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RESISTANCE WELDING. SOLVED.

RESISTANCE WELDERS

ITEM 8207A

INSTALLATION AND USE INSTRUCTION MANUAL

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INDEX

1 INTRODUCTION

1.1 PRELIMINARY REMARKS

CAREFULLY READ THIS MANUAL BEFORE INSTALLING AND OPERATING WELDER.

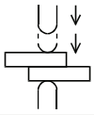
This manual is addressed to the factory responsible in charge who must release it to the personnel in charge of both welder installation, use and maintenance. He/she must check that the information given in this manual and in the enclosed documents have been read and understood. The manual must be stored in a well-known place, easy to reach, and must be looked up each time even little doubts should arise.

This welder has been designed for resistance welding of both ferrous and not ferrous (aluminium, brass) materials. The welder must not been used for other application, i.e. pieces heating, mechanical working carried out by using the electrodes force. The welder has been designed to be used by an operator by means of the foreseen control devices. All modifications, even slight ones, are forbidden.

The welders described in this manual have been designed to be used only for professional purposes in industrial environments. They must not be installed on public low voltage network which supplies domestic premises. This can cause electromagnetic interferences.

TECNA S.p.A is not responsible for any damage to both people, animals, things and to the welder itself caused by either a wrong use or the lack or the superficial observance of the safety warnings stated on this manual, nor it is responsible for damages coming from even slight tampering or from the use of not-suitable spare parts, or of spare parts other than the original ones.

1.2 SYMBOLS ON BOTH WELDER AND MANUAL

	WARNING! Danger of squashing.
	Double stroke control device.
	WARNING! Important safety information enclosed in this paragraph.

1.3 STANDARD ACCESSORIES

The welder is supplied equipped with the following accessories:

N° 1 Allen keys set 4-5-6-8-10 mm.
N° 1 Hexagonal key 19 mm.
N° 1 Electrodes extractor.
N° 1 High conductivity grease pot.
N° 1 Control unit instruction manual.
N° 1 Welder instruction and maintenance manual.
N° 1 Technical documentation booklet.
N° 1 Wrap-it-ties and hose clamps set.
N° 1 Spare silencers set.

Check that the welder is equipped with all the standard accessories; immediately inform the manufacturer in case some components should lack.

TECHNICAL FEATURES

IDENTIFICATION DATA

Item	8207A
Year of manufacturing	2011
Serial number	0112-11
Control Unit	TE550
Supply voltage / frequency	220-440V / 60Hz
Machine supplied with voltage set for	440V

Optional:

■ 8230	Valve to stop the flow of the water cooling when the machine is off and flow switch which makes the welder stop if the cooling water does not circulate.
❑ 8232	Rotary selector for the welding program recalling (9 programs).
❑ 8234	Double stroke control device with pneumatic foot instead of key one.
❑ 8235	Cylinder 1242 daN (∅ 125 double stage) total stroke 100 mm.
❑ 8236	Adjustable double stroke for cylinder 736 daN (standard).
❑ 8237	Adjustable double stroke for cylinder 1242 daN (option 8235).
■ 8238	Low pressure squeeze for cylinder 736 daN (standard).
❑ 8239	Low pressure squeeze for cylinder 1242 daN (option 8235).

ELECTRICAL DATA

Item		**8207A**	**8207A**
Supply voltage / frequency		440V 60Hz	220V 60Hz
Nominal power at 50 % duty cycle	kVA	80	80
Maximum welding power	kVA	250	250
Short circuit secondary current	kA	34	34
Maximum welding current on aluminium	kA	30	30
Maximum welding current on steel	kA	27	27
Secondary thermal current at 100 %	A	6200	6200
Secondary no load alternate voltage	V	9.1 – 7.3	9.1 – 6.1
Delayed fuses	A	125	250
Mains cables section for L=10 m *		50 mm^2 - 0 AWG	2×50 mm^2 - 2× 0 AWG
Mains cables section for L=30 m *		50 mm^2 - 0 AWG	2×50 mm^2 - 2× 0 AWG
Mains cables section for L=60 m *		70 mm^2 - 00 AWG	-
Supply transformer minimum power **			
single-phase	kVA	167	167
three-phase	kVA	289	289

* Section for every phase, calculated for PVC insulated, single conductor cables, considering the welder working at the maximum welding power and a 4% voltage drop on cables.

** Approximate value, calculated for a three phase transformer with a 4% short circuit voltage, with 6% voltage drop on transformer and a 4% voltage drop on cables, with the welder adjusted for the maximum welding power.

MECHANICAL DATA

Item		8207A
Electrodes throat depth	L =	540 mm - 21 ¼ inch
Projection plates throat depth	D =	420 mm – 16 ½ inch

Electrode-holder	❑ Standard ∅ 32 mm ❑ Special ∅ .....
Electrodes cone	❑ Standard #2 MT / #5 RWMA ❑ Special ∅ .....
Projection plates	❑ Standard centreline 63 mm for M12 nuts ❑ Special .....

Pneumatic circuit	■ Standard ∅ 125	❑ Optional ∅ 125 × 2
Electrode force per bar (100 kPa – 14 psi)	123 daN – 271 lbs	207 daN – 456 lbs
Electrode force at 6 bar (600 kPa – 87 psi)	736 daN – 1622 lbs	1242 daN – 2738 lbs
Maximum stroke	100 mm - 4 inch	100 mm - 4 inch
Double stroke	60 mm – 2 1/3 inch	60 mm – 2 1/3 inch
Adjustable Double stroke (options 8236-8237)	0 ÷ 80 mm 0 ÷ 3 1/8 inch	0 ÷ 80 mm 0 ÷ 3 1/8 inch

COMPRESSED AIR CONNECTIONS DATA

Minimum pressure	bar kPa psi	6.5 650 94
Maximum pressure	bar kPa psi	10 100 145
Hoses minimum inside diameter		15 mm – 2/3 inch

Consumption for 1000 spots at 6 bar (600 kPa)		Pneumatic cylinder ■ Standard ∅ 125	Pneumatic cylinder ❑ Optional ∅ 125 × 2
Standard pneumatic circuit			
with maximum working stroke	Nm^3	15,4	21,7
with 20 mm stroke and operating with maximum double stroke	Nm^3	4,6	9,4
Pneumatic circuit with low force squeeze (options 8238 - 8239)			
with maximum working stroke	Nm^3	9,2	15,5
with 20 mm stroke and operating with maximum double stroke	Nm^3	2,9	6

COOLING CIRCUIT CONNECTIONS DATA

Maximum water pressure	bar kPa psi	4 400 58
Hoses inside diameter - input/output		12 mm – ½ inch
Minimum consumption for nominal power		8 l/min – 2.1 gal/min

ADDITIONAL FEATURES

Item		**8207A**
Net weight of the machine		545 kg – 1200 lbs
Aerial noise produced (Continuous eqivalent acoustic pressure level; A weighed value)	dB(A)	72
Measurement position		h=1,60 m L=0,5 m h= 63 inch L=20 inch
Measurement conditions		
working stroke (mm)		50 mm – 2 inch
welding time (cycles)		25 (60Hz operation)
welding current (kA)		25
working rating (welds/min.)		6
Machine painting colour		■ Grey RAL7032 ❑ .....

2.7 MAIN WELDER FEATURES

- Cylinder with chrome plated stem for heavy duty works and long life; adjustable anti-rotation device.
- Lubrication free pneumatic components.
- Electrodes descent without pressure for set up and service.
- Built-in compressed air filter unit and tank.
- Silencers for compressed air discharge.
- Two stage electric foot control for clamping and welding pieces only if correctly positioned.
- Pre-setting for additional double stage electric foot connection for the direct recalling of welding program no.2 (not on welders equipped with option 8232).
- Water-cooled transformer, plates, electrode-holders and electrodes; transformer with epoxy resin coated windings.
- Synchronous SCR contactor insulated from cooling water circuit with protection thermostat.
- Two-hand safety control with timer for maximum safety, and removable key selector, standard on all models.
- Emergency push-button to stop the machine immediately.

OPTIONS:

8230 - Valve to stop the flow of the water cooling when the machine is off and flow switch which makes the welder stop if the cooling water does not circulate.

8232 - Rotary selector for recalling of 9 welding programs.

8234 - Double stroke control device with pneumatic foot instead of key one. To be used only for spot welding when the work necessarily requires it.

8235 - Cylinder 1242 daN (∅ 125 double stage) total stroke 100 mm

8236 - Adjustable double stroke for cylinder 736 daN (standard).

8237 - Adjustable double stroke for cylinder 1242 daN (option 8235).

8238 - Low pressure squeeze for cylinder 736 daN (standard).

8239 - Low pressure squeeze for cylinder 1200 daN (option 8235).

2.8 STANDARD WELDING CONTROL TE 500 DESCRIPTION

The TE500 is a microprocessor welding control unit for resistance welders.The welding contol unit can manage the welder-components , in particular the controlled diodes that carry out the welding current contol.

MAIN TECHNICAL DATA

- Semplified programmation through 6 keys and a LCD alphanumeric display.
- Syncronous contol with controlled diodes , phase control current adjustment.
- Storage of 63 welding programs, 31 recalled from the external.
- 18 programmable parameters for each program.
- Slope, pulses,pre-weld,post-weld functions and adjustment of the welding time in half-periods.
- Display of the RMS welding current in kA and relative angle of conduction.
- Double operating mode: standard and constant current.
- Welding current or angle of conduction limits.
- Stepper function to compense the electrodes wear with programmable curve.
- Counter of the performed welds.
- Compensation function of the secondary current to weld oxidized sheets and rods.
- Single and repeat cycle . WELD and NO-WELD function.
- Delay of first insertion.
- Control of 4 solenoidvalves 24 Vdc 7,2 W Max with notected output against short circuit.
- Autoregulation at power frequency 50/60 Hz.
- Serial communication by means of insulated RS-232 (OPTIONAL).
- Key to select foot control or two hands control.

PARAMETER	RANGE
WORKING MODE	IK-PW%-FIX
CONTROL MODE	NO-CUR-DEG
SQUEEZE 1	01-99 cycles
SQUEEZE	00-99 cycles
FORGE DELAY	00-99 cycles
PRE-WELD	00.0-99.5 cycles
PRE-POWER	05-99%
COLD 1	00-50 cycles
SLOPE UP	00-25 cycles
WELD	00.5-99.5 cycles
POWER (CURRENT)	05-99% (00.5-90.0 kA)
COLD 2	00-50 cycles
IMPULSE N.	1-9
SLOPE DOWN	00-25 cycles
COLD 3	00-50 cycles
POST-WELD	00.0-99.5 cycles
POST-POWER	05-99%
HOLD TIME	01-99 cycles
OFF TIME	00-99 cycles
CURR. MIN	1.0-90.0 kA
CURR. MAX	1.0-90.0 kA
ANGLE MIN	001°-180°
ANGLE MAX	001°-180°

For further information concerning TE500 see the relevant instruction manual.

3 INSTALLATION

These paragraphs are addressed to the specialised personnel in charge of both welder transport and installation. The welder dimensions diagram in the technical documentation booklet provides useful information for carrying out these operations.

3.1 PLACE OF INSTALLATION

The welder must be installed in a position fulfilling the following features:

- In an inner place. The use of the welder in an open place is not foreseen.
- Room temperature included between 0 and 40 °C (If water is removed, storage is allowed down to 20°C below 0); 1000 m. maximum altitudes.
- In a well ventilated area, free from dust, steam, and acid exhalations.
- The working place must be free from inflammable materials because the working process can produce spatter of melted metal.
- Around the welder there must be enough room to carry out both working and maintenance in a comfortable manner and without any risk.
- In a place with a suitable lighting system in comparison with the work to be carried out.
- The place of installation must necessarily be flat and the ground must be without unevenness which can be dangerous during the working.

If the welder is used to carry out welding processes which can cause smoke exhalations, there must be installed a proper aspirator. The welder must be properly fixed to the ground through the proper holes placed on the welder basement. Do not install nearby the welder neither supporting tables nor equipment limiting the approaching to the devices and/or making inaccessible or ineffectual the safety devices.

3.2 UNPACKING AND TRANSPORT

On receipt of the welder, verify the perfect integrity of the outer package; communicate to a responsible in charge possible anomalies which should be noticed. Possible damages on the outer package should arise some doubts on the integrity of its content. Remove the package and visually verify the welder integrity. Check that the welder is equipped with all the standards components; immediately inform the manufacturer in case some components should lack. All the material forming the package must be removed according to the present environmental protection regulations.

The welder barycentre is high from ground. For this reason, the welder must be moved only by means of the proper attachment placed on the unit upper side. Consider the welder weight stated on the “TECHNICAL FEATURE” paragraph.

3.3 PNEUMATIC INSTALLATION

For a correct compressed air supply to the welder, it is necessary either a centralised system or a compressor capable of supplying dry air cooled within the maximum pressure and in the quantity stated in the paragraph “Technical Features”. Pay attention to the hoses minimum diameter stated in the same paragraph.
In case the line is subject to great pressure variations, it is advisable to supply the welder by means of a tank of at least 50-100 litres equipped with a gauge-pressure supplied by means of a one-way valve.
The machine is equipped with a filter unit, the moisture of which must be discharged periodically.

Periodically discharge also the moisture eventually present in the built-in small air tank, by means of the tap placed on the bottom of the tank itself.
The welder has been assembled by using components which do not require lubrication. The insertion of a lubricator in the circuit causes no problems to the welder; nevertheless, pay attention to the fact that this brings the emission of oil mist in the environment.

3.4 COOLING WATER CONNECTION

For a correct cooling of the welder it is necessary clean water at a maximum temperature of 30°C at the quantity stated on the paragraph “Technical features”. When connecting the unit to the water line check for dirt or packing scraps in the hoses and connect the supply to the inlet, and the drain to the outlet, this to allow that still cool water immediately reaches the parts of the welder most subject to heating.
Different cooling circuit systems are available: with city supply water, with re-circulating water, with heat exchanger (air-water) and with refrigerator. If the circuit is with city supply or refrigerator and you are working in presence of high humidity, we suggest to avoid the use of low temperature water, as this could produce moisture inside the machine. In presence of hard water it is necessary to install a water softener at the inlet hose, this to avoid that deposits obstruct or reduce the water channels in the welder causing damages. If the machine is operated in a re-circulating water supply, the water softener must be placed on the supply of the tank, an insertion before the machine generate damages.

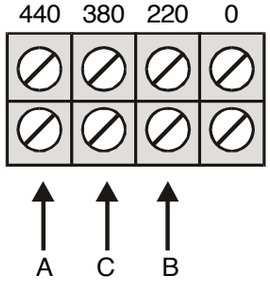
3.5 ELECTRICAL INSTALLATION

The welders described in this manual have been designed to be used only for professional purposes in industrial environments. They must not be installed on public low voltage network which supplies domestic premises. This can cause electrmagnetic interferences.

Installation must be carried out by specialised personnel, aware of all safety rules.
As this unit can be supplied for different power supply versions, before connecting the unit to the power line, check if the voltage shown on the features plate corresponds to the one of your power supply.
Consult the “technical features” paragraph to determine the cables section to be used, according to their length. On this paragraph you find also the values of fuses which must be placed on the welder supply input. Fuses must be delayed type. Connect machine to earth by using a cable having the same section of the mains cable. In order to facilitate the maintenance operation, we recommend you to supply the welder machine by means of a mains disconnecting switch.

The welder has been designed for work with voltages of 220 or 440 supply. It is shipped with the voltage marked on the data plate of the machine. If you desire a different voltage you must follow the following instructions.

TRANSFORMER AND CONTROL VOLTAGE CONNECTIONS
CONTROL TRANSFORMER CONNECTIONS



Four terminal barrier (mounted on the top of the control transformer.)

To change voltage insert wire into the position that matches your line voltage.

To set the voltage on the control transformer follow the directions

1. Locate the control transformer located inside the welder.

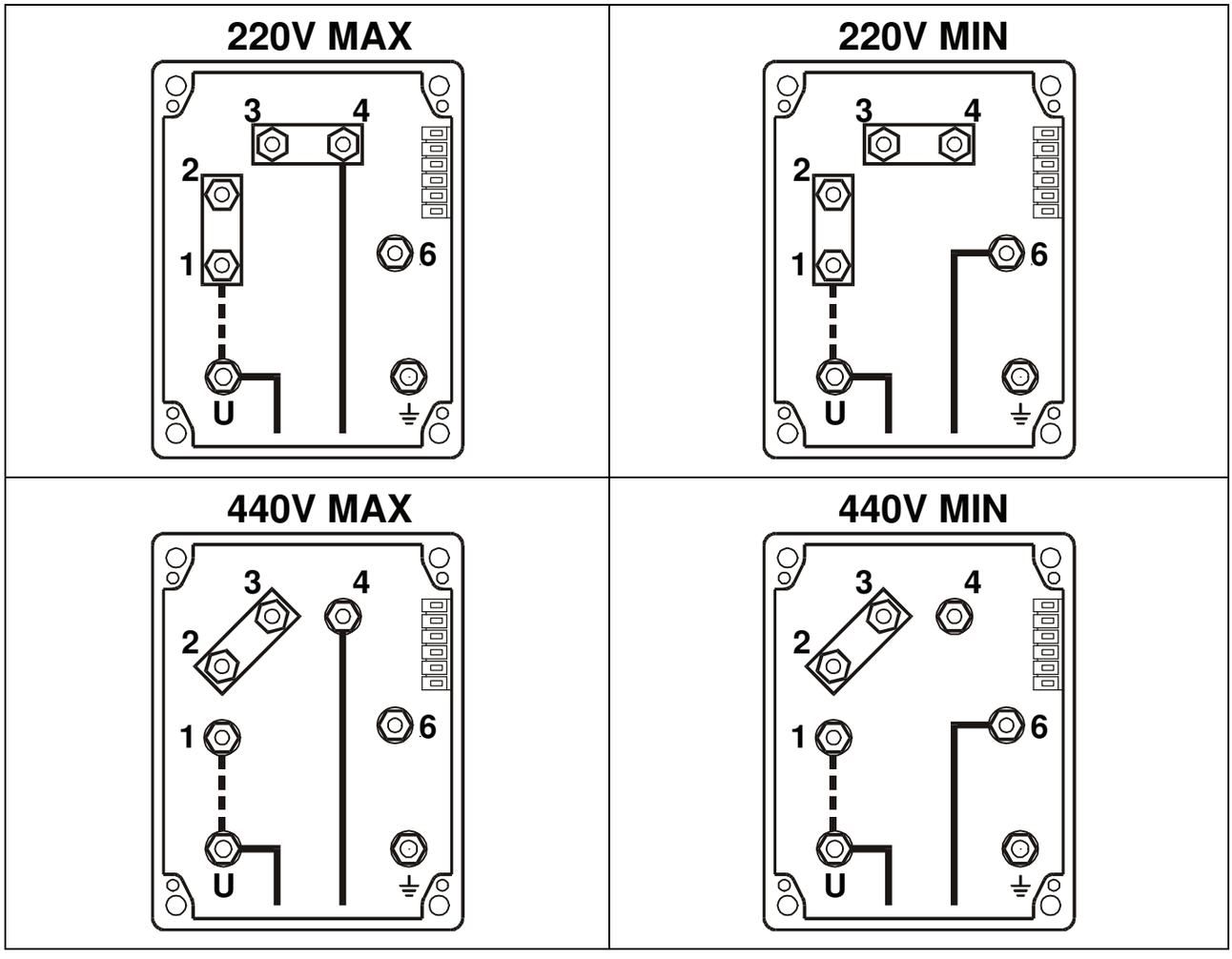
2. For 440 volt operation there must be a wire install in position “A” (see figure). If the wire is not installed in position “A” remove the wire from position “B” or “C” and reinstall it in position “A”.

3. For 220 volt operation the wire must be installed in position “B” (see figure)

The wire must be installed in position “A” **or** position “B” **not in both**.
The position of the labeled wire are not to be changed. The only wire you can change is on the opposite side of the labeled wires on the Terminal Barrier.

WELD TRANSFORMER WIRING

The transformer your 8207A is equipped is capable of 220 or 440 volt operation. To change the transformer voltage you must insure that the wire are on the correct taps and the copper connections are placed in the correct position. Follow the indications in this drawings.



The common wire remains the same for both voltages.

4 WORKING PROCESS

The welder has been designed for being used by an operator placed in front of the unit and working on the same working ground on which the welder is installed.
When arranging the working place, always follow the herewith stated instructions:

- Use a well ventilated area, free from dust, steam, and acid exhalations.
- The working place must be free from inflammable materials because the working can produce spatter of melted metal.
- Around the welder there must be enough room to carry out both working and maintenance in a comfortable manner and without any risk.
- If the welder is used to carry out welding processes which can cause smoke exhalations, there must be installed a proper aspirator.
- Do not install on the welder neither supporting tables nor equipment which either limit the approaching to the devices or make inaccessible or ineffectual the safety devices.

When switching on the welder, besides triggering the main switch, it is necessary to press also the control unit RESTART button. This device enables the welding control and supply the service circuit.

Before starting the working process, carry out the following adjustments:

1 - Mechanical set up
2 - Electrode force adjustment
3 - Welding parameters adjustment
4 - Calculation of the maximum welding rating

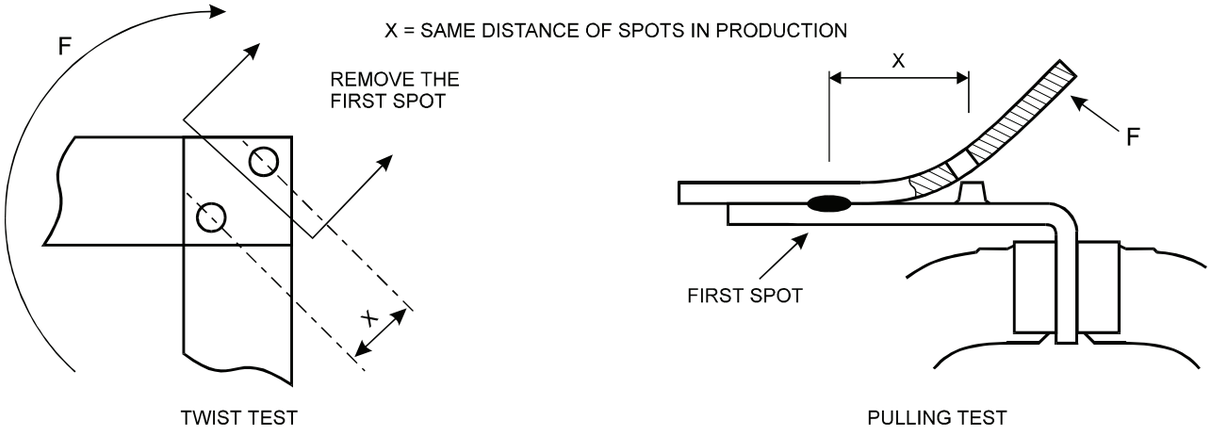
The following paragraphs carefully explain these different phases.

Before starting the working process:

- Check that all the safety instructions have been operated.
- Check that the correct device have been selected (by means of the TWO-HANDS / FOOT CONTROL push-button). Each time the type of production allows it, it is compulsory to use the unit by means of the push-buttons control device. The control device which is not employed must be detached and removed from the working place. Remember that on the control unit there is a 2 positions removable key-switch preventing the operator from freely modify the working conditions (with the consequent risk of altering the safety conditions); for further information, refer to the control unit instruction manual.
- Additional foot-control (which is supplied on request): if it is not used when working, disconnect it and remove it from the working place.
- Check that the automatic cycle is inserted only when it is really used.
- Check that the pneumatic circuit is supplied.
- Check the correct functioning of the control devices; at the first stage, the foot control must have a 10-12 mm stroke.
- Carry out some test cycles in order to verify both the cycle correctness and the operating speeds. These tests should be carried out without current circulation by means of the WELD/NO WELD selector placed on the control unit.

Before starting the welding process, check the welding conditions (time, pressure, etc.). If you are operating spot welding, use two off-cuts of the sheet to weld, carry out two spots at the same distance used during the production, then remove the first and check the second: the spot is

correct when the pulling test causes the coming out of the weld nugget with the hole of a sheet, and the twist test shows a pure area without porosity or causes the coming out of the nugget. Similar considerations and similar tests should be carried out also for projecting welding.



During the production it is advisable to monitor those parameters which can alter the working conditions and thus the welds quality. If you are operating spot welding, always monitor the electrodes which must always be clean, without any deformation and must have the proper diameter according to the work to be carried out. Check that there are not strong changing in the welder supply pressure as they could modify the force on the electrodes and thus the welding quality.

Do not use sealing products to remove water losses on the electrodes conic connection. To facilitate the electrode removal and to prevent from both cone seizure and water losses, use high conductivity grease similar to the standard one.

The cooling water must circulate inside the welder for a few minutes after having completed the production in order to allow the welder cooling. To prevent from both losses and moisture deposits, do not leave the cooling circuit open when the unit is not used.

Electrodes must not be used to force the clamping of the pieces to weld.

We recommend you to notice the adjustments carried out for each type of piece. In order to make it easier, a specific table has been added at the end of this manual.

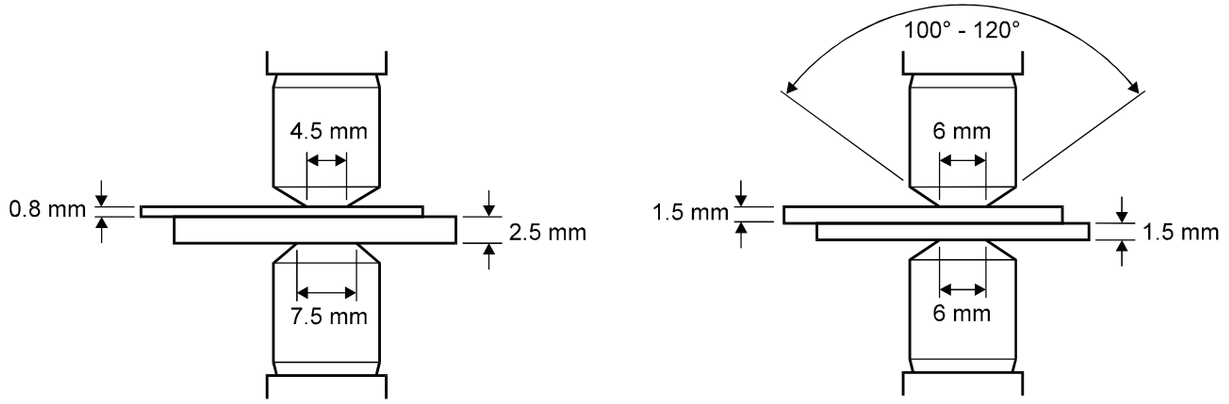
4.1 MECHANICAL SET UP

Spot welding electrodes adjustment.

With control unit set to NO WELD, the start device is activated; with the electrodes touching, contact between electrodes should be uniform. If required, carry out the adjustment. It is advisable to adjust electrodes with a fine file or with sandpaper. In case of steel welding, the electrodes diameter should correspond to the values shown on the following table.

Sheet thickness	mm	0,5	0,8	1	1,5	2	2,5	3	3,5	4
Required diameter	mm	4	4,5	5	6	7	7,5	8,5	9,5	11

Suggested electrode tip angle is 120 degrees. If the thickness of the two plates is different the electrode must have the diameter corresponding to the one required by the plate to which it gets in touch.



A too small diameter in comparison with the thickness to be welded produces spatter of melted material, sheets over mark, low spot quality. If the electrode diameter is too large, longer welding times are necessary, causing a higher heating of the welder and a shorter life of electrodes. For aluminium spot welding we suggest to use spherical electrodes, radius value varies according to the thickness to be welded and the kind of quality required.

Projection welding tools adjustments.

When assembling the tools on the projection plates, carefully follow the herewith stated instructions:

- Adjust the components in order to have them perfectly combine. To facilitate this operation, on the welding cylinder left side there is a hand-operated valve which enables the head descent by discharging the back pressure.

- Welding force must be equally distributed on the different welding spots; for this reason, tools must be parallel when the desired welding force is applied to them.

- Adjust stroke to the minimum value to increase the tool follow up.

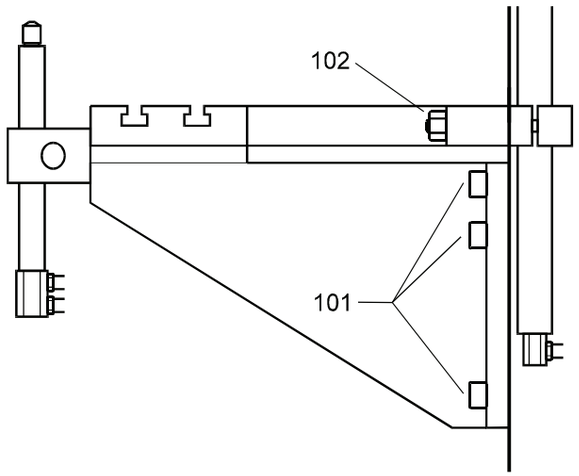
Working Stroke Adjustment

Adjust working stroke as short as possible to get:

1) Higher productivity.
2) Faster pressure rise time on the pieces to weld.
3) Higher follow up.
4) Higher working precision.
5) Reduced labour accident possibility.
6) Reduced air consumption.
7) Reduced noise.

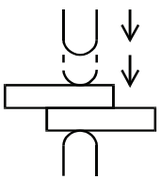
The working stroke can be adjusted either by moving the lower console or, if the unit is spot welding operated, by moving one of the two electrode-holders.

To adjust the lower console height, first slacken nuts 102, then slacken screws 101. Carry out the desired adjustment by means of the hydraulic jack, then tighten home first screws 101, then nuts 102.



The stroke adjustment must be carried out in order to avoid that the cylinder reaches the end of the stroke, limiting or cancelling by doing so the force on the piece. Remind that both electrodes and tools wear increases the working stroke.

When operating large-sized pieces spot welding it can be necessary to use a high stroke to be able to insert pieces among the electrodes. To allow the use of a reduced stroke even when operating in this way, this unit is equipped with a control device called “double stroke”. A key switch, placed on the welder and marked with the symbol hereby shown, enables to select two different electrodes gaps: the working stroke and the great gap used to position the piece. When the double-stroke is not used, the corresponding control key must be removed in order to avoid that its employ causes risks.



On request, on some welders it is assembled a foot-control device as the operator, who must hold the piece to weld, is not able to control also the key switch.
If the welder is equipped with the relevant option, it is possible to adjust the double stroke by means of the proper hand-wheel placed on the cylinder. Always carry out this operation keeping the double stroke disabled.

4.2 ELECTRODE FORCE ADJUSTMENT

The following paragraphs show how to adjust both the standard pneumatic circuit, and the optional one with a low force squeeze. The welding force must be selected taking into consideration both tables and personal experience, and in relation to the sheets thickness, the desired spot quality, etc.

Always adjust by keeping the welding control unit on "NO WELD" in order to avoid any risk caused by a wrong adjustment. Always carry out "NO WELD" cycle tests before starting the welding process.

An excessive electrodes force can cause:

- welding over marks;
- possible electrodes short life;
- weak welding or false welding due to a reduction of contact resistance, which allows the current to pass through without bringing the piece to the melting temperature.

An insufficient force on electrodes can cause:

- spatter of melted material;
- stuck weld of the pieces on the electrode;
- welding with a disagreeable outside surface.

If the welding to be carried out requires low or precise force values, it is advisable to use a dynamometer.

4.2.1 STANDARD PNEUMATIC CIRCUIT ADJUSTMENT

The electrodes force adjustment is carried out by means of the pressure control REG1. This carries out the pressure P1 adjustment, (displayed by pressure gauge MAN1), modifying the welding force. The reached force values, concerning the different pressure values showed on the pressure gauge, are listed in the following table:

PRESSURE			CYLINDER ∅125 (STANDARD)		CYLINDER ∅125 × 2 (OPTION 8235)	
bar	kPa	psi	FORCE in lbs	FORCE in daN	FORCE in lbs	FORCE in daN
0,5	50	7	134	61	227	103
1	100	14	269	122	456	207
2	200	29	540	245	912	414
3	300	43	811	368	1369	621
4	400	58	1080	490	1825	828
5	500	72	1351	613	2281	1035
6	600	87	1622	736	2738	1242

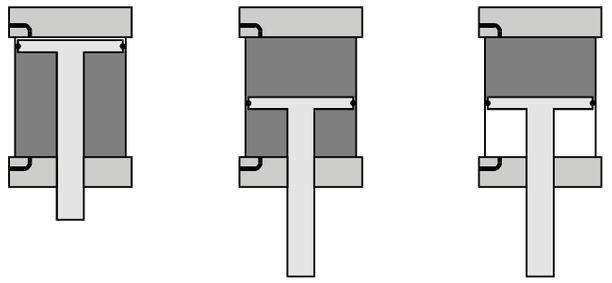
The head descent speed adjustment is carried out by means of the flow regulator RFL2; the rise speed adjustment is carried out by means of the flow regulator RFL1. The flow regulator RFL3 must be used in order to carry out the double stroke descent speed adjustment.

4.2.2 LOW FORCE SQUEEZE PNEUMATIC CIRCUITS ADJUSTMENT (OPTIONS 8238-8239)

On request, the welder can be equipped with a pneumatic circuit enabling the low force squeeze, useful especially for projection welding and with light alloys. The pneumatic circuit functioning varies according to the used pneumatic cylinder:

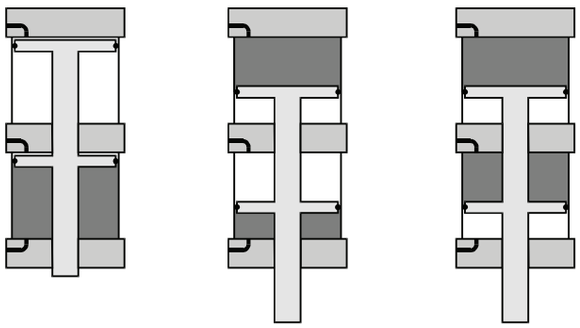
SINGLE STAGE (STANDARD)

The head low force descent is obtained by supplying both the cylinder lower and upper chamber. When the descent is over (after the SQUEEZE 1) the back pressure is removed in order to obtain the welding force.



DOUBLE STAGE (OPTION 8235)

The head low force descent is obtained by supplying both the cylinder lower chamber and one of the cylinder upper chambers. When the descent is over (after the SQUEEZE 1) the back pressure is removed and the other upper chamber is supplied in order to obtain the welding force.



The electrodes force adjustment is carried out by means of the pressure regulator REG1. This carries out the pressure P1 adjustment, displayed by pressure gauge MAN1, modifying both the welding and the squeeze force. The reached force values, concerning the different pressure values showed on the pressure gauge, are listed in the following table:

PRESSURE			CYLINDER ∅125 (STANDARD)		CYLINDER ∅125 × 2 (OPTION 8235)	
bar	kPa	psi	FORCE in lbs	FORCE in daN	FORCE in lbs	FORCE in daN
0,5	50	7	134	61	227	103
1	100	14	269	122	456	207
2	200	29	540	245	912	414
3	300	43	811	368	1369	621
4	400	58	1080	490	1825	828
5	500	72	1351	613	2281	1035
6	600	87	1622	736	2738	1242

The head descent speed adjustment is carried out by means of the flow regulator RFL2; the rise speed adjustment is carried out by means of flow regulator RFL1. The flow regulator RFL3 must be used in order to carry out the double stroke descent speed adjustment.

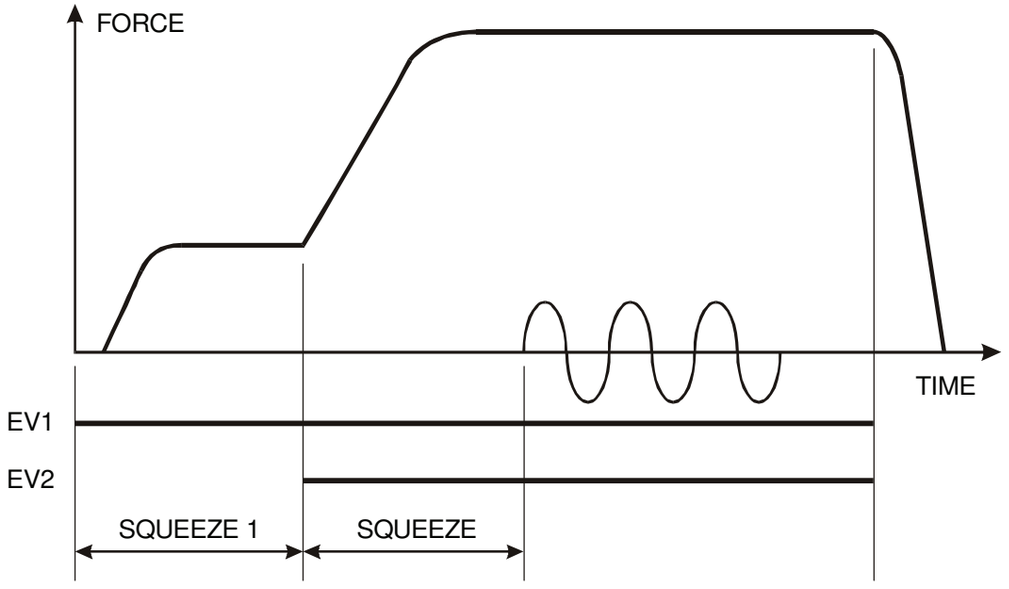
4.3 WORKING PROGRAM ADJUSTMENT

This operation consist in choosing the welding parameters and entering them directly on the welding control. Select parameters from table or personal experience taking into consideration the plate thickness, the welding desired quality etc..
Use short weld time to reduce the electrodes heating and to increase their life, avoiding at the same time oxidation on the contact surfaces. The best quality welds are obtained by using times as short as possible with high current and electrode force.
Notice that when operating pieces with different thickness, the welding parameters to be used are those referring to the lower thickness.

This welder can operate under two different working modes: single cycle and, by using only the foot device, automatic cycle. The adjustment instructions are stated on the welding control unit instruction manual. When working in automatic cycle, as long as the start-cycle control device is activated, the welder will repeat welding cycles at the settled off time. In single cycle, even though the start device is kept activated, the welding unit will stop after having carried out a single cycle; to carry out the next one, it is necessary first to release the device and then press it once again. **To prevent from any risk, use the automatic cycle only when it is really necessary; it must not be activated when it is not used**.

On welders equipped with option 8232, a rotary selector enables to select the required welding program. By adjusting the selector on “0”, the machine will work with the program selected on the control unit.

Welders equipped with low force squeeze:
Use a SQUEEZE 1 time long enough to allow the electrodes to reach the pieces to be welded before the welding force is activated.



Adjust SQUEEZE at a value high enough to allow the air coming out from the cylinder lower chamber (reaching, by doing so, the correct welding force) before the welding process starts.

4.4 CALCULATION OF THE MAXIMUM WELDING RATING

Before starting the production, it is necessary to check that the welding rating must not exceed the maximum welding rating allowed by the welder in comparison with the set welding conditions (time and current), otherwise causing a too high over heating.

The welder maximum welding rating is the function of the thermal load applied to the welder itself, depending from both the used time and welding current and from the numbers of welds for unit of time. With these different parameters it is possible to define the I_{th} value, that is the "equivalent thermal current at the duty cycle of 100%". Its value is calculated as follows:

$$I_{th} = \sqrt{\frac{\text{number of welding cycles per minute x (welding current in kA)}^2}{3600}}$$

The resulting value must be lower than the welder maximum one; this value is stated on the "technical features" paragraph. On the contrary, it is necessary to reduce the welding rate.

When different welding programs are employed or when using a welding cycle with post-heating, the value of these different currents must be calculate separately, then added in order to obtain the equivalent total value.

Example 1: Cycle without post-heating

Welding current = 41000 A
Welding time = 18 periods
5 welds per minute

$$I_{th} = \sqrt{\frac{(18\times 5)\times (41000)^2}{3600}} = 6483\,A$$

Example 2: Cycle with post-heating

Welding current = 30000 A
Welding time = 18 periods
Post-heating current = 11000 A
Post-heating time = 6 periods
8 welds per minute

$$I_{th1} = \sqrt{\frac{(18\times 8)\times (30000)^2}{3600}} = 6000\,A$$

$$I_{th2} = \sqrt{\frac{(6\times 8)\times (11000)^2}{3600}} = 1270\,A$$

$$I_{th} = \sqrt{(I_{th1})^2 + (I_{th2})^2} = \sqrt{6000^2 + 1270^2} = 6133\ A$$

The post-heating current value can be calculated by carrying out a weld at the post-heating power.

Example 3: Welds carried out with different welding programs.

2 welds per minute with:
Welding current = 30000 A
Welding time = 18 periods

$$I_{th1} = \sqrt{\frac{(18\times 2)\times (30000)^2}{3600}} = 3000\,A$$

6 welds per minute with:
Welding current = 22000 A
Welding time = 12 periods

$$I_{th2} = \sqrt{\frac{(12\times 6)\times (22000)^2}{3600}} = 3112\,A$$

$$I_{th} = \sqrt{(I_{th1})^2 + (I_{th2})^2} = \sqrt{3000^2 + 3112^2} = 4323\ A$$

NOTE: Above formulas are for 60Hz supply lines. For 50Hz supply lines excange the "3600" value with "3000".

5 SAFETY RULES

For a safe welder employ, the installation must be carried out by specialised personnel following all the instructions stated on the “INSTALLATION” chapter.

The welder maintenance must be carefully carried out by following all the safety instruction stated on the “MAINTENANCE” chapter. In particular, notice that the electrodes maintenance must be carried out with the welder switched off.

The welder should be operated only by trained personnel; in any case, **users operating the welder must be aware of the possible risks and must have both read and understood this manual.**
Only authorised personnel can carry out the welder adjustment. The welder adjustments affect the operative safety so much so that they must be carried out only by qualified personnel.

Carefully follow the instruction stated on the “WORKING PROCESS” chapter.
It is forbidden to have more people working on the welder at the same time.
No admittance allowed to the working area to people other than the operator.

The welder main risk is the squashing of the upper limbs caused by the moving of the mobile components: electrodes, electrode-holder, projection plate, tools, etc. For this reason, it is necessary to pay great attention and to follow all the instructions stated on this manual. In particular:

- Use the Two-Hands control each time that it is possible.
- Adjust the working stroke to the minimum allowed value.
- Avoid working with the hands nearby the mobile components.
- Use pliers or tools allowing the positioning of the pieces by keeping the hands far from the mobile components. These tools, which are often made of either insulating or non magnetic materials, allow to improve both productivity and mechanical positioning precision of both pieces and welds.
- When possible, place screens allowing to insert into the dangerous area only the pieces to be welded.
- Use sleight systems allowing to load and unload the pieces out of the welding area.

In case of water entering the welder, immediately stop the electrical supply.

Notice that these types of machines generate strong magnetic fields attracting metals and damaging watches, magnetic cards and magnetic data storage media. Since these magnetic fields can affect pace-makers, the wearers must consult their doctor before approaching to the welding area.

The personnel must wear both safety glasses and gloves. Avoid wearing rings, metal watches and clothes with either metal accessories or components.
When operating heavy working, high thickness and pieces with a difficult coupling, wear safety shoes and aprons, and use protection screens to protect the operator from possible split of melted materials.

The safety shoes must be worn each time the pieces, because of their shape or weight, bear risks requiring them.

Keep the nearby welder working area free from flammable materials. In case the material to be welded produces either smoke or exhalations, install a proper aspirator.

The noise produced by the welder depends mainly from the adjustments. To reduce the noise:

- Adjust the working stroke to the minimum value allowing to carry out the operation.
- Work keeping the double stroke activated.
- Adjust both the head rise speed and descent speed to low values.
- Periodically check the silencers.

In addition to the information stated on this chapter, always operate in accordance with all the relevant laws in force.

6 ACCESSORIES AND SPARE PARTS REQUEST

When ordering accessories, spare parts or expendable material please state: type of machine, year of manufacture, serial number, the voltage and frequency.

Available accessories:

70379 Additional electric foot-control for carrying out welding processes with direct recall of welding program No.2, equipped with stirrup for the connection with the main foot switch. Cable length 1.4 m. It cannot be connected to welders with option 8232 (selector for programs recall).

50115 Serial interface RS232, enabling the connection with a serial printer or a personal computer for production data recording.

7 MAINTENANCE

7.1 ORDINARY MAINTENANCE

This chapter states the necessary maintenance operations to be carried out for:

1) keeping the welding unit safe operating and preserving its efficiency;
2) avoiding the most common causes of wrong working worsening the welding quality.

GENERAL WARNINGS

Always disconnect both electrical and pneumatic supply before carrying out the following maintenance operations.

- Keep always the screws of both arms, electrode holder, plates and rigid/flexible connections well tightened.
- Remove oxidation from secondary circuit with fine sandpaper.
- Periodically lubricate (at least every 6 months) with some drops of oil the cylinder stem after having removed the grub screw on the piston base.
- Lubricate with grease the anti-rotation device; if necessary, adjustment can be made by means of both screws and nuts placed on the sides of the piston.
- Keep welder clean from dirt and metal scraps attracted by magnetic field generated by the welder during operation.
- Neither washing the welding unit with jets of water which could enter it, nor use strong solvents, thinner, nor benzine that could damage either painting or the machine plastic components.

ELECTRODES MAINTENANCE

Electrodes maintenance must be carried out with the welder switched off.

- When operating, the electrodes must be kept clean and their diameter must be kept suitable for the work to be carried out. Too worn electrodes must be replaced.
- When replacing electrodes, check that the tube bringing water to the electrode inside stops at a few mm from the bottom of the electrode hole.
- Do not use sealing products to remove water leakage on the electrode taper. To facilitate the electrode removal and to prevent from both taper seizure and leakage, use high conductivity grease similar to the standard one.

PNEUMATIC CIRCUIT MAINTENANCE

Pneumatic circuit maintenance must be carried out only by specialised personnel trained to accomplish it under safety conditions. When possible, maintenance must be carried out with the welder switched off and disconnected from the pneumatic supply, with the circuit free from left air. Pay attention to the welding cylinder descent following this operation.

- In case of air leakage, immediately stop operating and remove it.
- Periodically drain the moisture from the filter group.
- Periodically discharge also the moisture eventually present in the built-in small air tank by means of the tap placed at the bottom of the tank itself.
- Check pressure gauges calibration.
- Check the status of both compressed air and corresponding connections.

COOLING CIRCUIT MAINTENANCE

Cooling circuit maintenance must be carried out only by specialised personnel trained to accomplish it under safety conditions. When possible, maintenance must be carried out with the welder switched off and disconnected from the pneumatic supply, with the circuit free from left air.

- Check that cooling water circulates freely and in the required quantity and that the input temperature is included within 10 and 30°C.
- Check the status of both water hoses and corresponding connections.
- If, during the winter terms, the welder must be stored up in cool rooms, it is necessary to carefully drain first the cooling circuit to prevent from possible damages caused by frozen water.

ELECTRIC CIRCUIT

Electric circuit maintenance must be carried out only by specialised personnel trained to accomplish it under safety conditions. Disconnect electric mains before carrying out the following instructions as discharges coming from the supply can be lethal.

- Periodically check ground efficiency.
- Periodically check the safety device efficiency (emergency push-button, two-hand safety control, flow switch, etc.).
- Often check both the status and the proper working of the control devices and of the corresponding connecting cables.

7.2 EMERGENCY CONDITIONS WARNINGS.

In case of emergency, push the emergency push-button immediately stopping the welder working. This push-button is placed close to the welding cylinder and it is red on a yellow background. Once it has been activated, before restart the working it is necessary first to rotate this push-button to deactivate it.

If there take place any water leakage which could enter the welder, immediately disconnect the electric supply.

In case of fire do not use water but proper fire extinguishers.

The placing in service of the welder after an emergency condition must be carried out only by qualified personnel trained to accomplish all the machine necessary tests.

If the machine, by means of the emergency push button, is stopped during the welding process, it is necessary to execute the following procedure before restart production in order to restore the normal transformer magnetisation condition: perform some welds with an insulator between electrodes with different current adjustments, first low then progressively higher; remove the insulator between electrodes and execute some welds with a low current adjustment; at this point the procedure ends and the normal functioning conditions are restored.

Remember that the emergency push-button is a safety device. Do not use it for the normal switching off of the welder.

7.3 EXTRAORDINARY MAINTENANCE

This chapter states the maintenance operations to be carried out in case of:

1. lowering of the welder performances;
2. welder wrong operating;
3. welding faults.

7.3.1 LOWERING OF THE WELDING UNIT PERFORMANCES

Extraordinary maintenance must be carried out only by specialised personnel equipped with the proper instruments and trained to accomplish it under safety conditions. When possible, the welder must be disconnected from both pneumatic and electric supply.

If performances are lower than expected, check:

- That, during welding, line voltage drop is lower than 15%.
- That the supply cables section is adequate.
- That the electrodes diameter is appropriate for the work to be carried out.
- That cooling water circulates in the required quantity.
- That welding pressure shown by the pressure gauge is adequate for the work in process.
- That the pressure gauges works properly.

7.3.2 TROUBLESHOOTING

Troubleshooting must be carried out only by specialised personnel equipped with the proper instruments and trained to accomplish it under safety conditions. When possible, disconnect both electric and pneumatic supply.

In case of a wrong operating welder, use the following table for find out both fault cause and remedy.

FAULT	CAUSE	REMEDY
The control unit does not switch on. Control unit led ON keeps off.	Either connectors or cables disconnected.	Check.
	Fuses FU1-FU2 blown.	Replace them.
	Control unit fuse blown.	Replace it (see control unit use manual)
The control unit does not switch on. Control unit led ON is on.	Inadequate mains voltage	Check.
	Faulty control unit.	Replace it.
When operating the welding units blocks the cycle and the head rises up.	Excessive voltage drop.	Check that voltage drop is lower than 25%. On the contrary, check that supply cables section is adequate to their length.
The welder carries out the welding cycle without current circulation. Control unit CURRENT led, if present, is off during the welding cycle.	WELD/NO WELD function set to NO WELD	Set to WELD.
	Faulty control unit.	Replace it.
By pressing foot-control device the electrode descends but does not weld. Electrode rises up only when releasing the foot-control.	Inadequate or no water circulation. Flow Switch SF1 activated.	Check that water circulates in the required quantity. Eventually calibrate the Flow-switch.
	The foot-control device enables the micro-switch START but not the AUXILIARY one. The control unit AUXILIARY led switches on when pressing foot-control and keeps on until it is released.	Check both the foot-control connections and corresponding micro-switches. Check cams positioning inside the foot-control.

FAULT	CAUSE	REMEDY
The welder unit carries out the welding cycle without current circulation. The control unit CURRENT led, if present, lights.	Thermostat ST1 placed on SCR activated.	Check that water circulates in the required quantity and/or check the correct thermostat working.
	Either SCR or firing module wrong functioning. Firing modules led shows the presence of SCR trigger signals.	Identify the faulty component and replace it.
	Faulty contact in the secondary circuit	Check and tighten all the secondary connections. Do not forget the electrode and electrode-holder connection
No electrode descent. Welding control unit led EV1 lights.	Leak of compressed air.	It is shown by the corresponding manometer. Operate.
	Welding pressure inadequate.	It is shown by the corresponding manometer. Increase it by means of the pressure regulator.
	Broken connection between the control unit and the solenoid valve.	Check.
	Faulty solenoid valve EV1.	Replace it
Too slow or not uniform descent.	Inadequate welding pressure.	It is shown by the proper pressure gauge. Adjust it correctly by means of the pressure gauge.
	Faulty RFL2 flow-regulator adjustment.	Adjust it correctly.
Low electrodes welding force.	Low welding pressure.	It is shown by the proper pressure gauge. Adjust it by means of the welding pressure regulator.
	The back pressure is not removed before welding (optional pneumatic circuit).	Check that EV2 operates correctly and that the control unit corresponding led lights.

FAULT	CAUSE	REMEDY
The upper electrode does not rise up.	Low back pressure.	Correctly adjust the working pressure.
	Too closed flow regulator RFL1.	Correctly adjust it.
	Faulty solenoid valve EV2 (optional pneumatic circuit).	Replace it.
Spots or electrodes overheating.	Insufficient cooling.	Check that water circulates in the required quantity and at a low temperature.
	Too high welding current or welding time.	Reduce them.
	Too high post-heating time and/or current.	Change them.
Electrodes reduced life.	Insufficient cooling.	Check that water circulates in the required quantity and at a low temperature.
	Under-seized electrode in comparison with the work to carry out	Check both seize and contact diameter.
Secondary connections reduced life.	Insufficient cooling.	Check that water circulates in the required quantity and at a low temperature.
	Heating caused by an inadequate clamping of the flexible connection.	Carefully tighten the clamping screws.
	Too high heating caused by a too high welding rate	Reduce it.

7.3.3 REMEDIES FOR WELDS IMPERFECTIONS.

This chapter has been introduced in order to facilitate the troubleshooting of the most common imperfections caused by a wrong adjustment. Notice that each one can be caused by different causes as there are many parameters affecting the welding process. The following table specifically refers to low carbon steel spot welding, but, with the due considerations, it can be useful also for other applications.

FAULT	POSSIBLE CAUSE	POSSIBLE REMEDY
Weak welding	Low welding current.	Increase it.
	Low welding time.	Increase it.
	Too high electrodes force.	Reduce pressure.
	Lacking electrodes maintenance or too high electrodes diameter.	Clean and line up the electrodes, restore their dimensions.
	Faulty pieces contact.	Increase the electrodes force.
Spatter of melted material	Paint or dirt among pieces.	Clean the pieces.
	Inadequate electrodes cooling.	Check the cooling circuit.
	Faulty pieces contact or pieces and electrodes faulty contact.	Increase the electrodes force by increasing pressure.
	Too high welding current.	Reduce it.
	Too high welding time.	Reduce it.
	Too small electrodes diameter.	Adjust diameter to the value shown on the table.
	Inadequate welding force.	Increase pressure.
	Electrodes faulty clamping of the pieces.	Check stroke.
Burned welds or welds showing either craters or fissures.	Too high welding current.	Reduce it.
	Inadequate welding force.	Increase welding pressure.
	Oxidised pieces to weld.	Clean them by means of emery paper.
	Faulty pieces contact or pieces and electrodes faulty contact.	Increase electrodes force.
	Faulty pieces lining up.	Correct it.
	Electrodes tips deformations.	Restore them to the correct seize.
Pieces stuck weld on the electrode	Too high welding current.	Reduce it.
	Inadequate electrodes diameter.	Restore it to the correct dimensions.
	Inadequate welding force.	Increase the welding pressure.

8 ENCLOSURES

8.1 PRODUCTION FORM FACSIMILE

FIRM DATA

Firm	Department

WELDER DATA

Welder model	Number
Welding transformer connecting positioning	

PIECE TO BE WELDED

Description	
Code	Thickness
Material	Coating

WELDING PARAMETER ADJUSTMENT

Foreseen working with: ❑ FOOT-CONTROL ❑ TWO-HANDS CONTROL DEVICE	
Cycle foreseen working : ❑ SINGLE ❑ REPEAT	
Is during production foreseen the use of double stroke: ❑ YES ❑ NO	
Welding pressure adjustment bar	
Working stroke adjustment mm	Double stroke adjustment mm
Welding program number	Reached welding current kA

WELDING CONTROL UNIT TE500 PARAMETERS

PARAMETER	VALUE
WORKING MODE	
CONTROL MODE	
SQUEEZE 1	
SQUEEZE	
FORGE DELAY	
PRE-WELD	
PRE-POWER	
COLD 1	
SLOPE UP	
WELD 1	
POWER 1	
CURRENT 1	

PARAMETER	VALUE
N.IMPULSE	
COLD 2	
SLOPE DOWN	
COLD 3	
POST-WELD	
POST-POWER	
HOLD TIME	
OFF TIME	
CURR MIN	
CURR MAX	
ANGLE MIN	
ANGLE MAX	

POSSIBLE STEPPER FUNCTION ADJUSTING PARAMETERS

DELTA INCREMENT	SPOTS COUNTER

NOTES CONCERNING EITHER ELECTRODES OR WELDING TOOLS
(Electrodes type and diameter, maintenance and electrodes replacement terms, etc.)

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