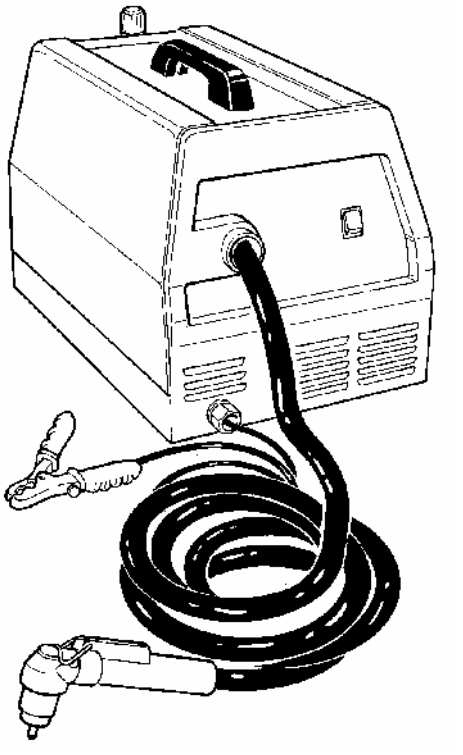
SERVICE MANUAL

118-023, 82021, M12155, PCS25, (37125)



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. 921 for plasma cutting systems.

1.2 - General service policy.

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

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

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

1.3 - Safety information.

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

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

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

2 - SYSTEM DESCRIPTION

2.1 - Introduction.

Art. 921 is a system for cutting electrically conductive materials using the plasma arc process.

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

2.2 - Technical specifications.

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

2.3 - Description of power source art. 921.

Art. 921 is a direct current power source consisting of a three-phase transformer, powered in single-phase, and a three-phase rectifier bridge.

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

The switch (43) powers the control board (8), that manages the output voltage generated by the power source, by means of the input contactor TLP (4) and output contactor TLM (4), based on the signals present at its inputs.

With the switch (43) closed, the control board (8) is powered and awaiting the start signal from the torch button. The power source provides no output voltage.

When the start button on the torch is pressed, the control board (8):

- opens the gas solenoid valve EL1 (7);
- after the pre-gas time (approximately 500 msec., non adjustable) opens the gas solenoid valve EL3 (9);
- after other 300 msec. closes input contactor TLP (4) and output contactor TLM (4).

The solenoid valve EL3 (9), drives the pilot arc firing ram inside the torch, that, when under pressure, push in shot-circuit electrode and nozzle of the torch. Since solenoid valve EL3 remains opened only 400 msec., the momentary short-circuit between electrode and nozzle interrupts at the end of such time, when between the two terminals is present the power source output voltage, so that, inside the torch plasma chamber, strike the arc, due to short-circuit interruption with voltage applied, to light the pilot arc.

Obviously, with this system, we have only one tentative to light the pilot arc every time you press the torch start button.

If pilot arc doesn't start, control board (8), detecting a power source output voltage greater than 200 Vdc, set the power source at its resting state, with TLP (4) and TLM (4) opened. This system performs a safety function against electrical shock from contact. It eliminates the risk of electroshock that the operator would face by touching the ground contact and the torch, in the event the torch is without nozzle or with pilot arc conductor interrupted, and the operator tries to light the pilot arc.

Once contactors TLP (4) and TLM (4) are opened, solenoid valve EL1 (7) remains opened for the post-gas time (60 sec. not adjustable).

When the torch approaches the work piece, with the pilot arc on, the arc current begins to circulate in the work piece, as this is the preferred path due to the voltage drop on resistor (19).

During cutting and pilot arc conditions, control board (8) detects the arc voltage to verify eventual power source output shot-circuit. A voltage lower than 40 Vdc is considered not corrected to keep the arc light on, and so produces the power source block, with contactors TLP (4) and TLM (4) opened, and lamp G (21) flashing, indicating the block cause code (1 flash with 1 sec. pause).

When cutting ends the contactors TLP (4) and TLM (4) are deactivated, and solenoid valve EL1 (7) remains opened for the post-gas time to complete the torch cooling. Once this time has elapsed, the solenoid valves EL1 (7) is deactivated, and the power source returns to its initial resting state (power circuit not powered and no output voltage).

With the input contactor TLP (4) closed, single-phase mains voltage is applied to the three-phase transformer (29) and the capacitors (23) and (16), which are connected in series to one of the windings of the primary circuit specifically to create the “third phase” needed by the transformer (29). Their value, calculated based on the characteristics of the primary winding, is the determining factor in proper phase shift and correct voltage for the “third phase”. The primary circuit of the transformer (29) is also made up of three windings, one for each column, with different numbers of turns, so that they can operate in a single-phase power mains in combination with the capacitors (23) and (16).

A different capacity of the capacitors or a different connection of the primary transformer circuit (29) produces three different voltages at the secondary circuit which, once rectified by the bridge (5), provide an unbalanced direct current voltage that may make it difficult to light the arc or produce poor-quality cutting.

For proper operation, it is therefore essential to observe the capacity of the capacitors (2 x 100 uF + 1 x 60 uF, parallel connected) and how these are wired to the primary circuit (**DO NOT** reverse the primary circuit terminals).

The fan (15) is supplied, through control board (8), at the same power source supply voltage, without any control from control board (8).

The pressure switch (11) inserted in the plasma gas line sends to the control board (8) the insufficient gas pressure signal, when the pressure is lower than 3,2 bar (minimum working pressure). Its normally closed contact also commands the lamp L (21) to signal the gas pressure error (lamp lit = pressure low).

The thermostat (24), in reality is made by two thermostat switches connected in series between them, located on two columns of the transformer (29) (temperature correct = contacts closed). The intervention of one of the two thermostat in sufficient to produce the power source block, signaled by lamp G (21).

3 - MAINTENANCE

WARNINGS

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

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

3.1 - Periodic inspection, cleaning.

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

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

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

3.2 - Operating sequence (fig. 3.2.1).

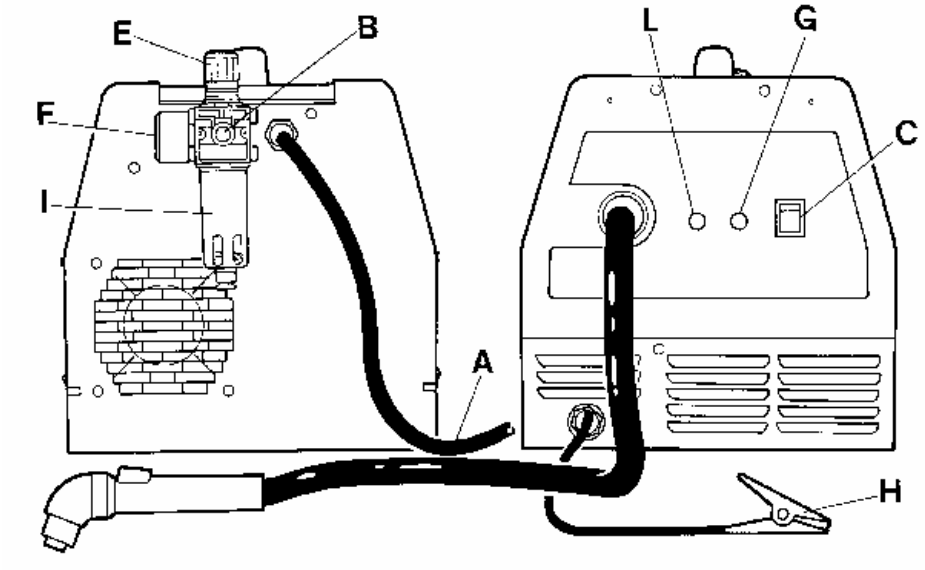
The following sequence represents correct functioning of the machine. It may be used as a guiding procedure for troubleshooting.

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

NOTE

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

3.2.1 - Power source commands and signals.



3.2.2 - Power source operation.

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

Correct? NO (see 3.3.1, 3.4).

YES

WARNING

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

- Briefly press the torch start button.
  - Gas flows from the torch for approximately 60 sec. (post-gas time). The pressure reading on the pressure gauge (F) remains constant.

Correct? NO (see 3.3.2, 3.3.3).

YES

- Press the torch start button and hold it down for approximately 5 seconds to start the pilot arc.
  - Pilot arc lights for the pressure over the start button lasting time. The gas continues to flow for approximately 60 sec. after the start button is released (post-gas time).

Correct? NO (see 3.3.4, 3.3.5).

YES

- With pilot arc lit, place the torch near the work piece.
  - Begin cutting.

Correct? NO (see 3.3.6).

YES

- Release the torch start button.
  - The arc shuts off immediately. The gas continues to flow for the post-gas time (approximately 60 seconds after the start button is released).

Correct? NO (see 3.3.3).

YES

REGULAR OPERATION.

3.3 - Troubleshooting.

WARNINGS

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

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

NOTE

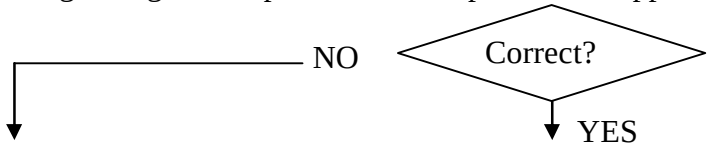
Items in **boldface** describe problems that may occur on the machine (symptoms).

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

3.3.1 - The power source does not start, lamp in the switch (C) off, fan (15) stopped.

MAINS SUITABILITY TEST.

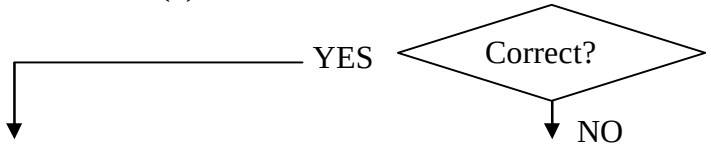
- ❑ Missing voltage at the power source input due to tripped mains protections.



- ♦ Eliminate any short-circuits or insulation leakage toward earth of the connections between power cable, switch (43), control board (8), and input contactor TLP (4).
- ♦ Check the insulation towards earth of the fan (15). If leaking or short-circuited towards earth, replace.
- ♦ Mains not suited to power the power source (ex.: insufficient installed power).

CONTROL BOARD (8) POWER SUPPLY TEST.

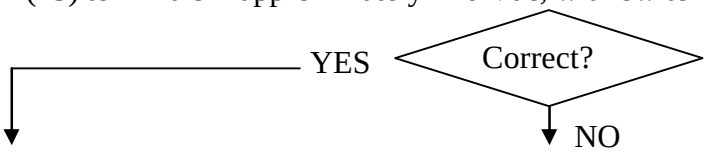
- ❑ Control board (8), terminal 1 of J6 and terminal 1 of J8 = 24 Vac, LED1 (green) lit.



- ♦ Check the wiring between switch (43) and terminals 5 and 6 of J3 on control board (8).
- ♦ Check integrity of fuses F1, F2 and F3 on control board (8). If F1 is interrupted, replace it and make sure the integrity of the fan (15), that is connected under that fuse. If F2 is interrupted, replace it and make sure that there is perfect isolation between the conductors of the start button and those of the electrode and nozzle in the torch cable. If insulation is reduced, replace torch cable or the complete torch. If F3 is interrupted, replace it considering that if it trips again you need replace control board (8).
- ♦ Check switch (43) and replace if defective.
- ♦ Check the mains voltage conditions.

FAN (15) TEST.

- Fan (15) terminals = approximately 120 Vac, with switch (43) closed.



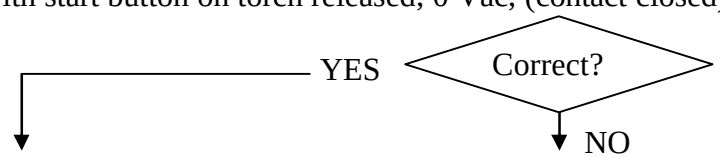
  - Check the wiring between terminals of fan (15) and terminals J1 and J2 of the control board (8).
  - Check the wired bridge between terminals 1 and 4 of J3 on control board (8).
  - Disconnect temporarily the wires of fan (15) from J1 and J2 of control board (8), and make sure the resistance of the fan (15) terminals. Corrected value = 130 ohm approximately. If 0 ohm, short-circuit, replace fan (15) and make sure the integrity of the printed circuit board traces (J1 and J2 with F1 and with J3 connections) on the control board (8). If you find traces interrupted or burned fix them or replace control board (8).

- Make sure that there are no mechanical impediments blocking the fan (15).
- Disconnect temporarily the wires of fan (15) from J1 and J2 of control board (8), and make sure the resistance of the fan (15) terminals. Corrected value = 130 ohm approximately. If >Mohm, circuit interrupted, replace fan (15).
- Replace switch (43).

3.3.2 - The start button produces no effect.

START COMMAND TEST.

- Control board (8), connector J6 terminals 1 and 2 = approximately 24 Vac (contact opened) with start button on torch released; 0 Vac, (contact closed) with button pressed.



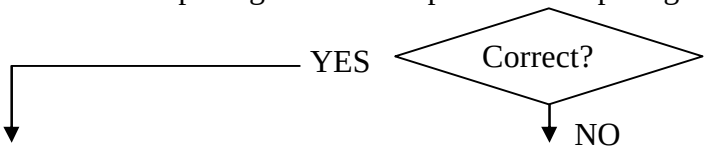
  - Check the wiring between J6 control board (8), torch cable, nozzle guard on the torch and start button.
  - Make sure the nozzle protection and torch button are correctly assembled and in good working order. If defective or showing signs of wear, replace them.
  - Check integrity of fuse F2 on control board (8). If interrupted, replace it and make sure that there is perfect isolation between the conductors of the start button and those of the electrode and nozzle in the torch cable. If isolation is reduced, replace the torch cable or the complete torch. Any loss of isolation between the torch cable conductors may damage the control board (8).
  - Replace the control board (8).

- Check the wired bridge between terminals 1 and 4 of J3 on control board (8). All auxiliary services, contactors and solenoid valves, are connected under such wired bridge and fuse F1.
- Replace control board (8).

3.3.3 - No gas flows from the torch.

PILOT ARC EL1 (7) SOLENOID VALVE TEST.

- Solenoid valve EL1 (7) terminals = approximately 120 Vac, with torch button pressed. The solenoid valve opening time also depends on the post-gas time.

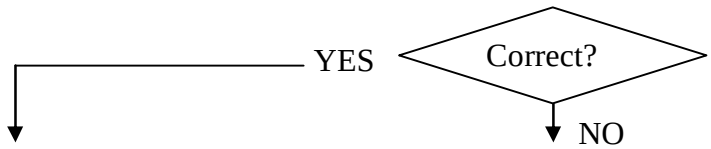


  - Check the wiring between solenoid valve EL1 (7) and terminals 6 and 12 of J4 on control board (8).
  - With power source off, check the resistance between terminals of solenoid valve EL1 (7) = approximately 350 ohm. If 0 ohm (short-circuit), replace solenoid valve EL1 (7) and control board (8).
  - Perform the CONTROL BOARD (8) POWER SUPPLY TEST, par. 3.3.1.
  - Replace control board (8).
- With power source off, check the resistance between the terminals of solenoid valve EL1 (7) = approximately 350 ohm. If >Mohm (winding broken) replace solenoid valve EL1 (7).
- Make sure there are no occlusions in the gas hoses of the power source.
- Check the presence of the gas at the inlet fitting (B) and that the pressure and flow rate in the intake conduit meet the specification values (see Instruction Manual).
- Make sure that the pressure regulator (E) and pressure gauge (F) are working properly.
- Make sure that the air fitting (B) inserted in the pressure regulator (E) has a threaded part no longer than 6 - 8 mm (1/4” - 5/16”), to avoid a possible malfunction of the regulator (E).
- Replace solenoid valve EL1 (7).

3.3.4 - Gas flows from the torch, the pilot arc does not light.

CONTACTOR TLP (4) COMMAND TEST.

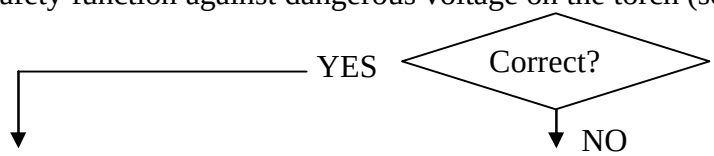
- Contactors TLP (4) = closed (120 Vac on coil terminals), with start button pressed, for the pressure over start button lasting time, in normal conditions, or for a brief period in case of pilot arc doesn't start.



- ♦ Check the wiring between contactor TLP (4) coil and J4 of control board (8).
- ♦ With power source off, check the resistance between terminals of contactor TLP (4) coil. Corrected value = approximately 120 ohm. If 0 ohm (short-circuit), replace contactor TLP (4) and control board (8). If >Mohm (coil interrupted), replace contactor TLP (4).
- ♦ Perform the CONTROL BOARD (8) POWER SUPPLY TEST, par. 3.3.1.
- ♦ Replace control board (8).

POWER SOURCE OPEN CIRCUIT OUTPUT VOLTAGE TEST.

- Torch terminal board (6), nozzle and electrode (gnd) terminals = fig. 5.2.1 (or similar), with start button pressed. Power source output voltage interrupted for missing pilot arc light on (safety function against dangerous voltage on the torch (see par. 2.3)).



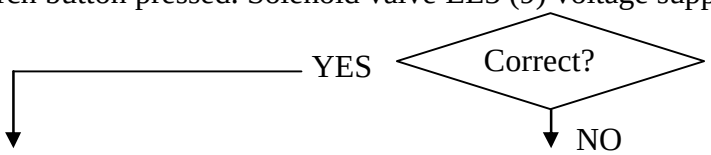
- ♦ Check the wiring between J7 of control board (8) and torch cable electrode and nozzle terminals on terminal board (6).
- ♦ Check the wiring between rectifier (5) negative terminal, and torch cable electrode terminal on terminal board (6), and between rectifier (5) positive terminal, resistor (19) and torch cable nozzle terminal on terminal board (6). If you find loose connections, tighten them and replace any components with damaged terminals.
- ♦ With power source off, check the resistance of resistor (19). Corrected value = 0.85 ohm. If not correct replace resistor (19).
- ♦ With the power source off and disconnected from the mains, check the efficiency of the contacts of contactor TLP (4), manually activating it, and make sure that the resistance on each contact is approximately 0 ohm. If you find burnt contacts or interference in moving the parts, replace the TLP (4).
- ♦ With the power source off, temporarily disconnect terminals 4, 5 and 6 of the transformer (29) from the rectifier (5), and check the efficiency of the rectifier (5). If defective, replace.
- ♦ Check the condition of the torch cable and torch, especially making sure there are no short-circuits or isolation leaks between the conductors.
- ♦ Check the efficiency of the capacitors (23) and (16), the transformer (29) and the corresponding connections, performing the CAPACITORS (23) AND (16) WITH OPEN CIRCUIT POWER SOURCE TEST, located at the end of this paragraph, if necessary.

PILOT ARC FIRING SOLENOID VALVE EL3 (9) TEST.

NOTE

All auxiliary services, contactors, solenoid valves, fan, are supplied directly at mains potential, so that detecting the following waveform use a battery scope or a scope with insulating probe.

- Solenoid valve EL3 (9) terminals = fig. 5.2.2, 120 Vac for 400 msec. approximately, with torch button pressed. Solenoid valve EL3 (9) voltage supply.



  - Check the wiring between solenoid valve EL3 (9) and terminals 4 and 10 of J4 on control board (8).
  - With power source off, check the resistance between terminals of solenoid valve EL3 (9) = approximately 430 ohm. If 0 ohm (short-circuit), replace solenoid valve EL3 (9) and control board (8).
  - Perform the CONTROL BOARD (8) POWER SUPPLY TEST, par. 3.3.1.
  - Replace control board (8).
- With power source off, check the resistance between the terminals of solenoid valve EL3 (9) = approximately 430 ohm. If >Mohm (winding broken) replace solenoid valve EL3 (9).
- Make sure that the pressure in the torch plasma chamber is not excessive, and regulator (E) and pressure gauge (F) are working properly.
- Make sure there are no occlusions in the gas hoses of the power source, especially in the conduit between EL3 and the pilot arc firing ram inside the torch.
- With power source off, make sure the pilot arc firing ram inside the torch is working properly, by manually supplying the EL3 (9) air conduit. If you find a firing ram in defective working conditions replace it or replace the complete torch.
- Check the electrode, cooling hose, swirl ring and torch nozzle conditions; replace if worn or damaged.
- Replace solenoid valve EL3 (9).
- Replace the complete torch.
- Replace control board (8).

WARNING

FOR THE FOLLOWING TEST TAKE MAXIMUM PRECAUTIONS ESPECIALLY AT THE MOMENT OF MANUAL ACTIVATION OF CONTACTOR TLP (4), BECAUSE YOU MANUALLY SUPPLY THE POWER SOURCE POWER CIRCUIT, WHICH CAN BE IN DEFECTIVE WORKING CONDITION (I.E. CONSIDER THE POSSIBILITY OF EXPLOSION OF CAPACITORS (23) AND (16), OTHER THAN THE RISK OF ELECTRICAL SHOCK FROM CONTACT WITH PARTS UNDER VOLTAGE).

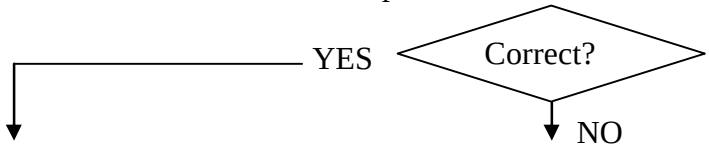
CAPACITORS (23) AND (16) WITH OPEN CIRCUIT POWER SOURCE TEST.

- Terminals of transformer (29) = voltages according to the table, with open circuit power source (no pilot arc), and contactor TLP (4) manually activated (push with a plastic stick over the contactor mobile equipment, up to close its contacts).

Terminals of transformer (29)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	320 Vac	217 Vac	121 Vac	241 Vac	217 Vac	113 Vac

NOTE

The values shown in the table are merely indicative, with a rather broad tolerance, due to the tolerances of the capacitors and how the transformer (29) is made.



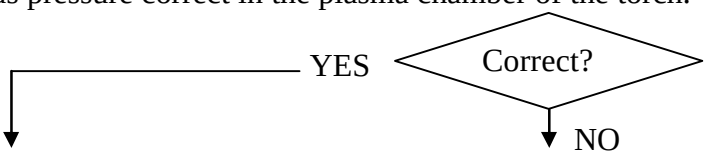
- Check the wiring between the capacitors (23) and (16) and terminals 1 and 2 of the primary circuit of the transformer (29), considering that every connection other than the one shown in the diagram is to be considered mistaken, and may cause further damage to the components of the power source.
- Make sure that the capacity of the capacitors is correct; (23) = 2 x 100 uF and (16) = 60 uF, using a specifically designed instrument “RLC Bridge”, or, if not available, replace the capacitors (23) and (16).
- Check the condition of the windings of transformer (29), especially making sure that there are no signs of overheating or dents in the winding columns that may lead to partial short-circuits in the turns. If necessary, replace the transformer (29).

- Regular operation.

3.3.5 - Irregular pilot arc starts, unstable pilot arc.

PLASMA GAS PRESSURE TEST.

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



- ♦ Make sure that solenoid valve EL1 (7) = opened, during the pilot arc.
- ♦ Check for the presence of gas at the intake fitting (B) and make sure that the pressure and flow rate in the intake line meet specifications (see Instruction Manual).
- ♦ Make sure that the air fitting (B) inserted in the pressure regulator (E) has a threaded part no longer than 6 - 8 mm (1/4" - 5/16"), to avoid a possible malfunction of the regulator (E).
- ♦ Make sure that the pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.
- ♦ Make sure there are no occlusions in the gas hoses of the power source.

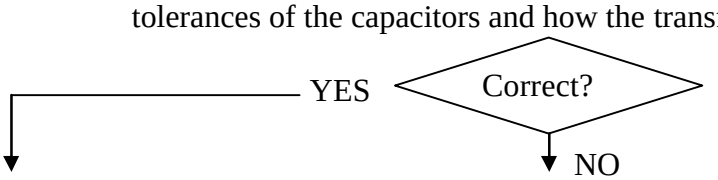
CAPACITORS (23) AND (16) WITH PILOT ARC TEST.

- Terminals of transformer (29) = voltages according to the table, with pilot arc on.

Terminals of transformer (29)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	161 Vac	144 Vac	116 Vac	106 Vac	120 Vac	120 Vac

NOTE

The values shown in the table are merely indicative, with a rather broad tolerance, due to the tolerances of the capacitors and how the transformer (29) is made.



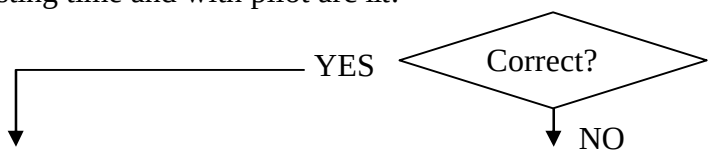
- ♦ Check the wiring between the capacitors (23) and (16) and terminals 1 and 2 of the primary circuit of the transformer (29), considering that every connection other than the one shown in the diagram is to be considered mistaken, and may cause further damage to the components of the power source.
- ♦ Make sure that the capacity of the capacitors is correct; (23) = 2 x 100 uF and (16) = 60 uF, using a specifically designed instrument "RLC Bridge", or, if not available, replace the capacitors (23) and (16).
- ♦ Check the condition of the windings of transformer (29), especially making sure that there are no signs of overheating or dents in the winding columns that may lead to partial short-circuits in the turns. If necessary, replace the transformer (29).

- ♦ Check the connections between torch cable and terminal board (6).
- ♦ Make sure the internal parts of the torch are properly isolated, including the cables, and if in doubt replace the entire torch.
- ♦ Check the electrode, swirl ring and torch nozzle; replace if worn or damaged.
- ♦ With power source off, make sure the pilot arc firing ram inside the torch is working properly, by manually supplying the EL3 (9) air conduit. If you find a firing ram in defective working conditions replace it or replace the complete torch.

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

CONTACTOR TLM (4) COMMAND TEST.

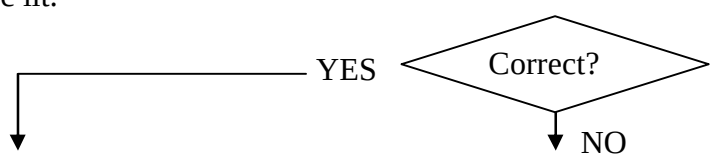
- Contactor TLM (4) = closed (120 Vac on coil terminals), for the pressure over start button lasting time and with pilot arc lit.



- ♦ Check the wiring between contactor TLM (4) coil and control board (8).
- ♦ With power source off, check the resistance between terminals of contactor TLM (4) coil. Corrected value = approximately 120 ohm. If 0 ohm (short-circuit), replace contactor TLM (4) and control board (8). If >Mohm (coil interrupted), replace contactor TLM (4).
- ♦ Replace control board (8).

POWER SOURCE OUTPUT VOLTAGE WITH PILOT ARC LIT TEST.

- Electrode terminal on terminal board (6) (-) and power source output terminal (H) (+) = approximately +100 - 150 Vdc, for the pressure over start button lasting time and with pilot arc lit.



- ♦ Check connections between positive terminal of rectifier (5), contactor TLM (4) and output terminal (H) of the power source. If any defective connections are found, restore them and replace any components with damaged terminals.
- ♦ With the power source off, check the efficiency of the contacts of contactor TLM (4), by manually activating it, and make sure that the resistance on each contact is approximately 0 ohm. If you find burnt contacts or interference in moving the parts, replace the TLM (4) contactor.

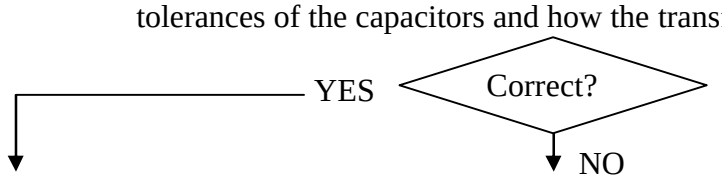
CAPACITORS (23) AND (16) WHILE CUTTING TEST.

- Terminals of transformer (29) = voltages according to the table, with transfer arc.

Terminals of transformer (29)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	169 Vac	109 Vac	116 Vac	78 Vac	72 Vac	72 Vac

NOTE

The values shown in the table are merely indicative, with a rather broad tolerance, due to the tolerances of the capacitors and how the transformer (29) is made.



- ♦ Check the wiring between the capacitors (23) and (16) and terminals 1 and 2 of the primary circuit of the transformer (29), considering that every connection other than the one shown in the diagram is to be considered mistaken, and may cause further damage to the components of the power source.
- ♦ Make sure that the capacity of the capacitors is correct; (23) = 2 x 100 uF and (16) = 60 uF, using a specifically designed instrument “RLC Bridge” or, if not available, replace the capacitors (23) and (16).

- Check the condition of the windings of transformer (29), especially making sure that there are no signs of overheating or dents in the winding columns that may lead to partial short-circuits in the turns. If necessary, replace the transformer (29).

- Check connections between torch cable and negative terminal of the rectifier (5), and between work cable, contactor TLM (4) and positive terminal of the rectifier (5). If you find any deteriorated connections, reset them and replace any damaged components.
- With power source off, check the resistance of resistor (19) = 0.85 ohm. If not correct replace resistor (19).
- Check the presence of the gas at the inlet fitting (B) and that the pressure and flow rate in the intake conduit meet the specification values (see Instruction Manual).
- Make sure that the air fitting (B) inserted in the pressure regulator (E) has a threaded part no longer than 6 - 8 mm (1/4” - 5/16”), to avoid a possible malfunction of the regulator (E).
- Make sure that pressure regulator (E) and pressure gauge (F) are working properly; replace if defective.
- Make sure that the gas lines in the power source are not partially clocked, so that the gas throughput is enough for the pilot arc but not for the transfer arc.
- Make sure that solenoid valve EL1 (7) is working properly, performing, if necessary, the PILOT ARC EL1 (7) SOLENOID VALVE TEST, in par. 3.3.3..

3.4 - Alarm signals.

3.4.1 - Lamp G (21) lit, with fix light = transformer (29) temperature above the limit.

Power source remains in block with contactors TLP (4) and TLM (4) opened.

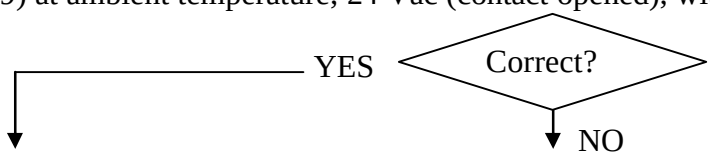
This is reset automatically when the temperature returns within the allowed limits.

Thermostat (24) in reality is made by two thermostat switches connected in series between them, located on two columns of the transformer (29).

To analyze the problem perform the following test.

THERMOSTAT (24) TEST.

- Control board (8), connector J6, terminals 6 and 7 = 0 Vac (contact closed), with transformer (29) at ambient temperature; 24 Vac (contact opened), with temperature excessive.



  - Check the wiring between thermostat (24) and terminals 6 and 7 of J6 on control board (8), considering that in reality thermostat switches are two, series connected between them.
  - Make sure that the two thermostat switches are intact and properly positioned on the windings of the transformer (29).
  - If the alarm occurs while cutting, and the transformer (29) is evenly heated, make sure that the duty-cycle is not greater than indicated in the power source specifications.
  - If the alarm occurs while cutting, and only some of the windings of the transformer (29) are heated, check the status of the capacitors (23) and (16) and replace if necessary. If the problem continues even with the capacitors in good conditions, one may infer that the transformer (29) is partially short-circuited, and must therefore be replaced. (An indication regarding the status of the capacitors (23) and (16) and primary circuit of the transformer (29) may be obtained by measuring the voltages on the terminals of transformer (29) in the conditions described in the tables CAPACITORS (23) AND (16) TEST, in pars. 3.3.4, 3.3.5 and 3.3.6).
  - Replace thermostat (24).
- Replace control board (8).

3.4.2 - Lamp G (21) flashing (one flash with one second pause) = arc voltage lower than working minimum threshold.

Usually is due to a short-circuit or excessive load at the power source output, so that the output voltage falls down 40 Vdc. Control board (8) detects such signal (J7, terminals 1 (+) and 4 (-)) and commands power source block, with contactors TLP (4) and TLM (4) opened.

This is reset by turning off the power source.

At the origin of the problem you can hypothesize that the electrode and nozzle shot-circuit lasts to much, caused by firing ram in the torch blocked in extended position, or electrode and nozzle attachment, or short-circuit in the torch cable, or else an overload during cutting caused by a wrong use of the torch over the work piece.

3.4.3 - Lamp G (21) flashing (two flashes with one second pause) = start button pressed during power source start-up.

If at the start up the start button on the torch is detected closed, the power source remains in block with contactors TLP (4) and TLM (4) opened, without output voltage and with lamp (G) (21) flashing.

The reset is automatic when the start button is released.

For the problem analysis perform the START COMMAND TEST, in par. 3.3.2.

3.4.4 - Lamp L (21) lit = low gas pressure.

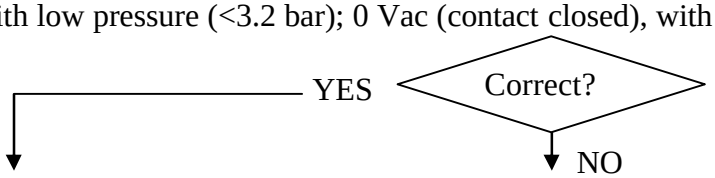
With this alarm the power source remains in block with contactors TLP (4) and TLM (4) opened, without output voltage.

This is automatically reset when the pressure returns within the allowed limits, but to restart pilot arc you need a new start command by torch start button.

To analyze the problem perform the following test.

PRESSURE SWITCH (11) TEST.

- Control board (8), connector J6, terminals 3 and 5 (NC contact) = 0 Vac (contact closed), with low pressure (<3.2 bar); 24 Vac (contact opened), with suitable pressure.
- Control board (8), connector J6, terminals 3 and 4 (NO contact) = 24 Vac (contact opened), with low pressure (<3.2 bar); 0 Vac (contact closed), with suitable pressure.



  - Check the wiring between pressure switch (11) and terminals 3, 4 and 5 of J6 on control board (8).
  - Check for the presence of gas at the intake fitting (B) and make sure the pressure and flow rate in the in feed line meet specifications (see Instruction Manual).
  - Make sure that the pressure regulator (E) and pressure gauge (F) are working properly.
  - Make sure that the air fitting (B) inserted in the pressure regulator (E) has a threaded part no longer than 6 - 8 mm (1/4” - 5/16”), to avoid a possible malfunction of the regulator (E).
  - Make sure there are no occlusions in the gas hoses of the power source.
  - Replace the pressure switch (11).
  - Replace the control board (8).
- Proper operation of the pressure switch (11).
- Replace control board (8).

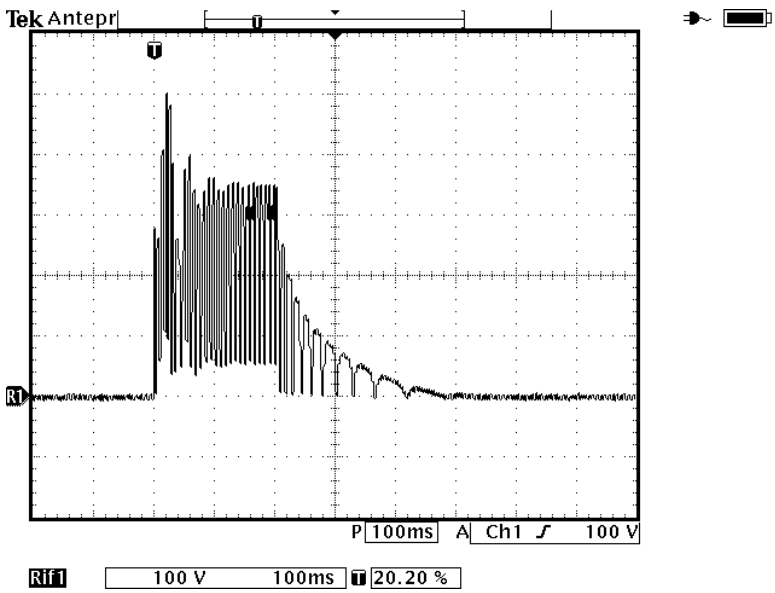
4 - COMPONENTS LIST

4.1 - Power source art. 921 : see file ESP921.pdf enclosed at the end of the manual.

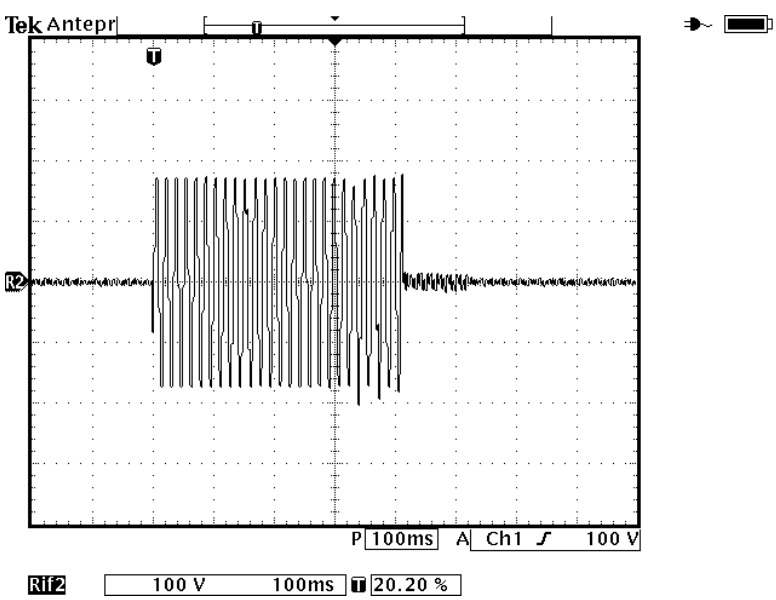
5 - ELECTRICAL DIAGRAMS

5.1 - Power source art. 921 : see file SCHE921.pdf enclosed at the end of the manual.

5.2 - Waveforms.



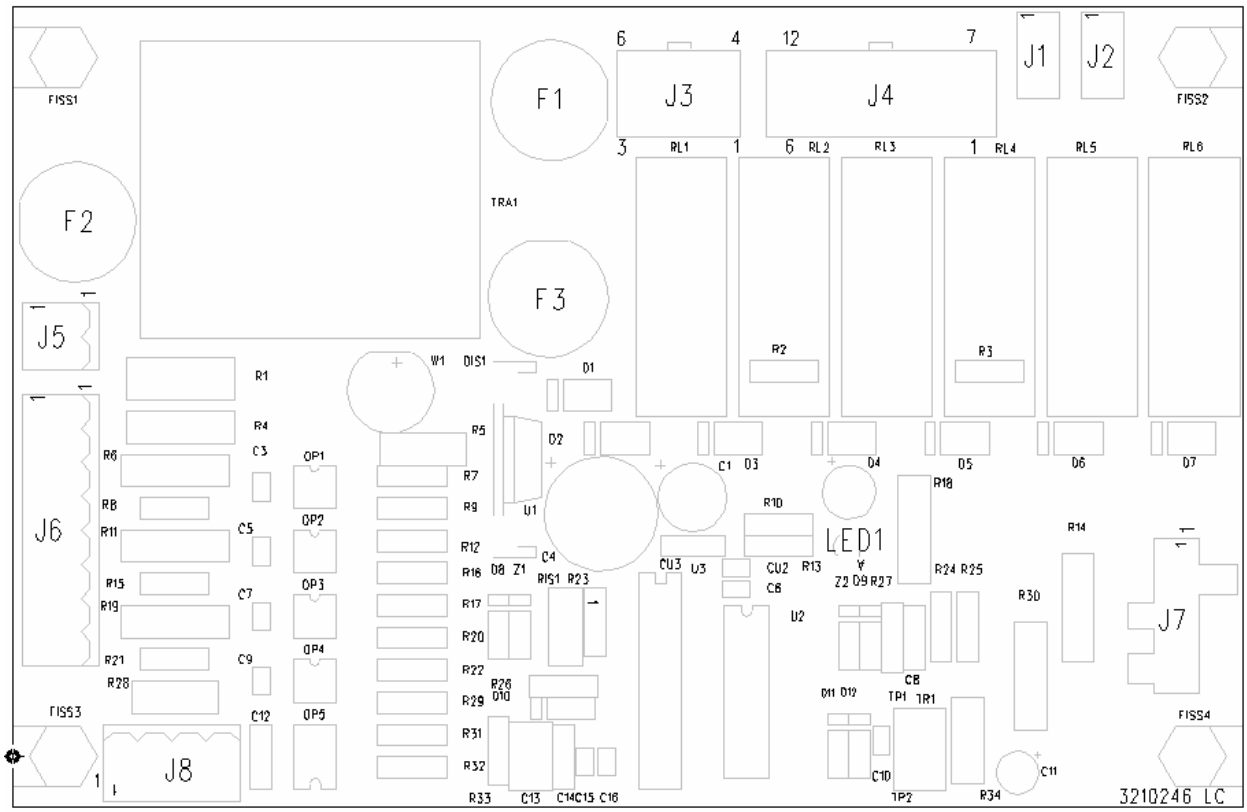
5.2.1 - Power source output voltage interrupted for missing pilot arc light on (par. 3.3.4).



5.2.2 - Solenoid valve EL3 (9) voltage supply (par. 3.3.4).

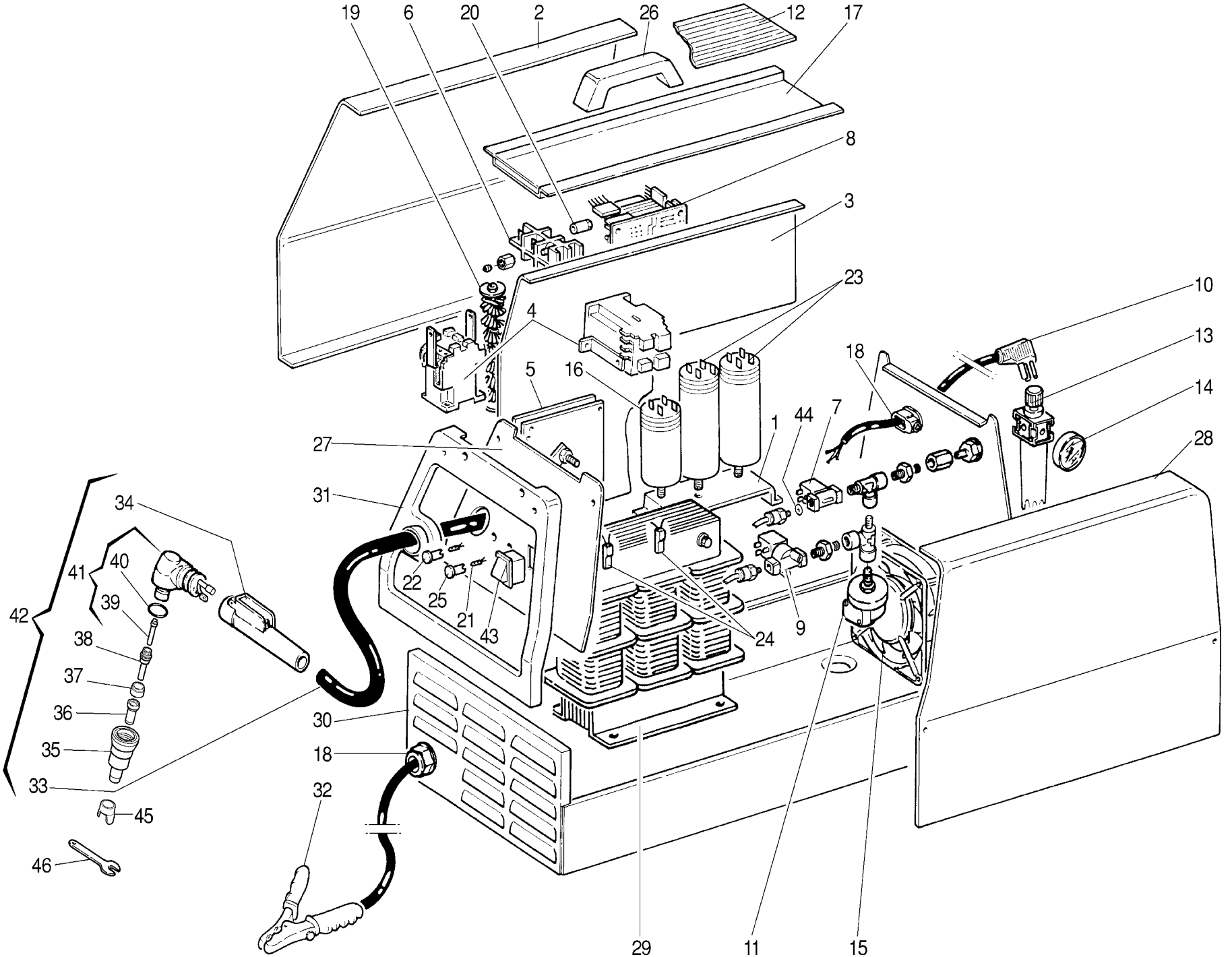
5.3 - Control board (8) code 5.602.146.

5.3.1 - Topographical drawing.



5.3.2 - Connector table.

Connector	Terminals	Function
-	J1 – J2	120 Vac output for fan (15) power supply.
J3	1 – 4	wired bridge for fan, solenoid valves, contactors power supply.
J3	2 – 3	NU.
J3	5 – 6	120 Vac input for control board (8) power supply.
J4	1 – 7	contactor TLM (4) command output.
J4	2 – 8	contactor TLP (4) command output.
J4	3 – 9	NU.
J4	4 – 10	solenoid valve EL3 (9) command output.
J4	5 – 11	NU.
J4	6 – 12	solenoid valve EL1 (7) command output.
J5	-	NU.
J6	1 – 2	start signal input from torch button.
J6	3 – 4 – 5	pressure signal input from pressure switch (11).
J6	6 – 7	temperature signal input from thermostat (24).
J7	1(+) – 4(-)	power source output voltage signal input.
J8	1 – 2	lamp L (21) command output (pressure insufficient).
J8	3 – 4	lamp G (21) command output (overtemperature and code alarms).



118-023, 82021, M12155, PCS25, (37125)

118-023, 82021, M12155, PCS25, (37125)

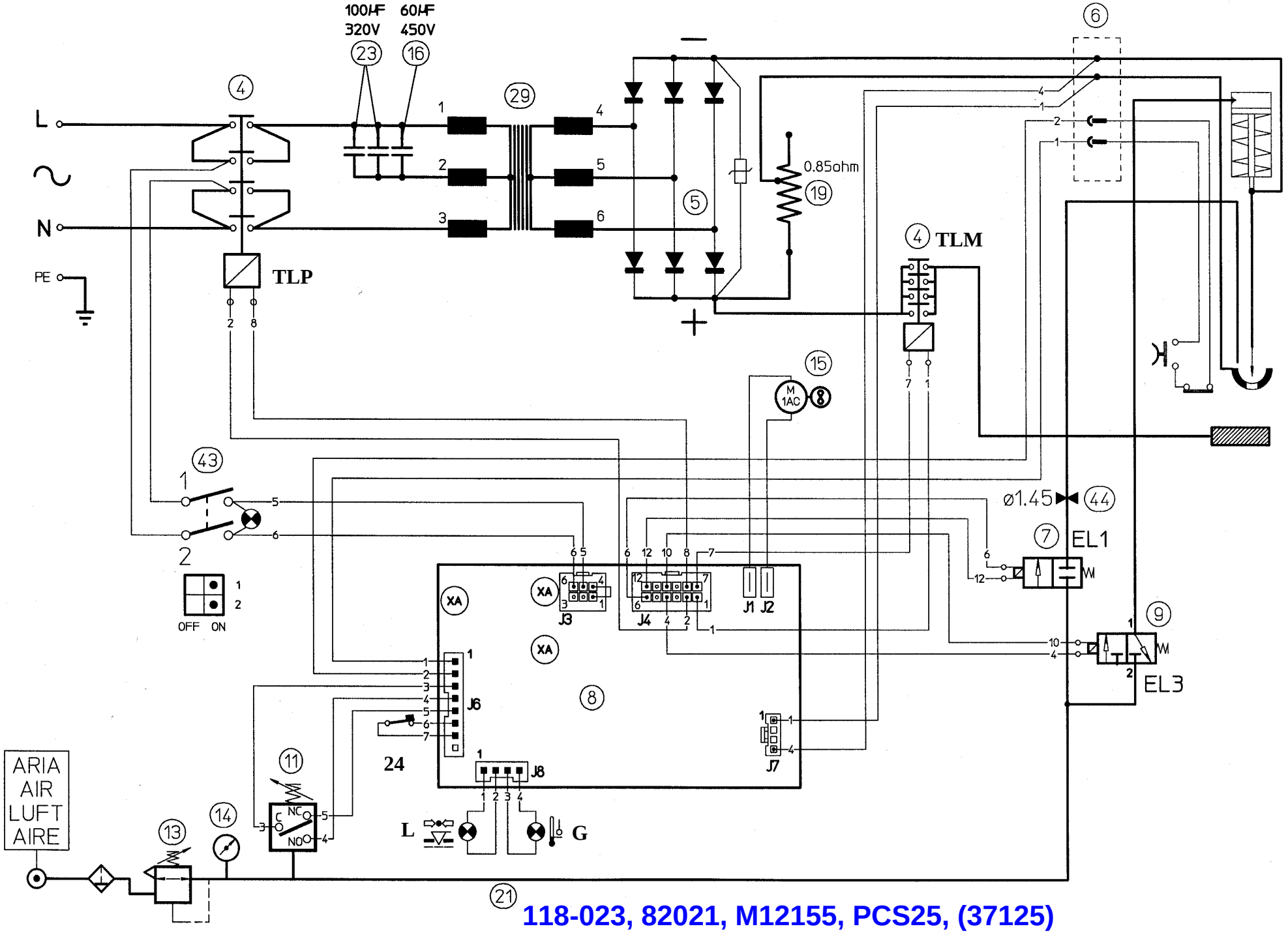
Item	Lincoln Stock #	Customer #	Description
1	412-754-666	260457	Support
2	411-118-026	260460	Left Side Panel
3	412-755-666	260459	Intermediate Plane
4	246-519-666	B7053370	Contactor
5	244-089-666	251146, 244-088-666	Rectifier
6	239-298-666	B7009380	Terminal Board
7	246-530-666	251036	Solenoid Valve
8	860-997-666	5602146	Control Circuit Board
9	246-524-666	3160195	Solenoid Valve
10	238-707-666	251150	Input Cable
11	246-532-666	B7005380	Pressure Switch
12	512-265-666	260467	Rubber Mat
13	254-006-666	B7006380	Regulator
14	251-030-666	B7014380	Gauge
15	216-110-666	260453	Fan Motor
16	213-043-666	260468	Capacitor, 60 µF
17	411-119-026	260466	Top Panel
18	414-020-666	B7018380	Strain Relief
19	215-036-666	B7029380	Resistance
20	253-341-666	B7004380	Joint
21	215-035-666	5585773	Lamp
22	245-170-666	B7015380	Lamp Holder
23	260-001-666	251155	Capacitor, 100 µF
24	246-531-666	251156	Thermostat

Item	Lincoln Stock #	Customer #	Description
25	245-169-666	246251	Lamp Holder
26	312-515-666	250975	Handle
27			Control Panel - 82021
			Control Panel - M12155
			Control Panel - PCS25
28	411-110-026	260461	Right Side Panel
29	880-579-666	260464	Transformer
30	411-116-016	260500	Bottom
31	312-516-666	260470	Front Panel Frame
32	238-708-666	251159	Earth/Ground Cable Assy
33	238-715-666	5580778	Torch Cable
34	312-518-666	B7037380	Handgrip + Button
35	334-584-100	--	Nozzle Holder/Cap
36	334-581-100	--	Long Nozzle 0.9 mm (pk.5)
37	334-583-100	--	Diffuser or Swirl Ring (pk.2)
38	334-580-100	--	Long Electrode (pk.2)
39	334-587-666	3065225	Diffuser
40	512-264-666	251194	O-ring
41	334-588-666	1346	Torch Head
42	**238-710-666**	**1210.18**	**Complete Torch Assy**
43	246-537-666	B7069370	Switch
44		3175881	Limiting Device
45	334-585-100	--	Two-Point Spacer - Standoff
46	334-604-000	5800818	Electrode Wrench

10/16/2006

Model	Primary Input	Input Plug	Duty Cycle at Rated Output
118-023	120 Vac	15A	20%

Rated Output	Voltage Settings	Agency Listing	Max Cutting Thickness
24 amps	1	CSA	3/16"



118-023, 82021, M12155, PCS25, (37125)