PLASMA PROF 123 ACC

POWER SOURCE art. 956

SERVICE MANUAL

CONTENTS

1 - GENERAL INFORMATION.

1.1 - Introduction.

The purpose of this manual is to train the personnel in charge of maintaining Plasma PROF 123 ACC 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 repair must be carried out by qualified personnel who are responsible for any intervention on the equipment.

Each repair must be carried out in compliance with Standard CEI 26-29 (IEC 60974-4).

After each repair, make sure the wires are replaced so as to ensure safe insulation between the primary side and the secondary side of the machine.

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.

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 123 ACC is a cutting system, designed for plasma arc cutting of electro-conducting materials. It consists of an electronic Power Source art. 956 and a set of torches and accessories, to be used in manual applications (see list in the Sales Catalogue).

The Power Source is controlled by microprocessor-based circuits, which manage the operative functions of the cutting system and the operator interface.

2.2 - Technical specifications.

To check the technical specifications, see the plates affixed to the equipment, the Instruction Manual and the Sales Catalogue.

2.3 - Power Source art. 956.

Art. 956 is a direct voltage, current controlled Power Source consisting in a three phase bridge rectifier and a igbt DC/DC converter.

With reference to the electrical diagram of par. 5.1, drawing 4.1 and table 4.2, you can identify the main blocks that make up the Power Source.

The switch (49) works on the service transformer (53) which feeds the electronic boards and the internal services through the fuse board (53).

The power transformer (37) primary circuit consists of six windings. When switched appropriately by the voltage changer, these allow the Power Source to operate at 230, 400 or 440 Vac 50/60 Hz. The service transformer (53) voltage changer is set in the vicinity of the main voltage changer.

The transformer (37) is powered through contactor (2), which is controlled, in closing, by the control board (47), once the DC-capacitor (20) pre-charge and transformer (37) pre-magnetization phases are completed.

From one of the windings of the transformer (37) primary circuit, the 230 Vac voltage is drawn to power the fan (23) for cooling the Power Source power elements. Since this is directly connected to the transformer (37) primary circuit, the closing of contactor (2) is sufficient to power the fan (23).

From the secondary circuit of transformer (37) the mains voltage signal is picked-up and analyzed by the measure board (57). In particular, the presence and the amplitude of the supply voltage three phases of the Power Source is checked; any incorrect value causes an error signal which is sent to the control board (47).

The rectifier bridge (34), connected to the transformer (37) secondary circuit, feeds the capacitor (20) and the power board (56), which contains the igbt module and the two Hall effect current transducers to draw the Power Source and the pilot arc output currents.

The igbt module contains the switching item, the igbt, and the freewheeling diode connected in “chopper” layout.

At the negative output (1) of igbt module on the power board (56) the choke (35), to level the arc current, is connected; then the HF transformer (50) is connected as well at the output for the electrode potential, on the central adapter (41) for the cutting torch.

The terminal TP1 of the power board (56) corresponds to the positive output (3) of the igbt module and represents the output of the ground potential ready for workpiece connection.

On this connection, inside the power board (56), the Hall effect current transducer is connected, which sends to the control board (47) the Power Source output current signal.

The J1 terminal of the power board (56) corresponds to the positive output (3) of the igbt module as well and represents the nozzle potential output. The nozzle resistor (33) which facilitates the operation with the pilot arc is connected to it. On this connection as well, inside the power board (56), the Hall effect current transducer is connected which sends to the control board (47) the pilot arc current signal.

The system current is adjusted by the control board (47).

It generates the igbt drive signal, obtaining the waveform (duty cycle), based on a comparison between the current reference signal originating from the control board (47) and the current feed-back signal originating from the current transducers on the power board (56).

The signals of the two current transducers are used also for switching the pilot arc and the transfer arc.

More precisely:

- when the Power Source output current (transducer signal on TP1) is the same as the pilot arc current (transducer signal on J1) the control drives the pilot arc operation, with the nozzle contactor (55) closing.
- when the Power Source output current (transducer signal on TP1) becomes higher than the pilot arc current (transducer signal on J1) the control drives the transfer arc operation (cutting) and opens the nozzle contactor (55).

The fuse board (53) contains the fuses related to the electronic boards and Power Source internal services (contactors and solenoid valves) power supply.

The supply board (51), powered by the fuse board (53), generates the control board (47) power voltage. On the input voltage of the supply board (51) a control circuit is provided, which generates an error signal if this voltage becomes 30% lower than the rated value. This error signal is sent to the control board (47) and causes the immediate stop of the Power Source and the code error is displayed on the operator panel (error 99 “OFF”).

The pre-charge board (3) controlled by the control board (47) commands the power transformer (37) pre-magnetization, through resistors R16, R17, R18 and relay RL3, fitted on the pre-charge board (3).

The control board (47) contains the main microprocessor of the Power Source and manages:

– the other boards that are more specialized in the relative functions;
– processes the driver signal to be sent to the driver board (56) built in the power board (56) igbt module;
– commands the line contactor (2) and the nozzle contactor (55);
– manages the plasma gas control devices (solenoid valves and pressure detector);
– manages the diagnostics of the cutting system, conditioning or stopping it as required, the system operation and displays any code errors on the operator panel.

The control board (47) also manages the operator interface which, in this case, is the operator panel built in the same board.

It contains:

- two displays (U) and (V) to show the type of connected cutting torch, error codes, cutting current and nozzle hole diameter;
- a knob (Z) to set the cutting current;
- a series of leds to display the operating status;
- a button (W) for functions selection.

On the control board (47), inside the Power Source, the RS232 communication port (BD1) is fitted, for connection to a Personal Computer, allowing the Power Source Firmware updating.

The control board (47) receives the temperature signals originating from the thermostats placed on the transformer (37) and on the igbt module dissipater on the power board (56). According to these over-temperature signals, the Power Source is stopped and the corresponding error code is displayed on the operator panel.

The sensor board (52) works as an interface to the Power Source output, it receives and conditions disturbed signals originating from the system critical areas.

These signals are:

- HF board (27) command;
- Power Source output voltage;
- pilot arc voltage.

The Power Source output voltage signal, received through the HF-filter board (32), is filtered and converted into PWM type signal, on the sensor board (52) and then sent to the control board (47) where it is used to check the cutting condition.

The HF board (27), combined with the HF transformer (50), generates the high voltage and high frequency pulses to the torch electrode and nozzle terminals, needed to start the pilot arc.

Its operation is conditioned by the Power Source output voltage value, detected between the output positive pole of the Power Source (nozzle potential, downstream of resistor (33),when contactor (55) is closed) and the common point between choke (35) and HF transformer (50) (electrode potential). With a voltage higher than 200 Vdc the circuit generates high voltage and high frequency pulses; with a lower voltage the circuit stops working.

This system is based on the system according to which under no load condition the Power Source output voltage is maximum, approximately 280 Vdc, while with pilot arc or transfer arc the voltage depends on the working conditions (current level, material to be cut, type of gas etc.), therefore considerably lower than 200 Vdc (150 Vdc approximately with pilot arc on).

The pilot arc has a 2,5 s. maximum length; after this time if the cutting operation does not start, e.g. the control board (47) has not received from the power board (56) the signals to cause switching into transfer arc, the pilot arc halts until it receives the next start command.

The HF-filter board (32) is extremely important because it prevents the HF pulse from going back to the Power Source thus damaging other components. Therefore, during maintenance operations make sure that this board is always correctly connected to the original terminals, before activating start-up with HF.

The signals processed by the electronic boards and present at its connectors are listed in the table in chapter five .

3 - MAINTENANCE.

WARNINGS

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

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

3.1 - Periodic inspection, cleaning.

Periodically remove dirt or 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 power supply cables of the Power Source; replace if damaged.

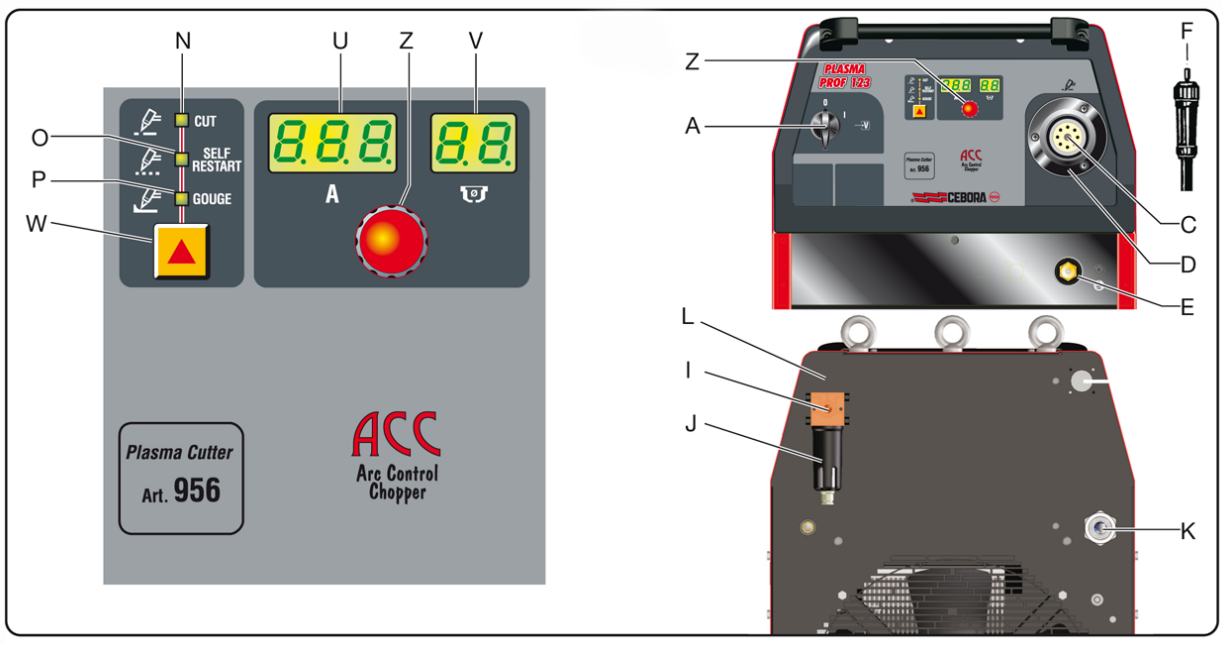
Check the condition of the internal power connections and connectors on the electronic boards; if you find “loose” connections, tighten or replace the connectors.

3.2 - Operative sequence.

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

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

3.2.1 - Power Source controls and signals.



3.2.2 - Power Source operation.

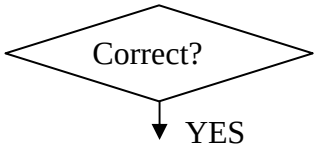
WARNING!

DURING THE FOLLOWING TESTS DO NOT AIM THE TORCH AT PEOPLE OR PARTS OF THE BODY, BUT ONLY TOWARDS AN OPEN SPACE OR THE WORKPIECE.

NOTES

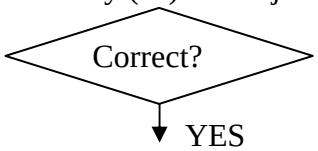
- ❑ Operations preceded by this symbol refer to operator actions.
- ♦ Operations preceded by this symbol refer to machine responses that must occur following an operator action.

- ❑ System shut off and disconnected from the mains.
- ❑ Connect the gas supply to the fitting (I) on the rear panel.
- ❑ Connect the torch to the Power Source.
- ❑ Connect the ground cable of the workpiece to the positive pole (E) of the Power Source.
- ❑ Connect the Power Source to the mains.
- ❑ Close the switch (A) on the Power Source.
  - ♦ System powered, on the operator panel all leds and displays are lit (lamp-test).
  - ♦ After one second, display (U) reads “956” and display (V) shows the Power Source Firmware version.
  - ♦ After one second, displays (U) and (V) indicate the type of torch connected to the Power Source (e.g.: 161 – CP and then LEn - 6). The fan (23) starts running. The transformer (37) pre-magnetization and the DC-capacitor (20) pre-charge phases take place during this time, and when these phases are completed the contactor (2) closes.
  - ♦ After three seconds, display (U) shows the value of the programmed current and display (V) shows the set nozzle hole diameter.



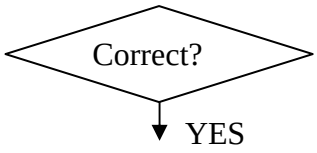
NO (see 3.3.1, 3.3.2, 3.3.3).

- ❑ Press the key (W) several times to select the type of operation.
- ❑ Turn the knob (L) of the pressure regulator (I) for a pressure value, read on the regulator (I) gauge, adequate to the selected working operation type (see Instruction Manual).
  - ♦ Each time the key (W) is pressed, the leds (N)(O)(P) light in sequence, to indicate the type of work to be carried out.
  - ♦ Displays (U) and (V) display the current and diameter values assigned to the operation selected with key (W) and adjustable with knob (Z).

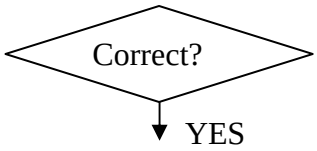


NO (see 3.3.3).

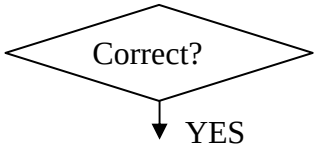
- ❑ Press the key (W) to select the CUT operation (led (N) lit).
- ❑ Turn the knob (Z) for a cutting current suited to the type of workpiece to be cut (see Instruction Manual).
  - ♦ Display (U) and (V) show the set cutting current and the suggested nozzle diameter.



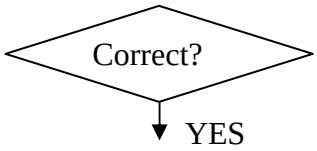
- Hold down the torch start button for a very short time.
  - Gas flows from the torch for 40 seconds. The pressure reading on the pressure gauge (I) remains constant.



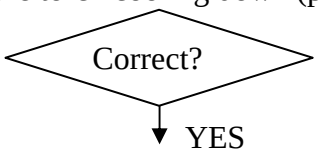
- Press the start button for about 5 seconds to start the pilot arc.
  - Pilot arc lights for its maximum time (2,5 s.). The gas flowing continues for approximately 40 seconds, after the start button has been released.



- Move the torch near the workpiece to be cut and press the torch trigger.
  - Begin cutting. Adjust the knob (Z) to the current level suited to the kind of cutting.
  - On the operator panel displays (U) and (V) show the set cutting current and the torch nozzle diameter.



- Release the torch start button.
  - The arc shuts off immediately. The gas flowing continues for approximately 40 seconds, because of the torch cooling down (post-gas).



REGULAR OPERATION.

3.3 - Troubleshooting.

WARNINGS

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

SWITCH **(A)** IS A FUNCTION SWITCH NOT A GENERAL SWITCH.
FOR THIS REASON INSIDE THE POWER SOURCE A VOLTAGE IS PRESENT WHICH IS DANGEROUS EVEN WHEN THE SWITCH IS SET TO "0".

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

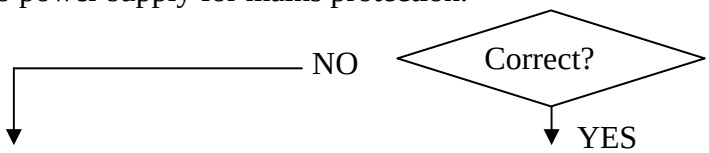
Items in **boldface** describe problems that may occur on the machine (symptoms).

- ❑ Operations preceded by this symbol refer to situations of which the operator must determine (the 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, operator panel off.

MAINS SUITABILITY TEST.

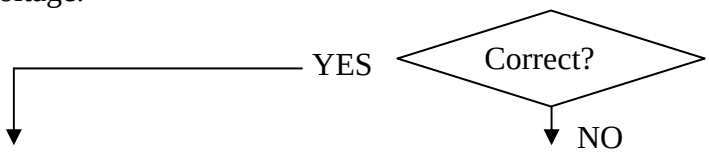
- ❑ No power supply for mains protection.



- ♦ Position the voltage changers correctly.
- ♦ Eliminate any short circuits on the transformers (37) connections.
- ♦ Check if the bridge rectifier (34) is short-circuited.
- ♦ Check the wiring between J5 pre-charge board (3) and the mains input terminal board (5) and between J7 of pre-charge board (3) and contactor (2) terminals.
- ♦ Make sure that terminals J5 and J7 on the pre-charge board (3) are not short-circuited. Replace pre-charge board (3) if necessary.
- ♦ Make sure that contactor (2) has not stuck contacts or it is not controlled to closing before the DC-capacitor (20) pre-charge and transformer (37) pre-magnetization phases completion If required, carry out the DC-CAPACITOR (20) PRE-CHARGE AND TRANSFORMER (37) PRE-MAGNETIZATION TEST, of par. 3.3.2.
- ♦ Mains not suitable to power the Power Source (e.g.: insufficient installed power).

MAINS CONNECTION TEST.

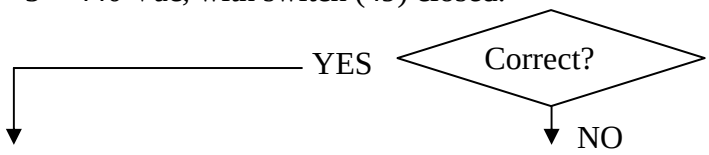
- Mains terminal board (5), terminals U1, V1, W1 = 3 x 230/400/440 Vac according to mains voltage.



- ♦ Check power cable and plug and replace if necessary.
- ♦ Check the mains voltage conditions.

SERVICE TRANSFORMER (53) POWER SUPPLY TEST.

- Fuse board (53), connector J5, terminals 1 - 3 = 230 Vac; terminals 1 - 4 = 400 Vac; terminals 1 - 5 = 440 Vac, with switch (49) closed.



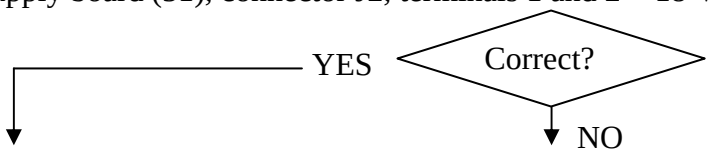
WARNING

SOME PRE-CHARGE BOARD (3) CIRCUITS ARE LIVE EVEN WITH SWITCH (49) OPEN. UNPLUG THE POWER SOURCE FROM THE MAINS SOCKET IN ORDER TO WORK WITHOUT ANY DANGEROUS VOLTAGE.

- ♦ Check the wiring between mains terminal board (5) and J5 pre-charge board (3) and between J6 pre-charge board (3), switch (49), services transformer (53) voltage changer and connector J5 of fuse board (53).
- ♦ Check for the correct position of the services voltage changer, located on the transformer (37) voltage changer terminal board.
- ♦ Check fuse F2 on pre-charge board (3); replace it if broken and check that there is no short-circuit in the services transformer (53) or in the related wiring.
- ♦ Check for broken services transformer (53) primary winding.
- ♦ Check switch (49); replace if defective.
- ♦ Replace pre-charge board (3).

SUPPLY BOARD (51) POWER SUPPLY TEST.

- Supply board (51), connector J2, terminals 1 and 2 = 18 Vac, with switch (49) closed.

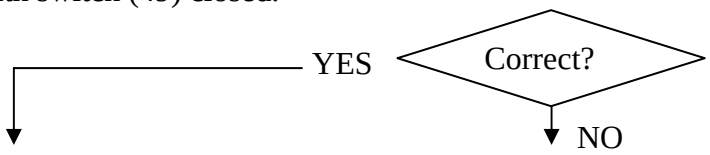


- ♦ Check the wiring between J2 supply board (51) and J3 fuse board (53).
- ♦ Check fuse F2 on fuse board (53); replace if broken, making sure that terminals 1 and 2 of J2 on the supply board (51) are not short-circuited.
- ♦ Check 18 Vac voltage on terminals 0V-18V on fuse board (53); If lacking, check the wiring between service transformer and fuse board (53) and replace service transformer (53), if necessary.

CONTROL BOARD (47) POWER SUPPLY TEST.

- Control board (47), connector J1, terminals 1 - 2 = 24 Vac (start button, torch recognition, central adapter protection circuits power supply).
- Control board (47), connector J10, terminals 7 - 14 = 27 Vac (solenoid valves, contactors, pre-charge relay on pre-charge board (3) power supply).
- Control board (47), connector J8, terminals 1(+) and 2(-) = +15 Vdc.
- Control board (47), connector J8, terminals 3(+) and 2(-) = -15 Vdc.
- Control board (47), connector J8, terminals 4(+) and 2(-) = -15 Vdc.
- Control board (47), connector J8, terminals 5(+) and 6(-) = +8 Vdc.

  with switch (49) closed.



- ♦ Check the wiring between J1 control board (47) and J2 fuse board (53).
- ♦ Check fuse F1 on fuse board (53). Replace if broken after having checked, with Power Source off and J1 disconnected from control board (47), the resistance between terminals 1 and 2 of J1 on control board (47). Correct value = >Mohm in both directions (7 Kohm approximately, with CP161 torch inserted in the central adapter (41)). If incorrect, replace control board (47).
- ♦ Check 24 Vac voltage on terminals 0V-24V on fuse board (53); if lacking check the wiring between services transformer (53) and fuse board (53) and replace services transformer (53), if necessary.
- ♦ Check the wiring between J10 control board (47) and J4 fuse board (53).
- ♦ Check fuse F4 on fuse board (53). Replace if broken after having checked, with Power Source off and J4 disconnected from fuse board (53), the resistance between terminals disconnected from J4 of fuse board (53). Correct value = >Mohm in both directions. If incorrect, replace control board (47).
- ♦ Check 27 Vac voltage on terminals 0V-27V on fuse board (53); if lacking check the wiring between services transformer (53) and fuse board (53) and replace services transformer (53), if necessary.
- ♦ Check the wiring between J8 control board (47) and J1 supply board (51).
- ♦ With Power Source off, temporarily disconnect J8 on control board (47) and check on J1 of supply board (51):
  - terminals 1(+) and 2(-) = +15 Vdc;
  - terminals 3(+) and 2(-) = -15 Vdc;
  - terminals 4(+) and 2(-) = -15 Vdc;
  - terminals 5(+) and 6(-) = +8 Vdc.

  If correct, replace control board (47).

  If incorrect, replace the supply board (51), first making sure that terminals 1-2, 3-2, 4-2 and 5-6 of J8 on control board (47) are not short-circuited. Also replace control board (47), if necessary.

- ♦ Replace control board (47).

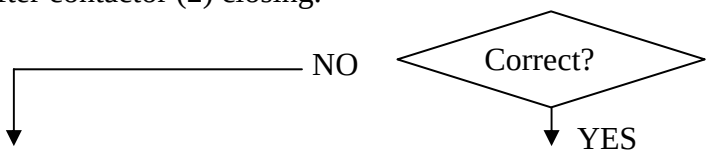
3.3.2 - Power Source powered, operator panel on, fan (23) stopped.

WARNING

SOME PRE-CHARGE BOARD (3) CIRCUITS ARE LIVE EVEN WITH SWITCH (49) OPEN. UNPLUG THE POWER SOURCE FROM THE MAINS SOCKET IN ORDER TO WORK WITHOUT ANY DANGEROUS VOLTAGE.

FAN (23) TEST.

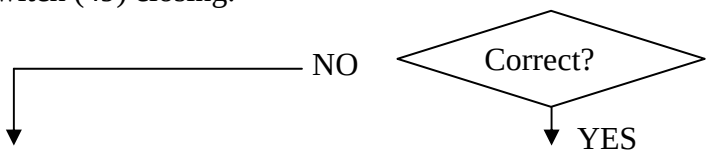
- Fan (23), terminals A (black wire) - H (blue wire), on fast-on connector, voltage = 230 Vac, after contactor (2) closing.



- ♦ Check the wiring between fan (23) and starting capacitor.
- ♦ Replace starting capacitor.
- ♦ Replace fan (23).

DC-CAPACITOR (20) PRE-CHARGE AND TRANSFORMER (37) PRE-MAGNETIZATION TEST.

- DC-capacitor (20), terminals (+) and (-), voltage = >200 Vdc, contactor (2) closed, after switch (49) closing.



- ♦ Check the wiring between fan (23), starting capacitor and power voltage changer.
- ♦ Check correct positioning of power voltage changer.
- ♦ Check for the presence of the three phases of supply voltage on transformer (37) primary circuit, at the contactor (2) output.

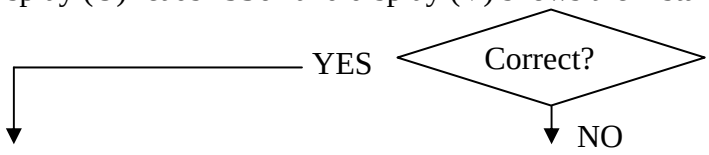
- ♦ Check the wiring between J3, terminals 3 and 4 on pre-charge board (3) and terminals 6 and 13 of J10 on control board (47) (PRE-CHARGE AND PRE-MAGNETIZATION RELAY COMMAND LINE).
- ♦ Check on J3 of pre-charge board (3), terminals 3 and 4, voltage = 25 Vac approximately for 1 s., starting 1 s. after switch (49) closing (pre-charge and pre-magnetization relay command pulse). If incorrect, with Power Source off, temporarily disconnect J3 on pre-charge board (3) and check the resistance between terminals 3 and 4 of J3 on pre-charge board (3). Correct value = approximately 72 ohm (RL3 coil). If >Mohm replace the pre-charge board (3). If 0 ohm (short-circuit), replace pre-charge board (3) and control board (47). If correct, check the supply voltage of the control board (47) taking special care for 27 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- ♦ Check the wiring between contactor (2) coil and terminals 5 and 12 of J10 on control board (47) (CONTACTOR (2) COMMAND LINE).
- ♦ Check on contactor (2) coil terminals, voltage = 25 Vac with switch (49) closed, after DC-capacitor (20) pre-charge and transformer (37) pre-magnetization phases. If incorrect, with the Power Source off, temporarily disconnect J10 from control board (47) and check resistance between the contactor (2) coil terminals. Correct value = approximately 5,6 ohm. If >Mohm, replace contactor (2). If 0 ohm (short-circuit), replace contactor (2) and control board (47). If correct, check the supply voltage of the control board (47) taking special care for 27 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.

- ♦ Replace contactor (2) and/or pre-charge (3) and/or control (47) boards.
- ♦ Check correct positioning of power voltage changer.
- ♦ Check for the presence of the three phases of supply voltage on transformer (37) primary circuit, at the contactor (2) output. If not correct check the mains voltage conditions performing, if necessary, the MAINS SUITABILITY TEST and MAINS CONNECTION TEST of par. 3.3.1.

3.3.3 - Power Source powered, display and signalling do not show the correct values.

LAMP-TEST.

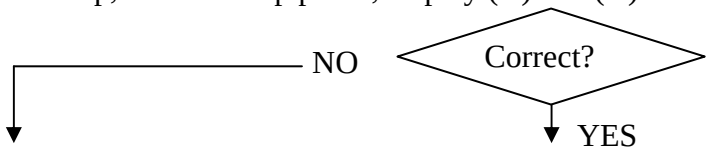
- ❑ At start-up, on operator panel, displays and leds are all lit (lamp-test). After one second, display (U) reads “956” and display (V) shows the installed firmware version (e.g. 01).



- ♦ Check the supply voltages of control board (47) performing, if necessary, the SUPPLY BOARD (51) POWER SUPPLY TEST and CONTROL BOARD (47) POWER SUPPLY TEST, of par. 3.3.1.
- ♦ Make sure that the correct program is loaded in control board (47), performing the programming procedure “Firmware updating” available on the Cebora Web site, if necessary (on art. 956 Power Source, the Firmware update is possible by connecting a Personal Computer directly to the BD1 connector on control board (47)).
- ♦ Replace control board (47).

ERROR CODE TEST.

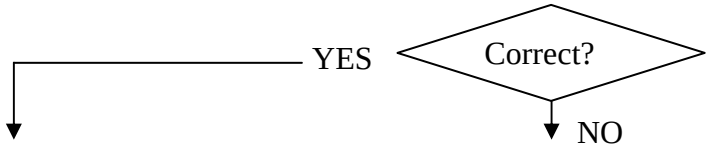
- ❑ At start-up, after start-up phase, display (U) and (V) show an alarm condition.



- ♦ See Error codes and alarm signals, par. 3.4.

COMMANDS AND SIGNALS TEST.

- ❑ At power on, after start-up phase, on operator panel all passages related to “Operation” and “Mode” selections can be carried out using panel commands, as described in par. 3.2 and in Plasma PROF 123 ACC Instruction Manual.



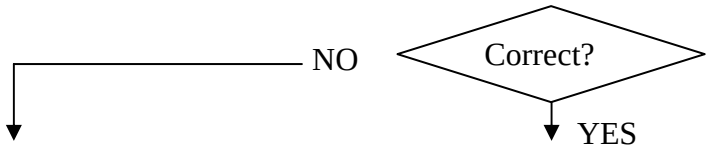
- ♦ Check the supply voltages of control board (47) performing, if necessary, the SUPPLY BOARD (51) POWER SUPPLY TEST and CONTROL BOARD (47) POWER SUPPLY TEST, of par. 3.3.1.
- ♦ Replace control board (47).

- ♦ Regular operation.

3.3.4 - The start command produces no effect.

START COMMAND TEST.

- Control board (47), terminals J6-A(+) and J6-B(-) = 0 Vdc, with start button pressed; +33 Vdc with start button released.



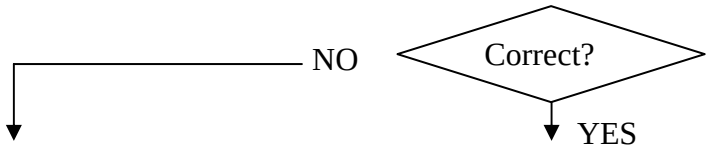
  - Replace control board (47).
- Check the wiring between terminals J6-A and J6-B of control board (47), central adapter (41), torch button and contact of the nozzle guard on the torch.
- Make sure that the torch nozzle guard is correctly assembled and in good working order. If defective or showing signs of wear replace.
- Check the wiring between J5 of control board (47) and central adapter (41) protection reed (31).
- Check the assembly and operation of the central adapter (41) guard; protection device inserted = reed closed = 0 Vdc between terminals 1 and 2 of J5 on control board (47) (protection device not inserted = reed opened = 33 Vdc approximately, between terminals 1(+) and 2(-) of J5.
- Check correct position of dip-switch DIP1-1 on control board (47). Right position = ON (closed contact) (start command from torch button activated).
- Check the supply voltage of the control board (47) taking special care for 24 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- With the Power Source off, temporarily disconnect terminals J6-A, J6-B, J5-1 and J5-2 from control board (47), and check resistance on terminals J6-A and J6-B and between terminal J5-1 and J5-2 on control board (47). Correct values:
  - J6-A e J6-B = 8 Kohm approximately, in both measure directions;
  - J5-1 e J5-2 = >Mohm in both measure directions.

  If incorrect, replace control board (47).
- Check the perfect isolation between conductors of start button and conductors of electrode and nozzle of the torch. If isolation is reduced replace the entire torch. Any isolation leak between torch cable conductor may damage the control board (47).
- Replace the control board (47).

3.3.5 - No gas flows from the torch.

PILOT ARC SOLENOID VALVE TEST.

- Solenoid valve V01 (14) terminals = 27 Vac for 40 seconds (post-gas), with torch button pressed.

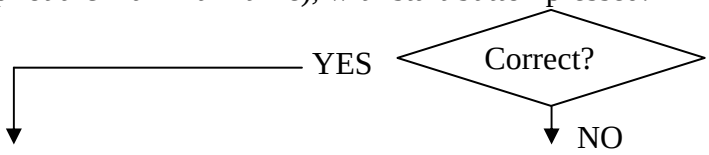


  - Check for presence of gas at the intake fitting (I) and make sure the pressure and flow rate in the supply line meet specifications values of Plasma PROF 123 ACC (see Instruction Manual and Sales Catalogue).
  - Make sure there are no occlusions in the gas hoses of the Power Source or in the flow reducer inserted on the solenoid valve V01 (14) body.
  - Make sure the pressure regulator (L) is working properly; replace if defective.
  - With Power Source off, temporarily disconnect J10 from control board (47) and check the resistance on solenoid valve V01 (14) coil terminal. Correct value = approximately 25 ohm. If >Mohm (circuit broken), replace the solenoid valve V01 (14).
  - Replace the solenoid valve V01 (14).
- Check the wiring between solenoid valve V01 (14) and terminals 1 and 8 of J10 control board (47).
- With the Power Source off, temporarily disconnect J10 from the control board (47) and check the resistance on solenoid valve V01 (14) coil terminals. Correct value = approximately 25 ohm. If 0 ohm (short-circuit), replace solenoid valve V01 (14) and control board (47).
- Check the supply voltage of the control board (47) taking special care for 27 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- Replace control board (47).

3.3.6 - Gas flows from the torch, pilot arc does not start (no nozzle voltage).

POWER SOURCE OUTPUT VOLTAGE TEST.

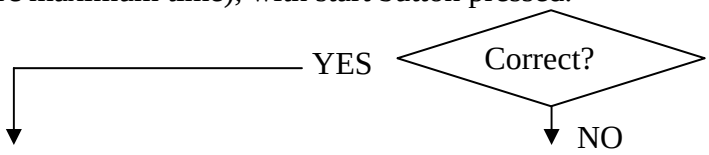
- Power board (56), terminals TP1(+) – TP6(or terminal 1 of igbt module)(gnd) = fig. 5.2.1a (+280 Vdc approximately) Power Source output voltage with pilot arc off, for 2.5 seconds (pilot arc maximum time), with start button pressed.



  - ♦ Go to par. 3.3.8.

POWER BOARD (56) OUTPUT VOLTAGE TEST.

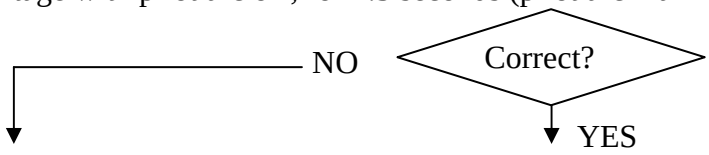
- Power board (56), terminals J1(+) – TP6(or terminal 1 of igbt module)(gnd) = fig. 5.2.1a (+280 Vdc approximately) output voltage for nozzle, with pilot arc off, for 2.5 seconds (pilot arc maximum time), with start button pressed.



  - ♦ Make sure that terminals TP1 and J1 on power board (56) are connected between them, through the LEM Hall effect current transducer. If interrupted restore the connection. If not possible replace power board (56).

NOZZLE VOLTAGE TEST.

- Power board (56), terminal TP6(or terminal 1 of igbt module)(gnd) and terminal J4(+) on sensor board (52) = fig. 5.2.2a (+280 Vdc approximately, contactor (55) closed) nozzle voltage with pilot arc off, for 2.5 seconds (pilot arc maximum time), with start button pressed.



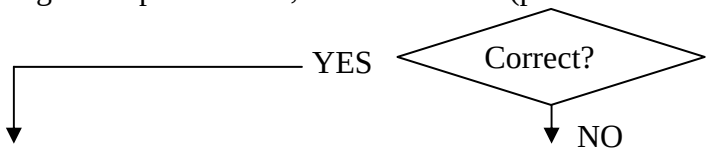
  - ♦ Go to par. 3.3.7.

- ♦ Check the wiring between terminal J1 power board (56), nozzle resistor (33), contactor (55) and J4 terminal on sensor board (52). If you find loose connections, tighten and replace any damaged components.
- ♦ Check resistor (33). Correct value = 1.5 ohm. If incorrect, replace it.
- ♦ Check the wiring contactor (55) coil terminals and J10, terminals 4 and 11 on control board (47) (CONTACTOR (55) COMMAND LINE).
- ♦ Check on contactor (55) coil terminals, voltage = 25 Vac with start button pressed. If correct, make sure that contactor (55) has not contacts blocked in open position. If required, replace contactor (55). If incorrect, check the supply voltage of the control board (47) taking special care for 27 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- ♦ With Power Source off, temporarily disconnect J10 from control board (47) and check the resistance between contactor (55) coil terminals. Correct value = approximately 7 Kohm. If >Mohm, replace contactor (55). If 0 ohm (short-circuit), replace contactor (55) and control board (47).
- ♦ Replace control board (47) and/or contactor (55).

3.3.7 - Gas flows from the torch, pilot arc does not start (no high frequency).

NOZZLE VOLTAGE TEST.

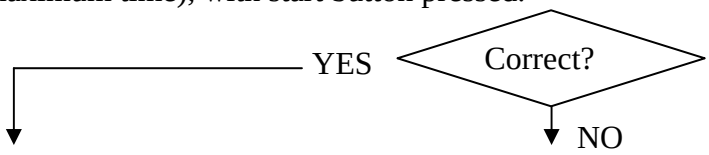
- Power board (56), terminal TP6(or terminal 1 of igbt module)(gnd) and terminal J4(+) on sensor board (52) = fig. 5.2.2a (+280 Vdc approximately, contactor (55) closed) nozzle voltage with pilot arc off, for 2.5 seconds (pilot arc maximum time), with start button pressed.



- ♦ Go to par. 3.3.6.

VOLTAGE PRESENCE ON HF BOARD (27) TEST.

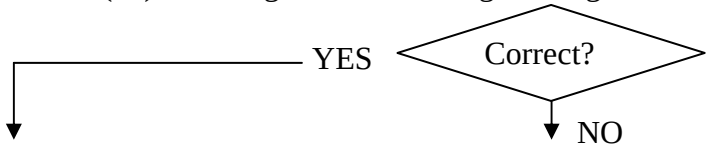
- HF board (27), terminals CN2(+) and CN3(-), voltage = fig. 5.2.3a (+280 Vdc approximately) voltage on HF board (27) with pilot arc off, for 2.5 seconds (pilot arc maximum time), with start button pressed.



- ♦ Check the wiring between CN2 - CN3 of HF board (27) and terminals 1 - 4 of J1 on sensor board (52).
- ♦ Check the wiring between J1 terminal on power board (56), nozzle resistor (33), contactor (55) and J4 terminal on sensor board (52). If you find loose connections, tighten and replace any damaged components.
- ♦ Check for continuity between terminal J4 and terminal 4 of J1 on sensor board (52). If interrupted reset the connection and replace sensor board (52), if necessary.
- ♦ Check wiring between TP7 terminal of power board (56), choke (35), HF transformer (50), TP2 terminal on HF-filter board (32), TP4 terminal on HF-filter board (32) and terminal 1 of J5 on sensor board (52). If loose connections are found, tighten them and replace any damaged components.
- ♦ Check for continuity between terminal 1 of J5 and terminal 1 of J1 on sensor board (52). If interrupted reset the connection.
- ♦ Check resistor (33). Correct value = 1.5 ohm. If incorrect, replace it.
- ♦ Replace sensor board (52) and/or HF-filter board (32).

HF OSCILLATOR TEST.

- HF board (27), discharger SCI1 discharges at regular intervals.



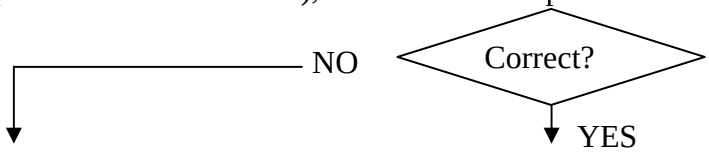
- ♦ Make sure that connection between terminals CN1 and CN4 of HF board (27), and HF transformer (50) primary circuit is not interrupted.
- ♦ Check distance between discharger SCI1 tips (correct distance = 0.95 mm).
- ♦ Replace HF board (27).

- Check the wiring between HF transformer (50) and electrode terminal on central adapter (41). If you find loose connections, tighten and replace any damaged components.
- Check the wiring between J2 on sensor board (52) and nozzle terminal on central adapter (41). If you find loose connections, tighten and replace any damaged components.
- Check for continuity between terminals J4 and J2 on sensor board (52). If interrupted reset the connection.
- Make sure there are no short-circuits between connectors CN1 and CN4 of HF board (27) or in the HF transformer (50) primary circuit wiring.
- Check distance between discharger SCI1 tips (correct distance = 0.95 mm).
- Check torch cable. Replaced it if old and cracked or with reduced isolation.
- 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 (see Instruction Manual).
- Replace HF board (27).
- Replace the HF transformer (50).

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

POWER SOURCE OUTPUT VOLTAGE TEST.

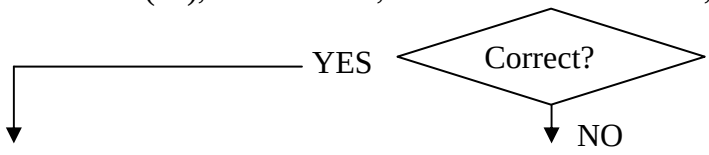
- Power board (56), terminals TP1(+) – TP6(or terminal 1 of igbt module)(gnd) = fig. 5.2.1b (+160 Vdc approximately) Power Source output voltage with pilot arc on, for 2.5 seconds (pilot arc maximum time), with start button pressed.



- ♦ Correct Power Source output voltage.

DRIVER BOARD (56) POWER SUPPLY TEST

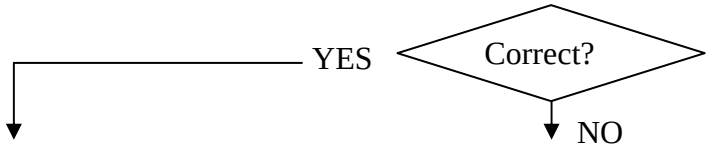
- Driver board (56), connector J3, terminals 1 - 2 = 20 Vac, with switch (49) closed.



- ♦ Check the wiring between J3 driver board (56) and J1, terminals 1 and 2 on fuse board (53).
- ♦ Check fuse F5 on fuse board (53). Replace if interrupted after having checked, with Power Source off and J3 disconnected from driver board (56), the resistance between terminals 1 and 2 of J3 on driver board (56). Correct value = >Mohm in both directions. If incorrect replace the driver board (56).
- ♦ Check 20 Vac voltage on terminals 0V-20V on fuse board (53); if lacking check the wiring between services transformer (53) and fuse board (53) and replace services transformer (53), if necessary.

PILOT ARC CURRENT REFERENCE TEST.

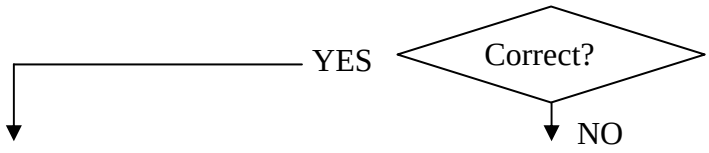
- Driver board (56), connector J3, terminals 5(+) - 4(gnd) = fig. 5.2.4 (+4.4 Vdc approximately) pilot arc current reference signal, for 2.5 seconds (pilot arc maximum time), with start button pressed.



- ♦ Check the wiring between J3 driver board (56) and J3, terminals 5 and 6 on control board (47).
- ♦ With Power Source off, temporarily disconnect J3 from control board (47) and check the resistance on terminals 5 and 4 of J3 on driver board (56). Correct value = 1.5 Kohm in both measure directions. If incorrect replace driver board (56).
- ♦ Check the supply voltages of the control board (47), performing, if necessary, the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- ♦ Replace control board (47).

POWER SOURCE OUTPUT CURRENT TRANSDUCER POWER SUPPLY TEST.

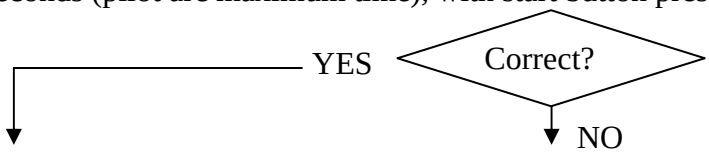
- Power board (56), connector J3, terminals 2(+) - 3(-) = +15 Vdc; terminals 4(+) - 3(-) = -15 Vdc.



- ♦ Check the wiring between J3 power board (56) and J3 control board (47).
- ♦ With Power Source off, temporarily disconnect J3 from power board (56) and check resistance on terminals 2 and 4 of J3 on power board (56). Correct value = approximately 2.4 Kohm in both measure directions. If incorrect replace the power board (56).
- ♦ Power up the Power Source again, with J3 still disconnected from power board (56) and check voltage on J3 of control board (47), terminals 2(+) and 3(-) = +15 Vdc; terminals 4(+) and 3(-) = -15 Vdc. If incorrect, replace control board (47).
- ♦ Check the supply voltages of the control board (47), performing, if necessary, the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- ♦ Replace control board (47) and/or power board (56).

POWER SOURCE OUTPUT CURRENT SIGNAL TEST.

- Control board (47), connector J3, terminals 1(+) - 3(gnd) = fig. 5.2.5 (+0.6 Vdc approximately) Power Source output current feedback signal with pilot arc lit, for 2.5 seconds (pilot arc maximum time), with start button pressed.



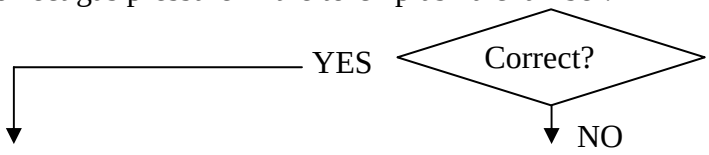
- ♦ Check the wiring between J3 control board (47) and J3 power board (56).
- ♦ With Power Source off, temporarily disconnect connector J3 from control board (47) and check resistance between terminals 1 and 3 of J3 on control board (47). Correct value = 67 ohm. If incorrect, replace control board (47).
- ♦ Replace control board (47) and/or power board (56).

- ♦ Check the wiring between output terminal (+) (ground potential) of Power Source and terminal TP1 of power board (56). If you find loose connections, tighten and replace any damaged components.
- ♦ Check the wiring between output terminal (-) (electrode potential) on central adapter (41), HF transformer (50), choke (35) and terminal TP6 of power board (56). If you find loose connections, tighten and replace any damaged components.
- ♦ Replace control board (47) and/or power board (56).

3.3.9 - Irregular pilot arc striking, unstable pilot arc.

PLASMA GAS PRESSURE TEST.

- Correct gas pressure in the torch plasma chamber.

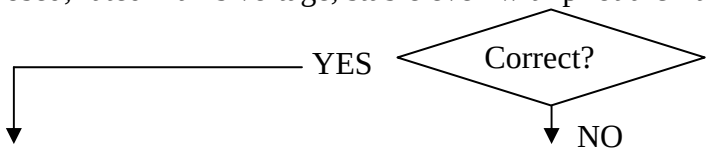


- ♦ Make sure that the pressure regulator (L) is working properly; replace it if defective.
- ♦ Make sure that gas pressure and flow rate in the supply line meet specifications of Plasma PROF 123 ACC (see Instruction Manual).
- ♦ Check the following conditions of solenoid valves (13) and (14), during pilot arc phases:
  - V01 (pilot arc solenoid valve (14)) = opened = 27 Vac on coil terminals.
  - V03 (transferred arc solenoid valve (13)) = closed = 0 Vac on coil terminals.

  If incorrect, check for solenoid valve operation, wiring between solenoid valve and connector J10 of control board (47) and if necessary replace control board (47).
- ♦ Check for the presence of the flow reducer on the pilot arc V01 solenoid valve (14).

POWER BOARD (56) INPUT VOLTAGE TEST.

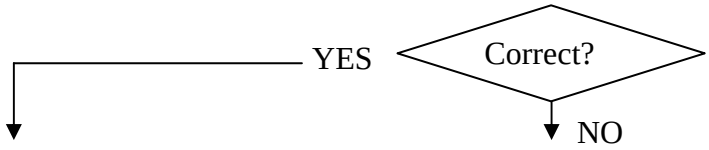
- Power board (56), terminals J5-A(+) – J5-C(-) = +280 Vdc approximately, with switch (49) closed, rated mains voltage, stable even with pilot arc lit (- 10% max. with pilot arc lit).



- ♦ Check 3 x 190 Vac, with rated mains voltage, on input terminals of power bridge rectifier (34); if incorrect, check connection of transformer (37), main voltage changer, contactor (2) and mains voltage.
- ♦ Check power bridge rectifier (34); replace if defective.
- ♦ Replace pre-charge board (3) and/or control board (47).

NOZZLE VOLTAGE TEST.

- Power board (56), terminal TP6(or terminal 1 of igbt module)(gnd) and terminal J4(+) on sensor board (52) = fig. 5.2.2a (+280 Vdc approximately, contactor (55) closed) nozzle voltage with pilot arc off or fig. 5.2.2b (+130 Vdc approximately, contactor (55) closed) nozzle voltage with pilot arc lit, for 2.5 seconds (pilot arc maximum time), with start button pressed.



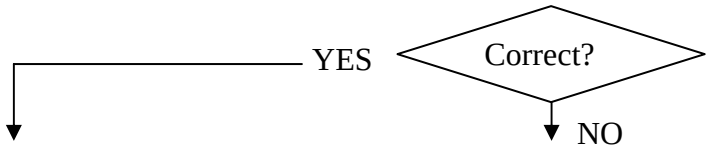
- ♦ Go to par. 3.3.6.

- Check the wiring between terminals TP6 of power board (56), choke (35), HF transformer (50) and electrode terminal on central adapter (41). If you find loose connections, tighten and replace any damaged components.
- Check the wiring between J1 power board (56), nozzle resistor (33), contactor (55), terminal J4 on sensor board (52) and between terminal J2 sensor board (52) and nozzle terminal on central adapter (41). If you find loose connections, tighten and replace any damaged components.
- Check the continuity between terminals J4 and J2 on sensor board (52). If interrupted reset the connection.
- Check wiring between TP1 HF-filter board (32) with Power Source output terminal (+) (ground potential) and between terminal TP2 HF-filter board (32) and common terminal between choke (35) and HF transformer (50).
- Check resistor (33). Correct value = 1.5 ohm. If incorrect, replace it.
- Replace control board (47) and/or power board (56) and/or sensor board (52).

3.3.10 - There is no transfer arc or it is too weak to perform cutting.

NOZZLE CURRENT TRANSDUCER POWER SUPPLY TEST.

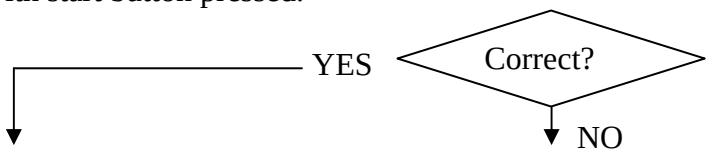
- Power board (56), connector J2, terminals 2(+) - 3(-) = +15 Vdc; terminals 4(+) - 3(-) = -15 Vdc.



- ♦ Check the wiring between J2 power board (56) and J4 control board (47).
- ♦ With Power Source off, temporarily disconnect connector J2 from power board (56) and check resistance between terminals 2-3 and 4-3 on power board (56). Correct value = 27 Kohm approximately in each measure point. If incorrect replace the power board (56).
- ♦ Power up the Power Source again, with J2 still disconnected form power board (56) and check the voltage on J4 of control board (47), terminals 2(+) and 3(-) = +15 Vdc; terminals 4(+) and 3(-) = -15 Vdc. If incorrect replace the control board (47).
- ♦ Check the supply voltages of the control board (47), performing, if necessary, the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- ♦ Replace control board (47) and/or power board (56).

NOZZLE CURRENT SIGNAL TEST.

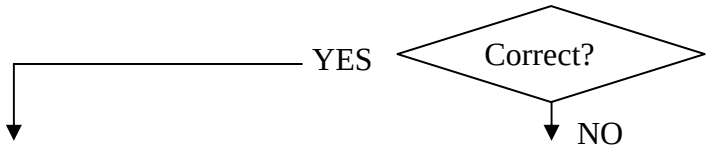
- Control board (47), connector J4, terminals 1(+) - 3(gnd) = fig. 5.2.6 (+4 Vdc approximately) nozzle current feedback signal with pilot arc lit, for 2.5 seconds (pilot arc maximum time), with start button pressed.



- ♦ Check the wiring between J2 power board (56) and J4 control board (47).
- ♦ With the Power Source off, temporarily disconnect connector J4 from control board (47) and check resistance between terminals 1 and 3 of J4 on control board (47). Correct value = approximately 21 Kohm. If incorrect, replace control board (47).
- ♦ Replace power board (56).

TRANSFER ARC SWITCHING TEST.

- Move the torch with pilot arc lit near the workpiece. Transfer arc switching occurs:
  - – the signal of fig. 5.2.6 (nozzle current) becomes 0 Vdc and remains unaltered for the cutting time duration (pilot arc current during cutting = 0).
  - – the signal of fig. 5.2.5 (Power Source output current) changes level. The new current level depends on the set cutting current and remains unchanged for the cutting time duration.
  - – At the same time, switching of solenoid valves V01 (14)(pilot arc) and V03 (13)(transfer arc) occurs.



- ♦ Replace the control (47) and/or power board (56).

- ♦ Make sure that the gas lines of Power Source are not clogged and, if necessary, perform the PLASMA GAS PRESSURE TEST of par. 3.3.9..
- ♦ Check for the correct opening of solenoid valve V03 (13)(27 Vac on coil terminals) in cutting operation.
- ♦ Check for torch condition, wear conditions of electrode, diffusers and nozzle.
- ♦ Check the wiring between terminals TP6 of power board (56), choke (35), HF transformer (50) and electrode terminal on central adapter (41). If you find loose connections, tighten and replace any damaged components.
- ♦ Check the wiring between J1 of power board (56), nozzle resistor (33), contactor (55), terminal J4 on sensor board (52) and between terminal J2 on sensor board (52) and nozzle terminal on central adapter (41). If you find loose connections, tighten and replace any damaged components.

3.4 - Error codes and alarm signals.

3.4.1 - 02 - Hardware lockup.

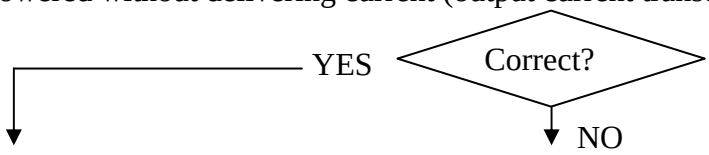
Block due to user data memory writing error. Replace control board (47).

3.4.2 - 30 - Minimum current signal error from power board (56) (current transducer offset).

This alarm is displayed when there is a current signal higher than 0 with Power Source powered but without start command.

POWER SOURCE OUTPUT CURRENT TRANSDUCER OFFSET TEST.

- Control board (47), connector J3, terminals 1(+) - 3(-) = <0.05Vdc, with Power Source powered without delivering current (output current transducer on power board (56)).



  - ♦ Check the wiring between J3 control board (47) and J3 power board (56).
  - ♦ With the Power Source off, temporarily disconnect J3 from control board (47), and check resistance between terminals 1 and 3 of J3 on control board (47). Correct value = 67 ohm. If incorrect, replace control board (47).
  - ♦ Check the presence of supply voltage at the output current transducer on power board (56), performing the POWER SOURCE OUTPUT CURRENT TRANSDUCER POWER SUPPLY TEST of par. 3.3.8.
  - ♦ Replace power board (56) and/or control board (47).
- ♦ Replace control board (47).

3.4.3 - 35 - No current at power board (56) output.

This code signals that during the cutting operation the output current delivered by the power board (56) does not correspond to the reference signal generated by the control board (47). This trouble may be caused by a fault (e.g. reduced mains voltage) and as a consequence the power board (56) cannot reach the current value expected from the control, even if the maximum possible current is fed.

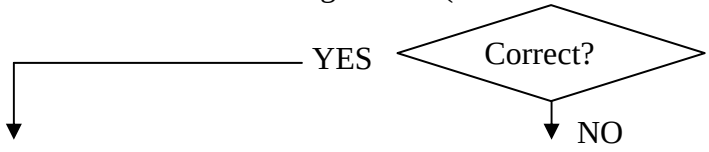
For an analysis of the trouble, perform tests of par. 3.3.8, 3.3.9 and 3.3.10, considering that the trouble may be caused by an error of the current transducers fitted in the power board (56) and so see also par. 3.4.2, 3.4.4.

3.4.4 - 39 - Nozzle current transducer reading error (current transducer offset).

This alarm is displayed when a nozzle current signal detected is higher than 0 with Power Source powered but without start command.

NOZZLE CURRENT TRANSDUCER OFFSET TEST.

- Control board (47), connector J4, terminals 1(+) - 3(-) = <0.1Vdc, with Power Source powered without delivering current (nozzle current transducer on power board (56)).



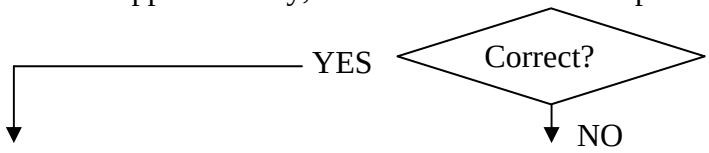
  - ♦ Check the wiring between J2 power board (56) and J4 control board (47).

- ♦ With Power Source off, temporarily disconnect J4 from control board (47) and check resistance between terminals 1 and 3 of J4 on control board (47). Correct value = approximately 21 Kohm. If incorrect, replace control board (47).
- ♦ Check the presence of supply voltage at the nozzle current transducer on power board (56), performing the NOZZLE CURRENT TRANSDUCER POWER SUPPLY TEST of par. 3.3.10.
- ♦ Replace power board (56).

3.4.5 - 40 - Dangerous voltage.

DANGEROUS VOLTAGE TEST.

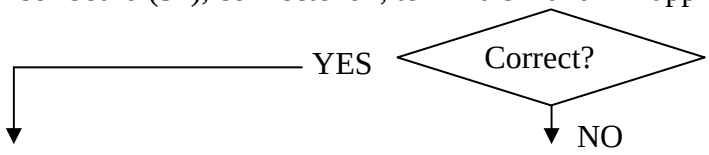
- ❑ Sensor board (52), connector J5, terminals 4(+) - 1(-) = approximately 0 Vdc, with Power Source powered and without start command; +280 Vdc approximately, with pilot arc off; +160 Vdc approximately, with start command and pilot arc lit.



- ♦ Check wiring between terminal 1 of J5 on sensor board (52), TP4 terminal on HF-filter board (32), TP2 terminal on HF-filter board (32) and common terminal between choke (35) and HF transformer (50).
- ♦ Check wiring between terminal 4 of J5 on sensor board (52), TP3 terminal on HF-filter board (32), TP1 terminal on HF-filter board (32) with output terminal (+) (ground potential) of Power Source.
- ♦ Check the continuity between terminals TP4 and TP2 on HF-filter board (32) and between terminal TP3 and TP1 on HF-filter board (32). If broken reset the connection.
- ♦ Check delivery of output voltage, performing, if necessary, the tests in par. 3.3.6..

SENSOR BOARD (52) POWER SUPPLY TEST.

- ❑ Sensor board (52), connector J7, terminals 1 and 2 = approximately 20 Vac.



- ♦ Check the wiring between J7 sensor board (52) and J1, terminals 4 and 5 on fuse board (53).
- ♦ Check fuse F3 on fuse board (53). Replace if broken after having checked, with Power Source off and J7 disconnected from sensor board (52), the resistance between terminals 1 and 2 of J7 on sensor board (52). Correct value = >Mohm in both directions. If incorrect replace the sensor board (52).
- ♦ Check 20 Vac voltage on terminals 0V-20V on fuse board (53); if correct check the wiring between services transformer (53) and fuse board (53) and replace services transformer (53), if necessary.

♦ With Power Source off, temporarily disconnect J5 from sensor board (52) and check the resistance on terminals 1 and 4 of J5 on sensor board (52). Correct value = approximately 9.5 Kohm. If incorrect replace the sensor board (52).

- ♦ Check the wiring between J3 sensor board (52) and J16 control board (47).
- ♦ With Power Source off, temporarily disconnect J16 from control board (47) and check the resistance on terminals 5 and 6 of J16 on control board (47)(V_ARC signal). Correct value = 4.7 Kohm approximately. If incorrect, replace control board (47).
- ♦ Replace sensor board (52) and/or control board (47).

3.4.6 - 49 - Nozzle current during cutting.

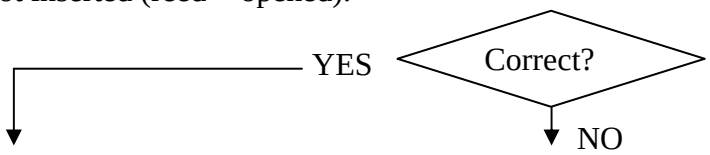
When cutting operation starts, the nozzle current must become 0. If not, torch problems or a poor cutting quality may be caused: this is signalled by error 49.

To analyze the problem perform tests in par. 3.3.10, 3.4.2 and 3.4.4.

3.4.7 - 50 - Torch central adapter protection not inserted.

TORCH CENTRAL ADAPTER PROTECTION SIGNAL TEST.

- ❑ Control board (47), connector J5, terminals 1(+) and 2(-) = 0 Vdc approximately, with protection device inserted (reed = closed); +33 Vdc approximately, with protection device not inserted (reed = opened).



  - ♦ Check wiring between J5 of control board (47) and central adapter (41) protection reed (31).
  - ♦ Check the correct position of the reed on Power Source front panel. The position is correct when the magnet on the protection hood corresponds to the reed fitted on the central adapter (41) support, when the protection device is inserted.
  - ♦ Check the supply voltage for the control board (47), performing, if necessary, the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
  - ♦ Replace the control board (47).
- ♦ Replace control board (47).

3.4.8 - 51 - Torch recognition failed.

This alarm signals that the inserted torch is not suitable for the Power Source.

On Plasma PROF 123 ACC actually is possible to install cutting torch CP161 (artt. 1230 or 1231), which is provided with an automatic recognition system.

The recognition signal is delivered by the type of connection set in the torch central adapter.

More precisely:

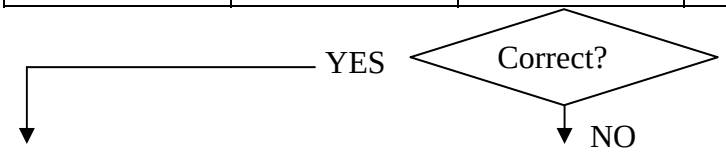
- terminals 2 and 7 of torch central adapter must be connected together;
- terminals 2 and 8 of torch central adapter are connected to a diode, with anode connected to terminal 2.

The control board (47) receives the torch recognition signal from the central adapter (41) and perform the recognition, thus enabling or stopping the Power Source operation.

CP161 TORCH RECOGNITION TEST

- Control board (47), connector J9 = signals according to following table with torch CP161 inserted in the central adapter (41).

Torch type	Voltage on J9 terminals on control board (47)			
	2 - 3	2 - 4	2 - 5	2(+) - 6(-)
CP161	24 Vac	24 Vac	0 Vac	-12 Vdc



- ♦ Check wiring between J9 control board (47) and central adapter (41).
- ♦ Check the supply voltage of the control board (47), taking special care for 24 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- ♦ Check if the torch recognition connections in the torch central adapter are intact and correspond to the CP161 torch type (see description above).
- ♦ With Power Source off, temporarily disconnect J9 from control board (47) and check the resistance between terminal 2 of J1 and terminals 3, 4, 5 and 6 of J9 on control board (47). Correct value = 7 Kohm approximately, for terminals 3, 4 and 5; junction of two diodes in both measure directions for terminal 6. If incorrect replace the control board (47).
- ♦ Replace control board (47).

♦ Replace control board (47).

3.4.9 - 53 - "trG" on displays (U). Start button pressed at start-up or during operating mode reset.

A few alarms such as "excessive temperature" stop the Power Source with the relevant signal goes on but they are not memorized and are reset automatically when conditions return within the allowed limits again.

To prevent the Power Source from starting suddenly due to a random reset, this situation is detected and causes the Power Source block, with the message "trG" displayed.

To reset the regular operation, switch off Power Source, remove the start command and switch on the Power Source again.

3.4.10 - 55 - Exhausted electrode.

NOTE

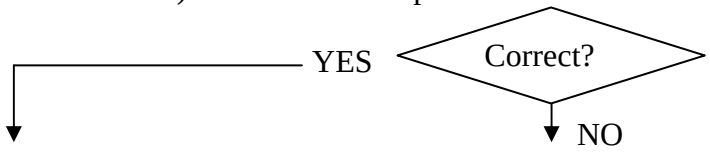
This function is controlled only during cutting (transfer arc).

This alarm signals that the electrode conditions are not sufficient to guarantee the Power Source correct operation and consequently it may be difficult to execute good quality cuts.

The following checks are recommended to solve this problem.

NOZZLE VOLTAGE TEST.

- Sensor board (52), terminal J4(+) and connector J5, terminal 1(-), voltage = fig. 5.2.3b (approximately +130 Vdc, with pilot arc lit), for a duration of 2.5 seconds (pilot arc maximum time) with start button pressed.



- ♦ Check delivery of output voltage, performing, if necessary, the tests in par. 3.3.6., taking special care the NOZZLE VOLTAGE TEST of par. 3.3.6.
- ♦ Replace sensor board (52) and/or control board (47).

- ♦ With Power Source off, temporarily disconnect J5 from sensor board (52) and check the resistance between terminals J4 and 1 of J5 on sensor board (52). Correct value = approximately 10 Kohm. If different replace the sensor board (52).
- ♦ Check the wiring between J3 sensor board (52) and J16 control board (47).
- ♦ With Power Source off, temporarily disconnect J16 from control board (47) and check the resistance on terminals 1 and 2 of J16 on control board (47)(V_NOZZLE signal). Correct value = 4.7 Kohm approximately. If incorrect, replace control board (47).
- ♦ Check the supply voltage for the sensor board (52) performing, if necessary, the SENSOR BOARD (52) POWER SUPPLY TEST of par. 3.4.5.
- ♦ Check electrode and torch nozzle; replace if worn or damaged.
- ♦ Check good isolation of torch internal parts, cable included and replace the complete torch if necessary.
- ♦ Replace sensor board (52) and/or control board (47).

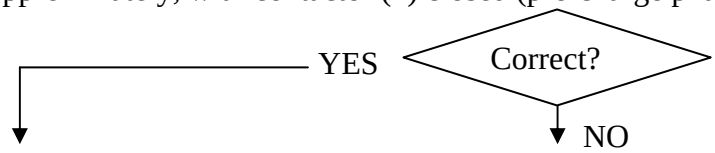
3.4.11 - 67 - Mains voltage does not meet specifications.

The measure board (57) contains detect and analysis circuit of mains voltage, whose result is sent to control board (47). Specifically, the presence and correct values of the mains voltage three phases are detected by checking if their values meet the allowed limits.

The mains voltage is taken on the rectifier bridge (34) terminals and consequently the mains analysis is performed only when contactor (2) is closed (after pre-charge phase).

MAINS VOLTAGE SIGNAL TEST.

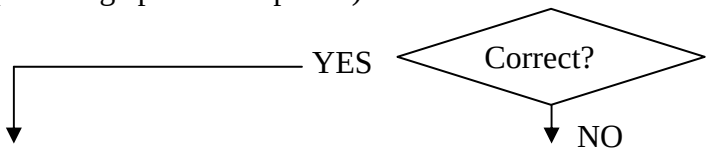
- ❑ Measure board (57), connector J2, terminals 1-3 = terminals 3-5 = terminals 5-1 = 190 Vac approximately, with contactor (2) closed (pre-charge phase completed).



- ♦ Check the wiring between J2 measure board (57) and rectifier bridge (34) terminals.
- ♦ Make sure the presence and correct values of the mains voltage three phases performing, if necessary, the tests of par. 3.3.1.

MEASURE BOARD (57) POWER SUPPLY TEST.

- ❑ Measure board (57), connector J5, terminals 1(+) and 6(-) = +5 Vdc, with contactor (2) closed (pre-charge phase completed).



- ♦ Check the wiring between J5 measure board (57) and J19 control board (47).

- ♦ With Power Source off, temporarily disconnect J19 from control board (47) and check the resistance between terminals 1 and 2 of J19 on control board (47). Correct value = junction of two diodes in both measure directions. If incorrect, replace control board (47).
- ♦ Replace the measure board (57).

♦ With Power Source off, temporarily disconnect J2 from measure board (57) and check resistance between terminals 1-3-5 of J2 on measure board (57). Correct value = 7 Mohm approximately, between all points and in both measure directions. If incorrect replace the measure board (57).

♦ With Power Source off, temporarily disconnect J19 from control board (47) and check the resistance between terminals 1 and 2 of J19 on control board (47). Correct value = junction of two diodes in both measure directions. If incorrect, replace control board (47).

♦ Replace measure board (57) and control board (47).

3.4.12 - 73 - "TH""0" on displays (U) (V). Transformer (37) high temperature.

3.4.13 - 74 - "TH""1" on displays (U) (V). Power board (56) igbt group high temperature.

With these alarms we recommend that you do not shut off the Power Source, to keep the fan running and thus cool the unit more rapidly. Normal operation is restored automatically as soon as the temperature returns within the allowed limits.

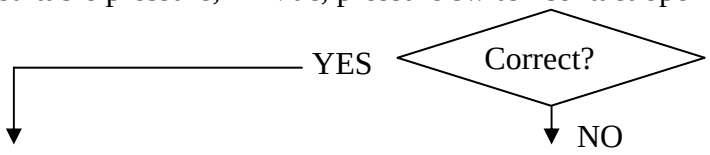
- Make sure the fan (23) is working properly, performing if necessary the test in par. 3.3.2.
- Check for proper air flow and make sure there is no dust nor obstacles to cooling the Power Source internal part.
- Make sure that the operating conditions meet the specification values; especially observe the "duty cycle".
- Make sure the thermostats on transformer (37) and on power boards (56) igbt group dissipater are properly fitted and in good working order; at room temperature their contacts must be closed.
- Check the supply voltage of the control board (47) taking special care for 27 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
- Check the wiring between the thermostat on transformer (37) and J12, terminals 3 and 4 on control board (47).
- With Power Source off, temporarily disconnect the thermostat on transformer (37). Power up the Power Source again and check on the patch connectors disconnected from the thermostat, voltage = 27 Vac, with switch (49) closed (alarm condition). If incorrect, replace control board (47).
- Check wiring between the thermostat on power board (56) igbt group dissipater and terminal J4-A and J4-B on power board (56) and between J6 power board (56) and J12, terminals 1 and 2 on control board (47).
- Make sure the continuity between terminals J4-A with J6-2 and between J4-B with J6-1 on power board (56). If interrupted reset original connections.
- With Power Source off, temporarily disconnect J6 from power board (56). Power up the Power Source again and check on the patch connector disconnected from J6 voltage = 27 Vac (alarm condition). If incorrect, replace control board (47).
- Replace control board (47).

3.4.14 - 78 - "GAS""LO" on displays (U) (V). Gas low pressure.

This alarm signals that plasma gas pressure is below the minimum value allowed for a correct operation. The pressure signal is supplied by the pressure switch (15).

PRESSURE SWITCH (15) TEST.

- Control board (47), connector J12, terminals 5 and 6 = 0 Vdc, pressure switch contact closed = suitable pressure; 27 Vac, pressure switch contact open = pressure low).



  - ♦ Check the wiring between pressure switch (15) and J12, terminals 5 and 6 on control board (47).
  - ♦ Check the supply voltage of the control board (47) taking special care for 27 Vac voltage carrying out the CONTROL BOARD (47) POWER SUPPLY TEST of par. 3.3.1.
  - ♦ With Power Source off, temporarily disconnect the wires from pressure switch (15) terminals. Power up the Power Source again and check on the patch connector disconnected from pressure switch (15), voltage = 27 Vac, with switch (49) closed (alarm condition). If incorrect, replace control board (47).
  - ♦ Check for pressure switch (15) integrity, varying, with knob (L), the gas plasma pressure, during the post gas phase (that is with the gas flowing out from the torch). The pressure switch (15) contact must opens for a pressure value of approximately 3.2 bars, read on the regulator (L) gauge. If defective replace it.
  - ♦ Make sure that gas lines are not clogged where pressure switch (15) is connected.
  - ♦ Replace pressure switch (15) and/or control board (47).

- ♦ Replace control board (47).

3.4.15 - 99 - "OFF" on display (U). Incorrect mains voltage (machine shutdown).

This message appears normally, and briefly, each time the Power Source is shut off.

When mains voltage is missing, for example after the switch (49) opening, all control circuits remain powered for a few seconds due to the effects of the capacitors charge in the various boards power feeders.

The supply board (51) detects the control board (47) supply voltage decreased (for instance failed mains voltage), transfers it to control board (47) ("UV" signal on connector J2 of control board (47)) that stops the Power Source with the "OFF" indication shown on display (U).

The "UV" signal may be tested on J3 of supply board (51), on terminals 1(+) and 2(-);:0 Vdc = mains not suitable; +1.1 Vdc approximately = mains suitable.

If correct replace control board (47).

If not correct, with Power Source off, temporarily disconnect J3 from supply board (51) and check the resistance between terminals 1 and 2 of the patch connector disconnected from J3 of supply board (51). Correct value = junction of two diodes in both measure directions. If incorrect, replace control board (47). If correct replace the supply board (51).

Carry out the tests of par. 3.3.1 and replace the supply board (51) and or control board (47) if necessary.

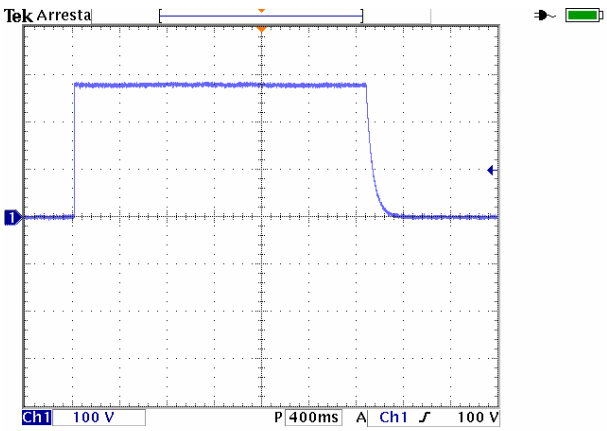
4 - COMPONENTS LIST.

4.1 - Plasma PROF 123 ACC : see file ESP956.pdf enclosed at the end of the manual.
4.2 - Components table: see file ESP956.pdf enclosed at the end of the manual.

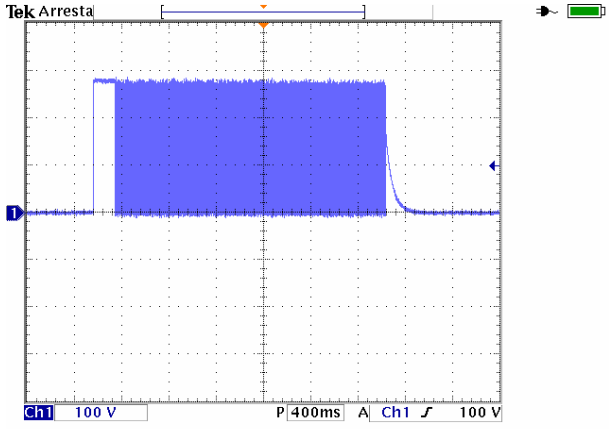
5 - ELECTRICAL DIAGRAMS.

5.1 - Plasma PROF 123 ACC : see file SCHE956.pdf enclosed at the end of the manual.

5.2 - Waveforms.

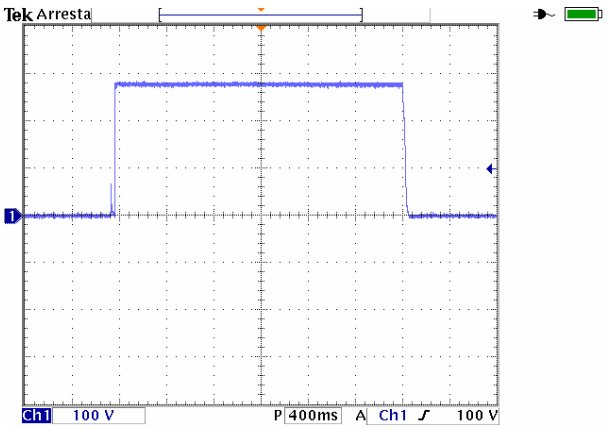


a) with pilot arc off

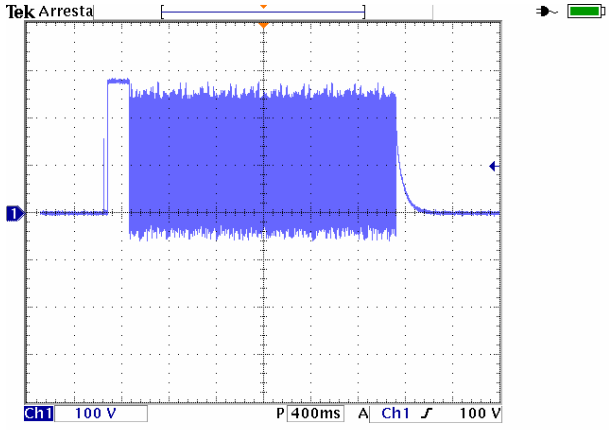


b) with pilot arc on

5.2.1 - Power Source output voltage (par. 3.3.6, 3.3.8).

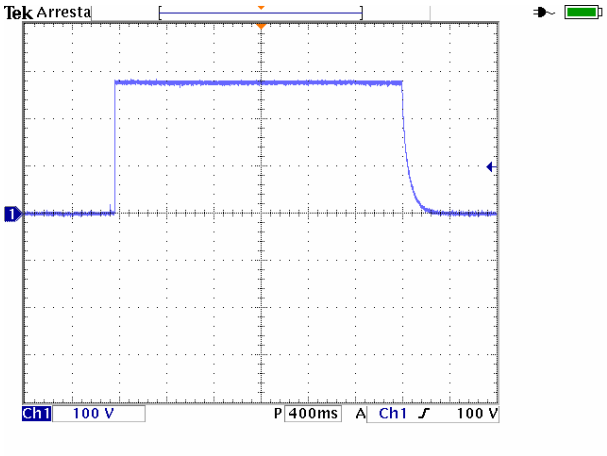


a) with pilot arc off

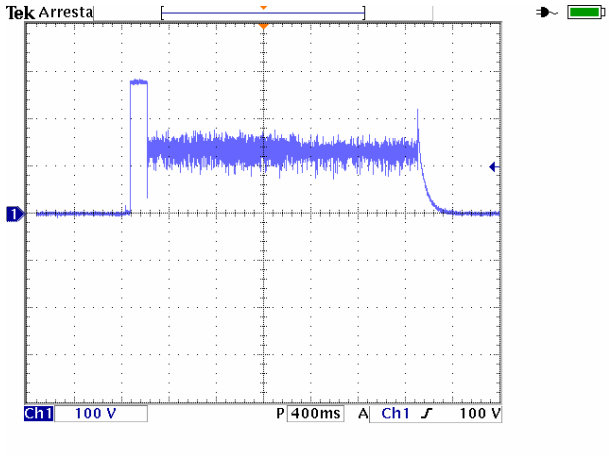


b) with pilot arc on

5.2.2 - Nozzle output voltage (par. 3.3.6, 3.3.7, 3.3.9).

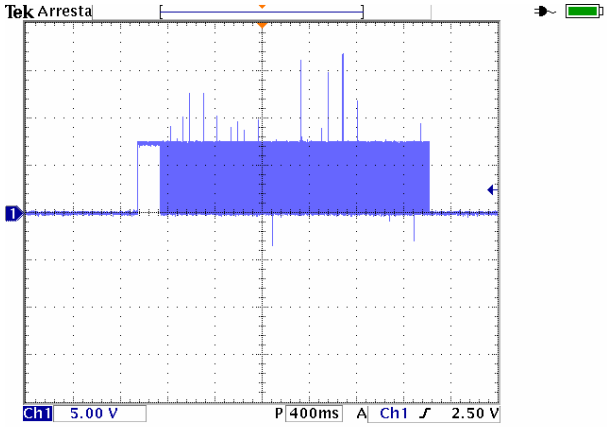


a) with pilot arc off

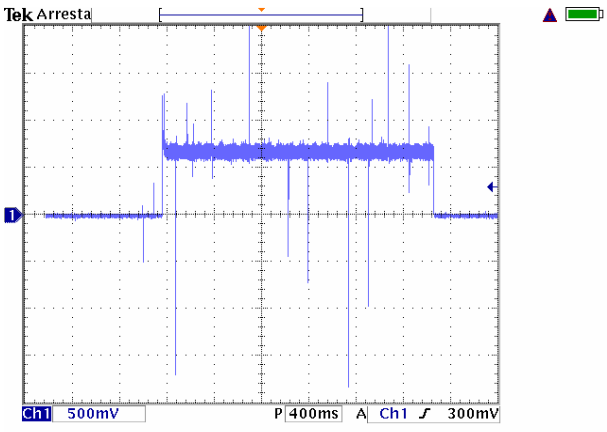


b) with pilot arc on

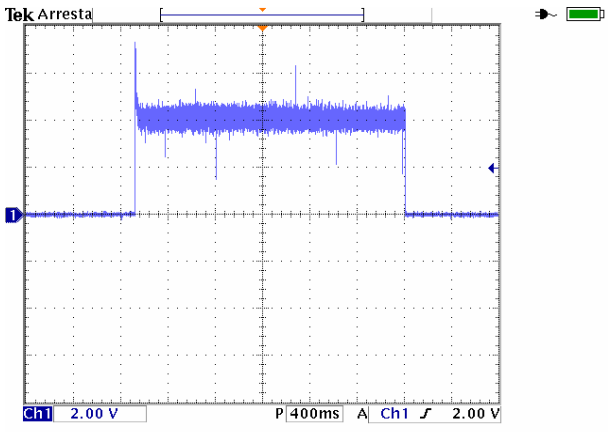
5.2.3 - HF board (27) input voltage = pilot arc voltage (par. 3.3.7, 3.4.10).



5.2.4 - Pilot arc current reference signal (par. 3.3.8).



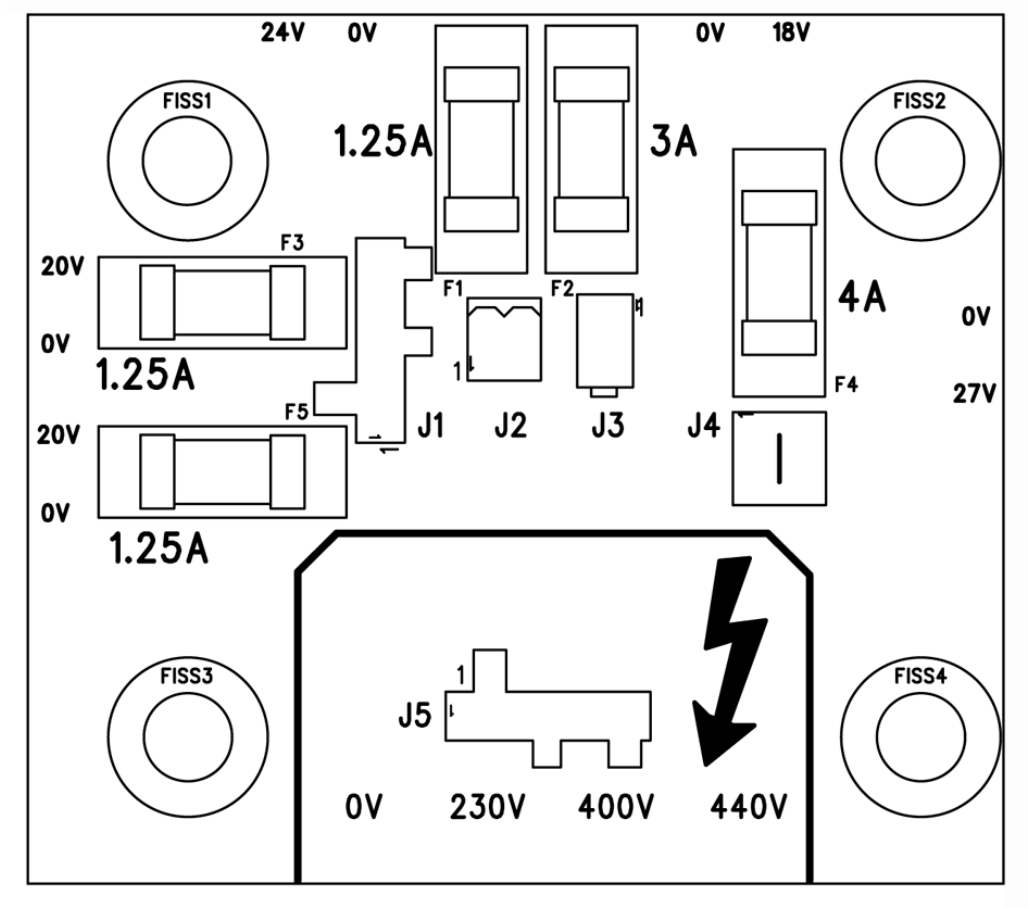
5.2.5 - Power Source output current feedback signal (par. 3.3.8).



5.2.6 - Nozzle current feedback signal (par. 3.3.10).

5.3 - Fuse board (53), code 5.602.403.

5.3.1 - Topographical drawing.

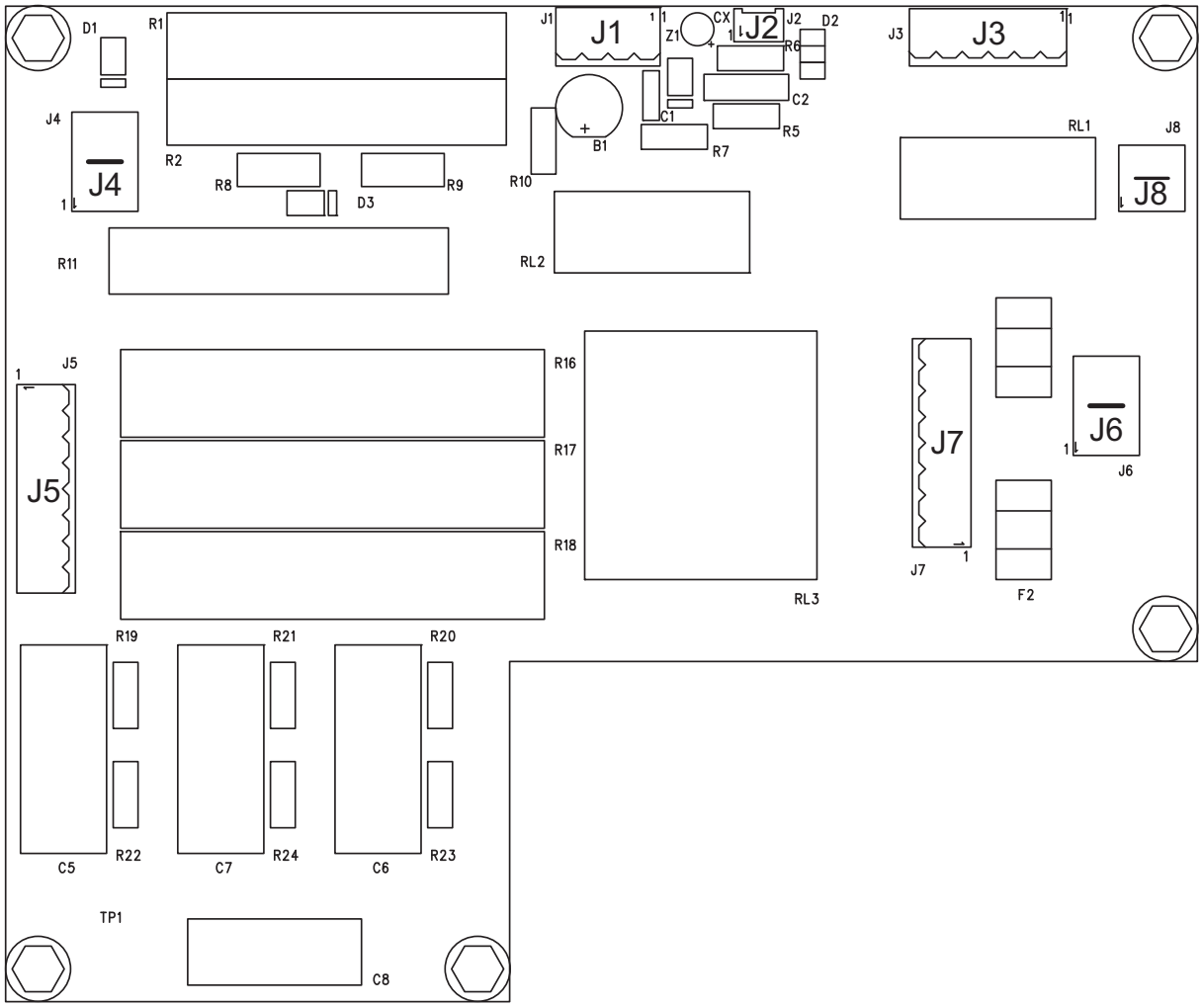


5.3.2 - Connector and fuse table.

Conn.	Terminals	Fuse	Value	Function
J1	1 - 2	F5	1.25 A	20 Vac output, driver board (56) power supply.
J1	4 - 5	F3	1.25 A	20 Vac output, sensor board (52) power supply.
J2	1 - 2	F1	1.25 A	24 Vac output, control board (47) power supply (start button, torch recognition, central adapter (41) protection circuits).
J3	1 - 2	F2	3 A	18 Vac output, supply board (51) power supply.
J4	A - B	F4	4 A	27 Vac output, control board (47) power supply (solenoid valves, contactors, pre-magnetization circuits).
J5	1	-	-	0 Vac input, services transformer (53) power supply.
J5	3	-	-	230 Vac input, services transformer (53) power supply.
J5	4	-	-	400 Vac input, services transformer (53) power supply.
J5	5	-	-	440 Vac input, services transformer (53) power supply.

5.4 - Pre-charge board (3), code 5.602.415.

5.4.1 - Topographical drawing.



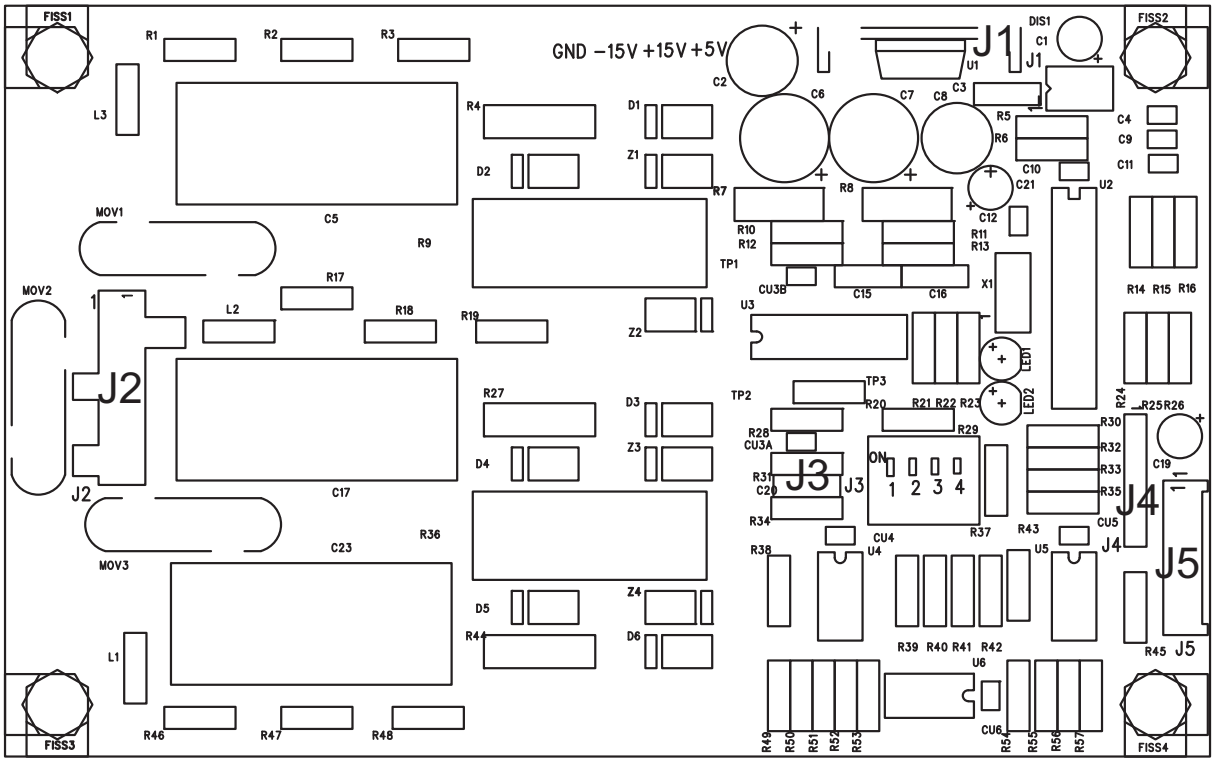
5.4.2 - Connector and fuse table.

Conn.	Terminals	Function
J1	-	NU.
J2	-	NU.
J3	1 - 2	NU.
J3	3 - 4	transformer (37) pre-magnetization relay command input.
J3	5 - 6	NU.
J4	B(+) - A(-)	+280 Vdc input from DC-capacitor (20), for load resistors on pre-charge board (3).
J5	1-4-7	transformer (37) pre-magnetization power supply input.
J6	A - B	services transformer (53) power supply output.
J7	1-4-7	transformer (37) pre-magnetization power supply output.
J8	-	NU.

Fuse	Value	Function
F2	5 A	services transformer (53) power supply.

5.5 - Measure board (57), code 5.602.388.

5.5.1 - Topographical drawing.

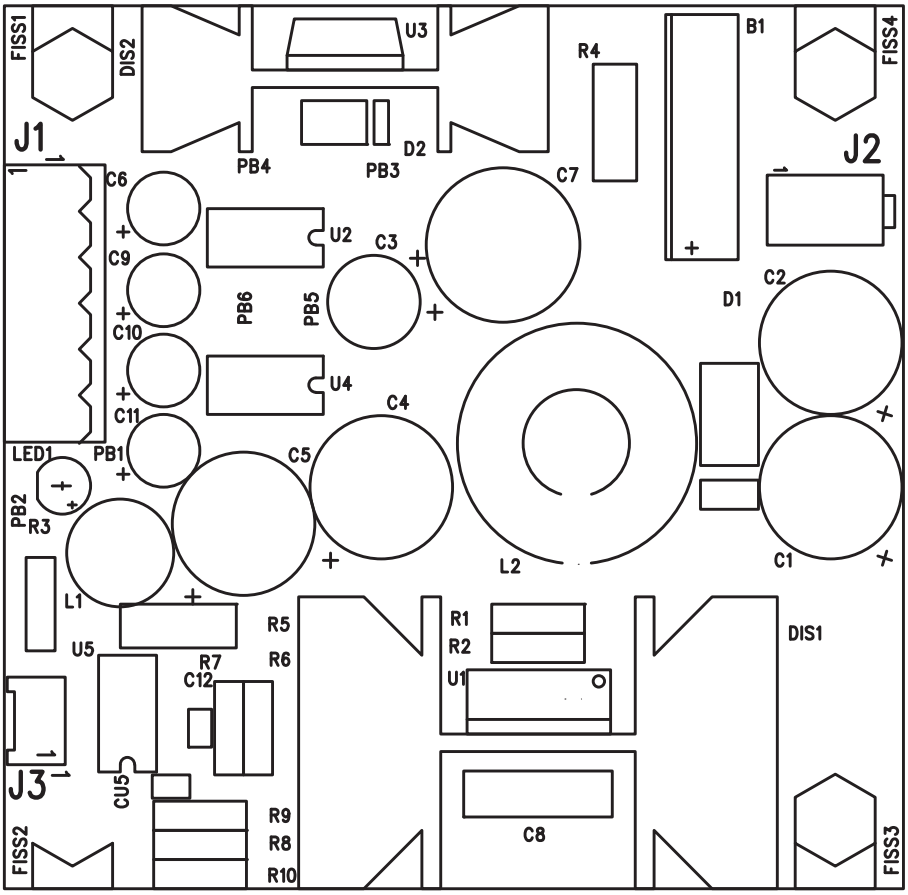


5.5.2 - Connector table.

Conn.	Terminals	Function
J1	-	NU.
J2	1-3-5	rectifier bridge (34) three phase voltage supply input.
J3	-	NU.
J4	-	NU.
J5	1(+) - 2(-)	“suitable mains voltage” signal output.
J5	3-4-5	NU.
J5	6	Gnd.

5.6 - Supply board (51), code 5.602.299/D.

5.6.1 - Topographical drawing.

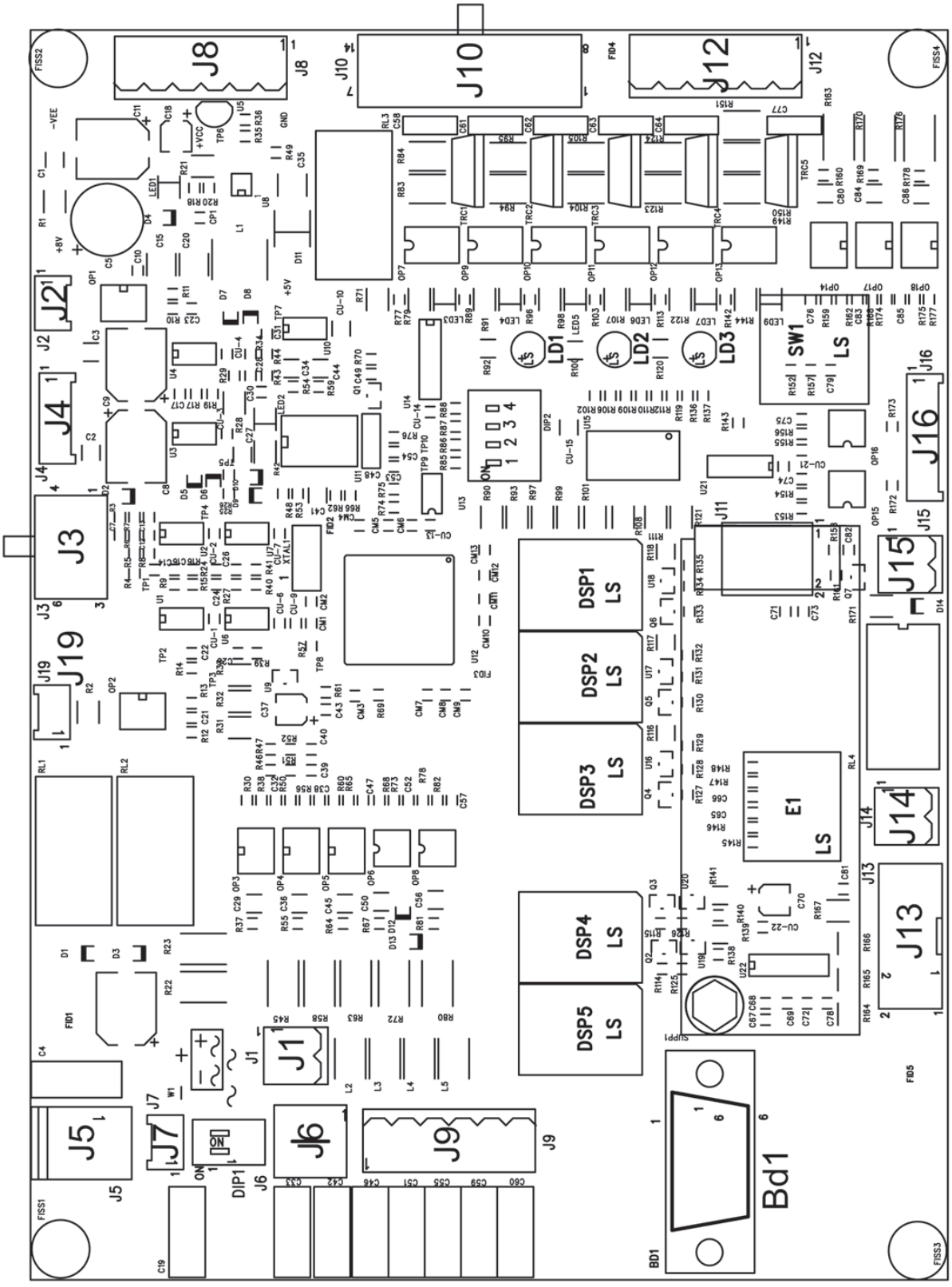


5.6.2 - Connector table.

Conn.	Terminals	Function
J1	1(+) - 2(-)	+ 15 Vdc output for control board (47) power supply.
J1	3(+) - 2(-)	-15 Vdc-1 output for control board (47) power supply.
J1	4(+) - 2(-)	-15 Vdc-2 output for control board (47) power supply.
J1	5(+) - 6(-)	+8 Vdc output for control board (47) power supply.
J2	1 - 2	18 Vac input for supply board (51) power supply.
J3	2(+) - 1(-)	“UV” signal output (control board (47) power supply incorrect voltage).

5.7 - Control board (47), code 5.602.398/A.

5.7.1 - Topographical drawing.

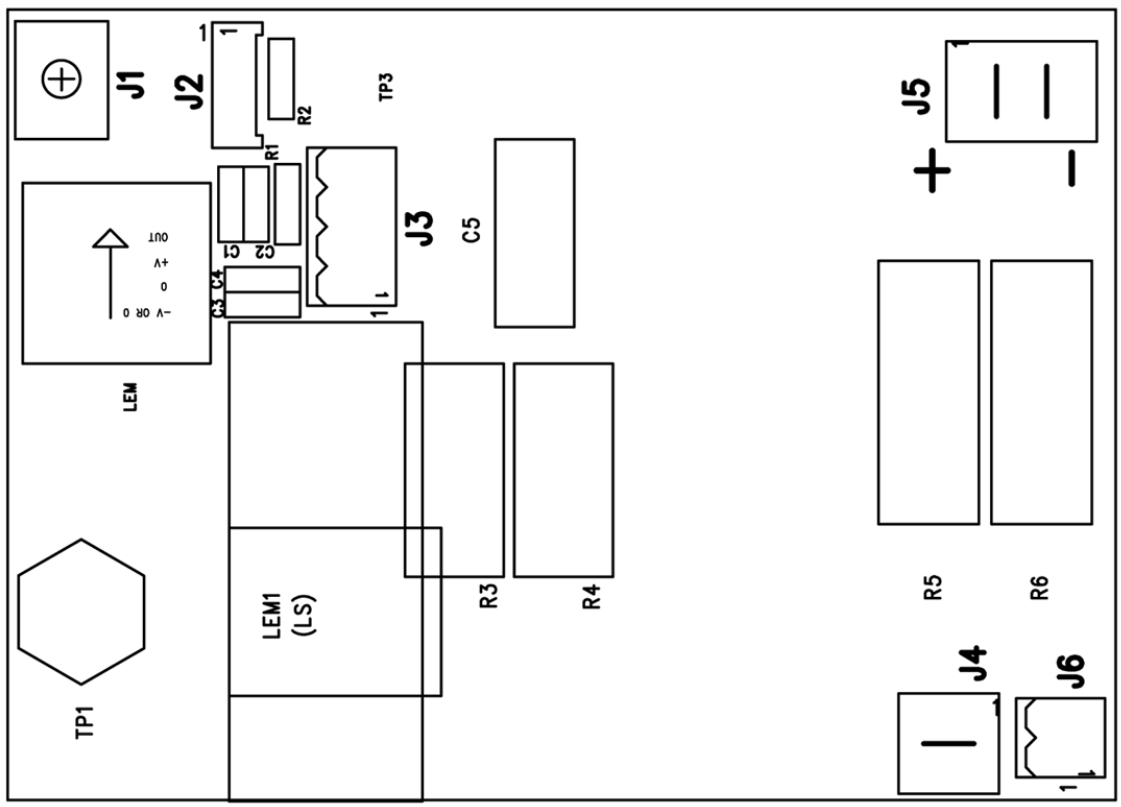


5.7.2 - Connector table.

Conn.	Terminals	Function
J1	1 - 2	24 Vac input for services power supply (start button, torch recognition, central adapter (41) protection circuits).
J2	1(+) - 2(-)	“UV” signal input (control board (47) power supply incorrect voltage).
J3	1	“Power Source output current” signal input.
J3	2(+) - 3(-)	+15 Vdc output for Power Source output current transducer power supply.
J3	4(+) - 3(-)	-15 Vdc output for Power Source output current transducer power supply.
J3	5(+) - 6(-)	igbt command output on power board (56).
J4	1	“nozzle current” signal input.
J4	2(+) - 3(-)	+15 Vdc output for nozzle current transducer power supply.
J4	4(+) - 3(-)	-15 Vdc output for nozzle current transducer power supply.
J5	1(+) - 2(-)	“torch central adapter (41) protection” signal input.
J6	A(+) - B(-)	“start” signal input from torch button.
J7	-	NU.
J8	1(+) - 2(-)	+15 Vdc input for control board (47) power supply.
J8	3(+) - 2(-)	-15 Vdc- 1 input for control board (47) power supply.
J8	4(+) - 2(-)	NU. (-15 Vdc-2).
J8	5(+) - 6(-)	+8 Vdc input for control board (47) power supply.
J9	1	NU.
J9	2	common output for torch recognition signals.
J9	3-4-5-6	torch recognition signals inputs.
J10	1 - 8	solenoid valve V01 (14) command output.
J10	2 - 9	solenoid valve V03 (13) command output.
J10	3 - 10	NU.
J10	4 - 11	contactor (55) command output.
J10	5 - 12	contactor (2) command output.
J10	6 - 13	transformer (37) pre-magnetization relay command output.
J10	7 - 14	27 Vac input for services power supply (solenoid valves, contactors, pre-magnetization relay circuits).
J11	-	NU.
J12	1 - 2	temperature signal input from thermostat on power board (56) igbt group dissipater.
J12	3 - 4	temperature signal input from thermostat on transformer (37).
J12	5 - 6	Plasma gas pressure signal input from pressure switch (15).
J13	-	NU.
J14	-	NU.
J15	-	NU.
J16	1(+) - 2(-)	“nozzle voltage” digital signal input.
J16	3 - 4	NU.
J16	5(+) - 6(-)	“arc voltage” digital signal input.
J17	-	NU.
J18	-	NU.
J19	1(+) - 2(-)	“mains voltage suitable” signal input.
BD1	-	Power Source programming connector.

5.8 - Power board (56), code 5.602.401.

5.8.1 - Topographical drawing.

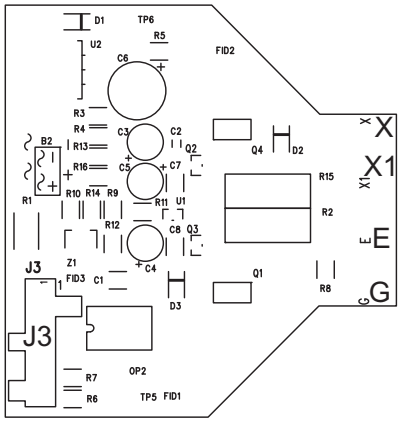


5.8.2 - Connector table.

Conn.	Terminals	Function
J1	-	output voltage output, nozzle potential (+).
J2	1	“nozzle current” signal output.
J2	2(+) - 3(-)	+15Vdc input for nozzle current transducer power supply.
J2	4(+) - 3(-)	-15 Vdc input for nozzle current transducer power supply.
J3	1	“Power Source output current” signal output.
J3	2(+) - 3(-)	+15 Vdc input for Power Source output current transducer power supply.
J3	4(+) - 3(-)	-15 Vdc input for Power Source output current transducer power supply.
J4	A - B	temperature signal input from thermostat of power board (56) igbt group dissipater.
J5	A(+) - C(-)	+280 Vdc output for connection with load resistors on pre-charge board (3).
J6	1 - 2	temperature signal output from thermostat on power board (56) igbt group dissipater.
-	TP1	output voltage output, ground potential (+).
-	TP6	output voltage output, electrode potential (-).

5.9 - Driver board (56), code 5.602.396.

5.9.1 - Topographical drawing.

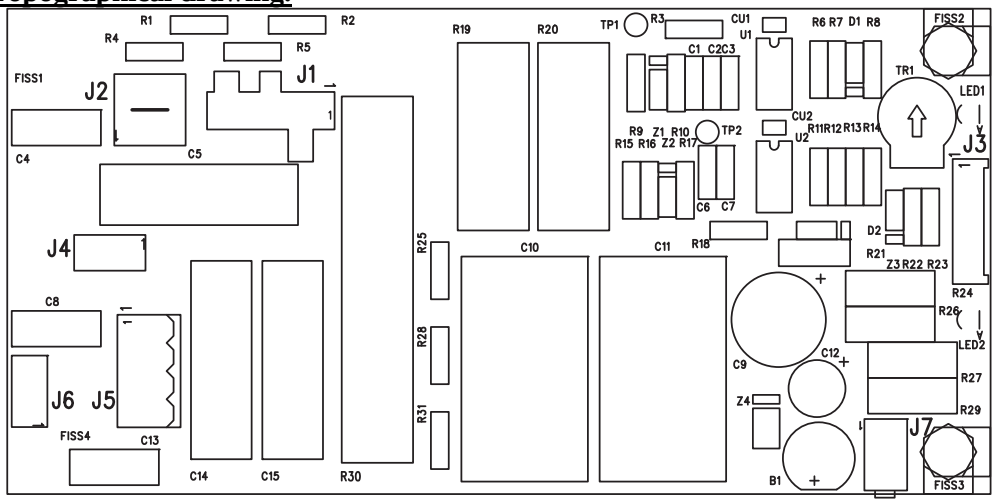


5.9.2 - Connector table.

Conn.	Terminals	Function
J3	1 - 2	20 Vac input for driver board (56) power supply.
J3	3	NU.
J3	5(+) - 4(-)	power board (56) igbt command input.
-	G	output for igbt gate terminal on power board (56).
-	E	output for igbt emitter terminal on power board (56).
-	X - X1	NU.

5.10 - Sensor board (52), code 5.602.416.

5.10.1 - Topographical drawing.

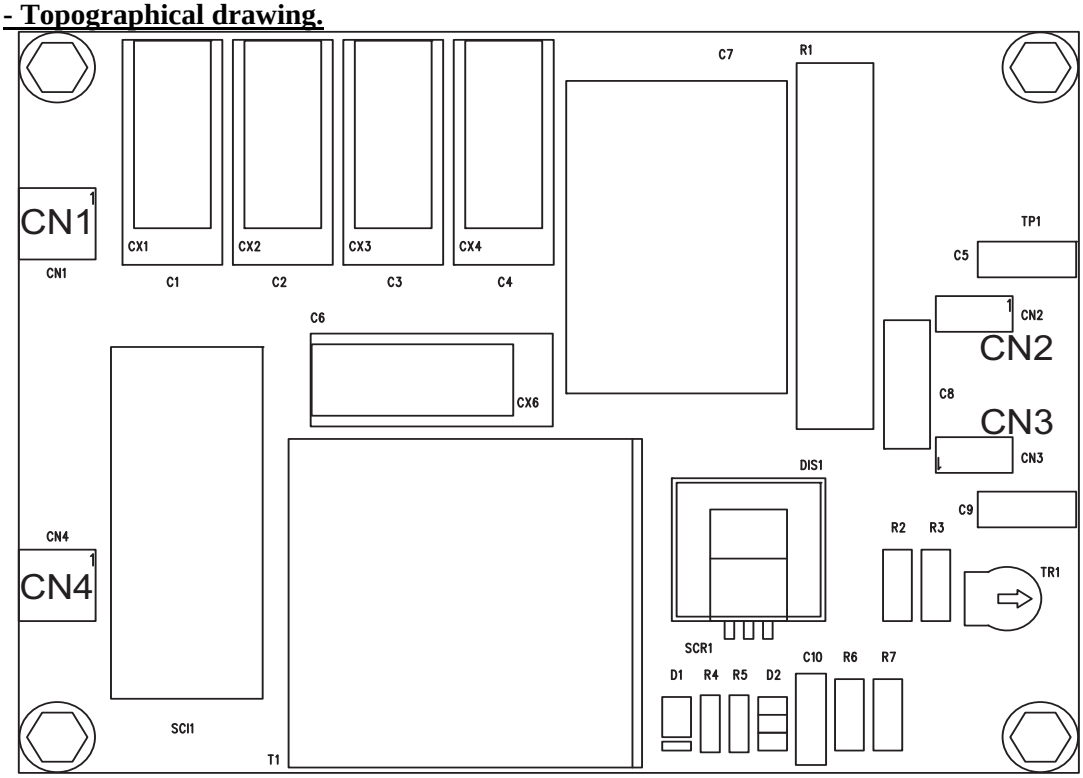


5.10.2 - Connector table.

Conn.	Terminals	Function
J1	4(+) - 1(-)	“Power Source output voltage” output for HF board (27) command.
J2	A-B	Power Source output voltage output for central adapter (41)(nozzle potential).
J3	1(+) - 2(-)	“nozzle voltage” digital signal output.
J3	3 - 4	NU.
J3	5(+) - 6(-)	“arc voltage” digital signal output.
J4	-	Power Source output voltage input (nozzle potential).
J5	4(+) - 1(-)	Power Source output voltage input (ground - electrode).
J6	-	NU.
J7	1 - 2	20 Vac input for sensor board (52) power supply.

5.11 - HF board (27), code 5.602.034/B.

5.11.1 - Topographical drawing.

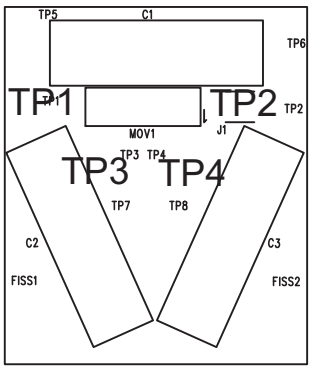


5.11.2 - Connector table.

Conn.	Terminals	Function
-	CN1 - CN4	output for HF transformer (50) primary circuit.
-	CN2	Power Source output voltage input (nozzle potential).
-	CN3	Power Source output voltage input (electrode potential).

5.12 - HF-filter board (32), code 5.602.376.

5.12.1 - Topographical drawing.



5.12.2 - Connector table.

Conn.	Terminals	Function
J1	-	NU.
-	TP1	connection to Power Source + output terminal (ground potential).
-	TP2	connection to Power Source - output terminal (electrode potential).
-	TP3	Power Source output voltage output (ground potential) for sensor board (52).
-	TP4	Power Source output voltage output (electrode potential) for sensor board (52).

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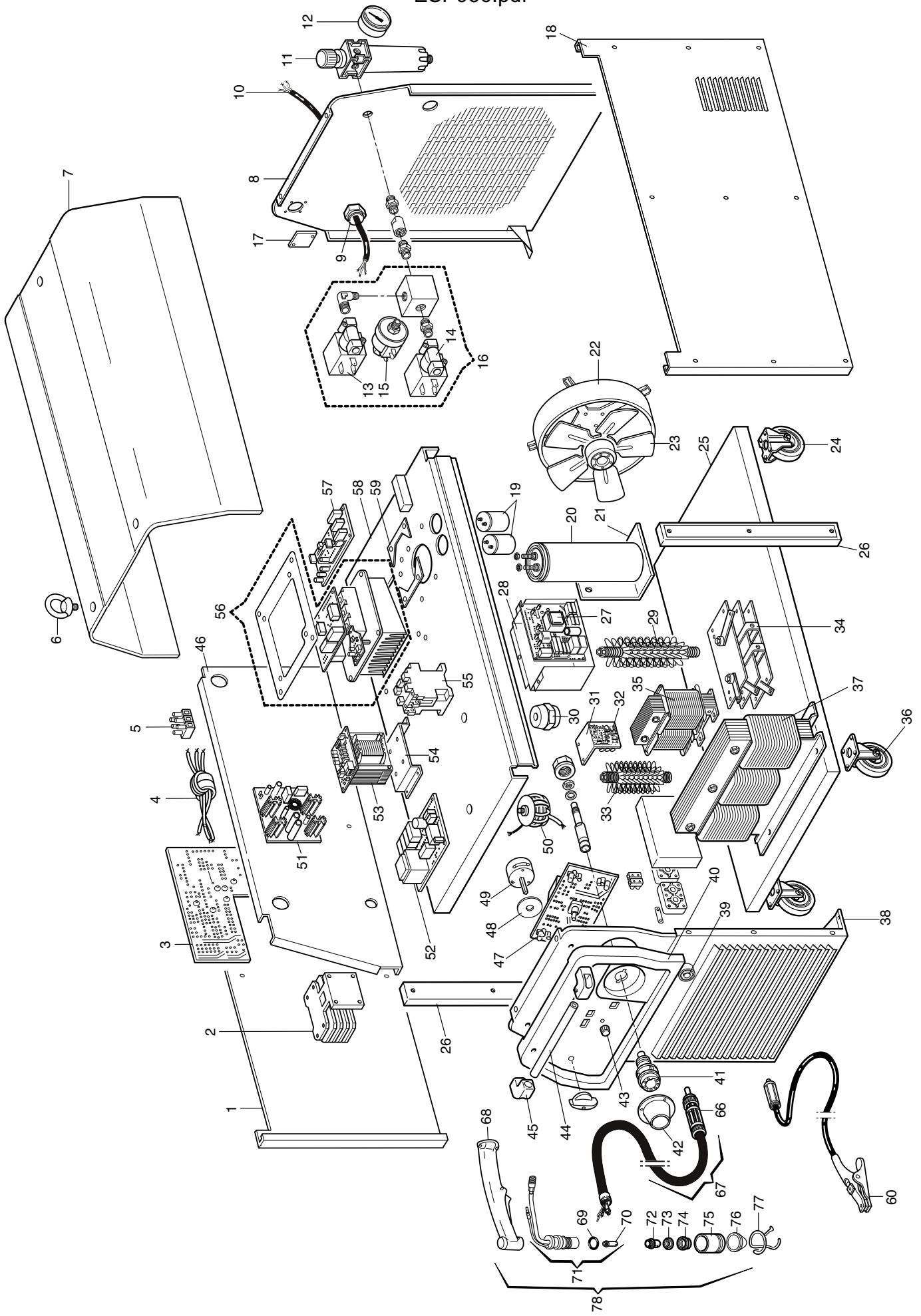
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pos	DESCRIZIONE	DESCRIPTION
01	LATERALE SINISTRO	LEFT SIDE PANEL
02	TELERUTTORE	CONTACTOR
03	CIRCUITO DI PRECARICA	PRECHARGE CIRCUIT
04	CONNESSIONE	CONNECTION
05	MORSETTIERA	TERMINAL BOARD
06	GOLFARA	EYEBOLT
07	COPERCHIO	COVER
08	PANNELLO POSTERIORE	BACK PANEL
09	PASSACAVO	CABLE OUTLET
10	CAVO RETE	POWER CORD
11	RIDUTTORE	REGULATOR
12	MANOMETRO	GAUGE
13	ELETTROVALVOLA	SOLENOID VALVE
14	ELETTROVALVOLA	SOLENOID VALVE
15	PASSACAVO	CABLE OUTLET
16	GRUPPO ARIA	AIR UNIT
17	APPOGGIO	REST
18	LATERALE DESTRO	RIGHT SIDE PANEL
19	CONDENSATORE	CAPACITOR
20	CONDENSATORE	CAPACITOR
21	SUPPORTO CONDENSATORE	CAPACITOR SUPPORT
22	TUNNEL	COOLING TUNNEL
23	MOTORE CON VENTOLA	MOTOR WITH FAN
24	RUOTA FISSA	FIXED WHEEL
25	FONDO	BOTTOM
26	RINFORZO	REINFORCEMENT
27	CIRCUITO H.F	H.F. CIRCUIT
28	PROTEZIONE	PROTECTION
29	RESISTENZA	RESISTANCE
30	SUPPORTO	SUPPORT
31	SUPPORTO CIRCUITO	CIRCUIT SUPPORT
32	CIRCUITO FILTRO H.F	H.F. FILTER CIRCUIT
33	RESISTENZA	RESISTANCE
34	RADDRIZZATORE	RECTIFIER
35	IMPEDENZA	CHOKE
36	RUOTA PIROETTANTE	SWIVELING WHEEL
37	TRASFORMATORE DI POTENZA	POWER TRANSFORMER

pos	DESCRIZIONE	DESCRIPTION
38	PANNELLO ANTERIORE	FRONT PANEL
39	PRESA GIFAS	GIFAS SOCKET
40	CORNICE	FRAME
41	ADATTATORE FISSO	FIXED ADAPTOR
42	PROTEZIONE TORCIA	TORCHE PROTECTION
43	MANOPOLA	KNOB
44	MANICO	HANDLE
45	SUPPORTO MANICO	HANDLE SUPPORT
46	PIANO INTERMEDIO	INSIDE BAFFLE
47	CIRCUITO MICRO	MICRO CIRCUIT
48	PROTEZIONE	PROTECTION
49	INTERRUTTORE	SWITCH
50	TRASFORMATORE H.F.	H.F. TRANSFORMER
51	CIRCUITO ALIMENTAZIONE	SUPPLY CIRCUIT
52	CIRCUITO FILTRO	FILTER CIRCUIT
53	TRASFORMATORE DI SERVIZIO	AUXILIARY TRANSFORMER
54	SUPPORTO TRASFORMATORE	TRANSFORMER SUPPORT
55	TELERUTTORE	CONTACTOR
56	GRUPPO IGBT	IGBT UNIT
57	CIRCUITO DI MISURA	MEASUR CIRCUIT
58	PIANO INTERMEDIO	INSIDE BAFFLE
59	BLOCCAGGIO	LOCKING DEVICE
60	CAVO MASSA	EARTH CABLE
66	ADATTATORE MOBILE	MOVABLE ADAPTOR
67	CAVO TORCIA	TORCH CABLE
68	IMPUGNATURA CON PULSANTE	HANDGRIP WITH PUSHBUT TON
69	ANELLO O.R.	O.RING
70	DIFFUSORE	DIFFUSER
71	CORPO TORCIA (TESTINA)	TORCH BODY (HEAD)
72	ELETTRODO (CONF. DA 5 PZ.)	ELECTRODE (PACK. 5 PCS.)
73	DIFFUSORE ISOLANTE (CONF. DA 2 PZ.)	SWIRL RING (PACK 2 PCS.)
74	UGELLO (CONF. DA 5 PZ.)	NOZZLE (PACK. 10 PCS.)
75	PORTAUGELLO	NOZZLE HOLDER
76	PROTEZIONE UGELLO	NOZZLE PROTECTION
77	MOLLA DISTANZIALE	SPACING SPRING
78	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.

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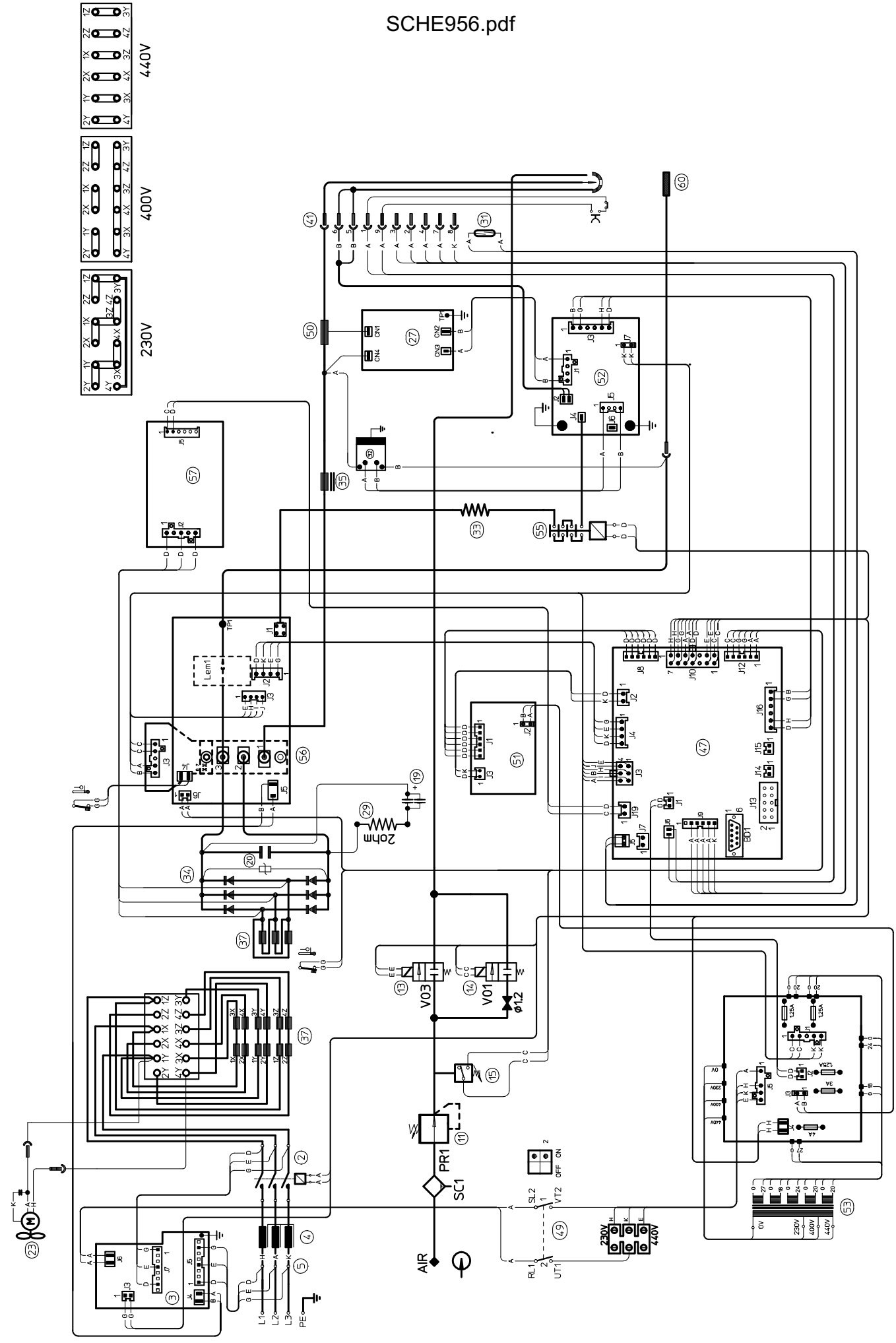
440V
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L1
L2
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RL1
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SL2
OFF
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