

TIG SOUND 3340/T AC-DC Synergic

POWER SOURCE + **COOLING UNIT** **art. 352**

SERVICE MANUAL



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1 - GENERAL INFORMATION

1.1 - Introduction.

The purpose of this manual is to train personnel assigned to carry out maintenance on the TIG SOUND 3340/T AC-DC Synergic welding system, art. 352.

1.2 - General service policy.

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

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

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

1.3 - Safety information.

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

Always disconnect the power cord from the mains, and wait for the internal capacitors to discharge (4 minutes, approximately) 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 TIG SOUND 3340/T AC/DC Synergic is a multi-process system for MMA welding with any type of covered electrode (no cellulosic), and TIG welding with arc starting in both contact and high frequency mode, with possibility to use Synergic Mode, a “welding parameter set-up online guide”.

It is made up of the TIG AC/DC 3340/T electronic power source, the GR52 Cooling Unit, and a series of accessories to adapt to various types of use (see list in the Sales Catalogue).

Operator interface of welding system is made by Control Panel included in the power source.

2.2 - Technical specifications.

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

2.3 - Description of TIG SOUND 3340/T AC/DC Synergic system (art. 352).

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

Referring to the electrical diagrams in par. 5.1, drawing 4.1, and table 4.2, you may identify the main blocks that make up the system.

NOTE

The control board (163) is composed from two boards (interface and micro) mounted one on the other. For greater clarity in the identification of the connectors, in the present manual the two boards are indicated singularly, and with the same identification number of control board (es.: control board (163); interface board (163); micro board (163)).

Power source and control panel contain a microprocessor circuit, which not only manages the functions of the unit to which it belongs, but also communicates one each other via CAN-BUS serial line, to actively and continuously assist system operation.

Based on this architecture, the following units may be identified:

- MASTER microprocessor, in the micro board (163);
- PANEL microprocessor, in the panel board (156).

Each microprocessor is programmed with a different program, which must obviously be compatible with those of the other microprocessors. To make it easier to enter and upgrade these programs, a single-access system is provided (the connector (155) for RS232 serial communication, (BO) on the front panel of the power source), which allows the 2 microprocessors to be programmed in a single programming session. With this step the 2 programs are simultaneously entered into the microprocessors, each automatically in its place.

The upgraded MASTER and PANEL programs are grouped together in a single programming file, recognizable from the extension “.ceb”, available from the Cebora Web site www.cebora.it.

For their use is necessary to download and to install in the computer the “Cebora Device Manager” program, available in Cebora Web site www.cebora.it. With such program it is possible to record in the computer the files relative to “firmware Cebora” (programs releasable from the Cebora site) and to insert them in the machines that have to be programmed or updated.

The “Cebora Device Manager” user instructions are enclosed to the program.

The version of the inserted programs, is visible during start-up in the control panel, in the following form:

- display O = “PAn”; display (U) = “02_” = version 02 of PANEL program.
- display O = “MSt”; display (U) = “04_” = version 04 of MASTER program.

Working programs related to programmed by Cebora are integrated in the Master program.

Customizations of the welding system modes (parameter set-up) and the welding programs created by the operator are saved in the EEprom in the micro board (163).

In order to concur the substitution of control board (163) without to lose these data, the EEprom is mounted on socket so as to be able to be removed from the board and being inserted in one new board. In the same way it is also possible to transfer the customizations and the customer programs from a generator to the other, so that this last one is found to operate with the same identical parameters of the first generator.

2.4 - Description of power source TIG 3340/T AC/DC.

The TIG 3340/T is a direct current power source with controlled current, consisting of a three-phase rectifier bridge, a DC/AC (inverter) converter, and an additional rectifier bridge.

Furthermore, an additional DC/AC converter downstream of the second rectifier converts the welding current back to AC.

The main switch (110) powers the filter board (107), which contains the filter to reduce conducted interference reflected in the mains, and the three-phase choke (118) to level the current absorbed by the mains.

The pre-charge board (183), inserted downstream from the choke (118), contains the power rectifier bridge, the DC-capacitors (179) pre-charge circuit of the inverter, and the circuits to analyze the mains voltage. It communicates with the control board (163) through optically isolated signals.

The rectifier bridge converts the alternating mains voltage (400 Vac) to direct current (540 Vdc) suitable for powering the inverter and the DC-capacitors (179) to level this direct current.

The pre-charge circuit of the DC-capacitors (179) is made up of the PTC (PTC1 - PTC8) and relay RL1 on pre-charge board (183). The latter is controlled by the micro board (163), which analyzes the “mains voltage presence” and the “direct current voltage on the DC-capacitors (179)” signals, coming from pre-charge board (183), through interface board (163).

More specifically, check the presence of each phase of the mains voltage, the level of the direct current voltage at the rectifier bridge output, thus on the DC-capacitors (179).

If the test result is positive, the pre-charge relay RL1 is closed and the power source is operated; otherwise RL1 remains open and the power source is blocked, while the control panel (156) displays the cause of the block.

From auxiliary output of filter board (107) is picked up the mains voltage to supply the service transformer (106), which supply the power supply board (105) that generates the service voltages for the various system circuits.

The inverter is made up of four igbt (2 for each igbt module (170)) connected in an “H-bridge” configuration, driven by the driver-igbt boards (170), mounted directly on the terminals of the igbt modules (170), in turn controlled by the interface board (163).

Mounted on the power terminals of the igbt modules (170) are two “snubber” capacitors, electrically connected in parallel to the DC-capacitors (179), whose task is to reduce the overvoltages that develop on the igbt during operation. Their integrity and connection (which must be as short as possible on the igbt terminals) is essential for the inverter to operate; tampering with them may seriously damage the igbt (170).

The task of the igbt inverter is to generate the square-wave alternating voltage for the power transformer (188). The welding current is adjusted by modulating this voltage appropriately.

The TA (177) inserted in the circuit between an igbt module (170) and the transformer (188) provides the micro board (163) with the current feedback signal of the primary circuit of the transformer (188), to verify that the inverter is working properly; this signal does not normally affect the welding current adjustment.

The transformer (188) provides the secondary circuit with voltage and current values suitable for welding. Its secondary circuit is made up of 4 windings connected to a shared point on the central socket, to which the choke (142) is connected to level the welding current.

The HF transformer (143) is connected on the same connection, before the “-” (BA) output terminal of the power source. Appropriately driven by the HF board (157), the transformer generates the high voltage and high frequency to strike the arc in TIG welding.

Operation of the HF board (157) is subject to the presence of alternating voltage on the secondary transformer circuit (188) and is controlled by the interface board (163).

The other ends of the secondary circuit windings are connected to the diode group (127), which rectifies the alternating current generated by the inverter, making it available to the next AC-inverter group.

The diode group (127) is made up of four diodes connected in a single-phase bridge, and provides a dual output voltage, thus a positive and negative with regard to the central socket of the transformer (188) acting as a potential “0”. This configuration simplifies the insertion of the subsequent AC-inverter group, present on the power source art. 352.

The Hall-effect current transducer (130), inserted at the diode group (127) output, sends the secondary current feedback signal to the micro board (163), used to regulate the welding current.

The AC-inverter unit, made up of the igt modules (134), reverses the polarity of the power source output voltage in AC operating mode.

The two igt (134) are connected in “half-bridge” configuration, so that the alternating closing of the two provides positive then negative voltage at the “+” (BB) output of the power source, present on the output terminals of the diode group (127). These voltages obviously refer to the potential of the “-” (BA) terminal of the power source output, corresponding to the “0” of the central socket of the secondary circuit of the transformer (188).

A thermostat board (131) is mounted on the dissipater of the igt modules (170), which receives the power supply from the interface board (163) and sends the igt (170) temperature signal to the latter. A second thermostat board (131) is mounted on the igt dissipater (134), which receives the power supply from the AC-driver board (136), and sends the igt (134) temperature signal to the interface board (163) via the AC-driver board (136).

The fan (119) to cool the power elements of the power source is controlled by the interface board (163). Its operation is conditioned by the temperature of the inverter and diode groups and the ambient temperature, and in particular, is activated in the following conditions:

- upon machine start-up, and for 10 seconds after the pre-charge phase;
- with ambient temperature greater than 40°C;
- during welding, in the 3 minutes after welding is finished, and after 3 minutes if the igt temperature (170) and (134) is greater than 40°C;
- with the machine blocked, signaling an error code;

The micro board (163) contains the main power source microprocessor.

It supervises management of the other boards, more specialized in their respective functions, regulates the welding current by generating the PWM signal to be sent to the driver-igt boards (170), and communicates with the panel board (156) to manage the welding system.

The AC-driver board (136) is the main board of the AC-inverter stage and contains the drive circuits for the two igt (134) and for the arc maintenance igt. This igt is mounted on the AC-driver board (136), and is necessary for providing the high voltage pulse necessary to maintain the arc during AC operation.

The commands for these igt come directly from the micro board (163) through interface board (163). Special “snubber” circuits are provided to protect these igt, and include the resistors in the resistor group (184).

The AC-driver board (136) also contains the “AC-capacitors”, which serve to store energy for the arc maintenance pulse during AC operation, and recover energy from the choke (142) while reversing the output voltage in AC mode. These capacitors are supplied from power supply board (105) with a stabilized DC voltage of 260 Vdc.

The power source output voltage, taken from the HF-filter board (159), is appropriately filtered and adapted by the measurement board (104) and then sent to the interface board (163),

where it is used for the “Anti-stick” and “Arc-force” functions in MMA mode, and to read the power source output voltage on display (U).

The HF-filter board (159) is of fundamental importance in TIG mode with HF, since it prevents the HF pulse from traveling through the internal circuits of the power source and damaging other parts. Therefore, during the various maintenance operations, make sure that this board is always firmly connected to the original terminals before activating start-up with HF.

Near the output terminals is the connector board (146), which acts as an interface for the input and output signals of the power source. It communicates directly with the interface board (163), and contains the filters to eliminate the disturbances present on the input and output signals of the power source.

These signals include:

- Power source start from torch button.
- External welding current adjustment with external potentiometer.
- External welding current adjustment with UP/DOWN buttons on the torch.
- Arc on (relay contact free from voltage) (contact closed = arc on).

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

2.5 - Description of GR52 Cooling Unit.

The GR52 cooling unit is powered with two phases of the mains voltage, drawn from the pre-charge board (183), practically in parallel to the mains input terminals.

This voltage arrives at the cooling board (31), which acts as a connection interface between the components of the unit and the actual control circuit, the control board (163) of the power source, to which it is connected.

More specifically, the “enable cooling unit” signal of the control board (163) commands the relay on the cooling board (31), which directly powers the coolant pump (36), and the autotransformer (32), which adapts (400/230 Vac) the supply voltage of the fan (33). The pressure switch (37), inserted in the hydraulic circuit on the pump (36) delivery, provides the isolated signal for the fluid pressure to the control board (163), via the cooling board (31).

Upon power source start-up, the control board (163) checks whether the cooling unit is connected, by means of the signal provided by the jumper on terminals 3 and 4 of J6 on interface board (163). With J6 disconnected, or with the jumper open, the cooling unit is disabled, and a eventual MAN or AUT operating mode selection cause the alarm condition with flashing indication “H2O” on display (O) and “n.c.” (not connected) on display (U) of the control panel.

If set to continuous or automatic mode (see Instruction Manual), when the unit is switched on the pump (36) and fan (33) will operate for 30 seconds, to fill the torch tubes and check the pressurization of the hydraulic circuit; If no welding command is received from the operator, they will then stop awaiting a new start command.

If the pressure switch (37) does not detect the appropriate pressure within 30 seconds after start-up, the control board (163) orders the power source blocked, with “H2O” flashing indication on display (O) (see error code, par. 3.7.18).

In automatic mode the pump and fan start running when TIG welding begins, and stop 3 minutes after welding has stopped.

In continuous mode the pump and fan are always kept running. Only a lack of pressure can stop them, along with the power source. In the MMA process, cooling unit operation is disabled.

The factory setting of the cooling unit is “OFF”, thus this setting must be changed the first time the welding system is used (see Instruction Manual).

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 (4 MINUTES APPROXIMATELY).

3.1 - Periodic inspection, cleaning.

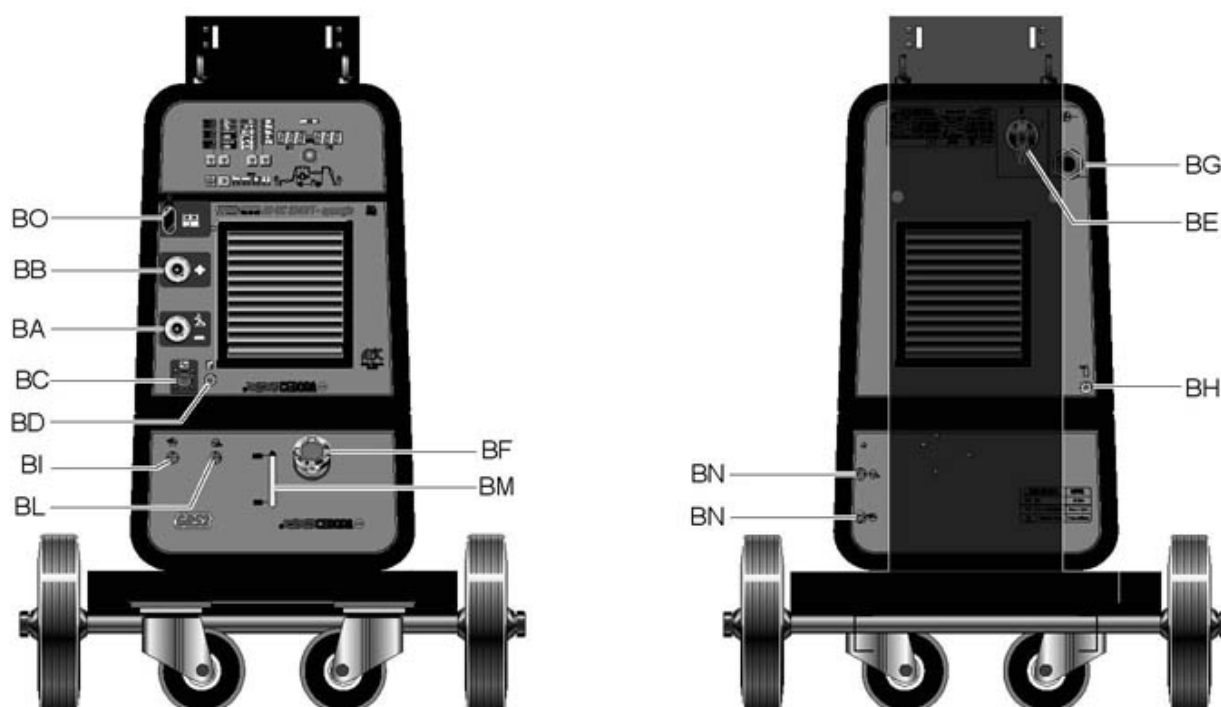
Periodically open the grids on the power source and check inside the aeration tunnel.

Remove any dirt or dust to ensure smooth air flow, and thus adequate cooling of the internal parts of the power source.

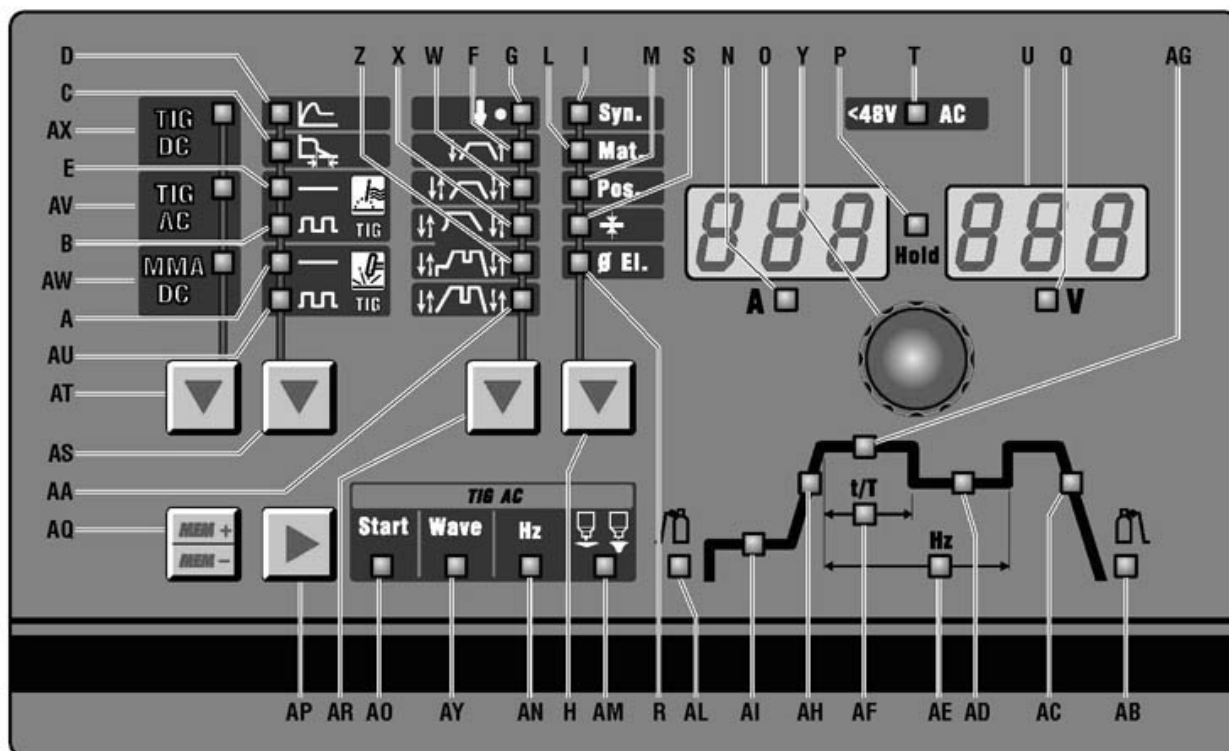
Check the condition of the output terminals, output and power supply cables of the power source; replace if damaged.

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 - Welding system fittings and connectors.



3.3 - Control panel commands and signals.



3.4 - Operating sequences.

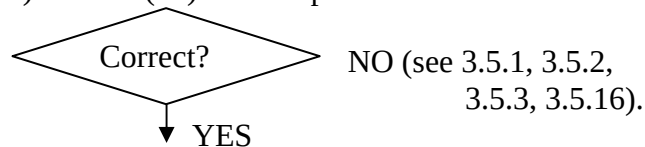
The following sequences reflect proper machine operation. They may be used as guidelines for troubleshooting. After each repair, they must be carried out without encountering any error or impediment.

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.

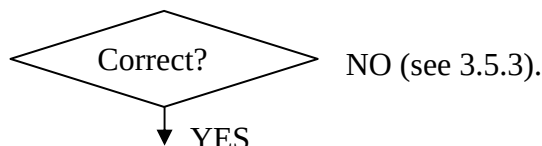
3.4.1 - Welding system operation.

- System shut off and disconnected from the mains.
- Connect a rubber hose to fittings (BI) and (BL) of the cooling unit to create a by-pass for the coolant circulation.
- Connect the power source to the mains.
- Close the switch (BE).
 - ◆ System powered.
 - ◆ After one second, all leds and display light on (lamp test).
 - ◆ After one second, the display (O) reads “Art”, and display (U) reads “352”.
 - ◆ After one second, the display (O) reads “PAn”, and display (U) reads the version of the PANEL program inserted into control panel (156) (es.: 02_).
 - ◆ After one second, the display (O) reads “MSt”, and display (U) reads the version of the MASTER program inserted into micro board (163) (es.: 04_).
 - ◆ After one second, the display (O) reads P-L (o P01 – P09) (working program) and display (U) remains OFF.
 - ◆ Subsequently, display (O) indicates the programmed current value and display (U) the output voltage (60 in MMA, display off in TIG); the Process, Mode and Program signaling are lit as set before the last time the unit was shut off.
 - ◆ After one second the switch (BE) is closed, the fan (119) on the power source runs for 10 seconds, then stops.
 - ◆ With power source in TIG, if the cooling unit mode is set to:
 - “automatic”, the pump (36) and fan (33) run for 30 seconds then stop;
 - “continuous”, the pump (36) and fan (33) run continuously;
 - “OFF”, the pump (36) and fan (33) do not operate.



- Press the button (AT) several times; the “Process” selection is repeated in sequence.
- Press the button (AS) several times; the “Mode” selection is repeated in sequence.
- Press the button (AR) several times; the “Program” selection is repeated in sequence (it is not possible to select the “Program” in MMA mode).
- Press the button (H) several times; the “Synergic” selection is repeated in sequence (synergic selection is allowed only in NON PULSED TIG).
- Press the button (AP) several times; the “Accessory functions” selection is repeated in sequence.
 - ◆ Each time the button (AT) is pressed, the leds AX, AV and AW light in sequence.
 - ◆ Each time the start button (AS) is pressed, the leds E, B, A and AU light in sequence (only leds D and C in MMA).

- ◆ Each time the button (AR) is pressed, the leds G, F, W, X, Z and AA light in sequence.
- ◆ Each time the button (H) is pressed, the leds L, M, S and R light in sequence, together to the light of led (I) that indicates the Synergic mode selection. Displays (O) and (U) shown available options for the function indicated by corresponding led lit (see Instruction Manual).
- ◆ Each time the button (AP) is pressed, the leds AO, AY, AN, AM, AL, AI, AH, AG, AD, AE, AF, AC and AB light in sequence, in observance of the conditions imposed by the selected “Process” and “Mode”. Displays (O) and (U) show available options for the function indicated by corresponding led lit (see Instruction Manual).



3.4.2 - TIG-AC Mode.

NOTE

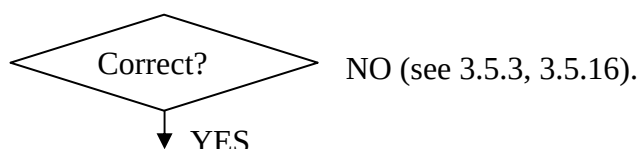
The TIG-AC operating sequence is described below, because it involves all of the internal power source units, including those for TIG-DC operation.

WARNINGS

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

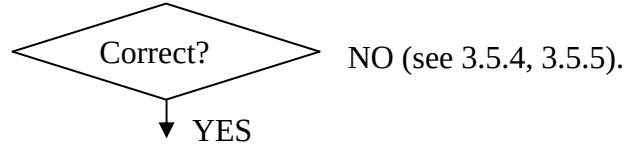
DO NOT TRY TO MEASURE THE OUTPUT VOLTAGE DURING THESE STEPS. THE PRESENCE OF HIGH FREQUENCY MAY DAMAGE THE INSTRUMENT OR THE POWER SOURCE ITSELF.

- ❑ Shut off the power source using the switch (BE).
- ❑ Connect the gas supply to the fitting (BH) on the rear panel.
- ❑ Connect the TIG torch to the negative pole (BA) of the power source.
- ❑ With the water-cooled torch, connect the torch cooling circuit hoses to fittings (BI) and (BL) of the cooling unit.
- ❑ Connect the cable of the positive pole (BB) of the power source to the workpiece.
- ❑ Restart the power source using the switch (BE).
- ❑ Use the button (AT) to select the TIG-AC “Process”, led (AV) lit.
- ❑ Use the button (AS) to select the TIG-CONTINUOUS “Mode” with HF, led (E) lit.
- ❑ Use the button (AR) to select the 2-STAGE-TIG “Program”, led (F) lit.
- ❑ With water-cooled torch, simultaneously press the buttons (AQ) and (AP) to enter the page to select the cooling unit operating mode.
- ❑ Turn the knob (Y) to select the CONTINUOUS or AUTOMATIC operating mode.
 - ◆ Display (O) indicates “H2O”. display (U) indicates “OnC” for continuous mode or “OnA” for automatic mode. In “automatic”, the pump (36) and fan (33) run for 30 seconds then stop. In “continuous”, the pump (36) and fan (33) run continuously.



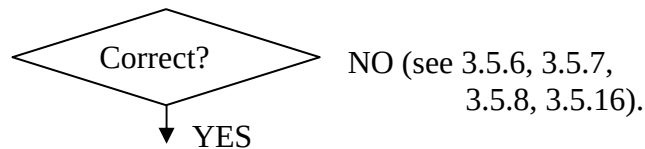
- Briefly press the torch start button.

- ◆ Gas begins flowing from the torch, pre-gas led (AL) lit, for as long as the button is held down.
- ◆ Gas continues to flow from the torch for the duration of the post-gas time set, led (AB) lit, even after the start button is released.



- Press the start button and hold it down for approximately 5 seconds.

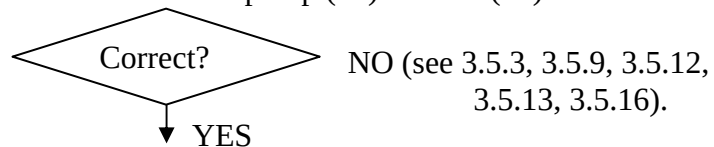
- ◆ Gas output begins; the high frequency is then generated to start the arc, as well as the power source output voltage. Display (O) indicates programmed welding current, adjustable with knob (Y), display (U) shows output voltage.
- ◆ After approximately three seconds, the output voltage and high frequency are no longer generated (TIG operation stops if there is no current at the power source output after start) and the post-gas stage begins.
- ◆ If cooling unit is set in “automatic” the pump (36) and fan (33) run for 30 seconds then stop.



- Use the knob (Y) to set the current based on the welding you intend to perform.

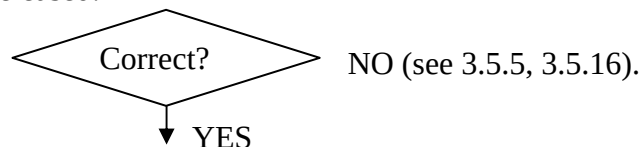
- Move the torch near the workpiece and press the torch trigger.

- ◆ Begin welding. Turn the knob (Y) or the torch potentiometer, or press the UP/DOWN buttons on the torch, to obtain the current level suitable for the type of welding to be done.
- ◆ During welding display (O) indicates the welding current, display (U) the output voltage.
- ◆ If cooling unit is set in “automatic” the pump (36) and fan (33) start to run.



- Release the torch start button.

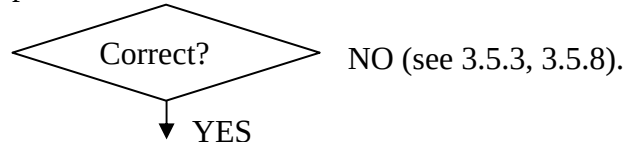
- ◆ The arc shuts off immediately (if long ramp times are not set).
- ◆ Gas continues to flow for the entire post-gas time.
- ◆ If cooling unit is set in “automatic” the pump (36) and fan (33) run for 3 minutes after start button is released.



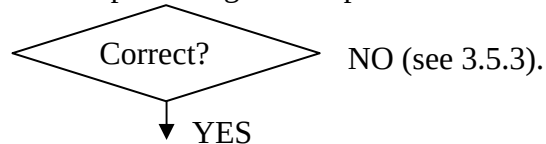
REGULAR OPERATION.

3.4.3 - MMA mode.

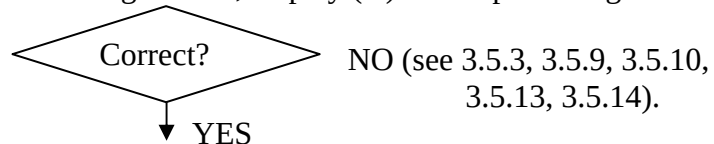
- ❑ Shut off the power source using the switch (BE).
- ❑ Connect the cable to the electrode holder and the earth cable to the negative (BA) and positive (BB) connectors, observing the polarity of the electrodes to be used.
- ❑ Restart the power source using the switch (BE).
- ❑ Use the button (AT) to select the MMA “Process”, led (AW) lit.
 - ◆ Voltage begins to be generated at the power source output.
 - ◆ Display (O) shows the programmed welding current, display (U) the open-circuit output voltage of the power source.



- ❑ Use the button (AS) to select the HOT-START and ARC-FORCE functions (indicated by leds D and C) you intend to use.
 - ◆ Display (U) shows the value assigned to the function indicated by corresponding led light. This value is adjustable with knob (Y). After 3 seconds display (U) indicates the open-circuit output voltage of the power source.



- ❑ Use the knob (Y) to set the current based on the electrode you intend to use.
- ❑ Move the electrode clip near the workpiece.
 - ◆ Begin welding. Adjust the knob (Y) to obtain the current level suitable for the type of welding to be done.
 - ◆ Use the buttons (AS) and knob (Y) to adjust the “hot-start” or “arc-force” functions if necessary (see Instruction Manual) to maximize welding quality.
 - ◆ Display (O) shows the welding current, display (U) the output voltage.



REGULAR OPERATION.

3.5 - 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 (4 MINUTES).

NOTE

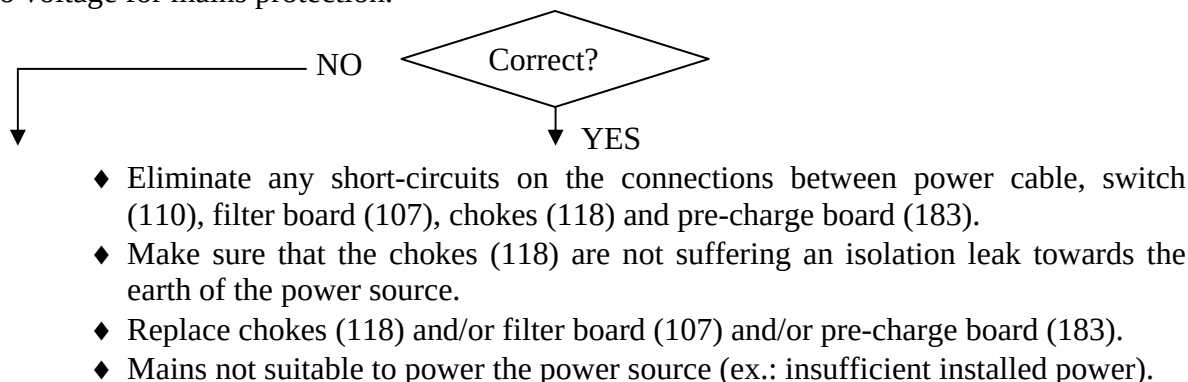
Items in **boldface** describe problems that may occur on the machine (symptoms).

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

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

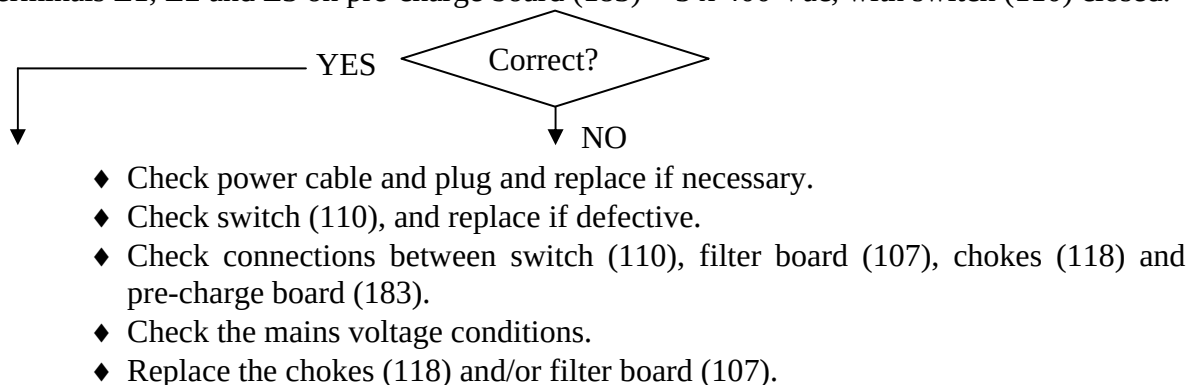
MAINS SUITABILITY TEST.

- No voltage for mains protection.



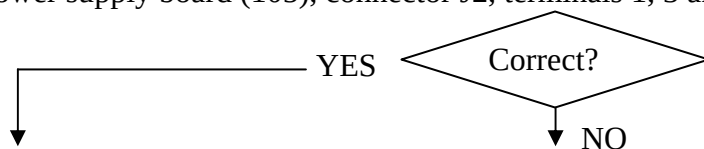
MAINS CONNECTION TEST.

- Terminals L1, L2 and L3 on pre-charge board (183) = 3 x 400 Vac, with switch (110) closed.



POWER SUPPLY BOARD (105) POWER SUPPLY TEST.

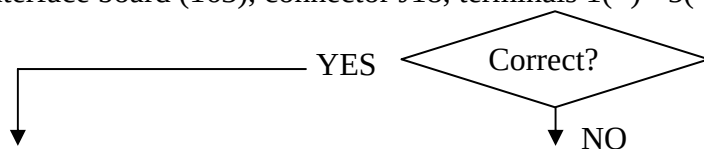
- Power supply board (105), connector J10, terminals 1, 2 and 4 = 3 x 29 Vac, approximately.
- Power supply board (105), connector J2, terminals 1, 3 and 5 = 3 x 220 Vac, approximately.



- ◆ Check the wiring between terminals J-L1, J-L2 e J-L3 on filter board (107), service transformer (106) and connectors J2 and J10 power supply board (105).
- ◆ Temporarily disconnect the power source from the mains and check integrity of fuses on the connection board of service transformer (106). If interrupted, before to replace check resistance of primary winding terminals. Correct value = 3 x 130 ohm approximately. If not correct, replace service transformer (106).
- ◆ Temporarily disconnect connectors J2 and J10 from power supply board (105). Power up the power source again, with switch (110), and check the voltage on path connectors disconnected from J2 and J10. Correct values: 3 x 29 Vac on terminals 1, 2 and 4 of J10; 3 x 220 Vac on terminals 1, 3 and 5 of J2. If incorrect, replace service transformer (106). If correct replace the power supply board (105).
- ◆ Replace the power supply board (105).

CONTROL BOARD (163) POWER SUPPLY TEST.

- Micro board (163), connector J3, terminals 2(+) – 1(-) = +8 Vdc.
- Micro board (163), connector J3, terminals 4(+) - 3(-) = +15 Vdc, led +15 lit.
- Micro board (163), connector J12, terminals 1(+) - 6(-) = +5 Vdc, led +5 lit.
- Interface board (163), connector J4, terminals 1(+) - 2(-) = +25 Vdc, led 1 lit.
- Interface board (163), connector J18, terminals 1(+) - 5(-) = +25 Vdc, led 1 lit.

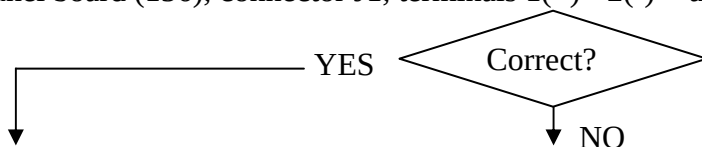


- ◆ Check wiring between J11 power supply board (105), J3 micro board (163), J4 and J18 interface board (163).
- ◆ With the power source off, temporarily disconnect all connectors except J2 and J10 on power supply board (105). Power up and check again for the presence of voltages on the following connector of power supply board (105):
 - connector J3, terminals 1(-), 4(+) = 0 Vdc;
 - connector J4 = J5 = J6 = J8 = J9, terminals 1, 2 = 25 Vac square wave 50 kHz;
 - connector J7, terminals 1(+) e 2(-) = +8 Vdc;
 - connector J11, terminals 4(+) e 3(-) = +8 Vdc;
 - connector J11, terminals 5(+) e 1(-) = +25 Vdc;
 - connector J11, terminals 6(+) e 2(-) = +25 Vdc;
 - connector J11, terminals 7(+) e 8(-) = +15 Vdc.

If correct, identify which of the connectors disconnected from the power supply board (105) causes the incorrect value and eliminate the cause of the probable overload or short-circuit. If incorrect, replace the power supply board (105).
- ◆ Replace the power supply board (105).

PANEL BOARD (156) POWER SUPPLY TEST.

- Panel board (156), connector J1, terminals 1(+) - 2(-) = approximately +8 Vdc.



- ◆ Check the wiring between J1 panel board (156) and J7 power supply board (105).
- ◆ With the power source off, temporarily disconnect connector J7 on power supply board (105) and check the resistance between terminals 1 and 2 of J1 on panel board (156). Correct value = junction of one diode in one direction and >Mohm with the instrument probes reversed. If incorrect replace the panel board (156). If short-circuited, also replace power supply board (105).
- ◆ Replace panel board (156) and/or power supply board (105).
- ◆ Check the wiring between J14 interface board (163) and J5 panel board (156).
- ◆ Replace panel (156) and/or control (163) and/or power supply (105) boards.

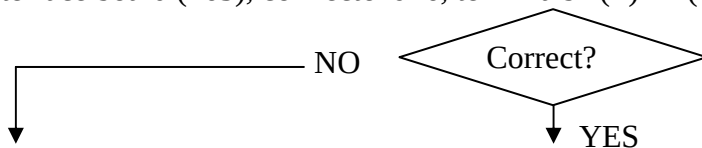
3.5.2 - Power source powered, control panel on, fan (119) stopped.

NOTE

The fan (119) on the power source is controlled by the control board (163), and its operation is subordinate to the condition of the power source, as described in par. 2.4 Description of power source TIG 3340/T AC/DC. For this reason, the following tests may be verified only during the first 15 seconds of power supply or during a blocked situation. **For this purpose it is possible to simulate the error 20, by disconnecting the connector J1 on the TA board (177).**

FAN (119) TEST.

- With the power source off, temporarily disconnect connector J1 on TA board (177) to block the power source and thus cause the fan (119) to run continuously.
- Interface board (163), connector J16, terminals 1(+) – 2(-) = +24 Vdc.

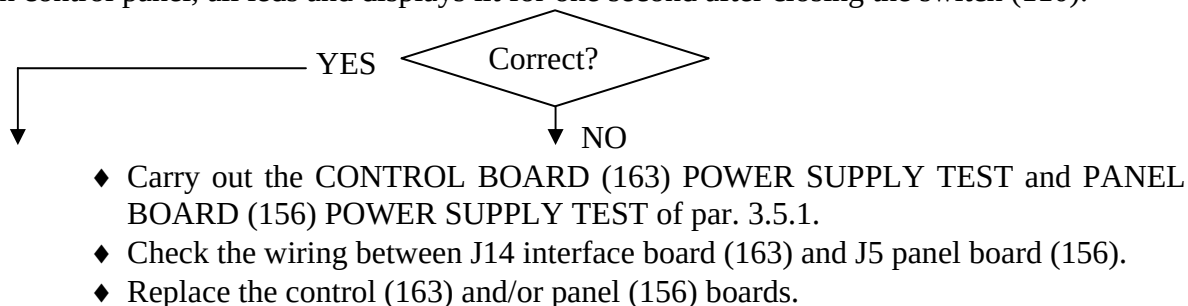


- ◆ Check the wiring between the fan (119) and J16 on interface board (163).
- ◆ Make sure that there are no mechanical impediments blocking the fan.
- ◆ Replace the fan (119).
- ◆ Perform the CONTROL BOARD (163) POWER SUPPLY TEST, par. 3.5.1.
- ◆ Replace control board (163) and/or fan (119).

3.5.3 - System powered, display and signals do not show the correct values.

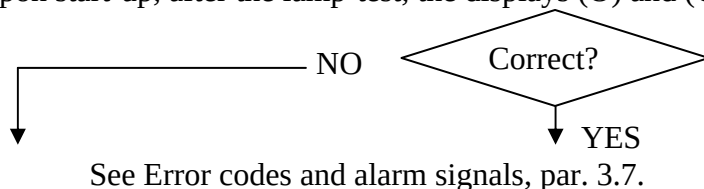
LAMP-TEST.

- On control panel, all leds and displays lit for one second after closing the switch (110).



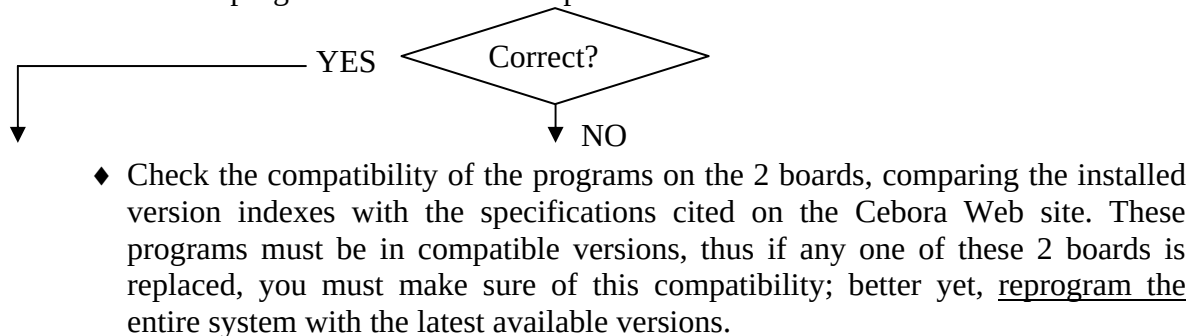
ERROR CODE TEST.

- Upon start-up, after the lamp-test, the displays (O) and (U) show an error code.



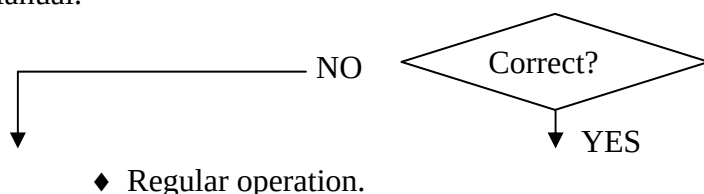
PROGRAMS INSTALLED TEST.

- At start-up, after lamp-test, display (O) reads “Art” and display (U) shows “352”.
- After one second, the display (O) reads “PAn”, and display (U) reads the version of the PANEL program inserted into control panel (156) (es.: 02_).
- After one second, the display (O) reads “MSt”, and display (U) reads the version of the MASTER program inserted into micro board (163) (es.: 04_).
- After one second, the display (O) reads P-L (o P01 – P09) (working program) and display (U) remains OFF.
- The versions of the programs entered are compatible with one another.



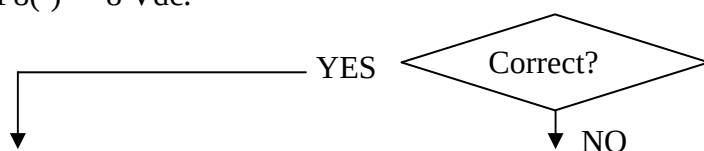
COMMANDS AND SIGNALS TEST.

- The keys on control panel (156) allow all of the steps regarding the selection of “Process”, “Mode” and “Programs”, as described in par. 3.4 Operating sequences, and in the Instruction Manual.



CONNECTOR (146) AND MEASUREMENT (104) BOARDS POWER SUPPLY TEST.

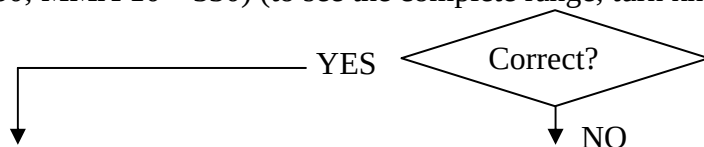
- ❑ Connector board (146), connector J2, terminals 2(+) – 7(-) = + 5 Vdc (with connector J2 free, no components connected to J2).
- ❑ Connector board (146), connector J2, terminals 10(+) and 7(-) (potentiometer cursor) = +5 Vdc, (with connector J2 free, no components connected to J2).
- ❑ Connector board (146), connector J2, terminals 1(+) and 9(-) (START command) = +17 Vdc, (with connector J2 free, no components connected to J2).
- ❑ Measurement board (104), test-point TP7(+) and TP8(-) = +8 Vdc; test-point TP6(+) and TP8(-) = -8 Vdc.



- ◆ Check the wiring between J4 power supply board (105) and J5 connector board (146) and between J5 power supply board (105) and J3 measurement board (104).
- ◆ With the power source off, temporarily disconnect connector J5 on connector board (146) and check the resistance between terminals 1 and 4 of J5 on connector board (146). Correct value = 10 ohm approximately. If incorrect replace the connector board (146); if short-circuited also replace power supply board (105).
- ◆ With the power source off, temporarily disconnect connector J3 on measurement board (104), and check the resistance between terminals 1 and 2 of J3 on measurement board (104). Correct value = 10 ohm approximately. If incorrect, replace measurement board (104); if short-circuited, also replace power supply board (105).
- ◆ Replace power supply (105) and/or connector (146) and/or measurement (104) boards.

CURRENT EXTERNAL ADJUSTMENT TEST.

- ❑ Connector board (146), connector J2, terminals 8(+) and 9(-) (UP command) = +17 Vdc, (with connector J2 free, no components connected to J2).
- ❑ Connector board (146), connector J2, terminals 4(+) and 9(-) (DOWN command) = +17 Vdc, (with connector J2 free, no components connected to J2).
- ❑ Insert a torch with current adjustment (potentiometer or UP/DOWN buttons). When the potentiometer on the torch is adjusted, the value shown on the display (O) will change (TIG-DC = 82 – 330; TIG-AC 82 – 330; MMA 10 – 330). When the UP and DOWN buttons are pressed, the value shown on the display (O) will change (TIG-DC = 5 – 330; TIG-AC 10 – 330; MMA 10 – 330) (to see the complete range, turn knob (Y) to the maximum).



- ◆ Check the wiring between J4 connector board (146) and J13 interface board (163).
- ◆ With the power source off, temporarily disconnect connector J13 from interface board (163), and check the resistance between terminals 1 and 2, 5 and 6, 7 and 8 of J13 interface board (163). Correct value = junction of one diode in both measurement directions (for this measurement, the voltage on the diode junction may be between approximately 0.5 and 1 Vdc). If incorrect, replace interface board (163).
- ◆ Make sure the torch connector is correctly inserted on J2 of connector board (146) and that the potentiometer and UP/DOWN buttons on the torch work properly.

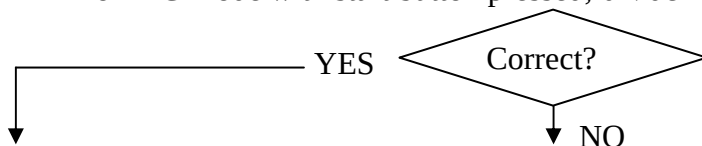
- ◆ Replace the connector board (146) and/or control board (163).

OUTPUT VOLTAGE DISPLAY TEST.

WARNING

FOR THIS TEST **DISCONNECT THE CONNECTOR J4 ON THE HF BOARD (157) TO PREVENT HIGH FREQUENCY GENERATION.**

- Display (U) indicates the output voltage: approximately 60 V, with open-circuit power source, in MMA or TIG mode with start button pressed; 0 Vdc in TIG mode with button released.

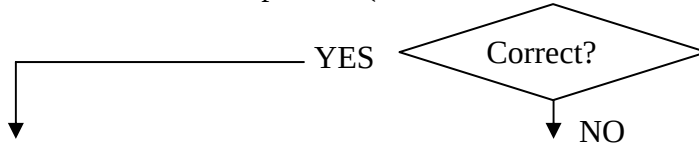


- ◆ Make sure on output terminals (BB)(+) and (BA)(-) of the power source, voltage = approximately +60 Vdc in TIG-DC or MMA, -60 Vdc in TIG-AC, with open-circuit power source and start button pressed; 0 Vdc in TIG mode with button released. If incorrect, perform the open circuit operation test in par. 3.5.8. (AC voltage is generated subordinate to the presence of current at the power source output; in open circuit operation in TIG-AC mode, the power source has continuous DC output voltage. Also see par. 3.7.13).
- ◆ Make sure on the measurement board (104), connector J2, terminals 1(+) and 4(-) voltage = approximately +60 Vdc in TIG-DC or MMA, -60 Vdc in TIG-AC, with open-circuit power source, and with start button pressed; 0 Vdc in TIG mode with button released. If incorrect check the wiring between J2 measurement board (104) and TP3 and TP4 on HF-filter board (159), and between J1 and TP1 of HF-filter board (159) with output terminal (+)(BB) of the power source shared point between choke (142) and HF transformer (143) (remove the ventilation grid on the front panel to inspect).
- ◆ Make sure the connections from TP3 to TP1 and TP4 to J1 on HF-filter board (159) are intact, by measuring the continuity between the output terminal (+)(BB) of the power source and terminal 1 of J2 measurement board (104), and between J6 of AC-driver board (136) and terminal 4 of J2 measurement board (104). If necessary replace the HF-filter board (159).
- ◆ Check the wiring between J1 measurement board (104) and J7 interface board (163).
- ◆ With the power source off, temporarily disconnect J7 from interface board (163), and check the resistance between terminals 1 and 2, 5 and 6, of J7 on interface board (163). Correct value = junction of one diode in one direction and junction of two diodes with the instrument probes reversed. If incorrect, replace control board (163).
- ◆ Replace panel (156) and/or control (163) and/or measurement (104) boards.
- ◆ Check the supply voltages of the panel board (156) and control board (163), performing the CONTROL BOARD (163) POWER SUPPLY TEST and PANEL BOARD (156) POWER SUPPLY TEST in par. 3.5.1.
- ◆ Replace panel (156) and/or control (163) boards.

3.5.4 - In TIG mode, the start button produces no effect.

START SIGNAL TEST.

- Interface board (163), optocoupler OP11 (near J13), pins 1(+) and 2(-) = approximately +1 Vdc, with start button pressed (0 Vdc with button released).

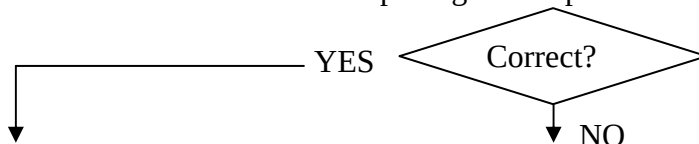


- ◆ Check the wiring between J4 connector board (146) and J13 interface board (163).
- ◆ With the power source off, temporarily disconnect the connector J13 on interface board (163) and check the resistance between terminals 3 and 4 of J13 on interface board (163). Correct value = junction of one diode in both measurement directions (for this measurement, the voltage on the junction diode may be between approximately 0.5 and 1 Vdc). If incorrect, replace control board (163).
- ◆ Check the connector board (146) power supply, performing the CONNECTOR (146) AND MEASUREMENT (104) BOARDS POWER SUPPLY TEST in par. 3.5.3 if necessary.
- ◆ Make sure the torch connector is properly inserted on J2 connector board (146), and that the START button on the torch is working properly.
- ◆ Replace connector board (146) and control board (163).
- ◆ Replace the control board (163).

3.5.5 - In TIG, no gas flows from the torch.

SOLENOID VALVE TEST (116).

- Solenoid valve terminals (116) = approximately 24 Vdc, in TIG, with start button pressed (the duration of the solenoid valve opening also depends on the post-gas parameter set).

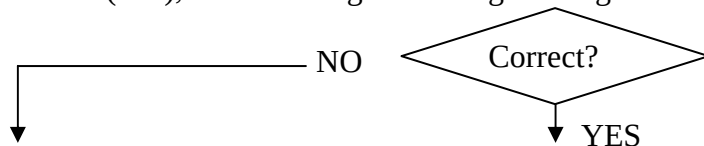


- ◆ Check the wiring between solenoid valve (116) and terminals 9 and 10 of J16 on interface board (163).
- ◆ With power source off, make sure the resistance between the terminals of solenoid valve (116) = approximately 56 ohm. If 0 ohm (short-circuit), replace solenoid valve (116) and control board (163).
- ◆ See CONTROL BOARD (163) POWER SUPPLY TEST, par. 3.5.1 and START COMMAND TEST, par. 3.5.4.
- ◆ Replace the control board (163).
- ◆ With power source off, make sure the resistance between the terminals of solenoid valve (116) = approximately 56 ohm. If >Mohm (winding broken), replace solenoid valve (116).
- ◆ Check the presence of the gas at the inlet fitting (BH) and that the pressure and flow rate in the intake conduit meet the specification values.
- ◆ Make sure there are no occlusions in the gas hoses of the power source.
- ◆ Replace the solenoid valve (116).

3.5.6 - In TIG, gas flows from the torch, the arc does not light (high frequency missing).

HF OSCILLATOR TEST.

- From the control panel, set TIG mode with HF (leds AX and E lit).
- HF board (157), SC1 discharger discharges at regular intervals, with start button pressed.



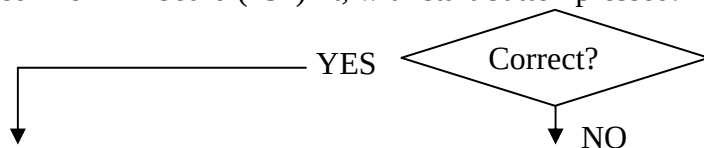
- ◆ Check connections between choke (142), HF transformer (143) and output terminal (-)(BA) of the power source (remove the ventilation grid on the front panel to inspect). If you find loose connections, tighten and replace any components with damaged terminals.
- ◆ Check connections between output terminals “+” and “-” of the diode group (127), igbt (134) and output terminal (+)(B) of the power source. If you find loose connections, tighten and replace any components with damaged terminals.
- ◆ Make sure that there are no short-circuits between terminals J2 and J3 of HF board (157) or in the connection of the HF transformer (143) primary circuit.
- ◆ Make sure the HF-filter board (159) is intact, paying special attention to the state of the 3 capacitors, the board connection to earth, and the connections between terminals TP1 of HF-filter board (159) with output terminal (+)(BB) of the power source and J1 of HF-filter board (159) with shared point between choke (142) and HF transformer (143). If you find damaged components or connections, replace the HF-filter board (159).
- ◆ Make sure that the (+)(BB) and (-)(BA) output terminals of the power source (gigas) are not suffering an isolation leak, thus that they are not shot with high-voltage surface discharge. Replace with new ones if necessary.
- ◆ Check the torch and torch cable; replace if worn or damaged.
- ◆ Go to par. 3.5.8. (open circuit operation).
- ◆ Make sure that the connection between terminals J2 and J3 of HF board (157) with the primary circuit of the HF transformer (143) is not interrupted. If necessary reset the connection or replace the HF transformer (143) and/or HF board (157).
- ◆ Check the distance between the tips of the discharger SC1 (correct value = 1,1 mm.).

HF BOARD (157) COMMAND TEST.

WARNING

FOR THIS TEST **DISCONNECT THE CONNECTOR J4 ON THE HF BOARD (157) TO PREVENT HIGH FREQUENCY GENERATION.**

- HF board (157), connector J1, terminals 1(+) - 2(-) = approximately +24 Vdc, green led “led1” on HF board (157) lit, with start button pressed.



- ◆ Check the wiring between J1 HF board (157) and J16 interface board (163).
- ◆ With power source off, temporarily disconnect the connector J1 from HF board (157) and check the resistance between the terminals 1 and 2 of J1 on HF board (157). Correct value = >Mohm in one direction and junction of two diodes with the instrument probes reversed (with this polarity led 1 on HF board (157) is

weakly lit). If incorrect replace the HF board (157). If short-circuited, also replace control board (163).

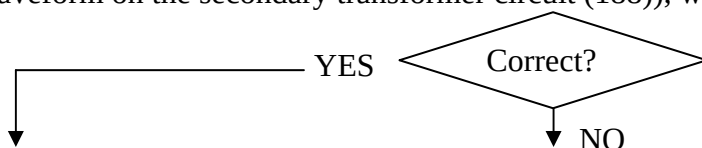
- ◆ Replace the HF (157) and/or control (163) boards.

HF BOARD (157) POWER SUPPLY TEST.

WARNING

FOR THIS TEST, RECONNECT THE WIRE ON J4 AND **DISCONNECT THE CONNECTOR J1** ON HF BOARD (157) TO KEEP THE HIGH FREQUENCY DISABLED.

- HF board (157), connector J4, terminals 1 - 4 (gnd) = fig. 5.2.1 (open-circuit voltage waveform on the secondary transformer circuit (188)), with start button pressed.



- ◆ Check the wiring between terminal 1 of J4 on HF board (157) and the central terminal of the secondary winding on the transformer (188) (remove the ventilation grid on the front panel to inspect), and between terminal 4 of J4 on HF board (157) and one end of the secondary winding of the transformer (188), connected on the diode group (127).
- ◆ Go to par. 3.5.7.
- ◆ Replace HF board (157).

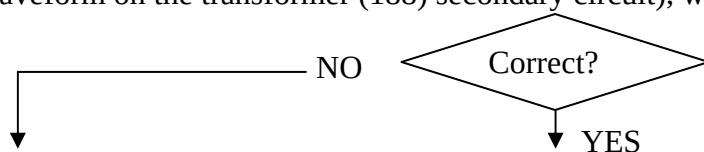
3.5.7 - In TIG, gas flows from the torch, the arc does not light (voltage is missing at the transformer (188) secondary circuit).

HF BOARD (157) POWER SUPPLY TEST.

WARNING

FOR THIS TEST **DISCONNECT THE CONNECTOR J1 ON THE HF BOARD (157) TO PREVENT HIGH FREQUENCY GENERATION.**

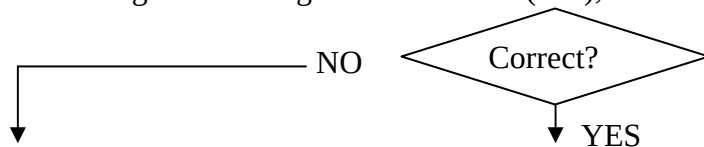
- HF board (157), connector J4, terminals 1 - 4 (gnd) = fig. 5.2.1 (open-circuit voltage waveform on the transformer (188) secondary circuit), with start button pressed.



- ◆ Open-circuit voltage regular on the transformer (188) secondary circuit.
- ◆ Go to par. 3.5.6.
- ◆ Check the wiring between terminal 1 of J4 on HF board (157) and the central terminal of the secondary winding of the transformer (188) (remove the ventilation grid on the front panel to inspect), and between terminal 4 of J4 on HF board (157) and one end of the secondary winding of transformer (188), connected on the diode group (127).

IGBT-DRIVER BOARDS (170) COMMAND TEST.

- With power source off, temporarily disconnect connectors J2 and J3 on interface board (163).
- Power up the power source again, and check the following terminals on interface board (163): connector J2, terminals 1 and 2 (gnd) = terminals 5 and 4 (gnd) = fig. 5.2.2, connector J3, terminals 1 and 2 (gnd) = terminals 5 and 4 (gnd) = fig. 5.2.2, command signal for the igbt-driver boards (170), in TIG mode, with start button pressed:



- ◆ With the power source off make sure that the output of the diode group (127) is not short-circuited or suffering an isolation leak towards earth. If necessary, seek out the cause in components and wiring downstream of the diode group (127), performing the “open circuit operation” test in par. 3.5.8. if necessary.
- ◆ With power source off, temporarily disconnect the end terminals of the secondary circuit of transformer (188) from the diode group (127), and make sure the diode group (127) is intact, considering that it is made up of 8 diode modules connected in a double “single-phase bridge” and that each module is actually made up of two parallel-connected diodes.
- ◆ Check wiring between J2 - J3 interface board (163) and igbt-driver boards (170).
- ◆ With power source off, and connectors J2 and J3 disconnected from interface board (163), check the resistance on the following connectors of the igbt-driver boards (170):
 L+ (+) and L- (-) = approx. 380-455 ohm; L+ (-) and L- (+) = approx. 455 ohm.
 H+ (+) and H- (-) = approx. 380-455 ohm; H+ (-) and H- (+) = approx. 455 ohm.
 GH(+) and EH(-) = approx.2200 ohm; GH(-) and EH(+) = approx.1200-1600 ohm.
 GL(+) and EL(-) = approx.2200 ohm; GL(-) and EL(+) = approx. 1200-1600 ohm.

If incorrect, replace the igbt-driver board (170) and the igbt module (170) to which it is connected.

- ◆ With power source off, check the resistance on the following power terminals of the igbt modules (170) (the final values in the measuring instrument are reached slowly due to the effect of the DC-capacitors (179)):

1 (+) and 2 (-) = >Mohm; 1 (-) and 2 (+) = junction of one diode.

1 (-) and 3 (+) = >Mohm; 1 (+) and 3 (-) = junction of one diode.

If incorrect, replace the defective igbt module (170), along with the igbt driver board (170) to which it is connected.

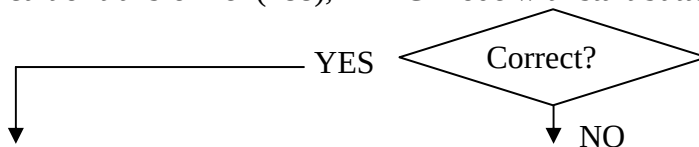
WARNING

In case of a fault on an igbt module (170) or igbt driver board (170), it is advisable to replace both the igbt module (170) and the igbt driver board (170) at the same time. An igbt defective frequently damages the igbt driver board to which it is connected. Similarly, an igbt-driver board defective frequently damages the igbt to which it is connected.

- ◆ Make sure that 540 Vdc is present on the terminals of the DC-capacitors (179). If incorrect, check the connections between the DC-capacitors (179) and pre-charge board (183) terminals VDC+1 and VDC+2, and replace the pre-charge board (183) and/or DC-capacitors (179) if necessary.
- ◆ Make sure that the primary circuit of the transformer (188) and corresponding connections are not interrupted, short-circuited, or in isolation leak towards earth.
- ◆ Replace the igbt driver (170) and/or igbt (170) boards and/or transformer (188).

CURRENT TO TRANSFORMER (188) PRIMARY CIRCUIT TEST.

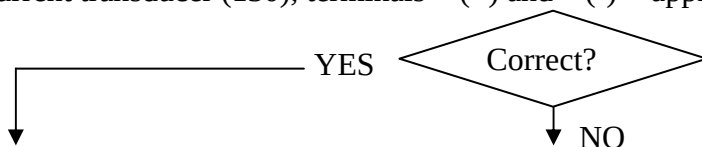
- Micro board (163), connector J1, terminals 6(+) - 5(-) = <0.1 Vdc, current to the primary circuit of transformer (188), in TIG mode with start button pressed or in MMA.



- ◆ Check the wiring between J1 micro board (163) and J1 TA board (177).
- ◆ Make sure that there are no short-circuits or isolation leaks towards earth in the connections between the primary circuit of the transformer (188) and the terminals 1 of the igbt modules (170).
- ◆ With the power source off, temporarily disconnect J1 from the TA board (177) and check the resistance on terminals 1 and 2 of J1 on TA board (177). Correct value = 10 ohm. If incorrect replace the TA board (177).
- ◆ With power source off, temporarily disconnect J1 from the micro board (163) and check the resistance on terminals 6 and 5 of J1 on micro board (163). Correct value = 130 ohm. If incorrect, replace micro board (163).
- ◆ Check the conditions of the transformer (188) inserted in the aeration tunnel (remove the ventilation grid on the front panel to inspect). Replace it if you find any burn marks or deformities.
- ◆ Replace the control (163) and/or TA (177) boards.
- ◆ Replace the transformer (188).

CURRENT TRANSDUCER (130) POWER SUPPLY TEST.

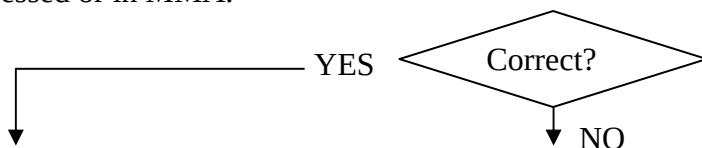
- Current transducer (130), terminals + (+) and – (-) = approximately +30 Vdc.



- ◆ Check the wiring between current transducer (130) and J1 micro board (163).
- ◆ With power source off, temporarily disconnect connector J1 from the micro board (163) and check the resistance between terminals 4 and 1 of the patch connector disconnected from J1. Correct value = approximately 2000 ohm. If incorrect, replace the current transducer (130).
- ◆ With power source off, reconnect J1 to the micro board (163) and temporarily disconnect the connector from the current transducer (130). Power up the power source again and check the voltage on J1 of micro board (163), terminals 4(+) and 5(-) = +15 Vdc; terminals 1(+) and 5(-) = -15 Vdc. If incorrect, replace control board (163).
- ◆ Replace the current transducer (130) and/or control board (163).

CURRENT TO SECONDARY CIRCUIT OF THE TRANSFORMER (188) TEST.

- Control board (163), connector J1, terminals 3(+) - 5(-) = +360 mVdc, +/- 10 mVdc, (current signal to secondary circuit, with open-circuit power source), in TIG mode with start button pressed or in MMA.



- ◆ Check the wiring between current transducer (130) and J1 micro board (163).
 - ◆ With power source off, temporarily disconnect J1 from micro board (163) and make sure the resistance on terminals 3 and 5 of J1 on micro board (163) = 22.5 ohm. If incorrect, replace control board (163).
 - ◆ Check the wiring between diode group (127), igt modules (134), and output terminals of the power source. If you find short-circuits or deteriorated connections, restore the original connections and replace any components with damaged terminals.
 - ◆ Make sure that the control board (163) is correctly set by carrying out the MINIMUM CURRENT THRESHOLD SETTING TEST in par. 3.7.10.
 - ◆ Check the igt (134). If short-circuited, replace them.
 - ◆ Replace current transducer (130).
 - ◆ Replace the control board (163).
- ◆ Replace the control board (163).
- ◆ Replace the transformer (188).

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

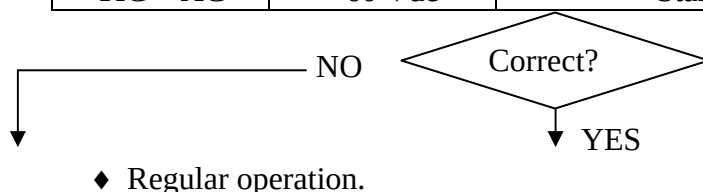
WARNING

FOR THESE TESTS **DISCONNECT THE CONNECTOR J1 ON THE HF BOARD (157) TO PREVENT HIGH FREQUENCY GENERATION.**

OPEN-CIRCUIT OUTPUT VOLTAGE TEST.

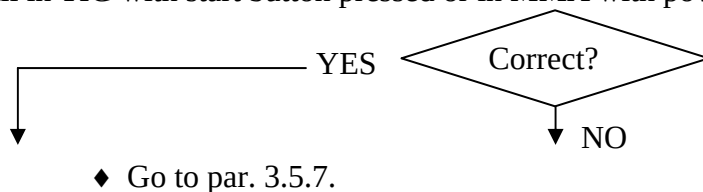
- Power source output terminal – (BA)(-) and output terminal + (BB)(+) = voltages per table:

Process	Voltage	Condition
TIG – DC	+ 60 Vdc	Start button pressed
MMA	+ 60 Vdc	Power source powered
TIG – AC	- 60 Vdc	Start button pressed



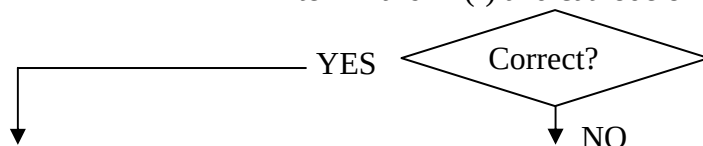
DIODE GROUP (127) OUTPUT VOLTAGE TEST WITH OPEN-CIRCUIT POWER SOURCE.

- Output terminal – (BA) power source (-) and positive terminal of diode group (127)(+) = +61 Vdc.
- Output terminal – (BA) power source (-) and negative terminal of diode group (127)(+) = -61 Vdc.
- (all in TIG with start button pressed or in MMA with power source powered).



AC-DRIVER BOARD (136) POWER SUPPLY TEST.

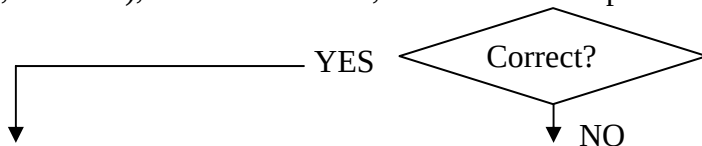
- AC-driver board (136), terminal E1 (-) and anode of Z1 (+) = -5 Vdc;
 terminal E1 (-) and cathode of Z4 (+) = +18 Vdc;
 terminal E2 (-) and anode of Z2 (+) = -5 Vdc;
 terminal E2 (-) and cathode of Z5 (+) = +18 Vdc;
 terminal J12 (-) and anode of Z6 (+) = -5 Vdc;
 terminal J12 (-) and cathode of Z3 (+) = +15 Vdc.



- ◆ Check the wiring between J9 AC-driver board (136) and J8 power supply board (105).
- ◆ With the power source off, temporarily disconnect the connector J9 on the AC-driver board (136) and check the resistance between terminals 1 - 2 of J9 on the AC-driver board (136). Correct value = approximately 2,5 ohm. If not correct replace AC-driver (136) and power supply (105) boards.
- ◆ Replace the AC-driver (136) and/or power supply (105) boards.

AC-DRIVER BOARD (136) ENABLE TEST.

- AC-driver board (136), connector J8, terminals 1(+) and 2(-) = +3.8 Vdc approximately (led 1 lit, led 2 off), in TIG-DC and MMA mode, with power source powered.
- AC-driver board (136), connector J8, terminals 3(+) and 4(-) = +3.8 Vdc approximately (led 2 lit, led 1 off), in TIG-AC mode, with start button pressed.



- ◆ Check the wiring between J8 AC-driver board (136) and J8 interface board (163).
 - ◆ With the power source off, temporarily disconnect the connector J8 on AC-driver board (136) and check, with the digital multi-meter in “diode test” mode, the resistance between terminals 1 – 2 and between 3 – 4 of J8 on AC-driver board (136). Correct value = approximately 2 - 3 Vdc, in one direction (leds 1 and 2 weakly lit) and >Mohm with the instrument probes reversed. If short-circuited, replace the AC-driver board (136) and control board (163). If >Mohm in all measurements (circuit broken), replace the AC-driver board (136).
 - ◆ Replace the AC-driver (136) and/or control (163) boards.
 - ◆ Make sure the AC-driver board (136) is properly mounted on the igbt modules (134), especially that the holding screws that create the electrical connections between the AC-driver (136) and igbt (134) board are properly tightened.
 - ◆ Check the wiring between diode group (127), igbt (134) and +(BB) output terminal of the power source, and between the transformer (188) central socket, choke (142), HF transformer (143) and – (BA) output terminal of the power source (remove the ventilation grid on the front panel to inspect). If you find short-circuits or deteriorated connections, restore the original connections and replace any components with damaged terminals.
 - ◆ Replace AC-driver board (136).
 - ◆ Make sure the igbt (134) are intact, making sure the resistance on the following terminals of the AC-driver board (136):
 - C-1 (+) and C2E1 (-) = >Mohm; C-1 (-) and C2E1 (+) = junction of one diode.
 - C2E1 (+) and E-2 (-) = >Mohm; C2E1 (-) and E-2 (+) = junction of one diode.
- If incorrect, replace the defective igbt module (134), along with the AC-driver board (136).

WARNING

In case of a fault on an igbt module (134), it is advisable to replace both the igbt module (134) and the AC-driver board (136) containing the igbt driver circuit at the same time. An igbt defective frequently damages the igbt driver board to which it is connected. Similarly, an igbt driver board defective frequently damages the igbt to which it is connected.

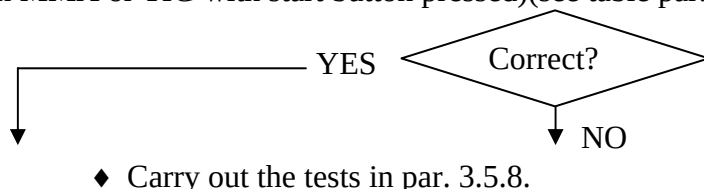
3.5.9 - In resistive load operation, the output voltage is not regular.

WARNING

FOR THESE TESTS **DISCONNECT THE CONNECTOR J1 ON THE HF BOARD (157) TO PREVENT HIGH FREQUENCY GENERATION.**

OPEN-CIRCUIT OPERATING TEST.

- Output terminal - (BA) and output terminal + (BB) on power source = approximately 60 Vdc (in MMA or TIG with start button pressed)(see table par. 3.5.8).



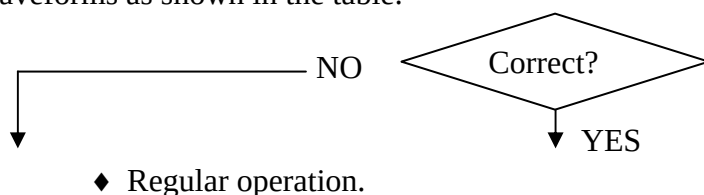
NOTE

For the following tests use a resistive load capable of withstanding the maximum power source current. The appropriate values are shown in the table.

Process	Resistive load resistance	Output current	Output voltage	Conditions
TIG - DC	0.07 ohm	330 A _{dc}	+ 23 V _{dc}	Start button pressed
TIG - AC	0.07 ohm	330 A _{ac}	23 V _{ac} (fig. 5.2.3)	“Waveform” square-square, “frequency” at minimum (50 Hz), “balance” (0 on display U), start button pressed.
MMA	0.1 ohm	330 A _{dc}	+ 33 V _{dc}	Power source powered.

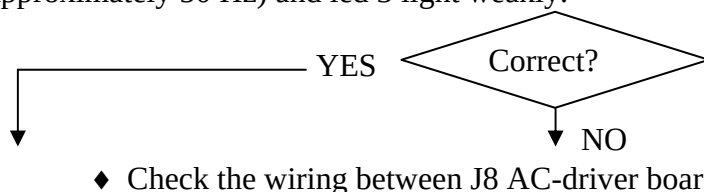
OUTPUT VOLTAGE TEST ON RESISTIVE LOAD.

- From control panel, set TIG-AC mode, waveform square-square (11 on display U), frequency at minimum (50 Hz), ideal balance (0 on display U) and welding current at maximum (330 on display O).
- Output terminal (–) (BA) (gnd) and output terminal (+) (BB) on power source = values and waveforms as shown in the table.



AC-DRIVER BOARD (136) ENABLE TEST WITH POWER SOURCE LOADED.

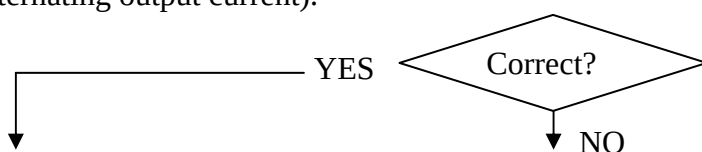
- AC-driver board (136), led 1 = lit, in TIG-DC and MMA mode, loaded in the table conditions.
- AC-driver board (136), led 1, led 2 and led 3 = simultaneously lit in TIG-AC mode, loaded in the table conditions. Led 1 and 2 actually alternate lighting at the output current frequency (approximately 50 Hz) and led 3 light weakly.



- ◆ With the power source off, temporarily disconnect the connector J8 on AC-driver board (136) and check the resistance between terminals 1-2, 3-4 and 5-6 of J8 on AC-driver board (136), with the digital multi-meter in “diode test” mode. Correct value = approximately 2-3 Vdc, in one direction (leds 1, 2 and 3 light weakly) and >Mohm with the instrument probes reversed. If short-circuited, replace the AC-driver (136) and control boards (163). If >Mohm in all measurements (circuit interrupted), replace the AC-driver board (136).
- ◆ Replace the AC-driver (136) and/or control (163) boards.

TRANSFORMER (188) PRIMARY CIRCUIT CURRENT TEST, ON LOAD.

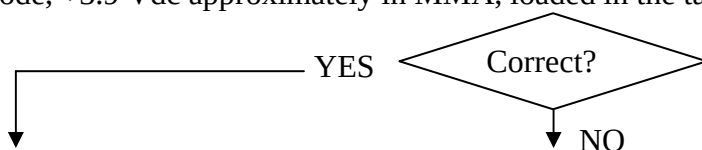
- Micro board (163), connector J1, terminals 6 – 5 (gnd) = fig. 5.2.4 current waveform at the transformer (188) primary circuit, in TIG-DC mode, loaded in the table conditions.
(In MMA similar waveform, with slightly different frequency and amplitude values).
(In TIG-AC similar waveform, with the dips visible caused by polarity reversal of the alternating output current).



- ◆ Check the wiring between J1 TA board (177) and J1 micro board (163).
- ◆ Check for correct and intact connections of the primary circuit of the transformer (188) with terminals 1 of the igbt (170). If you find loose connections, tighten and replace any components with damaged terminals.
- ◆ Check the conditions of the transformer (188) inserted in the lower aeration tunnel (remove the ventilation grid on the front panel to inspect). Replace it if you find any burn marks or deformities.
- ◆ Replace the control boards (163).
- ◆ Replace the transformer (188).
- ◆ Replace the igbt modules (170).

TRANSFORMER (188) SECONDARY CIRCUIT CURRENT TEST, ON LOAD.

- Micro board (163), connector J1, terminals 3(+) - 5(-) = +3.5 - 4 Vdc approximately in TIG mode, +3.9 Vdc approximately in MMA, loaded in the table conditions.



- ◆ Check the wiring between transducer (130) and connector J1, micro board (163).
- ◆ Check the wiring between central socket of transformer (188) secondary circuit, choke (142), HF transformer (143) and – (BA) output terminal of the power source, and between diode group (127), igbt modules (134) and + (BB) output terminal of the power source. If you find loose connections, tighten and replace any components with damaged terminals.
- ◆ Make sure the transducer (130) is properly mounted on the connection cables between the diode group (127) and igbt (134).
- ◆ Make sure the AC-driver board (136) is properly mounted on the igbt modules (134), especially that the holding screws that create the electrical connections between the AC-driver (136) and igbt (134) board are properly tightened.

- ◆ Make sure the igt (134) are intact, making sure that the resistance on the following terminals of the AC-driver board (136):
 - C-1 (+) e C2E1 (-) = >Mohm; C-1 (-) e C2E1 (+) = junction of one diode.
 - C2E1 (+) e E-2 (-) = >Mohm; C2E1 (-) e E-2 (+) = junction of one diode.
- If incorrect, replace the defective igt module (134), along with the AC-driver board (136).

WARNING

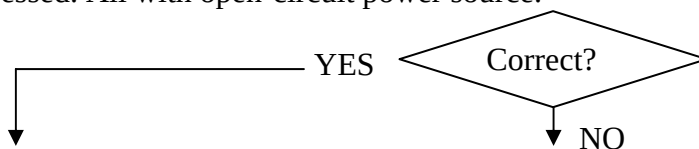
In case of a fault on an igt module (134), it is advisable to replace both the igt module (134) and the AC-driver board (136) containing the igt driver circuit, at the same time. An igt defective frequently damages the driver board to which it is connected. Similarly, a driver board defective frequently damages the igt to which it is connected.

- ◆ Make sure the resistor group (184) is intact (see table 5.12.2).
- ◆ See CURRENT TRANSDUCER (130) POWER SUPPLY TEST, par. 3.5.7.
- ◆ Replace current transducer (130).
- ◆ Replace the igt (134).
- ◆ Replace the AC-driver (136) and/or control (163) boards.
- ◆ Replace the control board (163).

3.5.10 - In MMA mode, anti-stick incorrect.

OUTPUT SHORT-CIRCUIT SIGNAL TEST.

- Control board (163), connector J7, terminals 1(+) and 2(-) = approximately +1.5 Vdc (output voltage low, short-circuit) in TIG mode with start button released; approximately 0 Vdc (output voltage higher than short-circuit threshold) in MMA or in TIG mode with button pressed. All with open-circuit power source.



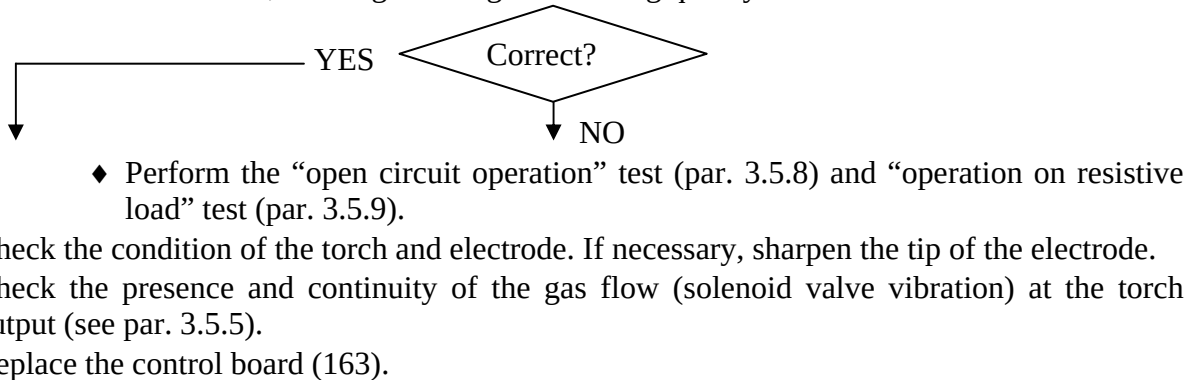
- ◆ Check wiring between J7 interface board (163) and J1 measurement board (104).
- ◆ Check the wiring between J2 of measurement board (104) and terminals TP3 and TP4 of HF-filter board (159).
- ◆ Check the wiring between J1 HF-filter board (159) and HF transformer (143) terminal, choke (142) side, and between TP1 HF-filter board (159) and + (BB) output terminal of the power source.
- ◆ Make sure the connections from TP3 to TP1 and TP4 to J1 on HF-filter board (159) are intact, by measuring the continuity between the output terminal (+) (BB) of the power source and terminal 1 of J2 measurement board (104), and between J6 of AC-driver board (136) and terminal 4 of J2 measurement board (104). If necessary replace the HF-filter board (159).
- ◆ With the power source off, temporarily disconnect the connector J7 on interface board (163) and check the resistance between terminals 1 - 2 of J7 on interface board (163). Correct value = junction of one diode in one direction and junction of two diodes with the instrument probes reversed. If incorrect, replace control board (163).
- ◆ Replace the measurement board (104) and/or control board (163).
- ◆ Replace the control board (163).

3.5.11 - TIG-DC, arc unstable, welding irregular.**NOTE**

In TIG-DC the welding quality may not be acceptable due to current instability. In this case we recommend performing MMA welding tests.

WELDING QUALITY TEST IN MMA.

- Power source in MMA, welding tests = good welding quality.

**3.5.12 - In AC mode, arc unstable, welding irregular.****NOTE**

In AC operation, the welding quality may not be acceptable due to current instability. We therefore recommend that you make sure the power source works properly in DC, by carrying out welding tests in DC and, if necessary, the “open circuit operation” test (par. 3.5.8) and “operation on resistive load” test (par. 3.5.9).

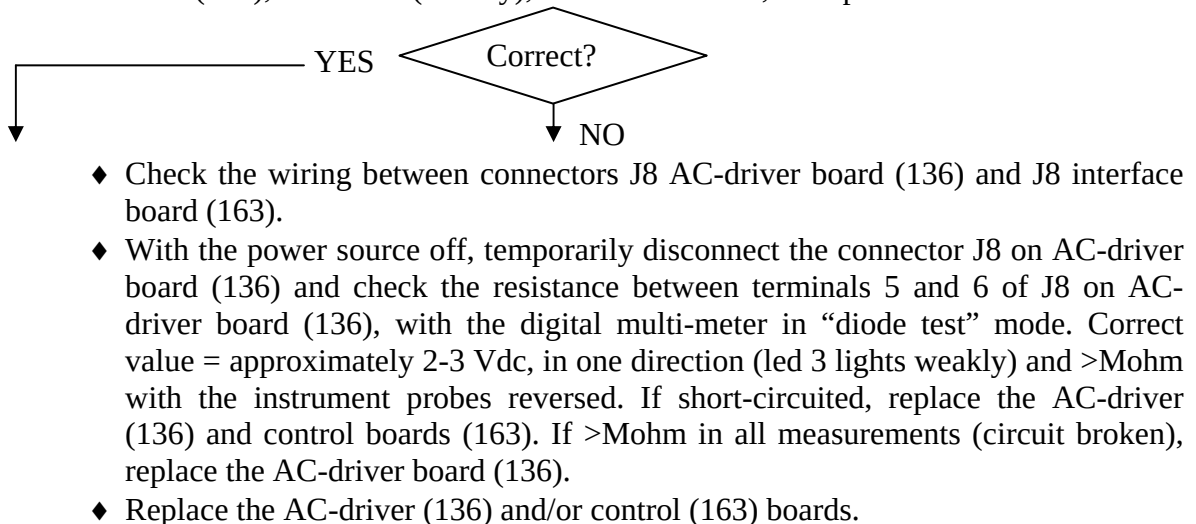
Then carry out the following tests.

WARNING

FOR THESE TESTS **DISCONNECT THE CONNECTOR J1 ON THE HF BOARD (157) TO PREVENT HIGH FREQUENCY GENERATION.**

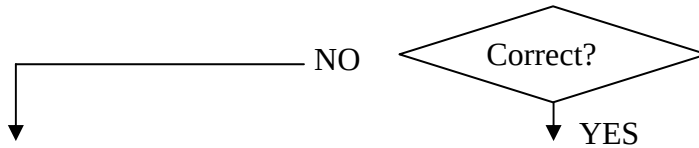
AC ENABLE TEST ON AC-DRIVER BOARD (136).

- AC-driver board (136), led 3 = lit (weakly), in TIG-AC mode, with power source loaded.



POWER SUPPLY BOARD (105) OUTPUT VOLTAGE TEST.

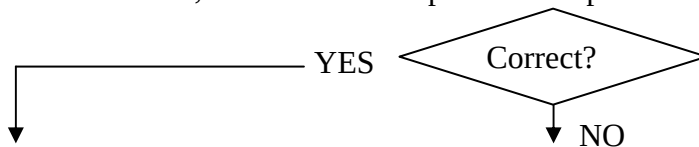
- AC-driver board (136), terminals J6 (+) and J10 (-) = +260 Vdc approximately, (fig. 5.2.5) power supply board (105) output voltage waveform, in TIG-AC mode, with power source loaded.



- ◆ Check the wiring between AC-driver board (136) and resistor group (184).
- ◆ Make sure the resistor group (184) is intact (see table 5.12.2).
- ◆ Check the efficiency of the “balance” adjustment, checking the effects of “cleaning” and “penetration” on the welding, attainable by turning the knob (Y), when the function “balance” is selected (les (AM) lit), or by checking the changes in the duty-cycle in figures 5.2.3. and 5.2.4. If no changes are found, check the efficiency of the potentiometer (Y) or replace panel (156) and/or control (163) boards.
- ◆ Check the condition of the torch and electrode. If necessary, sharpen the tip of the electrode.
- ◆ Check the presence and continuity of the gas flow (solenoid valve vibration) at the torch output (see par. 3.5.5).
- ◆ Replace the control board (163) and/or AC-driver board (136).
- ◆ Check wiring between J6 and J10 AC-driver board (136) and J3 power supply board (105).
- ◆ Make sure the correct supply for power supply board (105), performing the POWER SUPPLY BOARD (105) POWER SUPPLY TEST, par 3.5.1, if necessary.

POWER SUPPLY BOARD (105) ENABLE AND START COMMAND TEST.

- Power supply board (105), connector J1, terminals 1(+) and 2(-) = +24 Vdc (enable), in TIG-AC mode, with power source powered.
- Power supply board (105), connector J1, terminals 3(+) and 4(-) = +24 Vdc (start command), in TIG-AC mode, with start button pressed and power source loaded.



- ◆ Check the wiring between J1 power supply board (105) and J16 interface board (163).
- ◆ With the power source off, temporarily disconnect the connector J1 on the power supply board (105) and check the resistance between terminals 1-2 and 3-4 of J1 on the power supply board (105). Correct values: terminals 1-2 = approximately 1000 ohm; terminals 3-4 = approximately 4.4 Kohm. If 0 ohm (short-circuit), replace power board (105) and control board (163). If >Mohm (circuit interrupted) replace power supply board (105).
- ◆ Replace the control board (163).
- ◆ With the power source off, temporarily disconnect connector J3 from the power supply board (105) and check the resistance between the terminals J6 and J10 of AC-driver board (136). Correct value = junction of one diode in one direction and >Mohm with the instrument probes reversed. If 0 ohm (short-circuit), replace AC-driver board (136) and power supply board (105). If >Mohm (circuit interrupted), replace the AC-driver board (136).
- ◆ Replace power supply board (105).

3.5.13 - In TIG or MMA mode, the arc is difficult to strike, and shuts off immediately after lighting.**3.5.14 - Unsatisfactory welding quality in MMA.**

To assist welding starts, the “Hot-Start” function is available in both TIG and MMA, adjustable using by control panel (see Instruction Manual).

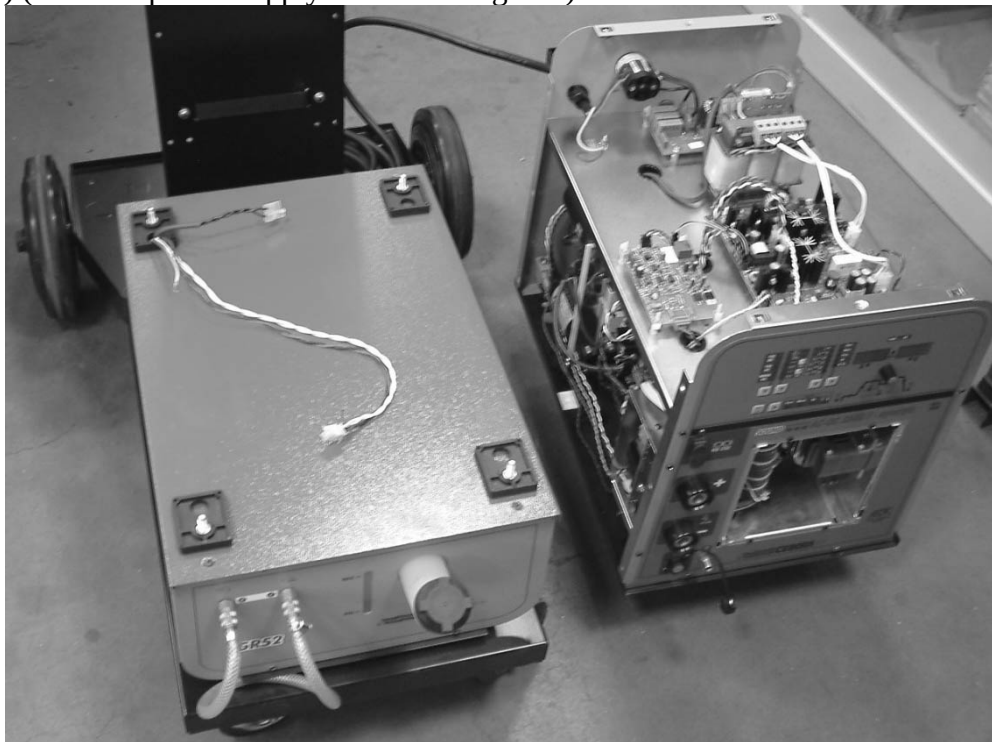
In MMA, should you find it difficult to determine the proper balance between welding with too much splattering or an electrode that is “hard to melt”, the “Arc-force” function is available to work based on the arc voltage, and automatically modulates the welding current for faster detachment of the welding drop. Also this function is adjustable by control panel (see Instruction Manual).

In all these situations, when there are problems striking the arc or welding difficulties despite careful management of the parameters available on the control panel, we recommend that you:

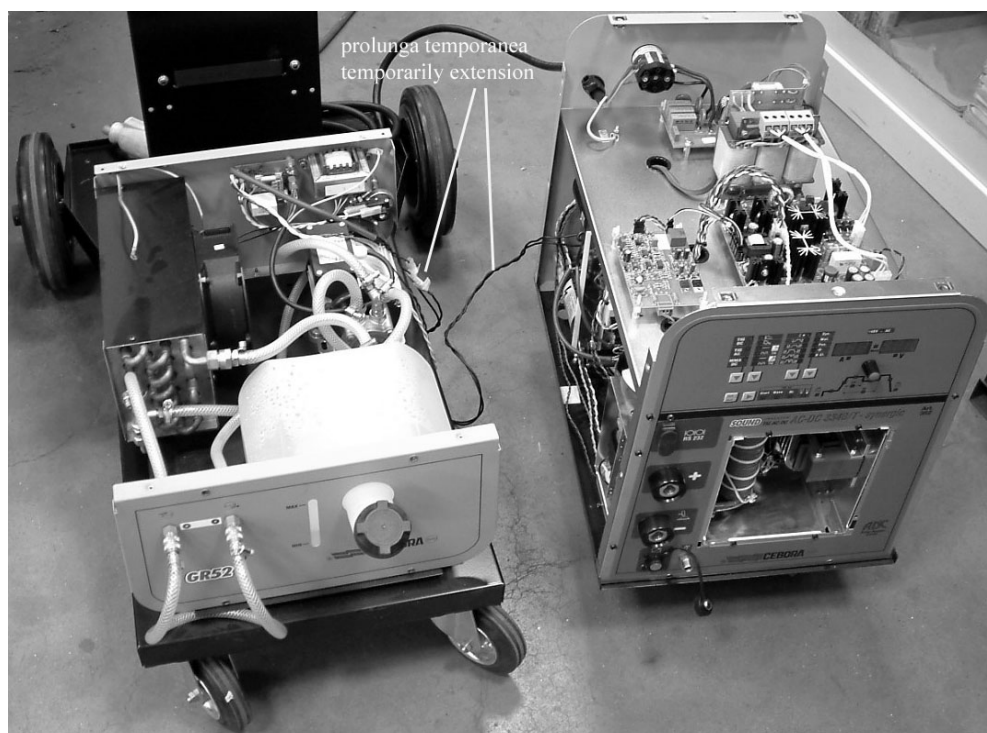
- Make sure that the parameters set reflect the actual needs of the current welding task.
- Make sure that the power source is working properly, performing if necessary the “open circuit operation” test in par. 3.5.8, “operation on resistive load” in par. 3.5.9 and “AC operation” par. 3.5.12.
- Make sure that the adjustments are working properly, by carrying out welding tests with different parameter settings. If changes to the parameters do not correspond to welding differences, or if you encounter problems in selecting the parameters, check the wiring between the panel board (156) and control board (163), and replace if necessary.
- Check the compatibility and wear and tear on the parts being used (electrode clamp, electrodes, type of electrodes, earth cables, type of gas, etc.) with the type of welding being carried out.
- Check the wear status of the torch and its components, replacing them if necessary.

3.5.15 - Cooling unit accessibility.

The internal parts of the cooling unit may be reached by setting the power source next to the cooling unit. In this way the system may be operated by applying a temporary extension only to the connection between connector J5 of pre-charge board (183) and TP1 and TP2 on cooling board (31) (400 Vac power supply of the cooling unit).



Separating the power source from the cooling unit.



Restore connections using the temporary extension for the power cord.

NOTE

In the MMA process, cooling unit operation is disabled.

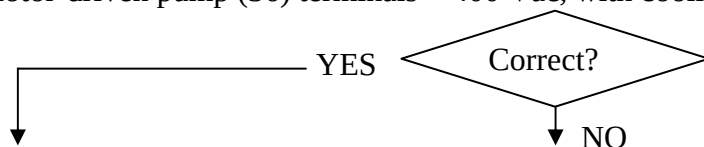
- ❑ Cooling board (31), terminals TP1 and TP2 = 400 Vac, with power source powered.



-
- ```
graph TD; A{Correct?} -- YES --> B[]; A -- NO --> C[];
```
- ◆ Check the wiring between terminals TP6 (+) and TP5 (-) of cooling board (31) and terminals 1 (+) and 2 (-) of connector J6, on interface board (163).
  - ◆ With power source off, temporarily disconnect connector J6 on interface board (163) and check the resistance between terminals TP6 and TP5 of cooling board (31). Correct value = approximately 1400 ohm. If 0 ohm (short-circuit), replace cooling board (31) and control board (163). If >Mohm (circuit open), replace the cooling board (31).
  - ◆ Check for the presence of a jumper between terminals 3 and 4 of the patch connector on J6 of interface board (163) (“cooling unit connected” signal).
  - ◆ With power source off, temporarily disconnect J6 from interface board (163), and make sure that when the power source is turned back on, voltage on terminals 3 (+) and 4 (-) of J6 on interface board (163) = +24 Vdc. If incorrect, replace control board (163) (power supply for “cooling unit connected” signal).
  - ◆ Replace the control board (163) and/or cooling board (31).

**MOTOR-DRIVEN PUMP (36) TEST.**

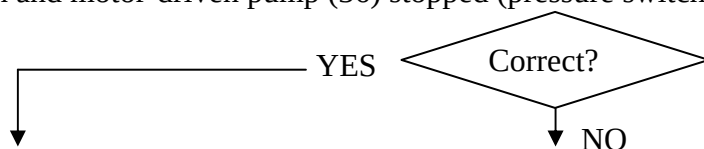
- Motor-driven pump (36) terminals = 400 Vac, with cooling unit enabled.



- ◆ Check the wiring between the terminals of the motor-driven pump (36) and terminals J1A and J1B on cooling board (31).
- ◆ Check fuse on cooling board (31). If tripped, replace and temporarily disconnect the terminals J1A and J1B from cooling board (31), and check the resistance on the terminals of the motor-driven pump (36). Correct value = approximately 60 ohm. If incorrect replace motor-driven pump (36). If correct check the resistance on terminals J1A and J1B of cooling board (31). Correct value = approximately 130 ohm (resistance of the autotransformer (32) winding). If incorrect replace autotransformer (32), or eliminate any short-circuit on the cooling board (31).
- ◆ Replace the cooling board (31).
- ◆ Check the integrity and connection of the starting capacitor of the motor-driven pump (36) (located on the motor terminal board). Replace if necessary.
- ◆ Make sure that there are no mechanical impediments jamming the motor-driven pump (36). Replace if necessary.
- ◆ Replace motor-driven pump (36).

**PRESSURE SWITCH (37) TEST.**

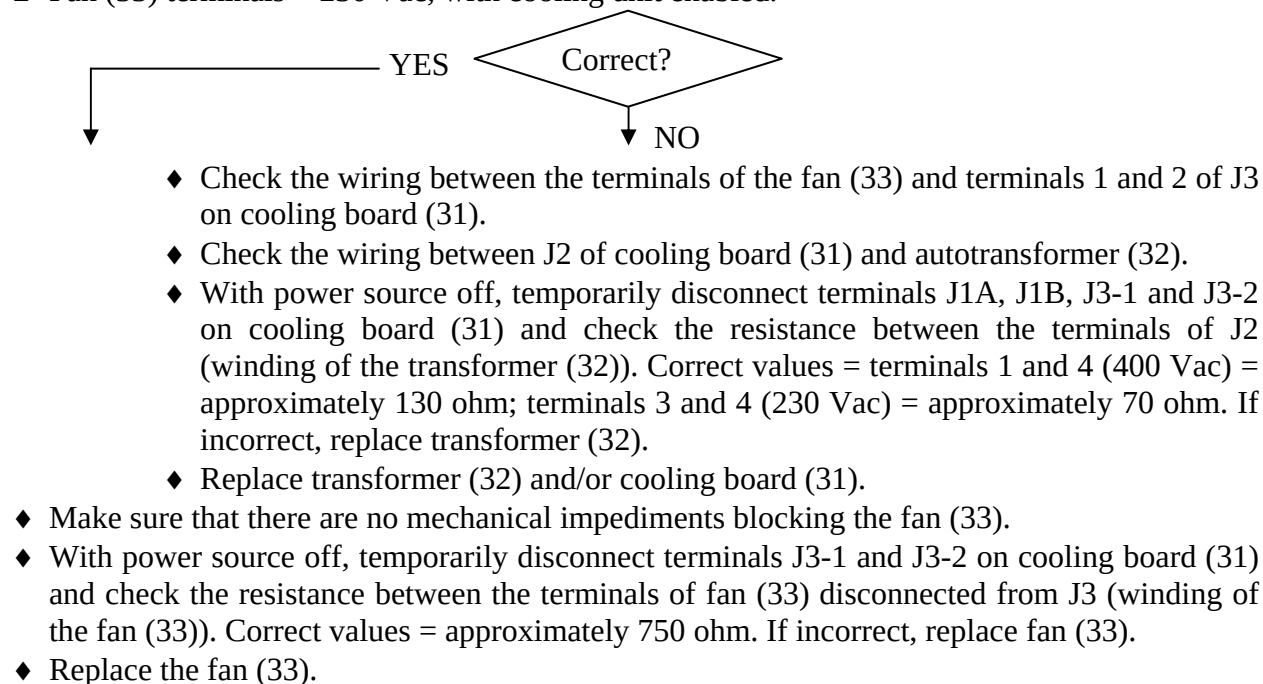
- Interface board (163), connector J6, terminals 5(+) and 6(-) = 0 Vdc, with motor-driven pump (36) running (pressure switch contact closed = suitable pressure); +24 Vdc, with power source on and motor-driven pump (36) stopped (pressure switch contact open = pressure low).



- ◆ Check the wiring between terminals 5(+) and 6(-) of J6 interface board (163) with terminals TP4 (+) and TP3 (-) of cooling board (31), and between TP8 and TP7 with pressure switch (37).
- ◆ Check the integrity of pressure switch (37), replace if defective.
- ◆ With power source off, temporarily disconnect J6 from interface board (163). Power up the power source again and once again check the voltage on the terminals 5 (+) and 6 (-) of J6, interface board (163) = +24 Vdc. If incorrect, replace control board (163).
- ◆ Check the continuity of the printed circuit tracks on the cooling board (31). TP7 must be connected to TP3; TP8 must be connected to TP4. If necessary, restore the tracks or replace the cooling board (31).
- ◆ Check rotation direction of the motor-driven pump (36).
- ◆ Make sure that the lines of the cooling circuit are not clogged, especially in the part where it is connected the pressure switch (37).
- ◆ Replace pressure switch (37) and/or motor-driven pump (36).

### FAN (33) TEST.

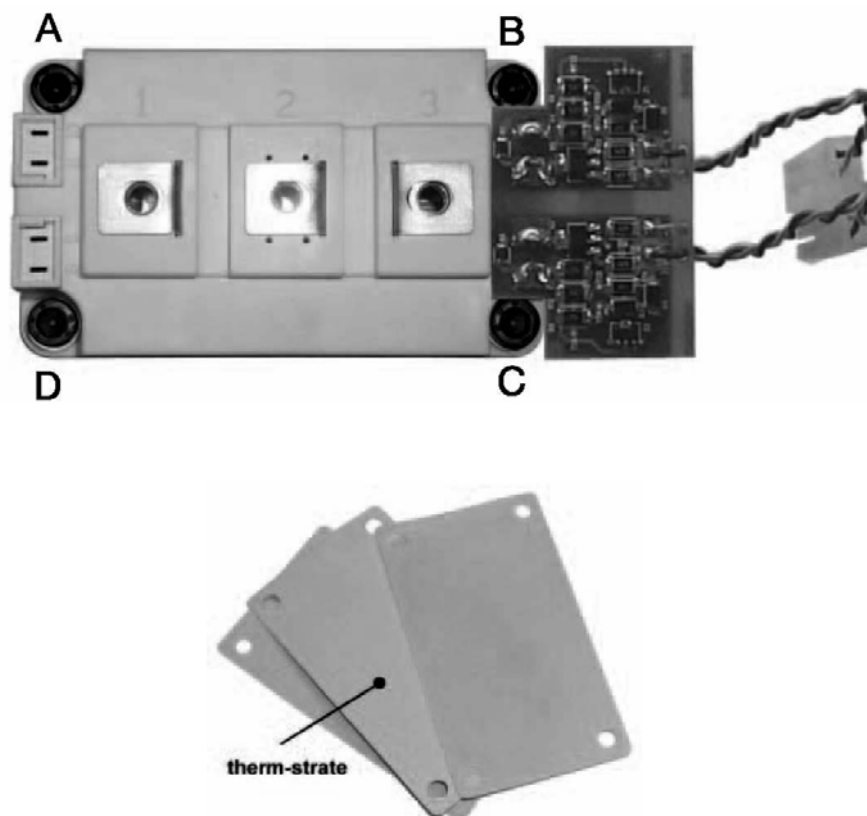
- Fan (33) terminals = 230 Vac, with cooling unit enabled.



### 3.6 - Kit Driver + igt + insulation replace instructions.

#### NOTE

For the substitution of Kit 5710507 (igt (134)), 5710511 (igt (170)), 5710512 (B1 on pre-charge board (183)) and 5710514 (diode (127)) to follow the present instructions, obviously considering the obvious differences of the various members who constitute the Kit.



#### 3.6.1 - Removing igt or diodes from heatsink and preparing heatsink.

- Remove the igt or diode modules from heatsink.
- Remove the thin sheets of metal Therm-strate covered with grease and inserted between the heatsink and the igt or diode modules.
- Clean the dissipater to remove the residue left by the metal sheet Therm-strate, using a rag soaked in denatured alcohol. No residue must be left on the heatsink which must be perfectly clean.

#### 3.6.2 - Apply the igt o diode to the heatsink.

- Take the Therm-strate sheet, being careful not to crease it, gently remove the two protective films to uncover the two layers of thermally conductive grease with your hands; also take care not to contaminate it with dust or dirt.
- Apply the Therm-strate sheet on the dissipater in place of those previously removed.
- Make sure that the bottom part of the igt or diode modules (metal base) is perfectly clean.
- Apply the igt or diode modules over the Therm-strate sheet.
- Insert the 4 holding screws (A, B, C and D) and turn them without tightening completely.
- Continue tightening the screws by degrees, proceeding in the order A, C, D, B.
- Caution! The tightening torque of the screws must be between 3 and 5 Nm.

### **3.7 - Error codes and alarm signals.**

#### **3.7.1 - 2 - EEPROM error.**

Block due to software error. Replace the control board (163).

#### **3.7.2 - 6 - Communication error on CAN-BUS, detected by control board (163).**

#### **3.7.3 - 9 - Communication error on CAN-BUS, detected by panel board (156).**

Communication error between control board (163) and panel board (156), detected by MASTER control, on control board (163) (error 6) or by PANEL control, on panel board (156) (error 9).

In both cases perform the CONTROL BOARD (163) POWER SUPPLY TEST and PANEL BOARD (156) POWER SUPPLY TEST of par. 3.5.1., and check wiring between J14 interface board (163) and J5 panel board (156).

Make sure compatibility of the programs on the two boards, confronting the review indices installed with which specified in the Cebora Internet site. Such programs must be in compatible review between them, for which in case of substitution of one of these 2 boards, it is necessary to assess themselves of such compatibility, or better still, re-program the complete system with the last versions available.

#### **3.7.4 - 10 - Missing voltage and current at the power source output.**

When the start command is activated, the circuits to detect the output voltage and output current on the control board (163), detect voltage = 0 and current = 0. This situation is possible only with the inverter broken (thus it does not generate the alternating voltage on the primary circuit of the transformer (188)), or with the AC-inverter stage broken (voltage at the rectifier (127) output doesn't arrive to the power sources output terminals), or one or both voltage and current detection lines interrupted.

Perform the "open circuit operation" test in par. 3.5.8 and the "operation on resistive load" test in par. 3.5.9.

#### **3.7.5 - 13 - Missing communication between control board (163) and pre-charge board (183).**

This alarm is operative only at the power source start-up. The control board (163) check the "MAINS" (mains voltage presence) and "PRECHARGE" (DC-capacitors (179) direct current voltage) signals, coming from pre-charge board (183).

These signals can be checked on J15 of interface board (163):

- "MAINS" : mains voltage present = +0,1 Vdc, approx. on terminals 4(+) and 5(-).
- "PRECHARGE" : DC-capacitors (179) voltage present = fig. 5.2.6 on terminals 8 and 6 (gnd) (in this waveform is more important the pulses regular presence than their period and frequency).

Based on these signals, the control board (163) perform the following conditions:

| "MAINS" | "PRECHARGE" |                      |
|---------|-------------|----------------------|
| absent  | absent      | = error 13 alarm.    |
| present | absent      | = error 16 alarm.    |
| absent  | present     | = error 61 alarm.    |
| present | present     | = regular operation. |

At the power source start-up, once detected both signal presence, control board (163) order the pre-charge relay closed, on pre-charge board (183) and set the power source for regular operation. Starting from this moment error 13 alarm is no more operative.

Check the wiring between connectors J3 on pre-charge board (183) and J15 on interface board (163), and replace the two boards if necessary.

**3.7.6 - 14 - Microprocessor supply voltage error on control board (163).**

Perform the CONTROL BOARD (163) POWER SUPPLY TEST in par. 3.5.1, paying special attention to the 8 Vdc and 5 Vdc voltages.

**3.7.7 - 16 - Direct current voltage at pre-charge board (183) output below minimum permitted value.**

This alarm is operative only at the power source start-up.

The direct current voltage on the DC-capacitors (179) is not sufficient to ensure proper operation of the inverter, and thus of the power source. This may be due to a possible distortion of the mains voltage (or of a single phase of the mains voltage), a short-circuit, or strong absorption from DC-capacitors (179) or igt (170) modules, or a fault in the pre-charge board (183), or in the built-in rectifier bridge.

**3.7.8 - 20 - No interlock signal on TA board (177).**

The “interlock” signal is provided by a jumper between terminals 3 and 4 of J1 on TA board (177), and is used to make sure that the TA board (177) is connected to the control board (163) (current feedback signal line of the primary circuit of the transformer (188)).

Check the wiring between terminals 3 and 4 of J1 on TA board (177) and terminals 8 and 7 of J1 on micro board (163).

Make sure that there is a short-circuit between terminals 3 and 4 of J1 on TA board (177).

With power source off, temporarily disconnect connector J1 from micro board (163).

Power up the power source again and check the voltage on J1 of micro board (163), terminals 8 (+) and 7 (-) = +5 Vdc. If incorrect, replace control board (163).

Replace the control (163) and/or TA (177) boards.

**3.7.9 - 25 - Malfunction on the EPLD bus in the control board (163).**

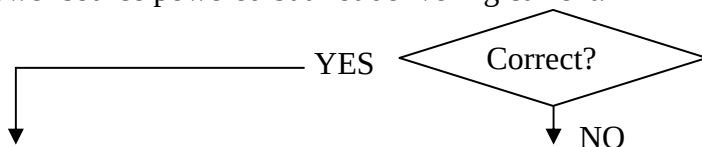
This code calls up various problems that may occur in controlling the igt inverter (170).

Generally they are those defects that cause a high absorbed current in the primary circuit of the transformer (188), due for example to a short-circuit in the windings of the transformer (188) or in the diode group (127).

For an analysis of the problem, see “open circuit operation” par. 3.5.8 and “operation on resistive load” par. 3.5.9.

**3.7.10 - 30 - Incorrect setting of the minimum current threshold on control board (163).****SETTING THE MINIMUM CURRENT THRESHOLD.**

- Micro board (163), connector J1, terminal 3(+) and 5(-) = +360 mVdc, +/- 10 mVdc with power source powered but not delivering current.



- ◆ With power source off, temporarily disconnect J1 from micro board (163) and make sure the resistance on terminals 3 and 5 of J1 on micro board (163) = 22.5 ohm. If incorrect, replace control board (163).
- ◆ Adjust trimmer TR1 on micro board (163) to have 360 mVdc +/- 10 mV.
- ◆ Replace the control board (163).

- ◆ Regular setting.

**3.7.11 - 52 - “trG” flashing on display (O). In TIG, start button pressed during start-up.**  
See START COMMAND TEST, par. 3.5.4.

**3.7.12 - 53 - “trG” flashing on display (O). In TIG, start button pressed while resetting from stop due to temperature beyond allowable limits.**

The high temperature alarm stops the power source and signals on display (O) the corresponding alarm (TH1 or TH2). These alarms are automatically reset when the temperature returns within the allowed limits.

It may occur that the unit resets when the start command is present; therefore, to prevent the power source from starting suddenly due to a random reset, this situation is detected and causes a memory block in the power source, with error message 53 “trG” on display (O).

To restore proper operation, remove the start command, performing the START SIGNAL TEST, par. 3.5.4. if necessary.

**3.7.13 - 54 - Power source output voltage greater than 48 Vac.**

For safety reasons, the power source is blocked if the output voltage exceeds 48 Vac during welding.

In TIG-AC open circuit operation, the power source has an output voltage of approximately 60 Vdc.

AC voltage is generated subordinate to the presence of current at the power source output.

Hazardous AC voltage control at the power source output is activated when welding current ceases, to make sure that any breakdown in the control circuits continues generating alternating voltage with the power source in open-circuit.

This block is indicated when the code “54” appears on the display (O) and the led (T) shuts off on the control panel (156).

For an analysis of the problem, see “open circuit operation” par. 3.5.8, “operation on resistive load” par. 3.5.9 and “AC operation” par. 3.5.12.

**3.7.14 - 56 - Short-circuit at the output lasts too long.**

It is normal to detect short-circuits at the output during welding, as long as they do not last beyond a given interval. “Error 56” indicates that the short-circuit has exceeded this limit.

This situation may be caused by a short-circuit created between the electrode and gas nozzle on the torch due to deposits of dirt or metal dust.

In MMA mode it may also derive from an interruption in the output voltage detection line.

In any case, in addition to cleaning the torch, perform the OUTPUT VOLTAGE DISPLAY TEST, of par. 3.5.3 and the tests for “open circuit operation”, par. 3.5.8, and “operation on resistive load”, par. 3.5.9 if necessary.

If you find defective connections, fix and replace any damaged components.

Replace control (163) and/or measurement (104) and/or HF-filter (159) boards.

**3.7.15 - 61 - Mains voltage below minimum permitted.**

The control board (163) checks for the “MAINS” signal (mains voltage presence) status coming from pre-charge board (183). If not correct commands power source bloc with error 61 code. This signal can be checked on J15 of interface board (163):

- mains voltage present (MAINS) = +0,1 Vdc approx., on terminals 4(+) and 5(-).

Check the wiring between J3 on pre-charge board (183) and J15 interface board (163), and if necessary, perform the MAINS CONNECTIONS TEST in par. 3.5.1, or replace the pre-charge (183) and/or control (163) boards.

**3.7.16 - 74 - “TH” on display (O), “1” on display (U). High temperature of the igt groups (170).****3.7.17 - 77 - “TH” on display (O), “2” on display (U). High temperature of the diode group (127) and igt group (134).**

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

- Make sure that the fan (119) is working properly (see par. 3.5.2).
- Check for proper air flow and make sure there is no dust or obstacles to cooling in the aeration tunnel.
- Make sure that the operating conditions meet the specification values, especially observe the “duty cycle”.
- Check the wiring between J1 interface board (163), and thermostat (131) on the igt group (170).
- Check the wiring between J7 AC-driver board (136), and thermostat board (131) on diode (127) and igt (134) groups.
- Make sure that thermostat boards (131) are properly mounted on the igt group (170) and on diode (127) and igt (134) groups; the temperature signal transmitted to the control board (163) and to the AC-driver board (136) is PWM type, with duty cycle proportional to the temperature, and thus difficult to check. If necessary replace the thermostat boards (131).
- Make sure that on J1 of interface board (163), terminals 3(+) and 4(-) voltage = +5 Vdc. If incorrect, with power source off, temporarily disconnect J1 on interface board (163) and check the resistance between terminals 3 and 4 of the patch connector disconnected from J1. Correct value = junction of one diode in one direction and >Mohm with the probes reversed. If incorrect replace the thermostat board (131), and check the voltage on terminals 3 and 4 of J1 again without the thermostat board connection. If incorrect, also replace control board (163).
- Check the wiring between thermostat board (131) on igt group (134) and J7 on AC-driver board (136), and between J8 (terminals 9 and 10) on AC-driver board (136) and J2 (terminals 9 and 10) on control board (163).
- Make sure that on J7 of AC-driver board (136), terminals 3 (+) and 4 (-), voltage = +5 Vdc. If incorrect, with power source off, temporarily disconnect J7 on AC-driver board (136) and check the resistance between terminals 3 and 4 of the patch connector disconnected from J7. Correct value = junction of one diode in one direction and >Mohm with the probes reversed. If incorrect replace the thermostat board (131), and check the voltage on terminals 3 and 4 of J7 again without the thermostat board connection. If incorrect, also replace AC-driver board (136).
- Replace thermostat (131) and/or control (163) and/or driver-ac (136) boards.

**3.7.18 - 75 - “H2O” on display (O). Low pressure in the cooling circuit.**

The pressure switch (37) measures the coolant pressure in the cooling circuit. For an analysis of the corresponding circuit, see PRESSURE SWITCH (37) TEST, par. 3.5.16.

**3.7.19 - 76 - “H2O” on display (O) and “n.c.” on display (U). Cooling unit not connected.**

The signal “cooling unit connected” is provided by the jumper on terminals 3 and 4 of J6 on interface board (163). For an analysis of the corresponding circuit, see the COOLING UNIT ENABLE TEST, par. 3.5.16.

**3.7.20 - 99 - “OFF” on display (O). Incorrect mains voltage (machine shutdown).**

This signal can be introduced in case of short lack of the mains voltage, during which the control circuits remain powered for some moments and detect the mains voltage not corrected. In particular the pre-charge board (183) detects the lack of the mains voltage, communicates it to the control board (163) that it commands the arrest of power source, and the signaling of “OFF” on display (O) of the control panel (156).

For this alarm is tested the “MAINS” signal, verifiable on J15 4-5 of interface board (163), the same signal that provokes error 61 (see par. 3.7.5) at the start-up, and error 99 “OFF” during operation.

Carry out the MAINS CONNECTIONS TEST and POWER SUPPLY TEST, in par 3.5.1, and replace the pre-charge (183) and/or control (163) boards, if necessary.

**4 - COMPONENTS LIST**

**4.1 - Power source art. 352 : see file ESP352.pdf enclosed at the end of the manual.**

**4.2 - Components table : see file ESP352.pdf enclosed at the end of the manual.**

**4.3 - List of spare parts.**

**Essential spare parts.**

| Ref. | Code    | Description                 | Qty |
|------|---------|-----------------------------|-----|
| 33   | 3165092 | fan                         | 1   |
| 36   | 3165090 | electric pump               | 1   |
| 105  | 5602195 | power supply circuit        | 1   |
| 134  | 5710507 | igbt + insulation kit       | 1   |
| 157  | 5602213 | HF circuit                  | 1   |
| 183  | 5710512 | pre-charge + insulation kit | 1   |

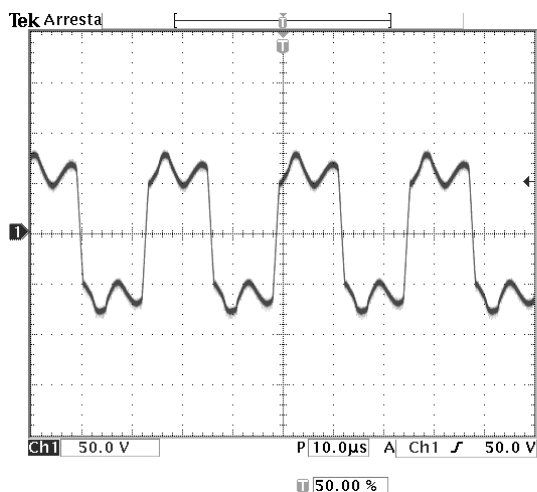
**Recommended spare parts.**

| Ref. | Code    | Description                    | Qty |
|------|---------|--------------------------------|-----|
| 29   | 3065287 | radiator                       | 1   |
| 37   | 5710190 | pressure switch                | 1   |
| 127  | 5710514 | diode + insulation kit         | 1   |
| 146  | 5602192 | connector circuit              | 1   |
| 163  | 5605136 | control circuit                | 1   |
| 170  | 5710511 | driver + igbt + insulation kit | 1   |

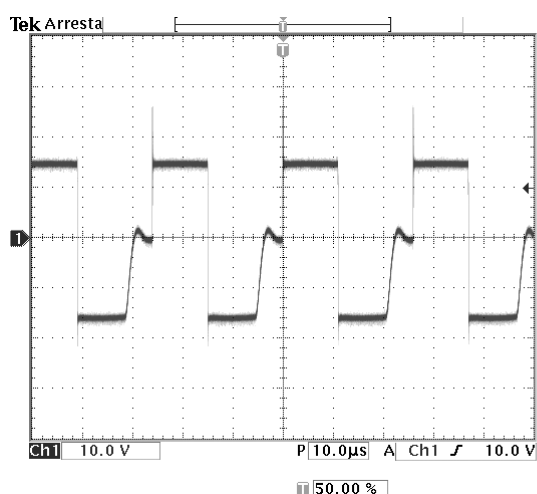
## 5 - ELECTRICAL DIAGRAMS

5.1 - Power source art. 352 : see file SCHE352.pdf enclosed at the end of the manual.

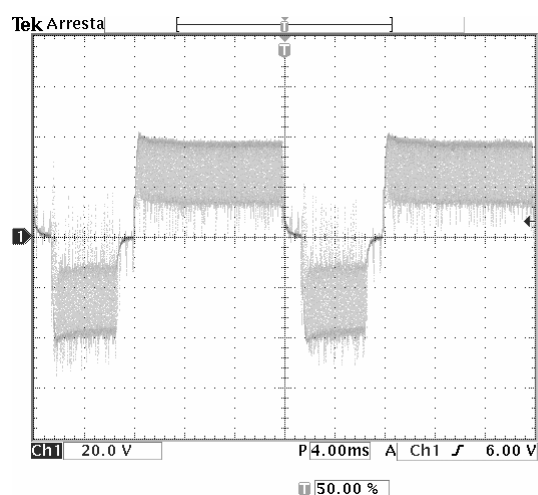
### 5.2 - Waveforms.



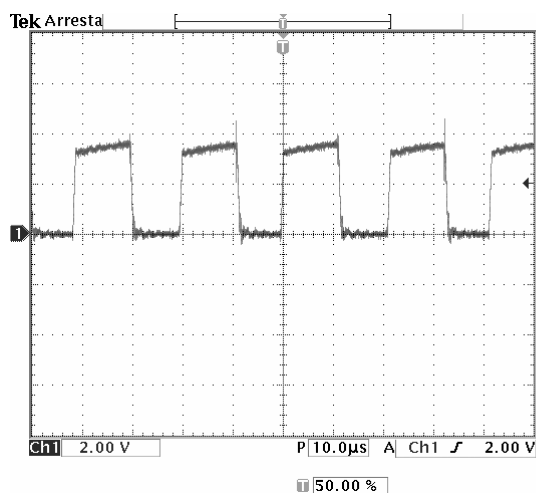
5.2.1 - Open-circuit voltage on the transformer (188) secondary circuit (par. 3.5.6, 3.5.7).



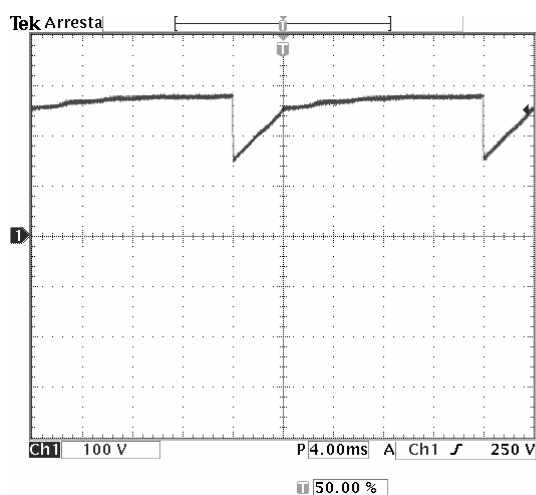
5.2.2 - Command signal for driver-igbt boards (170) (par. 3.5.7).



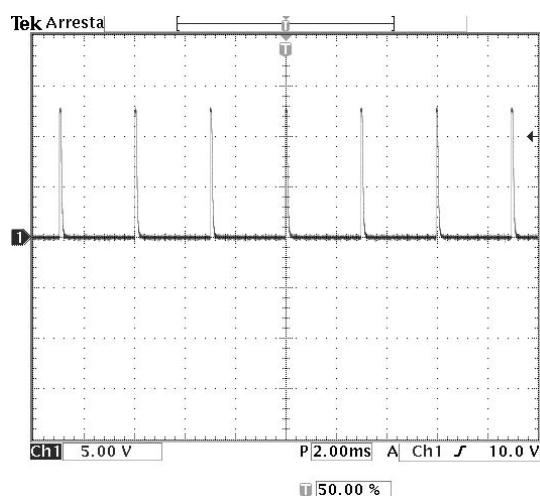
5.2.3 - Power source output voltage in TIG-AC, with resistive load (par. 3.5.9).



5.2.4 - Transformer (188) primary circuit current in TIG-DC, with resistive load (par. 3.5.9).



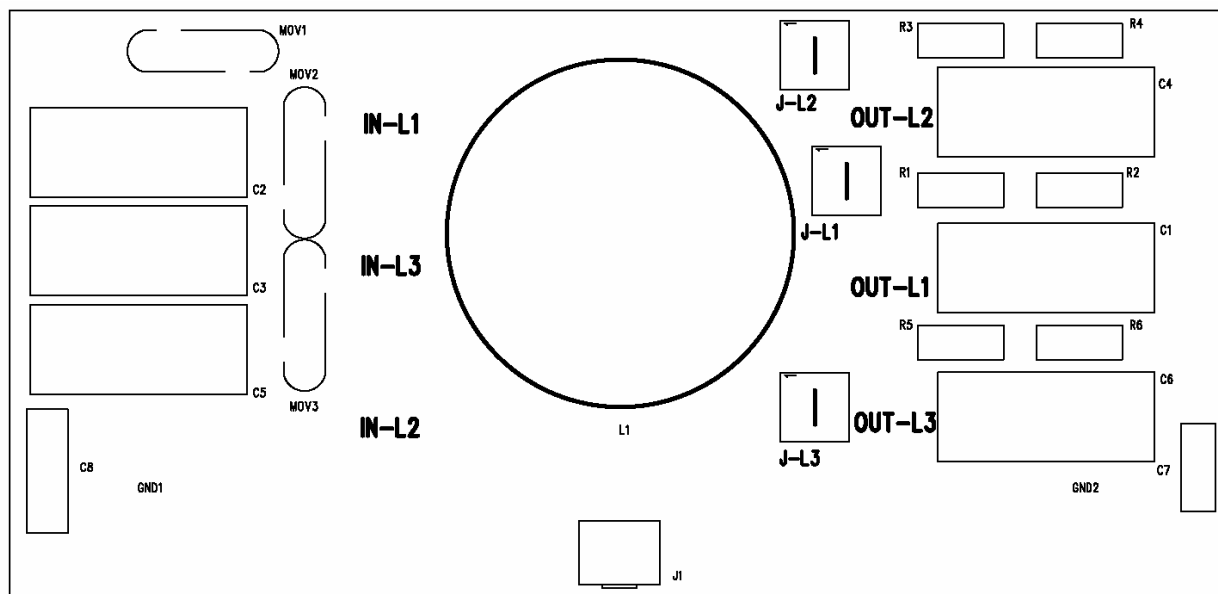
5.2.5 - Power supply board (105) output voltage (par. 3.5.12).



5.2.6 - "PRECHARGE" signal (par. 3.7.5).

### 5.3 - Filter board (107) code 5.602.196/A.

#### 5.3.1 - Topographical drawing.

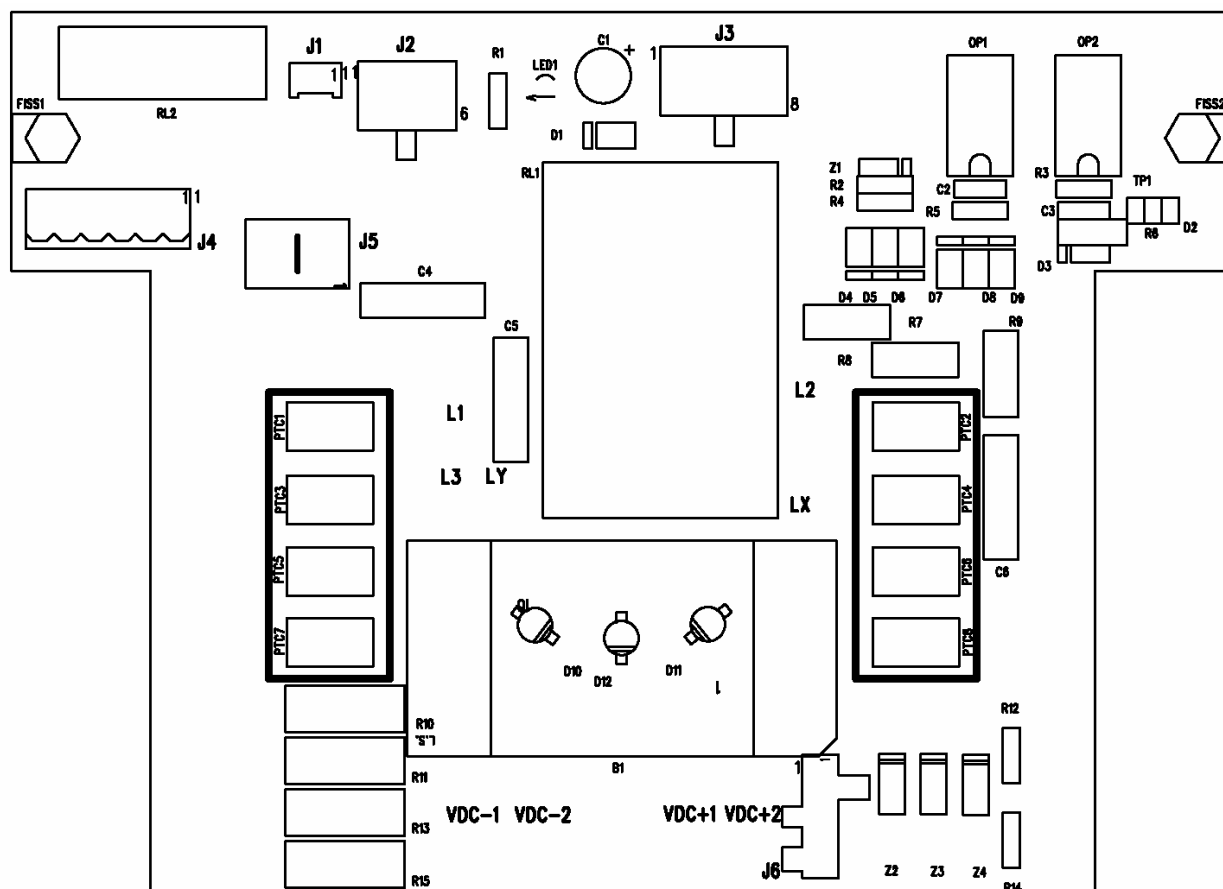


#### 5.3.2 - Connector table.

| Connector | Terminals | Function                                            |
|-----------|-----------|-----------------------------------------------------|
| -         | IN-L1     | phase 1 mains input.                                |
| -         | IN-L2     | phase 2 mains input.                                |
| -         | IN-L3     | phase 3 mains input.                                |
| -         | OUT-L1    | phase 1 mains output.                               |
| -         | OUT-L2    | phase 2 mains output.                               |
| -         | OUT-L3    | phase 3 mains output.                               |
| -         | J-L1      | phase 1 mains output for service transformer (106). |
| -         | J-L2      | phase 2 mains output for service transformer (106). |
| -         | J-L3      | phase 3 mains output for service transformer (106). |
| J1        | -         | earth connection.                                   |

## 5.4 - Pre-charge board (183) code 5.602.187/A.

### 5.4.1 - Topographical drawing.

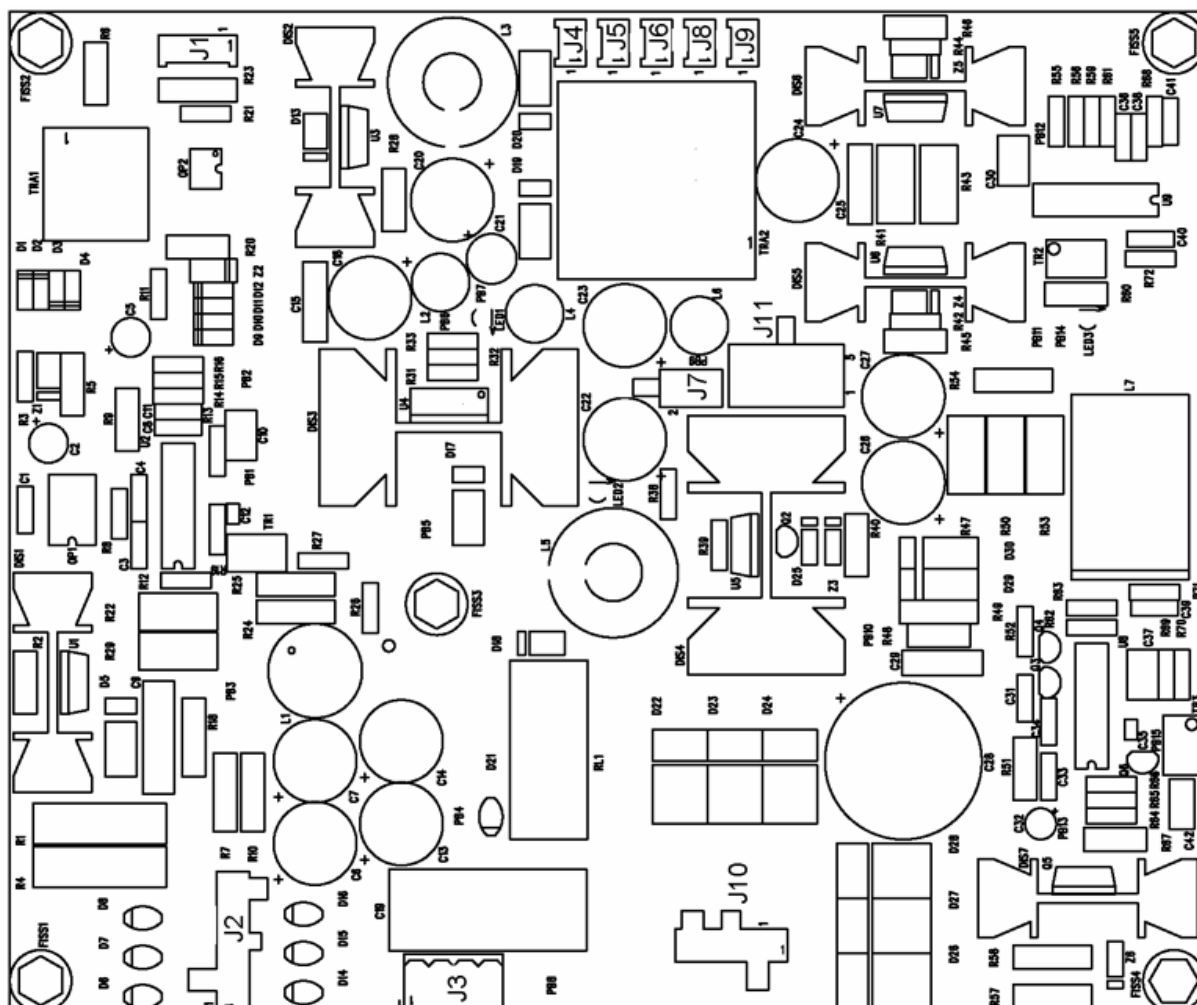


### 5.4.2 - Connector table.

| Connector | Terminals  | Function                                      |
|-----------|------------|-----------------------------------------------|
| -         | L1-L2-L3   | three-phase mains input.                      |
| -         | VDC+1      | +540 Vdc power output.                        |
| -         | VDC+2      | +540 Vdc power output.                        |
| -         | VDC-1      | 0 Vdc power output.                           |
| -         | VDC-2      | 0 Vdc power output.                           |
| J1        | -          | NU.                                           |
| J2        | -          | NU.                                           |
| J3        | 1(+)- 2(-) | +25 Vdc input for pre-charge relay command.   |
| J3        | 3          | GND.                                          |
| J3        | 4 - 5      | “mains voltage presence” signal output.       |
| J3        | 6          | GND.                                          |
| J3        | 7 - 8      | “enable pre-charge” signal output.            |
| J4        | -          | NU.                                           |
| J5        | A - D      | 400 Vac input for services power supply.      |
| J5        | B - E      | 400 Vac output for cooling unit power supply. |
| J6        | 1(+)- 4(-) | NU.                                           |

## 5.5 - Power supply board (105) code 5.602.195/C.

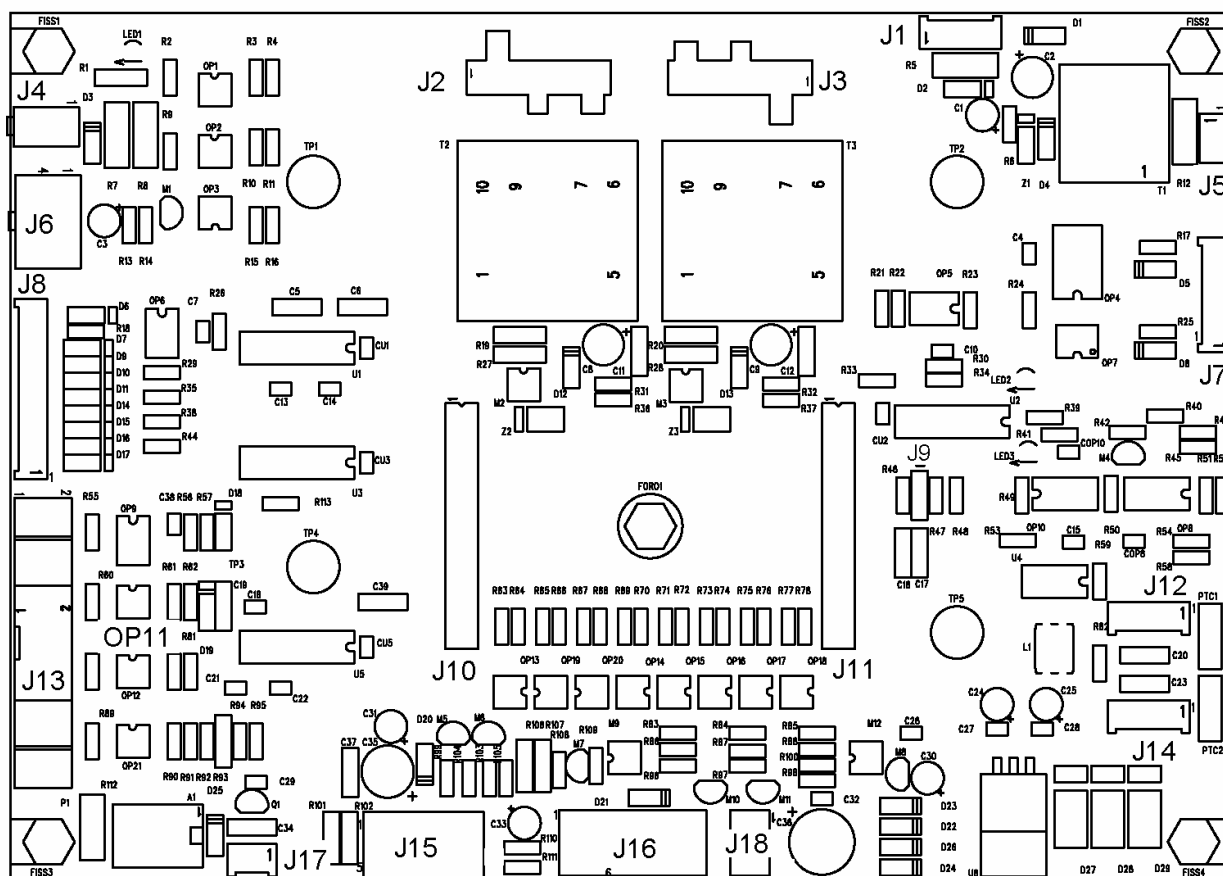
### 5.5.1 - Topographical drawing.



### 5.5.2 - Connector table.

| Connector | Terminals   | Function                                                 |
|-----------|-------------|----------------------------------------------------------|
| J1        | 1(+) - 2(-) | power supply board (105) start command input.            |
| J1        | 3(+) - 4(-) | power supply board (105) enable input.                   |
| J2        | 1 - 3 - 5   | 220 Vac input for power supply board (105) power supply. |
| J3        | 4(+) - 1(-) | +260 Vdc output for AC-driver board (136) power supply.  |
| J4        | 1 - 2       | 25 Vac output for connector board (146) power supply.    |
| J5        | 1 - 2       | 25 Vac output for measurement board (104) power supply.  |
| J6        | 1 - 2       | NU.                                                      |
| J7        | 1(+) - 2(-) | +8 Vdc output for panel board (156) power supply.        |
| J8        | 1 - 2       | 25 Vac output for AC-driver board (136) power supply.    |
| J9        | 1 - 2       | 25 Vac output for interface board (163) power supply.    |
| J10       | 1-2 / 3-4   | 29 Vac input for power supply board (105) power supply.  |
| J11       | 5(+) - 1(-) | +25 Vdc output for interface board (163) power supply.   |
| J11       | 6(+) - 2(-) | +25 Vdc output for interface board (163) power supply.   |
| J11       | 4(+) - 3(-) | +8 Vdc output for micro board (163) power supply.        |
| J11       | 7(+) - 8(-) | +15 Vdc output for micro board (163) power supply.       |

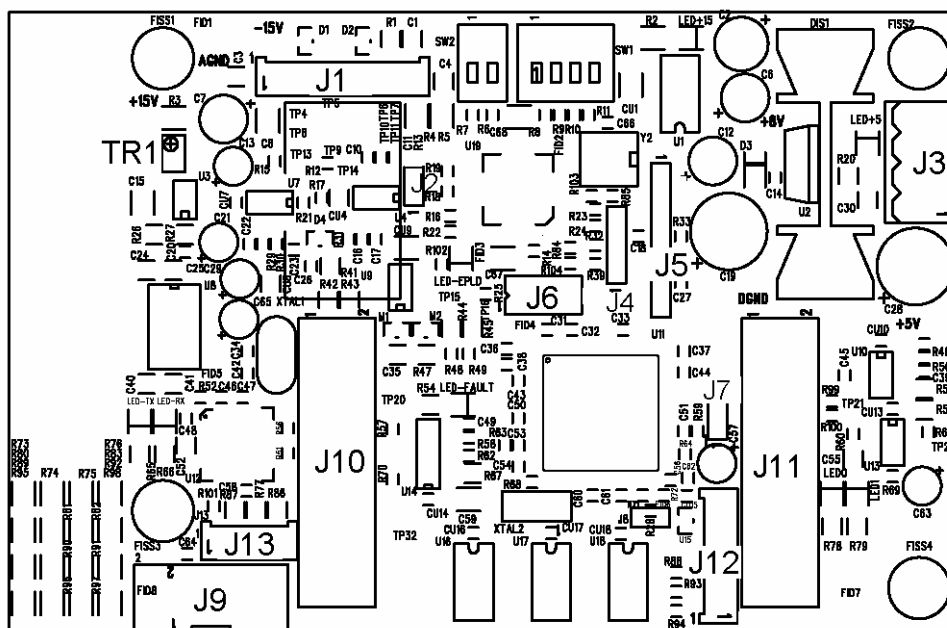
### 5.6.1 - Topographical drawing.



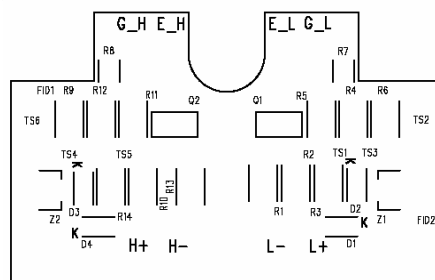
**5.6.2 - Connector table.**

| Connector | Terminals       | Function                                                                    |
|-----------|-----------------|-----------------------------------------------------------------------------|
| J1        | 1               | igbt group (170) temperature signal input.                                  |
| J1        | 3(+) - 4(-)     | +5 Vdc output for thermostat board (131) power supply.                      |
| J2        | 1(GH1) - 2(EH1) | drive signal output for igbt H1 (170).                                      |
| J2        | 3               | NU.                                                                         |
| J2        | 4(EL1) - 5(GL1) | drive signal output for igbt L1 (170).                                      |
| J3        | 1(GH2) - 2(EH2) | drive signal output for igbt H2 (170).                                      |
| J3        | 3               | NU.                                                                         |
| J3        | 4(EL2) - 5(GL2) | drive signal output for igbt L2 (170).                                      |
| J4        | 1(+) - 2(-)     | +25 Vdc input for cooling unit enable circuits power supply.                |
| J5        | 1 - 2           | 25 Vac input for thermostat board (131) circuit power supply.               |
| J6        | 1(+) - 2(-)     | +24 Vdc output, enable signal for motor-driven pump (36) on cooling unit.   |
| J6        | 3(+) - 4(-)     | “cooling unit connected” signal input.                                      |
| J6        | 5(+) - 6(-)     | cooling liquid pressure signal input.                                       |
| J7        | 1(+) - 2(-)     | “short-circuit at the power source output” signal input.                    |
| J7        | 3 - 4           | NU.                                                                         |
| J7        | 5(+) - 6(-)     | “power source output voltage” signal input.                                 |
| J8        | 1(+) - 2(-)     | signal output for igbt G on AC-inverter unit (134).                         |
| J8        | 3(+) - 4(-)     | signal output for igbt F on AC-inverter unit (134).                         |
| J8        | 5(+) - 6(-)     | signal output for arc maintenance igbt on AC-driver board (136).            |
| J8        | 7 - 8           | NU.                                                                         |
| J8        | 9(+) - 10(-)    | igbt group (134) temperature signal input.                                  |
| J9        | -               | NU.                                                                         |
| J10       | -               | signals bus with micro board (163).                                         |
| J11       | -               | signals bus with micro board (163).                                         |
| J12       | -               | NU.                                                                         |
| J13       | 1 - 2           | PWM signal input for current external adjustment.                           |
| J13       | 3(+) - 4(-)     | “START” signal input from connector board (146).                            |
| J13       | 5(+) - 6(-)     | “DOWN” signal input from connector board (146).                             |
| J13       | 7(+) - 8(-)     | “UP” signal input from connector board (146).                               |
| J13       | 9(+) - 10(-)    | “arc-on” signal output.                                                     |
| J14       | 1(+) - 2(-)     | +8 Vdc input for CAN-BUS-0 on interface board (163) power supply.           |
| J14       | 3 - 4           | CAN-BUS-0 communication line.                                               |
| J15       | 1(+) - 2(-)     | +25 Vdc output for pre-charge relay command.                                |
| J15       | 3               | GND.                                                                        |
| J15       | 4 - 5           | “mains voltage presence” signal input.                                      |
| J15       | 6               | GND.                                                                        |
| J15       | 7 - 8           | “pre-charge enable” signal input.                                           |
| J16       | 1(+) - 2(-)     | +24 Vdc output for fan (119).                                               |
| J16       | 3(+) - 4(-)     | + 24 Vdc output to enable power supply board (105).                         |
| J16       | 5(+) - 6(-)     | +24 Vdc output start command for power supply board (105).                  |
| J16       | 7(+) - 8(-)     | +24 Vdc output to HF enable relay command.                                  |
| J16       | 9(+) - 10(-)    | +24 Vdc output for solenoid valve (116) command.                            |
| J17       | 1(+) - 2(-)     | NU. (hardware key).                                                         |
| J18       | 1(+) - 2(-)     | +25 Vdc input for interface board (163) opto-coupled circuits power supply. |

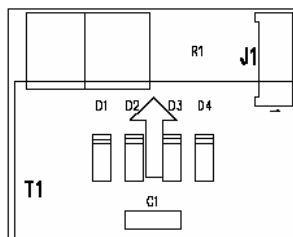
### 5.7.1 - Topographical drawing.



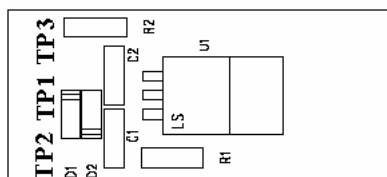
| Connector | Terminals   | Function                                                                    |
|-----------|-------------|-----------------------------------------------------------------------------|
| J1        | 1           | -15 Vdc output for current sensor (130) power supply.                       |
| J1        | 2           | NU.                                                                         |
| J1        | 3           | power source output current signal input.                                   |
| J1        | 4           | +15 Vdc output for current sensor (130) power supply.                       |
| J1        | 5           | GND. (0 Vdc reference for power supply and signals of current transducers). |
| J1        | 6           | transformer (188) primary circuit current signal input.                     |
| J1        | 7           | “interlock” signal input.                                                   |
| J1        | 8           | +5 Vdc output for interlock signal.                                         |
| J2        | -           | NU.                                                                         |
| J3        | 2(+) - 1(-) | +8 Vdc input for micro board (163) power supply.                            |
| J3        | 4(+) - 3(-) | +15 Vdc input for micro board (163) power supply.                           |
| J4        | -           | NU.                                                                         |
| J5        | -           | NU.                                                                         |
| J6        | -           | NU.                                                                         |
| J7        | -           | NU.                                                                         |
| J8        | -           | NU.                                                                         |
| J9        | -           | RS232 serial communication for system programming.                          |
| J10       | -           | signals bus with interface board (163).                                     |
| J11       | -           | signals bus with interface board (163).                                     |
| J12       | -           | NU.                                                                         |

**5.8 - Igbt-driver board (170) code 5.602.188.****5.8.1 - Topographical drawing.****5.8.2 - Connector table.**

| Connector | Terminals | Function                                  |
|-----------|-----------|-------------------------------------------|
| -         | H+ - H-   | drive signal input for igbt H (H1 or H2). |
| -         | L+ - L-   | drive signal input for igbt L (L1 or L2). |
| -         | GH - EH   | command output for igbt H (H1 or H2).     |
| -         | GL - EL   | command output for igbt L (L1 or L2).     |

**5.9 - TA board (177) code 5.602.123.****5.9.1 - Topographical drawing.****5.9.2 - Connector table.**

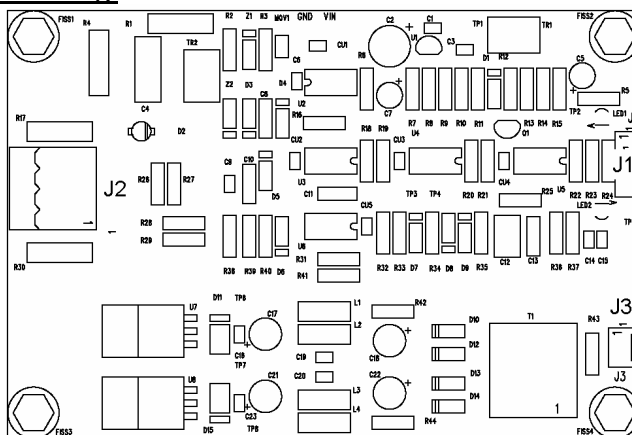
| Connector | Terminals   | Function                                                 |
|-----------|-------------|----------------------------------------------------------|
| J1        | 2(+) - 1(-) | transformer (188) primary circuit current signal output. |
| J1        | 3 - 4       | “interlock” output signal.                               |

**5.10 - Thermostat board (131) code 5.602.137.****5.10.1 - Topographical drawing.****5.10.2 - Connector table.**

| Connector | Terminals | Function                                                      |
|-----------|-----------|---------------------------------------------------------------|
| -         | TP1       | 0 Vdc input for thermostat board (131) power supply.          |
| -         | TP2       | +5 Vdc input for thermostat board (131) power supply.         |
| -         | TP3       | igbt group (170) or AC-group (134) temperature signal output. |

### 5.11 - Measurement board (104) code 5.602.193.

#### 5.11.1 - Topographical drawing.

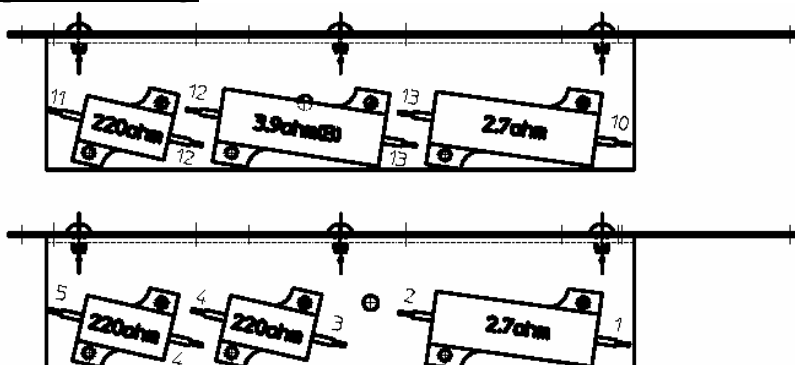


#### 5.11.2 - Connector table.

| Connector | Terminals   | Function                                                  |
|-----------|-------------|-----------------------------------------------------------|
| J1        | 1(+) - 2(-) | “power source output voltage” signal output.              |
| J1        | 3(+) - 4(-) | “short-circuit at the power source output” signal output. |
| J2        | 1(+) - 4(-) | power source output voltage input.                        |
| J3        | 1 - 2       | 25 Vac input for measurement board (104) power supply.    |

### 5.12 - Resistor group (184) code 5.710.434/B.

#### 5.12.1 - Topographical drawing.



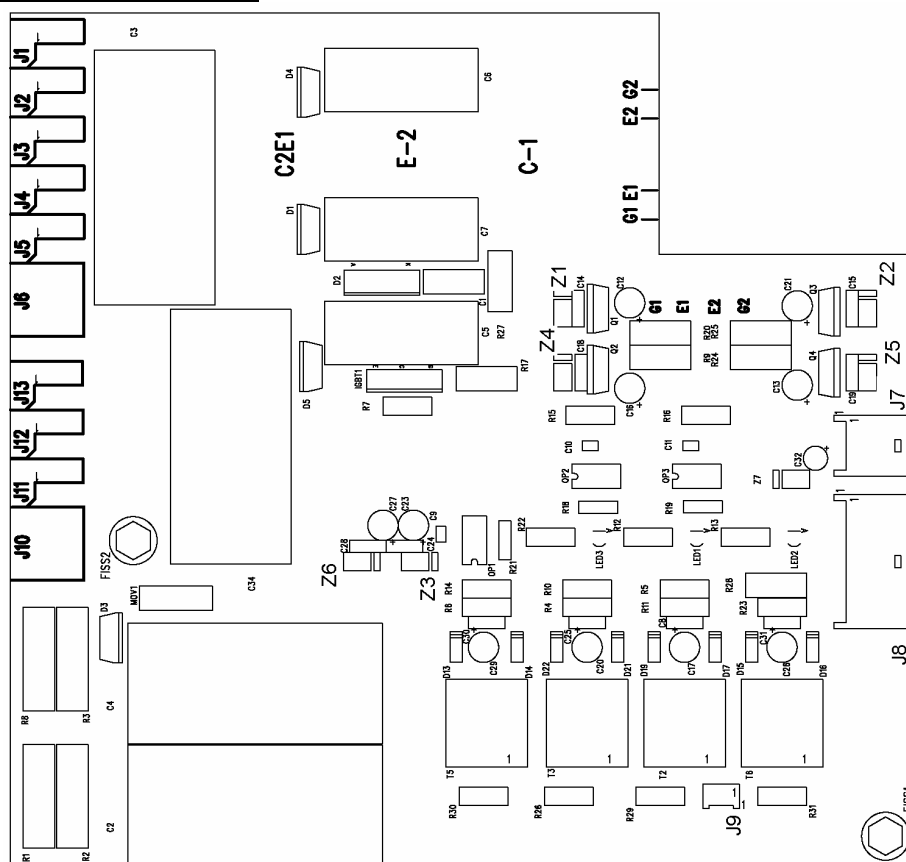
#### 5.12.2 - Connector table.

| Terminals board<br>AC-driver (136) | Terminals group<br>resistors (184) | Value          |
|------------------------------------|------------------------------------|----------------|
| J1-J2                              | 1 - 2                              | 2,7 ohm, 50 W. |
| J3-J4                              | 3 - 4                              | 220 ohm, 25 W. |
| J4-J5                              | 4 - 5                              | 220 ohm, 25 W. |
| J10-J13                            | 10 - 13                            | 2,7 ohm, 50 W. |
| J11-J12                            | 11 - 12                            | 220 ohm, 25 W. |
| J12-J13                            | 12 - 13                            | 3,9 ohm, 50 W. |

(these values may be measured on the terminals of the AC-driver board (136), with the power source off and the terminals of the resistor board (184) connected to the AC-driver board (136)).

### 5.13 - AC-driver board (136) code 5.602.194.

#### 5.13.1 - Topographical drawing.

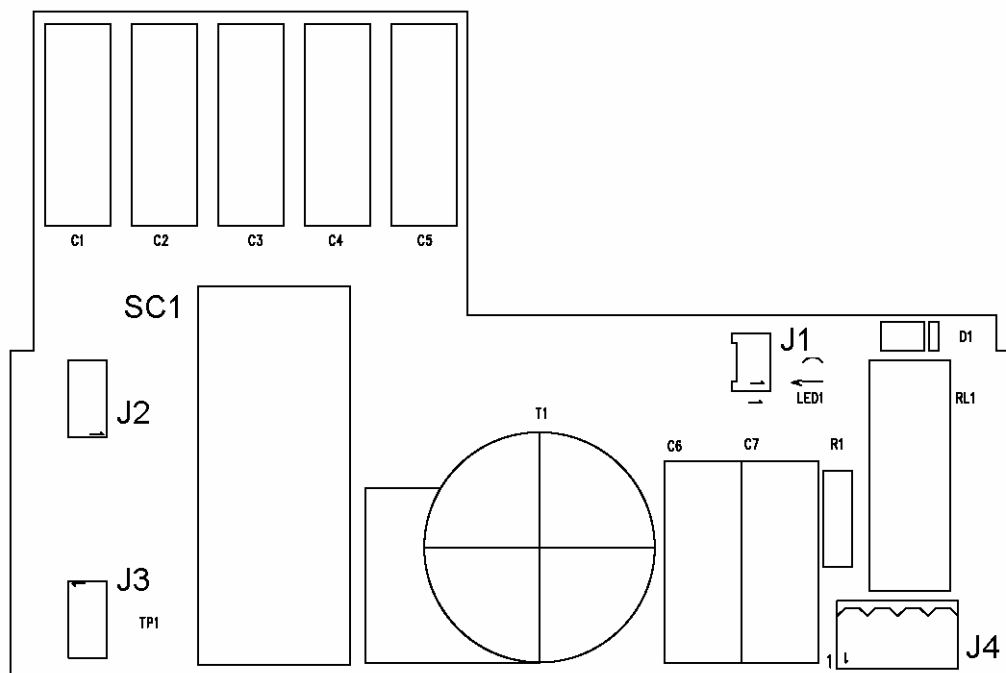


#### 5.13.2 - Connector table.

| Connector | Terminals   | Function                                                                    |
|-----------|-------------|-----------------------------------------------------------------------------|
| J1        | -           | connection to terminal 1 of the resistor group (184).                       |
| J2        | -           | connection to terminal 2 of the resistor group (184).                       |
| J3        | -           | connection to terminal 3 of the resistor group (184).                       |
| J4        | -           | connection to terminal 4 of the resistor group (184).                       |
| J5        | -           | connection to terminal 5 of the resistor group (184).                       |
| J6        | -           | +260 Vdc input for AC-driver board (136) power supply;                      |
|           |             | connection to the HF transformer (143) secondary circuit, choke (142) side. |
| J7        | 1           | igbt group (134) temperature signal input.                                  |
| J7        | 3(+) - 4(-) | +5 Vdc output for thermostat board (131) power supply.                      |
| J8        | 1(+) - 2(-) | signal input for igbt G on AC-inverter unit (134).                          |
| J8        | 3(+) - 4(-) | signal input for igbt F on AC-inverter unit (134).                          |
| J8        | 5(+) - 6(-) | signal input for arc maintenance igbt on AC-driver board (136).             |
| J8        | 7 - 8       | NU.                                                                         |
| J8        | 9 - 10      | igbt group (134) temperature signal output.                                 |
| J9        | 1 - 2       | 25 Vac input for AC-driver board (136) power supply.                        |
| J10       | -           | 0 Vdc input for AC-driver board (136) power supply;                         |
|           |             | connection to terminal 10 of the resistor group (184).                      |
| J11       | -           | connection to terminal 11 of the resistor group (184).                      |
| J12       | -           | connection to terminal 12 of the resistor group (184).                      |
| J13       | -           | connection to terminal 13 of the resistor group (184).                      |
| -         | G1 - E1     | drive signal output for igbt G (134).                                       |
| -         | G2 - E2     | drive signal output for igbt F (134).                                       |

#### 5.14 - HF board (157) code 5.602.213.

##### 5.14.1 - Topographical drawing.

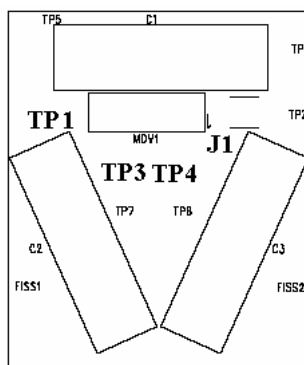


##### 5.14.2 - Connector table.

| Connector | Terminals   | Function                                               |
|-----------|-------------|--------------------------------------------------------|
| J1        | 1(+) - 2(-) | +24 Vdc input to HF enable relay command.              |
| -         | J2 - J3     | output for HF transformer (143).                       |
| J4        | 1 - 4       | AC power supply input for HF board (157) power supply. |

#### 5.15 - HF-filter board (159) code 5.602.119.

##### 5.15.1 - Topographical drawing.

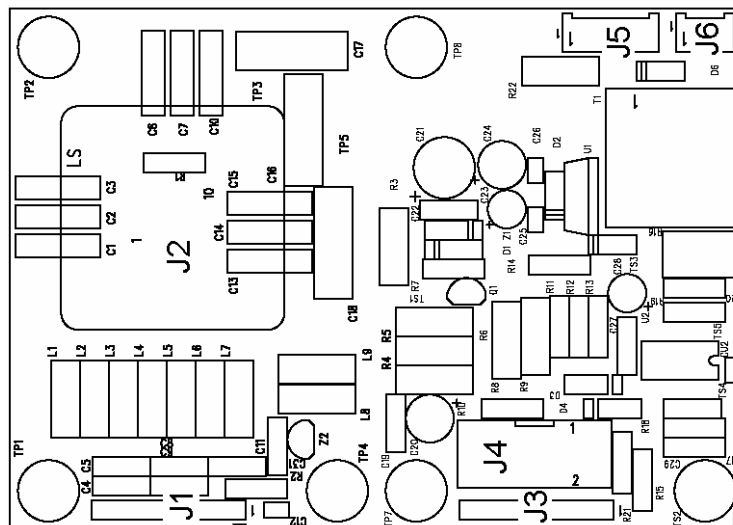


##### 5.15.2 - Connector table.

| Connector | Terminals       | Function                                                                |
|-----------|-----------------|-------------------------------------------------------------------------|
| -         | TP1(+) - J1(-)  | power source output voltage input.                                      |
| -         | TP3(+) - TP4(-) | power source output voltage signal output, for measurement board (104). |

## 5.16 - Connector board (146) code 5.602.192/A.

### 5.16.1 - Topographical drawing.

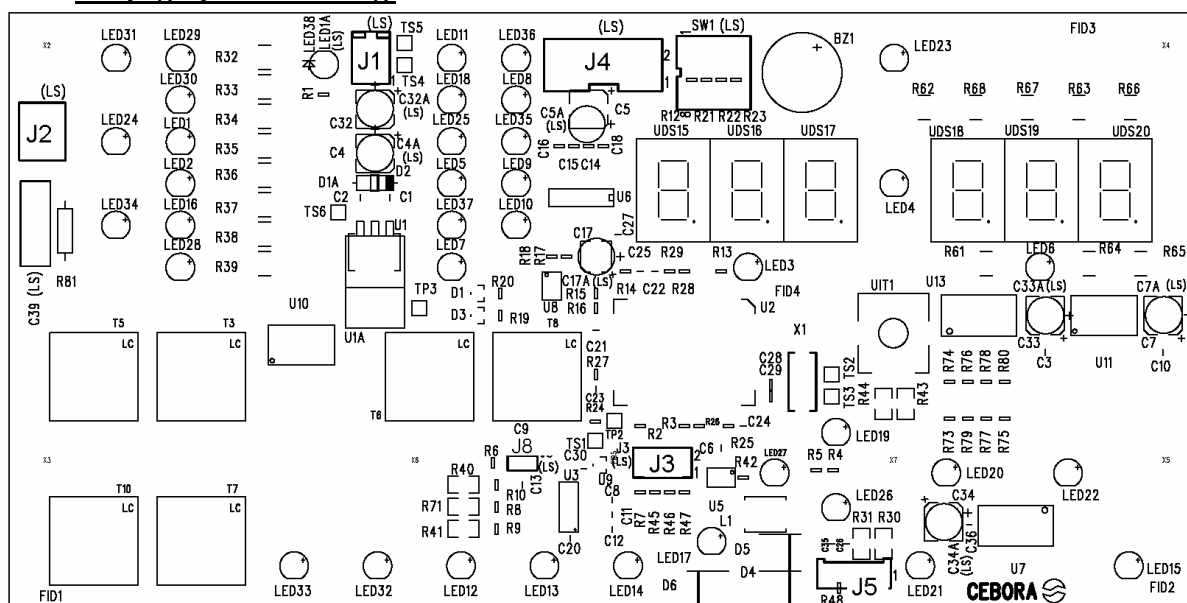


### 5.16.2 - Connector table.

| Connector | Terminals    | Function                                             |
|-----------|--------------|------------------------------------------------------|
| J1        | -            | connector board (146) internal connection.           |
| J2        | 1            | “start” signal input.                                |
| J2        | 2(+) - 7(-)  | +5 Vdc output for torch potentiometer.               |
| J2        | 3 - 6        | “arc on” signal output.                              |
| J2        | 4            | “down” signal input.                                 |
| J2        | 5            | GND.                                                 |
| J2        | 8            | “up” signal input.                                   |
| J2        | 9            | “shared” output for signals from outside.            |
| J2        | 10           | torch potentiometer cursor input.                    |
| J3        | -            | connector board (146) internal connection.           |
| J4        | 1(+) - 2(-)  | PWM signal output of current external adjustment.    |
| J4        | 3(+) - 4(-)  | “start” signal output.                               |
| J4        | 5(+) - 6(-)  | “down” signal output.                                |
| J4        | 7(+) - 8(-)  | “up” signal output.                                  |
| J4        | 9(+) - 10(-) | “arc on” signal input.                               |
| J5        | 1 - 2        | 25 Vac input for connector board (146) power supply. |

## 5.17 - Panel board (156) code 5.602.190/C.

### 5.17.1 - Topographical drawing.

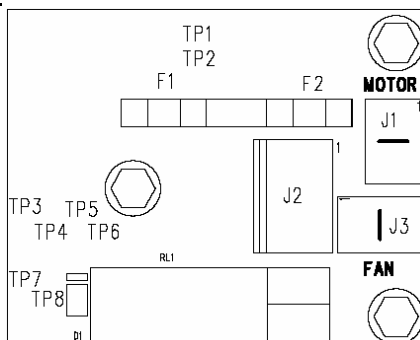


### 5.17.2 - Connector table.

| Connector | Terminals   | Function                                              |
|-----------|-------------|-------------------------------------------------------|
| J1        | 1(+) - 2(-) | +8 Vdc input for control panel (156) power supply.    |
| J5        | 1(+) - 2(-) | +8 Vdc power supply for CAN-BUS on panel board (156). |
| J5        | 3 - 4       | CAN-BUS communication line.                           |
| J6        | -           | NU.                                                   |

## 5.18 - Cooling board (31) code 5.602.093/A.

### 5.18.1 - Topographical drawing.



### 5.18.2 - Connector table.

| Connector | Terminals | Function                                            |
|-----------|-----------|-----------------------------------------------------|
| -         | TP1 - TP2 | 400 Vac input for cooling unit power supply.        |
| -         | TP3 - TP4 | cooling liquid pressure signal output.              |
| -         | TP5 - TP6 | +24 Vdc input motor-driven pump (36) enable signal. |
| -         | TP7 - TP8 | pressure switch (37) input.                         |
| J1        | A - B     | output for motor-driven pump (36).                  |
| J2        | 1         | 400 Vac connection for autotransformer (32).        |
| J2        | 2         | NU.                                                 |
| J2        | 3         | 230 Vac connection for autotransformer (32).        |
| J2        | 4         | 0 Vac connection for autotransformer (32).          |
| J3        | A - B     | output for fan (33).                                |

