T-DRILL

PRODUCTIVITY AS A PRODUCT.

INSTRUCTION MANUAL

FLANGING MACHINE

F-170

Version

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Original instructions

Original instructions for the operation and maintenance of the T-Drill F-170 flanging machine.
Type code 3804.

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Is 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.

CONTENTS

1. NOTES ON THE USE OF THE INSTRUCTION MANUAL

1.1 GENERAL

This instruction book contains the instructions for use, maintenance and setting of the T-DRILL F-170 flanging machine, as well as recommendations regarding different working procedures and the use of the forming tools.

Before proceeding with installation and operation of the F-170 flanging 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 WARNING AND DANGER SYMBOLS USED IN THIS MANUAL

ⓘ DANGER! CAUSES OR 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 precautions have not been taken. This symbol is also used to generally emphasize a particular detail.

Gray base color is used to emphasize an important detail.

1.3 SYMBOLS AND WARNINGS USED IN THE F-170 M FLANGING MACHINE

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

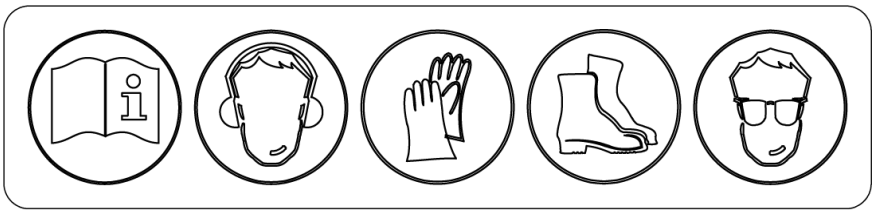
Electric box. Danger may be caused by electric installation.

Warning! Danger of crushing!

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

Mind the rotating forming pin!

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.



1.4 PERSONAL PROTECTIVE EQUIPMENT FOR THE OPERATOR

Always wear the appropriate personal protective equipment, and use extreme caution when operating the machine. It is highly recommended to use ear protection when operating the machine.

The local safety guidelines and regulations are to be followed for safe operation. The T-Drill instruction manual will not repeal the federal, state and local 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. Keep the unauthorized people out of working area.

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 (STOP-button), all functions of the machine are immediately stopped.

After installation of the machine, before operating it, carry out the “Start-up Inspection”, described in Chapter 5, Section 5.4.

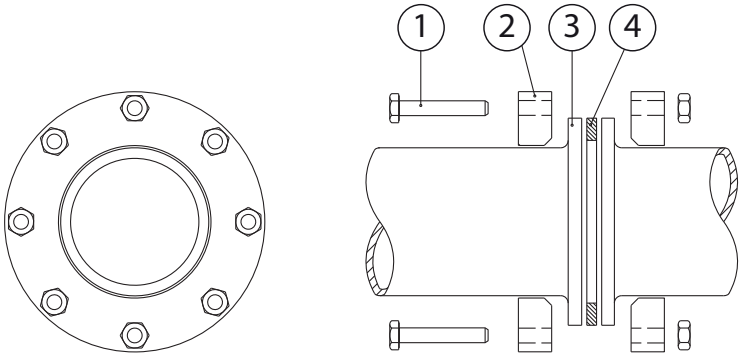
Always use personal protective equipment when operating the machine.

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

3. GENERAL INFORMATION ABOUT F-170

3.1 INTRODUCTION

The T-DRILL F-170 is a flanging machine, which is used for forming the tube ends for a loose flanged joint.



Flanged joint: 1. Bolt, 2. Loose flange, 3. Tube, 4. Sealing

The machine is attached to the work piece with tube specific hydraulic clamps. The tube remains immobile during the entire work cycle, and consequently also branched and bent tubes can be flanged.

The forming device is driven by a hydraulic gear motor. The device rotates inside the tube end, and the forming pin bends the tube at the same time using hydraulic force.

The rotation and bending move are done simultaneously. The rotation speed is constant regardless of the load. Bending movement is slightly slower under possible overload situation and the machine may abort the work cycle if necessary.

The F-170 is operated from a graphic 7” touch panel.

3.2 THE PURPOSE OF THE MACHINE

T-DRILL F-170 is a completely automatic flanging machine for job site or pipe fabrication shop, the main purpose of which is forming the tube end into a 90º 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.

Flanging by using T-DRILL method takes about five minutes, whereas a similar process made by welding in stainless steel tube takes up to one hour including the preparation.

➡ NOTE! Do not use the machine for any other purpose than described in this manual.

3.3 INFORMATION ON THE EQUIPMENT

Following equipments are available for F-170 machine:

• Forming pin - The standard forming pin delivered with the machine is for use on normal steel and copper tubes. It is recommended to use a separate pin for each material.

• Tube gripping clamps which can be ordered according to tube diameter, available for diameters from Ø26,9 - Ø168.3mm.

3.4 TUBE CLAMPS

DN20	OD Ø26,9
DN32	OD Ø42,4
DN40	OD Ø48,3
DN50	OD Ø60,3
DN65	OD Ø76,1
DN80	OD Ø88,9
DN100	OD Ø114,3
DN125	OD Ø139,7
DN150	OD Ø168,3

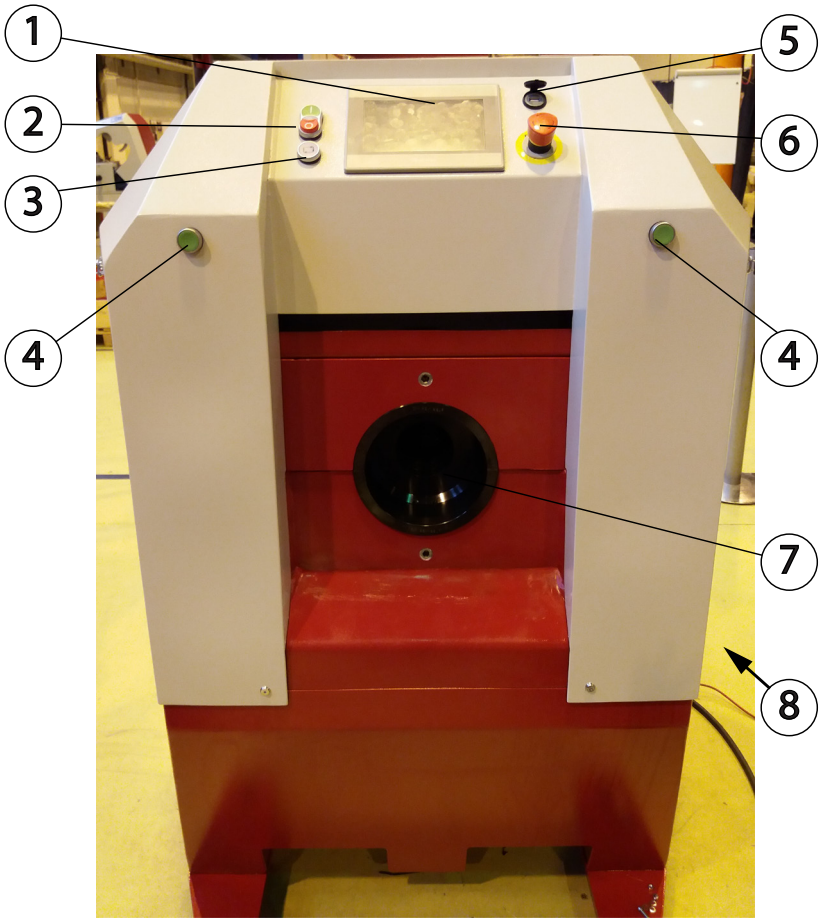
For other sizes, quote T-Drill sales.

3.5 TECHNICAL SPECIFICATIONS

Type	Unit	F-170	NOTE!
Type code		3804	
Tube to be flanged	mm	OD 26,9 - OD Ø168,3 (1½" - 6")	
Max. wall-thickness		Fe & St. steel, Aluminium / CU (L-typ): 3,5 mm Aluminium / CU (K-typ): 4,0 mm DN20 S(max)=2mm	
Materials to be formed		Copper, , CuNi, Carbon steel, Stainless steel, Aluminium	
Connected power	kW	5	See machine plate
Fuse sizes	A	3x16	
Operating voltage		380 - 480 V / 50/60 Hz - 3-phase	See machine plate
Machine dimensions h x w x d	mm	1446 x 916 x 1204	
Weight of the machine	kg	950	
Noise level	dBl	During flanging 73 dB (A)	
Standard		EN10192-1	
Pressure class		PN 16 Sch. 10	
Flanging time		~50-100s	

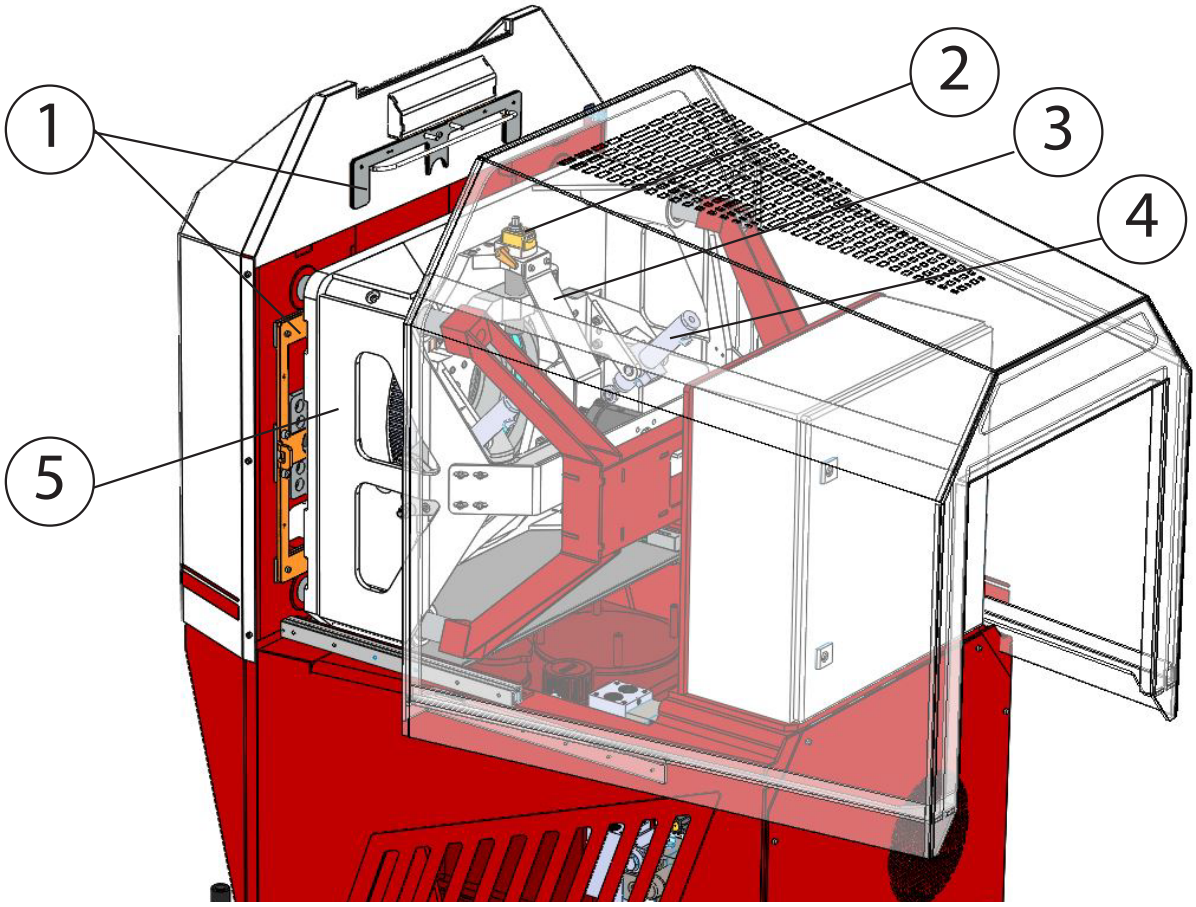
1 bar = 100 kPa

3.5.1 MACHINE MAIN PARTS



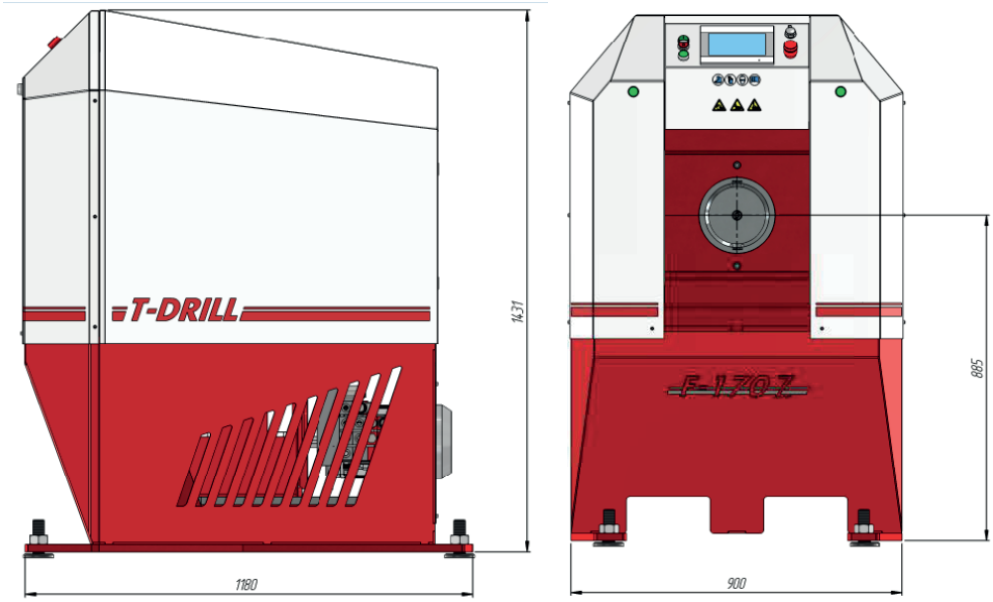
1.	Touch screen : Operation panel display
2.	Power on-off buttons
3.	Work cycle ON button
4.	Clamp operation buttons: two-hand control - To close and open the hydraulic clamp locks - To run the tool to the start position
5.	USB-connection for a memory stick (only to upload / download programs)
6.	Emergency stop switch (turn to release)
7.	Clamps
8.	Electric cabin and main power switch, hydraulic unit (inside the machine covers)

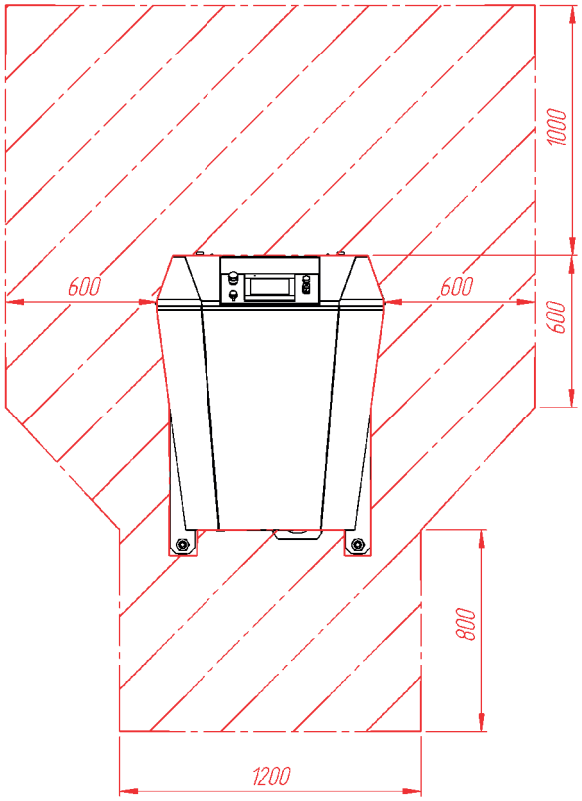
3.5.1.1 FLANGING UNIT PARTS



1.	Buffer plates
2.	Diameter adjustment scale and adjustment locking lever
3.	Rotating flanging unit
4.	Turn cylinders (of flanging unit)
5.	Flanging unit frame

3.6 LAYOUT OF THE MACHINE AND SPACE REQUIREMENT





Machine measures and required working space

➡ **NOTE! Leave enough room around the machine for tube and machine operator!**

4. TRANSPORT, HANDLING AND STORAGE

For transport the F-170 is packed into a wooden case and bolted to its bottom or is bolted to a wooden base and covered in plastic.

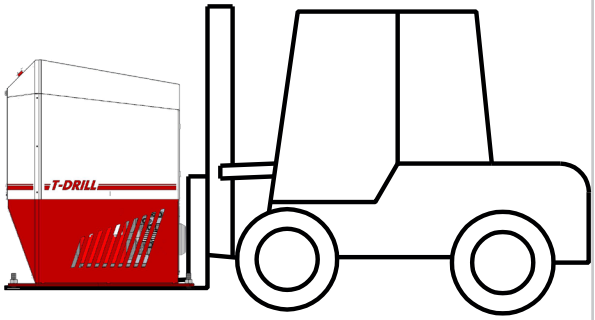
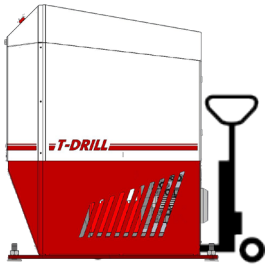
For storage the F-170 is to be protected by grease and sufficient dehumidification should be provided in the storage accommodation. Especially the electric equipment must be kept dry.

Weight of the machine is stated in technical specifications Chapter 3, Section 3.5.

➡ **NOTE! Always keep the F-170 machine in upright position. Never allow the machine to tip over.**

4.1 MOVING AND LIFTING THE MACHINE

The machine must be lifted under the main frame, from behind the machine.

	Use a fork lift to move the machine.
	Use a pallet truck to move the machine.

➡ **NOTE! Do not let the machine to tip over!**

5. INSTALLATION

5.1 INSTALLATION OF THE UNIT

Install the machine on a solid level foundation, free from vibration, preferably on a concrete bed.

- Required floor load capacity 2.2 t/m²

- Floor level ± 10 mm

The machine is designed to be easily moved from job site to another, or to be used in a pipe fabrication shop.

The F-170 machine must be leveled on its foundation before use, the leveling tolerance is 0,5 mm on 1000mm. Use a water level. Machine can be leveled from any flat surface on the machine frame. If the machine is not straight or any of the feet is off the floor, lift the machine up a bit with the pallet truck and adjust the feet on its corners. (Use wrenches size 14 and 18).

Machine to floor anchor bolts M12-85-100/180, 4 pcs.

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 tube to be formed.

5.2 AMBIENT CONDITIONS

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

Operating temperature	12.5…40°C (54.5…104°F)
Relative humidity of air	85% or less, non condensing
Electromagnetism	The surrounding appliances should not cause such electromagnetic perturbations which exceed the general standards established for workshop machinery.
Altitude	max. 2200m

5.3 CONNECTING THE MACHINE TO SOURCES OF ENERGY

↯ DANGER! ONLY A QUALIFIED AND AUTHORIZED PERSON IS ALLOWED TO CARRY OUT THE CONNECTION TO THE MAINS.

↯ DANGER! BEFORE YOU CONNECT THE MACHINE, ENSURE THAT THE VOLTAGE INDICATED ON THE NAME PLATE CORRESPONDS TO THE LOCAL POWER VOLTAGE.

↯ DANGER! EVEN IF THE POWER ON BUTTON IS NOT PRESSED, THE SUPPLY CABLE IS STILL ALIVE- FATALLY DANGEROUS VOLTAGE

↯ DANGER! DISCONNECT THE ELECTRIC POWER TO THE SUPPLY CABLE BEFORE STARTING TO CARRY OUT THE CONNECTION –FATALLY DANGEROUS VOLTAGE.

↯ DANGER! EVEN WHEN THE MAIN SWITCH IS IN OFF POSITION, THE SWITCH AS WELL AS THE SUPPLY CABLE STILL ARE ALIVE - FATALLY DANGEROUS VOLTAGE.

The terminals for connection of the external supply cable of the F-170 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. Compare the diagram with the nameplate of the machine.

The machine can be supplied for a voltage range of 380-480V/50Hz/60Hz.

➡ 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.

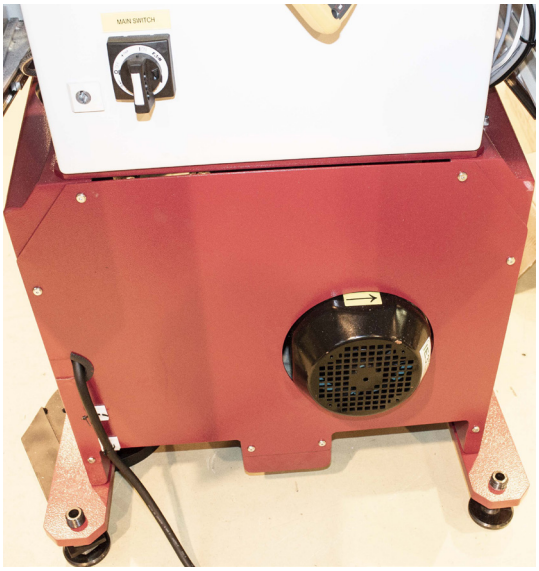
5.4 START-UP INSPECTION

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

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. Check the rotation direction of the motor, correct direction is marked on top of the motor.

3. Check the amount of the hydraulic oil, and the rotating direction of the pump (information can be found also in the pneumatic schema). The electric motor rotates clockwise, so does the hydraulic pump. The flanging unit rotates counterclockwise.

Turn the main power on and press POWER ON from the control panel. The hydraulic pump motor will start.

4. Check the lubrication points of the machine.

5. Check the correct function of the switches and push-buttons of the control panel.

6. THE OPERATION OF THE FLANGING MACHINE

➡ **NOTE! The work cycle will not start, if the machine cover is open.**

6.1 DESCRIPTION OF THE CONTROL DEVICES

The main switch is located on the electric cabin door, behind the machine.

Number	Description
1	Power on
2	Power off
3	Work cycle start (user interrupt)
4	USB-connection for a memory stick (only to upload / download programs)
5	Touch screen
6	Emergency stop switch (turn to release)

➡ **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.**

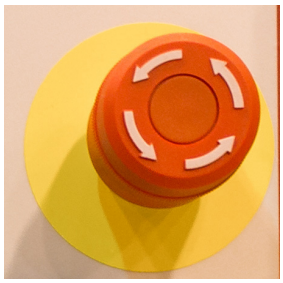
6.2 STOPPING OF THE MACHINE

6.2.1 NORMAL STOPPING

1. Press the WORK CYCLE -button.
2. Wait until the automatic work cycle has stopped.
3. Disconnect the current by pressing the OFF  -button.
4. Switch power off by turning the main switch on the electric box to O.

6.2.2 EMERGENCY STOPPING

In case of danger, stop the machine by pressing the EMERGENCY STOP  -button completely down. This interrupts all functions of the machine. The emergency stop is released by turning the red button counter clockwise.

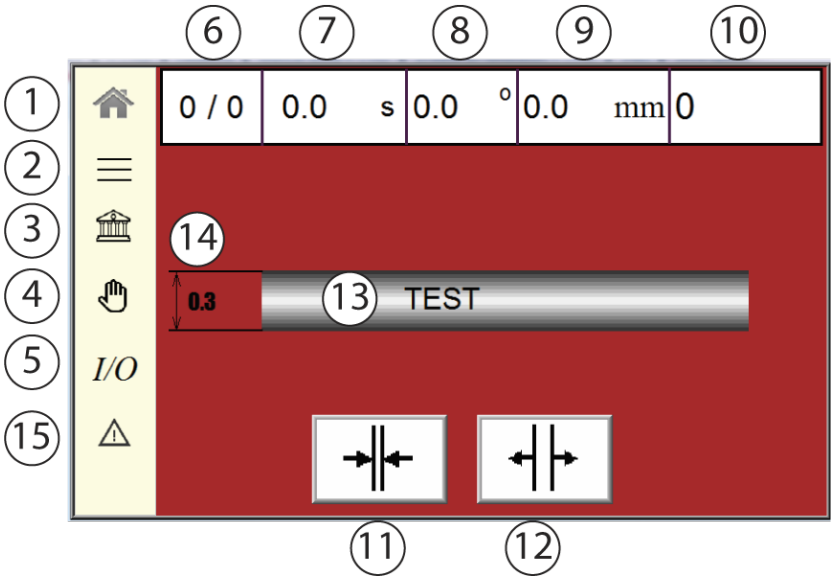


6.2.3 USER INTERRUPT OF PROGRAM

Press WORK CYCLE START  button for 5 seconds to interrupt work cycle.

6.3 DESCRIPTION OF THE OPERATION PANEL SCREENS

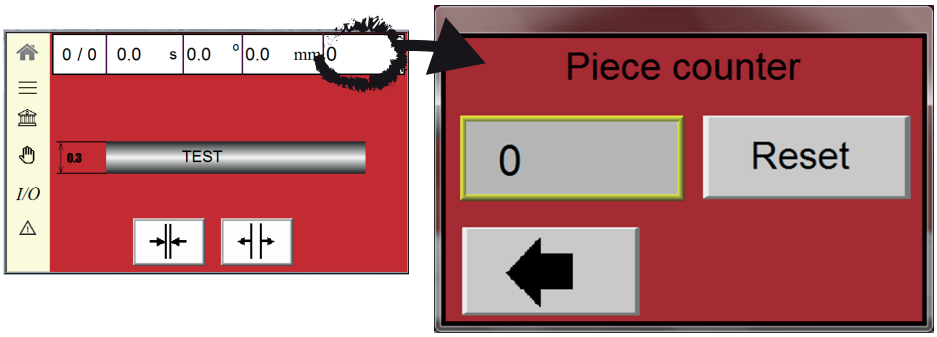
6.3.1 MAIN SCREEN



1.	Tap to go to MAIN screen
2.	Tap to go to MENU screen (6.3.2)
3.	Tap to go to LIBRARY screen (6.3.3)
4.	Tap to go to MANUAL screen(6.3.4)
5.	Tap to go to I/O screen (6.3.5)
6.	Number of flanging phases / which phase is in process
7.	Work cycle duration
8.	Tool position / bend position in degrees
9.	Carriage position in mm (or inch)
10.	Piece counter (tap to open reset pop-up screen 6.3.1.1)
11.	Clamps close (Operation switch function selection)
12.	Clamps open (Operation switch function selection)
13.	Tube material and the name of the chosen program
14.	Tube diameter
15	Tap to go to ALARMS screen (6.3.6)

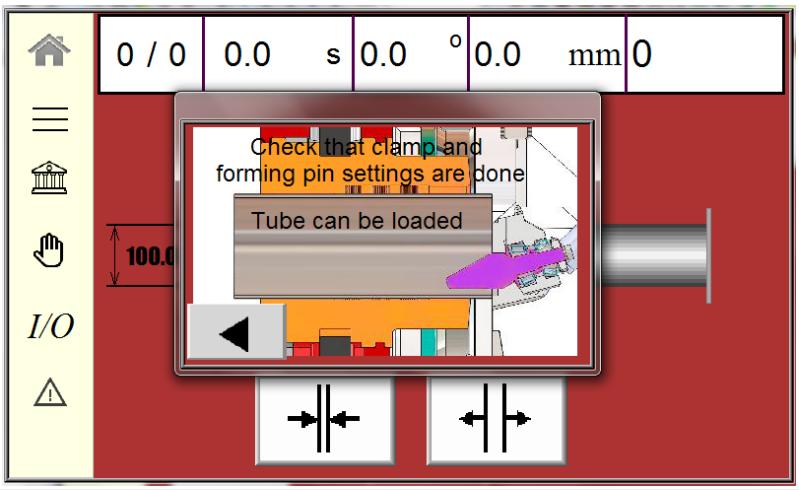
6.3.1.1 PIECE COUNTER AND RESET POP-UP

The main screen piece counter can be reset:

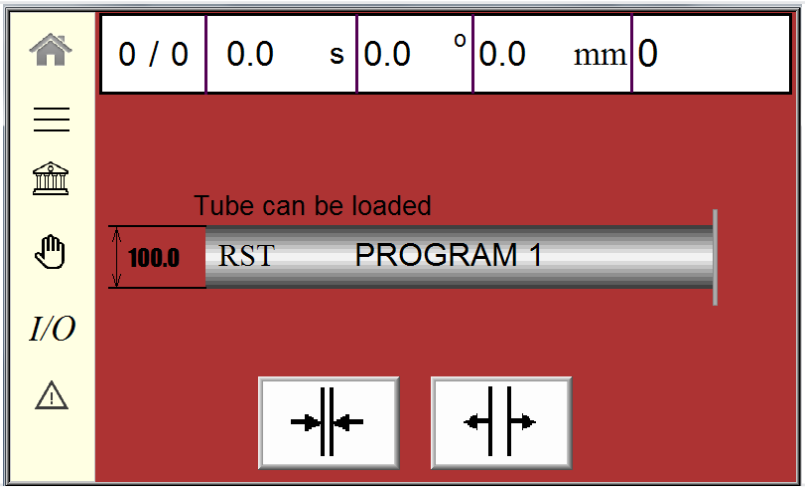


Tap the piece counter to open a pop-up reset window.

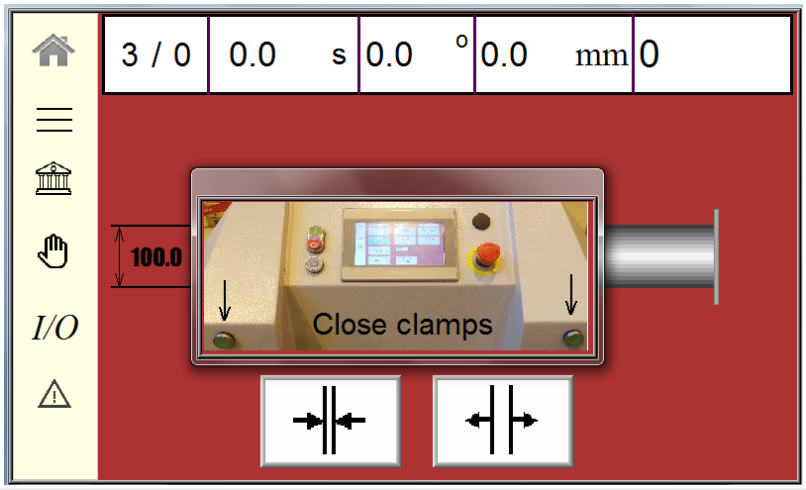
6.3.1.2 POP-UP HELP-SCREENS THAT APPEAR DURING THE USE OF THE MACHINE



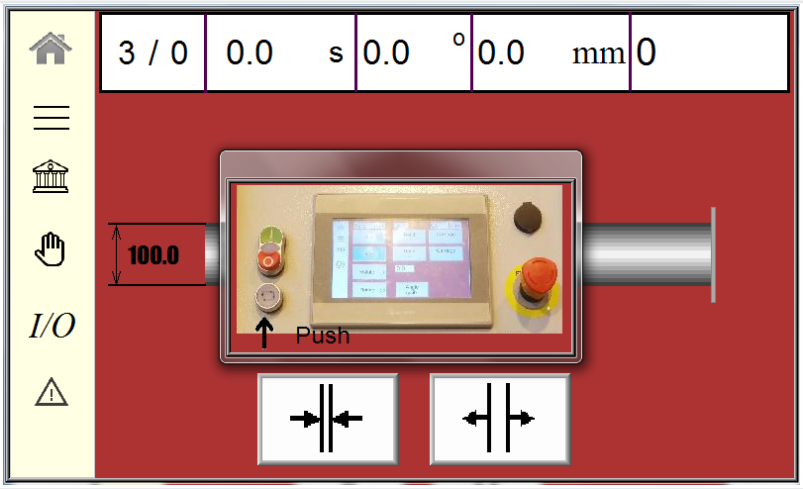
First run of a new program: When a new program has been loaded from the library, the machine will ask to check the clamp and forming pin settings. When the carriage is in the starting position, a pop-up will appear to inform that the machine is ready and tube can be put into the machine.



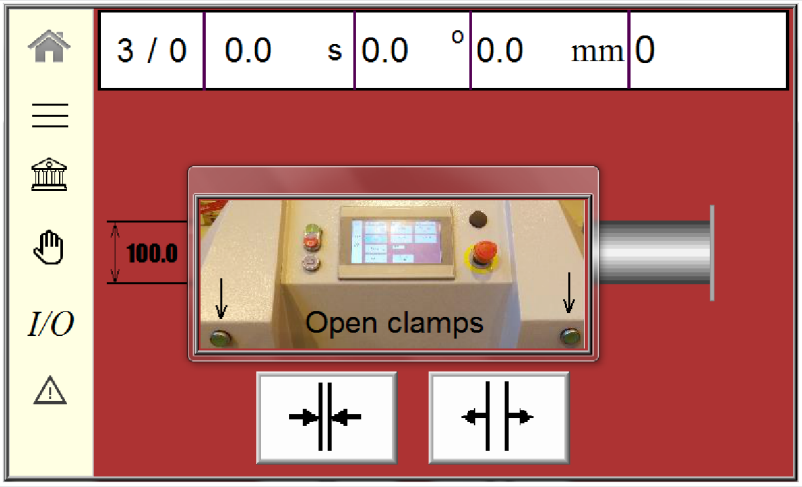
Next runs of the program: The machine will only inform above program name: "Tube can be loaded".



If the clamp is not completely closed, there will appear a pop-up advising to close the clamps when trying to start worck cycle (push work cycle button).

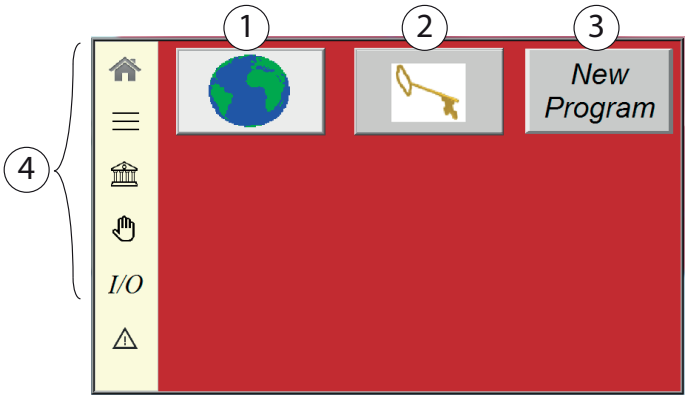


When the clamps are completely closed, there will appear a pop-up to advise to push the CYCLE START button.



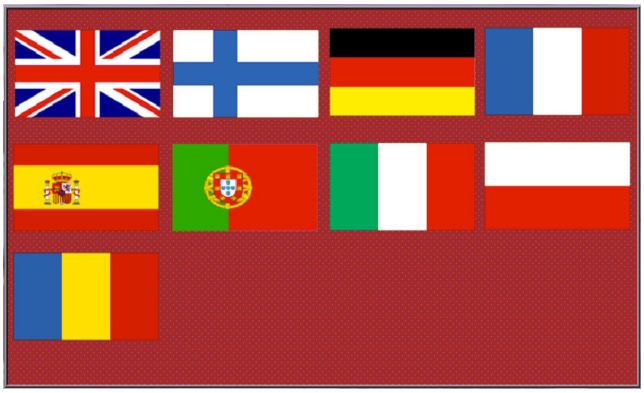
When the work cycle is done, there will appear a pop-up to advise to open the clamps.

6.3.2 MENU SCREEN



1. Tap to enter language selection screen (6.3.2.1)
2. Tap to enter user level selection screen (6.3.2.2.)
3. Tap to enter New Program screen, to make new programs (6.3.2.3.)
4. Side navigation panel

6.3.2.1 LANGUAGE SELECTION SCREEN

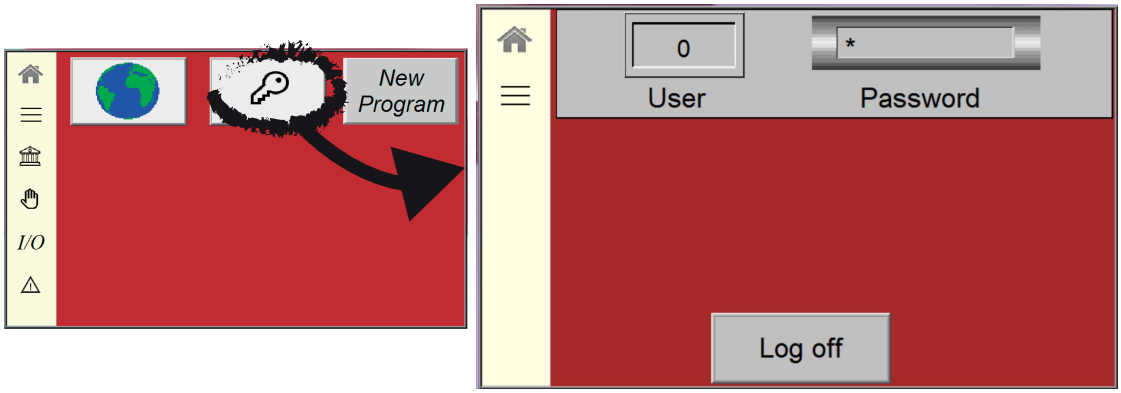


Always when main switch is switched ON language screen is shown on the panel. Select desired language by tapping corresponding flag on the screen. The display will open the menu-screen in chosen language.

NOTE: press flag for 3 seconds.

6.3.2.2 USER LEVELS SCREEN

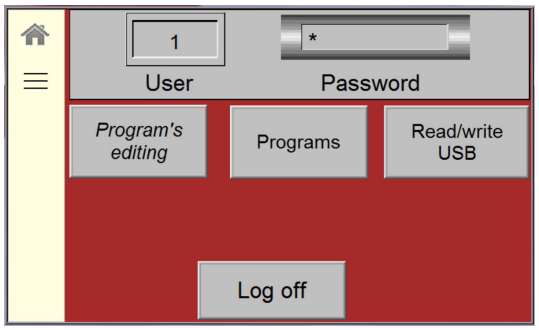
Tap  -button to enter User level selection screen:



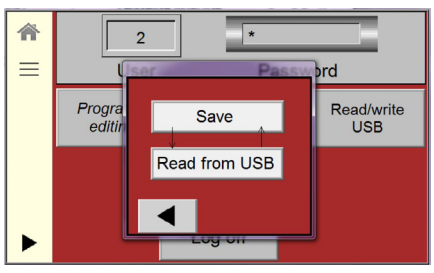
There are three different user levels on user interface. First level is for operator, levels two and three are for supervisor and level four for T-Drill service.
User levels are protected with passwords (Default passwords are level 1: “1” and 2: “2”).

Activate features on user level screens by tapping the feature button, activated feature is lit green.

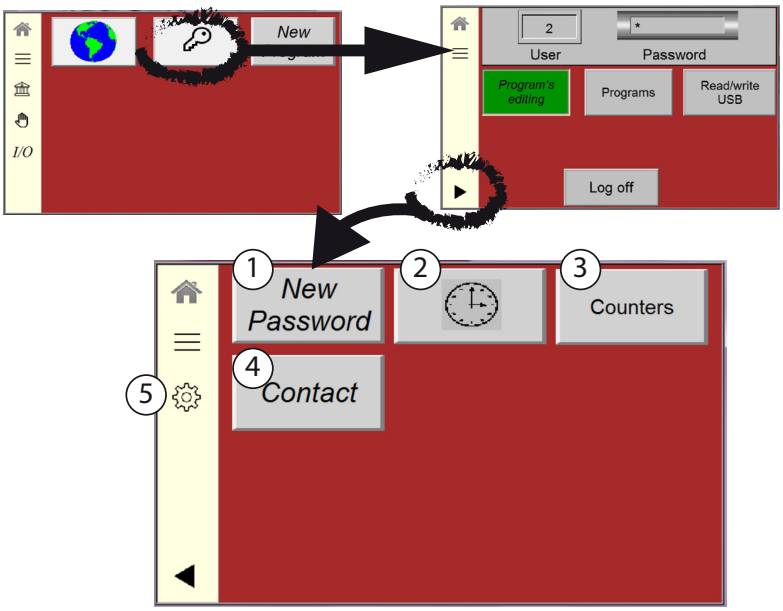
User level 1



1.	Activate to enable all users to make and edit programs.	Program's editing
2.	Tap to enter machine program information screen.	Programs
3.	Tap to open pop-up screen to download / upload programs (OPTIONAL equipment)	Read/write USB



User level 2:



1. Tap to enter screen: Set new passwords for users.

2. Tap to enter clock setting screen.

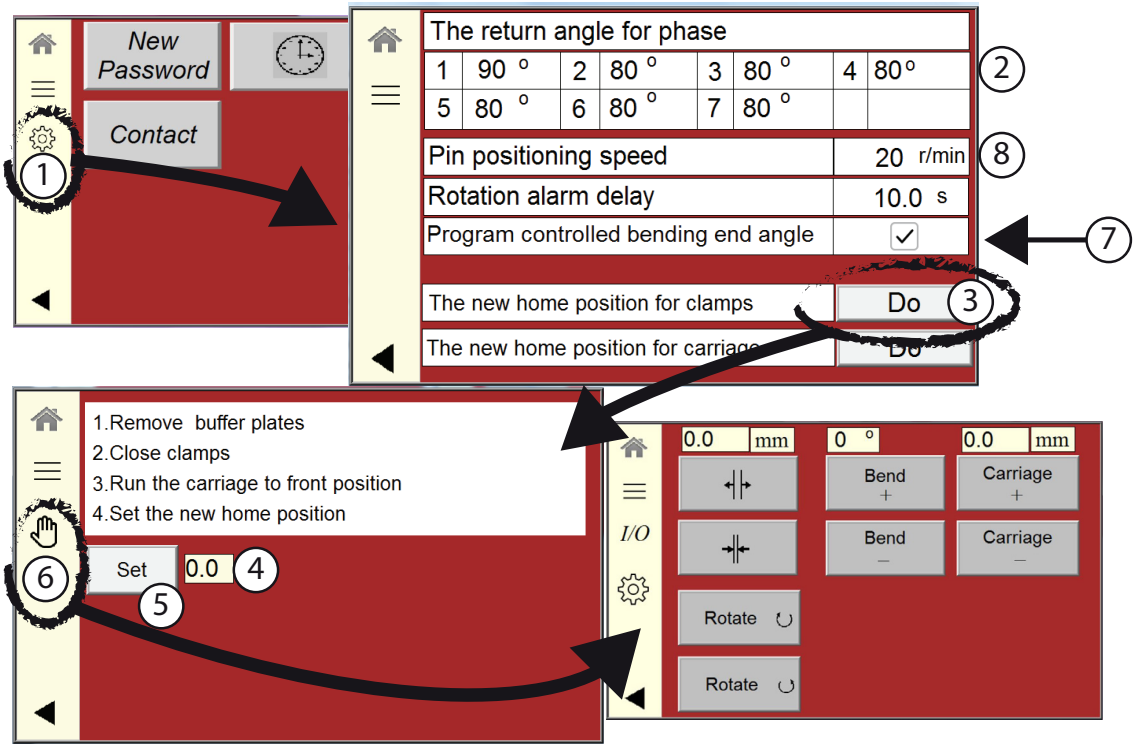
3. Tap to enter Counters screen: Total piece counter and machine total running hours.

4. Tap to enter T-Drill contact information screen

5. Tap the gear button to enter “Home position for clamps” and “Home position for carriage” screens.
(6.3.2.2.1 Home position for clamps 6.3.2.2.2 Home position for carriage)
User level 2 or higher only.

6.3.2.2.1 HOME POSITION FOR CLAMPS

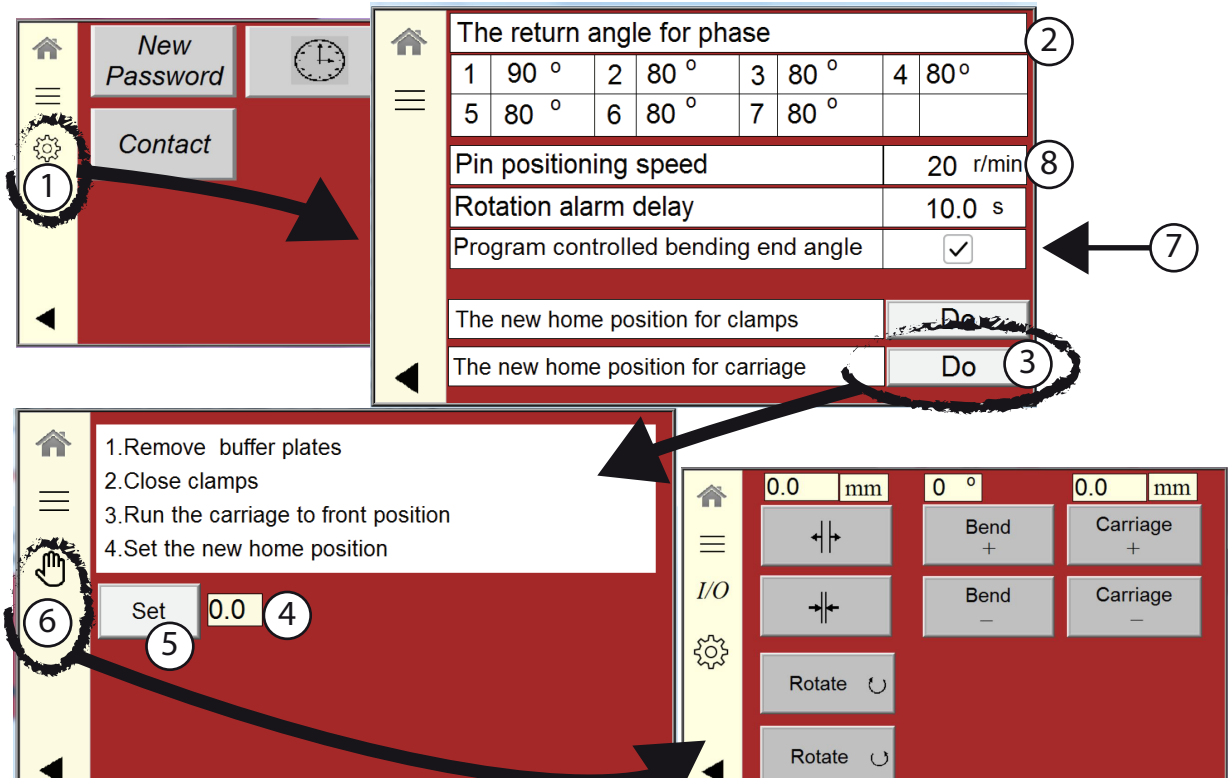
Allowed for user level 2 or higher only! (Start from user level 2 second screen, gear button). Required only when mechanical parts have been replaced to the machine and the position has changed.



1	Tap gear button on user level 2 second screen to open next screen: Set return angles	
2	Tap angle value field to open keypad, enter return angles for each flanging phase if required.	
3	Tap “Do” to go to “Home position setting screen”	
4	Follow the instructions on display: 1. Close clamps (on MANUAL screen) 2. Write the new position to field (4)	
5	Tap “Set” button to set the home position	
6	Tap hand button to go to MANUAL screen. (Use MANUAL-screen when moving the clamps! Back to “Home position setting screen” from the MANUAL-screen by tapping the arrow button)	
7	Tap to check and activate “Program controlled bending end angle” function in flanging program: Set bending end angle when making the program. (Without setting, the bending end angle is 90°)	
8	Pin positioning speed: This value can be reduced when the tube is very thick. The value is used to position the tool to correct position for the next work piece.	

6.3.2.2.2 HOME POSITION FOR CARRIAGE

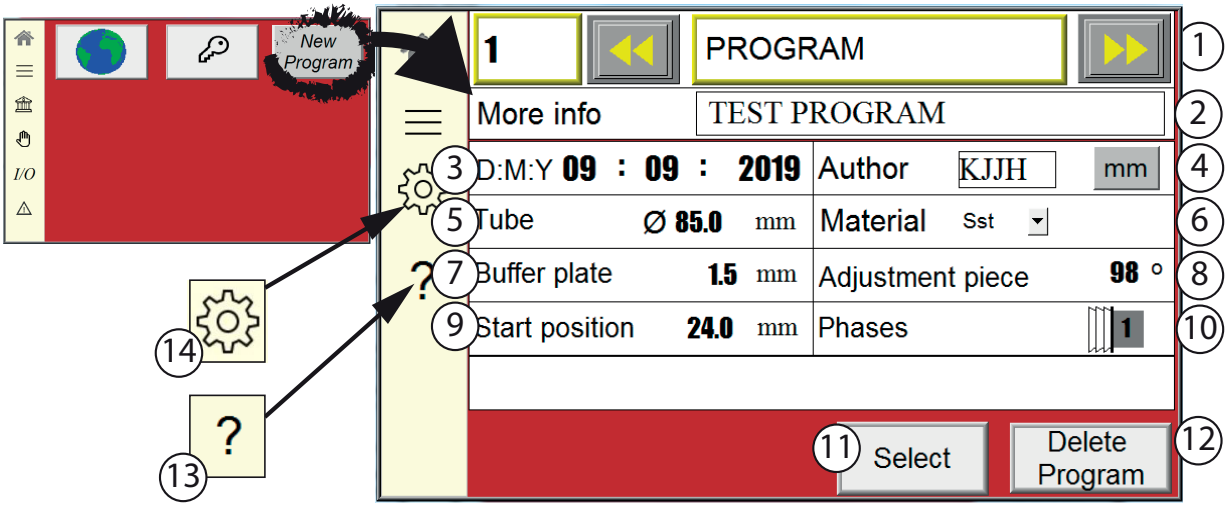
Allowed for user level 2 or higher only! (Start from user level 2 second screen, gear button). Required only when mechanical parts have been replaced to the machine and the position has changed.



1	Tap gear button on user level 2 second screen to open next screen: Set return angles	
2	Tap angle value field to open keypad, enter return angles for each flanging phase if required.	
3	Tap “Do” to go to “Home position setting screen”	
4	Follow the instructions on display: 1. Remove backstop plates, except for the basic plate. 2. Close clamps 3. Run the carriage to front position by pushing the two-hand control buttons or from the MANUAL-screen (“Carriage “-”). 4. Set the new position to field (4)	
5	Tap “Set” button to set the home position	
6	Tap hand button to go to MANUAL screen. (Use MANUAL-screen when moving the carriage! Back to “Home position setting screen” from the MANUAL-screen by tapping the arrow button)	

7	Tap to check and activate “Program controlled bending end angle” function in flanging program: Set bending end angle when making the program. (Without setting, the bending end angle is 90°)
8	Pin positioning speed: This value can be reduced when the tube is very thick. The value is used to position the tool to correct position for the next work piece.

6.3.2.3 NEW PROGRAM SCREEN



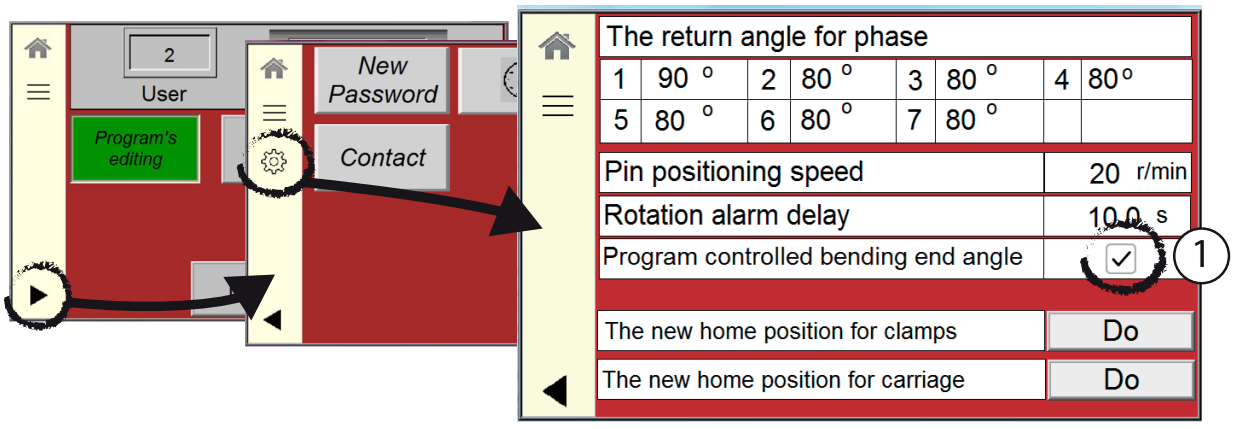
1.	Program number / name. Tap field to open a pop-up keypad. Use arrow buttons to browse through program library.
2.	More info - a good place to fill in the standard number.
3.	Program date
4.	Author - maker of the program and operating measure mm or inch (tap to change), **check program with care after changing the measure!**
5	Tube diameter
6.	Material, select from pull-down menu.
7.	Backstop plate value (backstop plates are mechanical components, see chapter 6.4.1.2 Tube wall thickness setting backstop plates.
8.	Adjustment piece - The adjustment pieces are used with cases when the flange is desired to be made to other that 90 degree turning angle (see chapter 6.4.1.4 Setting the angle of the flange (Option)).
9.	Flanging start position: This value is the flange width adjustment, the position of the carriage when the tube is placed to the clamps and the forming pin works as backstop. (The flange width reading is typically in between 25 - 31, the final adjustment depends on tube material and required flange size, the new tube program adjustment should be tested on a scrap tube first). See chapter 6.4.1.5.

10.	Phases: 1...8 (tap to open keypad).
11.	Select the program to use.
12.	Delete the program
13. ?	Tap “?” to open pop-up table guide for backstop (buffer) plates. See chapter 6.4.1.2 Tube wall thickness setting backstop (buffer) plates
14.	Tap to open adjustment screen for bending speed (°/r) and flange ready pressure.  When the flange is ready, the machine drives a little further to achieve the desired result after material spring back. The formed flange depends on material quality and hardness and its spring back feature. Factory setting is 80 bar.

Some fields are just informative / note fields, and optional to use.

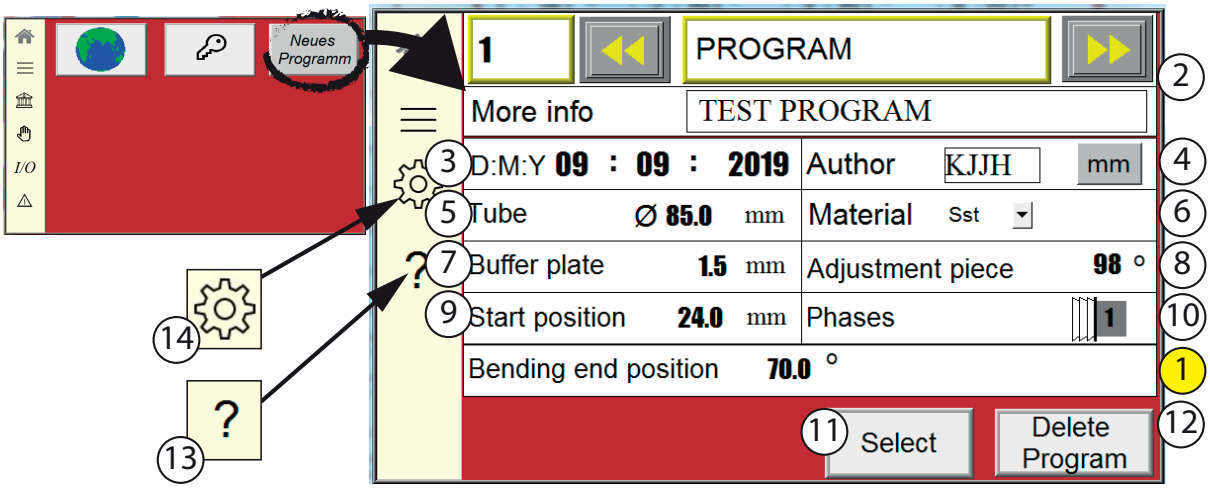
6.3.2.3.1 NEW PROGRAM SCREEN WITH BENDING END ANGLE CONTROL

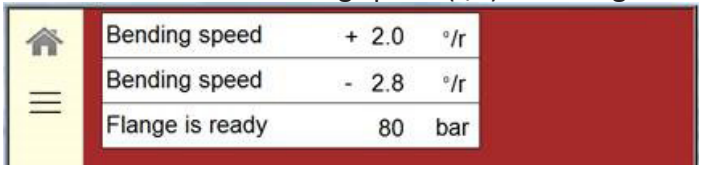
Activate “Program controlled bending end angle” function:



USER2 screen, tap “gear”-button and tap to check and activate “Program controlled bending end angle” function in flanging program: Set bending end angle when making the program. (Without setting, the bending end angle is 90°)

The flanging program is made the same way as the program without bending end angle setting.



1.	Bending end position angle setting: Set the desired flange angle here.
2.	Program number / name. More info - a good place to fill in the standard number.
3.	Program date
4.	Author - maker of the program and operating measure mm or inch (tap to change), **check program with care after changing the measure!**
5	Tube diameter
6.	Material, select from pull-down menu.
7.	Backstop plate value
8.	Adjustment piece info.
9.	Flanging start position:
10.	Phases: 1...8 (tap to open keypad).
11.	Select the program to use.
12.	Delete the program
13. ?	Tap "?" to open pop-up table guide for backstop (buffer) plates.
14.	Tap to open adjustment screen for bending speed (°/r) and flange ready pressure.  When the flange is ready, the machine drives a little further to achieve the desired result after material spring back. The formed flange depends on material quality and hardness and its spring back feature. Factory setting is 80 bar.

6.3.2.3.2 BENDING SPEED

Do not exceed factory values.

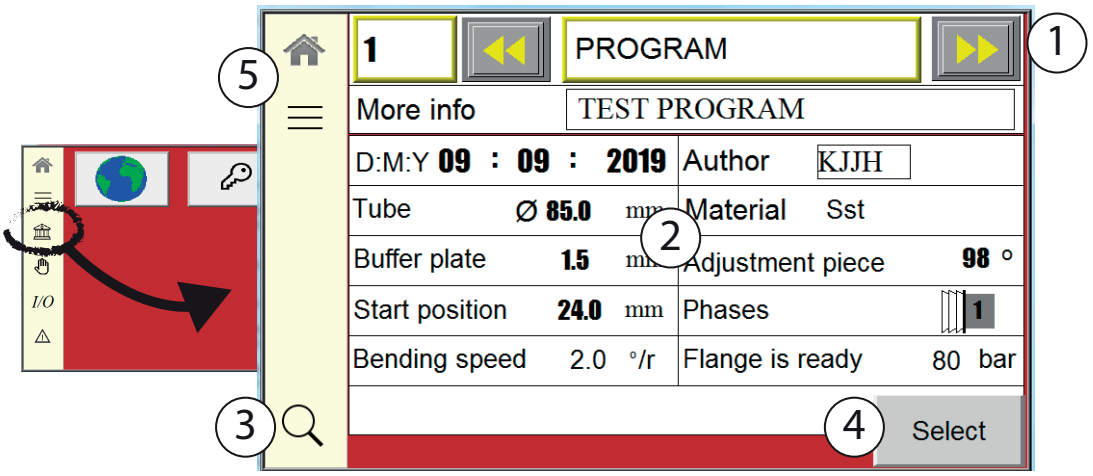
Factory values for bending speed:

Pipe wall thickness	Bending speed
2 mm or less	3° / r
3 mm	2° / r

For flange ready-pressure factory setting is 80 bar.

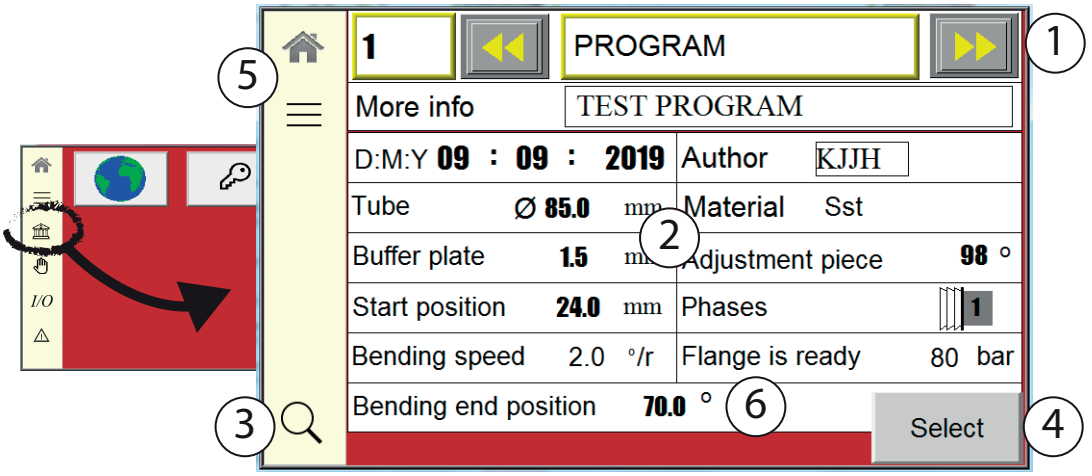
6.3.3 LIBRARY SCREEN

The machine user can browse the saved programs and choose a program to run. User level 0 can not change the program features like number of flanging phases.



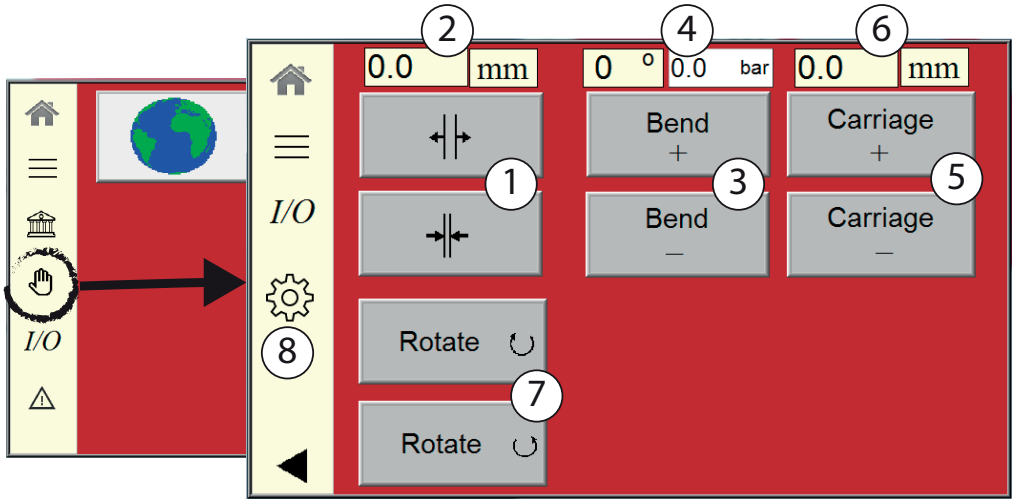
1. Program number and name. Browse programs from the arrow buttons.
2. Program information fields, not available to edit in LIBRARY screen.
3. Search for programs (Tap to open pop-up screen).
4. Select the program on the screen to run.
5. Back to MAIN or MENU screen by tapping side panel button.

6.3.3.1 LIBRARY SCREEN WITH BENDING END ANGLE CONTROL



1. Program number and name. Browse programs from the arrow buttons.
2. Program information fields, not available to edit in LIBRARY screen.
3. Search for programs (Tap to open pop-up screen).
4. Select the program on the screen to run.
5. Back to MAIN or MENU screen by tapping side panel button.
6. Bending end angle setting

6.3.4 MANUAL SCREEN

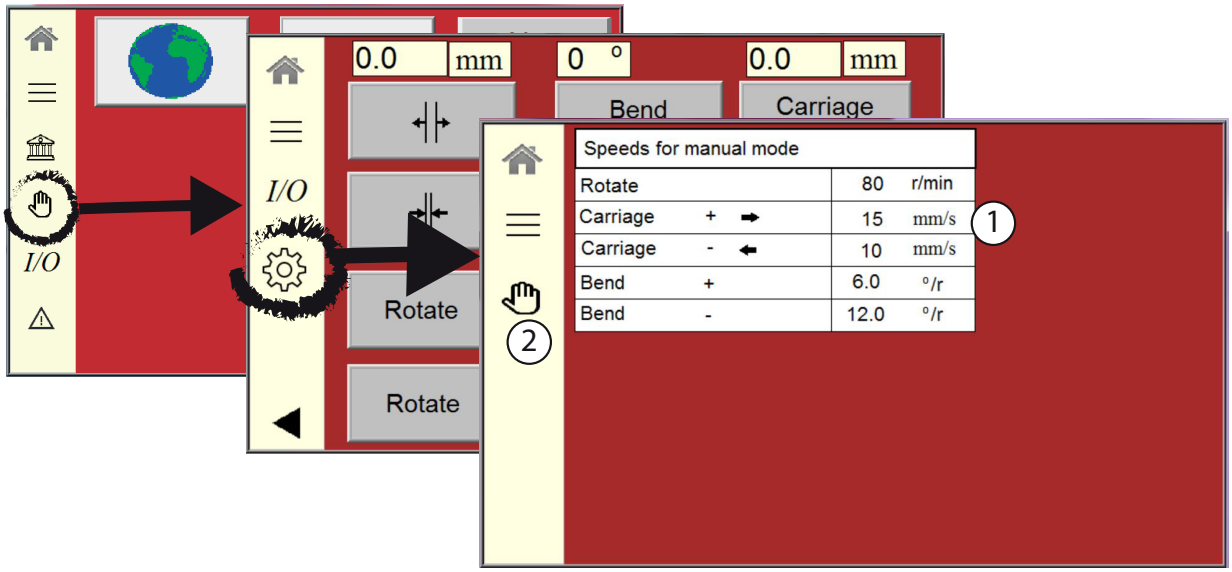


Tap the “HAND” button on side panel to enter the “MANUAL” screen.

1.	Manual clamps movement: Tap button to activate which movement to drive, open or close, and drive the clamps by the two-hand control buttons.
2.	Clamp position in mm (or inch)
3.	Forming pin angle adjustment (“Bend +” button will increase the angle).
4.	Forming pin position in degrees. When the reading is 0°- the pin is in its horizontal position.
5.	Move the carriage manually (Press “Carriage+” to move the carriage backwards from the clamps. (For home position setting, see 6.3.4.2 Home position of carriage).
6.	Carriage distance in mm (or inch) from home position! (For home position setting, see 6.3.4.2 Home position of carriage).
7.	Rotation of the flanging unit.
8.	Tap to go to speed adjustment screen (6.3.4.1) for manual drive

For movement speed settings see 6.3.4.1 Speed adjustment screen

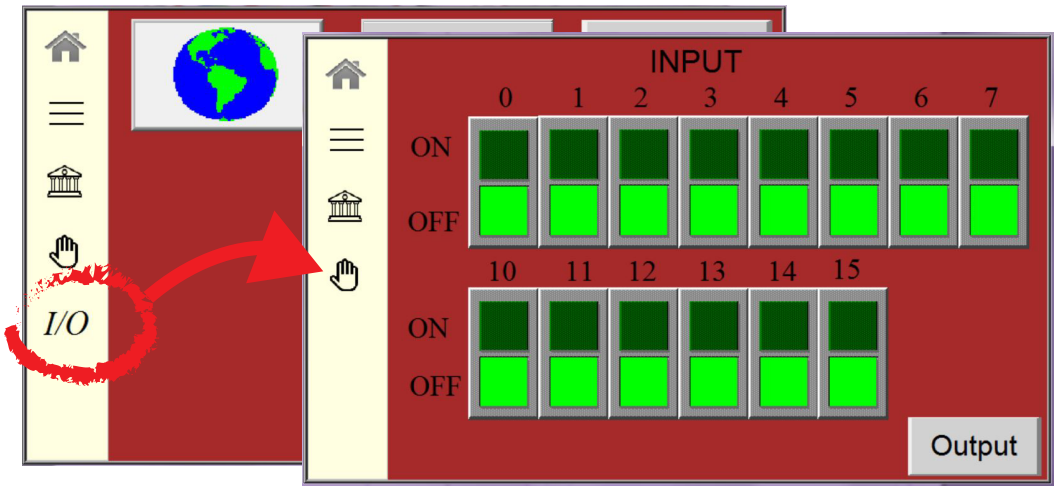
6.3.4.1 SPEED ADJUSTMENT SCREEN FOR MANUAL DRIVE

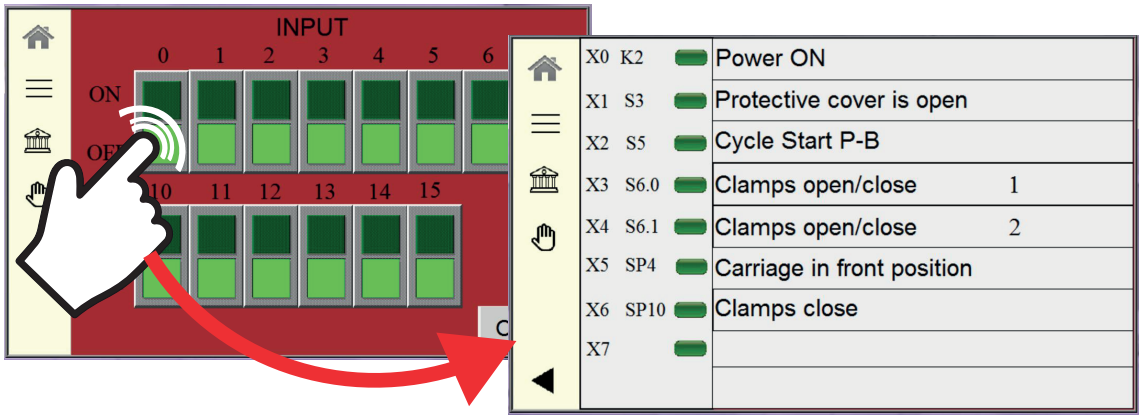


1.	Tap setting value field to open keypad; set desired speeds for manual drive. (Note: Machine has factory preset values and factory set limitations for speed values!)	
2.	Tap “HAND” button to return to “MANUAL SCREEN”	

6.3.5 I/O SCREEN

The I/O -screen shows the actual outputs and inputs. Helps with Troubleshooting.

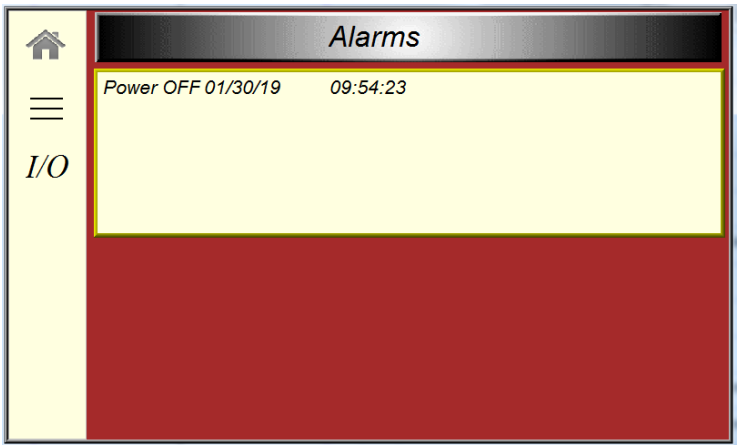




Tap a certain input “light” to see details of the functions.

Tap “Output” button to investigate outputs.

6.3.6 ALARMS SCREEN



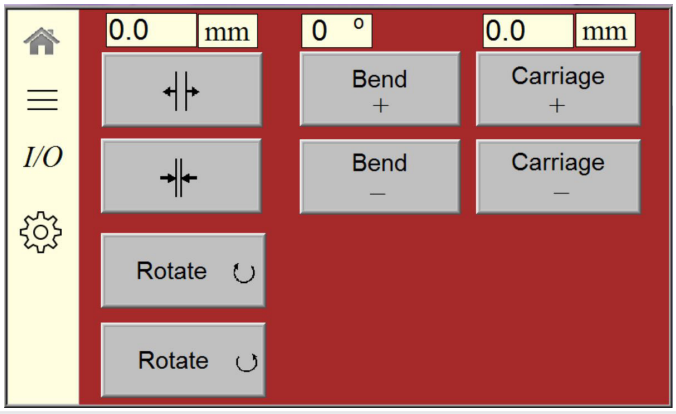
Helps with Troubleshooting.

6.4 THE MACHINE SETTINGS

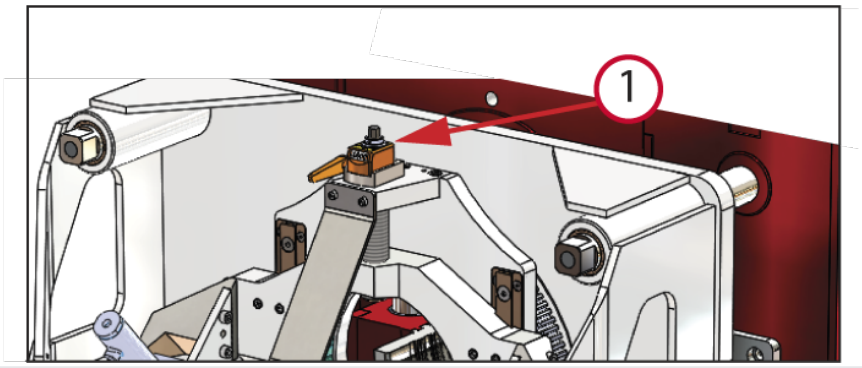
6.4.1 CHANGE THE PIPE DIAMETER

ⓘ DANGER! THE MACHINE CAN NOT BE RUN WITH THE COVER OPEN! ROTATING PARTS. RISK OF A SERIOUS ACCIDENT!

1. On MANUAL screen: drive the carriage to rear position (Carriage “+” movement) and open clamps completely.



MANUAL screen



1. Pin height adjustment scale screw

2. Adjust the forming pin height to fit inside the pipe from the adjustment scale screw.

Open the machine cover. Open the adjustment scale locking from the lever, and adjust the clamp fastener opening diameter from the scale screw so, that the desired size clamp will fit inside the clamp fastener).

3. Change clamps and backstop plates. (See next chapters for instructions).

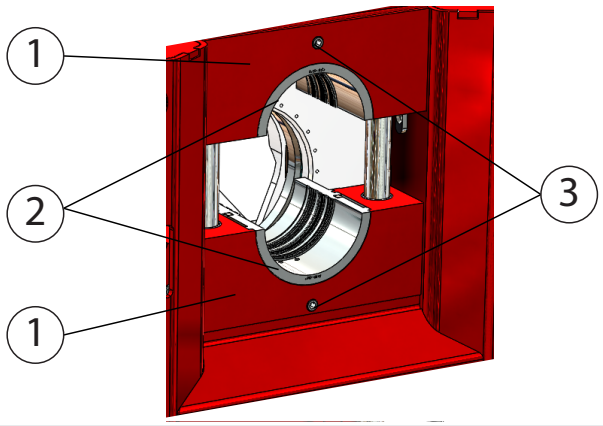
6.4.1.1 CHANGE CLAMPS

ⓘ DANGER! BE CAREFUL NOT TO DROP THE CLAMPS ON YOUR FEET! CRUSHING DANGER!

Open the clamping device jaws and remove locking pins of the clamps.

Remove clamps.

Place new clamps to the machine to the guides in the jaws, fasten with care.

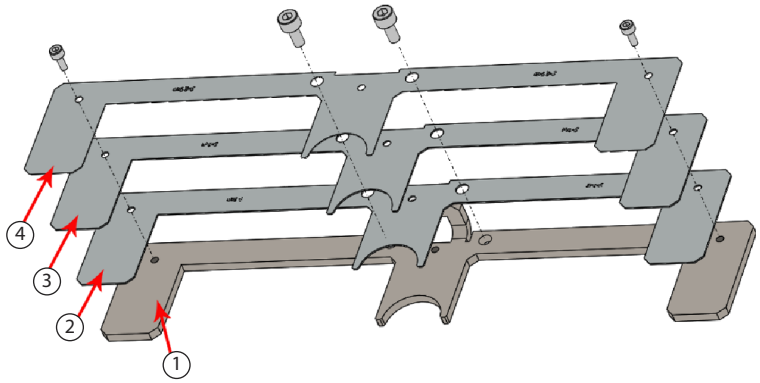


1. Clamping device jaws, 2. Clamps, 3. Clamp locking pins.

➡ NOTE! The clamp locking screws must be screwed completely in! The pin heads must be below the jaw surface.

6.4.1.2 TUBE WALL THICKNESS SETTING BACKSTOP (BUFFER) PLATES

Total Backstop Plate Thickness should ALWAYS be at least -0,5mm thinner than Tube nominal wall thickness !
You can always use Thicker Backstop Plate Setup than listed on table!

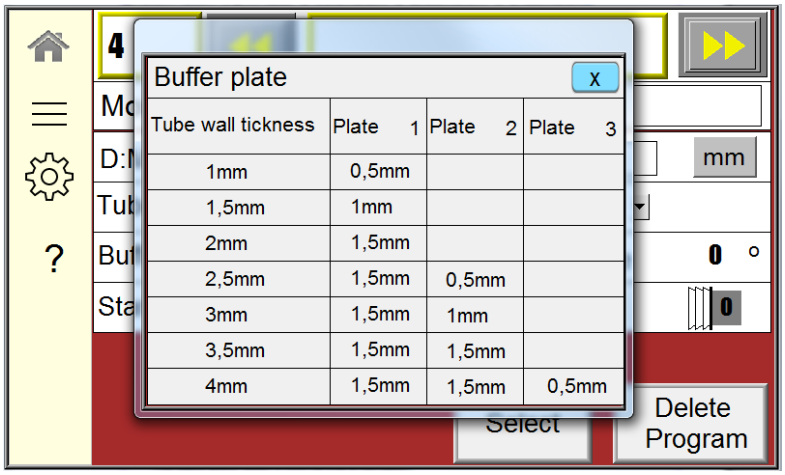


Backstop plates: 1 Base plate, 2. 1st backstop, 3. 2nd backstop, 4. 3 rd backstop

Tube wall thickness	Back Stop Base plate	Back Stop Plate 1	Back Stop Plate 2	Back Stop Plate 3	MIN TOTAL THICKNESS
1 mm	Always installed	0,5mm	0	0	0,5mm
1,5 mm	Always installed	1,0mm	0	0	1,0mm
2 mm	Always installed	1,5mm	0	0	1,5mm
2,5 mm	Always installed	1,5mm	0,5mm	0	2,0mm
3 mm	Always installed	1,5mm	1,0mm	0	2,5mm
3,5 mm	Always installed	1,5mm	1,5mm	0	3,0mm
4 mm	Always installed	1,5mm	1,5mm	0,5mm	3,5mm

The backstop plates have the thickness value engraved on them. Always change both backstop plates!

The table can be found on “New program”-screen, tap “?” to open pop-up:

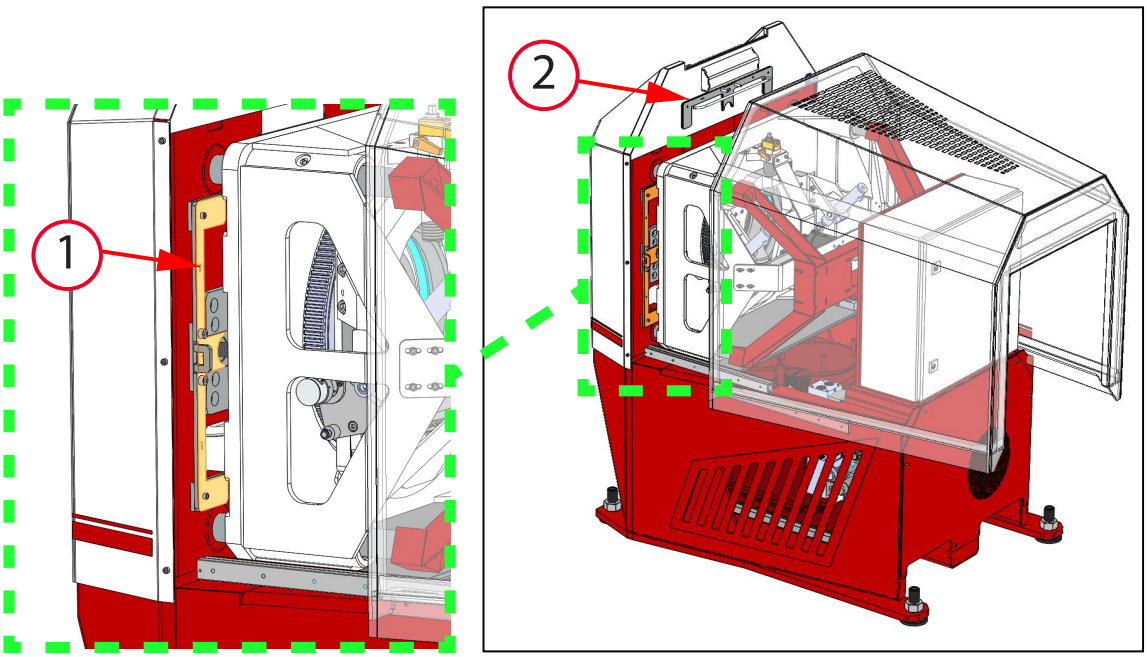


6.4.1.2.1 CHANGE OF THE BACKSTOP PLATES

Select backstop plates according to the pipe wall thickness. The backstop plates have the thickness value engraved on them. Always change both backstop plates! The backstop plates have a depository inside the machine cover.

- Switch power off from the machine main switch.
- Open machine cover.
- Open the fastening screws of backstop plates and replace plates to both sides of the machine, fasten with care.
- Close machine cover and switch on power from the main switch.

➡ NOTE! Always secure the extra backstop plates to the rack with the screw!

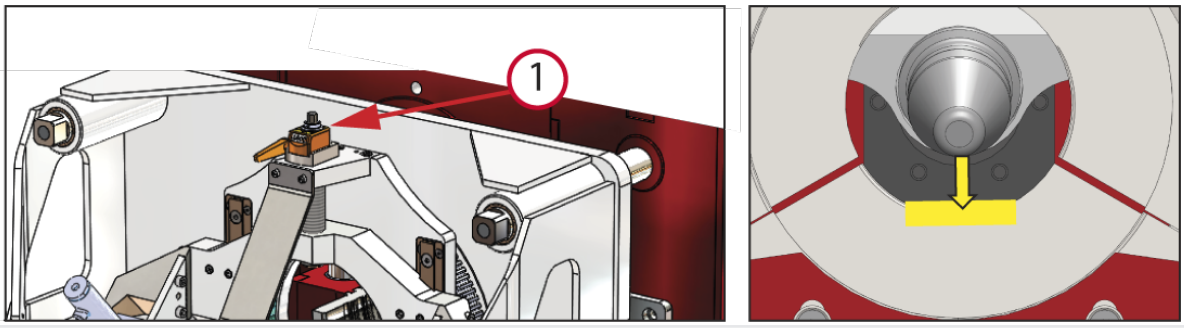


1. Backstop plate, 2. Extra backstop plates on the depository rack.

Where to type the buffer plate value: See 6.3.2.3 New program screen

6.4.1.3 ADJUST THE FORMING PIN HEIGHT TO MATCH PIPE WALL THICKNESS

1. Make sure, that the forming pin is in horizontal position ”0° Bend –“.
2. Place a piece of pipe to the clamps, push the pipe far enough for the forming pin to enter fully to the pipe. Close clamps.
3. Adjust the forming pin to touch the pipe surface by the diameter adjustment scale. (Lock the adjustment screw from the lever!)

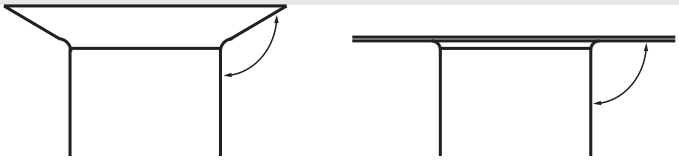


1. Adjustment scale and screw.

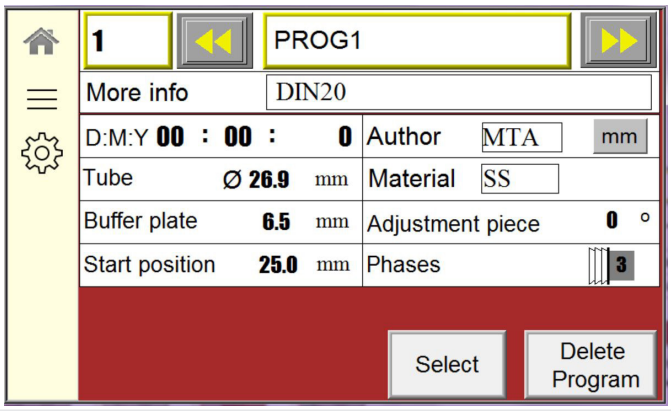
Test a new program and pipe material / size to a scrap pipe after the settings. Increase adjustment if required.

6.4.1.4 SETTING THE ANGLE OF THE FLANGE (OPTION)

ⓘ DANGER! DISCONNECT POWER FROM MAIN SWITCH BEFORE CARRYING OUT ANY MECHANICAL ADJUSTMENTS OR REPAIRS INSIDE THE MACHINE.



The angle of the flange to be made is adjusted by putting chosen angle adjustment pieces to the flanging unit forming pin frame. Tube material has great influence to the flange forming, and the correct piece size can only be found through testing.

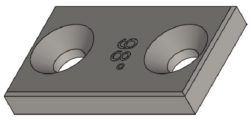
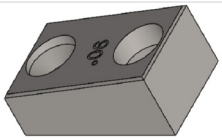


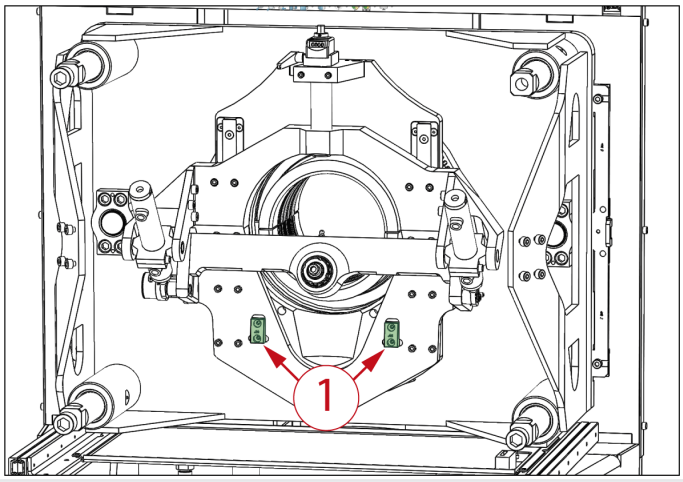
New program screen: Adjustment piece angle value.

The angle adjustment piece angle value has to be set in the program, otherwise the machine will attempt to bend the pipe to the normal bending angle, and the program will be interrupted.

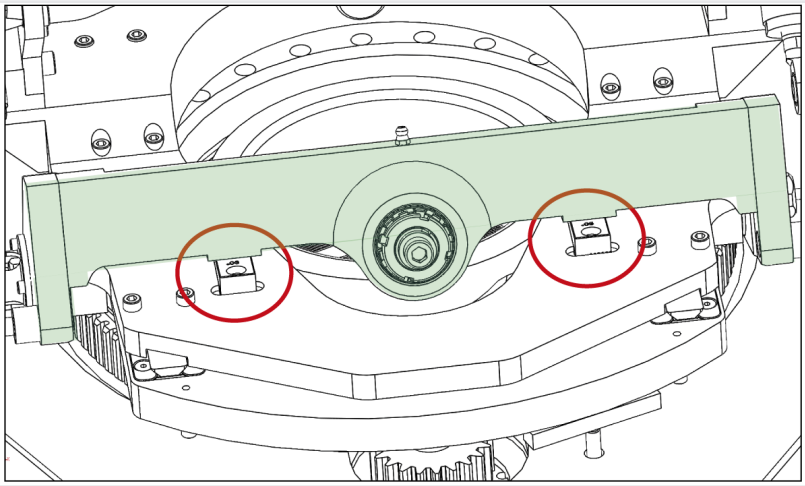
The angle adjustment plates are an optional accessory, and they are chosen by testing with customer pipe materials and sizes. Also, if any other flange angles are desired, the adjustment has to be tested.

The adjustment pieces have an engraved size marking on them. The F-170 machine comes with a set of 2 adjustment pieces and a set of thin adjustment plates.

Description	Order number	Picture
Plate 98°	6380312	
Plate 90°	6380234	
Adjustment plate set	6380453	S=2; 1 ; 0,5; 0,25; 0,1; 0,05mm



1. Angle plates on the machine body. Each fixed with 2 M5x16 socket head cap screws (3mm tool).



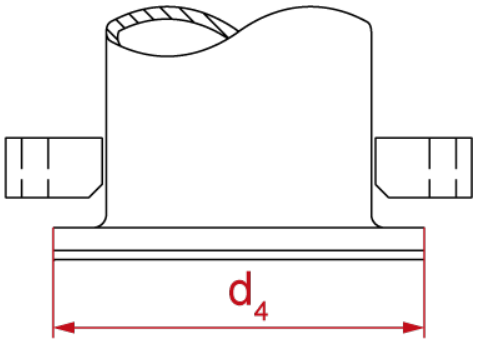
The angle of the flange is mechanically limited with the adjustment plates as the swinging arm leans to the plates, and also an electric limit switch controls the flanging program. It is important to add the angle adjustment piece value to the program settings!

6.4.1.5 SETTINGS OF THE FLANGE WIDTH (TUBE CLAMPING DEPTH)

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

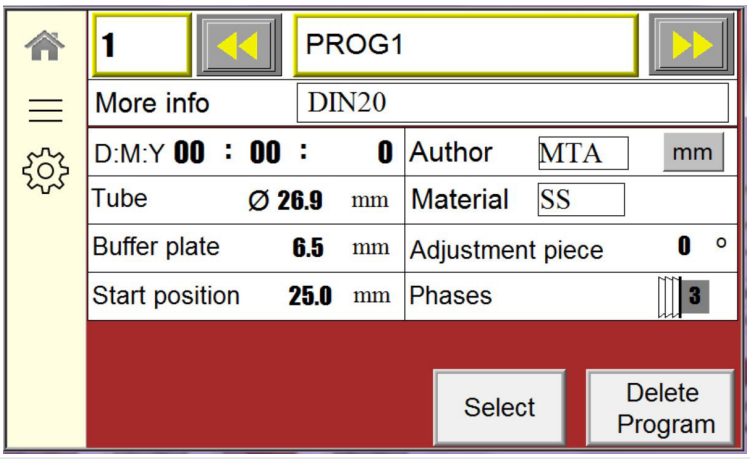
The start position can be calculated using the DIN-table value D4:

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



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.

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. Push the pipe firmly against forming pin.

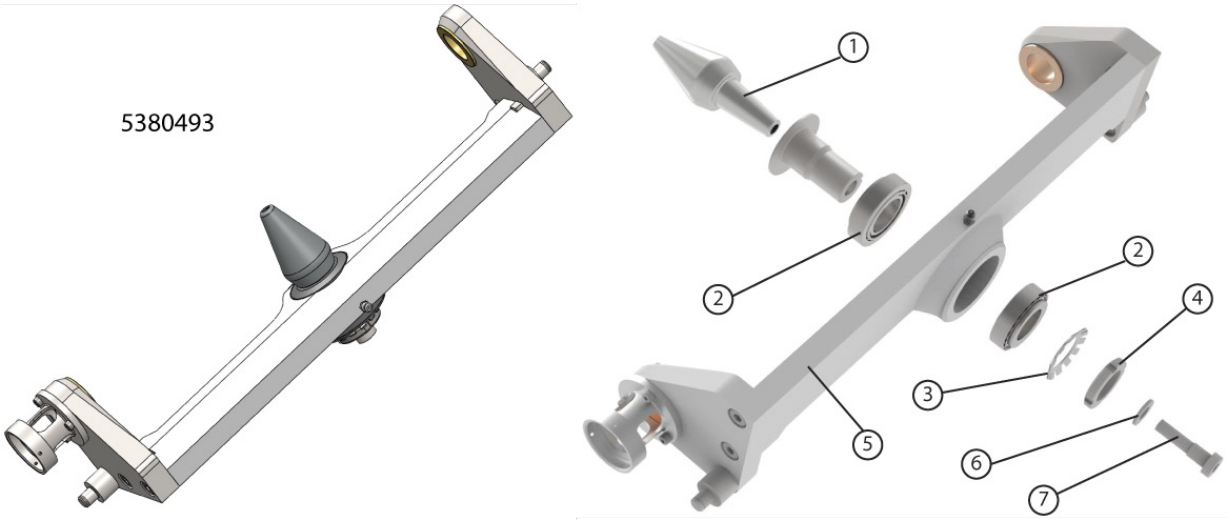


New program screen: Start position value sets the flange width.

The flange width reading is typically in between 25 - 31, the final adjustment depends on pipe material and required flange size, the new pipe program adjustment should be tested on a scrap pipe first.

6.4.2 CHANGING THE FORMING PIN

ⓘ DANGER! DISCONNECT POWER FROM THE OPERATION PANEL AND MAIN SWITCH BEFORE CARRYING OUT ANY MECHANICAL ADJUSTMENTS OR REPAIRS INSIDE THE MACHINE.



Swinging arm assembly 5380493: 1. Forming pin, 2. Bearing, 3. Spring washer, 4. Lock nut, 5. Swinging arm, 6. Washer, 7. Fastening screw of the pin (M10 socket head cap screw, 8mm key)

The pin has a width across flats for a wrench. Hold the pin with a wrench and open the fastening screw 7. Replace pin, fasten with care.

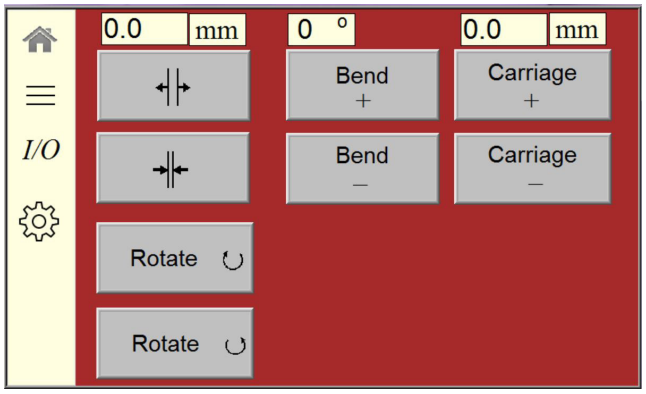
If required to check the bearings: Open the lock nut using a spanner wrench. Check the condition of the bearings every time the pin is replaced.

It is recommended to use separate forming pins for each pipe material.

6.5. WORK CYCLE

➡ NOTE! The work cycle will not start, if the securing cover is open. No machine movements can be run if the cover is open, there is a danger of serious accident because of the rotating parts!

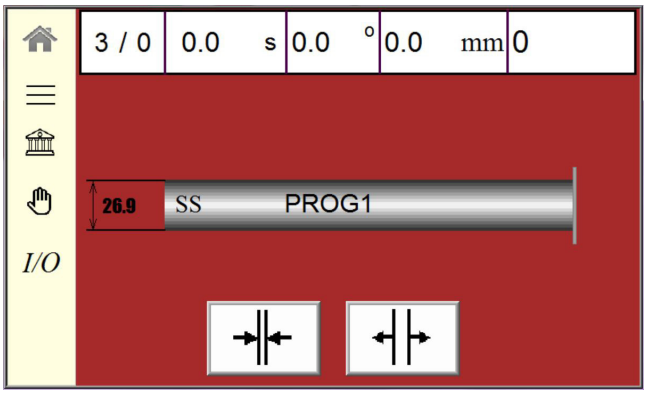
MANUAL MODE



The machine is controlled manually from the control panel. The machine cover must be closed to perform any movements.

All adjustments to the machine are done in manual mode, all movements of the machine are driven in slow speed.

AUTO MODE



Machine control panel on MAIN SCREEN. Program is loaded and settings are done according to the tube size.
The machine is ready for the automatic work cycle. All manual movements are disabled and the carriage is driven to READY position ready for tube insertion. The machine cover must be closed to start the work cycle.

The automatic work cycle:

- Close the safety cover.
- Switch power ON.
- Load the correct flanging program and make tube settings according to tube size.
- Tap “Close clamps” button on the main screen and push both two-hand control buttons to close clamps to SETUP position, the carriage moves forward at the same time. (Follow the popup instructions on the display!)
- Push the tube against the forming pin which operates as a backstop, and close the clamps with two-hand control button.
- Push the “CYCLE START” button.
- The machine will perform the work cycle according to the program and stop.
- Open the clamps: tap “open clamps” button on the operation panel (lits green), and push the two-hand control button to release tube.
- Remove the flanged tube from the clamps.

- For a new work cycle: Push the two-hand control buttons simultaneously to return the forming pin to horizontal position and the carriage is positioned to the tube specified length, ready to receive new tube.

The work cycle routine (the operation panel has information and instructions about every step of the work cycle):

- The bending cylinders start “-” movement, to bend the forming pin to horizontal position.
- The carriage cylinders drive the “-” movement to the fixed limiters and activate the limit switch.
- The rotation motor switches on, and rotates the flanging unit clockwise (~60 r/min)
- The bending cylinders start “+” movement, to bend the forming pin around the bending point.
- When the bending cylinders reach the limit, the bending movement will stop, and device returns to the 0-angle to continue to next phase from there.
    - The movement control devices are pressure limit switch and an angle sensor.
    - When the flanging is done in 2 or 3 phases, the bending stops at intermediate angle (chosen by the operator) and returns to the 0-angle to continue to next phase from there.
- The carriage cylinders start to move to “+” position (x-axis movement).
- The rotation stops immediately when the forming pin disengages from the flange surface.
- The work cycle is finished when the carriage reaches the rear limit (the “+” movement stops).

6.5.1 FLANGING OF SMALL TUBES ø26 AND ø33

➡ NOTE! The machine starts the works cycle by starting to drive the rotating pin into the pipe, and carriage movement stops for 1 second to allow machine to rise the hydraulic pressure to working state. The work cycle continues automatically.

6.5.2 ATTACHING THE TUBE TO THE F-170 FLANGING MACHINE

It is highly recommended to use separate tube supports under the tube to be flanged when ever it is possible.

Always use separate tube supports when flanging tubes longer that 600 mm.

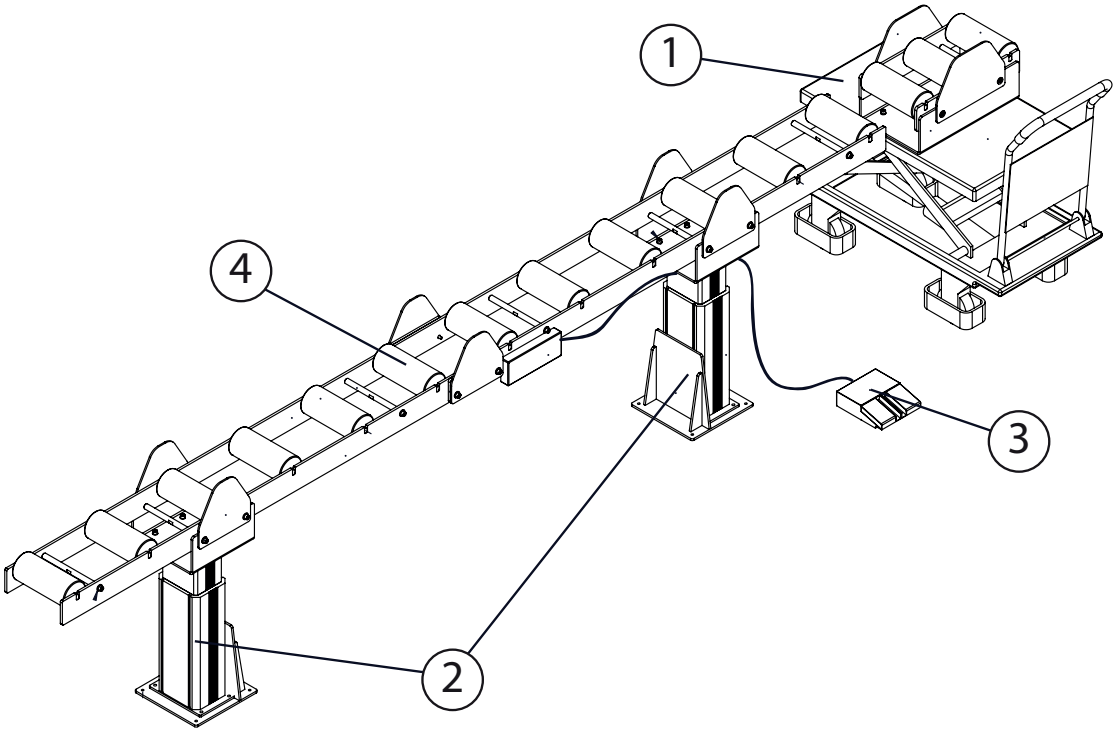
Never use a feeding table as the only support for the tube when flanging.

➡ NOTE! A long tube requires to use at least two separate tube supports.

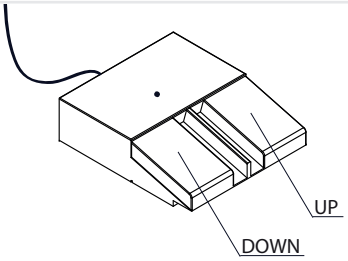
The tube support height is adjusted so, that the tube is easily slid into the machine from the supports, the long tube is set to the supports and aligned horizontally. The longer the tube is, the more separate supports it requires.

➡ NOTE! Never use the lifting crane as the only support for the tube when flanging!

6.6 ROLLER TRACK (OPTION)



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.

6.6.1 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-170 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.**

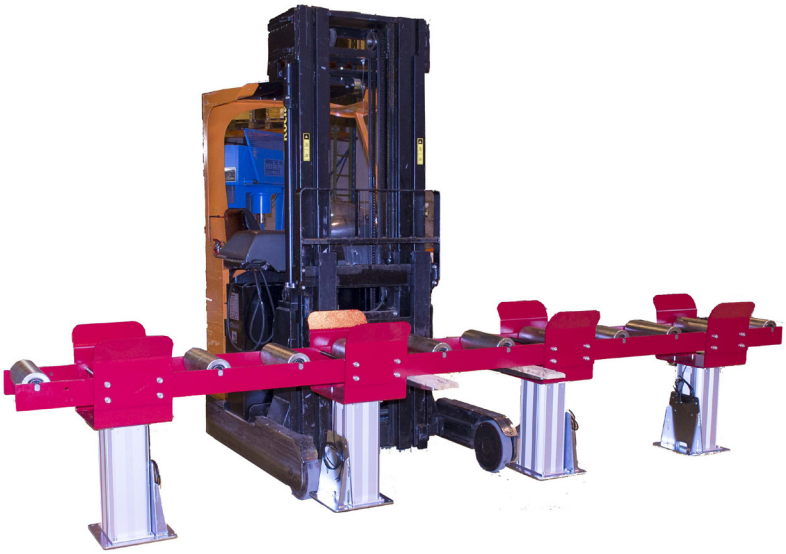
Fasten the roller track to the floor with anchor bolts. Use M8 x 50…80 bolts, chemical anchors are highly recommended to use.

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.

ⓘ DANGER! 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.

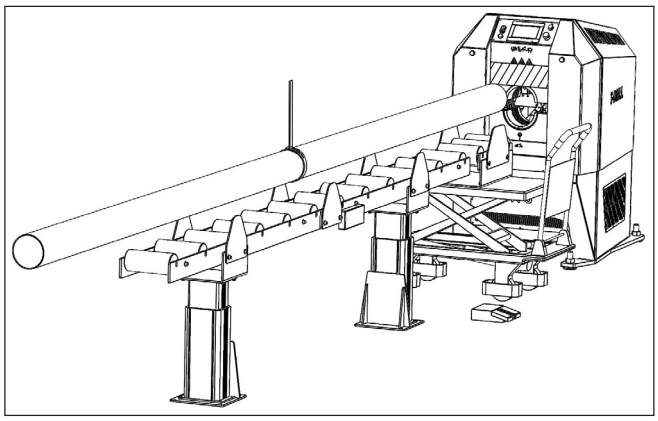
If necessary the track can also be moved using a crane and lifting straps. Place straps with care.

6.6.2 HOW TO USE THE ROLLER TRACK

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

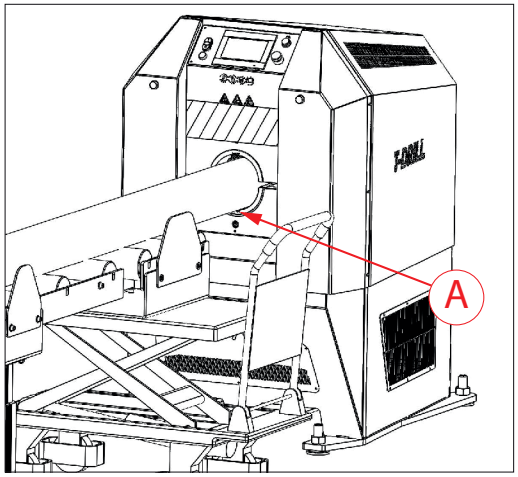
The pipe is lifted to the roller track using a crane and lifting straps.

(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. (A = 5-25 mm).

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

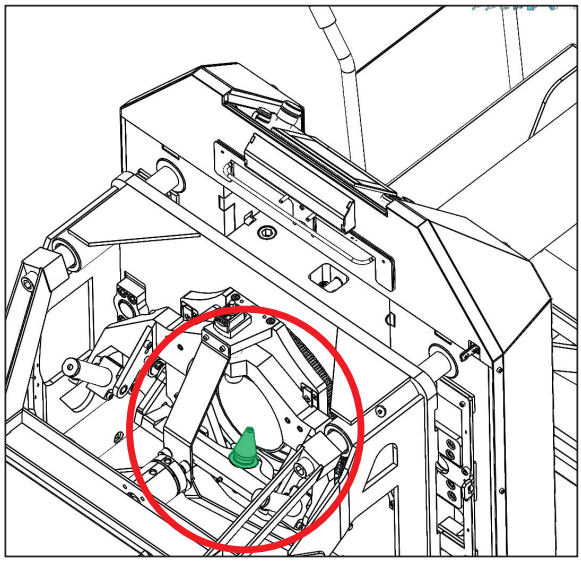


➡ NOTE! The pipe must be lowered to the roller track in a controlled manner to avoid damaging the track. A falling track will cause a high risk of injury!

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!

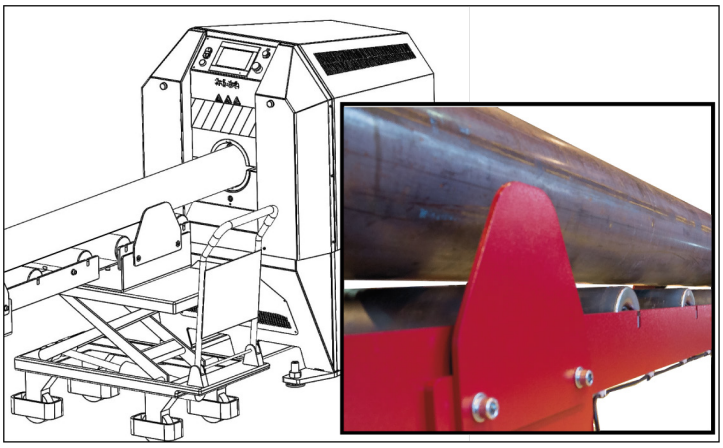
Check that the pipe does not press the roller track (if the pipe is not straight, the end of the pipe may press the track when clamps are closed).



➡ 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-170 clamps hold the pipe, and there is a gap between the roller track and the pipe.



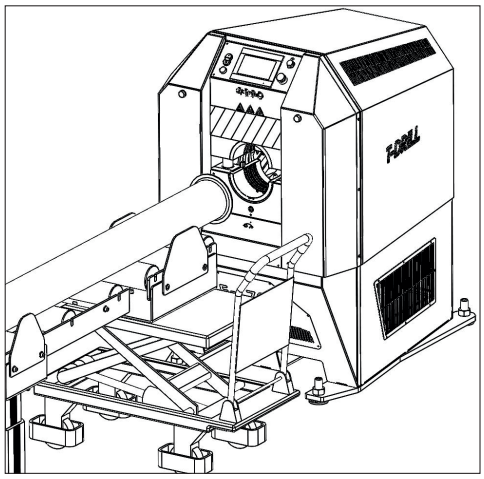
Start work cycle.

When the work cycle is done, stop the machine.

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

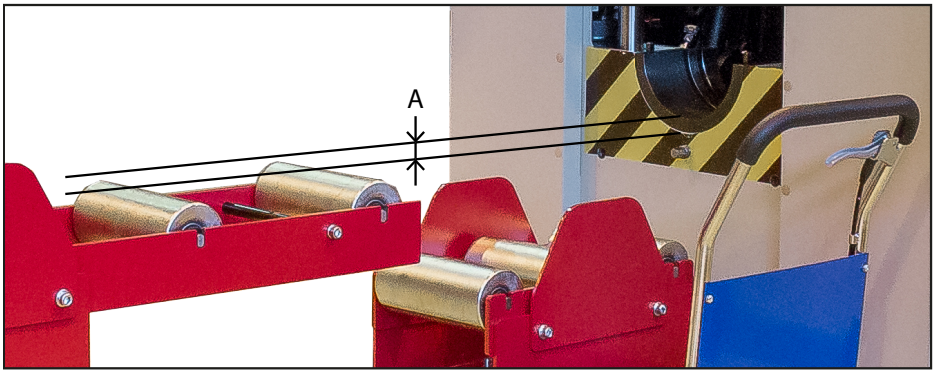
Use the lift trolley to detach the pipe from the clamps.

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):

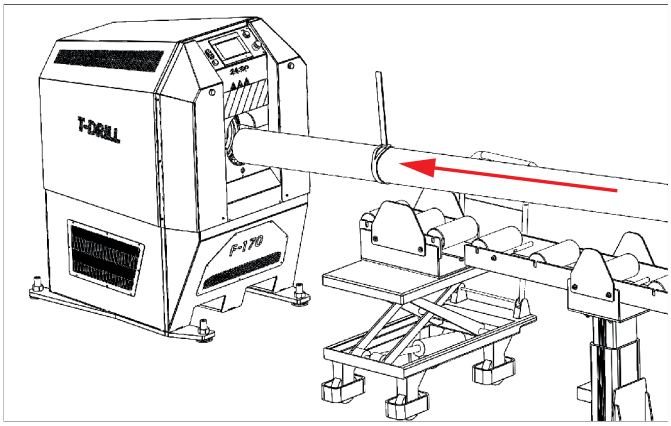


Lift the pipe with a crane to the roller track, use a lifting strap.

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

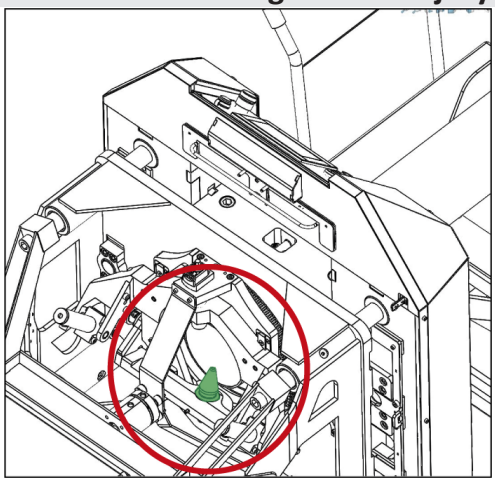
Move the lifting strap behind the mass centre to tilt the pipe. Lift the pipe with the crane a bit.

Lower the pipe to the machine aslant towards 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!

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.



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

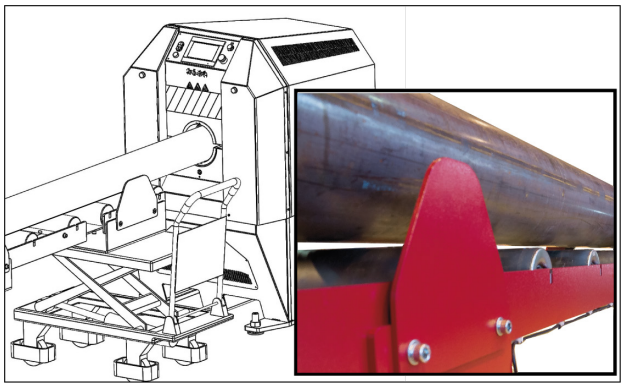
Lower the pipe down towards the roller track (keep still supported by the strap), and start closing clamps slowly.

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-170 clamps hold the pipe, and there is a gap between the roller track and the pipe.

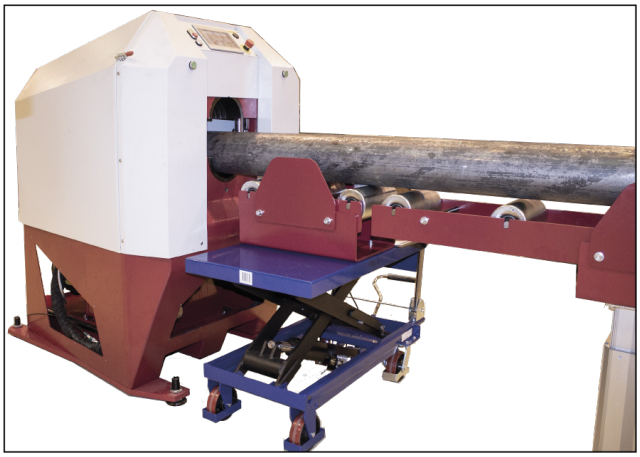


Run the work cycle as required.

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

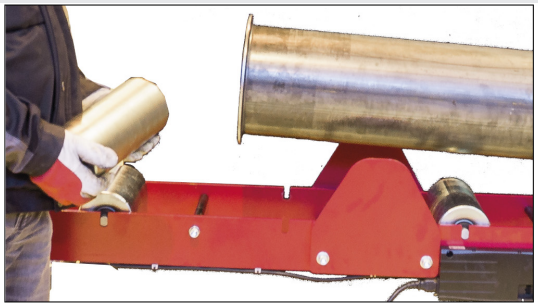
Use the lift trolley to detach the pipe from the clamps.

Do not lift too much, check that there is enough room between clamps to take the flange out.



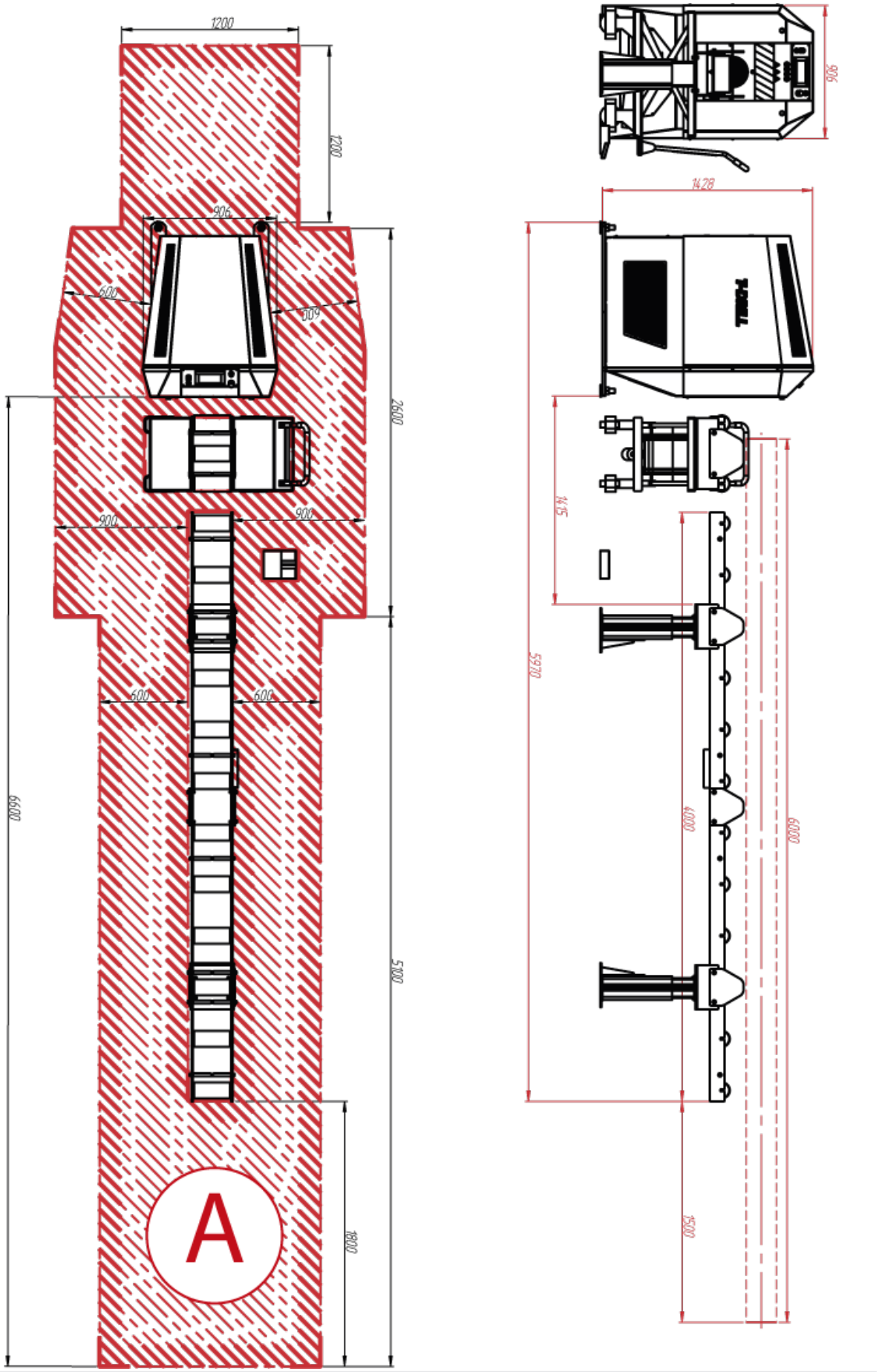
➡ NOTE! Always lock the wheels of the lifting trolley before moving the pipe to the roller track!

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



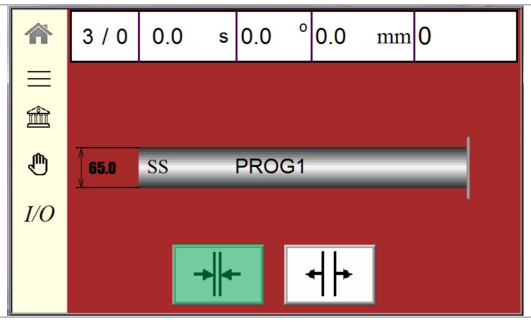
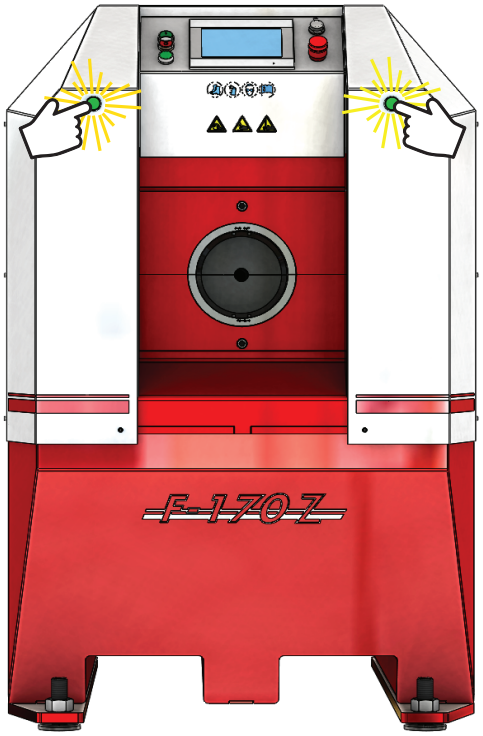
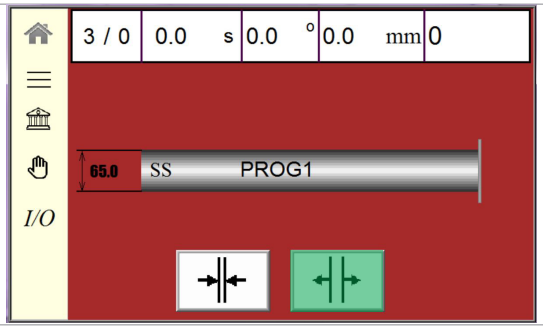
The roller track can handle pipes Ø 20 mm ... Ø 219,1 mm.

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



Layout and safety area F-170 with roller track

7. QUICK INSTRUCTIONS FOR FLANGING WITH F-170

	Adjust tube diameter and flange length. Load the correct flanging program to the machine. Close clamps partly: tap “close clamps” button on the operation panel (lits green).
	Push both two-hand control buttons simultaneously to run the clamps to READY position. Place the tube to the clamps and push it towards the forming pin. Close the clamps with two-hand control button (just one button will close the clamps).
	Tap “cycle start”. The machine will stop automatically when the flange has been made according to the programming.
	Open the clamps: tap “open clamps” button on the operation panel (lits green), and push one two-hand control button to release tube. Remove the flanged tube from the clamps.

8. MAINTENANCE

ⓘ DANGER! DISCONNECT THE ELECTRIC CURRENT SUPPLY TO THE MACHINE BEFORE PROCEEDING TO THE MAINTENANCE ROUTINE - UNINTENTIONAL STARTING OF THE MACHINE MAY CAUSE A SERIOUS ACCIDENT OR DAMAGES TO PROPERTY.

8.1 DAILY CARE

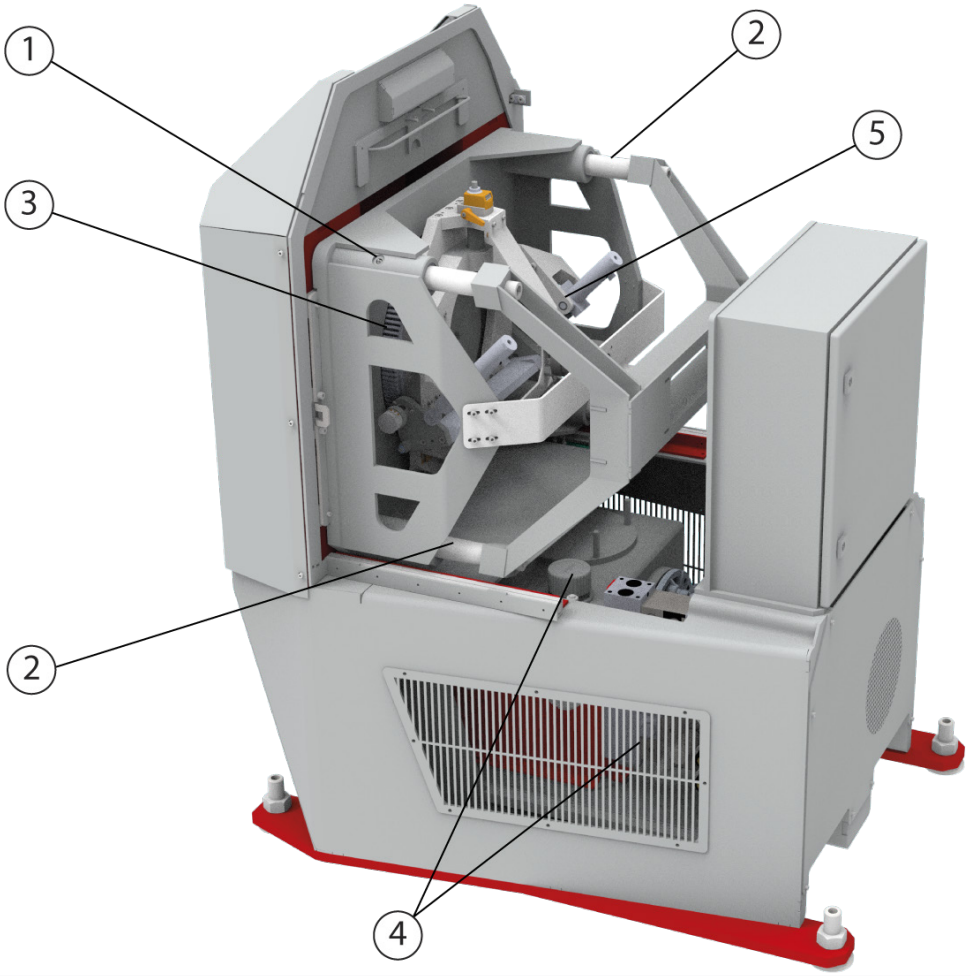
Wipe the machine clean daily, check for oil leaks.

Wipe slide guides with lint free cloth every time chips or debris appear on them.

Clean and check clamp frame and clamps on every clamp change.

Wipe the clamp surfaces clean before use to avoid markings on tube and slipping of the tube during flanging.

8.2 FORMING UNIT MAINTENANCE



1. & 2. Flanging unit bearings and slides, 3. Rotation motor gear wheels, 4. Hydraulic system and hoses, 5. Flanging unit maintenance

1. & 2. FLANGING UNIT BEARINGS AND SLIDES

Lubricate the slide bearings of the flanging unit through the grease nipple every six months, or 1000 flanges made.
If there is too much free play in the slide bearings, they must be replaced (contact T-Drill service). The excess free play can be noticed when adjusting the diameter of the tube.
Lubricant: Use, for example: DIN 51825 KP 2K or NLGI 2, EP-grease, lithium complex, 40°C 190cSt, -20…+120°C. E.g. Shell Alvania EP2 or equivalent

3. ROTATION MOTOR GEAR WHEELS

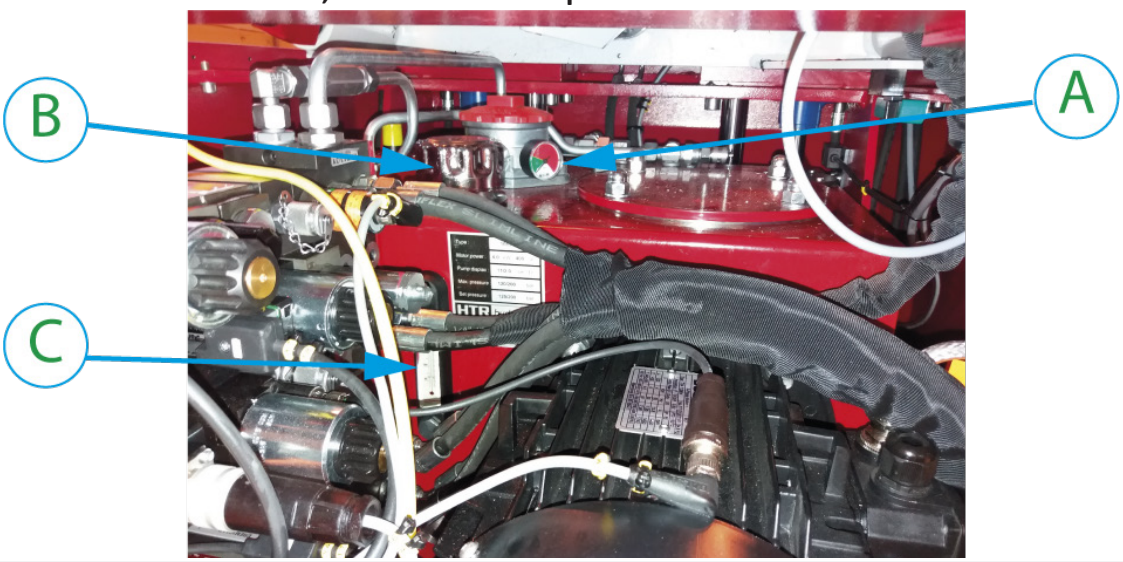
Lubricate and inspect wear on the gear wheel once a month. Apply a thin layer to all gear wheels using a brush.
Lubricant: For example Klüber Isoflex Topas NB2 or equivalent.

4. HYDRAULIC SYSTEM AND HOSES

See separate HTR manual for details. The manual PDF is on the memory stick delivered with the machine.

- Check hydraulic oil level occasionally.
- Observe surface and temperature alarms on display.
- Observe leaks: Check all hoses, tubes and joints for leaks, wear and tear occasionally
- Observe pressure
- Observe for damage caused by external factors

Oil temperature and amount are both on the same gauge, which is located on the rear side of the oil container, behind the valve pack.

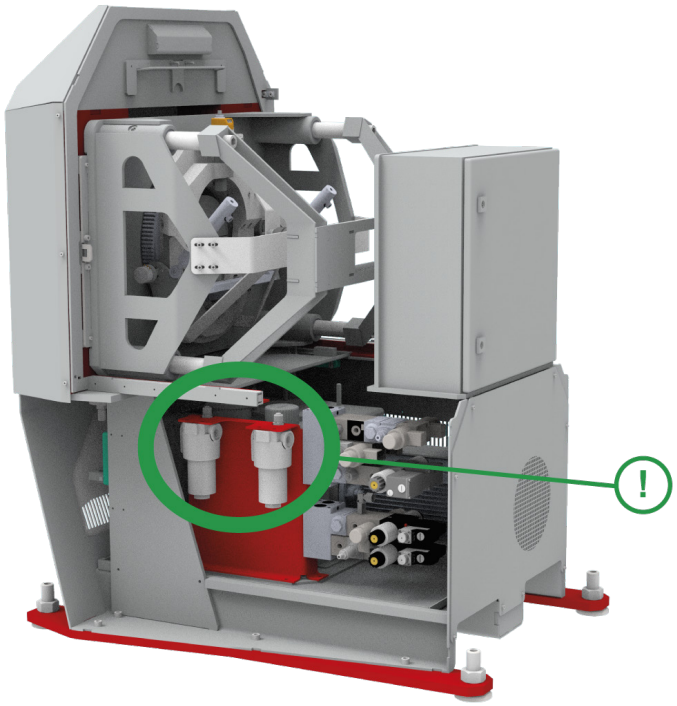


Hydraulic oil container (pictured from behind the machine): A. Oil pressure gauge, B. Oil refill cap, C. Oil temperature / amount gauge

Selecting of the hydraulic oil:

In a hydraulic system the oil used is according to the ISO VG 15-100 class, generally VG 32-68 depending on the utilization temperature. When utilization temperature is +20...+60 °C the viscosity of the oil needs to be in the following area 13...100 cSt, optimum area 16...36 cSt.

Oil filter indicators

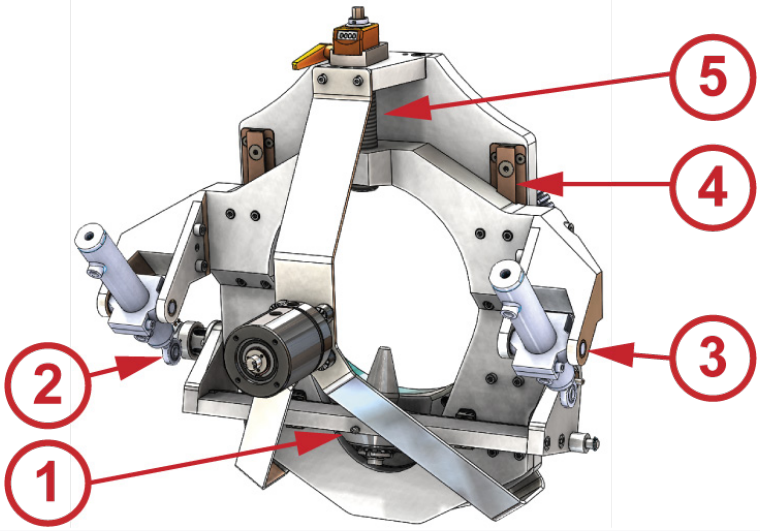


! Hydraulic unit filters with indicator on top

Check oil filter indicators occasionally. The indicators are positioned on top of oil filters, under yellow plastic cover cups. Remove cup to see indicator, use a mirror for viewing. If the indicator is green, oil is clean, if the indicator is red, oil needs to be changed (contact T-Drill service).

➡ NOTE! Do not touch the three choking valves inside the machine, those are preset at the factory to guide simultaneous movement of the clamp locks.

5. FLANGING UNIT MAINTENANCE



1. Lubricate the forming pin through the grease nipple with grease gun, 2. Check joints for wear and tear occasionally, 3. Check bearings for wear occasionally, 4. Wipe slides clean, lubricate with spray grease, 5. Wipe thread clean occasionally, lubricate with spray grease.

1. Lubricate the forming pin through the grease nipple once a week. Wipe excess grease away.

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.
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 0.1mm and the axial play may not exceed 0.2mm. If necessary, replace the bearings.

2. Check joints for wear and tear occasionally

3. Check bearings for wear occasionally

4. Wipe slides clean occasionally, lubricate with spray grease

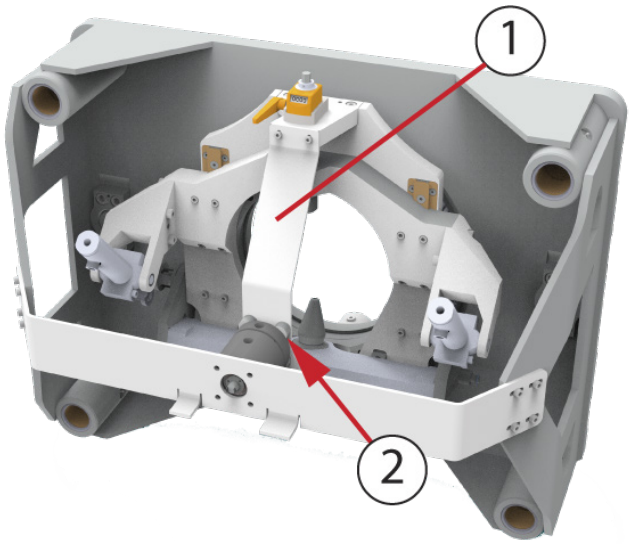
5. Wipe thread clean occasionally, lubricate with spray grease

(Spray grease: For example Würth HHS-2000)

8.3 OTHER MAINTENANCE POINTS

Main frame of the machine

Check the vibration dampers of the support frame regularly.

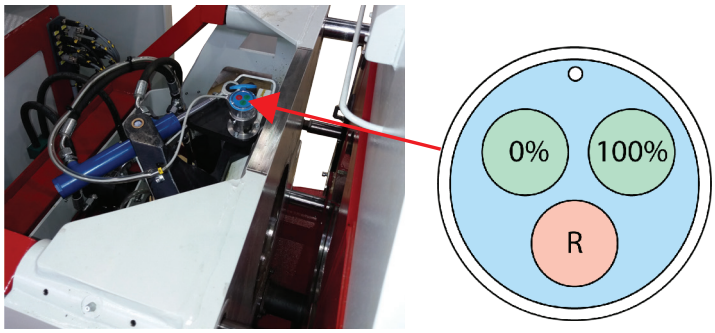


1. Support frame, 2. Vibration damper

All component manuals mentioned in the manual are only in PDF format, saved on the USB-memory stick delivered with the machine.

8.4 SETTING OF THE ANGLE SENSOR

If the angle sensor has to be removed or replaced, the start and end positions have to be reset.



All angle adjustment plates have to be removed before starting to make settings of the angle sensor (Angular Position Transducer). The setting is not accurate with adjustment plates!

1.	Rotate the flanging unit to a position, where the sensor can be reached. Rotate using the “MANUAL” screen functions, or by hand. (See 6.3.4 Manual screen)
Rotate	Press “Rotate” button to rotate flanging unit.
2.	When the spindle rotated to a suitable position,run the bending cylinder to “minus” direction from the “MANUAL”-screen as far as it goes.
Bend −	Press “Bend -” button to move flanging unit.
3.	Open the machine cover and set the 0-position to the angle sensor: • Program mode ON: Press quickly 2 x the red “R” button R R • Drive transmitter to initial position program 0%: Press quickly 1 x left green button “0%” 0% Now the start position is set. Close the machine cover.
4.	Run the bending cylinder to “plus” direction from the “MANUAL”-screen as far as it goes.
Bend +	Press “Bend +” button to move flanging unit.
5.	Open the machine cover and set the 100%-position (flanging ready position) to the angle sensor: • Drive transmitter to final position program 100%: Press quickly 1 x right green button “100%” 100% • Program mode OFF: Press quickly 2 x the red “R” button R R Now the end position is set. Close the machine cover.

9. TROUBLESHOOTING

Problem	Cause	Remedy
Tube does not remain in its place during flanging	Clamping force insufficient	Check the clamping. Is the tube undersized?
	Wrong size of clamps	Install clamps of correct size
The clamping device is hard to close	Wrong size of clamps	Install clamps of correct size
	The tube is oversize or tube is not round.	The tube must fit properly to the clamps, oversize tube cannot be flanged.
Quality of the flange is not good: The forming pin does not rotate during flanging (The quality decreases if the pin does not rotate, the process requires more force)	The tube diameter adjustment is too tight	Adjust the forming pin towards the center from the surface
	The forming pin bearings are damaged	Check the bearings and replace if the pin does not rotate properly
The flange quality is not good	Wrong diameter adjustment	Check adjustment
	Swinging arm bearings are damaged	Check bearings
The forming pin breaks	Unsuitable material	Check the capacity table (contact T-Drill)
	Wrong diameter adjustment	Check adjustment
The automatic work cycle does not start	The safety cover is open	Close the safety cover
	The clamps are open	Close clamps, follow instructions on chapter 6.4.
The flange has ripped during flanging	The cut edge was uneven.	Pay attention to cutting of the tubes, clean all burr from the cut surface before flanging.
	Faulty adjustment	Check forming pin adjustment. Test
	Uneven material of the tube	Test to flange using multiphase

Problem	Cause	Remedy
Flange size varies on a set of tubes the same size	The tubes slip on clamps	Check the tube sizes, oversize / undersize?.
The machine does not start	Power?	Check the power supply and main switch.
	The safety cover is open	Close the safety cover
		The cover limit switch is broken.
The machine does not complete the flanging. The angle reading doesn't match the formed flange. The reading is not 0° when the pin is in horizontal position.	Angle detector fault	Contact T-Drill service
		See for angle detector reset from separate manual.
	The angle adjustment pieces are assembled to the flanging unit forming pin frame, but the value is not set in the program. (6.4..1.4. Setting the angle of the flange)	The angle adjustment piece value has to be set in the program, otherwise the machine will attempt to bend the tube to the normal bending angle, and the program will be interrupted.

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 if available:

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

10. DISPOSAL OF THE T-DRILL MACHINE

Various kinds of metals, plastics and lubricants have been used in the manufacture of the T-DRILL machines. Dispose of your T-DRILL machine according to federal, state and local regulations.

11. 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.

LIMITATION OF LIABILITY

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.

12. ORDERING SPARE PARTS

When ordering spare parts, please state the following details:

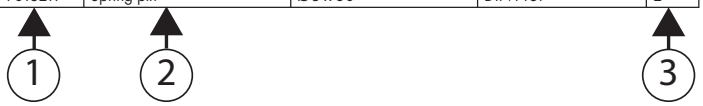
- Type code of the machine
- Manufacturing code of the machine
- The part number
- A description of the part
- The quantity of the parts required

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	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, make a copy of the Service Sheet, fill it out and fax or mail it, or send an e-mail.

To 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

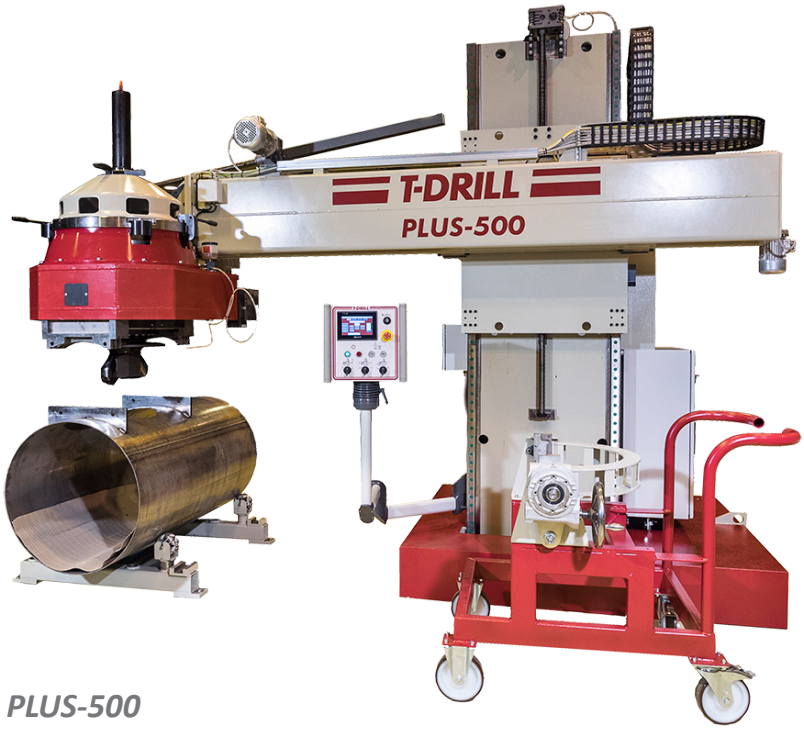
More T-DRILL products for tube fabrication

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 Ø 273 – unlimited, and collaring range mainly Ø 219 - Ø508 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