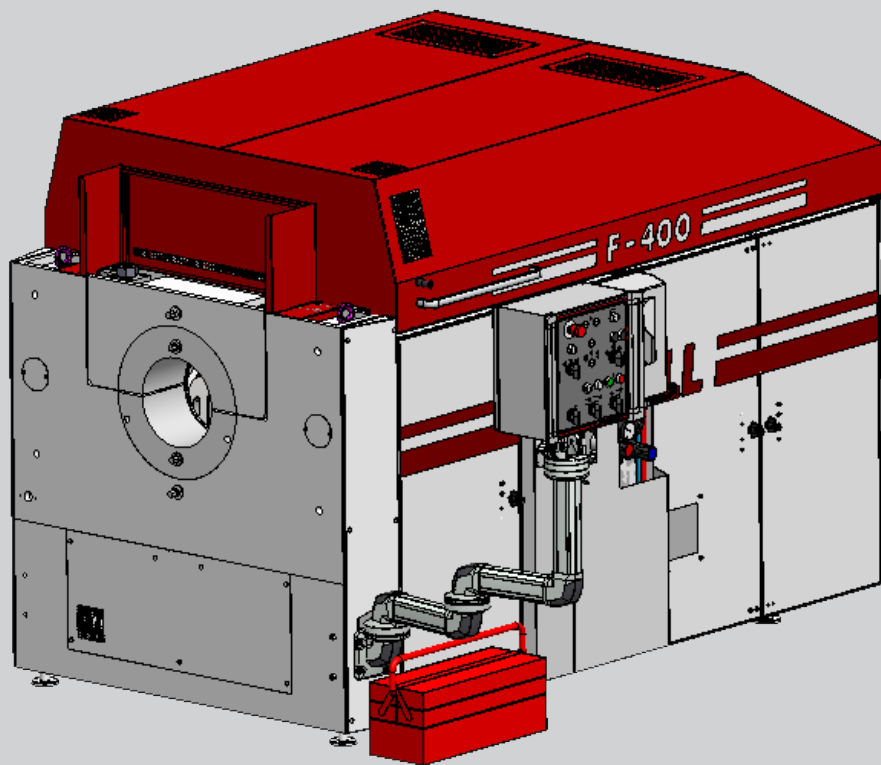


# T-DRILL

PRODUCTIVITY AS A PRODUCT.

## INSTRUCTION MANUAL



**FLANGING MACHINE (COLD)**

**F-400**

## Version

6402768EN  
10.03.2019 / MT

## Original instructions

Instructions for use of the T-Drill **F-400 cold flanging machine, type code 4014.**

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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 THIS INSTRUCTION MANUAL

### 1.1 GENERAL

This instruction book contains the instructions for use, maintenance and setting of the T-DRILL machine, as well as recommendations regarding different working procedures and the use of the forming tools.

Before proceeding with installation and operation of the machine, read the safety instructions in chapter 2 "General safety instructions"

➔ **NOTE!** Read all the instructions for the entire operation sequence before proceeding with 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 safety precautions have not been taken.

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

➔ **NOTE!** May cause an accident or damage other property if the correct safety precautions have not been taken. This symbol is used also to draw the general attention to a certain 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.



Sharp edges!  
Be extremely cautious when handling this area of the machine.



Mind the rotating spindle.



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



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



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.



Danger of collision!  
When changing the forming pin note to adjust the correct flanging radius. (See flange standard tables).

## 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.

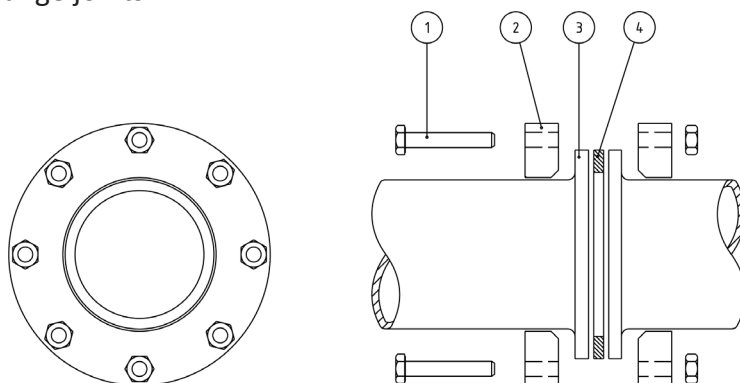
➡ **NOTE! Be especially careful when adjusting the machine and when clamping and unclamping the pipe. Be constantly prepared to stop the machine if necessary. See instructions for adjusting the forming pin according to pipe size, chapter 6.3 Machine settings.**

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

## 3. F-400 GENERAL INFORMATION

### 3.1 INTRODUCTION OF FLANGING

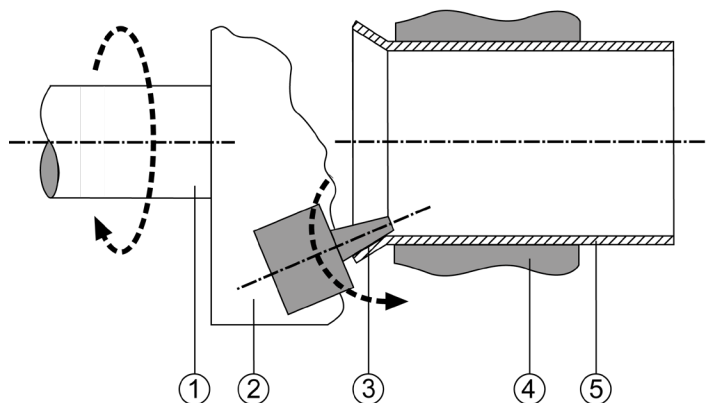
The machine is intended for widening the end of a pipe to form a flange using a rotating forming cone. The flange thus formed is used as a sealing and joining element in so-called loose flange joints.



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.

Flange O.D. (  $d_4$  ) :  $42.4 < O.D. < 50 d_4$ : EN1092-1  
 $50 < O.D. < 406.4 d_4$ : EN1092-1

## 3.2 METHODS OF FLANGING

### 3.2.1 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 406 mm (16") pipes. See chapter 6.3. Cold flanging and flaring of the pipe.

## 3.4 INFORMATION ON THE EQUIPMENT

Following equipment is available for F-400 machine:

- Heating unit is 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.
- Bevelling unit to be used for bevelling 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  $\varnothing 42.4$ - $\varnothing 419$ mm.
- Potentiometer and display.



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

## 3.5 FORMABLE MATERIALS

- Various copper alloys, e.g. CZ110 BS 2871
- Austenitic steels, e.g. AISI 316
- Soft steels, e.g. St 35 DIN 17175
- Soft aluminium alloys

## 3.6 TECHNICAL SPECIFICATIONS

Type	Unit	F-400	NOTE!
Type code		4014	
Pipe to be flanged	mm	( $\emptyset 33,7^{**}$ ) $\emptyset 42.4$ - $\emptyset 419$	
Maximum wall thickness		See capacity diagrams	
Materials to be formed		Copper, Carbon steels, RST, Aluminium	Other materials: Consult T-DRILL Oy
Flanging time		See Machine time (13.3)	
Connected power	kW	15,5	See Machine plate
Max size of fuses	A	3 x 100	
Working voltage		3 x 200V - 240 V 50/60 Hz 3 x 380V - 480V / 50Hz/60Hz.	See Machine plate
Spindle motor	kW	11	
Rotational speed of spindle	rpm	approx.41	
Measurements of machine (h x w x d)	mm	1720 x 1625 x 3100	
Motor of hydraulics	kW	4	
Pressure of hydraulic pump (Max.)	MPa	16	
Hydraulic pump output (adjustable)	ltr/ min	0...25 l/min	
Noise level	dB	74 (During flanging)	
Weight	kg	4200	
Compressed air supply*	MPa	0,6	

1 bar = 0,1 MPa

\*\* ) Flanging pipes  $\emptyset 33,7$  --  $\emptyset 42,4$  is possible by using forming pin: 5401793

## 4. TRANSPORT, HANDLING AND STORAGE

For transport the F-400 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 4500 kg. For storage the F-400 is to be protected by grease and sufficient dehumidification should be provided in the storage accommodation. Especially the electric equipment must be kept dry.

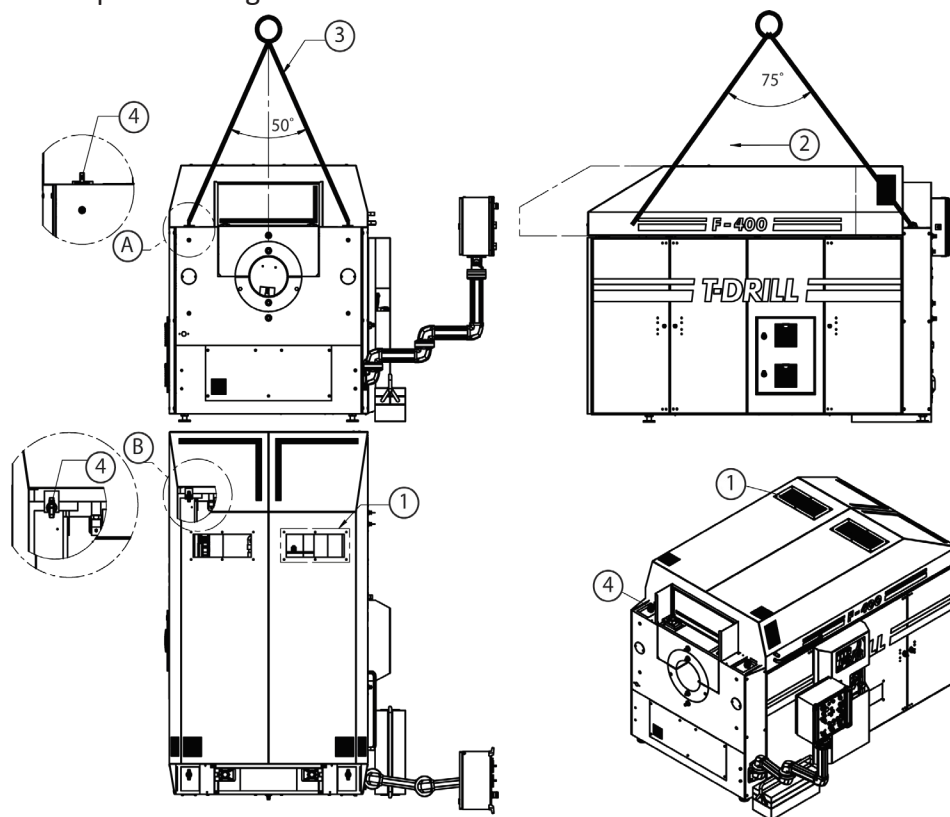
To remove the machine from the pallet, remove all fixing screws first. The corner plates have to be removed to reach the screws and adjustable machine feet (adjustment of the machine feet requires special tools).

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. The lifting eyes can be removed after the machine is installed.

Before installing the machine, see layout for required space.

### Before lifting the F-400 machine:

1. Remove the rear top mesh lids (1) of the hood to reach the lifting eyes (4).
2. Open the hood to reach rear lifting points.
3. Fix the lifting chains as illustrated.
4. Fix a four-part hoisting chain.



*Instructions for lifting and parts: 1. Top mesh lids, 2. Lifting chains, 3. Adjustable machine feet, 4. Lifting eyes, 5. Corner plates, remove to detach machine from the pallet, fix the machine to the floor and adjust feet.*

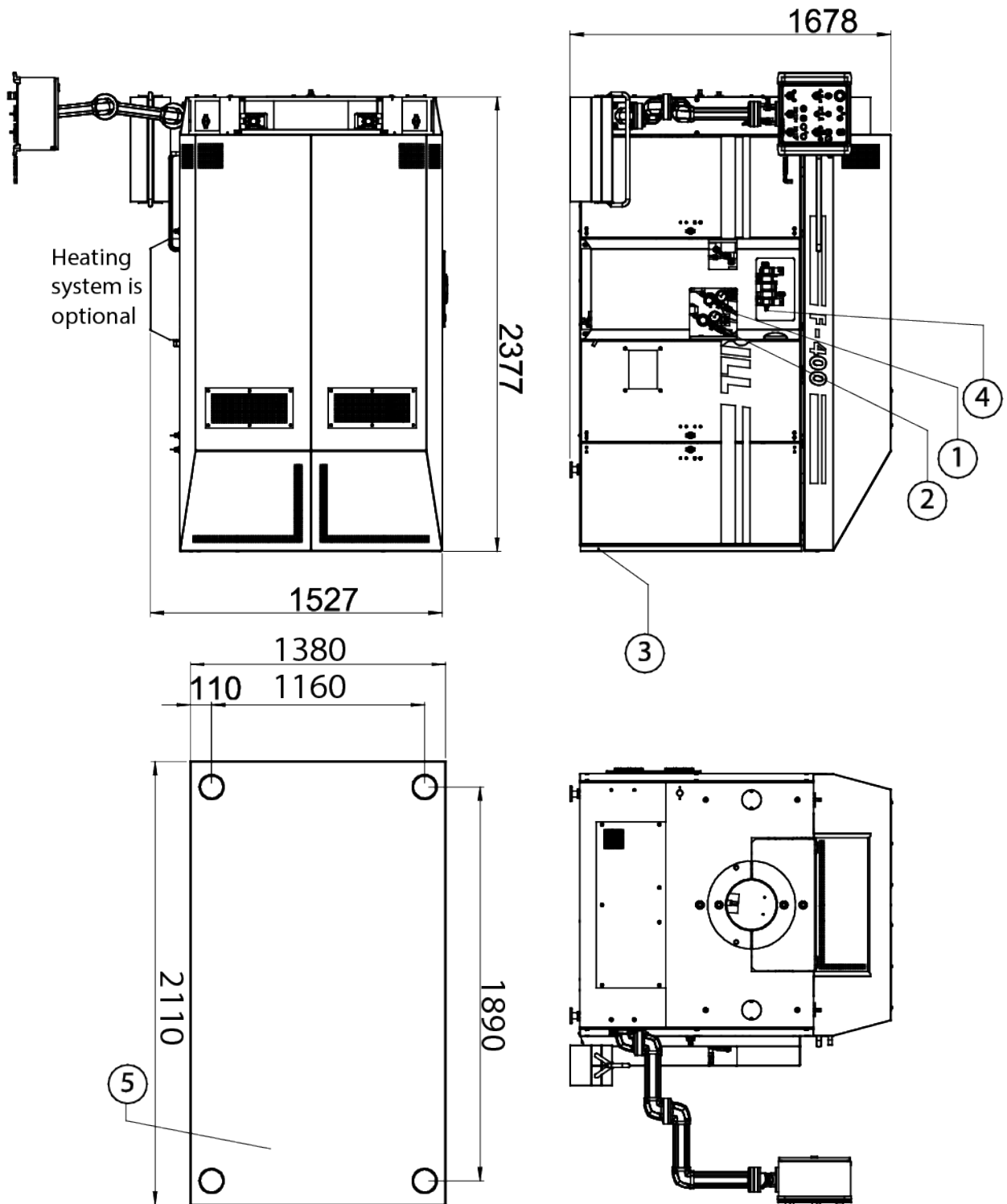
**➔ NOTE! Do not use a forklift truck to lift the F-400!**

## FLANGING MACHINE

### 5. INSTALLATION

#### 5.1 INSTALLATION AND LEVELLING OF THE MACHINE

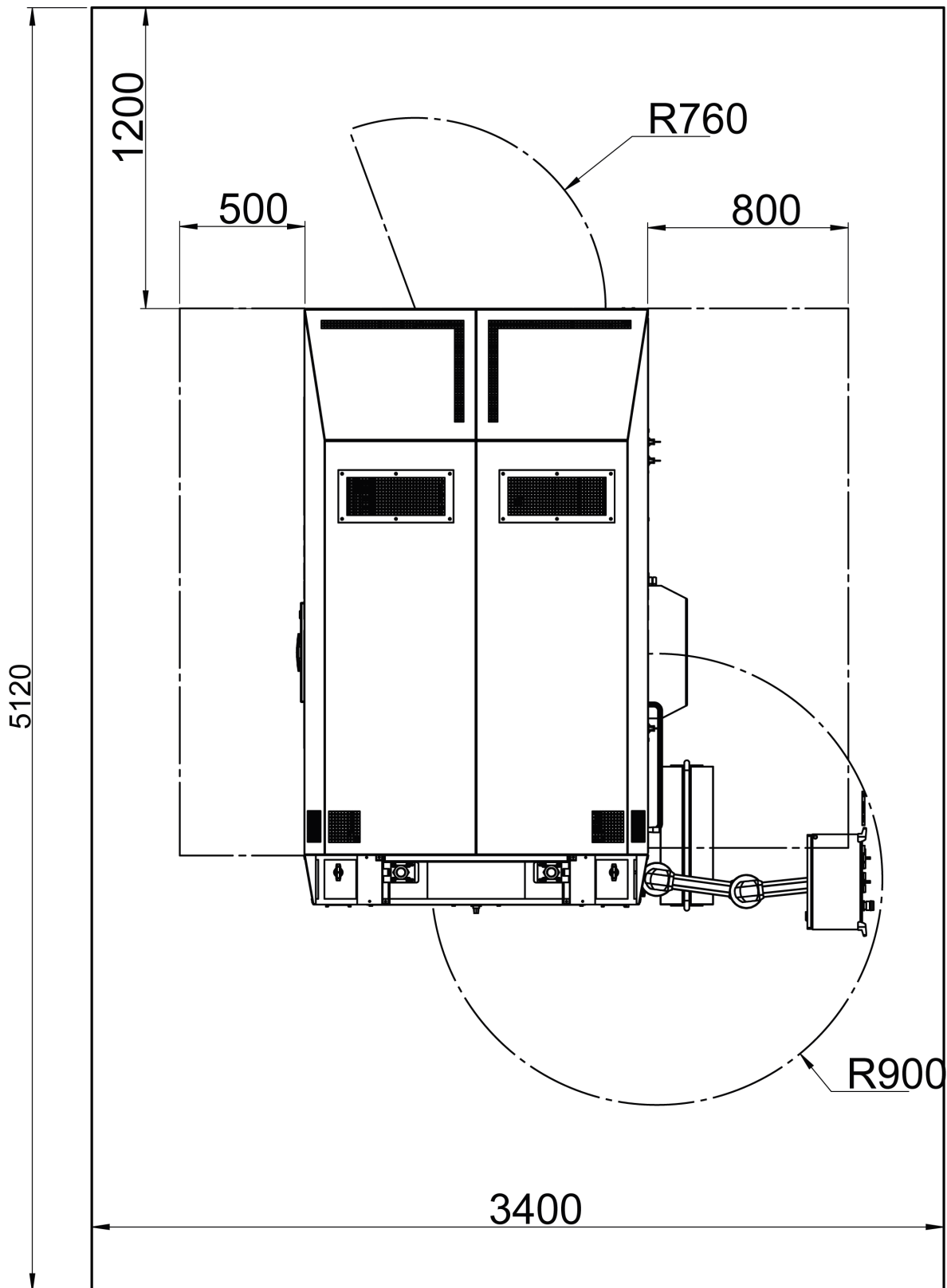
##### 5.1.1 LAYOUT



1. Gas valve\*, 2. Oxygen valve\*, 3. Electric connection, 4. Compressed air connection and regulator, 5. Machine outline measures.

\* Heating system is optional accessory!

### 5.1.2 SPACE REQUIREMENT



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

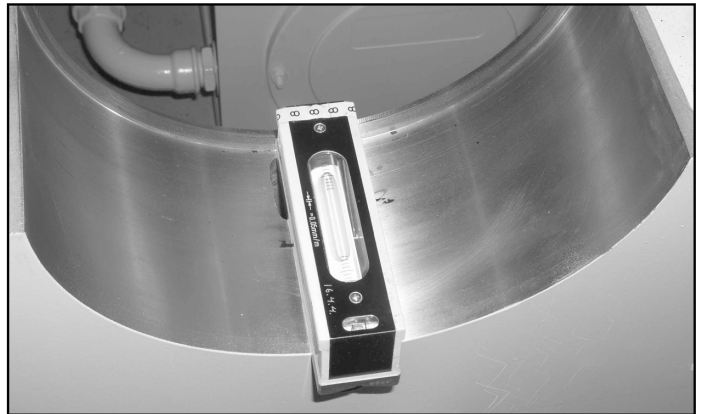
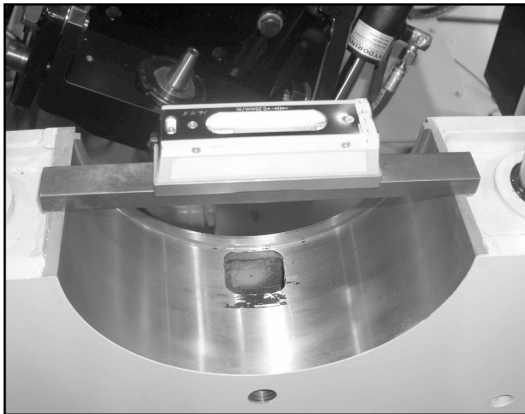
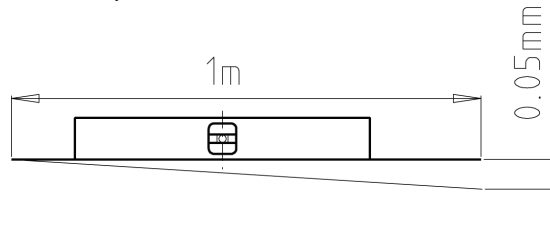


## 5.1.3 LEVELING

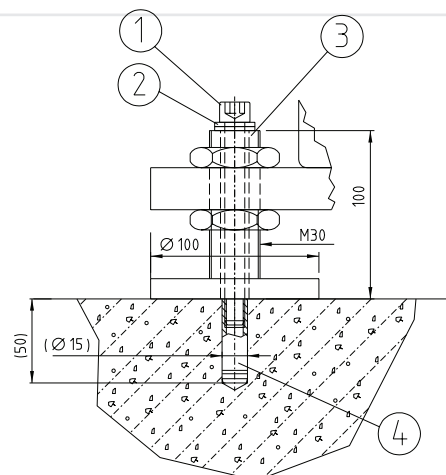
The machine should be installed on a solid and level foundation, preferably on a concrete bed.

- Required floor load capacity 3.0 t/m<sup>2</sup>
- Floor level  $\pm 5$  mm /m<sup>2</sup>

The F-400 machine must be leveled on its foundation before use. The leveling tolerance is 0,05mm 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.*



*Screw M12, Washer  $\varnothing 13$ , Hole in anchor foot  $\varnothing 17$ , Anchor bolt M12*

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

## 5.2 AMBIENT CONDITIONS

The machine must be placed in an working area, the environmental conditions of which do not exceed the following limit values:

Temperature:	+5...+40°C (41...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 and 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-400 machine to the mains.

The terminals for connection of the external supply cable of the F-400 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. The EMC-filters of the machine may cause disturbance tripping for regular (type AC) residual-current circuit breakers.

## 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.

➡ **NOTE!** Before starting the cycle on rotating the spindle, always make sure that the lock nuts (4 pcs) of the slide are tightened.

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.	If the machine is equipped with 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
4.	Check the amount of the hydraulic oil and of the lubrication oil of the machine.
5.	Check the rotation direction of the hydraulic pump motor. Turn the main power switch on and press the push button of the contactor, 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. A wrong rotation direction may cause the hydraulic pump to be damaged.
6.	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.
7.	Check the correct function of the switches and push-buttons of the control panel.

➡ **NOTE!** Always before flanging or expansion make sure that correct tooling is used and that the buffer plates are of correct thickness.

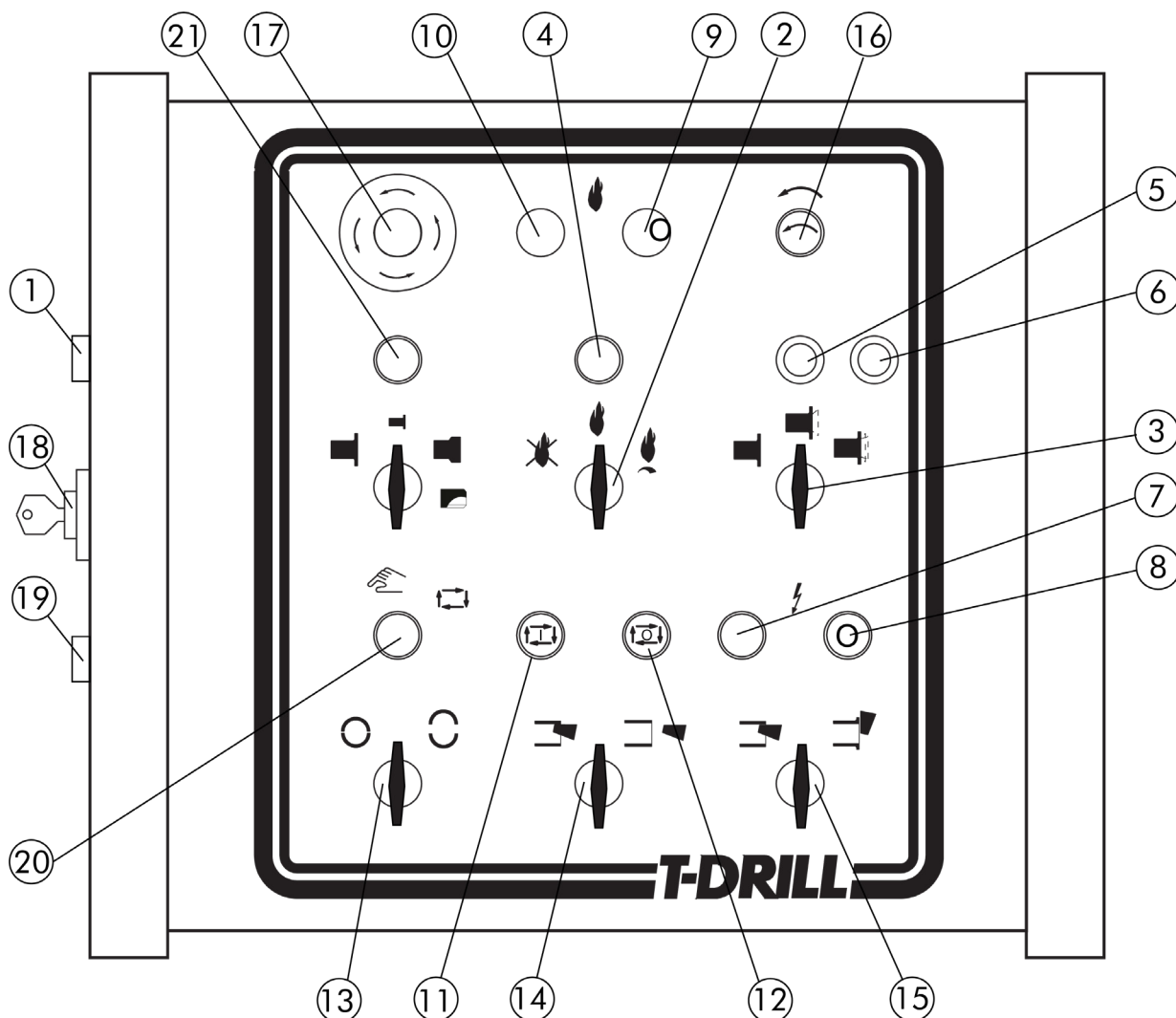
### 6. THE OPERATION OF THE FLANGING MACHINE F-400

#### 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 "I" (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 (padlock not included to delivery).

##### 6.1.2 CONTROL PANEL










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

Heating system is optional accessory!




#	Denomination	Description of the function
1	Selector of the forming	Selects the forming of the pipe end (see separate table below)
2	Selector of the way of forming	Selects either cold or hot forming (see separate table below)
3	Selector of the flanging mode	Selects the way of flanging the pipe (see separate table below)
4	Heating time regulator	This gives the heating time, i.e. time which the heating gas valves are open in automatic work cycle. One scale number increment equals to abt. 20 sec. For example: Scale value 6 is 120 seconds.
5	Regulator of the time of the first return movement in multi-phase flanging	Time regulator for the 1. return time of forming pin. Guide value 1 - 3 sec. One scale number increment equals to 1 sec
6	Regulator of the time of the second return movement in multi-phase flanging	Time regulator for the 2:nd return time of forming pin. Guide value 14-16 sec. One scale number increment equals to 2 sec. For example: Scale value 7 is 14 sec and scale value 8 is 16 sec. 1:st and 2:nd return times for forming pin are the times determining the start of return movement of forming pin in 2 or 3 phase flanging. 2 or 3 phase flanging is sometimes necessary to use with thin walled pipes in order to avoid collapsing of the pipe during flanging.
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 rotating motor.
9	Heating stop push-button	Abortion of heating in automatic cycle. Automatic cycle continues to finish the work cycle. It is also used to finish flame adjustment mode (see chapter 6.4.3) and to drive heating arm to side position. This is also used for getting the pressurized air main valve on. Press this always when the power of the machine has been pressed on.
10	Heating pilot lamp	Heating on pilot lamp indicates that heating is on (it also indicates flame adjustment heating).

#	Denomination	Description of the function
11	Cycle start push-button	Starts the automatic cycle. Cycle starts only when the moving carriage is in start position. Push button also starts main burner gas flow during hot forming heating cycle. Cycle start lamp is on also when machine is driven to flame adjustment position.
12	Cycle interrupt push button	Abortion of automatic work cycle Cycle stops and the carriage returns to back position and heating arm goes to side position.
13	Control switch of pipe clamp	Closes or opens the pipe clamp.
14	Control switch of carriage	Moves the carriage forward or back.
15	Control switch of the tool	Turns the tool.
16	Rotation of the drum.	Pipe clamps cannot be opened if the drum is not in correct position. When the automatic cycle stops the drum is normally positioned automatically into correct position. If not, the drum is positioned by pressing button nr 9.
17	Emergency switch (red STOP button)	Stops the machine in case of danger
18	Key-switch	To connect control of spindle motor brake release push button (see detailed information below)
19	Brake release push button	When emergency switch is pushed and the key switch (19) is in position 2, with pressing this push-button the spindle motor brake is released and the slide can be turned manually.
20	-	-
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

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)

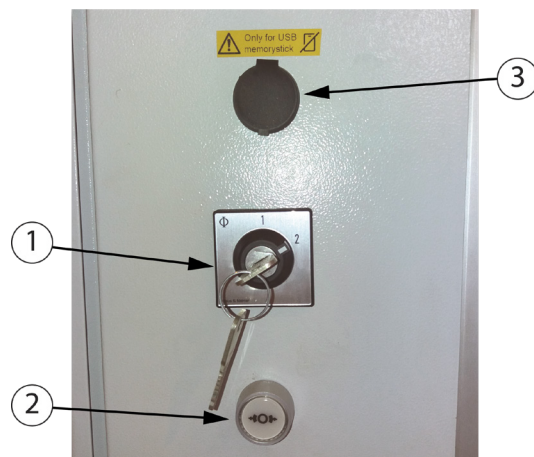
2. FORMING TYPE SELECT SWITCH	
	Cold forming.
	Hot forming.
	Flame adjustment.

**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.

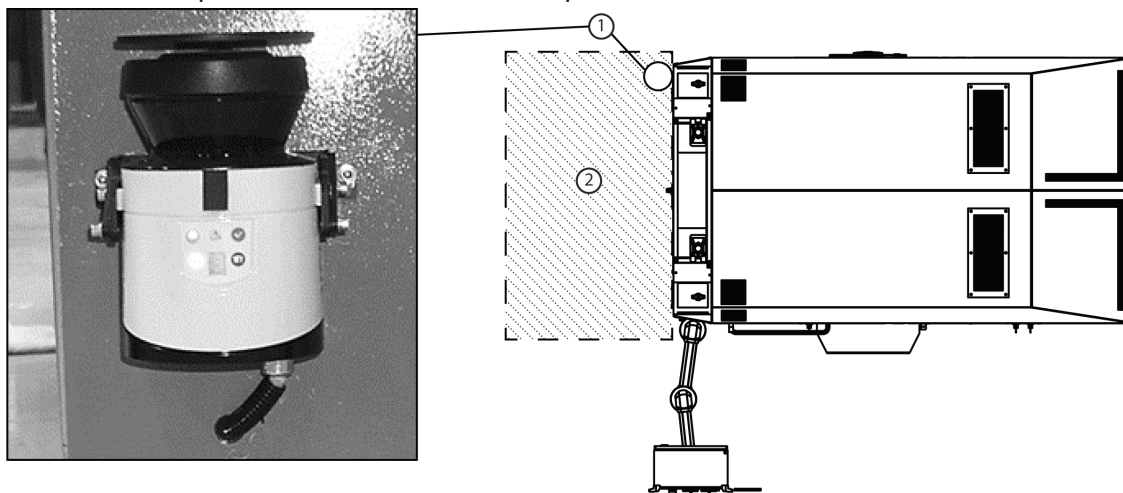
Green = Flanging in progress

White = Process is completed

Red = Machine has a problem

### 6.1.5 SAFETY AREA SCANNER (OPTIONAL)

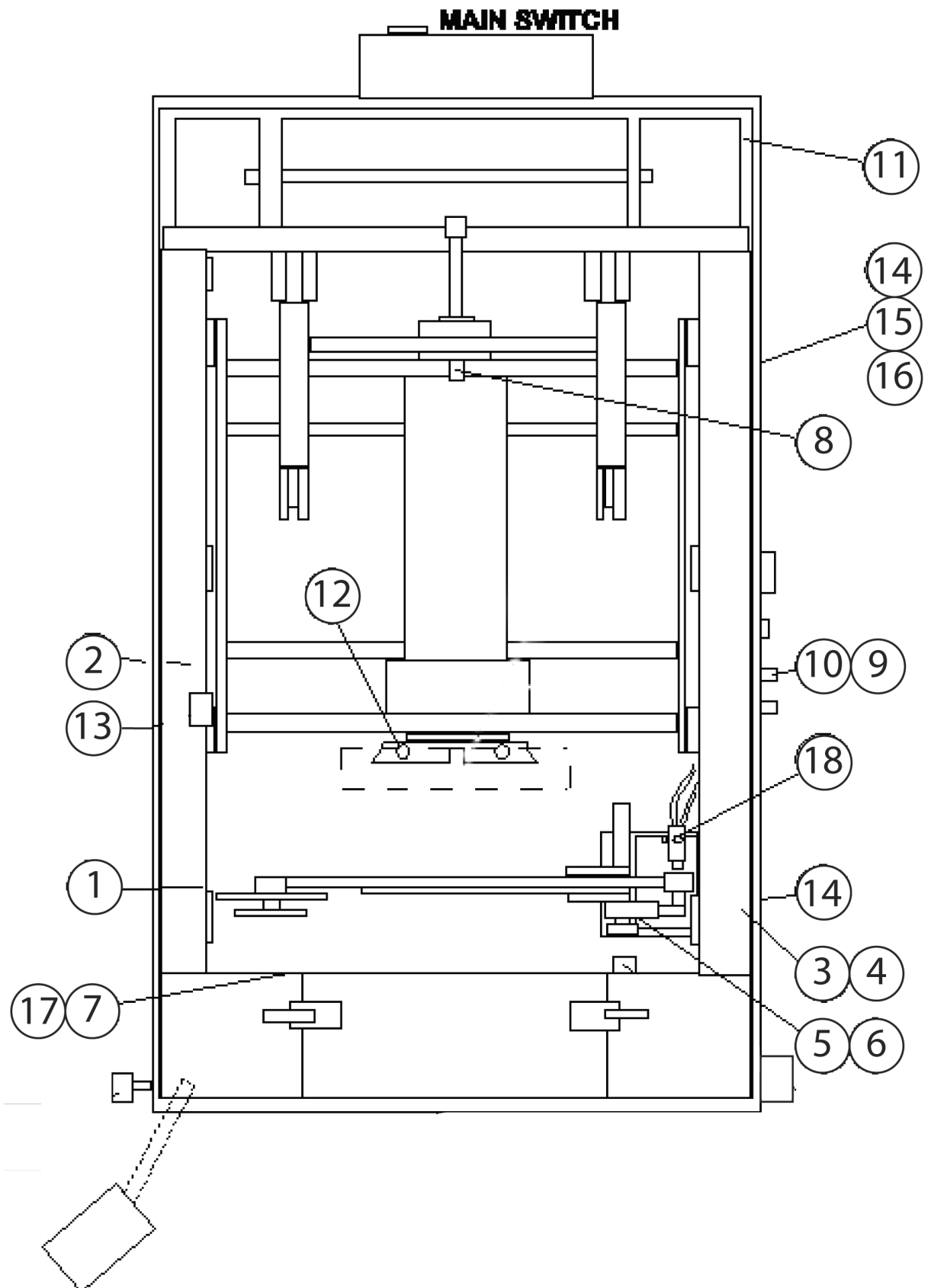
Machine is equipped with safety laser scanner. Scanner will stop the machine if there is something/someone on the area it scans. The scanner safety area can be set from the scanner as required. Scanner is reset with push button 21.



1. Safety Area Scanner, 2. Safety area



## 6.1.6 CONTROL ELEMENTS



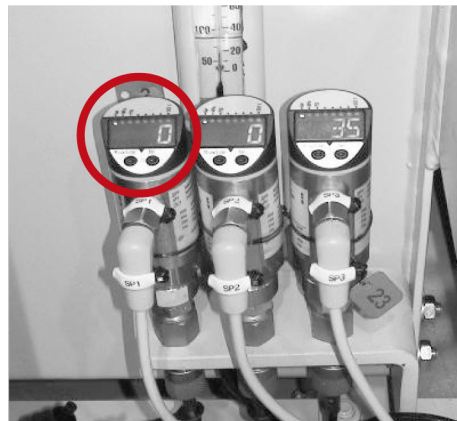
### Description of the elements

No.	Name	Function
1	Buffer plates	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 $S < N < S + 2$ S = wall thickness - For hot flanging $S + 2 < N < 2S$ N = thickness of the buffer plate Pipes $\varnothing 33,7 \leq D < \varnothing 42,4$ use special forming pin and use 4mm thinner buffer plate, see chapter 3.6.
2	Potentiometer	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.
3 4 5 6	Limit switches (OPTIONAL) * Optional heating system parts	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).
7	Limit switch S37	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.
8	Proximity switch B6	Indicates that the spindle is in correct position.
9	Throttle valves of oxygen and propane of main burner. (OPTIONAL) * Optional heating system parts	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.
10	Gas heating parts. (OPTIONAL) * Optional heating system parts	See separate part list, assembly drawing and leaflets.
11	Hood limit switch	The hood in front of the machine is equipped with a limit switch.
12	Adjusting screw	Adjusting screw to regulating the position of the slide according to the pipe size. Three nuts on the right side of the slide are for locking the setting. See chapter 6.7.

No.	Name	Function
13		Frequency converter
14	Pressure switches (Behind service cover) * Optional heating system parts	Pressure switches control automatic operation and in some cases limit the effect of the hydraulic cylinders. Pressure switches control automatic operation and in some cases limit the effect of the hydraulic cylinders. 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. SP2 indicates that forming pin is in start position. Pressure switch is set just below the main pressure (155 bar). SP3 regulates the working pressure of the forming pin. Pressure switch is set just below the main pressure (155 bar).



*Clamp pressure regulator*



*Clamp closed pressure switch (SP1)*

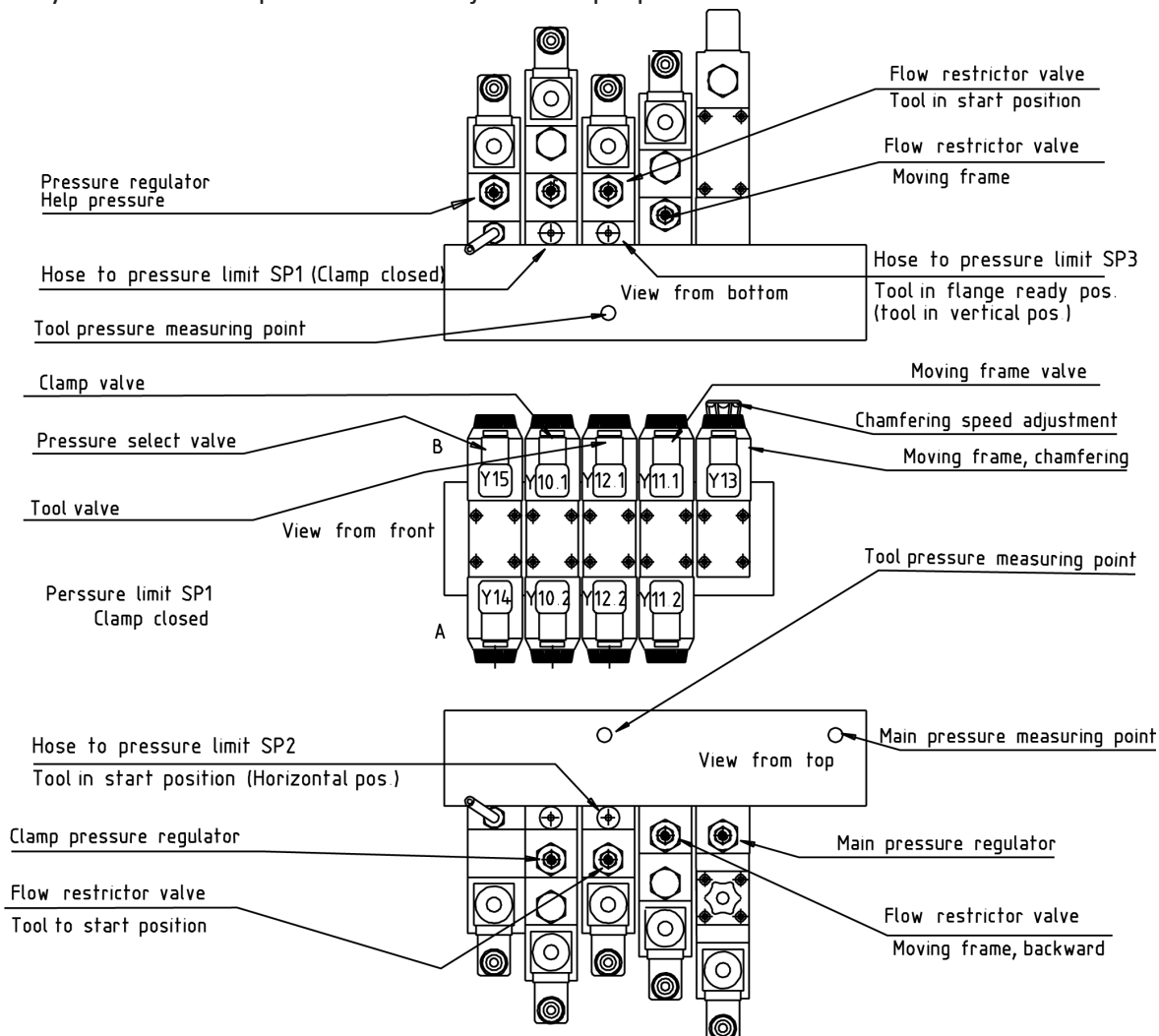
If you change the clamp pressure set the pressure switch SP1 about 10 bars below the clamp pressure. See attached hydraulic documents and pressure sensor operating instructions for further instructions.

15	Throttle valves of hydraulic cylinders (marked according to hydraulic diagram). (behind service cover)	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). Flow restrictor valve (tool to start position) for forming pin return movement speed. 4 sec. Flow restrictor valve (Chamfering speed adjustment, (optional)) for creeping speed of moving frame forward movement. 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.
----	--	--

No.	Name	Function
16	Main pressure regulator (behind service cover) * Optional heating system parts	Setting pressure 160 bar Help pressure- setting pressure 80 bars.
17	Limit switch	Clamp open limit switch (S38)
18	Limit switch of safety cover	Indicates that the safety cover is closed. Machine won't start if the safety cover is open.

### 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.



*Valve arrangement board.*

**Speed of clamping jaw movement:**

Closing movement: 9–10 mm/s

Opening movement: 25–30 mm/s

**Speed of carriage movement:**

Backwards: 28–33 mm/s

Forward: 15–20 mm/s



**Speeds of tool movements:**

Flanging movement: 15–19 s

Return movement: normally 4 s

**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 carriage to the stop of the regulating rod 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  push-button.
4. Open and close the clamping jaws by turning the  cam switch.
5. Adjust the pressure of the jaws to the desired value (look at the manometer) by operating the pressure regulator of the jaws.

### 6.2 STOPPING THE MACHINE

#### 6.2.1 THE NORMAL STOPPING OF THE F-400 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.

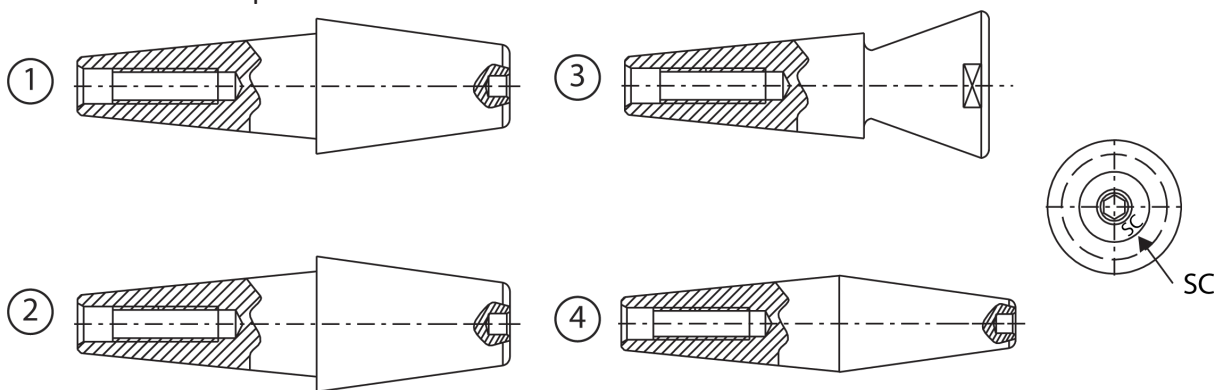
#### 6.2.2 THE EMERGENCY STOPPING OF THE F-400 MACHINE

In case of danger, stop the machine by pressing the emergency stop button (the red STOP-push-button) completely down. This interrupts immediately all functions of the F-400.

### 6.3 THE MACHINE SETTING

#### 6.3.1 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" in the end of the pin.



Forming pins: 1. Standard mild steel pin, 2. "SC" marked for stainless steel, 3. Expansion pin. 4. Forming pin for small pipes ( $\varnothing 33,7 - 42,4$ )







**ⓘ DANGER! When changing the forming pin note to adjust the correct flanging radius. (See flange standard tables).**

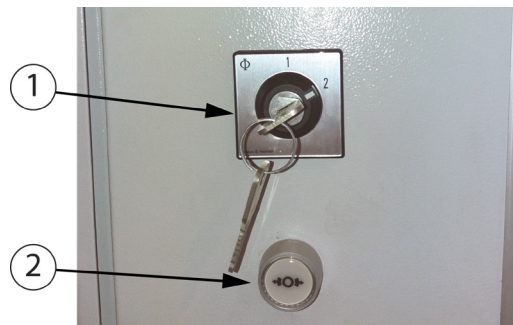
#### Range of use of the F-400 forming pins

F-200 forming pin	Pipe $\varnothing < \varnothing 42,4$
F-400 forming pin	Pipe $\varnothing \geq \varnothing 42,4$

## 6.3.2 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 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.

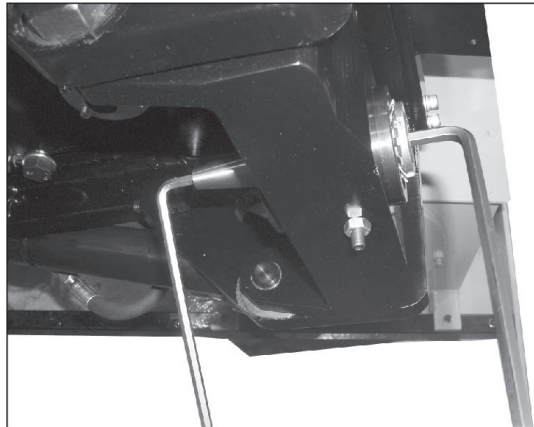
7. Open the hood.

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

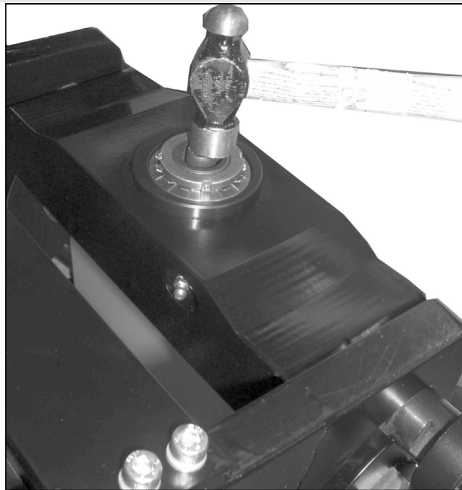
**➡ NOTE!** Be careful when turning the forming device, because it has the tendency to turn backwards, due to its eccentric mass.

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 AUTO position "1".



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.

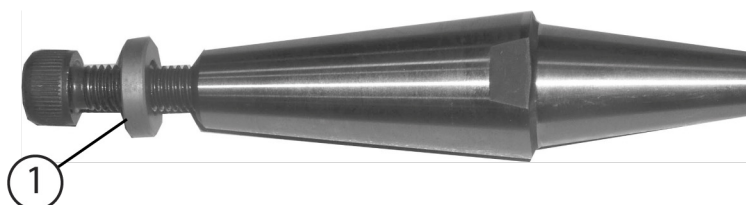


12. If the forming pin does not easily come out of its housing, knock on the hexagon socket screw head with a hammer (the hexagon socket screw has not been removed completely, but is screwed sufficiently inside).

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

**ⓘ DANGER! When changing the forming pin note to adjust the correct flanging radius. (See flange standard tables).**

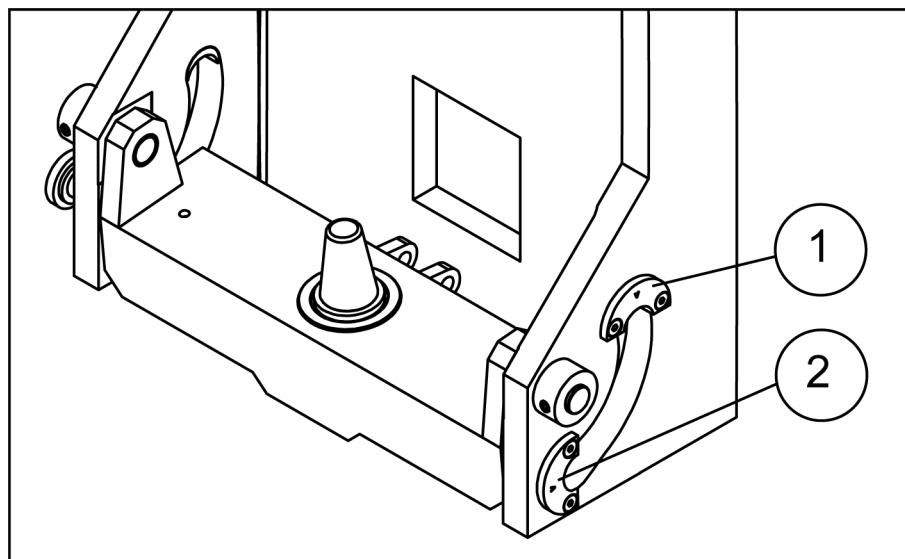


### 6.3.3 ADJUSTMENT OF THE ANGLE OF THE FORMING PIN

The start and end positions of the forming pin are adjusted by changing the stopper of the forming device. There are 11 different stoppers available. The stopper affects to the angle of the flange. Check the table below.

#### Stoppers



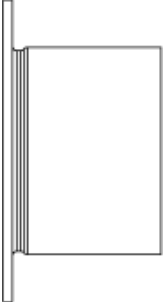
Order number	Stopper thickness ~ (mm)
6402347	3.5
6402348	4.0
6402349	4.5
6402350	5.0
6402351	5.5
6402352	6.0
6402353	6.5
6402354	7.0
6402355	7.5
6402426	8.0
6402427	8.5



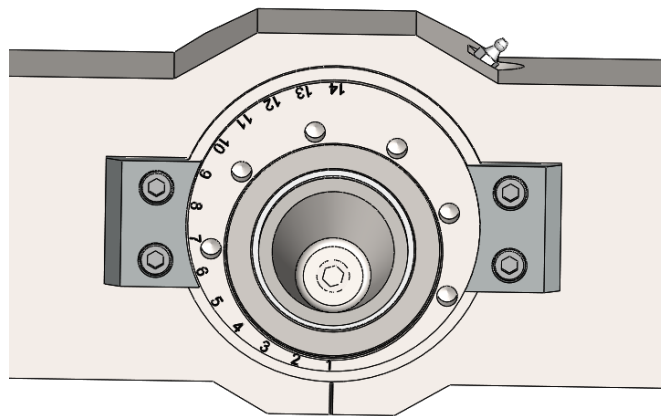
1. Starting position stopper, 2. End position stopper

Stoppers are attached to the forming device with two fixing screws. When changing the stoppers, remember to change on both sides of the forming device. Normally the starting position stopper does not have to be changed.

### 6.3.4 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 6.1.6 Control elements)</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>	

## 6.3.5 ADJUSTMENT OF THE FORMING PIN RADIUS



*Bending radius adjustment scale*

**Radius readings 1 - 7 are used with the small forming pin (F-200 forming pin)**

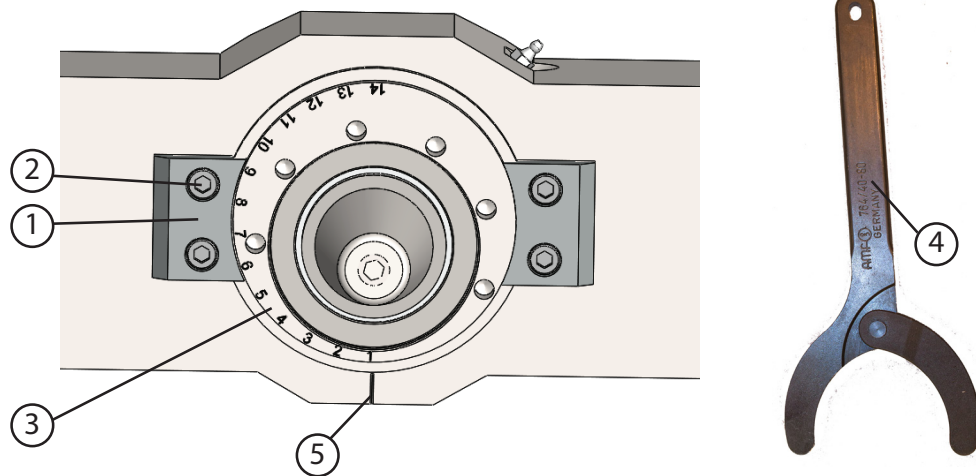
**ⓘ Never use the radius readings 1 - 6 with large forming pin! (F-400 pin).  
The forming pin will crash into the clamp!**

F-400 theoretical bending radius:

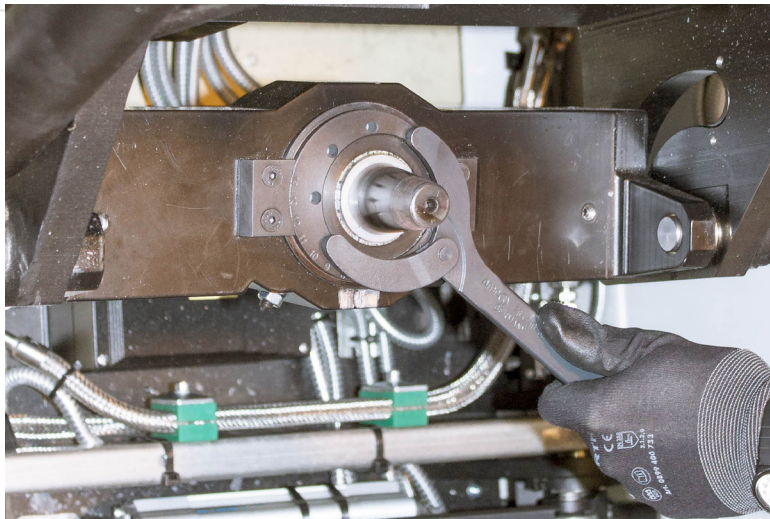
Adjusting reading, Eccentric sleeve	Internal bending radius F-200 Forming pin	Internal bending radius F-400 Forming pin
1	1,2	DO NOT USE
2	2,4	DO NOT USE
3	3,6	DO NOT USE
4	4,8	DO NOT USE
5	6	DO NOT USE
6	7,3	DO NOT USE
7	8,5	2,5
8		3,8
9		5
10		6,2
11		7,5
12		8,7
13		10
14		11,2

**ⓘ DANGER! When changing the forming pin note to adjust the correct flanging radius. (See flange standard tables).**

### HOW TO ADJUST:



1. Fastening piece, 2. Locking screw M6, 3. Radius reading, 4. Forming pin tool, 5. Setting point



1. Loose the locking screws (4 pcs socket head screw M6) to release fastening pieces (1). Do not remove the screws and pieces.
  2. Turn forming pin to required radius with forming pin tool (4).
  3. Tighten locking screws with care.
- See flange standard tables for correct flanging radius.

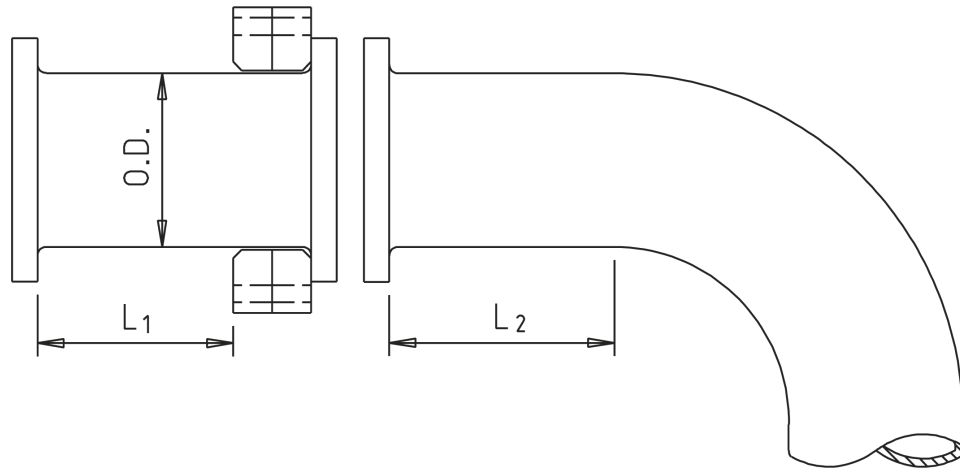
**➔ NOTE! Check the R-setting by driving the machine on manual control before starting the automatic work cycle!**

## FLANGING MACHINE

### 6.3.6 THE FASTENING OF THE PIPE

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

#### Fastening measures of the pipe



Pipe O.D.		L1		L2	
mm	N.S. Inch	mm	inch	mm	inch
42.4	1 1/4	125	4.92	260	10.24
48.3	1 1/2	125	4.92	260	10.24
60.3	2	125	4.92	260	10.24
73.0	2 1/2	125	4.92	260	10.24
88.9	3	125	4.92	260	10.24
114.3	4	125	4.92	260	10.24
139.7	5	260	10.24	260	10.24
168.3	6	260	10.24	260	10.24
219.1	8	260	10.24	260	10.24
273.0	10	260	10.24	260	10.24
323.9	12	260	10.24	260	10.24
355.6	14	260	10.24	260	10.24
406.4	16	260	10.24	260	10.24

1. Before switching the flanging machine on, the work supervising personnel and the employees shall carefully acquaint them with the manual, the structure of the machine and it's functioning. Memorise the location of each operating switch and the function the switch regulates.

**Make sure that:**

- There are no unauthorised persons in vicinity of the machine.
- All service doors and safety guards are in place.
- Gas throttle and closing valves are closed (only in hot version).
- Cams are in correct position for flanging.
- Make sure that the forming pin is suitable for the work.

2. Start the hydraulic motor (the hydraulic pump begins to run) with button 7 and press heating stop push button 9 to energize the air valve (latter only in hot version).

3. Set the switches to point the desired work cycle.

For example cold flanging




Normal flanging.



Cold forming. (If you have heating unit)








1 phase flanging.

4. To pressurize the hydraulic system close the clamp with switch 13 . Make sure that the clamp jaw can move freely (i.e. no foreign obstacles are between jaws.)


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

**ⓘ DANGER! Do not loosen the upper clamps tightening screw when clamps are open. The clamp might fall down and crush your fingers!**

5. Drive the moving carriage to back position. with switches 13  and 14  . Note that the switches have to be used simultaneously.

6. Turn the forming pin (tool head) to the starting position. Switches 13  and 15  simultaneously.

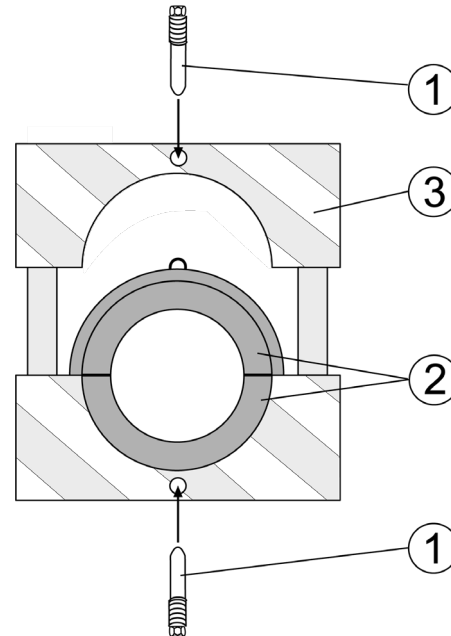
7. Slide must be in position where the adjustment screws are in upper (abtrubtly 120°) sector. If not, rotate spindle to correct position. (Press the drum rotation push button briefly until drum is positioned to limit)

8. Open the clamping jaw. Switch 13 

9. Stop the motor by pressing power off -button. Button 8 

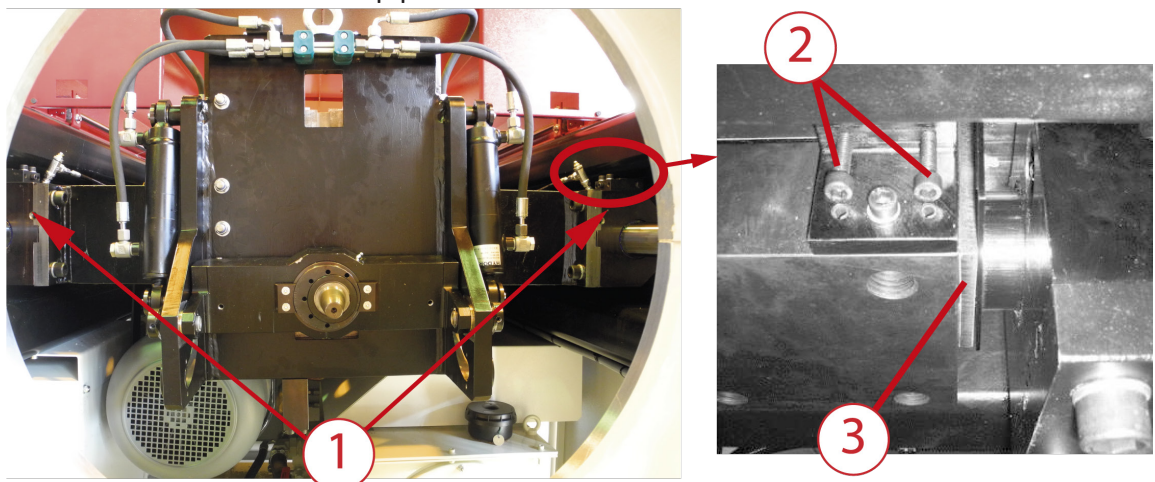
10. Select the proper clamps. With clamp size 139.7 mm and smaller, the clamp adapters has to be used. The adapters are installed same way as clamps, and the small clamps are installed to adapters.

Lift the pipe clamps into clamping jaws, use gloves to protect your hands. If you are using clamps bigger than  $\varnothing 219.1$ , you must use clamp lifting tool for easier changing (for normal clamps only), for instructions see separate manual for clamp lifting tool.



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

11. Replace the buffer plates according to the wall thickness. The plates are located on the guide bars. Open lock screw and pull the pin out together with back-up plates. Insert correct thickness of back-up plates and lock with screw.



*Change of the buffer plates. 1. Buffer plate location, 2. Lock screw, 3. Buffer plate*


The thickness (N) of the plate chosen:

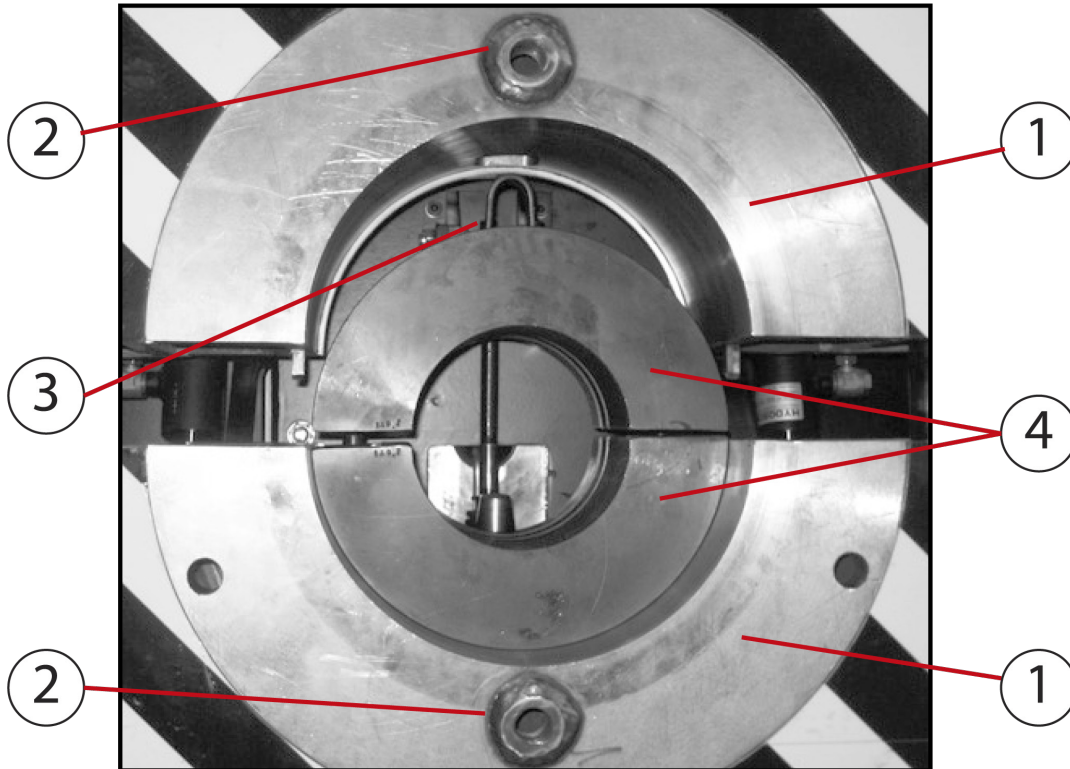
- For cold flanging  $S < N < S+2$      $S$  = wall thickness
- For hot flanging  $S + 2 < N \leq 2S$      $N$  = thickness of the back-up plate

See also control elements from chapter 6.1, buffer plates are delivered with the machine.

Spare number for buffer plate set: 4401438

12. Power on (hydraulic motor on).

13. Close the clamping jaw carefully (switch 13  ). Beware that the jaw does not cut in to the clamping tool or its fixing extensions. Fixing pins should be removed before that. Keep the fingers (hands) away from the moving jaws.



*Fixing pins removed. 1. Adapters, 2. Fixing pin holes, 3. Fixing extension of the clamp, 4. Clamps. **Note that in picture the clamp adapter is in use.***

14. Insert and tighten the fixing pins of the pipe clamp (upper and lower).

*Fixing the locking pins. Pre-tighten with hands and finally tighten with wrench*

15. Clamp the pipe to be flanged in the jaws so that approximately 30 mm (1.2 ") of the pipe stays out of clamp.

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



### 6.3.7 SETTING THE LENGTH OF THE PART OF THE PIPE TO BE FLANGED

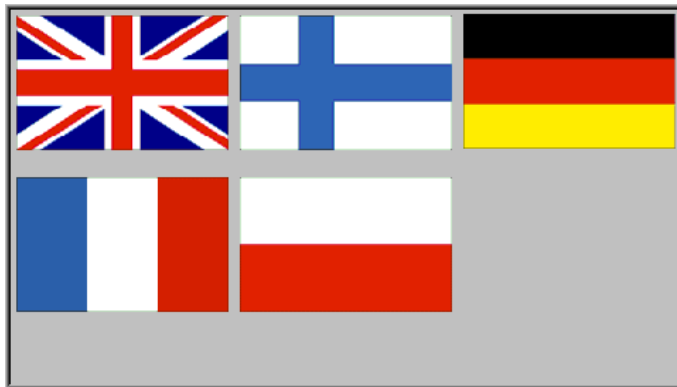
F-400 flanging machine is equipped with potentiometer and display. (picture below). Display unit is located on the top of the control panel. With the display you can adjust length of the part of the pipe which is to be flanged, the rearmost and the front most position of the frame.



*Display unit for the programming*

### 6.4 INSTRUCTIONS FOR THE USE OF THE DISPLAY

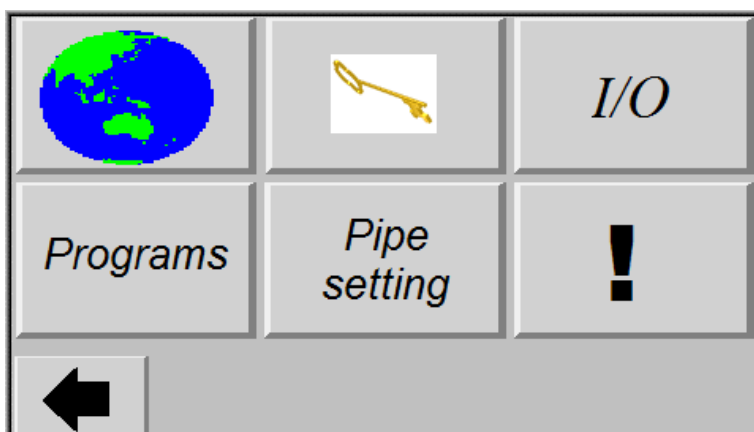
Turn on the main power of the machine. The language selection screen appears.



Language selection screen




Select language. Now the menu- screen is shown.

#### 6.4.1 MENU-SCREEN



Menu- screen

##### Description of the buttons:

	Move to: Language selection screen		Move to: User level selection screen (6.4.1.1)	<i>I/O</i>	Move to: Input / Output screen (6.4.1.4)
<i>Programs</i>	Move to: Programming screen (6.4.1.2)	<i>Pipe setting</i>	Move to: Pipe setting screen (6.4.1.3)	!	Move to: Alarms-screen (6.4.1.5)
	Back to MAIN screen (6.4.1.6)				

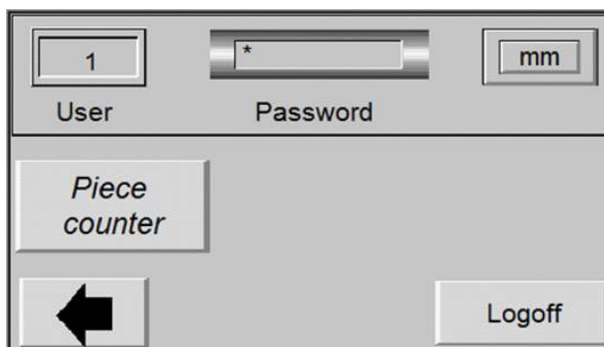
## 6.4.1.1 USER LEVEL SELECTION - SCREEN



In this screen you can select the user level. These levels contain different rights for programming. Levels need a password except the basic level. You can insert the password by touching the password- field.

**There are three different user levels:**

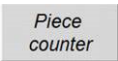
- Basic level. On basic level you can execute programs.
- User level 1 (Default password: 1). On level 1 you can compile programs, change the units mm/inch and reset the piece counter.
- User level 2 (Default password: 2). On level 2 you have same rights as on level 1 and you can also change the passwords.

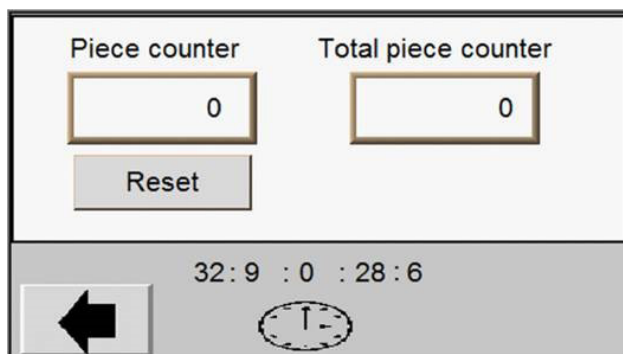


User level 1



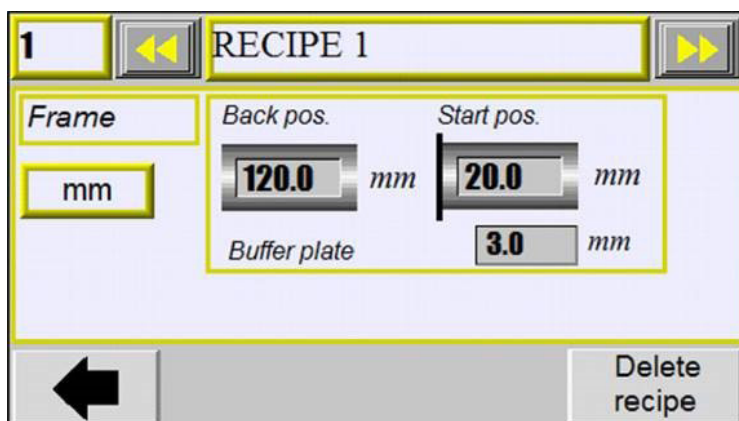
User level 2

With Piece counter  - button you can open the piece counter screen:



In this screen you can check the values of the counters and reset the piece counter. Total piece counter cannot be reset.



### 6.4.1.2 PROGRAMMING- SCREEN



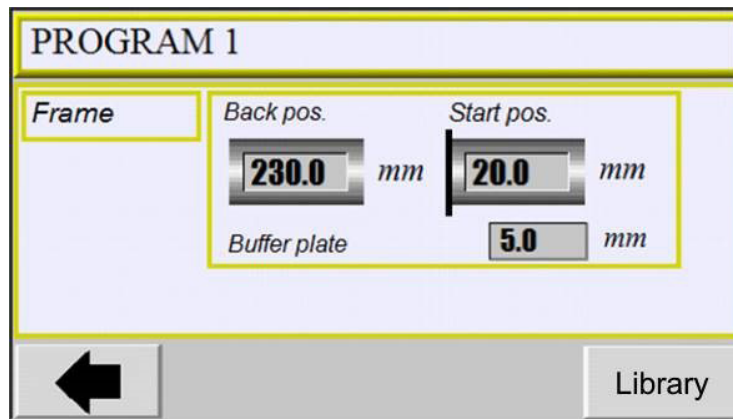
You have to be logged in at least in level 1 to edit the programs. You can save 5000 programs. You cannot execute programs in this screen.

- You can set the program name by pushing the name- field on the top of the field.
- You can 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.
- By pushing the mm/inch- field you can change the unit.
- On "Back pos."- field is shown the position where the work cycle starts. After that the frame slides to start position of the forming. You can 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 bend the pipe end. You can change the value by pushing the field. Recommended value for this is 23mm + the buffer plate thickness.
- On "Buffer plate"- field is shown the thickness of buffer plate. (See buffer plates in page 31 ) You can change the value by pushing the field.
- With "Delete recipe"  - button you can delete the current recipe.
- With arrow  - button you can return to Menu- screen.

## 6.4.1.3 PIPE SETTING- SCREEN



In this screen you select and edit the program you want to execute, but you cannot save it. Edit the values by touching the fields.

➔ **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.

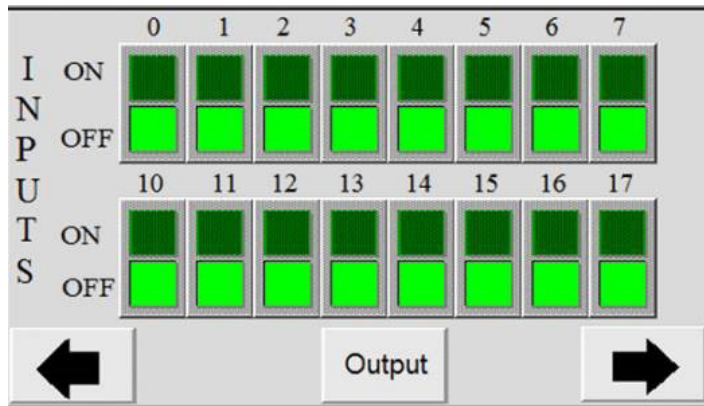
You can also open the Library- screen by pushing  - button. With arrow  - button you can return to Menu- screen.

### 6.4.1.3.1 LIBRARY- SCREEN




In the library you can 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. Activate the program by pushing “Select”  . With arrow  - button you can return to Pipe setting- screen.

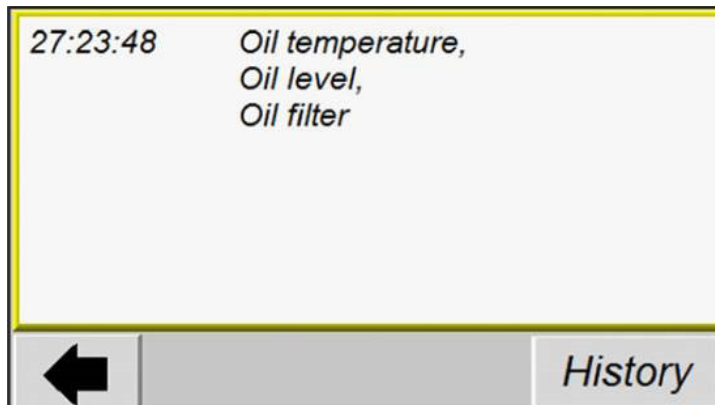
## 6.4.1.4 INPUT/OUTPUT- SCREEN




In this screen you can check the status of the inputs. When you touch the specific input, the name of the input is shown.

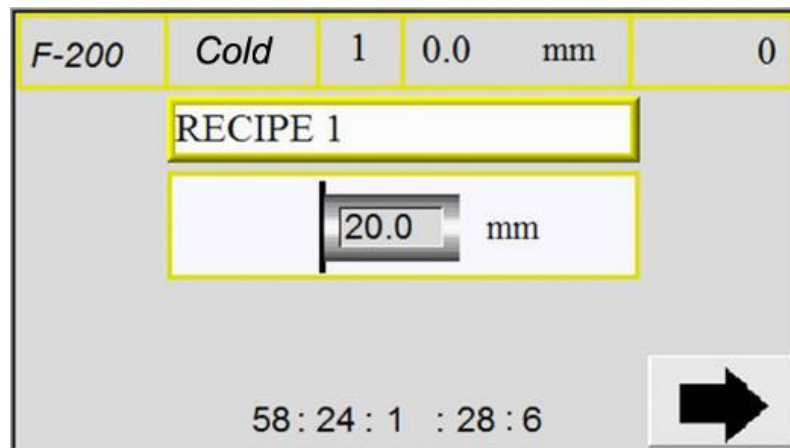
Enter the Outputs screen with “Output”  - button to check the status of the outputs the same way.


## 6.4.1.5 ALARMS - SCREEN



In the Alarm- screen is shown the cause of the alarm. With “History”  - button you can check the 200 recent alarms. The history is cleared when main power is turned off.


## 6.4.1.6 MAIN SCREEN



By pushing arrow  - button in the Menu- screen you can move to Main- screen. 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 option).
3. Forming mode:
  1. One-phase flanging, flaring, expanding and bevelling
  2. Two-phase flanging
  3. Three-phase flanging
4. Position of the frame.
5. Value of the piece counter.

The time is shown on the lower part of the screen.

With arrow  - button you can return to Menu- screen.

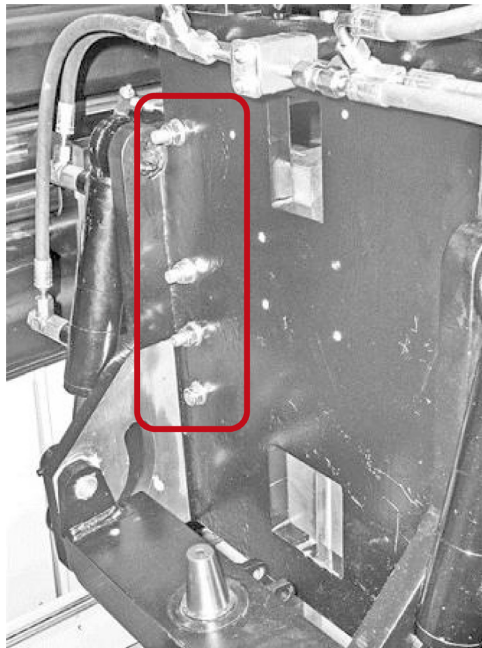
### 6.5 ADJUSTMENT OF FORMING DEVICE

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

1. Clamp the pipe.
2. Set the "Start Pos." to zero (0.0mm) on the display (See previous chapter).
3. Drive the carriage forward until the tool almost reaches the pipe end with switches 13  and 14 . Both switches have to be pressed simultaneously.
4. Press power off, open the protective hood and ensure that the forming pin can go into the pipe without collision.

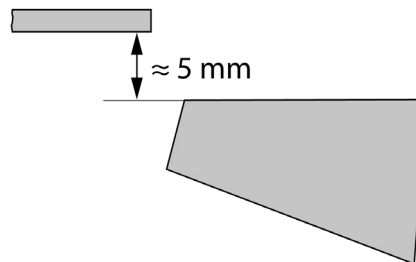
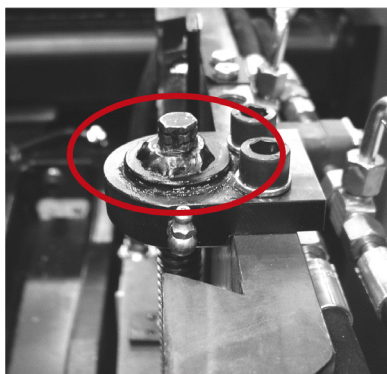
**If not, adjust the forming pin position:**

- Loosen the lock nuts (4 pcs) of slide.





*Locking nuts of the slide*

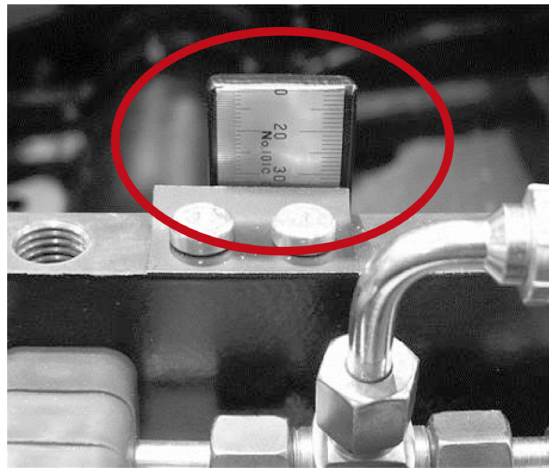
- Adjust the slide position by means of adjustment screw so that there is a clearance of abt. 5 mm between the pipe and the pin.
- After adjusting the slide position, tighten the lock nuts. (Tightening torque 70 Nm)



*Adjustment screw of the slide and the clearance between pipe wall and forming pin.*









5. Close the protective hood. Drive the carriage forward with switches 13  and 14  until the pin goes into the pipe. Press the power off. Open the hood. Adjust the slide so that the forming pin slightly touches the inner surface of the pipe. Or you can use the values of the setting value table according to the pipe size. The position of the slide can be read from the scale on it (see picture below).



#### *Scale of the slide*


In case of hot forming (option), it is recommended to leave a space of 1 mm between the inner wall and the pin.


Tighten the three locking nuts carefully (see picture on previous page.)

5. Drive the moving carriage to back position with switches 13  and 14 .
6. Open the clamps with switch  and remove the pipe.
7. Close the clamps with switch .
8. Set the length of the part of the pipe which is to be flanged "Start pos." to the program (See chapter 6.2.5). A recommended value for this setting is, that the display readings indicates 23mm + the thickness of the buffer plate used, thus N (See 6.2.4., point 11). 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.**
9. Drive the forming pin to the flanging position with switches 13  and 15 .
10. Drive the moving carriage forward until the potentiometer stops it.
11. Open the clamp and place the pipe to the clamps so that the pipe end is against the forming pin. If the pipe does not lie evenly in the clamps, knock the pipe in to the clamp with a soft hammer. Close the clamps. Be careful when closing them.
12. If you have the cold forming mode selected, the machine is ready for trial flanging.

*In cold flanging one-, two- or three-phase flanging can be used. Multi-phase flanging is used especially with small pipe dimensions and thin-walled pipes. Selection of the multi-phase forming process can be done with a flanging mode select switch.*

*Multi-phase flanging means that the forming cone does not accomplish the forming motion to the end but returns to the beginning once or twice. This return motion presses away the fold, which reduces the flow area of the pipe.*

14. Press the CYCLE START button  and machine carries out the flanging cycle.

The spindle stops automatically in correct position. If not, rotate it to correct position by pressing the drum rotation push button .

(Press the drum rotation push button briefly until drum is positioned to limit.)

**If the spindle doesn't revolve smoothly or if it stops, interrupt the work cycle immediately by pressing EMERGENCY STOP).**

Measure the flange, make necessary corrections and then enter to the setting value table.


## 6.6 COLD FLANGING AND FLARING OF THE PIPE

The work cycle of the cold flanging and flaring.

1. Choose the correct forming pin and install it..
2. Fasten the pipe.
3. Carry out the settings of the forming tool 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.

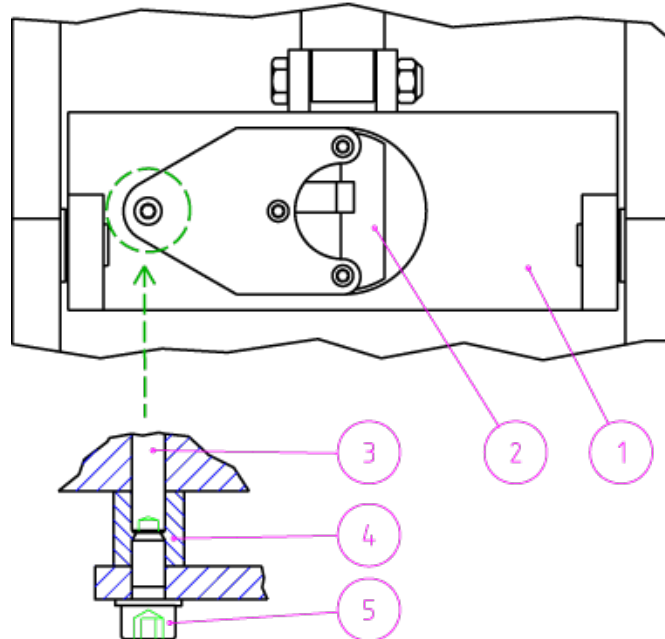
## 6.7 WORKING INSTRUCTIONS FOR BEVELLING

The outer diameter of the tube to be bevelled can be between  $\varnothing 42,4$  and  $\varnothing 325$ mm.

➔ **NOTE!** The bevel can be produced only, if the F-400 machine has been ordered with this optional accessory.

### 6.7.1 THE INSTALLATION OF THE BEVELLING TOOL

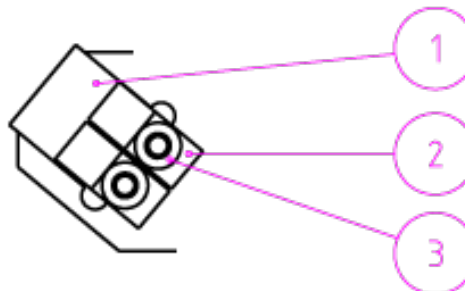
- 1 Remove the forming pin (see chapter "Changing of the forming pin", points 1-12)
2. Install the beveling tool into the chuck of the pin and tighten it carefully.
3. Change the fixing screw at the left side of the arch for a M8x25 fixing screw and tighten it properly.
4. Tighten the locking pin on the fixing screw by means of a 17mm wrench.
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*

### 6.7.2 THE ADJUSTMENT OF THE FORMING TOOL

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

1. Fasten the tube into the clamp
2. Turn the bevelling blade into starting position by turning the switch 13  and turning at the same time the control switch 15 of the tool into the position .
3. The forming tool must be in such position, where the adjusting screws are up in an approx. 120° sector. Should this not be the case, turn the spindle into the correct position by shortly pressing the drum rotation push button , until the pilot lamps lights.
4. Set the "Start Pos." to zero (0.0mm) on the display (See previous chapter).
5. Drive the carriage forward towards the tube, by turning the switch 13  at the same time turning the control switch of the carriage 14 into the  position, until the bevelling blade almost reaches the tube.
6. Stop the machine and push the protective hood backward. Check that the tube wall is in the middle of the bevelling blade. Should this not be the case, then adjust the position of the blade: loosen the locking nuts 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 tube + 10mm. For instance, if the outer diameter of the tube 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.
7. Loosen the locking lever of the regulating rod and set 30 to the scale of the regulating rod - tighten the locking lever.
8. Pull the protective hood on its place and start the machine.
9. Drive the carriage forward until the limiter of the regulating rod stops it.

### 6.7.3 THE WORK CYCLE OF THE BEVELLING OPERATION

1. Install the bevelling tool.
2. Fasten the tube into the clamp
3. Regulate the creeping speed of the forward movement of the carriage by closing the valve, and then open the valve by 1/5 of a turn.
4. Carry out the settings of the forming tool and select suitable program from display.

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

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

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

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

**➡ NOTE! The tube end may be hot after the bevelling operation.**

7. Loosen the bevelled tube, inspect the result and the quality of the operation, and make corrections if necessary

## **6.8 ADJUSTMENT AND OPERATION OF FLANGING MACHINE BASED ON SETTING VALUE TABLE**

**Set the select switches corresponding to the pipe to be flanged.**

1. Remove the previously used pipe clamp and change the pipe clamps to match the pipe to be flanged.

- Open the locking screws of the jaws in order to remove them. Open the pipe clamp. Remove the old clamp. Mount the required clamp proceeding in the reverse order. See chapter 6.3.6 The fastening of the pipe for further instructions

2. Adjust the position of the slide according to the setting value table. See chapter 6.2.6. Adjustment of forming device.

3. Adjust the flanging position (distance between the front surface of the clamp and the forming tool in its final position) replacing the buffer plate according to the table.

4. Set back and start position values, buffer plate thickness to pipe settings screen. See chapter 6.4.1.3 Pipe setting- screen

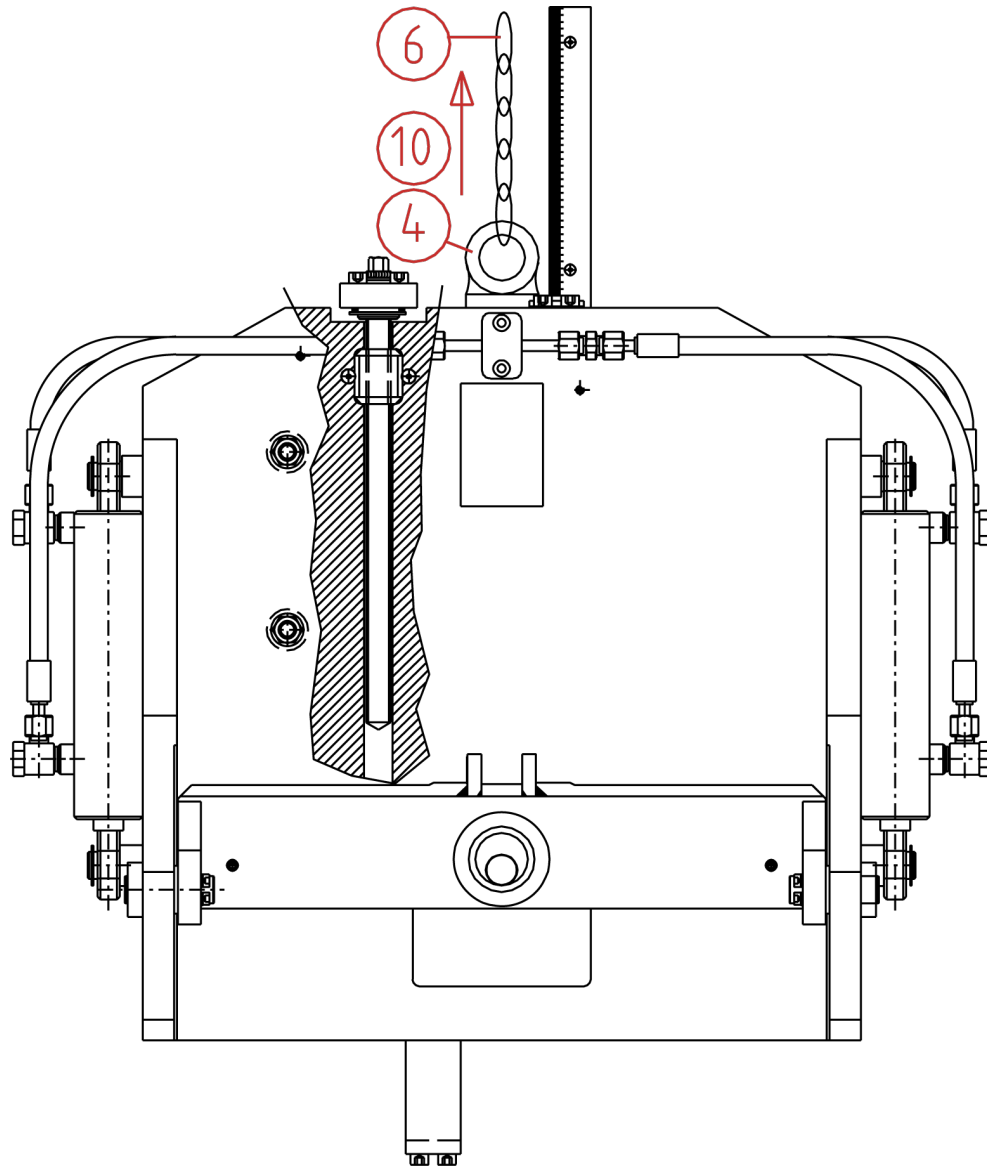
5. Change the heating burner (In hot version). Be careful when handling them.


6. Adjust the throttles according to the trial heat. Adjust the feed pressures of the gas network according to the setting value table. Open the gas feed valves (In hot version).

7. Make sure that the forming pin is proper for the tube and that it is in the flanging position. Drive the moving carriage to the limit of adjustment cam.

8. 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.

## 7. CHANGING OF THE FORMING SLIDE

*Flanging slide changing instruction*

1. Drive the moving carriage backwards until slide is close to the top cover line.
2. Turn the flanging pin to start position.
3. Press the emergency stop and open the hood.
4. Install the lifting eyelet to slide. (Picture)
5. Remove hydraulic lines from spindle at large hex nut. Make sure the connectors opened in the right place. Keep the quick connectors male part steady with the wrench.
6. Support the slide with a crane but do not lift it. (Picture)
7. Loosen the three locking nuts of slide.
8. Turn the key switch to position '2'
9. Press brake release push button .

➔ **NOTE! Do not enter the rotating area of the slide. The slide may rotate due to eccentric mass.**

10. Lift the slide upwards by rotating the adjustment screw counter clockwise. Simultaneously keep the crane lifting so that the lifting chain does not get loose. However, do not try to lift slide with crane until adjustment screw gets loose. When the screw is loose, lift slide carefully upwards until you can move it aside. (Picture)

11. Installing of flanging slide in reverse order:

➔ **NOTE! When the slide is installed release “Brake release” push button and turn key switch to ‘1’ position.**

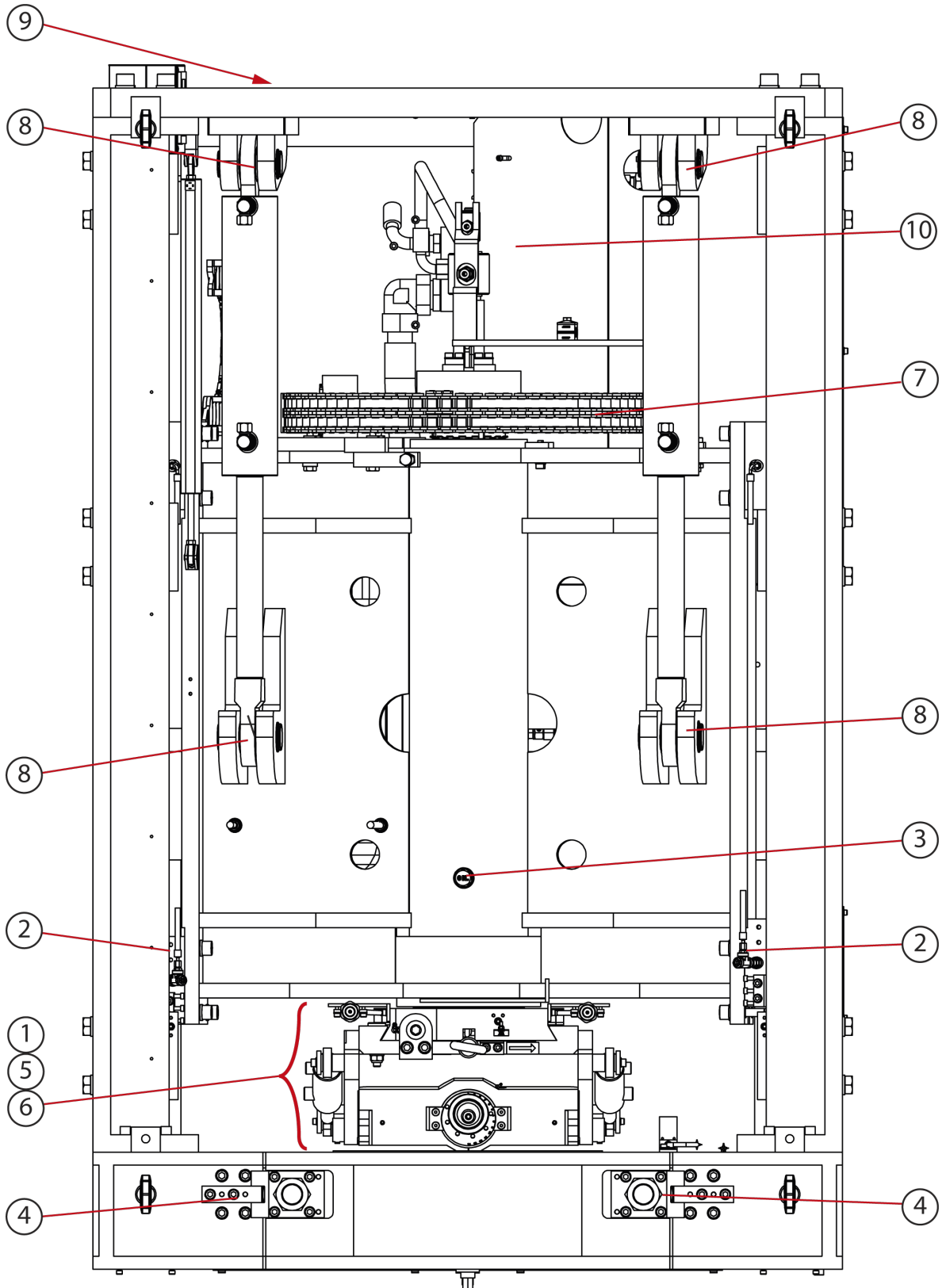
12. Install hoses to the slide and tighten securely with a wrench.

During tightening, operator must see to it that the quick connectors male part does not get loose. Keep it steady with another wrench.

13. Remove the lifting eyelet.



## 8. MAINTENANCE

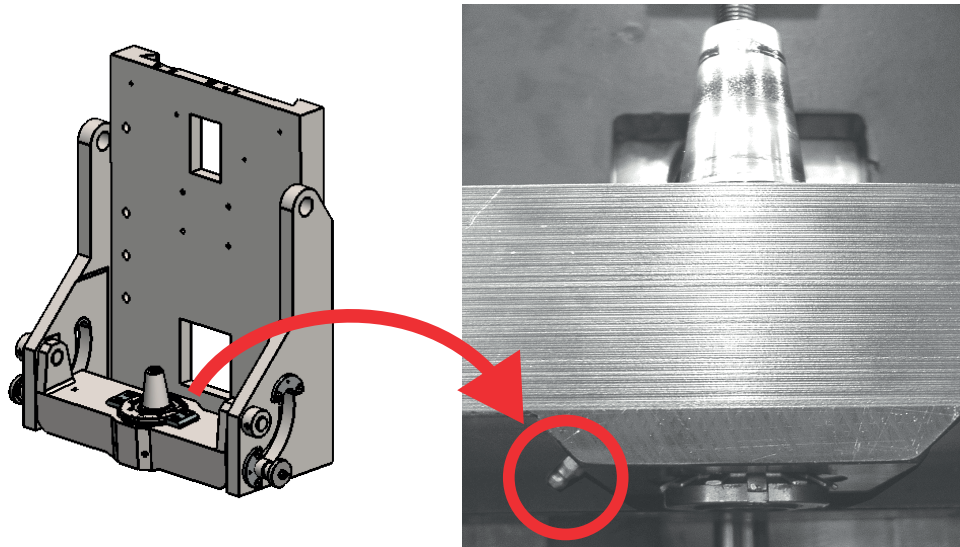


*Maintenance points, F-400 cold flanging machine*

See following pages for details.

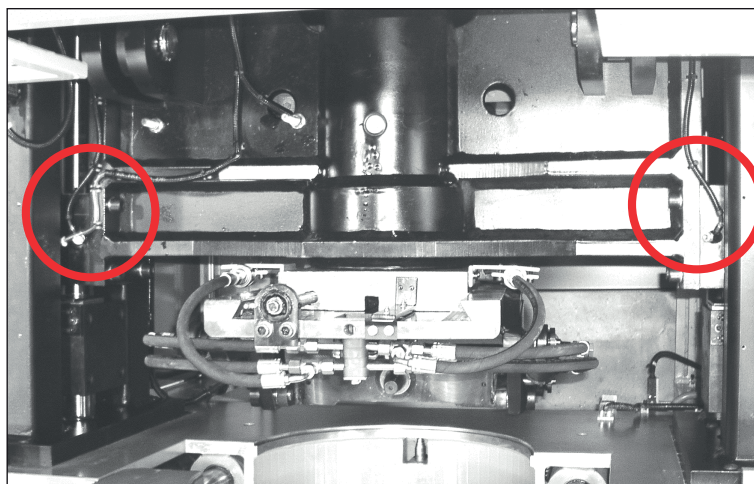
### 8.1 LUBRICATION

#### DAILY LUBRICATION MAINTENANCE:



#### 1. Bearings of the flanging pin and or expanding pin.

- Grease nipple behind swinging frame
- Lubricant: DIN 51825 KP 2K or NLGI 2, EP-grease, lithium complex, 40°C 190cSt, 20...+120°C. E.g. Shell Gadus S2 V220 2 or equivalent.



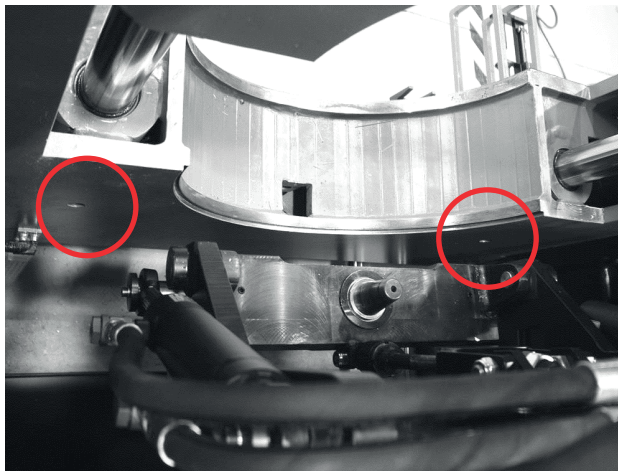
#### 2. Carriage guideways

- Clean with clean cotton cloth and apply grease through the grease nipples in bearing housings.
- Lubricant: NLGI 1,5 , EP-grease, lithium complex, viscosity 40°C 550cSt, -20°...+150°C. E.g. Shell Gadus S3 V550L 1 or equivalent.

## 10. Hydraulic System

Daily checks: Oil level, oil temperature, filter condition indicator, replacement of filter inserts when necessary, checking components and pipework for leaks and repairing when necessary, operating noise, visual inspection of hoses (abrasions, cracking, etc.), surface temperatures of actuators and components using a surface thermometer (max. temperature 65oC).

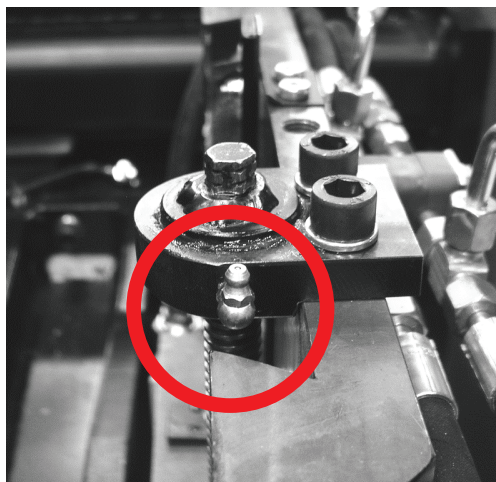
**See separate instructions of the hydraulic unit, delivered on a memory stick with machine.**



## 4. Clamp guideways

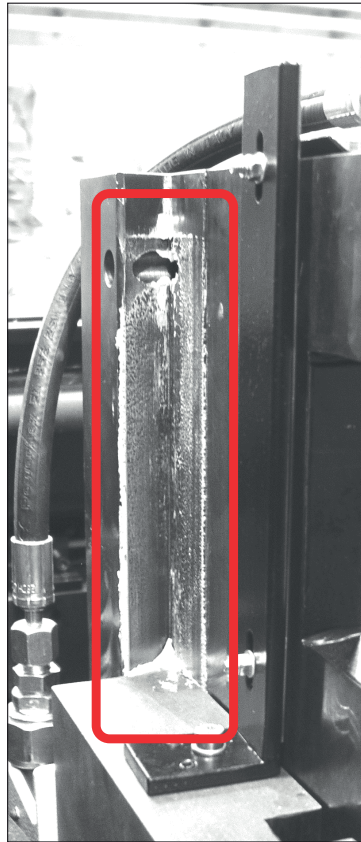
- Clean with clean cotton cloth and apply grease through the grease nipples in bearing housings.
- Lubricant: NLGI 1,5 , EP-grease, lithium complex, viscosity 40°C 550cSt, -20°...+150°C. E.g. Gadus S3 V550L 1 or equivalent.

## WEEKLY LUBRICATION MAINTENANCE:



## 5. Adjuster screw of the slide

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



## 6. The slide

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



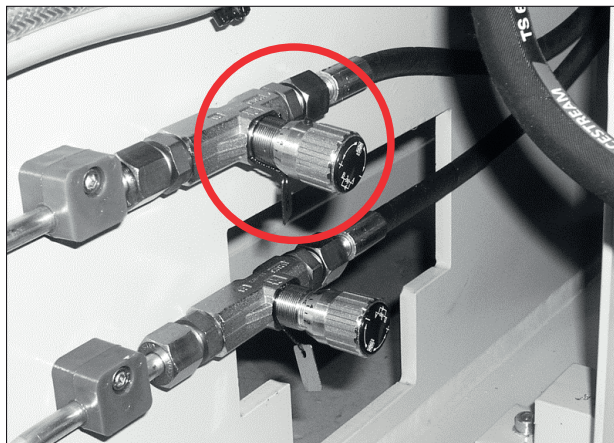
## 7. Chain transmission

- Lubricate with oil can, lubricant: chain oil

## MONTHLY MAINTENANCE:

### 8. Moving carriage and slide cylinder rod ends

- Lubricant: DIN 51825 KP 2K or NLGI 2, EP-grease, lithium complex, 40°C 190cSt, -20... +120°C. E.g. Shell Gadus S2 V220 2 or equivalent.

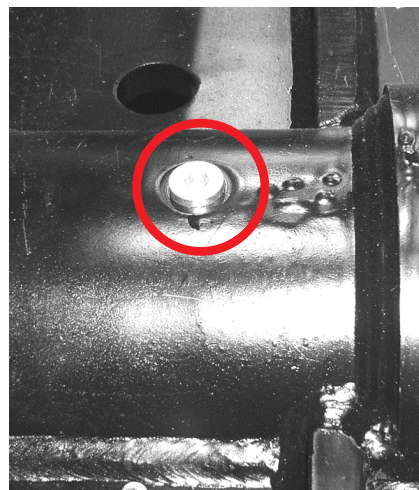


### 9. Speed of the clamping jaw closing movement

Check the speed adjustment monthly, or at least after the hydraulic system maintenance. The valves are preset at the factory. 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. Valve is located on the rear end of the machine.

**See separate instructions for maintenance of gear motor of spindle and hydraulic unit.**

## EVERY 6 MONTHS



### 3. Bearings of the spindle

- Change the oil once every two months. Remove the oil through the draining hole which is under the spindle. Fill the new oil through the filling hole (shown in the picture)

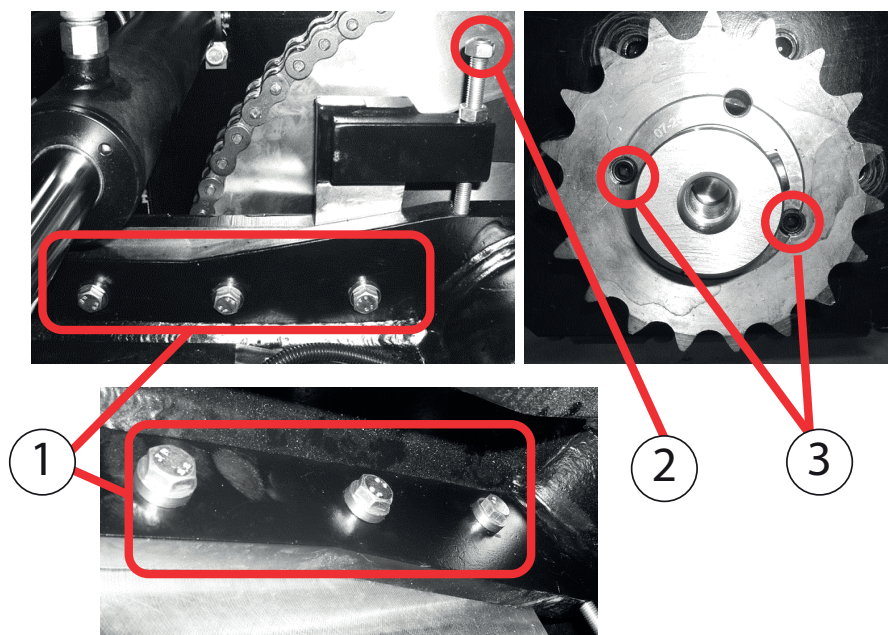
- Lubricant: ISO VG 100, DIN 51517 part 3-CLP or ISO 12925-1 type CKC or AGMA 250.04. E.g. Shell Omala Oil 100 or equivalent.

Volume of oil 0,9 L.

### 8.2 REGULAR WEEKLY INSPECTION

#### 8.2.1 INSPECTIONS OF SPINDLE CHAIN TIGHTNESS

The tightness of the chain should be adjusted so that the sag is 7...12 mm, i.e. when the centre point of the free part of the chain is made to swing, the length of the movement is approx. 14...24 mm. If the chain needs to be tightened, loosen the retaining screws (1) (6 pcs) of the motor base from the top and the bottom of the spindle frame and set the chain to the required tightness with the adjuster screw (2). Now tighten the retaining screws (1) of the base carefully. Before inspection, the chain should be oiled (lubricant: chain oil). At this stage, the chain wheel retaining screws (3) should also be checked.



#### 8.2.2 FASTENINGS OF MOVING CARRIAGE CYLINDERS AND PISTON SHAFTS

Tighten retaining screws of eyelet.

#### 8.2.3 FASTENING OF FLANGING TOOL

Check that bearings of flanging tool are not worn. The tool should, however, rotate easily by hand. A radial play of up to 0,2 mm and an axial play of up to 0,4 mm are permissible. Check the condition of bearings. If needed, change the bearings.

#### 8.2.4 SETTING OF LIMIT SWITCH

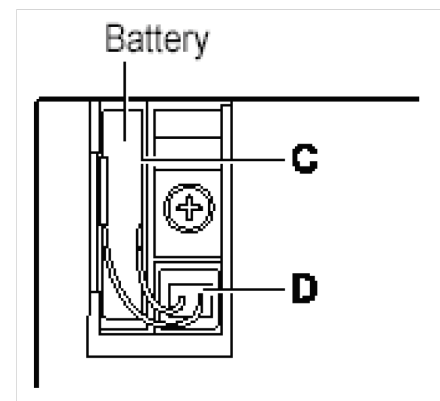
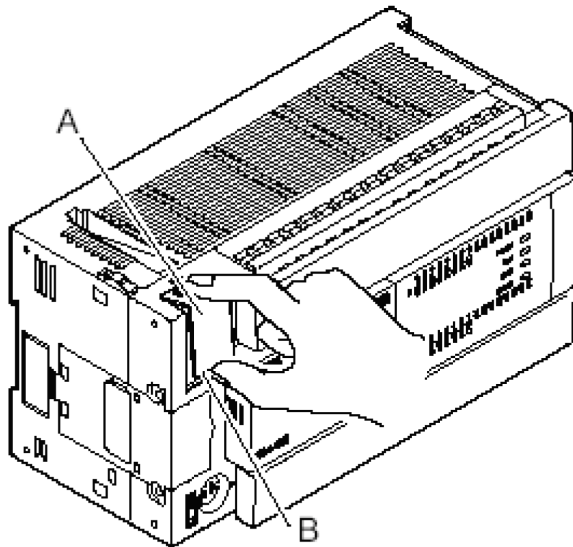
Check also that the safety limit of the hood is functioning. The machine must not run when the lid is open.

### 8.3 PLC-BATTERY MAINTENANCE

Nominal voltage of the battery is 3V (battery type: FX3U-32BL). Battery of the PLC should be changed after 4-5 years of use.

1. Turn of the power.
2. Remove the battery cover:

Slightly lift the "B" side of the battery cover ("A"). Grasp the cover ("A") between your fingers and remove it.



3. Remove the old battery

Extract the old battery from the battery holder ("C"), and disconnect the battery connector ("D").

4. Install the new battery

Connect the battery connector ("D") to the new battery, and insert the battery into the battery holder ("C").

➡ **NOTE!** The connector of the new battery should be attached within 20 seconds after removing the connector of the old battery.

5. Refit top cover.

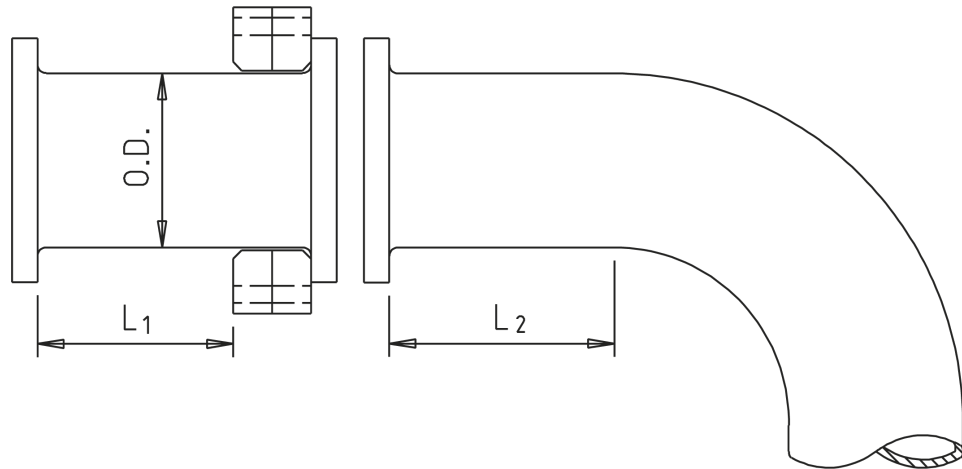
## **9. ELECTRICAL EQUIPMENT**

### **9.1 FUNCTIONING**

1. Power is supplied through the connection box located in the back of the machine. In the connection box there is the main switch Q1 and the transformer for control supply.
2. Protection against short-circuiting is provided by means of the fuses and the protecting elements in the connection box.
3. Electric motors have a contactor and an overloading relay (thermal relay).
4. The control circuit receives power from the transformer. The transformer produces direct current of 24 V.
5. The automatic flanging cycles are made possible by using the programmable controller. The controller is powered by 220 -240 vac.



## 10. APPENDIX

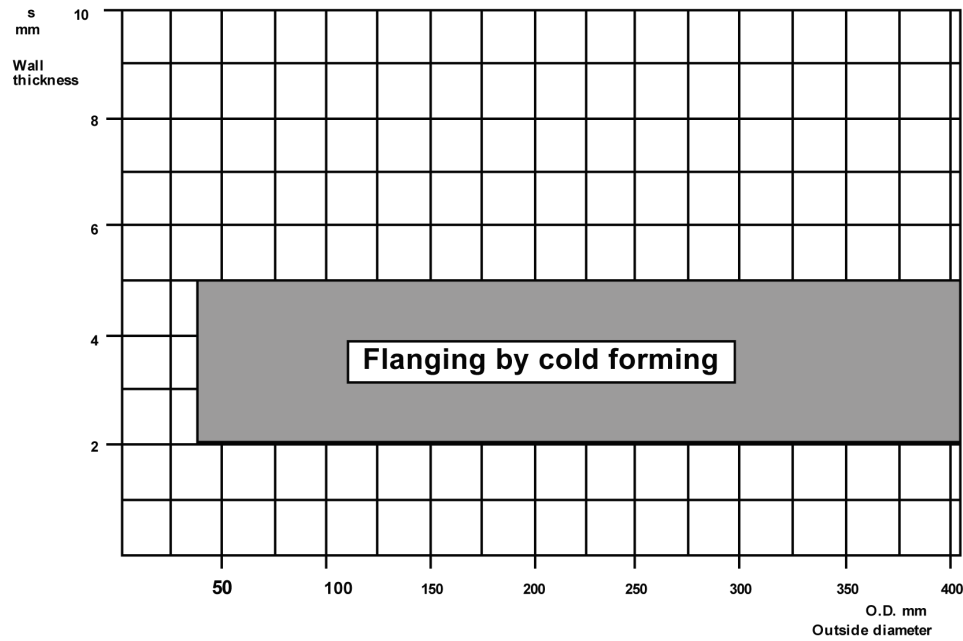


### 10.1 CLAMPING LENGTHS (STANDARD CLAMPS)

Pipe O.D.		L1		L2	
mm	N.S. Inch	mm	inch	mm	inch
42.4	1 1/4	125	4.92	260	10.24
48.3	1 1/2	125	4.92	260	10.24
60.3	2	125	4.92	260	10.24
73.0	2 1/2	125	4.92	260	10.24
88.9	3	125	4.92	260	10.24
114.3	4	125	4.92	260	10.24
139.7	5	260	10.24	260	10.24
168.3	6	260	10.24	260	10.24
219.1	8	260	10.24	260	10.24
273.0	10	260	10.24	260	10.24

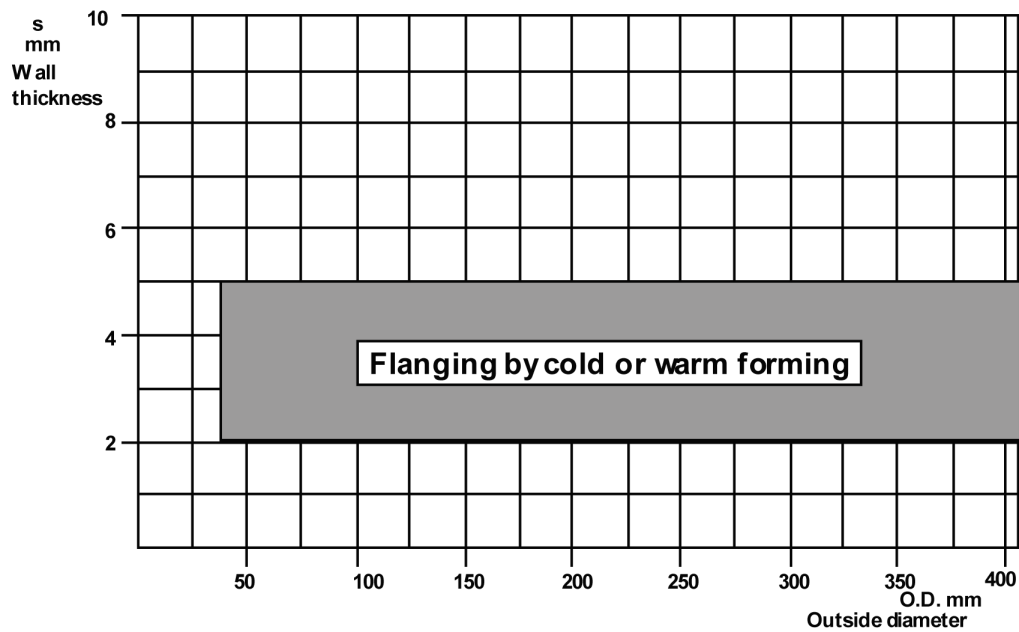
## 10.2 F-400 CAPABILITIES

### 10.2.1 CARBON STEELS



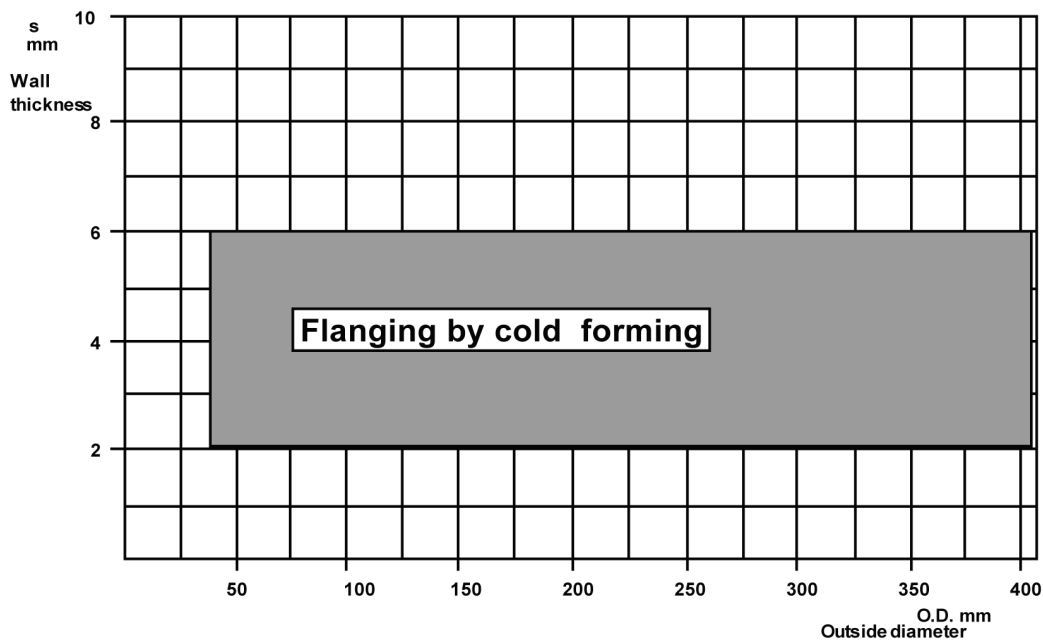
*Flanging by cold forming: Pipe dimensions to be flanged*

### 10.2.2 AUSTENITIC STAINLESS STEELS



*Flanging by cold or warm forming: Pipe dimensions to be flanged*

## 10.2.3 COPPER ALLOYS (COPPER, COPPER NICKEL, ALUMINIUM BRASS)

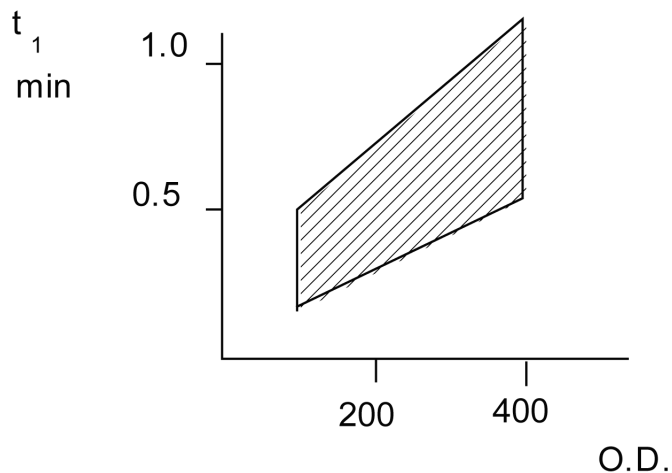


*Flanging by cold forming: Pipe dimensions to be flanged*

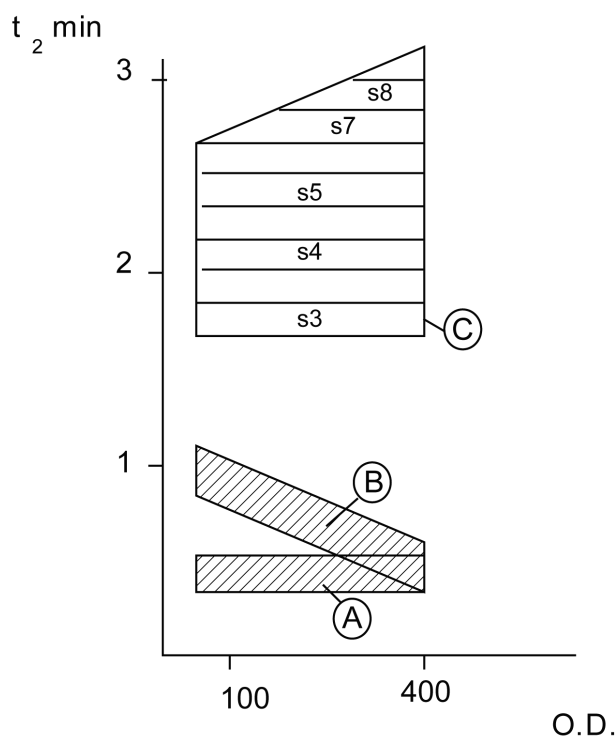
### 10.3 APPROXIMATE OPERATION TIMES OF FLANGING

(By installed equipment)

#### 10.3.1 FIXING OF THE PIPE INTO THE CLAMP



#### 10.3.2 FLANGING (MACHINE TIME)

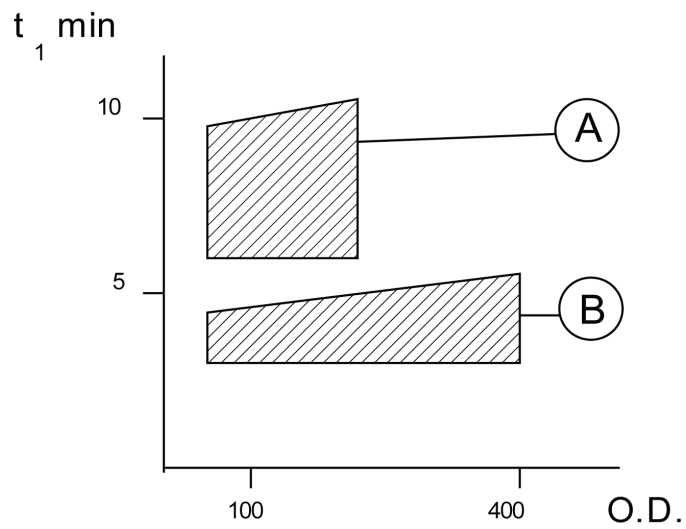


A: One-turn flanging (generally if  $S > 3 \dots 4$  mm, F.I. carbon steel  $\varnothing 114.3 * 4$  Cold forming)

B: Multiturn flanging (generally by thin materials, F.I. stainless steel and copper alloy  $\varnothing 57 * 2.0$ )

C: Hot flanging

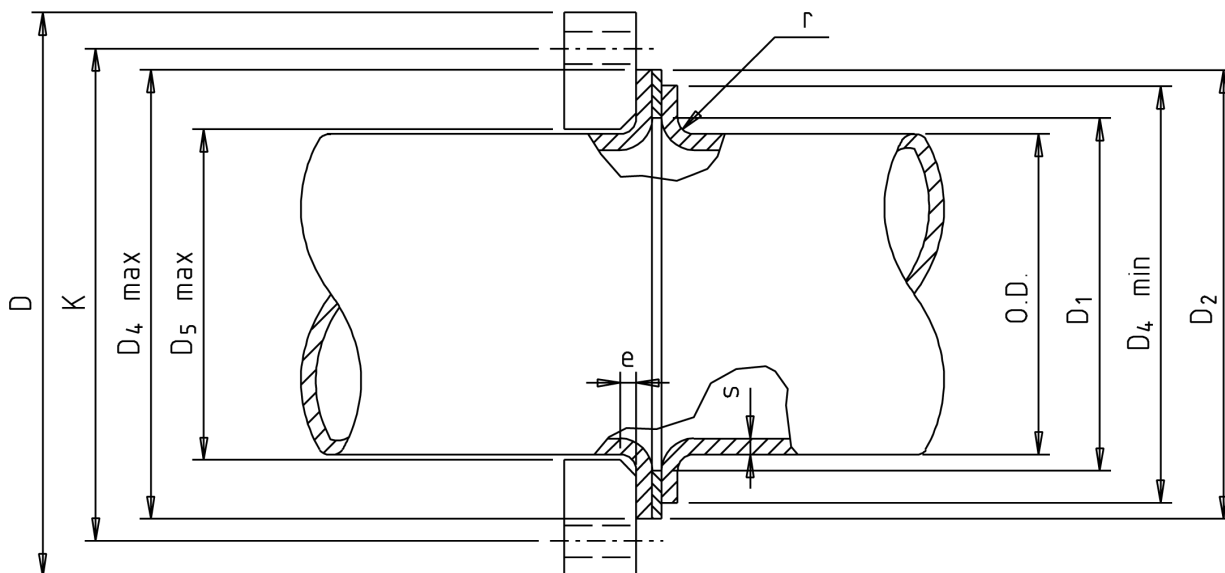
## 10.4 INSTALLATION TIMES



Operation time 0,7...5,6 min/flange  
 Installation time 3...1 min/dimension

## 10.5 LOOSE FLANGE JOINT

Dimension Chart for Nominal Pressure 10 bar when using standard forming pin (3401288)



### 10.5.1 LAPPED JOINT

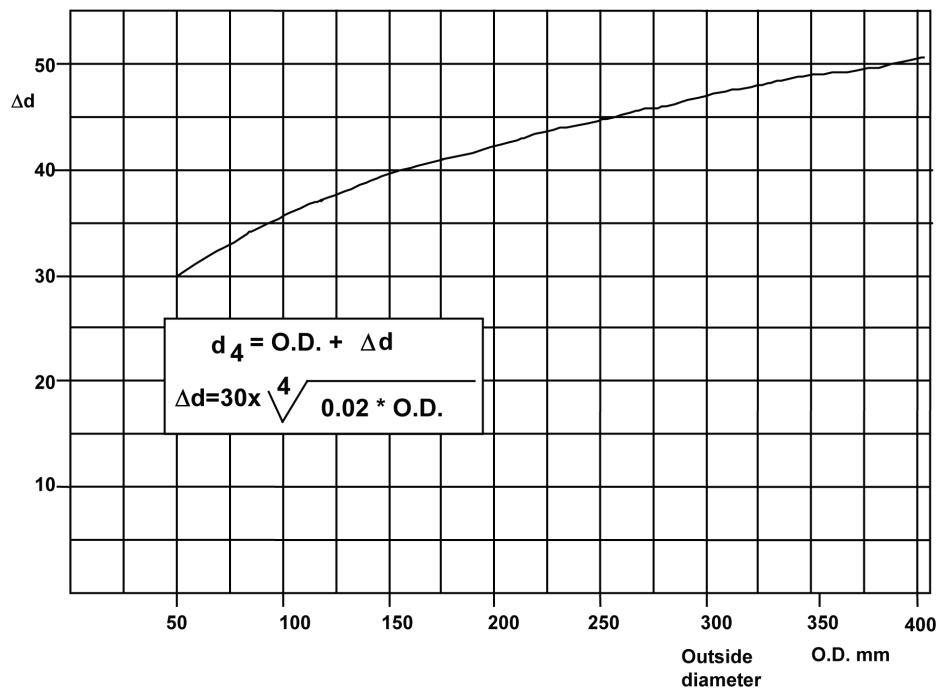
OD	Outside diameter
S	Wall thickness
D4 max.	EN1092-1 or BS 4504 or corresponding
D4 min	$OD + 30 \times \sqrt{0.02 \times OD}$
R	EN1092-1 or BS 4504 or corresponding

### 10.5.2 LOOSE FLANGE

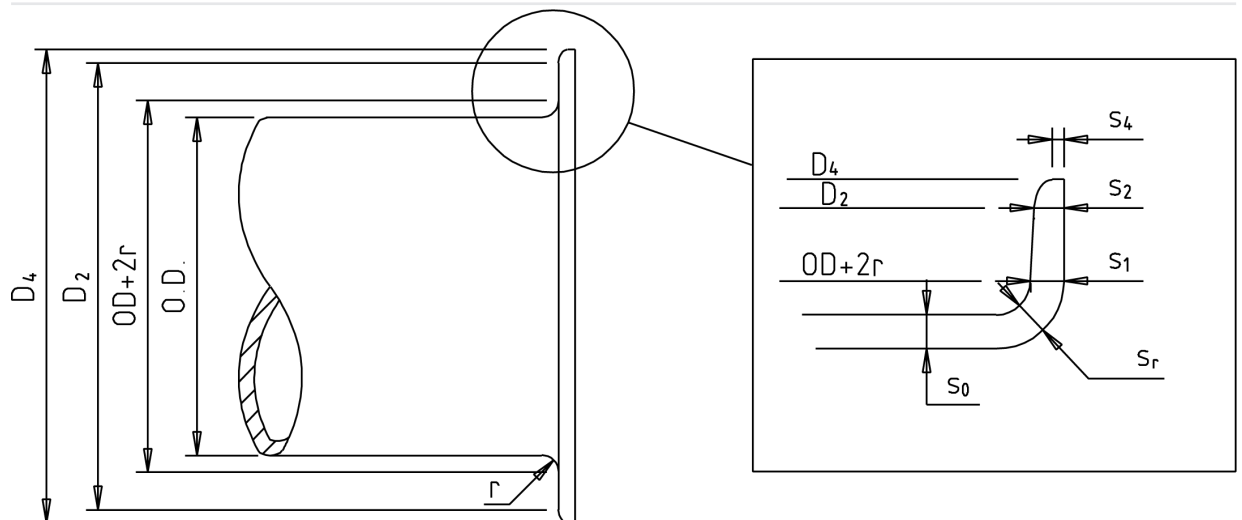
D	EN1092-1 or BS 4504 (DIN 2576)
K	EN1092-1 or BS 4504 (DIN 2576)
e	EN1092-1 or BS 4504 (DIN 2576)
b	EN1092-1 or BS 4504 (DIN 2576)
D5 max.	EN1092-1 or BS 4504 (DIN 2576)
D4 min	DIN 2576

### 10.5.3. GASKET

D2	DIN 2690 or corresponding
D1	DIN 2690 or corresponding



Min flange diameter  $d_4$



Wall thickness on the flanged pipe end

**The wall-thickness of the flanged pipe end:**

- O.D. = Outside diameter of the pipe
- $S_0$  = 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
- $s_r \approx 1...1,1 * s_0$
- $s_1 \approx 1...0,9 * s_0$
- $s_2 \geq (O.D./D_2) * s_0$
- $s_4 \geq (O.D./D_4) * s_0$

### 11. TROUBLESHOOTING

When some kind of problem appears first check the alarm- screen on the display (see chapter 6.2.5). You might find the reason to the problem there.

Problem	Cause	Remedy
Power does not go on	The hood is open	The hood is open
Automatic work cycle does not start	The carriage is not in the start position limit.	Drive the carriage to the start position limit.
	The spindle is not in correct position.	Position the spindle by briefly pressing the spindle rotation push button until the spindle is positioned.
Limit B6 is acting	The clamp-closed limit B5 is not acting.	Make sure that the pipe matches the pipe clamp size and close the clamp from manual clamp closing switch.
	The clamp-closed pressure switch SP1 is not acting.	Adjust the pressure switch just below the clamp pressure.
The moving carriage does not come forward in automatic cycle.	The forming pin on the starting position pressure switch SP2 does not act.	Adjust the pressure switch just below the main pressure.
The moving carriage does not come forward in manual mode.	The spindle is not in correct position.	Position the spindle by briefly pressing the spindle rotation push button until the spindle is positioned.
The clamp does not open in manual mode.	The spindle is not in correct position.	Position the spindle by briefly pressing the spindle rotation push button until the spindle-positioned limit B6 is acting.
The flange is not bent 90° or is bent over 90°	Bending angle adjustment, see chapter 6.2.2.	Adjust the bending.
	“Flange ready” -pressure SP3 is acting before the tool head has turned to set mechanical limit.	Maximum pipe wall is exceeded or pressure switch SP3 is not correctly set. Set the pressure just below the working pressure,



Problem	Cause	Remedy
The pipe is collapsing	The flange O.D. is too big compared to the pipe O.D.	Check the machine settings.
	The wall of the pipe is thin.	Use three-phase flanging.
	The flanging pin is set too far from the pipe I.D.	Check the flanging pin setting.

**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
- e-mail –address

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

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

## 12. ORDERING SPARE PARTS

When ordering spare parts, please state the following details:

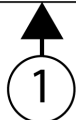
- Type code of the machine
- Manufacturing code of the machine
- The part number
- A description of the part
- The quantity of the parts required

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	∅6m6 x 32	DIN6325	4
7	9018219	Spring pin	∅6 x 30	DIN1481	2



1. Part number 2. Description 3. Quantity

**When ordering spare parts, send an e-mail or a fax with all required information.**

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

<b>Contact information:</b>	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