PRO-CUT™ 40

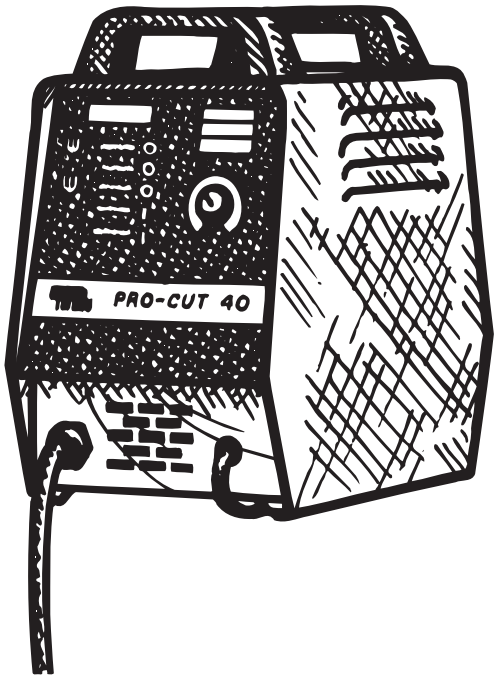
IM422-A

October, 1995

PLASMA CUTTING POWER SOURCE - for Single Phase Input - Code Numbers 9628-1 & 9628-2 only

Safety Depends on You

Lincoln plasma cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. DO NOT INSTALL OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT. And, most importantly, think before you act and be careful.



This manual covers equipment which is obsolete and no longer in production by The Lincoln Electric Co. Specifications and availability of optional features may have changed.

OPERATOR'S MANUAL

World's Leader in Welding and Cutting Products

LINCOLN® ELECTRIC

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⚠ WARNING

PLASMA CUTTING or GOUGING can be hazardous.

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

ELECTRIC SHOCK can kill.

1.a. The electrode and work (or ground) circuits are electrically "hot" when the power source is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

1.b. When the power source is operating voltages in excess of 250 volts are produced. This creates the potential for serious electrical shock - potentially even fatal.

1.c. Insulate yourself from work and ground using dry insulation. When cutting or gouging in damp locations, on metal framework such as floors, gratings or scaffolds and when in positions such as sitting or lying, make certain the insulation is large enough to cover your full area of physical contact with work and ground.

1.d. Always be sure the work cable makes a good electrical connection with the metal being cut or gouged. The connection should be as close as possible to the area being cut or gouged.

1.e. Ground the work or metal to be cut or gouged to a good electrical (earth) ground.

1.f. Maintain the plasma torch, cable and work clamp in good, safe operating condition. Replace damaged insulation.

1.g. Never dip the torch in water for cooling or plasma cut or gouge in or under water.

1.h. When working above floor level, protect yourself from a fall should you get a shock.

1.i. Operate the pilot arc with caution. The pilot arc is capable of burning the operator, others or even piercing safety clothing.

1.j. Also see Items 4c and 6.

ARC RAYS can burn.

2.a. Use safety glasses and a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when performing or observing plasma arc cutting or gouging. Glasses,headshield and filter lens should conform to ANSI Z87. I standards.

2.b. Use suitable clothing including gloves made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

2.c. Protect other nearby personnel with suitable non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

3.a. Plasma cutting or gouging may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When cutting or gouging, keep your head out of the fumes. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When cutting or gouging on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes keep exposure as low as possible and below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

3.b. Do not use plasma arc cutting or gouging in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

3.c. Gases used for plasma cutting and gouging can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

3.d. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices.

CUTTING SPARKS can cause fire or explosion.

4.a..Remove fire hazards from the plasma cutting or gouging area. If this is not possible, cover them to prevent the cutting or gouging sparks from starting a fire. Remember that welding sparks and hot materials from plasma cutting or gouging can easily go through small cracks and openings to adjacent areas. Avoid cutting or gouging near hydraulic lines. Have a fire extinguisher readily available.

4.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.

4.c. When not cutting or gouging, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

4.d. Do not cut or gouge tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned." For information purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).

4.e. Vent hollow castings or containers before heating, cutting or gouging. They may explode.

4.f. Do nor fuel engine driven equipment near area where plasma cutting or gouging.

4.g. Sparks and spatter are thrown from the plasma arc. Wear safety glasses, ear protection and oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when cutting or gouging out of position or in confined places. Always wear safety glasses with side shields when in a cutting or gouging area.

4.h. Connect the work cable to the work as close to the cutting or gouging area as practical. Work cables connected to the building framework or other locations away from the cutting or gouging area increase the possibility of the current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

CYLINDER may explode if damaged.

5.a. Use only compressed gas cylinders containing the correct gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

5.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

5.c. Cylinders should be located:
- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from plasma cutting or gouging, arc welding operations and any other source of heat, sparks, or flame.

5.d. Never allow any part of the electrode, torch or any other electrically "hot" parts to touch a cylinder.

5.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

5.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

5.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, "Precautions for Safe Handling of Compressed Gases in Cylinders,"available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

6.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

6.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

6.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

PLASMA ARC can injure.

7.a. Keep your body away from nozzle and plasma arc.

7.b. Operate the pilot arc with caution. The pilot arc is capable of burning the operator, others or even piercing safety clothing.

ELECTRIC AND MAGNETIC FIELDS may be dangerous

8.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Cutting or gouging current creates EMF fields around torch cables and cutting machines.

8.b. EMF fields may interfere with some pacemakers, so operators having a pacemaker should consult their physician before cutting or gouging.

8.c. Exposure to EMF fields during cutting or gouging may have other health effects which are now not known.

8d. All operators should use the following procedures in order to minimize exposure to EMF fields from the cutting or gouging circuit:

8.d.1. Route the torch and work cables together - Secure them with tape when possible.

8.d.2. Never coil the torch cable around your body.

8.d.3. Do not place your body between the torch and work cables. If the torch cable is on your right side, the work cable should also be on your right side.

8.d.4. Connect the work cable to the workpiece as close as possible to the area being cut or gouged.

8.d.5. Do not work next to cutting power source.

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.

   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.

   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

TABLE OF CONTENTS

Thank You —— for selecting a **QUALITY** product by Lincoln Electric. We want you to take pride in operating this Lincoln Electric Company product ••• as much pride as we have in bringing this product to you!

Please Examine Carton and Equipment For Damage Immediately

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, Claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

Model Name & Number _____

Code & Serial Number _____

Date of Purchase _____

Whenever you request replacement parts for or information on this equipment always supply the information you have recorded above.

Read this Operators Manual completely before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. The level of seriousness to be applied to each is explained below:

⚠ WARNING

This statement appears where the information **must** be followed **exactly** to avoid **serious personal injury** or **loss of life**.

⚠ CAUTION

This statement appears where the information **must** be followed to avoid **minor personal injury** or **damage to this equipment**.

PRODUCT DESCRIPTION

The PRO-CUT™ 40 is a constant current, continuous control plasma cutting system. The machine is inverter based for portability, and is one of the most sophisticated on the market. It provides excellent starting characteristics, cutting visibility and arc stability. The torch has a patented safety mechanism which ensures that the consumables are in place before cutting can begin. This is extremely important due to the high voltages involved with the plasma process.

The PRO-CUT 40 comes with an air regulator, coarse air filter, oil coalescing filter, and pressure gauge. The system is available with a 25 ft. or a 50 ft. torch cable. The system is capable of cutting with compressed air or nitrogen. Nitrogen is typically used to cut aluminum and other nonferrous metals.

The PRO-CUT is controlled by a microprocessor-based system. The machine performs rudimentary self troubleshooting when powered up, which aids in field servicing.

PREHEAT TEMPERATURE FOR PLASMA CUTTING

Preheat temperature control is recommended for optimum mechanical properties, crack resistance and hardness control. This is particularly important on high alloy steels and heat treated aluminum. Job conditions, prevailing codes, alloy level, and other considerations may also require preheat temperature control. The following minimum preheat temperature is recommended as a starting point. Higher temperatures may be used as required by the job conditions and/or prevailing codes. If cracking or excessive hardness occurs on the cut face, higher preheat temperature may be required. The recommended minimum preheat temperature for plate thickness up to 1/2 inch is 70 (°F).

USER RESPONSIBILITY

Because design, fabrication, erection and cutting variables affect the results obtained in applying this type of information, the serviceability of a product or structure is the responsibility of the user. Variation such as plate chemistry, plate surface condition (oil, scale), plate thickness, preheat, quench, gas type, gas flow rate and equipment may produce results different than those expected. Some adjustments to procedures may be necessary to compensate for unique individual conditions. Test all procedures duplicating actual field conditions.

SPECIFICATIONS

Type	K1396-1 (60 Hz) Torch with 25 ft.(7.6 m) Cable K1396-2 (60 Hz) Torch with 50 ft.(15.2 m) Cable
Input Frequency	60 Hz, 1ø
Output Rating	40 Amps @ 60% Duty Cycle 35 Amps @ 100% Duty Cycle
Pilot Current	8 amps
Pilot Duty Cycle	50% (30 seconds out of 60 seconds)
Current Range	15-40 Amps
Maximum OCV	330
Normal OCV	320
Input Power	
Standard Voltages	208/230V
Current	41 Amps/38 Amps @ 60% 34 Amps/32 Amps @ 100%
Idle Current	0.6
Idle Power	140W
Power Factor @ Rated Load	0.64
Net Weight	
w/25 ft. (7.6 m) Cable	88 lbs/40 kg
w/50 ft. (15.2 m) Cable	96 lbs/43.4 kg
Dimensions, H x W x D	17.7” x 10.5” x 22.6” (443 x 267 x 574 mm)

INSTALLATION

SAFETY PRECAUTIONS

- Read the safety precautions at the beginning of this Operator's Manual before proceeding.
- Only personnel that have read and understood this Operator's Manual should install and operate this equipment.
- Machine must be connected to system ground per any national, local or other applicable electrical codes.
- The power switch is to be in the "OFF" position when connecting power cord to input power.

⚠ WARNING

TURN THE INPUT POWER OFF USING THE DISCONNECT SWITCH AT THE FUSE BOX BEFORE ATTEMPTING TO CONNECT THE INPUT POWER LINES.

- Only qualified personnel should perform this installation.

- Turn the power switch on the PRO-CUT 40 "off" before connecting or disconnecting output cables.

- Connect the PRO-CUT 40 grounding terminal located on the side of the case back to a good electrical earth ground.

⚠ WARNING

DISCHARGE INPUT CAPACITORS BEFORE WORKING INSIDE MACHINE.

LOCATION

Place the PRO-CUT 40 where clean cooling air can freely circulate in through the side louvers and out through the front opening. Dirt, dust or any foreign material that can be drawn into the machine should be kept at a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown of the machine. Before planning the installation, read the next section entitled "High Frequency Interference Protection".

A source of clean, dry, compressed air or nitrogen must be supplied to the PRO-CUT 40. Oil in the air is a severe problem and must be avoided. The supply pressure must be between 70 and 150 psi (482 and 1032 kPa). The flow rate is approximately 4.7 cfm (133 l/min.). Failure to observe these precautions could result in excessive operating temperatures or damage to the torch.

HIGH FREQUENCY INTERFERENCE PROTECTION

The PRO-CUT 40 employs a solid state high frequency torch starting circuit which drastically reduces high frequency emissions from the machine compared with spark gap type high frequency generators.

Radiated interference can develop, however, in the following four ways:

(1) Direct interference radiated from the machine.

(2) Direct interference radiated from the cutting leads.

(3) Direct interference radiated from feedback into the power lines.

(4) Interference from reradiation of "pickup" by ungrounded metallic objects.

Keeping these contributing factors in mind, installing equipment per the following instructions should minimize problems.

(1) Keep the machine power supply lines as short as possible.

(2) Keep the work and torch leads as short as possible and as close together as possible. Lengths should not exceed 50' (15.2 m). Tape the leads together when practical.

(3) Be sure the torch and work cable rubber coverings are free of cuts and cracks that allow high frequency leakage.

(4) Keep the torch in good repair and all connections tight to reduce high frequency leakage.

NOTE: The machine frame MUST also be grounded - see paragraph under "Electrical Input Connection". The work terminal ground does not ground the machine frame.

(5) When the machine is enclosed in a metal building, several good earth driven electrical grounds around the periphery of the building are recommended.

Failure to observe these recommended installation procedures may cause radio or TV interference problems and result in unsatisfactory cutting performance resulting from lost high frequency power.

ELECTRICAL INPUT CONNECTION

⚠ WARNING

ELECTRIC SHOCK can kill.

• Disconnect input power before proceeding.

• Have a qualified electrician make the input connections.

• Be sure to discharge capacitors with the procedure outlined below before working in that area of equipment.

Electrical Installation for PRO-CUT 40

a. The PRO-CUT 40 should be connected only by a qualified electrician. Installation should be made in accordance with the U.S. National Electrical Code, all local codes and the information detailed below.

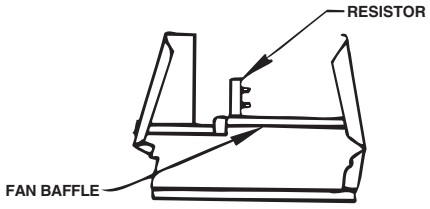
b. When received directly from the factory, the dual voltage (208-230) machines are internally connected for the highest voltage (230) input. If 230 is the desired input, then the machine may be connected to the power system without any setup required inside the machine.

c. 208 volt operation requires a voltage panel setup: Remove roof, discharge input capacitors, and move lead "A" from "230" to "208" of terminal strip "1". See following instructions.

NOTE: Do not power the PRO-CUT 40 off of the auxiliary power supply of an engine driven welder. If the voltage peaks from the engine welder exceed 380V the filter capacitors, FETS of other circuity may fail on the PRO-CUT 40.

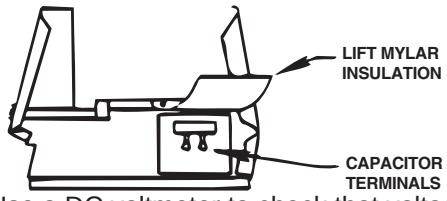
Capacitor Discharge Procedure

a. Locate discharge resistor (25 ohms 25W) attached to fan baffle. Resistor has no leads connected to it.



b. Remove resistor from fan baffle.

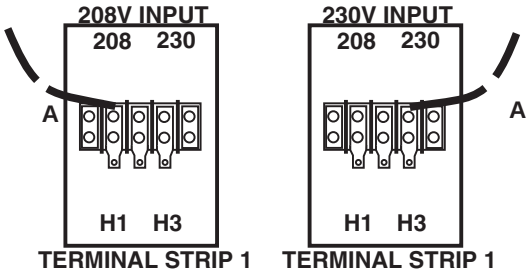
c. Hold resistor body with electrically insulated glove. **DO NOT TOUCH TERMINALS**. Carefully lift mylar insulation. Connect resistor terminals across two hex head cap screws in position shown. Hold in position for 1 second. Repeat for capacitor located on opposite side.



d. Use a DC voltmeter to check that voltage is not present across terminals.

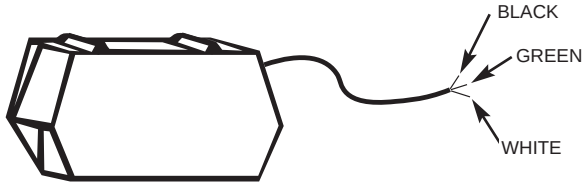
e. Replace discharge resistor onto fan baffle.

Input Voltage Setup



Power Cord Connection

A 10-foot power cord is provided and wired into the machine. Follow the power cord connection instructions. Incorrect connection may result in equipment damage.



Install in accordance with all local and national electric codes.

	RECOMMENDED FUSE SIZES BASED ON THE U.S. NATIONAL ELECTRICAL CODE AND MAXIMUM MACHINE OUTPUTS	
	INPUT VOLTS*	FUSE SIZE IN AMPS (TIME DELAY FUSES)
1 Phase 60 Hz / 50 Hz	208 230	60 60

* Input voltage must not exceed ± 10% of rated value.

Air Input Connections

⚠ WARNING

CYLINDER may explode if damaged

- Keep cylinder upright and chained to a fixed support.
- Keep cylinder away from areas where it may be damaged.
- Never lift equipment with cylinder attached.
- Never allow the cutting torch to touch cylinder.
- Keep cylinder away from live electrical circuits.
- Maximum inlet pressure 150 psig.

A source of clean, compressed air or nitrogen must be supplied to the PRO-CUT 40. The supply pressure must be between 70 and 150 psi (482 and 1032 kPa). The flow rate is approximately 4.7 cfm. Oil in the air is a very severe problem and must be avoided.

Remove the plastic thread protector from the regulator input port (located on the back of the machine). Use a suitable gas connection fitting to make the connection to the available air supply. The input port is a 1/4" NPT thread. Tighten the air fitting to prevent leakage but do not overtighten. The use of Teflon tape to seal the connection is recommended.

Nitrogen from cylinders may be used with this machine. The cylinder of nitrogen gas must be equipped with a pressure regulator. No more than 150 psi (1032 kPa) may be supplied to the regulator on the machine. Install a hose between the regulator on the gas cylinder and the gas inlet on the cutter.

OUTPUT CONNECTIONS

⚠ WARNING

HIGH FREQUENCY SHOCK CAN CAUSE INJURY OR FALL.

- Keep the cutting torch and cables in good condition.
- Secure yourself in position to avoid a fall.

Torch Connection

The PRO-CUT 40 comes factory equipped with a cutting torch. Cutting torches come with a 25 ft. (7.6 m) or a 50 ft. (15.2 m) cable.

Illustrations of the torch along with the required replacement parts are shown in the parts lists as P210-E and Figure 1. The ends of the cable to be connected to the power source are unique. Follow the applicable instructions as given in Figure 1 of the parts lists.

OPERATING INSTRUCTIONS

Sequence of events:

A. Turn on the line power.

B. Connect the air supply to the machine.

C. Turn the power switch on.

-The green "Power On" LED should begin to glow.

-The fan should start.

-If the "Safety" LED is glowing, push the "Safety Reset" button. If there is no problem, the LED will go off. If there is a problem, refer to Step 5 of the Test Step Chart , and the Troubleshooting Guide.

D. Set the Purge/Run switch to Purge.

-The air should start.

-The "Air Pressure" LED should be lit.

-Adjust the air regulator for 70 psi (482 kPa).

E. Set the Purge/Run switch to Run.

-The air will continue to run for 20 seconds of postflow. If the trigger is activated within this time period, the pilot arc will immediately start.

F. When ready to cut, connect the work lead clamp to the piece to be cut, place the torch near the work, make certain all safety precautions have been taken and pull the trigger.

-Air will flow for a preflow time of 2 seconds and the pilot arc will start. (This is true unless the machine is in postflow, then the preflow time is skipped and the pilot arc will start immediately.)

-The "Output On" LED will light.

-The pilot arc will run for 3.0 seconds and shut off unless the plasma is brought in contact with the work and the arc is transferred.

-When the arc is transferred, cutting begins. Finish the cut to be made and release the trigger.

G. When the trigger is released, the arc will stop.

-The air will continue to run for 20 seconds of postflow. If the trigger is activated within this

time period, the pilot arc will immediately restart.

⚠ WARNING

ELECTRIC SHOCK CAN KILL.

- Turn off machine at the disconnect switch at the back of the machine before tightening, cleaning or replac ing consumables.

H. If the "Safety" LED lights at any time, check the following:

- Check the torch consumables. If they are not properly in place the machine will not start.
- Check the condition of the inside of the nozzle. If debris has collected, scrape it out with a piece of sturdy wire or a suitable drill bit. Refer to "Suggestions for Extra Utility from the PRO-CUT system".
- After the problem is found, reset the machine by pressing the "Safety Reset" button. (It is possible for electrical noise to trip the safety circuit on rare occasions. This should not be a regular occurrence.)
- If the machine does not reset or continues to trip, consult the Troubleshooting Section.

Pilot Arc Discussion:

The PRO-CUT 40 has a smooth, continuous pilot arc. The pilot arc is only a means of transferring the arc to the workpiece for cutting. Repeated pilot arc starts, in rapid succession, is not recommended. These starts will generally reduce consumable life. Occasionally, the pilot arc may sputter or start intermittently. This is aggravated when the consumables are worn or the air pressure is too high. Keep in mind that the pilot arc is designed to transfer the arc to the workpiece and not for numerous starts without cutting.

Procedure Recommendations

When used properly, plasma arc cutting is a very economical process. Improper use will result in a very high operating cost.

General

- Follow safety precautions as printed inside the operating manual and on the machine.
- The S19425-1 Drag Cup is recommended when the output control is set in the blue range to protect the torch from dross and improper arcing conditions.
- Use proper cutting procedures referred to in the Procedures Guidelines.

Thin Gauge Sheet Metal:

Output set below mid-range.

- The torch should be dragged on the metal surface, touching the nozzle lightly to the surface after piercing a hole. Current control should be set in the yellow range only.
- The S19425-1 Drag Cup should not be used at very low outputs, as it will cause erratic arc action.
- Do not allow the torch cable or body to contact hot surfaces.
- The best cut quality is obtained by reducing the current to a level that is adequate for the maximum travel speed.
- Aluminum, copper and other nonferrous metals typically require more current than the same thickness of steel.

Expanded Metal:

Output set near mid-range.

- Cut as you would light gauge sheet metal.
- If the trigger is continuously pressed and released to obtain the bright pilot arc for long periods of time, the machine will go into pilot arc duty cycle limit. This is a 30 seconds out of 60 seconds pilot duty cycle. The pilot arc is disabled in the limit period. Pilot arc duty cycle limit is indicated by alternately flashing "OUTPUT ON" and "FAULT" LED's.
- Placing a thin piece of scrap sheet metal above the area to be cut and cutting through both can make the job easier.
- Do not allow the torch cable or body to contact hot surfaces.

Thick Sections of Metal:

Output set above mid-range.

- The best quality and consumable life will be obtained by holding the torch nozzle off the surface about 1/8 inch. Output control should be set in the blue range only. Do not touch the nozzle to the work or carry a long arc.
- Use the S19425-1 Drag Cup to protect the torch. The only reason not to use the Drag Cup when the output control is in the blue region, is in special tight corners. Always hold at least a 1/8" standoff in those situations.
- Set the current to the minimum necessary to make the cut.
- Pierce the plate by slowly lowering the torch onto it at an angle of about 30° to blow the dross away from the torch tip and slowly rotate the torch to a vertical position as the arc becomes deeper.
- Where possible, start the cut from the edge of the workpiece.
- Keep moving! A steady speed is necessary. Do not pause.
- Do not allow the torch cable or body to contact hot surfaces.

In All Cases:

- Do not carry a long arc. This may trip the safety or fault circuits and wears consumables rapidly.
- Always hold a standoff while cutting.
- Use the proper machine setting. Cranking the machine to maximum output will not produce the best cutting performance in most situations.
- Use proper cutting procedures referred to in the Procedures Guidelines.
- Use the nozzle with the largest orifice size that gives an acceptable cut. This will improve parts life.
- Tighten the nozzle for a snug fit using the S18808 wrench included in the PCT 40 tool box. **Do not use pliers or overtighten.**

Suggestions for Extra Utility from the PRO-CUT System:

- If it becomes absolutely necessary to cut through a very thick section, the air flow at the regulator on the back of the machine may be raised to 75 psi (516 kPa) to get a better cut result, and may give better consumable life. 70 psi (482 kPa) is the recommended pressure in all situations.

⚠ WARNING

ELECTRIC SHOCK CAN KILL.

Turn off machine at the disconnect switch at the back of the machine before tightening, cleaning or replacing consumables.

- The PRO-CUT 40 will cut with consumables that are worn considerably. Many competitive systems require replacement consumables long before a PRO-CUT system does. This is because of the solid state current regulation that the PRO-CUT has. Also, the safety reset circuit provides a means of extending nozzle life.

  Sometimes a small piece of material breaks off from the electrode and bridges the gap between the nozzle and the electrode. In a competitive unit, this would often result in the destruction of the electrode and nozzle due to overheating. This will result in the tripping of the PRO-CUT safety circuit. When this happens, turn the power off, remove the nozzle and scrape any debris from its inside cavity with a piece of sturdy wire or a suitable drill bit. Replace the nozzle, turn on the power and continue cutting.

- The PRO-CUT 40 is capable of operation with a 50 ft. (15.2 m) plasma torch. Pilot arc operation may be slightly degraded with this torch installed. Sputtering may occur after the pilot arc is established and occasionally the pilot arc may not light after the trigger is depressed. Neither cutting performance nor machine reliability will be lessened by this condition. Keep in mind that the condition of the consumables and air pressure level have a large impact on pilot arc ignition.

MAINTENANCE PROCEDURES

⚠ WARNING

ELECTRIC SHOCK CAN KILL.
BEFORE PERFORMING ANY MAINTENANCE THAT REQUIRES OPENING THE CASE OF THE POWER SOURCE:

- Disconnect input power to this machine at the Disconnect switch and discharge input capacitors before working inside machine.
- Do not touch electrically live parts or internal wiring.
- Only qualified personnel should service this machine.

ROUTINE MAINTENANCE

1. Keep the cutting area and the area around the machine clean and free of combustible materials. No debris should be allowed to collect which could obstruct air flow to the machine.

2. Every 6 months or so, the machine should be cleaned with a low pressure airstream. Keeping the machine clean will result in cooler operation and higher reliability. Be sure to clean these areas:

   - Power, Driver, Switch, and Control printed circuit boards
   - Power switch
   - Main Transformer
   - Input Rectifier (located on fan baffle)

3. Examine the sheet metal case for dents or breakage. Repair the case as required. Keep the case in good condition to assure that high voltage parts are protected and correct spacings are maintained. All external sheet metal screws must be in place to insure case strength and electrical ground continuity.

4. Check the air regulator filters to be sure they do not become clogged. The first stage of the air filter on the machine is self draining and will stop most of the water in the air line. The second stage of the filter is also self draining and will stop almost all of the oil in the line as well as particulate matter. Both stages will drain automatically when the flow rate changes rapidly.

5. Check the filter elements every several months to see if they are clogged (weekly in very dirty environments). Replace if necessary.

6. Inspect the cable periodically for any slits or puncture marks in the cable jacket. Replace if necessary. Check to make sure that nothing is crushing the cable and blocking the flow of air through the air tube inside. Also, check for kinks in the cable periodically and relieve any so as not to restrict the flow of air to the torch.

⚠ WARNING

ELECTRICAL SHOCK CAN KILL.
Turn off machine at the disconnect switch at the back of the machine before tightening, cleaning or replacing consumables.

Change consumables as required.

PERIODIC MAINTENANCE

Thermal Protection

Two thermostats protect the machine from excessive operating temperatures. Excessive temperatures may be caused by a lack of cooling air or operating the machine beyond the duty cycle and output rating. If excessive operating temperature should occur, the yellow thermal LED will light and the thermostat will prevent output voltage or current.

Thermostats are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fan is operating normally, the Power Switch may be left on and the reset should occur within a 15 minute period. If the fan is not turning or the air intake louvers were obstructed, then the power must be switched off for 15 minutes in order to reset. The fan problem or air obstruction must also be corrected.

TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK CAN KILL.
BEFORE PERFORMING ANY MAINTENANCE THAT REQUIRES OPENING THE CASE OF THE POWER SOURCE:

- Disconnect input power to this machine at the Disconnect switch and discharge input capacitors before working inside machine.
- Do not touch electrically live parts or internal wiring.
- S1 power switch, D9 input rectifier, C1 and C2 capacitors, Switch PC boards, R1, R2, R3, R4, and R5 resistors and T2 main transformer are all connected to the main lines. Use care when making voltage measurements.
- Do not troubleshoot the machine with an oscilloscope. Do not use electrical test equipment which has one test probe in common with the equipment case or grounding pin of the 115 VAC power plug. Use a battery power VOM for all troubleshooting.
- Only qualified personnel should service this machine.

HOW TO USE THIS GUIDE: Carefully read through each applicable section listed below. Remember that most problems are caused by improper setup, such as switch settings, control settings, etc.

If you believe the set up is correct and the trouble still exists, first check for the obvious: input power, blown fuses, loose PC board connectors, broken wires and the like. The sections listed below are intended to help you find the less obvious sources of trouble.

TROUBLESHOOTING GUIDE

⚠ WARNING

ELECTRICAL SHOCK CAN KILL.
Turn off machine at the disconnect switch at the back of the machine before tightening, cleaning or replacing consumables.

Visual Inspection

Clean interior of machine with a low pressure airstream. Make a thorough inspection of all components. Look for signs of overheating, broken leads or other obvious problems. Many problems can be uncovered with a good visual inspection.

Test Conditions

Perform all tests at rated input voltage. Make ohmmeter checks only after power has been disconnected from machine and after capacitors have been discharged.

Certain high voltage connections have been insulated with RTV sealant. It is necessary to break through the sealant with a sharp probe in order to make voltage or resistance checks.

SYMPTOM	CHECK
No LED's light and the fan does not operate when the power switch is turned on.	1. Check the input power to be sure it is on. 2. Check the power line fuses and machine connection. 3. Replace line switch.
No LED's light when the power switch is turned on, but the fan operates.	1. Disconnect plug P5 from jack J5 at the auxiliary transformer, T1, and check that 18VAC is present between J5-1 (blue wire) and J5-2 (blue wire). Replace the transformer, T1, if the voltage is not within specifications. Reconnect plug P5 to jack J5. 2. Check for 15VDC being present between J6-6 (+, lead number 302) and J6-1 (-, lead number 275D). Replace the POWER BOARD if voltage is low. 3. Check for 5.5VDC being present between J2-8 (+, lead number 808) and J2-2 (-, lead number 802). Replace the MICRO CONTROL BOARD if voltage is low. Replace the STATUS BOARD if voltage is OK.
The "MACHINE ON" LED is lit, but there is no response when the trigger is pulled. If another LED or combination of LED's are on or blinking, refer to the section under that combination.	1. Check the air supply to the machine. If the air does not flow, the machine will not start. The "AIR PRESSURE" LED must be lit when air is flowing. 2. Check for proper TRIGGER SWITCH operation. There should be continuity between J20-2 and J20-4 when the trigger switch is depressed and no continuity when the switch is not depressed. Replace the trigger switch if defective. 3. Check for greater than 4VDC between J16-2 (+, lead number 502) and J16-1 (-, lead number 501) when the trigger switch is depressed (the voltage should be 0 otherwise). If the voltage is not correct, replace the PWM CONTROL BOARD. 4. Check the operation of the air solenoid by switching the machine to "PURGE". If the pressure is sufficient, the air should begin to flow and the "AIR PRESSURE" LED should turn on. A. If the air does not flow and the "AIR PRESSURE" LED does not light, check the following: 1. Check the 115VAC between J5-9 (lead number 215) and J5-6 (lead number 215A) at the auxiliary transformer, T1. If voltage is not correct, replace the transformer, T1. 2. Check for 115VAC between J18-1 (lead number 215C) and J18-4 (lead number 215A or 215B) at the air solenoid. a. If there is not 115VAC between J18-1 and J18-4, check for <0.5VDC between J1-5 (+, lead number 505) and J1-1, (-, lead number 501). Replace the PWM CONTROL BOARD if the voltage is OK, or replace the MICRO CONTROL BOARD if the voltage is high.

SYMPTOM	CHECK
	b. If there is 115VAC between J18-1 and J18-4, check for less than 0.5 VDC between J5-5 (+, lead number 255A or 255B) and J5-2 (-, lead number 272). If voltage is OK, replace the air solenoid. If voltage is high, (approx. 5.5 VDC), replace the pressure switch. B. If the air functions properly in "PURGE", switch the machine back to the "RUN" mode. The air should continue to flow and the "AIR PRESSURE" LED should remain on for 5 to 20 seconds. If air now functions properly, replace the MICRO CONTROL BOARD. If the air does not function properly, perform step 4.A.2.
The air begins to flow, the "OUTPUT ON" LED lights for a brief period and then the "MALFUNCTION" LED turns on until the trigger is released. No arc is established.	1. Check the torch consumables to be sure they are in tight, not dirty or greasy, and in good shape. Replace the consumables if necessary. 2. Check for 380VAC between leads H4 and H1 at the auxiliary transformer, T1. Replace the transformer, T1, if not correct. 3. Check for 115VAC between J5-9 (lead number 215) and J5-6 (lead number 215A) at the auxil iary transformer, T1. If voltage is not correct, replace the transformer, T1. 4. Check for 115VAC between J19-9 (lead number 215B) and J19-7 (lead number 215D) at the high frequency module. 115VAC should be applied for approximately 1/2 second while the "OUTPUT ON" LED is turned on. A. If there is not 115VAC between J19-9 and J19-7, check for < 0.5 VDC between J16-4 (+, lead number 504) and J16-1 (-, lead number 501). Replace the PWM CONTROL BOARD if the voltage is OK, or replace the MICRO CONTROL BOARD if the voltage remains high, approximately 15 VDC. B. If there is 115VAC between J19-9 and J19-7 check for less than 0.5 VDC between J5-5 (+, lead number 255A or 255B) and J5-2 (-, lead number 272). If voltage is OK, replace the air solenoid. If voltage is high, approximately 5.5 VDC, replace the pressure switch. 5. Check for a high frequency enable signal be- tween J3-1 (+, lead number 327) and J1-1 (-, lead number 501). The signal should be a 15V square wave at a 60 Hz frequency for approx. 1/2 second while the "OUTPUT ON" LED is turned on. If the signal remains high (+15 VDC) replace the MICRO CONTROL BOARD. If the enable signal is present, replace the HIGH FREQUENCY MODULE. 6. Check pilot to work for a value between 6 and 10 ohms of resistance. 7. Check each 300W resistor for its rated value. Replace if bad. 8. Replace PWM CONTROL BOARD. 9. Replace MICRO CONTROL BOARD.

SYMPTOM	CHECK
The air begins to flow, the “OUTPUT ON” LED lights for a brief period and then the “MALFUNCTION” LED begins blinking. No arc is established.	1. Check the torch consumables to be sure they are in tight, not dirty or greasy, and in good shape. Replace the consumables if necessary. 2. Check the torch consumables to see if they are melted together or are simply touching each other. Tighten, clean or replace as needed. 3. Check the torch cable to see if it is cut or punctured. Replace it as needed. 4. Check electrode to pilot for a short. 5. Check the output diodes. Perform test step 3. 6. Check the SWITCH PC BOARDS. Perform test steps 1 and 2 for BOTH SWITCH PC BOARDS, and perform test steps 4A and 4B. 7. Check for an open circuit in the electrode and work leads. 8. Replace the PWM CONTROL BOARD. 9. Replace the MICRO CONTROL BOARD.
The air begins to flow, the ‘OUTPUT ON” LED lights for a brief period and then the “MALFUNCTION” LED begins blinking. There was a brief arc.	1. Check the torch consumables to be sure they are tight, not dirty or greasy, and in good shape. Replace the consumables if necessary. 2. Replace the PWM CONTROL BOARD. 3. Replace the MICRO CONTROL BOARD.
The arc starts but sputters badly.	1. Check the torch consumables to be sure they are tight, not dirty or greasy and in good shape. Replace if necessary. 2. Check air supply for oil or a great deal of water. If there is oil or a great deal of water, the air must be filtered or the machine switched to nitrogen or bottled air.
Poor cutting, cutting settings drift or output power is low.	1. Check front panel wiring and controls. 2. Replace the PWM CONTROL BOARD. 3. Replace the MICRO CONTROL BOARD.
Main fuses open or Switch PC Boards appear overheated	1. Perform test steps 1 and 2 for both Switch PC boards, and perform test step 5.
Output power is low. Machine makes squealing noise while under load. Machine is connected for 208/230V or 220V.	1. Perform test steps 1 and 2 for both Switch PC Boards, and perform test steps 4A and 4B.
The “THERMAL” LED is lit. The “MALFUNCTION” LED is blinking.	1. The machine is overheated. Allow it to cool and reset. The air intakes of the machine must not be blocked, or this will become a nuisance

SYMPTOM	CHECK
The “MALFUNCTION” LED is lit.	1. The MALFUNCTION circuit monitors the torch to see if it is shorted as well as internal machine failures. 2. Check the torch consumables to see if they are melted together or are simply touching each other. Tighten, clean or replace. See “Suggestion for Extra Utility from the PRO-CUT System”. 3. Check the torch cable to see if it is cut or punctured. Replace. 4. Turn off the machine and turn it back on. If the “MALFUNCTION” LED will not stay off when you try to cut again and there is no problem with the torch, then something has failed in the machine and the machine should not be left on. A. Check electrode to pilot for short. B. Check airflow. C. Check the power board. During preflow, there should be no voltage between work a and electrode and at end of preflow open circuit voltage should be present. Replace if bad. 5. Replace PWM CONTROL BOARD. 6. Replace MICRO CONTROL BOARD.
Alternating “AIR/MALFUNCTION” LED lights	1. Replace MICRO CONTROL BOARD.
The “SAFETY” LED is lit.	1. The machine will not operate. The machine senses that the nozzle is not in place, or the operators could be exposed to dangerous voltages if the machine were allowed to operate. 2. Check the nozzle to be sure it is tightly in place. 3. Check the torch consumables to see if they are melted together or are simply touching each other. Tighten, clean or replace. See “Suggestion for Extra Utility from the Pro-Cut System”. 4. Check the torch cable to see if it is cut or punctured. Replace. 5. Check to see that the torch is hooked to the machine properly. 6. Push the ‘SAFETY RESET” button, the LED should go out. 7. This circuit rarely trips on power up or because of noise. If the circuit can be reset, it is OK to continue operation. 8. Replace PWM CONTROL BOARD, as this is a safety problem.
The “OUTPUT ON” and “MALFUNCTION” LED’s blink in alternating order.	1. The pilot arc duty cycle has been exceeded. The machine will cool down and the lights will quit blinking in about 30 seconds. The pilot arc is limited to 30 out of 60 seconds.

TEST STEPS

Step	Test	Check *	Test Result	Conclusion	Next Test Step	Repair Action
1	FET A1 in circuit test Remove leads 4/5 and 1/8 from Switch PC Board	Terminals on Switch PC Board: 1/8 (pos) to 12 (neg)	>1K ohms	FET OK		
			<100 ohms	Short	4A	Replace Switch PC Board
		1/8 (neg) to 12 (pos)	<100 ohms	FET OK		
			>1K ohms	FET Open	4A	Replace Switch PC Board
2	FET A2 in circuit test Remove leads 4/5 and 1/8 from Switch PC Board	Terminals on Switch PC Board: 9 (pos) to 4/5 (neg)	>1K ohms	FET OK		
			<100 ohms	Short	4A	Replace Switch PC Board
		9 (neg) to 4/5 (pos)	<100 ohms	FET OK		
			>1K ohms	FET Open	4A	Replace Switch PC Board
3	Output Diodes	Remove output load. + work to - electrode	<100 ohms	Shorted output diode (D1 or D2)		Test individually
			>500 ohms	Output diodes OK		

Step	Test	Check *	Test Result	Conclusion	Next Test Step	Repair Action
4A	Snubber resis-tors	Disconnect leads 401 thru 404 on Switch PC Boards. Measure across leads: 401 to 12	25 ohms	R4 OK		
			high resistance	R4 open		Replace R4
		402 to 9	25 ohms	R5 OK		
			high resistance	R5 open		Replace R5
		403 to 12	25 ohms	R2 OK		
			high resistance	R2 open		Replace R2
		404 to 9	25 ohms	R3 OK		
			high resistance	R3 open		Replace R3
4B	Snubber diodes	Disconnect all leads except R&W on Switch PC Board. Measure across terminals on Switch PC Board: 9 (neg) to 1/8 (pos)	<100 ohms	OK		
			>1K ohms	Open		Replace Switch PC Board
		9 (pos) to 1/8 (neg)	>1K ohms	OK		
			<100 ohms	Short		Replace Switch PC Board
		12 (neg) to 401/403 (pos)	<100 ohms	OK		
			>1K ohms	Open		Replace Switch PC Board
		12 (pos) to 401/403 (neg)	>1K ohms	OK		
			<100 ohms	Short		Replace Switch PC Board
		402/404 (neg) to 9 (pos)	<100 ohms	OK		
			>1K ohms	Open		Replace Switch PC Board
		402/404 (pos) to 9 (neg)	>1K ohms	OK		
			<1K ohms	Short		Replace Switch PC Board
		4/5 (neg) to 12 (pos)	<1K ohms	OK		
			>100 ohms	Open		Replace Switch PC Board
		4/5 (pos) to 12 (neg)	>1K ohms	OK		
			<100 ohms	Short		Replace Switch PC Board

Step	Test	Check *	Test Result	Conclusion	Next Test Step	Repair Action
5	D9 Input Rectifier	13 (pos) to T1 (neg)	>1K ohms	OK		
			<100 ohms	Shorted	1-2	Replace D9 In space S1 Test C1 and C2
		13 (pos) to T2 (neg)	>1K ohms	OK		
			<100 ohms	Shorted	1-2	Replace D9 Inspect S1 Test C1 and C2
		13 (pos) to T3 (neg) (3 phase only)	>1K ohms	OK		
			<100 ohms	Shorted	1-2	Replace D9 Inspect S1 Test C1 and C2
		12 (neg) to T1 (pos)	>1K ohms	OK		
			<100 ohms	Shorted	1-2	Replace D9 Inspect S1 Test C1 and C2
		12 (neg) to T2 (pos)	>1K ohms	OK		
			<100 ohms	Shorted	1-2	Replace D9 Inspect S1 Test C1 and C2

Step	Test	Check *	Test Result	Conclusion	Next Test Step	Repair Action
5 (con't)		12 (neg) to T3 (pos) (3 phase only)	>1K ohms	OK		
			<100 ohms	Shorted	1-2	Replace D9 Inspect S1 Test C1 and C2
		13 (neg) to T1 (pos)	<100 ohms	OK		
			>1K ohms	Open	1-2	Replace D9 Inspect S1 Test C1 and C2
		13 (neg) to T2 (pos)	<100 ohms	OK		
			>1K ohms	Open	1-2	Replace D9 Inspect S1 Test C1 and C2
		13 (neg) to T3 (pos) (3 phase only)	<100 ohms	OK		
			>1 K ohms	Open	1-2	Replace D9 Inspect S1 Test C1 and C2
		12 (pos) to T1 (neg)	<100 ohms	OK		
			>1K ohms	Open	1-2	Replace D9 Inspect S1 Test C1 and C2
		12 (pos) to T2 (neg)	<100 ohms	OK		
			>1K ohms	Open	1-2	Replace D9 Inspect S1 Test C1 and C2
		12 (pos) to T3 (neg) (3 phase only)	<100 ohms	OK		
			>1K ohms	Open	1-2	Replace D9 Inspect S1 Test C1 and C2

SWITCH PC BOARD REPAIRS

If a test indicates that one or more FET's are defective, both Switch PC boards must be replaced. A defective FET is likely to damage other devices in the power circuitry. The defect may be subtle and not detectable by ohmmeter measurement. Unknown defective parts may cause newly replaced parts to fail.

In addition to replacing Switch PC boards, replace C1 and C2 if the following conditions are met:

1.Switch PC boards have burned areas.

a)Switch PC Board Replacement Procedure

⚠ WARNING

ELECTRIC SHOCK CAN KILL.
BEFORE PERFORMING ANY MAINTENANCE THAT REQUIRES OPENING THE CASE OF THE POWER SOURCE:

- Disconnect input power to this machine at the Disconnect switch and discharge input capacitors before working inside machine.
- Do not touch electrically live parts or internal wiring.
- Only qualified personnel should service this machine.

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1) Remove the sheet of mylar insulation.

2) Carefully disconnect the leads at the top of the Switch PC board.

3) Remove the 4-socket head cap screws with a 3/16" hex key wrench.

4) While holding the Switch PC board, remove the 2 hex head cap screws from the center of Switch PC board.

5) Remove board.

6) Thoroughly clean the heat sink surface.

7) Apply a thin layer (ideally .002") of Dow 340 heat sink compound to the copper bars on the Switch PC board and also to the 2 capacitor terminals. Keep heat sink compound off of threads since this will affect the torque specifications.

8) Carefully place the Switch PC board onto the heat sink, being sure the 4 mounting holes are lined up before making full contact with the heat sink.

9) Carefully holding the Switch PC board, install the 4 socket headcap screws but do not tighten them. Next, install the 2 hex headcap screws into the capacitor but do not tighten them.

10) Torque the 4 socket head cap screws to 44" lbs. and then torque the 2 hex head cap screws to 50-60" lbs.

11) Reconnect the leads to the Switch PC boards and reinstall the sheet of mylar insulation.

⚠ CAUTION

Before applying power to the machine, check all connections. An incorrect connection will result in machine damage when power is switched on.

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12) Connect an ohmmeter set for X1000 to the hex head screw terminals on the Switch PC board. The meter will show the capacitors charging up. The meter may take a minute or so to stabilize. The value must not exceed 8000 ohms.If the meter reads less than 6000 ohms, reverse the meter leads and repeat the test. If OK, proceed with power tests.

13) Fuse input supply with 5 amp fuses.

14) Disconnect P19 from J19 at the high frequency module. Check output open circuit voltages during first 1/2 second of output. Do not apply output lead.

15) Fuse for 20 amps and test under load.

Replacement of Power Modules and Output Diodes

Input rectifier, D9 and A1 and A2 of each Switch PC board are power modules. When mounting power modules, the heat sink and module material mounting surface should be clean and free of burrs and foreign material. For A1 and A2, apply an even coating of joint compound to both the heat sink and module mounting surfaces. The joint compound should be, ideally, .002" per surface to eliminate all air pockets. This may be verified by mounting and then removing the module. When removed, the compound on both surfaces will appear textured as if a vacuum had created veinlike ridges when the parts were separated. If the compound does not have this appearance, apply more joint compound and recheck.

Replacement of output diodes D1 and D2 is similar. Clean and brighten mounting surfaces with fine steel wool. Compound should be used on surface between diode and heat sink when mounting individual diodes. DO NOT apply on diode stud and mounting nut threads.

Components must have proper torque applied to mounting screws and to electrical terminals. Torque the modules according to the following:

COMPONENT	COMPONENT TO HEAT SINK TORQUE ± 10%	TERMINAL TORQUE ± 10%
A1, A2 (M16100-1, -2)	44 Inch-Lbs.*	N.A.
Input Diode (M15454-1)	6 Inch-Lbs. **	26 Inch-Lbs.
Output diode (M15482-3)	25 Inch-Lbs.	N.A.

* Re-torque after 3 hours to allow for spread of compound.
** Tighten in staggered fashion one quarter turn at a time.

Environmental Protection

High voltage connections are covered with an RTV sealant to prevent malfunction in severe environments. Sealant must be applied to connections which have been opened or otherwise lost their protection. A noncorrosive electronic grade sealant such as Dow Corning 3140, 3145, 738, Columbus Adhesives 0172 or GE RTV-162 is recommended. Sealant may also be purchased from Lincoln Electric (order E2519 Silicone Rubber RTV coating). Apply sealant after the machine is repaired and tested.

High voltage areas which require sealant are listed:

- PC boards requiring protection are supplied from Lincoln Electric with required protection.
- Input rectifier D9, all 5 terminals.
- Output rectifiers, D1 and D2.

The Power Switch requires tape over connection areas and contact openings to minimize dirt build up.

PRO-CUT 40 STATUS LIGHTS OPERATING MODES:

STATUS LIGHTS	CONDITION	SUGGESTIONS
MACHINE ON	Should always be on when machine is on.	Normal
OUTPUT ON	On when there is voltage potential at the torch (cutting or pilot)	Normal .
	OUTPUT ON is blinking alternately with AIR PRESSURE when power is first applied to machine.	There is a problem with the microprocessor, replace the control PC board.
	OUTPUT ON is blinking alternately with MALFUNCTION.	Wait for machine to cool.
AIR PRESSURE	On whenever the air pressure is above 60 psi (413 kPa), there is an error condition mentioned above where air will turn on.	Normal conditions are purge, preflow, postflow and cutting.
THERMAL	Should normally be off.	If on, wait for machine to cool down.
MALFUNCTION	Light on. At end of preflow, machine checks to see if the torch is shorted.	Check consumables, replace as needed. Check torch cable to see if it is punctured or cut.
	Light blinking. If cutting tried with air pressure less than 60 psi (413 kPa), the machine will wait for air pressure to become greater than 60 psi (413 kPa).	No air connecter to machine, air pressure set too low, or air leak in system.
	Light blinking alternately with OUTPUT ON.	Pilot arc duty cycle has been exceeded. Wait for machine lights to stop blinking.
	Light turned on during cutting. There is an overcurrent condition caused by a surge of current the machine was not designed to handle. Release the trigger and resume cutting.	If cutting with standoff more than 1/8" at high range of machine and nozzle is accidentally touched to work, shorten stickout, or use drag cup. Check consumables to see if electrode is melted to nozzle.
	Light blinking with THERMAL light on.	Wait for machine to cool.

STATUS LIGHTS	CONDITION	SUGGESTIONS
Safety	It is possible that this light could turn on when power is first applied to machine.	If machine can be reset, it is OK to continue operation.
	The nozzle is not in place.	Securely fasten nozzle in place.
	While cutting if the voltage between the nozzle and the work is too high, it will put the machine into SAFETY.	By pressing reset, the machine will be functional. This occurs most often when the consumables are wearing out. By removing the hafnium that builds up on the inside of the nozzle, it is possible to extend the life of the consumables.
	If the cable is punctured or cut, it can trip the SAFETY.	By pressing reset, it will clear the SAFETY. When cutting is tired again, the machine will either go into MALFUNCTION or SAFETY; until that time, the machine will not indicate a malfunction.

PROCEDURE FOR REPLACING PC BOARDS

Before replacing a PC board which is suspected of being defective, visually inspect the PC board in question for any damage to any of its components and conductors on the back of the board.

If there is **no** visible damage to the PC board, install a new one and see if this remedies the problem. If the problem is remedied, reinstall the **old** PC board to see if the problem still exists. If it **does** no longer exist with the old PC board:

1. Check the PC board harness conductor pins for corrosion, contamination or looseness.

2. Check leads in the plug harness for loose or intermittent connection.

If PC board is visibly damaged electrically (components burned, copper traces opened or damaged), before possibly subjecting the new PC board to the same cause of failure, check for possible shorts, opens or grounds caused by:

1. Frayed or pinched lead insulation.

2. Poor lead termination, such as a poor contact or a short to adjacent connection or surface.

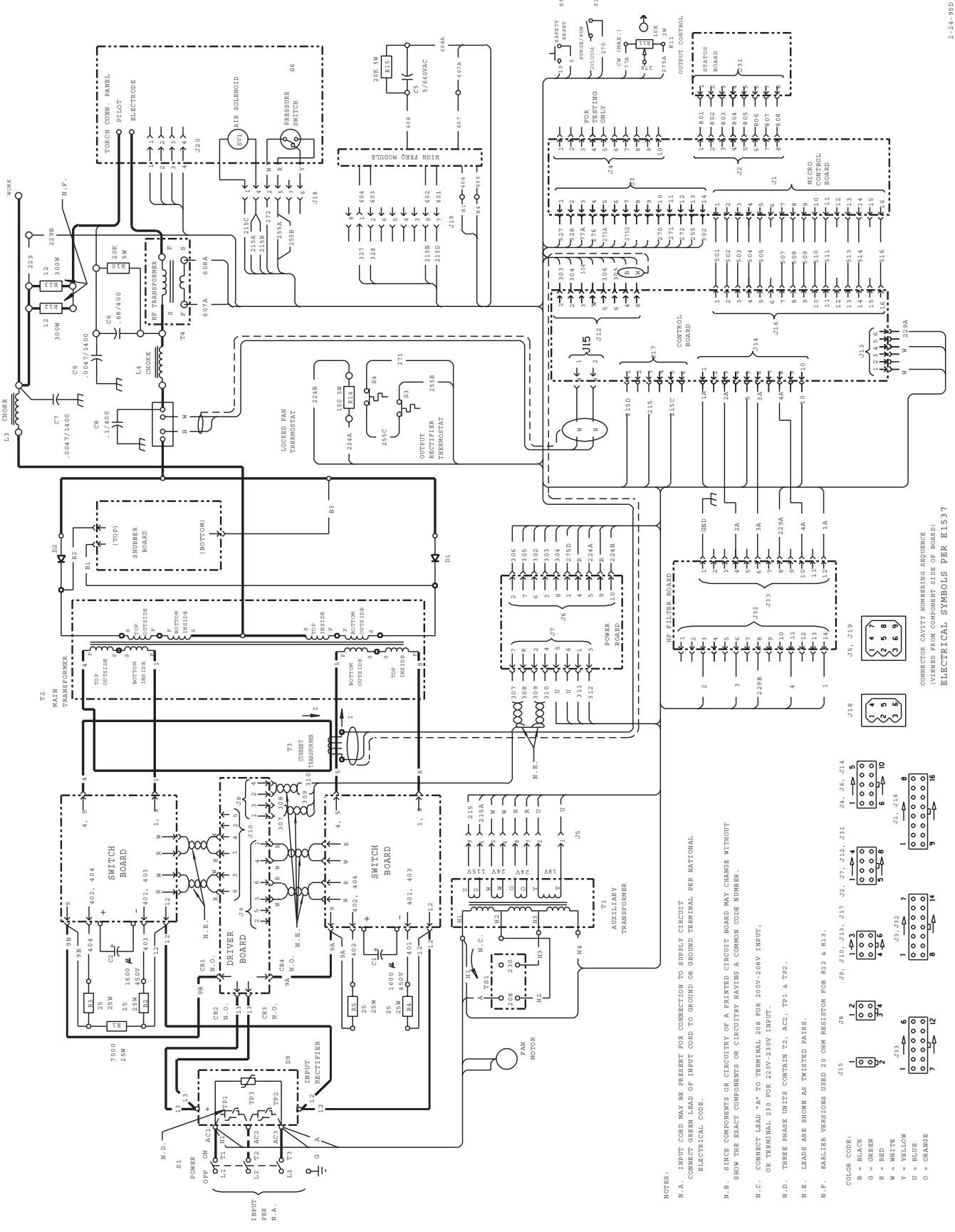
3. Two or more leads shorted together.

4. Foreign matter or interference behind the PC boards.

If PC board is visibly damaged mechanically (such as a part vibrated off or was crushed), inspect for cause, then remedy before installing a replacement PC board.

If there is damage to the PC board if replacing PC board corrects problem, return it to there local Lincoln Electric Field Service Shop.

WIRING DIAGRAM - PROCUT 40



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number..

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			TOTAL COST	

			
WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。	● 燃えやすいものの側での溶接作業は絶対にしてはなりません。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或濕衣物切勿接觸帶電部件及銲條。 ● 使你自己與地面和工件絕緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● パネルやカバーを取り外したままで機械操作をしないで下さい。	Japanese **注意事項**
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	●維修前切斷電源。	●儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه.	Arabic **تحذير**

LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的説明以及應該使用的銀捍材料，並請遵守貴方的有関勞動保護規定。

이 제폼에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

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3 YEAR WARRANTY PARTS & LABOR

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STATEMENT OF WARRANTY:

The Lincoln Electric Company (Lincoln) warrants to the original purchaser (end-user) of new equipment that it will be free of defects in workmanship and material.

This warranty is void if Lincoln finds that the equipment has been subjected to improper care or abnormal operation.

WARRANTY PERIOD:

All warranty periods date from the date of shipment to the original purchaser and are as follows:

Three Years:

Transformer Welders
Motor-generator Welders
Inverter Welders
Automatic Wire Feeders
Semiautomatic Wire Feeders
Plasma-cutting Power Source
Engine Driven Welders (except engine and engine accessories) with operating speed under 2,000 RPM

Two Years:

Engine Driven Welders (except engine, engine accessories and Power-Arc generator/welders) with operating speed over 2,000 RPM

All engine and engine accessories are warranted by the engine or engine accessory manufacturer and are not covered by this warranty.

One Year:

Equipment not listed above such as gun and cable assemblies, water coolers, FAS TRAK or MIG-TRAK equipment, Power-Arc generator/welders, Wire Feed Module (Factory Installed) and field-installed optional equipment.

TO OBTAIN WARRANTY COVERAGE:

You are required to notify Lincoln Electric, your Lincoln Distributor, Lincoln Service Center or Field Service Shop of any defect within the warranty period. Written notification is recommended.

WARRANTY REPAIR:

If Lincoln's inspection of the equipment confirms the existence of a defect covered by this warranty, the defect will be corrected by repair or replacement at Lincoln's option.

WARRANTY COSTS:

You must bear the cost of shipping the equipment to a Lincoln Service Center or Field Service Shop as well as return shipment to you from that location.

IMPORTANT WARRANTY LIMITATIONS:

- Lincoln will not accept responsibility for repairs made without its authorization.
- Lincoln shall not be liable for consequential damages (such as loss of business, etc.) caused by the defect or reasonable delay in correcting the defect.
- Lincoln's liability under this warranty shall not exceed the cost of correcting the defect.
- This written warranty is the only express warranty provided by Lincoln with respect to its products. Warranties implied by law such as the Warranty of Merchantability are limited to the duration of this limited warranty for the equipment involved.

August, '94