EVOLINE

Operating Instruction

Tangential rolling system **T3.18 EVO**

www.lmt-tools.com

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1. General

1.1 Introduction

The *rolling system* has been constructed according to the state of the art in accordance with the recognized safety rules and standards and manufactured in accordance with TÜV-CERT DIN ISO 9001 and VDA 6.4.

The operating instructions apply solely to the *rolling system* described in the *operating instructions*.

Terms in italics are defined as a collective term at the appropriate place:

- In using the collective term the information relates to all single terms.
- In using the singular term the information relates solely to the stated single term.

NOTE

The collective term *rolling system* includes the single terms rolling head, all accessories, consumables, and spare parts.

The illustrations and information contained in these operating instructions are subject to technical changes that are necessary to improve the *rolling system*.

NOTE

Modifications or amendments to these operating instructions made at a later time can be found online under www.lmt-tools.de/dokumente-downloads.

The operating instructions are written with the intention to be read, understood and observed in all respects by those who are responsible for the use of the *rolling system*.

A safe and error-free use of the *rolling system* is only possible if the contents of the operating instructions are understood by the competent persons and observed in all respects.

HINWEIS

Work instructions are supplemented by position numbers.
Compare the information with chapter 7.

Improper use of the *rolling system* can endanger people and cause property damage. No liability shall be assumed for any damage or malfunctions resulting from failure to observe these operating instructions.

NOTE

Note all warnings and safety instructions and the operating instructions for the machine.

Storage of the operating instructions

The entire operating instructions must be stored carefully and always kept with the *rolling system* as part of the product.

The operating instructions must be kept near the *rolling system* so that they are available to all persons working with the *rolling system* as required.

Warranty and technical support

We guarantee proper function of the delivered product with purchase. We are not liable for damage in case of:

- improper use of the *rolling system*.
- use of non-original components.
- use of accessories not authorized by us.
- modifications undertaken without our authorization.
- use of damaged components.

Modifications to the components are permitted only after written agreement with us.

We undertake modifications to the *rolling system* to adapt the *rolling system* to the requirements of the operator. We inform the operator of the modifications and impact on the use of the *rolling system*.
The operating instructions describe the use of a *rolling system* without modifications.

If you encounter any problems or have any questions, please contact our Service Hotline, which will be glad to help.

We offer training specially tailored to your needs for your staff at your site. We also hold regular seminars in the LMT Group Academy, our subsidiaries and representatives.

1.2 Operator's obligation of diligence

The operator of the *rolling system* must ensure that

- the intended use of the *rolling system* is ensured at all times.
- the *rolling system* is always in a perfect and functioning condition.
- only qualified and authorized personnel assemble and operate the *rolling system* in accordance with these operating instructions.
- the qualified and authorized personnel are regularly informed about all the necessary rules of occupational safety and environmental protection.
- the qualified and authorized personnel are informed in detail about modifications made and their impact.
- there is sufficient necessary protective equipment for the qualified and authorized personnel that is in good condition and that such equipment is worn.
- the operating instructions are available in legible condition and in full at the installation site of the *rolling system*.

1.3 Contact

Service-Hotline:

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21493 Schwarzenbek
Deutschland
Phone.: +49 4151 12 391
Fax: +49 4151 12 502
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1.4 Copyright

2. *Safety*

2.1 Explanation of symbols and instructions

All safety instructions and warnings in the operating instruction are structured as follows:

Danger level/Signal word

Type and source of the danger

Measures to avoid danger

Hazard symbols

The operating instructions differentiate between three hazard symbols, which allow an initial allocation of hazards. The yellow triangle indicates a general risk to people, property, animals or the environment.

Danger level

General danger to people, property, animals or the environment from the rolling system.
Measure to avoid the danger

The red, octagonal hazard symbol with the signal word IMPORTANT indicates a potentially harmful situation for the *rolling system*. Observing the operational steps, guidelines and instructions avoids damage to or destruction of the *rolling system*.

IMPORTANT

A potentially harmful situation for the *rolling systems*.

Fellow all operational steps, guidelines and instructions in order to avoid damage or destruction to the *rolling system*.

The third hazard symbol with the signal word NOTE indicates important information and tips for the user.

NOTE

No direct danger
Important information and additional tips for the user on using the *rolling system*.

Danger levels/Signal word

In the case of the yellow triangle the danger level indicates the degree of danger. Three danger levels are used. Each word is chracterized by a color that illustrate the danger levels.

CAUTION

The danger level indicates a hazard with a low level of risk which, if not avoided, may result in slight or moderate injury.

WARNING

The danger level indicates a hazard with a medium level of risk which, if not avoided, may result in death or serious injury.

DANGER

The danger level indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Example:

DANGER

General risk due to the use of the *rolling system* by unqualified or unauthorized personnel.

Use of the *rolling system* only by qualified and authorized personnel.

2.2 Basic safety instructions

DANGER

General danger when using the *rolling system*.

Follow the operating instructions.

These include

- the basic safety instructions from the entire chapter 2 for the entire operating instructions,
- the preceding instructions for a particular chapter and
- the embedded instructions for a particular step.

Follow all local health and safety and operational safety regulations.

Chapter 2, Safety, informs you about the basic safety instructions to ensure safe and trouble-free use of the *rolling system*.

- Please contact the operator in the event of any changes to the *rolling system*.
- Refrain from any methods of working which could compromise safety.
- Only ever perform work on the rolling system when the machine is at standstill and if necessary take the *rolling system* out of the machine room.
- Before starting work on the *rolling system*, secure the drives and additional devices of the machine against accidental activation.
- Make sure there is sufficient space in the machine and pay attention to the risk of injury originating from adjacent tools and machine parts.
- Before any commissioning, check that the screws on the *rolling system* are tightened.
-

WARNING

The *rolling system* is made of various materials (e.g. nickel), which can trigger an allergic reaction.
General risk of injury from sharp edges.

Wear protective gloves and protective eyewear when using the *rolling systems*.

The weight of the rolling system may cause harm when it falls down.
General risk of injury during transportation/lifting of the rolling system.

- Ensure that the *rolling system* is protected of falling down or tipping over.
- Wear safety boot/hard-toed boot at all times. .
- Use suitable hoisting devices.

2.3 Intended use

IMPORTANT

The *rolling system* may only be used for the intended use.
Make sure that the *rolling system* is free of chips at all times.
Never apply force when using the *rolling system*.

The *rolling system* must only be used as a tool on a processing machine for chip-free manufacture of profiles on the outside of rationally symmetrical work pieces.

NOTE

Note that the *rolling system* is customized to the requirements specified by the operator.
Please contact our Service Hotline if you wish to use the *rolling system* in any way other that the agreed use.

The scope of application for the rolling system is to carry out a *rolling process*.
The *rolling process* includes the following manufacturing processes:

- threading
- knurling
- smoothing
- reducing and
- cold forming of rotationally symmetrical workpieces, to produce other profiles.

Rollvorgang

NOTE

The collective term *rolling process* includes the production processes of knurling, smoothing and cold forming of rotationally symmetrical workpieces for manufacturing other profiles.

Smoothing is a surface compression.
Sizing by smoothing, to perform a tolerance constriction, is not possible.

IMPORTANT

Be sure to use a torque wrench for all work on the rolling head and observe the tightening torque for each bolt (see chapter 3.7).

CAUTION

Bear in mind that the rolling head contains tensioned springs. If sufficient care is not taken, they can come loose and cause injury to yourself or to bystanders.

Wear protective eyewear when working with the *rolling system*!

NOTE

Use other than the intended use is only allowed after written agreement with us.

Any use other than the intended use is considered improper use. We shall not be liable for any damage resulting from improper use. The risk is borne by the operator.

Intended use includes the observance of these operating instructions.

For each subchapter, read the corresponding main chapter.

Coolants and lubricants

Liquids that are also used during machining are suitable as coolants and lubricants:

- emulsions in dilutions ranging from 1:10 to 1:20 (in some cases with high-pressure additives),
- low viscosity cutting oils and
- molybdenum (IV) sulfide.

NOTE

Observe the information and instructions provided by the manufacturer.

You can increase the service life of the rolls by using high-pressure additives, because high-pressure additives improve the sliding characteristics between the rolls and the workpiece.

Please contact our Service Hotline if you want to undertake dry processing with the *rolling system*.

IMPORTANT

Ensure that the cooling lubricant is free from chips or particles to prevent foreign bodies from being rolled into the thread and to prevent undue wear of the thread rolls and of the rolling head.

The rolling process is negatively affected by strong presence of swarf. Make sure that the rolling head is connected to the central lubrication/cooling system of the processing machine.

Install the rolling head into the processing machine in such a way as to ensure minimu exposure to chips directly. The chip guard included in the delivery should be used.

IMPORTANT

Only use coolants and lubricants for the rolling system that meet the above mentioned properties in ordert o avoid corrosion oft he rolling system.
Observe the stated storage temperature and relative humiditiy in order to prevent corrosion on the *rolling system*.

Reasonably foreseeable misuse

Reasonably foreseeable misuse of the rolling system includes:

- use of the rolling system by non-qualified or unauthorized personnel.
- leaving tools in the *rolling system*.
- over rolling the thread.
- rolling outside of the permissible rolling speed. .
- rolling outside of the permissible operating range.
- Non-compliance with the operating instructions.

IMPORTANT

Avoid any reaonably foreseeable misuse of the rolling system.
We are not liable for damage resulting misuse.

2.4 Authorizied personnel and responsibilities

DANGER

General risk due to the use of the *rolling system* by unqualified or unauthorizied personnel.

Use of the *rolling system* only by qualified and authorizied personnel.

Authorizied personnel

- The *rolling system* may only be used by qualified and authorized personnel. These personnel must have received special instruction from the operator about possible hazards.
- The complete operating instructions must be read and understood by every person who deals with the use of the rolling system. We recommend the operator has this confirmed in writing.
- The qualification includes at least one mechanical technical training. In addition, we recommend staff training given by us at your site, training in our LMT Group Academy, our subsidiaries or our local representaitives.
- The operator is responsible for ensuring that work is undertaken by staff being trained only under the supervision of qualified and authorized personnel.
- The operator is responsible for ensuring that unauthorized persons have no access to the *rolling system* under any circumstances.

Responsibilities

- The operator must define all responsibilities for the use of the *rolling system* so that there are no ambiguities in terms of responsibility for safety aspects.
- The operator must clearly define the responsibilities of the personnel for each of the activities on the *rolling system*.

3. *The rolling system*

The *rolling system* forms the required profile in the workpiece with tangential feed direction. The *rolling process* is performed by chipless cold forming.

The modules of the *rolling system*

The *rolling system* consists of five components:

- rolling head (1)
- the rolling head holder (2)
- rolls (1 set = 2 pieces) (3)
- setting gauge (4)

} *rolling system*

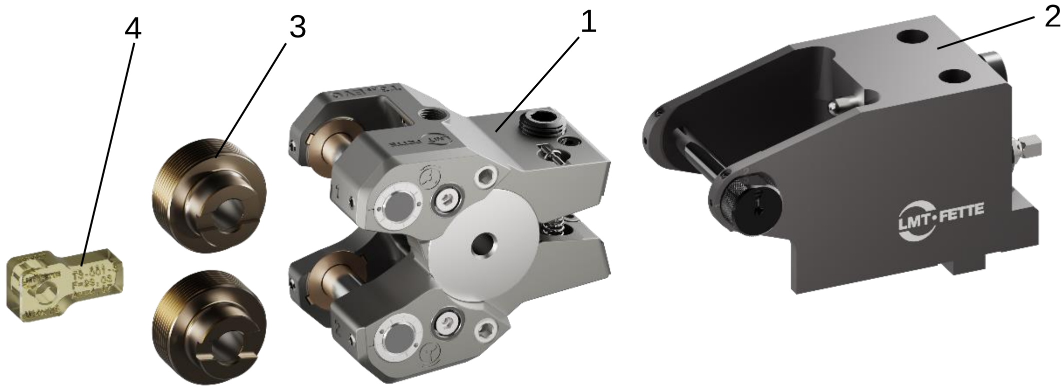

Figure 1: The components of the *rolling system*

The rolling system is designed specifically for the application, therefore the assemblies are ordered and provided separately from each other.

Designation of the rolling system

The designation of the rolling system is located on the outer surfaces of the rolling head (see Figure 2).

LMT-Fette:	Company
T3.18 EVO:	rolling head
000001: 7417009:	serial-No. (6-digits) ID number
Ø3-18mm Ø0.118“-0.709“	working range

Figure 2: Identification of the *rolling system*

3.1 The rolling head

The rolling head is the centerpiece of a *rolling system*.
Use the illustration below to verify if the selected rolling head would lead to collisions with processing machine, spindle or workpiece.
For the dimensions of your rolling head refer to Table 3 (see chapter 3.5).

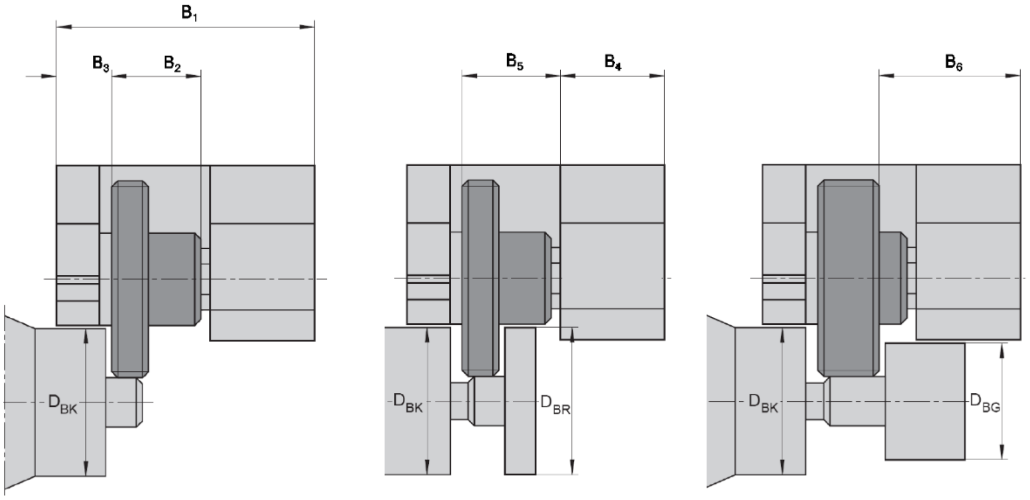

Figure 3: Width dimensions and collar diameter at the rolling head

> **NOTE**
>
> Take into account that the rolling head can also be rotated in the rolling head holder. Thus, either the slim or the broad side of the arm can be pointing towards the workpiece clamping device.

The maximum shoulder diameters D_{BK}, D_{BG} and D_{BR} at the workpiece depend on the thread size in each case.

> **NOTE**
>
> For conical threads (metric and Whitworth profile), collar diameters and working strokes are identical with cylindrical threads of the same dimensions.

The rolling head can be used across the entire work range. All you need to do is adjust the rolls and the setting gauge to the individual application

3.2 The rolling head holder

Please note that due to the different versions of processing machines specifically adapted rolling head holder are available.

For information about suitable rolling head holders for your processing machine, please contact our Cus- tomer Service (see chapter 1.3). Our employees have extensive experience in installing our rolling systems and will be pleased to help you define the right rolling head holder for your processing machine.

3.3 The thread rolls

Important

Use rolls only in the sets delivered by us. Do not combine rolls from different sets.

Check that the roll set number (serial number) is the same.

As a standard, LMT Fette Werkzeugtechnik delivers the following thread tolerances:

- 6g (for threads in acc. with DIN)
- 7e[1] (for threads in acc. with DIN)
- 2A (for UN threads in acc. with ANSI)

However, you can order any other thread tolerance.

HINWEIS

The T3.18 EVO uses the same rolls as T3 EVO.

Tool life

The tool life of the rolls is influenced by the following factors:

- material properties (particularly tensile strength and elongation at fracture)
- hardness increase behavior of the material under cold forming
- degree of roll out of the profile
- Execution of chamfers during workpiece preparation
- correct adjustment of the tool
- rolling speed and operating feed
- sufficient supply of clean coolant
- avoidance of chips on workpieces and thread rolls prior to the rolling process
- thread roll start and run-out
- maintenance of the system
- cleanliness of the system
- wear on spare parts

Review your application and discuss it with our personnel (see chapter 1.3). They will be pleased to give you useful advice with regard to the ideal design of your thread roll.

When the thread rolls are worn, they must be replaced with new ones. (see chapter 4.3)

[1] For trapezoidal threads

Versions

Depending on the application, the thread rolls are available in different versions (see Tables 1 and 2).

Version A is the standard case.

> **NOTE**
>
> If the profile length is not specified, the roll will be of cylindrical design and full roll width.

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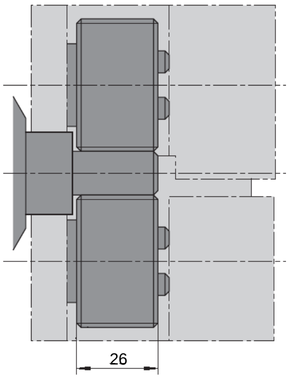
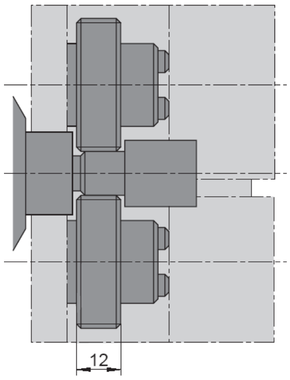
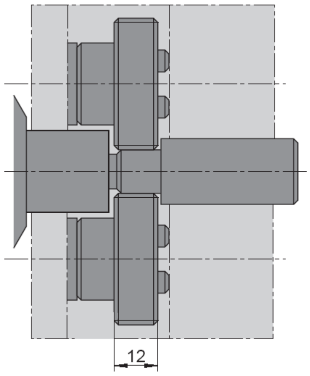
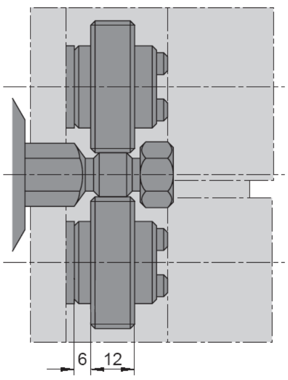
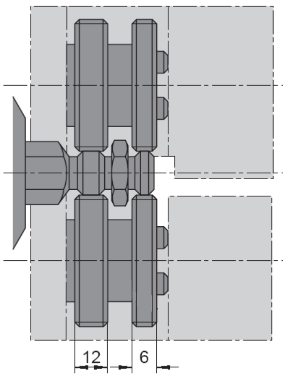
<tr><th>full roll width</th><th>A</th><th>B</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td colspan="3">Code number (example)</td></tr>
<tr><td>T3-10-26</td><td>T3-10-12A</td><td>T3-10-12B</td></tr>
<tr><th>M</th><th>AB</th><td></td></tr>
<tr><td></td><td>Only possible in the case of identical thread dimensions</td><td></td></tr>
<tr><td>
</td><td>
</td><td></td></tr>
<tr><td colspan="2">Code number (example)</td><td></td></tr>
<tr><td>T3-10-12M6</td><td>T3-10-12A-6B</td><td></td></tr>
<tr><td></td><td>if both thread lengths are equal, then: T3-10-12AB</td><td></td></tr>
</table>

Table 1: Roll versions for cylindrical threads

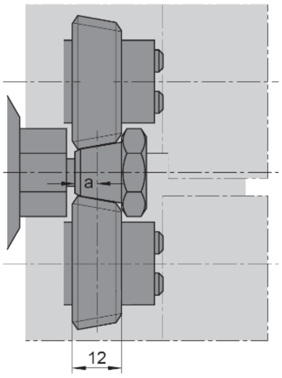
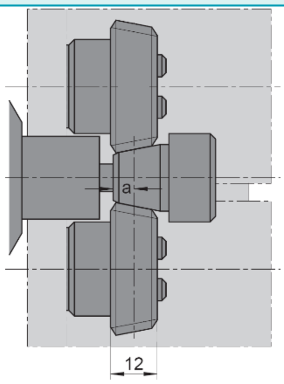
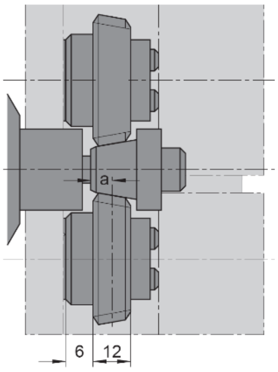
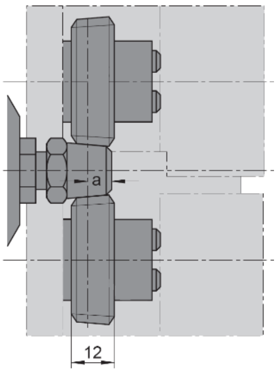
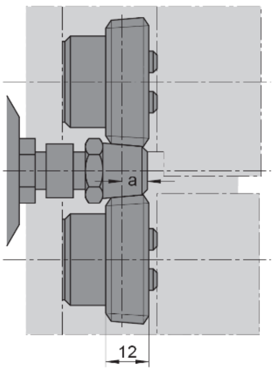
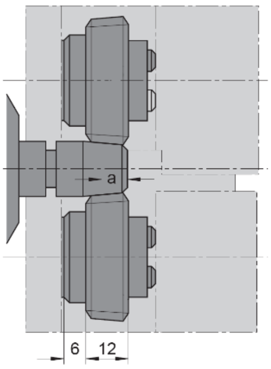
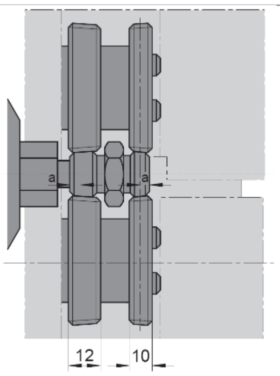
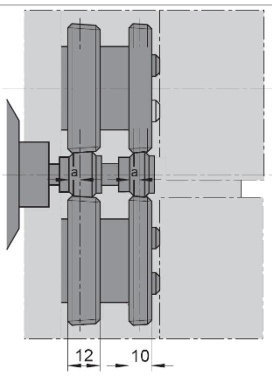
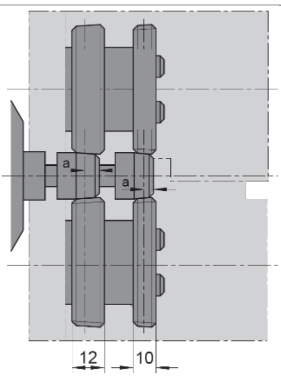
Roll version		
A	**B**	**M**
		
Code number (example)		
T3-100-12A	T3-100-12B	T3-100-12M
AV	**BV**	**MV**
		
Code number (example)		
T3-100-12AV	T3-100-12BV	T3-100-12MV
ABV	**AB**	**AVBV**
only possible in the case of identical thread dimensions	only possible in the case of identical thread dimensions	only possible in the case of identical thread dimensions
		
Code number (example)		
T3-100-12A-10BV if both thread lengths are equal: T3-100-12ABV	T3-100-12A-10B if both thread lengths are equal: T3-100-12AB	T3-100-12AV-10BV if both thread lengths are equal: T3-100-12AVBV

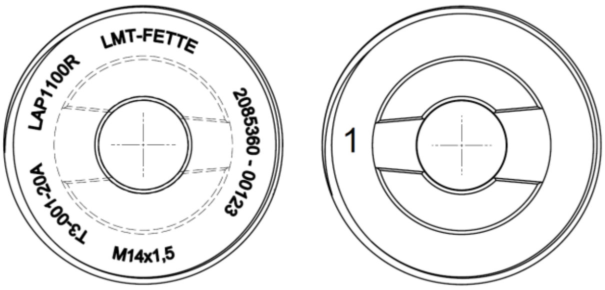
Table 2: Roll versions for conical threads

For conical threads, state standard and version (regular or short). For threads which deviate from standard, the checking plane (a) is to be stated.

Labelling

- Thread dimensions
- Rolling head type
- Code number
- Roll width
- Roll version
- LMT material code (roll material)
- Company
- ID number
- Serial number
- Roll number

Each thread roll is marking with following information:



M14x1,5:	Thread dimensions
T3:	Rolling head type
001:	Code number
20:	Roll width (Profile section)
A:	Roll version
LAP1100R:	LMT material code (roll material)
LMT-Fette:	Company
2085360:	ID number
00123:	Serial number (5-digits)
1 (2):	Roll number

Figure 4: Example of roll marking

3.4 The setting gauge

The setting gauge has the following tasks:

- preadjustment of the axle distance in the rolling head
- adjustment of the cross stroke in the processing machine

The setting gauge is inscribed with following information:

- Company
- ID-number
- Thread dimensions
- Code number
  (rolling head type and roll code number)
- Setting values F und A_V

Figure 5: Setting gauge

Adjust the cross stroke of the processing machine as follows:

- Mount the rolling head holder to the processing machine
- Install the setting gauge into the rolling head holder by pulling the quick-release axis out of one side of the rolling head holder and inserting the setting gauge.
- Move the cross slide towards the workpiece until the leading edge of the gauge touches the blank diameter d_A (see chapter 5.5). This position is the end of the cross stroke.

NOTE

Only if the rolling head size (e.g. T3) and the consecutive number (e. g. 001) are the same in the code number of the setting gauge and of the thread roll does the gauge match the thread rolls. (see Figures 4 and 5).

3.5 Technical data

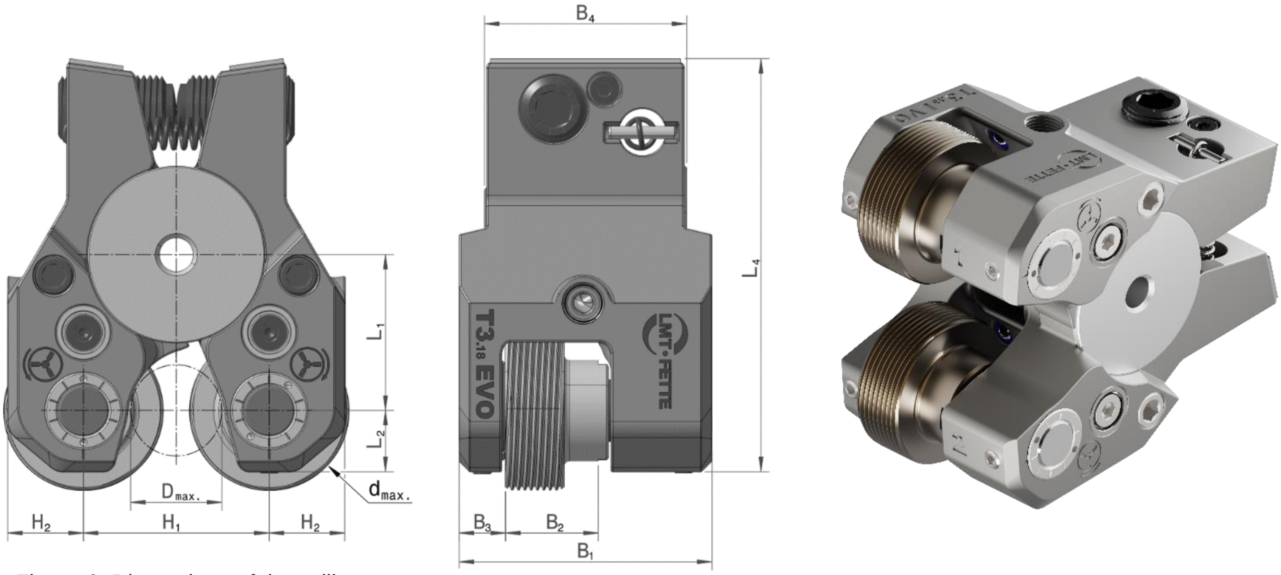


Figure 6: Dimensions of the *rolling system*

Construction dimensions [mm | Inch]											
B_1	**B_2 max**	**B_3**	**B_4**	**d max**	**H_1 min**	**H_1 max**	**H_2**	**L_1 min**	**L_1 max**	**L_2**	**L_4**
60	22	11	48	45	40,5	59	18	31,3	38	14,5	98
2.362	0.866	0.433	1.89	1.752	1.594	2.323	0.709	1.232	1.495	0.571	3.858
m-Rk1)		**m-Rh**1)		**m-Ro**1)		**m-Gesamt**1)					
ca. 2,2 kg		ca. 1 - 2 kg		ca. 0,5 - 1 kg		ca. 4 - 5 kg					
4.9 lb		2 – 4.5 lb		1 – 2.3 lb		9 – 11 lb					

Table 3: Dimensions of the *rolling system*

3.6 Capacity ranges

Capacity ranges for cylindrical threads						
Bevorzugter Arbeitsbereich		Major-Ø [mm | Inch]		max. pitch / min. TPI		Roll with [mm | Inch]
min.	max.	min.	max.	max.	min.	max.
M6 | $^{1}/_{4}$“	M18 | $^{3}/_{4}$“	3 | 0.118	18 | 0.847	2 | 0.709	12	22 | 0.866

Table 4: Capacity range for cylindrical and taper threads

Capacity ranges for taper threads			
Standard	Außen-Ø		Rollenbreite [mm | Inch]
	min.	max.	max.
DIN 158	M 6 x 1 taper	M 16 x 1,5 taper	22 | 0.866
DIN 2999	R $^{1}/_{16}$ - 28	R $^{3}/_{8}$ - 19	
DIN 3858	R $^{1}/_{8}$ - 28	R $^{3}/_{8}$ - 19	
ANSI B 1.20.1	$^{1}/_{16}$ - 27 NPT (NPTF)	$^{3}/_{8}$ - 18 NPT (NPTF)	

Table 5: Capacity range for taper threads

Permissible collar diameters and travel paths: for metric (DIN 158) and Whitworth (DIN 2999; DIN 3858) pro- files, collar diameters and travel paths for cylindrical threads of the same dimensions are identical. For NPT and NPTF threads (ANSI B 1.20.1), see Internet.

Rollable materials

A variety of factors influence the rollability of materials and the resulting profile quality.

The selected characteristics:

- elongation at break and
- tensile strength

enable an assessment of the rollability of materials that is suitable for everyday use (reduced complexity).

Reducing complexity does not guarantee rollability, but it does create an assessment framework that has proven itself in practice.

IMPORTANT

Metallic materials with the following properties can be rolled:

- with an elongation at fracture of $\delta_Z \geq 7$ % and
- with a tensile strength of $\delta_B \leq 1000$ N/mm^2.

Please contact our Service Hotline if you wish to perform *rolling processes* outside of these limits or very near them.

3.7 Tightening torques

IMPORTANT

Observe the tightening torques.

Tightening torques for the T3.18 EVO *rolling system*

Abmessung	Anzugsmoment
M3	1,2 Nm
M4	3,0 Nm
M5	5,9 Nm
M6	10,1 Nm
M8	24,6 Nm
M10	48 Nm
M12	84 Nm

Table 6: Tightening torques

3.8 Condition upon delivery

We deliver your rolling system in the following condition separately:

- the rolling head with tools (without set of rolls)
- the set of rolls
- a setting gauge
- the rolling head holder with chip guard

NOTE

Please note that the delivered components are matched to the size of the rolling system.
Only use the supplied components for the delivered rolling system.

The condition upon delivery is the proper storage condition.

CAUTION

The components of the rolling system are sprayed with a commercially available creeping oil to protect them against corrosion. Touching the oily surface of the components may result in skin irritations. Avoid skin contact, especially in case of allergies or open skin lesions.
Do not touch the oiled surface if you have an open skin lesion. Do not touch the oiled surface if you are worried about an allergic reaction.
Call the service hotline to find out the contents of the creeping oil and check your tolerability.

4. Installation

IMPORTANT

Please contact our Service Hotline in the event of initial installation of the rolling system.

We will gladly advise you on:

- inserting the rolls into the *rolling system*,
- functional testing of the *rolling system*,
- inserting the rolling head into the rolling head holder and
- installing the rolling system into the processing machine.

CAUTION

General risk of injury from sharp edges.

Wear protective gloves and protective eyewear when using the rolling system.

The weight of the rolling system may cause harm when it falls down.
General risk of injury during transportation/lifting of the rolling system.

- Ensure that the rolling system is protected of falling down or tipping over.
- Wear safety boot/hard-toed boot at all times.
- Use suitable *hoisting devices.*

4.1 Machine requirements

Collision check

WARNUNG

General risk of collision.

Don´t equipe the machine with a rolling system without a collision check.

Please contact our Service Hotline in the event of initial equipment or change of a rolling system on your machine. We will be happy to guide you through.

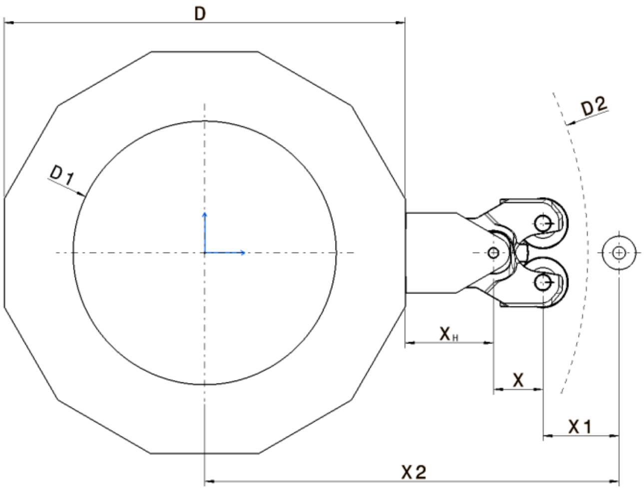


Figure 7: sketched illustration of a rolling system on a turret

NOTE

D turret outside dimenions

D1 inner turret dimenions

D2 max. swing circle-Ø

X2 turret center to workpiece center

X1 travel

X_H machine contact surface till joint point: rolling head/holder

X joint point: rolling head/holder till rolling center (workpiece center)

For a collision-free use of the rolling system dimensions must lay be within the max. swing circle-Ø.

See chapter 3.5 for *rolling system* dimensions.

4.2 Connection to the cooling system

The cooling or flushing of the rolling system takes place via the connection to the cooling system of the machine tool. This can be done either via the coolant connection on the top (bottom) or on the side.
The connection is made using a screw connection (Pos.1) with a 1/8" thread.
The connection that is not required is closed with a plug (Pos.2).

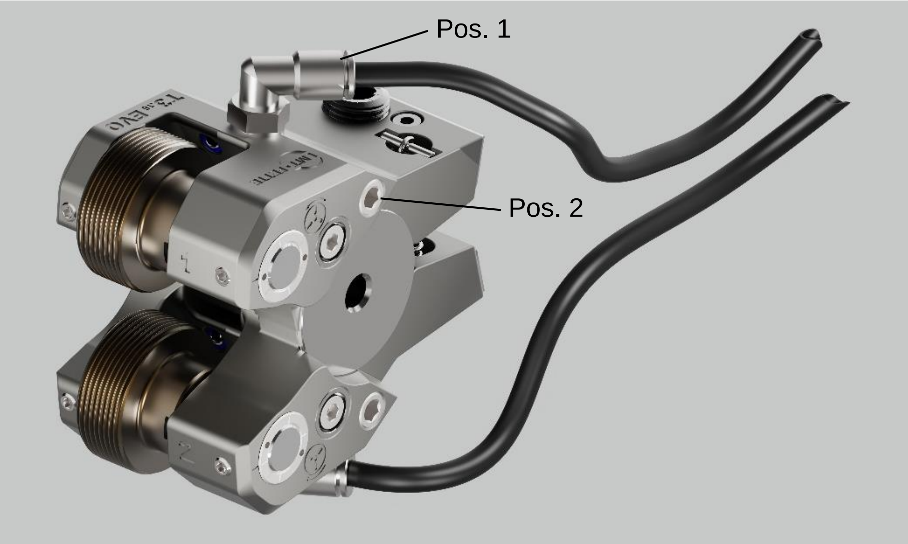


Figure 8: Coolant supply from above (below)

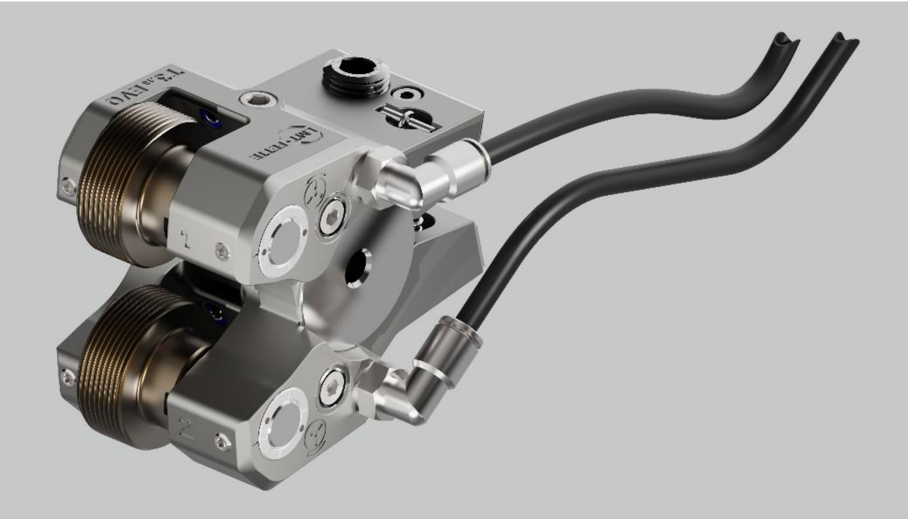


Figure 9: Coolant supply from the side

4.3 Checking the gear position

The thread rolls are synchronized by mean of a gearbox. After installation, check the gearbox for synchronous running.

To do so, proceed as follows:

- Loosen the clamping screw (Pos. 11) of the roll axis.
- For better visibility, pull out the roll axis (Pos. 10) and remove the rolls.
- Loosen the clamping screw (Pos. 17) of the adjusting screw (Pos. 16).
- Adjust the axle distance (chapter 4.6) so that the rolling head arm move together as closely as possible
- Turn one of the pinions (Pos. 4) manually until the small cam is positioned above the small marking and the large cam is positioned above the large marking.
- The visual inspection must correspond to Fig. 8, otherwise the transmission is not synchronized.

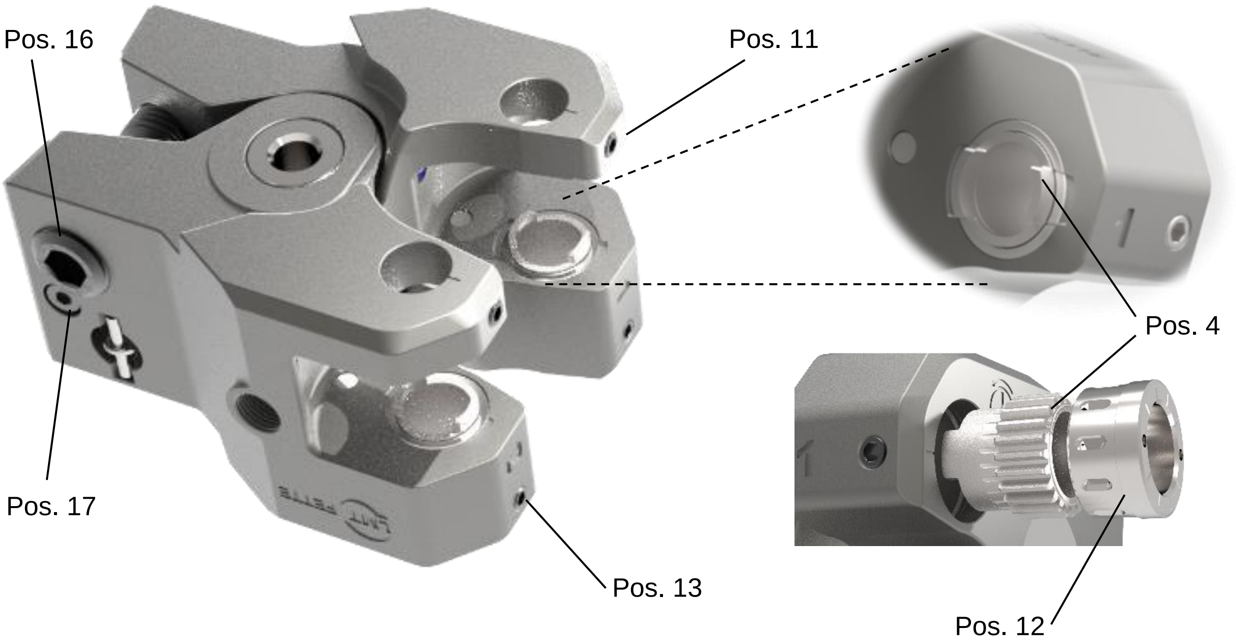


Figure 10: Check the gear position

Correct the synchronous running of the gearbox as follows:

- Loosen the clamping screw (Pos. 11) of the roll axis (Pos. 10) and remove the roll axis and the rolls.
- Loosen the clamping screw (Pos. 13) of the adjustment bushing (Pos. 12) and remove the adjustment bushing
- Remove the pinion (Pos. 4) so that it cannot engage with the gears.
- Turn the other pinion until the small cam is positioned above the small marking and the large cam is positioned above the large marking.
- Insert the pinion in this position, mount the adjustment bushing and tighten the adjustment bushing clamping screw.
- The visual inspection must correspond to Fig. 8, only then is the gear unit synchronized.

4.4 Inserting the rolls into the *rolling system*

Note that the position of the thread rolls in the rolling head is prescribed. The thread rolls must be installed in such a way that the numbers on the rolls match the numbers on the front side of the rolling head. Make sure that the numbers on both rolls point to the wide rolling head arm side after installing.

NOTE

Before installing the rolls, verify that the rolls match. In order to do so, check the set numbers on the rolls. (see chapter 3.3).

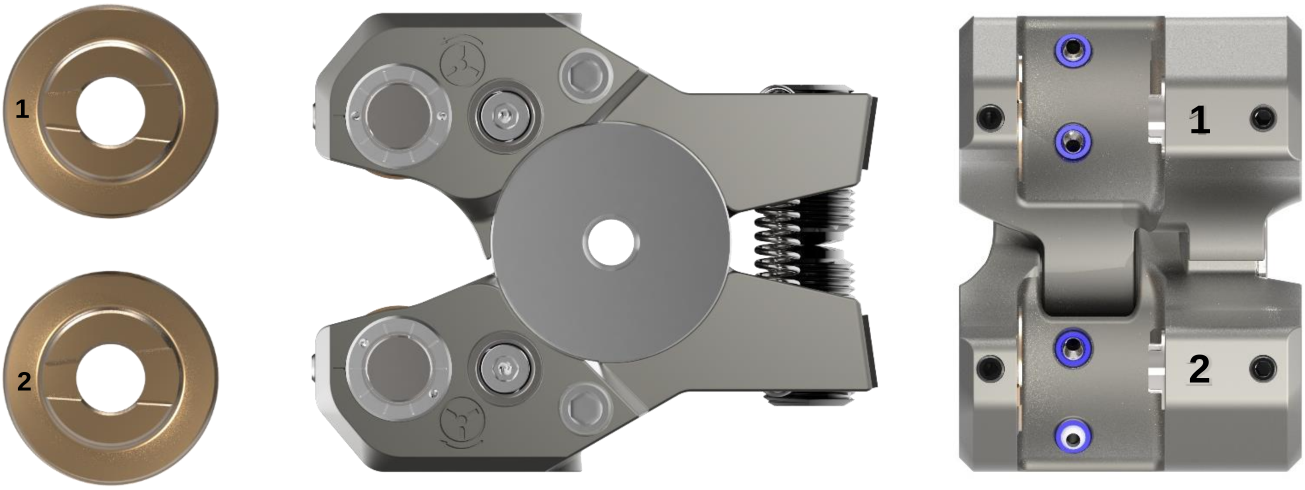


Figure 11: Installing the rolls

To install the rolls, proceed as follows:

- Loosen the clamping screw of the roll axis (Pos. 11) and remove the roll axis (Pos. 10)
- Ensure that the wear plate is fitted correctly
- Lubricate sufficiently the bore of the roll with molybdenum sulfide grease
- Check if the numbers on the roll match the numbers on the wide rolling head arm side of the rolling head
- Check if the signed side of the roll points to the wide rolling head arm side
- Slide the roll with the matching groove recess onto the pinion
- Lubricate sufficiently also the roll axis with molybdenum sulfide grease and insert it from the gearbox side into the thread roll bore
- Adjust the axis in such a way that the slot on the roll axis shows in the direction of the roll axis set screw.
- Fix the roll axis in position with the clamping screw of the roll axis

IMPORTANT

In order to ensure a good friction coefficient between roll and roll axis, be sure to lubricate sufficiently the roll bore and the roll axis in the region of the roll and the pinion using molybdenum sulfide grease (e.g. Molykote).

4.5 Adjusting the axial roll allowance

After installing the thread rolls, the axial roll allowance must be adjusted. Make sure that the axial roll allowance does not exceed 0.1 mm. For fine thread pitches, adjust the axial roll allowance to 0.05 mm. In the case of strong wear, replace the wear plate (Pos. 15).

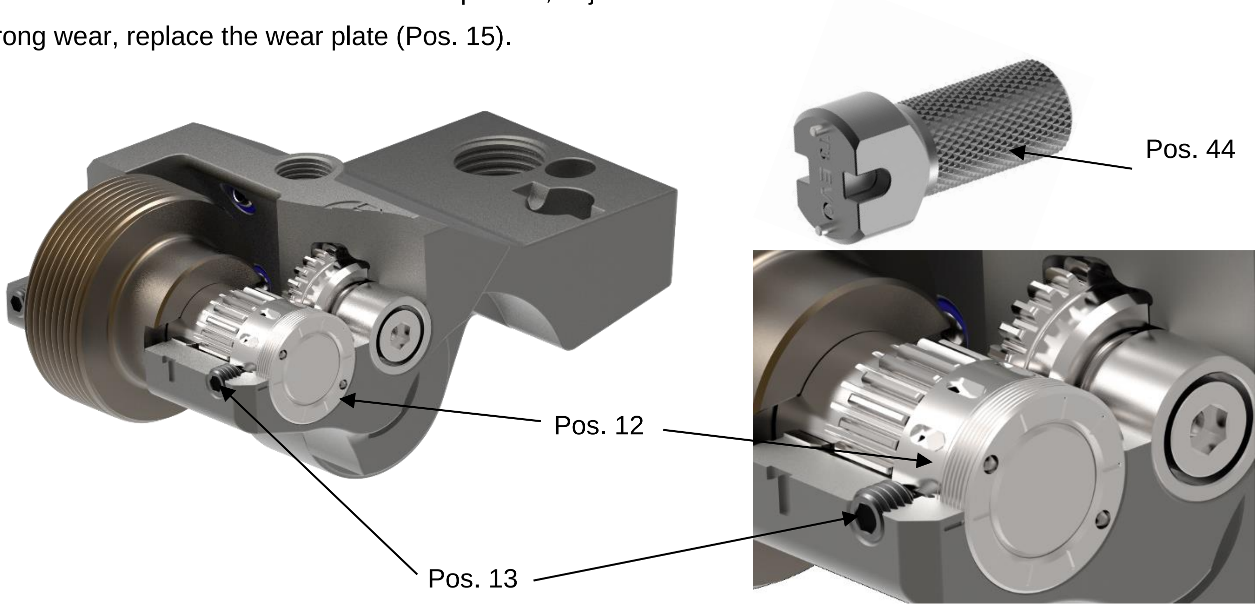


Figure 12: Adjusting the axial allowance

To adjust the axial roll allowance, proceed as follows:

- Loosen the clamping screw (Pos. 13) of the adjustment bushing (Pos. 12).
- Place the adjusting key (Pos. 44) on the adjustment bushing (Pos. 12) and turn the adjustment bushing clockwise until you feel a slight resistance.
- Turn the adjustment bushing anti-clockwise until the clamping screw of the adjustment bushing can engage in the next groove. The positions of the grooves are indicated by line marks on the top side of the bushing.
- Tighten the clamping screw of the adjustment bushing.
- Repeat the previous steps for the other thread roll.
- Check the rolls for a even and jerk-free movement.

The axial allowance of the thread roll is now 0.05 mm max.

NOTE

Changing the bushing position (Pos. 12) by one groove corresponds to an axial adjustment of 0.05 mm

4.6 Functional test

Check the functioning of the rolling head as follows:

- Check the rolls for rotation.
- Hold one thread roll in position and check if the other thread roll can be rotated towards the inside of the head.
- Let go of the rotated thread roll and check if it rotates back automatically to its initial position.

IMPORTANT

Contact our service hotline if you were unable to successfully carry out the function check..

CAUTION

Do not perform a roll if you have not been able to successfully complete the functional check.

General risk of injury due to component breakage.

4.7 Adjusting the axle distance

Figure 13: Adjusting the axle distance to work piece dimensions

The distance between the thread rolls - the so-called center distance - is to be set to the required core dimensions of the workpiece by turning the two adjusting screws (Pos 16).
The width of the setting gauge (D_{KW}) corresponds approximately to the core Ø d_3 of the workpiece.

General adjustment of the axle distance:

- Loosen the clamping screw (Pos 17) of the adjustment screw (Pos. 16)
- Turn the two adjustment screws until the setting gauge fits exactly between the two thread rolls
- Make sure that the two adjustment screws are adjusted evenly in the upper and lower part
- Tighten the clamping screw of the adjustment screw.

IMPORTANT

Make sure that the adjustment screws are adjusted evenly so that the rolling head is adjusted symmetrically and thus retains its center position.

4.8 Adjusting the cooling and spraying systemdistance

> **NOTE**
>
> The rolling head has upto four spray nozzles.
> The optimally adjusted spray nozzle jet protects against foreign particles during the rolling process and acts in the rolling zone wear-reducing on the thread rolls.
> Adjust the spray nozzles as required for your processes.
> We recommend that the two inner spraying nozzles are directed into the working zone between roller and workpiece. They outer spray nozzles should be aligned such that the spray jet covers the engagement area of the roller.

Adjusting the cooling and spraying systemdistance:

- Install a supply of cooling lubricant or emulsion to the rolling head.
- Screw the L-fitting into the connection holes.
- Insert the connecting hose into the installed L-screw joints to ensure coolant lubricant or emulsion supply to the rolling head.
- If necessary, remove the rolls.
- Adjust the spray nozzle by turning the ball with the nozzle outlet.
- Correct the alignment of the spray nozzles if you observe poor feeding during the process.

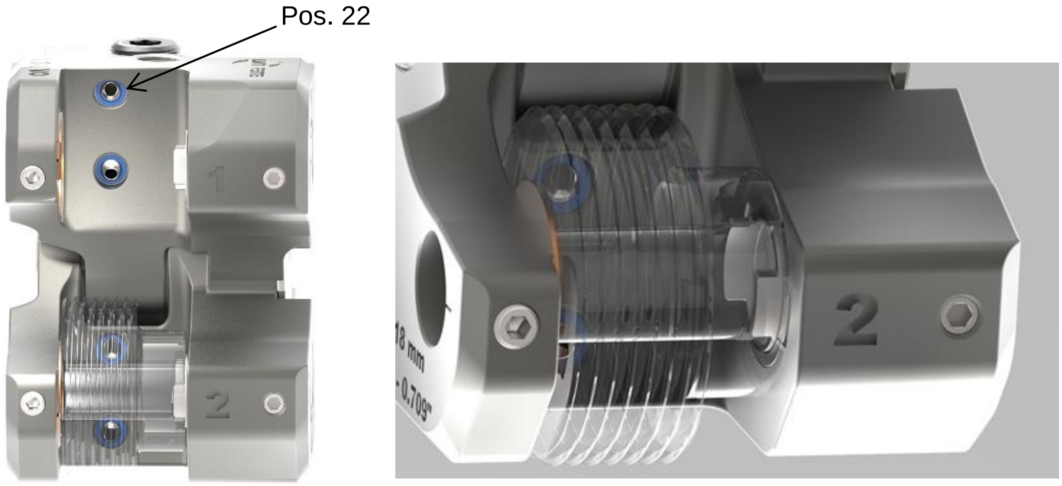


Figure 14: Adjusting the cooling and spraying system

4.9 Installing the rolling system in the processing machine

Installing the rolling head holder in the processing machine

NOTE

The rolling head holder must be installed in such a way that the axis is parallel to the workpiece axis. If the two axes are not in parallel, conical threads will be generated.

Insert the rolling head holder into the processing machine.

Using a precision dial gauge, verify the position in parallel with the tool axle

CAUTION

The weight of the rolling system can cause injuries, especially due to tipping over and falling down.

There is a general risk of injury when transporting the *rolling system.*

- Secure the *rolling system* against tipping over and falling down.
- Wear safety shoes.
- Use suitable lifting gear and slings.

- Check whether you have a suitable hoist, e.g. a crane, for inserting the rolling system into the processing machine.
- Lift the rolling system into the processing machine in a suitable mounting position.
- Clamp the rolling system into the processing machine.

Inserting the rolling head into the rolling head holder

Installing the rolling head holder in the processing machine.

Insert the rolling head into the rolling head holder.

Gehen Sie zum Einbau des Rollkopfes wie folgt vor:

- Loosen the clamping screws on the rolling head holder.
- Pull the axle sideways out of the rolling head holder.
- Slide the rolling head into the rolling head holder and insert the axle through the rolling head holder and through the rolling head.
- Check whether the rolling head can easily swing around the holder axis.
- Tighten the clamping screws.

Figure 15: Inserting the rolling head into the holder

NOTE

Take into account that the rolling head can also be rotated in the rolling head holder. Thus, either the slim or the broad side of the rolling head arm can be pointing towards the workpiece clamping device. We recommend that the rolling head be inserted in such a way that the narrow rolling head arm side points towards the workpiece clamping device..

IMPORTANT

First check if the work space inside the processing machine is sufficient for the rolling head.
To do so, mount the rolling head holder in the processing machine and insert the rolling head into the rolling head holder. Move the rolling head slowly!
Especially if mounting in a tool revolver, you need to check if the rolling head is within the allowable swing diameter.

Adjusting the pendular play

Adjust the pendular play to ensure that the rolling head touches the workpiece with the right thread roll first. The pendular play is limited by the stroke of the spring plungers in combination with the rolling head holder.

> **NOTE**
>
> With both holder versions make sure that the thread roll first touches the workpiece which has the arrow direction marked on the rolling head and which has the same rotational direction as the workpiece.

The pendulum play is achieved in the holder variants by two different principles:
There are holders in design with spring bolt (ET-31-2) in combination with a stop bolt (ET-31-3) or holders in design with a spring steel sheet (ET-31-6).

Version with spring-loaded bolt and stop bolt:
The spring-loaded bolt (ET-31-2) can be inserted in the rolling head holder at two positions (see Figure 14). If the upper thread roll (1) rotates in the same direction as the workpiece (2), the spring-loaded bolt (ET-31-2) also has to be inserted in the holder at the top (and accordingly).
Move the rolling head in front of the pre-turned workpiece (2) so that both thread rolls (2 and 3) can pivot against the workpiece. In this position manually press the roll rotating in the same direction against the workpiece. Adjust the stop bolt (ET-31-3) so that the second roll has a pendulum clearance e ≈ 0.5 mm to the workpiece. Then secure the stop bolt with the nut (ET-31-11).

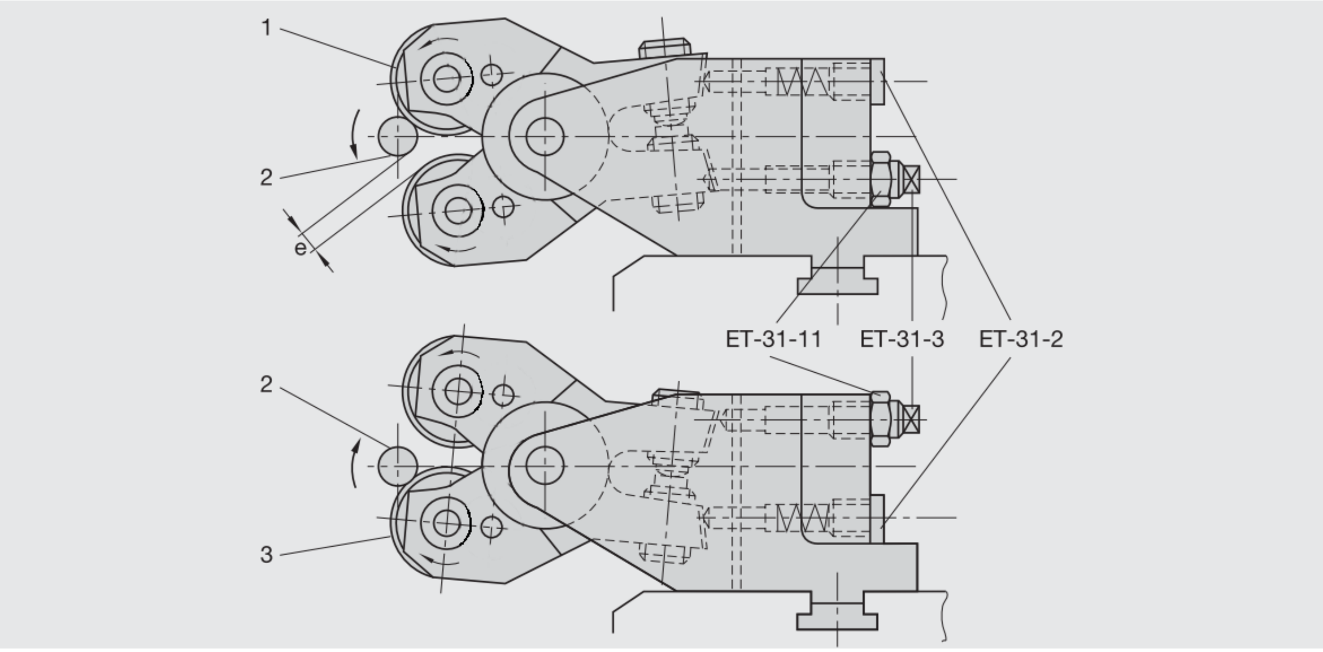


Figure 16: Adjusting the pendulum clearance with a spring-loaded bolt

IMPORTANT

Make sure that the stop bolt (ET-31-3) is not located at the edge of the plate (ET-14). Otherwise the stop bolt could slide beyond the edge of the plate. In such a case, select the alternative location holes for the spring-loaded bolt and the stop bolt, which are located further inwards (or further outwards) in the rolling head holder.

Version with spring steel sheet:

In the case of a holder with a spring steel sheet design (see Figure 15), the spring steel sheet (ET-31-7) engages between the set screws (ET-30) of the rolling head. An angle of inclination is achieved by the set screws moving out of their symmetrical position. The pendulum clearance also has to be adjusted to max. e ≈ 0.5 mm I 0.02 inch here.

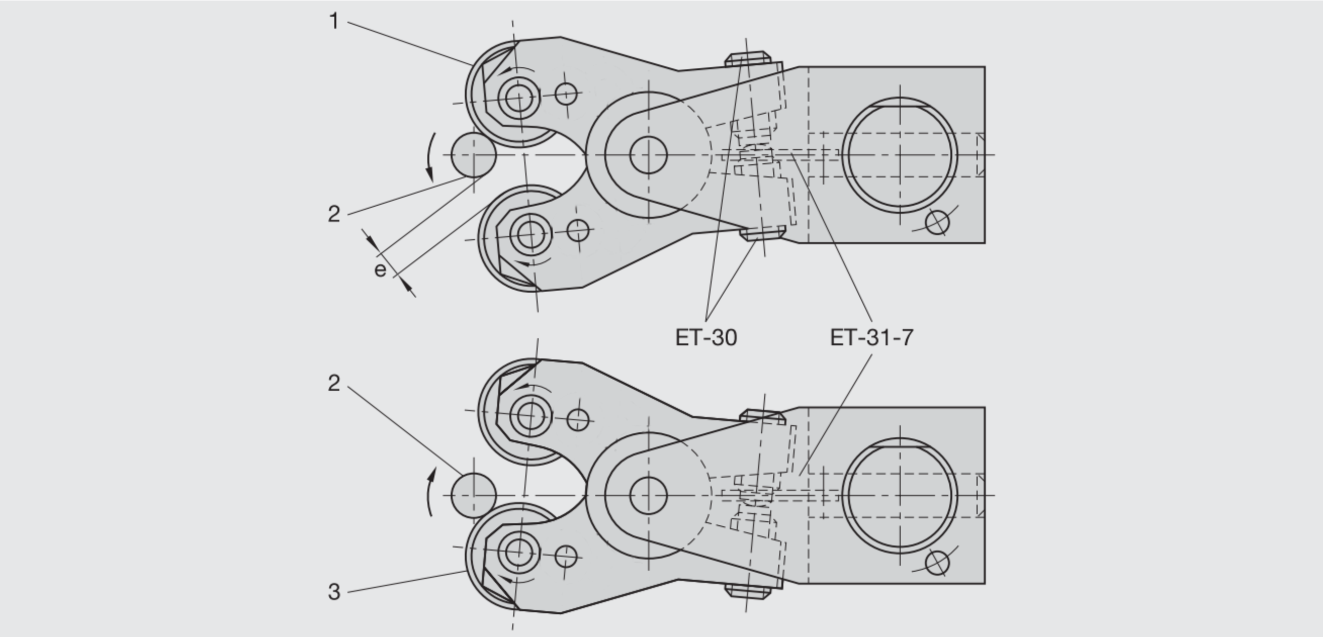


Figure 17: Adjusting the pendulum clearance with a spring steel sheet

WICHTIG

After the set screws (ET-30) have been adjusted the distance between the axes must be checked (see Chapter 4.6).

4.10 Special applications

Rolling tapered threads

Adjusting the distance between the axes:

To adjust the distance between the axes (see also Chapter 4.6), place the setting gauge (ET-32) in the region of the largest roll diameter between the two thread rolls (ET-18), see Figure 16-left.
Adjust the distance between the axes with the set screws (ET-30) until the setting gauge in this region fits exactly between the thread rolls

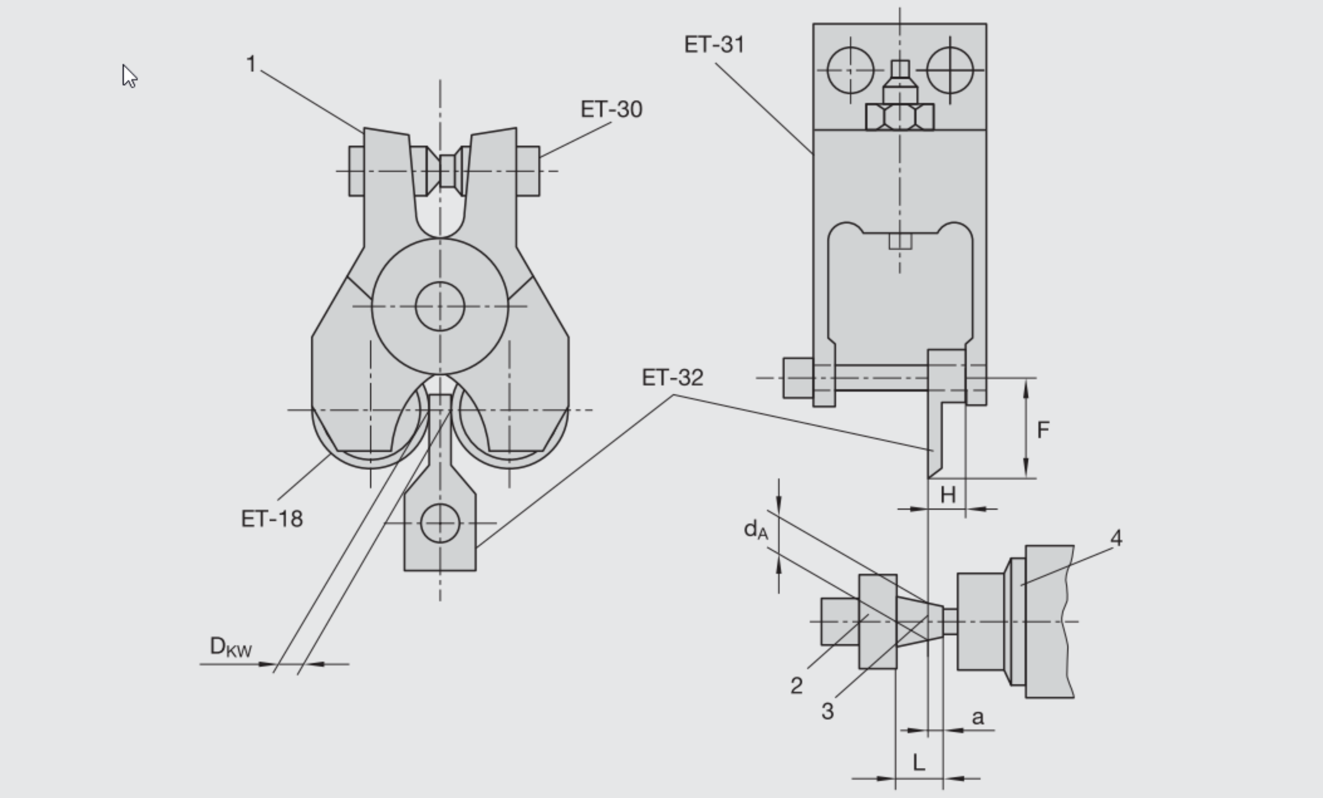


Figure 18: Using the setting gauge for tapered threads

Adjusting the traverse paths:

Figure 16-right shows the workpiece (2) in the collet (4) of the machine spindle.
To adjust the rolling position (see also Chapter 5.5) for a conical thread, it must be ensured that the setting gauge is touching the workpiece (2) at the reference plane (3) of the tapered thread. This is located on the workpiece at the distance a from the start of the thread. Insert the setting gauge (ET-32) into the rolling head holder (ET-31) in such a way that the shoulder surface is against the side in the rolling head holder at which the short arm side of the tangential rolling head is usually located. The height dimension H of the setting gauge ensures that the tip of the setting gauge is located where the reference plane of the thread roll will be later.
It is now possible to move the rolling head as described in Chapter 5.5 towards the workpiece and set the rolling position via the F-gauge.

Thread rolling on pipe

NOTE

Rolling of threads on seamlessly extruded pipes depends on the existing pipe wall thickness.
Schedule several rolling trials for the present application if the pipe bore/core diameter ratio is
d3 ≤ 0,65 .
Do not fall short of the number of workpiece revolutions nW = 25 for the rolling process on pipes.
In special cases, deviations from the predefined setting values are possible.

Knurling and burnishing

Tangential rolling heads can also be used to produce knurling and burnishing on workpieces.
Several points need to be considered:

Installation of the knurling or burnishing rolls:

- Loosen the clamping screw of the rolling head arm axis (Pos. 6).
- Remove the rolling head arm axis (Pos. 5).
- Remove and conserve the compensation gear (Pos. 2).
- Reinsert the rolling head arm axis into the rolling head holder.
- Counter the rolling head arm axis with the clamping screw of the rolling head arm axis.
- Insert the the knurling or smoothing rollers into the rolling head. To do so, proceed as for inserting the thread rolls. (see chapter 4.3)

NOTE

The maximum roll width is equivalent to the width of a normal thread roll.

IMPORTANT

Follow the instructions carefully when removing and inserting the gear set. Also ensure a chip-free work-environment. Foreign particles in the gearbox can lead to gearbox damage.
We will be happy to support you with the conversion.

NOTE

Only have qualified personnel perform the conversion of the rolling head, or alternatively send the rolling head to LMT Fette.

Preparation of the workpiece:

- For smoothing, choose the blank diameter d_A approx 0.04 mm larger than the desired finished dimension.

NOTE

The achievable surface quality and diameter tolerance depends on the surface quality and diameter tolerance of the rough machining. For burnishing and knurling, the blank diameter d_A should be within a tolerance of ±0.015 mm.

- Use the following formula to calculate the blank diameter d_A of the workpiece for standard knurling [1)] :
  $d_A = d - h$ [mm]:

NOTE

d_A: Blank diameter [mm]
d: Nominal diameter [mm]
h: Tooth depth [mm]

For the tooth depth refer to DIN 82.

To adjust the travel, proceed as follows:

When knurling, use a short dwell time, since overrolling will occur otherwise.
When burnishing, use a longer dwell time to allow better formation of the press-polished surface.

[1] RAA, RBL, RBR, RGE, RKE

5. Operation

IMPORTANT

First follow the instructions in chapter 4, Installation

Please contact our Service Hotline in the event of initial commissioning of the rolling system.

We will gladly advise you on:

- preparing the workpiece,
- defining the process variables and.
- fine-adjusting the *rolling system*.

5.1 Preparing the workpiece

NOTE

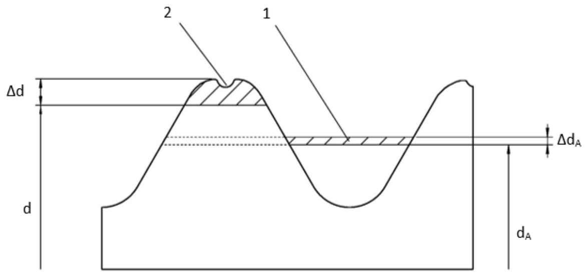
Do not change the clamping during rough machining and chamfering. If possible, work with a thread undercut. Choose the undercut width *g* in accordance with DIN 76-A.

NOTE

For the external diameter of the required thread, refer to the annex of our catalog, or contact our Service Hotline. (see chapter 1.3)

NOTE

Larger chamfers substantially reduce the tool life of the thread roll.



d_A: Blank diameter [mm]
d_2: Pitch diameter [mm]

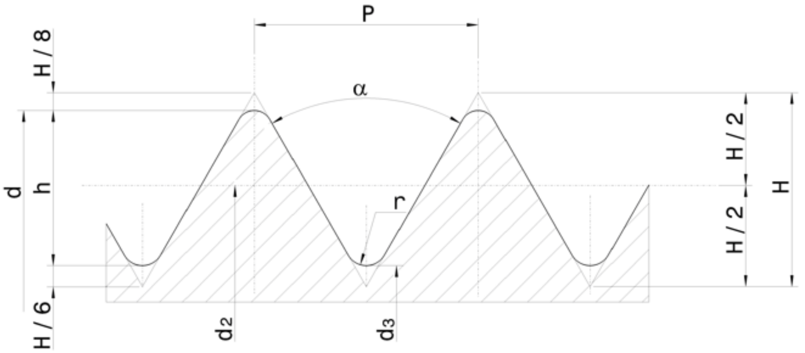
Figure 19: Change of the blank diameter

External diameter is approximately equivalent to the pitch diameter (d_2).
$d_A \approx d_2$ - 0,03 [mm]

When adjusting the blank diameter, bear in mind that in Figure 17, areas 1 and 2 are identical in size. This means that an increase in blank diameter d_A by Δd_A results in an increase in the external diameter by 3 to 5 times the value of Δd_A

5.2 Kenngrößen von dem Gewinde und dem umzuformenden Werkstück

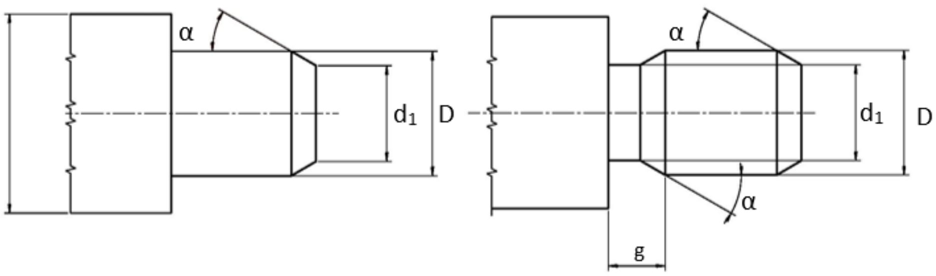
Characteristics of threads



P : Thread pitch [mm]
(for multiple threads: thread pitch)
α : Flank angle [°]
H : Theoretical profile height [mm]
h : Profile depth [mm]
r : Core radius [mm]
d : Nominal diameter [mm]
d_2 : Pitch diameter [mm]
d_3 : Core diameter [mm]

Figure 20: Characteristics of threads (example: metrical ISO thread)

Characteristics of the workpiece to be formed



g : Freistich (Gewindeauslauf) [mm]
α : Anfaswinkel [°]
D : Ausgangsdurchmesser [mm]
d_1 : Innendurchmesser [mm]
d_3 : Kerndurchmesser [mm]

Figure 21: Characteristics of the workpiece to be formed

IMPORTANT

The resulting blank diameter must be complied with with a tolerance of ± 0,015 mm!

The chamfer angle should be α ≤ 30°. The interior diameter d_1 must be smaller than the core diameter:

$d_i = d_3 - 0{,}1$ mm [mm]

After thread rolling, a chamfer angle of α = 30° yields a chamfer of approx 45° in the workpiece

5.3 Rolling speed and machine speed

Rolling speed

NOTE

Never use a rolling speed of less than 20 m/min.

Set the rolling speed to 20–60 m/min. For certain applications, the rolling speed can be up to 100 m/min.

Steel grade	Material strength N/mm²	Abbreviation	Material number	Rollability	Rolling speed m/min	Rolling speed ft/min
Ferrous metals						
General structural steels	500	S235JRC	1.0120	☺	40-80	130–265
	500-600	S550GD	1.0531	☺	30-60	100–200
	750-900	C50	1.0540	☺	20-50	65–165
	630-850	C45E	1.1191	☺	20-50	65–165
Case hardening steels	590-780	C15E	1.1141	☺	40-70	130–230
	780-1080	16MnCr5	1.7131	😐	30-50	100–165
Nitriding steels	780	34CrAl6	1.8504	😐	20-50	65–165
	900-1300	31CrMoV9	1.8519	😐	20-40	65–130
Free cutting steels	350-530	10S10	1.0711	☺	30-60	100–200
	360-760	11SMnPb30	1.0718	☺	30-60	100–200
	590-830	35S20	1.0726	☺	30-60	100–200
Heat treatable steels	630-780	C35	1.0501	☺	40-70	130–230
	850-1000	C60E	1.1221	😐	30-60	100–200
	1100-1300	42CrMo4	1.7225	😐	20-50	65–165
	1250-1450	30CrMoV9	1.7707	☹	20-40	65–130
	1200-1400	34CrNiMo6	1.6582	☹	20-40	65–130
	1100-1300	51CrV4	1.8159	☹	20-40	65–130
Tool steels	800-850	X210Cr12	1.2080	😐	30-50	100–165
	800-1000	X130W5	1.2453	😐	20-40	65–130
	760-810	115CrV3	1.2210	😐	30-50	100–165
High speed steels	920	HS6-5-2C	1.3343	☹	20-40	65–130
	880	HS6-5-2-5	1.3243	☹	20-40	65–130
Stainless steels	650-730	X12Cr13	1.4006	😐	30-50	100–165
	800-950	X17CrNi16-2	1.4057	😐	30-50	100–165
	650-850	X14CrMoS17	1.4104	😐	30-50	100–165
	500-700	X5CrNi18-10	1.4301	☺	35-55	115–175
	500-750	X8CrNiS18-9	1.4305	☺	35-55	115–175
	500-700	X5CrNiMo17-12-2	1.4401	😐	30-50	100–165
	500-700	X6CrNiMoTi17-12-2	1.4571	😐	30-50	100–165
Cast steels	380-530	GE200	1.0420	☺	40-60	130–200
	540	G36Mn5	1.1176	☺	40-60	130–200
	1000-1200	G50CrMo4	1.7232	😐	30-50	100–165
Malleable cast iron	450	EN-GJMB-450-06	EN-JM 1140	😐	30-60	100–200
	650	EN-GJMB-650-02	EN-JM 1180	😐	30-60	100–200
Cast iron	400	EN-GJS-400-15	EN-JS 1030	☺	30-60	100–200
	500	EN-GJS-500-7	EN-JS 1050	😐	30-50	100–165
	600	EN-GJS-600-3	EN-JS 1060	😐	30-50	100–165
High temperature materials	≥970	NiCo20Cr20CoMoTi (Nimonic 263)	2.4650	😐	30-50	100–165
	700-950	NiMo16Cr15W (Hastelloy C276)	2.4819	😐	20-40	65–130
Nickel alloys	580-800	NiCr15Fe (Inconel 600)	2.4816	☹	20-40	65–130

Non-ferrous metals						
Copper	240-300	E-Cu	CW004A	☺	40-80	130–265
Copper alloys (Brass)	310	CuZn37	CW508L (R310)	☺	40-80	130–265
	410	CuZn38Pb2	CW608N (R410)	😐	40-70	130–230
	360	CuZn38Pb2	CW608N (R360)	☺	40-70	130–230
	430	CuZn39Pb3	CW614N (R430)	😐	40-70	130–230
Aluminum alloys	150-240	AlMg2	EN AW-5251	☺	40-70	130–230
	160-310	AlSi1MgMn	EN AW-6082	😐	40-70	130–230
	220-350	AlZn4,5Mg1	EN AW-7020	☹	30-50	100–165
	220-440	AlCu4Mg1	EN AW-2024	😐	30-50	100–165
	275-540	AlZn5,5MgCu	EN AW-7075	😐	30-50	100–165
Titanium alloys	390-540	Ti2	3.7035	☺	30-60	100–200
	540-650	TiCu2	3.7124	☺	30-60	100–200
	750-950	TiAl5Sn2,5	3.7115	😐	30-60	100–200
	1030-1100	Ti6Al4V	3.7164.7	😐	20-40	65–130

Table 7: Rolling speeds

Symbol:	☺ good rollable	😐 rollable	☹ conditionally rollable

Tensile strength and elongation at fracture of the material

For materials with high tensile strength, operate at 20–30 m/min. Bear in mind that the rolling speed depends on the tensile strength. Choose low rolling speeds for high tensile strengths, and for low tensile strengths choose high rolling speeds.

Machine speed

The machine speed is calculated as follows:

$$n = \frac{1000 \cdot v}{d_A \cdot \pi} \text{ [min}^{-1}\text{]}$$

NOTE

n : Machine speed [min^{-1}]
v : Rolling speed [m/min]
d_A : Blank diameter [mm]

The direction of rotation (left- or right-handed) of the machine spindle is not important.

5.4 Operating feed – number the workpiece revolutions

> **NOTE**
>
> Be sure to adhere to the recommended number of workpiece revolutions.

The number of workpiece revolutions depends on:

- thread pitch
- thread length
- tensile strength

Guide values for the number of workpiece revolutions for materials of medium tensile strength (900–1000 N/mm²) can be found in the following table:

number of workpiece revolutions (n_w)									
pitch		**thread length**		**n_w**	**pitch**		**thread length**		**n_w**
[mm]	**[inch]**	**[mm]**	**[inch]**		**[mm]**	**[inch]**	**[mm]**	**[inch]**	
< 0,5	< 0.020	< 10	< 0.394	10 - 12	1,1 - 1,5	0.043 - 0.059	< 10	< 0.394	18 - 20
		10 - 12	0.394 – 0.63	15 - 20			10 - 12	0.394 – 0.63	20 - 25
		16 - 22	0.63 – 0.866	20 - 25			16 - 22	0.63 – 0.866	25 - 30
0,5 - 0,8	0.020 - 0,031	< 10	< 0.394	12 - 15	1,5 - 1,8	0.059 - 0.071	< 10	< 0.394	18 - 20
		10 - 12	0.394 – 0.63	15 - 20			10 - 12	0.394 – 0.63	20 - 25
		16 - 22	0.63 – 0.866	20 - 25			16 - 22	0.63 – 0.866	25 - 30
0,8 - 1,1	0.031 - 0.043	< 10	< 0.394	15 - 18	1,8 - 2,0	0.071 - 0.079	< 10	< 0.394	18 - 20
		10 - 12	0.394 – 0.63	18 - 22			10 - 12	0.394 – 0.63	20 - 25
		16 - 22	0.63 – 0.866	22 - 30			16 - 22	0.63 – 0.866	25 - 30

Table 8: Number of workpiece revolutions for materials of medium tensile strength

Calculate the operating feed *f* and the feed rate f_V as follows:

Cam controlled machines:

$$f = \frac{A_V}{n_W}\ [mm/rev.]$$

Non-cam-controlled machines:

$$f_V = \frac{A_V \cdot n}{n_W}\ [mm/min]$$

> **HINWEIS**
>
> f : Operating feed [mm/rev]
> f_V : Feed rate [mm/min]
> n : Machine speed [min^{-1}]
> n_W : Workpiece revolutions
> A_V : Working stroke [mm]

5.5 Travel paths

Creating the travel paths

As shown in the cam design elements (Figure 19), the ideal movements of the attachment during one complete cycle are: rapid advance, a controlled power feed rate until the centerline of the rolls are on the centerline of the component, zero dwell, and rapid turn

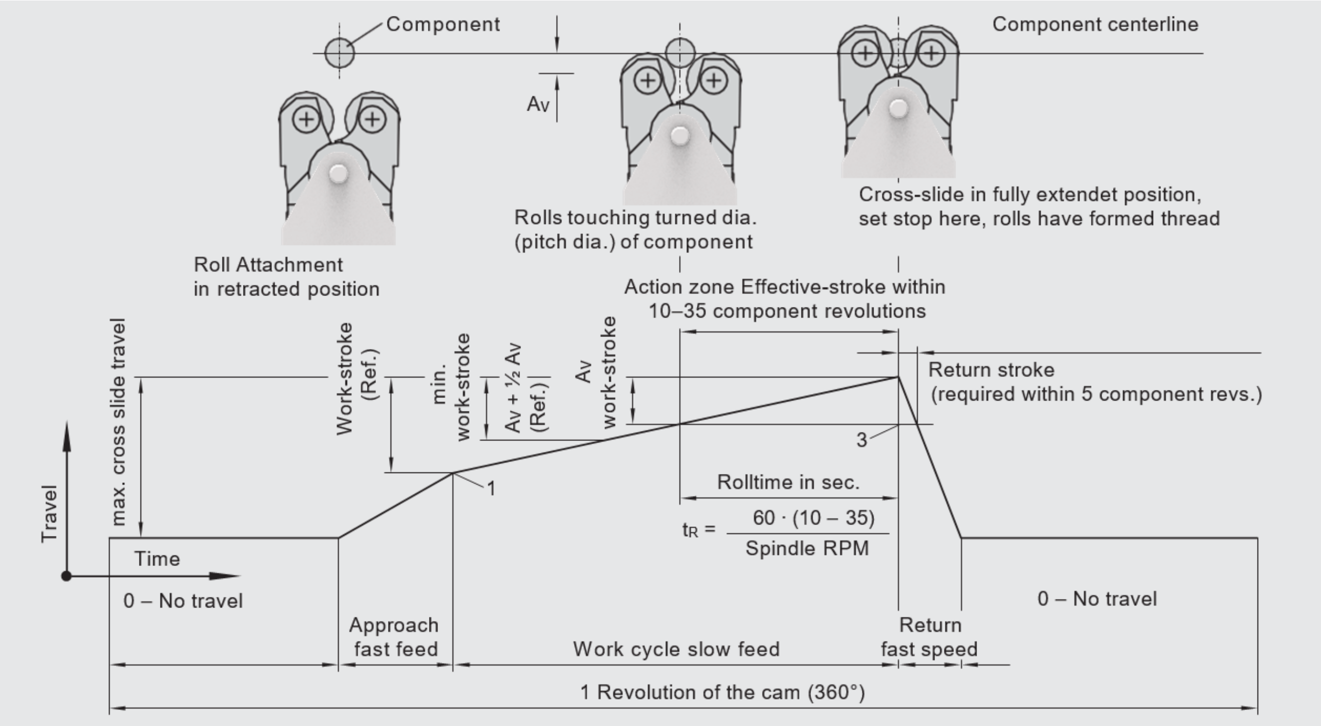


Figure 22: Travel paths

The tangential rolling head is moved laterally against the rotating workpiece.
Figure 20 is a schematic representation of the travel path of the tangential rolling head:

- Move the rolling head in fast movement to position 1, which is located in front of the workpiece axis, at a distance of AW (work distance).

  $A_W = 2{,}5 \cdot A_v \, [mm]$

> **HINWEIS**
>
> A_W : Total working stroke [mm]
> A_V : Working stroke [mm] (see setting gauge)
> d_A : Blank diameter [mm]

- From position 1, move to position 3 at operating feed.

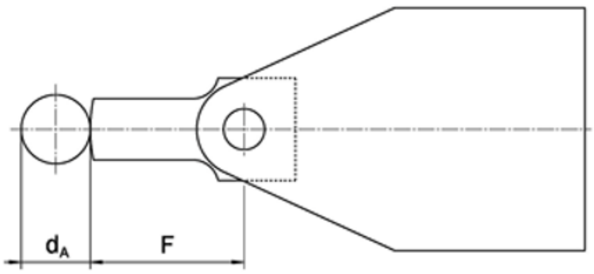


Figure 23: Using the setting gauge

Ensure the correct position 3 using the setting gauge matching the rolling head and the thread rolls via the F dimension (see Figure 21).

> **IMPORTANT**
>
> Make sure that the thread rolls are never moved over the center of the workpiece.

- Note that depending on the application it may be advantageous to dwell at position 3 for 2 … 5 dwell time revolutions W_V, bearing in mind that the maximum number of total tool revolutions ≤ 35 must not be exceeded. In the case of cam-controlled processing machines do not dwell in position 3.

Calculate the dwell time t_V as follows:

$$t_V = \frac{60 \cdot W_V}{n} [s]$$

> **NOTE**
>
> W_V : Dwell time revolutions
> n : Maschine speed [min^{-1}]
> t_V : Dwell time [s]

- Move the rolling head in fast movement back to position 1. The *rolling process* is finished.

Notes on designing a cam curve for cam-controlled processing machines

The production of a cam curve for thread rolling should be performed by the manufacturer of the machine. Provide the following information:

- manufacturer of the machine, machine type and serial no.
- spindle position (rolling station)
- workpiece revolutions for thread rolling
- Werkstückumdrehung beim Gewinderollen
- spindle speed
- travel in operating feed

When designing the cam curve, note the following:

- The cam curve roll should be as small as possible.
- The return stroke must be assured by means of a return cam or by a return mechanism.
- Make sure that the feed movement of the cross slide is limited by means of a fixed stop after the highest point of the curve is reached.
- The calculated operating feed must be correct.
- The maximum number of $n_{W\,max.}$ = 35 must not be exceeded.

5.6 Thread length

NOTE

On each thread roll side there is a chamfer with the width of the thread pitch *P*. The greatest theoretical thread length *L* equals the maximum thread rolls width B_2 minus 2 x thread pitch *P*

When ordering thread rolls please state the minimum and maximum possible thread roll width.

Thread roll width A [mm | Inch]									
6 0.236	8 0.315	10 0.394	12 0.472	14 0.551	16 0.630	18 0.728	20 0.787	22 0.866	

Table 9: Thread roll width

NOTE

Before the start of the *rolling process* check if the thread length *L* is allowable.

Allowable thread length as a function of the tensile strength of the workpiece [mm]			
<500 N/mm²	500 … 700 N/mm²	700 … 900 N/mm²	>900 N/mm²
$L = \frac{580,5}{P \cdot d}$	$L = \frac{483}{P \cdot d}$	$L = \frac{446}{P \cdot d}$	$L = \frac{414}{P \cdot d}$

Table 10: Allowable thread length

NOTE

L : rollable thread length
P : thread pitch
d : nominal diameter

5.7 Position of the thread run-out

NOTE

When thread rolling close to the collar, the safety clearance of $c = 0.5 \cdot P$ must be observed!

P: pitch

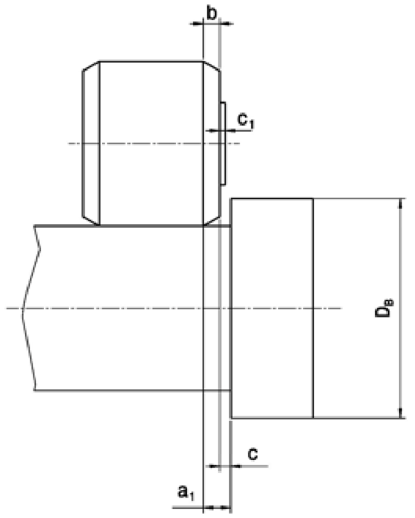


Figure 24: Clearance between thread roll and collar

Angle of the roll start chamfer	thread roll start b	Clearance a_1
45°	0,6 x P	1,1 x P
60° (Standard)	P	1,5 x P
70°	1,55 x P	2,05 x P

Table 11: Thread roll start *b* and clearance a_1

NOTE

c : Safety clearance to the collar
c_1 : Thickness of the wear plate
a_1 : Clearance between the collar and the screwable thread
b : Thread roll start
D_B : Collar diameter

5.8 Tangential force, driving power, torque and rolling time

Tangential force

The rolling head works with the plunge cutting method. The two thread rolls move laterally over the workpiece. The thread roll profile penetrates tangentially into the workpiece, creating the desired shape. The processing machine generates the tangential force F_T. The rolling head absorbs the radial force F_R

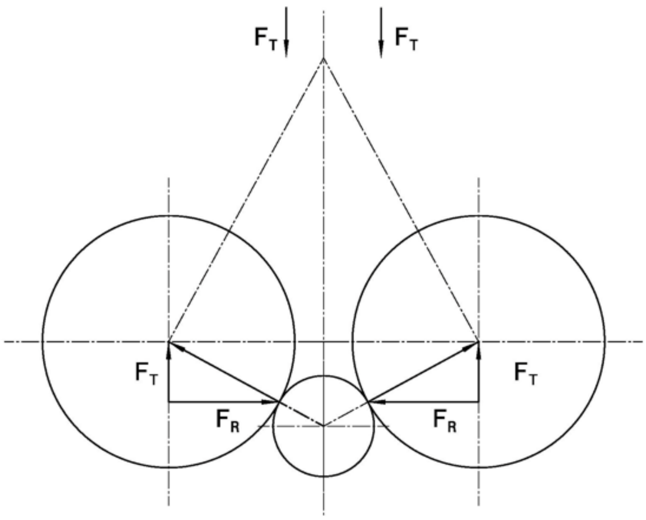


Figure 25: Forces occurring in tangential rolling

Tensile strenght R_m of the workpiece [N/mm²]	K_{WT}
0 … 500	1
500 … 700	1,2
700 … 900	1,3
> 900	1,4
Copper	1,1
Brass	0,9

Table 12: Material constant

In the case of hydraulically or electrically driven slides check the maximum tangential force.
Calculate the tangential force F_T as follows:

$$F_T = \frac{2340 \cdot L \cdot K_{WT}}{n_W} (0{,}06 \cdot d^{0{,}82} + 0{,}46 \cdot P - 0{,}1 \cdot Z + 1)\ [N]$$

NOTE

F_T	: Tangential force [N]
F_R	: Radial force [N]
L	: Thread length [mm]
K_{WT}	: Material constant
n_W	: Workpiece revolutions
d	: External diameter [mm]
P	: Thread pitch [mm]
Z	: Thread roll number of starts

NOTE

Increase the number of workpiece revolutions in order to get a lower tangential force.

Calculate the driving power and torque as follows:

Driving power

$N = 0{,}105 \cdot 10^{-5} \cdot n \cdot F_T$ [kW]

Torque

$M = 0{,}01 \cdot F_T$ [Nm]

NOTE

n	: Machine speed [min^{-1}]
F_T	: Tangential force [N]
N	: Driving power [kW]
M	: Torque [Nm]

Calculate the rolling time as follows:

- with speed:

$$t_r = \frac{60}{n} \cdot (n_W + W_V) \text{ [s]}$$

- with rolling speed:

$$t_r = \frac{0{,}06 \cdot d_A \cdot \pi}{v} \cdot (n_W + W_V) \text{ [s]}$$

NOTE

t_r	: Rolling time [s]
n	: Machine speed [1/min]
n_W	: Workpiece revolutions
W_V	: Dwell time revolutions
d_A	: Blank diameter [mm]
V	: Rolling speed [m/min]

5.9 Fine-adjusting the *rolling system*

Degree of forming

IMPORTANT

When rolling threads, always operate at the calculated work feed (processing machine at 100 %)! Never operate the rolling cycle in single set and never reduce the speed.

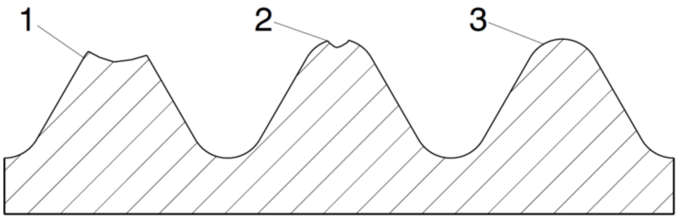


Figure 26: Degree of forming at the thread tooth

Closely inspect the rolled profile. Figure 24 shows the possible degrees of forming of a thread tooth:

- Tooth 1 represents a thread tooth that is not completely formed. This degree of forming normally yields a stable thread. In most applications this degree of forming is aimed for
- Tooth 2 represents a thread tooth that is completely formed. This degree of forming is used to meet the highest requirements in optics and tightness.
- Tooth 3 represents a thread tooth that is overformed.

NOTE

After thread rolling, the workpiece external diameter *d* must not have a burnished finish and must not be overformed in the thread crests. This leads to increased thread roll wear.

If you have completed the installation as per the instructions for use, you get a non-completely formed thread tooth. If the pitch diameter d_2 is too large and the external diameter *d* too small, make the following adjustments:

- Decrease the axle distance (see chapter 4.6). This makes the rolling head narrower and the pitch diameter smaller.
- As a result of reducing the axle distance, more material is pressed into the tooth crest. This automatically increases the external diameter of the thread.
- If, following correction of the axle distance, the pitch diameter is correct but the thread tooth overformed, reduce the blank diameter d_A. Less material flows into the tooth crest.
- If, following correction of the axle distance, the pitch diameter is correct, but the external diameter is too small, increase the blank diameter. More material flows into the tooth crest.

Correcting the axle distance

If the external diameter *d* or the pitch diameter d_2 is too small and/or the thread is not rolled out, the axle distance needs to be corrected.

To correct the axle distance, proceed as follows:

- Loosen the clamping screws (Pos. 17) of the adjustment screws (Pos. 16).
- Rotate the adjustment screw clockwise: the axle distance decreases. Reversely, the axle distance increases. Only turn the spindle in small increments!
- Tighten the clamping screws (Pos. 17) of the adjustment screws.

IMPORTANT

Observe the tightening torques. (see Chapter 3.7)

6. Disassembly after operation

IMPORTANT

Please contact our Service Hotline in the event of dismounting after operation for the first time. We will gladly advise you on:

- Removing the rolling system from the processing machine,
- dismounting the rolling head and
- dismounting the thread rolls.

Check all modules of the rolling system for wear and damage. Please contact the operator, if you notice wear or the wear on a component of the rolling system.

CAUTION

Risk of injuries to the hands!

During decommissioning, dismounting or disposal activities there is a risk of sustaining injuries caused by rough, sharp surfaces of transport crates, boxes, pallets or packaging aides.

Wear safety gloves to avoid injuries by cutting.

WARNING

Risk of burns from the hot surface of the *rolling system*.

Tragen Sie Schutzhandschuhe und Schutzbrille bei dem Gebrauch des *Rollsystems*.

The weight of the rolling system may cause harm when it falls down.

General risk of injury during transportation/lifting of the rolling system.

- Ensure that the rolling system is protected of falling down or tipping over.
- Wear safety boot/hard-toed boot at all times.
- Use suitable hoisting devices.

6.1 Removing the *rolling system* from the processing machine

WARNING

Risk of burns from the hot surface of the rolling system.

Only remove the *rolling system* after the rolling system has cooled down.

Risk of cuts due to chips adhering to the *rolling system*.
Remove any chips adhering to the system from the rolling system before removing the *rolling system* from the processing machine.

- Check if you need suitable hoisting device.

  We advise to use suitable hoisting device when lifting the rolling system from a weight of 5 kg | 11 lb.

NOTE

Suitable hoisting devices are for example:

- A sling
- Hoisting Chain
- Lift cable

Please contact your occupational safety specialist before transportating the *rolling system*.

- Make sure that the *rolling system* or components do not fall down.
- Unclamp the *rolling system* in the processing machine.
- Remove the rolling system

6.2 Removing the rolling head from the rolling head holder

To remove the rolling head from the rolling head holder proceed as follows:

- Loosen the clamping screws on the rolling head holder.
- Pull the axle sideways out of the rolling head holder.
- Slide the rolling head into the rolling head holder and insert the axle through the rolling head holder and through the rolling head.
- Push the axle sideways into the rolling head holder.
- Tighten the clamping screws

6.3 Dismounting the thread rolls

To remove the thread rolls:

- Loosen the clamping screw of the roll axis (Pos. 11) and remove the roll axis (Pos. 10).
- Hold the thread rollers with your hand to secure them.
- Remove the thread rolls.

NOTE

Use only thread rolls with the same roll set number (thread dimensions, rolling head type, roll code number, roll width and roll version).

Be sure to lubricate the thread roll bores and the axles with molybdenumsulfide grease (e. g. Molykote).

After changing the thread rolls, check the rolled profile. In particular if the external diameter is not correct, compensate this by making changes to the rolling head settings.

7. Wear parts, parts list

Wear parts

NOTE

Wear parts are

- thread roll set,
- wear plate,
- rolling axle,
- pinion,
- spur gear,
- compensating gear and
- wear ring

Please contact the operator if you notice wear or the wear on a component of the *rolling system*.

Parts list

NOTE

When ordering rolling heads, spare parts, rolling head holders and thread rolls, be sure to state the ID number.

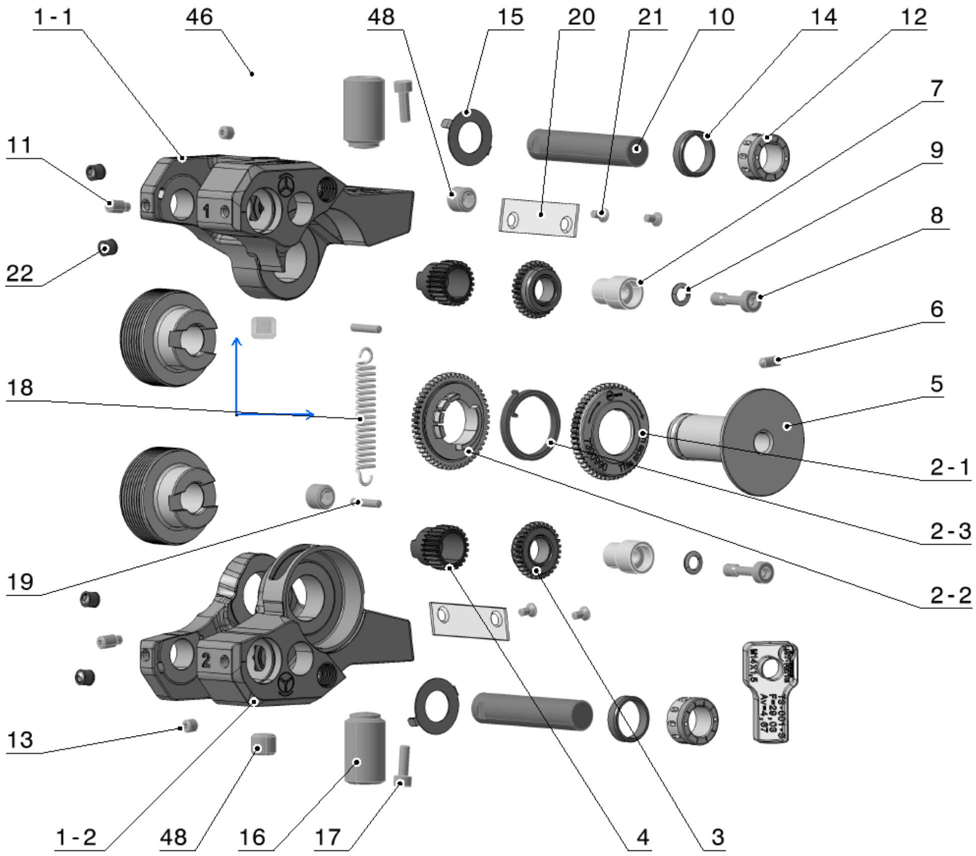


Figure 27: Exploded view T3.18 EVO

The following ID numbers apply to the standard rolling head.

Ersatzteiliste							
Part no.	**Qty.**	**Part description**	**ID no.**	**Part no.**	**Qty.**	**Part description**	**ID no.**
1-1	1	Pair of rolling head arms	7417008	16	2	Adjustment screw	2173449
1-2				17	2	Clamping screw	7408343
2	1	Compensation gear	7390990	18	1	Tension spring	2173439
3	2	Spur gear	7294303	19	2	Straight pin	2141245
4	2	Pinion	7294304	20	2	Plate	2173444
5	2	Axis rolling head arms	2173434	21	4	Countersunk screw	2143237
6	1	Clamping screw	7350146	22	4	Nozzle	7045437
7	2	Bearing pin	7294307	23			
8	2	Bearing pin screw	7294308	24			
9	2	Lock washer	2149271	25			
10	2	Roll axis	7294310				
11	2	Clamping screw	2142159	44	1	Adjusting key	7294340
12	2	Adjustment bushing	7294312	45			
13	2	Clamping screw	2142119	46	2	L-Fitting G1/8-6	7167804
14	2	Wear ring	7294314	47	2	PA Hose D6/4 0,7m	7167807
15	2	Wear plate	7294315	48	2	Closing screw	7417003

Table 13: Components of the rolling head

8. Installing and removing components

IMPORTANT

If you have any questions concerning the installation of components , please feel free to contact our Service Hotline.

Check all modules of the rolling system for wear and damage.

Please contact the operator if you notice damage or wear on a component of the rolling system.

CAUTION

The weight of the rolling system can cause injuries, especially due to tipping over and falling down.

There is a general risk of injury when transporting the *rolling system.*

- Secure the *rolling system* against tipping over and falling down.
- Wear safety shoes.
- Use suitable lifting gear and slings.

- To remove the rolling system, carry out the instructions from chapter 6.1.
- Refer to chapter 3 to find out which of the three components the part to be installed or removed belongs to.
- Replace the corresponding component at the corresponding work step.

Replacing the thread rolls

Follow the corresponding steps in Chapter 6.2.

NOTE

After replacing the thread roll set, follow the instructions of Chapter 5.9.

9. Maintenance

Maintenance during operation

Daily:

Check all modules of the *rolling system* for wear and damage.

Weekly:

- Follow the instructions in chapter 6.
- Follow the instructions in chapter 4.

Maintenance when replacing a thread roll set

- Follow the instructions in chapter 6.
- Follow the instructions in chapter 4.

Maintenance intervals

Be sure to adhere to the maintenance intervals listed in Table 14. If the *rolling system* is used under more difficult conditions, the cleaning and maintenance intervals must be shorter.

Intervall	Activity	Description
Weekly (preferably daily)	Clean and check the rolling head	- Remove the rolling head from the rolling head holder - Clean the rolling head and the rolling head holder, removing potential chips. - Reinsert the rolling head into the rolling head holder.
		Check the rolling head for axial allowance and adjust if necessary. (see chapter 4.4)
Weekly	Clean the thread rolls	- Loosen the clamping screw roll axis (Pos. 11) and pull out the roll axis. - Manually secure the thread roll (Pos. 11) and remove it together with the wear plate - Clean the thread roll, roll axis and wear plate removing dirt and chips. - Before installing, lightly lubricate these parts with molybdenum sulfide grease. - Reinsert the thread rolls. (see chapter 4.3)
Weekly	Check the disks	Check the wear plates for even wear. Replace the disks if:: - If the thickness of the two disks differs by > 0.02 mm - the thickness of a disk is less than 0.5 mm
Intervall	**Activity**	**Description**

Quarterly/after an extended period of non-use	Complete cleaning of the rolling head	Disassemble the complete tool and remove soilage and chips. When assembling, lubricate all parts as per the specifications.
Quarterly/after an extended period of non-use	Checking for run-in marks	Perform visual inspection of all parts for run-in marks, particularly ■ the roll axis, ■ the gears in the region of the tooth flanks, ■ the pinion in the region of the driver cams and ■ the rolling head arm 1 and 2 in the region of the wear plate. Replace the parts if significant wear is found

Table 14: Cleaning and maintenance intervals

10. Storage

> **NOTE**
>
> The storage state is the condition upon delivery.

- Follow the instructions in Chapter 6 Disassembly after operation.
- Conserve the *rolling system*.
- Store the *rolling system*.

Storage temperature: at least –10 °C maximum +30 °C

Relative humidity: < 60 %%

11. Disposal

> **NOTE**
>
> Dispose of the *rolling system* with harmful coatings such as oils and fats properly. Improper disposal of the materials used is harmful to the environment. When disposing of materials, comply with national and local regulations.

Ensure that all national and local safety requirements are met.

- After discarding the rolling head, sorted disposal must be performed.
- Separate iron, non-ferrous metals, etc.
- Grease, oils and objects and lines soiled with grease or oil must be disposed of separately.

12. Troubleshooting

NOTE

Perform a visual and functional inspection prior to each troubleshooting.

	Fault	Cause	Solution
1	Incorrect pitch diameter and/or external diameter of the thread	Axle distance and/or blank diameter not properly selected.	Adjust the axle distance and/or blank diameter. (see chapter 4.6)
2	Unclean thread, chips during thread rolling, cracks in the workpiece, marks in the threads of the workpiece or splinters	Thread roll sets were mixed up.	Check if the labelling on the thread rolls matches the roll number.(see chapter 3.3)
		Thread rolls incorrectly installed in the rolling head.	Follow the instructions in Chapter 4.3.
		Thread starts of rolls incorrectly positioned to each other.	Check the position of the pinions. (see chapter 4.2)
		The workpiece axis is not parallel with the thread roll axis.	Establish the parallelism of the thread roll axis. (see chapter 4.8)
		The thread rolls are worn or broken.	Install new thread rolls. (see chapter 4.3)
		The workpiece is bent during thread rolling.	Support the workpiece.
		The material has cracks even prior to thread rolling.	Do not roll this material.
		The wear plate is worn.	Replace the wear plate. Re-adjust the axial play. (see chapter 4.4)
3	Thread out of round	The blank diameter is out of round.	Machine the workpiece so as to be round.
		The workpiece axis is not parallel with the thread roll axis.	Establish the parallelism of the thread roll axis. (see chapter 4.8)
		The feed rate is too high.	Correct the feed rate. (see chapter 5.4)
		The rolling speed is too low.	Do not roll at rolling speeds < 20 m/min. (see chapter 5.3)
		Rolling was done with overload.	Reduce the blank diameter
		The dwell time is too short.	Increase the dwell time to a maximum n_W = 35. (see chapter 5.4)
4	Drunken thread	The thread roll sets were mixed up.	Check if the labelling on the thread rolls matches the roll number. (see chapter 3.3)
		Thread rolls incorrectly installed in the rolling head.	Follow the instructions in chapter 4.3.
		Thread starts of rolls incorrectly positioned to each other.	Check the position of the pinions. (see chapter 4.2)
		The workpiece axis is not parallel with the thread roll axis.	Establish the parallelism of the thread roll axis. (see chapter 4.8)
		Incorrect feed movement of the slide. (Thread rolls engaged for too many/too few revolutions)	Check the feed movement of the slide. (see chapter 5.4)
		Rolling was done with overload.	Reduce the blank diameter.
	Fault	**Cause**	**Solution**

5	Thread roll teeth break after short period of use	Incorrect chamfer angle of the work piece.	Ensure a chamfer angle of at least 30°. (see chapter 5.1)
		The thread roll sets were mixed up.	Check if the labelling on the thread rolls matches the roll number. (see chapter 3.3)
		Thread rolls incorrectly installed in the rolling head.	Follow the instructions in chapter 4.3.
		Thread starts of rolls incorrectly positioned to each other.	Überprüfen Sie die Stellung der Ritzel mit der Prüflehre. (siehe Kapitel 4.2)
		Incorrect feed movement of the slide. (Thread rolls engaged for too many/too few revolutions)	Using the test gauge, check the position of the pinions (see chapter 5.4)
		Rolling was done with overload.	Reduce the blank diameter.
6	Strongly sloping pro- file in the roll start and run-out of short thread lengths	The material flows in axial direction is too great.	Increase the diameter of roll start and run-out.
7	Poor rolling results on work pieces with thin walls (pipes)	The remaining wall thickness is too small for thread rolling.	Reduce the bore. Bore after rolling the thread. Place an arbor inside the bore.
		Incorrect feed movement of the slide. (Thread rolls engaged for too many/too few revolutions)	Check the feed movement of the slide. (see chapter 5.4)
		The workpiece is bent during thread rolling.	Support the workpiece.
		Uneven wall thickness of the pipe.	Only pipes with even wall thickness can be rolled. Note that welded pipes are not suitable for rolling.
8	Cylindrical threads are conical after thread rolling	The workpiece was premachined with taper.	Ensure cylindrical premachining.
		The workpiece axis is not parallel with the thread roll axis.	Establish the parallelism of the thread roll axis.
		The workpiece is bent during thread rolling.	Support the workpiece.
		The axes are bent apart unevenly owing to too much rolling pressure.	Check and correct the pendular play. (see chapter 4.8)
9	Gear broken and/ or thread roll driving dogs sheared off	Rolling was done with overload.	Reduce the blank diameter.
		Twisting of roll axis.	Tighten the clamping screws of roll axis (Pos. 11) with the specified tightening torques. (see chapter 3.7)
		Cross slide not restricted in travel by a fixed stop.	Set a fixed stop to ensure that the thread rolls cannot move beyond the middle of the workpiece
		Roll axis have seized.	Ensure that the coolant/lubricant is free from chips and particles.(see chapter 2.3)
			Increase the workpiece revolutions to a maximum n_W = 35. (see chapter 5.4)

Table 15: Troubleshooting

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