PLASMA PROF 80

POWER SOURCE art. 947

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. 947 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 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.

1.4 - Electromagnetic compatibility.

Please read and observe the instructions provided in the paragraph “Electromagnetic compatibility” of the Instruction Manual.

2 - SYSTEM DESCRIPTION

2.1 - Introduction.

The PLASMA PROF 80 is a system for cutting electrically conductive materials, using a plasma arc process.

It is made up of an electronic power source (art. 947), and a set of accessories for use in both manual applications and automated systems (see list in Sales Catalogue).

The power source is controlled by microprocessor circuits, which manage the operative functions of the cutting system and operator interface.

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. 947.

Art. 947 is a direct current power source with controlled current, essentially consisting of a three-phase transformer and scr-controlled rectifier bridge.

Referring to the electrical diagram in par. 5.1, the drawing in par. 4.1 and table 4.2, we can identify the main blocks that make up the power source.

The switch (8) powers the power transformer (50), the primary circuit of which consists of three windings with a center socket. When switched appropriately by the voltage changer, these allow the power source to operate at 230, 400 or 440 Vac at 50/60 Hz.

Voltage may be delivered (always at 230 Vac) from 2 terminals on the voltage change, which correspond to the terminals of one of the primary windings of the transformer (50), to power the fan (45) and the service transformer (18). The latter powers the electronic boards and internal services of the power source, and supports the fuse board (18) with the fuses arranged to protect these circuits.

The secondary circuit of the power transformer (50) is connected to the power board (20) containing the scr rectifier bridge for power source output current rectifying and adjustment.

This bridge is made up of a single module containing 6 thyristors (scr) connected in a “total controlled bridge” configuration. This configuration supplies the output terminals of the power board (20), TP4(+) and TP5(-), with direct current regulated based on the cutting current.

The power board (20), inserted upstream from the output TP4, contains the solenoid with reed bulb (26) to detect the cutting current on the earth conductor of the power source.

The resistor (39) (280 ohm), connected between J2 and J3 of power board (20), thus essentially parallel to the rectifier bridge output TP4 and TP5, is used to ensure that the bridge scr are properly engaged in every load condition of the power source.

The choke (44) is used to level the cutting current and the HF transformer (23) to engage the pilot arc.

The connector cable of the choke (44) contains the Hall-effect current transducer (34), which provides the setting board (19) with the output current signal of the power source, required for current adjustment.

The control board (9) that is mounted on the front panel of the power source also acts as a control panel, and for these functions has a set of leds to indicate the operating status, a potentiometer to adjust the cutting current, and a button to activate the “pilot self-restart” function.

Depending on the signals to its inputs, the control board (9) sets the power source operating mode by controlling the solenoid valves EL1 and EL2 (37), the nozzle relay RL1 on relay board (27), and processing the current interface and reference signals to be sent to the setting board (19). It also makes sure that conditions for power source operation are always present, by checking the signals originating from the pressure switch (35), thermostat in the transformer (50) and reed sensor (14) on the protection of the central adapter (12).

The pressure switch (35) inserted on the plasma gas line stops the power source and lights the led (L) when the pressure falls below the minimum permitted value.

The thermostat on one winding of the transformer (50) stops the power source and lights the led (G) when the temperature of the transformer (50) is too high.

The setting board (19) makes up the actual system regulator.

It generates the drive signals for the rectifier bridge scr on the power board (20), based on a comparison between the current reference signal originating from the control board (9) and the current feed-back signal originating from the transducer (34).

The HF board (25), combined with the HF transformer (23), generates the high voltage and high frequency pulses needed to start the pilot arc. Its operation is controlled by the setting board (19) and is subject to the presence of alternating voltage on terminals J4 and J5 of power board (20), provided by a specific secondary winding of the transformer (50).

Near the output terminals of the power source is the HF-filter board (22), which serves to prevent the high voltage and high frequency pulses generated by the HF transformer (23) from travelling along the wiring into the power source, where they would cause malfunctions or errors. Therefore, <u>during maintenance operations, make sure that this board is always firmly connected to the original terminals before striking the arc.</u>

The power outputs of the power source, to which the torch is connected, are gathered into the central adapter (12) on the front panel. This is a multiple connector that incorporates a power socket for the torch electrode, two contacts for the torch nozzle, two contacts for the start button, four contacts for torch type recognition, and a pneumatic socket for the plasma gas. This central adapter is fitted with a protective hood; the reed switch (14) mounted on the panel board detects its presence, and prevents the power source from running if the hood is missing.

When the start button is pressed, the control board (9) strikes the pilot arc by activating the solenoid valve EL1 (37) (the one with the flow reducer), the nozzle relay RL1 on relay board (27), produces output voltage on the power board (20) and high frequency. With the contact of nozzle relay RL1 on relay board (27) closed, the positive voltage on J2 of power board (20) is applied to the torch nozzle through the 1.3 ohm resistor (38).

When the pilot arc is lit, you have approximately 2 seconds to begin cutting, after which timer the pilot arc shuts off until the start button is pressed again.

When the torch with lit pilot arc is placed near the workpiece, the arc current begins circulating on the earth conductor due to the potential difference caused by the resistors (38).

The solenoid with reed bulb (26) detects this arc current and provides information about it to the control board (9), which begins operation in transfer arc. Thus it controls solenoid valve EL2 (37) (the one without flow reducer), opens the contact of nozzle relay RL1 on relay board (27) (to allow the torch to function properly and control the actual cutting current), and switches the current reference signal from the pilot arc level to transfer arc (cutting) level based on the setting of knob (M).

When cutting ends, output voltage is no longer output, the solenoid valve EL2 (37) is disengaged, while EL1 (37) remains powered for the post-gas time (approximately 90 seconds).

The signals processed by the electronic boards and present at their connectors are listed in the tables in chapter five of this manual.

3 - MAINTENANCE

WARNINGS

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

DISCONNECT THE POWER SOURCE FROM THE MAINS BEFORE PERFORMING MAINTENANCE.

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 output terminals and the power source power cord; replace if 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.

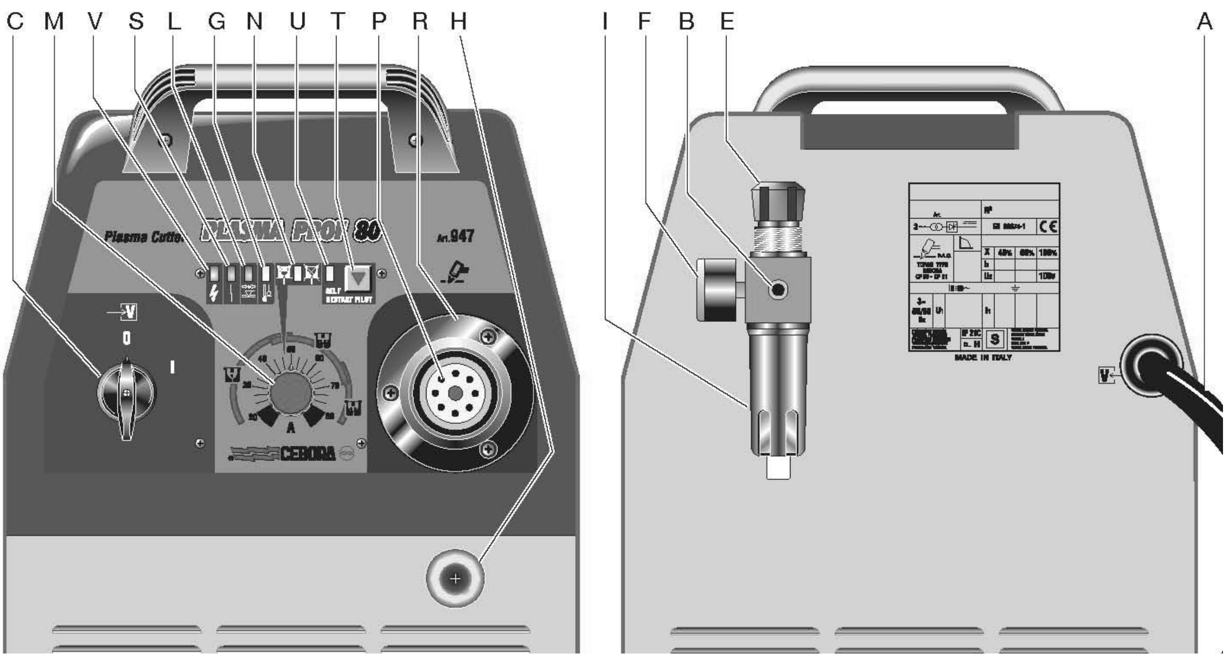
The following sequence reflects correct machine operation. It may be used as a guiding procedure for troubleshooting.

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 torch to the power source.
- Connect the cable of the positive pole of the power source to the workpiece.
- Connect the power source to the mains.
- Close the switch (C) on the power source.
    - ♦ System powered, fan (45) running.
    - ♦ On the front panel, all leds are lit for one second (lamp-test), thereafter only led (V) remains lit. Led (N) may be lit depending on the position of knob (M).

Correct? NO (see 3.3.1, 3.3.2).

YES

<u>WARNING</u>

<u>DURING THE FOLLOWING TESTS, DO NOT POINT THE TORCH AT PEOPLE OR PARTS OF BODY, BUT ALWAYS TOWARDS AN OPEN SPACE OR THE WORKPIECE.</u>

- Briefly press the torch start button.
    - ♦ Gas flows from the torch for approximately 40 seconds (maximum pre-gas time without pilot arc). The pressure reading on the pressure gauge (F) remains constant.

Correct? NO (see 3.3.3, 3.3.4).

YES

- Press the start button and hold it down for approximately 5 seconds.
    - ♦ Pilot arc lights for its maximum time (2 sec.). The gas continues to flow for approximately 90 sec. more (post-gas time).

Correct? NO (see 3.3.5, 3.3.6, 3.3.7, 3.3.8).

YES

- With pilot arc lit, place the torch near the workpiece.
    - ♦ Begin cutting. Adjust the knob (M) to the current level suited to the kind of cutting.

Correct? NO (see 3.3.9).

YES

- Release the torch start button.
    - ♦ The arc shuts off immediately. The gas continues to flow for approximately 90 sec. more (post-gas time).

Correct? NO (see 3.3.4).

YES

<u>REGULAR OPERATION.</u>

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.

NOTE

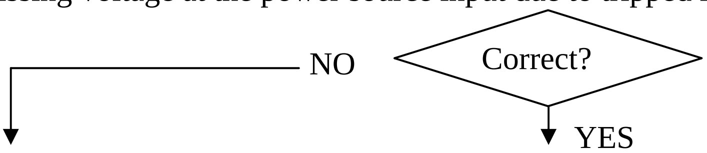
Items in **boldface** describe problems that may occur on the machine (symptoms).

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

3.3.1 - The power source does not start, led (V) off.

MAINS SUITABILITY TEST.

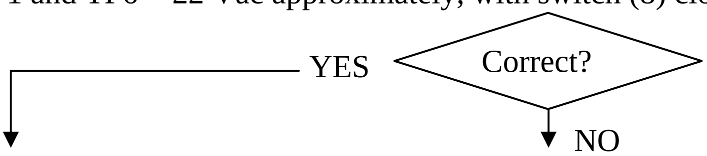
- ❑ Missing voltage at the power source input due to tripped mains protections.



- ♦ Eliminate any short-circuits on the connections between power cable, switch (8), transformer (50), terminals TP1, TP2, TP3 and TP6 of power board (20), J4 on fuse board (18) and J3 on setting board (19).
- ♦ Check the insulation towards earth of the transformer (50), service transformer (18) and fan (45). If leaking or short-circuited towards earth, replace.
- ♦ With the power source off, temporarily disconnect the wires of the transformer (50) from terminals TP1, TP2, TP3 and TP6 of power board (20) and check the resistance between the above terminals. Correct value = >Mohm in all measurements. If short-circuited replace the power board (20).
- ♦ Mains not suitable to power the power source (ex.: insufficient installed power).

MAINS CONNECTION TEST.

- ❑ Terminals TP1, TP2 and TP3 of power board (20) = approximately 3 X 170 Vac; terminals TP1 and TP6 = 22 Vac approximately, with switch (8) closed.



- ♦ Check power cable and plug and replace if necessary.
- ♦ Check switch (8) and replace if defective.
- ♦ Check the conditions of the voltage change on the transformer (50). If you find burnt or worn terminals replace them or replace the entire transformer (50).
- ♦ Check the mains voltage conditions, and especially that none of the three power supply phases is missing.
- ♦ Replace the transformer (50).

SERVICES POWER SUPPLY TEST.

- Fuse board (18): terminals J4 = approx. 230 Vac;
  terminals J5 = approx. 230 Vac;
  connector J1, terminals 1 and 2 = approx. 24 Vac;
  connector J2, terminals 1 and 2 = approx. 27 Vac;
  connector J3, terminals 3 and 4 = terminals 2 and 3 = approx. 16 Vac,
  all with switch (8) closed and rated mains voltage.

YES Correct? NO

- ♦ Make sure the wiring and the fuses on the fuse board (18) are intact, based on the diagram and fuse table in par. 5.3.
- ♦ With the power source off, temporarily disconnect the connectors J1, J2, J3 and J5 on fuse board (18), and check the voltages on the above connectors again. If the values are not correct, replace transformer (50). If correct, seek out which of the disconnected connectors is the cause of the operating error and replace the component to which it is connected.

CONTROL BOARD (9) POWER SUPPLY TEST.

- Control board (9), potentiometer P1, terminals 3(+) and 1(-) = +5 Vdc; terminal 1 of potentiometer P1(-) and cathode of diode Z1(+) = approx. +22 Vdc, with switch (8) closed.

YES Correct? NO

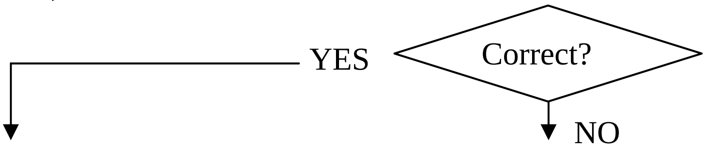
- ♦ Check the wiring between connectors J1 control board (9) and J7 setting board (19), and between J1 setting board (19) and J3 fuse board (18).
- ♦ With the power source off, temporarily disconnect the connector J1 on control board (9). Power up the power source again and check on the patch connector disconnected from J1, on the terminals 3(+) and 1(-) voltage = approximately +22 Vdc, and on terminals 4(+) and 2(-) voltage = +5 Vdc. If correct, replace control board (9). If incorrect replace the setting board (19).
- ♦ Replace the control (9) and/or setting (19) boards.

♦ Replace control board (9).

3.3.2 - Power source powered, led (V) lit, fan (45) stopped.

FAN (45) TEST.

- Fuse board (18), connector J5, terminals A and B = approximately 230 Vac, with switch (8) closed, both with mains at 230 and at 400 Vac.

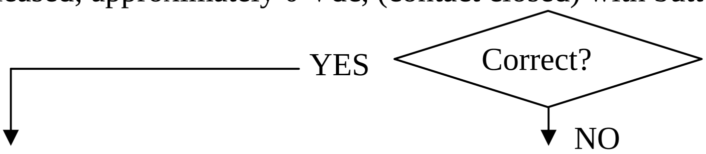


  - Check the wiring between connector J5, fuse board (18) and fan (45).
  - Check the presence of service voltages, performing the SERVICES POWER SUPPLY TEST in par. 3.3.1 if necessary.
- With power source off, temporarily disconnect terminals A and B of J5 on fuse board (18) and make sure resistance on the terminals of the fan (45) disconnected from J5, fuse board (18) = approximately 60 ohm. If correct, make sure that there are no mechanical impediments blocking the fan (45). If incorrect, replace fan (45).
- Replace the fan (45).

3.3.3 - The start button produces no effect.

START COMMAND TEST.

- Control board (9), terminals J8 A and B = approximately 24 Vac, with start button on torch released; approximately 0 Vdc, (contact closed) with button pressed.



  - Check on control board (9), connector J6 terminals 1 and 2, voltage = approximately 24 Vac, with power source powered. If incorrect, with the power source off temporarily disconnect connector J6 from control board (9) and make sure resistance on the terminals of J6 of control board (9) = >1 Kohm. If correct check the wiring between J6 of control board (9) and J1 of fuse board (18), and perform the SERVICES POWER SUPPLY TEST in par. 3.3.1 if necessary. If incorrect, replace control board (9).
  - Check the wiring between terminals J8 of control board (9), terminals 1 and 9 central adapter (12), torch button and contact of the nozzle guard on the torch.
  - Make sure that the nozzle guard is correctly assembled and in good working order on the torch. If defective or showing signs of wear, replace.
  - Check torch button. Replace if defective.
  - Replace control board (9).
- Perform the CONTROL BOARD (9) POWER SUPPLY TEST, par. 3.3.1.
- Replace control board (9).

3.3.4 - No gas flows from the torch.

PILOT ARC SOLENOID VALVE EL1 (37) TEST.

- Solenoid valve EL1 (37) terminals = approximately 26 Vac, with torch button pressed. The solenoid valve opening time also depends on the post-gas time.

Correct?

YES

NO

- ♦ Check the wiring between solenoid valve EL1 (37) and terminals 5 and 11 of J5 on control board (9).
- ♦ With power source off, check the resistance between the terminals of solenoid valve EL1 (37) = approximately 25 ohm. If 0 ohm (short-circuit), replace solenoid valve EL1 (37) and control board (9).
- ♦ Check on control board (9), connector J5 terminals 6 and 12, voltage = approximately 27 Vac, with power source powered. If incorrect, with the power source off temporarily disconnect connector J5 from control board (9) and make sure resistance on the terminals of J5 of control board (9) = >2 Kohm. If correct check the wiring between J5 of control board (9) and J2 of fuse board (18), and perform the SERVICES POWER SUPPLY TEST in par. 3.3.1 if necessary. If incorrect, replace 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 (37) = approximately 25 ohm. If >Mohm (winding broken) replace solenoid valve EL1 (37).
- ♦ 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 threaded part of the air fitting (B) inserted in the pressure regulator (E) is no more than 6 - 8 mm (1/4” - 5/16”) long, to avoid any possible malfunction of the regulator (E).
- ♦ Replace solenoid valve EL1 (37).

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

HF BOARD (25) POWER SUPPLY TEST.

- HF board (25), connector J1, terminals 1 and 2 = approximately 192 Vac, with power source powered.

Correct?

YES

NO

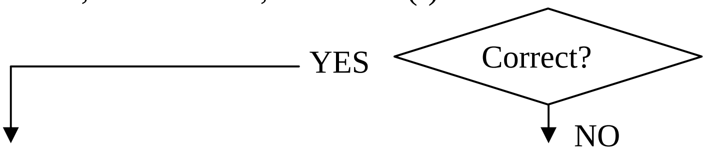
- ♦ Check the wiring between J1 HF board (25) and terminals J4-J5 power board (20).
- ♦ Check on the power board (20), terminals TP1 and TP6 voltage = approximately 22 Vac, and terminals TP2 and TP1 voltage = approximately 170 Vac, with power

source powered. If incorrect, carry out the MAINS CONNECTION TEST in par. 3.3.1. If correct make sure fuse F1 on the power board (20) is intact, and replace the power board (20) if necessary.

- ♦ Replace the power board (20).
- ♦ Replace the transformer (50).

SETTING BOARD (19) POWER SUPPLY TEST.

- ❑ Setting board (19), connector J2, terminals 3(+) and 2(-) = +15 Vdc and terminals 1(+) and 2(-) = -15 Vdc..
- ❑ Setting board (19), connector J1, terminal 3(-) and diode D1 cathode (+) = approximately +22 Vdc; connector J1, terminal 3(-) and diode D13 anode (+) = +5 Vdc.



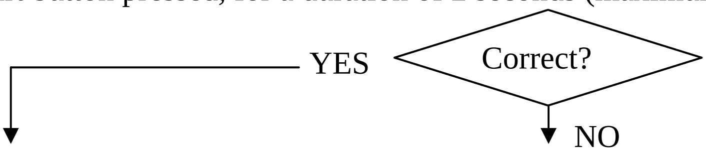
- ♦ Check the wiring between J1 of setting board (19) and J3 fuse board (18).
- ♦ Perform the SERVICES POWER SUPPLY TEST in par. 3.3.1.
- ♦ With power source off, temporarily disconnect connectors J2 and J7 on setting board (19) and check the supply voltages again. If correct, identify the connector causing the malfunction and replace the component to which it is connected (current transducer (34) or control board (9)). If incorrect replace the setting board (19).
- ♦ Replace the control (9) and/or setting (19) boards.

WARNING

FOR THE FOLLOWING TEST **DISCONNECT THE CONNECTOR J4** ON POWER BOARD (20) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

HF COMMAND TEST.

- ❑ HF board (25), connector J1, terminals 5 and 4 (gnd) = fig. 5.2.1, (HF command pulse), with start button pressed, for a duration of 2 seconds (maximum pilot arc time).



- ♦ Check the wiring between J1 of HF board (25) and J8 of setting board (19), being especially careful to observe the polarity of this connection.
- ♦ Check the wiring between J7 of setting board (19) (terminal 10) and J1 of control board (9) (terminal 10) (HF enable signal).
- ♦ Check on setting board (19), connector J1, terminal 3(-) and R98 (J7 connector side)(+) (HF enable signal), voltage = +5 Vdc with start button pressed and for a duration of two seconds (maximum pilot arc time). If correct replace the setting board (19). If incorrect perform the CONTROL BOARD POWER SUPPLY TEST (9), par. 3.3.1., and replace control board (9) if necessary.

- ♦ Make sure that there are no short-circuits between terminals J2 and J3 of HF board (25), and that there are no short-circuits or interruptions in the connection of the primary circuit of the HF transformer (23).
- ♦ Replace HF board (25).
- ♦ Go to par. 3.3.6.

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

WARNING

FOR THE FOLLOWING TESTS **DISCONNECT THE CONNECTOR J1** ON HF BOARD (25) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

POWER SOURCE OUTPUT VOLTAGE TEST.

- Output terminal (H) of the power source and central terminal of the central adapter (12) (gnd) = fig. 5.2.2, with start button pressed (open-circuit output voltage for a duration of approximately two seconds (maximum pilot arc time)).

Correct?

YES

NO

- ♦ Go to par. 3.3.7.

NOZZLE VOLTAGE TEST.

- Terminal J1 of HF-filter board (22) and central terminal of the central adapter (12) (gnd) = fig. 5.2.2, with start button pressed (open-circuit output voltage, for the duration of approximately two seconds (maximum pilot arc time)).

Correct?

NO

YES

- ♦ Check the condition of the central adapter, the torch cable and torch; especially make sure there are no short-circuits or insulation leaks between the conductors or between the contacts of the central adapter. Replace any worn or damaged components.
- ♦ Check electrode and torch nozzle; replace if worn or damaged.
- ♦ 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. 3.3.5.

NOZZLE RELAY COMMAND TEST.

- Relay board (27), connector J5 = approximately 26 Vac with start button pressed and for a duration of 2 seconds (maximum pilot arc time).

Correct?

YES

NO

- ♦ Check the wiring between J5 HF-filter board (27) and terminals 3 and 9 of J5 control board (9).
- ♦ Check the condition of the nozzle relay on relay board (27). If you find burnt contacts or have difficulty moving the mobile unit, replace the relay with a similar one, or the entire relay board (27).
- ♦ Replace the relay (27) and/or power (20) and/or control (9) boards.

CURRENT TRANSDUCER (34) POWER SUPPLY TEST.

- Setting board (19), connector J2, terminals 3(+) and 2(-) = +15 Vdc; terminals 1(+) and 2(-) = -15 Vdc.

YES Correct?

NO

- ♦ Check the wiring between the current transducer (34) and connector J2 on setting board (19).
- ♦ With the power source off, temporarily disconnect connector J2 on setting board (19). Power up the power source again, keeping the cable of the current transducer (34) disconnected, and check the supply voltages again. If correct, replace the current transducer (34). If incorrect replace the setting board (19).

WARNING

FOR THE FOLLOWING TESTS **RE-CONNECT THE CONNECTOR J1** ON HF BOARD (25) TO ENABLE GENERATING HIGH FREQUENCY.

PILOT ARC CURRENT TEST.

- Setting board (19), connector J2, terminals 4 and 2 (gnd) = fig. 5.2.3 (pilot arc current signal) with start button pressed and pilot arc lit.

NO Correct?

YES

- ♦ Regular pilot arc operation.

- ♦ Check the wiring between the current transducer (34) and connector J2 on setting board (19).
- ♦ With the power source off, temporarily disconnect connector J2 on setting board (19), and make sure resistance on J2 terminals 4 and 2 = approximately 10 Kohm (load resistance of the current transducer (34)). If incorrect replace the setting board (19).
- ♦ Check wiring between terminals 5 and 6 of the central adapter (12) and J1 on HF-filter board (22) (nozzle potential), between J2 of HF-filter board (22) and J2 of relay board (27), between J1 of relay board (27), resistor (38) and J2 power board (20).
- ♦ With the power source off, check the resistance of the resistor (38). Correct value = 1.3 ohm. If incorrect, replace the resistor (38).
- ♦ Check the continuity between terminals TP4 and J2 on the power board (20). Reset the connection on the board if necessary, considering that the solenoid with reed bulb (26) must be inserted.
- ♦ Check the continuity between terminals J1 and J2 on HF-filter board (22). Reset the connection on the board if necessary.
- ♦ Replace current transducer (34).
- ♦ Replace the setting (19) and/or control (9) and/or power (20) boards.

3.3.7 - In open circuit operation, the output voltage is not regular.

<u>WARNING</u>
FOR THE FOLLOWING TESTS **DISCONNECT THE CONNECTOR J1** ON HF BOARD (25) TO <u>PREVENT HIGH FREQUENCY FROM BEING GENERATED.</u>

POWER SOURCE OUTPUT VOLTAGE TEST.

- Output terminal (H) of the power source and central terminal of the central adapter (12) (gnd) = fig. 5.2.2, with start button pressed (open-circuit output voltage, for the duration of approximately two seconds (maximum pilot arc time)).

Correct? NO ↓ / YES ↓

- ♦ Open circuit output voltage regular.

POWER BOARD (20) OUTPUT VOLTAGE TEST.

- Power board (20), terminals TP4(+) and TP5(-) = fig. 5.2.2, with start button pressed (open-circuit rectifier output voltage, for a duration of approximately two seconds (maximum pilot arc time)).

Correct? NO ↓ / YES ↓

- ♦ Check the wiring between central adapter (12) central terminal, HF transformer (23) secondary circuit, choke (44) and terminal TP5 on the power board (20) (electrode potential), and between output terminal (H) and terminal TP4 on the power board (20). If you find loose connections, tighten and replace any components with damaged terminals.

SYNCHRONISM SIGNAL TEST FOR SETTING BOARD (19).

- Setting board (19), connector J3, terminals 1 and 3 = terminals 6 and 8 = terminals 10 and 12 = approximately 230 Vac, both with mains at 230 Vac and with mains at 400 Vac (the three voltages are shifted 120° from one another).

Correct? YES ↓ / NO ↓

- ♦ Check the wiring between J3 setting board (19) and voltage change on the transformer (50). In particular make sure that the connection of each individual wire has been made as shown in the diagram in par. 5.1.
- ♦ Replace the transformer (50).

- ♦ Check the wiring between J1 power board (20) and J5 setting board (19).
- ♦ Check the presence of voltage at the input to power board (20) by performing the MAINS CONNECTIONS TEST in par. 3.3.1.
- ♦ Check the wiring of the transformer (50) secondary circuit with power board (20) and between J3 of setting board (19) and terminals of the voltage change of the transformer (50). In particular make sure that the connection of each individual wire has been made as shown in the diagram in par. 5.1.

- With the power source off, temporarily disconnect the wires from terminals TP1, TP2, TP3, TP4 and TP5 on the power board (20) and check the integrity of the scr rectifier bridge, making sure that resistance on the aforementioned terminals of power board (20) = >Mohm for all measurements. If incorrect replace the scr rectifier bridge on the power board (20) or the entire power board (20) (between TP4 and TP5 you will find a resistance of 280 ohm due to the resistor (39) connected between J2 and J3. To exclude it, also disconnect J5 on the power board (20)).
- With the power source off, temporarily disconnect connector J1 on the power board (20) and check the integrity of the scr rectifier bridge, checking the gate junction of each scr on the following terminals of J1: terminals 1 and 2 = terminals 3 and 4 = terminals 5 and 6 = terminals 7 and 8 = terminals 9 and 10 = terminals 11 and 12 = approximately 25 ohm. If incorrect replace the scr rectifier bridge on the power board (20) or the entire power board (20).
- Replace the setting (19) and/or power (20) boards.

3.3.8 - Irregular pilot arc starts, unstable pilot arc.

PLASMA GAS PRESSURE TEST.

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

YES — Correct? — NO

- ♦ 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.
- ♦ Make sure that the threaded part of the fitting (B) inserted in the pressure regulator (E) is no more than 6 - 8 mm (1/4" - 5/16") long, to avoid any possible malfunction of the regulator (E).
- ♦ Make sure that the pressure regulator (E) and pressure gauge (F) are working properly.
- ♦ Make sure there are no occlusions in the gas hoses of the power source.
- ♦ Make sure that solenoid valve EL1 (37) = open, and solenoid valve EL2 (37) = closed, during the pilot arc. If necessary, perform the tests PILOT ARC SOLENOID VALVE EL1 (37) TEST, par. 3.3.4, and TRANSFER ARC SOLENOID VALVE EL2 (37) TEST, par. 3.3.9.
- ♦ Check presence of the flow regulator on the solenoid valve EL1 (37).

PILOT ARC CURRENT TEST.

- ❑ Setting board (19), connector J2, terminals 4 and 2 (gnd) = fig. 5.2.3 (pilot arc current signal) with start button pressed and pilot arc lit.

NO — Correct? — YES

- ♦ Regular pilot arc operation.

- ♦ Carry out the test in par. 3.3.6.
- ♦ Check for the presence of the three phases of supply voltage on terminals TP1, TP2, TP3 of power board (20).
- ♦ Check the wiring of the primary and secondary windings of the transformer (50), considering that any connection other than the one shown in the diagram in par. 5.1 is to be considered incorrect and may cause additional damage to the power source components.
- ♦ Check the wiring between J3 setting board (19) and voltage change on the transformer (50). In particular make sure that the connection of each individual wire has been made as shown in the diagram in par. 5.1.
- ♦ Check the condition of the windings of transformer (50), 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 pins. If necessary, replace the transformer (50).
- ♦ Check connections between central adapter (12), HF transformer (23), choke (44) and terminal TP5 of power board (20). If you find loose connections, tighten and replace any components with damaged terminals.
- ♦ Check the condition of the central adapter (12), the torch cable, and the internal parts of the torch. If you find short-circuits or isolation leaks, restore the original isolation or replace the damaged components.
- ♦ Check the electrode, swirl ring and torch nozzle; replace if worn or damaged.

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

OPERATING TEST IN PILOT ARC.

- ❑ Pilot arc lights normally, pilot arc stable.

Correct?

YES → Go to par. 3.3.8.

NO ↓

TRANSFER ARC SWITCHING TEST.

- ❑ Control board (9), connector J2, terminals 1 and 2 = 0 Vdc, with transfer arc, thus while cutting (27 Vac with pilot arc on). This situation remains constant for as long as cutting continues.

Correct?

YES ↓

NO ↓

- ♦ Make sure the reed bulb (26) is properly mounted in the corresponding solenoid, and the solenoid on the power board (20).
- ♦ With the power source off, make sure that the switch in the reed bulb (26) is working properly: move a magnet near the bulb and check the resistance between the terminals 1 and 2 of J2 on control board (9) = 0 ohm (reed contact closed). Move the magnet away from the bulb; resistance = approximately 7 Kohm (reed contact open). If incorrect replace reed bulb (26) or the complete power board (20).
- ♦ Check the earth cable connection to the workpiece.
- ♦ Replace control board (9).

TRANSFER ARC SOLENOID VALVE EL2 (37) TEST.

- ❑ Solenoid valve EL2 (37) terminals = 26 Vac with transfer arc, for the entire cutting time.

Correct?

YES ↓

NO ↓

- ♦ Check the wiring between solenoid valve EL2 (37) and terminals 4 and 10 of J5 on control board (9).
- ♦ With power source off, check the resistance between the terminals of solenoid valve EL2 (37) = approximately 25 ohm. If 0 ohm (short-circuit), replace solenoid valve EL2 (37) and control board (9).
- ♦ Replace control board (9).

- ♦ With power source off, check the resistance between the terminals of solenoid valve EL2 (37) = approximately 25 ohm. If >Mohm (winding broken) replace solenoid valve EL2 (37).
- ♦ Check connections between central terminal of central adapter (12), HF transformer (23) secondary circuit, choke (44) and terminal TP5 of power board (20), and between earth cable, output terminal (H) of the power source and terminal TP4 power board (20). If you find any deteriorated connections, reset them and replace any damaged components.
- ♦ Check the condition of the central adapter, the torch cable and torch; especially make sure there are no short-circuits or insulation leaks between the conductors or between the contacts of the central adapter. Replace any worn or damaged components.

- Check the condition of the electrode, nozzle, nozzle holder and swirl ring of the torch. Replace if they show signs of wear.
- Check for the presence of the three phases of supply voltage on terminals TP1, TP2, TP3 of power board (20).
- 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.
- Make sure that there are no partial blocks in the gas lines of the power source, especially in the section involving the solenoid valve EL2 (37).
- Replace solenoid valve EL2 (37).
- Replace the control (9) and/or power board (20).

3.4 - Alarm signals.

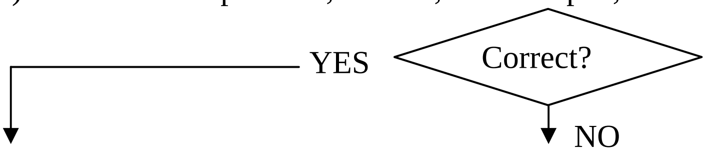
3.4.1 - Led (G) lit = transformer (50) temperature outside limits.

This alarm indicates that the temperature of the transformer (50) has risen beyond the allowed limits. We recommend not to shut off the power source, to keep the fan (45) running and thus allow rapid cooling.

This is reset automatically when the temperature returns within the allowed limits.

THERMOSTAT ON THE TRANSFORMER (50) TEST.

- ❑ Control board (9), connector J3, terminals 3 and 4 = 0 Vac (contact closed), with transformer (50) at ambient temperature; 27 Vac, contact open, with temperature beyond limits.



  - ♦ Check the wiring between the thermostat on transformer (50) and terminals 3 and 4 of J3 on control board (9).
  - ♦ Make sure the thermostat on the winding of the central column of the transformer (50) is intact and correctly positioned.
  - ♦ If the alarm occurs while cutting, and the transformer (50) is evenly heated, make sure that the usage cycle is not greater than indicated in the power source specifications.
  - ♦ If the alarm occurs while cutting, and only some windings of the transformer (50) are heated, the transformer (50) may be partially short-circuited and thus need to be replaced.
  - ♦ Replace thermostat.
- ♦ Replace control board (9).

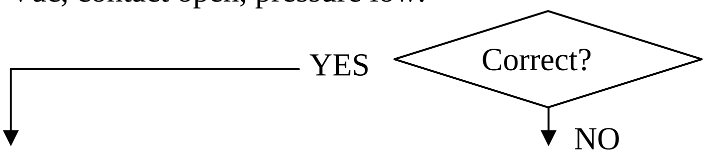
3.4.2 - Led (L) steadily lit = low gas pressure.

This alarm indicates that the gas pressure at the power source intake (B) has fallen below the allowed limits (approximately 3 bar).

This is automatically reset when the pressure returns within the allowed limits.

PRESSURE SWITCH (35) TEST.

- ❑ Control board (9), connector J3, terminals 1 - 2 = 0 Vac, contact closed, with pressure correct; 27 Vac, contact open, pressure low.



  - ♦ Check the wiring between control board (9) and pressure switch (35).
  - ♦ Check for the presence of gas at the intake fitting (B) and make sure the pressure and flow rate in the intake line meet specifications (see Instruction Manual).
  - ♦ Make sure that the pressure regulator (E) and pressure gauge (F) are working properly.
  - ♦ Make sure that the threaded part of the air fitting (B) inserted in the pressure regulator (E) is no more than 6 - 8 mm (1/4” - 5/16”) long, to avoid any possible malfunction of the regulator (E).
  - ♦ Make sure there are no occlusions in the gas hoses of the power source.
  - ♦ Replace the pressure switch (35).

- ♦ Proper operation of the pressure switch.
- ♦ Replace control board (9).

3.4.3 - Led (L) flashing = start button pressed during the power source start-up.

See par. 3.3.3.

3.4.4 - Led (S) lit = protection (R) of the central adapter not activated.

When the central adapter protection is missing, this stops the power source with red led (S) lit. This is reset automatically when the protection is correctly positioned in its slot.

CENTRAL ADAPTER PROTECTION TEST.

- ❑ Control board (9), connector J4, terminals 1 and 2 = 0 Vac with protection engaged, 24 Vac approximately, with protection disengaged.

Correct? — YES ↓ / NO ↓

- NO:
  - ♦ Check the wiring between reed switch (14) of the central adapter (12) protection and J4 on control board (9).
  - ♦ Check correct assembly of the torch fitting protection, and especially that the magnet in the protective hood is positioned close to the reed when the hood is inserted.
  - ♦ Replace reed (14).
- YES:
  - ♦ Replace control board (9).

3.4.5 - Led (S) flashing = reed contact (26) closed upon power source start-up.

If the reed contact (26) on power board (20) is found closed upon start-up, the power source remains blocked, without delivering current and with the led (S) flashing.

To restore proper operation, shut off and restart the power source after first removing the cause that closed the reed contact (26).

To analyze the problem, carry out the TRANSFER ARC SWITCHING TEST, par. 3.3.9.

4 - COMPONENTS LIST

4.1 - Power source art. 947 : see file ESP947.pdf enclosed at the end of the manual.

4.2 - Components table: see file ESP947.pdf enclosed at the end of the manual.

4.3 - List of spare parts.

Essential spare parts.

Ref.	Code	Description	Qty.
8	3190038	switch	1
9	5602160	control circuit	1
18	5610046	service transformer	1
32	3160165	pressure gauge	1
35	5710129	pressure switch	1
37	3160181	solenoid valve	1

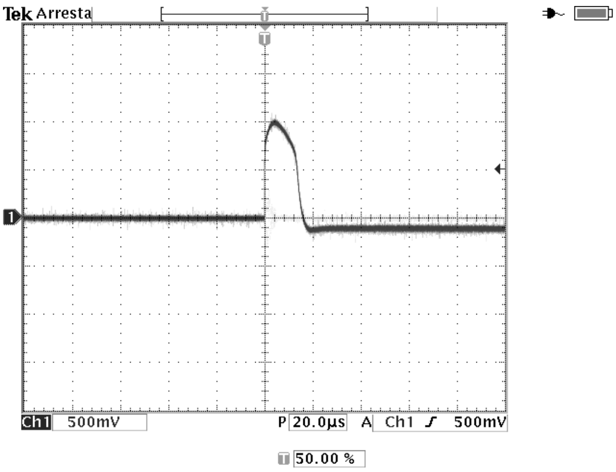
Recommended spare parts.

Ref.	Code	Description	Qty.
20	5710075	scr diode kit	1
31	3160167	reducer	1
34	5710303	transducer	1
38	3205056	resistor	1
39	3205098	resistor	1

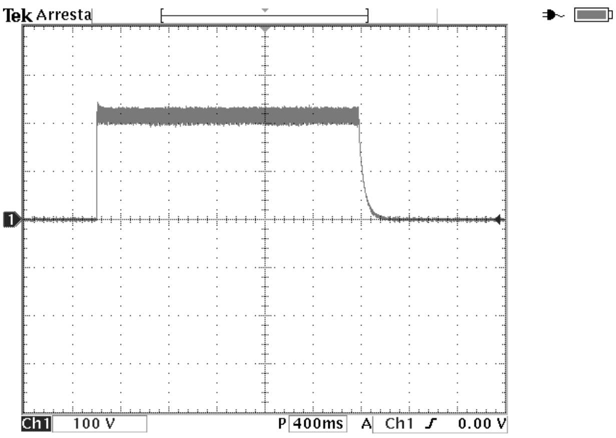
5 - ELECTRICAL DIAGRAMS

5.1 - Power source art. 947 : see file SCHE947.pdf enclosed at the end of the manual.

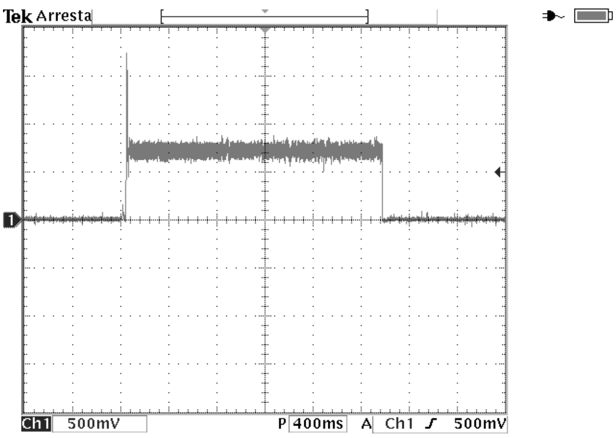
5.2 - Waveforms.



5.2.1 - HF command pulse (par. 3.3.5).



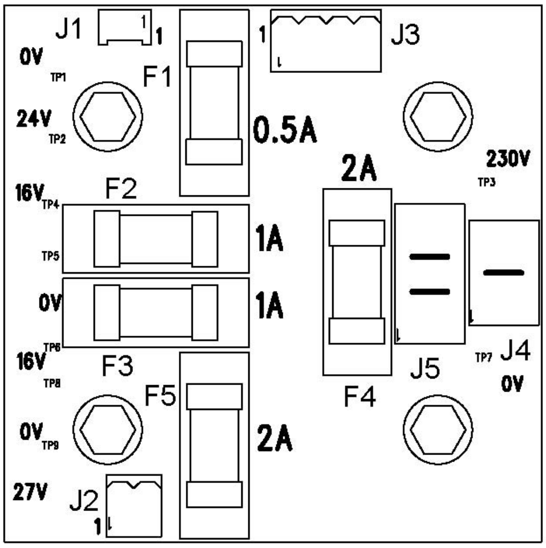
5.2.2 - Open-circuit output voltage for the duration of approximately two seconds (maximum pilot arc time) (par. 3.3.6, 3.3.7).



5.2.3 - Pilot arc current signal (par. 3.3.6, 3.3.8).

5.3 - Fuse board (18) code 5.602.148.

5.3.1 - Topographical drawing.

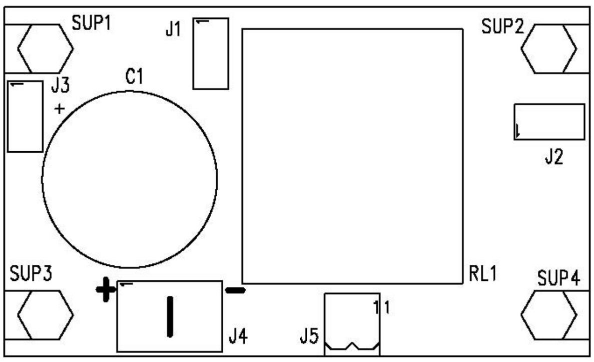


5.3.2 - Connector and fuse table.

Conn.	Terminals	Fuse	Value	Function
J1	1 – 2	F1	0.5 A	24 Vac power supply output for start button circuit on the torch.
J2	1 – 2	F5	2 A	27 Vac power supply output for solenoid valves (37) and pilot arc relay.
J3	2 – 3	F2	1 A	16 Vac setting board (19) power supply output.
J3	3 – 4	F3	1 A	16 Vac setting board (19) power supply output.
J4	A – B	-	-	service transformer (18) power supply input.
J5	A – B	F4	2 A	service transformer (18) power supply, 230 Vac power supply output for fan (45).

5.4 - Relay board (27) code 5.602.161.

5.4.1 - Topographical drawing.

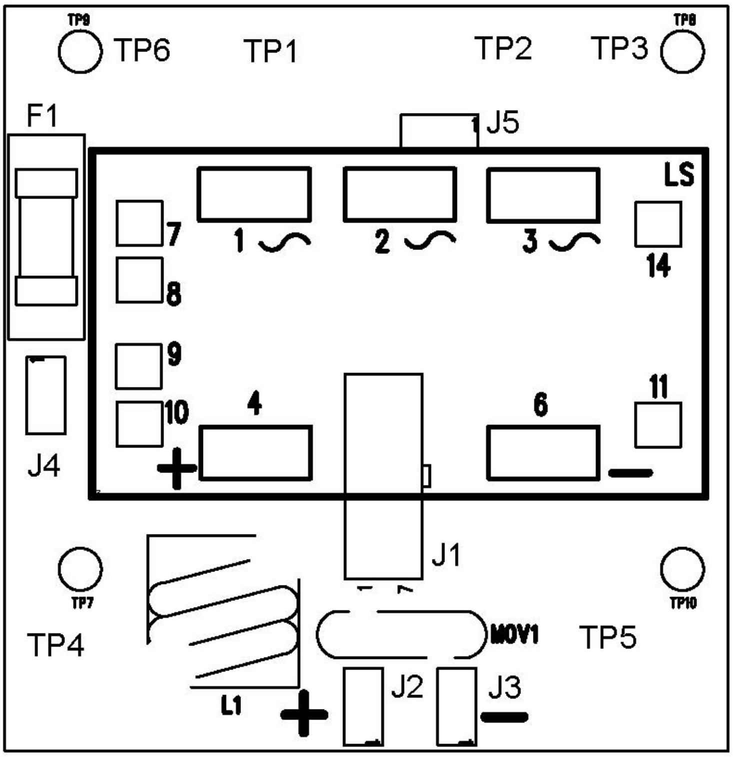


5.4.2 - Connector table.

Connector	Terminals	Function
-	J1	nozzle voltage input.
-	J2	nozzle voltage output.
-	J3	NU.
J4	1(+) – 2(-)	filter capacitor connection on relay board (27).
J5	1 - 2	27 Vac input for pilot arc relay command on relay board (27).

5.5 - Power board (20) code 5.602.156.

5.5.1 - Topographical drawing.



5.5.2 - Connector table.

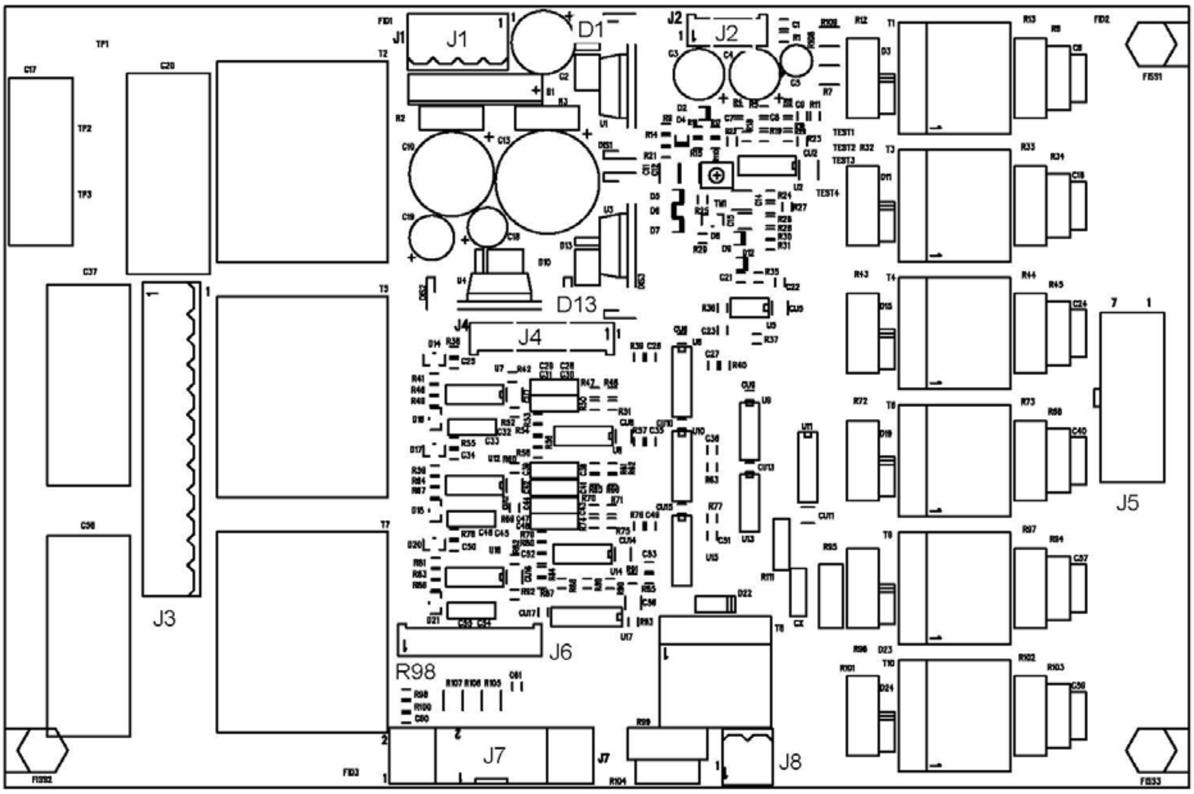
Connector	Terminals	Function
J1	1(G) - 2(K)	scr 11 gate command input.
J1	3(G) - 4(K)	scr 10 gate command input.
J1	5(G) - 6(K)	scr 9 gate command input.
J1	7(G) - 8(K)	scr 14 gate command input.
J1	9(G) - 10(K)	scr 7 gate command input.
J1	11(G) - 12(K)	scr 8 gate command input.
-	J2	nozzle potential and resistor (39) (-) power output.
-	J3	output for resistor (39).
-	J4 - J5	HF board (25) power supply output.
-	TP1-TP2-TP3	power supply input.
-	TP4	earth potential (+) power output.
-	TP5	electrode potential (-) power output.
-	TP6	power supply input for HF board (25).

5.5.3 - Fuse table.

Fuse	Value	Function
F1	2 A	power supply for HF board (25).

5.6 - Setting board (19) code 5.602.159/C.

5.6.1 - Topographical drawing.

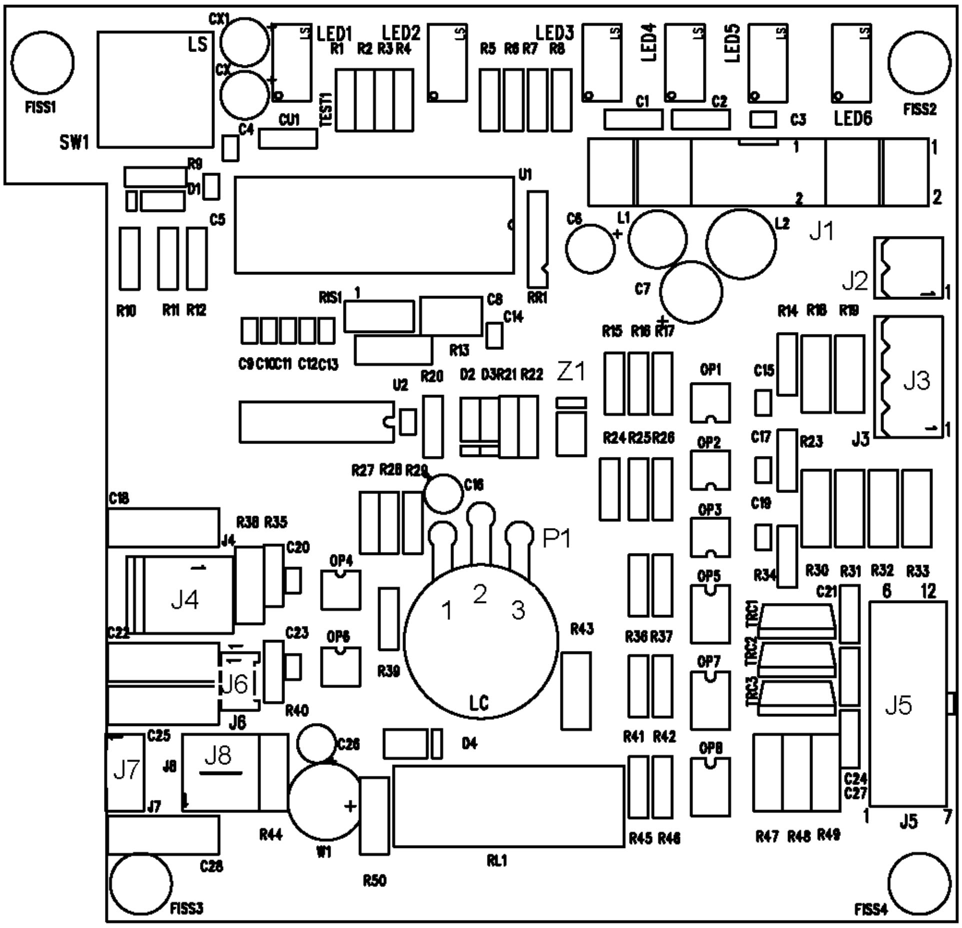


5.6.2 - Connector table.

Connector	Terminals	Function
J1	2 - 3	setting board (19) 16 Vac power supply input.
J1	3 - 4	setting board (19) 16 Vac power supply input.
J2	1	current transducer (34) -15 Vdc power supply output.
J2	2	current transducer (34) 0 Vdc power supply output.
J2	3	current transducer (34) +15 Vdc power supply output.
J2	4	power source output current signal input.
J3	1 - 3	mains synchronism (phase 1) signal input.
J3	6 - 8	mains synchronism (phase 2) signal input.
J3	10 - 12	mains synchronism (phase 3) signal input.
J4	-	NU.
J5	1(G) - 2(K)	scr 11 gate command output.
J5	3(G) - 4(K)	scr 10 gate command output.
J5	5(G) - 6(K)	scr 9 gate command output.
J5	7(G) - 8(K)	scr 14 gate command output.
J5	9(G) - 10(K)	scr 7 gate command output.
J5	11(G) - 12(K)	scr 8 gate command output.
J6	-	NU.
J7	1-2	control board (9) 0 Vdc power supply output.
J7	3	control board (9) +22 Vdc power supply output.
J7	4	control board (9) +5 Vdc power supply output.
J7	5	output current reference signal input.
J7	6	input power supply for scr pulse generator on setting board (19).
J7	7	NU.
J7	8	output current signal output.
J7	9	scr driver enable signal input.
J7	10	HF enable signal input.
J8	A-B	HF board (25) command output.

5.7 - Control board (9) code 5.602.160.

5.7.1 - Topographical drawing.

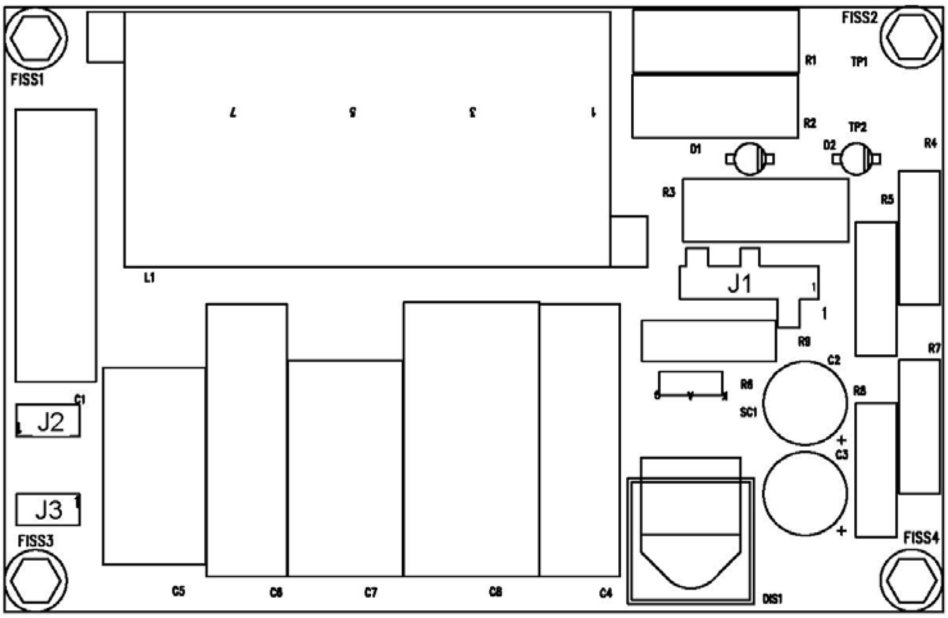


5.7.2 - Connector table.

Connector	Terminals	Function
J1	1-2	control board (9) 0 Vdc power supply input.
J1	3	control board (9) +22 Vdc power supply input.
J1	4	control board (9) +5 Vdc power supply input.
J1	5	output current reference signal output.
J1	6	output power supply for scr pulse generators on setting board (19).
J1	7	NU.
J1	8	output current signal input.
J1	9	scr driver enable signal output.
J1	10	HF enable signal output.
J2	1 - 2	“transfer arc” signal input from reed (26) to power board (20).
J3	1 - 2	signal input from pressure switch (35).
J3	3 - 4	signal input from thermostat on transformer (50).
J4	1 - 2	reed (14) for central adapter protection (12) input.
J5	3 - 9	26 Vac output for pilot arc relay command on relay board (27).
J5	4 - 10	26 Vac output to control solenoid valve EL2 (37).
J5	5 - 11	26 Vac output to control solenoid valve EL1 (37).
J5	6 - 12	27 Vac power supply input for solenoid valves (37) and pilot arc relay circuits.
J6	1 - 2	24 Vac power supply input for torch start button circuit.
J7	-	GND.
J8	A - B	start signal input from torch button.

5.8 - HF board (25) code 5.602.155.

5.8.1 - Topographical drawing.

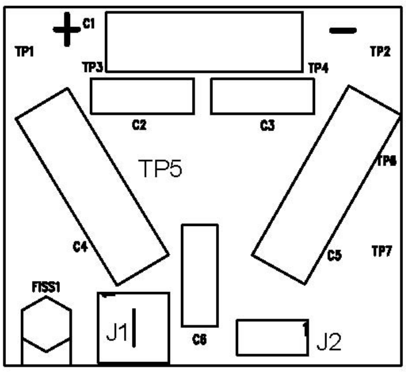


5.8.2 - Connector table.

Connector	Terminals	Function
J1	1 - 2	HF board (25) power supply input.
J1	4 - 5	HF board (25) command input.
-	J2 - J3	output for HF transformer (23).

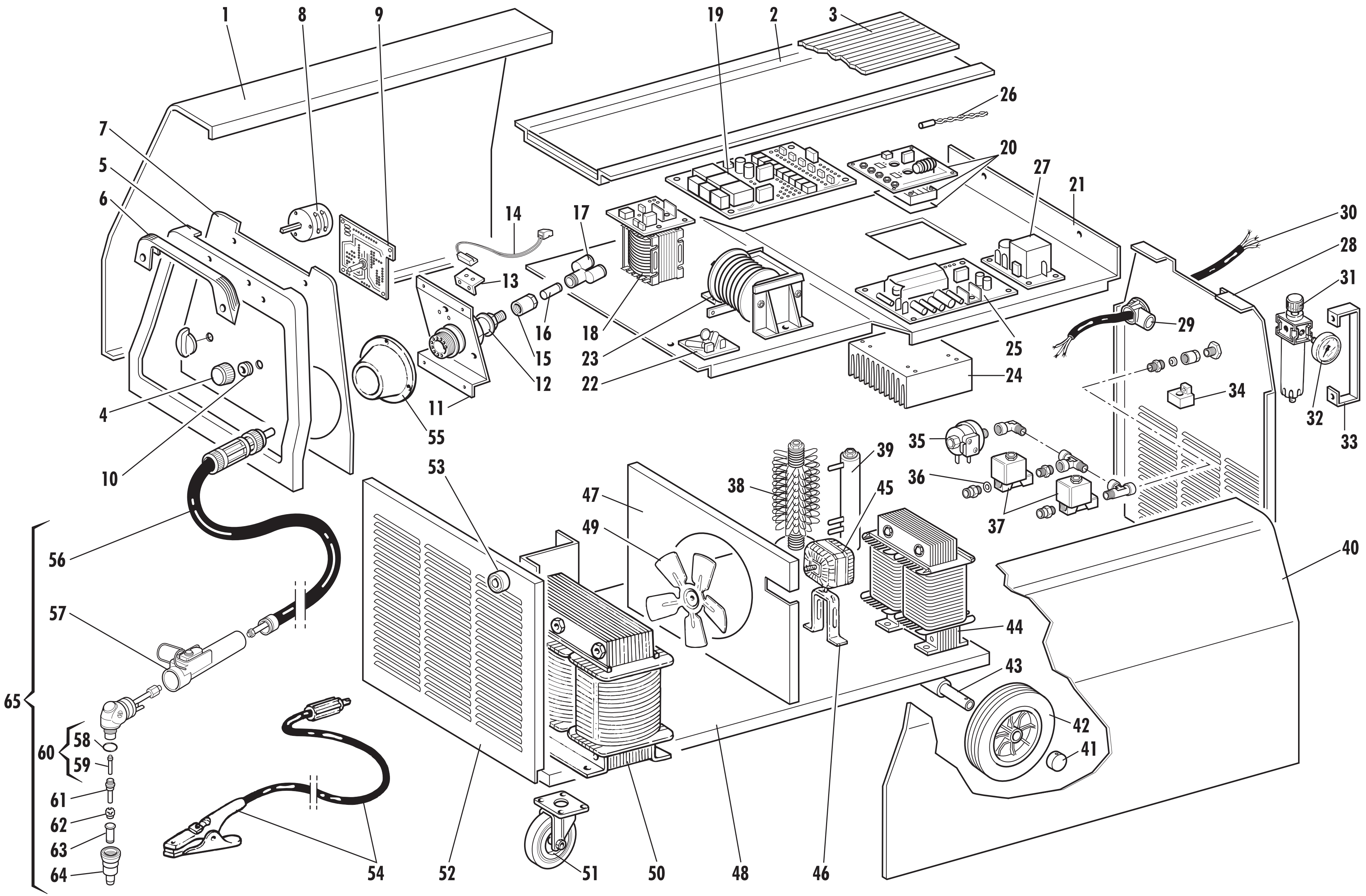
5.9 - HF-filter board (22) code 5.602.165/D.

5.9.1 - Topographical drawing.



5.9.2 - Connector table.

Connector	Terminals	Function
J1	A - B	torch nozzle voltage output.
-	J2	torch nozzle voltage input.
-	TP3	connection to earth potential (workpiece).
-	TP4	connection to electrode potential (upstream from the HF transformer (23)).
-	TP5	connection to earth.



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pos	DESCRIZIONE	DESCRIPTION
01	LATERALE SINISTRO	LEFT SIDE PANEL
02	COPERCHIO	COVER
03	COPERTURA GOMMA	RUBBER MAT
04	MANOPOLA	KNOB
05	CORNICE	FRAME
06	MANICO	HANDLE
07	PANNELLO COMANDI COMP.	COMPLETE CONTROL PANEL
08	INTERRUTTORE	SWITCH
09	CIRCUITO DI CONTROLLO	CONTROL CIRCUIT
10	PROTEZIONE	PROTECTION
11	SUPPORTO ADATTATORE	ADAPTOR SUPPORT
12	ADATTATORE FISSO	FIXED ADAPTOR
13	SUPPORTO SENSORE	SENSOR SUPPORT
14	MICROSENSORE	MICRO SENSOR
15	RACCORDO	FITTING
16	RACCORDO	FITTING
17	RACCORDO A 3 VIE	T-FITTING
18	TRASFORMATORE DI SERVIZIO	AUXILIARY TRANSFORMER
19	CIRCUITO DI REGOLAZIONE	REGULATION CIRCUIT
20	KIT DIODO S.C.R.	S.C.R. DIODE KIT
21	PIANO INTERMEDIO	INSIDE BAFFLE
22	CIRCUITO FILTRO	FILTER CIRCUIT
23	TRASFORMATORE H.F.	H.F. TRANSFORMER
24	DISSIPATORE	RADIATOR
25	CORCUITO ALTA FREQUENZA	HIGH-FREQ. CIRCUIT
26	CONNESSIONE REED	REED CONNECTION
27	CIRCUITO RELAIS	RELAY CIRCUIT
28	PANNELLO POSTERIORE	BACK PANEL
29	PRESSACAVO	STRAIN RELIEF
30	CAVO RETE	POWER CORD
31	RIDUTTORE	REGULATOR
32	MANOMETRO	GAUGE
33	PROTEZIONE	PROTECTION
34	TRASDUTTORE	TRANSDUCER

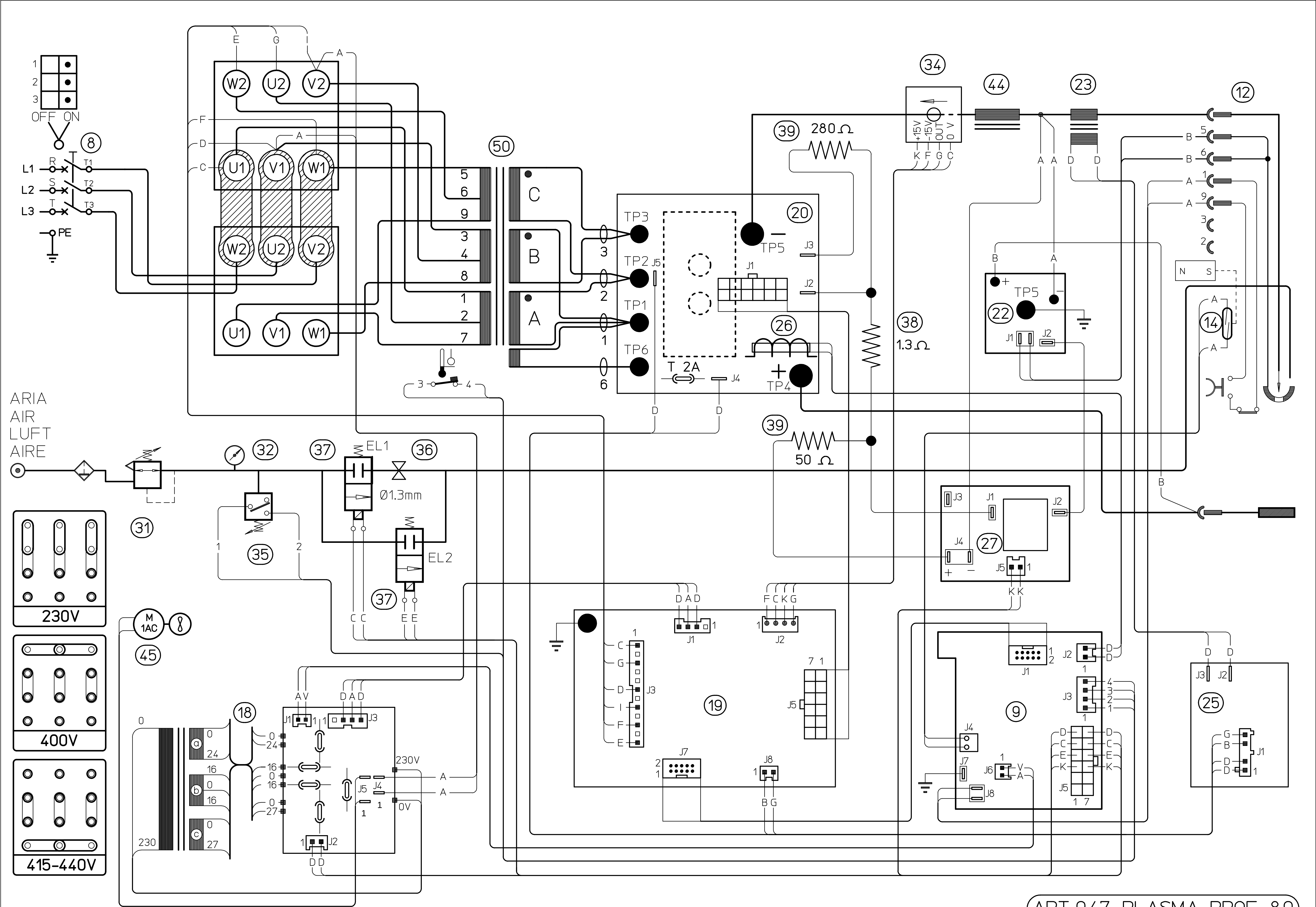
pos	DESCRIZIONE	DESCRIPTION
35	PRESSOSTATO	PRESSURE SWITCH
36	CONTATTORE	CONTACTOR
37	ELETTROVALVOLA	SOLENOID VALVE
38	RESISTENZA	RESISTANCE
39	RESISTENZA	RESISTANCE
40	LATERALE DESTRO	RIGHT SIDE PANEL
41	TAPPO	CAP
42	RUOTA FISSA	FIXED WHEEL
43	ASSALE	AXLE
44	IMPEDENZA	CHOKE
45	MOTORE	MOTOR
46	SUPPORTO VENTOLA	FAN SUPPORT
47	TUNNEL	COOLING TUNNEL
48	FONDO	BOTTOM
49	VENTOLA	FAN
50	TRASFORMAT. DI POTENZA	POWER TRANSFORMER
51	RUOTA PIROETTANTE	SWIVELING CASTOR
52	PANNELLO ANTERIORE	FRONT PANEL
53	PRESA GIFAS	GIFAS SOCKET
54	MORSETTO + CAVO	SCREW KNOB + CABLE
55	PROTEZIONE	PROTECTION
56	CAVO TORCIA	TORCH CABLE
57	IMPUGNATURA CON PULSANTE	HANDGRIP WITH PUSHBUT TON
58	ANELLO O.R.	O.RING
59	DIFFUSORE	DIFFUSER
60	CORPO TORCIA (TESTINA)	TORCH BODY (HEAD)
61	ELETTRODO (CONF. DA 5 PZ.)	ELECTRODE (PACK. 5 PCS.)
62	DIFFUSORE ISOLANTE (CONF. DA 2 PZ.)	SWIRL RING (PACK 2 PCS.)
63	UGELLO (CONF. DA 10 PZ.)	NOZZLE (PACK. 10 PCS.)
64	PORTAUGELLO	NOZZLE HOLDER
65	TORCIA COMPLETA	COMPLETE TORCHE

La richiesta di pezzi di ricambio deve indicare sempre: numero di articolo, matricola e data di acquisto della macchina, posizione e quantità del ricambio.

When ordering spare parts please always state the machine item and serial number and its purchase data, the spare part position and the quantity.

	CODIFICA COLORI CABLAGGIO ELETTRICO	WIRING DIAGRAM COLOUR CODE
A	NERO	BLACK
B	ROSSO	RED
C	GRIGIO	GREY
D	BIANCO	WHITE
E	VERDE	GREEN
F	VIOLA	PURPLE
G	GIALLO	YELLOW
H	BLU	BLUE
K	MARRONE	BROWN
J	ARANCIO	ORANGE
I	ROSA	PINK

	CODIFICA COLORI CABLAGGIO ELETTRICO	WIRING DIAGRAM COLOUR CODE
L	ROSA-NERO	PINK-BLACK
M	GRIGIO-VIOLA	GREY-PURPLE
N	BIANCO-VIOLA	WHITE-PURPLE
O	BIANCO-NERO	WHITE-BLACK
P	GRIGIO-BLU	GREY-BLUE
Q	BIANCO-ROSSO	WHITE-RED
R	GRIGIO-ROSSO	GREY-RED
S	BIANCO-BLU	WHITE-BLUE
T	NERO-BLU	BLACK-BLUE
U	GIALLO-VERDE	YELLOW-GREEN
V	AZZURRO	BLUE



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