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INVERTEC® 170S

For use with machines having code numbers: 52068 - 52097

SERVICE MANUAL

LINCOLN ELECTRIC EUROPE
www.lincolnelectric.eu

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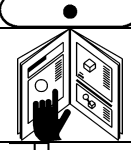
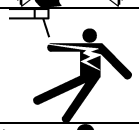
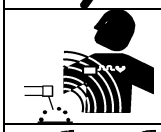
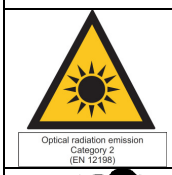
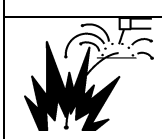
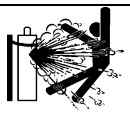
SAFETY

01/11

WARNING

This equipment must be used by qualified personnel. Be sure that all installation, operation, maintenance and repair procedures are performed only by qualified person. Read and understand this manual before operating this equipment. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment. Read and understand the following explanations of the warning symbols. Lincoln Electric is not responsible for damages caused by improper installation, improper care or abnormal operation.

	WARNING: This symbol indicates that instructions must be followed to avoid serious personal injury, loss of life, or damage to this equipment. Protect yourself and others from possible serious injury or death.
	READ AND UNDERSTAND INSTRUCTIONS: Read and understand this manual before operating this equipment. Arc welding can be hazardous. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment.
	ELECTRIC SHOCK CAN KILL: Welding equipment generates high voltages. Do not touch the electrode, work clamp, or connected work pieces when this equipment is on. Insulate yourself from the electrode, work clamp, and connected work pieces.
	ELECTRICALLY POWERED EQUIPMENT: Turn off input power using the disconnect switch at the fuse box before working on this equipment. Ground this equipment in accordance with local electrical regulations.
	ELECTRICALLY POWERED EQUIPMENT: Regularly inspect the input, electrode, and work clamp cables. If any insulation damage exists replace the cable immediately. Do not place the electrode holder directly on the welding table or any other surface in contact with the work clamp to avoid the risk of accidental arc ignition.
	ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS: Electric current flowing through any conductor creates electric and magnetic fields (EMF). EMF fields may interfere with some pacemakers, and welders having a pacemaker shall consult their physician before operating this equipment.
	CE COMPLIANCE: This equipment complies with the European Community Directives.
	ARTIFICIAL OPTICAL RADIATION: According with the requirements in 2006/25/EC Directive and EN 12198 Standard, the equipment is a category 2. It makes mandatory the adoption of Personal Protective Equipments (PPE) having filter with a protection degree up to a maximum of 15, as required by EN169 Standard.
	FUMES AND GASES CAN BE DANGEROUS: Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. To avoid these dangers the operator must use enough ventilation or exhaust to keep fumes and gases away from the breathing zone.
	ARC RAYS CAN BURN: 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. Use suitable clothing made from durable flame-resistant material to protect you skin and that of your helpers. Protect other nearby personnel with suitable, non-flammable screening and warn them not to watch the arc nor expose themselves to the arc.
	WELDING SPARKS CAN CAUSE FIRE OR EXPLOSION: Remove fire hazards from the welding area and have a fire extinguisher readily available. Welding sparks and hot materials from the welding process can easily go through small cracks and openings to adjacent areas. Do not weld on any tanks, drums, containers, or material until the proper steps have been taken to insure that no flammable or toxic vapors will be present. Never operate this equipment when flammable gases, vapors or liquid combustibles are present.
	WELDED MATERIALS CAN BURN: Welding generates a large amount of heat. Hot surfaces and materials in work area can cause serious burns. Use gloves and pliers when touching or moving materials in the work area.

	SAFETY MARK: This equipment is suitable for supplying power for welding operations carried out in an environment with increased hazard of electric shock.
	CYLINDER MAY EXPLODE IF DAMAGED: 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. Always keep cylinders in an upright position securely chained to a fixed support. Do not move or transport gas cylinders with the protection cap removed. Do not allow the electrode, electrode holder, work clamp or any other electrically live part to touch a gas cylinder. Gas cylinders must be located away from areas where they may be subjected to physical damage or the welding process including sparks and heat sources.

INSTALLATION AND OPERATOR INSTRUCTIONS

Read this entire section before installation or operation of the machine.

Location and Environment

This machine can operate in harsh environments. However, it is important that simple preventative measures are followed to assure long life and reliable operation:

- Do not place or operate this machine on a surface with an incline greater than 15° from horizontal.
- Do not use this machine for pipe thawing.
- This machine must be located where there is free circulation of clean air without restrictions for air movement to and from the air vents. Do not cover the machine with paper, cloth or rags when switched on.
- Dirt and dust that can be drawn into the machine should be kept to a minimum.
- This machine has a protection rating of:
  - 170S: IP23

  Keep it dry when possible and do not place it on wet ground or in puddles.
- Locate the machine away from radio controlled machinery. Normal operation may adversely affect the operation of nearby radio controlled machinery, which may result in injury or equipment damage. Read the section on electromagnetic compatibility in this manual.
- Do not operate in areas with an ambient temperature greater than 40°C.

Input Supply Connection

Check the input voltage, phase, and frequency supplied to this machine before turning it on. The allowable input voltage is indicated in the technical specification section of this manual and on the rating plate of the machine. Be sure that the machine is grounded.

Make sure the power available at the input connection is adequate for normal operation of the machine. The fuse rating and cable sizes are both indicated in the technical specification section of this manual.

Input Supply From Engine Driven Generators

- 170S:

  The machines are designed to operate on engine driven generators as long as the auxiliary can supply adequate voltage, frequency and power as indicated in the "Technical Specification" section of this manual. The auxiliary supply of the generator must also meet the following conditions:
  - Vac peak voltage: below 410V.
  - Vac frequency: in the range of 50 and 60Hz.
  - RMS voltage of the AC waveform: 230Vac ± 15%.

  It is important to check these conditions because many engine driven generators produce high voltage spikes. Operation of this machine with engine driven generators not conforming to these conditions is not recommended and may damage the machine.

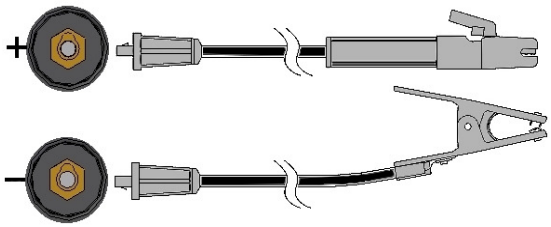
Output Connections

A quick disconnect system using Twist-Mate™ cable plugs is used for the welding cable connections. Refer to the following sections for more information on connecting the machine for operation of stick welding (MMA) or TIG welding.

- (+) Positive Quick Disconnect: Positive output connector for the welding circuit.
- (-) Negative Quick Disconnect: Negative output connector for the welding circuit.

Stick Welding (MMA)

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 of the machine for the selected polarity. Shown here is the connection method for DC(+) welding.

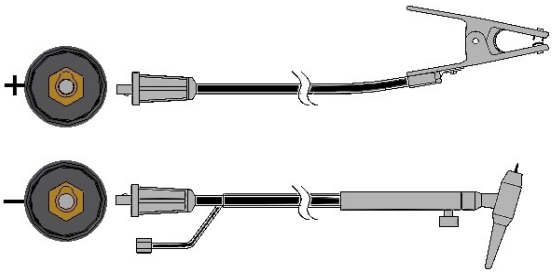


Connect the electrode cable to the (+) terminal and the work clamp to the (-) terminal. Insert the connector with the key lining up with the keyway and rotate approximately ¼ turn clockwise. Do not over tighten.

For DC(-) welding, switch the cable connections at the machine so that the electrode cable is connected to (-) and the work clamp is connected to (+).

TIG Welding

This machine does not include a TIG torch necessary for TIG welding, but one may be purchased separately. Refer to the accessories section for more information. Most TIG welding is done with DC(-) polarity shown here. If DC(+) polarity is necessary switch the cable connections at the machine.



Connect the torch cable to the (-) terminal of the machine and the work clamp to the (+) terminal. Insert the connector with the key lining up with the keyway and rotate approximately ¼ turn clockwise. Do not over tighten. Finally, connect the gas hose to the gas regulator on the cylinder of gas to be used.

Allowable TIG processes:

- 170S: Lift TIG

Arc Force

Auto Adaptive Arc Force (with MMA welding):

During MMA welding is activated the function Auto Adaptive Arc Force that increases temporary the output current, used to clear intermittent connections between the electrode and the weld puddle that occur during stick welding.

This is an active control feature that guarantees the best arrangement between the arc stability and spatter presence. The feature "Auto Adaptive Arc Force" has instead of a fixed or manual regulation, an automatic and multilevel setting: its intensity depends by the output voltage and it is calculated in real time by the microprocessor where are also mapped the Arc Force levels. The control measure in each instant the output voltage and it determines the amount of the peak of current to apply; that value is enough to breaks the metal drop that is being transferred from the electrode to the workpiece as to guarantee the arc stability, but not too high to avoid spatters around the welding puddle. That means:

- Electrode / workpiece sticking prevention, also with low current values.
- Spatters reduction.

The welding operations are simplified and the welded joins looks better, also if not brushed after the welding.

With the MMA welding are also enabled the following features:

- Hot Start: This is a temporary increase in the initial welding current. This helps ignite the arc quickly and reliably.
- Anti-Sticking: This is a function that decreases the output current of the machine to a low level when the operator makes an error and sticks the electrode to the work piece. This decrease in current allows the operator to remove the electrode from the electrode holder without creating large sparks that can damage the electrode holder.

Refer to the section below for more details.

Controls and Operational Features

Machine Start-Up:

When the machine is turned ON, an auto-test is executed; during this test only the Thermal LED is ON; after few seconds the Thermal LED turns OFF and the Power ON/OFF LED lights up.

- 170S: The Machine is ready to operate when on the Front Control Panel lights up the Power ON LED with one of the three LED of the Welding mode command.

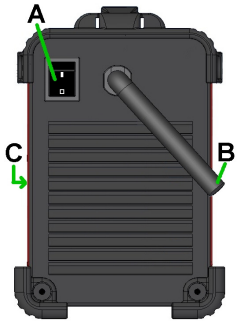
Front Panel Controls

	Output Current Knob: Potentiometer used to set the output current used during welding.
	Power ON/OFF LED: This LED lights up when the machine is ON. 170S: If blinking, this LED indicates that an Input Voltage Overrange protection is active; the Machine restarts automatically when the Input Voltage returns in the correct range.
	Thermal LED: This indicator will turn on when the machine is overheated and the output has been disabled. This normally occurs when the duty cycle of the machine has been exceeded. Leave the machine on to allow the internal components to cool. When the indicator turns off, normal operation is again possible.
170S 	VRD LED's (enabled on Australian Machines only): This machine is provided by VRD (Voltage Reduction Device) function: this reduces the voltage at the output leads. **The VRD function is enabled by factory default only on machines that meet the AS 1674.2 Australian Standards.** (C-Tick logo "✓" on/near the Rating Plate applied on the machine). **The VRD LED is ON** when the Output Voltage is below 32V with the Machine at idle (no welding time). For others machines this function is disabled (the LED is always OFF).

170S 	Welding Mode Switch: With three positions, controls the welding mode of the machine: two for Stick welding (Soft and Crisp) and one for Lift TIG welding. • Soft Stick: For a welding with a low spatter presence. • Crisp Stick: For an aggressive welding, with an increased Arc stability. • Lift TIG: When the mode switch is in the Lift TIG position, the stick welding functions are disabled and the machine is ready for Lift TIG welding. Lift TIG is a method of starting a TIG weld by first pressing the TIG torch electrode on the work piece in order to create a low current short circuit. Then, the electrode is lifted from the work piece to start the TIG arc.
	Meter: The meter displays the preset welding current before welding and the actual welding current during welding.

A. Power Switch: It turns ON / OFF the input power to the machine.

B. Input cable: This machine is provided with a plugged input cord. Connect it to the mains.



C. Fan:
- 170S: This machine has a F.A.N. (Fan As Needed) circuitry inside. The machine automatically reduces the speed of the fan or turns it OFF. This feature reduces the amount of dirt which can be drawn inside the machine and reduces power consumption. When the machine is turned ON the fan will turn ON. The fan will continue to run whenever the machine is welding. The F.A.N. feature is active after that the machine doesn't weld for more than 10 minutes, the fan speed will return to the maximum speed if a welding operation restarts.

Electromagnetic Compatibility (EMC)

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This machine has been designed in accordance with all relevant directives and standards. However, it may still generate electromagnetic disturbances that can affect other systems like telecommunications (telephone, radio, and television) or other safety systems. These disturbances can cause safety problems in the affected systems. Read and understand this section to eliminate or reduce the amount of electromagnetic disturbance generated by this machine.

This machine has been designed to operate in an industrial area. The operator must install and operate this equipment as described in this manual. If any electromagnetic disturbances are detected the operator must put in place corrective actions to eliminate these disturbances with, if necessary, assistance from Lincoln Electric. The Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances. This equipment does not comply with IEC 61000-3-12. If it is connected to a public low-voltage system, it is responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

Before installing the machine, the operator must check the work area for any devices that may malfunction because of electromagnetic disturbances. Consider the following.

- Input and output cables, control cables, and telephone cables that are in or adjacent to the work area and the machine.
- Radio and/or television transmitters and receivers. Computers or computer controlled equipment.
- Safety and control equipment for industrial processes. Equipment for calibration and measurement.
- Personal medical devices like pacemakers and hearing aids.
- Check the electromagnetic immunity for equipment operating in or near the work area. The operator must be sure that all equipment in the area is compatible. This may require additional protection measures.
- The dimensions of the work area to consider will depend on the construction of the area and other activities that are taking place.

Consider the following guidelines to reduce electromagnetic emissions from the machine.

- Connect the machine to the input supply according to this manual. If disturbances occur if may be necessary to take additional precautions such as filtering the input supply.
- The output cables should be kept as short as possible and should be positioned together. If possible connect the work piece to ground in order to reduce the electromagnetic emissions. The operator must check that connecting the work piece to ground does not cause problems or unsafe operating conditions for personnel and equipment.
- Shielding of cables in the work area can reduce electromagnetic emissions. This may be necessary for special applications.

MAINTENANCE

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 preventive maintenance, perform the following capacitor discharge procedure to avoid electric shock

INPUT FILTER CAPACITORS DISCHARGE PROCEDURE

This procedure will drain off any charge stored in the four capacitors that are part of the 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.

1. Remove input power to Invertec 170S machine
2. Remove the cover following the instruction available in this Service manual.
3. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is NOT supplied with the machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
4. Locate the resistor **R86** that is directly connected to the terminals **DC+** and **DC –** on the main board, **See Figure 1** and check the voltage across it, it should be zero; if not follow the next step.
5. Use electrically insulate gloves and insulated pliers. **See Figure 1a**. Hold the body of the resistor and connect the resistor leads across the resistor **R86**. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
6. Check the voltage across the resistor **R86**. Voltage should be zero. If any voltage remains, repeat this procedure.

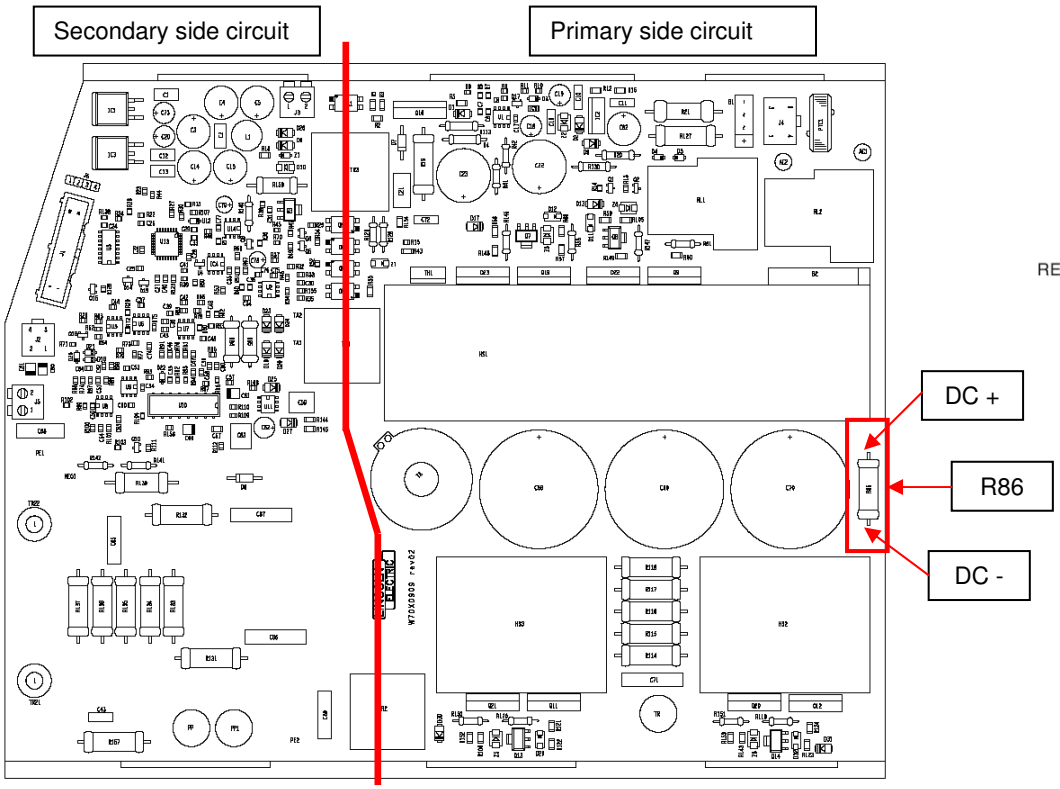


Figure 1 - Capacitors discharge location

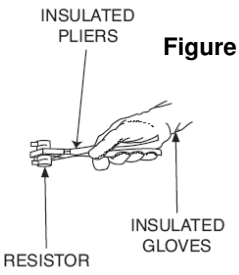


Figure 1a

ROUTINE MAINTENANCE

1. Keep the welding area around the machine clean and free of combustible materials. No debris should be allowed to collect which could obstruct air flow to the machine
2. Every 6 months the machine should be cleaned with a low pressure and dry airstream. Keeping the machine clean will result in cooler operation and higher reliability.
3. Examine the sheet metal case for dents or breakage. Repair the case as required. Keep the case in good condition to insure that high voltage parts are protected and correct spacing are maintained. All external sheet metal screw must be in place to ensure case strength and electrical ground continuity.

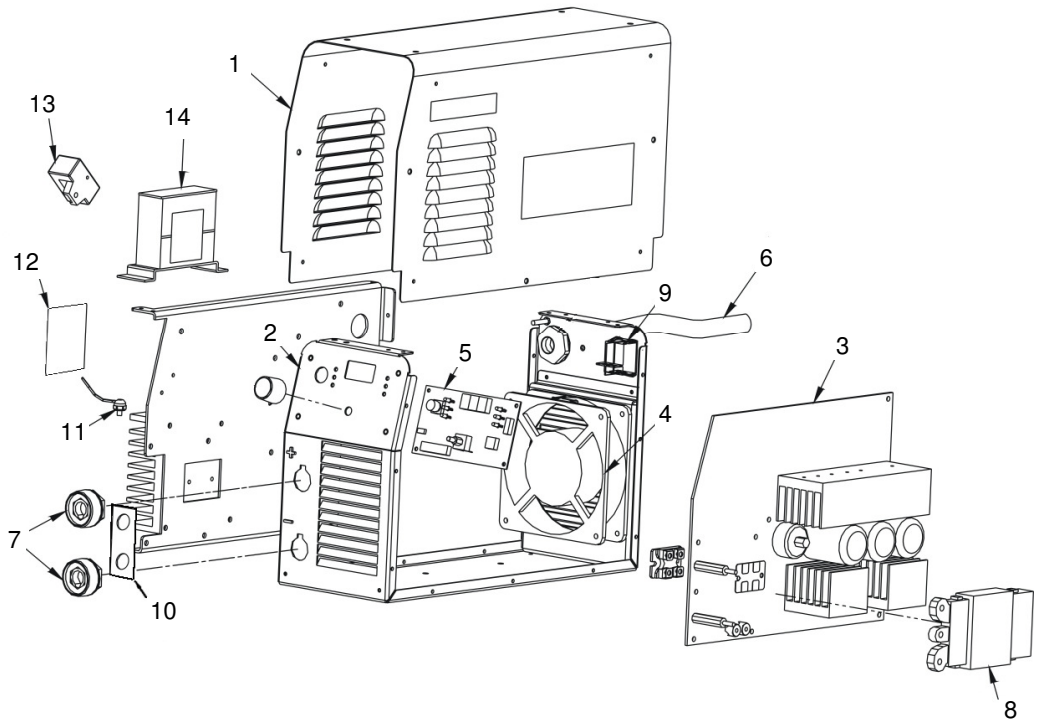
THERMAL PROTECTION

Thermal detection device protect the machine from excessive operating temperatures. Excessive temperatures may be caused by a lack of cooling air or operating the machine beyond the duty cycle and output rating. If excessive operating temperatures should occur, the yellow LED will light and the detection device will prevent output voltage or current.

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

MAJOR COMPONENTS LOCATION

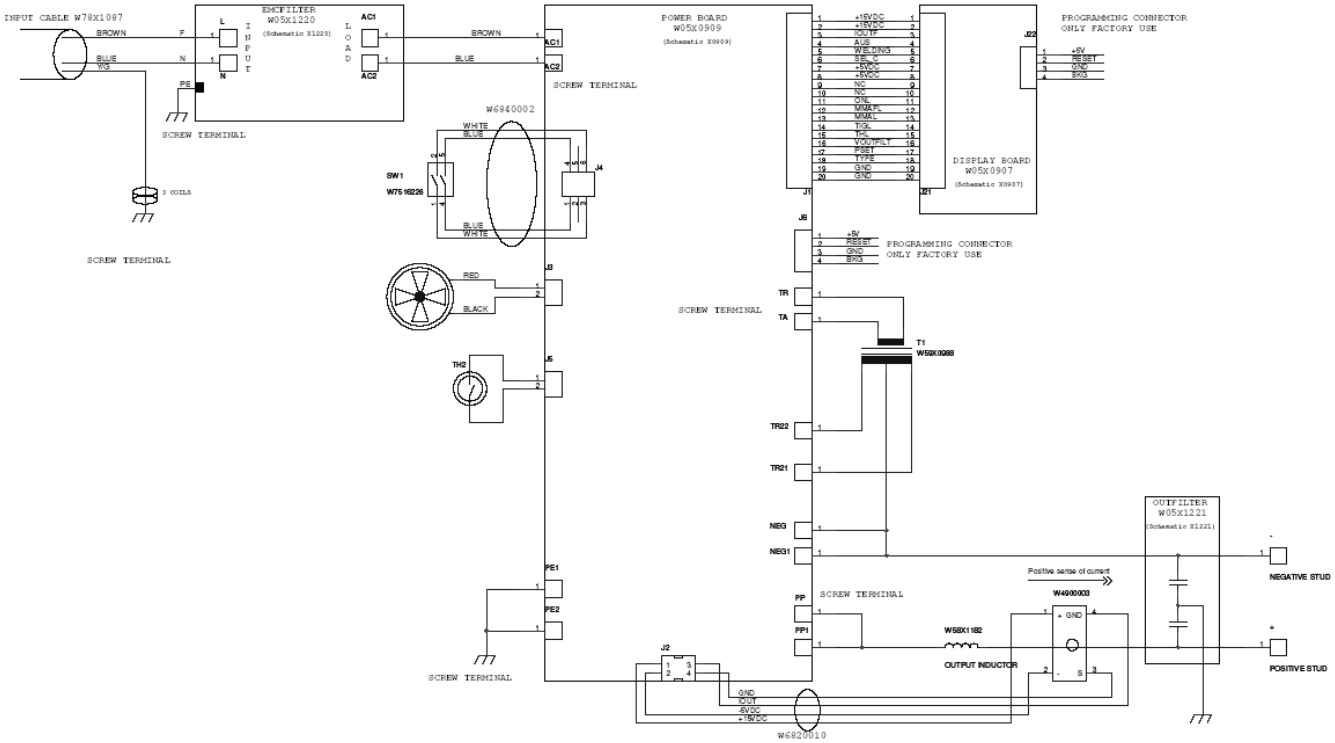
1. Wraparound
2. Main Frame
3. Inverter Board
4. Fan
5. Control Board
6. Input Cable
7. Output Dinse Connectors
8. Power Transformer
9. Mains Switch
10. Output Filter
11. Thermostat Sensor
12. Input Filter
13. Hall Sensor
14. Output Inductor



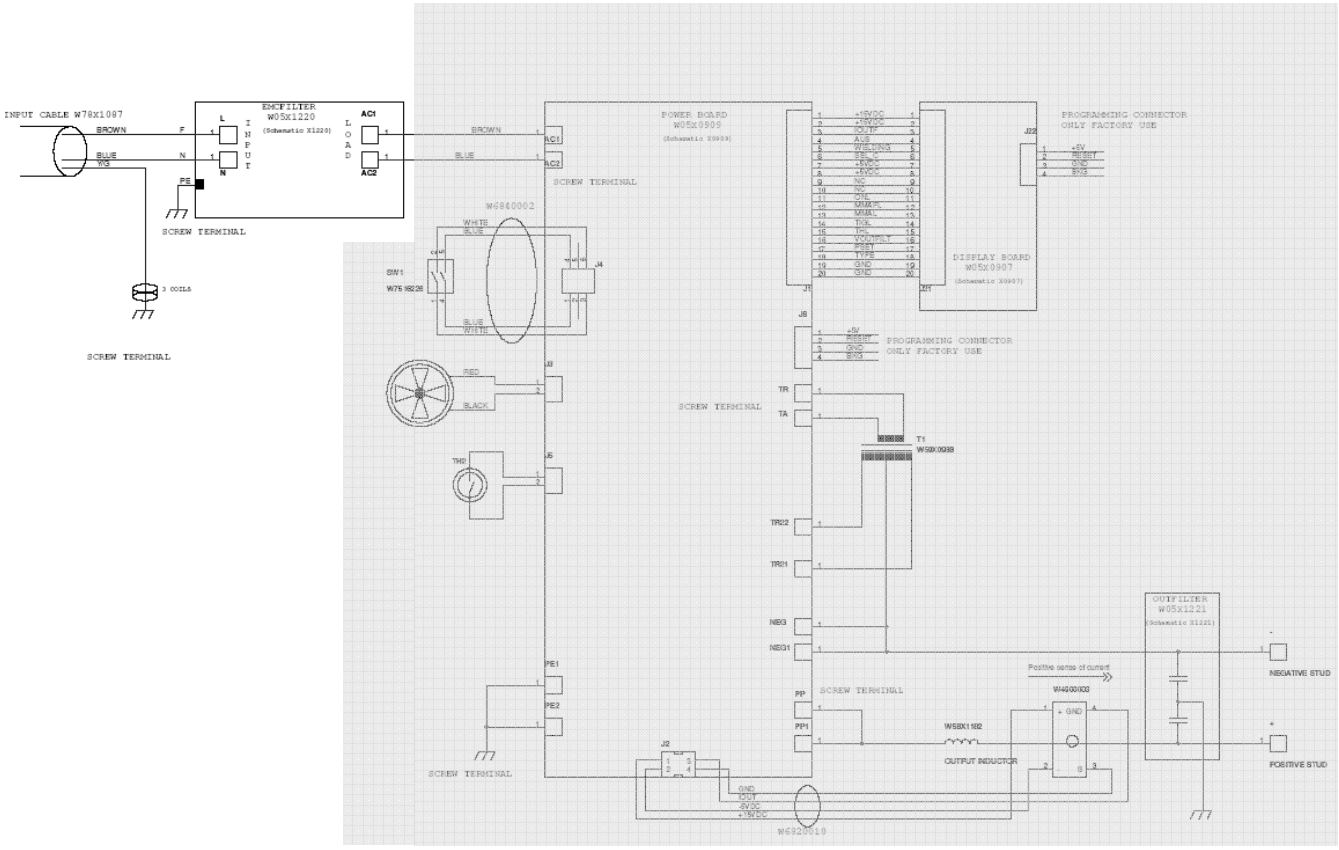
THEORY OF OPERATION

- General description
- Input Line Voltage, Auxiliary Voltage, Precharge
- Inverter Board , Main Transformer, Output Rectifier, Choke and Output Current Probe
- Control Board
- Protection Circuits and IGBTs operation

BLOCK DIAGRAM



GENERAL DESCRIPTION AND EMC FILTER BOARD



GENERAL DESCRIPTION

The INVERTEC® 170S is an industrial 160 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 LIFT TIG (GTAW). The unit is ideal for industrial applications where portability is important.

EMC FILTER BOARD

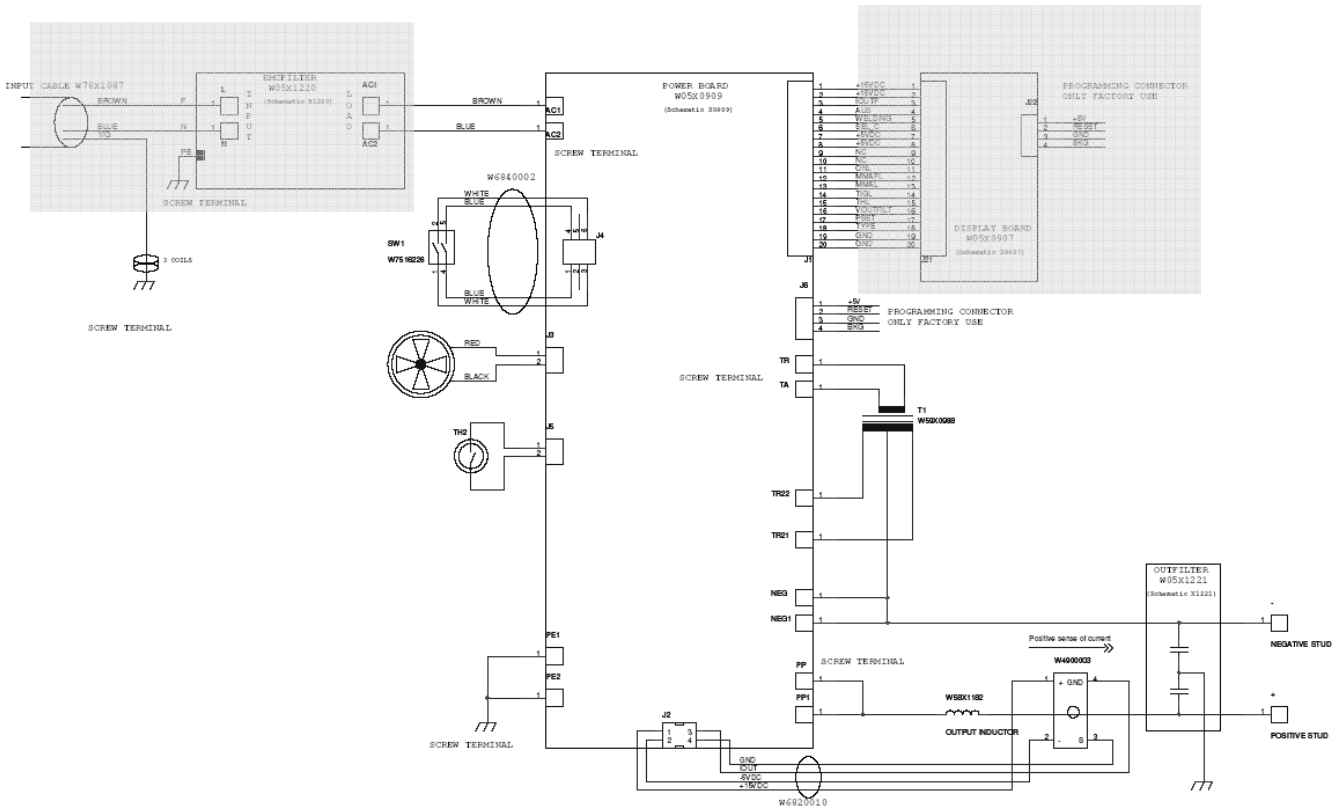
Prevents noise from the machine from being transmitted along the main power line and vice versa, necessary to be in accordance with all relevant directives and standards.

WARNING

ELECTRIC SHOCK can kill

EMC filter board is always always electrically hot when even the mains switch is to the OFF position

MAIN BOARD (INPUT-INVERTER-OUTPUT)



INPUT LINE VOLTAGE, AUXILIARY VOLTAGE AND PRECHARGE

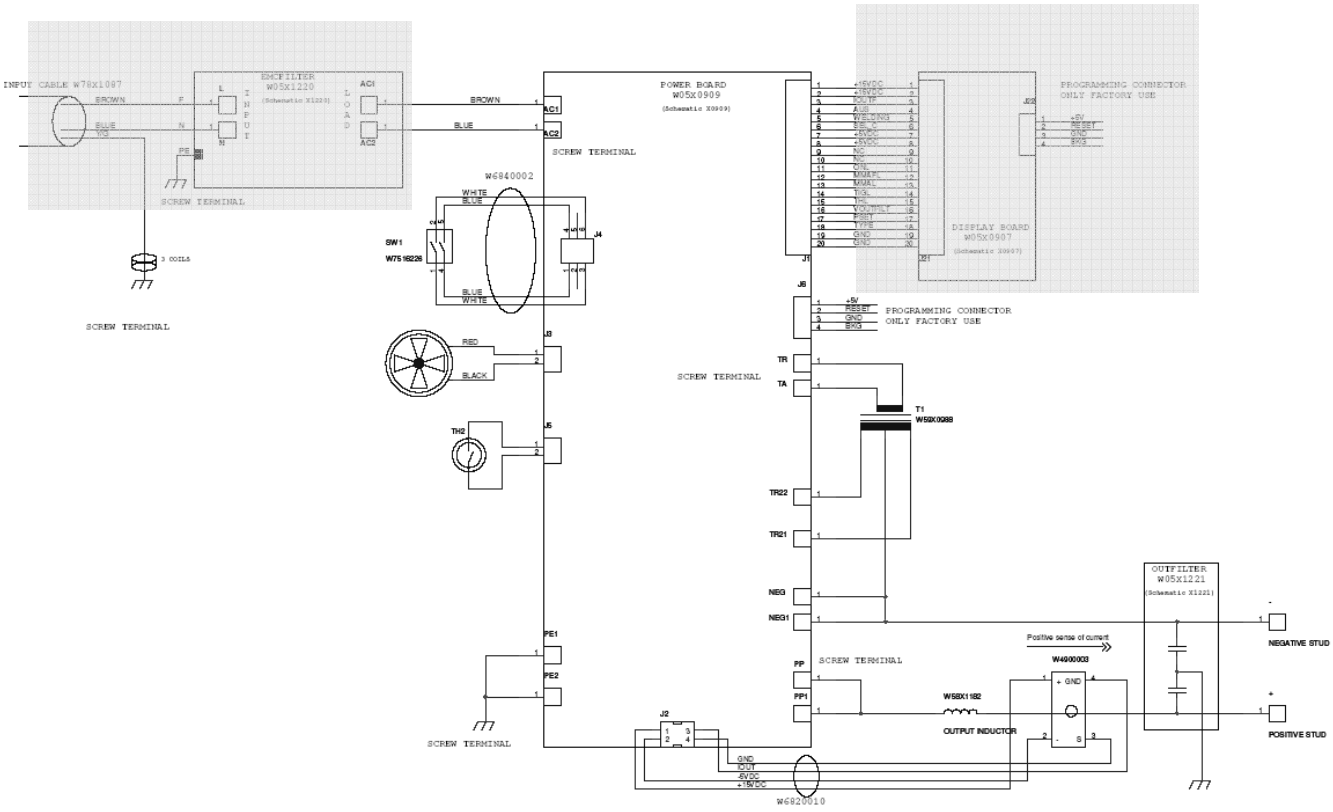
The Invertec 170S can be connected to a 230V +/- 15% single phase input voltage.
This unit can be also connect to engine driven generators but it must follow the below conditions:

- Vac peak voltage: below 410V.
- Vac frequency: in the range of 50 and 60 Hertz.
- RMS voltage of the AC waveform: 230Vac ± 15%.

The 230V 1 phase input power AC is conneted to the machine, through an input cable and an EMC filter board, directly to the main board. Once the input switch is moved to ON position the 230 Vac +/- 15% voltage is applied to the input circuits and the following activities will starts:

- +24Vdc is generated by the flyback power supply circuits
- +15Vdc, +5Vdc, -5Vdc are generated by linear regulator
- Control circuit and PTC1 manage the pre-charge phase. Pre-charge phase takes about 5 second to be completed.
- Control and protection from input power supply overvoltage.

MAIN BOARD (INPUT-INVERTER-OUTPUT) (continued)



INVERTER BOARD, MAIN TRANSFORMER, OUTPUT RECTIFIER, OUTPUT CHOKE AND OUPUT CURRENT PROBE

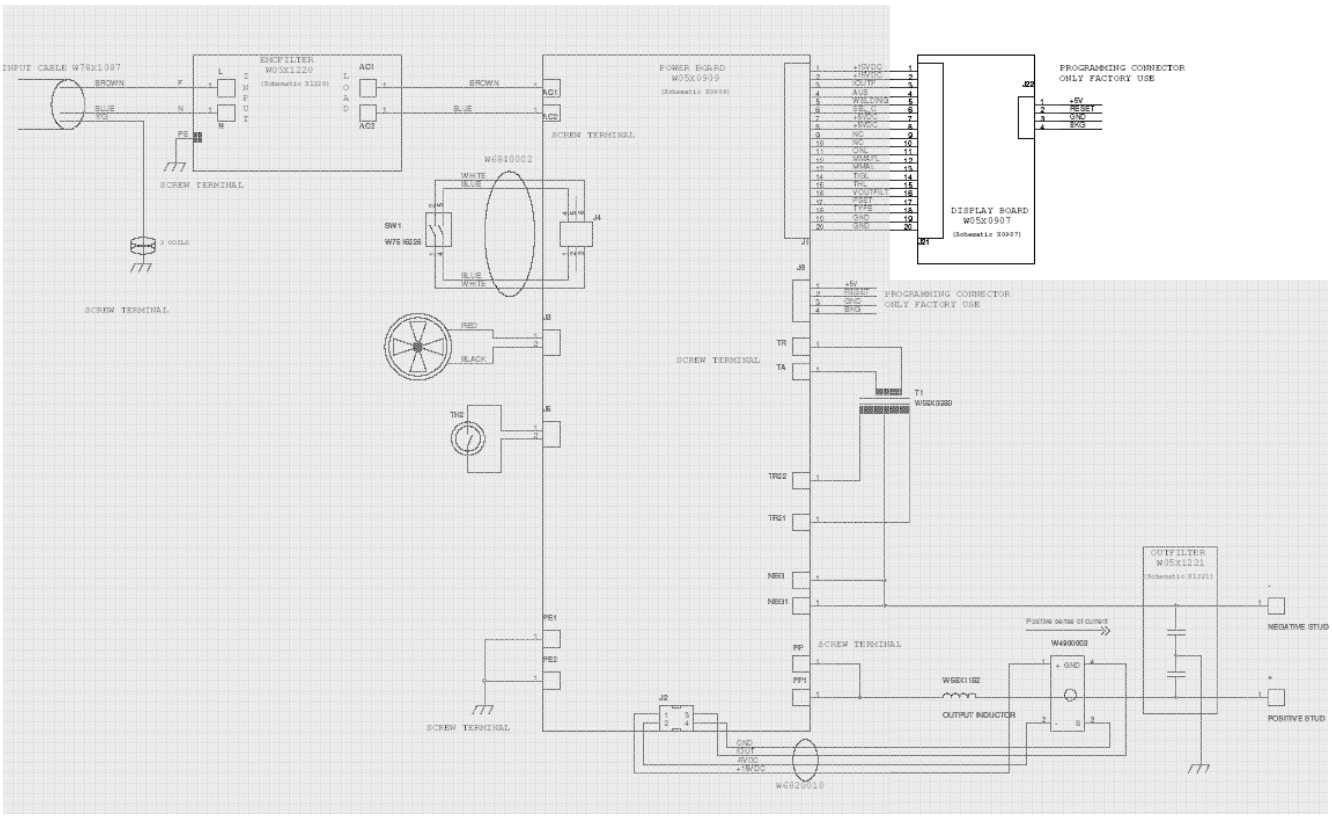
When the input filter capacitors are fully charged they act as power supplies for the IGBT switching circuit.
The IGBTs supply the main transformer winding with 50KHz current flow.
The inverter board also monitors the filter capacitors for overvoltage. If this occurs, the appropriate error signal is sent to the control board to disable the machines output and to turn on the thermal/voltage Overload LED.
The IGBTs act as a switch assembly. This assembly feeds the primary winding of the main transformer. When current is pulsed through this primary winding, a resultant current is produced on a secondary winding of the main transformer. Current transformer located on the inverter board monitor the primary current. If the primary current become abnormally high, the inverter control circuit will shut off the IGBTs, thus disabling the machine's output.

A thermal protector is also present, to the inverter heatsink, to protect the IGBTs from overheating conditions and to the output rectifier bridge heatsink.

The main transformer, insulate the primary circuit from the secondary circuit. Power transformer ratio is 5.5 that means the output voltage without control is 60Vdc. Power transformer is a planar type and it is outside the board.

The output rectifier receives the high frequency AC output from the main transformer secondary winding and rectifies it to a DC voltage level. As the current is passing throught the output choke a filtered DC output is applied to the machine's output terminals.
An output hall current probe read the output current and send the signal to the analog control loop that manage the output current.

CONTROL BOARD



Control Board (User Interface)

Control Board takes signals (Iout, Vout, Iset), shows the proper value on the display and generate the proper set reference for inverter board: manages stick function (soft crisp,hot start, arc force, antisticking). Manages input error (overvoltage), precharge of capacitor phase, fan and thermal error. It feeds this information to the WeldController. The Weld Controller is a micro-processor that uses these signals along with input from the Mode Switchand the Control Potentiometer to make decisions and change the machine mode and output to satisfy the requirements as decided by the operator. These changes are relayed to the PWM circuit on the Inverter Board to regulate the gate signals to the IGBT"s.

The Weld Controler also responds to thermal and input errors to shut down the machine output. The error information is then displayed by the LEDs on the front panel.

OVERLOAD PROTECTION

Invertec 170S are electrically protected from producing higher than normal output currents. An electronic protection circuit limits the current to within the capabilities of the machine.

THERMAL PROTECTION

There are one thermal device located on the output diodes heatsink;it protect the machine from excessive operating temperature.
Excessive temperature may be caused by a lack of cooling air or by operating the machine beyond the duty cycle and output rating. If excessive operating temperature should occur, the Thermal LED indicator on the control board, will turn ON and the thermostat will prevent output current.

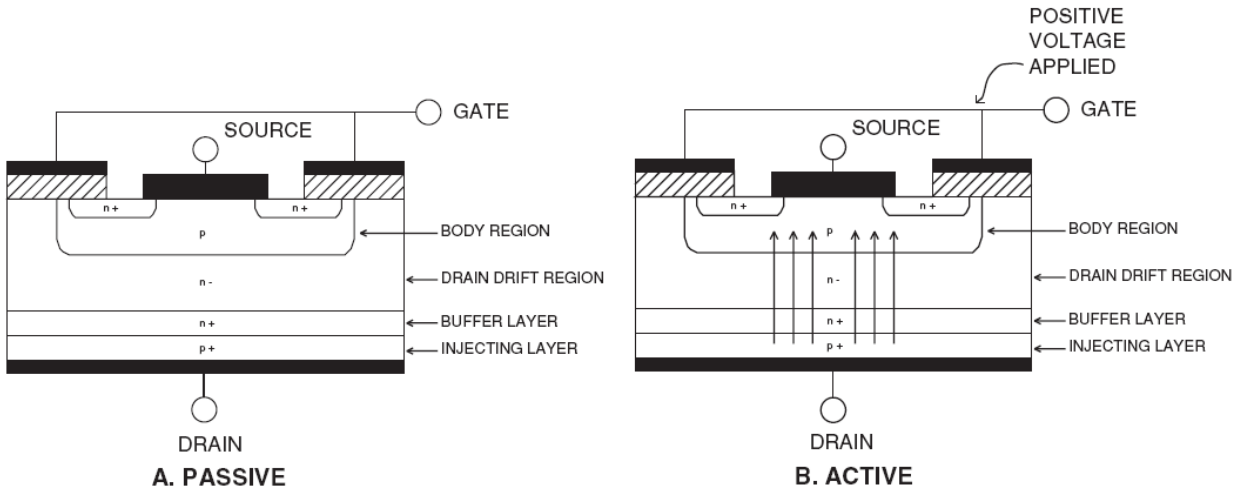
The thermal protection device is self-resetting once the machine cools sufficiently. If the shut down was caused by excessive output or duty cycle and the fan is operating normally, the power switch may be left on and the reset should occur within about 15 minute period. If the fan is not turning or the air intake louvers are obstructed, the input power must be removed and the fan problem or air obstruction must be corrected.

INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semicon-ductors well suited for high frequency switching and high current applications.
Drawing A shows an IGBT in a passive mode. There is no gate signal, zero volts relative to the source, and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

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

IGBT



TROUBLESHOOTING AND REPAIR SECTION

- How to use troubleshooting Guide
- Troubleshooting Guide
- Case cover removal and capacitor discharge procedure

HOW TO USE TROUBLESHOOTING GUIDE

Service and repair should be performed by only Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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 “PROBLEMS”. 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 three main categories: Output Problems, Function Problems, and LED Function Problems.

Step 2. PERFORM EXTERNAL TESTS. The second column, labeled “CHECKS”, lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

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

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

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 preventive maintenance, perform the following capacitor discharge procedure to avoid electric shock

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

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

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   - 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.
   - If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

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

TROUBLESHOOTING

!! WARNING !! **BEFORE CONNECT POWER SUPPLY, MAKE A CAREFUL VISUAL INSPECTION INSIDE THE MACHINE , CHECK ALL THE BOARDS AND HARNESS.**

= GENERAL PROBLEMS =

PROBLEMS / SYMPTOMS	POSSIBLE AREAS OF MISADJUSTMENT(S)	CHECK	RECOMMENDED COURSE OF ACTION
THE LINE CIRCUIT BREAKER TRIPS WHEN POWER SWITCH IS " ON"	• INPUT POWER BRIDGE IS IN SHORT CIRCUIT • ELECTROLYTIC CAPACITORS FAILURE • IGBTs SHORT CIRCUITED	• PERFORM THE MAIN BOARD RESISTANCE TEST • VISUAL INSPECTION AND PERFORM THE MAIN BOARD RESISTANCE TEST • PERFORM THE MAIN BOARD RESISTANCE TEST	• REPLACE W05X0909 INVERTER BOARD
THE MACHINE HAS, NO OUTPUT, NO FAN RUNNING	• THERE IS NO POWER SUPPLY ON LINE • THE POWER SUPPLY CABLE IS INTERRUPTED • LINE SWITCH FAILURE • THE INVERTER BOARD IS DAMAGED	• CHECK THE PHASE INPUT VOLTAGE ON THE MACHINE • CHECK THE POWER SUPPLY CABLE • CHECK THE LINE SWITCH • PERFORM THE MAIN BOARD RESISTANCE AND VOLTAGE TEST	• RECONNECT THE POWER SUPPLY • REPLACE THE INPUT POWER CABLE • REPLACE THE LINE SWITCH • REPLACE THE MAIN BOARD
NO LED ON FRONT PANEL IS ON AND THE FAN RUN FAST	• MAIN BOARD IS NOT FLASHED • FLAT CABLE IS NOT CONNECTED ON INVERTER BOARD	• OUTPUT VOLTAGE IS < 12 Vdc • OUTPUT VOLTAGE IS ALMOST 12 Vdc	• REPLACE MAIN BOARD • CONNECT FLAT CABLE

= OUTPUT PROBLEMS =

THE MACHINE SUPPLIES MORE THEN THE MAX CURRENT INDIPENDLY FROM POTENTIOMETER SETTING	• CURRENT SENSOR CABLE IS NOT CONNECTED • MAIN BOARD FAILURE	• CHECK THE SENSOR CABLE	• CONNECT THE CABLE • REPLACE THE MAIN BOARD
THE MACHINE DOES NOT HAVE MAXIMUM OUTPUT	• THE MAIN BOARD IS OUT OF CALIBRATION	----------	• REPLACE MAIN BOARD
THE OUTPUT VOLTAGE IS NOT REGUALTED (ALWAYS <65VDC MEASURED WITH TRUE RMS MULTIMETER)	• NEGATIVE CABLE FROM MAIN BOARD IS NOT CONNECTED TO CENTRAL PIN OF PLANAR TRANSFORMER	• CHECK IF THE CABLE IS CONNECTED	• CONNECT THE CABLE TO CENTRAL PIN

CASE COVER REMOVAL AND DC LINK 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 your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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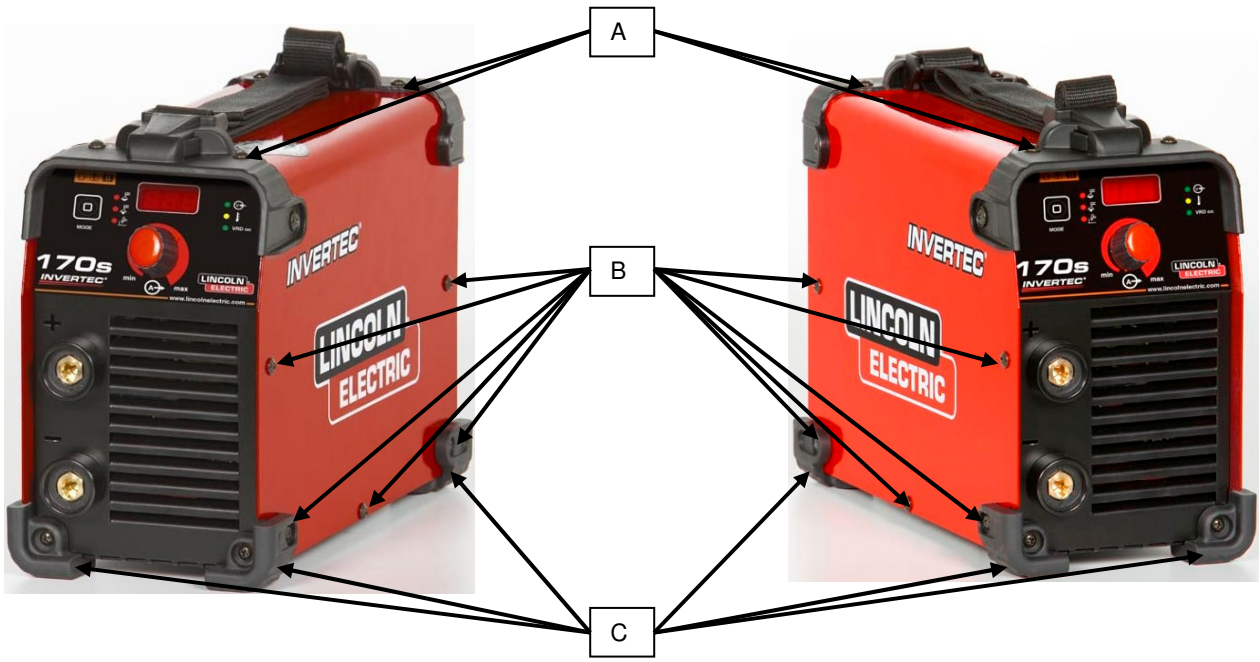
DESCRIPTION

This procedure will aid the technician in the removal and replacement of the case sheetmetal cover and discharging the DC link capacitor making it safe for the technician to workon the machine.

MATERIALS NEEDED

Phillips screwdriver PH02

INVERTEC® 170S - CASE COVER REMOVAL



Procedure:

1. Disconnect Input Power from the machine!
2. Turn on/off switch to off position.
3. Remove the 8 screws of the front and rear plastic handle (A).
4. Remove the 10 screws of the wraparound (B).
5. Don't remove the 4 bottom rubber corners (C).
6. Pull up the wraparound
7. Follow the next session to **perform the input filter discharge procedure**

DC LINK CAPACITORS DISCHARGE PROCEDURE

WARNING

ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment.
- Turn the input power off at the fuse box before working on equipment.
- Do not touch electrically hot parts.
- Prior to performing preventive maintenance, perform the following capacitor discharge procedure to avoid electric shock

INPUT FILTER CAPACITORS DISCHARGE PROCEDURE

This procedure will drain off any charge stored in the four capacitors that are part of the 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.

1. Remove input power to Invertec 170S machine
2. Remove the cover following the instruction available in this Service manual.
3. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is NOT supplied with the machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
4. Locate the resistor **R86** that is directly connected to the terminals **DC+** and **DC –** on the main board, **See Figure 1** and check the voltage across it, it should be zero; if not follow the next step.
5. Use electrically insulate gloves and insulated pliers. **See Figure 1a**. Hold the body of the resistor and connect the resistor leads across the resistor **R86**. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.

Check the voltage across the resistor **R86**. Voltage should be zero. If any voltage remains, repeat this procedure.

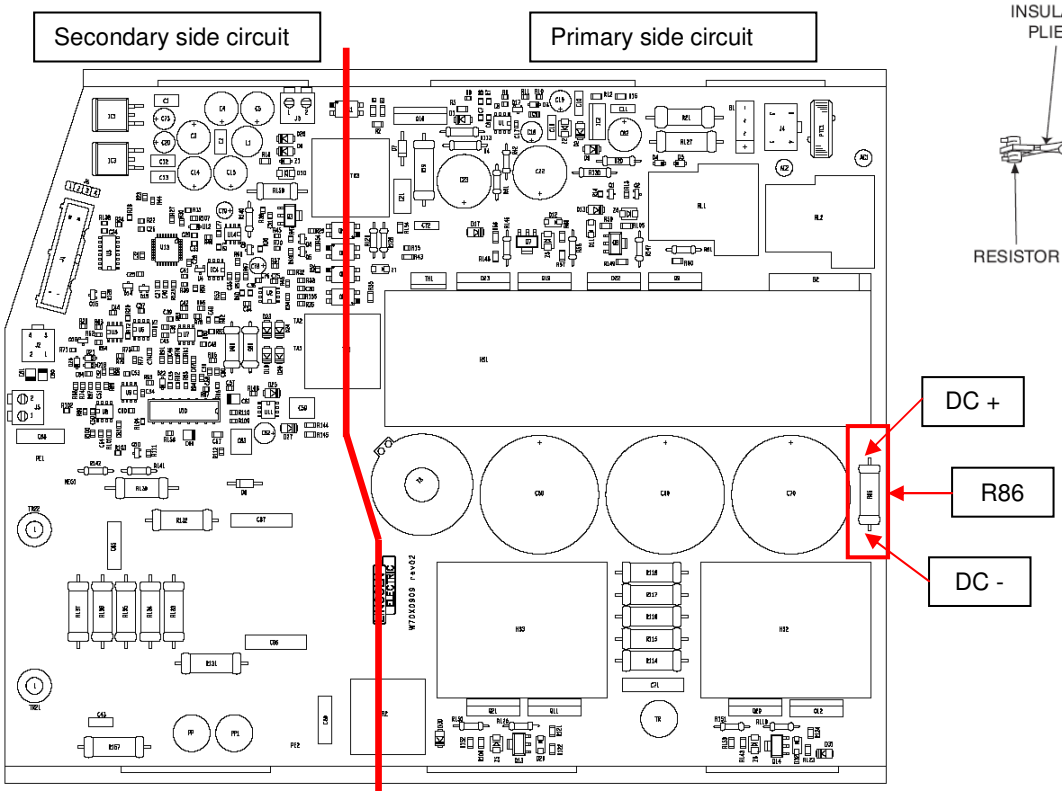


Figure 1 - Capacitors discharge location

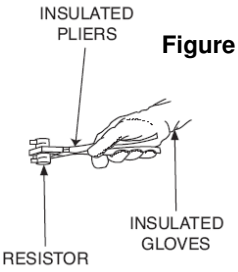


Figure 1a

EMC FILTER BOARD RESISTANCE TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.
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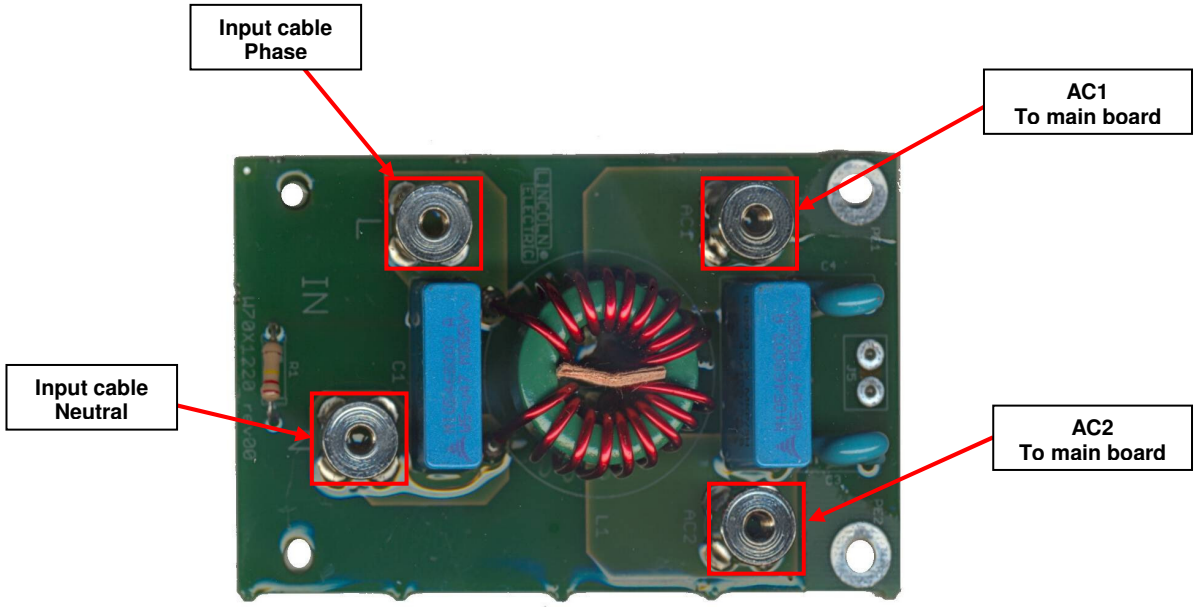
TEST DESCRIPTION

This test will determine if the EMC filter is good or defect.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram X1220

EMC FILTER BOARD RESISTANCE TEST (continued)



TEST PROCEDURE

1. Remove main input power to the INVERTEC® 170S
2. Follow the case cover removal procedure available in this Service Manual.
3. Perform the **Discharge procedure**
4. Visually check for burned or damaged components. If any components are physically damaged the board should be replaced.
5. Disconnect the cables from AC1 and AC2
6. Using the Volt-Ohmmeter (ohm mode) perform the tests following the below table test:

EMC Filter Board - Table tests 1

Positive Probe (RED)	*Negative Probe (BLACK)*	*Value*
L	AC1	*0 ohm*
N	AC2	*0 ohm*
AC1	AC2	*220Kohm +/- 10%*

MAIN BOARD RESISTANCE TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

……..

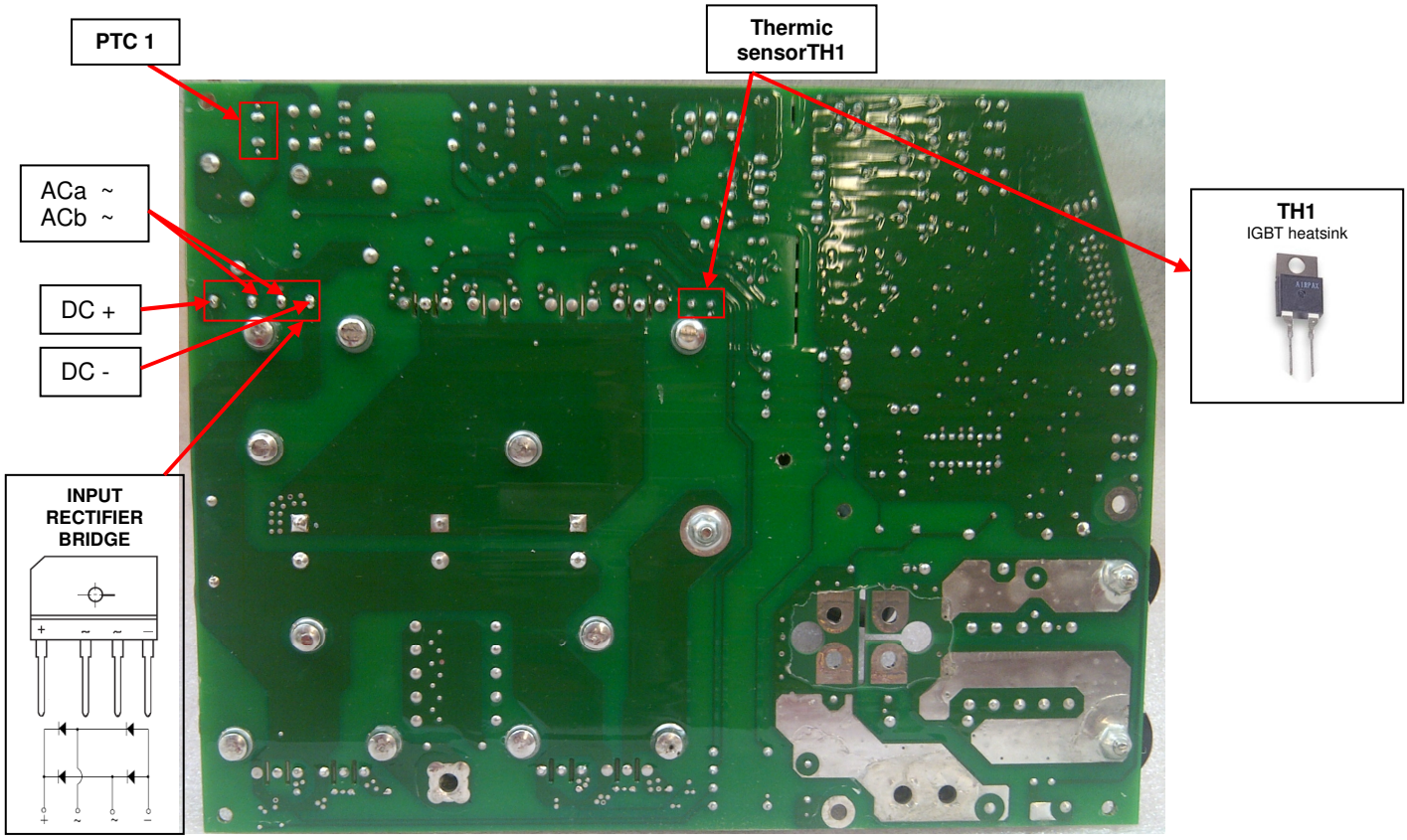
TEST DESCRIPTION

This test will determine if the main board has any " shorted " or "open" components.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram X0909

MAIN BOARD RESISTANCE TEST (continued)



TEST PROCEDURE

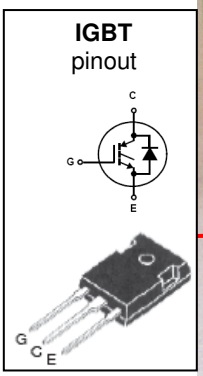
1. Remove main input power to the INVERTEC® 170S
2. Follow the main board disassembly operations available in this Service Manual.
3. Perform the **Discharge procedure**
4. Visually check for burned or damaged components.
5. If any components are physically damaged the main board should be replaced
6. Using the Volt-Ohmmeter (diode test mode) check the Input Rectifier (see **Test Table 1**)
7. Using the Volt-Ohmmeter (ohm mode) check **PTC 1** value, shall be 50 Ohms @ 20°C, +/- 10%
8. Using the Volt-Ohmmeter (ohm mode) check **TH1** (IGBT heatsink) value, shall be 0(zero) Ohms

Test Table 1 - Input Bridge test table

Positive Probe (RED)	*Negative Probe (BLACK)*	*Value*
ACa	**+**	*0.3V - 0.7V*
ACb	**+**	*0.3V - 0.7V*
+	**ACa**	*Capacitors charge*
+	**ACb**	*Capacitors charge*
-	**ACa**	*0.3V - 0.7V*
-	**ACb**	*0.3V - 0.7V*
ACa	**-**	*Capacitors charge*
ACb	**-**	*Capacitors charge*

MAIN BOARD RESISTANCE TEST (continued)

Note: OLD board version has 8 IGBTs in total, new board version, as shown in Figure1, has only 4 IGBTs in total



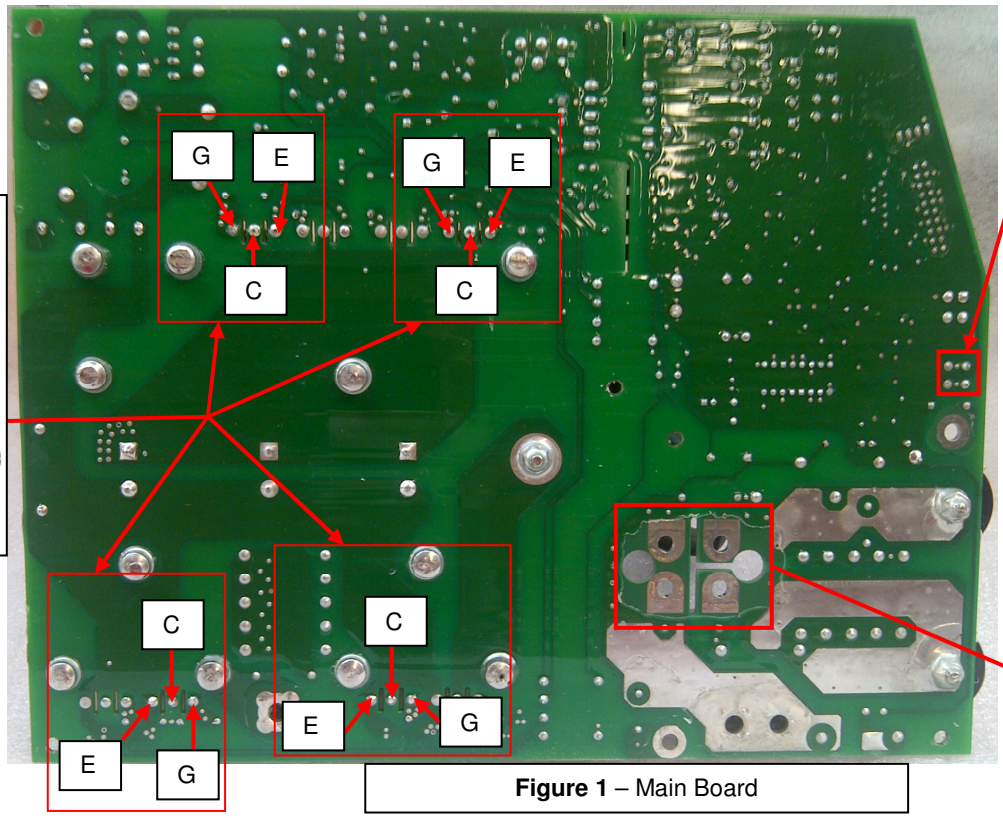


Figure 1 – Main Board

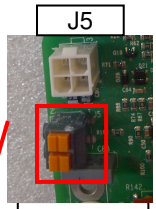
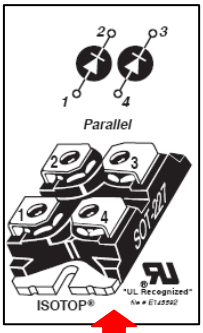


Figure 3



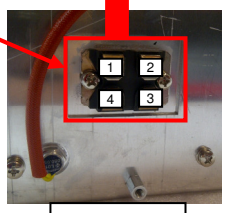


Figure 2

TEST PROCEDURE (continued)

7. Check each IGBT (Q11,Q20,Q9,Q23), with multimeter in diode test mode, following **Figure 1** and the **Table tests 1** below.
8. Check the output diode module (D33), with multimeter in diode test mode, for short, following the **Table tests 2** below (see **Figure 2**)
9. Disconnect the two wires of the thermal sensor mounted on the output rectifier diode heatsink from connector **J5** of the main board (see **Figure 3**) and check the thermal sensor using Volt-Ohmmeter in ohm mode, value shall be 0(zero) Ohms (see **Figure 4**)

IGBT - Table tests 1

Positive Probe (RED)	***Negative Probe (BLACK)***	***Value***
Emitter (E)	Collector (C)	*0.3V - 0.7V*
Collector (C)	Emitter (E)	*Capacitors charge*
Emitter (E)	Gate (G)	*0.3V - 0.7V*

Output Diodes module D33– Table tests 2

Positive Probe (RED)	**Negative Probe (BLACK)**	**Value**
4 (anode)	**3** (cathode)	0.3V - 0.7V
3 (cathode)	**4** (anode)	OPEN
1 (anode)	**2** (cathode)	0.3V - 0.7V
2 (cathode)	**1** (anode)	OPEN

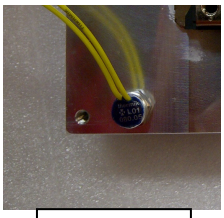


Figure 4

Note: Actual voltage readings will vary depending on the meter being used. Similar tests on all devices should give similar results

EMC FILTER BOARD VOLTAGE TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.
……..

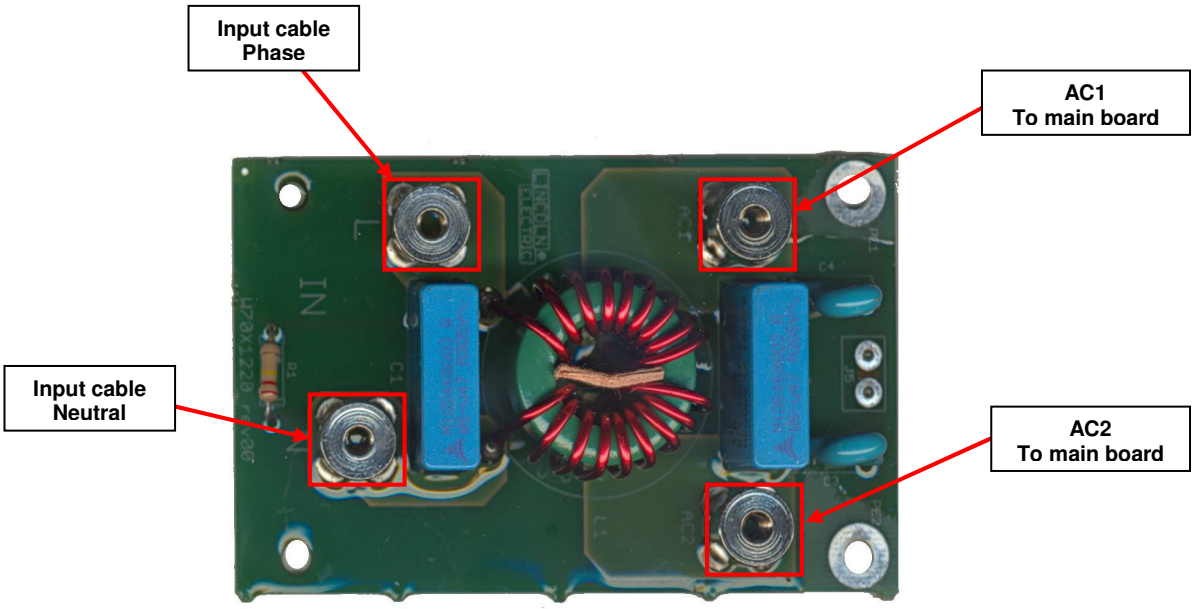
TEST DESCRIPTION

This test will help to determine if the input voltage applied to the EMC filter is passing through it and arrive cirrectly to the main board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram X1220

EMC FILTER BOARD VOLTAGE TEST (continued)



TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Remove main input power to the INVERTEC® 170S
2. Follow the case removal procedure available in this Service Manual
3. Apply 230Vac +/- 15% to the INVERTEC® 170S
4. Turn the machine mains switch to ON position
5. Check between **L** and **N** points for 230Vac +/- 15%
6. Check between **AC1** and **AC2** for 230Vac +/- 15%
7. If 230Vac is not present between **L** and **N** points may be the input cable or the plug are damaged
8. If 230Vac is present between **L** and **N** points but it is not present between **AC1** and **AC2** points, the EMC filter is damaged and must be replaced.

MAIN AND CONTROL BOARD VOLTAGE TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

……..

TEST DESCRIPTION

This test will help to determine if the correct input voltage is being applied to the main board and also if the correct regulated voltages are being processed on the main board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram X0909

MAIN AND CONTROL BOARD VOLTAGE TEST (continued)

⚠ WARNING

DO NOT CONNECT THE SAME SCOPE GROUND BETWEEN HIGH SIDE AND LOW SIDE

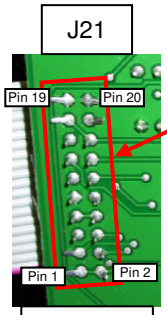


Figure 2

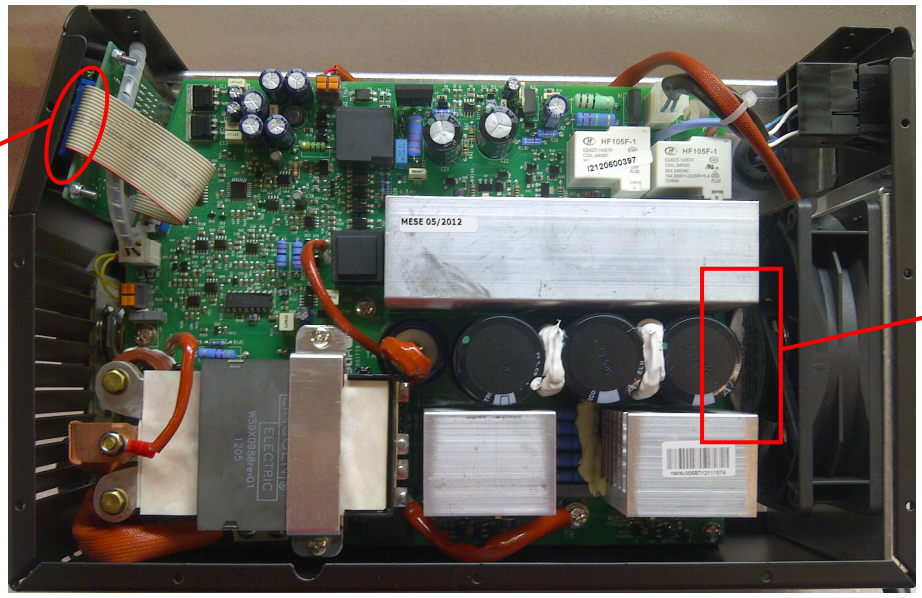


Figure 1

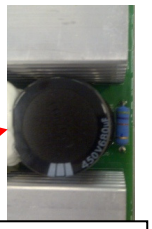


Figure 1A

TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Remove main input power to the INVERTEC® 170S
2. Follow the case removal procedure available in this Service Manual
3. Apply 230Vac +/- 15% to the INVERTEC® 170S
4. Turn the machine mains switch to ON position
5. Check between R86 terminals for 320 Vdc +/-15%, see **Figure 1A**
6. As it is too dangerous to disassembly the main board from the central frame and, with all components re-connected, perform the test, the easiest way to perform part of the voltage test is from the Control Board connector, see Figure 2. Follow the below table:

J21/J1: Control Bd / Main Bd connector

Pin #	Description	Value (use pins 19 or 20 as 0V ref.)	Notes
1	Aux +15Vdc	+15Vdc ±2%	Auxiliary supply
2	Aux +15Vdc	+15Vdc ±2%	Auxiliary supply
3	IOUTF	From 0,4Vdc to 4,5 Vdc +/- 5% 4,5Vdc= 160A output	Output current signal
4	AUS	-	Australian signal
5	WELDING	0Vdc= VRD ON / +15Vdc VRD OFF	Weldind signal for AUS version
6	SEL C	0 Vdc = selector mode button pressed +5Vdc selector mode button not pressed	Welding mode selection
7	Aux +5V	+5Vdc ±2%	Auxiliary supply
8	Aux +5V	+5Vdc ±2%	Auxiliary supply
9	NC	-	Not used
10	NC	-	Not used
11	ONL	3,5Vdc during initial auto-test execution 0Vdc = machine ready	ON led signal
12	MMAFL	+15Vdc when in Crisp mode and Lift TIG 0Vdc when Soft Mode	Enable led Soft mode
13	MMAL	+15Vdc when in Soft mode and Lift TIG 0Vdc when Crisp Mode	Enable led Crisp mode
14	TIGL	+15Vdc when in Crisp and Soft mode 0Vdc when Lift TIG mode	Enable led Tig mode
15	THL	+15Vdc = OK 0Vdc = Thermal error condition	Enable Thermal error led
16	VOUTFILT	3,7 Vdc= 40Vout / 0Vdc in Lift TIG	Output voltage
17	PSET	From 0Vdc to 4,3 Vdc 4,3 Vdc= output current knob to max	Set current reference
18	TYPE		Spare
19	GND	0Vdc	0V reference
20	GND	0Vdc	0V reference

MAIN BOARD VOLTAGE TEST (continued)

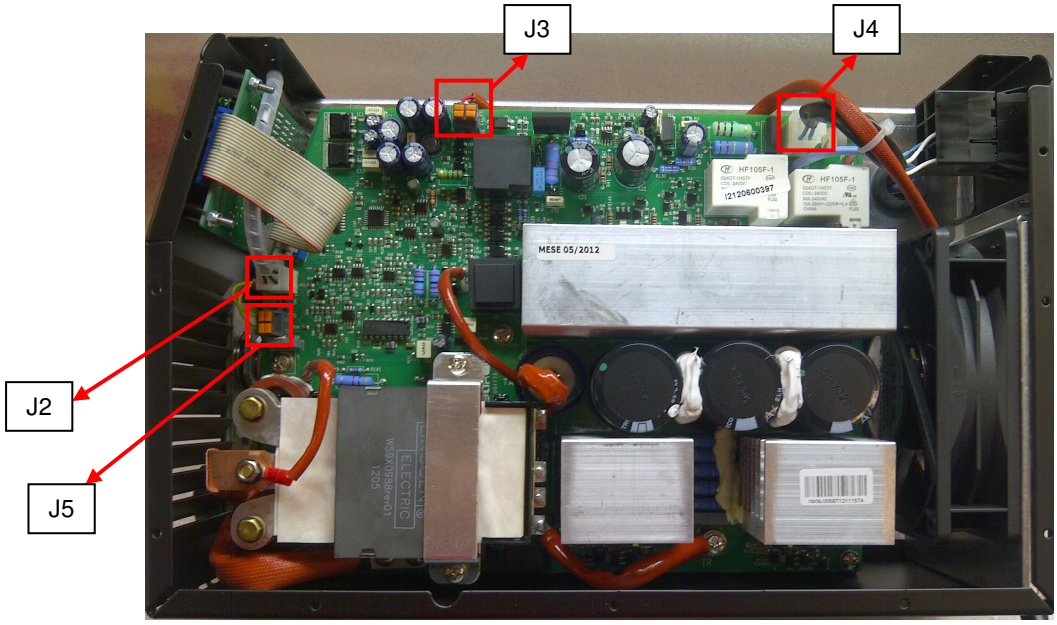


Figure 1

TEST PROCEDURE (continued)

⚠ **Use always electrically insulate gloves during this test procedure**

J2: Current Sensor Connector

Pin #	Description	Value (use pin 4 as 0V ref.)	Notes
1	+15Vdc		Auxiliary supply
2	-5Vdc	–5Vdc ±2%	Auxiliary supply
3	IOUT	From 0Vdc to 6,4Vdc ±5% 6,4 Vdc = 160A output	Output current LEM reference
4	GND	0Vdc	0V reference

J3: Fan Connector

Pin #	Description	Value	Notes
1	+24Vdc	+25Vdc ±2%	Fan auxiliary supply
2	No name	+25 ÷ 0Vdc	

J5: THD1 Thermal sensor on output diode heatsink

Pin #	Description	Value	Notes
1	THD-1	0Vdc or 5Vdc ±5% 5Vdc= Thermal condition 0Vdc= machine OK	Diode thermal sensor connector
2	THD-2		

J4: Power supply connector to mains switch

Pin #	Description	Value	Notes
1	IN	0Vac	Power supply return from switch button 230Vac+/- 10% only when mains switch is ON
2	NC.	NC.	
3	IN	230Vac ±10%	
4	OUT	0Vac	Power supply to switch button 230Vac+/- 10% always when plug connected to the mains
5	NC.	NC.	
6	OUT	230Vac ±10%	

CONTROL BOARD TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions
detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

.....

TEST DESCRIPTION

The control board is not easy to be checked, as it works mainly with software; this section will help, as best as possible, to determine if the control board is faulty and how to interpret error codes.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram X0907

CONTROL BOARD TEST (continued)

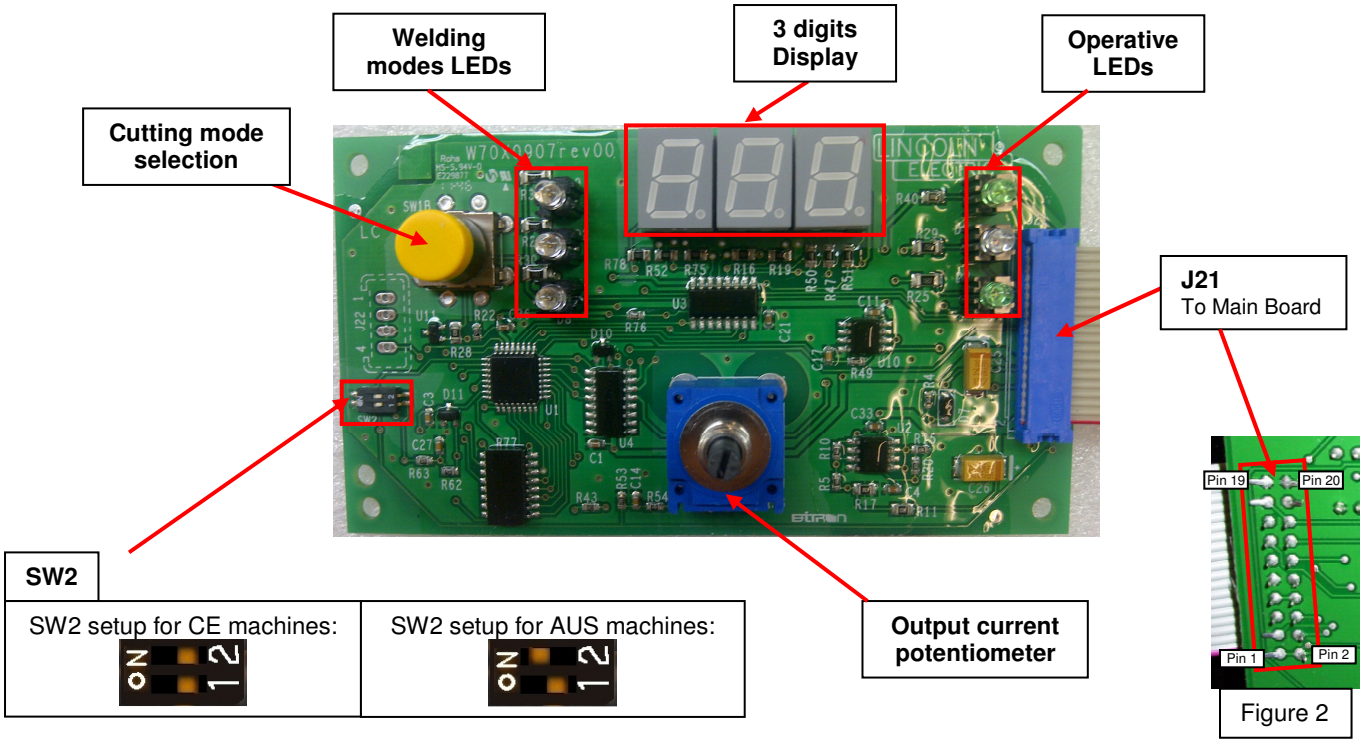


Figure 2

TEST PROCEDURE

1. Remove main input power to the INVERTEC® 170S
2. Follow the case removal procedure available in this Service Manual
3. Apply 230Vac +/- 15% to the INVERTEC® 170S
4. Turn the machine mains switch to ON position
5. Follow the below table to perform the voltage tests on connectors J21. Take note that J21 is a flat cable connector; the only way to check signals is from the solder side, see **Figure 2**.

J21: Control Bd / Main Bd connector

Pin #	Description	Value (use pins 19 or 20 as 0V ref.)	Notes
1	Aux +15Vdc	+15Vdc ±2%	Auxiliary supply
2	Aux +15Vdc	+15Vdc ±2%	Auxiliary supply
3	IOUTF	From 0,4Vdc to 4,5 Vdc +/- 5% 4,5Vdc= 160A output	Output current signal
4	AUS	-	Australian signal
5	WELDING	0Vdc= VRD ON / +15Vdc VRD OFF	Weldind signal for AUS version
6	SEL C	0 Vdc = selector mode button pressed +5Vdc selector mode button not pressed	Welding mode selection
7	Aux +5V	+5Vdc ±2%	Auxiliary supply
8	Aux +5V	+5Vdc ±2%	Auxiliary supply
9	NC	-	Not used
10	NC	-	Not used
11	ONL	3,5Vdc during initial auto-test execution 0Vdc = machine ready	ON led signal
12	MMAFL	+15Vdc when in Crisp mode and Lift TIG 0Vdc when Soft Mode	Enable led Soft mode
13	MMAL	+15Vdc when in Soft mode and Lift TIG 0Vdc when Crisp Mode	Enable led Crisp mode
14	TIGL	+15Vdc when in Crisp and Soft mode 0Vdc when Lift TIG mode	Enable led Tig mode
15	THL	+15Vdc = OK 0Vdc = Thermal error condition	Enable Thermal error led
16	VOUTFILT	3,7 Vdc= 40Vout / 0Vdc in Lift TIG	Output voltage
17	PSET	From 0Vdc to 4,3 Vdc 4,3 Vdc= output current knob to max	Set current reference
18	TYPE		Spare
19	GND	0Vdc	0V reference
20	GND	0Vdc	0V reference

ERROR CODES

If errors condition occurs, try to turn Off the machine, wait for a few seconds, then turn ON again.

If the error remains, control tests described into this manual are required.

Voltage Lockout	 Blink	 Blink
	This occurs when an internal auxiliary undervoltage condition is detected. To restore the machine: • Turn OFF then ON the Mains Switch to restart the machine.	

DISASSEMBLY OPERATIONS

PLANAR TRANSFORMER AND MAIN BOARD REMOVAL AND REPLACEMENT PROCEDURE

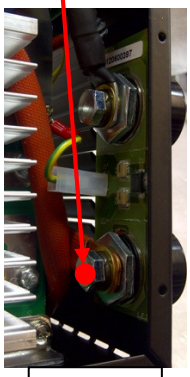


Figure 2

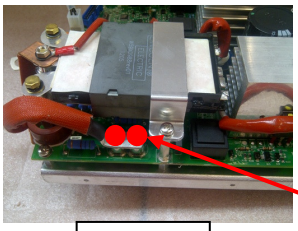


Figure 3

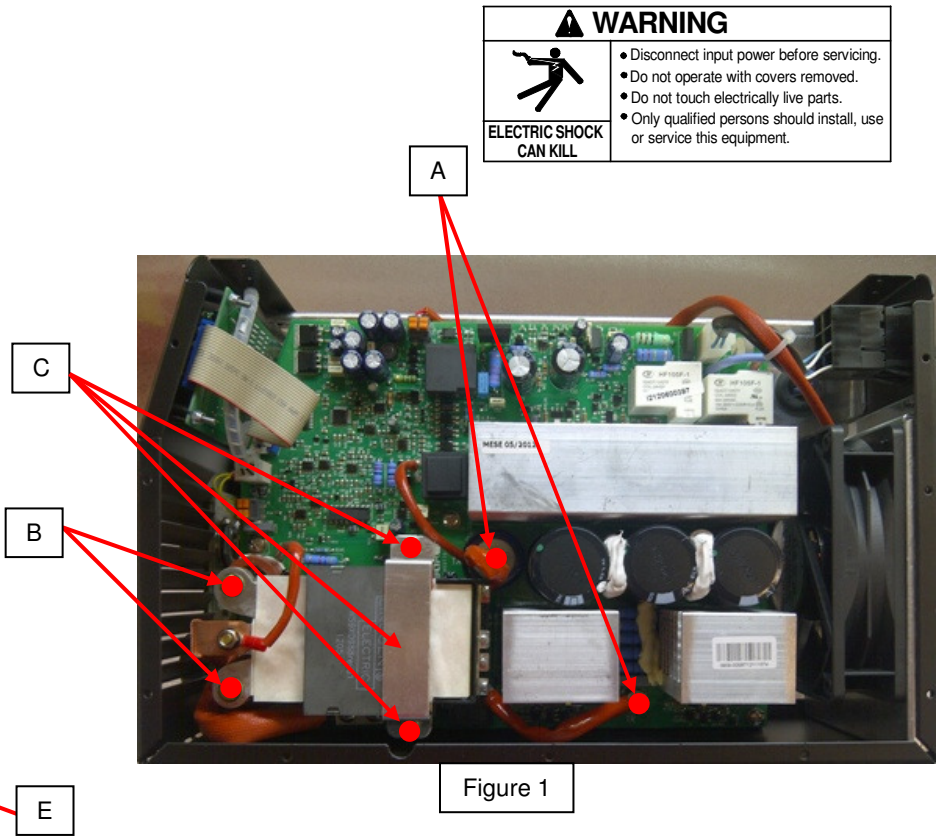


Figure 1

REMOVAL PROCEDURE

Necessary tools:

- Phillips screwdriver PH02
- 6 mm nutdriver
- 8 mm nutdriver
- 13 mm wrench
- Small pliers

1. Remove main input power to the INVERTEC® 170S
2. Follow the case removal procedure available in this Service Manual
3. Disconnect the two planar transformer cables using PH02 screwdriver from the main board, ref. **A Figure 1**
4. Unscrew the two M8 bolts, ref **B Figure 1**
5. Unscrew the bolt M13 from the output negative stud, ref. D Figure 2
6. Uncrew the two screws that fix the planar transformer to the main board and remove the braket, ref. **C Figure 1**
7. Remove the planar transformer from the main board.
8. Remove the two screws that fix the output choke cable to the main board. Ref. **E Figure 3**

DISASSEMBLY OPERATIONS

PLANAR TRANSFORMER AND MAIN BOARD REMOVAL AND REPLACEMENT PROCEDURE (CONTINUED)

WARNING

ELECTRIC SHOCK CAN KILL

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

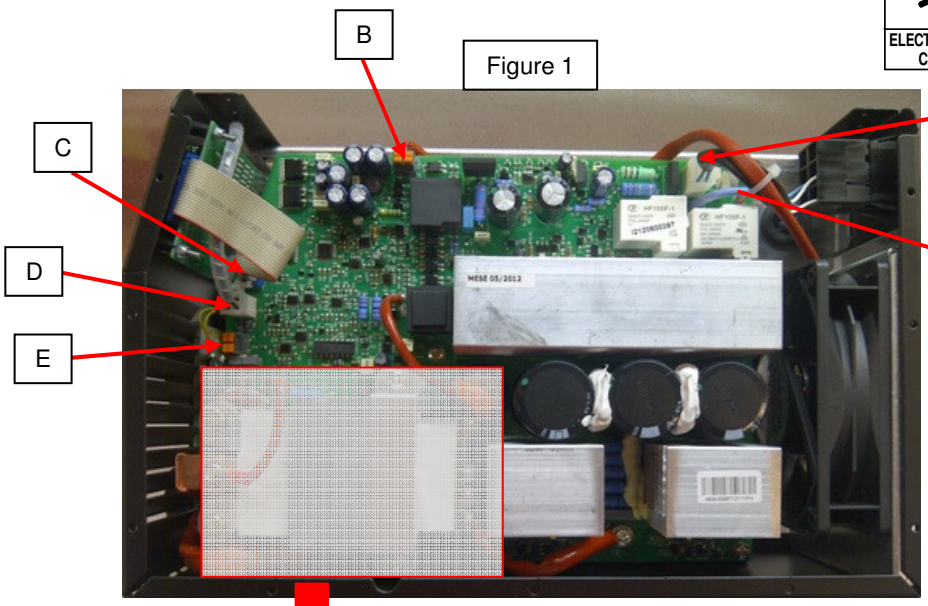


Figure 1

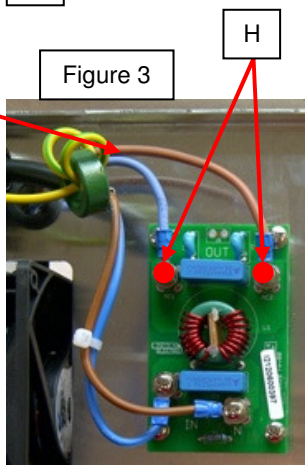


Figure 3

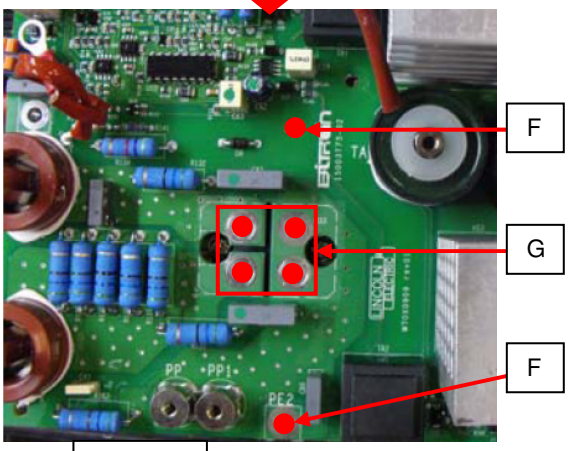


Figure 2

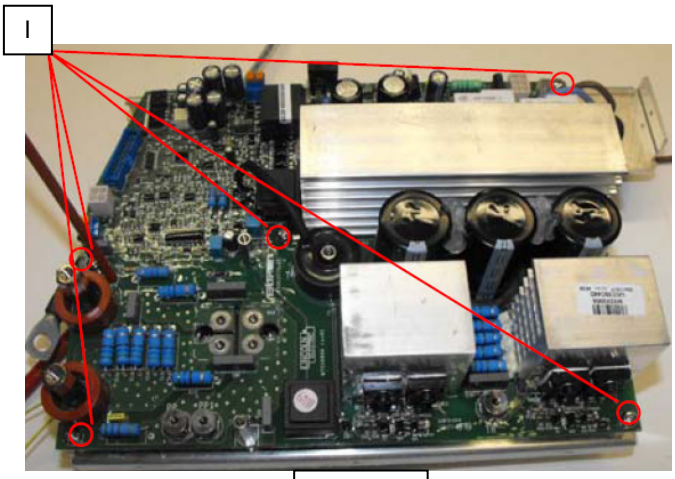


Figure 4

REMOVAL PROCEDURE (continued)

9. Disconnect the connector J4 from main board, ref. **A Figure 1**
10. Disconnect the two fan wires from the connector J3, ref. **B Figure 1**
11. Disconnect the flat cable from connector J1, ref. **C Figure 1**
12. Disconnect the hall effect proble connector J2 from main board, ref **D Figure 1**
13. Disconnect the two thermal sensor wires from connector J5, ref **E Figure 1**
14. Remove the two spacers that are used to fix the planar transformer, using the 6mm nutdriver, ref. **F Figure 2**
15. Remove the 4 screws that fix the output diode module to the main board, ref. **G Figure 2**
16. Remove the two mains wires from the EMC filter, ref. **H Figure 3**
17. Remove the 5 screws that fix the main board to the central frame, ref. **I Figure 4**
18. Remove the main board

For the re-assembly operations, make the previous steps in the reverse order.

PAY ATTENTION ! Apply a torque of 1,5Nm on the 4 output diode module screws during re assembly operation
DO NOT USE CORDLESS SCREWDRIVERS FOR THE POWER MODULEs.

DISASSEMBLY OPERATIONS

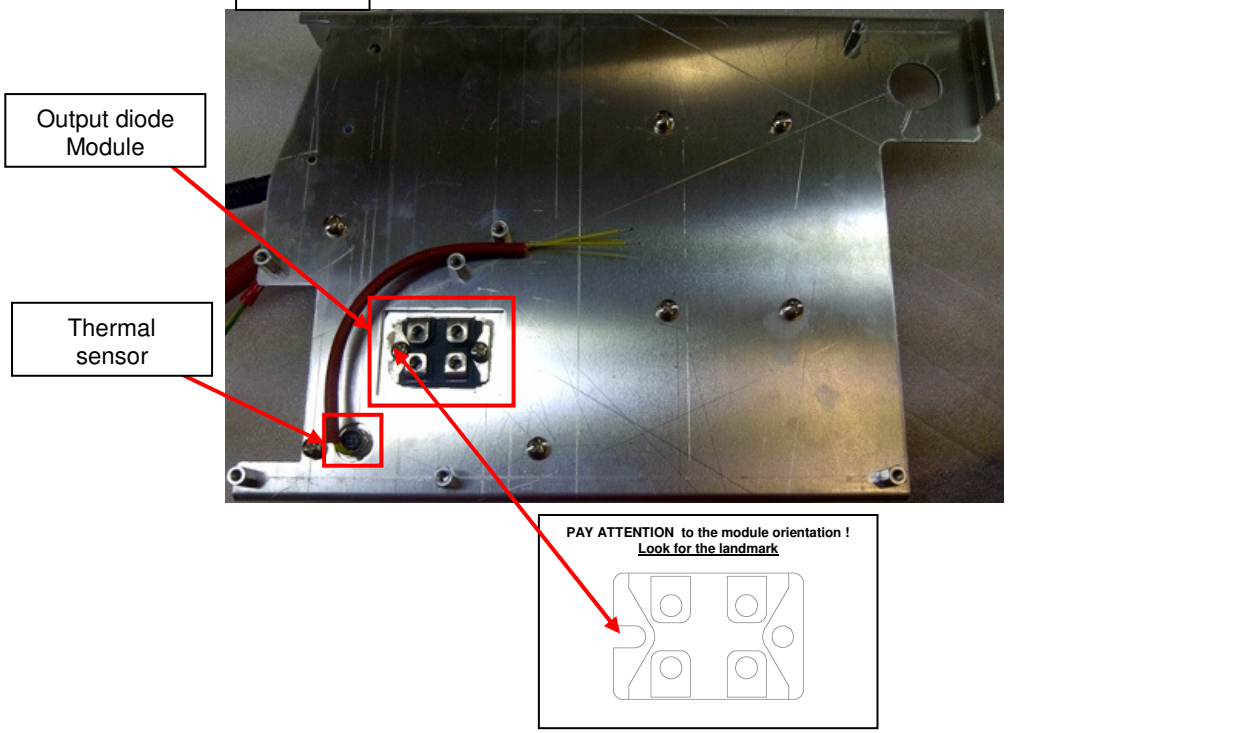
OUTPUT DIODE MODULE AND THERMAL SENSOR REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

ELECTRIC SHOCK CAN KILL

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

Figure 1



REMOVAL PROCEDURE

Necessary tools:

- Phillips screwdriver PH02
- 7 mm Nutdriver

Output Diode Module

1. Unscrew the two screws that fix the Output diode module (D33) and remove it from the heatsink. Keep its 2 fixing screws in a separate place.
2. Clean the heatsink from the grease, then apply a new thin layer of a thermal compound.
3. Remove now the D33 bridge from the new Inverter P.C. Board and keep its 4 fixing screws into another separate place.
4. **KEEP SEPARATE THE SCREWS that fix the module to the heatsink from the 4 that fix it to the inverter board because are different. Using a wrong screw to fix the Diode to the P.C. Board can break it.**
5. Replace the new D33 bridge on the heatsink. Take care about its orientation (ref. to indications on **Figure 1**) and screw it using the 2 screw you removed at point 1. Apply a torque of 1,5Nm.
   DO NOT USE CORDLESS SCREWDRIVERS FOR THE POWER MODULEs.

Thermal Sensor

6. Use the 7 mm nutdriver to remove and replace the thermal sensor

DISASSEMBLY OPERATIONS

HALL SENSOR, OUTPUT FILTER BOARD AND EMC FILTER
REMOVAL AND REPLACEMENT PROCEDURE

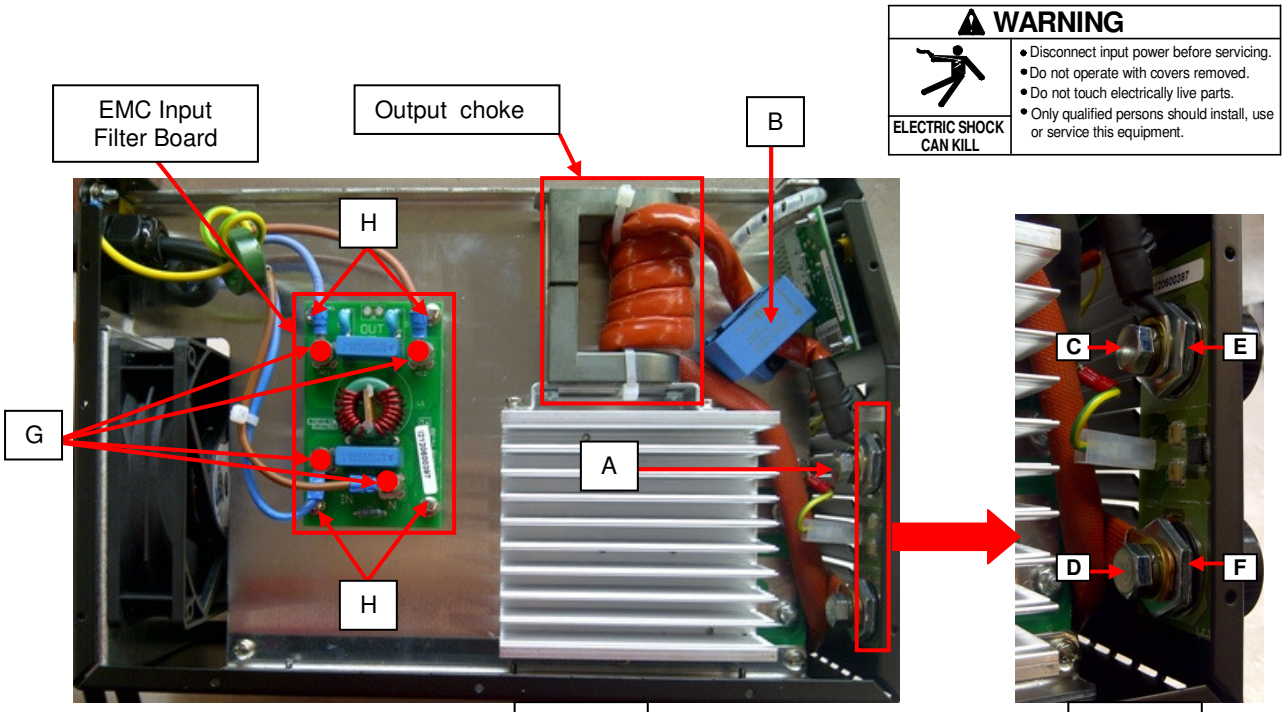


Figure 1

Figure 2

REMOVAL PROCEDURE

Necessary tools:

- Phillips screwdriver PH02
- 13 mm Wrench
- 24 mm Wrench

Hall Sensor

1. Disconnect the connector J2 from the main board
2. Using a 13 mm wrench remove the M8 bolt from the positive output stud.
3. Remove the output choke cable from the hall sensor
4. Unscrew the screw that fix the hall sensor to the central frame using a PH02 screwdriver
5. Remove the hall sensor

Output Filter Board

6. Remove the two M8 bolts ref. **C & D Figure 2**
7. Disconnect the ground faston connector
8. Remove the two nuts using the 24 mm wrench
9. Remove and replace the output filter board

EMC Input Filter Board

10. Remove the 4 screws that fix the input and output voltage cables, ref. **G Figure 1**
11. Remove the 4 screws that fix the EMC Input Filter to the central frame, ref. **H Figure 1**

For the re-assembly operations, make the previous steps in the reverse order.

DISASSEMBLY OPERATIONS

FAN REMOVAL AND REPLACEMENT PROCEDURE

WARNING

ELECTRIC SHOCK CAN KILL

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

Figure 1

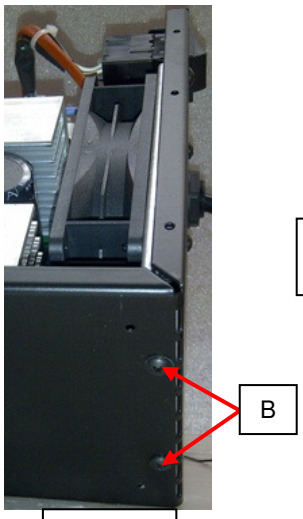


Figure 2

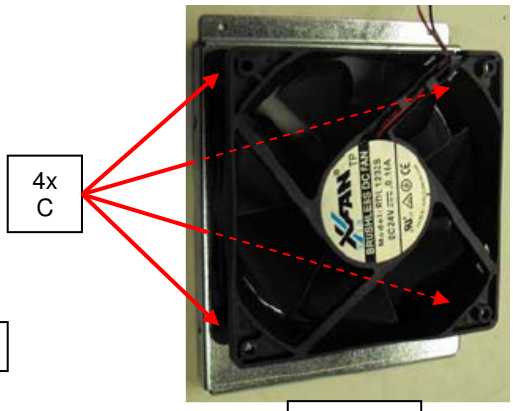


Figure 3

REMOVAL PROCEDURE

Necessary tools:

- Phillips screwdriver PH02
- Small pliers

1. Disconnect the two fan supply wires from connector J3 on main board
2. Remove the 3+2 screws, using a PH02 screwdriver, ref. **A and B Figure 1 and 2**
3. Pull away a bit the rear machine panel to be able to the fan assembly to be removed from the machine
4. Remove the 4 plastic rivets that fix the fan to the metal support using the small pliers

For the re-assembly operations, make the previous steps in the reverse order.

DISASSEMBLY OPERATIONS

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

WARNING

ELECTRIC SHOCK CAN KILL

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

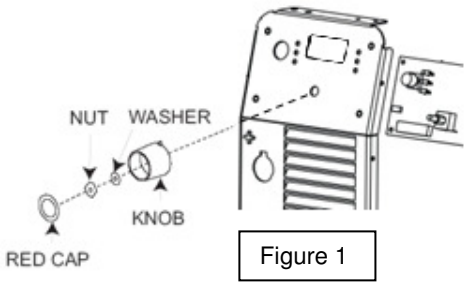


Figure 1

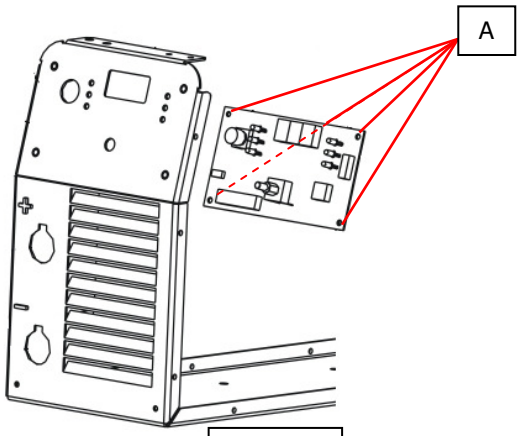


Figure 2

REMOVAL PROCEDURE

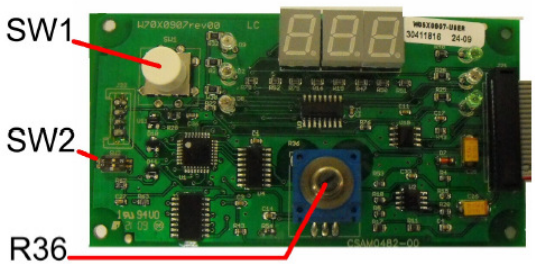
Necessary tool:

- 6 mm Nutdriver
- 5,5 mm Nutdriver

1. Using a thin knife blade, remove the red plastic cap on the end of the output knob, see **Figure 1**.
2. Using a 6mm nutdriver, remove the output knob mounting nut and washer located behind the red plastic cap previously removed, See **Figure 1**.
3. Disconnect the signal harness from the main board connector J1
4. Using a 5,5 mm nutdriver remove the 4 nuts located on the corners of the solder side of the control board (A), see **Figure 2**.

For the re-assembly operations, make the previous steps in the reverse order.

During re-assembly operation of a new control board make sure about the position of the dip-switches, follow the instruction that are inside the new control board box. See extraction below:



Operative notes:

SW1 (Job selection) and R36 (Output current potentiometer) aren't involved by the P.C. Board setup.

SW2 (machine configuration) is the unique item that has to be configured following the table below

SW2 setup for CE machines:

INVERTEC 170S CE

SW2 setup for AUS machines:

INVERTEC 170S AUS

RETEST AFTER REPAIR

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

Machine input and output

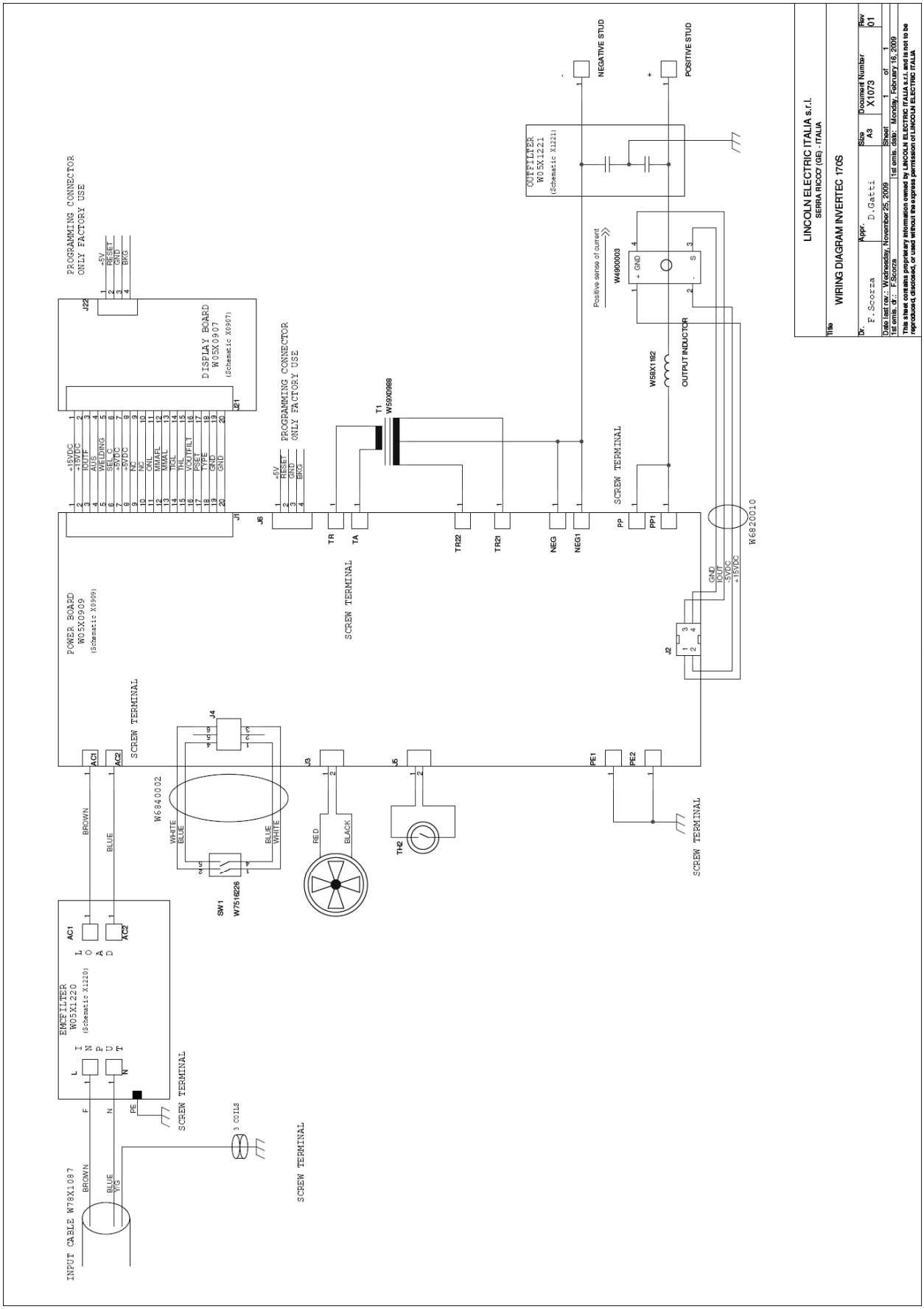
Input Voltage	Input Current	Rated Output
230Vac/1ph/50Hz	22A max 39A max	100A @ 100% duty cycle 160A @ 35% duty cycle

Output current range	10 – 160 Amps

Maximum Open Circuit Voltage	45 Vdc

ELECTRICAL DIAGRAMS

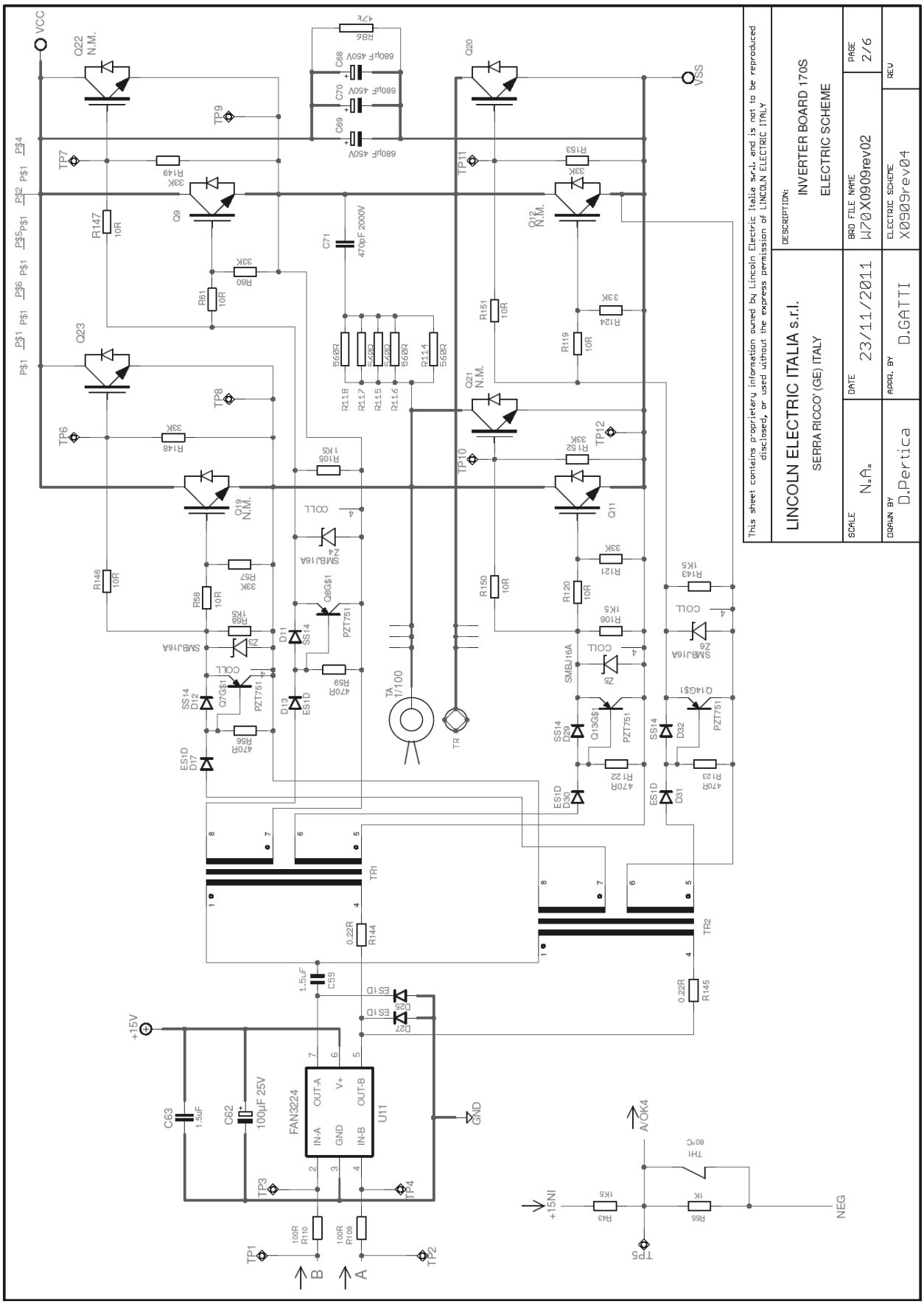
Wiring Diagram X1037



ELECTRICAL DIAGRAMS

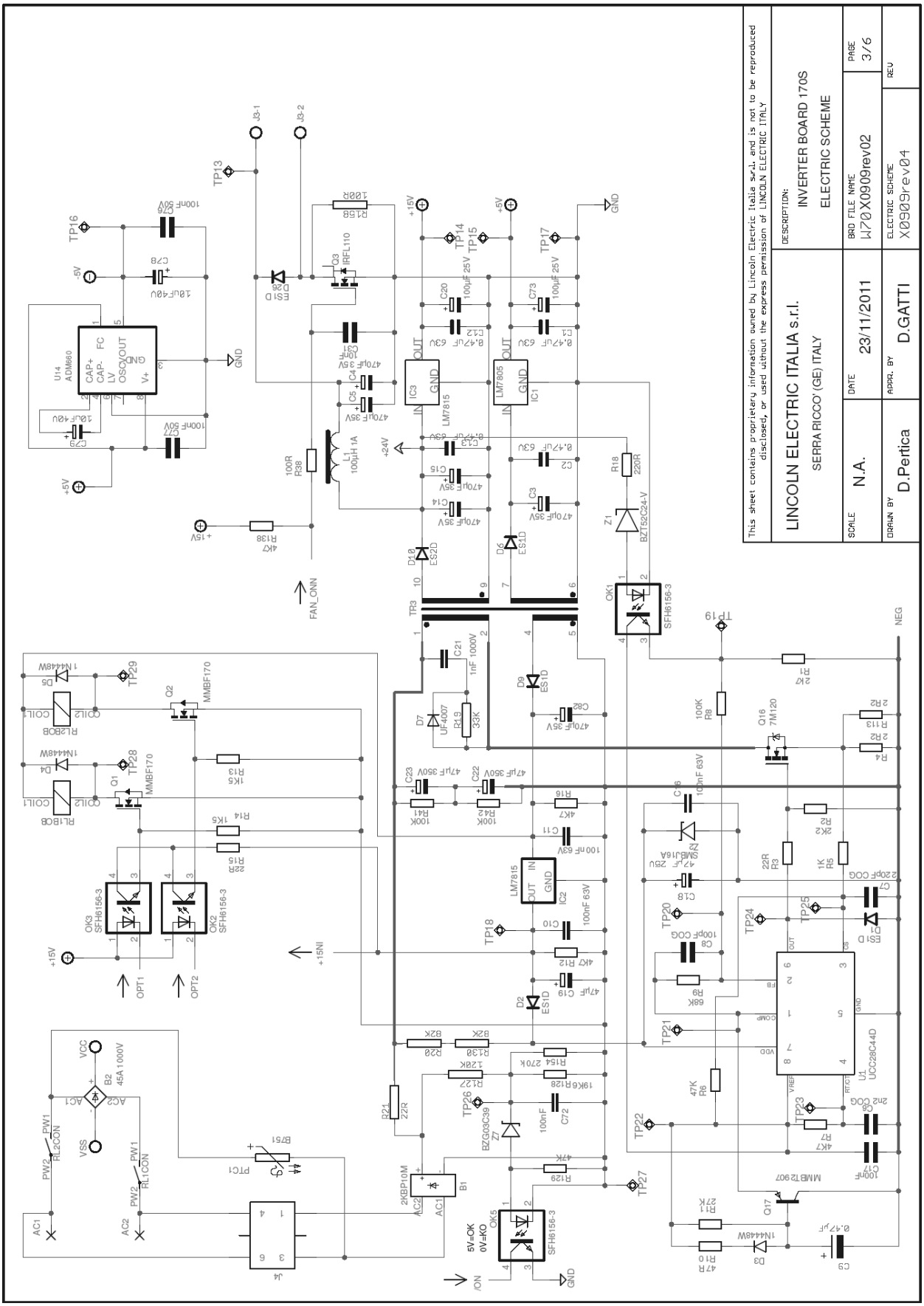
Main Board Schematic X0909. Page 1/5

Note: OLD boards version have 8IGBTs in total, new boards version, as shown in Figure1, have only 4 IGBTs in total



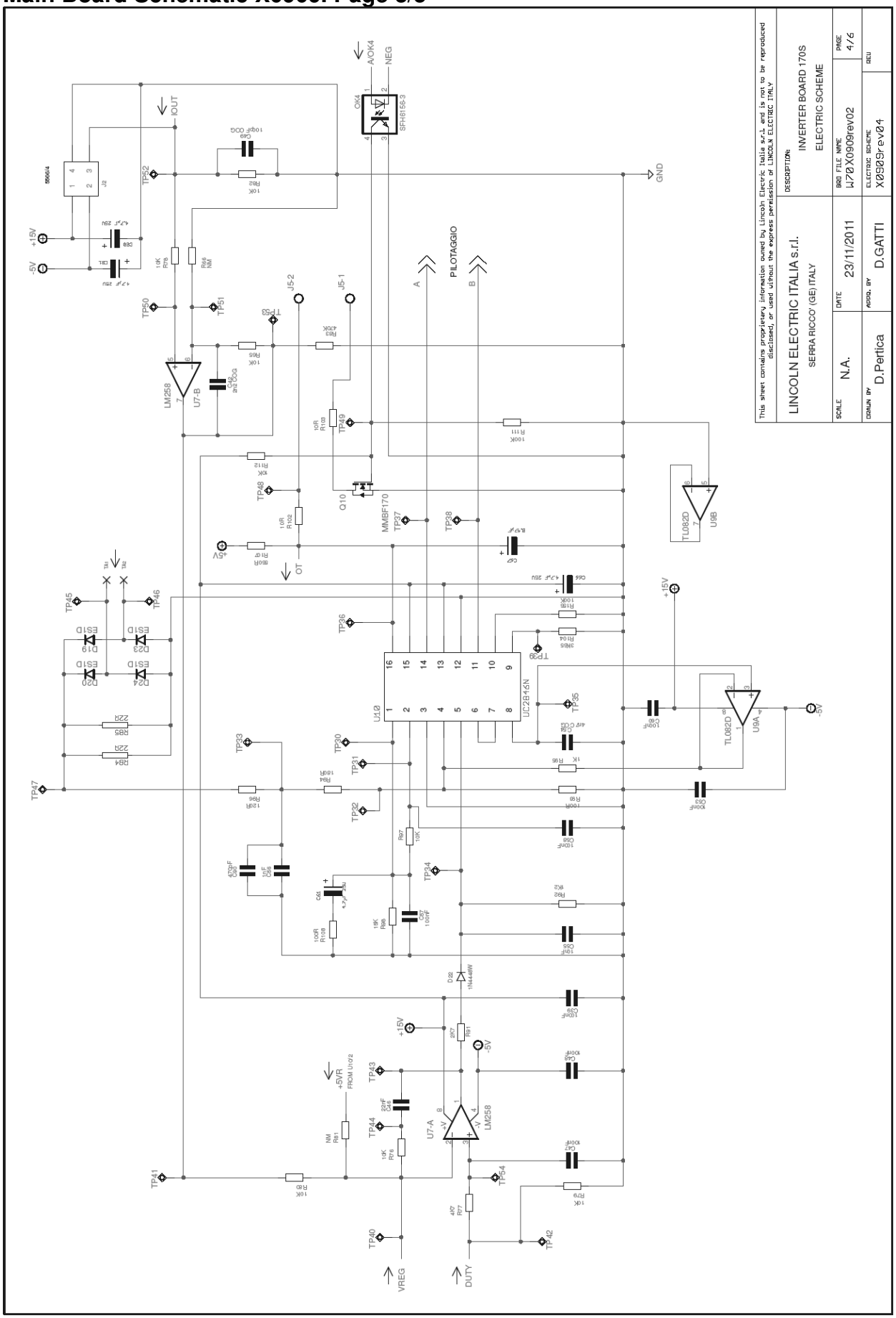
ELECTRICAL DIAGRAMS

Main Board Schematic X0909. Page 2/5



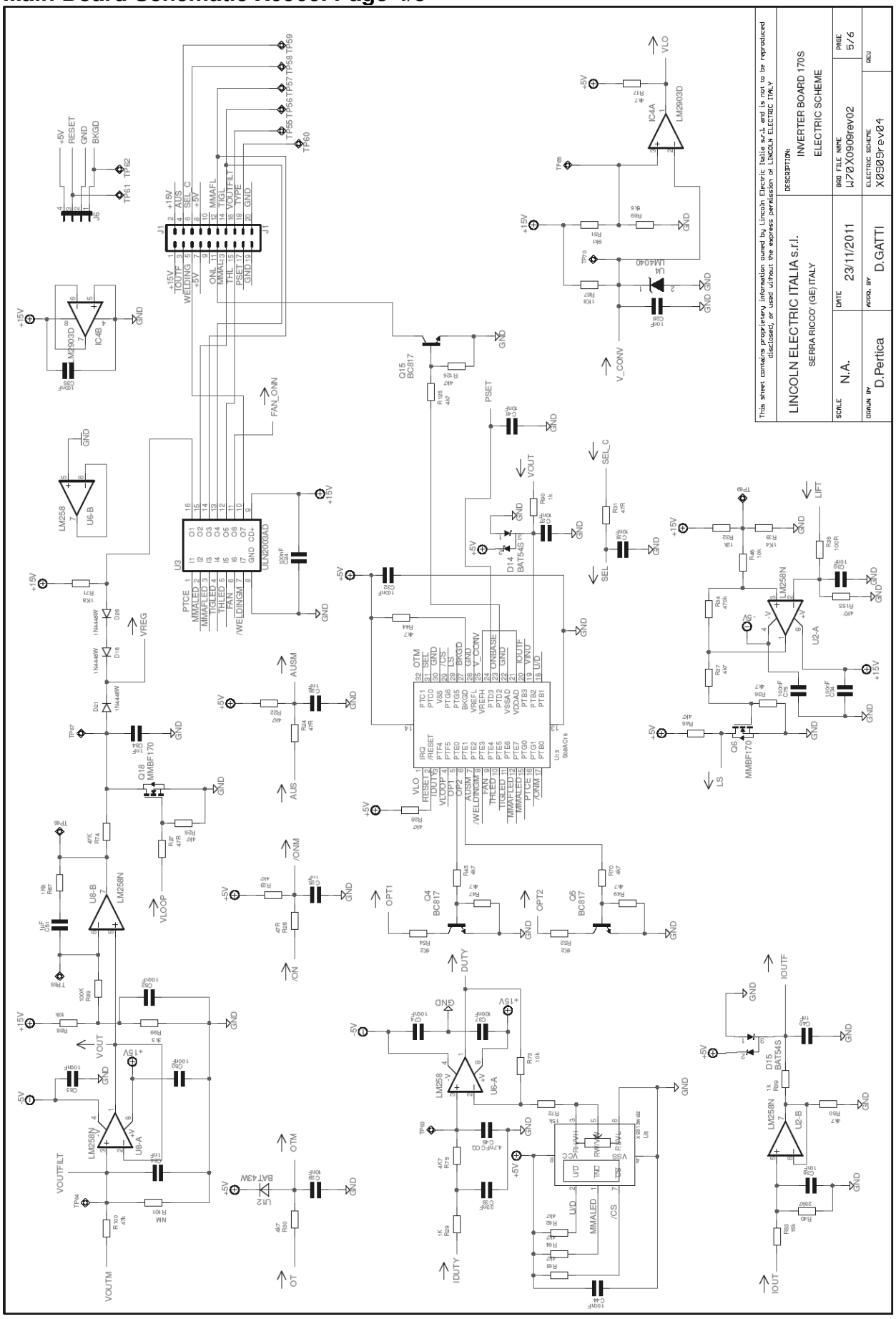
ELECTRICAL DIAGRAMS

Main Board Schematic X0909. Page 3/5

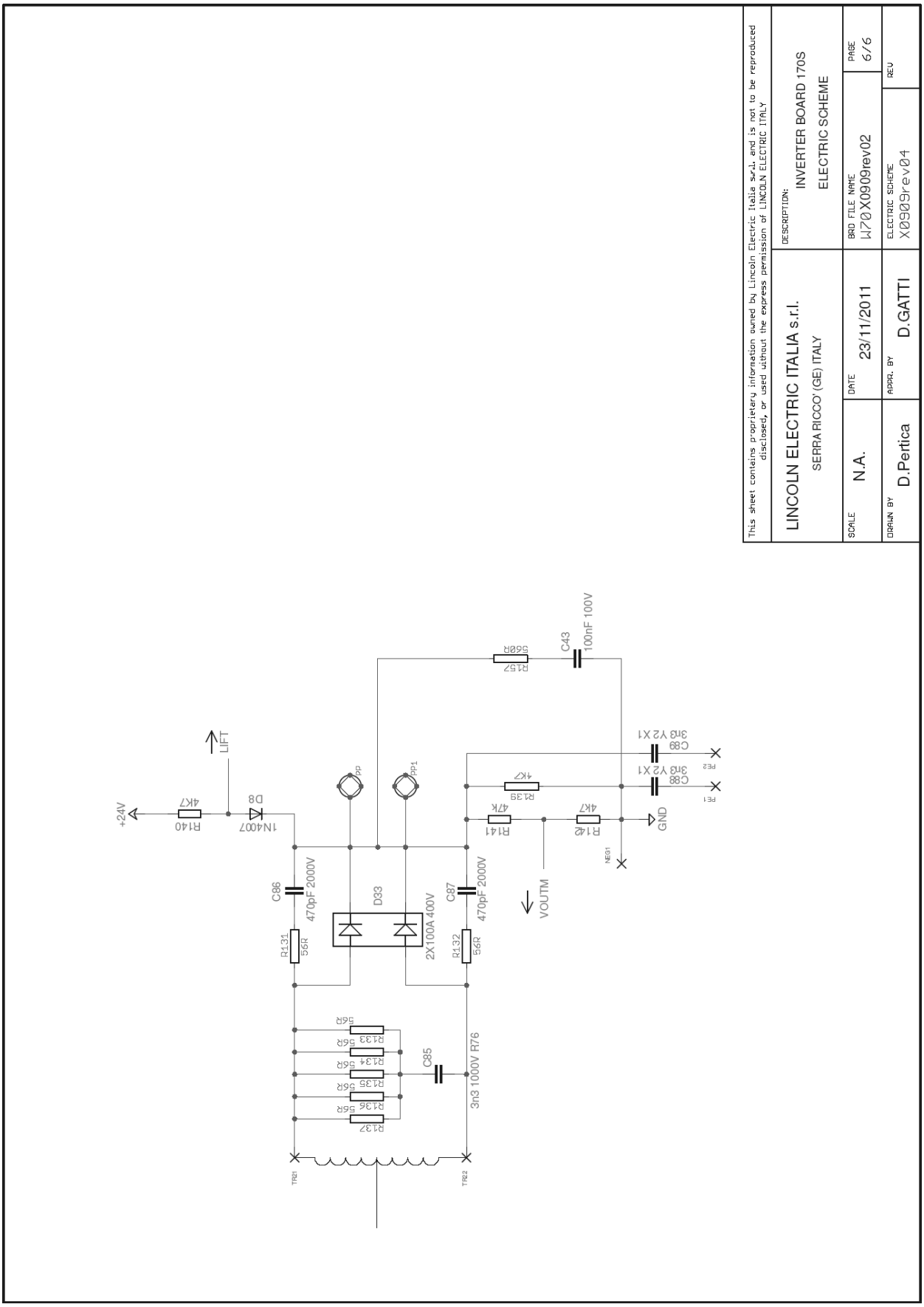


ELECTRICAL DIAGRAMS

Main Board Schematic X0909. Page 4/5

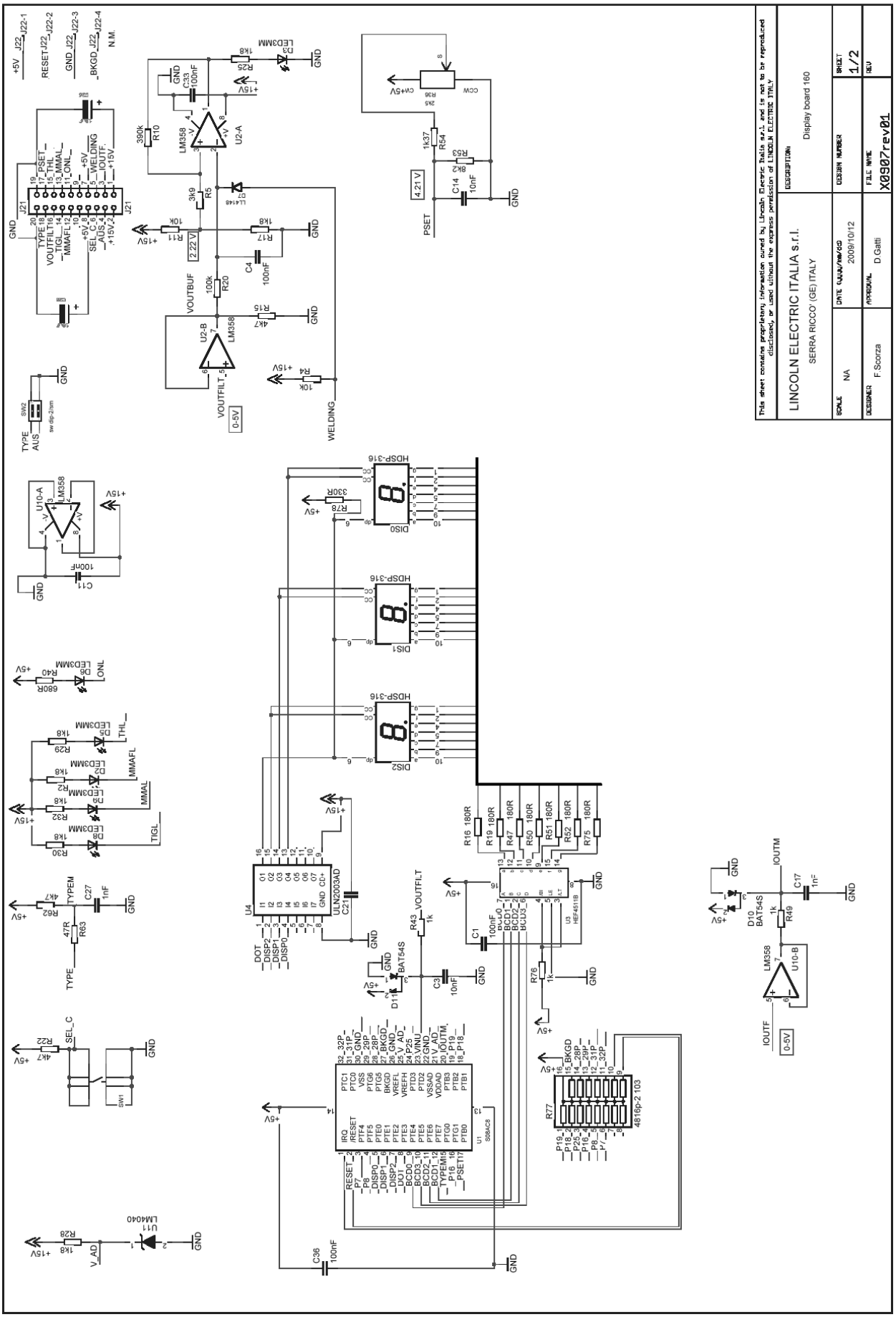


Main Board Schematic X0909. Page 5/5

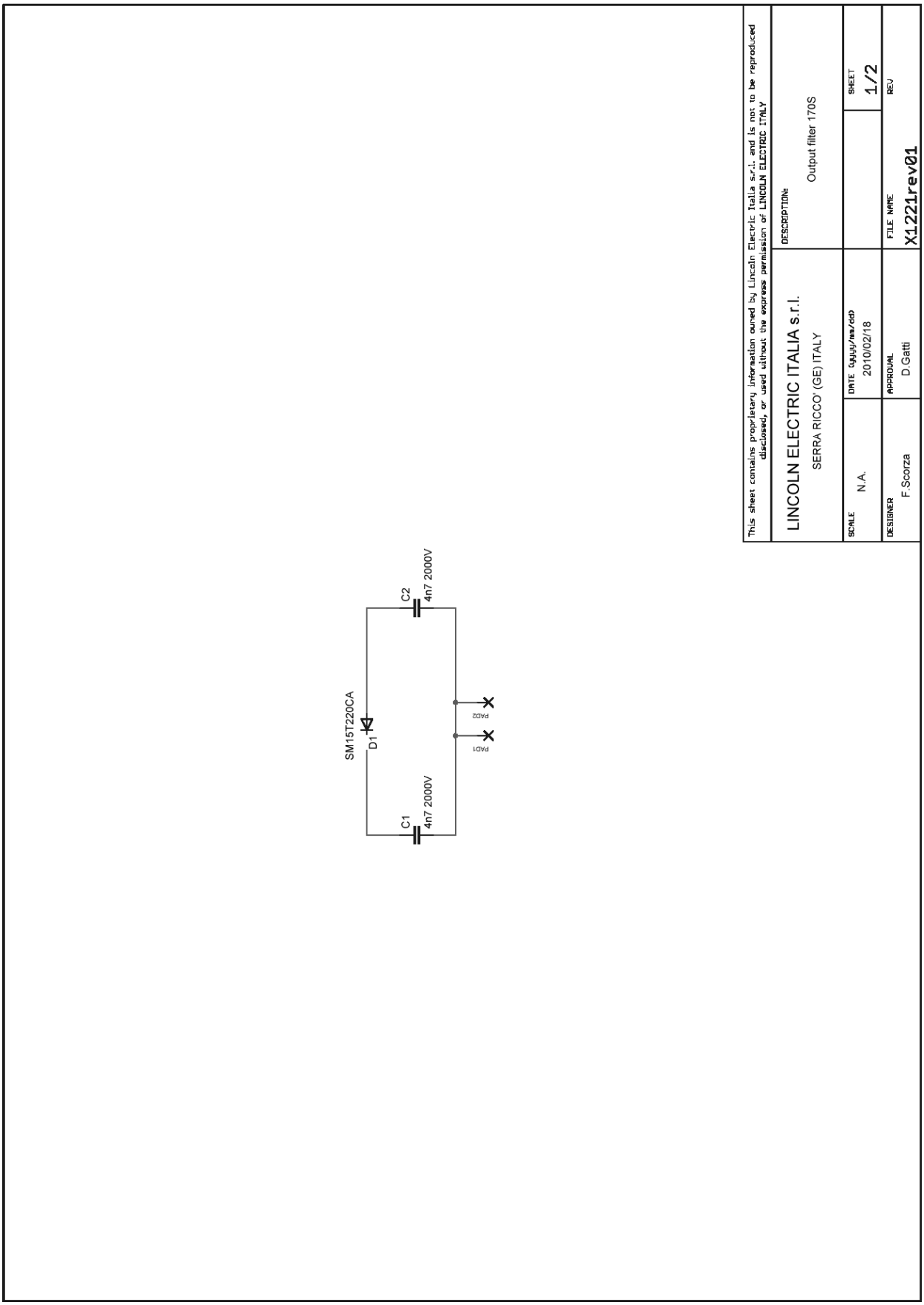


ELECTRICAL DIAGRAMS

Control Board Schematic X907

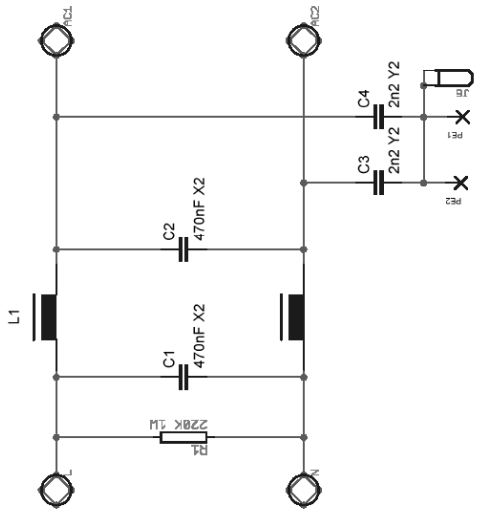


Output Filter Board Schematic X1221



ELECTRICAL DIAGRAMS

EMC Input Filter Board Schematic X1220



LINCOLN ELECTRIC ITALIA s.r.l.
SERRA RICCO' (GE) ITALY

DESCRIPTION: Input EMC filter 170S

SCALE	DATE (yyyy/mm/dd)	SHEET
N.A.	2009/10/08	1/2

DESIGNER	APPROVAL	FILE NAME	REV
F.Scorza	D.Gatti	X1220rev00	

NOTE