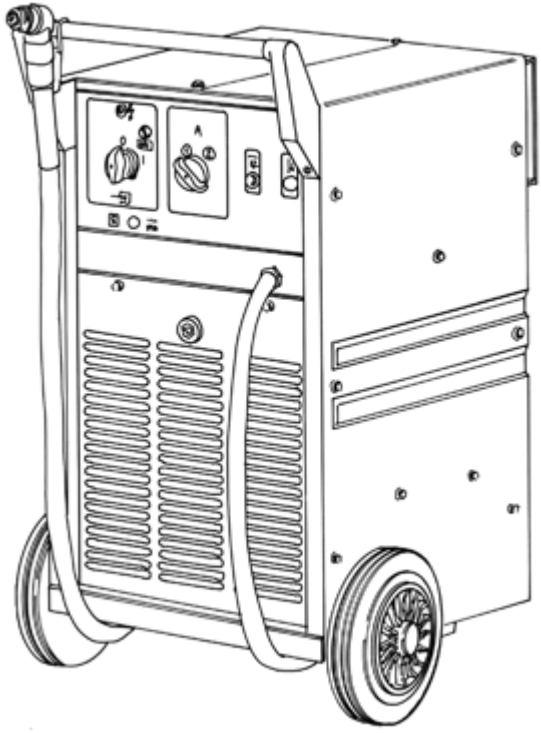
SERVICE MANUAL

118-025, 82051, M12157



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. 934 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. 934 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. 934.

Art. 934 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 (11) powers the lamp (20) (mains voltage presence signal) and the control board (10), that manages the output voltage generated by the power source, by means of the input contactor TLP (6), pilot arc contactor TLC (3) and output contactor TLM (3), based on the signals present at its inputs.

With the switch (11) closed, the control board (10) 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 (10):

- opens the gas solenoid valve EL1 (9);
- after the pre-gas time (approximately 500 msec., non adjustable), closes the pilot arc contactor TLC (3) and opens the gas solenoid valve EL3 (26);
- after other 300 msec. closes input contactor TLP (6) and output contactor TLM (3).

The solenoid valve EL3 (26), 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.

With the pilot arc on, we have approximately two seconds to start cutting, otherwise the power source returns to its resting state, with TLP (6), TLC (3) and TLM (3) opened, awaiting a new start command.

If pilot arc doesn't start, control board (10), detecting a power source output voltage greater than 200 Vdc, set the power source at its resting state, with TLP (6), TLC (3) and TLM (3) 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.

In both cases, up on contactors TLP (6), TLC (3) and TLM (3) are opened, also solenoid valve EL2 (9) is opened and remains so together to solenoid valve EL1 (9) for the post-gas time (60 sec. not adjustable). More exactly, with pilot arc only EL1 (9) is opened, while during cutting and post-gas time both EL1 (9) and EL2 (9) are opened.

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 (23).

The reed sensor (33) detects the passage of current on the work conductor, and sends the cutting start signal to the control board (10), which opens the contactor TLC (3) and the solenoid valve EL2 (9).

During cutting and pilot arc conditions, control board (10) 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 (6), TLC (3) and TLM (3) opened, and lamp G indicating the block cause code (1 flash with 1 sec. pause).

When cutting ends the contactors TLP (6) and TLM (3) are deactivated, and solenoid valve EL2 (9) is temporarily (5 sec.) closed, to improve the arc shoot off, by reducing the torch gas flux, and then opened again for the remaining post-gas time to complete the torch cooling. Once this time has elapsed, the solenoid valves EL1 (9) and EL2 (9) are deactivated, and the power source returns to its initial resting state (power circuit not powered and no output voltage).

The cutting current may be selected between two fixed values by means of the cutting current selector (21). In the maximum current “2” position, the resistor (22) is cut out of the cutting circuit; in the other “1” position, the resistor (22) is inserted in series with the work conductor and thus contributes to limiting the output current.

With the input contactor TLP (6) closed, single-phase mains voltage is applied to the three-phase transformer (45) and the capacitors (7) and (8), which are connected in series to one of the windings of the primary circuit specifically to create the “third phase” needed by the transformer (45). 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 (45) 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 (7) and (8).

A different capacity of the capacitors or a different connection of the primary transformer circuit (45) produces three different voltages at the secondary circuit which, once rectified by the bridge (24), 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 (3 x 60 uF + 1 x 30 uF, parallel connected) and how these are wired to the primary circuit (**DO NOT** reverse the primary circuit terminals).

The choke (36) connected to the output (–) of the rectifier (24) is necessary to level the output current of the power source, since the currents originating from the voltages of the transformer (45) secondary circuit are often slightly unbalanced due to the particular connection configuration. The choke (36) essentially improves the stability of the arc.

The fan (35) is supplied, through control board (10), at the same power source supply voltage, without any control from control board (10).

The pressure switch (25) inserted in the plasma gas line sends to the control board (10) 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 (30) to signal the gas pressure error (lamp lit = pressure low).

The thermostat (62) is located on a winding of the transformer (45) (temperature correct = contact closed). Its intervention, signaled by lamp G (30), and produce the power source block.

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).

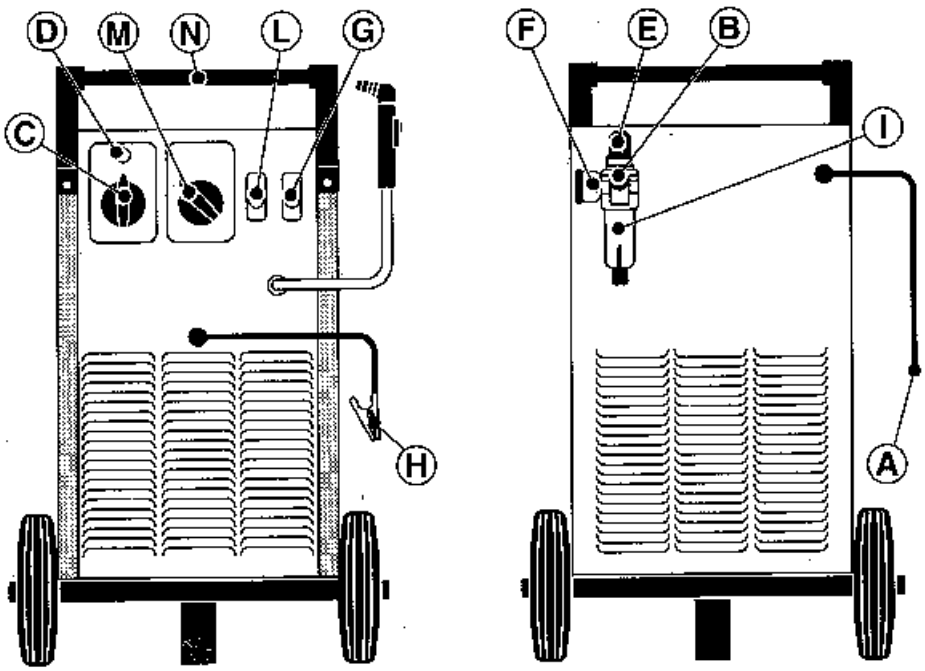
The following sequence represents correct functioning of the machine. It may be used as a guiding procedure for troubleshooting.

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 (D) lit, fan running.
  - On front panel, lamps (G) and (L) off.

Correct? NO (see 3.3.1).

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). During the first 5 sec. with reduced flux (only EL1 opened), then at full flux (EL1 and EL2 opened). The pressure reading on the pressure gauge (F) remains constant.

Correct? NO (see 3.3.2, 3.3.3, 3.3.6).

YES

- Press the torch start button and hold it down for approximately 5 seconds to start the pilot arc.
  - Pilot arc lights for approximately 2 seconds (maximum pilot arc time). The gas continues to flow for approximately another 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. If necessary turn the cutting current selector (M) to adjust the output current to the cut to be made.

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

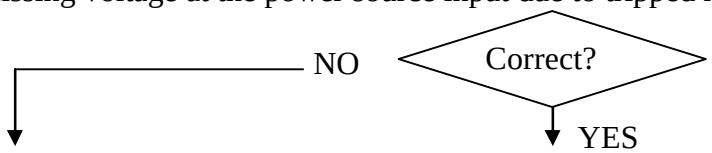
Items in **boldface** describe problems that may occur on the machine (symptoms).

- ❑ 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 (20) off, fan (35) stopped.

MAINS SUITABILITY TEST.

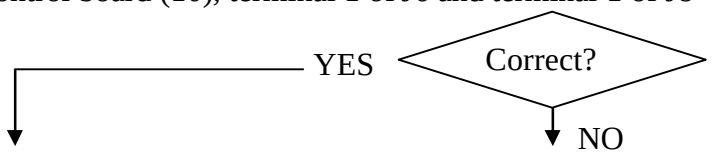
- ❑ Missing voltage at the power source input due to tripped mains protections.



- ♦ Eliminate any short-circuits on the connections between power cable, switch (11), control board (10), and input contactor TLP (6).
- ♦ Check the insulation towards earth of the fan (35). If leaking or short-circuited towards earth, replace.
- ♦ Mains not suited to power the power source (ex.: insufficient installed power).

CONTROL BOARD (10) POWER SUPPLY TEST.

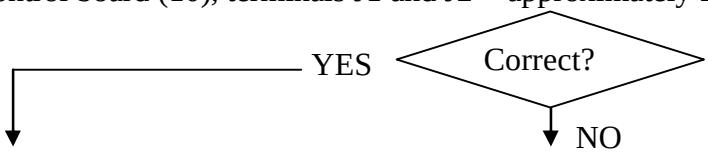
- ❑ Control board (10), terminal 1 of J6 and terminal 1 of J8 = 24 Vac, LED1 (green) lit.



- ♦ Check the wiring between switch (11) and terminals 3 and 6 of J3 on control board (10).
- ♦ Check integrity of fuses F1, F2 and F3 on control board (10). If F1 is interrupted, replace it and make sure the integrity of the fan (35), 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 (10).
- ♦ Check switch (11) and replace if defective.
- ♦ Check the mains voltage conditions.

FAN (35) TEST.

- Control board (10), terminals J1 and J2 = approximately 230 Vac, with switch (11) closed.



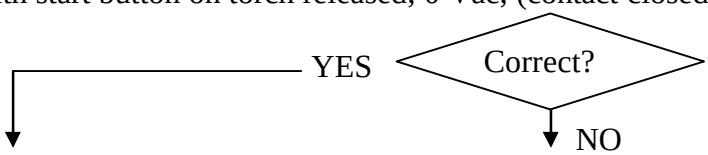
  - Check the wiring between terminals of fan (35) and terminals J1 and J2 of the control board (10).
  - Check the wired bridge between terminals 1 and 2 of J3 on control board (10).
  - Disconnect temporarily the wires of fan (35) from J1 and J2 of control board (10), and make sure the resistance of the fan (35) terminals. Corrected value = 70 ohm approximately. If 0 ohm, short-circuit, replace fan (35) and make sure the integrity of the printed circuit board traces (J1 and J2 with F1 and with J3 connections) on the control board (10). If you find traces interrupted or burned fix them or replace control board (10).

- Make sure that there are no mechanical impediments blocking the fan (35).
- Disconnect temporarily the wires of fan (35) from J1 and J2 of control board (10), and make sure the resistance of the fan (35) terminals. Corrected value = 70 ohm approximately. If >Mohm, circuit interrupted, replace fan (35).
- Replace the lamp (20).

3.3.2 - The start button produces no effect.

START COMMAND TEST.

- Control board (10), connector J6 terminals 1 and 2 = approximately 24 Vac (contact opened) with start button on torch released; 0 Vac, (contact closed) with button pressed.



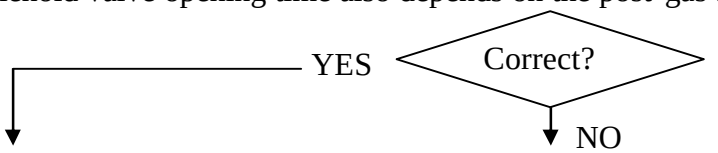
  - Check the wiring between J6 control board (10), torch cable, nozzle guard on the torch and start button.
  - Make sure the nozzle protection and torch button are correctly assembled and in good working order. If defective or showing signs of wear, replace them.
  - Check integrity of fuse F2 on control board (10). 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 (10).
  - Replace the control board (10).

- Check the wired bridge between terminals 1 and 2 of J3 on control board (10). All auxiliary services, contactors and solenoid valves, are connected under such wired bridge and fuse F1.
- Replace control board (10).

3.3.3 - No gas flows from the torch.

PILOT ARC EL1 (9) SOLENOID VALVE TEST.

- Solenoid valve EL1 (9) terminals = approximately 230 Vac, with torch button pressed. The solenoid valve opening time also depends on the post-gas time.



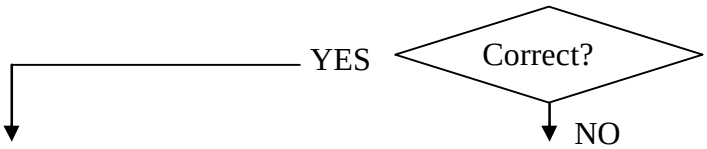
  - Check the wiring between solenoid valve EL1 (9) and terminals 6 and 12 of J4 on control board (10).
  - With power source off, check the resistance between terminals of solenoid valve EL1 (9) = approximately 2.4 Kohm. If 0 ohm (short-circuit), replace solenoid valve EL1 (9) and control board (10).
  - Perform the CONTROL BOARD (10) POWER SUPPLY TEST, par. 3.3.1.
  - Replace control board (10).

- With power source off, check the resistance between the terminals of solenoid valve EL1 (9) = approximately 2.4 Kohm. If >Mohm (winding broken) replace solenoid valve EL1 (9).
- 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 (9).

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

CONTACTORS TLP (6) AND TLC (3) COMMAND TEST.

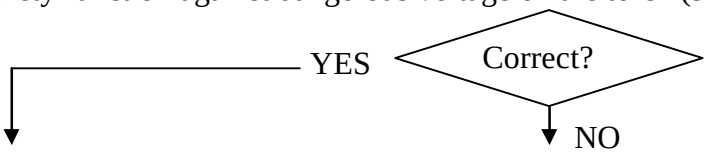
- Contactors TLP (6) and TLC (3) = closed (230 Vac on coils terminals), with start button pressed, for two seconds approximately in normal conditions, or for a brief period in case of pilot arc doesn't start.



  - Check the wiring between contactors TLP (6) and TLC (3) coils and J4 of control board (10).
  - With power source off, check the resistance between terminals of contactors TLP (6) and TLC (3) coils. Corrected values: TLP (6) = approximately 440 ohm; TLC (3) = approximately 500 ohm. If 0 ohm (short-circuit), replace contactors TLP (6) and/or TLC (3) and control board (10). If >Mohm (coil interrupted), replace contactors TLP (6) and/or TLC (3).
  - Perform the CONTROL BOARD (10) POWER SUPPLY TEST, par. 3.3.1.
  - Replace control board (10).

POWER SOURCE OPEN CIRCUIT OUTPUT VOLTAGE TEST.

- Torch terminal board (5), 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 (10) and torch cable electrode terminal on terminal board (5) and TLC (3) contact resistor (23) side.
  - Check the wiring between rectifier (24) negative terminal, choke (36), and torch cable electrode terminal on terminal board (5), and between rectifier (24) positive terminal, resistors (22) and (23), TLC (3) contactor and torch cable nozzle terminal on terminal board (5). If you find loose connections, tighten them and replace any components with damaged terminals.
  - With power source off, check the resistance of resistors (22) and (23). Corrected values: (22) = 2.1 ohm; (23) = 2.4 ohm. If not correct replace resistors (22) and/or (23).
  - With the power source off, check the efficiency of the contacts of contactors TLP (6) and TLC (3), manually activating them, 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 (6) and/or TLC (3) contactors.
  - With the power source off, temporarily disconnect terminals 4, 5 and 6 of the transformer (45) from the rectifier (24), and check the efficiency of the rectifier (24). 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 (7) and (8), the transformer (45) and the corresponding connections, performing the CAPACITORS (7) AND (8) WITH

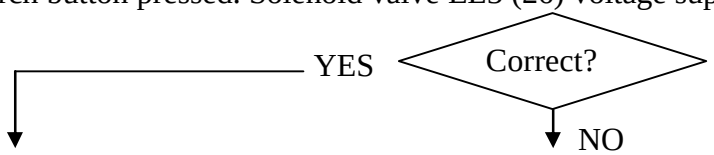
OPEN CIRCUIT POWER SOURCE TEST, located at the end of this paragraph, if necessary.

PILOT ARC FIRING EL3 (26) SOLENOID VALVE 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 (26) terminals = fig. 5.2.2, 230 Vac for 400 msec. approximately, with torch button pressed. Solenoid valve EL3 (26) voltage supply.



  - Check the wiring between solenoid valve EL3 (26) and terminals 4 and 10 of J4 on control board (10).
  - With power source off, check the resistance between terminals of solenoid valve EL3 (26) = approximately 2 Kohm. If 0 ohm (short-circuit), replace solenoid valve EL3 (26) and control board (10).
  - Perform the CONTROL BOARD (10) POWER SUPPLY TEST, par. 3.3.1.
  - Replace control board (10).

- With power source off, check the resistance between the terminals of solenoid valve EL3 (26) = approximately 2 Kohm. If >Mohm (winding broken) replace solenoid valve EL3 (26).
- 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 (26) 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 (26).
- Replace the complete torch.
- Replace control board (10).

WARNING

FOR THE FOLLOWING TEST TAKE MAXIMUM PRECAUTIONS ESPECIALLY AT THE MOMENT OF MANUAL ACTIVATION OF CONTACTOR TLP (6), 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 (7) AND (8), OTHER THAN THE RISK OF ELECTRICAL SHOCK FROM CONTACT WITH PARTS UNDER VOLTAGE).

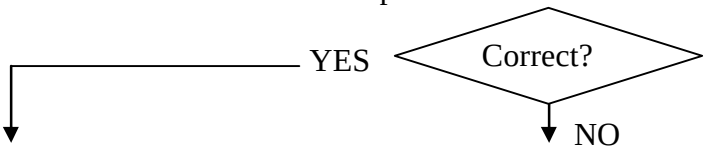
CAPACITORS (7) AND (8) WITH OPEN CIRCUIT POWER SOURCE TEST.

- Terminals of transformer (45) = voltages according to the table, with open circuit power source (no pilot arc), and contactor TLP (6) manually activated (push with a plastic stick over the contactor mobile equipment, up to close its contacts).

Terminals of transformer (45)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	430 Vac	250 Vac	230 Vac	200 Vac	140 Vac	130 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 (45) is made.



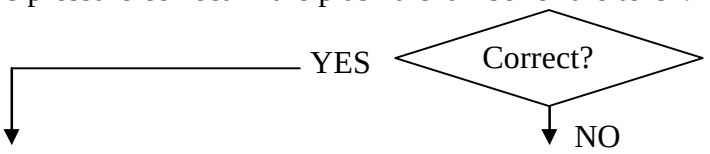
- Check the wiring between the capacitors (7) and (8) and terminals 1 and 2 of the primary circuit of the transformer (45), considering that every connection other than the one shown in the diagram is to be considered mistaken, and may cause further damage to the components of the power source.
- Make sure that the capacity of the capacitors is correct; (7) = 3 x 60 uF and (8) = 30 uF, using a specifically designed instrument “RLC Bridge”, or, if not available, replace the capacitors (7) and (8).
- Check the condition of the windings of transformer (45), 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 (45).

- 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 (9) = opened, and solenoid valve EL2 (9) = closed, 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.

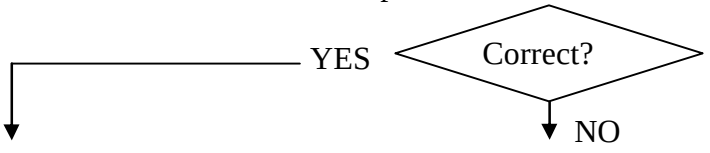
CAPACITORS (7) AND (8) WITH PILOT ARC TEST.

- Terminals of transformer (45) = voltages according to the table, with pilot arc on.

Terminals of transformer (45)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	360 Vac	280 Vac	230 Vac	170 Vac	170 Vac	140 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 (45) is made.



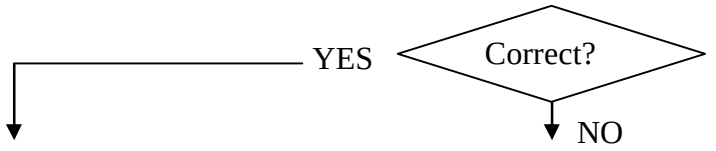
- ♦ Check the wiring between the capacitors (7) and (8) and terminals 1 and 2 of the primary circuit of the transformer (45), considering that every connection other than the one shown in the diagram is to be considered mistaken, and may cause further damage to the components of the power source.
- ♦ Make sure that the capacity of the capacitors is correct; (7) = 3 x 60 uF and (8) = 30 uF, using a specifically designed instrument "RLC Bridge", or, if not available, replace the capacitors (7) and (8).
- ♦ Check the condition of the windings of transformer (45), 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 (45).

- ♦ Check the connections between torch cable, contactor TLC (3) and choke (36).
- ♦ 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 (26) 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 (3) COMMAND TEST.

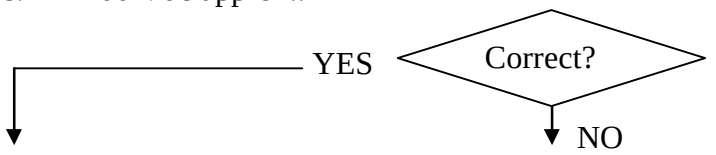
- Contactor TLM (3) = closed (230 Vac on coil terminals), for two seconds approximately with pilot arc lit.



- Check the wiring between contactor TLM (3) coil and control board (10).
- With power source off, check the resistance between terminals of contactor TLM (3) coil. Corrected value = approximately 500 ohm. If 0 ohm (short-circuit), replace contactor TLM (3) and control board (10). If >Mohm (coil interrupted), replace contactor TLM (3).
- Replace control board (10).

POWER SOURCE OUTPUT VOLTAGE WITH PILOT ARC LIT TEST.

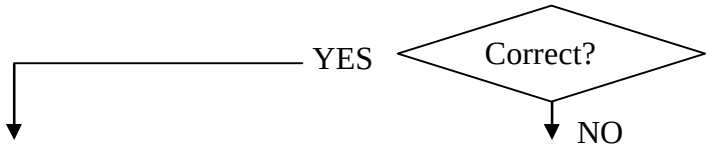
- Electrode terminal on terminal board (5) (-) and power source output terminal (29) (+) = approximately +150 - 200 Vdc, for approximately 2 seconds and pilot arc lit. The voltage value depends also of the cutting current selector (21) position: pos. 1 = 150 Vdc approx.; pos. 2 = 200 Vdc approx..



- Check connections between resistor (22), cutting current selector switch (21), reed solenoid (32), contactor TLM (3) and output terminal (29) 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 (3), 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 (3) contactor.
- Make sure that the cutting current selector switch (21) is working properly.

TRANSFER ARC SWITCHING TEST.

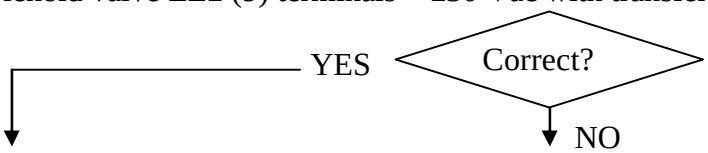
- Control board (10), connector J5, terminals 1 and 2 = 0 Vac, with transfer arc, thus while cutting (24 Vac with pilot arc on). This situation remains constant for as long as cutting continues.



- Make sure the reed bulb (33) is properly mounted in the solenoid (32).
- With the power source off, make sure that the switch in the reed bulb (33) is working properly: move a magnet near the bulb and check the resistance between the terminals 1 and 2 of J5 on control board (10) = 0 ohm (reed contact closed). Move the magnet away from the bulb, resistance = approximately 5 Kohm (reed contact opened). If incorrect replace reed bulb (33) and solenoid (32).
- Check the work cable connection to the work piece.

TRANSFER ARC EL2 (9) SOLENOID VALVE TEST.

- Solenoid valve EL2 (9) terminals = 230 Vac with transfer arc, for the entire cutting time.



  - Check the wiring between solenoid valve EL2 (9), and terminals 5 and 11 of J4 on control board (10).
  - With power source off, check the resistance between the terminals of solenoid valve EL2 (9) = approximately 2.4 Kohm. If 0 ohm (short-circuit), replace solenoid valve EL2 (9) and control board (10).
  - Replace control board (10).
- With power source off, check the resistance between the terminals of solenoid valve EL2 (9) = approximately 2.4 Kohm. If >Mohm (winding broken) replace solenoid valve EL2 (9).

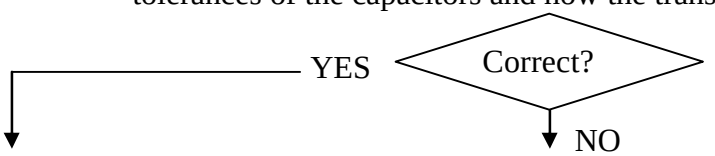
CAPACITORS (7) AND (8) WHILE CUTTING TEST.

- Terminals of transformer (45) = voltages according to the table, with transfer arc, cutting current selector switch (21) in position 1 (30 A.), and rated mains voltage.

Terminals of transformer (45)	1 - 2	2 - 3	3 - 1	4 - 5	5 - 6	6 - 4
Voltage	210 Vac	240 Vac	230 Vac	100 Vac	150 Vac	140 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 (45) is made.



  - Check the wiring between the capacitors (7) and (8) and terminals 1 and 2 of the primary circuit of the transformer (45), 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; (7) = 3 x 60 uF and (8) = 30 uF, using a specifically designed instrument “RLC Bridge” or, if not available, replace the capacitors (7) and (8).
  - Check the condition of the windings of transformer (45), 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 (45).
- Check connections between torch cable, choke (36) and (-) terminal of the rectifier (24), and between work cable, output terminal (29) of the power source, solenoid (32), cutting current selector switch (21), resistor (22) and (+) terminal of the rectifier (24). If you find any deteriorated connections, reset them and replace any damaged components.
- With power source off, check the resistance of resistor (22) = 2.1 ohm. If not correct replace resistor (22).
- 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.
- ♦ Replace solenoid valve EL2 (9).

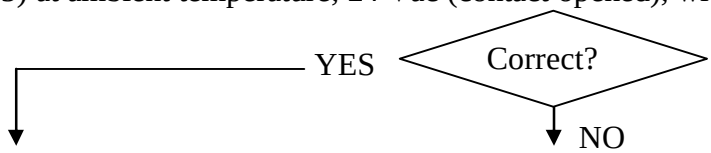
3.4 - Alarm signals.

3.4.1 - Lamp G (30) lit, with fix light = transformer (45) temperature above the limit.

Power source remains in block with contactors TLP (6), TLC (3) and TLM (3) opened.
This is reset automatically when the temperature returns within the allowed limits.
Thermostat (62) is located on the transformer (45) column winding.
To analyze the problem perform the following test.

THERMOSTAT (62) TEST.

- ❑ Control board (10), connector J6, terminals 6 and 7 = 0 Vac (contact closed), with transformer (45) at ambient temperature; 24 Vac (contact opened), with temperature excessive.



- ♦ Check the wiring between thermostat (62) and terminals 6 and 7 of J6 on control board (10).
- ♦ Make sure that the thermostat (62) is intact and properly positioned on the windings of the transformer (45).
- ♦ If the alarm occurs while cutting, and the transformer (45) 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 (45) are heated, check the status of the capacitors (7) and (8) and replace if necessary. If the problem continues even with the capacitors in good conditions, one may infer that the transformer (45) is partially short-circuited, and must therefore be replaced. (An indication regarding the status of the capacitors (7) and (8) and primary circuit of the transformer (45) may be obtained by measuring the voltages on the terminals of transformer (45) in the conditions described in the tables CAPACITORS (7) AND (8) TEST, in pars. 3.3.4, 3.3.5 and 3.3.6).
- ♦ Replace thermostat (62).

- ♦ Replace control board (10).

3.4.2 - Lamp G (30) 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 (10) detects such signal (J7, terminals 1 (+) and 4 (-)) and commands power source block.

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 (30) 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 (6), TLC (3) and TLM (3) opened, without output voltage and with lamp (G) 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 G (30) flashing (three flashes with one second pause) = bulb reed (33) contact closed at the power source start up.

If at the start up the bulb reed (33) contact is detected closed, the power source remains in block with contactors TLP (6), TLC (3) and TLM (3) opened, without output voltage and with lamp (G) flashing.

This is reset by turning off the power source and removing the cause of the block.

For the problem analysis perform the TRANSFER ARC SWITCHING TEST, in par. 3.3.6.

3.4.5 - Lamp L (30) lit = low gas pressure.

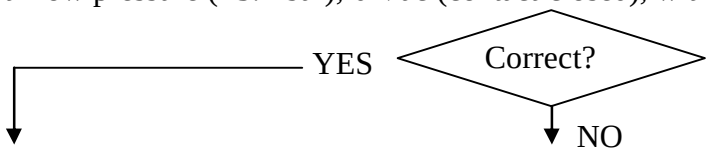
With this alarm the power source remains in block with contactors TLP (6), TLC (3) and TLM (3) opened, without output voltage.

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

To analyze the problem perform the following test.

PRESSURE SWITCH (25) TEST.

- Control board (10), 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 (10), 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 (25) and terminals 3, 4 and 5 of J6 on control board (10).
- 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 (25).
- Replace the control board (10).

- Proper operation of the pressure switch (25).
- Replace control board (10).

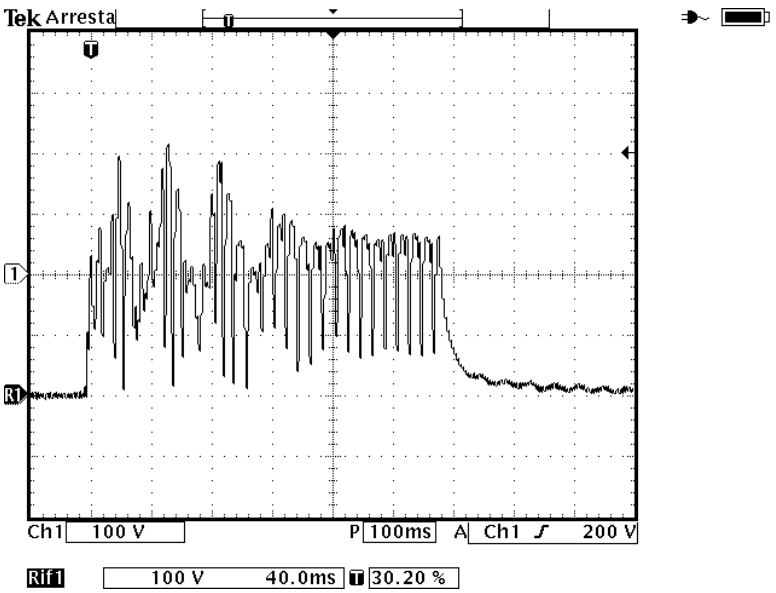
4 - COMPONENTS LIST

4.1 - Power source art. 934 : see file ESP934.pdf enclosed at the end of the manual.

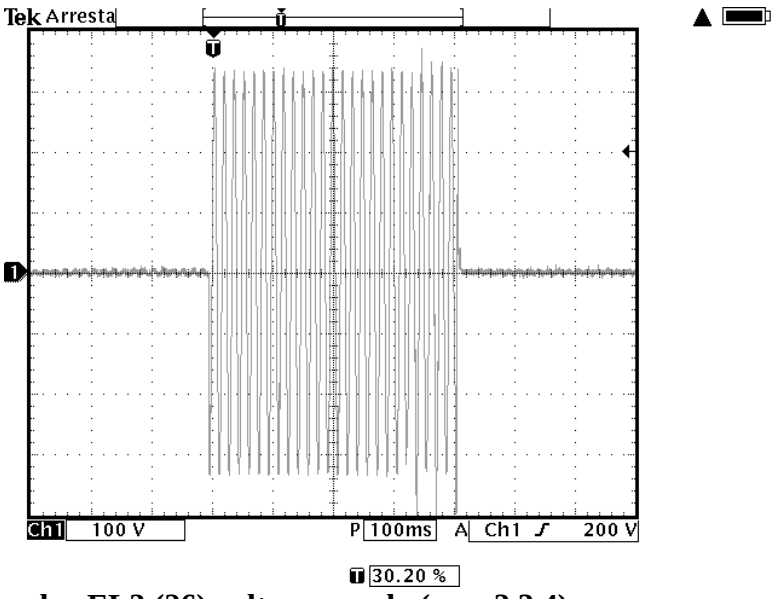
5 - ELECTRICAL DIAGRAMS

5.1 - Power source art. 934 : see file SCHE934.pdf enclosed at the end of the manual.

5.2 - Waveforms.



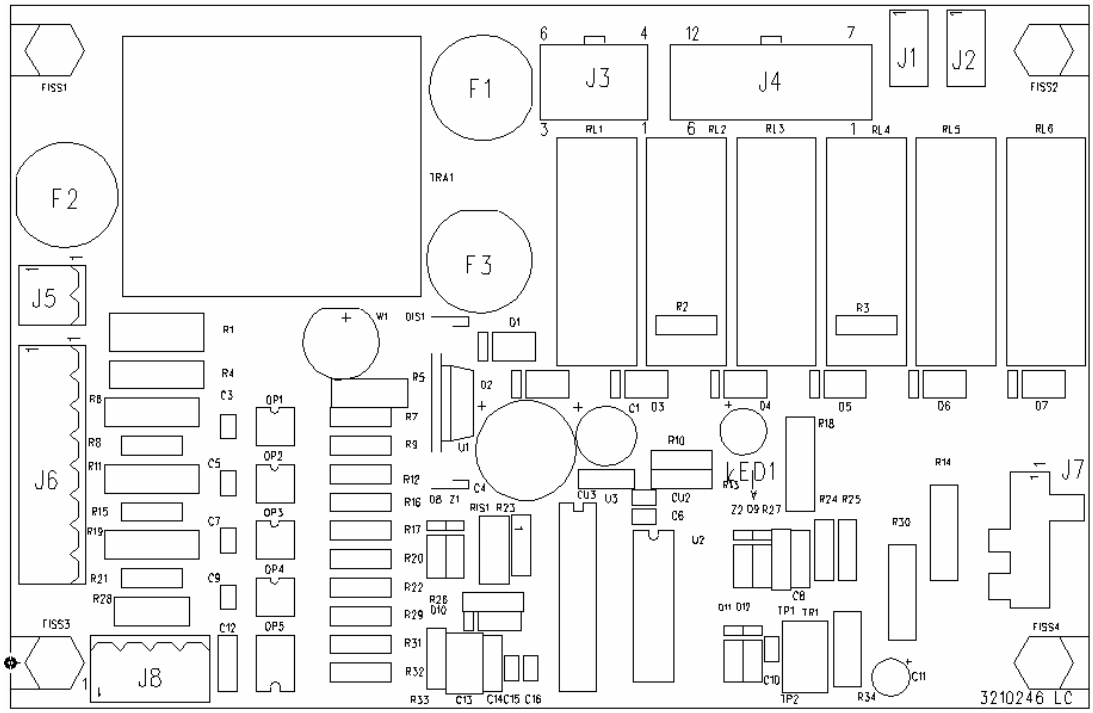
5.2.1 - Power source output voltage interrupted for missing pilot arc light on (par. 3.3.4).



5.2.2 - Solenoid valve EL3 (26) voltage supply (par. 3.3.4).

5.3 - Control board (10) code 5.602.150.

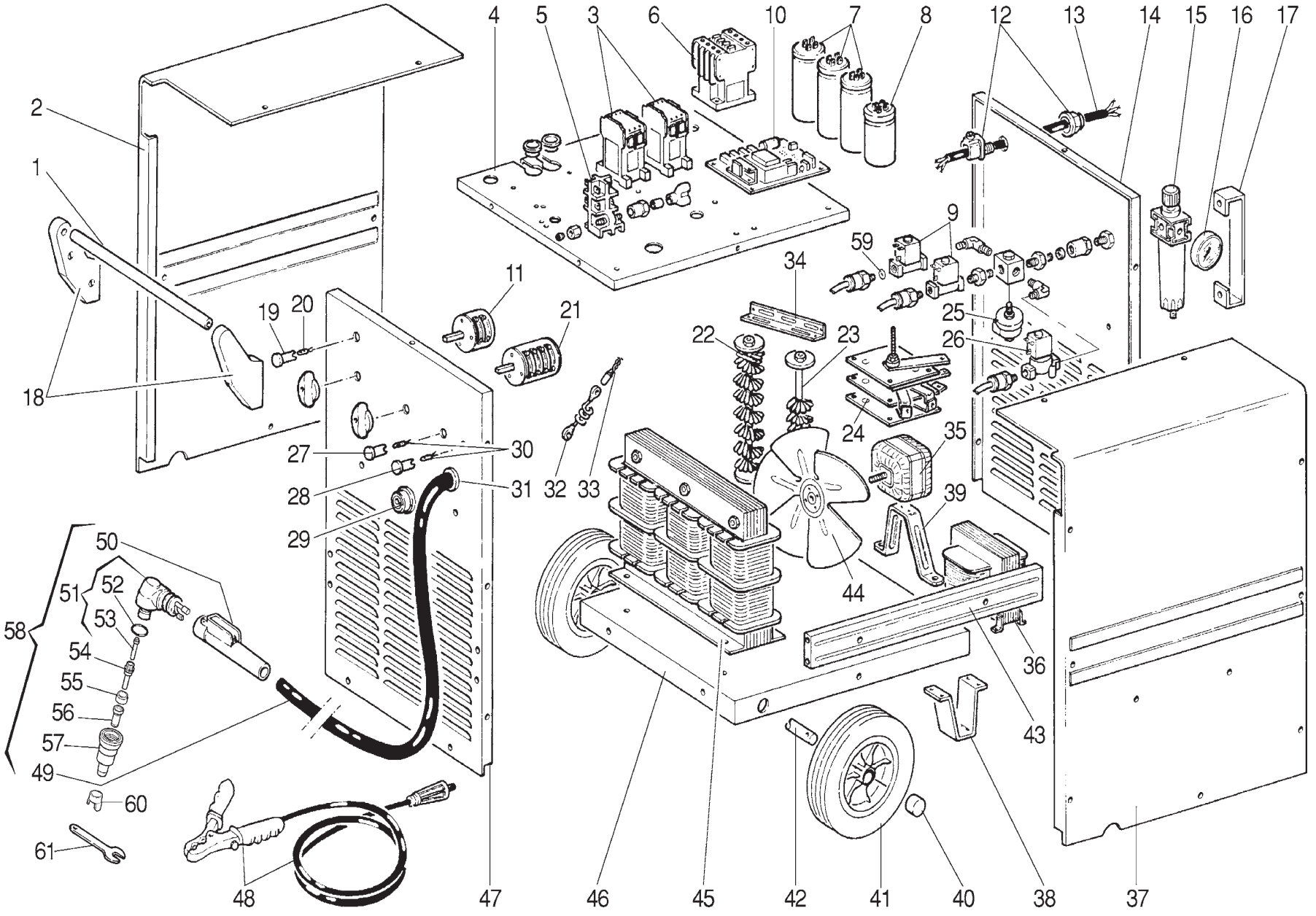
5.3.1 - Topographical drawing.



5.3.2 - Connector table.

Connector	Terminals	Function
-	J1 – J2	230 Vac output for fan (35) power supply.
J3	1 – 2	wired bridge for fan, solenoid valves, contactors power supply.
J3	3 – 6	230 Vac input for control board (10) and auxiliary services power supply.
J3	4 – 5	NU.
J4	1 – 7	contactor TLM (3) command output.
J4	2 – 8	contactor TLP (6) command output.
J4	3 – 9	contactor TLC (3) command output.
J4	4 – 10	solenoid valve EL3 (26) command output.
J4	5 – 11	solenoid valve EL2 (9) command output.
J4	6 – 12	solenoid valve EL1 (9) command output.
J5	1 – 2	“transferred arc” signal input from reed (33).
J6	1 – 2	start signal input from torch button.
J6	3 – 4 – 5	pressure signal input from pressure switch (25).
J6	6 – 7	temperature signal input from thermostat (62).
J7	1 – 4	power source output voltage signal input.
J8	1 – 2	lamp L (30) command output (pressure insufficient).
J8	3 – 4	lamp G (30) command output (overtemperature and code alarms).

F1 = 2A fuse (blue, red, black, red)
F2 = 200ma fuse (blue, brown, black, maroon)
F3 = 200ma fuse (blue, brown, black, maroon)



118-025, 82051, M12157

118-025, 82051, M12157, (37150)

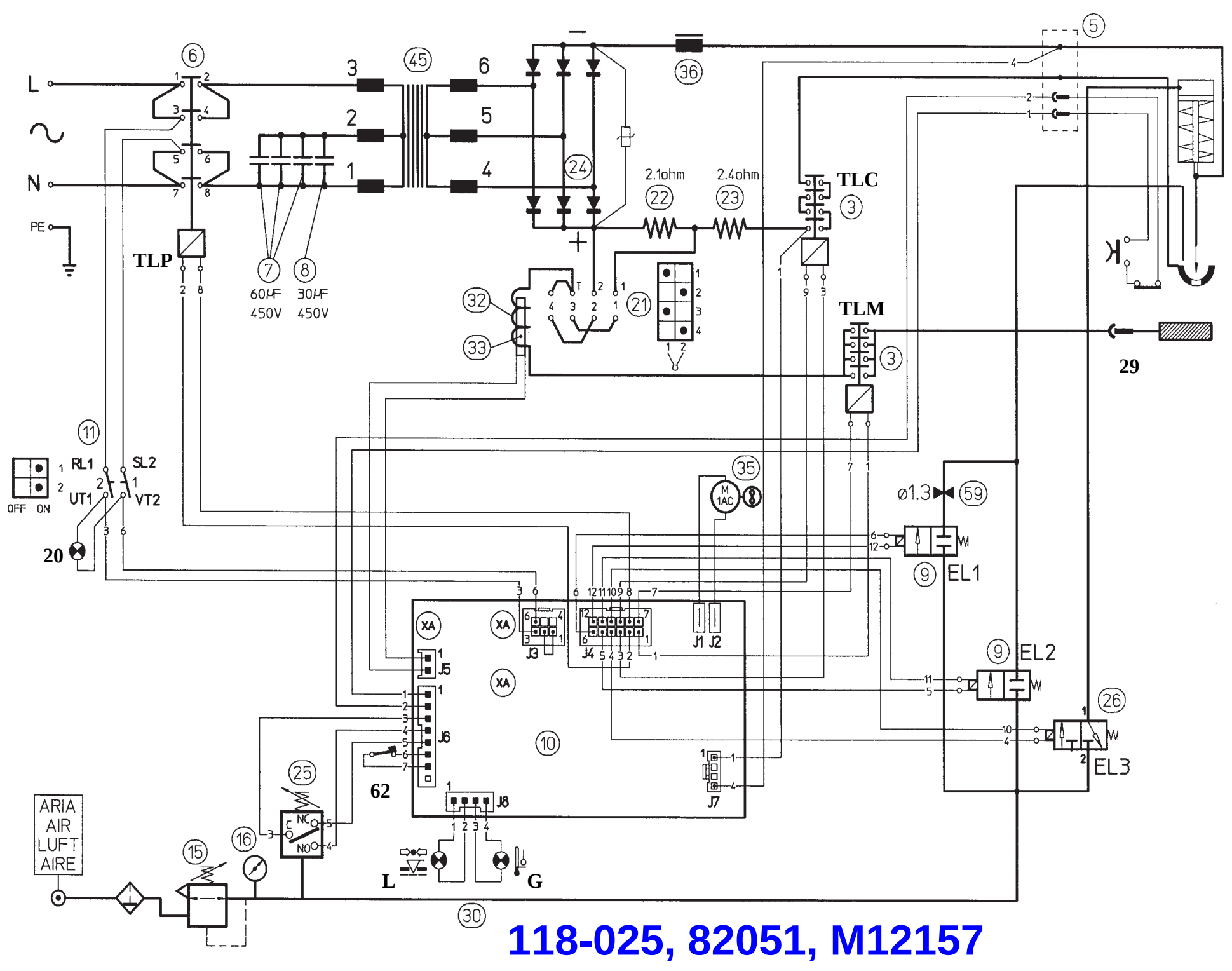
Item	Lincoln Stock #	Customer #	Description
1	312-512-666	250728	Handle
2	411-109-026	250907	Left Side Panel
3		3190275	Contactor
4	412-753-666	5802809	Intermediate Plane
5	239-298-666	B7009380	Terminal Board
6	246-529-666	3190280	Contactor
7	213-043-666	260468	Capacitor
8	213-044-666	260477	Capacitor
9	246-516-666	B7007380	Solenoid
10	880-466-666	5602150	Control Circuit
11	246-527-666	261543	Switch W/Knob
12	541-279-666	250874	Strain Relief
13	238-713-666	260472	Mains Cable
14	411-120-016	250877	Back Panel
15	254-006-666	B7006380	Air Regulator
16	251-030-666	B7014380	Gauge
17	215-031-666	250901	Protection
18	312-514-666	250896	Handle Support
19	245-168-666	246250	Lamp Holder
20	215-033-666	5585775	Pilot Lamp
21	246-526-666	251220	Switch W/Knob
22	215-029-666	251189	Resistor, 2.1Ω
23	215-030-666	251190	Resistor, 2.4Ω
24	244-086-666	251191	Rectifier
25	246-532-666	B7005380	Pressure Switch
26	246-525-666	3160196	Solenoid Valve
27	245-170-666	B7015380	Lamp Holder
28	245-169-666	246251	Lamp Holder
29	079-306-666	B7073370	Coupling
30	215-034-666	5586773	Pilot Lamp
31	334-607-666	B7016380	Cable Outlet

Item	Lincoln Stock #	Customer #	Description
32	210-358-666	251192	Coupling Coil for Reed Switch
33	411-125-666	250885	Reed Switch
35	216-108-666	246224	Fan Motor, 230V
36	860-998-666	3205331	Reactor Coil
37	411-108-026	250897	Right Side Cover
38	412-756-666	B7035380	Foot
39	312-513-666	250879	Support
40	411-107-026	250224	Cover
41	413-118-666	B7033380	Wheel
42	413-121-666	250881	Axle
43	312-517-666	251201	Base Support
44	216-109-666	250726	Fan Blade (4mm left thread bolt holds on)
45	880-578-666	251199	Transformer
46	411-124-666	250893	Base
47		5802295	Front Panel - 82051
			Front Panel - M12157
48	238-714-666	251196	Work Cable
49	238-706-666	5580779	Torch Cable
50	312-518-666	B7037380	Handgrip + Push Button
51	334-588-666	1346-00	Torch Head
52	512-264-666	251194	O-Ring
53	334-587-666	3065225	Diffuser
54	334-580-100	--	Electrode
55	334-583-100	--	Swirl Ring
56	334-581-100	--	Nozzle 0.9 mm
	334-582-100		Nozzle 1.1 mm
57	334-584-100	--	Nozzle Holder
58	**238-696-666**	**1212.18**	**Complete Torch Assy**
59	091-071-666	3175880	Limiting Device
60	334-585-100	--	Two-Point Spacer
61	334-604-000	5800818	Electrode Wrench

10/16/2006

Model	Primary Input	Input Plug	Duty Cycle at Rated Output
118-025	230V, 30 amp	Not supplied	50%

Rated Output	Voltage Settings	Agency Listing	Max Output
50 amps	2	CSA	50 amps



118-025, 82051, M12157