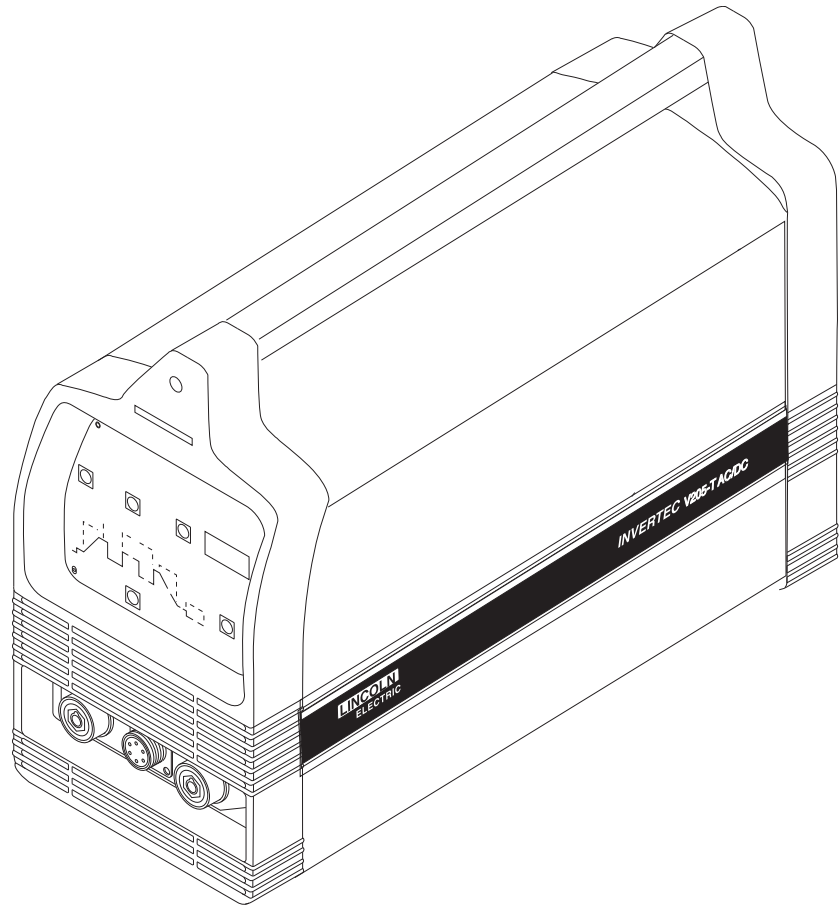


INVERTEC® V205-T AC/DC™

For use with machine code number: **10860**

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



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• World's Leader in Welding and Cutting Products •

• Sales and Service through Subsidiaries and Distributors Worldwide •

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

Download from Www.Somanuals.com. All Manuals Search And Download.

⚠ 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.

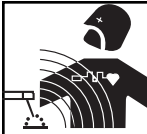


1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

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.

INVERTEC® V205-T AC/DC™





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 within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

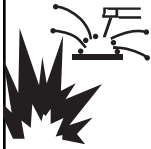
5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically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

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

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.



WELDING and CUTTING SPARKS can cause fire or explosion.

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

- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.
- 6.i. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.
- 6.j. Do not use a welding power source for pipe thawing.



CYLINDER may explode if damaged.

- 7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
 - Away from areas where they may be struck or subjected to physical damage.
 - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.



FOR ELECTRICALLY powered equipment.

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

Refer to <http://www.lincolnelectric.com/safety> for additional safety information.

PRÉCAUTIONS DE SÛRETÉ

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

Sûreté Pour Soudage A L'Arc

1. Protégez-vous contre la secousse électrique:
 - a. Les circuits à l'électrode et à la pièce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vêtements mouillés. Porter des gants secs et sans trous pour isoler les mains.
 - b. Faire très attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher métallique ou des grilles métalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
 - c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état de fonctionnement.
 - d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
 - e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
 - f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces précautions pour le porte-électrode s'appliquent aussi au pistolet de soudage.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas où on reçoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:
 - a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
 - b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
 - c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.
5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans latéraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.
7. Quand on ne soude pas, poser la pince à un endroit isolé de la masse. Un court-circuit accidentel peut provoquer un échauffement et un risque d'incendie.
8. S'assurer que la masse est connectée le plus près possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaînes de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'échauffement des chaînes et des câbles jusqu'à ce qu'ils se rompent.
9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particulièrement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumées toxiques.
10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou 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 place.

Electromagnetic Compatibility (EMC)

Conformance

Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2004/108/EC. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

Introduction

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

Installation and Use

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

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

Assessment of Area

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

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

Electromagnetic Compatibility (EMC)

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

Methods of Reducing Emissions

Mains Supply

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

Maintenance of the Welding Equipment

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

Welding Cables

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

Equipotential Bonding

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

Earthing of the Workpiece

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

Screening and Shielding

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

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

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INVERTEC® V205-T AC/DC™



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TECHNICAL SPECIFICATIONS - V205-T AC/DC™ TIG K1855-1 (Code Number 10860)
INPUT - SINGLE PHASE ONLY

<u>Input Voltages / 50 /60 Hz.</u> 115 230	<u>Max. Input Current</u> 34A at Rated Output 30A at Rated Output
--------------------------------------------------	-------------------------------------------------------------------------

RATED OUTPUT

<u>Duty Cycle</u>	<u>Output Amps</u>	<u>Volts at Rated Amperes</u>	<u>Input Amps</u>
(115V) 35% 60% 100%	(Stick) 110 90 70	24.4V 23.6V 22.8V	34A 28A 20A
(115V) 40% 60% 100%	(TIG) 150 120 100	16V 14.8V 14V	34A 25A 20A
(230V) 35% 60% 100%	(Stick) 180 150 130	27.2V 26V 25.2V	30A 23A 19A
(230V) 40% 60% 100%	(TIG) 200 170 140	18V 16V 15.6V	30A 18A 15A

OUTPUT

<u>Output Current Range</u> 6-200 Amps	<u>Maximum Open Circuit Voltage</u> 54 Volts Max.	<u>Type of Output</u> AC/DC
-------------------------------------------	------------------------------------------------------	--------------------------------

RECOMMENDED INPUT WIRE AND FUSE SIZES FOR MAXIMUM RATED OUTPUT

<u>INPUT VOLTAGE / FREQUENCY (HZ)</u>	<u>TYPE S, SO ST, STO, OR EXTRA HARD USAGE INPUT CORD AWG</u>	<u>TIME-DELAY CIRCUIT BREAKER OR FUSE SIZE (AMPS)</u>
115/50/60 230/50/60	#12	30A

PHYSICAL DIMENSIONS

<u>Height</u> 15 in. 381 mm	<u>Width</u> 8.5 in. 216 mm	<u>Depth</u> 19 in. 483 mm	<u>Weight</u> Approx. 38 lbs. 17 kgs.
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TEMPERATURE RANGES

<u>OPERATING TEMPERATURE RANGE</u> -20°C to +40°C	<u>STORAGE TEMPERATURE RANGE</u> -50°C to +85°C
------------------------------------------------------	----------------------------------------------------

INVERTEC® V205-T AC/DC™


Read entire installation section before starting installation.

Safety Precautions

⚠ WARNING



ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this installation.
- Turn the input power OFF and unplug the machine from the receptacle before working on this equipment. Allow machine to sit for 5 minutes minimum to allow the power capacitors to discharge before working inside this equipment.

- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.
- Always connect the V205-T to a power supply grounded according to the National Electrical Code and local codes.

SELECT SUITABLE LOCATION

The Invertec® 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.

STACKING

The Invertec® V205-T AC/DC™ can not be stacked.

TILTING

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

ENVIRONMENTAL AREA

Keep the machine dry. Do not place it on wet ground or in puddles.

MACHINE GROUNDING AND HIGH FREQUENCY INTERFERENCE PROTECTION

The Capacitor Discharge Circuit used in the high frequency generator, may cause many radio, TV and electronic equipment interference problems. These problems may be the result of radiated interference. Proper grounding methods can reduce or eliminate radiated interference.

The Invertec® V205-T AC/DC™ has been field tested under recommended installation conditions. It complies with FCC allowable limits for radiation.

Radiated interference can develop in the following four ways:

1. Direct interference radiated from the welder.
2. Direct interference radiated from the welding leads.
3. Direct interference radiated from feedback into the power lines.
4. Interference from re-radiation of "pickup" by ungrounded metallic objects.

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

1. Keep the welder power supply lines as short as possible and enclose as much of them as possible in rigid metallic conduit or equivalent shielding for a distance of 50 feet (15.2m). There should be good electrical contact between this conduit and the welder case ground. Both ends of the conduit should be connected to a driven ground and the entire length should be continuous.
2. Keep the work and electrode leads as short as possible and as close together as possible. Lengths should not exceed 25 ft (7.6m). Tape the electrode and work leads together into one bundle when practical.

3. Be sure the torch and work cable rubber coverings are free of cuts and cracks that allow high frequency leakage. Cables with high natural rubber content, such as Lincoln Stable-Arc® better resist high frequency leakage than neoprene and other synthetic rubber insulated cables.
4. Keep the torch in good repair and all connections tight to reduce high frequency leakage.
5. The work terminal must be connected to a ground within ten feet of the welder, using one of the following methods.
 - a) A metal underground water pipe in direct contact with the earth for ten feet or more.
 - b) A 3/4" (19mm) galvanized pipe or a 5/8" (16mm) solid galvanized iron, steel or copper rod driven at least eight feet into the ground.

The ground should be securely made and the grounding cable should be as short as possible using cable of the same size as the work cable, or larger. Grounding to the building frame electrical conduit or a long pipe system can result in re-radiation, effectively making these members radiating antennas.
6. Keep all panels securely in place.
7. All electrical conductors within 50 ft (15.2m) of the welder should be enclosed in grounded, rigid metallic conduit or equivalent shielding. Flexible metallic conduit is generally not suitable.
8. When the welder is enclosed in a metal building, several earth driven electrical grounds connected (as in 5b above) around the periphery of the building are recommended.

Failure to observe these recommended installation procedures can cause radio or TV interference problems.

INPUT CONNECTIONS

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

WARNING

ELECTRIC SHOCK can kill.



- **Have a qualified electrician install and service this equipment.**
- **Turn the input power OFF and unplug the machine from the receptacle before working on this equipment.**
- **Allow machine to sit for 5 minutes minimum to allow the power capacitors to discharge before working inside this equipment.**
- **Do not touch electrically hot parts.**
- **Machine must be plugged into a receptacle that is grounded according to the National Electrical Code and local codes.**
- **Do not remove or defeat the purpose of the power cord ground pin.**

RECONNECT PROCEDURE

The Invertec® V205-T AC/DC™ auto reconnects to either 115V or 230V supply.

Fuse the input circuit with time delay fuses or delay type¹ circuit breakers. Using fuses or circuit breakers smaller than recommended may result in "nuisance" shut-offs from welder inrush currents even if not welding at high currents.

The Invertec® V205-T AC/DC™ is recommended for use on an individual branch circuit.

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

230V INPUT

The equipment is provided with a 230/115V cable, 6.6ft.(2m) in length with a 230V 6-50P attachment plug.

The Invertec® V205-T AC/DC™ performs best when connected to 230VAC inputs. This input allows full output of the machine (200 amps).

115V INPUT

A suitable 115V attachment plug must be installed on the power cord to use the V205-T AC/DC™ with a 115V input supply. The rated output of the V205-T AC/DC™ is available when connected to a 30A branch circuit. When connected to a branch circuit with lower amp rating, lower welding current and duty cycle must be used. An output guide is provided below. The values are approximate and must be adjusted downward if the fuse or circuit breaker trips off. Other loads on the circuit and fuse/circuit breaker characteristics will affect the available output. Do not exceed these welding conditions:

15A branch circuit

10% duty cycle

Stick: 75A

TIG: 105A

20A branch circuit

10% duty cycle

Stick: 90A

TIG: 130A

ATTACHMENT PLUG INSTALLATION

Connect the white (neutral) wire under terminal clamp with silver screw, and black (hot) wire under terminal clamp with brass screw. Connect green wire under terminal clamp with green screw.

WARNING

Failure to wire as instructed may cause personal injury or damage to equipment. To be installed or checked by an electrician or qualified person only.

In all cases, the green or green/yellow grounding wire must be connected to the grounding pin of the plug, usually identified by a green screw.

Attachment plugs must comply with the Standard for Attachment Plugs and Receptacles, UL498.

The product is considered acceptable for use only when an attachment plug as specified is properly attached to the supply cord.

For use on engine drives, keep in mind the above input draw restrictions and the following precaution.

ENGINE DRIVEN GENERATOR

The Invertec® V205-T AC/DC™ can be operated on engine driven generators as long as the 230 volt auxiliary meets the following conditions:

- The AC waveform peak voltage is below 400 volts.
- The AC waveform frequency is between 45 and 65Hz.

The following Lincoln engine drives meet these conditions when run in the high idle mode:

- Ranger 250,305
- Commander 300, 400, & 500

Some engine drives do not meet these conditions (e.g. Miller Bobcats, etc). Operation of the Invertec® V205-T AC/DC™ is not recommended on engine drives not conforming to these conditions. Such drives may deliver unacceptably high voltage levels to the Invertec® V205-T AC/DC™ power source.

OUTPUT CONNECTIONS

⚠ WARNING



ELECTRIC SHOCK can kill.

- Keep the electrode holder, TIG torch and cable insulation in good condition and in place.
- Do not touch electrically live parts or electrode with skin or wet clothing.
- Insulate yourself from work and ground.
- Turn the input line Switch on the Invertec® V205-T AC/DC™ “off” before connecting or disconnecting output cables or other equipment.

OUTPUT AND GAS CONNECTION FOR TIG WELDING (FIGURE A.1)

The TIG Torch Twist-Mate and work cable Twist-Mate Connectors are supplied with the welder. To connect the cables, turn the Power Switch “OFF”. Connect the torch cable Twist-Mate plug into the DC(-) Electrode/Gas Output Receptacle on the front of the welder and turn it clockwise until snug, (Do not Overtighten). This is a quick connect terminal and also provides the gas connection for the shielding gas to the torch.

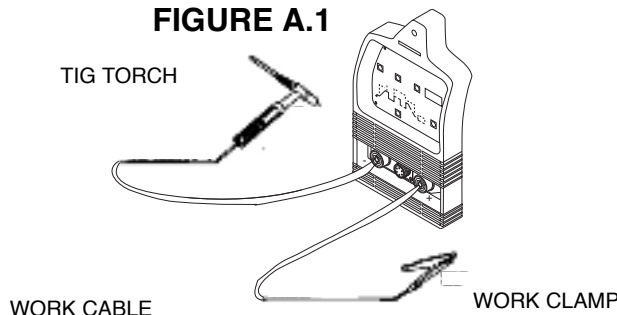
⚠ WARNING

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

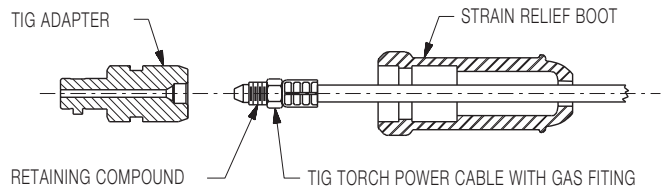
WORK CABLE CONNECTION

Next, connect the work cable to the “+” output terminal in the same way. To minimize high frequency interference, refer to **Machine Grounding and High Frequency Interference Protection** section of this manual for the proper procedure on grounding the work clamp and work piece.

FIGURE A.1



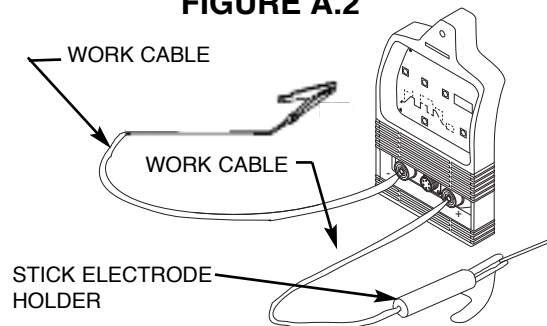
This unit does not include a TIG torch, but one may be purchased separately. The accessories section of this manual lists a number of Lincoln Electric TIG torches, and TIG Torch Starter Packs that are recommended for use with this machine; however, any similar TIG torch can be used. To attach the Twist-Mate Plug to a Lincoln Torch, slide the rubber boot onto the torch cable (enlarge the boot opening if necessary), screw the fitting on the torch cable into the brass connector snugly and slide the boot back over the brass connector.



OUTPUT CONNECTION FOR STICK WELDING (FIGURE A.2)

First determine the proper electrode polarity for the electrode to be used. Consult the electrode data for this information. Then connect the output cables to the output terminals corresponding to this polarity. For instance, for DC(+) welding, connect the electrode cable (which is connected to the electrode holder) to the “+” output terminal and the work cable (which is connected to the work clamp) to the “-” output terminal. Insert the connector with the key lining up with the keyway, and rotate clockwise; until the connection is snug. Do not over tighten.

FIGURE A.2



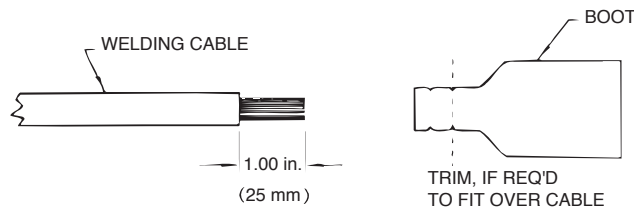
INVERTEC® V205-T AC/DC™



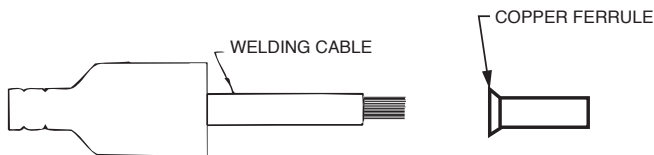
QUICK DISCONNECT PLUG (FOR STICK ELECTRODE CABLE and WORK CABLE)

A quick disconnect system is used for the welding cable connections. The stick electrode cable will need to have a plug attached.

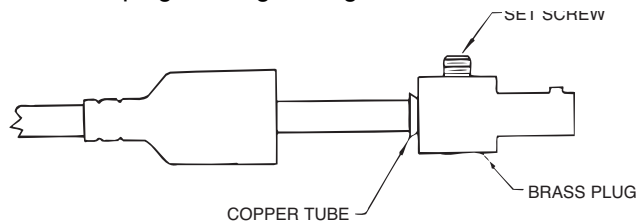
1. Cut off welding cable lug, if present.
2. Remove 1.00 in. (25mm) of welding cable insulation.
3. Slide rubber boot onto cable end. The boot end may be trimmed to match the cable diameter. Use soap or other nonpetroleum-based lubricant to help slide the boot over the cable, if needed.



4. Insert copper strands into ferrule.



5. Slide the copper ferrule into the brass plug.
6. 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.

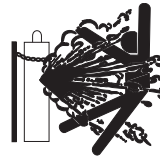


7. Slide rubber boot over brass plug. The rubber boot must be positioned to completely cover all electrical surfaces after the plug is locked into the receptacle.

SHIELDING GAS CONNECTION

Obtain the necessary inert shielding gas. Connect the cylinder of gas with a pressure regulator and flow gage. Install a gas hose between the regulator and gas inlet (located on the rear of the welder). The gas inlet has a 5/16-18 right hand female thread; CGA #032.

⚠ WARNING



CYLINDER could explode if damaged.

- Keep cylinder upright and chained to a support.

- Keep cylinder away from areas where it could be damaged.
- Never allow the torch or welding electrode to touch the cylinder.
- Keep cylinder away from live electrical circuits.

REMOTE CONTROL CONNECTION

A remote control receptacle is provided on the lower center case front of the welder for connecting a remote control to the machine. Refer to the Optional Accessories section of this manual for available remote controls.

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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, electrode 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® V205-T AC/DC™ is an industrial 200 amp arc welding power source which utilizes single phase input power, to produce constant current output. The welding response of this Invertec® has been optimized for stick (SMAW) and TIG (GTAW). The unit is ideal for industrial applications where portability is important.

The Invertec® V205-T AC/DC™ is a power source that can perform the following types of welding with excellent results:

- TIG (with high frequency or Touch Start Tig Starting).
- TIG AC with square, sinusoidal and triangular waveforms
 - Tig DC

The following items can be connected to the 6 pin socket on the front panel:

- Remote control potentiometer for Stick welding.
- Remote Foot Amptrol or Hand Amptrol
- Arc Start Switch

NOTE: See Accessories section of this manual for product numbers and complete description.

WELDING CAPABILITY

The Invertec® V205-T AC/DC™ is rated at 200 amps, 18 volts, at 40% duty cycle on a ten minute basis. It is capable of higher duty cycles at lower output currents. It is capable of 140 amps, 15.6 volts at 100% duty cycle. If the duty cycle is exceeded, a thermal protector will shut off the output until the machine cools. See Technical Specifications in A-1 for other rated outputs.

The Invertec® V205-T is recommended for stick welding with such popular electrodes as Fleetweld 35, Fleetweld 37, Fleetweld 180 and Excalibur 7018.

LIMITATIONS

The V205-T is not recommended for pipe thawing.

REAR CONTROL PANEL (FIGURE B.1)

⚠ WARNING

- I1: Off/On switch turns on the electric power to the welder. It has two positions, "O" off, and "I" on.

* With "I1" in the "I" (ON) position, the welding machine is operational and there is voltage between the positive (+) and negative (-) Terminals in stick welding. In TIG, the welding process needs a trigger closure command at the remote control connection. (Usually via an Arc Start Switch or Foot Amptrol)

* The welder is connected to the supply even if the "I1" (Power Switch) is in the "O" (Off) position, and therefore there are electrically live parts inside the power source. Carefully follow the instructions given in this manual.

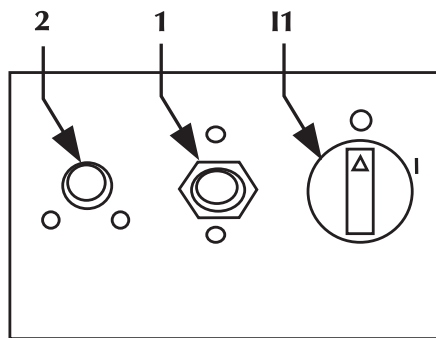


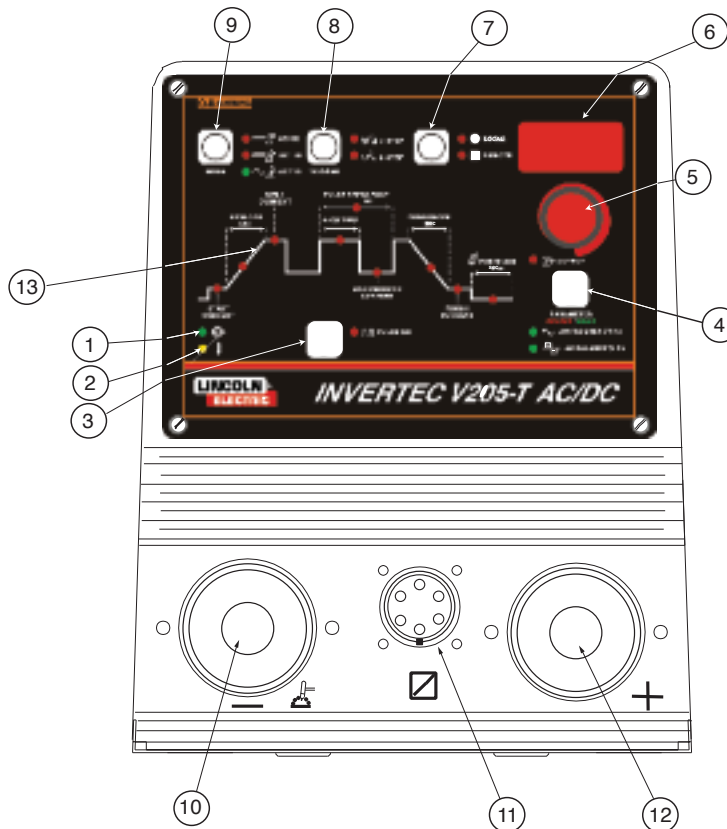
FIGURE B.1

- * 1 : Supply cable
- * 2 : Gas attachment
- I1 : Power Switch

CONTROLS AND SETTINGS

All operator controls and adjustments are located on the case front of the V205-T machine. Refer to Figure B.2 and the corresponding explanations.

FIGURE B.2



1. Input Voltage warning Light Green LED
2. Thermal / Device Warning Light Yellow LED
3. Pulse On/Off Button
4. Setup/Parameter Select Button
5. Output/Parameter Adjust Knob
6. Digital Display
7. Local/Remote Button
8. Trigger Selection Button
9. Welding Process (MODE) Button
10. Electrode Connection (Negative)
11. Remote Control Connector
12. Electrode Connection (Positive)
13. Welding Parameter Drawing

1. Input Voltage warning light green LED - Indicates that the machine is on and input voltage is within acceptable range.

2. Thermal Shutdown Light (yellow LED) - Indicates thermal over load or output disabled for incorrect supply voltage.

- With the "Yellow LED" on, and an alarm code blinking on "Digital Display Item 6" (see Troubleshooting Section E, "Possible electrical problems"), the machine will not supply power at the output.
- If over-heating occurs, the "Yellow LED" will stay on until the machine has sufficiently cooled. Leave the power source on to allow the fan to cool the unit.

3. Pulse On/OFF push button - CONSTANT current
- PULSED current

4. Setup/Parameter Select push button - "Setup/Parameter" push button has three (3) different functions:

- Accesses Welding Parameter. Repeatedly pressing the Parameter button will step through the Welding Parameter waveform lights on the front panel. Parameters which can be changed.

Start Current
Upslope
Weld Current (Peak Current)
Pulse Frequency
% on Time
Background Current
Downslope
Finish Current
Postflow sec.

There is a LED for each welding parameter. When lit, it has confirmed the mode or selection chosen.

- Accesses the "AC Frequency" and "AC Balance" by pressing and holding the Parameter button for three (3) seconds.
- Accesses the "Set Up Menu". See Set Up Menu section.

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5. Output / Parameter Adjust Knob- Allows you to continuously adjust the current both in TIG and in Stick welding. Allows you to change the value, shown on "Digital Display Item 6", of the parameter selected with "Setup/Parameter select button Item 4".

6. Digital Display - displays currently set values for each mode or welding parameter.

7. Local/Remote push button - Selects the welding current adjusting system:

- from front panel
- from remote control

The LED beside the symbol confirms the selection.

8. Tig Trigger Sequences -

For the V205-T AC/DC™, TIG welding can be done in either the 2-step or 4-step mode which is selected with the Trigger Mode Push Button.

2-Step Sequence

With the Trigger Mode switch in the 2-step position, the following welding sequence will occur. This sequence is shown in (2-step diagram 1)

1. Press and hold the Arc Start Switch to start the sequence.

The machine will open the gas valve to start the flow of the shielding gas. After a 0.5 second preflow time, to purge air from the torch hose, the output of the machine is turned ON. At this time the arc is started.

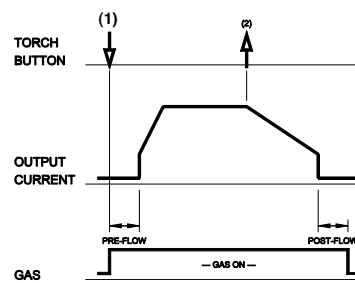
After the arc is started the output current will be increased from the start current to the welding current. Both the start current and increase, or upslope time are presettable. The default start current is 15 amps and the default upslope time is 0.2 seconds.

2. Release the Arc Start Switch to stop welding.

The machine will now decrease the output current at a controlled rate, or downslope time, until the Finish current, (also commonly referred to as Crater Current) is reached and the output of the machine is turned OFF. Both the Downslope Time and the Finish Current are can be preset.

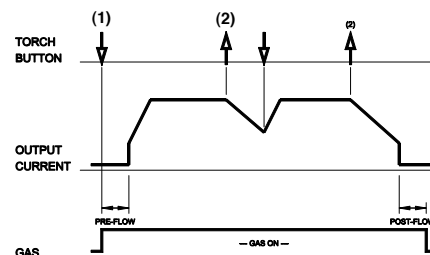
After the arc is turned OFF, the gas valve will remain open to continue the flow of the shielding gas to the hot electrode and work piece. The duration of this postflow shielding gas is adjusted by the Postflow Parameter.

2 STEP DIAGRAM 1



Possible variations of this standard sequence is shown in (2 step diagram 2). It is possible to press and hold the TIG torch trigger a second time during downslope to restart. After the trigger is pressed the output current will increase to the welding current. This operation is shown in (2 step diagram 2).

2 STEP DIAGRAM 2



4-Step Sequence

With the 4-step Selected, the following welding sequence will occur.

1. Press and hold the Arc Start Switch to start the sequence.

The machine will open the gas valve to start the flow of the shielding gas. After a 0.5 second preflow time, to purge air from the torch hose, the output of the machine is turned ON. At this time the arc is started.

After the arc is started the output current will be at the Start current. This condition can be maintained as long or as short as necessary.

If the Start current is not necessary, do not hold the TIG torch trigger as described at the beginning of this step. Instead, quickly press and release the trigger. In this condition, the machine will automatically pass from Step 1 to Step 2 when the arc is started.

2. Release the TIG torch trigger to start the main part of the weld.

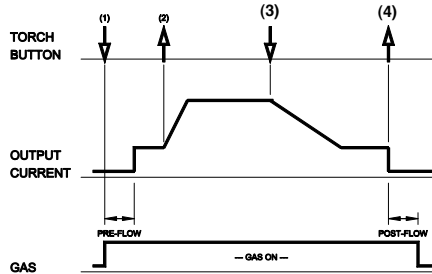
The output current will be increased from the start current to the welding current. Both the start current and increase, or upslope time are presettable. The default start current is 15 amps and the default upslope time is 0.2 seconds.

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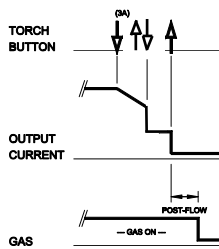
3. Press and hold the TIG torch trigger when the main part of the weld is complete.
The machine will now decrease the output current at a controlled rate, or downslope time, until the Finish current is reached. Both the Downslope Time and the Finish Current are presettable. This Finish current can be maintained as long or as short as necessary.
4. Release the TIG torch trigger.
The output current of the machine will turn OFF and the gas valve will remain open to continue the flow of the shielding gas. The duration of this postflow time is adjusted by the Postflow parameter. This operation is shown in (4 step diagram 1).

4 STEP DIAGRAM 1



Possible variations of this standard sequence are shown below.
By releasing and re-pressing the TIG torch trigger during the downslope step, the output will immediately drop to and hold at the Finish Current. Releasing the trigger will turn off the output and begin postflow. This operation shown in (4 step diagram 2)

4 STEP DIAGRAM 2



9. **Welding selection button** - Permits selection of the welding mode. The LED beside the symbol confirm the selection:
 - Stick
 - TIG DC
 - TIG AC
10. **Electrode Connection (Negative)** - For quick disconnect system using Twist-Mate™ cable plugs with gas pass through for TIG Torches.
11. **Remote Control Connector** - For the connection of a Lincoln Foot Amptrol, Hand Amptrol or Arc Start Switch. See the ACCESSORIES section for available options.
12. **Electrode Connection (Positive)** - For quick disconnect system using Twist-Mate™ cable plugs

13. **Welding Parameter Display** - LED's show which mode or welding parameter is activated for adjustment.
 - If it is necessary to modify the welding parameters "Item 13":
 - Wait four seconds after the LED's on the panel have gone out, the welding current LED will be lit.
 - Press the SETUP/Parameter push button "Item 4"; every time the push button is pressed, one of the LED's in the diagram "Item 13" comes on (in clockwise sequence) and the value of the parameter appears on the Digital display "Item 6". Stop at the desired parameter.
 - Rotate the Output/Parameter Adjust Knob "Item 5" and modify the parameter value.
 - Press the SETUP/Parameter "Item 4" push button again to pass to another parameter, or wait five seconds and the Weld Current LED will come on again.

WELDING PARAMETER DEFAULTS AND RANGES

PARAMETER	VALUE	MIN	MAX	DEFAULT
START CURRENT	AMPS	6	MAX	15
UPSLOPE	SEC.	0	10	0.2
WELD CURRENT*	AMPS	6	MAX	100
DOWNSLOPE	SEC.	0	10	1.0
FINISH CURRENT	AMPS	6	MAX	8
POSTFLOW	SEC.	0.2	60	5.0
PULSE FREQUENCY	HZ	0.1	500	0.5
% ON TIME	%	5	95	50
BACKGROUND CURRENT	% OF WELD CURRENT	1	100	20
AC FREQUENCY	HZ	20	150	100
AC BALANCE	% EN (EN = Electrode Negative)	35	85	65
MODE				DC TIG
TRIGGER				2 STEP
LOCAL / REMOTE				LOCAL

* Maximum Weld Current can be limited by input voltage, Welding Mode, AC TIG waveform and AC TIG frequency.

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OUTPUT LIMITATIONS

The maximum output current as specified in the installation section of this manual is derated in two situations; alternate AC Wave Forms and elevated AC Frequencies.

- Alternate AC Wave Forms (See Set Up Menu)
 - Square 200 amps max. output
 - Sinusoidal 150 amps max. output
 - Triangular 120 amps max output
- Elevated AC Frequencies
 - Above 85Hz (AC output) the square wave output is limited to 170 amps. Elevated AC Frequencies do not effect the output of Sinusoidal and Triangular Waveforms.

These derated values have been programmed into the Invertec® V205-T AC/DC™ to ensure reliable operation.

DC TIG WELDING

(see FIGURE B.3)

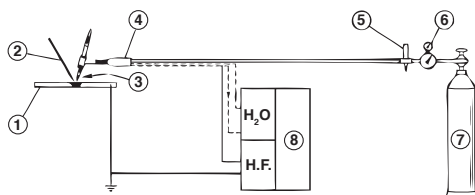
The TIG (Tungsten Inert Gas) welding process is based on the presence of an electric arc between a non-consumable electrode (pure or alloyed tungsten with an approximate melting temperature of 3370°C) and the workpiece. An inert gas (typically argon) atmosphere protects the weld pool.

To avoid inclusions of tungsten in the joint, the electrode should not contact the workpiece. For this reason the arc is started through a Hi. Freq. generator.

For situations requiring no Hi. Freq., Touch Start Tig reduces the short-circuit current to keep tungsten inclusions to the minimum.

To improve weld bead quality at the end of the weld it is important to carefully control the downslope of current and ensure proper gas coverage over the weld.

FIGURE B.3



- | | |
|-----------------------------|--------------------------------|
| 1) Workpiece | 5) Flowmeter |
| 2) Filler material | 6) Pressure reducer |
| 3) Non-consumable electrode | 7) Inert gas (typically argon) |
| 4) Torch | 8) Power source |

WELDING POLARITY

DC Electrode Negative Polarity (Direct Current Straight Polarity)

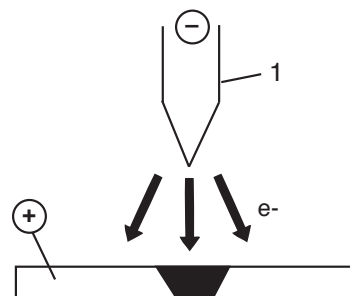
(see FIGURE B.4)

While Welding, there is a continuous flow of electrons from the electrode to the workpiece.

This is the most used polarity, ensuring limited wear of the electrode, since the majority of the heat concentrates on the anode (workpiece). Narrow and deep welds are obtained with high travel speeds.

Most materials, with the exception of aluminum and magnesium, are welded with this polarity.

FIGURE B.4



DC Electrode Positive Polarity. (Direct Current Reverse Polarity) (see Figure B.5)

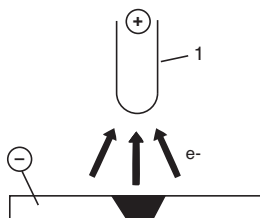
In this case, there is a continuous flow of electrons from the workpiece to the electrode. The reverse polarity is used for welding alloys covered with a layer of refractory oxide.

With this polarity the electrode functions as anode and is subjected to a high degree of heat; the workpiece is bombardment by positive ions sent from the electrode which break the surface oxide.

In Electrode Positive Polarity, high currents cannot be used, since they would cause an excessive wear of the electrode.

NOTE: (The Invertec® V205-T AC/DC™ cannot be used for Electrode Positive TIG welding without special adapters.)

FIGURE B.5



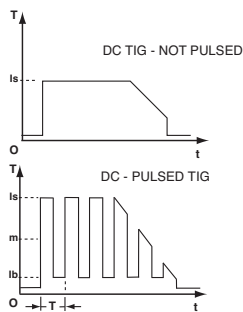
D.C.-Pulsed TIG (see Figure B-6)

The use of pulsed direct current allows better control of the weld pool during certain operating conditions.

When compared with traditional TIG welding performed at the same average current, pulsed welding results in a smaller heat affected zone which results in fewer deformations and reduced chance of cracking and gas entrapment.

Increasing the frequency constricts the arc, increases stability and improves weld quality.

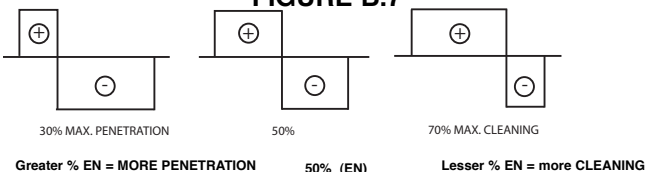
FIGURE B.6



A.C. (Alternating Current) (see Figure B.7)

Alternating Current welding is typically used for Tig welding aluminum (and its alloys) or magnesium. The polarity alternates between Electrode Positive and Electrode Negative (EN). During the positive half-wave the oxide is broken. During the negative half-wave, the electrode cools, the workpiece melts and penetration occurs.

FIGURE B.7

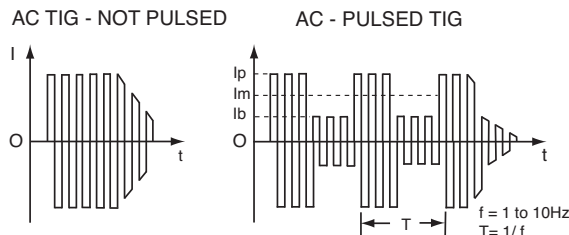


Changing the wave balance alters the ratio between the cleaning and the penetrating current.

A.C.-Pulsed TIG

When AC welding, a pulsed current can be used, with similar effects to those described in **pulsed direct current welding**.

FIGURE B.8



STEEL TIG WELDING

The TIG process is very effective for welding both carbon steel and alloy steel, especially in applications requiring precision results. DC Electrode Negative Polarity is required. Since this process does not include the removal of impurities, proper cleaning and preparation of the edges is required.

FILLER MATERIAL:

The filler rods must deposit welds with mechanical characteristics appropriate for the application.

COPPER TIG WELDING

Since the TIG welding is a process characterized by high heat concentration, it is particularly suitable for welding materials with high thermal conductivity, like copper. As with steel, the DC Electrode Negative Polarity is employed, with argon as protective gas. Considering the fluidity of molten copper, the use of backup support may prove useful.

FILLER MATERIAL:

In order to avoid the oxidation of the molten material, filler materials containing phosphorus, silicon or other deoxidating materials are typically used. The mechanical properties can also be improved through the use of silver.

TIPS FOR AC TIG WELDING

AC Inverter TIG power sources offer two significant advantages over conventional Silicon Controlled Rectifier (SCR) / transformer power sources:

1. The AC wave balance can be set to a higher percentage electrode negative which minimizes tungsten heating and erosion.
2. The AC frequency can be varied to "focus" the arc. Increasing the AC frequency above 60Hz will narrow the cone shape arc from the tungsten's tip. Decreasing the AC frequency below 60Hz will broaden the cone shape arc from the tungsten's tip.

The two above benefits can be used to maintain a tight focus of the arc for precise heat control and tight joint access. Because of the AC inverters abilities in these areas the following recommendations are made as a starting point:

- A 2% Thoriated tungsten is recommended instead of the Pure tungsten that is normally recommended for AC welding. Thoriated tungstens emit electrons easier and therefore will improve starting.
- Sharpen the tungsten to a point. Normally it is recommended to pre-ball a pure tungsten when AC welding with a conventional power source. However, the AC inverter with it's extended AC balance control minimized tungsten heating thus allowing for a pointed tungsten to be used.
- Set the AC Balance control to maximum 85% electrode negative. This can be reduced if the material welded is heavily oxidized, however starting at maximum and adjusting to less is desired.
- Set the AC Frequency in the 100 to 120 Hz range. This is a "Sweet Spot" for most aluminum applications.

GTAW Process					
Electrode Polarity		DC-	AC	Approximate Argon Gas Flow Rate C.F.H. (l/min.)	
Electrode Tip Preparation		Sharpened	Sharpened		
Electrode Type					
Electrode Size-in. (mm)		EWTh-2, EWLa-1	EWTh-2, EWLa-1	Aluminum	Stainless Steel
.010	(0.25)	Up to 15 A.	Up to 15 A.	3-8 (2-4)	3-8 (2-4)
.020	(0.50)	Up to 15 A.	Up to 20 A.	5-10 (3-5)	5-10 (3-5)
.040	(1.0)	Up to 80 A.	Up to 60 A.	5-10 (3-5)	5-10 (3-5)
1/16	(1.6)	Up to 150 A.	Up to 130 A.	5-10 (3-5)	9-13 (4-6)
3/32	(2.4)	Up to MAX. A.	Up to MAX. A.	13-17 (6-8)	11-15 (5-7)
1/8	(3.2)	X	X	15-23 (7-11)	11-15 (5-7)

Tungsten electrodes are classified as follows by the American Welding Society (AWS):

- +2% ThoriaEWTh-2...red
- +1.5% LanthanaEWLa-1...black

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PROTECTIVE GAS

Both argon and helium work when welding aluminum. Argon is preferred, due to its lower cost and consumption rate. This gas also tends to stabilize the arc, thus making it easy to operate. For some applications, however, the use of helium, or argon-helium blends, is recommended due to better weld penetration and faster travel speed. Helium is especially suitable for welding thick workpieces. The recommended gas flow rates are shown in table 5.

TABLE 5

Current (A)	Helium cfh-(l/min)
50	29 - (14)
100	29 - (14)
150	42 - (20)
200	42 - (20)
250	53 - (25)
300	53 - (25)

AC TIG WELDING QUICK START UP

⚠ WARNING



ELECTRIC SHOCK can kill.

- **Have an electrician install and service this equipment.**

- **Turn the input power off at the fuse box, disconnect or unplug supply lines and allow machine to sit for five minutes minimum to allow the power capacitors to discharge before working inside this equipment.**

- **Do not touch electrically hot parts.**

Connect the shielding gas – typically argon – using a appropriate regulator. Connect the foot amptrol, torch and work lead to the power source.

With the work cable connected to a properly grounded work piece, turn the power source on.

The Invertec® V205 T AC/DC TIG is ready to AC TIG weld with the following features:

- AC TIG
- Trigger Mode in 2 step mode
- Local control
- Pulser off
- AC Square Wave
- AC Balance 65% EN
- AC Frequency 100HZ
- Pre Flow .5sec.
- Post Flow 5 sec.
- High Freq Start

Change from Local to Remote control by pushing front panel push button.

Set the maximum output current desired using the Output Control. Initiate the arc by closing the arc start switch. The Amptrol will control the output current from 10 amps to current level set by Output Control.

To change the AC Frequency, press and hold the Parameter button for 3 seconds. The AC Frequency is now selected and can be varied by the Output Control. The frequency is displayed on the digital meter. After about 5 seconds, the power source will switch back to the welding mode ready to weld with the new selected AC Frequency.

To change the AC Balance, press and hold the Parameter button for 3 seconds, AC Frequency is selected, press the Parameter button again and AC Balance is selected. Adjust the Output Control for the desired AC Balance. After about 5 seconds, the power source will switch back to the welding mode ready to weld with the new selected AC Balance.

To change the Post Flow time, repeatedly push the Parameter button until the Post Flow indicator light is on. Adjust the Output control to the desired Post Flow time as indicated on digital display.

DC TIG WELDING QUICK START UP

 **WARNING**


ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment.

- Turn the input power off at the fuse box, disconnect or unplug supply lines and allow machine to sit for five minutes minimum to allow the power capacitors to discharge before working inside this equipment.

- Do not touch electrically hot parts.

Connect up the shielding gas – typically argon – using an appropriate regulator. Connect foot amptrol, torch and work lead to power source.

With the Work cable connected to a properly grounded work piece, turn the power source on.

To change to DC TIG Welding:

- Press Mode button to select "DC TIG."
- Press Trigger Mode button and set to 2-step.
- Press Local / Remote Mode button and set for Remote.
- Pulsing parameters selected by Parameter button, and changed using Output Control.

Set the maximum output current desired using the Output Control.

Initiate the arc by closing the Foot Amptrol's arc start switch. The Amptrol will control the output current from 10 amps to current level set by output control.

To change the Post Flow time, repeatedly push the Parameter button until the Post Flow indicator light is on. Adjust the Output control to the desired Post Flow time as indicated on digital display.

To change from High Frequency to Lift Start, turn power source off. Press and hold the Parameter button while the power source is turned on. A "0" in the center of the digital display indicates the Set Up Menu is now active. Rotate the Output Control until # 8 is displayed. Press the Parameter button again and rotate the Output Control until "1" is displayed. Press the Parameter button to accept this setting. Rotate the Output Control until "0" is displayed. Press the parameter button to exit the Set Up Menu.

Accessories **C-1**

Options/Accessories C-2

Factory Installed C-2

Field Installed C-2

Tig Torch Kits C-2

Cable Plugs C-2

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OPTIONAL ACCESSORIES AND COMPATIBLE EQUIPMENT

Factory Installed

Twist-Mate Cable Connectors
 1 – standard for Ground Clamp
 1 – Gas Pass through for Tig Torch
 Strap Packet
 Instruction Manual

Field Installed

K857 - Remote Output Control - For Stick welding. When the V205-T's Output Control is in the "REMOTE" position, this portable current control provides the same range as the current control on the welder. Consists of a 6-pin Amphenol connector which plugs into the remote control Amphenol. 25 foot cable length.

K870 - Foot Amptrol™ for TIG welding. When the V205-T's Output Control is in the "REMOTE" position, the foot Amptrol energizes the output and controls the output remotely. The Foot Amptrol connects directly to the 6 pin Amphenol.

K963-3 - Hand Amptrol™ for TIG welding. When the V205-T'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.

K814 - Arc Start Switch - Energizes the output for TIG welding if remote output control of the amperage is not desired. It allows on/off TIG welding at the current set by the Current Control on the control panel. When using the Arc Start Switch set the Output Control to the "LOCAL" position.

Magnum® PTA-9 and PTA-17 TIG Torches - The following standard Magnum® TIG torches with one-piece cable may be used with the Invertec® V205-T.

- K1781-1 PTA-9 12.5 ft medium back cap
- K1781-3 PTA-9 25 ft medium back cap
- K1782-1 PTA-17 12.5 ft long back cap
- K1782-3 PTA-17 25 ft long back cap

NOTE: Each torch requires a Twist-Mate adapter, (one is included with the machine). Collets, collet bodies, and nozzles are not included and must be ordered separately.

TIG TORCH KITS

K2266-1 – TIG-Mate 17 Air Cooled TIG Torch Starter Pack. One complete easy-to-order kit packaged in its own portable carrying case. Includes: PTA-17 torch, parts kit, Harris flowmeter/regulator, 10 ft. gas hose, Twist-mate™ adapter, work clamp and cable.

K2267-1 – TIG-Mate 20 Water-Cooled TIG Torch Starter Pack. One complete easy-to-order kit packaged in its own portable carrying case. Includes: PTW-20 torch, parts kit, Harris flowmeter/regulator, 10 ft. gas hose, Twist-Mate™ adapter, work clamp and cable, and 10 ft. water hose.

CABLE PLUGS

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

Twist-Mate Torch Adapter K1622-1 - One is shipped with the welder torch. If you do not care to interchange this part between torches (one is required to connect Magnum PTA-9 or PTA-17 TIG torches with one-piece cable to the V205-T) you may order an additional adapters. The quick connect plug provides connection for both gas and welding current.

K1622-4 – Twist-Mate adapter for Water-Cooled TIG torches. Adapter for PTW-18 and -20 Torches.

TIG Torch Parts Kits - Parts kits are available for the PTA-9 and PTA-17 TIG torches. These kits include back cap, collets, collet bodies, nozzles and tungstens.

Order KP507 for PTA-9 torches

Order KP508 for PTA-17 torches

See publication E12.150 for parts kits breakdown.

Cut Length Consumables - TIG welding filler metals are available for welding stainless steel, mild steel, aluminum and copper alloys. See publication C9.10.

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 Input Filter Capacitor Discharge ProcedureD-2

 Routine MaintenanceD-2

 Major Component LocationD-3

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SAFETY PRECAUTIONS



WARNING



ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box, disconnect or unplug supply lines and allow machine to sit for five minutes minimum to allow the power capacitors to discharge before working inside this equipment.
- Do not touch electrically hot parts.

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

The machine has internal capacitors which are charged to a high voltage during power-on conditions. This voltage is dangerous and must be discharged before the machine can be serviced. Discharging is done automatically by the machine each time the power is switched off. However, you must allow the machine to sit for at least 5 minutes to allow time for the process to take place.

ROUTINE MAINTENANCE

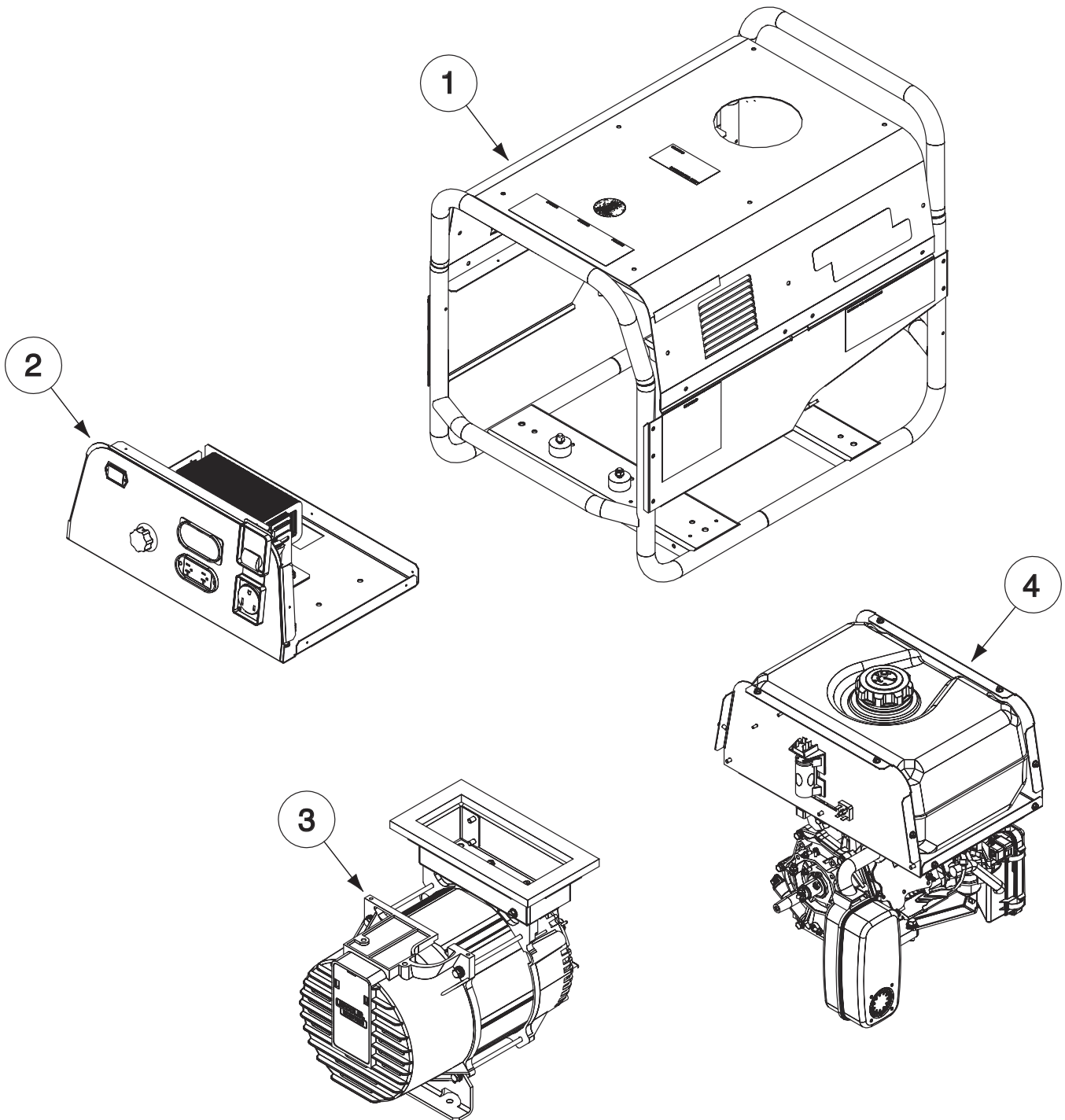
Prevent metal powder from accumulating near the aeration fins and over them.

Carry out the following periodic controls on the power source:

- Clean the power source inside by means of low-pressure compressed air.
- Check the electric connections and all the connection cables.
- Always use gloves in compliance with the safety standards.

FIGURE D.1 - MAJOR COMPONENT LOCATIONS

1. Cradle Tube Assembly and Roof
2. Control Panel Assembly
3. Stator & Rotor Assembly and Battery
4. Rear Control Panel, Fuel Tank Assembly, and Engine



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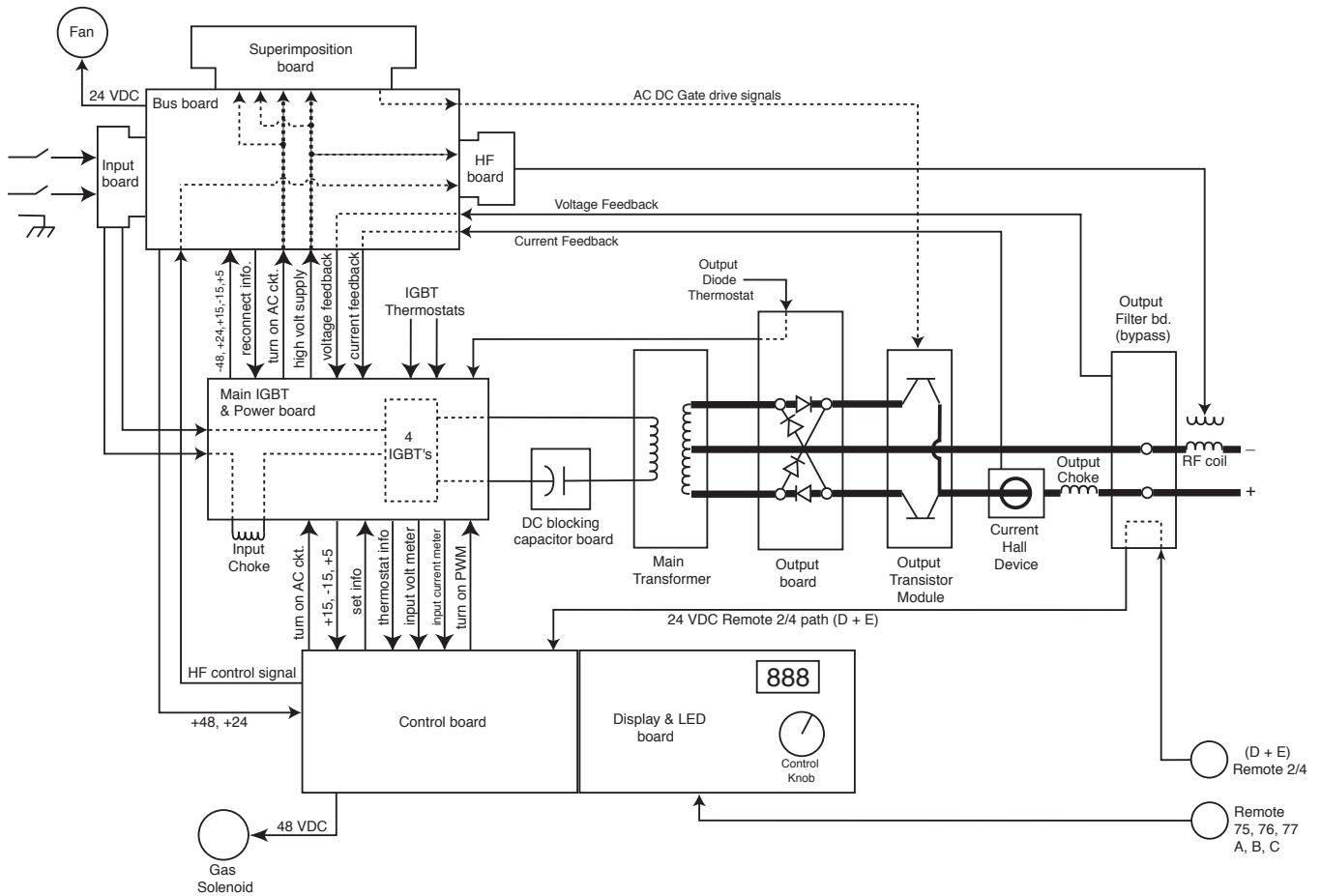
 Control/Display BoardE-5

 High Frequency BoardE-5

 Output Filter BoardE-5

 Insulated Gate Bipolar Transistor (IGBT) OperationE-6

FIGURE E.1 - V205-T BLOCK LOGIC DIAGRAM



INVERTEC® V205-T AC/DC™



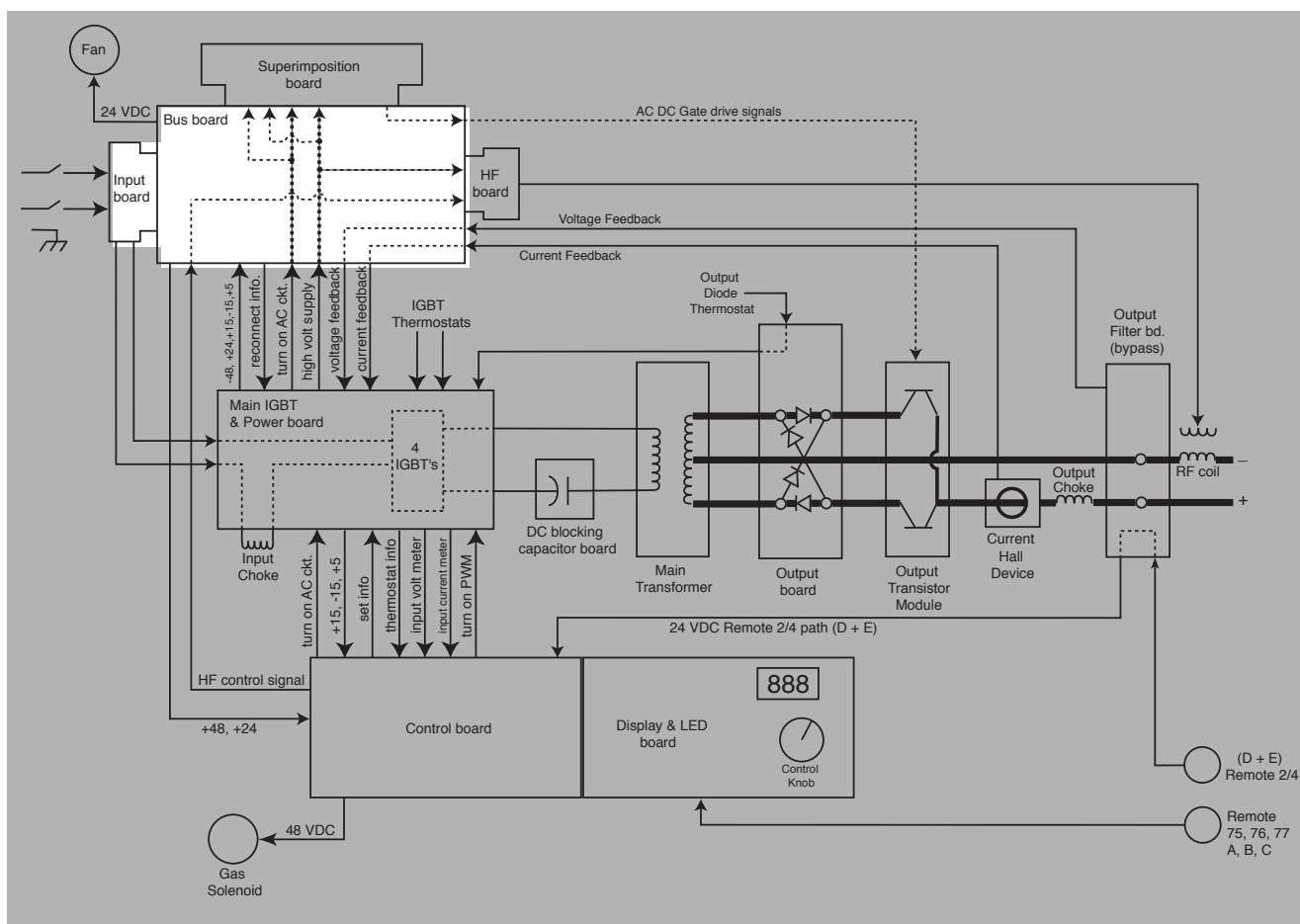
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FIGURE E.2 - GENERAL DESCRIPTION, INPUT BOARD & BUS BOARD



GENERAL DESCRIPTION

The Invertec® V205T AC/DC is an inverter based industrial welding power source that utilizes single-phase input power to produce constant current AC or DC output for both Stick (SMAW) and TIG (GTAW). With 230VAC input applied the V205T is rated at 200 amps, 18volts at a 40% duty cycle. With 115VAC applied the machine is rated at 150 amps, 16 volts at a 40% duty cycle. The machine has the capabilities to produce several varieties of AC waveforms (square, sinusoidal and triangular). The unit also employs an auto reconnect feature that does not require manual intervention when the input power is changed from 115VAC to 230VAC or 230VAC to 115VAC. When in the TIG mode the operator may select to use either the high frequency or touch start function.

INPUT BOARD AND BUS BOARD

The single phase input voltage is applied to the V205T through a line switch located on the back of the machine. The AC input voltage is filtered and conditioned by a network of inductors, capacitors and a varistor that are all located on the Input Board. This fil-

tered input voltage is applied to the Main IGBT Inverter Board. Another function of the Input Board is to prevent high frequency inverter generated “noise” from being induced back into the supply lines.

The Bus Board performs several functions within the V205T. It accepts and distributes power and information to other circuitry. This interfacing is accomplished through harness and ribbon connectors and also via other PC boards that are plugged directly into the Bus Board. The Input Board, the High Frequency Board and the AC Super-Imposition Board plug into the Bus Board. Circuitry located on the Main IGBT Inverter Board, the Control Board, the Output Module Board, the Output Filter Board and the Hall Effect Device interface with the Bus Board. Some circuits are also incorporated within the Bus Board. They are the fan circuit (24VDC) and an input voltage sensing circuit that is utilized by the auto reconnect circuitry located on the Main Inverter Board.

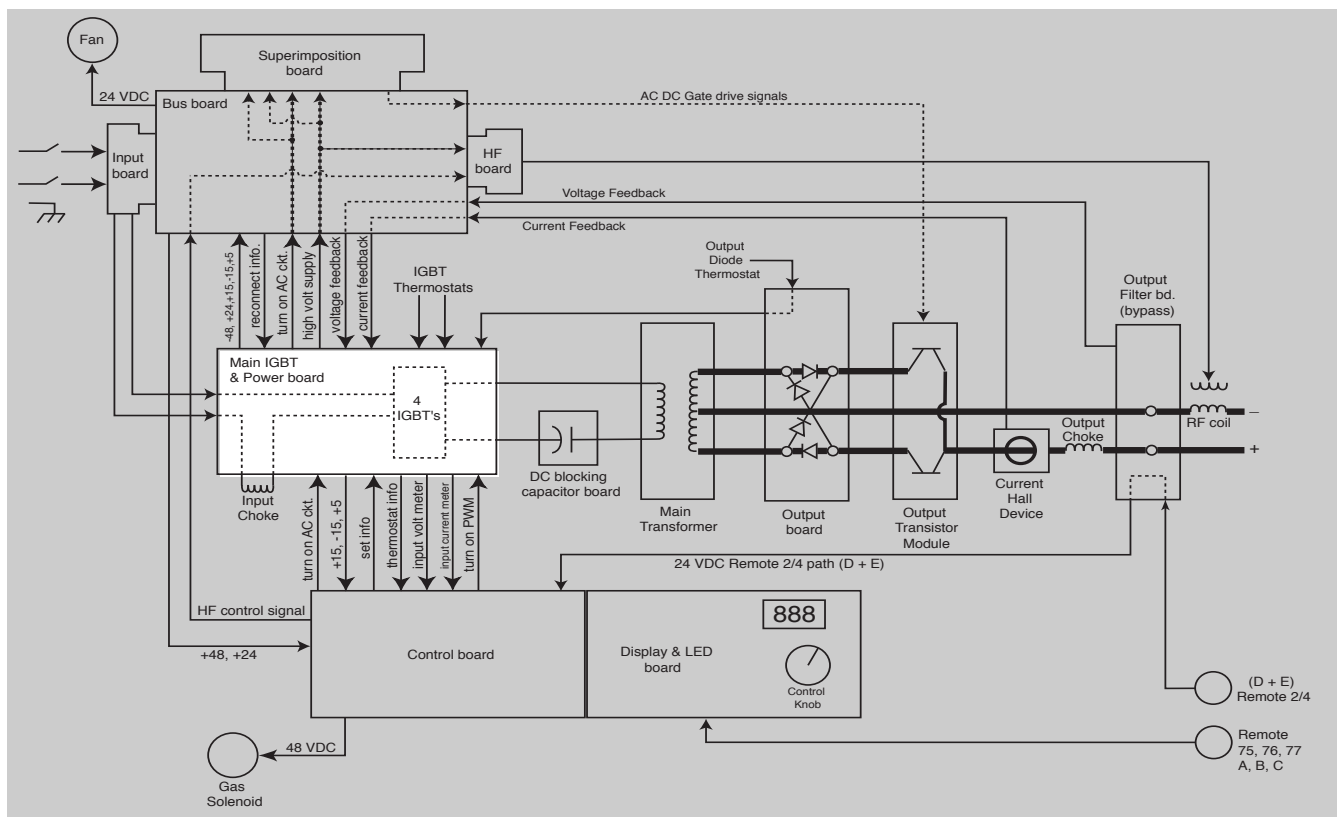
The fan fuse F3, the 400VDC fuse F2 and the water cooler F1 (not used) are also located on the Bus Board.

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

INVERTEC® V205-T AC/DC™



FIGURE E.3 - MAIN IGBT INVERTER BOARD



MAIN IGBT INVERTER BOARD

The filtered input voltage, from the Input Board, is applied through an input choke to the Main IGBT Inverter Board. This input voltage is rectified, regulated and a unity power factor output is developed for the main welding IGBTs. This unity power factor circuit provides several advantages over a traditional bridge rectifier circuit. Among these advantages are that the UPFR operates over a wide range of voltages, there is no need for any manual circuit changes when the input voltages are changed from 115VAC to 230VAC and there is absolute voltage stability maintained on the IGBT electrolytic capacitors. The four main welding IGBTs are located on a large center mounted heat sink assembly.

The pre-charge and auto reconnect circuits are positioned on the Main IGBT Inverter Board. When power is first applied to the V205T the rectified DC input voltage is applied to the input capacitors through a current limiting circuit. The capacitors are charged slowly and current limited for approximately five seconds. After five seconds a relay closes and the pre-charge circuit is bypassed and a controlled DC input voltage is applied to the weld capacitors and IGBTs making them ready for welding output demands when the IGBTs are gated on. The auto reconnect circuit receives and processes a low-level voltage signal from the Bus Board. This low level signal is utilized to adjust for the

different voltage requirements needed by the weld IGBT circuits. A signal is also sent to the Control Board so that when the input voltage is reduced the output of the machine will be limited accordingly.

The Auxiliary power portion of the board generates several voltages through flyback topology and a 50KHZ switching frequency. These various voltages (+24, +15, +5, +48 and -15) are utilized to operate the control and protection electronics, the gas solenoid, the trigger circuit and the fan motor.

The Main IGBT Inverter Board receives command and pre-set signals from the Control/Display board. It also receives feedback information, both voltage and current, from the Output Filter Board and Hall Effect Device via the Bus Board. It processes this information and generates the correct pulse width modulation signal (PWM) that is applied to the gates of the weld IGBTs. This controls and regulates the output of the machine. The thermostats signals are connected to the Main IGBT Inverter Board. This status information is passed on to the Control Board. In the case of an over temperature condition the Control Board will prevent output until the machine cools and the thermostats reset.

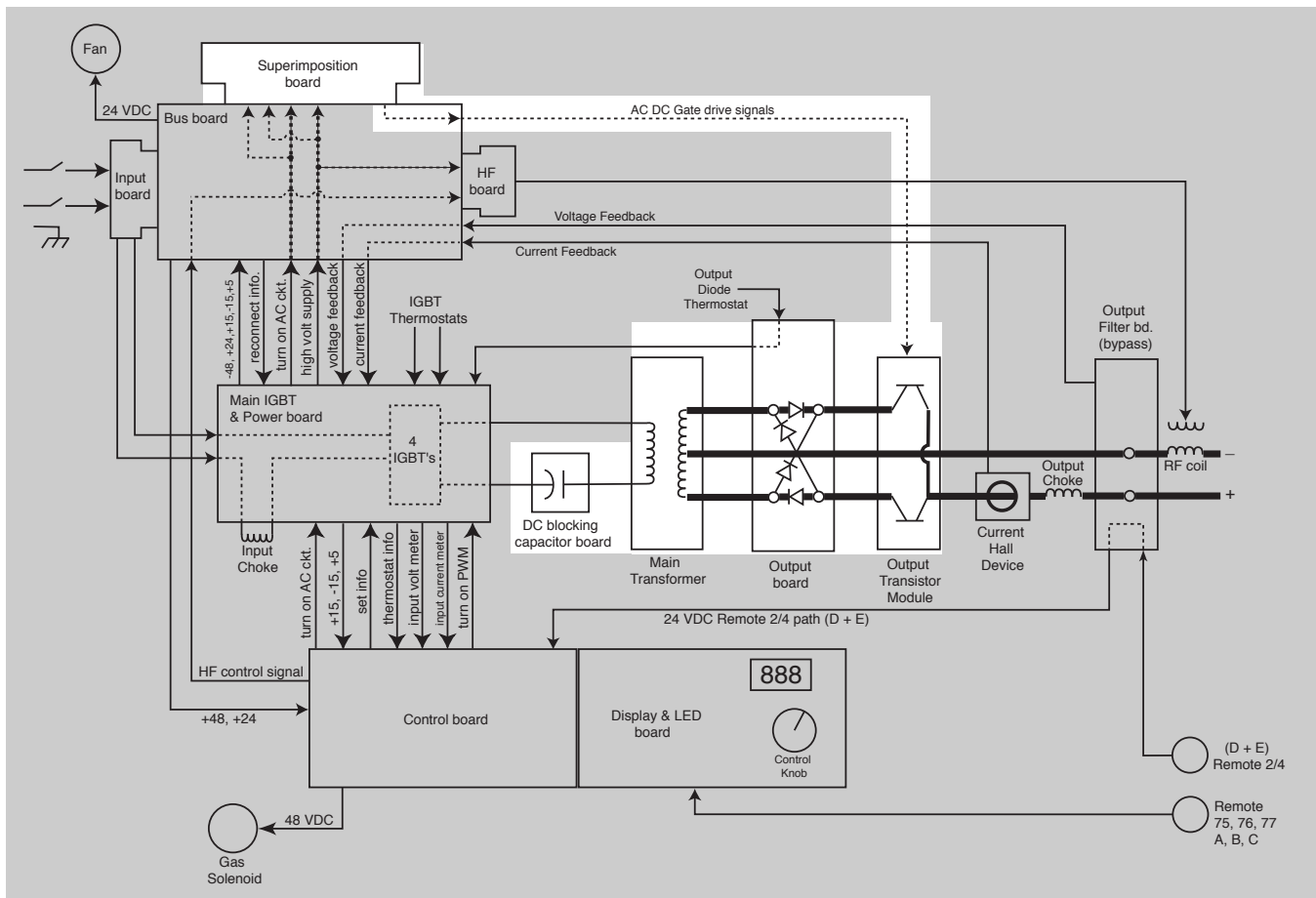
Low-level analog signals are generated on the Main IGBT Inverter Board and sent to the Control/Display Board for meter set and actual display values.

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

INVERTEC® V205-T AC/DC™

LINCOLN
ELECTRIC

**FIGURE E.4 - MAIN TRANSFORMER, OUTPUT DIODE MODULE & CLAMPING BOARD,
OUTPUT TRANSISTOR MODULE & SUPERIMPOSITION BOARD**



MAIN TRANSFORMER

The 100KHZ output of the Main IGBT Inverter Board is coupled, through a DC Blocking Capacitor Board, to the primary of the Main Transformer. The transformer reduces the high voltage (low current) input applied to the primary winding and through transformer action develops a lower secondary voltage capable of high output currents.

OUTPUT MODULE AND CLAMPING BOARD

The AC output of the Main Transformer is applied to the Output Modules for full wave rectification. The Clamping Diodes function as a filter eliminating any pulsed over-voltages that may be present at the Output Modules. The Clamping Board protects the Output Modules from damage due to higher than normal voltage spikes.

OUTPUT MODULE TRANSISTOR BOARD

This module produces the AC waveforms and frequencies. It receives command signals from the Superimposition Board. Depending on which of the two IGBTs is active at any given moment the welding output of the machine can be either positive or negative AC or DC.

SUPERIMPOSITION BOARD

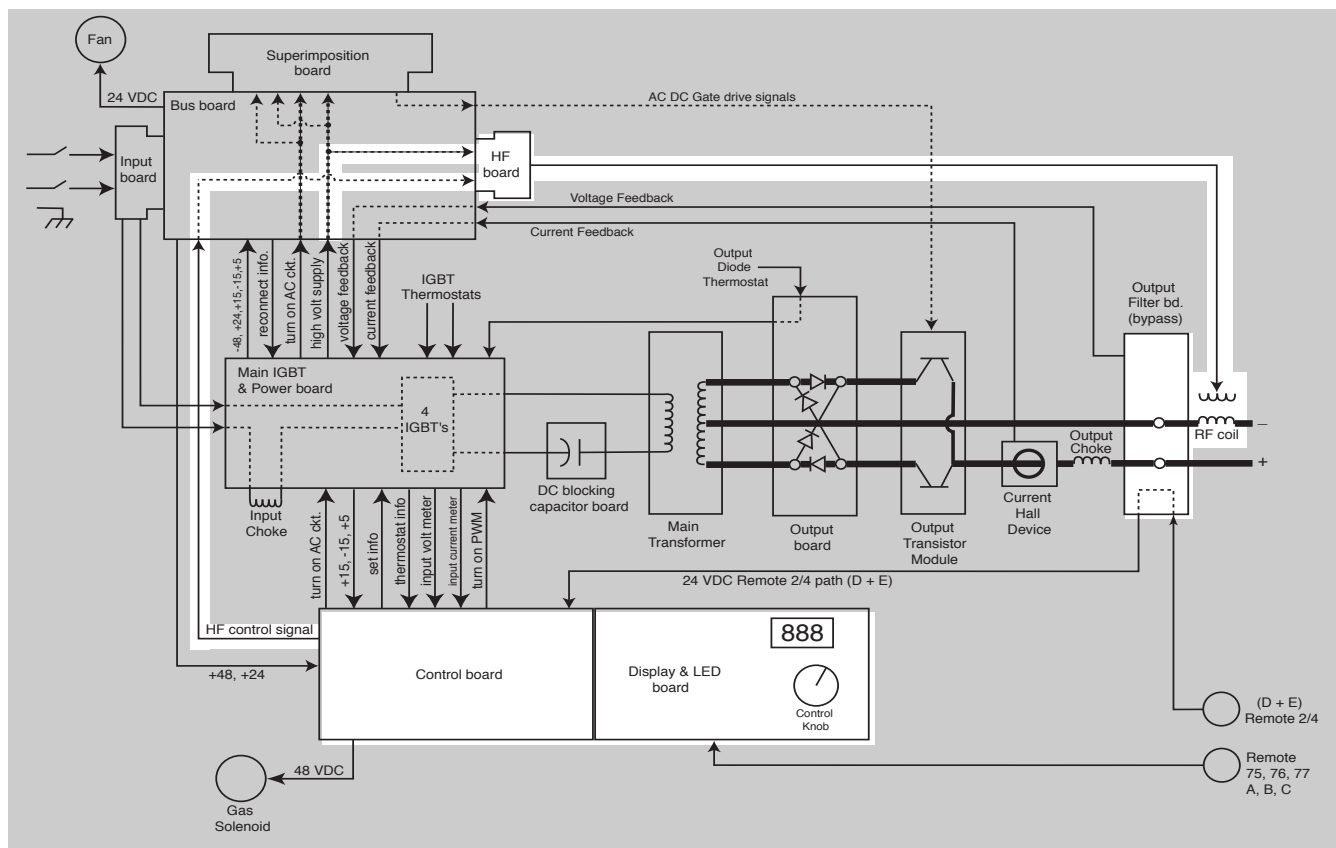
The Super Imposition Board receives signals from the Control/Display Board to control the status of the secondary inverter portion of the V205T machine. This board also generates voltage pulses at about +/- 200VDC that facilitate the re-striking of the arc when the TIG AC welding current is being utilized. The Superimposition Board internally generates the auxiliary power supply for the isolated piloting of the power elements (IGBTs) for the Output Module Transistor Board. The Superimposition Board plugs directly into the Bus Board.

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

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FIGURE E.5 - CONTROL/DISPLAY BOARD, HF BOARD & OUTPUT FILTER BOARD



CONTROL/DISPLAY BOARD

The Control/Display Board assembly is actually two boards mounted together. They should be replaced together. The Display portion houses the control panel, LEDs, push buttons and output encoders. The Display Boards functions as the interface between the user and the V205-T machine.

The Control Board functions as the support circuitry for the on board CPU (micro-processor). The Control Board receives information and power from the Bus Board, and Main IGBT Inverter Board. The Control Board supplies power for the Display Board and supplies signals for the Display Board to show set and actual current values, error codes and pre-set values. It also accepts signals via the Output Filter Board (Pins D and E- 24VDC) to initiate welding output. Upon closure of D and E a 24VDC relay is activated to indicate that welding output is required. The Control Board CPU sends a command to the Main IGBT Inverter Board to activate the welding IGBTs. The remote control signals (Pins A, B&C) are also fed into the Control/Display Board from the 6 pin connector located on the front of the machine. Based upon current and voltage feedback information the Control Board regulates the welding output to coincide with the pre-set welding commands. The Control/Display Board also activates and controls the High Frequency Board, the gas solenoid and the Super Imposition Board.

HIGH FREQUENCY (HF) BOARD

The HF Board generates a set of pulses of about 900V, which are amplified through the high voltage transformer to about 8 to 10KV. These pulses that are repeated at a frequency of about 80HZ are applied to the high frequency transformer that is located in the negative welding output leg of the machine. This high frequency pulse is transferred to the TIG torch via the high frequency transformer. This allows the remote starting of the TIG arc without the need for the tungsten electrode to touch the work. This high frequency pulse is removed when the welding arc is established.

The command signals are received from the micro-processor on the Control Board and last for about 1 second maximum. The HF Board receives it's power from the + 385 VDC derived from the electrolytic capacitors on the Main IGBT Inverter Board.

OUTPUT FILTER BOARD

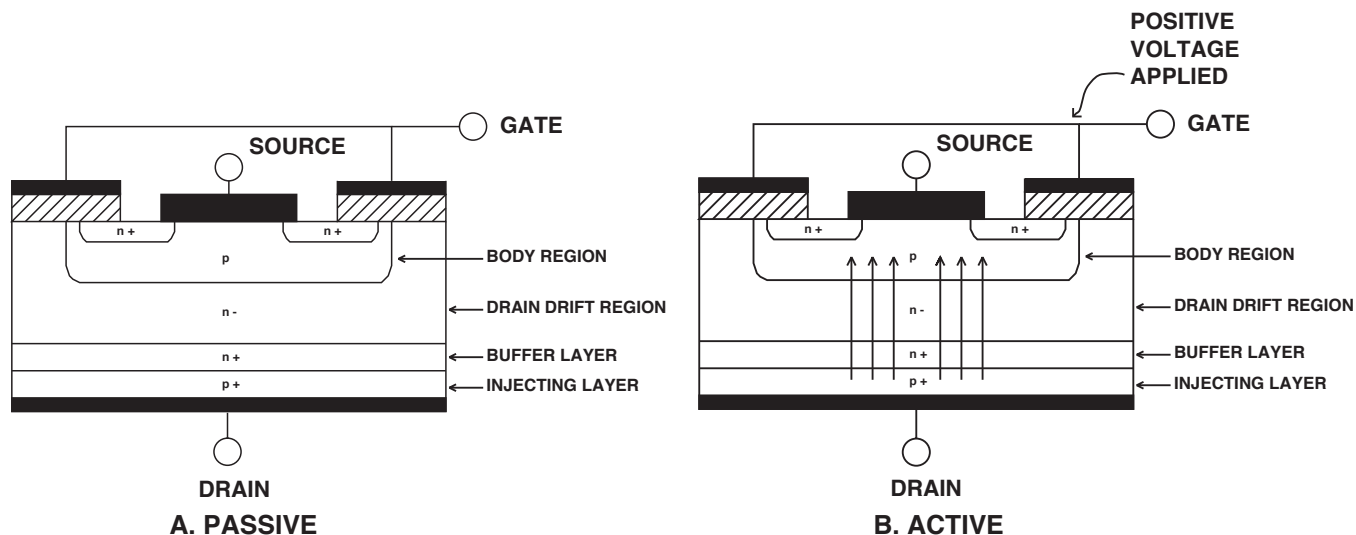
This PC board, located at the welding output terminals protects the internal circuitry of the machine from high voltage and high frequency pulses that may be fed back into the unit via the welding cables, torch cable or remote control equipment. This unwanted "noise" is shunted to case ground.

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

INVERTEC® V205-T AC/DC™



FIGURE E.6 - IGBT



INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

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

Example A in Figure E.6 shows an IGBT in 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.

Example 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 the 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.

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

INVERTEC® V205-T AC/DC™



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HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

Step 1. LOCATE PROBLEM (SYMPTOM).

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

Step 2. PERFORM EXTERNAL TESTS.

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

Step 3. RECOMMENDED COURSE OF ACTION

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

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

⚠ CAUTION

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

PC BOARD TROUBLESHOOTING PROCEDURES

WARNING**ELECTRIC SHOCK
can kill.**

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

CAUTION

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

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

PC board can be damaged by static electricity.**ATTENTION
Static-Sensitive
Devices
Handle only at
Static-Safe
Workstations**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident when the sheet metal cover(s) are removed.	1. Contact your local authorized Lincoln Electric Field Service Facility for assistance.	1. Contact the Lincoln Electric Service Department 1-800-833-9353.
The machine is dead—no fan —no output—no LEDs.	1. Make sure the input power switch is in the ON position. 2. Check the main input fuses. If open replace. 3. Make sure the correct input voltage is applied to the machine.	1. Check the input power switch for proper operation. Also check the associated leads for loose or faulty connections. See Wiring Diagram. 2. Perform the Input Filter Board Test .
The main input fuses or breakers repeatedly fail.	1. Make certain the fuses or breakers are properly sized for the input draw of the machine. 2. The welding procedure may be drawing too much input current or the duty cycle may be too high. Reduce the welding current and/or reduce the duty cycle.	1. The Input Filter Board may be faulty. Perform the Input Filter Board Test . 2. The Main IGBT Inverter Board may be faulty. Perform the Main IGBT Inverter Board Low Voltage Supply Test .

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
No or low output. Error code "E11" is flashing on the digital display.	1. "E11" is an indication that the input voltage being applied is too high. Check for the correct input voltage. 230VAC or 115VAC.	1. If the correct input voltage 230VAC or 115VAC is being applied to the machine the Input Filter Board may be faulty. Perform the Input Filter Board Test . 2. The Main IGBT Inverter Board May be Faulty. Perform the Main IGBT Inverter Board Low Voltage Supply Test .
No or low output. Error code "E12" is flashing on the digital display.	1. "E12" is an indication that the input voltage being applied is too low. Check for the correct input voltage. 230VAC or 115VAC.	1. If the correct input voltage 230VAC or 115VAC is being applied to the machine, the Input Filter Board may be faulty. Perform the Input Filter Board Test . 2. The Main IGBT Inverter Board May be Faulty. Perform the Main IGBT Inverter Board Low Voltage Supply Test .
No output. Error code "E10" is flashing on the digital display. The thermal indicator light is on.	1. The welding application may be exceeding the recommended duty cycle. 2. Dirt and dust may have clogged the cooling channels inside the machine. Refer to the Maintenance Section in this manual. 3. The air intake and exhaust louvers may be blocked due in inadequate clearance around the machine. 4. Make sure the cooling fan is operating correctly.	1. One of the thermal devices may be faulty. Check and replace if necessary. See the Wiring Diagram. 2. The Main IGBT Inverter Board may be faulty.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
Error code "E20", "E24", or "E25" is flashing on the digital display.	1. Any one of these codes indicates a memory error.	1. The Control/Display Board is faulty. Replace.
The machine functions normally except the cooling fan does not operate.	1. Check for obstructions that could prevent the fan from turning.	1. Check the fan fuse F3 located on the Bus Board Replace if faulty. 2. Perform the Bus Board Test . 3. The Main IGBT Inverter Board May be Faulty. Perform the Main IGBT Inverter Board Low Voltage Supply Test .
No High Frequency when the torch trigger is pulled and the machine is in the TIG mode.	1. Make sure the HF is in the active mode. See the Set-up Menu in this manual.	1. Check fuse F2 on the Bus Board. 2. Check for 385VDC at Test Points 9 and 20. See the Main IGBT Inverter Board Test . 3. Perform the Control/Display Board Test . 4. The HF board may be faulty. Replace.
Error code "E14" is flashing of the digital display	1. This is an indication that the output inductance is too high.	1. Check for excessive welding cable length. 2. The Main IGBT Inverter Board may be faulty. 3. The Superimposition Board may be faulty. 4. The Control/Display Board may be faulty.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
No current regulation in the Stick mode. Low open circuit voltage.	1. Make sure the machine is set-up and configured correctly for the Stick mode,	1. The Superimposition Board may be faulty 2. The Output Module Transistor Board may be faulty. See the Secondary Output Board Assembly Test and Wiring Diagram.
There is no response to changes to the output control settings. No current regulation in all modes.	1. Make sure the correct input voltage is applied to the machine. 230 or 115VAC.	1. The Control/Display board may be faulty.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
The machine does not have welding output in the Stick mode. Zero volts open circuit voltage. The Output LED on the control panel is blinking. The machine operates correctly in the TIG mode	1. Make sure the machine is properly set-up and configured for Stick mode.	<ol style="list-style-type: none"> 1. Check for output voltage feedback from the Output Filter Board. See the Output Filter Board Test. 2. Check for output voltage feedback through the Bus Board. See the Bus Board Test. 3. The Control/Display Board may be faulty.
The machine does not have welding output in either the Stick or TIG modes. Zero volts open circuit. The Output LED on the control panel is blinking.	1. Make sure the correct input voltage is applied to the machine. 230 or 115VAC.	<ol style="list-style-type: none"> 1. The output rectifier may be faulty. Check and replace if necessary. See the Secondary Output Board Assembly Test and Wiring Diagram. 2. The Output Clamp Board may be faulty. 3. The Output Module Transistor Board may be faulty. See the Secondary Output Board Assembly Test and Wiring Diagram. 4. Perform the Main IGBT Inverter Board Welding Logic and Inverter Test. 5. The Superimposition Board may be faulty. 6. The Hall Effect device may be faulty. 7. The Control/Display Board may be faulty.
The machine operates properly in the Stick and DC TIG modes. AC TIG mode does not function properly.	1. Make sure the machine is set-up and configured correctly for the AC TIG mode.	<ol style="list-style-type: none"> 1. The Output Module Transistor Board may be faulty. See the Secondary Output Board Assembly Test and Wiring Diagram. 2. The Superimposition Board may be faulty.

⚠ CAUTION

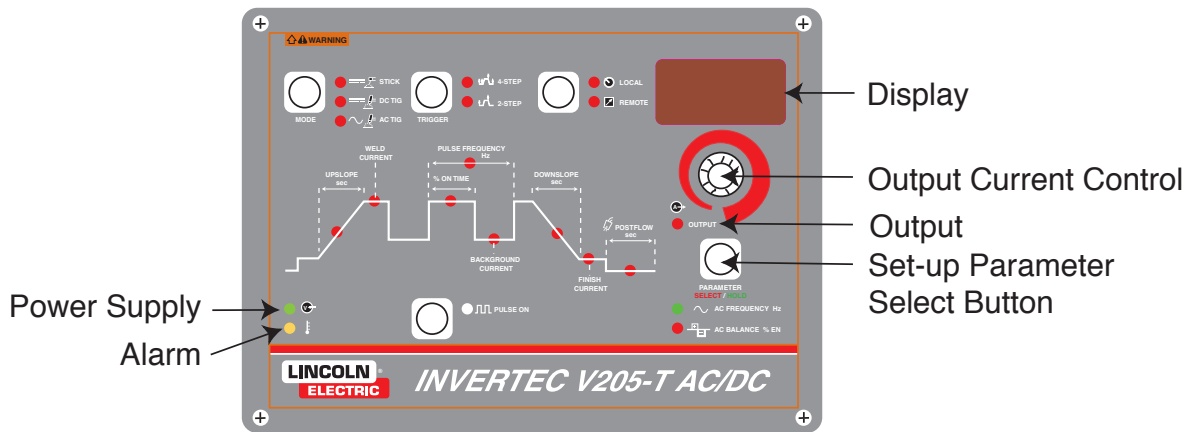
If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

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EXTERNAL DIAGNOSTICS

Figure F.1 External Diagnostics



The front panel controls the status of the equipment and shows it to the operator via the LED's and the display. Immediately after switch-on of the equipment, the front panel executes an autotest operation, all LED's will light up and the display shows "200" as a check.

Power supply LED (GREEN)

Indicates the machine switch-on status. Always present if the panel, and therefore the machine, is correctly powered.

Alarm LED (YELLOW)

Indicates a protection status of the equipment. Comes on to indicate the presence of a problem. The type of alarm is indicated in the display by an error code (see below).

Display

Immediately after the autotest operations above, the display briefly shows the software version of control panel (e.g. 01). It indicates the welding parameters requested by the operator (with the help of the other keys) and immediately after striking of the arc sets to reading mode, providing the real value of the current delivered by generator. It indicates a protection status via codes with simultaneous switch-on of the yellow LED.

Indic.	Type of Error	Action
E10	Internal Heatsink Overtemp.	Remove upper cover, check internal temperature, check thermal device status (N.C.). See machine layout.
E11	Power Supply Overvoltage	Remove upper cover, check that the power supply voltage is within the established range (+/- 15%). Check reading voltage on 15.14.314 CN1 (See Fig. 9)
E12	Power Supply Undervoltage	Remove upper cover, check that the power supply voltage is within the established range (+/- 15%). Check reading voltage on 15.14.315 CN1 (See Fig. 9)
E13	Front Panel Memory Error	Remove upper cover, check front panel power supplies. Perform front panel reset* test and replace if necessary.
E14	Front Panel Secondary Memory Error	Remove upper cover, check front panel power supplies. Perform front panel reset* test and replace if necessary.

*Note: to reset front panel (memory) see procedure in "Set-up parameters" chapter below.

Normally, when cause(s) of alarm(s) is (are) removed, press one of the keys to exit from alarm status (or switch off and on the machine).

Thermal alarm will be automatically reset by letting go down internal temperature: machine will execute a new autotest and then start as in normal operation.

In case of error code E10, see also the three thermal switches in fig. below.

In case of error codes E11/E12, check input power supply voltage, with reference to the following table.

Under/Overvoltage alarm thresholds		
Power supply rated voltage	Undervoltage	Overvoltage
115 VAC 230 VAC	92 VAC 184 VAC	138 VAC 276 VAC

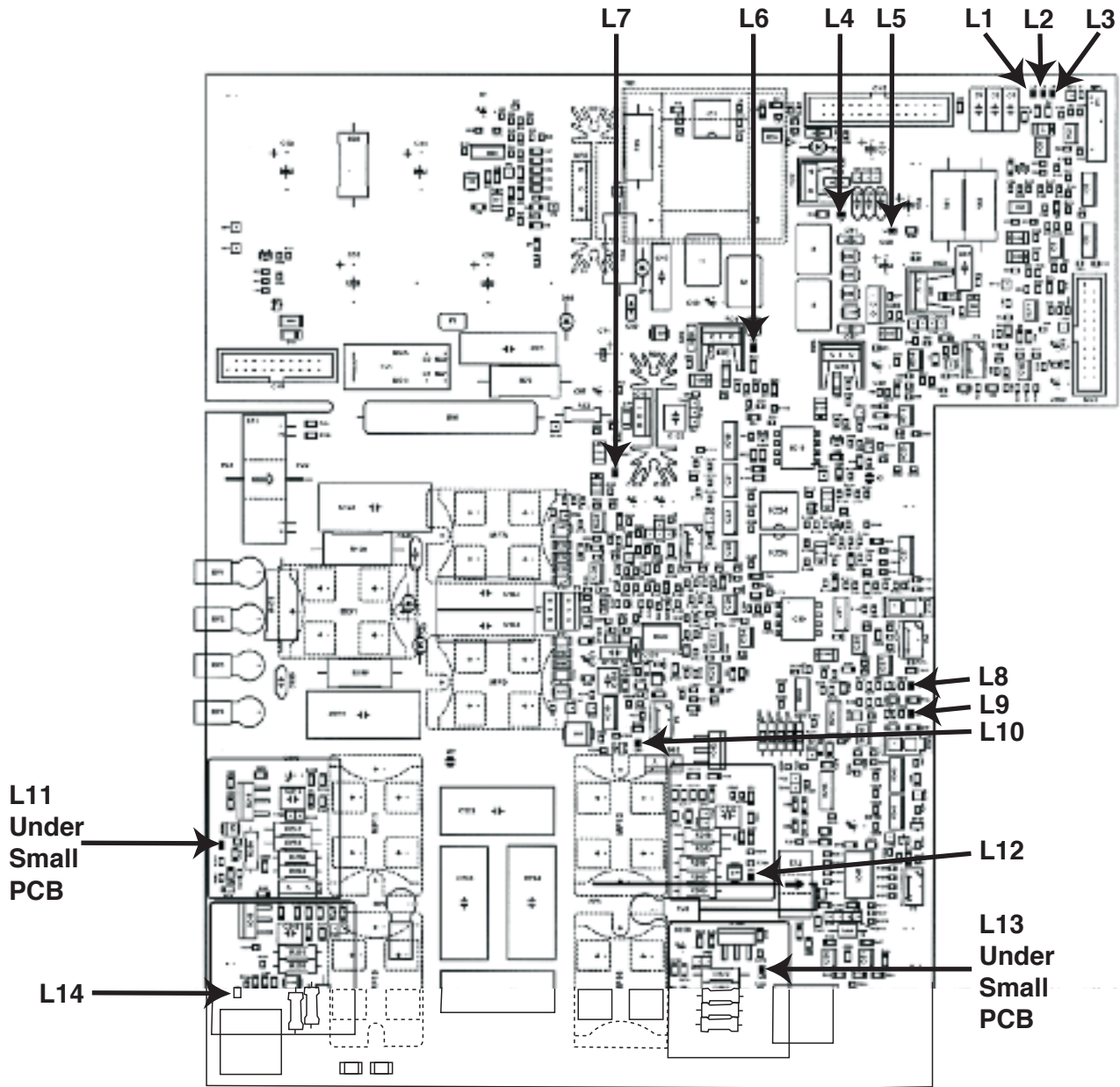
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INTERNAL DIAGNOSTICS

FIGURE F.2



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INTERNAL DIAGNOSTICS (*Continued*)

LED	Definition	Normal Status Conditions
L1	-15VDC supply by 15.14.316 for 15.14.316 logic part	ON [Green]
L2	+15VDC supply by 15.14.316 for 15.14.316 logic part	ON [Green]
L3	+5VDC supply by 15.14.316 for 15.14.316 logic part	ON [Green]
L4	+24VDC supply by 15.14.316 for power front panel	ON [Green]
L5	+48VDC supply by 15.14.316 for power front panel	ON [Green]
L6	-15VDC supply by 15.14.316 for 15.14.316 UPFR part	ON [Green]
L7	+15VDC supply by 15.14.316 for 15.14.316 UPFR part	ON [Green]
L8	Output power enabled (See " <i>pot signal</i> " & LED "Output")	STICK: ON [Green] TIG: ON (torch trigger pulled)
L9	Thermal Alarm	OFF = OK ON = ALARM [Red]
L10	UPFR on	Brightness proportional with actual output current.
L11	Gate MOS 11 active (output power enabled)	STICK: ON [Green] TIG: ON (torch trigger pulled)
L12	Gate MOS 12 active (output power enabled)	STICK: ON [Green] TIG: ON (torch trigger pulled)
L13	Gate MOS 16 active (output power enabled)	STICK: ON [Green] TIG: ON (torch trigger pulled)
L14	Gate MOS 15 active (output power enabled)	STICK: ON [Green] TIG: ON (torch trigger pulled)

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

WARNING

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

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

TEST DESCRIPTION

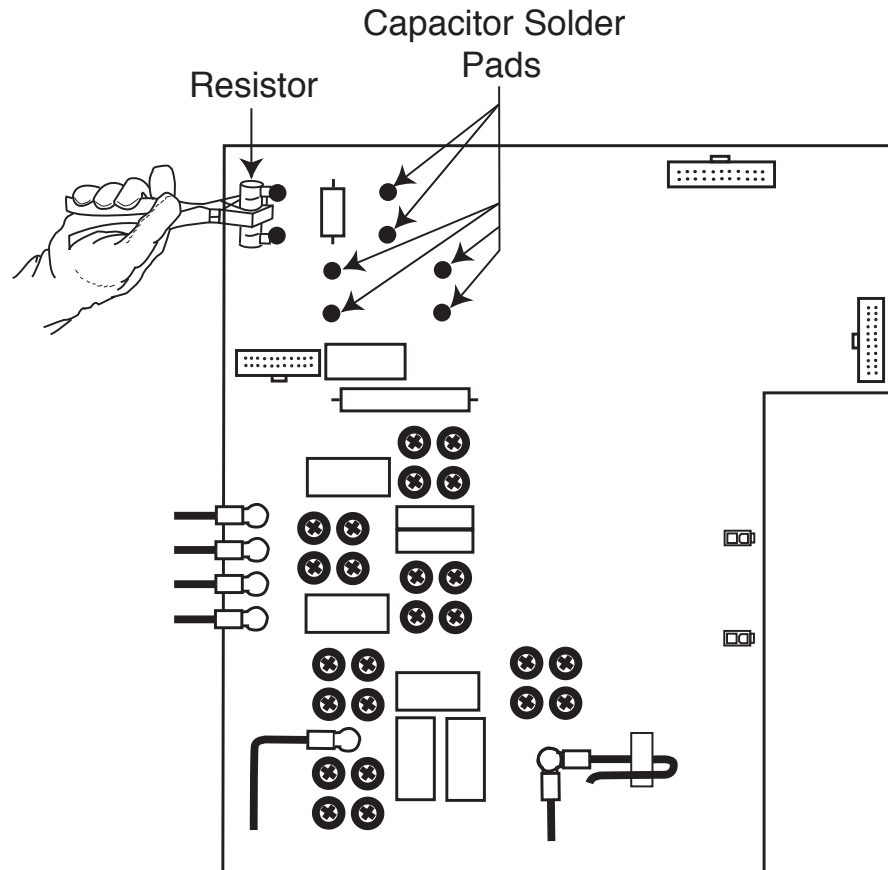
This procedure will drain off any charge stored in the four Capacitors that are part of the Main IGBT Inverter Board Assembly. This procedure **MUST** be performed, as a safety precaution, before conducting any test or repair procedure that requires you to touch internal components of the machine.

MATERIALS NEEDED

- Phillips Screwdriver
- Insulated Pliers
- Insulated Gloves
- High Wattage Resistor (25-1000 ohms and 25 watts minimum)
- Volt Meter

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE (continued)

FIGURE F.3 – LOCATION OF INPUT FILTER CAPACITOR TERMINALS ON MAIN IGBT INVERTER BOARD



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.

DISCHARGE PROCEDURE

1. Remove the input power to the machine.
2. Using the phillips head screwdriver remove the screws securing the case wraparound cover.
3. Be careful not to make contact with the capacitor solder pads located at the top of the IGBT power board.
4. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is not with the machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
5. Locate the eight capacitor solder pads shown in Figure F.3.
6. Using electrically insulated gloves and pliers, hold the body of the resistor with the pliers and connect the resistor leads across the two capacitor solder pads. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR SOLDER PADS WITH YOUR BARE HANDS.
7. Repeat the discharge procedure for the other three capacitors.
8. Check the voltage across the terminals of all capacitors with a DC voltmeter. Voltage should be zero. If any voltage remains, repeat this capacitor discharge procedure.

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INPUT FILTER BOARD TEST**⚠ WARNING**

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

TEST DESCRIPTION

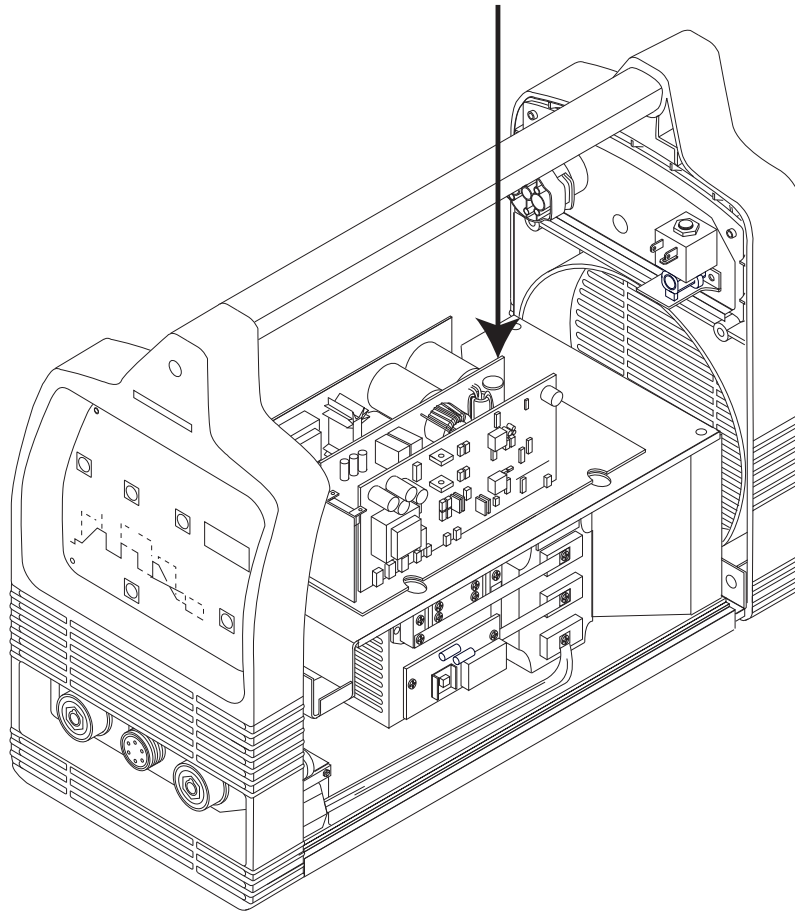
This test will help determine if the Input Filter Board is functioning properly.

MATERIALS NEEDED

- Analog Volt/Ohmmeter
- Phillips Head Screwdriver
- Wiring Diagram

FIGURE F.4 – INPUT FILTER BOARD LOCATION

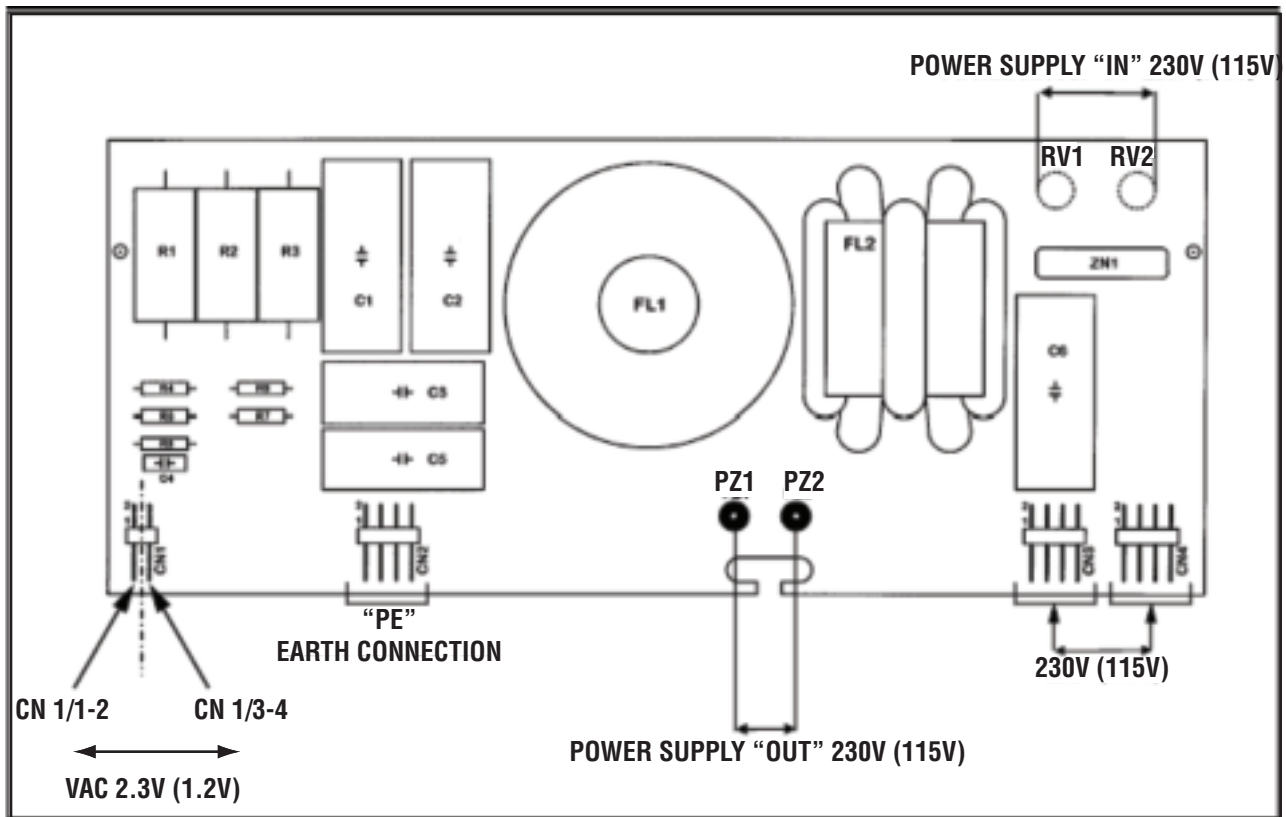
INPUT FILTER BOARD



PROCEDURE

1. Remove input power to the V205-T.
2. Using a phillips head screwdriver, remove the case wraparound.
3. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
4. Locate the Input Filter board. See Figure F.4.
5. See ***Note 1*** and ***Note 2.***
6. See ***Figure F.5*** for voltage checks.

FIGURE F.5 – INPUT FILTER BOARD



NOTE 1: A varistor ZN1 is placed between the two power supply phases, so if an instantaneous voltage in excess of 275VAC appears on terminals RV1 & RV2, the varistor very rapidly becomes conductive and thus absorbing a current peak sufficient to limit the above said overvoltage; this way the varistor ZN1 protects the other parts of the machine from energy-limited overvoltages. This process has no destructive effect on the component if the energy generated by the voltage peak is low, as in the case of atmospheric lightning strikes. However, if overvoltage is high and prolonged, the varistor cannot dissipate this high energy and fails. For example, the machine is improperly connected to 275VAC, or the over-voltage is caused by non stabilized power units of inadequate capacity.

NOTE 2: The radio noise suppression circuit has two purposes: to keep the machine's radio frequency emissions within limits specified by standards and to ensure the machine's immunity against the same type of problems caused any electronic devices connected to the same power supply source. The filter consists of a network of capacitors, some of which are grounded, and a toroidal inductor.

MAIN IGBT INVERTER BOARD LOW VOLTAGE TEST**⚠ WARNING**

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

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

TEST DESCRIPTION

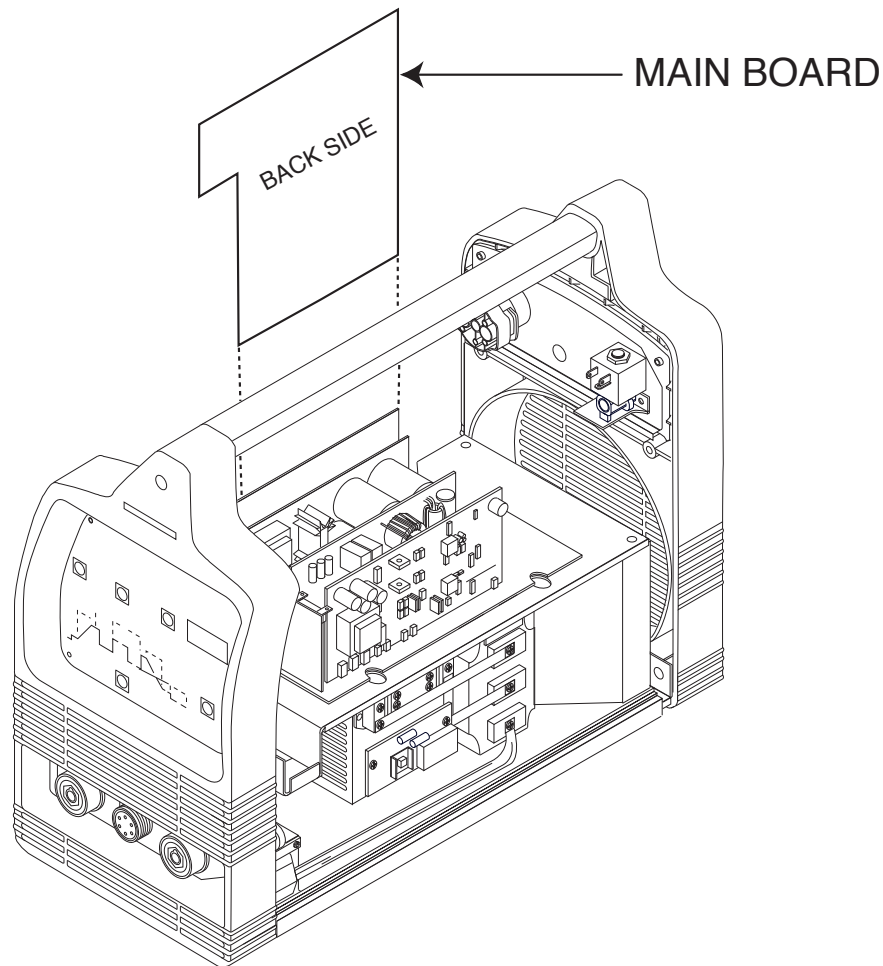
This test will help determine if all of the auxiliary voltages on the Main IGBT Inverter Board are correct.

MATERIALS NEEDED

- Voltmeter
- Phillips Head Screwdriver
- Wiring Diagram
- Voltmeter

MAIN IGBT INVERTER BOARD LOW VOLTAGE TEST (continued)

FIGURE F.6 – MAIN IGBT INVERTER BOARD LOCATION



PROCEDURE

1. Remove input power to the V205-T machine.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the **Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the Main IGBT Inverter board. See Figure F.6.
5. Use the voltmeter to perform the tests detailed in **Table F.1**. See the Wiring Diagram.

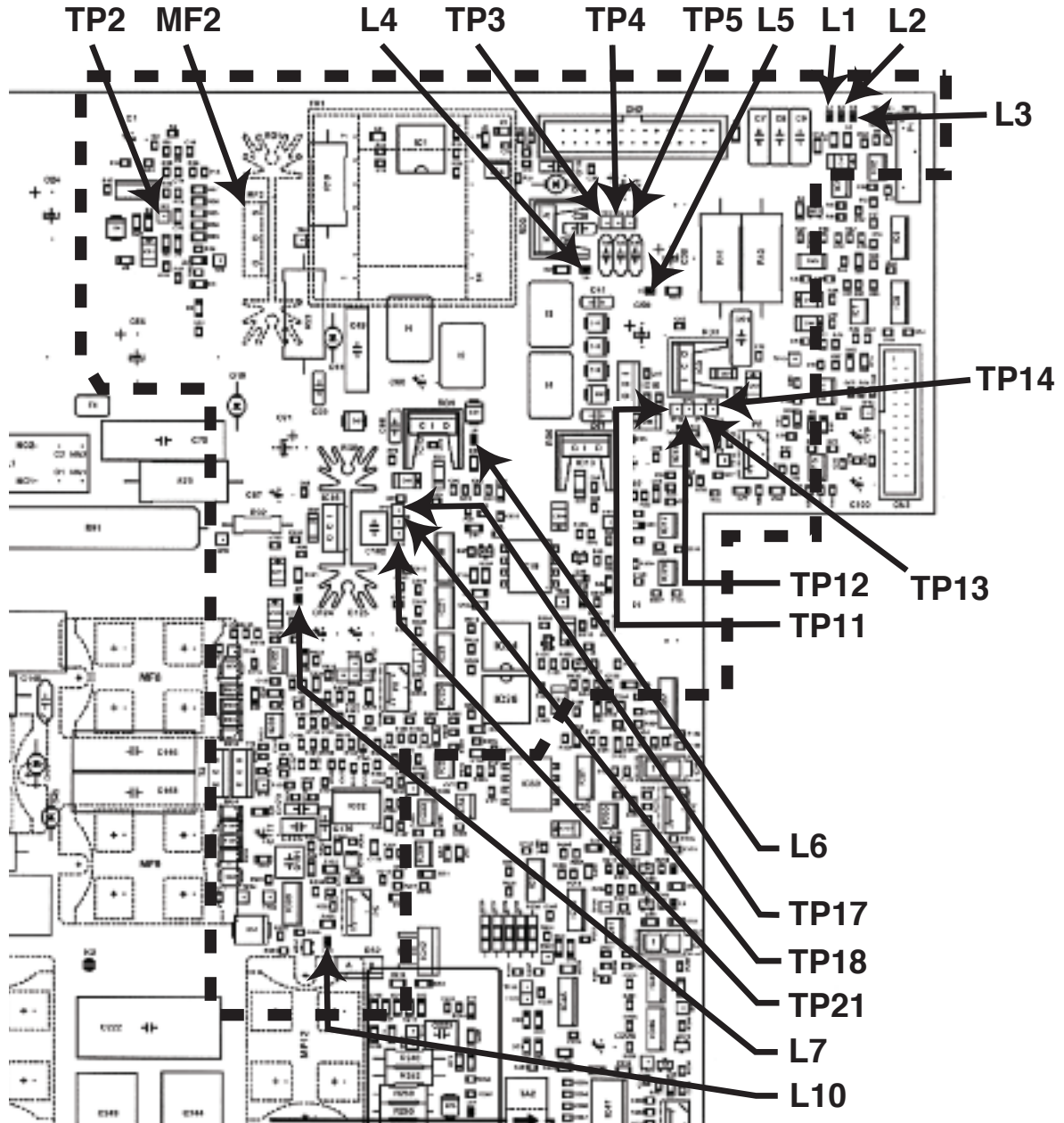
MAIN IGBT INVERTER BOARD LOW VOLTAGE TEST (continued)

Table F.1 Test Points

Machine Mode	Test Point	LED	Value
ON	TP13-TP14	L2	+15 VDC
ON	TP11-TP14	L3	+5 VDC
ON	TP12-TP14	L1	+15 VDC
ON	TP3-TP5	L4	+24 VDC
ON	TP4-TP5	L5	+48 VDC
ON	TP17-TP18	L6	+15 VDC
ON	TP21-TP18	L7	+15 VDC
ON	TP2[+],TP18[-]	---	+14.5 VDC

MAIN IGBT INVERTER BOARD LOW VOLTAGE TEST (continued)

FIGURE F.7 – MAIN IGBT INVERTER BOARD LOCATION
This is an illustration of the upper right corner of the P.C. board



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CONTROL/DISPLAY BOARD TEST**⚠ WARNING**

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

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

TEST DESCRIPTION

This test will help determine if the Front Panel Boards work properly.

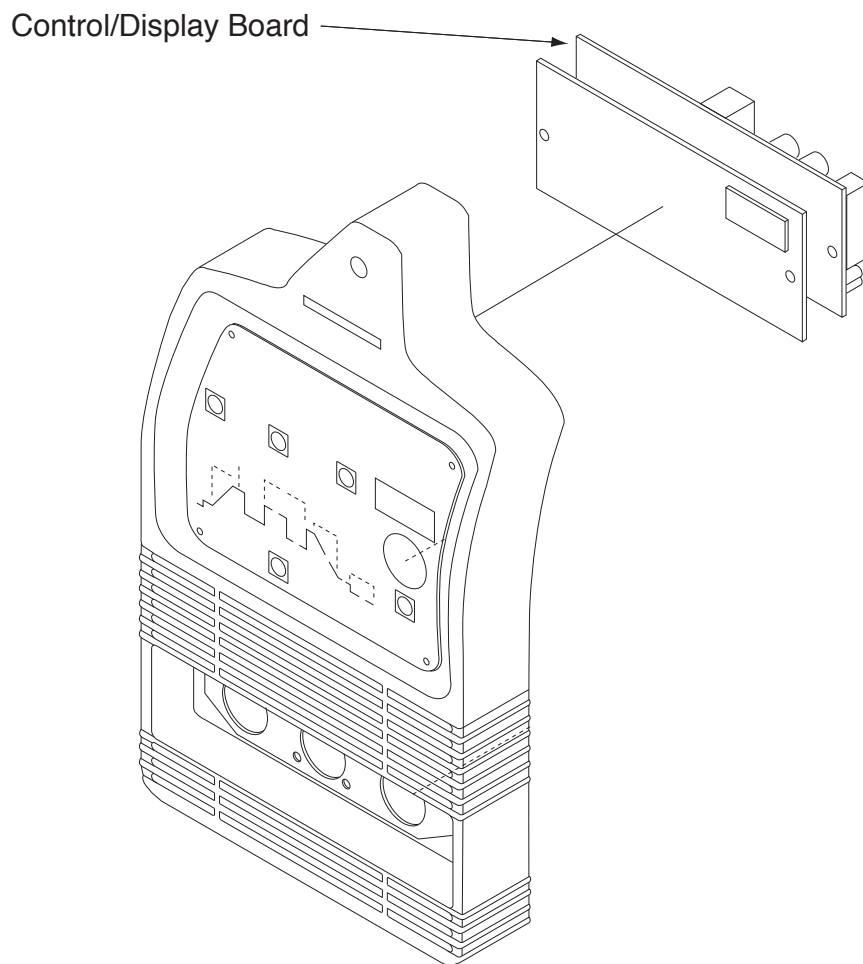
MATERIALS NEEDED

- Volt-Ohmmeter
- Phillips Head Screwdriver
- Wiring Diagram

TROUBLESHOOTING AND REPAIR

CONTROL/DISPLAY BOARD TEST (continued)

FIGURE F.8 – CONTROL/DISPLAY BOARD LOCATION



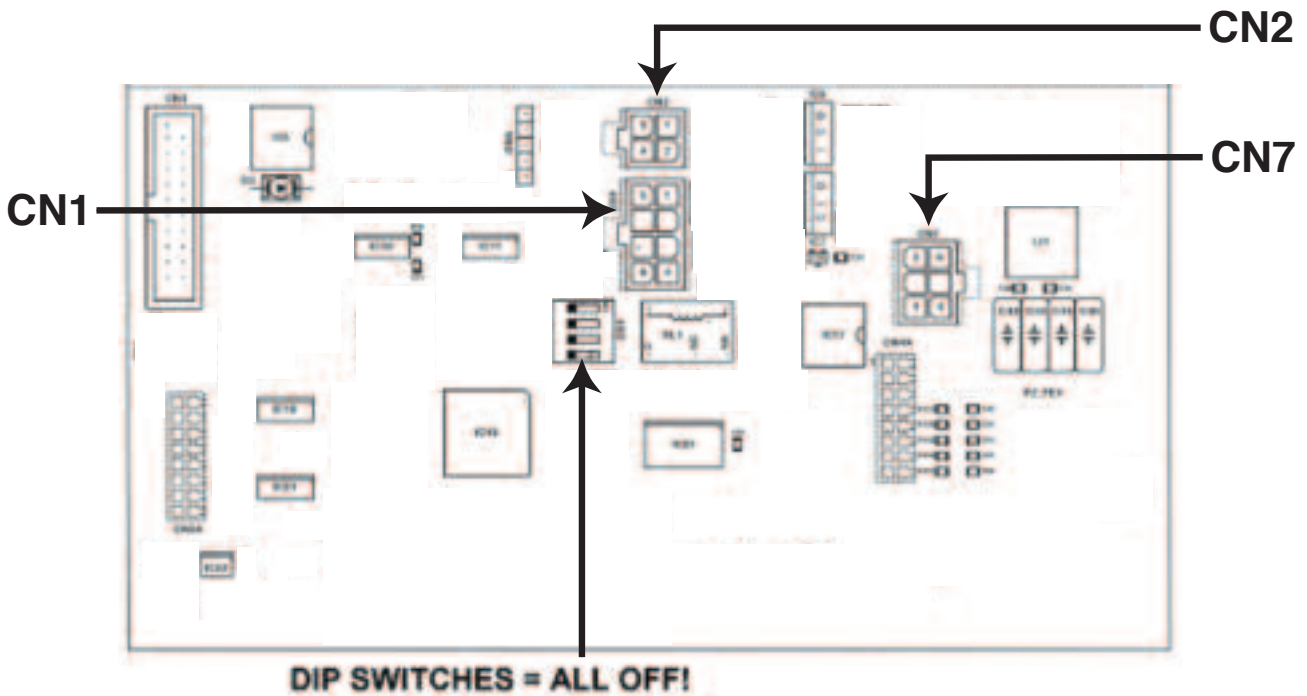
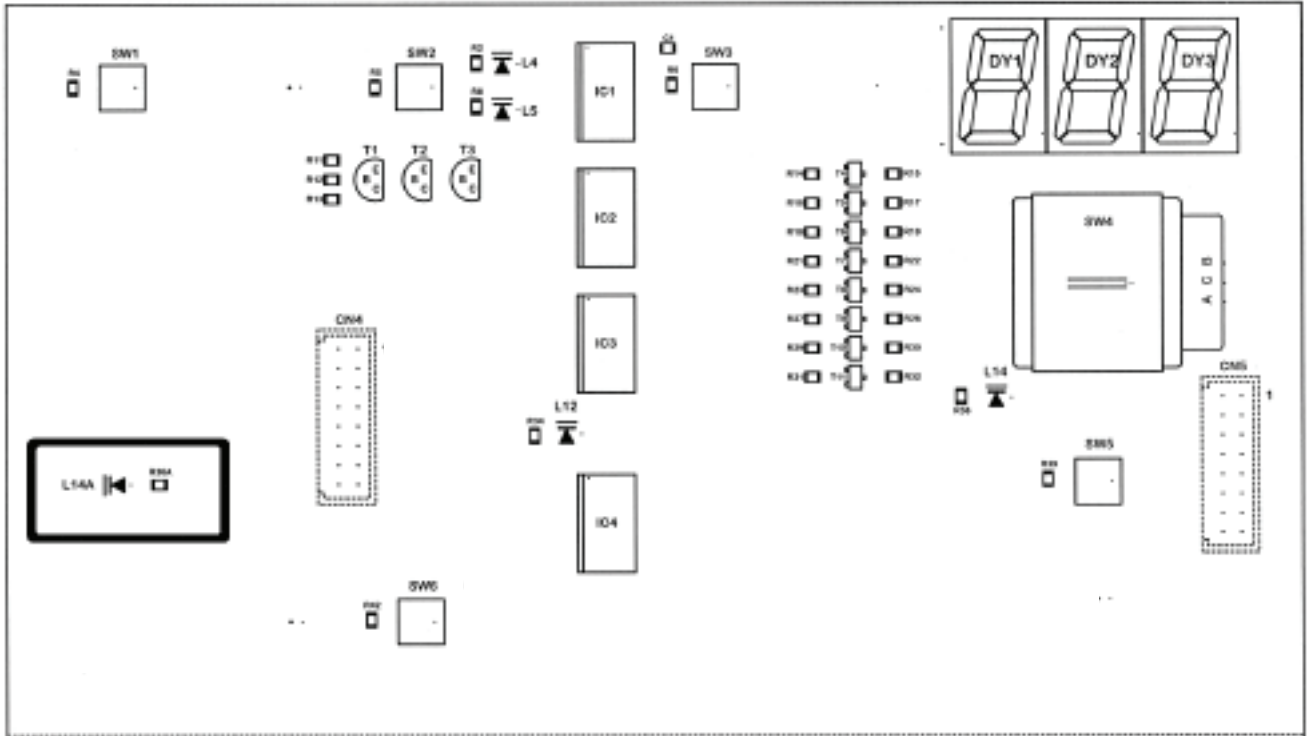
PROCEDURE

1. Remove input power to the V205-T machine.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the **Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the control/display board and associated plugs . **Do not remove plugs from the board.** See Figure F.8.
5. Carefully apply the correct input voltage to the V205-T and check for the correct secondary voltages per **Tables F.2, F3 & F.4.**

TROUBLESHOOTING AND REPAIR

CONTROL/DISPLAY BOARD TEST (continued)

FIGURE F.9 – CONTROL/DISPLAY BOARD LOCATION



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BUS BOARD TEST**⚠ WARNING**

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

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

TEST DESCRIPTION

This test will help determine if the BUS Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Phillips Head Screwdriver
Wiring Diagram

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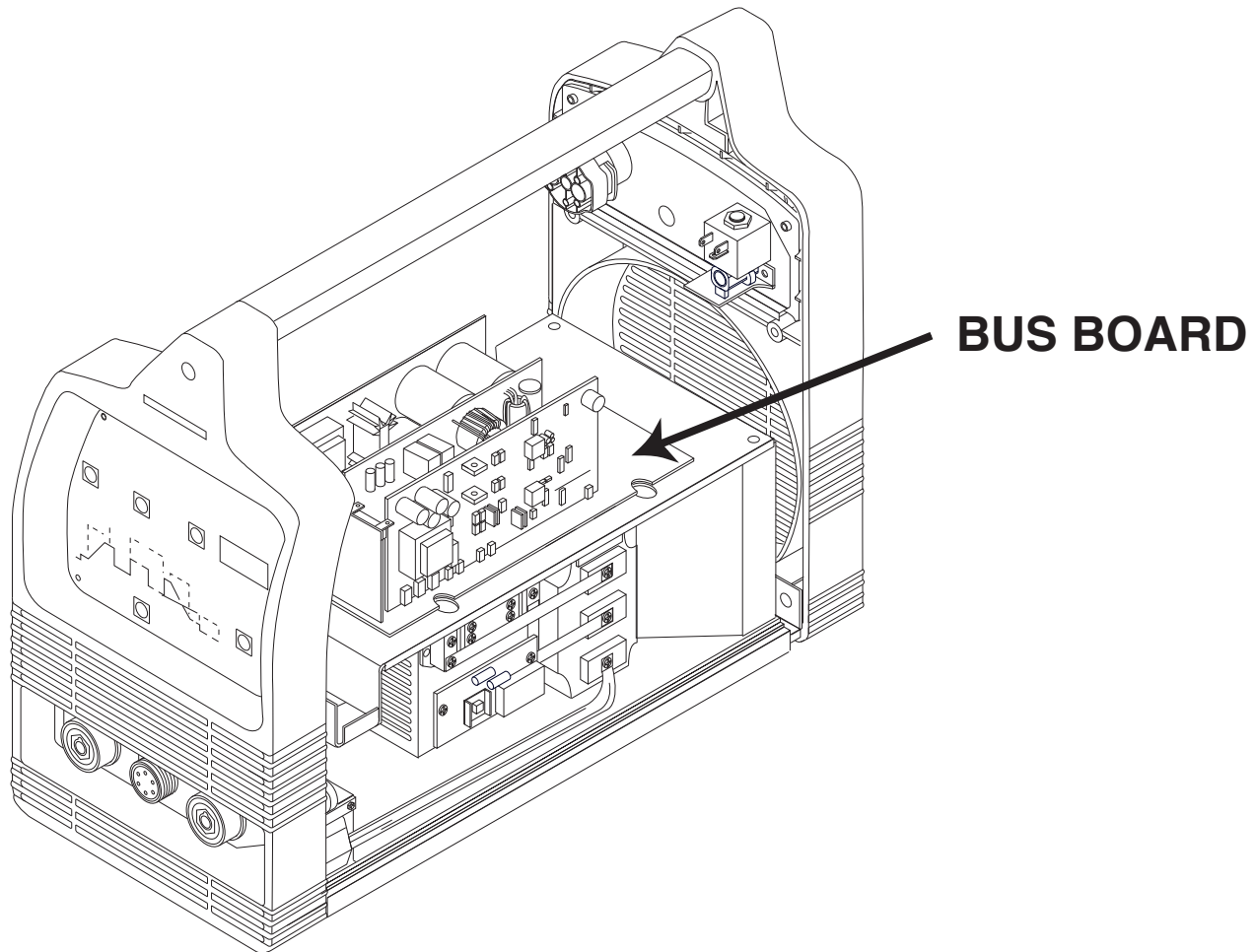
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BUS BOARD TEST (continued)

FIGURE F.11 – BUS BOARD LOCATION



PROCEDURE

1. Remove input power to the V205-T machine.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the **Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the Bus board and associated plugs. **Do not remove plugs from the board.** See Figure F.11.
5. Carefully apply the correct input voltage to the V205-T and check for the correct voltages per **Tables F.5, F.6, F.7, F.8 & F.9**
6. Machine should be set to "STICK" mode.

BUS BOARD TEST (continued)

TABLE F.5 PLUG CN2 TEST POINTS

Wire #	Description	Expected Voltage
21	Thermal Trigger	-----
22	Output Hall Probe	-----
23	Hall Probe	+15 VDC
24	Ground Gate Switch B	-----
26	Ground Gate Switch A	-----
27	Thermal Trigger (AC Unit)	-----
28	Ground Hall Probe	-----
29	Hall Probe	-15 VDC
30	Gate Switch B	-----
32	Gate Switch A	-----

TABLE F.6 PLUG CN3 TEST POINTS

Wire #	Description	Expected Voltage
61	- Superimposition	53.2 VDC ⁽¹⁾
65	Ground Superimposition	-----
63	+ Superimposition	53.2 VDC ⁽¹⁾
64[-], 66[+]	Welding Voltage	52.6 VDC

⁽¹⁾In TIG mode only when Remote is pushed, comes on for two sec. then goes to zero. In STICK mode is present all the time.

TABLE F.7 PLUG CN4 TEST POINTS

Wire #	Description	Expected Voltage
41	Front Panel Supply	24 VDC
42	Front Panel Supply Ground	-----
44	HF Start	-----
45	Front Panel Supply	48 VDC
48	HF Start Ground	-----

TABLE F.8 PLUG CN7 TEST POINTS

Wire #	Description	Expected Voltage
11	Water Cooling Supply	-----
Earth Cable	Water Cooling Supply	-----
12	Water Cooling Supply	-----
Earth Cable	-----	-----

TABLE F.9 PLUG CN1 TEST POINTS

Wire #	Description	Expected Voltage
5[+], 6[-]	Fan	24 VDC

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MAIN INVERTER BOARD POWER FACTOR SECTION TEST**⚠ WARNING**

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

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

TEST DESCRIPTION

This procedure will help determine if the Power Factor section on the Main Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Phillips Head Screwdriver
Wiring Diagram

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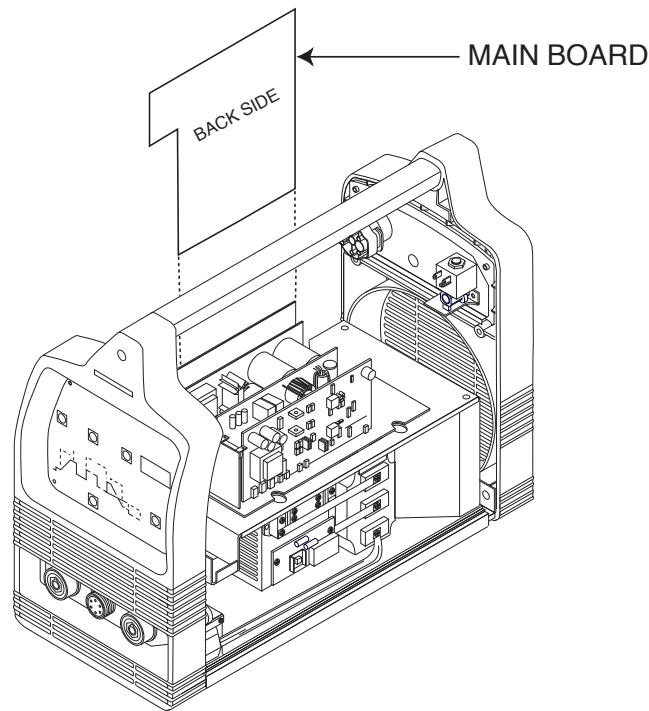
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MAIN INVERTER BOARD POWER FACTOR SECTION TEST (continued)

FIGURE F.14 – LOCATION ON MAIN BOARD



PROCEDURE

1. Remove input power to the V205-T machine.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the **Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the power factor section on the main board and associated plugs. **Do not remove plugs from the board.** See **Figure F.15**.
5. Carefully apply the correct input voltage to the V205-T and check for the correct secondary voltages per tables F.10 & F.11. Voltage readings were taken with a Fluke RMS meter. See **Figure F.15** for joint locations.

TABLE F.10 – VOLTAGE CHECKS WITH 115 VAC APPLIED TO MACHINE

Generator/Mode	Component	Ref. Point	Value
ON/STICK	DD1	A[-],K[+]	250-260 VDC
ON/STICK	MF8	S[-],D[+]	125 VDC
ON/STICK	MF8	S[-],G[+]	2.2 VDC
ON/STICK	MF9	S[-],D[+]	120 VDC
ON/STICK	MF9	S[-],G[+]	2.2 VDC
ON/STICK	-----	L10 (LED)	ON
ON/STICK	TP20-TP9	-----	385 VDC +/-5V

TABLE F.11 – RESISTANCE CHECKS

Generator/Mode	Component	Ref. Point	Value
OFF	F1	-----	<1 OHM
OFF	R82	-----	46 OHM

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OUTPUT FILTER BOARD TEST**⚠ WARNING**

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

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

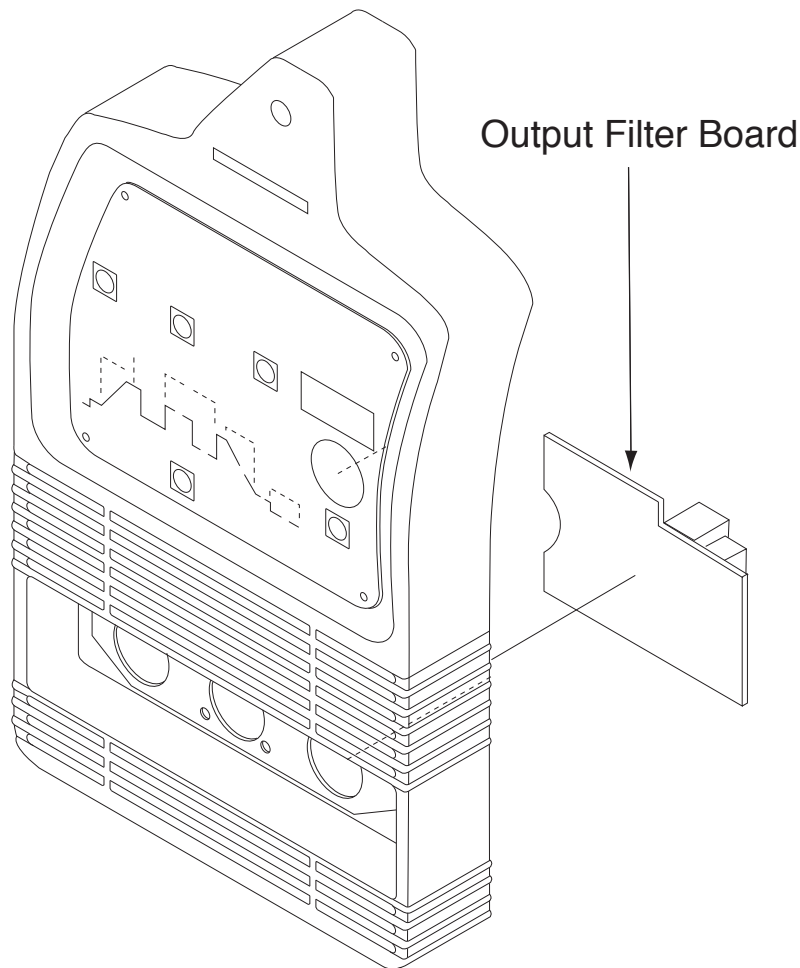
TEST DESCRIPTION

This test will help determine if output voltages and external trigger signals are being processed through the Output Board.

MATERIALS NEEDED

Volt/Ohmmeter
Phillips Head Screwdriver
External DC Ammeter

FIGURE F.16 – OUTPUT FILTER BOARD LOCATION



PROCEDURE

1. Remove input power to the V205-T machine.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the **Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the Output Filter board and associated plugs . **Do not remove plugs from the board.** See Figure F.16.
5. Carefully apply the correct input voltage to the V205-T and check for the correct secondary voltages per **Table F.12**.

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

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TROUBLESHOOTING AND REPAIR

SECONDARY OUTPUT BOARD ASSEMBLY TEST

WARNING

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

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

TEST DESCRIPTION

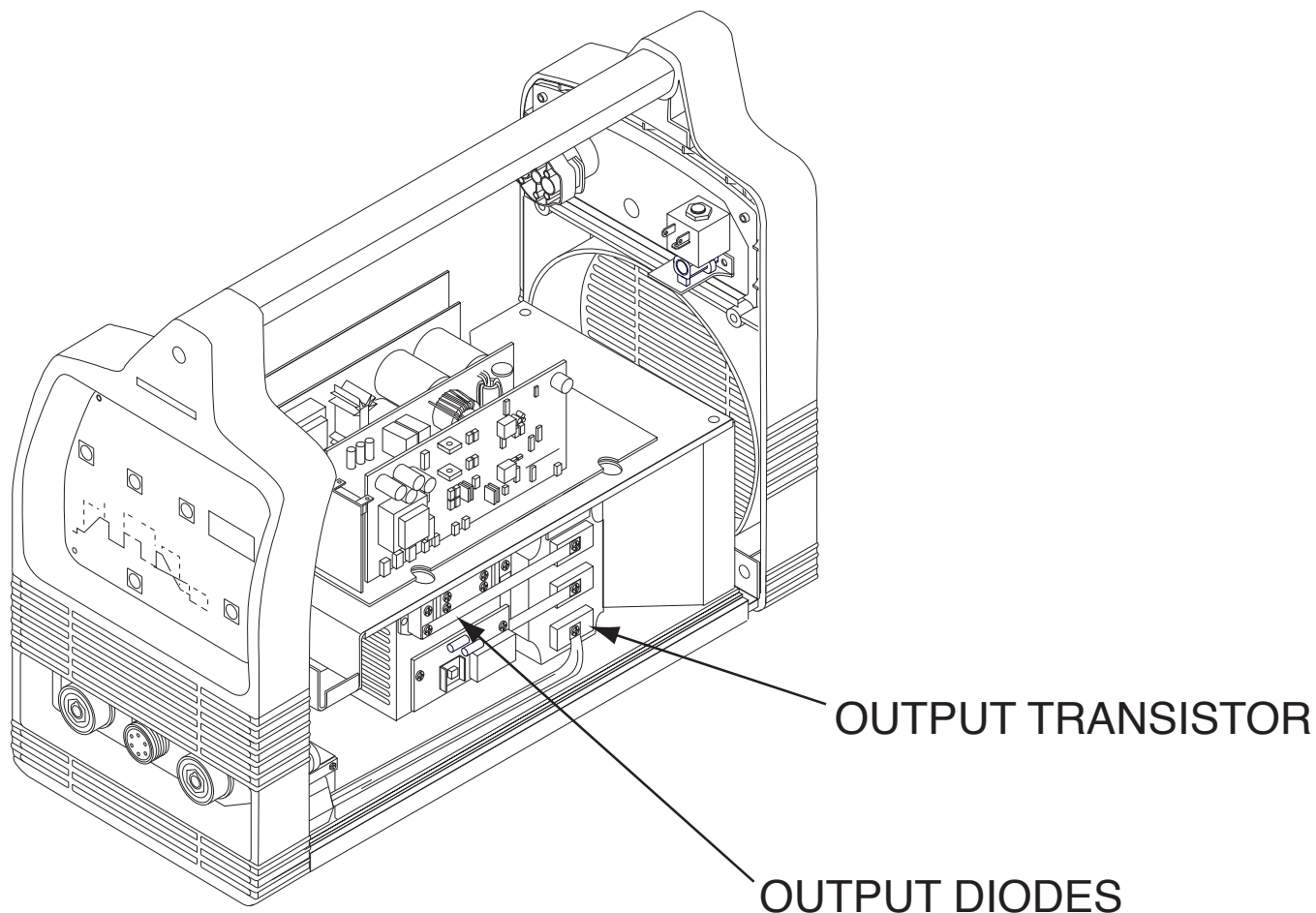
This test will help determine if the Secondary Output Board Assembly has shorted or damaged components.

MATERIALS NEEDED

- Volt/Ohmmeter
- Phillips Head Screwdriver
- Wiring Diagram

SECONDARY OUTPUT BOARD ASSEMBLY TEST (continued)

FIGURE F.19 – SECONDARY POWER BOARD LOCATION



PROCEDURE

1. Remove input power to the V205-T machine.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the **Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the Secondary Power board and associated plugs. **Do not remove plugs from the board.** See Figure F.19.
5. Perform the output diode resistance check per **Table F.13**.
6. Carefully apply the correct input voltage to the V205-T and check for the correct secondary voltages per **Table F.13**.

SECONDARY OUTPUT BOARD ASSEMBLY TEST (continued)

FIGURE F.20 – SECONDARY POWER BOARD TEST POINT LOCATIONS

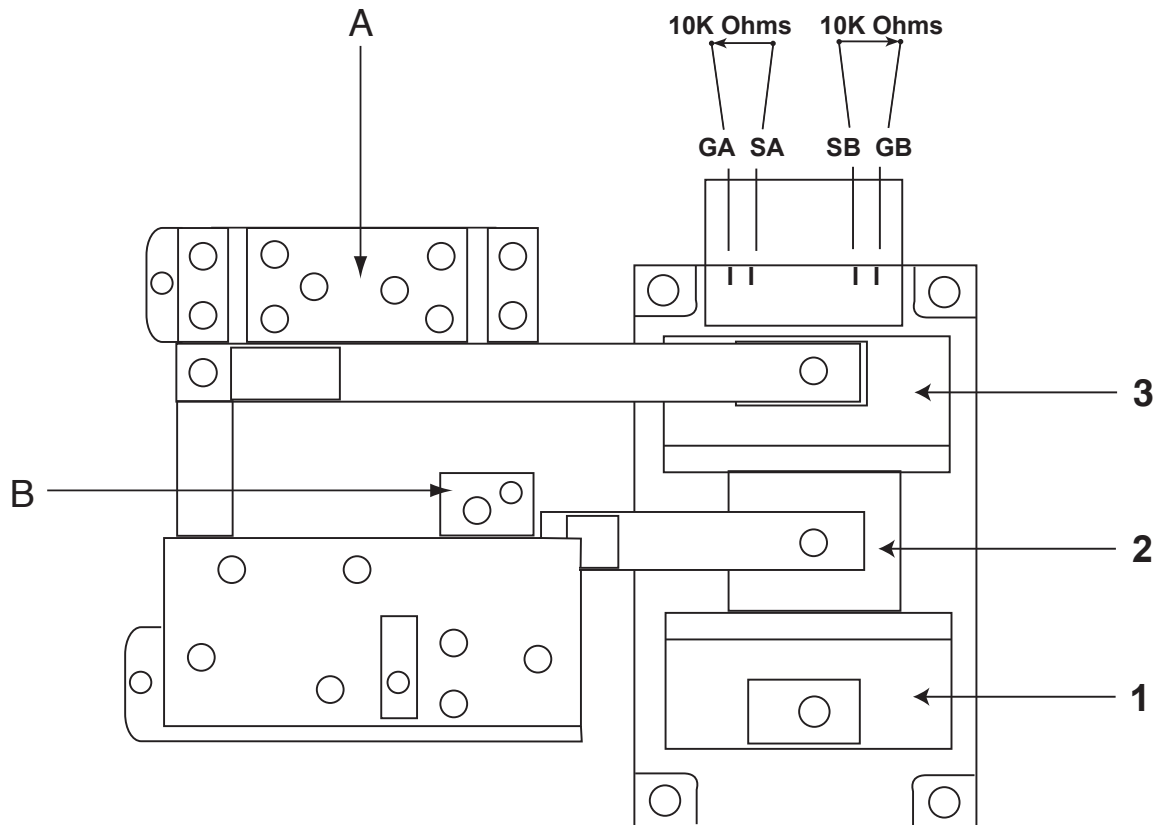


TABLE F.13 – VOLTAGE CHECKS WITH 115 VAC APPLIED TO MACHINE

Generator/Mode	Test Point	Value
ON/STICK	GA[+],SA[-]	-13 VDC
ON/STICK	GB[+],SB[-]	+13 VDC
ON/STICK	3[+],1[-]	+ 0.5 VDC
ON/STICK	1[+]2[-]	+ 105 VDC
ON/STICK	OCV @ Outpt Terminals	+ 52 VDC
OFF/-	R GA-SA	10 K Ohms
OFF/-	R GB-SB	10 K Ohms

SECONDARY OUTPUT BOARD ASSEMBLY TEST (continued)

TABLE F.14 – OUTPUT DIODE RESISTANCE CHECK

MODE	POSITIVE METER PROBE	NEGATIVE METER PROBE	EXPECTED READING
MACHINE OFF	TEST POINT A	TEST POINT 3	LOW - LESS THAN 200 OHMS
MACHINE OFF	TEST POINT 3	TEST POINT A	HIGH - MORE THAN 1000 OHMS
MACHINE OFF	TEST POINT B	TEST POINT 3	LOW - LESS THAN 200 OHMS
MACHINE OFF	TEST POINT 3	TEST POINT B	HIGH - MORE THAN 1000 OHMS
MACHINE OFF	TEST POINT 2	TEST POINT A	LOW - LESS THAN 200 OHMS
MACHINE OFF	TEST POINT A	TEST POINT 2	HIGH - MORE THAN 1000 OHMS
MACHINE OFF	TEST POINT 2	TEST POINT B	LOW - LESS THAN 200 OHMS
MACHINE OFF	TEST POINT B	TEST POINT 2	HIGH - MORE THAN 1000 OHMS

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MAIN INVERTER BOARD “WELDING LOGIC AND INVERTER” SECTION TEST

WARNING

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

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

TEST DESCRIPTION

This test will help determine if all functions of the Welding Logic Circuit and Inverter are functioning properly

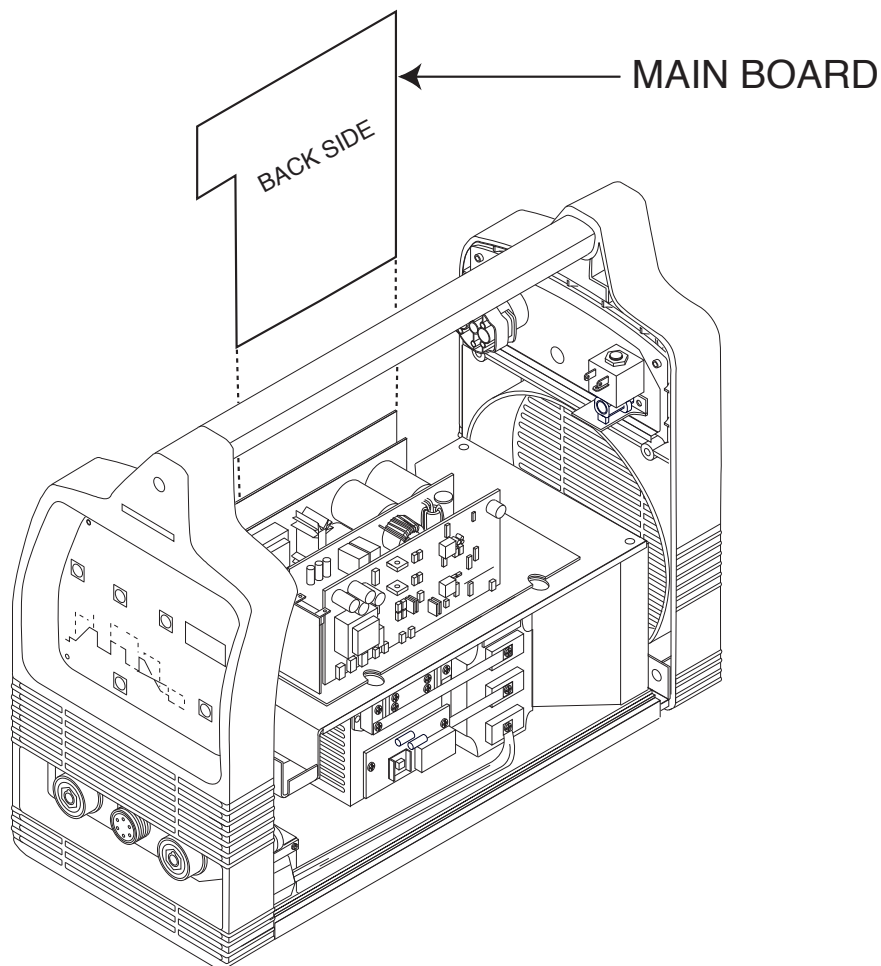
MATERIALS NEEDED

- Volt/Ohmmeter
- Phillips Head Screwdriver
- Wiring Diagram

MAIN INVERTER BOARD

“WELDING LOGIC AND INVERTER” SECTION TEST (continued)

FIGURE F.21 – MAIN BOARD LOCATION



PROCEDURE

1. Remove input power to the V205-T machine.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the **Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the Welding Logic and Inverter section of the Main Inverter board and associated plugs. **Do not remove plugs from the board.** See Figure F.21. See **Figures F.22 & F.23.**
5. Carefully apply the correct input voltage to the V205-T and check for the correct secondary voltages per **Tables F.15, F.16, F.17 & F.18.**

MAIN INVERTER BOARD

“WELDING LOGIC AND INVERTER” SECTION TEST (continued)

TABLE F.15 – LED FUNCTION

Machine/Mode	Component	Value	Condition	Note
ON/STICK	L8	-----	ON AND FLASHING	POT SIGNAL
ON	L9	-----	OFF	THERMAL
ON	TP31-TP9	2.56 VDC	-----	ALWAYS

TABLE F.16 – FEEDBACK VOLTAGE SIGNALS

Machine/Mode	Component	Value	Condition
ON/TIG	TP15-TP14	-2 VDC @ 100A -4 VDC @ 200A	WELDING ON: CURRENT FEEDBACK
ON/STICK	TP16-TP14	4.3 VDC OPEN CIRCUIT VOLTAGE CONDITION	WELDING ON: VOLTAGE FEEDBACK
ON/TIG	TP19-TP14	2 VDC @ 100A 4 VDC @ 200A	WELDING ON: CURRENT REFERENCE

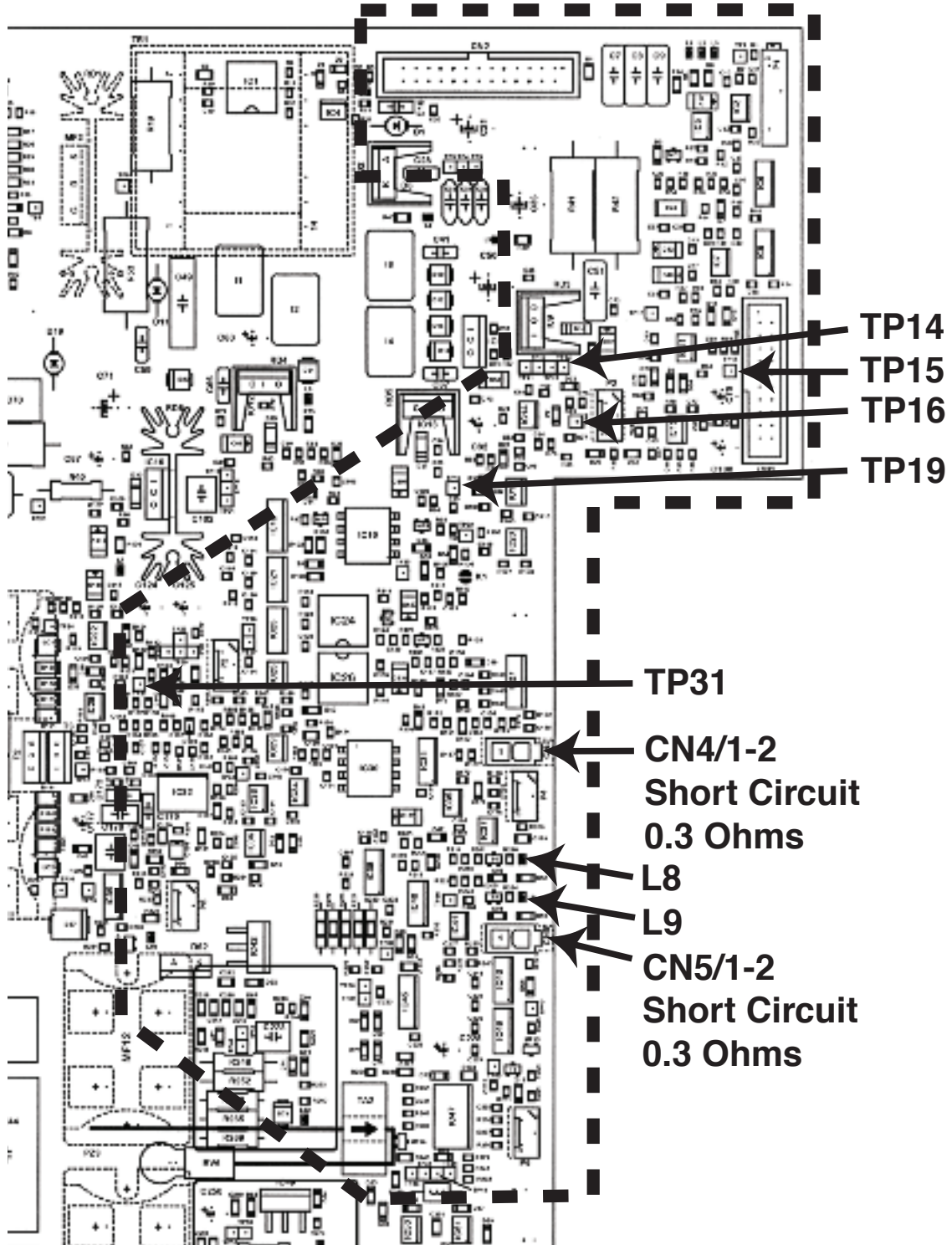
TABLE F.17 – VOLTAGE CHECKS WITH 115 VAC APPLIED TO MACHINE

Generator/Mode	Component	G[+],S[-]	D[+],S[-]
ON/STICK	MF11	3.75 VDC	178 VDC
ON/STICK	MF12	3.75 VDC	260 VDC
ON/STICK	MF15	3.75 VDC	260 VDC
ON/STICK	MF16	3.75 VDC	34 VDC

TABLE F.18 – LED (CHECK IN STICK MODE)

Generator/Mode	Component	Value
ON/STICK	L11	ON AND FLASHING
ON/STICK	L12	ON AND FLASHING
ON/STICK	L13	ON AND FLASHING
ON/STICK	L14	ON AND FLASHING

MAIN INVERTER BOARD
“WELDING LOGIC AND INVERTER” SECTION TEST (continued)
FIGURE F.22 – MAIN BOARD (INVERTER SECTION)



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Return to Master TOC

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INPUT FILTER BOARD REMOVAL AND REPLACEMENT**⚠ WARNING**

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

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

TEST DESCRIPTION

The following procedure will aid the technician in removing the Input Filter Board for replacement.

MATERIALS NEEDED

7mm Nutdriver
Phillips Head Screwdriver

Return to Section TOC

Return to Master TOC

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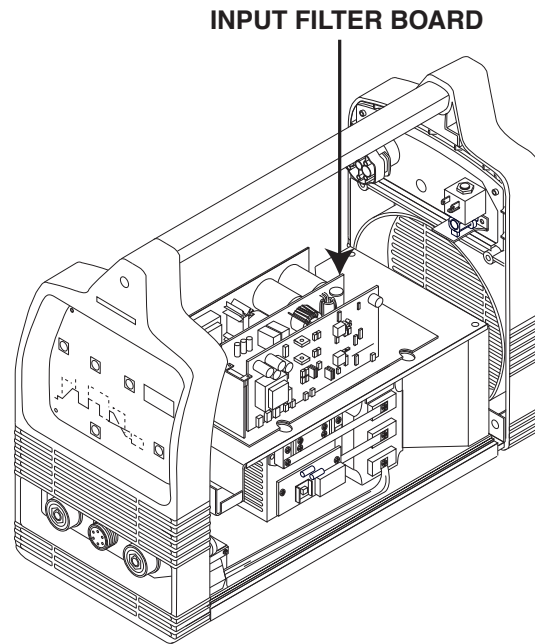
Return to Master TOC

Return to Section TOC

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INPUT FILTER BOARD REMOVAL AND REPLACEMENT (continued)

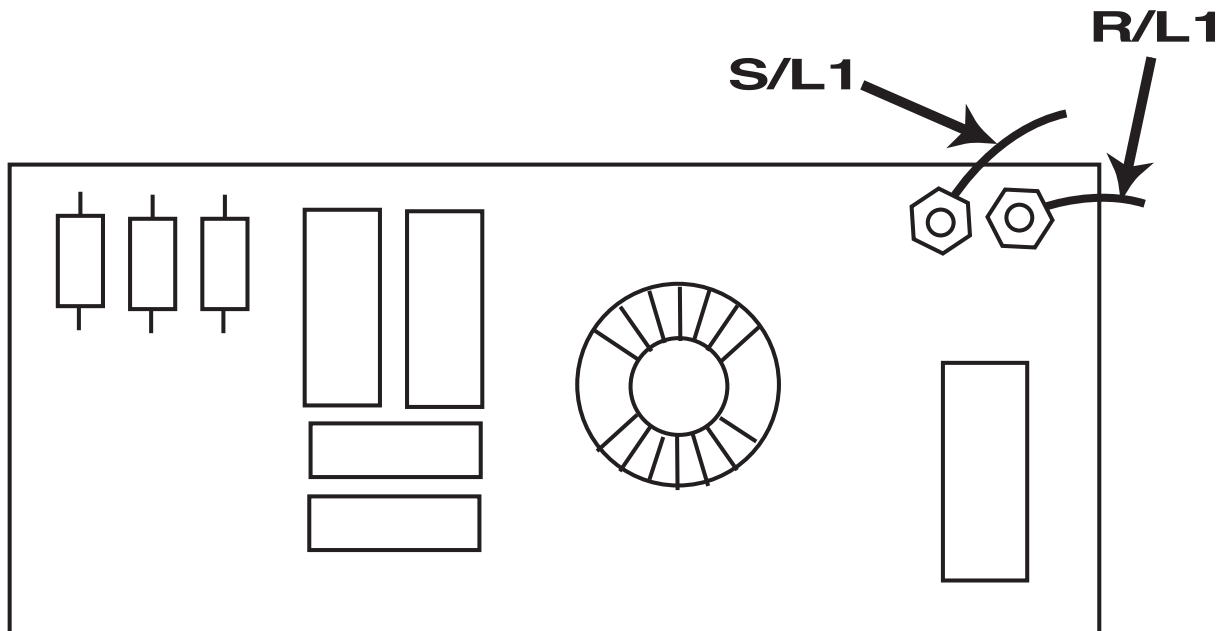
FIGURE F.24 – INPUT FILTER BOARD LOCATION



PROCEDURE

1. Remove input power to the V205-T.
2. Using a phillips head screwdriver remove the case wraparound cover.
3. Perform the **Input Filter Capacitor Discharge Procedure** detailed earlier in this section.
4. Locate the input filter board. See Figure F.24.
5. Using a 7mm nut driver, label and remove leads R/L1 and S/L2 from the upper right corner of the input filter board. See Figure F.25.
6. Using a 7mm nut driver, label and remove leads RV1 and RV2 from the left side of the main IGBT board. See **Figure F.26**. See Wiring Diagram

FIGURE F.25 – INPUT FILTER BOARD LEADS

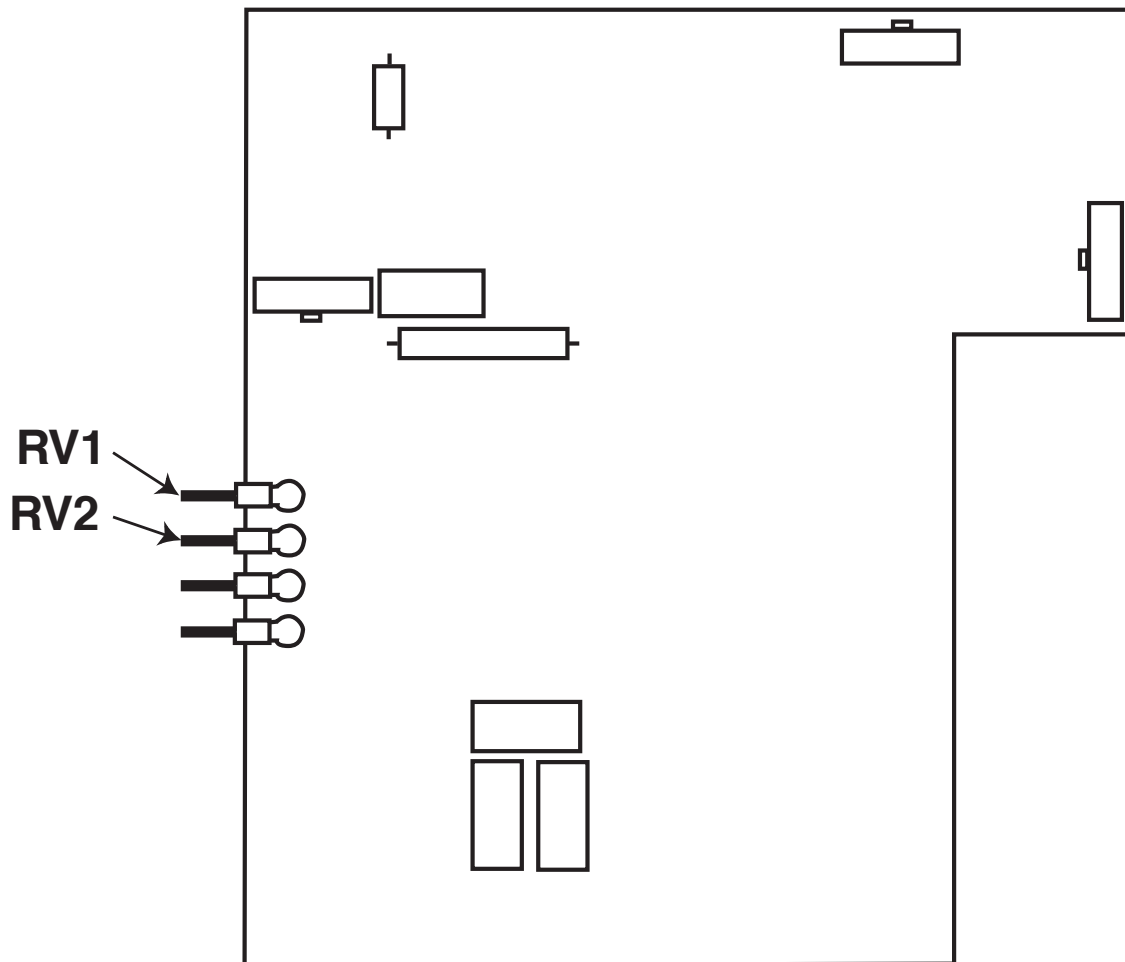


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INPUT FILTER BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.26 – MAIN IGBT BOARD LEAD REMOVAL



⚠ CAUTION

Observe static precautions detailed in *PC Board Troubleshooting Procedures* at the beginning of this section.

7. Clean RTV off of the top of the input filter board mounting slides.
8. Release the board by simply pressing the two metal buttons at the ends of the board with your thumbs. Depressing these buttons will free the plastic lock pins that prevent the P.C. board from sliding upward.
9. Remove and replace the input filter board.
10. Slide the new input filter board into its proper position on the mounting slides.
11. Push on backside of mounting pins to ensure that the P.C. board is secured in its proper position.
12. Reconnect all previously removed leads to their proper locations. See Wiring Diagram if necessary.
13. Replace case wraparound assembly.

MAIN IGBT BOARD REMOVAL AND REPLACEMENT**⚠ WARNING**

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

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

TEST DESCRIPTION

The following procedure will aid the technician in removing the Main IGBT Board for replacement.

MATERIALS NEEDED

7mm Nutdriver
Phillips Head Screwdriver
Wiring Diagram

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

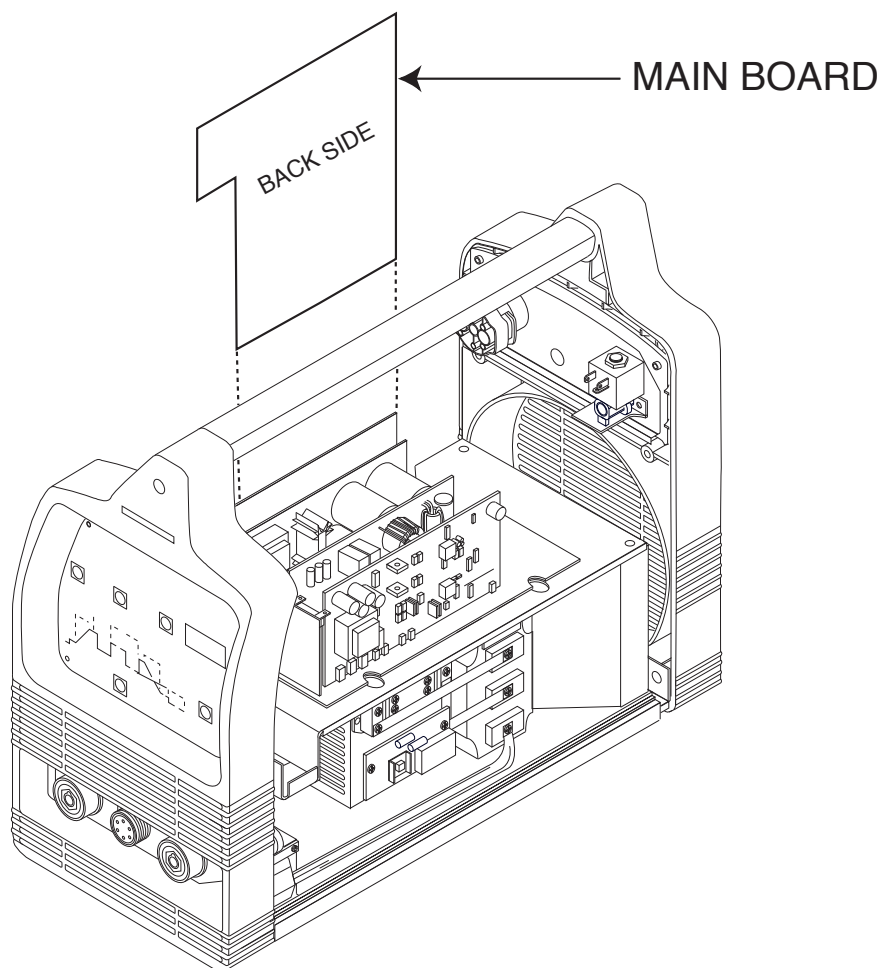
Return to Master TOC

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Return to Master TOC

MAIN IGBT BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.27 – MAIN IGBT BOARD LOCATION



PROCEDURE

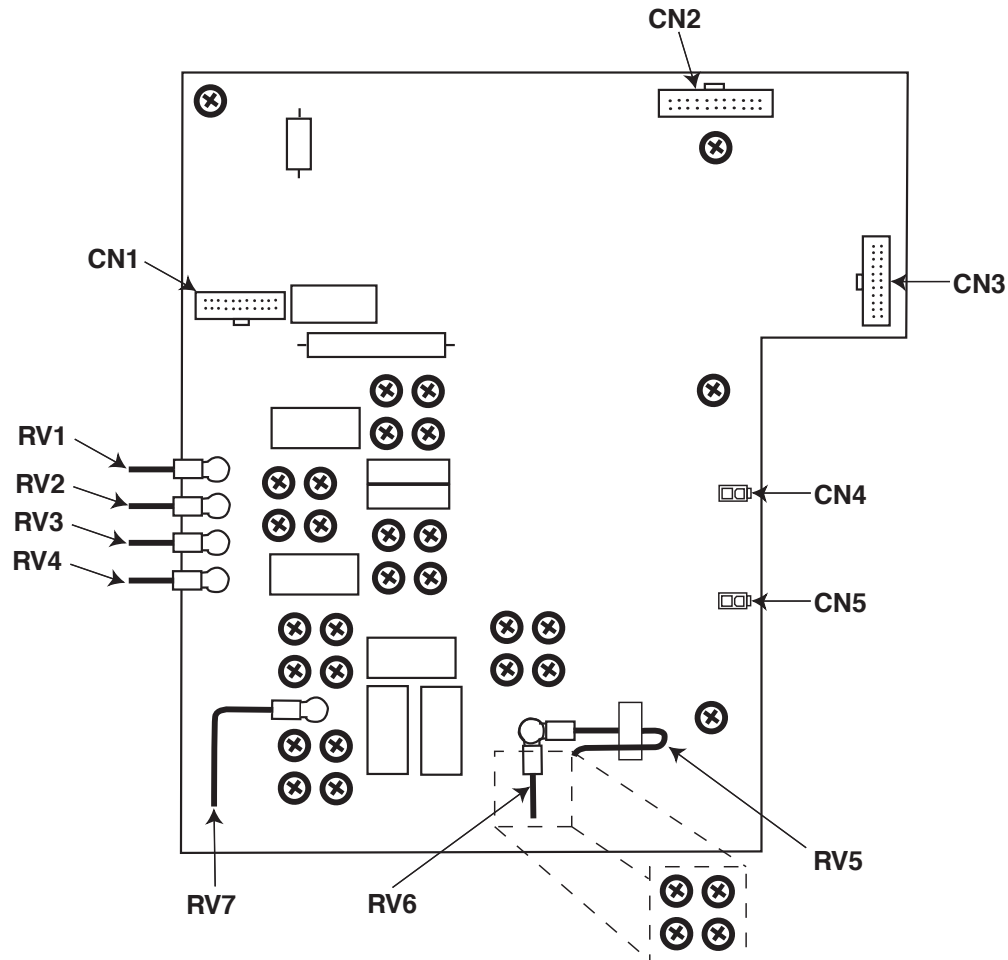
1. Remove input power to the V205-T.
 2. Using a phillips head screwdriver remove the case wraparound cover.
 3. Perform the **Input Filter Capacitor Discharge Procedure** detailed earlier in this section.
 4. Locate the main IGBT board. See Figure F.27.
 5. VERY CAREFULLY, label and disconnect plugs CN1, CN2, CN3, CN4 & CN5. See **Figure F.28**.
 6. Using a 7mm nut driver, label and disconnect leads RV1, RV2, RV3, RV4, RV5, RV6 & RV7. See **Figure F.28**.
 7. Using a phillips head screwdriver, remove the thirty-two (32) phillips head screws from the main board. Note washer positions for replacement. See **Figure F.28**.
 8. Carefully maneuver the main board out of the machine. Replace.
 9. Maneuver new board into its proper location and secure to machine using the thirty-two phillips head screws previously removed.
- NOTE:** All ribbon cable connections are secured by a small amount of RTV on the outside surface to keep the connections secure.

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MAIN IGBT BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.28 – MAIN BOARD PLUG AND MOUNTING SCREW LOCATION



10. Reconnect previously removed leads RV1 thru RV7 to the P.C. board. See Wiring Diagram if necessary.
11. Reconnect previously removed plugs CN1 thru CN5 to the P.C. board.
12. Replace the case wraparound cover previously removed.

NOTE: All ribbon cable connections have an "indexing location slot" to assure proper replacement.

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CONTROL/DISPLAY BOARD REMOVAL AND REPLACEMENT**⚠ WARNING**

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

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

TEST DESCRIPTION

The following procedure will aid the technician in removing the Control/Display Board for replacement.

MATERIALS NEEDED

Phillips Head Screwdriver
Wiring Diagram

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

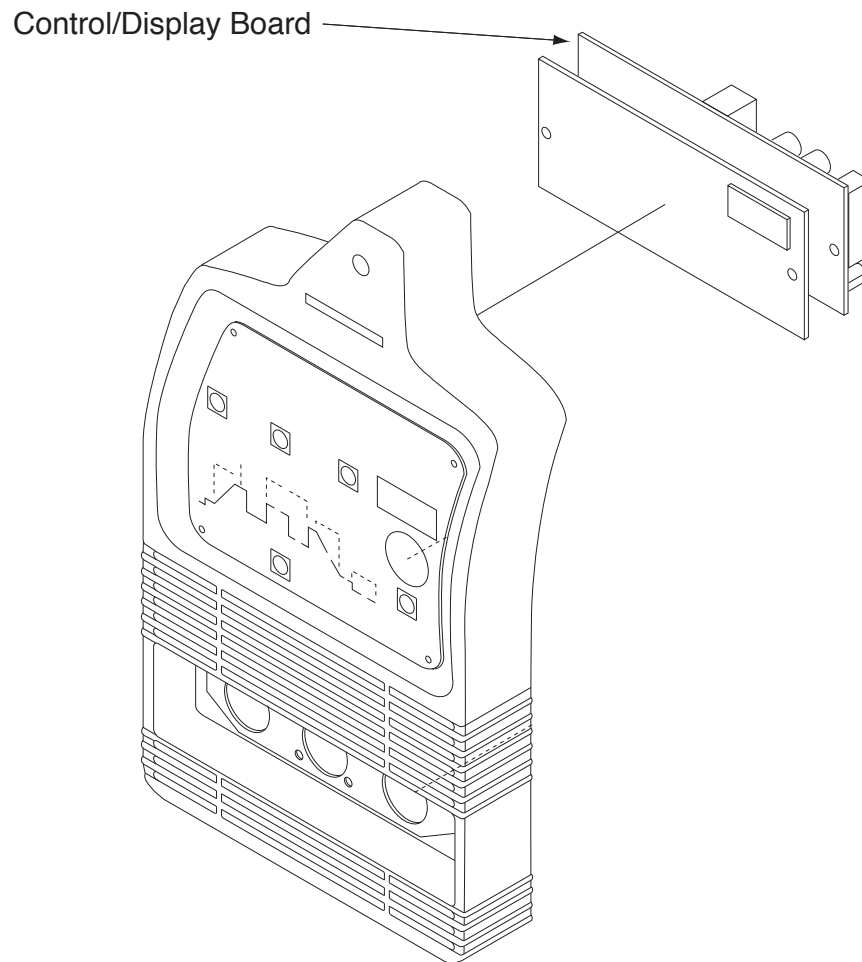
Return to Master TOC

Return to Master TOC

Return to Master TOC

CONTROL/DISPLAY BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.29 – CONTROL/DISPLAY BOARD LOCATION



PROCEDURE

1. Remove the input power to the V205-T.
2. Using a phillips head screwdriver remove the four screws from the corners of the nameplate/keypad on the front of the machine. See **Figure F.30**.
3. Tilt display plate forward and carefully label and disconnect leads CN1, CN2, CN3 & CN7. See **Figure F.31**.
4. Disconnect the ground lead running from the P.C. board to the machine frame. See **Figure F.31**.
5. Carefully remove the board assembly.
6. Replace the board assembly.
7. Connect previously removed ground lead.
8. Connect previously removed leads CN1, CN2, CN3, & CN7.
9. Replace the four phillips head screws previously removed from the corners of the nameplate/keypad.

NOTE: The board assembly is attached to the nameplate/keypad and is to be replaced as one unit.

CAUTION

Observe static precautions detailed in **PC Board Troubleshooting Procedures** at the beginning of this section. Failure to do so can result in permanent damage to equipment.

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OUTPUT FILTER BOARD REMOVAL AND REPLACEMENT

WARNING

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

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

TEST DESCRIPTION

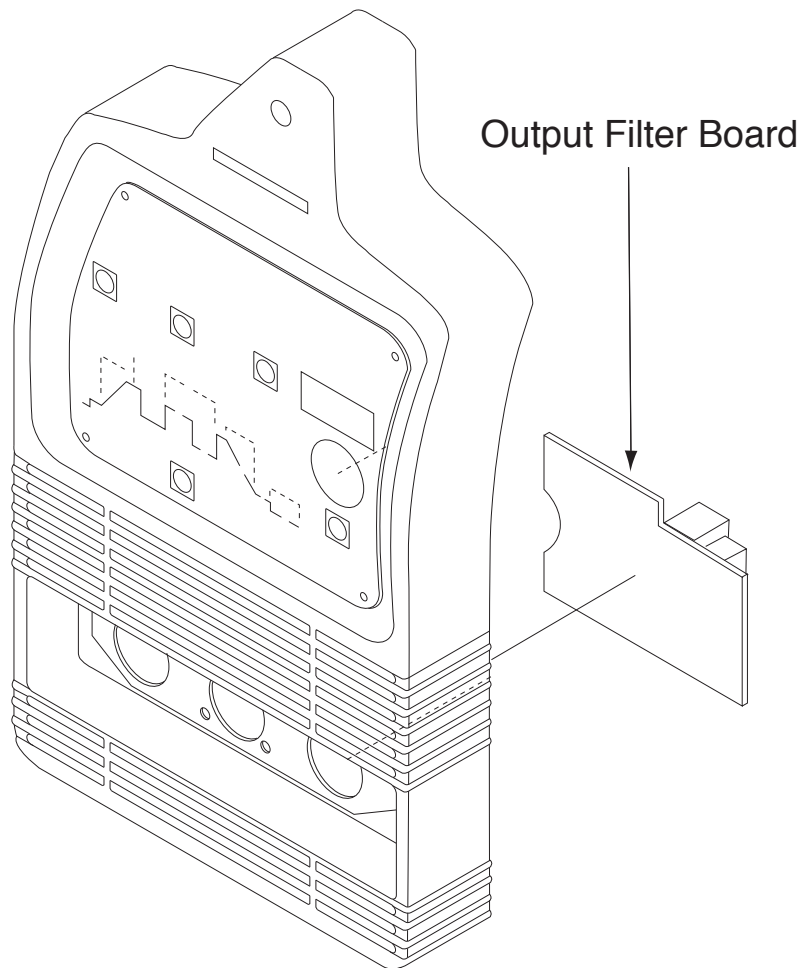
The following procedure will aid the technician in removing the Output Filter Board for replacement.

MATERIALS NEEDED

- 17mm Wrench
- 13mm Wrench
- Large Crescent Wrench
- Phillips Head Screwdriver
- 90° Phillips Head Screwdriver

OUTPUT FILTER BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.32 – OUTPUT FILTER BOARD LOCATION



PROCEDURE

1. Remove input power to the V205-T.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
4. Using a phillips head screwdriver, remove the four screws at the corners of the nameplate/keypad. See ***Figure F.33***.
5. Gently pull the Control/Display board assembly forward and up to gain access to the two casefront mounting screws located beneath. See ***Figure F.33***.
6. Remove the two phillips head casefront mounting screws located behind the metal display plate. See ***Figure F.33***.
7. Remove the four phillips head screws located around the output terminals on the lower front of the machine. See ***Figure F.33***.
8. Carefully manipulate the casefront off of the machine.

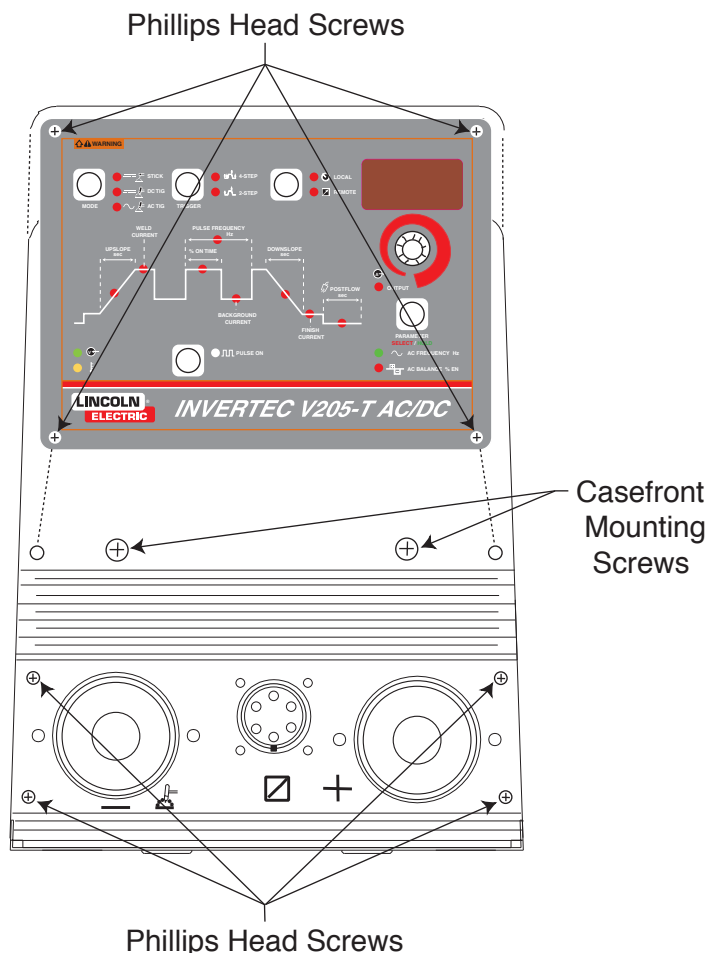
NOTE: There is no need to disconnect any leads from the P.C. boards located behind the nameplate/keypad.

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OUTPUT FILTER BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.33 – CASE FRONT SCREW REMOVAL



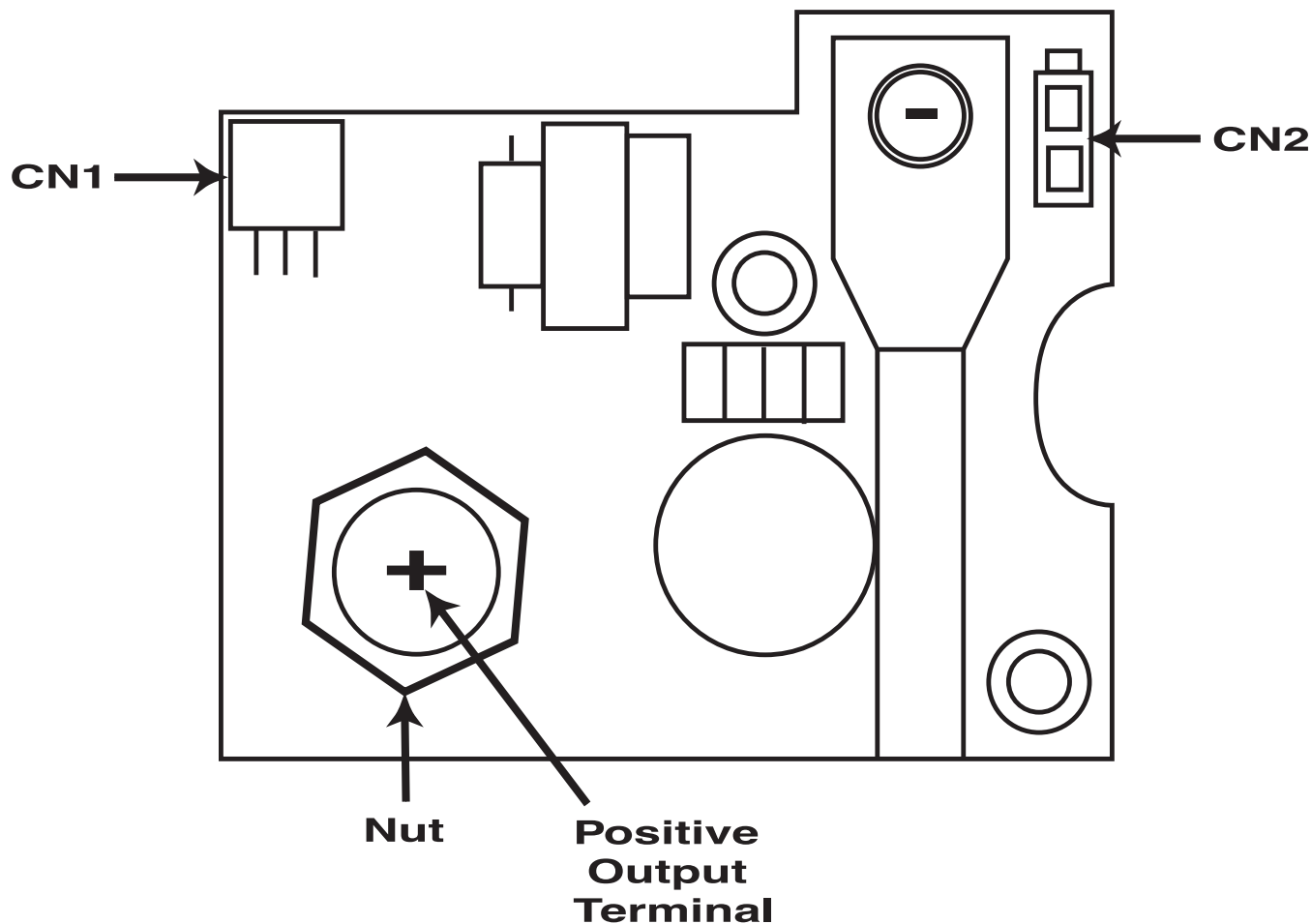
9. Using a 17mm wrench, remove the heavy lead from the positive output terminal.
 10. Using a 13mm wrench, remove the heavy lead from the high frequency transformer.
 11. Disconnect plugs CN1 and CN2 from the output filter board. See **Figure F.34**.
 12. Using a 90° phillips head screwdriver, remove the output filter board mounting screws.
- NOTE:** The output terminal assembly may have to be removed to gain access to the output filter board mounting screws.
13. Remove the large nut holding the output filter board to the positive terminal. See **Figure F.34**.
 14. Disconnect plug CN7 from the control/display board assembly. See **Control/Display Board Removal Procedure** for plug CN7 location.
 15. Carefully remove the output filter board by sliding it by the plug and lead assembly.
 16. Replace the output filter board.
 17. Maneuver the new board into its proper location from which it was previously removed.

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OUTPUT FILTER BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.34 – OUTPUT FILTER BOARD



18. Reconnect lead CN7 previously removed from the control/display board assembly.
19. Replace the large nut previously removed from around the positive output terminal.
20. Replace the two output filter board mounting screws previously removed.
21. Reconnect plugs CN1 and CN2 previously removed from the output filter board.
22. Reconnect all heavy leads previously removed.
23. Replace casefront.
24. Replace all casefront mounting screws.
25. Replace the four nameplate/keypad mounting screws previously removed.
26. Replace the case wraparound cover.

TROUBLESHOOTING AND REPAIR

OUTPUT DIODES REMOVAL AND REPLACEMENT

WARNING

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

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

TEST DESCRIPTION

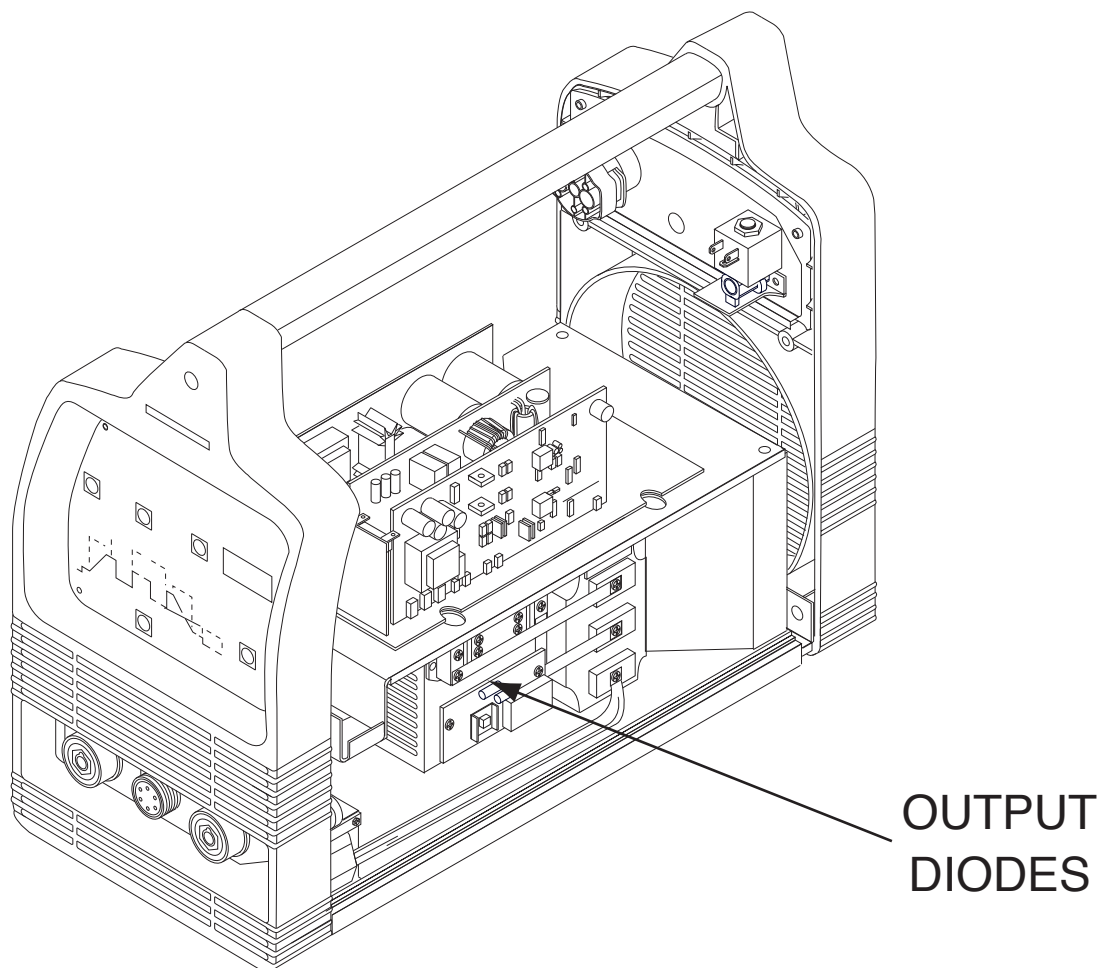
The following procedure will aid the technician in removing the Output Diodes for replacement.

MATERIALS NEEDED

- Phillips Head Screwdriver
- 7mm Nutdriver
- Heatsink Compound

OUTPUT DIODES REMOVAL AND REPLACEMENT (continued)

FIGURE F.35 – OUTPUT DIODE LOCATION



TO REPLACE ANY OF THE OUTPUT DIODES (D1, D2, D3 OR D4)

1. Remove input power to the V205-T.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
4. Locate the output diodes. See Figure F.35.
5. Using a phillips head screwdriver, remove the P.C. board mounting screws.
6. Using a phillips head screwdriver and/or a 7mm wrench, remove the copper bus bars from the diode module that is to be replaced.
7. Using a phillips head screwdriver, remove the two mounting screws from the output diode.
8. Remove and replace the output diode.
9. Apply a thin layer of heatsink compound to the areas of contact on the new diode/s.
10. Replace the two output diode mounting screws previously removed.
11. Replace the copper bus bars to their proper locations.
12. Mount the P.C. board previously removed.
13. Replace the case wraparound cover.

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OUTPUT TRANSISTOR REMOVAL AND REPLACEMENT

WARNING

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

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

TEST DESCRIPTION

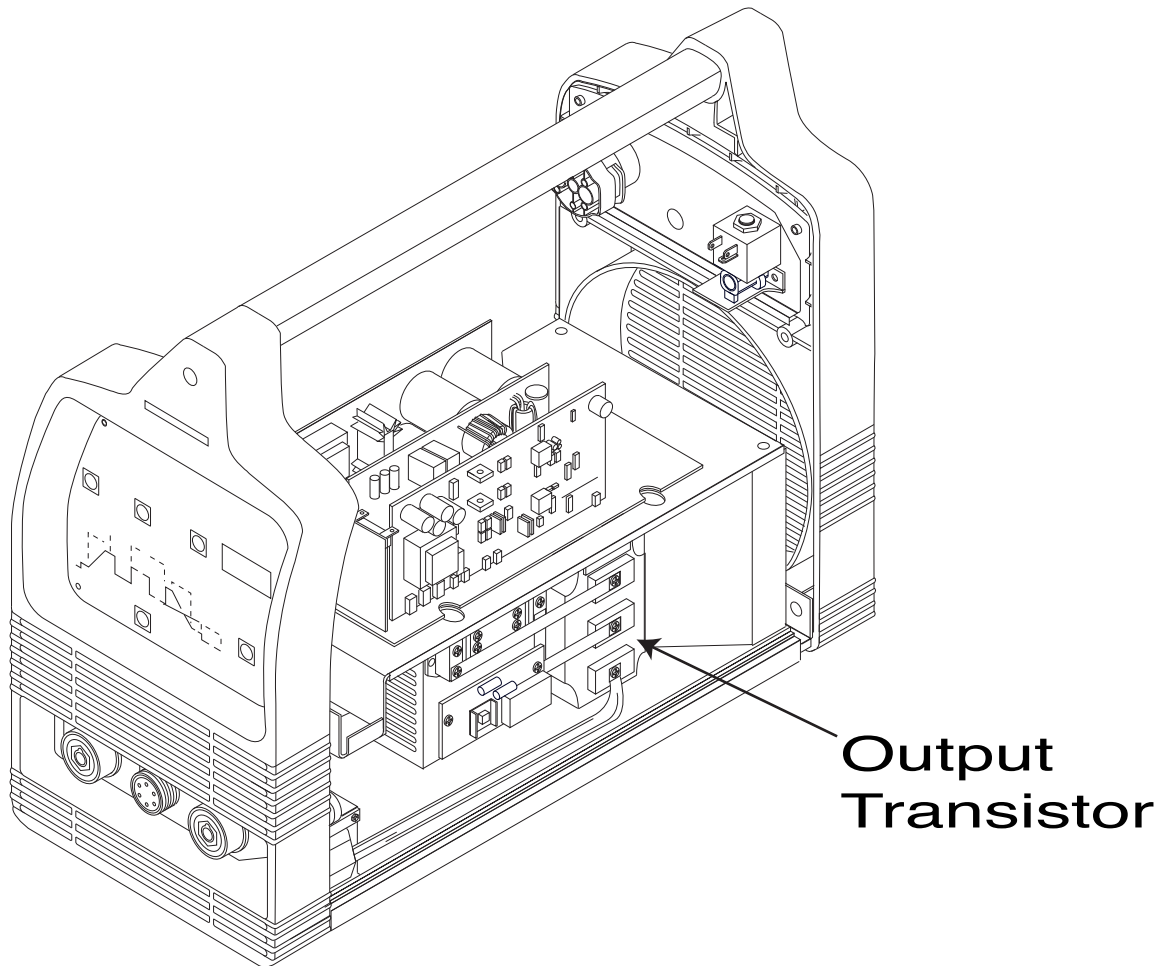
The following procedure will aid the technician in removing the Output Transistor for replacement.

MATERIALS NEEDED

- Phillips Head Screwdriver
- 5mm Allen Wrench
- Heatsink Compound

OUTPUT TRANSISTOR REMOVAL AND REPLACEMENT (continued)

FIGURE F.36 – OUTPUT TRANSISTOR LOCATION



PROCEDURE

1. Remove input power to the V205-T.
2. Using a phillips head screwdriver, remove the case wraparound cover.
3. Perform the ***Input Filter Capacitor Discharge Procedure*** detailed earlier in this section.
4. Locate the output transistor. See Figure F.36.
5. Disconnect plug CN1 from the output transistor. See ***Figure F.37***.
6. Using a phillips head screwdriver, disconnect leads 1, 2 & 3. See ***Figure F.37***.
7. Using a 5mm allen wrench, remove the output transistor mounting bolts.
8. Remove and replace the output transistor.
9. Apply a thin layer of heatsink compound to all contact surfaces.
10. Replace the output transistor mounting bolts previously removed.
11. Reconnect leads 1, 2 & 3 previously removed.
12. Reconnect lead CN1.
13. Replace the case wraparound cover.

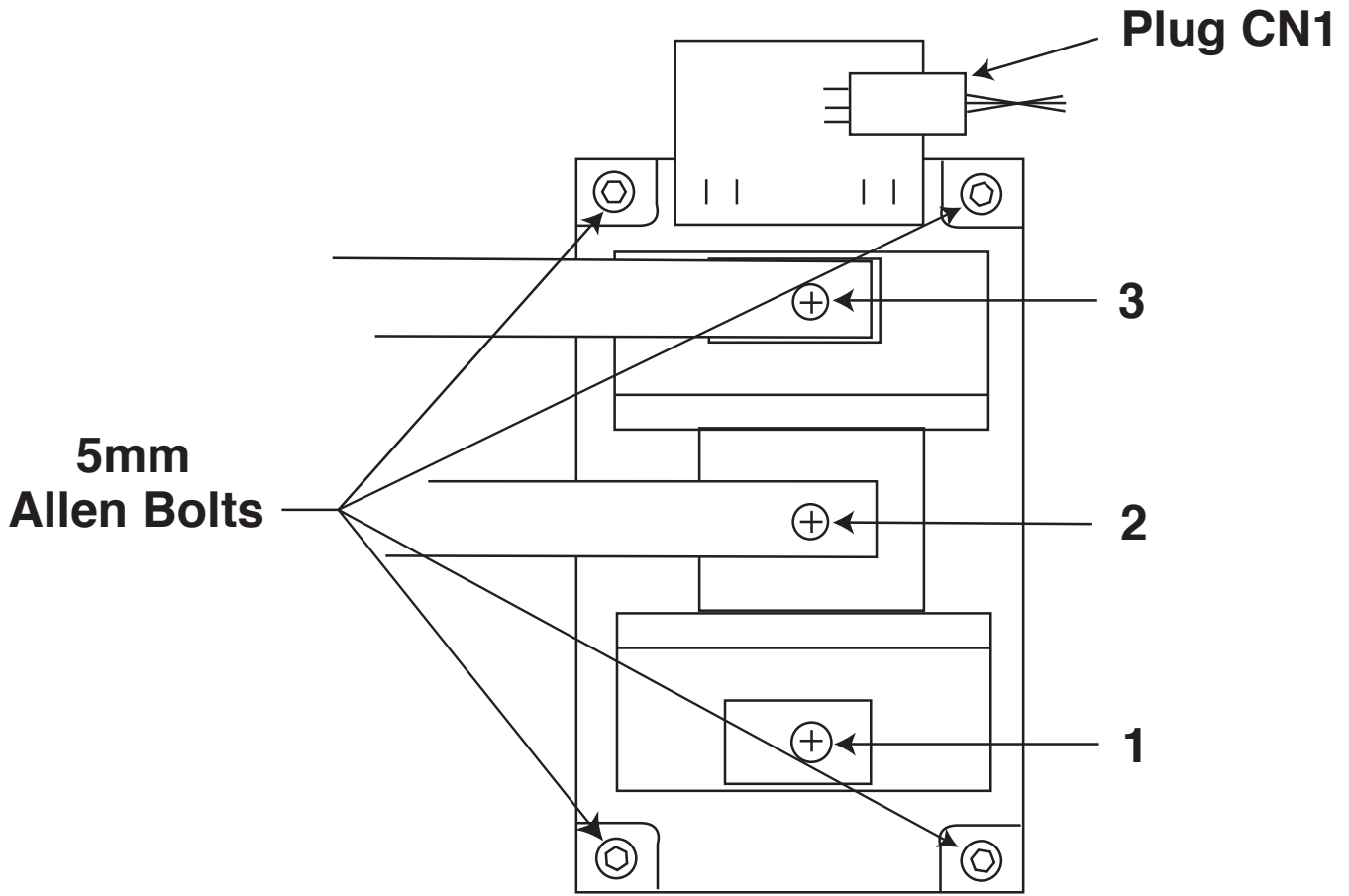
NOTE: Be careful not to bend the copper bus bars.

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OUTPUT TRANSISTOR REMOVAL AND REPLACEMENT (continued)

FIGURE F.37 – OUTPUT TRANSISTOR LEAD LOCATION



Return to Section TOC

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**TABLE OF CONTENTS
-ELECTRICAL DIAGRAMS SECTION-**

ELECTRICAL DIAGRAMS	SECTION G
WIRING DIAGRAM (CODE 10860 ONLY)	G-2

* NOTE: Many PC Board Assemblies are now totally encapsulated and are therefore considered to be unserviceable.

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