

Operating Instruction

F RN *Rolling Systems*



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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 *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 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.



NOTE

Work instructions are supplemented by position numbers.
Compare the information with the figure in 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 systems. 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 these 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:

Team Rollen
Grabauer Strasse 24
21493 Schwarzenbek
Germany
Phone.: +49 4151 12 391
Fax: +49 4151 12 502
teamrollen@lmt-tools.com

Postal address:

LMT Fette Werkzeugtechnik
GmbH & Co KG
Postfach 1180
D-21484 Schwarzenbek

LMT Group Academy:

Grabauer Strasse 24
21493 Schwarzenbek
Germany
Phone: +49 4151 12 424
Fax: +49 4151 1277 225
academy@lmt-group.com

Delivery address:

LMT Fette Werkzeugtechnik
GmbH & Co. KG
Grabauer Strasse 24
21493 Schwarzenek
Germany

1.4 Copyright

The copyright of these operating instructions remains with LMT Fette Werkzeugtechnik GmbH & Co. KG.

These operating instructions include regulations and technical drawings, which may be neither duplicated in full or in part, distributed or utilized for the purpose of competition or communicated to others.

Disclosure to third parties is not permitted.

We do not allow copying of the *rolling systems* or parts of the *rolling systems*.

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 characterized by a color that illustrates 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 instruction

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 than 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
 - burnishing
 - pipe forming
 - reducing and
 - Cold forming of rotationally symmetrical workpieces, to produce other profiles.
- } *rolling process*



NOTE

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

Burnishing/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.

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 minimum 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 order to avoid corrosion of the rolling system.

Observe the stated storage temperature and relative humidity 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 reasonably foreseeable misuse of the rolling system.

We are not liable for damage resulting misuse.

2.4 Authorized personnel and responsibilities

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.

Authorized 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 representatives.
- 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 F RN axial *rolling system* forms the required profile in the work-piece with axial feed direction.
The *rolling process* is performed by chipless cold forming.

The *rolling system* is closed by the closing mechanism, forms the required profile on the workpiece and opens automatically.

Labeling of the *rolling system*

The labeling of the *rolling system* is placed on the front plate (see Figure 1).

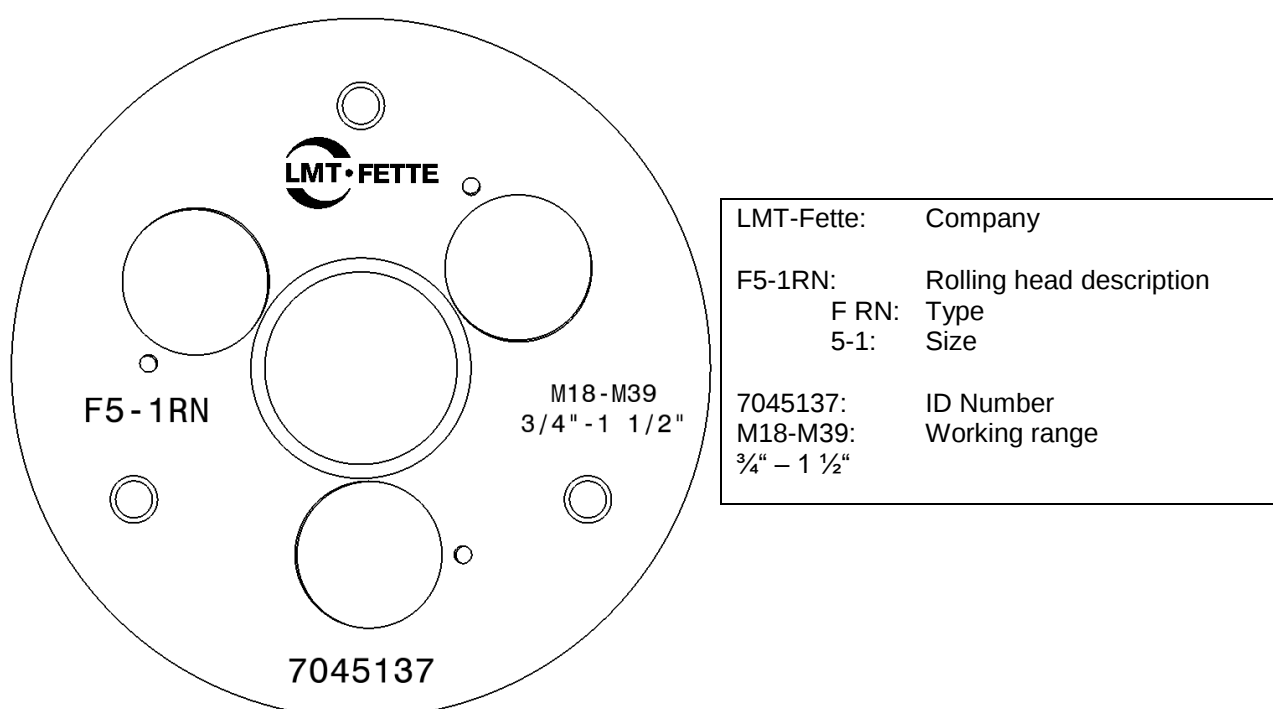


Figure 1: Labeling of the *rolling system* F RN (Example F5-1RN)

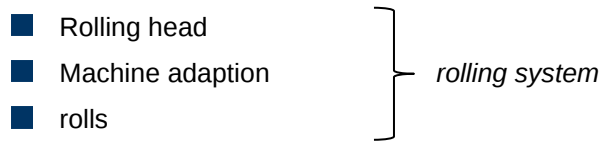


NOTE

The ID number is labeled on the spring housing.

The modules of the *rolling system*

The *rolling system* consists of three components:



The three components of the *rolling system* F RN are shown in figure 2.

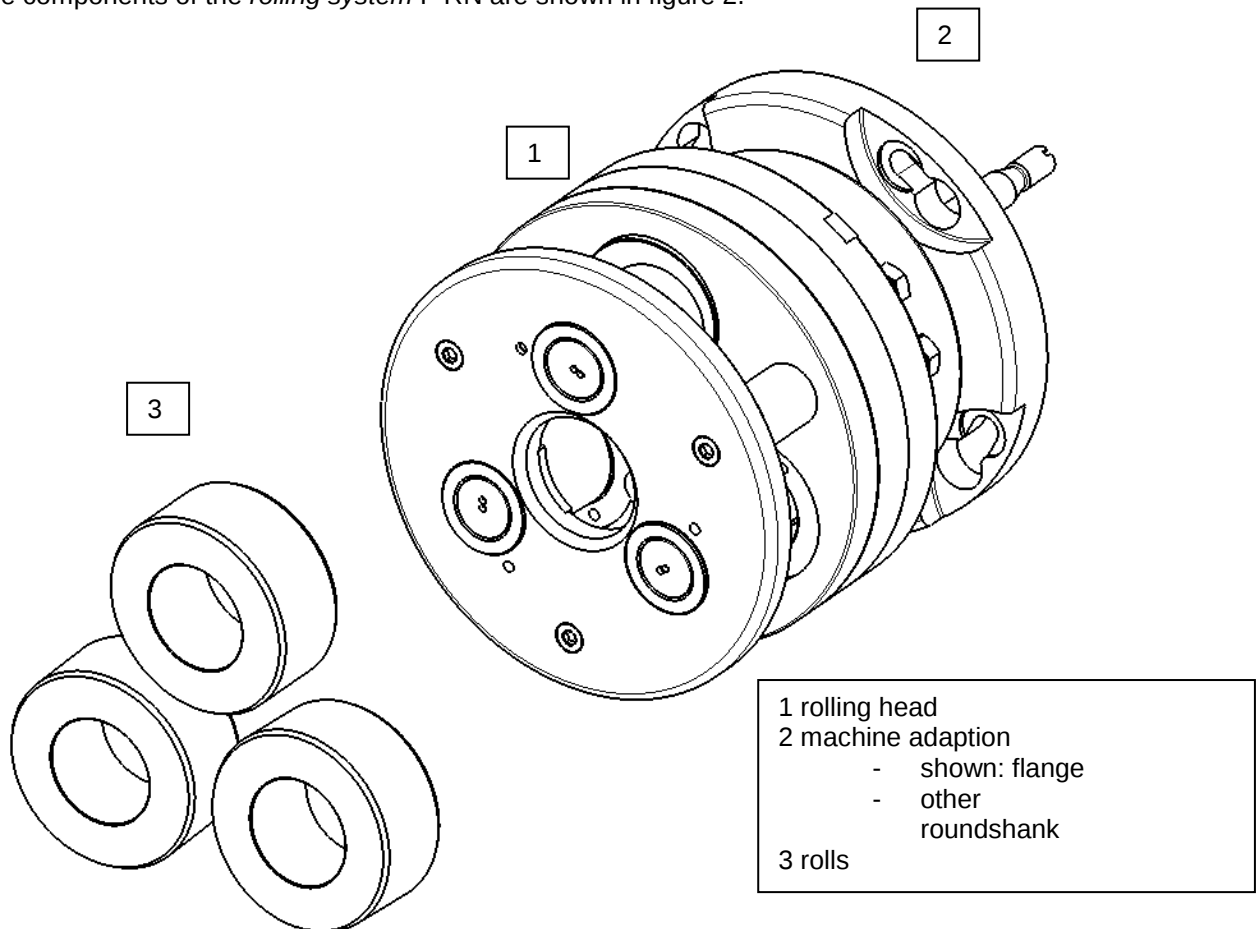


Figure 2: The three components of the F RN *rolling system*

3.1 Rolling head

The F RN rolling head stores the rolls and has a section for the machine adaption. The machine adaption is normally a roundshank or a flange adaption.



NOTE

F RN *rolling systems* can be used stationary or rotating.

Considering the used machine and the rolling head dimension we advise to choose the rolling head who will operate within the lower 2/3 of its working range.

F RN *rolling systems* are available in the following sizes:

- F3-1 RN
- F34-1 RN
- F4-1 RN
- F45-1 RN
- F5-1 RN
- F56-1 RN

- Special designed rolling head are labeled in same manner, but are complemented by the letter „X“ and a consecutively number.

Figure 3 shows a F RN rolling head with flange adaption:

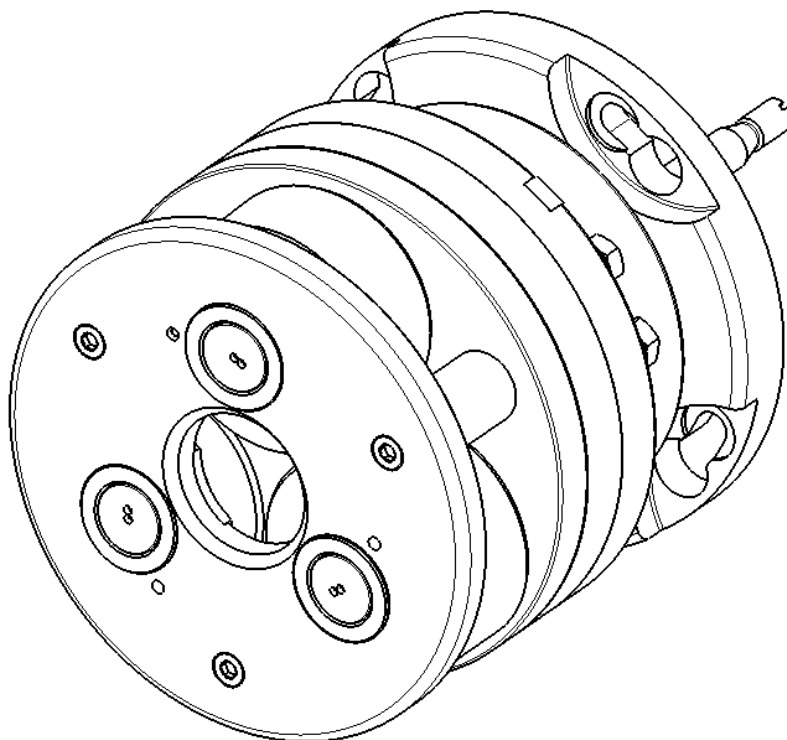


Figure 3: Example of rolling head F5-1RN X139 with flange

3.2 Machine adaption

The F RN rolling head is mounted to the operating machine via roundshank or flange adaption.
Different machine adaptations are available on request.

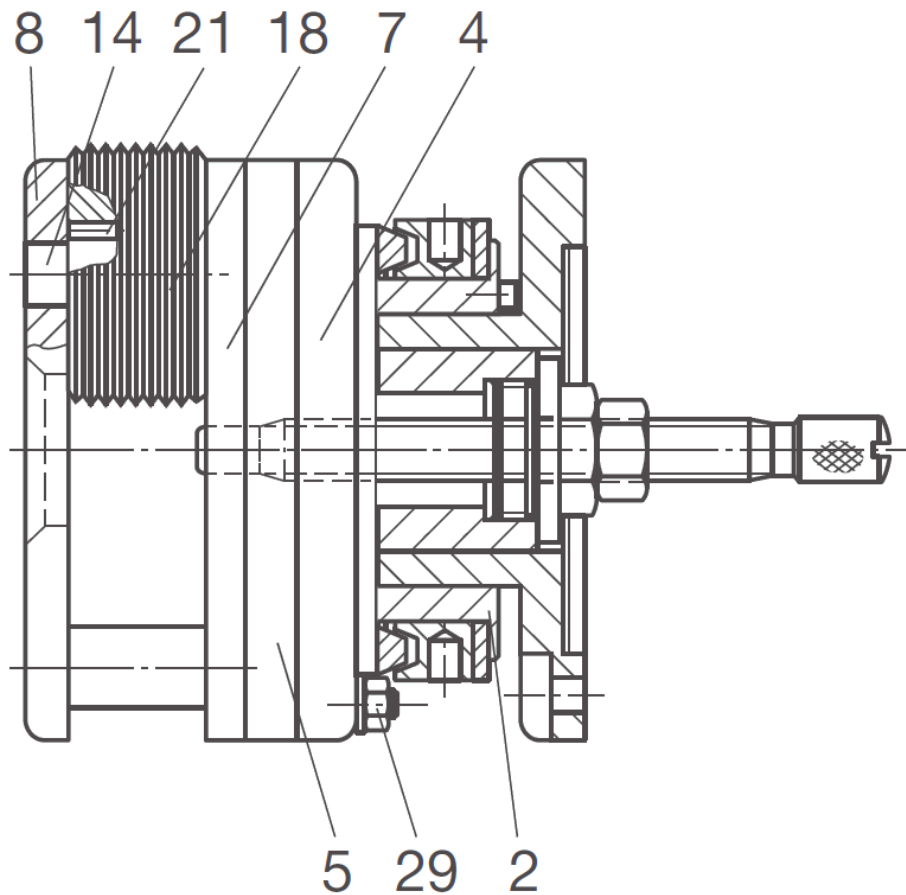


Figure 4: Example of a F RN *rolling system* with integrated flange adaption



NOTE

Position numbers are shown in chapter 7.

3.3 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.

Labeling of the rolls



NOTE

The label on the rolls varies depending on the *rolling process*, but at the same point there is always

- the ID number
- the numbers (1, 2, 3) and
- the letters (A, C, B)

labeled on the rolls.

When contacting the Service Hotline always state the ID-number of the roll.

Respect the numbers (1, 2, 3) and the letters (A, B, C) of the set of rolls when inserting the rolls into the *rolling system*.

Each roll has a number and a letter side, which are shown in figure 5.

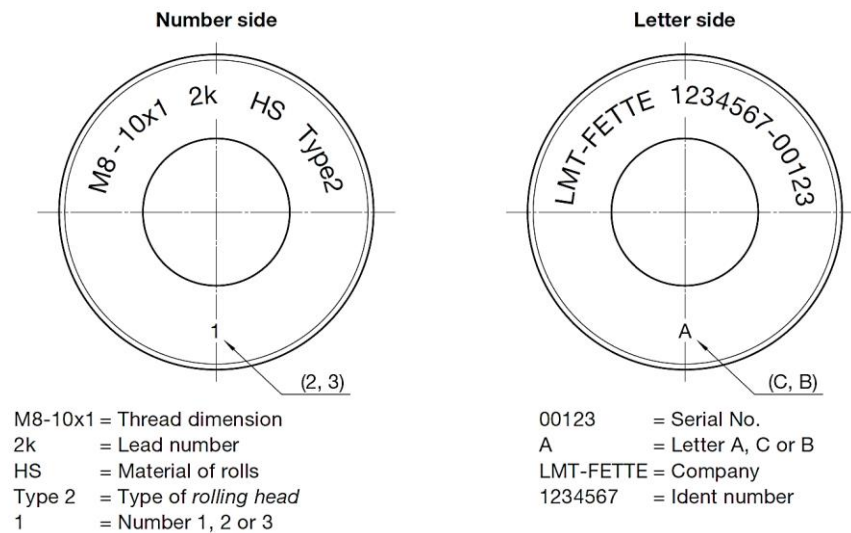


Figure 5: Number side and letters side of thread rolls

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

- 6g (for threads in acc. with DIN)
- 7e¹ (for threads in acc. with DIN)
- 2A (for UN threads in acc. with ANSI)

However, you can order any other thread tolerance.

¹ For trapezoidal threads

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 rolls prior to the rolling process
- profile roll start and run-out

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

When the rolls are worn, they must be replaced with new ones.



NOTE

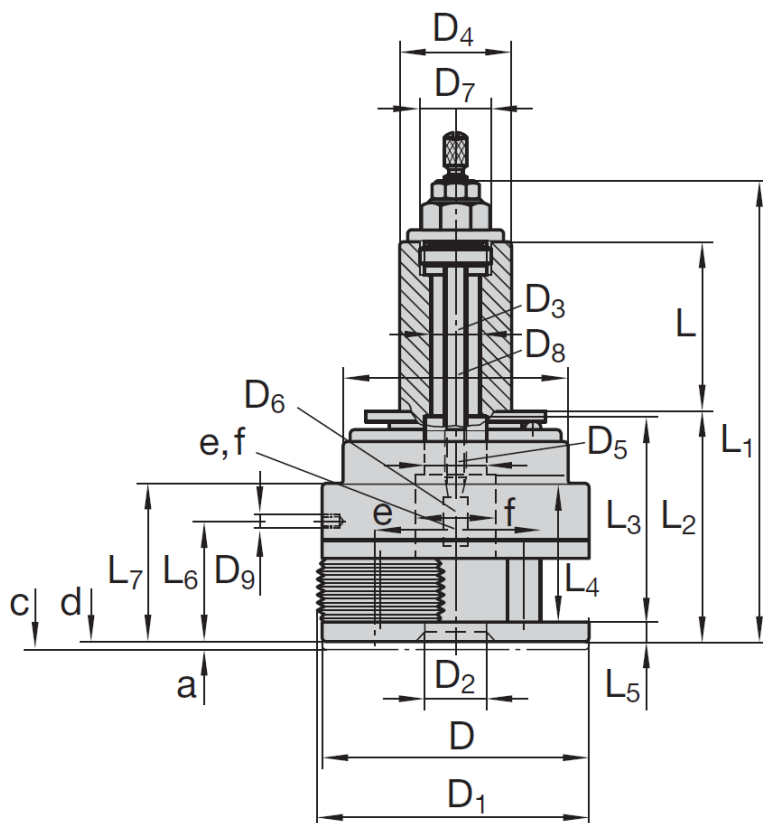
Respect the numbers on the number side or the letters on the letters side for inserting the rolls:

- Roll 1 – Letter A
- Roll 2 – Letter C
- Roll 3 – Letter B

For cylindrical workpieces and the following *rolling processes*, use the rolls on both sides to increase the service life:

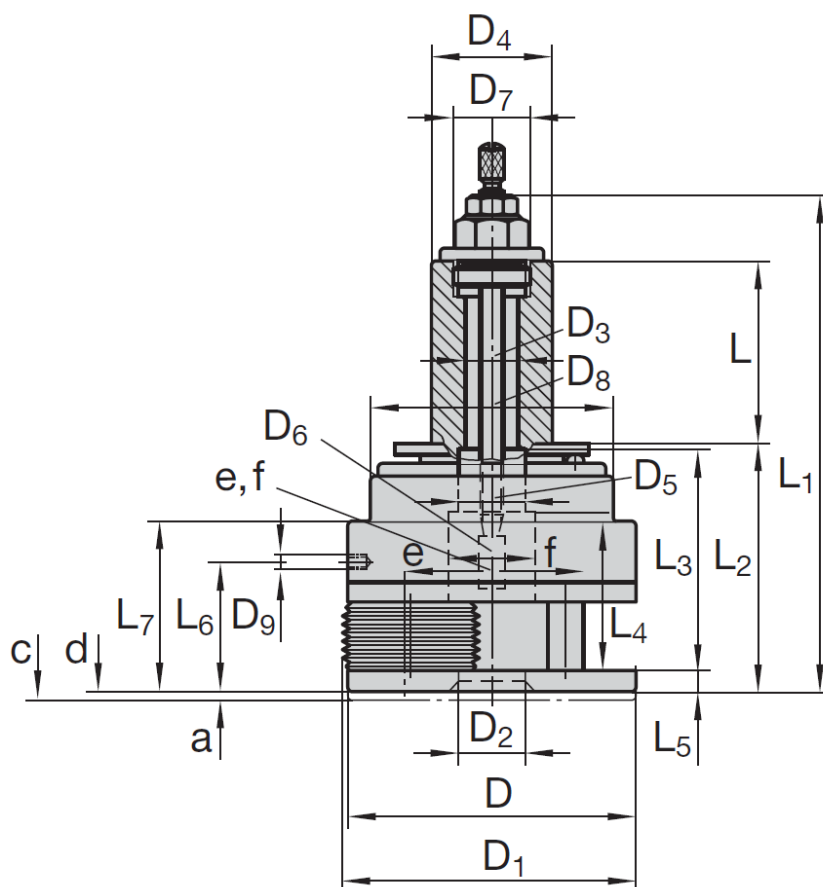
- threading,
- knurling,
- burnishing and
- reducing (depending on the roll type)

3.4 Dimension of the *rolling system*



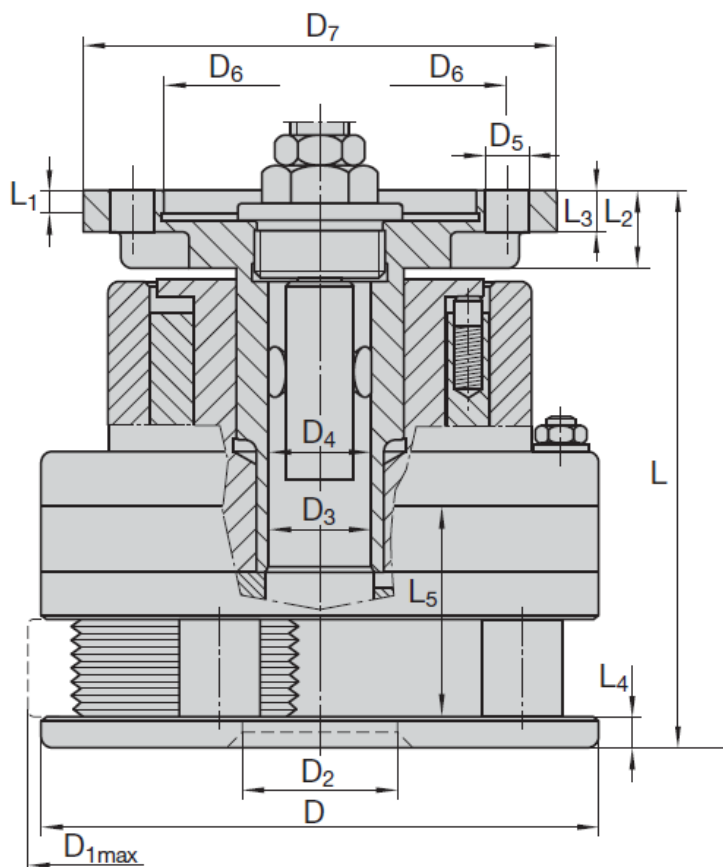
Dimension for F RN <i>rolling systems</i> with roundshank										
Rollkopf	D	D1	D2	D3	D4	D5	D6	D7	D8	D9
F3-1 RN				19	30			M24x1,5		
F34-1 RN	125	128	44	25	40	25	32	M30x1,5	125	M8
				19	30			M24x1,5		
F4-1 RN	165	161	46	32	60	32	-	M39x1,5	125	M8
				32	50			M39x1,5		
				32	1"3/4			M39x1,5		
				28	40			M30x1,5		
F45-1 RN	165	161	48	32	60	32	37	M39x1,5	125	M8
				32	50			M39x1,5		
				32	1"3/4			M39x1,5		
				29	41			M30x1,6		
F5-1 RN	200	204	55	40	70	40	-	M48x1,5	156	M10
				40	60			M39x1,5		
				32	2" 1/2			M39x1,5		
				32	50			M39x1,5		
F56-1 RN	200	204	58	40	70	40	53	M48x1,5	156	M10
				40	60			M39x1,5		
				32	2" 1/2			M39x1,5		
				32	50			M39x1,5		

Table 1: Dimension for F RN *rolling systems* with roundshank part 1/2



Dimension for F RN rolling systems with roundshank										
Rollkopf	L	L1	L2	L3	L4	L5	L6	L7	a	α
F3-1 RN	79,5	234		113	-					
F34-1 RN	79,5	241	133,5	123	84	10	56,5	132	4	30°
		236		113						
F4-1 RN	79,5	248,5	138	133	-	10	62	86,5	4	30°
		248,5		133						
		248,5		133						
		248,5		120						
F45-1 RN	79,5	251	140	133	89	10	65,2	89,7	4	30°
		251		133						
		251		133						
		249		121						
F5-1 RN	95	303	173,5	175	-	14	88,9	121	5	30°
		297,5		175						
		297,5		139						
		297,5		139						
F56-1 RN	95	300	168	170	99	14,56	85,7	117,7	5	30°
		293,5		170						
		293,5		134						
		293,5		134						

Table 2: Dimension for F RN rolling systems with roundshank part 2/2



Dimension for F RN rolling systems with flange adaption																	
	D	D _{1max}	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇	D ₈	L	L ₁	L ₂	L ₃	L ₄	L ₅	m-Rk	m-Ro
F3-1 RN X129	125	131	38	25	25	13	110	140	94	175	8,5	22	11,5	10	108	ca. 12 kg	ca. 0,75-1,2 kg
F34-1 RN X135	125	128	44	32	25	13	110	140	94	176,5	8,5	22	11,5	10	84	ca. 11,40 kg	ca. 0,32-0,85 kg
F4-1 RN X170	165	161	46	32	31	13	110	165	92	163	8,5	23	10,5	10	120	ca. 13,50 kg	ca. 1,1-2,0 kg
F45-1 RN X154	165	161	46	32	31	13	110	165	92	163	8,5	23	10,5	10	28	ca. 13,50 kg	ca. 1,1-2,0 kg
F5-1 RN X139	200	204	55	53	40	13	170	200	140	200	8,5	23	15	14	---	ca. 29,10 kg	ca. 2,0-4,2 kg
F56-1 RN X140	200	204	58	53	40	13	170	200	140	197	8,5	23	14	14,56	38	ca. 29,10 kg	ca. 2,0-4,2 kg

Table 3: Dimension for F RN rolling systems with flange adaption

3.5 Working ranges and rollable materials

F RN	metric threads	metric fine threads	knurling Ø-dia. x pitch	UN (C,F) threads
F3-1 RN	M12x1,75 - M22x2,5	M12x1,5 - M22x2	Ø12x0,5 – Ø22x2,0	UNC 7/16–20 – UNC 7/8-9
F34-1 RN	---	M12x1 – M30x1,5	---	UN ½-28 – UNC 1-12
F4-1 RN	M14x2 – M30x3,5	M14x1,5 – M24x2	Ø14x0,5 – Ø30x2	UNF 9/16-12 – UNC 1 1/8-7
F45-1 RN	---	M16x1 – M42x2	---	UN ¾-32 – UNF 1 9/16-12
F5-1 RN	M18x2,5 – M39x4	M18x1,5 – M36x3	Ø18x0,5 – Ø39x2,0	UNC ¾-10 – UNF 1-12
F56-1 RN	---	M22x1,5 – M52x3	---	UN 7/8-32 – UNF 1 ¾ -12

Table 4: Working ranges *rolling systems* F RN

Rollable materials

A large number of characteristics and properties influence the rollability of materials and the resulting profile quality. In order to reduce the complexity the chosen properties:

- elongation and
- tensile strength

enable an evaluation of the rollability of materials suitable for everyday use.



IMPORTANT

The following property values aren't hard limits, rather empirical values who define the feasible.

Metallic materials with the following properties can be rolled with a *rolling system* TK EVO:

- elongation $\sigma_B \geq 7\%$ und
- tensile strenght $\sigma_Z \leq 1000 \text{ MPa}$

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

3.6 Tightening torques



IMPORTANT

Observe the tightening torques.

Dimension	Tightening torque
M3	1,28 Nm
M4	2,97 Nm
M5	3,03 Nm
M6	10,25 Nm
M8	24,93 Nm
M10	49 Nm
M12	86 Nm
M14	138 Nm
M16	215 Nm
M18	296 Nm
M20	420 Nm

Table 5: Tightening torque

3.7 Condition upon delivery

We deliver your *rolling system* in the following condition separately:

- the rolling head with tools (without set of rolls)
 - normally with integrated machine adaption
- the set of rolls
- machine adaption



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 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.

WARNING



General risk of injury from sharp edges.

The *rolling system* is made of various materials (e.g. nickel), which can trigger an allergic reaction.

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.

4.1 Machine requirements

Collision check

CAUTION



General risk of collision.

Don't equip 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.

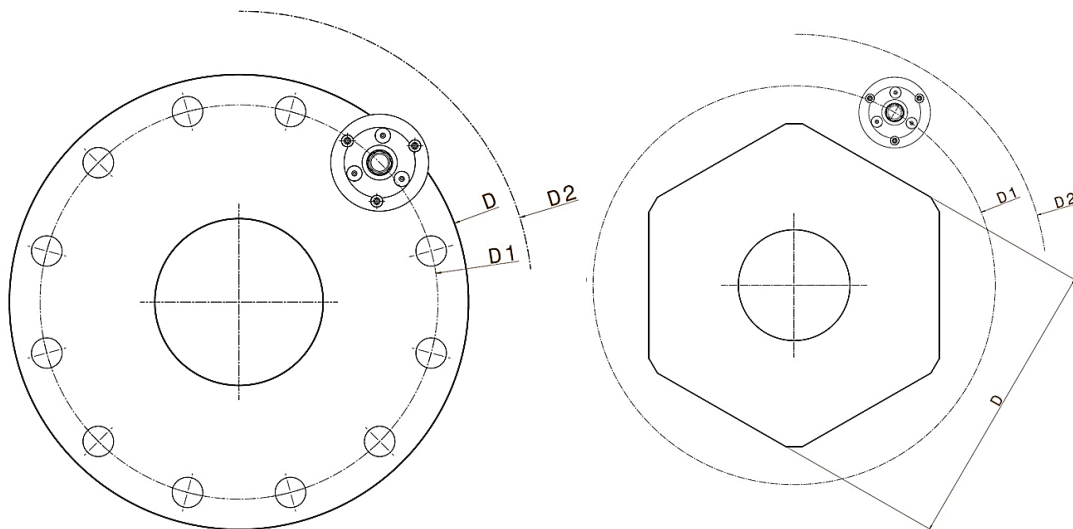


Figure 6: schematic illustration of a *rolling system* on a turret



NOTE

D Outer-Ø of the turret

D1 tool-position-Ø

D2 max. swing circle-Ø

In order to ensure a collision free operation of the *rolling system* the outer diameter of the rolling head must be added to the tool-position-Ø (D1). The sum of D1 and outer-Ø of the rolling head must be smaller than the max. swing circle-Ø of the machine.

Condition:

$$\text{Outer-Ø rolling head} + D1 < D2$$

See chapter 3.4 for *rolling system* dimensions.

4.2 Inserting the rolls into the *rolling systems*

WARNING



General risk due to the weight of the rolling system, it may cause harm when it falls down or roll over.
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.



NOTE

A set of rollers is required for each thread dimension.

Only use rolls with the same code number. Check also thread dimension, rolling head type and thread width.

1. Loosen the front plate screws and remove the front plate

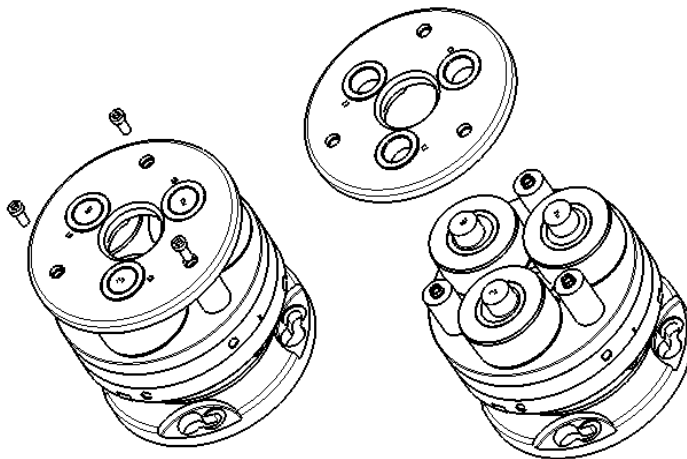


Figure 7: inserting the rolls 1 / 4

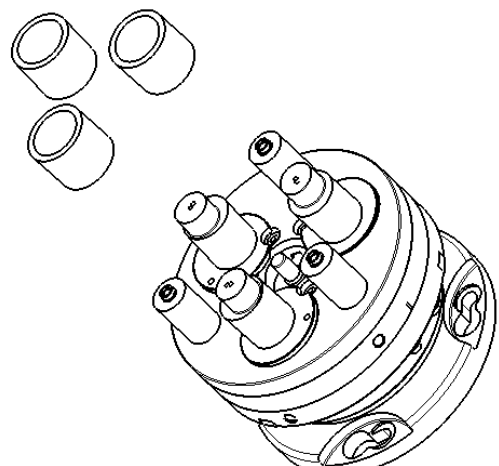


Figure 8: inserting the rolls 2 / 4

2. If necessary remove the washer and the needle bearing set
3. Remove rolls and the carbide bushing
4. Lubricate the eccentric bolts, holes in the carbide bushings and inclined surfaces of the front and center plate



IMPORTANT

In order to ensure a good friction coefficient between roll (8) and eccentric bolt and carbide bushing, be sure to lubricate sufficiently the roll bore and the carbide bushing using molybdenum sulfide grease. (e.g. Molykote).

5. Put one set of washer and needle bearing set over the eccentric bolts on the center plate
6. Place the carbide bushings on the eccentric bolts
7. Lubricate the roll holes

8. Insert the rolls, but bear in mind to check whether the name of the rolling system is marked on the front plate with an L
 - Designation without L (e.g.: F5-1RN); Place the rolls on the carbide bushings in a **clockwise** direction 1-2-3... or A-B-C...
 - Designation with L (e.g.: F5L-1RN); Place the rolls on the carbide bushings in a **counterclockwise** direction in the order 1-2-3... oder A-B-C....

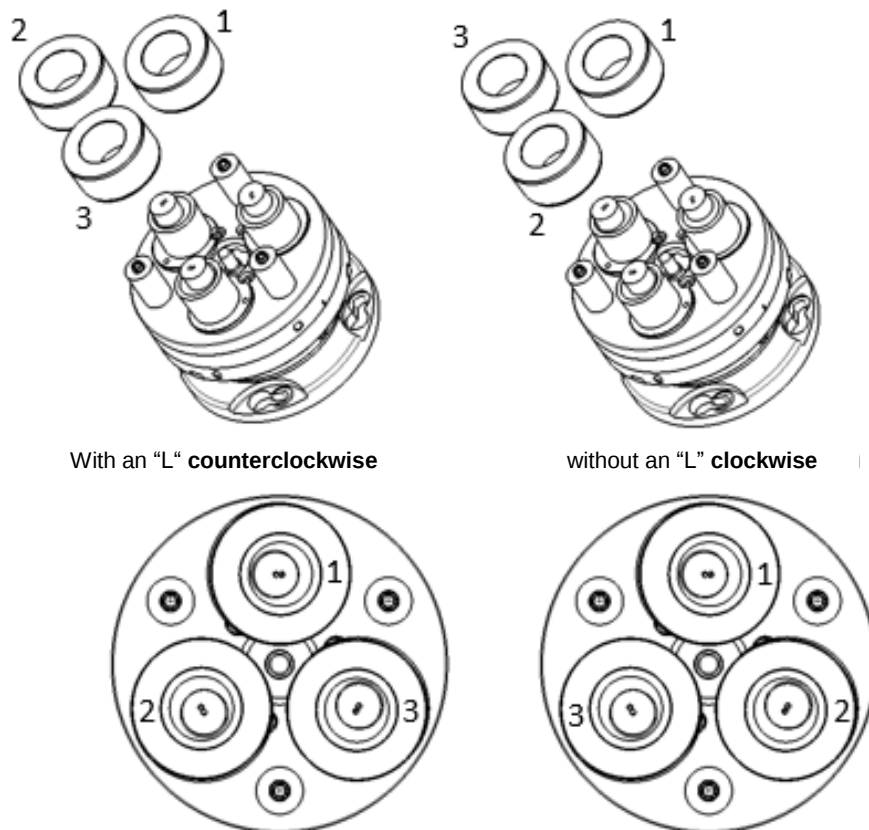


Figure 9: inserting the rolls 3 / 4

9. If present place the needle bearing set and the washer over the eccentric bolts on the rolls
10. Put the front plate back onto the *rolling system* and tighten the front plate screws

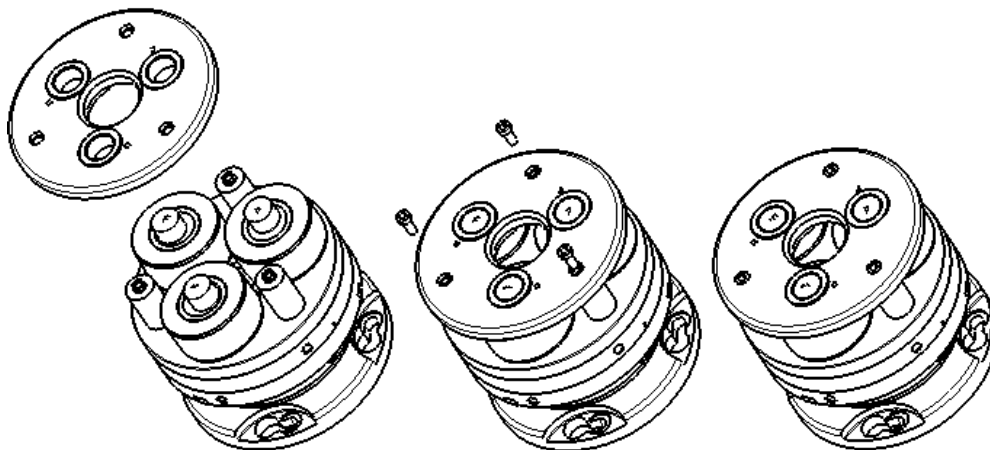


Figure 10: inserting the rolls 4 / 4

Checking the rolls

Move or rather rotate the rolls in order to check a smooth running.

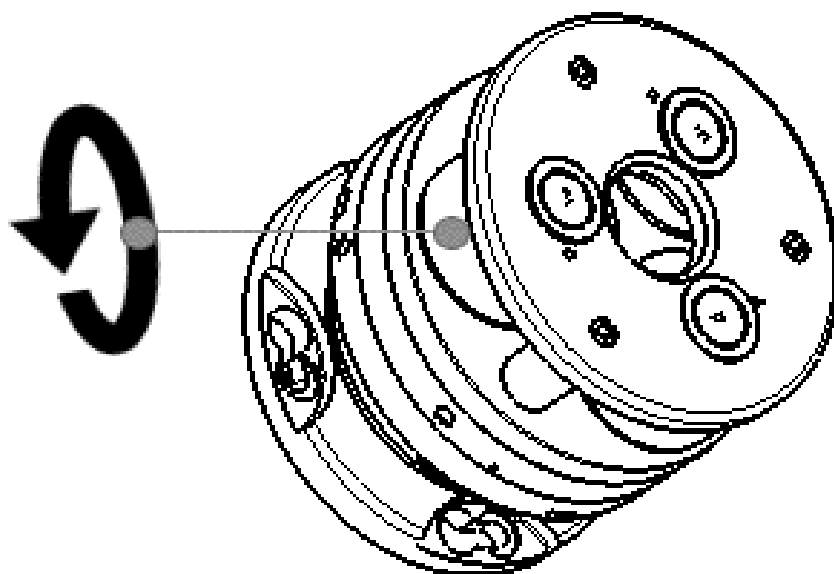


Figure 11: Checking the rolls



IMPORTANT

Contact our Service Hotline if you can't move the rolls.



CAUTION

General risk of component breakage.

Don't do a *roll process* if you can't move the rolls.

4.3 Adjusting the diameter to work piece dimension

Verify that rolling head is closed, i.e. clutch parts 2 and 4 are in complete engagement.

1. Ensure that the *rolling system* is protected of falling down or tipping over.
2. Loosen the hex nuts (29)
3. Turn the gear ring (5) within the slotted holes(4) by means of the handle (38) until the outside diameter of the rolls reach the required position or touch a setting sample.
4. Tighten the hex nuts (29)
5. If the produced pitch diameter is too small or to large, fine adjustment is needed. In order to fine adjust the rolling head use the labeled scale (see figure 12).



NOTE

The adjusted diameter on the rolling head will differ to the produced diameter on the work piece, due to the force in the forming process, which results in a slight deflection.

See in Figure 12 the labeled scale on the rolling head.

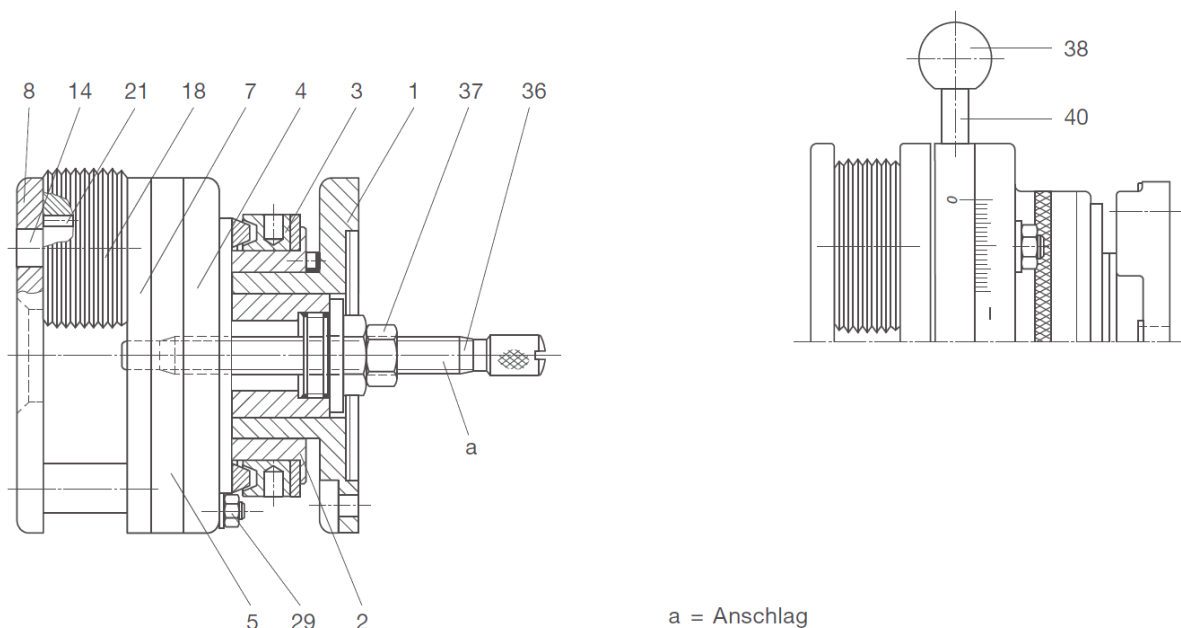


Figure 12: labeled scale on the *rolling system* RN



IMPORTANT

Don't perform a second *rolling process* on a once rolled profile.

4.4 Installing the *rolling system* in the processing machine

WARNING



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.

1. Check if you need and have suitable hoisting devices
 - We recommend the use of hoisting devices for the transportation from a weight of 5 kg or higher



NOTE

Suitable hoisting devices are for example:

- A sling
- Hoisting Chain
- Lift cable

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

2. Insert the *rolling system* in the processing machine.
3. Fix and secure the mounting position of the *rolling system*.



NOTE

Ensure the work piece is sufficiently clamped in the processing machine so that the torque generated by the *rolling process* can be absorbed.

4.5 Setting the machine-side closing element

Set the machine-side closing element depending on the conditions of the processing machine.



NOTE

Please contact our Service Hotline in the event of initial commissioning of the *rolling system*.
We will gladly advise on setting the machine-side closing element.

Closing the rolling head

When the rolling head closes the rolls (18) are brought back in to working position.

As closing elements we recommend:

- using the handle manually
- end-stop using the processing machine or
- closing cam using the processing machine

5. Operation



IMPORTANT

First follow the instruction in chapter 4, installation.

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

We will gladly advice on:

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

WARNING



General risk of injury from sharp edges.

The *rolling system* is made of various materials (e.g. nickel), which can trigger an allergic reaction.

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.

5.1 Preparing the work piece

Characteristics of threads

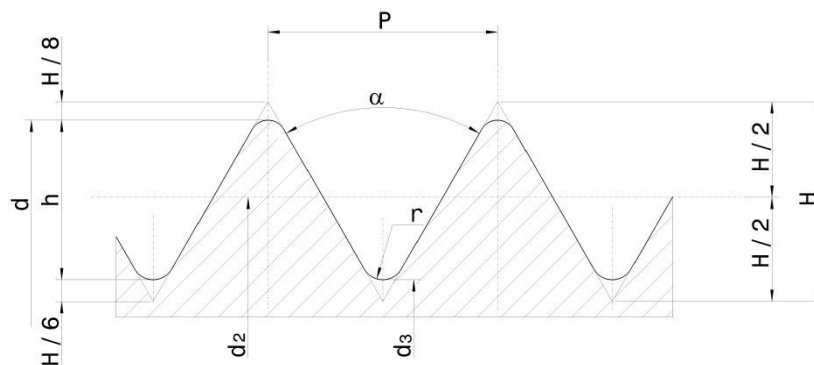


Figure 13: Characteristics of threads (e.g.: ISO metric threads)



NOTE

P : Thread pitch (for multiple threads: thread pitch) [mm]

α : Flank angle [°]

H : Theoretical profile height [mm]

h : Profile depth [mm]

r : Core radius [mm]

d : Nominal thread diameter [mm]

d_2 : Pitch diameter [mm]

d_3 : Core diameter [mm]



NOTE

For the geometry of the workpiece, note

- the blank diameter,
- the chamfer and
- the undercut.

Blank diameter

The resulting blank diameter must be complied with a tolerance of -0,02mm.

- for threading:



NOTE

$$d_v \approx d_2 - 0,03 \text{ mm}$$

d_v : Blank diameter [mm]

d_2 : Pitch diameter [mm]

If you increase/decrease the blank diameter d_v , the nominal thread diameter d increases/decreases by three to five times as much.

- for knurling:



NOTE

$$d_v \approx d - h_z$$

d_v : Blank diameter [mm]

d : Nominal thread diameter [mm]

h_z : Tooth depth acc. to DIN [mm]

Chamfer



NOTE

Only chamfer the work piece under the following *rolling processes*:

- Threading,
- Knurling and,
- Cold forming of rotationally symmetrical work pieces, to produce other profiles.

Perform the chamfering in accordance with figure 14:

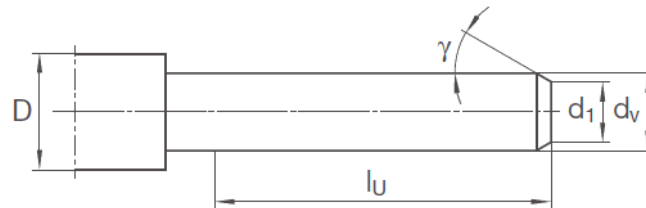


Figure 14: Preparing the work piece without undercut (thread runoff)



NOTE

γ : Chamfer angle [°]
 D : Collar diameter [mm]
 d_1 : End face diameter [mm]
 d_v : Blank diameter [mm]
 l_U : length to be formed of the work piece

- The chamfer angle should be $\gamma = 10^\circ - 30^\circ$.
- The interior diameter d_1 must be smaller than the core diameter.



NOTE

$d_1 \leq d_3 - 0,1 \text{ mm}$
 d_1 : interior (end face) diameter [mm]
 d_3 : core diameter [mm]

Undercut



NOTE

The minimum undercut (thread runout) g depends on:

- the rolling head size,
- the thread pitch and
- the thread roll lead.

1. Read off the rolling head size from the front plate of the *rolling system*.
2. Determine the thread pitch.
3. Determine the thread roll lead b .



NOTE

The thread roll lead b denotes the number of teeth that are in front of a full-profile tooth.
We distinguish between $b = 1 K$ and $b = 2 K$.

The thread roll lead is shown in figure 15: and 16.

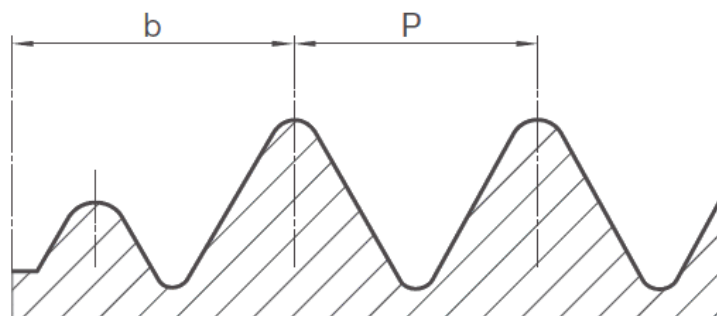


Figure 15: Thread roll lead 1 K

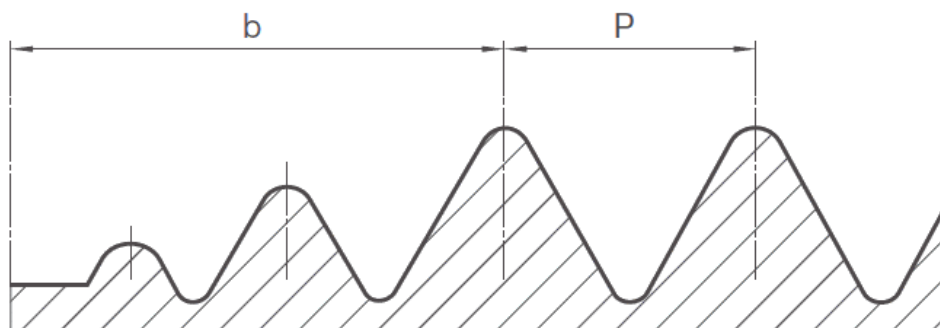


Figure 16: Thread roll lead 2 K

4. Read off the minimum undercut (thread runout) g using the values determined from table 5..
5. Perform the undercut and the two chamfers according to figure 17.

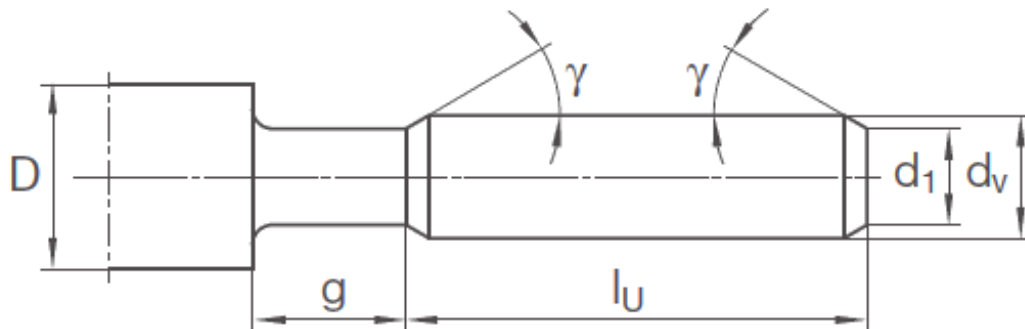


Figure 17: Preparing the work piece with undercut (thread runout)



NOTE

g : undercut (profile outlet) [mm]
 γ : chamfer angle [°]
 D : shoulder diameter [mm]
 d_1 : interior diameter [mm]
 d_v : blank diameter [mm]
 l_U : profile length

Steigung Pitch mm Zoll	Anlauf Lead	Rollkopfgröße Rolling head size											
		0	001	01 01- 1	1 23	12	1223	2 233400 34 34-1	2T 3 32 3-1 45- 1	4-1 56-1	3T 3-1T	4-1T 5-1 6700	5-1T 6a-1 6b-1
mm inch													
0,25	1 ,	0,438 0,017	0,417 0,016	0,417 0,016									
0,01	2 ,	0,688 0,027	0,667 0,026	0,667 0,026									
0,3	1 ,	0,475 0,019	0,550 0,022	0,550 0,022	0,500 0,020		0,450 0,018						
0,012	2 ,	0,775 0,031	0,850 0,033	0,850 0,033	0,800 0,031		0,750 0,030						
0,35	1 ,	0,588 0,023	0,583 0,023	0,683 0,027	0,558 0,022		0,583 0,023						
0,014	2 ,	0,938 0,037	0,933 0,037	1,033 0,041	0,908 0,036		0,933 0,037						
0,4	1 ,	0,700 0,028	0,767 0,03	0,667 0,026	0,767 0,030		0,667 0,026						
0,016	2 ,	1,100 0,043	1,167 0,046	1,067 0,042	1,167 0,046		1,067 0,042						
0,45	1 ,	0,738 0,029	0,875 0,034	0,800 0,031	0,825 0,032		0,775 0,031						
0,018	2 ,	1,188 0,047	1,325 0,052	1,250 0,049	1,275 0,050		1,225 0,048						
0,5	1 ,	0,875 0,034	0,833 0,033	0,833 0,033	0,833 0,033	0,833 0,033	0,833 0,033	0,833 0,033					
0,02	2 ,	1,375 0,052	1,333 0,052	1,333 0,052	1,333 0,052	1,333 0,052	1,333 0,052	1,333 0,052					

		0.054											
0,6	1 ,	1,150 0.045	0,900 0.035	0,900 0.035	1,000 0.039	1,000 0.039	1,100 0.043	1,100 0.043					
0.024	2 ,	1,750 0.069	1,100 0.043	1,500 0.059	1,600 0.063	1,600 0.063	1,700 0.067	1,700 0.067					
0,7	1 ,	1,025 0.040	1,167 0.046	1,267 0.050	1,317 0.052	1,217 0.048	1,167 0.046	1,367 0.054					
0.028	2 ,	1,725 0.068	1,867 0.073	1,967 0.077	2,017 0.079	1,917 0.075	1,867 0.073	2,067 0.081					
0,75	1 ,	1,188 0.047	1,375 0.054	1,375 0.054	1,250 0.049	1,250 0.049	1,125 0.044	1,125 0.044	1,375 0.054				
0.03	2 ,	1,938 0.076	2,125 0.084	2,125 0.084	2,000 0.079	2,000 0.079	1,875 0.074	1,875 0.074	2,125 0.084				
0,8	1 ,	1,400 0.055		1,533 0.060	1,233 0.049	1,333 0.052	1,533 0.060	1,333 0.052	1,433 0.056				
0.031	2 ,	2,200 0.087		2,333 0.092	2,033 0.08	2,133 0.084	2,333 0.092	2,133 0.084	2,233 0.088				
0,9	1 ,	1,525 0.060		1,550 0.061	1,350 0.053	1,650 0.065	1,750 0.069	1,600 0.063	1,400 0.055				
0.035	2 ,	2,425 0.095		2,450 0.096	2,250 0.089	2,550 0.1	2,650 0.104	2,500 0.098	2,300 0.091				
1,0	1 ,	1,750 0.069		1,667 0.066	1,667 0.066	1,667 0.066	1,667 0.066	1,667 0.066	1,667 0.066	1,667 0.066		1,667 0.066	
0.039	2 ,	2,750 0.108		2,667 0.105	2,667 0.105	2,667 0.105	2,667 0.105	2,667 0.105	2,667 0.105	2,667 0.105		2,667 0.105	
1,25	1 ,			2,083 0.082	2,083 0.082	1,833 0.072	2,208 0.087	2,083 0.082	2,083 0.082	2,083 0.082		2,083 0.082	
0.049	2 ,			3,333 0.131	3,333 0.131	3,083 0.121	3,458 0.136	3,333 0.131	3,333 0.131	3,333 0.131		3,333 0.131	
1,5	1 ,			2,250 0.089	2,500 0.098	2,500 0.098		2,750 0.108	2,250 0.089	2,500 0.098		2,250 0.089	2,750 0.108
0.059	2 ,			3,750 0.148	4,000 0.157	4,000 0.157		4,250 0.167	3,750 0.148	4,000 0.157		3,750 0.148	4,250 0.167
1,75	1 ,					2,792 0.110		3,276 0.129	3,145 0.124	3,042 0.120		2,792 0.110	3,417 0.135
0.069	2 ,					4,542 0.179		5,042 0.198	4,899 0.193	4,792 0.189		4,542 0.179	5,167 0.203
2,0	1 ,							3,333 0.131	3,833 0.151	3,333 0.131		3,292 0.130	3,333 0.131
0.079	2 ,							5,333 0.210	5,833 0.230	5,333 0.210		5,292 0.208	5,333 0.210
2,5	1 ,								4,150 0.163	4,167 0.164	4,167 0.164	4,135 0.163	4,167 0.164
0.098	2 ,								6,655 0.262	6,667 0.262	6,667 0.262	6,640 0.261	6,667 0.262
3,0	1 ,								5,488 0.216	4,983 0.196	4,500 0.177	5,476 0.216	4,500 0.177
0.118	2 ,								8,488 0.334	7,983 0.341	7,500 0.295	8,500 0.335	7,500 0.295
3,5	1 ,								6,083 0.239	6,807 0.268	5,833 0.230	6,555 0.258	6,333 0.249
0.138	2 ,								9,583 0.377	10,307 0.406	9,333 0.367	10,055 0.396	9,833 0.387
4,0	1 ,										6,167 0.243	6,680 0.263	7,667 0.302
0.157	2 ,										10,167 0.40	10,667 0.420	11,667 0.459
4,5	1 ,										7,000 0.276	11,748 0.463	7,750 0.305
0.177	2 ,										11,500 0.453	16,248 0.640	12,250 0.482
5,0	1 ,										8,333 0.328	8,357 0.329	8,333 0.328
0.197	2 ,										13,333 0.525	13,333 0.525	13,333 0.525
5,5	1 ,												9,417 0.371
0.217	2 ,												14,917 0.587
6,0	1 ,												
0.236	2 ,												

Table 6: Determining the undercut (thread runout in relation to thread roll lead) 1/2

Steigung (Gang pro Zoll) Pitch (TPI)	An- lauf Lead	Rollkopfgröße Rolling head size											
		0	001	01 01 -1	1 23	12	1223	2 233400 34 34-1	2T 3 32 3-1 45-1	4-1 56-1	3T 3-1T	4-1T 5-1 6700	5-1T 6a-1 6b-1
mm inch													
90	1 ,	0,546 0.021	0,445 0.018	0,535 0.021									
	2 ,	0,828 0.033	0,727 0.029	0,817 0.032									
80	1 ,	0,582 0.023	0,532 0.021	0,602 0.024	0,557 0.022		0,534 0.021						
	2 ,	0,900 0.035	0,850 0.033	0,919 0.036	0,875 0.034		0,852 0.034						
72	1 ,	0,588 0.023	0,558 0.022	0,646 0.025	0,675 0.027		0,528 0.021						
	2 ,	0,911 0.036	0,911 0.036	0,999 0.039	1,028 0.040		0,881 0.035						
64	1 ,	0,725 0.029	0,589 0.023	0,699 0.028	0,619 0.024	0,707 0.028	0,714 0.028						
	2 ,	1,122 0.044	0,986 0.039	1,096 0.043	1,016 0.040	1,104 0.043	1,111 0.044						
60	1 ,	0,722 0.028	0,821 0.032	0,629 0.025	0,803 0.032	0,783 0.031	0,726 0.029						
	2 ,	1,145 0.045	1,244 0.049	1,052 0.041	1,226 0.048	1,206 0.047	1,149 0.045						
56	1 ,	0,709 0.028	0,852 0.034	0,763 0.030	0,766 0.030	0,855 0.034	0,720 0.028						
	2 ,	1,163 0.046	1,306 0.051	1,217 0.048	1,220 0.048	1,309 0.052	1,174 0.046						
48	1 ,	0,958 0.038	0,944 0.037	0,856 0.034	0,976 0.038	0,798 0.031	1,005 0.040	0,831 0.033					
	2 ,	1,487 0.059	1,472 0.058	1,385 0.055	1,505 0.059	1,327 0.052	1,534 0.060	1,360 0.054					
44	1 ,	0,971 0.038	1,000 0.039	0,480 0.019	0,961 0.038	0,903 0.036	1,038 0.041	0,864 0.034					
	2 ,	1,548 0.061	1,577 0.062	1,057 0.042	1,538 0.061	1,480 0.058	1,615 0.064	1,441 0.057					
40	1 ,	0,984 0.039	1,066 0.042	0,978 0.038	0,938 0.037	1,025 0.040	1,073 0.042	1,216 0.048					
	2 ,	1,619 0.064	1,700 0.067	1,613 0.063	1,891 0.074	1,661 0.065	1,708 0.067	1,851 0.073					
36	1 ,	1,353 0.053	1,147 0.045	1,235 0.049	1,264 0.050	1,176 0.046	1,117 0.044	1,293 0.051					
	2 ,	2,059 0.081	1,853 0.073	1,941 0.076	1,970 0.078	1,882 0.074	1,823 0.072	1,999 0.079					
32	1 ,	1,419 0.056	1,250 0.049	1,559 0.061	1,281 0.050	1,368 0.054	1,574 0.062	1,399 0.055	1,516 0.060				
	2 ,	2,214 0.087	2,044 0.080	2,353 0.093	2,074 0.082	2,162 0.085	2,368 0.093	2,192 0.086	2,310 0.091				
28	1 ,	1,506 0.059		1,523 0.060	1,755 0.069	1,616 0.064	1,710 0.067	1,535 0.060	1,767 0.070				
	2 ,	2,413 0.095		2,430 0.096	2,663 0.105	2,523 0.099	2,617 0.103	2,442 0.096	2,674 0.105				
26	1 ,	1,801 0.071		1,743 0.069	1,801 0.071	1,766 0.070	1,789 0.070	1,858 0.073	1,916 0.075				
	2 ,	2,778 0.109		2,720 0.107	2,778 0.109	2,743 0.108	2,766 0.109	2,836 0.112	2,893 0.114				
24	1 ,	1,620 0.064		2,002 0.079	1,858 0.073	1,944 0.077	1,887 0.074	1,712 0.067	2,097 0.083		1,661 0.065		
	2 ,	2,678 0.105		3,060 0.120	2,915 0.115	3,002 0.118	2,944 0.116	2,771 0.109	3,154 0.124	3,010 0.118	2,719 0.107		

22	1 , 2 ,	1,845 0.073 3,000 0.118		1,728 0.068 2,883 0.113	1,912 0.075 3,067 0.121	2,147 0.085 3,303 0.130	1,991 0.078 3,147 0.124	2,108 0.083 3,263 0.128	1,720 0.068 2,875 0.113	1,910 0.075 3,065 0.121		1,713 0.067 2,868 0.113	
20	1 , 2 ,	2,413 0.095 3,683 0.145		2,037 0.080 3,307 0.130	1,996 0.079 3,267 0.129	2,402 0.095 3,672 0.145	2,132 0.084 3,402 0.134	1,957 0.077 3,227 0.127	1,916 0.075 3,187 0.125	2,512 0.099 3,782 0.149		2,431 0.096 3,701 0.146	
19	1 , 2 ,				2,376 0.094 3,713 0.146	2,213 0.087 3,550 0.140	2,543 0.100 3,880 0.153	2,202 0.087 3,537 0.139	2,027 0.080 3,364 0.132	2,521 0.099 3,858 0.152		2,173 0.086 3,510 0.138	
18	1 , 2 ,				2,090 0.082 3,502 0.138	2,708 0.107 4,119 0.162	2,297 0.090 3,708 0.146	2,474 0.097 3,886 0.153	2,152 0.085 3,563 0.140	2,536 0.100 3,947 0.155		2,536 0.100 3,952 0.156	2,660 0.105 4,071 0.160
16	1 , 2 ,				3,000 0.118 4,589 0.181	2,295 0.090 3,883 0.153		2,324 0.091 3,913 0.154	2,443 0.096 4,031 0.159	2,561 0.101 4,149 0.163		2,797 0.110 4,385 0.173	3,033 0.119 4,621 0.182
14	1 , 2 ,				3,267 0.129 5,081 0.200			3,046 0.120 4,860 0.191	2,826 0.111 4,640 0.183	3,511 0.138 5,325 0.210		3,069 0.121 4,883 0.192	2,628 0.103 4,441 0.175
13	1 , 2 ,							3,486 0.137 5,441 0.214	3,056 0.120 5,010 0.197	3,602 0.142 5,556 0.219		3,717 0.146 5,671 0.223	2,855 0.112 4,809 0.189
12	1 , 2 ,							4,002 0.158 6,119 0.241	3,327 0.131 5,443 0.214	3,710 0.146 5,826 0.229		3,417 0.135 5,534 0.218	3,125 0.123 5,241 0.206
11	1 , 2 ,							3,459 0.136 5,767 0.227	3,649 0.144 5,957 0.235	3,840 0.151 6,149 0.242		4,223 0.166 6,531 0.257	3,450 0.136 5,758 0.227
10	1 , 2 ,							4,074 0.160 6,614 0.260	4,033 0.159 6,562 0.258	3,994 0.157 6,534 0.257	3,911 0.154 6,493 0.256	3,914 0.154 6,453 0.254	3,834 0.151 6,374 0.251
9	1 , 2 ,							4,826 0.190 7,648 0.301	4,491 0.177 7,327 0.288	4,183 0.165 6,991 0.275	5,271 0.208 8,093 0.319	4,949 0.195 7,771 0.306	4,305 0.169 7,127 0.281
8	1 , 2 ,							4,179 0.165 7,354 0.290	5,092 0.200 8,267 0.325	6,041 0.238 9,161 0.361	5,330 0.210 8,505 0.335	4,654 0.183 7,829 0.308	4,892 0.193 8,067 0.318
7	1 , 2 ,								5,847 0.230 9,476 0.373	6,523 0.257 10,152 0.400	5,427 0.214 9,056 0.357	6,070 0.239 9,698 0.382	5,645 0.222 9,274 0.365
6	1 , 2 ,								6,856 0.270 11,089 0.437	7,240 0.2851 11,473 0.452	7,623 0.300 11,856 0.467	8,006 0.315 12,239 0.482	6,657 0.262 10,890 0.429
5	1 , 2 ,										13,267 0.522 18,347 0.722	8,100 0.319 13,180 0.519	8,147 0.3211 13,133 0.517
4 1/2	1 , 2 ,										9,975 0.393 15,619 0.615		9,006 0.355 14,615 0.575
4	1 , 2 ,										9,033 0.356 15,383 0.606		10,183 0.401 16,533 0.651
3 1/2	1 , 2 ,												11,696 0.460 18,953 0.746
3	1 , 2 ,												13,711 0.540 22,178 0.873

Table 7: Determining the undercut (thread runout in relation to thread roll lead) 2/2

5.2 Rolling process and feed

F RN rolling systems are designed to operate on CNC machines.

IMPORTANT



When the rolling systems opens a part of the rolling head is pulled in axial direction forward, hence the overall length of the rolling system increases by the value a ($a = 4$ up to 5 mm, depending on the rolling head size).

In order to ensure a successful rolling process either the rolling head is stationary and the workpiece rotating or vice versa. In general, the rolling process can undergo the following steps:

1. **Axial** supply of the work piece or the rolling head
2. **Push in** of the work piece in to the rolling head
3. **Forming process**
4. **Following the axial feed movement** by the rolling head (feed rate: thread lead -5%)
5. **Feed stop** or the use of an internal stop will cause the **opening** of the **rolling head**
6. Pull back to **initial position**
7. **Removal** of the produced **work piece**
8. **Closing** of the rolling head → **read for next operation**

Usually the rolling head carries 3 rolls, in special application up to 6 rolls. The rolls are defined by cylindrical profile grooves. The rolling head angle determines the producible thread lead. So that by one rotation of the work piece or the rolling head the axial movement equals the thread lead of the work piece (see figure 18).

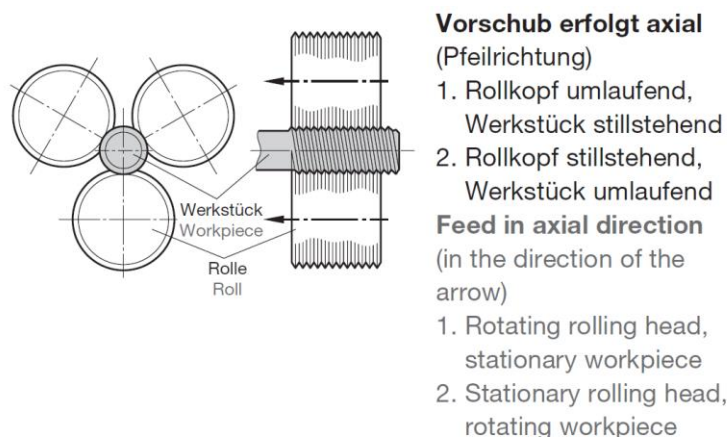


Figure 18: functional principle



NOTE

The operation machine only follows the axial movement caused by the thread length (by -5%).

Operating feed

The rolling head is pushed/pressed on the prepared work piece via the CNC operation machine or rather rare manually pushed via a special machine unit. The friction caused by the pressing force will start the forming process and a self-contained feed movement in the working direction.



NOTE

Select the machine feed 5% smaller than the thread lead.

The forming process will cause a slight elongation of the work piece. Because of the elongation it is necessary to reduce, the CNC feed rate about -5% of the thread lead.

Example:

Thread M20 x 1,5 / thread lead 1,5 mm

CNC operating feed rate reduced by ca. 5%: 1,47 mm/rotation

Rolling head angle and lead angle

As long the outer diameter of the work piece matches the working range of the rolling head, you can manufacture any type of thread. The limitation however is the rolling head angle in reference to the lead angle of thread.



NOTE

Metric, UN-, BS-, BA- und similar threads can be manufactured with the same rolling head as long the deviation between the rolling head angle and thread lead angle is below $\pm 30\%$.

When operating near the limit or when you are unsure, please contact our Service Hotline, we will assist you.



NOTE

By definition:

$$\alpha = \arctan \frac{p}{\pi \cdot D}$$

α = thread lead angle [°]

p = lead [mm]

D = pitch-Ø [mm]

5.3 Rolling speed and machine speed

Rolling speed



NOTE

Determine the rolling speed depending on the material of the work piece, using Table 8.
Recommended rolling speeds depending on the material:

- V-thread: select the value specified in the table
- Trapezoidal and round thread: select 50% of the stated value of the table

Symbols:

☺ good rollability

☹ rollable

⊗ conditionally rollable

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

Nickel alloys	580-800	NiCr15Fe (Inconell 600)	2.4816	⊗	20-40
Non-ferrous metals					
Copper	240-300	E-Cu	CW004A	☺	40-80
Copper alloys	310	CuZn37	CW508L (R310)	☺	40-80
(Brass	410	CuZn38Pb2	CW608N (R410)	☺	40-70
	360	CuZn38Pb2	CW608N (R360)	☺	40-70
	430	CuZn39Pb3	CW614N (R430)	☺	40-70
Aluminium alloys	150-240	AlMg2	EN AW-5251	☺	40-70
	160-310	AlSi1MgMn	EN AW-6082	☺	40-70
	220-350	AlZn4,5Mg1	EN AW-7020	⊗	30-50
	220-440	AlCu4Mg1	EN AW-2024	☺	30-50
	275-540	AlZn5,5MgCu	EN AW-7075	☺	30-50
Titanium alloys	390-540	Ti2	3.7035	☺	30-60
	540-650	TiCu2	3.7124	☺	30-60
	750-950	TiAl5Sn2,5	3.7115	☺	30-60
	1030-1100	Ti6Al4V	3.7164.7	☺	20-40

Table 8: Recommended rolling speed depending on the material

Tensile strength (yield) 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 strength, and for low tensile strength choose high rolling speeds.

Machine speed



NOTE

The machine speed is calculated as follows:

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

n : machine speed [min^{-1}]

v : rolling speed [m/min]

d_A : blank diameter [mm]

5.4 Driving power and torque

The thread is gradually generated in axial direction. Therefore, the thread length does not influence the power requirements.



NOTE

The required driving power is calculated as follows:

$$N \approx 0,174 \cdot 10^{-6} \cdot C \cdot \delta_B \cdot p \cdot d \cdot n \quad [kW]$$

N: driving power

C: shape factor (V.thread: 1 | trapezoidal and round thread: 2)

δ_B : Tensile strength [N/mm²]

p: thread lead [mm]

d: nominal thread diameter [mm]

n: machine speed [min⁻¹]



NOTE

The required torque is calculated as follows:

$$M = \frac{9740 \cdot N}{n} \quad [Nm]$$

M: torque [Nm]

N: driving power [kW]

n: machine speed [min⁻¹]



NOTE

The machine speed is calculated as follows:

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

n : machine speed [min⁻¹]

v : rolling speed [m/min]

d_A: blank diameter [mm]



NOTE

Example: **M 20 x 2,5**

Nominal thread dia.	$d = 20 \text{ mm}$
Thread lead	$p = 2,5 \text{ mm}$
Tensile strength	$\delta_B = 700 \text{ N/mm}^2$
Machine speed	$n = 600 \text{ min}^{-1}$
Forming factor	$C = 1$

Driving power:

$$N = 0,174 * 10^{-6} * 1 * 700 * 2,5 * 20 * 600$$

$$N = 3,65 \text{ kW}$$

Torque:

$$M = \frac{9740 * 3,65}{600} [\text{Nm}]$$

$$M = 59,25 \text{ Nm}$$

5.5 Rolling time



NOTE

Rolling time for threading and cold-forming of rotationally symmetrical workpieces for manufacturing other profiles

$$t_R \approx \frac{60 * L}{n * P} [sec]$$

t_R : rolling time [sec]

L : roll length [mm]

n : machine speed [min^{-1}]

P : thread lead [mm]



NOTE

Rolling time for burnishing and knurling

Determine the rolling speed using the rolling head constant k :

- Determine the rolling head constant k
- Determine the rolling time

$$t_R \approx \frac{60 * L}{n * d_V * k} [sec]$$

t_R : rolling time [sec]

L : roll length [mm]

n : machine speed [min^{-1}]

d_V : blank diameter [mm]

k : rolling head constant

Rolling head size	constant k	Rolling head size	constant k
4-1	0,14	7800	0,032
45-1	0,06	8-1	0,073
5-1	0,14	96-1	0,082
56-1	0,05	11600	0,023
6a-1	0,11	12600	0,027
6b-1	0,11		
6700	0,04		
700	0,09		

Table 9: Determining the rollong head constant k

5.6 Fine adjustment of the *rolling system*

Following our instructions, you will probably produce a non-completely formed profile tooth. If the pitch diameter is too large or the external diameter too small, make the following adjustments:

1. Verify that rolling head is closed, i.e. clutch parts 2 and 4 are in complete engagement
2. Ensure that the *rolling system* is protected of falling down or tipping over.
3. Loosen the hex nuts (29)
4. Turn the gear ring (5) within the slotted holes(4) by means of the handle (38) until the outside diameter of the rolls reach the required position or touch a setting sample.
4. If the produced pitch diameter is too small or to large, fine adjustment is needed. In order to fine adjust the rolling head use the labeled scale (see figure 12).



NOTE

The adjusted diameter on the rolling head will differ to the produced diameter on the work piece, due to the force in the forming process, which results in a slight deflection.

Figure 19 shows the scale on the rolling system housing

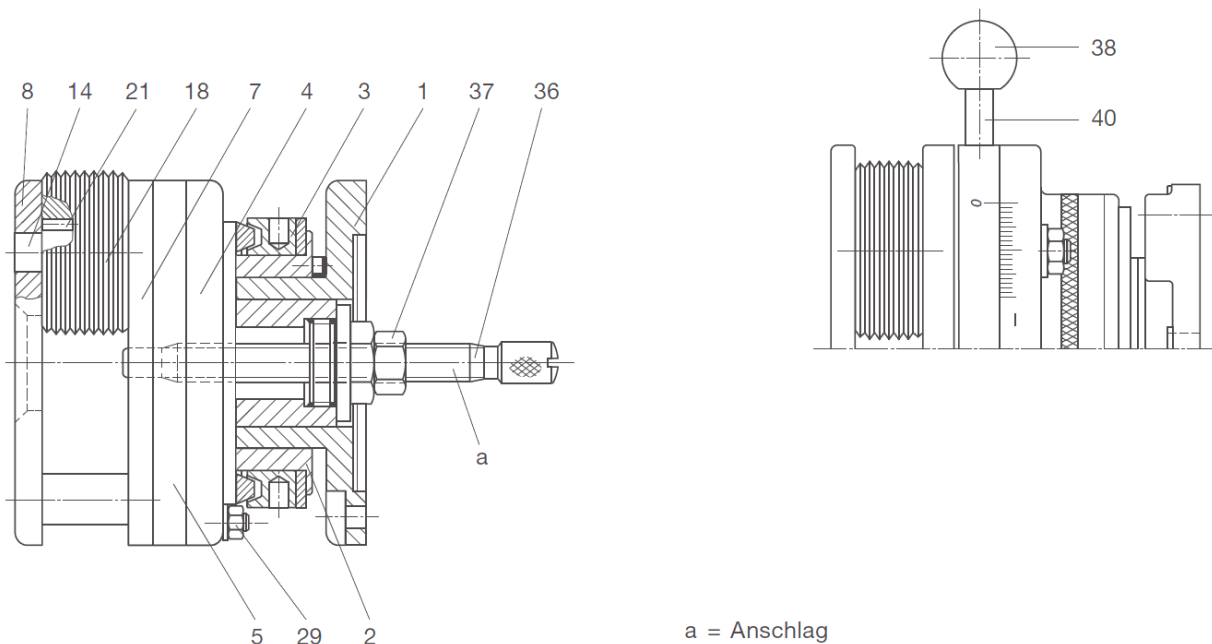


Figure 19: using the labeled scale on the *rolling system* RN for fine adjustment

Following our instructions, you will probably produce a non-completely formed profile tooth. If the pitch diameter is too large or the external diameter too small, make the following adjustments:

1. Decrease the roll adjustment on the scale.
2. 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.

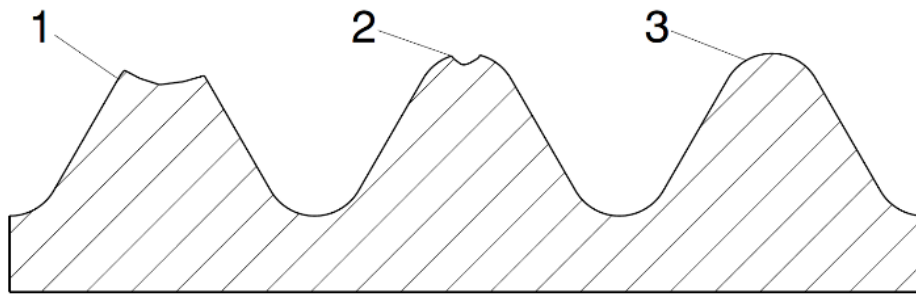


Figure 20: Degree of forming at the profile tooth

Closely inspect the rolled profile. Figure 20 shows the possible degrees of forming of a profile tooth:

- Tooth 1 represents a profile tooth that is **not completely formed**. This degree of forming normally yields a stable profile. In most applications this degree of forming I 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 profile tooth that is **overformed**.



NOTE

Bear in mind, that the degree of forming effects the produced diameter. Check the produced dimension, to ensure that they meet the tolerances.



NOTE

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

The infeed of the rollers presses more material into the tooth tip. This automatically increases the outer diameter of the thread:

- If the flank diameter is correct after closing the rolling head, the thread tooth, however, is excessively shaped, than you have to reduce the original diameter so that less material will flow into the thread top. Under these circumstances, the rolling head possibly can be opened easily.
- If the flank diameter is correct after closing the rolling head, the outer diameter, however, is too small, you have to increase the original diameter. Thus, more material will flow into the tooth top. Possibly, you will have to close the rolling head as well.

5.7 Adjusting the length to be formed of the work piece

The thread length to be rolled is set while the rolling head is open, with a opened clutch. When the clutch is open, the rolling head length increases by the amount of the clutch height. Once the clutch is pulled apart during the rolling process, the thread is being formed. Hence, the opening of the rolling head must be coordinated with the required thread length.

1. Pull the rolling head forward
2. The rolling head opens and rotates .

Zwischen Mitnehmer und der Kupplung ist jetzt nur noch ein ganz kleiner Spalt sichtbar.

a) Opening by using an internal stop

1. Adjust the internal stop (36) according to your thread length.
2. Secure the internal stop by clamping the hex nut (37).

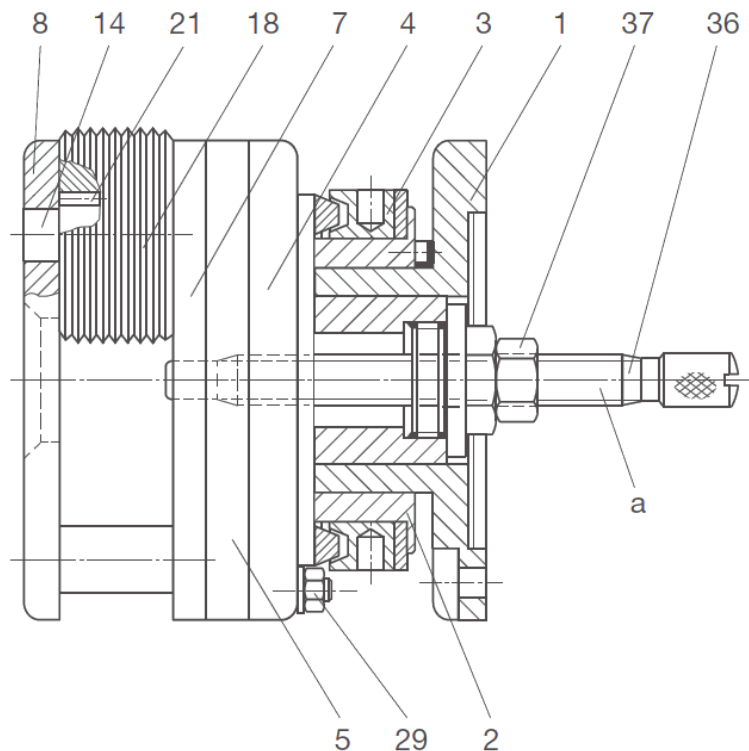


Figure 21: Opening of the rolling head by using an internal stop

You can use an inside stop for fixed or revolving use of the rolling system.



IMPORTANT

Please contact our Service Hotline if you plan to use an internal stop. We gladly assist you by adjusting the thread length to be formed.

b) Opening by stop of the operating feed

1. The stop of the operating feed will pull the clutch apart and open the rolling head.

5.8 Special applications: trapezoidal and acme threads, threads on pipes, knurls, enlarged front plate bore

Capacity of axial rolling heads for trapezoidal and acme threads

Rolling heads of special design – with helix angle corresponding to the trapezoidal or acme thread to be rolled – are generally required for rolling of trapezoidal or acme threads. The letter “T” shown in connection with the designation of the thread type and its helix angle indicates that this is a special design. General overall dimensions and flange dimensions for mounting of these heads are the same as for standard type heads except for the length.

Auswahl der Rollkopfgrößen für Trapez- und Acme-Gewinde Selection of rolling head sizes for trapezoidal and acme threads				
Rollkopf Rolling head	Gewindeabmessungen Thread dimension			
	Nennmaß x Steigung in mm Nominal size x Pitch in mm		Nennmaß – Gangzahl auf 1" Zoll Nominal size – TPI in inches	
	Trapezgewinde Trapezoidal thread DIN 103	Trapezgewinde Trapezoidal thread mit gekürzter Gewindetiefe 	Acme-Gewinde Acme threads ANSI B 1.5 – 1988 (R 1994)	Stub-Acme-Gewinde Stub acme threads ANSI B 1.8 – 1988 (R 1994)
F 1 EVO	Tr 8 x 1,5			
F 1 T – 4° 40'			5/16 – 14	1/4 – 16
F 2 T – 4°	Tr 9 – 10 x 2	FN-Tr 9 – 11 x 2	5/16 – 14	5/16 – 14
			3/8 – 12	5/16 – 14
			7/16 – 12	3/8 ... 7/16 – 12
			1/2 – 10	1/2 – 10
F 2 T – 5° 30'	Tr 12 x 3	FN-Tr 10 – 12 x 3		
F 3 T – 4°	Tr 14 x 3	FN-Tr 14 x 3	1/2 – 10	1/2 – 10
or FU 3 – 1 T – 4°			5/8 – 8	5/8 – 8
F 3 T – 5° 30' or	Tr 16 x 4	FN-Tr 14 – 16 x 4		
FU 3 – 1 T – 5° 30'				
FU 4 – 1 T – 4° 30'	Tr 18 x 4	FN-Tr 18 – 20 x 4	5/8 – 8	5/8 – 8
	Tr 20 x 4	FN-Tr 22 – 24 x 5	3/4 – 6	3/4 – 6
	Tr 22 x 5		7/8 – 6	7/8 – 6
	Tr 24 x 5			
FU 5 – 1 T – 4°	Tr 20 x 4	FN-Tr 20 – 22 x 4	7/8 – 6	7/8 – 6
	Tr 22 x 5	FN-Tr 22 – 24 x 5	1 – 5	1 ... 1 1/8 – 5
	Tr 24 x 5	FN-Tr 24 – 26 x 5	1 1/8 – 5	1 1/8 ... 1 1/4 – 5
	Tr 26 x 5	FN-Tr 26 – 28 x 5	1 1/4 – 5	1 3/8 – 4
	Tr 28 x 5	FN-Tr 30 – 32 x 6	1 3/8 – 4	
	Tr 30 x 6			
	Tr 32 x 6			
FU 6a – 1 T – 3° 30'	Tr 32 x 6	FN-Tr 32 – 34 x 6	1 1/4 – 5	1 1/4 – 5
	Tr 34 x 6	FN-Tr 34 – 36 x 6	1 3/8 – 4	1 3/8 ... 1 1/2 – 4
	Tr 36 x 6	FN-Tr 36 – 38 x 6	1 1/2 – 4	
	Tr 38 x 7	FN-Tr 38 – 40 x 7		
FU 6b – 1 T – 3° 20'	Tr 40 x 7	FN-Tr 40 – 42 x 6		
	Tr 42 x 7	FN-Tr 40 – 44 x 7		
	Tr 44 x 7			
FU 6 – 1 T – 3°			1 1/2 – 4	1 1/2 – 4
			1 3/4 – 4	1 3/4 – 4
			2 – 4	2 – 4
			1 1/4 – 3	1 1/4 – 3
FU 6 – 1 T – 3° 20'	Tr 40 x 7	FN-Tr 40 – 44 x 7		
	Tr 42 x 7	FN-Tr 44 – 48 x 8		
	Tr 44 x 7	FN-Tr 48 – 52 x 8		
	Tr 46 x 8	FN-Tr 52 – 56 x 8		
	Tr 48 x 8	FN-Tr 56 – 60 x 8		
	Tr 50 x 8			
	Tr 52 x 8			

Table 10: Select the rolling head size and type depending on the trapezoidal and acme thread

Note:

- Thread rolls for trapezoidal type threads up to 5 mm pitch (5 TPI) have a 2 pitch lead (2 K). Trapezoidal threads starting at 6 mm (4 TPI) up to and including 8 mm pitch (3 TPI) have a roll lead of 4 pitches (4 K). Thread run-out: approx. 3 pitch for roll lead 2 K; approx. 5 pitch for roll lead 4 K.
- Rolls with 2 K lead are reversible and they can be used for r.h. threads as well as for l.h. threads. Rolls with 4 K lead are not reversible, but also can be used for r.h. threads as well as for l.h. threads.
- The width of trapezoidal type thread rolling heads is different in comparison to standard type heads. For head type F2T and K2T width of rolls increased by 5 mm (0.197"). For head type F3T up to FU6-T width of rolls increased by 10 mm (0.394").

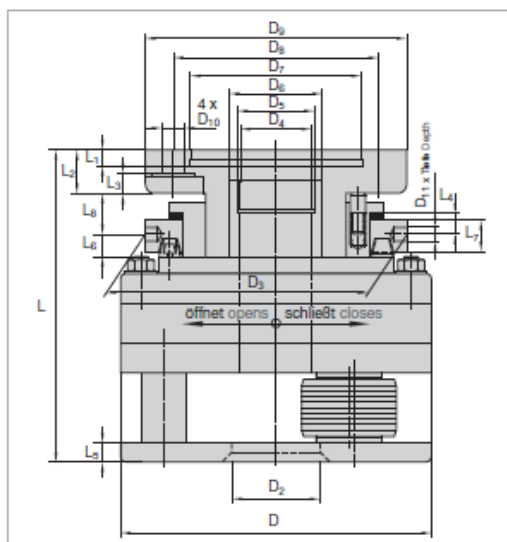
Pipe threads

Rolling heads with 5 and 6 rolls have been designed especially for rolling of threads on thin-walled tubing. By distributing the rolling pressure over 5 and 6 rolls, danger of tube deformation (out of roundness) is considerably decreased.



Figure 22: F "P" with 5 or 6 rolls for pipe threads

Depending on the wall thickness of the tubing to be rolled, thread rolling can be done with or without a supporting mandrel.



Rollkopf Rolling head	Ident No.
FUP 3	2169180
FUP 4	2245977
FUP 5	–
FUP 7	2247935
FUP 8	–
FUP 9	2167370
FUPT 10	2168500
FUP 11	2167182
FUP 1100	2168331
FUPT 12	–
FUPT 13	2246296
FUPT 14	2249755
FUPT 15	2245267
FUPT 17	–
FUPT 18	9177492
FUPT 19	2248630
FUPT 20	–

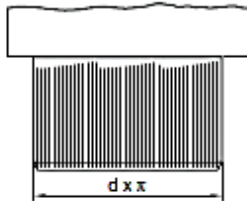
Rollkopf Rolling head	Anzahl Rollen Number of rolls	Rollkopf ∅ Rolling head ∅	Arbeitsbereiche Capacity mm inch	Arbeitsbereiche Capacity pipe thread DIN ISO 228
FUP 3	5	1° 20'	Ø 23 – 27 Ø 0.906 – 1.063	G 5/8 – G 3/4
FUP 4	5	1° 20'	Ø 27 – 30 Ø 1.063 – 1.181	G 7/8
FUP 5	5	1° 20'	Ø 30 – 33 Ø 1.181 – 1.299	G 7/8 – G 1
FUP 7	5	1° 20'	Ø 32,5 – 35,5 Ø 1.280 – 1.398	G 1
FUP 8	5	1° 10'	Ø 36 – 40 Ø 1.417 – 1.575	G 1 1/8
FUP 9	5	1° 10'	Ø 39,5 – 48 Ø 1.555 – 1.890	G 1 1/4 – G 1 1/2
FUPT 10	5	1°	Ø 48 – 52 Ø 1.890 – 2.047	G 1 1/2 – G 1 5/8
FUP 11	6	0° 40'	Ø 48 – 52 Ø 1.890 – 2.047	–
FUP 1100	6	0° 40'	Ø 48 – 56 Ø 1.890 – 2.205	–
FUPT 12	5	1°	Ø 54 – 59 Ø 2.126 – 2.323	G 1 5/8 – G 1 3/4
FUPT 13	5	0° 40'	Ø 60 – 70 Ø 2.362 – 2.756	G 2 – G 2 1/4
FUPT 14	5	0° 40'	Ø 65 – 76 Ø 2.559 – 2.992	G 2 1/4 – G 2 1/2
FUPT 15	5	0° 30'	Ø 70 – 86 Ø 2.756 – 3.386	G 2 1/2 – G 2 3/4
FUPT 17	5	0° 30'	Ø 80 – 110 Ø 3.150 – 4.331	G 2 3/4 – G 3 1/4
FUPT 18	5	0° 20'	Ø 95 – 140 Ø 3.740 – 5.512	G 3 1/2 – G 5
FUPT 19	5	0° 20'	Ø 120 – 180 Ø 4.724 – 7.087	G 5 – G 6
FUPT 20	5	0° 30'	Ø 165 – 230 Ø 6.496 – 9.055	–

Table 11: Selection of special rolling heads FUP und FUPT – working ranges

Knurling according to DIN 82

Knurls can be manufactured using a F RN *rolling systems*.

**Abwicklung eines
Rändelauslaufes:**
Rändelauslauf ca.
3,5 x Zahnhöhe (h)
Knurl runout approx.
3.5 x tooth height (h)



**Achsparallele
Rändelung Form RAA**
Straight knurl
Design RAA



**Rechtsgängige
Rändelung Form RBR**
R. H. Helical knurl
Design RBR



**Linksgängige
Rändelung Form RBL**
L. H. Helical knurl
Design RBL



**Links-Rechts-Rändel
Form RGE**
Diamond knurl
Design RGE



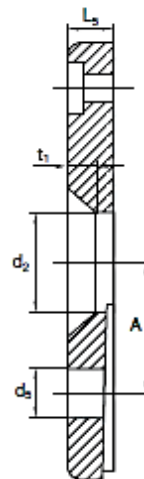
Figure 23: Knurling according to DIN 82

The rolled knurls run-out on the component has a zigzag shape (see figure 23). This is caused by how the rolls are assembled – which is not of importance for the knurls. If this condition is not desired, a recess could be machined or the mating part could be chamfered accordingly.

When rolling up to a shoulder it may be necessary to enlarge the hole in the front plate, see figure 24.

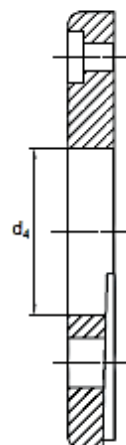
-
- Technical drawing of a shaft-hub assembly. The drawing shows a shaft with a diameter of d_2 passing through a hub with a bore diameter of d_3 . The hub has a total width of W and a flange with a thickness of a . The shaft has a diameter of d_4 in the flange section.

2
Frontplattenbohrung
Normalausführung
Bore of front plate
standard design



-

- 4 Frontplattenbohrung
Sonderausführung 2
Bore of front plate
special design 2**



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6. Disassembly after operation

IMPORTANT



Please contact our Service Hotline in the event of dismantling:

- removing the *rolling system* from the processing machine.
- Dismounting the rolling head
- dismantling the thread rolls.

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

CAUTION



Risk of injuries the hands!

During decommissioning, dismantling 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



General risk of injury from sharp edges.

The *rolling system* is made of various materials (e.g. nickel), which can trigger an allergic reaction.

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.

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.

1. Check if you need and have suitable hoisting devices
 - We recommend the use of hoisting devices for the transportation of F RN *rolling systems*
 - Place the hoisting device on a suitable area. You will find a bore hole for a ring bolt on the outer surface of the *rolling system*.



NOTE

Suitable hoisting devices are for example:

- A sling
- Hoisting Chain
- Lift cable

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

2. Make sure that the rolling system or components do not fall down.
3. Unclamp the *rollig system* in the processing machine.
4. Remove *the rolling system*.

6.2 Removing the rolls

1. Place the *rolling system* in such a way that front plate shows upwards.
2. Ensure that the *rolling system* is protected of falling down or tipping over.
3. Remove the screws and remove the front plate (see figure 25).

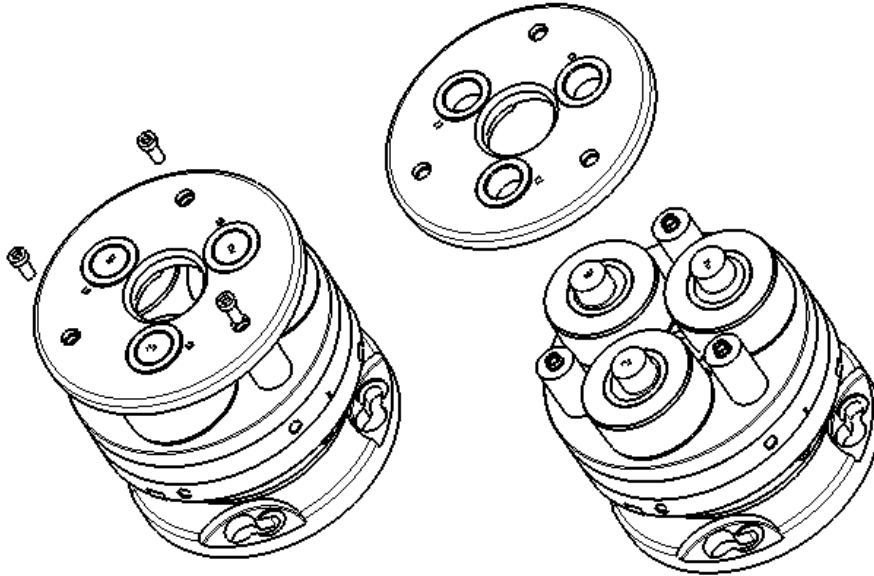


Figure 25: Removing the rolls 1/2

4. In some cases you have to remove a bearing set as well.
5. Remove the rolls (see figure 26).

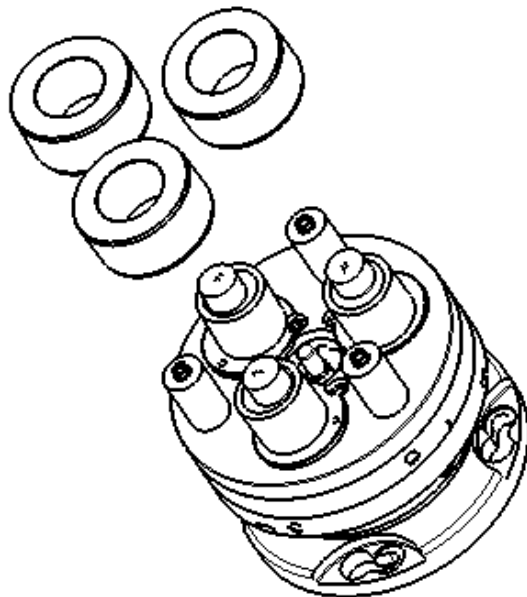


Figure 26: Removing the rolls 2/2

6. If present put the bearing set on the eccentric bolts.
7. Put the front plate back on position and screw in the screws.



NOTE

Only use rolls with the same code number (check also thread dimension, rolling head type, thread width). In order to ensure a good friction coefficient between roll (8) and eccentric bolt and carbide bushing, be sure to lubricate sufficiently the roll bore and the carbide bushing using molybdenum sulfide grease. (e.g. Molykote).

If you replace/change the rolls make sure to check the produced thread. Maybe some adjustments need to be done.

7. Wear parts, parts list

Wear parts



NOTE

Wear parts are

- Clutch (Pos. 2)
- Clutch wedge (Pos. 47),
- Center plate (Pos. 7)
- Front plate (Pos. 9)
- Eccentric spindles (Pos. 14)
- Front and center plate bushing (Pos. 8 und 10)
- Carbide bushing
- rolls (Pos. 18)

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

Parts list



NOTE

When ordering spare parts be sure to state the ID number.

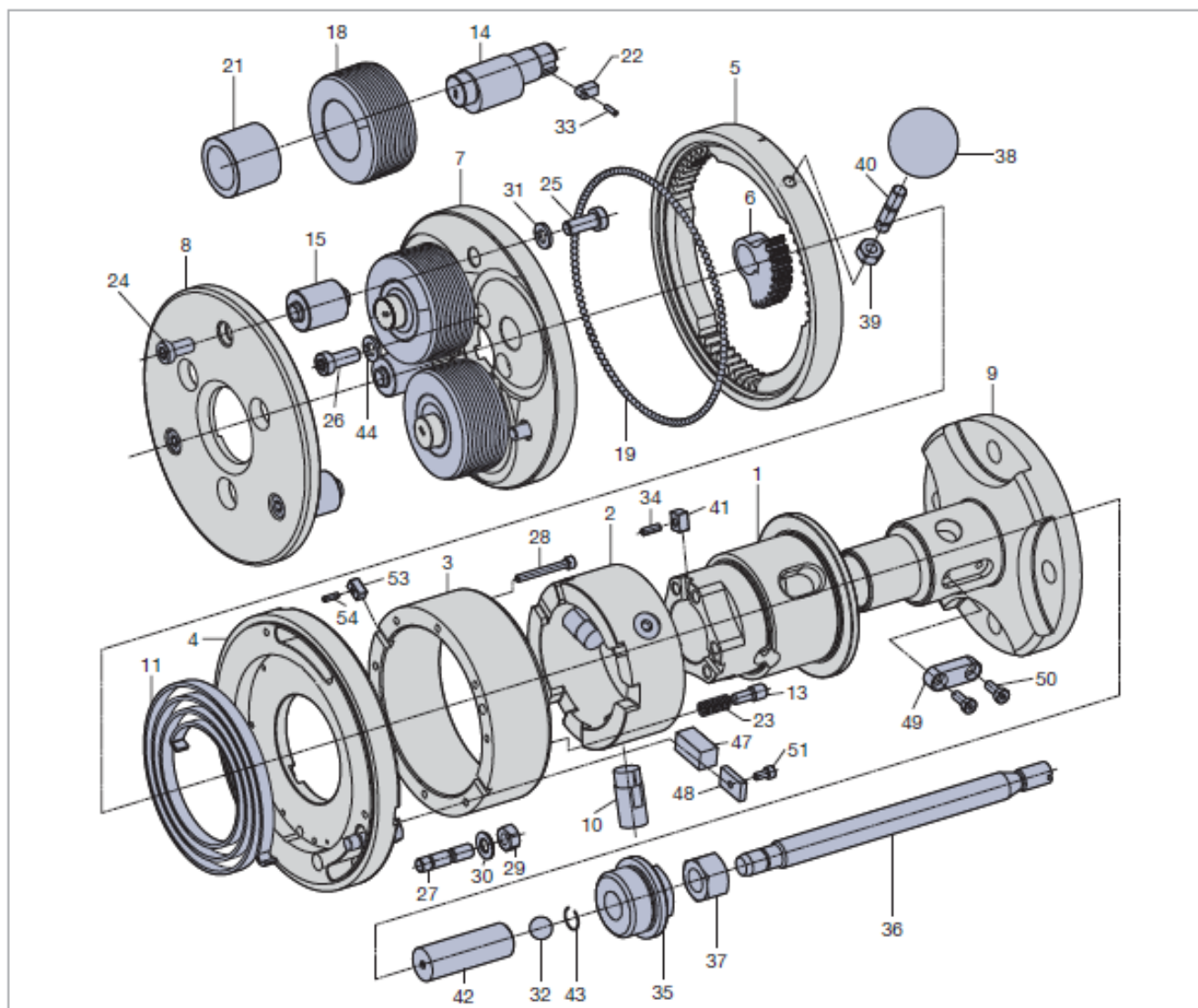


Figure 27: Exploded View F4-1RN

Ersatzteile für Axial-Rollkopf F3-1RN X129 **Spare parts for axial type rolling head F3-1RN X129**

Rollkopf Rolling head			F3-1RN X129 Ident No.	Rollkopf Rolling head			F3-1RN X129 Ident No.
Teil Nr. Part No.	Stück Qty.	Benennung Part description		Teil Nr. Part No.	Stück Qty.	Benennung Part description	
1	1	Mitnehmer Flange	2165558	23	4	Druckfeder Pressure spring	2165095
2	1	Kupplung Clutch	2165559	24	3	Zylinderschraube Cap screw	2143007
3	1	Schutzring Operating ring	2165560	25	3	Zylinderschraube Cap screw	2143011
4	1	Federgehäuse Spring housing	2165081	26	6	Zylinderschraube Cap screw	2148740
5	1	Zahnkranz Gear ring	2165082	27	6	Stiftschraube Stud	2148825
6	3	Zahnbogen Gear sectors	2165083	28	3	Zylinderschraube Cap screw	2148739
7	1	Zwischenplatte Centre plate	2165084	29	6	Sechskantmutter Hexagon nut	2148398
8	1	Frontplatte Front plate	2165085	30	6	Scheibe Washer	2141465
9	1	Schaft mit Flansch X106 Shank with flange X10	2249293	31	3	Federring Lock washer	2141716
10	3	Bolzen Pin	2165087	32	1	Stahlkugel Steel ball	2148795
11	1	Spiralfeder Coil spring	2165088	33	3	Zylinderstift Pin	2148376
13	4	Federbolzen Spring pin	2165090	34	3	Spannhülse Roll pin	2142566
14	3	Exzenterbolzen Eccentric spindles	2165091	35	1	Schraubstutzen Stop screw body	2165009
15	3	Distanzbolzen Spacer studs	2165092	36	1	Anschlagschraube Stop screw	2165565
19	87	Stahlkugel Steel ball	2148807	37	1	Sechskantmutter Hexagon nut	2148391
21	3	Hartmetall-Laufbuchse Carbide bushing	2165072	38	1	Kugelknopf Ball	2141701
22	3	Passfeder Fitting key	2165094	39	1	Sechskantmutter Hexagon nut	2148398

Rollkopf Rolling head			F3-1RN X129 Ident No.	Rollkopf Rolling head			F3-1RN X129 Ident No.
Teil Nr. Part No.	Stück Qty.	Benennung Part description		Teil Nr. Part No.	Stück Qty.	Benennung Part description	
40	1	Stiftschraube Stud	2148839	48	8	Zylinderschraube Cap screw	2141888
41	3	Passfeder Fitting key	2165096	49	1	Passfeder Fitting key	2167804
42	1	Drehbarer Anschlag Rotating end stop	2167300	50	2	Zylinderschraube Cap screw	2142996
43	1	Sprengring Circlip	2165008	53	2	Passfeder Fitting key	2165097
44	6	Sicherungsscheibe Lock washer	2149274	54	2	Spannhülse Roll pin	2142566
47	3	Kupplungskeil Clutch wedge	2165098				

Ersatzteile für Axial-Rollkopf F34-1RN X135
Spare parts for axial type rolling head F34-1RN X135

Rollkopf Rolling head			F34-1RN X135	Rollkopf Rolling head			F34-1RN X135
Teil Nr. Part No.	Stück Qty.	Benennung Part description		Teil Nr. Part No.	Stück Qty.	Benennung Part description	
1	1	Mitnehmer Flange	2165558	31	3	Federring Spring washer	2141716
2	1	Kupplung Clutch	2165559	32	1	Stahlkugel Steel ball	2148795
3	1	Schutzring Operating ring	2165560	33	3	Zylinderstift Pin	2148376
4	1	Federgehäuse Spring housing	2165081	34	3	Spannhülse Roll pin	2142566
5	1	Zahnkranz Gear ring	2165082	35	1	Schraubstutzen Stop screw body	2165009
6	3	Zahnbogen Gear sectors	2165543	36	1	Anschlagschraube Stop screw	2165565
7	1	Zwischenplatte Centre plate	2165544	37	1	Sechskantmutter Hexagon nut	2148391
8	1	Frontplatte Front plate	2165545	38	1	Kugelknopf Ball	2141701
9	1	Schaft mit Flansch X106 Shank with flange X10	2249293	39	1	Sechskantmutter Hexagon nut	2148398
10	3	Bolzen Pin	2166919	40	1	Stiftschraube Stud	2148839
11	1	Spiralfeder Coil spring	2165088	41	3	Passfeder Fitting key	2165096
13	4	Federbolzen Spring pin	2165090	42	1	Drehbarer Anschlag Rotating end stop	2167300
14	3	Exzenterbolzen Eccentric spindles	2165548	43	1	Sprengring Circlip	2165008
15	3	Distanzbolzen Spacer studs	2165549	44	6	Sicherungsscheibe Lock washer	2149274
19	87	Stahlkugel Steel ball	2148807	45	6	Axial-Nadelkäfi Axial bearing cage	2149267
21	3	Hartmetall- Laufbuchse Carbide bushing	2164887	46	3	Axial-Scheibe Axial washer	2148881
22	3	Passfeder Fitting key	2165550	47	3	Kupplungskeil Clutch wedge	2165098
23	4	Druckfeder Pressure spring	2165095	48	8	Zylinderschraube Cap screw	2141888
24	3	Zylinderschraube Cap screw	2143007	49	1	Passfeder Fitting key	2167804
25	3	Zylinderschraube Cap screw	2143011	50	2	Zylinderschraube Cap screw	2142996
26	6	Zylinderschraube Cap screw	2148740	51	3	Zentrierscheibe Centering ring	2165551
27	6	Stiftschraube Stud	2148825	52	3	Zentrierscheibe Centering ring	2165552
28	3	Zylinderschraube Cap screw	2148739	53	2	Passfeder Fitting key	2165096
29	6	Sechskantmutter Hexagon nut	2148398	54	2	Spannhülse Roll pin	2142566
30	6	Scheibe Washer	2141465				

Ersatzteile für Axial-Rollkopf F4-1RN X170
Spare parts for axial type rolling head F4-1RN X170

Rollkopf Rolling head			F4-1RN X170 Ident No.	Rollkopf Rolling head			F4-1RN X170 Ident No.
Teil Nr. Part No.	Stück Qty.	Benennung Part description		Teil Nr. Part No.	Stück Qty.	Benennung Part description	
1	1	Mitnehmer Flange	2165631	23	4	Druckfeder Pressure spring	2165095
2	1	Kupplung Clutch	2165632	24	3	Zylinderschraube Cap screw	2143016
3	1	Schutzring Operating ring	2165633	25	3	Zylinderschraube Cap screw	2143017
4	1	Federgehäuse Spring housing	2165584	26	6	Zylinderschraube Cap screw	2148743
5	1	Zahnkranz Gear ring	2165585	27	6	Stiftschraube Stud	2148839
6	3	Zahnbogen Gear sectors	2165586	28	8	Zylinderschraube Cap screw	2141888
7	1	Zwischenplatte Centre plate	2165587	29	6	Sechskantmutter Hexagon nut	2148398
8	1	Frontplatte Front plate	2165588	30	6	Scheibe Washer	2141465
9	1	Schaft mit Flansch X138 Shank with flange X13	2240585	31	3	Federring Lock washer	2141717
10	3	Bolzen Pin	2165590	32	1	Stahlkugel Steel ball	2148795
11	1	Spiralfeder Coil spring	2165591	33	3	Zylinderstift Pin	2141237
13	4	Federbolzen Spring pin	2165090	34	3	Spannhülse Roll pin	2142576
14	3	Exzenterbolzen Eccentric spindles	2165593	35	1	Schraubstutzen Stop screw body	2165596
15	3	Distanzbolzen Spacer studs	2165594	36	1	Anschlagschraube Stop screw	2165565
19	116	Stahlkugel Steel ball	2148807	37	1	Sechskantmutter Hexagon nut	2148391
21	3	Hartmetall-Laufbuchse Carbide bushing	2167324	38	1	Kugelknopf Ball	2141701
22	3	Passfeder Fitting key	2165595				

Rollkopf Rolling head			F4-1RN X170 Ident No.	Rollkopf Rolling head			F4-1RN X170 Ident No.
Teil Nr. Part No.	Stück Qty.	Benennung Part description		Teil Nr. Part No.	Stück Qty.	Benennung Part description	
39	1	Gewindestift Setscrew	2142086	48	3	Abdeckscheibe Cover plate	2165597
40	1	Schelle Clip	2167024	49	1	Passfeder Fitting key	2165641
41	3	Passfeder Fitting key	2173673	50	2	Zylinderschraube Cap screw	2167742
42	1	Drehbarer Anschlag Rotating end stop	2167300	51	3	Zylinderschraube Cap screw	2141882
43	1	Sprengring Circlip	2165008	53	2	Passfeder Fitting key	2165097
44	6	Sicherungsscheibe Lock washer	2149015	54	2	Spannhülse Roll pin	2142566
47	3	Kupplungskeil Clutch wedge	2165598				

Ersatzteile für Axial-Rollkopf F45-1RN X154
Spare parts for axial type rolling head F45-1RN X154

Rollkopf Rolling head			F45-1RN X154	Rollkopf Rolling head			F45-1RN X154
Teil Nr. Part No.	Stück Qty.	Benennung Part description	Ident No.	Teil Nr. Part No.	Stück Qty.	Benennung Part description	Ident No.
1	1	Mitnehmer Flange	2165631	29	6	Sechskantmutter Hexagon nut	2148398
2	1	Kupplung Clutch	2165632	30	6	Scheibe Washer	2141465
3	1	Schutzring Operating ring	2165633	31	3	Federring Spring washer	2141717
4	1	Federgehäuse Spring housing	2165584	32	1	Stahlkugel Steel ball	2148795
5	1	Zahnkranz Gear ring	2165585	33	3	Zylinderstift Pin	2148376
6	3	Zahnbogen Gear sectors	2165653	34	3	Spannhülse Roll pin	2142576
7	1	Zwischenplatte Centre plate	2165654	35	1	Schraubstutzen Stop screw body	2165596
8	1	Frontplatte Front plate	2165655	36	1	Anschlagschraube Stop screw	2165565
9	1	Schaft mit Flansch X138 Shank with flange X13	2240585	37	1	Sechskantmutter Hexagon nut	2148391
10	3	Bolzen Pin	2165590	38	1	Kugelknopf Ball	2141701
11	1	Spiralfeder Coil spring	2165591	39	1	Sechskantmutter Hexagon nut	2148398
13	4	Federbolzen Spring pin	2165090	40	1	Stiftschraube Stud	2148839
14	3	Exzenterbolzen Eccentric spindles	2165658	41	3	Passfeder Fitting key	2173673
15	3	Distanzbolzen Spacer studs	2165659	42	1	Drehbarer Anschlag Rotating end stop	2167300
17	6	Axial-Scheibe Axial washer	2148881	43	1	Sprengring Circlip	2165008
19	116	Stahlkugel Steel ball	2148807	44	6	Sicherungsscheibe Lock washer	2149015
21	3	Hartmetall-Laufbuchse Carbide bushing	2165072	46	6	Axialnadelager Thrust bearing	2147534
22	3	Passfeder Fitting key	2165094	47	3	Kupplungskeil Clutch wedge	2165598
23	4	Druckfeder Pressure spring	2165095	48	3	Abdeckscheibe Cover plate	2165597
24	3	Zylinderschraube Cap screw	2143016	49	1	Passfeder Fitting key	2165641
25	3	Zylinderschraube Cap screw	2143017	50	2	Zylinderschraube Cap screw	2167742
26	6	Zylinderschraube Cap screw	2148743	51	3	Zylinderschraube Cap screw	2141882
27	6	Stiftschraube Stud	2148839	53	2	Passfeder Fitting key	2165097
28	8	Zylinderschraube Cap screw	2142014	54	2	Spannhülse Roll pin	2142566

Ersatzteile für Axial-Rollkopf F5-1RN X139
Spare parts for axial type rolling head F5-1RN X139

Rollkopf Rolling head			F5-1RN X139 Ident No.	Rollkopf Rolling head			F5-1RN X139 Ident No.
Teil Nr. Part No.	Stück Qty.	Benennung Part description		Teil Nr. Part No.	Stück Qty.	Benennung Part description	
1	1	Mitnehmer Flange	2165705	15	3	Distanzbolzen Spacer studs	2165681
2	1	Kupplung Clutch	2165706	16	2	Passfeder Fitting key	2165096
3	1	Schutzring Operating ring	2165707	17	2	Spannhülse Roll pin	2142566
4	1	Federgehäuse Spring housing	2165668	19	145	Stahlkugel Steel ball	2148807
5	1	Zahnkranz Gear ring	2165669	21	3	Hartmetall-Laufbuchse Carbide bushing	2173803
6	3	Zahnbogen Gear sectors	2165670	22	3	Passfeder Fitting key	2165683
7	1	Zwischenplatte Centre plate	2165671	23	3	Druckfeder Pressure spring	2165713
7-1	3	Buchse für Zwischenplatte Centre plate bushing	2165673	24	3	Zylinderschraube Cap screw	2143017
8	1	Frontplatte Front plate	2165672	25	3	Zylinderschraube Cap screw	2143029
8-1	3	Buchse für Frontplatte Front plate bushing	2165674	26	6	Zylinderschraube Cap screw	2128712
9	1	Flansch Flange	2167599	27	6	Stiftschraube Stud	2148827
10	3	Bolzen Pin	2165676	28	8	Zylinderschraube Cap screw	2141889
11	1	Spiralfeder Coil spring	2165677	29	6	Sechskantmutter Hexagon nut	2148399
13	3	Federbolzen Spring pin	2165679	30	6	Scheibe Washer	2141466
14	3	Exzenterbolzen Eccentric spindles	2165680	31	3	Federring Spring washer	2141718

Rollkopf Rolling head			F5-1RN X139 Ident No.	Rollkopf Rolling head			F5-1RN X139 Ident No.
Teil Nr. Part No.	Stück Qty.	Benennung Part description		Teil Nr. Part No.	Stück Qty.	Benennung Part description	
32	1	Stahlkugel Steel ball	2148795	44	6	Sicherungsscheibe Lock washer	2149015
33	3	Zylinderstift Pin	2141244	45	3	Spannhülse Roll pin	2148850
34	3	Spannhülse Roll pin	2142576	46	3	Spannhülse Roll pin	2148850
35	1	Schraubstutzen Stop screw body	2165685	47	2	Spannhülse Roll pin	2142588
36	1	Anschlagschraube Stop screw	2165714	48	3	Abdeckscheibe Cover plate	2165687
37	1	Sechskantmutter Hexagon nut	2148391	49	1	Passfeder Fitting key	2165641
38	1	Kugelknopf Ball	2141702	50	2	Zylinderschraube Cap screw	2142999
39	3	Kupplungskeil Clutch wedge	2165688	53	1	Schraubenring Screw ring	2141751
40	1	Stiftschraube Stud	2148828	54	3	Zylinderschraube Cap screw	2143009
41	3	Passfeder Fitting key	2173673	55	1	Sechskantmutter Hexagon nut	2148399
42	1	Drehbarer Anschlag Rotating end stop	2167300	56	2	Passfeder Fitting key	2165096
43	1	Sprengring Circlip	2165008	57	2	Spannhülse Roll pin	2142566

Ersatzteile für Axial-Rollkopf F56-1RN X140
Spare parts for axial type rolling head F56-1RN X140

Rollkopf Rolling head			F56-1RN X140	Rollkopf Rolling head			F56-1RN X140
Teil Nr. Part No.	Stück Qty.	Benennung Part description	Ident No.	Teil Nr. Part No.	Stück Qty.	Benennung Part description	Ident No.
1	1	Mitnehmer Flange	2165705	29	6	Sechskantmutter Hexagon nut	2148399
2	1	Kupplung Clutch	2165706	30	6	Scheibe Washer	2141466
3	1	Schutzring Operating ring	2165707	31	3	Federring Spring washer	2141718
4	1	Federgehäuse Spring housing	2165668	32	1	Stahlkugel Steel ball	2148795
5	1	Zahnkranz Gear ring	2165669	33	3	Zylinderstift Pin	2141237
6	3	Zahnbogen Gear sectors	2165729	34	3	Spannhülse Roll pin	2142576
7	1	Zwischenplatte Centre plate	2165730	35	1	Schraubstutzen Stop screw body	2165685
7-1	3	Buchse für Zwischenplatte Centre plate bushing	2165731	36	1	Anschlagschraube Stop screw	2165714
8	1	Frontplatte Front plate	2165732	37	1	Sechskantmutter Hexagon nut	2148391
8-1	3	Buchse für Frontplatte Front plate bushing	2165733	38	1	Kugelknopf Ball	2141702
9	1	Schaft mit Flansch X118 Shank with flange X11	2167599	39	3	Kupplungskeil Clutch wedge	2165688
10	3	Bolzen Pin	2165676	40	1	Stiftschraube Stud	2148828
11	1	Spiralfeder Coil spring	2165677	41	3	Passfeder Fitting key	2173673
13	3	Federbolzen Spring pin	2165679	42	1	Drehbarer Anschlag Rotating end stop	2167300
14	3	Exzenterbolzen Eccentric spindles	2165736	43	1	Sprengring Circlip	2165008
15	3	Distanzbolzen Spacer studs	2165737	44	6	Sicherungsscheibe Lock washer	2149015
17	3	Axial-Scheibe Axial washer	2165738	48	3	Abdeckscheibe Cover plate	2165687
19	145	Stahlkugel Steel ball	2148807	49	1	Passfeder Fitting key	2165641
21	3	Hartmetall-Laufbuchse Carbide bushing	2167324	50	2	Zylinderschraube Cap screw	2142999
22	3	Passfeder Fitting key	2165595	51	6	Zentrierscheibe Centering ring	2165630
23	3	Druckfeder Pressure spring	2165713	52	6	Axialnadellager Thrust bearing	2147347
24	3	Zylinderschraube Cap screw	2143017	54	3	Zylinderschraube Cap screw	2143009
25	3	Zylinderschraube Cap screw	2143029	55	1	Sechskantmutter Hexagon nut	2148399
26	6	Zylinderschraube Cap screw	2128712	56	2	Passfeder Fitting key	2165096
27	6	Stiftschraube Stud	2148827	57	2	Spannhülse Roll pin	2142566
28	8	Zylinderschraube Cap screw	2141889				

8. Maintenance

Maintenance

Daily:

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

Weekly:

1. Follow the instructions in chapter 6.
2. Follow the instructions in chapter 4.

Maintenance when replacing the roll set

1. Follow instructions in chapter 6.
2. Follow instructions in chapter 4.

Maintenance intervals

Be sure to adhere to the maintenance intervals listed in table 11. If the *rolling system* is used under more difficult conditions, the cleaning and maintenance intervals must be shorter.

Interval	Activity	Description
Weekly (preferable daily)	Machine operator	- Check the rolls for wear or other damages. - Clean the rolls from chips.
Weekly	Machine setter	- Lubricate the rolls and the roll axis with molybdenumsulfide (e.g. Molykote).

Table 12: Cleaning and maintenance intervals

9. Storage



NOTE

The storage state is the condition upon delivery.

1. Follow the instruction in Chapter 6.
2. Conserve the *rolling system*.
3. Store the *rolling system*.

Storage temperature: –10 °C maximal +30 °C

Relative humidity: < 60 %

10. Disposal



NOTE

Dispose the rolling system with harmful coatings such as oils and fats properly. Improper disposal of the used materials is harmful to the environment. When you dispose 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 which are soiled with grease or oil must be disposed separately.

11. Troubleshooting



NOTE

Perform a visual and functional inspection prior to each troubleshooting.

Fault	Cause	Solution
1 Conical profile	a) Rolling head holder worn out	a) Replace the rolling head holder with a new holder
	b) Roll axis worn	b) Replace roll axis if wear $\varnothing > 0,03\text{mm}$
	c) Misalignment of head and part ($\geq 0,2\text{mm}$ error)	c) realign rolling system and part
	d) blank diameter tapered	d) manufacture a cylindrical blank diameter
2 Profile out of tolerance	a) Incorrect rolling head setting	a) Renew rolling head set up
	b) Incorrect blank diameter (too big / too small)	b) accurate pre-machining
3 Pitch error	a) Misalignment of head and part ($\geq 0,2\text{mm}$ error)	a) realign rolling system and part
	b) Wrong roll	b) use correct roll
	c) Material not rollable	c) check and follow table 8
	d) Incorrect feed	d) choose feed rate according to chapter 5.2
4 Roll breakage	a) Inappropriate chamfer	a) chamfering according to chapter 5.1
	b) Blank diameter too big	b) accurate pre-machining of blank diameter (chapter 5.1)
	c) Rolling head setting too tight	c) adjust the rolling head (chapter 4.3)
	d) Misalignment	d) realign the machine
	e) Material too hard	e) only roll on materials with max. material strength of 1000N/mm^2 or lower
	f) Too much material transforming	f) choose bigger rolling head
	g) Rolled with overload	g) adjust the rolling head (chapter 4.3)
5 Extended roll wear	a) Material with bad rollability	a) check and follow table 8
	b) Examination of rolling speed	b) check and follow table 8
	c) Elongation properties inadequate	c) choose different material
	d) Not enough coolant	d) start using coolant, readjust coolant nozzles, increase coolant pressure
	e) Inappropriate chamfer	e) chamfering according to chapter 5.1
6 Profile not smooth	a) Workpiece deflection	a) increase workpiece support
	b) Inappropriate chamfer	b) chamfering according to chapter 5.1
	c) Rolling speed too large or too small	c) check and follow table 8
	d) Too much or too little power for pushing on to the workpiece	d) Adjust the pressing/pushing force

Table 13: Troubleshooting



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