

1 Foreword

1.1 General Instructions

This guide will help you to use the RUD System Fork Link Chain (Forky) safely, properly and profitably. By following the instructions in this guide, you will

- Increase the reliability and service life of the RUD System Forky and the plant
- Avoid dangers
- Reduce repairs and down times

This guide must

- **Be available at all times at the place of use**
- **Be read and followed by everyone who works on the RUD System Forky**

The RUD System Forky has been manufactured according to the state-of-the-art and in compliance with the recognized safety rules. However, improper handling or use for other than intended purpose may endanger the life and limb of the user or third parties and/or damage the conveyor system and other tangible assets. Spare parts must fulfill the technical requirements specified by RUD Ketten. This is guaranteed in the case of original spare parts, as they are subjected to continuous quality control by a quality management system certified under ISO 9001. Third party spare parts may, under certain circumstances, change the specified design characteristics of the system, and lead to serious defects which, in such a case, would not be the responsibility of RUD Ketten. Use a suitably equipped workshop for performing maintenance work. Only the manufacturer can guarantee to carry out a professional overhaul or repair. This guide has been drawn up with the greatest possible care. However, if you would like further information, please contact:

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1.2 Intended Use

- The RUD System Forky is a conveyor system for bulk materials.
- It serves as a traction device for horizontal and inclined conveying of bulk materials in conveyors.
- In stationary operation, the permitted power transfer through the components when conveying a specific material at a specific speed and with an appropriate distance between axes is specified in the order placed with RUD Ketten and in the order confirmation by RUD Ketten. Any other use or use going beyond the intended use – for example higher conveying capacities or speeds, conveying other materials, or use under unapproved operating conditions – shall be regarded as use for other than the intended purpose.
- Use for the intended purpose also includes complying with this fitting and operating guide, and complying with the inspection and maintenance specifications.

The manufacturer shall not be liable for damage resulting from use for other than the intended purpose. The user shall bear the risk alone.

2 Safety Instructions

2.1 Explanation of Symbols and Notes

 <p>Warning!</p>	<p>Danger to life and limb, or substantial material damage can occur if the appropriate safety instructions are not followed.</p>
 <p>Attention!</p>	<p>Undesirable consequences or working conditions can arise if the appropriate safety instructions are not followed.</p>

2.2 General

 <p>Warning!</p>	<p>Follow the safety instructions. Otherwise there is danger to life and limb of the user and third parties, and of damage to the machine and other tangible assets.</p>
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- Mounting, dismounting, repairs, overhauls, and wear measurement may only be performed by competent persons who are familiar with the operating manuals and trained people.
- Inform the operating personnel and appoint supervisors before starting maintenance work.
- Secure machines and equipment against unintentional starts.
- Switch off the main control systems, remove keys, and attach danger signs.
- Before mounting/dismounting work, secure the chain strand against movement. When mounting/dismounting chain equipment, a one-sided load can set the chain in motion and cause injuries which may prove to be fatal.
- Protect the working area against falling materials and components.
- When mounting and replacing individual parts or larger modules, attach and secure them carefully to the lifting equipment so that they cannot become a source of danger. Only use suitable and technically sound lifting equipment and load handling devices.
- Do not stand or walk under suspended loads.
- As a rule, all components must be mounted and dismantled in an electrically dead state, unless otherwise stated. Risk of crushing!
- All parts of the plant must have cooled down to the extent that they can be touched without causing burns.

- Appoint only operating personnel with valid qualification certificates to sling loads and instruct crane operators. The banksman has to stay in view of the operator or be in voice contact with him.
- The platforms provided and climbing aids complying with safety regulations must be used for assembly work over head. Do not use machine parts as climbing aids. Wear protection against falling when performing maintenance work at great heights.
- Operating and process materials must be disposed of safely and in a way that does not harm the environment.
- In principle, no welding work is permitted on round steel chains, chain couplings or case-hardened components. The chain must not be used as a ground connection to the steel structure for electric welding.
- Welding, burning and grinding work may only be performed on the plant when this has been expressly authorized. Before starting welding, burning or grinding work, clean the plant and its surroundings of dust and combustible materials, and ensure adequate ventilation. There could, for example, be a risk of fire or explosion.
- Ensure that screw connections are tightened with the defined torque. Always check these connections with a torque wrench.
- Persons are not allowed to ride on the conveyor.
- For safety reasons, you should refrain from any modifications or alterations to the components without the manufacturer's authorization.
- Refrain from any risky operations.
- In addition to the operating instructions, comply with and implement the generally applicable, legal and other binding accident prevention and environmental protection regulations. For example, the handling of hazardous substances and the provision and wearing of personal protective clothing and equipment.

2.3 Care and Maintenance

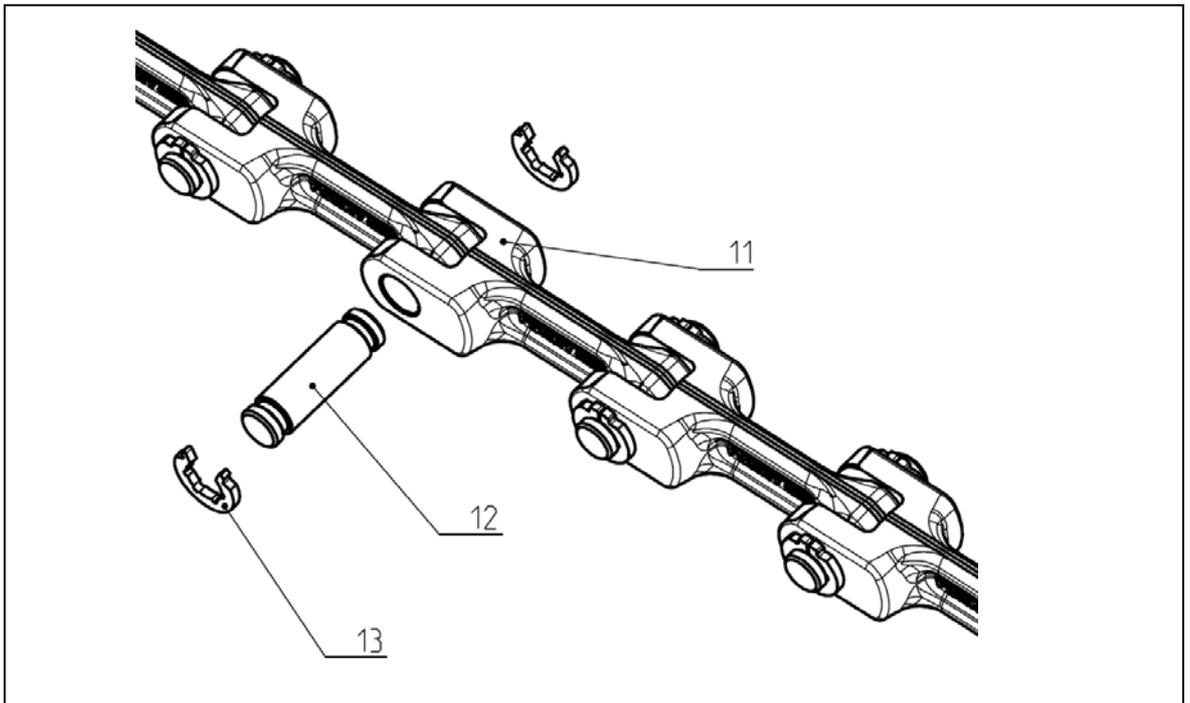
- Wherever necessary, cordon off the maintenance area, allowing a wide safety margin.
- Before starting maintenance work, cordon off the working area of the machine/equipment to prevent the access of unauthorized persons. Attach or put up suitable signs advising the maintenance work.
- Any material adhering to or remaining in the scraper bars can come loose and fall out. Switch off the material feed, and empty the conveyor before opening the inspection flaps. Wear a safety helmet while working.

3 Description

The RUD Forky is a fork link chain. The main components (picture 1) are:

- Fork link RUD Forky (11)
- Pin (12)
- Circlip (13)

RUD Forky will be supplied in components or pre-assembled in easy-to-manage strands.



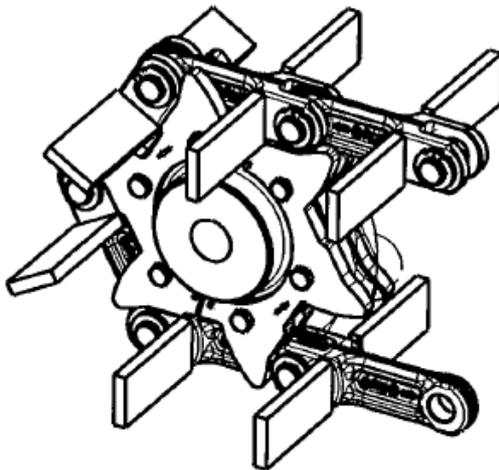
Pict. 1

The RUD system Forky consists of the following components (picture 2):

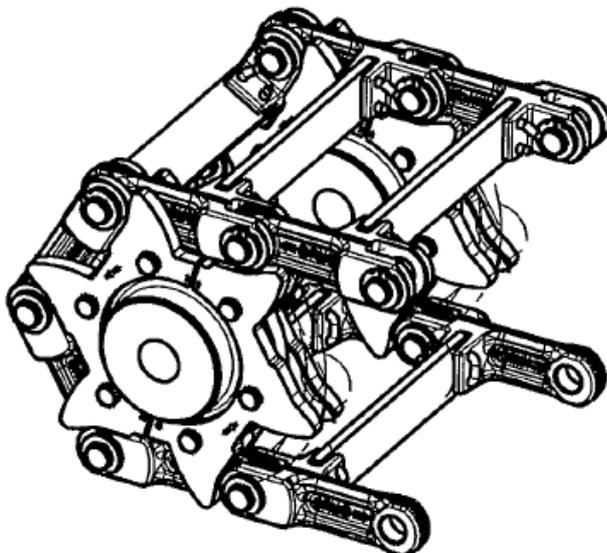
- Drive wheel with exchangeable drive segments (90)
- Forky (11) with welded or mounted scraper
- Reversing wheel (100)

Note: The reversing wheel can also be designed as a toothed wheel like the drive wheel (depending on the application)

○ FORKY EINSTRANG/FORKY SINGLE STRAND



○ FORKY DOPPELSTRANG/FORKY DOUBLE STRAND



Picture 2

4 Assembly

4.1 Mount the wheels on the appropriate shafts

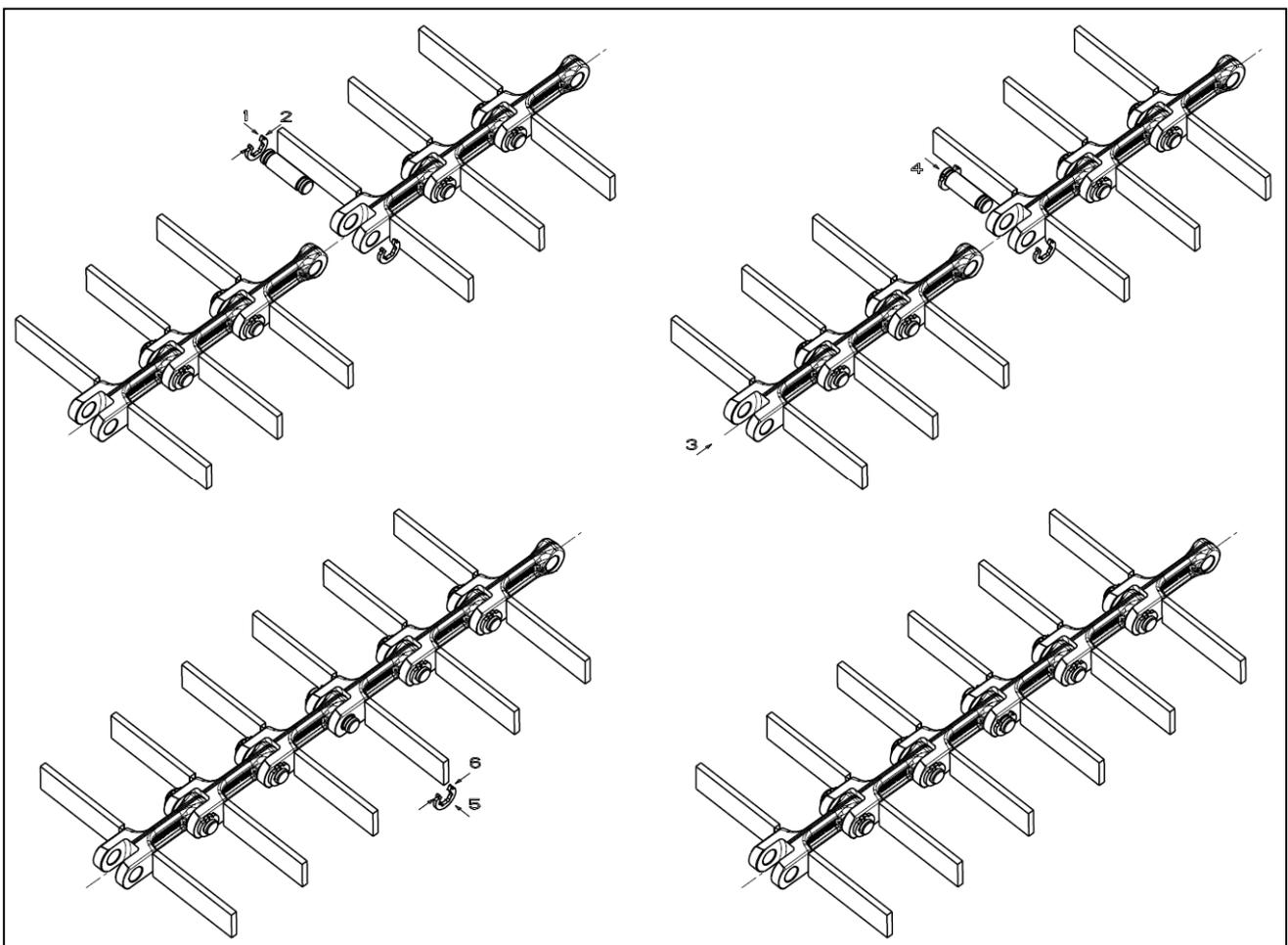
1. Mount the drive wheels and guide wheels so that the centres of the wheels are exactly aligned with one another.
2. Relieve the tensioning station. That will facilitate subsequent assembly.

4.2 Align the shafts

Align the shafts exactly parallel and horizontally. This and correct positioning of the wheel centres are absolutely essential.

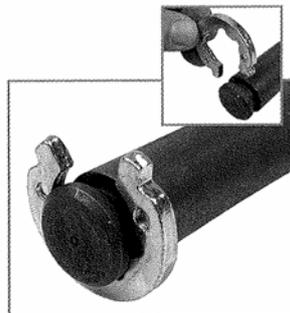
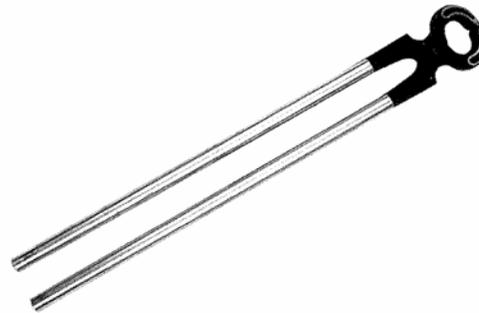
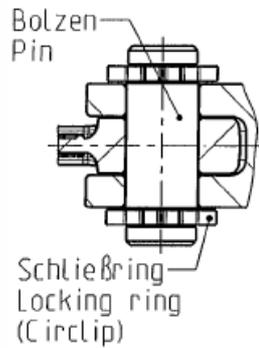
4.3 Mount the single chain strands into an open chain strand.

1. Lay out the chain strands parallel to each other (picture 3)
2. Mount the first circlip on top of the circlip pin (1) and lock (2)
3. Push the chain strands together (3) and connect with circlip pins (4)
4. Mount the second circlip on top of the circlip pin (5) and lock (6)



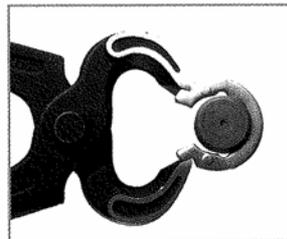
Pict. 3

RUD System Fork Link Chain (Forky)
GENERAL OPERATING INSTRUCTIONS
F21115 / WV1



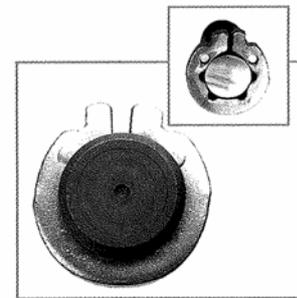
Schritt 1
Schließring in die Bolzennute legen.

Step 1
Place locking ring into the pin groove.



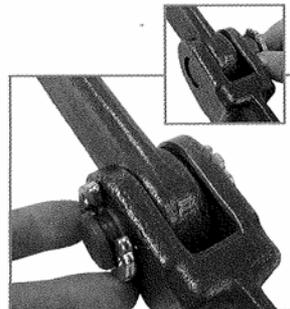
Schritt 2
Zange mit Klauen in die Einkerbungen am Schließring setzen.

Step 2
Place pincers jaws into the notches of the locking ring and crimp it.



Schritt 3
Einwandfrei verpresster Schließring.

Step 3
Perfectly crimped ring.



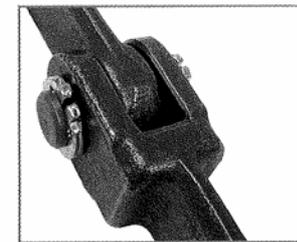
Schritt 4
Laschenaug zwischen Gabelaugen platzieren und Bolzen einfügen.

Step 4
Place single link eye between fork eyes and insert pin.



Schritt 5
Schritt 1-3 wiederholen.

Step 5
Repeat step 1 to 3.



Schritt 6
Fertig montierte Laschen.

Step 6
Assembled links.

Picture 4

4.4 Assembly and disassembly of the circlips (picture 4)

The gap of the mounted circlip may be 1mm wide max. Check the circlip for close fit when assembled.

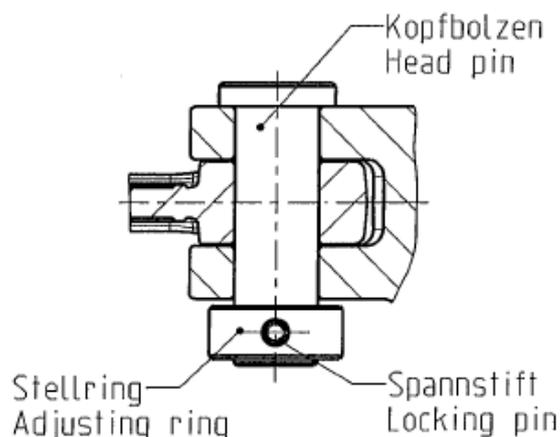
The circlips may only be used once and have to be discarded / scrapped after disassembly. A re-use is not allowed.

The disassembly of the circlip is done by opening the circlip gap with a chisel, until it can be taken out of the bolt groove.

4.5 Assembly and disassembly of bolts in double strand fork link chains (picture 5)

Before assembly please make sure that all bores and parts are absolutely clean and free of debris.

The head pin always has to be inserted from the outside of the double strand into the links To be connected. Push the circlip with the pre-assembled locking pin onto the head bolt and take care that their bores are aligned. Now drive in the locking pin in such a way that it will not protrude the circlip. Take care not to drive in the locking pin inclined to the bore centre. The disassembly is done by a mandril expelling the locking pin. Disassembled locking pins may not be used again.



Picture 5

4.6 Mount the connected chain strands into the conveyor

1. Please follow the operating instructions resp. operating manual of the plant manufacturer.
2. Insert the pre-mounted open chain strand into the conveyor
3. Position the chain strands at the most suitable location for assembly.
4. Move the reversing wheel in slack position (shortest possible axle-base)
5. Close the chain strand acc. to above assembly steps 2 – 4.

4.7 Tension the chain

Tension the reversing wheel. This position of the reversing wheel is at the same time starting point for following wear measurements.

4.8 Please observe:

The casing dimensions specify the tension for the reversing wheel.

Attention!

Avoid a slack chain.

Reversing wheel may not arrive at the back limit stop of the clamp travel

1. Due to chain wear and the resulting chain elongation the reversing wheel moves towards the back limit stop of the clamp travel.
2. If the chain is not tensioned any more by the tensioning station, an undesirably heavy wear occurs at the Forky.
3. Continuing run of the conveyor chain in this position will result in a chain sack. This condition is called slack chain and has to be avoided. This may lead to undesirably high dynamic loads, destroying the chain and causing additional wear.
4. If the chain is run with too much tension this will result also in undesirably heavy wear at the Forky.

5 Disassembly

5.1 Shortening the chain

It is important to shorten the chain in time. Shorten the chain before it has lengthened so much, that it will not be tensioned by the clamp travel, otherwise the cover panel of the reversing station, resp. the casing of the conveyor will be damaged.

 Warning!	Secure chain strand against moving! Charge by imbalance possible
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Shorten the chain as follows:

1. Observe the operating guidelines of the equipment manufacturer.
2. The conveyor has to be free of conveying material, check for missing or damaged drivers.
3. Bring the conveyor to a halt in a favorable position for shortening.
4. Switch off the conveyor and provide a safeguard to prevent unintentional restart.
5. Safeguard the chain strand against run-off.
6. Relieve the reversing wheel at the start of the tensioning unit (shortest possible axle-base)
7. The chain has to be adequately slack to be opened and to remove the necessary number of links from the strand.
8. Tensioning of the conveyor as described in point 4.5 and 4.6
9. Removal of the chain strand safeguard
10. Electric connection of the motor and trial run of the conveyor

5.2 Exchange of the drive wheel segments

1. Don't remove chain.
2. Conduct disassembly and assembly in the chain free room of the wheel..
3. This is only possible if there is sufficient room for the exchange.

Bolting in property class 8.8 and safety nut V acc. to DIN 980-8. Please take the admissible screw locking torque from the table in the last paragraph.

5.3 Disassembly of the system

 Warning!	Secure chain strand against moving! Charge by imbalance possible
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1. Observe the operating guidelines of the equipment manufacturer.
2. The conveyor has to be free of conveying material
3. Switch off the conveyor and provide a safeguard to prevent unintentional restart.
4. Safeguard the chain strand against run-off.
5. Relieve the reversing wheel at the start of the tensioning unit (shortest possible axle-base)
6. The chain has to be adequately slack to be opened.
7. Removal of the chain strand safeguard
8. Remove chain from conveyor
9. Disassemble the Forky outside the conveyor
10. Disassemble the wheels from the shaft

6 Care and Maintenance

We recommend that you keep records of your maintenance work on the conveyor system, including their running times and the repairs that have been made. Only well-maintained conveyor systems achieve long running times.

6.1 Lubrication

RUD Forky does not require any lubrication.

6.2 Pre-Tension

Check the chain tension regularly, especially during the initial break-in phase of new chains and/or long chain loops. The pre-tension may only be as strong as necessary to assure a chain run without any problems at normal working conditions.

In certain intervals the chain has to be checked. The reversing wheel has to be adjusted, if necessary.

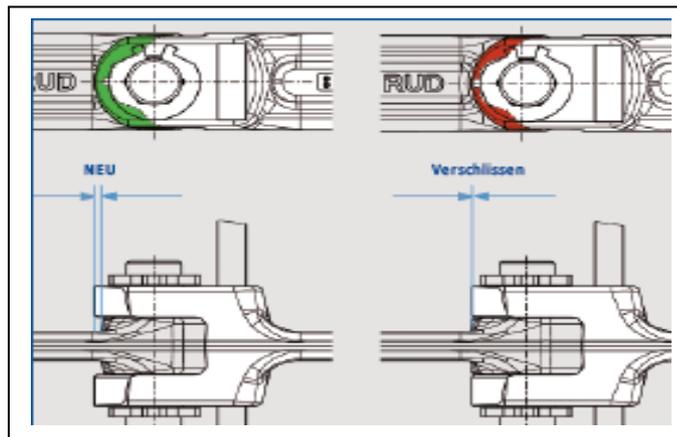
Attention! **Unnecessary high pre-tension reduces the lifetime of the system.**
No too large chain slack span. This may lead to undesirably high dynamic loads able to destroy the chain.

6.3 Monitoring

Examine the chains, couplings, sprockets, wheels and flange-mounted parts every six months, or at least annually, for damage, corrosion and points of unusual wear. Check the attachments for cracks at the welding seams. Pay particular attention to the condition of the bolted joints and safety components. Repair all defects found without delay and replace parts, if they cannot be repaired.

7 Wear and Replacement State of Wear

1. Check the lengthening of the chain by regular wear measurements.
2. Check chain wear at 3 successive chain link pitches by the wear control (picture 4).
3. According to axle-base execute and record approx. 8 – 12 length wear measurements.



Pict. 6

Record the check and the operating hours in a table. The intervals given in the table below are minimum requirements and depending on the operating conditions, like conveying speed, temperature and conveyed material.

Measurement table

Operating hours	Wear control visible?
5.000	
10.000	
15.000	
18.000	
21.000	
24.000	

7.1 Attention should be paid to the following:

1. The chain is worn out when the wear indicator is visible.
2. At the same time you should check the backlash at the teeth of the drive wheel, if they are fit for further operation. If the backlash is used up, new teeth segments have to be inserted.

- **Attention!** The chain has to be discarded when reaching the length wear limit.

Generally, components should be exchanged with damages, jeopardizing directly or indirectly the safety or the operation of the conveyor.

The abrasion at the chain links, caused by the transported material and sliding on the trough bottom, or on the guide rails and wear rails, should not exceed 2 – 2,5 mm on each side. If this is the case, the hardened layer is completely used up and the danger of chain fractures increases with further abrasion.

Scrapers are subject to the same wear. These have to be exchanged or repaired, if they don't adequately fulfill their conveying task any more.

8 Maximum Permissible Bolt Tightening Torques

The factors influencing the tightening torques stated in VDI 2230 must be taken into account when mounting bolted parts. Retighten all nuts after two weeks' operation, and ensure that they are tightly seated.

8.1 Table 1: Maximum Tightening Torques

Thread size	For bolt strength class 8.8 with overall coefficient of friction $\mu_{\text{over}} = 0.14$		For 2win and SWA threads with overall coeff. of friction $\mu_{\text{over}} = 0.14$		For DIN 555 hex nuts quality class 5	For DIN 934 hex nuts quality class 8	For DIN 980V hex nuts
	Tightening torque (Nm)	Tightening torque (ft-pd)	Tightening torque (Nm)	Tightening torque (ft-pd)	Tightening torque (Nm)	Tightening torque (Nm)	Tightening torque (Nm)
M 6	10	7					
M 8	25	18					
M 10	49	35			30	51	55
M 12	85	62			52	89	95
M 14	135	98			83	140	149
M 16	210	152	149	108	127	213	225
M 20	425	307	293	212	245	420	439
M 22	580	420					
M 24	730	528	506	366	420	725	752
M 27	1100	796					
M 30	1450	1049	1000	723	847	1451	1487
M 33	1900	1347					
M 36	2450	1772	1700	1230	1480	2531	2575

8.2 Table 2: Recommended Values for the Tightening Factor α_A :

Tightening factor α_A	Variation	Tightening method	Setting method	Comments	
1.7 to 2.5	26% to 43%	Torque-controlled tightening with mechanical screwdriver	The screwdriver is set with a tightening torque comprising a nominal tightening torque (for estimated coefficient of friction) plus an allowance.	Low values for: → Large number of checks (tightening torque) → Screwdriver with breaking coupling	Low values for: → Small angles of rotation, i.e. relatively rigid connections. → Relatively soft backing. → Backings which do not tend to scuff. Higher values for: → Large angles of rotation, i.e. relatively flexible connections. → Very hard backing coupled with rough surface. → Form errors
2,5 to 4	43% to 60%	Pulse-controlled tightening with impact wrench.	Screwdriver set with tightening torque, as above.	Low values for: → Large number of setting attempts (tightening torque). → On horizontal axis of screwdriver curve. → Zero-backlash pulse transmission.	

8.3 Example of Procedure

Attention!

This procedure cannot replace calculations as defined in VDI 2230 (Association of German Engineers), and it does not correspond to the state-of-the-art. Nevertheless, it can at least prevent bolts breaking during assembly work with bolts for which no calculation has been made.

Step 1: Coefficient of friction μ_{over} corresponding to the friction class.

The lowest coefficient of friction practically achievable with the state of the surfaces and lubrication of the thread and contact area must be selected. For simplification, $\mu_{\text{over}} = 0.14$ is assumed for bolts that have not been given any after-treatment.

Step 2: Maximum assembly tightening torque M_A .

The maximum tightening torque is defined for each specific product below 90 percent utilization of the 0.2% permanent elongation limit ($R_{p0.2}$) or the apparent limit of elasticity (R_{el}). These values can be found in table 1.

Step 3: Tightening factor α_A :

This takes into account the variation of the tightening force achievable during assembly between F_M min and F_M max. The bolt is dimensioned for the maximum tightening torque so that it will not be overstressed during assembly. The imprecision of the tightening process is caused by:

- Errors calculating the coefficient of friction
- Variation of the frictional behaviour and repeating accuracy
- Differing tightening methods
- Device, operating and reading errors

The tightening factor α_A has to be selected in accordance with how the above-mentioned influences can be controlled. These values can be found in table 2.

Step 4: Assembly tightening torque M_A of the tool

This is the torque set on the tool, for example a mechanical screwdriver.

$$M_{A\text{Werkzeug}} = M_A \text{ max.} - \left(\frac{M_A \text{ max.} - M_A \text{ min.}}{2} \right)$$

$$M_A \text{ min.} = \frac{M_A \text{ max.}}{\alpha_A}$$

Example: Maximum tightening torque $M_A \text{ max.} = 425\text{Nm}$
Tightening factor $\alpha_A = 1.7$

$$\rightarrow M_{A\text{Werkzeug}} = \frac{1}{2} \left(M_A \text{ max.} + \frac{M_A \text{ max.}}{\alpha_A} \right) = \frac{1}{2} \left(425\text{Nm} + \frac{425\text{Nm}}{1.7} \right)$$

$$\rightarrow M_{A\text{Werkzeug}} = 337,5\text{Nm}$$

Step 5: Check

Thoroughly check the bolted connections with a torque wrench.