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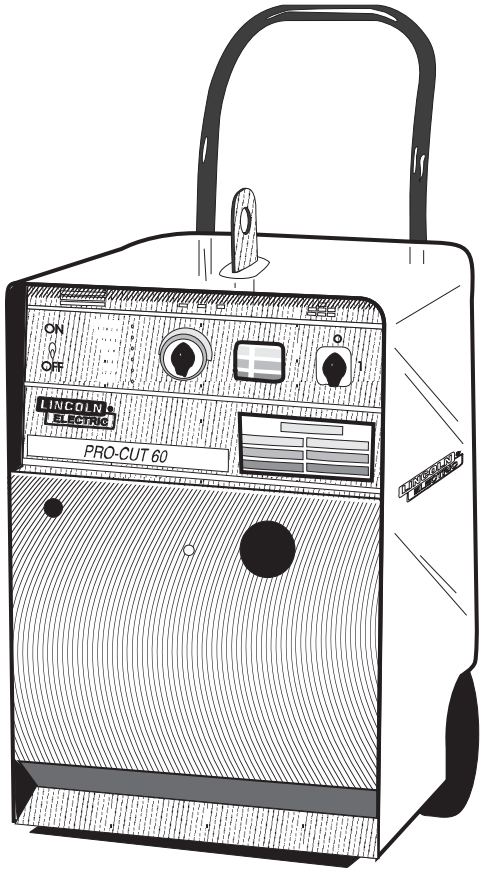
SVM104-A
March, 1999

PRO-CUT™ 60 (Single Phase)

For use with machines having Code Numbers: **9819, 10096, 10112 10118, 10217, 10218 10393, 10394**

Safety Depends on You

Lincoln arc welding and 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.



SERVICE MANUAL

ISO 9002
Accredited by the Dutch Council for Certification
REGISTRAR ACCREDITATION BOARD
Manufactured Under a Quality Program Certified by ABS Quality Evaluations, Inc. to ISO 9002 Requirements.
CERTIFICATE NUMBER: 30273

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⚠ WARNING

CUTTING 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 W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

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 welder or cutter 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. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding or cutting must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

1.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

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

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

1.f. Maintain the electrode holder, work clamp, welding or cutting cable and welding or cutting machine in good, safe operating condition. Replace damaged insulation.

1.g. Never dip the electrode in water for cooling.

1.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

1.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

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

ARC RAYS can burn.

2.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or cutting or observing open arc welding or cutting. Headshield and filter lens should conform to ANSI Z87. I standards.

2.b. Use suitable clothing 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. Welding or cutting may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, or cutting keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding or cutting with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or 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 weld or cut 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. Shielding gases used for arc welding or cutting 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. MSDS forms are available from your welding distributor or from the manufacturer.

3.e. Also see item 7b.

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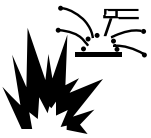


WELDING OR CUTTING SPARKS can cause fire or explosion.

4.a. Remove fire hazards from the welding or cutting area. If this is not possible, cover them to prevent the welding or cutting sparks from starting a fire. Remember that welding or cutting sparks and hot materials from welding or cutting can easily go through small cracks and openings to adjacent areas. Avoid welding or cutting 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 welding or cutting, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

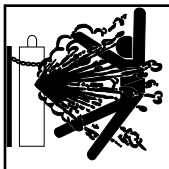
4.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe 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 welding. They may explode.

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

4.g. Connect the work cable to the work as close to the welding or cutting area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding or cutting 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.

4.h. Also see item 7c.



CYLINDER may explode if damaged.

5.a. Use only compressed gas cylinders containing the correct shielding 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 arc welding or cutting operations and any other source of heat, sparks, or flame.

5.d. Never allow the electrode, electrode holder 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-l, “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.

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FOR ENGINE powered equipment.

7.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

7.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

7.c. Do not add the fuel near an open flame welding or cutting arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

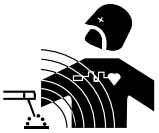
7.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

7.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

7.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

7.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

7.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS may be dangerous

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

8.b. EMF fields may interfere with some pacemakers, and welders or cutters having a pacemaker should consult their physician before welding or cutting.

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

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

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

8.d.2. Never coil the electrode lead around your body.

8.d.3. Do not place your body between the electrode and work cables. If the electrode 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 welded.

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

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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.

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TECHNICAL SPECIFICATIONS - PRO-CUT 60

INPUT - SINGLE PHASE / 60 HERTZ ONLY

Standard Voltage	Input Current at Rated Output	Codes
208/230/460	50/45/23	10112, 9819
460/575	23/18	10118, 10096

RATED OUTPUT

Duty Cycle	*AMPS*	*Volts at Rated Amps*
60% Duty Cycle	60	115
100% Duty Cycle	45	115

OUTPUT

Current Range	*Open Circuit Voltage*	*Pilot Current*
25-60 Amps	MIN 235VAC MAX 280 VAC	22.5A (20 seconds out of 80 seconds)

RECOMMEND INPUT WIRE AND FUSE SIZES

For all plasma cutting applications
Based on U.S. National Electrical Code
Ambient Temperature 30oC or Less

AC Input Voltage at 60 Hertz	Fuse (Super Lag) Circuit Breaker (Delay Type)	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes	
		2 Input Supply Wires	1 Ground Wire
208/230	50 AMPS	#8 (8.4mm²)	#10 (5.3mm²)
460/575	25 AMPS	#10 (5.3mm²)	#10 (5.3mm²)

PHYSICAL DIMENSIONS
(INCLUDES LIFT BAIL AND UNDERCARRIAGE W/O HANDLE)

Height	Width	Depth	Weight Including Machine Torch Cable (Length)	
			(25ft/7.6m)	(50ft/15.2m)
34 in. 864 mm	19 in. 483 mm	22 in. 559 mm	322 lbs. 146 kg.	329 lbs. 149 kg.

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Read entire Installation Section before installing the PRO-CUT 60.

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK CAN KILL.

- Only qualified personnel should install this machine.
- Turn the input power OFF at the disconnect switch or fuse box before working on the equipment.
- Do not touch electrically hot parts.
- Always connect the PRO-CUT 60 grounding terminal (located on the side of the Case Back Assembly) to a good electrical earth ground.
- Turn the PRO-CUT Power Switch OFF when connecting power cord to input power.

SELECT PROPER LOCATION

Place the PRO-CUT 60 where clean air can freely circulate in through the front intake and out through the rear louvers. Dirt, dust, or any foreign material that can be drawn into the machine should be kept at a minimum. Not following these precautions can result in the nuisance shutdown of the machine because of excessive operating temperatures.

The location or improper installation of the machine could affect the operation of radio, TV, or electronic equipment. See the HIGH FREQUENCY INTERFERENCE PROTECTION Section for more information.

STACKING

The PRO-CUT 60 cannot be stacked.

TILTING

The PRO-CUT 60 must be placed on a stable, level surface using the attached undercarriage so it will not topple over.

HIGH FREQUENCY INTERFERENCE PROTECTION

Locating, installing, or maintaining the PRO-CUT 60 incorrectly could cause interference with proper radio, TV, or electronic equipment operation and result in poor cutting and gouging performance. The spark gap oscillator in the machine's high frequency generator generates electrical signals like a radio transmitter that can cause high frequency interference. Therefore, properly locating, installing, and maintaining the machine can reduce or eliminate the effects of high frequency interference or the loss of high frequency machine operating power.

The following procedures should be followed to minimize interference to the following areas:

- the machine
- the cutting leads
- feedback into the power lines
- ungrounded metallic objects

1. Make the power supply lines as short as possible.
2. Enclose power supply lines entirely in rigid metallic conduit (or equivalent shielding)
   a. Provide a good electrical ground between the conduit and the machine.
   b. Connect both ends of the conduit to a driven ground.
   c. Entire conduit length should be continuous.

   NOTE: The machine frame must be grounded. The work terminal ground DOES NOT ground the machine frame.

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3. Connect the work terminal to a ground within ten feet of the machine.

   a. Use grounding cable that is the same size as, or larger than, the work cable.

   b. Make grounding cable as short as possible.

   c. Connect the ground tightly.

   d. Use one of the following ground methods:

   (1) Connect to a metal underground water pipe that is in direct contact with earth for ten feet or more.

   (2) Connect to 3/4" (19mm) galvanized pipe or a 5/8" (16mm) solid galvanized iron, steel, or copper rod driven at least eight feet into the ground.

   NOTE: Do Not use the building frame electrical conduit or a long pipe system for grounding the machine. This could result in increased high frequency interference.

   NOTE: When the machine is used in a metal building, drive several good earth grounds around the edge of the building. Use the method in 2 above.

4. Enclose all electrical conductors within 50 feet (15.2m) of the machine in grounded rigid metallic conduit or equivalent shielding.

   a. Do not use flexible metallic conduit.

5. Make work and torch leads as short and as close together as possible.

   a. Lead length should not exceed 50 feet (15.2m).

   b. Tape leads together when possible.

6. Check torch and work cable rubber insulation coverings to be sure they do not have any cracks or cuts that could result in high frequency leakage that could interfere with other electronic equipment.

   a. Use insulated work cables with a high natural rubber content, such as the Lincoln Stable-Arc cables. These better resist high frequency leakage than neoprene or other synthetic rubber insulated cables.

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

8. Keep all access panels and covers tightly closed.

Follow these procedures for the best operating results. Failure to follow these procedures can cause interference and machine performance problems.

INPUT ELECTRICAL CONNECTIONS

Before installing the machine, check that input supply voltage, phase, and frequency are the same as the machine's voltage, phase, and frequency as specified on the machine's rating plate on the Case Front Assembly. See Figure A.1 for the location of the machine's input cable entry opening, terminal block, and reconnect panel assembly. Input power supply entry is through the hole in the Case Back Assembly.

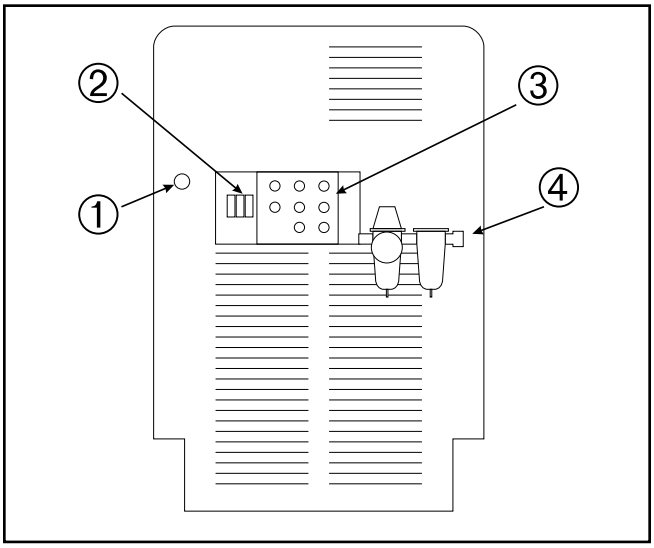

FIGURE A.1 - Case Back Assembly
1. Input Supply Cable Entry Opening
2. Terminal Block
3. Reconnect Panel Assembly
4. Air Pressure Regulator.

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FUSE AND WIRE SIZES

Protect the input circuit with the super lag fuses or delay type circuit breakers listed on the Specifications page of this manual for the machine being used. The tripping action of delay type circuit breakers decreases as the magnitude of the current increases. They are also called inverse time or thermal/magnetic circuit breakers.

DO NOT use fuses or circuit breakers with a lower amp rating than recommended. This can result in "nuisance" tripping caused by inrush current even when machine is not being used for cutting or gouging at high output currents.

Use input and grounding wire sizes that meet local electrical codes or see the Specifications page in this manual.

GROUND CONNECTION

Ground the frame of the machine. A ground terminal marked with the symbol (⏚) is located at the left side of the Input Box Assembly. Access to the Input Box Assembly is at the top-rear of the machine. See your local and national electrical codes for proper grounding methods.

INPUT POWER SUPPLY CONNECTIONS

A qualified electrician should connect the input power supply leads to the L1 and L2 terminals on the Input Box Assembly Terminal Block.

1. Follow all national and local electrical codes.
2. Follow Input Supply Connection Diagram located on the inside of the access door.
3. Use a single-phase line or one phase of a three-phase line.
4. Connect leads to machine's terminal block. See Figure A.2.
   a. For #8 AWG wire (8.4mm), connect leads directly to machine's terminal block.
   b. For #10 AWG wire (5.3mm), connect leads to terminal block using the ferrules (S19117-1)provided.
      (1) Strip 1/2" (12.7mm) of insulation from wire.
      (2) Place ferrule over wire.
      (3) Connect to machine terminal block.
   c. Tighten screws to 16 in/lbs (1.8 N.M.)

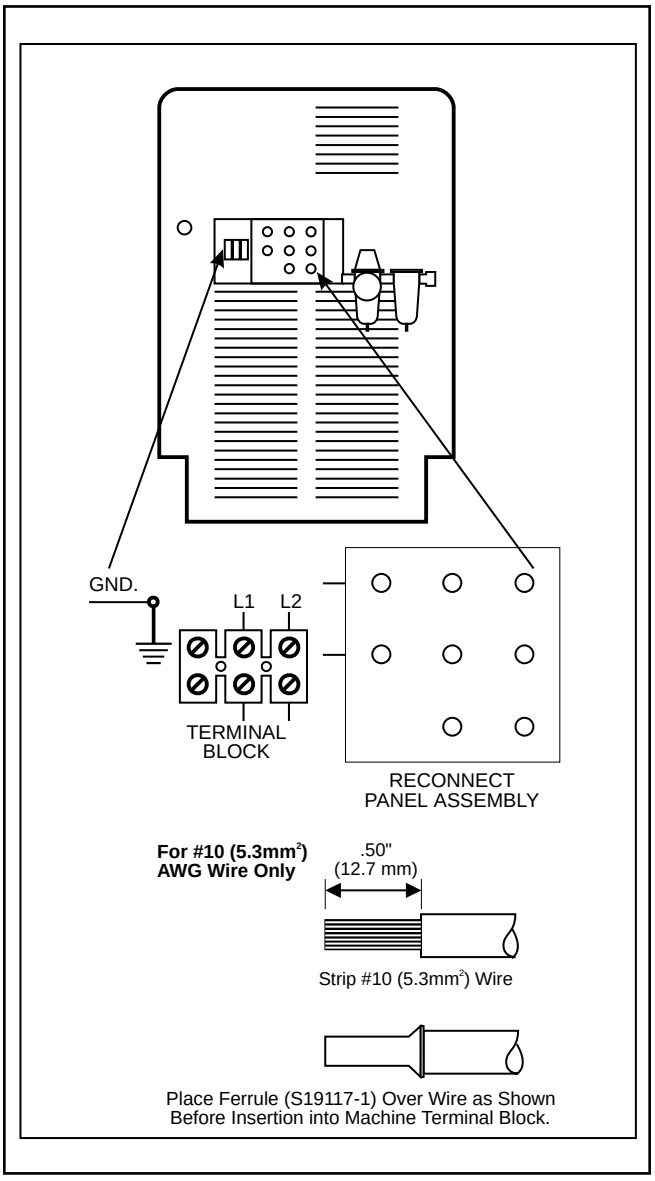

FIGURE A.2 - Input Power Supply Connections.

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AIR INPUT CONNECTIONS

Supply the PRO-CUT 60 with clean compressed air or nitrogen.

- Supply pressure must be between 70 psi and 120 psi (482 kPa and 827 kPa).
- Flow rate should be approximately 4.7 cfm (133 l/min.).

NOTE: Oil in the air supply to the PRO-CUT 60 can cause severe problems. Use only a clean air supply.

1. Connect the air supply to the PRO-CUT 60 regulator.

   a. Remove the plastic thread protector from the machine's regulator input port located on the back of the machine. Refer to figure A.1.

      -The input port is a 1/4" (6.3mm) NPT thread.

   b. Connect the air supply to the machine regulator with an appropriate gas connection fitting. Sealing the connection with Teflon tape is recommended.

2. Tighten the air fitting connection to prevent leakage.
   -Do not overtighten.

NOTE: When using nitrogen gas from a cylinder, the cylinder must have a pressure regulator.

- Maximum psi from nitrogen gas cylinder to PRO-CUT 60 regulator should never exceed 120 psi (827 kPa).
- Install a hose between the nitrogen gas cylinder regulator and the PRO-CUT 60 regulator's gas inlet.

⚠ WARNING

CYLINDER could explode if damaged.

- Keep cylinder upright and chained to a fixed support.
- Keep cylinder away from areas where it could be damaged.
- Never lift machine with cylinder attached.
- Never allow the cutting torch to touch the cylinder.
- Keep cylinder away from live electrical parts.
- Maximum inlet pressure 120 psi (827kPa).

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RECONNECT PROCEDURE

Multiple voltage machines are shipped connected to the highest input voltage listed on the machine's rating plate. Before installing the machine, check that the Reconnect Panel in the Input Box Assembly is connected for the proper voltage.

⚠ CAUTION

Failure to follow these instructions can cause immediate failure of components within the machine.

To reconnect the machine to a different voltage, change the position of the power straps (links) on the reconnect panel assembly. Follow The Input Supply Connection Diagram located on the inside of the access door.

1. For 208/230/460 VAC machines, see Figure A.3a.
2. For 460/575 VAC machines, see Figure A.3b.

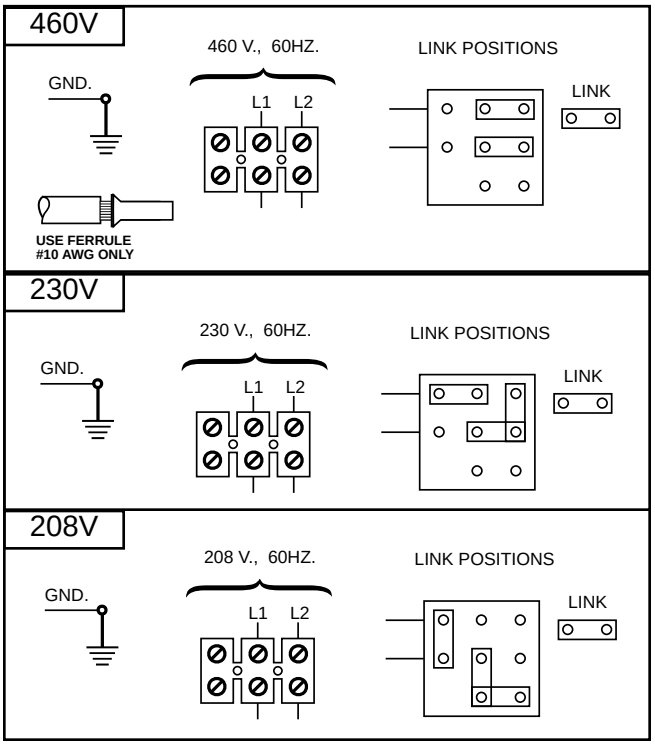


FIGURE A.3a-Voltage Link Positions for 208/230/460 VAC machines.

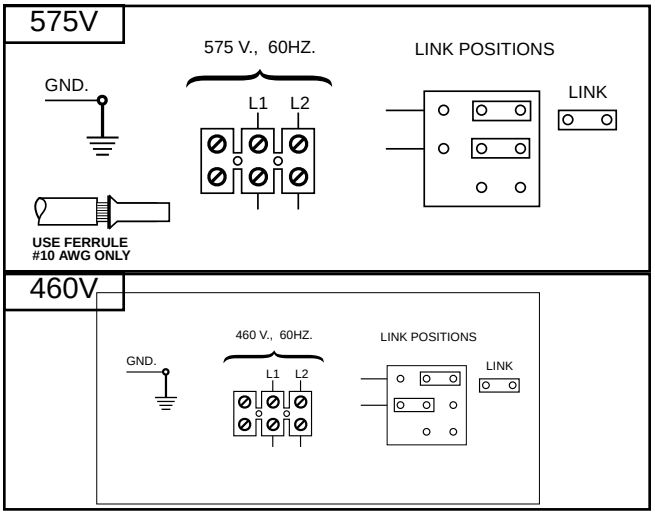


FIGURE A.3b - Voltage Link Positions for 460/575 VAC machines.

OUTPUT CONNECTIONS

⚠ WARNING

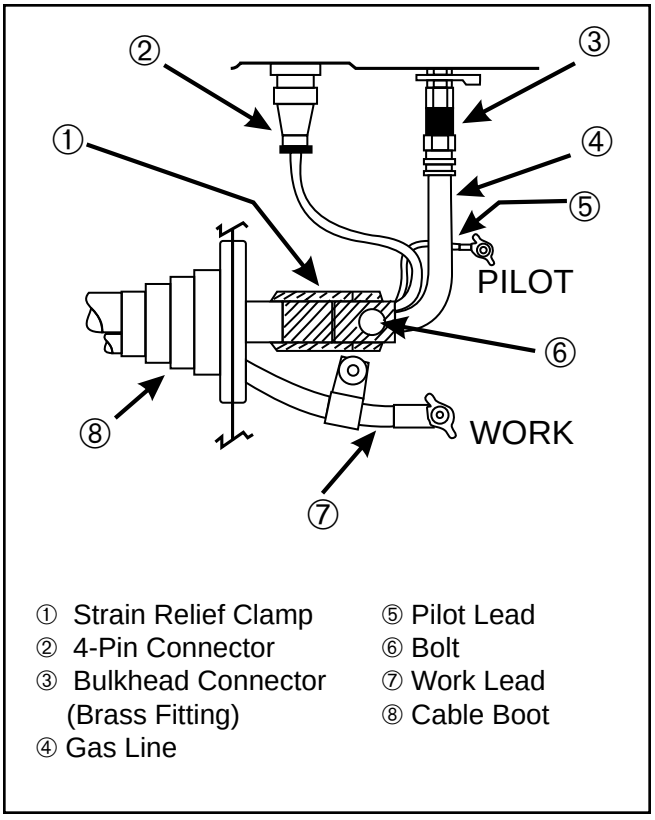
To avoid receiving a high frequency shock, keep the torch and cables in good condition.

The standard PRO-CUT 60 cutting torch comes with a 25 ft. (7.6m) cable. A cutting torch with a 50 ft. (15.2m) cable is available. The PRO-CUT 60 is shipped with the torch and work cables already connected. Should you have to connect the torch or work cables, use the following procedure:

See Figure A.4 for the location of torch and work connections.

Connect cutting torch to machine. See Figure A.4.

1. Turn OFF Power Line switch.
2. Disconnect input power to the machine.
3. Insert the torch cable into the machine through the cable boot (8).
   a. Insert enough torch cable to make all connections.
4. Turn and lock strain relief clamp (1) onto bolt to secure the gas line.
5. Connect the gas line fitting to the brass union and tighten with a wrench.
6. Connect to pilot lead (5) to terminal marked “PILOT”.
7. Connect work lead (7) to terminal marked “WORK”.
8. Connect 4-pin connector (2).



① Strain Relief Clamp
② 4-Pin Connector
③ Bulkhead Connector (Brass Fitting)
④ Gas Line
⑤ Pilot Lead
⑥ Bolt
⑦ Work Lead
⑧ Cable Boot

FIGURE A.4. -- Connect Torch Cable To Machine

Connect work clamp to work clamp cable, which extends from the front of the machine. See Figure A.5.

1. Insert the cable through the hole at the end of the work clamp handle.
2. Pull the work clamp cable through the hole until it reaches the nut and bolt assembly.
3. Tighten the nut and bolt.

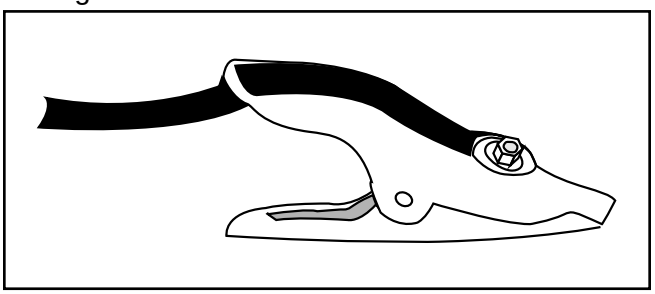


FIGURE A.5. -- Connect Work Clamp

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- OPERATION SECTION -

SAFETY PRECAUTIONS - Read and understand entire section before operating machine.

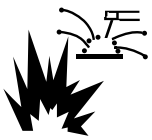
⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrode with skin or wet clothing.
- Insulate yourself from work and ground.
- Always wear dry insulating gloves.

FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.

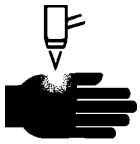


WELDING, CUTTING and GOUGING SPARKS can cause fire or explosion

- Keep flammable material away.
- Do not weld, cut or gouge on containers that have held combustibles.

ARC RAYS can burn.

- Wear eye, ear and body protection.



PLASMA ARC can injure

- Keep your body away from nozzle and plasma arc.
- Operate the pilot arc with caution. The pilot arc is capable of burning the operator, others or even piercing safety clothing.

Observe additional Safety Guidelines detailed in the beginning of this manual.

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GENERAL DESCRIPTION

The PRO-CUT 60 is a constant current, single range, continuous control plasma cutting system. The microprocessor-based PRO-CUT 60 is capable of cutting with compressed air or nitrogen gas. Nitrogen gas is used to cut aluminum or other non-ferrous metals. This sophisticated system has excellent starting characteristics, cutting visibility, and arc stability. The machine automatically performs fundamental troubleshooting when turned ON.

The PRO-CUT 60 is equipped with a patented plasma torch that has a safety mechanism that assures consumables are in place before cutting or gouging. This is extremely important due to the high voltages involved. Two standard torch cable lengths are available: a 25 ft. (7.6m) torch cable or a 50 ft. (15.2m) torch cable. The machine also comes with an air regulator, coarse air filter, pressure gage, and spare parts kit. The standard undercarriage is shipped assembled, except for the handle.

RECOMMENDED PROCESSES AND EQUIPMENT

The PRO-CUT 60 is capable of all cutting and gouging applications within its output capacity of 25 to 60 amps. These applications include thin gage sheet metal and expanded metal.

OPERATIONAL FEATURES AND CONTROLS

The PRO-CUT 60 comes with an ON/OFF POWER SWITCH, OUTPUT CURRENT CONTROL, and a RUN/PURGE SWITCH.

DESIGN FEATURES AND ADVANTAGES

The microprocessor controlled PRO-CUT 60 design makes plasma cutting and gouging tasks uncomplicated. This list of design features and advantages will help you understand the machine's total capabilities so that you can get maximum use of your machine.

- Single continuous output range of 25-60 amps.
- Microprocessor controlled overshooting limiting function increases consumable life.
- High intensity, high frequency starter.
- Unique microprocessor controlled starting sequence for consistent starting and torch protection.
- Solid state pilot duty cycle limiting.Protects components without fuses that would have to be replaced.
- Bright 2.5-second timed pilot arc.
- Purge/Run switch.
- Two independent mechanisms for sensing a shorted torch. Needed for safety and torch protection.
- Patented safety sensor monitors if torch parts are in place.
- Latching safety circuit mechanism requires that the operator reset the circuit.
- Exposed torch parts voltage monitoring with safety shutdown.
- Built-in undercarriage for portability.
- Built-in air controls, including air pressure regulator.
- Air line filtering.
- Preflow/Afterflow timing. Preflow stops if cutting or gouging resumes in previous afterflow.
- Easy to use torch trigger switch.
- Line voltage compensated.
- Thermostatically protected.
- Solid state overcurrent protection.

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- Works with pure nitrogen for cutting non-ferrous metal.
- Smart switching of pilot contactor so that it does not switch under load.
- Low fan noise at idle.
- Modular construction for easy servicing.

CUTTING AND GOUGING CAPABILITY

The PRO-CUT 60 is rated at 60 amps, 115 VAC, at 60% duty cycle on a 10 minute basis or 45 amps, 115VAC, at 100% duty cycle. If the duty cycle is exceeded, a thermal protector will shut off the output of the machine until it cools to the normal operating temperature.

LIMITATIONS

Do not exceed output current and duty cycle rating of machine. Do not use the PRO-CUT 60 for pipe thawing.

CONTROLS AND SETTINGS

All operator controls and adjustments are located on the Case Front Assembly of the PRO-CUT 60. See Figure B.1 for the location of each control.

1. SAFETY RESET BUTTON:The SAFETY RESET BUTTON is pressed to resume operation after the SAFETY LED glows and the operating problem is cleared.

2. PURGE/RUN SWITCH: This switch controls the air supply to the machine. In the PURGE position, air flows continuously through the torch to allow for the adjustment of air pressure. Note that the output is disabled in this mode. In the RUN position, air flows through the torch when the torch trigger is activated.

3. STATUS LED DISPLAY: The following machine conditions are displayed:

   MACHINE ON LED: The green POWER ON LED glows when the POWER LINE SWITCH is in the ON position and AC power is connected to the machine.

   OUTPUT ON LED: The OUTPUT ON LED glows when the pilot arc starts and remains glowing during cutting.

   AIR PRESSURE LED: The AIR PRESSURE LED glows whenever there is adequate air pressure (above 50 psi).

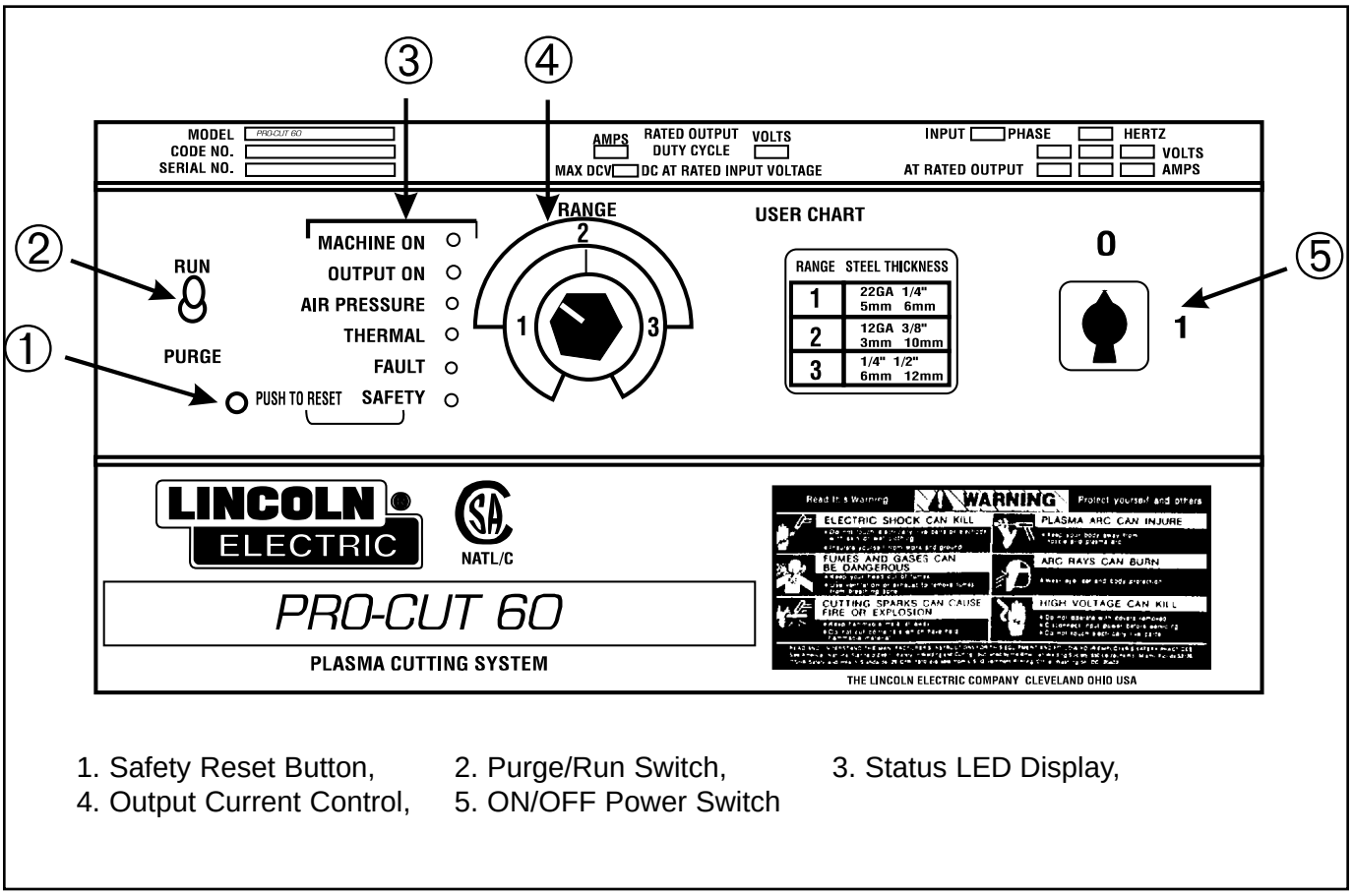
   THERMAL LED: The THERMAL LED glows when the machine overheats.

   FAULT LED (MALFUNCTION LED): The FAULT LED glows/blinks if a short circuit has occurred in the torch, in the machine, or when the air pressure is too low.

   SAFETY LED: The SAFETY LED glows when there is an operating problem with the machine, torch, or torch consumables.

4. OUTPUT CURRENT CONTROL: The OUTPUT CURRENT CONTROL adjusts the current flow for maximum cutting results. See User Chart Range guide on machine's nameplate for recommended range settings based on thickness of steel being cut.

5. ON/OFF POWER SWITCH: Turns the machine ON or OFF.



1. Safety Reset Button, 2. Purge/Run Switch, 3. Status LED Display,
4. Output Current Control, 5. ON/OFF Power Switch

FIGURE B.1 Control Panel Keys

OPERATING STEPS

When preparing to cut or gouge, position the machine as close to the work as possible. Make sure you have all materials needed to complete the job and have taken all safety precautions. It is important to follow these operating steps each time you use the machine.

1. Turn the machine's ON/OFF POWER SWITCH to OFF position.

2. Connect air supply to the machine.

3. Turn on main AC power supply to the machine.

4. Turn the machine's ON/OFF POWER SWITCH to ON.

   - The green POWER ON LED glows.
   - The fan starts.

   NOTE: If the SAFETY LED glows, press the SAFETY RESET button. If there is no problem, the SAFETY LED will go off. If the SAFETY LED remains on, turn the ON/OFF POWER SWITCH to OFF and refer to the TROUBLESHOOTING GUIDE in the TROUBLESHOOTING AND REPAIR SECTION of this manual for a recommended course of action.

5. Set the PURGE/RUN switch in the PURGE position.
   - The air flow starts.
   - The AIR PRESSURE LED glows.

6. Adjust air pressure to 60 psi with the air flowing.

7. Move the PURGE/RUN SWITCH to RUN.
   -Postflow air flows for 20 seconds.

   During this time, the pilot arc immediately starts when the torch trigger is pulled. After 20 seconds, air preflows for two seconds.

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8. Pull the torch trigger to cut.
   - OUTPUT ON LED glows.
   If postflow has not timed out, the pilot arc lights immediately.
   If postflow air has timed out (after 20 seconds), air preflows for two seconds before pilot arc lights.
   If the arc is not transferred by bringing plasma in contact with the work with in 2.5 seconds, the pilot arc shuts off.

9. Make a cut.

10. Stop cutting by releasing the torch trigger.
    - Arc stops.
    - Postflow air continues for 20 seconds.
    - To continue cutting, repeat Step 8.

11. Turn ON/ OFF POWER SWITCH to OFF when job is done.

If the SAFETY LED glows at any time during operation, check the following:

-Torch consumables are assembled properly. Machine will not start if they are not properly in place.

-Nozzle condition. The nozzle must be clean.

After the problem is corrected or no problem is found, press the SAFETY RESET button. If SAFETY LED goes out, machine is ready for use. If SAFETY LED continues to glow, refer to the TROUBLESHOOTING GUIDE in the TROUBLESHOOTING AND REPAIR SECTION of this manual for a recommended course of action.

CUTTING PROCEDURE RECOMMENDATIONS

For best results, use proper cutting or gouging procedures. Plasma arc cutting is a very economical process when used properly. Improper procedures or equipment use will result in poor quality work and high operating costs. The following procedures will help you get maximum performance from your PRO-CUT 60.

Use Pilot Arc Properly

The pilot arc transfers the arc to the work piece for cutting. Do not start the pilot arc repeatedly over short periods of time. This could reduce consumable life. Start the pilot arc and then make and finish the cut before releasing the trigger.

If the pilot arc sputters or does not start each time the torch trigger is pulled, check the consumable for wear or high air pressure. If either is found, take proper action.

Cutting and Gouging Recommendations

General

1. Make a continuous cut. Do not pause during cutting, gouging, or at the end of the work piece. Stopping and starting causes poor cuts and results in poor machine operation. In addition, it reduces consumable life.

2. Position the torch so that dross and hot air cannot be deflected into the torch.

3. Do not drag the nozzle when cutting above the mid-range setting. Above mid range, always hold the torch 1/8" away from the work piece.

4. Proper drag cup/shield cup use gives you maximum nozzle and consumable life.

   - When operating in the blue or red current ranges, use a drag cup when possible.

   - When operating in the yellow range, use a drag cup or a shield cup.

5. Use the proper machine setting for the work to be done. Adjusting the machine to maximum output does not produce the best cutting in most situations.

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6. Use nozzle with the largest orifice that gives the best cut for the work being done. This produces the best work results and consumable life. As the size of the nozzle orifice increases, its current capability increases. Therefore, the nozzle used for cutting or gouging work must be able to handle the current needed to give the best cutting results. A nozzle working beyond its current capability overheats causing poor performance. Never use the .035 inch (0.8mm) nozzle when the current output is above the yellow current range.

7. Use the S24114 Drag Cup when the output current is in the red range to protect the torch from dross and the effects of improper arcing conditions.

   NOTE: The S24114 Drag Cup should not be used at very low outputs.

8. Do not allow your body or the torch cable to touch hot surfaces.

9. Refer to the User Chart Range guide on the machine's nameplate for recommended output current ranges for the thickness of the metal being cut.

Cutting Thin Gauge Sheet Metal

1. Set the OUTPUT CURRENT CONTROL output at mid-range (Yellow range) or below.

2. Pierce a hole in the metal surface to start the cut. Then, lightly touching the nozzle to the metal surface, drag the torch along the cut line.

3. Use the .035" (0.8mm) nozzle for fine cuts. Larger nozzle sizes work better and provide longer life, but produce wider kerfs (cuts.)

4. Use a current level setting that is adequate to produce an acceptable cut at maximum travel speed. Operating at a current level that exceeds the requirements needed to cut the metal results in poor cutting quality and machine operation.

5. Cut thin gage sections of aluminum, copper, and other non-ferrous metals using a higher current range. If acceptable results are not obtained, use the procedures listed under Cutting Thick Sections of Metal.

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Cutting Expanded Metal

1. Cut expanded metal with OUTPUT CURRENT CONTROL set near the mid-range position using the same methods listed under Cutting Thin Gauge Metal. Keep the following points in mind:

   a. Place a thin piece of scrap metal over the area to be cut and then cut through both to make cutting easier.

   b. After 30 seconds of cutting expanded metal, the pilot arc changes from a bright continuous arc to an arc that rapidly goes on and off. This produces a slight spatter. You can still cut metal when this condition occurs as long as metal has been cut in the last five seconds. If metal is not cut in this condition for more than five seconds, the arc shuts off and the machine goes into postflow.

   c. The pilot arc duty cycle is 20 seconds out 80 seconds. If the torch trigger is continuously pulled and released to obtain a bright, continuous arc, the duty cycle limit will be reached and the arc will be turned off for the duty cycle limit. When the arc is turned off, the OUTPUT ON and FAULT LEDs flash alternately.

Cutting Thick Sections of Metal

1. Set the OUTPUT CURRENT CONTROL above the mid-range (Red) position.

   a. Use the minimum current needed to make a satisfactory cut.

2. Hold the torch nozzle about 1/8" (3.2mm) from the cutting surface. Do not let the torch nozzle touch the work or carry a long arc.

   a. Use the S24114 Drag Cup to protect the torch.

   b. Use only the .052" (1.3mm) or the .042" (1.0mm) nozzles. Do not use the .035" (0.8mm) nozzle for cutting thick sections of metal.

3. Start the cut from the edge of the work piece when possible. Pierce the work piece by slowly lowering the torch onto the metal at a 30^0 angle. This will blow the dross away from the torch tip. Slowly rotate the torch to vertical position as the arc becomes deeper. See Figure B. 2.

4. Keep moving while cutting. Cut at a steady speed without pausing.

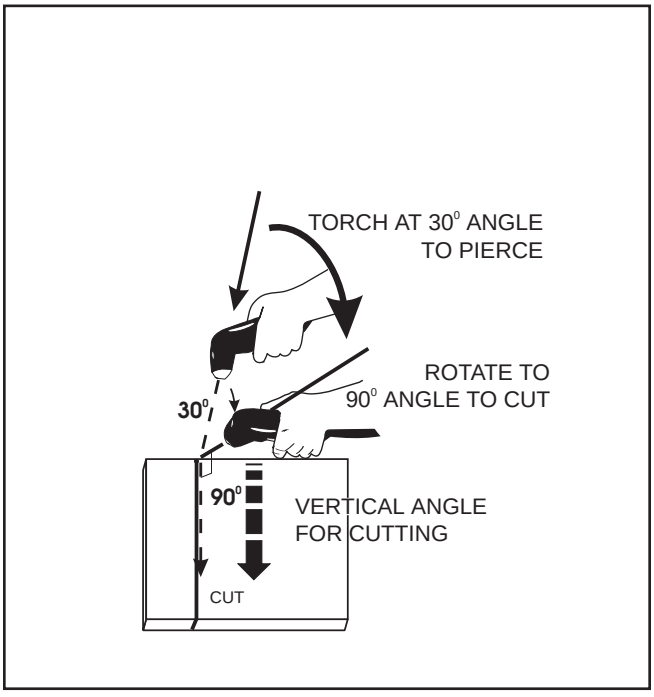

FIGURE B.2 -- Cutting Thick Piece of Metal.

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Gouging Metal

1. Set the OUTPUT CURRENT CONTROL to maximum.

2. Use the plasma torch with a S24114 Drag Cup assembly or a S24162 shield cup.

3. Bring the torch slowly towards the work piece at a 30° angle, but do not pierce the work piece. Do not touch the nozzle to the work piece. See Figure B.3.

   a. Blow molten metal away from the torch.

   b. If needed, raise the air pressure to approximately 75 psi to help blow away molten metal.

   c. This process will blow a lot of molten metal and dross. BE CAREFUL! Blow the dross away from the torch, away from the operator and away from flammable objects.

   d. Do not allow the torch cable or body to contact hot surfaces.

   e. Performance is similar to air carbon arc gouging with a 1/8" (3.2mm) carbon electrode.

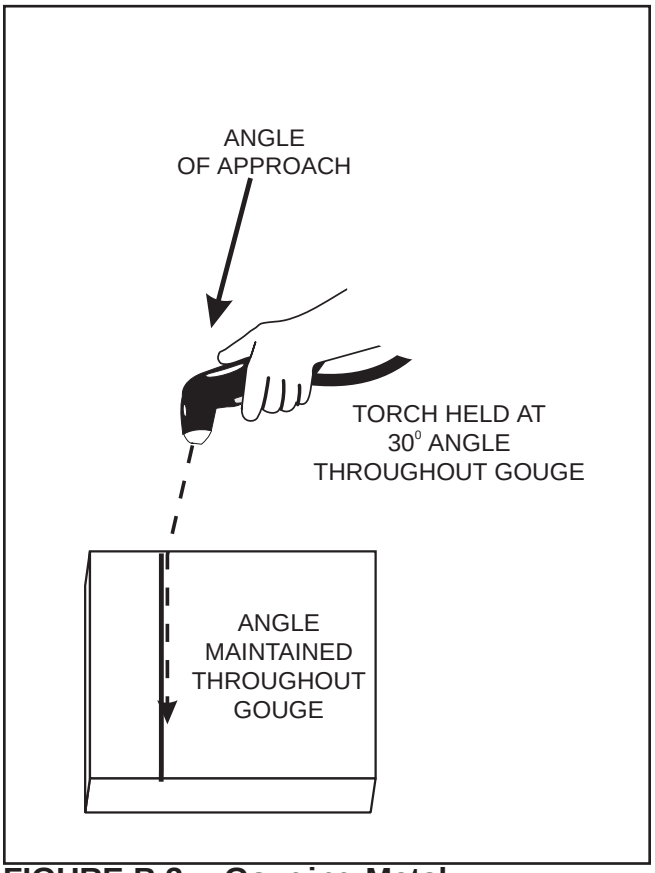

FIGURE B.3 -- Gouging Metal.

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OPTIONS/ACCESSORIES

DRAG CUP ASSEMBLY (S24114)

The drag cup protects the torch by preventing the torch from touching the workpiece.

SHIELD CUP ASSEMBLY (S24162)

This shields the torch tip and provides more visibility to the workpiece than the drag cup. Note the shield cup does not prevent the torch tip from touching the workpiece.

TORCH SPARE PARTS KIT (K872)

(Included with each machine)

Includes:

Shield Cup Asmbly	S24162
Nozzles:	
.035 (0.9mm) Orifice	S18497-1D[1]
.042 (1.1mm) Orifice	S18497-2D[1]
.052 (1.3mm) Orifice	S18497-3D[1]
.078 (Gouging) (2.0mm)Orifice	S18497-4D[1]
Electrode	S18752D[1]
Drag Cup Asmbly	S24114
Wrench	S18808
Tool Box	S19576-1

[1] These parts come in a 5-pack.

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SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this maintenance.
- Turn the input power OFF at the disconnect switch or fuse box before working on this equipment.
- Failure to follow this capacitor discharge procedure can result in electric shock.
- Do not touch electrically hot parts.

CAPACITOR DISCHARGE PROCEDURE

PROCEDURE DESCRIPTION

This procedure must be performed before performing any maintenance inside the machine.

MATERIALS NEEDED

High resistance, high wattage resistor
(25-1000 ohms, 25 watts minimum).
Insulated pliers
Insulated gloves
DC Volt/Ohm meter (Multimeter)

CAPACITOR DISCHARGE PROCEDURE

PROCEDURE

NOTE: See Figure D.1.

1. Disconnect input power to the machine.
2. Remove the Left Case Side Assembly.
3. Locate the two capacitors shown Figure D.1 and D.2.
4. Put on the insulated gloves.
5. Grip the middle of the resistor with the insulated pliers.
6. Touch the resistor leads across the two capacitor straps as shown for 10 seconds.
   a. DO NOT TOUCH THE CAPACITOR STRAPS WITH YOUR HANDS OR ANY OTHER PART OF YOUR BODY.
7. Test for zero volts across the capacitor terminals with a DC voltmeter.
   a. Capacitor terminal polarity is marked on the capacitor straps.
   b. If any voltage is measured, REPEAT PROCEDURE.

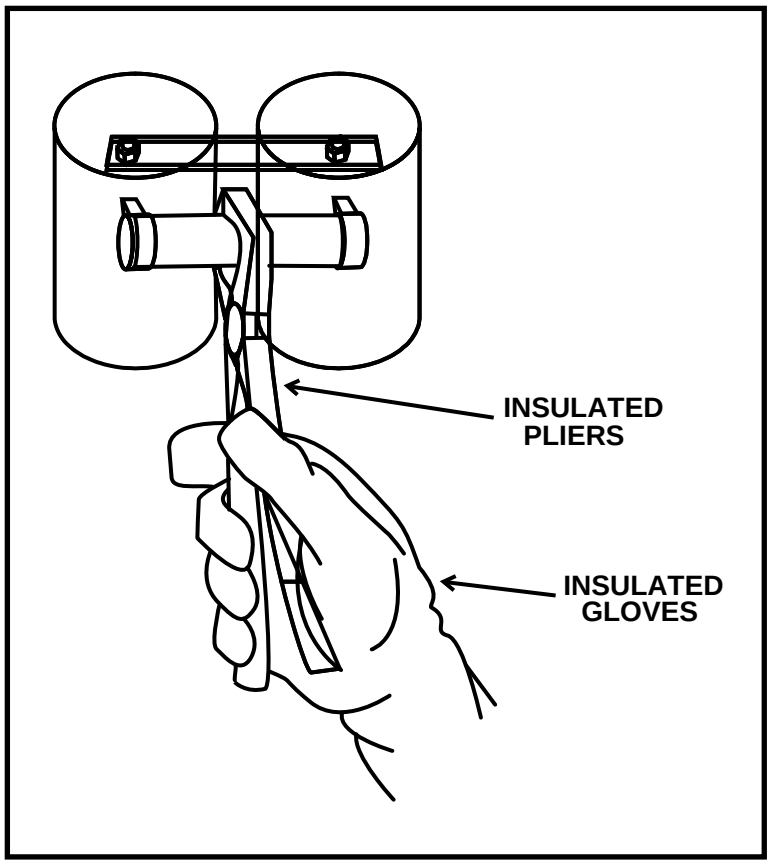

FIGURE D.1 - Capacitor Discharge Procedure

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ROUTINE AND PERIODIC MAINTENANCE

1. Disconnect input power supply lines to the machine before performing periodic maintenance, tightening, cleaning, or replacing parts. See Figure D.2.

2. Perform Capacitor Discharge Procedure

Perform the following daily:

1. Check that no combustible materials are in the cutting or gouging area or around the machine.

2. Remove any debris or materials that could block the air flow to the machine for cooling.

3. Inspect the torch cable for any slits, puncture marks in the cable jacket, kinks, or any condition that could restrict air flow to the torch. Repair or replace when needed.

⚠ WARNING

To avoid receiving a high frequency shock, keep the torch and torch cables in good condition.

Perform the following every three months or sooner:

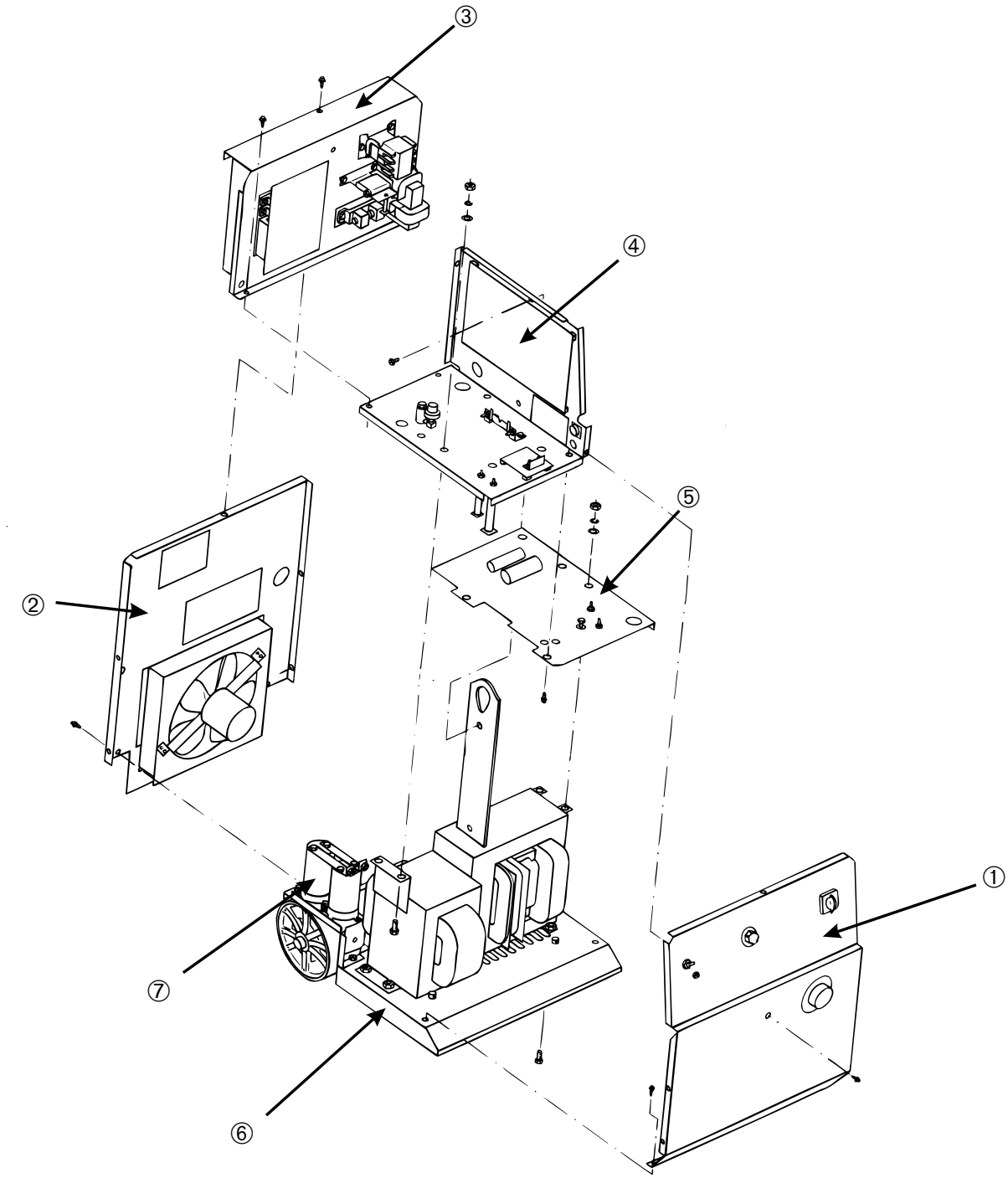
1. Check air regulator filters (weekly in dirty environments).

   a. If clogged or dirty, replace them.

Perform Periodically:

Clean inside the machine with a low pressure air stream. Clean the following components. Refer to figure D.2.

- Main transformer
- Torch, pilot and work connections
- Spark gap (Inspect for .060 spacing)
- Control board
- Power board
- Heat sink fins
- Fan motor and blade



① CASE FRONT ASSEMBLY
② CASE BACK ASSEMBLY
③ INPUT BOX ASSEMBLY
④ CONTROL PANEL ASSEMBLY
⑤ HIGH FREQUENCY BOARD ASSEMBLY
⑥ BASE ASSEMBLY
⑦ CAPACITOR BANK

FIGURE D.2 - General Assembly Exploded View

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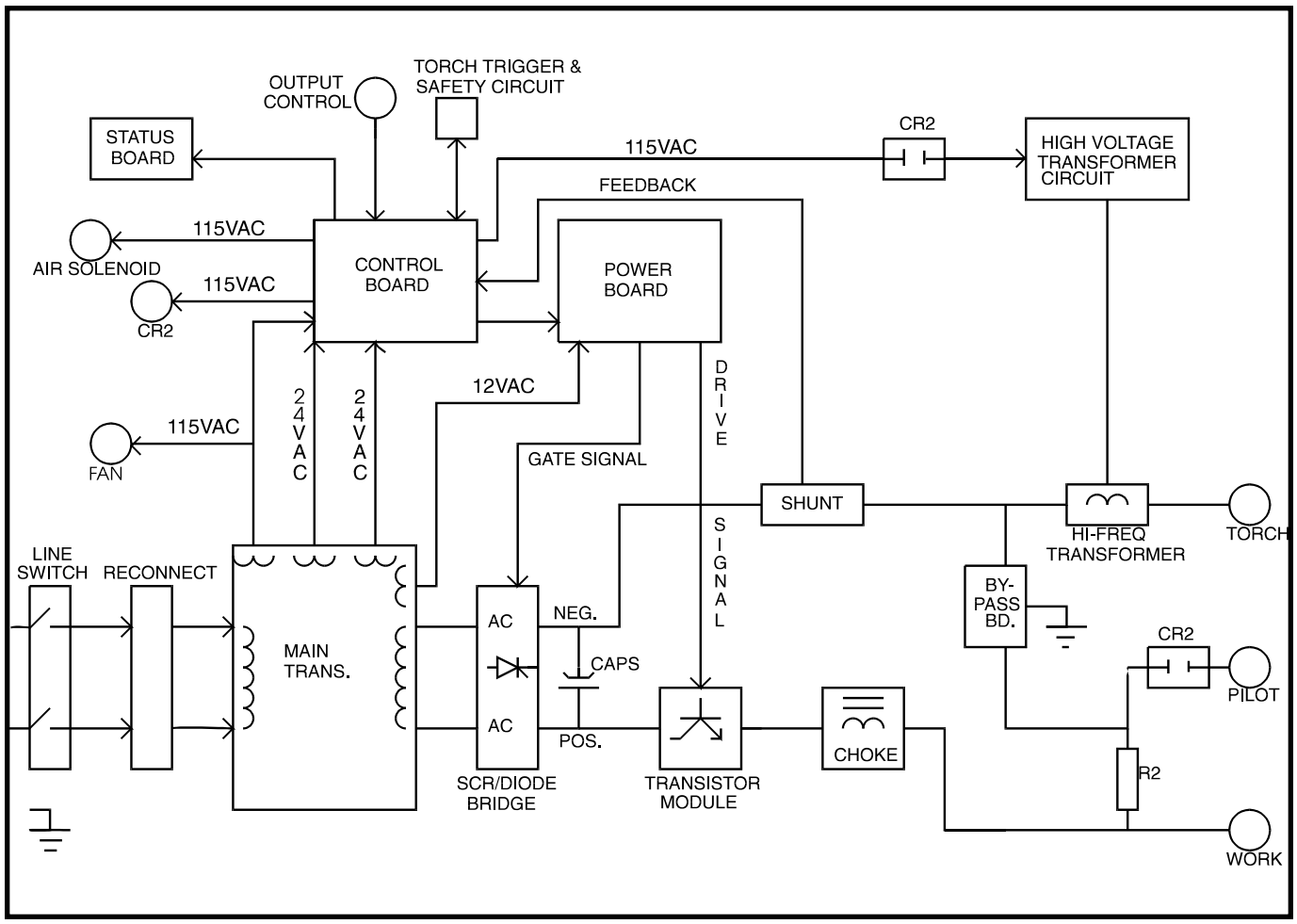
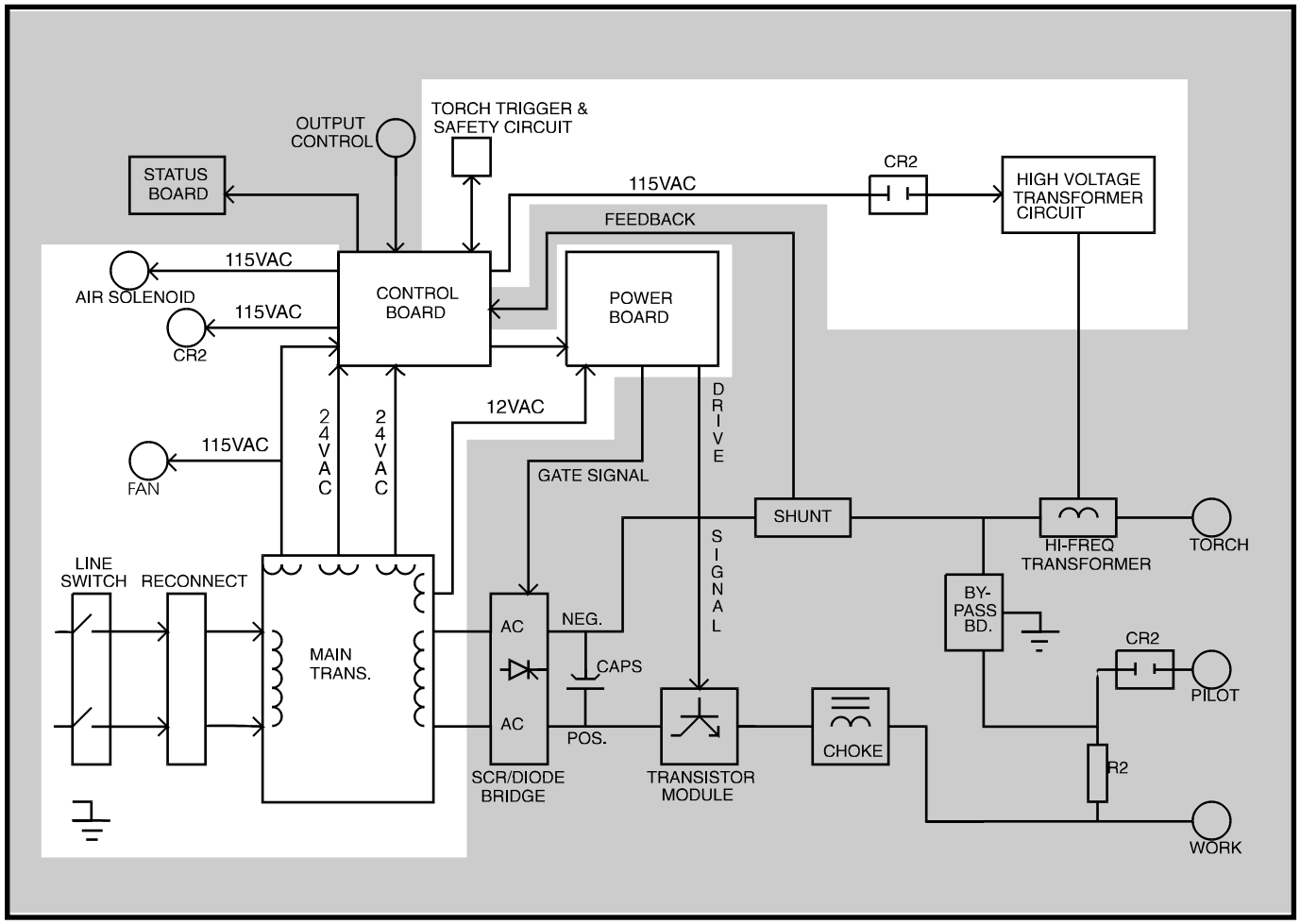


FIGURE E.1 Block Logic Diagram

FIGURE E.2. - Input Line Voltage and Main Transformer



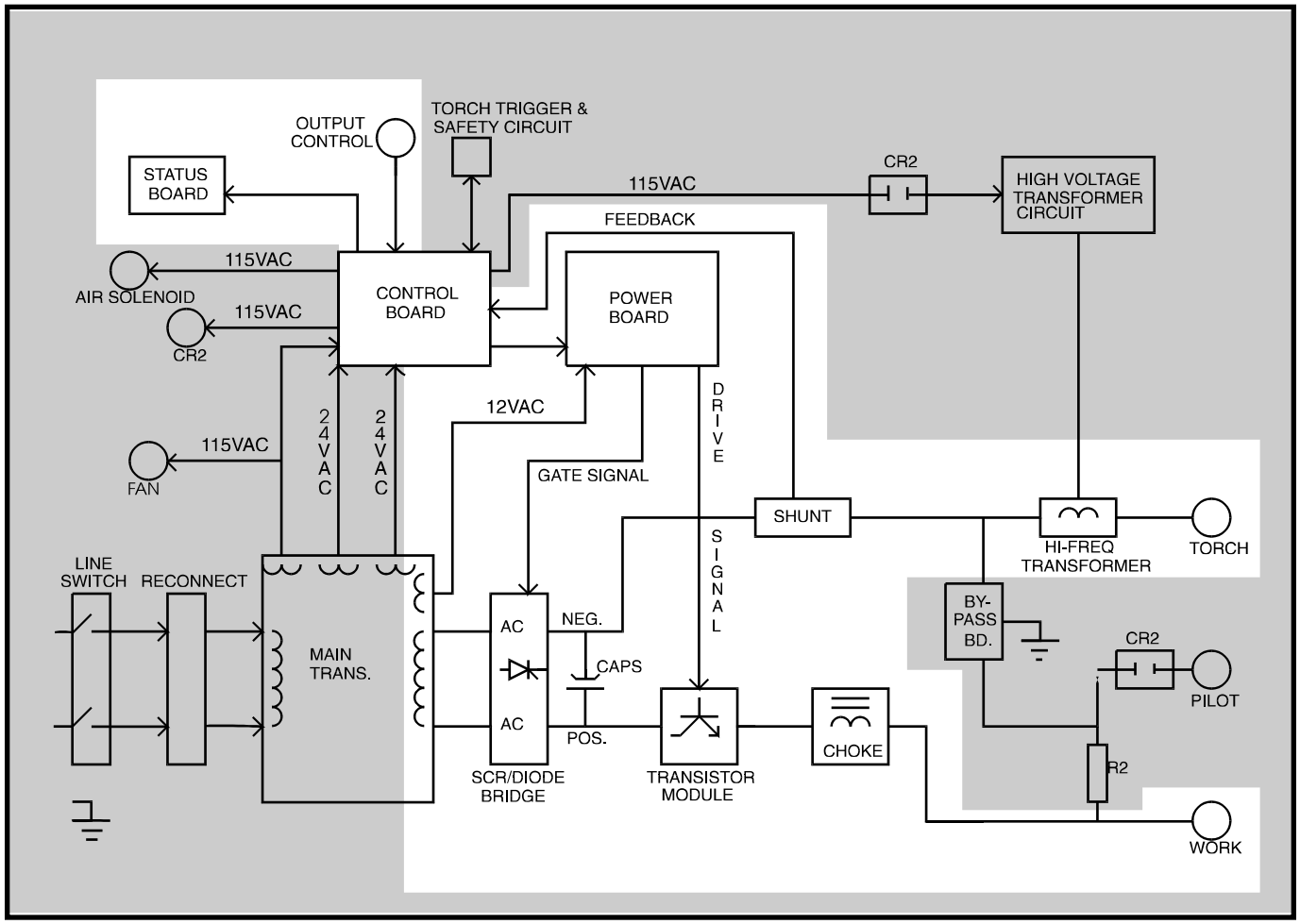
INPUT LINE VOLTAGE AND MAIN TRANSFORMER

The desired single-phase input power is connected to the Pro-Cut 60 through a line switch located on the front panel of the machine.

A reconnect panel allows the user to configure the machine for the desired input voltage. This AC input voltage is applied to the primary of the main transformer. This main transformer changes the input voltage and current to the voltage and current levels necessary for plasma cutting. In addition, the main transformer also has several isolated auxiliary windings (115vac, 24vac and 12vac). The 115vac winding supplies power for the cooling fan and powers the air solenoid , the CR2 relay and the high voltage transformer via the control board. One 24vac winding produces supply power for the control board. The other 24vac winding is applied to the control board and is used in the Pro-Cut 60 torch safety and trigger network. The 12vac winding is required to operate the power board.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

FIGURE E.3 - Output Rectification, Control and Feedback



OUTPUT RECTIFICATION, CONTROL AND FEEDBACK

The AC output from the main transformer secondary is rectified through the SCR/ DIODE bridge. The machine output is controlled through the transistor module. The output current is sensed at the shunt, as a low voltage signal, and fed back to the control board. The control board compares the commands of the output control potentiometer with the shunt feedback signal and the appropriate pulse width modulated (PWM) control signal is sent to the power board. The power board converts the PWM control signal into an isolated drive signal. This isolated signal drives the transistor module to the optimum level to obtain the desired machine output current. The control and power board also generate the gate firing pulses for the SCR/DIODE bridge. The rectified and controlled DC voltage is filtered by the output capacitors and choke and is applied to the machine's torch and work terminals. The control board also operates the status board and commands the pilot arc circuitry.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

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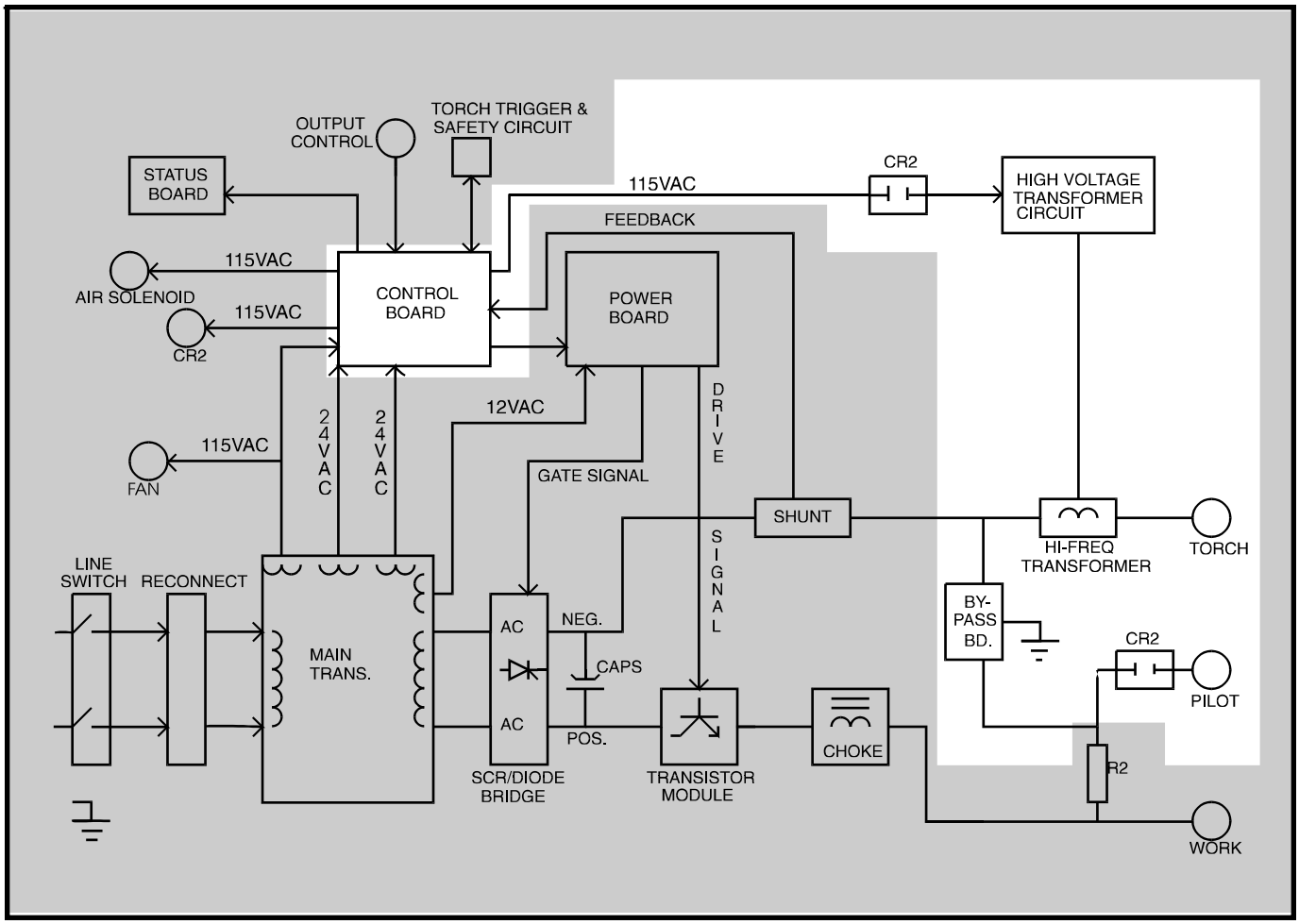
FIGURE E.4 - High Voltage/High Frequency and By-Pass Circuit



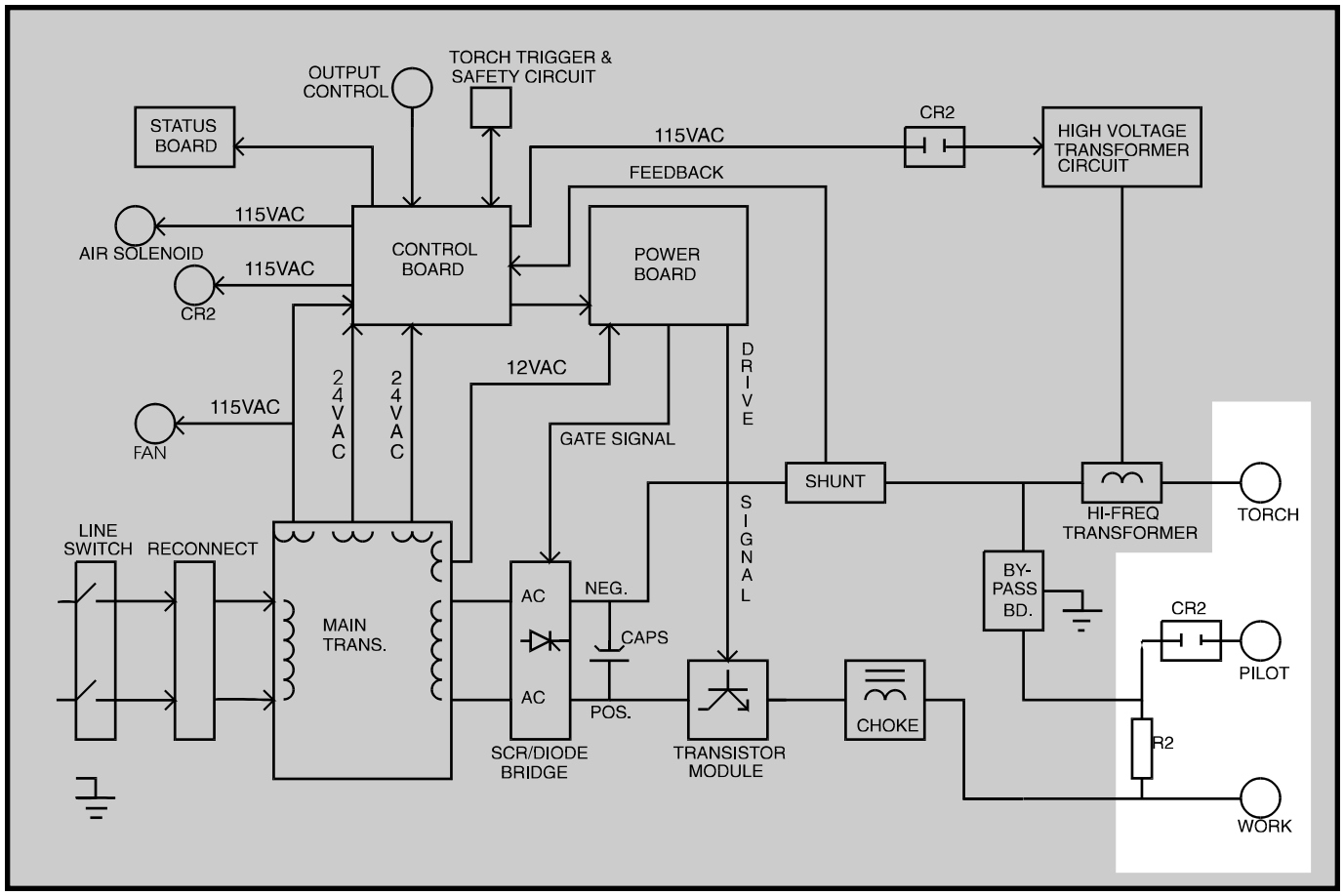
HIGH VOLTAGE / HIGH FREQUENCY AND BY-PASS CIRCUIT

The control board passes the 115vac through the CR2 relay contacts to the primary of the high voltage transformer. The secondary of the high voltage transformer delivers a high voltage to the spark gap generator and also to the high frequency transformer. The high frequency transformer transfers the high frequency "spark" to the torch terminal. This momentary burst of high frequency is used to ignite the pilot arc.

The by-pass board is necessary to prevent any unwanted signals from interfering with the Pro-Cut 60 circuitry.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

FIGURE E.5 - Pilot Arc



PILOT ARC

The Pro-Cut 60 has a smooth, continuous pilot arc. The pilot arc is a means of establishing and transferring the arc to the work piece for cutting. The pilot arc current flow is from the positive potential work terminal through the R2 resistor and CR2 contacts to the pilot lead circuit in the torch cable. The pilot current transfers from the nozzle to the electrode in the torch head and then on to the torch bulkhead connector, which is connected to the negative potential within the machine. When the torch head is brought close to the work piece the pilot arc transfers to the work surface and the cutting arc is established. This transition takes place because of the low resistance between the torch electrode and the work piece.

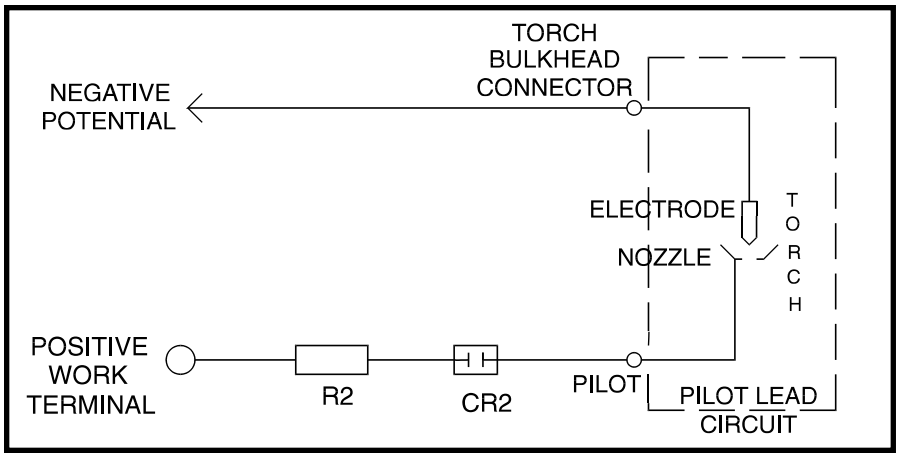
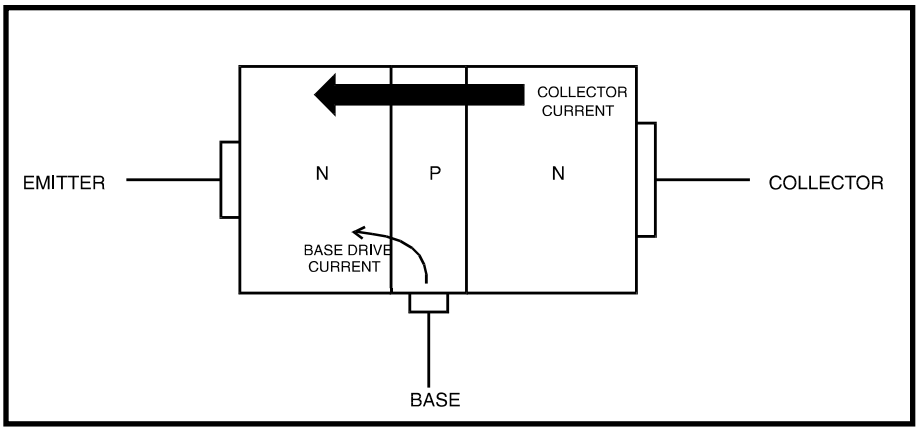


FIGURE E.6 - Pilot Lead Circuit

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

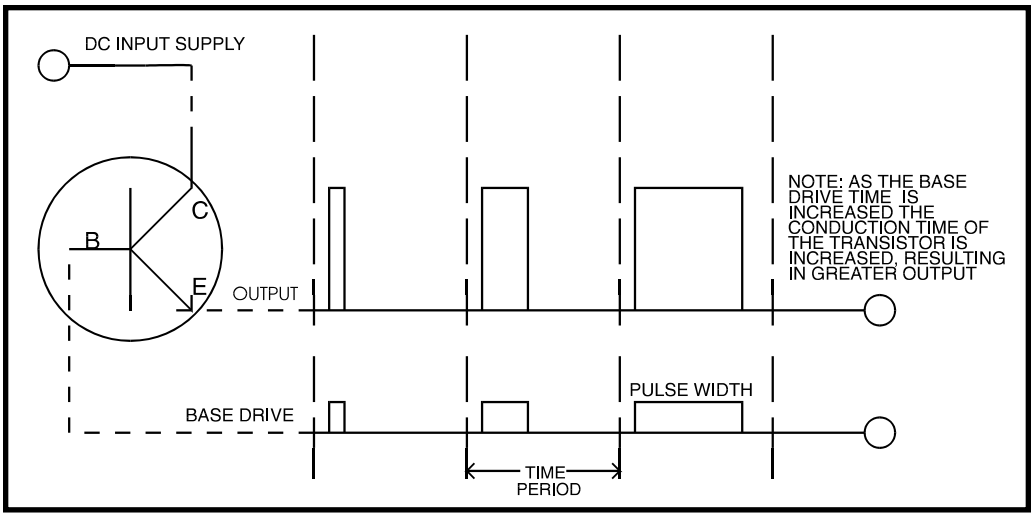
FIGURE E.7 - Transistor Switching Operation



TRANSISTOR SWITCHING OPERATION

A transistor is a solid state device consisting of three layers of silicon crystal. These three layers form the emitter, collector and base regions of a transistor. They are used at high frequencies in high power applications and switching circuits. When used as a switch the transistor will be "turned on" (collector current flow) when there is adequate base drive current. Likewise the device will be "turned off" (no collector current) when there is insufficient base drive current. The transistor allows the control of a large amount of current flow through the collector and emitter with a much smaller current in the base circuit. See Figure E.7.

FIGURE E.8 - Pulse Width Modulation



PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION is used to describe how much of a given time period is devoted to conduction(collector current flow). Changing the pulse width, within a given time period, is known as MODULATION. A PWM control signal is applied to the base of the transistor module to "turn on" the device. Varying of this pulse width controls the output current of the machine. See Figure E.8.

THERMAL PROTECTION

THERMOSTAT

A thermostat protects the machine from excessive operation temperatures. Excessive operating 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 thermostat will disable the machine output and the yellow thermal indicator light will glow. The fan should remain on during this period. Once the machine cools sufficiently the thermostat will reset. If the thermostat shutdown is 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 are obstructed, then the input power must be removed and the fan problem or air obstruction be corrected.

THERMAL SENSOR

There is a thermal sensor in the torch head to protect it from abusive use. If the thermal sensor is tripped the "SAFETY" LED will light and the machine will not function. This thermal sensor interrupts the safety circuit which prompts the control board to prevent output from the machine and signal the status board to light the "SAFETY" LED. Wait for the torch to cool and reset the safety circuit.

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NOTES

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HOW TO USE TROUBLESHOOTING GUIDE

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into several main categories: output problems, function problems, airflow problems, and cutting problems.

Step 2. PERFORM EXTERNAL TESTS.
The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. PERFORM COMPONENT TESTS.
The last column labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the specified test points, components, terminal strips, etc. can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

⚠ CAUTION

HIGH VOLTAGE / HIGH FREQUENCY can damage test equipment.

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

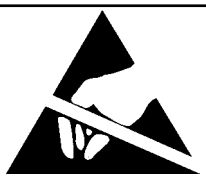
ELECTRIC SHOCK can kill.
Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.

CAUTION: Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.

2. Check for loose connections at the PC board to assure that the PC board is properly connected.

3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:



ATTENTION
Static-Sensitive Devices
Handle only at Static-Safe Workstations

Reusable Container
Do Not Destroy

P.C. Board can be damaged by static electricity.

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.

- If you don't have a wrist strap, touch an unpainted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

- Tools which come in contact with the P.C. Board must be either conductive, anti-static or static-dissipative.

- Remove the P.C. Board from the static-shielding bag and place it directly into the equipment. Don't set the P.C. Board on or near paper, plastic or cloth which could have a static charge. If the P.C. Board can't be installed immediately, put it back in the static-shielding bag.

- If the P.C. Board uses protective shorting jumpers, don't remove them until installation is complete.

- If you return a P.C. Board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: It is desirable to have a spare (known good) PC board available for PC board troubleshooting.

NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.

   a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.

   b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.

6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major Physical or Electrical Damage is Evident	1. Contact The Lincoln Electric Service Dept. (216)383-2531 or 1-800-833-9353 (WELD)	
No LEDs light when the ON/OFF Power Switch is turned "ON". Machine is dead. Fan is not running.	1. Make sure input voltage corresponds to machine nameplate voltage. 2. Make sure the reconnect panel is configured properly for the input voltage being applied to the PRO-CUT 60 (Single Phase). 3. Check the input line fuses. Replace if blown.	1. Make sure ON/OFF Power Switch (S1) is operating properly. 2. Check the main transformer primary leads to the re-connect panel for loose or faulty connections. 3. Check the leads from the ON/OFF Power Switch (S1) to the reconnect panel (T1 and T2) for loose or faulty connections. 4. Perform Main Transformer Test. The main transformer could be faulty. Check for an open or grounded primary winding.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No LEDs light when the ON/OFF Power Switch is turned "ON". Machine is dead. Fan runs normally.	1. Make sure input voltage corresponds to machine nameplate voltage. 2. Make certain the reconnect panel is configured properly for input voltage being applied to PRO-CUT 60	1. Check plug J7 (located on the Control Board) and associated wires for loose or faulty connections. 2. Check Plug J9 on Status Board and J8 on Control Board for loose or faulty connections 3. Test for 24 VAC between leads C2 and H6 (plug J7) on Control Board. Refer to wiring diagram. a. If the 24 VAC IS NOT present or voltage is very low, the main transformer could be faulty. Perform Main Transformer Test. b. If the 24 VAC is present at leads C2 to H6, the Control Board could be faulty. Replace.
The "MACHINE ON" LED is lit and the "SAFETY" LED is lit.	1. Push the "SAFETY RESET" button, the LED should go out. This circuit sometimes trips on power up or because of "noise". If the circuit can be reset, it is OK to continue. 2. Maintain proper stand-off while cutting (.10” to .15”). Too long a stand-off may cause nuisance safety trips. 3. Check torch consumables. Replace if needed. 4. Replace the torch and cable assembly.	1. The torch and cable assembly may be faulty. Perform Torch, Torch Cable Assembly, and Internal Trigger and Safety Circuit Tests. 2. Check for continuity (zero ohms) between leads #336 and #337 from the torch 4-pin connector on the machine to plug J5 on the Control Board. Refer to wiring diagram. 3. Check Pilot bleed resistor R3. Normal is 40 ohms. See wiring diagram. 4. The control board could be faulty. Replace. 5. Perform Main Transformer Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

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TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The air begins to flow, the "OUTPUT ON" LED lights for a short time, but no pilot arc is established. The high frequency arc does NOT appear across the torch tip.	1. Check the torch consumables to be sure they are installed securely. Make sure they are not dirty or greasy and are in good condition. Replace the consumables if necessary. 2. Check for the presence of high frequency at the spark gap, located inside the Right Case Side Assembly panel of the machine. The “spark” normally will be present for a second or two when the torch trigger is pulled. 3. Check the high frequency spark gap setting. It should be at .060” (1.5mm). DISCONNECT ALL INPUT POWER BEFORE ADJUSTING THE HIGH FREQUENCY CIRCUIT. 4. If the high frequency “spark” is present at the spark gap located inside the panel, the torch and cable assembly may be faulty.	1. If the high frequency "spark" is present at the spark gap located inside the panel, the torch and cable assembly may be faulty. Perform the Torch, Torch Cable Assembly, and Internal Trigger and Safety Circuit Tests. 2. If the high frequency "spark" is not present at the spark gap, check that pilot control relay (CR2) contacts close when the torch trigger is pulled. a. If pilot control relay (CR2) contacts close when torch trigger is pulled, perform High Voltage Transformer Test. b. If pilot control relay (CR2) contacts DO NOT close, test for 115 VAC between leads #36 and #31 on pilot control relay (CR2) when the torch trigger is pulled. If 115 VAC IS present, pilot control relay (CR2) could be faulty. Replace. If 115 VAC IS NOT present, check plug J10 on Control Board and associated wires for loose or faulty connections. If none are found, Control Board could be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The air begins to flow, the "OUTPUT ON" LED lights for a short time, but no pilot arc is established.	1. The pilot arc will shut off after 2.5 seconds unless it is brought in contact with the work and the cutting arc is established. This is a normal condition. 2. Check the torch consumables to be sure they are installed properly. Make sure they are not dirty or greasy and are in good con dition. Replace the consumables if necessary. 3. Check for the presence of high frequency "spark" at the spark gap, located inside the right panel of the machine. The "spark" will normally be present for a second or two when the torch trigger is pulled. 4. Check the high frequency spark gap setting. It should be set at .060"(1.5mm). DISCONNECT ALL INPUT POWER BEFORE ADJUSTING THE HIGH FREQUENCY CIRCUIT. 5. The machine's upper compartment could be dirty, blow out the upper compartment with compressed air.	1. The torch and cable assembly may be faulty. Perform Torch, Torch Cable Assembly, and Internal Trigger and Safety Circuit Tests. If the high frequency "spark" is present at the spark gap (for 1 second) go to step #3. 2. If the high frequency "spark" is not present at the spark gap, check that the pilot control relay (CR2) contacts close when the torch trigger is pulled. a. If pilot control relay (CR2) contacts close when torch trigger is pulled, perform High Voltage Transformer Test. b. If pilot control relay (CR2) contacts DO NOT close, test for 115 VAC between leads #36 and #31 on pilot control relay (CR2) when the torch trigger is pulled. Refer to wiring diagram. If 115 VAC is present, pilot control relay (CR2) could be faulty.Replace. c. If 115 VAC IS NOT present, check plug J10 on Control Board and associated wires for loose or faulty connections. Refer to wiring diagram. If none are found, Control Board could be faulty. Replace. 3. Check resistor R2. Normal resistance is 2 ohms. Refer to wiring diagram. 4. Check resistor R7. Normal resistance is 5 ohms. Refer to wiring diagram. 5. Check the two "jump-start" diodes mounted on a plastic board just in front of the shunt. Refer to wiring diagram. 6. If check 3, 4, and 5 are OK, the Control Board could be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The "THERMAL" LED is lit. The "MALFUNCTION" or "FAULT" LED is blinking. The machine has no output.	1. The machine may be overheated. This condition may be due to not enough ventilation. Make certain that the machine's air intakes and exhaust louvers are not blocked or restricted. Allow machine to cool. 2. The machine's duty cycle may have been exceeded. Allow machine to cool and modify cutting process.	1. The normally closed primary thermostat could be faulty. Replace. See wiring diagram. 2. Check leads #321 and #322 for loose or faulty connections at plug J8 on the Control Board. 3. If no loose or faulty wiring is found, the Control Board could be faulty. Replace.
The "MALFUNCTION" or "FAULT" LED is lit. The machine has no output.	1. Check the torch consumables to see if they are melted together or are touching each other. Clean or replace. 2. Turn the machine off and on again. If the "FAULT" LED will not stay off when you try to cut there is a failure within the machine. THE MACHINE SHOULD NOT BE LEFT ON. 3. Replace the torch and cable assembly.	1. The torch and cable assembly could be faulty. Perform the Torch, Torch Cable Assembly, and Internal Trigger and Safety Circuit Tests. 2. The Power Board could be faulty. Perform Power Board Test. 3. Perform Transistor Module Test. 4. The Control Board could be faulty. Replace. 5. Perform Main Transformer Test.
When the torch trigger is pulled the "OUTPUT ON" LED lights for a very short period of time. The pilot arc is unusually bright but the cutting arc does not transfer to the work.	1. Check Torch Consumables. 2. Check for proper Air Pressure. 3. Check work cables and connections. 4. Clean any painted or heavily corroded work surfaces. 5. If no malfunction or fault indicators are lit, then contact your local Lincoln Authorized Field Service Facility.	1. The Transistor Module could be faulty. Perform the Transistor Module Test. 2. If the transistor module is faulty, replace the Power Board also.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

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TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The "OUTPUT ON" and "MALFUNCTION" or "FAULT" LED's blink in alternating order. No pilot arc.	1. The pilot arc duty cycle has been exceeded. The machine should cool down and the lights quit blinking in 20 seconds. The pilot arc duty cycle is limited to 20 out of 80 seconds except in special circumstances such as cutting expanded metal.	Make sure operator is not exceeding pilot arc duty cycle.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
Airflow does not shut off.	1. Remove input power to the PRO-CUT 60. If the air continues to flow the air solenoid (SV1) could be jammed or stuck open. 2. If air pressure is above 125 PSI solenoid may be damaged. Set for 60-65 PSI.	1. Remove leads #38 and #31 (plug J12) from air solenoid (SV1). Refer to wiring diagram. a. If air continues to flow the solenoid is faulty. Replace. b. If the airflow stops when the solenoid (SV1) leads are removed then the Control Board could be faulty.
The "OUTPUT ON" and "AIR PRESSURE" LED's blink in alternating order.	Turn power off - then restart machine	1. The Control Board could be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

Observe Safety Guidelines
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TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
AIR FLOW PROBLEMS		
The "MACHINE ON" LED is lit but there is no response when the torch trigger is pulled. The "AIR PRESSURE" LED does not turn on. The fan runs normally. The “FAULT” LED blinks.	1. Check the air supply to the machine. Make sure sufficient air pressure is supplied to the PRO-CUT 60. If the air does not flow, the machine will not operate. 2. Low air pressure will also result in a "no start" condition. With the machine in "PURGE" adjust the air regulator to 60 psi (413kPa) minimum while air is flowing. "AIR PRESSURE" LED must be lit when the air is flowing. 3. Check the operation of the air solenoid by switching the machine to "PURGE". If the air pressure is sufficient the air should begin to flow and "AIR PRESSURE" LED should turn on. Return to the "RUN" mode. If air does not flow when the torch trigger pulled, consult your local Lincoln Authorized Field Service Facility. 4. Check torch consumables - replace if necessary.	1. With 60 PSI applied to the machine the air pressure switch should be “closed.” Check for continuity (less than 1 ohm) between leads #319 to #323. See wiring diagram. 2. Check the air solenoid (SV1) operation by applying 115 VAC to the solenoid leads. a. If the solenoid activates and air flows, the solenoid is good. b. If the solenoid does not activate, replace the solenoid. 3. Check plug J10 on the Control Board for loose or faulty connections. 4. The Control Board could be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

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TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
CUTTING PROBLEMS		
The arc starts but sputters badly. (If cutting expanded metal, condition may be normal, see operation section.)	1. Make sure the torch consumables are tight and are in good condition. Replace if necessary. 2. Check the air supply for oil or water contamination. If there is oil or water present the air supply must be filtered or the machine switched to nitrogen or bottled air. 3. Make sure air pressure is 60 to 65 PSI. 4. Check spark gap setting - .060" - clean if necessary.	1. The torch and cable assembly could be faulty. Perform the Torch, Torch Cable Assembly, and Internal Trigger and Safety Circuit Tests. 2. Check Pilot Resistor R2. See Wiring Diagram 3. The Control Board could be faulty. Replace. 4. Check "Jump Start Diode" - see wiring diagram.
The "MALFUNCTION" or "FAULT" LED starts blinking during cutting or gouging.	1. This is an overcurrent condition caused by a surge of current the machine is not designed to handle. Release the torch trigger and resume cutting or gouging. 2. Check torch consumables for wear - replace if necessary.	1. Perform the Torch, Torch Cable Assembly, and Internal Trigger and Safety Circuit Tests. 2. Perform the Transistor Module Test. 3. Perform the Main Transformer Test. 4. The Control Board could be faulty. Replace.
Pilot arc is OK but cutting arc will not establish.	1. Make sure work cable and clamp are secure. 2. Clean any painted or heavily corroded work surfaces.	1. Perform Transistor Module Test. 2. Perform Power Board Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed call 216-383-2531 or 1-800-833-9353.

CONTROL BOARD CONNECTOR LOCATION

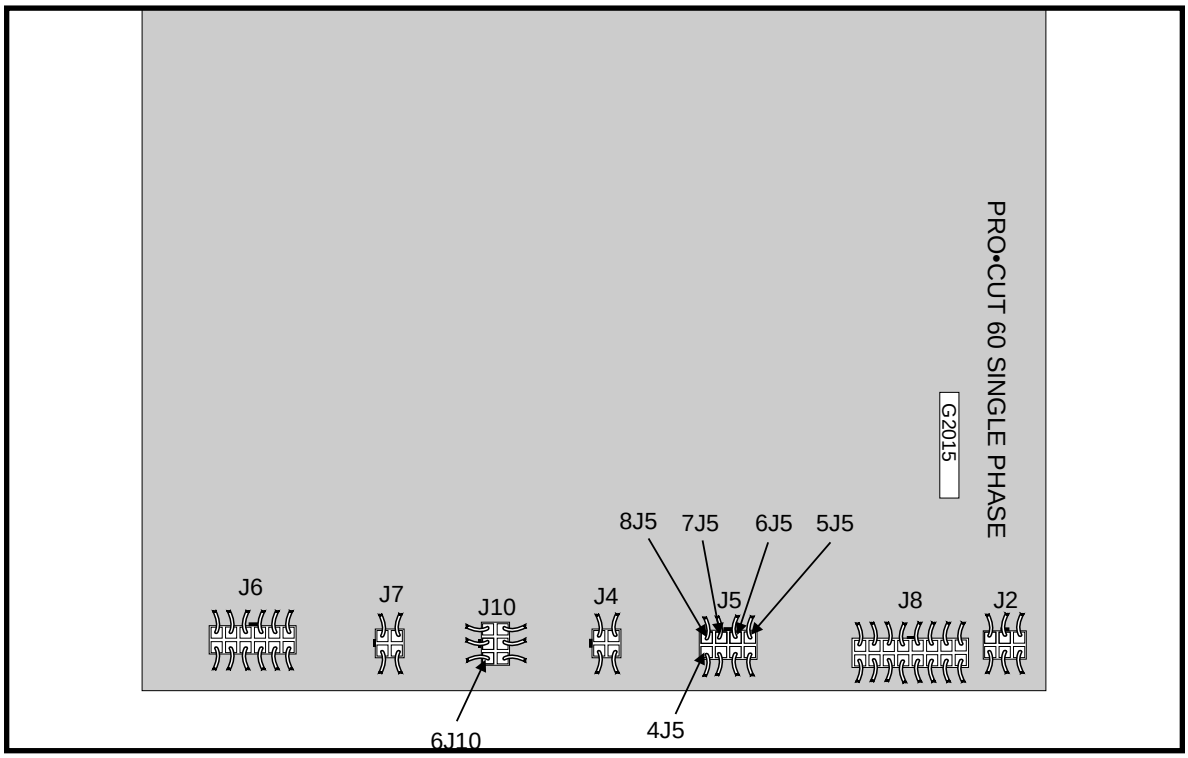

FIGURE F.1 - Control Board Connector Locations

POWER BOARD CONNECTOR LOCATION

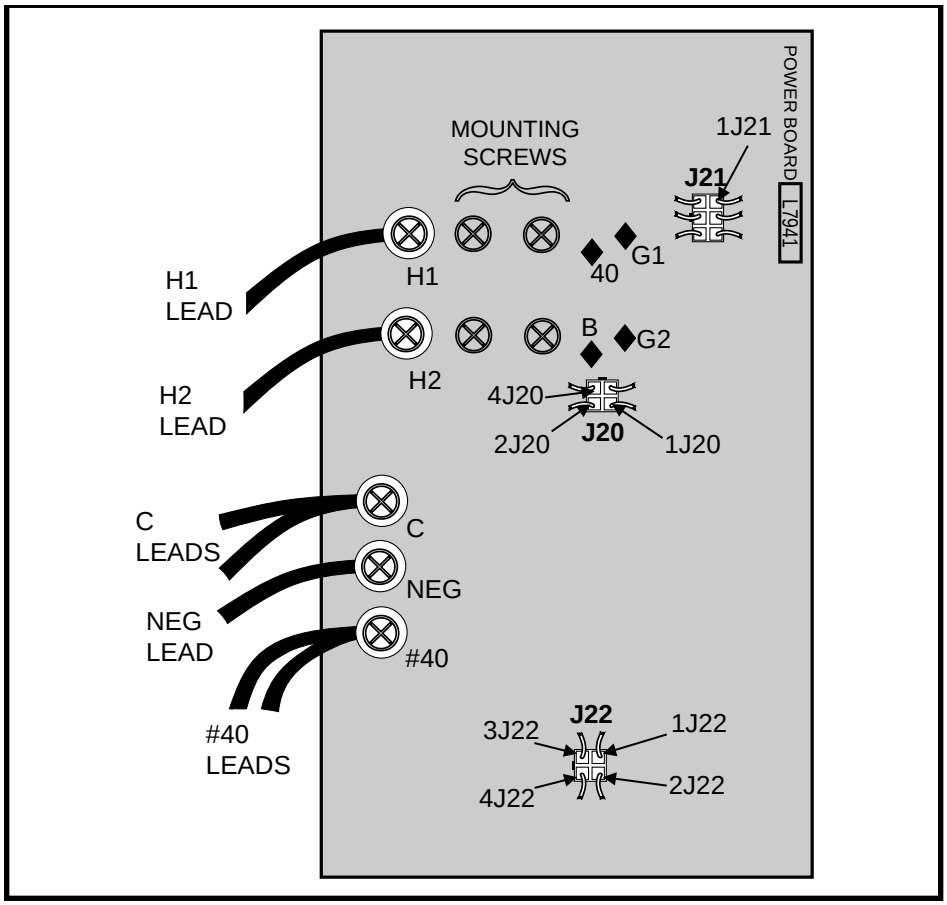

FIGURE F.2 - Power Board Connector Locations

CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ WARNING

Failure to follow this capacitor discharge procedure can result in electric shock.

PROCEDURE DESCRIPTION

This procedure must be performed before any test or removal procedure that does not require the machine to be electrically “hot.”

MATERIALS NEEDED

High resistance, high wattage resistor
(25-1000 ohms, 25 watts minimum).
Insulated pliers
Insulated gloves
DC Volt/Ohm meter (Multimeter)

CAPACITOR DISCHARGE PROCEDURE

PROCEDURE

NOTE: See Figure F.19.

1. Disconnect input power to the machine.
2. Remove the Left Case Side Assembly.
3. Locate the two capacitors shown in Figure F.19.
4. Put on the insulated gloves.
5. Grip the middle of the resistor with the insulated pliers.
6. Touch the resistor leads across the two capacitor straps as shown for 10 seconds.
   a. DO NOT TOUCH THE CAPACITOR STRAPS WITH YOUR HANDS OR ANY OTHER PART OF YOUR BODY.
7. Test for zero volts across the capacitor terminals with a DC volt meter.
   a. Capacitor terminal polarity is marked on the capacitor straps.
   b. If any voltage is measured, REPEAT PROCEDURE.

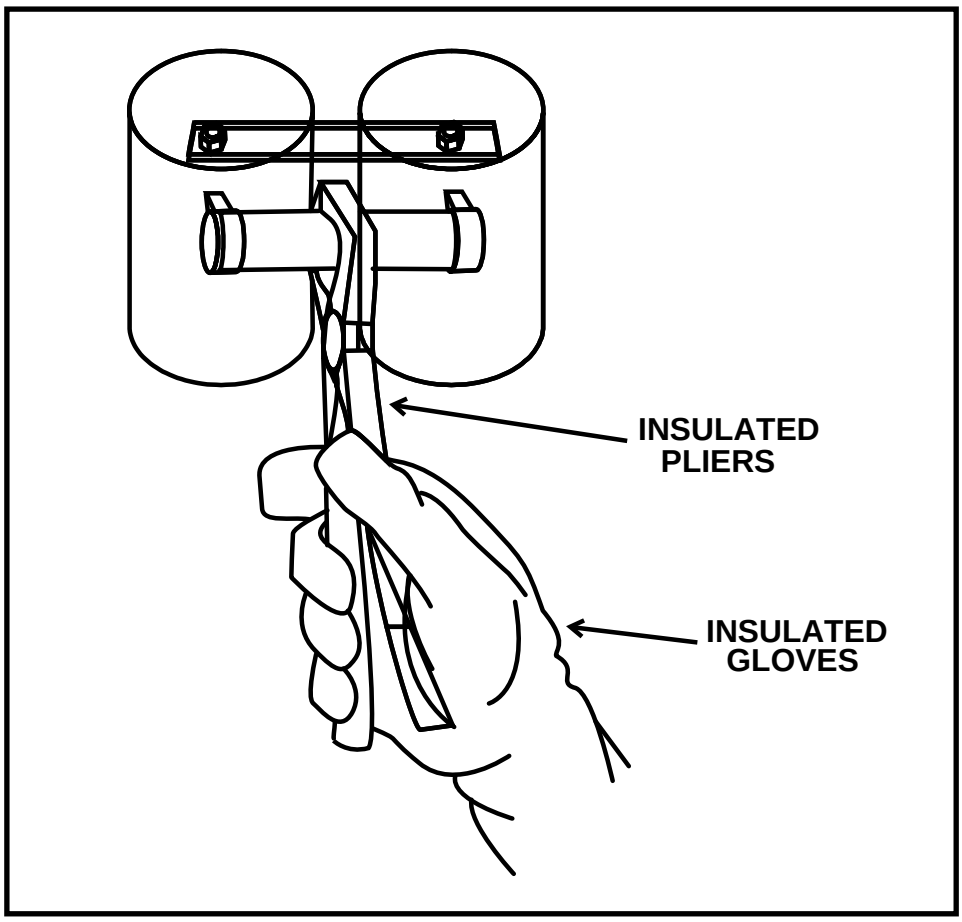

FIGURE F.19-Capacitor Discharge Procedure

Return to Section TOC
Return to Master TOC

TORCH, TORCH CABLE ASSEMBLY, INTERNAL TRIGGER, AND SAFETY CIRCUIT TEST

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

TEST DESCRIPTION

This test will identify any problems or faults in the torch, torch cable assembly, and associated circuits.

MATERIALS NEEDED

Volt/Ohmmeter (Multimeter)
PRO-CUT 60 Wiring Diagrams
PRO-CUT 60 Torch Spare Parts Kit (Supplied)
9/16” Open end wrench

TORCH, TORCH CABLE ASSEMBLY, INTERNAL TRIGGER, AND SAFETY CIRCUIT TEST

TORCH AND CABLE RESISTANCE TEST PROCEDURE

1. Turn PRO-CUT 60 ON/OFF Power Switch to OFF.

2. Disconnect main power supply to machine.

3. Perform the CAPACITOR DISCHARGE PROCEDURE.

4. Disconnect and remove the torch cable from the bulkhead compartment. See Figure F.3.

a. Locate the torch cable access door on the Right Case Side Assembly of the machine.

b. Remove the one sheet metal screw on the left-hand side of the access door and swing open the door.

c. Test for a voltage across the stud marked WORK and the bulkhead connector (brass fitting). NO voltage should be present. If a voltage is present, STOP. DO NOT perform this test. Contact the Lincoln Electric Service Department. If no voltage is present, continue test procedure.

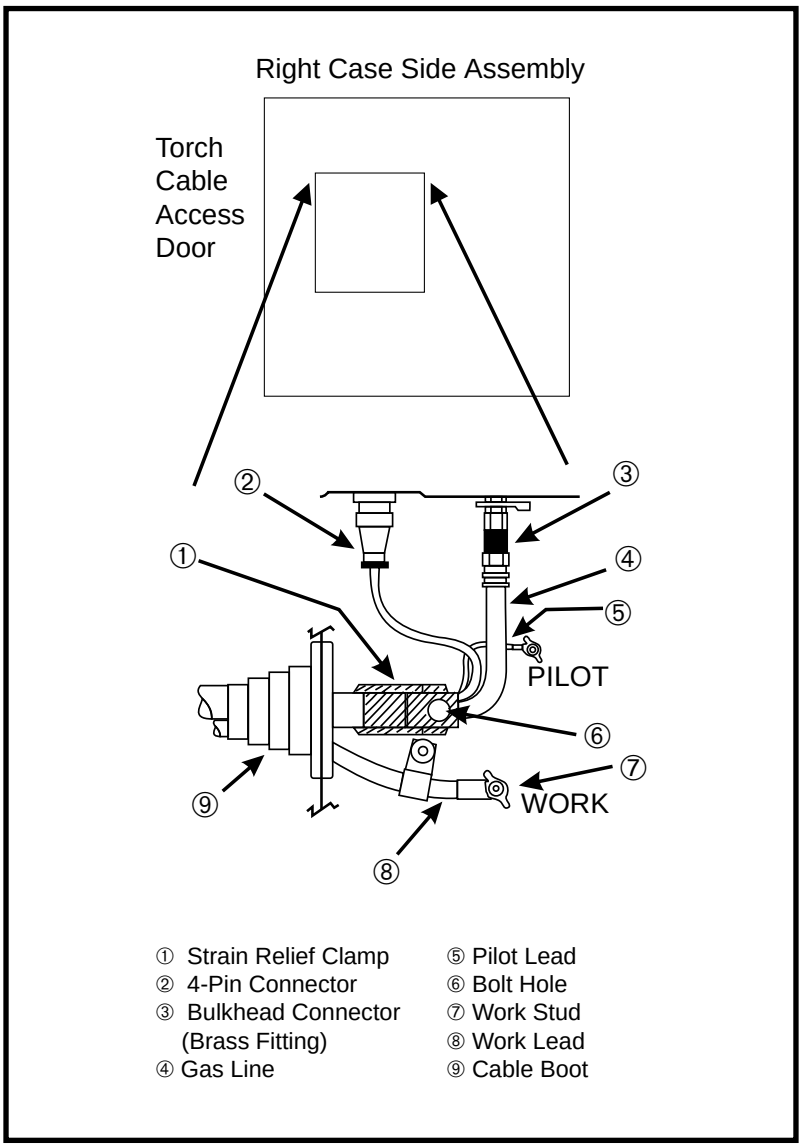

FIGURE F.3 - Torch Cable Connections

Return to Section TOC
Return to Master TOC

TORCH, TORCH CABLE ASSEMBLY, INTERNAL TRIGGER, AND SAFETY CIRCUIT TEST

d. Disconnect the trigger lead 4-pin connector by unscrewing it.

e. Disconnect the electrode lead using a 9/16" open-end wrench to remove the brass adaptor fitting attached to the bulkhead connector.

f. Disconnect the pilot lead by removing the wing nut marked PILOT. Remove only the pilot lead. Do not remove any of the leads below the brass nut.

g. Rotate and lift the torch cable strain relief clamp to remove it from the bolt head. Do not remove the strain relief clamp from around the three leads.

h. Pull the trigger lead, electrode lead, and pilot lead bundled in the strain relief clamp out of the machine through the rubber boot.

5. Move the torch cable assembly to a convenient work area.

6. Perform the following resistance tests using a volt/ohm meter (Multimeter). See Figures F.4. and F.5 for Torch and Cable Resistance Tests Points and Circuit Diagram.

   a. Test for resistance on 4-pin connector of 1 ohm or less (continuity) from:
   - pins #1 to #3.
   - pin #3 to the pilot lead.
   - pilot lead to the torch nozzle.
   - pins #2 to #4 when the torch trigger is pulled.

   NOTE: Remove the torch nozzle with the supplied wrench to perform this test.
   - electrode lead to the torch electrode.

   b. Test for high resistance (500K ohm minimum) from the pilot lead to the electrode lead.

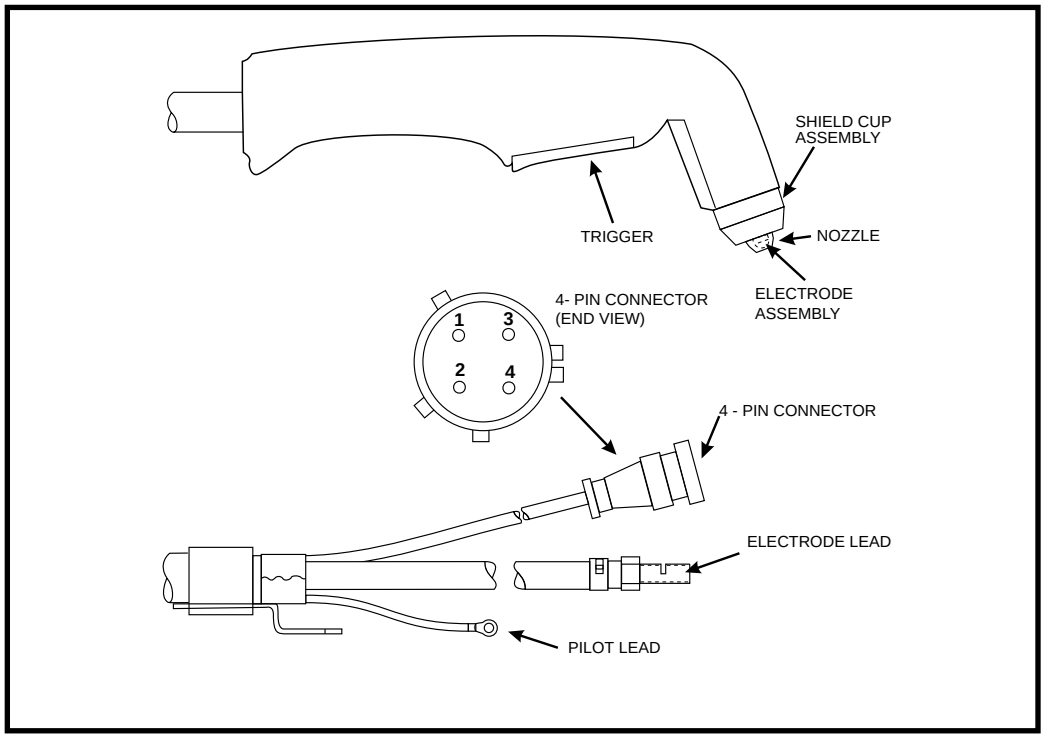

FIGURE F.4 - Torch and Cable Resistance Test Points

TORCH, TORCH CABLE ASSEMBLY, INTERNAL TRIGGER, AND SAFETY CIRCUIT TEST

c. If any of the above tests do not agree with the expected normal resistance specifications, then the torch and/or cable must be repaired or replaced.

d. Go to INTERNAL TRIGGER AND SAFETY CIRCUIT TEST if all resistance values are within the specified range.

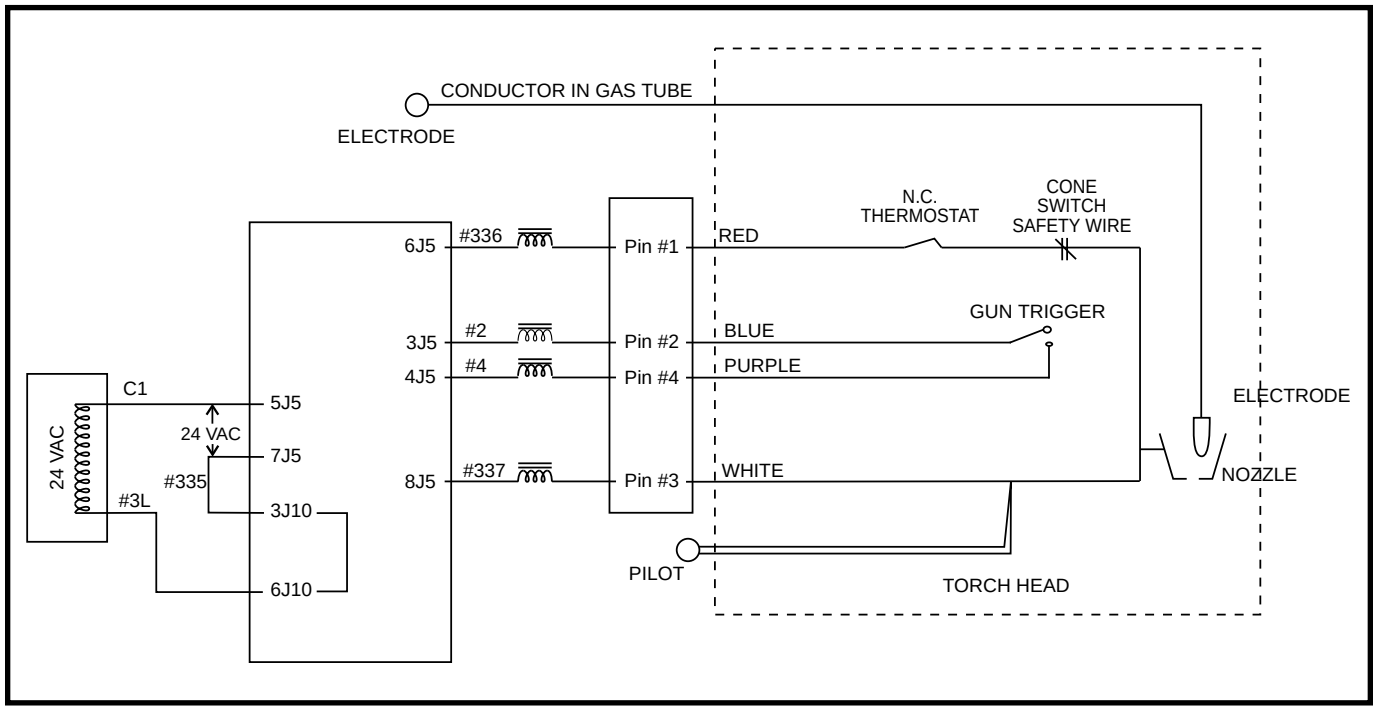

FIGURE F.5-Torch and Cable Wiring Diagram

INTERNAL TRIGGER AND SAFETY CIRCUIT TEST PROCEDURE

1. Turn the PRO-CUT 60 ON/OFF Power Switch to OFF.
2. Disconnect input power supply to machine.
3. Remove the roof and the Right and Left Case Side Assemblies using a 5/16” nut driver.
4. Perform the CAPACITOR DISCHARGE PROCEDURE.

5. Disconnect the 4-pin connector.
6. Locate Plug J5 on the Control Board. See Figure F.6 and Figure F.1 for the location of the Control Board and Plug J5.
7. Locate the 4-pin receptacle. See Figure F.6 for location.

TORCH, TORCH CABLE ASSEMBLY, INTERNAL TRIGGER, AND SAFETY CIRCUIT TEST

8. Disconnect Plug J5 from its header on the Control Board.

9. Test for zero ohms (continuity) from the following test points on Plug J5 header to the 4-pin leads on the bulkhead of the machine (See Figure F.7):

- Pin 4J5 (lead #4) to 4-pin pin #4
- Pin 3J5 (lead #2) to 4-pin pin #2
- Pin 6J5 (lead #336) to 4-pin pin #1
- Pin 8J5 (lead #337) to 4-pin pin #3

   a. If any of the above tests do not agree with the expected nor mal resistance specifications, then Plug J5 on the Control Board, the torch 4-pin receptacle, or the associated wiring must be repaired.

   b. If all of the above tests are within the normal resistance specifications, continue with test procedure.

10. Re-connect Plug J5 back into its header.

11. Test for 24 VAC between Pin 5J5 (lead C1) and Pin 7J5 (lead # 335) on Plug J5.

   a. Carefully insert the volt/ohm (Multimeter) probes into the back of the J5 plug into pin cavity 5J5 (lead C1) and pin cavity 7J5 (lead #335). See Figure F.1.

   b. Connect input power to PRO-CUT 60.

   c. Turn ON/OFF Power Switch to ON.

   d. Read meter.
   - If 24 VAC is NOT present, continue with test procedure.

12. Turn ON/OFF Power Switch to OFF.

13. Disconnect main input power to machine.

14. Perform the CAPACITOR DISCHARGE PROCEDURE.

15. Check Plug J10 and Plug J5 and associated wiring for loose or faulty connections.

16. Disconnect Plug J10 from Header J10.

17. Test for continuity (zero ohms) between 3J10 and 6J10 on Control Board Header J10.

   a. If continuity is not indicated, the Control Board could be faulty.

18. Perform MAIN TRANSFORMER TEST.

19. Replace the Control Board if all of the above tests are within normal specifications.

TORCH, TORCH CABLE ASSEMBLY, INTERNAL TRIGGER, AND SAFETY CIRCUIT TEST

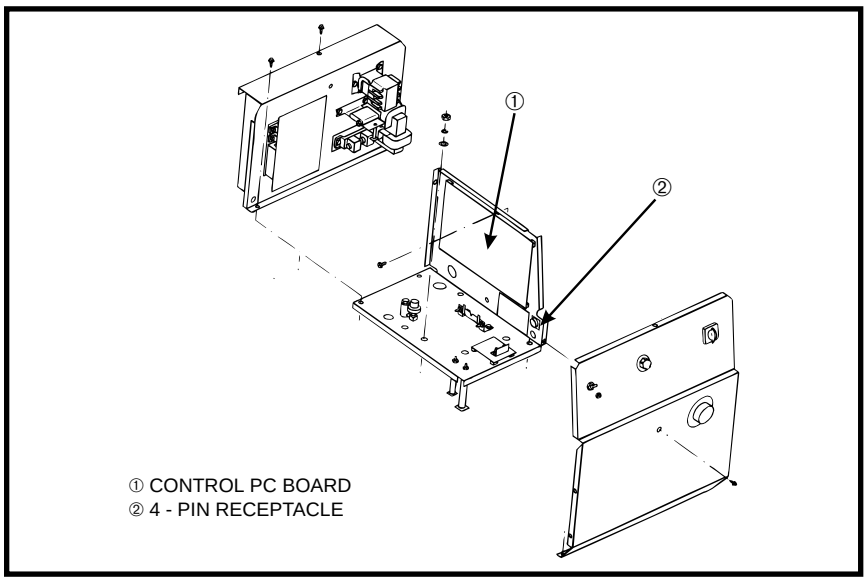

FIGURE F.6-Control Board and 4-pin Locations.

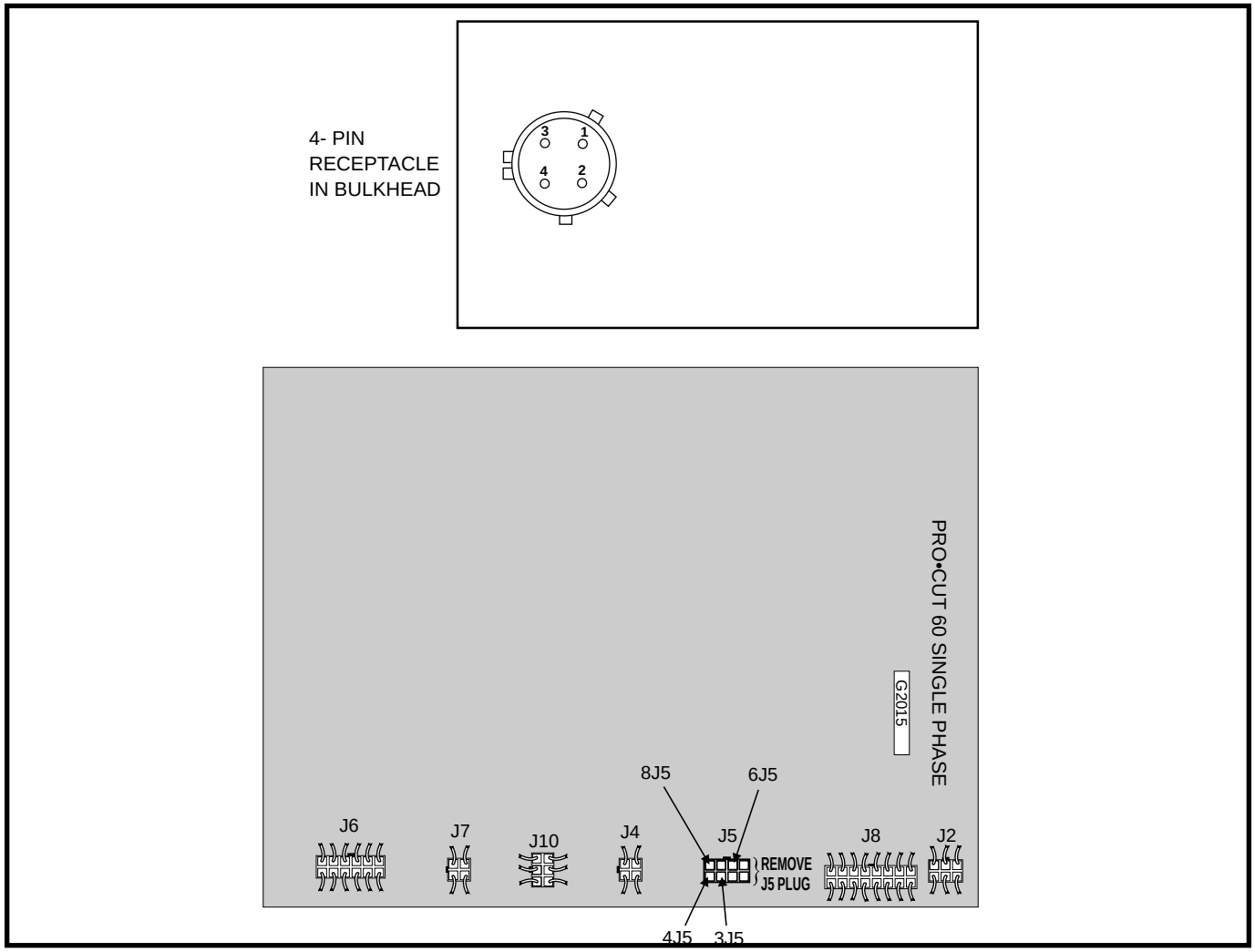

FIGURE F.7-Control Board and 4-Pin Connector Test Points

TRANSISTOR MODULE TEST

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

TEST DESCRIPTION

This test will identify any problems or faults in the Transistor Module.

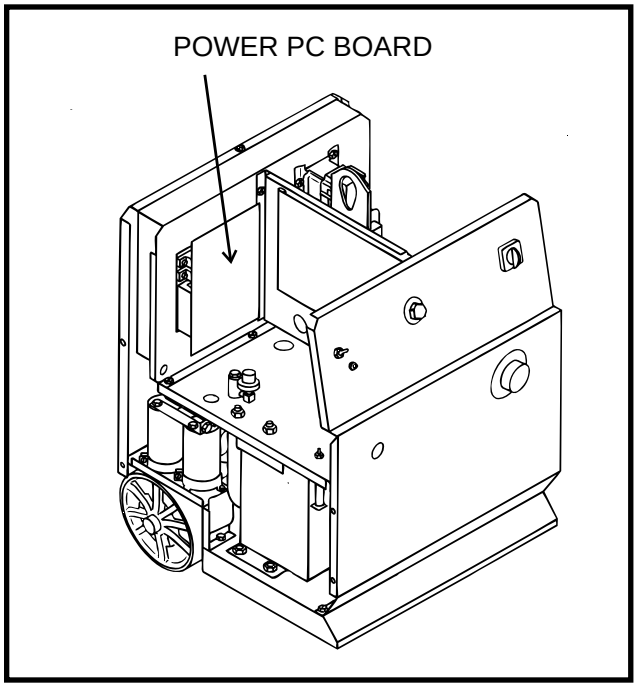

FIGURE F.8-Power Board Location

TRANSISTOR MODULE TEST

MATERIALS NEEDED

- Analog Volt/Ohmmeter (Multimeter) with RX10 or RX1000 scale.
- PRO-CUT 60 Wiring Diagrams
- Phillips Head Screwdriver

TEST PROCEDURE

1. Turn ON/OFF Power Switch to OFF.

2. Disconnect main input power to machine.

3. Perform the CAPACITOR DISCHARGE PROCEDURE.

4. Locate Power Board. See Figure F.8.

5. Locate and remove the leads marked #40 by removing the terminal screw connecting them to the Power Board. See Figure F.9.

   a. Move the leads out of the way.

6. Replace the terminal screw snugly, a little more than finger tight. The Transistor Module is mounted behind the Power Board and the terminal screw completes the electrical connection.

7. Locate and remove the one lead marked NEG by removing the terminal screw connecting it to the Power Board. See Figure F.9.

   a. Move the lead out of the way.

8. Replace the terminal screw snugly, a little more than finger tight. The Transistor Module is mounted behind the Power Board and the terminal screw completes the electrical connection.

9. Remove the two leads marked C by removing the terminal screw connecting them to the Power Board. See Figure F.9.

   a. Move the lead out of the way.

	NEGATIVE (-) PROBE TO TERMINAL MARKED:	POSITIVE (+) PROBE TO TERMINAL MARKED:	EXPECTED RESISTANCE
TEST	C	#40	1,000 ohms or less
TEST B	#40	C	4,500 ohms or higher
TEST C	#40	Neg	1,000 ohms or less
TEST D	Neg	#40	4,500 ohms or higher

TABLE F.1 - Transistor Module Resistance Tests

TRANSISTOR MODULE TEST

10. Replace the terminal screw snugly, a little more than finger tight. The Transistor Module is mounted behind the Power Board and the terminal screw completes the electrical connection.

11. Perform the following resistance tests listed in Table F.1:

NOTE: Meter lead polarity must be observed for these resistance tests.

a. If a low resistance is measured in both polarities, the transistor module is "shorted." Replace the transistor module, the Power Board, and the Control Board.

b. If a high resistance is measured in both polarities, the transistor module is "open." Replace the transistor module, the Power Board, and the Control Board.

12. Replace all leads.

a. Torque screws to 17 in./lbs. (1.9 N.M.)

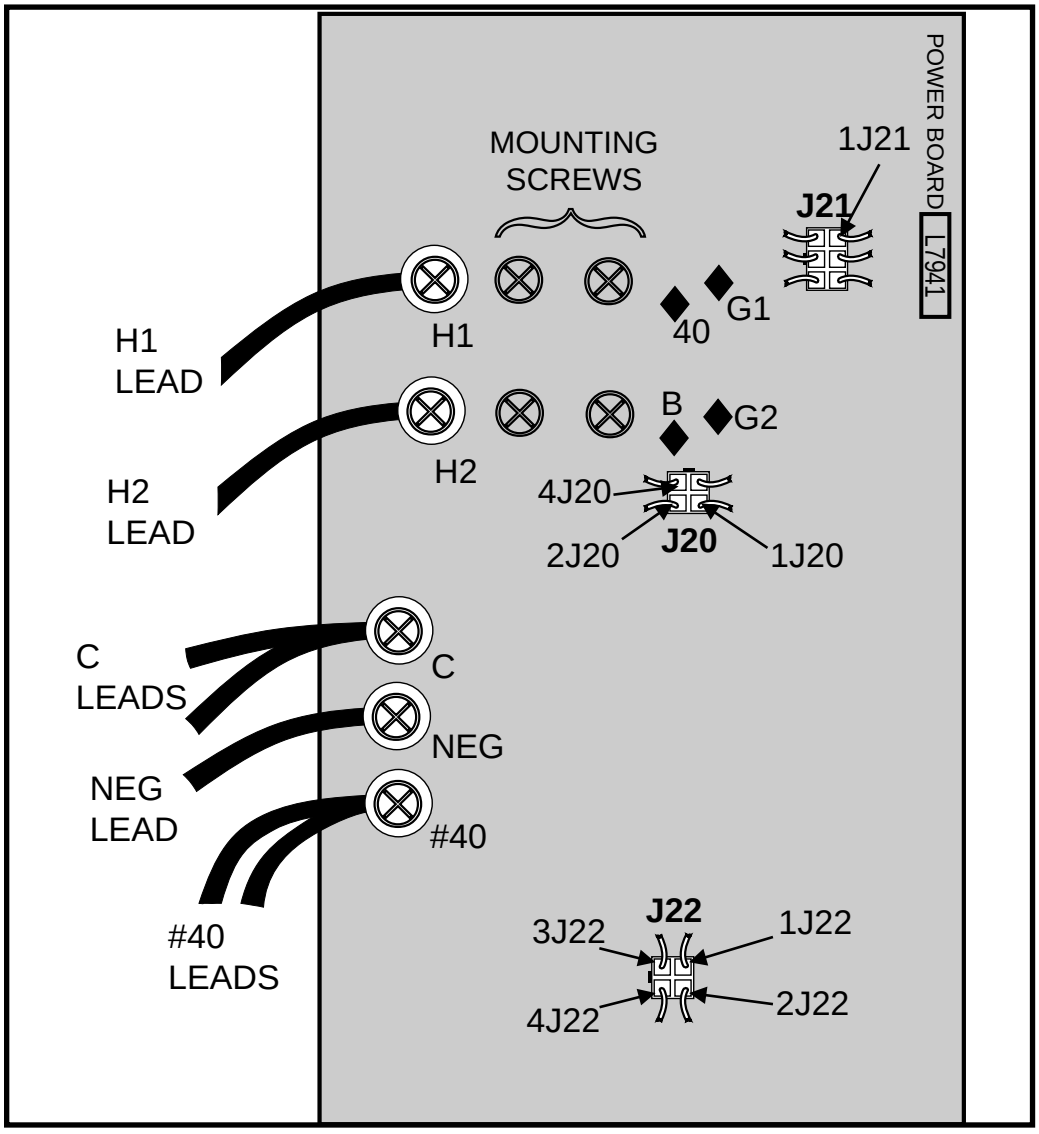

FIGURE F.9-Transistor Module Test Points

MAIN TRANSFORMER TEST

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

TEST DESCRIPTION

This test will identify any problems or faults in the Main Transformer's primary and secondary windings. These tests require that the machine be connected to the input power supply and turned ON.

MATERIALS NEEDED

Volt/Ohmmeter (Multimeter)
PRO-CUT 60 Wiring Diagrams

Return to Section TOC
Return to Master TOC

MAIN TRANSFORMER TEST

TEST PROCEDURE

1. Connect main input power supply to machine.

NOTE: When performing Tests A and B

a. If any one voltage is missing or below the specification, inspect the associated plugs and wiring. If there are no loose plugs or wiring, then the associated winding in the main transformer could be defective. Replace the main transformer.

b. If all secondary and auxiliary voltages are missing, then inspect the Reconnect Panel to make sure the machine is connected for the proper operating voltage. If the machine is connected properly, the primary winding in the main transformer could be defective. Replace.

Test A: Main Secondary Voltage Test

1. Locate on the Power Board leads H1 and H2 to the SCR module. See Figure F.2.

2. Turn ON/OFF Power Switch to ON.

3. Test for 190 VAC across leads H1 and H2.

4. Turn ON/OFF Power Switch to OFF.

Test B: Auxiliary Winding Tests

1. Perform the four Auxiliary Winding Tests in Table F.2. Turn the ON/OFF Power Switch to ON for each test. Turn the ON/OFF Power Switch to OFF between each test. When testing a lead connected to a Molex plug, carefully insert the probe into the cavity of the plug to make contact with the lead. See Figures F.1, F.2, and F.10 for component and lead connection locations. Refer to wiring diagram.

Auxiliary Winding Test #	Test Voltage From	To	Expected Voltage
1	Lead #31 on Control Relay CR2	Lead #32 on Control Board at Plug location 6J10	115 VAC
2	Lead #C1 on Control Board at Plug location 5J5	Lead #32 on Control Board at Plug location 6J10	24 VAC
3	Lead #C2 on Control Board at Plug location 1J7	Lead #H6 on Control Board at Plug location 3J7	24 VAC
4	Lead #H3 on Power Board at Plug location 3J22	Lead #H4 on Power Board at Plug location 1J22	12 VAC

Table F.2-Auxiliary Winding Tests

MAIN TRANSFORMER TEST

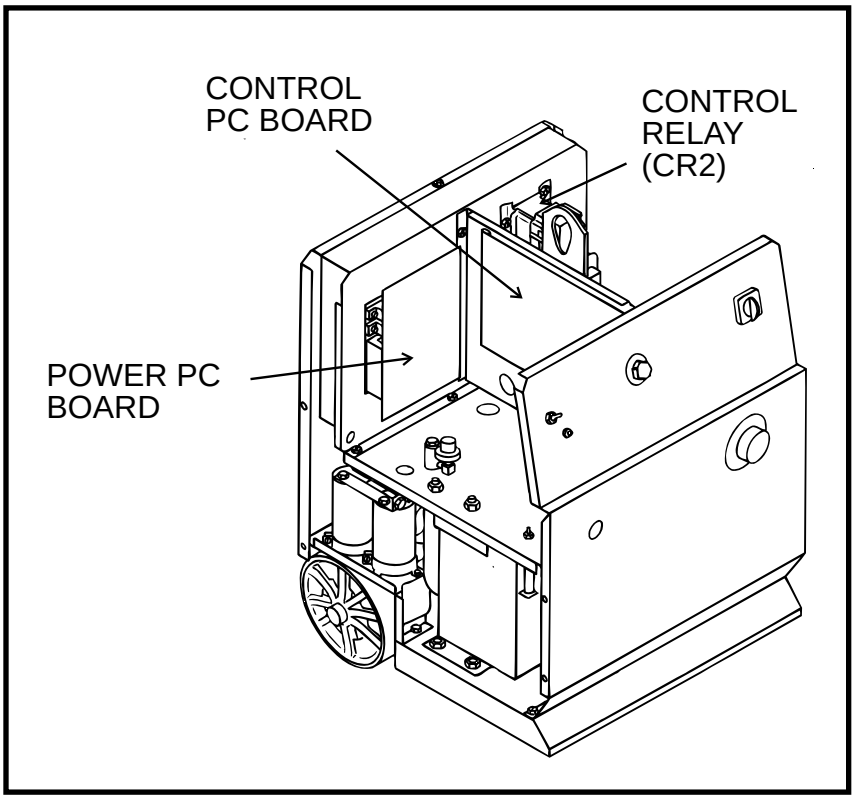

FIGURE F.10 Main Transformer Test Components

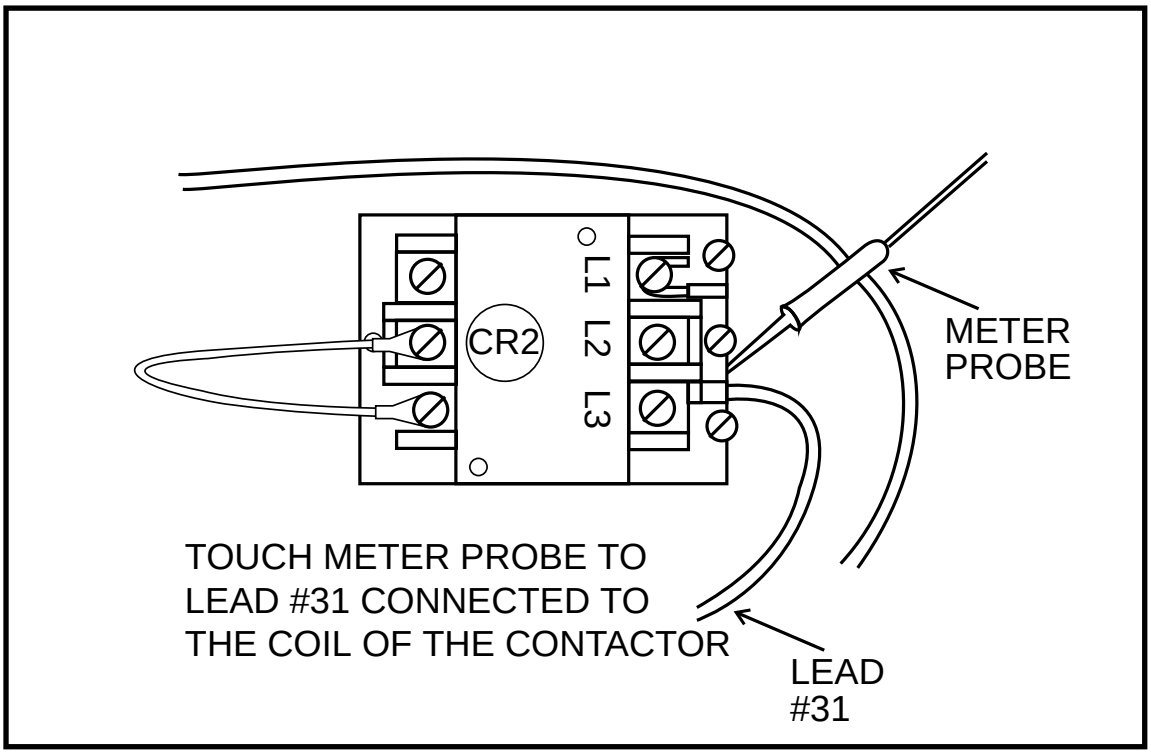

FIGURE F.10A CR2 Lead Locations for Table F.2.

POWER BOARD TEST

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ WARNING

HIGH VOLTAGE/HIGH FREQUENCY CAN DAMAGE TEST EQUIPMENT

TEST DESCRIPTION

This test will identify any problems or faults in the Power Board.

MATERIALS NEEDED

Isolated Volt/Ohmmeter (Multimeter) (analog only). This test has the potential to damage test equipment.
PRO-CUT 60 Wiring Diagrams

POWER BOARD TEST

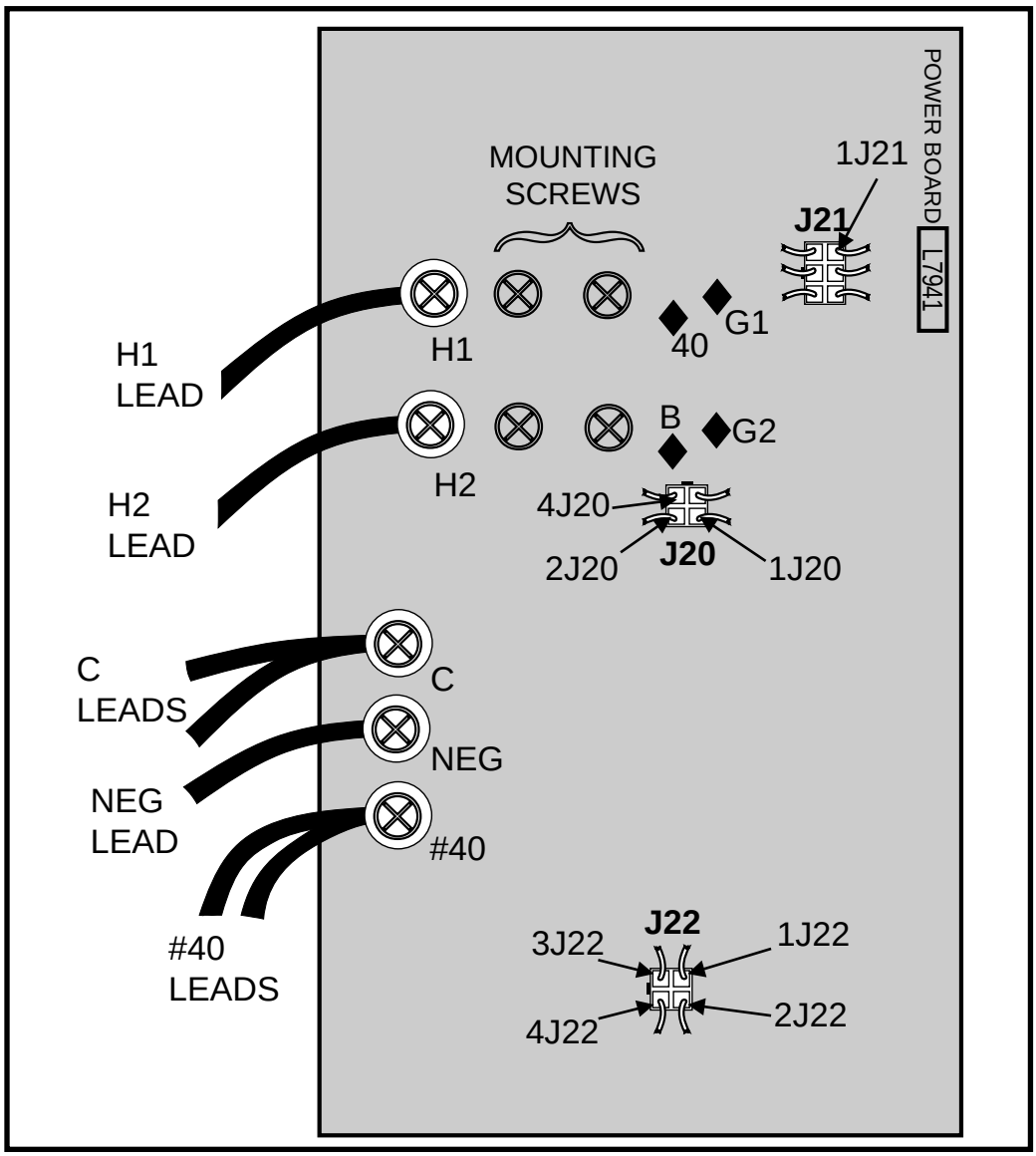

FIGURE F.11-Power Board Test Points

TEST PROCEDURE

1. Connect input power to machine.

2. Turn ON/OFF Power Switch to OFF.

Test A: Test for 12 VAC voltage to Power Board

1. Locate and insert probes into Power Board Plug locations 1J22 (lead H4) and 3J22 (lead H3). See Figure F.11. Carefully insert the probes into the lead cavity to make contact with the lead.

2. Turn ON/OFF Power Switch to ON.

   a. If 12 VAC is NOT present, check Plug J22 for loose or faulty wiring.

   b If no loose or faulty wiring is found, perform Main Transformer Test.

3. Turn ON/OFF Power Switch to OFF.

POWER BOARD TEST

Test B: Test for 7 VDC signal between Power Board and Control Board

NOTE: This test requires that the torch trigger be pulled to activate the circuit. Be sure to use an isolated meter because of the high voltage and high frequency produced.

NOTE: This test requires testing DC voltages. Polarity must be observed.

1. Locate and insert probes into the following Power Board plug locations (See Figure F.11):
   a. Insert the NEGATIVE probe into Plug 4J22 (lead #332 -) lead cavity.
   b. Insert the POSITIVE probe into Plug 2J22 (lead #338 +) lead cavity.
2. Turn the ON/OFF Power Switch to ON.
3. Pull torch trigger. When air pre-flow times out and the pilot arc is established, 7 VDC should be present.
4. Release torch trigger. Turn ON/OFF Power Switch to OFF.
   a. If 7 VDC is NOT present, check Power Board Plug J22 and Control Board Plug J6 for loose or faulty wiring.
   b. If no loose or faulty wiring is found, the Power Board or the Control Board could be faulty. Replace.

Test C: Test for 1.0 VDC to 1.5 VDC Base Voltage to Transistor Module

NOTE: This test requires that the torch trigger be pulled to activate the circuit. Be sure to use an isolated meter because of the high voltage and high frequency produced.

NOTE: This test requires testing DC voltages. Polarity must be observed.

1. Locate and insert probes into the following Power Board plug locations (See Figure F.11):
   a. Insert the NEGATIVE probe into Plug 2J20 (lead #40 -) lead cavity.
   b. Insert the POSITIVE probe into Plug 1J20 (lead B +) lead cavity.
2. Turn the ON/OFF Power Switch to ON.
3. Pull torch trigger. When air pre flow times out and the pilot arc is established, 1.0 VDC to 1.5 VDC should be present.
4. Release torch trigger. Turn ON/OFF Power Switch to OFF.
   a. If this voltage IS NOT present or an incorrect voltage is present, perform TRANSISTOR MODULE TEST.
   b. If transistor module test is OK, then the Power Board could be faulty. Replace.

POWER BOARD TEST

Test D: Test for 0.2 VDC to 0.3 VDC Gate Drive Voltages to the SCR Module.

NOTE: This test requires that the torch trigger be pulled to activate the circuit. Be sure to use an isolated meter because of the high voltage and high frequency produced.

NOTE: This test requires testing DC voltages. Polarity must be observed.

1. Locate and insert probes into the following Power Board plug locations (See Figure F.11):
   a. Insert the NEGATIVE probe into Plug 1J21 (lead #383 -) lead cavity.
   b. Insert the POSITIVE probe into Plug 3J20 (lead G2 +) lead cavity.
2. Turn the ON/OFF Power Switch to ON.
3. Pull torch trigger. When air pre-flow times out and the pilot arc is established, 0.2 VDC to 0.3 VDC should be present.
4. Release torch trigger.
5. Locate and insert probes into the following Power Board plug locations (See Figure F.11):
   a. Insert the NEGATIVE probe into Plug 1J21 (lead #383 -) lead cavity.
   b. Insert the POSITIVE probe into Plug 4J20 (lead G1 +) lead cavity.
2. Turn the ON/OFF Power Switch to ON.
3. Pull torch trigger. When air pre-flow times out and the pilot arc is established, 0.2 VDC to 0.3 VDC should be present.
4. Release torch trigger. Turn ON/OFF Power Switch to OFF.
   a. If specific voltages ARE NOT present, check Power Board Plugs J20 and J21 and Control Board Plug J6 for loose or faulty wiring.
   b. If no loose or faulty wiring is found, the Power Board, Control Board, or SCR module could be faulty. Replace.

Return to Section TOC
Return to Master TOC

HIGH VOLTAGE TRANSFORMER AND CIRCUIT TEST

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ WARNING

HIGH VOLTAGE/HIGH FREQUENCY CAN DAMAGE TEST EQUIPMENT

TEST DESCRIPTION

This test will identify any problems or faults in the High Voltage Transformer.

MATERIALS NEEDED

Isolated Volt/Ohmmeter (Multimeter) with alligator clips (analog meter only)
PRO-CUT 60 Wiring Diagrams

HIGH VOLTAGE TRANSFORMER AND CIRCUIT TEST

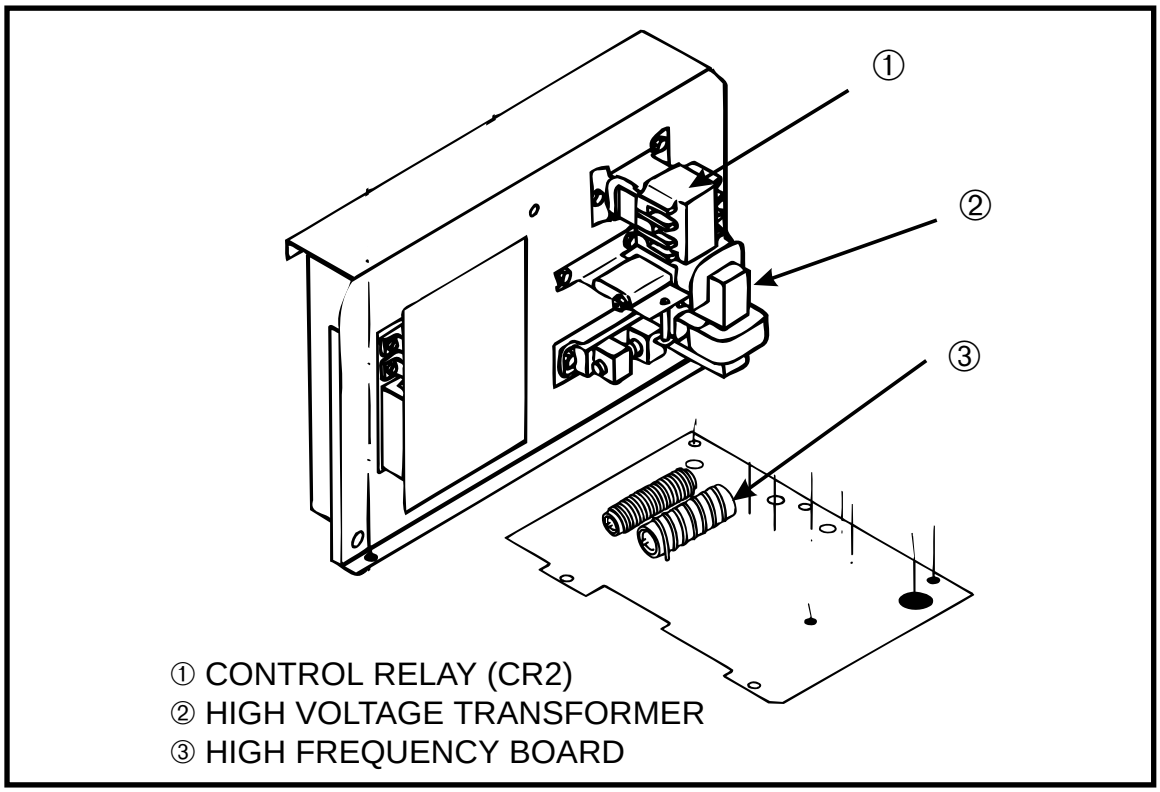

FIGURE F.12-High Voltage Test Component Locations

TEST PROCEDURE

NOTE: This test can be performed best with alligator clips used with the meter probes.

NOTE: This test requires that the torch trigger be pulled to activate the circuit. Be sure to use an isolated meter because of the high voltage and high frequency produced.

1. Connect input power to the machine.

2. Turn ON/OFF Power Switch to OFF.

Test A: Test for 115 VAC primary voltage to High Frequency Transformer

1. Locate and connect probes to leads #35 and #31 on Control Relay CR2. Use alligator clips for best results. See Figure F.12.

2. Turn ON/OFF Power Switch to ON.

3. Pull the torch trigger to close Control Relay CR2 contacts. 115 VAC will be present for only ONE SECOND when the torch trigger is pulled.

NOTE: When using an analog meter, the pointer will deflect to approximately 20 VAC. This is normal.

4. Turn ON/OFF Power Switch to OFF.

   a. If the 115 VAC primary voltage is not present, Control Relay CR2 or the Control Board could be faulty. Replace.

HIGH VOLTAGE TRANSFORMER AND CIRCUIT TEST

Test B: Test Resistance of High Voltage Transformer Primary

1. Disconnect input power to machine.
2. Turn ON/OFF Power Switch to OFF.

3. Perform the CAPACITOR DISCHARGE PROCEDURE.
4. Locate and touch probes to lead #31 and lead #35 on the Control Relay CR2. Resistance should be 4 ohms.
   a. If 4 ohms resistance is not measured, replace the High Voltage Transformer.

Test C: Test Resistance of High Voltage Transformer Secondary

1. Perform Test B Steps #1, 2, & 3 if needed.
2. Locate the two white leads soldered into the two black doughnut chokes located below the High Frequency Transformer. See Figure F.12.
3. Touch the probes to the two white leads. Resistance should be about 12,500 ohms.
   a. If approximately 12,500 ohms is not measured, replace the High Voltage Transformer.

Test D: Test Chokes L501 and L502 for continuity

1. Perform Test B Steps # 1, 2, & 3 if needed.
2. Touch probes to each side of the black chokes located below the High Frequency Transformer. Resistance should be 10 ohms (continuity).
   a. If continuity is not measured, chokes are open. Replace.

ON/OFF POWER SWITCH REMOVAL

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

REMOVAL/REPLACEMENT DESCRIPTION

This procedure will assist you in removing or replacing the ON/OFF Power Switch.

MATERIALS NEEDED

Slot head screw driver
Replacement ON/OFF Power Line Switch

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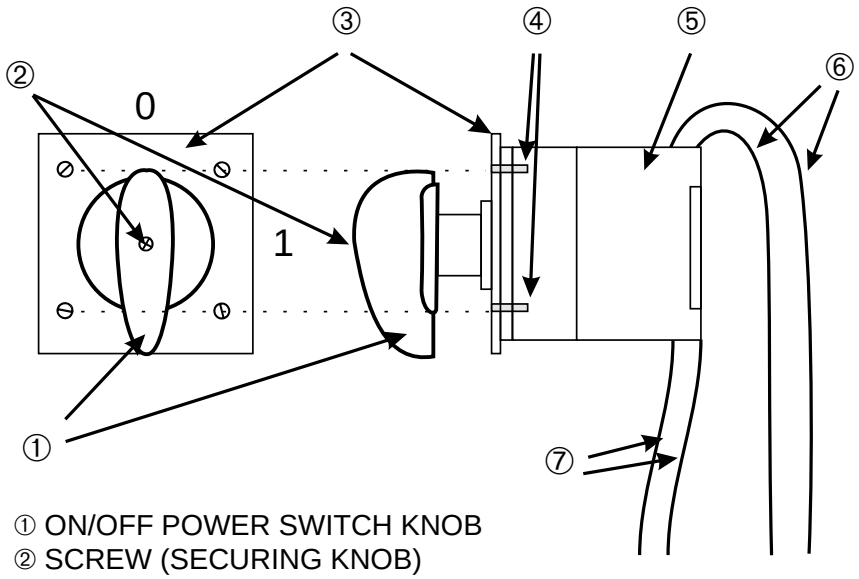
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

ON/OFF POWER SWITCH REMOVAL (LATER CODES MAY HAVE TOGGLE SWITCH)



① ON/OFF POWER SWITCH KNOB
② SCREW (SECURING KNOB)
③ FACE PLATE
④ SCREWS (SECURING FACE PLATE)
⑤ SWITCH
⑥ L1 & L2 LEADS
⑦ T1 & T2 LEADS

FIGURE F.13-ON/OFF Power Switch Removal/Replacement

REMOVAL/REPLACEMENT PROCEDURE

1. Disconnect input power to the machine.

2. Perform the CAPACITOR DISCHARGE PROCEDURE.

3. Remove the Right Case Side Assembly by removing the sheet metal screws.

4. Remove the black ON/OFF Power Switch knob and plastic insert by unscrewing the small screw in the center of the knob. Remove from the shaft. See Figure F.13.

5. Remove the face plate by squeezing the two tabs together and sliding the plate off. See Figure F.13.

6. Loosen the four screws on the plastic frame. These screws go through the Case Front Assembly into the line switch. When the screws no longer engage the line switch, remove the line switch so it can be worked on.

7. Remove and save the electrical tape. The electrical tape will be re-applied during assembly.

8. Remove leads T1, T2, L1, & L2.

9. Install new ON/OFF Power Switch in reverse order of removal. Be sure to re-apply electrical tape to switch.

CONTROL BOARD REMOVAL

⚠ WARNING

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If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ CAUTION

Printed Circuit Boards can be damaged by static electricity.

REMOVAL/REPLACEMENT DESCRIPTION

This procedure will assist you in removing or replacing the Control Board.

MATERIALS NEEDED

Phillips head screw driver
Static grounding strap
Replacement Control Board

Return to Section TOC
Return to Master TOC

CONTROL BOARD REMOVAL

REMOVAL/REPLACEMENT PROCEDURE

1. Disconnect input power to the machine.
2. Remove the Left Case Side assembly.
3. Perform the CAPACITOR DISCHARGE PROCEDURE.
4. Remove the seven Molex plugs from their headers and position out of the way. See Figure F.1.
5. Remove the 10 mounting screws.
6. Remove the Control Board from the machine by carefully lifting it straight up until clear of all other parts.
7. Insert the replacement Control Board carefully into the machine and install in reverse order of removal. Be sure to re-connect the seven Molex plugs back into their headers securely.

POWER BOARD REMOVAL

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ CAUTION

Printed Circuit Boards can be damaged by static electricity.

REMOVAL/REPLACEMENT DESCRIPTION

This procedure will assist you in removing or replacing the Power Board.

MATERIALS NEEDED

Phillips head screw driver
7/16” Nut driver
Static grounding strap
Replacement Power Board

Return to Section TOC
Return to Master TOC

POWER BOARD REMOVAL

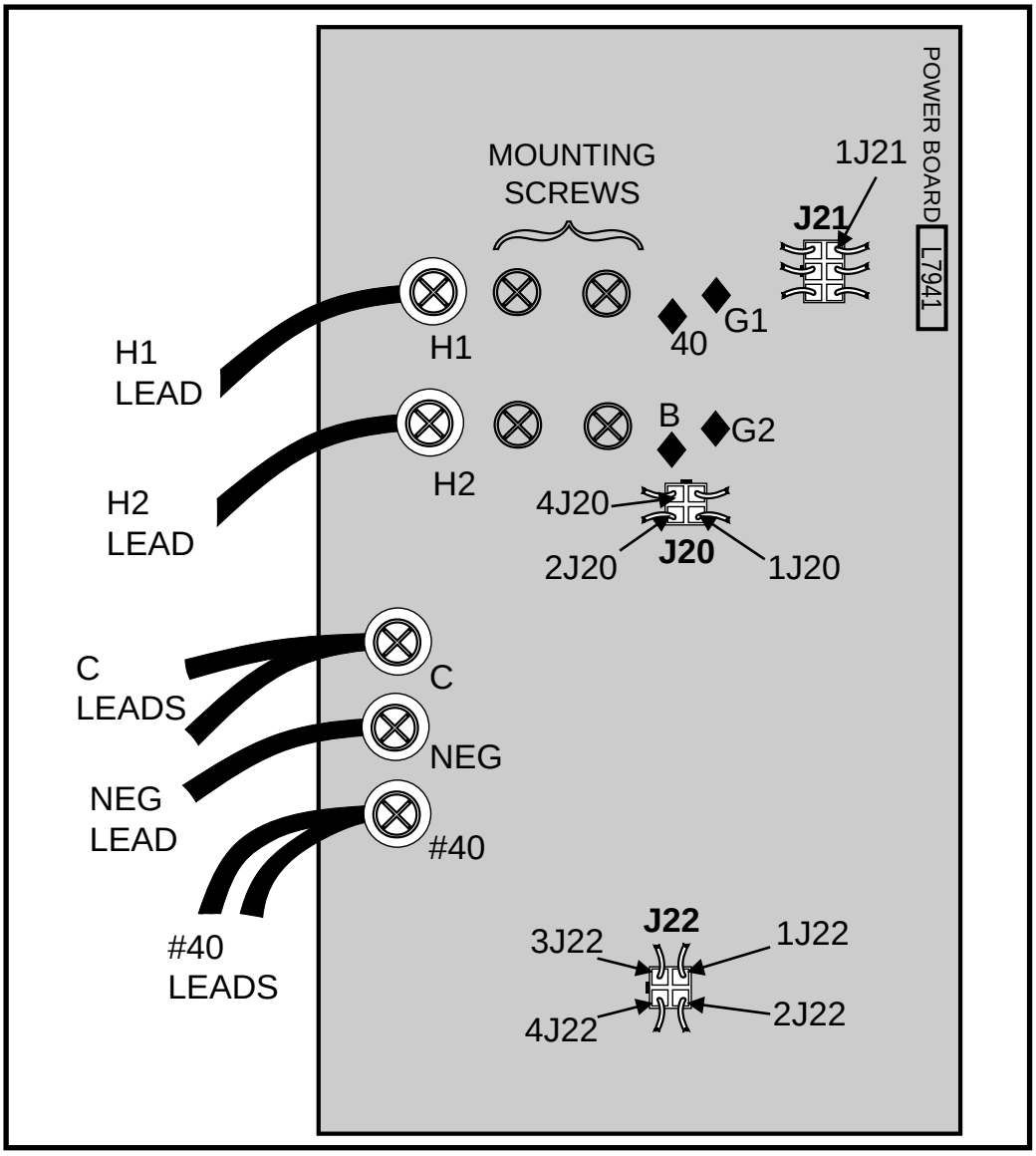

FIGURE F.14-Power Board Removal/Replacement

REMOVAL/REPLACEMENT PROCEDURE

1. Disconnect input power to the machine.
2. Remove the Left Case Side Assembly.
3. Perform the CAPACITOR DISCHARGE PROCEDURE.
4. Remove the Molex Plugs J20, J21, and J22 from the Power Board.
5. Remove G1, G2, 40, & B lead spade lugs from the terminals on the SCR modules. See Figure F.14.
6. Remove the two C leads, the NEG lead, and the two # 40 leads by unscrewing the terminal screws with a Phillips head screw driver. See Figure F.14.
7. Remove leads H1 and H2 by unscrewing the terminal screws with a Phillips head screw driver. See Figure F.14.

POWER BOARD REMOVAL

8. Remove the four mounting Phillips head screws holding the Power Board to the SCR module.

9. Remove the two nylon nuts from the studs on which the Power Board is mounted with a 7/16" nut driver.

10. Remove the Power Board by pulling it out clear of the studs and lifting it straight up out of the machine.

11. Install replacement Power Board by sliding it over the mounting studs.

12. Replace the nylon nuts loosely on the mounting studs so the Power Board position can be adjusted when installing the mounting and terminal screws.

13. Install the four mounting screws finger tight.

14. Connect leads H1 and H2 to the SCR modules with the terminal screws finger tight.

15. Connect leads C (two wires), NEG, and #40 (two wires) with the terminal screws finger tight.

16. Tighten the six screws connecting the Power Board to the SCR modules to 35 in/lbs (3.9 N.M.).

17. Tighten the three screws connecting the C, NEG, and #40 leads to the Power Board and the Transistor Module to 17 in/lbs (1.9 N.M.).

18. Tighten the nylon nuts on the mounting studs.

19. Reconnect tightly all Molex Plugs (J20, J21, and J22) and plug in spade lug leads marked G1, G2, #40, and B through the Power Board to terminals on the SCR modules.

TRANSISTOR MODULE REMOVAL

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ CAUTION

Printed Circuit Boards can be damaged by static electricity.

REMOVAL/REPLACEMENT DESCRIPTION

This procedure will assist you in removing or replacing the Transistor Module.

MATERIALS NEEDED

5mm Allen-type wrench
Static grounding strap
Replacement Transistor Module
Joint Compound: Lincoln T12837 or equivalent (Dow Corning 340).
Replacement Power Board

TRANSISTOR MODULE REMOVAL

REMOVAL/REPLACEMENT PROCEDURE

NOTE: It is recommended that when the Transistor Module is replaced, the Power Board and the Control Board should be replaced.

NOTE: See Figure F.15.

1. Disconnect input power to the machine.
2. Remove the Left Case Side assembly.

3. Perform the CAPACITOR DISCHARGE PROCEDURE.
4. Perform the POWER BOARD REMOVAL PROCEDURE.

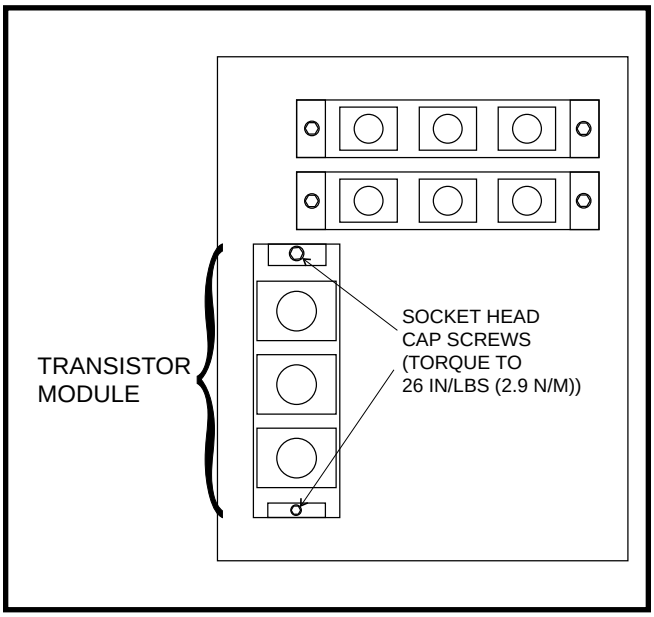

FIGURE F.15-Transistor Module location with Power Board Removed

5. Remove the two socket head cap screws from the Transistor Module using the 5mm Allen-Type wrench.
6. Remove the Transistor Module from the heat sink.
7. Install the replacement Transistor Module.
   a. Clean the heat sink surface with “000 fine steel wool.
   b. Rinse the heat sink surface with alcohol or acetone.
   c. Apply a .002” to .005” coat of joint compound evenly to the heat sink mounting surface and the Transistor Module mounting surface. Use Lincoln Joint Compound T12837, or equivalent, such as Dow Corning #340.
   d. Press the Transistor Module onto the heat sink surface. Remove the module to make sure enough joint compound has been applied. When removed, both surfaces should have an even texture with no bare spots. If this even-textured look does not appear, re-apply the joint compound.
   e. Mount the Transistor Module on the heat sink with the 5mm socket head cap screws to 26 in/lbs. Partially tighten each cap screw one at a time to avoid uneven torque on the base plate.
8. Install replacement Power Board. See POWER BOARD REMOVAL PROCEDURE.

SCR MODULE REMOVAL

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ CAUTION

Printed Circuit Boards can be damaged by static electricity.

REMOVAL/REPLACEMENT DESCRIPTION

This procedure will assist you in removing or replacing the SCR Modules.

MATERIALS NEEDED

4mm Allen-type wrench
Static grounding strap
Replacement SCR Module
Joint Compound: Lincoln T12837 or equivalent (Dow Corning 340).

SCR MODULE REMOVAL

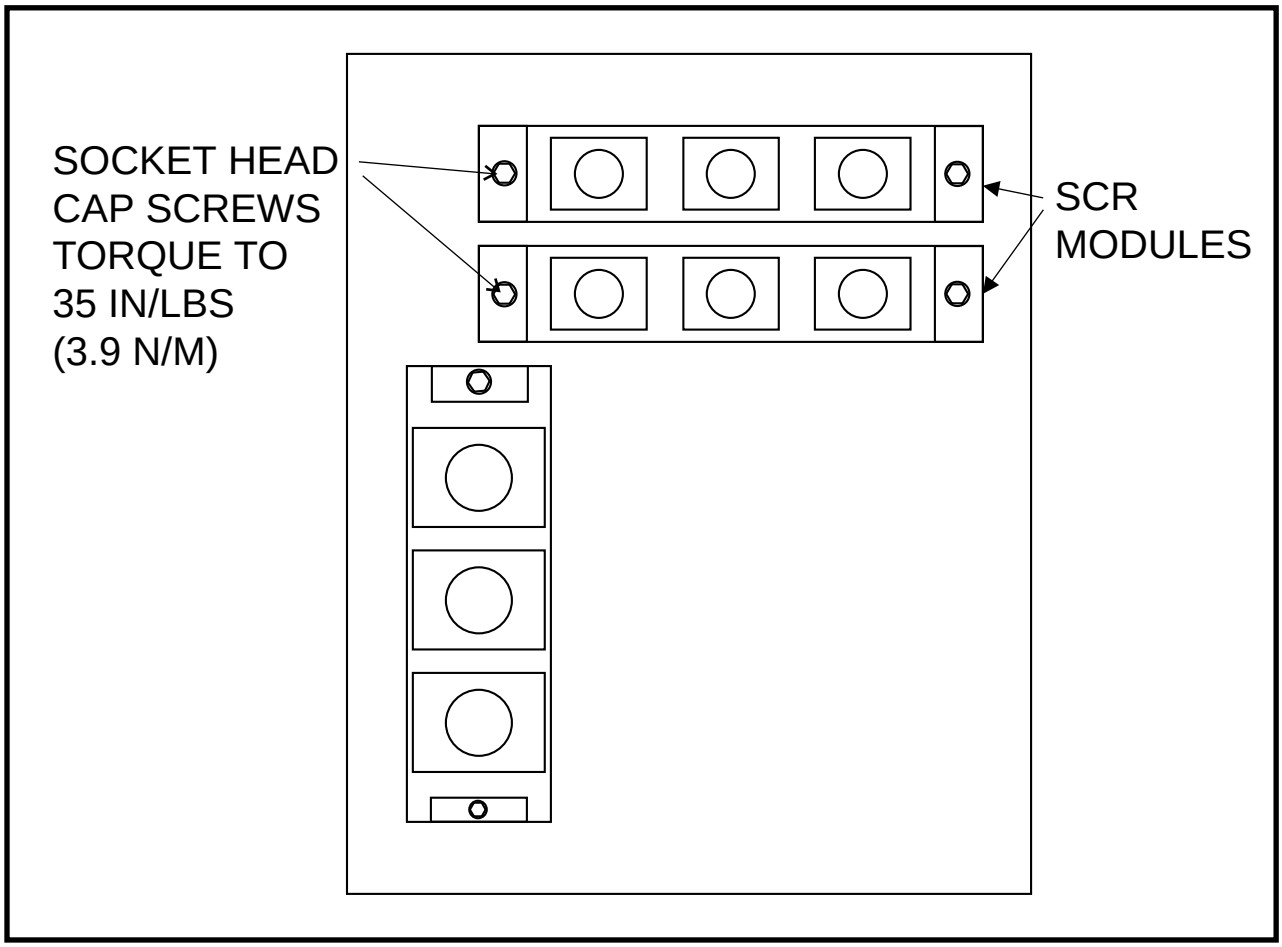

FIGURE F.16-SCR Module Location with Power Board Removed

REMOVAL/REPLACEMENT PROCEDURE

NOTE: See Figure F.16.

1. Disconnect input power to the machine.
2. Remove the Left Case Side assembly.
3. Perform the CAPACITOR DISCHARGE PROCEDURE.
4. Perform the POWER BOARD REMOVAL PROCEDURE.
5. Remove the two socket head cap screws of the top SCR module using a 4mm Allen-type wrench.
6. Remove the SCR module from the heat sink.
7. Remove the second SCR module following Steps # 5 and # 6.
8. Install the replacement SCR Modules. Procedure is the same for both SCR modules.
   a. Clean the heat sink surface with “000 fine steel wool.

SCR MODULE REMOVAL

b. Rinse the heat sink surface with alcohol or acetone.

c. Apply a .002” to .005” coat of joint compound evenly to the heat sink mounting surface and the SCR Module mounting surface. Use Lincoln Joint Compound T12837, or equivalent, such as Dow Corning #340.

d. Press the SCR Module onto the heat sink surface. Remove the module to make sure enough joint compound has been applied. When removed, both surfaces should have an even texture with no bare spots. If this even-textured look does not appear, re-apply the joint compound.

e. Mount the SCR Module on the heat sink with the 4mm socket head cap screws to 35 in/lbs (3.9 N.M.). Partially tighten each cap screw one at a time to avoid uneven torque on the base plate.

8. Install Power Board. See POWER BOARD REMOVAL/ REPLACEMENT PROCEDURE.

FAN BLADE AND FAN MOTOR REMOVAL/REPLACEMENT

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

⚠ CAUTION

If the Case Back Assembly is removed, a restraining strap must be used so the panel cannot be completely removed until the fan motor leads are disconnected. Failure to do this could cause damage to the fan motor or fan motor leads.

REMOVAL/REPLACEMENT DESCRIPTION

This procedure will assist you in removing or replacing the fan blade and fan motor in case of a faulty motor or broken fan blade.

MATERIALS NEEDED

Strap to keep Case Front Assembly from falling open
5/16” Nut driver/Screw driver
11/32” Open end wrench
Wire cutter
Pliers

FAN BLADE AND FAN MOTOR REMOVAL/REPLACEMENT

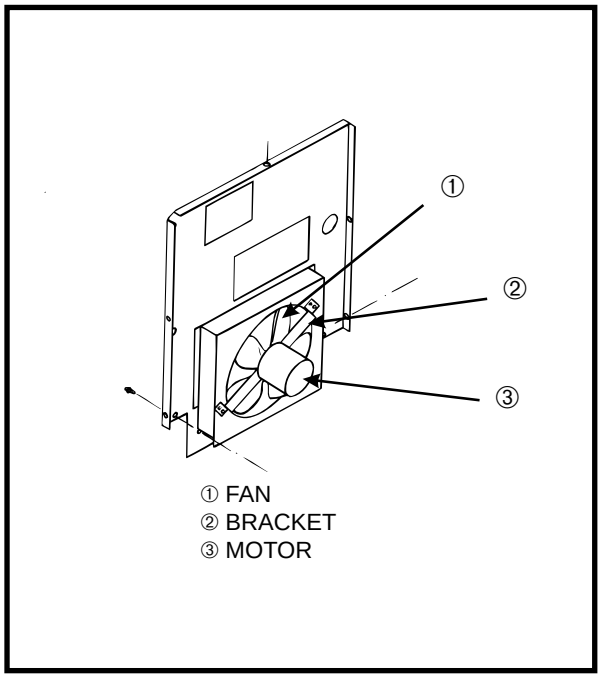

FIGURE F.17-Fan Blade & Fan Motor

REMOVAL/REPLACEMENT PROCEDURE

NOTE: See Figure F.17.

1. Disconnect input power to the machine.

2. Perform the CAPACITOR DISCHARGE PROCEDURE.

3. Disconnect the air line to the air regulator on the Case Back Assembly.

4. Remove the Case Back Assembly Access Door.

5. Disconnect the input power supply leads from the terminal block.

6. Remove the six screws from the Case Back Assembly. There are two screws at the top and four at the bottom. After the last screw is removed, be prepared to use a strap or other support to keep the Case Back Assembly from falling open. The motor leads could be pulled out of their connectors if this should happen.

7. Unscrew the brass air line connector from the male elbow using pliers or channel locks.

8. Remove the brass air line connector and companion nylon compression fitting.

FAN BLADE AND FAN MOTOR REMOVAL/REPLACEMENT

9. Pull the rubber air line hose into the machine out of the rubber grommet. Be sure to keep the Case Back Assembly supported. Allow it to lean out away from the machine at about a 45^0 angle so you have plenty of room to work on the fan blade and fan motor.

10. Remove the fan blade. Note fanblade position on motor shaft for reference when replacing fan.

    a. Loosen the fan blade clamp using a slot head screwdriver or 5/16" nut driver. Do not completely unscrew the clamp.

    b. Slide the fan blade and clamp off the motor shaft.

NOTE: See Step 13 when reinstalling the fan.

11. Remove the fan motor.

    a. Loosen and remove the two nuts, flat washers, and lock washers from the motor mounting bracket using an 11/32" open end wrench. When the motor is free from the mounting bracket, place it carefully on the bottom of the machine.

    b. Remove the Case Back Assembly.

    c. Cut the wire wraps bundling the motor leads.

    d. Cut the motor leads or remove the wire connectors to remove the motor.

12. Install replacement motor in reverse order of removal.

13. Install fan blade. When installing the fan blade, be sure the clamp is placed on the motor side of the shaft.

    a. Slide the fan .25" past the end of the shaft and tighten the clamp.

    b. Spin the fan to be sure it is free to rotate.

14. Reassemble the remaining components in reverse order of removal.

TORCH HEAD REMOVAL/REPLACEMENT

⚠ WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment could result in danger to the technician or the machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric service department for technical troubleshooting assistance before you proceed.
Call (216) 383-2531 or (800) 833-9353 (WELD).

REMOVAL/REPLACEMENT DESCRIPTION

This procedure will assist you in the replacing torch head components that need to be repaired because of a safety, pilot, or trigger circuit problem.

MATERIALS NEEDED

Phillips head screw driver
13mm wrench supplied with the machine.

TORCH HEAD REMOVAL/REPLACEMENT

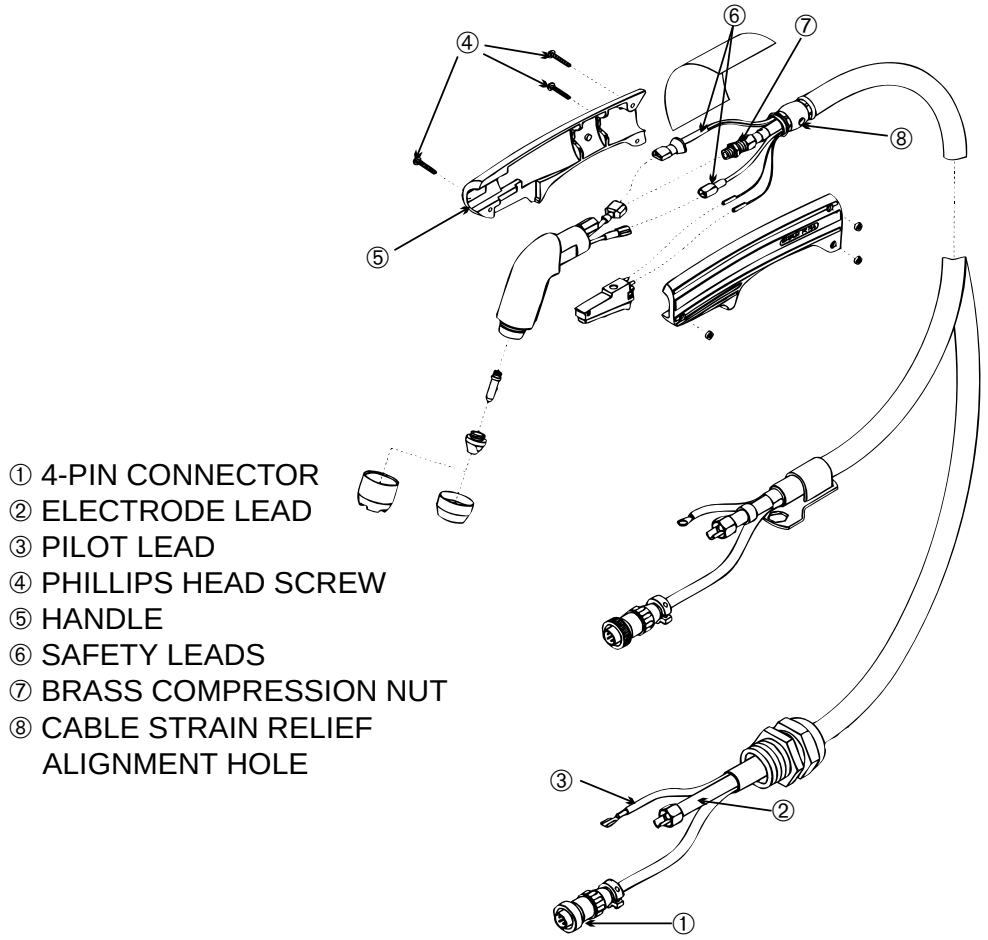

FIGURE F.18-Torch Head Removal/Replacement

REMOVAL/REPLACEMENT PROCEDURE

NOTE: See Figure F.18.

1. Disconnect input power to the machine.

2. Perform the CAPACITOR DISCHARGE PROCEDURE.

3. Disconnect and remove the torch cable assembly from the bulkhead compartment.

   a. Locate the torch cable access door on the Right Case Side Assembly of the machine.

   b. Remove the one sheet metal screw on the left-hand side of the access door and swing open the door.

   c. Test for a voltage across the stud marked WORK and the bulkhead connector (brass fitting). NO voltage should be present. If a voltage is present, STOP. **Perform Capacitor Discharge Test again.** If no voltage is present, continue test procedure.

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TORCH HEAD REMOVAL/REPLACEMENT

d. Disconnect the trigger lead 4-pin connector by unscrewing it.

e. Disconnect the electrode lead using a 9/16" open-end wrench to remove the brass adaptor fitting attached to the bulkhead connector.

f. Disconnect the pilot lead by removing the wing nut marked PILOT. Remove only the pilot lead. Do not remove any of the leads below the brass nut.

g. Detach the strain relief clamp wrapped around the trigger lead, electrode lead, and pilot lead from the bolt to which the strain relief clamp is attached. Do not remove the strain relief clamp from around the three leads.

h. Pull the trigger lead, electrode lead, and pilot lead bundled in the strain relief clamp out of the machine through the rubber boot.

4. Move the torch cable assembly to a convenient work area.

5. Remove the three Phillips head screws holding the torch handle together.

6. Unplug the red and white safety leads in the torch head.

7. Remove the tape and insulation carefully. Save the tape and insulation to re-apply during assembly. The insulation is extremely important because of the high voltages present in the torch head during operation.

8. Loosen and remove the brass compression nut closest to the torch head. Use fi" (13mm) wrench to loosen the brass compression nut. Support the brass nipple while turning the nut.

9. Install replacement torch head in reverse order of removal.

   a. Tighten the brass compression nut to 75 in/lbs.

   b. Re-apply the insulation and tape the outer seams of the insulation.

   c. Reconnect the red and white safety circuit leads.

   d. Insert the trigger and cable assembly into the torch handle making sure that the hole on each side of the cable strain relief lines up with the tabs in the torch handle sides.

   e. Replace the three Phillips screws.

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Return to Section TOC
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Return to Section TOC
Return to Master TOC

RETEST AFTER REPAIR

Should a machine under test be rejected for any reason requiring the removal of any mechanical part that could affect the machine's electrical characteristics, or if any electrical components are repaired or replaced, the machine must be retested.

INPUT IDLE AMPS

INPUT VOLTS / HERTZ	MAXIMUM IDLE AMPS
208 / 60	4.4
230 / 60	4.0
460 / 60	2.0
575 / 60	1.6

MAXIMUM ACCEPTABLE OUTPUT VOLTAGE - AT MINIMUM OUTPUT SETTING

Output Control at Minimum	26 Amps @ 43VDC

MINIMUM ACCEPTABLE OUTPUT VOLTAGE - AT MAXIMUM OUTPUT SETTINGS

Output Control at Maximum	60 Amps @ 90VDC

RECOMMENDED METERS FOR MACHINE OUTPUT TESTS

VOLTMETER: Analog type meter

NOTES

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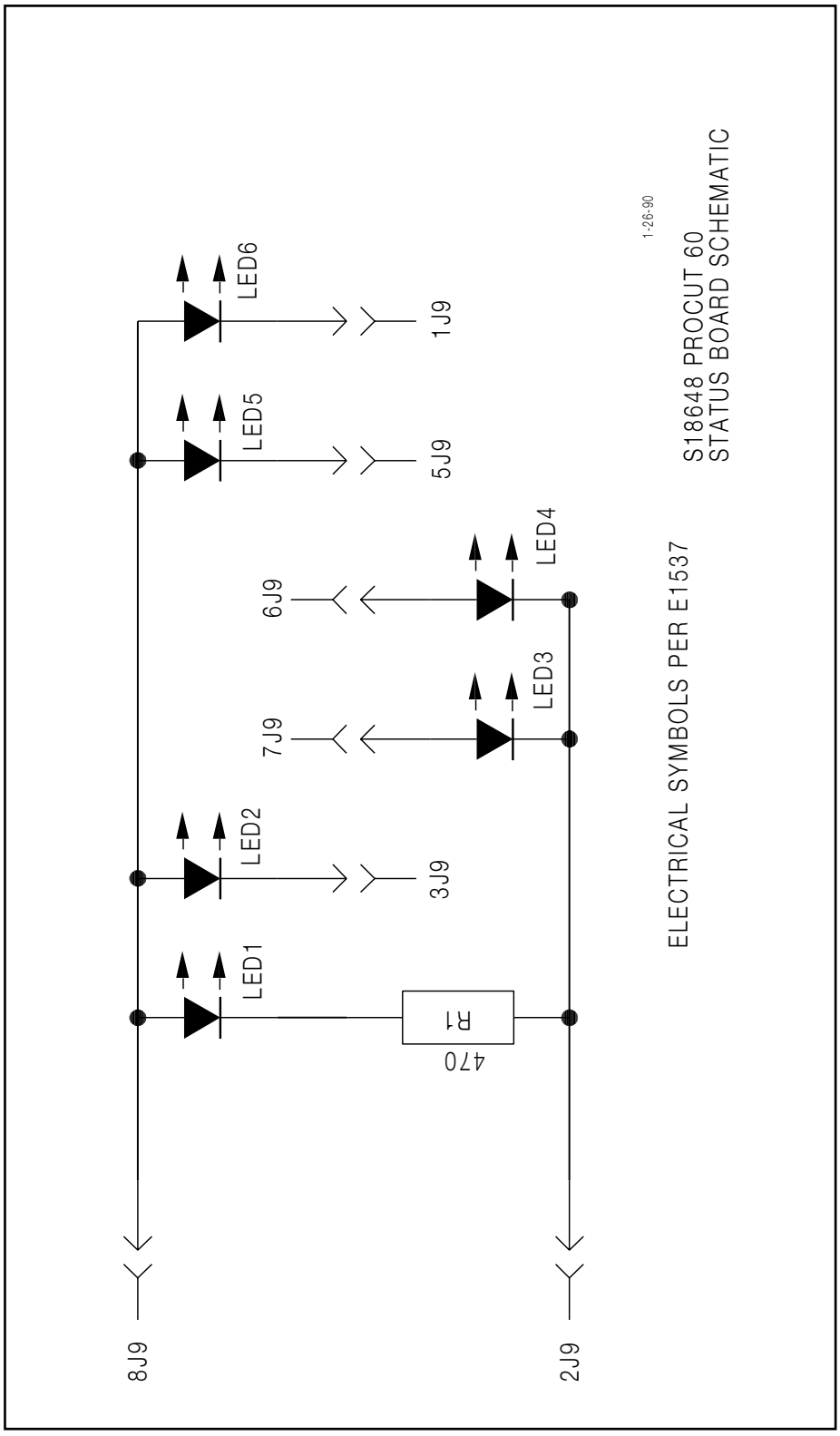
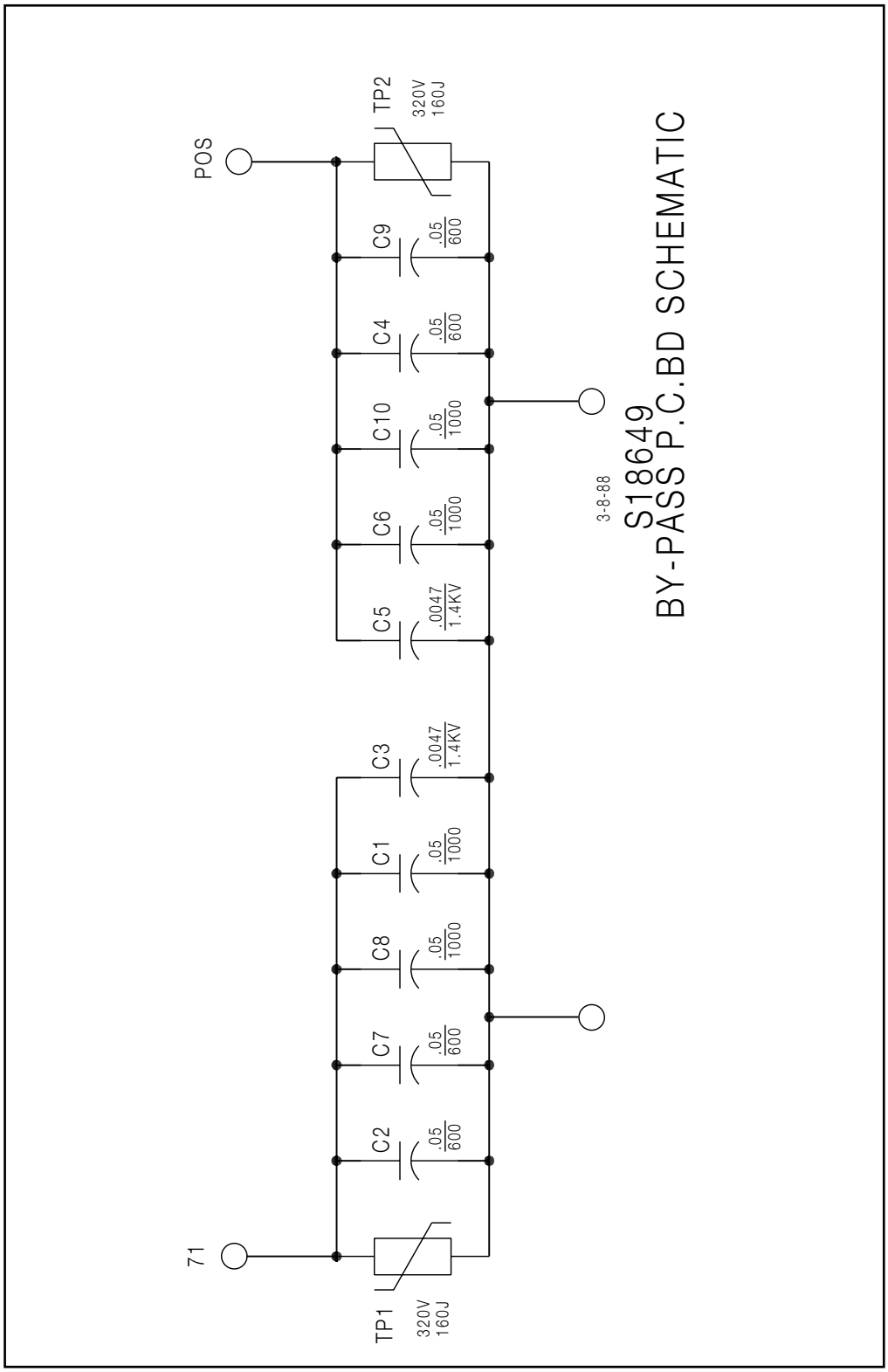
- ELECTRICAL DIAGRAMS -

STATUS BOARD SCHEMATIC DIAGRAM



NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. Individual Printed Circuit Board Components are not available from Lincoln Electric. This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

BYPASS BOARD SCHEMATIC DIAGRAM (M15603)



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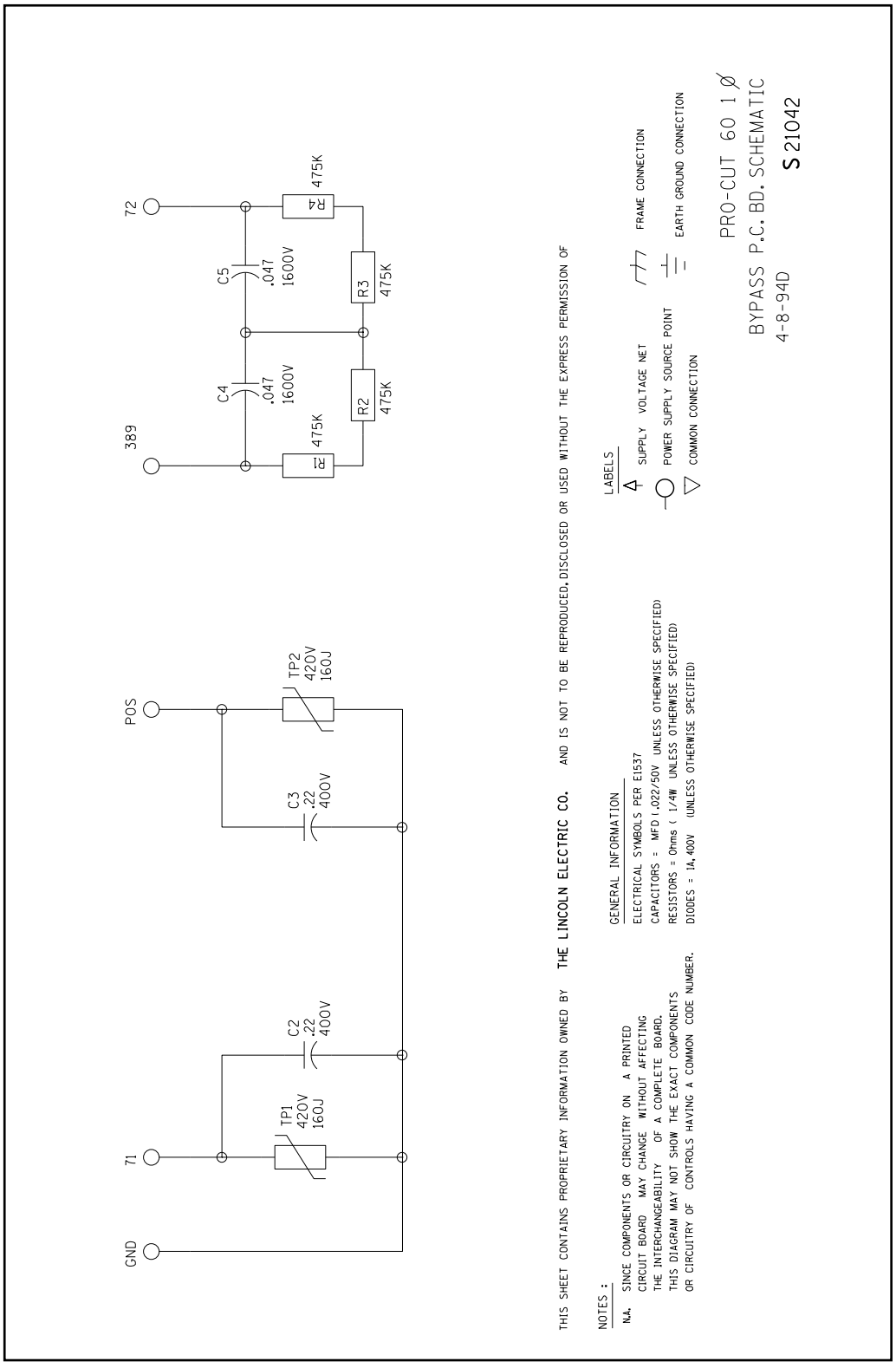
BYPASS BOARD SCHEMATIC DIAGRAM (M17322)



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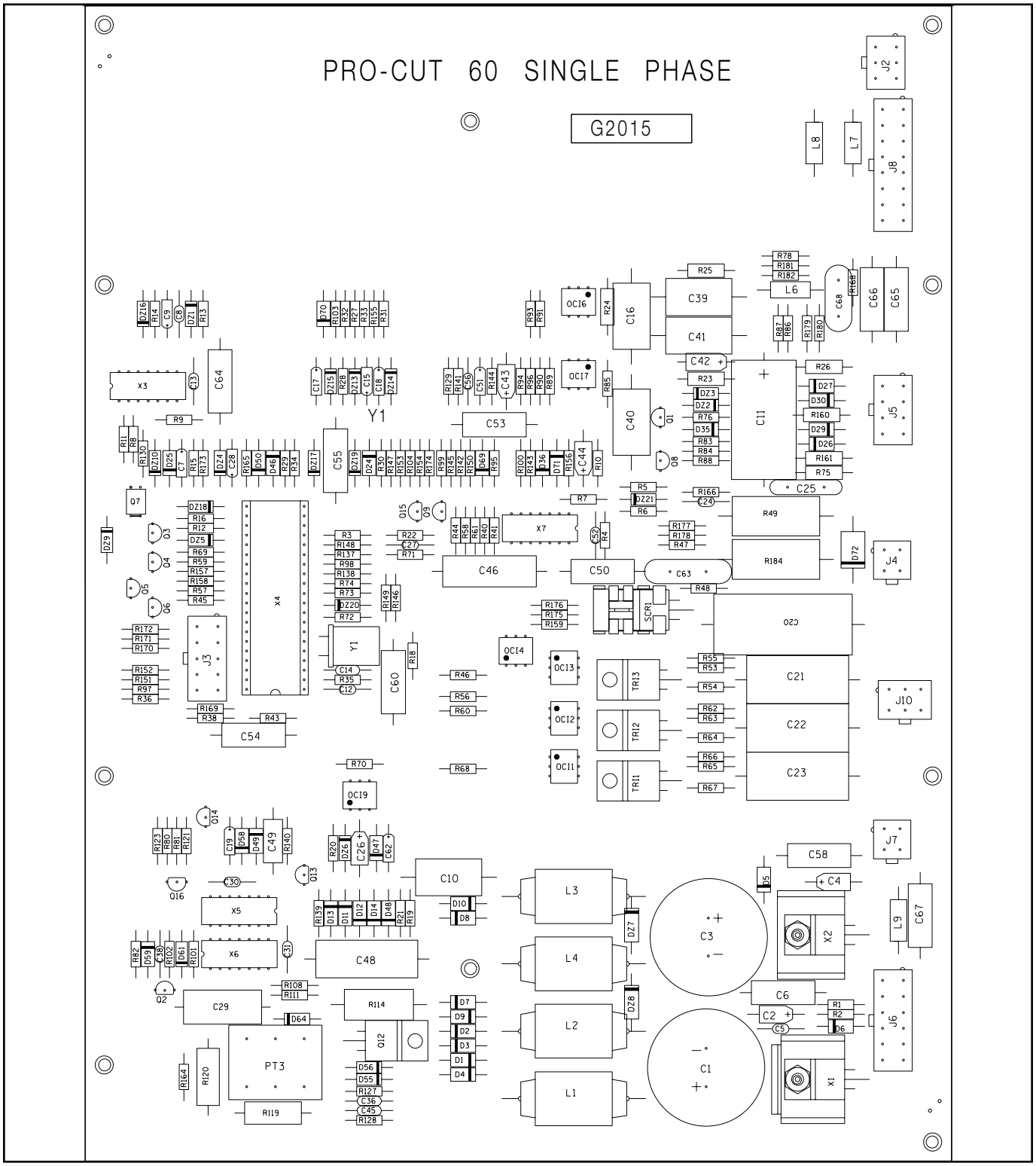
CONTROL BOARD



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CONTROL BOARD

Item	Identification
X4	IC,NMOS,MCU,68705R3CS
X5	IC-CMOS,GATE,NAND,2-INPUT,QUAD,4011
X6	IC-CMOS,INVERTER,SCHMITT,HEX,4584
C14	CAPACITOR-CEMO,22P,100V,5%
C36,C45	CAPACITOR-CEMO,100P,100V,5%
C5,C8,C12,C13,C27,C30,C31 C38,C52,C56	CAPACITOR-CEMO,.022,50V,20%
J4,J7	CONNECTOR,MOLEX,MINI,PCB,4-PIN
J2,J10	CONNECTOR,MOLEX,MINI,PCB,6-PIN
J5	CONNECTOR,MOLEX,MINI,PCB,8-PIN
C11	CAPACITOR 150uF, 50V, +150% -10%
D1,D2,D3,D4,D5,D6,D7,D8,D9 D10,D11,D12,D13,D14,D24 D25,D35,D36,D46,D47,D48 D49,D50,D58,D59,D69,D70 D71 *	DIODE-AXLDS,1A,400V
D26,D27,D29,D30	DIODE-AXLDS,1A,1000V
L6	CHOKE-5.6MH,10%,28MA,MOLDED
L1,L2,L3,L4	CHOKE-5.0MH,5%,160MA,CONFORMAL,SLV
PT3	TRANSFORMER-PULSE,3-WINDING,1:1:1
C2,C4,C26,C43,C44	CAPACITOR-TAEL,4.7,35V,10%
C42	CAPACITOR-TAEL,2.7,50V,10%
C6,C50,C53,C54,C55,C58,C60 C64,C65,C66,C67	CAPACITOR,PCF, 0.027,50V,20%
C1,C3	CAPACITOR-ALEL,3300,50V,+30/-10%
C10,C16,C39,C40,C41	CAPACITOR,PEMF, 0.33,200V,10%
OCI1,OCI2,OCI3	OPTOCOUPLER-TRIAC DRIVER,ZVC,3043
TRI1,TRI2,TRI3	TRIAC, T220, 6A, 400V
J3	CONNECTOR,MOLEX,MINI,PCB,10-PIN
J6	CONNECTOR,MOLEX,MINI,PCB,12-PIN
J8	CONNECTOR,MOLEX,MINI,PCB,16-PIN
C46	CAPACITOR-PEF,0.1,100V,10%
C48	CAPACITOR-PEF,0.22,100V,10%
C29	CAPACITOR-PEF,.047,200V,10%
C25	CAPACITOR-CD,.02,600V,+80/-20%
C63	CAPACITOR-CD,.05,600V,+80/-20%
C21,C22,C23	CAPACITOR-PEF,0.1,400V,10%
DZ8	ZENER DIODE-5W,15V,5%,1N5352B
DZ3,DZ9,DZ10	ZENER DIODE-1W,15V,5%,1N4744A
DZ7	ZENER DIODE-5W,17V,5%,1N5354B
Q1,Q3,Q4,Q5,Q6,Q8,Q9,Q13 N,T226,0.5A,40V,2N4401 Q14,Q16	TRANSISTOR
Q2,Q15	TRANSISTOR-P,T226,0.5A,40V,2N4403
D55,D56,D61,D64	DIODE-AXLDS,1A,400V,FR,1N4936
R119,R120	RESISTOR-CC,1W,3.3,5%
R114	RESISTOR-CC,2W,15,5%
R160,R161	RESISTOR-CC,1/2W,100,5%
R23,R24	RESISTOR-CC,1/2W,150,5%
R25,R26,R75	RESISTOR-CC,1/2W,330,5%
C49	CAPACITOR-PEMF,.047,100V,10%
Q12	TRANSISTOR-ND,T220,5A,100V,TIP122
R27,R31,R33,R85,R102,R127 R128,R164	RESISTOR-MF,1/4W,100,1%
R12,R18,R19,R38,R48,R53 R56,R60,R63,R65,R68,R72 R73,R74,R80,R121,R159,R169 R175,R176	RESISTOR-MF,1/4W,1.00K,1%
R3,R8,R14,R20,R21,R35,R36 R40,R41,R43,R44,R81,R82 R94,R95,R96,R97,R98,R103 R104,R111,R123,R130,R150 R151,R152,R165,R170,R171 R172,R173	RESISTOR-MF,1/4W,10.0K,1%
R140,R142,R143	RESISTOR-MF,1/4W,100K,1%
R144	RESISTOR-MF,1/4W,1.00M,%
R76	RESISTOR-MF,1/4W,10.0,1%
R46,R90,R93	RESISTOR-MF,1/4W,1.50K,1%
R55,R62,R66	RESISTOR-MF,1/4W,200,1%
R30,R45,R57,R59,R69,R83 R157,R158,R174	RESISTOR-MF,1/4W,2.21K,1%
R101,R137	RESISTOR-MF,1/4W,22.1K,1%
R70,R89,R91,R100,R139,R156	RESISTOR-MF,1/4W,221K,1%
R2	RESISTOR-MF,1/4W,267,1%
R1,R54,R64,R67	RESISTOR-MF,1/4W,26.7,1%
R71,R148,R149	RESISTOR-MF,1/4W,3.01K,1%
R32	RESISTOR-MF,1/4W,332,1%
R47,R129,R168,R177,R178	RESISTOR-MF,1/4W,3.32K,1%
R86,R87,R145,R179,R180	RESISTOR-MF,1/4W,33.2K,1%
R28,R29,R34,R84,R99,R108 R153,R154,R155	RESISTOR-MF,1/4W,475,1%
R16	RESISTOR-MF,1/4W,4.75K,1%
R22,R58,R138,R146,R147	RESISTOR-MF,1/4W,5.11K,1%
R15	RESISTOR-MF,1/4W,5.62K,1%
R9	RESISTOR-MF,1/4W,681,1%
R5,R6,R10,R61,R141	RESISTOR-MF,1/4W,6.81K,1%
R4,R7,R11	RESISTOR-MF,1/4W,68.1K,1%
R166	RESISTOR-MF,1/4W,68.1,1%
X3,X7	IC-OP-AMP,QUAD,GEN-PURPOSE,224N
OCI6,OCI7,OCI9	OPTOCOUPLER-PHOTO-Q,70V,CNY17-3
DZ1	ZENER DIODE-1W,10V,5%,1N4740A
DZ6	ZENER DIODE-1W,6.2V,5%,1N4735A
DZ2,DZ4,DZ5,DZ13,DZ14,DZ15 DZ17,DZ18,DZ19,DZ20,DZ21	ZENER DIODE-1W,5.1V,5%,1N4733A
Q7	TRANSISTOR-NMF,4PDIP,1A,100V,RFD110
C9,C15,C17,C18,C19,C28,C51 C62 *	CAPACITOR-TAEL,1.0,50V,10%
C24	CAPACITOR-CEMO,4700P,50V,10%
L7,L8,L9	CHOKE-330UH,10%,110MA,MOLDED
C68	CAPACITOR-CD,.0047,3000V,20%
DZ16	ZENER DIODE-1W,12V,5%,1N4742A
R13	RESISTOR-MF,1/4W,243,1%
R88	RESISTOR-MF,1/4W,8.25K,1%
Y1	CRYSTAL-QUARTZ,3.579545MHZ
OCI4	OPTOCOUPLER-TRIAC DRIVER,3023
C20	CAPACITOR-PEF,0.22,400V,10%
D72	DIODE-AXLDS,3A,600V,1N5406
R49,R184	RESISTOR, WW, 5W, 390, 5%
R78,R181,R182	RESISTOR, MF, 1/4W, 90.0K, 1%
SCR1	SCR-T220,25A,600V,2N6508
C7	CAPACITOR,CEMO,0.1,50V,10%
X1	IC-VOLT REG, FIXED,3-T,(+),1A,5V
X2	IC-VOLT REG, FIXED,3-T,(+),1A,15V

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. Individual Printed Circuit Board Components are not available from Lincoln Electric. This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

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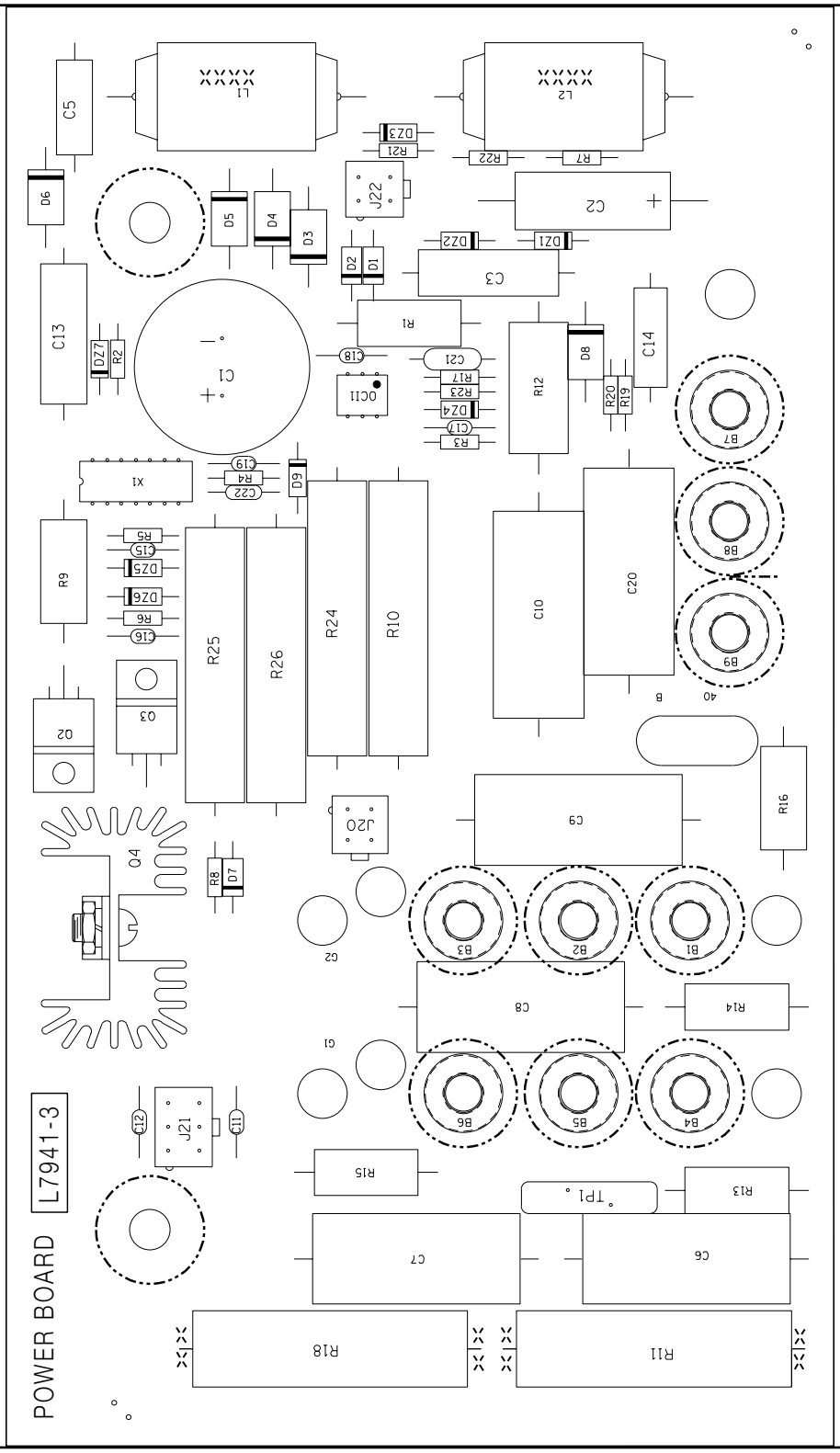
POWER BOARD



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POWER BOARD

Item	Identification
Q4	TRANSISTOR HEAT SINK ASBLY
C14	CAPACITOR-PEF,.0047,400V,10%
X1	IC-CMOS,INVERTER,SCHMITT,HEX,4584
C11,C12,C19	CAPACITOR-CEMO,.022,50V,20%
C15,C16,C17,C18	CAPACITOR-CEMO,820P,50V,5%
J20,J22	CONNECTOR,MOLEX,MINI,PCB,4-PIN
J21	CONNECTOR,MOLEX,MINI,PCB,6-PIN
D1,D2,D7	DIODE-AXLDS,1A,400V
R13,R14,R15,R16	RESISTOR-CC,2W,27,10%
R12	RESISTOR-WW,5W,40,5%,SQ
R11,R18	RESISTOR-WW,15W,2.5K,5%,SQ
C2	CAPACITOR,ALEL,50,50V,+75/-10%
C5	CAPACITOR,PCF,.27,50V,20%
C1	CAPACITOR-ALEL,3300,50V,+30/-10%
OCI1	OPTOCOUPLER-PHOTO-Q,70V,CNY17-3
C3,C13	CAPACITOR-PEF,0.1,100V,10%
C6,C7,C8,C9,C10,C20	CAPACITOR-PEF,0.22,400V,10%
L1,L2	CHOKE-RF,390UH,10%,1A,SLEEVED
DZ7	ZENER DIODE-1W,27V,10%,1N4750A
DZ4,DZ5,DZ6	ZENER DIODE-1W,15V,5%,1N4744A
DZ1,DZ2,DZ3	ZENER DIODE-1W,6.2V,5%,1N4735A
Q2,Q3	TRANSISTOR-NMF,T220,3.5A,60V,IRF513
D3,D4,D5,D6	DIODE-AXLDS,3A,600V,1N5406
R1,R9	RESISTOR-CC,2W,120,5%
TP1	MOV-320VRMS,160J,20MM
R4,R21,R23	RESISTOR-MF,1/4W,1.00K,1%
R3	RESISTOR-MF,1/4W,10.0K,1%
R22	RESISTOR-MF,1/4W,150,1%
R5,R6	RESISTOR-MF,1/4W,2.00K,1%
R19,R20	RESISTOR-MF,1/4W,20.0,1%
R8	RESISTOR-MF,1/4W,26.7,1%
R2,R7	RESISTOR-MF,1/4W,4.75K,1%
R17	RESISTOR-MF,1/4W,47.5K,1%
D9	DIODE-AXLDS,1A,400V,FR,1N4936
C22	CAPACITOR,CEMO,100P,100V,5%
C21	CAPACITOR,CEMO,4700P,50V,2%
D8	DIODE-AXLDS,3A,600V,FR,856
B1,B2,B3,B4,B5,B6,B7,B8,B9	EYELET
R10,R24,R25,R26	RESISTOR-WW,10W,7.5,5%

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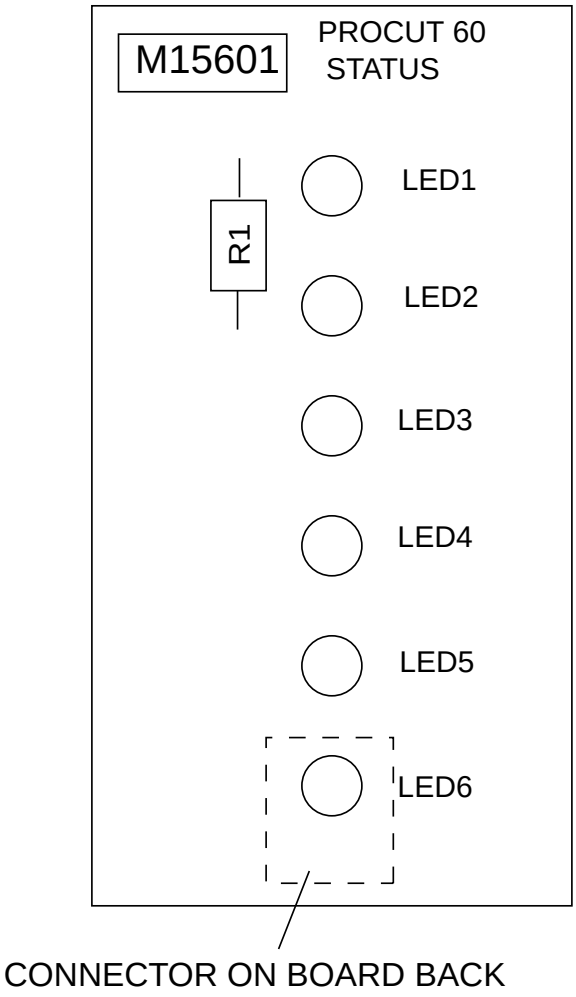
STATUS PC BOARD



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STATUS PC BOARD M15601

Item	Identification
R1	RESISTOR-MF, 1/2W, 470, 2%
LED1, LED3	LED-T-1 3/4, GREEN,HLMP-3502
LED2,LED5,LED6	LED-T-1 3/4, RED,HLMP-3003
LED4	LED-T-1 3/4, YELLOW,HLMP-3400
CONNECTOR	8 PIN MOLEX CONNECTOR

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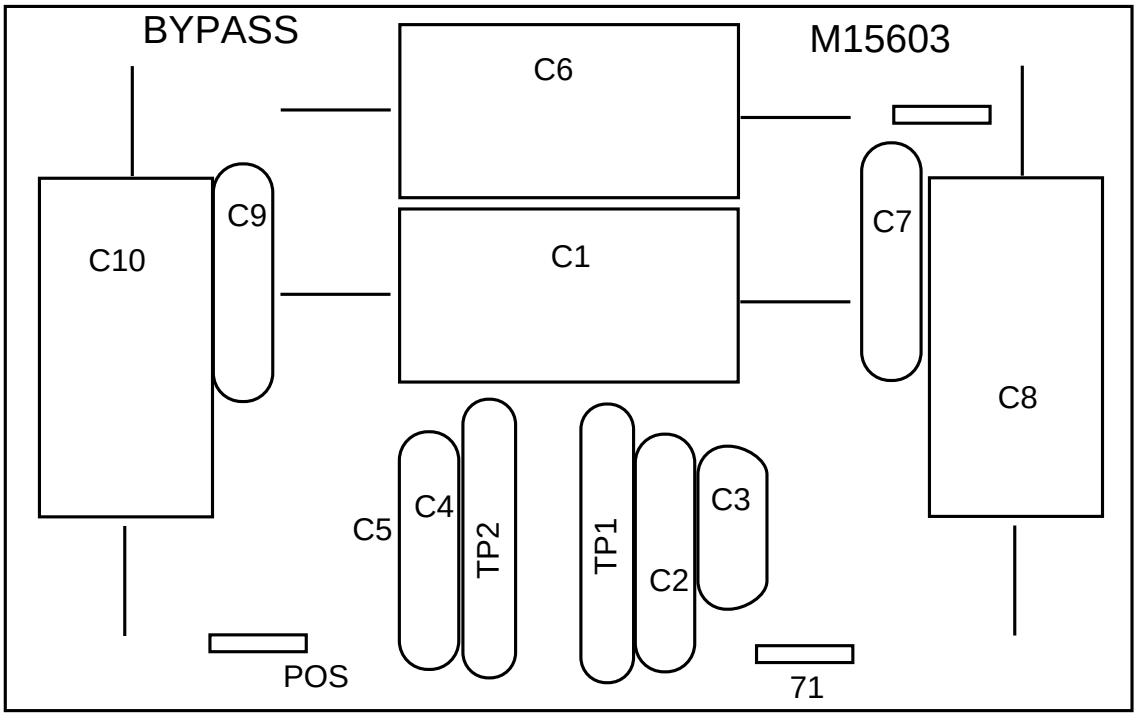
BYPASS PC BOARD (M15603)



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BYPASS PC BOARD (M15603)

Item	Identification
C1,C6,C8,C10	0.047uF, 1000V, 10%
C2,C4,C7,C9	0.05uF, 600V, +80% -20%
C3,C5	0.0047uF, 1400V
TP1,TP2	320V, 160J MOV

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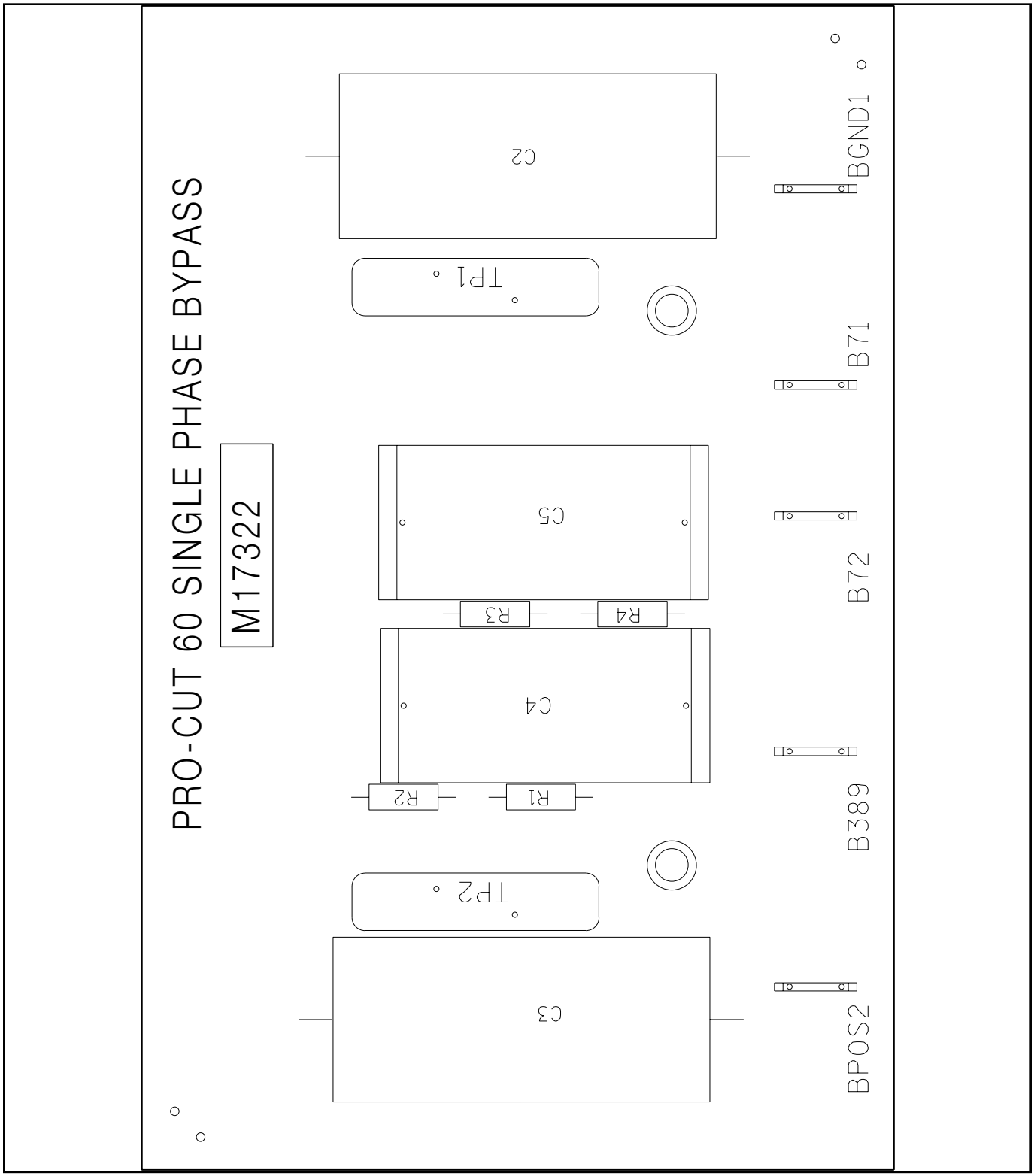
BYPASS PC BOARD (M17322)



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BYPASS PC BOARD (M17322)

Item	Identification
B71,B72,B389,BGND1,BPOS2	1/4" TAB TERMINAL
TP1,TP2	420V/160J
C2,C3	22MFD,400VDC CAPACITOR 10%
R1,R2,R3,R4	475K 1/4W 1%
C4,C5	047/1600 10% CAPACITOR

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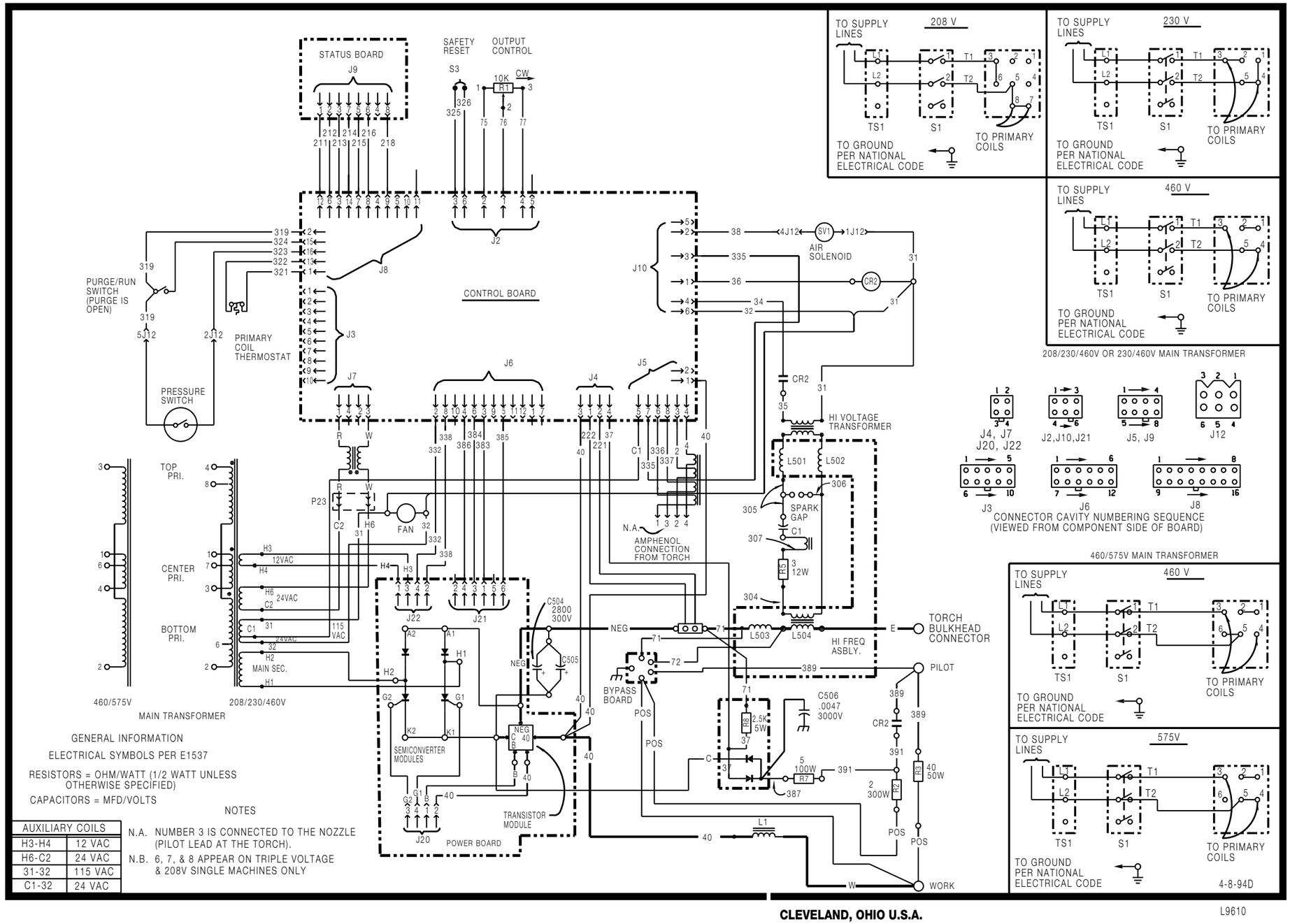
WIRING DIAGRAM FOR CODES 10112, 10118



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537

RESISTORS = OHM/WATT (1/2 WATT UNLESS OTHERWISE SPECIFIED)

CAPACITORS = MFD/VOLTS

NOTES

AUXILIARY COILS	
H3-H4	12 VAC
H6-C2	24 VAC
31-32	115 VAC
C1-32	24 VAC

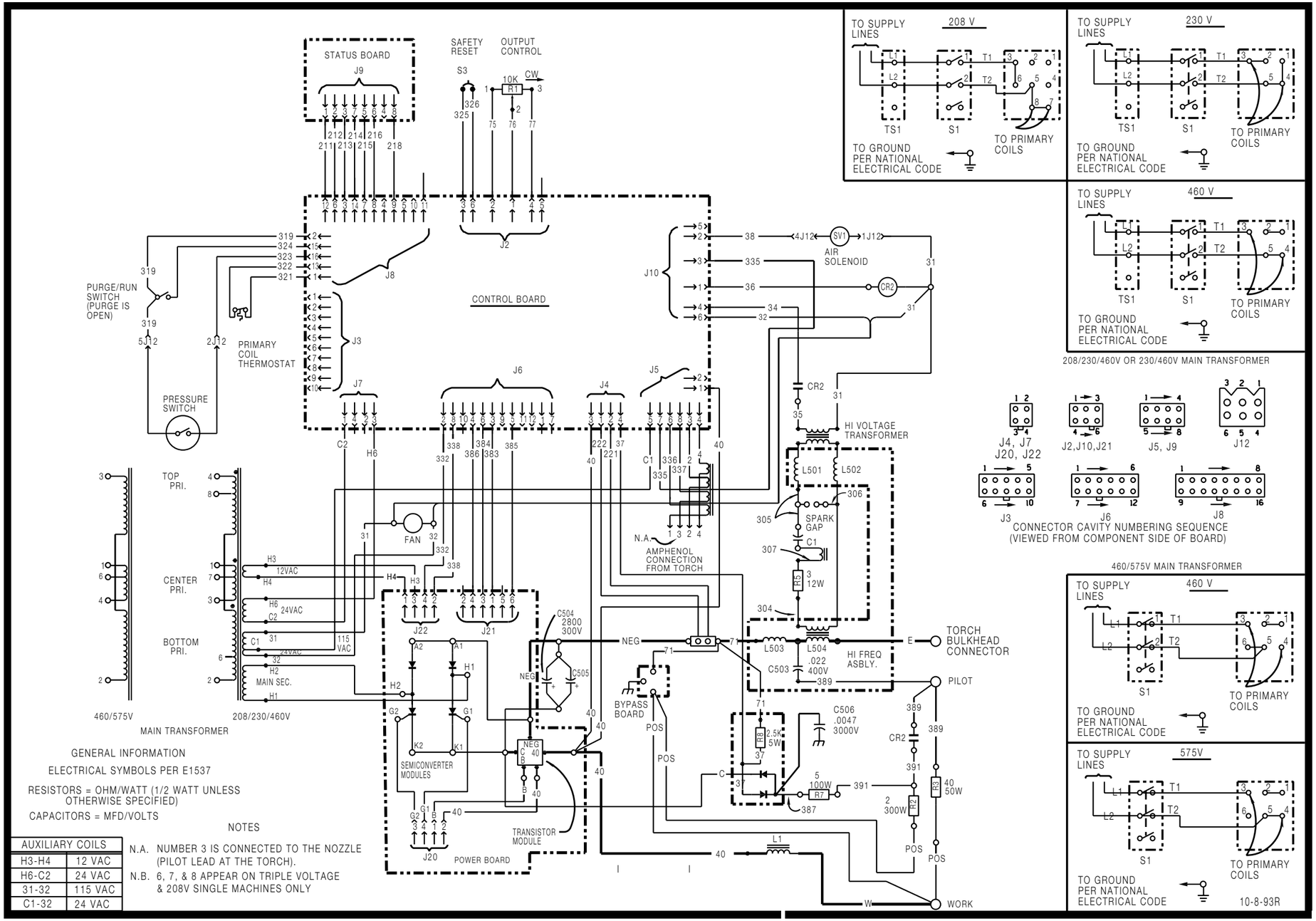
N.A. NUMBER 3 IS CONNECTED TO THE NOZZLE (PILOT LEAD AT THE TORCH).

N.B. 6, 7, & 8 APPEAR ON TRIPLE VOLTAGE & 208V SINGLE MACHINES ONLY

CLEVELAND, OHIO U.S.A.

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.

WIRING DIAGRAM FOR CODES 9819, 10096



CLEVELAND, OHIO U.S.A.

L7830

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.

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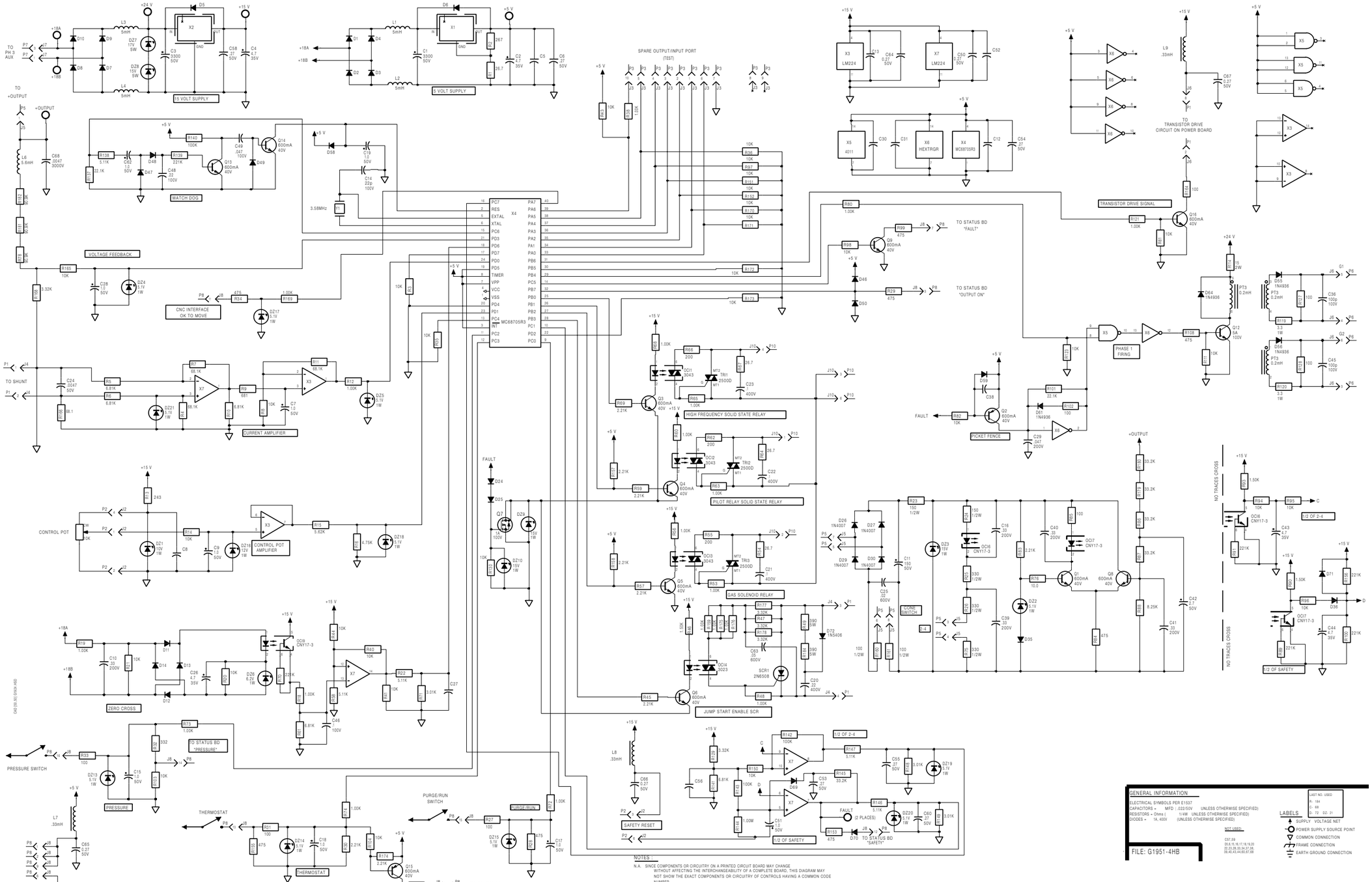
CONTROL BOARD SCHEMATIC DRAWING (G2015)



NOTES: -
N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD / .022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

NOT USED:
C67,68
R5,6,15,16,17,18,19,20
22,23,28,32,34,37,38,
39,42,43,44,80,87,88

LAST NO. USED
R= 184
C= 68
D= 72 Q2, Z1

LABELS
SUPPLY VOLTAGE NET
POWER SUPPLY SOURCE POINT
COMMON CONNECTION
FRAME CONNECTION
EARTH GROUND CONNECTION

FILE: G1951-4HB

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LINCOLN ELECTRIC

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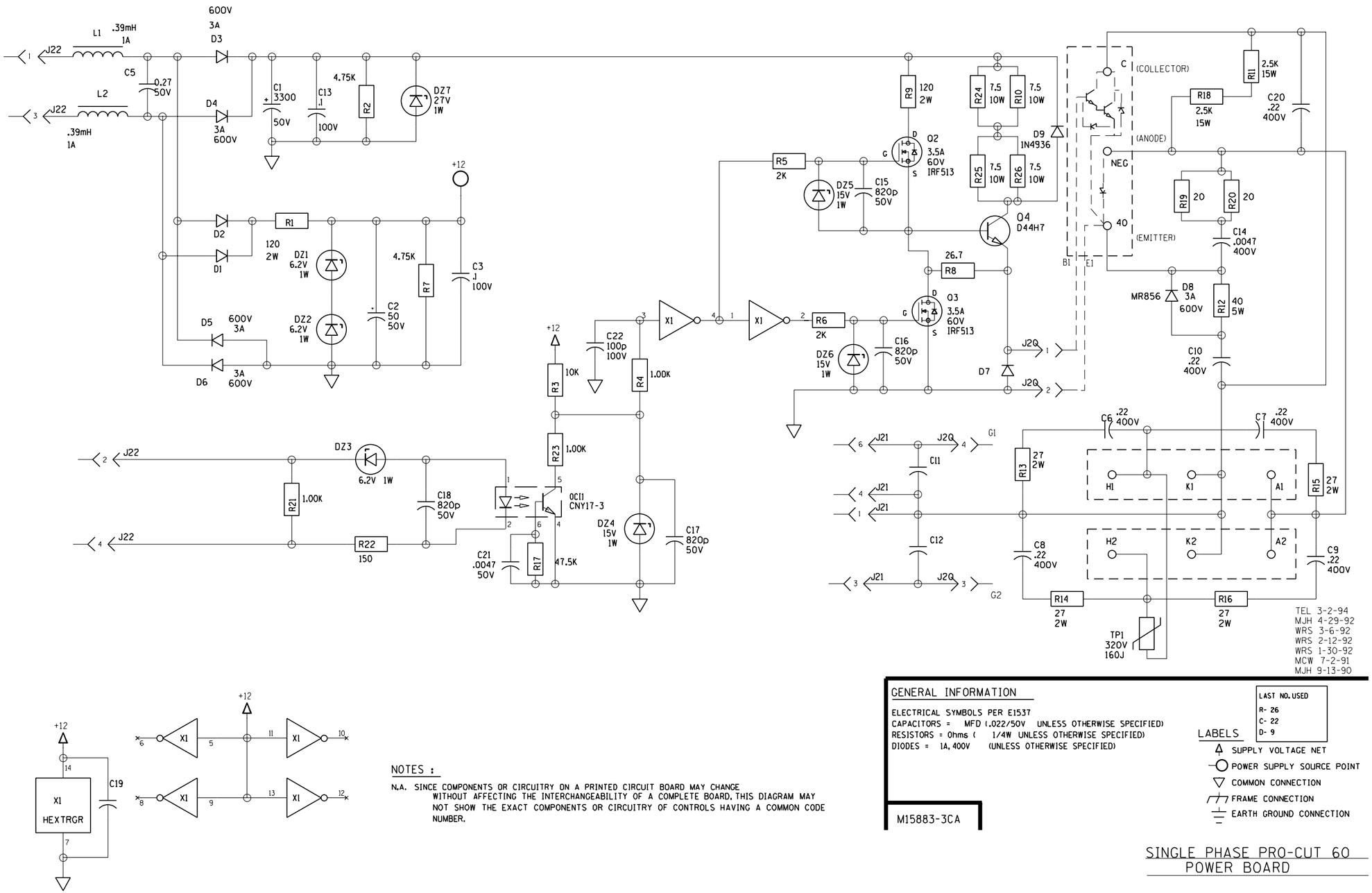
POWER BOARD SCHEMATIC DESIGN



TEL 3-2-94
MJH 4-29-92
WRS 3-6-92
WRS 2-12-92
WRS 1-30-92
MCW 7-2-91
MJH 9-13-90

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- 26
C- 22
D- 9

LABELS

- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

M15883-3CA

NOTES :

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SINGLE PHASE PRO-CUT 60
POWER BOARD

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SVM ERROR REPORTING FORM

We need to know if there are errors in our manuals. We also value any suggestions as to additional tests or procedures that would make this SVM a better tool for you.

If you discover new or different “Problems or Symptoms” that are not covered in the three column troubleshooting chart, please share this information with us. Please include the machine’s code number and how the problem was resolved.

Thank You,
Technical Services Group
Lincoln Electric Co.
22801 ST. Clair Ave.
Cleveland, Ohio 44117-1199

FAX 216-481-2309

SVM Number _____

Page Number if necessary_____

Your Company_____

Your Name_____

Please give detailed description below:

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SD287 01/99

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