

# T-DRILL

PRODUCTIVITY AS A PRODUCT.

## INSTRUCTION MANUAL



**FLANGING MACHINE**

**F-200**

## Version

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## Original instructions

Instructions for use and maintenance of the T-Drill F-200 flanging machine (cold and hot flanging versions).

Type code: 3926

### Manufacturer:

**T-DRILL** OY  
Ampujantie 32 / P.O BOX 20  
FIN-66401 Laihia, Finland  
Tel.Int +358-6-4753 333  
Telefax: +358-6-4753 300  
[www.t-drill.fi](http://www.t-drill.fi)

### Sales and Service in the USA:

**T-DRILL** INDUSTRIES, INC.  
1740 Corporate Drive, Suite 820,  
Norcross, Georgia 30093, USA  
Phone: 800-5542730  
Fax#: 770-925-3912  
[www.t-drill.com](http://www.t-drill.com)

Your local **T-DRILL** dealer is:

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It has been our aim to elaborate this instruction book with the greatest possible care and attention. The accuracy of the information has been carefully checked during the preparation of the manual. Should any subsequent modifications be made to the product, we decline liability for erroneous or incomplete information.

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## 1. NOTES ON THE USE OF THE INSTRUCTION MANUAL

### 1.1 GENERAL

This manual contains the instructions for use, maintenance and setting of the T-DRILL F-200 flanging machine.

Before proceeding with the installation or operation of F-200 flanging machine, read the general safety instructions in chapter 2.

If the F-200 flanging machine forms part of a system supplied by T-DRILL, then also the general safety instructions related to the other appliances should be studied before use.

➔ **NOTE! Read all the instructions for the entire operation sequence before proceeding with the installation, operation or maintenance of the machine.**

### 1.2 SYMBOLS FOR WARNING AND DANGER USED IN THIS MANUAL

ⓘ **DANGER! May cause a serious accident or even death if the correct precautions have not been taken.**

⚡ **DANGER! Danger originated from the electrical equipment, which causes or may cause a serious accident or death, if the correct precautions have not been taken.**

➔ **NOTE! May cause an accident or damage property, if the correct measures have not been taken. This symbol is also used to generally emphasize a particular detail.**

**IMPORTANT! Gray base color is used to emphasize an important detail.**

## 1.3 SYMBOLS AND WARNINGS USED IN THE MACHINE



Read the instruction manual attentively before carrying out installation, operation, setting or maintenance of the machine.



Electric box. Danger may be caused by electric installation.



Caution! Hot!



Don't look into the pipe during the process relating to the collar.



Don't stay on the pipe line or beside the holes.



Don't put your hands on the tube line under the machine or in the end of the machine during process.



Warning! Moving parts. Be extremely cautious when handling this area of the machine.



Do not loosen the upper clamps tightening screw when clamps are open. The clamp might fall down.



Tighten the clamp tightening screws to 40 Nm or so that the ends of the screws' threads are level with front panel.

## 1.4 PERSONAL PROTECTIVE EQUIPMENT FOR THE OPERATOR

Always wear the appropriate personal protective equipment, and use extreme caution when operating the machine.

**Take all local safety regulations into account! This manual does not undermine any your own safety regulations.**



Use hearing protector when operating with the machine.



Use protective glasses when operating with the machine.



Use safety gloves when operating with the machine



Use safety boots when operating with the machine

## 2. GENERAL SAFETY INSTRUCTIONS

Read the instruction book attentively before carrying out installation, operation, setting or maintenance of the machine. The T-DRILL machine is to be used only for the purposes and in the way as specified in this manual.

Do not allow visitors or unqualified persons to enter the working area or to come near the machine.

When operating the machine, all protection devices should be fitted in their right place and be in proper condition.

Do not keep any loose objects or tools on the machine.

Never exceed the capacity of the machine.

Observe special caution when using the pipe clamp.

Always disconnect the current supply before opening the electric box of the machine.

Disconnect the current supply before carrying out any maintenance or repair inside the machine.

When pressing the emergency stop switch, all functions of machine are immediately stopped.

After installation of the machine, before operating it, carry out the “Start-up Inspection”, described in chapter 5.4.

Always use personal protection equipment when using the machine.

**➔ NOTE! ALWAYS KEEP THIS INSTRUCTION BOOK AT HAND FOR ANY FUTURE USE.**

## 2.1 FLANGING MACHINE SAFETY INSTRUCTIONS

Before switching the flanging machine on, the work supervising personnel and the employees shall carefully acquaint themselves with the manual, the structure of the machine and its functioning. Memorize the location of each operating switch and the function the switch regulates.

Use the machine for no other purpose than for those allowed in the manual; be careful at all times. Ensure that there are no unauthorized persons in the vicinity of the machine.

Flanging shall take place under the supervision of the management in such a manner as no excess of the machine functioning values may occur and the machine is generally used according to the manual and safety regulations.

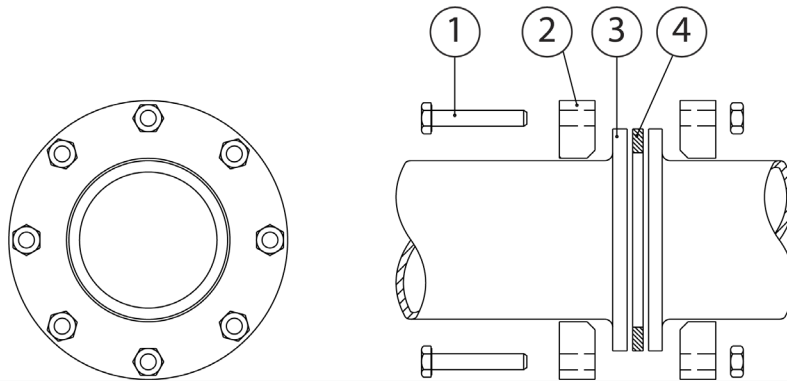
➔ **NOTE! Be especially careful when adjusting the machine and when clamping and unclamping the pipe. Be constantly prepared to stop the machine if necessary. See instructions for adjusting the forming pin according to pipe size, chapter 6.3 Machine settings.**

**Keep all the hoods and covers in good condition.**

### 3. F-200 GENERAL INFORMATION

#### 3.1 INTRODUCTION OF FLANGING

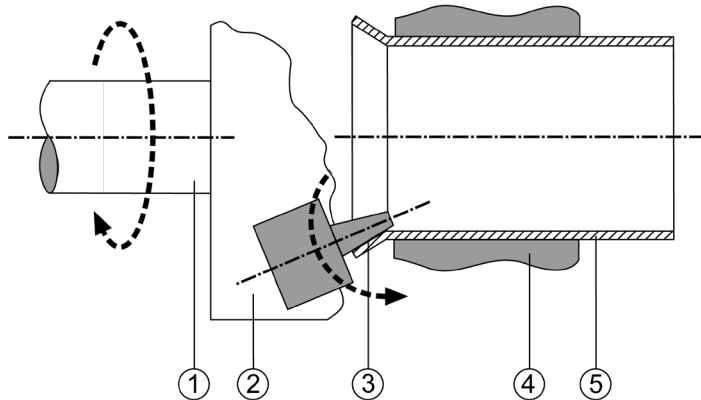
The machine is intended for widening the end of a pipe to form a flange using a rotating forming cone. The flange thus formed is used as a sealing and joining element in so-called loose flange joints.



1. Bolt, 2. Loose flange, 3. Flanged pipe, 4. Seal

#### The work method of the machine

The spindle and the flange spinning tool attached to it are made to rotate by an electric motor. The bearing-mounted forming pin in the flange forming device turns directed by the guide of the slide and while turning forms the flange in the pipe end. All machine movements are hydraulic, except for the spindle rotation and the movement of the arm of the heating burner.



The flanging operation: 1. Spindle, 2. Flange forming tool, 3. Forming pin, 4. Pipe clamp, 5. Pipe

The pipe remains immobile during the entire work cycle and consequently also branched and bent pipes can be flanged. The work method makes it possible to flange a great number of pipes of different diameters, since the forming pin and the pipe are linearly in contact with each other. The wall thickness of the pipe determines almost completely the necessary amount of force to be exercised on the material for flanging.

Pipes flanged by this method can be used in loose flange joints to replace lapped and partly also cast pipe ends involving welding or soldering. The maximum dimensions of the flange are the same as those of equivalent welded on lapped pipe ends.

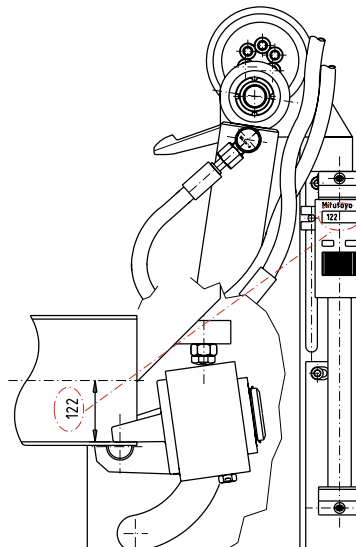
Depending on the conditions of use, EN1092-1 standard or standard derived from this can be used in dimensioning. The main factor, which defines the maximum diameter of the flange, is deforming capability of material. In practice this capability is expressed as elongation. This means that the proportion  $d_4/OD$  should be smaller than the elongation value of material to be flanged. However, the experimental results show that much higher elongation values can be achieved thanks to the multidimensional straining scheme.

In hot forming the sealing surface can be changed in quality from smooth to rough by selecting the appropriate profile for the forming cone.

### 3.2 INFORMATION ON THE EQUIPMENT

Following equipment is available for the F-200 machine:

- **Heating unit is an equipment used for heating the pipe to be flanged or otherwise formed.** The heating unit enables the flanging of thick-walled pipes. The equipment comprises an optional range of different heating nozzles, an infrared thermometer and an automatic flame guard.
- **Beveling unit** to be used for beveling the edge of the pipe end, to prepare it for welding.
- **Forming pin.** Different forming pins are available for forming a grooved flange and for flanging stainless steel pipes. The standard forming pin delivered with the machine is for use on normal steel pipes. For flaring not necessary to use grooved forming pin.
- **Expansion pin** to expand the end of the pipe for a sleeve extension.
- **Pipe gripping clamps** which can be ordered according to pipe diameter, available for diameters from  $\varnothing 21.3$ -  $\varnothing 219.1$ mm.
- **Digital measuring device for positioning of the forming pins.** Indicates the distance from the surface of the forming pin to the center of the pipe clamp. Read the instructions which are supplied with machine (as PDF on memory stick).



*Digital measuring device for positioning of the forming pins*

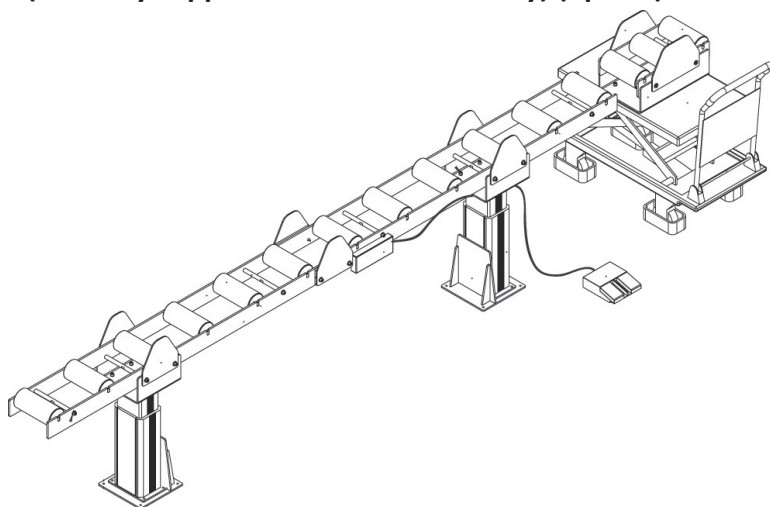


- Potentiometer and display.



*Display for adjusting the potentiometer (Diameter of the flange, the rearmost and the front position of the frame.)*

- Roller track (auxiliary support table with lift trolley) (option) 5391547



*Designed to help handling of larger and longer pipes, and to ease removal from the clamps after the flanging. Read the instructions which are supplied with machine.*

The roller track can handle pipes  $\varnothing$  20 mm ...  $\varnothing$  219,1 mm.

The maximum weight of the pipe is 250 kg, and maximum length of the pipe is 6000 mm.

### 3.3 THE USE OF THE MACHINE

T-DRILL F-200 is a flanging machine, the main purpose of which is forming the pipe end into a 90° flange by means of a revolving spinning tool. This method is indicated for soft steels (f.inst. St 35 DIN 17175), different copper alloys (f.inst. CZ110 BS 2871), stainless steels (f.inst. AISI 316) and soft aluminium alloys. The flanging can be performed on cold or hot pipe.

**Cold flange forming** can be used for stainless steel, mild steel and copper alloys. Some cases the tube needs a heat treatment to remove tension. With small diameters the relative tube stretch may be 75%.

The wall thicknesses of the pipe to be used are:  $s=1,5...5-6\text{mm}$ .

**Flange forming after preheating** is used for stainless steels. Before flanging, the pipe end is preheated to 200°C-300°C, which prevents hardening of the material during the flanging. The preheating may be done by means of the heating unit or else by heating the pipe in another way before the flanging operation.

The wall thicknesses of the pipe to be used are:  $s=1,5...4-5\text{mm}$

**Hot flanging** is used for mild steels. The pipe end is heated to about 900°C-950°C, so as to reduce the force required for the flanging. Moreover no further heat treatment after flanging is then necessary. The heat treatment instructions regarding the material to be treated must be observed.

The wall thicknesses of the pipe to be used are:  $s=3...8\text{mm}$ , depending on the temperature of the pipe.

**Flanging in two or three stages** is used for thin-walled pipes. First the flange is being spun the time set, after which it returns, preventing the pipe to wrinkle at the bending radius of the flange.

Hereafter the forming pin continues the flanging operation until completed if no order for a second return, i.e. a third flanging stage, is given.

### 3.4 METHODS OF FLANGING

#### 3.4.1 COLD FLANGING

This is definitely the most efficient method due to its simplicity. However, in most cases, annealing is required for stress relief after forming because, for example, with small pipe dimensions the relative elongation may be up to 75 %. This is considerably greater than obtained in tension tests, and results in hard and brittle structure.

Wall thicknesses: 2...5 mm for mild steel, stainless steel and copper alloys, up to 219,1 mm (8") pipes. See chapter 6.3. Cold flanging and flaring of the pipe.

#### 3.4.2. FLANGING AT RAISED TEMPERATURES

This method is used for austenitic steels. Before flanging the pipe end is preheated to 200...300 degrees centigrade, which prevents hardening during the flanging operation. Wall thicknesses: 2...5 mm. Up to 219,1 mm (8") pipes. See chapter 8. Hot flanging (and flaring) of the pipe.

### 3.4.3. HOT FLANGING (OPTIONAL EQUIPMENT)

With soft steels, the part to be flanged can be austenitized at a temperature of about 900...950 degrees centigrade, thus avoiding the need for heat treatment after flanging and reducing the force required in machining. When using this method, it is necessary to adhere to the instructions for the hot forming of the material being treated. Heating can be done by gas heating.

### 3.4.4 EXPANSION (OPTIONAL EQUIPMENT)

The second additional purpose is to expand the pipe end so that the inner diameter will be expanded to the extent that another tube can be joined in. That kind of expansion gives a possibility to join pipes by means of "slide on".

### 3.4.5 BEVELING (OPTIONAL EQUIPMENT)

The bevel for welding can be done on carbon steel and copper pipes. The outer diameter of the pipe to be beveled can be between  $\varnothing$  42,4 and 219,1mm, and the wall thickness of the pipe to be beveled must be more than 3mm.

## 3.5 TECHNICAL SPECIFICATIONS

See 15. Addenda / 15.1 Capacity of the machine.

The Outer Diameter (O.D.) of the flange and its corresponding d4 standard:

21.3 < O.D. < 50	->	d4: EN 1092-1 / PN 6
50 < O.D. < 219,1	->	d4: EN 1092-1 / PN 10

Type	F-200	NOTE!
Type code	3926	
Pipe to be flanged	$\varnothing$ 21,3- $\varnothing$ 219,1	
Maximum wall thickness	2...5 mm	See capacity diagrams
Materials to be formed	Copper, Carbon steels, Stainless steel, Aluminium	Other materials: Consult T-DRILL Oy
Flanging time	See 16.2 Processing times	
Connected power	10 kw	See Machine plate
Max size of fuses	3 x 35–100 (min–max) A	
Working voltage	200V - 240 V 50/60 Hz 380V - 480V / 50Hz/60Hz.	See Machine plate
Spindle motor	10 kW	
Rotational speed of spindle	approx. 100 rpm	
Measurements of machine (h x w x d)	1605 x 1200 x 2000 mm	
Noise level	73 (During flanging) dB(A)	
Weight	2800 kg	
Compressed air supply*	6 bar (0,6 MPa)	*Heating unit, optional equipment

1 bar = 0,1 MPa

## 4. TRANSPORT, HANDLING AND STORAGE

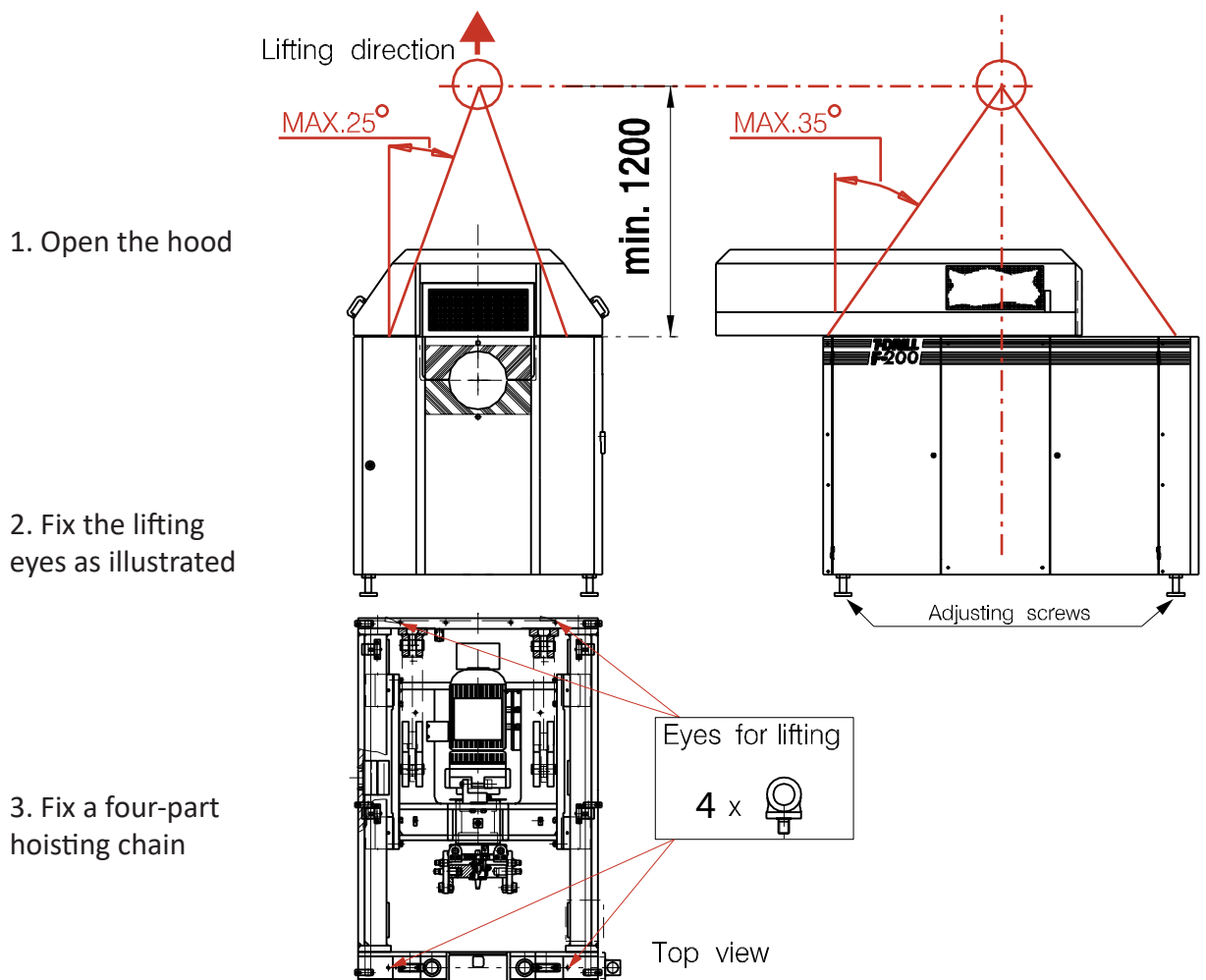
For transport the F-200 is packed into a wooden case and bolted to its bottom or is bolted to a wooden base and plastic covered. Weight of the machine is approximately 3150 kg. For storage the F-200 is to be protected by grease and sufficient dehumidification should be provided in the storage accommodation. Especially the electric equipment must be kept dry. The machine can be lifted with a fork lift when attached on the pallet, from under the pallet.

To remove the machine from the pallet, remove all fixing screws first. The corner plates have to be removed to reach the screws and adjustable machine feet (adjustment of the machine feet requires special tools).

To lift the machine, use adequately strong lifting chains. The machine must be lifted from the lifting eyes, do not use fork lift to lift the machine without the pallet. The lifting eyes can be removed after the machine is installed.

Before installing the machine, see layout for required space.

**Before lifting the F-200 machine:**



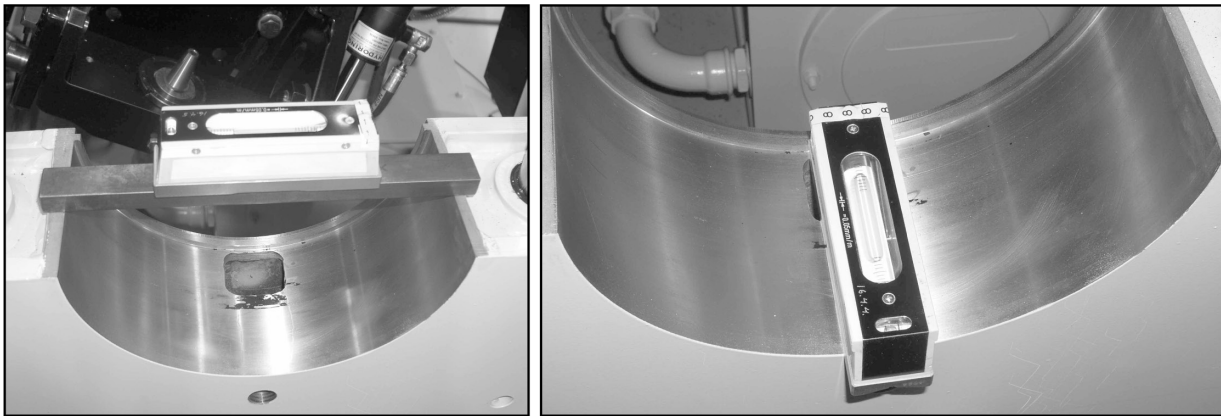
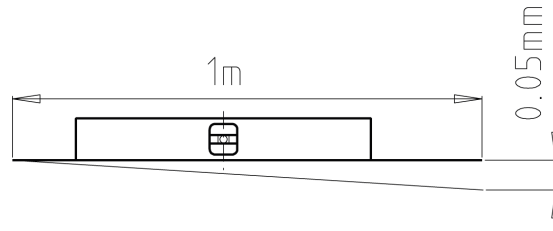
➔ **NOTE! Do not use a forklift truck to lift the F-200 without the pallet!**

### 5. INSTALLATION

#### 5.1 INSTALLATION OF THE F-200

The machine should be installed on a solid and level foundation, preferably on a concrete bed.

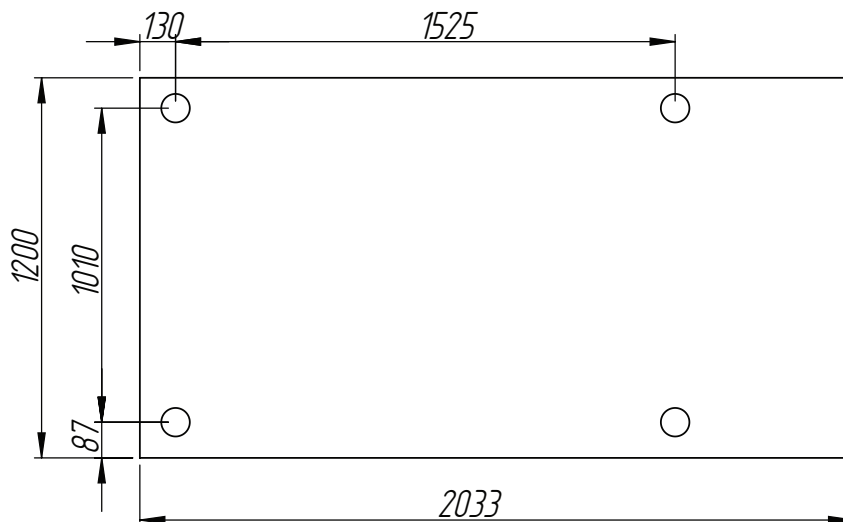
The F-200 machine must be leveled on its foundation before use. The leveling tolerance is  $\pm 5$  mm on 1000mm. Use a spirit level.



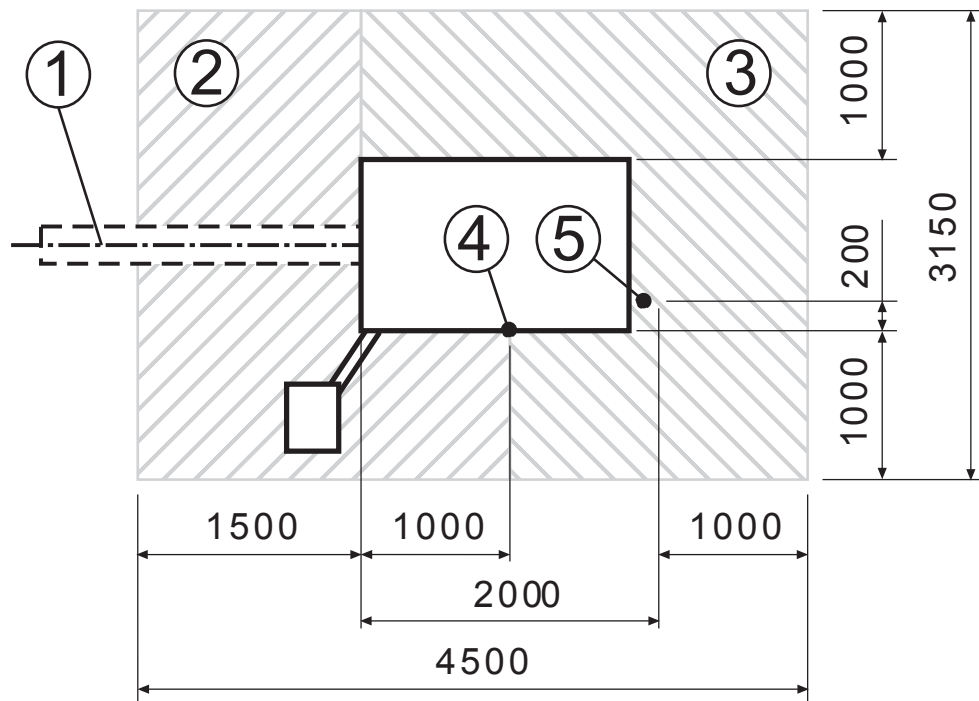
After leveling, fastening the machine to the foundation by means of anchor bolts is recommended. Use anchor bolts M12 x 150... 200 mm.

Remove the protective grease from the machine using a detergent, which will not damage plastic or rubber parts.

Leave enough space around the machine for operation and maintenance. Also take into account the space required for the pipe to be formed.



Position of the machine feet, measured from the front side of the machine.



*Layout: 1. Space required for the pipe, 2. Space for operator, 3. Space for maintenance, 4. Gas line connections, 5. Electric connection*

## 5.2 AMBIENT CONDITIONS

The F-200 flanging machine must be placed in a working area, the environmental conditions of which do not exceed the following limit values:

Temperature:	12,5°...40°C (32...104°F)
Relative humidity of air:	85% or less
Electromagnetism	Surrounding appliances should not cause such electromagnetic perturbations, which exceed the general standards established for workshop machinery.
Altitude:	max. 2200m / 7200ft

### 5.3 CONNECTION OF THE MACHINE TO THE SOURCES OF ENERGY

#### 5.3.1 CONNECTION TO THE ELECTRIC NETWORK

⚡ **DANGER!** Disconnect the electric current to the supply cable before starting to carry out the connection - fatally dangerous voltage.

⚡ **DANGER!** Even if the main switch is in “0” (OFF) position, the switch as well as the supply cable still are alive - fatally dangerous voltage!

⚡ **DANGER!** Only a qualified and authorized person is allowed to carry out the connection of the F-200 machine to the mains.

The terminals for connection of the external supply cable of the F-200 machine are located in the electric box. Pay special attention to the correct earthing of the machine. Check that the working voltage indicated on the machine and the supply voltage coincide. Also check that the current value of the overload circuit breakers corresponds to the current value of the motors. The machine can be supplied for a voltage range of 200-240V/50Hz/60Hz and of 380V-480/50Hz/60Hz. Check the correct connection with the help of the circuit diagram delivered with the machine. This circuit diagram will be found in the pocket of the electric box door. Compare the diagram with the nameplate of the machine.

➡ **NOTE!** If the residual-current circuit breaker is wanted to use with machine power supply system, a pulsating DC type (type A) is recommended to be used.

#### 5.3.2 CONNECTION TO THE COMPRESSED AIR SYSTEM

ⓘ **DANGER!** The connection of the F-200 machine to the compressed air system as well as to the propane and oxygen supply is to be performed only by a person authorized to this effect by the employer.

The heating equipment demands the machine to be connected to a compressed air system. Moreover an oxygen supply and a propane supply are required.



*Compressed air connection and regulator*



Requirements of these supplies:

Compressed air	0,6 MPa
Oxygen	0,4--0,6 MPa
Propane	0,20 MPa

These supplies should be provided with pressure regulators.

► **NOTE!** If there's a danger that particles will get loose from the inside of the heating gas or oxygen pipes, the operation of the valves must be assured by installing a filter in the heating gas and oxygen feed line (filtering at least 50µm). E.g. Krom Schroder GFK 20 (propane).

## Main gas valves

Machine is equipped with main gas valves for oxygen and propane. Gas supplies are connected to these valves. There are also pressure regulators for gas on these valves.





*Main gas valves*

### 5.4 START-UP INSPECTION

➔ **NOTE!** Carry out a start-up inspection before using the machine. A wrong direction of rotation or a wrong voltage may damage the machine.

➔ **NOTE!** The start-up inspection is to be carried out only by a person authorized to perform this duty by the employer.

**Before using the machine, proceed as follows:**

1. Measure the supply voltage of the machine and check, that it corresponds to the tension and the frequency values indicated on the nameplate of the machine.
2. Heating equipment: Check the supplies of the compressed air, of the oxygen and of the propane. If necessary, adjust the values to coincide with the data indicated in the technical specifications (chapter 3.6 of the instruction book).
3. Check the amount of the hydraulic oil and of the lubrication oil of the machine (see chapter 14. Maintenance).
4. Check the rotation direction of the hydraulic pump motor. Turn the main power switch on and press the power on push button  , on the control panel. The hydraulic pump motor will start. Check the rotation direction, indicated by an arrow on the end of the motor. Should the rotation direction be wrong, change phases of the supply cable on the terminal board.
5. Check that the flange forming tool turns in the direction indicated by the arrow (on its body), by pressing the push-button  on the control panel.
6. Check the correct function of the switches and push-buttons of the control panel.

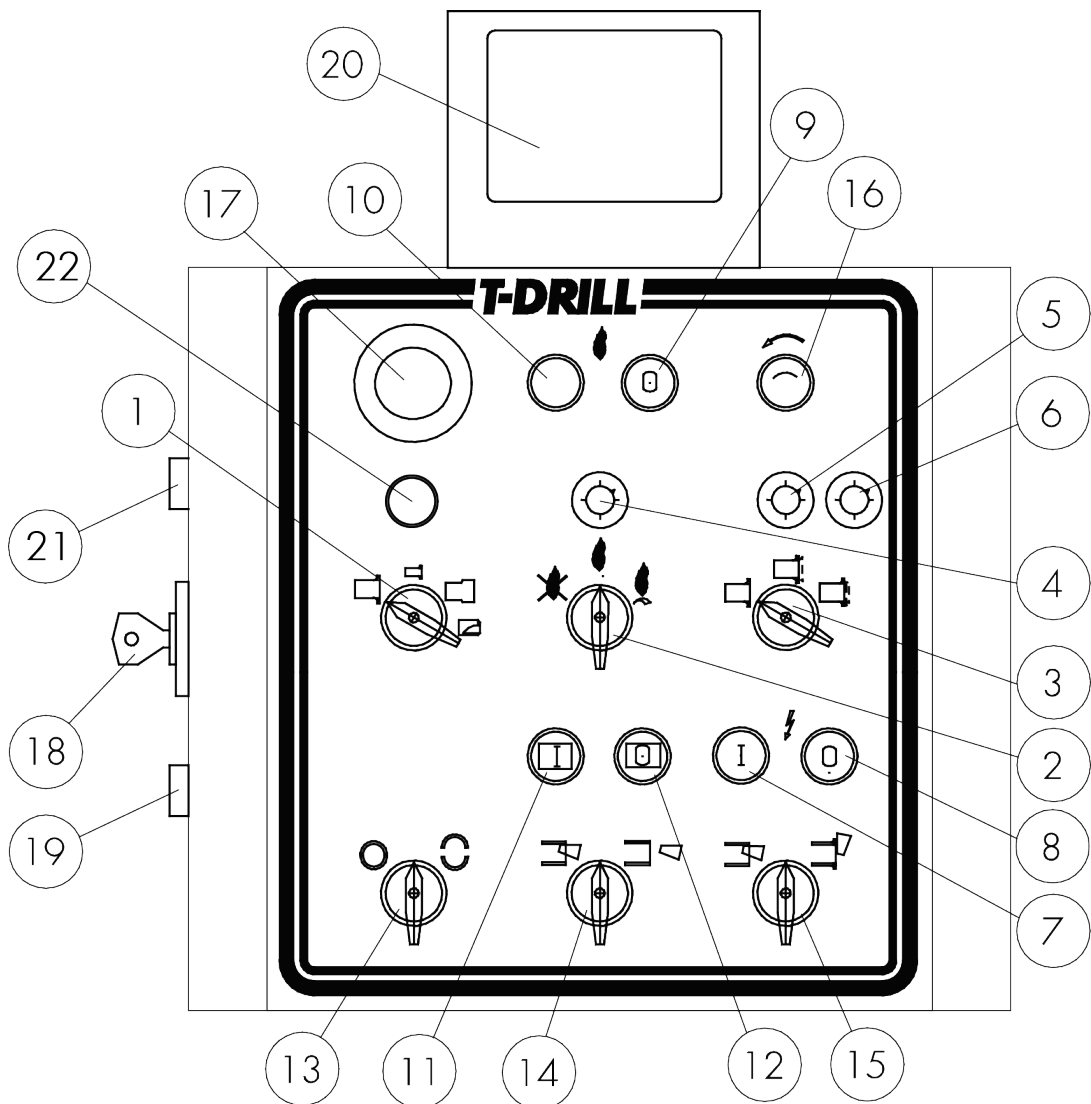
## 6. THE OPERATION OF THE FLANGING MACHINE F-200

### 6.1 DESCRIPTION OF THE CONTROL DEVICES

#### 6.1.1 MAIN SWITCH

The main switch of the machine is located on the door of the electric box on the backside of the machine. The power is connected by turning the main switch to the position "1" (ON). The power is disconnected by turning the switch to the position "0" (OFF). The main switch can be locked in the "0" position by means of a separate padlock in order to prevent unauthorized use of the machine. (A padlock is not included in the T-Drill delivery).

#### 6.1.2 CONTROL PANEL



**Description of the push-buttons and switches on next pages!**





**Heating system is optional accessory!**

**Never use the T-Drill machine USB socket to charge mobile phones or any other devices. The USB connection is only for program upload / download.**




No.	Denomination	Description of the function
1	Selector of the forming	Selects the forming of the pipe end (see separate table on next page)
2	Selector of the way of forming	Selects either cold or hot forming (see separate table on next page)
3	Selector of the flanging mode	Selects the way of flanging the pipe (see separate table on next page)
4	Heating time regulator	Sets the heating time, i.e. the time during which the heating gas valves are open. One number on the scale represents 20 seconds.
5	Regulator of the time of the first return movement in multi-stage flanging	Sets the time during which the flange is being spinned before the first return movement. One number on the scale represents 1 second
6	Regulator of the time of the second return movement in multi-stage flanging	Sets the time during which the flange is being spinned before the second return movement. One number on the scale represents 2 seconds.
7	Power on push-button	Puts the machine on standby, starts the hydraulic pump and connects the power to the control logic.
8	Stop button	Stops the hydraulic pump motor and interrupts the power to the control logic
9	Heating stop push-button	Stops the heating during the automatic work cycle, but the operations of the work cycle will continue until finished. Drives the heating burner arm to lower position, whereupon the main air valve opens.
10	Heating pilot lamp	Indicates that heating cycle is on.
11	Cycle start push-button	Starts the automatic work cycle when the frame is at starting point. Starts the gas flow of the main burner during the heating cycle.
12	Cycle interrupt push button	Interrupts the automatic work cycle, the slide of the burner is retracted to the rear and the arm of the heating burner is lowered.
No.	Denomination	Description of the function
13	Control switch of pipe clamp	Closes or opens the pipe clamp
14	Control switch of frame	Moves the frame forward or back
15	Control switch of the tool	Moves the tool into horizontal position (return movement) or into vertical position (flanging position)
16	Push-button for rotary movement of the forming tool	Makes the forming tool rotate
17	Emergency switch (red STOP button)	Stops the machine in case of danger (see: emergency stopping of machine)
18	Key-switch	To connect control of spindle motor brake
19	Brake release push button	When pressing this push-button, the spindle motor brake is released and the slide can be turned manually

No.	Denomination	Description of the function
20	Control display for potentiometer	For the adjustment of the potentiometer (see chapter 6.4 Machine display and settings)
21	Reset button of the area scanner	Resets the area scanner
22	Signal lamp of the area scanner (OPTION)	Lamp will light, when lens of the scanner is dirty. Clean the lens.

### 1. FORMING MODE SELECT SWITCH




	Flanging.
	Small pipe flanging
	Expansion. This is used when expansion tool is used.
	Welding bevel of the pipe end (OPTIONAL)

### 2. FORMING TYPE SELECT SWITCH

	Cold forming.
	Hot forming.
	Flame adjustment.

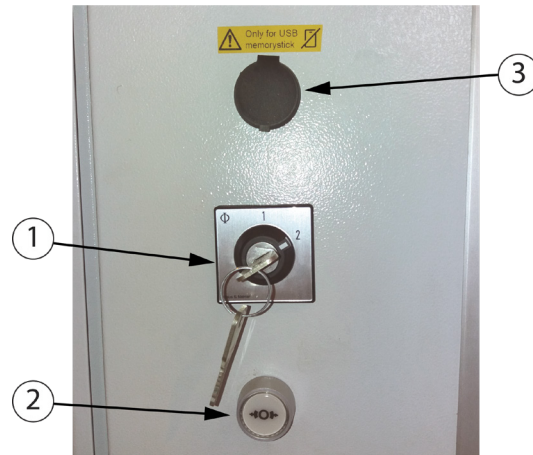
**Heating system is optional accessory!**

### 3. FLANGING MODE SELECT SWITCH

	1 phase flanging. This is used also for expansion.
	2 phase flanging.
	3 phase flanging.

### 6.1.3 KEY-SWITCH AND BRAKE RELEASE- PUSH BUTTON

(18 and 19)



1. Key-switch (1=auto, 2=manual), 2. Brake release- push button, 3. USB connection for memory stick

When key switch is in position 1, the Brake release- push button (19) is not active. When key switch is in position 2, the Brake release- push button (19) is active.

**➔NOTE! Never use the T-Drill machine USB socket to charge mobile phones or any other devices. The USB connection is only for program upload / download.**

### 6.1.4 SIGNAL LIGHTS (OPTIONAL)

Machine is equipped with signal lights which indicate the state of the machine.

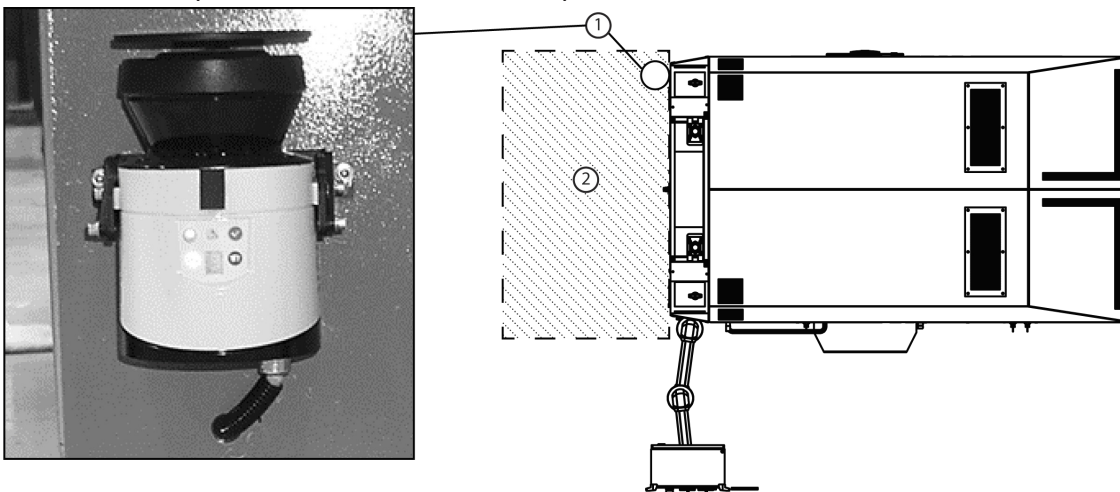
Green = Flanging in progress

White = Process is completed

Red = Machine has a problem

### 6.1.5 SAFETY AREA SCANNER (OPTIONAL)

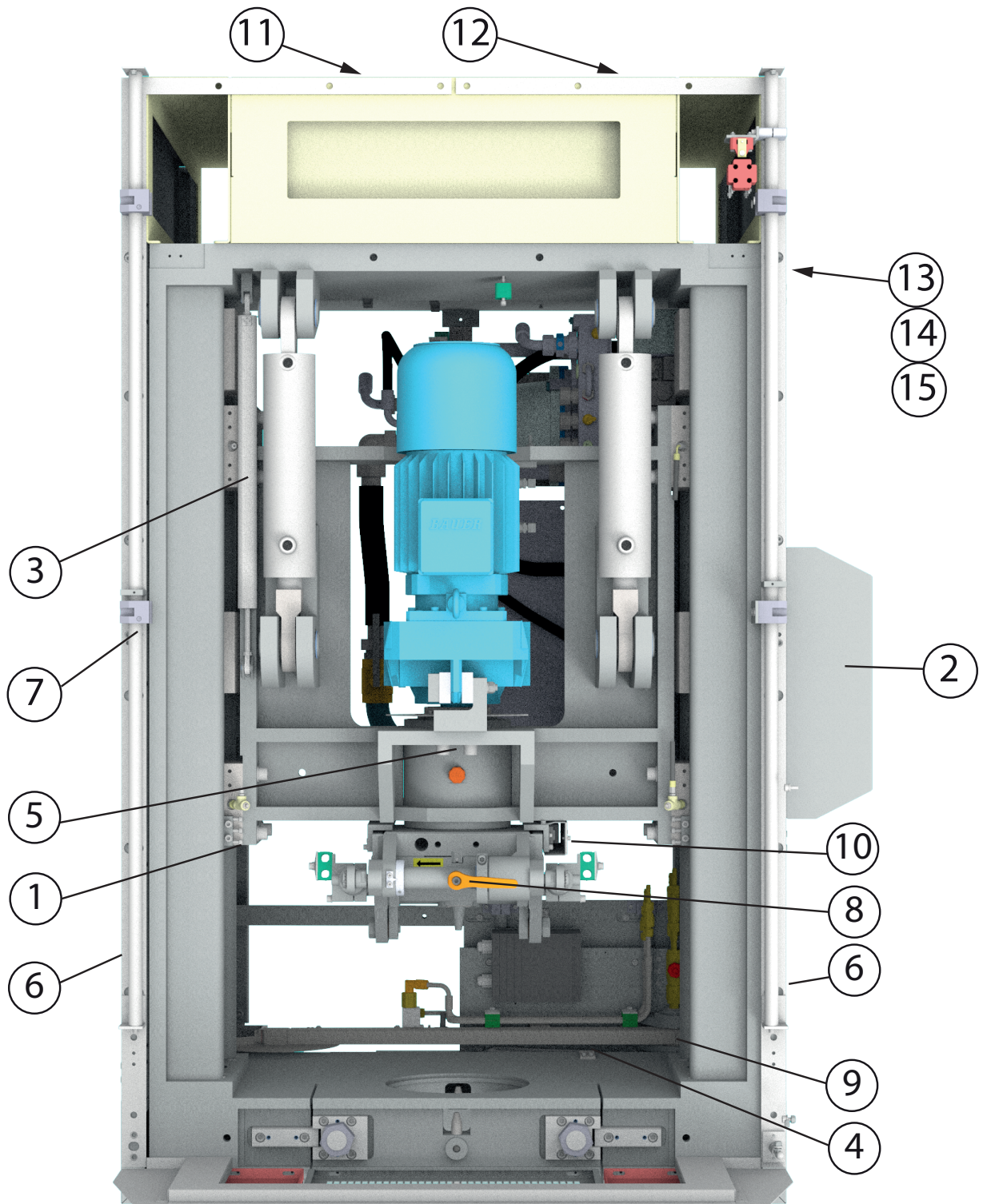
Machine is equipped with safety laser scanner. Scanner will stop the machine if there is something/someone on the area it scans. The scanner safety area can be set from the scanner as required. Scanner is reset with push button 21.



1. Safety Area Scanner, 2. Safety area


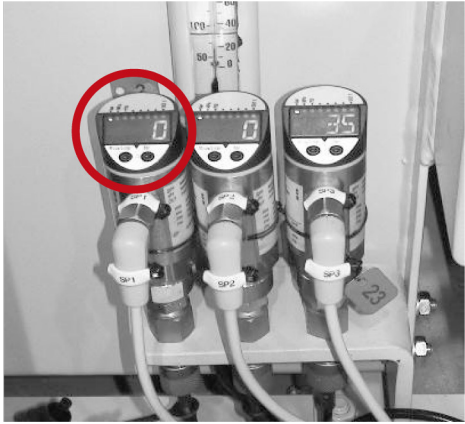


6.1.6 CONTROL ELEMENTS AND ADJUSTMENT POINTS



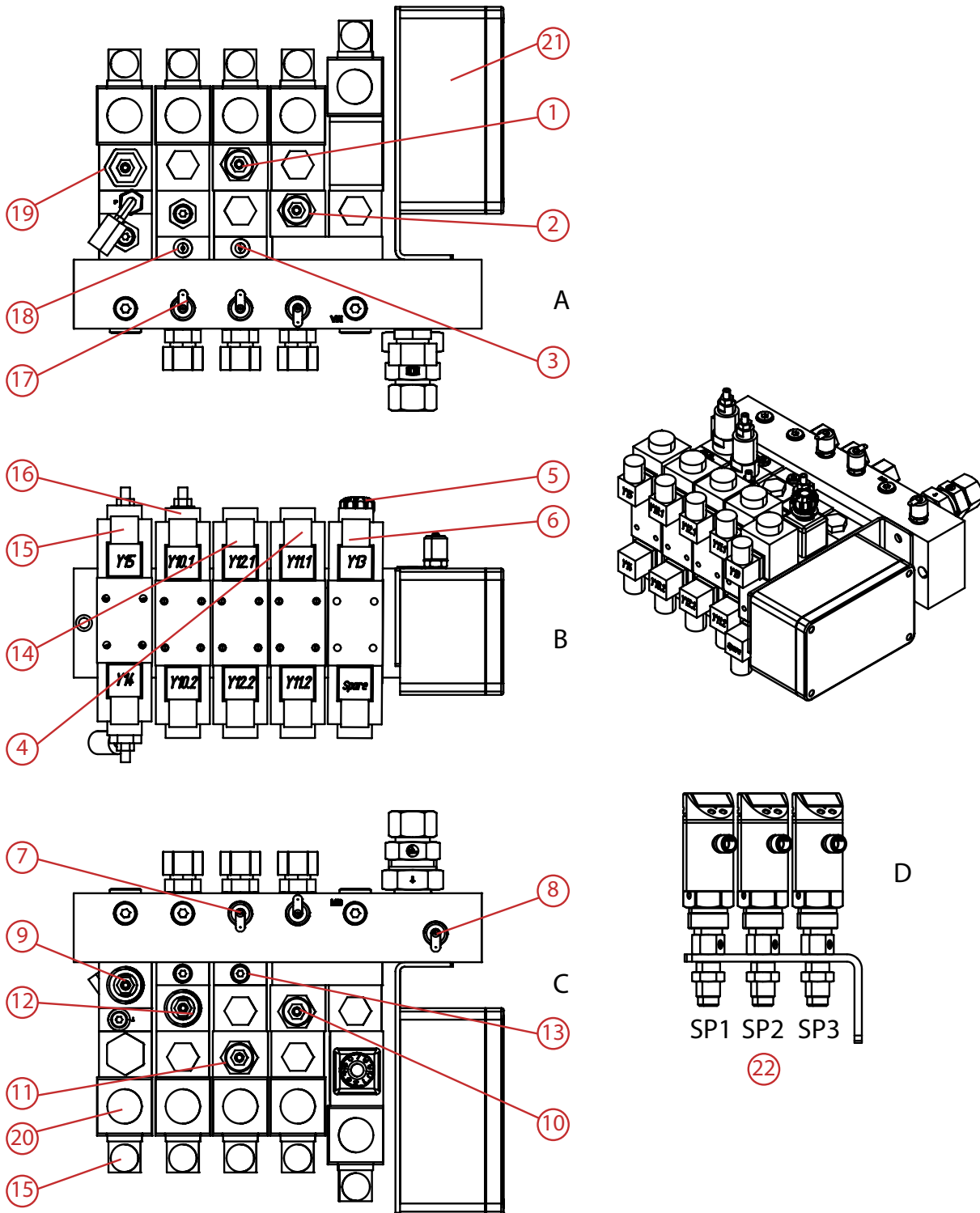


No.	Name	Function
1	Buffer plates	<p>These plates regulate the final distance of the tool and the pipe clamp. See chapter 6.3.4 Fastening of the pipe and clamp changing, item 8: Buffer plates.</p> <p>These plates regulate the distance between the tool and the clamp when the frame is in front position. Thickness (N) of the plate chosen: - For cold flanging <math>S &lt; N &lt; S + 2</math> - For hot flanging <math>S + 2 &lt; N &lt; 2S</math> (S = wall thickness, N = thickness of the buffer plate) Valid with 2.5 radius setting. Marks in housing. Buffer plate set is delivered with the machine, order number as spare: 4401438.</p>
2	Gas heating parts. (OPTIONAL) Throttle valves of oxygen and propane of main burner.	<p>See separate part list, assembly drawing and leaflets. Oxygen flow is determined by pressure in oxygen supply line and position of throttle. Propane flow is determined by pressure in propane supply line and position of throttle.</p>
3	Potentiometer	<p>Potentiometer adjusts the diameter of the flange, the rear and the front position of the frame. When driving moving frame towards the tool with manual control, the movement stops at setting of the start. In order to drive the moving frame (by manual control) into the foremost position, the cam has to be moved back. In automatic flanging cycle the moving frame stops to this limit in the end of cycle.</p>
4	Limit switch S37 Limit switch S38	<p>Clamp closed limit switch (S37) Clamp open limit switch (S38) Indicates that the pipe clamp is in closing position. Automatic cycle does not start if limit is not on. NOTE! Clamp closing pressure is engaged in automatic cycle when this limit is on.</p>
5	Proximity switch B6	Correct position of spindle. The pilot lamp lights when the spindle is in its correct position.
6	Limit switch, service door	Safety switch of service door, with heating system only!
7	Limit switch, hood	Safety switch indicates that the safety cover is open or closed. Machine won't start if the safety cover is open
8	Adjusting and locking device	Regulation of the turning angle of the tool
9	Limit switches (Optional heating system parts)	<p>Limit switch S 33 - burner arm back position. Limit switch S 34 - burner arm front position (heating position in flanging). Limit switch S36 - burner arm heating start position (expanding mode). Reed switch B 3 - burner arm side position. Reed switch B 4 - burner arm up position (heating position).</p>
10	Digital measuring unit	Digital measuring unit shows the pipes inside radius.
11	Frequency converter	
12	Main switch	

No.	Name	Function
13	Pressure switches (Behind service cover)	<p>Pressure switches control automatic operation and in some cases limit the effect of the hydraulic cylinders.</p> <p>Pressure switches control automatic operation and in some cases limit the effect of the hydraulic cylinders.</p> <p>SP1 indicates that the clamp is closed. Set pressure switch so that pressure is just below the clamp working pressure (Preadjusted to 120 bar, if pipe tends to deform because of the clamping force, decrease the clamping pressure, see picture on next page). If pressure deforms the pipe, the forming pin slide and forming pin may be defected.</p> <p>SP2 indicates that forming pin is in start position. Pressure switch is set just below the main pressure (155 bar).</p> <p>SP3 regulates the working pressure of the forming pin. Pressure switch is set just below the main pressure (155 bar).</p>
		
<p><i>Clamp pressure regulator</i></p>		<p><i>Clamp closed pressure switch (SP1)</i></p>
<p>If you change the clamp pressure set the pressure switch SP1 about 10 bars below the clamp pressure. See attached hydraulic documents and pressure sensor operating instructions for further instructions.</p>		
14	Throttle valves of hydraulic cylinders (marked according to hydraulic diagram). (Behind service cover)	<p>Flow restrictor valve (tool to ready position) for forming pin flanging movement speed. Set as required (recommended setting - 17 sec from starting position to final position).</p> <p>Flow restrictor valve (tool to start position) for forming pin return movement speed. 4 sec.</p> <p>Flow restrictor valve (Chamfering speed adjustment, (optional)) for creeping speed of moving frame forward movement.</p> <p>Frame moving speeds are preset at following: backwards 27 mm/s and forwards 19 mm/s. Clamp moving speeds are preset at following: closing 9-10 mm/s and opening 28 mm/s.</p>
15	Main pressure regulator (Behind service cover)	<p>Setting pressure 120 bar</p> <p>Auxiliary pressure- setting pressure 80 bars.</p>

### 6.1.7 THE VALVE ARRANGEMENT BOARD

The valve arrangement board is located in the rear part of the machine, on the hydraulic system. It can be pulled out for adjustment purposes.



The valve arrangement board; A. Below, B. Front view, C. Top view, D. Pressure regulators

1	One-way flow control valve, tool in start position (flanging speed)
2	One-way flow control, frame moving forward / backward
3	Pressure switch SP3, tool in flanging end position.
4	Frame valve Y11
5	Beveling speed adjustment
6	Frame valve for beveling (frame control)
7	Tool pressure measuring point
8	Main pressure measuring point
9	Main pressure regulator
10	One-way flow control, frame moving backwards
11	One-way flow control, tool returning to start position (speed)
12	Clamp pressure regulator
13	Pressure switch SP2, tool in flanging start position
14	Tool valve
15	Pressure selection valve (work pressure / auxiliary pressure)
16	Clamp valve Y10
17	Tool pressure measuring point
18	Pressure switch SP1, clamps closed
19	Pressure adjustment
20	Auxiliary pressure adjustment
21	Electric box
22	Pressure regulators

**Speed of clamping jaw movement:**

Closing movement:	9–10 mm/s
Opening movement:	25–30 mm/s

**Speed of frame movement:**

Backwards:	28–33 mm/s
Forward:	15–20 mm/s

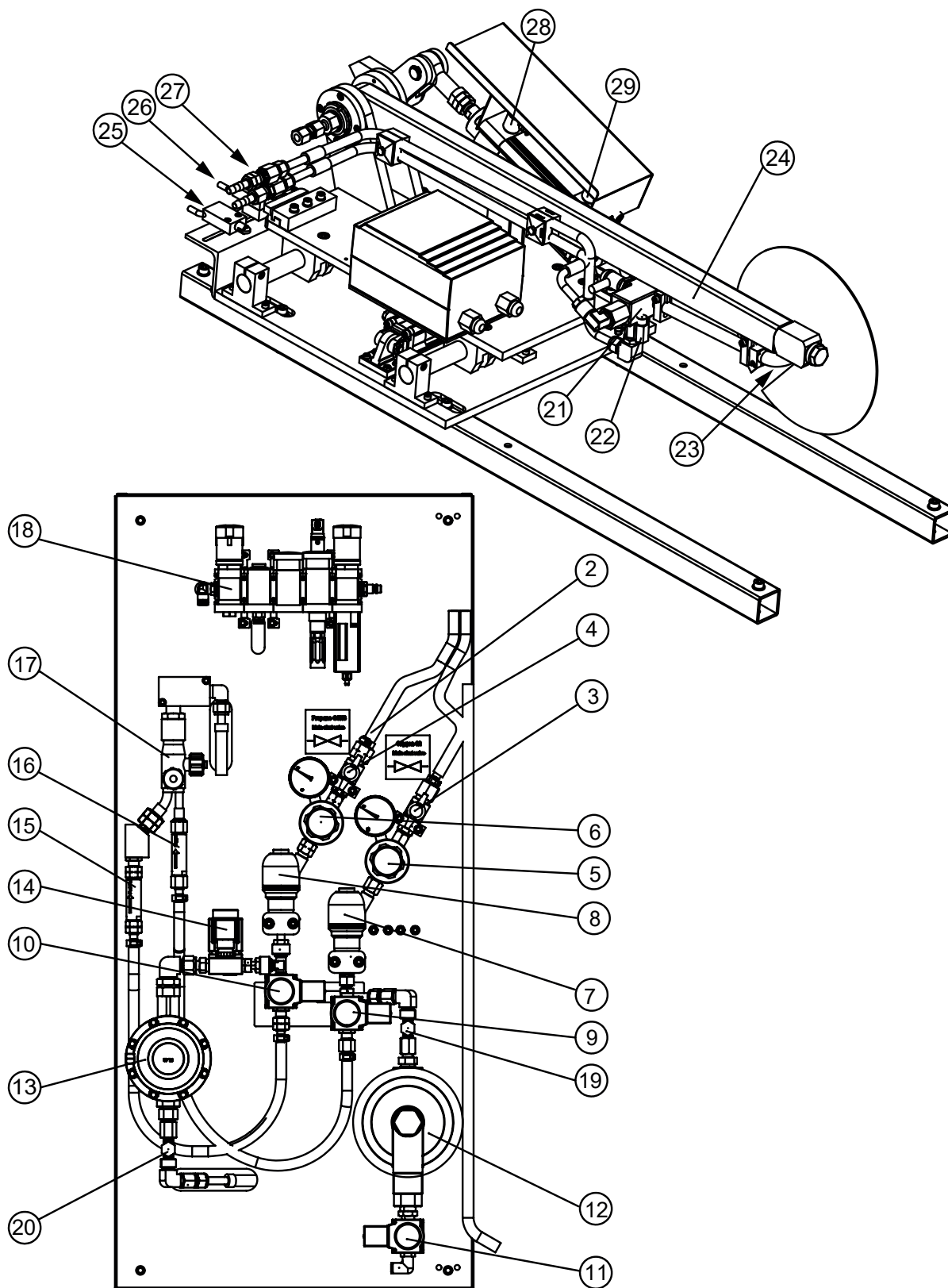
**Speeds of tool movements:**

Flanging movement:	7–13 s (normally 10 s)
Return movement:	normally 4 s

**Valves:**

Y13	Frame, beveling
Y11	Frame normal flanging
Y12	Tool
Y10	Clamp
Y14 / Y15	Work pressure / auxiliary pressure

### 6.1.8 HEATING UNIT (OPTIONAL)



Heating unit

## The parts of the heating unit

Nro.	Description
1	Oxygen supply
2	Fuel gas supply
3	Main shut off valve for oxygen
4	Main shut off valve for fuel gas
5	Pressure regulator for oxygen
6	Pressure regulator for fuel gas
7	Flashback arrestor for oxygen
8	Flashback arrestor for fuel gas
9	Magnetic valve for oxygen
10	Magnetic valve for fuel gas
11	Magnetic valve for compressed air (pilot burner)
12	Pressure reducing regulator for compressed air (pilot burner)
13	Pressure reducing regulator for fuel gas (pilot burner)
14	Magnetic valve for compressed air (pilot burner)
15	Flashback arrestor for fuel gas
16	Flashback arrestor for oxygen
17	Mixer
18	Pressure regulator for compressed air (pilot burner)
19	Regulating valve for compressed air (pilot burner)
20	Regulating valve for fuel gas (pilot burner)
21	Pilot burner
22	Ignition plug
23	Burner
24	Heating burner arm
25	Limit switch S33, the slide of the burner in rear position
26	Limit switch S36, the used with expansion (Optional)
27	Limit switch S34, the slide of the burner in front position
28	Reed switch B4, burner arm in upper position
29	Reed switch B3, burner arm in lower position
30	Compressed air supply

## 6.2 STOPPING OF THE MACHINE

### 6.2.1 NORMAL STOPPING OF THE F-200 MACHINE

1. Wait until the machine has finished the automatic work cycle
2. Stop the hydraulic motor by pressing the stop push-button .
3. Press the emergency stop push-button (red STOP button) completely down.
4. Disconnect the current to the machine by turning the main switch, on the electric box, on the back side of the machine, to the position "0".
5. Close the main valves of the compressed air, of the propane and of the oxygen supply.

### 6.2.2 EMERGENCY STOPPING

In case of danger, stop the machines by pressing the EMERGENCY STOP push button completely down. This immediately interrupts all functions of the machine.



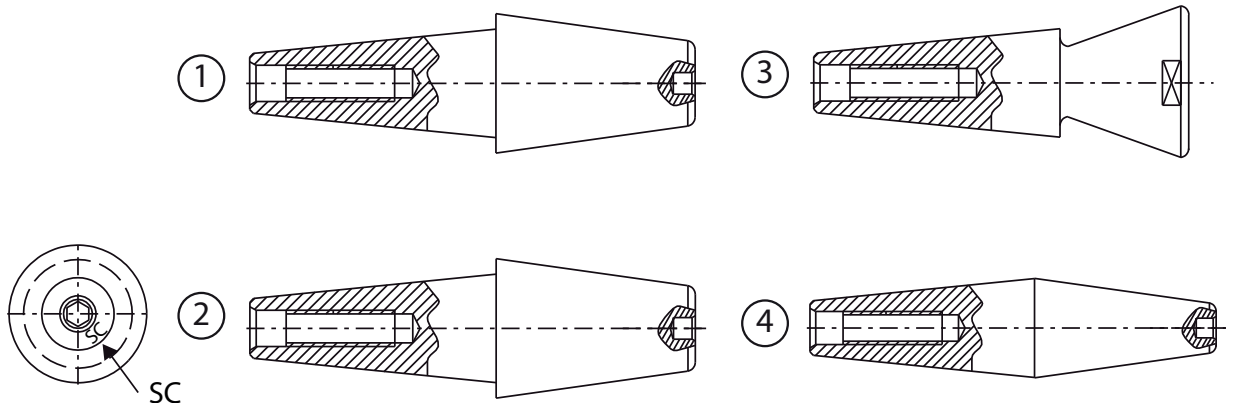


## 6.3 THE MACHINE MECHANICAL SETTINGS

### 6.3.1 CHANGING OF THE FORMING PIN

#### The identification of the forming pin







The forming pin which is part of the standard delivery has no particular markings. The forming pin intended for forming stainless steel bears however the stamped mark "SC" near the width across flats.



*Forming pins: 1. Standard mild steel pin, 2. "SC" marked for stainless steel, 3. Expansion pin, 4. Grooved pin, can be used for hot forming of mild steel pipes*

#### The changing of the forming pin


**ⓘ DANGER! Before closing the clamping jaws make sure they can move freely - the jaws may crush your hands!**

1. Start the machine by pushing the power on push-button .
2. Close the clamping jaws by turning the clamp control switch to , in order to pressurize the hydraulics. Keep the switch in this position until the jaws are closed.
3. Drive the carriage in the rear position by turning the control switch of clamps in position  and turn at the same time the control switch of the carriage to the position  (reverse carriage).
4. Turn the forming pin in flanging position by means of the switch  and at the same time turn the control switch of the tool to the position .
5. Press the EMERGENCY STOP button completely down.



*1. Key-switch (1=auto, 2=manual), 2. Brake release- push button,*

6. Turn the key switch to the MANUAL position “2”.

➔ **NOTE!** The brake is released when the brake release push-button  is pressed down. The brake is engaged again when the push-button is released.

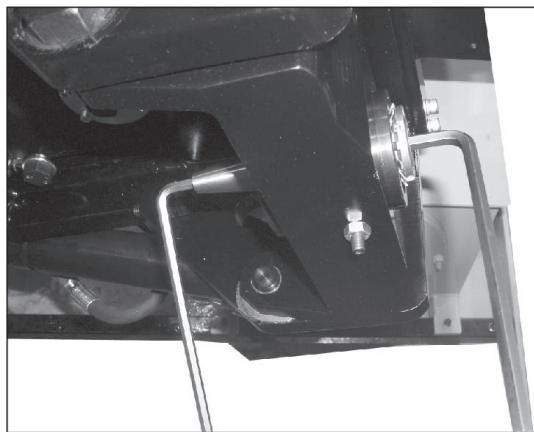
7. Open the hood.

8. Press the  push-button down, which will release the brake.

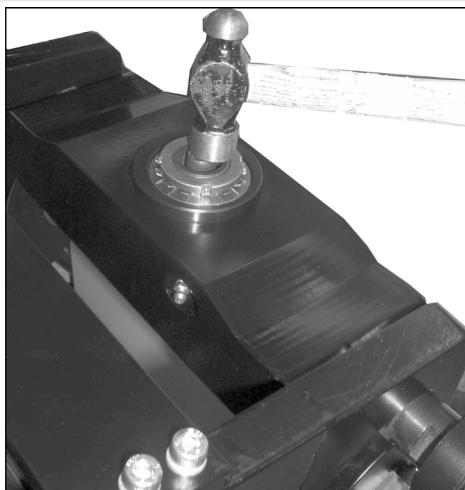
➔ **NOTE!** Be careful when turning the forming pin, because it has the tendency to turn backwards, due to its eccentric mass

9. Turn the forming device to its horizontal position, the adjustment unit will then point to the side. Lock the forming device by releasing the brake push-button.

10. Turn the key switch to the position “0”.



11. Block the rotary movement of the forming pin by means of a 6mm allen key and loosen the 8mm hexagon socket screw, which is behind the pin.

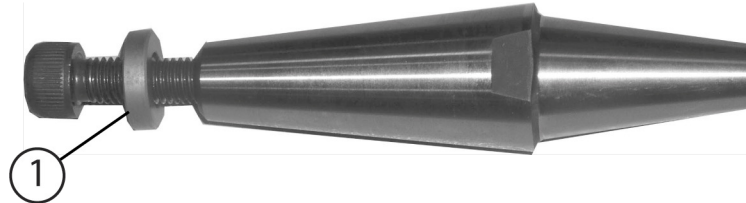


12. If the forming pin does not easily come out of its housing, knock on the hexagon socket screw head with a hammer (the hexagon socket screw has not been removed completely, but is screwed sufficiently inside).

13. Check, that the forming pin and chuck are clean, and the forming pin is fitted in its place and that it turns smoothly when turning it manually.

14. Install a new forming pin and tighten it with care.

➔ **NOTE!** Always use a special washer under the hexagon socket screw.




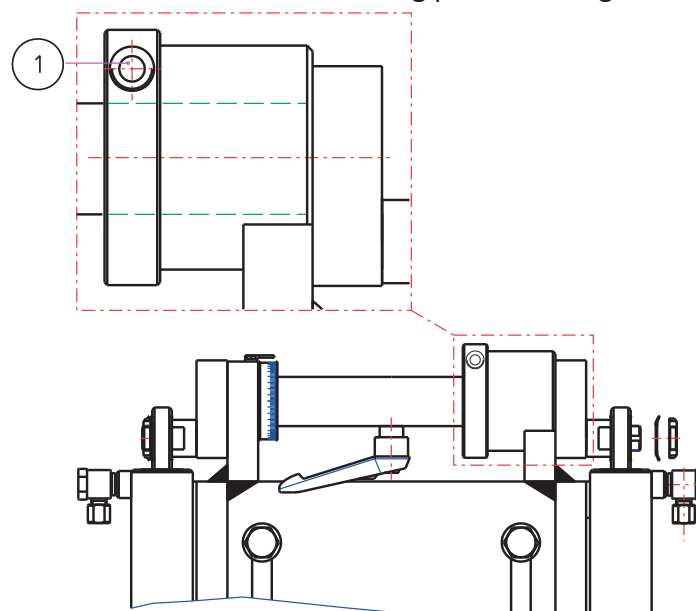
1. Special washer

## 6.3.2 THE ADJUSTMENT OF THE TURNING ANGLE OF THE FORMING PIN

The turning angle of forming pin can be adjusted. Use different angle settings for different forming methods.

### Adjustment of the starting and stopping of the flanging /flaring movement of the forming pin

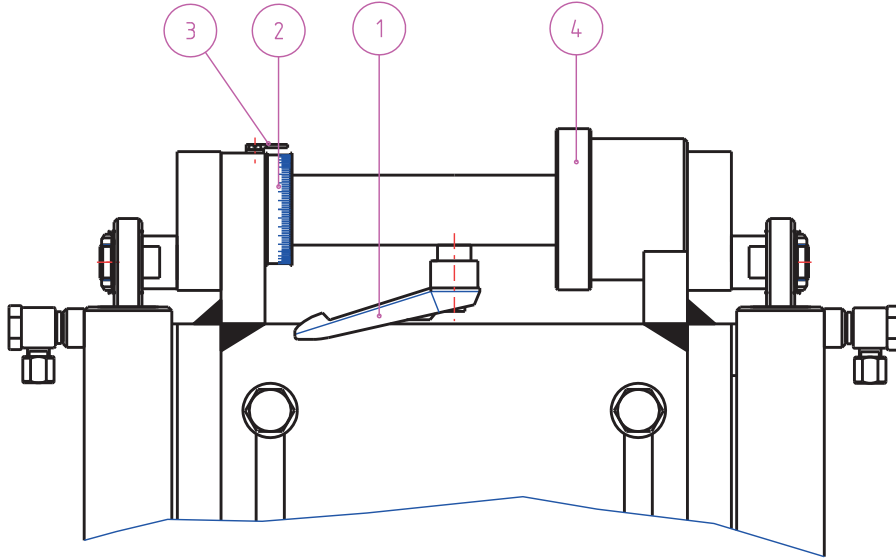
1. Make sure the adjusting rod of the turning of the forming pin is in a position, where it easily can be handled. If necessary, turn the spindle into the correct position by pressing the  push-button.
2. Press the emergency stop button completely down and open the protective hood.
3. Loosen the lock screw of the locking device and turn the adjustment lever. While turning the lever clockwise the forming pin turns less during the flanging operation and turning the lever counter-clockwise the forming pin turns longer. Pointer shows 29...31.



1. The hex socket-head screw of the locking unit.

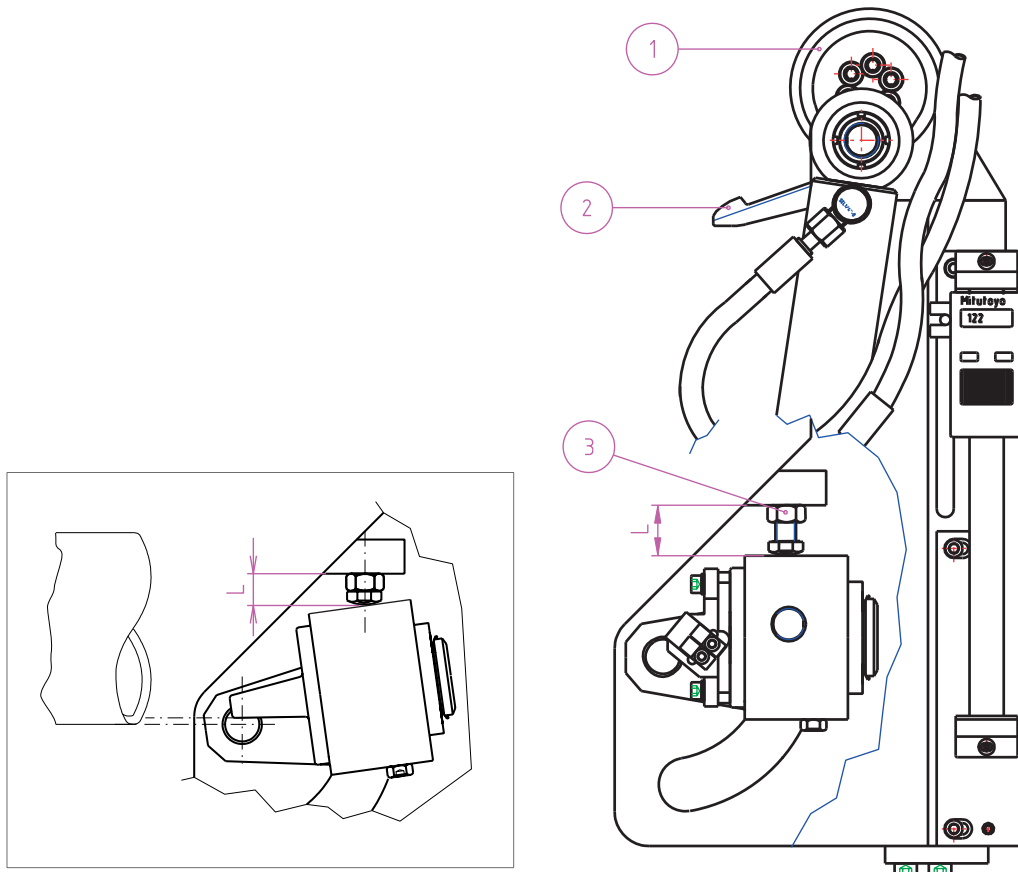
4. When making beveling settings, the adjustment lever has to be turned so, that the cylinder ends are in the upmost position. Pointer shows to 100.

5. Tighten the hex socket-head screw (4) of the locking units to 24 Nm by using torque spanner and 8 mm hex-key. Do not exceed 24 Nm.



1. Adjusting lever, 2. Scale, 3. Pointer, 4. Locking device

6. **When using forming device adjust the stopper screws so that the pin line is parallel with the pipe.** When using expanding tool the adjusting can be the same what forming tool has. Beveling device value  $L=18$ . Beveling angle can be changed by adjusting screws.




The adjustment of the start position of the forming pin, expanding tool and beveling device: 1. Locking device, 2. Adjustment lever, 3. Stop

### 6.3.3 ADJUSTING OF FLANGING RADIUS

See chapter 6.3.4 Fastening of the pipe and clamp changing, item 8: Buffer plates.

► **NOTE!** Before adjusting cut the power.

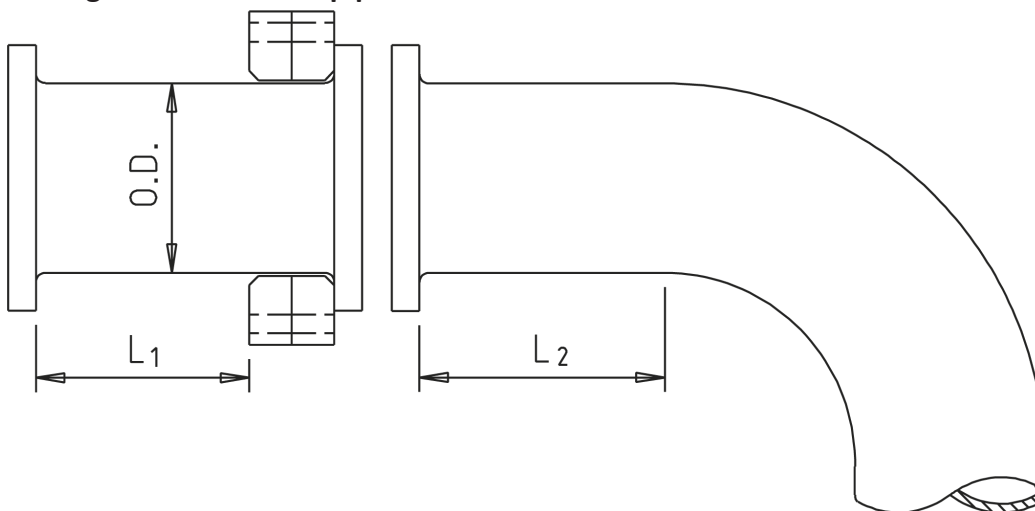
1. Push emergency button down and turn the key to position 2 “brake open”.
2. Push the release brake  push-button (on the side of control panel) down and turn the forming head until the tool is upside down.
3. Open the locking screw and adjust the tool housing.
4. Adjust the turning radius wanted of the forming pin by turning the eccentric sleeve. As turning radius you can select a value between 2,5...7,5mm.
5. Tighten the locking screw.
6. After the forming tool adjusting adjust the front stop position with buffer plates.
7. Check the level of the forming head and adjust it as instructed on chapter 7.1.1 Setting of the pipe end forming device.

### 6.3.4 FASTENING OF THE PIPE AND CLAMP CHANGING


In order to be able to fasten the pipe correctly for flanging, the following pipe dimensions are required:

O.D.	L1	L2
219	200	200
168	200	200
139	200	200
114	125	200
89	125	200
76	125	200
60	125	200
48	125	200
42	125	200
33	120	200
27	120	200
21	120	200

Fastening measures of the pipe



**ⓘ DANGER!** Before closing the clamping jaws, make sure they can move freely - the jaws may crush your hands!

1. Start the machine by pressing the power on push-button .
2. Select the forming type, the way of forming and the flanging mode by means of the selector switches in accordance with the desired automatic work cycle, for instance cold flanging:








Normal flanging.



Cold forming. (If you have heating unit)

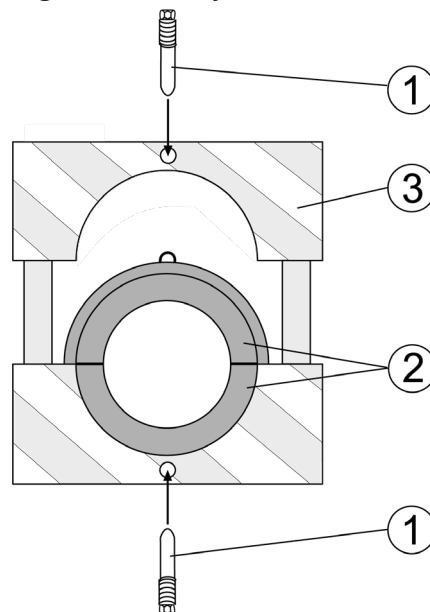


1 phase flanging.

3. Close the clamps by turning the clamp control  switch (clamps close) in order to pressurize the hydraulics. Keep the control device in this position until the clamps are closed.
4. Drive the frame to back position by turning the  switch (clamps close) and turning at the same time the control switch of the frame to the position .
5. Remove the locking pins of the pipe clamps and open the clamps by turning the  switch (clamps open).
6. Stop the machine by pressing the power off push-button .





► **NOTE! Always use protective gloves when handling the pipe clamps.**

7. Remove the previous pipe clamps and install clamps of the required dimension according to the pipe in the guides of the jaws.



*Installation of the pipe clamp or clamp adapter: 1. Locking pins, 2. Pipe clamps, 3. Clamp jaws.*


8. Select the correct buffer plates according to the wall-thickness of the pipe and position of the forming tool housing.


	S=wall-thickness of pipe, N=thickness of buffer plate.
	X=adjustment factor depending of forming tool housing position.
	Cold flanging: $S \leq N \leq S+2 \rightarrow$
	Hot flanging: $S+2 < N \leq 2xS \rightarrow$
	Valid with 2.5 radius setting. Marks in housing
	Select a 10mm buffer plate
	Select a 10mm buffer plate
	Select a 10mm buffer plate

If pin housing is rotated compensate buffer plate thickness correspondingly.


The thickness of the buffer plate is stamped on the plate itself.

9. Loosen the fixing screw and draw out the pin with the buffer plate. Install buffer plates of the correct thickness on both sides and lock them in this position with the fixing screw.

10. Start the machine by pressing the power on push-button  .

11. Close the clamping jaws by turning the clamp control  switch. Make sure the jaw does not cut into the guides of the pipe clamp.

12. Insert the locking pins into the pipe clamping jaws.

13. Open the clamping jaws by turning the clamp control  switch.





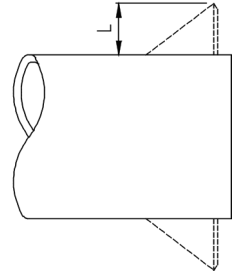
If housing is rotated to +direction, more than 36° (1mm) reduce plate thickness by 1mm.


If housing is rotated to -direction more than 18° (0,5mm) add 1mm to plate thickness.

After that add 1mm to every 36° to -direction.



14.






	<p>Install the pipe to be flanged into the clamp so, that approx. 25mm+N length of the pipe remains outside the end of the clamp</p>
	<p>Install the pipe to be expanded into the clamp using the setting gauge of the pipe</p>
	<p>Install the pipe to be beveled into the clamp using the setting gauge of the pipe</p>
	<p>Install the pipe to be flared into the clamp using the setting gauge of the pipe so that the distance from clamp housing to pipe end is 10mm + flaring length L.</p> <div data-bbox="1161 875 1393 1144" style="text-align: right;">  </div>

15. Close the clamping jaws by turning the clamp control  switch.

**Make set-up table for pipes you are using.**

### 6.3.5 THE PRESSURE REGULATION OF THE CLAMPING JAWS

➔ **NOTE! Only a person authorized by the employer is allowed to carry out the pressure regulation of the clamping jaws**

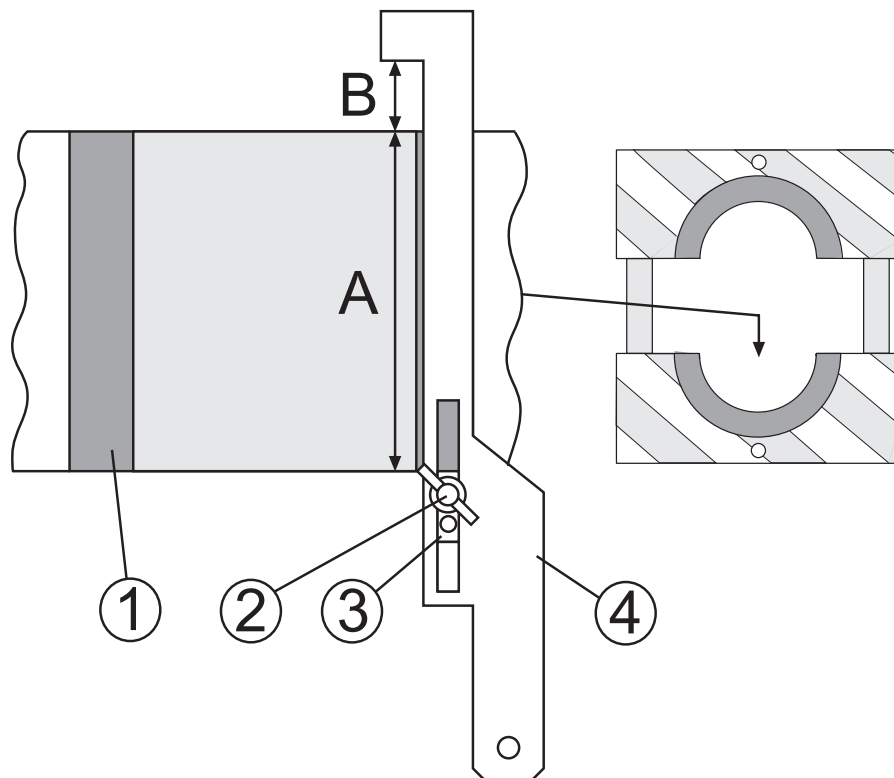
1. Set the machine so, that the work cycle can be started - drive the frame to the start position and the spindle into the correct position.
2. Fasten the mobile manometer of the hydraulics, included in the machine delivery, to the pressure measuring point of the pipe fastening clamp.
3. Start the hydraulics by pressing the power on  push-button.
4. Open the clamping jaws by turning the clamp control  switch and close them by turning the clamp control  switch.
5. Adjust the pressure of the jaws to the desired value (look at the manometer) by operating the pressure regulator of the jaws.
6. Open the pressure switch SP1 4-5 turns (counterclockwise). Make sure there is sufficient screw thread.
7. Press the cycle start  press-button and keep it pressed down. At the same time another person is to adjust the pressure switch SP1 screwing it down until the work cycle starts.
8. Stop the work cycle by pressing the cycle stop  push-button and adjust the pressure switch SP1 by opening it another 1/4 of a turn.
9. Try if the pipe remains in its place without any damages during the entire work cycle and if there is any trouble, carry out the adjustment once again.

## 6.3.6 THE SETTING GAUGE OF THE PIPE

The setting gauge of the pipe is used for regulating the protrusion of the pipe from the end of the clamp (measure B) when expansion, flaring or beveling of the pipe end is to be carried out. When the measure A (the length of the clamp) or B change, the setting gauge is to be adjusted again.


Protrusion B of the pipe:

Expansion	≤ 35mm
Beveling	12-15mm
Flaring	max. 50mm



*The setting gauge of the pipe: 1. Pipe clamp, 2. Wing screw, 3. Slide piece,*

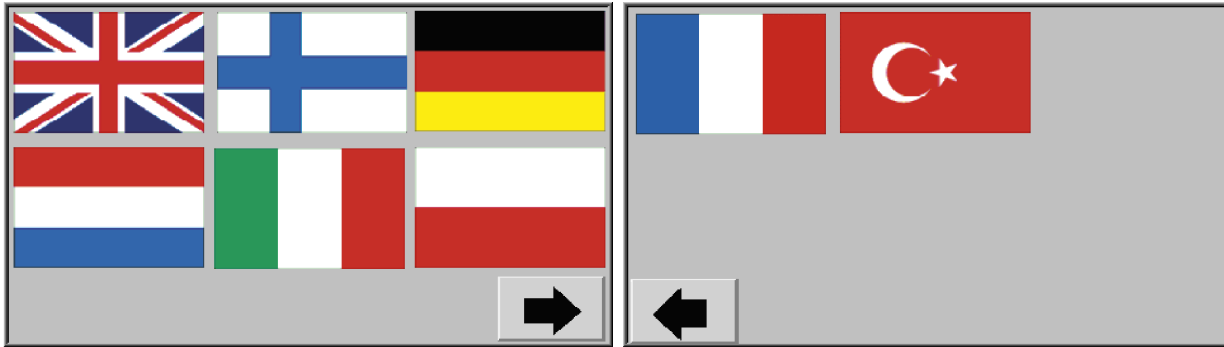
*4. Setting gauge of the pipe*

1. Open the clamping jaws and press the stop push-button .
2. Set the measures A+B on the setting gauge and tighten the wing screw
3. Put the setting gauge on the pipe clamp edge so, that the slide piece is against the outer edge of the clamp.
4. Insert the pipe to be formed into the clamp and push it against the end of the setting gauge.
5. Remove the setting gauge.

### 6.4 MACHINE DISPLAY AND SETTINGS


#### 6.4.1 INSTRUCTIONS FOR THE USE OF THE DISPLAY

Turn on the main power of the machine. The language selection screen appears.

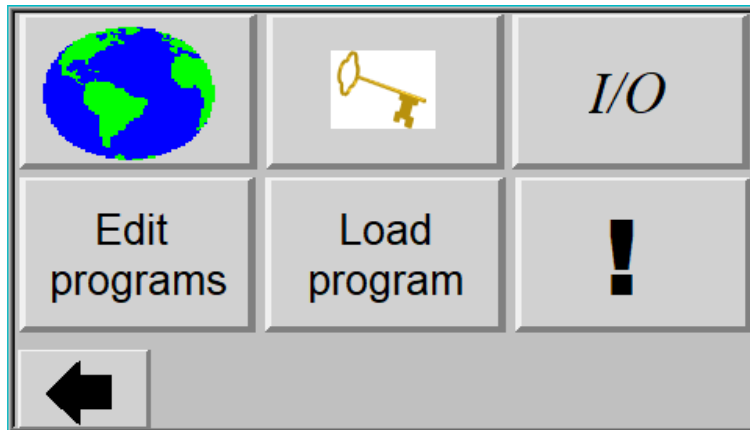


Language selection screen




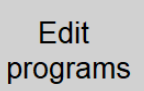
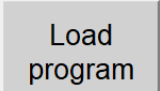
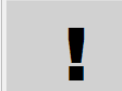

Select language. Now the menu- screen is shown in selected language.

Return to previous screen by pushing  - button.

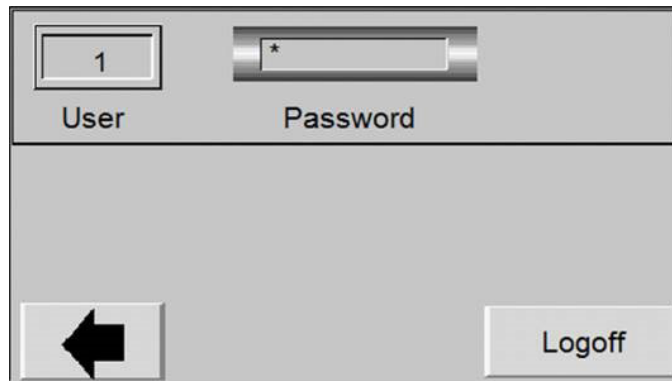
#### 6.4.2 MENU-SCREEN



Description of the buttons:

	Move to: Language selection screen		Move to: User level selection screen (6.4.2.1)		Move to: Input / Output screen (6.4.2.4)
	Move to: Edit programs screen (6.4.2.2)		Move to: Load program screen (6.4.2.3)		Move to: Alarms-screen (6.4.2.5)
	To MAIN screen (6.4.2.6)				

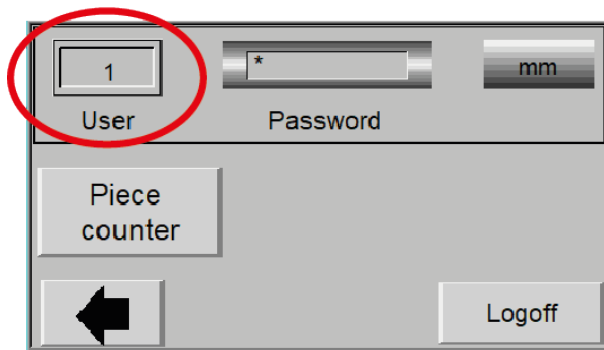
## 6.4.2.1 USER LEVEL SELECTION- SCREEN



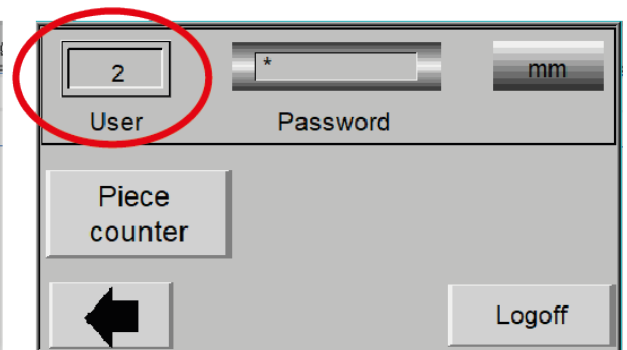
The user level is selected on this screen. These levels contain different rights for programming. Levels require a password to enter, except for the basic level. Insert the password by touching the password- field.

**There are three different levels:**

- Basic level. On basic level you can execute programs.
- User level 1 (Default password: 1). On level 1 you can compile programs, change the units mm/inch and reset the piece counter.
- User level 2 (Default password: 2). On level 2 has the same rights as on level 1 and you can also change the passwords and change flanging phase settings.



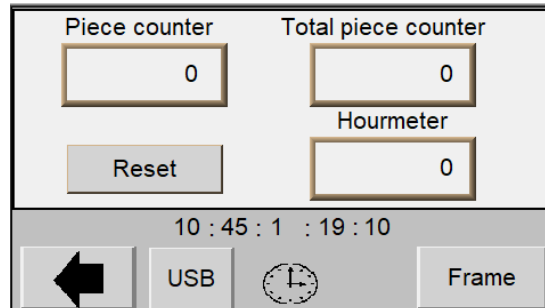
*User level 1*



*User level 2*

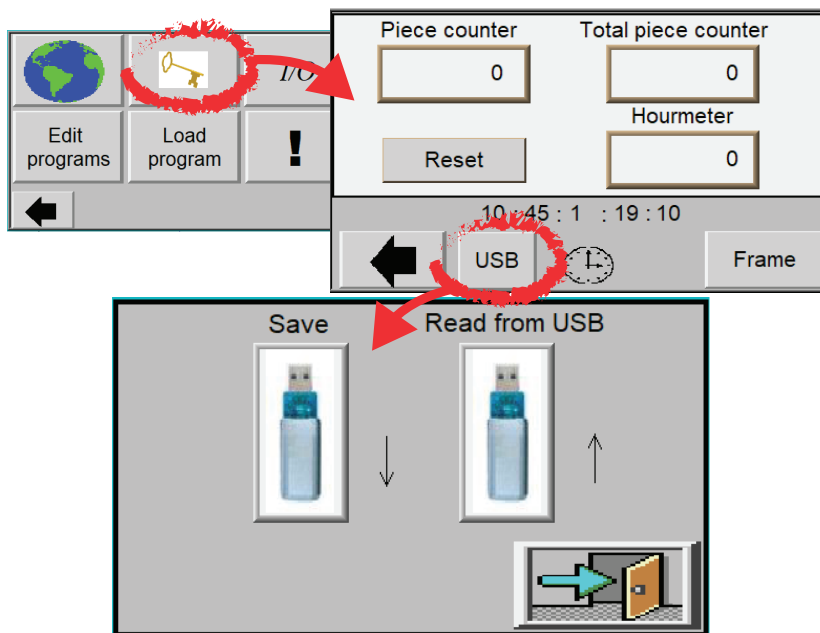
## 6.4.2.1.1 PIECE COUNTER

With “Piece counter”- button you can open the piece counter screen.



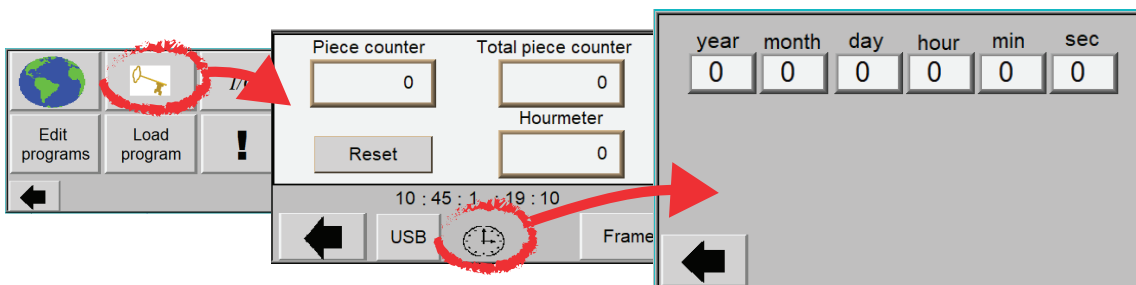
On this screen the piece counters and hourmeters can be checked and the piece counter can be reset if necessary (total piece counter cannot be reset), also buffer plate and password changing screens are entered from this screen. USB usage and clock settings are here.

## 6.4.2.1.2 USB USAGE



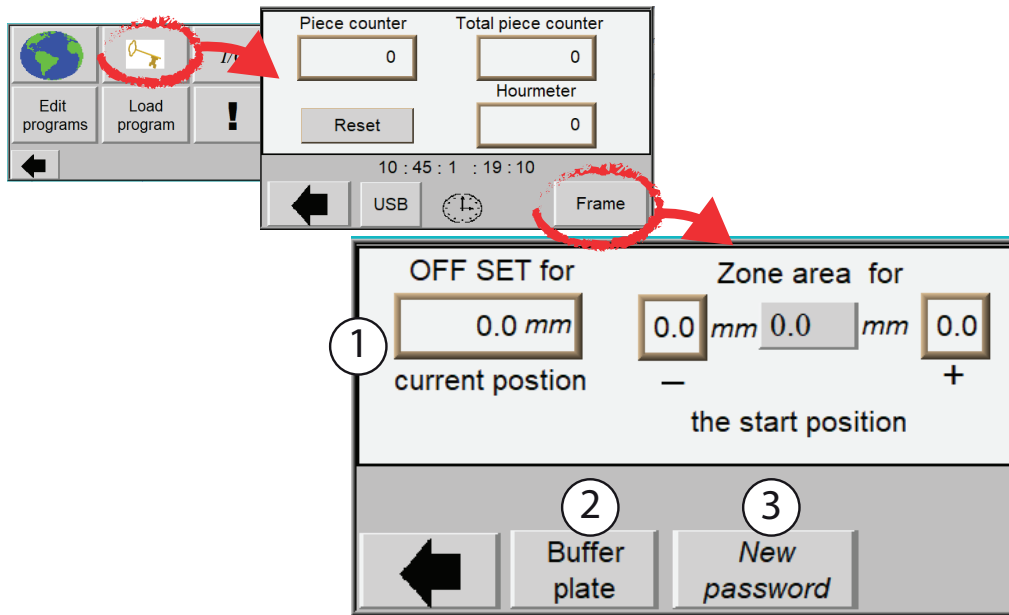
Follow the instructions on the screen.

## 6.4.2.1.3 CLOCK SETTING



Tap field to open pop-up keypad, and give desired values.

## 6.4.2.1.4 FRAME SCREEN

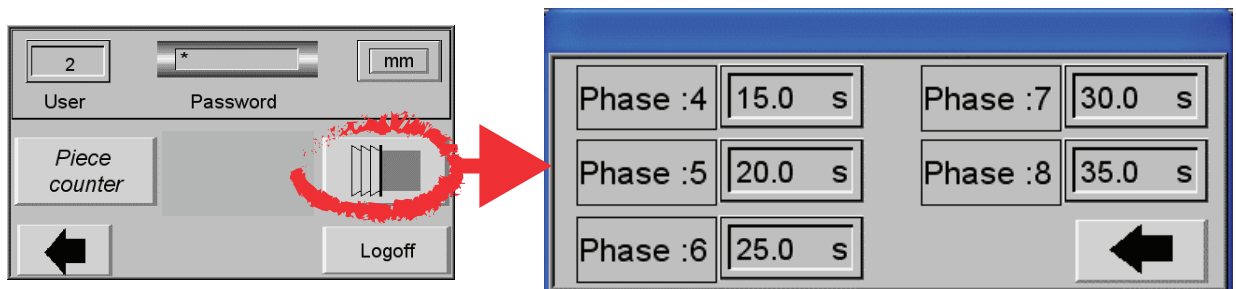


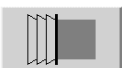
1		The offset value is the repairing value for the slide position. The offset value is factory set to 0. In normal situations this value does not need any adjustment.
2		Tap to enter Buffer plate thickness setting screen: Give buffer plate thickness to the field.
3		Tap to enter Password setting screen (For level 2 users).

## 6.4.2.1.5 MULTIPHASE FLANGING (OPTIONAL EQUIPMENT)

3-phase flanging is a basic setting, from the control panel switch.

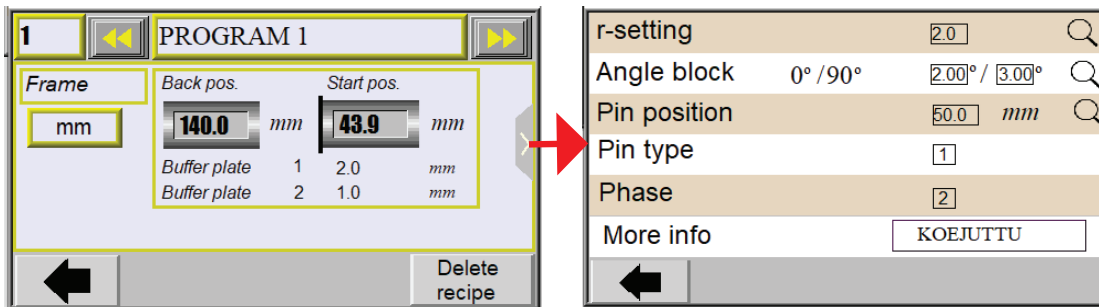
4-8-phase flanging timers: User2 only. For placement on screen program, see "MAIN"-screen.



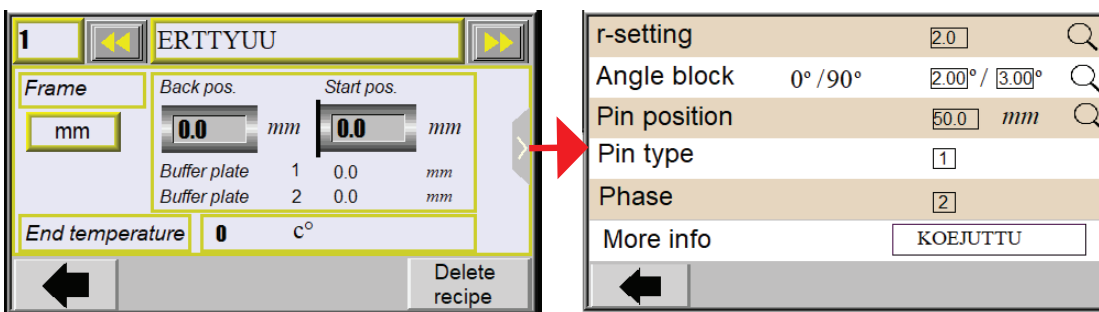
Tap  : user can setup multiphase timer settings.



### 6.4.2.2 EDIT PROGRAMS - SCREEN



Machine without pyrometer




Machine with pyrometer

Operator has to be logged in at least on level 1 to edit the programs. Up to 5000 programs can be saved to the machine memory. Programs can't be executed on this screen.

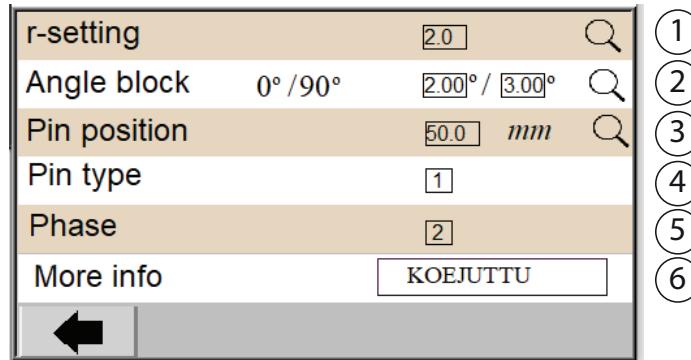
- Set the program name by pushing the "program name" - field on the top of the screen.
- Browse through programs with arrows on the top of the screen or you can give the program number to the top left corner on the screen.
- Change the unit by pushing the mm/inch- field.
- On "Back pos."- field is shown the position where the work cycle starts. After that the frame slides to start position of the forming. Change the value by pushing the field.

**➔NOTE! ! The value of the "Back pos." has to be 60mm larger than the value of the "Start pos.". For example if the "Start pos."= 25mm the "Back pos." has to be at least 25mm + 60mm= 85mm.**

- On "Start pos."- field is shown the position where the tool starts to turn the pipe end. Change the value by pushing the field. Recommended value for this is 23mm + the buffer plate thickness.
- On "Buffer plate 1"- field and "Buffer plate 2"- field is shown the thickness of buffer plates. (See 6.2.4, point 8) Change the value by pushing the number field. The PLC program will sum these values. When only one buffer plate is used, the value of the "Buffer plate 2"- field is 0. Three buffer plates can be used, then add thickness values of two plates to either buffer plate field value.
- When machine is equipped with pyrometer the heating stop temperature can be changed by pushing "End temperature"- field.

- Delete the current recipe with “Delete recipe” - button.
- Return to Menu- screen with  - button.

More information screen can be opened from the gray based arrow on the right side of the screen, **this is only for notes:**



1	r-setting : forming pin setting, see 7.1.1 Setting of the pipe end forming device
2	Angle block: blocks in F-400 only, F-200 see 6.3.2 The adjustment of the turning angle of the forming pin
3	Pin position: scale in F-400 only, F-200 see 7.1.1 Setting of the pipe end forming device
4	Pin type: Pin list see 6.3.1 Changing of the forming pin
5	Phase: in how many phases the flange is made
6	More info: Notes, free field

See information figure of adjustment point by tapping the magnifying glass.

### 6.4.2.3 LOAD PROGRAM - SCREEN

TEST

Frame	Back pos.	Start pos.
	<input type="text" value="0.0"/> mm	<input type="text" value="19.9"/> mm
Buffer plate 1	1	1.9 mm
Buffer plate 2	2	2.0 mm

← Save to library Library

Machine without pyrometer

TEST

Frame	Back pos.	Start pos.
	<input type="text" value="0.0"/> mm	<input type="text" value="19.9"/> mm
Buffer plate 1	1	1.9 mm
Buffer plate 2	2	2.0 mm

End temperature  c°

← Save to library Library

Machine with pyrometer

Select a program to edit the program on library screen. Tap "Library"-button to enter library. Return to previous screen from the black arrow button.

TEST

Frame	Back pos.	Start pos.
	<input type="text" value="0.0"/> mm	<input type="text" value="19.9"/> mm
Buffer plate 1	1	1.9 mm
Buffer plate 2	2	2.0 mm

← Save to ... Library

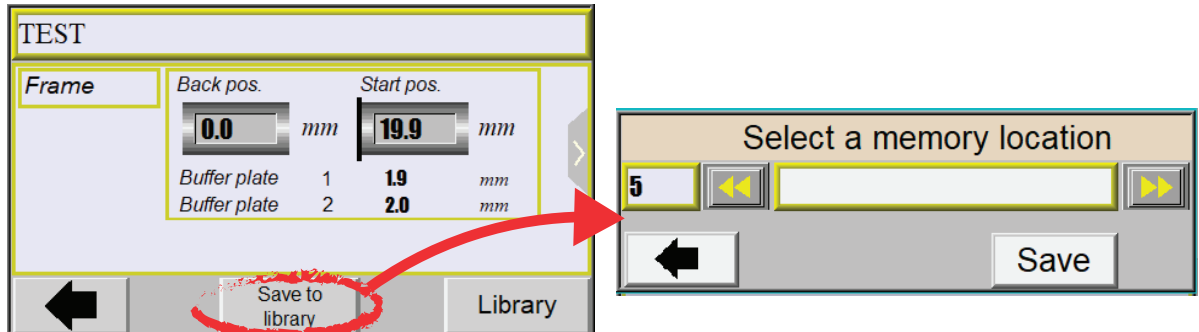
1 TEST

Frame	Back pos.	Start pos.
mm	<input type="text" value="0.0"/> mm	<input type="text" value="0.0"/> mm
Buffer plate 1	1	0.0 mm
Buffer plate 2	2	0.0 mm

← Select

Browse library programs from the arrow buttons or give a memory location number to the right top corner field. Tap "Select" to select desired program for editing. Programs cannot be edited in the library screen.

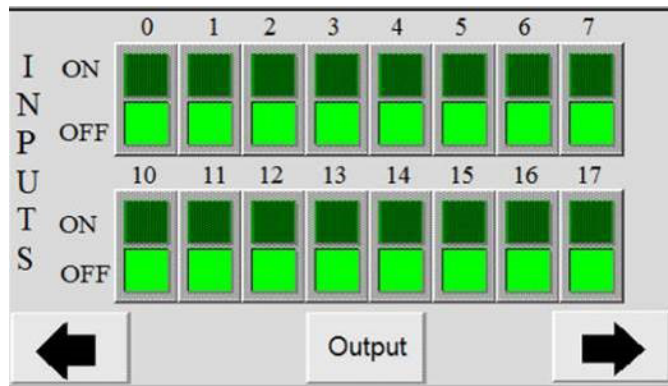
Edit the values by touching the fields to open a pop-up keypad. The changes can be saved on this screen to the library by user level 1 or higher operator.



The modified program can be either saved over the original program which was chosen, or as a new program, to another memory location. Browse library programs locations from the arrow buttons or give a number to the right top corner field. NOTE: The new name for the program must be given in the editing screen!

➡NOTE! The value of the “Back pos.” has to be 60mm larger than the value of the “Start pos.”. For example if the “Start pos.”= 25mm the “Back pos.” has to be at least 25mm + 60mm= 85mm.

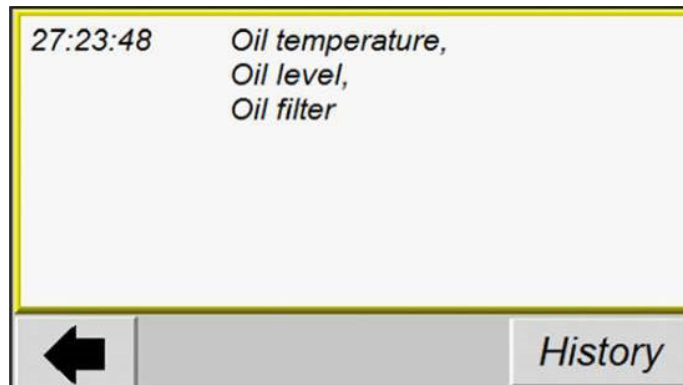
### 6.4.2.4 INPUT/OUTPUT- SCREEN



In this screen the status of the inputs can be checked. When the specific input is touched, the name of the input is shown. Switch to check the status of the outputs the same way by pushing "Output" - button.

I/O screen helps with troubleshoot.

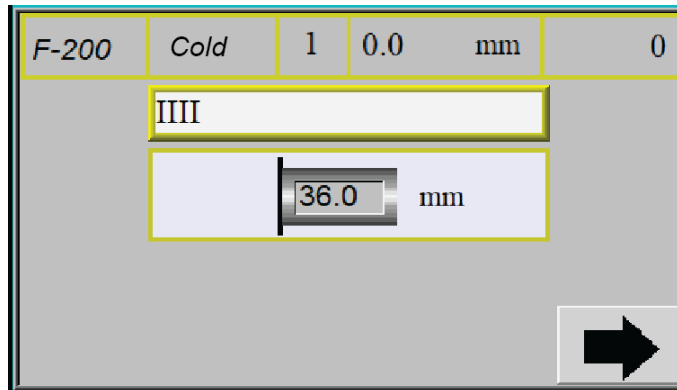
### 6.4.2.5 ALARM- SCREEN



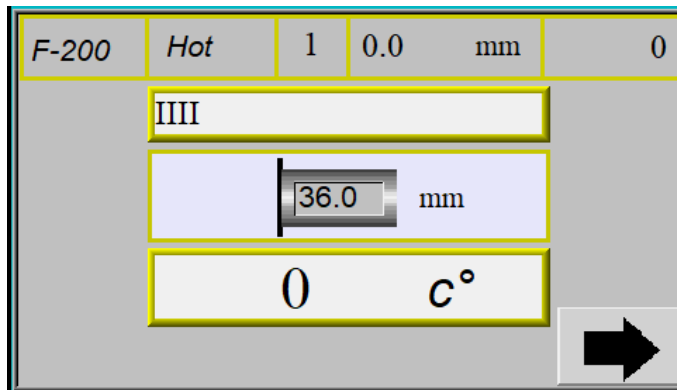
The cause of the alarm is shown in the Alarms- screen.

With "History" - button you can check the 200 recent alarms. The history is cleared when main power is turned off. The oil temperature alarm is not in use.

## 6.4.2.6 MAIN SCREEN




Machine without pyrometer



Machine with pyrometer

The values shown on top of the Main- screen from left to right.

1. Model of the machine.
2. Type of the forming: Cold or Hot (Hot forming is optional).
3. Forming mode:
  1. One-stage flanging, flaring, expanding and beveling
  2. Two-stage flanging
  3. Three-stage flanging
4. Position of the frame.
5. Value of the piece counter.

Return to the Menu-screen by pushing  - button.

### 7. MACHINE SETTINGS FOR FLANGING

#### 7.1 SETTINGS OF THE FLANGING WIDTH (TUBE CLAMPING DEPTH)

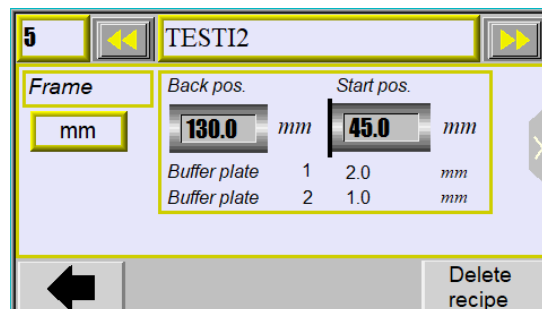
F-200 flanging machine is equipped with potentiometer and display.

Display unit is located on top of the control panel. With the display you can adjust length of the part of the pipe which is to be flanged, the rearmost and the frontmost position of the frame.



*Display unit for the programming*

Adjust the flange diameter (the width of the formed flange) by the setting of the start position in the program (carriage position). The forming pin works as a backstop when working. Push the pipe firmly against forming pin.



*“Edit programs”-screen: Start pos. setting defines the lip of the flange.*

The flange width setting has to be decided through testing, there are standards about flanged joints, for example EN1092, DIN 2641 and DIN2642.

The flange lip width for “Start position”- field can be calculated using the DIN-table value D4.

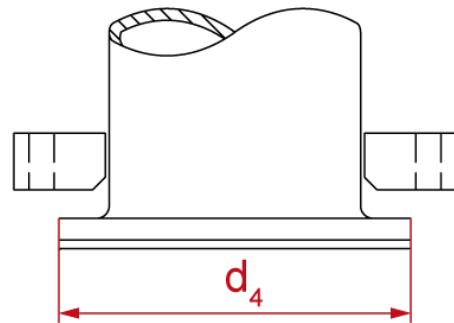
**➔NOTE! Tube material has great influence to the flange forming. Also the pipe can be either oversize or undersize. That is why it is highly recommended to test the adjustments to a scrap pipe.**

See also chapter 16.3 The measures of the loose flange joints.

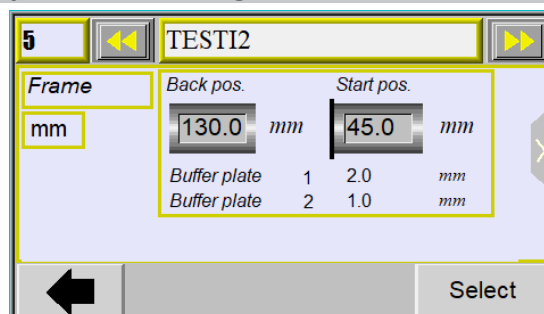
**To start with a safe value for program “Start pos”-field, count the flange lip width field with a simple formula:**



$$\frac{d_{4 \max} - \text{pipe O.D.}}{2}$$



**Recommendation! Make a setting value table for your own range of pipes, or use the program library to store settings.**








*Library-screen (without pyrometer)*

## 7.1.1 SETTING OF THE PIPE END FORMING DEVICE

**ⓘ DANGER! Before closing the clamping jaws, make sure they can move freely - the jaws may crush your hands!**


### Pipe size setting

1. Fasten the pipe
2. Turn the forming pin into its starting position by turning the clamp control  switch, at the same time turning the control switch of the tool into  - position.
3. The pipe forming device must be in such position, where the top of the unit is up. If this is not the case, turn the spindle in the correct position by pressing shortly the  push-button, until, the pilot lamp lights.
4. Set the "Start Pos." to zero (0.0mm) on the display (See previous chapter).
5. Drive the frame forward towards the pipe, by turning the clamp control  switch, at the same time turning the control switch of the frame into the  - position, until the forming pin almost reaches the pipe.
6. Stop the machine and push the protective hood backward. Check that the forming pin can freely enter into the pipe. Should this not be the case, then adjust the position of the pin.

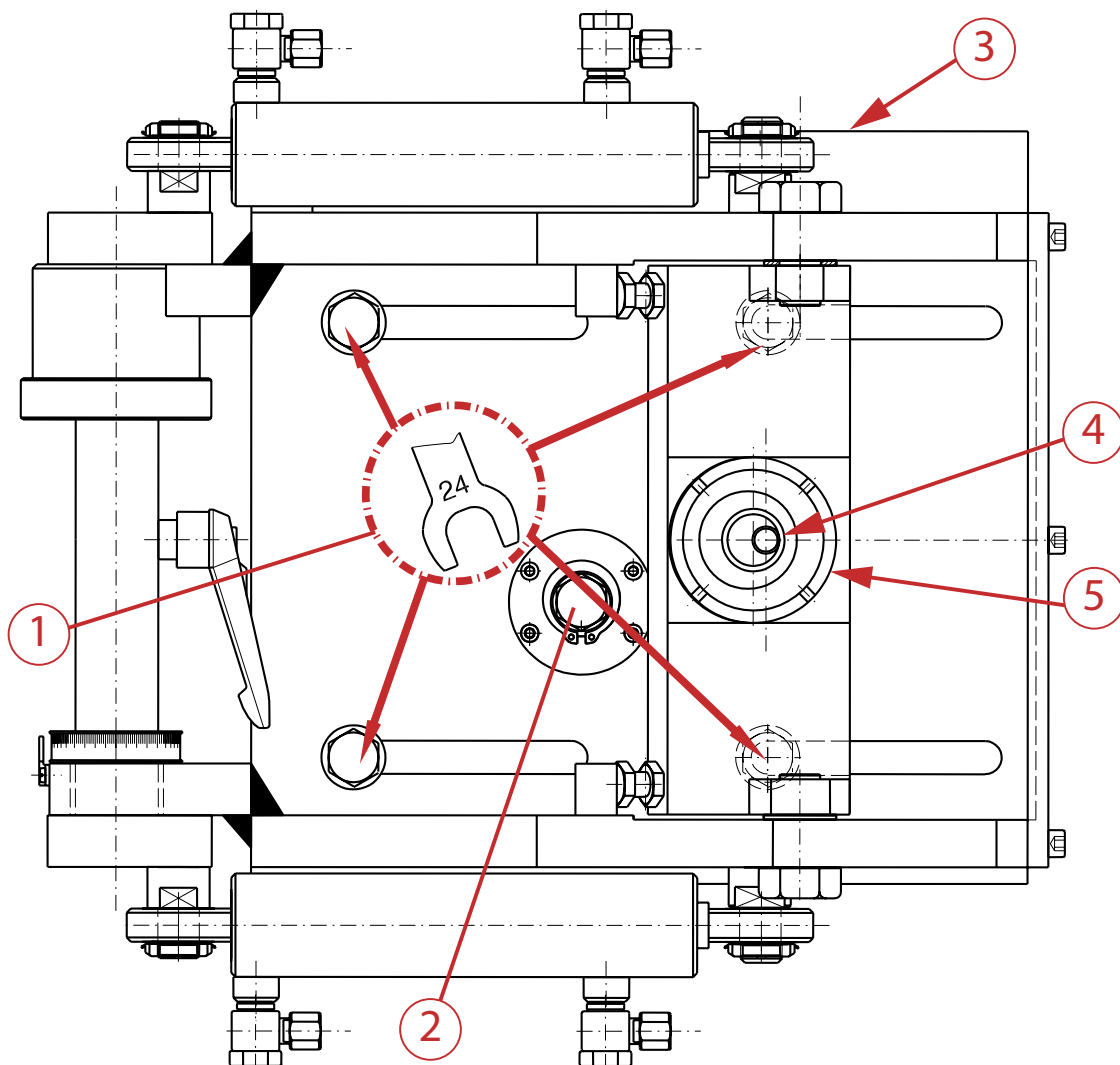
**ⓘ DANGER! If the tube is inserted too deep, the machine can be damaged!**

**Do not attempt to make an oversized flange.**

**ⓘ DANGER!** Do not open all locking screws when the forming head is in vertical position, because the forming head moves downward along the guides.



Turn the forming head 90° before adjusting. (The digital measure device has to be facing up). Release locking of the forming head rotation by pushing the brake release button  located on the control panel side, and rotate forming head (The brake is engaged again when the push-button is released).

Loosen the locking screws of the slide carefully and adjust the position of the slide by means of the adjusting bolt so, that the digital measure device indicates inside radius of the pipe. (See instruction point 10, picture and values).



90° Turned forming head : 1. Locking screws of the forming head, 2. Adjusting bolt, 3. Digital measure device (facing up), 4. Forming pin, 5. Turning radius adjustment eccentric sleeve

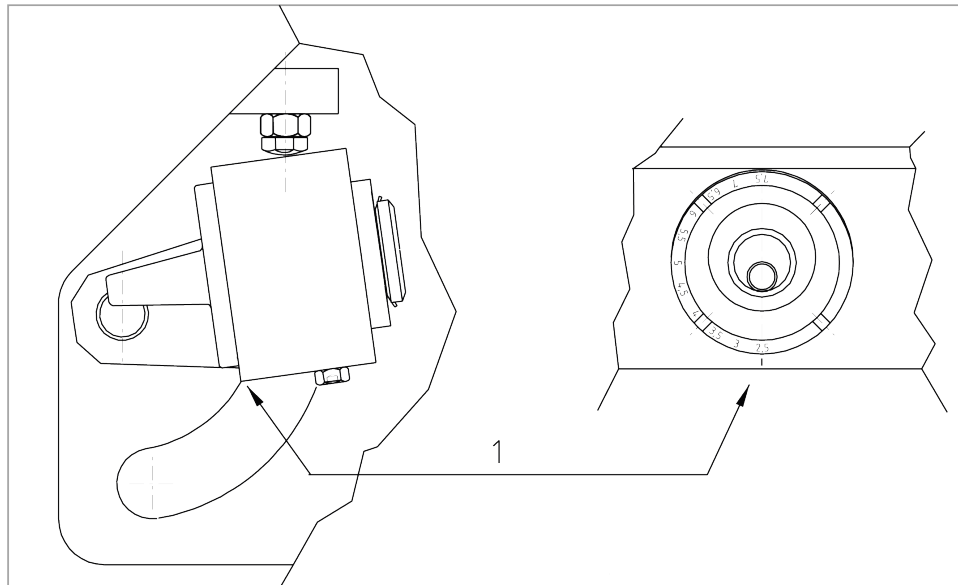
7. Pull the protective hood into its place and start the machine.

8. Drive the frame forward by turning the clamp control  switch and turning at the same time the control switch of the frame into the position , until the forming pin is completely inside the pipe.

9. Stop the machine and push the protective hood backwards.

10. Digital measure device indicates the real distance of the forming pin from center of the pipe (= radius 2.5).

Adjust the turning radius wanted of the forming pin by turning the eccentric sleeve. As turning radius you can select a value between 2,5...7,5mm.






### 1. Zero point

The diameter graduation compensation of the forming pin according to the turning radius: when the eccentric sleeve is turned in the direction of the smaller radius, the value of the digital reader is to be decreased correspondingly. If the eccentric sleeve is turned in the direction of the bigger radius, this value is to be increased correspondingly.

	<p>Adjust the slide in such way, that the forming pin just touches the inner surface of the pipe. Tighten the locking screw.</p>
	<p>Adjust the slide in such way, that the distance between the forming pin and the inner surface of the pipe is about 1 mm. Tighten the locking screw.</p>

11. Close the protective hood and start the machine.

12. Drive the frame to its rear position by turning the clamp control switch , at the same time turning the control switch of the frame into the position  .



13. Open the clamping jaws and remove the pipe.

14. Close the clamping jaws.

15. Set the length of the part of the pipe which is to be flanged "Start pos." to the program (see chapter 6.4 Machine display and settings). A recommended value for this setting is, that the display readings indicates 23mm + the thickness of the buffer plate used, thus N (See chapter 6.3.4 Fastening of the pipe and clamp changing, item 8: Buffer plates).

For instance, if the buffer plate is 4 mm thick, the setting of the scale should be 23mm + 4mm = 27mm.

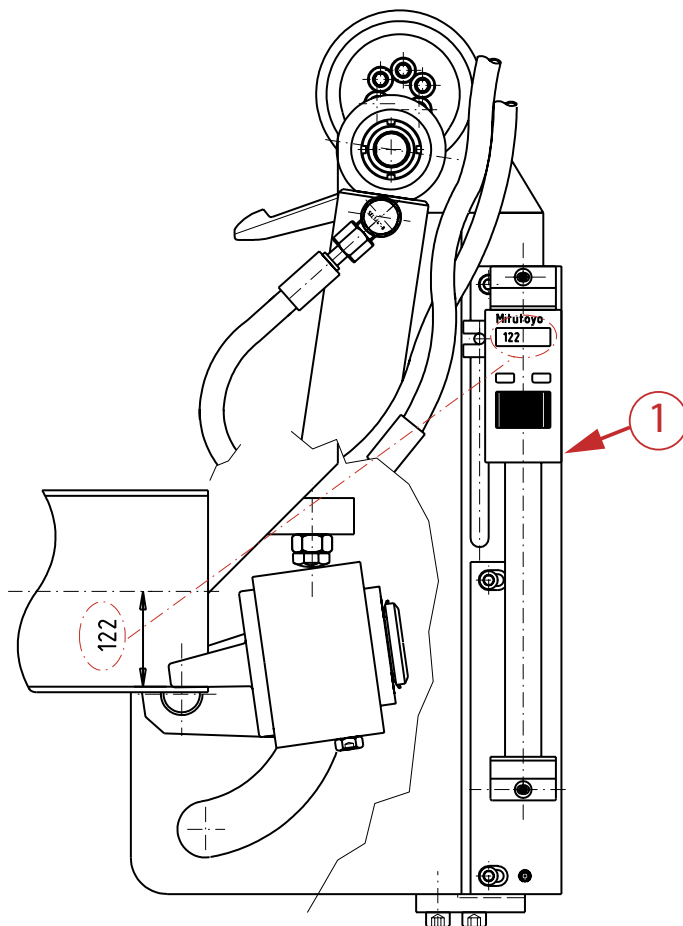
➔ **NOTE!** The value of the "Back pos." has to be 60mm larger than the value of the "Start pos.". For example if the "Start pos."= 25mm the "Back pos." has to be at least 25mm + 60mm= 85mm.

16. Turn the forming pin into flanging position, by turning the clamp control  switch, at the same time turning the control switch of the tool into the position .

17. Drive the frame forward, until it stops.

18. Open the clamping jaws and place the pipe into the clamp. Put the end of the pipe against the forming pin.

19. Close the clamping jaws by turning the clamp control  switch.




Forming head from the side: 1. Digital measuring device (Mitutoyo)

## 7.2 THE WORK CYCLE OF THE COLD FLANGING AND FLARING

1. Choose the correct forming pin and install it.
2. Fasten the pipe. Place the pipe to the clamp so that the pipe end is against the forming pin. Close the clamp. Be careful that the pipe clamp doesn't collide with the forming head.
3. Carry out the settings of the forming tool and flanging unit, and select suitable program from display.

**ⓘ DANGER! Before starting the automatic work cycle, make sure that the pipe has been clamped properly.**

**ⓘ DANGER! If the spindle does not rotate evenly or it stops, interrupt the work cycle immediately by pressing the EMERGENCY STOP button completely down.**



4. Press the "CYCLE START"  push-button. The machine will perform an automatic work cycle. When the work cycle is finished, the spindle will stop in its correct position - ready for the following work cycle to be carried out.

**➡NOTE! After flanging the pipe end may be hot.**

5. Loosen the flanged pipe, inspect its measures and if unsatisfactory, make the necessary corrections in the set values.

### 8. HOT FLANGING (AND FLARING) OF THE PIPE (OPTIONAL)



These instructions refer to hot flanging by means of the optional heating unit.

➔ **NOTE!** Always when starting the machine by pressing the contractor push-button  also press the stop push-button  of the heating, to open the main valve of the compressed air.


#### 8.1 THE WORK CYCLE OF THE HOT FLANGING AND FLARING


1. Choose the correct forming pin and install it.
2. Fasten the pipe into the clamp.
3. Carry out the adjustments of the forming device and select suitable program from display.
4. Install a heating burner of the right size.
5. Adjust the heating flame and time.

**ⓘ DANGER!** Before starting the work cycle make sure, that the pipe has been fastened properly and that the slide of the heating unit is in rear position.

6. Press the cycle start  push-button to start the automatic hot flanging work cycle. When the heating nozzle enters into the pipe, the pilot burner will start and the light in the  push-button will start blinking.

**ⓘ DANGER!** If the pilot burner does not go on, interrupt the work cycle immediately by pressing the **EMERGENCY STOP** push-button completely down.

7. The pilot burner flame is burning and the operator has to give a new starting signal by pressing the cycle start  push-button, whereupon the heating starts.

➔ **NOTE!** The operator has 8 seconds to give the heating start signal while the cycle start  push button is blinking. If this time is exceeded, the machine has to be driven back to the starting position for a new work cycle.

**ⓘ DANGER!** If the spindle does not rotate evenly or if it stops, interrupt the work cycle immediately by pressing the **EMERGENCY STOP** push-button.

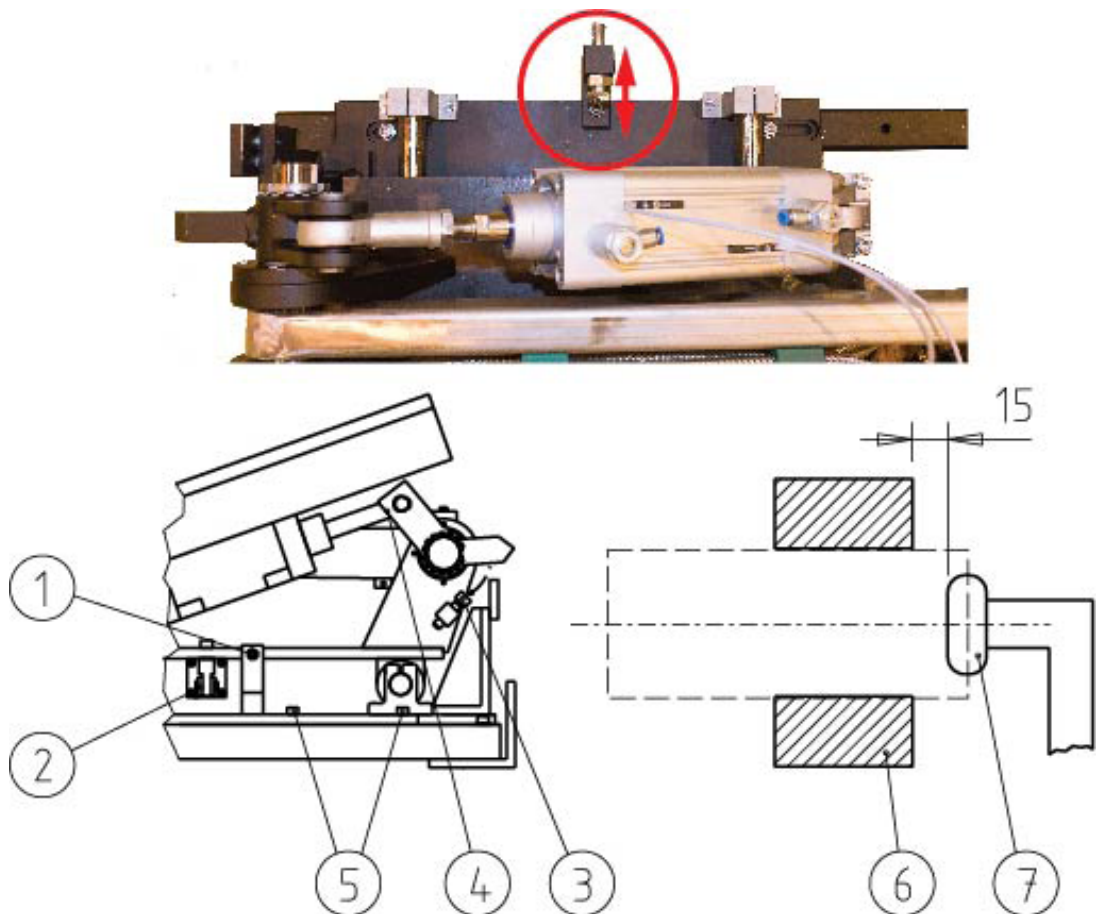
8. When the heating operation is finished, the machine carries out the work cycle until the end. When the work cycle is finished, the spindle stops in the correct position - ready for the next cycle.

**ⓘ DANGER!** The pipe end is hot after the flanging operation.

9. Loosen the flanged, readily machined pipe and check the measures of the flange. If necessary, make corrections in the setting values.

## 8.2 ADJUSTMENT OF THE HEATING STARTING POSITION

The starting position of the heating is correct, when the distance between the burner and the clamp is about 15mm, the arm being in its upper position. The pipe end and the pipe near the clamp are heated both as evenly. To change the distance of the burner, adjust the position of the stop screw of the burner slide and, if necessary, also the ball joint of the cylinder. If you want to change the ascending stroke of the burner, adjust the stop screw on the burner arm and, if necessary, the ball joint of the cylinder. If the burner does not centre inside the pipe, adjust the position of the bottom plate of the burner by loosening its fixing screws (6 only) and putting the bottom plate into the correct position.



*Adjustment of the heating starting position: 1. Stop screw of the slide, 2. Ball joint of the slide cylinder, 3. Stop screw of the arm, 4. Ball joint of the arm cylinder, 5. Fixing screws of the bottom plate, 6. Pipe clamp, 7. Burner nozzle*








### 8.3 CHANGING THE HEATING BURNER

1. Carry out the setting of the forming device
2. Check, that the valves of the gas mixer are closed.
3. Open the clamping jaws and remove the pipe.
4. Close the clamping jaws and remove the locking screws of the pipe clamp. Open the clamping jaws and remove the pipe clamp.

➔ **NOTE! Before proceeding with the next step, make sure the pipe is removed, otherwise the burner may bump into the pipe and get damaged.**

5. Select by means of the selector switch of the way of forming the adjustment of the

burner flame  and press the work cycle start push-button . The burner arm will turn into heating position.

6. Press the stop button  and open the protective hood.
7. Remove the burner, which is fastened to its arm by a screw coupling. Keep the burner arm in its place and loosen the coupling by means of a wrench, turning the nozzle counter-clockwise.
8. Choose a new heating burner and fasten it
9. Adjust the position of the pilot burner according to the main burner. The pilot burner must be able to give the flame to the main burner inside the pipe, but the main burner or a hot pipe may not heat the pilot burner nozzles.
10. Close the protective hood and start the hydraulic motor by pressing the  push-button.
11. Press the heating stop push-button  and keep it pressed down until the burner arm is in its lower position (the burner arm moves backwards and turns aside).

## 8.4 THE ADJUSTMENT OF THE BURNER FLAME AND HEATING TIME



ⓘ **DANGER!** When using the heating device, always keep the space in front of the pipe end completely free from obstacles.



➔ **NOTE!** Always observe the necessary caution when carrying out the adjustment of the burner flame and keep proper fire extinguishing equipment at hand.

1. Install the correct burner nozzle.
2. Install the pipe clamp
3. Drive the frame forward, until it stops.
4. Turn the forming pin into flanging position.
5. Open the clamping jaws and insert the pipe into the clamp so, that the end of the pipe is against the forming pin. Close the clamping jaws.
6. Open the valve of the gas supplies and adjust the gas pressures.


The oxygen pressure should be 0,2-0,5 MPa and the corresponding propane pressure about half of it. The maximum air pressure of the pilot burner is 0,2 MPa.

7. Make sure the way of flanging selector switch is in the flame adjustment position .
8. Press the work cycle start push-button , the burner arm will then move upwards and move towards the pipe. The burner enters into the pipe.


➔ **NOTE!** Should there be any obstacle on the way of the burner, press immediately the EMERGENCY STOP push-button completely down.

9. Stop the machine.


10. Open the service door of the burner, located on the right side of the machine.


11. Press the burner flame regulating push-button  and keep it pressed down during the regulation. The pilot burner air and propane line valves will then open and at the same time the ignition plug will give a spark to the nozzle of the pilot burner. After a short delay the valve of the propane main line will open. Open just a little the propane valve of the mixer. After a short delay the pilot burner will extinguish. Open just a little the oxygen valve of the mixer.



**➔NOTE! Do not use the pilot burner for longer than 15 seconds at a time. If you need it longer than that, wait 2 minutes before the following use, otherwise the burner heats up too much.**

12. Keep the  push-button still pressed down. Adjust the flame while burning in the pipe by adding first propane and then oxygen, until the flame is alright.

**➔NOTE! The F-200 machine is provided with a timer, which gives the operator 30 seconds' time to adjust the flame. If this time is exceeded, the valves will close and the adjustment procedure will have to be repeated if no satisfactory flame is obtained. If the pipe starts getting red hot before a satisfactory flame is obtained, drive the frame back into rear position and wait until the pipe cools off or replace it with another pipe.**

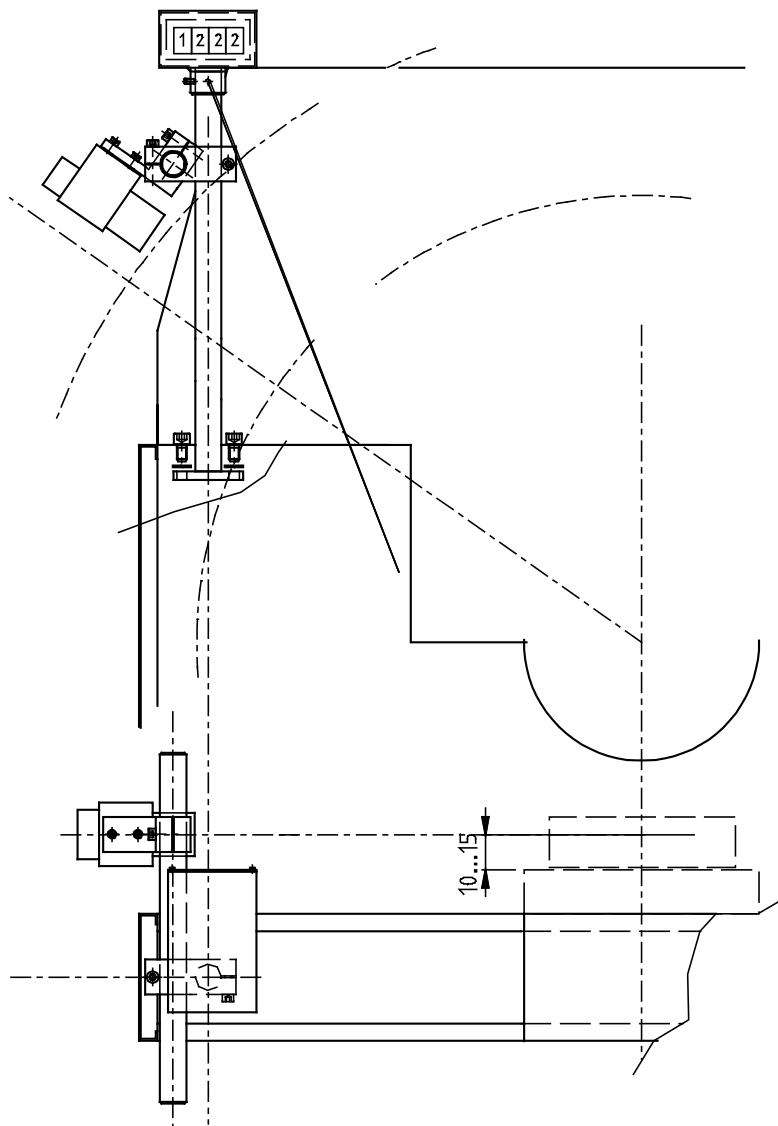
13. Release the  button, the flame will extinguish. Close the service door of the burner.

14. Start the machine and press the heating stop push-button , the burner arm will retract from the pipe and turn to its lower position.

15. The heating time is adjustable from 0-200 seconds. Adjust the heating time by means of the heating time regulator . The heating time is determined either just by ocular estimation on account of the color of the pipe or else with the help of a infrared thermometer (optional equipment). The heating can be interrupted by pressing the heating stop button  when the pipe has reached the proper temperature.

**8.5 SETTING OF THE INFRARED TEMPERATURE MEASURING UNIT**

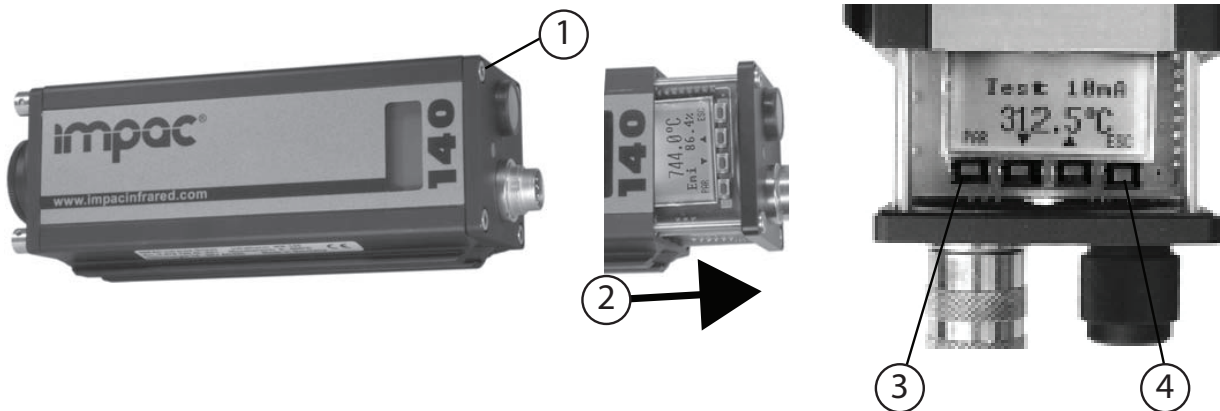
Infrared temperature measuring unit has to be pointed to the end of the tube, i.e. about 10-15 mm from the end of the clamp as shown in picture.



*Infrared measuring unit*

### 8.6 SETTING OF THE EMISSIVITY

1. The LC-display as well as the push buttons for displaying and setting of the parameters are found inside the unit. The pyrometer is opened by 4 allen screws (1). If unscrewed, the rear cover can be pulled out along with the attached display and push buttons. The pullout is limited by the lengths of the screws. The backlight of the display is always powered in either status, opened or closed pyrometer. Open the four screws from the back of the camera and pull the card outwards.



1. Screws of the card, 2. Pulling direction, 3. PAR-button, 4. ESC-button, 5. Laser targeting light push button

2. Check the correct value for the used material from the table below. Press the “PAR”-button once to set parameter. Insert the value with arrow keys. Accept the value with “ENT”- button.

(Pushing the ESC button changes the pyrometer to measuring mode. If a parameter is changed with the arrow keys the indication of the ESC button changes to ENT. Pressing the button again confirms the value into the pyrometer. Changing the parameters again by pushing the PAR button doesn't confirm this value in the pyrometer. If no button is pressed for 30 s, the pyrometer changes to the temperature indication without accepting the changed value).

Material	Emissivity
"Black body furnace"	100
Extruded Aluminum	13
Brass	18
Oxidized Brass	65...70
Copper	5
Oxidized Copper	70...80
Inconel	30
Oxydised Inconel	85
Oxidized Iron	85...90
Steel rolling scale	80...88
Liquid steel	20...30
Nickel	15...20
Non-oxidized Titanium	50
Oxidized Titanium	70...80
Molybdenum	10
Oxidized Molybdenum	75...80
Black Carbon	95
Graphite	80...90
Porcelaine glazed	60

### Focusing the lens

1. Release the lock of the lens by turning the lens counter-clockwise
2. Push the laser targeting light push-button on the back of the camera to activate the laser. When laser is active the led light on the back of the camera is blinking. Focus the lens by pushing and pulling it. The smaller the laser dot is, the better the focus.
3. Deactivate the laser by pushing the push button and tighten the lens by turning it clockwise.

**For more information about IMPAC 140 pyrometer: see separate manufacturer's instruction manual. (Delivered on memory stick as PDF)**

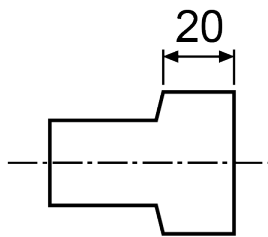
### 9. EXPANSION OF THE PIPE (OPTIONAL)

#### 9.1 WORKING INSTRUCTIONS FOR EXPANSION

➔ **NOTE!** The expansion operation is possible only, when a corresponding optional accessory to the effect has been ordered with the F-200 machine.

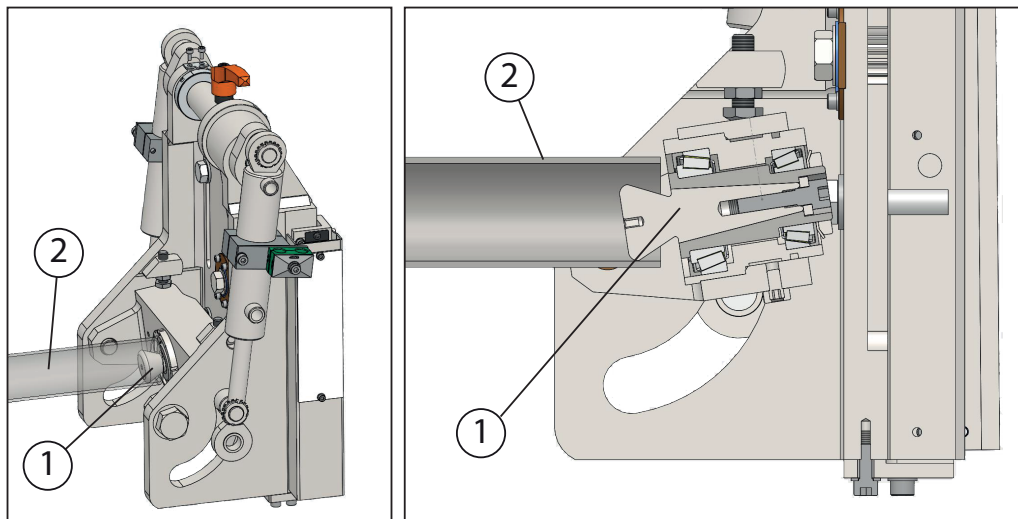
➔ **NOTE!** The maximum admissible length of expansion is 20mm.

Cold expansion can be performed on all materials admissible to the machine.



The maximum wall thickness of the pipe for cold expansion is 3mm.






The maximum wall thickness of carbon steel pipes for hot expansion is 5mm.







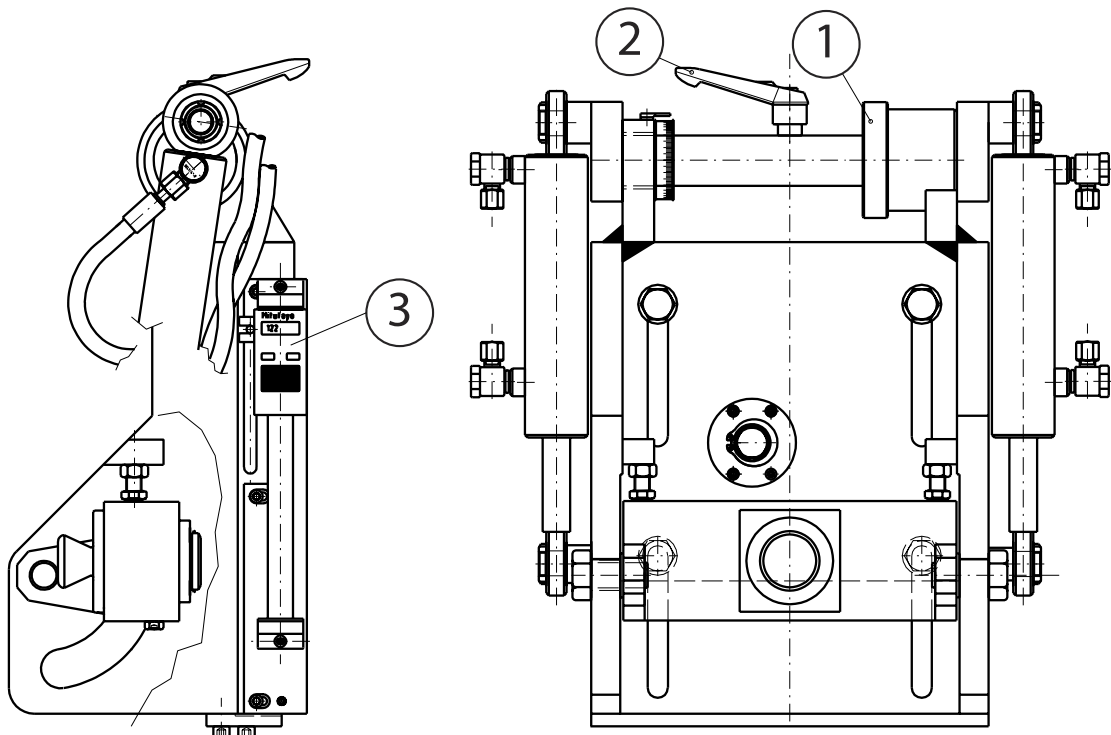
1. Expansion pin, 2. Pipe to be expanded

#### 9.1.1 THE ADJUSTMENT OF THE FORMING DEVICE FOR EXPANSION

ⓘ **DANGER!** Before closing the clamping jaws, make sure that they can move freely - the jaws might crush your hands!

1. Fasten the pipe into the clamp (see chapter "The fastening of the pipe")
2. Turn the expansion pin into starting position by turning the clamp control switch  and turning at the same time the control switch  of the tool into the position .
3. The forming device must be in such position, where the adjusting lever is up. Should this not be the case, turn the spindle into the correct position by pressing shortly the  - push-button, until the pilot lamps lights.
4. Set the "Start Pos." to zero (0.0mm) on the display (See chapter 6.2.6).
5. Drive the frame forward towards the pipe, by turning the switch, at the same time turning the control switch of the frame into the  - position, until the expansion pin almost reaches the pipe.

6. Stop the machine and push the protective hood backward. Check that the expansion pin can freely enter into the pipe. Should this not be the case, then adjust the position of the pin: loosen the locking screws of the slide and adjust the position of the slide by turning the adjusting bolt, that a distance of about 5 mm remains between the pipe and the expansion pin.
7. Tighten one screw for arrestment of the movement.
8. Pull the protective hood on its place and start the machine.
9. Drive the frame forward until the expansion pin is completely inside the pipe.
10. Stop the machine and push the protective hood backwards.
11. Adjust the slide in such way, that the expansion pin just touches the inner surface of the pipe. Tighten the locking screws (4 pcs).
12. Start the machine.
13. Drive the frame to its rear position by turning the switch  at the same time turning the control switch of the frame into the position .
14. Set the value (Start pos.) of the program to 40mm. (See chapter 6.2.6)
15. Adjust the turning angle of the expansion pin by turning the clamp control switch  and turning at the same time the control switch of the tool into the position . Drive the cylinders out fully. Turn the adjusting bar so that cylinders are in upmost position and tighten the locking bushing to the 24 Nm.
16. Drive the frame forward until it stops.



*The adjustment of turning angle of expansion pin: 1. Locking bushing, 2. Adjustment lever  
3. Digital display unit for leveling of forming tool*




### 9.1.2 THE WORK CYCLE FOR COLD EXPANSION OF THE PIPE

1. Choose the correct forming pin and install it (see chapter “Changing of the forming pin”).
2. Fasten the pipe (see chapter “The fastening of the pipe”).
3. Carry out the settings of the forming device and select suitable program from display.

**ⓘ DANGER! Before starting the automatic work cycle, make sure that the pipe has been clamped properly.**

**ⓘ DANGER! If the spindle does not rotate evenly or if it stops, interrupt the work cycle immediately by pressing the EMERGENCY STOP button completely down.**

4. Press the work cycle ON  push-button. The machine will perform an automatic work cycle. When the work cycle is finished, the spindle will stop in its correct position - ready for the following work cycle to be carried out.



**➔NOTE! After expansion the pipe end may be hot.**

5. Loosen the expanded pipe, inspect the measures of the expansion and if unsatisfactory, make the necessary corrections in the set values.


### 9.1.3 THE WORK CYCLE FOR HOT EXPANSION OF THE PIPE


1. Install the expansion pin (see chapter “Changing of the forming pin”)
2. Fasten the pipe into the clamp (see chapter “The fastening of the pipe”)
3. Carry out the adjustment of the forming tool.
4. Install a heating burner of the correct size (see chapter “Changing of the heating burner”)
5. Adjust the heating flame and time (see chapter “The adjustment of the burner flame and the heating time”)

**ⓘ DANGER! Before starting the work cycle make sure, that the pipe has been fastened properly and that the slide of the heating unit is in rear position.**

6. Press the  push-button to start the automatic hot expansion work cycle. When the heating nozzle enters into the pipe, the pilot burner will start and the light in the  push-button will start blinking

**ⓘ DANGER! If the pilot burner does not go on, interrupt the work cycle immediately by pressing the EMERGENCY STOP push-button completely down.**

7. The pilot burner flame is burning and the operator has to give a new starting signal by pressing the  push-button, whereupon the heating starts.

**➔NOTE! The operator has 8 seconds to give the heating starting signal while the  push button is blinking. If this time is exceeded, the machine has to be driven back to the starting position of a new work cycle.**

**ⓘ DANGER! If the spindle does not rotate evenly or if it stops, interrupt the work cycle immediately by pressing the EMERGENCY STOP push-button.**

8. When the heating operation is finished, the machine carries out the expansion work cycle until the end. When the work cycle is finished, the spindle stops in the correct position - ready for the next cycle.

**➔NOTE! The pipe end is hot after the expansion operation.**

9. Loosen the expanded, readily machined pipe and check the measures of the expansion. If necessary, make corrections in the setting values.

### 10. THE BEVELING OF THE PIPE END (OPTIONAL)

#### Beveling of the pipe

- The beveling can be executed on carbon steel and copper pipes.
- The outer diameter of the pipe to be beveled can be between  $\varnothing 42,4$  and 219,1mm.
- The wall thickness of the pipe to be beveled must be more than 3mm.

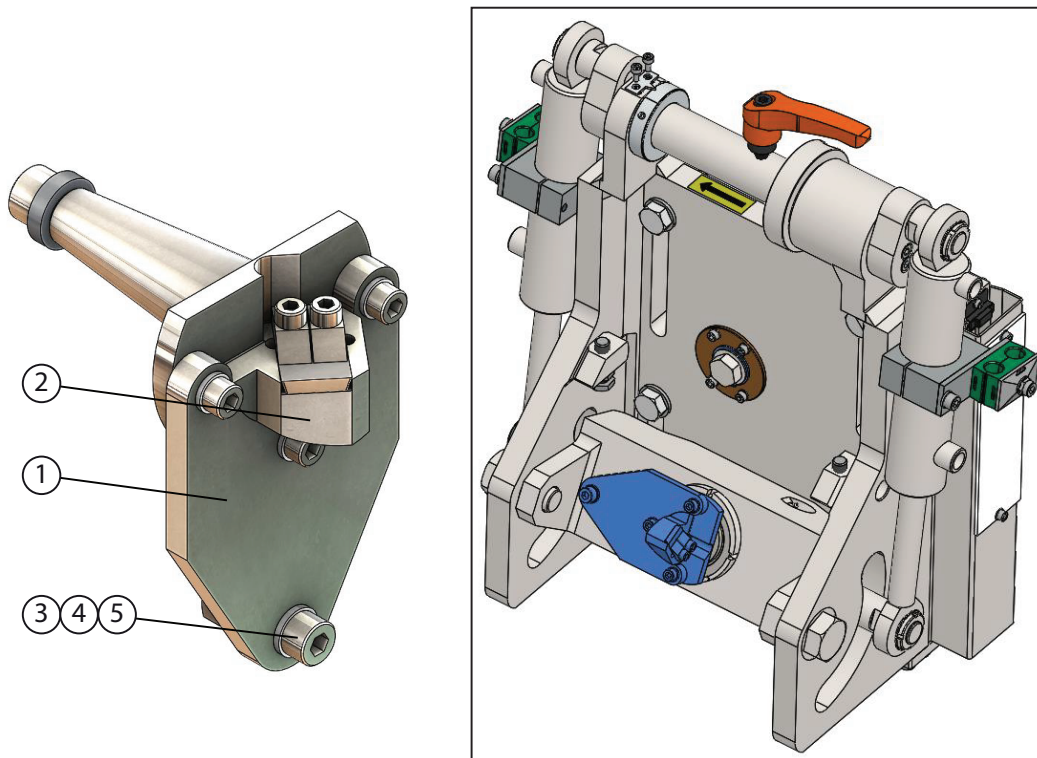
#### 10.1 WORKING INSTRUCTIONS FOR BEVELING

The outer diameter of the pipe to be beveled can be between  $\varnothing 42,4$  and  $\varnothing 219.1$  mm.

➔ **NOTE!** The bevel can be produced only, if the F-200 machine has been ordered with this optional accessory.

##### 10.1.1 THE INSTALLATION OF THE BEVELING TOOL

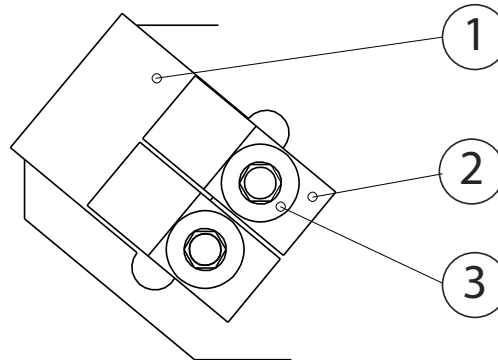
1. Remove the forming pin (see chapter “6.3.1 Changing of the forming pin”, points 1-12)
2. Install the beveling tool into the chuck of the pin and tighten it carefully.
3. Change the fixing screw at the left side of the arch for a M8x25 fixing screw and tighten it properly.
4. Tighten the locking pin on the fixing screw by means of a 17 mm wrench (2, 4, 5).
5. Tighten the beveling tool in the locking nut by means of a M8x16 hexagon socket screw, so as to prevent the tool from turning. Use a washer.



Beveling tool: 1. Arch, 2. Beveling tool, 3. Fixing screw, 4. Locking pin, 5. Hexagon socket screw

## The replacement of the cutter blade

1. Unscrew the M5x12 fixing screws of the blade fasteners and remove the fasteners.
2. Install a new cutter blade and secure it in its place by tightening the fasteners.

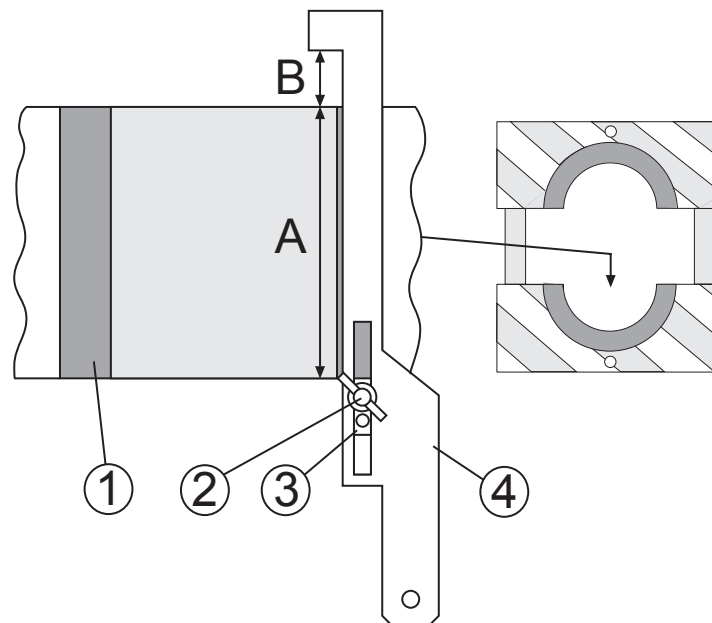


Replacement of the cutter blade: 1. Cutter blade, 2. Fastener of cutter blade, 3. Fixing screw

## 10.1.2 THE ADJUSTMENT OF THE FORMING TOOL FOR BEVELING

**ⓘ DANGER! Before closing the clamping jaws, make sure that they can move freely - the jaws might crush your hands!**

1. Install  $s=10$  mm buffer plates (2 pcs). See picture, measurement B: Tube end 12-15 mm from clamps.



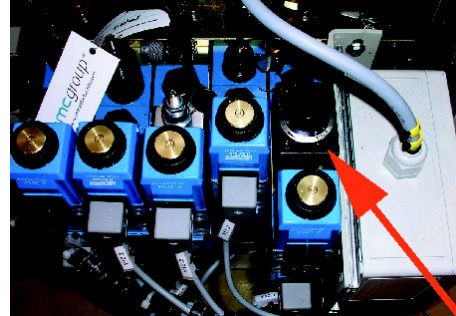
The setting gauge of the pipe: 1. Pipe clamp, 2. Wing screw, 3. Slide piece, 4. Setting gauge of the pipe.



2. Fasten the pipe into the clamp.

**The thickness of the cut chip depends on the feed speed setting! The feed speed can vary due to the running temperature of the hydraulic unit, the feed may be faster when the machine is running hot.**


Start the feed speed adjustment from 0,5-1 to start with and see, that the feed speed is not too fast and the machine does not cut the chip too deep. (The beveling unit can break if the cut chip is too thick, and the beveling result is not smooth).

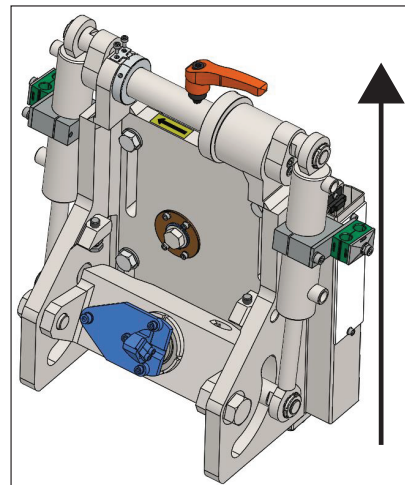
3. Regulate the feed speed of the forward movement of the frame by adjusting the beveling speed to value 0,5-1 to start with (max. 2) from the valve (see the photo on the right).





4. Turn the beveling blade into starting position by turning the clamp control switch  and turning at the same time the control switch of the tool into the position .

5. The forming tool must be in such position, where the orange adjusting lever is up in an approx. 120° sector.

Should this not be the case, turn the spindle into the correct position by shortly pressing the  push-button, until the pilot lamp lights to inform that the spindle is in correct position.



6. Set the "Start Pos." to zero (0.0mm) on the display (See chapter 6.2.6).

7. Drive the frame forward towards the pipe, by turning clamp control switch to  at the same time turning the control switch of the frame into the  position, until the beveling blade almost reaches the pipe.


8. Stop the machine and push the protective hood backward. Check that the pipe wall is in the middle of the beveling blade. Should this not be the case, then adjust the position of the blade: loosen the locking screw of the slide and adjust the position of the slide by means of the adjusting screw. The basic setting value is half of the outer diameter of the pipe + 10mm. For instance, if the outer diameter of the pipe is 60mm, the setting value is  $60\text{mm}/2 + 10\text{mm} = 40\text{mm}$ . Set the value obtained to the scale of the adjustment measure of the slide.

9. Set the value (Start pos.) of the program to 30mm (see chapter 6.2.6).

10. Pull the protective hood on its place and start the machine.

11. Drive the frame forward until the potentiometer stops it.

**ⓘ DANGER! Before starting the automatic work cycle, make sure that the pipe has been clamped properly.**

12. Press the cycle start  push-button. The machine performs the automatic work cycle.


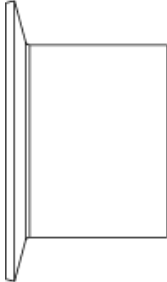
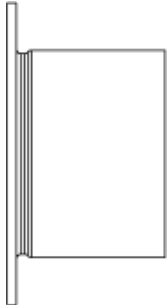
**ⓘ DANGER! If the spindle does not rotate evenly or if it stops, interrupt the work cycle immediately by pressing the EMERGENCY STOP button completely down.**

13. Check the swarf thickness. If the frame speed is not correct, stop the machine and adjust the speed of the frame movement. At the end of the cycle the spindle will stop automatically in the right position, ready to perform the following cycle.

**➔NOTE! The pipe end may be hot after the beveling operation.**

14. Loosen the beveled pipe, inspect the result and the quality of the operation, and make corrections if necessary.

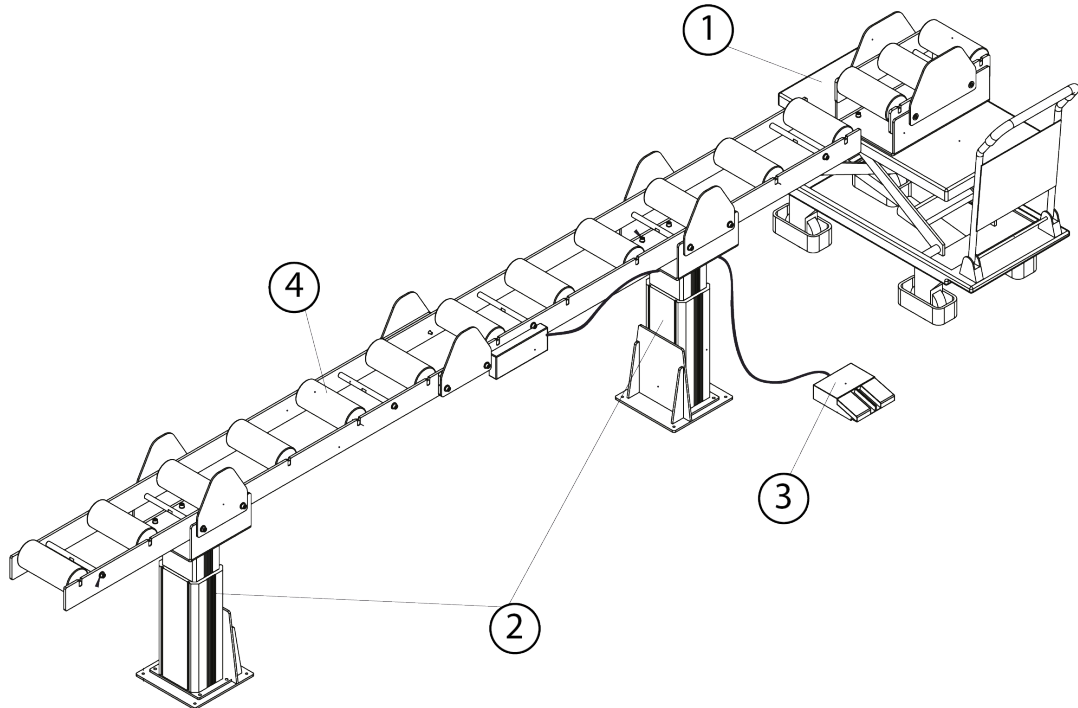
### 11. HOW TO CORRECT UNDESIRABLE FLANGE SHAPE

<p><b>Angle of the flange more than 90°</b>          If the desired angle of the flange is 90° and the result is more than 90°, the flange shape is corrected by increasing the thickness of the end position stoppers.</p>	
<p><b>Angle of the flange less than 90°</b>          If the desired angle of the flange is 90° and the result is less than 90°, the flange shape is corrected by decreasing the thickness of the end position stoppers.</p>	
<p><b>Angle of the flange is correct, but there is fold behind the flange</b>          If there occurs folding of the tube behind the flange it might be result of following matters:</p> <ol style="list-style-type: none"> <li>1. Size of the flange is too big for the tube size. Check the flange size</li> <li>2. Wrong thickness of the buffer plates. Check the thickness of the buffer plates. (See chapter 6.3.4 Fastening of the pipe and clamp changing, item 8: Buffer plates.)</li> <li>3. The slide is adjusted so that the forming pin is too far from the tube wall. Adjust the slide.</li> <li>4. You have used one- phase flanging. Try to use multi- phase flanging for better result.</li> </ol>	

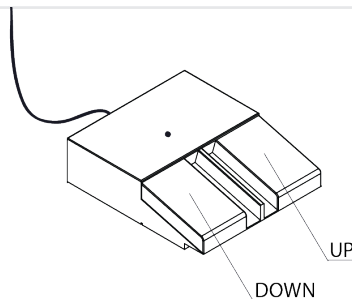
## 12. ROLLER TRACK (OPTIONAL)

The roller track 5391547, with two (2) lifting devices, can handle pipes  $\varnothing$  20 mm ...  $\varnothing$  219,1 mm.

The maximum weight of the pipe is 250 kg, and maximum length of the pipe is 6000 mm.



Parts of the roller track: 1. Lift trolley, 2. Roller track lifting device, 3. Roller track operating pedal, 4. Support roll



The track operating pedal is marked with stickers, which is the up, and which is the down movement of the roller track. A hand control is also available.

### 12.1 INSTALLATION OF THE ROLLER TRACK (OPTION)

Align the roller track to meet the machine tube line / center line), see layout. Leave enough room for the lift trolley in between track and F-200 / F-400 machine.

The track lift columns must be installed indoors, in well-lit premises that are at room temperature.

When installing mechanically-linked lift columns for parallel operation, the columns must be assembled so that any deviation in parallelism is less than 0,5 mm per 1000 mm.

See enclosed Gigant instructions.

➔ **NOTE! Be careful, the track is unsteady until fastened to the floor.**



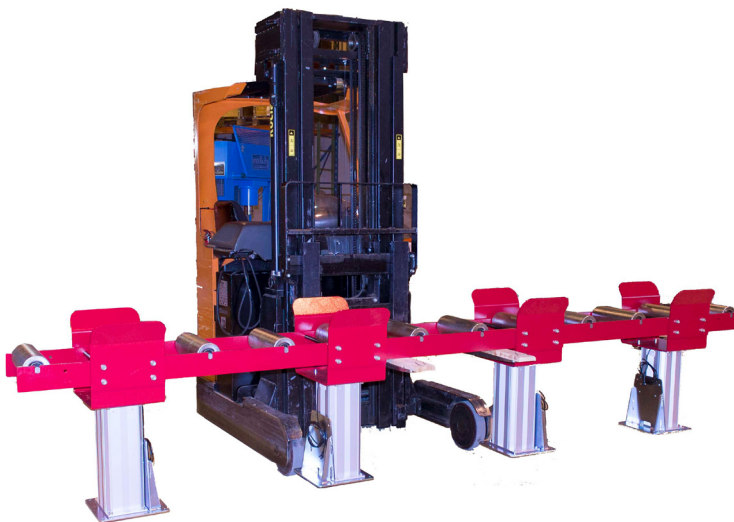
Fasten the roller track to the floor with anchor bolts. Use M8 x 50...80 bolts, chemical anchors are highly recommended to use.

The roller track lifting column system uses low voltage current, and has an European electric plug.

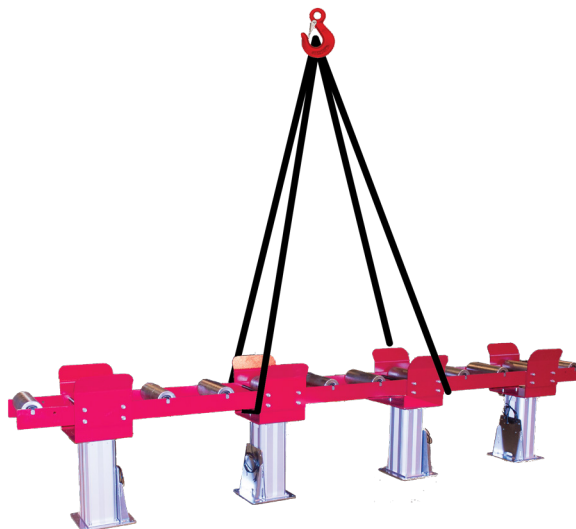
**Lifting / moving the roller track:**

Use a fork lift truck to move the roller track. Place wooden planks between the forks and track frame.

**➔ NOTE! DO NOT LET THE TRACK TO TIP OVER OR FALL FROM FORKS! DANGER OF SEVERE DAMAGE.**



Use a forklift truck to move the roller track. Be careful with the balance, do not let the track tip over.

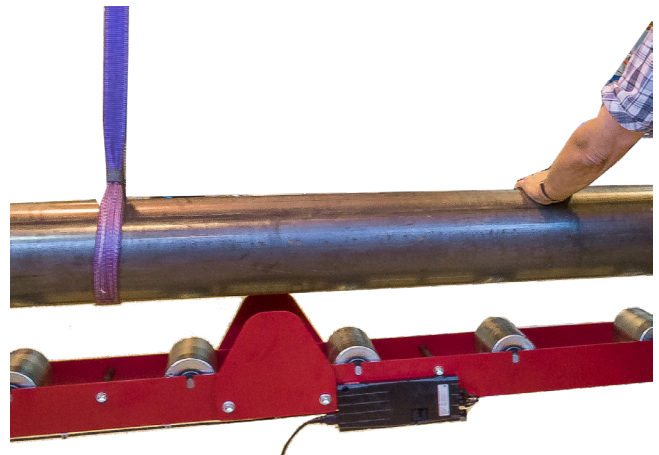


If necessary the track can also be moved using a crane and lifting straps. Place straps with care.

## 12.2 HOW TO USE THE ROLLER TRACK

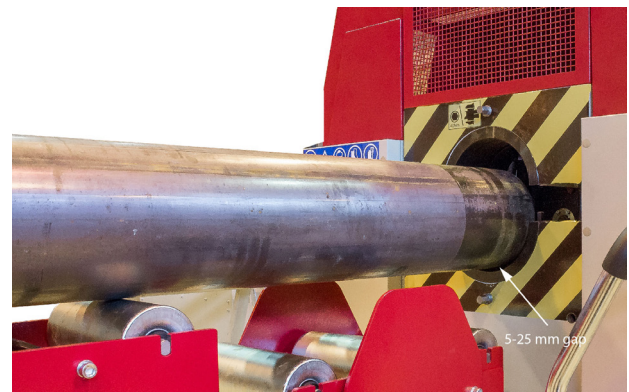
**A. When the pipe end is adequately round and within the nominal size ( not oversize), follow the instruction :**

The pipe is lifted to the roller track using a crane and lifting straps.  
 (The mass centre of the pipe must be in between the first and the last roll of the roller track).



Lift the roller track a little higher than the pipe clamp lower surface. (5-25 mm)

If the pipe is not within nominal size, it will not fit into the clamps.

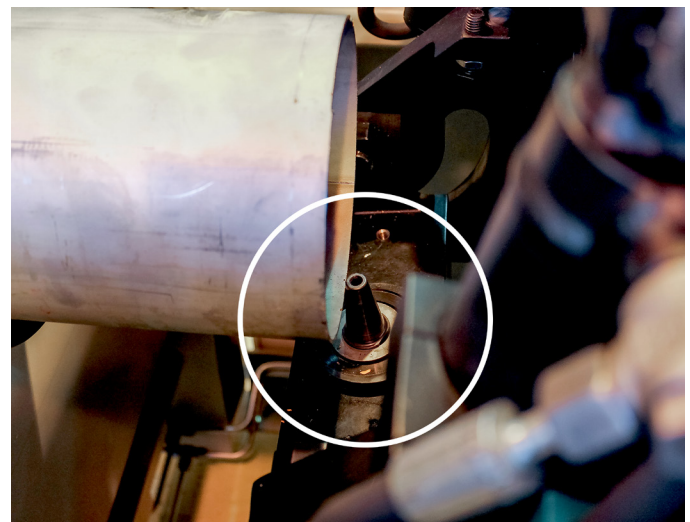


**➔NOTE! The pipe must be lowered to the roller track in a controlled manner to avoid damaging the track. A falling track will cause a high risk of injury!**

Push the pipe into the machine opening, steer it to the clamps and into the machine so, that the pipe end touches the forming pin.

Lower the track and close clamps simultaneously. The pipe is still supported with the lifting straps!

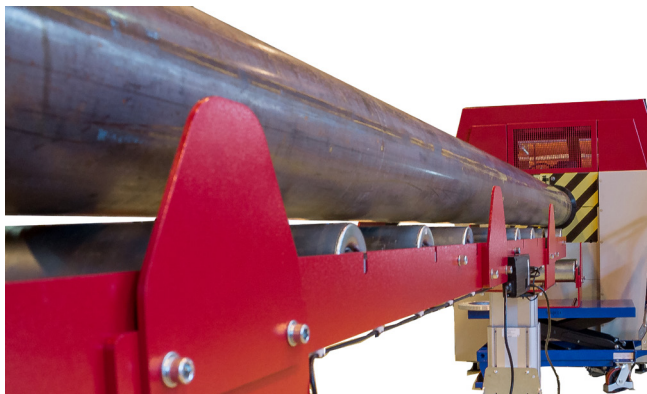
Check that the pipe does not press the roller track (if the pipe is not straight, the end of the pipe may press the track when clamps are closed).



➔ **NOTE!** Do not push the pipe in to the machine too hard, the heavy pipe may damage the forming pin.

Let the pipe weight fully off the crane lifting strap support (strap can remain around the pipe).

Lower the roller track so that the F-200 clamps hold the pipe, and there is a gap between the roller track and the pipe.

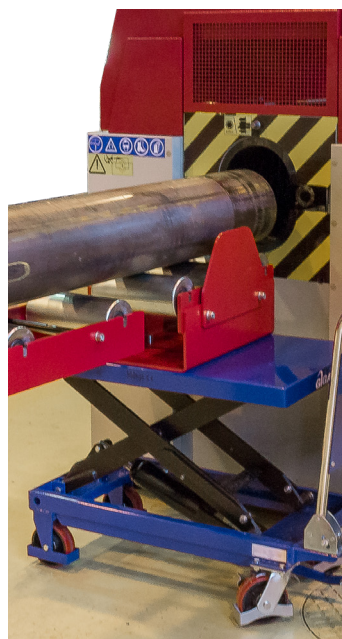


Start work cycle.

When the work cycle is done, stop the machine.

Lift the roller track to support the pipe and open clamps.

Use the lift trolley to detach the pipe from the clamps.

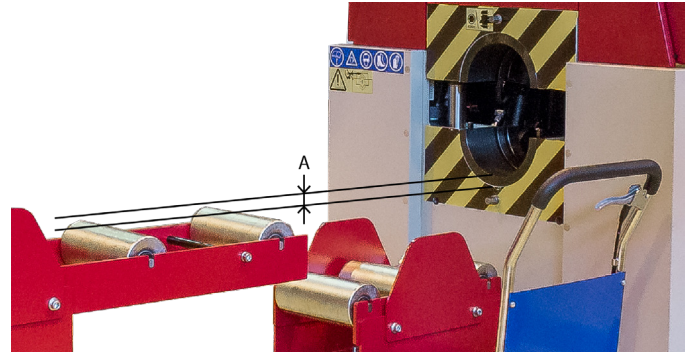


Lower the lift trolley and move the pipe away from the machine opening, attach straps and remove pipe.



**B. If the pipe end to be flanged is not round, or not within nominal size, follow the instruction below:**

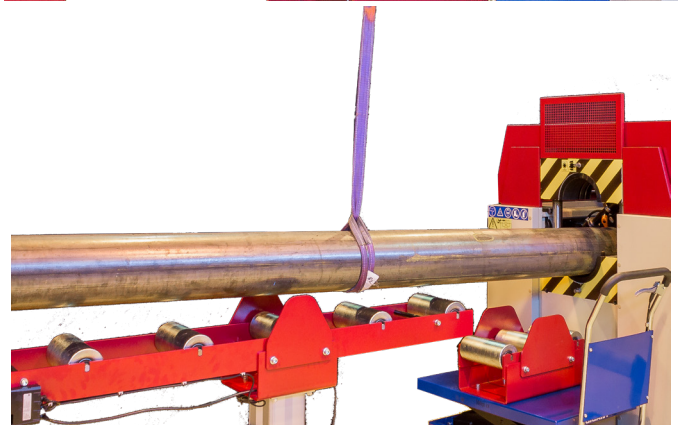
Move the roller track to same level or a little lower than the pipe clamp lower surface. (A)



Lift the pipe with a crane to the roller track, use a lifting strap.

(The mass centre of the pipe must be in between the first and the last roll of the roller track).

Move the lifting strap behind the mass centre to tilt the pipe. Lift the pipe with the crane a bit.



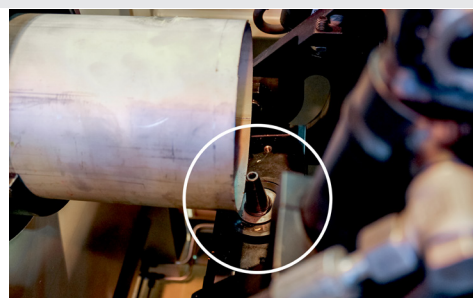
**➔NOTE! The pipe must be lowered to the roller track in a controlled manner to avoid damaging the track. A falling track will cause a high risk of injury!**

Lower the pipe to the machine aslant towards the clamps.



**➔NOTE! Do not push the pipe in to the machine too hard, the heavy pipe may damage the forming pin.**

Support the pipe with the strap and steer it to the clamps and into the machine so, that the pipe end touches the forming pin.





Lower the pipe down towards the roller track (keep still supported by the strap), and start closing clamps slowly.

Ensure that the pipe will not strain the lifting strap when clamps are closed.

Ensure that the pipe is still in contact with the forming pin and close clamps fully.

Let the pipe weight fully off the crane lifting strap support (strap can remain around the pipe).

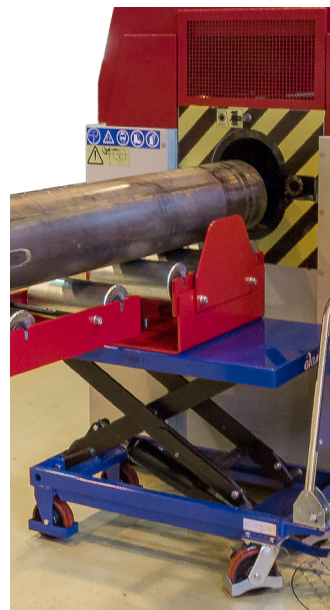
Lower the roller track so that the F-200 clamps hold the pipe, and there is a gap between the roller track and the pipe.



Run the work cycle as required.

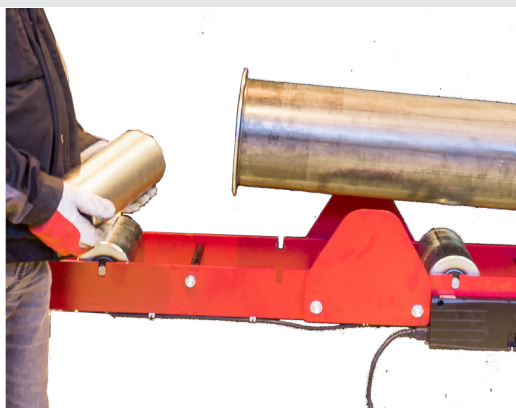
Lift the roller track to support the tube and open clamps.

Use the lift trolley to detach the pipe from the clamps.



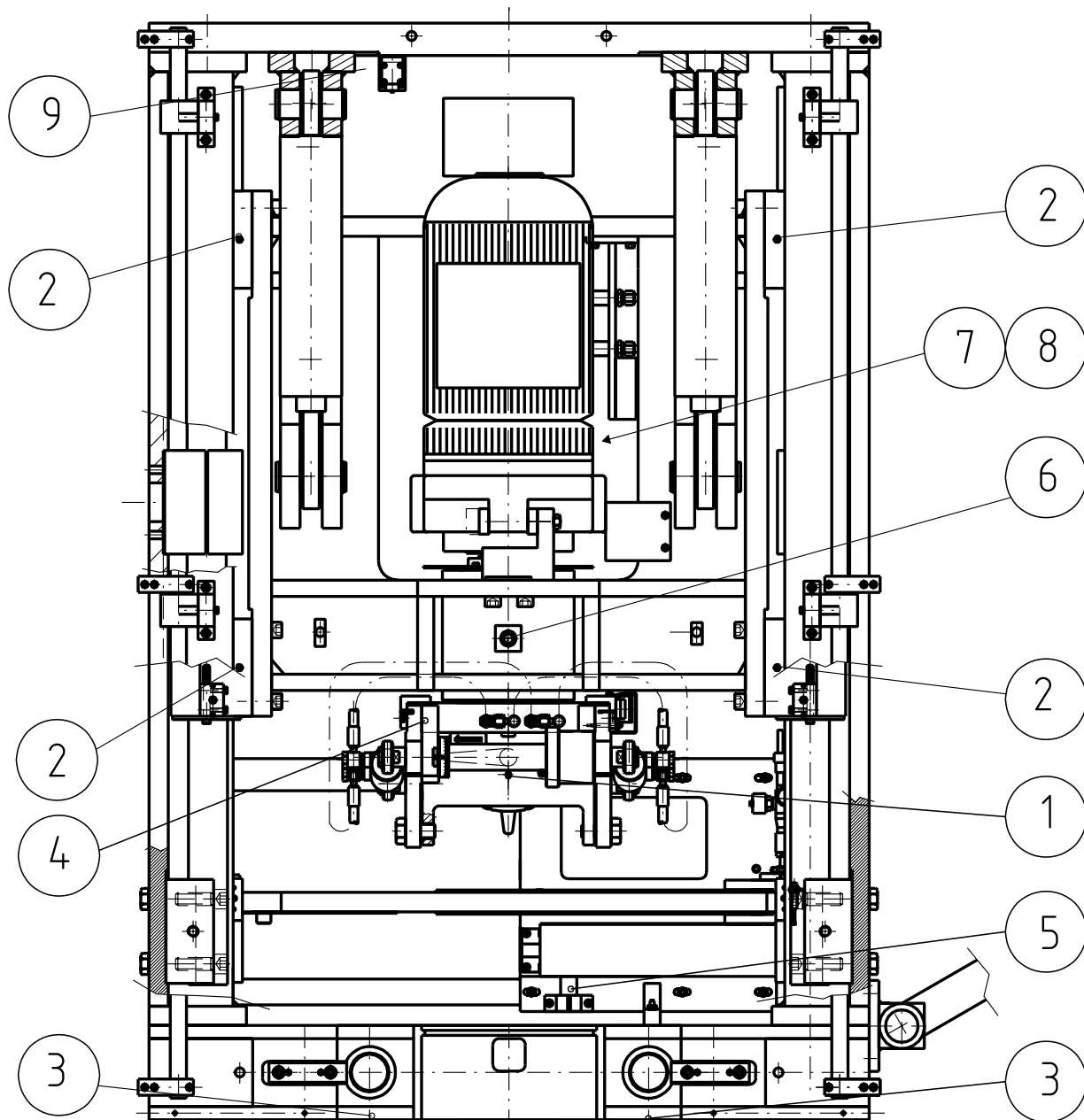
**➔NOTE! Always lock the wheels of the lifting trolley before moving the pipe to the roller track!**

The rolls can be removed from the track if there is a flange on the other end of the pipe.



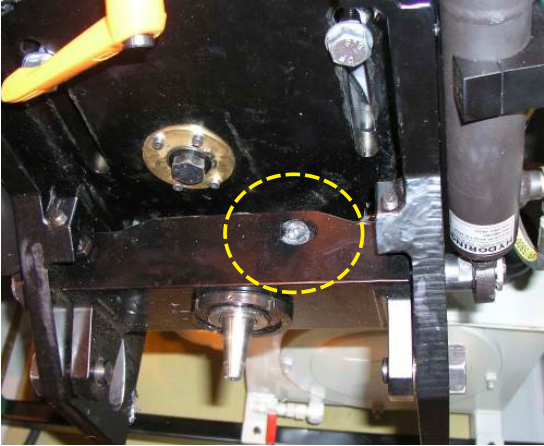
## 13. THE MAINTENANCE OF THE MACHINE

### 13.1 LUBRICATION AND INSPECTION POINTS



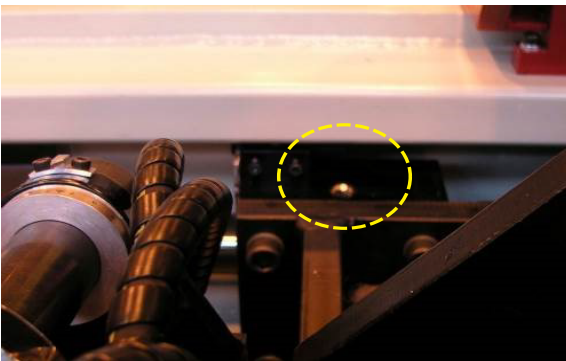
*Lubrication points of the machine*

Lubricate daily the following points:



**1. The bearings of the forming pin.**

Lubricate through the grease nipple.  
Lubricant: DIN 51825 KP 2K or NLGI 2, EP-grease, lithium complex, 40°C 190cSt, -20...+120°C. E.g. Shell Alvania EP2 or equivalent.



**2. The guideways of the frame.**

Clean the guides with cotton waste and lubricate through the grease nipples of the bearing shells with a grease gun.  
Lubricant: NLGI 1,5, EP-grease, lithium complex, viscosity 40°C 550cSt, -20°...+150°C. E.g. Shell Gadus S3 V550L 1 or equivalent.



**3. The slide bearings of the clamping jaws.**

Lubricate through the grease nipples with a grease gun.  
Lubricant: NLGI 1,5, EP-grease, lithium complex, viscosity 40°C 550cSt, -20°...+150°C. E.g. Shell Gadus S3 V550L 1 or equivalent.

Lubricate every week the following points:



**4. The slide**

Lubricate with a brush.  
Lubricant: NLGI 1,5, EP-grease, lithium complex, viscosity 40°C 550cSt, -20°...+150°C. E.g. Shell Gadus S3 V550L 1 or equivalent.

## 5. The guides of the heating unit.

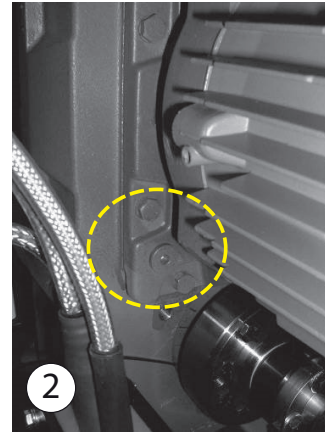
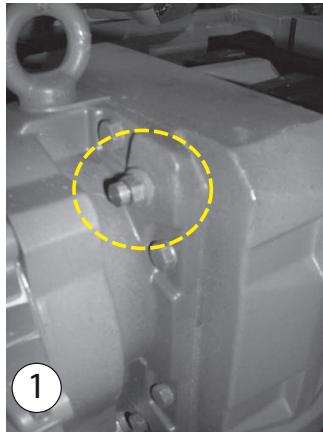
Clean with cotton waste, lubricate using a brush and lubricate the bearing shells through the grease nipples with a grease gun.

Lubricant: NLGI 1,5, EP-grease, lithium complex, viscosity 40°C 550cSt, -20°...+150°C. E.g. Shell Gadus S3 V550L 1 or equivalent.

**Lubricate every second week the following points:**

## 7. Gear motor.

Check the amount of oil and add whenever necessary. Open the fillerplug (1) and the drainplug (2). Add oil trough the fillerplug (1) until the oil comes out from the drainplug (2). Install and tighten the plugs. The maximum amount of oil is 3,5 litre. Lubricant: ISO VG 220, DIN 51517 part 3-CLP or ISO 12925-1 type CKC or AGMA 250.04. E.g. Shell Morlina S4 B 220. See separate instructions.

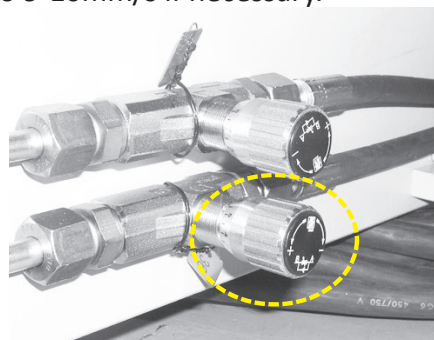


## 8. Rotary connection.

Lubricate trough the grease nipple with a grease gun. Lubricant: NLGI 1,5, EP-grease, lithium complex, viscosity 40°C 550cSt, -20°...+150°C. E.g. Shell Gadus S3 V550L 1 or equivalent.

## 9. Speed of the clamping jaw closing movement

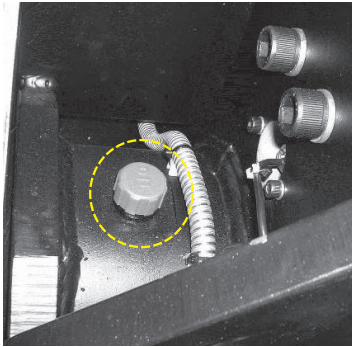
For the safety reasons the closing speed of the clamps is restricted to less than 10mm/s. Check the speed and adjust to 9-10mm/s if necessary.



*Adjustment valve for closing speed*



Once a month:



Fill plug

### 6. The spindle bearings

Change the spindle bearing oil once a month. Empty the spindle through drain plug. Open the fill plug and fill in the oil. The maximum amount of oil is 2 dl.

Lubricant: ISO VG 100, DIN 51517 part 3-CLP or ISO 12925-1 type CKC or AGMA 250.04. E.g. Shell Omala Oil 100 or equivalent.

## 13.2 REGULAR INSPECTION

**ⓘ DANGER! Disconnect the electric current supply to the machine by turning the main switch into “0” position and close the compressed air, oxygen and propane supplies before proceeding to the following maintenance routine - unintentional starting of the machine may cause a serious accident or damages to property.**

### The cylinders of the frame

Check the fixing screws of the ball joints located on the ends of the piston rods of the cylinders. Tighten if necessary.

### Forming tool

Check that the bearings of the forming tool are not worn. The forming pin must turn easily when moved by hand. The radial play may not be more than 0.2mm and the axial play may not exceed 0.4mm. If necessary, change the bearings.

### Limit switches

Check that the switches S33 and S34 trip just before the movement of the heating burner arm reaches the extreme limits. Check that the B3 and B4 micro switches actuate just before the end of the cylinder stroke. Adjust if necessary.

Check the correct function at the right moment of the safety switches of the protective hood and of the service door of the burner. The machine should stop when opening these doors and covers and it should be impossible to restart the machine when they are open.

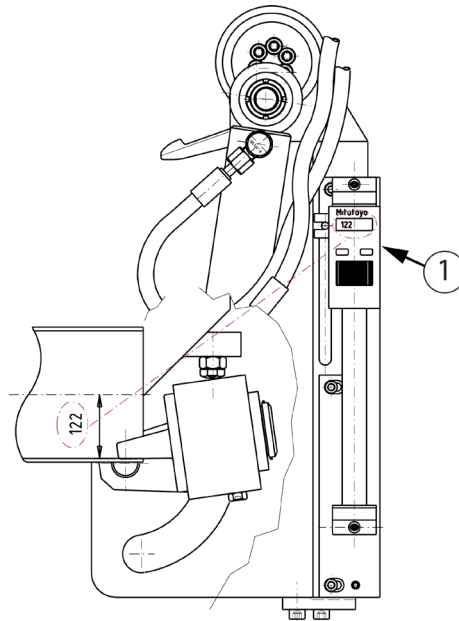
### The hydraulic system

See the separate instructions for the hydraulics.

### The heating unit

The tightness of the gas system joints and couplings should be checked daily. The membranes of the valves must be clean at all times. Even the smallest dirt particle may cause a gas leakage, which can be perceived by an abnormal function of the burner when lighting and extinguishing it. Tighten the leaking joints or replace the worn hoses and other damaged parts by new ones.

## 13.3 REPLACEMENT OF DIGITAL DISPLAY UNIT'S BATTERY



Forming head: 1. Digital display

F-200 flanging machine is equipped with digital display unit (pictured above).

Digital measuring unit is located to the forming device. It displays the pipes inside radius. Digital measuring unit is battery operated (silver oxide cell SR44). When battery power is low "B" appears in the upper left corner of the LCD .

See separate Digimatic Scale Unit 572 manual for changing battery. (Chapter 10.)

After the battery changing the digital measuring unit have to calibrate.

Move the forming head to the upmost position against the stopper and fasten screws. Preset the display according the Digimatic Scale Unit 572 manual (Chapter 10.) Preset value is the same as minimum radius of machine.

Presetting value is 6.5mm. at 2.5mm of forming pin housing position.





Mount the smallest tube clamps into the machine. Turn the forming pin into horizontal position. Adjust the height of the forming pin so that it cannot collide with the clamps. Drive the slide to front position (air buffers). Set the forming pin against the jaw. Set the reading of the digital measuring unit. Clamp diameter /2. For example: tube clamp =25. Preset value is 12.5.

➔ **NOTE! Notice the position of forming pin housing.**

**Position of forming pin housing effects to the level of forming tool.**

**If the forming pin housing position is not 2.5mm the reading of digital measuring units and pipe inside radius are not equal. (See chapter 6.2.6)**

### 14. TROUBLESHOOTING

Problem	Cause	Remedy
The machine does not start	Protective hood is open	Close the protective hood
	The service door of the burner is open (HOT option)	Close the service door
The automatic work cycle does not start	The frame is not at the starting point	Drive the frame to starting point of the work cycle.
	The arm of the burner is not in its lower position or the slide of the burner is not in rear position	Press the stop push button of the heating operation and drive the arm down and the slide backwards.
	The spindle is not in its correct position	Drive the spindle into correct position by pressing the  button a short moment, until the pilot lamp of the spindle position sensor B6 lights.
	The pipe clamp is not closed.	
	Check that the dimensions of the pipe clamp and the pipe correspond to each other and close the clamp.	
	The clamping jaw pressure switch SP 1 does not function	Adjust the pressure switch SP1
The arm of the burner does not go up	The slide of the burner is not in back position. (HOT option)	Press the heating stop  push-button and drive the slide backwards.
The frame does not move forward during manual control operation	The spindle is not in correct position	Drive the spindle into correct position by shortly pressing the  push button, until the pilot lamp of the sensor indicating the spindle position lights up.
The frame does not move forward during the automatic work cycle	The pressure switch SP2 does not function (tool in starting position for flanging)	Adjust the pressure switch SP2
The clamp does not open in manual operation mode	The spindle not in correct position.	Drive the spindle into correct position by pressing the  push-button a short moment, until the pilot lamp of the sensor of the spindle position lights up

Problem	Cause	Remedy
The flange is not being spinned to 90° or is over 90°	The turning angle of the forming pin is wrong.	Adjust the turning angle of the forming pin.
	The pressure switch SP3 (flange ready) actuates before the tool has performed the spinning movement of the flange to the end	The maximum admissible wall thickness of the pipe exceeded or else the pressure switch has not been regulated correctly. Adjust the pressure switch SP3.
Wrinkling in the pipe in the flange bending radius	Outer diameter of the flange too big compared to the outer diameter of the pipe	Check the fastening of the pipe
	Thin-walled pipe	Use multi-stage flanging
	The forming pin set to far from the inner surface of the pipe	Check the centering of the forming pin
The radius of the flange is not even	The heating uneven	Check the burner
The digital readout of the forming head is off or not working properly	Battery is dead.	Charge the battery.
	Origin point is in wrong position	Set the origin point.
	Some other problem	See Mitutoyo instruction manual, chapter 10.
Alert “Check the size of the buffer plate” appears while moving the frame forward.	Wrong buffer plate thickness defined in the program.	Verify buffer plate thickness in pipe settings screen.

**If the problem is not solved with the help of trouble shooting instructions, contact your local T-DRILL dealer.**

**Give your contact information**

- The name of the company
- Your own name and position
- Telephone number
- Fax number
- e-mail –address

**To accelerate the problem solution, please give the following information:**

- The serial number of the machine
- Type code
- The reading of the piece counter
- Short description of the appeared problem.

## 15. ADDENDA

### 15.1 CAPACITY OF THE MACHINE

The maximum diameters (d4) of the flanges. For the dimensioning the 1092-1 or other equivalent standards can be used.

The Outer Diameter (O.D.) of the flange and its corresponding d4 standard:

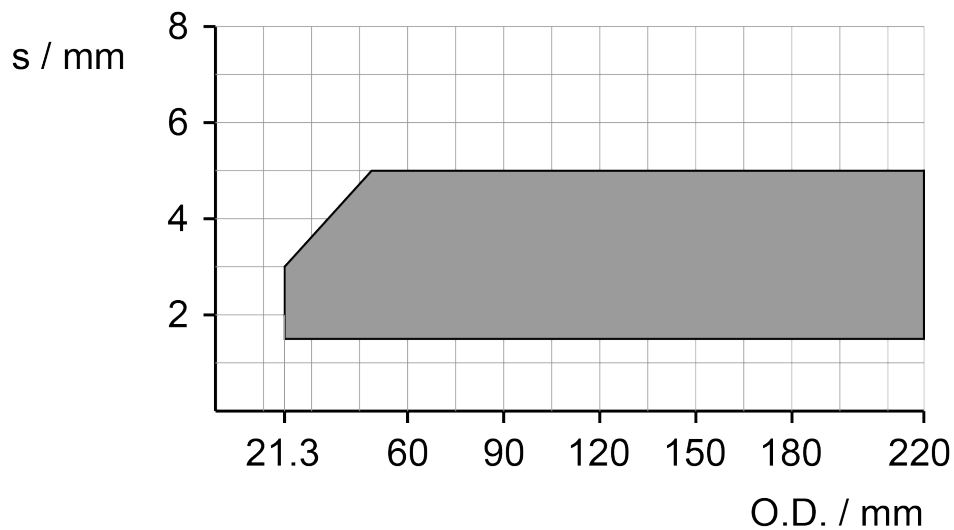
$21.3 < \text{O.D.} < 50$	->	d4: EN 1092-1 / PN 6
$50 < \text{O.D.} < 219,1$	->	d4: EN 1092-1 / PN 10

The deformation capacity i.e. the elongation of the material is a decisive factor, which determines the greatest possible diameter of the flange. By means of the multidimensional way of elongation, however, much greater elongation values are attainable. Also the sealing face of the flange can be changed to be uneven in hot flanging by means of a suitable forming pin.

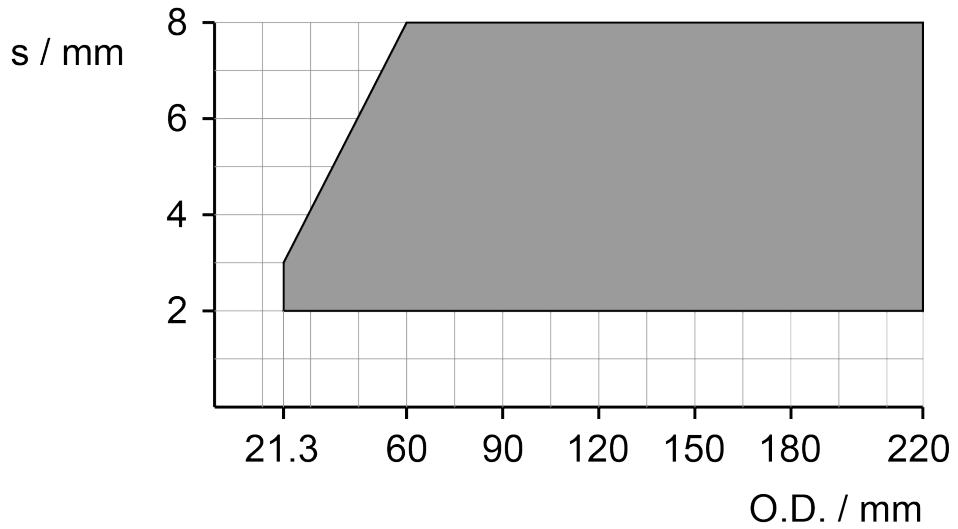
#### Capacity diagrams

The F-200 flanging machine is able to form the pipe dimensions shown in the following diagrams.

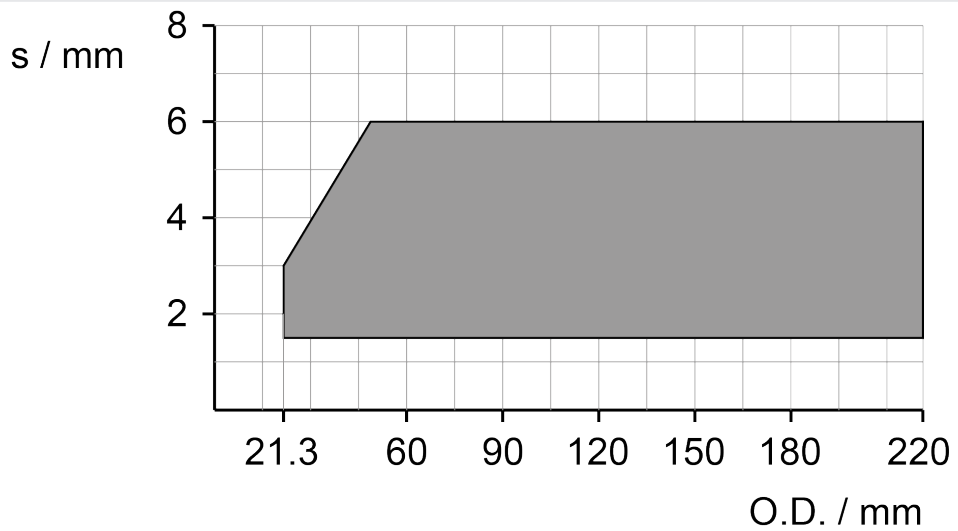
#### Flanging of pipes:



*Cold flanging of carbon steels and flanging of austenitic stainless steels*

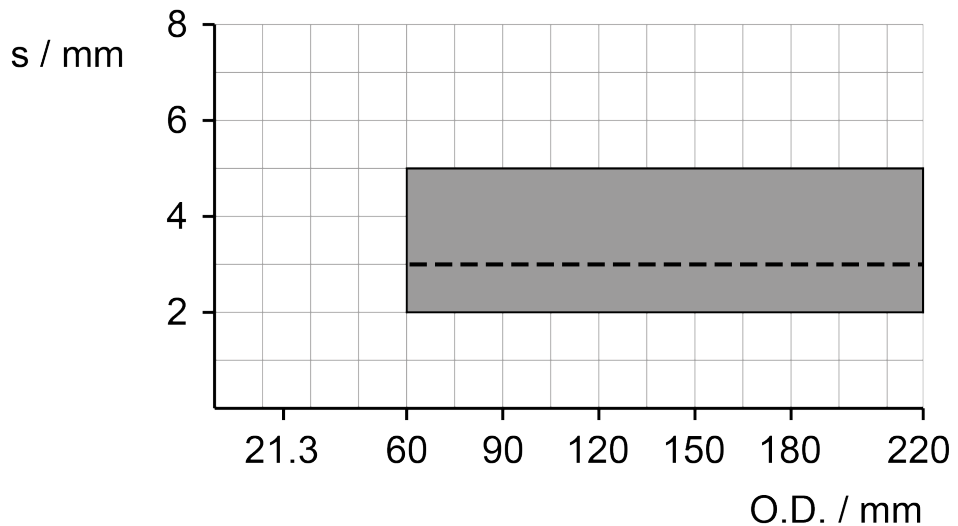


*Hot flanging of carbon steels*



*Flanging of copper alloys*

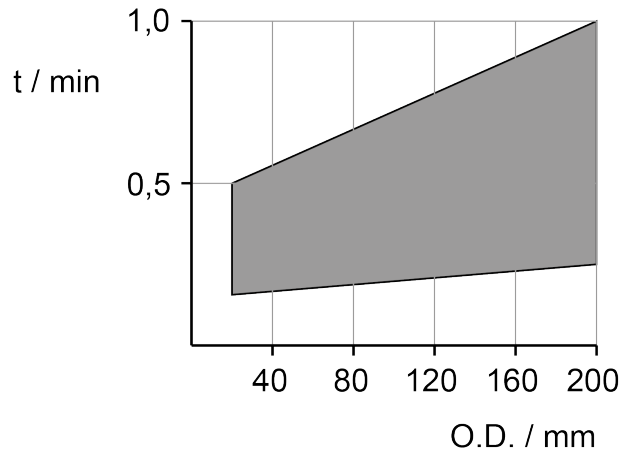
**Expansion of pipe ends**



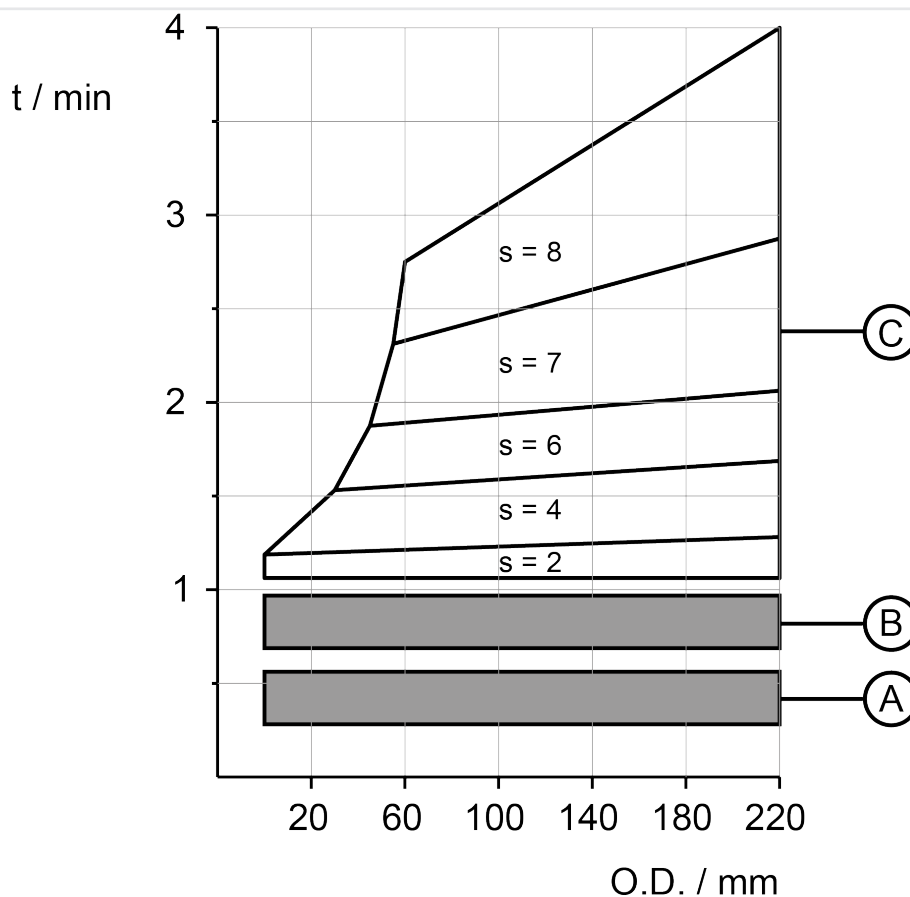
*Expansion of pipes*

## 15.2 PROCESSING TIMES

The processing times for the different stages of flanging



The fastening into and removing from the machine of the pipe



The flanging time of the machine A: Flanging in one stage, B. Multi-stage flanging, C. Hot flanging on different wall thicknesses

## 15.3 THE MEASURES OF THE LOOSE FLANGE JOINTS

### Dimensioning of the loose flange joints

Dimensioning for 1 MPa pressure according to EN 1092-1 PN10

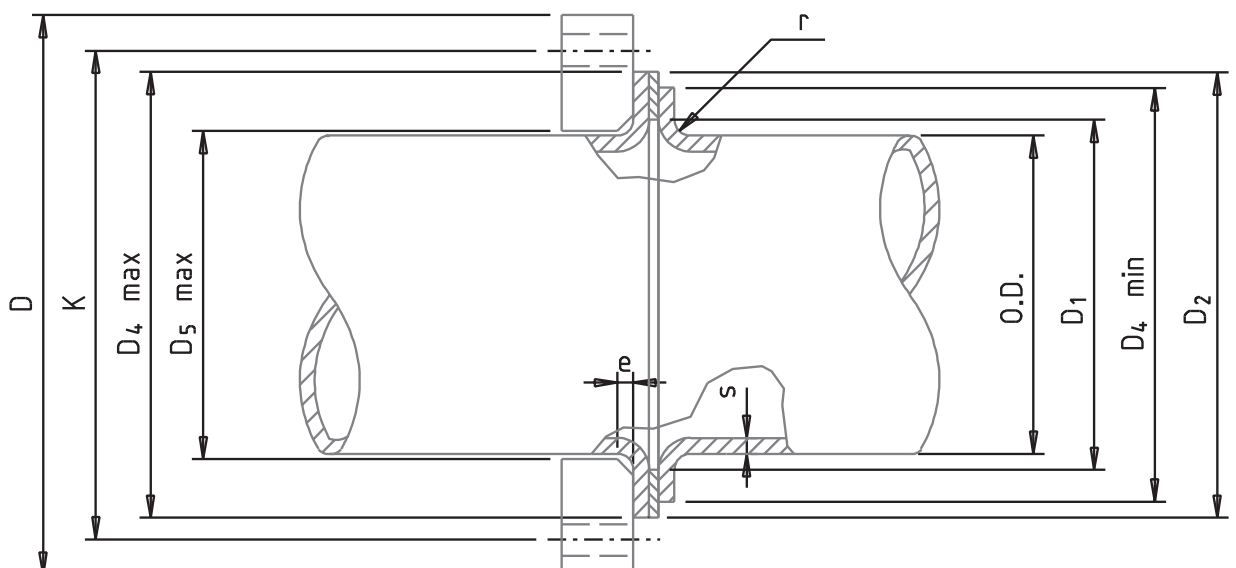
Flanged pipe	
O.D.	Outer diameter of pipe
S	Wall thickness of pipe
D4	According to EN 1092-1 or equivalent standards

Loose flange	
D	According to EN 1092-1 PN10
K	According to EN 1092-1 PN10
e	According to EN 1092-1 PN10
b	According to EN 1092-1 PN10
D5 max	According to DIN 2576
D4 min	According to EN 1092-1 PN10

Sealing	
D2	According to DIN 2690 equivalent standards
D1	According to DIN 2690 equivalent standards

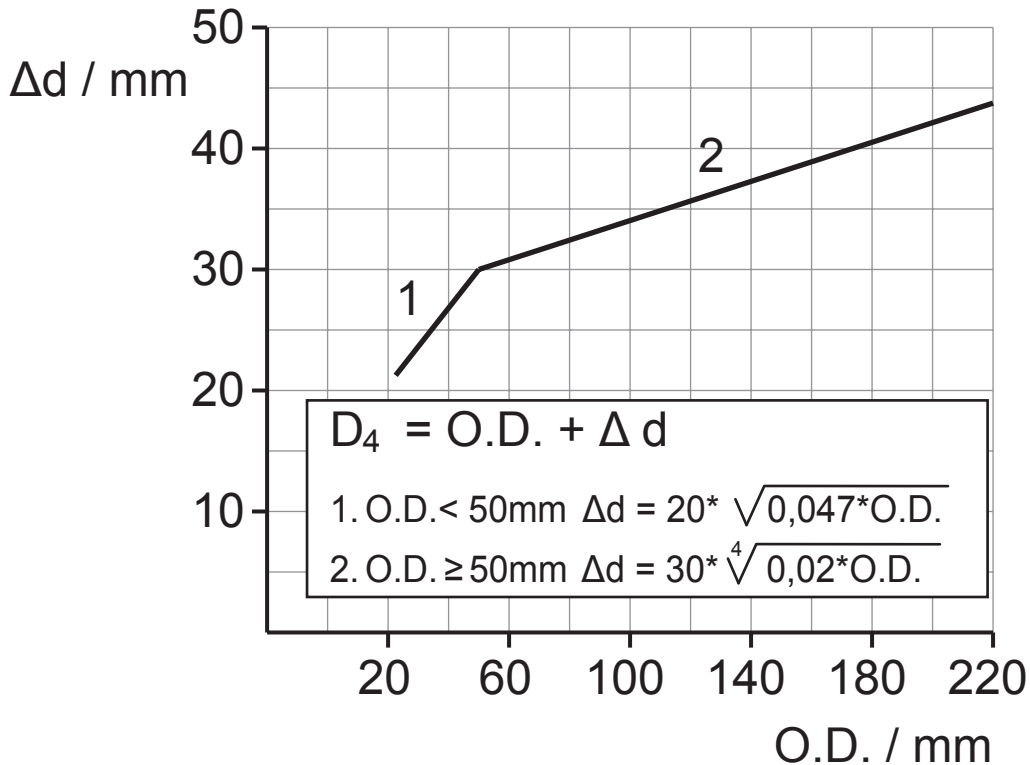


*Dimensioning of loose flange joints*



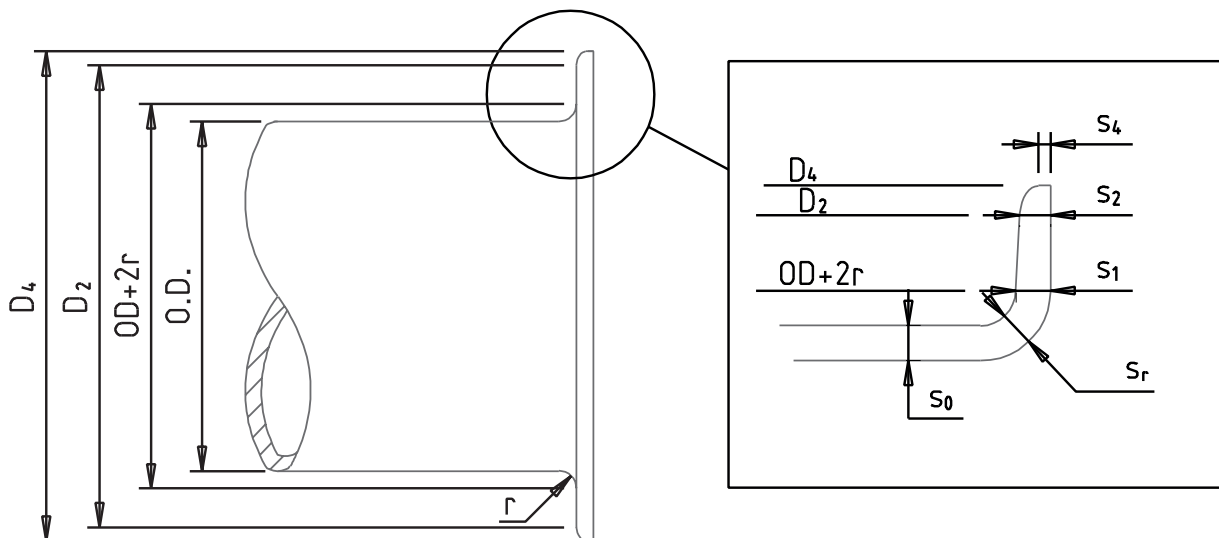
### Determination of the outer diameter of the flange

The outer diameter  $D_4$  of the flange is obtained as indicated in the following figure



The outer diameter of the flange

### The wall thicknesses of the flanged pipe end



The wall-thicknesses of the flanged pipe end:  $S_0$  = the original wall-thickness of the pipe,  $r$  = the inner radius of the bent area,  $D_2$  = the running measure of the diameter,  $D_4$  = outer diameter of the flange,  $s_r \approx 1...1,1 * s_0$ ,  $s_1 \approx 1...0,9 * s_0$ ,  $s_2 \geq (O.D./D_2) * s_0$ ,  $s_4 \geq (O.D./D_4) * s_0$

## 16. T-DRILL STANDARD WARRANTY

T-Drill agrees to warrant to the original purchaser, that the Product is free from defects in material and workmanship under normal use and service. The warranty period is: (a) twelve (12) months from the date of taking-over, or (b) 2000 hours of operation from the date of taking-over, or (c) eighteen (18) months from the date of delivery to the Customer, whichever occurs first. For spare parts and packages for retrofit the warranty period is 6 months from the date of delivery to the Customer. Warranty is not transferable from the original purchaser to further owners.

Extended warranty shall be available only subject to separate written Service agreement between T-Drill and the Customer.

In the event that the Customer wants to avail itself of this warranty, the Customer shall complete the Warranty Claim Form and send it to T-Drill without delay, and in any event within seven (7) days of the Customer being put on notice of the defect. The Customer shall, immediately upon being put on notice of a defect in the Product, take all reasonable steps to avoid aggravation of the defect or further damage to the Product.

In the event of a valid warranty claim, T-Drill shall, at its sole discretion, have the option of repairing or replacing the relevant part or parts free of charge and supplying them to the Customer. In such cases, replaced parts may be either new or factory refurbished, at T-Drill's discretion. Repair or replacement services shall be carried out by the Customer at its own risk and expense. The Customer shall ensure that T-Drill or any third party appointed by T-Drill have all necessary access to the Product in question. In no event shall the Customer have a right to return any Product without the prior written consent of T-Drill. The Customer acknowledges and agrees that the provisions of this warranty constitute the sole and exclusive remedy available to it with regard to said defective Products.

This warranty shall not extend to any Product which has been: (a) rendered in need of repair due to normal wear and tear; (b) subjected to unusual physical or other stress (e.g. from electricity, gas, water or compressed air), misuse, neglect, accident or abuse, or damaged by any other external causes; (c) repaired or altered by any third party or maintenance is carried out by other than T-Drill authorized service provider; (d) improperly installed by any third party; (e) installed on foundations or in environmental conditions which are not in accordance with specifications; (f) used or maintained in violation of instructions furnished by T-Drill; (g) rendered defective due to materials, components, use of other spare parts than T-Drill's original spare parts, or design provided by T-Drill; or (h) rendered defective or in need of repair due to any other cause which is not under the control of T-Drill. The warranty does not cover defects which are insignificant to the use of the Product, such as repair of superficial scratches. In addition the warranty does not cover the adjustments or structural changes to the Product, nor any per diem, traveling costs, freights or remuneration for out-of-operation days.

EXCEPT AS EXPRESSLY PROVIDED HEREIN, ALL WARRANTIES, CONDITIONS, REPRESENTATIONS, INDEMNITIES AND GUARANTEES WITH RESPECT TO THE PRODUCT, WHETHER EXPRESS OR IMPLIED, ARISING BY LAW, CUSTOM, PRIOR ORAL OR WRITTEN STATEMENTS BY T-DRILL OR OTHERWISE (INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE) ARE HEREBY OVERRIDDEN, EXCLUDED AND DISCLAIMED.

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UNDER NO CIRCUMSTANCES WILL T-DRILL OR ITS AFFILIATES BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, SPECIAL, PUNITIVE, OR INCIDENTAL DAMAGES OR LOST PROFITS, WHETHER FORESEEABLE OR UNFORESEEABLE, BASED ON CLAIMS OF THE CUSTOMER (INCLUDING, BUT NOT LIMITED TO, CLAIMS FOR LOSS OF GOODWILL, LOSS OF SHARE VALUE OR INVESTMENT, USE OF MONEY OR USE OF THE PRODUCTS, INTERRUPTION IN USE OR AVAILABILITY, STOPPAGE OF OTHER WORK OR IMPAIRMENT OF OTHER ASSETS), ARISING OUT OF BREACH OR FAILURE OF EXPRESS OR IMPLIED WARRANTIES, BREACH OF CONTRACT, MISREPRESENTATION, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE, EXCEPT IN THE CASE OF PERSONAL INJURY CAUSED DESPITE THE PROPER USE OF THE PRODUCTS, IF AND TO THE EXTENT REQUIRED BY APPLICABLE LAW. IN NO EVENT WILL THE AGGREGATE LIABILITY WHICH T-DRILL OR ITS OFFICERS, DIRECTORS, EMPLOYEES, AGENTS OR AFFILIATES MAY INCUR IN ANY ACTION OR PROCEEDING EXCEED THE TOTAL AMOUNT ACTUALLY PAID TO T-DRILL BY THE CUSTOMER FOR THE SPECIFIC PRODUCT THAT DIRECTLY CAUSED THE DAMAGE.

## 17. ORDERING SPARE PARTS

When ordering spare parts, please state the following details:

- Type code of the machine
- Manufacturing code of the machine
- The part number
- A description of the part
- The quantity of the parts required

The type code and manufacturing code of the machine are indicated on the nameplate of the machine. The other information can be found from parts list.

For example:

### 10.1. CLAMP SUPPORT <168 5500896

Item	Part No.	Name	Size/Type	Std./Manuf.	Qty
1	3500903	Clamp frame			2
2	3500904	Fastening plate			2
3	9214010	Screw	M8 x 25	8.8 DIN7984	8
4	9016007	Set screw	M8 x 8	12.9 DIN913	4
5	4280104	Clamp holder pin			4
6	9018037	Parallel pin	Ø6m6 x 32	DIN6325	4
7	9018219	Spring pin	Ø6 x 30	DIN1481	2



1. Part number 2. Description 3. Quantity

When ordering spare parts, send an e-mail or a fax.

By proceeding this way you will prevent misunderstandings, and you make sure to receive the correct spare parts and a prompt service.

Contact information:	Global	USA, Mexico, Canada
Spare part inquiries and orders	sales@t-drill.fi	sales@t-drill.com
Technical support	service@t-drill.fi	service@t-drill.com
Fax:	+358-6-4753 383	(+1) 770-925-3912
Telephone:	+358-6-4753 344	(+1)770-925-0520 ext. 245



# More T-DRILL products for tube fabrication



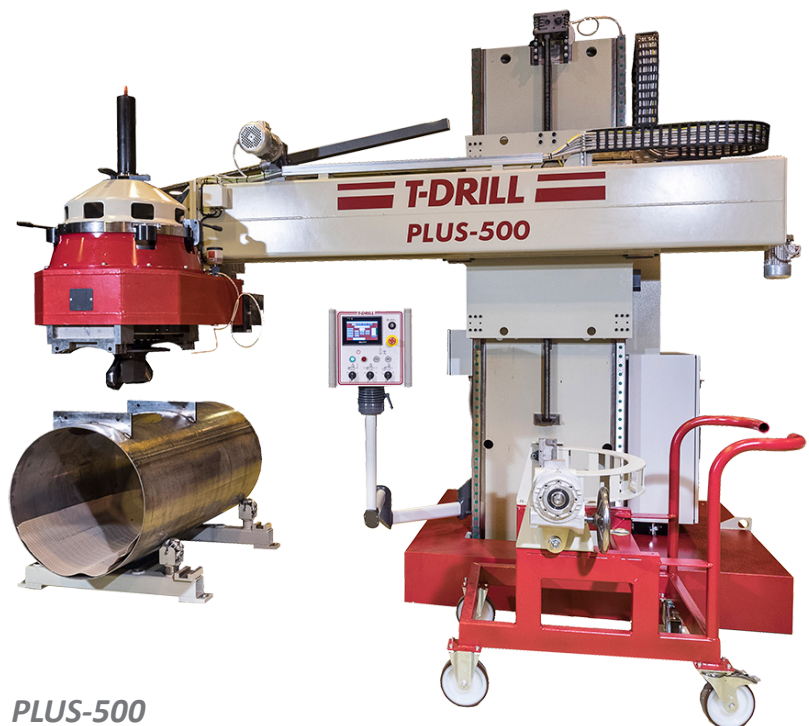
## SEC-100 TBC

Automatic Tube Collaring System for multiple collars with 2-axis positioning up to 114.3 mm collars.



## TEC-150 HD

Heavy Duty Collaring Station  
-Collar sizes 21.3 - 219.1 mm  
-Run tube sizes 33.7 - 804 mm



## PLUS-500

Powerful and competitive collaring system for large pipe/vessel collaring by one operator for most malleable materials.  
Run pipe diameter range is  $\varnothing$  273 – unlimited, and collaring range mainly  $\varnothing$  219 -  $\varnothing$ 508 mm.



## SP-55/SP-110

Tube End Spinning machine for closing, reducing and expanding of copper tubes.

- Max tube diameter 108 mm
- Max wall thickness 3 mm