PLASMA PROF 162

POWER SOURCE art. 952

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. 952 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 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 (2 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 PLASMA PROF 162 is a plasma arc system for cutting electrically conductive materials, which includes the electronic power source art. 952, and a set of torches and accessories, for use in both manual applications and automated systems (see list in Sales Catalogue).

The power source is controlled by a microprocessor circuit, which manages the operative functions of the cutting system and operator interface.

2.2 - Technical specifications.

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

2.3 - Description of power source art. 952.

Art. 952 is a direct current power source with controlled current, consisting of a three-phase rectifier bridge and a DC/DC (Chopper) IGBT converter.

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

The switch (60) acts on the service transformer (8), which powers the electronic boards and internal services through the fuse board (8).

The power transformer (79) has the primary circuit consisting of six windings which, appropriately switched by the voltage change, allow the power source to function at 230, 400 or 440 VAC at 50/60 Hz. Near the main voltage change is also the voltage change of the service transformer (8).

From one of the primary circuit windings comes the voltage, always 230 VAC, for the fan (77) and the socket (21) for the cooling unit art. 1339.

The transformer (79) is powered via the remote switch (5), which is closed by the control board (62), once the DC capacitor (40) has been pre-charged and the transformer itself pre-magnetized.

The rectifier bridge (78), which powers the DC capacitor (40) and the IGBT module (72), is connected to the secondary circuit of the transformer (79).

Inside the module (72) is the switching element, the IGBT, and the recirculation diode, connected in a “Chopper” configuration.

The snubber board (75), mounted alongside the module (72), contains the RC IGBT protection network.

At the negative output (1) of the module (72) is connected the choke (43), to level the arc current. Next is connected the secondary circuit of the HF transformer (69) to light the pilot arc.

At the positive output (3) of the module (72) are connected the resistor (74) and the coil with reed (14). The resistor (74) generates the potential difference needed to switch from pilot arc to transfer arc, while the reed (14) detects the passage of the transfer arc current and provides this information to the control board (62).

The Hall-effect current transducer (71) is inserted on their connector cable. It sends the current reaction signal to the driver board (9) to stabilize the cutting current.

By effect of the signal from the reed (14), the control board (62) opens the remote switch (18), closed during the pilot arc phase, to stabilize the maintained transfer arc and eliminate unnecessary dissipation of energy on the resistor (74).

The fixed fitting of the torch (50) is a multiple connector with a built-in power start for the torch electrode, two contacts for the torch gas nozzle, two contacts for the start button, four contacts to recognize the type of torch, and a pneumatic actuator for the plasma gas. The torch is connected to this fitting; depending on the model, it may use all or only part of these contacts and actuators.

A second reed is positioned to detect the presence of the fitting safety hood (50), to prevent the power source from operating without the hood.

The connector (P) on the rear panel (see fig. 3.2.1) is set up to connect to the cooling unit art. 1339.

On the rear panel is mounted the pressure regulator (35) complete with filter, pressure gauge and pneumatic fitting to connect the plasma gas. The regulator makes it possible to adapt the gas pressure to the type of torch being used.

The fuse board (8) contains the fuses for the following circuits:

- Electronic boards power supply;
- Pre-charging of the DC capacitor (40);
- Alternating current devices (solenoid valves (29) and remote switches (5) and (18).

The pre-charge board (7), controlled by the Control board (62), performs:

- Pre-charges the DC capacitor (40), and sends the information regarding the voltage reached by the capacitor during this phase to the control board;
- Pre-magnetizes the power transformer (79);
- Supplies power to the socket (21) for the cooling unit.

Based on the signals to its inputs, the control board (62) prepares the power source to run by controlling the service devices (solenoid valves (29) and remote switches (5) and (18), processes the reference signal of the cutting current to send to the driver board (9), and makes sure that proper operating conditions are always present.

These functions are governed by the control board microprocessor (62), which also manages all of the information displayed by the operator panel (64), including the system diagnostics messages.

The operator panel (64) includes:

- Two displays to show error codes, the cutting current and nozzle hole diameter;
- A set of LEDs to indicate the operating status;
- A potentiometer to adjust the cutting current.

For more detailed information, see the Instruction Manual.

The driver board (9) forms the actual system regulator. It generates the IGBT pilot signal, calculating the waveform (duty cycle) by comparing the current reference signal from the control board (62) to the current reaction signal from the transducer (71).

The HF board (15), combined with the HF transformer (69), generates the high voltage and high frequency pulses needed to start the pilot arc. Its operation is conditioned by the value of the power source output voltage, measured between the positive output pole of the power source and the terminal downstream from the choke (43). With a voltage greater than 200 VDC, the circuit generates the high voltage and frequency pulses; at lower voltages the circuit stops.

This system takes relies on the principle according to which the output voltage is greatest, approximately 260 VDC, under no-load, while with the pilot arc or transfer arc this voltage is determined by the cutting conditions (level of current, material to be cut, type of gas, etc.), thus significantly below 200 VDC.

The torch board (68) acts as an input interface and condition for those signals especially affected by disturbances, as they come from critical areas of the system.

These signals include:

- Start from torch button;
- Start from rear connector for remote control art. 197;
- Presence of fixed fitting protection (50);
- Power source output voltage;
- Torch type recognition from fixed fitting (50).

The signals processed by the electronic boards and present at their connectors are listed in the tables 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 (2 MINUTES)

3.1 - Periodic inspection, cleaning.

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

Check the condition of the output terminals and output 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 - Operating sequence.

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

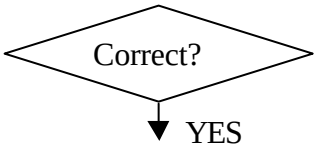
It must be carried out after each repair without any errors.

For references to the components mentioned, see fig. 3.2.1.

NOTE

- ❑ Operations preceded by this symbol refer to operation 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 (I) on the rear panel.
- ❑ Connect the torch to the power source.
- ❑ With the CP200 torch, connect the hoses of the cooling circuit to the torch.
- ❑ With the CP200 torch, connect the hoses of the cooling unit to the power source.
- ❑ Connect the cable of the positive pole of the power source to the workpiece.
- ❑ Connect the power source to the mains.
- ❑ Close the switch (A) on the power source.
    - ♦ System powered, fan running, lamp (B) lit.
    - ♦ All indicators on operator panel lit for one second (lamp-test).
    - ♦ Display (X) shows the software version installed (self-test) for two seconds, followed by the current value programmed by the knob (Z).
    - ♦ Display (Y) indicates the diameter of the gas nozzle hole.
    - ♦ LEDs (T) and (U) indicate the type of torch connected to the power source.
    - ♦ With torch CP200, the LED (V) flashes for the first 15 seconds. During this time, the liquid circulates in the hoses and torch.



NO (see 3.3.1., 3.3.2. and 3.3.3).

- Turn the gas setting knob (H) to a pressure, as read on the pressure gauge (G), suited to the type of torch being used (see table (S) on operator panel).
- Turn the knob (Z) to a cutting current suited to the thickness of the workpiece (see Instruction Manual).
  - Display (X) indicates the programmed cutting current.

Correct? NO (see 3.3.3. and 3.3.4.).

▼ 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 the post-gas time (2 minutes);
    The pressure reading on the pressure gauge (G) remains constant.

Correct? NO (see 3.3.4. and 3.3.11).

▼ YES

- Press the torch button to light the pilot arc.
  - Pilot arc starts for a maximum duration of two seconds (pre-gas).

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

▼ YES

- Move the torch near the workpiece and press the torch start button.
  - Begin cutting. Adjust the knob (Z) to the current level suited to the kind of cutting.
  - On the operator panel, the displays indicate the cutting current and nozzle diameter of the torch, and only the LEDs for the type of torch (T) and (U) are lit.

Correct? NO (see 3.3.8. and 3.3.9.).

▼ YES

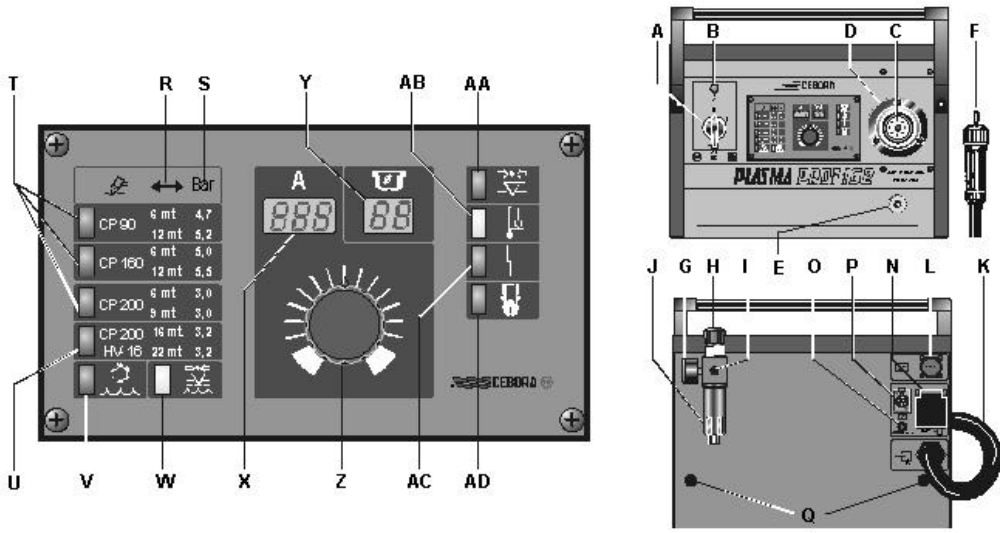
- Release the torch start button.
  - The arc shuts off immediately. Gas continues to flow out for two minutes (one minute with torch CP200) to cool the torch (post-gas).

Correct? NO (see 3.3.10.).

▼ YES

REGULAR OPERATION.

3.2.1 - Power source commands and signals.



3.3 - Troubleshooting.

WARNINGS

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

THE SWITCH (A) IS A FUNCTION SWITCH, NOT A MAIN POWER SWITCH. THIS IS WHY THERE IS HAZARDOUS VOLTAGE PRESENT INSIDE THE POWER SOURCE 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 (2 MINUTES).

NOTE

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

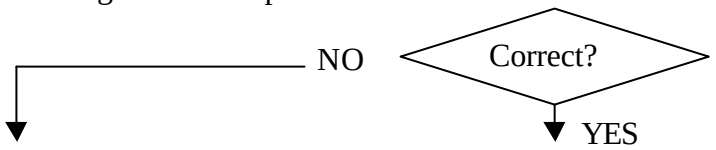
- ❑ Operations preceded by this symbol refer to situations the operator must determine (causes).
- ♦ Operations preceded by this symbol refer to actions the operator must perform in order to solve the problems (solutions).

For references to the components mentioned, also see the diagram in par. 5.1.

3.3.1 - The power source does not start, operator panel (64) off.

MAINS SUITABILITY TEST.

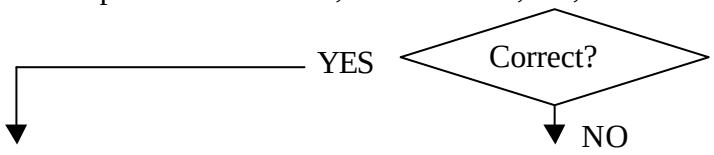
- ❑ No voltage for mains protection.



- ♦ Correctly position the voltage changes.
- ♦ Remove any short-circuits on the transformer connections (79).
- ♦ Make sure that the bridge (78) is not short-circuited.
- ♦ Make sure that the remote switch (5) does not have stuck contacts, or that it is not ordered to close before the capacitor (40) has been fully pre-charged and the transformer (79) fully pre-magnetized.
- ♦ Mains not suitable to power the power source (ex.: insufficient installed power).

MAINS CONNECTION TEST.

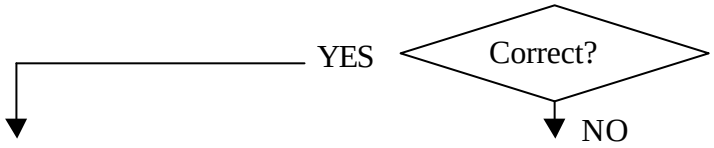
- ❑ Mains input terminal board, terminals U1, V1, W1 = 3 x 230/400/440 VAC.



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

SERVICE TRANSFORMER POWER SUPPLY TEST.

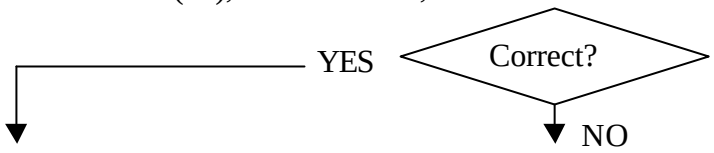
- ❑ Fuse board (8), connector J6, terminals 0 - 230 = 230 VAC; connector J6 – 0 and connector J5 – 400 = 400 VAC; connector J6 – 0 and connector J5 – 440 = 440 VAC.



- ♦ Check the wiring between mains input terminal board and J5 connector on board (7) and between connector J6 on board (7), switch (60), and connectors J5 and J6 on board (8).
- ♦ Make sure the service voltage change is correctly positioned.
- ♦ Check fuse F1 on board (7); replace if broken, and make sure there is no short-circuit in the service transformer (8) or corresponding wiring.
- ♦ Check switch (60); replace if defective.
- ♦ Service transformer (8) primary circuit interrupted.

CONTROL BOARD POWER SUPPLY TEST.

- ❑ Control board (62), connector J14, terminals 1 – 2 = 10 VAC.



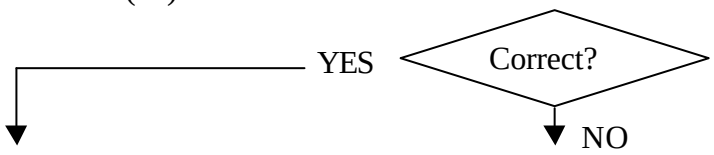
- ♦ Check the wiring between J14 board (62) and J4 board (8).
- ♦ Check fuse F4 on board (8); if broken, replace and make sure that terminals 1 - 2 of J14 on board (62) are not short-circuited. If so, replace board (62).
- ♦ Check the 10 VAC voltage on terminals 0 – 10 of board (8); if missing, check the wiring between the service transformer and board (8), or replace the service transformer (8). If present replace board (8).

- ♦ Check the wiring between connector J11 on board (62) and the operator panel (64).
- ♦ Replace the operator panel (64).
- ♦ Replace board (62).

3.3.2 - Power source powered, operator panel (64) on, fan (77) stopped.

CAPACITOR PRE-CHARGING (40) AND TRANSFORMER PRE-MAGNETIZATION (79) TEST.

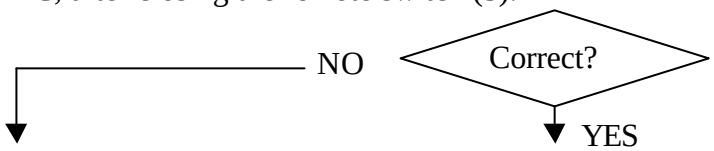
- Capacitor (40), terminals + and – = > 200 VDC, and remote switch (5) closed, after closing the switch (60).



- ♦ See “Pre-charge board power supply test” par. 3.3.2.
- ♦ Check the wiring between J3 board (7) and J13 board (62).
- ♦ Check the wiring between J2 board (7) and J9 board (62).
- ♦ Check the wiring between the remote switch (5) coil terminals and J13 on board (62).
- ♦ Replace board (7).
- ♦ Replace board (62).
- ♦ Replace remote switch (5).

VENTILATION TEST.

- Fan (77), terminals A (black wire) – H (blue wire), on the faston patch connector = 230 VAC, after closing the remote switch (5).

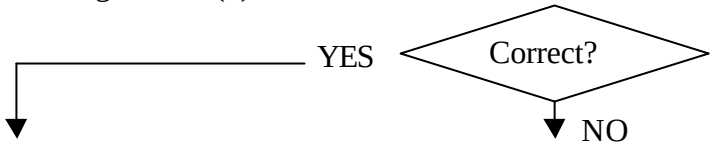


- ♦ Check the wiring between the fan motor (77) and starting capacitor connected to terminals A and K of the motor (77).
- ♦ Replace starting capacitor.
- ♦ Replace motor (77).

- ♦ Check the wiring between power voltage change and motor (77).
- ♦ Make sure the voltage change is correctly positioned.
- ♦ Check for the presence of the three power supply phases on the primary circuit of the transformer (79).

PRE-CHARGE BOARD POWER SUPPLY TEST.

- Pre-charge board (7), connector J1 terminals 1 - 4 = 180 VAC.



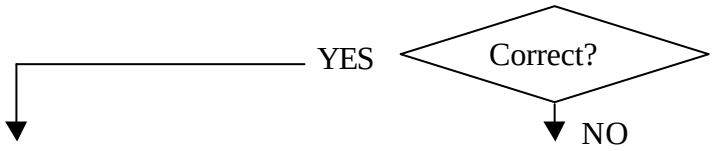
- ♦ Check the wiring between connectors J1 on board (7) and J1 on board (8).
- ♦ Check fuse F1 on board (8); if broken, replace and make sure that terminals 1 - 4 of J1 on board (7) are not short-circuited. If so, replace board (7).
- ♦ Check the 180 VAC on terminals 0 – 180 of board (8); if missing, check the wiring between the service transformer and board (8), or replace the service transformer (8). If present replace the fuse board (8).

- ♦ Regular power supply to pre-charge board (7).

3.3.3 - Power source powered, display and signals doe not indicate the correct values.

LAMP-TEST AND SELF-TEST.

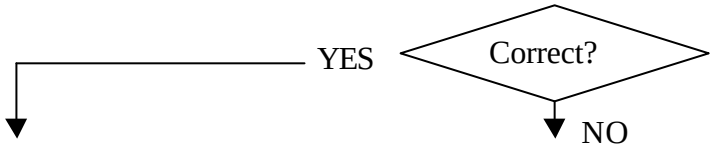
- The lamp-test (all operator panel signals lit) and self-test functions (display (X) indicates the software version installed) take place during the first two seconds after the machine is switched on.



  - Check the wiring between connector J11 on board (62) and the operator panel (64).
  - Replace board (62).
  - Replace the operator panel (64).

DISPLAY TEST.

- After the self-test, the display (X) indicates the value of the programmed current, variable via the knob (Z), and the display (Y) indicates the most appropriate nozzle diameter for said current value.

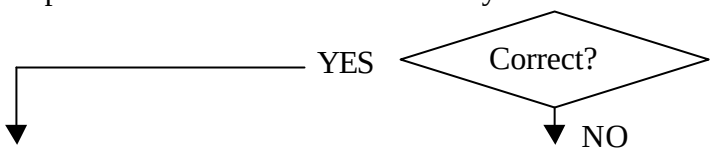


  - If display (X) indicates an error message (Exx) see par. 3.4.
  - If the interface module of remote control art. 197 is inserted, also see the Service Manual of said module.
  - Replace board (62).
  - Replace the operator panel (64).
- Operation is correct.

3.3.4 - The start button produces no effect.

PRESSURE SWITCH TEST (AA signal).

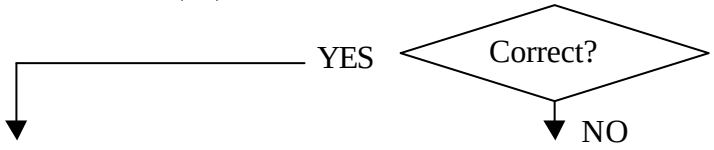
- Board (62), connector J6, terminals 3 – 4 and 5 - 6 = 0 VDC, contact closed, pressure OK. The pressure switches are automatically selected according to the type of torch connected.



  - Make sure there is gas at the intake fitting (I), and that the pressure and flow rates in the intake conduit meet the values specified for the PROF 162 (see specifications in the Sales Catalogue).
  - Make sure that the pressure regulator (H) and pressure gauge (G) are working properly; replace if defective.
  - Make sure there are no occlusions in the gas hoses of the power source.
  - Check the wiring between connector J6 on board (62) and pressure switches (27) and (33).
  - Replace pressure switches (27) and/or (33).

COOLING UNIT TEST (only with CP200 torch).

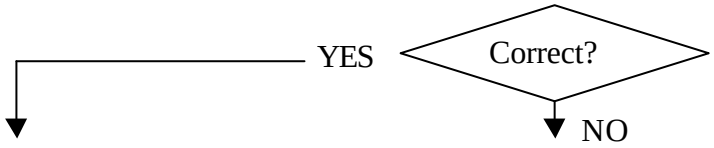
- Control board (62), connector J5, terminals 2 – 4 = 0 VDC (unit activated);
- Control board (62), connector J5, terminals 3 – 4 = 0 VDC (pressure OK).



- ♦ See Cooling Unit Service Manual art. 1339.

TORCH BOARD POWER SUPPLY TEST.

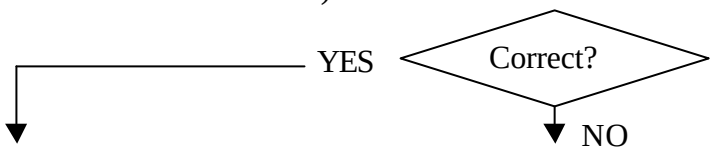
- Torch board (68), connector J3 terminals A – B = 24 VAC.



- ♦ Check the wiring between connectors J3 on board (68) and J3 on board (8).
- ♦ Check fuse F3 on board (8); if broken, replace and make sure that terminals A - B of J3 on board (68) are not short-circuited. If so, replace board (68).
- ♦ Check the 24 VAC on terminals 0 – 24 of board (8); if missing, check the wiring between the service transformer and board (8), or replace the service transformer (8). If present replace the fuse board (8).

START COMMAND TEST.

- Control board (62), connector J4 terminals 1 – 2 = 0 VDC (start) with torch button pressed (5 VDC with button released).



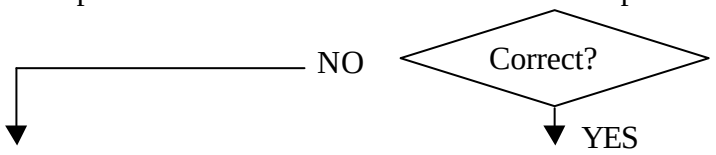
- ♦ Make sure that the nozzle guard is correctly assembled and in good working order. If defective or showing signs of wear, replace.
- ♦ Check the wiring between connectors J4 of board (62) and terminals S6 and S7 of board (68), and between J2 on board (68), fixed fitting (50), torch button and torch nozzle protection contact (if HV-16 module is installed, see par. 3.6).
- ♦ Make sure that the fixed fitting (50) is correctly assembled and in good working order: protection on = reed closed, 0 ohm between terminals SW1 and SW2 on board (68).
- ♦ Check for bridge presence on terminals 1 - 2, connector J8 on board (68). If the interface module art 197 is installed, J8 must be connected to connector (L) for remote control. (see Service Manual and Instruction Manual of the remote control interface art. 197).
- ♦ Replace the torch start button.
- ♦ Replace board (68) and make sure the conductors of the start button, the electrode and torch nozzle are perfectly insulated. If insulation is reduced, replace the complete torch. A loss of insulation between the conductors of the torch cable may damage the board (68).

♦ Replace board (62).

3.3.5 - No gas flows from the torch.

PILOT ARC SOLENOID VALVE TEST.

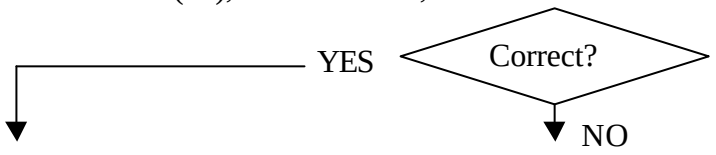
- Solenoid valve terminals (29), EL1 (terminals 7 – 8 of J12 control board (62), or EL2 (terminals 5 - 6 of J12 control board (62) = 27 VAC for two minutes (post-gas), with torch button pressed. Selection of the solenoid valve depends on the type of torch inserted.



  - Make sure there is gas at the intake fitting (I), and that the pressure and flow rates in the intake conduit meet the values specified for the PROF 162 (see specifications in the Sales Catalogue).
  - Make sure that the pressure regulator (H) and pressure gauge (G) are working properly; replace if defective.
  - Make sure there are no occlusions in the gas hoses of the power source.
  - Replace solenoid valve (29) EL1 or EL2.
- Check the wiring between connector J12 on board (62) and solenoid valves.

AC SERVICES POWER SUPPLY TEST.

- Control board (62), connector J14, terminals 3 – 4 = 27 VAC.

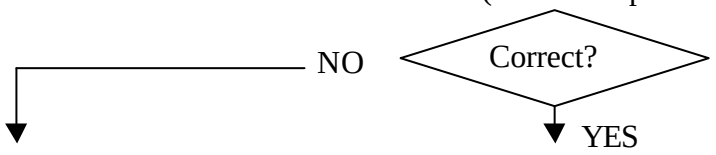


  - Check the wiring between connectors J14 on board (62) and J4 on board (8).
  - Check fuse F5 on board (8); if broken, replace and make sure that terminals 3 - 4 of J14 on board (62) are not short-circuited. If so, replace board (62).
  - Check the 27 VAC on terminals 0 – 27 of board (8); if missing, check the wiring between the service transformer and board (8), or replace the service transformer (8). If present replace the board (8).
- Replace board (62).

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

VOLTAGE TEST AT IGBT OUTPUT.

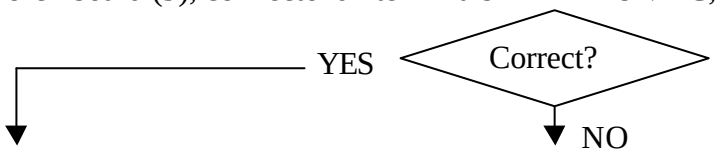
- Terminals 1 – 3 of IGBT (72) = 260 VDC with rated mains voltage, after pressing start button and for a duration of 2 seconds (maximum pilot arc time).



  - Go to par. 3.3.7.

DRIVER BOARD POWER SUPPLY TEST.

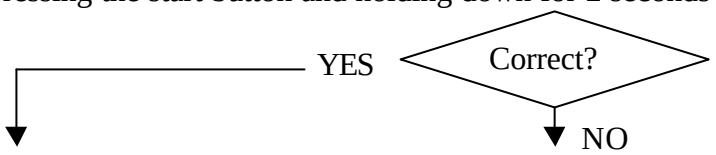
- Torch board (9), connector J1 terminals 1 – 2 = 18 VAC, terminals 5 – 6 = 20 VAC.



  - Check the wiring between connectors J1 on board (9) and J2 on board (8).
  - Check fuses F6 and F7 on board (8); if broken, replace and make sure that terminals 1 - 2 and 5 - 6 of J1 on board (9) are not short-circuited. If so, replace board (9).
  - Check the 18 VAC and 20 VAC on terminals 0 - 18 and 0 - 20 of board (8); if missing, check the wiring between the service transformer and board (8), or replace the service transformer (8). If present replace the board (8).

DRIVER BOARD ENABLED TEST.

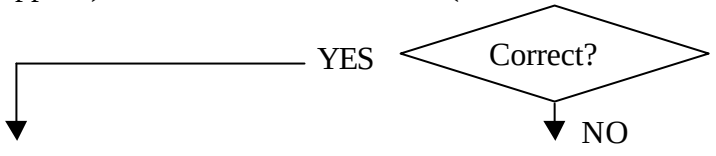
- Driver board (9), connector J3, terminals 1 – 2 = fig. 5.2.1 (pilot arc current set-point), after pressing the start button and holding down for 2 seconds (maximum pilot arc time).



  - Check the wiring between connectors J3 on board (9) and J2 on board (62).
  - Make sure that terminals 1 - 2 of J3 on board (9) are not short-circuited. If so, replace board (9).
  - Replace board (62).

CURRENT TRANSDUCER TEST (71).

- Control board (9), connector J4 terminals 2 – 3 = +15 VDC and 2 - 1 = -15 VDC (power supplies); terminals 2 - 4 = 0 VDC (current reaction, with power source started in stop).



  - Check the wiring between current transducer (71) and connector J4 on board (9).
  - Replace current transducer (71).
  - Replace board (62).
- Check the wiring between connector J5 on board (9) and IGBT (72).
- Replace board (9).
- Replace IGBT (72).

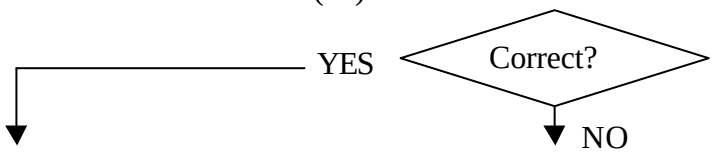
3.3.7 - Gas flows from the torch, the pilot arc does not light (high frequency missing).

NOTE

The following tests may be checked only in the two seconds after pressing the torch start button (maximum pilot arc time).

VOLTAGE PRESENCE TEST AT IGBT OUTPUT.

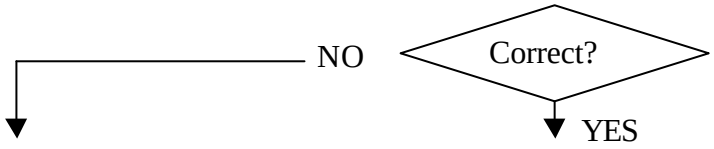
- Terminals 1 – 3 of IGBT (72) = > 200 VDC.



- ♦ Go to par. 3.3.6.

HF OSCILLATOR TEST.

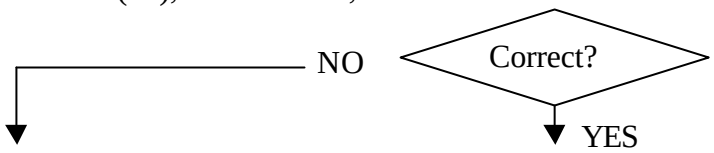
- HF board (15), scintillator SC2 discharges at regular intervals.



- ♦ Make sure that there is no short-circuit between connectors J8 and J9 on board (15) or in the wiring of the primary HF transformer circuit (69).
- ♦ Check the secondary HF transformer circuit connections (69), choke (43) and fixed fitting (50). If you find loose connections, tighten and replace any damaged components.
- ♦ Check the adapter and torch cable; replace if aged or cracked.
- ♦ Check electrode and torch nozzle; replace if worn or damaged.
- ♦ Check distance between tips of the scintillator SC2 (correct = 0.95 mm.).
- ♦ Make sure that the gas pressure in the torch plasma chamber is not too high (see “Plasma gas pressure test”, par. 3.3.8.).
- ♦ Replace HF transformer (69).
- ♦ Replace board (15).

HF BOARD INPUT VOLTAGE TEST.

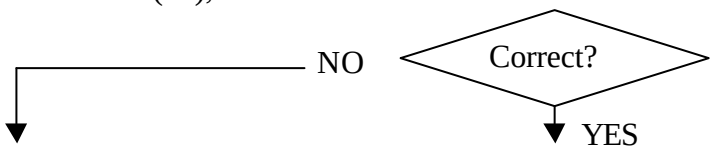
- HF board (15), connector J7, terminals 1 – 4 = > 200 VDC.



- ♦ Make sure that the connection between J8 and J9 on board (15) and the primary HF transformer circuit (69) is not broken.
- ♦ Check 0 VAC on terminals A - B of J3 on board (15), in normal configuration; 27 VAC if HV-16 module is installed (also see Service Manual for HV-16 Module).
- ♦ Replace board (62).
- ♦ Replace board (15).

TORCH BOARD INPUT VOLTAGE TEST.

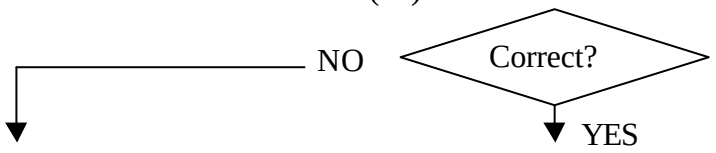
- Torch board (68), connector J5 terminals AB and connector J7 terminal 1= > 200 VDC.



- ♦ Check the wiring between connectors J6 on board (68) and J7 on board (15).
- ♦ Replace board (68).

NOZZLE REMOTE SWITCH TEST.

- Remote switch coil terminals (18) = 27 VAC.



- ♦ Check the wiring between the resistor (74), remote switch contacts (18) and connector J5 terminals AB on board (68). If you find loose connections, tighten and replace any damaged components.
- ♦ Check the connection between the choke (43) and connector J7, terminal 1, on board (68).
- ♦ Check the jumpers on power contacts of remote switch (18).
- ♦ Check the resistor (74); replace if broken.
- ♦ Replace remote switch (18).

♦ Check the wiring between the remote switch (18) and connector J12 on board (62).
♦ Replace board (62).

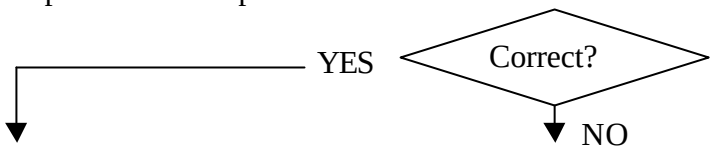
3.3.8 - Irregular pilot arc starts, unstable pilot arc.

NOTE

Some of the following tests may be checked only during the pilot arc time (max. 2 seconds).

PLASMA GAS PRESSURE TEST.

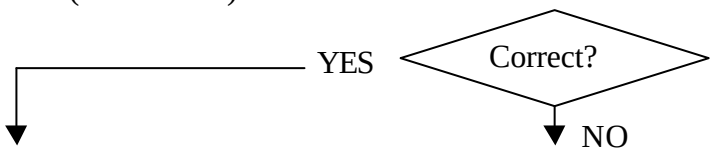
- Gas pressure in the plasma chamber of the correct torch.



- ♦ Make sure that the pressure regulator (H) and pressure gauge (G) are working properly; replace if defective.
- ♦ Make sure that the gas pressure, on the pressure gauge (G), corresponds to the value indicated in table (S) of the operator panel (see fig. 3.2.1.).
- ♦ Check solenoid valve (29), EL1 or EL2, for pilot arc = open; solenoid valve (29), EL3, for transferred arc = closed. If not correct, check efficiency of solenoid valves, wiring between solenoid valves and connector J12 of board (62), or replace board (62) (see “Pilot arc solenoid valve test” par.3.3.5).
- ♦ Check presence of flow reducers on solenoid valves (29) EL1 and EL2.

VOLTAGE TEST AT IGBT INPUT.

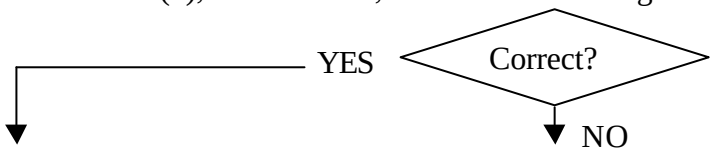
- Terminals 2 - 3 of IGBT (72) = 260 VDC, with rated mains voltage, stable even with pilot arc lit (- 10% max.).



  - Check 3 x 180 VAC, with rated mains voltage, on input terminals of rectifier bridge (78); if not correct check transformer connections (79), main voltage change, remote switch (5) and mains voltage.
  - Check rectifier bridge (78); replace if defective.
  - Replace board (62).

PILOT ARC REFERENCE TEST.

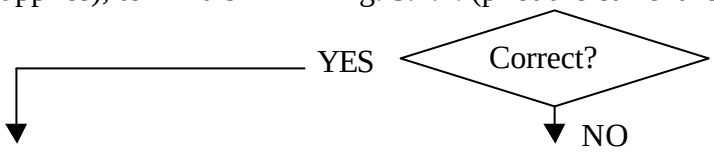
- Driver board (9), connector J3, terminals 1 – 2 = fig. 5.2.1. (pilot arc current set-point).



  - Check the wiring between connectors J3 on board (9) and J2 on board (62).
  - Make sure that terminals 1 - 2 of J3 on board (9) are not short-circuited. If so, replace board (9).
  - Replace board (62).

PILOT ARC CURRENT REACTION TEST.

- Control board (9), connector J4 terminals 2 – 3 = +15 VDC and 2 - 1 = -15 VDC (power supplies); terminals 2 - 4 = fig. 5.2.2. (pilot arc current feed-back).

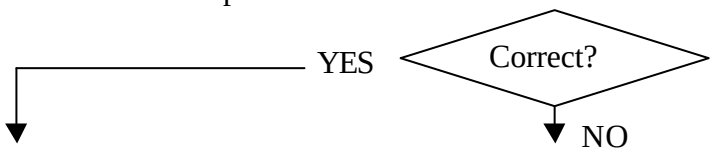


  - Check the wiring between current transducer (71) and connector J4 on board (9).
  - Replace current transducer (71).
  - Check IGBT (72). Replace if defective. According to the type of defect, it may also be necessary to replace the board (9).
  - Replace board (9).
- Check the adapter and torch cable; replace if aged or cracked.
- 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.

3.3.9 - Transfer arc does not take place, pilot arc remains and cutting is impossible.

REED TEST.

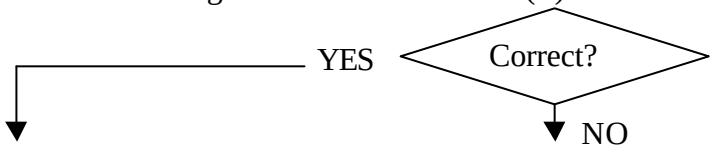
- Board (62), connector J8, terminals 1 – 2 = 0 VDC (reed contact closed) with pilot arc lit and torch next to workpiece.



- ♦ Check the wiring between connector J8 on board (62) and reed (14).
- ♦ Make sure the reed is correctly positioned inside the coil (13).
- ♦ Check the coil connections (13); if you find loose or damaged connections, tighten or replace the damaged components.
- ♦ Replace reed (14).
- ♦ Replace board (62).

TRANSFER ARC REFERENCE TEST.

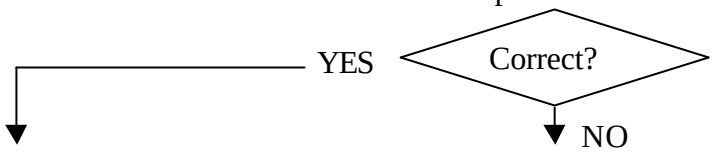
- Board (9), connector J3, terminals 1 – 2 = fig. 5.2.3. (transfer arc current set-point), with knob (Z) turned to mid-point. Waveform of the transfer arc current set-point, with duty-cycle variable according to rotation of the knob (Z).



- ♦ Check the wiring between connectors J3 on board (9) and J2 on board (62).
- ♦ Check the wiring between connectors J1 on operator panel (64) and J11 on board (62).
- ♦ Replace the operator panel (64).
- ♦ Replace board (62).

TRANSFER ARC SOLENOID VALVE TEST.

- Solenoid valve terminals (29), EL3 (terminals 3 – 4 of J12 control board (62) = 27 VAC, with transfer arc and torch next to workpiece.



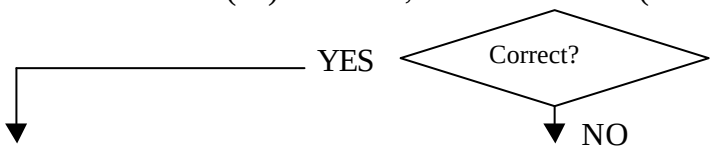
- ♦ Check the wiring between connector J12 on board (62) and solenoid valve terminals (29) EL3.
- ♦ Replace board (62).

- ♦ Make sure there are no occlusions in the gas hoses of the solenoid valve EL3.
- ♦ Check pressure and gas flow when solenoid valve (29) EL3 is powered.
- ♦ Replace solenoid valve EL3.

3.3.10 - Weak transfer arc that shuts off as soon as cutting begins.

NOZZLE REMOTE SWITCH OPENING TEST.

- Resistor terminals (74) = 0 VDC, with transfer arc (> 25 VDC with pilot arc).



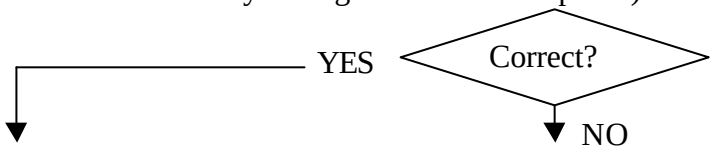
  - Check voltage on the remote switch coil (18): if 0 VAC replace remote switch (18); if 27 VAC replace board (62).

- See “Transfer arc reference test” and “Transfer arc solenoid valve test” par. 3.3.9.

3.3.11 - Post-gas does not take place upon releasing the start button and after cutting.

POST-GAS TEST.

- Solenoid valve terminals (29), EL1 (terminals 7 – 8 of J12 control board (62)), or EL2 (terminals 5 - 6 of J12 control board (62) = 27 VAC during pilot arc, transfer arc and post-gas stages. Selection of the solenoid valve depends on the type of torch.
  (EL3 = 27 VAC only during the transfer arc phase).



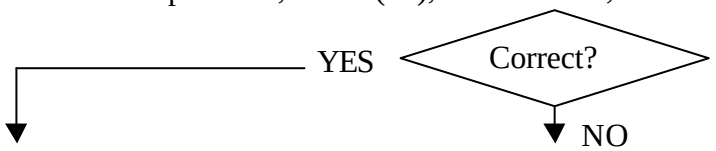
  - Check the wiring between the solenoid valves (29) EL1, EL2 and EL3 and connector J12 on board (62).
  - Replace board (62).

- See “Pilot arc solenoid valve test” par. 3.3.5. and “Transfer arc solenoid valve test” par. 3.3.9..

3.4 - Error messages.

E1 - Hardware lockup.
E2 - Hardware lockup.
Power source lockup due to software error. Replace control board (62).

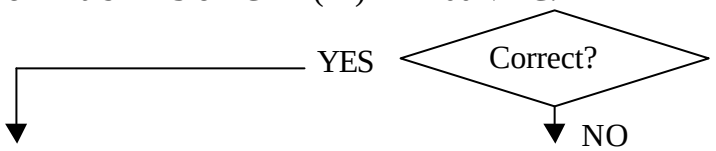
E12 - Transfer reed closed during start-up.
REED TEST.
- Power source powered, board (62), connector J8, terminals 1 – 2 = 35 VDC.



  - ♦ Check the wiring between connector J8 on board (62) and reed (14).
  - ♦ Check reed contact (14): if closed, replace reed (14).
  - ♦ Check 27 VAC on terminals 3 - 4 of J14 on board (62). If missing, see "AC services power supply test", par. 3.3.5.; if present, replace board (62).
- ♦ Replace board (62).

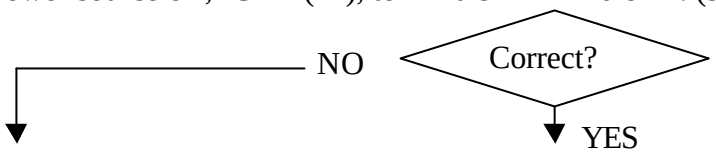
E13 - Hazardous voltage on the torch.

VOLTAGE PRESENCE TEST AT IGBT OUTPUT.
- Terminals 1 – 3 of IGBT (72) = > 200 VDC.



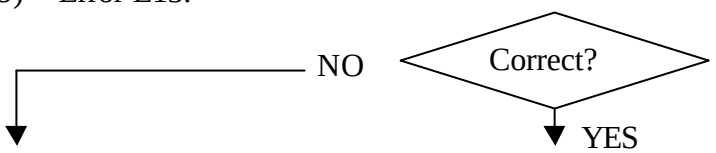
  - ♦ Replace board (62).

IGBT TEST.
- Power source off, IGBT (72), terminals 1 – 2 = 0 ohm. (short-circuit).



  - ♦ Replace IGBT (72).

IGBT COMMAND TEST.
- Turn on the power source with the connector J3 on driver board (9) disconnected from board (9) = Error E13.



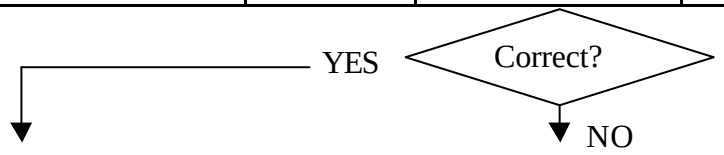
  - ♦ Replace board (9).
- ♦ Replace board (62).

E51 - Torch not recognized.

TORCH RECOGNITION TEST.

- Control board (62), connector J3, terminals 1, 2, 3 – 4 = 1.2 VDC according to table below.

Type of torch	Voltage on terminals of J3 board (62)			Jumpers (T) on torch adapter
	1 – 4	2 – 4	3 – 4	
CP90	1.2 VDC	1.2 VDC	0	2 – 3 – 4
CP160	0	0	1.2 VDC	2 – 7
CP200	0	1.2 VDC	0	2 – 4
CP200 + HV-16	0	1.2 VDC	1.2 VDC	2 – 4 – 7



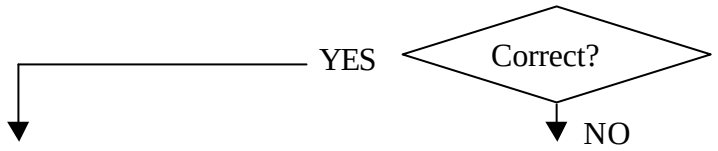
- ♦ Check the wiring between connectors J3 of board (62) and terminals S1, S2, S4 and S5 of board (68), and between J1 on board (68), fixed fitting (50) and torch adapter.
- ♦ Check the jumpers on the patch torch adapter, according to table above.
- ♦ Check power supply board (68); see "Torch board power supply test" par. 3.3.4.
- ♦ Replace board (68).

♦ Replace board (62).

E52 - Start button pressed during start-up.

START BUTTON TEST.

- Power source on, control board (62), connector J4, terminals 1 – 2 = 5 VDC with torch button released.



- ♦ Make sure there is no short-circuit in the wiring between the terminals of J4 on board (62), S6 and S7 on board (68), J2 on board (68), the fixed fitting (50), the torch cable and button.
- ♦ Replace the torch start button.
- ♦ Replace board (68).
- ♦ Replace board (62).

♦ Replace board (62).

E53 - Start button pressed while resetting from stop due to pressure or temperature beyond allowable limits.

The "low gas pressure " and "high temperature" alarms will stop the power source, lighting the corresponding signal (see Instruction Manual), but do not remain in memory. They are automatically reset when the pressure and temperature return to within the allowed limits. On automated systems, the system may be reset when the start command has not yet been removed, since before the stop occurred. To prevent the power source from starting suddenly due to such a random reset, this situation is detected and causes a saved block of the power source, indicating error E53.

To reset this situation, shut off the power source, remove the start command and restart the power source.

E54 - Short-circuit between electrode and nozzle.
E55 - Electrode finished.

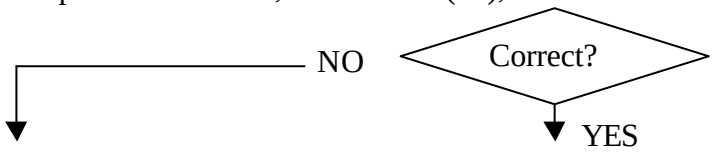
NOTE

These functions are controlled only during cutting (transfer arc).

These two alarms use the same circuits and same transmission line. The difference between the two errors consists only of the level of the signal transmitted to the control. The troubleshooting procedures are therefore similar.

SHORT-CIRCUIT TEST.

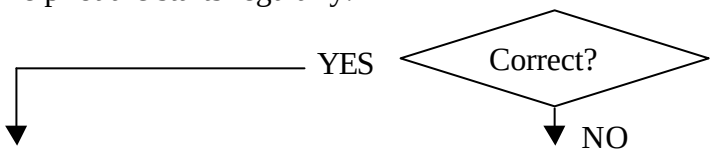
- With power source off, torch board (68), connector J4 terminals AB and choke (43) = 0 ohm.



  - Check the adapter, cable, electrode and torch nozzle; replace if worn or damaged.

DETECTION CIRCUIT TEST.

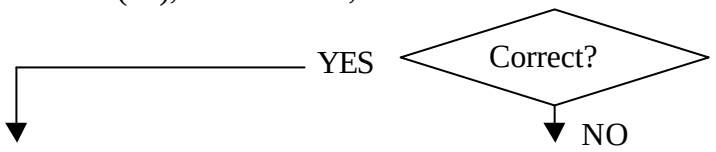
- The pilot arc starts regularly.



  - See par. 3.3.6. and 3.3.7.

DETECTION CIRCUIT POWER SUPPLY TEST.

- HF board (15), connector J2, terminals 1 - 2 = 10 VAC.



  - Check the wiring between connectors J2 on board (15) and J3 on board (8).
  - Check fuse F2 on board (8); if broken, replace and make sure that terminals 1 - 2 of J2 on board (15) are not short-circuited. If so, replace board (15).
  - Check the 10 VAC on terminals 0 – 10 of board (8); if missing, check the wiring between the service transformer and board (8), or replace the service transformer (8). If present replace the board (8).
- Check the adapter, cable, electrode and torch nozzle; replace if worn or damaged.
- Check the wiring between connectors J7 on board (62) and J4 on board (15), and between J1 on board (15) and J10 on board (62).
- Replace board (15).
- Replace board (62).

4 - COMPONENTS LIST

4.1 - Power source art. 952 : see file ESP952.pdf enclosed at the end of the manual.

4.2 - Components table: see file ESP952.pdf enclosed at the end of the manual.

4.3 - Spare parts list.

Essential spare parts.

Ref.	Code	Description	Qty.
7	5.602.026	pre-charging board	1
9	5.602.023	driver board	1
15	5.602.024	HF board	1
62	5.602.027	control board	1

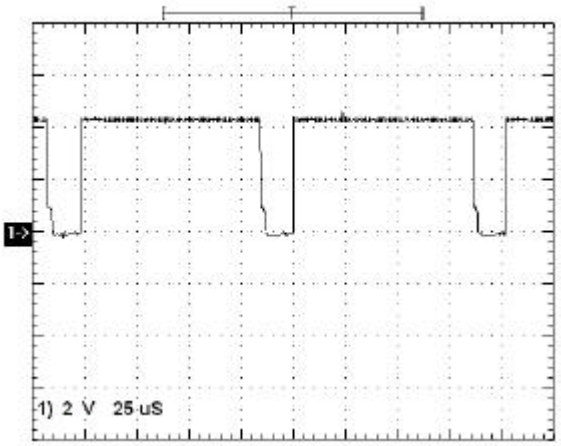
Recommended spare parts.

Ref.	Code	Description	Qty.
5	3.190.278	remote switch	1
8	5.600.621	transformer	1
13	5.580.236	reed connection	1
18	3.190.268	remote switch	1
29	3.160.181	solenoid valve	1

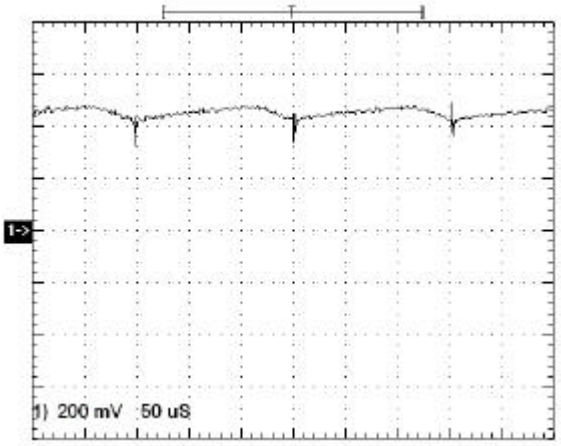
5 - ELECTRICAL DIAGRAMS

5.1 - Power source art. 952 : see file SCHE952.pdf enclosed at the end of the manual.

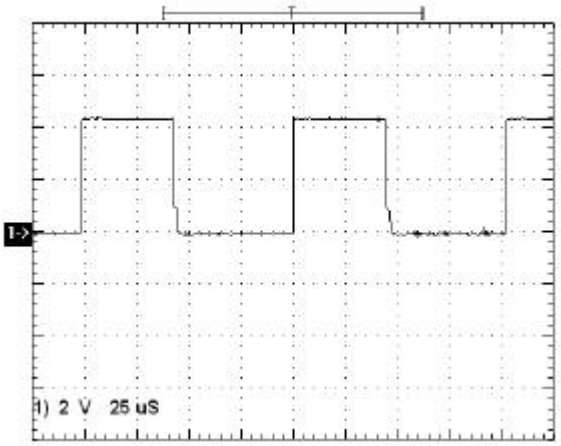
5.2 - Waveforms.



5.2.1 - Pilot arc current set-point (par.3.3.6 – 3.3.8).



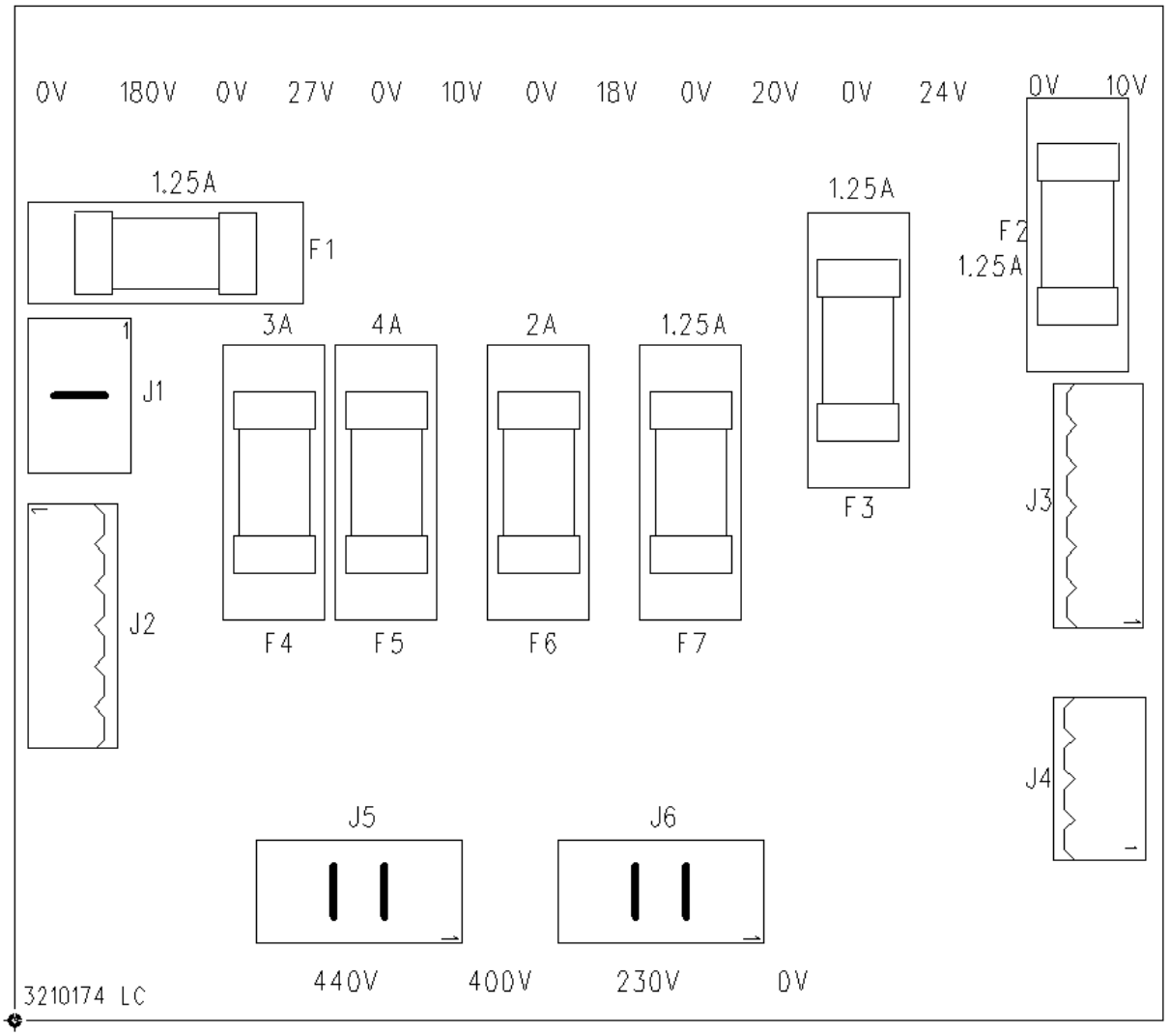
5.2.2 - Pilot arc current feed-back (par. 3.3.8).



5.2.3 - Transfer arc current set-point (par. 3.3.9).

5.3 - Fuse board (8) code 5.602.025.

5.3.1 - Topographical drawing.

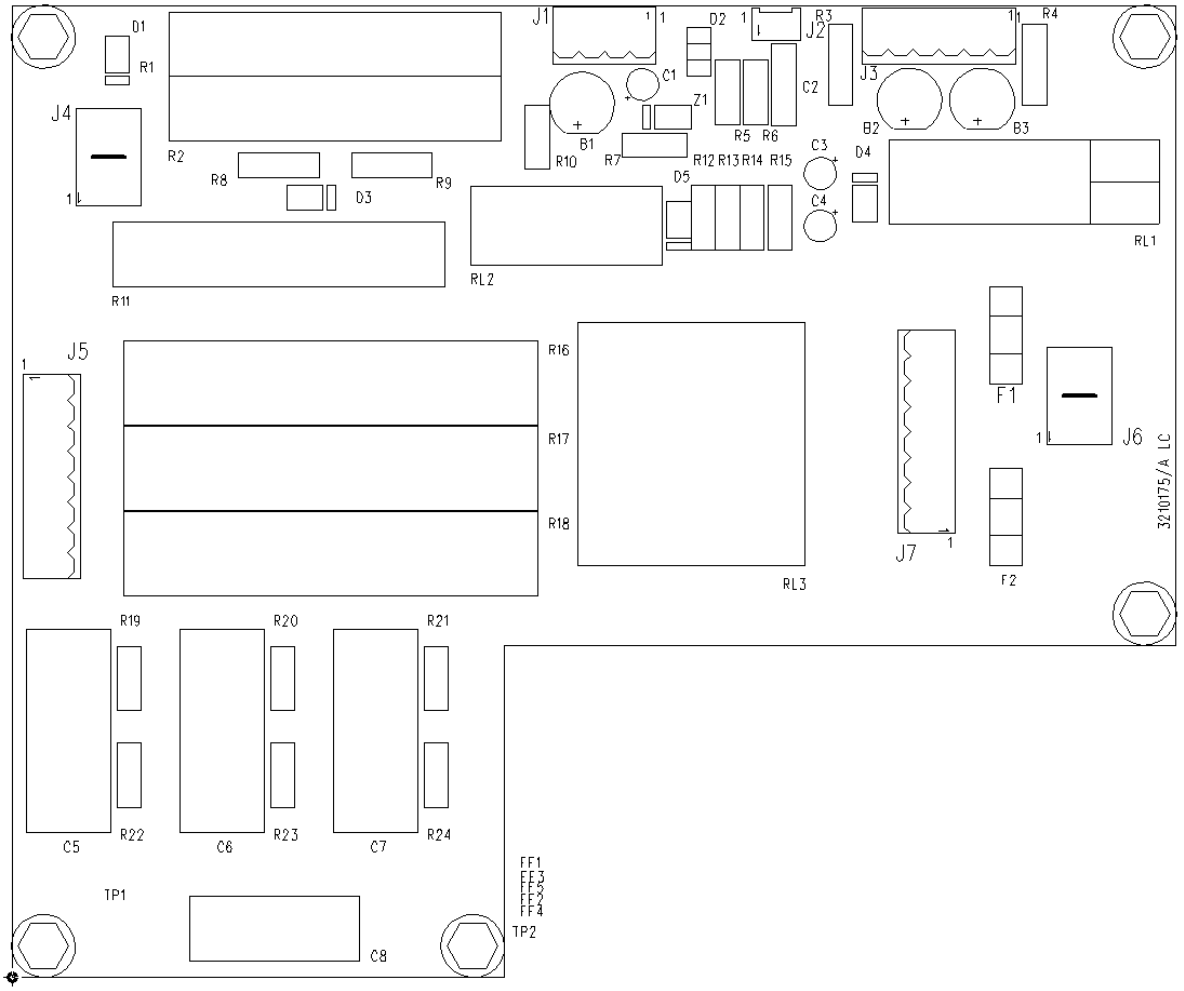


5.3.2 - Connector and fuse table.

Connector	Terminals	Fuse	Value	Function
J1	A – B	F1	1,25 A	180 VAC capacitor pre-charge output (40).
J2	1 – 2	F6	2 A	18 VAC driver board power supply output (9).
J2	5 – 6	F7	1.25 A	20 VAC IGBT driver board power supply output on board (9).
J3	1 – 2	F3	1.25 A	24 VAC output torch board power supply (68).
J3	5 – 6	F2	1.25 A	10 VAC HF board power supply output (15).
J4	1 – 2	F4	3 A	10 VAC control board power supply output (62).
J4	3 – 4	F5	4 A	27 VAC AC auxiliary power supply output.
J5	A	-	-	400 VAC service transformer power supply phase input.
J5	B	-	-	440 VAC service transformer power supply phase input.
J6	A	-	-	230 VAC service transformer power supply phase input.
J6	B	-	-	0 VAC service transformer power supply phase input.

5.4 - Pre-charge board (7) code 5.602.026/A.

5.4.1 - Topographical drawing.



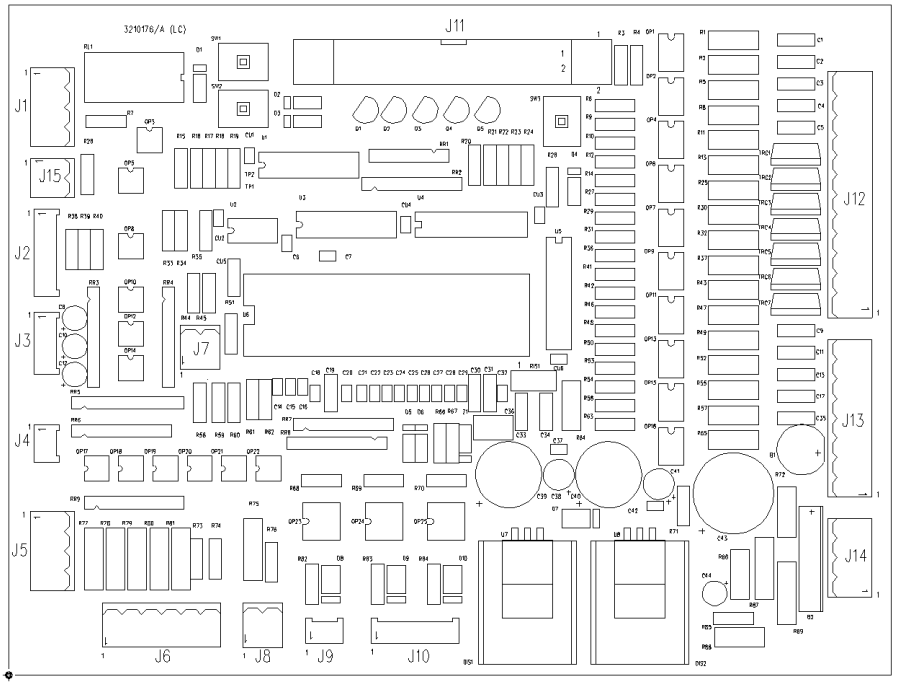
5.4.2 - Connector and fuse table.

Connector	Terminals	Function
J1	1 – 4	180 VAC capacitor pre-charge input (40).
J2	1 – 2	“capacitor pre-charge (40) complete” signal output.
J3	1 – 2	socket power supply command input (21).
J3	3 – 4	transformer pre-magnetizing command input (79).
J3	5 – 6	capacitor pre-charge command input (40).
J4	A – B	250 VDC output for capacitor pre-charge (40).
J5	1-4-7	power supply input for transformer pre-magnetizing (79).
J6	A - B	control and service power supply output.
J7	1-4-7	power supply output for transformer pre-magnetizing (79).

Fuse	Value	Function
F1	5 A	service transformer power supply (8).

5.5 - Control board (62) code 5.602.027/A.

5.5.1 - Topographical drawing.

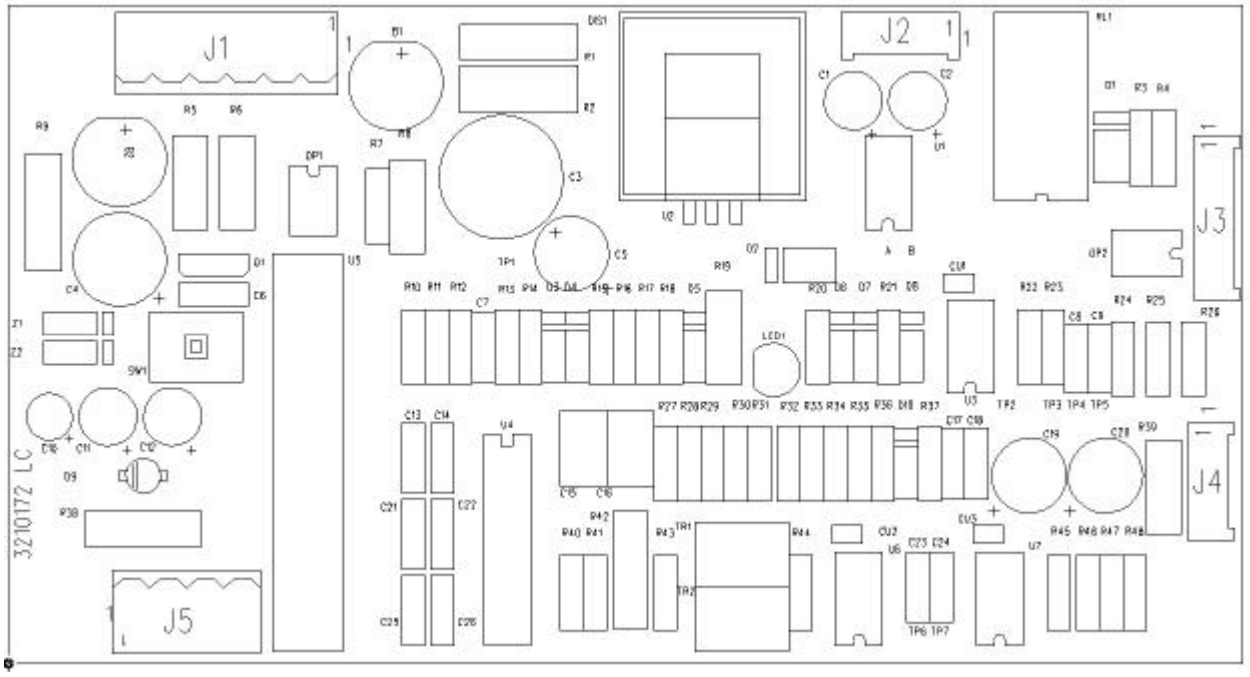


5.5.2 - Connector table.

Conn.	Terminals	Function
J1	1 – 4	“transfer arc” output.
J1	3 – 4	current digital reference input.
J2	1 – 2	current set-point PWM output.
J2	1 – 3	IGBT driver command output.
J2	5 – 6	block input from driver board (9).
J3	1-2-3-4	torch recognition output.
J4	1 – 2	power source start command input.
J5	2 - 4	“cooling unit presence” input.
J5	3 - 4	“cooling liquid pressure” input.
J6	1 - 2	“power source temperature” input.
J6	3 – 4	“pressure 1 gas” input.
J6	5 – 6	“pressure 2 gas” input.
J7	1 – 2	“electrode finished” digital reference output.
J8	1 – 2	transfer reed input.
J9	1 – 2	“capacitor (40) pre-charge complete” input.
J10	1 – 2	“hazardous voltage” input
J10	5 – 6	PWM "electrode finished” input.
J11	1 – 34	operator panel inputs/outputs.
J12	1 – 2	solenoid valve EL4 output (n.u.).
J12	3 – 4	solenoid valve EL3 output.
J12	5 – 6	solenoid valve EL2 output.
J12	7 – 8	solenoid valve EL1 output.
J12	9 – 10	remote switch output (18).
J12	11–12	internal HF cut-out output.
J13	1 – 2	remote switch output (5).
J13	3 – 4	socket command output (21).
J13	5 – 6	pre-magnetization output (79).
J13	7 – 8	capacitor pre-charge output (40).
J14	1 – 2	power supply input board (62).
J14	3 – 4	AC service power supply input.
J15	1 – 2	input “autopilot”.

5.6 - Driver board (9) code 5.602.023/A.

5.6.1 - Topographical drawing.

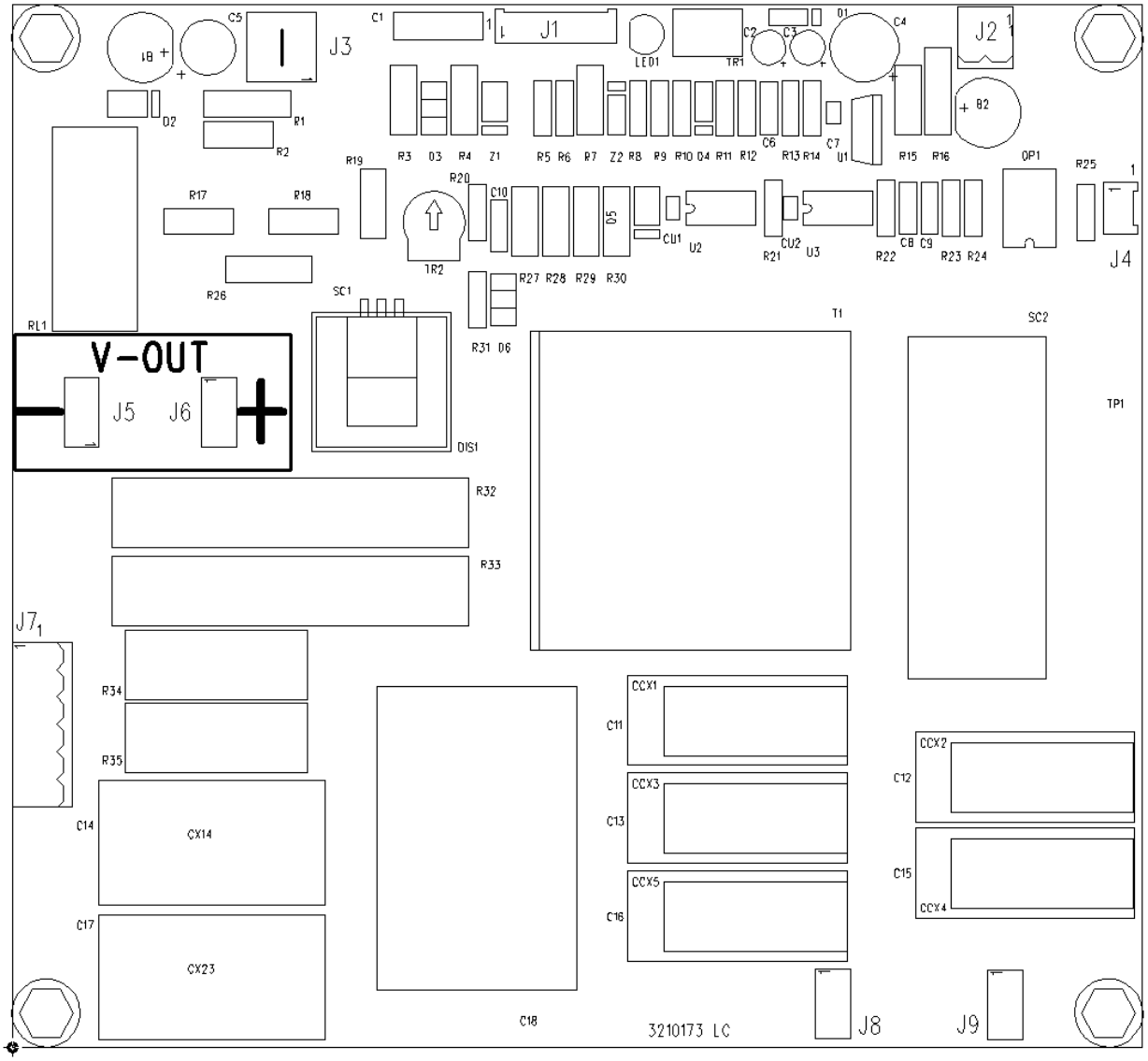


5.6.2 - Connector table.

Connector	Terminals	Function
J1	1 – 2	18 VAC driver board power supply input (9).
J1	5 – 6	20 VAC IGBT driver power supply input.
J2	1-3-4	block output from driver board (9).
J3	1 – 2	current set-point PWM input.
J3	1 – 3	IGBT driver command input.
J3	5 – 6	block output from driver board (9).
J4	1-2-3-4	current reaction input from transducer (71).
J5	3 - 4	IGBT command output (72).

5.7 - HF Board (15) code 5.602.024.

5.7.1 - Topographical drawing.

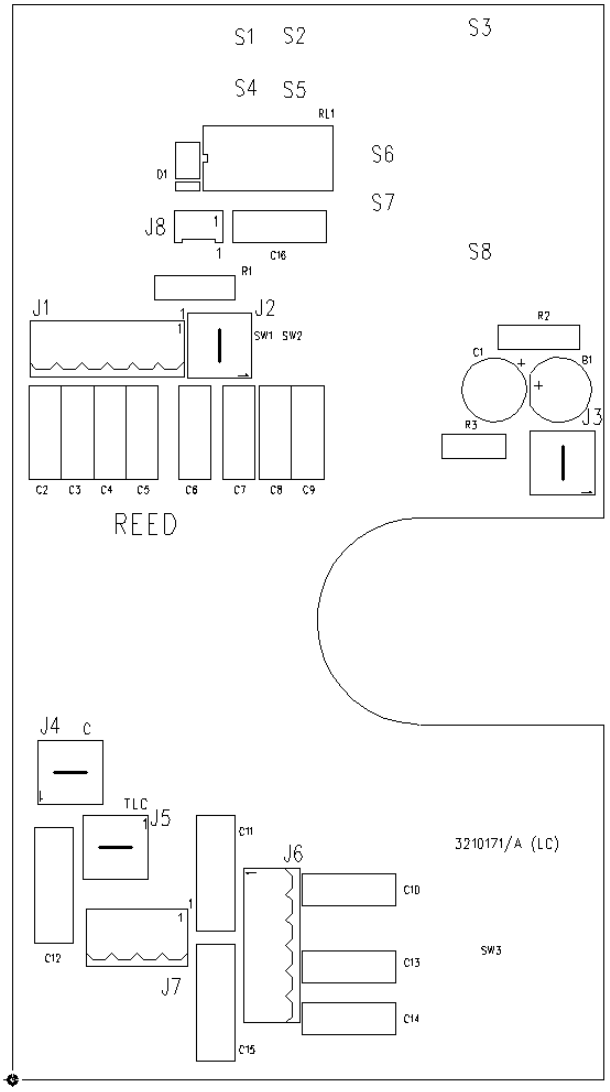


5.7.2 - Connector table.

Connector	Terminals	Function
J1	1 – 2	"hazardous voltage" output.
J1	5 – 6	PWM “electrode finished” output.
J2	1 – 2	HF board power supply input (15).
J3	A - B	internal HF cut-out input.
J4	1 – 2	"electrode finished" digital reference input.
J5	-	output voltage output, electrode potential.
J6	-	output voltage output, earth potential + power source (n.u.).
J7	1	output voltage input, nozzle potential.
J7	4	output voltage input, electrode potential.
J7	1	output voltage input, earth potential + power source.
J8-J9	-	HF transformer primary circuit output (69).

5.8 - Torch board (68) code 5.602.022/A

5.8.1 - Topographical drawing.

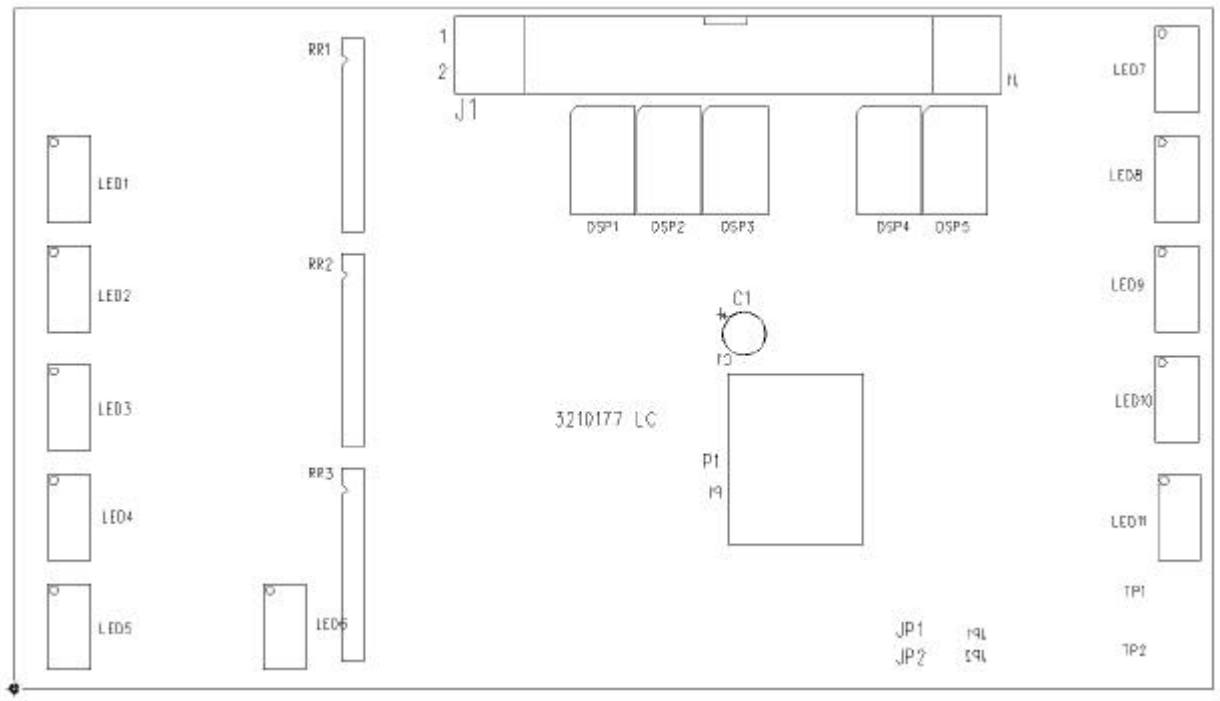


5.8.2 - Connector table.

Connector	Terminals	Function
J1	2-3-4-5	torch recognition input.
J2	A - B	start input from torch button.
J3	A – B	torch board power supply input (68).
J4	AB	nozzle power source voltage output.
J5	AB	input voltage from power source, nozzle potential.
J6	1	output voltage output, nozzle potential for HF board (15).
J6	4	output voltage output, electrode potential for HF board (15).
J6	6	output voltage output, earth potential + power source for HF board (15).
J7	1	output voltage input, electrode potential.
J7	4	output voltage input, earth potential + power source.
J8	A - B	start input from remote control.
	S1-S2-S4-S5	torch recognition outputs (shielded cable).
	S7-S8	start command output (shielded cable).

5.9 - Operator panel board (64) code 5.602.028.

5.9.1 - Topographical drawing.



5.9.2 - Connector table.

Connector	Terminals	Function
J1	1 - 34	inputs/outputs from control board (62).

6 - UPGRADES

6.1 - Power source art. 952 with enhanced pilot arc lighting.

6.1.1 - Description of upgrade.

Valid for machines with serial N° A67063 and later.

The purpose of this upgrade is a variation to improve pilot arc lighting.

This variation, shown in the diagram in par. 6.1.4., consists of:

- Replacing the HF transformer (69) with an autotransformer HF.
- Addition of the RC board (80).
- Upgrade of the software program to version n° P03, shown on display X during the self-test phase (see fig. 3.2.1).

6.1.2 - Operating description.

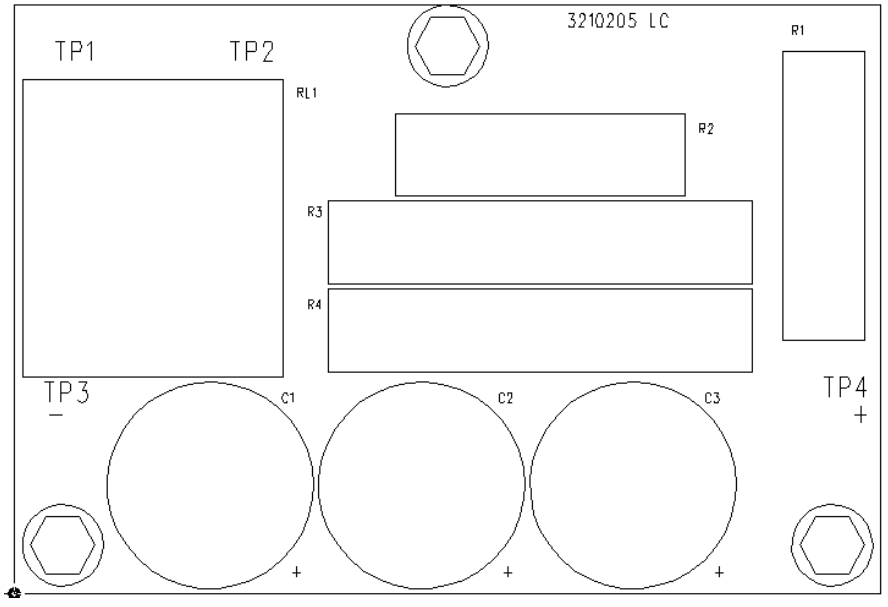
The board (80), taking the signal from the terminals of the remote switch (18), inserts a battery of capacitors between the common resistance point (74) with solenoid (13) and the common choke point (43) with HF autotransformer (69), in order to provide a greater energy reserve for lighting the pilot arc.

The battery of capacitors on the RC board (80) remains inserted only for the duration of the pilot arc, thus for as long as the remote switch (18) remains powered.

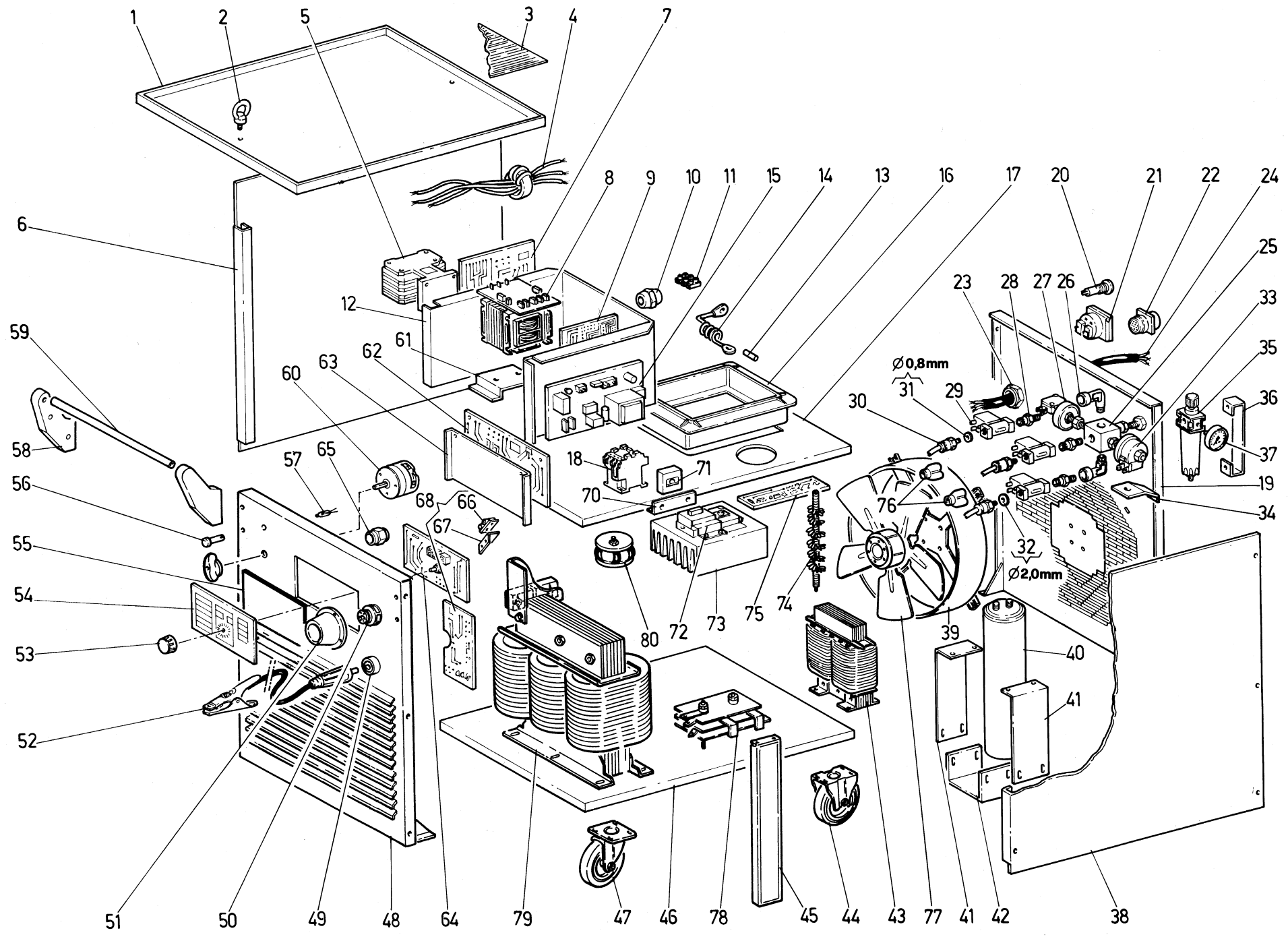
In addition, the autotransformer (69) offers a faster response to the high frequency, thus ensuring better conditions for lighting the pilot arc.

The change to the software program was necessary to re-synchronize the command signals with the signals of any errors detected in the power source circuits.

6.1.3 - RC board code 5.602.076.



6.1.4 - Power source art. 952 + RC board upgrade: see file SCHE952-A.pdf enclosed at the end of the manual.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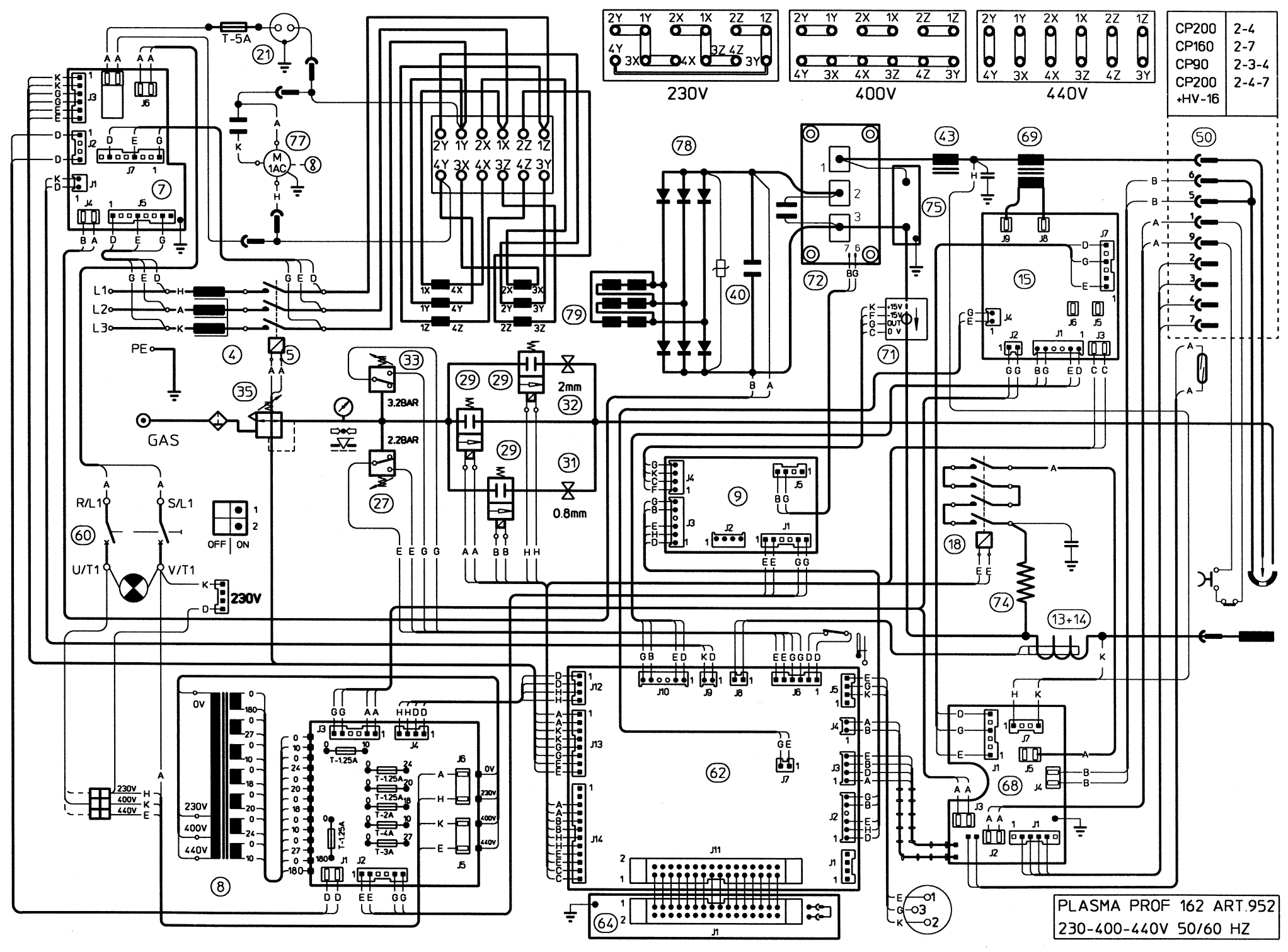
pos	DESCRIZIONE	DESCRIPTION
1	COPERCHIO	COVER
2	GOLFARA	EYEBOLT
3	COPERTURA GOMMA	RUBBER MAT
4	FERRITE	FERRITE
5	TELERUTTORE	CONTACTOR
6	LATERALE SINISTRO	LEFT SIDE PANEL
7	CIRCUITO DI PRECARICA	PRECHARGE CIRCUIT
8	TRASFORMATORE DI SERVIZIO	AUXILIARY TRANSFORMER
9	CIRCUITO DRIVER	DRIVER CIRCUIT
10	SUPPORTO	SUPPORT
11	MORSETTIERA	TERMINAL BOARD
12	SUPPORTO	SUPPORT
13	CONNETTORE	CONNECTOR
14	BOBINA	COIL
15	CIRCUITO ALTA FREQUENZA	HIGH-FREQ. CIRCUIT
16	SUPPORTO	SUPPORT
17	PIANO INTERMEDIO	INSIDE BAFFLE
18	TELERUTTORE	CONTACTOR
19	PANNELLO POSTERIORE	BACK PANEL
20	PORTA FUSIBILE	FUSE HOLDER
21	PRESA	SOCKET
22	CONNETTORE	CONNECTOR
23	PASSACAVO	CABLE OUTLET
24	CAVO RETE	POWER CORD
25	RACCORDO A TRE VIE	T-FITTING
26	RACCORDO A GOMITO	UNION ELBOW
27	PRESSOSTATO	PRESSURE SWITCH
28	RACCORDO	FITTING
29	ELETTROVALVOLA	SOLENOID VALVE
30	RACCORDO	FITTING
31	LIMITATORE	LIMITING DEVICE
32	LIMITATORE	LIMITING DEVICE
33	PRESSOSTATO	PRESSURE SWITCH
34	APPOGGIO	REST
35	RIDUTTORE	REGULATOR
36	PROTEZIONE	PROTECTION
37	MANOMETRO	GAUGE
38	LATERALE DESTRO	RIGHT SIDE PANEL
39	TUNNEL	COOLING TUNNEL
40	CONDENSATORE	CAPACITOR

pos	DESCRIZIONE	DESCRIPTION
41	SUPPORTO	SUPPORT
42	SUPPORTO	SUPPORT
43	IMPEDENZA	CHOKE
44	RUOTA FISSA	FIXED WHEEL
45	RINFORZO	REINFORCEMENT
46	FONDO	BOTTOM
47	RUOTA	WHEEL
48	PANNELLO ANTERIORE	FRONT PANEL
49	PRESA GIFAS	GIFAS SOCKET
50	ADATTATORE FISSO	FIXED ADAPTOR
51	PROTEZIONE TORCIA	TORCH PROTECTION
52	CAVO MASSA	EARTH CABLE
53	MANOPOLA	KNOB
54	PANNELLO IN ALLUMINIO	ALUMINIUM PANEL
55	CORNICE IN GOMMA	RUBBER FRAME
56	PORTA LAMPADA	LAMP HOLDER
57	LAMPADA	LAMP
58	SUPPORTO MANICO	HANDLE SUPPORT
59	MANICO	HANDLE
60	INTERRUTTORE	SWITCH
61	SUPPORTO	SUPPORT
62	CIRCUITO DI CONTROLLO	CONTROL CIRCUIT
63	SUPPORTO	SUPPORT
64	CIRCUITO PANNELLO	PANEL CIRCUIT
65	RACCORDO	FITTING
66	REED	REED
67	SUPPORTO	SUPPORT
68	CIRCUITO TORCIA	TORCH CIRCUIT
69	TRASFORMATORE H.F.	H.F. TRANSFORMER
70	SUPPORTO	SUPPORT
71	TRASDUTTORE	TRANSDUCER
72	IGBT	IGBT
73	DISSIPATORE	RADIATOR
74	RESISTENZA	RESISTANCE
75	CIRCUITO SNUBBER	SNUBBER CIRCUIT
76	RACCORDO A TRE VIE	T-FITTING
77	MOTORE CON VENTOLA	MOTOR WITH FAN
78	RADDRIZZATORE	RECTIFIER
79	TRASFORMATORE DI POTENZA	POWER TRANSFORMER
80	CIRCUITO FILTRO	FILTER CIRCUIT

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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2.28AR
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L3
R/L1
S/L1
U/T1
V/T1
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230V
400V
440V
2Y 1Y 2X 1X 2Z 1Z
4Y 3X 4X 3Z 4Z 3Y
CP200 2-4
CP160 2-7
CP90 2-3-4
CP200 +HV-16 2-4-7
PLASMA PROF 162 ART.952
230-400-440V 50/60 HZ

	CODIFICA COLORI CABLAGGIO ELETTRICO	WIRING DIAGRAM COLOUR CODE	FARBENCODIERUNG ELEKTRISCHE SCHALTPLAN	CODIFICACION COLORES CABLAJE ELECTRICO
A	NERO	BLACK	SCHWARZ	NEGRO
B	ROSSO	RED	ROT	ROJO
C	GRIGIO	GREY	GRAU	GRIS
D	BIANCO	WHITE	WEISS	BLANCO
E	VERDE	GREEN	GRÜN	VERDE
F	VIOLA	PURPLE	VIOLETT	VIOLA
G	GIALLO	YELLOW	GELB	AMARILLO
H	BLU	BLUE	BLAU	AZUL
K	MARRONE	BROWN	BRAUN	BRUNO
J	ARANCIO	ORANGE	ORANGE	NARANJO
I	ROSA	PINK	ROSA	ROSA
L	ROSA-NERO	PINK-BLACK	ROSA-SCHWARZ	ROSA-NEGRO
M	GRIGIO-VIOLA	GREY-PURPLE	GRAU-VIOLETT	GRIS-VIOLA
N	BIANCO-VIOLA	WHITE-PURPLE	WEISS-VIOLETT	BLANCO-VIOLA
O	BIANCO-NERO	WHITE-BLACK	WEISS-SCHWARZ	BLANCO-NEGRO
P	GRIGIO-BLU	GREY-BLUE	GRAU-BLAU	GRIS-AZUL
Q	BIANCO-ROSSO	WHITE-RED	WEISS-ROT	BLANCO-ROJO
R	GRIGIO-ROSSO	GREY-RED	GRAU-ROT	GRIS-ROJO
S	BIANCO-BLU	WHITE-BLUE	WEISS-BLAU	BLANCO-AZUL
T	NERO-BLU	BLACK-BLUE	SCHWARZ-BLAU	NEGRO-AZUL
U	GIALLO-VERDE	YELLOW-GREEN	GELB-GRÜN	AMARILLO-VERDE
V	AZZURRO	BLUE	HELLBLAU	AZUL CLARO

CP200	2-4
CP160	2-7
CP90	2-3-4
CP200 +HV-16	2-4-7

230V

400V

440V

PLASMA PROF 162 ART.952
230-400-440V 50/60 HZ