WSI WELD SYSTEMS INTEGRATORS, INC.

RESISTANCE WELDING. SOLVED.

MEDIUM FREQUENCY RESISTANCE WELDER

ITEM 612XNX

INSTALLATION AND USE INSTRUCTION MANUAL

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1 INTRODUCTION

1.1 PRELIMINARY REMARKS

CAREFULLY READ THIS MANUAL BEFORE INSTALLING AND OPERATING WELDER.

The purpose of this manual and of the enclosed documents is to provide the necessary information so to enable a competent and safe use of the related product. It includes information about the safety, installation, use, maintenance and disposal of the product.

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 instruction manual is essential part of the product. It must be kept with care all the machine's operative life long and must always follow the welder in all the changes of property that it could have during its life.

The regular functioning and safety of the product may be achieved by respecting and observing the instructions described in this very manual. It is mandatory to cling to what is described in this very manual.

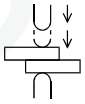
This welder has been designed for resistance welding of both ferrous and not ferrous (aluminium, brass) materials. The welder must not be used for other application, i.e. pieces heating, mechanical working carried out by using the electrodes force. The welder has been designed to be used by an operator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

TECNA S.p.A. is not responsible for any damage to both people, animals, things and to the welder itself caused by:

- failure to comply with all the requirements of the applicable safety standards;
- an incorrect installation;
- a misuse or a wrong use of the welder;
- a use not complying with what specified in this manual;
- serious deficiencies in maintenance;
- even slight changes or tampering or any unauthorized intervention;
- use of not-suitable spare parts, or of spare parts other than the original ones.
- total or partial failure to observe the instructions;
- exceptional events.

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.

1.2 SYMBOLS ON BOTH WELDER AND MANUAL

	WARNING! Danger of squashing.
	WARNING! The machine produces magnetic fields.
	Double stroke control device.

	Lifting point
	WARNING! Important safety information enclosed in this paragraph, read with particular care.
	WARNING! Fire risk
	Obligation to wear goggles
	Obligation to wear protective gloves
	No access to people wearing metallic implants
	No access to people wearing pace-maker
	Do not wear watches
	Prohibition of wearing magnetic stripe documents

1.3 STANDARD ACCESSORIES

The welder is supplied equipped with the following accessories:
N° 1 Allen wrench 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 TE700 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.

2 TECHNICAL FEATURES

2.1 IDENTIFICATION DATA

Item	
Year of manufacturing	2023
Serial number	
Mains voltage	480 V
Mains frequency	60 Hz
Optional:	
6130	Valve for the automatic block of the cooling circuit when the welder is off.
6131NX	Digital flowmetre.
6132	Rotary selector for the welding program recalling.
6133	Double stroke control device with pneumatic foot instead of key one.
6135	Cylinder 1242 daN (∅ 125 double stage) total stroke 100 mm / 3.93 inch.
6135/150	Cylinder 1242 daN (∅ 125 double stage) total stroke 150 mm / 5.89 inch.
6138	Low pressure squeeze for cylinder 736 daN.
6139	Low pressure squeeze for cylinder 1242 daN.
6140	Proportional valve.
6142/1	Position sensor.
6145	Cylinder 736 daN (∅ 125) total stroke 150 mm / 5.89 inch.
6147	Load cell.
6148	Control on suspended arm.
6149	Electrode cooling closing command with solenoid valve.
6033	USB interface board.

2.2 ELECTRICAL DATA

Item		6122NX	6123NX	6128NX
Nominal power at 50% duty factor	kVA	90	90	153
Maximum welding power	kVA	156	156	266
Short circuit output current	kA	30	30	40
Permanent output current at 100%	kA	5.6	5.6	6.5
No load output voltage	V	10.7	10.7	13.1
Delayed fuses	A	100	100	160
Minimum mains cables section for L = 30 m *	mm^2 awg	50 0	50 0	70 00
Minimum mains cables section for L = 60 m *	mm^2 awg	95 000	95 000	2x70 2x00

* 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.

2.3 MECHANICAL DATA

Item		6122NX 6128NX	6123NX
Electrodes throat depth	L = mm L = inch	535 21	800 31.4
Projection plates throat depth	D = mm D = inch	410 16.15	- - - - - -

Electrode-holder	Standard ∅ 1”1/4 L=8” Special .....
Electrodes cone	Standard 2MT Special .....
Projection plates	Standard centreline 63 mm for M12 nuts Special .....

Pneumatic circuit		Std ∅ 125 L=100	Opt ∅ 125 L=150	Opt ∅ 125 X 2 L=100	Opt ∅ 125 X 2 L=150
Electrode force per bar (100 kPa)	daN lbs	123 276	123 276	207 465	207 465
Electrode force at 6 bar (600 kPa)	daN lbs	736 1654	736 1654	1242 2792	1242 2792
Maximum stroke	mm inch	100 3.9	150 5.85	100 3.9	150 5.85
Adjustable Double stroke	mm inch	0÷80 0÷3.15	0÷100 0÷3.93	0÷80 0÷3.15	0÷100 0÷3.93
Working stroke	mm inch	5÷100 0.2÷3.9	5÷150 0.2÷5.85	5÷100 0.2÷3.9	5÷150 0.2÷5.85

2.4 COMPRESSED AIR CONNECTION DATA

Minimum pressure	bar kPa psi	6,5 650 94
Maximum pressure	bar kPa psi	10 1000 145
Hoses minimum inside diameter	mm inch	16 0.6

Consumption for 1000 spots at 6 bar (600 kPa)		Pneumatic cylinder Std ∅ 125 L=100	Opt ∅ 125 L=150	Opt ∅ 125x2 L=100	Opt ∅ 125x2 L=150
Standard pneumatic circuit					
with maximum working stroke	Nm^3	15,4	19,3	21,7	27,2
with 20 mm stroke and operating with maximum double stroke	Nm^3	4,6	6	9,4	12,2
Pneumatic circuit with low force squeeze (optional)					
with maximum working stroke	Nm^3	9,2	11,4	15,5	19,3
with 20 mm stroke and operating with maximum double stroke	Nm^3	2,9	3,8	6	7,8

2.5 COOLING CIRCUIT CONNECTION DATA

Maximum water pressure	bar kPa psi	4 400 58
Hoses inside diameter	mm inch	16 0.6
Minimum consumption for nominal power		
Item 6122NX-6123NX	l/min Gal/min	10 2.6
Item 6128NX	l/min Gal/min	12 3.2

2.6 ADDITIONAL FEATURES

Item		6122NX	6123NX	6128NX
Net weight of the machine	kg lbs	500 1102	550 1212	510 1124
Machine painting colour		Grey RAL7035		
Aerial noise produced (continuous acoustic pressure level produced; A weighed value)	dB(A)	75	77	75
Measurement position		h=1,60 m L=0,5 m		
Measurement condition				
Working stroke	mm	50	20	50
Welding time	ms	440	180	460
Welding current	kA	24	24	32
Working rating	welds/min	6	15	6

2.7 GENERAL WELDER DESCRIPTION

- Medium frequency welder. In comparison with a traditional welder, it offers the following advantages:
  - High mains Cos φ.
  - Reduced load on plant primary electrical service.
  - Balanced load distribution on the three phases.
  - No effect of magnetic materials between arms on the welding current.
  - Reduced installation costs.
- 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.
- Electrodes descent without pressure for set up and service.
- Lubrication free cylinder with chrome plated stem for heavy-duty works and long life.
- Water-cooled transformer, inverter, plates, electrode-holders and electrodes; transformers with epoxy resin coated windings.
- Adjustable double stroke with key control, adjustable antirotation device.
- Built-in compressed air filter unit and tank.
- Silencers for compressed air discharge.
- Two-hand safety control with timer for maximum safety, and removable key selector, standard on all models. The push buttons of the two-hand control are standard on projection models only (on request on spot welder models).
- Emergency push-button to stop the machine immediately.
- Automatic circuit breaker for protection.
- Flow-switch to prevent welding if water is not circulating (active either with recirculating water system or with city water).

OPTIONS:

6130 - Valve for the automatic block of the cooling circuit when the welder is off.
6131NX - The unit displays the current flow and temperature.
6132 - Rotary selector for recalling the welding programs, placed on the welder frontal side.
6133 - Double stroke with pneumatic foot control instead of a key one. To be used only for spot welding when the working necessarily requires it.
6135 - Cylinder 1242 daN (∅ 125 double stage) total stroke 100 mm.
6138 - Low-pressure squeeze for cylinder 736 daN (1654 lbs).
6139 - Low-pressure squeeze for cylinder 1242 daN (2792 lbs).
6140 - Proportional valve. Allows to adjust the working pressure directly from the control unit and to combine a proper pressure value to each program.
6142 - Position sensor.
6149 – Key selector that allows you to electrically close the electrode cooling, allowing the electrodes to be changed.
6033 - USB interface.

2.8 WELDING CONTROL TE700 DESCRIPTION

The TE700 is a microprocessor-based welding control unit for resistance welders equipped with inverter technology. The task of the welding control unit is to manage the components of the welder, specifically the IGBT power unit that adjusts the welding current.
The TE700 is a particularly versatile control unit since it can be adapted to different types of welders. In addition to the spot and projection welders, it may also be installed on seam welders and work with constant current, FIX, constant power, constant voltage, constant energy adjustment and in dynamic mode. The number of the inputs and outputs may be increased to better adapt the welding control unit to automatic machines.
The control unit can manage up to max 4 different welding transformers.
It is possible to store up to 300 different welding programs, 255 of which are recalled directly from an external device. An alphanumeric identifier may be associated with each program to simplify its identification. Each program comprises several programmable parameters that describe the work cycle. In addition to the plain 4-stage welding cycle, the control unit allows the running of welding processes with pre-welding current, post-welding current, slope and pulses.

MAIN FEATURES

- Simplified programming via 6 keys and a backlit alphanumeric LCD.
- Inverter command with medium frequency IGBT, with possibility of choosing the operating frequency of the inverter between 1000 Hz and 4000 Hz.
- Storage of up to 300 welding programs; 255 may be called from external devices.
- Possibility of associating an 8-character alphanumeric identifier with each weld program.
- Possibility of managing *as* many as 4 different welding transformers or one transformer and 4 different types of electrodes.
- Overheating protection for the welding transformers.
- Up to 32 programmable parameters for each program.
- Slope up, Slope down, pulses, pre-weld, post-weld functions and adjustment of the welding times with units of 1 mS.
- Display of the RMS of the welding current, energy, power, RMS of voltage to the electrodes, of the initial and final resistance, of the machine's thermal use percentage, of the machine's use percentage and, as an option, of the initial thickness of the welded material and the indentation at the end of the weld.
- 6 WORKING MODEs: conventional, constant current, constant power, constant voltage, FIX, constant energy, DYNAMIC mode.
- Limit indicators for: Current, voltage at the electrodes, energy, power, inverter use percentage, initial and final resistance of the material to be welded; thickness and indentation limit of the material (optional).
- Double stroke function.
- Stepper function to compensate the wear and tear of the electrodes with programmable curves and possibility of intervening independently on the time and the welding current through differentiated stepper laws. Possibility of using 4 different stepper options associated with 4 different spot counters associated with each weld program.
- Single and automatic cycle. WELD and NO-WELD function.
- Control of 5 solenoid valves 24 VDC max. 5 W with self-protected output.
- Self-adjustment to the mains frequency 50/60 Hz.
- Serial communication with insulated RS232 as an option.
- Output for proportional solenoid valve.
- Key for selecting foot control or two-hand control.
- Selectable languages: Italian, English, French, German, Spanish, Hungarian, Swedish or Portuguese.
- Possibility of upgrading control unit Firmware via appropriate software.
- Electrode tip dressing for up to max of 4 different spot counters (optional).

PROGRAMMABLE PARAMETERS

PARAMETER	RANGE VALUE
PROGRAM N.	001 – 300
WORKING MODE	IK – FIX – VEK – PWK – ENE - DYN
CONTROL MODE *	NO
SQUEEZE 1	0.5 – 99.0 cycles
SQUEEZE	00.0 – 99.0 cycles
PRESSURE	00.5 – 10.0 bar
FORGE DELAY	00 – 99 cycles
FORG.PRESS.	00.5 – 10.0 bar
PRE-WELD	0000 – 1000 mS
PRE-CURR.	000.30 – 200.00 KA
COLD 1	0000 – 1000 mS
SLOPE UP	0000 – 1000 mS
WELD	0001 – 2000 mS
CURRENT	000.30 – 200.00 KA
COLD 2	0000 – 1000 mS
IMPULSE N.	1 – 9
WELD 2	0000 – 1000 mS
CURRENT 2	000.30 – 200.00 KA
SLOPE DOWN	0000 – 1000 mS
COLD 3	0000 – 1000 mS
POST-WELD	0000 – 1000 mS
POST-CURR.	000.30 – 200.00 KA
HOLD TIME	00.5 – 99.0 cycles
OFF TIME	00.0 – 99.0 cycles

For further information concerning TE700 see the relevant instruction manual.

3 INSTALLATION

These paragraphs are addressed to the specialized 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. It is forbidden to use the machine in environments with explosive atmospheres or fire risk.
- 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.

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. This is mentioned on the machine by the symbol reported here beside. Consider to the welder weight stated on the “TECHNICAL FEATURE” paragraph.
All the materials that make up the package must be disposed of in compliance with the current laws on environmental protection.

3.3 PNEUMATIC INSTALLATION

The system which supplies the welder shall provide compressed air within the pressure limits and in the quantity stated on the paragraph “TECHNICAL DATA”. Pay attention to the hoses minimum diameter stated on the same paragraph.
Air shall be clean and free from oil and moisture.
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/manometer supplied by means of a one-way valve.
The machine is equipped with a filter unit, whose moisture 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 that do not require lubrication. The insertion of a lubricator in the equipment 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 / 86 °F 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 subjected to heating.
Different cooling circuit systems are available: with city supply water, with recirculating 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 avoiding the use of low temperature water (lower than 15-20 °C), 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 recirculating water supply, the water softener must be placed on the supply of the tank.
We recommend to use water with a maximum hard water of 10 °fH (French degrees). 1 °fH (French degree) corresponds to 0.56 °dH (German degree) and to 0.7 °eH (English degree).
Check that the water being used is clean. Suspended particles in the cooling liquid might sediment in the machine reducing or cancelling the cooling capability and causing serious damages. For this reason, it is always advisable to assemble a proper filter on the machine supply.
Once the installation has been carried out, it is necessary to check that the quantity of water mentioned in the paragraph “Technical Features” is actually flowing in the machine.

3.5 ELECTRICAL INSTALLATION

The installation should be carried out by qualified personnel, aware of safety rules, who closely adhere to the directions contained in this manual.

The welders described in this manual are designed only for professional purposes in industrial environments use. They must not be installed on public low voltage network, which supplies domestic premises. This can cause electromagnetic interferences.
The welder is designed for connection to Three Phase Four Wire Wye distribution systems only.
As this unit can be supplied for different power supply versions, before connecting the unit to the power line, check if the voltage shown in the features plate corresponds to the one of your power supply. The welder cannot be adjusted to work at different mains voltages.
When carrying out the supply line of the welder, consult the “Technical features” paragraph to determine the cables section to be used. These values are the minimum advised. However, they must be checked taking into consideration the installation conditions, the typology of the materials being used, the laws in force in the installation place.
On this paragraph you find also the values of the fuses which must be placed on the welder supply input. Fuses must be delayed type only.
It is compulsory to connect the welder to the protection circuit (ground circuit). Use a cable having the same section of the mains cables. Check that the system's protection circuit is efficient and complies with regulations in force.
In order to facilitate the maintenance operation, we recommend you to supply the welder by means of a mains disconnecting switch.
The welder is not designed to be supplied by power generators. Any use must be carefully considered to avoid the presence of supply overvoltages that can damage the machine.

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 following 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 supplies the service circuit. **Before pressing the button, check that this does not cause damages to both people and tools**.

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

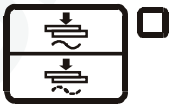
1 - Mechanical set up
2 - Electrode force adjustment
3 - Welding parameters adjustment
4 - Calculation of the maximum welding rating

The following paragraphs carefully explain these different phases.

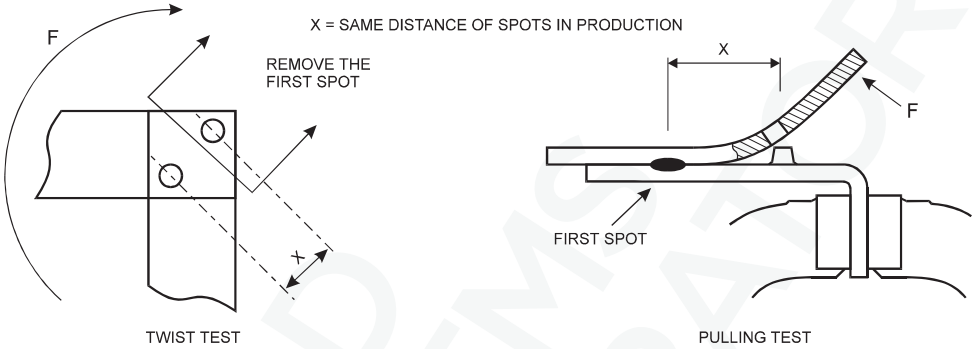
Before starting the working process:

- Check that all the safety instructions have been operated.
- Check that the correct device has been selected (by means of the TWO-HAND/FOOT CONTROL). 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 2 positions removable key-switch preventing the operator from freely modifying 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 control device WELD/NO WELD placed on control unit TE700.



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 that can alter the working conditions and thus the welds quality. If you are operating spot welding, always monitoring the electrodes which must always be clean, without any deformations 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 that 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.

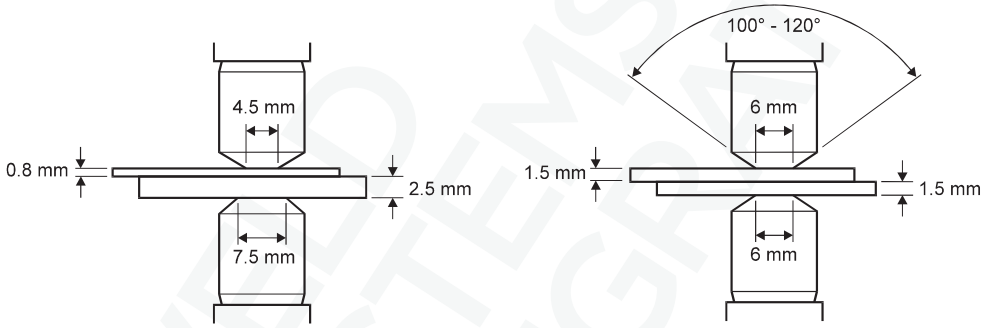
4.1 MECHANICAL SET UP

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 sand paper. 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 equipment on the projection plates, carefully follow the following 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 backpressure.
- 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.

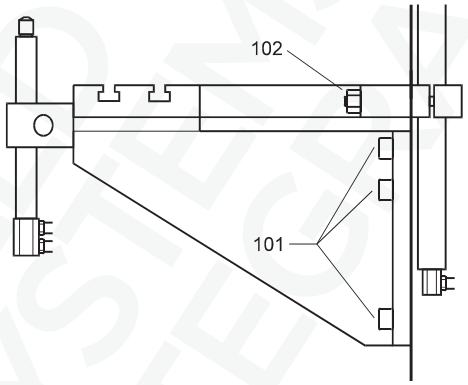
Working Stroke Adjustment

Adjust working stroke as short as possible to get:

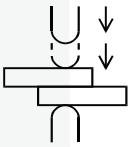
1) Higher productivity.
2) Faster pressure rise time on the pieces to weld.
3) Higher follow up.
4) Higher working precision.
5) Reduced labour accident possibility.
6) Reduced air consumption.
7) Reduced noise.

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 equipment 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 large 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 use 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.
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.
Upon demand, it is possible to have a proportional valve EVP to adjust the working pressure directly from the control unit and to combine a proper pressure value to each program. Assures constant and accurate working pressure.
The reached force values, concerning the different pressure values showed on the pressure gauge, are listed in the following table:

PRESSURE		CYLINDER ∅125 (STANDARD) FORCE		CYLINDER ∅125 × 2 (OPTION 6135) FORCE	
bar	kPa	daN	lbs	daN	lbs
1	100	122	274	207	465
2	200	245	550	414	930
3	300	368	827	621	1396
4	400	490	1101	828	1861
5	500	613	1378	1035	2326
6	600	736	1654	1242	2792

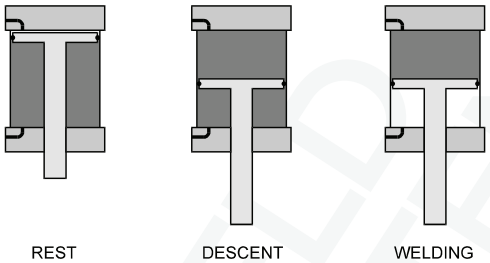
The head descent speed adjustment is carried out by means of the flow regulator RFL2; the rise speed adjustment is carried out by means of the flow regulator RFL1. The flow regulator RFL3 must be used in order to carry out the double stroke descent speed adjustment.

4.2.2 LOW FORCE SQUEEZE PNEUMATIC CIRCUITS ADJUSTMENT (OPTION)

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:

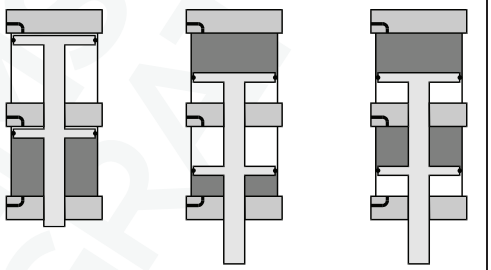
SINGLE STAGE (STANDARD)

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



DOUBLE STAGE (OPTION 6135)

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 1° SQUEEZE) the backpressure 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.
Upon demand, it is possible to have a proportional valve EVP to adjust the working pressure directly from the control unit and to combine a proper pressure value to each program. Assures constant and accurate working pressure.
The reached force values, concerning the different pressure values showed on the pressure gauge, are listed in the following table:

PRESSURE		CYLINDER ∅125 (STANDARD) FORCE		CYLINDER ∅125 × 2 (OPTION 6135) FORCE	
bar	kPa	daN	lbs	daN	lbs
1	100	122	274	207	465
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4	400	490	1101	828	1861
5	500	613	1378	1035	2326
6	600	736	1654	1242	2792

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.

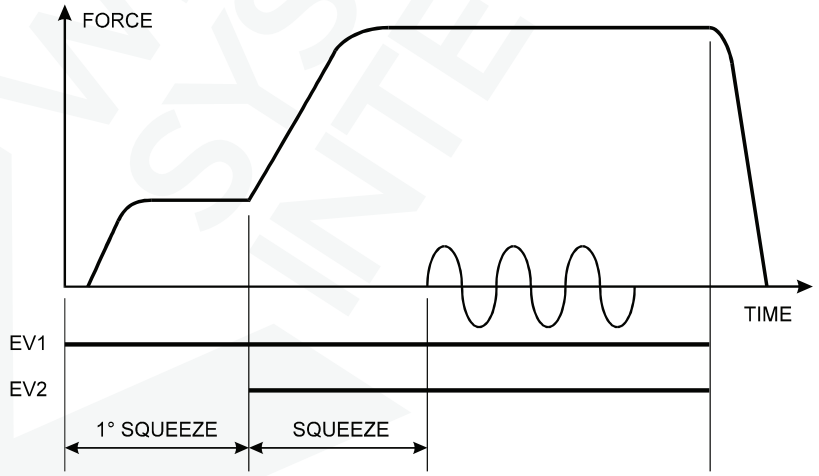
4.3 WORKING PROGRAM ADJUSTMENT

This operation consists 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 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 1° SQUEEZE 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 verify that the welding rating does not exceed the maximum limit 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 weld for unit of time. With these different parameters it is possible to define the I_{th} value, which is the "equivalent thermal current at the duty cycle of 100%". Its value is calculated as follows:

$$I_{th} = \sqrt{\frac{\text{number of welding cycles per minute x (welding current in kA)}^2}{60000}}$$

The resulting value must be lower than the welder maximum one. On the contrary, it is necessary to reduce the welding rate.

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

Examples:

Example 1: Cycle simple

Welding current = 41000 A
Welding time = 360 ms
5 welds per minute

$$I_{th} = \sqrt{\frac{(360 \quad 5) \times (41000)^2}{60000}} = 7101A$$

Example 2: Cycle with pre-weld

Welding current = 30000 A
Welding time = 360 ms
Pre-current = 11000 A
Pre-weld = 120 ms
8 welds per minute

$$I_{th1} = \sqrt{\frac{(360 \quad 8) \times (30000)^2}{60000}} = 6573A$$

$$I_{th2} = \sqrt{\frac{(120 \quad 8) \times (11000)^2}{60000}} = 1391A$$

$$I_{th} = \sqrt{I_{th1}^2 \quad I_{th2}^2} \quad \sqrt{(6573) \quad (1391)^2} = 6718A^2 + \quad =$$

The post-welding current can be calculated in the same mode.

Example 3: Cycle with pre-weld and post-weld

Welding current = 23000 A
Welding time = 280 ms
Pre-current= 15000 A
Pre-weld= 140 ms
Post-current= 9500 A
Post-weld= 80 ms
8 welds per minute

$$I_{th1} = \sqrt{\frac{(280 \quad 8) \times (23000)^2}{60000}} = 4444A$$

$$I_{th2} = \sqrt{\frac{(140 \quad 8) \times (15000)^2}{60000}} = 2049A$$

$$I_{th3} = \sqrt{\frac{(80 \quad 8) \times (9500)^2}{60000}} = 981A$$

$$I_{th} = \sqrt{I_{th1}^2 \quad I_{th2}^2 \quad I_{th3}^2} \quad \sqrt{(4444) \quad (2098) \quad (981)^2} = 5011A^2 +$$

Example 4: Welds carried out with different welding programs.

2 welds per minute with:
Welding current = 30000 A
Welding time = 360 ms

$$I_{th1} = \sqrt{\frac{(360 \quad 2) \times (30000)^2}{60000}} = 3286A$$

6 welds per minute with:
Welding current = 22000 A
Welding time = 240 ms

$$I_{th2} = \sqrt{\frac{(240 \quad 6) \times (22000)^2}{60000}} = 3408A$$

$$I_{th} = \sqrt{I_{th1}^2 \quad I_{th2}^2} \quad \sqrt{(3286) \quad (3408)^2} = 4734A \quad ^2 \quad + \quad =$$

5 SAFETY RULES

This paragraph contains important information on the safe use of the product. It is important that every user has read and understood its contents before operating the machine. It is mandatory to cling to what was stated.

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

Only trained personnel must operate the welder; 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 only qualified personnel must carry them out.

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, tools, etc. In order to avoid this risk, the electrodes stroke must be adjusted at a very low value, never higher than 6 mm, so to prevent the fingers insertion between the movable parts. If the features of the pieces to be welded require the usage of bigger strokes, relevant precautionary measures must be taken in order to avoid any risk. It is forbidden to use bigger strokes if the necessary precautionary measure are not taken.
Those measures can be:

- Use the Two-Hands control.
- 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.
- 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 any case, arrange the work so to avoid working with the hands nearby the mobile components.

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

Notice that these types of machines generate strong magnetic fields attracting metals (including metallic implants) and damaging watches, magnetic cards and magnetic data storage media.

The use of the machine by operators wearing implantable medical devices (e.g. pacemakers, hearing aids, metallic implant, etc.) is forbidden without previous medical approval.

The high electricity used by the machine to perform the welding can overheat any metal objects that inadvertently is subject to its passage. Avoid wearing rings, metal watches and clothes with either metal accessories or components.

During the welding process, spatters of melted materials may occur. This condition may particularly occur when operating heavy working, high thickness and pieces with a difficult coupling. In case, arrange

for appropriate protective screens. In any case, the personnel must wear proper protection devices: goggles, safety gloves and proper clothes.

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

Keep the welder's nearby working area free from flammable materials as the welding process may involve spatters of melted materials. In case of fire do not use water but proper fire extinguishers.

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 carrying 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.

The welder maintenance must be carefully carried out by following all the safety instructions stated in the "MAINTENANCE" paragraph. In particular, notice that the electrodes maintenance must be carried out with the welder switched off.

In addition to the information stated on this chapter, always operate in accordance with all the relevant regulations 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:

73070 - Additional welding foot-control with direct recalling of welding program n°2, equipped with connection plate for connecting to the main foot-control. Cable L=1,4m.

72628 - Two-hand safety control with timer for maximum safety The push buttons of the two-hand control are standard on projection models only.

71379 - 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 arms, electrode holder, plates and rigid/flexible connections well tightened.
- Remove oxidation from secondary circuit with fine sand paper.
- 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 antirotation 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 washes 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.

- Only In machines with option 6149, positioning the “ELECTRODE WATER” selector on OFF closes the cooling flow to the spark plugs, allowing the electrodes to be changed without having to turn off the machine. This operation blocks all machine functions until the selector is repositioned to ON.

PNEUMATIC CIRCUIT MAINTENANCE

Only specialized personnel trained to accomplish it under safety conditions must carry out pneumatic circuit maintenance. 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

Only specialized personnel trained to accomplish it under safety conditions must carry out cooling circuit maintenance. 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 (50 – 86 °F).
- Check the status of both water hoses and corresponding connections.
- If, during the winter time, 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

Only specialized personnel trained to accomplish it under safety conditions must carry out electric circuit maintenance. 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 totally disconnecting the welder from the electric mains. This push-button is placed close to the welding cylinder and it is red on a yellow background. Once it has been activated, before switching on the welder it is necessary first to rotate this push-button to disconnect it; on the contrary, it will be impossible to activate the main switch.

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

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

Only qualified personnel trained to accomplish all the machine necessary tests must carry out the placing in service of the welder after an emergency condition.

Remember that the emergency push-button is a safety device that has been designed and weighed specifically for this function. 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 WELDER PERFORMANCES

Only specialized personnel equipped with the proper instruments and trained to accomplish it under safety conditions must carry out extraordinary maintenance. 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 work properly.

7.3.2 TROUBLESHOOTING

Only specialized personnel equipped with the proper instruments and trained to accomplish it under safety conditions must carry out troubleshooting. When possible, disconnect both electric and pneumatic supply.

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

FAULT	CAUSE	REMEDY
Main switch does not close.	Emergency push-button activated.	Rotate emergency push-button to deactivate it.
	No mains voltage or mains voltage inadequate to operate coil minimum voltage.	Check that mains voltage is correct on all the three phases.
	Fuses FU4-FU5 blown.	Replace them.
	Faulty switch.	Replace it.
Main switch closes, but control unit does not switch on. Control unit led ON keeps off.	Fuses FU1-FU2 blown.	Replace them.
	Either connectors or cables disconnected.	Check.
	Control unit fuse blown.	Replace it (see control unit use manual)

FAULT	CAUSE	REMEDY
Main switch closes, but 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.
By pressing foot-control device the electrode don't descend, the display shows "FLOW-SWITCH / PRESSURE-SWITCH ACTIVATED".	Inadequate or no water circulation, or insufficient pressure air. Flow Switch SF1 activated.	Check that water circulates in the required quantity. Eventually calibrate the Flow-switch.
The display shows "BOOSTER NOT READY".	Thermostat placed on booster or thermostat placed on welding transformer activated.	Check that water circulates in the required quantity and/or check the correct thermostat working.
By pressing foot-control device the electrode descends but does not weld. Electrode rises up only when releasing the foot-control.	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.
The welder carries out the welding cycle without current circulation. Control unit CURRENT led is off during the welding cycle.	WELD/NO WELD control device set to NO WELD.	Set to WELD (led on)
	Faulty control unit.	Replace it.
Welding cycle carried out with reduced current circulation.	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 is on.	Lack of compressed air.	The corresponding manometer shows it (MAN5). Operate.
	Welding pressure inadequate.	The corresponding manometer shows it (MAN1). 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

FAULT	CAUSE	REMEDY
Too slow or not uniform descent.	Inadequate welding pressure.	It is shown by the proper pressure gauge (MAN 1). Adjust it correctly by means of the pressure regulator (REG1).
	Faulty Flow-switch RFL2 adjustment.	Adjust it correctly.
Low electrodes welding force.	Low welding pressure.	It is shown by the proper pressure gauge (MAN 1). Adjust it by means of the welding pressure regulator (REG 1).
	The backpressure is not removed before welding (optional pneumatic circuit).	Check that EV2 operates correctly and that the control unit corresponding led lights.
The upper electrode does not rise up.	Low backpressure.	Correctly adjust the working pressure (REG 1).
	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 size 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 WELDING TABLES

In order to facilitate the search for the best welding conditions, we have herewith inserted the following tables stating the approximate adjusting values. Notice that the same weld can be carried out under different working conditions, so much so that the following data are not binding ones.

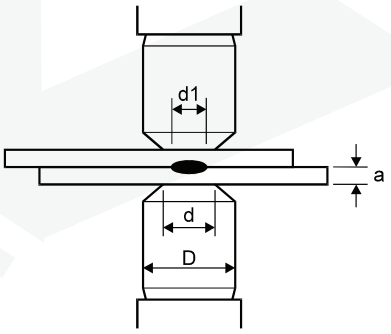
Low carbon steel spot welding

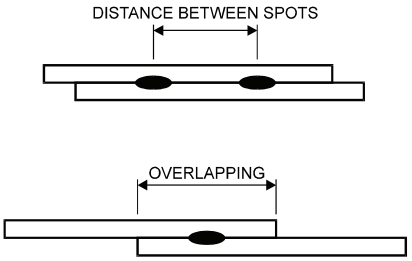
Welding class A

Thickness a mm	Spots minimum distance mm	Minimum overlap-ping mm	Electrodes D min mm	Electrodes d max mm	Electrodes force daN	Welding current kA	Welding time ms	Obtained nugget d1 mm
0.25	6	9.5	9.5	3	90	4	80	3
0.5	9.5	11	9.5	4.5	136	7	100	4
0.75	12.5	11	9.5	4.5	181	8	140	5
1.0	19.5	12.5	13	6.5	225	9.5	160	5.5
1.25	22.5	15	13	6.5	294	10.5	200	6
1.5	27	16	13	6.5	362	12	240	6.5
2.0	35	18	16	8	498	14	360	7.3
2.5	42	19	16	8	590	15.5	440	8.3
2.8	48	21	16	9	725	17.5	480	9
3.2	50	23	22	9	820	19	500	10

Welding class B

Thickness a mm	Spots minimum distance mm	Minimum overlap-ping mm	Electrodes D min mm	Electrodes d max mm	Electrodes force daN	Welding current kA	Welding time ms	Obtained nugget d1 mm
0.25	6	9.5	9.5	3	60	3.6	100	3
0.5	9.5	11	9.5	4.5	90	5	160	4
0.75	12.5	11	9.5	4.5	120	6.4	260	5
1.0	19.5	12.5	13	6.5	160	7.5	360	5.5
1.25	22.5	15	13	6.5	200	8.3	400	6
1.5	27	16	13	6.5	240	9	480	6.5
2.0	35	18	16	8	324	10.5	600	7.3
2.5	42	19	16	8	370	11.5	740	8.3
2.8	48	21	16	9	470	12.5	840	9
3.2	50	23	22	9	550	13.5	1000	10
4.0	68	32	25	11	640	14.4	1500	11.5

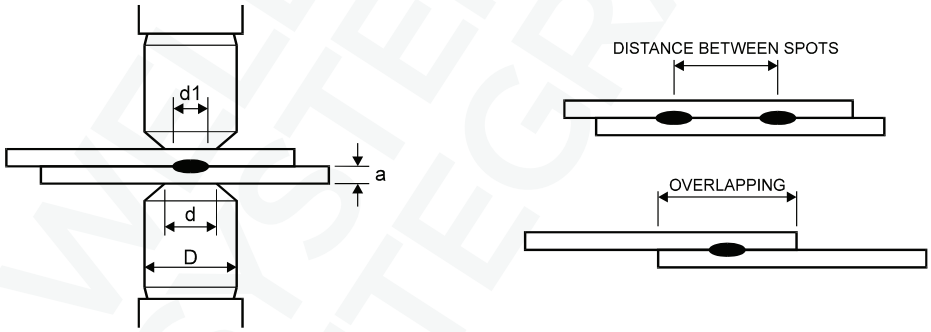




Stainless steel 18/8 spot welding

Thickness a mm	Spots minimum distance mm	Minimum overlapping mm	Electrodes D min mm	Electrodes d max mm	Electrodes Force daN	Welding current * kA	Welding current ** kA	Welding time ms	Obtained nugget d1 mm
0.2	5	5	5	2.5	90	2	2	60	1.4
0.3	6	6	6	3	120	2.1	2	60	1.4
0.4	8	6	6	3	150	3	2.5	80	2.2
0.5	8	8	6	4	180	4	3.2	80	2.5
0.6	11	10	10	4	235	5	4.1	80	3
0.8	12	10	10	5	295	6	4.8	80	3.3
1	16	11	10	5	410	7.8	6.3	80	4
1.2	20	12	12.5	6	545	9.5	7.5	140	4.8
1.4	22	14	12.5	6	620	10.3	8.3	180	5.3
1.6	25	16	12.5	6	680	11	9	180	5.6
1.8	28	16	16	6	770	12.3	10	200	6.3
2	32	18	16	7	860	14	11	240	7
2.5	35	20	19	8	1090	15.7	12.7	260	7.2
3	50	22	19	10	1500	18	15.5	340	7.65

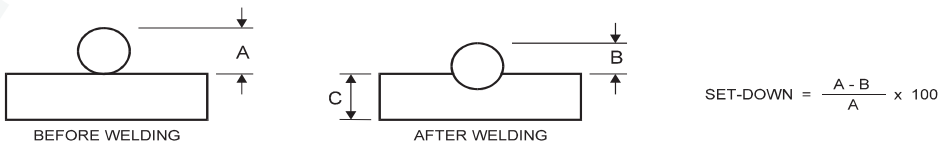
* for stainless steel with tensile strength up to 100 kg/mm²
** for stainless steel with tensile strength over 100 kg/mm²



Crossed rods welding of cold drawn low carbon steel

Rod diameter mm	Welding time ms	Set-down 15% Electrodes Force daN	Set-down 15% Welding current kA	Set-down 30% Electrodes Force daN	Set-down 30% Welding current kA
1.6	80	45	0.6	68	0.8
3.2	160	56	1.8	117	2.6
4.8	280	160	3.3	270	5
6.35	380	260	4.5	380	6.7
8	500	415	6.2	650	9.3
10	660	495	7.4	925	11.8
11	840	630	9.3	1300	13.8
12.5	1000	765	10.3	1530	15.8

N.B. In the welding of reinforced concrete rods there are cases in which with the same parameters you can weld different diameters, much higher.



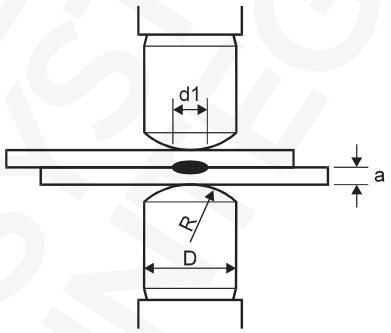
Aluminium spot welding

Welding Class A

Thickness a mm	Electrodes force daN	Welding current kA	Welding time ms	Electrodes D mm	Electrodes R mm	Obtained nugget d1 mm
0.5	180	18	100	16	50	3.5
0.75	230	24	120	16	50	4.0
1.0	250	30	140	16	50	4.5
1.5	320	35	180	19	100	5.5
2.0	400	40	200	19	100	6.5
2.5	520	49	220	19	100	7.5
3.0	600	58	240	25	100	8.5

Welding class B

Thickness a mm	Electrodes force daN	Welding current kA	Welding time ms	Electrodes D mm	Electrodes R mm	Obtained nugget d1 mm
0.5	140	16	120	16	50	3.0
0.75	160	18	140	16	50	3.5
1.0	180	21	160	16	50	4.0
1.5	240	25	200	19	50	5.0
2.0	280	29	240	19	50	6.0
2.5	340	33	260	19	50	7.0
3.0	370	36	280	25	50	8.0



Projection welding of low carbon steel

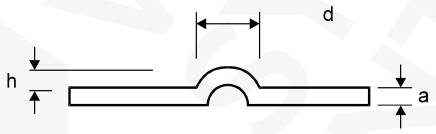
Projections dimensions

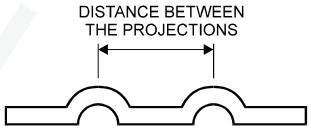
Thickness a	Projection		Minimum distance between projections	Minimum overlapping
	Diameter d	Height h		
mm	mm	mm	mm	mm
0.5	2.3	0.6	10	7
0.75	2.3	0.6	10	7
1.0	2.7	0.8	13	10
1.5	3.8	1	19	13
2.0	4.6	1.2	22	13
2.5	6	1.4	30	19
3.0	6.8	1.4	40	21

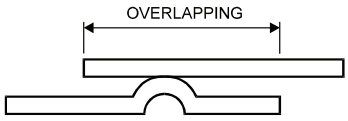
Welding parameters

Thickness	Single projection			1-3 projections (data for each projection)			3 or more projections (data for each projection)		
a	Time	Current	Force	Time	Current	Force	Time	Current	Force
mm	ms	kA*	daN	ms	kA*	daN	ms	kA*	daN
0.5	60	4400	68	100	3850	68	100	2900	36
0.75	60	5500	88	100	4450	68	140	3300	45
1.0	80	8000	150	160	6000	90	240	4300	70
1.5	160	10300	250	320	7650	166	400	5400	150
2.0	240	11850	365	480	8850	240	580	6400	215
2.5	300	14100	550	600	10600	370	800	8300	330
3.0	360	14850	680	740	11300	450	1000	9200	400

* Starting values.







8.2 PRODUCTION FORM FACSIMILE

FIRM DATA

Firm	Department

WELDER DATA

Welder model	Number

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	Reached welding current kA
Working stroke adjustment mm	Double stroke adjustment mm

WELDING CONTROL UNIT TE700 PARAMETERS

PROGRAM N.	
WORKING MODE	
CONTROL MODE	
SQUEEZE 1	
SQUEEZE	
PRESSURE	
FORGE DELAY	
FORG.PRESS.	
PRE-WELD	
PRE-CURR.	
COLD 1	
SLOPE UP	
WELD	
CURRENT	
COLD 2	
IMPULSE N.	
WELD 2	
CURRENT 2	
SLOPE DOWN	
COLD 3	
POST-WELD	
POST-CURR.	
HOLD TIME	
OFF TIME	

POSSIBLE STEPPER FUNCTION ADJUSTING PARAMETERS

DELTA INCREMENT 1	SPOTS COUNTER 1
DELTA INCREMENT 2	SPOTS COUNTER 2
DELTA INCREMENT 3	SPOTS COUNTER 3
DELTA INCREMENT 4	SPOTS COUNTER 4
DELTA INCREMENT 5	SPOTS COUNTER 5
DELTA INCREMENT 6	SPOTS COUNTER 6
DELTA INCREMENT 7	SPOTS COUNTER 7

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

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