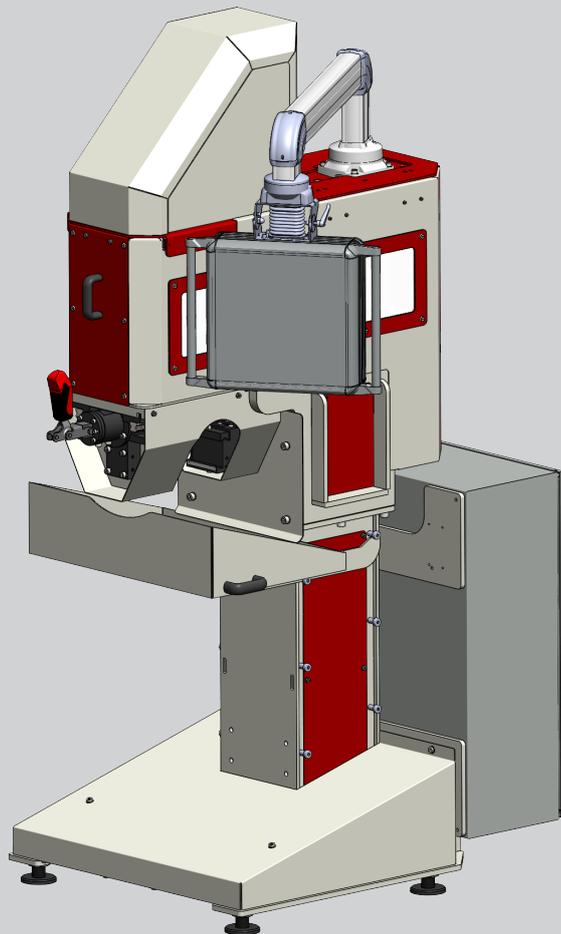


T-DRILL

PRODUCTIVITY AS A PRODUCT.

INSTRUCTION MANUAL



COLLARING MACHINE

S-56

Version

6580357EN
05.10.2021 / MT

Original instructions

Instruction manual for set-up, operation and maintenance of the S-56 collaring machine.

Type code : 5801

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

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

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1. NOTES ON THE USE OF THE INSTRUCTION MANUAL

1.1 GENERAL

This manual contains the instructions for use, maintenance and setting of the different models of T-DRILL's S-56 Collaring Units, as well as recommendations regarding the use and choice of the collaring heads.

Before proceeding with the installation or operation of S-56 collaring machine, read the general safety instructions in chapter 2

If the S-56 collaring machine forms part of a system supplied by T-DRILL, then also the general safety instructions related to the other appliances should be studied before use.

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

1.2 SYMBOLS FOR WARNING AND DANGER USED IN THIS MANUAL

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

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

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

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

1.3 SYMBOLS AND WARNINGS USED IN THE MACHINE



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



Electric box. Danger may be caused by electric installation.



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



Use safety shoes when handling pipes and the tools of the machine.



Use protective glasses when operating with the machine.



Always use protective gloves when handling the tools - the cutting edges and the lubricant used may cause wounds and inflammations.



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

1.4 PERSONAL PROTECTIVE EQUIPMENT FOR THE OPERATOR

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



Use hearing protector when operating with the machine.

2. GENERAL SAFETY INSTRUCTIONS

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

The T-DRILL S-56 are to be used only for collaring and drilling in the specific way as described in this manual.

When operating the T-DRILL S-56 it must be fastened on the floor.

When operating the machine, all the covers must be on their places.

Do not exceed the capacity of the machine.

Before removing or mounting a collaring head or a clamp, the electric current supply must be disconnected by pushing the power OFF (O) button in the front panel.

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

Make sure the ventilation is sufficient.

Always use protective glasses when operating the S-56 machine.

Always wear protective gloves when handling the collaring tools.

It is highly recommended to wear hearing protector when operating the S-56 machine.

Study also the safety data sheet concerning the lubricant which is supplied with the machine.

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

When pressing the Emergency switch (STOP-button) all functions of the S-56 collaring machine are immediately interrupted.

If the S-56 collaring machine forms part of a system supplied by T-DRILL, then also the instructions for use related to the other appliances supplied should be read attentively before use.

After installation of the machine and before using the functions of the S-56 collaring unit, carry out the measures described in chapter "start-up checking".

➔NOTE! Always keep this instruction book at hand for any future use.

Use of a flue gas extractor is highly recommended.

The S-56 machines are prepared for adding a hood and a vacuum device for suctioning of vapors from the lubricant, that may be generated in the collaring process. However such device is not included in the T-Drill delivery.

3. GENERAL INFORMATION ON THE S-56

3.1 INTRODUCTION

T-DRILL S-56 is a highly effective collaring machine for producing T-outlets for brazed and welded joints. The machine is designed for both straight and bent tubes. The S-56 produces quality collars up to 54 mm (O.D. 2 1/8") with round pilot hole, and 60,3 mm (O.D. 2 1/4") with an elliptical pilot hole. It is ideal for producing collars in steel tubes, but also suitable for all malleable materials (steel, stainless steel, aluminum, copper & copper-nickel).

Being an Industry 4.0 ready machine utilizing the latest technology, the S-56 is very versatile and easily customized to fit specific customer needs. The machine is easy to program and use, featuring user-friendly GUI Interface with color touch panel, adjustable machining parameters, and fine-tuning of motion profiles.

A wide range of feeding tables and automated systems are available for improved manifold production efficiency.

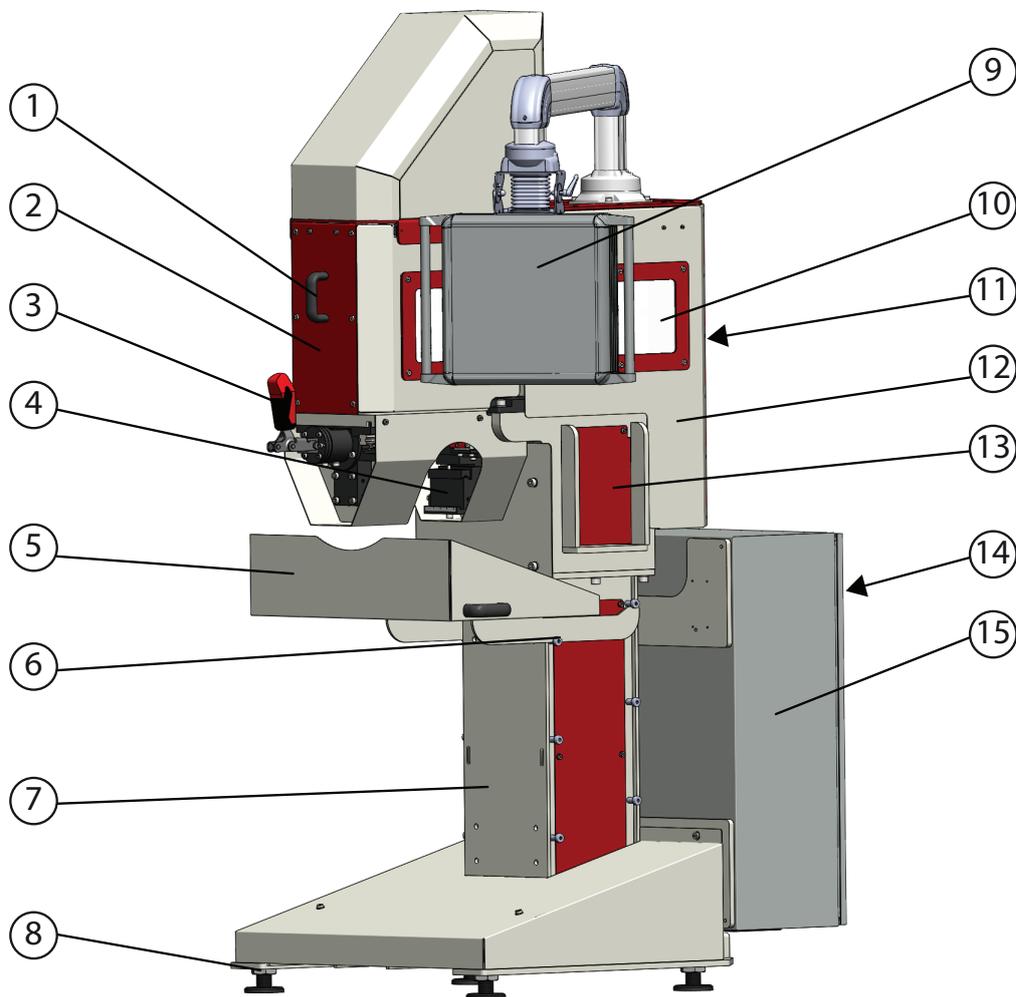
3.2 THE PURPOSE OF THE MACHINE

The T-DRILL S-56 collaring process is fully automated and drilling & trimming process optimized.

The specially designed S-56 collaring heads enables three types of process:

1. Drilling/Collaring/Trimming - Used for butt weld method where branch tube is put on top of collar.
2. Elliptical pilot hole - Used for butt weld method. Elliptical pilot hole is done beforehand with laser, plasma, milling or with punching machine. Enables 1:1 collaring.
3. Drilling/Collaring - Used for lap joint method where branch tube is put inside of collar.

3.3 MAIN PARTS OF THE S-56 MACHINE



1	Front cover handle
2	Front cover
3	Clamping handle of the tube fastener
4	Tube fastener (Manual tube clamp 5580295)
5	Oil and chip tray
6	Chip tray support knobs (see 6.6 Adjustable chip tray)
7	Machine base
8	Machine foot (adjustable to level the machine, fasten machine to floor through machine feet)
9	Control panel
10	Side window: View to the inside of the spindle compartment
11	Rear cover handle
12	Rear cover
13	Side maintenance hatch
14	Main switch
15	Electric cabinet

3.4 TECHNICAL SPECIFICATIONS

	S-56
Type Code	5801
Collar diameter	
- Drilling/collaring	Ø6–54 mm (I.D. ¼"–2 1/8")
- Drilling/collaring/trimming	Ø12–58 mm (O.D. ½"–2 ¼")
- Premade, elliptical pilot hole	Ø17,2–60,3 mm (O.D. ¾"–2 ¼")
Diameter of tube to be collared	Ø8–114,3 mm (O.D. 5/16"–4 ½")
Max. wall thickness	See capacity charts
Materials to be collared	Fe, Stainless Steel, Al, Cu, CuNi
Compressed air supply (basic machine only)	6 bar 87 psi
Consumption of air	55 l/min 14.5 GPM
Rated power	4 kW
Size of fuses	3 x 16 A – 40 A (min–max)
Supply voltage	380–480 V / 50 Hz / 60 Hz 3-phase
Dimensions of the machine	1990 x 800 x 1200 mm
Machine weight, w/o electric cabinet	536 kg 1179 lbs
Noise level	During machining less than 70 dB (A)

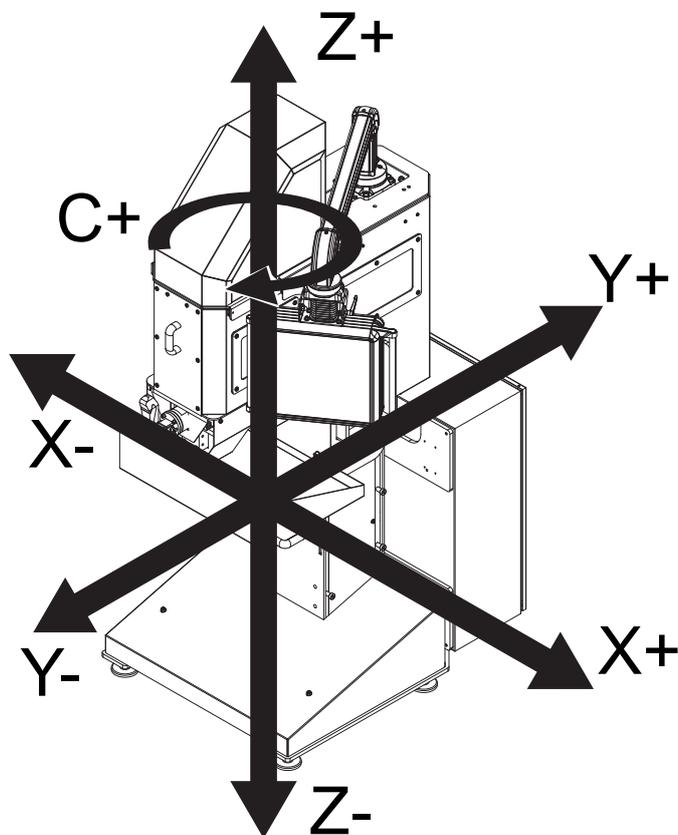
1 bar = 100 kPa

It is highly recommended to wear hearing protector when operating the S-56 machine.

3.5 WALL THINNING AND WORK HARDENING

When forming a collar, it is normal that the wall thickness of the collar will get thinner. Collar forming makes also some work hardening. This should be taken into account while making design of the branch connection and if necessary, the part should be heat treated.

3.6 AXIS DIRECTIONS OF THE S-56



Axis name	Movement / function
Z - axis	Up / down direction (of the spindle)
X - axis	Sideways direction
Y - axis	Depth direction (clamps)
C - axis	Spindle rotation

These directions are important to be correct, when setting the offsets to the collaring program.

4. TRANSPORT, HANDLING AND LOCATION

4.1 TRANSPORT AND LOCATION

For transport the S-56 is bolted to a wooden pallet and covered with plastic. A waterproof protection is provided for the electric cabinet.

The machine can be stored in a dry place.

Storing of T-Drill machines and tools: Clean machines, tools and parts from lubricant, chips and other debris, lubricate all components lightly with protective oil to prevent rust. Use, for example, Zerust, WD40 or other light rust protection oil. Keep the machine and tools stored in a cool, dry place, and covered against dust.

➔ **NOTE!** Always keep the S-56 unit in vertical position, either on its column or fastened to its transport base! Never allow the unit to overturn.

4.2 INSTRUCTIONS FOR LIFTING

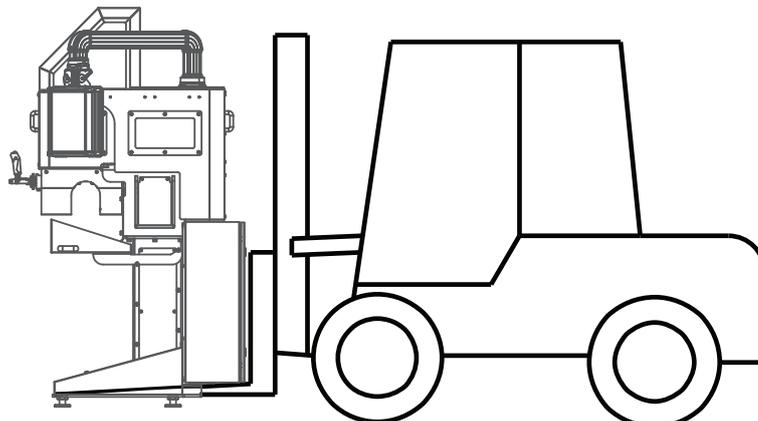
The unit can be moved using a fork lift truck or a hand truck.

➔ **NOTE!** Make sure that the lifting equipment is adequately strong. Weight of the machine approximately 540 kg.

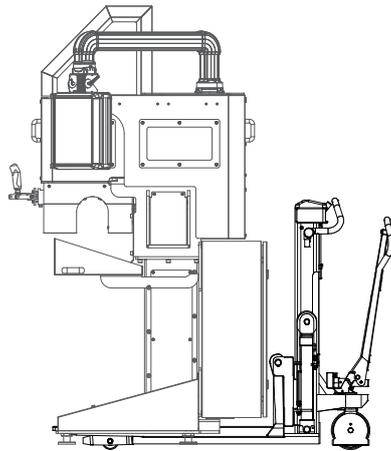


Push hand truck forks under the pallet, be careful, do not let the machine tip over.

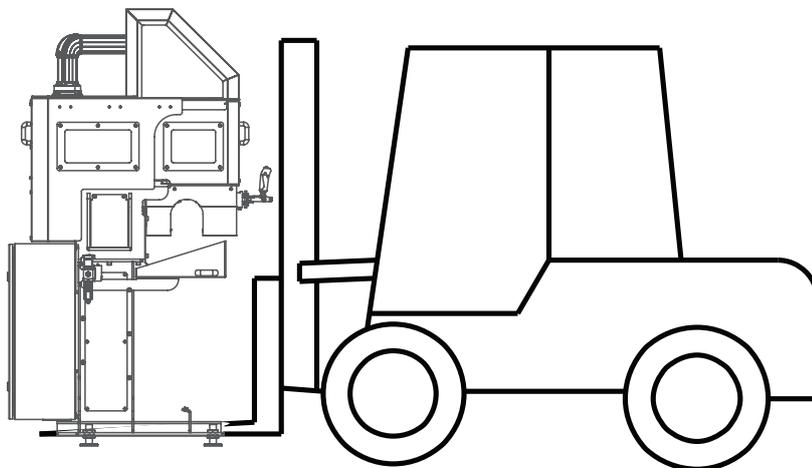
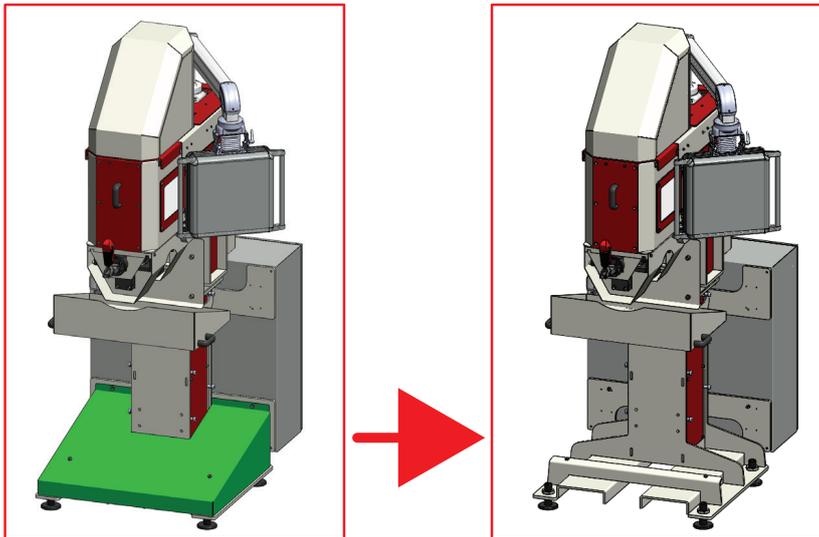
When the machine is removed from the cargo pallet, it is recommended to lift the machine from behind, under the electric cabinet.



S-56 lifting by fork lift truck, place the truck forks to the machine body channels.



Lifting the S-56 by means of a hand truck (or lift truck), place the truck forks to the machine body channels.



Optional lifting of the S-56 from front side: Remove lower front panel (colored green in the picture above) to access the frame channels for truck forks.

5. INSTALLATION

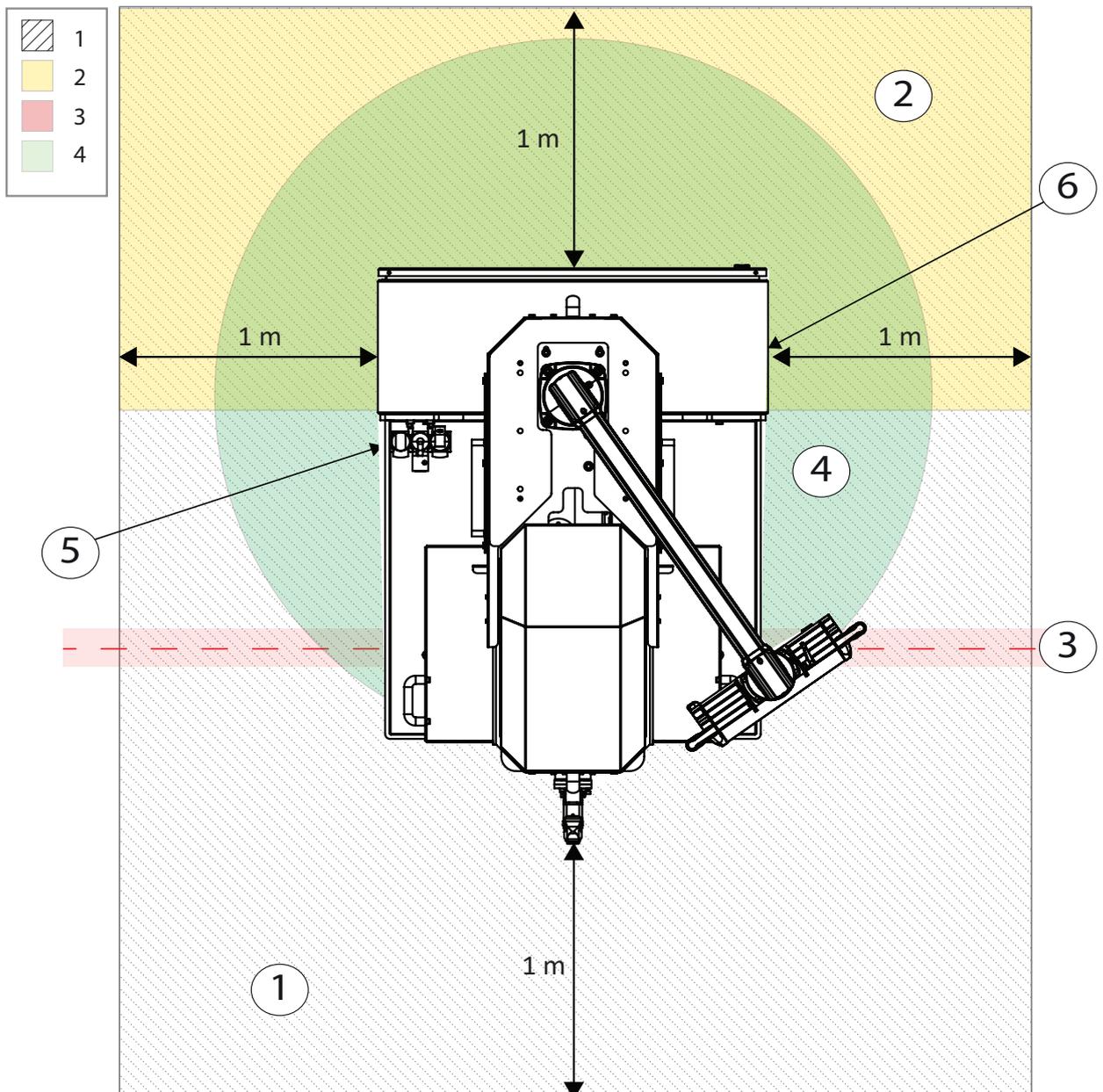
5.1 INSTALLATION OF THE S-56 UNIT

Install the base column on a solid level foundation, free from vibration. Fasten it on floor with M12 anchor bolts through machine shoes.

Leave enough space for operation and maintenance.

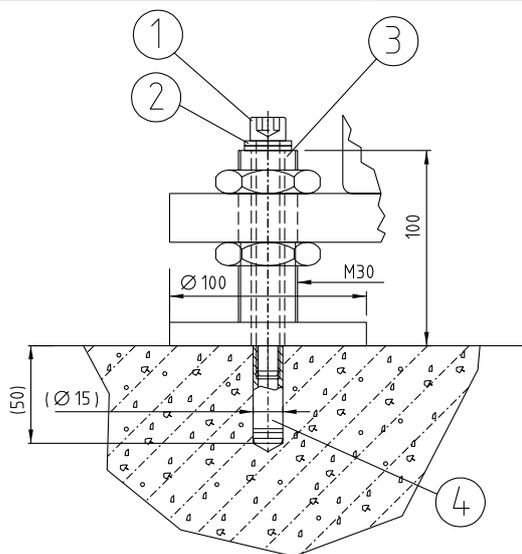
Connect the supply cable through the inlet on the side of the machine electric box.

Level the machine from the Z-axis slide, use a spirit level.



Layout, space requirement for operation and maintenance of the machine: 1. Space for the operator 2. Space for maintenance (yellow) 3. Space required for tube (red), 4. Display reach area (green), 5. Air supply connection, 6. Electric supply.

The floor under this machine must stand the weight of 250 kg /anchor foot.



1. Screw M12x150, 2. Washer $\varnothing 13$, 3. Hole in anchor foot $\varnothing 17$, 4. Anchor bolt LA12

➔ **NOTE!** The machine can overturn, if it is not fastened on the floor properly.

5.2 AMBIENT CONDITIONS

The S-56 collaring unit must be placed in a working area, where the environmental conditions of which do not exceed the following limit values:

Temperature:	+12,5 °C...+ 40°C (54,5 ... 104 F)
Relative humidity:	75% or less
Electromagnetism:	The surrounding appliances should not cause such electromagnetic perturbations which exceed the general standards established for workshop machinery.

5.3 CONNECTION OF THE MACHINE TO THE SOURCES OF ENERGY

5.3.1 CONNECTION TO THE ELECTRICITY NETWORK

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

⚡ **DANGER!** Even when the main switch of the unit is in OFF / (O) position, the switch as well as the supply cable are alive - fatally dangerous voltage.

⚡ **DANGER!** Only a qualified and authorized person is allowed to carry out the connection of the S-56 units to the mains.

The terminals for connection of the external supply cable to the S-56 machine is situated in the rear of the unit. Special attention is to be paid to correct grounding of the machine. Make sure the operating voltage of the machine corresponds to the supply voltage of the circuit. The machine can be supplied for a voltage range of 380-480 V/ 50Hz/60 Hz. Check the correct connection with the help of the circuit diagram supplied with the machine. Compare the diagram with the values on the identification plate of the machine.

➡ **NOTE!** If the S-56 unit is supplied as a part of a system, the connection of the unit is to be carried out according to the connection instructions and circuit diagrams of these elements.

➡ **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 C) residual-current circuit breakers.

5.3.2 CONNECTION TO THE COMPRESSED AIR SYSTEM

➡ **NOTE!** The connection of the S-56 units to the compressed air system is to be performed only by a person authorized to this effect by the employer.

The compressed air is to be connected to a pressure regulator supplied with the machine. Compressed air supply requirements: 4 - 6 bar.



Service unit

5.4 START-UP CHECKING

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

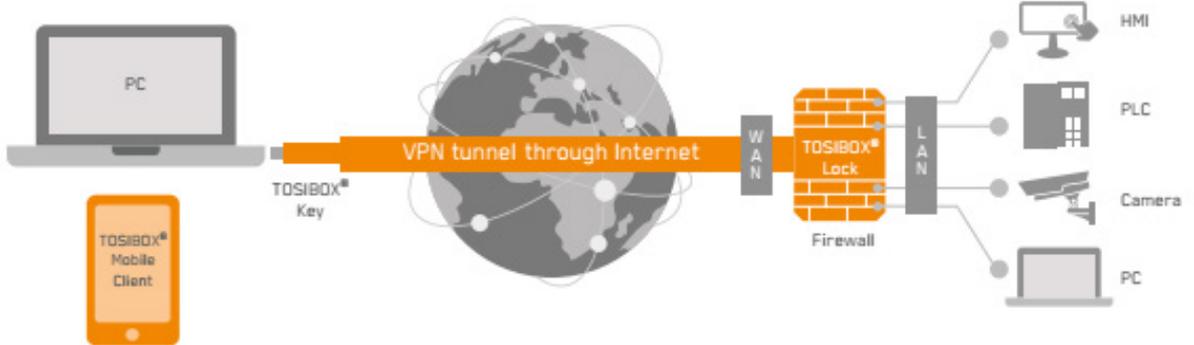
Before using the machine, proceed as follows:

1. Measure the supply voltage of the machine and check if it corresponds to the tension and frequency indicated on the identification plate of the machine.
2. Check the direction of rotation of the spindle. Connect the current from the main switch and press the control voltage push-button, then start the spindle movement by pressing the “spindle start” push-button, situated on the front panel. The spindle must rotate clockwise viewed from above. Should the spindle rotate counterclockwise, change the phasing at the terminals.
3. Check the air supply. Open the main valve of the machine and set the value of the operation pressure to 6 bar (85 psi).
4. Carry out some work cycles on the machine without tube and check its correct functioning.

5.5 TOSIBOX REMOTE ACCESS

Connect the internet cable to the Tosibox port marked with a globe icon.

Principle of operation:



Wired connection

1. Connect an Internet-connected ethernet cable to the Lock’s WAN port .
2. Make sure that internet connection doesn’t need any login. For example domain login.
3. For more information check from Tosibox manual from www.tosibox.com or PDF-files on a memory stick.

Wireless USB-modem connection

1. Remove PIN query from sim-card
2. Plug sim card to attached modem. In most cases Aluminum box Picture 3 or stick like in picture 2 connected to Tosibox Lock via USB-cable. If there is no USB-modem, connect to T-Drill Service.
3. If connection doesn’t work get your APN information and connect T-Drill service.



1. Tosibox USB modem, 2. Tosibox 4G modem

See enclosed Tosibox documentation for more information (PDF-files on a memory stick).

6. THE OPERATION OF THE S-56 UNIT

6.1 DESCRIPTION OF THE CONTROL DEVICES

6.1.1 MAIN SWITCH

The main switch of the unit is placed on the electric cabinet door. The main switch can be locked with a padlock in order to prevent unauthorized use of the machine. (A padlock is not included in the T-Drill delivery).

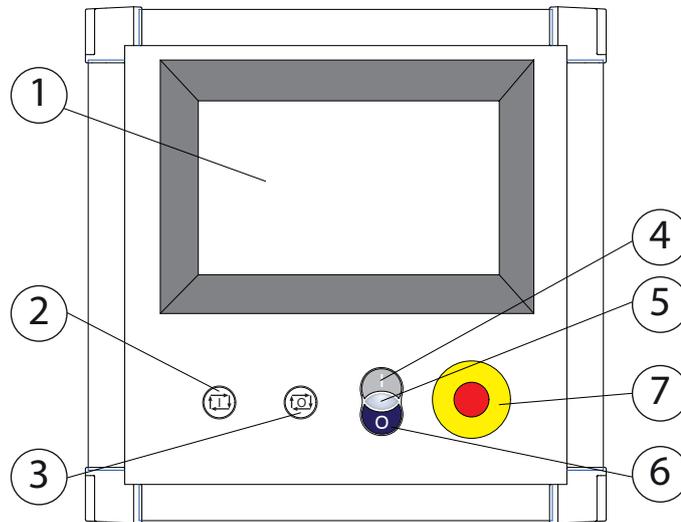
The power is switched on by turning the main switch to “ON” (I) position. The power is switched off by turning the main switch to “OFF” (O) position.



Rear of the machine. Do not cover fan filter grilles.

When the power is switched “ON” the machine “OFF”-button on the control panel is lit red, and the “Start-up” screen opens to the display.

6.1.2 CONTROL PANEL



1	Touch panel display	Operation modes and adjustments, see 6.2. Description of the user interface screens.
2	Work cycle START	Push for 2 seconds to start the automatic work cycle. The button has a pilot light, which is lit, when the work cycle is on.
3	Work cycle STOP PAUSE mode	Controlled stopping of the automatic work cycle. Push shortly to PAUSE (interrupt). When the machine status is ALARM or when machine is on PAUSE of the work cycle the pilot lamp is lit. The work cycle can be started again by pressing the "CYCLE START" push-button. If the button is pushed for 2 sec. the automatic work cycle stops completely.
4	Machine ON push-button (I)	Puts the machine in the state of readiness, switches the machine control voltage on.
5	Indicator light	The indicator light is lit, when the machine power is on.
6	Machine OFF push-button (O)	Disconnects the control voltage from the S-56 machine. The PC is on and can be used to make collaring programs etc.
7	Emergency stop (release by turning)	Stops the machine in case of danger.

6.1.2.1 PAUSE

Put the machine to PAUSE (interrupt) by pushing the “CYCLE STOP” button quickly, the button pilot light is lit to inform that the machine is paused. (To switch PAUSE off push “CYCLE STOP” button again).

6.1.2.2 STEP MODE

The step mode is used to run the machine program code step-by-step:

Switch the machine to “STEP” mode on “Machine settings” screen (see 6.2.2.3 Machine settings screen).

Run the program step-by-step by pushing the “CYCLE START” button, one push is one step in the code (NOTE: one step in the code may not do anything visible).

6.2. DESCRIPTION OF THE USER INTERFACE SCREENS

6.2.1 START-UP SCREEN

When the power is switched “ON” the start screen opens to the display.



Tap the key icon on display to enter.

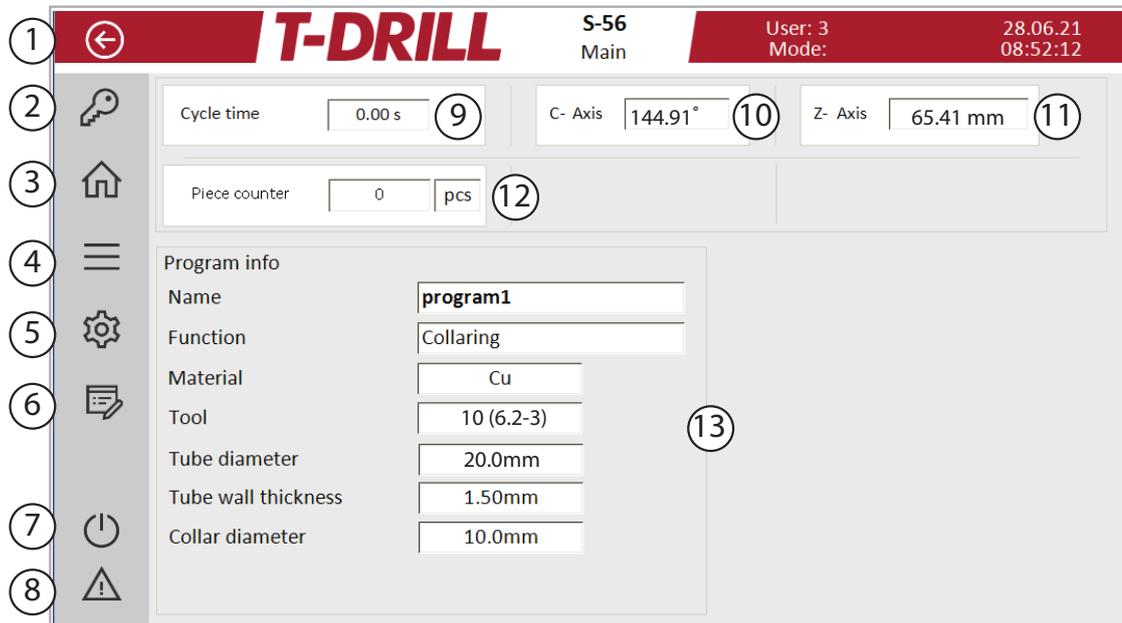
6.2.1.1 USER GROUPS AND DEFAULT PASSWORDS

The S-56 user interface has 5 different user groups. Passwords for user groups can be changed by Supervisor level users.

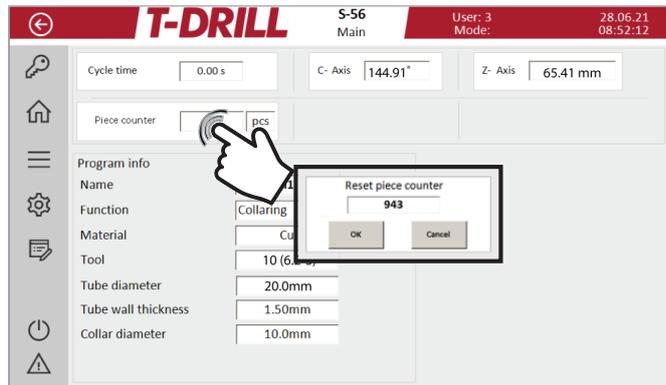
The default passwords for each user group are following:

User group	User name	Default password
Operator 1	1	1
Operator 2	2	2
Operator 3	11	11
Maintenance	3	3
Supervisor	4	4

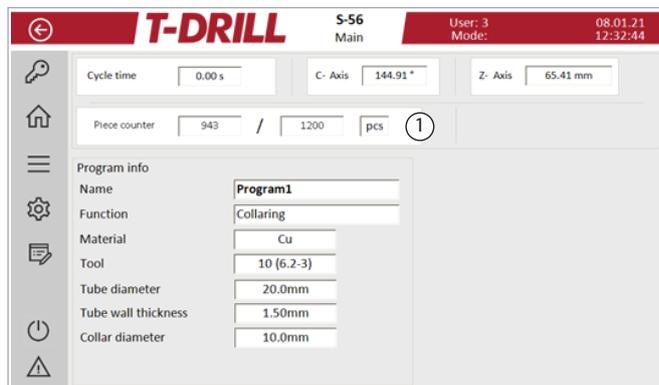
6.2.2 MAIN SCREEN



1	Tap arrow button to return to previous screen.
2	Key-icon - Tap to log on / change user level.
3	House-icon - back to main screen
4	Tap to enter Menu-screen (6.2.2.1)
5	Tap to enter Settings screen (6.2.2.2)
6	Tap to enter Programming-screen (6.2.2.3)
7	Stop the S-56 PLC - The PLC closed and the Windows system stays on. Restart the PLC program from the MS Windows menu on the left, or taskbar on the right.
8	Tap to enter Alarms screen: Alarms will appear to this screen. When there are active alarms, the button flashes red. (6.2.2.3)
9	Informative field: Cycle time of current program
10	Informative field: Current position of C-axis
11	Informative field: Current position of Z-axis
12	Piece counter: Tap the data field to reset the counter. Shows the amount of collars done, or with batch counter option, shows the batch set amount / done amount. If the batch counter option is active, the machine will not start a new work cycle until the counter is reset!
13	Program info: Main features of the current program: name, function, material, tool, tube diameter, tube wall thickness and collar size.



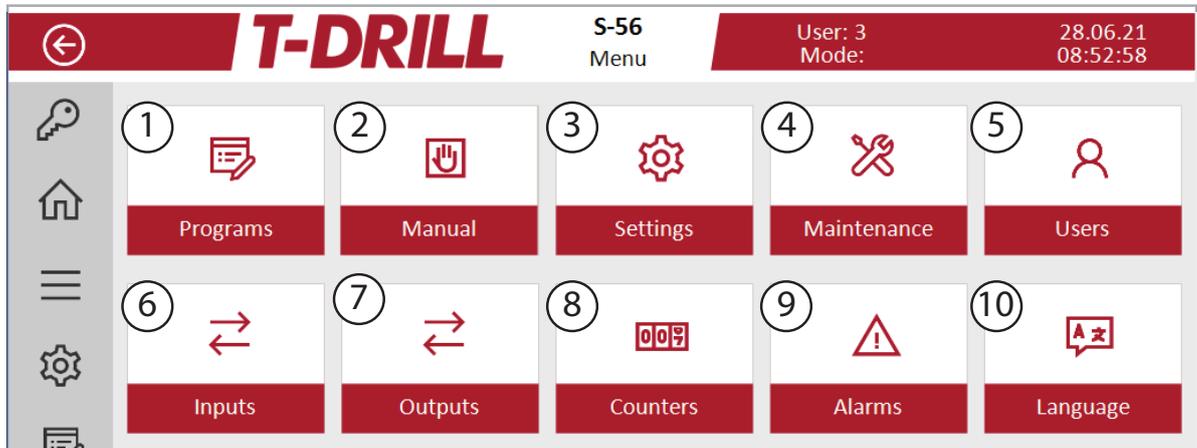
Tap the data field to reset the counter: a pop-up reset window opens.



Main screen with batch counter option, note, that the machine will not start a new work cycle until the counter is reset!

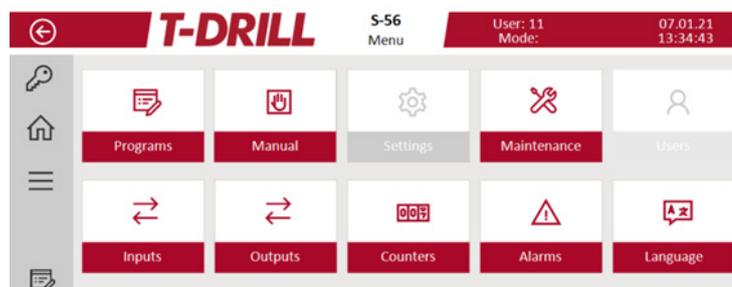
6.2.2.1 MENU SCREEN

The available functions depend on user level. Below shown as Maintenance user level:



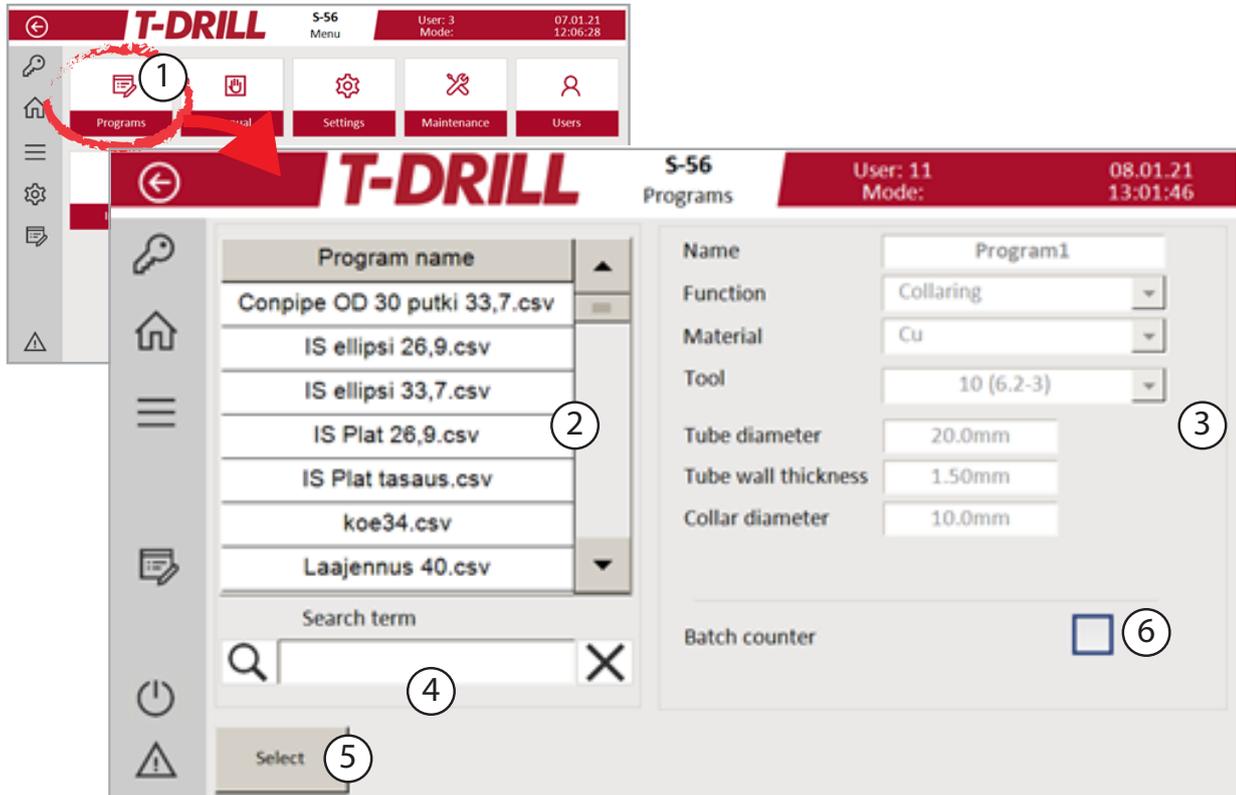
1	Tap to enter Programs screen: Load, make and edit programs (6.2.2.1.1)
2	Tap to enter Manual screen (6.2.2.1.2)
3	Tap to enter Settings screen (6.2.2.2)
4	Tap to enter Maintenance screen (6.2.2.1.3)
5	Tap to enter Users screen: Manage user information (6.2.2.1.4)
6	Tap to enter PLC data: inputs (6.2.2.1.5)
7	Tap to enter PLC data: outputs (6.2.2.1.5)
8	Tap to enter Counters screen: machine counters list (6.2.2.1.6)
9	Tap to enter Alarms screen: All alarms will appear to this screen (6.2.2.3)
10	Tap to enter Language screen: Change display language by tapping a flag on screen.

The buttons are dim when the user has no rights (pictured below is operator3):



6.2.2.1.1 PROGRAMS SCREEN: LOAD, MAKE AND EDIT PROGRAMS

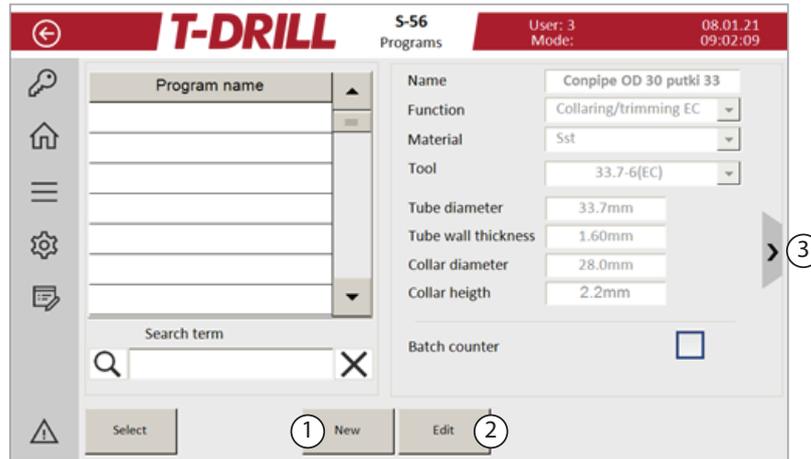
Below shown as Operator 3 user level: Operator 3 is only enabled to search for programs on the list and select to be run. The Operator 3 user has no rights to make or edit the programs.



1	Tap to enter program screen
2	Program file list (predefined location).
3	Program contents list
4	Search for a program to run:
	 Write a search term to the field and tap the magnifier button.
	 tap the "X" button to clear the search field
5	Select: Activate line from the programs list, and tap "Select" to choose program to run it.

6.2.2.1.1.1 MAKING AND EDITING OF THE WORK PROGRAMS

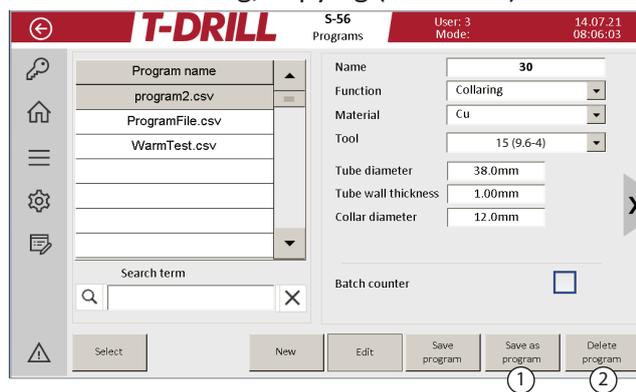
Below shown as Maintenance user level (3): Maintenance, Supervisor, Operator 1 and Operator 2 users have rights to make, delete, copy and edit the programs. The Operator2 user has no entry rights to the page 2 of the programs screen.

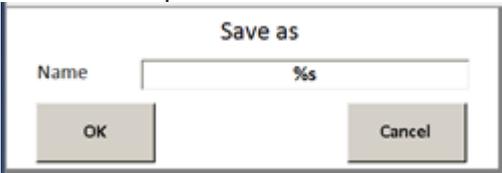


1	Tap to make a new program
2	Tap to edit the selected program
3	Tap to enter page 2. The Programs screen page 2 is for optimizing and altering program related machine settings and to select special features.

6.2.2.1.1.1.1 EDIT WORK PROGRAMS

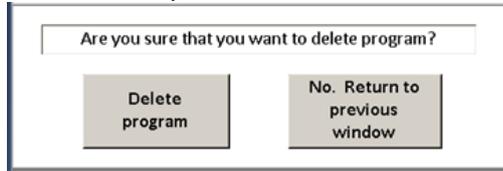
Press “Edit” button to enable editing, copying (“Save as”) and deleting of programs.



1	Select the work program to be copied, and press “Save as program” button. A pop-up screen will open:  Give the new copy of a program a name, and press OK.
---	---

Select the work program to be deleted, and press “Delete program” button. A pop-up screen will open:

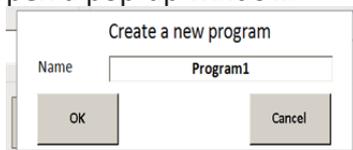
2



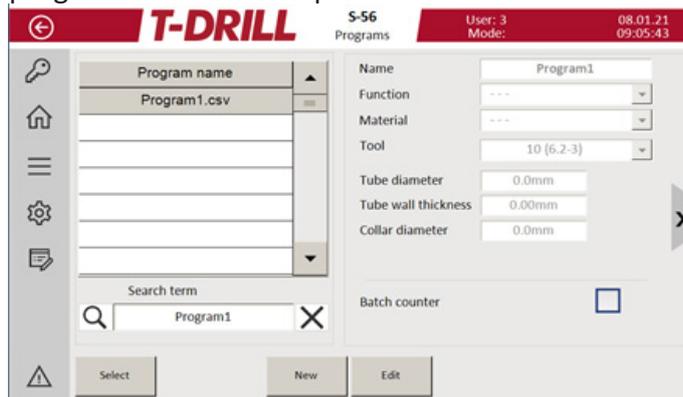
If you are sure, press “Delete program”.

6.2.2.1.1.2 MAKING OF A NEW WORK PROGRAM

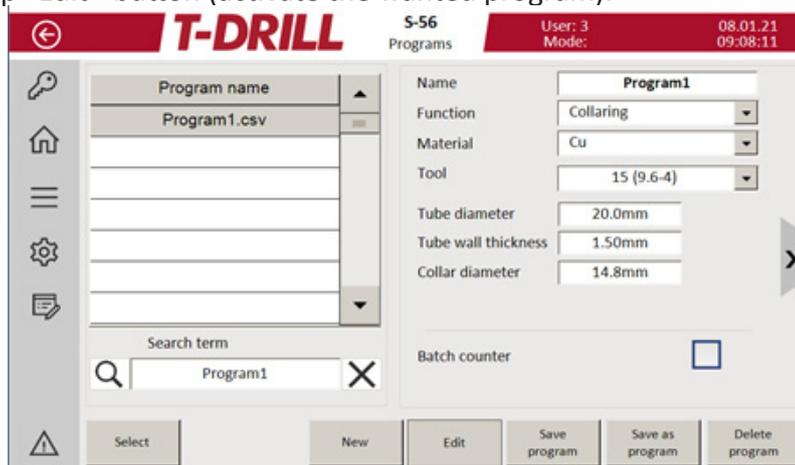
1. Tap the “New” button to open a pop-up window.



2. Give the new program a name and tap OK.



3. The new program will now appear to the programs list. To continue making the program tap “Edit”-button (activate the wanted program).



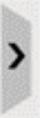
4. Fill in the basic information of the program and tap “Save program”-button to save.

- Name: Program name (to ease searching, name the program as descriptive as possible)
- Function: Work cycle method
- Material: Cu,St,Sst,Al
- Tool: Tool choice

Batch counter	<input checked="" type="checkbox"/>
Set	<input type="text" value="1300"/> <input type="text" value="pcs"/>

Batch option: If it is required to drive certain amounts of pieces, check the “Batch counter” box (3) and fill in amount.

Available work cycle methods:	
With basic tools	With EC-tools, that don't have a drill and require a premade elliptic pilot hole
Collaring	Only collaring EC
Drilling	Collaring / trimming EC
Only collaring	Only trimming EC
Collaring / trimming	
Only trimming	

 Tap the arrow button on the right side to enter page 2: The Programs screen page 2 is for optimizing and altering program related machine settings and to select special features. The Operator2 user has no entry rights to the page 2 of the programs screen

6.2.2.1.1.1.3 THE PROGRAMS SCREEN PAGE 2 WHEN FUNCTION IS COLLARING

←
T-DRILL
S-56
Programs

User: 3
Mode:
28.06.21
09:23:12


Collaring 1

Start offset

End offset

Correction spindle speed

Vc:Cutting speed

Correction forming speed

Save program


Drilling 2

Start offset

Correction spindle speed

Vc:Cutting speed

Correction drilling speed

Chip cut distance

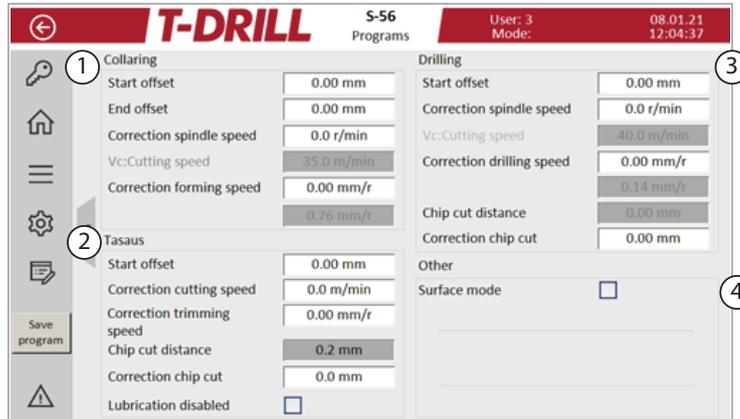
Correction chip cut

Surface mode 3

1 Collaring	
	Start offset / End offset: Collaring start and end positions (offsets) can be edited. Optimizing of the positioning distance will have affect on the work cycle time and in some case, to the quality of the collar.
	Correction (of the) spindle speed: Changing of the spindle speed may affect the quality of the collar.
	Vc: Cutting speed: Non-editable data field. If the “Correction spindle speed” is other than 0, the change is seen in the cutting speed in this field.
	Correction forming speed: The collar forming speed can be edited. The effect can be seen as a change in the quality of the collar. The dark gray field below the editable value shows the factory setting value.
2 Drilling	
	Start offset: The drilling start position (height) can be edited: Optimizing of the positioning offset will have affect on the work cycle time.
	Correction (of the) spindle speed: Changing of the spindle speed may affect the quality of the collar.
	Vc: Cutting speed: Non-editable data field. If the cutting speed is other than 0, the change is seen in the cutting speed.
	Correction drilling speed: The drilling speed can be edited. The effect can be seen as a change in the quality of the collar and on the work cycle time. The dark gray field below the editable value shows the factory setting value.
	Chip cut distance: Non-editable data field. A factory setting of the chip cut distance. When the value is 0, there is no chip cut.
	Correction chip cut: The chip cut correction value can be edited. Optimizing of the chip cut will have affect on the work cycle time. For example, when the “Correction chip cut” value is set to 1 mm, the chip cut is at intervals of 1 mm. The program sequence runs the drill downwards for 1 mm, and then runs upwards for 0,1 mm, which will cut the chip. This sequence is run for as long as the desired drill depth is reached.
3 Surface mode (6.2.2.1.1.1.3 Surface mode).	

6.2.2.1.1.1.4 MAKING OF A COLLARING PROGRAM FOR COLLARING HEAD WITH TRIMMING FEATURE - PAGE 2

Except for the trimming, settings for trimming are identical to settings for collaring process (6.2.2.1.1.1.2 The Programs screen page 2 when function is Collaring).



1	Collaring settings
2	Trimming settings
	Start offset: Trimming start position (offset) can be edited. Optimizing of the positioning distance will have affect on the work cycle time and in some case, to the quality of the collar.
	Correction (of the) cutting speed: Changing of the spindle speed may affect the quality of the collar rim. (Factory setting is 40m/min).
	Correction trimming speed: The trimming speed can be edited. The effect can be seen as a change in the quality of the collar and on the work cycle time. (Factory setting is 0,05 mm/r/cutting blade).
	Chip cut distance: Non-editable data field. A factory setting of the chip cut distance. When the value is 0, there is no chip cut.
	Correction chip cut: The chip cut correction value can be edited. Optimizing of the chip cut will have affect on the work cycle time, collar quality and durability of the cutting inserts. For example, when the “Correction chip cut” value is set to 1 mm, the chip cut is at intervals of 1 mm. The program sequence runs the drill downwards for 1 mm, and then runs upwards for 0,1 mm, which will cut the chip. This sequence is run for as long as the desired drill depth is reached.
	Lubrication disabled: It is not always necessary to use lubrication. Check the box to disable lubrication during trimming.
3	Drilling settings
4	Surface mode (6.2.2.1.1.1.3 Surface mode).

6.2.2.1.1.1.5 SURFACE MODE

Surface mode is used, for example, when the tubes are curved, or when the tube is designed so, that the center of the tube is not the same as the center of the tube fastener (clamp).

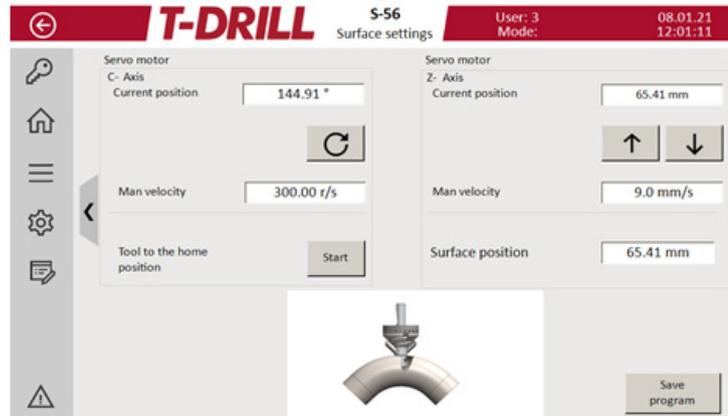
The position of the collar is set manually when the surface mode is on.

Move to “Surface settings screen” by pressing arrow on the right from the “Surface mode” check box.

The image shows two screenshots of the T-DRILL control interface. The top screenshot is the 'S-56 Programs' screen, where the 'Surface mode' checkbox is checked and a red circle highlights the right-pointing arrow button next to it. A red arrow points from this button to the 'Surface settings' screen below. The 'Surface settings' screen shows parameters for the Servo motor C-Axis (Current position: 144.91°, Man velocity: 300.00 r/s) and Z-Axis (Current position: 65.41 mm, Man velocity: 9.0 mm/s). A 'Surface position' field is set to 65.41 mm. A 'Save program' button is at the bottom right, labeled with a circled '5'. An inset image on the left shows a drill bit with a red arrow pointing to a point on the tube labeled 'A'.

1	Servo motor settings: Spindle position (C-axis = rotation) and manual rotation velocity. Press rotation button to start spindle rotation.
2	Tool to home position: Press “Start” to rotate the tool to correct position for reference setting.
3	Z-axis setting: Drive the tool (spindle) up / down with the arrow buttons. Position the tool so, that the tool is lowered into the tube, and the tool shoulder is very close to the surface of the tube (A). Man velocity is the speed of the up-down movement, and the value can be edited.
4	The reference position is written here: When the tool is in correct position (shoulder on tube surface), write the value from “Current position” field to the “Surface position” field (Tap the field to open a pop-up keypad).
5	Save-button: Always remember to save after making changes to the settings.

6.2.2.1.1.1.5.1 SETTING OF THE REFERENCE ON SURFACE MODE, WITH DRILLING TOOL

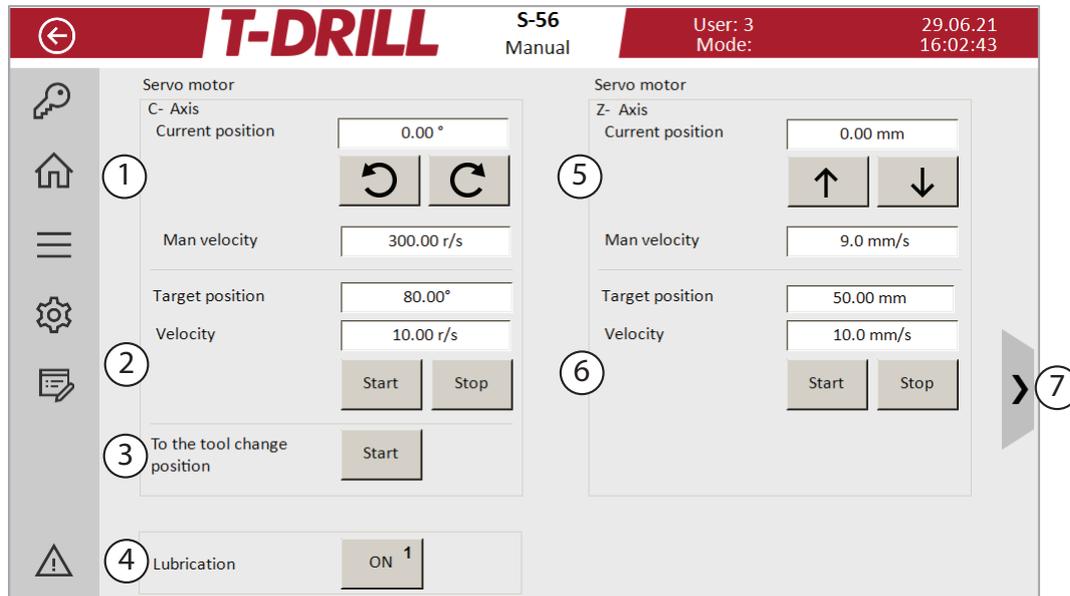


1. Place the tool to the spindle.
2. Press  rotation button to start spindle rotation.
3. Drive the tool (spindle) downwards with the arrow button , until the tool shoulder is very close to the surface of the tube.
4. Write the reference position value from “Current position” field to the “Surface position” field (Tap the field to open a pop-up keypad).
5. Save.

6.2.2.1.1.1.5.2 SETTING OF THE REFERENCE ON SURFACE MODE, WITH EC TOOL (TO A PREMADE, ELLIPTIC PILOT HOLE)

1. Place the tool to the spindle.
2. Rotate the tool to home position: Press “Start” to rotate the tool to correct position for reference setting.
3. Drive the tool (spindle) downwards with the arrow button , until the tool shoulder is very close to the surface of the tube.
4. Write the reference position value from “Current position” field to the “Surface position” field (Tap the field to open a pop-up keypad).
5. Save.

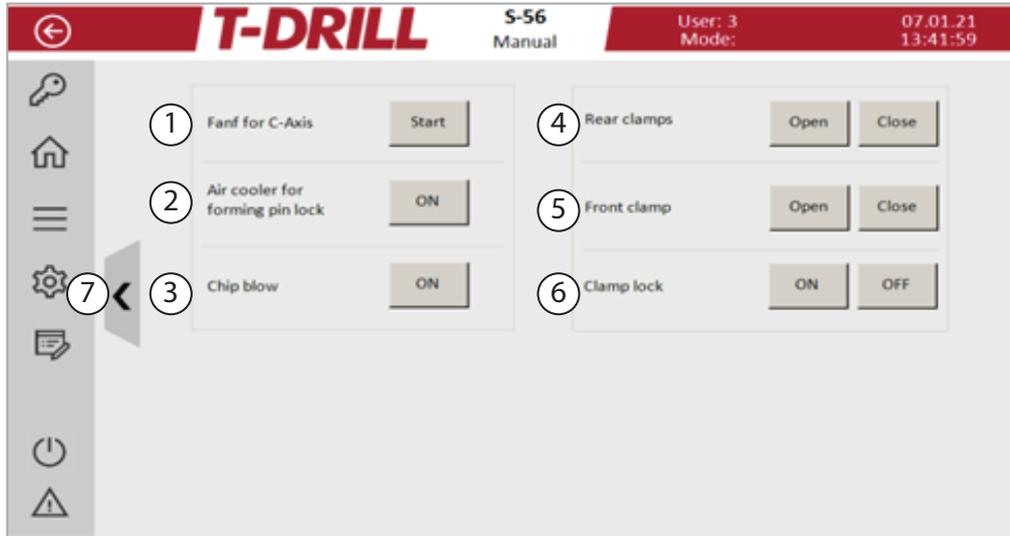
6.2.2.1.2 MANUAL SCREEN



1	C-axis, spindle rotation. The spindle will rotate as long as either one of the rotating arrow buttons is pressed. Man. velocity: Setting of the speed used when the positioning of the C-axis is done.
2	The spindle can also be rotated to certain position by “Target position”: Tap the field to open a pop-up keypad, and give the desired position 0-360°, desired velocity of the movement and press “Start”.
3	To the tool change position: Rotates the spindle to a predefined tool change position (define the tool change position on “Settings”: 6.2.2.2.1 Servo motors screen: servo settings)
4	Lubrication: Press <input type="button" value="ON 1"/> to lubricate; as long as the button is pressed, the pump is on.
5	Z-axis, up-down movement of the spindle: The spindle will move up or down as long as either direction arrow button is pressed.
6	The spindle can also be moved upwards or downwards to certain position by “Target position”: Tap the field to open a pop-up keypad, and give the desired position in mm, desired velocity of the movement and press “Start”.
7	Move to page 2 of “Manual screen”

6.2.2.1.2.1 MANUAL SCREEN: PAGE TWO

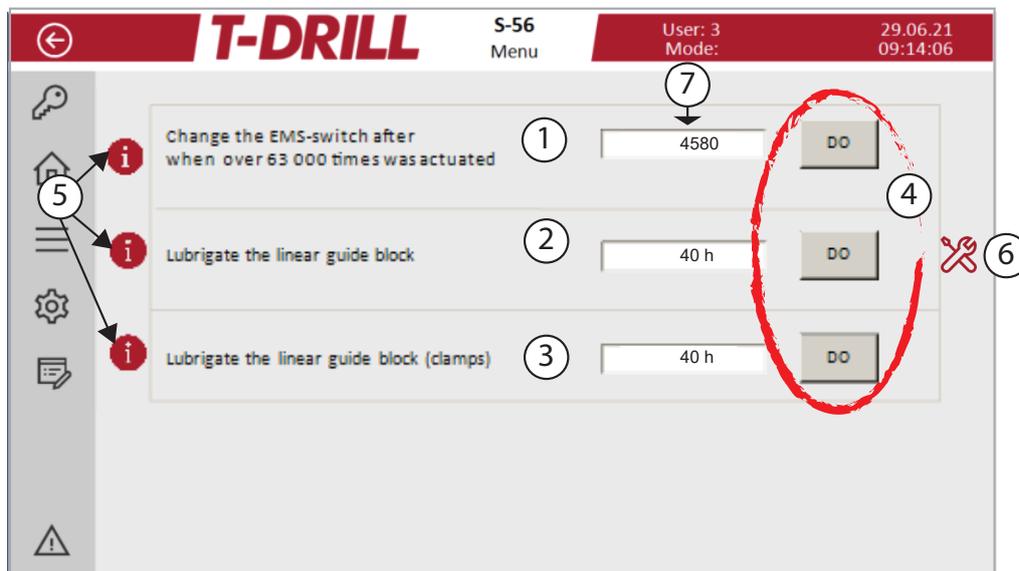
Page 2 with optional equipment:



1	Fan for C-axis: Press button to start
2	Air cooler for forming pin lock: press button to start
3	Option: Chip blow: Press button to start. Removes cutting chips from the tool and collar during machining.
4	Option, with pneumatic clamps: Rear clamps
5	Option, with pneumatic clamps: Front clamp
6	Option, with pneumatic clamps: Clamp lock

6.2.2.1.3 MAINTENANCE SCREEN

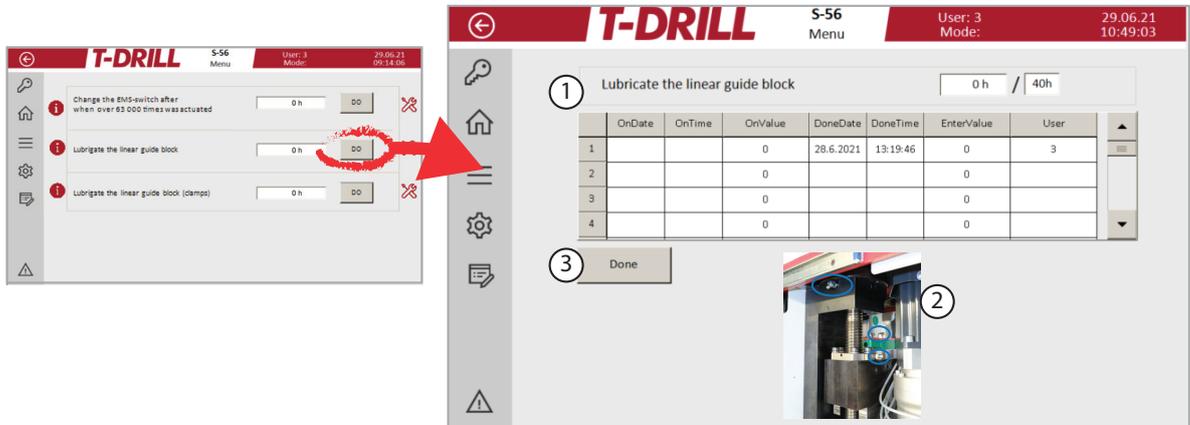
The Maintenance can only be performed and checked “Done” by the Maintenance users, and the “Do” buttons are visible only for them.



1	Change the EMS-switch after actuated 63000 times
2	Lubricate the linear guide blocks every 40 hours of use (spindle)
3	Lubricate the linear guide blocks every 40 hours of use (clamps)
4	 Tap to open the certain maintenance screen
5	 Tap to open maintenance history.
6	 When the maintenance is required, the tools-symbol will appear next to the maintenance target.
7	Maintenance counters

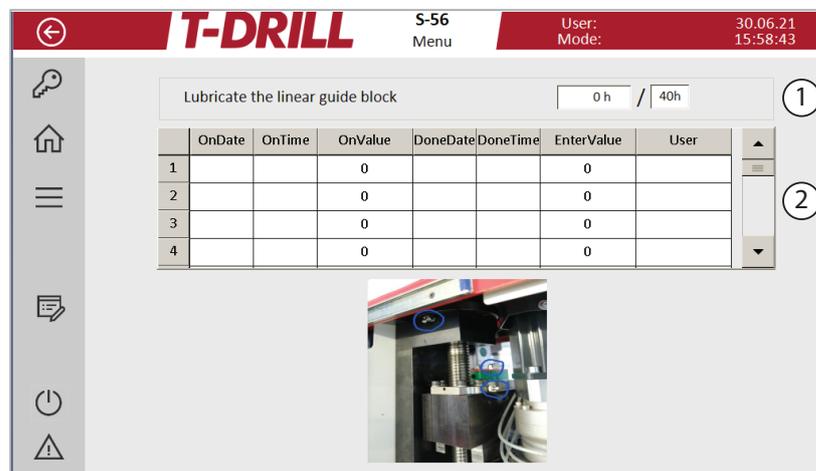
For details, see also chapter 7. Maintenance.

6.2.2.1.3.1 DO MAINTENANCE



- | | |
|---|--|
| 1 | Maintenance description |
| 2 | Maintenance target photo to help locating of it. |
| 3 | When the maintenance is done, check it done by pressing “Done” button. The performed maintenance date will appear to top row and the maintenance counter is reset. Maintenance can be done (and checked) before it is due, if desired. |

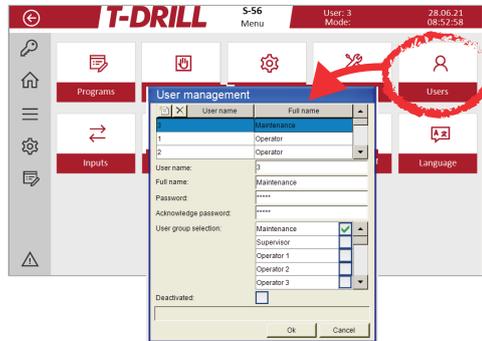
6.2.2.1.3.2 MAINTENANCE HISTORY



- | | |
|---|---|
| 1 | The current reading of the maintenance counter |
| 2 | The table shows the 20 most recently acknowledged maintenance, with the last maintenance always at the top. The table stores the time and value of the maintenance request, and the date, value and user name, who acknowledged the maintenance. OnValue = The counter reading before the maintenance is acknowledged. EnterValue = The counter reading when the maintenance is acknowledged. |

6.2.2.1.4 USERS SCREEN: MANAGE USER INFORMATION

Tap the “Users” button to open pop-up setting screen. All users information can be edited here.



	<ol style="list-style-type: none"> 1 List of users, scroll users with the arrow buttons. The bottom row is always empty. 2 User names 3 Password of the activated user 4 User groups list, scroll groups with the arrow buttons. 5 New user button  6 Delete user button  7 Check box to deactivate the chosen user. Does not remove but puts the user on pause, and it can be activated again. 7 OK-button acknowledges the changes and closes the popup-window. 7 NOTE: when creating a new user, the user is activated with the “New user” button 
--	---

TO MAKE A NEW USER:

1. Activate a new, empty row from the list.
2. Write user information and create password.
3. Select the user group for this user.
4. Press “New use” button  to finalize.

➔NOTE! The delete button deletes the chosen user without any questions.

6.2.2.1.5 PLC DATA: INPUTS AND OUTPUTS



Inputs



Outputs

T-DRILL				S-56	User: 3	30.06.21
				Inputs	Mode:	14:16:18
I1	K1	Power ON		0		
I2	S2	EMS-switch		0		
I3	S8	Cycle start		0		
I4	S9	Cycle stop		0		
I5						
I6						
I7						
I8						
X1	SP1	Air pressure		0		
X2						
X3						
X4						
X5						
X6						
X7						
X8						

T-DRILL				S-56	User: 3	30.06.21
				Outputs	Mode:	14:17:03
O1	H8	Cycle ON		0		
O2	H9	Cycle interrupt		0		
O3	H12	Alarm		0		
O4						
O5	M3.2	Blower for C-axis		0		
Out 0	Y??	Forming pins unlock		0		
Out 1	Y??	Forming pins lock		0		
Out 2	Y??	Lubrication 1		0		
Out 3						
Out 4						
Out 5						
Out 6						
Out 7						
Out 8						
Out 9						
Out 10						

Status 0=off, 1=on

6.2.2.1.6 COUNTERS SCREEN: MACHINE COUNTERS LIST

←
T-DRILL
S-56
Menu
User: 1
07.01.21

Mode:
13:52:41



1



2

Hourmeters	Total	<input type="text" value="0h"/>
C-Axis	Z-Axis	<input type="text" value="0h"/> <input type="text" value="0h"/>
Total piece counter	0	pcs

Tool	Cu	St	Sst	Al
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0



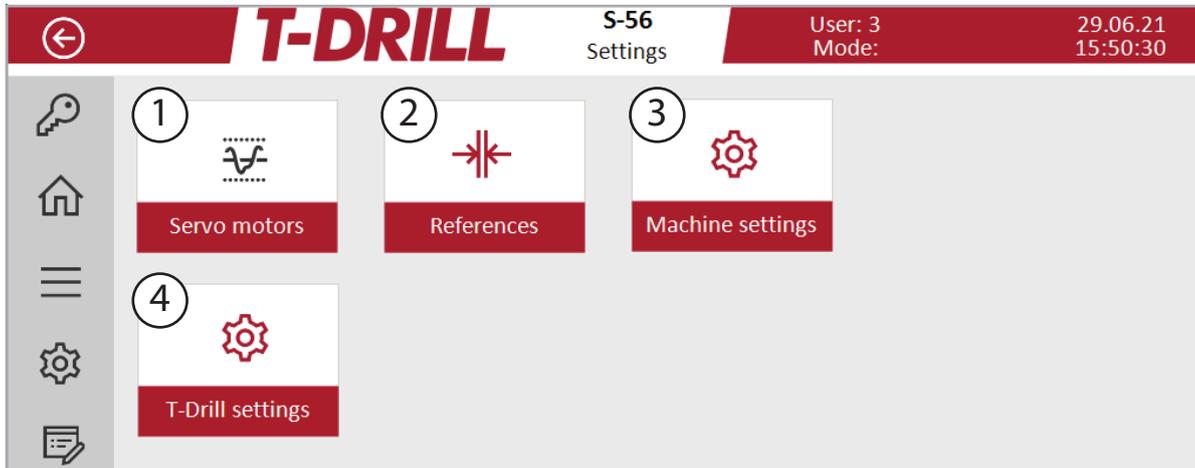
3



- | | |
|---|---|
| 1 | Hourmeters and total piece counter |
| 2 | Counters for every tool and material (collars made) |
| 3 | If there are different collaring tools in use, those will have their own tables (Collaring tool with trimming feature and AC-tool for premade pilot holes).
Table is changed by pressing the tool picture. |

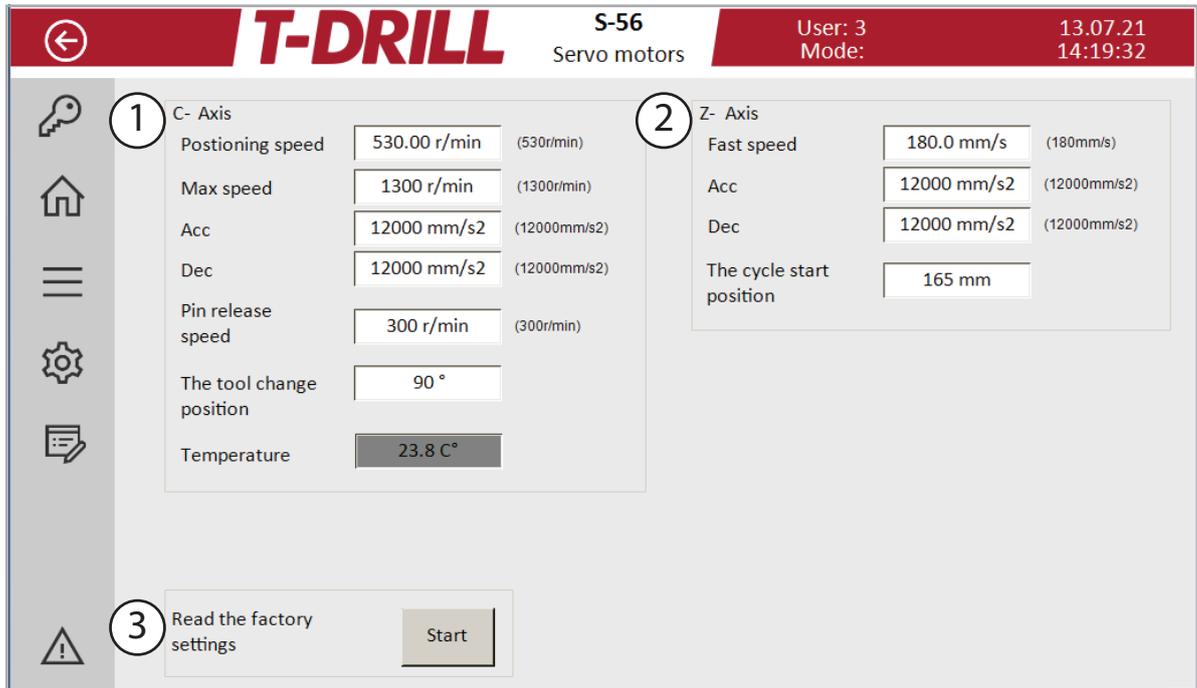
6.2.2.2 SETTINGS SCREEN

The settings are editable only for the following users: Maintenance, Supervisor and Operator1.



1	Servo motor settings (6.2.2.2.1)
2	Reference settings (6.2.2.2.2)
3	Machine settings (6.2.2.2.3)
4	<i>T-Drill Service only</i>

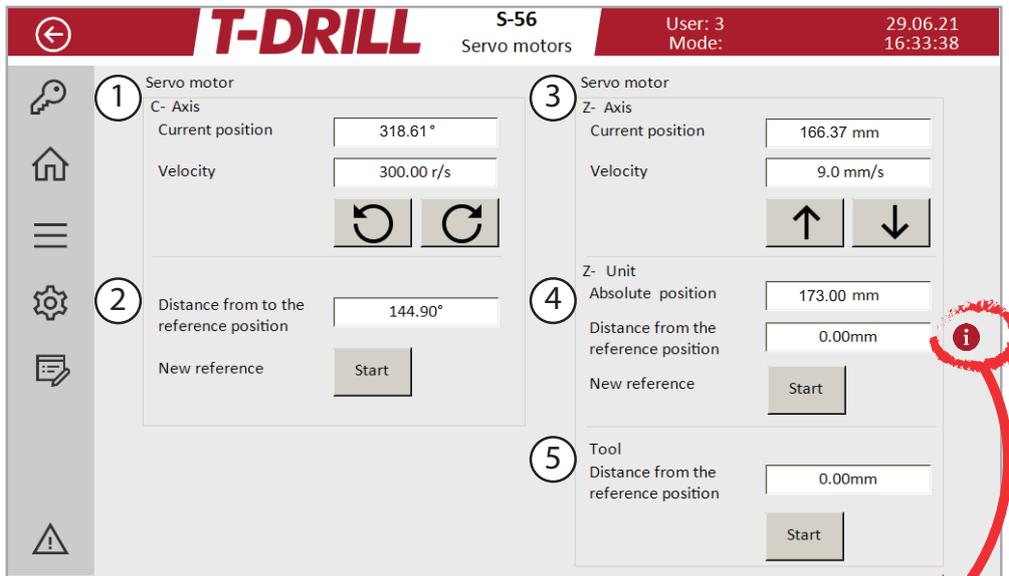
6.2.2.2.1 SERVO MOTORS SCREEN: SERVO SETTINGS



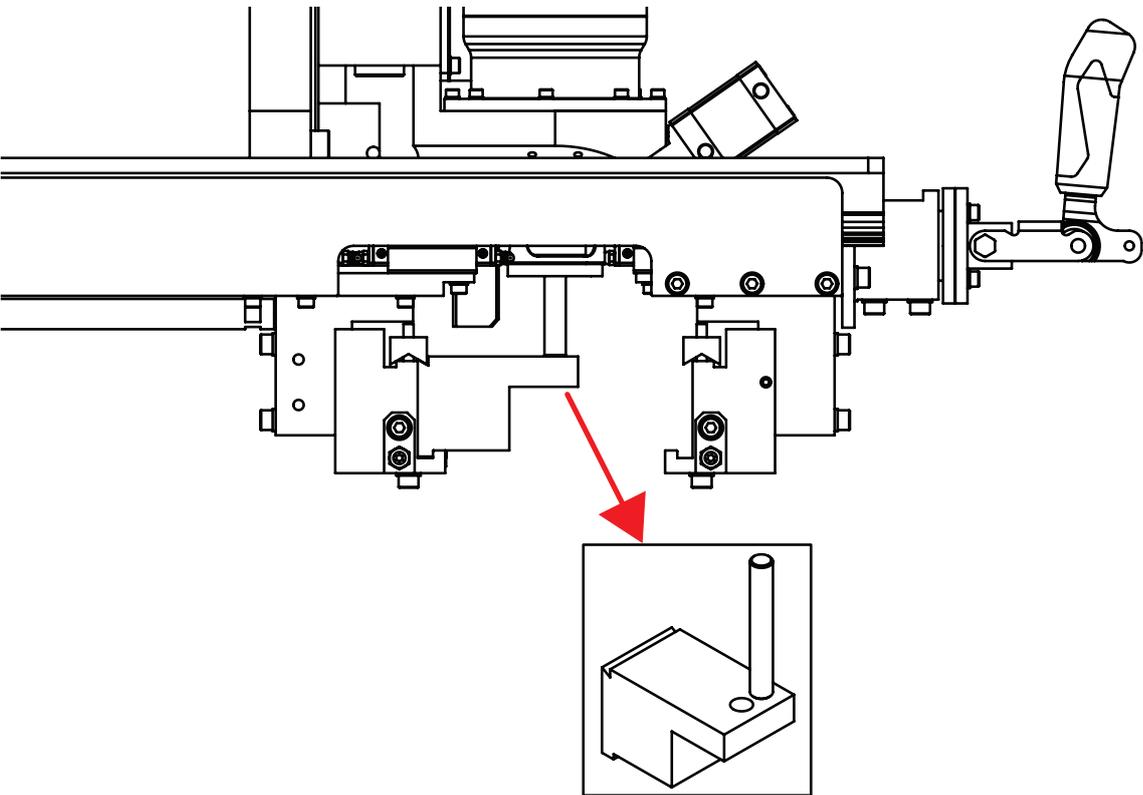
1	C-Axis	
	Positioning speed	The speed used when positioning the tool (EC tools).
	Max speed	Maximum speed (rpm) of the spindle. Decreasing of the spindle speed reduces heating of the spindle motor.
	Acc / Dec	Acceleration / Deceleration of the spindle
	Pin release speed	Decreasing of the spindle speed when the tool forming pins are released before the collaring process begins.
	The tool change position	Predefined position of the spindle to ease tool change.
	Temperature	Information field: Spindle motor temperature.
2	Z-Axis:	
	Fast speed	Speed setting for the rapid movement of the spindle
	Acc / Dec	Acceleration / Deceleration of the up / down movement of the spindle
	The cycle start position	The position of the tool when the work cycle begins. The work cycle start and stop position values can be adjusted when the shorter tools are used. Shorter travel reduces work cycle time.
3	Read the factory settings	Reset factory settings to this screen. (Factory setting values are on the right side of the field)

6.2.2.2.2 REFERENCE SETTINGS SCREEN

The reference settings have to be done, if the feed unit parts are removed or replaced, or the PC of the machine breaks.

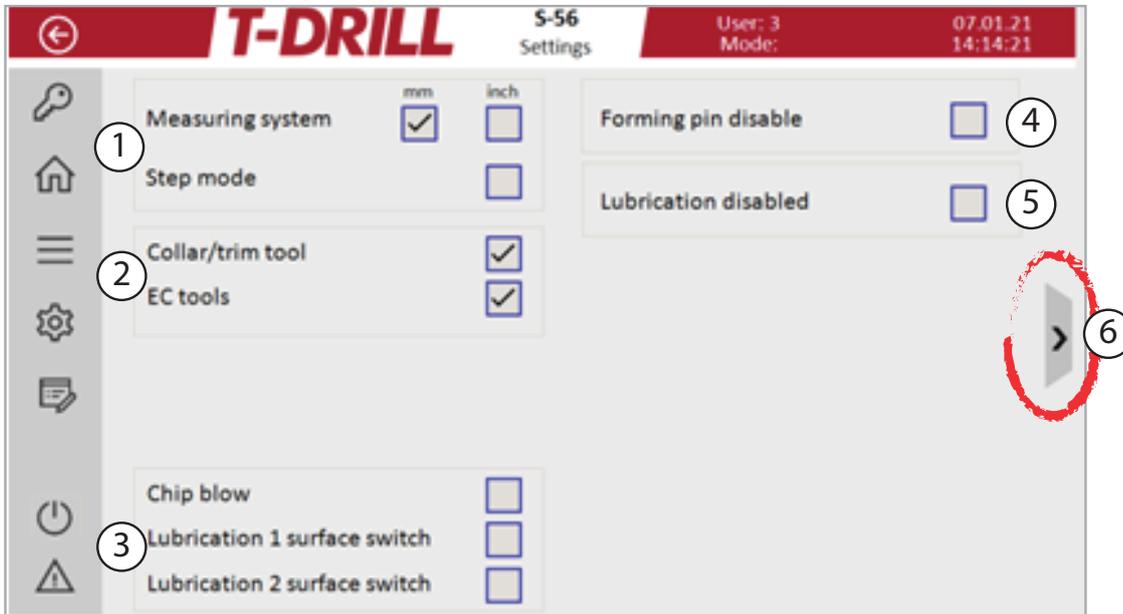


1	<p>C-Axis servo motor / rotation: Current position: The current position of the spindle C-axis. Velocity = The desired speed of movement (rotate by arrow buttons on this speed). <i>Preparation to make the reference setting: Rotate the spindle by the arrow buttons so that the collaring tool fastening screw is perpendicular to the tube line.</i> No need for a tube or a tool.</p>
2	<p>C-Axis reference setting: Write "0" to the "Distance from the reference position" field. Press "Power Off"-button to shut off power from the machine. Press "New reference" "Start"-button to set the point.</p>

3	<p>Z-axis servo motor / moving: Current position: The current position of the spindle Z-axis. Velocity = The desired speed of movement (move up / down by arrow buttons on this speed).</p>
4	<p>Z-unit reference setting: “Absolute position” data field shows the position of the Z-unit. Open the safety door on the machine side. Measure (use a caliper) the distance between moving frame and fixed frame. (See picture from info-button i). Write the measured value to the “Distance from the reference position” field. Press “Power Off”-button to shut off power from the machine. Press New reference “Start”-button to set the reference point.</p>
5	<p>Tool reference setting: Assemble the reference tools to the machine (clamp and pin). Place the clamp a little to the side, so, that the pin will not go to the hole (picture below). Set the velocity to very slow, the pin must not start to bend the clamp! Slowly drive the reference pin against the reference clamp, pin to the surface of the clamp (=to 0) by the up / down by arrow buttons. Write “0” to the “Distance from the reference position” field. Press “Start”-button to set the reference point. (The tool reference can also be done by measuring the distance between ref. pin and ref. clamp, and writing that to the “Distance from the reference position” field).</p> 

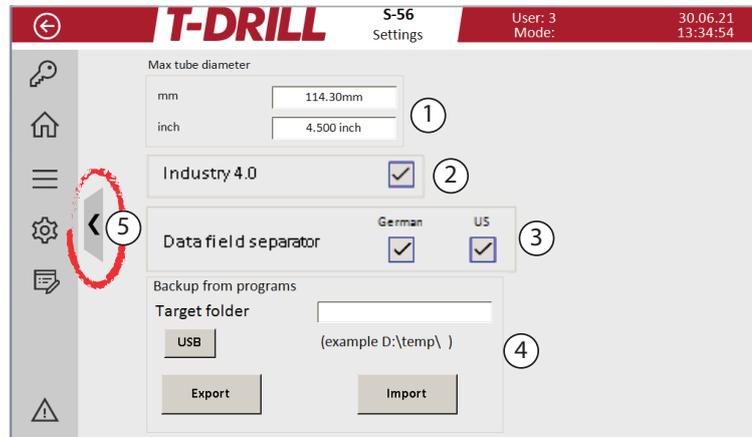
6.2.2.2.3 MACHINE SETTINGS SCREEN

Basic machine delivery, page 1:



1	<p>Measuring system: Choose mm / inch</p> <p>Step mode: Check box to activate the step mode. Step mode is used to run the machine program code step-by-step.</p>
2	<p>Collar/trim tool and EC tools: Check box to activate tools to the program edit page tool list. (see 6.2.2.1.1.2 Making of a new work program)</p>
3	<p>Chip blow (Optional!): Check box to activate / deactivate chip blow function. Chip blow is used to clean chips from the drilled tube.</p> <p>Lubrication 1 surface switch / Lubrication 2 surface switch (Optional!): Check box to activate / deactivate lubricant level sensor for lubricant container.</p>
4	<p>Forming pin disable: Check the box to disable release of the forming pins when collaring. This feature is used when searching for the optimal collaring start point and good collaring quality.</p> <p>The collaring start point is optimal, when the shoulder of the collaring tool leaves a small mark to the surface of the tube.</p> <p>Optimizing of the collaring start point is necessary especially with the small collaring tools.</p> <p>When the correct start point is defined, uncheck the box.</p>
5	<p>Lubrication disable: Check box to disable lubrication. It is unnecessary to use lubrication when adjusting the machine.</p> <p>When the adjustments are done, uncheck the box.</p>
6	<p>Go to page 2 of machine settings</p>

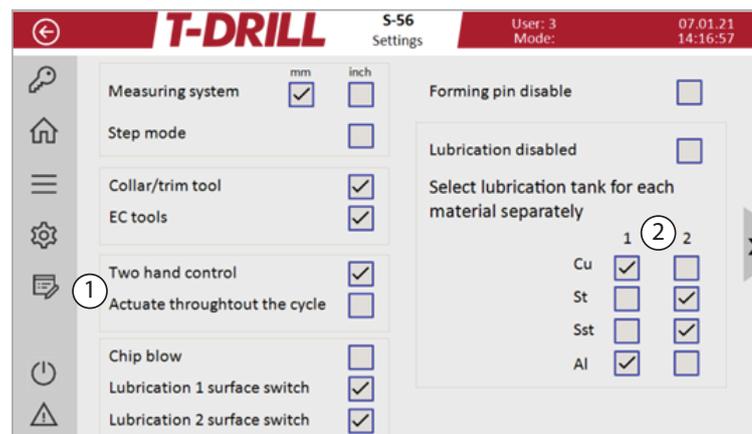
6.2.2.2.3.1 PAGE 2 OF THE MACHINE SETTINGS SCREEN:



1	Maximum tube diameter factory setting is 114.3 mm. This can be reduced to avoid, for example, errors when making work programs.
2	Industry 4.0, check box to set feature on / off.
3	Data field separator, check box to set type (CSV file).
4	<i>Backup target folder path setting, not available yet</i>
5	Return to page 1 of machine setting

6.2.2.2.3.2 MACHINE OPTIONS ON MACHINE SETTINGS SCREEN

For example, these options will appear to the machine settings screen, when ordered to the machine:

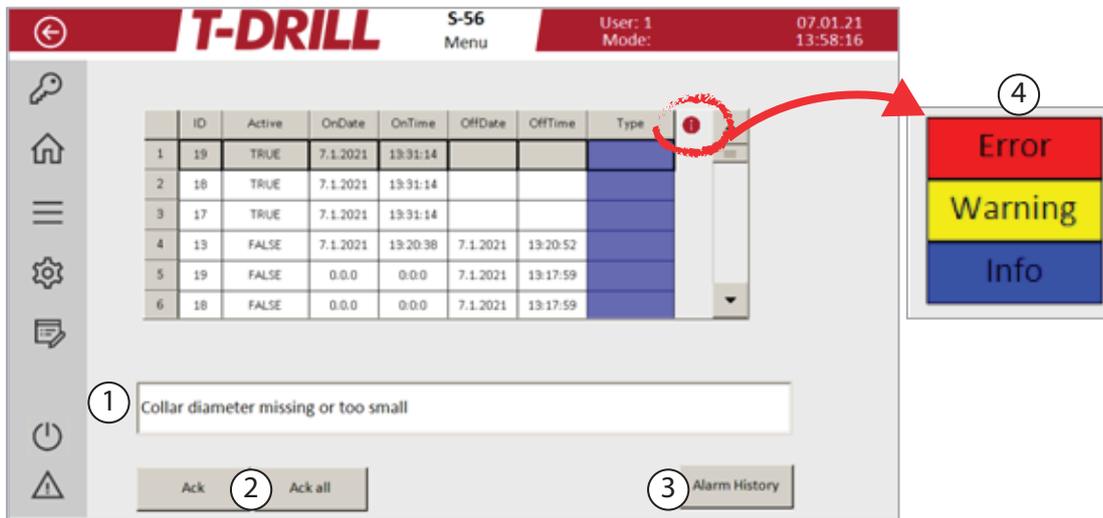


1	Two hand control: Feature improves machine operator safety. Check box to set feature on / off. Actuate buttons throughout the cycle: Machine work cycle is started with two-hand buttons, and the buttons have to be pressed during the whole work cycle.
2	Two lubrication tanks: Select lubrication tank for each material separately: Check a box to select tank and lubricant.

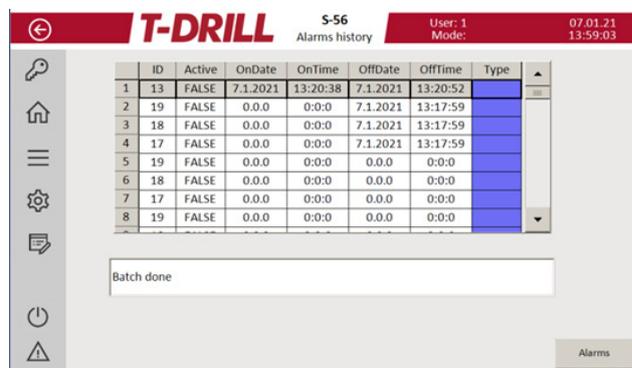
6.2.2.3 ALARMS SCREEN

All alarms will appear to this screen. The alarms are listed to the table by the time of appearance, last one on top.

The columns of the table are appearing date and time, acknowledgement date and time, and the type of the alarm.



1	Alarm information area: shows the explanation of the activated alarm line
2	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 10px;">Ack</div> <div>Acknowledge only selected alarm line.</div> </div>
	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 10px;">Ack all</div> <div>Acknowledge all alarm lines (Non-active alarms).</div> </div>
3	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 10px;">Alarm History</div> <div>Press to enter alarm history screen: The last 1000 acknowledged alarms are found on the table.</div> </div>
4	Alarm line colors information opens as a popup from the info button : Alarm types are red=error, yellow=warning and blue=informative.



Alarms history screen

6.3 THE WAYS OF STOPPING THE MACHINE

6.3.1 THE NORMAL STOPPING OF THE S-56

1. Wait until the unit has finished the automatic work cycle.
2. Disconnect the control voltage from the power off switch (O) on the control panel.
3. Close the air supply main valve on the pressure regulator.
4. Switch off main power from the main switch behind the machine.

6.3.2 THE EMERGENCY STOPPING OF THE S-56

In case of a dangerous situation, stop the machine by pushing the  -button on the control panel completely down. This will immediately stop all functions of the machine. To release the red knob, turn it counterclockwise. The machine will not start again until the main switch has been pushed.



➡ **NOTE!** After having pushed the emergency stop button, the spindle still will continue turning freely a little while. **DO NOT TOUCH THE SPINDLE BEFORE IT HAS STOPPED COMPLETELY.**

The machine covers have safety limit switches, and when the machine has power on, they operate as emergency stop switches as well if the covers are opened.

6.4 COLLARING HEAD REPLACEMENT

ⓘ DANGER! Starting the machine unintentionally may cause a serious accident. Always turn power off (O) from the control panel before changing the clamps, or any other action.

➡NOTE! Always use protective gloves when handling the collaring tool - the cutting edges of the bit and the lubricant used when collaring may cause wounds and inflammations.

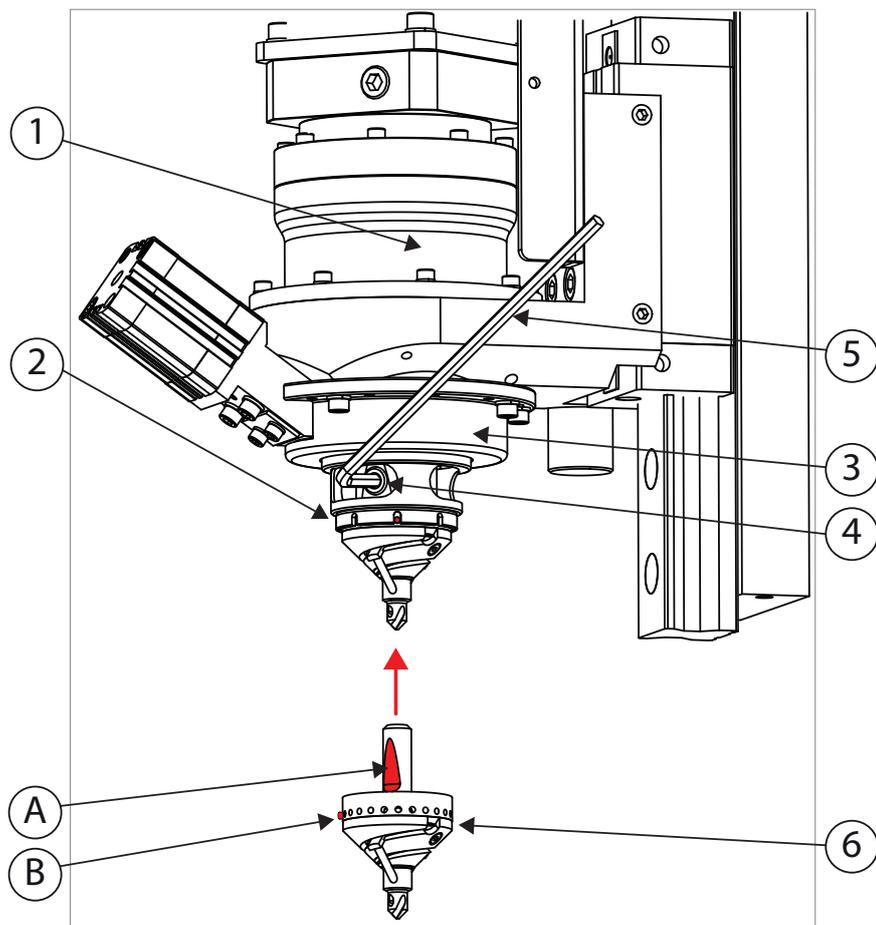
1. Rotate the spindle to the tool changing position (see chapter 6.2.2.1.2 Manual screen). The spindle can also be rotated by hand, when the power is off.

The tool changing position is set on the control panel, see chapter 6.2.2.2.1 Servo motors screen: servo settings. The predefined position of the spindle to ease tool change can be set to the desired side of the machine.

2. Push the power off button (O) to switch off the control voltage.

2. Open the front cover of the machine.

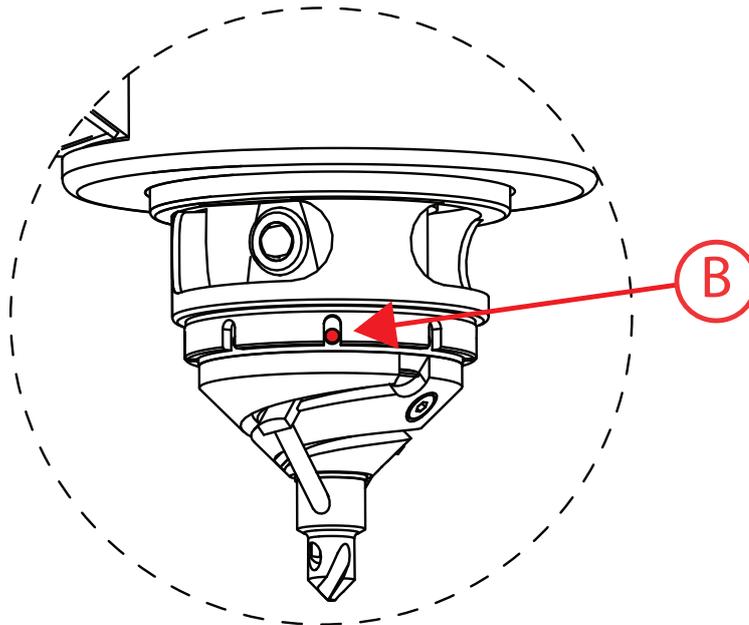
3. Loosen the collaring head fastening screw (4). Note! Hold the collaring tool so, that it won't fall. Remove collaring tool from the spindle chuck.



The parts of the chuck: A. Fixing wedge, B. Tool dowel pin. 1. Spindle, 2. Collaring tool without cover (brake drum pin visible), 3. Chuck, 4. Collaring tool locking screw, 5. Socket head wrench, 6. Collaring tool

4. Slide the collaring tool to be used into the chuck as far as it will go. The flat surface of the tool must be on the same side as the fastening screw.

➔ **NOTE!** The collaring tool is placed into the spindle so that the beveled side (A) faces the fastening screw. The collaring tool dowel pin (B) must also fit into one of the grooves in the spindle shroud.



Chucking the collaring tool: The dowel pin (B) of the adjustment cone fits into the spindle brake drum groove. (Pictured without the sleeve of the chuck brake drum).

5. Lock the collaring tool by tightening the screw. Check that the collaring tool does not move in the chuck by pushing it up.

ⓘ DANGER! Never start the machine when the collaring tool is not locked in the chuck - if not sufficiently fastened the tool may come loose, thus causing accidents.

6.5 CLAMPING THE TUBE

6.5.1 GENERAL

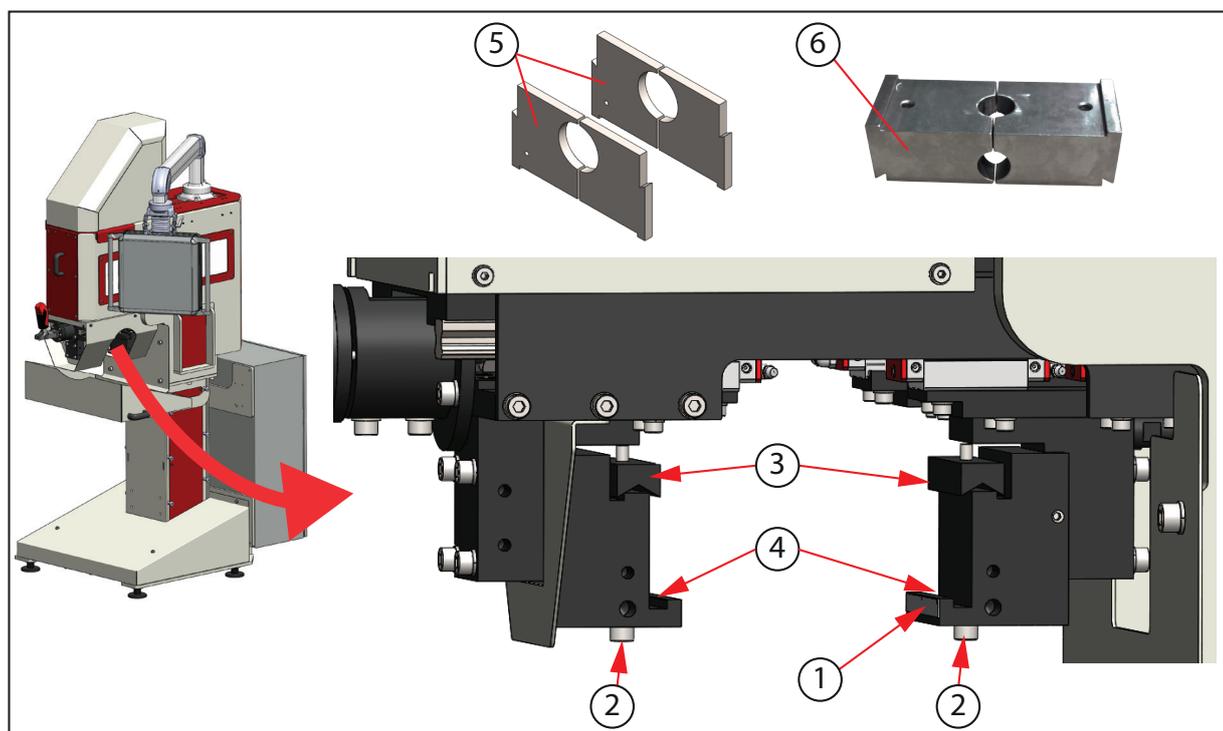
In order for the S-56 collaring unit to reach its performance characteristics, the clamping equipment has to be sized correctly. The clamps have to be able to resist all leverage of the collaring process.

ⓘ DANGER! Starting the machine unintentionally may cause a serious accident. Always turn power off (O) from the control panel before changing the clamps or undertaking any other action.

There are two types of S-56 clamping equipment, manual and pneumatic. In the manual clamping equipment only the frontal clamp moves while the rear clamp is fixed. In the pneumatic clamping equipment both clamps move and it is meant to be used with the feeding table. With either equipment the tube diameter can be between 8 and 114,3 mm. It is important to use clamp sizes that correspond to the diameter of the tube processed.

Keep the clamping device guide rails clean and lubricate due to maintenance instructions to avoid malfunction.

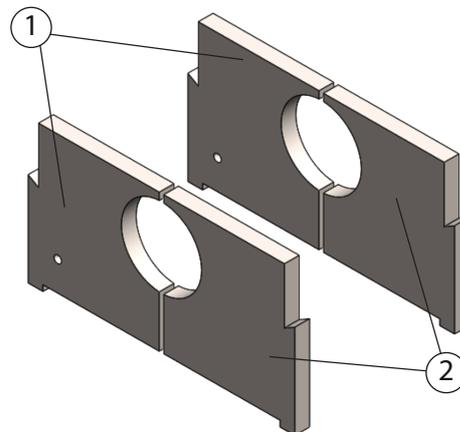
6.5.2 CLAMPS AND CLAMP FRAME



Manual clamping device: 1. Scale for clamp assembly (distance between the clamps (L)), 2. Clamp tightening screw, 3. Clamp tightener piece, 4. Clamp assembly groove, 5. Basic clamp, 6. Whole body clamp (WBC)

The S-56 clamps have the nominal size engraved to them.

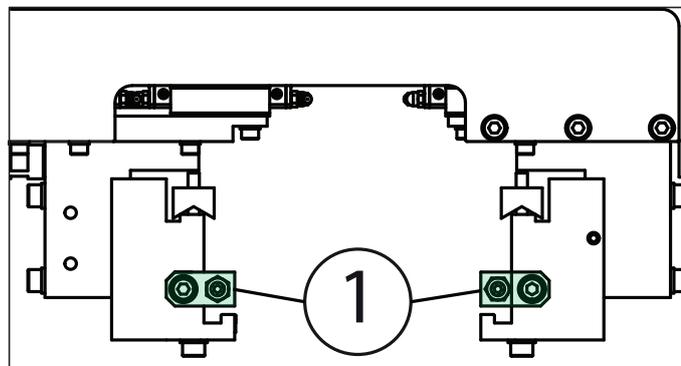
Place the clamps to the machine so, that the clamp with a hole is in the rear clamp holder, 0-side. The rear clamp is the work piece centering clamp.



Clamp pairs: 1. Rear clamp, 2. Front clamp

For the correct functioning of the S-56 collaring machine it is absolutely necessary that the tube is clamped in the right way. This is best achieved when T-DRILL tube clamps are used. When using clamps from other manufacturers it is always advisable to consult your local T-DRILL dealer or T-DRILL Oy in Finland.

When the whole body clamps are used, it is recommended to turn ON the stoppers to keep the clamps in the middle of the clamping device. Open the fastening screws and turn the stoppers ON. Tighten the fastening screws with care.



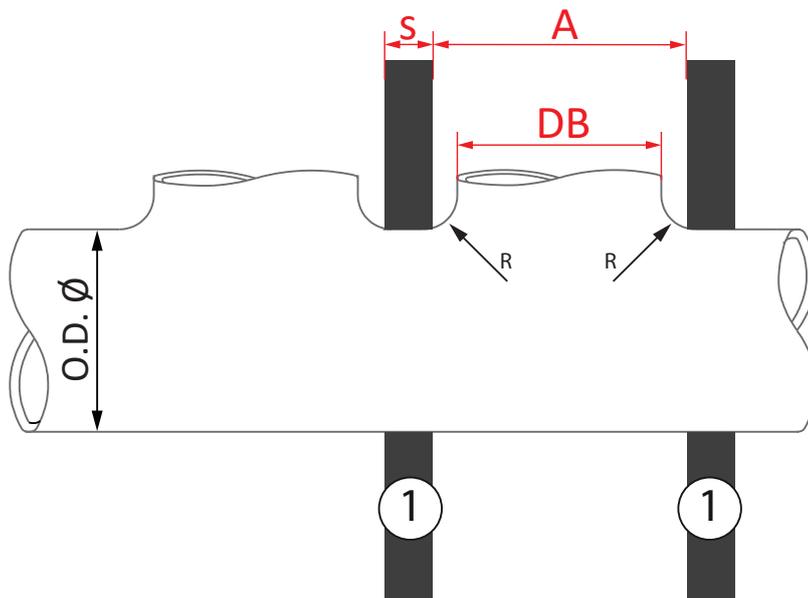
1. Stoppers for whole body clamps, pictured turned ON. Stoppers keep the whole body clamps centered.

6.6 DISTANCES BETWEEN COLLARS

The distance between the clamps (A) is defined according to the collar diameter to be processed. In order to ensure the secure clamping of the tube, the clamps have to be near enough the location of the collar to be processed.

- The clamp pieces are positioned to the clamp frame by hand.
- Clamps can be set to different positions on tube length direction to ease collar positioning.
- Note the positions of the collars on the other side of the tube.

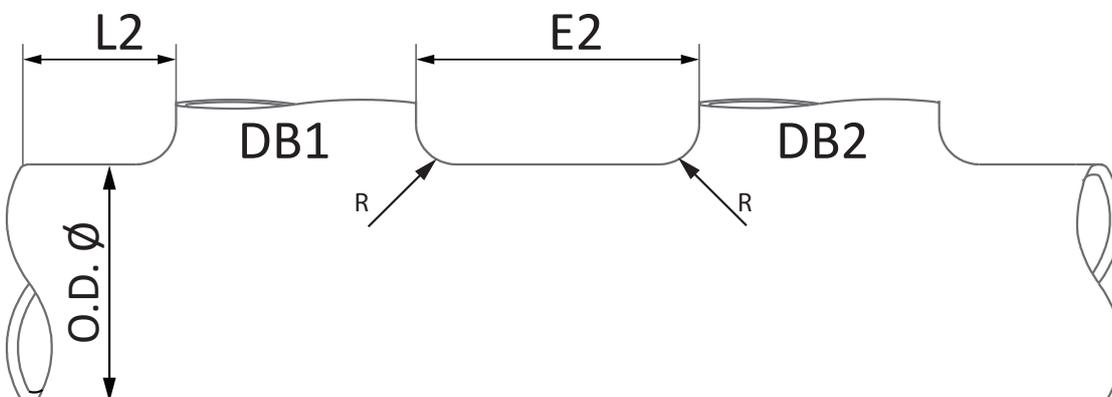
Distance from the clamps:



1. Clamp, s = clamp thickness (basic clamp: 10 mm), DB = collar O.D., R = radius of the collar neck, A = Distance between clamps.

Definition of distance between collar and clamps: Minimum distance of the clamp from the collar: $s + 2 \times R$.

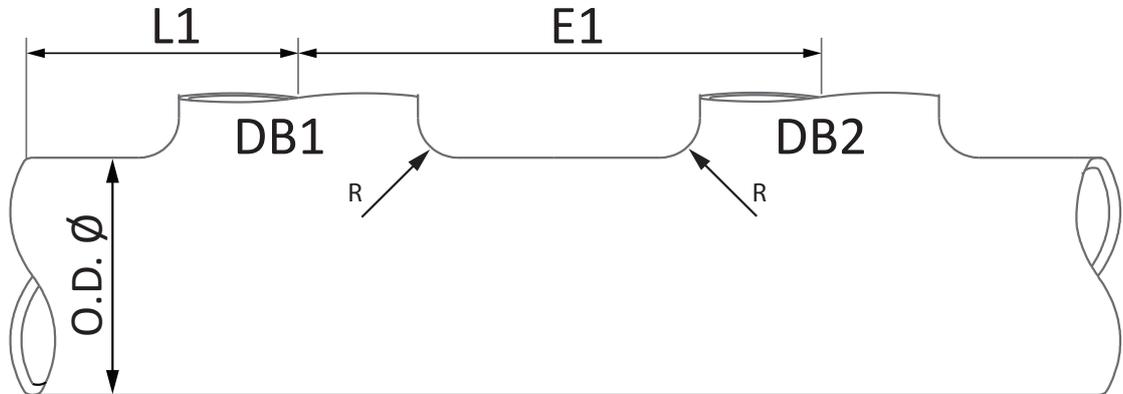
Distance from the next collar:



$L2$ = Distance from the end of the tube to the collar side, $E2$ = distance between two collars, $DB1$ and $DB2$ are collar outer diameters O.D., R = radius of the collar neck.

Calculation: $E2$ minimum = $s + DB1R + DB2R$ (s =clamp thickness).

The distance between two collars, from center to center is typically counted the following way:



$L1$ = Distance from the end of the tube to the center of the collar / hole, $E1$ = distance between two collar / hole centers, $DB1$ and $DB2$ are collar outer diameters O.D., R = radius of the collar neck.

Calculation $E1$ minimum, from center of the collar / hole to the next = $DB1/2 + DB2/2 + DB1R + DB2R + s$

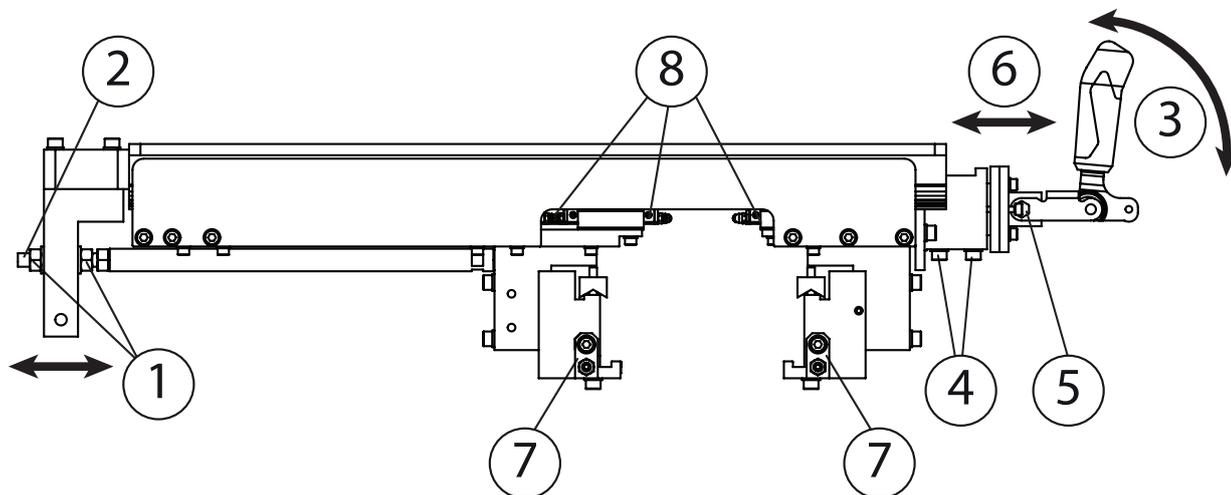
(s =clamp thickness).

$L1$ minimum : The first collar distance from the end of the tube is $1.5 \times$ run tube O.D..

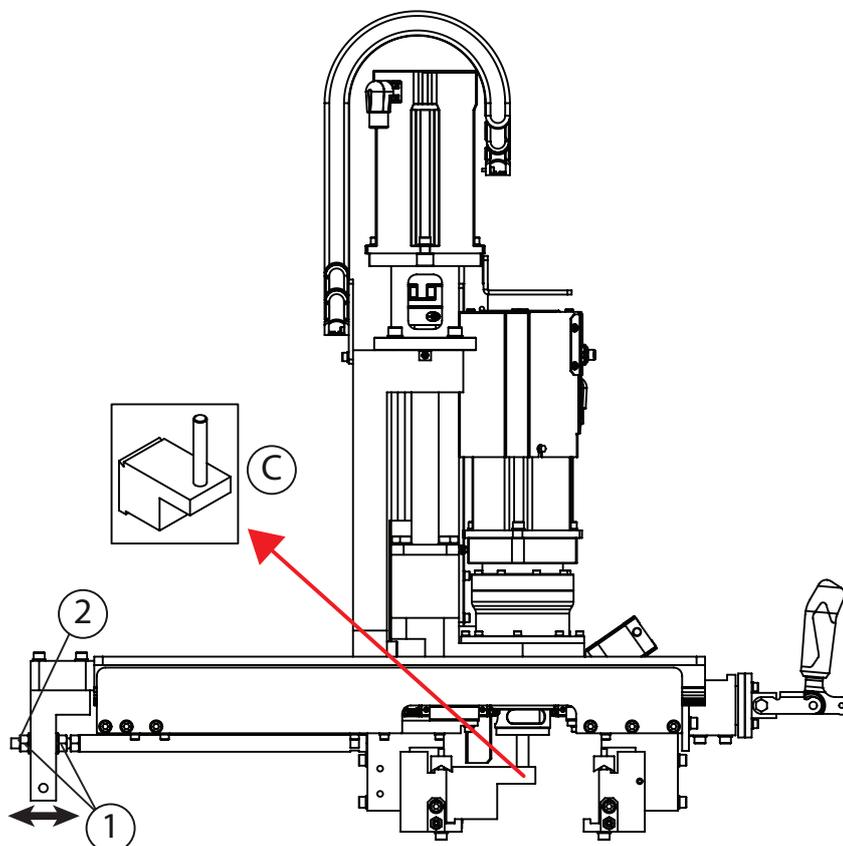
* DB = Diameter Branch, outer

6.7 MANUAL CLAMPING DEVICE

If metal chips accumulate inside the clamp, chips and lubricant have to be removed regularly in order to ensure the reliability of function and visibility.



1. Center adjustment locking nuts (Adjusting of the center point), 2. Adjustment bar of the clamp center point, 3. Drive lever (open/close, pictured closed position), 4. Locking screws (clamping compression adj.), 5. Adjustment screw (clamping compression adj.), 6. Setting the compression force, 7. Stoppers for whole body clamps, 8. Lubrication points (see maintenance)



Adjusting the clamping device center point: 1. Center adjustment locking nuts (Adjusting of the center point), 2. Adjustment bar of the clamp center point, C. Reference tools

1. Adjusting the clamping device center point

The center point of the tube has to be in the same line with the centerline of the spindle.

- Place the reference clamp to the rear clamp assembly groove, and the reference pin to the spindle chuck. Position the clamp as close to the sideways center as possible and tighten to place.
- Open the locking nuts (1) of the center point adjustment.
- Lower down the spindle slowly closer to the reference clamp, and move the clamp by the adjustment bar (2) to get the pin to the hole.
- Tighten the locking nuts with care when the position is correct.

2. Drive lever (open/close) and setting the compressive force

When the drive lever is closed position, the tube is locked (3). Check the suitable compressive force.

The compression force has to be strong enough so that the tube does not move during the work cycle. It may be necessary to adjust the compression force (6) when the tube diameter is changed (if the clamp is too tight or too loose when closed). To adjust, open the locking screws (4), and adjust from the set screw (5). Tighten the locking nuts with care.

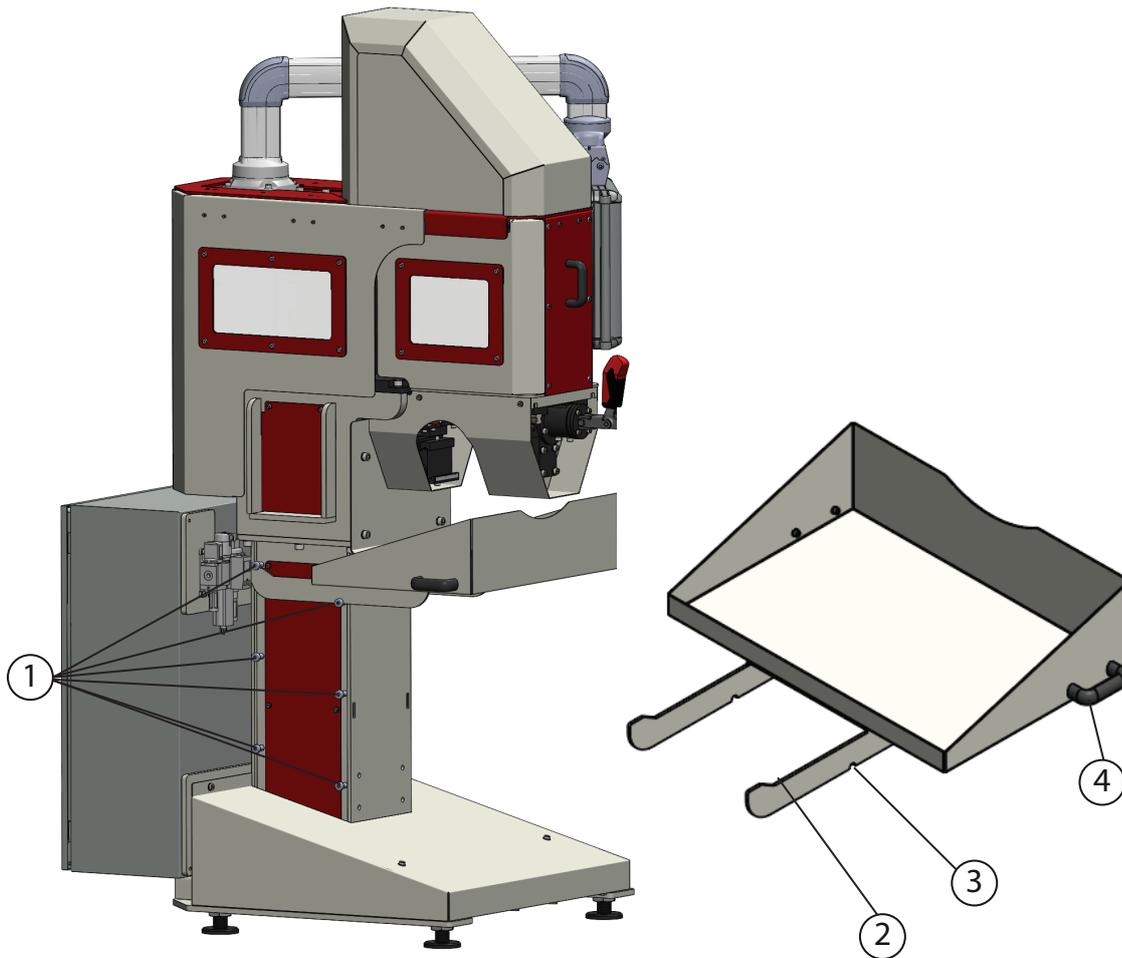
3. Lubrication of the slide blocks (8)

Lubricate the linear rail bearings after 40 000 working cycles or when lubricating other parts of the machine. Use Lithium-based grease as lubricant, for example SHELL GADUS S2 V220 2 or equivalent. See also chapter 7. Maintenance.

6.8 ADJUSTABLE OIL AND CHIP TRAY

The S-56 oil and chip tray has a height adjustment. Hold the tray by the handles, lift and tilt, pull it out, and position to the support knobs to the required height. Make sure, that the support arms are fully leaning to the support knobs.

It is recommended to use the tray always when collaring, to avoid lubricant and metal chips from spreading to the surrounding area.



Adjustable chip tray parts: 1. Support knobs of the chip tray (front and rear), 2. Rear support groove, 3. Front support groove, 4. Tray handle (on both sides)

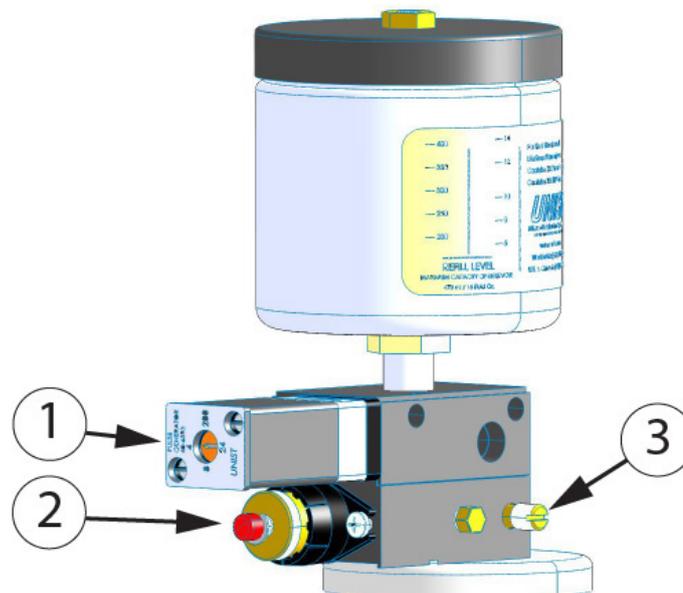
6.9 THE LUBRICATION OF THE COLLARING TOOL

Mist lubrication

The mist lubrication system consists of a lubricator and a special-made nozzle pipe. With copper and brass tubes use suitable lubricant for instance Accu-Lube LB 2000. With stainless steel tubes use for instance Petrofer Drawlub TD-50.

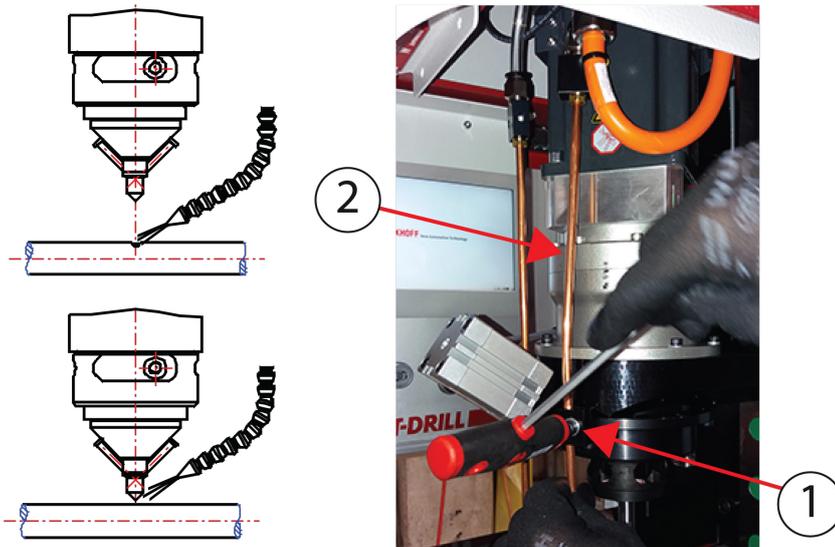
The use of the mist lubrication system:

1. Fill the oil container with lubricant.
2. Let the machine execute several work cycles without tube, until the lubricant emerges from the nozzle.
3. Adjust the frequency of lubricant ejection per minute by means of the impulse generator (at the end of the lubricator (1)).
4. Adjust the quantity of lubricant ejected by one impulse by turning the screw (under the impulse generator (2)).
5. With the air flow adjustment screw (on the side of the lubricator (3)), adjust the air flow so that the mist spray reaches the collaring area.



-
1. Adjustment of time between pulses, 2. Adjustment for the amount of lubricant / pulse, 3. Adjustment of air flow
-

6. Point the lubrication nozzle, i.e the flexible tube towards the bit as shown in figure.



Direct the lubricant towards the tool: Open the lubricant tube holder screw (1) and position the lubricant tube (2) as required, the tube can be moved up and downwards a bit, and bent, if required. Tighten tube holder screw with care.

➔ **NOTE!** Before using the lubricant, make yourself familiar with the instructions for its use! (Instructions enclosed).

6.9.1 OPTION: DOUBLE LUBRICATION SYSTEM

This option has two separate lubrication systems with different lubricants. The lubricant is chosen to match the drilled material. Double lubrication system consists of two similar mist lubrication systems controlled by control panel programming.

Usage: See 6.2. Control panel functions

6.9.2 OPTION: LARGE LUBRICANT CONTAINER WITH WARNING LIGHT

This option has a large lubricant container, which is equipped with a lubricant level sensor and an alarm system with a warning light at the top of the machine.

This system will not allow S-56 to start the work cycle when the lubricant level is too low in the container and the warning lamp is lit. The lamp will switch off and the work cycle can be started right after the lubricant container is filled.



6.10 COLLARING WITH THE S-56 UNIT

1. Select the correct collaring head according to the capacity chart (see chapter “Capacity charts”). Check the adjustment of the forming pins. Readjust if necessary (see chapter 7.4.2 The adjustment of the head).
2. Chuck the collaring head (see chapter “6.4 Collaring head replacement”).
3. Select tube clamps according to the tube size.
4. Clamp the tube.
5. Select the correct collaring program on the user interface.

ⓘ Before starting the automatic work cycle, make sure that the tube is clamped properly.

7. Press the -push button. The unit will carry out a work cycle.
9. Remove the collared, finished tube and insert a new one.
10. Press the -push button to start a new work cycle.

7. MAINTENANCE

7.1 GENERAL MAINTENANCE INSTRUCTIONS

ⓘ DANGER! Disconnect the power from the main switch and close the compressed air supply from the pressure regulator before proceeding to do any maintenance work - unintentional starting of the machine may cause a serious accident or damage to property.

Daily:

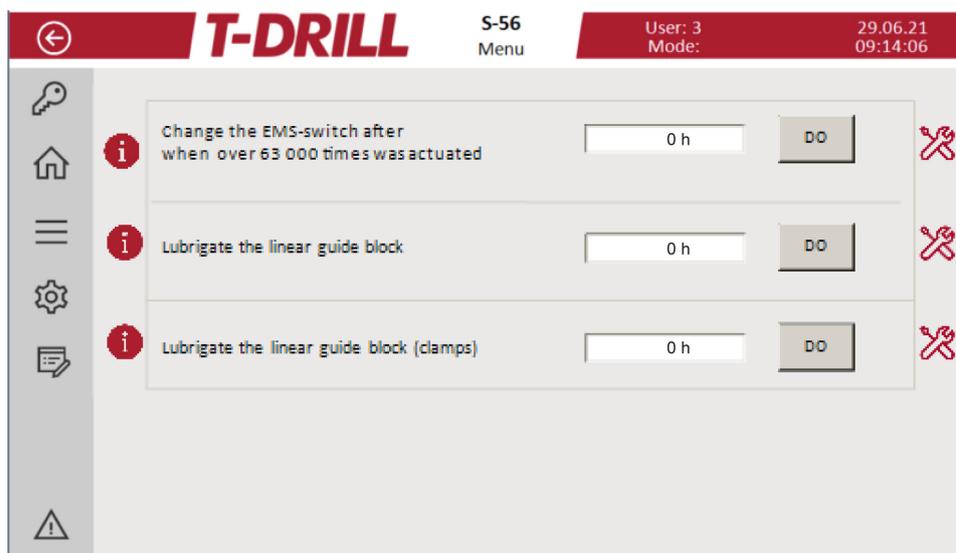
Keep the machine and floor area around it clean of lubricant, debris and metal chips. Use a lint-free cloth to clean machine surfaces.

If chips accumulate inside the clamp, they have to be removed regularly in order to ensure the reliability of function and visibility.

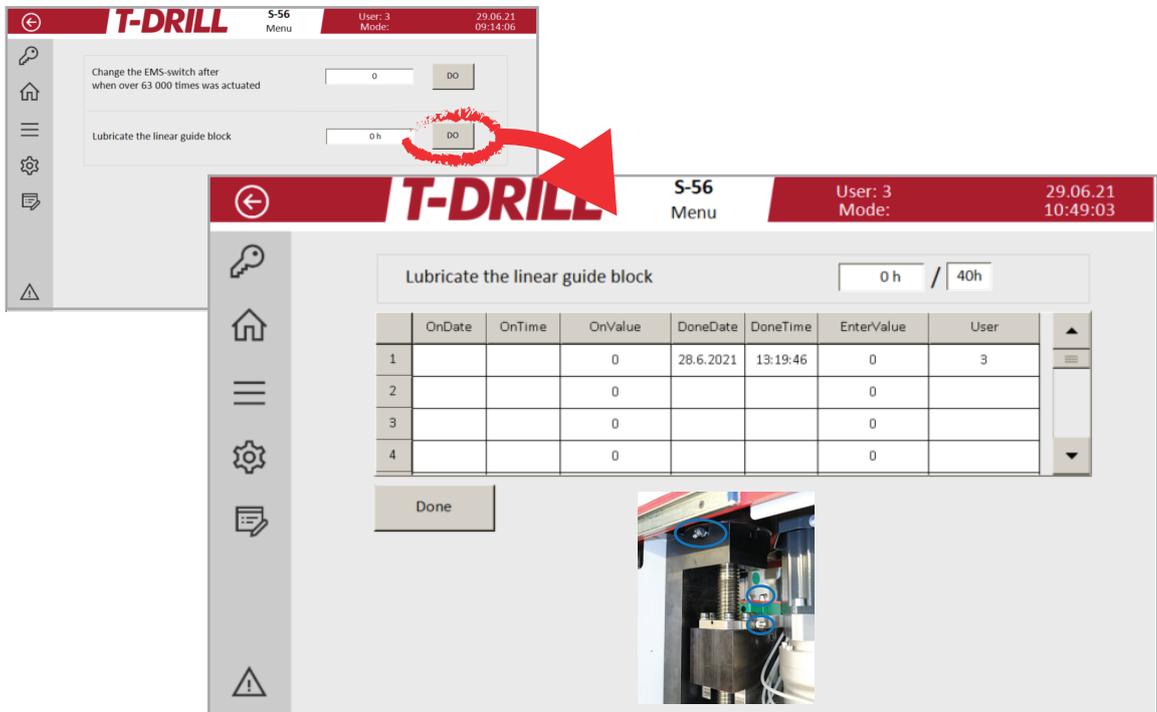
Clean tool with a lint-free cloth, and lubricate when changing the tool.

Scheduled:

When the maintenance is required, the tools-symbol will appear next to the maintenance target on the User Interface "MAINTENANCE"screen.



The Maintenance can only be performed and checked “Done” by the Maintenance users, and the “Do” buttons are visible only for them.



Enter the certain maintenance screen from the “Do”-button. When the maintenance is done, check it done by pressing “Done” button.

The performed maintenance date will appear to top row and the maintenance counter is reset.

Maintenance can be done (and checked) before it is due, if desired.

See chapter: 6.2.2.1.3 Maintenance screen.

Change the Emergency stop-switch after actuated 63000 times

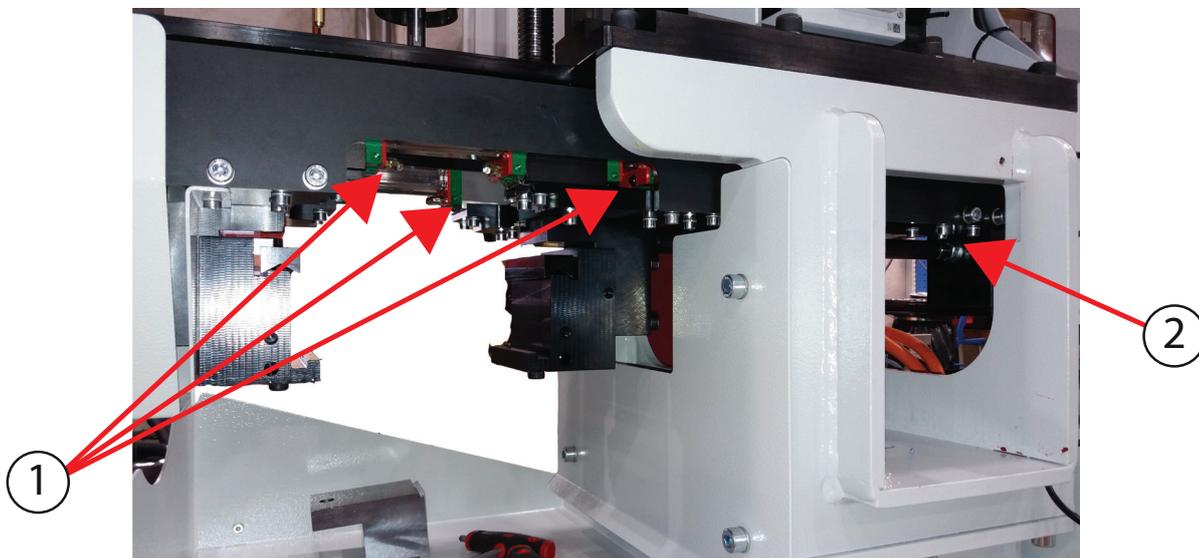


Emergency stop switch on control panel

Lubricate the screwjack block every 40 hours of use



Lubricate the linear guide block (clamps) every 40 hours of use:



Open the covers. Remove red maintenance cover panel from the side of the machine to reach the rear grease nipples. Press grease through the nipples. Use vaseline, for example: SHELL GADUS S2 V220 2 or equivalent.

See separate Hiwin manual for details on guides and blocks.

7.2 MAINTENANCE OF THE FAN

During the first month of operation, control how soon the fan filters gets dirty under the prevailing working conditions. Clean or change the dirty filters at regular intervals according to the need.

There are two filters, one on the top of the unit and the other one on the bottom of the electric box.

7.3 REPLACEMENT OF THE BRAKE SHOE

1. Pull the clamp frame fully out, holding it by the handle located at the front of the machine.

2. Remove the brake cylinder by loosening its 4 fastening screws (1).



3. Pull out the brake cylinder and shoe.



4. Remove the brake shoe. The minimum length of the brake shoe is 17mm.

5. Install a new brake shoe and tighten it carefully.

6. Install the brake cylinder and shoe: the brake body has a guide wedge for the brake shoe, make sure to fit the brake shoe into the body in correct position. Tighten the 4 fastening screws of the brake cylinder securely.

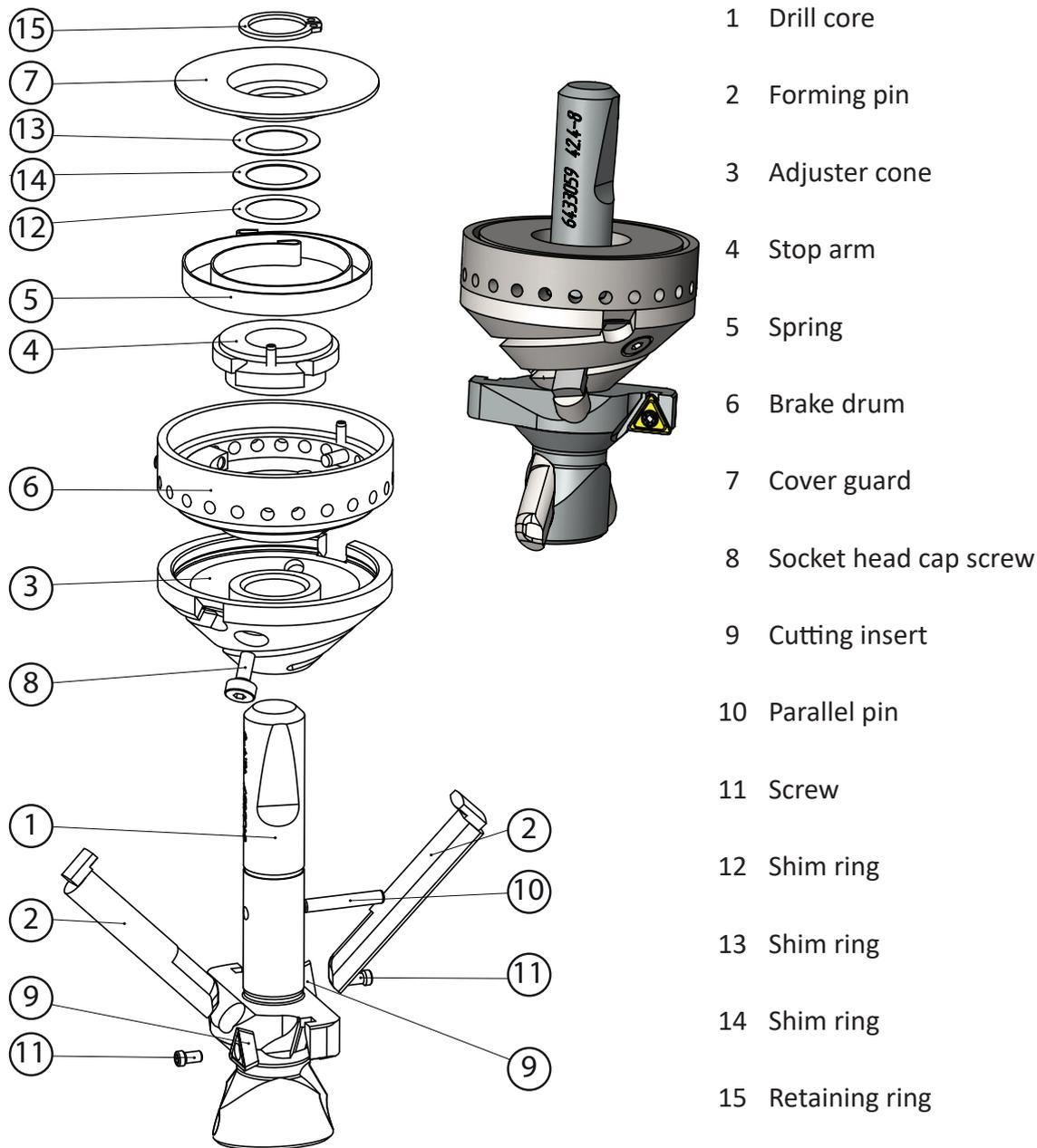
7. Close the clamp frame and switch power and air supply on.

- The brake has a pressure gauge and a regulator on the valve terminal. The operating pressure of the brake is 6 bar, which has been adjusted at the factory and does not require adjustment.
- The brake has air cooling, the blow can be adjusted from the flow control valve on the brake saddle.

7.4 THE COLLARING HEAD

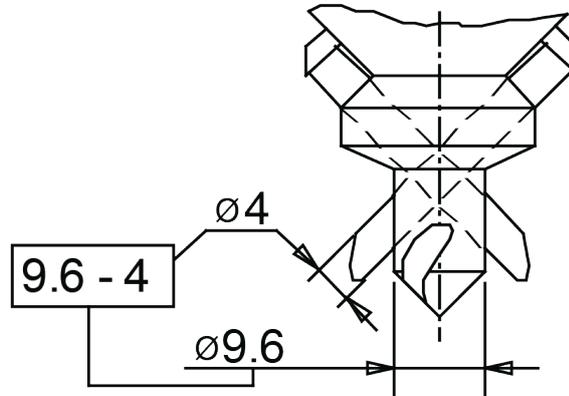
The T-DRILL collaring heads are used to make tube branches with the S-56 units. The construction of the head is illustrated in figure below.

Collaring head parts, example 5433066, size 42,4-8:



Identification of the collaring head

The different collaring heads can be identified as shown in figure:

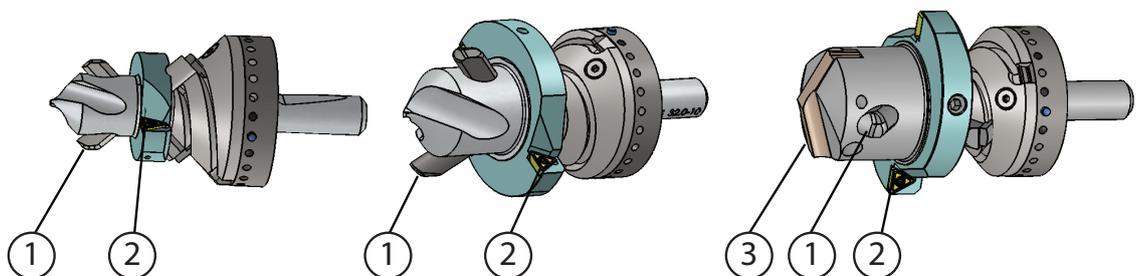


Identification of the collaring head

7.4.1 THE COLLARING HEAD WITH TRIMMING FEATURE (OPTION)

The S-56 machine can be equipped with collaring heads that have trimming feature, and the machine will also be installed with a trimming mode programming. For program instructions, see 6.2. Operation panel functions.

Collaring heads that have the trimming feature are installed and adjusted the same way as ordinary heads. The reference setting is also done the same way.



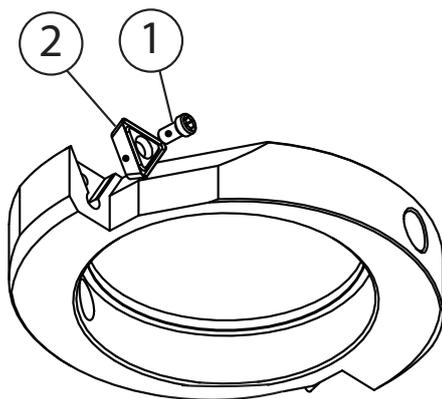
1. Forming pin, 2. Trimming cutting insert, 3. Drill cutting insert of the large head

7.4.1.1 THE TRIMMING BLADE CUTTING INSERTS

The trimming blade cutting inserts are triangular in shape, and can be turned two times to use all edges. To remove blade open fixing screw CSTB-2,5.

When the trimming quality is not as desired, the blades can be either turned or changed.

➔NOTE! Always turn / change both cutting inserts on the blade holder at once.

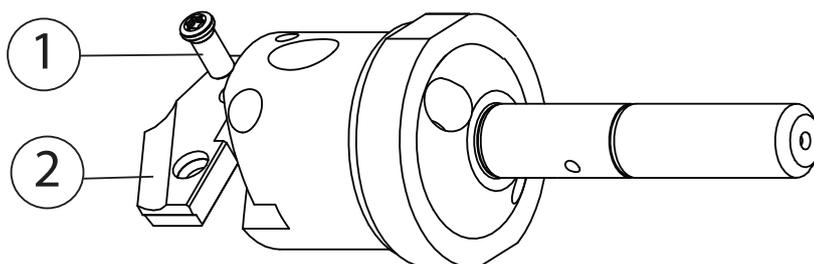


1. Fixing screw CSTB-2,5, 2. Trimming blade cutting insert

7.4.1.2 THE DRILL CUTTING INSERT OF THE LARGE COLLARING HEAD

Other sizes of drills of the collaring heads with trimming feature can be sharpened like the ordinary collaring head drills, but the large size collaring head has a changeable cutting insert. See 7.3.4 Resharpener of the drill bit.

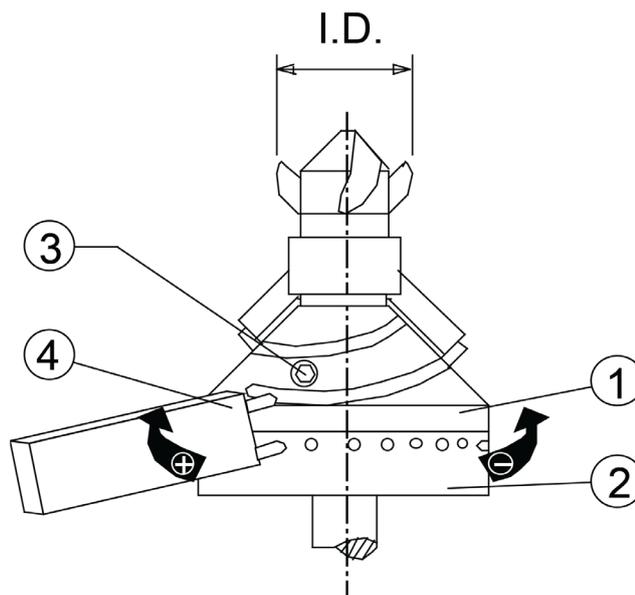
To change insert, open the fastening screws (2 pcs, M5x10 Torx T20). Tighten carefully!



1. Drill insert fastening screws (2 pcs, M5x10 Torx T20), 2. Drill cutting insert

7.4.2 THE ADJUSTMENT OF THE HEAD

1. Draw a line on the on the adjustment cone and the brake drum to mark the present setting.
2. Clamp the collaring head by its shank into a bench vice (using however soft jaws, copper or plastic coated, to avoid damage to the shank).
3. Turn the adjustment cone to completely extend the forming pins. Measure the setting (see figure below).



The adjustment of the collaring head: 1. Adjustment cone, 2. Brake drum, 3. Locking screw, 4. Adjustment tool.

If an adjustment is required, proceed as follows:

1. When the forming pins are completely retracted, loosen both locking screws located in the cone.
2. Rotate the cone in relation to the brake drum by means of the special adjustment tool.
 - A: If a larger inner diameter of the collar is required, turn the cone in the (+) direction.
 - B: If the inner diameter of the collar is to be smaller, turn the cone in the (-) direction. The distance between the holes in the brake drum correspond to about 1,1 mm (0,043 inch) in collar inner diameter variation.
3. Tighten one of the locking screws of the cone.
4. Rotate the cone to fully extend the forming pins. Measure once again.
5. If the inner diameter value is alright, tighten both locking screws of the cone carefully. If the inner diameter adjustment is not satisfactory, repeat the procedure (points 1-4).

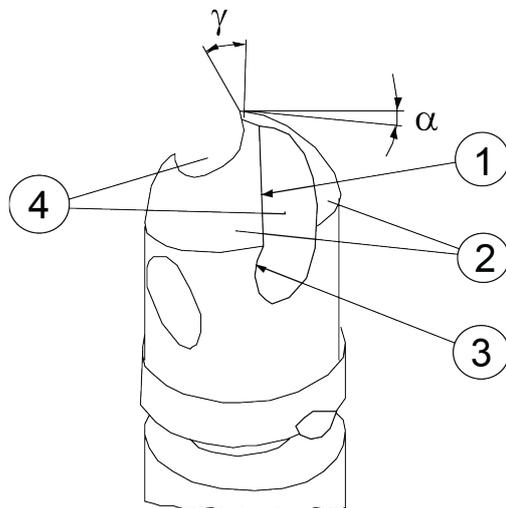
7.4.3 REPLACEMENT AND MAINTENANCE OF THE FORMING PINS

1. Loosen both locking screws of the cone by 1 - 2 turns.
2. Hold the collaring head in your hand by the break drum or the shank.
3. Rotate the cone clockwise with the other hand until the forming pin lugs reach the end of the cone groove.
4. Pull the forming pins out.
5. Insert new forming pins into the holes and put the pin lugs into the groove of the cone. Rotate the cone counterclockwise to retract the forming pins into the head.
6. Carry out the adjustment of the head as described in chapter "The adjustment of the head".

➔**NOTE!** If the forming pins are caked with residue material, remove the material carefully by polishing the pins. Any material caked to the pins reduces the surface quality and the precision of the collar, which increases the strain on the head and the pins, thus shortening the tool's life expectancy.

7.4.4 RESHARPENING OF THE DRILL BIT

➔**NOTE!** Resharpenering of the drill bit demands a special professional skill - a wrongly sharpened drill bit reduces the quality of the collar.



The parts of the bit: α = Clearance angle, γ = Chisel edge angle, 1. Cutting edge, 2. Body clearance surface (land), 3. Rake face, 4. Flute.

The patented cutting geometry of the T-DRILL bit is designed in such a way that a perfect pilot hole without burrs can be achieved at a low feed rate. However, this presupposes that the cutting edge is always kept sharp.

When do we have to sharpen?

When the cutting performance of the bit declines, it does not seem to penetrate the tube surface easily or burrs occur on the edge of the pilot hole, it is time to sharpen. (Note! Burrs may also be a sign of insufficient lubrication). Use of a dull bit must be avoided, because a dull bit wears out very quickly and thus its life expectancy will be relatively short.

Where do we sharpen?

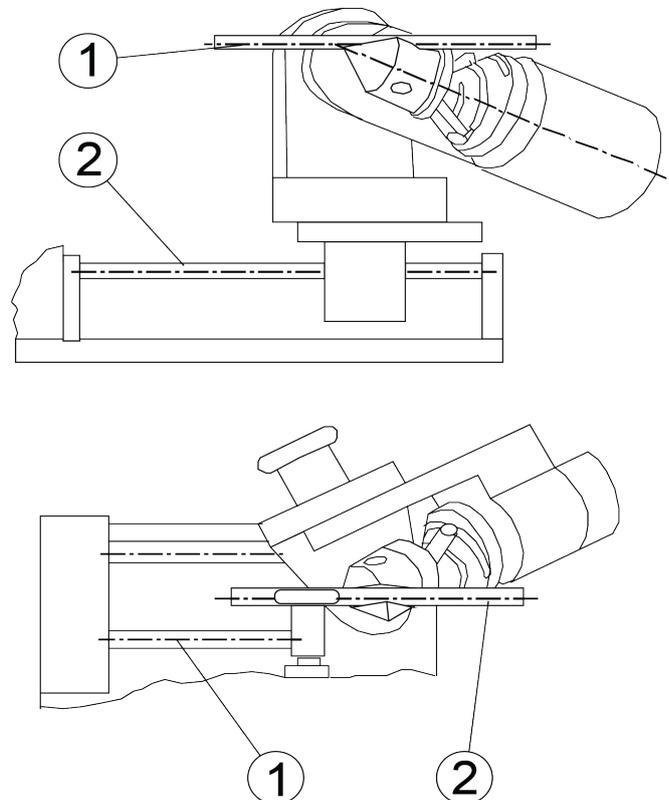
The bit is sharpened at the rake face only. The body clearance surface is never to be sharpened, because even the slightest variation in the grinding angle will radically reduce the cutting characteristics of the bit.

For the sharpening the following equipment is needed:

- A tool grinding machine equipped with a vertically tiltable rotary table
- A fine-grained, thin grinding wheel which fits in the flute
- A straight pin which fits in the cutting-groove by means of which it is easier to set the bit in the correct position.

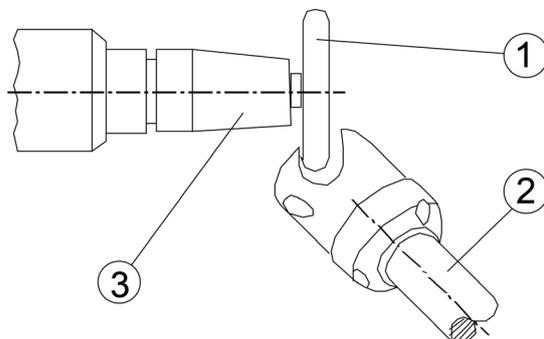
The correct positioning for grinding

1. Fasten the drill shank in the clamping fixture and put the straight pin into the flute. Set the pin parallel with the slide bars of the grinding machine carriage both vertically and horizontally. (See figure below).



The correct positioning for grinding: 1. Slide bars of grinder, 2. Straight pin.

2. The drill shank is turned around its axis so that the rake face is in vertical position. See figure below.



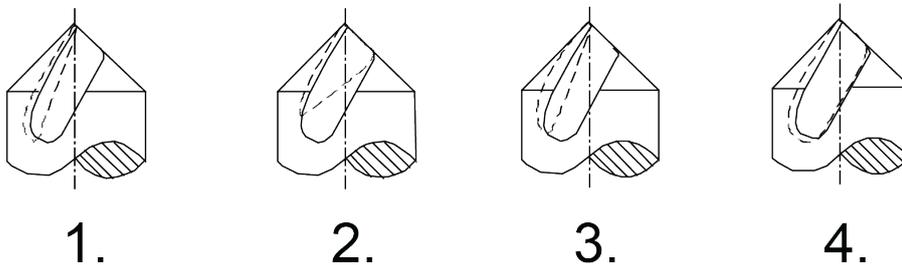
The grinding of the cutting edge: 1. Grinding wheel, 2. Drill shank, 3. Spindle of the grinder

3. Check that both settings mentioned in points 1 and 2 are correct.

4. Adjust the depth of the wheel to be as near to the bottom of the flute as possible.

Grinding operation

The grinding is carried out by moving the bit forward and back and turning it around its own axis until the cutting edge of the bit is perfectly ground. When grinding, be careful not to make the drill bit turn blue (which indicates too much heat) because that will soften the cutting edge.



Grinding the bit: 1. Correct grinding, 2. Bit has been ground too much, 3. Chisel angle too small, 4. The point of the bit has been ground too much.

8. THE INCLUSION OF THE S-56 UNITS INTO ANOTHER SYSTEM

Before connecting the S-56 to another system, please contact T-Drill Oy (Finland).

9. TROUBLESHOOTING

Problem	Cause	Remedy
The work cycle does not start	Check the User interface for alarms and program contents.	Do required repairs and ack alarms. Program may have missing parameters that prevent the work cycle from starting.
	There is no voltage supply	Check the main switch and the voltage supply.
	The spindle is not in home position	Drive the spindle to the home position by using the manual drive button.
The size of the collar varies.	The brake does not press the brake ring with sufficient force: – The brake shoe is worn out so much that the cylinder stroke is not sufficient (min.operation length), – The brake force is not sufficient.	Change brake shoe Adjust the brake
	The tube vibrates and resonates.	Clamp the tube in the correct way
	Axial play in the collaring head	Eliminate the play by means of spacer rings, max.play 0.1mm
	The operation of the collaring head is jerky or tight	Service the collaring head.
	Dirt stuck to the surface or the holes of the forming pins.	Clean or polish the forming pins.
	Bottom dead center of feed set too high, so that the forming pins cannot fully extend.	Adjust the reference position.
	Adjusting screw of the head too slack.	Tighten the screw.
	The tube does not stay in place during collaring	The clamping force is not sufficient

Problem	Cause	Remedy
Burs in the collar	Burrs in the pilot hole: - Dull drill bit - Unit almost out of lubricant - Lubricant of inferior quality	Resharpen drill bit Refill the lubricant container Only use lubricant recommended by T-Drill
	The forming pins are worn out or there is dirt caked on their surface	Clean or change the forming pins.
	Not enough lubricant during collaring	Increase the supply of lubricant, direct the nozzle pipe to the right spot
	The lubricant is not suitable for the material you are collaring	Consult your local T-DRILL dealer
	The wall thickness of the tube exceeds the max. allowed value	See the capacity charts.
	The setting of the head (forming pins) is too small	Choose the right collaring head
The forming pins break off or the drill shank breaks	Burrs in the pilot hole: – Drill bit dull – Lubricant almost finished	Resharpen drill bit Add lubricant to the container
	The wall-thickness of the tube exceeds the max. allowed value	See the capacity charts.
	Not enough lubricant during collaring	Increase supply of lubricant, direct nozzle pipe to the right spot
	The lubricant is not suitable for your material	Consult your local T-DRILL dealer.
	The tube vibrates and resonates	Clamp the tube in the proper way.
	The lower dead point of the feed is set too high	Adjust the reference position.
	The drilling start point is incorrect	Adjust the reference position and check the collaring head and the collaring head selector

Problem	Cause	Remedy
The unit performs a work cycle but the forming pins do not extend	The cylindrical pin (15) of the brake drum has come off	Replace the pin
	The head or one of its parts (crown, pin etc) is broken	Install a new head or replace the broken part
	The speed of the brake shoe is too low.	Adjust the speed of the brake with the adjustment valve.
	The brake shoe is worn out	Change the brake shoe.
	Air pressure is too low.	Check the air pressure.

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

Give your contact information

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

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

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

10. SUPPLEMENT

10.1 COLLARING HEADS S-56 (FOR PARTS, SEE SPARE PARTS CATALOGUE)

10.1.1 COLLARING HEADS S-54 (STANDARD)

Identif. of the head	4.5-2	5.2-2	6.2-3	7.4-3	9.6-4	11.5-5	14.0-6
Collar size I.D.	6mm / 1/4"	8mm / 5/16"	10mm / 3/8"	12mm / 1/2"	15mm / 5/8"	18mm / 3/4"	22mm / 7/8"
Collaring range mm	6.0-7.8mm	7.8-8.8mm	8.8-10.3mm	10.3-13.2mm	13.2-16.5mm	16.5-19.5mm	19.5-23mm
Part No.	5430011	5430012	5430013	5430014	5430016	5430017	5430018

Identif. of the head	16.0-6	18.0-8	22.0-8	27.0-8	32.0-10	37.0-10	37.0-10
Collar size I.D.	25mm / 1"	28mm / 1 1/8"	35mm / 1 3/8"	42mm / 1 5/8"	48 mm	51mm / 2"	54mm / 2 1/8"
Collaring range mm	23-26.5 mm	26.5-31 mm	34-38 mm	38-44 mm	48-51 mm	51-53 mm	53-56 mm
Part No.	5430019	5430020	5430021	5430022	5431831	5431974	5430023

10.1.2 TIALN COATED COLLARING HEADS S-54

Identif. of the head	4.7-2	5.2-2	6.2-3	7.4-3	9.6-4	11.5-5
Collar size I.D.	6mm / 1/4"	8mm / 5/16"	10mm / 3/8"	12mm / 1/2"	15mm / 5/8"	18mm / 3/4"
Collaring range mm	6.0-7.8mm	7.8-8.8mm	8.8-10.3mm	10.3-13.2mm	13.2-16.5mm	16.5-19.5mm
Part No.	5431593 TiAlN	5431582 TiAlN	5431520 TiAlN	5431532 TiAlN	5431525 TiAlN	5431533 TiAlN

Identif. of the head	14.0-6	16.0-6	18.0-8	22.0-8	27.0-8	32.0-10	37.0-10
Collar size I.D.	22mm / 7/8"	25mm / 1"	28mm / 1 1/8"	35mm / 1 3/8"	42mm / 1 5/8"	48 mm	54mm / 2 1/8"
Collaring range mm	19.5-23mm	23-26.5mm	26.5-31mm	34-38mm	38-44mm	48-51mm	53-56mm
Part No.	5431534 TiAlN	5431900 TiAlN	5431599 TiAlN	5431598 TiAlN	5431708 TiAlN	5432348 TiAlN	5431898 TiAlN

10.1.3 COLLARING HEADS FOR PREMADE ELLIPTIC PILOT HOLES

Identif. of the head	17,2-3	21,3-4	26,9-5	33,7-6
Part No.	5433062	5433063	5433064	5433065

Identif. of the head	42,4-8	48,3-8	60,3-10
Part No.	5433066	5433067	5433068

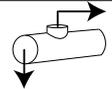
10.2 CAPACITY CHARTS

With the aid of the capacity charts on the following pages you will be able to determine the max. wall-thickness of the tube and select the right collaring head.

Instructions for the use of the capacity charts:

1. Find on one of the following pages the suitable capacity chart according to the material you are going to use (copper, steel, stainless steel).
2. Use the unit of measure you wish: the measures of the charts are both in mm and in inches.
3. From the horizontal black row, find the collar size you need, and from the vertical black column the diameter of your run tube.
4. The intersection of the horizontal and vertical rows will show you the max. wall thickness of the tube. This value is not to be exceeded.
5. The size of collaring head is indicated in the second horizontal row, below the black one (the underlined numbers).

Example: Run tube $\varnothing 12$, collar $\varnothing 10$:

	$\varnothing 6$	$\varnothing 8$	$\varnothing 10$	$\varnothing 12$	$\varnothing 15$
	4.5-2	5.2-2	6.2-3	7.4-3	9.6-4
$\varnothing 8$	0.5	0.5			
$\varnothing 10$	0.8	0.8	1.0		
$\varnothing 12$	0.8	1.0	1.0	1.0	
$\varnothing 15$	0.8	1.0	1.0	1.0	1.2
$\varnothing 18$	0.8	1.0	1.0	1.0	1.2
$\varnothing 22$	0.8	1.0	1.2	1.2	1.5
$\varnothing 25$	0.8	1.0	1.2	1.2	1.5
$\varnothing 28$	0.8	1.0	1.2	1.2	1.5
$\varnothing 35$	0.8	1.0	1.2	1.2	1.5

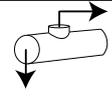
- Use head 6.2-3
- Wall thickness 1.0 or less

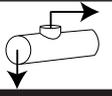
In addition, many thicker pipe walls than mentioned in the capacity table are suitable for S-56 HD (heavy duty) collaring process.

In case of thicker pipe walls - please contact T-DRILL Sales!

The capacity chart of the S-56 for collaring in copper tubes

A. Measures in millimetres (mm)

	Ø6x#	Ø8x	Ø10	Ø12	Ø15	Ø18	Ø22
	4.5-2	5.2-2	6.2-3	7.4-3	9.6-4	11.5-5	14.0-6
Ø8	0.5	0.5					
Ø10	0.8	0.8	1.0				
Ø12	0.8	1.0	1.0	1.0			
Ø15	0.8	1.0	1.0	1.0	1.2		
Ø18	0.8	1.0	1.0	1.0	1.2	1.2	1.5
Ø22	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø25	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø28	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø35	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø42	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø48	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø54	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø63	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø76	0.8	1.0	1.2	1.2	1.5	1.5	2.0
Ø108	0.8	1.0	1.2	1.2	1.5	1.5	2.0

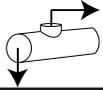
	Ø25	Ø28	Ø35	Ø42	Ø48	Ø51	Ø54
	16.0-6	18.0-8	22.0-8	27.0-8	32.0-10	37.0-10	37.0-10
Ø10							
Ø12							
Ø15							
Ø18							
Ø22							
Ø25	1.5						
Ø28	2.0	1.5					
Ø35	2.0	2.0	1.5				
Ø42	2.0	2.0	2.0	2.0			
Ø48	2.0	2.0	2.0	2.0	2.0		
Ø51	2.0	2.0	2.0	2.0	2.0	2.0	
Ø54	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ø63	2.0	2.0	2.5	2.5	2.5	2.5	2.5
Ø76	2.0	2.0	2.5	2.5	2.5	2.5	2.5
Ø108	2.0	2.0	2.5	2.5	2.5	2.5	2.5

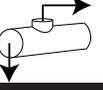
x) A slight internal burr may occur #) Collar height is shallow

➔NOTE! The measures of the charts are guide values - we reserve to ourselves the rights of changes. Other wall-thicknesses and tube sizes: please consult your local T-DRILL dealer.

The capacity chart of the S-56 for collaring in copper tubes

B. Measures in inches - Tube diameters outer diameter sizes

	Ø1/4x#	Ø5/16x	Ø3/8	Ø1/2	Ø5/8	Ø3/4	Ø7/8
	4.5-2	5.2-2	6.2-3	7.4-3	9.6-4	11.5-5	14.0-6
Ø 5/16	0.020	0.020					
Ø 3/8	0.031	0.031	0.031				
Ø 1/2	0.031	0.039	0.039	0.039			
Ø 5/8	0.031	0.039	0.039	0.039	0.047		
Ø 3/4	0.031	0.039	0.039	0.039	0.047	0.047	
Ø 7/8	0.031	0.039	0.047	0.047	0.059	0.059	0.059
Ø 1	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø1 1/8	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø1 3/8	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø1 5/8	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø48 mm	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø2 1/8	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø2 5/8	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø3 1/8	0.031	0.039	0.047	0.047	0.059	0.059	0.079
Ø4 1/8	0.031	0.039	0.047	0.047	0.059	0.059	0.079

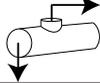
	Ø 1	Ø1 1/8	Ø13 /8	Ø1 5/8	Ø48 mm	Ø 2	Ø2 1/8
	16.0-6	18.0-8	22.0-8	27.0-8	32.0-10	37.0-10	37.0-10
Ø 5/16							
Ø 3/8							
Ø 1/2							
Ø 5/8							
Ø 3/4							
Ø 7/8							
Ø 1	0.059						
Ø1 1/8	0.079	0.059					
Ø1 3/8	0.079	0.079	0.059				
Ø1 5/8	0.079	0.079	0.079	0.079			
Ø48 mm	0.079	0.079	0.079	0.079	0.079		
Ø 2	0.079	0.079	0.079	0.079	0.079	0.079	
Ø2 1/8	0.079	0.079	0.079	0.079	0.079	0.079	0.079
Ø2 5/8	0.079	0.079	0.079	0.098	0.098	0.098	0.098
Ø3 1/8	0.079	0.079	0.079	0.098	0.098	0.098	0.098
Ø4 1/8	0.079	0.079	0.079	0.098	0.098	0.098	0.098

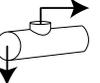
x) A slight internal burr may occur #) Collar height is shallow

The measures of the charts are guide values - we reserve to ourselves the rights of changes. Other wall-thicknesses and tube sizes: please consult your local T-DRILL dealer.

The capacity chart of the S-56 for collaring in steel tubes and stainless steel tubes, drilling, collaring and trimming

A. Measures in millimetres (mm)

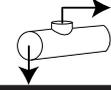
	Ø10	Ø12	Ø15	Ø18	Ø22
	6.2-3	7.4-3	9.6-4	11.5-5	14.0-6
Ø10	0.8				
Ø12	0.8	0.8			
Ø15	1.0	1.0	1.0		
Ø18	1.0	1.0	1.2	1.0	
Ø22	1.0	1.0	1.2	1.2	1.2
Ø25	1.0	1.0	1.2	1.2	1.2
Ø28	1.0	1.0	1.2	1.2	1.2
Ø35	1.0	1.0	1.2	1.2	1.4
Ø42	1.0	1.0	1.2	1.2	1.4
Ø48	1.0	1.0	1.2	1.4	1.4
Ø54	1.0	1.0	1.2	1.4	1.4
Ø63	1.0	1.0	1.2	1.4	1.6
Ø76	1.0	1.0	1.2	1.4	1.6
Ø108	1.0	1.0	1.2	1.4	1.6

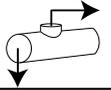
	Ø25	Ø28	Ø35	Ø42	Ø48	Ø51	Ø54
	16.0-6	18.0-8	22.0-8	27.0-8	32.0-10	37.0-10	37.0-10
Ø10							
Ø12							
Ø15							
Ø18							
Ø22							
Ø25	1.2						
Ø28	1.2	1.2					
Ø35	1.4	1.2	1.2				
Ø42	1.4	1.4	1.4	1.2			
Ø48	1.4	1.4	1.4	1.4	1.2		
Ø51	1.4	1.4	1.4	1.4	1.4	1.2	
Ø54	1.4	1.4	1.4	1.4	1.4	1.2	1.2
Ø63	1.6	1.6	1.6	1.6	1.4	1.4	1.4
Ø76	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Ø108	1.6	1.6	1.6	1.6	1.6	1.6	1.6

➔ **NOTE!** The measures of the charts are guide values - we reserve to ourselves the rights of changes. Other wall-thicknesses and tube sizes: please consult your local T-DRILL dealer.

The capacity chart of the S-56 for collaring in steel tubes and stainless steel tubes

B. Measures in inches - Tube diameters outer diameter sizes

	Ø3/8	Ø1/2	Ø5/8	Ø3/4	Ø7/8
	6.2-3	7.4-3	9.6-4	11.5-5	14.0-6
Ø 3/8	0.031				
Ø 1/2	0.031	0.031			
Ø 5/8	0.039	0.039	0.039		
Ø 3/4	0.039	0.039	0.047	0.039	
Ø 7/8	0.039	0.039	0.047	0.047	0.047
Ø1	0.039	0.039	0.047	0.047	0.047
Ø1 1/8	0.039	0.039	0.047	0.047	0.047
Ø1 3/8	0.039	0.039	0.047	0.047	0.055
Ø48 mm	0.039	0.039	0.047	0.047	0.055
Ø1 5/8	0.039	0.039	0.047	0.047	0.055
Ø2 1/8	0.039	0.039	0.047	0.055	0.055
Ø2 5/8	0.039	0.039	0.047	0.055	0.063
Ø3 1/8	0.039	0.039	0.047	0.055	0.063
Ø4 1/8	0.039	0.039	0.047	0.055	0.063

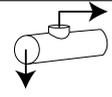
	Ø1	Ø1 1/8	Ø1 3/8	Ø1 5/8	Ø48 mm	Ø2	Ø2 1/8
	16.0-6	18.0-8	22.0-8	27.0-8	32.0-10	37.0-10	37.0-10
Ø 3/8							
Ø 1/2							
Ø 5/8							
Ø 3/4							
Ø 7/8							
Ø1	0.047						
Ø1 1/8	0.047	0.047					
Ø1 3/8	0.055	0.047	0.047				
Ø48 mm	0.055	0.055	0.055	0.047			
Ø1 5/8	0.055	0.055	0.055	0.047	0.047		
Ø2	0.055	0.055	0.055	0.055	0.055	0.047	
Ø2 1/8	0.055	0.055	0.055	0.055	0.055	0.047	0.047
Ø2 5/8	0.063	0.063	0.063	0.063	0.063	0.055	0.055
Ø3 1/8	0.063	0.063	0.063	0.063	0.063	0.063	0.063
Ø4 1/8	0.063	0.063	0.063	0.063	0.063	0.063	0.063

➔ **NOTE!** The measures of the charts are guide values - we reserve to ourselves the rights of changes. Other wall-thicknesses and tube sizes: please consult your local T-DRILL dealer.

The capacity chart of the S-56 for collaring in steel tubes and stainless steel tubes with premade elliptic pilot holes (EC-tool).

See 10.1.3 Collaring heads for premade elliptic pilot holes

Note! Collar outside diameter.

	17,2	21,3	26,9	33,7	42,4	48,3	60,3
	¾"	7/8"	1"	1 ¼"	1 ½"	1 ¾"	2 ¼"
21,3 7/8"	0,8 .030	0,8 .030					
26,9 1"	1,0 .040	1,0 .040	1,0 .040				
33,7 1 ¼"	1,0 .040	1,24 .049	1,24 .049	1,24 .049			
42,4 1 ½"	1,0 .040	1,24 .049	1,65 .065	1,65 .065	1,65 .065		
48,3 1 ¾"	1,0 .040	1,65 .065	1,65 .065	1,65 .065	1,65 .065	1,65 .065	
60,3 2 ¼"	1,0 .040	1,65 .065	1,65 .065	2,11 .083	2,11 .083	2,11 .083	1,65 .065
76,1 3"	1,24 .049	1,65 .065	2,11 .083	2,11 .083	2,11 .083	2,11 .083	2,11 .083
88,9 3 ½"	1,24 .049	1,65 .065	2,11 .083	2,11 .083	2,11 .083	2,11 .083	2,11 .083
101,6 4"	1,24 .049	1,65 .065	2,11 .083	2,11 .083	2,11 .083	2,11 .083	2,11 .083
114,3 4 ½"	1,24 .049	1,65 .065	2,11 .083	2,11 .083	2,11 .083	2,11 .083	2,11 .083

11. SAFETY DATA REGARDING THE LUBRICANTS

The safety data sheets regarding the following lubricants are sent together with the lubricants:

- ACCU LUBE LB 2000
- Petrofer Isoform TD 50

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

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

Contact information:	Global	USA, Mexico, Canada
Spare part inquiries and orders	sales@t-drill.fi	sales@t-drill.com
Technical support	service@t-drill.fi	service@t-drill.com
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More T-DRILL products for tube fabrication



S-54 AFT
S-54 collaring unit with Automatic Feed Table (AFT).



T-115
Transportable Collaring Unit for both factory and on-site
-Collar sizes 21.3 - 114.3 mm
-Run tube sizes 33.7 - 323.9 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



TCC-50 MCS
Transportable manually operated cutting machine with optional cut to length setting adjustment. For tube diameters 1.5 - 45 mm



TCC-28
Automatic tube cutting machine for chipless tube cutting from coil and straight lengths. Automatic cut length setting tube diameters 4.76 - 22 mm