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RESISTANCE SPOT WELDERS

MODELS: 4620N – 4630N

USER MANUAL

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1 INTRODUCTION

1.1 PRELIMINARY REMARKS

CAREFULLY READ THIS MANUAL BEFORE INSTALLING AND OPERATING THE WELDER.


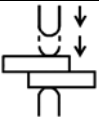
This manual is addressed to the factory responsible in charge who must release it to the personnel in charge of both welder installation, use and maintenance. He/she must check that the information stated on this manual and on the enclosed documents have been read and understood. The manual must be stored 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 (aluminum, brass) materials. The welder must not be used for other applications, i.e. pieces heating, mechanical working carried out by using the electrodes force. The welder has been designed for being used by an operator by means of the foreseen control devices. All modifications, even slight ones, are forbidden because they should invalidate the welder CE certification.

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! Important safety information enclosed in this paragraph.
	Double stroke control device.

1.3 STANDARD ACCESSORIES

The welder is supplied equipped with the following accessories:

- N° 1 Allen wrench set 5-6-8 mm.
- N° 1 Electrodes extractor.
- N° 1 High conductivity grease pot.
- N° 1 Fast clutch for hoses Ø 10 mm (for pneumatic circuit connection).
- N° 1 Wrap-it-ties and hose clamps set.
- N° 1 Spare silencers set. N° 1 Control unit instruction manual.
- N° 1 Welder use and maintenance manual.
- N° 1 Technical documentation booklet.

Additional standard accessory for items 4620N-4623N, 4627N, 4628N only:

- N° 1 Box wrench 30-32 mm.

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	
Serial number	
Mains voltage	V
Mains frequency	Hz.
Options	<input type="checkbox"/> 4631 TE180 control unit. <input type="checkbox"/> 4632 Constant current TE185 control unit.

2.2 ELECTRICAL DATA

Item		4620N	4621N	4622N	4623N	4625N	4626N	4627N	4628N	4629N	4630N
Nominal power at 50% duty cycle	KVA	35	35	50	50	35	50	35	50	35	50
Maximum welding power	KVA	75	62	104	82	67	84	68	87	64	84
Short circuit secondary current	kA	17.5	14	21	16.5	15.5	17	15.5	17.5	14.5	17
Maximum welding current on aluminum	kA	15.9	12.7	19.1	15	14.1	15.4	14.1	15.9	13.2	15.4
Maximum welding current on steel	kA	14	11.2	16.8	13.2	12.4	13.6	12.4	14	11.6	13.6
Short circuit secondary current											
with maximum throat depth	kA	12.9	10.9	14.3	12.2	-	-	-	-	-	-
with maximum gap	kA	-	-	-	-	-	-	11	12.6	10	12.1
Secondary thermal current at 100%	A	4500	4500	5700	5700	4500	5700	4500	5700	4500	5700
Secondary no load alternate voltage	V	5.4 4	5.4 4	6.1	6.1	5.4 4	6.1	5.4 4	6.1	5.4 4	6.1
Delayed fuses											
220 - 230 - 240 V	A	125	125	-	-	125	-	125	-	125	-
380 - 400 - 415 V	A	63	63	100	100	63	100	63	100	63	100
Mains cables section for L=10 m *											
220 - 230 - 240 V	mm ²	35	35	-	-	35	-	35	-	35	-
380 - 400 - 415 V	mm ²	16	16	35	35	16	35	16	35	16	35
Mains cables section for L=30 m *											
220 - 230 - 240 V	mm ²	50	50	-	-	50	-	50	-	50	-
380 - 400 - 415 V	mm ²	16	16	35	35	16	35	16	35	16	35
Mains cables section for L=60 m *											
220 - 230 - 240 V	mm ²	95	70	-	-	95	-	95	-	70	-
380 - 400 - 415 V	mm ²	35	25	50	35	35	35	35	35	25	35
Supply transformer minimum power **	KVA	87	72	120	95	78	97	79	101	74	97

* Section for every cable, calculated for PVC insulated, single conductor cables, considering the welder working at the maximum welding power, as well as 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.

2.3 MECHANICAL DATA

Item		4620N	4621N	4622N	4623N	4625N	4626N	4627N	4628N	4629N	4630N
Min. electrodes throat depth	L=mm	280	480	280	480	-	-	-	-	-	-
Electrode force at 6 bar (600 kPa)	daN	425	260	425	260	-	-	-	-	-	-
Working stroke	mm	5÷50	8÷77	5÷50	8÷77	-	-	-	-	-	-
Max. electrodes throat depth	L=mm	600	800	700	550	-	-	-	-	-	-
Electrode force at 6 bar (600 kPa)	daN	210	160	210	160	-	-	-	-	-	-
Working stroke	mm	8÷96	8÷125	8÷96	8÷125	-	-	-	-	-	-
Electrodes throat depth	L=mm	-	-	-	-	400	400	500	500	500	500
Electrode force at 6 bar (600 kPa)	daN	-	-	-	-	300	300	260	260	300	300
Total stroke	mm	-	-	-	-	5÷80	5÷80	5÷75	5÷75	5÷80	5÷80
Double stroke	mm	-	-	-	-	60	60	-	-	60	60
Minimum arms gap	mm	280	280	280	280	280	280	195	195	175	175
Maximum arms gap	mm	280	280	280	280	280	280	500	500	500	500
Arms diameter	mm	50	50	50	50	50	50	50	50	50	50
Electrode-holder diameter	mm	25	25	25	25	25	25	25	25	25	25
Electrodes cone	<input type="checkbox"/> Standard Ø (mm) <input type="checkbox"/> Special Ø (mm)	14.8	148	14.8	148	14.8	14.8	14.8	14.8	14.8	14.8
Net weight of the machine	kg	200	205	210	215	210	215	210	215	215	220

2.4 COMPRESSED AIR CONNECTIONS DATA

Minimum pressure	bar kPa	6.5 650
Maximum pressure	bar kPa	10 100
Hoses minimum inside diameter	mm	8

Item		4620N 4622N	4621 N 4623N 4627N 4628N	4625N 4626N 4629N 4630N
Consumption for 1000 spots at 6 bar (600 kPa)				
with maximum working stroke	Nm ³	6.2	6.2	5.4
with 20 mm working stroke and arms length adjusted to the minimum value	Nm ³	4.8	4.5	-
with 20 mm working stroke and operating double stroke	Nm ³	-	-	1.7

2.5 CIRCUIT CONNECTION DATA

Minimum water pressure	bar kPa	2.5 250
Maximum water pressure	bar kPa	4 400
Hoses inside diameter - input/output	mm	8
Minimum consumption for nominal power	l/min	4

2.6 ADDITIONAL FEATURES

Item	4620N	4621N	4622N	4623N	4625N	4626N	4627N	4628N	4629N	4630N
Color	<input type="checkbox"/> Standard: gray - RAL7032									
Machine painting color	<input type="checkbox"/>									
Aerial noise produced -Continuous equivalent acoustic pressure level; A weighed value (dB (A))	< 70	< 70	< 70	< 70	< 70	< 70	< 70	< 70	< 70	< 70
Measurement position	h=1.60 m L=0.5 m									
Measurement conditions										
working stroke (mm)	20	20	20	20	20	20	20	20	20	20
welding time (cycles)	14	21	15	24	17	23	17	22	20	24
welding current (kA)	13.1	10.5	16	12.4	11.6	12.7	11.6	13.1	10.9	12.4
working rating (welds/min)	15	15	15	15	15	15	15	15	15	15

2.7 WELDER MAIN FEATURES

ITEMS 4620N-4623N

- Rocker arm pneumatic spotwelder with microprocessor welding control unit.
- Adjustable arms depth up to 320 mm, enabling to adjust the welder according to the work exigencies. Arms gap 280 mm.
- Adjustable electrodes stroke, enabling to reach the max. working rate.

ITEMS 4627N-4628N

- Rocker arm pneumatic spotwelder with microprocessor welding control unit.
- Adjustable arms gap from 195 to 500 mm, enabling to adjust the welder according to the work exigencies. Arms depth 500 mm.
- Adjustable electrodes stroke, enabling to reach the max. working rate.

ITEMS 4625N-4626N

- Air operated linear action welding machine, equipped with microprocessor electronic welding control unit.
- Arms gap 280 mm, arms depth 400 mm.
- Cylinder with chrome plated stem for heavy duty works and long life. Adjustable anti-rotation device.
- Cylinder double stroke with hand control.

ITEMS 4629N-4630N

- Air operated linear action welding machine, equipped with microprocessor electronic welding control unit.
- Adjustable arms gap from 170 to 500 mm, enabling to adjust the welder according to the work exigencies. Arms depth 500 mm.
- Cylinder with chrome plated stem for heavy duty works and long life. Adjustable anti-rotation device.
- Cylinder double stroke with hand control.

STANDARD FEATURES ON ALL MODELS

- Chrome-copper electrode-holders for heavy duty and long life, designed for both straight and angled assembling.
- Water-cooled transformer, with epoxy resin coated windings.
- Water-cooled arms, electrode-holders and electrodes.
- Synchronous SCR contactor insulated from cooling water circuit with protection thermostat.
- Two stage electric foot control for clamping and welding pieces only if correctly positioned.
- The welder has been designed for connecting a second two stage electric foot. This additional electric foot enables the recalling of the twin pre-setting for time and current, useful when it is necessary to carry out two different welds on the same piece.
- Double effect pneumatic cylinder, lubrication free against oil mist.
- Electrodes force adjustable by means of a built-in compressed air filter unit with gauge-pressure, with semi-automatic moisture discharging.
- Electrodes speed regulators (both opening and closing), cylinder end-stroke shock absorber, and silencers for compressed air discharge assuring the minimum noise.

OPTIONS:

- 4631 Welding control unit model TE-180.
- 4632 Constant current welding control unit model TE-185.

2.8 WELDING CONTROL UNIT TE-90 DESCRIPTION

TE-90 is a microprocessor welding control unit for single-phase resistance welders. The welding control unit is used to control the welder components and in particular, the thyristor adjusting the welding current. The TE-90 working cycle is described through 12 programming parameters.

MAIN FEATURES

- Synchronous thyristor drive, phase shift control for welding current adjustment.
- Simplified programming by means of four push-buttons.
- Twin pre-setting for time and current, recallable by two independent controls.
- Slope and pulse functions.
- Single and automatic operating mode.
- Secondary current compensation function for the welding of oxidized sheets and rods.
- First phase shift delay adjustment. It enables the machine line current best balance.
- Control of solenoid valve 24 Vac 7.2 W Max with protected output against short circuits.
- "Watch-dog" safety circuit stopping the welder in case of control unit faulty operation, micro-interruptions or too high voltage drop.

For further information concerning TE-90 see the relevant instruction manual (No. MAN4072). On request the welder is supplied with other control units; the corresponding technical features are stated on the relevant instructions manuals.

3 INSTALLATION

These paragraphs are addressed to the specialized personnel in charge of both welder handling and installation. The drawing booklet includes the welder overall diagram, providing 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 welder has not been designed for being used in an open place.
- 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 spatters 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 carefully fixed to the floor 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 standard 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 centralized system or a compressor capable of supplying dry air cooled within the maximum pressure limits and in the quantity stated on the paragraph "Technical Features". Pay attention to the hoses minimum diameter stated on 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 liters, equipped with a gauge-pressure supplied by means of a one-way valve.

The machine is equipped with a filter unit; periodically discharge the moisture.

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 causes 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 the 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 cooling circuit inlet hose, this to avoid that deposits obstruct or reduce the water channels in the welder, thus causing damages. If the machine is operated in a re-circulating water supply, the water softener must be placed on the supply of the cooling water tank; the insertion before the machine generates 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 electromagnetic interferences.

Installation must be carried out by specialized personnel only, 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 the fuses which must be placed on the welder supply input. Fuses must be delayed type only. 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 not been designed for working with different voltages supply. If a voltage change is necessary consult your supplier for both the replacement of required parts and the new set-ups.

4 WORKING PROCESS

The welder has been designed for being used by an operator placed in front of the unit and operating on the welder same working plane. 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 spatters 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.

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

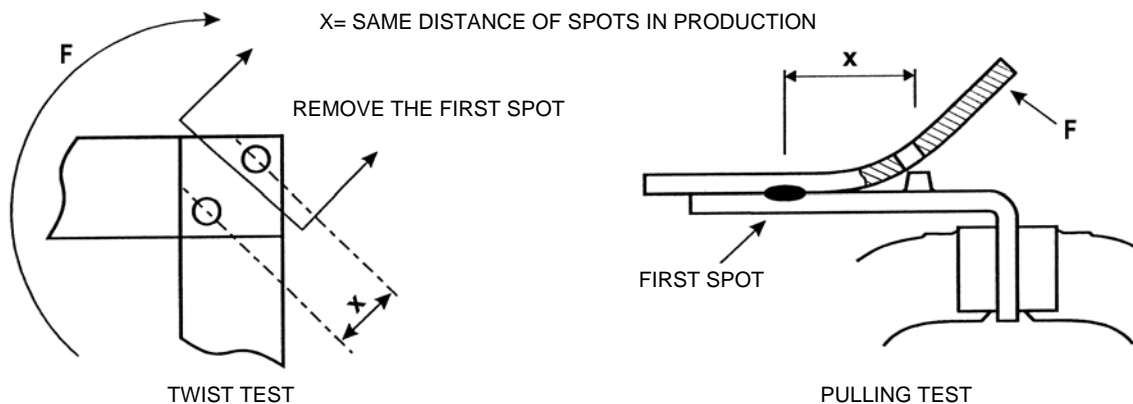
- 1- Mechanical set-up
- 2- Electrode force adjustment
- 3- Welding parameters adjustment
- 4- Calculation of the maximum welding rating

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 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.
- Additional foot-control (which is supplied on request): if it is not used when working, disconnect it and remove it from the working place.
- 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.). 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.



During the production it is advisable to monitor those parameters which can alter the working conditions, and thus the welds quality. 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 is not strong changing in the welder supply pressure as this 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

Arms and electrodes adjustment Items 4620N-4623N, 4627N, 4628N

The arms length can be adjusted in comparison with the different working exigencies. The lengthening of the arms causes a decreasing of the performances, so that it is advisable always to work with the shortest available length. Under working conditions, both arms and electrodes holder must be adjusted in order to have the electrodes tip coincide. Carry out some tests with the control unit on NO WELD mode, using the same electrodes force employed to carry out the work; place among the electrodes a thickness equal to that which must be weld. If it is necessary, pull out both arms and electrodes holder and carry out the adjustment operations.

It is advisable to adjust electrodes with a fine file or with sandpaper. The best performances can be reached by using sand paper folded upon a support having the same thickness of the sheets to weld.

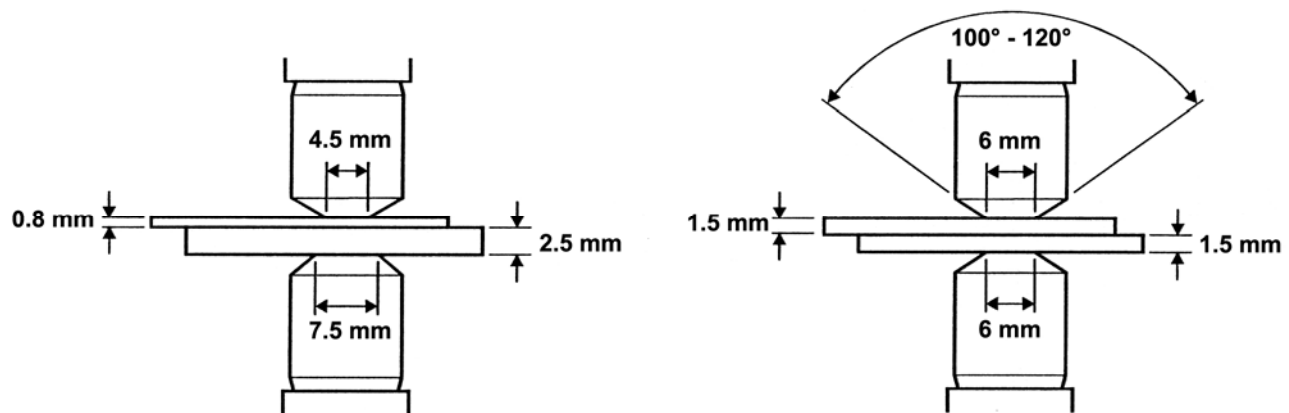
Electrodes adjustment Items 4625N-4626N-4629N-4630N

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 spatters 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 the electrodes. For aluminum spot welding we suggest to use spherical electrodes, radius value varies according to the thickness to be welded and to the kind of quality required.

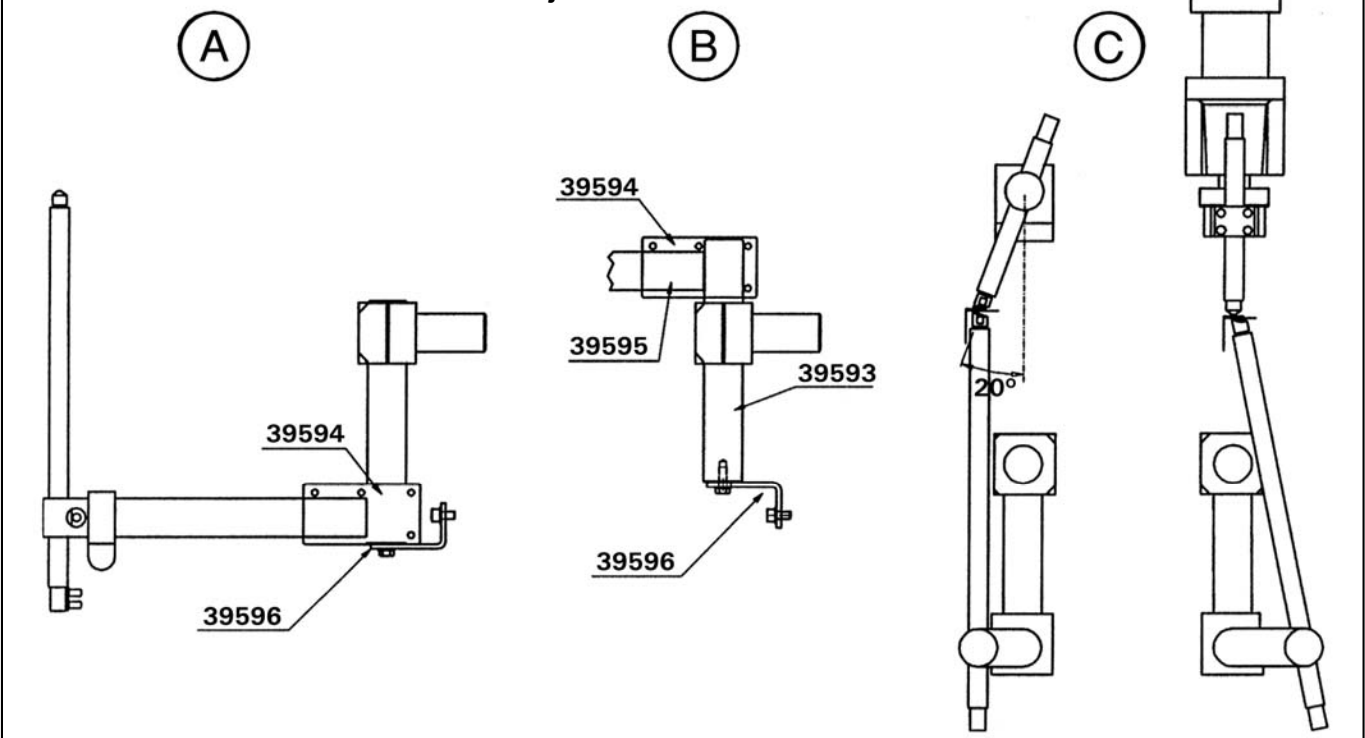
Arms, electrodes and arms gap adjustment Items 4627N-4628N-4629N-4630N

In these spot welders it has been chosen an electrode's depth fixed at 500 mm and an arms gap adjustable up to a maximum of 500 mm. The arms gap can be adjusted in order to meet different working exigencies; a large arms gap causes a decreasing of the performances so that it is necessary to take this into account when adjusting the welding parameters. It is possible to assemble the arms in different positions:

A - The arms gap can reach the maximum.

B - The minimum gap is obtained by turning upside down the support 39596 and by pushing upwards the arm-holder 39594.

C - When welding difficult-to-reach edges it is possible to put the electrodes out of alignment. The inclination should be kept within 20° max. so to avoid displacement under effort. Under working conditions, check that the electrodes tips coincide. Carry out some tests with the control unit on NO WELD mode, using the same electrodes force employed to carry out the work; place among the electrodes a thickness equal to that which must be welded. If it is necessary, pull out both arms and electrodes holder and carry out the adjustment operations. It is advisable to adjust electrodes with a fine file or with sandpaper. The best performances can be reached by using sand paper folded upon a support having the same thickness of the sheets to weld.

Item 4627N-4628N-4629N-4630N - Arms adjustment**Working Stroke Adjustment**

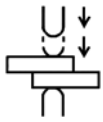
Adjust working stroke as short as possible to get:

- Higher productivity.
- Faster force rise time on the pieces to weld.
- Higher follow up.
- Higher working precision.
- Reduced labor accident possibility.
- Reduced air consumption and reduced noise.

The stroke adjustment must be carried out in order to avoid that the cylinder reaches the end of the stroke, limiting or clearing, by doing so, the force on the piece.

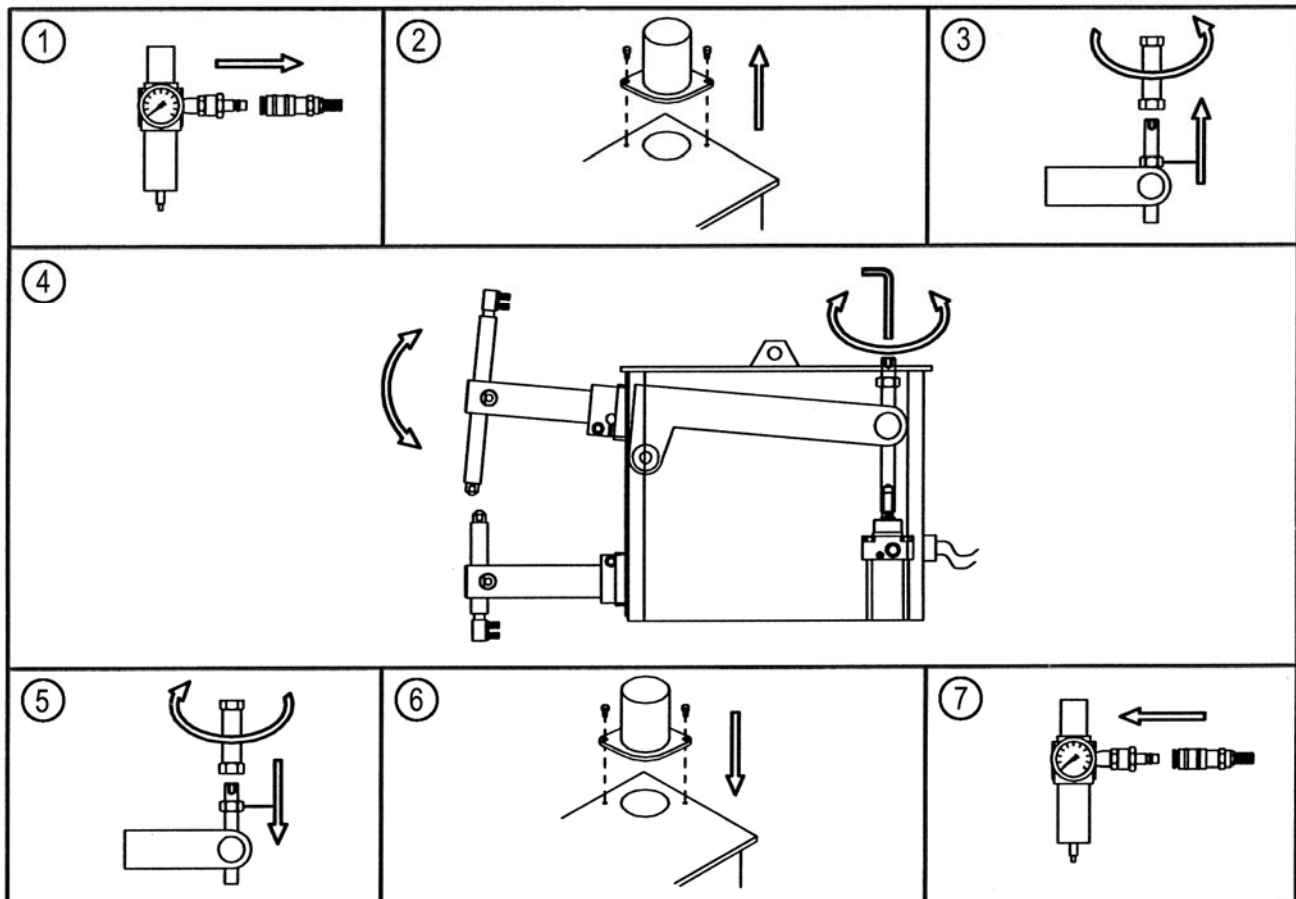
Remind that both electrodes and tools wear increases the working stroke.

Items 4625N-4626N-4629N-4630N: The working stroke can be adjusted moving one of the two electrode-holders. Since a high stroke is required in order to replace the electrodes, and a min. stroke is advisable when working, the welder is equipped with a control device called "double stroke". By means of the proper control device, marked with the symbol nearby shown, it is possible to select two different electrodes gaps: the working stroke (kept at the min. allowed value enabling to carry out the work); the great gap (used to replace the electrodes).



Items 4620N-4623N, 4627N, 4628N: The working stroke can be adjusted by carrying out the following operations:

- 1) Disconnect the pneumatic supply by means of the proper connection placed on the compressed air inlet.
- 2) Remove the safety protection.
- 3) Slacken lock nut by means of the box wrench supplied with the standard accessories.
- 4) Adjust the working stroke by turning the cylinder stem by means of an Allen key, 8 mm. The adjustment is carried out considering that, when clamping the pieces to weld, the arms must be in a parallel position.
- 5) Carefully tighten lock nut.
- 6) Assemble again safety protection.
- 7) Supply the pneumatic circuit.



4.2 ELECTRODE FORCE ADJUSTMENT

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 the contact resistance, which allows the current to pass through without bringing the piece to the melting temperature.

An insufficient force on electrodes can cause:

- Spatters 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.

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 MAN 1), 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 P1			Items 4620N-4623N				Items 4627N-4628N	Items 4625N-4626N 4629N-4630N
			Electrode force according to the arms length (daN)				Electrode force (daN)	Electrode force (daN)
bar	kPa	psi	280 mm	480 mm	600 mm	800 mm		
0.5	50	7	35	22	17	13	22	25
1	100	14	71	43	35	27	43	50
2	200	28	142	86	70	54	86	100
3	300	43	213	130	105	81	130	150
4	400	57	283	173	140	107	173	200
5	500	71	354	216	175	134	216	250
6	600	85	425	260	210	160	260	300

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.

4.3 ELECTRODE FORCE ADJUSTMENT

This operation enables to choose the welding parameters and to enter them directly on the welding control. Select parameters from table or personal experience, taking into consideration the plate thickness, the welding desired quality etc. We suggest using short welding times to reduce the electrodes heating, thus increasing their life, at the same time avoiding oxidation on the contact surfaces. The best quality welds are obtained by using times as short as possible with high current and high electrode force. Notice that when operating pieces with different thickness, the welding parameters to be used are those which refer 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.**

Adjust SQUEEZE time at a value high enough to enable the electrodes to reach the pieces to weld, as well as the chosen force, before the welding current is activated (especially in case of long stroke).

When the welding time is over, the electrodes must be kept closed for a few moments; the elapsing time is called HOLD time. This precaution enables to improve the weld quality. We recommend to set this parameter to a value corresponding to the half of the one chosen for the welding time.

4.4 CALCULATION OF THE MAXIMUM WELDING RATING

Before starting the production, it is necessary to check that the welding rating does 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.

To carry out this test, it is necessary to know the used welding current which must be measured with an adequate welding ammeter. Optional control units TE180-TE185 are equipped with a built-in ammeter.

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:

$$I_{th} = \sqrt{\frac{\text{welding cycles per minute} \times (\text{welding current in kA})^2}{3000}}$$

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 two different welding programs are employed, the value of the two welds must be calculate separately, then added in order to obtain the equivalent total value.

Example 1: Single welding program

Welding current = 13000 A, welding time = 15 periods, 8 welds per minute.

$$I_{th} = \sqrt{\frac{(15 \times 8) \times (13000)^2}{3000}} = 2600A$$

Example 2: Two different welding programs

3 welds per minute with welding current = 14000 A, welding time = 16 periods

6 welds per minute with welding current = 8000 A, welding time = 14 periods

$$I_{th1} = \sqrt{\frac{(16 \times 3) \times (14000)^2}{3000}} = 1771A$$

$$I_{th2} = \sqrt{\frac{(14 \times 6) \times (8000)^2}{3000}} = 1339A$$

$$I_{th} = I_{th1} + I_{th2} = 1771 + 1339 = 3110A$$

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

5 SAFETY RULES

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

The welder maintenance must be carefully carried out by following all the safety instructions 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 by trained personnel only; in any case, **users operating the welder must be aware of the possible risks and must have both read and understood this manual.**

Only authorized personnel can carry out the welder adjustment. The welder adjustments affect the operative safety so much so that they must be carried out by qualified personnel only.

Carefully follow the instructions 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. For this reason, it is necessary to pay great attention and to follow all the instructions stated on this manual. In particular:

- If the welder is equipped with optional control units TE180 or TE185, use, when possible, the two-hand control.
- 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 spatters 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 welder nearby 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 on the adjustments.

To reduce the noise:

- Adjust the working stroke to the minimum value allowing to carry out the operation.
- On items 4625N-4626N-4629N-4630N 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 always state: type of machine, year of manufacture, serial number, the voltage and frequency of the welder they must be assembled on.

Available accessories:

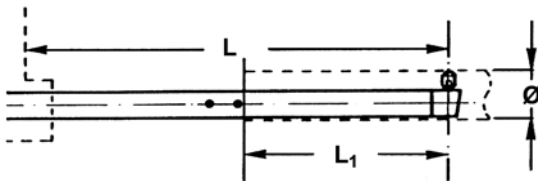
- 70379 Additional electric foot for carrying out welding processes with direct recall of welding program no. 2, equipped with stirrup for the connection to the main foot. Cable L=1.4 m.
- 70320 Two-hand safety control on pedestal (to be used only on welders equipped with optional control units TE180 - TE185).
- 50115 Serial interface RS232. It allows the connection with a serial printer or with a personal computer for the documentation of the production data (to be used only on welders equipped with optional control units TE180 - TE185).
- 4570 Brass arm with reduced overall dimensions, $\varnothing = 78$, D=50, $L_1 = 500$ mm (for items 4620N- 4623N).
- 4571 Brass arm with reduced overall dimensions, $\varnothing = 78$, D=50, $L_1 = 280$ mm (for items 4625N-4626N).
- 4577 Brass arm with reduced overall dimensions, $\varnothing = 78$, D=50, $L_1 = 280$ mm (for items 4627N-4630N).
- 4578 Brass arm with reduced overall dimensions with frontal electrode, $\varnothing = 60$, D=50, $L_1 = 280$ mm. With electrode holder item 4731, electrode item 4727, ring nut and fittings (for items 4627N-4630N).
- 4731 Electrode-holder with electrode item 4727, ring nut and fittings, to be assembled on the lower arm of welders item 4620N-4623N so to obtain a reduced arm with $\varnothing = 60$ mm, $L_1 = 500$ mm.

Expendable materials:

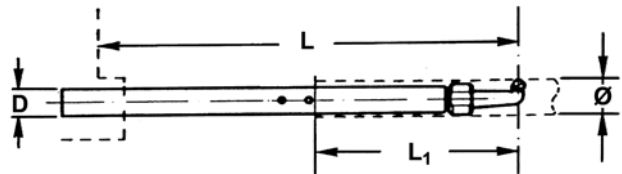
- 3620 Straight electrodes, a pair.
- 3621 Offset electrodes, a pair.
- 3622 Angled offset electrodes, a pair.
- 3623 Bent electrodes, a pair.
- 3624 Flat electrodes, a pair.
- 3625 Swivel electrode $\varnothing 30$ mm.
- 4727 Offset electrode for item 4731.
- 4729 Offset electrode for item 4731.

WARNING: On request, the welding unit can be supplied with a taper ratio other than standard. The listed items refer to the standard taper.

Item 4570-4571-4577



Item 4578



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.

- Always keep the screws of both arm, electrode holders, and rigid/flexible connections well tightened.
- Remove possible oxidation from secondary circuit with fine sandpaper.
- Keep welder clean from dirt and metal scraps attracted by magnetic field generated by the welder during the operation.
- Neither washing the welding unit with jets of water which could enter it, nor use strong solvents, thinner, nor benzene that could damage either painting or the machine plastic components.

Only Items 4620N-4623N, 4627N, 4628N:

- Periodically lubricate with grease and some drops of oil the welder joints (30106-30645-30647).

Only Items 4625N-4626N-4629N-4630N:

- 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.

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(s) 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 by specialized personnel only, 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.

- In case of air leakage, immediately stop operating and remove it.
- Periodically drain the moisture from the filter group placed on the welder supply inlet.
- Check pressure gauge calibration.
- Check the status of both compressed air and corresponding connections.

COOLING CIRCUIT MAINTENANCE



Cooling circuit maintenance must be carried out by specialized personnel only, trained to accomplish it under safety conditions. When possible, maintenance must be carried out with the welder disconnected from both electric and pneumatic supply.

- 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 the cooling circuit to prevent from possible damages caused by frozen water.

ELECTRIC CIRCUIT



Electric circuit maintenance must be carried out only by specialized personnel trained to accomplish it under safety conditions. Disconnect electric mains before carrying out the following instructions.

- Periodically check the ground efficiency.
- Check the power supply cable status.
- Often check both the status and the proper functioning of the control devices and of the corresponding connecting cables. At the first click the footswitch must have at least 10 mm stroke; at the second it must be at a few mm from the end stroke.

7.2 EMERGENCY CONDITIONS WARNINGS

In case of emergency, turn off the main switch immediately stopping the welder working.

In case of 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 stopped during the welding process, it is necessary to execute the following procedure before restart the production in order to restore the normal transformer magnetization condition: carry out some welds with an insulator placed between the electrodes with different current adjustments, first low ones, 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.

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 PERFORMANCES



Extraordinary maintenance must be carried out by specialized personnel only, 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 the performances are lower than expected, check:

- That, when 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 the welding pressure shown by the pressure gauge is adequate for the work in process.
- That the pressure gauge works properly.

7.3.2 TROUBLESHOOTING



Troubleshooting must be carried out by specialized personnel only, 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, follow the instruction stated on table 1 to find out both fault cause and remedy.

FAULT	CAUSE	REMEDY
The control unit does not switch on. Control unit led ON keeps off.	Inadequate or no mains voltage.	Check.
	Either connectors or cables disconnected.	Check.
	Fuse FU1 blown.	Replace it.
	Faulty main switch.	Check and eventually replace it.
	Faulty control unit.	Replace it.
	Control unit fuse blown (only optional control unit TE180-TE185).	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.	Too high 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 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.	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 unit carries out the welding cycle without current circulation. The control unit CURRENT led 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.	Lack of compressed air.	It is shown by the corresponding manometer. Operate.
	Inadequate welding pressure.	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.
The upper electrode does not rise up.	Low welding pressure.	Correctly adjust it.
	Too closed flow regulator RFL1.	Correctly adjust it.
	Faulty solenoid valve EV1.	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.
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 fault 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 usefully used 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.
Spatters 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.
	Oxidized 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.

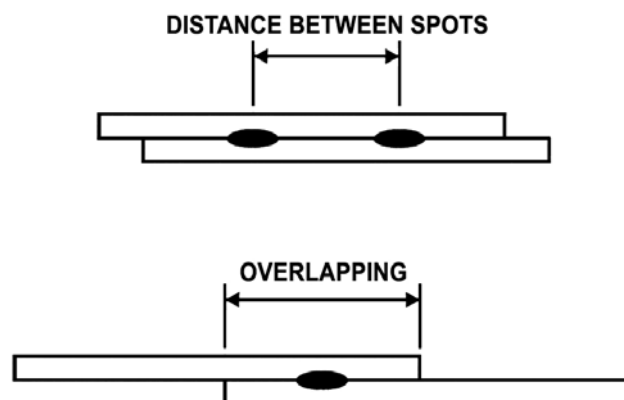
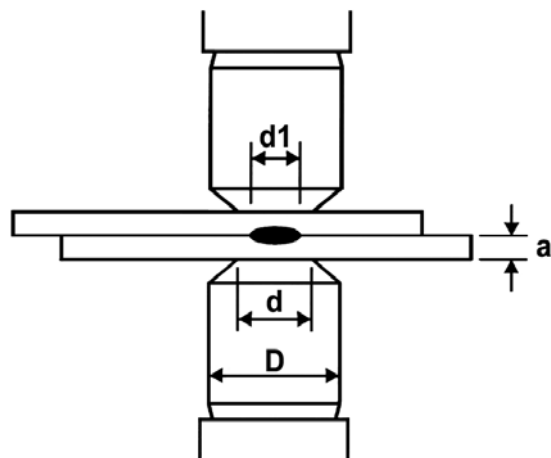
Low Carbon Steel Spotwelding

Welding class A

Thickness a mm	Spots min. distance mm	Minimum overlapping mm	Electrodes		Electrodes force daN	Welding current kA	Welding time cicli	Obtained nugget d1 mm
			D min mm	d max mm				
0.25	6	9.5	9.5	3	90	4	4	3
0.5	9.5	11	9.5	4.5	136	7	5	4
0.75	12.5	11	9.5	4.5	181	8	7	5
1.0	19.5	12.5	13	6.5	225	9.5	8	5.5
1.25	22.5	15	13	6.5	294	10.5	10	6
1.5	27	16	13	6.5	362	12	12	6.5
2.0	35	18	16	8	498	14	18	7.3
2.5	42	19	16	8	590	15.5	22	8.3
2.8	48	21	16	9	725	17.5	24	9

Welding class B

Thickness a mm	Spots min. distance mm	Minimum overlapping mm	Electrodes		Electrodes force daN	Welding current kA	Welding time cicli	Obtained nugget d1 mm
			D min mm	d max mm				
0.25	6	9.5	9.5	3	60	3.6	5	3
0.5	9.5	11	9.5	4.5	90	5	8	4
0.75	12.5	11	9.5	4.5	120	6.4	13	5
1.0	19.5	12.5	13	6.5	160	7.5	18	5.5
1.25	22.5	15	13	6.5	200	8.3	20	6
1.5	27	16	13	6.5	240	9	24	6.5
2.0	35	18	16	8	324	10.5	30	7.3
2.5	42	19	16	8	370	11.5	37	8.3
2.8	48	21	16	9	470	12.5	42	9

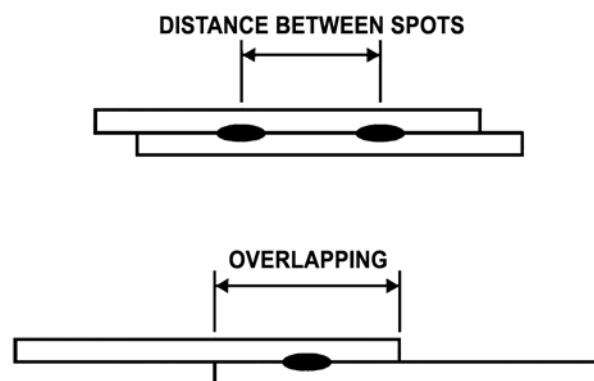
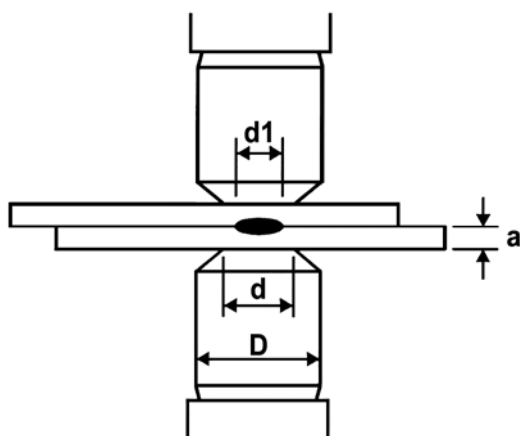


Stainless Steel 18/8 Spotwelding

Thickness a mm	Spots min. distance mm	Minimum overlapping mm	Electrodes		Electrodes force daN	Welding current		Welding time cicli	Obtained nugget d1 mm
			D min mm	d max mm		* kA	** kA		
0.2	5	5	5	2.5	90	2	2	3	1.4
0.3	6	6	6	3	120	2.1	2	3	1.4
0.4	8	6	6	3	150	3	2.5	4	2.2
0.5	8	8	6	4	180	4	3.2	4	2.5
0.6	11	10	10	4	235	5	4.1	4	3
0.8	12	10	10	5	295	6	4.8	4	3.3
1	16	11	10	5	410	7.8	6.3	4	4
1.2	20	12	12.5	6	545	9.5	7.5	7	4.8
1.4	22	14	12.5	6	620	10.3	8.3	9	5.3

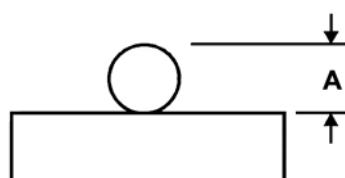
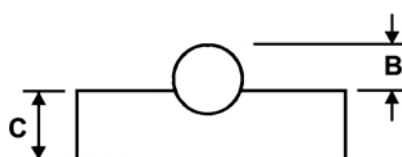
* for stainless steel with tensile strength up to 100 kg/mm²

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

**Crossed Rods Welding of Cold Drawn Low Carbon Steel**

Rod diameter mm	Welding time cicli/cycles	15% Electrodes force daN	Set-down 15% Welding current kA	30% Electrodes force daN	Set-down 30% Welding current kA
1.6	4	45	0.6	68	0.8
3.2	8	56	1.8	117	2.6
4.8	14	160	3.3	270	5
6.35	19	260	4.5	380	6.7
8	25	415	6.2	650	9.3

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

**BEFORE WELDING****AFTER WELDING**

$$\text{SET-DOWN} = \frac{A - B}{A} \times 100$$

8.2 PRODUCTION FORM FACSIMILE**FIRM DATA**

Company	Department
---------	------------

WELDER DATA

Welder Model	Number
Welding transformer connecting positions	

PIECE TO BE WELDED

Description	
Code	Thickness
Material	Coating

WELDING PARAMETER ADJUSTMENT

Foreseen working with: <input type="checkbox"/> FOOT-CONTROL <input type="checkbox"/> TWO-HANDED CONTROL DEVICE	
Cycle foreseen working: <input type="checkbox"/> SINGLE <input type="checkbox"/> REPEAT	
Welding pressure adjustment bar	Reached welding current kA
Working stroke adjustment mm	Arms length adjustment mm

WELDING CONTROL UNIT TE90 PARAMETERS

PARAMETER NUMBER	TYPE OF PARAMETER		VALUE
1	ACCOSTAGGIO	SQUEEZE	
2	TEMPO DI SALDATURA	WELD TIME	
3	CORRENTE	CURRENT	
4	MANTENIMENTO	HOLD	
5	INTERVALLO	OFF TIME	
6	COMP. / NON COMP.	COMP. / NO COMP.	
7	SALDA/NON SALDA	WELD / NO WELD	
8	TEMPO DI SALDATURA 2	WELD TIME 2	
9	CORRENTE 2	CURRENT 2	
10	SLOPE	SLOPE	
11	TEMPO FREDDO	COLD TIME	
12	NUMERO IMPULSI	IMPULSE NUMBER	

NOTES CONCERNING EITHER ELECTRODES OR WELDING TOOLS

(Electrode type and diameter, maintenance and electrode replacement terms, etc.)
