SVM 800036912
Rev.00 08-2018

INVERTEC® 165S

For use with machines having code numbers: 50396

SERVICE MANUAL

LINCOLN ELECTRIC EUROPE
www.lincolnelectric.eu

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1.0 TECHNICAL DESCRIPTION

1.1 DESCRIPTION

The system consists of a modern direct current generator for the welding of metals, developed via application of the inverter. This special technology allows for the construction of compact light weight generators with high performance. It's adjust ability, efficiency and energy consumption make it an excellent work tool suitable for coated electrode and GTAW (TIG) welding.

1.2 TECHNICAL SPECIFICATIONS

DATA PLATE

PRIMARY	
Single phase supply	230 V
Frequency	50 Hz / 60 Hz
Effective consumption	16 A
Maximum consumption	36 A
Fuse	16A
SECONDARY	
Open circuit voltage	85 V
Welding current	5 A ÷ 160 A
Duty cycle 20%	160 A
Duty cycle 60%	120 A
Duty cycle100%	80 A
Protection class	IP 23
Insulation class	H
Weight	Kg 7
Dimensions	145 x 230 x 365
European Standards	EN 60974.1 / EN 60974.10

1.3 DUTY CYCLE AND OVERHEATING

Duty cycle is the percentage of 10 minutes at 40°C ambient temperature that the unit can weld at its rated output without overheating . If the unit overheats, the output stops and the over temperature light comes On. To correct the situation, wait fifteen minutes for unit to cool. Reduce amperage, voltage or duty cycle before starting to weld again (See page III).

DO NOT EXCEED THE MAXIMUM WORK CYCLE. EXCEEDING THE WORK CYCLE SPECIFIED ON THE DATAPLATE CAN DAMAGE THE POWER SOURCE AND INVALIDATE THE WARRANTY.

1.4 VOLT - AMPERE CURVES

Volt-ampere curves show the maximum voltage and amperage output capabilities of the welding power source. Curves of other settings fall under curves shown (See page III).

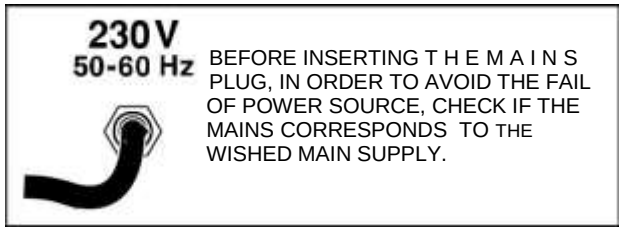
2.0 INSTALLATION

IMPORTANT: BEFORE CONNECTING, PREPARING OR USING EQUIPMENT, READ SAFETY PRECAUTIONS.

2.1 CONNECTING THE POWER SOURCE TO THE MAINS ELECTRICITY SUPPLY.

Serious damage to the equipment may result if the power source is switched off during welding operations.

Check that the power socket is equipped with the fuse indicated in the features label on the power source. All power source models are designed to compensate power supply variations. For variations of ±10%, a welding current variation of ±0.2% is created.

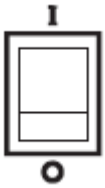


BEFORE INSERTING T H E M A I N S PLUG, IN ORDER TO AVOID THE FAIL OF POWER SOURCE, CHECK IF THE MAINS CORRESPONDS TO THE WISHED MAIN SUPPLY.

WARNING: THIS EQUIPMENT DOES NOT COMPLY WITH IEC 61000-3-12. IF IT IS CONNECTED TO A PUBLIC LOW VOLT AGE SYSTEM, IT IS THE 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.

THIS 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.

ON - OFF SWITCH: This switch has two positions: I and 0.



The welder is designed to be worked from a generator.

Before connecting the welder to the generator it is important to establish that the generator has the following technical requirement:

1. the 230V 50/60 Hz socket can supply sufficient power required for welding, see label on welder.
2. the socket supplies undistorted voltage RMS between 180 and 280 V.
3. the socket supplies peak voltage between 230 and 420 V.
4. the socket supplies alternate voltage with a frequency between 50 and 60 Hz.

IT IS ADVISABLE TO FOLLOW THE ABOVE INSTRUCTIONS OTHERWISE THE WELDER COULD BE DAMAGED.

2.2 POWER SOURCE POSITIONING

SPECIAL INSTALLATION MAY BE REQUIRED WHERE GASOLINE OR VOLATILE LIQUIDS ARE PRESENT. CONTACT THE COMPETENT AUTHORITIES. WHEN POSITIONING EQUIPMENT, ENSURE THAT THE FOLLOWING GUIDELINES ARE FOLLOWED:

1. The operator must have unobstructed access to controls and equipment connections.
2. Check that the power cable and fuse of the socket for power source connection is suited to current requirements of the latter.
3. Do not position equipment in confined, closed places. Ventilation of the power source is extremely important. Avoid dusty or dirty locations, where dust or other debris could be aspirated by the system.
4. Equipment (including connecting leads) must not obstruct corridors or work activities of other personnel.

Position the power source securely to avoid falling or overturning. Bear in mind the risk of falling of equipment situated in overhead positions.

2.3 HANDLING AND TRANSPORTING THE POWER SOURCE

OPERATOR SAFETY: WELDER'S HELMET -GLOWES-SHOES WITH HIGH INSTEPS.

THE WELDING POWER SOURCE DO NOT WEIGHT MORE THAN 25 KG AND CAN BE HANDLED BY THE OPERATOR. READ WELL THE FOLLOWING PRECAUTIONS.

The machine is easy to lift, transport and handle, though the following procedures must always be observed:

1. The operations mentioned above can be operated by the handle on the power source.
2. Always disconnect the power source and accessories from main supply before lifting or handling operations.
3. Do not drag, pull or lift equipment by the cables.

2.4 CONNECTION AND PREPARATION OF EQUIPMENT FOR STICK WELDING.

TURN OFF WELDER BEFORE MAKING CONNECTIONS.

Connect all welding accessories securely to prevent power loss. Carefully follow safety regulations described in SAFETY RULES.

- Fit the selected electrode to the electrode clamp.
- Connect the earth lead connector to the negative (-) quick-connection terminal (Ref. 6 - Picture 1 Page 3.) and the earth clamp of the work piece near the welding zone.
- Connect the electrode clamp connector to the positive (+) quick-connection terminal (Ref. 5 - Picture 1 Page 3.) .

CAUTION: MAKE THE ABOVE CONNECTION FOR DIRECT POLARITY WELDING; FOR INVERSE POLARITY, INVERT THE CONNECTION: EARTH LEAD CONNECTOR TO THE QUICK-CONNECTION POSITIVE (+) TERMINAL AND THE ELECTRODE HOLDER CLAMP CONNECTOR TO THE NEGA-TIVE (-) TERMINAL.

- Adjust welding current with ampere selector Ref. 2 - Picture 1 Page 3.) .
- Press the illuminated switch to turn on the power source Ref. 1 - Picture 1 Page 3.) .

N.B. Serious damage to the equipment may result if the power source is switched off during welding operations.

The power source is fitted with an anti-sticking device that disables power if output short circuiting occurs or if the electrode sticks, allowing it to be easily detached from the work piece.

This device enters into operation when power is supplied to the generator, even during the initial checking period, therefore any load input or short circuit that occurs during this phase is treated as a fault and will cause the output power to be disabled.

2.5 CONNECTION AND PREPARATION OF EQUIPMENT FOR GAS TUNGSTEN ARC WELDING (TIG)

TURN OFF WELDER BEFORE MAKING CONNECTIONS.

Connect welding accessories securely to avoid power loss or leakage of dangerous gases. Carefully follow the safety regulations.

1. Fit the required electrode and nozzle to the electrode holder (check the protrusion and state of the electrode tip).
2. Connect the earth lead connector to the positive (+) quick-connect terminal Ref. - Picture 1 Page 3.) and the earth clamp to the work piece near the welding zone.
3. Connect the torch lead connector to quick-connection negative (-) terminal Ref. 6 - Picture 1 Page 3.) .
4. Connect the torch gas hose to the gas cylinder outlet.
5. Press the illuminated switch to turn on the power source Ref. 1 - Picture 1 Page 3.) .
6. Check that there are no gas leaks.
7. Adjust welding current with ampere selector Ref. 2 - Picture 1 Page 3.) .

CHECK GAS DELIVERY; TURN GAS CYLINDER KNOB TO REGULATE FLOW .

NB: The electric welding arc is struck by lightly touching the work-piece with the electrode (Scratch start).

CAUTION: WHEN WORKING OUTDOORS OR IN WINDY CON-DITIONS PROTECT THE FLOW OF SHIELDING GAS OR IT MAY BE DISPERSED WITH RESULTING LACK OF PROTEC-TION FOR THE WELD.

3.0 CONTROLS, POSITION AND FUNCTIONS

3.1 FRONT PANEL

Picture 1.

1. Connect the earth lead to the work piece to the negative terminal (-) (Ref. 6 - Picture 1 Page 3.)
2. Connect the torch lead to the positive terminal (+) (Ref. 5 - Picture 1 Page 3.).

ENSURE THAT THESE CONNECTIONS ARE WELL TIGHT-ENED TO AVOID POWER LOSS AND OVERHEATING.

3. Use control knob (Ref. 2 - Picture 1 Page 3.) to regulate welding current.
4. Illuminated switch (Ref. 1 - Picture 1 Page 3.) must be ON (lamp light) before welding operations can be started.
5. Illumination of the yellow LED (Ref. 3 - Picture 1 Page 3.) on the front panel indicates a fault which prevents the equipment from functioning.

The yellow LED indicates two fault types:

1. overheating caused by an excessively intense duty cycle. In this case, stop welding and leave the power source switched on until the LED switches off.
2. power supply too high/too low.

   In this case, wait till the LED switches off, indicating normalization of the supply voltage and then resume welding.

4.0 MAINTENANCE

DISCONNECT POWER BEFORE MAINTENANCE. SERVICE MORE OFTEN DURING SEVERE CONDITIONS.

Every three (3) months, perform the operations below:

1. Replace unreadable labels.
2. Clean and tighten weld terminals.
3. Replace damaged gas hose.
4. Repair or replace cracked cables and cords.

Every six (6) months, perform the operation below:

Blow out the inside of the unit. Increase frequency of cleaning when operating in dirty or dusty conditions

REPAIR PROCEDURE

1.1 GENERAL CLEANING

Remove the machine shell and clean carefully with compressed air.

1.2 MACHINE: VISUAL INSPECTION

- Check the conditions of the main components and particularly:
- On the electronic circuit (Fig.1) if the varistor (R1) presents blisters or bursting marks then it is broken; replace the electronic circuit W000232541.

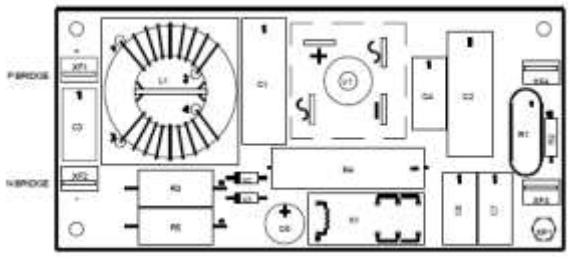


Fig.1

- Verify on the leveling condensers C1, C2, C3, C33 (Fig.1) the presence of swellings or of breaks on the container. They are signs of an irremediable damage.

2. Check on all the harnesses the insulation of the cables and the state at the connection points. If necessary replace paying attention to the following points:

- Always grease the thermostatic probe in case of replacement of the corresponding harness (grease with a basis of silicone).
- Verify the potentiometer (possible mechanical breaks) and the led: in case of harness replacement use denatured alcohol to remove the silicone fixing the led support.

3. Check for the presence of cracks or breaks on the welds of the following components:

- transformer T2
- impedance L1

4. Check for the presence of burn tracks or electric discharge marks on the printed circuit (Fig.1).

1.3 CHECK OF THE MAIN COMPONENTS WITH TESTER (OHMMETER)

1. Electronic circuit (Fig.2) check the presence of short circuits on the rectifier bridge and the correct value of the power resistance (Fig. 2).

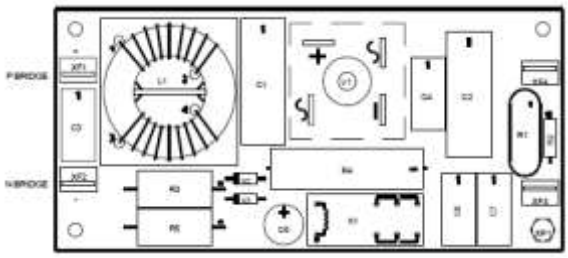


Fig.2

2. Electronic Inverter circuit (Fig.3): verify the following:

- IGBT of the primary circuit and diodes of recycle: test points G-C, G-E, C-E of components 1 and 2; points A-K of components 3 and 4 (Fig. 3); if there are short circuits in any of these components the board is broken.

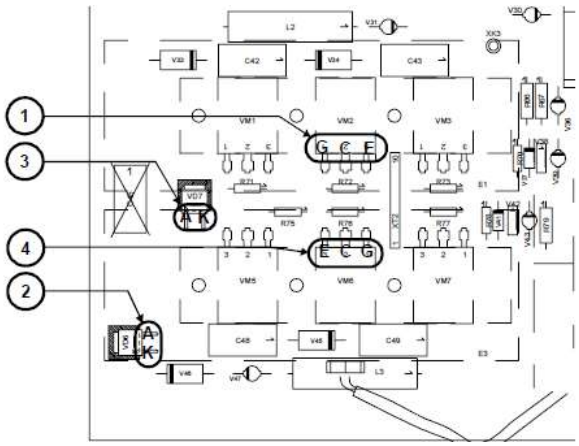


Fig 3

- Diodes of the secondary circuit: check points A-K of diode 1 and points A-K of diode 3 (Fig.4): if at least one shows short circuits the board is broken.

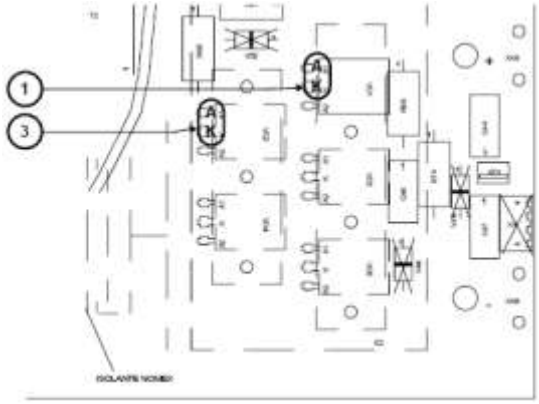


Fig 4

REPAIR PROCEDURE (continue)

1.4 CHECK OF MACHINE WORKING WITH OSCILLOSCOPE AND VOLTMETER

1. Connect a power supply on the points XT1-1 and XT1-5(GND) on the anode and supply with approx. 15Vdc, short-circuit points A and XT1-5 (Fig.5), set the oscilloscope on a time scale of 5 uS and a range of 0.5V/DIV with probe x10 and verify:

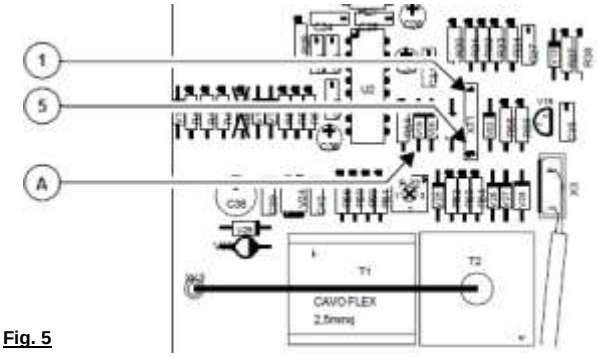


Fig. 5

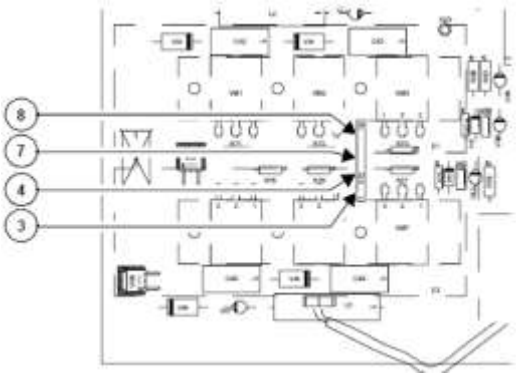


Fig. 6

2. The presence between points: XT2-8 (GND) - XT2-7(probe) and XT2-3(GND) - XT2-4 (probe) (Fig. 6) of the wave form shown in Fig. 7:

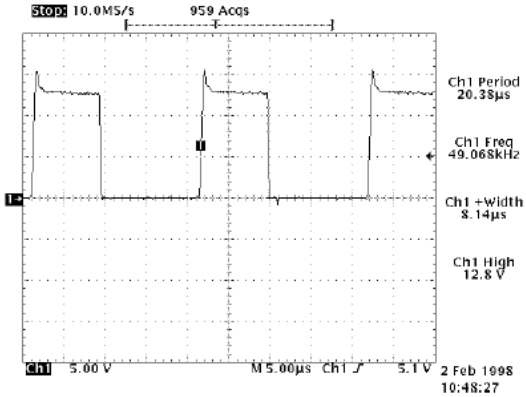


Fig. 7

If the wave form differs from the figure or there is no wave form, the electronic circuit is broken.

2. Now set the oscilloscope with a range of 5V/DIV and connect the probe between points XT2-3 (GND) and XT2-1(probe) (Fig. 8), connect the machine to the power supply, after approx. 2 seconds a wave will appear as in Fig. 9; check with a voltmeter that the output voltage is approx. 55V (see retest after repair section).

If the wave form does not appear:

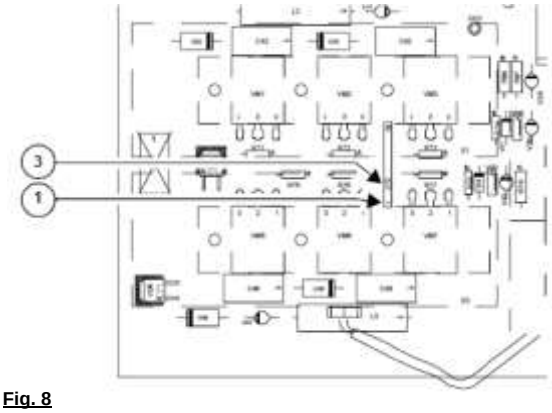


Fig. 8

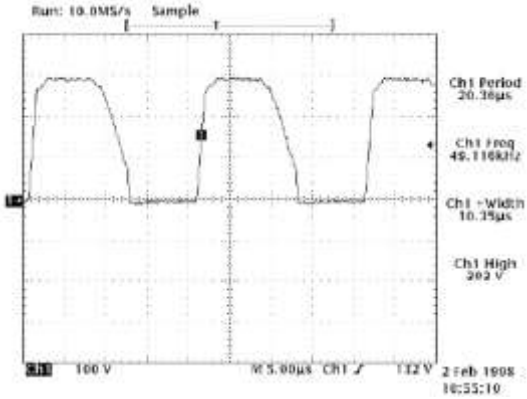


Fig. 9

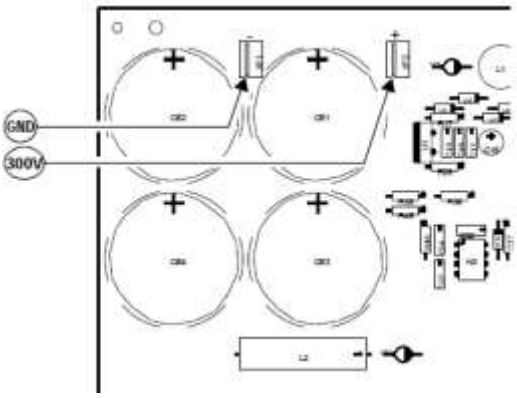


Fig. 10

3. Verify, with a voltmeter, the presence of 300V DC (output voltage of rectifier bridge on electronic inverter circuit board) between points XF-1 and XF-2 of Fig.10; with this reading, the electronic inverter circuit is correctly fed but it does not work.

Carry out the final test after the repair.

FINAL TEST PROCEDURE

2.0 FINAL TEST

a. Disconnect the fan faston, the ground cable and the clamp screw of the Input board turret.

b. Insert an insulating thickness to avoid discharges or short circuits between the Input board and their supporting turrets.

c. On the Inverter electronic board short-circuit points U, T and a rheofore of the primary circuit of the transformer (Fig. 11)

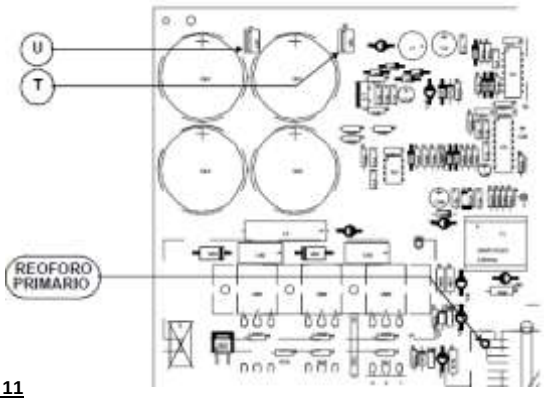


Fig. 11

- switch on
- short-circuit the feeder plug
- shor-circuit the output dinse

After the test remove all the short circuits and restore the connections.

1. Connect the generator to the power supply (230 Vac) and check if the voltage of the outputs is 55 Vdc (+/- 5%): switch off the generator.

2. Connect the generator to the resistive load: the load must be regulated so that the voltage on the load, with maximum current, is between 20V and 25V. Apply oscilloscope probe as in Fig. 8

3. Set the regulation knob to the center of the scale, switch on the generator, turn the knob to the maximum welding current and read with the ammeter the maximum current indicated on the technical table with +/- 5% tolerance. Moreover look on the oscilloscope, connected as in point 2 of the locating faults procedure, for a wave form as in Fig. 12.

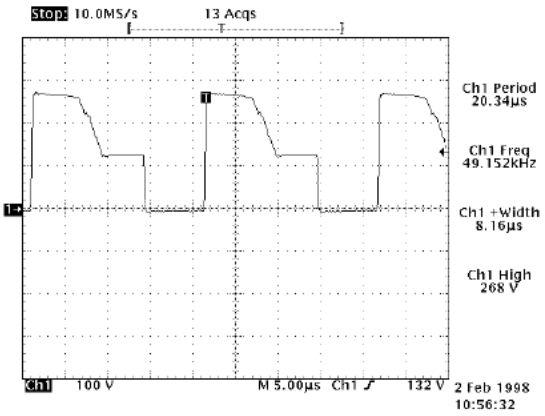


Fig. 12

4. If the current readings differ, adjust the trimmer T (Fig. 13) till the correct current value is obtained (Fig. 12).

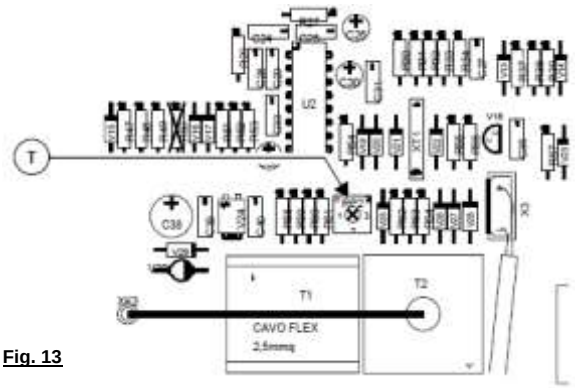


Fig. 13

5. Short-circuit the load and verify that after 1,5 sec. the current descends to approx. 40A.

6. Regulate the resistive load to measure the minimum current (8A - 20A), set the minimum current on the frontal panel and verify with the ammeter a value lower than the one indicated on the technical table.

7. Close the machine, disconnect the probe and with the load to the maximum current, let it work at the greatest capacity till the thermostatic protection intervenes (the thermostatic protection led switches on).

8. Disconnect the machine from the resistive load and wait until machine starts to work again (the thermostatic protection led switches off).

9. Carry out welding tests at the maximum current (one electrode).

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

INVERTEC 165S

Input Voltage	Input Current	Rated Output
230Vac/1ph/50Hz	36A max	160A@20%

Output current range SMAW	**5 – 160 Amps**

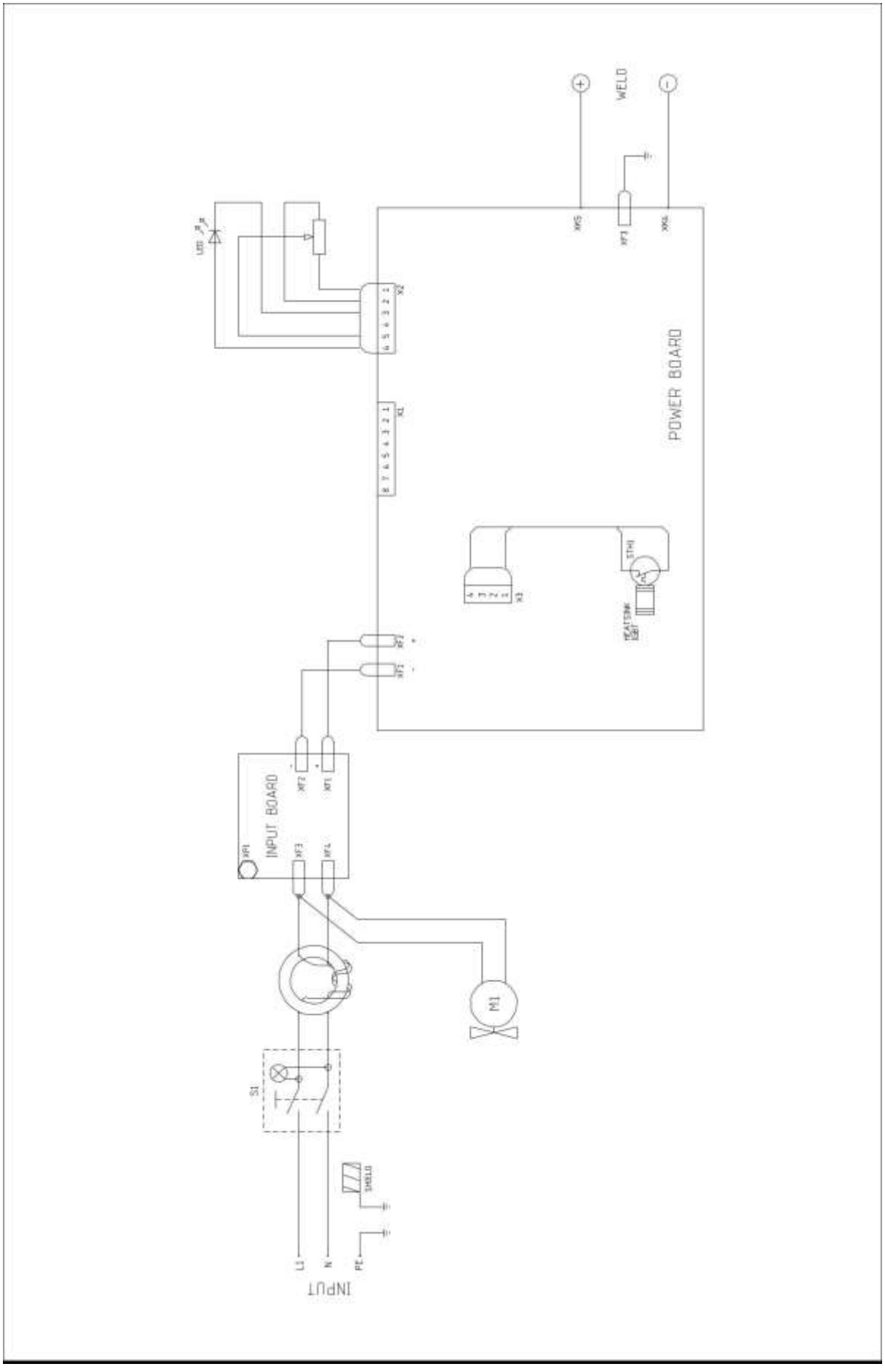
Maximum Open Circuit Voltage	**85 Vdc**

IMPORTANT !

After the repair the unit has to be tested accordingly to the norm **EN60974-4 Arc welding equipment "In-service inspection and testing"**

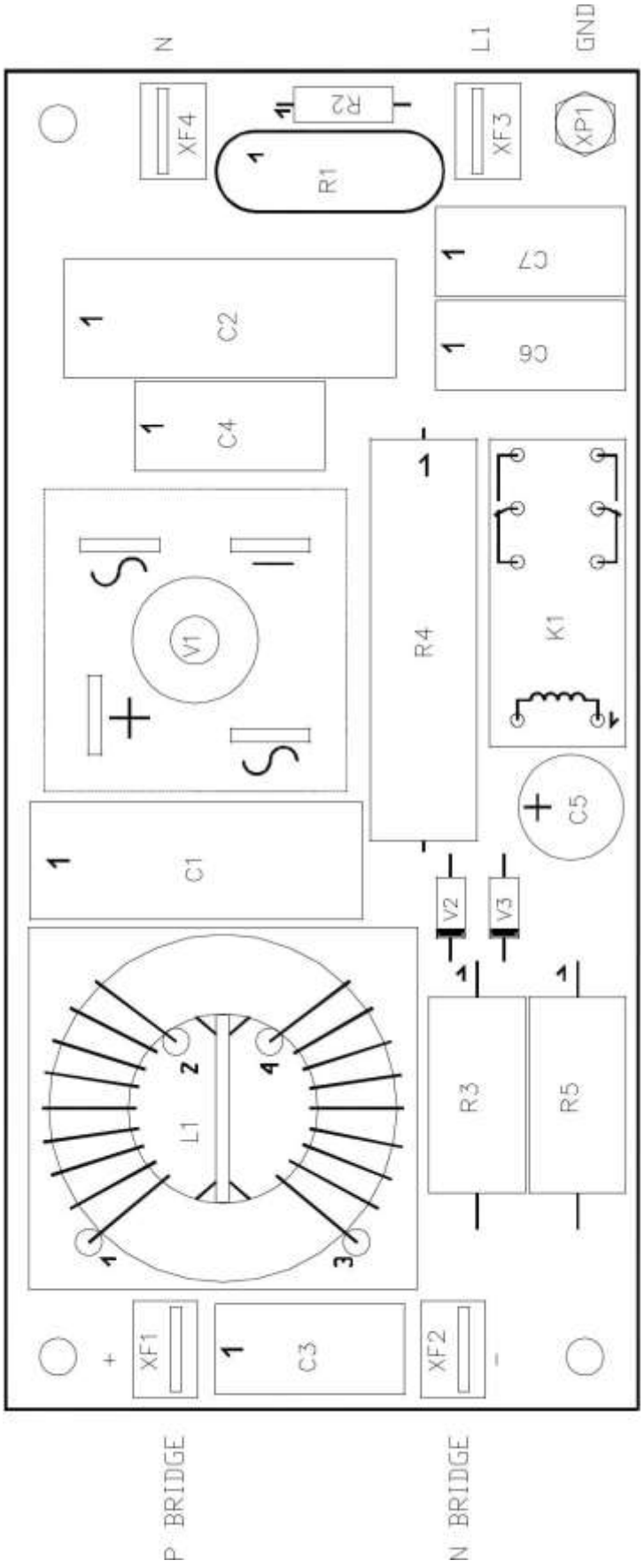
ELECTRICAL SCHEMATICS

Block Diagram



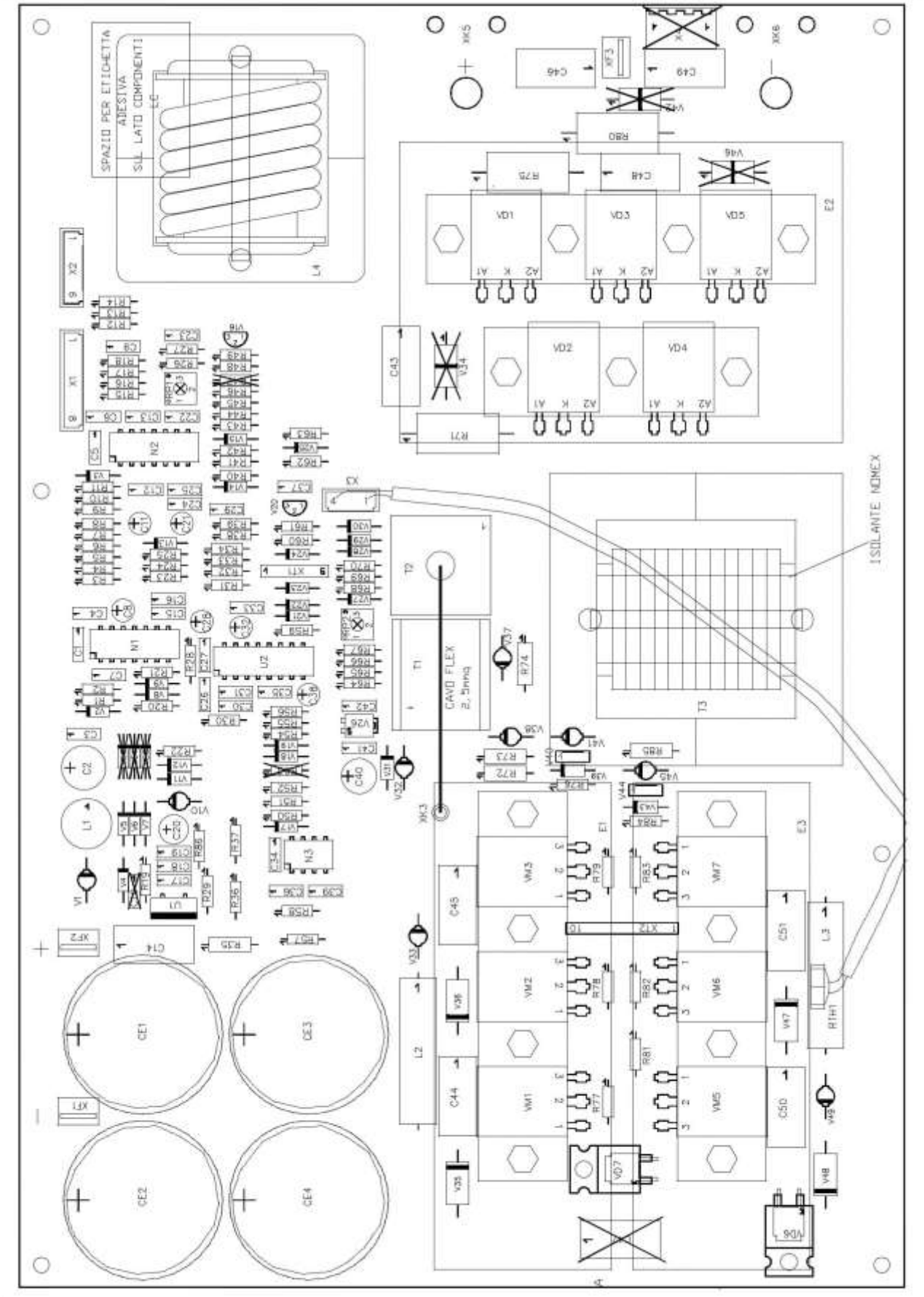
ELECTRICAL SCHEMATICS

Input Board W000232541



ELECTRICAL SCHEMATICS

Inverter Board W000050057



NOTE

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