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EQUIPMENT FOR RESISTANCE WELDING FOR INDUSTRIAL AND PROFESSIONAL USE.

Note: In the following text the term "spot welder" will be used.

1. GENERAL SAFETY RULES FOR RESISTANCE WELDING

The operator must receive full instructions regarding safe use of the spot welder and must be informed of the risks related to resistance welding procedures, as well as the related safety measures and emergency procedures.

The spot welder (only in the versions with pneumatic cylinder operation) is equipped with a main switch, that can be locked at position "O" (open), with emergency functions.

The lock key can only be given to operators who are expert or have been trained on the duties assigned to them and on the possible dangers deriving from this welding procedure or from the negligent use of the spot welder.

When no operator is present the switch must be moved to position "O", locked, and the key must be removed from the lock.



- Electrical installation must comply with health and safety legislations and standards.
- The spot welder must be connected only and exclusively to a power supply with the neutral conductor connected to earth.
- The power supply outlet must be correctly connected to the earth conductor.
- Do not use cables with worn insulation or loose connections.
- Use the spot welder in an ambient air temperature ranging from 5°C to 40°C, with relative humidity equal to 50% up to a temperature of 40°C, and 90% for temperatures up to 20°C.
- Do not use the spot welder in damp or wet conditions or under the rain.
- The connection of the welding cables and any routine maintenance operations on the arms and/or electrodes must be carried out with the spot welder switched off and disconnected from the electric and pneumatic (if present) power supply networks.

The same procedure must be respected when connecting to the hydraulic network or a closed circuit cooling unit (water cooled spot welders) and whenever repairs (extraordinary maintenance) are carried out.

- When using spot welders operated with pneumatic cylinder, the main switch must be locked at "O" using the supplied lock.

The same procedure must be respected when connecting to the hydraulic network or a closed circuit cooling unit (water cooled spot welders) and whenever repairs (extraordinary maintenance) are carried out.



- It is forbidden to use the equipment in environments comprising areas classed as being at risk of explosion because of the presence of gas, dust or mist.
- Do not weld containers, receptacles or piping that contain or have contained flammable liquids or gases.
- Do not work on materials cleaned with chlorinated solvents or in the vicinity of such substances.
- Do not weld containers under pressure.
- Remove all flammable substances (e.g. wood, paper, rags etc.) from the working area.
- Allow newly-welded pieces to cool! Do not leave the piece near flammable substances.
- Make sure there is an adequate air exchange or means suitable for removing the welding smoke near the electrodes; a systematic approach for evaluating the welding smoke exposure limits according to composition, concentration and exposure duration is necessary.



- Always wear suitable protection glasses.
- Wear protection gloves and clothing that is suitable for working with resistance welding machines.
- Noise level: If particularly intensive welding operations lead to a daily personal noise exposure (LEP,d) of 85dB(A) or more, the use of suitable personal protection equipment is obligatory.



- The passage of the spot welding current generates electromagnetic fields (EMF) around the spot welding circuit.

The electromagnetic fields can interfere with some medical equipment (e.g. Pace-makers, respirators, metal prostheses, etc.).

Suitable measures must be taken to protect those who use this equipment. As an example, prohibit access to the spot welder use area.

This spot welder complies with the requirements of the technical standard for products to be used only and exclusively in industrial environments and for professional purposes. Correspondence with the basic limits regarding human exposure to electromagnetic fields in a domestic environment is not guaranteed.

The operator must follow the procedures given below in order to reduce exposure to electromagnetic fields:

- Fix the two spotting cables (if present) as near to each other as possible.
- Operators must keep their heads and trunks as far away as possible from the spotting circuit.
- Operators must never wind the spotting cables (if present) around their body.
- Operators must not spot weld with their body in the middle of the spotting circuit. Operators must keep both cables on the same side of their body.
- Connect the spot welding current return cable (if present) to the piece to be welded, as close as possible to the join being made.
- Never spot weld near, sitting on, or leaning against the spot welder (minimum distance: 50cm).
- Do not leave ferromagnetic objects near the spot welding circuit.
- Minimum distance:
 - d = 40cm (FIG. I);



- Class A equipment:

This spot welder complies with the requirements of the technical standard for products to be used only and exclusively in industrial environments and for professional purposes.

Correspondence with the electromagnetic compatibility in domestic buildings and in those directly connected to a low voltage power supply network that supplies buildings for domestic use is not guaranteed.

INTENDED USE

The system must be used for spot welding one or more steel plates with a low carbon content, having a shape and size that varies according to the work to be carried out.



RESIDUAL RISKS RISK OF CRUSHING THE UPPER LIMBS DO NOT PLACE HANDS NEAR MOVING PARTS!

The spot welder operation mode and the variability of shape and size of the piece to be worked do not allow the realization of an integrated protection against the danger of crushing of the upper limbs (fingers, hands, forearms).

The risk must be reduced using suitable preventive measures:

- The operator must be an expert on or trained in resistance welding procedures using this type of equipment.
- A risk evaluation must be performed for each type of work to be carried out; it is necessary to use equipment and masks that support and guide the piece to be worked in order to distance hands from the electrode danger area.
- When using a portable spot welder: solidly grasp the clamp with both hands placed on the relative handles; always keep hands away from the electrodes.
- Whenever the shape of the piece allows it, adjust the electrode distance so that the stroke does not exceed 6 mm.
- Do not allow two or more people to work simultaneously with the same spot welder.
- People unconnected with the job must not be allowed in the working area.
- Do not leave the spot welder unattended: in this case it must be disconnected from the mains; with spot welders with pneumatic cylinder operation move the main switch to "O" and lock it with the supplied lock; the key must be removed and kept by the person in charge.

- Only use electrodes that are recommended for the machine (see spare parts list) without altering their shape.

RISK OF BURNING

Some of the spot welder parts (electrodes - arms and adjacent areas) can reach temperatures of above 65°C: suitable protective clothing must be worn.

Allow newly-welded pieces to cool before touching them!

RISK OF TOPPLING AND FALLS

- Place the spot welder on a horizontal surface that can suitably support the mass; constrain the spot welder to the supporting surface (when indicated in the "INSTALLATION" section of this manual). In contrary cases, where the flooring is sloped or broken, or with mobile supporting surfaces, the danger of toppling exists.

- It is forbidden to lift the spot welder, excluding where expressly indicated in the "INSTALLATION" section of this manual.

- When using machines on wheels: disconnect the spot welder from the electric and pneumatic (if present) power supplies before moving the unit to another work area. Pay attention to obstacles and unevenness on the ground (for example cables and piping).

UNINTENDED USE

It is dangerous to use the spot welder for any purpose other than that for which it is intended (see INTENDED USE).



SAFEGUARDS AND SHIELDS

The safeguards and mobile parts of the spot welder casing must be in position, before connecting it to the power supply.

WARNING! Any manual intervention on the accessible mobile parts of the spot welder, for example:

- Replacement of or maintenance on the electrodes
- Adjustment of the arm or electrode positions

MUST BE CARRIED OUT WITH THE SPOT WELDER SWITCHED OFF AND DISCONNECTED FROM THE ELECTRIC AND PNEUMATIC (if present) POWER SUPPLY.

MAIN SWITCH LOCKED AT "O" WITH LOCK CLOSED AND KEY REMOVED in the models with PNEUMATIC CYLINDER movement).

STORAGE

- Place the machine and its accessories (with or without packaging) in closed areas.

- The relative humidity of the air must not exceed 80%.

- The environmental temperature must be between -15°C and 45°C.

If the machine has a water cooling unit and the environmental temperature is lower than 0°C: add the indicated antifreeze liquid or completely empty the hydraulic circuit and the water tank.

Always use suitable measures for protecting the machine from humidity, dirt and corrosion.

2. INTRODUCTION AND GENERAL DESCRIPTION

2.1 MAIN CHARACTERISTICS

Column spot welding machine with electrode and curved descent for resistance welding system (single spot) with digital microprocessor control.

Their main characteristics are:

- limitation of line overcurrent at insertion (insertion $\cos\phi$ check);
- choice of the best spot welding current according to the mains power available;
- choice of the optimal welding cycles parameters (approach time, ramp time, welding time, pause time and pulse number);
- saving of favourite programmes;
- backlit LCD display that shows the controls and the set parameters;
- thermal protection with indicator (overload or lack of cooling water);
- indicating and blocking in the event of overload or underload of delivered voltage;
- no air indicator (only on PCP pneumatic control models);
- air flow regulation for slow arm closing (only on PCP pneumatic control models).

Operation:

- "PTE" models: mechanical, equipped with pedal with adjustable lever length;
- "PCP" models: pneumatic, equipped with double effect cylinder controlled by a pedal valve.

2.2 OPTIONAL ACCESSORIES

- Arm pair, length 500mm, complete with electrode holders and standard electrodes.
- Arm pair, length 700mm, complete with electrode holders and standard electrodes.
- Curved electrodes.
- Closed circuit water cooling system (suitable for PTE or PCP 18 only).

3. TECHNICAL DATA

3.1 RATING PLATE (FIG. A)

The main data relating to use and performance of the spot-welder are summarised on the rating plate and have the following meanings:

- 1- Number of phases and frequency of power supply.
- 2- Power supply voltage.
- 3- Mains power with permanent running (100%).
- 4- Rated mains power with 50% duty cycle.
- 5- Maximum loadless voltage over electrodes.
- 6- Maximum current when electrodes are shorted.
- 7- Current to secondary when running permanently (100%).
- 8- Gauge and length of arms (standard).
- 9- Minimum and maximum adjustable electrode force.
- 10- Rated pressure of compressed air supply.
- 11- Pressure of compressed air supply needed to obtain maximum electrode force.
- 12- Cooling water flow rate.
- 13- Rated pressure drop for coolant liquid.
- 14- Weight of welding device.
- 15- Safety symbols, the meanings of which are given in chapter 1 "General safety rules for resistance welding".

Note: The rating plate shown is an example to show the meaning of the symbols and numbers; the exact technical specifications of your spot-welder can be found on the rating plate of the spot-welder itself.

3.2 OTHER TECHNICAL DATA (FIG. B)

4. DESCRIPTION OF THE SPOT-WELDER

4.1 SPOT-WELDER ASSEMBLY AND DIMENSIONS (FIG. C)

4.2 CONTROL AND ADJUSTMENT DEVICES

4.2.1 Control panel (FIG. D1).

- 1- main switch (in PCP models with emergency stop function and lock function in position "O": lock and key supplied).
- 2- increase (+) decrease (-) buttons.
- 3- "MODE" settings selector button.
- 4- rear-lit LCD display;
- 5- run / START button (mod. PCP);
- 6- pressure only switch (no welding) / welding.

4.2.2 Description of the icons (FIG. D2).

Spot welding parameters (1-7):

- 1- power (%): spot welding current as a percentage of the maximum value;
- 2- approach (cycles): stand-by times in cycles before delivering current from the contact of the electrodes with the piece being processed;
- 3- ramp (cycles): time in cycles that the spot welding current takes to reach the value set for "power";
- 4- spot welding time (cycles): time in cycles that the current remains at the set value;
- 5- pause time (cycles): time in cycles during which the current is zero between one pulse and another (only in pulse mode);
- 6- pulse number (n°): if 1 then the spot welding stops after spot welding time (4); if greater than 1, it indicates the number of current pulses delivered by the machine (pulse mode);
- 7- circular synoptic indicator, with numerical value in the centre, of the set cycles;
- 8- thermal alarm icon;
- 9- multifunction numerical display;
- 10- spot welding enabled icon (delivery of current);
- 11- approach enabled icon, with selector switch in FIG. D1-6 in the NO WELDING position;
- 12- **START** START indicator: press the button in FIG. D1-5 to start the machine;
- 13- **PRG** customised PROGRAMME icon;
- 14- save / do not save customised programme icon;
- 15- circular synoptic indicator, with numerical value in the centre, of the set power.

4.2.3 Setting of the spot welding parameters

Each time the machine is switched on, and before pressing the "START" button, it is possible to change the function mode used to set the welding parameters:

- "REDUCED" = EASY mode: allows quick and user-friendly selecting of the two main spot welding parameters "POWER" (1) and "welding time" (4). This function mode does not foresee the saving of customised programmes.
- "EXTENDED" = EXPERT mode: allows the selecting of all the welding parameters described in the paragraph above. This function mode allows the saving of customised programmes.

4.2.4 Compression and flow regulator nut (FIG. D3)

1- The nut can be accessed via the hatch door on the rear of the spot welding machine.

The nut is used to regulate the force exerted by the electrodes intervening on the spring preload: the greater the spring load, the greater the force of the spot welding machine electrodes.

2- The flow regulator (PCP mod. only) is used to decrease the arm closure speed to prevent the electrodes from rebounding on the piece.

Rotate the adjuster screw counter clockwise (+) to increase air flow and descent speed of the electrodes; rotate the screw clockwise (-) to decrease air flow and the descent speed of the electrodes.

4.2.5 Pressure and pressure gauge regulation (FIG. D4 - PCP mod. only)

- 1- Pressure regulator knob;
- 2- Pressure gauge.

4.2.6 Air and water couplings (FIG. G and H)

G (1) - Compressed air pipe coupling (PCP mod. only);

G (2) - Condensate filter and bleeder (PCP mod. only);

H (1) - INLET water couplings.

H (2) - OUTLET water couplings.

4.3 SAFETY FUNCTIONS AND INTERLOCK

4.3.1 Main switch

- Position "O" = open and lockable (see chapter 1).



ATTENTION! The internal power cable connection terminals (L1+L2) are live when turned to the "O" position.

- Position "I" = closed: spot welding machine powered up but not operating (STAND BY) display ON.

Emergency function

Opening the spot welding machine when it is operating (position "I" => position "O") will instantly stop the machine in safe shutdown mode with:

- current inhibited;
- all movement is blocked: exhauster cylinder (if installed);
- automatic restart inhibited.



ATTENTION! PERIODICALLY MAKE SURE THE SAFE SHUTDOWN FUNCTION OPERATES CORRECTLY.

4.3.2 "START" button


This push-button must be pressed to control welding in each of the following conditions:

- every time the main switch has tripped (pos. "O" => pos. "I");
- each time the safety/protection devices cut in;
- when the power supply is reinstated (electricity and compressed air) following a shutdown of power supplies or a malfunction.




ATTENTION! PERIODICALLY MAKE SURE THE SAFE START FUNCTION OPERATES CORRECTLY.

4.3.3 NO WELDING / WELDING cycle switch

-  NO WELDING: allows use of the spot welding machine without welding. It is used to move the arms and close the electrodes without current supplies.



RESIDUAL RISK! This operating mode also causes the residual risk of crushing of the upper limbs: take all necessary precautions (see safety chapter).

-  WELDING (normal welding cycle): allows the spot welding machine to perform welding operations.

4.3.4 Thermal protection switch (AL1)

This is triggered by overheating of the spot welding machine due to low capacity or total lack of cooling water, or by a work cycle (DUTY CYCLE) that exceeds the allowed thermal threshold.

The triggered switch is signalled by the icon in FIG. D2-9 and the AL1 icon switching on.

EFFECT: current block (welding inhibited).

RESET: manual (using the "START" button) after the machine temperature falls within the allowed threshold (the AL1 icon will switch off and the "START" icon will switch on).

4.3.5 Compressed air safety switch (AL6 - PCP mod. only)

This is triggered by lack of or low pressure ($p < 2.5 + 3\text{bar}$) of the compressed air supply; the triggered switch is indicated on the pressure gauge ($0 + 3\text{bar}$) and the AL6 icon on the display.

EFFECT: all movement is blocked, the electrodes open (exhauster cylinder); power is shut down (welding inhibited).

RESET: manual (using the "START" button) after the machine pressure falls within the allowed threshold ("START" indication on the display).

4.3.6 Overvoltage and undervoltage trip switch (AL3 and AL4).

This is triggered by an excessive overvoltage or undervoltage of the electricity supply; the triggered switch is indicated on the display by AL3 (overvoltage) and AL4 (undervoltage).

EFFECT: all movement is blocked, exhauster cylinder (if installed); power is shut down (welding inhibited).

RESET: manual (using the "START" button) after the machine pressure falls within the allowed voltage limits ("START" indication on the display).

5. INSTALLATION



WARNING! CARRY OUT ALL INSTALLATION OPERATIONS AND ELECTRICAL AND PNEUMATIC CONNECTIONS WITH THE SPOT-WELDER COMPLETELY SWITCHED OFF AND DISCONNECTED FROM THE POWER SUPPLY OUTLET. THE ELECTRICAL AND PNEUMATIC CONNECTIONS MUST BE MADE ONLY AND EXCLUSIVELY BY AUTHORISED, SKILLED PERSONNEL.

5.1 PRELIMINARY OPERATIONS

Unpack the spot-welder, assemble the separate parts as indicated below.

5.2 LIFTING THE SPOT-WELDER (FIG. E)

The spot-welder should be lifted with a double cable and hooks, using the eyebolts fitted for this purpose.

It is absolutely prohibited to sling the spot-welder in a different way from the one we prescribed (e.g. on arms or electrodes).

5.3 POSITION

The installation area must be sufficiently large and without obstacles, suitable for ensuring safe access to the control panel and to the work area (electrodes).

Ensure that there are no obstacles near the cooling air inlets and outlets and that no conductive dusts, corrosive vapour, humidity, etc. can be sucked in.

Position the spot-welder on a plane surface made of homogeneous and compact material (floor made of concrete or similar physical characteristics).

Fasten the spot-welder to the floor by means of four M10 bolts, using the special holes on the base; each individual element anchoring the spot-welder to the floor must guarantee a tensile strength of at least 60 Kg. (60daN).

Maximum load

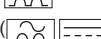
The maximum load that can be applied to the lower arm (concentrated on the electrode axis) is 35 Kg. (35daN).

5.4 CONNECTION TO THE MAIN POWER SUPPLY

5.4.1 Warnings

- Before making any electrical connection, check the rating plate data on the spot welder to make sure they correspond to the voltage and frequency of the available power supply where the machine is to be installed.
- The spot welder must be connected only and exclusively to a power supply with the neutral conductor connected to earth.
- To guarantee protection against any direct contact always use the differential switches indicated below:

- Type A  for single-phase machines;

- Type B  for three-phase machines;

- In order to satisfy the requirements of the EN 61000-3-11 (Flicker) standard we recommend connecting the spot welder to interface points of the main power supply that have an impedance of less than $Z_{max} = 0.066 \text{ ohm}$.

- The spot welder does not fall within the requisites of IEC/EN 61000-3-12 standard. Should it be connected to a public mains system, it is the installer's responsibility to verify that the spot welding machine itself is suitable for connecting to it (if necessary, consult the distribution network company).

5.4.2 Connecting the power supply cable to the spot-welder (FIG. F)

Remove the right side panel, assemble the supplied cable clip at the hole drilled on the back panel.

Pass the power supply cable through the cable clip and connect it to the power supply block (phases L1(N) L2) and to the screw terminal of the yellow-green earth protection conductor.

Depending on the terminal block model, fit the cable terminals as shown in the diagram (FIG. F1, F2).

Block the cable by tightening the screws on the cable guide.

See the "TECHNICAL DATA" paragraph for the minimum allowed section of the conductors.

5.4.3 Plug and socket

Connect a normalized plug to the power cable (3P+T: only 2 poles are used for the 400V INTERPHASE SYSTEM connection; 2P+T: 230V INTERPHASE connection) of appropriate capacity and prepare a power supply outlet fitted with fuses or an automatic circuit-breaker; the corresponding earth terminal should be connected to the (yellow-green) earth conductor of the power supply.

The capacity and intervention characteristics of the fuses and circuit-breaker switch are given in the paragraph "OTHER TECHNICAL DATA" and/or in TAB. 1.

Should two or more spot welders be installed, distribute the power supply cyclically between the three phases in order to create a more balanced load; for example:

spot welder 1: power supply L1-L2;

spot welder 2: power supply L2-L3;

spot welder 3: power supply L3-L1.



WARNING! Failure to observe the rules given above will invalidate the (class I) safety system provided by the manufacturer causing serious risks to people (e.g. electric shock) and objects (e.g. fire).

5.5 PNEUMATIC CONNECTION (FIG. G) (PCP mod. only)

- Prepare a compressed air supply line with a working pressure of at least 6 bar.
- Connect the gas pipe fitting, supplied as an accessory, to the 1/8 gas coupling in FIG. G-1; use teflon tape to guarantee airtight sealing.
- Connect a compressed air hose of an adequate size for the fitting used); use a suitable clip or collar to guarantee airtight sealing.

5.6 CONNECTING THE COOLING CIRCUIT (FIG. H)

It is necessary to set up a water delivery pipe for maximum temperature 30 °C, with minimum flow rate not less than that specified in TECHNICAL DATA. It is possible to set up an open cooling circuit (discarding the return water) or a closed circuit as long as the temperature and water flow rate parameters are respected.

Connect the water fittings supplied as accessories to the 1/8 gas couplings in FIG. H: the water couplings are fitted with "OR" sealing rings and do not require the application of teflon tape.

Connect the water delivery pipe (FIG. H-1) to the external water channelling, checking for correct outflow and the capacity of the return pipe (FIG. H-2); use a suitable clip or collar to guarantee airtight sealing.



WARNING! Welding operations performed without or with insufficient water flow could cause the spot-welder to break down due to overheating.

6. SPOT WELDING

6.1 PRELIMINARY OPERATIONS

Before carrying out any spot-welding operation it is necessary to make a series of checks and adjustments, which should be carried out with the general switch in the "O" position (with the padlock closed in PCP versions) and with the compressed air supply switched off (DISCONNECTED).

- Ensure that the electric connection is done according to the previous instructions.
- Put the cooling water into circulation.
- Adjust diameter "d" of the electrode contact surface according to the thickness "s" of the sheet to be spot welded, according to relationship $d = 4 + 6 \cdot \sqrt{s}$.
- Between the electrodes slide a shim equivalent to the thickness of the sheet to be spot welded; ensure that the arms, brought together manually, are parallel and that the electrode holders are centred.

If necessary, make some adjustments by loosening the electrode holder locking screws until you find the most suitable position for the job to be performed; secure the locking screws tightly.

In models PTE and PCP28, the gap between the arms can also be regulated by adjusting the fastening screws of the lower armholder casting (see technical data).

- Open the safety gate located on the rear of the spot-welder by loosening the four fastening screws to get at the electrode force adjustment nut (wrench No.30).

Compressing the spring (screw the nut clockwise) will cause the electrodes to exert gradually increasing force with values between the minimum and the maximum (see technical data).

Such force will increase in proportion to the increase in the thickness of the sheets to be welded and to the diameter of the electrode tip.

- Also regulate the flow reducer in FIG. D3-2 to decelerate the descent of the electrodes;

It is recommended to compensate the deceleration of the arm closure with a longer approach time to allow the force to reach the maximum level before the machine starts welding.

Indicatively, with an inlet pressure of 8 bar and the regulator screw unscrewed half way, set 100 approach cycles (2s); with the regulator screw fully open (screw completely turned in a counter clockwise direction and the airflow not choked) set 20 cycles (400ms).

- Close the gate to prevent extraneous matter from entering and to prevent accidental contact with live or moving parts.
- Check the compressed air connection in PCP models, connect the feed pipe to the pneumatic system, adjust the pressure by turning the reducer knob until the gauge reads 6 bar (90 PSI).

6.2 ADJUSTING THE PARAMETERS

The parameters determining the diameter (section) and the mechanical resistance of spot welding are:

- force exerted by the electrodes (daN); 1 daN = 1.02 Kg.
- diameter of the electrode contact surface (mm);
- welding current (kA);
- welding time (cycles): at 50Hz 1 cycle = 0.02 sec.

In summary, all the above factors must be taken into consideration in adjusting the spot-welder given that they interact between each other with relatively ample margins. Furthermore, other factors that could modify the results should not be neglected. These are:

- excessive voltage drops on the power line;
- spot-welder overheating due to insufficient cooling or non-observance of the duty

- cycle;
 - shape and size of workpiece between the arms;
 - gap between the arms (adjustable in PTE - PCP 28 models);
 - length of arms (see technical data).
- Failing precise knowledge, you should run some spot welding tests using sheets having the same quality and thickness as the job to be performed. Where possible, choose high voltage (using the "POWER" settings) and short times (using the "CYCLES" settings).

6.3 PROCEDURE

- Disable the spot welding machine main switch (pos. "I"); the display will come on: if the "START" icon is visible, the power supply is correct and the spot welding machine is ready but not yet enabled.
- Before pressing the START button in FIG. D1-5 it is possible to select one of two different machine operating modes: press the "MODE" button in FIG. D1-3 and select "REDUCED" mode ("POWER" and "CYCLES" icons only) or "EXTENDED" mode (all the welding parameters are enabled).
- Press the "START" button and turn the cycle selector to welding (fig D1-6).
- Set the welding parameters.
- Position the sheet metal to be spot-welded on the electrode.
- Press the pedal at stroke end (PTE model), or the pedal valve (PCP model) to obtain:
 - A) closing of the sheet metal between the electrodes using the preset force;
 - B) passage of the welding current at the preset intensity and duration (time), indicated by the switching ON and OFF of the icon in FIG. D2-11.
- Release the pedal a few seconds (0.5 ± 2s) after the icon switches off (end of welding); this delay (maintenance) confers improved mechanical properties to the spot weld. The spot weld is deemed to have been performed correctly when a piece undergoes a traction test and causes the extraction of the welding point kernel from one of the two sheets.

6.4 MANAGEMENT OF THE PROGRAMMES IN "EXTENDED" MODE

6.4.1 Saving the spot welding parameters

- Start from the initial free programme identified by the acronyms "PCP" or "PTE" in the centre of the display, and set the desired welding parameters.
- Press the "MODE" button repeatedly until the disc icon comes on (FIG. D2-15), then hold the "MODE" button in this position: the welding parameters will be saved to the first available customised programme, for instance "PRG 001"; the programme will be saved immediately and can be retrieved using the "PRG 001" icon in the centre of the display.

NOTE: the parameters of a free programme can be viewed using the "MODE" button and modified using the "+" and "-" buttons; the parameters of a customised programme can be viewed using the "MODE" button and modified following the procedure seen in the paragraph below.

6.4.2 Modifying the spot-welding parameters on a customised programme

- Starting from the customised programme identified by the name "PRG ---" in the centre of the display, press and hold the "MODE" button until the acronym "PRG" starts flashing;
- confirm the programme number using the "MODE" button and modify the displayed parameters;
- on completing the modifications, press and hold the "MODE" button until the crossed disc icon is displayed (DO NOT SAVE);
- press "MODE" again to display the disc icon (SAVE) then press and hold "MODE" to confirm.

6.4.3 Retrieving a programme

- Starting from any programme, press and hold the "MODE" button until the acronym "PRG" starts flashing, then select the number of the programme to be retrieved using the "+" and "-" buttons: the numbers correspond to the customised programmes whilst the acronym "DEF" is the default or free programme.
- Press and hold the "MODE" button to confirm.

6.4.4 Cancelling a programme

- Starting from any programme, press and hold the "MODE" button until the acronym "PRG" starts flashing, then select the number of the programme to be cancelled using the "+" and "-" buttons.
- Press and hold the "+" and "-" buttons simultaneously to cancel the programme parameters.

NOTE: the parameters of the "DEF" or free programme cannot be reset: pressing the "+" and "-" buttons simultaneously will load the factory default settings.

7. MAINTENANCE



WARNING! BEFORE CARRYING OUT ANY MAINTENANCE OPERATION MAKE SURE THE SPOT-WELDER HAS BEEN SWITCHED OFF AND DISCONNECTED FROM THE MAIN POWER SUPPLY. In the versions driven by pneumatic cylinder (PCP models) it is necessary to lock the main switch in the "O" position with the supplied padlock.

7.1 ROUTINE MAINTENANCE

ROUTINE MAINTENANCE CAN BE CARRIED OUT BY THE OPERATOR

- Adjustment/reset of electrode tip diameter and profile.
- Electrode alignment checks.
- Electrode and arm cooling checks (NOT INSIDE THE SPOT-WELDER).
- Checking the spring load (electrode force).
- Exhausting of condensation from the compressed air intake filter.
- Cooling check on cables and clamp.
- Check integrity of the spot welder and clamp power cable.
- Replacement of the electrodes and the arms.
- Periodic check of the level in the cooling water tank.
- Periodic check of the total absence of water leaks.

7.2 EXTRAORDINARY MAINTENANCE

EXTRAORDINARY MAINTENANCE OPERATIONS SHOULD BE CARRIED OUT ONLY AND EXCLUSIVELY BY EXPERT OR SKILLED ELECTRICAL-MECHANICAL TECHNICIANS.



WARNING! BEFORE REMOVING THE SPOT WELDER PANELS AND WORKING INSIDE THE MACHINE, MAKE SURE THE SPOT WELDER IS OFF AND DISCONNECTED FROM THE ELECTRIC AND PNEUMATIC (if present) POWER SUPPLIES.

Carrying out checks while the inside of the spot welder is live can cause serious electric shock due to direct contact with live parts and/or injury due to direct contact

with moving parts.

Periodically and as frequently as required by the use and environmental conditions, inspect inside the spot welder and remove the dust and metal particles that have deposited on the transformer, thyristor module, diode module, power terminal board, etc. using a jet of dry compressed air (max. 5 bar).

Do not direct the jet of air towards the electronics boards; clean them with a very soft brush and appropriate solvents, if necessary.

At the same time:



- Make sure the wiring does not show signs of insulation damage or loose or oxidized connections.
- Lubricate the joints and the pins.
- Make sure the screws that connect the transformer secondary with the arm-holding joints are tight and that there are no signs of oxidation or overheating; do the same for the arm locking and electrode-holder screws.
- Make sure the screws that connect the transformer secondary with the output bars / wires are tight and that there are no signs of oxidation or overheating.
- Make sure the transformer secondary screws (if present) are tight and that there are no signs of oxidation or overheating.
- Make sure the cooling water circulation is correct (minimum requested flow rate) and that the piping is perfectly sealed.
- Check for possible air leaks.
- After having carried out maintenance or repairs, restore the connections and wiring as they were before, making sure they do not come into contact with moving parts or parts that can reach high temperatures. Tie all the wires as they were before, being careful to keep the high voltage connections of the primary transformer separate from the low voltage ones of the secondary transformer. Use all the original washers and screws when closing the casing.

8. TROUBLESHOOTING

IF THE SPOT-WELDER DOES NOT RUN PROPERLY AND BEFORE PERFORMING A THOROUGH MACHINE CHECK OR GETTING IN TOUCH WITH THE AFTER SALES SERVICE CENTER, CHECK WHETHER:

- with the spot welding machine main switch closed (pos. "I") the display is ON; if this is not the case, the problem is in the power line (cables, plug and socket, fuses, excessive voltage drop etc.).
- no alarms have been triggered; if this is the case, wait for the "START" icon to light up and press the button to restart the spot welding machine; check that the cooling water is circulating correctly and decrease the duty cycle ratio as necessary; check for the presence of compressed air (PCP mod. only); check that the voltage is compatible with the value indicated on the rating plate ± 10%.
- with the pedal or cylinder enabled, the electric control actuator closes all the terminals (contacts) and sends the required consent to the electronic card: spot welding icon ON for the set time.
- the elements of the secondary circuit parts (arm-holder – arms – electrode holder moulds) are not working efficiently due to loosened or rusted screws.
- the welding parameters (electrode force and diameter, welding time and current) are suited to the job being done.

In PCP models check also whether:

- the compressed air pressure is lower than the triggering limit of the safeguard device;
- the cycle selector is erroneously in position  (pressure only - spot-welder does not weld);
- the start-up push-button  has actually been pressed after the general switch has been closed whenever the following protection/safety devices have triggered:
 - a) power failure;
 - b) lack of/insufficient compressed air pressure;
 - c) overheating;
 - d) overload or underload of delivered voltage.