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OPERATING MANUAL

Plastic Welder
WORK SP 4000 CNC

CE

TABLE OF CONTENTS:

1. Introduction:

The Operating Manual of the WORK SP 4000 CNC welding machine is an integral part of the machine.
The technical description will provide you with all information needed for putting the machine into operation and its maintenance and repair.

!Warning

Read this Manual carefully and get acquainted with the important advices and notices, which, if not observed or implemented incorrectly, may lead to an injury of the operator(s) or other persons(s) or to damage to the machine or its neighbourhood.

2. Purpose:

This processor-controlled machine meets the German standards for welding of thermoplastics using a hot element DVS 2207; the construction of the machine is based on the DVS 2208 standard and it is designed for welding of thermoplastic boards of a thickness of 4 to 40 mm and a maximum length of 4,250 mm. The design enables to weld flat surfaces, as well as to roll plastic plates into rings with a minimum diameter of 440 mm for a 4 mm thick board.
The entire welding process runs in automatic cycle with the possibility to manually correct the dressing time.
The machine is equipped with a pneumatic system by SMC.
The moving parts of the machine are placed on play-free anti-friction guides by MATIS.
The machine is operated by one or two persons, depending on the size of the material welded. They insert the material into the machine under the clamping shoes from the working space consisting of the inserting table.
For easier handling of longer material for welding, the plastic welder can be supplemented by auxiliary tables fitted with ball bushings improving the board's movement on the table.

3. Technical Data

3.1 Identification Data:

Plastic welder	WORK SP 4000 CNC
Serial number	
Year of manufacture	
Customer	
Place of installation	
Date of shipment	
Date of commissioning	
Commissioned by	
Received on behalf of the Customer	
Warranty for	24 months (does not cover the Teflon foil and mechanical damage to the machine)

3.2 Technical Parameters:

- Length	5,700 mm
- Width	2,180 mm
- Height	1,300 mm
- Weight	2,850 kg
- Working length	4,250 mm
- Working height of the machine	950 mm
- Minimum thickness of the plastic board	4 mm
- Maximum thickness of the plastic board in case of solid material	40 mm
- Maximum thickness of the plastic board in case of a wall element	80 mm

- Minimum diameter for rolling the plastic board into a ring 440 mm for a 4 mm thick board

- Machine power input	8 kW
- Supply cable CYSY	5 x 4 mm²
- Operating voltage - power circuits	3 PEN 50Hz 400/230V
- The electrical equipment complies with Standard	EN 60204 - 1
- Air consumption	0.8 m^3 / hour
- Minimum pneumatic pressure	0.8 MPa
- Maximum pneumatic pressure	1.0 MPa

- Applied basic and technical standards see Point 3.3 of the Manual
- The noise level at the point of operation does not exceed 70 dB.

3.3 Basic Technical Standards and Regulations

The machine is labelled with the CE mark.
Our plastic welding machines of the WORK SP CNC type have a CERTIFICATE of the Reg. No. 07.978.288, issued by TÜV SÜD Czech s.r.o., Prague

It meets the requirements of Government Orders (European Directives):
Government Order No. 176/2008 Coll. (Directive 2006/42/EC),
Government Order No. 616/2006 Coll. (Directive 2004/108/EC),
Government Order No. 17/2003 Coll. (Directive 2006/95/EC).

Applied harmonized standards, national standards, and technical specifications:
ČSN EN ISO 12100:2011,
ČSN EN ISO 13850:2009,
ČSN EN ISO 4414:2011,
ČSN EN 349+A1:2009,
ČSN EN 953+A1 :2009,
ČSN EN ISO 13857:2009,
ČSN EN ISO 13849-1: 2009,
ČSN EN 61000-6-4 ed.2:2007,
ČSN EN 60204-1ed.2:2007,

4. Description of the Machine:

4.1 Welding Tables
Welding table is divided into two halves and serves for loading and transporting the material for welding. Both halves of the table are placed on the play-free anti-friction guides and their desktops are planed flat.

4.2 Table Drive
The welding tables are driven by pneumatic cylinders. The operating pressure is set and controlled to have always the required magnitude. The operator(s) can change the pressure as needed.

4.3 Clamping Beam
Each half of the table is fitted with a clamping beam with pneumatic cylinders. The pistons of the cylinders are equipped with clamping shoes that develop the force necessary to fasten the welded material to the welding table. These beams are vertically adjustable according to the thickness of the welded material.
Position 1 - 0–20 mm
Position 2 - 20–40 mm
Position 3 - 40–60 mm
Position 4 - 60–80 mm

4.4 Clamping Shoes
The clamping shoes press the welded material against the welding table and thus enable to utilize the pressure force. The shoes, lined with non-slip layer, are attached to the piston rods of the clamping cylinders, which are built inside the clamping beam. The shoes are partially swivelling. The clamping force cannot be changed, but it depends on the system pressure in the air distribution (max. 650N at 1.0 MPa).

Warning !

Pay special attention to safety when clamping the material! 

4.5 Heating Bar
The heating bar is designed for heating the welded surfaces before welding. The bar is made of duralumin alloy and is coated with Teflon foil to prevent the welded plastics from sticking. When more porous material is welded, the adhered material has to be wiped from the bar in the end.
The bar is equipped with resistance electric heating controlled by a processor. The heating bar is mounted on a holder in the guide and is set to the working position by means of pneumatic cylinders.

The entire heating bar unit can be set in four functional positions:

basic -	in the bottom position inside the machine
material clamping -	stop at the table height

dressing and heating - heating bar at the table height
cleaning - the unit sticks out above the clamping beams

Warning !
Pay special attention to safety when handling!

4.6 Control Panel
The control panel is designed for the control and operation of the machine. It is located on the upper side of the switch board and contains control elements and a colour touch screen for comprehensive setting and control of the entire machine.

5. Instructions for Occupational Safety

5.1 General Safety Instructions
The equipment may only be operated by persons demonstrably familiar with the Operating Manual and meeting the qualification requirements for the operation of the equipment. The familiarization of the operator(s) may only be provided by the equipment manufacturer or by a person/organization authorized by the manufacturer.
The operator(s) must be equipped with personal protective equipment according to the user's instructions.
Recommendation: asbestos gloves.
The machine may only be used for the purposes corresponding to its technical parameters. (See Chapter 3.2 - Technical Parameters.)
The machine must be in proper technical condition corresponding to this documentation.
All maintenance on the machine may only be performed by a person demonstrably instructed and trained for such purpose.
The surroundings of the machine shall be tidy and free within at least 0.8 m in all directions.
For trouble-free operation of the machine, the air must be free of moisture, oil, and impurities.

Caution !
The equipment must not be operated by any person who has not been demonstrably trained by the manufacturer!

5.2 Safety Instructions for Operation
Before the start of work, the operator must check the technical condition of the machine. If any defects are found, the machine must not be operated until the defects are remedied.
After the end of works on the machine, switch off and lock the main switch, close the main air supply, and release the compressed air. It is forbidden to perform any works which the machine is not designed for. The machine works in automatic cycle, so any unauthorized persons are prohibited from staying in the machine's working area, and the authorized person is obliged to use special caution.

5.3 Safety Instructions for Maintenance
Maintenance and repair may only be performed by an employee who is demonstrably familiar with the design, function, and operation of the machine and is authorized by the user for the purpose.

Warning !
The safety guards must never be removed during the operation of the machine! Their removal

is only possible after switching off and locking the main switch on the control panel, closing the main air supply, and releasing the air from the pneumatic system.

6. Customer/Supplier Relations

6.1 Acceptance, Transport, Construction Preparation, Installation

Acceptance - the Supplier is obliged to invite the Customer by a registered letter or another data transfer means at least 7 days before the acceptance date, unless a shorter period has been agreed. The Customer takes part in the acceptance at their own expenses.
If the machine received does not meet the technical conditions, the Supplier is entitled to repair the machine and submit it for tests again within two weeks at the latest. The costs of the repeated acceptance are borne by the Supplier.

The manufacturer provides - loading of the machine and its securing at the loading.
Transport - the machine must be handled with special care.
Before the transport, the machine is prepared, packed, and secured by the manufacturer so that the machine or any of its parts cannot be damaged during the transport.

Way of handling: The machine should be preferably handled using a forklift (minimum lifting capacity of 3,000 kg). Take it using extended skids from the side under the base of the table.
When handling by means of a crane, suspend the machine by means of a textile rope by the bottom base so as not to damage the moving tables or covers; in the respective points, set suitable wooden blocks under the rope. When suspending, take care of correct balancing. Use a rope with a minimum carrying capacity of 2 x 1,500 kg and length 2 x 7 m.

Warning !
Pay special attention to safety when handling.

The Customer provides - unloading and storage in a space without direct climatic influences.

Storage - the machine shall be stored in dry places at a temperature of 5 °C to 40 °C with a relative humidity of 30% to 80%.

Construction preparation:
- Electric power supply as required - see 3.2 Technical Parameters
- For the entire wiring it is necessary to provide proper project documentation according to the local situation.
- Machine pneumatic supply (not included in the delivery) by dry non-lubricated compressed air 0.8 - 1.0 MPa
- The connection shall be provided by means of a utility supply.
- The floor must be made at least of properly hardened concrete foundation.

Installation
Set the machine on the required place and level it by means of the adjusting feet (maximum deviation 1 mm per 1 m).
The installation of wiring shall be done according to the wiring documentation, which is part

of this Manual.
The connection of pneumatic supply of the machine shall be performed by means of the utility supply.

6.2 Putting into Operation

The machine can be put into operation only after the conditions described in Chapter 6.1. are fulfilled. The machine may only be put into operation by a person demonstrably familiar with this Manual and the design of the machine.
Before putting into operation, the electrical equipment must be subjected to tests applicable in the user's country.
The way of control is described in Chapter 8.

6.3 Warranty

The Supplier grants a warranty for their manufactured equipment for 24 months from the commissioning.
The warranty does not cover mechanical damage to the Teflon foil and any defects caused by negligence and/or improper operation.
The warranty does not cover damage to the pneumatic parts caused by the ingress of condensate into the pneumatic system!
For this reason it is necessary to provide clean and dry compressed air!

Caution !
We recommend leaving the installation and commissioning of the machine to the Supplier!

7. Operational Information

7.1 Safe Operation

The welding machine is equipped with processor control that enables comfortable work and at the same time prevents operating errors. For this purpose, the control buttons are gathered on the operating panel with the indicators of the machine's reactions on the touch screen. The control performs commands in the set working cycle.

- Main shut-off valve for compressed air

The main shut-off valve for compressed air is located on the right side of the machine's switchboard and enables to switch the air supply on and off by means of the ball valve.

- Electric power supply main switch

The main switch of electric power supply is located on the right side of the machine's electric switchboard and enables the central switch-on and switch-off of the machine.

! In case of a longer interruption of work, as well as overnight, it is **recommended** to shut off the main air supply and switch off the main power switch. In case of service works and to secure it against unauthorized switch-on, the power switch can be locked.

- Emergency stop button

Your machine is equipped with emergency stop buttons to prevent dangerous situations. The emergency stop is not designed for normal shutdown!

! Necessary before setting the machine.

Before the start of work, the machine shall be prepared as follows:

It is necessary to set:
1) The pressure on the main valve min. 0.8 MPa, max. 1.0 MPa, so as to ensure the correct clamping of the welded plastic board.
2) The temperature of the heating bar according to the type and size of the welded material.

Time cycle data:
The welding machine has adjustable time presets of required times for all three cycles.

Dressing:
The material is pressed against the heating bar, which leads to its dressing. Melts are pressed out.

Heating:
The material is heated with reduced pressure on the heating ruler. The material is warmed through into the depth.

Connection:
Both welded parts are pressed against each other with the heated surfaces and welded together. At the same time, the parts are naturally cooled down.

Dressing time - depends largely on the flatness of the welded material's edges and on careful insertion into the machine. The time shall be long enough so that both welded surfaces flatten, which is signalled by the height of the burrs on the edges of the boards. This dressing time may be extended until sufficient burr is along the entire length. The parallelism of the welded edges is important. The occurring melted remnants should not be liquid.
Heating time - the set time influences the heated zone. This time is very important for the welding result.
Connecting time - is also the cooling time, which is necessary for sufficient cooling down of the welded material before taking it out from the machine.
The machine calculates all the described times on its own and it is not recommended to modify them!

Setting of the heating bar temperature:
The heating bar is warmed by electric heaters. The temperature of this heating is controlled by the control processor. The current temperature is sensed by an integrated sensor. The display contains an indicator of the actual temperature. The required temperature can be set on the display.

Notice:
The welding is not allowed to start before the set temperature corresponds to the actual.
In such case it is necessary to wait until the correct temperature is reached.

Notice:
The Teflon coating withstands a temperature up to 280 °C. When such temperature is exceed, the coating is damaged and toxic gases can be evolved. The properties of the welded plastic boards depend on the temperature too. For the correct welding temperature, ask the supplier of the welded material. So as to prevent reaching the unwanted temperature, the maximum temperature of 270 °C is set on the processor and cannot be exceeded.

Notice:
Under certain circumstances, the heating bar is very hot and even a short contact may lead to burning.
Always keep the safety distance and use protective gloves.

Space requirements:
We recommend adapting the space according to the size of the boards used, so that the work can proceed without idle time. Also note that there should be also enough space above the machine according to the planned production.

7.2 Operating Regulations for the Plastic Welder

1) The operation, maintenance, and work on this machine may only be performed by an employee who **is demonstrably familiar** and instructed about the machine's function and meets the qualification requirements for its operation.

2) Before the start of work, the employee is obliged to inspect the machine and check that it is capable of safe and reliable work.

3) The safety guards of the machine must never be removed during its operation! Their removal is only possible after switching the machine off by the main switch on the control panel and releasing the air. This provision does not apply to the activities connected with necessary settings and repairs of the machine which require the movement of its parts. This activity may only be performed by an employee authorized by the user of the machine (including the operator, if he/she fulfils the conditions necessary for performing such activity and meets the qualification requirements).

4) The surroundings of the machine shall be tidy and free within at least 0.8 m in all directions.

5) After the end of works on the machine, it is necessary to switch off the main switch and release the compressed air.

6) For trouble-free operation of the machine it is necessary to provide completely dry compressed air.

8.

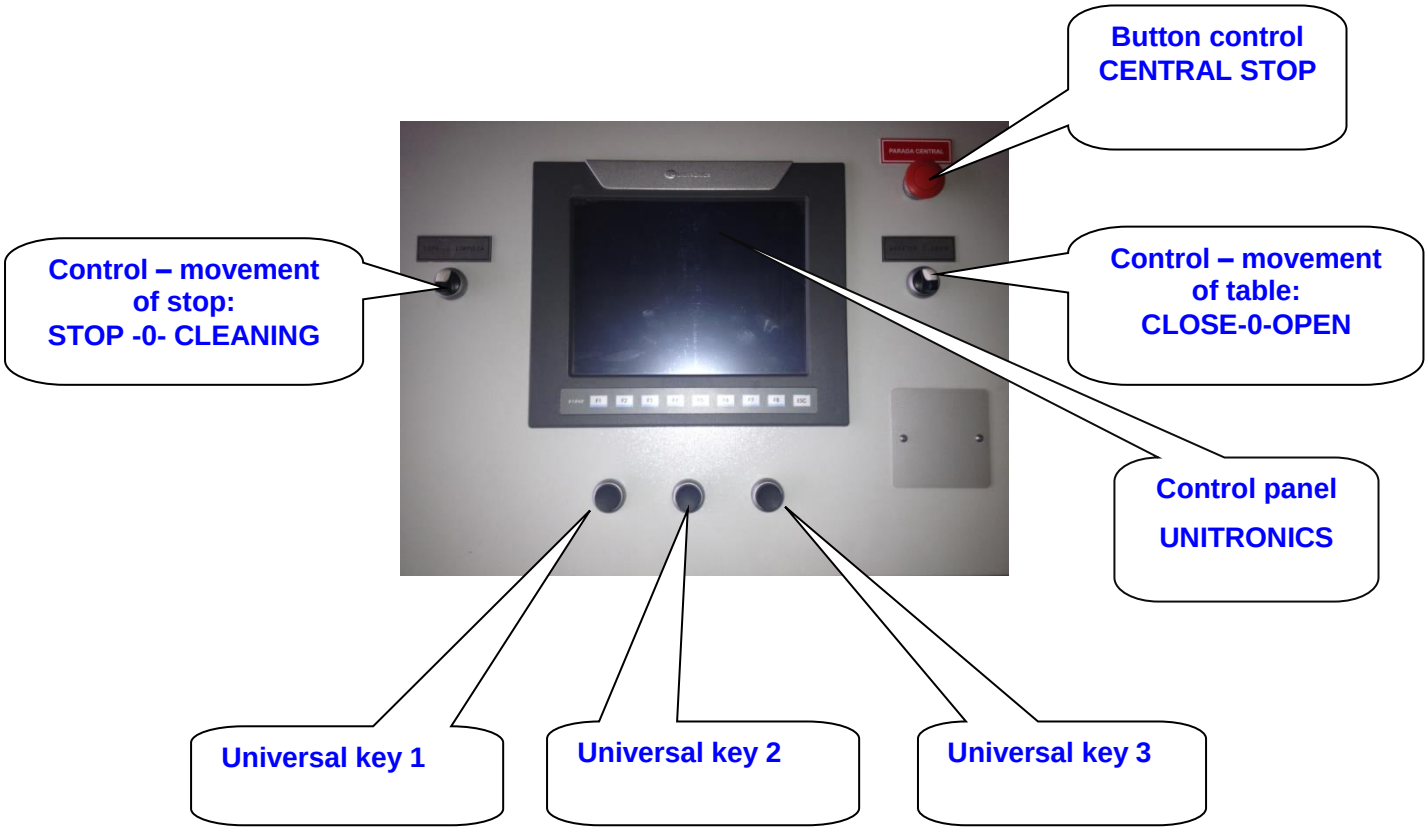
DESCRIPTION OF OPERATION OF

WORK SP 4000 CNC

8.1. Control Panel and Thermal Printer

The plastic welder WORK SP 4000 CNC is controlled by the UNITRONICS control PLC with a colour touch control panel. All settings are done directly on the touch screen by means of the displayed variable buttons. The expressions “touch the button…” in this Manual relate to the virtual buttons on the touch screen. The pop-up keyboard always appears after pressing a value which can be changed; after entering the numerical value or text, it is necessary to confirm it by pressing the symbol meaning “ENTER”.

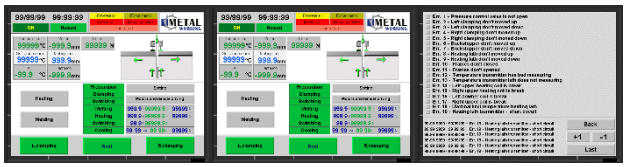
The control panel including control elements is installed on the front panel of the switchboard, which is located on the front of the machine. The switching and protective devices of the electrical equipment, measurement and control are also installed in this RM switchboard; all pneumatic elements are also installed in the RM switchboard.



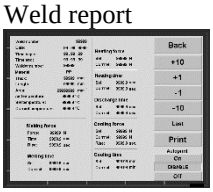
The functions of the universal keys below the screen are the same as those of the three buttons displayed in the bottom part of the screen and it is advised to use them so as to reduce the wear of the display. The current function of the buttons changes during the setting and welding and it is necessary to watch the values on the screen.

Screen - Process of Displaying

Start Settings Failures



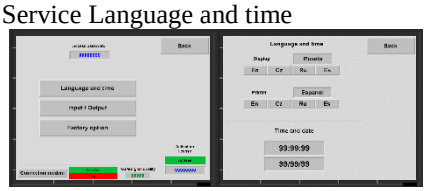
Weld report



Negative force

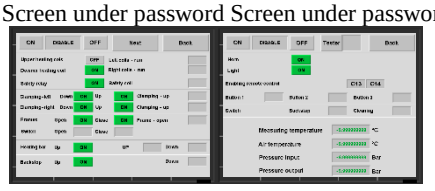
Check of force

Service Language and time



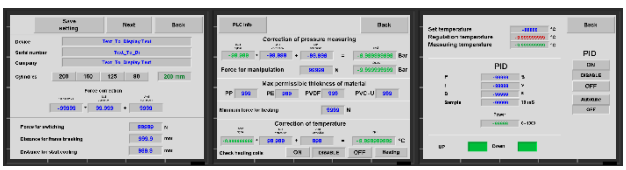
Inputs and outputs Next

Screen under password Screen under password

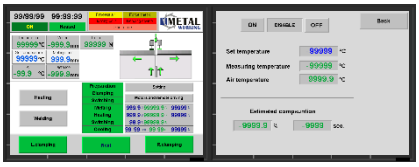


Factory options Next Heating

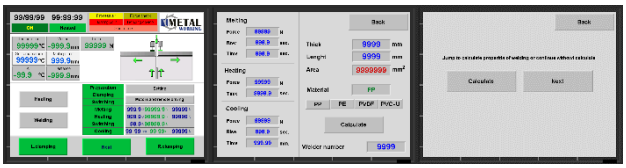
Screen under password Screen under password Screen under password



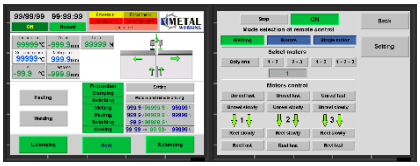
Start Heating



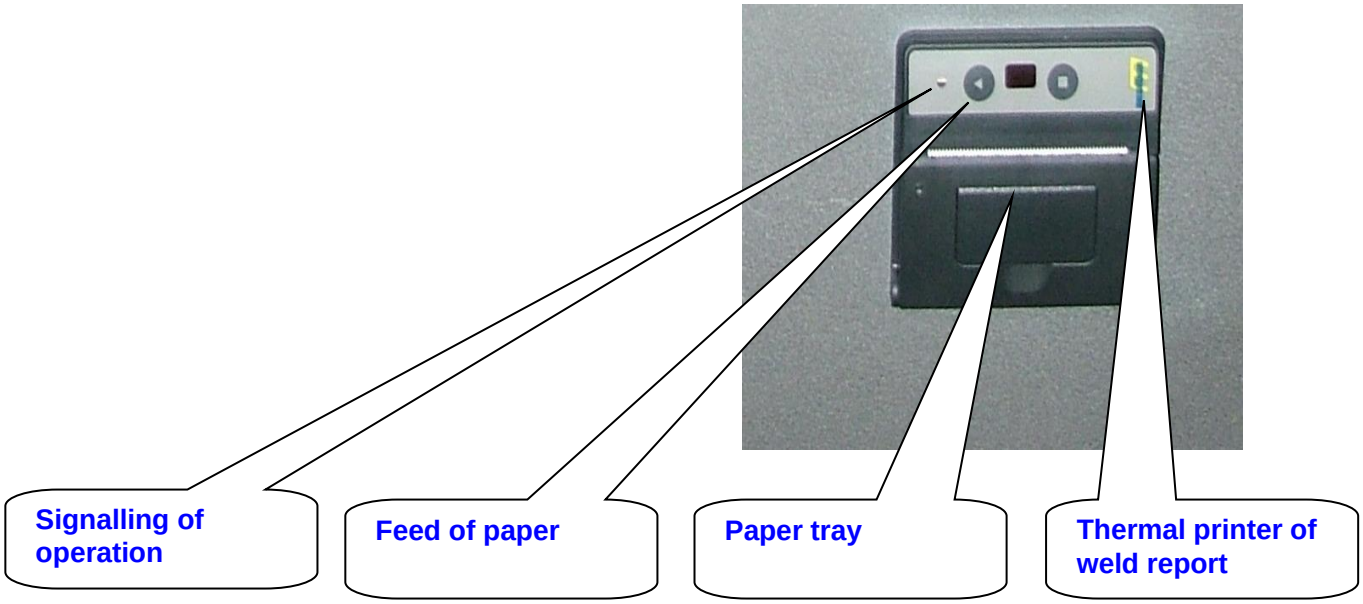
Start Welding Back



Start Winding equipment



Thermal printer:



For making the welding report, the plastic welder is equipped with a thermal printer on the customer's request, which is installed on the control panel. Paper is inserted in the printer from the front side of the printer after tilting out the paper tray.

8.2 Putting the Machine into Operation

Follow the correct procedure of switching on the machine:

1.- Open the compressed air supply to the machine – on the welder base to the left of the switchboard.

2.- Switch on the machine by means of the main switch, which is located on the right side of the switchboard.

- After the control system is activated, the basic screen with the START button is displayed (see Fig. 1).

3.- After pressing the START (middle) button there starts the check of the pneumatic part of the machine, i.e. the control PLC checks the pressure in the set two points - the heating bar starts warming and after its warming up, the machine is ready for the setting of welding parameters.

- The welding ruler temperature is signalled in the upper left part of the screen.
- After the required temperature is reached, the text HEATED UP (“NAHŘÁTO”) appears in the upper part of the screen (please note that before the required temperature is reached, automatic welding cannot be started!)

8.3 Selection of the Heating Bar Temperature

The setting of the required temperature can be done in two ways. Either by pressing directly the “set temperature” value (see Fig. 1), where you can enter the required value using the pop-up keyboard and press ENTER to confirm, or by switching to the temperature selection screen by pressing the HEATING (“TOPENÍ”) button (see Fig. 2). On this screen, the current temperature of the heating bar and the machine’s current ambient temperature are signalled too. To change the temperature, touch the value you want to change, enter the new one by means of the pop-up keyboard, and press ENTER to confirm. Using the ON/OFF (“ZAP/VYP”) button it is possible to switch on/off the machine heating (CAUTION! The heaters are always under voltage to earth, so before any intervention in the electrical equipment it is necessary to disconnect the machine from the power supply by the main switch!); the BACK button will take you back to the previous or basic screen (see Fig. 1) .

NOTE:

- The maximum allowed temperature of the machine is set to 280 °C; if this temperature is exceeded, the machine shuts down and the monitor signals the machine overheating by the red message (“TOPNICE”).

- The machine can only be restarted after it has been checked and cooled down below the maximum temperature, i.e. disconnected from the power supply and reconnected.

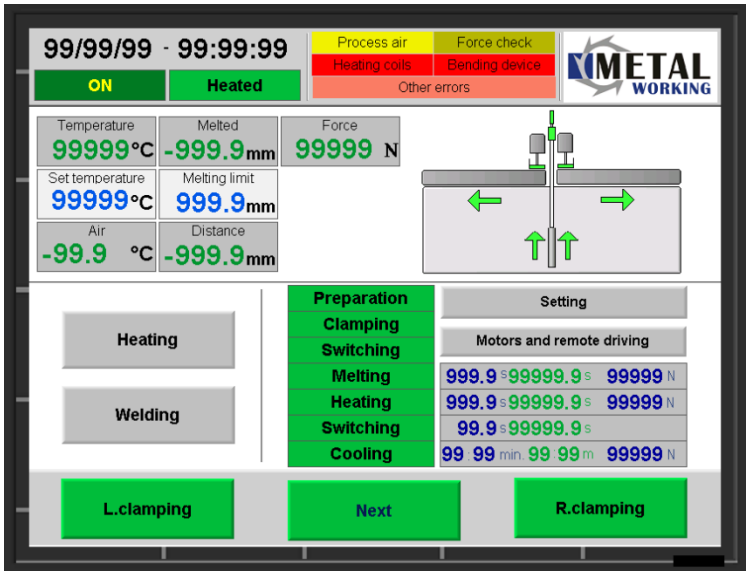


Fig. 1

Recommended Temperatures

Recommended Temperatures for Plastic Board Welding using the Butt Welding Method acc. to DVS 2207 - 11

Material: **PP**		Material: **PE**		Material: **PVC - U**		Material: **PVDF**	
Thickness mm	Temp. °C	Thickness mm	Temp. °C	Thickness mm	Temp. °C	Thickness mm	Temp. °C
3	215	3	220	3	230	3	240
4	215	4	220	4	230	4	240
5	210	5	220	5	228	5	240
6	210	6	215	6	227	6	240
8	210	8	215	8	226	8	240
10	205	10	215	10	225	10	240
12	205	12	215	12	224	12	240
15	205	15	210	15	222	15	240
20	200	20	205	20	219	20	240
25	200	25	205	25	216	25	240
30	200	30	205	30	213	30	240
40	200	40	200	40	213	40	240

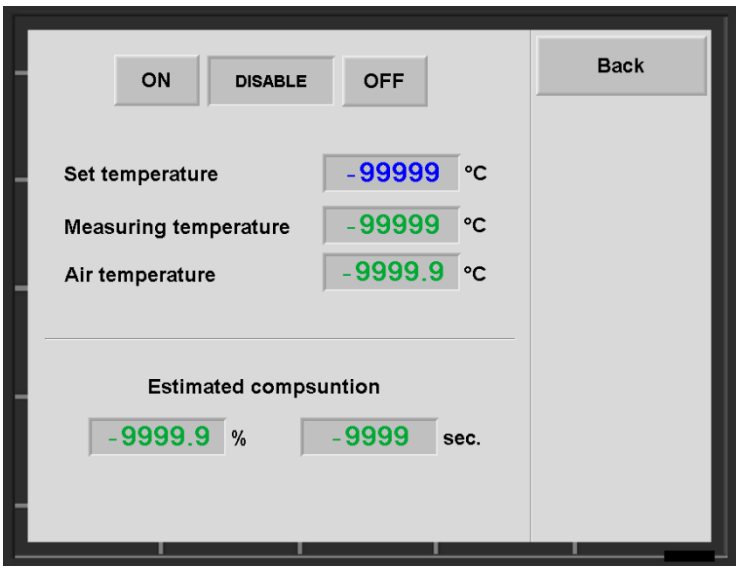


Fig. 2

8.4 Setting and Calculation of Welding Parameters

The machine calculates all important parameters on its own from the entered data. Press the WELDING ("SVÁŘENÍ") button on the main screen to switch to the menu for the setting and calculation of welding parameters (see Fig. 3)

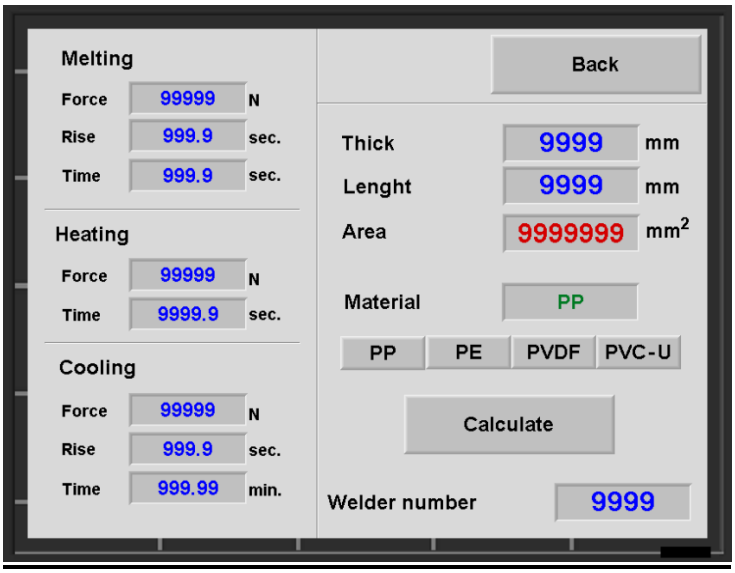


Fig. 3

Enter the input values (thickness, length, and type of material) in their boxes on the right and press the CALCULATE (“VYPOČÍTEJ”) button. This will perform the calculation of welding parameters according to the DVS 2007 standard and the parameters are automatically set in the control PLC in the respective boxes on the left for the next welding. If you want to change these parameters and weld using other settings than according to the DVS standard, the calculated parameters can be overwritten, but you must not press “CALCULATE” then. Otherwise the parameters would be overwritten again by those calculated from the data entered in the right part of the screen.

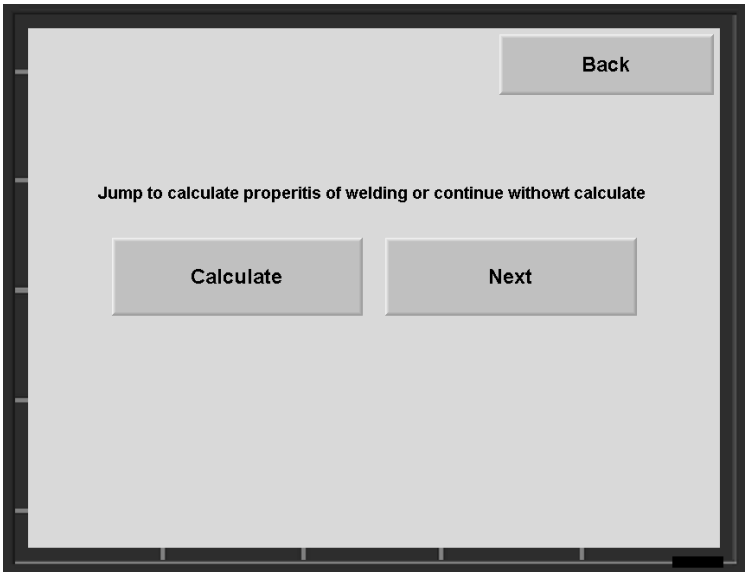


Fig. 4

In case of manual change of the value settings (dressing, warming, cooling), press the BACK (“ZPĚT”) button to confirm and then the NEXT (“DALŠÍ”) button on the next screen (Fig. 4). After the confirmation you will return automatically to the initial screen.

Welder number - using the WELDER NUMBER (“ČÍSLO SVÁŘEČE”) option in the bottom right corner (Fig. 3) you can select the assigned personal number of the welder by means of the pop-up keyboard, which will be then printed on the subsequent welding reports; after entering and confirming the welder personal number, the parameters screen opens again. (Fig. 3)

Purpose of the Material Dressing

Before the welding cycle can continue, the material has to be dressed. The entire edges of the welded boards must be reliably pressed against the welding ruler. It is possible to set both the time limit for board dressing and the length of the material melted off during dressing. The more even the board edge, the shorter the time for dressing.

The time limit can be set when entering the weld parameters (Fig. 3); the machine signals the end of that time by lighting up the orange beacon. However, after visual inspection it is necessary to confirm by pressing the CONTINUE ("POKRAČUJ") button on the screen that the welded material is really dressed.

Material Dressing Limit

On the initial screen (Fig. 1) it is possible to set the distance that shall be melted off during dressing; after pressing the DRESSING LIMIT ("LIMIT OROVNÁNÍ") value in the top left corner of the screen you can enter the value in mm using the pop-up keyboard. The setting of dressing is entered as the sum of the required distances melted-off from both welded parts. After the set distance is melted off, the machine automatically continues by the WARMING ("PROHŘEV") stage.

The DISTANCE ("VZDÁLENOST") value shows the current distance of both parts and during the cooling it is possible to find out how much material has disappeared in total as a result of welding.

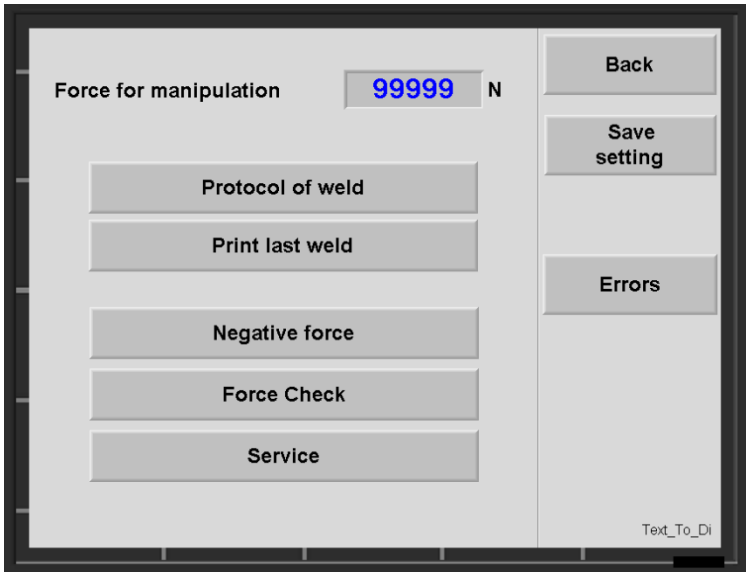


Fig. 5

8.5 Additional Settings

These settings are not necessary for the welding process itself, but after pressing the "SETTINGS" ("NASTAVENÍ") button on the main panel (Fig. 1) you can set the weld report, print the last report, measure the force that cause opening of the table because of strong boards rolled up in small diameter rings, set the checkpoints, change the language, or set the date and time corresponding to your time zone. (Fig. 5)

- Pressing the window with the HANDLING FORCE ("SÍLA PRO MANIPULACI") value opens the pop-up screen for selecting the required pressure for manual closing and opening of the tables; after entering and confirming the required pressure, the settings screen opens again (Fig. 5).
- Pressing the WELD REPORT ("PROTOKOL O SVÁRU") button switches to the screen for setting individual parameters of the report – see 8.7.
- Pressing the PRINT LAST WELD ("TISK POSLEDNÍHO SVÁRU") button prints the valid last weld report.
- Pressing the NEGATIVE FORCE ("ZÁPORNÁ SÍLA") button switches to the screen for the measuring and setting of the negative force parameters – see 8.8.
- Pressing the CHECK OF FORCE ("KONTROLA SÍLY") button switches to the screen for setting individual parameters of the force check – see 8.9.
- Pressing the SERVICE ("SERVIS") button switches to the screen for setting individual parameters of service and for checking the inputs and outputs of the machine's control PLC. You can set the language, time, and if you know the access password, also the inputs, outputs, and factory settings of the machine.

8.6 Failures

If the red field of failure (heating element, rolling equipment, or other) lights up on the main screen, press the SETTINGS ("NASTAVENÍ") button to switch to the FAILURES ("PORUCHY") screen (Fig. 6).

The list of possible failures appears. If the failure is still active, the indicator at the respective failure shines in red.

- The history of failures is displayed in the bottom half and the list can be browsed using the +1, -1 buttons.

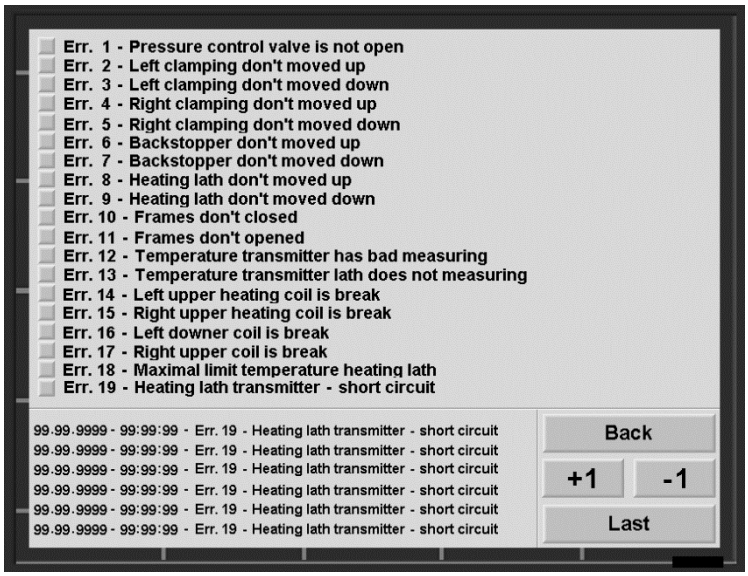


Fig. 6

8.7 Weld Report

- Pressing the WELD REPORT (“PROTOKOL O SVÁRU”) button on the screen (Fig. 5) switches to the screen containing the menu of parameters and history of welding reports (Fig. 7).

- Pressing the AUTO PRINT – ON (“AUTOTISK – ZAP”) button switches on the option of automatic printing of the report after every successful weld completion.

- Pressing the AUTO PRINT – OFF (“AUTOTISK – VYP”) button switches off the option of automatic printing of the report after the weld completion. The last report can be printed by pressing the PRINT (“TISK”) button on the previous screen.

- You can browse within the last one hundred weld reports by means of the + - 1 and + - 10 buttons; you can also print the selected report again by pressing the PRINT button.

- Selecting the BACK button switches back to the previous screen.

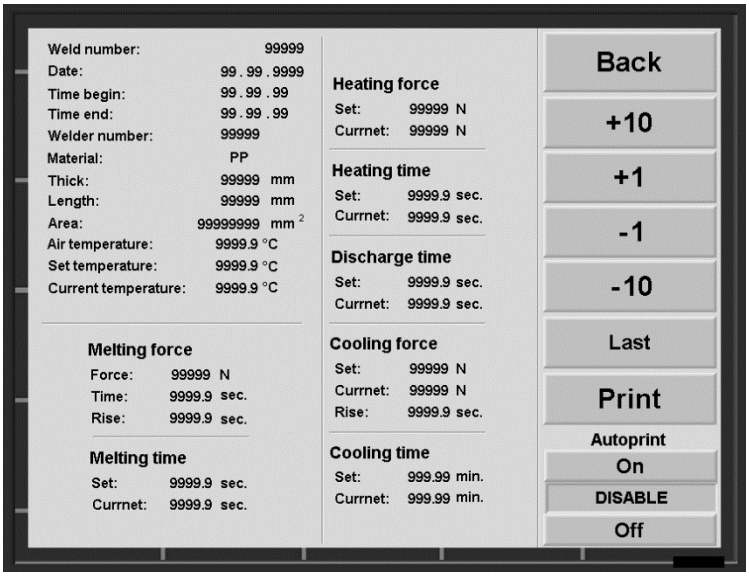


Fig. 7

8.8 Negative Force

- Pressing the NEGATIVE FORCE ("ZÁPORNÁ SÍLA") button (Fig. 5) switches to the screen for the measuring and setting of individual parameters of negative force (Fig. 8).
- After pressing the MEASURE ("ZMĚŘIT") button, the machine automatically measures the negative force and records it in the NEGATIVE FORCE table.
- This measured force will be automatically added to the calculated force for welding!
- The RESET ("NULUJ") button resets the force values.
- Selecting the BACK button switches back to the previous control screen.

NOTE:

This function is used mainly when welding the shells of circular tanks, where negative resistance (force) occurs and outstretches on its own the plastic welder tables!

After the weld is complete, the negative force must be reset!! Otherwise its value would be automatically added to all further performed welds and a faulty weld could occur!!

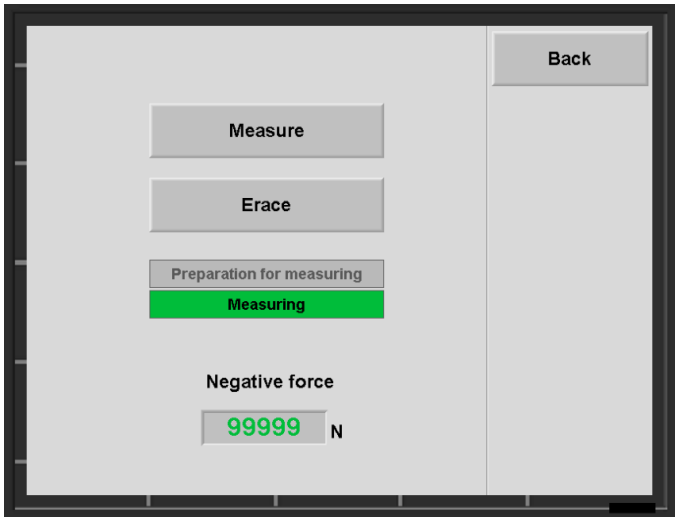


Fig. 8

8.9 Check of Force

- Pressing the CHECK OF FORCE button on the screen (Fig. 5) switches to the screen with the menu of force check parameters. These points serve for checking the function of proportional control of the welding force (Fig. 9).

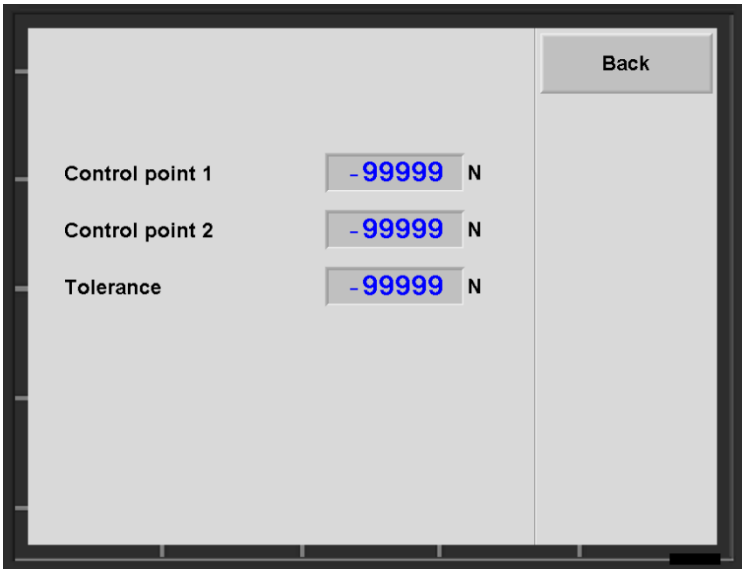


Fig. 9

- Recommended force in point 1: 2,500 N

- Recommended force in point 2: 5,000 N

- Recommended tolerance force: 800-1,000 N

These set parameters are important for the correct operation of the machine! DO NOT CHANGE!!

8.10 Service

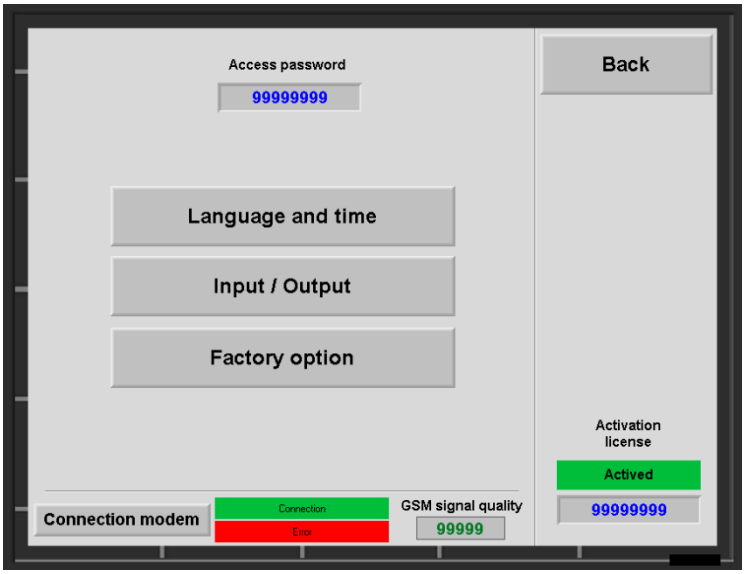


Fig. 10

- Pressing the SERVICE button on the previous screen takes you to the screen for setting individual service parameters and checking the inputs and outputs of the control PLC of the machine.

- Pressing the LANGUAGE AND TIME ("JAZYK A ČAS") button enables to select the communication language and the language in which the reports will be printed.

- In addition this screen enables to modify the current date and time (Fig. 11).

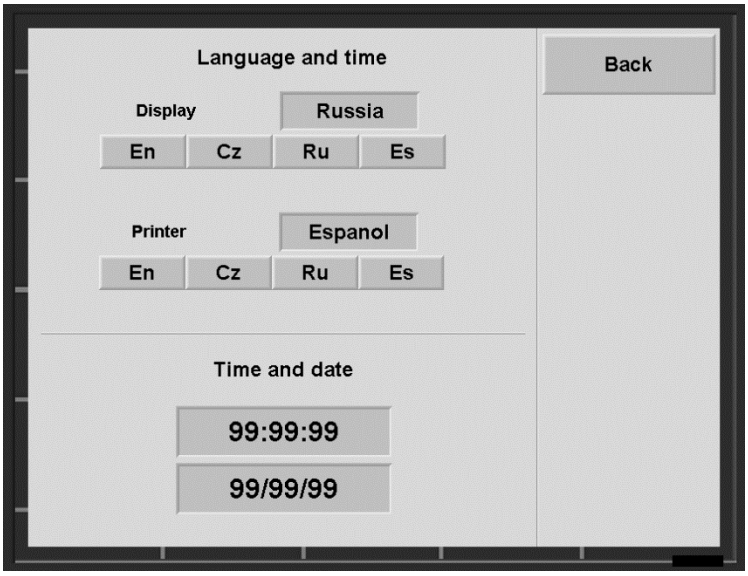


Fig. 11

- Entering the PASSWORD and pressing the INPUTS/OUTPUTS button opens the screen for the check of input and output signals to/from the control PLC (Fig. 12). Password for access to the service menu is at the manufacturer's service technician and during normal operation of the machine it is not necessary to enter the service menus.

Fig. 12

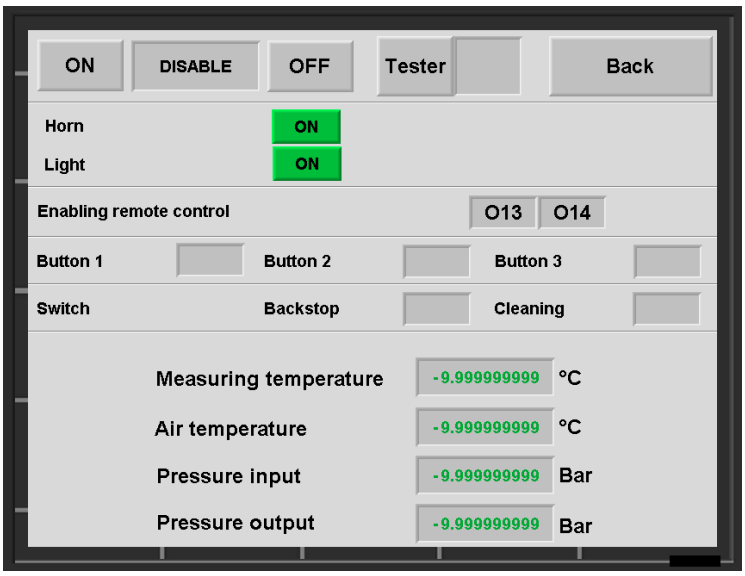


Fig. 13

- Display of the log. input signal 0 – uncoloured field
- Display of the log. input signal 1 – field coloured in green

MODEM

The modem is an optional accessory and it is only intended for remote access to the control PLC!

- SIM card shall be inserted only when the machine is off!
- The modem with antenna is under the lid of the control panel on the right side.
- Press the yellow button from the top side to slide out the slot for the SIM card.
- After inserting the SIM card and sliding the slot in, switch on the machine.
- Press the CONNECT MODEM (“PŘIPOJIT MODEM”) option on the SERVICE screen; the signal strength appears and the machine is ready for remote fault diagnosis.
- Selecting the BACK button switches back to the previous control screen.
- In this service mode, the service technician may verify the function of each actuator (operation of pneumatic cylinders, signalling elements, heating).
- Switching on the equipment – ON (“ZAP”)
- Switching on the equipment – OFF (“VYP”)
- Selecting the BACK button switches back to the previous control screen.

LAN connection

An optional accessory intended only for remote access to the control PLC!

- In this service mode, the service technician may verify the function of each actuator (operation of pneumatic cylinders, signalling elements, heating).
- For the LAN network connection it is necessary that the customer provides a public IP address.
- The connection is provided by means of a network cable to the internet socket.
- Enter the IP address in the machine‘s screen, SETTINGS screen, LAN connection.

8.12 Material - Tables:

Maximum permitted thickness for plastic welding:

PP	40 mm
PE	25 mm
PVDF	40 mm
PVC - U	20 mm
ECTFE	8 mm

Maximum permitted thickness for rolling of plastic:

Material	Thickness	Length	Thickness	Length
PP	30 mm	3 m	25 mm	4 m
PE	20 mm	3 m	15 mm	4 m
PVDF	30 mm	3 m	25 mm	4 m
PVC - U	20 mm	3 m	15 mm	4 m

Formula for calculation of the smallest possible rolling of material

Material thickness x 100 + 10 %

Example:
5 mm x 100 = 500 + 50 = 550 mm

8.11 Welding

Manual welding:

- Set the temperature depending on the material.
- Enter the thickness, length, and type of material in the WELDING ("SVÁŘENÍ") table.
- Confirm the calculation of the welding values.
- Set a higher value of the DRESSING LIMIT.
- The knob with the positions CLOSE – 0 – OPEN ("SEVŘÍT – 0 – ROZEVŘÍT") opens the table to the maximum (OPEN position).
- The knob with the positions STOP – 0 – CLEANING ("DORAZ – 0 – ČIŠTĚNÍ") lifts the stop bar (STOP position).
- The knob with the positions CLOSE – 0 – OPEN ("SEVŘÍT – 0 – ROZEVŘÍT") closes the table to the stop (CLOSE position).

(In this position the stop must not be lowered, otherwise there is a risk of damage to the Teflon foil!)

- The operator inserts material from both sides to the stop and clamps it on the left and right side (R.clamping ("R. upínání") and L.clamping ("L.upínání") buttons).
- The knob with the positions CLOSE – 0 – OPEN opens the table to the maximum.
- The knob with the positions STOP – 0 – CLEANING lowers the stop bar to the initial position (– 0 - position).
- Material alignment: The knob with the positions CLOSE – 0 – OPEN closes the table with the clamped material; set the knob to the – 0 – position (no pressure), release one side with material and align the materials edge to edge, then clamp the released side with material and open the tables to the maximum.
- Now you can press the "START" button.
- The stop moves up, the table moves down to the stop; continue by the NEXT command, the material is already clamped.
- The tables automatically move apart.
- The machine automatically lifts the heating bar to the material level.
- When the heating bar reaches the material heating position, the tables with material close and the material is being dressed.
- After visual inspection of the weld-out material (it must be along the entire length of both welded boards) continue by the NEXT command.
- The following steps run automatically without operator intervention until the end of welding.

- The force decreases to the material heating value.

From the clamping of the boards until their connection, the END ("KONEC") button is shining in the bottom left corner. The button enables to interrupt the welding, for example to replace the boards, shift them, or solve another unforeseen situation. After interrupting the welding, the tables open and the heating bar moves down to the lower position; after pressing the END button, the machine returns to the basic position.

- After heating, the tables open, then the heating bar is lowered to the initial position, the tables close to connect the welded material, which is followed by cooling down.
- After resetting the tables, the welded materials are gradually pressed against each other.
-After the force is reached, the welded materials are kept at the calculated force.
- The cooling time is signalled on the screen.
- After the cooling time is reached, the beacon lights up - intermittent signal.
- The clamping force is switched off.
- The operator stops the welding by pressing the END button, releases the left and right sides of material, opens the tables to the maximum, and takes out the weldment.

Semi-automatic welding:

- Set the temperature depending on the material.
- Enter the thickness, length, and type of material in the WELDING ("SVÁŘENÍ") table.
- Confirm the calculation of the welding values.
- Set the DRESSING LIMIT value on the main screen.
- Press the START button to put the machine into the semi-automatic welding cycle.
- The machine automatically lifts the stop.
- The table automatically move down to the stop.
- The operator clamps the material and confirms the clamping.
- After pressing the CONTINUE button, the machine continues the cycle.
- The tables automatically move apart.
- The machine automatically lifts the heating bar to the material level.
- When the heating bar reaches the material heating position, the tables with material close and the material is being dressed.
- The remaining dressing time is displayed in the bottom right corner of the screen and the dressed distance can be seen in the top left corner.
- After the preset dressing time elapses, the beacon shines permanently, or, after reaching the

dressing length limit, the machine continues by the “warming” stage.

- On the basis of the visual check, the operator may extend the time so as to ensure correct dressing of the material.
- To continue, the operator presses the CONTINUE button.
- The following steps run automatically without operator intervention until the end of welding: decrease of the force to the material heating (warming) force (the heating time is signalled in the top right corner of the screen).
- After heating, the tables open, then the heating bar is lowered to the initial position, the tables close to connect the welded material, which is followed by cooling down.
- After resetting the tables, the welded materials are gradually pressed against each other.
-After the force calculated for welding is reached, the welded materials are kept at the maximum set force.
- The cooling time is signalled in the bottom right corner of the screen.
- After the cooling time is reached, the beacon signalling is switched on - intermittent signal.
- The clamping force is reduced to the minimum.
- The operator presses the END button, releases the left and right sides of material, opens the tables to the maximum, and takes out the weldment.

The rest of material on the heating bar can be removed after sliding the heating bar to the STOP - CLEANING position using the switch. The heating bar is stuck out over the table and can be cleaned. The reverse process is similar.

! Notice:
Always keep the safety distance and use protective gloves when cleaning.
To clean, wipe with a soft cotton towel. Never use sharp objects or solvents!

Completion after welding:
Depending on the required weld quality, remove the weld rests in the end (after cooling down) using an appropriate tool.

8.13 Maintenance and Repairs

8.13.1 Maintenance of Electrical Equipment:
The electrical equipment of the machine is completely maintenance-free. The user is advised to ask the manufacturer of the welding machine to check the function and protection of the electrical equipment in the specified intervals. All electrical installation works have to be done in accordance with valid electrical regulations of ČSN EN standards.

8.13.2 Maintenance of Pneumatic Equipment:
To ensure long-term functionality it is necessary to keep the following procedures:

- Empty the vessel on the main valve by opening the exhaust valve until any remnants are disposed of.

For trouble-free operation of the machine, the air must be free of moisture, oil, and impurities!

Caution:

Exercise special caution when draining the condensate, otherwise it could splash in your eyes!

- The new welder types are equipped with a vessel with automatic condensate drainage.

- Check regularly the set minimum pressure of 0.6 MPa (insufficient amount of supply air is signalled on the display).

In case of lower pressure, the pressing force of the clamping shoes may be insufficient. Higher pressure (more than 10 bars) may damage the pneumatic elements of the machine. The built-in manometer is used to check.

Notice!

Keep the machine free of dust!

8.13.3 Replacement of the Teflon Foil of the Heating Bar:

The Teflon foil has to be replaced if its upper layer is damaged or if it is damaged mechanically - i.e. punctured. In case of puncture of the Teflon foil, the welded plastic starts flowing under the Teflon foil, where it is burnt and creates a layer badly conducting heat. In that place the bar heats badly than. For this reason the welds are poor and may crack.
That is why we recommend replacing the Teflon foil immediately if damaged.
It is advisable to order the replacement of the Teflon foil from the machine manufacturer's service technicians.

8.14 Service of the Machine

All service, both warranty and post-warranty, and deliveries of spare parts are provided by the manufacturer or a company authorized by the manufacturer.
Minor failures can be remedied by the user within the maintenance described in this Manual. In case of larger failures, it is necessary to consult the Manufacturer. Service ordered from the manufacturer is usually provided within 48 hours. The term depends on the geographical location of the user and the scope of failure.

9. Accessories and Supplementary Equipment

On the customer's request it is possible to supplement the machine with auxiliary tables fitted with ball bushings. These tables serve for easier handling of larger welded parts.

10. Dismantlement and Disposal

The machine is assembled from metal and non-metal parts. To ensure environment-friendly disposal it is necessary to dismantle all non-metal parts from the machine. These parts shall be handed over for professional disposal to organizations engaged in the processing of the above mentioned materials.
The metal parts shall be sorted to:
- parts made of iron and cast iron
- aluminium parts
- parts made of non-ferrous metals

These parts shall be handed over to organizations engaged in the processing of metal wastes.

11. Appendices

11.1 Sequential Stages of Butt Welding Using a Hot Element:

1. **Dressing stage (segment 1)** – after pressing the start of welding, the welded surfaces are pressed against the heating bar at the dressing pressure of F1 = 0.10 – 0.15 N/mm2. The pressure is exerted on the welded parts until both welded surfaces flatten, which is signalled by the height of the burrs on the edges of the boards. When the dressing of the surfaces is complete, the dressing pressure drops to the value of the warming pressure.

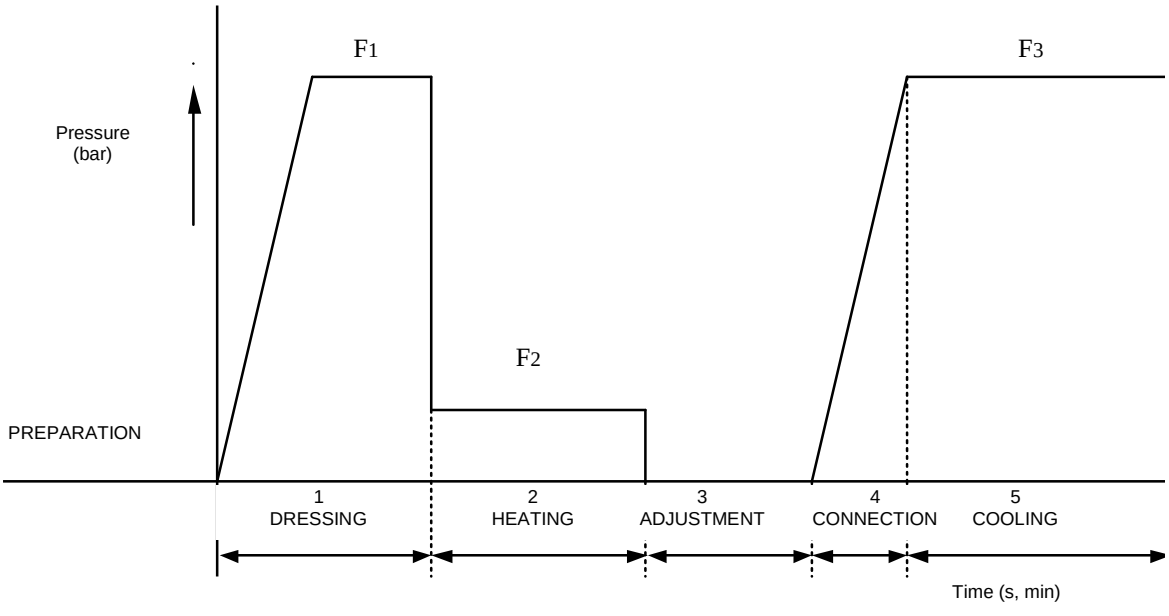
2. **Heating stage (segment 2)** – the welded surfaces are heated with the minimum pressure F2 = 0.02 N/mm2. The surfaces to be connected apply tightly to the heating bar and they are gradually warmed until the welded zone is plasticized. The heating time is calculated by the processor according to the German standard DVS 2207.

3. **Adjustment stage (segment 3)** – The faces of the welded surfaces move away from the heating bar and the bar moves down to the bottom position. The warmed faces must be shifted together as quickly as possible so that the welded surfaces touch each other.

4. **Connection stage (segment 4)** – After the welded surfaces touch each other, the pressure increases until the full welding pressure value F3 = F1 is reached. The time of so-called rise until the full connecting pressure is calculated by the processor and it must not be exceeded. On both sides of the welded parts there forms a burr, which is the subject of visual inspection of the weld.

5. **Cooling stage (segment 5)** – the connecting pressure must be kept constant during the cooling time. The time is calculated by the processor and it must not be reduced.

Diagram Pressure - Time



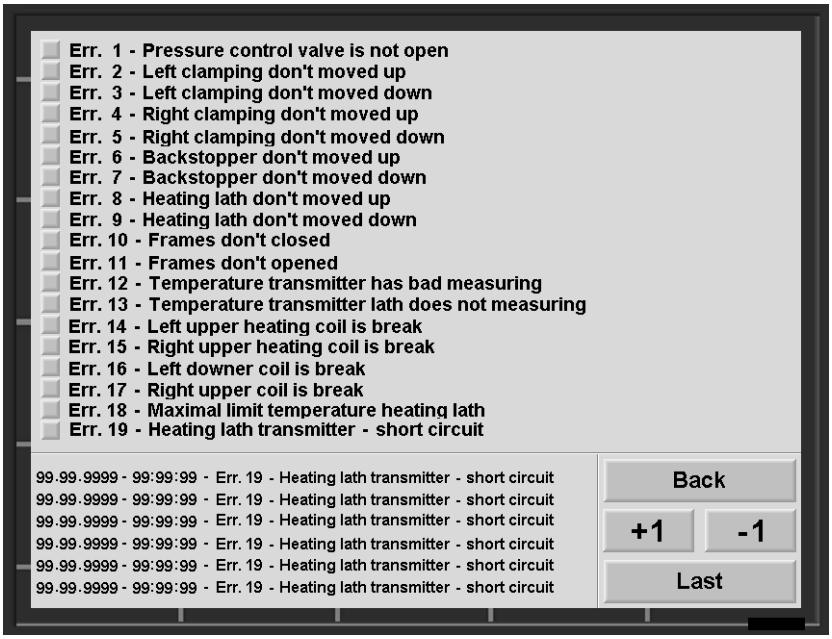
11.2 Troubleshooting

Failure Identification Remedy

Machine cannot be started	**1) Defective fuse 2FU9**	**1) Replace**
	2) Pressed button CENTRAL STOP	**2) Release button** CENTRAL STOP
	3) No voltage to the machine	**3) Check the state of main switch, supply protection**
Unable to start welding	**1) The set temperature has not been reached**	**1) Set the temperature - wait until the bar reaches the set temperature**
	2) Wrong switching of the "table" and "bar" switches on the panel	**2) Switch the switches to the initial position - 0 -**
	3) Table closed or table in an intermediate position	**3) Open the table**
	4) Lifted stop	**4) Lower the stop**
	5) Material not clamped	**5) Clamp the material**
Uneven heating of the welded material	**Warmup failure** **(the message "Warmup Failure" is shining on the display)**	**1) Check the fuses 1FU1**
		2) Check the connection of the heater, measure the heater, replace if faulty
Uneven operation of the stop pistons or heating bar	**Different supply of air into the cylinders**	**Adjust by the throttle valve on the cylinder**
The welding material slips under the clamping shoes	**1) Little air pressure in the system**	**1) Increase the air pressure in the system**

	3) Dirt on the welded surfaces or on the welded material	**3) Clean the clamping shoes, table surface, welded material**
The welded material is welded with overlap	**Different height of the welding tables**	**Support the table guide housings or the central bearing**
After pressing the "START WELDING" button, the heating bar moves upwards and the tables with material are not shifted together	**The sensors 3SQ2 & 4SQ2 on the pneumatic cylinders of the heater are not shining**	**Loosen and adjust the sensors, so that the LEDs on both sensors are shining**

11.3 Failures and How to Fix Them



Caution!! Any repairs related to works inside the switchboard must be performed by persons having respective electrical qualifications.

Failure No. 1 Occurs and persists, if the measured pressure is lower than the required by 0.5 bars for 4 seconds
- follow the correct procedure of starting the machine: first release the air and then switch on the power supply when the pressure is sufficient
- check the output pressure from the proportional valve

Failure No. 1 Occurs and persists, if the flap is commanded upwards and the command is not fulfilled within 5 seconds
- check the settings of the sensor on the first cylinder in the arm from the switchboard
- check the pressure after the control valve

Failure No. 3 Occurs and persists, if the flap is commanded downwards and the command is not fulfilled within 5 seconds
- check the settings of the sensor on the first cylinder in the arm from the switchboard
- check the pressure after the control valve

Failure No. 4 Occurs and persists, if the flap is commanded upwards and the command is not fulfilled within 5 seconds
- check the settings of the sensor on the first cylinder in the arm from the switchboard
- check the pressure after the control valve

Failure No. 5 Occurs and persists, if the flap is commanded downwards and the command is not fulfilled within 5 seconds
- check the settings of the sensor on the first cylinder in the arm from the switchboard
- check the pressure after the control valve

Failure No. 6 Occurs and persists, if the stop is commanded upwards and the command is not fulfilled within 10 seconds
- check the air pressure
- check the settings of the position sensor

Failure No. 7 Occurs and persists, if the stop is commanded downwards and the command is not fulfilled within 10 seconds

- check the pressure after the control valve
- check the position sensor

Failure No. 8 Occurs and persists, if the heating bar is commanded upwards and the command is not fulfilled within 10 seconds
- check the tables' opening
- check the position sensor on the tables movement cylinder
- check the pressure after the control valve

Failure No. 9 Occurs and persists, if the heating bar is commanded downwards and the command is not fulfilled within 10 seconds
- check the settings of the position sensor
- check the pressure after the control valve

Failure No. 10 Occurs and persists, if the tables are commanded together at a force of at least 1000 N and the command is not fulfilled within 10 seconds
- check that the air pressure is not too low
- check the settings of the sensor on the tables cylinder
- check the output pressure from the proportional valve

Failure No. 11 Occurs and persists, if the tables are commanded apart and the command is not fulfilled within 10 seconds
- check that the air pressure is not too low
- check the settings of the sensor on the tables cylinder
- check the pressure after the control valve

Failure No. 12 Used only in special types of welding tables, which is not your case

Failure No. 13 Used only in special types of welding tables, which is not your case

Failure No. 14 Broken heating element
- check the terminal block in the heating bar box for any wire break
Caution! This check may only be performed by a skilled person with electrical qualifications

Failure No. 15 Broken heating element
- check the terminal block in the heating bar box for any wire break
Caution! This check may only be performed by a skilled person with electrical qualifications

Failure No. 16 Broken heating element
- check the terminal block in the heating bar box for any wire break
Caution! This check may only be performed by a skilled person with electrical qualifications

Failure No. 17 Broken heating element
- check the terminal block in the heating bar box for any wire break
Caution! This check may only be performed by a skilled person with electrical qualifications

Failure No. 18 The current temperature is higher than 300 °C. Necessary to reset the machine
- check the temperature sensor
- check the supply cable of the temperature sensor for any break
- defective heater

Failure No. 19 The current temperature is lower than 0°C. Necessary to reset the machine
- check the temperature sensor
- check the supply cable of the temperature sensor for any break

11.4 Replacement of the Pressing Shoe Joint

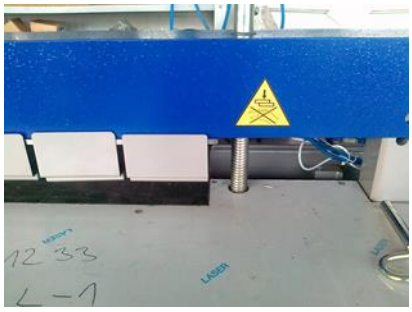
Unscrew the auxiliary screw,
unlock the arm closure.

Loosen the main screw,
take out the locking pin.

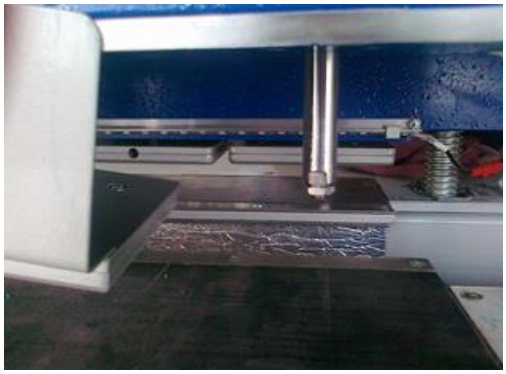
Use the auxiliary screw to lift the arm.

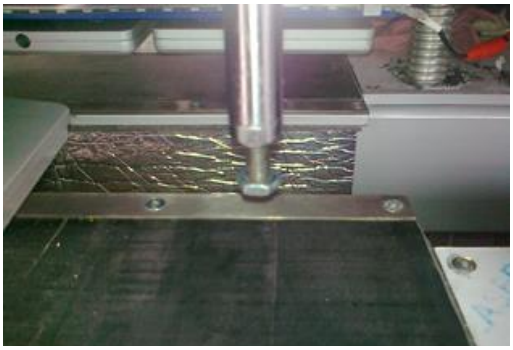
Use the main screw to lift the arm.

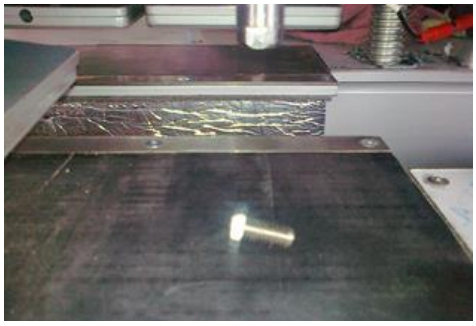
Clamp the pressing shoes.



Unscrew the thread from the piston rod using the locknut.

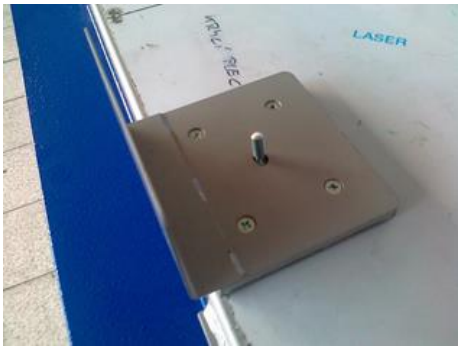




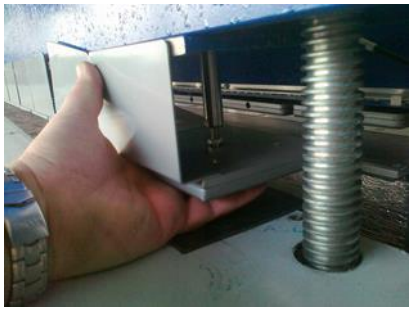


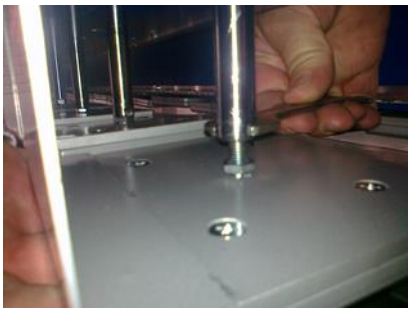
Dismantle the pressing shoe, insert the new shoe joint, and assemble the shoe.

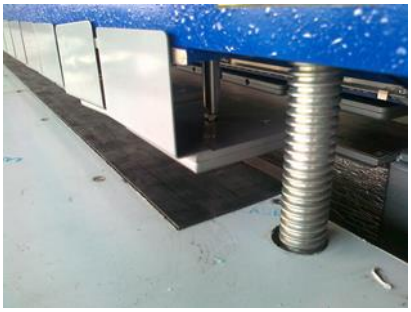
Screw the nut onto the thread.



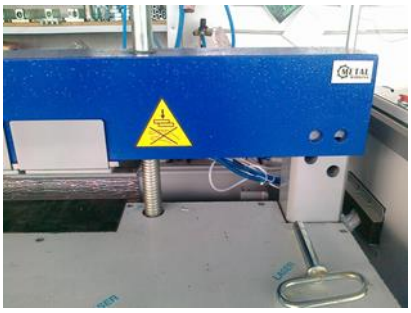
Put the pressing shoe onto the piston rod and by turning the piston rod using a wrench No. 14 (13) screw the pressing shoe on. Tighten the nut to the piston rod.







Return the arm to the original position using the screws.



Lock the pin and the arm closure.

The replacement is complete.