

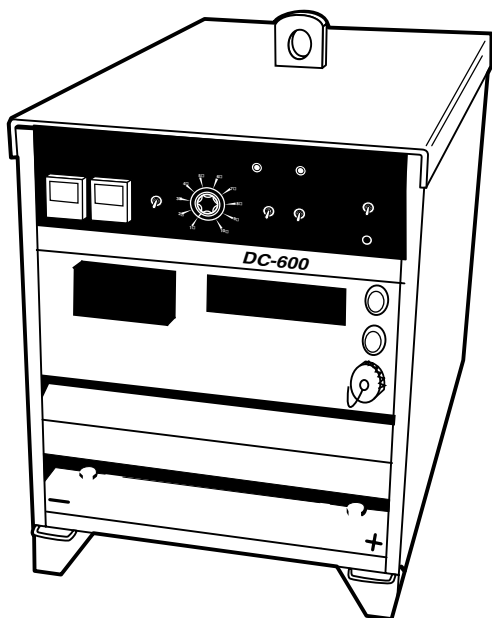


NOTE: This manual will cover most of the troubleshooting and repair procedures for the code numbers listed. Some variances may exist when troubleshooting/repairing later code numbers.

DC-600

For use with machines having Code Numbers: **10588; 10589; 10590; 10591; 10592; 10593; 10594; 10595; 10596; 10639; 10640; 10641; 10700; 10701; 11071; 11072; 11129; 11130; 11131; 11132; 11133; 11140; 11335; 11336; 11337; 11338; 11339; 11537; 11538; 11539; 11540; 11541; 11568; 12390**

SERVICE MANUAL



⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

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.



FOR ENGINE powered equipment.

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



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



1.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.

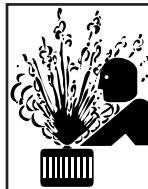
1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.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.



1.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.

1.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.



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



ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.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

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

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

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

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

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

2.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.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.



ELECTRIC SHOCK can kill.

3.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.

3.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.

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.

3.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.

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

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

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

3.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.

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

3.j. Also see Items 6.c. and 8.



ARC RAYS can burn.

4.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.

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

4.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.

5.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.**

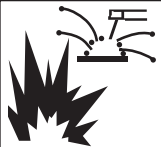
5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

5.c. 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.

5.d. 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.

5.e. 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.

5.f. Also see item 1.b.



WELDING and CUTTING SPARKS can cause fire or explosion.

6.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.

- 6.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.
- 6.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.
- 6.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).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.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.
- 6.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.
- 6.h. Also see item 1.c.
- 6.i. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.
- 6.j. Do not use a welding power source for pipe thawing.



CYLINDER may explode if damaged.

7.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.

- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.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.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.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.

- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

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 reçoit 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.

Electromagnetic Compatibility (EMC)

Conformance

Products displaying the CE mark are in conformity with European Community Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC). It was manufactured in conformity with a national standard that implements a harmonized standard: **EN 60974-10** Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

Introduction

All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

Installation and Use

The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve construction of an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons according to national codes. Changing the earthing arrangements should only be authorized by a person who is competent to access whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

Assessment of Area

Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;
- b) radio and television transmitters and receivers;
- c) computer and other control equipment;
- d) safety critical equipment, e.g., guarding of industrial equipment;
- e) the health of the people around, e.g., the use of pacemakers and hearing aids;
- f) equipment used for calibration or measurement
- g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- h) the time of day that welding or other activities are to be carried out.

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Electromagnetic Compatibility (EMC)

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of Reducing Emissions

Mains Supply

Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

Maintenance of the Welding Equipment

The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to floor level.

Equipotential Bonding

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece

Where the workpiece is not bonded to earth for electrical safety, not connected to earth because of its size and position, e.g., ships hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications. ¹

¹ Portions of the preceding text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

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TECHNICAL SPECIFICATIONS – DC-600

INPUT - THREE PHASE ONLY					
Standard Voltage	Input Current at Rated Output				
	100% Duty Cycle	60% Duty Cycle	50% Duty Cycle		
230/460/60		122/61	134/67		
230/460/575/60	108/54	122/61/49	134/67/54		
460/60	108/54/43	61	67		
575/60	54	49	54		
220/380/440/50/60	43	128/74/64	138/80/69		
380/500/50/60	116/67/58	74/56	80/61		
440/50/60	67/51	64	69		
200/400/50/60	58	140/70	152/76		
415/50/60	128/64	68	73		
	61				
RATED OUTPUT					
Duty Cycle	Amps	Volts at Rated Amperes			
100% Duty Cycle	600	44			
60% Duty Cycle	680	44			
50% Duty Cycle	750	44			
OUTPUT					
Output Range	Maximum Open Circuit Voltage	Auxiliary Power			
70A/13V-780A/44V (CV) 90A/24V-780A/44V (CC)	72V for 60 HZ models 69V for 50/60 HZ models	See the OPERATION section for Auxiliary Power information by model			
RECOMMENDED INPUT WIRE AND FUSE SIZES					
INPUT VOLTAGE / FREQUENCY	HERTZ	INPUT AMPERE RATING ON NAMEPLATE	TYPE 75°C COPPER WIRE IN CONDUIT AWG(IEC-MM ²) SIZES 30°C (86°F) Ambient	TYPE 75°C GROUND WIRE IN CONDUIT AWG(IEC-MM ²) SIZES	TYPE 75°C (SUPER LAG) OR BREAKER SIZE (AMPS) ¹
230	60	108	2 (34)	6 (14)	175 Amp
460	60	54	6 (14)	8 (8.4)	90 Amp
575	60	43	8 (8.4)	8 (8.4)	70 Amp
200	50/60	128	1 (43)	6 (14)	175 Amp
220	50/60	116	2 (34)	6 (14)	175 Amp
380	50/60	67	6 (14)	8 (8.4)	100 Amp
400	50/60	64	6 (14)	8 (8.4)	100 Amp
415	50/60	61	6 (14)	8 (8.4)	100 Amp
440	50/60	58	6 (14)	8 (8.4)	90 Amp
500	50/60	51	8 (8.4)	8 (8.4)	80 Amp
PHYSICAL DIMENSIONS					
HEIGHT	WIDTH	DEPTH	WEIGHT		
30.75 in 781 mm	22.25 in 567 mm	39.0 in 988 mm	522 lbs. 237 kg.		

¹Also called "inverse time" or "thermal/magnetic" circuit breakers; circuit breakers which have a delay in tripping action that decreases as the magnitude of the current increases.

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SAFETY PRECAUTIONS

Read entire Installation Section before installing the DC-600.

ELECTRIC SHOCK CAN KILL.

⚠ WARNING



- Only qualified personnel should install this machine.
- Turn the input power OFF at the disconnect switch or fuse box before working on the equipment.

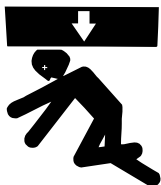
- Do not touch electrically hot parts.
- Always connect the IDEALARC DC-600 grounding terminal to a good electrical earth ground.
- Set the DC-600 Power ON/OFF PUSH BUTTON to the OFF position when connecting power cord to input power.

SELECT PROPER LOCATION

Place the welder where clean cooling air can freely circulate in through the front louvers and out through the rear louvers. Dirt, dust or any foreign material that can be drawn into the welder should be kept at a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shut-downs.

LIMIT ON STACKING

⚠ WARNING



FALLING EQUIPMENT can cause injury.

- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.
- Do not lift this machine using lift bail if it is equipped with a heavy accessory such as trailer or gas cylinder.
- Do not lift machine if lift bail is damaged.
- Do not operate machine while suspended from lift bail.
- Do not stack more than three high.
- Do not stack the DC-600 on top of any other machine.

STACKING

Three DC-600 machines can be stacked.

DO NOT stack more than three machines in one grouping.

DO NOT stack the DC-600 on another type of machine.

Follow these guidelines when stacking:

1. Select a firm, level surface capable of supporting the total weight of up to three machines (1570 pounds/712 kilograms).
2. Set the bottom machine in place.
3. Stack the second machine on top of it by aligning the two holes in the base rails of the second machine with the two pins on top front of the bottom machine.
4. Repeat process for third machine.

NOTE: The machines must be stacked with the Case Front of each machine flush with each other. See Figure A.1.

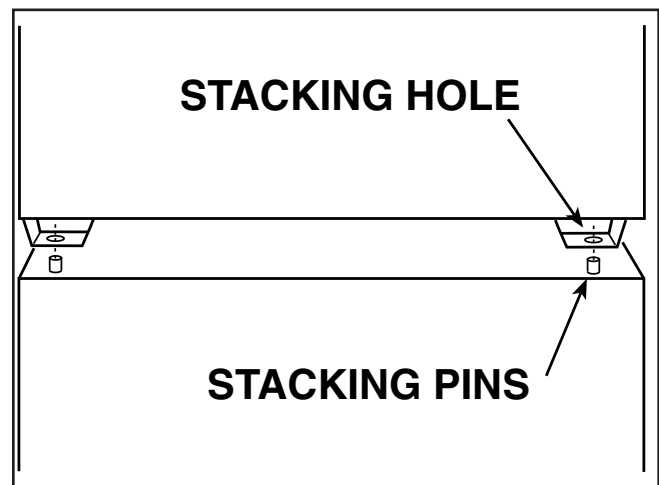


FIGURE A.1 - Stacking DC-600 machines

TILTING

The DC-600 must be placed on a stable, level surface so it will not topple over.

DC-600

LINCOLN
ELECTRIC

ELECTRICAL INPUT CONNECTIONS

Before installing the machine check that the input supply voltage, phase, and frequency are the same as the voltage, phase, and frequency as specified on the welder Rating Plate located on the Case Back Assembly. Input power supply entry is through the hole in the Case Back Assembly. See Figure A.2 for the location of the machine's input cable entry opening, Input Contactor (CR1), and reconnect panel assembly for dual voltage machines.

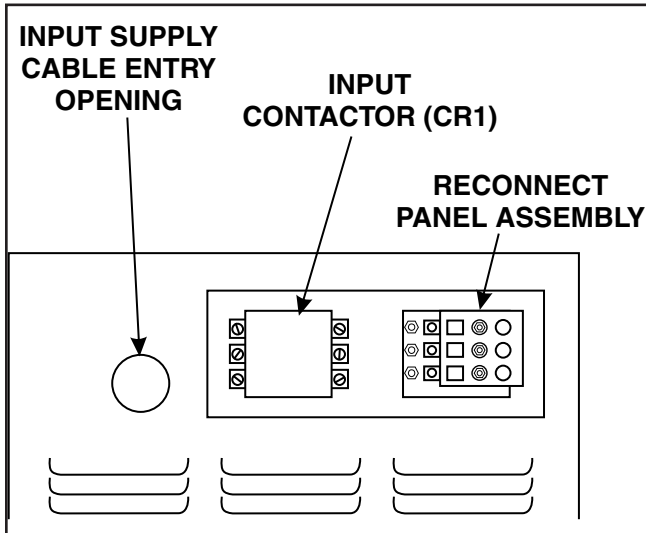


FIGURE A.2 - Rear Panel

FUSE AND WIRE SIZES

Protect the input circuit with the super lag fuses or delay type circuit breakers listed on the Technical Specifications page of this manual for the machine being used. They are also called inverse time or thermal/magnetic circuit breakers.

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

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

GROUND CONNECTION

Ground the frame of the machine. A ground terminal marked with the symbol () is located inside the Case Back of the machine near the input contactor. Access to the Input Box Assembly is at the upper rear of the machine. See your local and national electrical codes for proper grounding methods.

INPUT POWER SUPPLY CONNECTIONS

A qualified electrician should connect the input power supply leads.

1. Follow all national and local electrical codes.
2. Use a three-phase line.
3. Remove Input Access Door at upper rear of machine.
4. Follow Input Supply Connection Diagram located on the inside of the door.
5. Connect the three-phase AC power supply leads L1, L2, and L3 to the input contactor terminals in the Input Box Assembly by passing them thru the three aligned .50” diameter holes in the baffle and tighten them in the terminal connectors. Be sure to close the baffle by inserting the tab into the slot in the baffle. See Figure A.3.

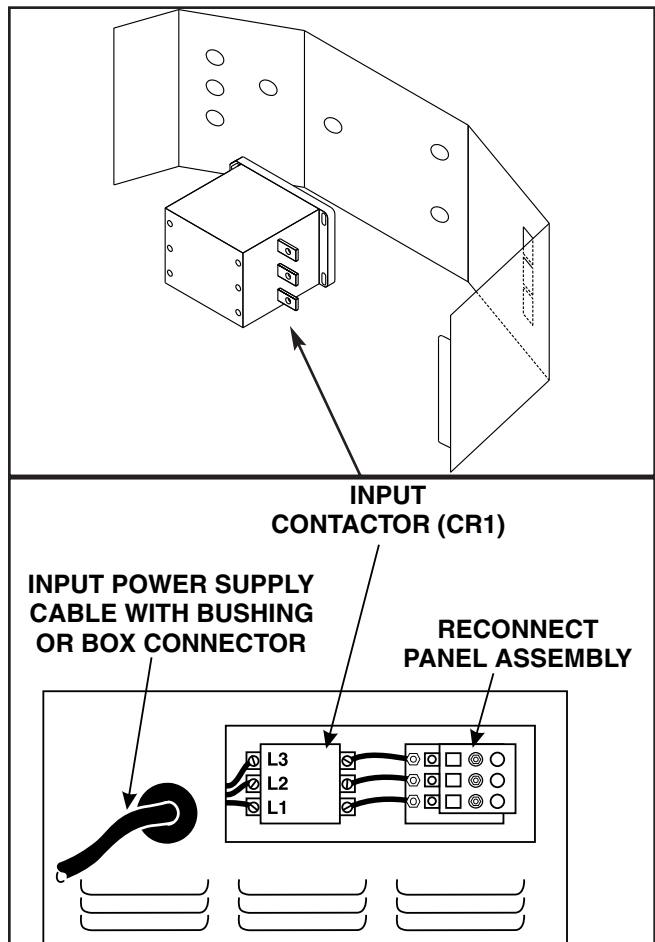


FIGURE A.3 - Input Power Supply Connections

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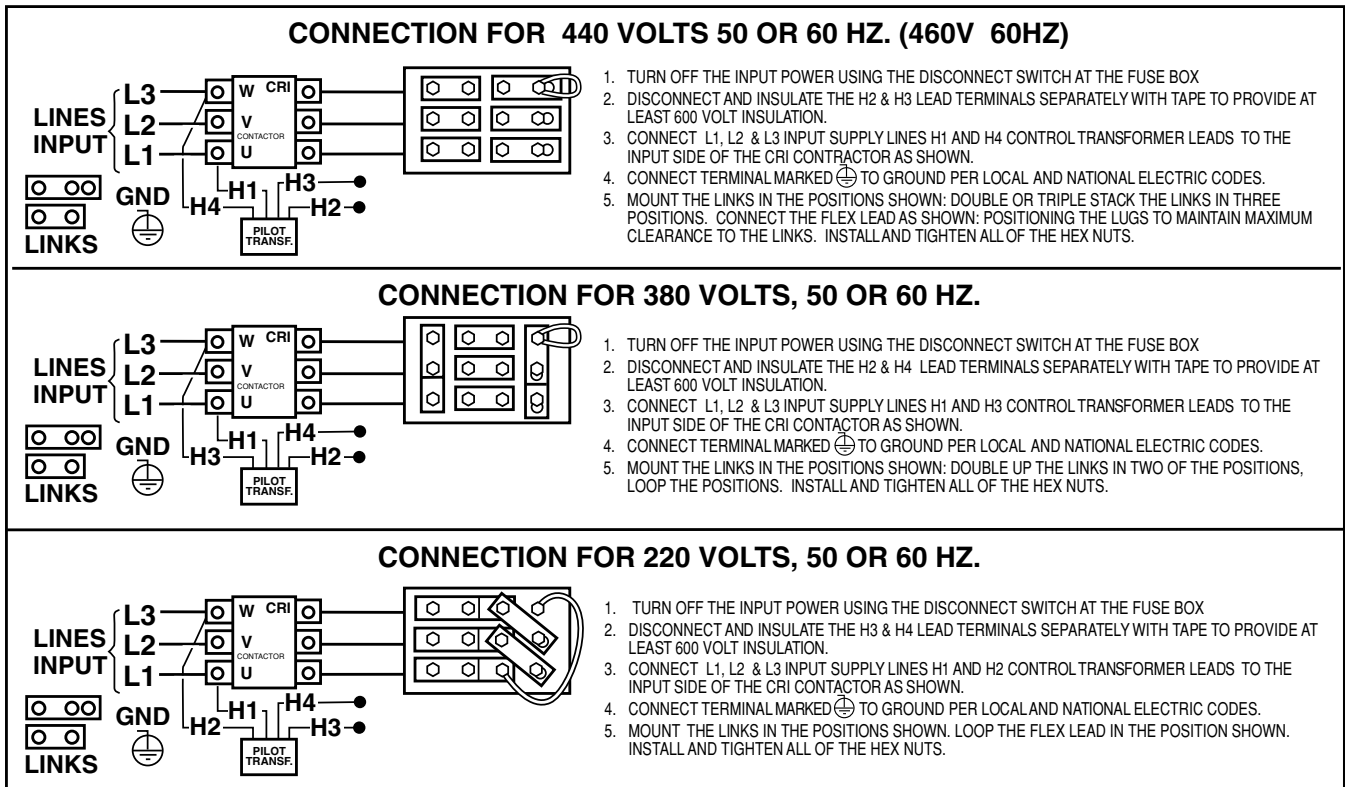


FIGURE A.5-Reconnect Panel Board Positions for 220/380/440 VAC Machines

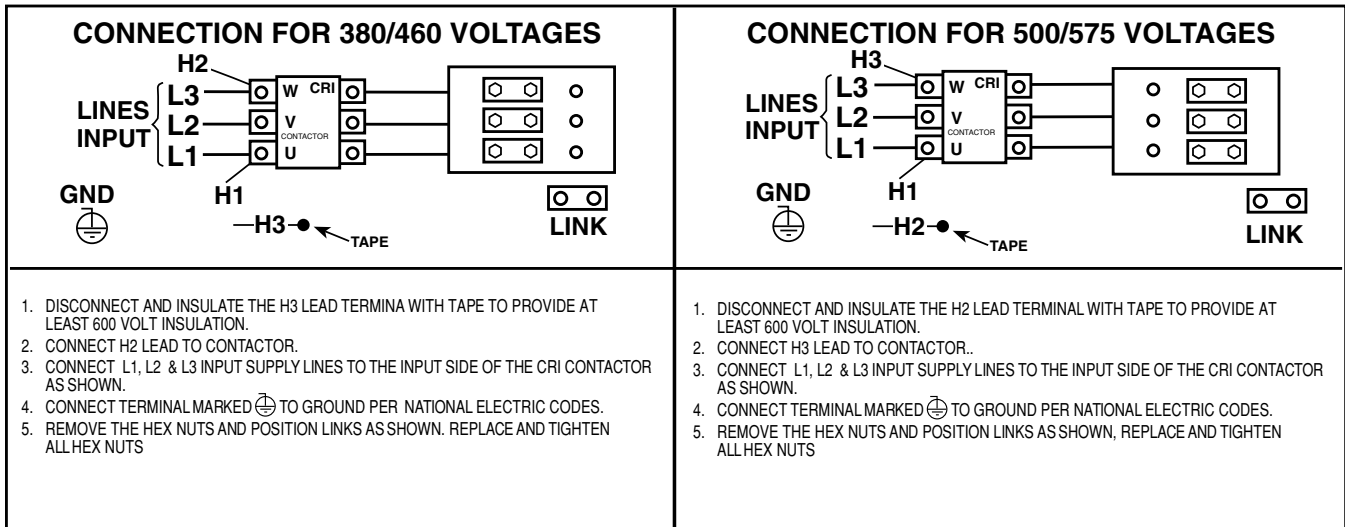


FIGURE A.6-Reconnect Panel Board Positions for 380/500, 460/575 VAC Machines

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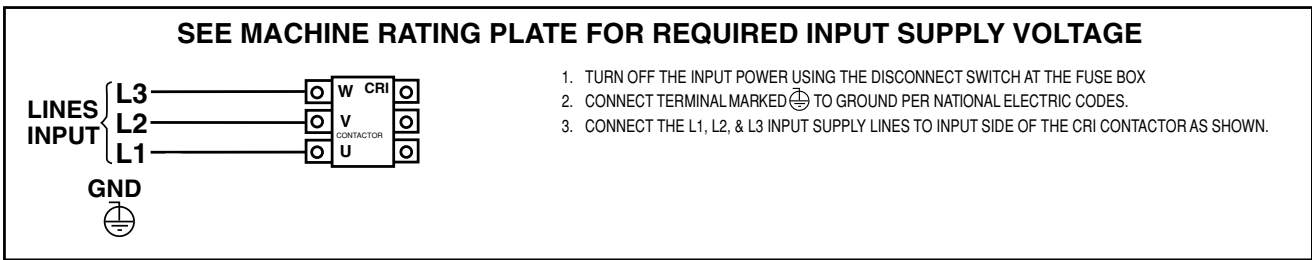


FIGURE A.7-Reconnect Panel Board Positions for Single Voltage Machines

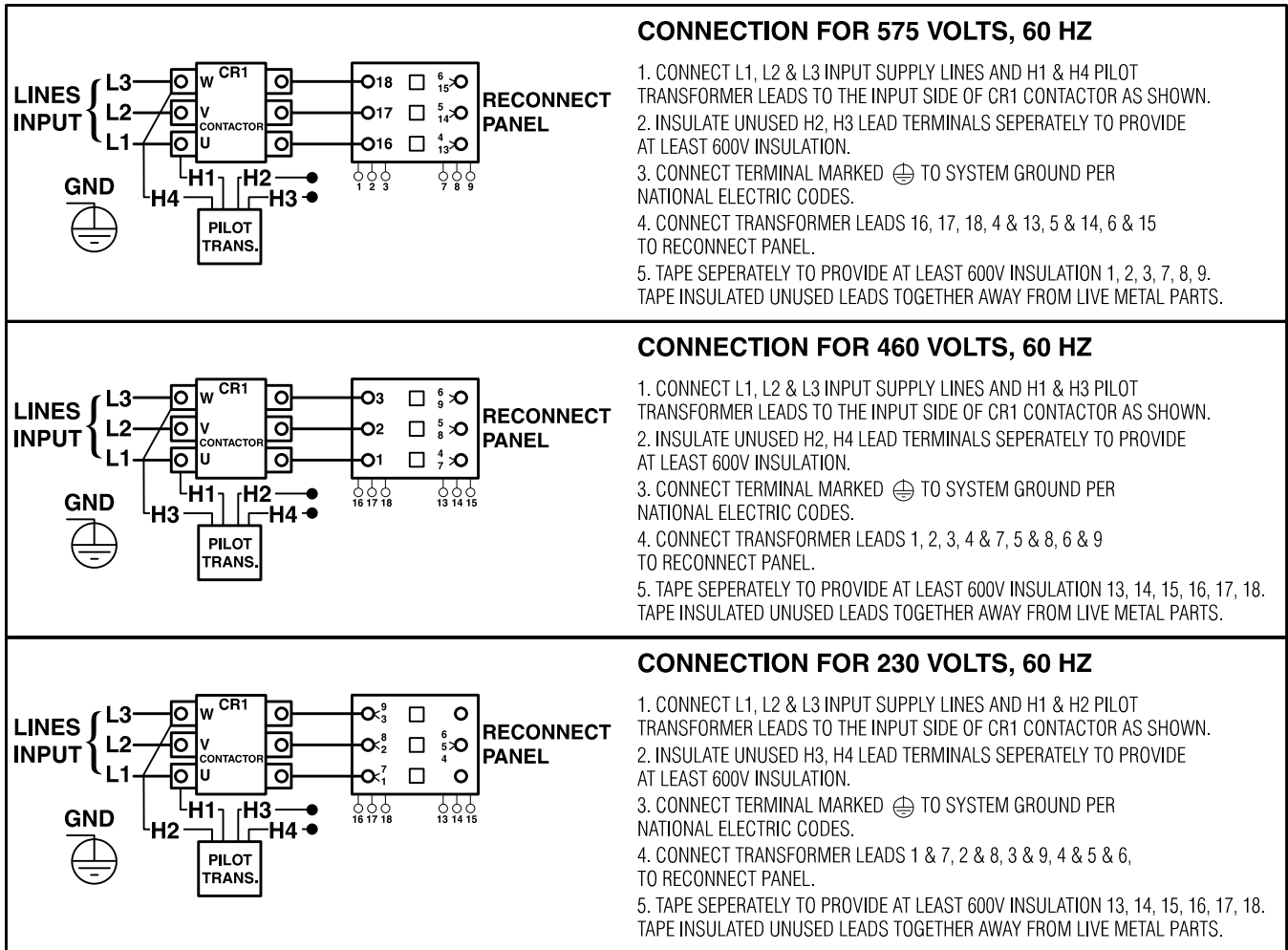


FIGURE A.8-Reconnect Panel Board Positions for 230/460/575 VAC Machines

OUTPUT CONNECTIONS

See Table A.1 for recommended DC-600 cable sizes for combined lengths of electrode and work cables.

TABLE A.1
DC-600 Cable Sizes for Combined Lengths of Copper Electrode and Work Cable
at 100% Duty Cycle

ELECTRODE, WORK AND #21 LEAD

Cable Length	Parallel Cables	Cable Size
Lengths up to 150 ft. (46m)	2	1/0 (53mm ²)
150 ft.(46m) to 200 ft (61m)	2	2/0 (67mm ²)
200 ft.(61m) to 250 ft.(76m)	2	3/0 (85mm ²)

CONNECTIONS

A. Connect Electrode and Work Leads to Output Terminals.

1. Set the ON/OFF toggle switch to OFF.
2. Locate the retractable strain relief loops directly below the output terminals in the lower right and lower left corners of the Case Front Assembly. See Figure A.9.
3. Pull out the retractable strain relief loops.
4. Insert the electrode lead through the loop directly below the desired polarity (positive or negative). Pull through enough cable to reach the output terminals.
5. Connect electrode lead to the desired terminal (positive/negative).
6. Tighten the output terminal nut with a wrench.
7. Connect the work lead to the other output terminal following steps 4-6.

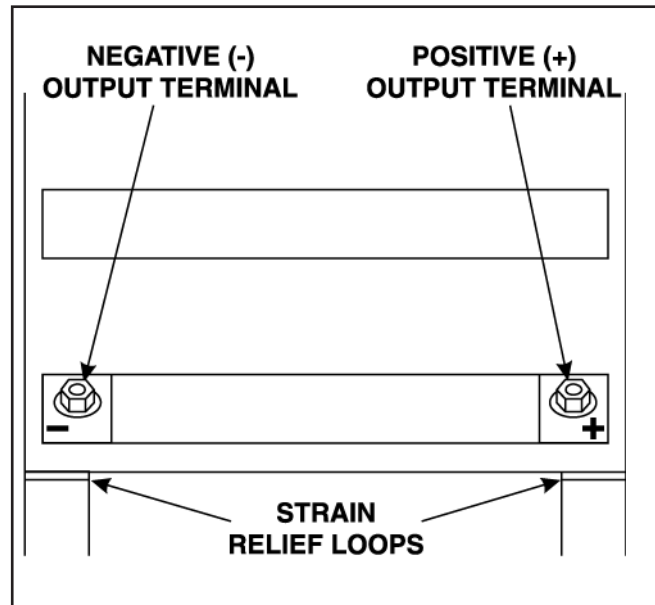


FIGURE A.9 - Output Terminals.

B. Connect #21 Work Sense Lead to Proper Terminal

There are two work sense lead connection points (+21 and -21) on terminal strip (T.S.2) located behind the hinged access panel on the right side of the case front. See 14 Pin MS Type Receptacle section or Terminal Strip Section for connection procedure.

AUXILIARY POWER AND CONTROL CONNECTIONS

Located at the left side of the front of the welder behind a hinged cover is a 115VAC duplex receptacle for auxiliary power (60 Hertz Models only). On the right side of the case front is a 14 Pin MS type receptacle for connection of auxiliary equipment such as wire feeders. Also, terminal strips with 115VAC and connections for auxiliary equipment are located behind the hinged access panel on the right side of the case front. (see Auxiliary Power Table for details)

AUXILIARY POWER TABLE

Voltage and Circuit Breaker Ratings at Auxiliary Power Connections for Various Models

Auxiliary Power Connections	60 Hz Models	50/60 Hz Models
At Duplex Receptacle	115V 15A	No Duplex
Terminal strip terminals 31 & 32	115V 15A	115V 15A
MS-Receptacle pins A & J	115V 15A	115V 15A
MS-Receptacle pins I & K	42V 10A	42V 10A

115VAC DUPLEX RECEPTACLE (60 HERTZ MODELS ONLY)

The 115VAC duplex receptacle is protected by a circuit breaker located on the nameplate. The receptacle is a NEMA 5-15R.

14 PIN MS TYPE RECEPTACLE

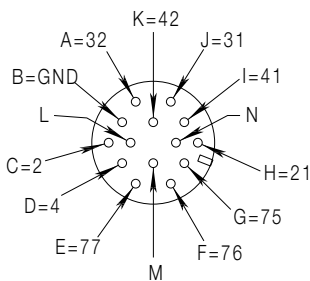
(For MS3106A-20-27PX Plug. L.E.C. Part #S12020-32)

Refer to the figure A.10 for the available circuits in the 14 pin receptacle.

42 VAC is available at receptacle pins I and K. A 10 amp circuit breaker protects this circuit.

115 VAC is available at receptacle pins A and J (All Models). A 15 amp circuit breaker protects this circuit. Note that the 42 VAC and 115 VAC circuits are electrically isolated from each other.

FIGURE A.10 FRONT VIEW OF 14-PIN CONNECTOR RECEPTACLE



PIN	LEAD NO.	FUNCTION
A	32	115 VAC
B	GND	Chassis Connection
C	2	Trigger Circuit
D	4	Trigger Circuit
E	77	Output Control
F	76	Output Control
G	75	Output Control
H	21	Work Sense Connection ²
I	41	42 VAC
J	31	115 VAC ¹
K	42	42 VAC
L	---	---
M	---	---
N	---	---

TERMINAL STRIPS

Terminal strips are available behind the cover on the case front to connect wire feeder control cables that do not have a 14 Pin MS-type connector. These terminals supply the connections as shown in the following Terminal Strip charts. NOTE: There are two work sense lead connection points on the terminal strip. Connect both the work sense lead #21 from the 14 pin connector and #21 lead of the control cable to “-21” when welding positive polarity or to “+21” when welding negative polarity.

TERMINAL STRIP 1 (T.S.1)

Lead No.	Function
75	Output Control
76	Output Control
77	Output Control

TERMINAL STRIP 2 (T.S.2)

Lead No.	Function
+21	Work Connection (Electrode Negative)
-21	Work Connection (Electrode Positive) ²
41	42 VAC
4	Trigger Circuit
2	Trigger Circuit
31	115 VAC ¹
32	115 VAC ¹

¹ 115VAC circuit is on all models.

² As shipped from the factory Lead #21 from the 14 Pin connector is connected to “-21” on the terminal strip (T.S.2). This is the configuration for positive welding. If welding negative polarity, connect lead #21 to the “+21” connection point on the terminal strip (T.S.2).

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SAFETY PRECAUTIONS

Read this entire section of operating instructions before operating the machine.



WARNING



ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.
- Do not use AC welder if your clothing, gloves or work area is damp or if working on, under or inside work-piece.



Use the following equipment:

- Semiautomatic DC constant voltage (wire) welder.
- DC manual (stick) welder.
- AC welder with reduced voltage control.
- Do not operate with panels removed.
- Disconnect input power before servicing.

READ THIS WARNING, PROTECT YOURSELF & OTHERS.



FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust at the arc, or both, to keep fumes and gases from your breathing zone and general area.



WELDING, CUTTING and GOUGING SPARKS can cause fire or explosion.

- Do not weld near flammable material.
- Do not weld, cut or gouge on containers which have held flammable material.



ARC RAYS can burn.

- Wear eye, ear, and body protection.

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

DC-600



GENERAL DESCRIPTION

The DC-600 is an SCR controlled three phase welding and cutting power source. It uses a single range potentiometer to control:

- Submerged Arc Semi-Automatic or Automatic Welding
- Open Arc Semi-Automatic or Automatic Welding
- Stick Welding
- Air/Carbon Arc Cutting (Carbon Rod Sizes up to 3/8" Diameter)

The DC-600 has a three-position Welding Mode Switch to enable the user to operate in one of three modes:

- Constant Current (CC) Stick (also used for AAC)
- Constant Voltage (CV) Submerged Arc
- Constant Voltage (CV) Innershield (also used for FCAW/GMAW)

Three models are available:

- Domestic - all 60 Hertz models except 230/460/575V.
- Canadian-230/460/575V 60 Hertz models
- Export-50/60 Hertz models

The optional Multi-Process Switch allows the user to switch between semi-automatic or automatic welding and stick welding or air/carbon arc cutting without disconnecting the wire feeder equipment control, electrode, and work leads.

RECOMMENDED PROCESSES AND EQUIPMENT

The DC-600 is designed for GMAW (MIG), FCAW, and submerged arc (SAW) within the capacity of the machine. It can also be used for stick welding (SMAW) and for air carbon arc (AAC) cutting with carbon rods up to 3/8" diameter.

The DC-600 is provided with a three position mode switch that selects CV Innershield, CV Submerged Arc, or CC Stick.

The DC-600 can be easily connected to wire feeding equipment, including:

- Semi-automatic wire feeders LN-7, LN-7 GMA, LN-742, LN-8, LN-9, LN-9 GMA, LN- 10, LN-15 LN-23P, LN-25, and DH-10.
- Automatic wire feeders NA-3, NA-5, and NA-5R.
- Tractors LT-56 and LT-7

DESIGN FEATURES AND ADVANTAGES

- Excellent arc characteristics for optimum constant voltage submerged arc and Innershield welding performance.
- A control circuit designed to provide good starting for a large variety of processes and procedures.
- Output Control Potentiometer that provides easy single range continuous control.
- Output Control Switch that provides simple switching from local to remote control.
- Output Terminals Switch to energize output terminals either local or remote.
- White neon pilot light to confirm that the Input Contactor is energized.
- DC Ammeter and Voltmeter
- 42VAC 10 Amp auxiliary power available for the wire feeder, circuit breaker protected.
- Single MS-type (14 pin) connector for wire feeder.
- 115VAC 15 Amp auxiliary power available for the wire feeder, circuit breaker protected.
- 115VAC 15 Amp duplex plug receptacle available on 60 Hertz models, circuit breaker protected.
- Multi-functional terminal strip for easy connection of wire feeding control cables.
- Recessed output terminals to avoid any person or object from accidentally coming into contact with the output terminals and labeled " + " and " - " for easy identification.
- Thermostatically protected power source.
- Electronic protection circuit to protect power source against overloads.
- Input line voltage compensation to provide an essentially constant output.
- SCR electronically controlled welder output provides extra long life, especially for highly repetitive welding applications.
- Solid state 2 and 4 circuit for extra long life.
- Two circuit solid state control system provides maximum performance and circuit protection.
- Low profile case provides maximum use of space.
- Convenient access to all controls.
- Output lead strain relief loops to prevent terminal and cable damage.
- Easily removed case side, even when stacked.
- Outdoor operation because enclosure is designed with air intake louvers that keep dripping water from entering the unit. Transformer, SCR bridge, and choke have special corrosion resistant paint for added protection.

DC-600



WELDING CAPABILITY

The DC-600 has the following Output and Duty Cycle based on operation for a 10 minute period:

- 600 Amps, 44 Volts at 100%
- 680 Amps, 44 Volts at 60%
- 750 Amps, 44 Volts at 50%

MEANINGS OF GRAPHICAL SYMBOLS ON CASE FRONT

Input POWER ON/OFF Switch

SYMBOL

MEANING



ON



OFF



INPUT POWER

Pilot Light



Input power on when light is illuminated (except for abnormal conditions). Always indicates POWER ON/OFF switch is in ON position.

OUTPUT CONTROL



OUTPUT VOLTAGE AND CURRENT



Clockwise Increase of Output Voltage and Current

TERMINALS ON/REMOTE Switch



OUTPUT TERMINALS ENERGIZED



Remote Control of Output Terminals (Energized or Non-Energized)

LOCAL/REMOTE Switch

SYMBOL

MEANING



Control Of Output Voltage and Current is Via DC-600's Control Dial



Remote Control of Output Voltage and Current

MODE Switch



CC STICK: Shielded Metal Arc Welding (SMAW), this switch position is also used for Air Carbon Arc Cutting (AAC)



CV SUBMERGED ARC: Constant Voltage Submerged Arc Welding (SAW)



CV INNERSHIELD: Flux Cored Arc Welding (FCAW), this switch position is also used for Gas Metal Arc Welding (GMAW).

Output Terminal Connections



Positive Output Terminal



Negative Output Terminal

WARNING Identification



Warning Identification

Circuit Breaker



Circuit Breaker (two breakers: 15A for 115V circuit and 10A for 42V circuit)


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MEANING OF GRAPHICAL SYMBOLS ON RATING PLATE (LOCATED ON CASE BACK)

NEMA EW 1 (100%) Designates welder complies with National Electrical Manufacturers Association requirements EW 1 Class I with 100% duty cycle at 600Amps output.

3 ~ Three Phase Input Power

 3 Phase transformer with rectified DC output


 Line Connection

 Gas Metal Arc Welding (GMAW)

 Flux Cored Arc Welding (FCAW)

 Shielded Metal Arc Welding (SMAW)

 Submerged Arc Welding (SAW)

 Designates welder complies with both Underwriters Laboratories (UL) standards and Canadian Standards Association (CSA) standards. (60 Hertz Models)

MEANING OF GRAPHICAL SYMBOL FOR GROUND CONNECTION



Signifies the equipment connection point for the protective earth ground

CONTROLS AND SETTINGS

All operator controls and adjustments are located on the Case Front Assembly of the DC-600. See Figure B.1 for the location of each control.

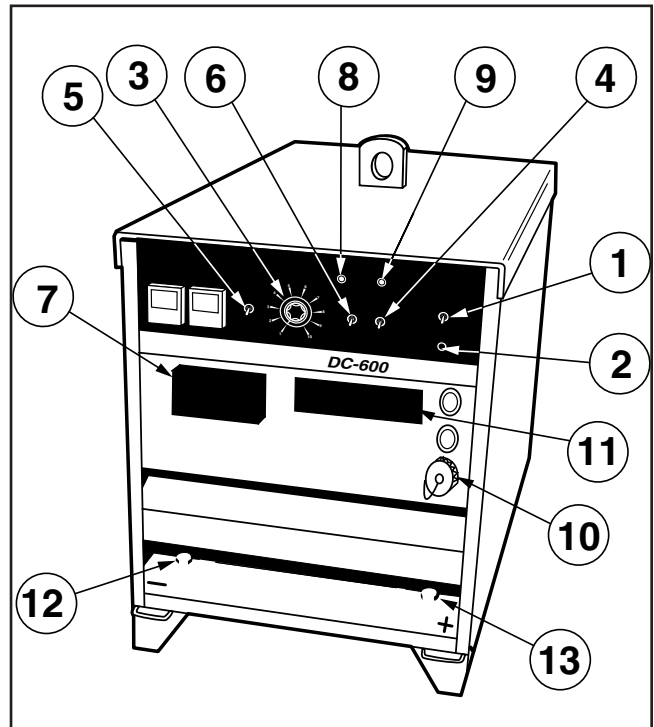






FIGURE B.1 - CONTROL PANEL KEYS

1. **Input POWER ON/OFF Switch**  This toggle switch turns the machine on or off. Putting the switch in the ON " | " position energizes the machine's input contactor applying input power to the machine. Switching the switch to the OFF " O " position de-energizes the input contactor.
2. **POWER Light**  When the POWER switch is in the ON position the machine's white POWER light will illuminate. If the input contactor de-energizes the machine in an abnormal situation the pilot light will still illuminate. In this situation it may be necessary to reset the machine by switching the POWER switch to the OFF and then to the ON position. (See Overload, Overcurrent, and Fault Protection Section)



3. OUTPUT CONTROL

This control provides continuous control of the machine's output voltage and current from minimum to maximum (typical full pot range between 15 to 44 volts and 90 to 750 amps) as it is rotated clock-wise. Voltage or current control is determined by setting of Mode Switch (CV or CC).

4. OUTPUT TERMINALS ON/REMOTE Switch

When this switch is in the REMOTE "  " position, the DC-600's output terminals will be electrically "cold" until a remote device such as a wire feeder closes the #2 and #4 circuit in the MS-receptacle or terminal strip (T.S.2). When this switch is in the ON "  " position the machine's output terminals will be electrically energized all the time.

5. LOCAL/REMOTE Switch

When this switch is set to the LOCAL "  " position, control of the output voltage and current is via the OUTPUT CONTROL on the DC-600's control panel. When this switch is set to the REMOTE "  " position, control is through a remote source such as a wire feeder via the #75, #76, and #77 leads in the MS-receptacle or terminal strip (T.S.1).

6. Mode Switch

This switch allows for selecting the welding process to be used:

CC STICK-for SMAW and AAC

CV SUBMERGED ARC- for SAW

CV INNERSHIELD- for FCAW and GMAW

7. 115VAC Duplex Receptacle (60 Hertz Models)

This receptacle provides up to 15 amps of 115 VAC auxiliary power.

8. 115VAC 15 Amp Circuit Breaker

This breaker protects the 115 VAC auxiliary circuits located in the duplex receptacle, terminal strip (T.S.2) and MS-receptacle.

9. 42VAC 10 Amp Circuit Breaker

This breaker protects the 42VAC auxiliary circuits located in the terminal strip (T.S.2) and MS-receptacle.

10. 14 Pin MS-Receptacle

This connector provides easy connection for a wire feeder control cable. It provides connections for auxiliary power, output switching, remote output control, wire feeder voltmeter sense lead and ground. Refer to 14 Pin MS Type Receptacle in the Installation Section for information about the circuits made available at this receptacle.

11. Terminal Strip Cover Panel

Rotate this panel to gain access to the circuits made available at the two terminal strips (T.S.1 and T.S.2). These terminal strips contains the same circuits as the 14 pin MS-receptacle. There is a box connector adjacent to this cover for routing leads to the terminal strips.

12. Negative Output Terminal

This output terminal is for connecting a welding cable. To change welding polarity and for proper welding cable size refer to Electrode and Work Cables in the Installation Section.

13. Positive Output Terminal

This output terminal is for connecting a welding cable. To change welding polarity and for proper welding cable size refer to Electrode and Work Cables in the Installation Section.

AUXILIARY POWER IN MS-RECEPTACLE

42 volt AC auxiliary power, as required for some wire feeders, is available through the wire feeder MS-receptacle. A 10 amp circuit breaker protects the 42 volt circuit from overloads.

DC-600 machines can also supply 115 volt AC auxiliary power through the wire feeder receptacle. A 15 amp circuit breaker protects the 115 volt circuit from overloads.

OVERLOAD, OVERCURRENT, AND FAULT PROTECTION

This welder has thermostatic protection from excessive duty cycles, overloads, loss of cooling, and high ambient temperatures. When the welder is subjected to an overload or loss of cooling, a thermostat will open. The input contactor will open and remain open until the machine cools; the white POWER light stays illuminated. No welding is possible during this cool down period. The machine will reset automatically when the thermostat cools.

The power source is also protected against overcurrents in the SCR bridge assembly through an electronic protection circuit. This circuit senses currents over 780 amps on the power source and opens the input contactor should the overcurrent remain for a predetermined time (the white POWER light stays illuminated). The predetermined time varies with the amount of overcurrent; the greater the overcurrent, the shorter the time. The input contactor will remain open until the power source is manually started by resetting the POWER ON/OFF toggle switch.

DC-600

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ELECTRIC

The power source circuitry is protected from faults on leads 75, 76, or 77. If any of these leads are connected to either the positive or negative output leads, the DC-600 will either shut down completely (input contactor opens and white POWER light stays illuminated), or will operate at minimum output thus preventing any damage to the DC-600. If DC-600 shuts down, it must be manually started by resetting the POWER ON/OFF toggle switch.

OPERATING STEPS

The following procedures are for using the DC-600 in the local control mode of operation. For remote control of the machine, see the Remote Control of Machine Operation section.

Before operating the machine, make sure you have all materials needed to complete the job. Be sure you are familiar with and have taken all possible safety precautions before starting work. It is important that you follow these operating steps each time you use the machine.

1. Turn on the main AC power supply to the machine.
2. Connect the #21 work lead to either + or - on terminal strip (T.S.2).
3. Set the Welding Mode switch to welding process being used:
 - CC STICK (for SMAW and AAC)
 - CV SUBMERGED ARC (for SAW)
 - CV INNERSHIELD (for FCAW and GMAW)
4. Turn the POWER ON/OFF Toggle Switch to the "ON" position
 - The white pilot light glows.
 - The fan starts.
5. Set OUTPUT CONTROL Potentiometer to desired voltage or current.
6. Set the OUTPUT TERMINALS switch to either "ON" (output terminals energized) or "REMOTE" (output terminals energized when #2 and #4 closed by remote device such as wire feeder)
7. Make the weld.

REMOTE CONTROL OF MACHINE OPERATION

The toggle switch on the control panel labeled "Remote - Panel" gives the operator the option of controlling the machine output from a remote location. If in the Remote position a wire feeder with remote control capabilities or a remote control device such as a K775 must be connected to terminals 75, 76, and 77. Refer to Accessories Section for wire feeder remote information.

WELDING PROCEDURE RECOMMENDATIONS

Select Welding Mode Switch position based on type of welding to be done.

1. Innershield Welding (FCAW)/MIG (GMAW) Welding: Use the **CV INNERSHIELD** mode.
2. Submerged Arc Welding (SAW): Use the **CV SUBMERGED ARC** mode. If performing high speed welding, switch between the CV Submerged Arc and the CV Innershield mode and use the mode that produces the best welding results.
3. Air/Carbon Arc Cutting (AAC) / Stick Welding (SMAW) / High Current, Large Puddle Submerged Arc Welding (SAW): Use the **CC STICK** mode. When the DC-600 is used for Air/Carbon Arc cutting, the OUTPUT CONTROL potentiometer should be set to "9" initially. Based on the size of the carbon being used or the process, turn the potentiometer to a lower setting as required by the process. You can use carbon rods up to 3/8" in diameter at currents as high as 750 amps with excellent arc control. The welder protection circuit protects the machine from extremely high short circuiting pulses.

SEMI-AUTOMATIC AND AUTOMATIC WIRE FEEDING WITH THE DC-600 AND WIRE FEEDERS

When using the DC-600 with semi-automatic or automatic wire feeding equipment and for stick welding or air/carbon arc cutting, it is recommended that the optional MULTI-PROCESS SWITCH be used. This switch permits you to easily change the polarity of the connected wire feeding equipment or switch to stick welding or air/carbon arc cutting.

NA-3 AUTOMATIC WIRE FEEDER

1. Set the DC-600 LOCAL/REMOTE Switch to REMOTE. Set the OUTPUT TERMINALS switch to REMOTE. NOTE: Later model NA-3 automatic wire feeders are capable of cold starts when the NA-3 Mode switch is in the CV or CC mode position. Some earlier models are capable of cold starting only in the CC mode position. Cold starting enables you to inch the wire down to the work, automatically stop, and automatically energize the flux hopper valve.
 2. Connect the NA-3 Control Cable to the 14 pin Amphenol of the DC-600.
 3. Connect the #21 work lead (on T.S.2) to the same polarity as the work cable connection or follow instructions on the Connection Diagram (S22978) for remote connection (recommended) of the #21 lead.
 4. Connect the electrode cables to terminal polarity to be used.
 5. Set the DC-600 welding mode switch for the desired process: CV SUBMERGED ARC, CV INNERSHIELD mode or CC STICK mode.
 6. Set the NA-3 mode Switch Position to either CV or CC to match the DC-600 mode selected in step 2.
 7. Refer to the NA-3 operators manual for instructions on how to use the NA-3 in conjunction with the DC-600.
 8. Follow the following guidelines for good arc striking detailed below for each welding mode.
4. Connect the electrode cables to terminal polarity to be used.
 5. Connect the #21 work lead (on T.S.2) to the same polarity as the work cable connection.
 6. Set the DC-600 LOCAL/REMOTE Switch to REMOTE.
 7. Set the DC-600 OUTPUT TERMINALS switch to REMOTE.
 8. Set the DC-600 WELDING MODE SWITCH to the position that matches the welding process being used.
 - For submerged arc welding, set WELDING MODE SWITCH to CV SUBMERGED ARC position.
 - For all open arc welding processes set WELDING MODE SWITCH to CV INNERSHIELD position.

GOOD ARC STRIKING GUIDELINES FOR THE DC-600 IN THE CV INNERSHIELD, CV SUBMERGED ARC MODES

Following are some basic arc striking techniques that apply to all wire feed processes. Using these procedures should provide trouble-free starting. These procedures apply to single, solid wires and Innershield wires.

1. Cut the electrode to a sharp point.
2. Set the NA-3 Open Circuit Voltage Control (NA-5 STRIKE VOLTS Control) to the same dial setting as the Arc Voltage Control. For the NA-3, If this is a new welding procedure, a good starting point is to set the Open Circuit Voltage Control to # 6.

NOTE: The open circuit voltage of the DC-600 varies from approximately 16 volts to 56 volts in the CV INNERSHIELD or CV SUBMERGED ARC modes. The open circuit voltage is constant in the CC STICK mode.

DC-600 POWER SOURCE SETTING WHEN CONNECTED TO NA-5 WIRE FEEDER

When using the DC-600 with the NA-5 wire feeder, set the controls on the DC-600 as follows for the best performance:

1. Turn OFF main AC input power supply to the DC-600.
2. Connect the NA-5 Control Cable to the 14 pin Amphenol of the DC-600.
3. Connect the #21 work lead (on T.S.2) to the same polarity as the work cable connection or follow instructions on the Connection Diagram (S22979) for remote connection (recommended) of the #21 lead.

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3. Run a test weld. Set proper current, voltage, and travel speed.

- For the best starting performance, the NA-3 Open Circuit Voltage Control and Voltage Control setting should be the same. Set the Inch Speed Control for the slowest inch speed possible.
- To adjust the Open Circuit Voltage Control to get the best starting performance, make repeated starts observing the NA-3 voltmeter.

When the voltmeter pointer swings smoothly up to the desired arc voltage, without undershooting or overshooting the desired arc voltage, the Open Circuit Voltage Control is set properly.

If the voltmeter pointer overshoots the desired voltage and then returns back to the desired voltage, the Open Circuit Voltage Control is set too high. This can result in a bad start where the wire tends to "Blast off."

If the voltmeter pointer hesitates before coming up to the desired voltage, the Open Circuit Voltage Control is set too low. This can cause the electrode to stub.

4. Start and make the weld.

- Cold starts. For cold starts, be sure the work piece is clean and the electrode makes positive contact with the work piece.
- Hot "On the Fly" starts. For hot starts, travel should begin before the wire contacts the work piece.

ARC STRIKING WITH DC-600 AND THE NA-3 OR NA-5 START BOARD

When electrical stickout exceeds 1 3/4" (44.4mm) the optional Start Board (K221 for the NA-3 and K334 for the NA-5) may be required to improve arc striking.

See the NA-3 or NA-5 Operator's Manual for detailed instructions on setting the Start Circuit controls.

LN-8 OR LN-9 SEMI-AUTOMATIC WIRE FEEDER

To use the LN-8 or LN-9 Semi-Automatic Wire Feeder with the IDEALARC DC-600

1. Set the IDEALARC DC-600 WELDING MODE SWITCH to either CV Innershield mode or CV Submerged Arc mode depending on the welding process being used.

2. Connect the LN-8 or LN-9 Control Cable to the 14 pin Amphenol of the DC-600.

3. Connect the #21 work lead (on T.S.2) to the same polarity as the work cable connection or follow instructions on the Connection Diagram (S22977) for remote connection (recommended) of the #21 lead.

4. Connect the electrode cables to terminal polarity to be used.

2. Set the IDEALARC DC-600 OUTPUT CONTROL SWITCH to the REMOTE position.

3. Set the LN-8 Welding Mode Switch to the CV or VV position. The LN-8 Welding Mode Switch is located on the variable voltage (CC) board.

4. Refer to the LN-8 Operator's Manual for instructions on how to use the LN-8 in the CC (VV) mode.

LN-7 AND OTHER CONSTANT WIRE FEEDERS

To use the LN-7 or other constant wire feed speed semi-automatic wire feeders with IDEALARC DC-600

1. Set the IDEALARC DC-600 WELDING MODE SWITCH to either CV Innershield mode or CV Submerged Arc mode depending on the welding process being used.

2. Connect the Wire Feeder Control Cable to the 14 pin Amphenol of the DC-600.

3. Connect the #21 work lead (on T.S.2) to the same polarity as the work cable connection or follow instructions on the Connection Diagram (S22978) for remote connection (recommended) of the #21 lead.

4. Connect the electrode cables to terminal polarity to be used.

5. Set the IDEALARC DC-600 OUTPUT CONTROL SWITCH per the Connection Diagram for the feeder being used

NOTE: Older Lincoln control cables that do not have an Amphenol connector on the Power Source end can be connected to the T.S.1 & T.S.2 terminal strips behind the DC-600 nameplate. See the Installation section of this manual and the appropriate Connection Diagram.

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WIRE FEEDERS AND TRACTORS

The DC-600 can be used to power any of the following Lincoln Wire Feeders and Tractors:

Semi-Automatic Wire Feeders:

DH-10	LN-9
LN-7	LN-9 GMA
LN-7 GMA	LN-23P
LN-742	LN-25
LN-8	LN-10

Automatic Wire Feeders:

NA-3	NA-5R
NA-5	

Tractors:

LT-7	LT-56
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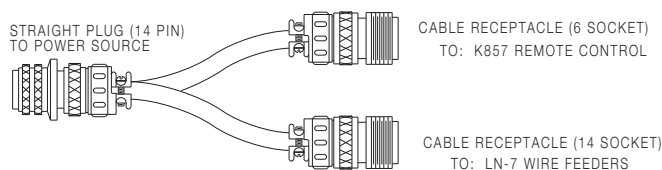
FIELD INSTALLED OPTIONS

Remote Output Control (K775 or K857 with K864 Adapter)

An optional "remote out control" is available. The K775 is the same remote control that is used on other Lincoln power sources. The K775 consist of a control box with 28 feet (8.5mm) of four conductor cable. This connects to terminals 75,76, and 77 on the terminal strip (T.S.1) and the case grounding screw so marked with the symbol " $3\sim$ " on the machine. These terminals are located behind the hinged cover on the case front. This control will give the same control as the output control on the machine.

The K857 is similar to the K775, except the K857 has a 6-pin MS-style connector. The K857 requires a K864 adapter cable which connects to the 14-pin connector on the case front.

Remote Control Adapter Cable (K864)



A "V" cable 12" (.30 m) long to connect a K857 Remote Control (6-pin connector) with an LN-7 wire-feeder (14-pin connector) and the machine (14-pin connector). If a remote control is used alone the wire-feeder connection is then not used.

Undercarriages (K817P, K842)

For easy moving of the machine, optional undercarriages are available with polyolefin wheels (K817P) or a platform undercarriage (K842) with mountings for two gas cylinders at rear of welder.

Paralleling Kit (K1611-1)

Permits paralleling of two DC-600's for welding currents of up to 1200 amps, 100% duty cycle.

Tig Module (K930-2)

Portable high frequency generator for AC/DC TIG welding.

FACTORY OR FIELD INSTALLED OPTIONS

Multi-Process Switch (K804-1)

The MULTI-PROCESS SWITCH gives you the ability to:

- Switch between "stick welding or air/carbon arc cutting" and using a semi-automatic or automatic wire feeder.
- Change the polarity of a semi-automatic or automatic wire feeder without changing any electrical cable connections.

See Figure C.1

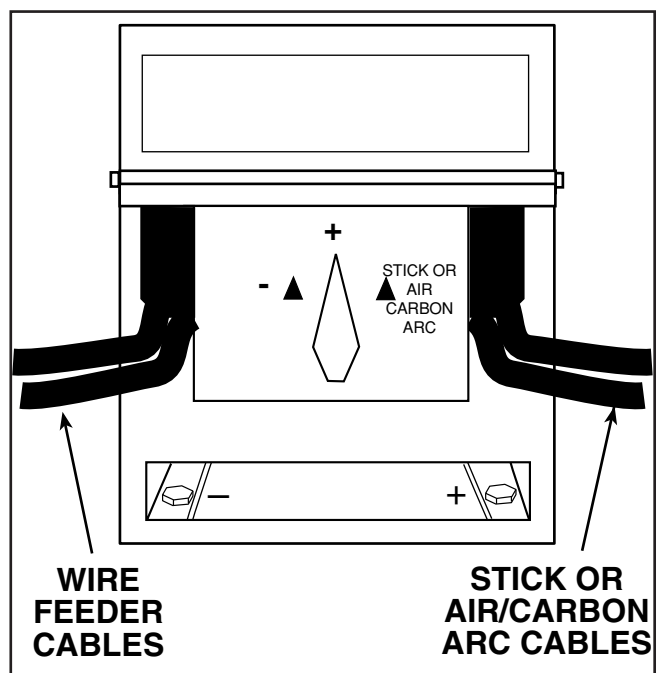


FIGURE C.1 - MULTI-PROCESS SWITCH

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The MULTI-PROCESS SWITCH has two sets of output terminals. You connect the wire feeder unit cables to the set of terminals on the left side of the box and the stick or air/carbon arc cables to the set of terminals on the right side (facing the front of the machine) as shown in **Figure C.1**. The output terminals are protected against accidental contact by hinged covers.

When the MULTI-PROCESS SWITCH is in the "Stick or Air/Carbon Arc" position, only those terminals are energized. The wire feeder nozzle or gun and electrode are not electrically "hot" when in this mode.

Follow these steps to install the MULTI-PROCESS SWITCH:

1. Confirm that the DC-600 POWER ON/OFF switch is in the OFF position.
2. Disconnect main AC input power to the DC-600.
3. Open the terminal strip hinged cover located on the Case Front Assembly.
4. The MULTI-PROCESS SWITCH is mounted to the case front with four 1/4" self-tapping screws. The screw holes are 13.8" apart side to side and 4.5" apart top to bottom. Run one of the 1/4" screws part way in and out of the screw holes to open them up. Make sure that the two sleeved control leads do not get pinched when hanging the switch; route them out the side to the right of the switch. Support the switch in position and start the four screws, then tighten them.
5. Route the MULTI-PROCESS SWITCH control leads through the strain-relief box connectors and into the terminal strip. Connect wire feeder control cable as specified in specific connection diagram and make other terminal strip connections as specified on the connection diagram for the Lincoln wire feeder being used.
6. Connect the control leads from the MULTI-PROCESS SWITCH to terminals #2 and #4 on the DC-600's terminal strip.
7. Connect the right cable from the MULTI-PROCESS SWITCH (facing the front of the machine) to the DC-600 positive (+) output terminal. See Figure C.2.

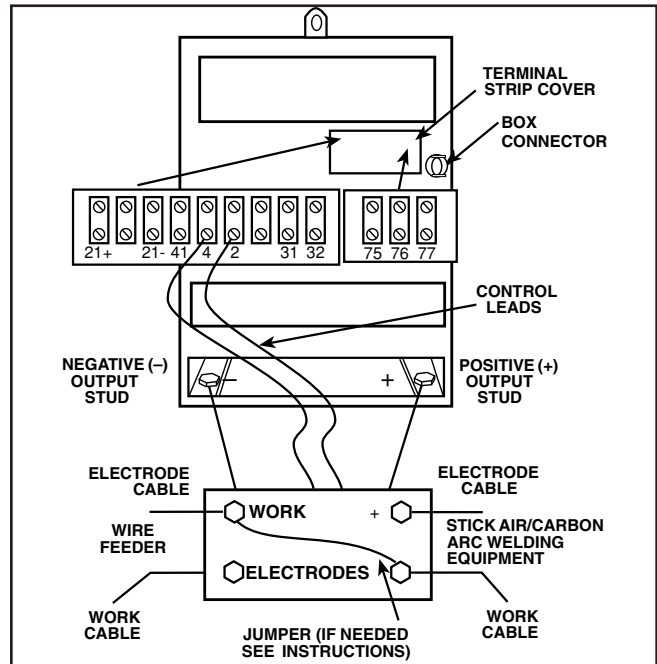


FIGURE C.2 - MULTI-PROCESS SWITCH CABLE CONNECTIONS.

8. Connect the left cable from the MULTI-PROCESS SWITCH (facing the front of the machine) to the DC-600 negative (-) output terminal. See Figure C.2.
9. Connect the wire feeder electrode and work cables. See Figure C.2.
 - Insert the wire feeder electrode and work cables through the strain relief loop on the left side of the DC-600 (facing the front of the machine).
 - Connect the wire feeder electrode and work cables to the electrode and work terminals on the left side of the MULTI-PROCESS SWITCH.
10. Connect wire feeder control cable and make other terminal strip connections as specified on the connection diagram for the Lincoln wire feeder being used.
11. Set the DC-600 OUTPUT TERMINALS switch to REMOTE.

12. Connect stick or air/carbon arc electrode and work cable. See *Figure C.2*.

- Insert the electrode and work cables through the strain relief loop on the right side (facing the front of the machine) of the DC-600.
- Connect the electrode cable to the "Positive" terminal on the right side of the MULTI-PROCESS SWITCH.
- Connect the work cable to the "Negative" terminal on the right side of the MULTI-PROCESS SWITCH.

NOTE: The instructions above are for connecting the stick polarity positive. To change the polarity, turn the DC-600 OFF, and reverse the cables.

NOTE: When it is not necessary to have separate ground cables for stick and semi-automatic or automatic welding, connect a jumper from the MULTI-PROCESS SWITCH "Work" terminal to the MULTI-PROCESS SWITCH "negative" terminal. See *Figure C.2*.

To operate the MULTI-PROCESS SWITCH, refer to the operating instructions on the switch nameplate.

CONNECTIONS FOR SEMI-AUTOMATIC OR AUTOMATIC WIRE FEEDER CONTROL

1. Set the DC-600 ON/OFF switch to OFF.
2. Set the DC-600 LOCAL/REMOTE switch to REMOTE.
3. Set the DC-600 OUTPUT TERMINALS switch to REMOTE.
4. Set the DC-600 MODE switch to the welding process being used.
5. Refer to the proper connection diagram in the DIAGRAMS section for more information.

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SAFETY PRECAUTIONS

ELECTRIC SHOCK CAN KILL.



Only qualified personnel should perform this maintenance.

Turn the input power OFF at the disconnect switch or fuse box before working on this equipment.

Do not touch electrically hot parts.

ROUTINE AND PERIODIC MAINTENANCE

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

Perform the following daily:

1. Check that no combustible materials are in the welding or cutting area or around the machine.
2. Remove any debris, dust, dirt, or materials that could block the air flow to the machine for cooling.
3. Inspect the electrode cables for any slits or punctures in the cable jacket, or any condition that would affect the proper operation of the machine.

Perform Periodically:

Clean the inside of the machine with low pressure air stream. Clean the following parts.

- Main transformer and choke.
- Electrode and work cable connections.
- SCR rectifier bridge and heat sink fins.
- Control board.
- Firing board.
- Fan Assembly.
NOTE: The fan motor has sealed bearings which require no maintenance.

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Theory of OperationE-1

General Description E-2

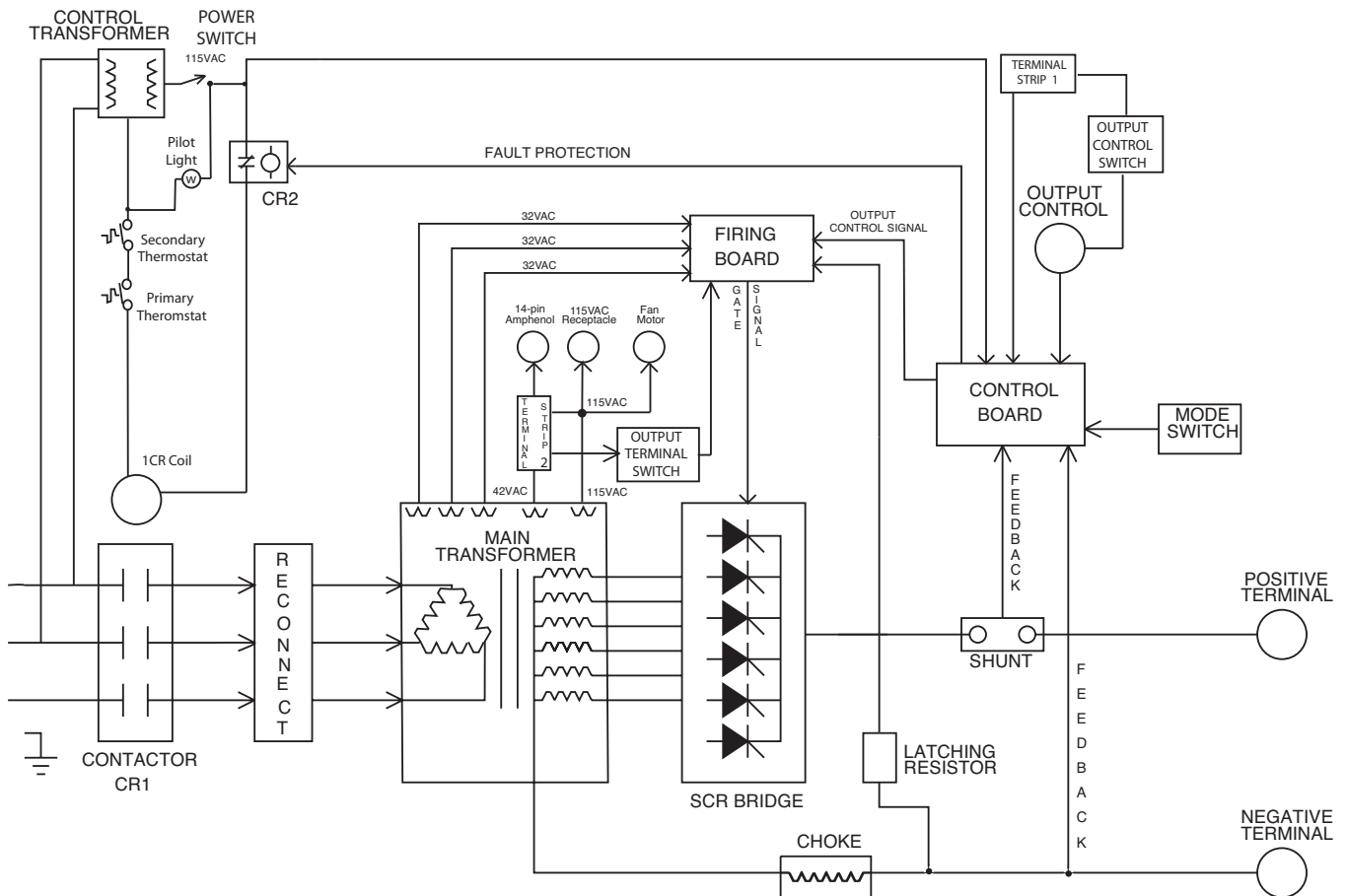
Input Circuit and Main Transformer E-2

Control Circuit, Firing Circuit and Rectifier E-3

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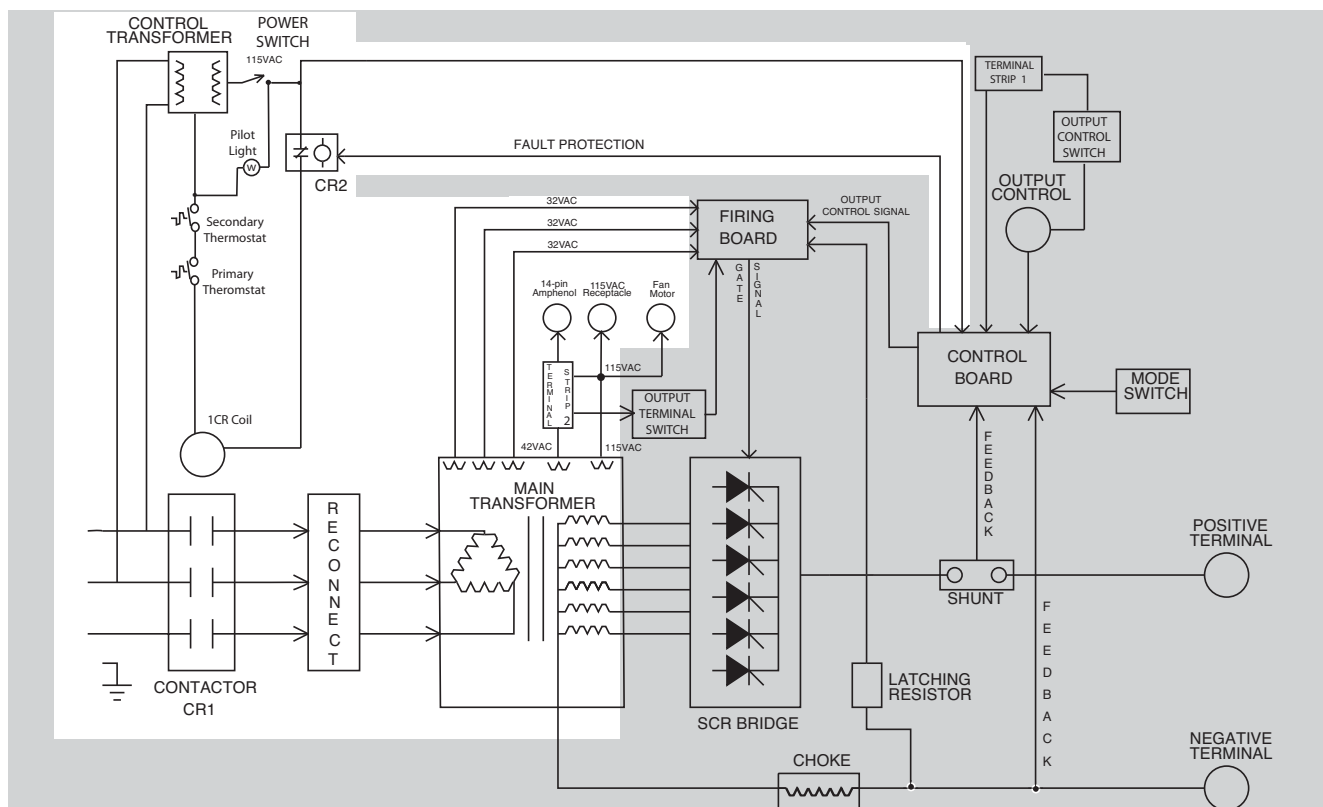
FIGURE E.1 BLOCK LOGIC DIAGRAM



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FIGURE E.2 - INPUT AND TRANSFORMER



GENERAL DESCRIPTION

The DC-600 is a three-phase, SCR controlled DC power source. It is capable of either constant current or constant voltage output. It is rated at 600 amps, 100% duty cycle with outstanding arc characteristics for multiple welding processes.

INPUT CIRCUIT AND MAIN TRANSFORMER

The desired three-phase input power is connected to the DC-600 through an input contactor located in the input box at the rear of the machine. Two phases of the input line are also connected to the control transformer. The secondary of the control transformer supplies 115 VAC power to the control board and to the input contactor through the fault protection relay.

A reconnect panel allows the user to configure the machine for the desired input voltage. This three-phase AC input is applied to the primary of the main transformer. The transformer changes the high voltage, low current input power to a lower voltage, higher current output. The finishes or "neutrals" of the main secondary coils are connected together, and the six starts of the secondary windings are connected to the SCR rectifier assembly.

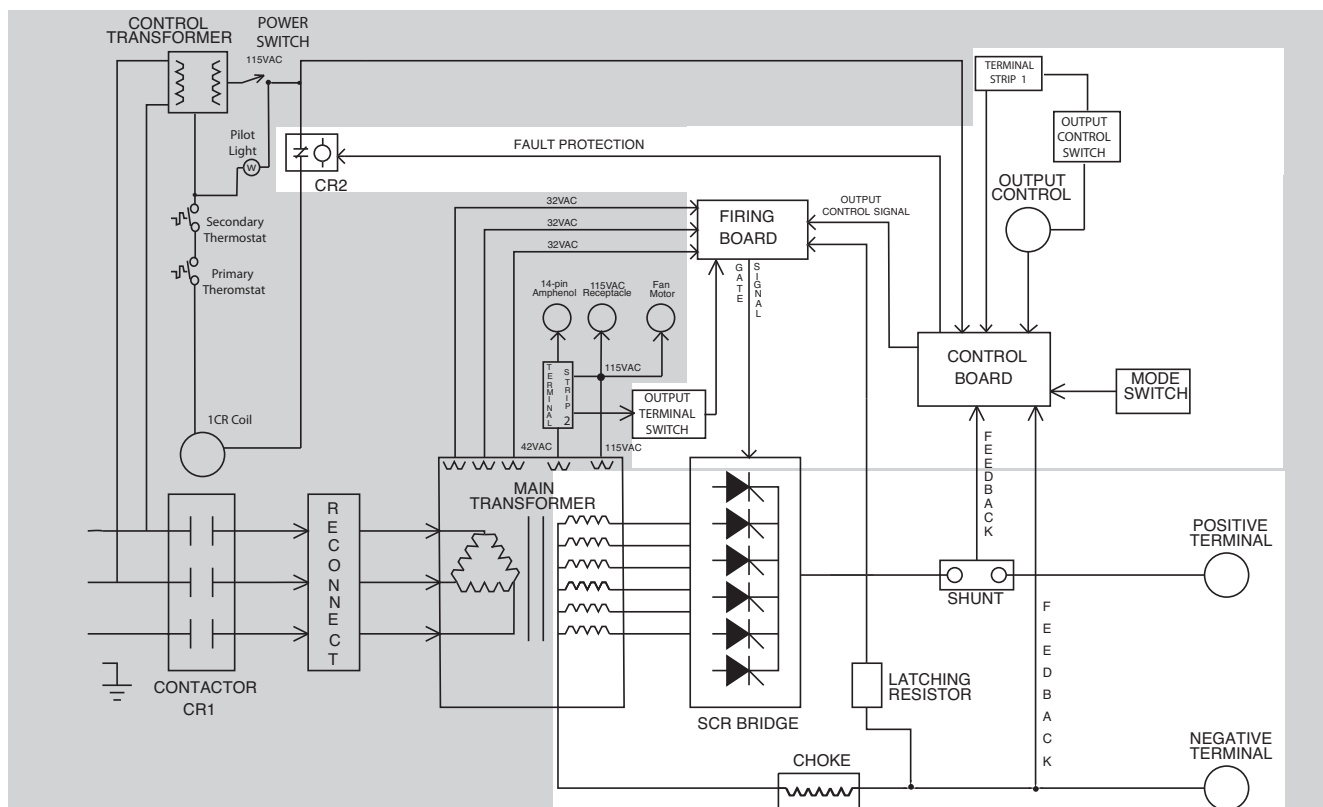
In addition, the main transformer also has five isolated secondary windings. There are three 32 VAC windings, which provide power and "timing" to the firing board. The 115 VAC winding powers the fan motor and provides the user with up to 20 amps of 115 VAC auxiliary power at the receptacle or 14-pin MS type connector. The 42 VAC winding provides 10 amps of power to the 14 pin MS type connector to power a wire feeder.

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

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FIGURE E.2 - FIRING BOARD, CONTROL BOARD AND RECTIFICATION



FIRING CIRCUIT, CONTROL CIRCUIT AND RECTIFICATION

RECTIFICATION

The “neutrals” of the welding secondary windings in the main transformer are connected together, and the six starts are connected to the six Silicon Controlled Rectifier (SCR) assemblies to form a six-phase output. This six-phase AC output from the main transformer secondary is rectified and controlled by the SCR bridge.

FIRING BOARD

The firing board is powered by the three-phase 32vac transformer windings. Each phase provides two firing pulses, one for each of the two SCRs controlled by that phase. When a gate firing enable* (trigger) signal is received, the firing circuit supplies the proper amount of energy to the gates of the power SCRs. When this gate firing signal is applied at the correct time, the SCR will turn ON. The amount of ON time versus OFF time determines the output of the machine. See **SCR Operation**. At the same time the latching resistor is connected across the machine's output circuit. The latching resistor provides a pre-load for the SCR bridge so the SCR's will stay activated providing open circuit voltage (OCV).

CONTROL BOARD

The control board receives current feedback information from the shunt and voltage feedback information from the choke and welding output terminals. This feedback information is processed on the control board. The control board compares the commands of the mode switch, the output control potentiometer (or remote control device) and the arc force control with the feedback information and sends the appropriate output control signal to the firing board. In the event of a “fault condition,” the control board de-activates the fault relay (CR2). See **Protective Devices and Shut Down Circuits**.

An output choke is connected between the neutral connection of the main transformer secondaries and the negative output terminal. This large inductor stores energy, and provides current filtering for the welding output of the DC-600.

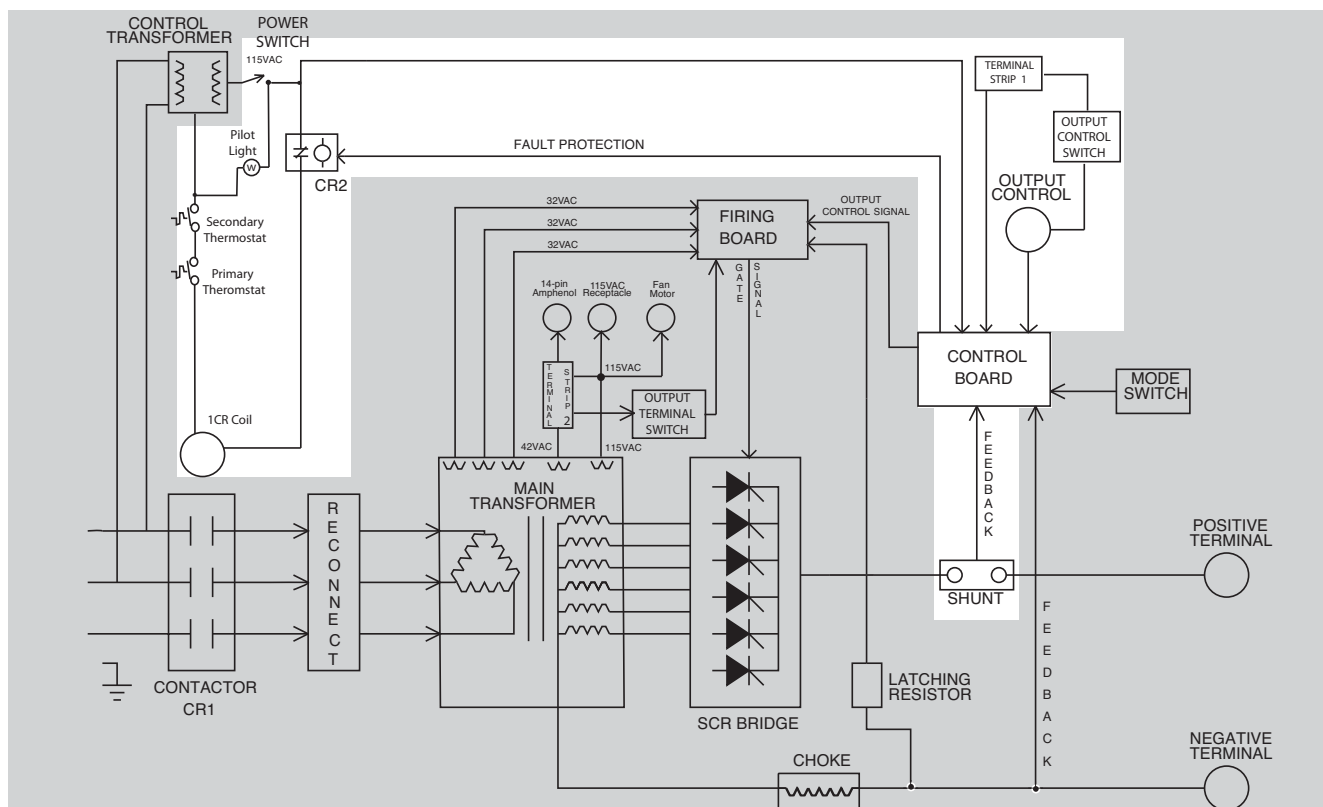
*Triggering is accomplished by a connection of lead #2 & #4 by way of the Output Terminal Switch or by a remote signal from a wire feeder. The 2 to 4 closure is indicated by LED10 on the firing Board and LED 6 on the Control Board.

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

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FIGURE E.2 - GENERAL DISCRPTION



PROTECTIVE DEVICES AND SHUTDOWN CIRCUITS

THERMAL PROTECTION

This welder has thermostatic protection from excessive duty cycles, overloads, loss of cooling, and high ambient temperatures. When the welder is subjected to an overload or loss of cooling, a thermostat will open. The input contactor will open and remain open until the machine cools; the white POWER light stays illuminated. No welding is possible during this cool down period. The machine will reset automatically when the thermostat cools.

OVER CURRENT PROTECTION

The power source is also protected against overcurrents in the SCR bridge assembly through an electronic protection circuit. This circuit senses currents over 780 amps on the power source and opens the input contactor should the overcurrent remain for a predetermined time (the white POWER light stays illuminated). The predetermined time varies with the amount of overcurrent; the greater the overcurrent, the shorter the time. The input contactor will remain open until the power source is manually started by resetting the POWER ON/OFF toggle switch.

REMOTE CONTROL FAULT PROTECTION

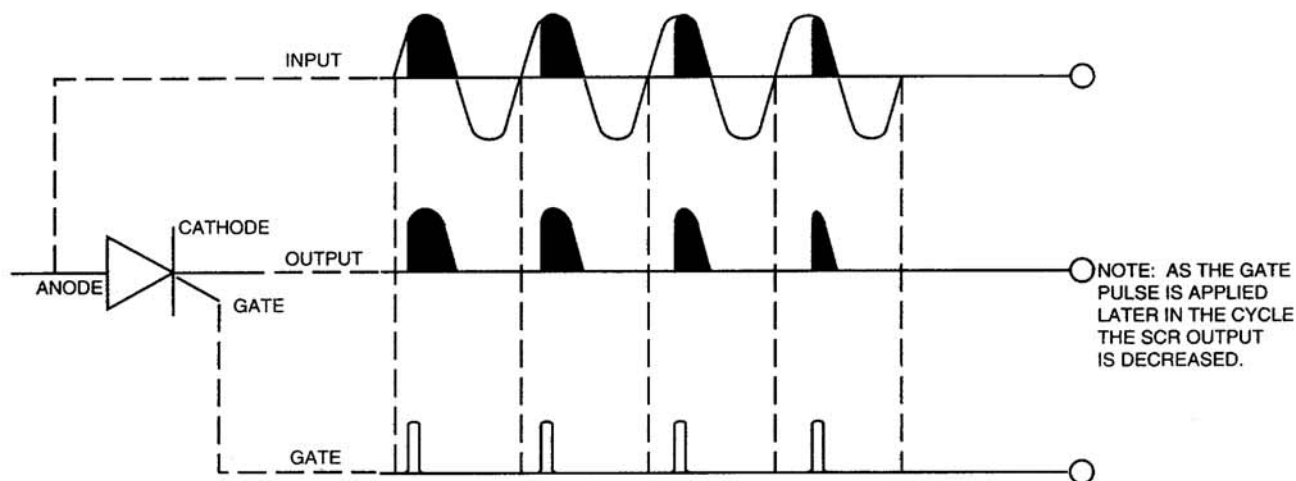
The power source circuitry is protected from faults on the control circuit leads (#75, 76, or 77). If any of these leads become common with either of the output leads, the DC-600 will either shut down completely (control lead fault to Negative Output), or will remain at minimum output (control lead fault to Positive Output) thus preventing any damage to the DC-600. If DC-600 shuts down, (input contactor opens and white POWER light stays illuminated) it must be manually started by resetting the POWER ON/OFF toggle switch.

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

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FIGURE E.2 - SCR OPERATION



SCR OPERATION

A silicon controlled rectifier (SCR) is a three-terminal device used to control rather large currents to a load. An SCR acts very much like a switch. When a gate signal is applied to the SCR, it is turned ON and 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 the ON 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 supply 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.

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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 repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).

Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, function problems, wire feeding 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. RECOMMENDED COURSE OF ACTION

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

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

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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PC BOARD TROUBLESHOOTING PROCEDURES

WARNING**ELECTRIC SHOCK
can kill.**

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

CAUTION

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

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

PC board can be damaged by static electricity.

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

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

- Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.

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

- If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

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

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

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

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

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

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

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

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

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

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The Machine is dead - The Input contactor does not operate.	<ol style="list-style-type: none"> 1. Check for blown or missing fuses in input lines. 2. Check the three phase input line voltage at the machine. The input voltage must match the rating plate and reconnect panel. 	<ol style="list-style-type: none"> 1. The ON/OFF Switch (S1) may be faulty 2. The Control Transformer (T2) may be faulty. Perform the Control Transformer Test. 3. The primary or secondary thermostats may be open. Check or replace. Also check the associated wiring. See the Wiring Diagram. 4. The pilot relay (CR2) may be faulty. Check or replace. 5. The input contactor coil may be open. 6. The Control Board may be faulty. Perform the Control Board Test.
Input contactor (CR1) chatters.	<ol style="list-style-type: none"> 1. The input line voltage may be low. Check all three phases. 2. Make sure input line voltage matches machine rating and the reconnect panel is connected correctly for the line voltage 	<ol style="list-style-type: none"> 1. The pilot relay (CR2) may have bad contacts. Check or replace relay. 2. Check for loose or faulty wiring between pilot relay (CR2) and input contactor (CR1) coil connections. See Wiring Diagram. 3. The input contactor (CR1) 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 1-888-935-3877.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>Input contactor pulls in when ON/OFF Switch is closed but immediately drops out.</p>	<ol style="list-style-type: none"> 1. Make sure input line voltage matches machine rating and the reconnect panel is connected correctly for the line voltage. Remove all weld cables and external wires attached to terminal strip and the 14pin MS connector and make sure the Output Terminals Switch is in the REMOTE position. 2. If the problem persists after performing step 1 the problem is in the DC600. 	<ol style="list-style-type: none"> 1. If contactor (CR1) functions correctly with the cables removed there may be a fault in the control cables or the wire feeder. See Protective Devices and Shutdown Circuits. 2. Check internal remote control circuit (leads 75, 76 and 77) including the Output Terminals Switch (S3) and the Output Control (R1) for grounds or shorts. See the Wiring Diagram. 3. The Control Board may be faulty. See the PC Board Troubleshooting Guide.
<p>Machine shuts off (input contactor drops out) when the welder output terminals are made electrically "hot". (Output Terminals Switch ON).</p>	<ol style="list-style-type: none"> 1. Remove all welding cables and control cables from the DC 600. If the machine does NOT shut off and normal open circuit voltage is present at the welder output terminals the problem is external to the DC600. Either the remote leads #75, #76 or #77 are grounded to the negative output circuit or there is a short on the welding output terminals. 2. If the machine still shuts off when all control and welding cables are removed then the problem is internal to the DC600. 	<ol style="list-style-type: none"> 1. Check for grounds and or shorts in the #75, #76, #77 circuit. See the Wiring Diagram. 2. Check for grounds and shorts in the welder output terminals and associated leads. See the Wiring Diagram. 3. Check the output shunt and associated leads. See the Wiring Diagram. 4. Perform the Control Board Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>Machine input contactor operates but machine has no weld output with the Output terminal Switch ON. Fan runs and pilot light glows.</p> <p>NOTE: Alternate Trigger methods.</p> <ul style="list-style-type: none"> Operate Wire Feeder trigger. Place a jumper across 2 & 4 on the terminal strip T.S.2. or across pins C & D in 14 pin connector. 	<ol style="list-style-type: none"> Check LED 10 on the Firing Board and LED 6 on the Control Board. Both Should be ON. Check all of the LEDs on both PC Boards for proper operation. 	<ol style="list-style-type: none"> If both LEDs are OFF, try an alternate method of triggering. If LEDs come ON and machine weld output is restored check the Weld Terminal Switch (S2) and the associated wiring. If not, see the Internal Trigger Circuit Test. If both LEDs are ON and there is still no output go to Step 2. The Firing Board or Control Board may be defective. See the PC Board Troubleshooting Guide.
<p>The machine does not have maximum weld output.</p>	<ol style="list-style-type: none"> Check all three phase input lines at the DC600. Make sure input voltages match machine rating and reconnect panel. Put LOCAL/REMOTE Switch (SW3) in "LOCAL" position. If problem is solved then check remote control unit or wire feeder. 	<ol style="list-style-type: none"> Check the Output Control Potentiometer (R1) and associated wiring for loose or faulty connections. See wiring diagram. Perform the Control Board Test. Perform the Firing Board Test. Perform the SCR Output Bridge Test. Perform the Main Transformer Test.
<p>The weld output terminals are always electrically "hot".</p>	<ol style="list-style-type: none"> Remove any external leads hooked to #2 and #4 on the terminal strip. If the problem disappears the fault is in the control cable or wire feeder. If some open circuit voltage is present (over 3VDC.) after performing Step #1. then the problem is within the DC600. 	<ol style="list-style-type: none"> Check for an internal short between leads #2 and #4. See wiring diagram. Perform Firing Board Test. Perform Control Board Test. Perform the SCR Output Bridge Test. The SCR Snubber(s) may be "leaky". Check or 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 1-888-935-3877.

DC-600



Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Machine has maximum weld output and no control.	<ol style="list-style-type: none"> 1. If remote control is being used set LOCAL/REMOTE SWITCH (SW3) to 'LOCAL' position and try to control weld output using the Output Control Potentiometer (R1) at the DC600. If the problem is solved check the remote control unit (or wire feeder) and associated control cable. 	<ol style="list-style-type: none"> 1. Check the LOCAL/REMOTE Switch (SW3) and associated wiring. 2. Check feedback leads #222 (negative output terminal), #215, and #210 (output shunt) for loose or faulty connections. See Wiring Diagram. 3. Check the #75 lead for continuity (zero ohms) from the Output Control Potentiometer (R1) to the control board connector J1,Pin2. See Wiring Diagram. 4. Possible defective Control Board or Firing Board. See the PC Board Troubleshooting Guide. 5. Perform the SCR Output Bridge Test.
Machine has minimum output and no control.	<ol style="list-style-type: none"> 1. If a remote control unit is NOT connected to the DC-600, the LOCAL/REMOTE Switch must be in the "LOCAL" position. 2. If a remote control cable is connected, the control leads may be "shorted" to the positive weld output. 3. Make certain the three phase input voltage is correct and matches the machine rating and the reconnect panel. 	<ol style="list-style-type: none"> 1. Check the Output Control Potentiometer (R1) and associated wiring. 2. Check the LOCAL/REMOTE Switch (SW3), the Weld Mode Switch (SW4) and associated wiring. 3. Perform the Control Board Test. 4. Perform the Firing Board Test. 5. Perform the SCR Output Bridge Test. 6. Perform the Main Transformer Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Poor arc starting when the DC600 is in the CV Sub-Arc or CV Innershield Modes.	<ol style="list-style-type: none"> 1. Make sure the proper welding procedures are being used. (wire feed speed, arc voltage and wire size) 2. Check weld cables for loose or faulty connections. 	<ol style="list-style-type: none"> 1. Check the connections from the shunt to the Control Board (leads 210 and 215). When weld current is present there should be a millivolt signal at the board (6.25mv/100 amps). 2. Perform the Firing Board Test. 3. Perform the SCR Output Bridge Test. 4. The Control Board may be faulty.
Poor arc characteristics in all processes.	<ol style="list-style-type: none"> 1. Check for the correct input voltages on the three phase input lines at the DC600. 2. Make sure the proper welding procedures are being used (wire feed speed, arc voltage and wire size). 3. Check the welding cables for loose or faulty connections. 	<ol style="list-style-type: none"> 1. Check the Mode Switch (SW4) and the associated wiring for loose or faulty connections. See the Wiring Diagram. 2. Check the voltage at the shunt (leads 210 and 215). When weld current is present there should be a millivolt signal at the board (6.25mv/100 amps). If not correct, the shunt may be defective 3. Perform the Firing Board Test. 4. Perform the SCR Output Bridge test. 5. The Control Board may be faulty.

⚠ 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 1-888-935-3877.

DC-600



WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This is a quick reference guide to explain the function of the LEDs (Light Emitting Diodes) on the PC Boards. If one (or more) of the LEDs is not performing correctly, see the test for the individual boards

MATERIALS NEEDED

Misc Hand Tools
Wiring Diagram or Machine Schematic

TEST CONDITIONS

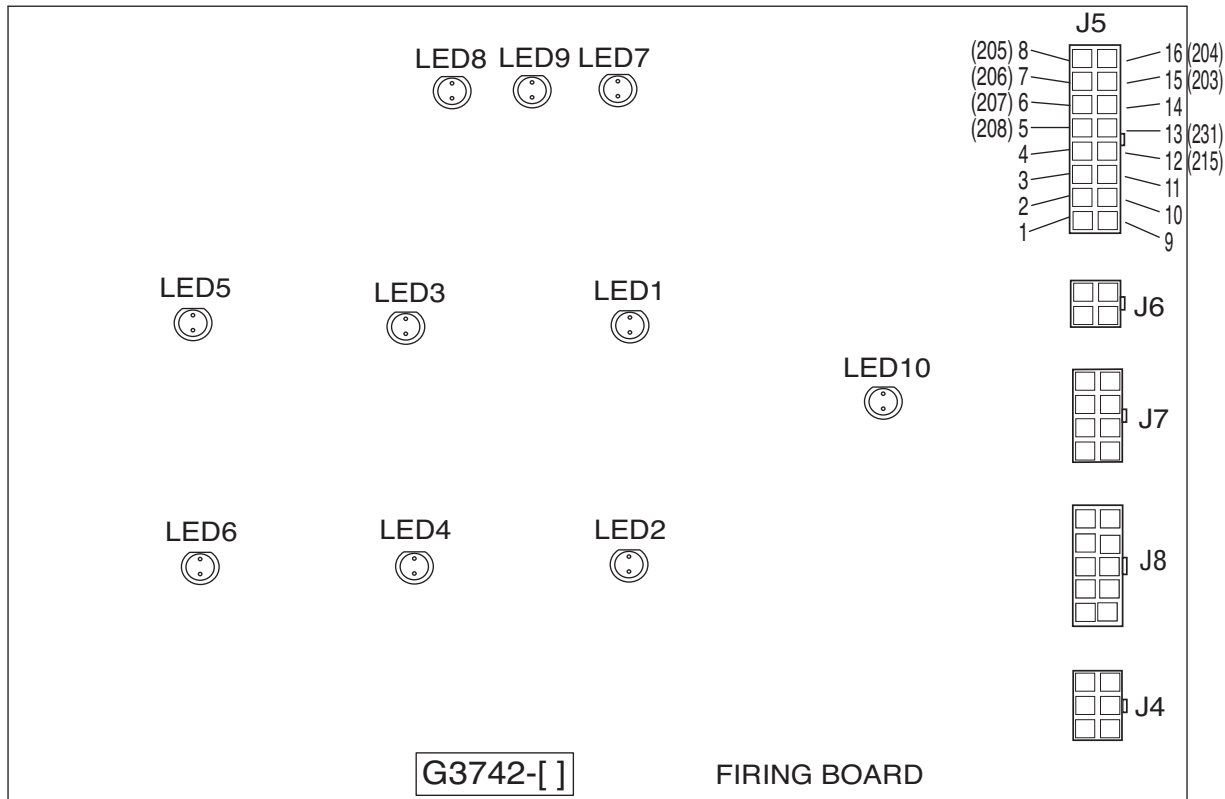
POWER SWITCH	ON
MODE SWITCH	CV INNERSHIELD
LOCAL/REMOTE Switch	LOCAL
OUTPUT TERMINAL SWITCH	ON

DC-600



PC BOARD TROUBLESHOOTING GUIDE (continued)

FIGURE F.1 – FIRING BOARD LEDs



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FIRING BOARD

FIRING BOARD

1. With DC-600 set for the **Test Conditions** all ten LEDs on the Firing Board should be lit.
2. **LEDs 7, 8 & 9** indicate that the three 34vac supplies from the Main Transformer are present on the Firing Board. They should all be ON whenever the Power Switch is ON.
 - If any are not ON check the voltages at P5
3. **LED 10** indicates that the machine is “triggered” (Output Terminal Switch ON).
 - Alternate Trigger Methods:
 - Operate Wire Feeder trigger.
 - Place a jumper across 2 & 4 on T.S.2.
 - Jumper between pins C & D of 14 pin connector.
 - If LED 10 does not come ON, check wiring. Perform the **Internal Trigger Circuit Test**.
4. **LEDs 1 thru 6** indicate that gate signals are being sent to the SCRs in the Main Rectifier. These LEDs will vary in brightness as the Output Control is changed.
 - It is important that all six LEDs are the same brilliance as each other.
 - If none are lit, check the voltage at lead 231 (P5 - Pin13). See the **Control Board Test**. If OK, Replace the Firing Board.
 - If LEDs are not the same brilliance, see the **SCR Bridge Test** and check the connections to J-4. If OK, replace the Firing Board.

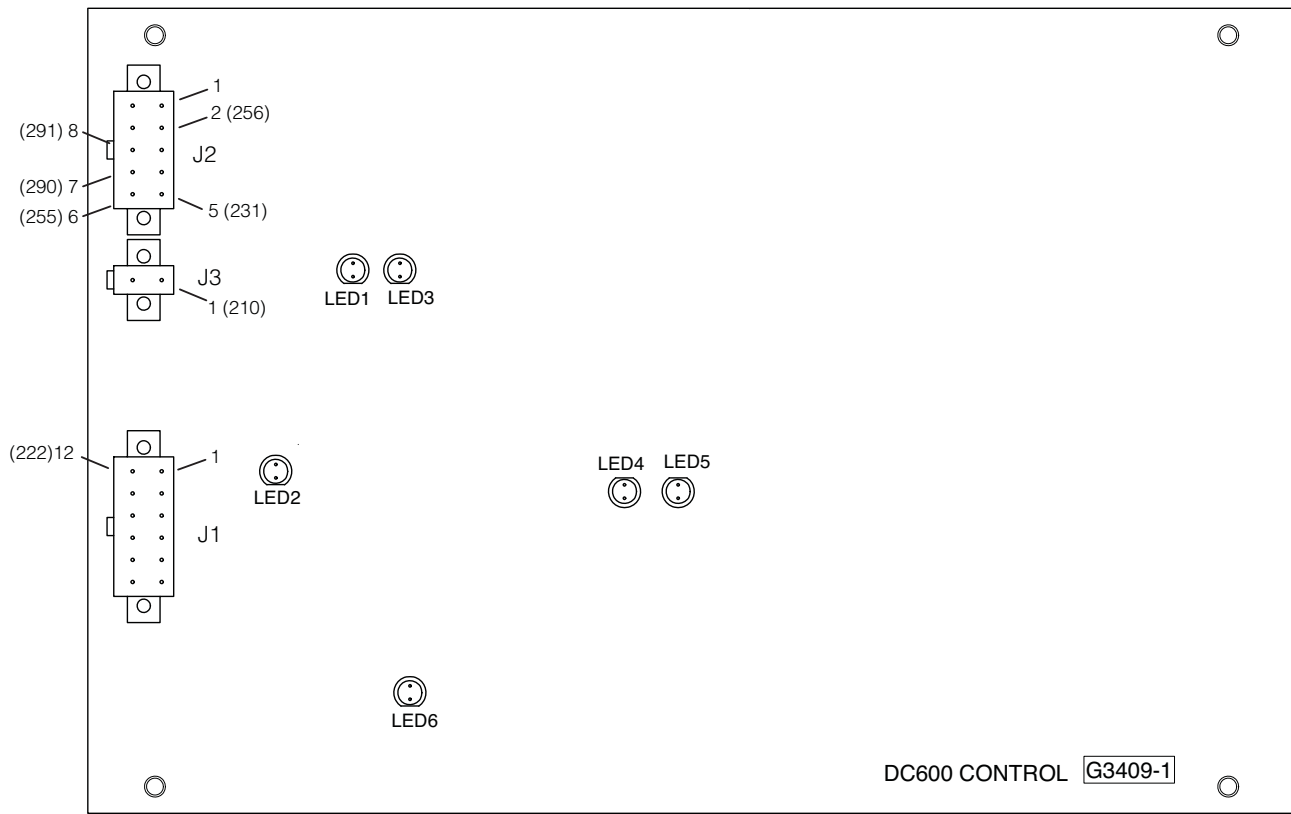
LED that was off	Check AC voltage between pins specified, it should be approximately 34VAC .
7	P5 pins 15 & 16 (wires 203,204)
8	P5 pins 7 & 8 (wires 205,206)
9	P5 pins 5 & 6 (wires 207,208)

- If voltage is present and the LED is OFF, replace the Firing Board

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PC BOARD TROUBLESHOOTING GUIDE (continued)

FIGURE F.2 – CONTROL BOARD LEDs



CONTROL BOARD

1. With the DC-600 set for the **Test Conditions**, all the LEDs except LED 4 should be lit.
 2. **LED 1** indicates the 120vac input to the Control Board and should be ON whenever the Power Switch is ON. If not check for voltage at leads 255 & 256 (J2- pin 6 & pin 3). If there is no voltage, check the wiring from the input power circuit. See the **Wiring Diagram**.
 3. **LED 2** indicates presence of Arc Voltage feedback to the Control Board and should be ON. LED 2 increases in brilliance as the arc voltage increases. If not ON check the voltage at leads 210+ (J3-pin1) to lead 222- (J1-pin12).
 4. **LED 3** indicates that power is being applied to the Fault Protection relay (CR-2) and should be ON whenever the Power Switch is ON. Under a "fault" condition, LED 3 will go OFF and LED 4 will turn ON. See **Protective Devices and Shutdown Circuits**.
 5. **LED 4** indicates an overload or "fault" condition and is normally OFF. If it comes ON, the input contactor (CR-1) will open and the machine will shut down. The Power Switch must be turned OFF and back ON to reset the welder. See **Protective Devices and Shutdown Circuits**.
 6. **LED 5** indicates a DC control signal to the Firing Board is present at lead 231 (J2-pin5). LED 5 will vary in brilliance as the Control Potentiometer is changed getting dimmer as output is increased (opposite of LED 2)
- NOTE:** LED 5 will be very dim or OFF in CC (Stick) Mode until a load is applied (arc struck).
7. **LED 6** indicates a signal from the Firing Board that a 'trigger' has been applied. LED 6 should be ON whenever there is a closure of the 2 & 4 circuit. See Firing Board information regarding LED 10.

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INTERNAL TRIGGER CIRCUIT TEST**⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help to determine if the wiring and connections are correct from the 14 Pin MS connector and the Terminal Strip to the Firing Board. It will also determine the presence of the 42vac trigger supply voltage.

MATERIALS NEEDED

- Multi-meter
- Misc. Hand Tools
- Wiring Diagram or Machine Schematic

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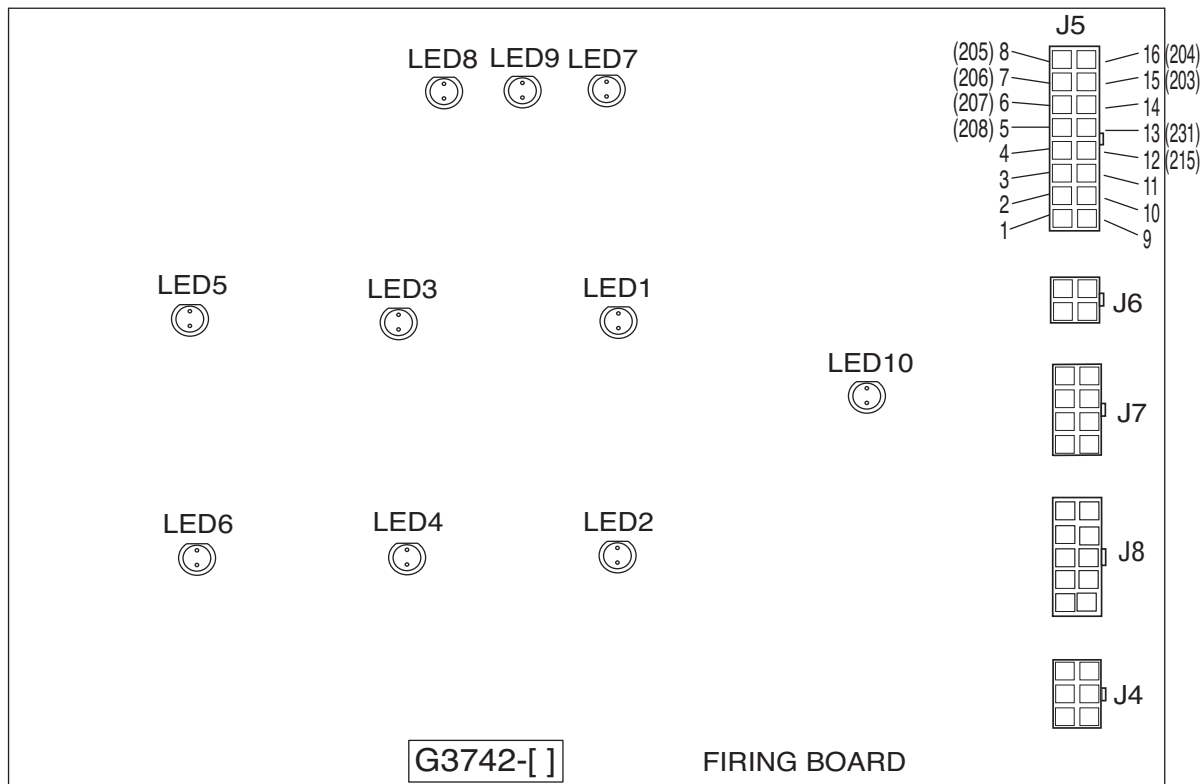
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FIGURE F.3 – FIRING BOARD



PROCEDURE

⚠ WARNING

ELECTRIC SHOCK can kill.



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

1. With the correct input power applied to the DC-600 and the trigger circuit not activated, LEDs 7, 8 & 9 on the firing board should be lit. When the trigger is activated, all of the LEDs should come ON. See **Figure F.1**.
2. If LED 10 and LEDs 1 thru 6 light when the trigger circuit is activated, the wiring and circuitry to the firing board is good. If there is no output at the studs, perform the **Firing Board Test** and see the **PC Board Troubleshooting Guide**.
3. If LED 10 does not light when the trigger circuit is activated check the 10 amp Circuit Breaker. See **Figure F.2**.
4. With a Voltmeter, check for 42vac at TS-2, terminals 2 & 42. See **Figure F.2**. If not present, check wiring per the **Simplified Trigger Diagram (Figure F.5)**. If OK, perform the **Main Transformer Test**.
5. Remove the main input supply power to the DC-600.
6. Check for continuity (zero ohms) from lead #42A to lead #2 at the 14-pin receptacle pin "C". Also check continuity to the Output Terminal Switch. See the **Simplified Trigger Diagram**. If a resistance of any value is indicated, check the associated wires and plugs.
7. Check for continuity (zero ohms) from pin "D" (lead #4) at the 14-pin receptacle to the output terminal switch and also to plug J5-pin 9 at the firing board. See the **Simplified Trigger Diagram** and **Figures F.1 and F.2**. If a resistance of any value is indicated, check the associated wires and plugs.
8. Check for continuity (zero ohms) from lead #41 (14 Pin Connector Pin I) to plug J5-pin 1 at the firing board. See the **Simplified Trigger Diagram** and **Figure F.1**.

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TROUBLESHOOTING AND REPAIR

INTERNAL TRIGGER CIRCUIT TEST (continued)

FIGURE F.4 - TERMINAL STRIPS AND AMPHENOL

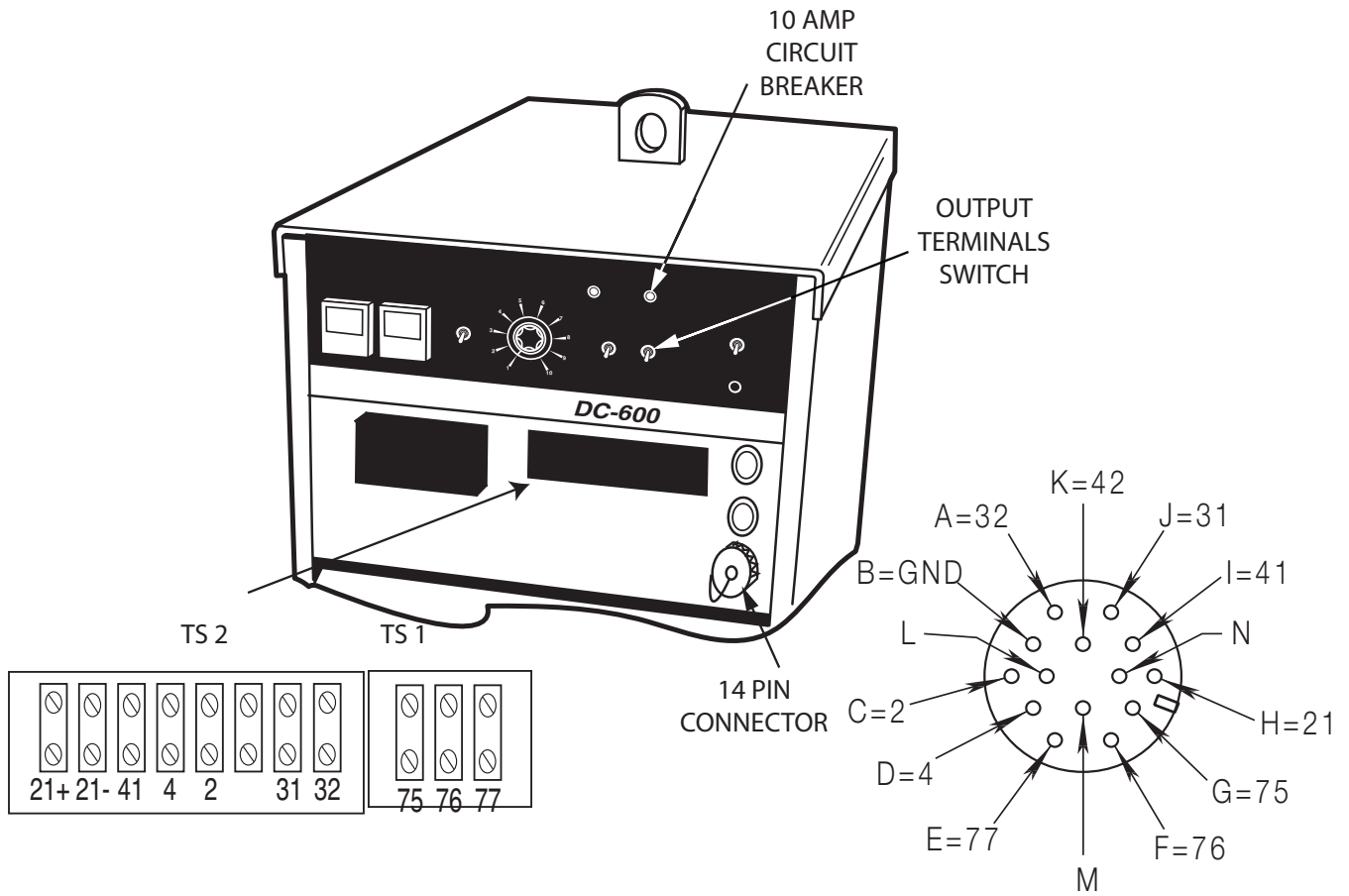
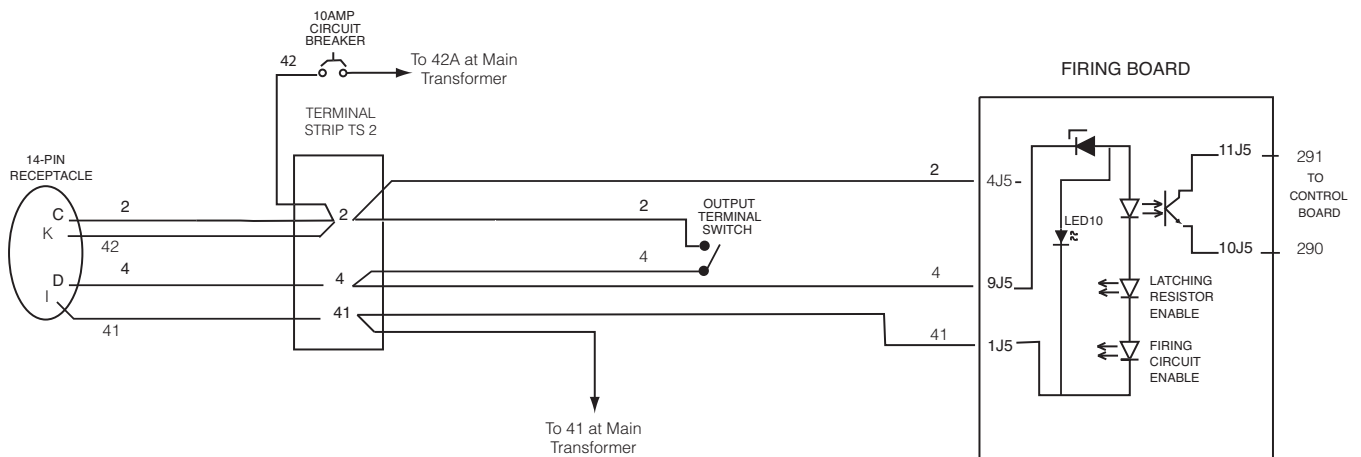


FIGURE F.5 - SIMPLIFIED TRIGGER DIAGRAM



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FIRING BOARD TEST**⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will help to determine if the Firing Board is receiving the correct signals. The LEDs (Light Emitting Diodes) will help to determine if the Firing Board is generating SCR gate signals.

MATERIALS NEEDED

- Misc. Hand Tools
- Multimeter
- Wiring Diagram or Machine Schematic

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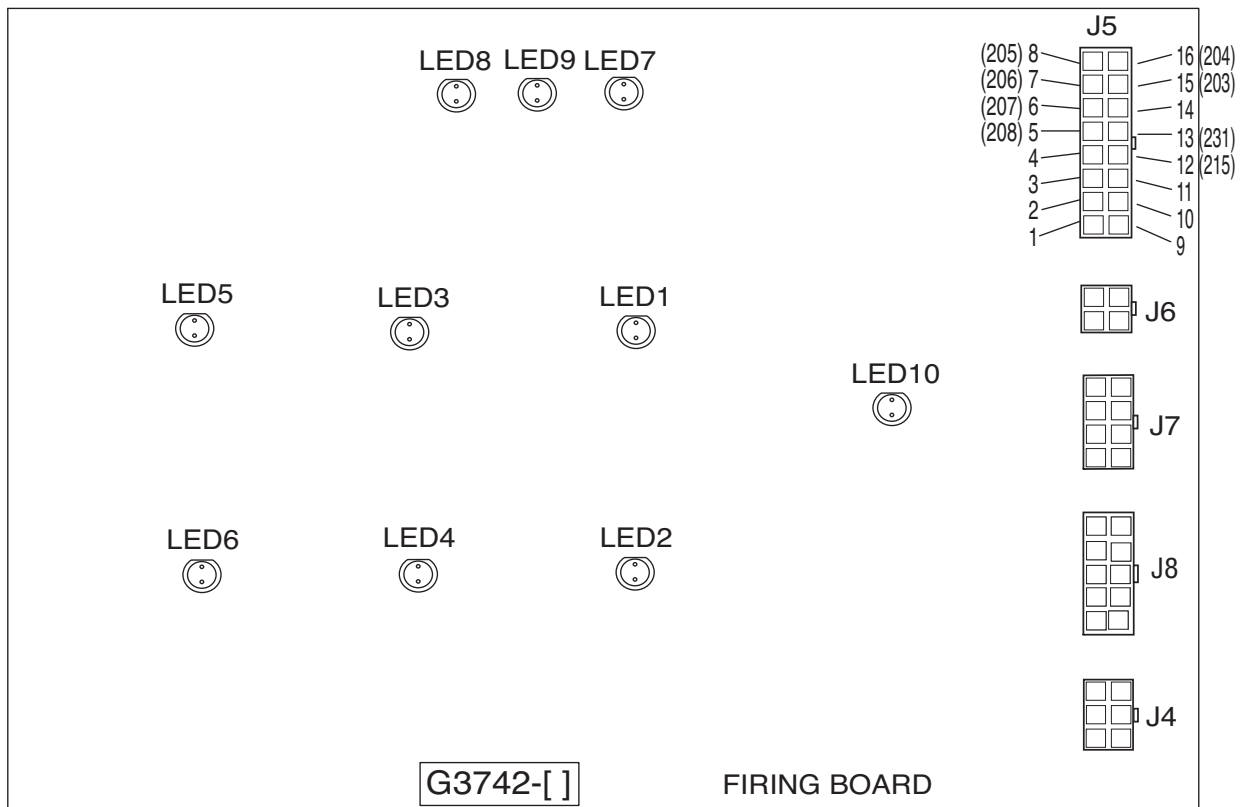
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FIRING BOARD TEST (continued)

FIGURE F.6 FIRING BOARD



PROCEDURE

 **WARNING**

ELECTRIC SHOCK can kill.

- Do not touch electrically hot parts.



1. Disconnect the AC input power to the DC-600 machine.
2. Locate the firing board on the left side of the control box.
3. Perform a visual inspection on the firing board to see if there are any loose or faulty connections or physical damage.
4. Connect the correct AC input power to the DC-600.
5. Turn the power switch (SW1) to the ON position.
6. LEDs 7, 8 and 9 should be lit and equally bright. See Figure F.4 to locate the LEDs. The three LEDs should be of equal intensity. If not correct, see the **PC Board Troubleshooting Guide**.

7. Trigger the DC-600 using the Output Terminal Switch and see that LEDs 1 thru 6 and LED 10 come on.

NOTE: LEDs 1 thru 6 should always be the same brilliance as each other. The brilliance will vary as the Output Control is changed.

8. If LED 10 does not come ON, perform the **Internal Trigger Test**.
9. If LEDs 7, 8 & 9 are ON and any of LEDs 1 thru 6 are not ON, turn the machine OFF, disconnect J4 and re-energize the machine. All six LEDs should be ON very bright. If not Replace the Firing Board. If so perform the **SCR Bridge Test**.
10. If LEDs 7, 8 & 9 are ON and any of LEDs 1 thru 6 are not the same brilliance as the others, Perform the **SCR Bridge Test**. If OK, replace the Firing Board.
11. If LEDs 1 thru 6 do not change as the output control is varied:
 - Check the Output Control Potentiometer.
 - Make sure that the Local/Remote Switch is in Local and functioning properly.
 - Perform the **Control Board Test**. If OK, replace the Firing Board

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CONTROL BOARD TEST**⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will help to determine if the Control Board is functioning properly. The LEDs (Light Emitting Diodes) will help to determine if the Control Board is receiving the correct signals and sending the proper signal to the Firing Board.

MATERIALS NEEDED

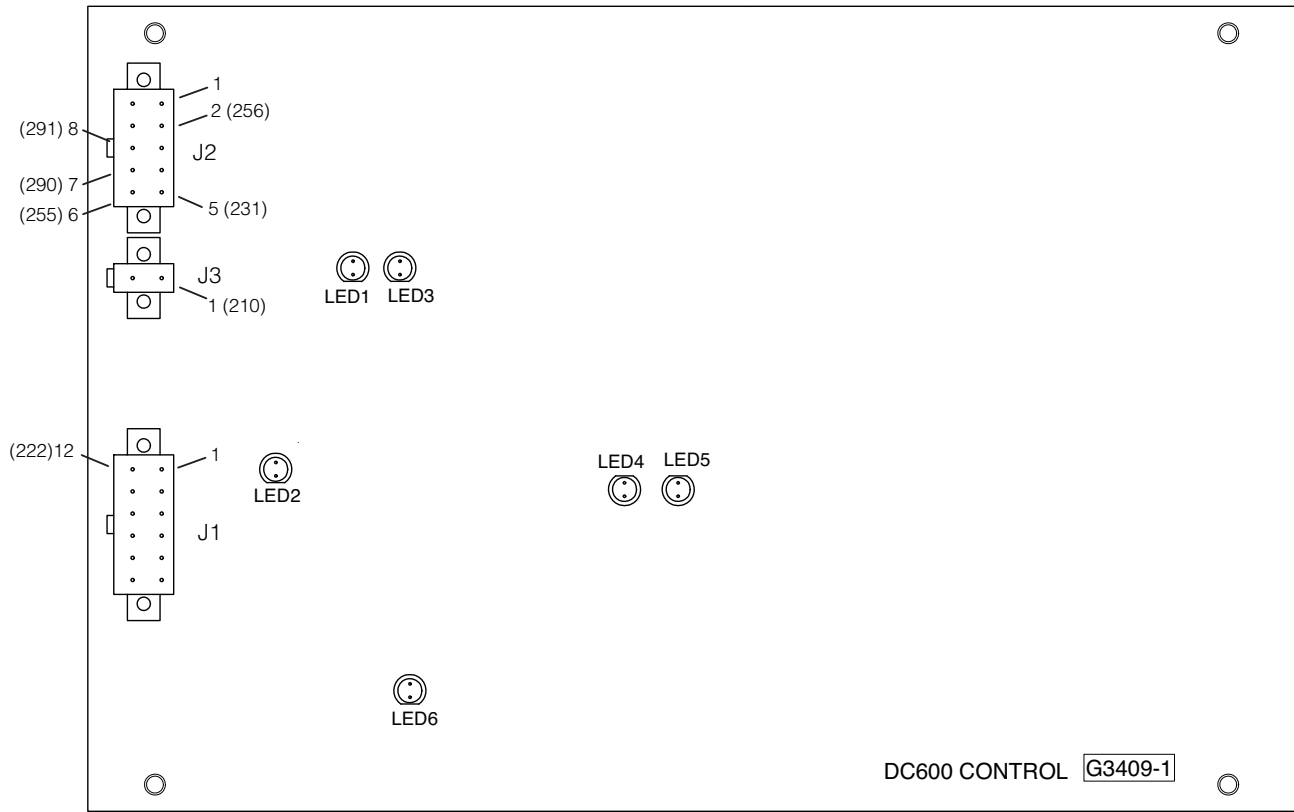
- Misc. Hand Tools
- Multimeter
- Wiring Diagram or Machine Schematic

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CONTROL BOARD TEST (continued)

FIGURE F.7 CONTROL BOARD



PROCEDURE

WARNING**ELECTRIC SHOCK** can kill.

- Do not touch electrically hot parts.

1. Turn the POWER Switch ON. LEDs 1 and 3 should turn ON.
2. If **LED 1** does not come ON, but the Power Light is ON, check for 120vac at J2 (pin 6 and pin 2). See the **Wiring Diagram**.
 - If the Power Light is not ON, perform the **Control Transformer Voltage Test** and check the Power Switch and associated wiring.
3. If **LED 3** does not come ON but LED4 is ON, the DC-600 has shut down due to over-current or a fault in the control leads (75,76 & 77).
 - Disconnect any control cables, welding leads or jumpers from the terminal strips (TS1& TS2).

4. If the machine stays ON and all LEDs are correct, the problem is external to the machine. If LED4 still comes ON:
 - Check the Output Studs and associated wiring for a 'shorted' or 'grounded' condition.
 - Check for grounds in the control circuit (Output Control, Local/Remote Switch & TS1).
 - Control Board may be defective.

NOTE: LED 4 should be OFF except in a "shutdown" condition. If ON and machine is still functioning, replace the Control Board.

5. **LED 5** indicates a signal to the Firing Board and should vary in brilliance as the Output Control is adjusted. If LED 5 is not ON or does not change:
 - Make certain that LED 6 is ON. The Output Terminal Switch the Local/Remote Switch must be in "LOCAL" position and the Mode Switch in CV. If switches are set properly and functional, the Control Board may be defective.
6. **LED 6** indicates a signal from the Firing Board that the DC-600 is "triggered". If not ON, perform the **Internal Trigger Test**.

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MAIN TRANSFORMER VOLTAGE TEST**⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the correct voltages are being applied to the primary windings of the main transformer and that the voltages from secondary windings, the auxiliary windings and the phase angle windings are correct.

MATERIALS NEEDED

- Misc. Hand Tools
- Multimeter
- Wiring Diagram or Machine Schematic

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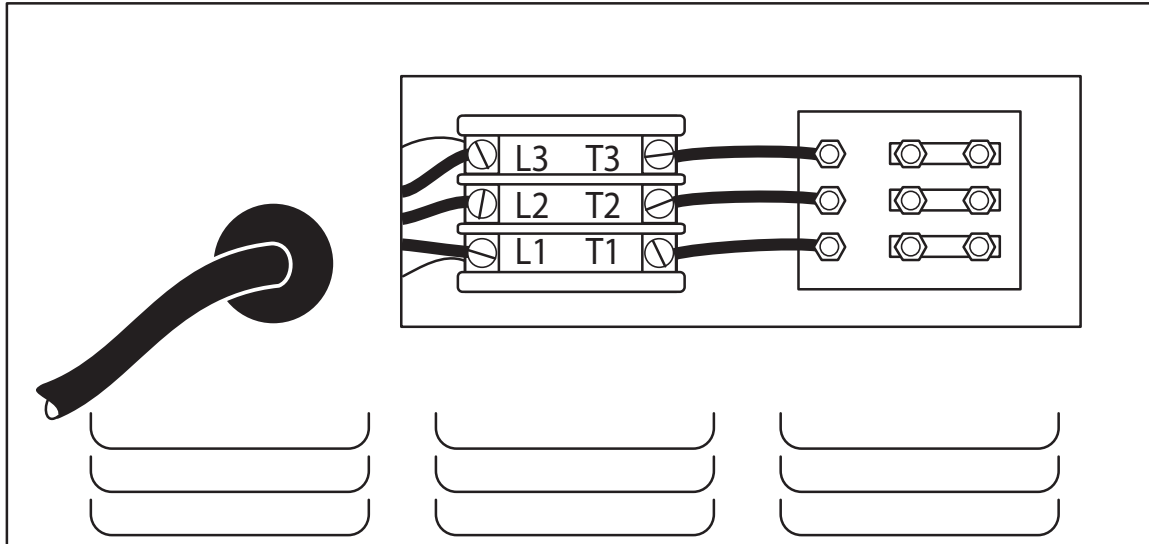
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MAIN TRANSFORMER VOLTAGE TEST (continued)

FIGURE F.8 - INPUT CONTACTOR AND RECONNECT PANEL



PROCEDURE

1. Disconnect the main input power from the DC-600.
2. Inspect the input contactor, reconnect panel and primary leads to the main transformer for loose or faulty connections. See Figure F.8.
3. Confirm that the reconnect panel is configured correctly for the three-phase AC input power supplied to the DC-600. See the connection diagram located on the inside of the input box assembly.
4. Connect the correct AC three-phase input power to the DC-600.
5. Turn the power switch (SW1) to the ON position.
6. Make sure the input contactor (CR1) energizes.
7. Test with an AC voltmeter for the proper main AC input voltages applied to the line side of the input contactor (CR1). See Figure F.8 .
 - a. L1 to L2
 - b. L2 to L3
 - c. L1 to L3
 - If the voltages are not correct at the line side of the input contactor, check the input fuses and leads.
8. Test with an AC voltmeter for the proper AC input voltages at the output side of the input contactor (CR1). See Figure F.8.
 - a. T1 to T2
 - b. T2 to T3
 - c. T1 to T3
 - If the correct voltages are not present, perform the **Input Contactor Test**.

WARNING



ELECTRIC SHOCK can kill.

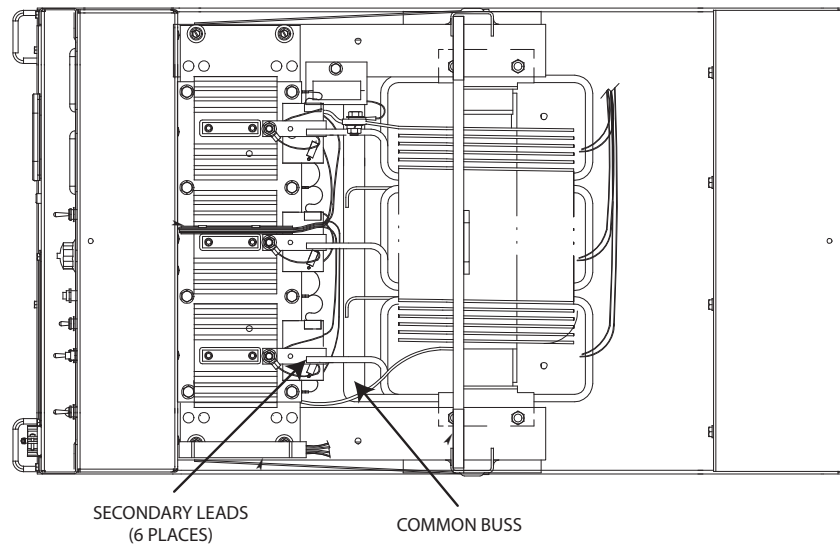
- Do not touch electrically hot parts.

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MAIN TRANSFORMER VOLTAGE TEST (continued)

FIGURE F.9 – TRANSFORMER SECONDARIES

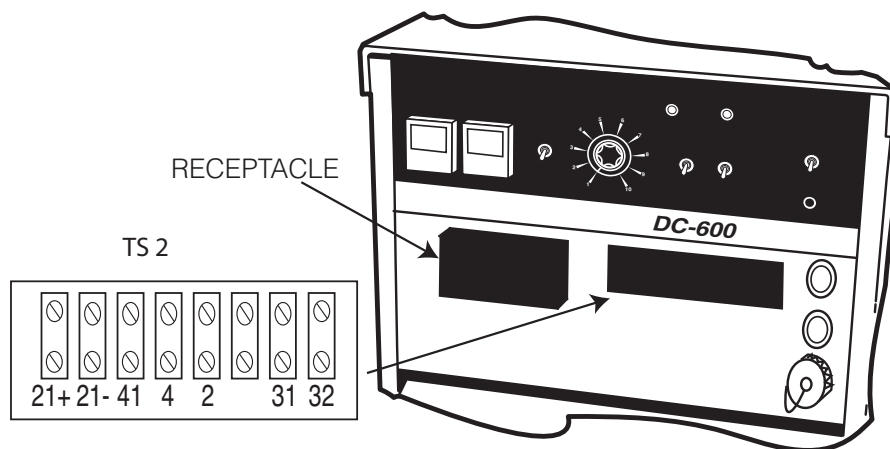


PROCEDURE

- Test with an AC voltmeter for approximately 55 VAC from each of the six main transformer secondary leads to the common bus connected to the output choke. See Figure F.9.

NOTE: All of the secondary voltages will vary if the input line voltages vary. If any one or more of the voltage checks are incorrect, check for loose or faulty connections. See the *Wiring Diagram*. If the leads and connections are OK, the main transformer may be faulty.

FIGURE F.10 – AUXILIARY VOLTAGES



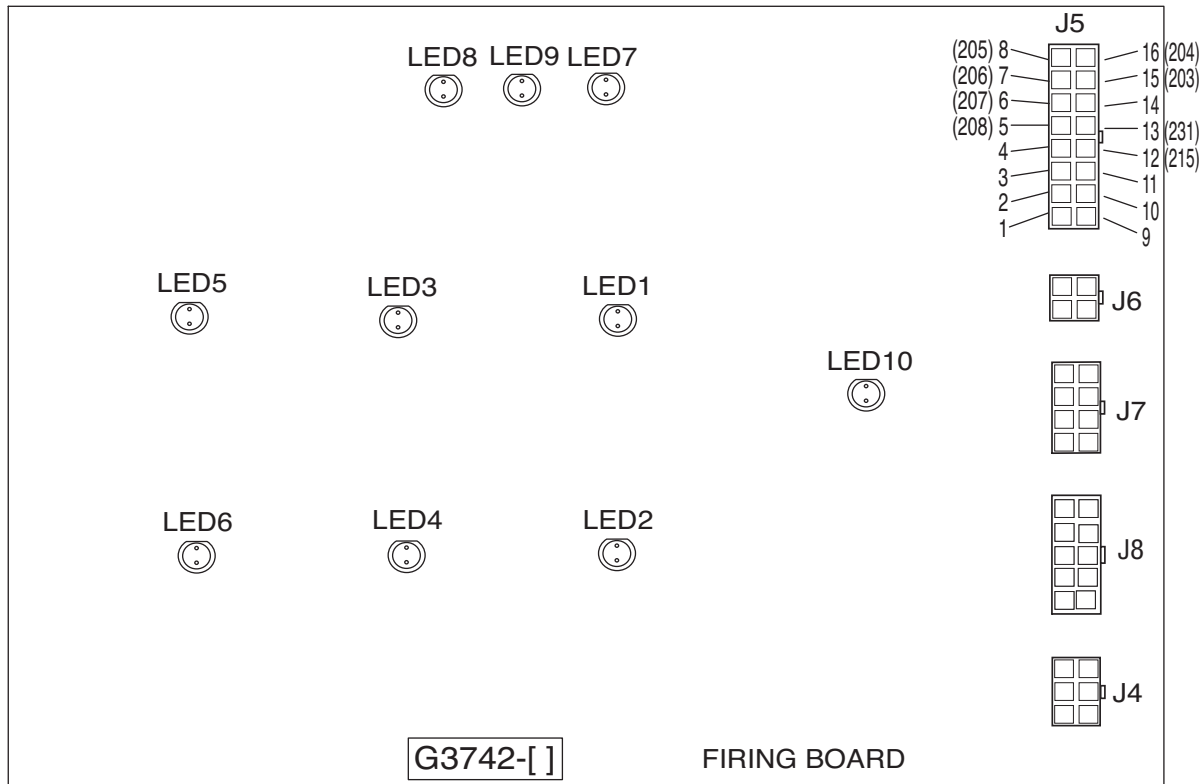
PROCEDURE

- Test for 120 VAC between leads #31 and #32 on terminal strip TS-2. See Figure F.10. 120 VAC should also be present at the receptacle. If the correct voltage is not present, make sure the 20 amp circuit breaker is not tripped or faulty. Also check the wiring between the main transformer, the terminal strip, the circuit breaker and the receptacle. See the *Wiring Diagram*.
- Test for 42 VAC between leads #41 and #2 on the terminal strip. See Figure F.10. If the correct voltage is not present, make sure the 10 amp circuit breaker is not tripped or faulty. Also check the wiring between the main transformer, the terminal strip, and the circuit breaker. See the *Wiring Diagram*.

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FIGURE F.11 – FIRING BOARD



PROCEDURE

WARNING



ELECTRIC SHOCK can kill.

- Do not touch electrically hot parts.

13. Remove the input power to the DC-600. Remove the screws from the control box cover and carefully lower the cover and locate plug J5 on the Firing Board. See Figure F.11.

14. Turn on the DC-600 and check for approximately 32 VAC at the following pins of plug J5. These are the phase angle winding voltages. See Figure F.11.

Plug J5 pin-15 (lead #203) to pin-16 (lead #204)

Plug J5 pin-8 (lead #205) to pin-7 (lead #206)

Plug J5 pin-6 (lead #207) to pin-5 (lead #208)

18. If the correct primary voltages are applied to the main transformer and any of the secondary voltages are missing or not correct, the transformer may be faulty.

NOTE: Always check the wiring between the transformer windings and the test points before replacing the transformer.

CONTROL TRANSFORMER TEST**⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will determine if the correct voltage is being applied to the primary of the control transformer and also if the correct voltage is being supplied by the secondary winding.

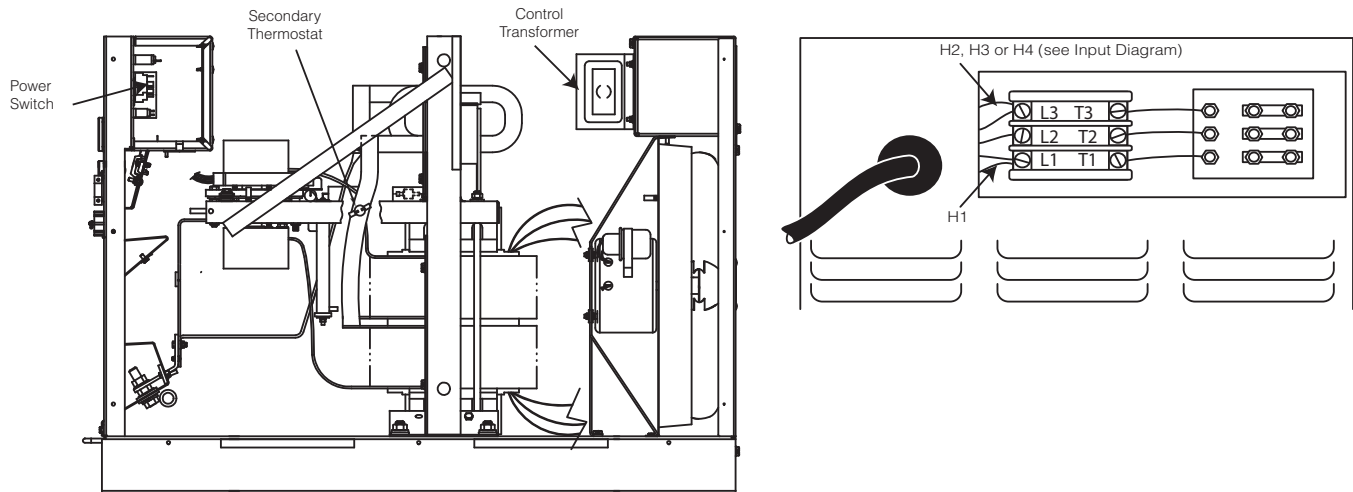
MATERIALS NEEDED

- Misc. Hand Tools
- Multimeter
- Wiring Diagram or Machine Schematic

DC-600



FIGURE F.12 - CONTROL TRANSFORMER



PROCEDURE

1. With the Input Power OFF, remove the case top, right side panel and the input access door. The Control Transformer is located on the back of the Input Box. See Figure F.12.
 - The Primary Leads (black) are routed through the Input Box and two of them (depending on input voltage) are connected to L1 and L3 of the Input Contactor. Any unused leads are to be insulated and taped.
 - The Secondary leads (red) are connected to the Power Switch (X1) and the Secondary Thermostat (X2).
2. Connect the Input Power and make certain that rated voltage is present at L1 and L3.

NOTE: The DC-600 does not need to be turned ON.

WARNING



ELECTRIC SHOCK can kill.

- Do not touch electrically hot parts.

3. Measure the voltage from X1 to X2. It should be approximately 120VAC.
4. If this reading is incorrect check the connections on the Primary and Secondary leads. If OK, the transformer may be defective.

NOTE: Common causes of control transformer failure are;

- Improper connection of the Primary leads.
- A defective (shorted) Input Contactor coil.

IMPORTANT

Before installing a new transformer perform the ***Input Contactor Test***.

Carefully read and follow the Input Connection instructions located on the Input Access Door when installing the new transformer. If you do not have those instructions, call The Lincoln Electric Co. (1-888-935-3877) with the Code Number of the DC-600 and the instructions can be faxed or e-mailed to you.

DC-600

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INPUT CONTACTOR TEST

WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in determining if the Input Contactor is defective.

MATERIALS NEEDED

- Misc. Hand Tools
- Multimeter
- External 120VAC Supply
- Wiring Diagram or Machine Schematic

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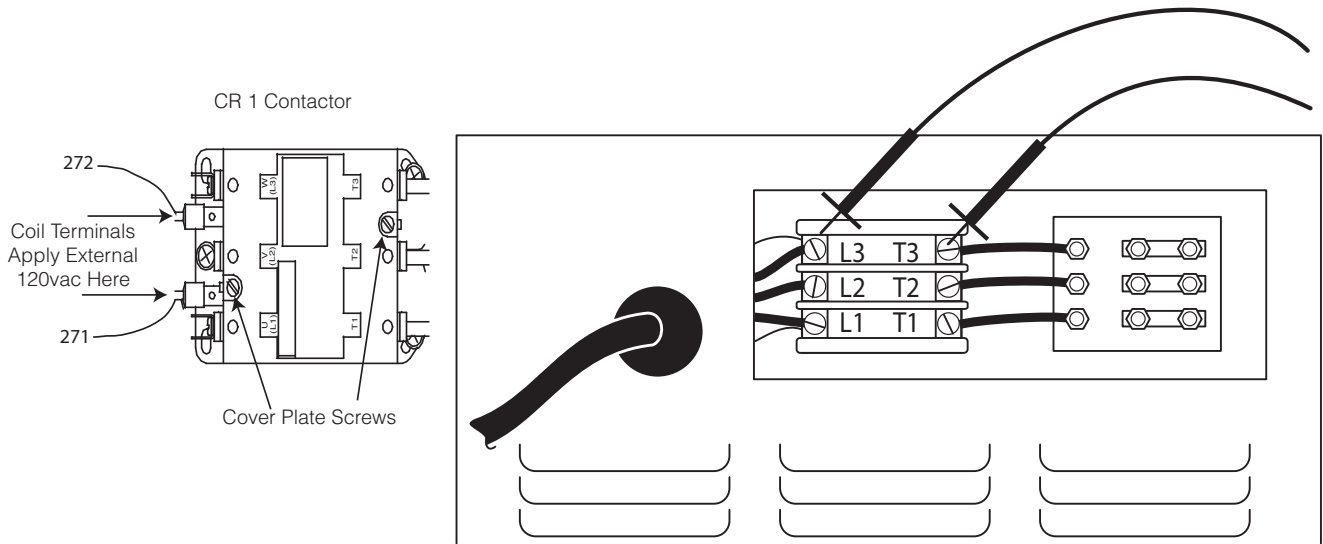
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INPUT CONTACTOR TEST (continued)

FIGURE F.13 – INPUT CONTACTOR



PROCEDURE
VOLTAGE TEST

1. Disconnect the input power and remove the Input Access Panel from the rear of the machine
2. Connect an AC voltmeter to the two coil terminals of the Contactor See Figure F.13.
3. Apply the 3 phase power to the DC-600 and turn the Power Switch ON.

WARNING



ELECTRIC SHOCK can kill.
• Do not touch electrically hot parts.

4. If the meter shows 120vac and the Contactor does not operate, it is defective.
5. If the 120VAC is not present at the coil:
 - Check the Power Switch, Thermostats and associated wiring. See the **Wiring Diagram**.
 - Also check the Control Board LEDs to be certain that the machine is not in a “shut down” condition. See the **PC Board Troubleshooting Guide**.
 - Check the CR 2 relay for proper operation.

CONTACT TEST

1. Disconnect the input power and remove leads 271 and 272 from the CR1 coil terminals. See Figure F.13.
2. Remove the contactor cover plate, blow out any dust or dirt with low pressure air.
3. Examine the contacts for signs of arcing, sticking or pitting. If any of these conditions exist, the Contactor should be replaced.
4. With the cover back in place, apply an external 120VAC supply to the coil terminals and make sure the Contactor activates and is not ‘noisy’. A noisy contactor should be cleaned or replaced.

NOTE: A noisy or shorted contactor can damage the Control Transformer.

5. With an ohmmeter, check across each set of contacts for continuity (0 | 's). See Figure F.13.

- L1 to T1
- L2 to T2
- L3 to T3

If there is any resistance, replace the contactor.

6. Remove the 120VAC supply and re-check the contacts for an open condition. If any resistance is measured, replace the contactor.

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SCR BRIDGE TEST

WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in testing of the SCRs in the output rectifier assembly by providing both a static and an active test for the devices.

MATERIALS NEEDED

- Misc. Hand tools
- Analog Multimeter
- SCR Tester (Described in this procedure)

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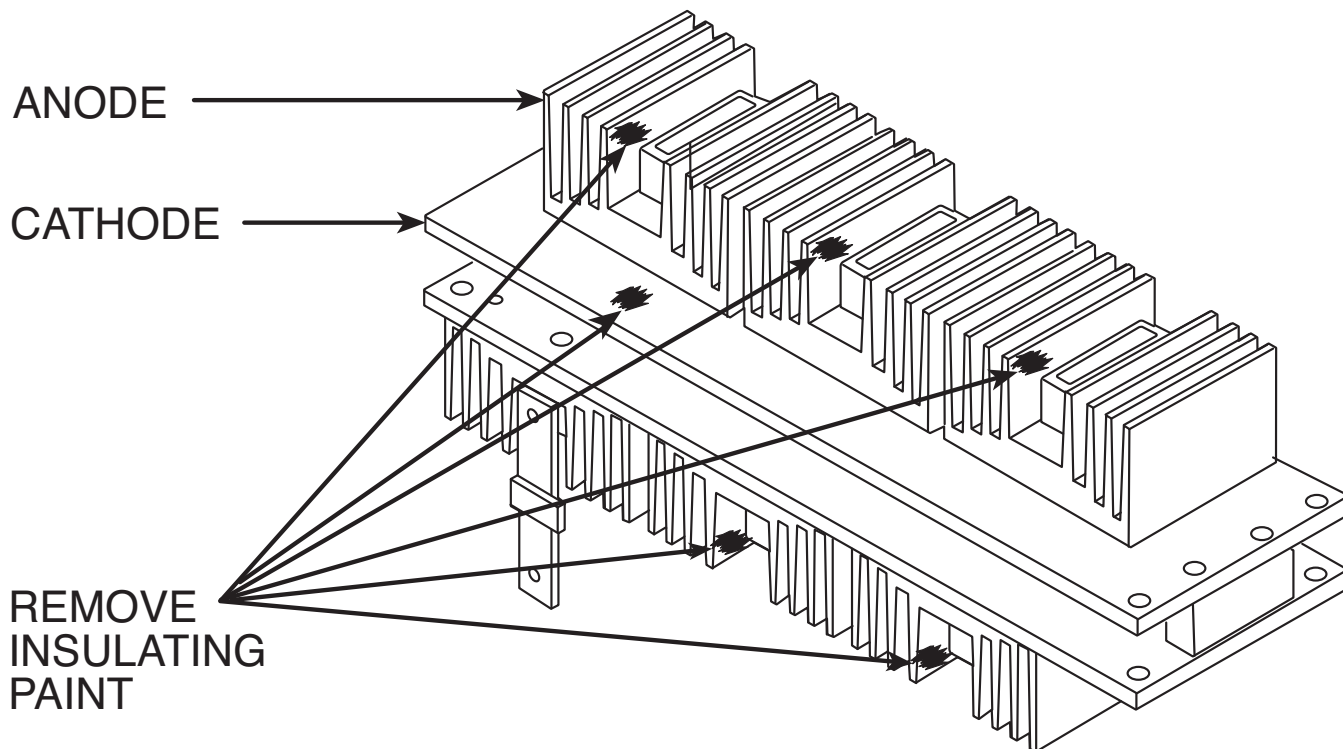
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DC-600



SCR BRIDGE TEST(continued)

FIGURE F.14 – SCR BRIDGE ASSEMBLY



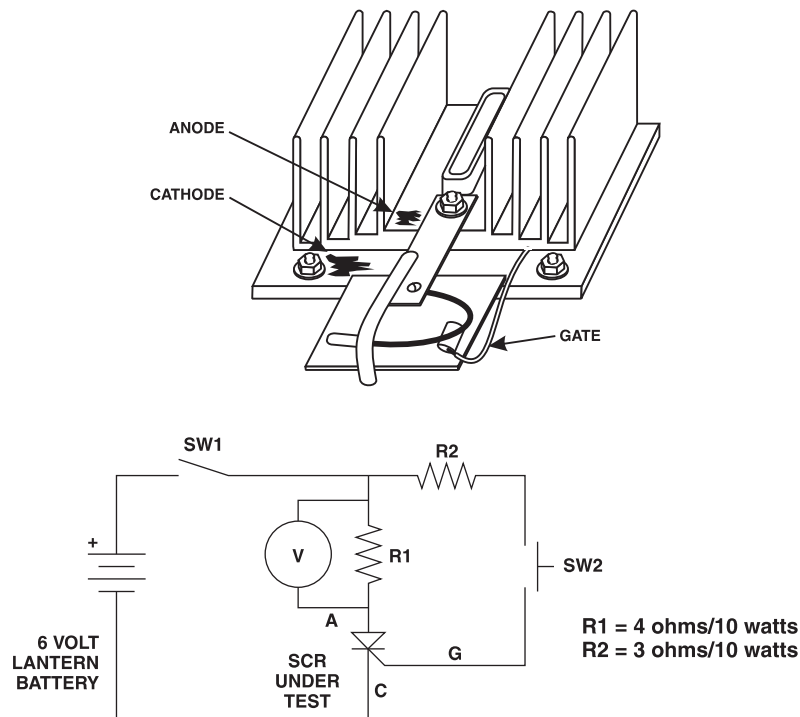
PROCEDURE

STATIC TEST

1. Disconnect the input power from the DC-600.
 2. Remove the top and side panels and drop the nameplate to access the PC Boards.
 3. Unplug the Molex connectors from both the Control Board and the Firing Board.
 4. Scratch off some of the insulating paint from each of the six heat sinks (anodes) and the base plate (cathode). See Figure F.14.
 5. Using the analog ohmmeter:
 - Measure the resistance from each Anode to the Cathode plate with the Positive meter lead on the Anodes. The resistance should be very high or 'open'.
 - Reverse the meter leads and measure all the same points. The readings should be very high or 'open', and typically, will all be similar.
 6. If any of the test points shows a low resistance, disconnect the Snubber Board from that SCR. If the reading is still low, the SCR is defective.
 7. Continue to the Active Test.
- The Active test will require constructing a test circuit or use of a commercial SCR Tester. See **Figure F.15**.

SCR BRIDGE TEST(continued)

FIGURE F.15 – ACTIVE SCR TEST



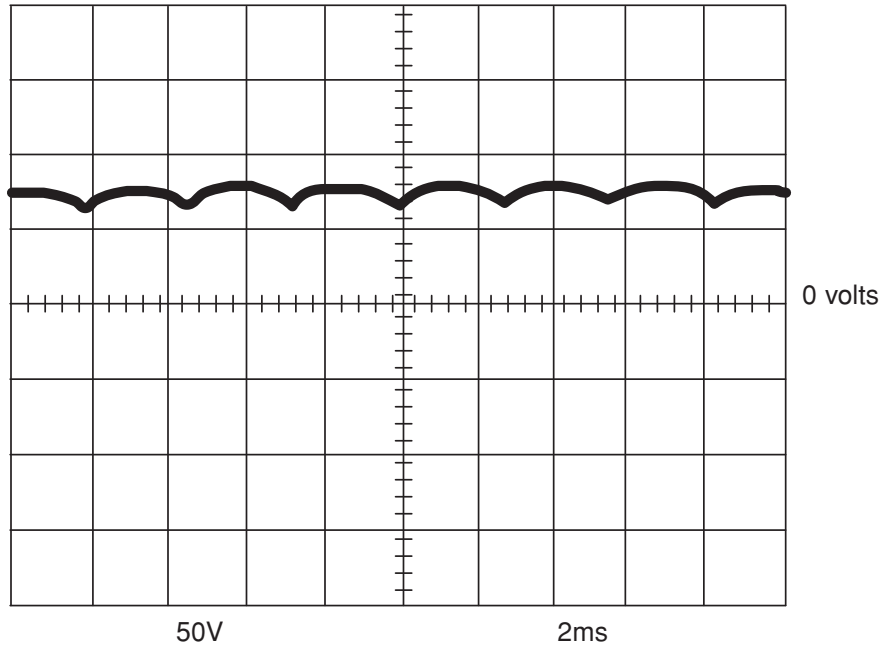
To test SCRs construct the circuit outlined above. Resistor values are plus or minus ten percent. The voltmeter scale should be low, approximately 0-5 or 0-10 volts DC.

PROCEDURE

ACTIVE TEST

1. With the circuit shown in Figure F.17. One 6-volt lantern battery can be used. Set the voltmeter scale low, at approximately 0-5 volts or 0-10 volts.
 - a. Test the voltage level of the battery. Short leads (A) and (C). Close switch SW-1. Battery voltage should be 4.5 volts or higher. If lower, replace the battery.
 2. Connect the Tester to SCR 1 as shown in **Figure F.17**.
 - a. Connect Tester lead (A) to the anode.
 - b. Connect Tester lead (C) to the cathode.
 - c. Connect Tester lead (G) to the gate.
 3. Close switch SW-1.
NOTE: Switch SW-2 should be open.
 4. Check the meter for zero voltage.
 - a. If the voltage reading is higher than zero, the SCR is shorted.
 - b. If the reading is zero volts, continue to Step 6.
 5. Close switch SW-2 for 2 seconds and release and read the meter.
 - a. If the voltage is 3-6 volts while the switch is closed and after the switch is open, the SCR is functioning.
 - b. If the voltage is 3-6 volts only when the switch is closed or there is no voltage when the switch is closed, the SCR is defective.
- NOTE:** A low battery can affect the results of the test. Repeat the battery test procedure in Step 1 if needed.
7. Open switch SW-1.
 8. Reconnect the Tester leads. See **Figure F.17**.
 - a. Connect Tester lead (A) to the cathode.
 - b. Connect Tester lead (C) to the anode.
 - c. Disconnect Test lead (G) from the gate.
 9. Close switch SW-1.
 10. Read the meter for zero voltage.
 - a. If the voltage is zero, the SCR is functioning.
 - b. If the voltage is higher than zero, the SCR is shorted.
 11. Repeat steps 2 through 10 for each SCR.

NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM CONSTANT CURRENT MODE – NO LOAD



This is the typical DC open circuit voltage waveform generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 2 milliseconds in time.

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

SCOPE SETTINGS

Volts/Div	50V/Div.
Horizontal Sweep	2 ms/Div.
Coupling	DC
Trigger	Internal

DC-600



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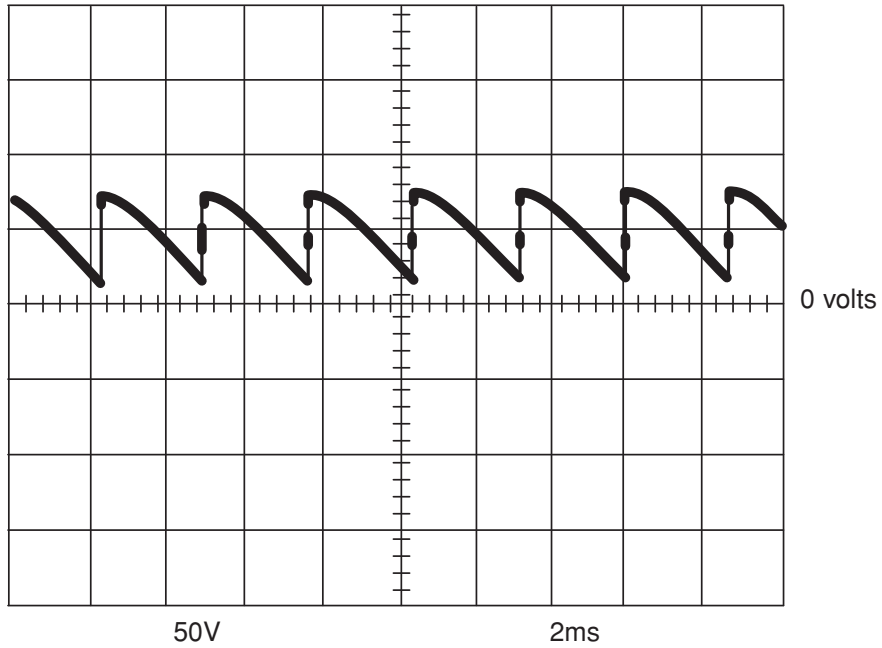
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NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM
CONSTANT VOLTAGE INNERSHIELD
MAXIMUM OUTPUT SETTING – NO LOAD



This is the typical DC open circuit voltage waveform generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 2 milliseconds in time.

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

SCOPE SETTINGS

Volts/Div	50V/Div.
Horizontal Sweep	2 ms/Div.
Coupling	DC
Trigger	Internal

DC-600



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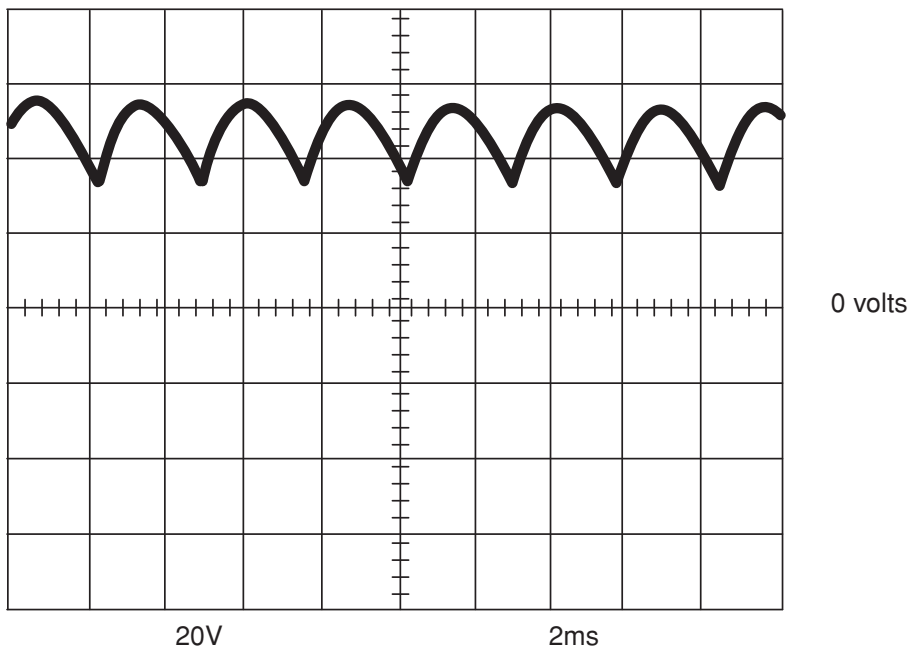
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TYPICAL OUTPUT VOLTAGE WAVEFORM - MACHINE LOADED CONSTANT VOLTAGE INNERSHIELD MODE



This is the typical DC open circuit voltage waveform generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 2 milliseconds in time. The machine was loaded with a resistance grid bank. The grid bank meters read 650 amps at 44 VDC.

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

SCOPE SETTINGS

Volts/Div	20V/Div.
Horizontal Sweep	2 ms/Div.
Coupling	DC
Trigger	Internal

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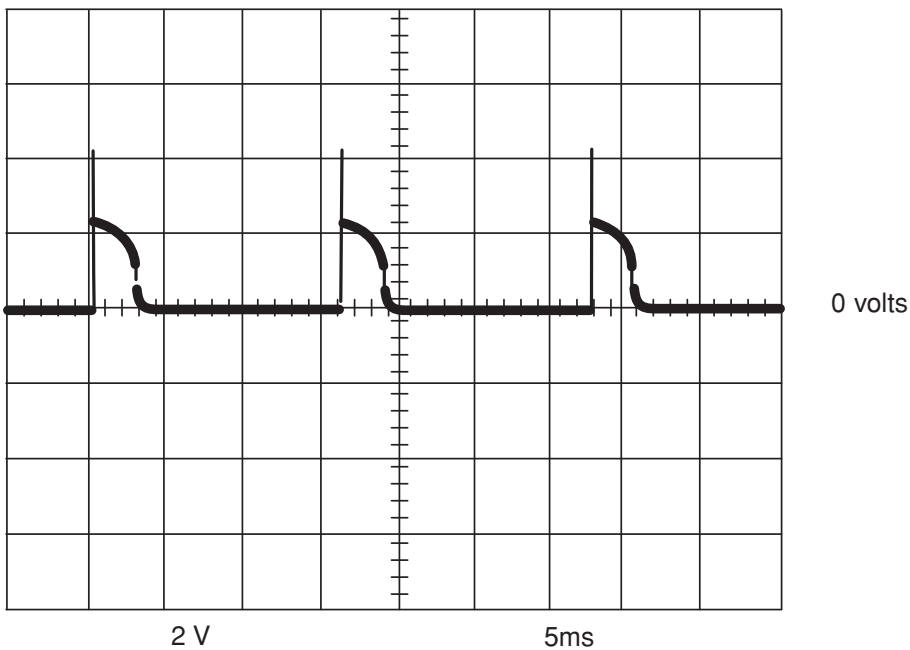
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TYPICAL SCR GATE VOLTAGE WAVEFORM
CONSTANT VOLTAGE INNERSHIELD
MAXIMUM OUTPUT SETTING – NO LOAD



This is the typical DC open circuit voltage waveform. The machine was in an open circuit condition (no load) and operating properly. Note that each vertical division represents 2 volts and that each horizontal division represents 5 milliseconds in time.

Note: Scope probes connected at SCR gate and cathode: (+) probe to gate, (-) probe to cathode.

SCOPE SETTINGS

Volts/Div	2V/Div.
Horizontal Sweep	5 ms/Div.
Coupling	DC
Trigger	Internal

DC-600



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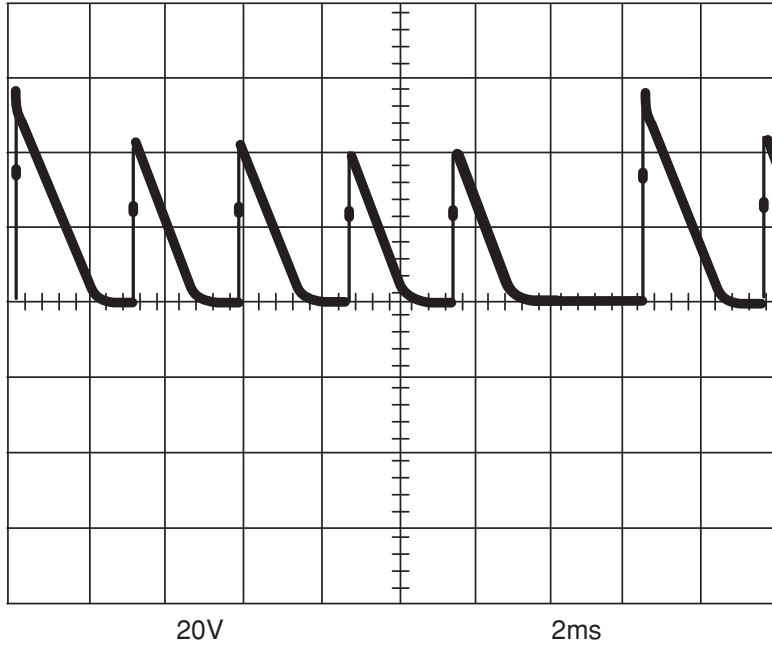
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ABNORMAL OPEN CIRCUIT VOLTAGE WAVEFORM
CONSTANT VOLTAGE INNERSHIELD
ONE OUTPUT SCR NOT FUNCTIONING



This is NOT the typical DC open circuit voltage waveform. One output SCR is not functioning. Note the “gap” in the waveform. One SCR gate is disconnected to simulate an open or non-functioning output SCR. Each vertical division represents 20 volts and each horizontal division represents 2 milliseconds in time.

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

SCOPE SETTINGS

Volts/Div20V/Div.
Horizontal Sweep2 ms/Div.
Coupling.....DC
TriggerInternal

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INPUT CONTACTOR (CR1) CLEANING/REPLACEMENT

WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

The following procedure will aid the technician in inspecting, cleaning, and replacing the input contactor.

MATERIALS NEEDED

- Misc. Hand Tools
- Low Pressure Air Supply
- Wiring Diagram

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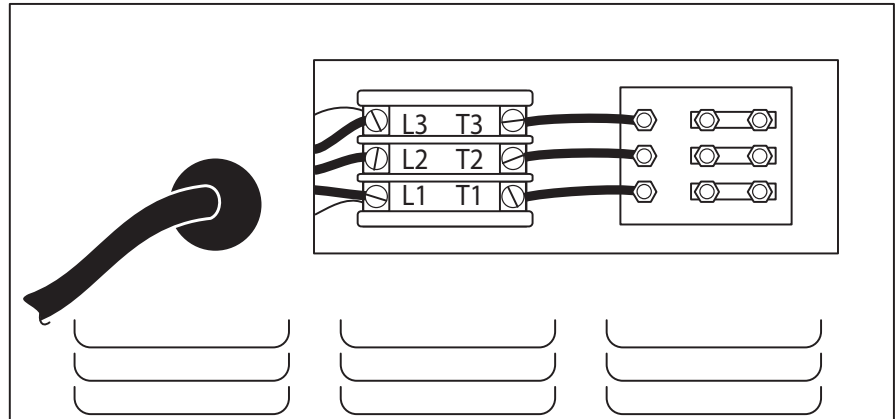
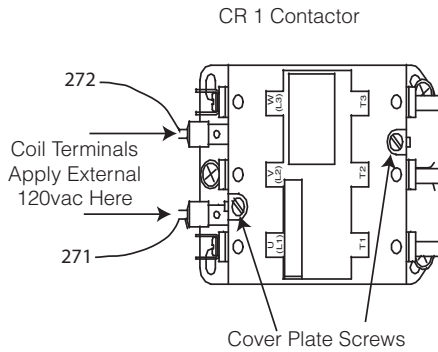
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INPUT CONTACTOR CLEANING/REPLACEMENT PROCEDURE (continued)

FIGURE F.16 – CONTACTOR



CLEANING PROCEDURE

1. Remove the main input supply power to the machine.
2. Locate and get access to the input contactor (CR1) in the input box. See **Figure F.18**.
3. Remove the input contactor cover plate using a phillips head screwdriver.

WARNING



Do not apply input power to the machine with the input contactor cover plate removed.

4. Blow out any dirt or dust in or around the contacts with a low pressure air stream.
5. Inspect the contacts for signs of excessive wear, pitting, or contacts fused (stuck) together.
 - a. If any of these conditions are present, replace the input contactor assembly.

NOTE: Lincoln does not supply contactor parts. They may be available through the manufacturer.

6. Replace the input contactor cover plate.

CONTACTOR REPLACEMENT PROCEDURE

1. Disconnect main input supply power to the machine.
2. Locate and get access to the input contactor (CR1) in the input box. See **Figure F.18**.
3. Disconnect the main input supply power leads L1, L2, and L3 to the input contactor.

Remove the control transformer primary leads H1, H2 or H3 (dependent on input voltage) from the L1 and L3 terminals on the input side of the contactor.

4. Disconnect the output leads T1, T2, and T3 from the input contactor.
5. Identify and label the leads connected to the input contactor coil. See the **Wiring Diagram**.

6. Disconnect the leads from the input contactor coil (leads X1, #256 and #255A). See the **Wiring Diagram**.
7. Remove the three self-tapping mounting screws using a 5/16" socket wrench.
8. Remove the input contactor.
9. Insert the replacement input contactor and install it following the procedures in reverse order.

NOTE: Be sure to reconnect all leads correctly.

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SCR RECTIFIER BRIDGE REMOVAL AND REPLACEMENT PROCEDURE

WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the SCR Rectifier Assembly.

MATERIALS NEEDED

Misc, Hand Tools
Wiring Diagram

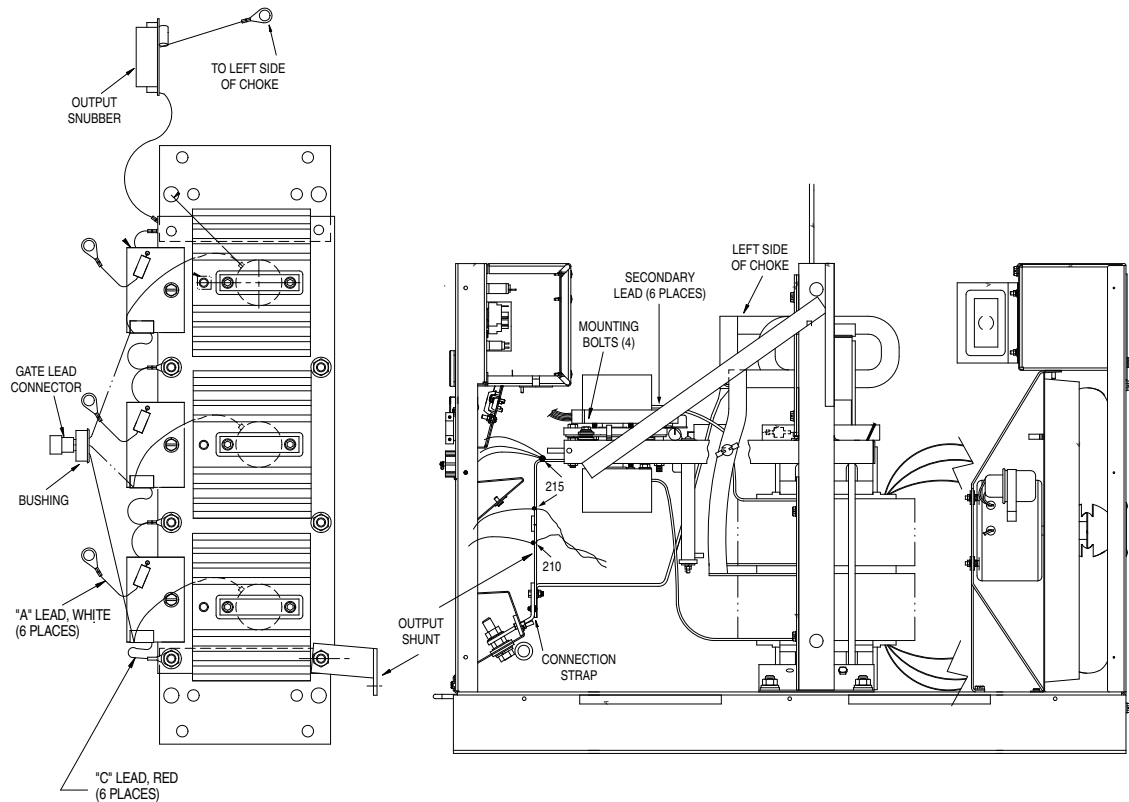
NOTE: If the Transformer and Rectifier both need to be replaced, perform the *Transformer Removal and Replacement Procedure* first to provide easier access to the rectifier assembly

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SCR RECTIFIER BRIDGE REMOVAL AND REPLACEMENT PROCEDURE (cont.)

FIGURE F.17 – RECTIFIER ASSEMBLY



REMOVAL PROCEDURE

1. Remove the input lead power to the DC-600.
2. Remove the case sides and top and lower the nameplate.

NOTE: Before removing the Rectifier Assembly pay particular attention to the original placement and location of the electrical connections to assure proper reassembly. Tag any leads where the Lincoln lead number is not evident.

3. Disconnect J4 from the firing PC Board and push it and the plastic bushing through the bottom of the control box.
4. Disconnect the Output Snubber lead from the left side of the Choke and remove the Output Snubber from the left side rectifier mounting bracket. See Figure F.17.

5. Disconnect the #210(2) and #215(5) leads from the Shunt, noting their positioning for proper reassembly. See Figure F.17.
6. Unbolt the Shunt from the Connection Strap at the Positive Output Stud. See Figure F.17.
7. Remove the four (4) mounting bolts, noting the placement of the insulators and hardware for proper reassembly.
8. Remove the rectifier assembly from the machine. Loosening the Choke mountings will increase the flexibility of the bracket and make it easier to remove the rectifier.

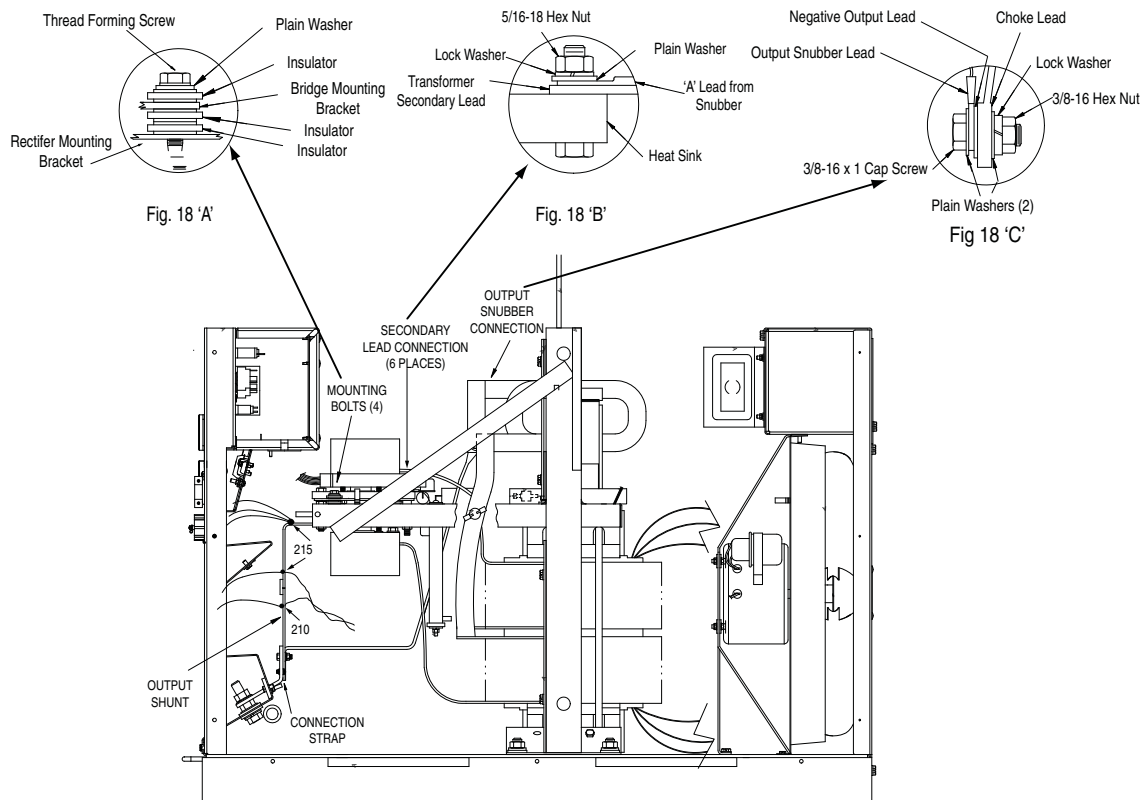
NOTE: Lincoln Electric does not recommend replacement of individual SCRs. In the event of a failure, the entire assembly should be replaced.

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SCR RECTIFIER BRIDGE
REMOVAL AND REPLACEMENT PROCEDURE (cont.)

FIGURE F.18 – RECTIFIER REPLACEMENT



REPLACEMENT PROCEDURE

NOTE: Any instructions packaged with the replacement SCR Bridge assembly will supercede these instructions.

1. Use steel wool or Scotch-Brite to provide a bright, clean, smooth paint-free surface for connection of the leads. Clean the surfaces of the heat sink as well as those of the leads. Wipe away any abrasive material with a clean cloth.
2. Apply a thin coating of joint compound (provided with new assembly) to all of the heatsink areas where leads will be connected.
3. Carefully mount the SCR assembly into the DC-600 using the original hardware or the hardware provided with the new assembly. See Figure F.18'A'.

NOTE: A new rectifier assembly will have mounting brackets with both 1/2" holes and 3/8" holes to allow for proper mounting in all units. The spare insulating tubes and washers are for use in older machines.

4. Reconnect the transformer secondary and snubber 'A' leads to the assembly. See Figure F.18'B'.
5. Mount the Output Snubber to the left side bracket and connect the lead to the Choke. See Figure F.18'C'.

NOTE: Torque all bolts for the following minimum settings:

1/4" bolts	6 ft/lbs.
5/16" bolts	11 ft/lbs.
3/8" bolts	19 ft/lbs.
1/2" bolts	45 ft/lbs.

6. Bolt the shunt to the Positive Output Stud connection strap and connect the # 210 and #215 leads as they were on the original assembly.

NOTE: It is important that the current feedback leads (twisted pair) and the meter leads are connected across the shunt and the other 215 leads connected near the top of the shunt assembly. See Figure F.18.

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MAIN TRANSFORMER AND CHOKE REMOVAL AND REPLACEMENT

WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Main Transformer and Output Choke.

MATERIALS NEEDED

- Misc. Hand Tools
- Crane or Hoist
- Wiring Diagram

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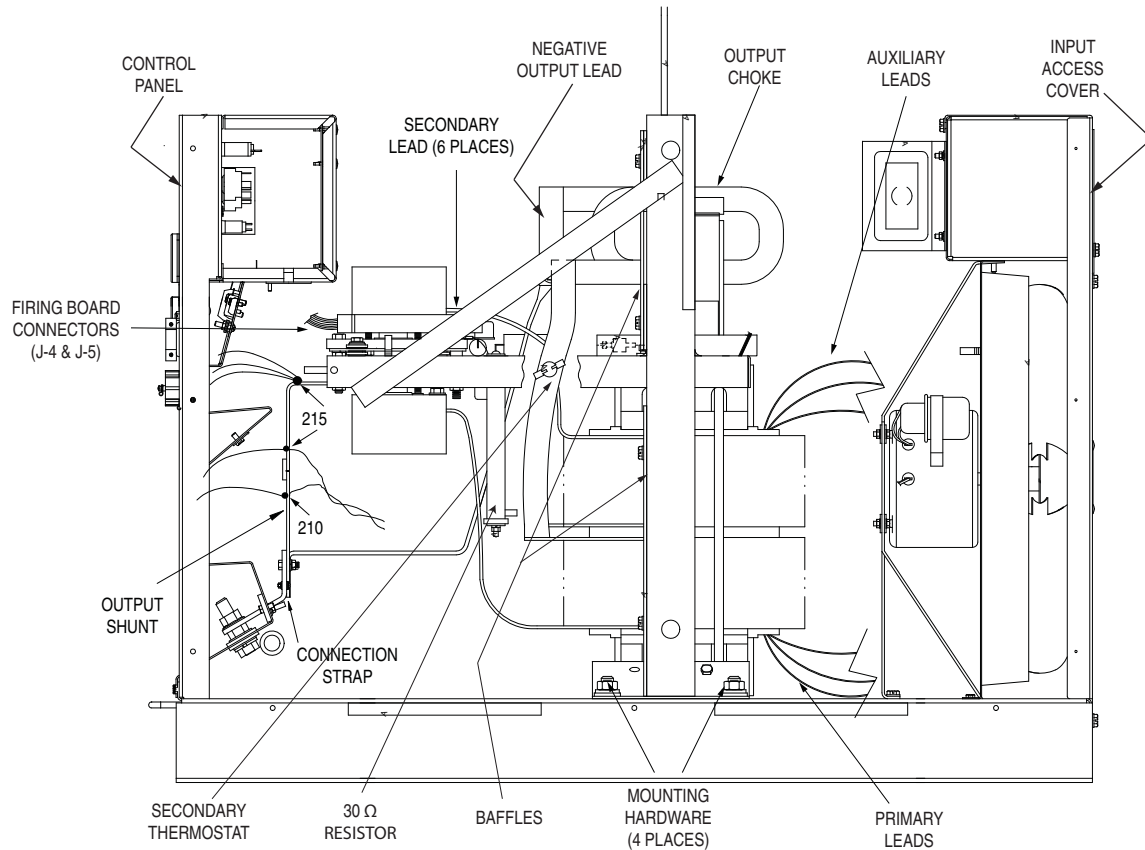
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MAIN TRANSFORMER AND CHOKE REMOVAL AND REPLACEMENT (continued)

FIGURE F.19 – TRANSFORMER REMOVAL



REMOVAL PROCEDURE

1. Disconnect all input power and remove the case top, sides, terminal strip cover and the input access cover and drop the Control Panel.
2. Remove the fiber baffles that are around the Choke and Transformer and save for installation when the new transformer is installed.
3. Disconnect the Transformer Primary leads from the reconnect panel.

NOTE: Pay close attention to the positioning of the brass and steel hex nuts for reassembly.

4. Pull the leads out of the Input Box. This will require removing some of the RTV sealant from the inside of the box.

NOTE: Tag any leads where the Lincoln lead numbers are not evident to facilitate reassembly.

5. Cut off the crimp connectors from the fan leads (#31 & #32A) and lead #41 and #42A. Tag any leads where the Lincoln lead number is not evident.

NOTE: Cut ties and remove sleeving as necessary to perform the following steps. Note the positioning for reassembly.

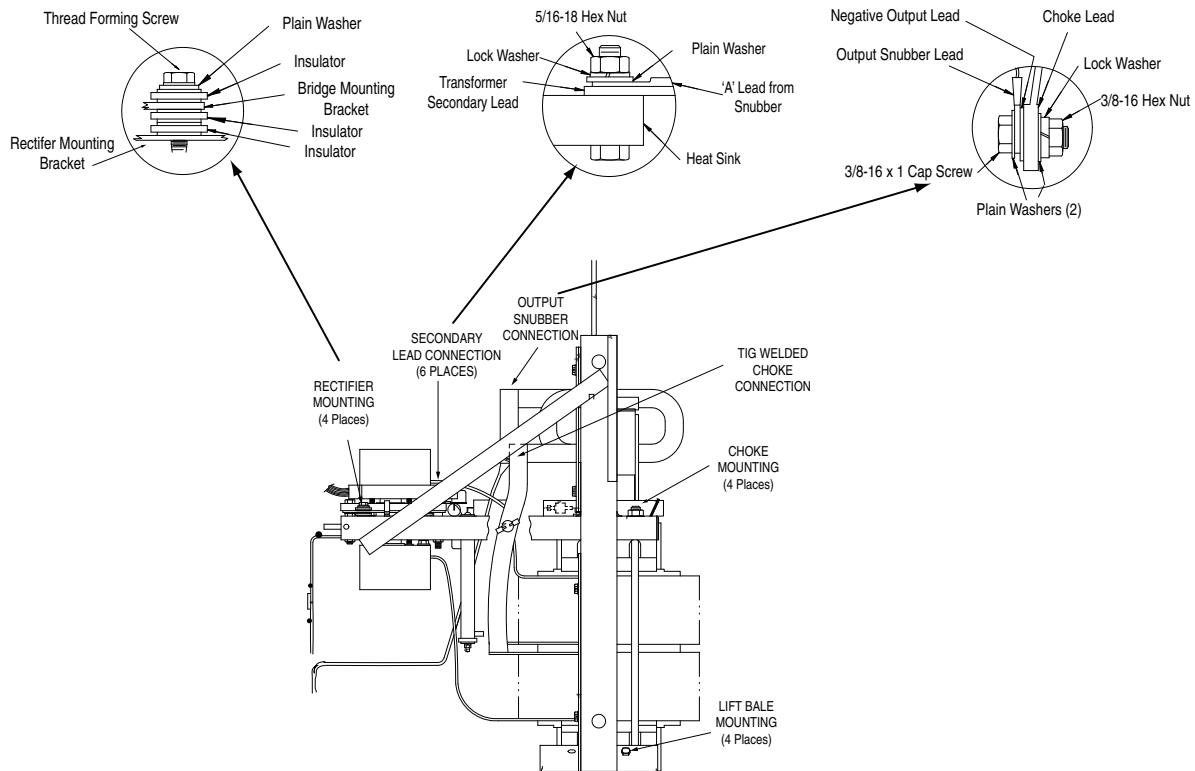
6. Disconnect leads #271 and #272 from the Contactor coil and pull them through the back of the Input Box.
7. Disconnect the leads from the Secondary Thermostat and separate the X2 lead from the #256 lead.
8. Pull the three leads from Step 4 and the #271 lead towards the Control Box.
9. Disconnect the #41, #2, and #4 leads from the Terminal Strip and separate the "piggy-back" connections.
10. Separate the three in-line connectors between J5 of the Firing Board and J2 of the Control Board (Leads 231, 290, & 291).
11. Unplug J5 and J4 from the Firing Board and work them through the bottom of the Control Box. It will be necessary to remove the grommet with the J4 connector. (A new grommet is provided with the replacement transformer).

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MAIN TRANSFORMER AND CHOKE REMOVAL AND REPLACEMENT (continued)

FIGURE F.20 – TRANSFORMER REMOVAL



REMOVAL PROCEDURE (cont.)

12. Disconnect the five (5) #215 and the two (2) #210 leads from the Shunt, noting their positions for reassembly.

NOTE: It is important that the twisted pair (feedback leads) and the meter leads be reconnected correctly to the Shunt.

13. Disconnect the four (4) #222 leads from the Negative Output lead and the two leads from the 30 Ω resistor.
14. Unbolt the Output Shunt from the Connection Strap at the Positive Output Stud and the Negative Output Lead from the Negative Output Stud.
15. Attach a hoist to the lift bale with very slight tension to provide support during the following Steps.
16. Remove the mounting hardware (4 places) that holds the transformer/choke assembly to the base. Note the sequence of the washers for reassembly. See Figure F.20

17. Carefully lift the entire assembly out of the machine and move it to a work bench or other area where it can be safely disassembled.

18. Remove the SCR assembly. See the **SCR Rectifier Bridge Removal Procedure**. Some of this procedure is already done. Save the hardware and insulators for reassembly.

19. Carefully grind the welds from the right hand choke connection to separate the common secondary strap from the choke. Do not cut the choke lead or reduce its size any more than necessary. See Figure F.20.

20. Remove the mounting hardware (4 places) that holds the choke to the top of the transformer. Note the hardware placement for reassembly. See Figure F.20.

21. Remove the 4 bolts holding the lift bale assembly to the transformer and lift it off and remove the choke.

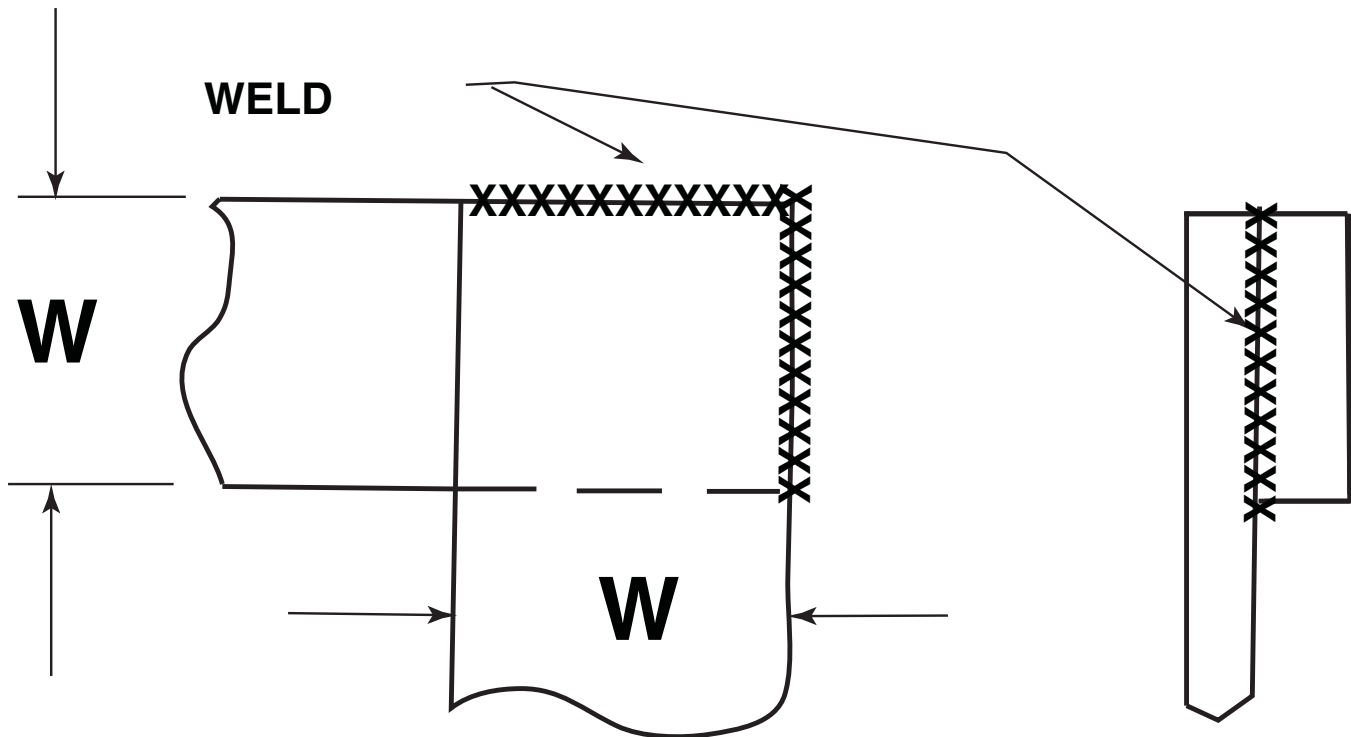
NOTE: The hole in the lift bale assembly is to allow access to the mounting bolts with a socket and extension.

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MAIN TRANSFORMER AND CHOKE REMOVAL AND REPLACEMENT (continued)

FIGURE F.21 – CHOKE TIG WELD



REPLACEMENT PROCEDURE

1. Place the flat washers and the choke on top of the transformer and the lift bale assembly over both.
2. Install the four thread cutting bolts that mount the lift bale to the transformer and then replace the choke mounting hardware that was removed in Step 20 of the removal procedure. See **Figure F.20**.

NOTE: Cover the transformer assembly with 'damp' shop cloths before performing Step 3 to prevent weld spatter from damaging the transformer.

3. Thoroughly clean the choke lead and the secondary lead and TIG weld along the two edges. The welds must be at least as long as the widths of the two pieces. See Figure F.21.
4. Mount the SCR Bridge assembly using the hardware and insulators removed in Step 18 of the removal procedure. See **Figure F.18**.

5. Connect the transformer secondary and snubber leads to the SCR assembly. See **Figure F.19** for proper assembly. Torque all bolts per the following:

1/4" bolts	6 ft/lbs.
5/16" bolts	11 ft/lbs.
3/8" bolts	19 ft/lbs.
1/2" bolts	45 ft/lbs.

6. Using the hoist, place the transformer/lift bale assembly over the mounting bolts in the base and replace the hardware removed in Step 21 of the removal procedure.
7. Carefully back track through the removal procedure, re-routing and re-connecting the leads that were cut, removed or separated using proper electrical techniques and insulating where required.
8. Replace the baffles and any sleeving, cable ties or sealants that were removed during the disassembly procedure.

RETEST AFTER REPAIR

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

INPUT IDLE AMPS AND WATTS

Input volts/Phase/Hertz	Maximum Idle Amps	Maximum Idle KW
208/3/60	11.0	1.0
230/3/60	10.0	1.0
380/3/60	6.0	1.0
416/3/60	5.5	1.0
460/3/60	5.0	1.0
550/3/60	4.2	1.0
575/3/60	4.0	1.0
200/3/50	21.0	1.3
220/3/50	19.1	1.3
230/3/50	18.3	1.3
380/3/50	11.0	1.3
400/3/50	10.5	1.3
415/3/50	10.1	1.3
440/3/50	9.6	1.3
500/3/50	8.4	1.3
550/3/50	7.7	1.3

MAXIMUM OPEN CIRCUIT VOLTAGES

Mode	Input Hertz	Open Circuit Volts
CC Stick	60	66/70
CV MIG	60	44/47
Auxiliary Output (#31-#32)	60	122/128 VAC
Auxiliary Output (#41-#42)	60	44/48 VAC

MINIMUM ACCEPTABLE OUTPUT VOLTAGE - AT MAXIMUM OUTPUT SETTINGS

Mode	Control Settings	Load
CC Stick	Output Control at Maximum Arc Force Control at Minimum	815 Amps @ 44.0 Volts (Min)
CV MIG	Output Control at Maximum	815 Amps @ 44.0 Volts (Min)
Auxiliary Output (#31-#32)	N/A	5 Amps @ 120/126 VAC (Min)
Auxiliary Output (#41-#42)	N/A	5 Amps #41/45 VAC (Min)

DC-600



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Electrical Diagrams **G-1**

 Wiring Diagram (G3506) G-2

 Wiring Diagram - 230/460/575 Volt Machines (G3506-1) G-3

 Schematic – Complete Machine (G3575) G-4

 Schematic – Control PC Board (G3408) G-5

 Control PC Board Assembly (G3409-[]) G-6

 Schematic – Firing PC Board (G3741) G-7

*** NOTE:** Many PC Board Assemblies are now totally encapsulated, surface mounted and or multi-layered and are therefore considered to be unserviceable. Assembly drawings of these boards are no longer provided.

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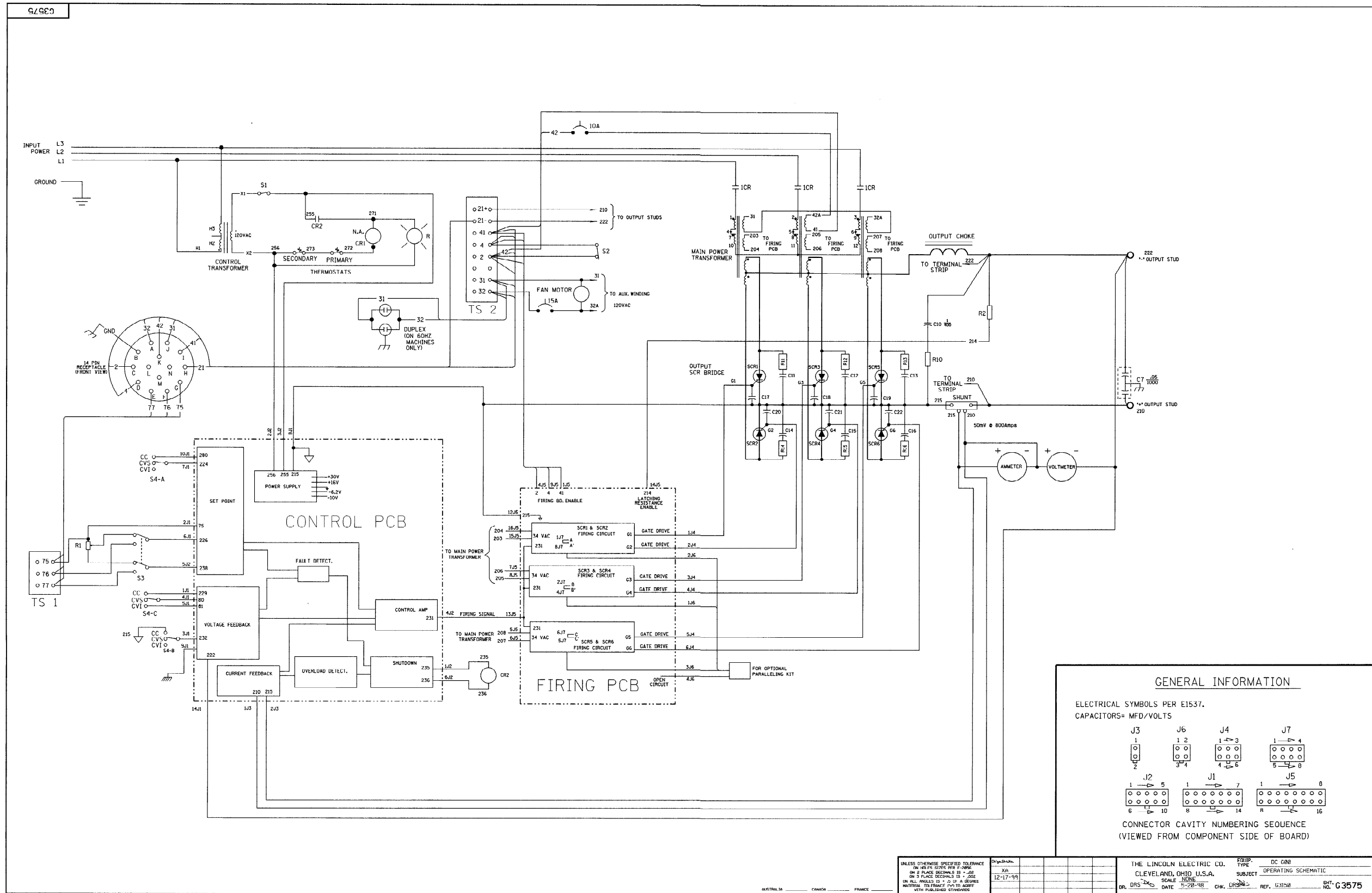
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SCHEMATIC - COMPLETE MACHINE - G3575

Printed by John Howell

Printed at 10:20 on 08/15/2008 (month/day/year)

Drawing Number- G3575



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Revision- 12-17-99

Status- STANDARD

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

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UNLESS OTHERWISE SPECIFIED TOLERANCE ON HOLE DIA. IS ±.0005" ON 2 PLACE DECIMALS IS ±.001" ON 3 PLACE DECIMALS IS ±.0005" ON ALL ANGLES IS ±.015" R UNLESS NOTED. THIS PRINT IS TO BE MADE WITH PUBLISHED STANDARDS	DR: DNS DATE: 5-28-98 CHK: DRS	THE LINCOLN ELECTRIC CO. EQUIP. TYPE: DC CAB CLEVELAND, OHIO U.S.A. SUBJECT: OPERATING SCHEMATIC SCALE: NONE DATE: 5-28-98 CHK: DRS REF: 151536 SHT. NO. C 3575
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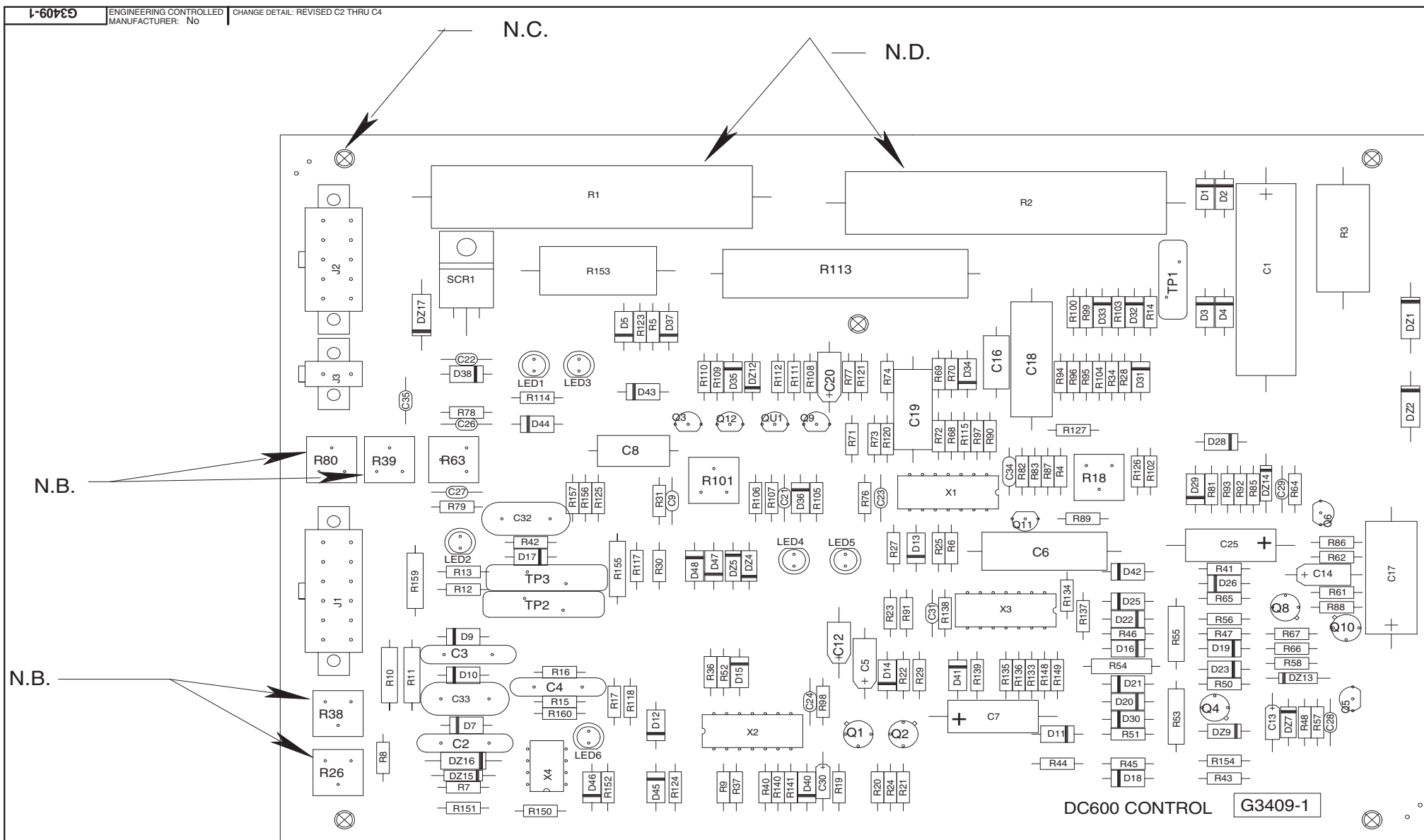
CONTROL PC BOARD ASSEMBLY - G3409-1

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ITEM	REQ'D	PART NO.	IDENTIFICATION
C1	1	S13490-48	47/150
C2, C3, C4	3	T11577-38K	02/600
C5, C14	2	S13490-39	18/15
C6, C18	2	T11577-26	.1/100
C7	1	S13490-12	10/25
C8	1	T11577-32	01/200
C9, C21, C22, C23, C24, C26, C27, C28, C29, C31, C35	11	S16668-5	022/50
C12	1	S13490-25	4.7/35
C13	1	S13490-63	47/50
C16	1	S13490-102	047/100
C17	1	S13490-61	6/150
C19	1	S13490-4	022/200
C20	1	S13490-40	2.7/50
C25	1	S13490-67	2/50
C30	1	S13490-19	1.8/20
C32, C33	2	T11577-58	0047/3000V
C34	1	S16668-3	100pF/100
D1, D2, D3, D4, D7, D9, D10, D19, D20, D21	10	T12199-2	1N4007
D5, D11, D12, D13, D14, D15, D16, D17, D18, D22, D23, D25, D26, D28, D29, D30, D31, D32, D33, D34, D35, D36, D37, D38, D40, D41, D42, D43, D44, D45, D46, D47, D48	33	T12199-1	1N4004
DZ1	1	T12702-42	1N5353 ZENER DIODE
DZ2, DZ16	2	T12702-33	1N5347B
DZ4	1	T12702-27	1N4740A ZENER DIODE
DZ5	1	T12702-29	1N4744A
DZ7	1	T12702-19	1N4722A
DZ9, DZ12	2	T12702-58	1N4751
DZ13, DZ14, DZ15	3	T12702-30	1N5225B
DZ17	1	T12702-41	1N5359B ZENER DIODE
J1	1	S24020-12	HEADER, VERTICAL
J2	1	S24020-10	HEADER, VERTICAL
J3	1	S24020-2G	HEADER, VERTICAL, GOLD
LED1, LED2, LED3, LED4, LED5, LED6	6	T13657-2	RED LED
Q1, Q2, Q4, Q8, Q10	5	T12704-36	2N4857
Q3, Q5, Q6, Q11	4	T12704-68	2N4401
Q9, Q12	2	T12704-69	2N4403
QU1	1	T12707-4	2N6027
R1, R2	2	T14900-1	200 20W
R3	1	T14648-17	270 5W
R4, R46	2	S19400-3320	332 1/4W
R5, R96, R123, R136	4	S19400-1503	150K 1/4W
R6, R23, R48, R154	4	S19400-6252	62.5K 1/4W
R7, R22, R24, R29, R44, R45, R102	7	S19400-1001	1K 1/4W
R8, R72, R76, R79, R88, R97, R103, R150	8	S19400-2211	2.21K 1/4W
R9, R34, R42, R56, R57, R64, R71, R96, R125, R156, R157	11	S19400-6811	6.81K 1/4W
R10, R11, R155	3	S24000-3300	330 75W
R12, R61, R93, R106	4	S19400-4752	47.5K 1/4W
R13, R62, R120	3	S19400-4753	47.5K 1/4W
R14, R124	2	S19400-3692	39 2 1/4W
R15, R160	2	S19400-2431	2.43K 1/4W
R16, R118	2	S19400-1372	13.7K 1/4W
R17	1	S19400-3011	3.01K 1/4W
R18, R101	2	T10812-77	20K 1/2W TRIMMER
R19, R58, R65, R81, R105, R133, R134	7	S19400-1002	10K 1/4W
R20, R21, R50	3	S19400-1003	100K 1/4W
R25, R51, R67, R73, R77, R107, R121, R137	8	S19400-1004	1M 1/4W
R26, R38	2	T10812-68	1K 1/2W TRIMMER
R27, R37, R41, R76, R91, R114, R115	7	S19400-4751	4.75K
R28, R87, R108	3	S19400-4750	475 1/4W
R30, R104	2	S19400-2670	267 1/4W
R31, R85, R99, R151	4	S19400-1501	1.5K 1/4W
R36, R94, R126, R127	4	S19400-1502	15K 1/4W
R39, R63, R80	3	T10812-39	50K 1/2W TRIMMER
R40, R88, R89, R139	4	S19400-6812	68.1K 1/4W
R43, R82, R89, R92	5	S19400-2212	22.1K 1/4W
R47, R110, R117	3	S19400-1301	1.3K 1/4W
R52, R141	2	S19400-2213	22.1K 1/4W
R53, R54, R55, R159	4	S24000-1000	100 75W
R66	1	S19400-5622	56.2K 1/4W
R69, R100, R109	3	S19400-6810	68.1 1/4W
R70, R86, R140	3	S19400-1821	1.82K 1/4W
R74	1	S19400-3923	392K 1/4W
R85, R138	2	S19400-3322	33.2K 1/4W
R111	1	S19400-4755	47.5 1/4W
R112	1	S19400-1000	100 1/4W
R113	1	T12300-68	250 10W
R135	1	S19400-3922	39.2K 1/4W
R148, R149	2	S19400-2432	24.3K 1/4W
R152	1	S19400-2001	2.0K 1/4W
R153	1	T14648-23	20 5W
SCR1	1	S15181-19	RA_300V_SCR
TP1	1	T13640-11	45J
TP2, TP3	2	T13640-18	160J
X1	1	S15128-16	IC.LT1014.LIN.INT. CIR.
X2, X3	2	S15128-4	IC.LM224.OP-AMP
X4	1	S15128-10	IC.431.VOLTAGE REF.

NOTES
 N.B. DO NOT COAT WITH ENCAPSULATION MATERIAL.
 N.C. Ø .30 AREA TO BE FREE OF ENCAPSULATION MATERIAL BOTH SIDES OF BOARD (TOTAL 5 PLACES)
 N.D. RESISTOR FEET MUST BE FLAT AGAINST BOARD. APPLY ITEM 2 TO R1 AND R2 RESISTOR FEET TO ANCHOR TO BOARD.

CAPACITORS = MFD/VOLTS
 RESISTORS = OHMS

ITEM	REQ'D	PART NO.	IDENTIFICATION
1	1	G3409-C	CONTROL P.C. BOARD BLANK
N.D.	2	.04oz. E2861	RTV COATING

FOR PARTS ORDERS:
 SEAL TRIMMERS WITH A DROP OF E4018.
 AND INCLUDE T11590-90.

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MANUFACTURING TOLERANCE PERFORMANCES UNLESS OTHERWISE SPECIFIED TO DRAWING: DIMENSIONS: 2 PLACE DECIMALS ± .02 IN. ± 0.3 mm ON 3 PLACE DECIMALS ± .005 IN. ± 0.125 mm ON ALL ANGLES IS ± 3 OF A DEGREE MATERIAL TOLERANCES: P1 TO AGREE WITH PUBLISHED STANDARDS	CONTROL CLEVELAND DESIGNED BY: Henry DRAWN BY: CHECKED BY: APPROVED BY:	SCALE: IF PRINTED @ A1 SIZE: UNIT: INCH MATERIAL DISPOSITION: UF	EQUIPMENT TYPE: DC 600 SUBJECT: CONTROL PC BOARD ASSEMBLY DATE: 11-16-2007 PROJECT NUMBER: CRM39073 REFERENCE: G1504-4	PAGE 1 OF 1 DOCUMENT NUMBER: G3409-1 REVISION: C
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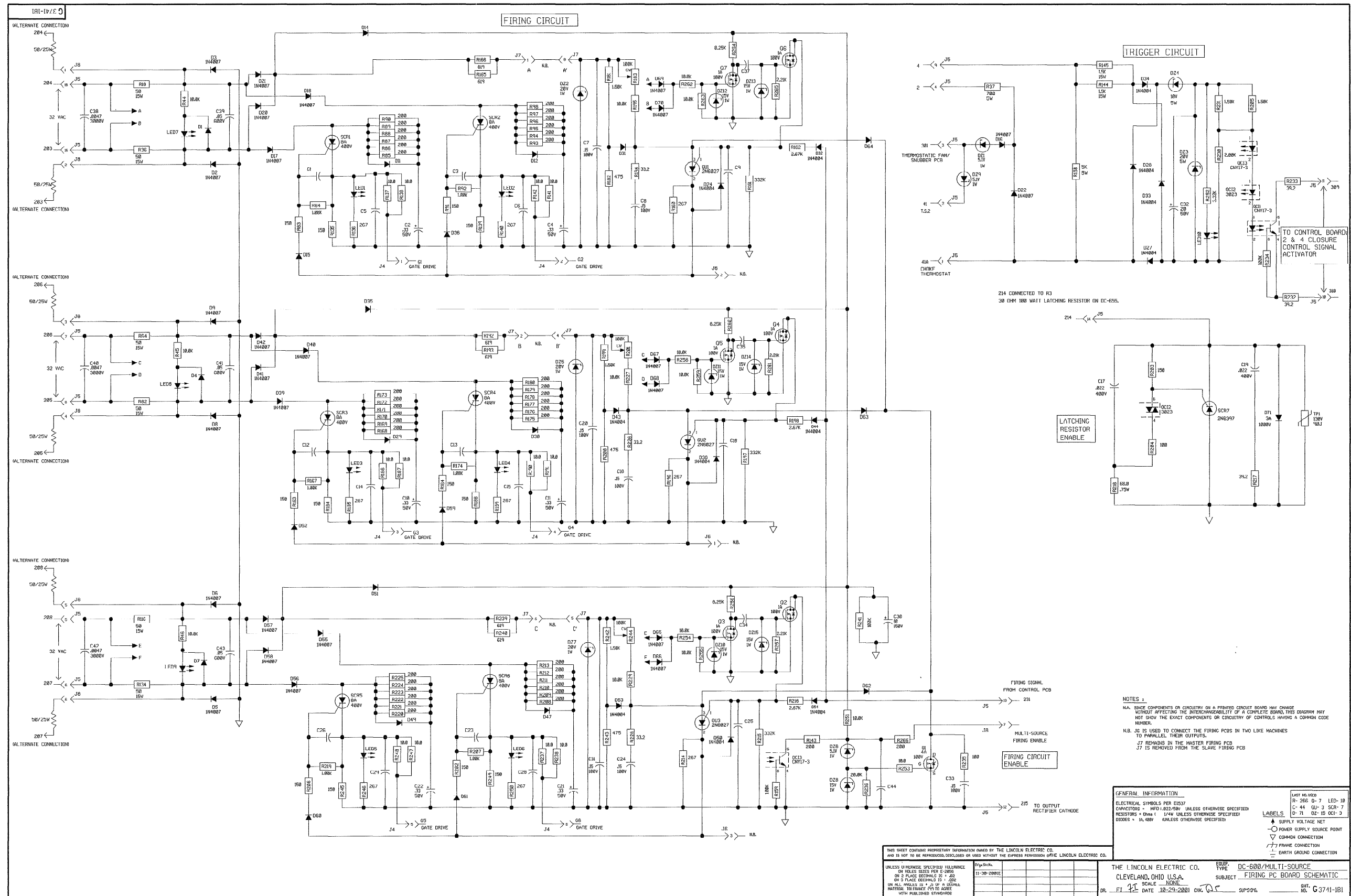
NOTE: Lincoln Electric assumes no responsibility for liabilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. Individual Printed Circuit Board Components are not available from Lincoln Electric. This information is provided for reference only. Lincoln 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.

SCHEMATIC - FIRING PC BOARD - G3741-1

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Printed at 10:23 on 08/15/2008 (month/day/year)

Drawing Number- G3741-1B1



NOTES:

- N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCONNECTABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.
- N.B. J6 IS USED TO CONNECT THE FIRING PCB'S IN TWO LIKE MACHINES TO PARALLEL THEIR OUTPUTS.
- J7 REMAINS IN THE MASTER FIRING PCB
- J7 IS REMOVED FROM THE SLAVE FIRING PCB

GENERAL INFORMATION		LABELS									
UNLESS OTHERWISE SPECIFIED, TOLERANCE ON VALUES SHALL BE:	ON HOLES: 0.10	RESISTORS: 0.10	1/4W UNLESS OTHERWISE SPECIFIED								
ON 2 PLACE DECIMALS: 0.10	ON 3 PLACE DECIMALS: 0.10	DIODES: 1/4W UNLESS OTHERWISE SPECIFIED									
ON ALL VALUES: 0.10	ON ALL VALUES: 0.10										
THIS SHEET CONTAINS PROPRIETARY INFORMATION OWNED BY THE LINCOLN ELECTRIC CO. AND IS NOT TO BE REPRODUCED, DISCLOSED OR USED WITHOUT THE EXPRESS PERMISSION OF THE LINCOLN ELECTRIC CO.		<table border="1"> <tr> <td>REV. NO.</td> <td>DATE</td> <td>BY</td> <td>CHK.</td> </tr> <tr> <td>11-29-2008</td> <td></td> <td></td> <td></td> </tr> </table>		REV. NO.	DATE	BY	CHK.	11-29-2008			
REV. NO.	DATE	BY	CHK.								
11-29-2008											

THE LINCOLN ELECTRIC CO. CLEVELAND, OHIO U.S.A.
 SCALE: NONE
 DATE: 10-29-2008
 EQUIP. TYPE: DC-600/MULTI-SOURCE
 SUBJECT: FIRING PC BOARD SCHEMATIC
 SHEET NO.: G3741-1B1

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Revision- 11-30-2001E

Status- STANDARD

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