

RETURN TO MAIN INDEX

SVM102-A

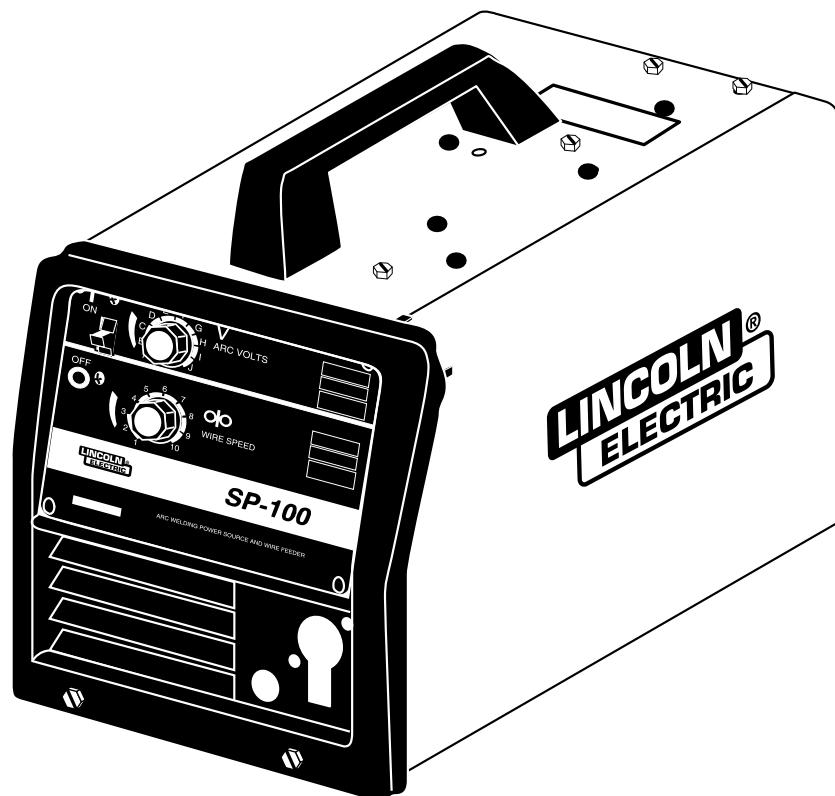
March, 1999

SP-100

For use with machines
having Code Numbers **9284-10050**

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



World's Leader in Welding and Cutting Products

LINCOLN[®]
ELECTRIC

Premier Manufacturer of Industrial Motors

• Sales and Service through Subsidiaries and Distributors Worldwide •

Cleveland, Ohio 44117-1199 U.S.A. TEL: 216.481.8100 FAX: 216.486.1751 WEB SITE: www.lincolnelectric.com



WARNING

ARC WELDING 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 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 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 cable and welding 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.



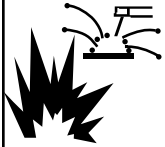
ARC RAYS can burn.

- 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 observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 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 may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, 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 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 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 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.



WELDING SPARKS can cause fire or explosion.

4.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire.

Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding 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, 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 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 out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

4.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding 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-1, "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.

Mar. '93



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 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 current creates EMF fields around welding cables and welding machines
- 8.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- 8.c. Exposure to EMF fields in welding may have other health effects which are now not known.
- 8.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding 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 power source.

Mar. '93

PRÉCAUTIONS DE SÛRETÉ

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

Sûreté Pour Soudage A L'Arc

1. Protégez-vous contre la secousse électrique:
 - a. Les circuits à l'électrode et à la pièce 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 vêtements mouillés. Porter des gants secs et sans trous pour isoler les mains.
 - b. Faire très attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher métallique ou des grilles métalliques, 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 de fonctionnement.
 - 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 précautions pour le porte-électrode s'appliquent 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 où 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 latéraux 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 un endroit isolé de la masse. Un court-circuit accidentel peut provoquer un échauffement et un risque d'incendie.
8. S'assurer que la masse est connectée le plus près 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 chaînes de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'échauffement des chaînes et des câbles jusqu'à ce qu'ils se rompent.
9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particulièrement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumées 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 phosgène (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 châssis du poste conformément au code de l'électricité et aux recommandations du fabricant. Le dispositif de montage ou la pièce 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 faire des travaux à l'intérieur de poste, la débrancher à l'interrupteur à la boîte de fusibles.
4. Garder tous les couvercles et dispositifs de sûreté à leur place.

MASTER TABLE OF CONTENTS FOR ALL SECTIONS

	Page
InstallationSection A	
Technical Specifications	A-1
Identify and Locate Components	A-2
Select Suitable Location	A-3
Output Connections	A-3
Input Connections.....	A-5
Code Requirements	A-6
OperationSection B	
Safety Precautions	B-1
General Description	B-2
Design Features and Advantages.....	B-2
Welding Capability	B-2
Limitations	B-2
Controls and Settings.....	B-2
Welding Operations	B-3
Overload Protection	B-6
AccessoriesSection C	
Accessories	C-1
Replacement Parts	C-1
MaintenanceSection D	
Safety Precautions	D-1
Items Requiring No Maintenance	D-1
Routine and Periodic Maintenance.....	D-1
Component Replacement Procedures	D-2
Location of Components.....	D-4
Theory of OperationSection E	
Input Line Voltage, Fan Motor and Main Transformer	E-1
Output Control, Rectification and Voltage Feedback.....	E-2
Trigger, Gas Solenoid and Wire Drive	E-3
SCR Operation	E-4
Thermal Protection	E-5
Troubleshooting and Repair.....Section F	
How To Use Troubleshooting Guide.....	F-1
PC Board Troubleshooting Procedures	F-2
Troubleshooting Guide.....	F-3
Oscilloscope Waveforms	F-9
Replacement Procedures	F-12
Retest After Repair	F-14
Electrical Diagrams.....Section G	
SP-100 Parts Manual	P-180

TABLE OF CONTENTS – INSTALLATION SECTION –

Section A

Installation	Section A
Technical Specifications	A-1
Input and Output Specifications	A-1
Cable and Fuse Sizes	A-1
Physical Dimensions	A-1
Identify and Locate Components	A-2
Select Suitable Location	A-3
Stacking	A-3
Tilting.....	A-3
Output Connections	A-3
Work Clamp Installation	A-3
Work Cable Installation	A-3
Gun Installation	A-4
Connecting Gun Cable to the SP-100	A-4
Gas Connection	A-4
Input Connections.....	A-5
Code Requirements For Input Connections.....	A-6
Requirements For Rated Output.....	A-6
Requirements For Maximum Output	A-6
Requirements For CSA Rated Output	A-6
Extension Cord Usage	A-6

[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

TECHNICAL SPECIFICATIONS – SP-100

INPUT – SINGLE PHASE ONLY

<u>Standard Voltage/Frequency</u>	<u>Input Current</u>
115V/60Hz	20 Amps - Rated Output
115V/60Hz	25 Amps - Maximum Output
115V/60Hz	12 Amps - CSA Rated output

RATED OUTPUT

<u>Duty Cycle</u>	<u>Amps</u>	<u>Volts at Rated Amperes</u>
20% Duty Cycle	90	18
30% Duty Cycle	100	17
20% Duty Cycle - CSA Rated Output	63	20

OUTPUT

<u>Welding Current Range (Continuous)</u>	<u>Maximum Open Circuit Voltage</u>	<u>Auxiliary Power</u>
Rated DC Output: 0 - 90 amps Maximum DC Output: 0 - 100 amps CSA Rated DC Output: 0 - 63 amps	28	N/A

RECOMMENDED INPUT CABLE AND FUSE SIZES

Output Mode	Input Voltage	Fuse or Breaker Size	Input Amps	Power Cord	Extension Cord
RATED	115V/60Hz	20 Amp	20	15 Amp, 125V, Three Prong Plug (NEMA Type 5-15P)	Three Conductor #14 AWG (2.1 mm ²) or Larger For lengths up to 25 Ft. (7.5 m) Three Conductor #12 AWG (3.3 mm ²) For lengths up to 50 Ft. (15 m)
MAXIMUM	115V/60Hz	25 Amp	25	25 Amp, 125V, Three Prong Plug (NEMA Type 5-20P)	
CSA	115V/60Hz	15 Amp	12	15 Amp, 125V, Three Prong Plug (NEMA Type 5-15P)	

PHYSICAL DIMENSIONS

<u>Height</u>	<u>Width</u>	<u>Depth</u>	<u>Weight</u>
12.0 in 305 mm	9.75 in 248 mm	16.5 in 419 mm	54 lbs 24.3 kg

Read entire installation section before starting installation.

SAFETY PRECAUTIONS

⚠ WARNING



ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this installation.
- Only personnel that have read and understood the SP-100 Operating Manual should install and operate this equipment.
- Machine must be plugged into a receptacle which is grounded per any national, local or other applicable electrical codes.
- The SP-100 power switch is to be in the OFF ("O") position when installing work cable and gun and when connecting power cord to input power.

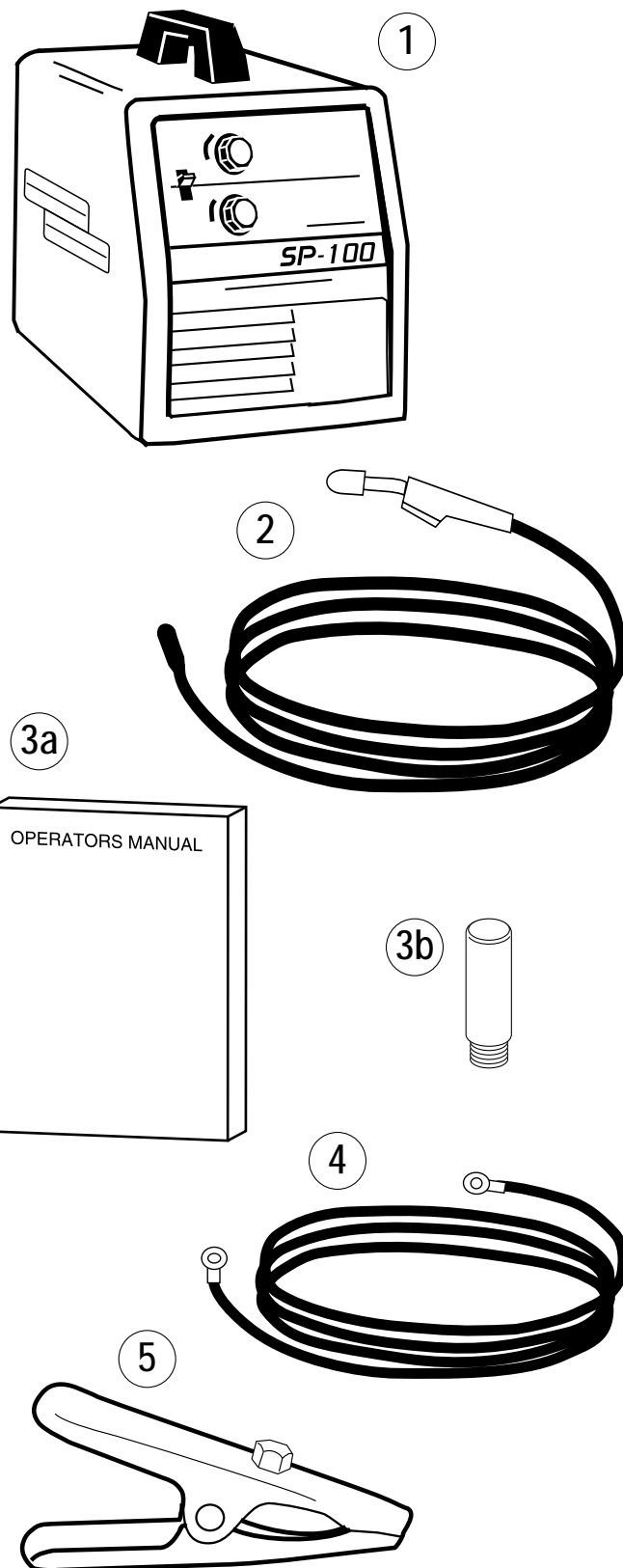
IDENTIFY AND LOCATE COMPONENTS

If you have not already done so, unpack the SP-100 from its carton and remove all packing material around the SP-100. Remove the following loose items from the carton (see Figure A.1):

1. SP-100
2. Gun and cable assembly⁽¹⁾
3. Literature envelope which contains:
 - a) This operating manual
 - b) A contact tip for .030" (0,8 mm) diameter wire.
4. 10 ft (3,0 m) work cable.
5. Work clamp.

⁽¹⁾ Gun is ready to feed .025" (0.6 mm) diameter wire (also .023 and .024 diameter wire).

FIGURE A.1



SELECT SUITABLE LOCATION

Locate the welder in a dry location where there is free circulation of clean air into the louvers in the back and out the front of the unit. A location that minimizes the amount of smoke and dirt drawn into the rear louvers reduces the chance of dirt accumulation that can block air passages and cause overheating.

STACKING

SP-100's cannot be stacked.

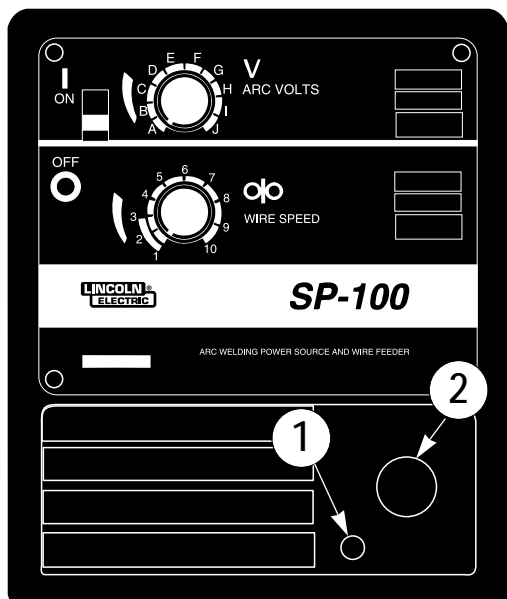
TILTING

Each machine must be placed on a secure, level surface, either directly or on a recommended undercarriage. The machine may topple over if this procedure is not followed.

OUTPUT CONNECTIONS

Refer to Figure A.2.

1. Work Cable Access Hole.
2. Gun Cable and Control Lead Access Hole.
3. Connector Block.
4. Gun Trigger Lead Connectors.
5. Positive (+) and negative (–) output terminals.

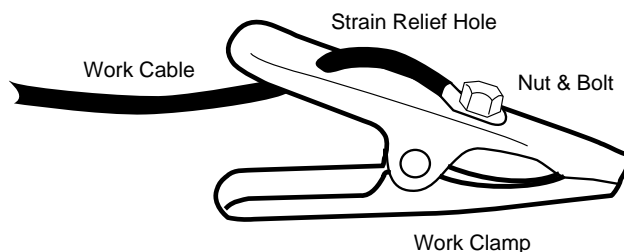


WORK CLAMP INSTALLATION

Attach the work clamp per the following:

1. Unplug the machine or turn the power switch to the "OFF" position.
2. Insert the work cable terminal lug with the larger hole through the strain relief hole in the work clamp as shown in Figure A-3.
3. Fasten securely with the bolt and nut provided.

FIGURE A.3

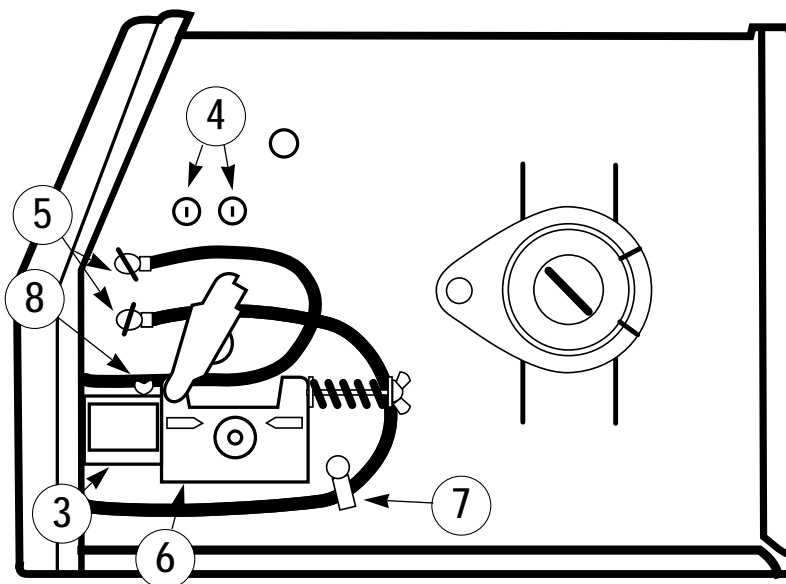


WORK CABLE INSTALLATION

Refer to Figure A.2.

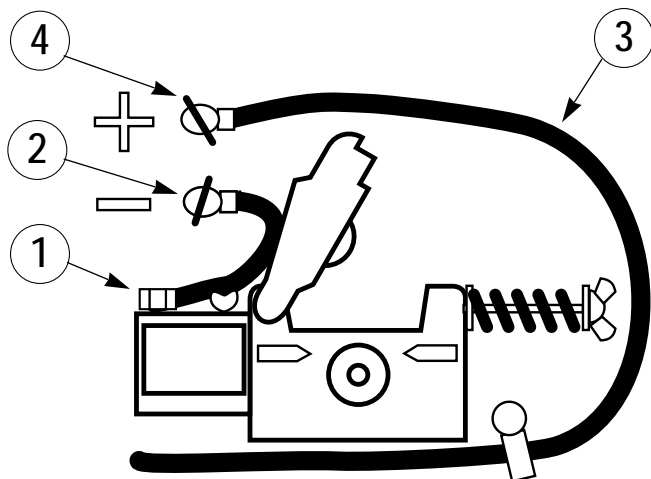
1. Open the wire feed section door on the right side of the SP-100.
2. Pass the end of the work cable that has the terminal lug with the smaller hole through the Work Cable Access Hole (1) in the case front.

FIGURE A.2



3. Route the cable under and around the back of the Wire Feed Gearbox (6).
4. **For GMAW Only:** Refer to Figure A.2. As delivered, the SP-100 is wired for positive polarity. This is the appropriate configuration for the Gas Metal Arc Welding (GMAW) process. To complete installation, use the provided wing nut to connect the work cable's terminal lug to the negative (–) output terminal (5) located above the Wire Feed Gearbox (6). Make sure that both wing nuts are tight.
5. **For Innershield Only:** Refer to Figure A.4. To wire for negative polarity, connect the short cable attached to the connector block (1) to the negative (–) output terminal (2) and the work cable (3) to the positive (+) terminal (4).

FIGURE A.4



GUN INSTALLATION

As shipped from the factory, the SP-100 gun is ready to feed 0.023 - 0.025" (0,6 mm) wire. If 0.030" (0,8 mm) wire is to be used install the 0.030" (0.8 mm) contact tip. Refer to the MAINTENANCE section for contact tip installation details.

CONNECTING GUN CABLE TO THE SP-100

1. Refer to Figure A.2. Unplug the machine or turn power switch to the off "O" position.
2. Pass the insulated terminals of the gun trigger control leads, one at a time, through the Gun Cable and Control Lead Access Slot (2) in the case front. The leads are to be routed under the Wire Feed Gearbox (6) and through the Cable Hanger (7) on the inner panel.

3. Insert the connector on the gun conductor cable into the Gun Cable Access Hole (2) in the SP-100 case front. Make sure the connector is all the way in the metal connector block to obtain proper gas flow. Rotate the connector so control leads are on the underside and tighten the Thumbscrew (8) in the connector block.
4. Connect the gun trigger control lead terminals to the two insulated 1/4" (6,4 mm) tab connector bushings located above the "Gun Trigger Connection" decal in the wire feed section (4). Either lead can go to either connector. Form the leads so that they are as close as possible to the inside panel.

CAUTION

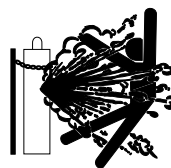
If the gun trigger switch being used is other than that supplied with the SP-100, the switch must be a normally open, momentary switch. The terminals of the switch must be insulated from the welding circuit. Malfunction of the SP-100 may result if this switch shorts to the SP-100 welding output circuit or is common to any electrical circuit other than the SP-100 trigger circuit.

GAS CONNECTION

Refer to Figure A.5

When using the GMAW process, a cylinder of carbon dioxide (CO₂) or argon-carbon dioxide mixed shielding gas, flow regulator, and an inlet gas hose must be obtained. For more information about selecting gas cylinders for use with the SP-100, refer to the ACCESSORIES section.

WARNING



CYLINDER may explode if damaged. Keep cylinder upright and chained to support

- Keep cylinder away from areas where it may be damaged.
- Never lift welder with cylinder attached.
- Never allow welding electrode to touch cylinder.
- Keep cylinder away from welding or other live electrical circuits.

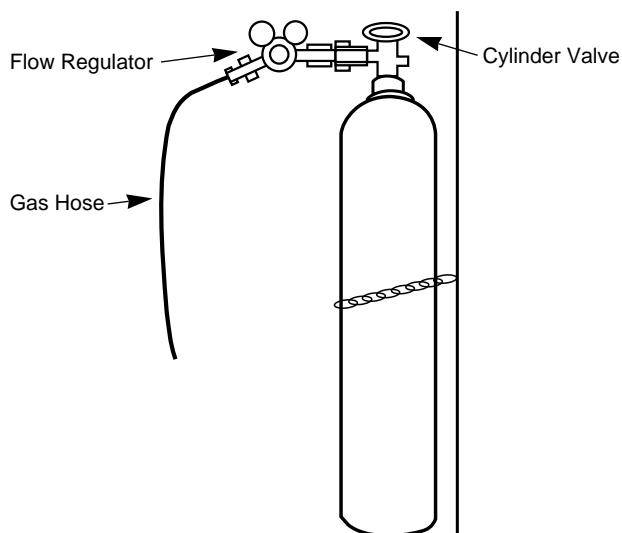
WARNING

BUILDUP OF SHIELDING GAS may harm health or kill.

- Shut off shielding gas supply when not in use.
- **SEE AMERICAN NATIONAL STANDARD Z-49.1, "SAFETY IN WELDING AND CUTTING" PUBLISHED BY THE AMERICAN WELDING SOCIETY.**

1. Chain the cylinder to a wall or other stationary support to prevent the cylinder from falling over. Insulate the cylinder from the work circuit and earth ground.

FIGURE A.5



2. With the cylinder securely installed, remove the cylinder cap. Stand to one side away from the outlet and open the cylinder valve very slightly for an instant. This blows away any dust or dirt which may have accumulated in the valve outlet.

WARNING

BE SURE TO KEEP YOUR FACE AWAY FROM THE VALVE OUTLET WHEN "CRACKING" THE VALVE. Never stand directly in front of or behind the flow regulator when opening the cylinder valve. Always stand to one side.

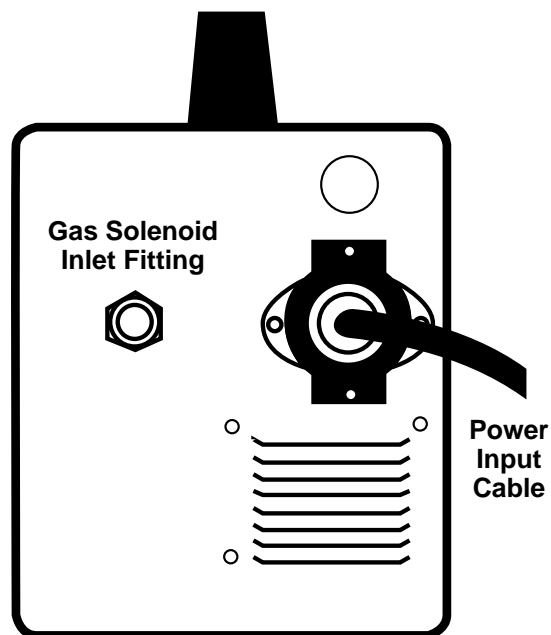
3. Attach the flow regulator to the cylinder valve and tighten the union nut securely with a wrench. The flow regulator for carbon dioxide **must** have a plastic washer seated in the fitting that attaches to the cylinder to prevent leakage.
4. Refer to Figure A.6. Attach one end of inlet gas hose to the outlet fitting of the flow regulator and tighten the union nut securely with a wrench. Connect the other end to the SP-100 Gas Solenoid Inlet Fitting (5/8-18 female threads — for CGA — 032 fitting). Make certain the gas hose is not kinked or twisted.

INPUT CONNECTIONS

Refer to Figure A.6.

The SP-100 has two input connections, the power input cable, and the Gas Solenoid Inlet Fitting. Both connections are located on the rear of the machine.

FIGURE A.6



CODE REQUIREMENTS FOR INPUT CONNECTIONS

WARNING

This welding machine must be connected to power source in accordance with applicable electrical codes.

The United States National Electrical Code (Article 630-B, 1990 Edition) provides standards for amperage handling capability of supply conductors based on duty cycle of the welding source.

If there is any question about the installation meeting applicable electrical code requirements, consult a qualified electrician.

CAUTION

Do not connect the SP-100 to an input power supply with a rated voltage that is greater than 125 volts.

Do not remove the power cord ground prong.

REQUIREMENTS FOR RATED OUTPUT

A power cord with a 15 amp, 125 volt, three prong plug (NEMA Type 5-15P) is factory installed on the SP-100. Connect this plug to a mating grounded receptacle which is connected to a 20 amp branch circuit with a nominal voltage rating of 115 to 125 volts, 60 Hertz, AC only.

The rated output with this installation is 90 amps, 18 Volts, 20% duty cycle (2 minutes of every 10 minutes used for welding).

REQUIREMENTS FOR MAXIMUM OUTPUT

An optional power cord (K467 Input Line Cord) is available to permit the SP-100 to be connected to a 25 amp branch circuit with a nominal voltage rating of 115 to 125 volts, 60 Hertz, AC only. With this installation the SP-100 can be used at an output of 100 amps, 17 volts, 30% duty cycle.

Refer to the ACCESSORIES section for specific information about the K467 Input Line Cord

REQUIREMENTS FOR CSA RATED OUTPUT

A line cord with a 15 amp, 125 volt, three-prong plug (NEMA Type 5-15P) is factory installed. Connect this plug to a mating grounded receptacle which is connected to a 15 amp branch circuit with a nominal voltage rating of 115 volts to 125 volts, 60 hertz, AC only. With this installation, the SP-100 can be used at an output of 63 amps, 20 volts, 20% duty cycle.

EXTENTION CORD USAGE

If an extension cord is required, use one that is rated for the application and is 3 conductor #14 AWG (2.1 mm²) or larger. The recommended maximum lengths are 25 ft (7.5 m) if #14 AWG (2.1 mm²) is used and 50 ft (15 m) if #12 AWG* (3.3 mm²) is used.

TABLE OF CONTENTS – OPERATION SECTION –

Section B

Operation	Section B
Safety Precautions	B-1
General Description	B-2
Recommended Processes.....	B-2
Operational Features and Controls.....	B-2
Design Features and Advantages	B-2
Welding Capability	B-2
Limitations	B-2
Controls and Settings.....	B-2
Welding Operations.....	B-3
Process Guidelines.....	B-3
Sequence of Operations.....	B-3
Wire Loading.....	B-3
Friction Brake Adjustments.....	B-4
Wire Threading	B-4
Shielding Gas	B-5
Making a Weld	B-5
Cleaning Tip and Nozzle.....	B-6
Changing Machine Over To Feed Other Wire Sizes	B-6
Welding With Innershield	B-6
Overload Protection	B-6
Output Overload	B-6
Thermal Protection	B-6
Wire Feed Overload Protection	B-6

[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

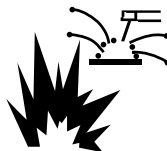
Read entire operation section before operating the SP-100.

**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 SPARKS can cause fire or explosion.**

- Keep flammable material away.
- Do not weld on closed containers.

**ARC RAYS can burn eyes and skin.**

- Wear eye, ear and body protection.

Observe all safety information throughout this manual.

GENERAL DESCRIPTION

The SP-100, Type K462, is a complete semiautomatic constant voltage DC arc welding machine. Included is a solid state controlled, single phase constant voltage transformer/ rectifier power source and a wire feeder for feeding solid steel electrode and cored electrode.

The SP-100 is ideally suited for individuals having access to 115 volt AC input power, and wanting the ease of use, quality and dependability of both gas metal arc welding or GMAW (also known as MIG welding) and the Innershield electrode process (self shielded flux cored or FCAW). The SP-100 is a rugged and reliable machine that has been designed for dependable service and long life.

RECOMMENDED PROCESSES

The SP-100 can be used for welding mild steel using the GMAW, single pass, process which requires a supply of shielding gas or it can be used for the self shielded, Innershield electrode process (FCAW). The SP-100 is configured for use with the GMAW (MIG) process as delivered from the factory.

OPERATIONAL FEATURES AND CONTROLS

The SP-100 has the following controls as standard: Power ON/OFF Switch, Voltage Control, Wire Speed Control, and a Circuit Breaker.

DESIGN FEATURES AND ADVANTAGES

- Operates on 115 volt input — no special wiring required.
- Solid state output control.
- "Cold electrode" until gun trigger is pressed for an added measure of safety.
- Overload protection — incorporates both a thermostat and a circuit breaker.
- Quality wire drive with electronic overload protection.
- Easy-to-set continuous range controls for precise setting of arc voltage and wire speed.
- Continuous voltage control.
- "Quick Release" idle roll pressure arm is easily adjusted.

- Reversible, dual groove drive roll. Drive roll will feed .023-.025" (0,6- 0,9 mm) diameter wire.
- Accommodates both 8" (200 mm) diameter and 4" (100 mm) diameter spools of wire.
- No external shielding gas is required when used with Lincoln Innershield .035" (0,9 mm) NR®-211-MP electrode.
- Easy to change polarity.

WELDING CAPABILITY

The SP-100 is rated at 90 amps, 18 volts, at 20% duty cycle on a ten minute basis. It is capable of higher duty cycles at lower output currents.

LIMITATIONS

Arc Gouging cannot be performed with the SP-100. The SP-100 is not recommended for pipe thawing.

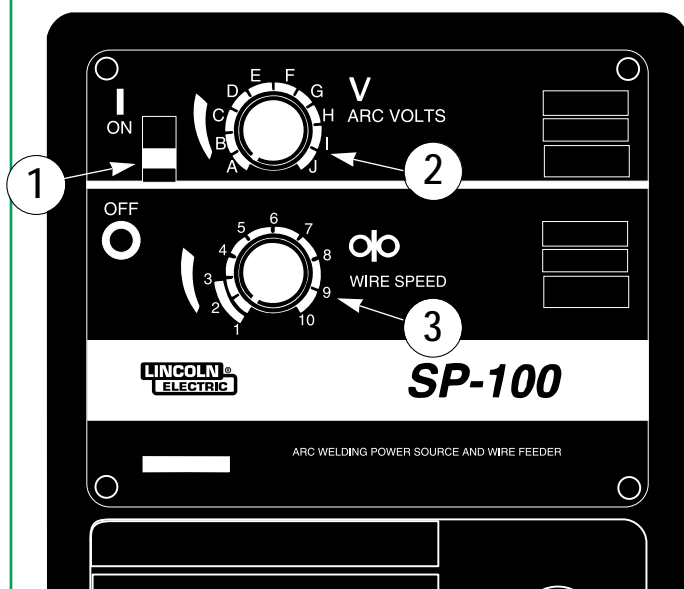
CONTROLS AND SETTINGS

Refer to Figure B.1a.

1. Power ON/OFF Switch — When the power is on the fan motor will run and air will be exhausted out the louvers in the front of the machine. The welding output and wire feeder remain off until the gun trigger is pressed.
2. Voltage Control — A continuous control that gives full range adjustment of power source output voltage. Voltage can be adjusted while welding.
3. Wire Speed Control — Controls the wire feed speed from 50 – 400 in /min (1.3 – 10 m/min). The control can be preset on the dial to the setting specified on the SP-100 Application Guide located on the inside of the wire feed section door. Wire speed is not affected when changes are made in the voltage control.



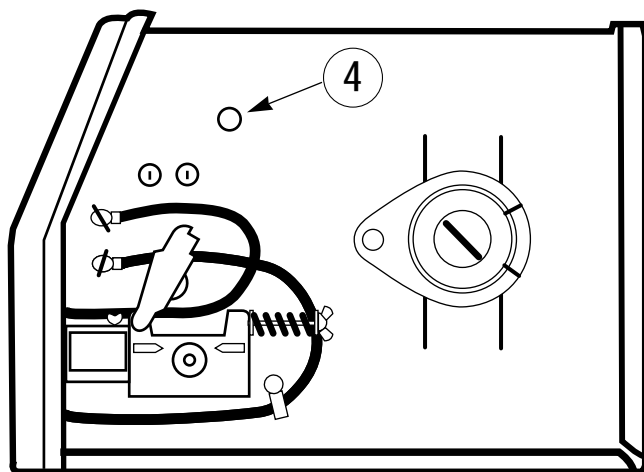
FIGURE B.1a



Refer to Figure B-1b.

4. Circuit Breaker - Protects machine from damage if maximum output is exceeded. Button will extend out when tripped (Manual reset).

FIGURE B.1b



WELDING OPERATIONS

PROCESS GUIDELINES

The SP-100 can be used for welding mild steel using the GMAW, single pass, process which requires a supply of shielding gas or it can be used for the self shielded, Innershield electrode process.

The recommended gas and electrode for GMAW is welding grade CO₂ gas and 0.025" (0.6 mm) diameter Lincoln L-56 mild-steel welding wire [supplied on 121/2 lb (6 kg) spools]. For 14 gauge (2.0 mm) and thinner, CO₂ gas is recommended because it gives equal or better performance than a blended gas at a lower cost. A mixed gas consisting of 75 to 80% Argon and 20 to 25% CO₂ is recommended for welding on heavier gauge [12 gauge (2.5 mm) for example] steel.

The recommended electrode for the self-shielded process is 0.035" (0.9 mm) diameter Lincoln Innershield NR-211-MP on 10 lb (4.5 kg) spools. This electrode can be used for all position welding of 20 gauge through 5/16" (1.0 – 8.0 mm) thick steel [multiple passes are required for 1/4" and 5/16" (6.0 and 8.0 mm)].

SEQUENCE OF OPERATION

WIRE LOADING

Refer to Figure B.2. and B.3.

The machine power switch should be turned to the OFF ("O") position before working inside the wire feed enclosure.

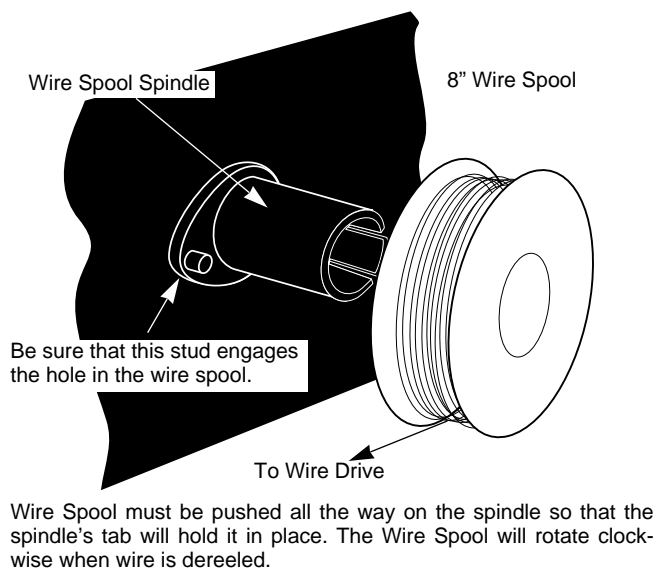
The machine is shipped from the factory ready to feed 8" (200 mm) diameter spools [2.2" (56 mm) max. width]. These spools fit on a 2" (50 mm) diameter spindle that has a built-in adjustable* friction brake to prevent overrun of the spool and excess slack in the wire. The thumb screw at the end of the shaft is not intended to be loosened. It should be tightened full clockwise. **NOTE: If full tightening of the spindle thumbscrew causes too much tension in the wire spool, the thumb screw stop point should be adjusted.**

*Earlier spindle shafts did not include a set screw to adjust brake friction. If a set screw is desired, order Lincoln part number T12932-2.

Load an 8" (200 mm) diameter spool on the wire spool spindle shown in Figure B.2.

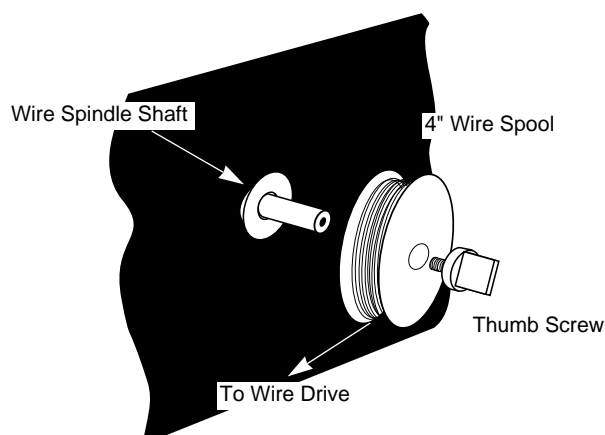
To use 4" (100 mm) diameter spools, the 2" (50 mm) diameter spindle must be removed (See Figure B.3). Remove the thumb screw at the end of the shaft and remove the spindle. The spindle can be stored in the wire feed compartment. A 4" (100 mm) diameter spool is mounted directly on the 5/8" (16 mm) diameter shaft and held in place with the previously removed thumb screw. Make certain that the thumbscrew is

FIGURE B.2



tightened fully clockwise. Also make certain the start end of the wire, which may protrude through the side of the spool does not contact any metallic case parts.

FIGURE B.3



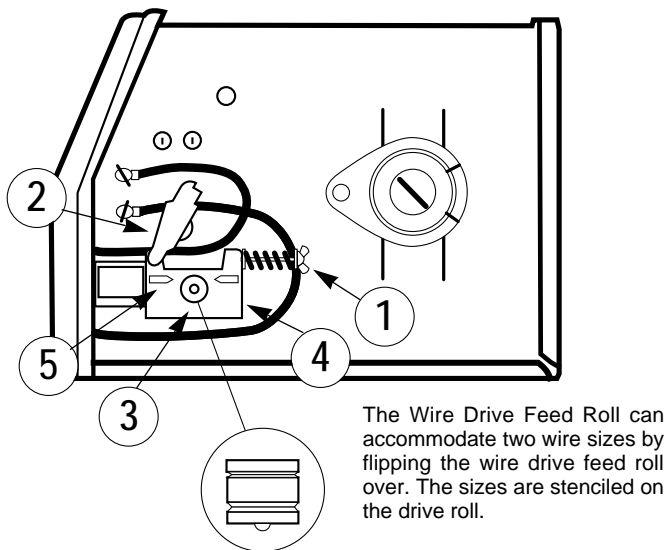
FRICTION BRAKE ADJUSTMENTS

1. Remove the Wire Spool thumbscrew.
2. Using a 3/16" (4,8 mm) hex wrench, turn the set screw, located inside the tapped hole in the spindle shaft, one or two turns counter-clockwise.
3. Fully reinstall the thumbscrew and check for proper brake force to prevent spool overrun, but still allow smooth and easy wire feeding. Readjust, if necessary.

WIRE THREADING

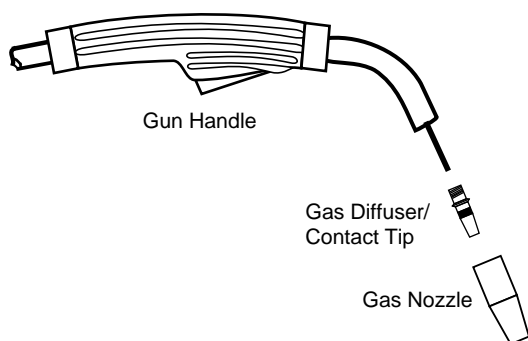
Refer to Figure B-4

FIGURE B.4



1. Release the Spring Loaded Pressure Arm (1) rotate the Idle Roll Arm (2) away from the Wire Feed Drive Roll (3). Ensure that the visible, stenciled size on the drive roll matches the wire size being used.
2. Carefully detach the end of the wire from the spool. To prevent the spool from unwinding, do not release the wire until after step 5.
3. Cut the bent portion of wire off and straighten the first 4" (100 mm).
4. Thread the wire through the In-going guide tube (4), over the drive roll (3), and into the out-going guide tube (5).
5. Close the idle roll arm and latch the spring loaded pressure arm (2) in place (now you may release the welding wire).
6. The idle roll pressure adjustment wing nut is normally set for mid-position on the pressure arm threads. If feeding problems occur because the wire is flattened excessively, turn the pressure adjustment counter-clockwise to reduce distortion of the wire. Slightly less pressure may be required when using 0.023 – 0.025" (0,6 mm) wire. If the drive roll slips while feeding wire, the pressure should be increased until the wire feeds properly.

FIGURE B.5



⚠ WARNING

When inching the welding wire, the drive rolls, the gun connector block and the gun contact tip are always energized relative to work and ground and remain energized several seconds after the gun trigger is released.

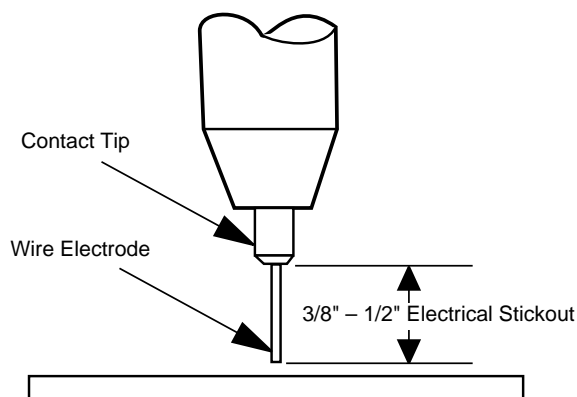
7. Refer to Figure B.5. Remove gas nozzle and contact tip from end of gun.
8. Turn the SP-100 ON ("I").
9. Straighten the gun cable assembly.
10. Depress the gun trigger switch and feed welding wire through the gun and cable. (Point gun away from yourself and others while feeding wire.) Release gun trigger after wire appears at end of gun.
11. Replace contact tip and gas nozzle.
12. Refer to Figure B-6. Cut the wire off $1/4"$ – $3/8"$ (6 – 10 mm) from the end of the tip. The SP-100 is now ready to weld.

SHIELDING GAS

When using the GMAW process, a cylinder of carbon dioxide (CO_2) or argon-carbon dioxide mixed shielding gas, flow regulator, and an inlet gas hose must be obtained. Refer to the ACCESSORIES section for more information about selecting gas cylinders for use with the SP-100.

1. For CO_2 , open the cylinder very slowly. For argon-mixed gas, open cylinder valve slowly a fraction of a turn. When the cylinder pressure gauge pointer stops moving, open the valve fully.

FIGURE B.6

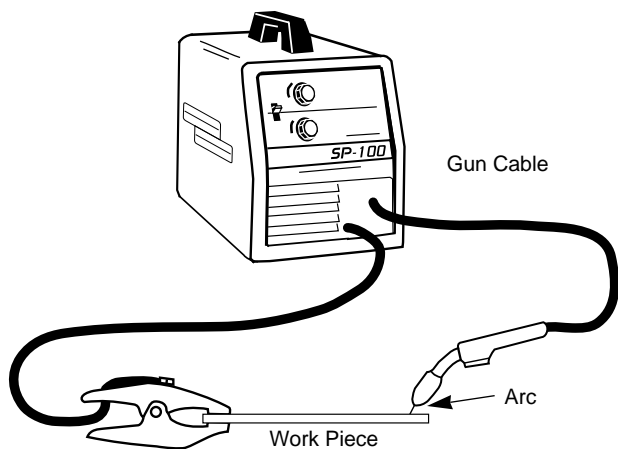


2. If using a regulator with an adjustable flow meter, close the gun trigger and adjust the flow to give 15 – 20 cubic ft per hour (CFH) (7 – 10 l/min) [use 20 – 25 CFH (10 – 12 l/min) when welding out of position or in a drafty location for CO_2]. For argon mixed gas, trigger to release gas pressure, and turn off the adjust the flow to give 25 – 30 CFH (12 – 14 l/min).
3. Keep the cylinder valve closed, except when using the SP-100. When finished welding:
 - a) Close the cylinder valve to stop gas flow.
 - b) Depress the gun trigger briefly to release the pressure in the gas hose.
 - c) Turn off the SP-100.

MAKING A WELD

1. See Recommended Processes And Equipment section for selection of welding wire and shielding gas and for range of metal thicknesses that can be welded.
2. See the Application Guide on the inside of wire feed section door for information on setting the SP-100 controls.
3. Set the Voltage ("V") and Wire Speed ("olo") controls to the settings suggested for the welding wire and base metal thickness being used.
4. Check that the polarity is correct for the welding wire being used and that the gas supply, if required, is turned on.
5. When using Innershield electrode, remove the gas nozzle and install the gasless nozzle. This will improve visibility of the arc and protect the gas diffuser from weld spatter. Refer to the MAINTENANCE section for details on nozzle replacement.

FIGURE B.7



6. Refer to Figure B.7. Connect work clamp to metal to be welded. Work clamp must make good electrical contact to the workpiece. The workpiece must also be grounded as stated in "Arc Welding Safety Precautions" in the beginning of this manual.
7. Position gun over joint. End of wire may be lightly touching the work.
8. Lower welding helmet, close gun trigger, and begin welding. Hold the gun so the contact tip to work distance is about 3/8 inch (10 mm).
9. To stop welding, release the gun trigger and then pull the gun away from the work after the arc goes out.
10. When no more welding is to be done, close valve on gas cylinder (if used), momentarily operate gun trigger to release gas pressure, and turn off the SP-100.

CLEANING TIP AND NOZZLE

Clean the contact tip and nozzle to avoid arc bridging between the nozzle and contact tip which can result in a shorted nozzle, poor welds and an overheated gun. Hint: Anti-stick spray or gel, available from a welding supply distributor, may reduce buildup and aid in spatter removal.

CHANGING MACHINE OVER TO FEED OTHER WIRE SIZES

The SP-100 is shipped from the factory ready to feed 0.023-0.025" (0,6 mm) diameter wire. To operate the SP-100 with other sizes of wire, it is necessary to change the contact tip and change the drive roll over to other sizes. Refer to Changing the Contact Tip and Changing the Drive Roll, in the MAINTENANCE section, for specific information on these procedures.

WELDING WITH INNERSHIELD

Welding with Innershield requires an Innershield Welding Kit. A gasless nozzle is provided in the Innershield Welding Kit. When using Innershield electrode, installing the gasless nozzle will improve visibility of the arc and protect the gas diffuser from weld spatter. Additionally included is a gun cable liner to permit proper feeding of .035" (0,9 mm) Innershield wire. Refer to the ACCESSORIES section for details on obtaining this kit.

OVERLOAD PROTECTION

OUTPUT OVERLOAD

The SP-100 is equipped with a circuit breaker which protects the machine from damage if maximum output is exceeded. The circuit breaker button will extend out when tripped. The circuit breaker must be manually reset.

THERMAL PROTECTION

The SP-100 has a rated output duty cycle of 20%. If the duty cycle is exceeded, a thermal protector will shut off the output until the machine cools to a normal operating temperature. This is an automatic function of the SP-100 and does not require user intervention.

WIRE FEED OVERLOAD PROTECTION

The SP-100 has an automatic electronic protection circuit to protect the wire feed motor. If excessive motor overload occurs (due to excessive feeding force jammed drive rolls, or shorted motor leads) the circuit will shut down the wire feed motor and the welding power output.

The wire feed shut-down circuit will reset automatically when the gun trigger is released. However shut-down will reoccur if the overload situation is not corrected.

TABLE OF CONTENTS
– ACCESSORIES SECTION –

AccessoriesSection C
AccessoriesC-1
Replacement PartsC-1

LINCOLN GAS REGULATOR KITS

The Lincoln K463 CO₂ or K499 Ar-mixed Gas Regulator and Hose Kit is recommended for use with the SP-100.

K463 CO₂ Regulator

The K463 kit includes a preset, non-adjustable pressure flow regulator for use on CO₂ cylinders. The K463 CO₂ pressure-flow regulator is preset at the factory to provide a flow rate of 20 cubic feet per hour (10 l/min). This setting cannot be changed. Also included is a 10 foot (3,0 m) gas hose which connects to the rear of the SP-100.

The K463 CO₂ pressure-flow regulator can be used with a cylinder of argon mixed gas if a CGA-580-320 (Western Enterprises No. 810) adapter is used between the cylinder and the regulator.

Weld shielding gas may be obtained from a welding supply distributor.

K499 Ar-Mixed Gas Regulator

K499 Ar-Mixed Gas Regulator and Hose Kit – Includes a preset, non-adjustable pressure and flow regulator for use on argon-mixed gas cylinders. Also included is a 10 foot (3 0 m) gas hose which connects to the rear of the SP-100.

INNERSHIELD WELDING KITS

0.035 (0.9 mm) Innershield Welding Kit – Includes a contact tip, a gasless nozzle and a cable liner to permit the SP-100 gun and cable to use a 0.035" (0,9 mm) diameter flux-cored electrode. Also included is a spool of 0.035 (0,9 mm) Innershield NR-211-MP.

Two kits are available:

K549-1 kit is for use with Magnum 100L gun (with red trigger).

K464 kit is for use with the original Lincoln Electric gun (with black trigger).

DRIVE ROLL

M15448-1 Reversible Drive Roll with double knurled grooves for 0.035 (0,9 mm) cored electrode.

K467 INPUT LINE CORD

The K467 Input Line Cord is the same as the line cord supplied with the SP-100, but has a NEMA type 5-20P plug for use on 25 amp branch circuits.

To install optional features, refer to instructions included with the kit.

REPLACEMENT PARTS

Complete Gun and Cable Assembly

L7538 – Black Trigger; L8311-2 (K530-2) – Red Trigger

Contact Tip 0.025" (0,6 mm)

S18704-1 – Black Trigger; S19726-1 – Red Trigger

Contact Tip 0.030" (0,8 mm)

S18704-2 – Black Trigger; S19726-2 – Red Trigger

Contact Tip 0.035" (0,9 mm)

S18704-3 – Black Trigger; S19726-3 – Red Trigger

Liner 0.023 - 0.030" (0,6 - 0,8 mm)

S18704-4 – Black Trigger; M16291-2 – Red Trigger

Liner 0.035" (0,9 mm)

S18704-5 – Black Trigger; M16291-1 – Red Trigger

Gas Diffuser

S18704-6 – Black Trigger; S19728 – Red Trigger

Gas Nozzle

S18704-7 – Black Trigger; M16294 – Red Trigger

Gasless Nozzle (Innershield Only)

S18704-14 – Black Trigger; M16418 – Red Trigger

TABLE OF CONTENTS – MAINTENANCE SECTION –

Section D

Maintenance	Section D
Safety Precautions	D-1
Items Requiring No Maintenance	D-1
Routine and Periodic Maintenance.....	D-1
Before Each Use	D-1
After 5 Minutes of Welding.....	D-1
After Each Spool of Wire Feed	D-1
Component Replacement Procedures	D-2
Changing The Contact Tip	D-2
Changing Drive Roll	D-2
Replace Liner	D-3
Replace Internal Gun Handle Parts As Necessary	D-3
Location of Components.....	D-4

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.



- Disconnect input power by removing plug from receptacle before working inside SP-100. Use only grounded receptacle. Do not touch electrically "hot" parts inside SP-100.
- Have qualified personnel do the maintenance and trouble shooting work.

ITEMS REQUIRING NO MAINTENANCE

- Drive Motor and Gearbox – Lifetime lubrication
- Fan Motor- Lifetime lubrication.
- Wire Reel Spindle – Do NOT lubricate shaft.

ROUTINE AND PERIODIC MAINTENANCE

BEFORE EACH USE

- Check over machine and accessories for any obvious condition that may prevent safe performance or operation, repair or replace items as necessary to correct any abnormal condition.

AFTER 5 MINUTES OF WELDING or when spatter accumulates in nozzle

- Clean nozzle to avoid bridging between nozzle and contact tip which results in shorted nozzle, poor welds and overheated gun. Hint: Anti-stick spray or gel available from a welding supply distributor may reduce buildup and aid in spatter removal.

AFTER EACH SPOOL OF WIRE FEED

- Remove contact tip and clean inside diameter with short piece of wire
- Clean cable liner – when rough and erratic wire feeding occur.

AFTER FEEDING 50# OF FLUX CORED WIRE OR 300# OF SOLID WIRE

- Unplug machine or turn power switch to OFF – "O" position. Remove gun and cable from machine.
- Remove gas nozzle and contact tip from gun
- Lay cable out straight - blow out gently with compressed air. Bend cable back and forth – blow out again – Repeat until clean.

⚠ CAUTION

Excessive pressure at start may cause the dirt to form a plug.

PERIODICALLY AS REQUIRED

- Unplug machine or turn power switch to OFF – "O" position.
- Blow dirt out of the welder with low pressure air to eliminate excessive dirt and dust buildup that could cause welder to run hot.
- Blow dirt out of: Rectifier & Fan Motor Assembly; PC Board located on Case Side Assembly; and Center Assembly components. **Refer to Figure D.4.**
- Vacuum accumulated dirt from gearbox and wire feed section. **Refer to Figure D.4**
- Inspect the incoming guide tube and clean inside diameter if necessary. Replace when excessively worn.
- Replace Contact Tip – when hole is enlarged or elongated (refer to Changing Contact Tip, below).

- Replace Liner – when wire feeding problems occur and other items have been checked (refer to Changing Liner, in this section).

COMPONENT REPLACEMENT PROCEDURES

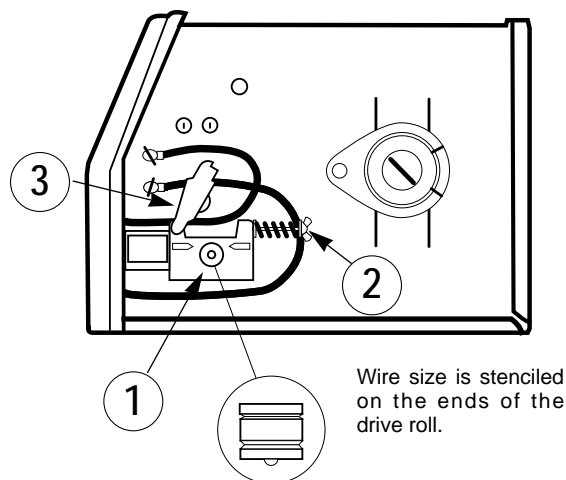
CHANGING THE CONTACT TIP

1. Refer to Figure D.2. Remove the gas nozzle from the gun by unscrewing counter-clockwise.
2. Remove the existing contact tip from the gun by unscrewing counter-clockwise.
3. Insert and hand tighten desired contact tip.
4. Replace gas nozzle.

CHANGING DRIVE ROLL

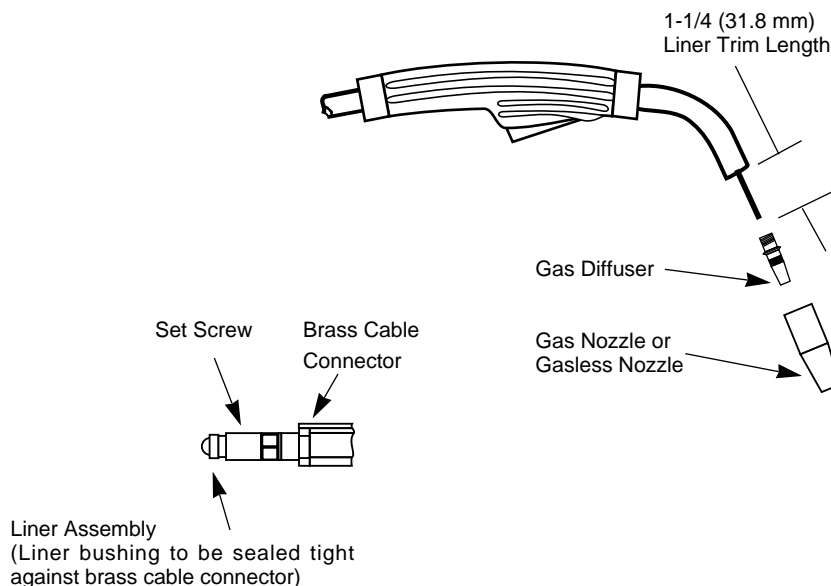
The SP-100 Wire Feed Drive Roll (1) has two grooves; one for 0.023" – 0.025" (0,6 mm) solid steel electrode and the other for 0.030" (0,8 mm) solid and 0.035" (0,9 mm) flux-cored steel electrode. See Figure D.1. As shipped, the drive roll is installed in the 0.023" – 0.025" (0,6 mm) position (as indicated by the stenciling on the exposed side of the drive roll). If 0.030" (0,8 mm) or 0.035" (0,9 mm) wire is to be used, the drive roll must be reversed as follows:

FIGURE D.1



1. Make certain the SP-100 power switch is off "O".
2. Open the Spring Loaded Pressure Arm (2); Lift up the Idle Roll Arm (3).
3. Remove the drive roll retaining screw and washer.
4. Remove the drive roll, flip over and install with the 0.030/0.035" (0.8/0.9 mm) stencil visible (away from gearbox). Make certain the small key is in place in the key-way.
5. Replace the washer and retaining screw.

FIGURE D.2
Liner trim length for the Magnum 100L gun (red trigger)



CHANGING LINER

NOTICE: The variation in cable lengths prevents the interchangeability of liners. Once a liner has been cut for a particular gun, it should not be installed in another gun unless it can meet the liner cutoff length requirement. Refer to Figure D.2.

1. Remove gun and cable assembly from machine.
2. Remove the gas nozzle from the gun by unscrewing counter-clockwise.
3. Remove the existing contact tip from the gun by unscrewing counter-clockwise.
4. Remove the gas diffuser from the gun tube by unscrewing counter-clockwise.
5. Lay the gun and cable out straight on a flat surface. Loosen the set screw located in the brass connector at the wire feeder end of the cable. Pull the liner out of the cable.
6. Insert a new untrimmed liner into the connector end of the cable. Be sure the liner bushing is stenciled appropriately for the wire size being used.
7. Fully seat the liner bushing into the connector. Tighten the set screw on the brass cable connector. At this time, the gas diffuser should not be installed onto the end of the gun tube.
8. With the gas nozzle and diffuser removed from the gun tube, be sure the cable is straight, and then trim the liner to the length shown in the Figure D.2. Remove any burrs from the end of the liner.
9. Screw the gas diffuser onto the end of the gun tube and securely tighten.
10. Replace the contact tip and nozzle.

REPLACE INTERNAL GUN HANDLE PARTS AS NECESSARY

The gun handle consists of two halves that are held together with a collar on each end. To open up the handle, turn the collars approximately 60 degrees counter-clockwise (the same direction as removing a right hand thread) until the collar reaches a stop. Then pull the collar off the gun handle. If the collars are difficult to turn, position the gun handle against a corner, place a screwdriver against the tab on the collar and give the screwdriver a sharp blow to turn the collar past an internal locking rib. See Figure D-3.

FIGURE D.3

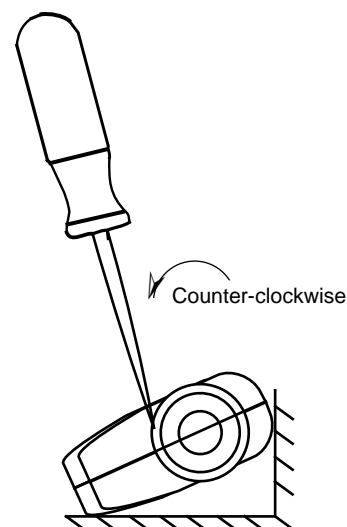
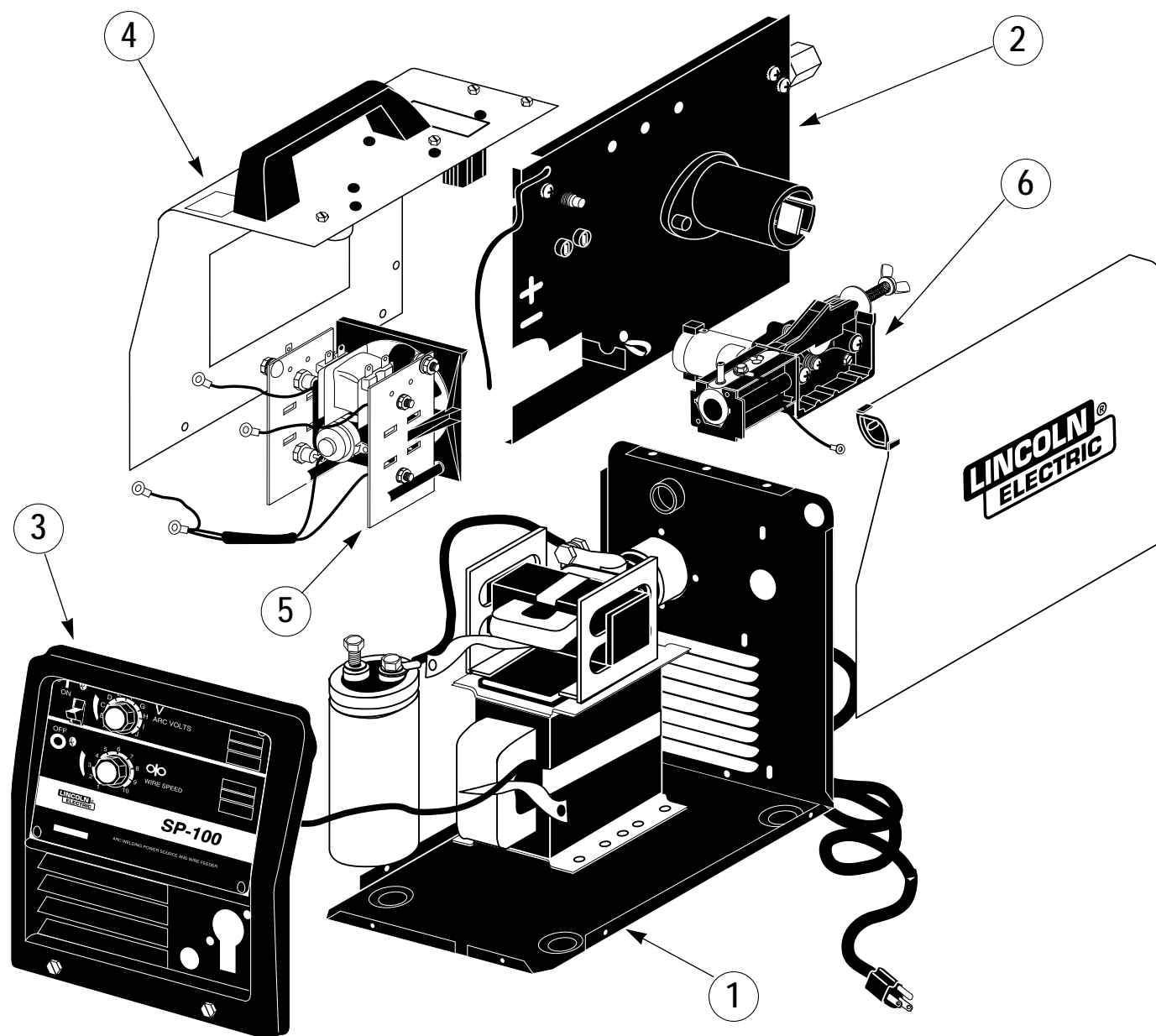


FIGURE D.4 – LOCATION OF COMPONENTS



SP-100 SUB ASSEMBLIES

- | | |
|---|--------------------------------|
| 1 | Case Back and Bottom Assembly |
| 2 | Center Panel Assembly |
| 3 | Case Front Assembly |
| 4 | Case Side Assembly |
| 5 | Rectifier & Fan Motor Assembly |
| 6 | Wire Drive Assembly |

TABLE OF CONTENTS

– THEORY OF OPERATION –

Section E

Theory of Operation	Section E
Input Line Voltage, Fan Motor and Main Transformer	E-1
Output Control, Rectification and Voltage Feedback.....	E-2
Trigger, Gas Solenoid and Wire Drive	E-3
SCR Operation	E-4
Thermal Protection	E-5

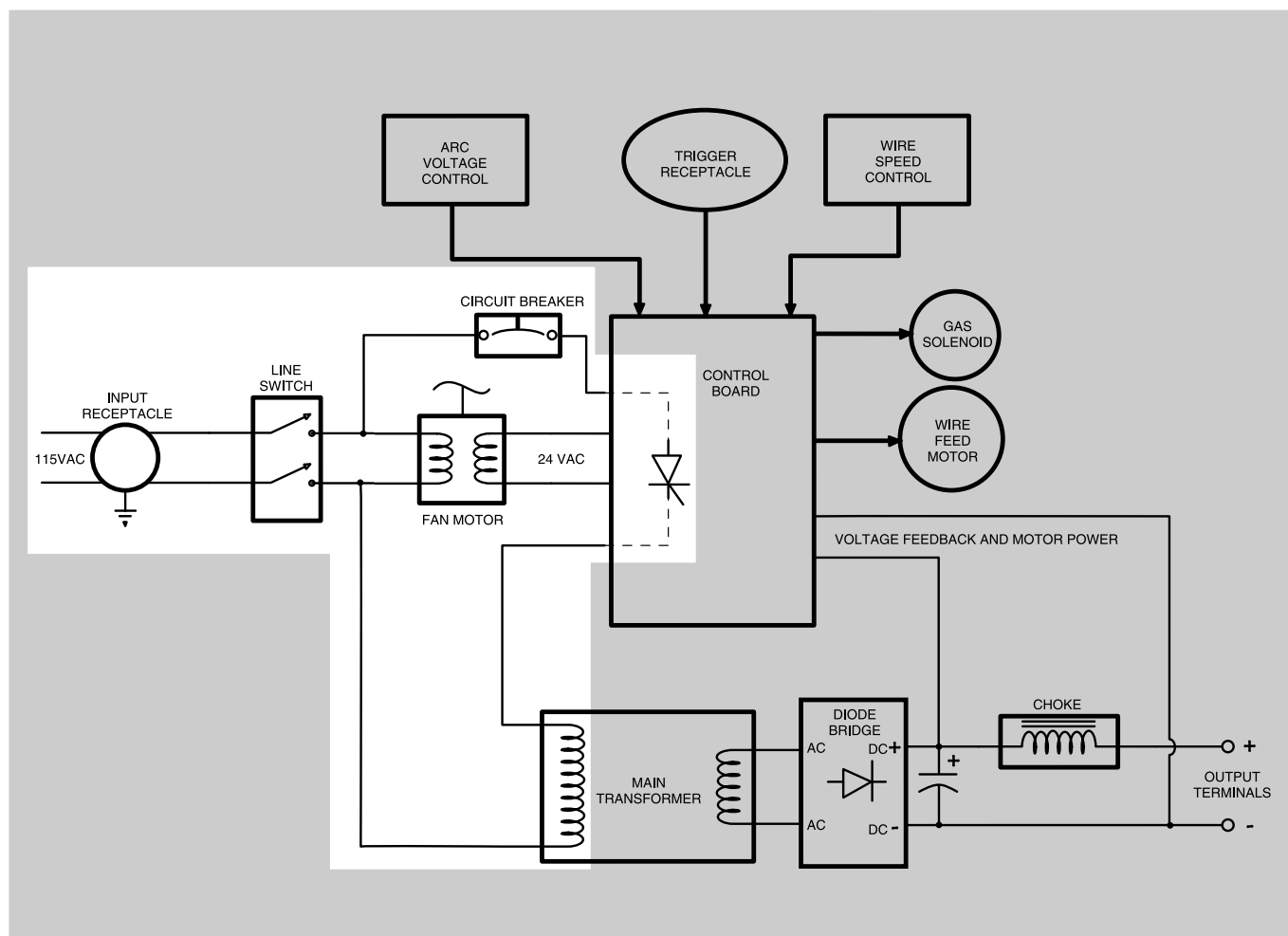
[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

FIGURE E.1 – Input Power Circuits

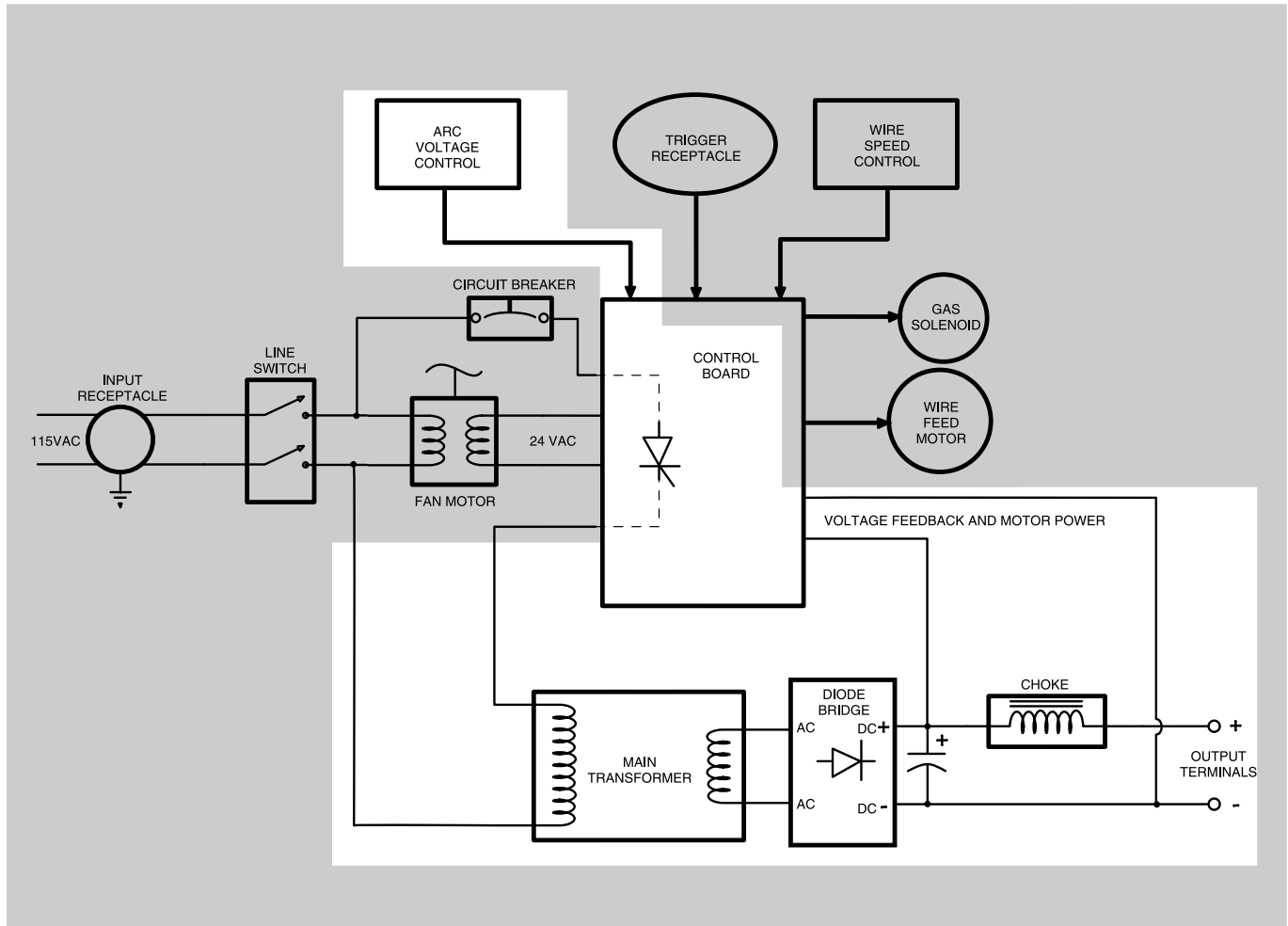


INPUT LINE VOLTAGE, FAN MOTOR AND MAIN TRANSFORMER

The 115 vac input power is applied to the SP-100 through a receptacle located on the rear panel. The input power is connected to the fan motor, control board and main transformer through a line switch located on the front panel. A circuit breaker is incorporated in the 115 vac circuit to protect the unit from current overloads. The fan motor employs a 24 vac auxiliary winding which powers the control board. The main transformer changes the high voltage, low current input power to a low voltage, high current output for welding.

NOTE: Unshaded areas of block logic diagram are the subject of discussion.

FIGURE E.2 – Output Circuits



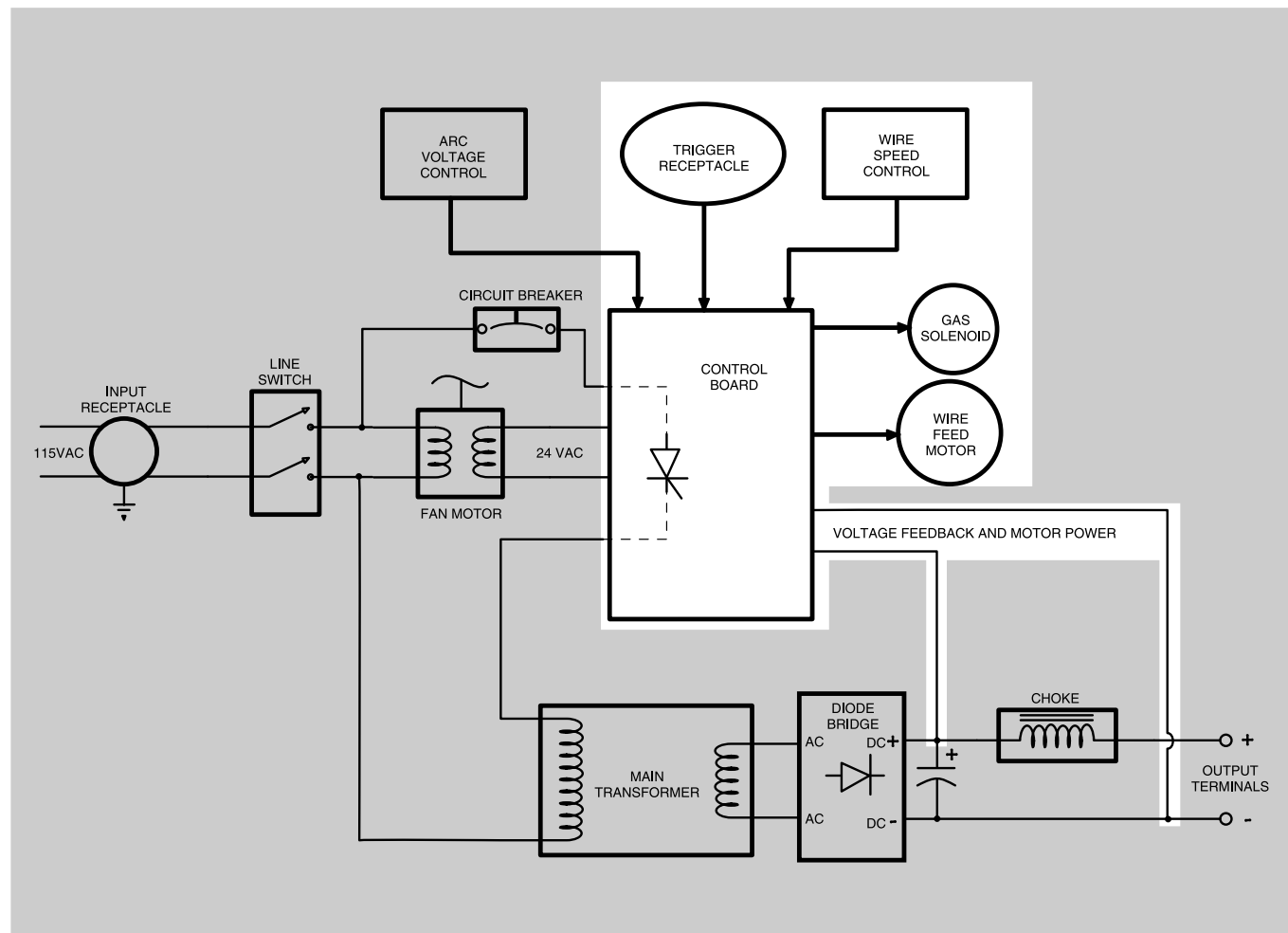
OUTPUT CONTROL, RECTIFICATION AND VOLTAGE FEEDBACK

The AC voltage that is applied to the main transformer primary is controlled at the control board by two SCR's (Silicon Controlled Rectifiers). The SCR's are controlled by a pulse signal developed on the control board. The control board compares the commands of the arc voltage control with the voltage feedback signal. The board circuitry then sends a pulse to turn on the SCR's. In this manner, the voltage applied to the primary of the transformer is varied and controlled. This variable and controlled voltage is

reflected at the transformer secondary winding and is applied to the rectifier diode bridge. This rectified DC voltage is filtered by the output capacitor and choke circuit and is applied to the machine's output terminals.

NOTE: Unshaded areas of block logic diagram are the subject of discussion.

FIGURE E.3 – Trigger, Gas Solenoid and Wire Drive



TRIGGER, GAS SOLENOID AND WIRE DRIVE

Closure of the trigger circuit (pulling the gun trigger) signals the control board to start several functions. 115 vac is applied to the gas solenoid to allow shielding gas to flow. The SCRs are activated and voltage is applied to the main transformer. Output voltage is developed at the output terminals and fed back to the control board. This welding output voltage is also used to power the wire drive motor.

The welding output voltage that powers the wire drive motor is varied and controlled on the control board. The control board monitors the drive motor armature current and voltage and compares the feedback information with the commands sent from the wire speed control. The control board varies and controls power to the drive motor, which, in turn, controls the speed of the wire drive. The SP-100 also has an automatic protection circuit which protects the wire drive motor from excessive motor overloads.

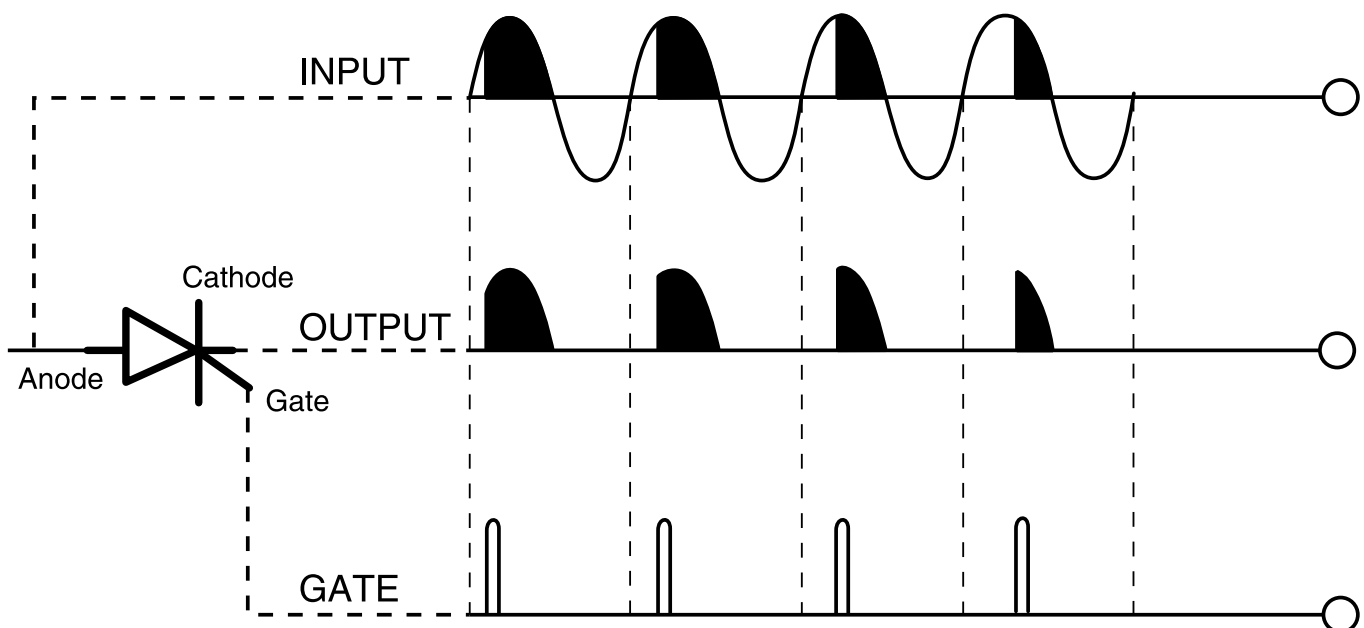
NOTE: Unshaded areas of block logic diagram are the subject of discussion.

SCR OPERATION

A silicon controlled rectifier (SCR) is a three terminal device used to control large currents to a load. An SCR acts very much like a switch. When it is turned on there is current flow from anode to cathode. In the ON state, the SCR acts like a closed switch. When the SCR is turned OFF, there is no current flow from anode to cathode, thus the device acts like an open switch. As the name suggests, the SCR is a rectifier, so it passes current only during positive half cycles of the AC supply. The positive half cycle is the portion of the sine wave in which the anode of the SCR is more positive than the cathode.

When an AC supply voltage is applied to the SCR, the device spends a certain portion of the AC cycle time in the ON state and the remainder of the time in the OFF state. The amount of time spent in each state is controlled by the Gate.

An SCR is fired by a short burst of current into the gate. This gate pulse must be more positive than the cathode voltage. Since there is a standard PN junction between gate and cathode, the voltage between these terminals must be slightly greater than 0.6V. Once the SCR has fired, it is not necessary to continue the flow of gate current. As long as current continues to flow from anode to cathode, the SCR will remain on. When the anode to cathode current drops below a minimum value, called holding current, the SCR will shut off. This normally occurs as the AC voltage passes through zero into the negative portion of the sine wave. If the SCR is turned on early in the positive half cycle, the conduction time is longer, resulting in greater SCR output. If the gate firing occurs later in the cycle, the conduction time is less, resulting in lower SCR output.



Note: As the gate pulse is applied later in the cycle, the SCR output is decreased.

FIGURE E.4 SCR OPERATION

THERMAL PROTECTION

A thermostat protects the machine from excessive operating temperatures. Excessive operating temperatures may be caused by lack of cooling or operating the machine beyond the duty cycle and output rating. If excessive operating temperature should occur, the thermostat will prevent voltage and wire drive. The fan will remain on during this period. The thermostat is self-resetting once the machine cools sufficiently. If the thermostat shutdown is caused by excessive output or duty cycle and the fan is running 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 must be corrected.

TABLE OF CONTENTS – TROUBLESHOOTING SECTION –

Section F

Troubleshooting	Section F
Safety Precautions	F-1
How To Use Troubleshooting Guide	F-1
PC Board Troubleshooting Procedures	F-2
Troubleshooting Guide.....	F-3
Output Problems	F-3
Feeding Problems	F-6
Gas Flow Problems	F-7
Welding Problems	F-7
PC Board Connector Locations	F-8
Oscilloscope Waveforms	
Normal Open Circuit Voltage Waveform	F-9
Typical Output Voltage Waveform – Machine Loaded	F-10
Abnormal Open Circuit Voltage Waveform	F-11
Replacement Procedures	
Fan Blade and Motor Removal.....	F-12
Wire Drive Assembly Removal.....	F-13
Retest After Repair	F-14

[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

HOW TO USE TROUBLESHOOTING GUIDE

WARNING

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 correct possible machine malfunctions or misadjustments. 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 the following categories: Output Problems; Feeding Problems; Gas Flow Problems; and Welding 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 the needed test specifications and repair procedures are described in detail on the referenced pages. All the needed electrical test points, terminal strips, junctions, etc., can be found on the referenced electrical wiring diagrams and schematics. See Electrical Diagram Section.

CAUTION

If for any reason you do not understand the test procedures or are unable to Perform the tests/repairs safely, contact your **LOCAL AUTHORIZED LINCOLN ELECTRIC FIELD SERVICE FACILITY** for assistance before you proceed. Call 216-383-3531 or 1-800-833-9353

PC BOARD TROUBLESHOOTING PROCEDURES

 **WARNING**

ELECTRIC SHOCK can kill.

Have an electrician install and service this equipment. Turn the input power OFF and unplug the machine 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.)

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

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

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 the 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.	Contact your LOCAL LINCOLN AUTHORIZED FIELD SERVICE FACILITY .	Contact the Lincoln Electric Service Department. (216) 383-2531 or 1-800-833-9353 (WELD)
No wire feed, weld output or gas flow when gun trigger is pulled. Fan does NOT operate.	<ol style="list-style-type: none"> 1. Make sure correct voltage is applied to the machine (115 vac). 2. Make certain that power switch is in the ON position. 	<ol style="list-style-type: none"> 1. Check for 115 VAC at input to fan motor (leads #31 to #32). If correct voltage is present and fan motor does not function, replace the fan motor. See wiring diagram. 2. If 115 vac is not present at leads #31 to #32, then check the power switch and input line cord. (SI)
No weld output or wire feed when gun trigger is pulled. Fan runs and gas flows normally.	Contact your LOCAL LINCOLN AUTHORIZED FIELD SERVICE FACILITY .	<ol style="list-style-type: none"> 1. Check voltage from leads #202 to #201 at the output diode heat sinks. Normal voltage is from 2 vac to 20 VAC, depending on arc voltage control setting. If the correct AC voltage is present, check the output diodes and connections. Also check the output capacitor, C1. See wiring diagram. 2. If the correct AC voltage is not present at the diode heat sink leads #202 to #201, then check the AC voltage on the transformer (TI) primary leads #531 to #32 (normal is 115 vac with arc voltage control at maximum). If the correct voltage is present at the transformer primaries (#531 to #32), the transformer may be faulty. See wiring diagram. 3. If the correct voltage is not present at leads #531 to #32, then check the arc voltage control potentiometer (RI) and associated wires #205, #206 and #207 for loose or broken connections. See wiring diagram. 4. The control board may 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 detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No weld output when gun trigger is pulled. Fan runs, gas flows and wire feeds normally.	<ol style="list-style-type: none"> 1. Arc voltage may be set too low. 2. Gun tip may be worn – Replace. 3. Check for correct input voltage to machine. 4. Gun or work cable may be faulty. 	<ol style="list-style-type: none"> 1. Check for open circuit voltage (OCV) at the machine's output terminals, located in wire drive compartment. Normal OCV is from 10 vdc to 28 vdc depending on arc voltage control setting. If correct OCV is present, check gun and work cable. 2. If correct OCV is not present at the output terminals, then check for broken leads at the output choke or at the positive output terminal.
BELOW CODE 9794 ONLY No wire feed, weld output or gas flow when gun trigger is pulled Fan operates normally.	<ol style="list-style-type: none"> 1. Check the circuit breaker located in the machine's wire drive compartment. Reset if tripped. 2. The thermostat may be tripped due to overheating. Let machine cool. Weld within the duty cycle or remove any air obstruction to machine. 3. Wire feed motor may be overloaded. Correct feeding problem. 4. Gun trigger may be faulty. 	<ol style="list-style-type: none"> 1. Remove main power supply to SP-100. With gun trigger pulled, check for continuity (zero ohms) from 8J2 (lead #213) to 9J2 (lead #211) at harness plug. If zero ohms is indicated, then trigger circuit is OK. See wiring diagram and Figure F.1. 2. If an open circuit or high resistance is indicated in Step 1, then check leads #211, #212 and #213 for loose or broken connections. Also check the normally closed thermostat mounted on the diode heat sink assembly. See wiring diagram. 3. Check for 115 vac at lead #31A to plug 3J1 on control board. If 115 vac is NOT present, remove main supply power to machine. Test continuity (zero ohms) of leads #32 and #31A. See Figure F.1. 4. If 115 vac is present at lead #31A to plug 3J1 (lead #32), then control board may be faulty – Replace. See Figure F.1.

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.

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		
CODE 9794 and ABOVE No Wire feed, weld output or gas flow when the gun trigger is pulled - Fan operates normally.	<ol style="list-style-type: none"> 1. Check the circuit breaker in the machine – Located in the wire drive compartment. Reset if tripped. 2. The thermostat may be tripped due to overheating. Let machine cool. Weld within the duty cycle or remove any air obstruction to machine. 3. Wire feed motor may be overloaded – correct feeding problem. 4. Gun trigger may be faulty. 	<ol style="list-style-type: none"> 1. Check for 24 vac at plug 2J1 to 6J1 on the control board. If voltage is not present, check continuity of leads to fan motor. If leads are OK, replace fan motor. See Figure F.1 2. Remove main power supply to SP-100. With gun trigger pulled check for continuity (zero ohms) from 8J2 (lead #213) to 9J2 (lead #211) at harness plug. If zero ohms is indicated then trigger circuit is OK. See Figure F.1. 3. If an open circuit or high resistance is indicated in Step 2, then check leads #211, #212 and #213 for loose or broken connections. Also check the normally closed thermostat mounted on the diode heat sink assembly. 4. The control board may 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 detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FEEDING PROBLEMS		
No wire feed when gun trigger is pulled. Fan runs, gas flows and machine has correct open circuit voltage (28 vdc maximum) – weld output.	<ol style="list-style-type: none"> 1. If the wire drive motor is running check to see if the correct wire is in the machine. 2. If the wire drive motor is running make sure that the correct drive rolls are installed in the machine. 3. Check for clogged cable liner or feeding problems. 	<ol style="list-style-type: none"> 1. Check for a DC voltage at wire drive motor armature (leads #539 to #541). The voltage should be between 2 vdc and 10 vdc. This voltage will vary with the wire speed control setting. If the correct voltage is present, the drive motor may be faulty. Replace. See wiring diagram. 2. If the motor armature voltage is not present, then check for OCV at leads #203 (3J2) and #204 (4J2) on the control board. If correct voltage is present, go to Step 3. If OCV is not present at leads #203 and #204, check continuity (zero ohms) of leads. 3. If the motor armature voltage is not present, then check the wire speed control potentiometer and associated wires #208, #209 and #203 for faulty connections. 4. The control board may be faulty. Replace.
Wire feed speed motor runs very fast. Weld output, gas flow and fan operate normally.	<ol style="list-style-type: none"> 1. Make sure that the wire speed control is not set at maximum. 	<ol style="list-style-type: none"> 1. Remove main supply power to machine. Disconnect plug J2 from the control board. Test the resistance from lead #539 (2J2) in the harness plug to the wire feed motor case. If the resistance is below 500,000 ohms, replace the drive motor. 2. Check the wire speed control potentiometer and associated wires #208, #209 and #203 for loose or broken connections. 3. The control board may 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
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
GAS FLOW PROBLEMS		
Low or no gas flow when gun trigger is pulled. Wire feed, weld output and fan operate normally.	<ol style="list-style-type: none"> 1. Check gas supply, flow regulator and gas hoses. 2. Check gun connection to machine for obstruction or leaky seals. 	<ol style="list-style-type: none"> 1. Check for 115 vac at the gas solenoid leads #7 to #32A. If the correct voltage is present but the solenoid does not activate, replace solenoid. See wiring diagram . 2. If voltage is not present at leads #7 to #32A, remove main supply power to machine. Test leads #7 and #32A for continuity (zero ohms) to the control board. 3. Control board may be faulty. Replace.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
Arc is unstable – Poor starting	<ol style="list-style-type: none"> 1. Check for correct input voltage to machine – 115 vac. 2. Check for proper electrode polarity for process. 3. Check gun tip for wear or damage – Replace. 4. Check for proper gas and flow rate for process. 5. Check work cable for loose or faulty connections. 6. Check gun for damage or breaks. 	<ol style="list-style-type: none"> 1. Check for correct open circuit voltage (OCV) at machine's output terminals, 10 vdc to 28 vdc, depending on arc voltage control setting. If correct OCV is present check gun and work cable. 2. If OCV is low, check output capacitor and output diodes. 3. Check arc voltage control potentiometer and associated wires #205, #206 and #207 for loose or broken connections. See wiring diagram. 4. Control board may be faulty. Replace.

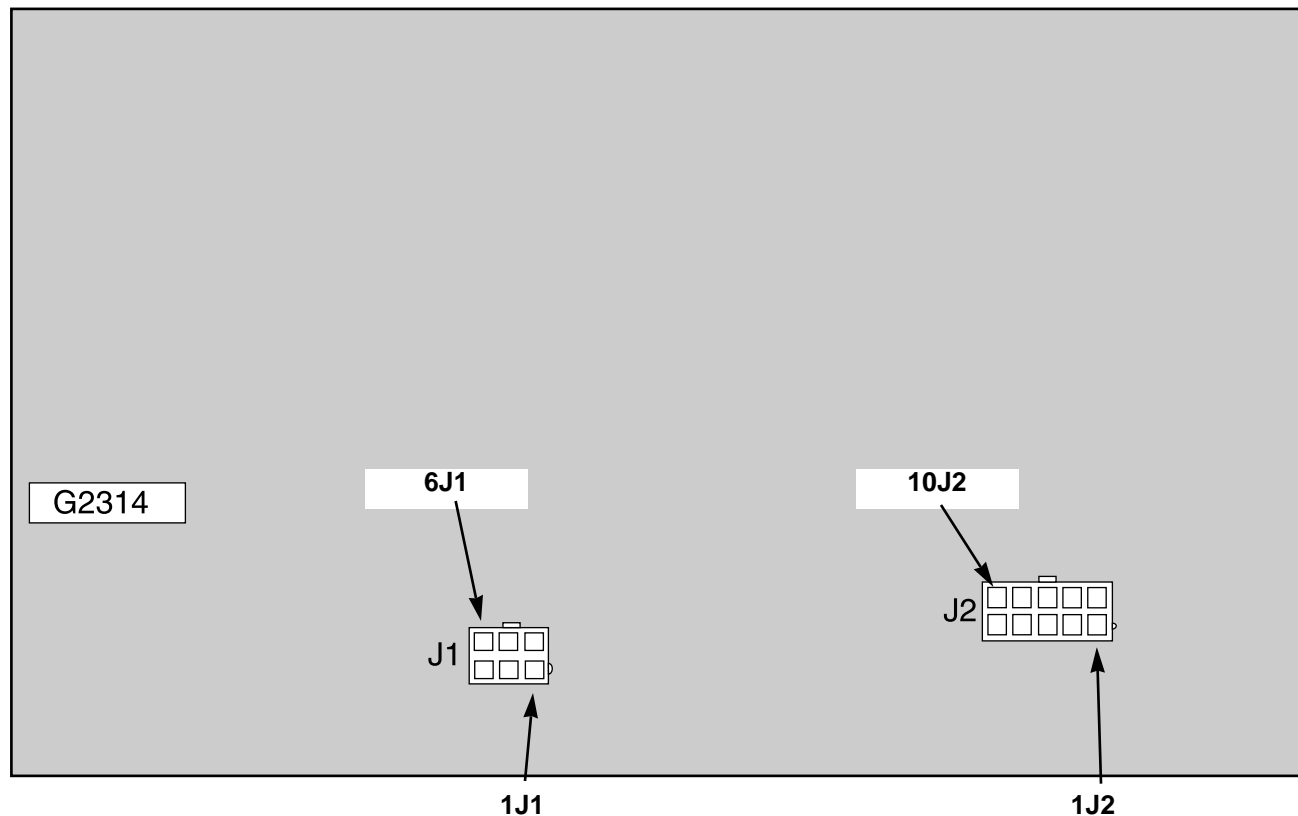
 **CAUTION**

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.

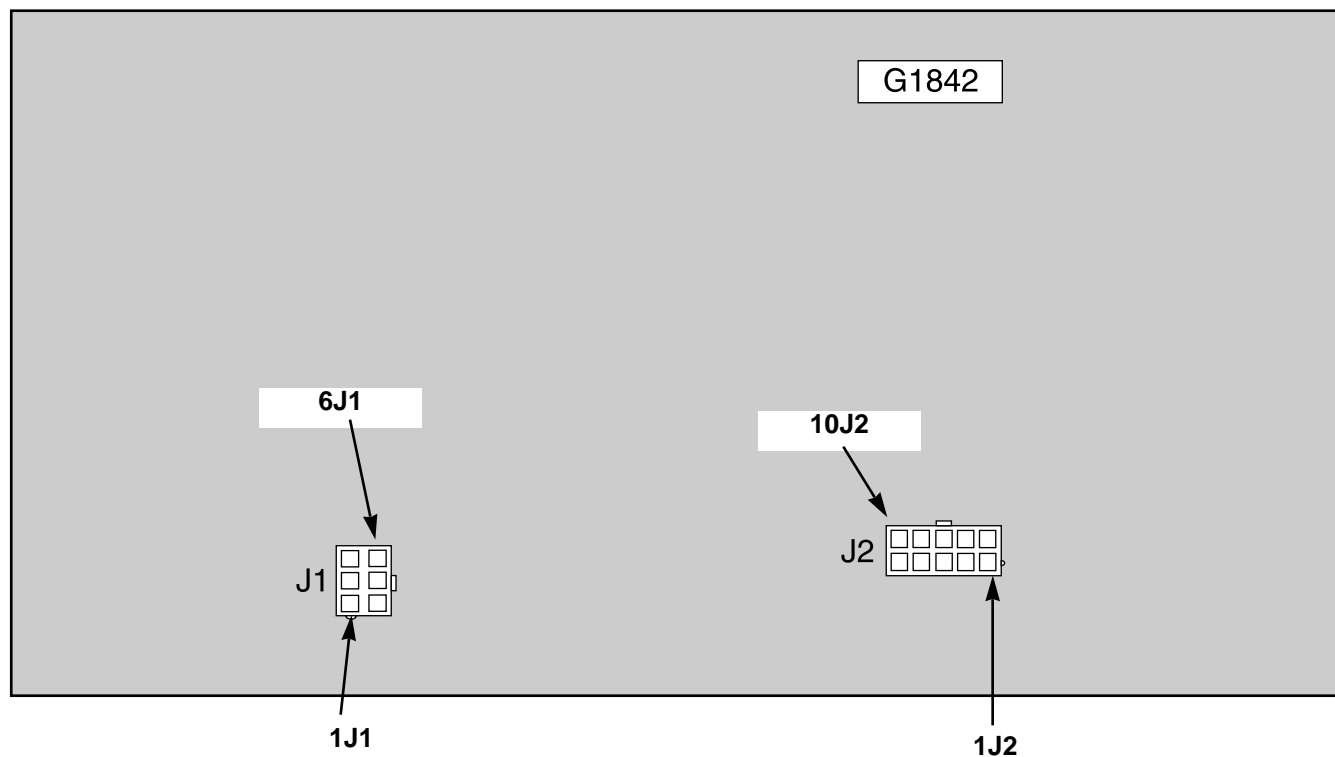
PC BOARD CONNECTOR LOCATIONS

FIGURE F.1

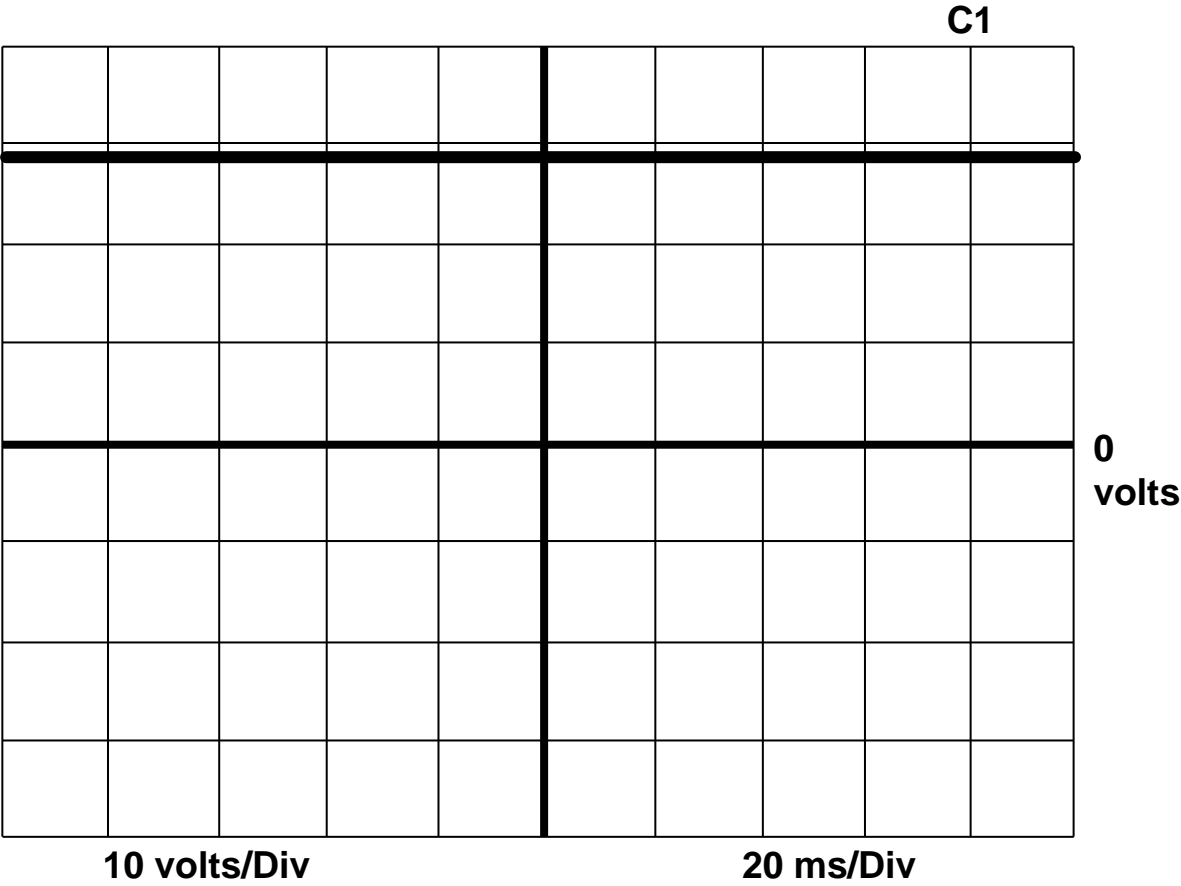
Codes 9794 and above



Codes below 9794



NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM



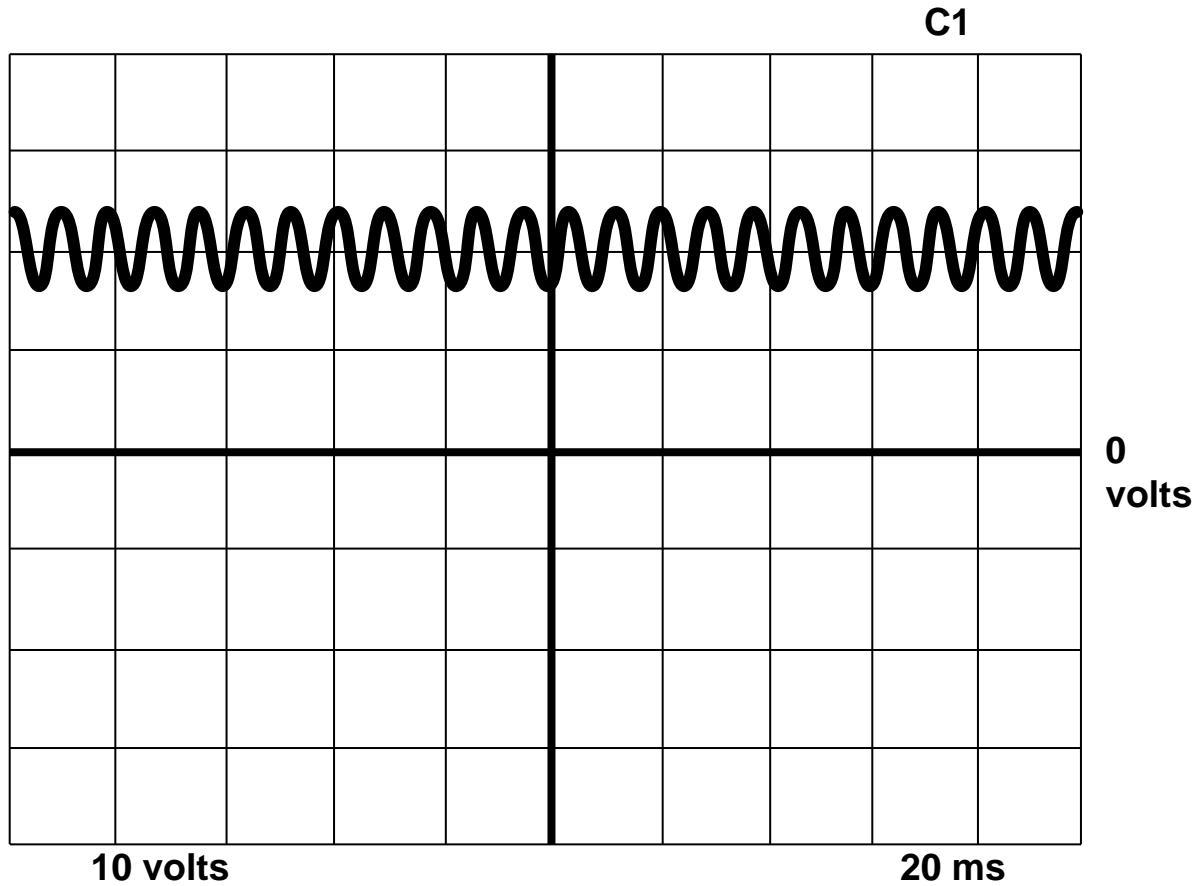
This is the typical output voltage waveform generated from a properly operating machine. Note that each vertical division represents 10 volts and that each horizontal division represents 20 milliseconds in time.

Note: Scope probes connected at machine output terminals. Positive probe to (+) terminal, negative probe to (–) terminal.

SCOPE SETTINGS

Volts/Div	10/Div
Horizontal Sweep	20 ms/Div
Coupling	DC
Trigger.....	Internal

TYPICAL OUTPUT VOLTAGE WAVEFORM – MACHINE LOADED



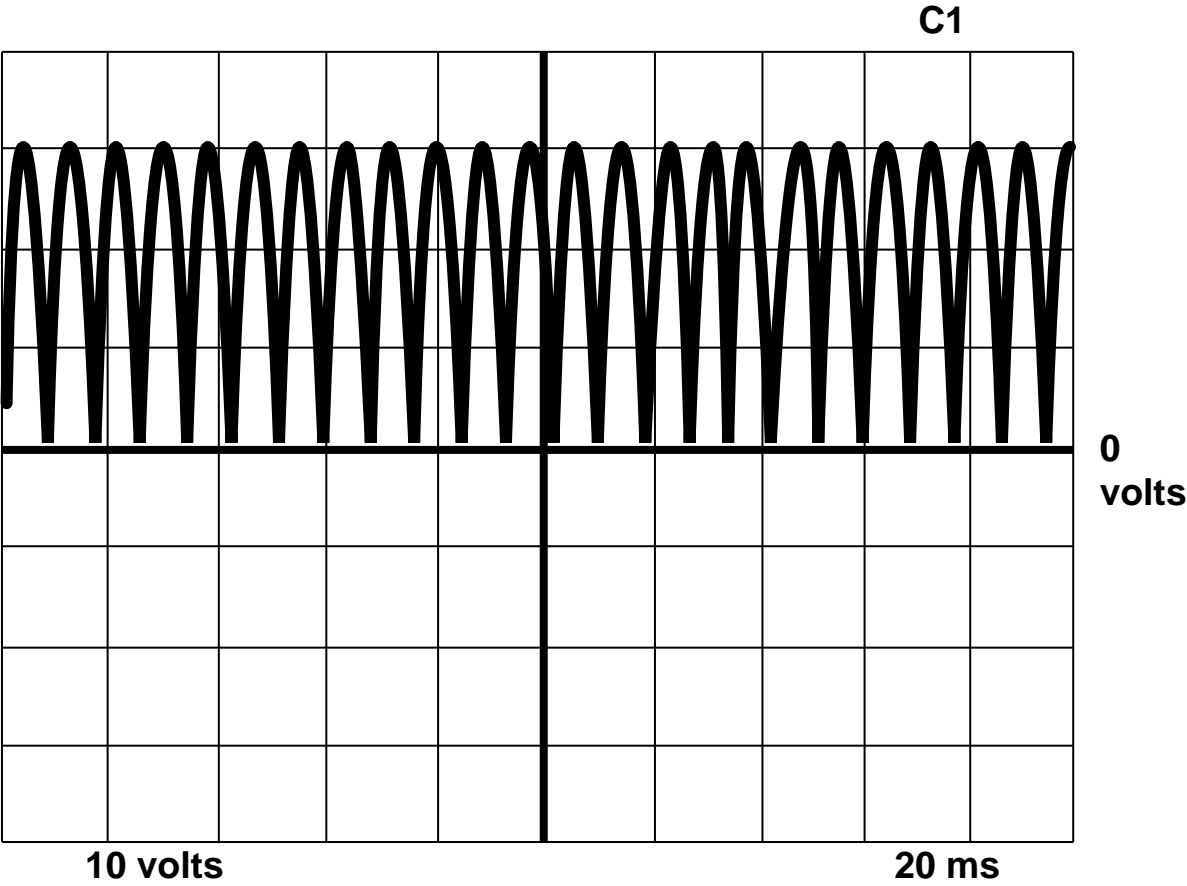
This is the typical output voltage waveform generated from a properly operating machine. Note that each vertical division represents 10 volts and that each horizontal division represents 20 milliseconds in time. The machine was loaded with a resistance grid bank. The ammeter read 90 amps and the voltmeter read 19 vdc.

Note: Scope probes connected at machine output terminals. Positive probe to (+) terminal, negative probe to (–) terminal.

SCOPE SETTINGS

Volts/Div	10/Div
Horizontal Sweep	20 ms/Div
Coupling	DC
Trigger	Internal

ABNORMAL OPEN CIRCUIT VOLTAGE WAVEFORM



This is NOT the typical output voltage waveform. The output capacitor was disconnected from the circuit. Note the increased ripple in the waveform. This condition simulates the faulty output filter capacitor. Each vertical division represents 10 volts and that each horizontal division represents 20 milliseconds in time.

Note: Scope probes connected at machine output terminals. Positive probe to (+) terminal, negative probe to (-) terminal.

SCOPE SETTINGS

Volts/Div10/Div
Horizontal Sweep20 ms/Div
CouplingDC
Trigger.....Internal

FAN BLADE AND MOTOR REMOVAL

PROCEDURE DESCRIPTION

The following procedure will aid in the removal and replacement of the fan blade and/or fan motor. It will also provide reasonable access to the output diode heat sinks.

TOOLS REQUIRED

- 5/16" nutdriver or socket wrench
- 7/16" nutdriver or socket wrench
- 7/16" open end wrench
- Phillips head screwdriver
- Needle nose pliers

PROCEDURE

1. Using the 5/16" nut driver, remove the three self-tapping screws holding the fan bracket to the rear panel.

Refer to Figure F-2.

2. Remove the two aluminum transformer secondary leads from the diode heat sinks.

Note: When reassembling, use Dow 340 Heat Sink Compound on connection surfaces.

3. Remove three large black leads and one small blue lead from the large choke lead.
4. Remove leads #211 and #212 from the thermostat located on the diode heat sink.
5. Remove the four leads from the fan motor noting their positions. (TWO LEADS ON CODES BELOW 9794.)
6. Remove the three wires connected to the input receptacle. Note lead placement and connections. (L1, L2, and green ground lead.)
7. Remove the four self tapping screws holding the line cord and input receptacle to the back panel.
8. Remove input receptacle.
9. Remove the two Phillips head screws holding the gas solenoid to the center baffle – See Figure F.3.
10. Remove the gas solenoid and set aside.
11. Lift up the rectifier fan motor bracket assembly and support it near the top of the machine. This should provide access to the fan blade and motor.

FIGURE F.2

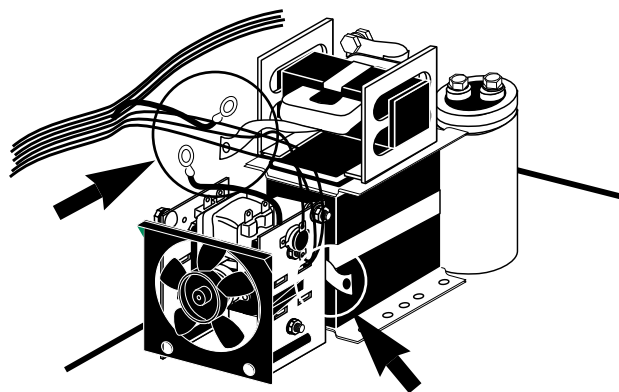


FIGURE F.3

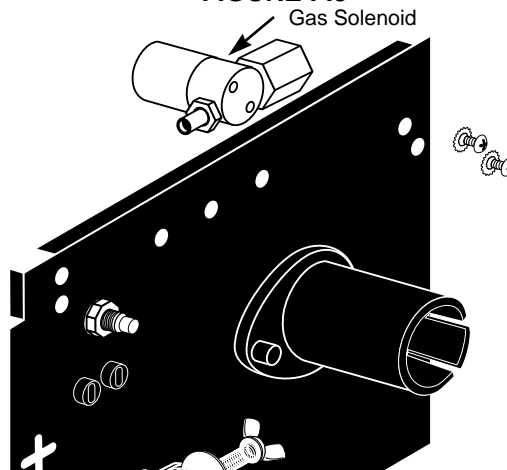
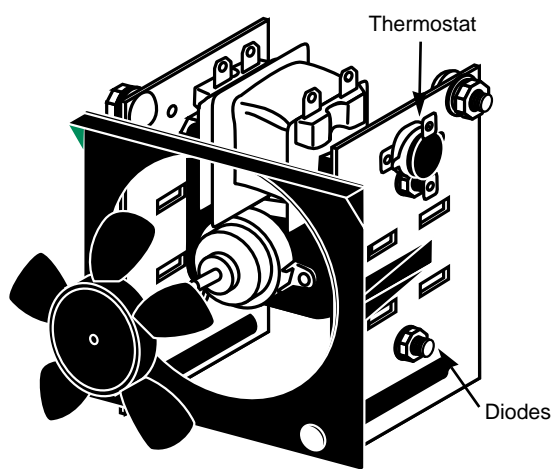


FIGURE F.4



12. Slide the blade from the motor shaft, *taking note of blade placement on motor shaft.* (Shaft Indented approximately 0.10" from blade hub) -- Figure F.4.
13. Remove the two Phillips head screws holding the motor to the bracket. Remove the motor.
14. If the output diodes are to be removed, the leads must be removed from the diodes and the heat

WIRE DRIVE ASSEMBLY REMOVAL

PROCEDURE DESCRIPTION

The following procedure will aid in the removal of the entire wire drive unit for possible motor or gear box replacement.

TOOLS REQUIRED

- 5/16" nutdriver or socket wrench
- 1/4" nutdriver or socket wrench
- Phillips head screwdriver
- Needle nose pliers
- Knife or side cutters
- Screwdriver (slot head)

PROCEDURE

Refer to Figure F.5.

1A. FOR CODES ABOVE 10000

Cut heads off of two plastic fastener buttons located on the front panel. (Order new fastener buttons – Part No. T14659-3)

1B. FOR CODES BELOW 10000

Remove two flat head screws holding conductor block to front panel.

2. Remove gas hose from Connector block.
3. Remove cable running from output terminal to Connector block (1).
4. With 5/16" nutdriver, remove mounting screw at rear of wire drive assembly.
5. With 5/16" nutdriver, remove screw holding the front panel to the case bottom. Carefully move front panel forward 1/2".
6. Carefully slide out wire drive unit until motor leads are visible. Using needle nose pliers, remove motor leads, taking note of lead positions.
7. Remove wire drive unit from machine.

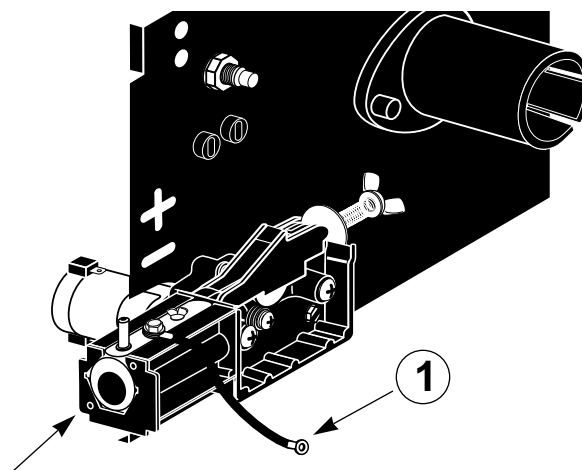
MOTOR REMOVAL PROCEDURE

Refer to Figure F.6

1. Remove one Phillips head screw connecting front to rear housing (1).
2. Using 1/4" nutdriver, remove two 8-32X1" thread forming screws connecting front to rear housing (2).

Refer to Figure F-7

FIGURE F.5



Two plastic fastener buttons attach the Connector Block to the Front Panel at these points. To remove the Connector Block, cut the heads off of the two fastener buttons.

FIGURE F.6

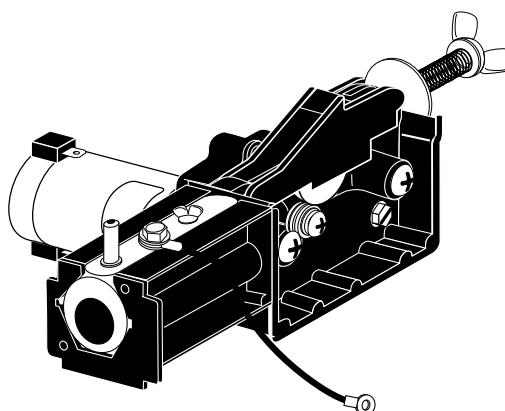
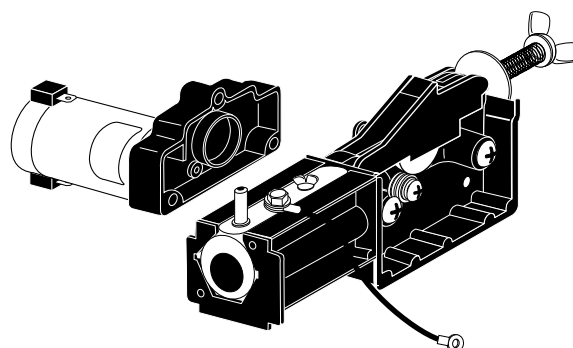


FIGURE F.7



Note: Slight resistance as rear housing is separated from the front is caused by the bearing, which will remain attached to the front housing.

3. Remove motor with rear housing.
4. Remove two screws holding motor to rear housing.
5. Separate motor from rear housing.

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.

MAIN TRANSFORMER SECONDARY VOLTAGES

TEST POINTS	VOLTAGES
LEADS #201 – #202 Located on Output Diode Heat Sinks.	2-20 vac Dependent on arc voltage control setting (min. to max.)

INPUT AMPS AT RATED OUTPUT

INPUT AMPS (AC)	@ OUTPUT (DC)
20 amps	90 amps @ 18 vdc

OPEN CIRCUIT VOLTAGES

TEST POINTS	VOLTAGES
OUTPUT TERMINALS	10 to 27 vdc Dependent on arc voltage control setting (min. to max.)

WIRE SPEED RANGE

50 to 400 in /min. (1,2 to 10,2 m/min.)	Dependent on wire speed control setting
--	---

TABLE OF CONTENTS

– ELECTRICAL DIAGRAMS SECTION –

Section G

Electrical Diagrams	Section G
SP-100 Wiring Diagram (codes 9794 and above).....	G-2
SP-100 Wiring Diagram (codes below 9794)	G-3
Control PC Board (G1842) Components.....	G-4
Control PC Board (G2314) Components.....	G-6
Machine Schematic (codes 9794 and above)	G-8
Machine Schematic (below code 9794)	G-9

[Return to Master TOC](#)

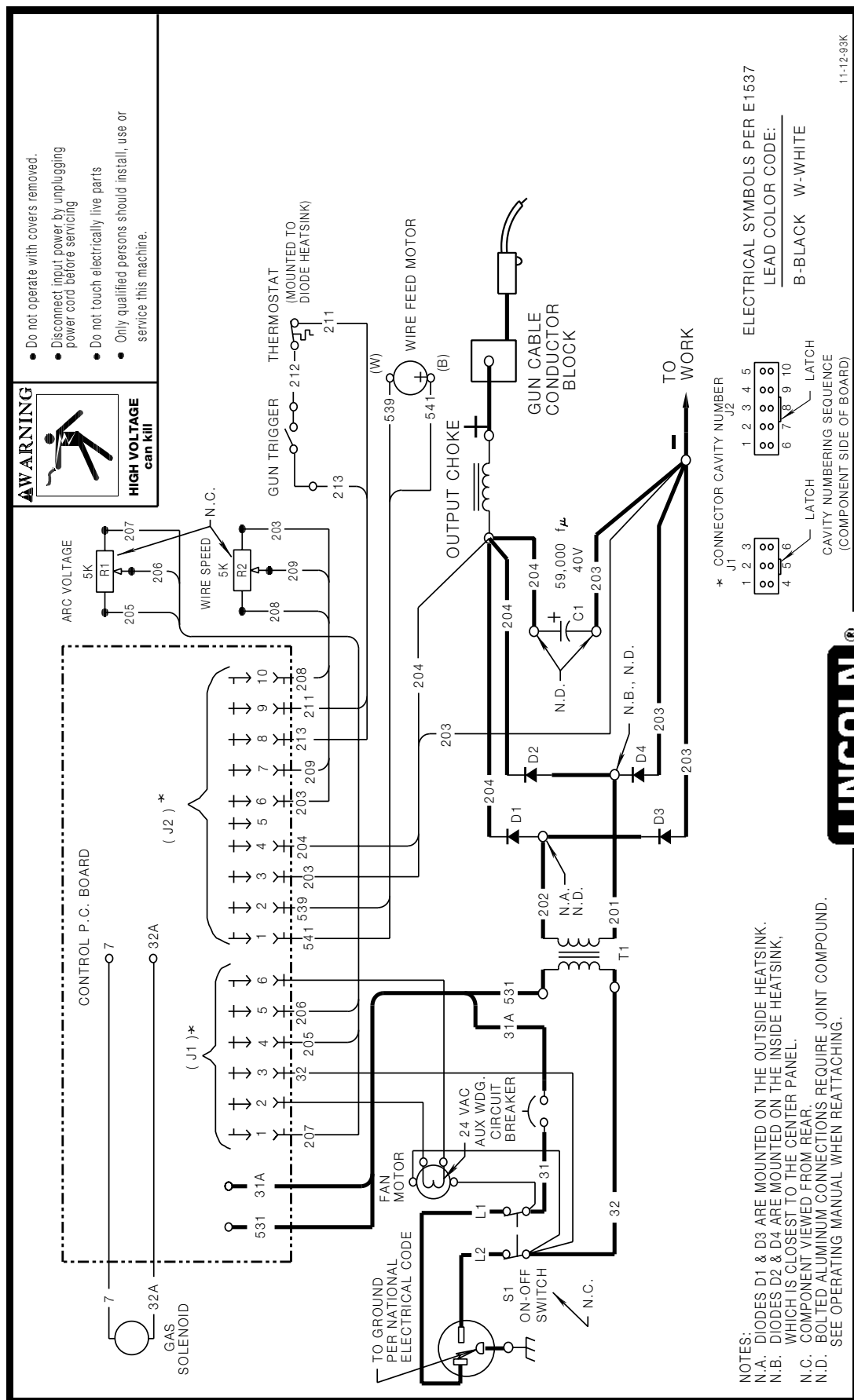
[Return to Master TOC](#)

[Return to Master TOC](#)

[Return to Master TOC](#)

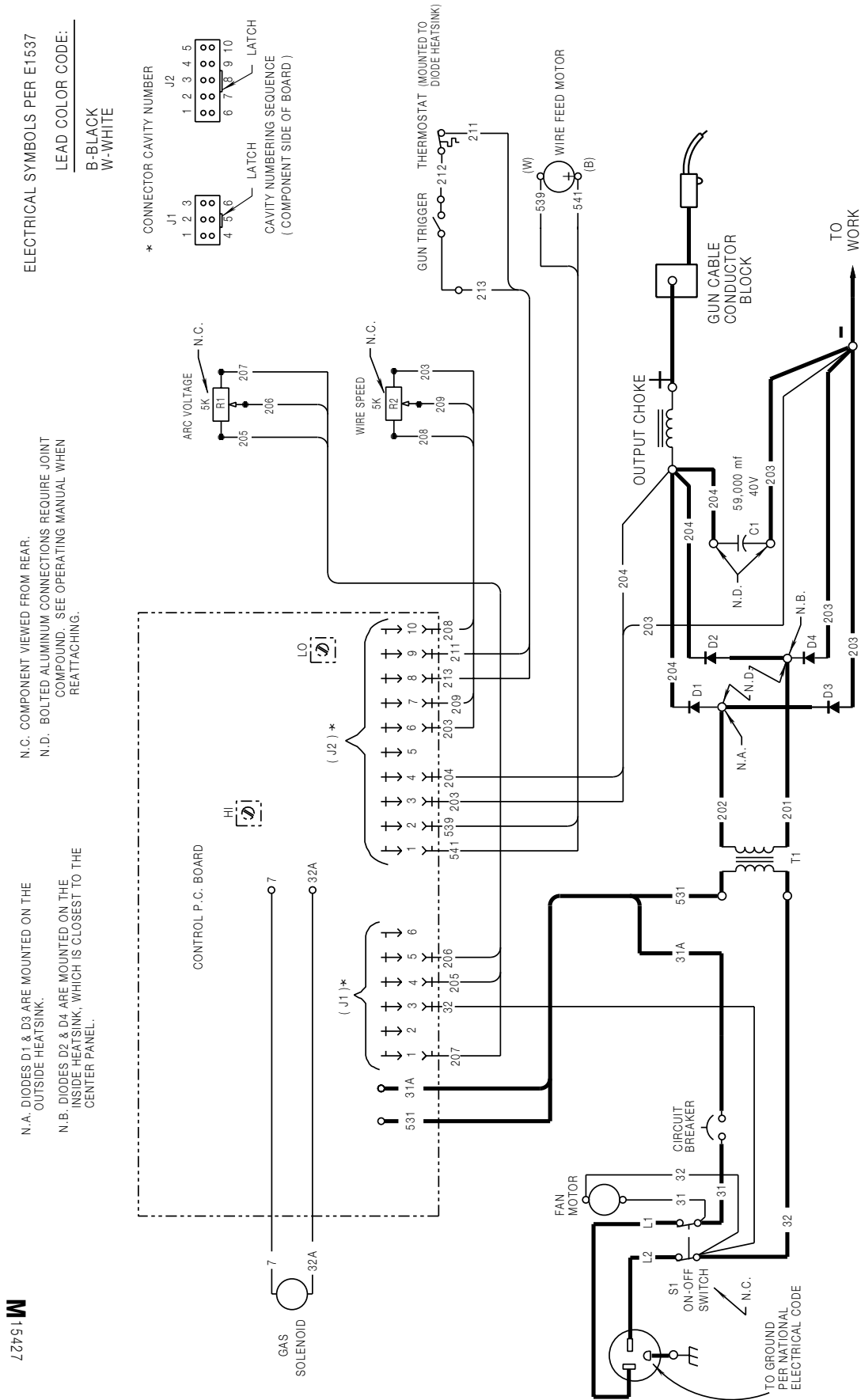
SP-100 WIRING DIAGRAM: CODES 9794 and Above

SP 100 WIRING DIAGRAM



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 posted inside the machine on one of the enclosure panels.

SP-100 WIRING DIAGRAM: CODES Below 9794

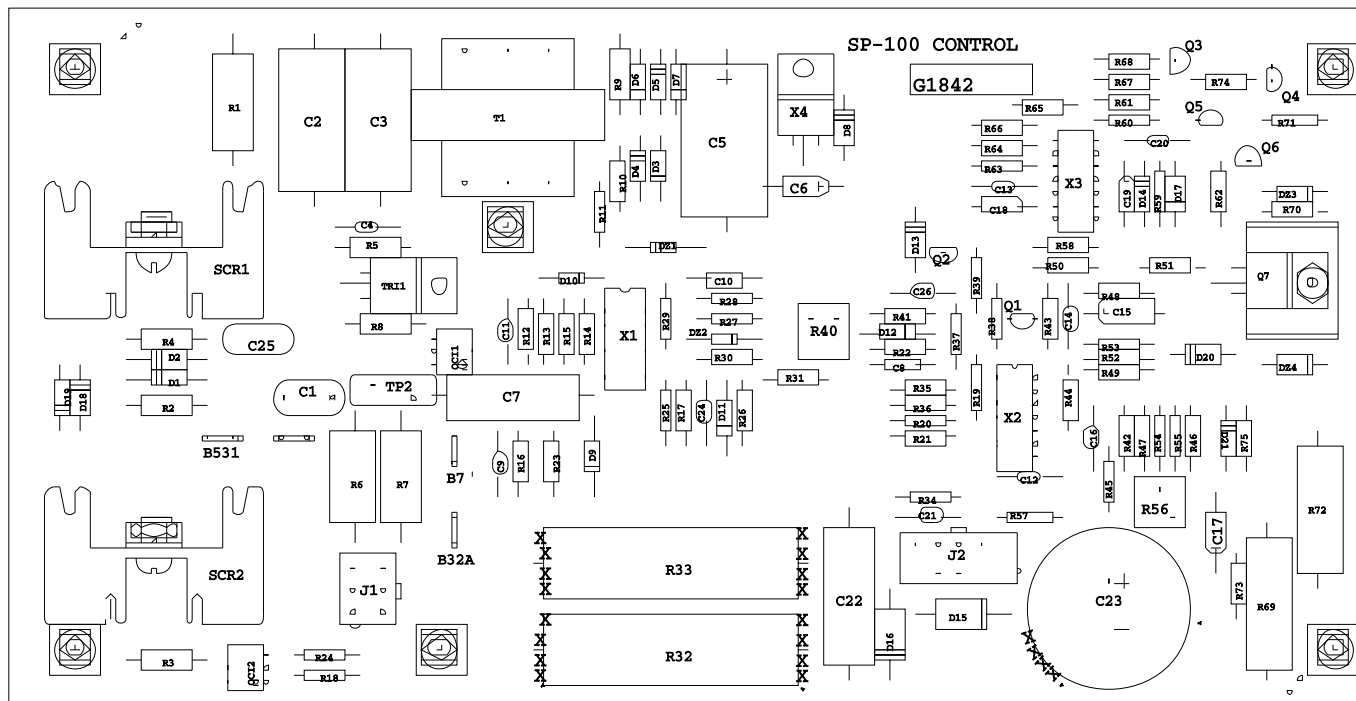


SP WELDERS
WIRING DIAGRAM
M 15427
8-1-910



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.

CONTROL P.C. BOARD G1842



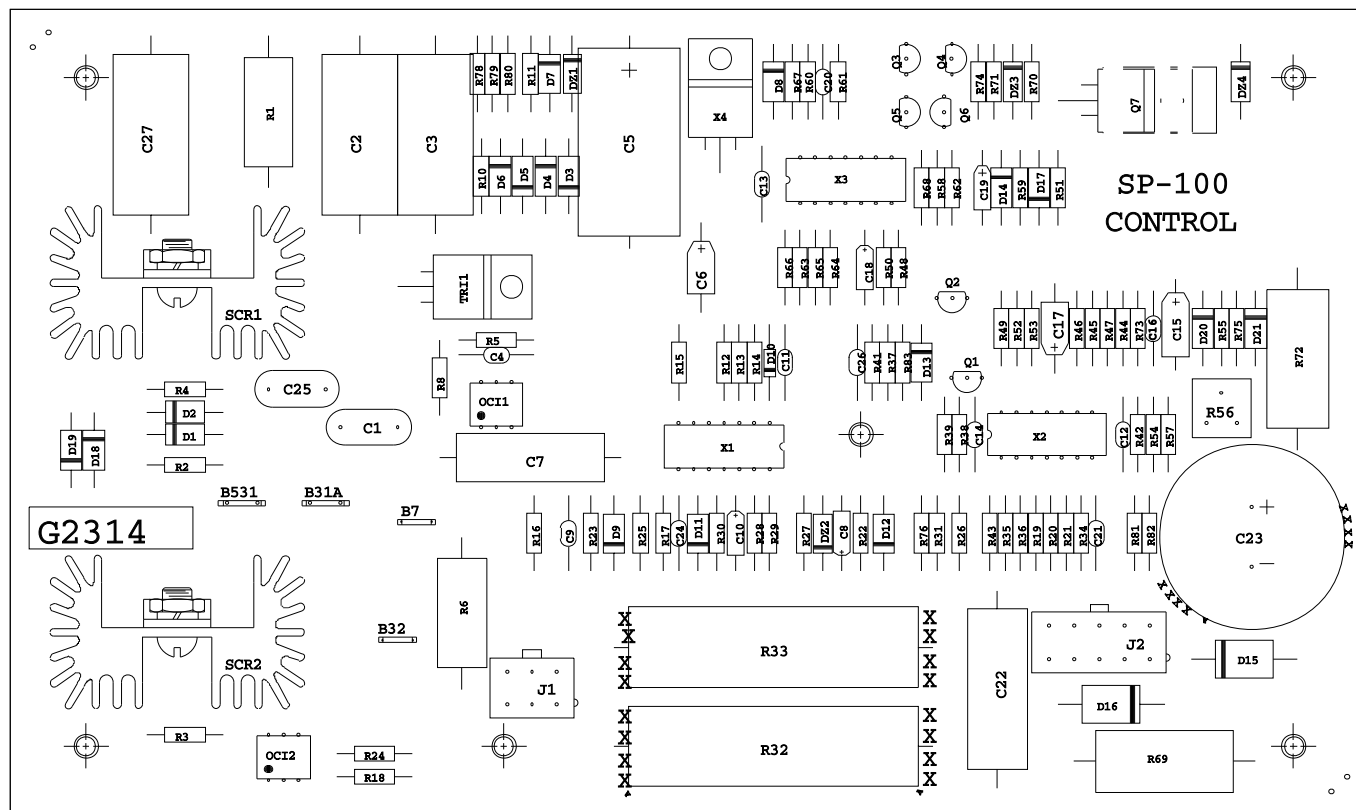
NOTE: Lincoln Electric assumes no responsibility for liabilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. This Printed Circuit Board schematic is provided for reference only. It may not be totally applicable to your machine's specific PC board version. This diagram is intended to provide general information regarding PC board function. 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.

CONTROL P.C. BOARD G1842

Item	Identification	Item	Identification
SCR1, SCR2	SCR & HEATSINK ASBLY	R45	RESISTOR-MF, 1/4W, 18.2K, 1%
X4	C-VOLT REG, FIXED, 3-T, (+), 1A, 15V	R28, R31, R47, R49	RESISTOR-MF, 1/4W, 2.21K, 1%
C4, C9, C11, C12, C13, C14, C16, C20, C21, C24, C26	CAPACITOR-CEMO, .022, 50V, 20%	R12, R38, R39, R60, R61	RESISTOR-MF, 1/4W, 22.1K, 1%
J1	CONNECTOR, MOLEX, MINI, PCB, 6-PIN	R75	RESISTOR-MF, 1/4W, 267, 1%
C5	CAPACITOR-ALEL, 150, 50V, +150/-10%	R22	RESISTOR-MF, 1/4W, 267K, 1%
D1 D2 D3, D4, D5, D6 D7 D8, D9, D11, D12, D13, D14 D17, D18, D19, D20, D21	DIODE-AXLDS, 1A, 400V	R46, R78, R79, R80	RESISTOR-MF, 1/4W, 3.32K, 1%
R32, R33	RESISTOR-WW, 15W, 80, 5%, SQ	R21, R35	RESISTOR-MF, 1/4W, 33.2K, 1%
C19	CAPACITOR-TAEL, 1.8, 20V, 10%	R44	RESISTOR-MF, 1/4W, 392K, 1%
C6, C17	CAPACITOR-TAEL, 4.7, 35V, 10%	R11	RESISTOR-MF, 1/4W, 4.75K, 1%
C15	CAPACITOR-TAEL, 18, 15V, 10%	R10, R62	RESISTOR-MF, 1/4W, 47.5K, 1%
C8, C10, C18	CAPACITOR-TAEL, 1.0, 35V, 10%	R23, R24	RESISTOR-MF, 1/4W, 562, 1%
C23	CAPACITOR-ALEL, 3300, 50V, +30/-10%	R17, R25, R29, R30	RESISTOR-MF, 1/4W, 56.2K, 1%
OC1, OC12	OPTOCOUPLER-TRIAC DRIVER, 3023	R76	RESISTOR-MF, 1/4W, 681, 1%
TRI1	TRIAC-T220, 6A, 400V, 2500D	R19, R65	RESISTOR-MF, 1/4W, 6.81K, 1%
J2	CONNECTOR, MOLEX, MINI, PCB, 10-PIN	R14, R20	RESISTOR-MF, 1/4W, 68.1K, 1%
C7	CAPACITOR-PEF, 0.1, 100V, 10%	R13	RESISTOR-MF, 1/4W, 82.5K, 1%
C22	CAPACITOR-PEF, 0.22, 100V, 10%	Q7	TRANSISTOR-PMF, T220, 6A, 100V, IRF9520
C1, C25	CAPACITOR-CD, .0047/.005, 1400V, 20%	X1, X2, X3	C-OP-AMP, QUAD, GEN-PURPOSE, 224N
C2, C3, C27	CAPACITOR-PEF, 0.1, 400V, 10%	Q1, Q6	TRANSISTOR-N, T226, 0.5A, 300V, MPS-A42
DZ3	ZENER DIODE-1W, 16V, 5%, 1N4745A	R37, R83	RESISTOR-MF, 1/4W, 2.00K, 1%
DZ1	ZENER DIODE-1W, 10V, 5%, 1N4740A	R34, R81, R82	RESISTOR-MF, 1/4W, 3.01K, 1%
DZ4	ZENER DIODE-1W, 43V, 5%, 1N4755A	R56	TRIMMER-ST, 1/2W, 10K, 10%, LINEAR
DZ2	ZENER DIODE-1W, 5.1V, 5%, 1N4733A	R6	RESISTOR-WW, 5W, 25, 5%, SQ
Q2, Q3, Q4, Q5	TRANSISTOR-N, T226, 0.5A, 40V, 2N4401	R1	RESISTOR-WW, 5W, 150, 5%, SQ
D15, D16	DIODE-AXLDS, 3A, 200V, 1N5402		
D10	DIODE-AXLDS, 0.15A, 75W, 1N914		
B31A, B531	CONNECTOR, TAB, QC, VERTICAL, 1/4		
B7, B32	CONNECTOR, TAB, QC, VERTICAL, 3/16		
R69, R72	RESISTOR-WW, 5W, 0.5, 5%, SQ		
R5	RESISTOR-MF, 1/4W, 100, 1%		
R2, R4, R8, R26, R27, R41, R48, R51, R55, R58, R70	RESISTOR-MF, 1/4W, 1.00K, 1%		
R50, R57, R53, R54, R71, R73, R74	RESISTOR-MF, 1/4W, 10.0K, 1%		
R42, R52, R53, R54, R59	RESISTOR-MF, 1/4W, 10.0K, 1%		
R43	RESISTOR-MF, 1/4W, 1.00M, %		
R15, R16, R18	RESISTOR-MF, 1/4W, 1.30K, 1%		
R3	RESISTOR-MF, 1/4W, 150, 1%		
R36, R63, R64, R67	RESISTOR-MF, 1/4W, 15.0K, 1%		

NOTE: Lincoln Electric assumes no responsibility for liabilities 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.

CONTROL P.C. BOARD G2314



NOTE: Lincoln Electric assumes no responsibility for liabilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. This Printed Circuit Board schematic is provided for reference only. It may not be totally applicable to your machine's specific PC board version. This diagram is intended to provide general information regarding PC board function. 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.

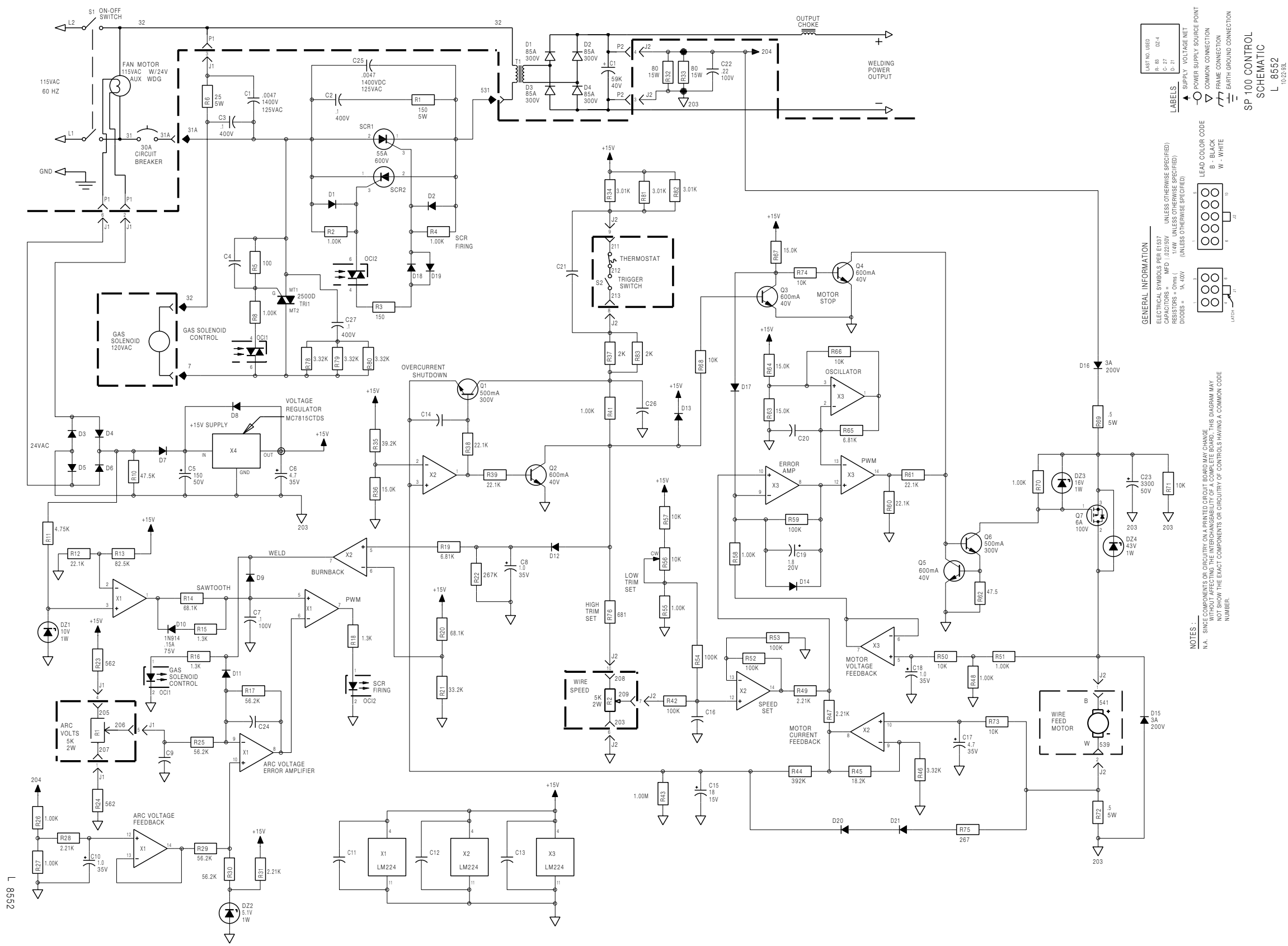
CONTROL P.C. BOARD G2314

Item	Identification	Item	Identification
SCR1, SCR2	SCR 81 HEATSINK ASBLY	R45	RESISTOR-MF, 1/4W, 18.2K, 1%
X4	C-VOLT REG, FIXED, 3-T, (+), 1A, 15V	R28, R31, R47, R49	RESISTOR-MF, 1/4W, 2.21 K, 1%
C4, C9, C11, C12, C13,	CAPACITOR-CEMO, .022, 50V, 20%	R12, R38, R39, R60,	RESISTOR-MF, 1/4W, 22.1K, 1%
C14, C16, C20, C21,		R61	
C24, C26		R75	RESISTOR-MF, 1/4W, 267,1 %
J1	CONNECTOR, MOLEX, MINI, PCB,	R22	RESISTOR-MF, 1/4W, 267K, 1%
	6-PIN	R46, R78, R79, R80	RESISTOR-MF, 1/4W, 3.32K, 1%
C5	CAPACITOR-ALEL, 150, 50V, +150/	R21	RESISTOR-MF, 1/4W, 33.2K, 1%
	-10%	R35	RESISTOR-MF, 1/4W, 39.2K, 1%
D1, D2, D3, D4, D5, D6,	DIODE-AXLDS, 1A, 400V	R44	RESISTOR-MF, 1/4W, 392K, 1%
D7, D8, D9, D11, D12,		R11	RESISTOR-MF, 1/4W, 4.75K, 1%
D13, D14, D17, D18,		R10	RESISTOR-MF, 1/4W, 47.5K, 1%
D19, D20, D21		R62	RESISTOR-MF, 1/4W, 47.5,1%
R32, R33	RESISTOR-WW, 15W, 80,5%, SQ	R23, R24	RESISTOR-MF, 1/4W, 562,1%
C19	CAPACITOR-TAEL, 1.8, 20V, 10%	R17, R25, R29, R30	RESISTOR-MF, 1/4W, 56.2K, 1%
C6, C17	CAPACITOR-TAEL, 4.7, 35V, 10%	R76	RESISTOR-MF, 1 /4W, 681,1 %
C15	CAPACITOR-TAEL, 18,15V, 10%	R19, R65	RESISTOR-MF, 1/4W, 6.81K, 1%
C8, C10, C18	CAPACITOR-TAEL, 1.0, 35V, 10%	R14, R20	RESISTOR-MF, 1/4W, 68.1K, 1%
C23	CAPACITOR-ALEL, 3300, 50V, +30/-10%	R13	RESISTOR-MF, 1/4W, 82.5K, 1%
OC1 OC12	OPTOCOUPLER-TRIAC DRIVER, 3023	Q7	TRANSISTOR-PMF, T220, 6A, 100V,
TRI1	TRIAC-T220, 6A, 400V, 2500D		IRF9520
J2	CONNECTOR, MOLEX, MINI, PCB,	X1, X2, X3	C-OP-AMP, OUAD, GEN-PURPOSE,
	10-PIN		224N
C7	CAPACITOR-PEF, 0.1,100V, 10%	Q1, Q6	TRANSISTOR-N, T226, 0.5A, 300V,
C22	CAPACITOR-PEF, 0.22, 100V, 10%		MPS-A42
C1, C25	CAPACITOR-CD, .0047/.005, 1400V,	R37, R83	RESISTOR-MF, 1/4W, 2.00K, 1%
	20%	R34, R81, R82	RESISTOR-MF, 1/4W, 3.01K, 1%
C2 C3 C27	CAPACITOR-PEF, 0.1, 400V, 10%	R56	TRIMMER-ST, 1/2W, 10K, 10%,
DZ3	ZENER DIODE-1W, 16V, 5%,1N4745A		LINEAR
DZ1	ZENER DIODE-1W, 10V, 5%,1N4740A	R6	RESISTOR-WW, 5W, 25, 5%, SQ
DZ4	ZENER DIODE-1W, 43V, 5%,1N4755A	R1	RESISTOR-WW, 5W, 150, 5%, SQ
DZ2	ZENER DIODE-1W, 5.1V, 5%,1N4733A		
Q2, Q3, Q4, Q5	TRANSISTOR-N, T226, 0.5A, 40V,		
	2N4401		
D15, D16	DIODE-AXLDS, 3A, 200V, 1N5402		
D10	DIODE-AXLDS, 0.15A, 75V, 1N914		
B31 A, B531	CONNECTOR, TAB, QC, VERTICAL,		
	1/4		
B7, B32	CONNECTOR, TAB, QC, VERTICAL,		
	3/16		
R69, R72	RESISTOR-WW, 5W, 0.5,5%, SQ		
R5	RESISTOR-MF, 1/4W, 100, 1%		
R2, R4, R8, R26, R27,	RESISTOR-MF, 1/4W, 1.00K, 1%		
R41, R48, R51, R55,			
R58, R70			
R50, R57, R66, R68,	RESISTOR-MF, 1/4W, 10.0K, 1%		
R71, R73, R74			
R42, R52, R53, R54,	RESISTOR-MF, 1/4W, 100K, 1%		
R55			
R43	RESISTOR-MF, 1/4W, 1.00M, %		
R15, R16, R18	RESISTOR-MF, 1/4W, 1.30K, 1%		
R3	RESISTOR-MF, 1/4W, 150,1%		
R36, R63, R64, R67	RESISTOR-MF, 1/4W, 15.0K, 1%		

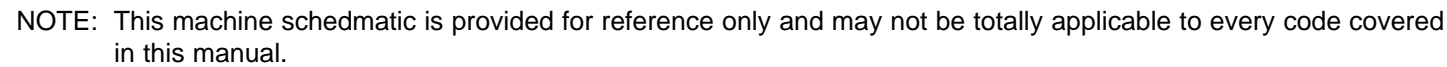
NOTE: Lincoln Electric assumes no responsibility for liabilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. 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.

ELECTRICAL DIAGRAMS

MACHINE SCHEMATIC: Codes 9794 and Above



NOTE: This machine schedmatic is provided for reference only and may not be totally applicable to every code covered in this manual.



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

LINCOLN®
ELECTRIC