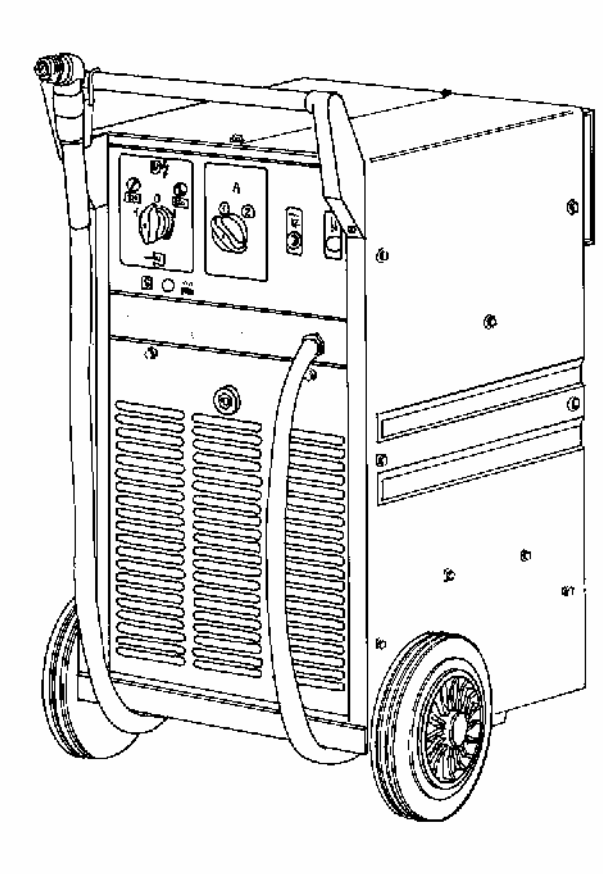
POWER SOURCE art. 939

SERVICE MANUAL



CONTENTS

1 - GENERAL INFORMATION

1.1 - Introduction.

The purpose of this manual is to train personnel assigned to carry out maintenance on the power source art. 939 for plasma cutting systems.

1.2 - General service policy.

It is the responsibility of the customer and/or operator to use the equipment appropriately, in accordance with the instructions in the Instruction Manual, as well as to maintain the equipment and related accessories in good working condition, in compliance with the instructions provided in the Service Manual.

Any internal inspection or repairs must be carried out by qualified personnel who are responsible for any intervention on the equipment.

It is forbidden to attempt to repair damaged electronic boards or modules; replace them with original Cebora spare parts.

1.3 - Safety information.

The safety notes provided in this manual are an integral part of those given in the Instruction Manual. Therefore, before working on the machine, please read the paragraph on safety instructions in the aforementioned manual.

Always disconnect the power cord from the mains, and wait for the internal capacitors to discharge (1 minute) before accessing the interior of the equipment.

Some internal parts, such as terminals and dissipaters, may be connected to mains or otherwise hazardous potentials. It is therefore forbidden to work with the safety guards removed from the machine unless strictly necessary. In this case, take special precautions such as wearing insulating gloves and footwear, and working in a perfectly dry environment with dry clothing.

2 - SYSTEM DESCRIPTION

2.1 - Introduction.

Art. 939 is a system for cutting electrically conductive materials using the plasma arc process.

It is made up of an electronic power source with built-in torch, controlled by electronic circuits to manage the operative functions of the cutting system.

2.2 - Technical specifications.

To verify the technical specifications, see the machine plate, Instruction Manual, and Sales Catalogue.

2.3 - Description of power source art. 939.

Art. 939 is a direct current power source consisting of a three-phase transformer, powered in single-phase, and a three-phase rectifier bridge.

Referring to the electrical diagram in par. 5.1, and drawing 4.1, we can identify the main blocks that make up the power source.

The switch (22) powers the lamp (20) (mains voltage presence signal), the service transformer (7) to power the control board (9), and the fan (40).

The control board (9) manages the output voltage generated by the power source, by means of the input contactor TLP (8) and pilot arc contactor TLC (70), based on the signals present at its inputs.

With the switch (22) closed, the control board (9) is powered and awaiting the start signal from the torch button. The power source provides no output voltage.

When the start button on the torch is pressed, the control board (9):

- opens the gas solenoid valve EL1 (29) (the one with the flow reducer);
- after the pre-gas time, approximately 500 msec. (non adjustable), closes the input contactor TLP (8) and pilot arc contactor TLC (70);
- generates the high frequency to start the pilot arc.

With the contactors TLP (8) and TLC (70) closed, the voltage rectified by the bridge (34) is present on the electrode and torch nozzle terminals, and the pilot arc may be started by generating high frequency. This situation lasts approximately 1 second, after which, if the pilot arc has not been started, high frequency generating ceases. After two more seconds the contactors TLP (8) and TLC (70) are deactivated, thus opened. The power source remains blocked in this situation until the start button is released.

With the pilot arc on, we have approximately two seconds to start cutting, otherwise the power source returns to its resting state (TLP and TLC opened) awaiting a new start command.

When the torch approaches the work piece with the pilot arc on, the arc current begins to circulate in the work piece, as this is the preferred path due to the voltage drop on the resistor (33). The reed sensor (39) detects the passage of current on the work conductor, and sends the cutting start signal to the control board (9), which opens the contactor TLC (70) and the solenoid valve EL2 (29).

When cutting ends the input contactor TLP (8) and solenoid valve EL2 (29) are deactivated, and only the solenoid valve EL1 (29) remains powered for the post-gas time (approximately 30 seconds, non-adjustable). Once this time has elapsed, the solenoid valve EL1 (29) is also deactivated, and the power source returns to its initial resting state (power circuit not powered and no output voltage).

The cutting current may be selected between two fixed values by means of the cutting current selector (23). In the maximum current position the resistor (32) is cut out of the cutting circuit; in the other position, the resistor (32) is inserted in series with the work conductor and thus contributes to limiting the output current.

With the input contactor TLP (8) closed, single-phase mains voltage is applied to the three-phase transformer (57) and the capacitors (68) and (71), which are connected in series to one of the windings of the primary circuit specifically to create the “third phase” needed by the transformer (57). Their value, calculated based on the characteristics of the primary winding, is the determining factor in proper offset and the correct voltage for the “third phase”. The primary circuit of the transformer (57) is also made up of three windings, one for each column, with different numbers of turns, so that they can operate in a single-phase power mains in combination with the capacitors (68) and (71).

A different capacity of the capacitors or a different connection of the primary transformer circuit (57) produces three different voltages at the secondary circuit which, once rectified by the bridge (34), provide an unbalanced direct current voltage that may make it difficult to light the arc or produce poor-quality cutting.

For proper operation, it is therefore essential to observe the capacity of the capacitors (3 x 60 uF + 1 x 30 uF, parallel connected) and how these are wired to the primary circuit (**DO NOT** reverse the primary circuit terminals).

The choke (67) connected to the output (–) of the rectifier (34) is necessary to level the output current of the power source, since the currents originating from the voltages of the secondary transformer circuit (57) are often slightly imbalanced due to the particular connection configuration. The choke (67) essentially improves the stability of the arc.

The pressure switch (11) inserted in the plasma gas line prevents the input contactor TLP (8) from closing when the pressure falls below the minimum operating value (3,2 bar).

Its normally closed contact also commands the lamp L (30) to signal the gas pressure error (lamp lit = pressure low).

The thermostat (31) is located on a winding of the transformer (57) (temperature correct = contactor closed). Its intervention, signaled by lamp G (30) interrupts the start command of the torch button.

3 - MAINTENANCE

WARNINGS

ANY INTERNAL INSPECTIONS OR REPAIRS MUST BE CARRIED OUT BY QUALIFIED PERSONNEL.

BEFORE BEGINNING MAINTENANCE OPERATIONS, UNPLUG THE POWER SOURCE FROM THE MAINS AND WAIT FOR THE INTERNAL CAPACITORS TO DISCHARGE (1 MINUTE).

3.1 - Periodic inspection, cleaning.

Periodically remove dirt and dust from the internal parts of the power source, using a jet of low-pressure dry compressed air or a brush.

Check the condition of the power cables of the power source and torch; replace if aged or damaged.

Check the condition of the internal power connections and connectors on the electronic boards; if you find “loose” connections, tighten or replace the connectors.

3.2 - Operating sequence (fig. 3.2.1).

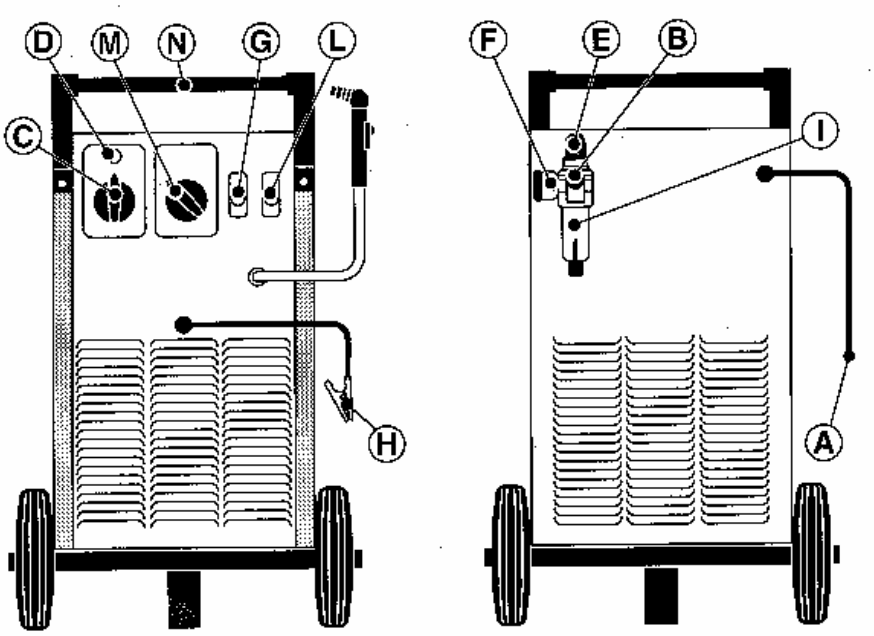
The following sequence represents correct functioning of the machine. It may be used as a guiding procedure for troubleshooting.

It must be carried out after each repair without any errors.

NOTE

- ❑ Operations preceded by this symbol refer to operator actions.
- ♦ Operations preceded by this symbol refer to machine responses that must occur following an operator action.

3.2.1 - Power source commands and signals.



3.2.2 - Power source operation.

- System shut off and unplugged from the mains.
- Connect the gas intake to the fitting (B) on the rear panel.
- Turn the gas setting knob (E) to a pressure, as read on the pressure gauge (F), suited to the type of torch being used (see Instruction Manual).
- Connect the work clamp (H) to the work piece.
- Connect the power source to the mains.
- Close the switch (C) on the power source.
  - ♦ System powered, lamp (D) lit, fan running.
  - ♦ On front panel, lamps (G) and (L) off.

Correct? — NO (see 3.3.1, 3.3.2, 3.3.3, 3.3.4).

▼ YES

WARNING

DURING THE FOLLOWING TESTS, DO NOT POINT THE TORCH AT PEOPLE OR PARTS OF BODY, BUT ALWAYS TOWARDS AN OPEN SPACE OR THE WORK PIECE.

- Briefly press the torch start button.
  - ♦ Gas flows from the torch for approximately 30 seconds (post-gas time). The pressure reading on the pressure gauge (F) remains constant.

Correct? — NO (see 3.3.5, 3.3.6).

▼ YES

- Press the torch start button and hold it down for approximately 5 seconds to start the pilot arc.
  - ♦ Pilot arc lights for approximately 2 seconds (maximum pilot arc time). The gas continues to flow for approximately another 30 sec. after the start button is released (post-gas time).

Correct? — NO (see 3.3.7, 3.3.8, 3.3.9).

▼ YES

- With pilot arc lit, place the torch near the work piece.
  - ♦ Begin cutting. If necessary turn the cutting current selector (M) to adjust the output current to the cut to be made.

Correct? — NO (see 3.3.10).

▼ YES

- Release the torch start button.
  - ♦ The arc shuts off immediately. The gas continues to flow for the post-gas time (approximately 30 seconds after the start button is released).

Correct? — NO (see 3.3.6).

▼ YES

REGULAR OPERATION.

3.3 - Troubleshooting.

WARNINGS

ANY INTERNAL INSPECTIONS OR REPAIRS MUST BE CARRIED OUT BY QUALIFIED PERSONNEL.

BEFORE REMOVING THE PROTECTIVE GUARDS AND ACCESSING INTERNAL PARTS, DISCONNECT THE POWER SOURCE FROM THE MAINS AND WAIT FOR THE INTERNAL CAPACITORS TO DISCHARGE (1 MINUTE).

NOTE

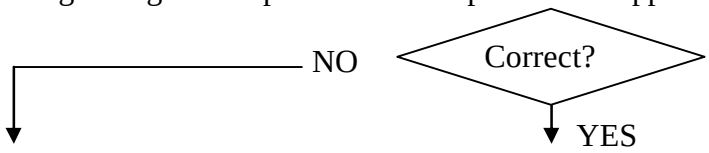
Items in **boldface** describe problems that may occur on the machine (symptoms).

- ❑ Operations preceded by this symbol refer to situations the operator must determine (causes).
- ♦ Operations preceded by this symbol refer to actions that the operator must perform in order to solve the problems (solutions).

3.3.1 - The power source does not start, lamp (22) off, fan (40) stopped.

MAINS SUITABILITY TEST.

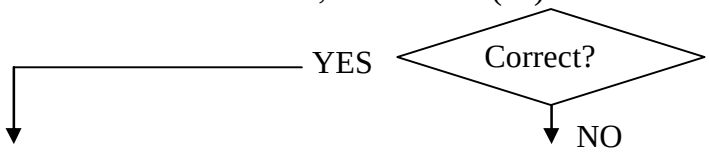
- ❑ Missing voltage at the power source input due to tripped mains protections.



- ♦ Eliminate any short-circuits on the connections between power cable, switch (22), service transformer (7), and input contactor (8).
- ♦ Check the insulation towards earth of the service transformer (7) and fan (40). If leaking or short-circuited towards earth, replace.
- ♦ Mains not suited to power the power source (ex.: insufficient installed power).

CONTROL BOARD (9) POWER SUPPLY TEST.

- ❑ Control board (9), connector CN4, terminals 10 and 6 = 20 Vac, and connector CN1, terminals 1 and 2 = 27 Vac, with switch (22) closed.



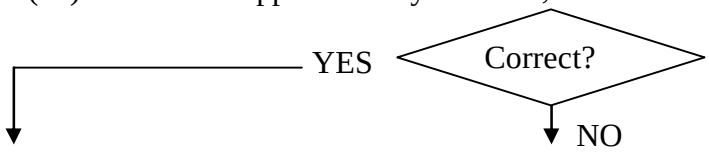
- ♦ Check the wiring between switch (22), service transformer (7) and connectors CN4 and CN1 of control board (9).
- ♦ Make sure the fuses on the terminal board of the service transformer (7) are intact. If you find tripped fuses on the primary circuit, replace with similar fuses, and make sure the service transformer (7) and fan (40) are intact. If you find tripped fuses on the secondary circuit, replace with similar ones, and make sure that the terminals 10 and 6 of CN4 and 1 and 2 of CN1 on control board (9) are not short-circuited. Replace control board (9) if necessary.
- ♦ Check switch (22) and replace if defective.
- ♦ Check the mains voltage conditions.

- ♦ Make sure the fan (40) is operating correctly (see par. 3.3.2).
- ♦ Replace lamp (22).

3.3.2 - Power source powered, lamp (22) lit, fan (40) stopped.

FAN (40) TEST.

- Fan (40) terminals = approximately 230 Vac, with switch (22) closed.

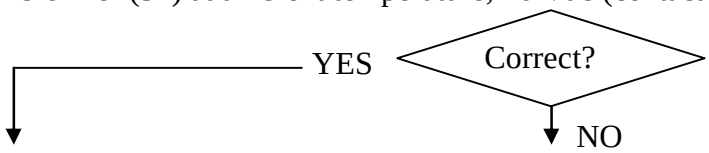


  - Check the wiring between the terminals of fan (40) and terminals 0 and 220 of the service transformer (7).
  - Make sure the fuses on the terminal boards of the service transformer (7) are intact. If you find tripped fuses on the primary circuit, replace with similar fuses, and make sure the service transformer (7) and fan (40) are intact. If defective, replace.
  - Check the wiring between service transformer (7) and switch (22).
- Make sure that there are no mechanical impediments blocking the fan (40).
- Replace the fan (40).

3.3.3 - Power source powered, lamp G (30) lit, (transformer (57) overtemperature).

THERMOSTAT (31) TEST.

- Control board (9), connector CN4, terminals 4 and 9 = 0 Vac (contact closed), with transformer (57) at ambient temperature; 20 Vac (contact open), with temperature excessive.

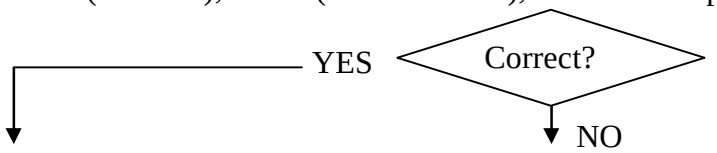


  - Check the wiring between thermostat (31) and terminals 4 and 9 of CN4 on control board (9).
  - Make sure that the thermostat (31) is intact and properly positioned on the windings of the transformer (57).
  - If the alarm occurs while cutting, and the transformer (57) is evenly heated, make sure that the duty-cycle is not greater than indicated in the power source specifications.
  - If the alarm occurs while cutting, and only some of the windings of the transformer (57) are heated, check the status of the capacitors (68) and (71) and replace if necessary. If the problem continues even with the capacitors in good condition, one may infer that the transformer (57) is partially short-circuited, and must therefore be replaced. (An indication regarding the status of the capacitors (68) and (71) and primary circuit of the transformer (57) may be obtained by measuring the voltages on the terminals of transformer (57) in the conditions described in the tables in pars. 3.3.9 and 3.3.10).
  - Replace thermostat (31).
- Replace control board (9).

3.3.4 - Power source powered, lamp L (30) lit, (low gas pressure).

PRESSURE SWITCH (11) TEST.

- Control board (9), connector CN1, terminal 7, and terminal NC of the pressure switch (11) (the one connected to lamp L) = 0 Vac (contact closed), with low pressure (<3.2 bar); 27 Vac (contact opened), with suitable pressure.
- Control board (9), connector CN1, terminal 7, and terminal NO of the pressure switch (11) (the one connected to the input contactor (8) coil = 27 Vac (contact opened), with low pressure (<3.2 bar); 0 Vac (contact closed), with suitable pressure.



- ♦ Check the wiring between pressure switch (11), lamp L (30), input contactor (8) coil and terminal 7 of CN1 on control board (9).
- ♦ Check for the presence of gas at the intake fitting (B) and make sure the pressure and flow rate in the infeed line meet specifications (see Instruction Manual).
- ♦ Make sure that the pressure regulator (E) and pressure gauge (F) are working properly.
- ♦ Make sure that the air fitting (B) inserted in the pressure regulator (E) has a threaded part no longer than 6 - 8 mm (1/4" - 5/16"), to avoid a possible malfunction of the regulator (E).
- ♦ Make sure there are no occlusions in the gas hoses of the power source.
- ♦ Replace the pressure switch (11).

♦ Proper operation of the pressure switch (11).

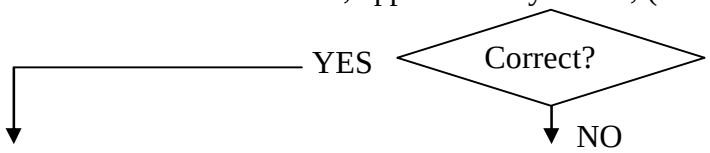
3.3.5 - The start button produces no effect.

WARNING

FOR THE FOLLOWING TESTS **DISCONNECT THE TERMINALS FT1 AND FT2** ON HF BOARD (10) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

START COMMAND TEST.

- Control board (9), connector CN4 terminals 7 (+) and 1 (-) = approximately +25 Vdc, with start button on torch released; approximately 0 Vdc, (contact closed) with button pressed.



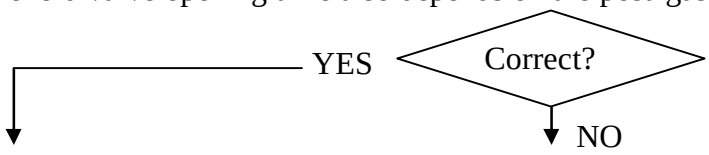
  - Check the wiring between CN4 control board (9), torch cable, nozzle guard on the torch and start button.
  - Make sure the nozzle protection and torch button are correctly assembled and in good working order. If they are defective or showing signs of wear, replace them.
  - Make sure that there is perfect isolation between the conductors of the start button and those of the electrode and nozzle in the torch cable. If isolation is reduced, replace the complete torch. Any loss of isolation between the torch cable conductors may damage the control board (9).
  - Make sure that the thermostat (31) is working properly, performing the test in par. 3.3.3. if necessary (the thermostat (31) acts directly on the power supply circuit of the start button, inside the control board (9)).
  - Perform the CONTROL BOARD (9) POWER SUPPLY TEST, par. 3.3.1.
  - Replace the control board (9).

- Perform the CONTROL BOARD (9) POWER SUPPLY TEST, par. 3.3.1.
- Replace control board (9).

3.3.6 - No gas flows from the torch.

PILOT ARC EL1 (29) SOLENOID VALVE TEST.

- Solenoid valve EL1 (29) terminals = approximately 25 Vac, with torch button pressed. The solenoid valve opening time also depends on the post-gas time.



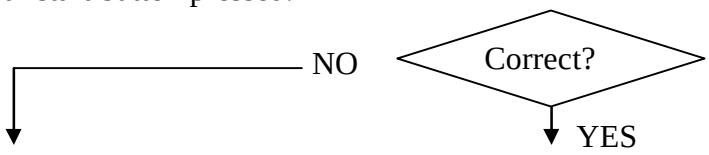
  - Check the wiring between solenoid valve EL1 (29) and terminals 3 and 6 of CN1 on control board (9).
  - With power source off, check the resistance between the terminals of solenoid valve EL1 (29) = approximately 25 ohm. If 0 ohm (short-circuit), replace solenoid valve EL1 (29) and control board (9).
  - Perform the CONTROL BOARD (9) POWER SUPPLY TEST, par. 3.3.1.
  - Replace control board (9).

- With power source off, check the resistance between the terminals of solenoid valve EL1 (29) = approximately 25 ohm. If >Mohm (winding broken) replace solenoid valve EL1 (29).
- Make sure there are no occlusions in the gas hoses of the power source.
- Check the presence of the gas at the inlet fitting (B) and that the pressure and flow rate in the intake conduit meet the specification values (see Instruction Manual).
- Make sure that the pressure regulator (E) and pressure gauge (F) are working properly.
- Make sure that the air fitting (B) inserted in the pressure regulator (E) has a threaded part no longer than 6 - 8 mm (1/4” - 5/16”), to avoid a possible malfunction of the regulator (E).
- Replace solenoid valve EL1 (29).

3.3.7 - Gas flows from the torch, the pilot arc does not light (high frequency missing).

HF OSCILLATOR TEST.

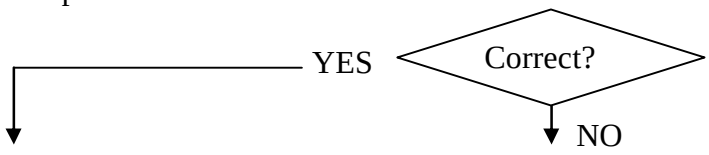
- HF board (10), discharger SC1 discharges at regular intervals, for approximately one second, with start button pressed.



  - Make sure that there are no short-circuits between terminals FT3 and FT4 of HF board (10) or in the connection of the primary circuit of the HF transformer (25).
  - Check the connection of the HF transformer (25) secondary winding circuit with choke (67) and torch electrode cable. If you find damaged connections or with isolation leaks, fix them.
  - Check the condition of the torch cable and torch, especially making sure there are no short-circuits or isolation leaks between the conductors, and that the electrode, nozzle, nozzle holder and swirl ring are not to be replaced (see Instruction Manual).
  - Make sure that the gas pressure in the torch plasma chamber is not too high. If necessary check operation of the pressure regulator (E) and pressure gauge (F) and adjust in observance of the technical specifications.
  - Go to par. 3.3.8.
- Check the distance between the tips of the discharger SC1 (correct value = 0.9 mm.).
- Check the wiring between HF transformer (25) and terminals FT3 and FT4 of HF board (10). In particular, make sure that the primary winding circuit is not broken. If necessary reset the connection or replace the HF board (10).

HF COMMAND TEST.

- HF board (10), terminals FT1 and FT2 = 25 Vac for approximately one second, with start button pressed.



  - Check the wiring between FT1 and FT2 of HF board (10) and terminals 8 and 5 of CN1 on control board (9).
  - With power source off, temporarily disconnect the connector CN1 from control board (9) and check the resistance between terminals FT1 and FT2 on HF board (10). Correct value = >Mohm in both measurement directions. If 0 ohm (short-circuit) replace the HF (10) and control (9) boards, otherwise replace only the HF board (10).
  - Replace control board (9).
- Replace the HF board (10).

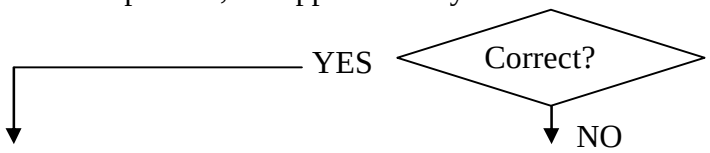
3.3.8 - Gas flows from the torch, the pilot arc does not light (nozzle voltage missing).

WARNING

FOR THE FOLLOWING TESTS **DISCONNECT THE TERMINALS FT1 AND FT2** ON HF BOARD (10) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

CONTACTORS TLP (8) AND TLC (70) COMMAND TEST.

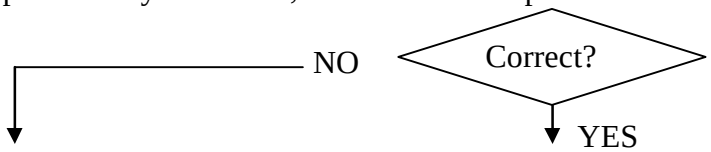
- TLP (8) and TLC (70) contactors = closed (approximately 23 Vac on the coil terminals) with start button pressed, for approximately 2 seconds.



  - ♦ Check the wiring between the contactors TLP (8) and TLC (70) coils with the control board (9).
  - ♦ Perform the CONTROL BOARD (9) POWER SUPPLY TEST, par. 3.3.1.
  - ♦ Make sure that the pressure switch (11) is working properly (see par. 3.3.4).
  - ♦ Replace control board (9).

POWER SOURCE OUTPUT VOLTAGE TEST.

- Filter board (6), connector CN1, terminals 2 (+) and 6 (-) = approximately 250 Vdc, for approximately 2 seconds, with start button pressed.



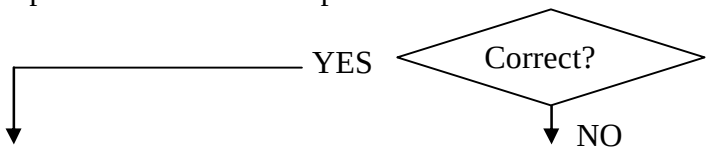
  - ♦ See par. 3.3.7.

- ♦ Check the wiring between CN1 filter board (6), shared point between choke (67) and HF transformer (25) secondary circuit and the connection point of the torch cable nozzle terminal.
- ♦ Check the wiring between the (-) terminal of rectifier (34), choke (67), HF transformer (25) secondary circuit and the terminal electrode of the torch cable, and between the (+) terminal of the rectifier (34), resistors (32) and (33), contactor TLC (70) and torch cable nozzle terminal. If you find loose connections, tighten them and replace any components with damaged terminals.
- ♦ With the power source off, temporarily disconnect terminals 4, 5 and 6 of the transformer (57) from the rectifier (34), and check the efficiency of the rectifier (34). If defective, replace.
- ♦ With the power source off, check the resistance of the resistors (32) and (33). Correct values: (32) = 2.1 ohm; (33) = 2.4 ohm. If incorrect, replace resistors (32) and/or (33).
- ♦ With the power source off, check the efficiency of the contacts of contactors TLP (8) and TLC (70), manually activating them, and make sure that the resistance on each contact is approximately 0 ohm. If you find burnt contacts or interference in moving the parts, replace the TLP (8) and/or TLC (70) contactors.
- ♦ Check the efficiency of the capacitors (68) and (71), the transformer (57) and the corresponding connections, performing the CAPACITORS (68) AND (71) WITH PILOT ARC TEST in par. 3.3.9. if necessary.

3.3.9 - Irregular pilot arc starts, unstable pilot arc.

PLASMA GAS PRESSURE TEST.

- Gas pressure correct in the plasma chamber of the torch.



- ♦ Check for the presence of gas at the intake fitting (B) and make sure that the pressure and flow rate in the intake line meet specifications (see Instruction Manual and Sales Catalogue).
- ♦ Make sure that the air fitting (B) inserted in the pressure regulator (E) has a threaded part no longer than 6 - 8 mm (1/4" - 5/16"), to avoid a possible malfunction of the regulator (E).
- ♦ Make sure that the pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.
- ♦ Make sure there are no occlusions in the gas hoses of the power source.
- ♦ Make sure that solenoid valve EL1 (29) = opened, and solenoid valve EL2 (29) = closed, during the pilot arc.

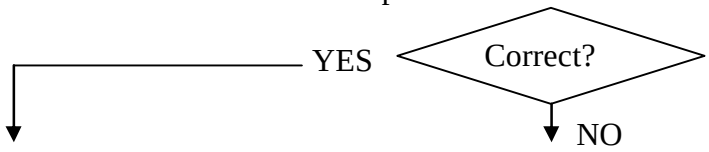
CAPACITORS (68) AND (71) WITH PILOT ARC TEST.

- Terminals of transformer (57) = voltages according to the table, with pilot arc on, and rated mains voltage.

Terminals of transformer (57)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	360 Vac	270 Vac	230 Vac	140 Vac	160 Vac	170 Vac

NOTE

The values shown in the table are merely indicative, with a rather broad tolerance, due to the tolerances of the capacitors and how the transformer (57) is made.



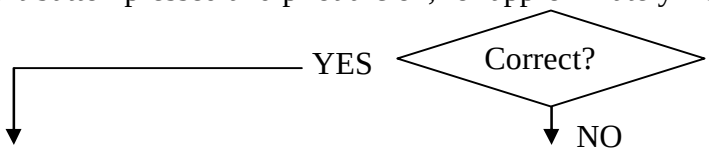
- ♦ Check the wiring between the capacitors (68) and (71) and terminals 1 and 2 of the primary circuit of the transformer (57), considering that every connection other than the one shown in the diagram is to be considered mistaken, and may cause further damage to the components of the power source.
- ♦ Make sure that the capacity of the capacitors is correct; (68) = 3 x 60 uF and (71) = 30 uF, using a specifically designed instrument "RLC Bridge", or, if not available, replace the capacitors (68) and (71).
- ♦ Check the condition of the windings of transformer (57), especially making sure that there are no signs of overheating or dents in the winding columns that may lead to partial short-circuits in the turns. If necessary, replace the transformer (57).

- ♦ Check the connections between torch cable, secondary HF transformer circuit (25) and TLC (70) contactor.
- ♦ Make sure the internal parts of the torch are properly isolated, including the cables, and if in doubt replace the entire torch.
- ♦ Check the electrode, swirl ring and torch nozzle; replace if worn or damaged.

3.3.10 - Transfer arc does not take place or is too weak for cutting.

POWER SOURCE OUTPUT VOLTAGE TEST.

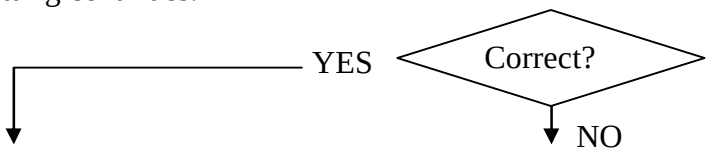
- Filter board (6), connector CN1, terminals 4 (+) and 6 (-) = approximately 150-200 Vdc, with start button pressed and pilot arc on, for approximately 2 seconds (maximum pilot arc time).



- ♦ Check the wiring between CN1 filter board (6), shared point between choke (67) and HF transformer (25) secondary circuit and output terminal (41) of the power source.
- ♦ Check connections between resistor (32), cutting current selector switch (23), reed solenoid (38) and output terminal (41) of the power source. If any defective connections are found, restore them and replace any components with damaged terminals.
- ♦ Make sure that the cutting current selector switch (23) is working properly.

TRANSFER ARC SWITCHING TEST.

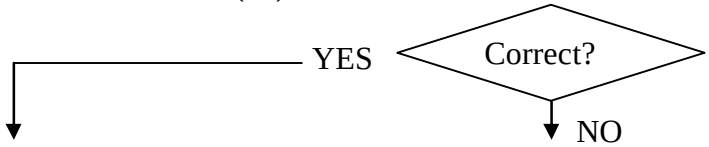
- Control board (9), connector CN3, terminals 1 (+) and 2 (-) = 0 Vdc, with transfer arc, thus while cutting (+13 Vdc with pilot arc on). This situation remains constant for as long as cutting continues.



- ♦ Make sure the reed bulb (39) is properly mounted in the solenoid (38).
- ♦ With the power source off, make sure that the switch in the reed bulb (39) is working properly: move a magnet near the bulb and check the resistance between the terminals 1 and 2 of CN3 on control board (9) = 0 ohm (reed contact closed). Move the magnet away from the bulb, resistance = approximately 5 Kohm (reed contact opened). If incorrect replace reed bulb (39) and solenoid (38).
- ♦ Check the work cable connection to the work piece.

TRANSFER ARC EL2 (29) SOLENOID VALVE TEST.

- Solenoid valve EL2 (29) terminals = 25 Vac with transfer arc, for the entire cutting time.



- ♦ Check the wiring between solenoid valve EL2 (29), and terminal 1 of CN2, and terminals 6 of CN1 on control board (9).
- ♦ With power source off, check the resistance between the terminals of solenoid valve EL2 (29) = approximately 25 ohm. If 0 ohm (short-circuit), replace solenoid valve EL2 (29) and control board (9).
- ♦ Replace control board (9).

- ♦ With power source off, check the resistance between the terminals of solenoid valve EL2 (29) = approximately 25 ohm. If >Mohm (winding broken) replace solenoid valve EL2 (29).

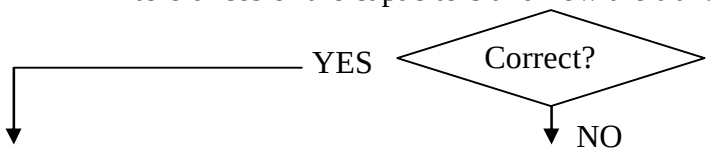
CAPACITORS (68) AND (71) WHILE CUTTING TEST.

- Terminals of transformer (57) = voltages according to the table, with transfer arc, cutting current selector switch (23) in position 1 (30 A.), and rated mains voltage.

Terminals of transformer (57)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	280 Vac	250 Vac	230 Vac	135 Vac	145 Vac	130 Vac

NOTE

The values shown in the table are merely indicative, with a rather broad tolerance, due to the tolerances of the capacitors and how the transformer (57) is made.



- ♦ Check the wiring between the capacitors (68) and (71) and terminals 1 and 2 of the primary circuit of the transformer (57), considering that every connection other than the one shown in the diagram is to be considered mistaken, and may cause further damage to the components of the power source.
- ♦ Make sure that the capacity of the capacitors is correct; (68) = 3 x 60 uF and (71) = 30 uF, using a specifically designed instrument “RLC Bridge” or, if not available, replace the capacitors (68) and (71).
- ♦ Check the condition of the windings of transformer (57), especially making sure that there are no signs of overheating or dents in the winding columns that may lead to partial short-circuits in the turns. If necessary, replace the transformer (57).

- ♦ Check connections between torch cable, HF transformer (25) secondary circuit, choke (67) and (-) terminal of the rectifier (34), and between work cable, output terminal (41) of the power source, solenoid (38), cutting current selector switch (23), resistor (32) and (+) terminal of the rectifier (34). If you find any deteriorated connections, reset them and replace any damaged components.
- ♦ Check the presence of the gas at the inlet fitting (B) and that the pressure and flow rate in the intake conduit meet the specification values (see Instruction Manual).
- ♦ Make sure the pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.
- ♦ Make sure that the gas lines in the power source are not partially clocked, so that the gas throughput is enough for the pilot arc but not for the transfer arc.
- ♦ Replace solenoid valve EL2 (29).

4 - COMPONENTS LIST

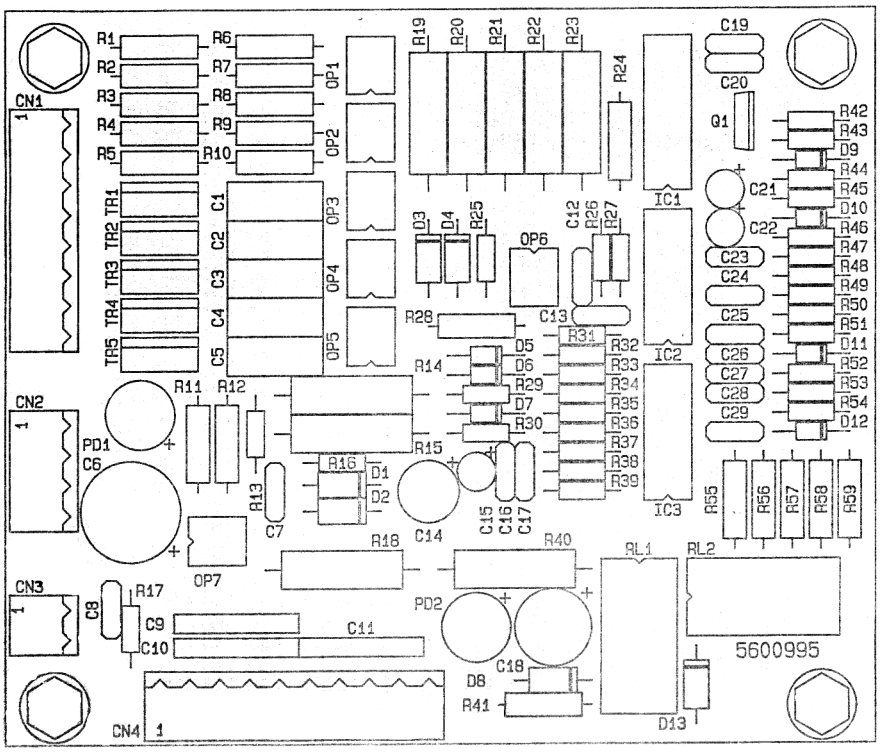
4.1 - Power source art. 939 : see file ESP939.pdf enclosed at the end of the manual.

5 - ELECTRICAL DIAGRAMS

5.1 - Power source art. 939 : see file SCHE939.pdf enclosed at the end of the manual.

5.2 - Control board (9) code 5.600.995.

5.2.1 - Topographical drawing.

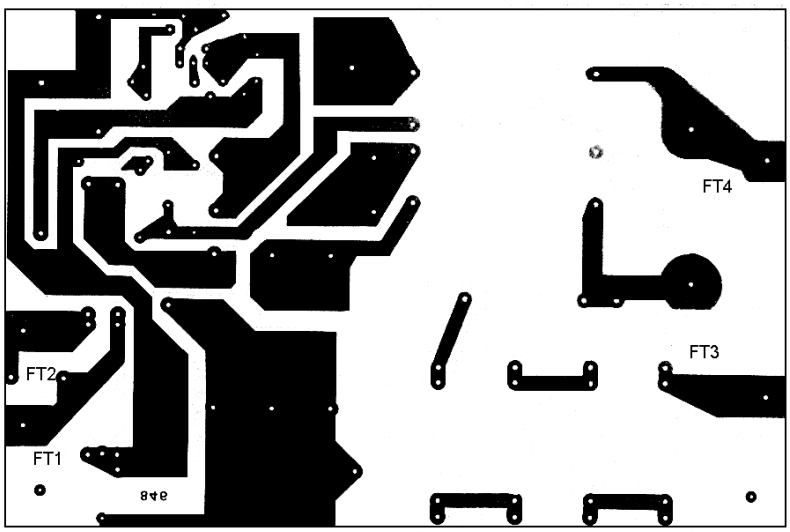


5.2.2 - Connector table.

Connector	Terminals	Function
CN1	1 – 2	27 Vac input for control board (9) power supply.
CN1	3	solenoid valve EL1 (29) command output.
CN1	4 – 7	contactor TLP (8) command output.
CN1	5 – 8	HF board (10) command output.
CN1	6	shared output for solenoid valves EL1 and EL2.
CN2	1	solenoid valve EL2 (29) command output.
CN2	2 – 3	contactor TLC (70) command output.
CN3	1 – 2	“transferred arc” signal input from reed (39).
CN4	1 – 7	start signal input.
CN4	2	NU.
CN4	3	GND.
CN4	4 – 9	temperature signal input from thermostat (31).
CN4	5 – 8	lamp G (30) command output (overtemperature alarm).
CN4	6 – 10	20 Vac input for control board (9) power supply.

5.3 - HF board (10) code 5.600.846.

5.3.1 - Topographical drawing.

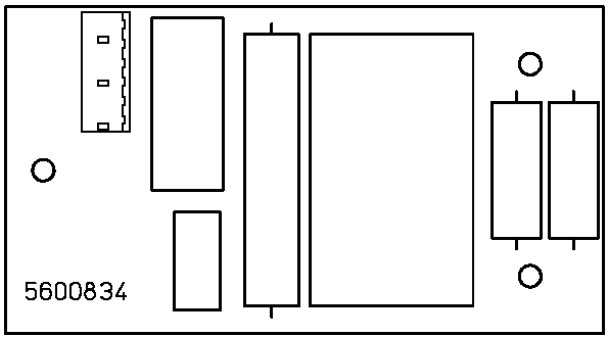


5.3.2 - Connector table.

Connector	Terminals	Function
-	FT1 – FT2	HF board (10) command input.
-	FT3 – FT4	HF board (10) output.

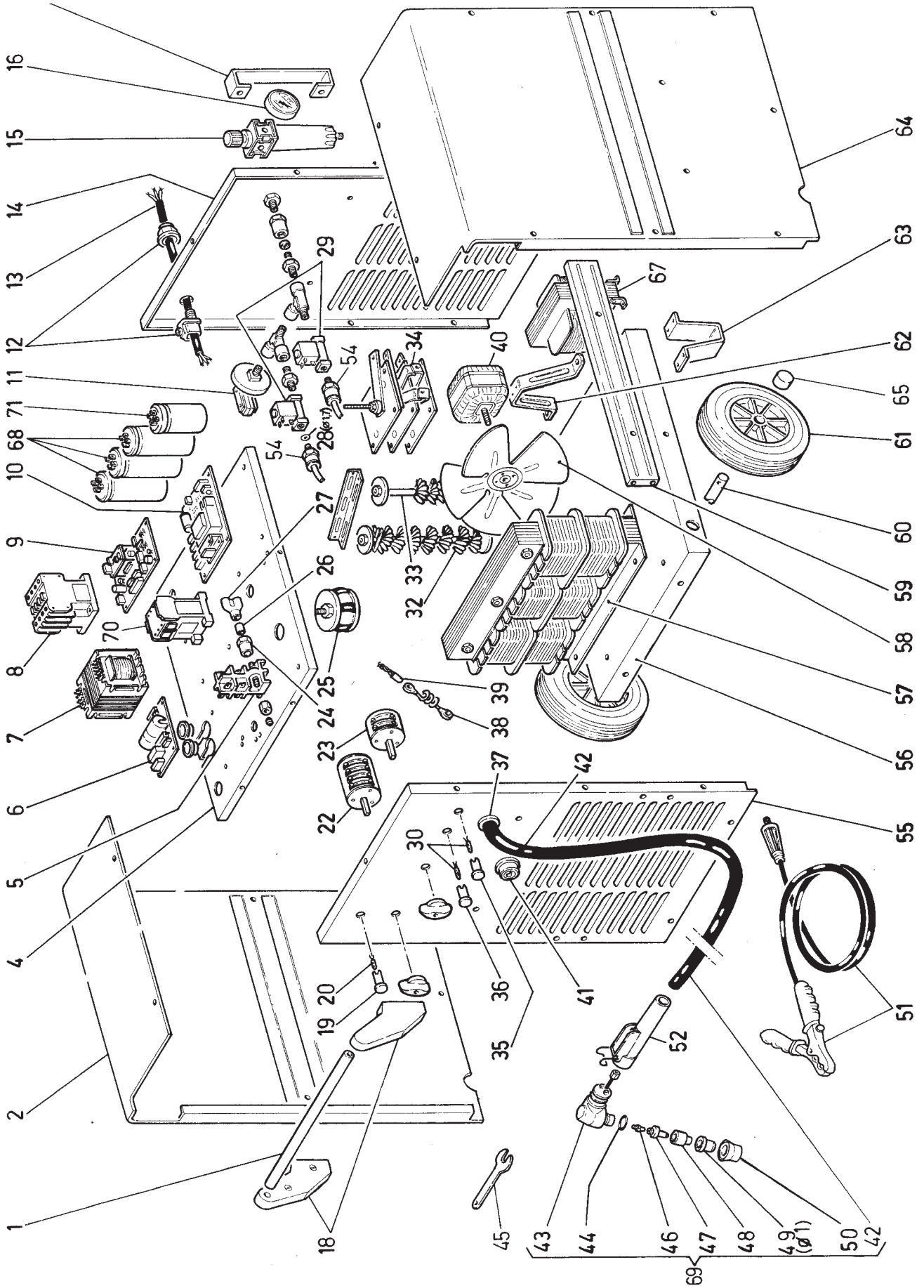
5.4 - Filter board (6) code 5.600.834.

5.4.1 - Topographical drawing.



5.4.2 - Connector table.

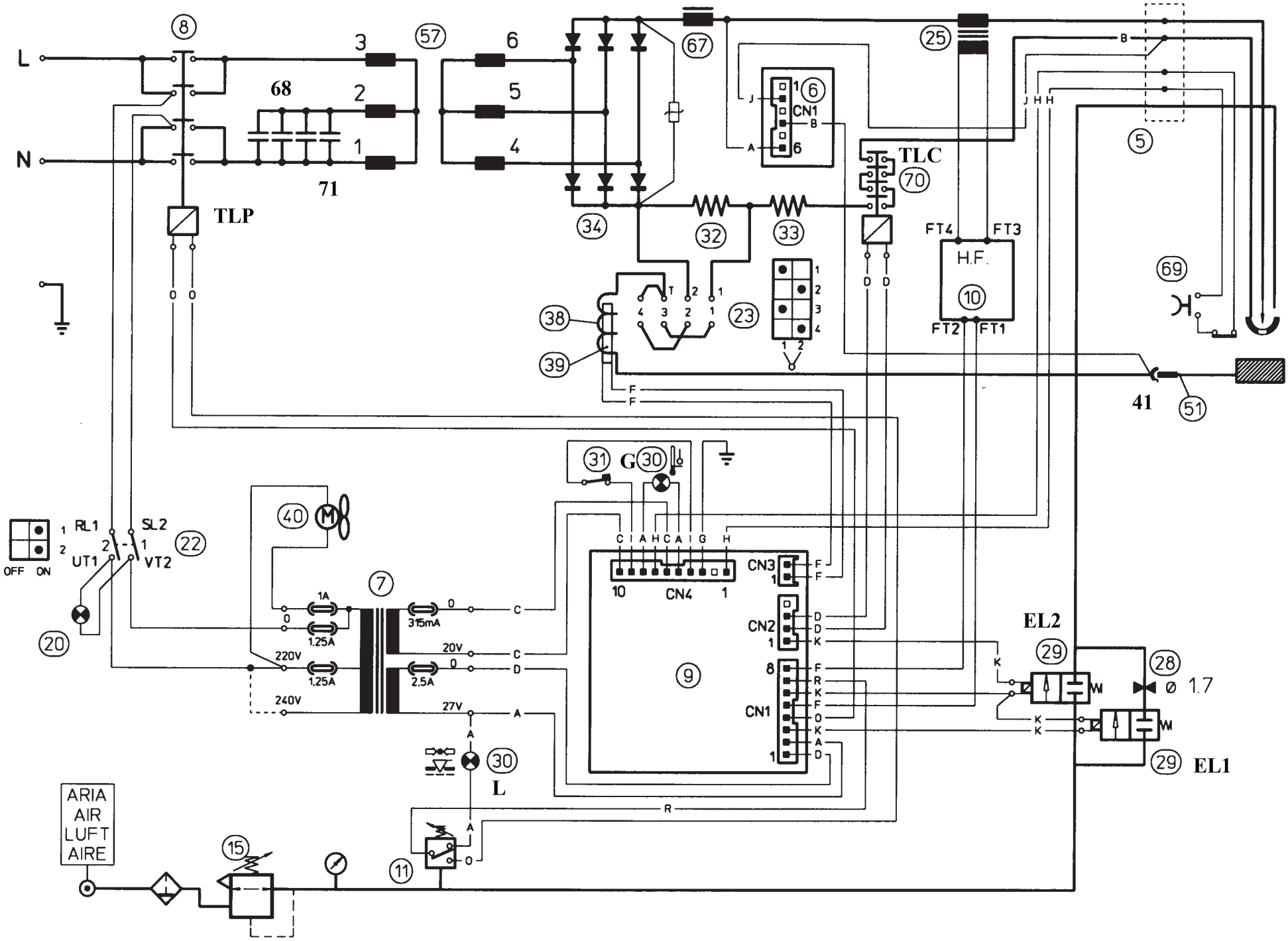
Connector	Terminals	Function
CN1	2	connection to torch nozzle potential.
CN1	4	connection to work potential (work piece).
CN1	6	connection to electrode potential (upstream from the HF transformer (25)).



When ordering spare parts, alwais state the following: machine part number, item position number, the quantity, and the machine serial number.

La demande de piéces de rechange doit toujours indiquer le numéro de l'article ,la position ,la quantitè et la date d'achat.

El pedido de las piezas de repuesto debe indicar siempre el número de articulo, la posición ,la cantidad y la fecha de la adquisición.


L
N
TLP
TLC
68
71
H.F.
FT4
FT3
FT2
FT1
CN1
CN2
CN3
CN4
RL1
SL2
UT1
VT2
OFF ON
EL2
EL1
ARIA
AIR
LUFT
AIRE
220V
240V
27V
20V
315mA
1,25A
2,5A
1A