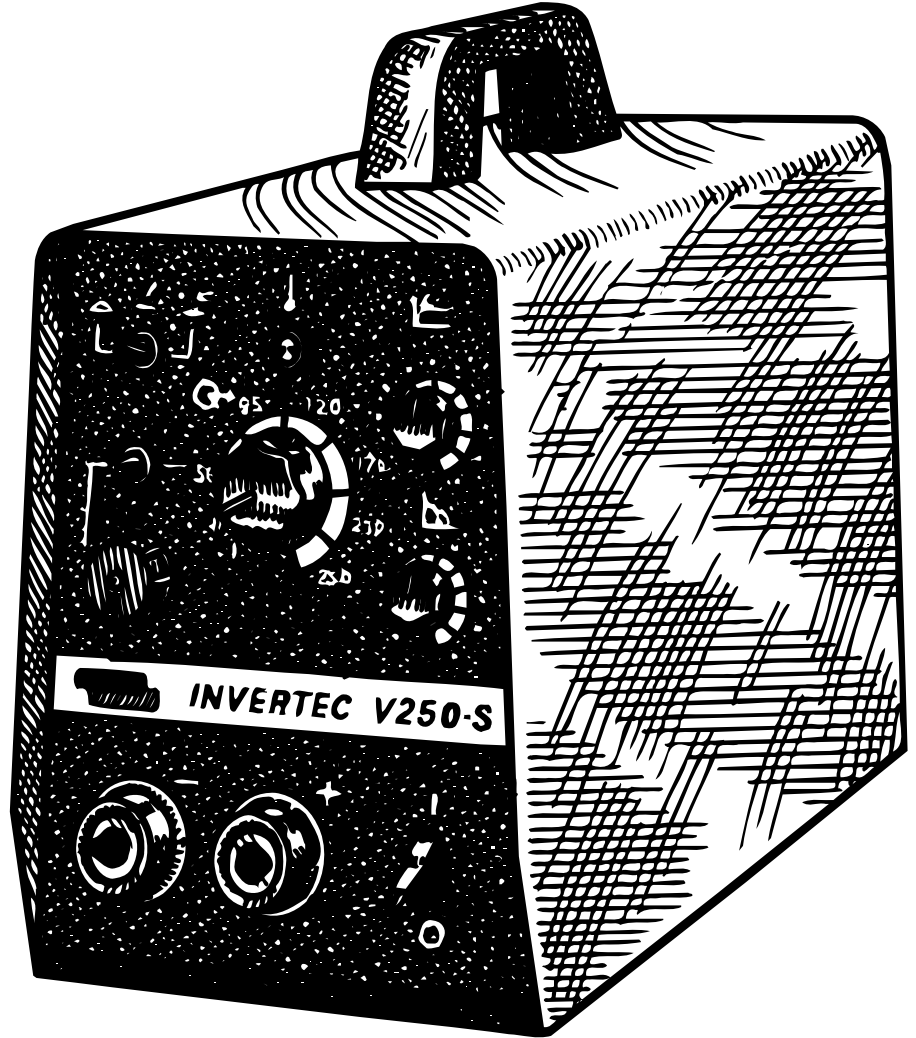


# INVERTEC V250-S

For use with machine Code Numbers 10102 to 10188

## Safety Depends on You

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



## SERVICE MANUAL



World's Leader in Welding and Cutting Products

Premier Manufacturer of Industrial Motors

Sales and Service through Subsidiaries and Distributors Worldwide  
22801 St. Clair Ave. Cleveland, Ohio 44117-1199 U.S.A. Tel. (216) 481-8100

## ⚠ 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.

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## 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.

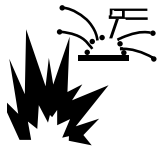
- 4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to 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. 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.c. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 5.d. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.
- 5.e. Also see item 1.b.

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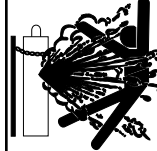


### WELDING SPARKS can cause fire or explosion.

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.



### 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.

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## 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 soleil, 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 pistologie. 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

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## Technical Specifications - Invertec V250-S

INPUT									
THREE PHASE					SINGLE PHASE				
Standard Voltage		Input Current at Rated Output		Model	Standard Voltage		Input Current at Rated Output		Model
208/230/460		34/32/16		60Hz	208/230/460 60Hz		59/57/29		60Hz
200/220/400/440		35/33/18/17		50/60 Hz	200/220/400/440 50/60 Hz		58/58/30/30		50/60 Hz
RATED OUTPUT									
THREE PHASE					SINGLE PHASE				
Duty Cycle <sup>(1)</sup>	Amps	Volts at Rated Amps		Model	Duty Cycle <sup>(1)</sup>	Amps	Volts at Rated Amps		Model
35% Duty Cycle	250	30		60Hz	35% Duty Cycle	250	27 <sup>†</sup> -30		60Hz
60% Duty Cycle	200	28-32		60Hz	60% Duty Cycle	200	28-32		60Hz
100% Duty Cycle	165	26.5		60Hz	100% Duty Cycle	165	26.5		60Hz
35% Duty Cycle	250	28 <sup>†</sup> -30		50/60Hz	35% Duty Cycle	250	26 <sup>†</sup> -30		50/60Hz
60% Duty Cycle	200	29-32		50/60Hz	60% Duty Cycle	200	28-32		50/60Hz
100% Duty Cycle	165	26.5		50/60Hz	100% Duty Cycle	165	26.5		50/60Hz
OUTPUT									
THREE PHASE					SINGLE PHASE				
Welding Current Range		Constant Open Circuit Voltage			Welding Current Range		Constant Open Circuit Voltage		
1-250 Amps		65-80 VDC			1-250 Amps		65-80 VDC		
RECOMMENDED INPUT WIRE AND FUSE SIZES									
THREE PHASE					SINGLE PHASE				
Input Voltage Frequency <sup>(2)</sup>	Fuse (Superlag) or Breaker Size	Input Ampere Rating on Nameplate	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes	Type 75°C Copper Ground Wire in Conduit AWG (IEC) Sizes	Input Voltage Frequency <sup>(2)</sup>	Fuse (Superlag) or Breaker Size	Input Ampere Rating on Nameplate	Type 75°C Copper Wire in Conduit AWG (IEC) Sizes	Type 75°C Copper Ground Wire in Conduit AWG (IEC) Sizes
208/60	50	34	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )	208/60 <sup>(3)</sup>	80	59	8 (10mm <sup>2</sup> )	10 (6mm <sup>2</sup> )
230/60	50	32	10(6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )	230/60 <sup>(3)</sup>	80	57	8 (10mm <sup>2</sup> )	10 (6mm <sup>2</sup> )
460/60	30	16	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )	460/60	40	29	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )
200/50/60	50	35	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )	200/50/60	80	58	8 (16mm <sup>2</sup> )	10 (6mm <sup>2</sup> )
220/50/60	50	33	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )	220/50/60	80	58	8 (16mm <sup>2</sup> )	10 (6mm <sup>2</sup> )
400/50/60	30	18	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )	400/50/60	40	30	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )
440/50/60	30	17	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )	440/50/60	40	30	10 (6mm <sup>2</sup> )	10 (6mm <sup>2</sup> )
PHYSICAL DIMENSIONS									
Height			Width			Depth			Weight
15.0 in.			9.1 in.			19.7 in.			36 lbs.
381 mm			231 mm			500 mm			17 Kg

(1) Based on a 10 min. period.

(2) Input voltage must be within  $\pm 10\%$  of rated value.

(3) For 1 phase use on 208 or 230 VAC input with output usage above 175A/60% or 200A/35%, the #10 input line cord supplied with the unit should be changed to a #8 or larger conductor cord.

(†) 200 & 208VAC input may not meet NEMA/IEC specifications at 250 Amps.

INVERTEC V250-S





Read this entire installation section before you start installation.

## SAFETY PRECAUTIONS

### ⚠ 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.
- Be sure to discharge capacitors with the procedure outlined in the Maintenance Section of this manual before working in that area of the equipment.

## SELECT SUITABLE LOCATION

The Invertec V250-S will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

- The machine must be located where there is free circulation of clean air such that air movement in the back and out the front will not be restricted.
- Dirt and dust that can be drawn into the machine should be kept to a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.
- Keep machine dry. Shelter from rain and snow. Do not place on wet ground or in puddles.

## STACKING

V250-S's cannot be stacked.

## TILTING

Place the machine directly on a secure, level surface or on a recommended undercarriage. The machine may topple over if this procedure is not followed.


## HIGH FREQUENCY PRECAUTIONS

If possible locate the V250-S away from radio controlled machinery. The normal operation of the V250-S may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

## INPUT CONNECTIONS

The Invertec V250-S should be connected only by a qualified electrician. Installation should be made in accordance with all local and national electric codes and the information detailed below.

## GROUND CONNECTION

Ground per National Electrical Code for 60Hz machines connect the green lead to earth ground. For 50/60Hz machines connect the ground terminal marked  located in the machine on the lower right side the base of the welder to earth ground.

## INPUT SUPPLY CONNECTIONS

Be sure the voltage phase and frequency of the input power is as specified on the rating plate, located on the rear of the machine.

Supply line entry provision is in the case rear panel.


## POWER INPUT CONNECTION FOR 60HZ MACHINES

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

**Single Phase Input:** Connect green lead to ground per U.S. National Electrical Code. Connect black and white leads to power. Wrap red lead with tape to provide 600V insulation.

**Three Phase Input:** Connect green lead to ground per U.S. National Electrical Code. Connect black, red and white leads to power.

**POWER INPUT CONNECTION FOR 50/60 HZ MACHINES**

1. Connect terminal marked  to earth ground per National Electric Code.
2. Connect the supply lines to the line switch. Torque to 3.0 Nm.
3. Install in accordance with all local and national electric codes.

The Invertec V250-S 50/60 Hz machine is supplied with one cord connector. The cord connector provides a strain relief for the input power cord as it passes it through the rear access hole. The cord connector is designed for a cord diameter of 7.9 to 27.2mm (.310 to 1.070 in).

Strip away outer jacket of cord, trim fillers and insert conductors through cord connector. The jacketed portion of the cord must go through the cord connector. Tighten both connector screws.

**INPUT FUSE AND SUPPLY WIRE**

Refer to the *Technical Specifications* page at the beginning of this chapter for the proper fuse sizes and supply cable sizes.

- Fuse the input circuit with recommended super lag fuses or delay type circuit breakers.
- Install the proper fuse in the fuse holder in the main disconnect panel.

**INPUT VOLTAGE RECONNECT PROCEDURE**

When received directly from the factory, units are connected for the highest input voltage, 440 VAC for 50/60 Hz machines and 460 VAC for 60 Hz machines. If 440 or 460 VAC is the desired input, then the machine may be connected to the power system without any setup required inside the reconnect door. However, verify the connection with the following procedure. For other voltages refer to the instructions located on the Reconnect Panel Access Door or follow the instructions below.





**⚠ CAUTION**

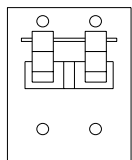
Failure to follow these instructions can cause immediate failure of components within the welder.

1. Open the access door on the right side of the machine.
2. For 200-230: Position the large switch to 200-230. For 380-460: Position the large switch to 380-460.
3. Move the "A" lead to the appropriate terminal. Refer to figure A.1 below.

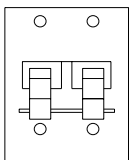
**RECONNECT PROCEDURE**

1. BE SURE POWER SWITCH IS OFF.
2. CONNECT LEAD 'A' TO DESIRED INPUT VOLTAGE RANGE.
 

440-460V		→ 'A'
380-415V		
220-230V		
200-208V		
3. POSITION SWITCH TO DESIRED INPUT VOLTAGE RANGE.
 



↑ VOLTAGE=380-460V



↓ VOLTAGE=200-230V

**⚠ WARNING**

- Disconnect input power before inspecting or servicing machine.
- Do not operate with wraparound removed.
- Do not touch electrically live parts.
- Only qualified persons should install, use or service this equipment.

**ELECTRIC SHOCK CAN KILL**

IF MACHINE CEASES TO OPERATE (NO METER, NO FAN) AND THERE IS NO OTHER KNOWN FAILURE: CHECK FUSE; REPLACE WITH SPECIFIED FUSE.

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S21230

Figure A.1 Input Voltage Reconnect Instructions

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## OUTPUT CONNECTIONS

Refer to figure A.2 for the location of the 6 Pin Remote Receptacle and the Output Terminals.

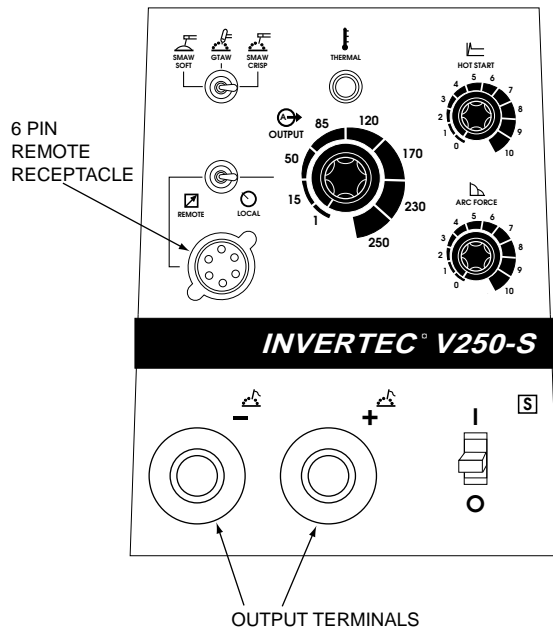


FIGURE A.2 OUTPUT CONNECTIONS

### REMOTE CONTROL RECEPTACLE

Remote control (K857), Arc start switch (K814), Hand amptrol (K963) and Foot amptrol (K870) connect directly to 6 pin amphenol on the front of the unit.

### OUTPUT CABLES

Select the output cable size based on Table A.1.

TABLE A.1

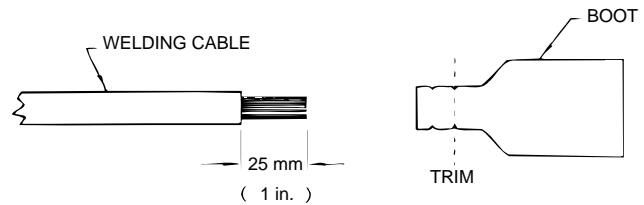
Cable Sizes for Combined Length of Electrode and Work Cable ( Copper Cable Rated at 75°C).

Length	Cable Size
up to 150 ft.(46m)	1/0 (50mm <sup>2</sup> )
up to 250 ft.(72m)	2/0 (70mm <sup>2</sup> )

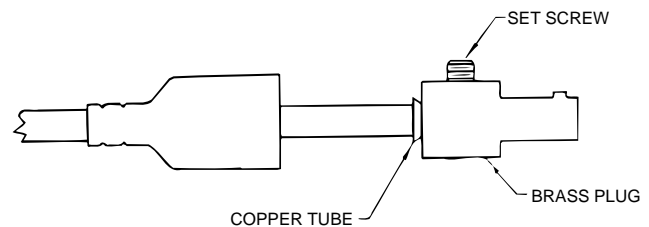
## QUICK DISCONNECT PLUGS

A quick disconnect system is used for the welding cable connections. The welding plug included with the machine is designed to accept a welding cable size of 1/0 to 2/0.

1. Remove 1 in. (25mm) of welding cable insulation.
2. Slide rubber boot onto cable end. The boot end may be trimmed to match the cable diameter. Soap or other lubricant will help to slide the boot over the cable.



3. Slide the copper tube into the brass plug.
4. Insert cable into copper tube.
5. Tighten set screw to collapse copper tube. Screw must apply pressure against welding cable. The top of the set screw will be well below the surface of the brass plug after tightening.



6. Slide rubber boot over brass plug. The rubber boot must be positioned to completely cover all electrical surfaces after the plug is locked into the receptacle.

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    WELDING CAPABILITY .....B-2

    LIMITATIONS .....B-2

CONTROLS AND SETTINGS .....B-3

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    MANUAL ARC WELDING (STICK).....B-4

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Read and understand this entire section before operating your machine.

## SAFETY INSTRUCTIONS

### WARNING



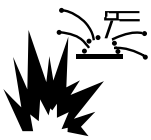
#### **ELECTRIC SHOCK can kill.**

- Do not touch electrically live parts such as output terminals or internal wiring.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.



#### **FUMES AND GASES can be dangerous.**

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



#### **WELDING, CUTTING and GOUGING SPARKS can cause fire or explosion**

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



#### **ARC RAYS can burn.**

- Wear eye, ear and body protection.

Only qualified personnel should operate this equipment. Observe all safety information throughout this manual.

## GENERAL DESCRIPTION

The Invertec V250-S is a 250 amp arc welding power source that utilizes single or three phase input power, to produce constant current output. The welding response of this Invertec has been optimized for stick (SMAW) and TIG (GTAW).

## OPERATIONAL FEATURES

The Invertec V250-S provides continuous total range output current adjustment, selectable welding modes and local or remote output control. Welding characteristics can be controlled via an arc force control. Additionally, starting characteristics can be adjusted via a "hot start" control.

## WELDING CAPABILITY

The Invertec V250-S is rated at 250 amps, 35% duty cycle (based on a 10 minute cycle). It is also rated at 165 amps, 100% duty cycle, and 200 amps, 60% duty cycle.

## LIMITATIONS

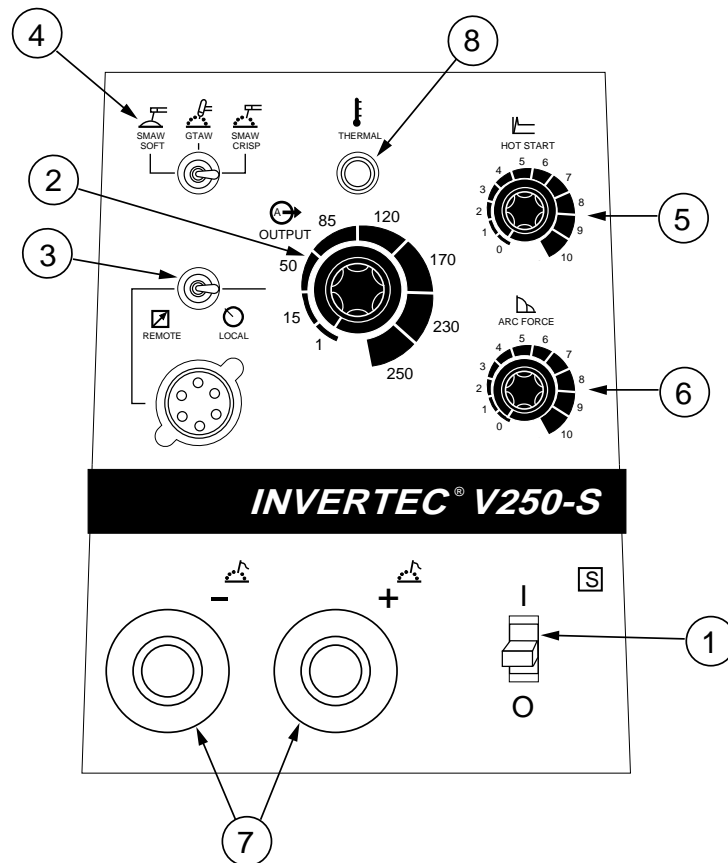
The V250-S is not recommended for pipe thawing.

The V250-S should not be powered from the auxiliary power supply of an engine welder. Special protection circuits may operate causing loss of output.

## CONTROLS AND SETTINGS

All operator controls and adjustments are located on the case front of the V250-S. Refer to Figure B.1 and corresponding explanations.

FIGURE B.1 — CASE FRONT CONTROLS.



**1. Power Switch** - Place the lever in the “ON” position to energize the machine. When the power is on, the fan will operate and the output will be energized in SMAW modes. GTAW mode requires remote trigger to energize the output.

**2. Output Control** - This controls the output current. Control is provided over the entire output range of the power source with 1 turn of the control knob. This control may be adjusted while under load to change power source output. When using remote control this function becomes the limit setting.

**3. Local/Remote Switch** - Place in the “LOCAL” position to allow output adjustment at the machine. Place in the “REMOTE” position to allow output adjustment at remote pot or amptrol. In Remote, the machine output control pot is the limit setting for remote control.

#### 4. Mode Switch

*GTAW* Optimized for touch start use. Triggering at amphenol is required using an Arc Start Switch, Amptrol or similar means. Short circuit current is limited to approximately 25 amps to aid in touch starting.

*CC SoftBest* for EXX18 thru EXX28 stick electrodes. Output energized when machine is on.

*CC Crisp* Use this mode for stick welding with EXX10 thru EXX14 electrodes. Output energized when machine is on.

**5. Hot Start** - Controls the amount of starting energy in SMAW.

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**6. Arc Force** - This control functions in SMAW modes to adjust the Arc Force. The arc is soft at the minimum settings and more forceful or driving at the maximum settings. Higher spatter levels may be present at the maximum settings.

#### RECOMMENDED ARC FORCE/INDUCTANCE SETTINGS FOR SELECTED APPLICATIONS

FULL RANGE IS 1-10. 1 is VERY SOFT,  
10 IS VERY CRISP

Mode	Process	Nominal Setting	Recommended Adjustment Range
CC SMAW 1 (soft)	EXX18 thru EXX28 stick	5	1 (gentle, may stick) to 9 (forceful, more spatter)
CC SMAW 2 (crisp)	EXX10 thru EXX14 stick	6	3 to 10
	Air Carbon Arc Cutting	1	None

**7. Output Terminals** - These quick disconnect terminals provide connection points for the electrode and work cables. Refer to **Output Connections** in the Installation chapter for proper cable sizes. For positive polarity welding connect the electrode cable to the positive terminal and the work cable to the negative terminal. To weld negative polarity reverse the electrode and work cables.

**8. Thermal Shutdown Indicator** - This light will illuminate if an internal thermostat has been activated. Machine output will return after the internal components have returned to a normal operating temperature. See **Thermal Protection** later in this chapter.

## CONSTANT CURRENT PROCESSES

### MANUAL ARC WELDING (STICK)

The Invertec may be utilized as a manual DC arc welder with the electrode cable, work cable, and electrode holder being the only equipment required.

### AIR CARBON ARC CUTTING

Air carbon arc cutting may be performed with the Invertec within its output rating using 5/32" (3.9mm) and 3/16" (4.7mm) diameter carbon rods. Output cables, an air carbon arc electrode cable assembly, and a source of compressed air are required.

#### NOTE:

1. Best performance will be at settings of 200 amps and below.
2. The electronic protection circuit in the V250S will limit the current to approximately 290 amps.

### TIG WELDING

The V250S is capable of touch start TIG welding. An electrode cable, work cable, Arc Start Switch or Amptrol, TIG torch, and gas supply with regulator are required. Refer to **Accessories** section of this manual.

Touch starting is done as follows:

1. Place the shield cup edge on the work piece.
2. Rock the tungsten down to touch.
3. Trigger the output.
4. Gently rock back the tungsten from the work-piece.

Note: The short circuit current is limited to 25 amps to aid in touch starting. Panel output control becomes the current limit setting when in remote control



## PARALLEL OPERATION

The Invertec's are operable in parallel. For best results, the currents of each machine should be reasonably well shared. As an example, with two machines set up in parallel for a 300 amp procedure, each machine should be set to deliver approximately 150 amps, not 200 amps from one and 100 amps from the other. This will minimize nuisance feedback conditions. In general, more than two machines in parallel will not be effective due to the voltage requirements of procedures in that power range.

To set machine outputs, start with output control pots and arc force pots in identical positions. Adjust outputs and arc forces to maintain current sharing while establishing the proper output current.

## OVERLOAD PROTECTION

The machine is electrically protected from producing high output currents. Should the output current exceed 290A, an electronic protection circuit will reduce the current to less than 200A. The machine will continue to produce this low current until the protection circuit is reset. Reset occurs when the output load is removed.

## THERMAL PROTECTION

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

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

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  REMOTE CONTROLS .....C-2  
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## OPTIONS / ACCESSORIES

### CABLE PLUGS

**K852-70** - Cable Plug Kit for 1/0-2/0 cable. Attaches to welding cable to provide quick disconnect from machine.

**K852-95** - Cable Plug Kit for 2.0-3/0 cable.

NOTE: Two K852-70 plugs are included with the V250-S.

### REMOTE CONTROLS

**K857** - Remote Output Control for stick welding.

**K963** - Hand Amptrol™ for TIG welding. When the V250-S's Output Control is in the "Remote" position, the hand Amptrol energizes the output and controls the output remotely. The Hand Amptrol connects directly to the 6 pin Amphenol.

**K870** - Foot Amptrol™ for TIG welding. When the V250-S's Output Control is in the "REMOTE" position, the foot Amptrol energizes the output and controls the output remotely. The Hand Amptrol connects directly to the 6 pin Amphenol.

**K814** - Arc Start Switch. Energizes the output for TIG welding if remote output control of the amperage is not desired. When using the Arc Start Switch set the Output Control to the "LOCAL" position.

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**WARNING**

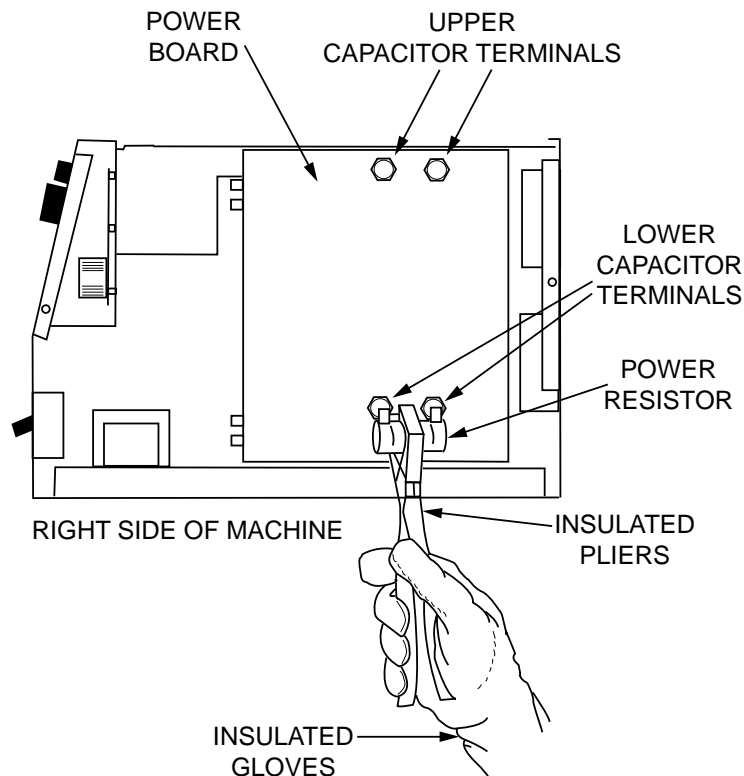
**ELECTRIC SHOCK** can kill.

- 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.
- Prior to Performing preventative maintenance, perform the following capacitor discharge procedure to avoid electric shock.

## INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

1. Turn off input power or disconnect input power lines.
2. Remove the 5/16" hex head screws from the side and top of the machine and remove wrap-around machine cover.
3. Be careful not to make contact with the capacitor terminals that are located in the top and bottom of the Power Board.
4. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is not supplied with machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
5. Locate the four capacitor terminals (large hex head cap screws) shown in Figure D.1. One pair at the top and one pair at the bottom of the Power Board.
6. Use electrically insulated gloves and insulated pliers. Hold body of the resistor and connect resistor leads across the two capacitor terminals. Hold resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
7. Repeat discharge procedure for the capacitor on other two terminals.
8. Check voltage across terminals of all capacitors with a DC voltmeter. Polarity of capacitor terminals is marked on PC board above terminals. Voltage should be zero. If any voltage remains, repeat this capacitor discharge procedure.

FIGURE D.1 — LOCATION OF INPUT FILTER CAPACITOR TERMINALS.



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## ROUTINE MAINTENANCE

1. Perform the following preventive maintenance procedures at least once every six months. It is good practice to keep a preventive maintenance record; a record tag attached to the machine works best.
2. Remove the machine wrap-around cover and perform the input filter capacitor discharge procedure (detail at the beginning of this chapter).
3. Keeping the machine clean will result in cooler operation and higher reliability. Be sure to clean the following areas with a low pressure air stream. See figure D.2 for component locations.
  - Power and control printed circuit boards
  - Power switch
  - Main transformer
  - Input rectifier
  - Heat sink fins
    - Input Filter Capacitors
    - Output Terminals
4. Examine capacitors for leakage or oozing. Replace if needed.
5. Examine the sheet metal case for dents or breakage. Repair the case as required. Keep the case in good condition to ensure that high voltage parts are protected and correct spacings are maintained. All external sheet metal screws must be in place to assure case strength and electrical ground continuity.
6. Check electrical ground continuity. Using an ohmmeter, measure resistance between either output terminal and an unpainted surface of the machine case. (See Figure D.2 for locations.) Meter reading should be 500,000 ohms or more. If meter reading is less than 500,000 ohms, check for electrical components that are not properly insulated from the case. Correct insulation if needed.
7. Replace machine cover and screws.

## FILTER CAPACITOR CONDITIONING

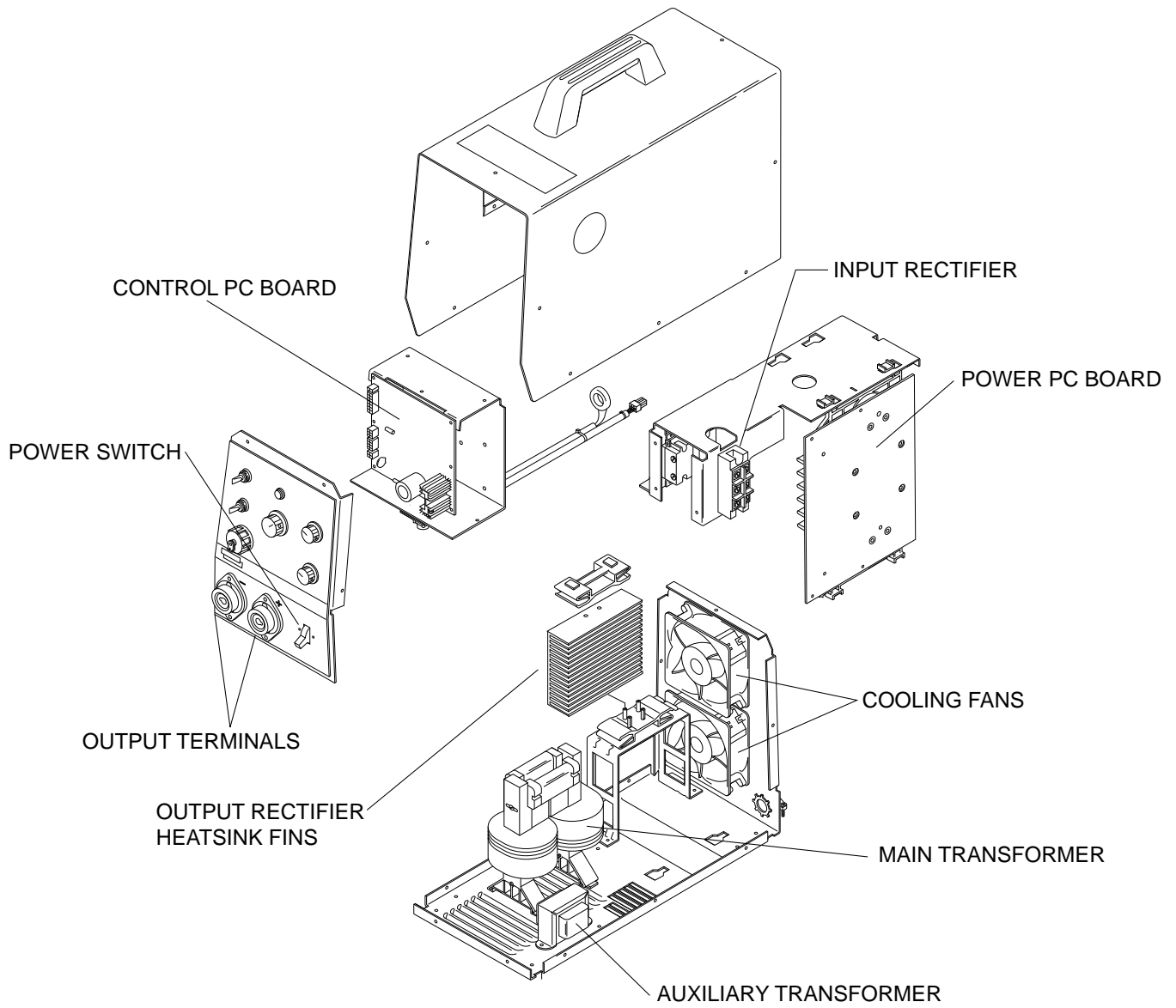
A protection circuit is included to monitor the voltage across filter capacitors C1 and C2. In the event that the capacitor voltage is too high, the protection circuit will prevent output. Nominal trip setting is at 230/460 VAC +15%. Reset occurs about 3% lower (230/460 VAC +12%).

On new installations, the protection circuit may also prevent output providing all these circumstances are met:

1. Machine is connected for 380-415 or 440-460 VAC input.
2. Machine did not have power applied for many months.
3. Machine will not produce output when power is first switched on.

If these circumstances apply, the proper action is to switch the machine on and let it idle for up to 30 minutes. This is required to condition the filter capacitors after an extended storage time. The protection circuit will automatically reset once the capacitor conditioning and resultant voltage levels are acceptable. It may be necessary to turn the power switch off and back on again after this period.

FIGURE D.2 — LOCATION OF MAINTENANCE COMPONENTS.



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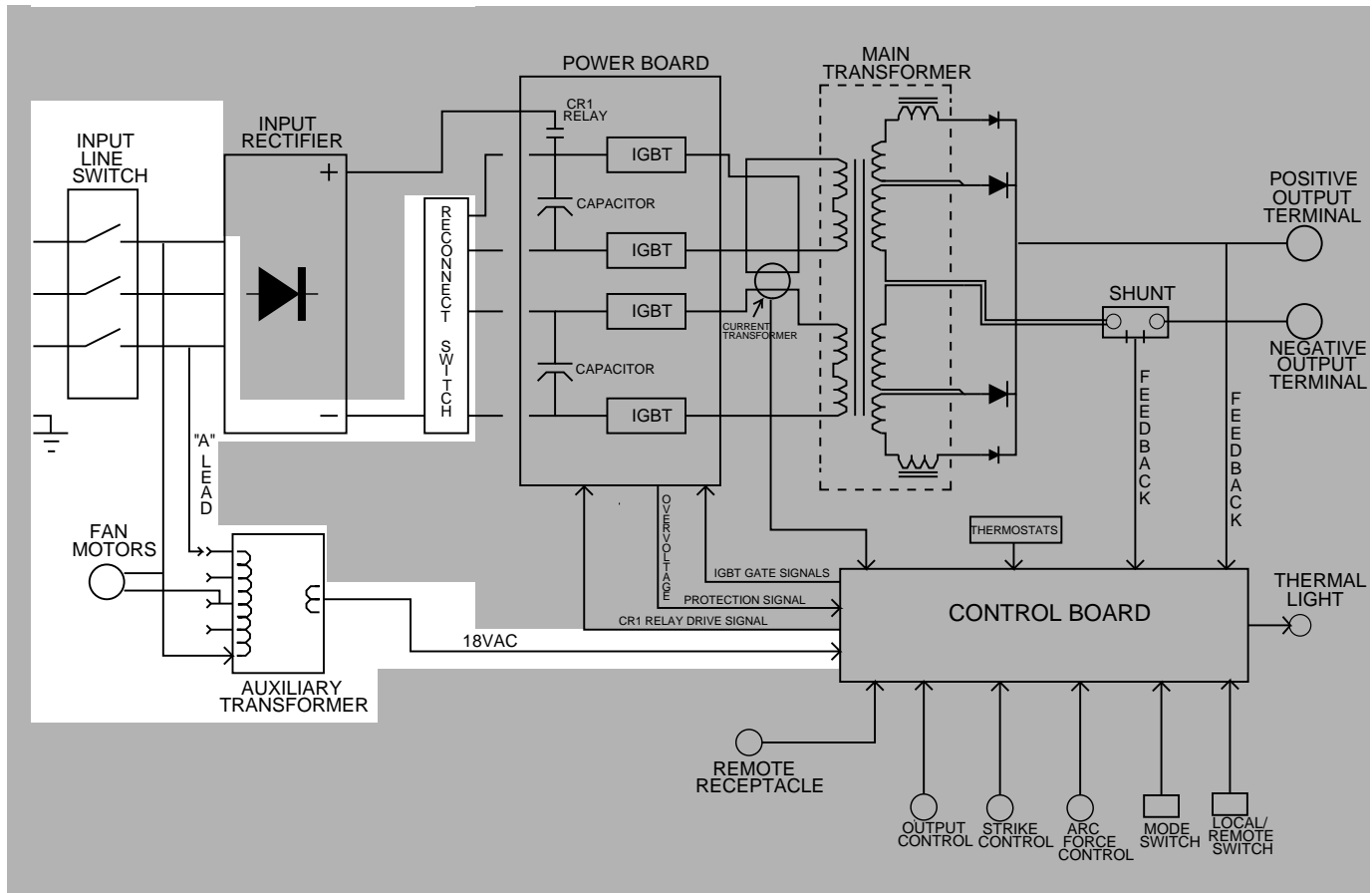
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## GENERAL DESCRIPTION

The Invertec V250-S is a 250 amp arc welding power source that utilizes either single or three phase input power to produce a constant current output. The output response of this machine has been optimized for the SMAW and TIG welding processes.

FIGURE E.1 - INPUT VOLTAGE CIRCUITS



## INPUT LINE VOLTAGE

The single-phase or three-phase input power of 208, 230 or 460 volts AC is connected to the machine, through a line switch located on the front panel.

A reconnect panel and switch allows the user to configure the machine for either a low or high input voltage and also connect the auxiliary transformer for the appropriate input voltage.

The auxiliary transformer develops the appropriate AC voltages to operate the cooling fans and the control board.

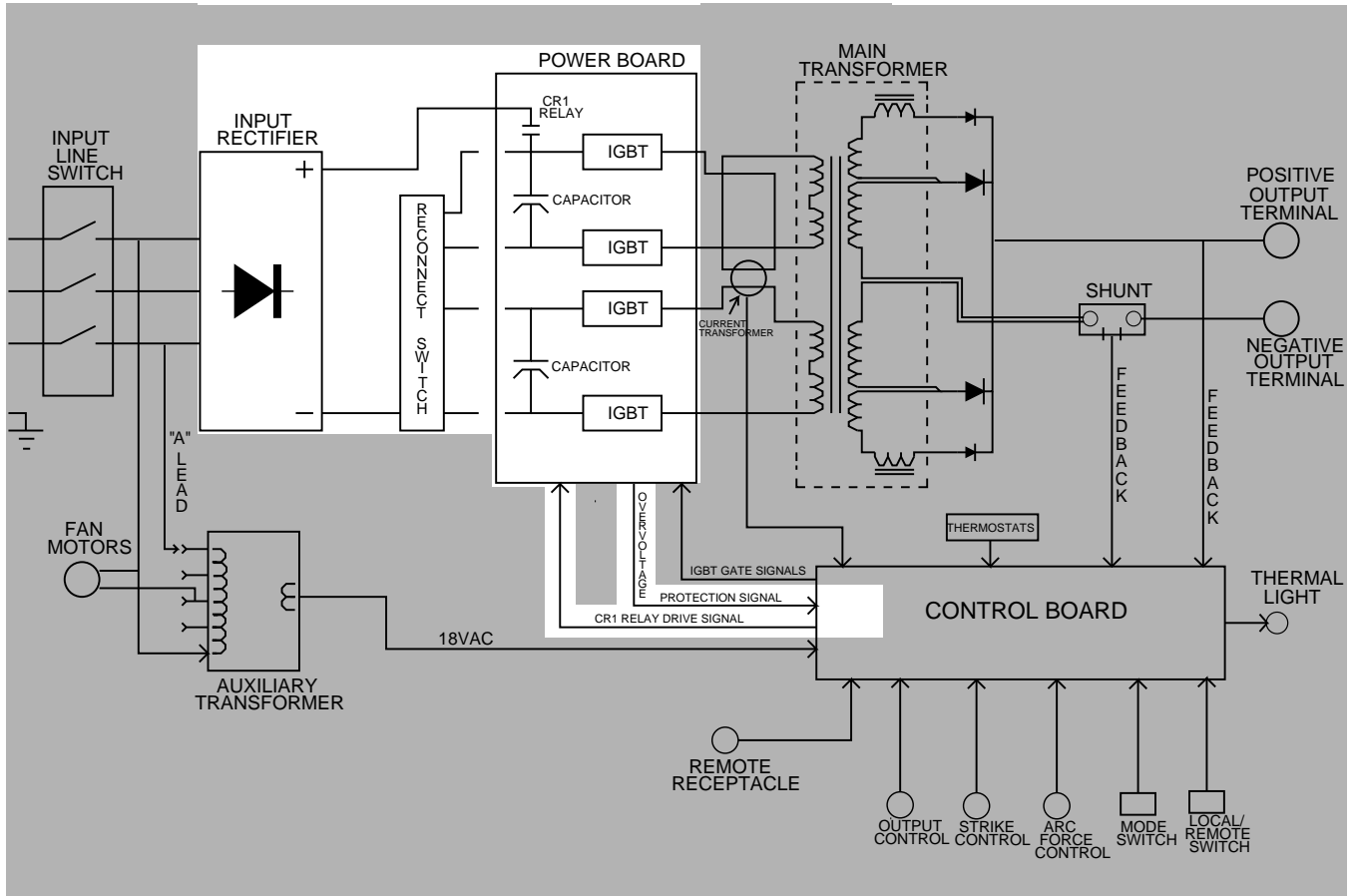
**NOTE:** Unshaded areas of block logic diagrams are the subject of discussion.

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FIGURE E.2 PROTECTION AND PRE-CHARGE CIRCUITS



## PRECHARGE AND PROTECTION

The input voltage is rectified and the DC voltage is applied, through the reconnect switch, to the power board. The power board contains precharging circuitry for the safe charging of the input filter capacitors. Once the capacitors are precharged and balanced the control board activates the CR1 input relay which connects full input power to the filter capacitors. When the filter capacitors are fully charged they act as power supplies for the IGBT switching circuit. The Insulated Gate Bipolar Transistors supply the main transformer primary windings with DC current flow. See *IGBT Operation Discussion and diagrams* in this section.

The power board also monitors the filter capacitors for voltage balance and/or overvoltage and, if either should occur, sends the appropriate signal to the control board to deactivate the CR1 input relay. The machine output will also be disabled.

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

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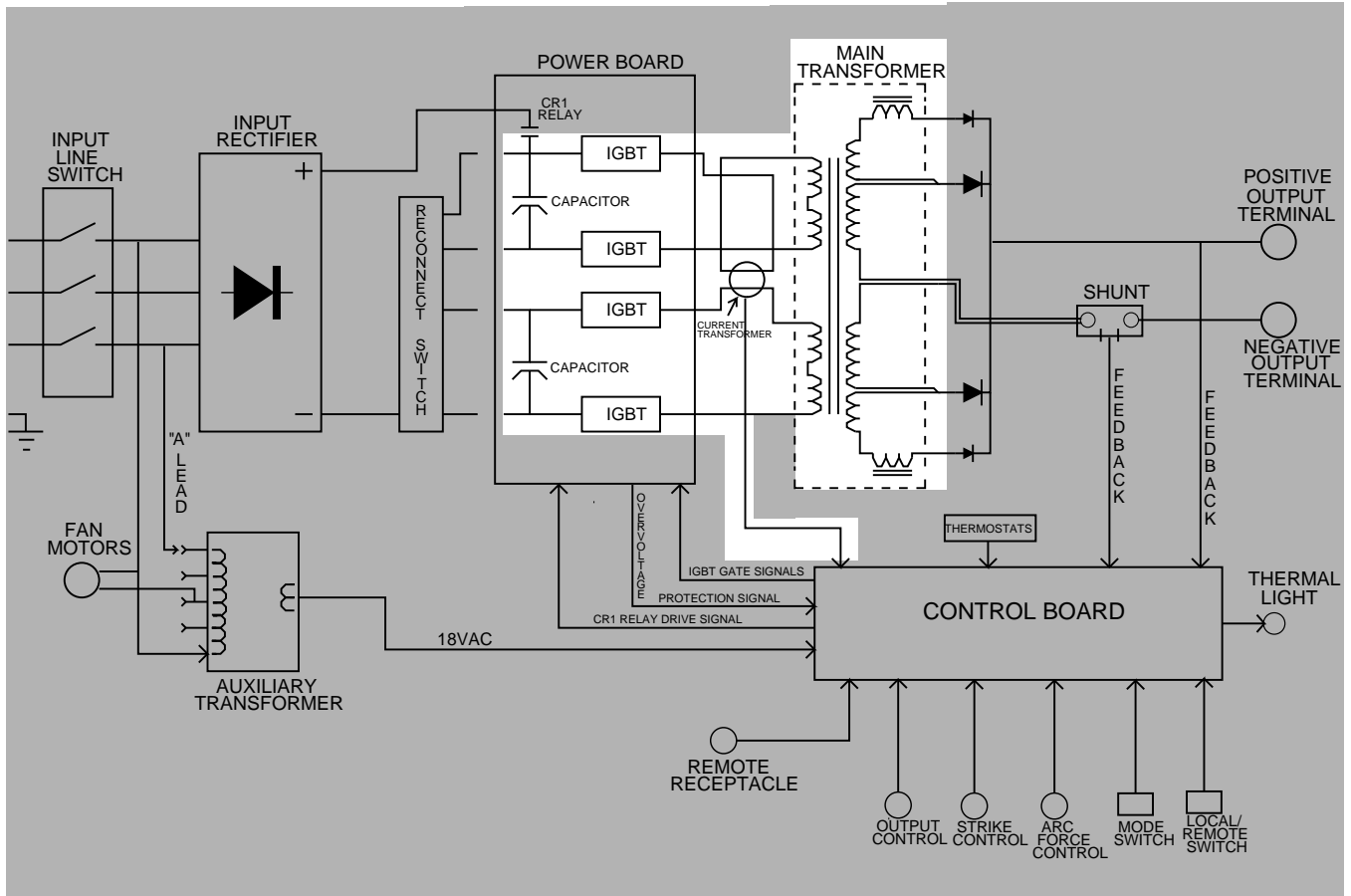
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FIGURE E.3 MAIN TRANSFORMER



## MAIN TRANSFORMER

Each IGBT pair acts as a switch assembly. Each assembly feeds a separate, oppositely wound primary winding of the main transformer. The reverse directions of current flow through the main transformer primaries and the offset timing of the IGBT pairs induce an AC square wave output signal at the secondary of the main transformer.

The DC current flow through each primary winding is redirected or “clamped” back to each respective filter capacitor when the IGBTs are turned off. This is needed due to the inductance of the transformer primary winding.

The primary currents also pass through the current transformer which sends a signal to the control board. If the primary currents are not equal the control board compensates by adjusting the IGBT gate signals.

The firing of both IGBT pairs occurs during halves of the 50 microsecond intervals, creating a constant 20 KHZ output.

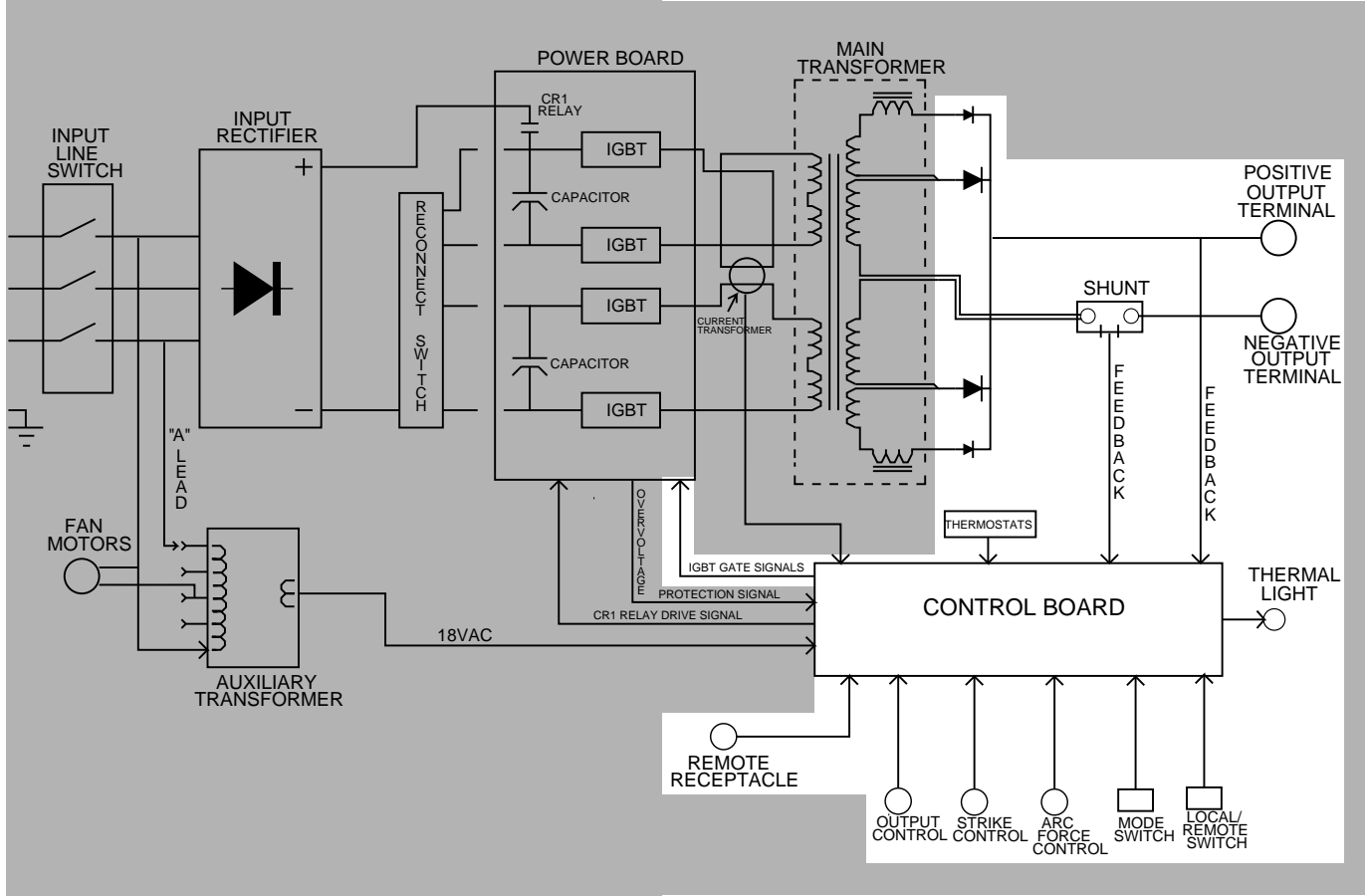
**NOTE:** Unshaded areas of block logic diagrams are the subject of discussion.

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### FIGURE E.4 OUTPUT RECTIFICATION AND CONTROL



## OUTPUT RECTIFICATION AND CONTROL

The AC output from the main transformer secondary is rectified to a DC output and applied to the output terminals. Output voltage and current feedback information, which is fed to the control board, is sensed at the output terminals and shunt. The control board monitors the panel controls and remote control receptacle and compares these commands to the feedback information to determine how the output should be controlled to optimized welding results. The control board controls the IGBT switching through pulse width modulation circuitry. See *IGBT Operation* Discussion in this section.

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

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## PROTECTION CIRCUITS

Protective circuits are designed into the V250-S machine to sense trouble and shut down the machine before the trouble damages the internal machine components. Both overload and thermal protection circuits are included.

### OVERLOAD PROTECTION

The V250-S is electrically protected from producing high output currents. Should the output current exceed 290 amps, an electronic protection circuit will reduce the current to less than 200 amps. Lincoln Electric refers to this current reduction as "Fold Back". The machine will continue to produce this low current until the protection circuit is reset. Reset occurs when the output load is removed.

A protection circuit is included to monitor the voltage across the input filter capacitors. In the event that the capacitor voltage is too high, the protection circuit will prevent output.

On new installations, the protection circuit may prevent output, due to unbalanced capacitor leakages, providing the following circumstances are met:

1. Machine is connected for 380 - 460VAC input.
2. Machine did not have power applied for many months.
3. Improper connections.
4. Internal component damage.

### THERMAL PROTECTION

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

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

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

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# INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

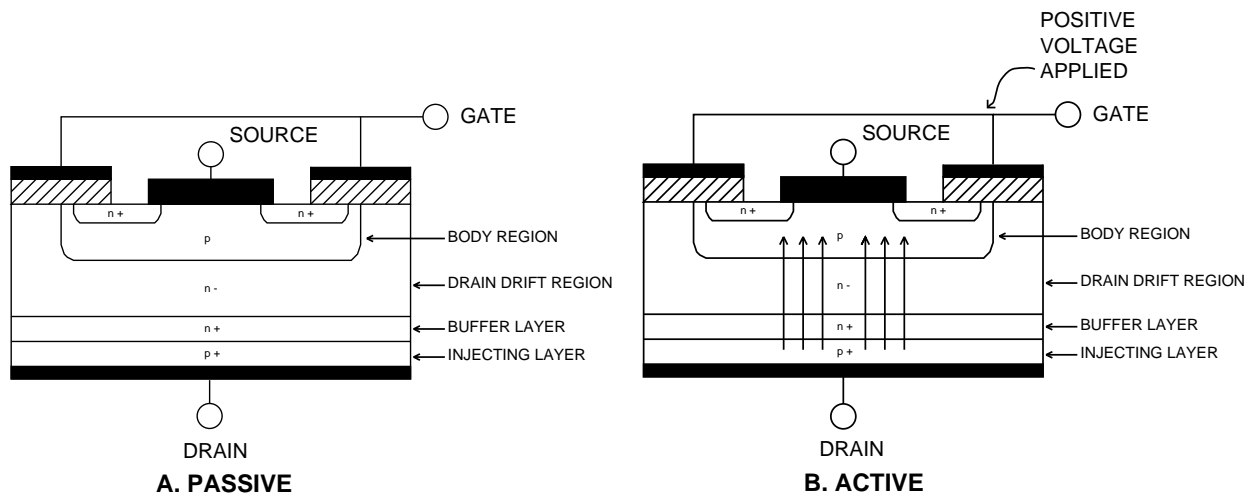
An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.

Drawing A shows an IGBT in a passive mode. There is no gate signal, zero volts relative to the source, and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the

source, is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

FIGURE E.6 IGBT OPERATION



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### PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION is used to describe how much time is devoted to conduction in the positive and negative portions of the cycle. Changing the pulse width is known as MODULATION. Pulse Width Modulation (PWM) is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

The positive portion of the signal represents one IGBT group<sup>1</sup> conducting for 1 microsecond. The negative portion is the other IGBT group<sup>1</sup>. The dwell time (off time) is 48 microseconds (both IGBT groups off). Since only 2 microseconds of the 50-microsecond time period is devoted to conducting, the output power is minimized.

### MINIMUM OUTPUT

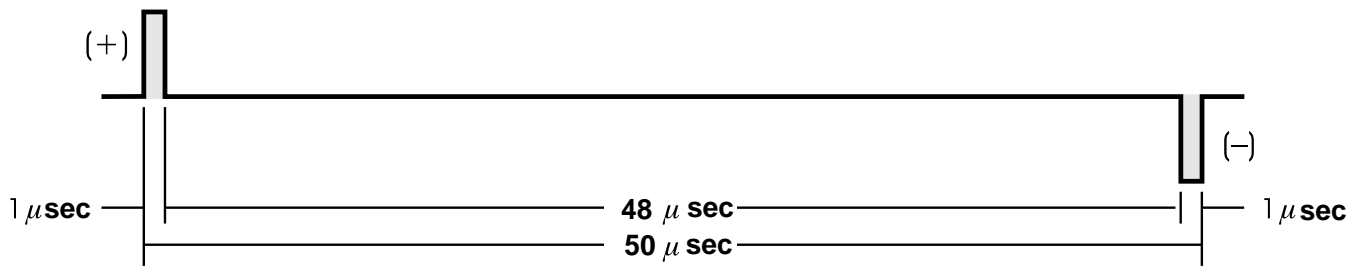
By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing below shows the minimum output signal possible over a 50-microsecond time period.

### MAXIMUM OUTPUT

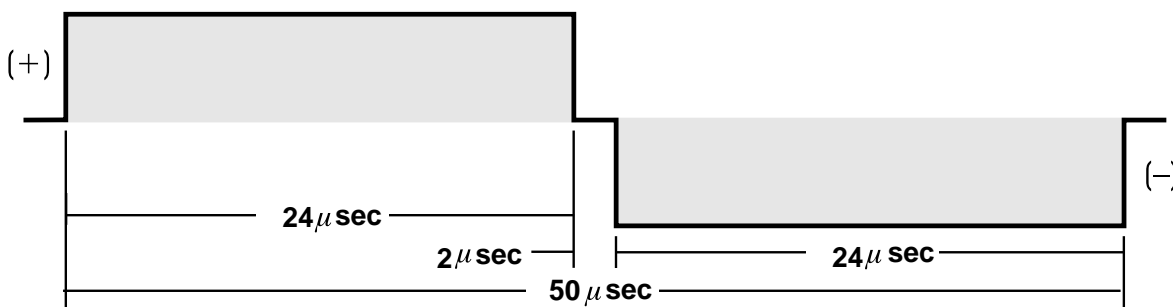
By holding the gate signals on for 24 microseconds each and allowing only 2 microseconds of dwell time (off time) during the 50-microsecond cycle, the output is maximized. The darkened area under the top curve can be compared to the area under the bottom curve. The more dark area under the curve, the more power is present.

<sup>1</sup> An IGBT group consists of two IGBT modules feeding one transformer primary winding.

FIGURE E.7 TYPICAL IGBT OUTPUTS



MINIMUM OUTPUT



MAXIMUM 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 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 216-383-2531 or 1-800-833-9353.

## OSCILLOSCOPE WARNING

### ⚠ WARNING

Do not use oscilloscopes and other test equipment which are powered by 115 VAC. This equipment should not be used with inverter-type machines, such as Invertec V250-S. There are high voltages present, which are "floating" off case ground (floating ground). Connecting the ground lead of a test probe (which may be connected to the case of the test equipment) to a high voltage potential presents a shock hazard as well as the possibility of damage to the equipment in question.

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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:



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
Major physical or electrical damage is observed when cover wrap-around is removed.	Contact your local Lincoln Authorized Field Service Facility.	Contact Lincoln Electric Service Department (216)-383-2531 or 1-800-833-9353
The machine is dead - no output - no fan.	<ol style="list-style-type: none"> <li>1. The input power switch must be in the ON position.</li> <li>2. Make sure the input voltage is correct for the machine.</li> <li>3. If the machine is set for single-phase operation, inspect to assure that the WHITE and BLACK leads are connected properly and the RED lead is not connected and is insulated.</li> <li>4. Check that the input voltage set-up switch and jumper "A" (the reconnect auxiliary jumper) are in the proper position for the input voltage being applied. Refer to <b>Input Voltage Reconnect Procedure</b> in the Installation Chapter.</li> <li>5. Check continuity of the 0.6-amp slow blow fuse located on the reconnect panel.</li> </ol>	<ol style="list-style-type: none"> <li>1. The power switch (S1) may be faulty. Check or replace.</li> <li>2. Check for loose or broken leads between the power switch (S1) and the input rectifier D9. See wiring diagram.</li> <li>3. Perform the <b>Auxiliary Transformer Test</b>.</li> </ol>

**⚠ CAUTION**

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

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Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>No output but the fan operates normally.</p>	<ol style="list-style-type: none"> <li>1. The mode switch must be in one of the SMAW modes or if in the GTAW mode the remote trigger circuit must be activated.</li> <li>2. The Local/Remote switch (S3) must be in the LOCAL position unless a remote control device is attached to the remote receptacle.</li> <li>3. If the machine has not been used for a long time and is connected for 380 VAC or higher, the capacitors may need "conditioning". See <i>Input Filter Capacitor Conditioning</i>.</li> <li>4. The machine may be overheated. Check the thermal indicator light. Wait for the machine to cool and the thermostats to reset.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform the <i>Auxiliary Transformer Test</i>.</li> <li>2. Check for loose or broken connections on the high current carrying parts of the V250-S. (i.e., output diodes, output terminals, shunt and main transformer connections.)</li> <li>3. Check the continuity of the normally closed thermostats and associated wiring. See wiring diagram.</li> <li>4. Perform the <i>Output Diode Test</i>.</li> <li>5. Perform the <i>Capacitor Balance Test</i>.</li> <li>6. Perform the <i>Protection Circuit Test</i>.</li> <li>7. Perform the <i>Power Board Voltage Checks</i>.</li> <li>8. Perform the <i>Control Board Voltage Checks</i>.</li> </ol>

**⚠ CAUTION**

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

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Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>Output turns on momentarily, then switches off and repeats cycle.</p>	<ol style="list-style-type: none"> <li>1. Check the input voltages and reconnection procedures. Make sure the input voltage is correct for the machine. See <b><i>Input Voltage Reconnect Procedure</i></b>.</li> <li>2. Check or replace remote control device. (If used)</li> </ol>	<ol style="list-style-type: none"> <li>1. Check Local/Remote switch (S3) and associated wiring for loose or faulty connections.</li> <li>2. Check Mode Switch (S2) and associated wiring for loose or faulty connections.</li> <li>3. If the machine is connected for 380VAC input or higher, perform the <b><i>Capacitor Balance Test</i></b>.</li> <li>4. The power board may be faulty. Replace.</li> <li>5. The control board may be faulty. Replace.</li> </ol>
<p>Remote output control not functioning. The machine operates normally on LOCAL control.</p>	<ol style="list-style-type: none"> <li>1. Make sure the Local/Remote switch (S3) is in the REMOTE position.</li> <li>2. The remote control device may be faulty. Replace.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the Local/Remote switch (S3) and the associated wiring. See wiring diagram.</li> <li>2. Check for loose or faulty connections at the remote control receptacle.</li> </ol>

**⚠ CAUTION**

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

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Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>No output - Main input fuses open, indicating excessive current draw.</p>	<ol style="list-style-type: none"> <li>1. Inspect input leads for possible shorts or grounds or mis-connections.</li> <li>2. Install new fuses and reapply power. If fuses open again, consult a Lincoln Authorized Field Service Facility.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inspect interior of machine for physical signs of electrical and heat damage. Replace any damaged components after conducting the following tests.</li> <li>2. Perform the <i>Input Rectifier Test</i>.</li> <li>3. Perform <i>Power Board Resistance Test</i>.</li> <li>4. Check the reconnect switch and associated leads for "shorts" or faulty wiring.</li> </ol>
<p>The machine operates normally when connected for 200 - 230VAC input. There is no output when the machine is connected to 380VAC or higher.</p>	<ol style="list-style-type: none"> <li>1. Check the input voltage and input voltage reconnect procedures. See <i>Installation Section</i> of this manual.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform the <i>Capacitor Balance Test</i>.</li> <li>2. Perform the <i>Protection Circuit Test</i>.</li> <li>3. Perform the <i>Auxiliary Transformer Test</i>.</li> <li>4. Perform the <i>Power Board Resistance Test</i>.</li> </ol>

**⚠ CAUTION**

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

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>The machine will not produce more than 200 amps.</p>	<ol style="list-style-type: none"> <li>1. This may be normal operation. If the output current exceeds 290 amps, an electronic protection circuit will reduce the current to less than 200 amps. The machine will continue to produce this low current until the protection circuit is reset. Reset occurs when the output load is removed.</li> <li>2. Check the input voltage and input voltage reconnect procedures. See <b><i>Input Voltage Reconnect Procedure</i></b>.</li> <li>3. Check for loose or faulty welding cables.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform the <b><i>Output Diode Test</i></b>.</li> <li>2. The control board may be faulty. Replace.</li> </ol>

**⚠ CAUTION**

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

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Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>WELDING PROBLEMS</b>		
<p>Poor welding, weld settings drift, or output power is low.</p>	<ol style="list-style-type: none"> <li>1. Make sure the machine settings are correct for the weld process being used.</li> <li>2. Check machine performance on LOCAL control. If OK then the remote control device may be faulty. Check or replace.</li> <li>3. Check the input voltages and input voltage reconnect procedures. See <i>Installation Section</i> of this manual.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the operation of the mode switch (S2) and the associated circuitry. See wiring diagram.</li> <li>2. Check for loose or faulty connections in the heavy current carrying leads (i.e., output diodes, output terminals, shunt and main transformer.)</li> <li>3. Perform <b>Output Diode Test</b>.</li> <li>4. Perform <b>Control Board Voltage Test</b>.</li> </ol>
<p>Poor stick electrode welding performance. The arc pops out.</p>	<ol style="list-style-type: none"> <li>1. Check for loose or faulty welding cables.</li> <li>2. Is the electrode DRY? Try welding with another electrode from a different container. Make sure you have the correct electrode for the application.</li> <li>3. Make sure the machine settings are correct for the weld process being used.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for loose or faulty connections in the heavy current carrying leads (i.e., output diodes, output terminals, shunt and main transformer.)</li> <li>2. Perform <b>Output Diode Test</b>.</li> <li>3. Perform <b>Control Board Voltage Test</b>.</li> </ol>

**⚠ CAUTION**

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

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**AUXILIARY TRANSFORMER TEST****⚠ WARNING**

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

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

**TEST DESCRIPTION**

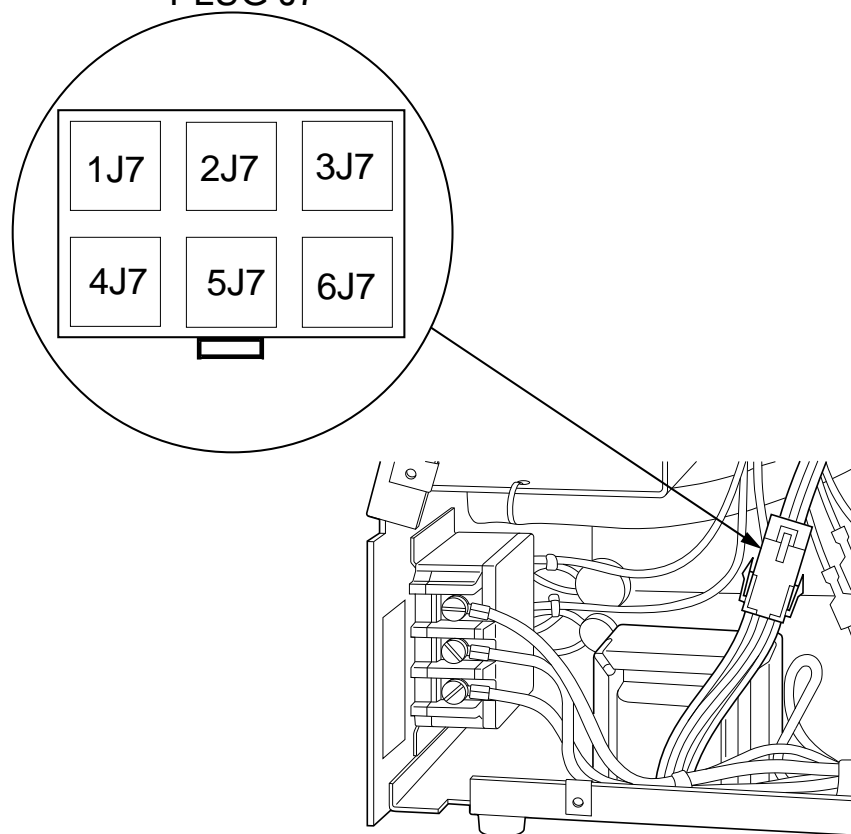
This test will determine if the auxiliary transformer is functional when the correct primary voltage is applied to the primary winding.

**MATERIALS NEEDED**

Volt/ohmmeter  
Machine wiring diagram  
5/16" nut-driver  
230VAC isolated power supply

**AUXILIARY TRANSFORMER TEST (continued)****TEST PROCEDURE**

1. Remove main input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section
3. Locate the Auxiliary Transformer just behind the input line switch on the lower right side of the machine.
4. Locate and disconnect plug J7 from the wiring harness.
5. Carefully apply the 230VAC isolated supply to leads H1(1J7) and H3(2J7) of the auxiliary transformer.
6. Carefully check for the presence of the following voltages at the appropriate leads. See **Table F.1**.

**AUXILIARY TRANSFORMER  
PLUG J7****Figure F.1 Auxiliary Transformer and Plug J7.**

## AUXILIARY TRANSFORMER TEST (continued)

**TABLE F.1 Auxiliary Transformer Test Points**

TEST POINT	TEST POINT	EXPECTED VOLTAGE
H1 (1J7)	H2 (4J7)	200 - 208VAC
H1 (1J7)	H4 (3J7)	380 - 415VAC
H1 (1J7)	H5 (6J7)	440 - 460VAC
RED LEAD (1J1) On Control Board	RED LEAD (3J1) On Control Board	18VAC (SECONDARY)

7. If the correct test voltages are present the auxiliary transformer is good.
8. If any of the voltages are missing or very low, with the proper primary voltage applied, the auxiliary transformer may be faulty. Replace.
9. If the auxiliary transformer tests good but does not function when connected to the V250-S check the harness wiring to the auxiliary transformer. See wiring diagram.

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## INPUT RECTIFIER TEST

### WARNING

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

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

### TEST DESCRIPTION

This test will help determine if the input rectifier has “shorted” or “open” diodes.

### MATERIALS NEEDED

Analog voltmeter/ohmmeter (Multimeter)  
Phillips head screwdriver  
Wiring diagram

## INPUT RECTIFIER TEST (continued)

## TEST PROCEDURE

1. Remove main input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate Input Rectifier (D9) and lead locations.
4. With the Phillips head screwdriver remove leads #207, 207A and #209 from the rectifier. See Figure F.2.
5. Use the analog ohmmeter to perform the tests detailed in **Table F.2**. See wiring diagram.

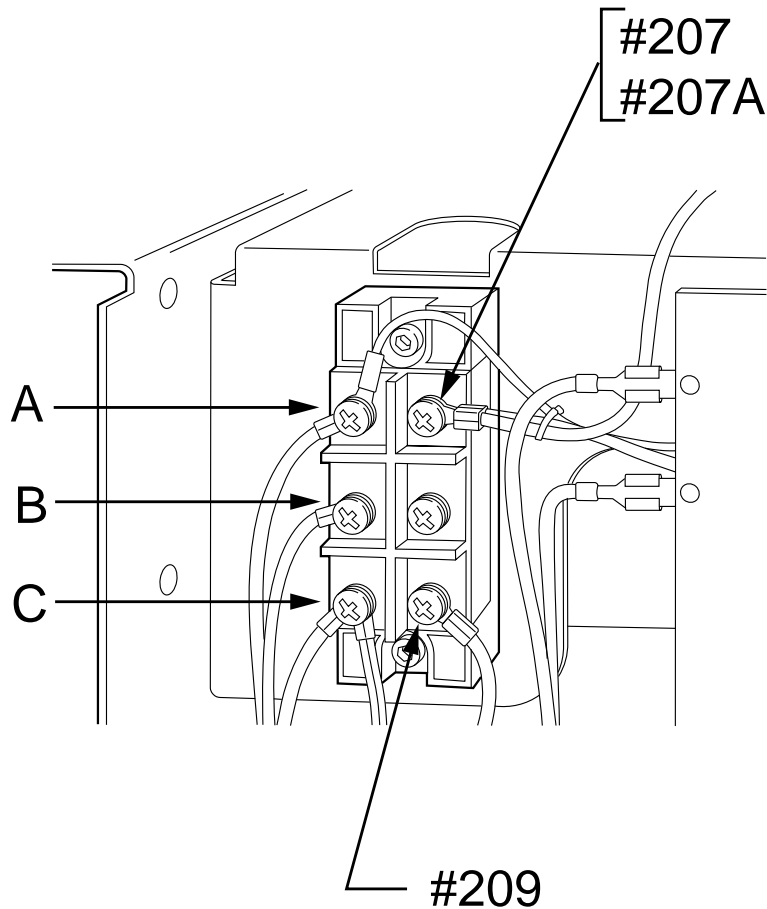


Figure F.2 Input Rectifier and Leads.



## INPUT RECTIFIER TEST (continued)

TABLE F.2 Input Rectifier Test Points

TEST POINT TERMINALS		ANALOG METER X10 RANGE Acceptable Meter Readings
+ Probe	- Probe	
A	207	Greater than 1000 ohms
B	207	Greater than 1000 ohms
C	207	Greater than 1000 ohms
A	209	Less than 100 ohms
B	209	Less than 100 ohms
C	209	Less than 100 ohms
207	A	Less than 100 ohms
207	B	Less than 100 ohms
207	C	Less than 100 ohms
209	A	Greater than 1000 ohms
209	B	Greater than 1000 ohms
209	C	Greater than 1000 ohms

6. If the Input Rectifier does not meet the acceptable readings outlined in Table F.2. the component may be faulty. Replace.
8. If the Input Rectifier is good be sure to reconnect leads #207, #207A and #209 to the correct terminals and torque to 31IN-LBS. See wiring diagram and Figure F.2.

Note: Before replacing the Input Rectifier(D9) check the input power switch (S1) and perform the **Power Board Resistance Test**. Also check for leaky or faulty filter capacitors.

7. When installing a new Input Rectifier, torque the mounting nuts to 44IN-LBS. A thin coating of Dow Corning 340 Heat Sink Compound (Lincoln E1868) is recommended. Torque the lead terminals to 31IN-LBS. See **Input Rectifier Bridge Removal And Replacement**.

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## POWER BOARD RESISTANCE TEST

### WARNING

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

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

### TEST DESCRIPTION

This test will help determine if the Power Board has any “shorted” or “leaky” power diodes or Insulated Gate Bipolar Transistors. Also it will help to indicate any “shorted” filter capacitors.

### MATERIALS NEEDED

Analog voltmeter/ohmmeter (Multimeter)  
Wiring diagram

## POWER BOARD RESISTANCE TEST (continued)

### TEST DESCRIPTION

1. Remove main input power to the V250 -S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate the Power Board and associated lead locations. See Figure F.3.
4. Carefully remove main transformer primary leads #201, #204, #205 and #208 from the power board.
5. Use the analog ohmmeter to perform the tests outlined in **Table F.3**. See power board schematic.

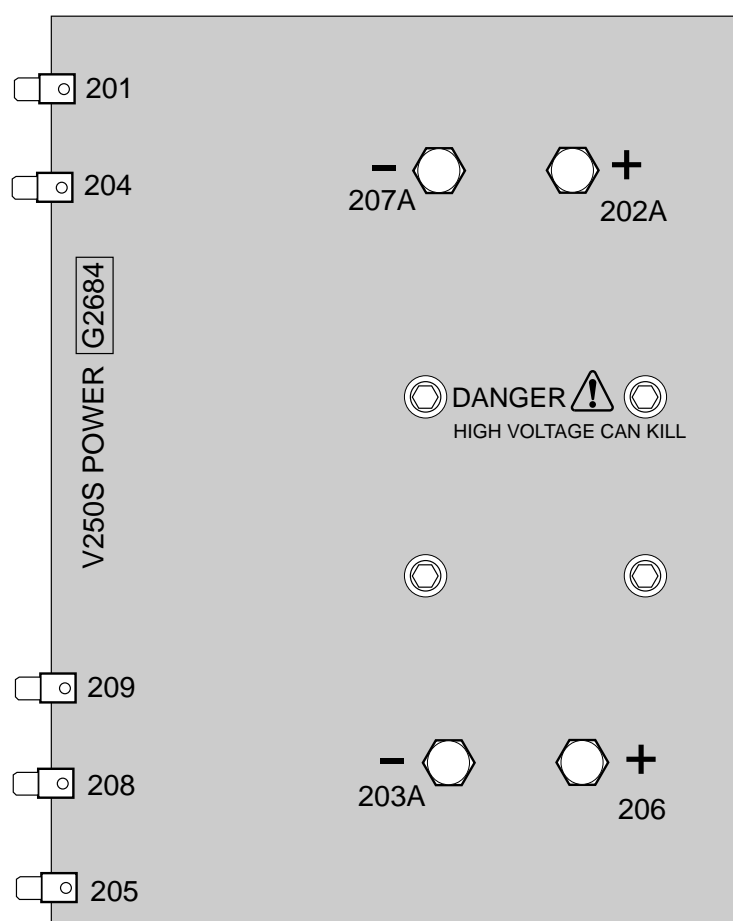


Figure F.3 Power Board Test Points.

## POWER BOARD RESISTANCE TEST (continued)

TABLE F.3 Power Board Resistance Test Points.

TEST POINT TERMINALS		ANALOG METER X10 RANGE
+ Probe	- Probe	Acceptable Meter Readings
201	207A	Greater than 1000 ohms
207A	201	Less than 100 ohms
204	207A	Greater than 1000 ohms
207A	204	Less than 100 ohms
202A	204	Greater than 1000 ohms
204	202A	Less than 100 ohms
202A	201	Greater than 1000 ohms
201	202A	Less than 100 ohms
205	203A	Greater than 1000 ohms
203A	205	Less than 100 ohms
208	203A	Greater than 1000 ohms
203A	208	Less than 100 ohms
206	208	Greater than 1000 ohms
208	206	Less than 100 ohms
206	205	Greater than 1000 ohms
205	206	Less than 100 ohms

6. If the power board does not meet the acceptable readings outlined in Table F.3. the board may be faulty. Replace. See ***Power Board Removal and Replacement Procedure***.

Note: Complete power board and filter capacitor replacement is recommended

7. If the power board “passes” the resistance test proceed to the ***Power Board Voltage Test***.

Note: Reconnect leads #201, #204, #205 and #208 to their appropriate terminals.

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Return to Master TOC  
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Return to Master TOC

INVERTEC V250-S



## OUTPUT DIODES TEST

### WARNING

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

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

### TEST DESCRIPTION

This test will help determine if any of the output diodes are “shorted”.

### MATERIALS NEEDED

Analog voltmeter/ohmmeter (Multimeter)  
Wiring diagram. Note: Output diode polarity will vary with machine codes.

## OUTPUT DIODES TEST (continued)

### TEST PROCEDURE

1. Remove main input power to the V250-S.
2. Locate the output terminals on the front panel of the machine. See Figure F.4.
3. Remove any output cables and load from the output terminals.

4. Using the analog ohmmeter test for more than 200 ohms resistance between positive and negative output terminals. Positive test lead to the positive terminal; Negative test lead to the negative terminal. See Figure F.5.

NOTE: THE POLARITY OF THE TEST LEADS IS MOST IMPORTANT. IF THE TEST LEADS POLARITY IS NOT CORRECT THE TEST WILL HAVE ERRONEOUS RESULTS.

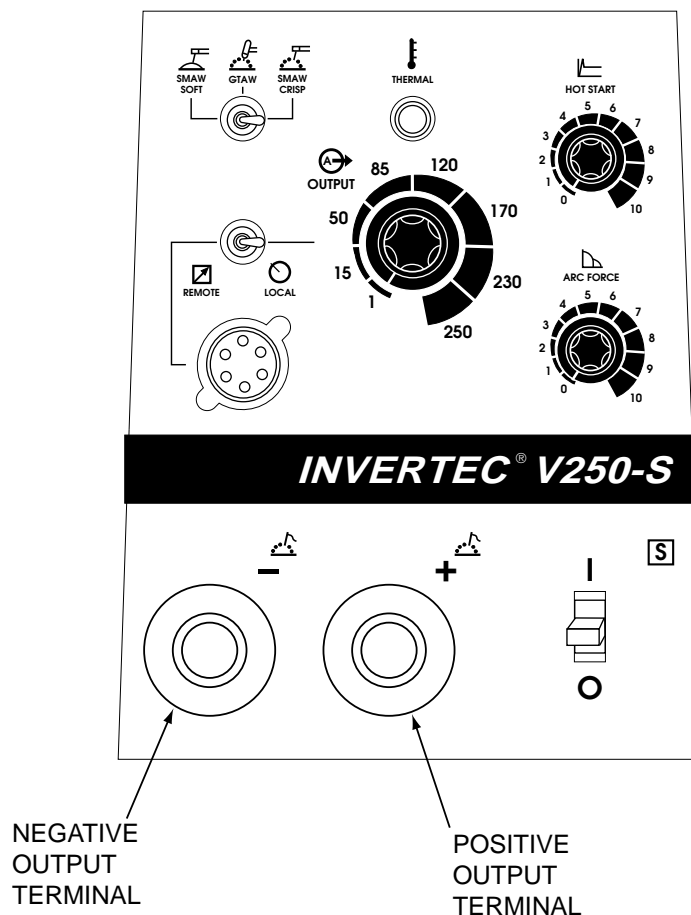


Figure F.4 Machine Output Terminals.

INVERTEC V250-S





## OUTPUT DIODES TEST (continued)

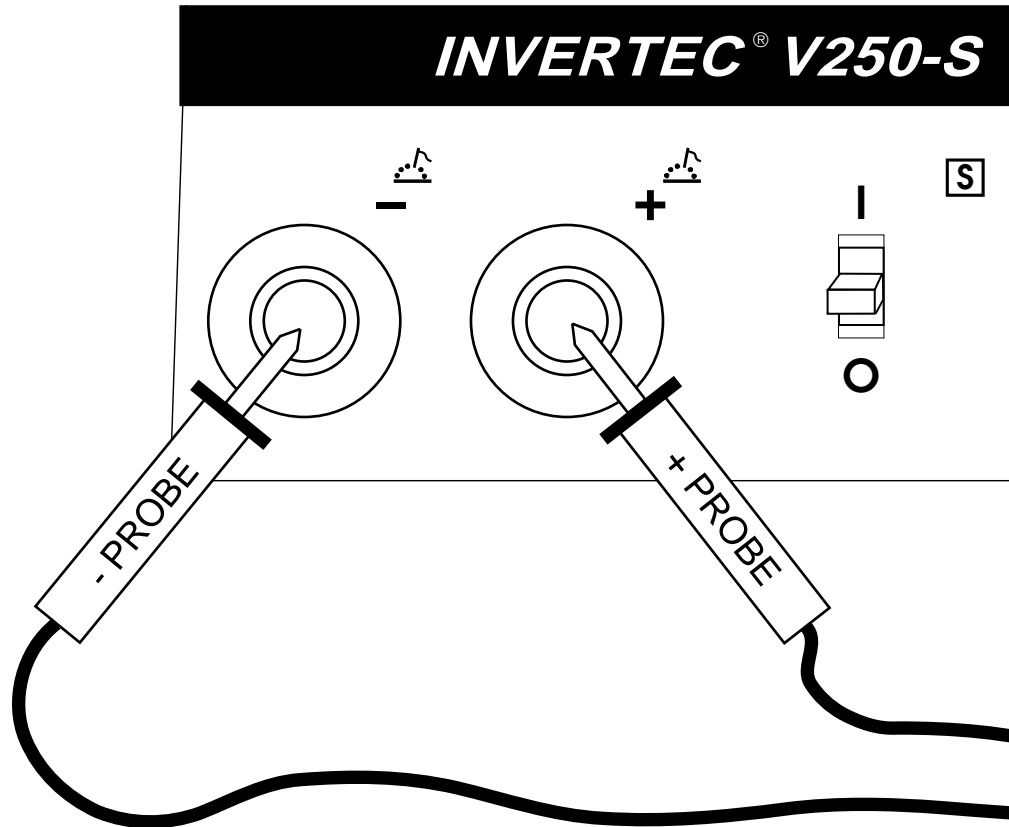
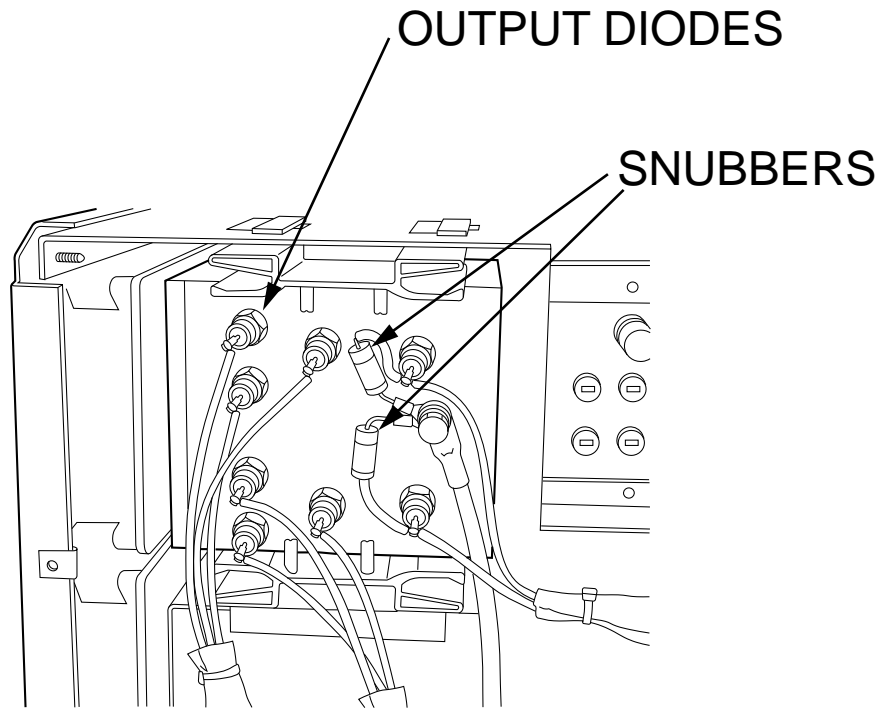


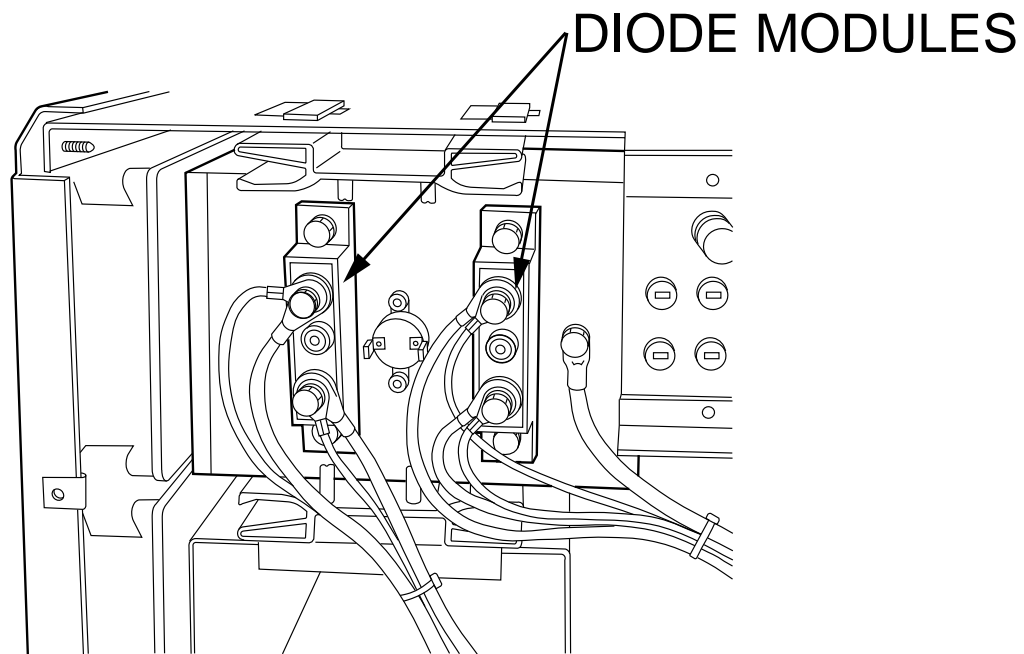
Figure F.5 Meter Probes.

5. If more than 200 ohms is measured the output diodes are not "shorted".
6. If less than 200 ohms is measured, one or more output diodes or snubbers may be shorted or "leaky".
7. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
8. Locate output diodes and snubbers. See Figure F.6. for machine codes 10102 and 10103 only. See Figure F.7. for machine codes 10187 and 10188 only.
9. Test all output diodes and snubbers (if used) individually.

**OUTPUT DIODES TEST (continued)**



**Figure F.6 Output Diodes and Snubber Locations (Codes 10102 and 10103)**



**Figure F.7 Output Diode Module Locations (Codes 10187 and 10188)**

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

**POWER BOARD VOLTAGE TEST****⚠ WARNING**

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

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

**TEST DESCRIPTION**

This test will aid the technician in determining if the voltage board or some other machine component may be faulty.

**MATERIALS NEEDED**

Voltmeter/ohmmeter (Multimeter)  
Wiring diagram.  
Power board schematic drawing.

POWER BOARD VOLTAGE TEST (continued)

TEST PROCEDURE

1. Remove main input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate and familiarize yourself with the leads and pin locations in plug J6 on the power board. See Figure F.8.
4. The following tests will be performed with the input power applied to the V250-S. **BE CAREFUL. ALWAYS REMOVE INPUT POWER AND PERFORM FILTER CAPACITOR DISCHARGE PROCEDURE BEFORE TOUCHING ANY MACHINE COMPONENT.**
5. Apply input power and turn On the V250-S.
6. Perform the voltage checks outlined in **Table F.4.** making sure all of the test conditions are in effect.

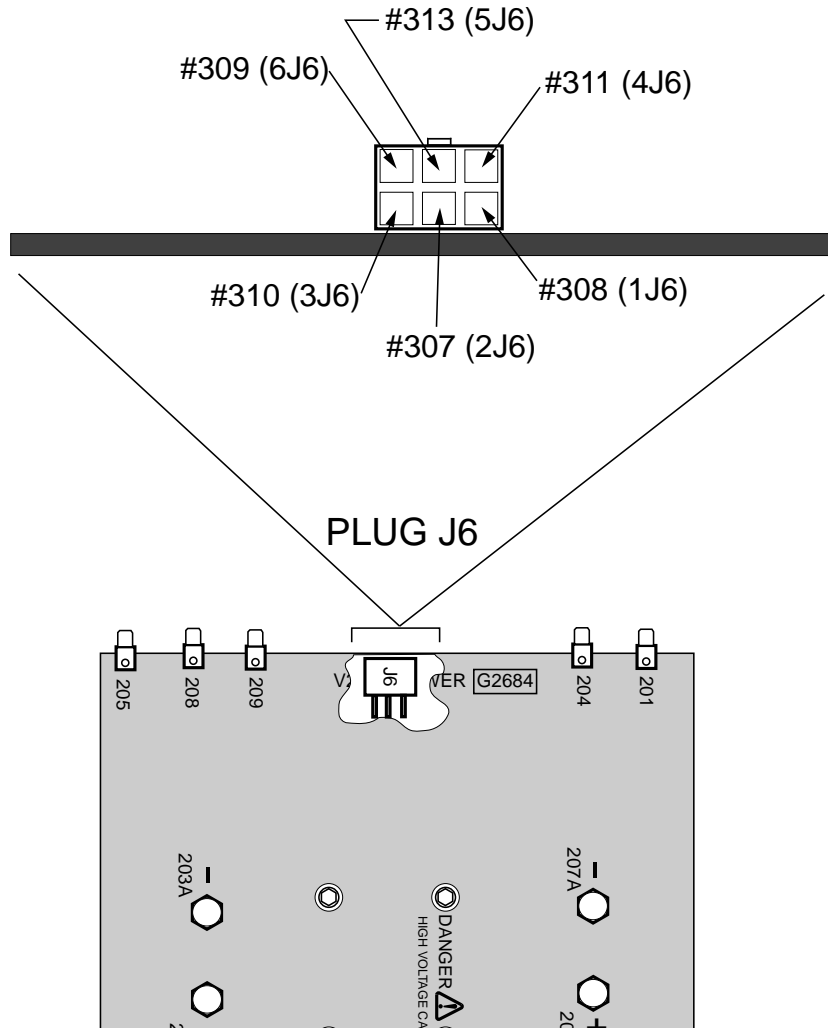


Figure F.8 Plug J6 on Power Board

Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

Return to Section TOC

Return to Master TOC

## POWER BOARD VOLTAGE TEST (continued)

TABLE F.4. Power Board Voltage Test Points.

TEST DESCRIPTION	TEST POINTS	ACCEPTABLE VOLTAGES	TEST CONDITIONS
The PWM pulse drive from the control board to the pulse transformer primary located on the power board.	Lead #307 (2J6) to Negative output terminal	14VDC.	No load on the machine - the mode switch in SMAW position.
The PWM pulse drive from the control board to the pulse transformer primary located on the power board.	Lead #308 (1J6) to Negative output terminal	14VDC.	No load on the machine - the mode switch in SMAW position.
The PWM pulse drive from the control board to the pulse transformer primary located on the power board.	Lead #307 (2J6) to Negative output terminal	7VDC.	Machine loaded to 250Amps. The output control R3 at the maximum position.
The PWM pulse drive from the control board to the pulse transformer primary located on the power board.	Lead #308 (1J6) to Negative output terminal	7VDC.	Machine loaded to 250Amps. The output control R3 at the maximum position.
CR1 (charge relay) coil voltage.	Lead #309 (6J6)+ to lead #310 (3J6)	12VDC	This voltage should be present only after the protection circuit as been satisfied.
This low voltage will be present when the protection circuit has determined that the filter capacitor voltage is acceptable. Note: The CR1 charge relay should be activated.	Lead #311 (4J6)+ to lead #313 (5J6)-	0 to 1VDC.	If voltage protection circuit IS satisfied.
This voltage will be present unit the protection circuit determines that the filter capacitor is at an acceptable level. Note: The CR1 charge relay will not be activated.	Lead #311 (4J6)+ to lead #313 (5J6)-	15VDC.	If voltage protection circuit is NOT satisfied.

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

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**CONTROL BOARD VOLTAGE TEST****⚠ WARNING**

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

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

**TEST DESCRIPTION**

This test will aid the technician in determining if the control board or some other machine component may be faulty.

**MATERIALS NEEDED**

Voltmeter/ohmmeter (Multimeter)  
Wiring diagram.  
Control board schematic drawing.

CONTROL BOARD VOLTAGE TEST (continued)

TEST PROCEDURE

1. Remove main input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate and familiarize yourself with the leads and pin locations in plugs J1 thru J5 on the control board. See Figure F.9.
4. The following tests will be performed with the input power applied to the V250-S. BE CAREFUL. ALWAYS REMOVE INPUT POWER AND PERFORM FILTER CAPACITOR DISCHARGE PROCEDURE BEFORE TOUCHING ANY MACHINE COMPONENT.
5. Apply input power and turn ON the V250 -S.
6. Perform the voltage checks outlined in **Table F.5.** making sure all of the test conditions are in effect.

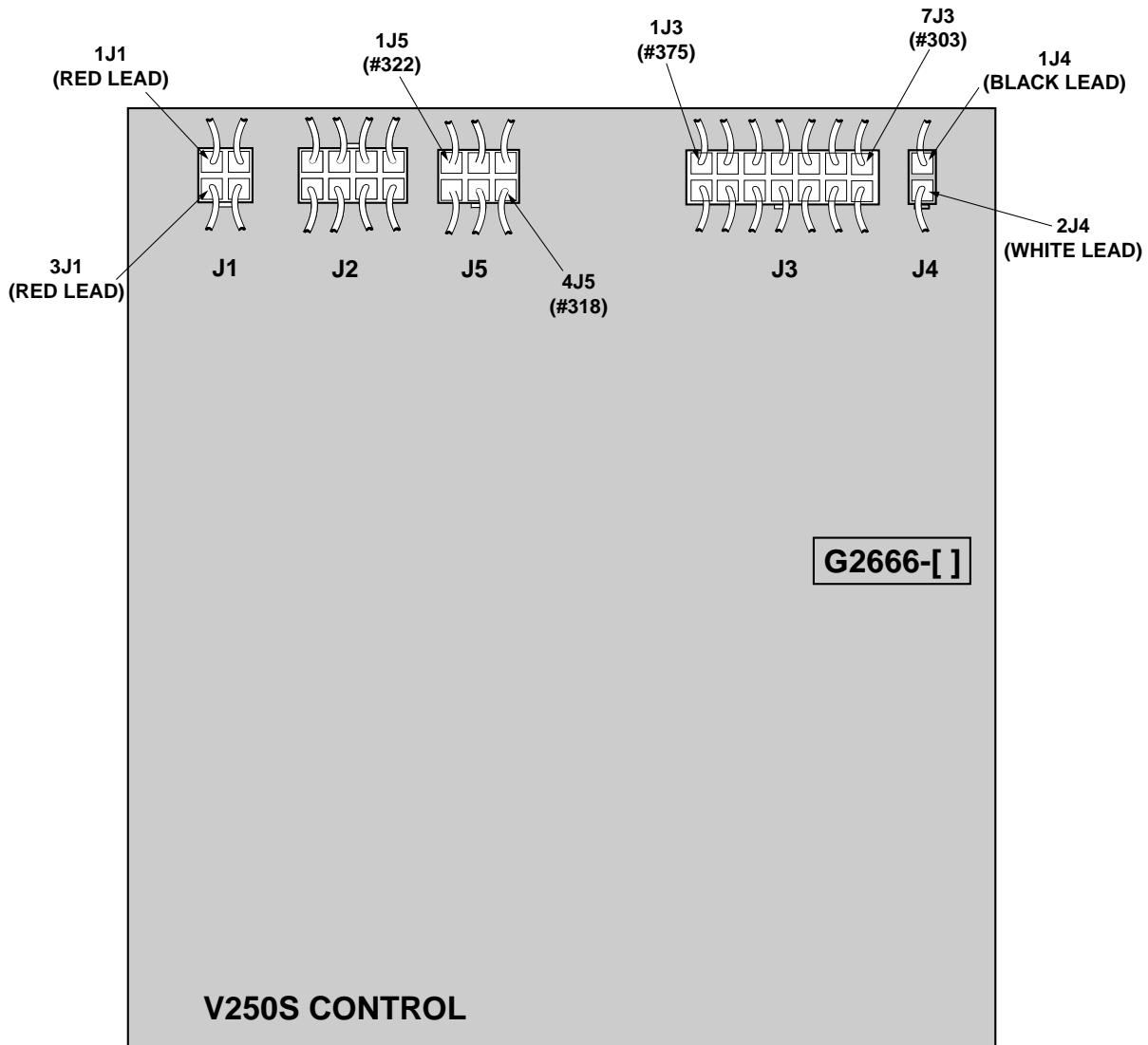


Figure F.9 Plugs J1-J5 on Control Board

Return to Section TOC

Return to Master TOC



## CONTROL BOARD VOLTAGE TEST (continued)

TABLE F.5. Control Board Voltage Test Points.

TEST DESCRIPTION	TEST POINTS	ACCEPTABLE VOLTAGES	TEST CONDITIONS
The 18VAC from the auxiliary transformer to the control board.	Red lead (1J1) to Red lead (3J1)	18VAC Note: voltage will vary with input line voltage.	The correct input voltage applied to the V250-S and the input power switch (S1) in the ON position.
Remote trigger circuit test. (#2 and #4)	Lead #318 (4J5) to Lead #322 (1J5)	0 VDC.	When remote trigger circuit is "closed".
Remote trigger circuit test. (#2 and #4)	Lead #318 (4J5) to Lead #322 (1J5)	12VDC.	When remote trigger circuit is "open".
Shunt feedback milli-volt check.	White lead (2J4)+ to Black lead (1J4)-	100 mV.	Machine loaded to 120 Amps
Check for 15VDC control board supply voltage.	Lead #303 (7J3)+ to Lead #375 (1J3)-	15VDC.	The correct input voltage applied to the V250-S and the input power switch (S1) in the ON position.

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

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## PROTECTION CIRCUIT TEST

### WARNING

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

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

### TEST DESCRIPTION

This check will aid the technician in the understanding and evaluation of the V250-S protection circuit.

### MATERIALS NEEDED

Voltmeter/ohmmeter (Multimeter)  
Machine wiring diagram  
Protection circuit simplified wiring diagram

## PROTECTION CIRCUIT TEST (continued)

### TEST PROCEDURE

1. Remove main input power to the V250-S.
2. Perform *Filter Capacitor Discharge Procedure* detailed in Maintenance Section.
3. Locate and familiarize yourself with the leads and pin locations in plug J2 on the control board and also plug J6 on the power board. See Figures F.10. and F.11.

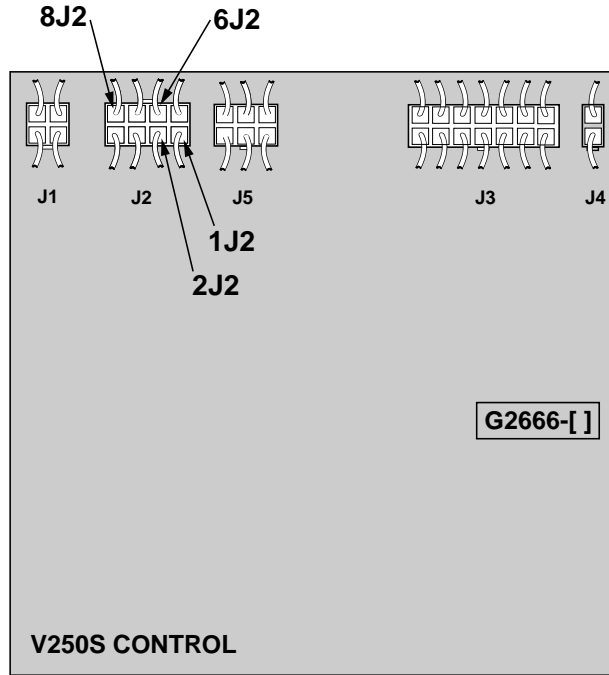


Figure F.10 Control Board Plug J2 Test Points

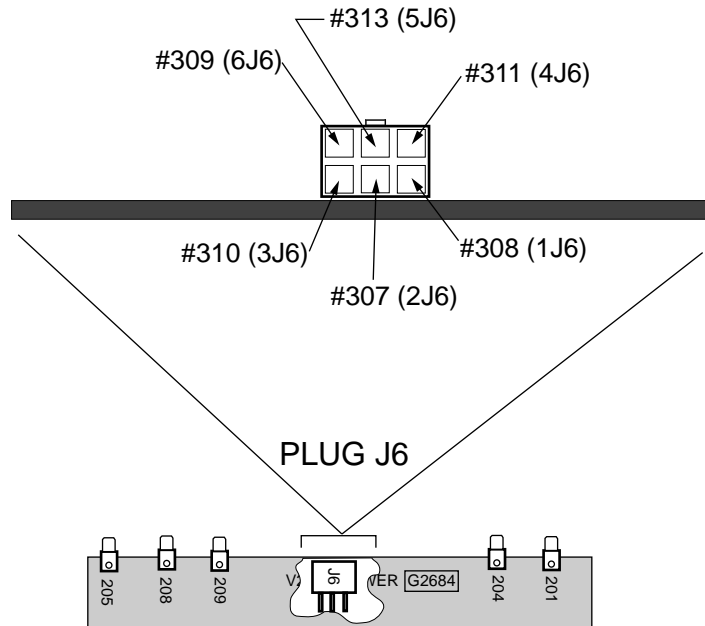


Figure F.11 Power Board Plug J6 Test Points

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Return to Section TOC

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

PROTECTION CIRCUIT TEST (continued)

4. The following tests will be performed with the input power applied to the V250-S. **BE CAREFUL. ALWAYS REMOVE INPUT POWER AND PERFORM FILTER CAPACITOR DISCHARGE PROCEDURE BEFORE TOUCHING ANY MACHINE COMPONENT.**

5. Apply input power and turn ON the V250-S.

6. Check for 0 to 1 VDC at leads #311(4J6)+ to #313(5J6)- at the power board. If the correct voltage is present go to step #7.

If 15VDC is present the overvoltage protection circuit has not been satisfied. Perform the **Capacitor Balance Test**. If the capacitor balance is good and the overvoltage protection circuit has NOT been satisfied the power board may be faulty. Replace.

7. Check for 0 to 1VDC at leads #311(2J2)+ to #313(8J2)- at the control board. If the correct voltage is present go to step 8.

If the correct voltage is present at the power board but not at the control board check associated leads and connections.

8. Check for 15VDC at leads #309(1J2)+ to #310(6J2)- at the control board. If the correct voltage is present check for 15VDC at leads #309(6J6) + to #310(3J6)- at the power board.

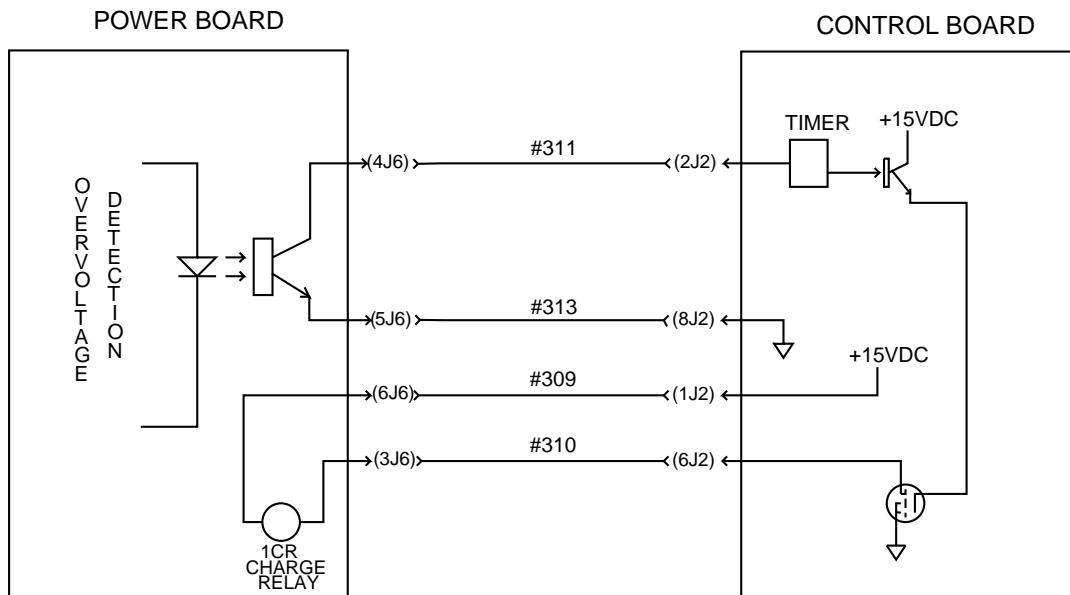
If the correct voltage is present at the control board but not at the power board check the associated leads and connections.

If the correct voltage, 15VDC, is not present at the control board the control board may be faulty. Perform the **Control Board Voltage Test**.

9. If 15VDC IS present at leads #309(6J6)+ to #310(3J6)- at the power board the input relay (1CR), should activate (pull-in) and apply full input power to the filter capacitors.

If this does not take place the power board may be faulty. Replace.

PROTECTION CIRCUIT (SIMPLIFIED)



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Return to Master TOC

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## CAPACITOR BALANCE TEST

### WARNING

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

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

### TEST DESCRIPTION

This test will help the technician to determine if the input filter capacitors are being charged equally and to the correct voltage levels. Note: This test should only be conducted with the V250-S reconnect switch and "A" jumper configured for 380VAC and above.

### MATERIALS NEEDED

Voltmeter/ohmmeter (Multimeter)  
Machine wiring diagram.

## CAPACITOR BALANCE TEST (continued)

### TEST PROCEDURE

1. Remove main input power to the V250-S.
2. Perform *Filter Capacitor Discharge Procedure* detailed in Maintenance Section.
3. Put the mode switch S2 in the SMAW (soft) position and put the Local/Remote switch S3 in the LOCAL position.
4. Put the Output Control R3 at the minimum position.
5. Locate and familiarize yourself with the capacitor test locations on the power board. See Figure F.12.
6. The following tests will be performed with the input power applied to the V250-S. **BE CAREFUL. ALWAYS REMOVE THE INPUT POWER AND PERFORM FILTER CAPACITOR DISCHARGE PROCEDURE BEFORE TOUCHING ANY MACHINE COMPONENT.**
7. Apply the correct input power<sup>†</sup> and turn ON the V250-S.

† Note: This test should only be conducted with the V250-S reconnect switch and "A" jumper configured for 380VAC and above.

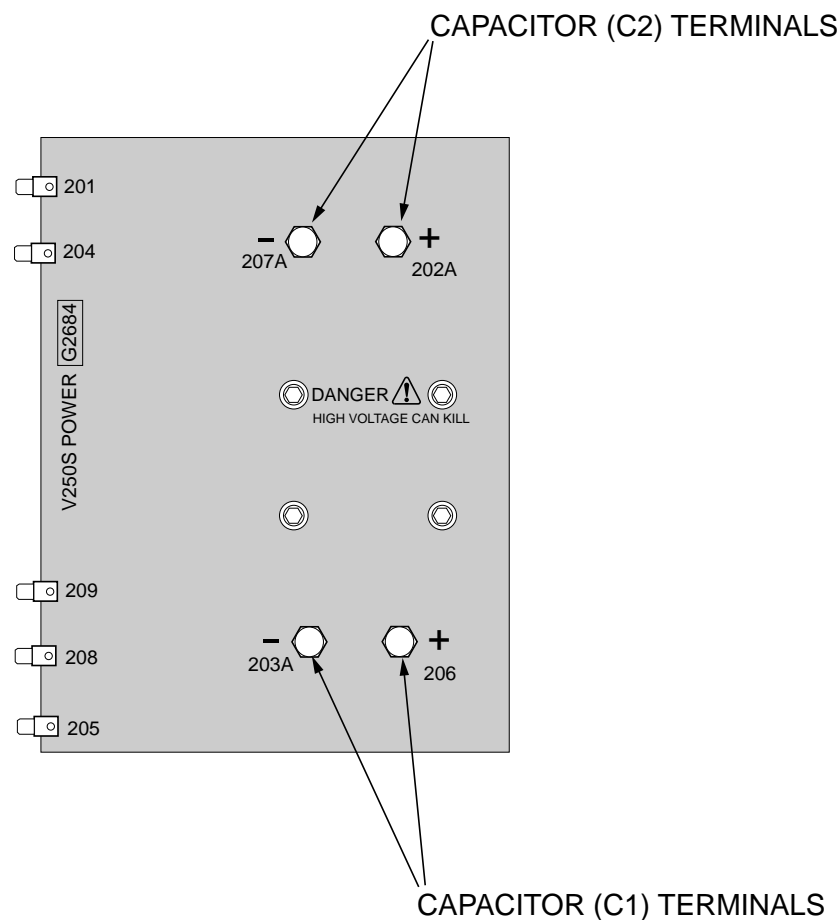


Figure F.12 Power Board and Capacitor Test Locations

INVERTEC V250-S





## CAPACITOR BALANCE TEST (continued)

8. Check for the appropriate voltages outlined in Table F.6. Note: Voltages may vary with the input line voltage.
9. If the capacitor voltages are NOT balanced within 20VDC the capacitors may be need "conditioning". See *maintenance* section.

In the event the capacitor voltage is too high or not balanced (within 20VDC) the protection circuit will prevent output. The overvoltage trip setting is nominal line voltage (230/460) +15%. Reset occurs about 3% lower (230/460) +12%.

The capacitors or other components on the power board may be faulty. Replace power board.

TABLE F.6 Capacitor Voltages

INPUT APPLIED	EXPECTED VOLTS DC AT CAPACITOR TERMINALS
460VAC	325VDC
440VAC	311VDC
415VAC	293VDC
380VAC	269VDC

### NOTE

The following machine parts must be replaced in matched sets. If Capacitor C1 is found to be defective, both Capacitors C1 and C2 must be replaced at the same time:

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Return to Section TOC  
Return to Master TOC

INVERTEC V250-S



## CONTROL BOARD REMOVAL AND REPLACEMENT

### WARNING

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

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

### MATERIALS NEEDED

Small needle-nose pliers  
Small screwdriver  
5/16" nut-driver

## CONTROL BOARD REMOVAL AND REPLACEMENT (continued)

### PROCEDURE

1. Remove input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate the control board and the five molex type plugs that are connected to it. See Figure F.13.
4. Carefully remove the five molex type plugs by depressing the locking tabs and gently extracting the plugs from the P.C. board receptacles.
5. Using the needle nose-pliers and small screwdriver gently remove the control board from the six mounting pins by depressing the tabs on the mounting pins and sliding the board from the pins. See Figure F.13.
6. When replacing the control board align the mounting holes with the mounting pins and gently slide the P.C. board onto the mounting pins until the board "snaps" onto the mounting pins.
7. Replace the five molex type plugs in their appropriate receptacles.
8. Inspect, clear and secure all leads in preparation for case wrap-around reassembly.
9. Using the 5/16" nut-driver replace the case wrap-around.

Note: Be sure to observe static electricity precautions when handling P.C. boards.

Note: Be sure to observe static electricity precautions when handling P.C. boards.

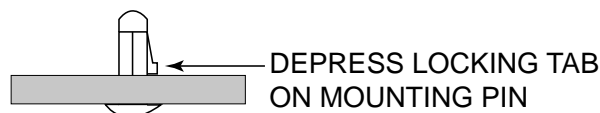
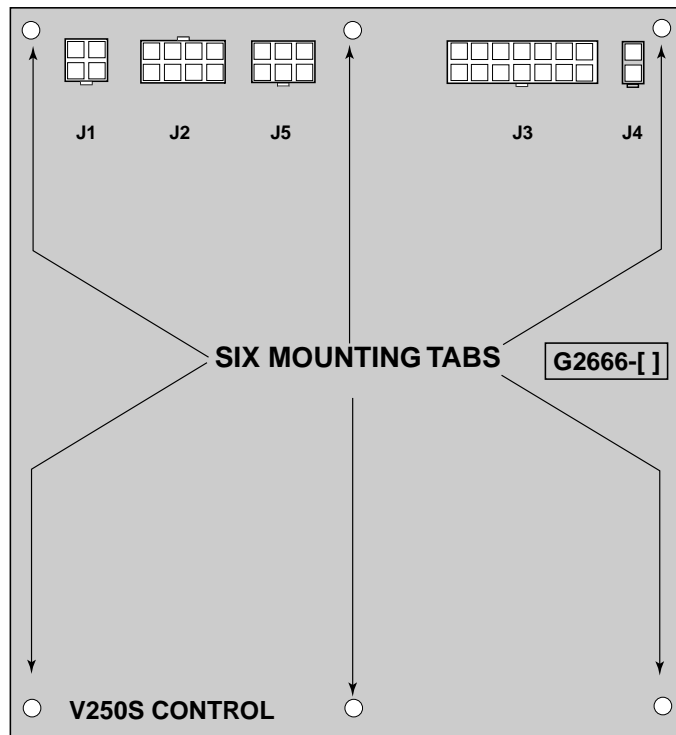


Figure F.13 Control Board Plugs and Mounting Pins

INVERTEC V250-S



## POWER BOARD REMOVAL AND REPLACEMENT

### WARNING

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

### MATERIALS NEEDED

5/16" nut-driver  
1/4" nut-driver  
7/16" wrench  
3/16" Allen type wrench

POWER BOARD REMOVAL AND REPLACEMENT (continued)

PROCEDURE

1. Remove input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate the power board, the molex type plug J6, the five leads with push-on connectors and the four capacitor leads that are connected to the power board.
4. Carefully remove leads (with push-on connectors) #201, #204, #205, #208, and #209 from the power board.

5. Remove plug J6 by depressing the locking tab and removing it from the power board.
6. With the 7/16" wrench remove the four bolts and washers from the filter capacitor terminals.

Remove leads #202A, #207A, #203A and #206 from the capacitor terminals.

See Figure F.14. Cut any necessary cable ties.

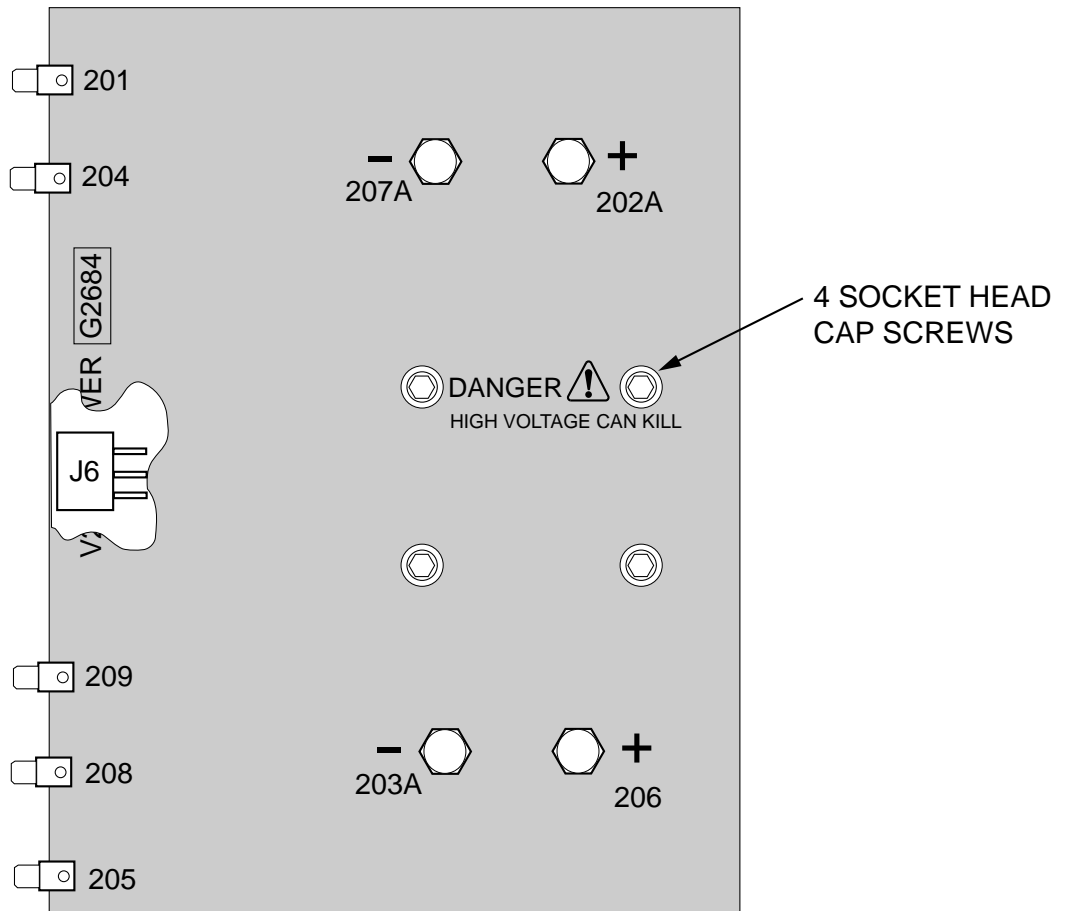


Figure F.14 Power Board Lead Locations

Return to Section TOC

Return to Master TOC

## POWER BOARD REMOVAL AND REPLACEMENT (continued)

7. Using the 1/4" nut-driver remove the two screws holding the P.C. board to the heat sink mounting bracket.
  8. With the 3/16" Allen wrench remove the four socket head cap screws and washers holding the power board to the large aluminum heat sink.
  9. Carefully remove the power board taking note as to the amount of heat sink compound used between the IGBTs and the large aluminum heat sink. Note: Be sure to observe static electricity precautions when handling P.C. boards.
- If the filter capacitors are to be removed see ***Filter Capacitor Removal and Replacement.***
13. Assemble the leads #202A, #207A, #203A and #206 to their respective capacitor terminals using the bolts, lockwashers and 7/16" wrench. Torque to 50 - 60 IN. Lbs.
  14. Using the 1/4" nut-driver install the two screws holding the P.C. board to the heat sink mounting bracket.
  15. Connect leads #201, #204, #205, #208, and #209 to their appropriate terminals.
  16. Replace plug J6 into power board.
  17. Replace any previously removed cable ties.
  18. Inspect, clear and secure all leads in preparation for case wrap-around reassembly.

### POWER BOARD REPLACEMENT PROCEDURE

10. Apply a thin coat of Dow Corning 340 heat sink compound (Lincoln E1868) to the filter capacitor terminals. Do not apply to screw threads or threaded area of terminals.
11. When replacing the power board apply a thin coating (.005 to .010) of Dow Corning 340 heat sink compound (Lincoln E1868) to the mating surfaces between the IGBTs and the aluminum heat sink. Compound is NOT permitted on the screw heads or mounting hole threads. The mating surfaces must be clean and free of any foreign material.
12. Install the power board and tighten the four cap head screws. Torque the cap head screws to 40 to 48 IN. Lbs. Note: Before tightening make certain the capacitor terminals are aligned with their respective holes in the power P.C. board.

Return to Section TOC  
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Return to Master TOC

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## FILTER CAPACITOR REMOVAL AND REPLACEMENT

### WARNING

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

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

### MATERIALS NEEDED

5/16" nut-driver  
Slot head screwdriver

### MATCHED PARTS

The following machine parts must be replaced in matched sets If Capacitor C1 is found to be defective, both Capacitors C1 and C2 must be replaced at the same time:

## FILTER CAPACITOR REMOVAL AND REPLACEMENT (continued)

### PROCEDURE

1. Remove input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Perform **Power Board Removal Procedure** in this section.
4. Using the 5/16" nut-driver remove the two screws from the top rear of the case back. See Figure F.15.
5. Using the 5/16" nut-driver remove the two screws from the top front of the case front panel. See Figure F.15.
6. Using the slot head screwdriver carefully disengage the heatsink/power board mounting bracket from the top center panel. This can be accomplished by sliding the bracket assembly towards the rear of the machine while at the same time gently lifting up on the top center panel. See Figure F.15.

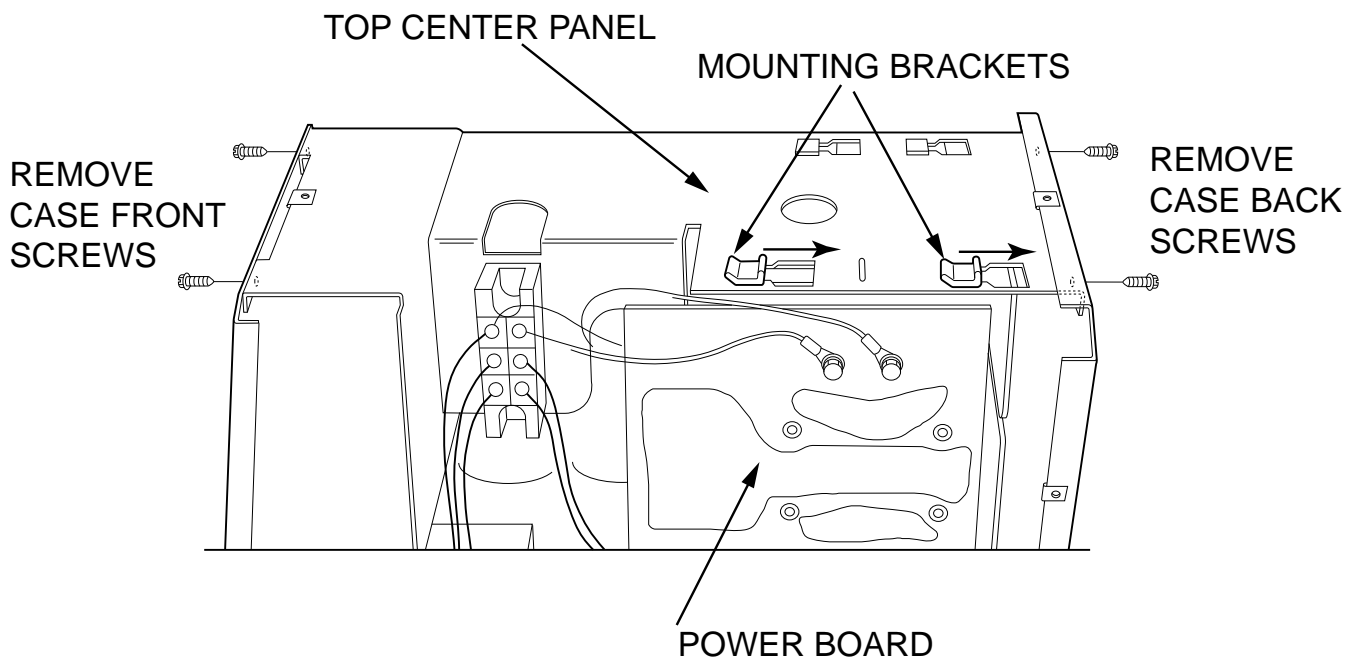


Figure F.15 Heatsink/Power Board Removal

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## FILTER CAPACITOR REMOVAL AND REPLACEMENT (continued)

7. Once the top of the bracket assembly is disengaged from the top center panel the bracket assembly can be removed from the bottom of the case by sliding the bracket assembly towards the front of the machine. The locking tab on the bottom of the bracket will have to be lifted slightly to enable the assembly to slide freely towards the front.
8. With the bracket assembly out of the machine the filter capacitors can be removed by loosening the capacitor clamps and sliding the filter capacitors out of the assembly.  
  
Note: Before removing the capacitors precisely mark where the capacitors are positioned in the clamp. This is important so the new capacitor terminals will align with the holes in the power board. Also mark polarity configuration for reassembly purposes.
9. Install the new capacitors taking note of position in the clamp and also polarity location.
10. Using the slot head screwdriver tighten the clamps.
11. Install the heatsink/power board bracket assembly (with new capacitors installed) into the machine by first positioning the bottom of the bracket into the slots in the case bottom and sliding the bracket assembly towards the rear of the machine.
12. Carefully position the top of the heatsink/power board bracket assembly into the top center panel and slide the panel towards the rear of the machine while holding the heatsink/power board mounting bracket in place.
13. Using the 5/16" nut-driver replace the two screws at the top rear of the case back. See Figure F.15.
14. Using the 5/16" nut-driver replace the two screws at the top front of the case front panel. See Figure F.15.
15. Perform **Power Board Replacement Procedure** in this section.

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

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## INPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT

### WARNING

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

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

### MATERIALS NEEDED

3/16" Allen type wrench  
Phillips head screwdriver  
7/16" Box wrench  
Torque wrench

## INPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT (continued)

### PROCEDURE

1. Remove input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate the input rectifier and the leads connected to it. See Figure F.16.
4. Identify and mark the leads connected to the rectifier terminals.
5. With the Phillips head screwdriver remove the eight leads connected to the rectifier terminals.
6. Using the 3/16" Allen wrench and 7/16" box wrench remove the two cap head screws, washers and nuts mounting the input rectifier bridge to the center panel assembly.

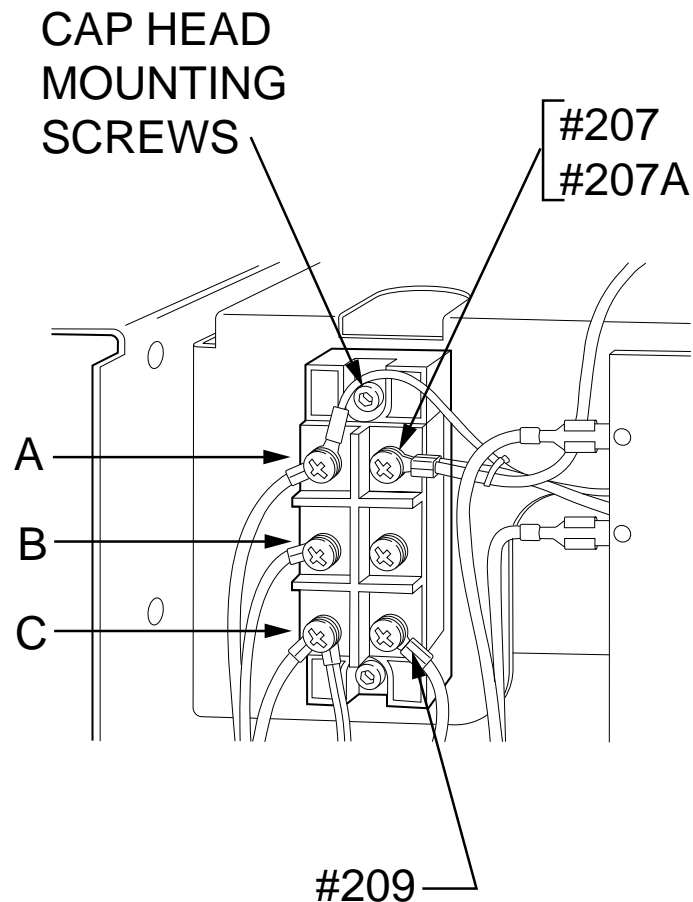


Figure F.16 Input Rectifier Lead Locations

**INPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT (continued)**

7. Carefully remove the input rectifier bridge.
8. When installing a new input rectifier apply a thin coating of Dow Corning 340 Heat Sink Compound (Lincoln E1868) to the mating surfaces. Torque the mounting cap screws and nuts to 44 IN-LBS.
9. Reconnect the eight leads to the correct terminals and torque the phillips head screws to 31 IN-LBS.

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## OUTPUT DIODE ASSEMBLY REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150)

### WARNING

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

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

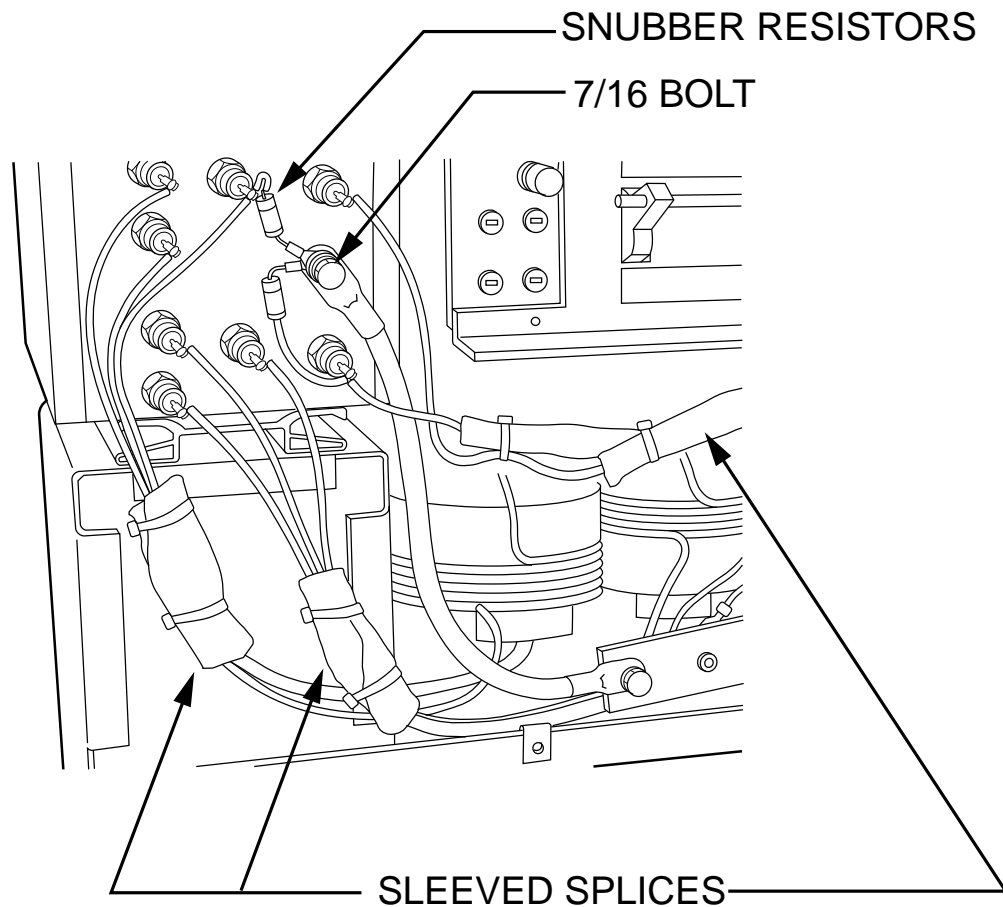
### MATERIALS NEEDED

Slot head screwdriver  
5/16" nut-driver  
7/16" wrench  
Wire cutters  
3/8" wrench

## OUTPUT DIODE ASSEMBLY REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150) (continued)

### PROCEDURE

1. Remove input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate output diode assembly and associated leads. See Figure F.17.
4. Cut the necessary wire ties and slide the sleeving from the four wire connections to be disassembled. See Figure F.17
5. Label the leads for identification purposes for reassembly.
6. Using the 7/16" wrench remove the bolts, nuts and washers from two of the splices.
7. Using the 3/8" wrench and slot head screwdriver disassemble the other two splices.
8. Using the 7/16" wrench remove the bolt and washers connecting the output cable to the diode heat sink. Be sure to take note of the small resistor connection at the same point. See Figure F.17.
9. With the 5/16" nut-driver remove the two screws from the top rear case back. See **Figure F.15**.

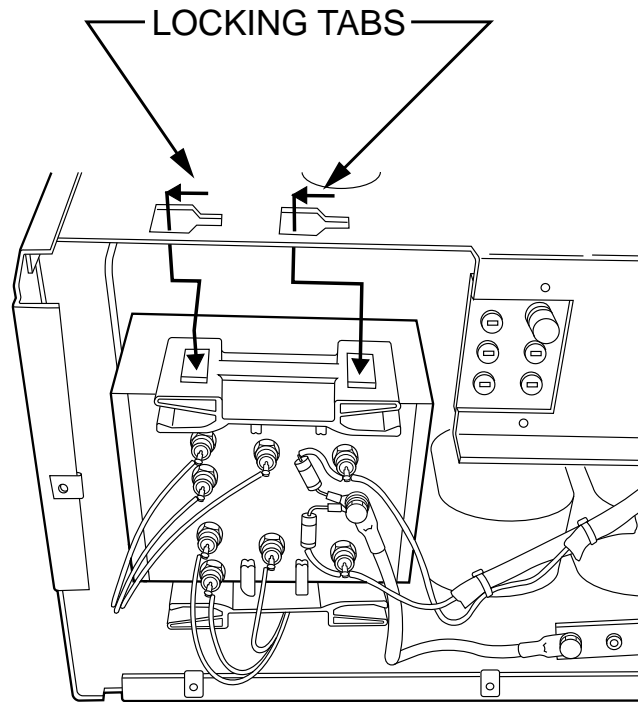


**Figure F.17 Output Diode Assembly and Leads**

INVERTEC V250-S



## OUTPUT DIODE ASSEMBLY REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150) (continued)



**Figure F.18 Heatsink Removal**

10. Using the slot head screwdriver carefully disengage the output diode heat sink mounting bracket from the top center panel. Also disengage the bottom heat sink mounting bracket from the support bracket. This can be accomplished by lifting the locking tab and sliding the heat sink assembly towards the rear of the machine. See Figure F.18.
11. Carefully remove the output diode assembly from the V250-S.
12. Remove the two heat sink holders from the heat sink/diode assembly.
13. Assemble the two heat sink holders to the new heat sink/diode assembly.
14. Install the new output diode assembly into position and slide it towards the front of the machine until the locking tabs (both top and bottom) are engaged. See Figure F.18.
15. Install the two screws into the top rear case back. See **Figure F.15**.
16. Using the 7/16" wrench, bolt and washers connect the output cable to the diode heat sink. Be sure to take note of the small resistor connection at the same point. See **Figure F.17**.
17. Using the 7/16" wrench, bolts, nuts and washers assemble and tighten the two splices.
18. Using the 3/8" wrench and slot head screwdriver assemble and tighten the other two splices.
19. Position sleeving and secure with cable ties. Clear all leads and prepare unit for reassembly of wrap-around case.

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## OUTPUT DIODE ASSEMBLY REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150)

### WARNING

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

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

### MATERIALS NEEDED

7/16" wrench  
1/8" Allen type wrench  
Torque wrench

## OUTPUT DIODE ASSEMBLY REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150)

(continued)

### PROCEDURE

1. Remove input power to the V250-S.
2. Perform **Filter Capacitor Discharge Procedure** detailed in Maintenance Section.
3. Locate output diode assembly and associated leads. See Figure F.19.
4. Label the leads for identification purposes for reassembly.
5. Using the 7/16" wrench remove the bolts, nuts and washers from the lead terminals of the module to be replaced. Clear leads and take careful note of lead placement.

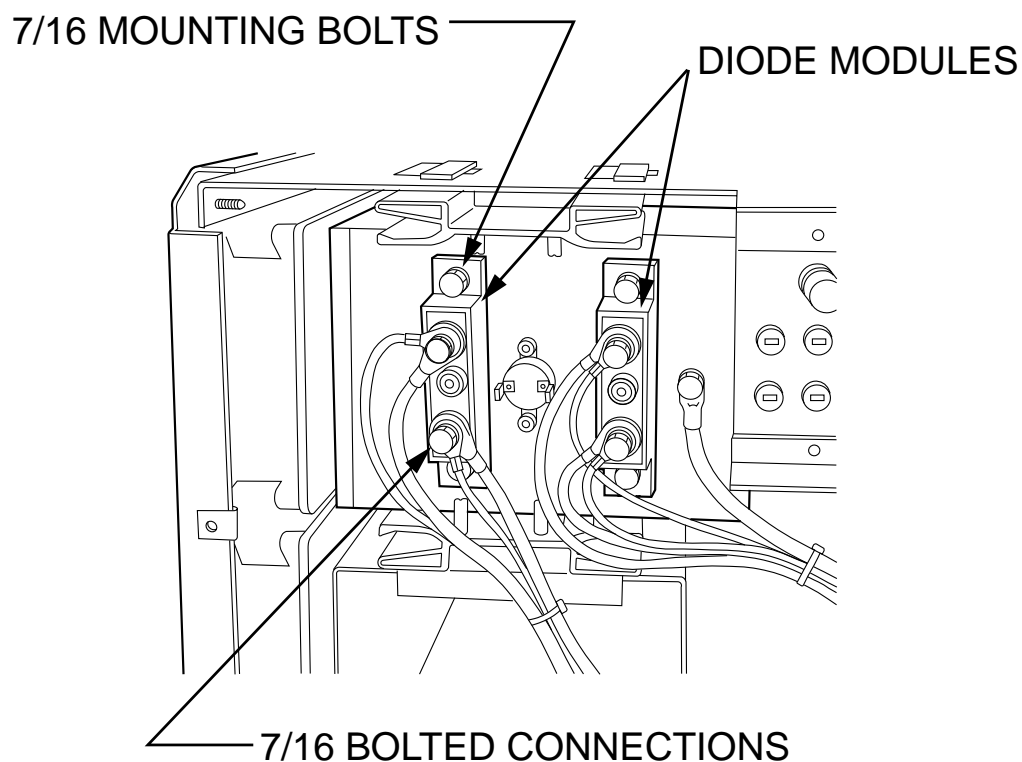


Figure F.19 Output Diode Assembly and Leads

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## OUTPUT DIODE ASSEMBLY REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150) (continued)

6. Using 7/16" wrench remove the top and bottom mounting bolts and associated washers from the diode module to be replaced.
7. Using 1/8" Allen wrench remove the center socket head cap screw from the diode module to be replaced.
8. Carefully remove the diode module.
9. To install the new module first make sure the heat sink surface is clean and free of dirt.
10. Apply a thin even coating (.004 to .010 IN.) of thermal compound Penetrox A13 (Lincoln E2529) to the bottom surface of the base plate. Keep the compound away from the mounting hole areas.
11. Apply a small amount of Loctite #271 (Lincoln E1777-1) to the first three threads of the socket head cap screw.
12. Start threading the top and bottom screws and associated washers by hand. Also start the center socket head cap screw and associated washer.
13. Run the center cap screw in by hand until it makes contact with the surface of the module. **Do not torque down yet!**
14. Tighten the top and bottom screws to between 5.0 and 10.0 IN-LBS.
15. Tighten the center cap screw to between 12 and 18 IN-LBS.
16. Further tighten the top and bottom screws to between 30 and 40 IN-LBS.
17. Connect the leads to the proper terminals and tighten the screws to between 30 to 40 IN-LBS. Do not stress the module terminals when making these connections.
18. Clear all leads and prepare unit for reassembly of wrap-around case.

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## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150)

### WARNING

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

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

### MATERIALS NEEDED

7/16" Wrench  
3/8" Wrench  
Wire cutters  
3/4" Wrench  
Slot head screwdriver

## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150) (continued)

### PROCEDURE

1. Remove input power to the V250-S.
2. Perform *Filter Capacitor Discharge Procedure* detailed in Maintenance Section.
3. Locate main transformer and associated primary leads. See Figure F.20.
4. Disconnect transformer primary leads #201, #204, #205 and #208 from the power board.

Note: Leads #204 and #205 will have to be removed from the T3 current transformer. Cut any necessary

cable ties. **Be sure to note the direction that the leads are threaded through the current transformer. Upon reassembly the leads must be threaded through correctly.**

5. Locate main transformer and associated secondary leads, reactor leads, and shunt connections. See Figure F.21.

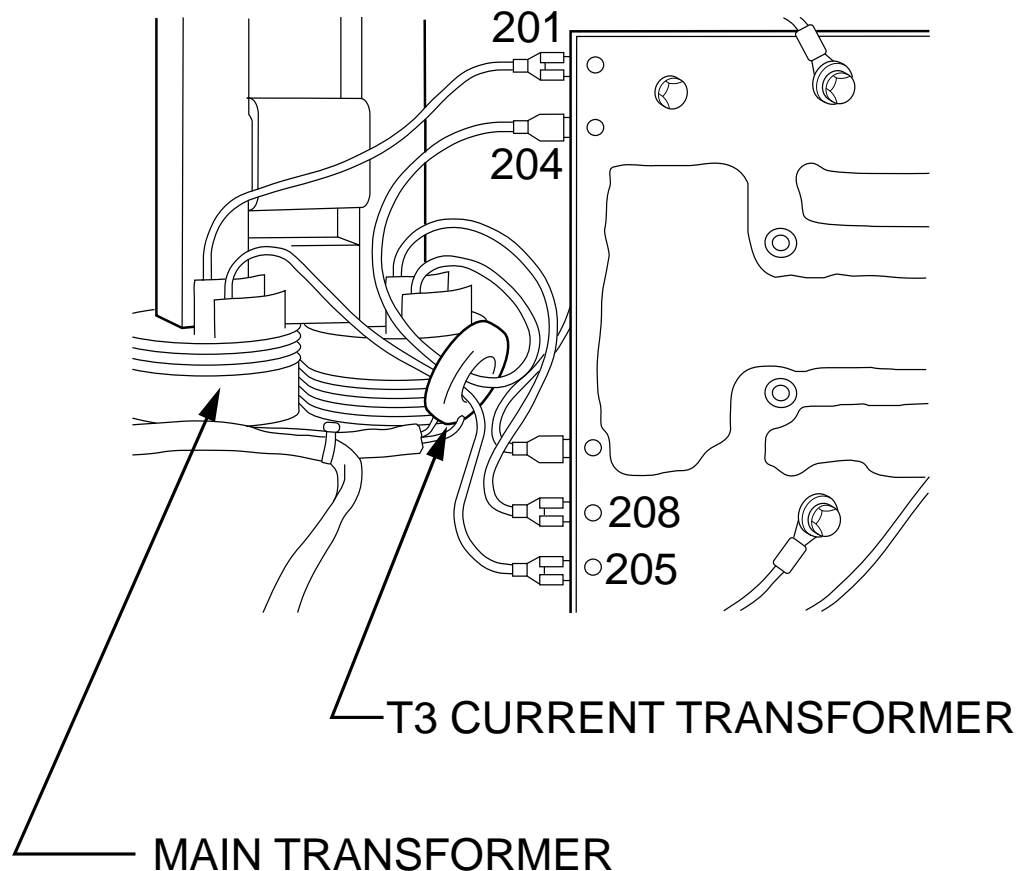
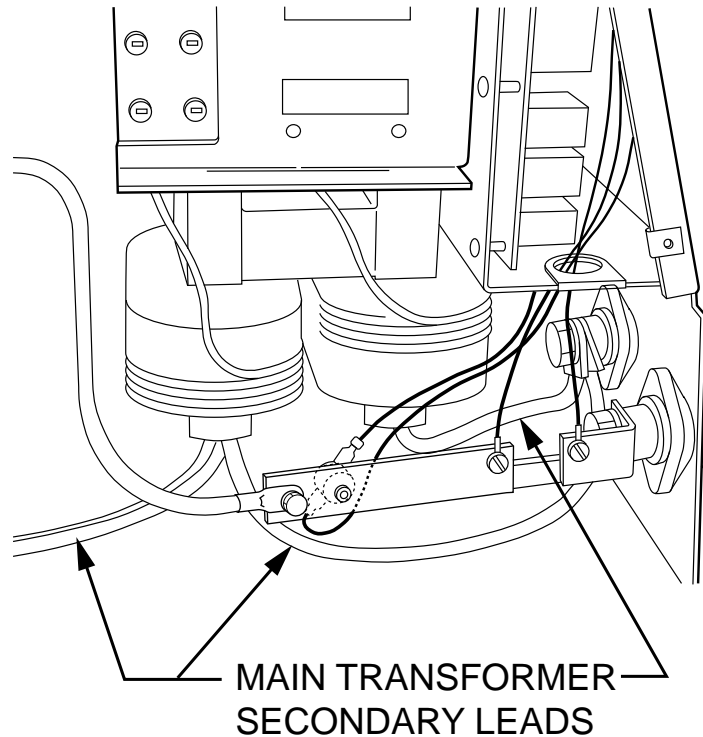


Figure F.20 Main Transformer Right Side

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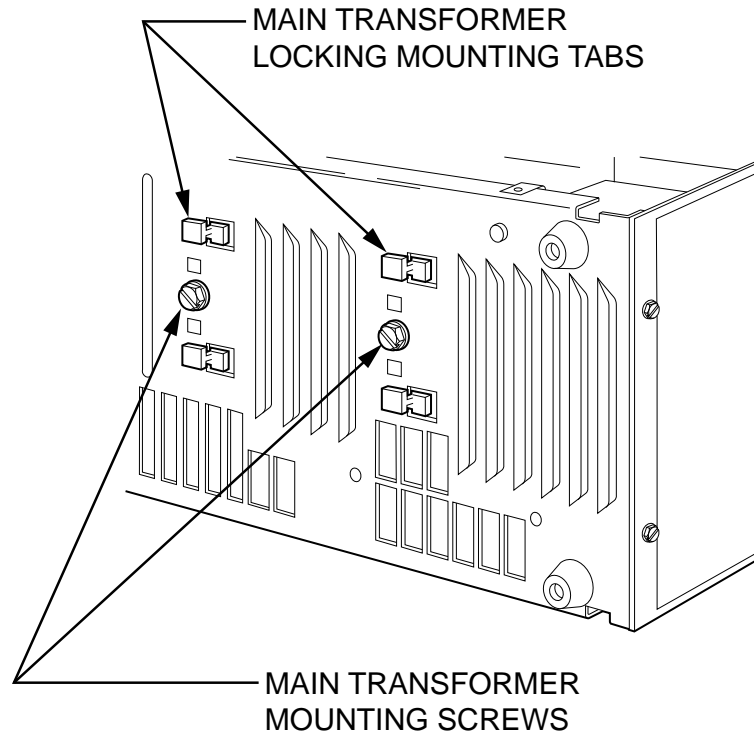
## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150) (continued)



**Figure F.21 Main Transformer Left Side**

6. Disconnect and clear the shunt sensing leads from the control board (plug J4).
7. Disconnect the thermostat leads from the thermostat mounted on the shunt assembly.
8. With the 3/4" wrench remove the shunt assembly from the negative output terminal. Take note of the bypass connection on the negative terminal. Clear the shunt to allow access to the main transformer and lead connections. Cut any necessary cable ties.
9. With the 3/4" wrench remove the two secondary leads from the positive output terminal. Take note of the bypass connection on the positive terminal.
10. Locate and cut the necessary wire ties and slide the sleeving from the four transformer secondary and reactor lead splices.
11. With slot head screwdriver and 3/8" nut-driver remove the two reactor leads from output rectifier leads. Label the leads for reassembly.
12. Using the 7/16" wrench remove the secondary leads from the output rectifier leads.  
  
Label the leads and note washer and lead placement for reassembly.
13. With 3/8" wrench remove the two screws mounting the transformer assembly to the base of the machine. See **Figure F.22**. Note: The machine will have to be tilted on its side to gain access to the bottom of the unit.

## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150) (continued)



**Figure F.22 Main Transformer Mountings**

- |   |   |
|---|---|
| <p>14. Using the slot head screwdriver unclip the locking tabs and slide the transformer towards the front of the machine until it is free of the slots in the bottom of the machine.</p> <p style="padding-left: 40px;">Note: The machine will have to be tilted on its side to gain access to the bottom of the unit.</p> | <p>Note: The machine will have to be tilted on its side to gain access to the bottom of the unit.</p>   |
| <p>15. With the main transformer loose from the base carefully tilt and remove the transformer from the left side of the machine.</p>   | <p>18. Using the 7/16" wrench reassemble the two secondary leads to the output rectifier leads. Note lead and washer placement and lead labels.</p>   |
| <p>16. Install the new transformer by tilting and carefully positioning it in place in the slots in the case bottom. Slide towards the rear of the machine until the locking tabs are in place.</p>   | <p>19. Using the slot head screwdriver and 3/8" nut-driver reassemble the two reactor leads to the output rectifier leads. Note lead labels.</p>  |
| <p>17. With the 3/8" wrench replace the two transformer mounting screws.</p>  | <p>20. Replace the sleeving on the four connections and replace the cable ties.</p> <p>21. With the 3/4" wrench assemble the two secondary leads to the positive output terminal.</p> <p style="padding-left: 40px;">Take note of the by-pass connection on the positive output terminal.</p> |

## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES BELOW 10150) (continued)

22. Reassemble the shunt assembly to the negative output terminal. Take note of the by-pass connection on the negative terminal. Clear leads and install any necessary cable ties.
23. Connect the two thermostat leads.
24. Connect the shunt sensing leads to the control board (plug J4).
25. Connect primary leads #201, #204, #205 and #208 to the power board. **Be sure leads #204 and #205 are routed through the current transformer (T3) in the correct manner. Secure leads with cable ties.**
26. Clear all leads and secure for case wrap-around assembly.

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## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150)

### WARNING

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

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

### MATERIALS NEEDED

7/16" Wrench  
3/8" Wrench  
Wire cutters  
3/4" Wrench  
Slot head screwdriver

## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150) (continued)

### PROCEDURE

1. Remove input power to the V250-S.
2. Perform *Filter Capacitor Discharge Procedure* detailed in Maintenance Section.
3. Locate main transformer and associated primary leads. See Figure F.23.
4. Disconnect transformer primary leads #201, #204, #205 and #208 from the power board.
5. Locate main transformer and associated secondary leads, reactor leads, and shunt connections. See *Figure F.24*.
6. Disconnect and clear the shunt sensing leads from the control board (plug J4).

NOTE: Leads #204 and #205 will have to be removed from the T3 current transformer.

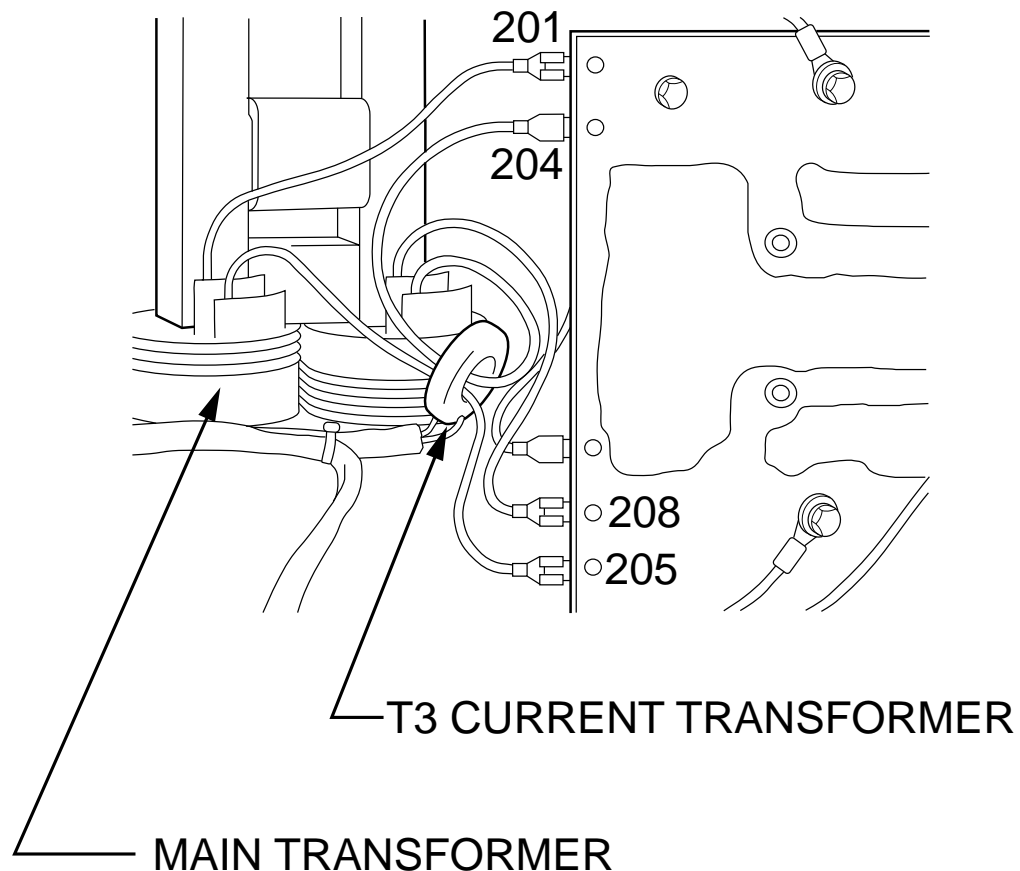
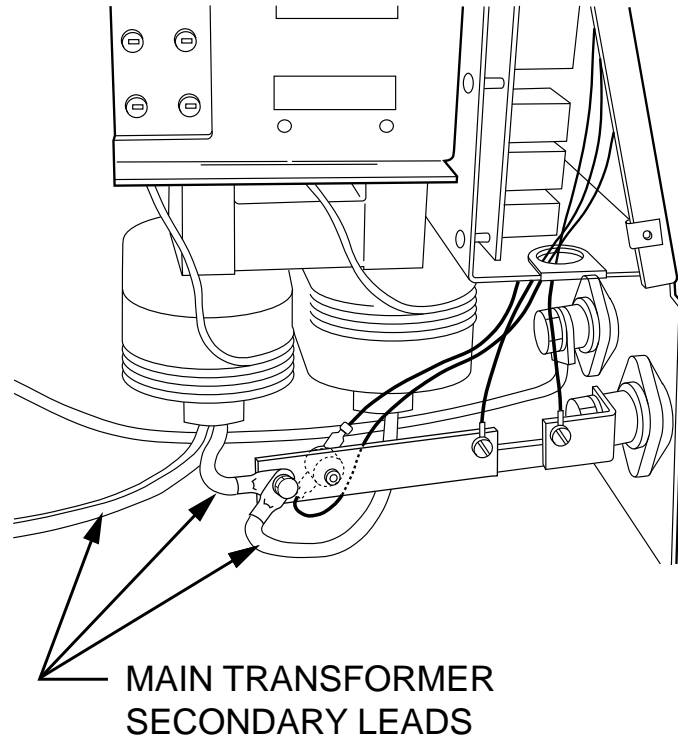


Figure F.23 Main Transformer Right Side



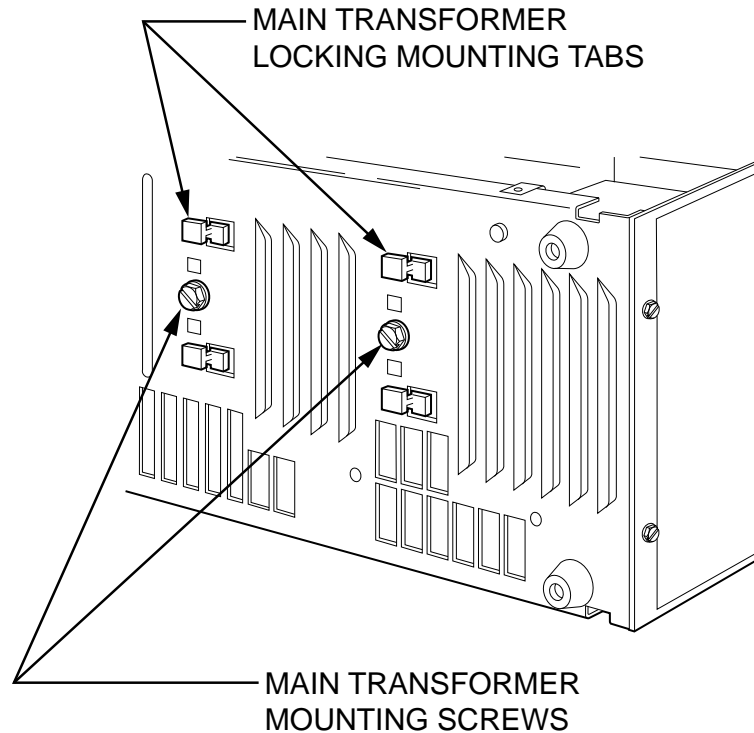
## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150) (continued)



**Figure F.24 Main Transformer Left Side**

7. Disconnect the thermostat leads from the thermostat mounted on the shunt assembly.
8. With the 3/4" wrench remove the shunt assembly from the negative output terminal. Take note of the bypass connection on the negative terminal. Clear the shunt to allow access to the main transformer and lead connections. Cut any necessary cable ties.
9. With the 3/4" wrench remove the positive output lead from the positive output terminal. Take note of the bypass connection on the positive terminal.
10. Locate and cut the necessary wire ties and slide the sleeving from the two transformer reactor lead splices.
11. With slot head screwdriver and 3/8" nut-driver remove the two reactor leads from output the rectifier leads. Label the leads for reassembly.
12. Using the 7/16" wrench remove the four secondary leads from the output rectifier module. Label the leads and note washer and lead placement for reassembly. See Figure F.24.
13. With 3/8" wrench remove the two screws mounting the transformer assembly to the base of the machine. See **Figure F.25**. Note: The machine will have to be tilted on its side to gain access to the bottom of the unit.

## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150) (continued)



**Figure F.25 Main Transformer Mountings**

14. Using the slot head screwdriver unclip the locking tabs and slide the transformer towards the front of the machine until it is free of the slots in the bottom of the machine. Note: The machine will have to be tilted on its side to gain access to the bottom of the unit.
15. With the main transformer loose from the base carefully tilt and remove the transformer from the left side of the machine.
16. Install the new transformer by tilting and carefully positioning it in place in the slots in the case bottom. Slide towards the rear of the machine until the locking tabs are in place.
17. With the 3/8" wrench replace the two transformer mounting screws. Note: The machine will have to be tilted on its side to gain access to the bottom of the unit.
18. Using the 7/16" wrench reassemble the four secondary leads to the output rectifier module. Note lead and washer placement and lead labels. Tighten to between 30 and 40 IN-LBS.  
  
Do not stress the module terminals when making these connections.
19. Using the slot head screwdriver and 3/8" nut-driver reassemble the two reactor leads to the output rectifier leads. Note lead labels.
20. Replace the sleeving on the reactor connections and replace the cable ties.

## MAIN TRANSFORMER REMOVAL AND REPLACEMENT (MACHINE CODES ABOVE 10150) (continued)

21. With the 3/4" wrench assemble the positive output lead to the positive output terminal.

Take note of the by-pass connection on the positive output terminal.

22. Reassemble the shunt assembly to the negative output terminal. Take note of the by-pass connection on the negative terminal. Clear leads and install any necessary cable ties.
23. Connect the two thermostat leads.
24. Connect the shunt sensing leads to the control board (plug J4).
25. Connect primary leads #201, #204, #205 and #208 to the power board. **Be sure leads #204 and #205 are routed through the current transformer (T3) in the correct manner.**  
  
Secure leads with cable ties.
26. Clear all leads and secure for case wrap-around assembly.

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## 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 IDLE WATTS

INPUT CURRENT @ IDLE	LESS THAN 2 AMPS
INPUT POWER @ IDLE	LESS THAN 200 WATTS

### MAXIMUM ACCEPTABLE OUTPUT (AT MINIMUM OUTPUT SETTINGS)

MODE	AMPS	VOLTS
All	1 Amp	10 VDC.

### MINIMUM ACCEPTABLE OUTPUT (AT MAXIMUM OUTPUT SETTINGS)

MODE	AMPS	VOLTS
All	250 Amps	33 VDC.

### OPEN CIRCUIT VOLTAGE RANGE

MODE	VOLTS
All	65 - 80 VDC.

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Wiring Diagram (Codes 10187, 10188) .....	G-3
Control PC Board (G2666) Layout .....	G-4
Power PC Board (G2684) Layout .....	G-5
Control PC Board (G2666) Schematic .....	G-6
Power PC Board (G2684) Schematic .....	G-7

# NOTES

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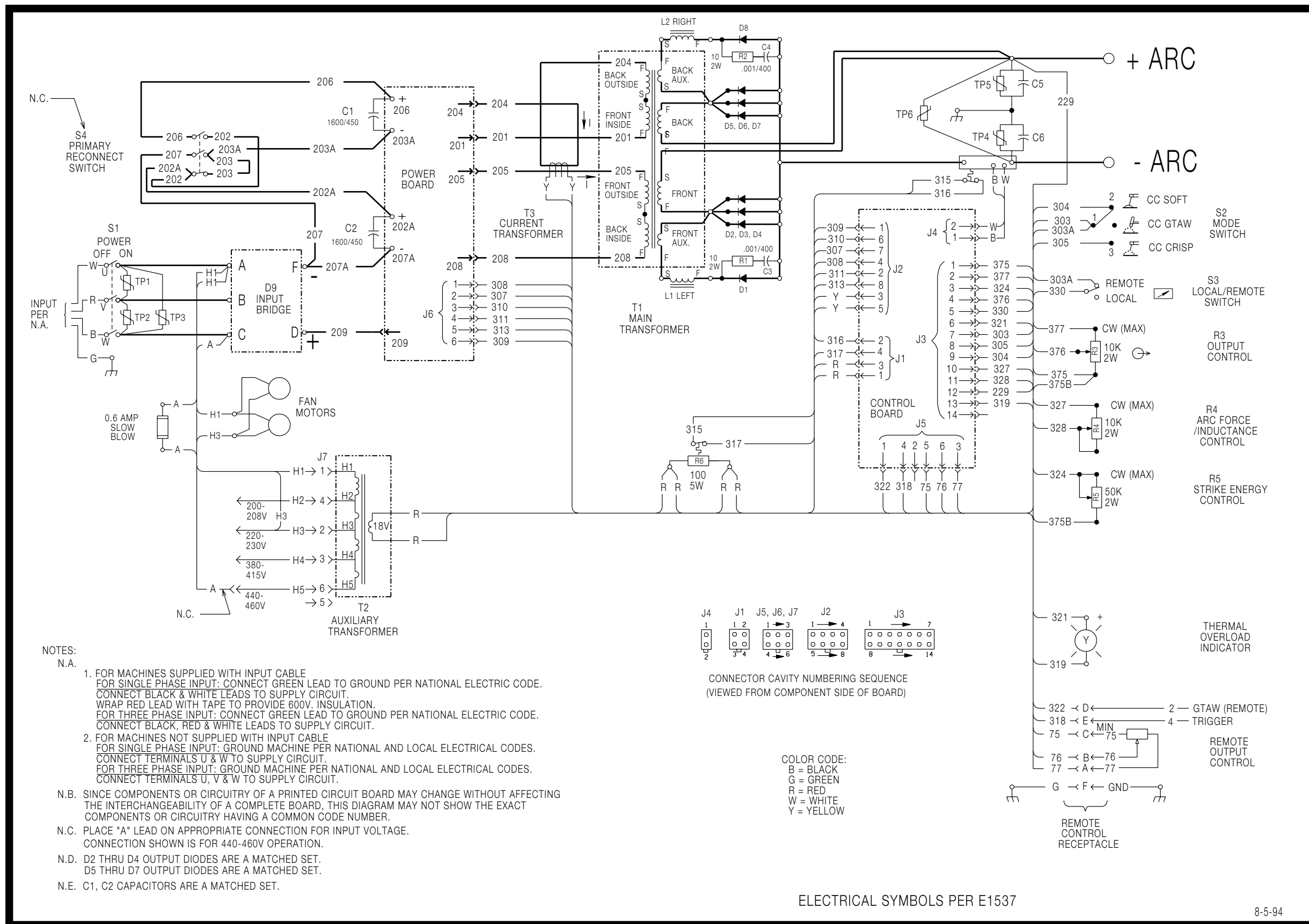
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Wiring Diagram (Codes 10102, 10103)



ELECTRICAL SYMBOLS PER E1537

CLEVELAND, OHIO U.S.A.

8-5-94

L9280

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

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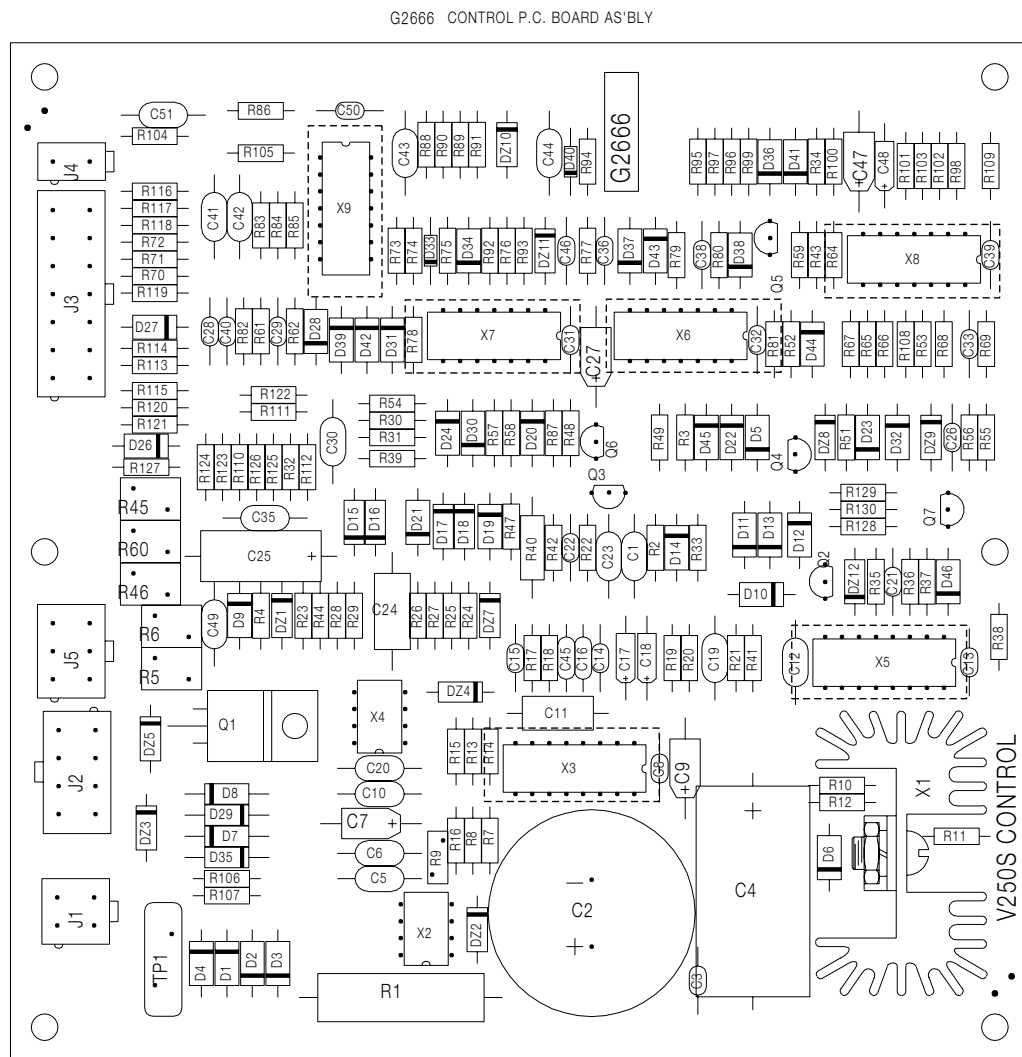
Control PC Board (G2666) Layout

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ITEM	REQ'D	IDENTIFICATION
C1, C5, C6, C10, C12, C20, C23, C30, C35, C41, C42, C49, C51	13	.1/50
C2	1	3300/50
C3, C8, C13, C15, C22, C28, C29, C31, C32, C33, C36, C38, C39, C40, C50	15	.022/50
C4	1	150/50
C7, C9, C27, C47	4	4.7/35
C11	1	.018/50V
C14, C46	2	150PF/100
C16, C45	2	47PF/100
C17, C18	2	1.8/20
C19, C43, C44	3	2700PF/50
C21, C26	2	4700PF/50
C24	1	.15/100
C25	1	100/20
C48	1	1.0/35
D1, D2, D3, D4, D5, D6, D9, D10, D11, D12, D13, D14, D19, D20, D21, D22, D23, D24, D26, D27, D28, D30, D31, D32, D34, D36, D37, D38, D39, D41, D42, D43, D44, D45, D46	35	1N4004
D7, D8, D29, D35	4	1N5818
D15, D16, D17, D18	4	1N4936
D33, D40	2	1N914
D21	1	1N4746A
D22, D24, D212	3	1N4742A
D23	1	1N4747
D25	1	1N4744A
D27	1	1N4735
D28	1	1N4761A
D29	1	1N4740
DZ10, DZ11	2	1N4733
J1	1	HEADER
J2	1	CONNECTOR
J3	1	HEADER
J4	1	HEADER
J5	1	HEADER
Q1	1	4A, 100V, MOSFET (SS)
Q2, Q3, Q5, Q6, Q7	5	2N4401
Q4	1	.5AMP / 300 VOLT PNP
R1	1	1.0 OHM, 5W RESISTOR
R2, R37, R52, R67, R96, R103, R109	7	332K 1/4W
R3, R8, R16, R36, R51, R56, R69, R85, R87, R98, R100, R101	12	100K 1/4W
R4, R10, R34, R39, R57, R99	6	1.5K 1/4W
R5, R6, R45, R46, R60	5	PTC THERMISTOR
R7, R15	2	267 1/4W
R9	1	PTC THERMISTOR
R11, R14	2	2.67K 1/4W
R12	1	243 1/4W
R13, R54	2	26.7K 1/4W
R17	1	22.1K 1/4W
R18, R88, R91	3	56.2K 1/4W
R19, R42, R43, R49, R55, R59, R73, R76, R79, R92, R108	11	10K 1/4W
R20	1	18.2K 1/4W
R21	1	332 1/4W
R22, R48	2	221 1/4W
R23, R38, R65, R93, R94, R128, R129	7	33.2K 1/4W
R24, R25, R26, R27	4	26.7 1/4W
R28, R29	2	10 1/4W
R30, R31, R32, R110, R111, R112, R116, R117, R118, R119, R120, R121, R122, R123, R124, R125, R126, R127	18	562 1/4W
R33, R68, R80, R83	4	2.21K 1/4W
R35, R61, R64, R77, R84, R95, R105	7	47.5K 1/4W
R40	1	1 1/2W
R41, R81, R130	3	1K 1/4W
R44, R75	2	15K 1/4W
R47	1	6.81K 1/4W
R53, R97	2	6.19K 1/4W
R58, R52, R66, R82	4	4.75K
R70, R78	2	3.32K 1/4W
R71, R72	2	8.25K 1/4W
R74	1	82.5K 1/4W
R86, R104	2	100 1/4W
R89, R90	2	2.94K 1/4W
R102	1	13.7K 1/4W
R106, R107, R113, R114, R115	5	47.5 1/4W
TP1	1	15J
X1	1	REGULATOR ASBLY
X2, X4	2	8 PIN I.C. (SS)
X3	1	PWM CONTROLLER I.C. (SS)
X5	1	16 PIN I.C. (SS)
X6	1	MC14584 (SS)
X7	1	DIGITAL INTEGRATED CIRCUIT (SS)
X8	1	LM224 OP-AMP
X9	1	LINEAR INTEGRATED CIRCUIT

CAPACITORS = MFD/VOLTS  
RESISTORS = OHMS

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Power PC Board (G2684) Layout

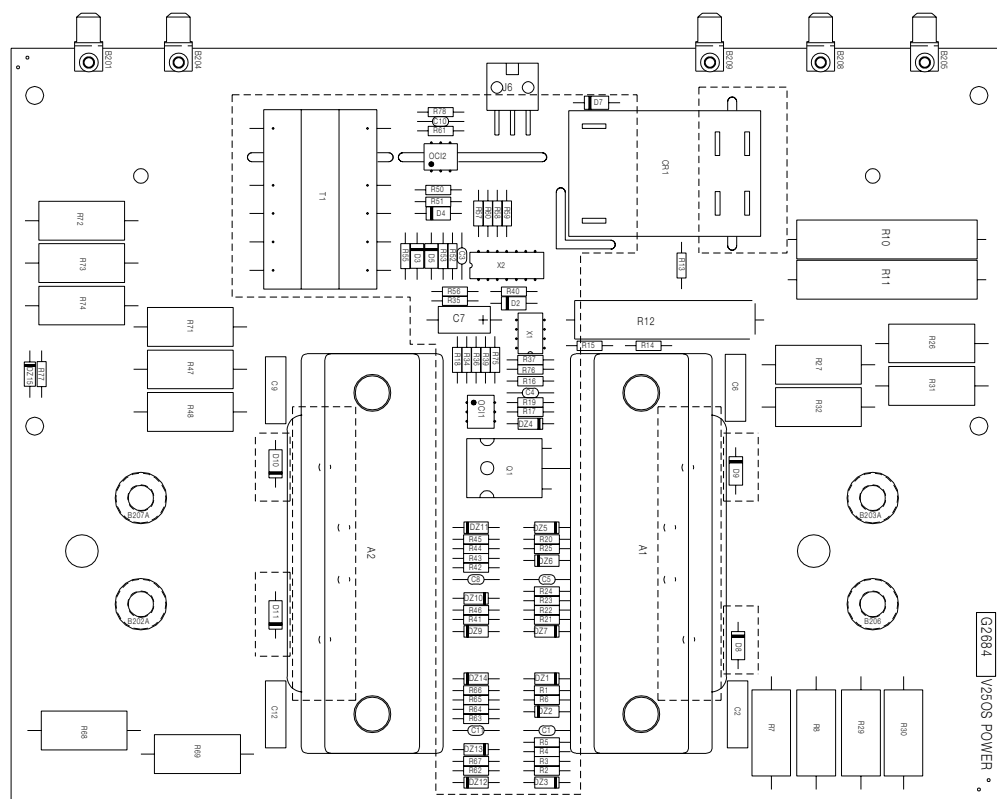
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Return to Master TOC

G2684 POWER P.C. BD. AS'BLY



ITEM	REQ'D	IDENTIFICATION
C1, C5, C8, C11	4	4700PF/50
C2, C6, C9, C12	4	.0047/1000V
C3, C4, C10	3	.022/50
C7	1	27/35
CR1	1	DPST RELAY
D2, D3, D4, D5, D7	5	1N4004
D8, D9, D10, D11	4	DIODE 1000V/1A
DZ1, DZ5, DZ9, DZ12	4	1N4735
DZ2, DZ3, DZ6, DZ7, DZ10, DZ11	9	1N4744A
DZ13, DZ14, DZ15		
DZ4	1	1N4742A
J6	1	HEADER
OC11, OC12	2	OPTO ISOLATOR
Q1	1	FET (SS)
R1, R6, R20, R25, R41, R46, R62	8	10 1/4W
R67		
R2, R3, R4, R5, R21, R22, R23	16	1K 1/4W
R24, R42, R43, R44, R45, R63		
R64, R65, R66		
R7, R8, R26, R27, R47, R48, R68	8	2.7 OHM 5W
R69		
R10, R11, R12	3	100 10W
R13, R14, R15, R16, R34, R35	8	150K 1/4W
R50, R51		
R17	1	100 1/4W
R18, R60, R77	3	1.82K 1/4W
R19	1	267K 1/4W
R29, R30, R31, R32, R71, R72	8	5W / 2500
R73, R74		
R36, R52	2	6.19K 1/4W
R37, R55	2	15K 1/4W
R39, R53	2	16.5K 1/4W
R40, R56	2	332K 1/4W
R57, R59	2	10K 1/4W
R58	1	3.32K 1/4W
R61	1	681K 1/4W
R75	1	562 1/4W
R76	1	2.8K 1/4W
R78	1	475 1/4W
T1	1	TRANSFORMER
X1	1	VOLTAGE REF.
X2	1	LM224 OP-AMP

CAPACITORS = MFD/VOLTS  
RESISTORS = OHMS

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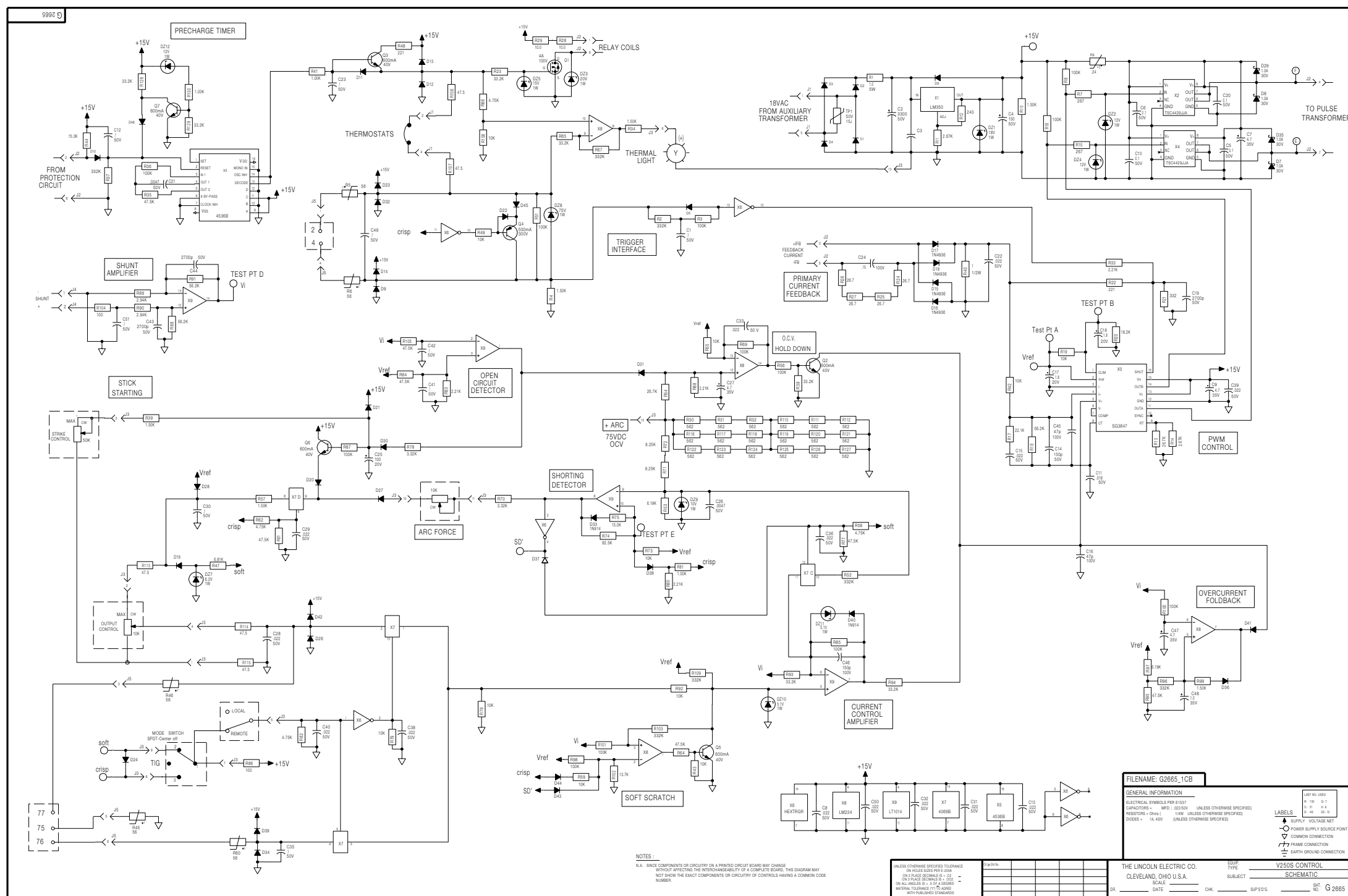
Control PC Board (G2666) Schematic

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Return to Master TOC



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