POWER PLASMA 3100

POWER SOURCE art. 296

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. 296 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 Instructions Manual, as well as to maintain the equipment and related accessories in good working condition, in compliance with the instructions provided in the Service Manual.

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

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

1.3 - Safety information.

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

Always disconnect the power cord from the mains, and wait for the internal capacitors to discharge (6 minutes) 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 POWER PLASMA 3100 is a plasma arc system for cutting electrically conductive materials.

It is made up of an electronic power source (art. 296), with built-in torch and trolley for easy movement.

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, Instructions Manual, and Sales Catalogue.

2.3 - Description of power source art. 296.

Art. 296 is a direct current power source with controlled current, consisting of a single-phase rectifier bridge and a DC/DC mosfet converter.

It may be powered at either 115 or 230 Vac; the unit adapts automatically based on the voltage applied to the power source input.

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

The main switch (9) powers the filter board (36), which contains the filter to reduce conducted interference reflected in the mains.

The power board (35) is the actual source of the cutting current, which converts the alternating voltage at the filter board (36) output into direct current, continuously adjusted based on cutting needs. It contains the power circuits and control circuits that adjust the cutting current.

The cutting current is adjusted in the power board (35), based on the signals generated by the microprocessor of the panel board (31), according to the signal of the current potentiometer (M) and the operating mode set using the button (P), located on the front panel of the power source.

The microprocessor also controls the conditions of the mains voltage, to select the supply voltage (115 or 230 Vac), and protections needed to safeguard the power source (see Alarm signals, par. 3.4). In the case of a 115 Vac power supply, a special voltage duplicator circuit is activated on the power board (35), to raise the direct current on the capacitors of the power board (35) to a value close to what would normally be had with a supply voltage of 230 Vac, thus approximately 320 Vdc.

In this way the DC/DC converter, serial-connected downstream from the capacitors on the power board (35), always works in the same way whatever the supply voltage.

Similarly, the fan (15) is also always powered at 230 Vac, even with a power source supply voltage of 115 Vac.

The panel board (31) is the control panel of the power source, and receives the power from the power board (35). It contains the leds to indicate the operating status, the button to activate the “PILOT SELF-RESTART”, and the cutting current adjustment knob. This board also receives the temperature signals from the thermostat on the power board (35) and the plasma gas pressure signals from the pressure switch (32). All of these functions are managed by the microprocessor on the panel board (31).

Connected to the output of the power board (35) is the HF board (22) which, together with the HF transformer mounted on it, generates the high voltage and high frequency pulses necessary to strike the pilot arc. Its operation depends on the presence of AC voltage on the secondary circuit of the power transformer on the power board (35), and is controlled by the HF enable signal generated by the microprocessor of panel board (31).

The HF board (22) also acts as an input and output interface for the torch; the board contains the torch start button circuit and the power anchors for the earth terminals, electrode and nozzle of the torch.

The HF board (22) also includes the circuit for switching from pilot arc to transfer arc. It is made up of a REED sensor which, when it detects the passage of current on the earth conductor, interrupts the pilot arc current at the torch nozzle and sends the corresponding signal to the microprocessor, which in turn switches the level of current from pilot arc to transfer arc, thus to the set cutting current.

The HF board (22) also contains the drive circuit for the plasma gas solenoid valve (20), which is controlled both with pilot arc and transfer arc.

On the rear panel is mounted the pressure regulator (7) completed with filter, pressure gauge and pneumatic fitting to connect the plasma gas.

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

3 - MAINTENANCE

WARNINGS

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

UNPLUG THE UNIT FROM THE POWER MAINS AND WAIT FOR THE INTERNAL CAPACITORS TO DISCHARGE (6 MINUTES) BEFORE PERFORMING MAINTENANCE.

3.1 - Periodic inspection, cleaning.

Periodically make sure that air is flowing properly within the aeration tunnels.

Remove any dirt or dust to ensure adequate cooling of the internal parts of the power source.

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

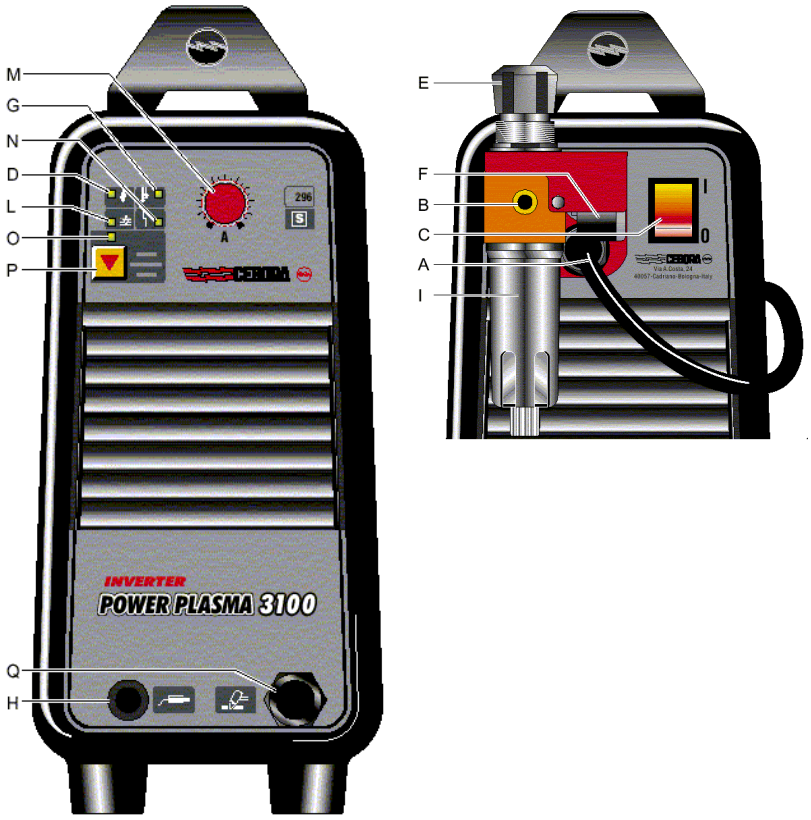
Check the condition of the internal power connections and connectors on the electronic boards; if you find “loose” connections, tighten or replace the connectors.

3.2 - Sequence of operations (fig. 3.2.1).

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

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

3.2.1 - Power source commands and signals.



3.2.2 - Power source operation.

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.

- System shut off and disconnected from the mains.
- Connect the gas intake to the fitting (B) on the rear panel.
- Use the earth clamp to connect the cable to the workpiece.
- Connect the power source to the mains.
- Close the switch (C) on the power source.
  - ♦ System powered, led (D) lit, fan running.
  - ♦ On the front panel, leds (G) and (L) off; led (N) lit for the first 3 seconds (auto test and mains voltage selection phase), then off; led (O) may be on or off depending on its status before the last shutdown.

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

▼ YES

- 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 Instructions Manual).
- Press the button (P) several times to make sure that the function “PILOT SELF-RESTART” is selected. Finally, leave it in the “off” position (led O off).
  - ♦ Each time the button (P) is pressed, the led (O) lights and shuts off in sequence, to indicate the status of the “PILOT SELF-RESTART” function.

Correct? — NO (see 3.3.3).

▼ YES

WARNING

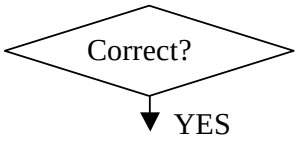
DURING THE FOLLOWING TESTS, DO NOT POINT THE TORCH AT PEOPLE OR PARTS OF THE BODY, BUT ALWAYS TOWARDS AN OPEN SPACE OR THE WORKPIECE.

- Briefly press the torch start button.
  - ♦ Gas flows from the torch for approximately 5 seconds (maximum pre-gas time without pilot arc).
    The pressure reading on the pressure gauge (F) remains constant.

Correct? — NO (see 3.3.4 and 3.3.5).

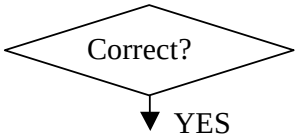
▼ YES

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



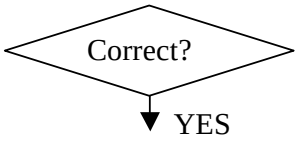
NO (see 3.3.5, 3.3.6, 3.3.7 and 3.3.8).

- 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.



NO (see 3.3.9).

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



NO (see 3.3.5).

REGULAR OPERATION.

3.3 - Troubleshooting.

WARNINGS

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

BEFORE REMOVING THE PROTECTIVE GUARDS AND ACCESSING INTERNAL PARTS, DISCONNECT THE POWER SOURCE FROM THE MAINS AND WAIT FOR THE INTERNAL CAPACITORS TO DISCHARGE (6 MINUTES).

NOTE

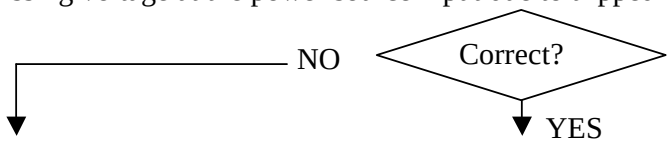
Items in **boldface** describe problems that may occur on the machine (symptoms).

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

3.3.1 - The power source does not start, control panel off.

MAINS SUITABILITY TEST.

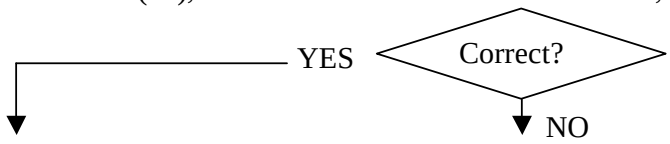
- ❑ Missing voltage at the power source input due to tripped mains protection.



- ♦ Eliminate any short-circuits on the connections between power cable, switch (9) and filter board (36).
- ♦ Make sure that the terminals IN1 and IN2 on filter board (36) are not short-circuited between them or towards earth. If short-circuited, disconnect the terminals OUT1 and OUT2 from the filter board (36) and repeat the checks on terminals P1 and P2 of power board (35). If the short-circuit is still present replace power board (35), if the short-circuit has been removed, replace filter board (36).
- ♦ Check the insulation towards earth of the choke (17). If leaking or short-circuited towards earth, replace it.
- ♦ Mains not suitable to power the power source (ex.: insufficient installed power).

POWER BOARD (35) POWER SUPPLY TEST.

- ❑ Power board (35), terminals P1and P2 = 115 or 230 Vac, with switch (9) closed.



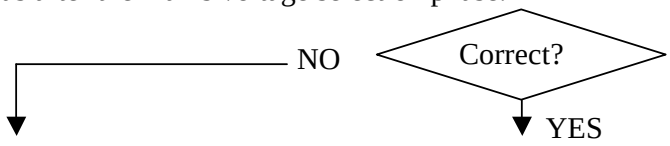
- ♦ Check the wiring between P1 and P2 on power board (35) with OUT1 and OUT2 on filter board (36).
- ♦ Check power cable and plug and replace if necessary.
- ♦ Check switch (9), and replace if defective.
- ♦ Make sure that the voltage on terminals IN1 and IN2 of filter board (36) = 115 or 230 Vac, with switch (9) closed. If correct, replace the filter board (36). If incorrect, make sure that the choke (17) is intact and check its connections to the

switch (9) and terminal IN2 of filter board (36). Replace the choke (17) if necessary.

- ♦ Check the mains voltage conditions.

MAINS VOLTAGE RECOGNITION TEST.

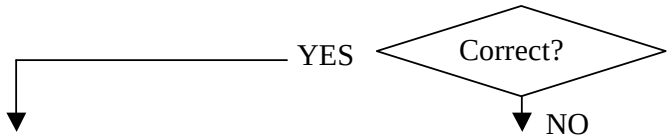
- ❑ Power board (35), terminals + (+) and - (-) of the rectifier bridge W1 = approximately +320 Vdc, with both mains voltages (115 Vac or 230 Vac), 3 seconds after closing the switch (9), thus after the mains voltage selection phase.



- ♦ Power board power supply (35) normal.

PANEL BOARD (31) POWER SUPPLY TEST.

- ❑ Panel board (31), connector J1, terminals 2 (+) and 14 (-) = +5 Vdc, terminals 4 (+) and 14 (-) = +14 Vdc; all 3 seconds after closing the switch (9), thus after the mains voltage selection phase.



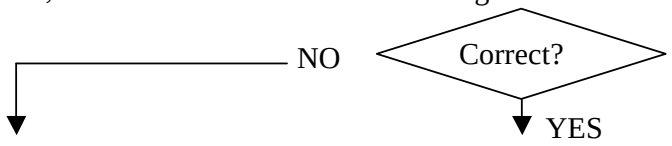
- ♦ Check the wiring between J1 power board (35) and J1 panel board (31).
- ♦ With the power source off, disconnect the connector J1 from the panel board (31) and check the resistance between terminals 2 and 14 and between terminals 4 and 14 of J1 on panel board (31). If you find short-circuits, also disconnect CN2 from the panel board (31) and repeat the test. If the short-circuit is still present, replace the panel (31) and power (35) boards; if the short-circuit is removed, check the wiring between CN2 on panel board (31) and J1 on HF board (22), and replace the HF (22) and power (35) boards if necessary.
- ♦ Replace the power board (35).

- ♦ Check the supply voltage (also see Alarm signals, par. 3.4).
- ♦ Replace the panel (31) and/or power (35) boards.

3.3.2 - Power source powered, control panel on, fan (15) stopped.

FAN (15) TEST.

- Fan (15) fast-on terminals = 115 Vac (with mains 115 Vac) or 230 Vac (with mains 230 Vac) in the first 3 seconds after closing the switch (9), thus during the mains voltage selection phase; thereafter 230 Vac with both voltages.

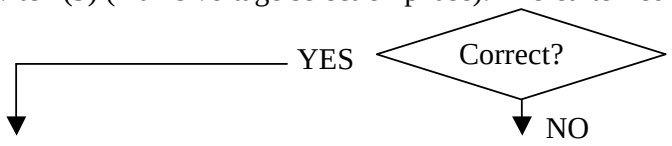


  - ♦ Make sure there are no mechanical obstacles blocking the fan (15).
  - ♦ Replace the fan (15).
- ♦ Check the wiring between the fan (15), “FAN” terminals on power board (35), and patch connector inserted in the wiring.
- ♦ Perform the MAINS VOLTAGE RECOGNITION TEST in par. 3.3.1. If the result is positive, replace the power board (35). If the result is negative, also perform the PANEL BOARD (31) POWER SUPPLY TEST in par. 3.3.1.
- ♦ Replace the power (35) and/or panel (31) boards.

3.3.3 - Power source powered, the indicators show no correct values.

MAINS VOLTAGE SELECTION AND ALARM SIGNALS TEST.

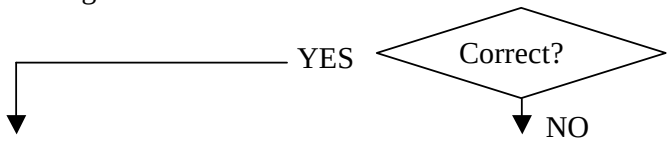
- Upon start-up, green (D) and red (N) leds = lit; leds (G) and (L) = off; led (O) lit or off depending on its status before the last shutdown. All in the first 3 seconds after closing the switch (9) (mains voltage selection phase). Thereafter led (N) = off.



  - ♦ See Alarm signals, par. 3.4.
  - ♦ Check the wiring between J1 power board (35) and J1 panel board (31).
  - ♦ Check the power source power supply (see par. 3.3.1).
  - ♦ Replace the power (35) and/or panel (31) boards.

SELF-RESTART PILOT SELECTION TEST.

- With power source powered, after selection of the mains voltage (3 seconds after closing the switch (9)), pressing button (P) will cause the led (O) to light and shut off in sequence, indicating the activation and deactivation of the “ Self restart pilot ” function.



  - ♦ See PANEL BOARD (31) POWER SUPPLY TEST, par. 3.3.1.
  - ♦ Replace panel board (31).
- ♦ Correct operation.

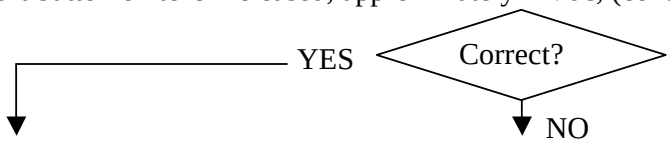
3.3.4 - The start button produces no effect.

WARNING

FOR THE FOLLOWING TESTS **DISCONNECT THE CONNECTOR J3** ON THE HF BOARD (22) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

START COMMAND TEST.

- Panel board (31), connector CN2 terminals 4 (+) and 5 (-) = approximately +14 Vdc, with start button on torch released; approximately 1 Vdc, (contact closed) with button pressed.



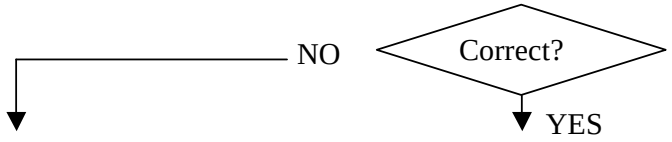
  - Check the wiring between CN2 panel board (31) and J1 HF board (22).
  - Make sure that on connector J6 of HF board (22), terminals A and B = approximately +14 Vdc, with start button released, and 0 Vdc (contact closed) with button pressed. If correct, replace the HF board (22). If incorrect, check the wiring between terminals A and B of connector J6 on HF board (22), torch button and contact of the nozzle protection on the torch; make sure the nozzle protection and torch button are correctly assembled and in good working order. If they are defective or showing signs of wear, replace them.
  - Make sure that there is perfect insulation between the conductors of the start button and those of the electrode and nozzle in the torch cable. If insulation is reduced, replace the complete torch. Any loss of insulation between the torch cable conductors may damage the HF (22) and panel (31) boards.
  - See PANEL BOARD (31) POWER SUPPLY TEST, par. 3.3.1.
  - Replace the HF (22) and/or panel (31) boards.

- Check the wiring between connector J1 panel board (31) and J1 power board (35).
- Check the wiring between CN2 panel board (31) and J1 HF board (22).
- Replace the HF (22) and/or panel (31) boards.

3.3.5 - No gas flows from the torch.

SOLENOID VALVE (20) TEST.

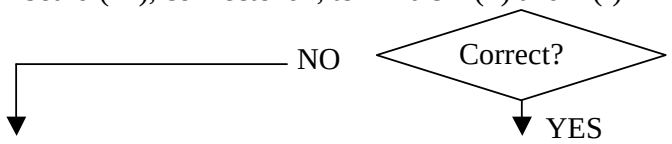
- Solenoid valve (20) terminals = +230 Vac with torch button pressed (with mains at either 115 or 230 Vac). The solenoid valve opening time depends on the post-gas time and testing conditions.



  - ♦ With power source off, make sure the resistance between the terminals of solenoid valve (20) = approximately 2500 ohm. If > Mohm (winding broken), replace the solenoid valve (20).
  - ♦ Replace solenoid valve (20).

SOLENOID VALVE (20) COMMAND TEST.

- HF board (22), connector J1, terminals 7 (+) and 1 (-) = +13 Vdc, with start button pressed.



  - ♦ Check the wiring between solenoid valve (20), connector J2 on HF board (22) and fan (15).
  - ♦ With power source off, make sure the resistance between the terminals of solenoid valve (20) = approximately 2500 ohm. If 0 ohm (short circuit), replace the solenoid valve (20) and HF board (22).
  - ♦ Make sure that the supply voltage on the fan (15) is correct, see par. 3.3.2.
  - ♦ Replace the HF board (22).
- ♦ Check the wiring between connectors J1 board HF (22) and CN2 panel board (31).
- ♦ Make sure that the power supply to panel board (31) is correct, see par. 3.3.1, and that the start command is working properly, see par. 3.3.4.
- ♦ Replace the panel (31) and/or HF (22) boards.
- ♦ Make sure there are no occlusions in the gas hoses of the power source.
- ♦ Check the presence of gas at the power supply fitting (B), and make sure that the pressure and air flow in the intake line comply with the specified values (see Instructions Manual).
- ♦ Make sure that the pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.

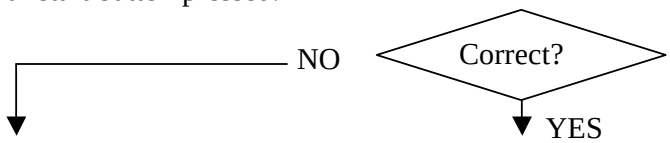
3.3.6 - Gas flows from the torch, the pilot arc does not light (high frequency missing).

NOTE

Some of the following tests may be checked only in the second after pressing the torch start button, due to failure by the pilot arc to strike.

HF OSCILLATOR TEST.

- HF board (22), discharger SC1 discharges at regular intervals, for approximately one second, with start button pressed.



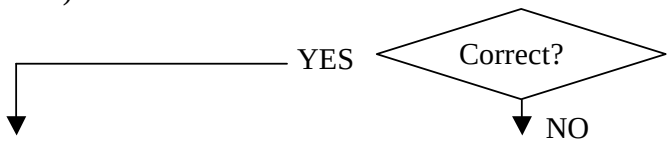
  - Check connections between HF board (22) and torch; more specifically, between TP5 and the torch electrode conductor, terminal E of J6 and nozzle conductor.
  - Check torch cable; if worn or damaged or losing its insulation, replace.
  - Check electrode and torch nozzle; replace if worn or damaged.
  - Make sure that the gas pressure in the torch plasma chamber is not too high. If necessary, check the operation of the pressure regulator (E) and pressure gauge (F), and observe the technical specifications (see Instructions Manual).
  - Go to par. 3.3.7.
- Check the distance between the tips of the discharger SC1 (correct value = 0.9 mm.).
- Make sure the HF transformer (T2) is correctly fixed on HF board (22), especially that the primary winding is not interrupted. If necessary reset the original connection or replace HF board (22).

WARNING

FOR THE FOLLOWING TESTS **DISCONNECT THE CONNECTOR J3** ON THE HF BOARD (22) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

CONTACT TIP VOLTAGE TEST.

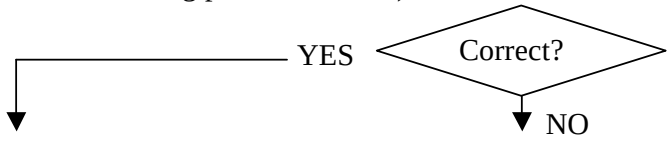
- HF board (22), connector J6-E and TP5 (gnd) = fig. 5.2.1, with start button pressed (open circuit nozzle voltage, interrupted after approximately 300 msec., for missing pilot arc current).



  - Go to par. 3.3.7.

HF BOARD (22) POWER SUPPLY TEST.

- HF board (22), connector J4 and patch terminal disconnected from J3 (gnd) = fig. 5.2.2, with start button pressed (HF board (22) power supply voltage, interrupted after approximately 300 msec., for missing pilot arc current).

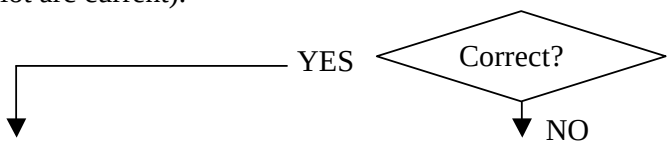


  - Check the wiring between J3 and J4 HF board (22) and transformer TF2 on power board (35).

- ♦ With power source off, check the resistance between the terminals J4 of HF board (22) and the patch terminal disconnected from J3 (winding of the transformer TF2 on power board (35)). If the winding is broken, replace the power board (35).
- ♦ Replace the power board (35).

HF COMMAND TEST.

- ❑ HF board (22), connector J1, terminals 7 - 2 (gnd) = fig. 5.2.3, with start button pressed (command signal for HF board (22), interrupted after approximately 300 msec., for missing pilot arc current).



- ♦ Check the wiring between J1 on HF board (22) and CN2 on panel board (31).
- ♦ With power source off, temporarily disconnect the connector J1 from HF board (22) and check the resistance between the terminals 7 and 2 of J1 on HF board (22). Correct value = approximately 200 ohm. If 0 ohm (short-circuit) replace the HF (22) and panel (31) boards. If >Mohm (circuit broken) replace the HF board (22).
- ♦ Replace panel board (31).

♦ Replace the HF board (22).

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

NOTE

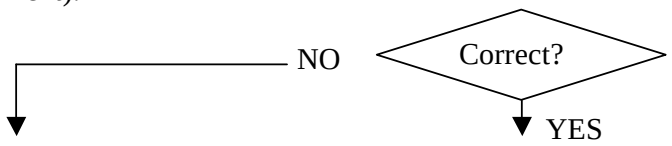
Some of the following tests may be checked only in the second after pressing the torch start button, due to failure by the pilot arc to strike.

WARNING

FOR THE FOLLOWING TESTS **DISCONNECT THE CONNECTOR J3** ON THE HF BOARD (22) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

NOZZLE VOLTAGE TEST.

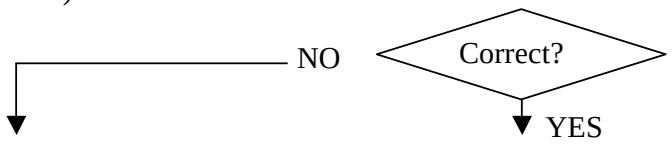
- HF board (22), connector J6-E and TP5 (gnd) = fig. 5.2.1, with start button pressed (open circuit nozzle voltage, interrupted after approximately 300 msec., for missing pilot arc current).



  - Go to par. 3.3.6.

POWER BOARD (35) OUTPUT VOLTAGE TEST.

- HF board (22), terminals FISS1 and J5 (gnd) = fig. 5.2.1, with start button pressed (open circuit nozzle voltage, interrupted after approximately 300 msec., for missing pilot arc current).

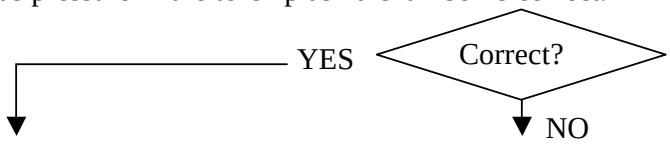


  - On HF board (22), check the connection of the secondary circuit of the HF transformer (T2) between terminals J5 and TP5. If you detect cold welds or interruptions in the printed circuit, reset the original connections, and make sure that the torch cable conductors are properly insulated.
  - With the power source off, check the resistance between the terminals FISS1 and J6-E on the HF board (22). Correct value = approximately 0 ohm (NC contact of relay RL2 closed). If incorrect, make sure that there are no interruptions in the printed circuit, make sure that the torch cable conductors are properly insulated, and replace RL2 if necessary.
  - Replace the HF board (22).
- Check the wiring between terminals FISS1 and J5 on HF board (22) with terminals P5 and P6 on power board (35).
- Check the wiring between connectors J1 panel board (31) and J1 power board (35).
- Replace the panel (31) and/or power (35) boards.

3.3.8 - Irregular pilot arc starts, unstable pilot arc.

PLASMA GAS PRESSURE TEST.

- Gas pressure in the torch plasma chamber is correct.



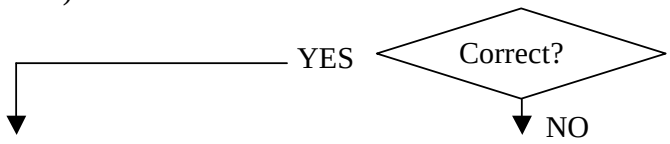
  - ♦ Check for the presence of gas at the supply fitting (B), and make sure that the pressure and air flow in the intake line comply with the specified values (see Instructions Manual and Sales Catalogue).
  - ♦ Make sure that the pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.
  - ♦ Make sure there are no occlusions in the gas hoses of the power source.
  - ♦ Make sure that solenoid valve (20) = open, during the pilot arc (see SOLENOID VALVE (20) TEST, par.3.3.5).

PILOT ARC VOLTAGE TEST.

WARNING

FOR THIS TEST **DISCONNECT THE CONNECTOR J3** ON THE HF BOARD (22) TO PREVENT HIGH FREQUENCY FROM BEING GENERATED.

- HF board (22), connector J6-E and TP5 (gnd) = fig. 5.2.1, with start button pressed (open circuit nozzle voltage, interrupted after approximately 300 msec., for missing pilot arc current).



  - ♦ Go to par. 3.3.7.

- ♦ Check the supply voltage of the power source. If it differs significantly from the rated values, power the power source with a voltage as close as possible to the specified values (also see Alarm signals, par. 3.4).
- ♦ Check connections between torch cable and HF board (22).
- ♦ Make sure the internal parts of the torch are properly insulated, including cables; if in doubt, replace the entire torch.
- ♦ Check electrode, swirl ring and torch nozzle; replace if worn or damaged.
- ♦ Replace the panel (31) and/or power (35) boards.

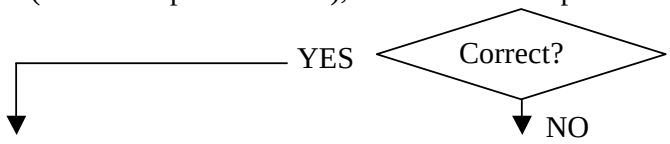
3.3.9 - Transfer arc does not take place or is too weak for cutting.

WARNING

Due to lighting the pilot arc and the HF pulses, some instruments may not be suitable for measuring signals in the following tests. Given the delicacy of the measuring points, we recommend that you be extremely cautious and precise, scrupulously observing the instructions provided in this manual and using only instruments certified as compatible with these phenomena.

POWER SOURCE OUTPUT VOLTAGE TEST.

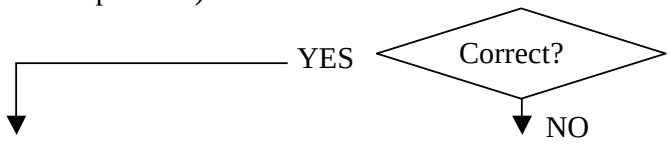
- HF board (22), terminals FISS2 (+) – J5 (-) = approximately +120 Vdc, for a duration of 2 sec. (maximum pilot arc time), with start button pressed and pilot arc lit.



- ♦ Make sure that the pilot arc is working properly (see par. 3.3.6, 3.3.7, 3.3.8).
- ♦ Check the connections of the reed solenoid SW1 between the terminals FISS1 and FISS2 on the HF board (22). If you detect cold welds or interruptions in the printed circuit, reset the original connections, and make sure that the torch cable conductors are properly insulated.
- ♦ Check the earth cable and its connection to FISS2 on HF board (22).
- ♦ Replace the HF board (22).

TRANSFER ARC SWITCHING TEST.

- Panel board (31), connector CN2, terminals 8 (+) and 3 (-) = 0 Vdc, with transfer arc, (+13 Vdc with pilot arc). This situation remains constant for as long as cutting continues.



- ♦ Check the wiring between CN2 panel board (31) and J1 HF board (22).
- ♦ With power source off, make sure that the switch in the reed bulb SW1 is properly assembled and in good working order, carrying out the REED TEST in par. 3.4.4.
- ♦ Check the connection of the earth cable with the workpiece.
- ♦ Replace the HF (22) and/or panel (31) boards.

- ♦ Check connections between torch cable and HF board (22), HF transformer secondary circuit with terminals J5 and TP5, and solenoid SW1 with terminals FISS1 and FISS2 on HF board (22). If you find any deteriorated connections, reset them and replace damaged components.
- ♦ Check the condition of the torch cable and torch, especially making sure there are no short-circuits or insulation leaks between the conductors, and that the electrode, nozzle, nozzle holder and swirl ring are not to be replaced (see Instructions Manual).
- ♦ Check the presence of gas at the power supply fitting (B), and make sure that the pressure and air flow in the intake line comply with the specified values (see Instructions Manual).
- ♦ Make sure that pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.
- ♦ Make sure that the gas hoses of the power source are not partly clogged, so that the gas flow is enough for the pilot arc but not for transfer arc.
- ♦ Replace the solenoid valve (20).
- ♦ Replace the panel (31) and/or power (35) boards.

3.4 - Alarm signals.

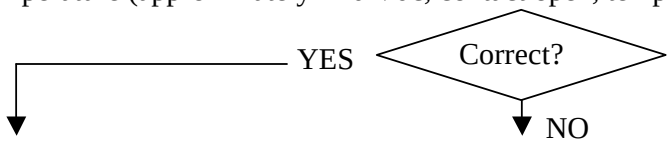
3.4.1 - Yellow (G) and red (N) leds lit = temperature outside limits.

The power source delivers no current, but the fan continues running; we therefore recommend leaving the power source powered to ensure rapid cooling.

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

THERMOSTAT TEST.

- Panel board (31), connector CN1, terminals 2 (+) - 3 (-) = 0 Vdc, contact closed, appropriate temperature (approximately +10 Vdc, contact open, temperature outside limits).



  - Check the wiring between CN1 panel board (31) and the thermostat, located on the dissipater of the power mosfet on the power board (35).
  - Replace the thermostat or power board (35).
  - Replace panel board (31).

- Make sure that the fan (15) is working properly (see par. 3.3.2).
- Make sure that air is flowing properly and that the aeration tunnel contains no dust or other obstacles to cooling.
- Make sure that the working conditions comply with the specified values, especially observing the “duty cycle”.
- Replace panel (31) and/or power (35) boards.

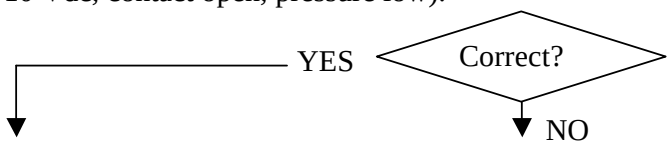
3.4.2 - Red leds (L) and (N) lit = low gas pressure.

The power source delivers no current, but remains powered.

This is automatically reset when the pressure returns within the allowed limits, but to re-start the pilot arc you must give a new start command from the torch button.

PRESSURE SWITCH (32) TEST.

- Panel board (31), connector CN1, terminals 1 (+) - 4 (-) = 0 Vdc, contact closed, pressure OK (+10 Vdc, contact open, pressure low).



  - Check the wiring between CN1 panel board (31) and pressure switch (32).
  - Make sure that gas is present at the intake fitting (B) and that the pressure in the supply line meets specifications (see Instructions Manual).
  - Make sure that the pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.
  - Make sure there are no occlusions in the gas hoses of the power source.
  - Replace the pressure switch (32).
  - Replace panel board (31).

- Replace panel board (31).

3.4.3 - Red led (N) lit = power source blocked.

This indicator indicates that the power source is in the process of selecting the mains voltage, in the first 3 seconds after closing the switch (9), or, thereafter, is blocked due to a hazardous condition.

To identify the cause, consider when the block occurs (for ex.: upon start-up, during operation with pilot arc or cutting), and seek out the possible error conditions among those described in the following chapters.

3.4.4 - Alarms shown at power source start-up.

NOTE

The moment of start-up is decisive in selecting the operating range.

With voltage below approximately 150 Vac, operation is set at 115 Vac; with voltage greater than approximately 150 Vac, operation is set at 230 Vac.

Once set, the range of operation does not change until the next start-up.

- Power source supply voltage high.

If the supply voltage of the power source, at the start-up, is greater than approximately 280 Vac, the control blocks the unit for high voltage in the range of 230 Vac.

If the supply voltage of the power source, at the start-up, is between approximately 140 and 150 Vac, the control blocks the unit for high voltage in the range of 115 Vac.

If the supply voltage of the power source, during working conditions, rise over 280 Vac or rise over 145 Vac, the control blocks the unit for high voltage in the respective ranges.

In these situations the power source delivers no current and the red led (N) remains lit.

Since the power source and fan (15) remain powered with high voltage, we recommend that you not allow this situation to continue for very long.

To restore proper operation, shut off the power source and power it with the correct voltage.

- Power source supply voltage low.

If the supply voltage of the power source, at the start-up, is between approximately 150 and 190 Vac, the control blocks the unit for low voltage in the range of 230 Vac.

In this situation the power source delivers no current and the red led (N) remains lit.

If the supply voltage of the power source, at the start-up, is less than approximately 90 Vac, the control blocks the unit for low voltage in the range of 115 Vac.

In this situation the red led (N) remains off, even in the first three seconds after closing the switch (9), and the power source delivers no current.

Proper operation is automatically restored when the supply voltage returns within the allowed limits.

- Unusual supply voltage to the mosfet drive circuits on power board (35).

If an incorrect voltage is detected, at the start-up, in the drive circuits of the power mosfets on the power board (35), with the correct power source supply voltage, the power source remains blocked, without delivering current and with the red led (N) lit.

To restore operation, shut off the power source, wait for the DC capacitors to discharge completely (approximately 9 minutes), and restart the power source with the rated supply voltage.

If the alarm persists, the power board (35) may be defective, and should thus be replaced.

- Start button pressed during power source start-up.

See START COMMAND TEST, par. 3.3.4.

- Start button pressed during the reset from stop due to temperature outside limits or low gas pressure.

The alarms for high temperature and for low gas pressure cause the power source to stop, and the leds (G) or (L) light together with led (N) on the control panel, but they are not saved. They are automatically reset when the pressure and temperature return to within the allowed limits.

It may occur that the reset takes place when the start command is present, thus to prevent the power source from starting suddenly because of a random reset, this will only cause the leds (G), (L) and (N) to shut off, but the power source will continue to not deliver current.

To restore proper operation, and thus strike the pilot arc, remove and reapply the start command to the power source.

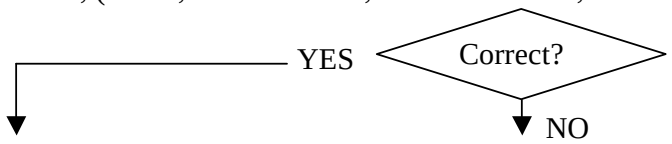
- Contact of the reed bulb SW1 on HF board (22) = closed during power source start-up.

If the reed contact SW1 on HF board (22) is found closed, at the start-up, with correct power source supply voltage, the power source remains blocked, without delivering current and with the red led (N) lit.

To analyse the problem, perform the following test:

REED TEST.

- Panel board (31), connector CN2, terminals 8 (+) and 3 (-) = +13 Vdc, with power source powered, (0 Vdc, contact closed, with transfer arc, thus while cutting).



  - Check the wiring between CN2 panel board (31) and J1 HF board (22).
  - Make sure the reed bulb SW1 is properly mounted in the solenoid provided on HF board (22).
  - Make sure that, with power source off, the switch in the reed bulb SW1 works properly: place a magnet near the bulb and check the resistance between the terminals 8 and 3 of J1 on HF board (22) = 0 ohm (reed contact closed). Move the magnet away from the bulb, resistance = approximately 1 Kohm (reed contact open). If incorrect replace the reed bulb and solenoid.
  - Replace the HF board (22) and/o panel board (31).
- Correct operation.

3.4.5 - Alarms shown during pilot arc or transfer arc (cutting) operation.

- Short-circuit between electrode and nozzle.

A short-circuit or heavy loss of insulation between the electrode and torch nozzle terminals may interfere with proper striking of the pilot arc.

This situation is detected and blocks the power source with led (N) lit.

To solve this problem, we recommend:

- Check electrode and torch nozzle; replace if worn or damaged.
- Make sure the internal parts of the torch are properly insulated, including cables; if in doubt, replace the entire torch.
- Check the wiring between the torch cable and the corresponding terminals on the HF board (22).
- Replace the HF (22) and/or panel (31) and/or power (35) boards.

4 - COMPONENTS LIST

4.1 - Power source art. 296 : see file ESP296.pdf enclosed at the end of the manual.

4.2 - Components table : see file ESP296.pdf enclosed at the end of the manual.

4.3 - Spare parts list.

Essential spare parts.

Ref.	Code	Description	Qty.
22	5602074	HF circuit	1
35	5602140	power circuit	1

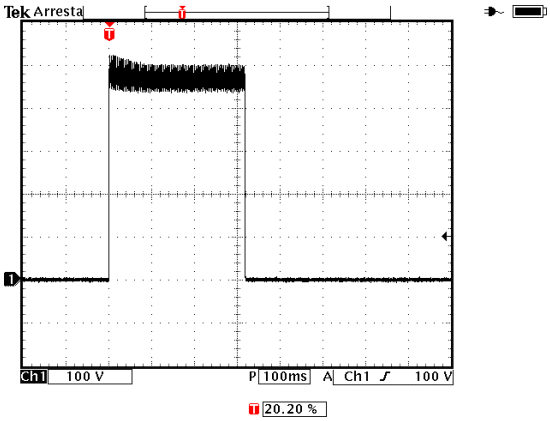
Recommended spare parts.

Ref.	Code	Description	Qty.
9	3190014	switch	1
15	3165075	fan	1
36	5602078	filter circuit	1

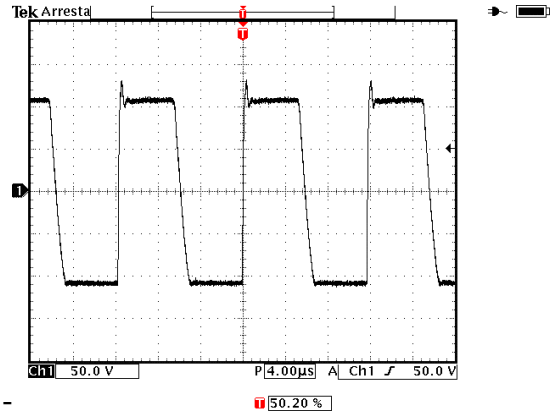
5 - ELECTRICAL DIAGRAMS

5.1 - Power source art. 296 : see file SCHE296.pdf enclosed at the end of the manual.

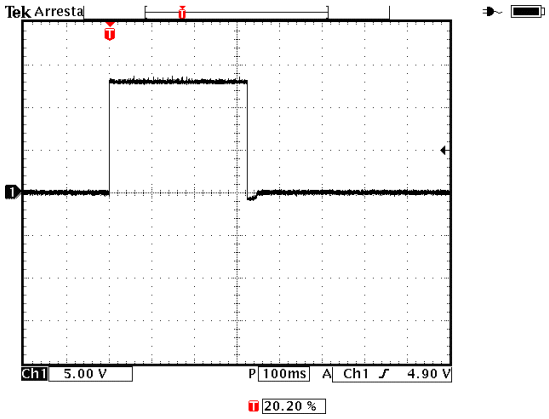
5.2 - Waveforms.



5.2.1 - Open circuit nozzle voltage, interrupted after approximately 300 msec., for missing pilot arc current (par. 3.3.6, 3.3.7, 3.3.8).



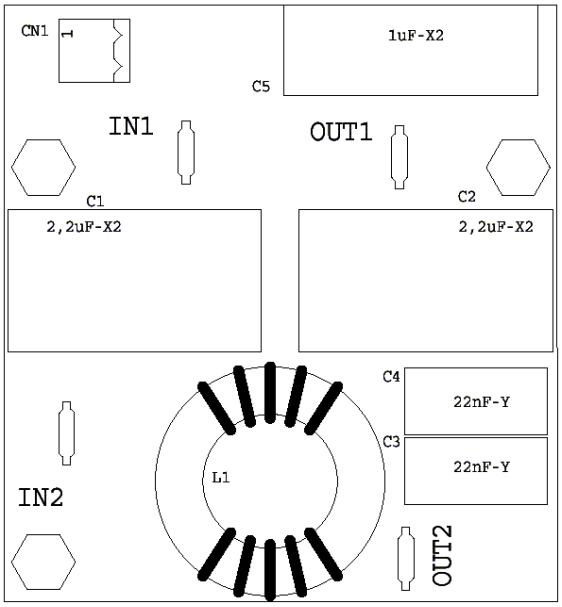
5.2.2 - HF board (22) power supply voltage, interrupted after approximately 300 msec., for missing pilot arc current (par. 3.3.6).



5.2.3 - Command signal for HF board (22), interrupted after approximately 300 msec., for missing pilot arc current (par. 3.3.6).

5.3 - Filter board (36) code 5.602.078.

5.3.1 - Topographical drawing.



5.3.2 - Connector table.

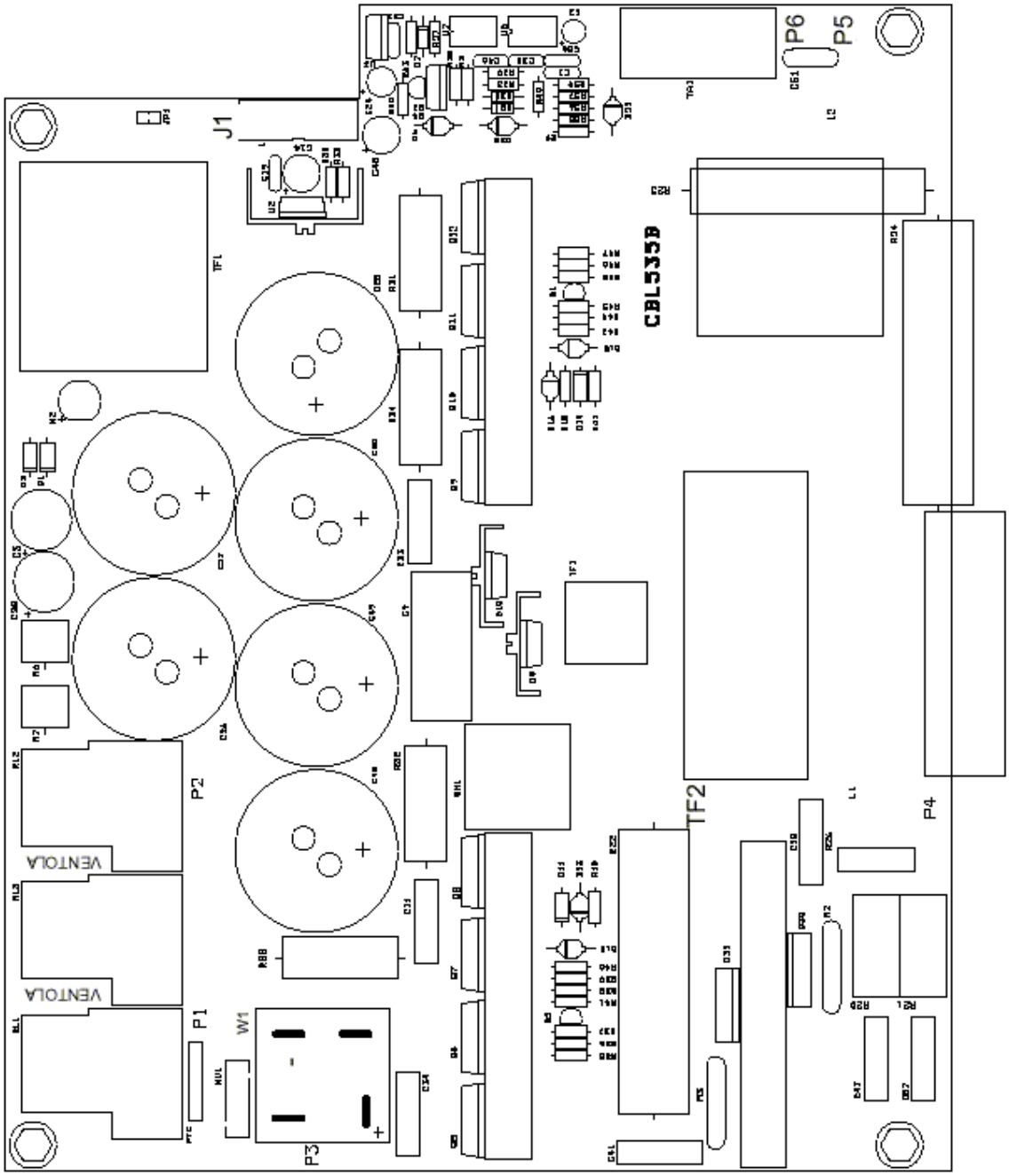
Connector	Terminals	Function
-	IN1 – IN2	115/230 Vac mains power supply input.
-	OUT1 – OUT2	115/230 Vac power supply output for power board (35).
CN1	1 - 2	filter capacitor connection.

5.4 - Power board (35) code 5.602.140/A.

5.4.1 - Connector table.

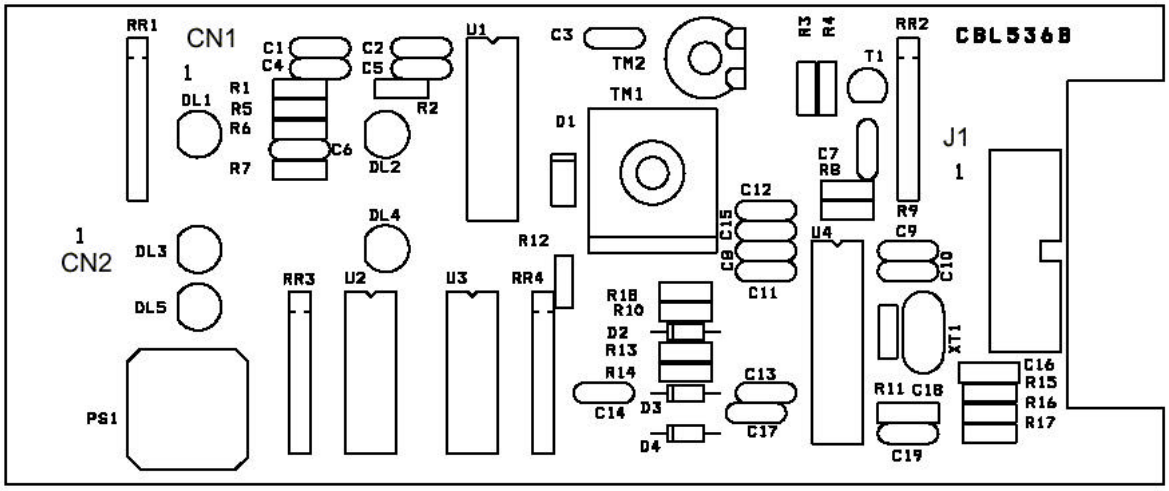
Connector	Terminals	Function
-	P1 – P2	115/230 Vac supply input from filter board (36).
-	VENTOLA	230 Vac output for fan (15).
-	P5 (+) – P6 (-)	output voltage for electrode and nozzle/earth.
J1	1,2	+5 Vdc boards power supply output.
J1	3,4	+13,8 Vdc boards power supply output.
J1	5	“mains voltage” signal output.
J1	6	relay2 command input (selector switch for 115/230 Vac operation range).
J1	7	relay1 command input (end pre-charge).
J1	8	“power board (35) output current” signal output.
J1	9	“PWM” signal input for power mosfet.
J1	10	“output current reference” signal input.
J1	11	“start from output current check” signal output.
J1	12	board analog circuits 0 Vdc power supply output.
J1	13,14	board digital circuits 0 Vdc power supply output.

5.4.2 - Topographical drawing.



5.5 - Panel board (31) code 5.602.124.

5.5.1 - Topographical drawing.

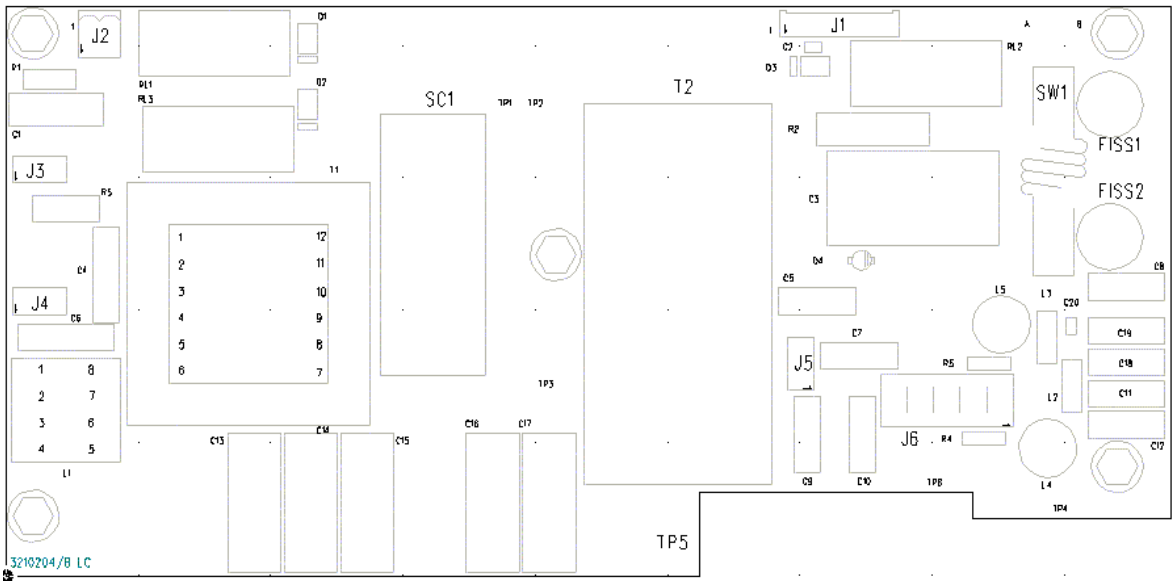


5.5.2 - Connector table.

Connector	Terminals	Function
J1	1,2	+5 Vdc board power supply input.
J1	3,4	+13,8 Vdc board power supply input.
J1	5	“mains voltage” signal input.
J1	6	relay2 command output (selector switch for 115/230 Vac operation range).
J1	7	relay1 command output (end pre-charge).
J1	8	“power board (35) output current” signal input.
J1	9	“PWM” signal output for power mosfet.
J1	10	“output current reference” signal output.
J1	11	“start from output current check” signal input.
J1	12	board analog circuits 0 Vdc power supply input.
J1	13,14	board digital circuits 0 Vdc power supply input.
CN1	1 – 4	input from pressure switch (32).
CN1	2 – 3	input from thermostat on power board (35).
CN2	1	gas solenoid valve (20) relay command output.
CN2	2	HF relay command output.
CN2	3	board digital circuits 0 Vdc power supply output.
CN2	4 – 5	“start” command input.
CN2	6,7	+13,8 Vdc board power supply output.
CN2	8	“transfer arc” signal input from reed on HF board (22).

5.6 - HF board (22) code 5.602.074/C.

5.6.1 - Topographical drawing.



5.6.2 - Connector table.

Connector	Terminals	Function
J1	1	gas solenoid valve (20) relay command input.
J1	2	HF relay command input.
J1	3	board digital circuits 0 Vdc power supply input.
J1	4 – 5	“start” command output.
J1	6,7	+13.8 Vdc board power supply input.
J1	8	“transfer arc” signal output from reed on HF board (22).
J2	1 – 2	enable output for gas solenoid valve (20).
-	J3 – J4	HF generator circuit power supply input.
-	FISS1 (+) – J5 (-)	voltage input for electrode and nozzle/earth.
J6	A – B	input from start button on the torch.
J6	E	output voltage for torch nozzle.
-	TP5	output voltage for torch electrode.
-	FISS2	output for earth terminal (potential of the workpiece).