MAX80®

Plasma Arc Cutting System

Instruction Manual
801140 - Rev. 4

HYPERTHERM®

MAX80
Plasma Arc Cutting System

Instruction Manual
IM-114
(P/N 801140)

for systems beginning with
serial number
80-000651

Revision 4 September, 1993

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ATTENTION

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

WARRANTY

GENERAL

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

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.

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SAFETY

INTRODUCTION

Abbreviated safety precautions are printed on the MAX80 unit. Before using the equipment (including compressed gas), each person operating, maintaining or supervising the use of this equipment must read the following safety instructions.

NOTES, CAUTIONS & WARNINGS

Throughout this manual, notes, cautions, and warnings are used to describe situations that require additional information. The following formats are used for each:

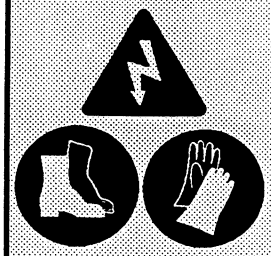
Notes: A note offers additional information, such as an operating tip, that aids the user in operating the MAX80.

Caution: A caution describes a situation that may cause damage to the MAX80, and offers advice to avoid or rectify the situation.

WARNING

A warning describes a situation that presents a physical danger to the operator, and offers advice to avoid or rectify the situation. Each type of warning displays an applicable danger symbol, ie. fire, explosion, electrical shock, etc.

WARNING



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

EXPLOSION WILL RESULT IF PRESSURIZED CONTAINERS ARE CUT.

ARC RAYS CAN INJURE EYES AND BURN SKIN.
- Wear correct eye and body protection.

NOISE CAN DAMAGE HEARING.
- Wear correct ear protection.

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

HEAT, SPLATTER AND SPARKS CAUSE FIRE AND BURNS.
- Do not cut near combustible material.
- Do not cut containers that have held combustibles.
- Do not have on your person any combustibles such as a butane lighter or matches.
- Pilot arc can cause burns. Keep the torch nozzle away from yourself and others when the switch is depressed.
- Wear correct eye and body protection.

SAFETY

SAFETY INSTRUCTIONS

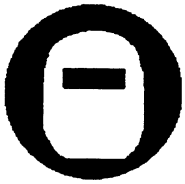
Burn Prevention

Eye Safety

To protect eyes against burns caused by high-intensity ultraviolet light, sparks and hot metal:

- Wear a welding helmet. Refer to the chart below for recommended lens shades:

Arc Current	Lens Shade
Up to 100 Amps	Shade No. 8
100 - 200 Amps	Shade No. 10
200 - 400 Amps	Shade No. 12
Over 400 Amps	Shade No. 14



- Replace the welding helmet when the lens becomes pitted or broken.
- Warn other people in the area not to look directly at the arc unless they wear welding helmets.
- Hold the torch away from your body when pressing the torch start button. The pilot arc will come on immediately when you press the torch start button.
- 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 Safety

To protect skin against burns caused by high-intensity ultraviolet light, sparks and hot metal:

- Wear protective clothing:
  - Wear gauntlet gloves, safety shoes and hat.
  - Wear flame-retardant clothing which covers all exposed areas.
  - Wear cuffless trousers to prevent entry of sparks and slag.
- Do not touch the front of the torch when starting it. After cutting, allow time for the front of the torch to cool.

Toxic Fume Prevention

To protect against the danger of toxic fumes which may be produced during cutting:

- 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 when cutting galvanized metal and use proper ventilation.
- Do not cut containers with toxic materials inside or containers that have held toxic materials. Clean such containers thoroughly before cutting.

WARNING

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

Fire Prevention

Cutting with the MAX80 produces hot metal, sparks and slag. Take the following precautions against fire:

- Make fire extinguishers available in the cutting area.
- Remove combustible material from the immediate cutting area to a distance of at least 35 feet (ten meters).
- Quench freshly cut metal or allow metal to cool before handling it or bringing it into contact with combustible materials.
- Never use a MAX80 to cut containers with potentially flammable materials inside. Such containers must be thoroughly cleaned prior to cutting.
- Ventilate potentially flammable atmospheres before using the MAX80. Never operate the MAX80 in an atmosphere which contains heavy concentrations of dust, flammable gas or combustible liquid vapors.

SAFETY

Electric Shock Prevention

The MAX80 uses high voltage (approximately 280 VDC) to initiate the plasma arc. Take the following precautions when operating the MAX80:

- Keep your body and clothing dry.
- Do not stand in, sit on or lie on any wet surface when using the MAX80.
- Maintain proper insulation against electrical shock. If you must work in or near a damp area, use extreme caution. Wear insulated gloves and boots.
- Provide a wall-mounted disconnect switch with proper size fuses close to the MAX80 power supply. This switch allows the operator to turn the MAX80 off quickly in an emergency situation.
- Conform to all local electrical codes for primary wiring sizes and types.
- Inspect the primary power cord and the torch lead frequently for damage or cracking of the covers. **Bare wiring can kill.** Do not use the system with a damaged power cord or torch lead. If a power cord or torch lead is damaged, replace it immediately.
- Should you need to remove the power supply cover after operation, disconnect the main power or unplug the power supply. Wait five minutes to allow capacitor discharge to occur. Failure to do so exposes you to severe electrical hazard.
- Never operate the MAX80 unless the power supply unit cover is in place. Exposed power supply connections present a severe electrical hazard.
- 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 at all times.
- Before changing the torch parts, disconnect the main power or unplug the MAX80. After changing the torch parts and returning the retaining cap to its operating position, plug the MAX80 in again.
- Never bypass or shortcut the safety interlocks.

Explosion Prevention

WARNING

The MAX80 uses compressed gas. Proper precautions must be observed when handling and using compressed gas equipment and cylinders. Refer to CGA standard P-1.

When cutting with the MAX80:

- Do not cut in atmospheres containing explosive dust or vapors.
- Do not cut pressurized cylinders.

Pressure Regulators

- Maintain all pressure regulators in proper working condition. Faulty regulators can cause damage or operator injury and must be serviced by trained repair technicians.
- 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.

Compressed Gas Cylinders

- Handle and use compressed gas cylinders in accordance with CGA and AWS safety standards.
- 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 the 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.

Hoses

Gas hose used for plasma arc cutting systems must adhere to the following color coding:

Green	Oxygen
Black	Inert gases and air

- Never use green oxygen hose for any gas other than oxygen.
- Replace hose that is damaged by physical abuse or by sparks, heat or open flame.
- Lay hose out straight to prevent kinks.
- Coil excess hose and place it out of the way to prevent damage and to eliminate tripping danger.
- Examine hoses at regular intervals for leaks, wear, loose connections or other hazard.
- Keep hose lengths to a minimum to prevent damage, reduce pressure drop and to prevent possible volume flow restriction.

Grounding

Before operating the MAX80:

Input Power

- Be sure the power cord ground wire is properly connected to the ground in the disconnect box.
- Be sure the power cord ground wire is properly connected to the ground stud in the MAX80. Place the power cord ground wire first on the stud, then place the other wires on top of the power cord ground. Fasten the retaining nut tightly.

Output Power

- Make sure that all electrical connections are tight to avoid excessive heating.
- Clamp the work cable with good metal-to-metal contact to the workpiece (not the portion that will fall away) or to the work table.
- Connect the work table to a good earth ground. Consult the National Electrical Code, Article 250, Section H *Grounding Electrode System*, or other appropriate code.

For additional information, refer to the *Standards Index* in this manual.

SAFETY DEVICES

- The MAX80 is designed with a safety interlock which turns off the power unit when the retaining cap is loosened.
- Never bypass or shortcut the safety interlocks.
- The MAX80 is designed specifically to be used with MAX80 torches. Do not use other torches.
- Use only Hypertherm replacement and consumable parts. Any damage caused by the use of other than genuine Hypertherm parts is not covered by the Hypertherm warranty.
- Never operate the MAX80 with any of the power supply covers not in place. It is hazardous to the operator and other people in the area, and prevents the equipment from properly cooling the components.

STANDARDS INDEX

The *Standards Index* contains a list of publications dealing with plasma arc cutting equipment safety practices. For additional information, refer to this index.

Section 2 SPECIFICATIONS

In this section:

SPECIFICATIONS

GENERAL

Hypertherm's MAX80 plasma cutting system is designed for cutting most metals from gauge to 1 inch 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 MAX80 provides continuously variable current output from 30 to 80 amps for optimum performance on all thicknesses of metal up to 1 inch thick. This allows the operator wide variations in cutting speeds on the same thickness of metal. The 30-amp setting is for metals up to 1/4 inch thick, while the 80-amp setting is used for thicker metals. Two nozzle sizes (40-amp and 80-amp) are provided to produce high quality cuts throughout the MAX80's 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 MAX80 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 right pressure and air flow are supplied to the system at the proper quality.

PRODUCT SPECIFICATIONS

Power Supply

The MAX80 is a constant current, secondary converter chopper power supply providing continuously variable amperage from 30 amps to 80 amps. It conforms to the following specifications:

Maximum OCV	280 VDC
Output Current	30-80 Amps
Output Voltage	90-200 VDC
Duty Cycle Rating	80% at 12 KW
Input Power: # 072056	208/240V/480, 1PH, 60 Hz
Dimensions	Width - 29-1/4" (74 cm) Height - 37-1/4 " (94 cm) Length - 27" (68 cm) Width - 29-1/4" (74 cm) (with handle) Height - 43-3/4" (111 cm) (with handle) Length - 29-1/2" (75 cm) (with handle)
Weight	420 pounds (190.5 kg)
Gas Type	Air Nitrogen
Gas Quality	Clean, Dry, Oil-Free
Gas Flow	440 scfh/7.4 scfm at 90-120 psi (208 l/min at 6.2 - 8.3 bar) supplied to power supply filter/pressure regulator
Filter/Pressure Regulator Setting	90 psi (6.2 bar)

SPECIFICATIONS

PAC130 Hand Torch

The PAC130 torch conforms to the following specifications:

Maximum cutting thickness range	1 inch (3 cm)
Maximum current at 80% duty cycle	80 amps
Gas Flow	440 scfh/7.4 scfm (208 l/min) at a psi/bar as determined by the *Cut Charts*
Weight	1 lb. 3 oz. (.462 kg)

Machine Torch

The machine torch conforms to the following specifications:

Maximum cutting thickness range	1 inch
Maximum current at 80% duty cycle	80 amps
Gas Flow	440 scfh/7.4 scfm (208 l/min) at a psi/bar as determined by the *Cut Charts*
Weight	1 lb. 7 oz. (0.604 kg)

Section 3 SETUP

In this section:

SETUP

UPON RECEIPT

The MAX80 System is shipped mounted on skid(s) and protected by heavy carton covers. Before unpacking, inspect the cartons for evidence of damage during shipment. If there evidence of damage, refer to *Claims for Damage During Shipment* below for details.

1. Remove all packing material and discard and remove the units and items from the shipping skid.

2. Verify that the system units, optional units, cables and hoses, and items listed below are included.

   Alert your distributor if any of the items are damaged or missing. All communications regarding this equipment must include the model number and serial number (located on the back of the MAX80). Refer to *Claims for Defective or Missing Merchandise* below for details.

   MAX80 System Units

   - Power Supply
   - PAC130 hand torch and torch lead assembly
     or
   - Machine torch and torch lead assembly (Remote Start/Stop Switch required)
   - 25-foot work cable with clamp
   - Consumable spare parts kit
   - Instruction manual IM-114 (P/N 801140)

   Optional Units (Machine torch configuration only)
   - Torch Height Control (THC-2) unit
   - THC-2 instruction manual IM-20 (P/N 800200)
   - Remote Start/Stop Switch
   - Remote Start/Stop Switch instruction manual IM-82 (P/N 800820)

CLAIMS

Claims for damage during shipment — If your unit was damaged during shipment, you must file a claim with the carrier. Hypertherm will furnish you with a copy of the bill of lading upon request. If you need additional assistance, call our Customer Service or Field Service group at 1-800-643-0030.

Claims for defective or missing merchandise — All units shipped from Hypertherm under go rigorous quality control inspections for defects. If any of the merchandise is defective or missing, call your distributor. If you need additional assistance, call our Customer Service or Field Service group at 1-800-643-0030.

Figure 3-1 MAX80 System

SETUP

POWER SUPPLY PLACEMENT

Position the MAX80 prior to making electrical, gas, and torch lead connections. This allows the operator to better determine cooling requirements, required electrical cable and air/gas hose lengths, and to place the line disconnect switch box close to the power supply for safety purposes.

If a machine torch is being used, route the torch lead to the cutting machine before positioning the power supply. Refer to *Route the Torch Lead* below.

1. Place the power supply in an area that is free of excessive moisture, has proper ventilation, and is relatively clean.

2. Place the power supply so that the 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.)

3. Do not place any filter device over the air intake locations. This reduces cooling efficiency and voids the warranty.

4. After placing the power supply, you can place the the line disconnect box close to it for safety purposes. Refer to *Power Requirements* in this section for information on the line disconnect switch.

ROUTE THE TORCH LEAD

When routing the torch lead to the cutting machine, you will generally need to route the torch lead through festoons or a power track. Before routing the lead using either method, remove the torch from the torch lead. Once the torch lead has been routed, replace the torch; it is now ready to be mounted to the torch mounting bracket. Refer to the *Maintenance* section for the torch removal and replacement procedures.

Caution:	**Do not route the torch lead with the torch connected. Damage to the torch could result from dropping, banging or scraping.**

AIR/GAS SUPPLY REQUIREMENTS AND CONNECTIONS

Air/Gas Hose

Whether you use pipeline shop air, compressed gas, or nitrogen, use an inert gas hose to connect the air/gas supply to the input connection on the filter/pressure regulator mounted on the rear of the power supply (see Figure 3-2).

Air Supply

WARNING

Do not exceed 120 psi (8.3 bar) to the filter/pressure regulator on the power supply. The plastic filter bowl may explode if this pressure is exceeded. See the warning label on the filter bowl for other safety warnings.

Cylinder Compressed Air

The cylinder air supply must be clean, dry and oil-free. A high-pressure regulator on the cylinder must be used and must be capable of delivering an output of 440 scfh/ 7.3 scfm (208 l/min) of air at a pressure of between 90 and 120 psi (6.2 and 8.3 bar). Feed the output of the cylinder high-pressure regulator into the filter/pressure regulator on the power supply. The filter/pressure regulator is mounted at the top rear of the MAX80 power supply (see Figure 3-2).

Note: Adjust the filter/pressure regulator for 90 psi (6.2 bar) delivery pressure to the power supply. Refer to the *Cut Charts* to set the correct cutting pressure at the power supply control panel. Exceeding this pressure will cause shortened torch parts life.

Shop Compressed Air

The shop air supply must be clean, dry and oil-free. Shop compressed air must be delivered at an output of 440 scfh/7.3 scfm (208 l/min) and at a pressure of between 90 and 120 psi (6.2 and 8.3 bar). Feed the output of the cylinder high-pressure regulator into the filter/pressure regulator on the power supply. The filter/pressure regulator is mounted at the top rear of the MAX80 power supply (see Figure 3-2).

Note: Adjust the filter/pressure regulator for 90 psi (6.2 bar) delivery pressuretothe power supply. Refer to the *Cut Charts* to set the correct cutting pressure at the power supply control panel. Exceeding this pressure will cause shortened torch parts life.

Nitrogen Supply

WARNING

Do not exceed 120 psi (8.3 bar) to the filter/pressure regulator on the power supply. The plastic filter bowl may explode if this pressure is exceeded. See the warning label on the filter bowl for other safety warnings.

To use nitrogen as the plasma gas, it must be supplied to the MAX80 at 99.995% purity. The nitrogen source can be compressed gas cylinders or liquid containers. A high-pressure regulator on the cylinder must be used and must be capable of delivering an output of 440 scfh/7.4 scfm (208 l/min) of nitrogen at a pressure of between 90 and 120 psi (6.2 and 8.3 bar). Feed the output of the cylinder high-pressure regulator into the filter/pressure regulator on the power supply. The filter/pressure regulator is mounted at the top rear of the power supply (see Figure 3-2).

Note: Adjust the filter/pressure regulator for 90 psi (6.2 bar) delivery pressure-tothe power supply. Refer to the *Cut Charts* to set the correct cutting pressure at the power supply control panel. Exceeding this pressure will cause shortened torch parts life.

Additional Air Filtration

When site conditions introduce moisture, oil, or other contaminants into the air line, additional filtration is required. A three-stage coalescing filtration system is recommended. (Refer to *Appendix A.*) The order in which the filtration components are to be mounted from the air supply towards the MAX80 power supply:

		Model #		Model #		Model #		
Air Supply	>	3401.4	>	1302.4	>	1502.4	>	MAX80

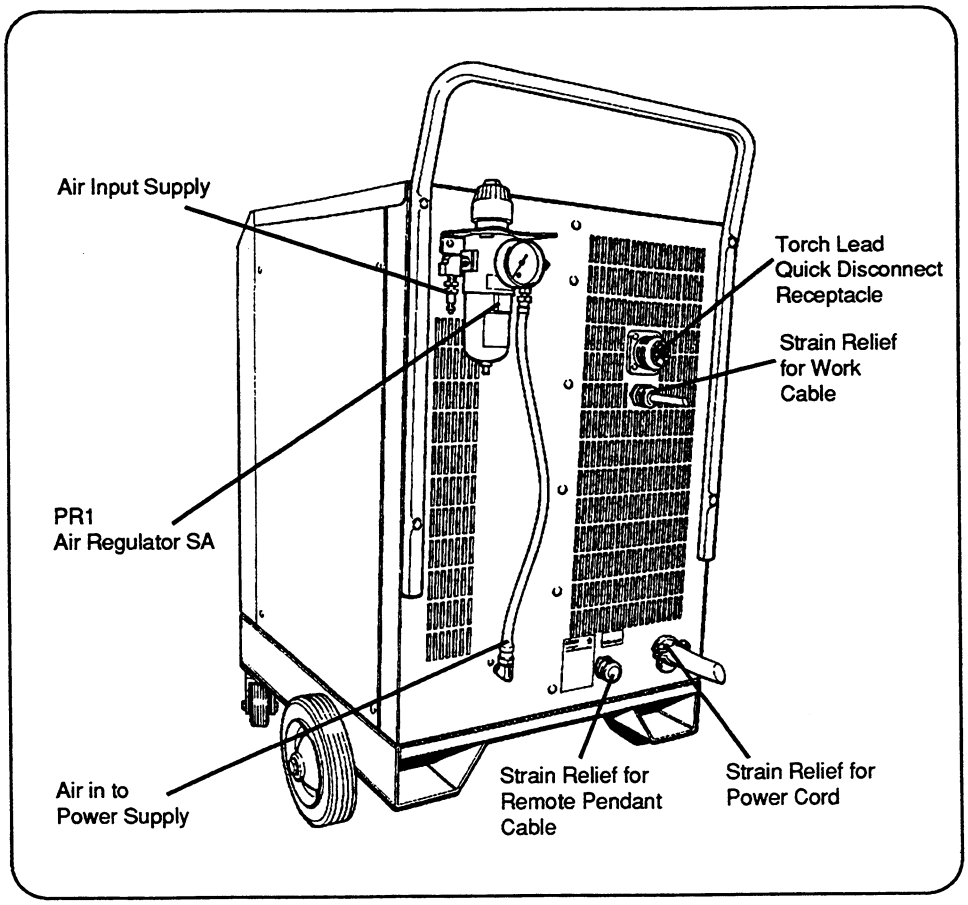


Figure 3-2

Rear Panel Connections and Cable Installation

POWER REQUIREMENTS

A separate line disconnect switch should be provided for each MAX80 power supply. The disconnect box should be sized with **SLO-BLO (time delay)** fuses to compensate for a potential high inrush current surge upon applying input power. Refer to the following data for the correct power and fusing requirements:

Input Voltage	Phase	Input Current @ 12 kw Output	Recommended Fuse Size
208/240/480 VAC	1	87/75/37 amps	110/100/50 amps

Line Disconnect Switch

Use a primary line disconnect switch for each power supply. This disconnect switch allows you to turn the power supply offf quickly in an emergency situation. The

switch should be located on a wall near the power supply, and should be easily accessible to the operator. The interrupt level of the switch must be equal to or exceed the continuous rating of the fuse. Refer to *Power Requirements* listed above.

Power Cord

For the 208-240-480 VAC, 1-phase power supply, use a # 4AWG/3-conductor (4/3 SO) type power cord.

Transformer T1 and T2 Voltage Configurations

The MAX80 power supply control transformer T1 and 12 kw transformer T2 can be configured for either 208, 240 or 480 volt operation.

- To configure T2 for the required 208, 240, or 480 VAC operation, change the L1A, L1B, L2A, and L2B leads from contactor CON1 at T2 . Refer to Figures 3-3 and 6-1. Refer to Section 5, *Standard Components,* Figure 5-4, item 5, to locate transformer T2 and item 6, to locate contactor CON1.

- To configure T1 for 208, 240, or 480 VAC operation, refer to Section 5, *Standard Components,* Figure 5-4, items 1 and 2, to locate fuses F1 and F2 and item 3, to locate transformer T1. The voltage change over is done on the side of the fuse block where the L1 and L2 lead from T1 are connected. Only the L2 lead needs to be swapped. Three L2 leads are available at T1: the brown lead provides 208 VAC, the black lead provides 240 VAC, and the gray lead provides 480 VAC. Refer to Figures 3-3 and 6-1.

GROUNDING REQUIREMENTS

To ensure personal safety, proper operation, and to reduce emission of radio frequency interference, the MAX80 must be properly grounded:

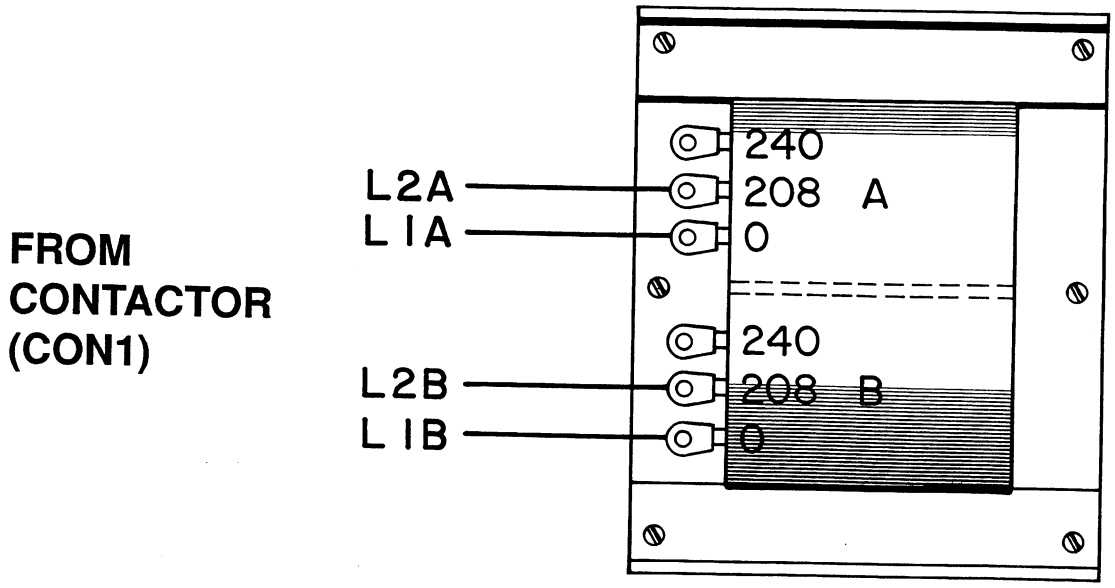
- Ensure the power cord ground wire is properly connected to the ground in the disconnect box.

- Ensure the the power cord ground wire is properly connected to the MAX80 power supply GROUND terminal (see Figure 3-4).

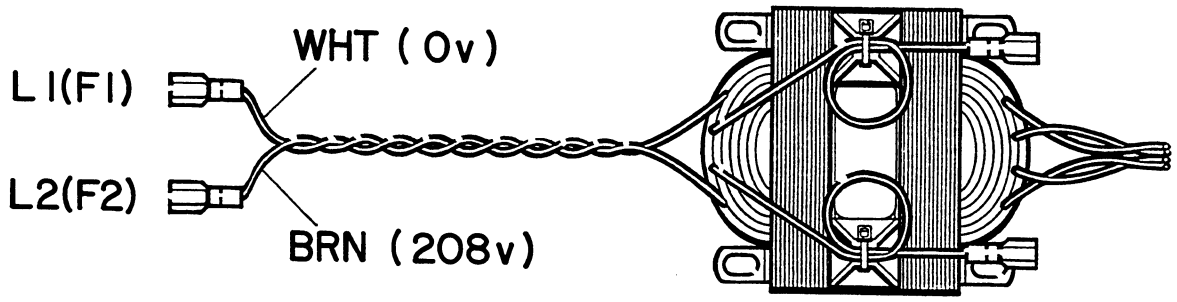
- Connect the work table to a high-quality earth ground within 20 feet (6.1 m) of the table. A suitable ground consists of a solid copper rod of at least 1/2-inch diameter (13 mm) driven to a depth of at least 8 feet (2.4 m) into the earth below the permanent moisture level.

- For more information, refer to the National Electrical Code, Article 250, Section H, *Grounding Electrode System* or other appropriate code. Refer to the *Standards Index* in this manual.

12 KW TRANSFORMER T2



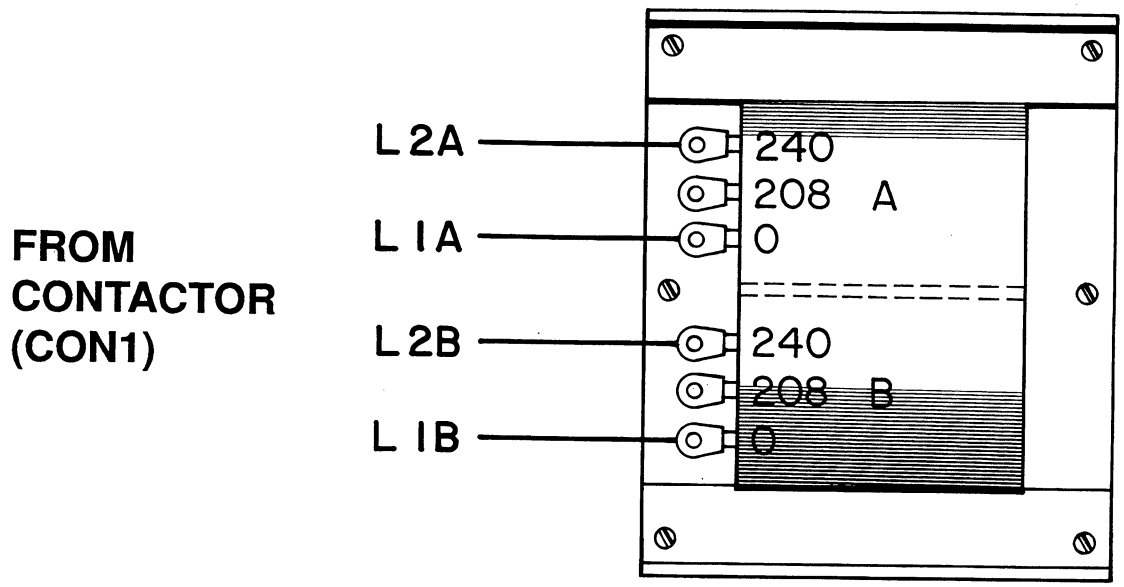
CONTROL TRANSFORMER T1



208 Volt

Figure 3-3 Transformer T1 and T2 Voltage Configurations (Sheet 1 of 3)

12 KW TRANSFORMER T2



CONTROL TRANSFORMER T1

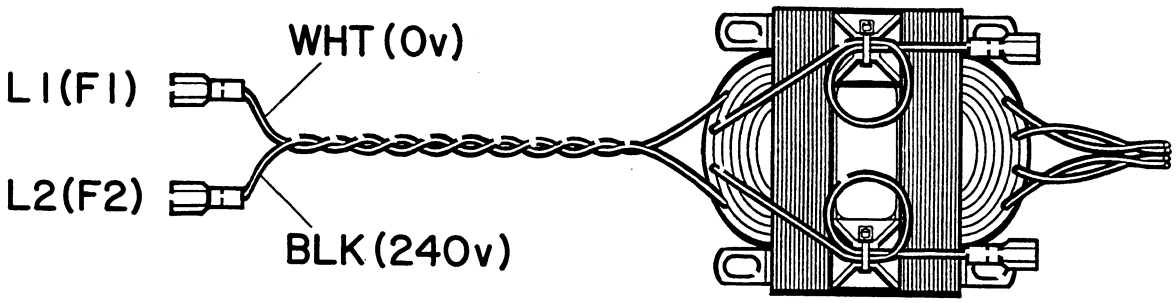
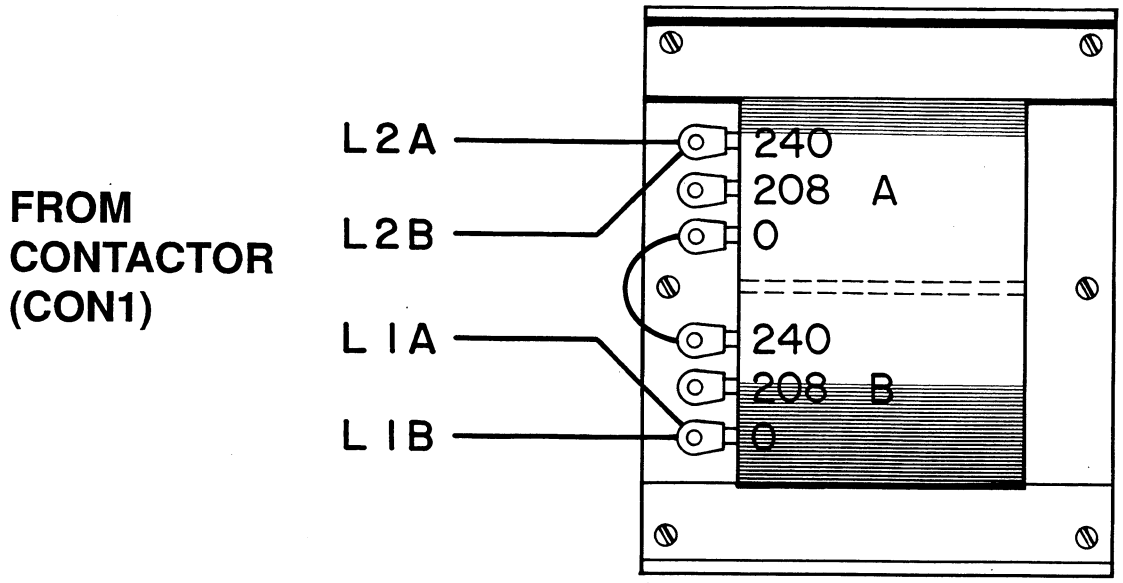
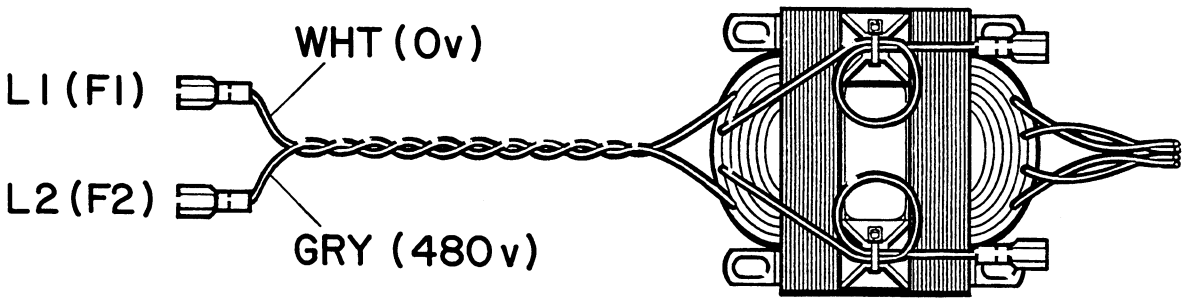


Figure 3-3 Transformer T1 and T2 Voltage Configurations (Sheet 2 of 3)

12 KW TRANSFORMER T2



CONTROL TRANSFORMER T1



480 Volt

Figure 3-3 Transformer T1 and T2 Voltage Configurations (Sheet 3 of 3)

SETUP

ELECTRICAL CONNECTIONS

Connect the Power Cord

To connect the power cord to the MAX80, see Figures 3-2 and 3-4 and proceed as follows:

1. Remove the left side panel and locate the main power contactor CON1 at left lower rear of the center panel.

2. Insert the power cord through the strain relief at the lower right of the rear panel.
3. Connect the power cord leads to the L1 and L2 terminals of CON1. Connect the ground lead using the screw labled GROUND (green) on the floor of the power supply.

Connect the Work Cable

To ensure personal safety and to reduce emission of radio frequency interference, connect the MAX80 work cable clamp as follows:

1. Attach the work cable clamp to the workpiece (hand torch) or bolt it to the work table (machine torch). Make sure that the work cable clamp and the workpiece or work table make good metal-to-metal contact.

2. Do not attach the work cable clamp to the portion of the workpiece being cut away.

Connect the Remote Start/Stop Switch (Machine Torch Only)

To connect the remote start/stop switch to MAX80, see Figures 3-2 and 3-4 and proceed as follows:

1. Pass the remote start/stop switch cable assembly through the strain relief at the rear of the MAX80.

2. Connect wires 33 and 34 to 1TB-3 and 1TB-4 for machine "start."

3. Connect wires 37 and 38 to 1TB-5 and 1TB-6 for "auxillary 24-volt AC input."

Connect the Torch Height Control (THC) (Machine Torch Only)

To connect the THC between the MAX80 and the cutting machine, refer to the THC-2 Instruction Manual IM-20 (#800200).

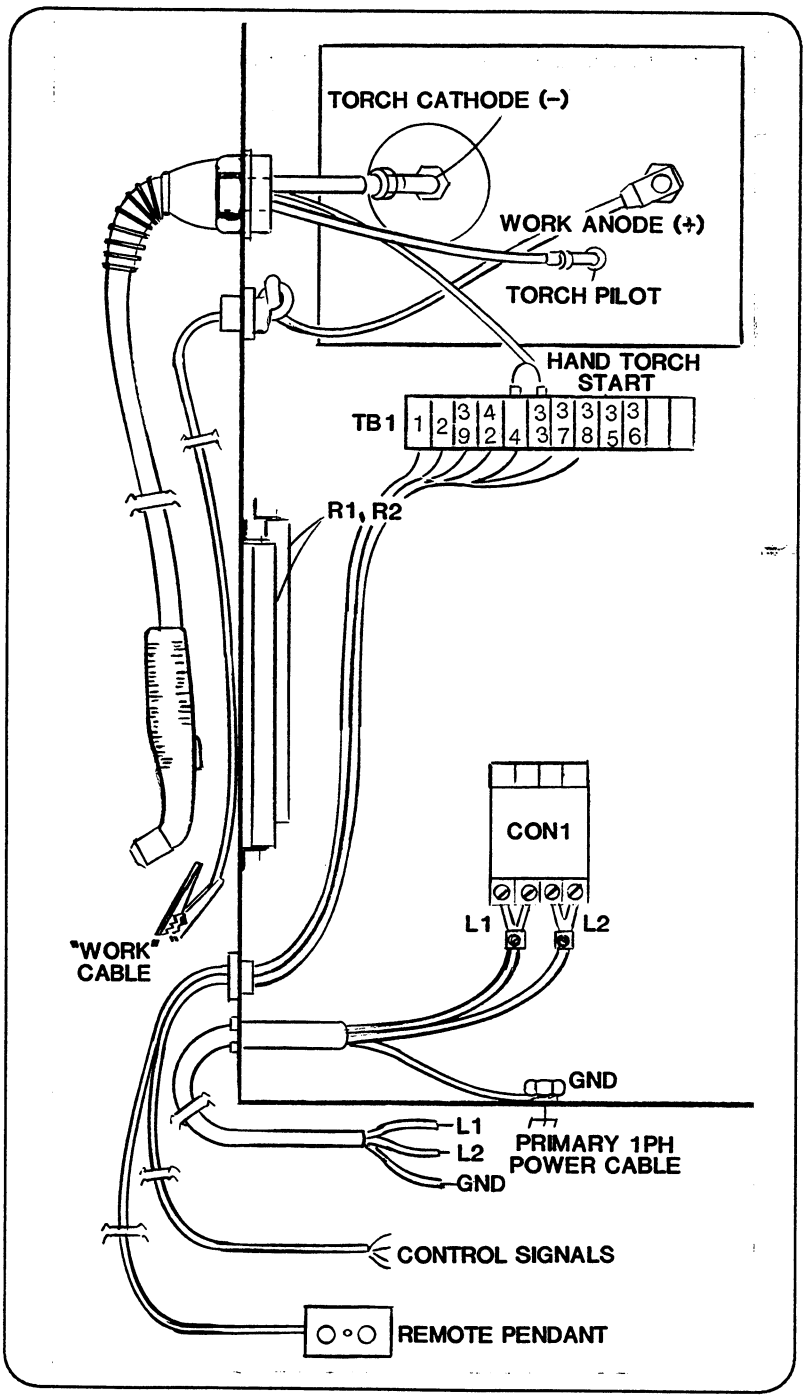


Figure 3-4 Electrical and Torch Lead Connections

CONNECT THE TORCH LEAD TO THE MAX80

To connect the hand or machine torch lead to the power supply, see Figure 3-4 and proceed as follows:

1. Align the torch lead connector plug key with the connector receptacle key slot on the power supply.

2. Push the connector plug in until the securing ring and the receptacle threads just touch. Ensure the securing ring threads and receptacle threads align.

> **Caution: The connector is fine-threaded. Cross threading can easily occur, which could cause thread damage. If the threads appear to be crossed, turn the connector securing ring counterclockwise until the securing ring is loose. Repeat step 2.**

3. Turn the securing ring clockwise to tighten. Tighten the securing ring until the connector is tight (no play or movement). This ensures that the pilot arc and the plasma gas connector O-rings have made a good seal and are leakage free.

Section 4 OPERATION

In this section:

OPERATION

DESCRIPTION OF CONTROLS

Located on the front panel are the:

- **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 infinitely between 30 and 80 amps. (Increasing the amperage increases the thickness that can be cut.)

- **PLATE TYPE EXPANDED/NORMAL switch**
  Turns the continuous pilot arc on or off. Used in the NORMAL position when cutting most metal plate. This switch should only be in the EXPANDED position when cutting expanded metals, and should never exceed 40 amps.

- **GAS TEST/RUN switch**
  Sets dynamic (flowing) air flow.

- **Gas adjustment valve**
  Adjusts dynamic (flowing) air flow.

- **Pressure gauge**
  Shows dynamic (flowing) gas pressure.

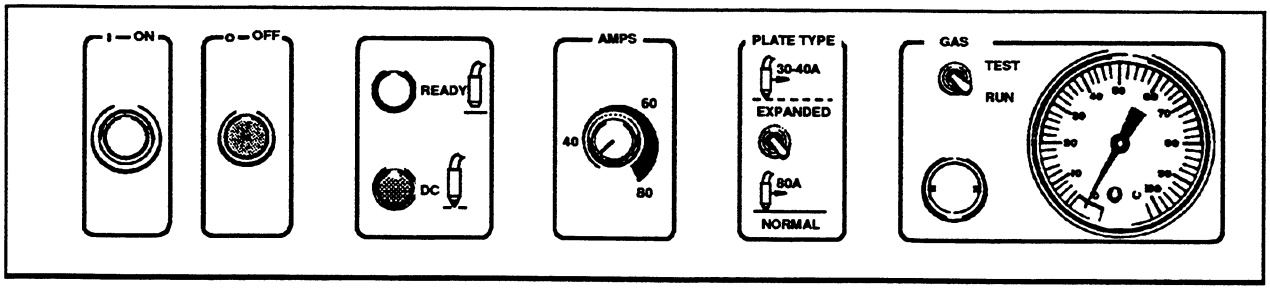


Figure 4-1 Front Panel Controls

OPERATING INSTRUCTIONS - HAND AND MACHINE TORCHES

1. Ensure that the work environment and your clothing meet the safety requirements outlined in the *Safety* section.

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

3. Be sure that the correct consumable parts are in the torch (See figure 5-7).

4. Turn on the facility gas supply.

5. Apply single-phase power to the MAX80.

WARNING

There is no indication that power has been applied to the power supply. Disconnect the power before servicing the MAX80.

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

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

8. Using the needle valve on the front panel of the MAX80, adjust the gas pressure according to the *Cut Charts.*

9. Place the GAS TEST/RUN switch in the RUN position.

10. Place the PLATE TYPE switch in the NORMAL position.

11. Adjust the current potentiometer to the desired current according to the *Cut Charts.*

12. Attach the work cable clamp to the workpiece (hand torch) or bolt it to the work table (machine torch). Make sure that the work cable clamp and the workpiece or work table make good metal-to-metal contact. Do not attach the work clamp to the portion of the workpiece that will fall away (see Figure 4-1).

13. Position the torch the appropriate distance from the workpiece —1/16-1/8" (1.6 - 3.2 mm) standoff for handcutting and 1/8" (3.2 mm) standoff for machine cutting.

14. Press and hold down the start switch on the hand torch to activate the pilot arc. Use a remote plasma start/stop switch configuration for the machine torch. When the start switch has been pressed, the following will occur:

/o-second delay, the pilot arc will activate, and transfer will occur if the close enough to the workpiece.

/o-second gas preflow delay starts timing.

r the two-second preflow, the following occurs simultaneously:

High frequency energizes and times out after one second.

The pilot arc circuit activates.

The pilot arc initiates and transfers to the workpiece if the torch is within 1/8" (3.2 mm) or touching the workpiece.

Arc transfer will not occur if:

- There is no material under the arc.
- The start switch is not held in.
- A safety interlock is not satisfied.
- The work cable is not connected to the workpiece or work table.

When the cut is finished, release the torch start button on the hand torch or the stop switch on the remote plasma start/stop switch to stop the arc. Postflow of gas will continue for ten seconds after release the torch start button.

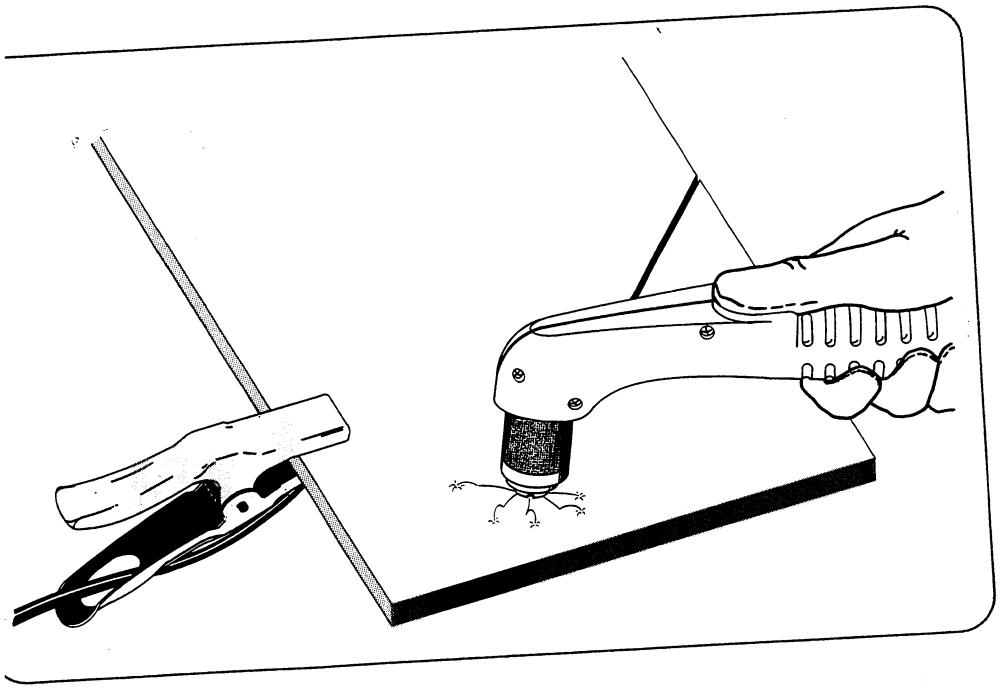


Figure 4-2 Proper Work Clamp Connection

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 monitored periodically for signs of wear. A good rule of thumb is to check the parts after every 150 starts (pierces, edge starts, parts cut, etc.).

To remove the consumables:

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 retaining cap 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 slip out easily; set them aside.

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

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

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

5. Inspect the O-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 2.0 mm (1/16") deep, replace it. If the electrode is still good, inspect its O-ring - it should be lubricated and undamaged. If it 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. Hold the swirl ring in place to avoid dropping it into the water of the water table.

12. Place the nozzle on top of the swirl ring. Hold the nozzle in place to avoid dropping it in the water.

13. Replace the retaining cap. Make sure that it is tightened snugly; if it is loose, it can affect the shield gas flow.

Cutting Techniques - Hand Torch

Cutting

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

2. Start cutting from the edge of the workpiece (Fig. 4-3) unless you must pierce. For tips on piercing, see *Piercing* .

3. 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.

4. 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.

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

6. Pull the torch through the cut. Pulling it is easier than pushing it.

7. Hold the torch nozzle at a vertical position and watch the arc as it cuts along the line (Fig. 4-4). 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.

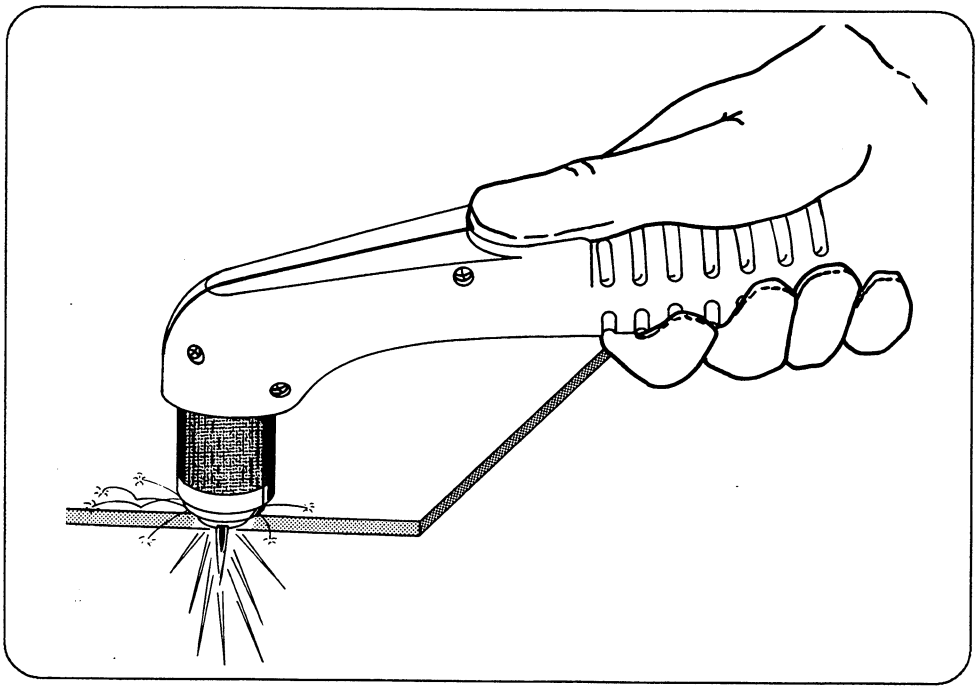


Figure 4-3
Starting a Cut

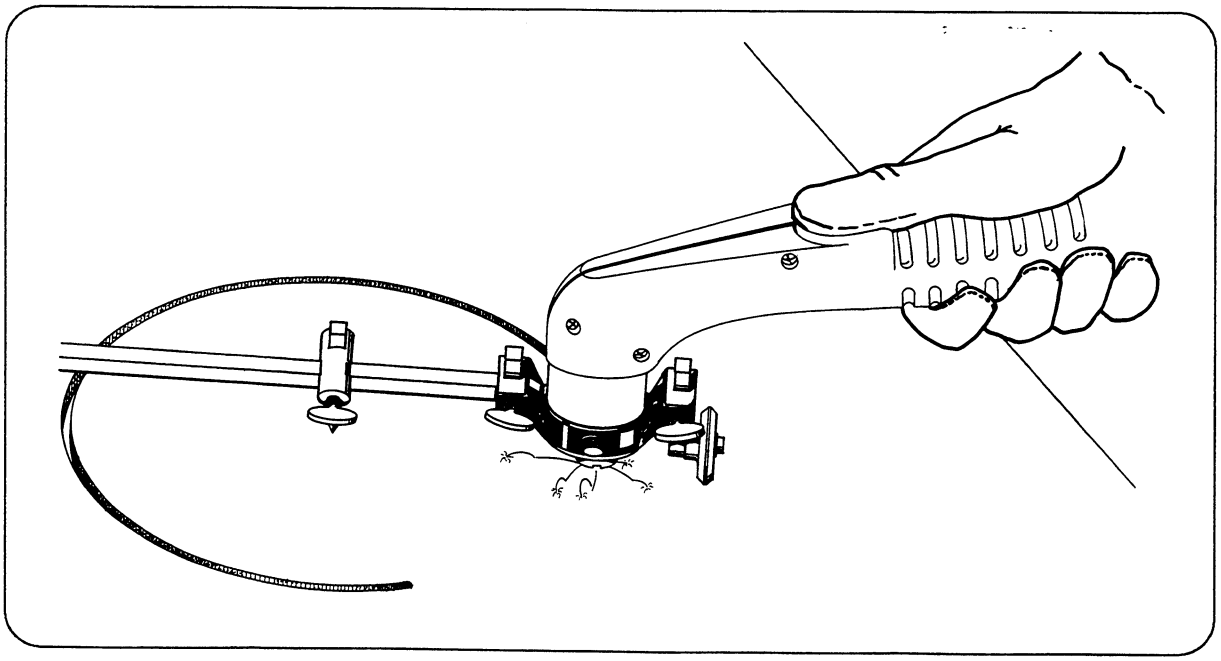


Figure 4-4 Cutting a Circle

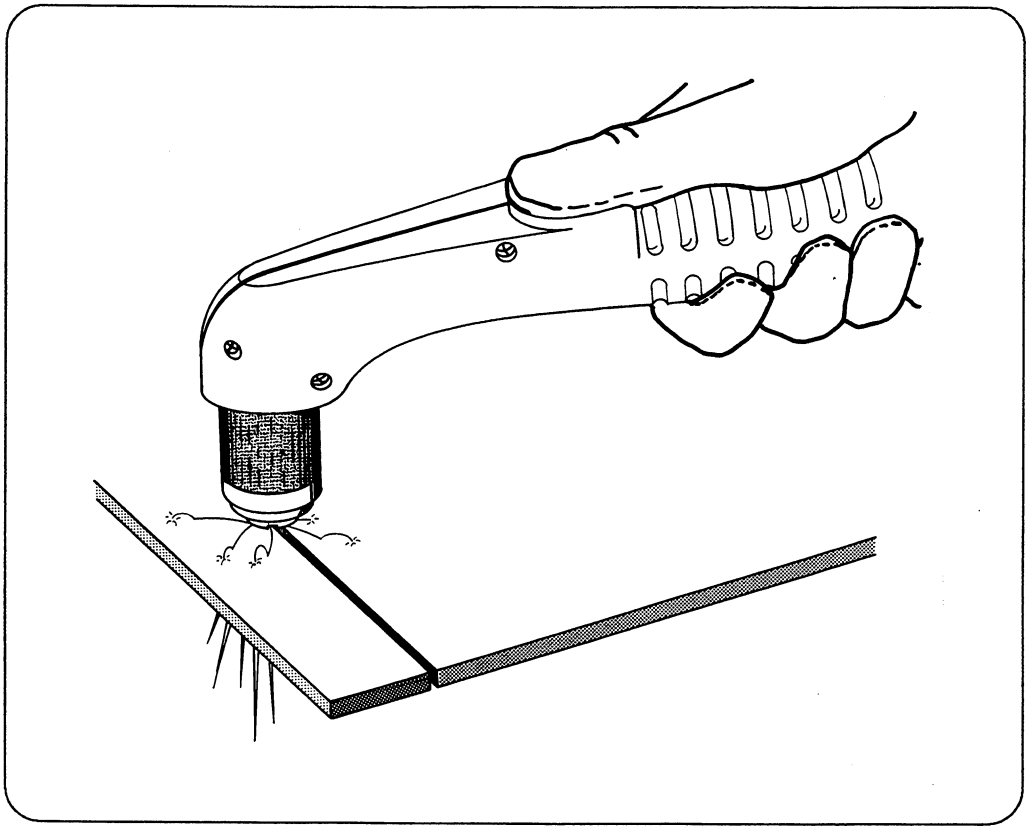


Figure 4-5 Dragging the Torch

Gouging

The MAX80 can be used for gouging mild steel by using the optional gouging nozzle (part number 020339). To gouge:

1. Wear full protection - a welding helmet with at least a #6 glass, welding gloves and a welding jacket. The arc is fully exposed and will cause serious burns if skin is not covered.

2. Install the gouging nozzle just as you would install a standard cutting nozzle.

3. Adjust the air pressure at the control panel to 50 psi (3.4 bar) (with air flowing at the torch). Note that this is slightly lower than the cutting pressure.

4. Tilt the torch approximately 45° from the surface to be gouged and feed into the gouge. Try not to allow the nozzle 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 4-6.)

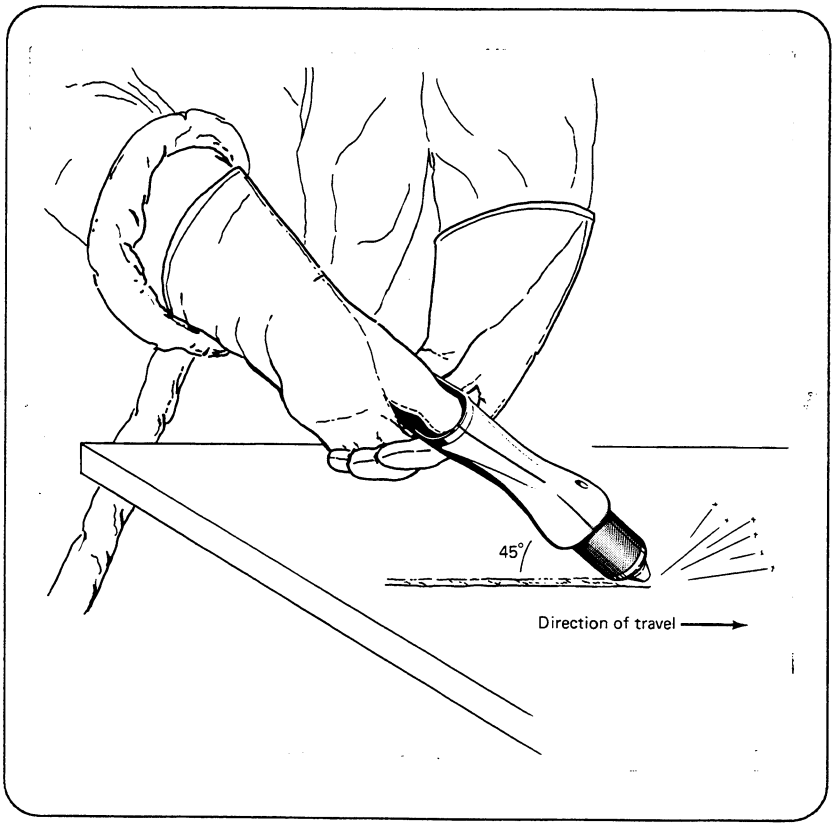


Figure 4-6 Gouging

Piercing

Note: The MAX80 can pierce metals up to a thickness of 1/2 inch (12.7 mm).

1. Hold the torch so that the nozzle is approximately 1/16 inch (1.6 mm) away from the workpiece before pressing the start button. This method maximizes the life of the nozzle.

2. 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.

3. 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).

4. When the pierce is complete, proceed with the cut.

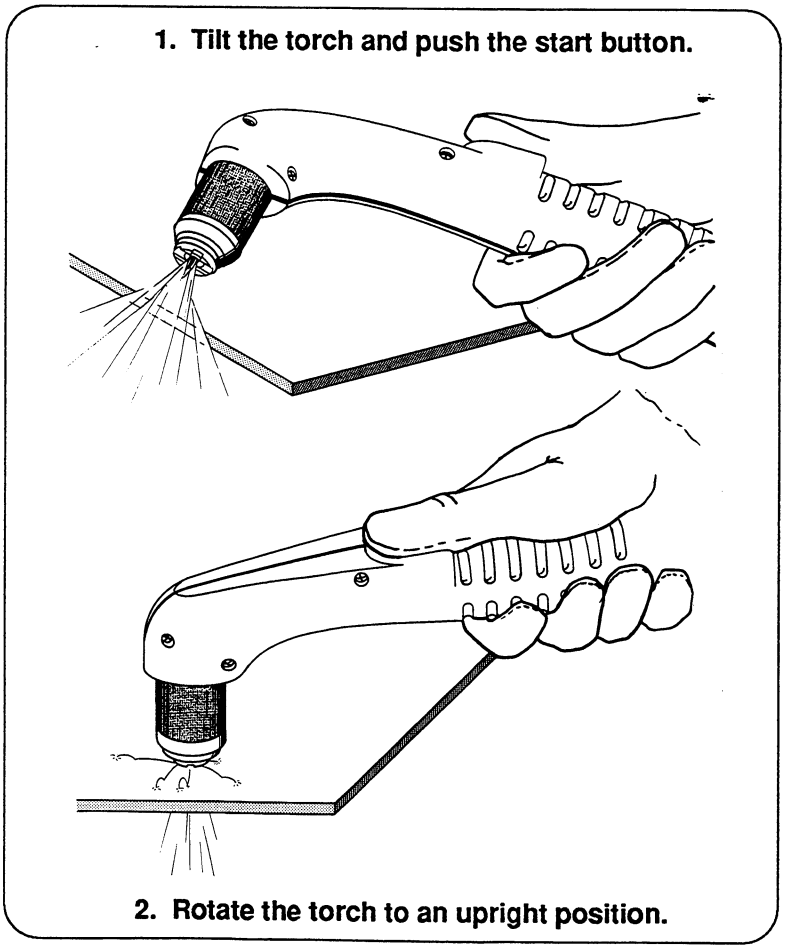


Figure 4-7
Piercing

Cutting Techniques - Machine Torch

Torch Alignment

Ensure that the torch is at right angles to the workpiece to get a clean, vertical cut. Use a square to align the torch.

Cutting

1. Start cutting from the edge of the workpiece, unless you must pierce. For tips on piercing, refer to the procedure on piercing, below.

2. When cutting, make sure that the sparks are coming out of the bottom of the workpiece. If not, check to see:

   - If the sparks are spraying on top of the workpiece. If so, the torch may be moving too fast. Check the *Cut Charts* for the correct travel speeds. The optimum travel speed is generally just slightly under the speed that causes the arc to "rooster tail" off of the workpiece.

   - If there is not sufficient power to fully penetrate the workpiece, reduce the travel speed. If this does not work, stop cutting and re-check the *Cut Chart* specifications.

Piercing

Note: The MAX80 can pierce metals up to a thickness of 1/2 inch (12.7 mm).

1. Set the torch-to-work distance (standoff) so that the shield cap is 1/8 inch (3.2 mm) or more away from the workpiece.

2. When piercing with the MAX80 machine torch, using the "running start" method is recommended. Position the torch off of the cutting line a sufficient distance in order for the pierce to be made before the cutting line is reached.

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.
- The duty cycle is reduced if:
  - The input line voltage is less than nominal, due to a long power cord, poor utility supply, etc.
  - The cutting material is greater than one inch thick.
  - The work clamp is not making a good electrical contact to the workpiece due to paint, rust, etc.

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 80 amps, the MAX80 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.

CLAIMS AND TECHNICAL QUESTIONS

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

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

CUT CHARTS

The following *Cut Charts* provide the necessary information in order for the operator using either a hand torch system or machine torch system to be successful in plasma arc cutting.

Caution:	**Before cutting always check all settings and check for damaged torch parts and worn consumable parts.**

– AIR –

MAX80 Operating Data For Mild Steel

Material Thickness (Inches)	(mm)	Nozzle Type/size (Inches)	Gas Pressure (psi/bar)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (Amps)	Arc Voltage Setting (Volts)	Travel Speed (ipm)	(mm/m)	Pierce Time (Sec.)
.0156	(28 GA)	Std. .038	65/4.5*	5/64	2	40	90	340	8,640	
.0188	(26 GA)			5/64	2	40	90	320	8,130	
.025	(24 GA)			5/64	2	40	95	285	7,240	
.035	1			5/64	2	40	100	235	5,970	
.050	(18 GA)			5/64	2	40	100	170	4,320	.50
1/16				5/64	2	40	105	150	3,810	.50
.075	2			5/64	2	40	105	130	3,300	1.00
1/8	3			5/64	2	40	105	85	2,160	1.50
.158	4			1/8	3	40	110	60	1,520	1.50
.197	5			1/8	3	40	120	45	1,140	1.75
1/4	6			1/8	3	40	120	30	760	2.00
3/8	10			1/8	3	40	125	8	200	200
Nozzle - 020203 Swirl ring - 020194 Electrode - 020191										
1/4	6	Shield .052	60/4.1 *	1/8	3	80	130	80	2,030	.75
3/8	10			1/8	3	80	125	45	1,140	1.00
1/2	13			1/8	3	80	130	30	760	1.25
5/8	15			5/32	4	80	140	20	500	1.50
3/4	19			3/16	5	80	150	15	300	1.75
Nozzle - 020397 Shield/cap - 020334/020336 Swirl ring - 020194 Electrode - 020191										
1/8	3	Std. .052	65/4.5 *	1/8	3	80	100	180	4,570	.50
3/16				1/8	3	80	110	110	2,790	.50
1/4	6			5/32	4	80	120	85	2,160	.75
3/8	10			5/32	4	80	115	50	1,270	1.00
1/2	13			5/32	4	80	125	35	890	1.25
5/8				3/16	5	80	130	20	500	1.50
3/4				3/16	5	80	140	15	380	1.75
1				1/4	6	80	150	8	200	2.00
Nozzle - 020345 Shield/cap - 020333/020336 Swirl ring - 020194 Electrode - 020191										

* Gas pressure setting is for 25-ft. leads. Add 5 psi (.345 bar) for 50-ft. leads. Add 10 psi (.690 bar) for 75-ft leads.

– AIR –

MAX80 Operating Data For Stainless Steel

Material Thickness (Inches)	(mm)	Nozzle Type/size (Inches)	Gas Pressure (psi/bar)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (Amps)	Arc Voltage Setting (Volts)	Travel Speed (ipm)	(mm/m)	Pierce Time (Sec.)
.0156	(28 GA)	Std. .038	65/4.5*	5/64	2	40	100	260	6,600	
.0188	(26 GA)			5/64	2	40	100	240	6,090	
.025	(24 GA)			5/64	2	40	105	215	5,460	
1/32				5/64	2	40	105	180	4,570	
.050	(18 GA)			5/64	2	40	110	130	3,300	
1/16				5/64	2	40	110	115	2,900	.50
1/8	3			5/64	2	40	120	65	1,650	1.00
1/4	6			1/8	3	40	130	25	635	1.75
3/8	10			1/8	3	40	135	7	175	2.00
Nozzle - 020203 Swirl ring - 020194 Electrode - 020191										
1/4	6	Shield .052	60/4.1*	1/8	3	80	130	65	1,650	.75
3/8	10			1/8	3	80	135	35	890	1.00
1/2	13			1/8	3	80	140	25	635	1.25
5/8	15			5/32	4	80	140	20	500	1.50
3/4	19			3/16	5	80	145	15	380	1.75
Nozzle - 020397 Shield/cap - 020334/020336 Swirl ring - 020194 Electrode - 020191										
1/8	3	Std. .052	65/4.5*	1/8	3	80	125	150	3,810	.50
1/4	6			5/32	4	80	125	70	1,780	.75
3/8	10			5/32	4	80	130	40	1,010	1.00
1/2	13			5/32	4	80	135	25	635	1.25
5/8	15			3/16	5	80	135	20	500	1.50
3/4	19			3/16	5	80	140	15	380	1.75
Nozzle - 020345 Swirl ring - 020194 Electrode - 020191										

* Gas pressure setting is for 25-ft. leads. Add 5 psi (.345 bar) for 50-ft. leads. Add 10 psi (.690 bar) for 75-ft leads.

– AIR –

MAX80 Operating Data For Aluminum

Material Thickness (Inches)	(mm)	Nozzle Type/size (Inches)	Gas Pressure (psi/bar)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (Amps)	Arc Voltage Setting (Volts)	Travel Speed (ipm)	(mm/m)	Pierce Time (Sec.)
1/32		Std. .038	65/4.5*	5/64	2	40	90	240	6,100	.50
1/16				5/64	2	40	100	150	3,810	.75
3/32				5/64	2	40	100	110	2,790	1.00
1/8	3			5/64	2	40	105	85	2,160	1.00
1/4	6			1/8	3	40	120	30	760	1.25
3/8	10			1/8	3	40	125	8	200	1.50
Nozzle - 020203 Swirl ring - 020194 Electrode - 020191										
1/4	6	Shield .052	60/4.1*	1/8	3	80	130	50	1,270	.75
3/8	10			1/8	3	80	130	30	760	1.00
1/2	13			5/32	4	80	140	20	500	1.25
5/8	15			5/32	4	80	145	13	330	1.50
3/4	19			3/16	5	80	155	8	200	1.75
Nozzle - 020397 Shield/cap - 020334/020336 Swirl ring - 020194 Electrode - 020191										
1/8	3	Std. .052	65/4.5*	1/8	3	80	110	150	3,810	.50
1/4	6			5/32	4	80	125	55	1,390	.75
3/8	10			5/32	4	80	120	35	890	1.00
1/2	13			5/32	4	80	130	25	635	1.25
5/8	15			3/16	5	80	135	13	330	1.50
3/4	19			3/16	5	80	145	8	200	1.75
Nozzle - 020345 Swirl ring - 020194 Electrode - 020191										

* Gas pressure setting is for 25-ft. leads. Add 5 psi (.345 bar) for 50-ft. leads. Add 10 psi (.690 bar) for 75-ft leads.

– NITROGEN –

MAX80 Operating Data For Stainless Steel

Material Thickness (Inches)	(mm)	Nozzle Type/size (Inches)	Gas Pressure (psi/bar)	Torch-to-work Distance (Inches)	(mm)	Arc Current Setting (Amps)	Arc Voltage Setting (Volts)	Travel Speed (ipm)	(mm/m)	Pierce Time (Sec.)
.0156	(28 GA)	Std. .038	65/4.5*	5/64	2	40	105	260	6,600	
.0188	(26 GA)			5/64	2	40	105	240	6,100	
.025	(24 GA)			5/64	2	40	110	215	5,460	
1/32				5/64	2	40	110	180	4,570	
.050	(18 GA)			5/64	2	40	115	130	3,300	
1/16				5/64	2	40	115	120	3,050	.50
1/8	3			5/64	2	40	125	65	1,650	1.00
1/4	6			1/8	3	40	135	25	640	1.75

Nozzle - 020203
Swirl ring - 020194
Electrode - 020193

1/4	6	Shield .052	60/4.1*	1/8	3	80	135	50	1,270	.75
3/8	10			1/8	3	80	140	32	810	1.00
1/2	13			1/8	3	80	145	20	500	1.25
5/8	15			5/32	4	80	145	13	330	1.50
3/4	19			3/16	5	80	150	10	250	1.75

Nozzle - 020397
Shield/cap - 020334/020336
Swirl ring - 020194
Electrode - 020193

1/8	3	Std. .052	65/4.5*	1/8	3	80	130	135	3,420	.50
1/4	6			5/32	4	80	130	65	1,650	.75
3/8	10			5/32	4	80	135	35	890	1.00
1/2	13			5/32	4	80	140	20	500	1.25
5/8	15			3/16	5	80	140	18	450	1.50
3/4	19			3/16	5	80	145	10	250	1.75

Nozzle - 020345
Swirl ring - 020194
Electrode - 020193

* Gas pressure setting is for 25-ft. leads. Add 5 psi (.345 bar) for 50-ft. leads. Add 10 psi (.690 bar) for 75-ft leads.

Section 5 Standard Components

In this section:

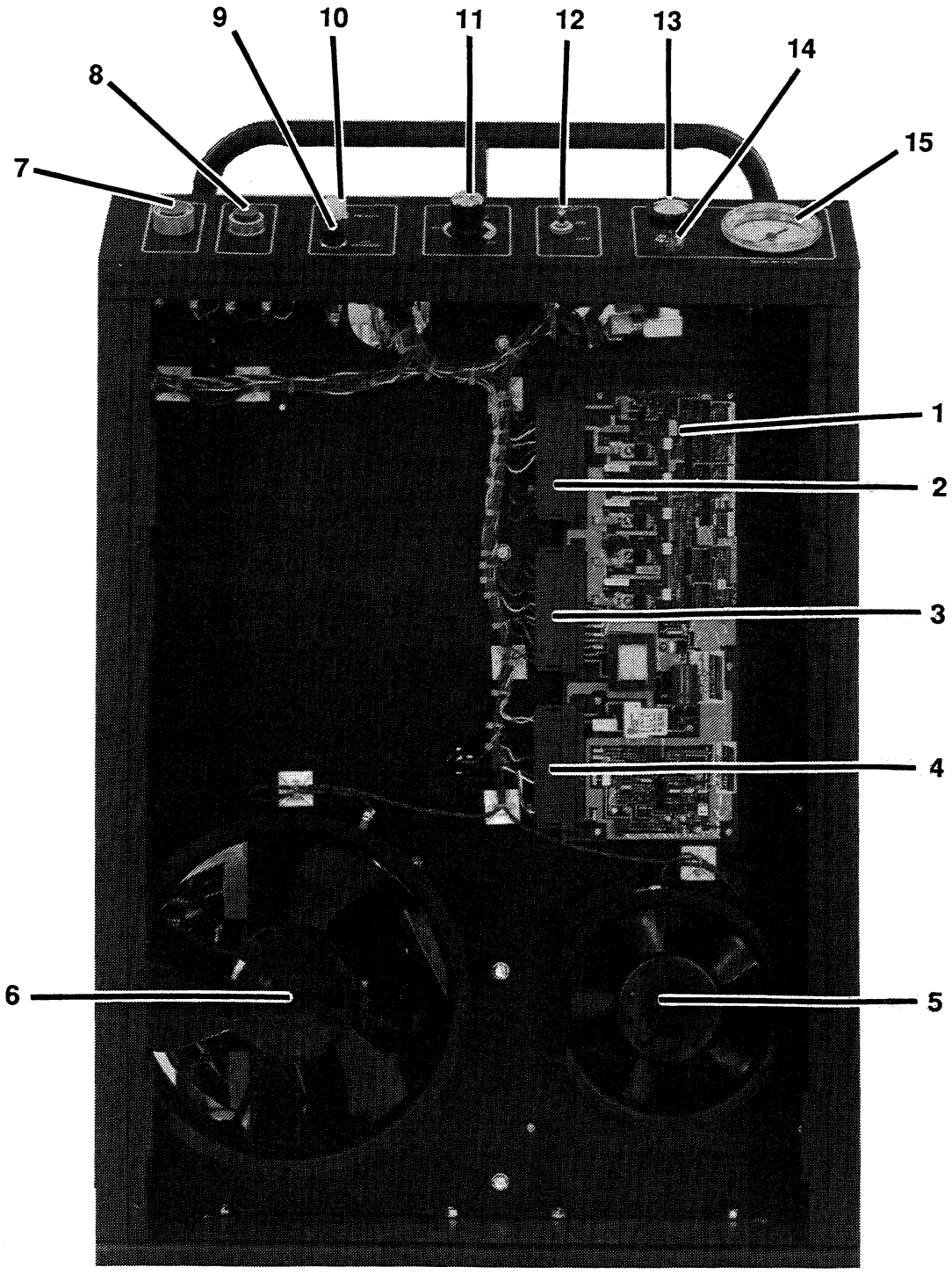


Figure 5-1 Power Supply - Front View

Item	Part Number	Description	Designator	Qty.
1	041224	PC BD assembly, control, MAX80	PCB4	1
2	008233	Plug, in-line, 16 POS	PL5	1
3	008233	Plug, in-line, 16 POS	PL6	1
4	008233	Plug, in-line, 16 POS	PL7	1
5	027080	Fan, 225 CFM, 120VAC, 50/60 Hz	M2	1
6	027079	Fan 450-550 CFM, 120VAC, 50/60 Hz	M1	1
7	005121	Switch, PB green, NO	PB1	1
8	005122	Switch, PB red, NC	PB2	1
9	005091	Cap, red	LT2	1
	005088	Lamp holder, T 3-1/4 bulb	-	1
	005090	Bulb, 28VDC, 40 MA, T 3-1/4	-	1
10	005089	Cap, white	LT1	1
	005088	Lamp holder, T 3-1/4 bulb	-	1
	005090	Bulb, 28VDC, 40 MA, T 3-1/4	-	1
11	009483	Resistor, variable, 1 K ohm, 1T, 1W	R6	1
12	005041	Switch, toggle	S1	1
13	005044	Switch, toggle SPDT	S2	1
14	006033	Valve, needle, 1/4 NPT	V4	1
15	022008	Gauge, pressure, 2-1/2", 100 psi	PG1	1

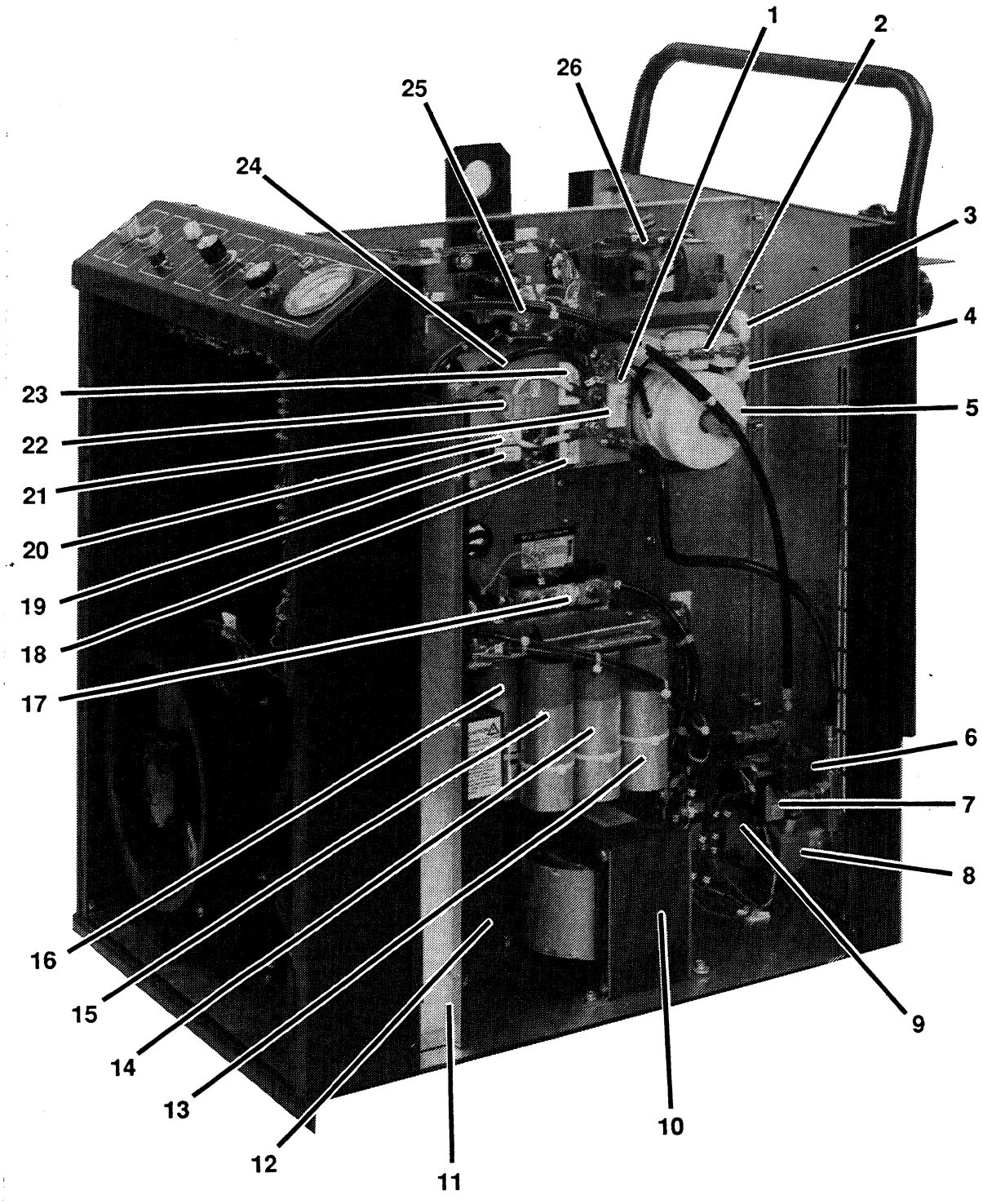


Figure 5-2 Power Supply - Right Side, Rear View

Item	Part Number	Description	Designator	Qty.
1	029190	Hi freq. input/output panel SA	PCB3	1
2	009350	Spark gap SA	SG1	1
3	009280	Capacitor, .002UF 15KV	C6	1
4	009280	Capacitor, .002UF 15KV	C7	1
5	009371	Coil assembly, hi-freq.	T4	1
6	006032	Valve, SOL	V3	1
7	005093	Switch, pressure 0-90 psi	PS1	1
8	006014	Valve, SOL 90#, 1/4 NPTF	V2	1
9	006014	Valve, SOL 90#, 1/4 NPTF	V1	1
10	014043	Inductor, 4MH, 100 ADC	L1	1
11	029506	Chopper SA	CH1	1
12	041121	Chopper module	PCB5	1
13	009559	Capacitor, ELE 2000UF, 350 VDC	C6	1
14	009559	Capacitor, ELE 2000UF, 350 VDC	C4	1
15	009559	Capacitor, ELE 2000UF, 350 VDC	C2	1
16	009559	Capacitor, ELE 2000UF, 350 VDC	C1 (C3, C5,C7)*	1
17	008317	Fuse 125A, 250V	F5	1
18	009224	Capacitor, pol, .22 uf, 1000 WVDC	C3	1
19	009214	Capacitor, pol, .047 uf, 1000 WVDC	C4	1
20	009214	Capacitor, pol, .047 uf, 1000 WVDC	C5	1
21	009224	Capacitor, pol, .22 uf, 1000 WVDC	C1	1
22	029202	Current sensor SA, MAX100	CS1	1
23	009224	Capacitor, pol, .22 uf, 1000 WVDC	C2	1
24	041120	PC board assembly, I/O	PCB6	1
25	003021	Relay, 120 VAC, NO SPST	CR1	1
26	014021	Transformer, HV 5000 VAC, 20 MA	T3	1

* Capacitors C3, C5, and C7 are not visible in this view.

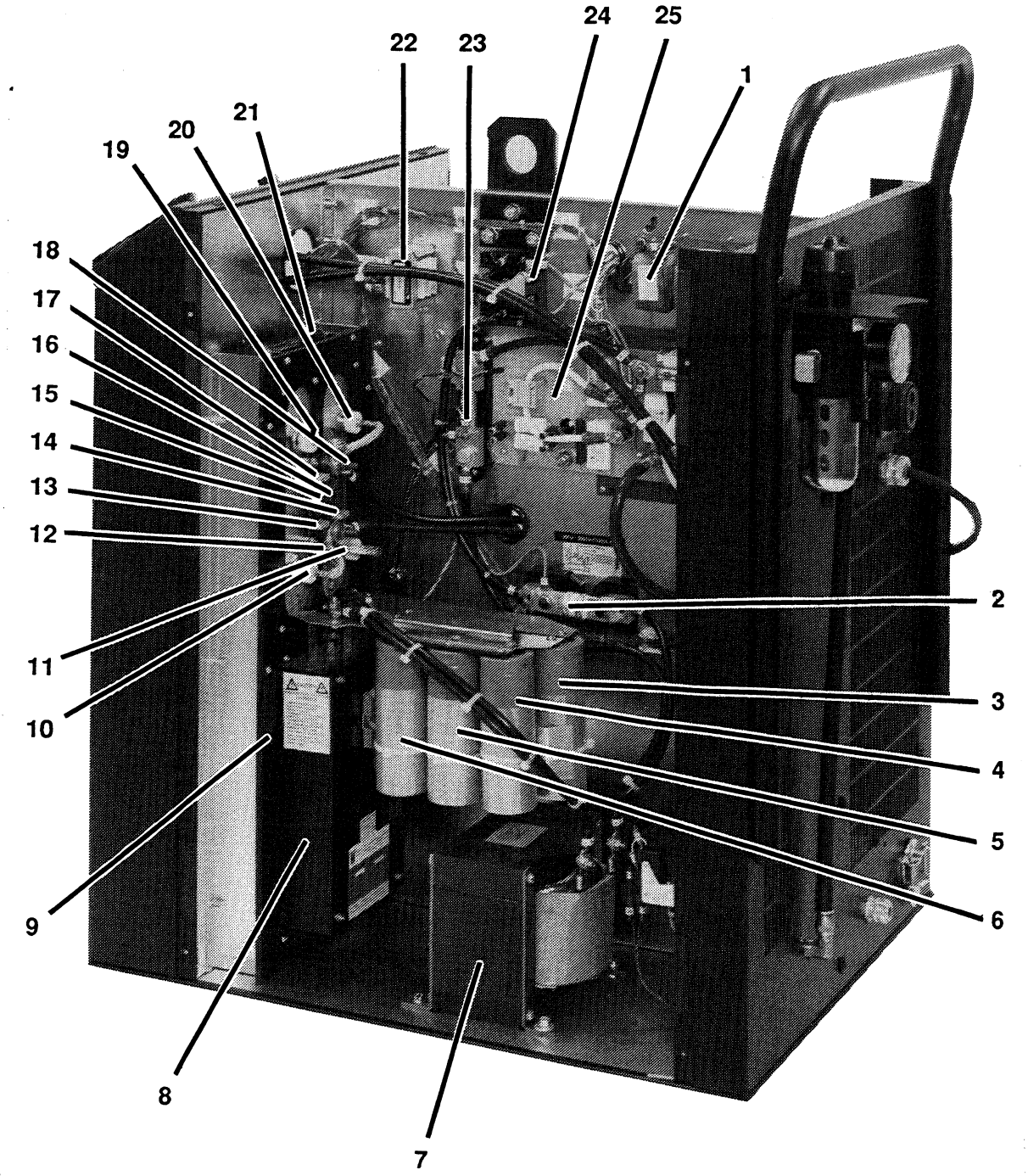


Figure 5-3 Power Supply - Right Side, Front View

Item	Part Number	Description	Designator	Qty.
1	029533	Transformer SA, HV 5000 VAC, 20 MA	T3	1
2	008317	Fuse 125A, 250V	F5	1
3	009559	Capacitor, ELE 2000UF, 350 VDC	C7 (C1, C3, C5)*	4
4	009559	Capacitor, ELE 2000UF, 350 VDC	C6	1
5	009559	Capacitor, ELE 2000UF, 350 VDC	C4	1
6	009559	Capacitor, ELE 2000UF, 350 VDC	C2	1
7	014043	Inductor, 4MH, 100 ADC	L1	1
8	029506	Chopper SA	CH1	1
9	041121	Chopper module	PCB5	1
10	009731	Diode, 150A, 1000V, FWD POL	D2	1
11	009732	Diode, 150A, 1000V, REV POL	D4	1
12	041118	PC board assembly, MAX80 snubber	PCB1	1
13	009282	Capacitor, pol, .022uf, 10% 250V	C3	1
14	009282	Capacitor, pol, .022uf, 10% 250V	C4	1
15	009353	MOV, 250V, 40A	MOV1	1
16	009353	MOV, 250V, 40A	MOV2	1
17	009282	Capacitor, pol, .022uf, 10% 250V	C2	1
18	009282	Capacitor, pol, .022uf, 10% 250V	C1	1
19	009731	Diode, 150A, 1000V, FWD POL	D1	1
20	009732	Diode, 150A, 1000V, REV POL	D3	1
21	009647	Resistor, 1000 ohm, 50W/brkt	R1	1
22	014042	Transformer, CH120 pwr 28VCT	T5	1
23	007022	Shunt, 100A, 100MV	R5	1
24	003021	Relay, 120 VAC, NO SPST	CR1	1
25	041120	PC board assembly, I/O	PCB6	1

* Capacitors C1, C3, and C5 are not visible in this view.

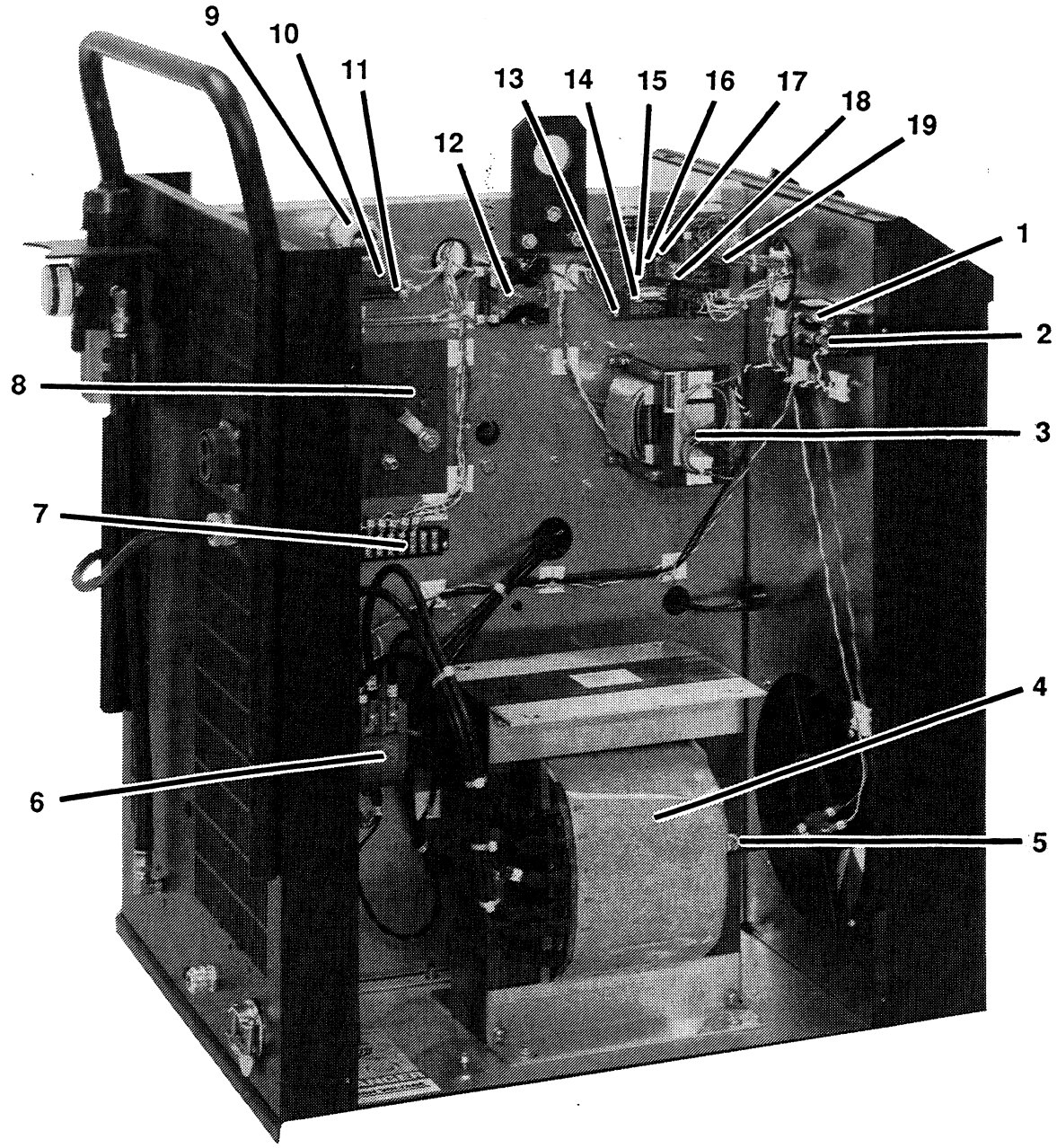


Figure 5-4 Power Supply - Left Side, Front View

Item	Part Number	Description	Designator	Qty.
1	008239	Fuse, 2A, 600V, FLQ-2	F1	1
2	008239	Fuse, 2A, 600V, FLQ-2	F2	1
3	029532	Xfmr SA, control 208-240-480	T1	1
4	014130	Xfmr, 12KW, 208-240-480V, 1 Ø, 60 Hz	T2	1
5	005102	Thermostat, 165° C	TS1	1
6	003115	Contactor, 50A, 4-pole, 24 VAC coil	CON1	1
7	008079	Terminal strip (12)	TB1	1
8	029190	Hi freq. input/output panel SA	PCB3	1
9	009296	Capacitor, ele 100uf 350VDC	C9	1
10	009015	Resistor, 10 Kohm, 10 W	R4	1
11	009622	Resistor, 10 ohm	R3	1
12	003021	Relay, 120 VAC, NO SPST	CR3	1
13	041223	PC board assembly, power dist. MAX80	PCB2	1
14	008322	Fuse, 8A 250VAC UL/CSA SLO-BLO	F4	1
15	009355	MOV, 82VRMS, 2 Joule	MOV6	1
16	009354	MOV, 150VRMS, 10 Joule	MOV5	1
17	008259	Fuse, 3A 250VAC UL/CSA SLO-BLO	F3	1
18	003067	Relay, gen purp, PC MNT scaled	CR2	1
19	003089	Relay, 4PDT, AGCDO, 24 VAC PC MT	CR4	1

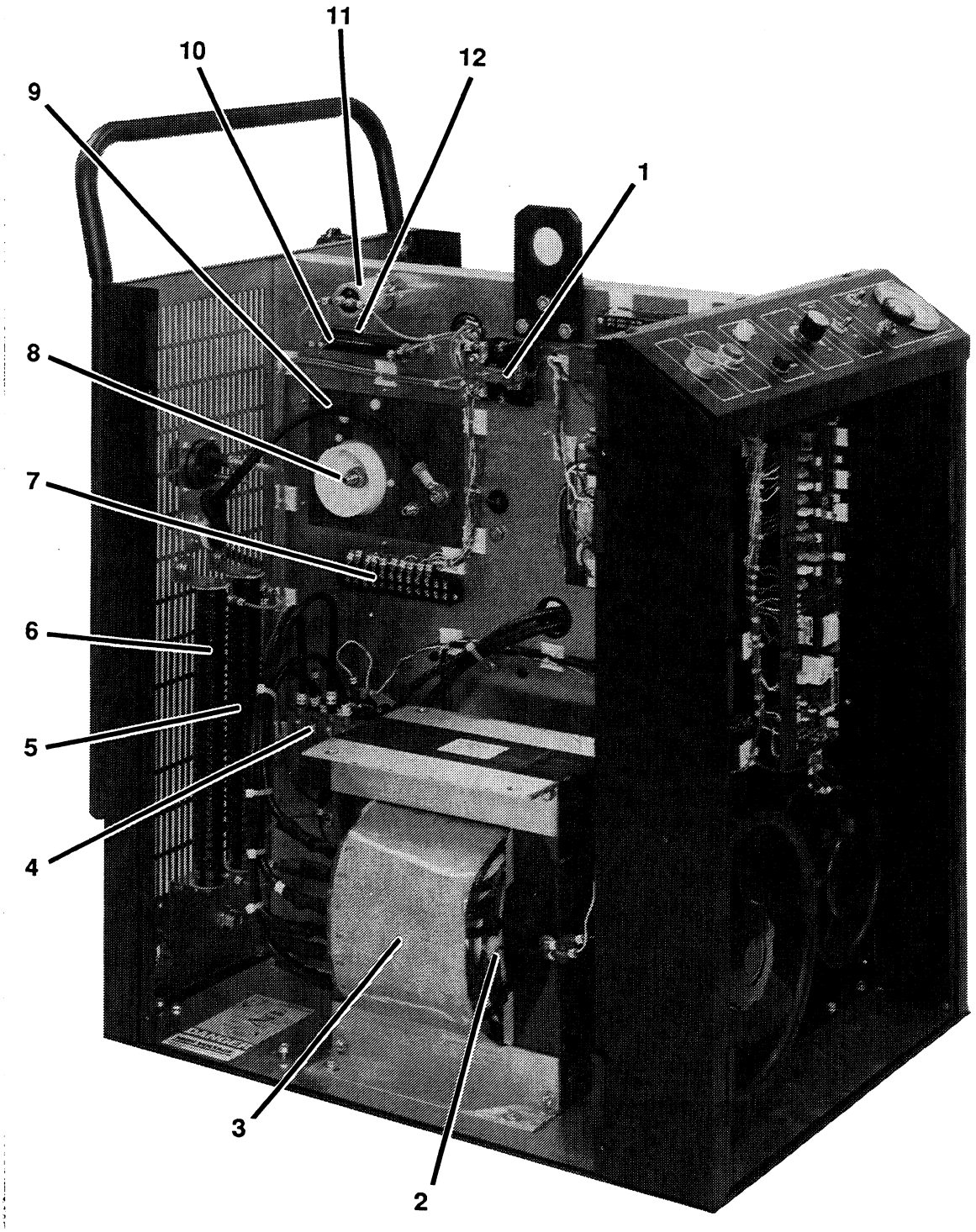


Figure 5-5 Power Supply - Left Side, Rear View

Item	Part Number	Description	Designator	Qty.
1	003021	Relay, 120 VAC, NO SPST	CR3	1
2	005102	Thermostat, 165° C	TS1	1
3	014130	Xfmr, 12KW, 208-240-480V, 1 Ø, 60 Hz	T2	1
4	003115	Contactor, 50A, 4-pole, 24 VAC coil	CON1	1
5	009625	Resistor, 2.0 ohm, 395 W	R1	1
6	009625	Resistor, 2.0 ohm, 395 W	R2	1
7	008079	Terminal strip (12)	TB1	1
8	009371	Coil assembly, hi-freq.	T4	1
9	029190	Hi freq. input/output panel SA	PCB3	1
10	009622	Resistor, 10 ohm	R3	1
11	009296	Capacitor, ele 100uf 350VDC	C9	1
12	009015	Resistor, 10 K ohm, 10 W	R4	1

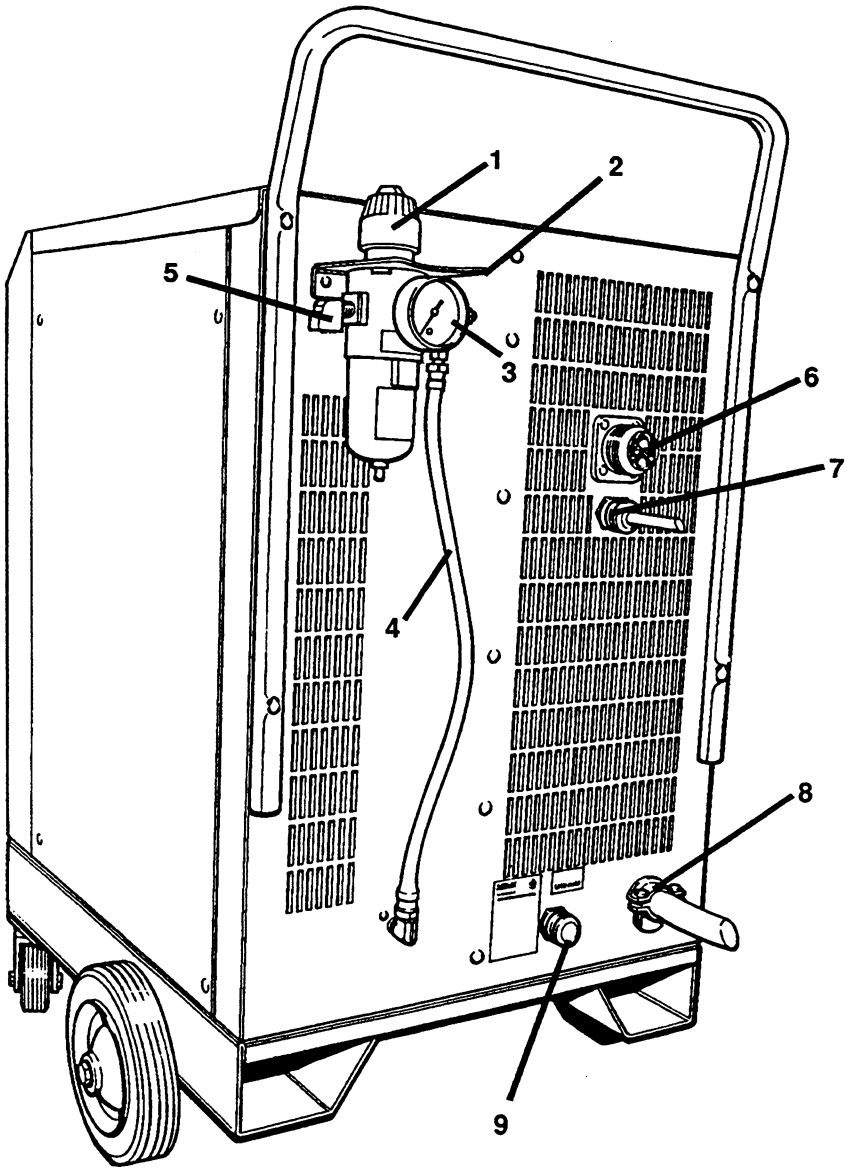


Figure 5-6 Power Supply - Rear View

Item	Part Number	Description	Designator	Qty.
	029203	Air Regulator SA	PR1	1
1	011025	Filter regulator, 0-120 psi 1/4 NPT air	-	1
2	004264	Bracket, 80/100/200 air regulator	-	1
3	011027	Gauge, 0-120 psi for 011025	-	1
4	024162	Hose assy, # 6 x 19-1/2" air reg	-	1
5	015015	Adapter 1/4 NPT x # 6 male Brs	-	1
6	028519	Receptacle assy, 80/100A QDisc	-	1
7	008415	Strain relief, work cable	-	1
8	008318	Strain relief, 2-screw insul, power cord	-	1
9	008070	Strain relief, 1/2" x .312-.375, remote start/stop pendant	-	1

CONSUMABLES, TORCHES & TORCH LEADS

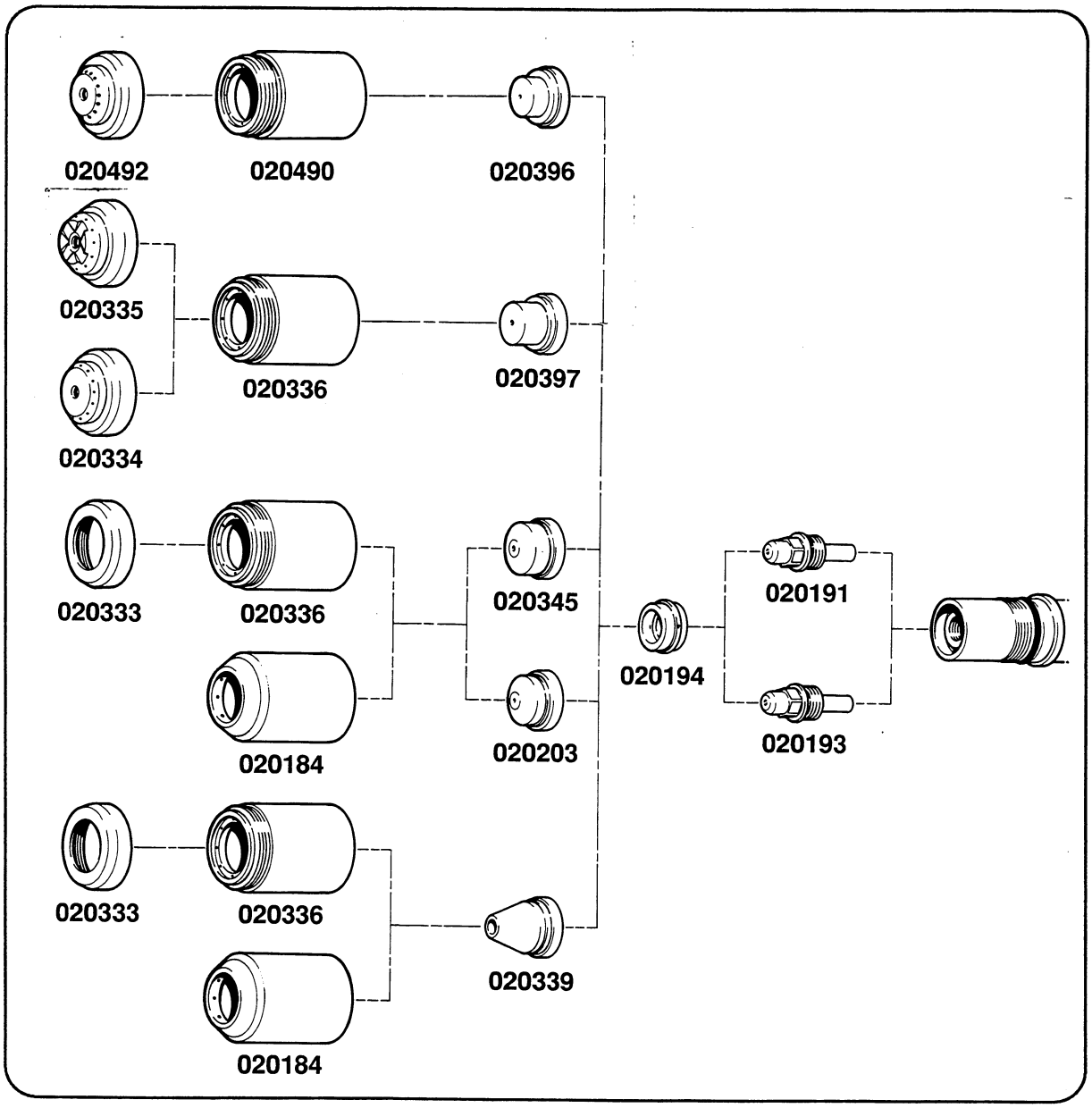


Figure 5-7 MAX80 Consumable Parts

CONSUMABLE PARTS

	Part Number	Description
Shielded Parts (40-amp)	020492 020490 020396	Shield, machine, 40-amp Cap, shield, 40-amp Nozzle, shield, 40-amp
Shielded Parts (80-amp)	020335 020334 020336 020397	Shield, hand, 80-amp Shield, machine, 80-amp Cap, shield, 80-amp Nozzle, shield, 80-amp
Non-shielded Parts	020333 020336 020184 020345 020203	Deflector, MAX80/100 Cap, shield Cap, retaining, standard Nozzle, standard, 80-amp Nozzle, standard, 40-amp
Gouging Parts	020333 020336 020184 020339	Deflector, MAX80/100 Cap, shield, 100-amp Cap, retaining, standard Nozzle, gouging
Swirl Ring & Electrode (To be used with all part combinations above.)	020194 020191 020193	Swirl ring Electrode, air Electrode, nitrogen

STANDARD COMPONENTS

CONSUMABLE PARTS KITS

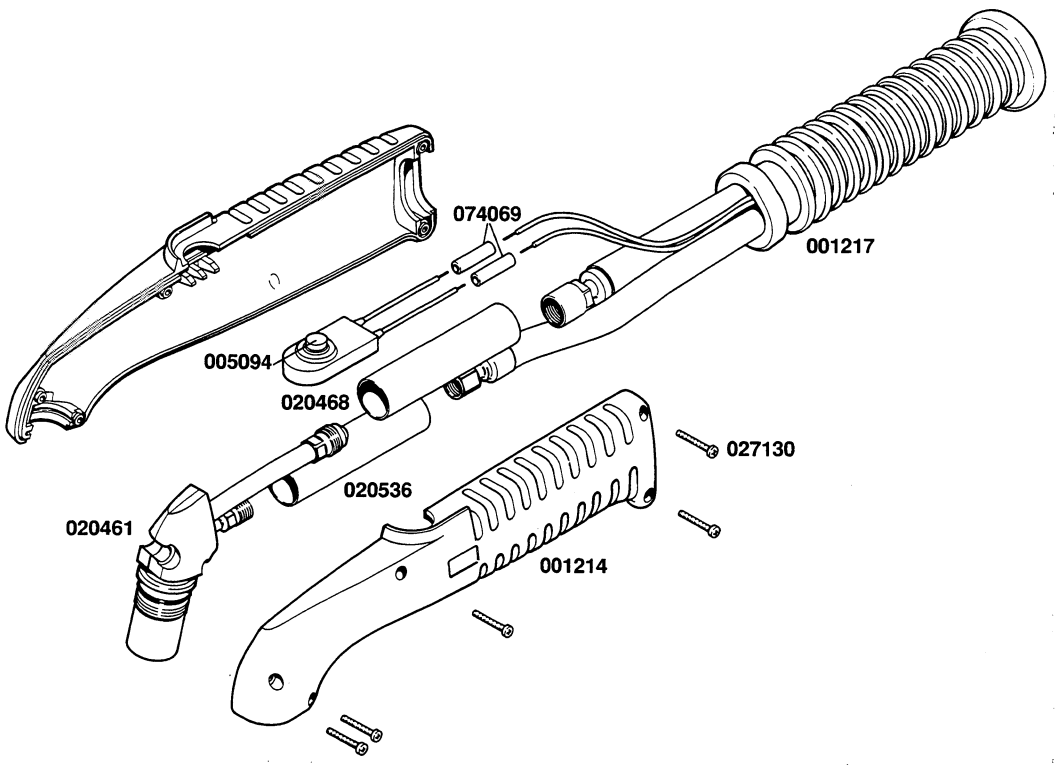
PAC130 Torch Consumable Parts Kit (028363)

020194 ..... Swirl ring (2)
020191 ..... Electrode (5)
020203 ..... .038 Nozzle (5)
020397 ..... .052 Nozzle (5)
001021 ..... Box (1)
020336 ..... Sleeve (1)
020333 ..... Deflector (for use with .038 nozzle only) (2)
020334 ..... Shield, hand torch (2)
026018 ..... O-ring (2)
027055 ..... Silicon (1)
027102 ..... Wrench (1)

Machine Torch Consumable Parts Kit (028412)

020194 ..... Swirl Ring (2)
020191 ..... Electrode (5)
020203 ..... .038 Nozzle (5)
020397 ..... .052 Nozzle (5)
001021 ..... Box (1)
020336 ..... Sleeve (1)
020333 ..... Deflector (for use with .038 nozzle only) (2)
020335 ..... Shield, machine torch (2)
026018 ..... O-ring (2)
027055 ..... Silicon (1)
027102 ..... Wrench (1)

PAC130 TORCH ASSEMBLY AND LEADS

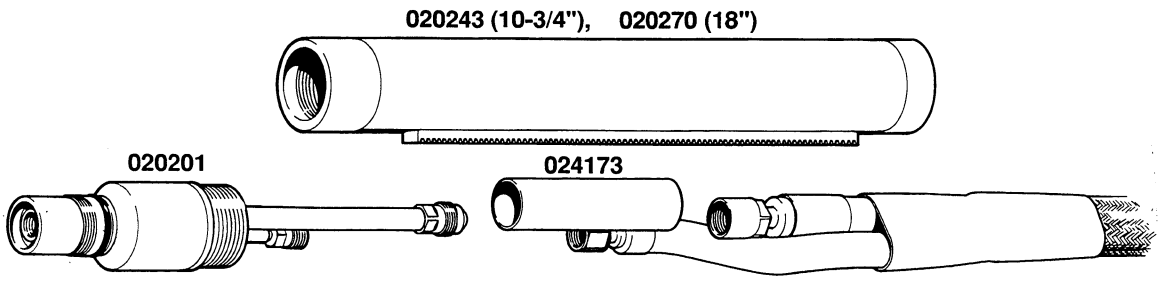


Part Number	Description
072037	PAC130 Torch Assembly (w/25 ft. lead)
072038	PAC130 Torch Assembly (w/50 ft. lead)
072039	PAC130 Torch Assembly (w/75 ft. lead)
020461	PAC130 Torch Main Body
005094	Switch, Pushbutton, Torch
020468	Negative Lead Insulator
020536	Lead Insulator
074069	Splice, Butt, Insulated (Two required)
001214	Handle, PAC130
075365	Screw #6 x 3/4"
001217	Boot, PAC130

Figure 5-8 PAC130 Torch Assembly & Leads

STANDARD COMPONENTS

MACHINE TORCH ASSEMBLY AND LEADS



Part Number	Description
072057	Machine Torch Assembly (w/25 ft. lead)
072058	Machine Torch Assembly (w/50 ft. lead)
072059	Machine Torch Assembly (w/75 ft. lead)
020201	MAX80 180° Torch Main Body
020243	Torch Position Sleeve, 10-3/4"
020270	Torch Position Sleeve, 18"
024173	Lead Insulator

Figure 5-9 Machine Torch Assembly & Leads

RECOMMENDED SPARE PARTS

Power Supply

Part Number	Description	Designator
005090	Bulb, 28 VDC, 40 MA, T 3-1/4	LT1, 2
005092	Switch, PB green, NO	PB1
005092	Switch, PB red, NC	PB2
009483	Resistor, variable 1K ohm, 1W, 1T	R6
027079	Fan, 450-550 CFM, 120V 50/60 Hz	M1
027080	Fan, 225 CFM, 120V 50/60 Hz	M2
022008	Gauge, pressure, 2-1/2", 100 psi	PG1
005041	Switch, toggle	S1
005044	Switch, toggle SPDT	S2
005093	Switch, pressure 0-90 psi	PS1
006014	Valve, SOL 90#, 1/4 NPTF	V1, 2
006032	Valve, SOL	V3
003021	Relay, 120 VAC, NO SPST	CR1, 3
003115	Contactor, 50A, 4-pole, 24 VAC coil	CON1
008239	Fuse, 2A, 600V, FLQ-2	F1, 2
009522	Capacitor, Ele 2000 UF, 350 VDC	C1 - 7
009625	Resistor, 2.0 ohm, 395 W	R1, 2
009622	Resistor, 10 ohm	R3
009015	Resistor, 10K ohm, 10W	R4
009296	Capacitor, ele 100 uf, 350 VDC	C9
009731	Diode, 150A, 1000V fwd polarity	D1, 2
009732	Diode, 150A, 1000V rev polarity	D3, 4
014043	Inductor, 4MH, 100 ADC	L1
029532	Xfmr SA, control 208-240-480V	T1
014130	Xfmr,12KW, 208-240-480V,1PH, 60 Hz	T2
005102	Thermostat, 165° C	TS1
014021	Transformer, HV 500V, 20 MA	T3
014042	Transformer, CH120 pwr 28 VCT	T5
041223	PC board assembly, pwr dist. MAX80	PCB2
029190	Hi Freq. input/output panel SA	PCB3
009371	Coil assembly, hi-freq.	T4
041114	PC board assembly control	PCB4
029278	Chopper subassembly	CH1
041118	PC board assembly, snubber	PCB1
041121	Chopper module	PCB5
041120	PC board assembly, I/O	PCB6
029203	Air regulator SA	PR1
011027	Gauge, high pressure	-
011025	Filter/regulator air	-
011031	Replacement filter	-

RECOMMENDED SPARE PARTS (Cont.)

Torch and Torch leads

Part Number	Description	Designator
020461	PAC130 Hand Torch	-
020201	Machine torch	-
029424	Hand torch lead, 25 ft.	-
029425	Hand torch lead, 50 ft.	-
029428	Hand torch lead, 75 ft.	-
028472	Machine torch lead, 25 ft.	-
028473	Machine torch lead, 50 ft.	-
028474	Machine torch lead, 75 ft.	-
072037	PAC130 hand torch assembly, 25 ft.	-
072038	PAC130 hand torch assembly, 50 ft.	-
072039	PAC130 hand torch assembly, 75 ft.	-
072057	Machine torch assembly, 25 ft.	-
072058	Machine torch assembly, 50 ft.	-
072059	Machine torch assembly, 75 ft.	-

Section 6 MAINTENANCE

In this section:

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).

TROUBLESHOOTING

Becoming familiar with the contents of this manual will aid in safely troubleshooting the MAX80 power supply and torch should the need arise. The following procedures show how to locate the most common problems. Refer to the electrical schematic, Figure 6-1 and the gas flow diagram, Figure 6-2 for additional information. Also, Section 5, *Standard Components* will help you locate the components when using these troubleshooting procedures.

If you need additional assistance, call our Customer Service or Technical Service Group at 1-800-643-0030.

Problem: **The green ON button is pushed, but the fans are not operating and there is no white READY light.**

Cause: Main power is not on.
Solution: Turn on main power.
Check the line fuses.

Cause: Fuses F1 or F2 are blown.
Solution: Replace the fuse(s).

Cause: Fuse F3 on the power distribution board PCB2 is blown.
Solution: Replace fuse F3.

Cause: There is a defective relay on the power distribution board PCB2.
Solution: Replace the relay.

Cause: Control transformer T1 is defective.
Solution: Replace transformer T1.

Cause: The green push-button ON switch PB1, the red push-button OFF switch PB2, or the switch wiring is defective.
Solution: Replace as required.

Problem: **The green ON button is pushed, the fans are operating, but the white READY light is not lit.**

Cause: The green push-button ON switch PB1 was not held down long enough.
Solution: Hold the push- button down for a minimum of five seconds.

Cause: The gas is not on, or the gas pressure is too low.
Solution: Be sure that the gas is turned on, and adjust the regulator to 90 psi minimum.

Cause: Thermostat TS1 is open.
Solution: Allow the MAX80 to cool, and try again.

Cause: There is an air leak in the pilot arc cable, or the connections are not tight.
Solution: Check the pilot cable connections for leaks. Replace the cable if it is defective.

Cause: The torch parts are not properly in place.
Solution: Re-install the torch parts.

Cause: The green push-button ON switch PB1 or the red push-button OFF switch PB2 is defective.
Solution: Replace as required.

Cause: Thermostat TS1 is defective.
Solution: Replace TS1.

Cause: Pressure switch PS1 is defective.
Solution: Replace PS1.

Cause: The white READY light LT1 bulb is defective, or the wiring is loose.
Solution: Repair or replace as necessary.

Problem: **The fans are operating, the white READY light is lit, but the red DC light is not lit and there is no high frequency (HF).**

Cause: The torch switch or the switch connections are defective.
Solution: Check the torch connections at 33 & 34 on TB1 for loose or broken wiring. Replace the torch start switch.

Cause: The control board PCB4 is defective.
Solution: Replace PCB4.

Problem: **The white READY and red DC lights are on, but there is no high frequency and no pilot arc.**

Cause: Pilot arc relay CR1 is defective.
Solution: Replace relay CR1.

Cause: The spark gaps (SG1) are dirty or incorrectly gapped.
Solution: Clean the gaps with emery cloth and regap to .015" per gap.

Cause: Capacitor C6 or C7 in the high frequency circuit is defective.
Solution: Replace capacitors. Always replace capacitors in pairs.

Cause: The high voltage transformer T3 is defective.
Solution: Replace transformer T3.

Problem: **The white READY and red DC lights are on, there is high frequency, but there is no pilot arc.**

Cause: The torch parts are worn.
Solution: Replace the torch parts.

Cause: The torch leads are loose or broken.
Solution: Replace or tighten the torch leads as required.

Cause: There are defective coupling capacitors.
Solution: Replace I/O board PCB6.

Cause: The surge injection circuit is defective.
Solution: Check capacitor C8 and resistor R8. Replace as required.

Cause: Pilot arc relay relay CR1 is defective.
Solution: Replace relay CR1.

Cause: The main bridge rectifier diode is defective.
Solution: Replace as required.

Cause: The chopper module PCB5 is defective.
Solution: Replace the chopper module.

Cause: The main control board PCB4 is defective.
Solution: Replace the main control board.

Cause: Fuse F5 is blown.
Solution: Replace fuse F5. If the fuse blows again, replace the chopper module.

Problem: The unit shuts itself off after it is turned on.

Cause: The system has overheated
Solution: Wait for the unit to cool down.

Cause: There is insufficient air pressure.
Solution: Check the pressure gauge on the back panel. It should read 90 psi minimum. Increase the air pressure to the unit.

Cause: The connections on contactor CON1 are loose.
Solution: Tighten the connections.

Problem: The unit is not cutting well.

Cause: The work clamp is not connected or it is broken.
Solution: Connect or repair the work clamp.

Cause: The torch is cracked.
Solution: Replace the torch.

Cause: The pilot arc relay CR1 is defective.
Solution: Check for contacts that are welded shut and replace.

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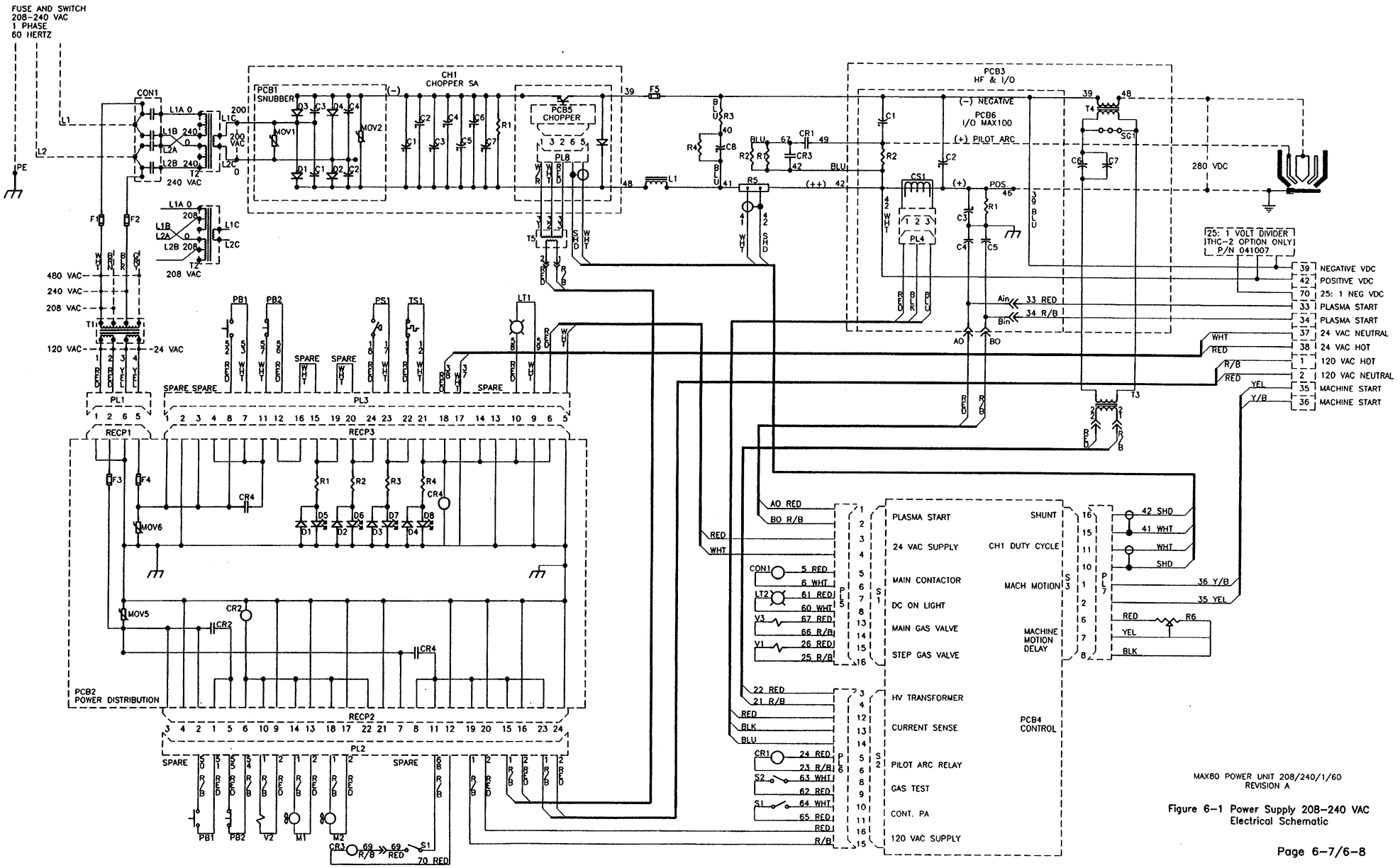


MAX80 POWER UNIT 208/240/1/60
REVISION A

Figure 6-1 Power Supply 208-240 VAC Electrical Schematic

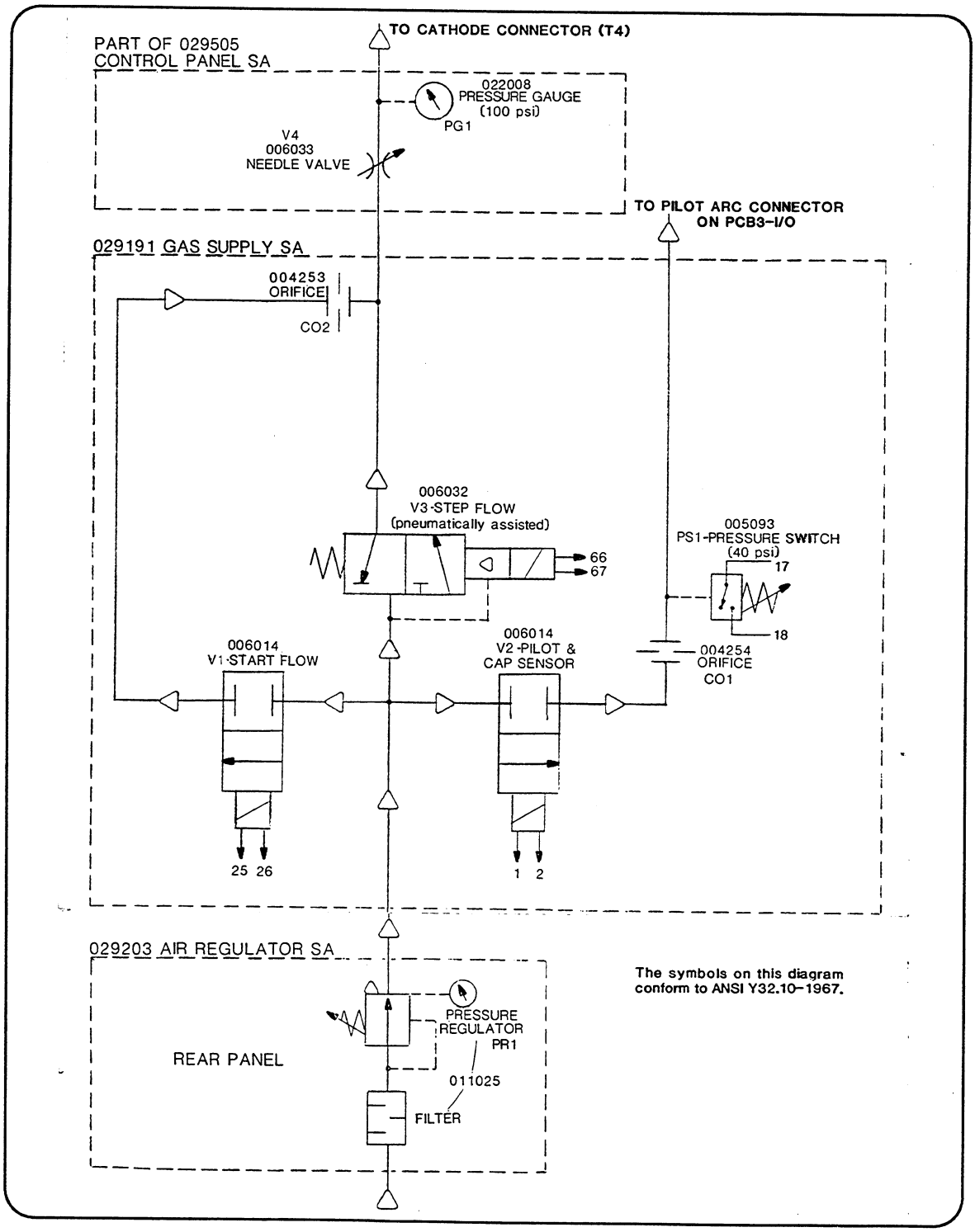


Figure 6-2 Power Supply Gas Flow Diagram

PAC130 TORCH REMOVAL AND REPLACEMENT

WARNING

Switch the power supply off, or unplug the power supply before working on the torch.

Tools Required

- 5/16" open-end wrench
- 7/16" open-end wrench
- 3/8" open-end wrench
- 1/2" open-end wrench

To remove and replace the PAC130 torch main body from the torch lead, perform the following procedure. See Figure 6-3.

Removal

1. Remove the five (5) screws (#027130) securing the two handle halves (#001214) and separate.
2. Remove the torch main body (#020461) and torch switch (#005094) from the handle.
3. Slide the lead insulators (#020536, #020468) away from the torch lead fittings.
4. Disconnect the torch leads from the torch main body. Always hold the torch main body fitting and turn the torch lead fitting counter clockwise (ccw) to loosen the connection.
5. Remove the torch main body from the torch lead.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Always hold the torch main body fitting and turn the torch lead fitting to tighten the connection.
2. Slide the lead insulators over the torch lead fittings.

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

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

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

6. Align both halves of the handle, press together, and secure with the five (5) screws.

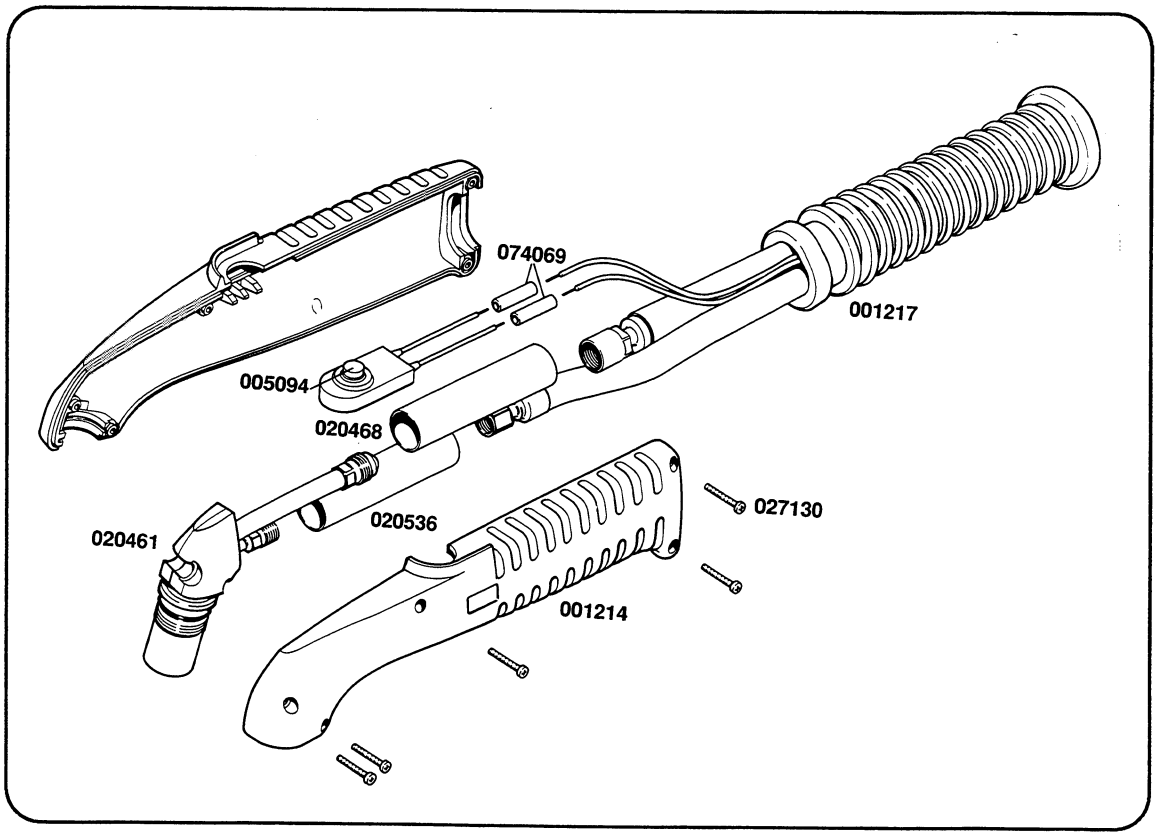


Figure 6-3 PAC130 Torch Removal and Replacement

MAINTENANCE

MACHINE TORCH REMOVAL AND REPLACEMENT

WARNING

Switch the power supply off, or unplug the power supply before working on the torch.

Tools Required

- 5/16" open-end wrench
- 7/16" open-end wrench
- 3/8" open-end wrench
- 1/2" open-end wrench

To remove and replace the torch main body from the torch lead, perform the following procedure. See Figure 6-4.

Removal

1. Unscrew the torch position sleeve (#020243 or #020270) from the torch main body (#020201) and slide the sleeve back to expose the torch lead fittings. Slide the lead insulator (#024173) covering the pilot arc lead fittings forward.

2. Disconnet the torch leads from the torch main body. Always hold the torch main body fitting and turn the torch lead fitting counterclockwise (ccw) to loosen the connection.

3. Remove the torch main body from the torch lead.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Always hold the torch main body fitting and turn the torch lead fitting to tighten the connection.

2. Slide the lead insulator over the pilot arc lead fittings.

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

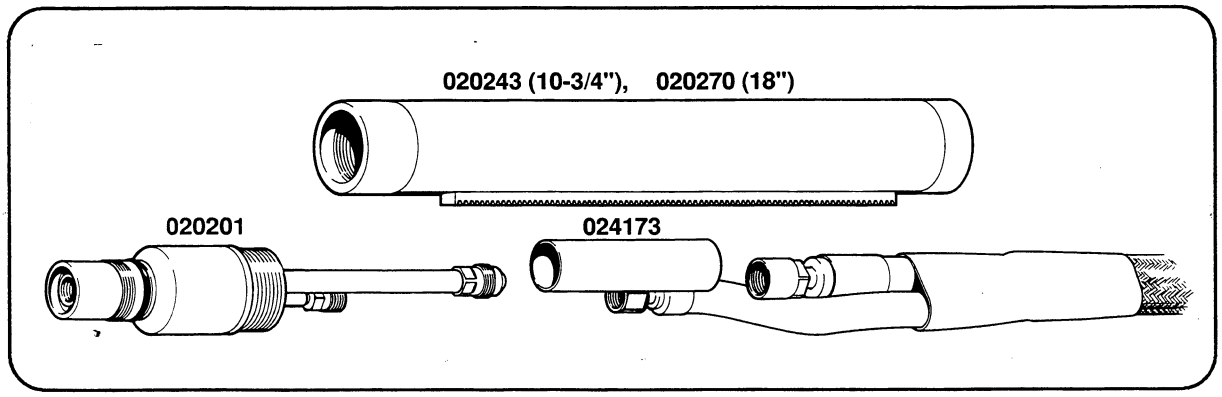


Figure 6-4 Machine Torch Removal and Replacement

MAINTENANCE

CHOPPER MODULE TEST PROCEDURE

WARNING

SHOCK HAZARD: Use extreme care when working near the chopper module. 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.

1. Turn all power to the MAX80 OFF.
   Disconnect terminals labeled 21 & 22 from their mating receptacles to disable the high-voltage transformer. Terminals 21 & 22 are located near the high-voltage transformer T3. See Figure 5-3 for location of T3.

2. Place the positive lead of a voltmeter to point #48 (Point #48 is labeled on cables and can be accessed at the large blue capacitors C1-C7). See Figure 5-3 for location of caps. Place the negative lead of the voltmeter on the opposite copper plate spanning the caps.

3. Turn power to the MAX80 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 there is no +280 VDC, check chopper diodes D1-D4. Also, check transformer T2, contactor (CON1), and connections and associated wiring to and from the contactor. Repair and/or replace defective component(s) if necessary.

4. If voltage from above step is +280 VDC, then input to chopper is OK. Check output by leaving the positive lead of the voltmeter at point #48 and placing the negative lead on point #39. Voltage at point #39 should be taken first on the left, and then on the right side of the large fuse F5. See Figure 5-3 for location of F5.

5. Turn the system on and press the START command. After the START command has been given, check the voltage. The output from the chopper at these points should be +280 VDC. If there is +280 VDC on the right side of fuse F5, but not at the left side, replace F5 and go to step 3.

6. If the chopper does <u>not</u> output +280 VDC, check for 28 VAC at secondary of chopper transformer T5. See Figure 5-3 for location of T5. If there <u>is</u> 28 VAC at the secondary, there is probably a problem either with the chopper module or with the control board PCB4. Go to step 8.

CHOPPER MODULE TEST PROCEDURE (CONT.)

7. If there is no 28 VAC at the secondary of chopper transformer T5, disconnect T5 primary input terminals labeled 1 & 2, and check for 120 VAC.

   If there is 120 VAC at these points, replace T5.

   If there is no 120 VAC at the primary, check terminals, pins, connectors and associated wiring between terminal pins 1 & 2 and pins 15 & 16 of RECP2 of power distribution board PCB2.

   If wiring is OK, replace power distribution board PCB2.

8. The chopper drive signal comes from the control board PCB4 as an analog level from 0 to +8 VDC, which varies the duty cycle and subsequent output current of the chopper. The 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 (points #39 and #48) and press the START command.
   - If the voltmeter reads +280 VDC, then replace control board PCB4.
   - If the voltmeter reads 0 volts, then replace chopper module PCB5.

Section 7 STANDARDS INDEX

In this section:

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.

GLOSSARY

AC — **A**lternating **C**urrent. Motion of current alternately in one direction, then the other. The number of times per second the direction changes (the "frequency") is measured in hertz.

amp — **Amp**eres. Measurement of the electron flow (the number of electrons per second) in an electrical circuit.

anode — The "positive" (+) side of a DC power source. Electrons leave the cathode and move toward the anode; ions move in the opposite direction. Plasma cutting requires the work and the nozzle to be the anode, and the electrode to be the cathode.

arc — Motion of electricity in a gas.

AWG — **A**merican **W**ire **G**auge. Defines the diameter of wires.

breaker — A device which interrupts an electrical current if the current exceeds a preset amperage setting. Breakers can be returned to their conducting (non-interrupting) state by some mechanical action, such as flipping a switch.

cap — Nozzle retaining cap. Holds the swirl ring, electrode and nozzle inside the torch.

capacitor — A device that stores electric energy in the form of voltage.

cathode — The "negative" (-) side of a DC power source. (See anode)

consumable — Electrode, O-ring, nozzle, swirl ring and retaining cap.

current — Movement of electricity, measured in amperes. Current is said to move in a direction opposite that of electron flow.

DC — **D**irect **C**urrent. Motion of current in one direction only, from anode (+) to cathode (-).

dross — Globs of metal hanging around the kerf, usually on the bottom side.

duty cycle — Percentage of on-time (measured in minutes) in a 10 minute period in which the MAX100 can be operated.

electricity — Fundamental property of atoms that atoms can have their electrons pulled away ("ionized") and then the electrons can move about in metals or gases. An atom missing one or more electrons is called an ion. Both electrons and ions can move about in gases.

electrode — A part inside the torch connected to the cathode (-) of the power supply. Electrons come out of the electrode.

fuse — A protective device which melts when the current running through it exceeds the usage rating.

GLOSSARY

ground	An electrical connection buried in the earth to establish a voltage of zero (0) volts.
Hertz (Hz)	Measurement of "frequency" of an AC voltage or current in cycles per second.
interlock	A safety device which must be activated before another device can be activated.
ion	An atom which has an excess or surplus of electrons.
kerf	Slit made in a workpiece by a cutting torch.
kilowatt	Thousand (kilo) watts. Measurement of electrical power.
LED	Light Emitting Diode. An electronic indicator lamp.
line	As in "line voltage." Utility voltage from a branch circuit (wall outlet).
nozzle	Tip of the plasma torch, made from copper, from which the plasma arc comes. The nozzle pinches the plasma arc. It is usually an anode (+)
OCV	Open Circuit Voltage. The highest voltage from a electrical power supply. It occurs when the power supply is on and active but not producing a plasma arc.
pilot arc	A plasma arc that attaches to the torch nozzle rather than the work.
plasma	An electrically charged gas is said to be "ionized". A cloud of ionized gas together with its electrons is called "plasma".
plasma arc	Movement of electric current in a plasma (ionized gas). An intensely hot and bright arc which exists between the cathode (-) (electrode) and the anode (+) (either the nozzle or the work).
pressure	Force per unit area.
psi	Pounds per Square Inch. Measurement of gas pressure.
quench	Put in water to cool.
regulator	A mechanical device to control the outlet pressure of a gas supply.
ripple	Unwanted variations in current or voltage from an electrical power supply.
scfm	Standard cubic feet per minute. A measurement of gas flow.
single phase	An alternating current carried by only two wires. In the U.S. the "hot" carries the AC voltage and the "neutral" is at approximately "ground" voltage. The "ground" wire carries current only in fault conditions.
swirl ring	An insulating ring that separates the electrode from the nozzle and causes the air

inside the plasma torch to swirl and aid in squeezing the arc.

transfer A pilot arc *transfers* to the work when the plasma arc leaves the surface of the nozzle and attaches to the work.

VAC Volts Alternating Current.

VDC Volts Direct Current.

volt Measurement of electrical force required to move an electric current through an electrical circuit.

watt Measurement of electrical power. The ability to heat the work equivalent to a current of one ampere times an electrical force of one volt.

work(piece) The object to be cut.

Appendix A FILTERS

In this section:

HANKISON®
CENTRIFLEX®
Compressed Air Separator/Filter

DESIGNED FOR PERFORMANCE
BUILT TO LAST

Efficient Separation and 3 Micron Filtration in One Compact Housing

SEPARATION—

The First Stage

A unique stainless steel separator core, using the principles of centrifugal force and impaction, is 99% efficient in removing particles 10 microns in size and larger.

The reusable cartridge type separator is completely removable for easy cleaning.

FILTRATION—

The Second Stage

A replacement filter sleeve, which fits over the separator core, assures absolute removal of solids and liquids 3 microns and larger in size.

Solids removal — finer filtration at less cost

The filter sleeve, constructed of an in-depth arrangement of glass fibers, has a high percentage of void spaces, allowing it to accumulate 3 to 4 times more particulates than coarser surface (pore) type filter element materials such as porous metal and plastic. Also the in-depth arrangement of fibers resists clogging due to gummy residues and sticky lacquers which are frequently present in compressed air systems and readily adhere to and foul surface type filters. This ability to accumulate large amounts of solid particles and resist clogging means that there is only a gradual increase in pressure drop across the filter, resulting in a long operating life and less operating cost.

Liquids removal — higher efficiencies from no flow to full flow

By using coalescence to force small droplets to form into larger droplets, the filter media continually collects all liquid droplets 3 microns in size and larger, as well as a portion of smaller droplets. This means that 99% of water droplets and 40% of oil aerosols are collected and discharged from the system.

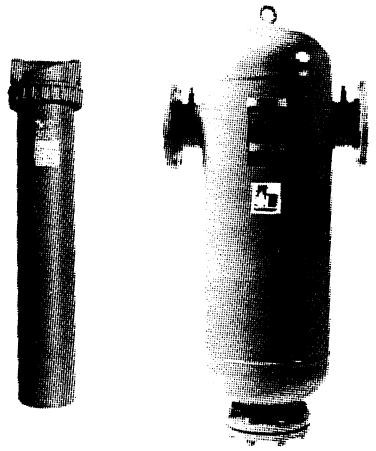
The combination of filter sleeve and separator core ensures high efficiency liquid separation over a full range of flows. There is no reduction in efficiency at less than rated flows, a common occurrence in purely centrifugal separators.

FEATURES:

- High efficiency separation — removes 99% of water droplets, 40% of oil aerosols.
- Combination of separator core and filter sleeve maintain high efficiency from no flow to full flow.
- Replaceable filter sleeve removes 100% of particles 3 microns and larger in size — while giving long sleeve life.

Housing design — features easy installation and maintenance

The in-line, inlet and outlet connection design reduces installation time and expense. Additional piping to maintain alignment is not required. Cartridge replacement is made easy by removable bowls for models C15 through C300 and by use of a convenient bottom access for models C400 and larger.



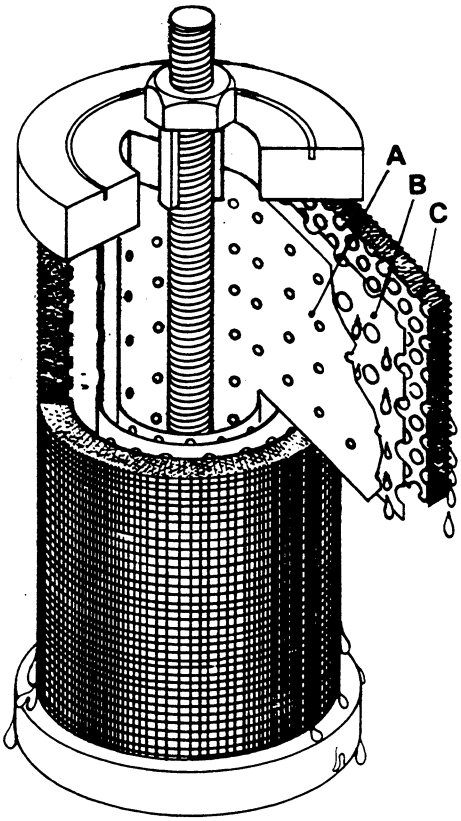
MODEL C150 MODEL C6600

OPERATION

Air enters the top of the Centriflex separator/filter and flows down through the center of the separator core and radially outward. The air is subjected to a strong centrifugal force as it passes through the separator core which is constructed of a pair of stainless steel perforated tubes. The orifices in the first tube (**A**) are staggered in relation to those in the second (**B**). This causes particles 10 microns and larger to continue in a straight course after leaving the inner tube, impacting and impinging on the inside of the outer tube where they form a film which drains to the bottom of the separator core.

The air then passes into the filter sleeve (**C**) which is composed of an in-depth bed of resin impregnated glass fibers. Solid particles (to 3 microns absolute) are captured and retained here. Liquid aerosols are coalesced on the glass fibers forming large droplets which move downward to the bottom of the cartridge where they drain by gravity into the filter housing and are removed from the air system.

This combination of separation and coalescence allows the Centriflex separator/filter to handle large inlet liquid loads (up to 25,000 ppm w/w) while removing 99% of water droplets and 40% of oil aerosols over a full range of flow conditions.



OPERATING CONDITIONS

Flow: maximum air flow for the various models at 100 psig is indicated in Table 1. To determine maximum air flows at inlet pressures other than 100 psig, multiply flow from Table 1 by multiplier from Table 2 that corresponds to the minimum operating pressure at the inlet of the filter.

EXAMPLE:

Choose a Centriflex separator/filter to handle 705 scfm at 150 psig. From Table 1 pick a C600 with an air flow of 600 scfm @ 100 psig. Multiply 600 scfm by the correction factor 1.43 for 150 psig from Table 2 (600 x 1.43 = 858). A C600 has ample capacity for this requirement.

CAUTION:

Do not select filters by pipe size. Make selection by flow rate and operating pressure only.

Pressure Drop:

Initial pressure drop (dry) is less than 1 psi. Increases in pressure drop above this point occur as the cartridge is loaded with solid contaminants. It is recommended that filter cartridge(s) be replaced when pressure drop exceeds 10 psi.

OPTIONS

Automatic Drains

Hankison drains automatically discharge liquids collected in the filter sump from the compressed air system. They are available with the drain mechanism mounted internally on smaller models or in their own housings for external mounting on larger models.

Differential Pressure Alarms

(Optional on models C15 thru C600; standard on models C1200 and larger.) The Hankison differential pressure alarm signals both audibly and visually when a 10 psi differential pressure has been reached, indicating the need for cartridge replacement.

Stainless Steel Cartridges

Cartridges may be ordered with stainless steel materials for use in systems where corrosive fumes are present in the compressed air system.

TABLE 1
Maximum Air Flow (scfm*) @ 100 psig

MODEL	C15	C35	C55	C100	C150	C200	C300	C400	C600	C1200	C1800	C2400	C3000	C4800	C6600	C8400	C11400
FLOW	15	35	55	100	150	200	300	400	600	1200	1800	2400	3000	4800	6600	8400	11400

*Convert scfm to metric units as follows: 1 scfm = 1.736 m^3_n/h

TABLE 2
Air Flow Correction Factor

Minimum inlet pressure (psig)	20	30	40	60	80	100	120	150	200	250	300
Multiplier	0.30	0.39	0.48	0.65	0.82	1.00	1.17	1.43	1.87	2.31	2.74

PHYSICAL DESCRIPTION

Model Number		Housing Type	Maximum Operating Pressure (psig)		Maximum Operating Temperature	Air Inlet/ Outlet Conn.	Width (Inlet to Outlet) and Height (in.)	Wt. (lb.)	Replacement Filter Cartridge	
with Manual Drain	with Internal Auto Drain		with Manual Drain	with Internal Auto Drain					No.	Qty. Reqd.
C15-03F-8P	—	8 oz. polycarbonate (2)	150	—	120°F	3/8" NPTF	3 1/4 x 6 1/4	1 5/8	0734-1	1
C15-03F-16P	C15-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0734-1	1
C15-03F-16M	C15-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0734-1	1
C15-04F-16P	C15-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0734-1	1
C15-04F-16M	C15-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0734-1	1
C35-03F-16P	C35-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0734-2	1
C35-03F-16M	C35-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0734-2	1
C35-04F-16P	C35-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0734-2	1
C35-04F-16M	C35-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0734-2	1
C55-08F-48	C55-08F-48-D	48 oz. metal	300	175	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0734-3	1
C100-08F-48	C100-08F-48-D	48 oz. metal	300	175	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0734-3	1
C150-12F-100	(1)	100 oz. metal	300	—	120°F	1 1/2" NPTF	5 1/4 x 23 1/4	13 1/4	0734-4	1
C200-12F-205	(1)	205 oz. metal	300	—	120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0734-5	1
C300-12F-205	(1)	205 oz. metal	300	—	120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0734-6	1
C400-16M-5L	(1)	5" pressure vessel	300 (3)	300 (3)	120°F	2" NPTM (4)	10 1/4 x 40 7/8	36	0734-7	1
C600-24M-5L	(1)	5" pressure vessel	300 (3)	300 (3)	120°F	3" NPTM (4)	10 1/4 x 40 7/8	37	0734-7	1
C1200-24M-8L	(1)	8" pressure vessel	225 (3)	—	120°F	3" NPTM (4)	16 x 48	86	0734-7	2
C1800-24M-10L	(1)	10" pressure vessel	225 (3)	—	120°F	3" NPTM (4)	16 1/4 x 49	131	0734-7	3
C2400-4FL-12L	(1)	12" pressure vessel	225 (3)	—	120°F	4" flange (5)	20 x 52 1/4	179	0734-7	4
C3000-4FL-12L	(1)	12" pressure vessel	225 (3)	—	120°F	4" flange (5)	20 x 52 1/4	182	0734-7	5
C4800-6FL-16L	(1)	16" pressure vessel	225 (3)	—	120°F	6" flange (5)	24 x 54 5/8	271	0734-7	8
C6600-6FL-20L	(1)	20" pressure vessel	225 (3)	—	120°F	6" flange (5)	28 x 62 9/16	518	0734-7	11
C8400-6FL-20L	(1)	20" pressure vessel	225 (3)	—	120°F	6" flange (5)	28 x 62 9/16	527	0734-7	14
C11400-8FL-24L	(1)	24" pressure vessel	225 (3)	—	120°F	8" flange (5)	33 x 69 1/8	709	0734-7	19

(1) Drain port is provided. Use externally mounted Hankison automatic drain. For models C150 thru C600 use a model 505 Trip-L-Trap. For models C1200 and larger use a model 506 Trip-L-Trap. Models C400 and C600 may also be supplied with an internal drain.
(2) Polycarbonate bowls are furnished with bowl guards. Do not use polycarbonate bowls when synthetic lubricants are present.
(3) Units with higher maximum working pressures are available. Models C1200 and larger are ASME code constructed and stamped.
(4) Flanges and couplings are available.
(5) Optional flange sizes are available.

HANKISON®

AEROLESCER®
Coalescing Type Oil Removal Filters

99.999+% efficient in removing oil aerosols from compressed air lines.

Why remove oil?

Compressor oil downstream — it can contaminate the end product, decrease the efficiency of the production process by ruining paint jobs, gumming up air tools, motors, etc., or clog the tiny orifices in instruments or fluid logic components. Oil from a lubricated compressor is subjected to high temperatures during the compression cycle. This alters its characteristics so that it does not adequately lubricate downstream pneumatic components. It's best to take this oil out of the system and add the proper lubricant at the point of use.

Are special filters required to remove oil?

In a typical 90 psig air system 72% by weight of the oil aerosols present are less than 5 microns in size. 50% are below 1 micron in size. Droplets of this size blow right through a mechanical separator. Air line filters (particulate filters e.g. a 5 micron filter) can't trap the bulk of the aerosols either. To adequately remove oil, a special filter is required. The Hankison Aerolescer filter has been designed to remove oil by means of coalescence.

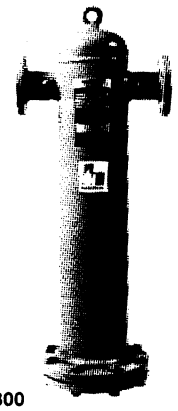
The result — an oil free compressed air system

The Hankison Aerolescer filter, when used within its rated design conditions, will eliminate the oil aerosols contained in a compressed air stream. Exhaustive tests verify a liquid oil removal efficiency of 99.999+%. In most instances, this means that the filtered air will contain less than .1 ppm of oil by weight. It assures virtually oil free air without the expense and maintenance headaches of non-lubricated compressors.

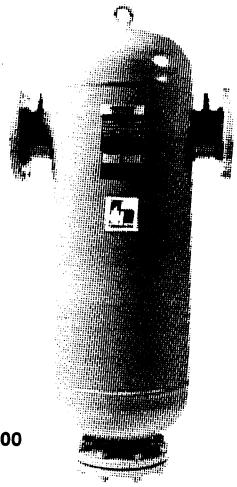
Features:

- Unique continuously stabilized filter media plus outer foam sleeve ensures 99.999+% efficiency for the life of the cartridge
- Removes: 100% of particles .025 micron and larger in size; some particles as small as .01 micron
- Cartridge replacement made easy by removable bowls or convenient bottom flange opening
- Rugged thru-bolt cartridge construction

MODELS from
10 SCFM to 6000 SCFM



MODEL A300



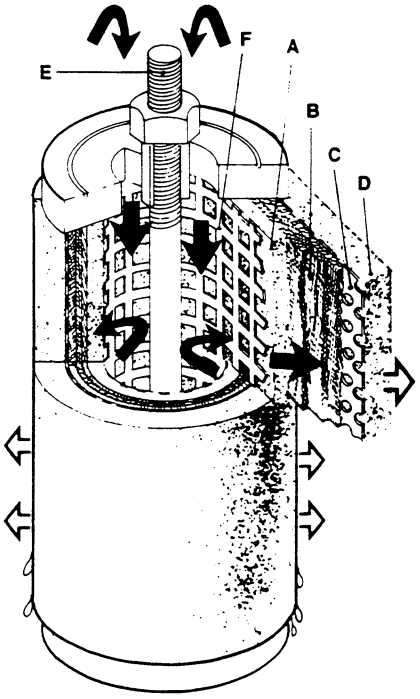
MODEL A900

The Patented* AEROLESCER Cartridge — designed for 99.999+% efficiency and long life

OPERATION

Oil aerosols moving through the filtering media (B), a maze of submicronic glass fibers with specific densities and diameters, are concentrated and coalesced into large droplets. High efficiency is achieved by stabilizing the filtering media between a rigid perforated cylinder (C) and an inner foam sleeve (A), which compensates for fluctuating flow rate and aerosol concentration. This design assures uniform distribution of oil aerosols which prevents liquid pocketing, fiber clotting, and subsequent air channelling. The coalesced oil droplets are collected by the outer foam sleeve (D). Having an enormous non-absorbing surface area, this sleeve allows oil droplets to drain to the bottom of the sleeve and then drop to the bottom of the housing for removal from the air system. When removing oil the life of the cartridge is indefinite.** The cartridge continuously coalesces and separates oil aerosols from your system.

Thru bolt construction (E) assures structural strength and prevents liquid bypassing of the filter media. There is no reliance on adhesives to hold the unit together. An inside support (F) offers positive protection in case flow is accidentally reversed through the cartridge.



*U.S. Patent No. 3,802,160

**Excessive solid matter accumulation will limit life. Prefilters are available to prolong life. Request Bulletin 3100 covering HANKISON 3100 Series Air Line Filters.

Operating Conditions

Flow: maximum air flow for the various models at 100 psig is indicated in Table 1. To determine maximum air flows at inlet pressures other than 100 psig, multiply flow from Table 1 by multiplier from Table 2 that corresponds to the minimum operating pressure at the inlet of the filter.

EXAMPLE:

Choose an Aerolescer filter to handle 705 scfm at 150 psig. From Table 1 pick an A500 with an air flow of 500 scfm @ 100 psig. Multiply 500 scfm by the correction factor 1.43 for 150 psig from Table 2 (500 x 1.43 = 715). An A500 has ample capacity for this requirement.

CAUTION:

Do not select filters by pipe size. Make selection by flow rate and operating pressure only.

Pressure Drop:

Initial pressure drop (dry) is less than 1 psi. As the cartridge collects and coalesces liquid droplets a working pressure drop of 3 to 5 psi will develop. Increases in pressure drop above this point occur as the cartridge is loaded with solid contaminants. It is recommended that filter cartridge(s) be replaced when pressure drop exceeds 10 psi.

OPTIONS

Automatic Drains

Hankison drains automatically discharge liquids collected in the filter sump from the compressed air system. They are available with the drain mechanism mounted internally on smaller models or in their own housings for external mounting on larger models.

Differential Pressure Alarms

(Optional on models A10 thru A320; standard on models A500 and larger.) The Hankison differential pressure alarm signals both audibly and visually when a 10 psi differential pressure has been reached, indicating the need for cartridge replacement.

Stainless Steel Cartridges

Cartridges may be ordered with stainless steel materials for use in systems where corrosive fumes are present in the compressed air system.

TABLE 1
Maximum Air Flow (scfm*) @ 100 psig

MODEL	A10	A20	A50	A100	A200	A250	A300	A320	A500	A600	A900	A1300	A1600	A2500	A3500	A4400	A6000
FLOW	10	20	50	100	200	250	300	320	500	632	948	1264	1580	2528	3476	4424	6004

*Convert scfm to metric units as follows: 1 scfm = 1.736m^3_n/h

TABLE 2
Air Flow Correction Factor

Minimum inlet pressure (psig)	20	30	40	60	80	100	120	150	200	250	300
Multiplier	0.30	0.39	0.48	0.65	0.82	1.00	1.17	1.43	1.87	2.31	2.74

PHYSICAL DESCRIPTION

Model Number		Housing Type	Maximum Operating Pressure (psig)		Maximum Operating Temperature	Air Inlet/ Outlet Conn.	Width (Inlet to Outlet) and Height (in.)	Wt. (lb.)	Replacement Filter Cartridge	
with Manual Drain	with Internal Auto Drain		with Manual Drain	with Internal Auto Drain					No.	Qty. Reqd.
A10-03F-8P		8 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 6 1/4	1 5/8	0713-2	1
A10-03F-16P	A10-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0713-2	1
A10-03F-16M	A10-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0713-2	1
A10-04F-16P	A10-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0713-2	1
A10-04F-16M	A10-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0713-2	1
A20-03F-16P	A20-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0713-3	1
A20-03F-16M	A20-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0713-3	1
A20-04F-16P	A20-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0713-3	1
A20-04F-16M	A20-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0713-3	1
A50-08F-48	A50-08F-48-D	48 oz. metal	300	175	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0713-4	1
A100-08F-100	(1)	100 oz. metal	300		120°F	1" NPTF	4 9/16 x 23 1/4	13 1/4	0713-5	1
A200-12F-205	(1)	205 oz. metal	300		120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0713-6	1
A300-12F-381	(1)	381 oz. metal	300		120°F	1 1/2" NPTF	5 1/4 x 36 3/8	29 1/4	0713-7	1
A250-16M-5L	(1)	5" pressure vessel	300 (3)		120°F	2" NPTM (4)	10 1/4 x 40 7/8	36	0713-12	1
A320-16M-5L	(1)	5" pressure vessel	300 (3)		120°F	2" NPTM (4)	10 1/4 x 40 7/8	37	0713-11	1
A500-24M-8L	(1)	8" pressure vessel	225 (3)		120°F	3" NPTM (4)	16 x 48	86	0713-12	2
A600-24M-8L	(1)	8" pressure vessel	225 (3)		120°F	3" NPTM (4)	16 x 48	86	0713-11	2
A900-24M-10L	(1)	10" pressure vessel	225 (3)		120°F	3" NPTM (4)	16 1/4 x 49	131	0713-11	3
A1300-4FL-12L	(1)	12" pressure vessel	225 (3)		120°F	4" flange (5)	20 x 52 1/4	179	0713-11	4
A1600-4FL-12L	(1)	12" pressure vessel	225 (3)		120°F	4" flange (5)	20 x 52 1/4	182	0713-11	5
A2500-6FL-16L	(1)	16" pressure vessel	225 (3)		120°F	6" flange (5)	24 x 54 5/8	271	0713-11	8
A3500-6FL-20L	(1)	20" pressure vessel	225 (3)		120°F	6" flange (5)	28 x 62 9/16	518	0713-11	11
A4400-6FL-20L	(1)	20" pressure vessel	225 (3)		120°F	6" flange (5)	28 x 62 9/16	527	0713-11	14
A6000-8FL-24L	(1)	24" pressure vessel	225 (3)		120°F	8" flange (5)	33 x 69 1/8	709	0713-11	19

(1) Drain port is provided. Use externally mounted Hankison automatic drain. For models A100 thru A1600 use a model 504 Snap-Trap® (175 psig MWP); for models A2500 thru A6000 use a model 505 Trip-L-Trap®. Models A250 and A320 may also be supplied with an internal drain.
(2) Polycarbonate bowls are furnished with bowl guards. Do not use polycarbonate bowls when synthetic lubricants are present.
(3) Units with higher maximum working pressures are available. Models A500 and larger are ASME code constructed and stamped.
(4) Flanges and couplings are available.
(5) Optional flange sizes are available.

HANKISON®
HYPERSORB®
Activated Carbon Adsorbent Filters

Eliminates undesirable oily smell/taste from compressed air. Removes oil vapor. Ends product contamination.

The final step in oil free air.

The Hypersorb filter is a final stage filter which adsorbs oil vapor (gaseous oil) present in compressed air. The Hypersorb filter will also remove various other gaseous hydrocarbons normally adsorbable by activated carbon. It is designed to be used after a coalescing filter (Hankison Aerolescer®) which removes liquid oil aerosols. The liquid oil aerosols must be removed from the air stream before the air enters the Hypersorb in order to prevent saturating of the activated carbon and premature reduction of the adsorptive capacity of the filter.

How oil free is air that has been filtered by an Aerolescer/Hypersorb Filter System?

At rated flow conditions and reasonable filtration temperatures (50°F to 100°F), the oil concentration in your air system, after being filtered, will be less than .01 ppm w/w. This means that the amount of oil left in your system is lower than the saturation level of oil vapor in atmospheric air (expanded condition) so that even a large drop in temperature downstream will not cause oil vapor to condense and foul your product.

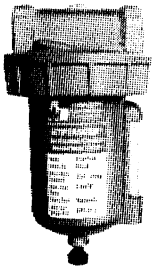
These low concentrations of oil vapor are well below the level where they can be detected by smell or taste.

Designed for long life.

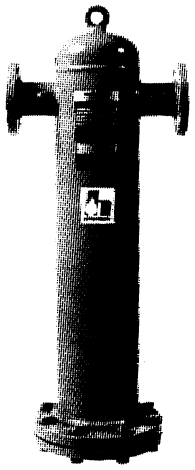
In contrast to most carbon filters that contain only a bed of carbon particles, the Hypersorb filter contains both a bed of finely divided activated carbon particles and a secondary section of multi-layered fibers to which microfine activated carbon particles are bonded. It is designed to operate for a minimum of 1500 hours at rated capacity without requiring replacement of the cartridge.

FEATURES:

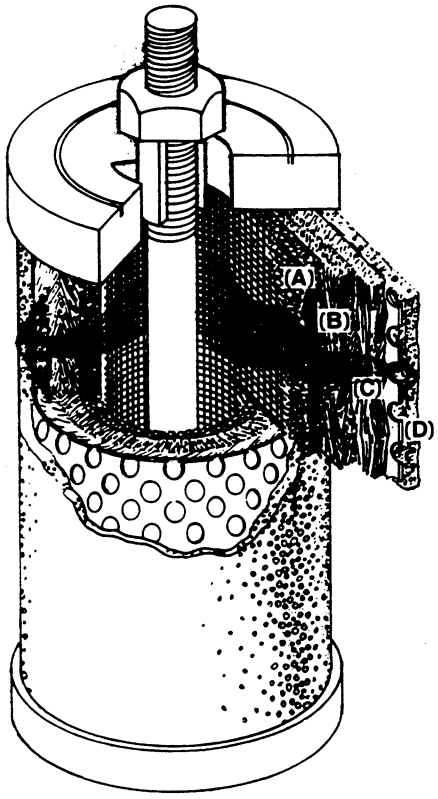
- Protects end processes from gaseous oil contamination and rids compressed air exhausted into worker environments of offensive oily smell
- Removes hydrocarbons for analytical instrument use
- Fine filter media traps 100% of any carbon dust or other particles as small as .025 micron — Ideal as an afterfilter for desiccant dryers
- Cartridge replacement made easy by removable bowls or convenient bottom access.



MODEL H10



MODEL H600



Elimination of carbon dust carryover.

Layers of microglass fibers prevent any possible carryover of carbon dust or other fine particulate matter and subsequent product contamination. Also, an outer porous foam sleeve provides protection against filter fiber migration.

Rugged construction resists vibration, prevents in-line failure.

A thru bolt and rigid metal perforated cylinder provide solid cartridge design that does **not** rely on an adhesive for structural strength. This minimizes the possibility of the filter media being by-passed.

OPERATION

Compressed air which has been treated by an air dryer and filtered to remove liquid contaminants enters the inner core of the Hypersorb filter cartridge and moves radially outward. It first passes through a bed of finely divided activated carbon particles (**A**) where 95% of the oil vapor contained in the air is adsorbed. The air then moves through layers of fibers (**B**) to which microfine activated carbon particles are bonded by a patented process and the remaining oil vapor is adsorbed. The virtually oil free air then continues through layers of microglass fibers (**C**) where all solid particles .025 microns in size and larger are captured. This prevents any possible carry over of carbon dust or other fine particulate matter. Finally the air exits through a porous foam outer sleeve (**D**) which provides protection against fiber migration.

OPERATING CONDITIONS

Flow: maximum air flow for the various models at 100 psig is indicated in Table 1. To determine maximum air flows at inlet pressures other than 100 psig, multiply flow from Table 1 by multiplier from Table 2 that corresponds to the minimum operating pressure at the inlet of the filter.

EXAMPLE:

Choose a Hypersorb filter to handle 705 scfm at 150 psig. From Table 1 pick an H500 with an air flow of 500 scfm @ 100 psig. Multiply 500 scfm by the correction factor 1.43 for 150 psig from Table 2 (500 x 1.43 = 715). An H500 has ample capacity for this requirement.

CAUTION:

Do not select filters by pipe size. Make selection by flow rate and operating pressure only.

Pressure Drop:

The Hypersorb® filter has an initial nominal pressure drop of 1 psi (0.07 bar) which should not change appreciably during the life of the cartridge.

Cartridge Replacement:

Periodic checks of filtered air should be conducted. A detectable odor indicates that the cartridge should be replaced. The Hypersorb is designed to give a minimum life of 1500 hours of continuous operation at rated capacity.

OPTIONS

Stainless Steel Cartridges

Cartridges may be ordered with all stainless steel materials for use where harmful vapors are present in the compressed air system. To order, add -S to unit or cartridge model number.

TABLE 1
Maximum Air Flow (scfm*) @ 100 psig

MODEL	H10	H20	H50	H100	H200	H250	H300	H320	H500	H600	H900	H1300	H1600	H2500	H3500	H4400	H6000
FLOW	10	20	50	100	200	250	300	320	500	632	948	1264	1580	2528	3476	4424	6004

*Convert scfm to metric units as follows: 1 scfm = 1.736m^3_n/h

TABLE 2
Air Flow Correction Factor

Minimum inlet pressure (psig)	20	30	40	60	80	100	120	150	200	250	300
Multiplier	0.30	0.39	0.48	0.65	0.82	1.00	1.17	1.43	1.87	2.31	2.74

PHYSICAL DESCRIPTION

Model Number	Housing Type	Maximum Operating Pressure (psig)	Maximum Operating Temperature	Air Inlet/ Outlet Conn.	Width (Inlet to Outlet) and Height (in.)	Wt. (lb.)	Replacement Filter Cartridge No.	Replacement Filter Cartridge Qty. Reqd.
H10-03F-8P	8 oz. polycarbonate (1)	150	120°F	3/8" NPTF	3 1/4 x 6 1/4	1 5/8	0715-2	1
H10-03F-16P	16 oz. polycarbonate (1)	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0715-2	1
H10-03F-16M	16 oz. metal	300	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0715-2	1
H10-04F-16P	16 oz. polycarbonate (1)	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0715-2	1
H10-04F-16M	16 oz. metal	300	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0715-2	1
H20-03F-16P	16 oz. polycarbonate (1)	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0715-3	1
H20-03F-16M	16 oz. metal	300	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0715-3	1
H20-04F-16P	16 oz. polycarbonate (1)	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0715-3	1
H20-04F-16M	16 oz. metal	300	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0715-3	1
H50-08F-48	48 oz. metal	300	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0715-4	1
H100-08F-100	100 oz. metal	300	120°F	1" NPTF	4 9/16 x 23 1/4	13 1/4	0715-5	1
H200-12F-205	205 oz. metal	300	120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0715-6	1
H300-12F-381	381 oz. metal	300	120°F	1 1/2" NPTF	5 1/4 x 36 3/8	29 1/4	0715-7	1
H250-16M-5L	5" pressure vessel	300 (2)	120°F	2" NPTM (3)	10 1/4 x 40 7/8	36	0715-12	1
H320-16M-5L	5" pressure vessel	300 (2)	120°F	2" NPTM (3)	10 1/4 x 40 7/8	37	0715-11	1
H500-24M-8L	8" pressure vessel	225 (2)	120°F	3" NPTM (3)	16 x 48	86	0715-12	2
H600-24M-8L	8" pressure vessel	225 (2)	120°F	3" NPTM (3)	16 x 48	86	0715-11	2
H900-24M-10L	10" pressure vessel	225 (2)	120°F	3" NPTM (3)	16 1/4 x 49	131	0715-11	3
H1300-4FL-12L	12" pressure vessel	225 (2)	120°F	4" flange (4)	20 x 52 1/4	179	0715-11	4
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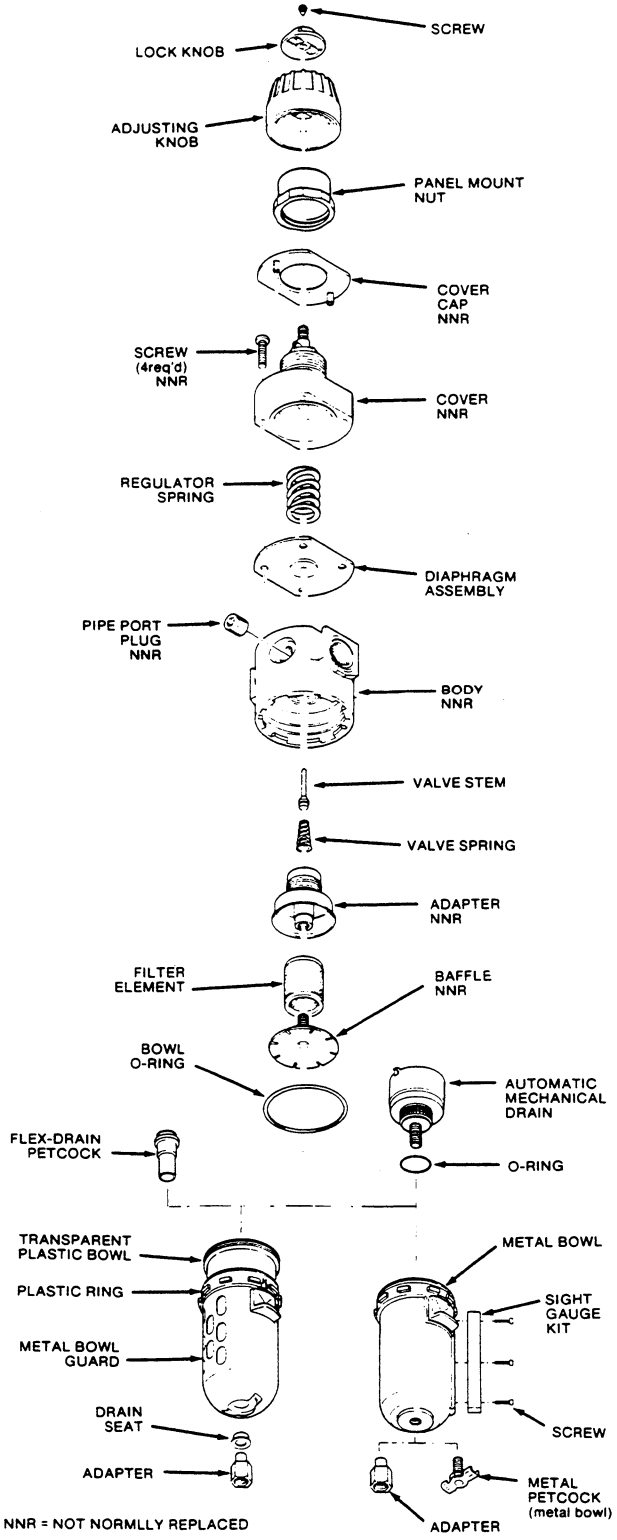
H2500-6FL-16L	16" pressure vessel	225 (2)	120°F	6" flange (4)	24 x 54 5/8	271	0715-11	8
H3500-6FL-20L	20" pressure vessel	225 (2)	120°F	6" flange (4)	28 x 62 9/16	518	0715-11	11
H4400-6FL-20L	20" pressure vessel	225 (2)	120°F	6" flange (4)	28 x 62 9/16	527	0715-11	14
H6000-8FL-24L	24" pressure vessel	225 (2)	120°F	8" flange (4)	33 x 69 1/8	709	0715-11	19

(1) Polycarbonate bowls are furnished with bowl guards. Do not use polycarbonate bowls when synthetic lubricants are present.
(2) Units with higher maximum working pressures are available. Models H500 and larger are ASME code constructed and stamped.
(3) Flanges and couplings are available.
(4) Optional flange sizes are available.

WILKERSON
CORPORATION • ENGLEWOOD, CO 80150

PRECISION AIR PRESSURE REGULATOR TYPE PC6 FILTER/REGULATOR



INSTALLATION

Install the Filter/Regulator as close as possible to the application. The inlet port is marked with an arrow cast into the body to indicate the direction of flow. Gauge ports (¼") are provided in either side of the body for installation of a gauge or use as an additional outlet port. Plug unused port(s). System piping should be same size as regulator porting. In systems with a cyclic demand, the regulator should be located upstream of cycling device.

OPERATION

Maximum pressure and temperature ratings are: for transparent plastic bowls, 150 psig (10 bar) and 125°F (52°C); and for metal bowls, 250 psig (17 bar) and 175 °F (79°C).

Before turning on the supply air pressure, turn the adjusting knob counterclockwise until there is no load on the regulating spring. Turn on the supply air pressure and then turn the adjusting knob clockwise until the desired secondary pressure is reached. To avoid minor readjustment after making a change in pressure setting, always approach the desired pressure from a lower pressure. When reducing from a higher to a lower setting, first reduce to some pressure less than that desired and then increase to the desired pressure.

CAUTION

EXCEPT as otherwise specified by manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication and manufacturer assumes no responsibility for any resulting loss.

The relief flow capacity of relieving type regulators is limited. Under some operating conditions, the secondary (outlet) pressure could increase above the initial setting. If over-pressure conditions could cause malfunction or failure of downstream equipment, additional external pressure relief devices of suitable capacity must be installed.

Before using with fluids other than air for non-industrial applications or for life support systems, consult Wilkerson Corporation for approval.

SEE REVERSE SIDE FOR LIST OF MATERIALS
UNSUITABLE FOR USE WITH POLYCARBONATE BOWLS

MAINTENANCE

1. The regulator can be disassembled for servicing without removal from line.
2. DEPRESSURIZE UNIT BEFORE REMOVING GUARD AND/OR BOWL.
3. TO DISASSEMBLE: shut off air to unit and vent air line on both sides of unit. Turn adjusting screw counterclockwise to relieve spring compression. Remove knob, cover cap, screws, cover, and spring. Diaphragm assembly can now be removed.
4. To remove valve from bottom of unit, remove bowl. Remove baffle and filter element exposing hex nut on adapter assembly. Remove adapter assembly, valve and spring.
5. If it is a plastic bowl unit, inspect daily to detect crazing, cracking, damage, or other deterioration. Immediately replace any crazed, cracked, damaged, or deteriorated bowl with a metal bowl or a new plastic bowl and metal bowl guard.
6. a. If unit has a rigid (felt) filter element, clean periodically by removing from filter, tapping on surface, and blowing off with air blow gun.

   1b. If unit has soft cloth element, replace with a new one at least every six months, or sooner if it looks dirty or causes excessive pressure drop (10 psi or more at rated flow).

(continued on reverse side)

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7. a. If unit is equipped with a manual petcock, drain bowl at least once per work shift.
   b. If unit is equipped with a float in the bowl, clean the bowl each time the element is cleaned or changed by turning the bowl upside down and tapping onto tabletop. Blow clean with blow gun.
8. If bowl is crazed, cracked, or otherwise damaged or deteriorated, replace bowl and use manufacturer's approved bowl seal.
9. IF UNIT WILL NOT REGULATE TO REQUIRED PRESSURE, OR IF PRESSURE BECOMES EXCESSIVE follow instructions (see 4.) for removal of valve. Remove valve and spring. Clean and check valve stem and valve seat for wear or damage and replace if required.
10. Before placing unit is service, make sure that bowl and bowl guard are reinstalled and securely locked in place.

REPAIR KITS AND REPLACEMENT PARTS

SELF-RELIEVING REPAIR KIT (includes self-relieving diaphragm assy, valve stem, valve spring, filter element, and bowl o-ring)	**PRP-95-025**
Regulating Springs:	
0-30 psi	**RRP-95-916**
0-50 psi	**RRP-95-222**
0-120 psi	**RRP-95-224**
Self-Relieving Diaphragm Kit	**PRP-95-960**
Valve Assembly (valve stem, valve spring)	**PRP-95-959**
Filter Element Assembly (includes element and bowl o-ring)	**FRP-95-034**
Transparent Bowl Assemblies:	
with flexible drain	**FRP-95-017**
with bowl guard, Auto Drain	**FRP-95-015**
with bowl guard, flexible drain	**FRP-95-014**
Bowl O-Ring Kit (10 per kit)	**GRP-95-009**
Bowl Guard Kit	**GRP-95-013**
Metal Bowl Assemblies:	
with metal petcock	**FRP-95-178**
with Sight Gauge, metal petcock (for units with "G" in model no.)	**GRP-95-133**
Drains:	
Auto Drain Kit (includes o-ring, spacer, nut)	**GRP-95-714**
Brass Petcock (for metal bowls)	**GRP-95-182**
Flex Drain Kit (for plastic bowls)	**FRP-95-610**
Adjusting Knob Kit	**RRP-95-007**

NOTE: All bowl kits include bowl o-ring

ACCESSORIES

Wall Mounting Bracket with Panel Mount Nut	**GPA-95-011**
Wall Mounting Bracket	**GPA-95-012**
Panel Mount Nut	**GPA-95-032**
Tamper Resistant Kit	**RPA-95-006**
Viton Valve Assembly	**PPA-95-067**
Gauges:	
0-30 psig	**PPA-95-107**
0-60 psig	**PPA-95-106**
0-120 psig	**PPA-95-108**

WARNING: IF YOUR UNIT HAS A PLASTIC BOWL

1. **DO NOT** use plastic bowl units without a metal bowl guard installed. Plastic bowl units are sold only with metal bowl guards to minimize the danger of flying fragments in the event of bowl failure.
2. **DO NOT** install the unit where it will be subjected to temperatures higher than 125°F (51,7°C).
3. **DO NOT** install the unit where it will be subjected to pressure higher than 150 psig (10,3 bar).
4. **CAUTION:**
   Certain compressor oils, household cleaners, chemicals, solvents, paints and fumes will attack plastic bowls and can cause plastic-bowl failure. See manufacturer's list below. Do not use near these materials.
5. **WHEN BOWL** becomes dirty, replace bowl or wipe only with a clean, dry cloth.
6. **DO NOT** install on a compressed air line where the compressor is lubricated with, or the air contains, a material that will attack plastic bowls.
7. **DO** inspect plastic bowls daily to detect crazing, cracking damage, or other deterioration. Immediately replace any crazed, cracked, damaged, or deteriorated bowl with a metal bowl or a new plastic bowl and metal bowl guard.

WARNING: IF YOUR UNIT HAS A METAL BOWL

1. **DO NOT** install unit where it will be subjected to temperatures higher than 175°(80°C).
2. **DO NOT** install the unit where it will be subjected to pressure higher than 250 psi (17 bar).

SOME OF THE MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS

Acetaldehyde	Chlorobenzene	Methylene chloride
Acetic acid (conc.)	Chloroform	Methylene salicylate
Acetone	Cresol	Milk of lime (CaOH)
Acrylonitrile	Cyclohexanol	Nitric acid (conc.)
Ammonia	Cyclohexanone	Nitrobenzene
Ammonium fluoride	Cyclohexene	Nitrocellulose lacquer
Ammonium hydroxide	Dimethyl formamide	Phenol
Ammonium sulfide	Dioxane	Phosphorous hydroxy chloride
Anaerobic adhesives & sealants	Ethane tetrachloride	Phosphorous trichloride
Antifreeze	Ethyl acetate	Propionic acid
Benzene	Ethyl ether	Pyridine
Benzoic acid	Ethylamine	Sodium hydroxide
Benzyl alcohol	Ethylene chlorohydrin	Sodium sulfide
Brake fluids	Ethlene dichloride	Styrene
Bromobenzene	Ethlene glycol	Sulfuric acid (conc.)
Butyric acid	Formic acid (conc.)	Sulphural chloride
Carbolic acid	Freon (refrigerant & propellant)	Tetrahydronaphthalene
Carbon disulfide	Gasoline (high aromatic)	Thiophene
Carbon tetrachloride	Hydrazine	Toluene
Caustic potash solution	Hydrochloric acid (conc.)	Turpentine
Caustic soda solution	Lacquer thinner	Xylene
	Methyl alcohol	Perchlorethylene and others

TRADE NAMES OF SOME COMPRESSOR OILS, RUBBER COMPOUNDS AND OTHER MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS

Atlas Perma-Guard	National Compound #N11
Buna N	Nylock VC-3
Cellulube #150 and #220	Parco #1306 Neoprene
Crylex #5 cement	* Permabond 910
* Eastman 910	Petron PD287
Garlock #98403 (polyurethane)	Prestone
Haskel #568-023	Pydraul AC
Hilgard Co. s hil phene	Sears Regular Motor Oil
Houghton & Co. oil #1120, #1130 and #1055	Sinclair oil Lily White
Houosate 1000	Stauffer Chemical FYROUEL #150
Kano Kroil	Stillman #SR 269-75 (polyurethane)
Keystone penetrating oil #2	Stillman #SR 513-70 (neoprene)
* Loctite 271	Tannergas
* Loctite 290	Telar
* Loctite 601	Tenneco anderol #495 and #500 oils
* Loctite Teflon-Sealant	Triton
Marvel Mystery Oil	* Vibra-tite
Minn. Rubber 366Y	Zerex

* When in raw liquid form

WE CANNOT POSSIBLY LIST ALL HARMFUL SUBSTANCES SO CHECK WITH A MOBAY CHEMICAL OR GENERAL ELECTRIC OFFICE FOR FURTHER INFORMATION ON POLYCARBONATE PLASTIC

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