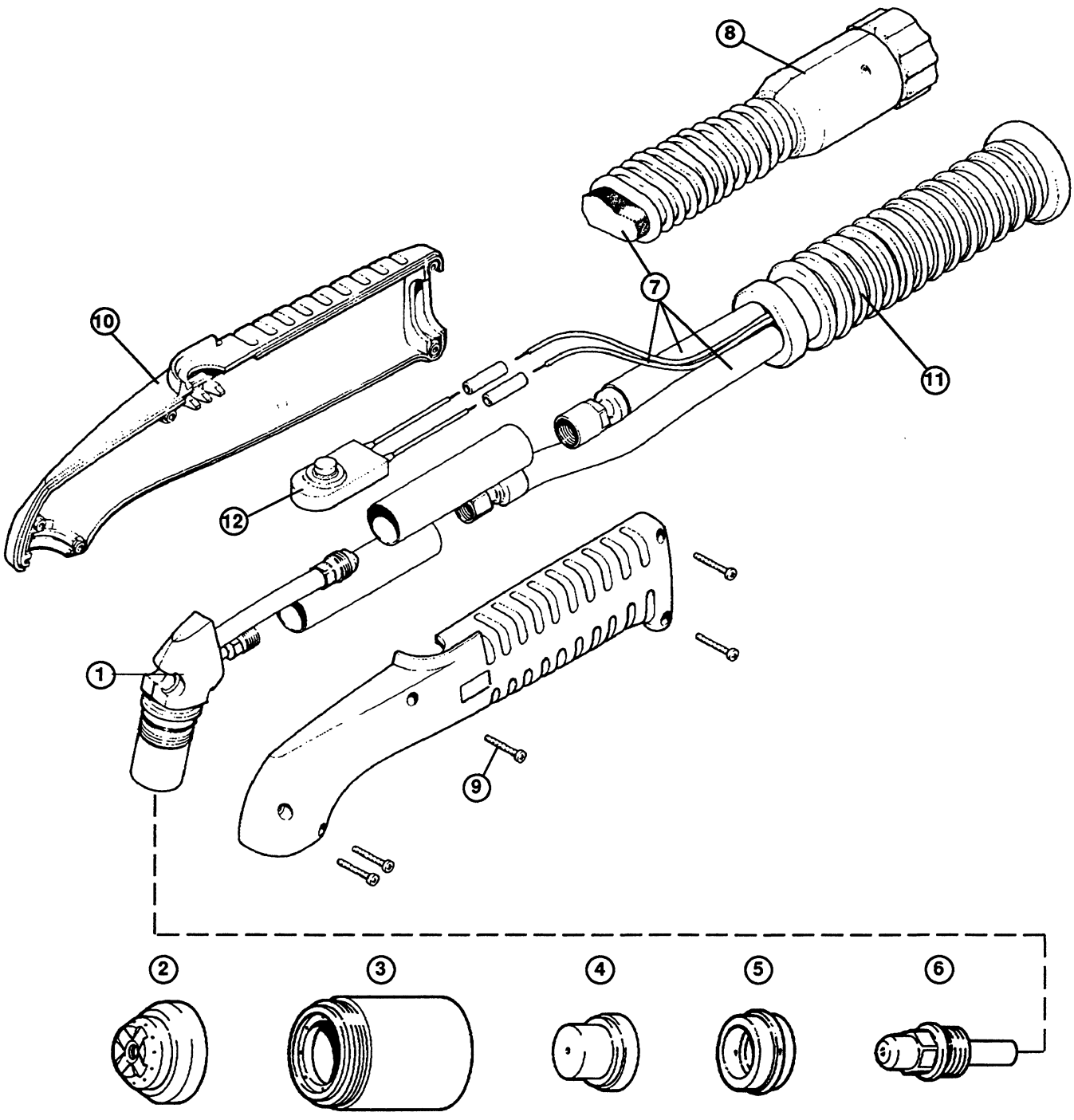



**Figure 6-6 PAC130 Hand Torch**

# PAC130 HAND TORCH

| Item | Part Number | Description | Qty. |
|---|---|---|---|
| | **059093** | **MAX100 Hand Torch Assy (PAC130) 25' QC** | |
| | **059094** | **MAX100 Hand Torch Assy (PAC130) 50' QC** | |
| | **059095** | **MAX100 Hand Torch Assy (PAC130) 75' QC** | |
| 1 | **020461** | **PAC130 Torch Main Body** | 1 |
| 2 | 020335 | Shld:PAC130/160 100A | 1 |
| 3 | 020336 | Cap, Shld 80A/100A MAX100/100C | 1 |
| 4 | 020337 | Nozzle, Shld 100A MAX100/PAC130 | 1 |
| 5 | 020194 | Swirl Ring, MAX100/PAC130 | 1 |
| 6 | 120433 | Electrode:PAC130/160/MAX100/D Air | 1 |
| 7 | **029667** | **Leads:PAC130 Torch QDisc 25'** | 1 |
| 7 | **029668** | **Leads:PAC130 Torch QDisc 50'** | 1 |
| 7 | **029669** | **Leads:PAC130 Torch QDisc 75'** | 1 |
| 8 | **028518** | **PL Assy:80A/100A QDisc** | 1 |
| 9 | 075365 | P/S, #6X3/4, PH, Rnd, S/B | 5 |
| 10 | 001214 | Hndl:PAC130/PAC140 TCH | 1 |
| 11 | 001217 | Boot:PAC130 Torch | 1 |
| 12 | 005094 | PB Sw: Tch | 1 |

## CONSUMABLE PARTS: MAX100 Machine Torch

| Item | Part Number | Description | Qty. |
|---|---|---|---|
| | **028375** | **Kit, Consum Parts, MAX100 Mach** | 1 |
| 1 | 120433 | Electrode: PAC130/160/MAX100/D Air | 10 |
| 2 | 020194 | Swirl Ring, MAX100/PAC130 | 2 |
| 3 | 020203 | Nozzle, Std 40A MAX100 | 5 |
| 4 | 020336 | Cap, Shield 80A/100A, MAX100/100D | 1 |
| 5 | 020333 | Deflector, MAX80/MAX100 | 1 |
| 6 | 020334 | Shield: MAX80/100/C/D 100A | 2 |
| 7 | 020337 | Nozzle, Shield 100A, MAX100/PAC130 | 5 |
| | 001067 | Box: Gra Plastic | 1 |
| | 015111 | Adapter: 1/4NPT X LH 'B' Inrt Fem Brs | 1 |
| | 026018 | O-Ring, Silicon | 5 |
| | 027055 | Lubricant, Silicon, 1/4 Oz Tube | 1 |
| | 027102 | Wrench: 3/8 Hex Electrode | 1 |

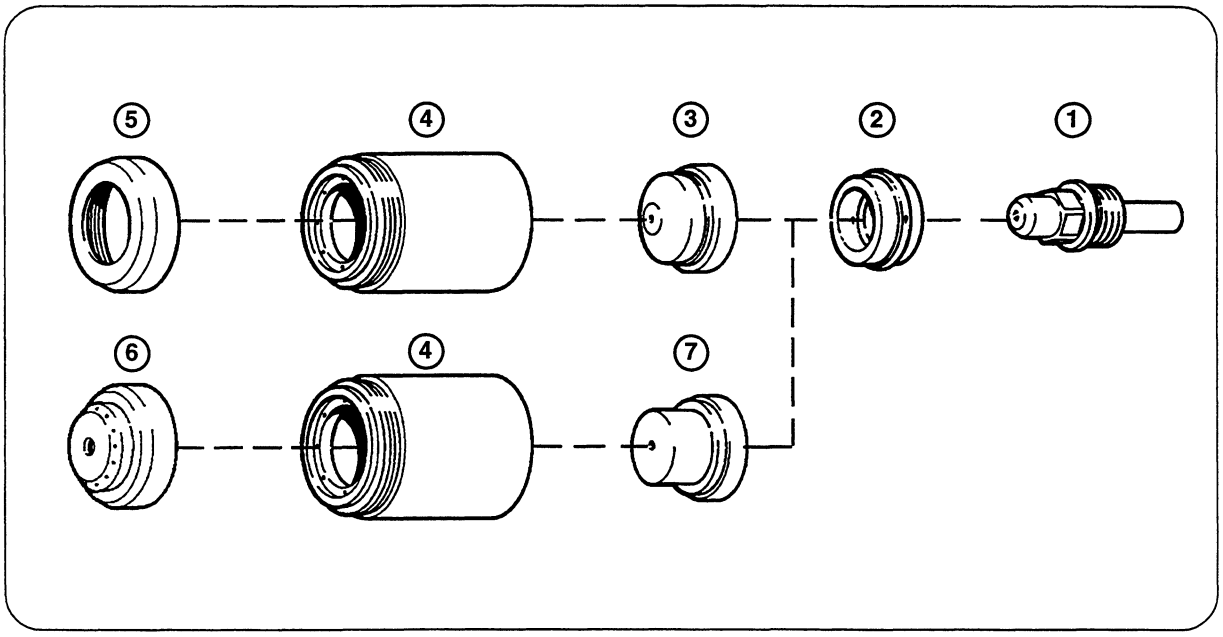



**Figure 6-7 MAX100 Machine Torch Consumable Parts**

# CONSUMABLE PARTS: MAX100 Hand Torch

| Item | Part Number | Description | Qty. |
|---|---|---|---|
| | **028325** | **Kit, Consum Parts, MAX100 Hand** | 1 |
| 1 | 120433 | Electrode: PAC130/160/MAX100/D Air | 5 |
| 2 | 020194 | Swirl Ring, MAX100/PAC130 | 2 |
| 3 | 020337 | Nozzle, Shield 100A, MAX100/PAC130 | 5 |
| 4 | 020336 | Cap, Shield 80A/100A, MAX100/100D | 1 |
| 5 | 020335 | Shield: PAC130/160 100A | 1 |
| 6 | 020744 | Electrode: Air Gouging | 1 |
| 7 | 120459 | Nozzle, Gouging, PAC130 | 1 |
| 8 | 020712 | Shield, PAC130 Gouging | 1 |
| | 001067 | Box: Gra Plastic | 1 |
| | 015111 | Adapter: 1/4NPT X LH 'B' Inrt Fem Brs | 1 |
| | 026018 | O-Ring, Silicon | 5 |
| | 027055 | Lubricant, Silicon, 1/4 Oz Tube | 1 |
| | 027102 | Wrench: 3/8 Hex Electrode | 1 |

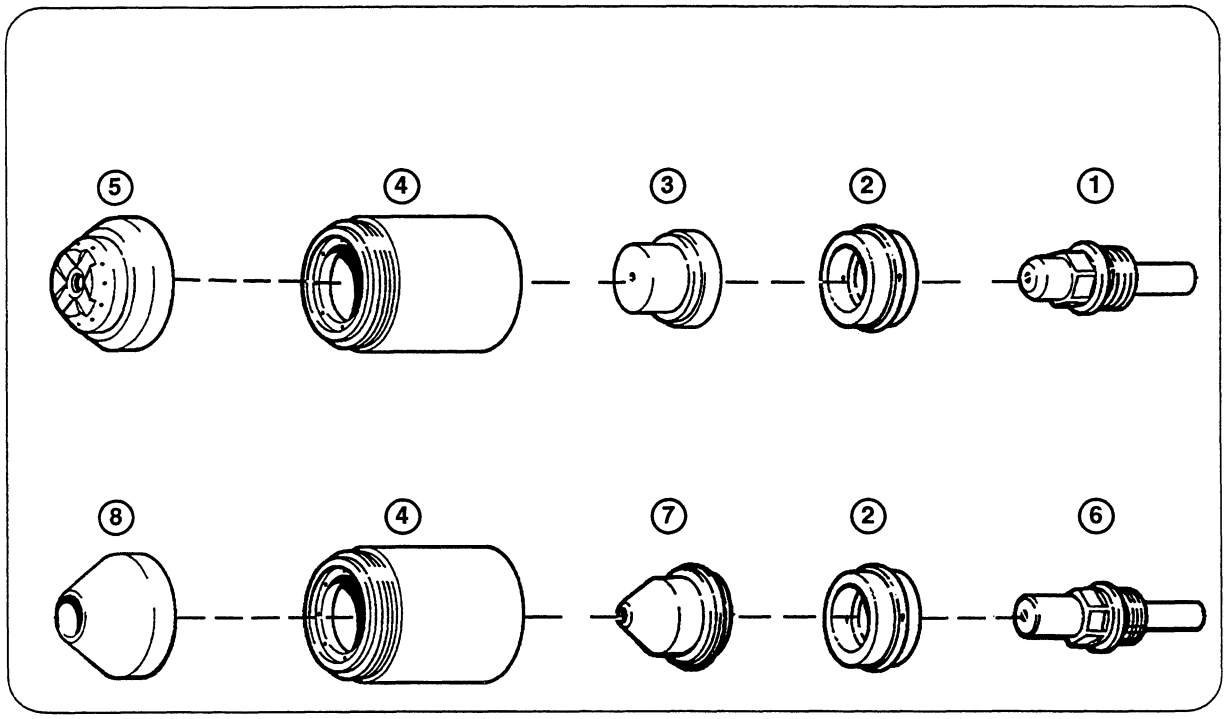



**Figure 6-8 MAX100 Hand Torch Consumable Parts**

# RECOMMENDED SPARE PARTS

| Part Number | Description | Designator | Page Number Showing Item |
|---|---|---|---|
| 001027 | Gauge, 0-120 psig for 011025 | | 6-10 |
| 011025 | Filter Regulator: 0-120 psi 1/4NPT Air | | 6-10 |
| 011031 | Replacement filter | | |
| 005168 | LTBULB:28VDC 40ma T3-1/4 | LT1,LT2 | 6-4 |
| 005121 | PB Sw: Grn NO Full Gd | PB1 | 6-4 |
| 005122 | PB Sw: Red NC | PB2 | 6-4 |
| 005093 | Press Sw: 0-90 psi 1/8 NPT | PS1 | 6-6 |
| 003021 | Relay: 120VAC SPST NO | 1CR,3CR | 6-6,-8 |
| 003153 | Contactor, MAX100 60A | CON1,CON2 | 6-8 |
| 003054 | Sw:MAX40/100/HT40C Aux Contactor | 1AUX,2AUX | 6-8 |
| 008239 | Fuse: 2A 500V 13/32 x 1-1/2 Slo | F1,F2 | 6-8 |
| 009622 | Res: 10 ohm, 50W 5% W/L Brk | R3 | 6-8 |
| 009296 | Cap: 100µF 350WV +50-10% | C3 | 6-8 |
| 005102 | Thermostat, 75°C | TS1 | |
| 014021 | Transformer, 5000VAC, 20ma | T3 | 6-6 |
| 009483 | Pot, 1K ohm, 1W,1T | R6 | 6-4 |
| 027079 | Fan 450-550 CFM 120VAC 50/60 Hz | FAN1 | 6-4 |
| 027080 | Fan 225 CFM 120VAC 50/60 Hz | FAN2 | 6-4 |
| 041114 | PC BD Assy Ctrl MAX100 | PCB4 | 6-4 |
| 029922 | CH130 Chopper SA 15KW | | 6-6 |
| 041116 | PC Bd Assy Power Dist. MAX100 | PCB2 | 6-8 |
| 020461 | PAC130 Torch Main Body | | 6-14 |
| 020201 | MAX100 180 Deg Torch Main Body | | 6-13 |
| 020400 | MAX100 90 Deg Torch Main Body | | |

# Section 7 WIRING DIAGRAMS

In this section:

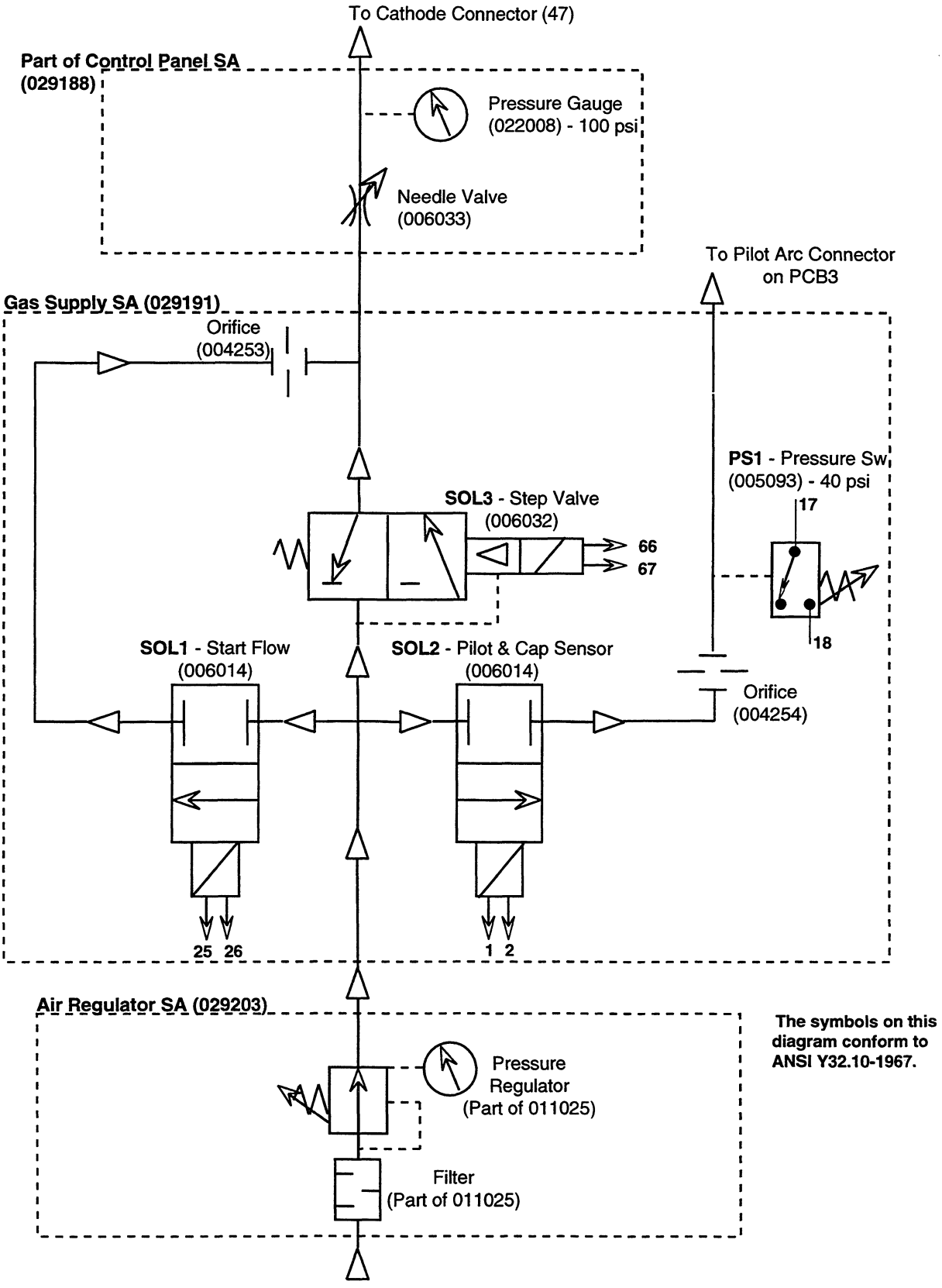



**Figure 7-0 MAX100 Gas Supply Schematic**

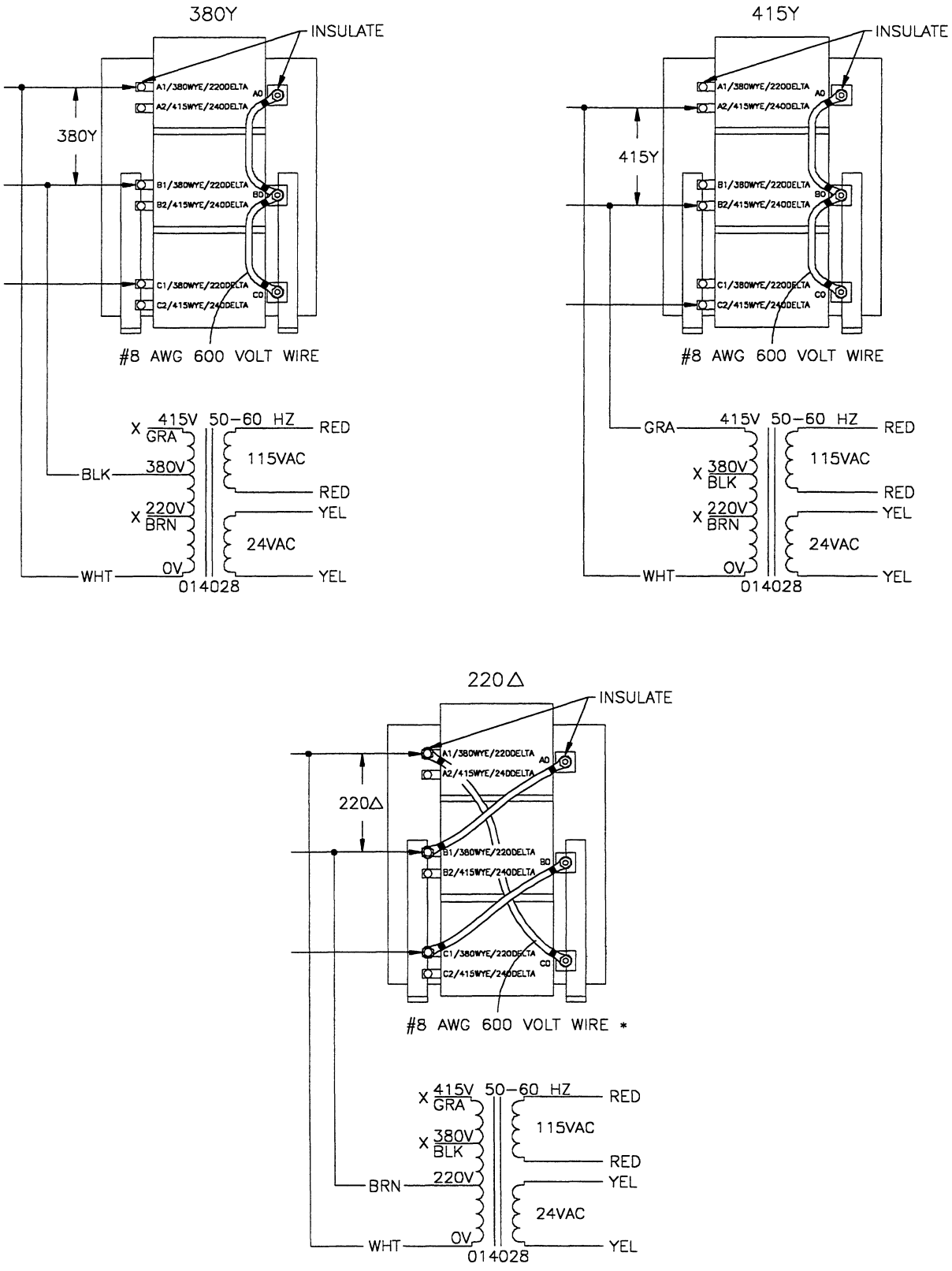



**Figure 7-1 Transformer Wiring - 220Δ/380Y/415Y**

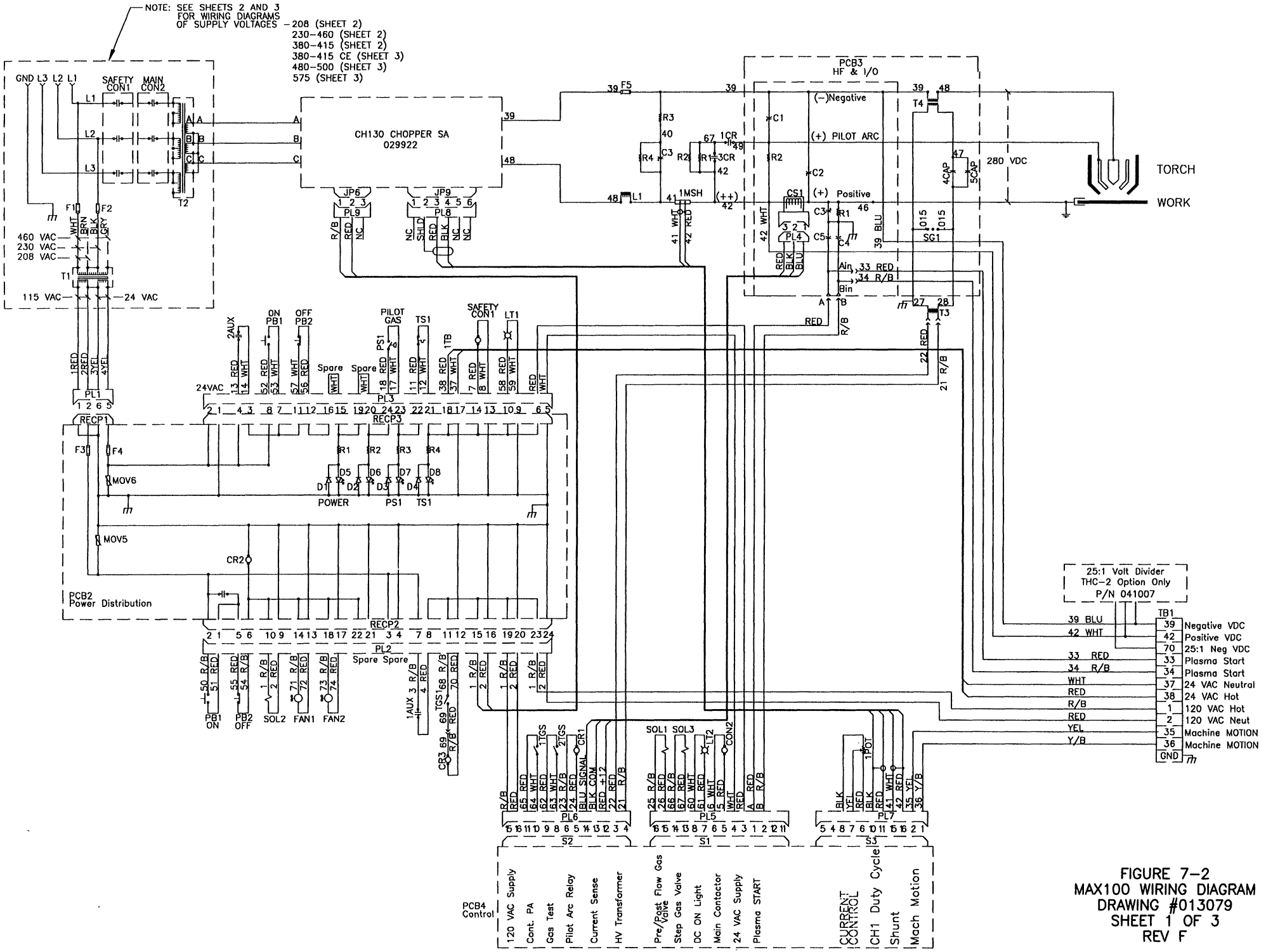
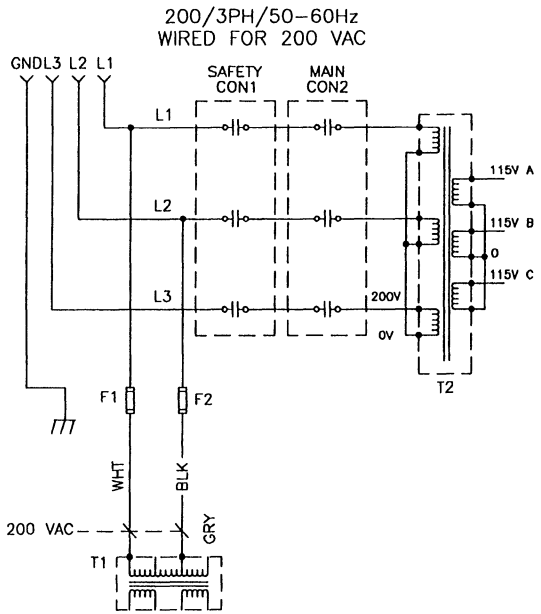
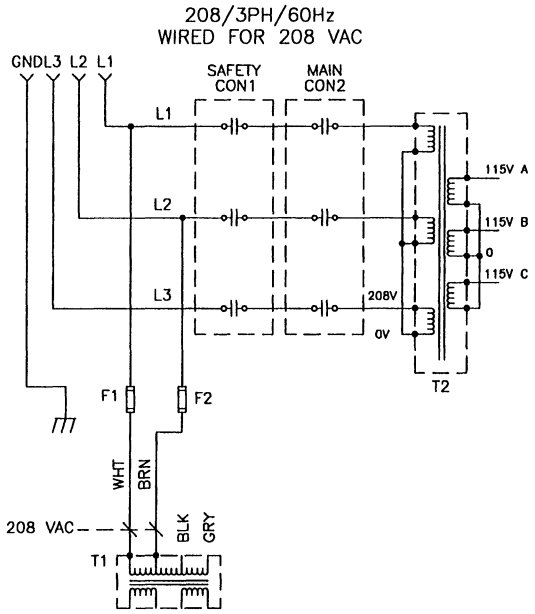



FIGURE 7–2
MAX100 WIRING DIAGRAM
DRAWING #013079
SHEET 1 OF 3
REV F



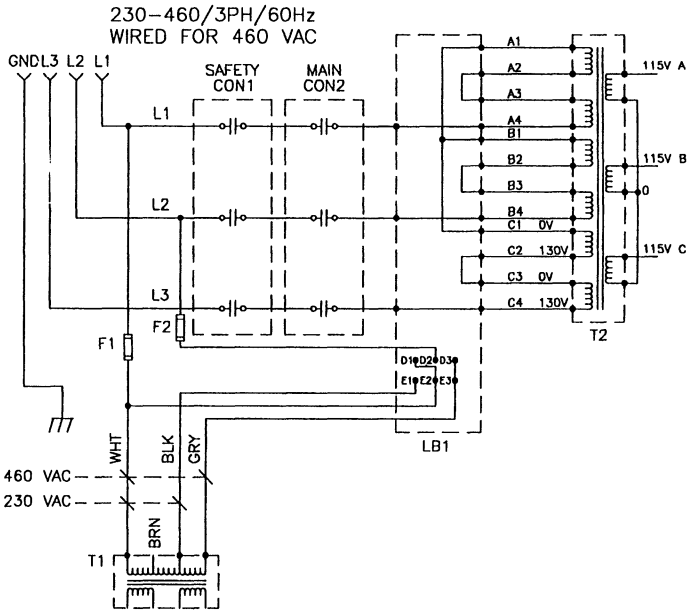
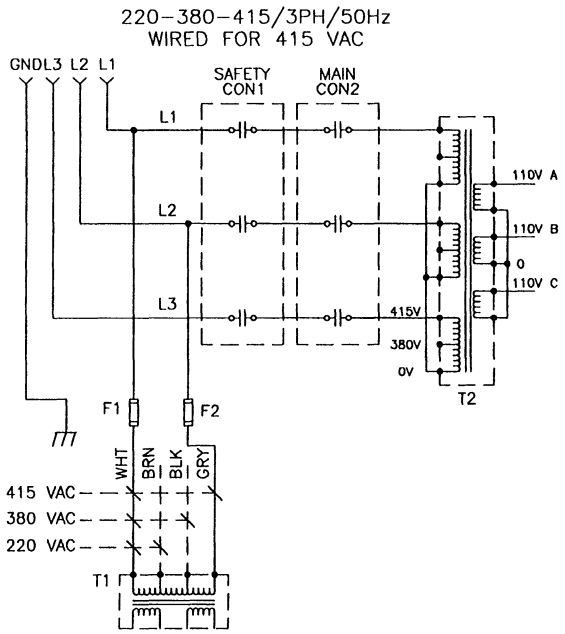
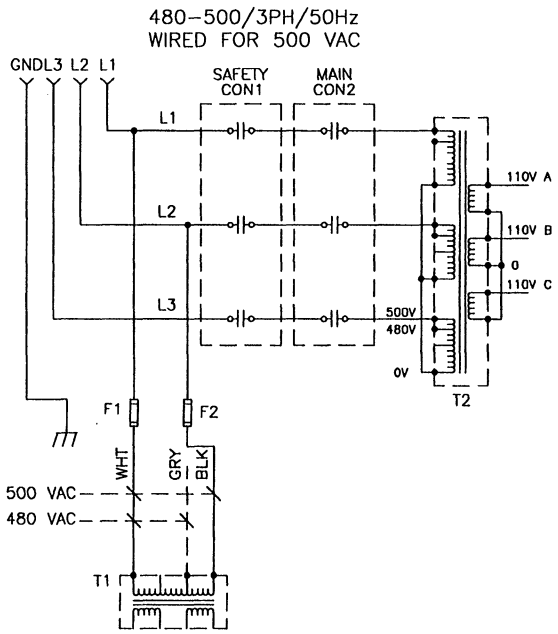




FIGURE 7-3
MAX100 WIRING DIAGRAM
DRAWING #013079
SHEET 2 OF 3
REV F



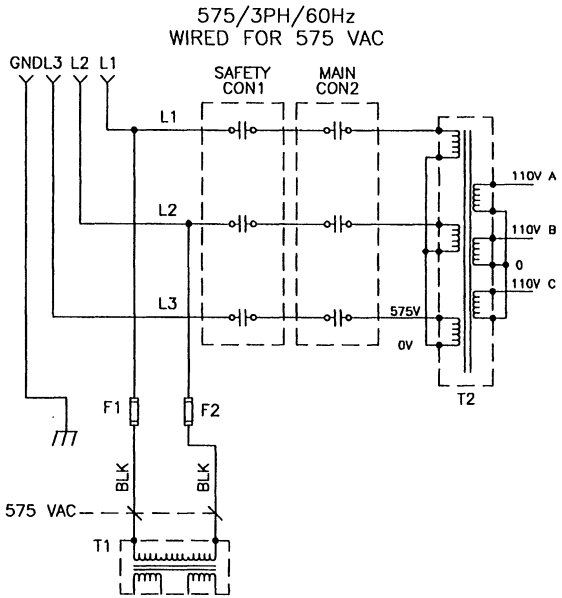




FIGURE 7–4
MAX100 WIRING DIAGRAM
DRAWING #013079
SHEET 3 OF 3
REV F

# 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



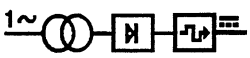
Direct Current (DC).

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).



The power is on.

O

The power is off.

Volt/amp curve.

APPENDIX

# 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.

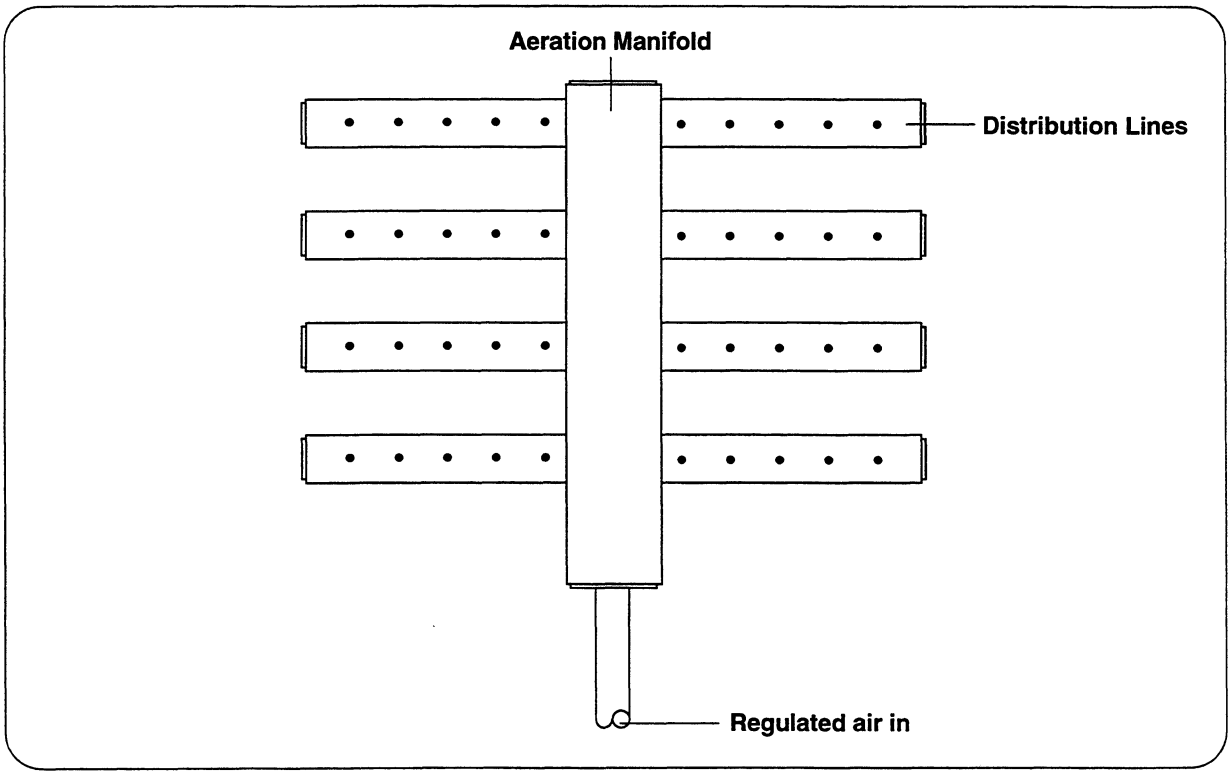



**Figure c-1 Aeration Manifold**

# 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.