

Technical Guide to Installation and Maintenance of Hinged Steel Belts

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Technical Guide to Hinged Steel Belts

2 Introduction

2.1 General information

To really make the most of the advantages of our extremely durable and wear-resistant hinged steel belts, select the correct parameters for your application carefully. The following pages describe the technical aspects of the product catalogue and support you in selecting the right hinged steel belt. In addition, our Technical Support team is also ready and willing to assist you with the design of your hinged steel belt.

For manufacturers of conveyors looking for proposals for a specific application, this document should be seen less as a set of instructions and more as a guideline. A document like this cannot cover all issues: it must instead be content to cover issues that occur frequently, and it is also no substitute for trials and tests specific to each application.

These notes are intended for designers, technicians, maintenance and service personnel, technical purchasers and other employees of conveyor manufacturers with an in-depth understanding of technical matters. This guide is designed to help you in your daily working life. Because the areas in which hinged steel belts are used are expanding and changing on an almost daily basis, we are open to and grateful for suggestions and criticism as to how we can improve this guide.

The recommendations and instructions set out in this document should be understood as minimum requirements. The inclusion of additional testing/assembly steps and inspections within the framework of the conveyor manufacturer's due diligence obligations are not only sensible, they are also a necessary part of ensuring a perfect product.

Descriptions that go beyond recommendations and instructions are for information purposes only and make no claim to be exhaustive or generally applicable. They are instead designed to give an understanding of the issues surrounding the hinged steel belt and its components, with a view to supporting the requirements associated with the wide range of different applications, conveyor designs, structural and other conditions etc.

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2.2 Safety instructions

The following safety instructions must be observed before and during work on and with hinged plate conveyor belts:



Due to the production process, there may be sharp edges and burrs on the conveyor belts. Therefore, among other things, cuts can occur, burrs can also flake off and cause eye damage.

Crushing may also occur between the individual parts.

Furthermore, the lubricants and greases used in connection with the conveyor belts belong to the group of hazardous substances.

To prevent injuries, always carry out a risk assessment before starting work, as required by the Occupational Health and Safety Act. To prevent injuries, we recommend wearing personal protective equipment commonly used in the industry, but especially:



- Cut-resistant gloves when handling hinged plate belts,
- Chemical protective gloves when handling hazardous substances, and
- Protective goggles when handling conveyor belts and when handling hazardous substances.

2.3 Function of the hinged steel belt

A hinged steel belt is available in many different versions and can be used for a large number of applications. Hinged steel belts are available

- In various pitches
- With different nominal widths
- Chains
- Carriers
- Side wings
- Surfaces
- Sheet thicknesses
- Tracks
- Pin locks
- Materials

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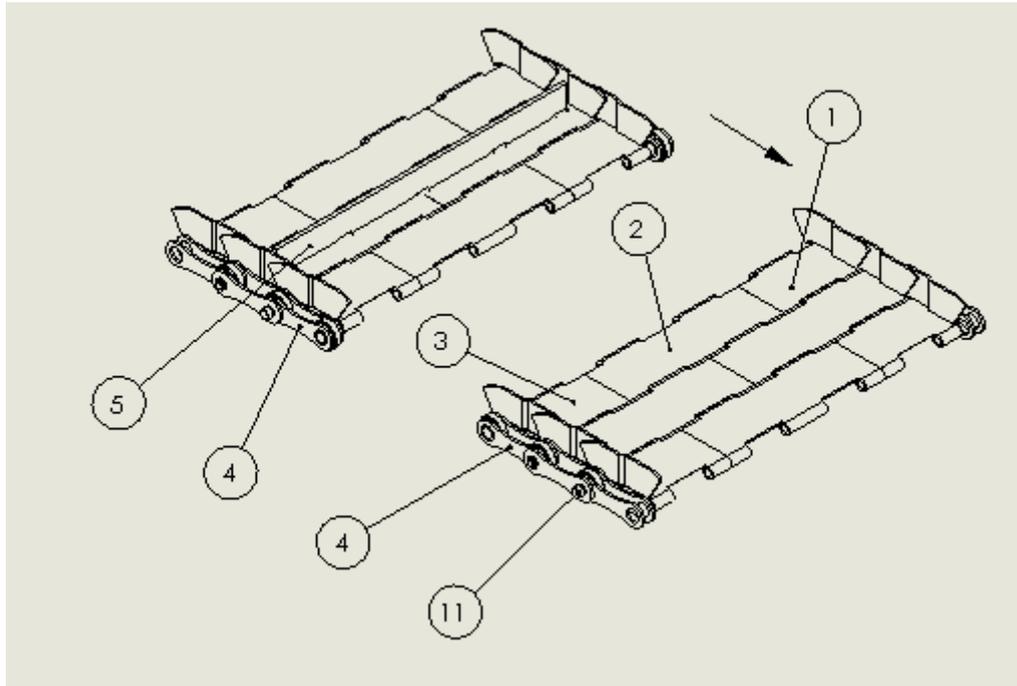


Figure 1 Schematic representation of a hinged steel belt with carrier

What can nevertheless be said about a hinged steel belt is that it is usually made up of the following parts:

- 1 Right hinge with side wings
- 2 Straight hinge
- 3 Left hinge with side wings
- 4 Hollow pin chain
- 5 Hinge plate with carrier consisting of
 - Left hinge with side wings and
 - Right hinge with side wings and
 - Welded carrier
- 11 Pin

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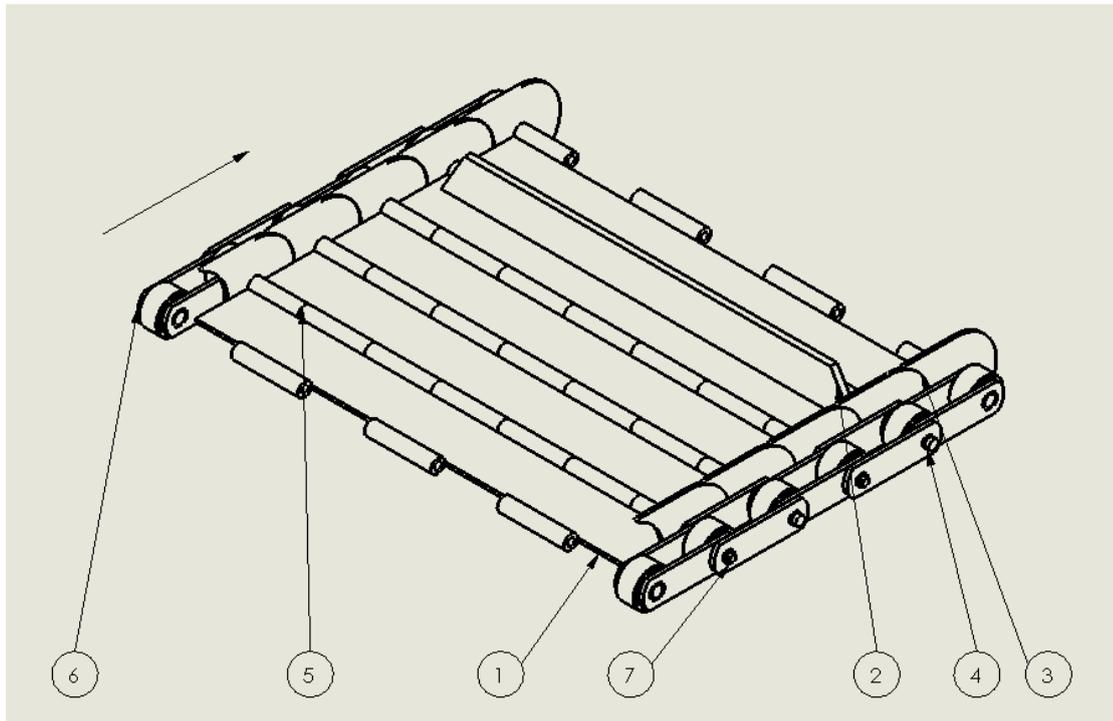


Figure 2 Schematic representation of a heavy-duty hinged steel belt

A heavy-duty hinged steel belt is usually made up of the following parts:

- 1 Hinge plate consisting of plate with welded pipe sections and side wings
- 2 Hinge plate with carrier
- 3 Side wing
- 4 Pin
- 5 Welded pipe sections as hinge eyes
- 6 Hollow pin chain
- 7 Split pin

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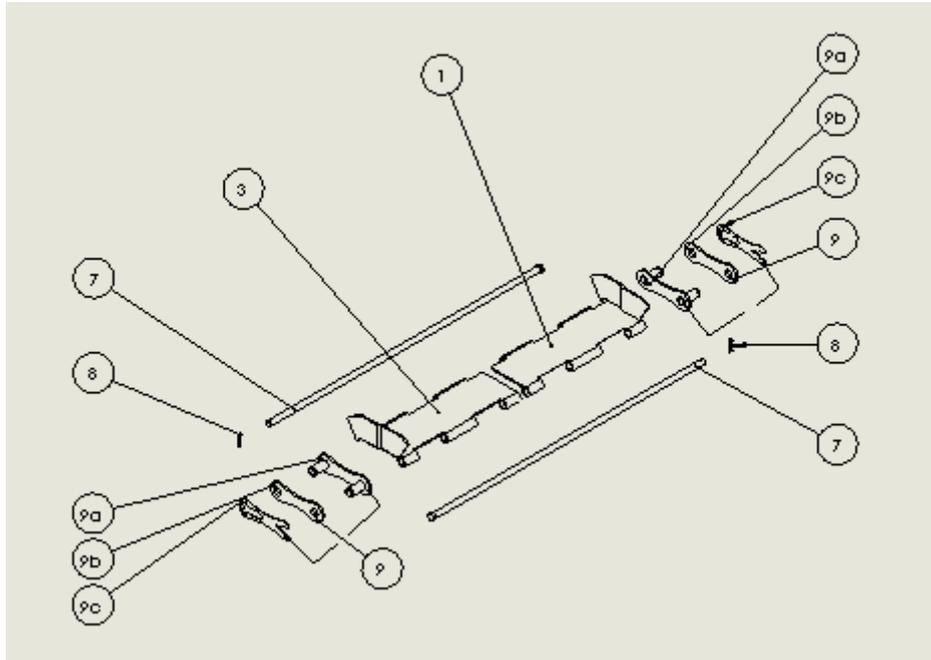


Figure 3 Representation of a connection link

To close the hinged steel belt, a connection link comprising the following parts is required:

- 1 Right hinge with side wings
- 3 Left hinge with side wings
- 7 Connection link pin
- 8 Split pin
- 9 Chain lock
 - 9a Outer plate with hollow pin
 - 9b Outer plate (cover plate)
 - 9c Locking spring

The side wings protect the chains against dirt from the conveyed goods and vice versa (abrasion, oil etc.). They also protect the goods against falling off. The side wings are usually protected by the conveyor's guard plates. The side wings are designed to ensure that parts do not fall off or get jammed in them. The side wings are either formed directly on the hinge or welded to it. The shape of the side wings determines the direction of conveyance.

The hinges are made in such a way that the individual hinges in the belt interlock to produce a stable unit. The minimum number of sprocket teeth required to ensure that parts do not get caught in the deflection or drive rollers can be found in the catalogue or can be requested from us.

2.4 Function of the chains

The standard hinged steel belt includes chains. Hinged steel belts without chains are usually driven by hinge eyes only and are only allowed for small loads.

The chains take the load and are the components of a hinged steel belt subject to most wear. The chains are hollow pin chains with an appropriate pitch and suitable materials.

The chains are driven by the sprockets and pull the hinged steel belt in the direction of conveyance via the pins.

The inner width of the chain and the load determine the pressure on the bearing area, which is an important factor in the design of the conveyor.

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For very high loads, duplex chains (2 single chains per side) or even triplex chains (3 single chains per side) are also used, although simplex chains with a larger inner width are preferred, as the outer chains can only take part of the load and these must also be compatible. For duplex chains, the chain strands are measured and are used only in pairs on the hinged steel belt.

The chains are characterised and selected by their inner width and the minimum breaking load. Allowance must be made for lateral spreading of the hinged steel belt. This can be reduced in several ways:

1. In most cases, guidance by the deflection and drive shaft sprockets is sufficient.
2. For long conveyors and large pitches, chains with flanged rollers are preferred
3. Using additional small sprockets between the deflection and drive pin.

In exceptional cases,

4. Lateral guidance is by means of the pin ends or side wings.

The type of guidance used is the responsibility of the conveyor manufacturer.

For most chains, the Allert logo is stamped on the outer plate. If you have any questions concerning design, please contact Technical Support.

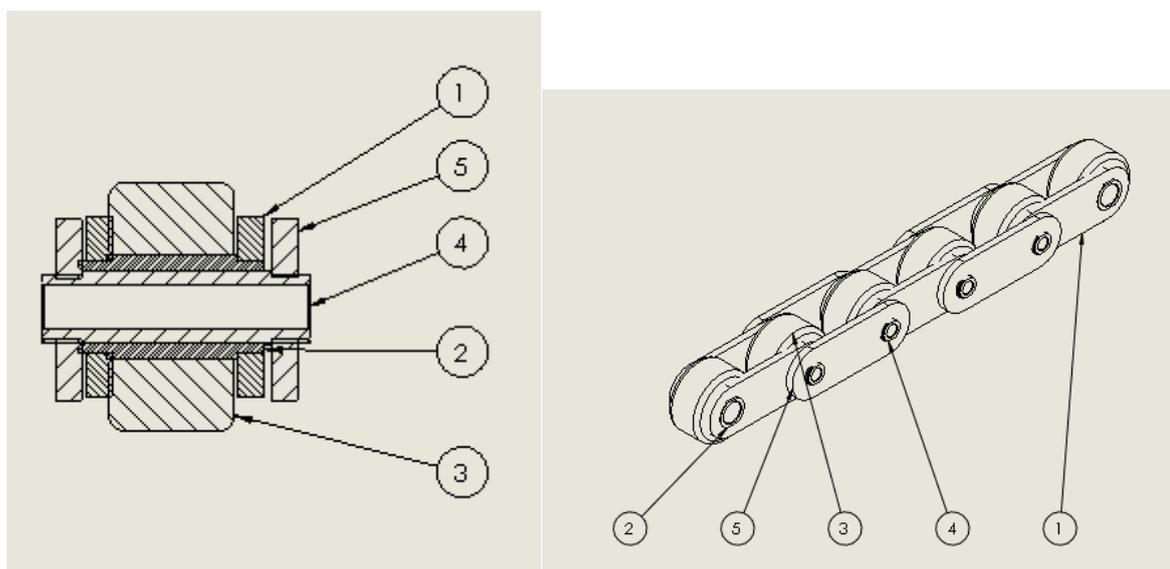


Figure 4 Section through a chain link with hollow pin

A chain is made up of:

- | | |
|---|-------------|
| 1 | Inner plate |
| 2 | Bushing |
| 3 | Roller |
| 4 | Hollow pin |
| 5 | Outer plate |

Each chain strand has an odd number of chain links with inner plates at both ends to ensure that the chain can always be closed by a connection link (as a substitute for an outer link plate).

A chain lock used to connect two chain strands is shown in Figure 3.

2.5 Sprockets

The function of the sprockets is both to transmit the engine power to the drive shaft on the chains, and also to hold the belt in position for the drive and deflection shaft. The number of teeth also determines the polygonal effect, the distance from upper to lower run and the maximum speed.

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The maximum speed for a hinged steel belt depends on the number of teeth, the pressure on the bearing area in the chain (including chain geometry and belt load), dirt, lubrication, application (freedom from impact) and required service life.

Hardened sprockets are used for increased wear.

The grooves are manufactured in accordance with DIN 6885/1 and the teeth are aligned ± 0.2 mm to the centre of the groove.

The tooth profile is manufactured in accordance with DIN 8196-2.

The minimum numbers of teeth required to ensure that the side wings do not open during deflection can be found in the catalogue.

If you have any questions concerning design, please contact Technical Support.

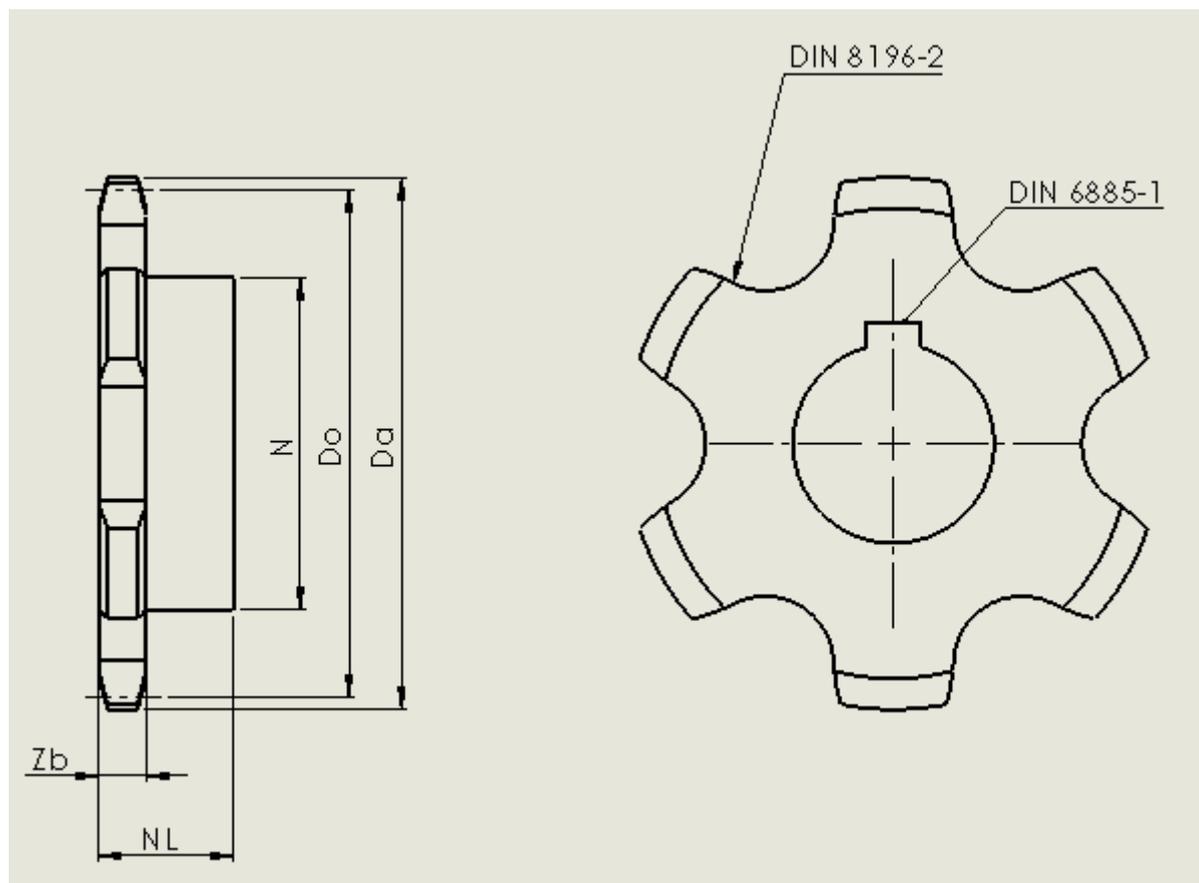


Figure 5 Schematic representation of a sprocket with hub and groove

2.6 Lubrication

In general, the purpose of lubrication is to minimise wear and corrosion with a view to maximising service life.

The better lubrication is adapted to the specific conveyor application, the longer the service life will be.

This final lubrication solution is agreed between the lubricant supplier and the conveyor manufacturer. Kurt Allert GmbH & Co. KG can offer only the benefit of some experience in this area as a starting point for this work. Customers also always determine their own approach to lubrication, provided that the hinge plates and chain are not adversely affected.

Lubrication must take account of various factors including:

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- Operating temperature
- Pressure on bearing area
- Initial lubricant
- Load capacity
- Type of relubrication
- Application area (food industry / textile industry / recycling industry etc.)
- Corrosion protection
- Compatibility with other machine components, in particular seals and coatings
- Non-drip and wetting ability
- Material to be conveyed
- General environmental compatibility
- General laws and regulations governing hazardous materials

One special case is application as a bulk material conveyor of powdery or fragmented dry substances, as the oil is absorbed by the dry dust and becomes a viscous paste. Here, lubrication is generally not advisable.

Another special case is use at high temperatures, such as belts in industrial ovens.

Very low temperatures, such as those occurring in flash freezers, present another challenge when choosing lubricants.

Lubricant manufacturers are familiar with these conditions and can usually offer advice.

To ensure effective lubrication, a sufficient quantity of a liquid lubricant should be introduced on the side facing the sprocket, between the roller and the inner plate and between the inner and outer plates.

The kinematic viscosity of the lubricating oils should be between 450 (at 40 °C) and 30 (at 100 °C) mm²/s.

Due to the many different applications, various initial lubricants are used for wear and corrosion protection:

- In the hot dip process with ANTICORIT TX 8 R from Fuchs
- In the hot dip process with Renolin Chainlube 11 from Fuchs
- Lube HT/SF from Interflon
- No initial lubrication

When relubricating, ensure that the lubricant is compatible with the initial lubricant.

Examples of general chain lubricants:

| | |
|----------------|---------------------------|
| STRUCTOVIS FHD | Manufactured by Klüber |
| FIN LUBE TF | Manufactured by Interflon |
| ANDEROL HTC | Manufactured by Fragol |

Examples of industrial ovens:

| | |
|----------------------|---------------------------|
| WOLFRASYN UL 129 G10 | Manufactured by Klüber |
| FIN LUBE HAT/SF 4 | Manufactured by Interflon |
| PLANTFLUID | Manufactured by Bechem |

For hinged steel belts, the following types of lubrication are generally used

- Handschmierung (nicht zu empfehlen)

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- Tropfschmierung (nur in automatisierter Form bei der die Kettenschmierung überwacht wird)

Note: Responsibility for regular lubrication must be imposed on the system operator. Improper or insufficient lubrication can cause considerable damage to the hinged steel belt or chain.

2.7 Pins

The pins used are available in different diameters of 5 / 8 / 10,8 / 20 mm, suitable for the chains and their typical load requirements.

The possible pin ends are sometimes required for production reasons, and sometimes also application-specific. If you would like to find out which pin end is right for your hinged steel belt, please contact Technical Support.

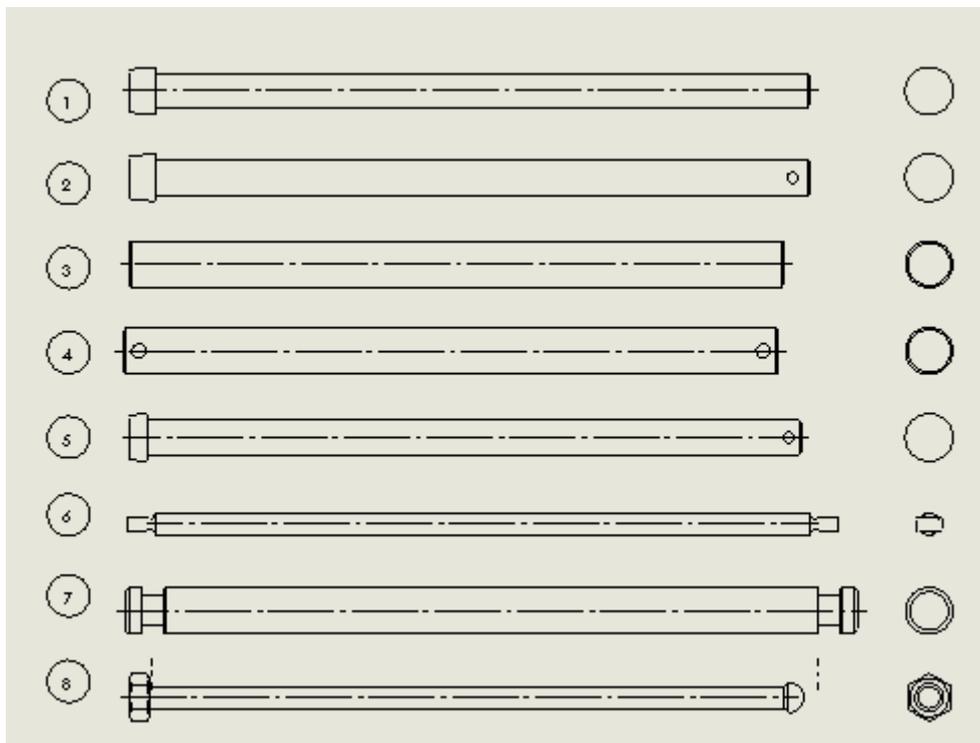


Figure 6 Overview of the different pin ends

The pin ends are

1. **Normal pin with head on one side** and the other side wobble riveted after assembly
2. **Pin with head and split pin bore, normally used for connection links**, can also be used for completely split pin belts
3. **Pin without head** for hinged steel belts without chains, where the pins disappear into the hinge eyes and the hinge parts are centre punched to secure the pins against falling out
4. **Pin without head with 2 split pin bores** for completely split pin belts on both sides (complex)
5. **Pin with low head** and split pin bore for connection links
6. **Pins made of spring steel peened at both ends** (no head and split pin bore drilling possible on the hard spring steel)
7. **Pin with groove for securing plate**, only in conjunction with special chain
8. **Pin with welded nut**
9. **Centre-punched hinge eyes** for pitch 38.1 hinged steel belts without chains (not shown)
10. **Notched hinge eyes** for pitch 63 hinged steel belts without chains (not shown)

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2.8 Service life

The level of wear depends on factors including

- Operating mode (reversing / continuous operation / clocking)
- Type of conveyor, e.g. horizontal / Z conveyor
- Torsional stiffness of the shaft
- Accuracies of the installed machine components (sprockets)
- Clamping unit for the belt
- Application of the load (e.g. drop heights)
- Design of the hinged steel belt for the load
- Lubrication (automatic / manual / etc.) with all influencing factors as set out above.
- Servicing and maintenance
- Dirt levels in general, and particularly for the chain
- Operating temperatures
- Substructure of hinged steel belt
- Material selection for all components
- Accuracy of settings during installation of the conveyor
- Slide rails
- Material to be conveyed

The service life of a belt in general can vary greatly due to these factors. The range extends from several months in extremely aggressive environments to up to 15 years (based on customer experience). It can ultimately only be predicted on the basis of similar and/or test applications.

2.9 Special environments and applications

Because today's machines are very specific, the applications can raise a wide range of issues. For example

- Loading type (e.g. for conveying screws)
- Temperature, particularly with reference to lubrication
- Food industry, where attention must be paid to the suitability of the lubricant for use with food and to ensuring that cleaning of the hinged steel belt is carried out. The belt components are mostly made of stainless steel
- At low temperatures, attention must be paid to freezing of the chain, which may lead to plate imprints when entering the sprocket
- When using corrosive ambient media, selection of the material for the components is important. In particular, attention must be paid to stress corrosion cracking, hydrogen embrittlement and the like
- When used in liquids, allowance must be made for the risk of formation of a galvanic cell due to the diversity of the materials used
- Material compatibility of all resources and components used (e.g. seals with the lubricant)
- Groundwater hazard of the lubricants when used in environmental engineering
- In dusty environments (e.g. when conveying cullet), attention must be paid to chain lubrication/wear
- With hinged steel belts used in the forestry sector in particular, parts often get into the chain that can destroy the chain when it enters the sprocket
- In noise-sensitive environments, ensure that high-viscosity lubricants are used

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- For use in laser welding systems, treatment of the hinge plates with anti-adhesive agents should be considered, as otherwise the weld spatter can weld to the hinges and impair the hinge eyes. The service life of the belt depends strongly on this factor

2.10 Requirements for the conveyor

The design of a conveyor should make allowance for the following at a minimum:

- Automatic lubrication equipment
- Automatic shutdown in the event of a failure (jammed parts, chain break etc.)
- A way to inspect the chain run
- A way to replace pins
- A way to remove parts that have got into the space between upper and lower run
- The minimum deflection radii for the hinged steel belt are not exceeded
- The slide rails with inlet and outlet radii are included and have the required hardness
- The materials as a sliding pair match each other
- If the slide rails are made up of several parts, the transition between the parts is smoothed
- The belt support as may be the case
- An automatic belt tensioning system that allows independent adjustment of the chain tension
- Provide a way to place the goods to be conveyed “gently” on the belt
- Use a drive with a gentle startup function
- A control system with an operating hours counter to ensure that the lubrication intervals can be strictly adhered to
- Ensure that the belt speed is appropriate for the chosen design
- The tensioning station should be able to manage at least 2 pitches
- A brushing system for adhering parts during return or the like
- A cover for the chains
- Allowance for the polygonal effect on the covers and flutter
- Do the sprockets on a shaft have the same orientation on the shaft?

Tensioning the hinged steel belt

To ensure that it runs perfectly, the hinged steel belt must be tensioned. This requires a tensioning station at which a shaft (usually the deflection shaft) can be moved in the longitudinal direction. The chain must be sufficiently tensioned, but not overstretched. An initial rough estimate can be obtained from Technical Support by calculating the tension force.

The tensioning station should be able to manage a path of at least 2 pitches. This is to ensure that when shortening the belt by removing 2 pitches (inner link and outer link), the tensioning station can bridge the path.

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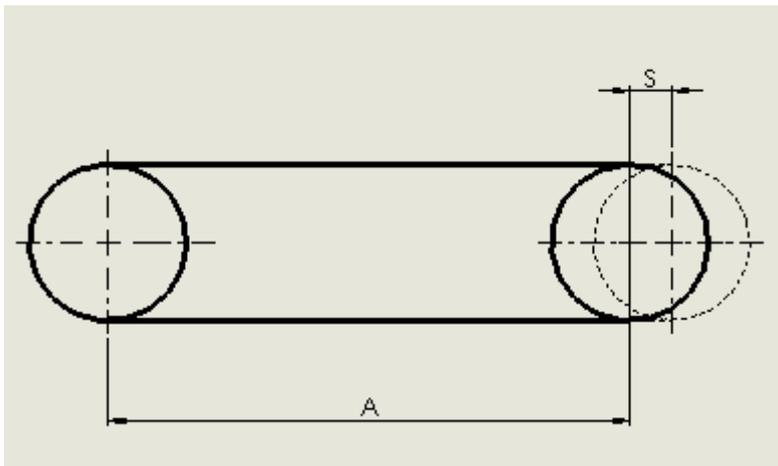


Figure 7 Tensioning length

The rule here is

- A distance of conveyor centres
- S tensioning distance

Belt support

A belt support is required if the belt load is greater than the permitted bending load of the pins when supported only by the rollers. Technical Support can help you with this calculation. The final technical design is the responsibility of the conveyor manufacturer. Experience confirms that the material should either be plastic or harder than the material used for the hinged steel belt.

Both the inlet and outlet edges in the upper run and the inlet and outlet edges in the lower run must be equipped with an inlet radius or inlet slope. Take care to ensure that the belt in the lower run can run freely and is not blocked by falling goods or the like.

Depending on the application and load, this support can be made from a semi-circular profile, e.g. 40 x 10 DIN 1018, or another rounded profile made of steel or plastic, for example from Murtfeld.

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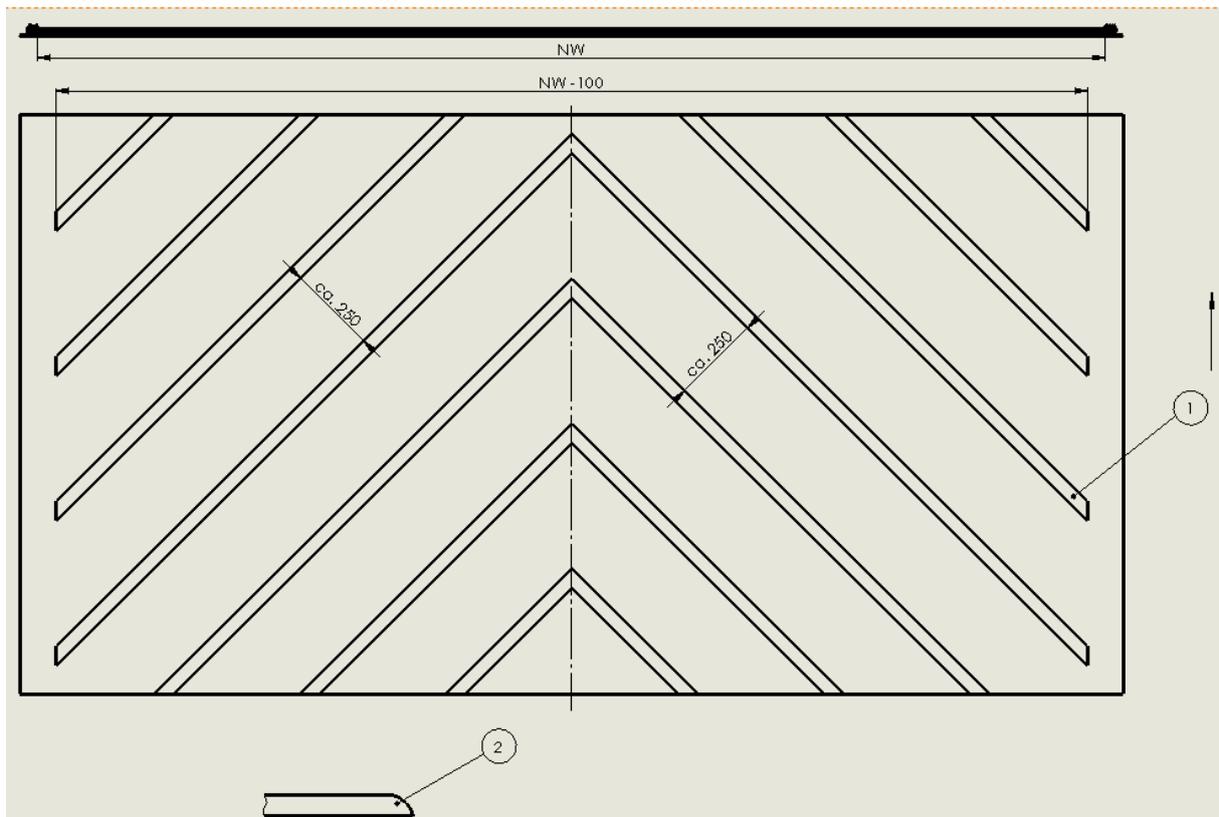


Figure 8 Example of a belt support for very heavy weights or very large nominal widths as is the case with baking oven belts

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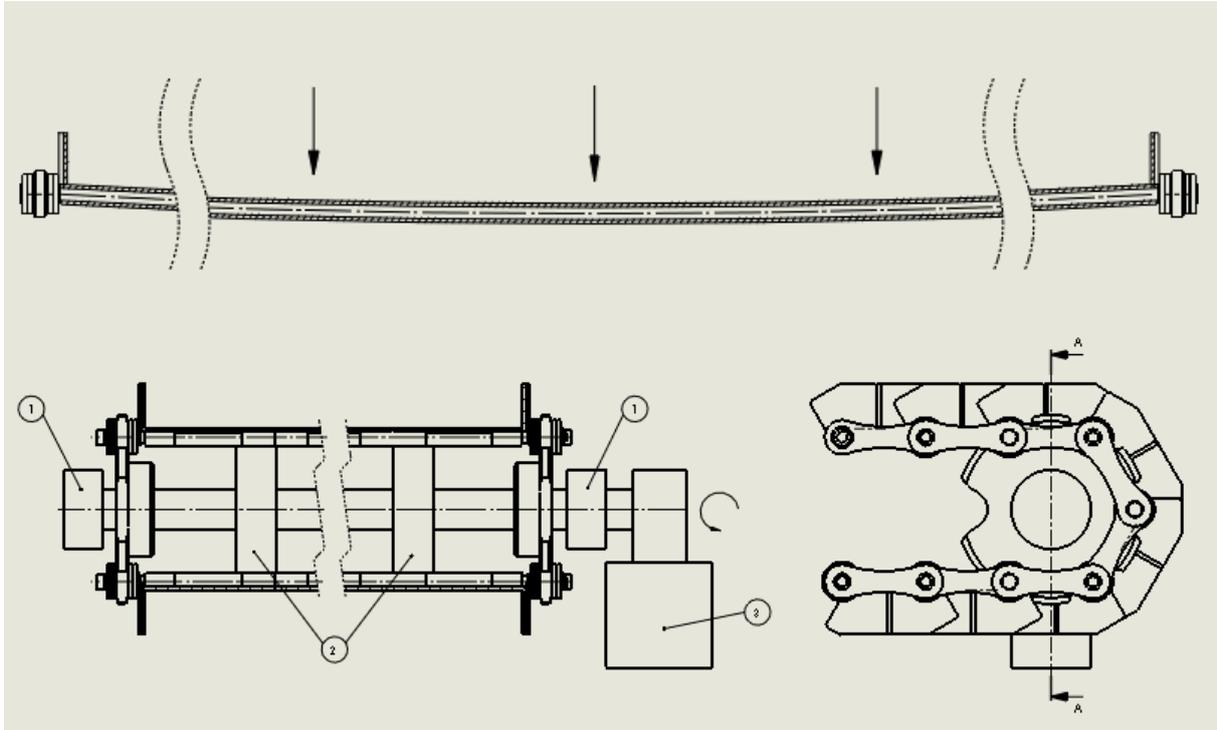


Figure 9 Belt support on the shafts to counteract sagging caused by the empty weight or load

Where

- 1 Bearing support
- 2 Support rollers
- 3 Motor

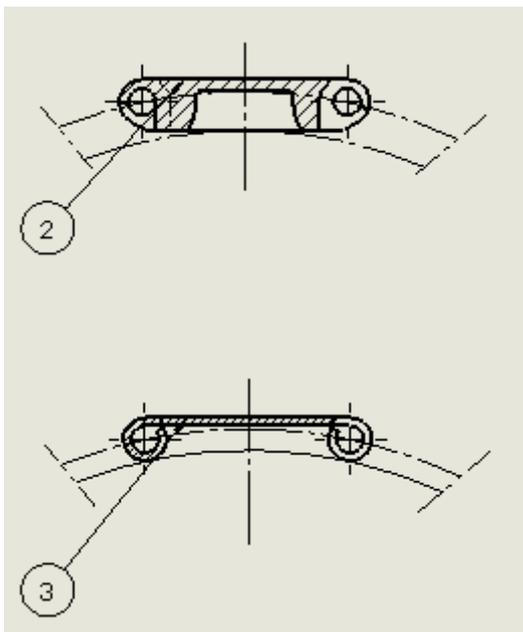


Figure 10 Methodology for designing the belt support on shafts for different hinge components (2 precision cast part, 3 hinge)

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Inappropriate due to point loading Appropriate for narrow belts Appropriate for wide belts

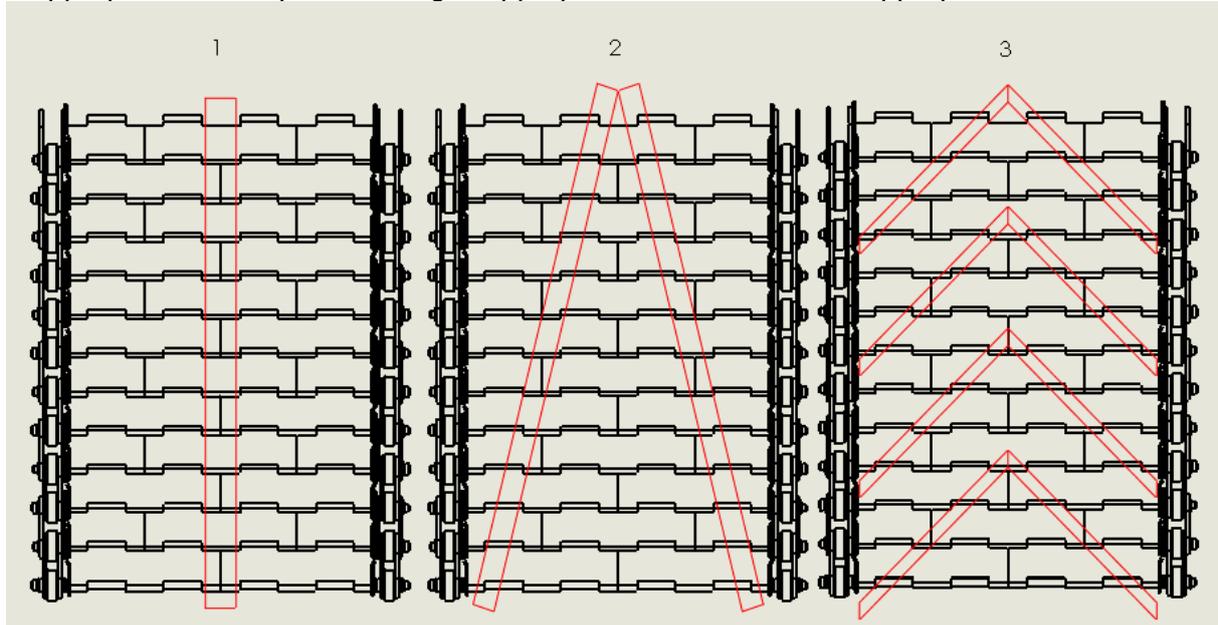


Figure 11 Examples and comparison for the installation of belt supports

Design of slide rails

With the slide rails on which the rollers or belt run, care must be taken to ensure that the transitions are well rounded, as otherwise the chains are subject to increased tensile or even impact loads.

At the transition from slide rail to sprocket and sprocket to slide rail, the chain should be lifted off the chain by the polygonal effect, as otherwise there is an additional load on the edge of the slide rail which should be avoided.

Wear protection for the slide rails is available for example in the form of Hardox 400 (an SSAB trademark), creusabro (an ArcelorMittal trademark) and others.

The exact technical design of the belt support is the responsibility of the conveyor manufacturer.

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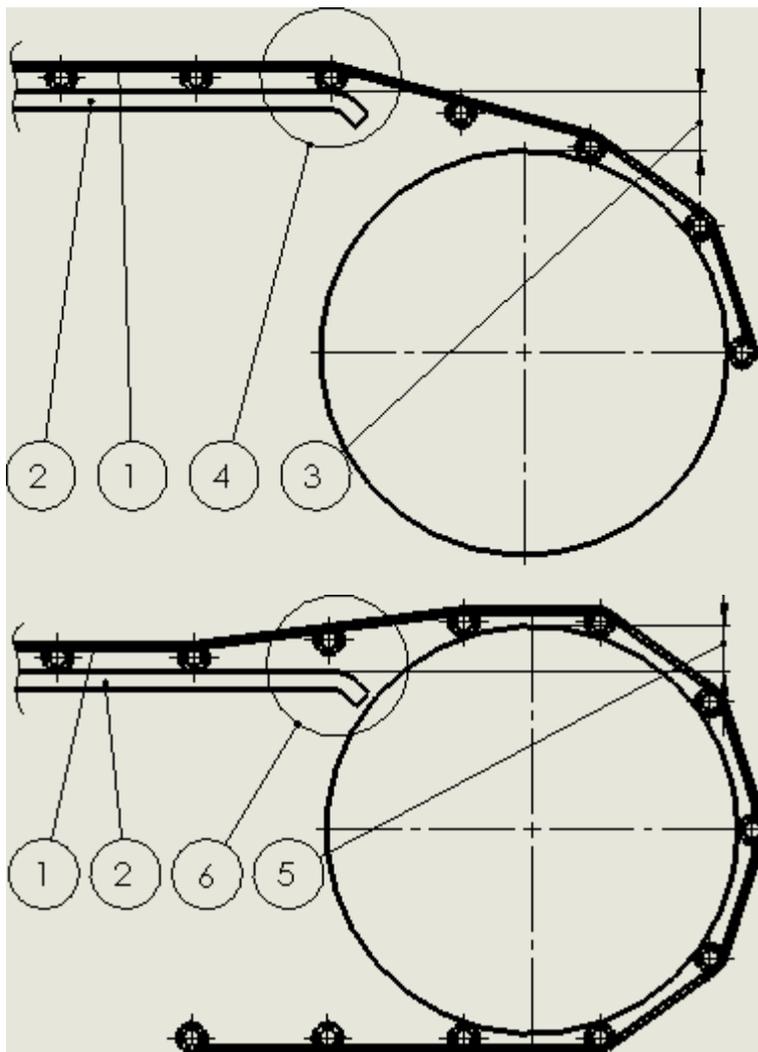


Figure 12 Design of slide rail transitions to the shaft

Where

- 1 Hinged steel belt
- 2 Belt support
- 3 Upper point of drive shaft too low
- 4 Wear edge where the hinge eyes rub
- 5 In the experience of our customers, target is min 5 mm (top point of the drive shaft should be at least 5 mm higher than the belt support)
- 6 The hinged steel belt is lifted off the belt support by the drive roller

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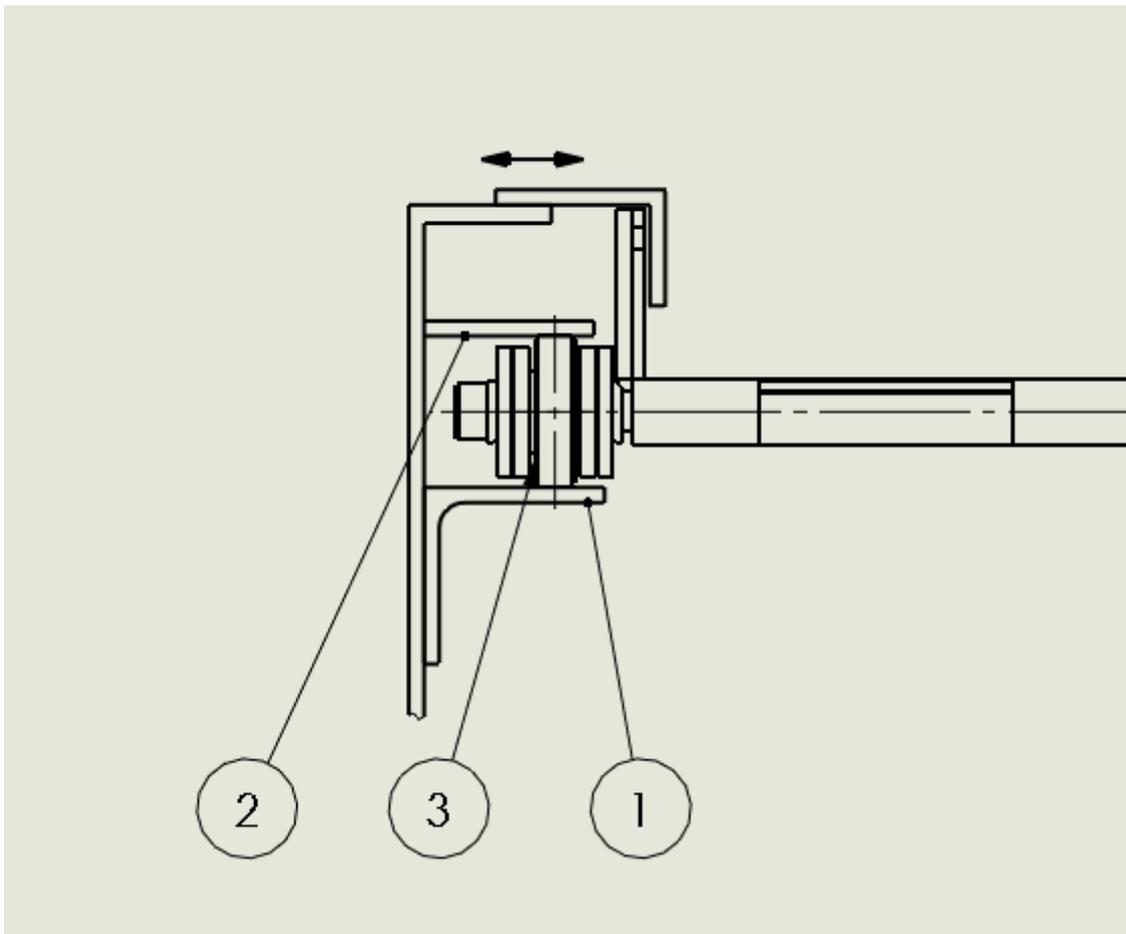


Figure 13 Transition of slide rails on deflection by slide rails, section view

Where

- 1 Slide rail for roller before deflection
- 2 Guide rail for roller in deflection radius area
- 3 Roller for hollow pin chain

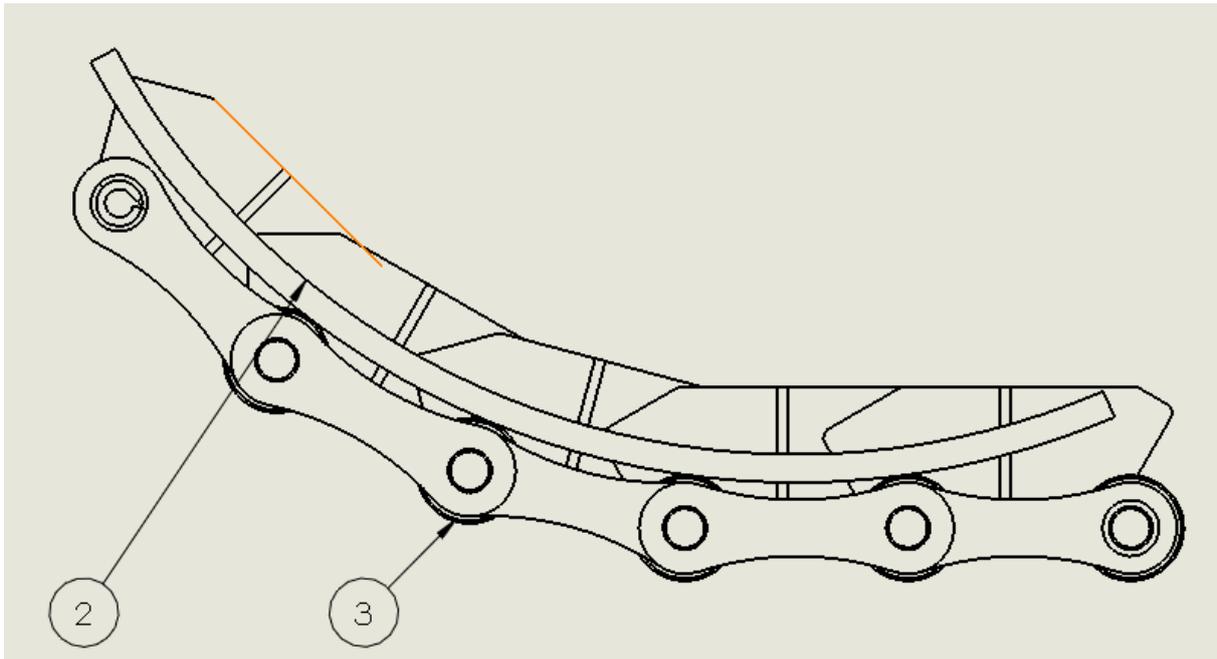


Figure 14 Transition of slide rails on deflection by slide rails, side view

For the deflections, the minimum radius must be adhered to. The space for sprockets is usually insufficient, which means that slide rails are used.

Design of belt supports on the drive and deflection rollers

The diameter of the drive and deflection rollers, which are used to support the belts, must be matched to the pitch diameter of the sprockets.

The bearing surface on the belt in the upper run should not be higher than the highest point of the drive and deflection roller.

If supports are required in the drive or deflection shaft, the diameters of the shaft for pitch 25.4 or 38.1 should be calculated as follows:

Pitch diameter of sprocket - 8.2 (hinge eye outer diameter) - 0.5 mm.

Lateral guidance of a hinged steel belt

Allowance must always be made for possible lateral spreading of the hinged steel belt.

- In most cases, guidance by the deflection and drive shaft sprockets is sufficient
- For long conveyors and large pitches, chains with flanged rollers are preferred

In exceptional cases, lateral spreading can be reduced as follows:

- With additional small sprockets installed between the deflection and drive pins
- With a lateral guide on the side wings
- With lateral guidance of the pin ends

The choice of variant should be assessed separately for each application, as it can have a significant impact on the service life of the hinged steel belt or conveyor.

Using a chute to drop large parts onto the conveyor

Large, heavy parts can be conveyed on hinged steel belts. The conveyed parts must be placed gently on the belt and should not be dropped from a height. To reduce the drop height, it's a good idea to use a chute to slide the parts onto the conveyor. The factors to be assessed are the load per pitch and the bearing surface for the heavy parts.

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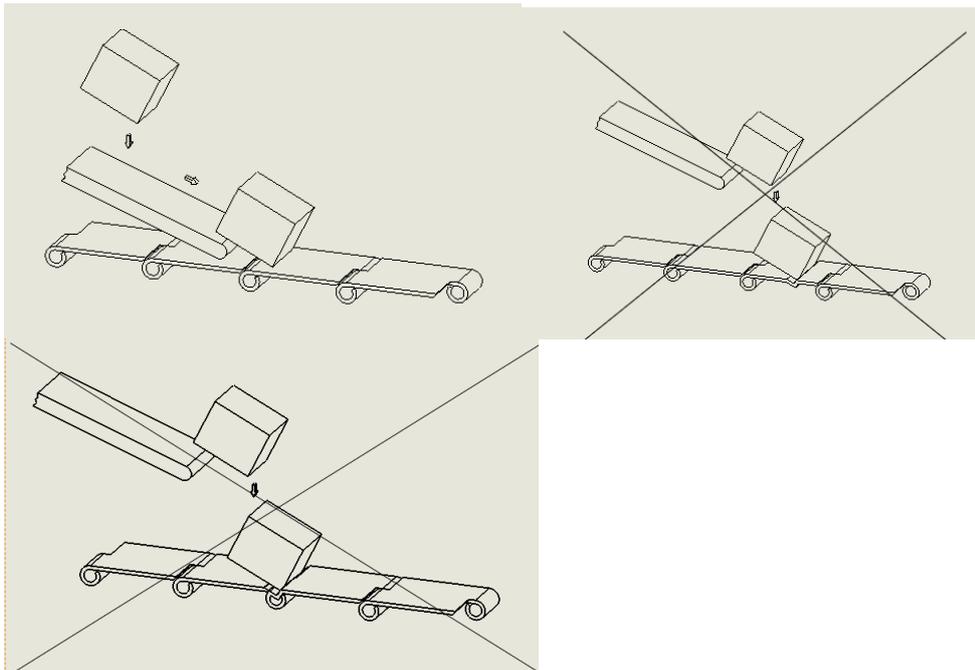


Figure 15 Belt loading and its impact on the belt

Dropping parts onto the hinged steel belt from a height with a lot of force will deform the surfaces of the hinge plates or hinge eyes, destroying the hinged steel belt (including reduction of the pitch dimension or jamming of the joint) and causing premature wear. If large drop heights are required, hinged steel belts with greater sheet thicknesses and larger pitch dimensions than would otherwise be necessary for the load are used. In addition, the application of the load determines the extent to which the conveyed material is damaged. Belt support in this area may be required.

Upper run

Both the inlet and outlet edges in the upper run and the inlet and outlet edges in the lower run must be equipped with an inlet radius or inlet slope.

The bearing surface on the belt in the upper run should not be higher than the highest point of the drive and deflection roller.

Lower run return

The return can be by means of rollers, sheet metal lining, grates or V-profiles.

Fitting the hinged steel belt into the conveyor

The hinged steel belt must be fitted into the conveyor in such a way as to ensure that not only the belt tolerances, but also the movements in the conveyor do not lead to collisions and the mobility of the chain and hinges is not restricted. The key factor is the length of the pin found in the catalogue "Maximum overall width B3". The clearance required on the side of the belt in the conveyor depends on the application, for example in baking oven belts as a result of the thermal expansion and length. We recommend a minimum width of $B3 + 2 \times 10$ mm. For long oven conveyors with centre of distances of 12 m, we recommend $B3 + 2 \times 30$ mm.

On both side walls of the oven, clearance of at least 20 mm is required between the hinged steel belt and oven wall. The clearance under the drive chains must always be at least 2 mm. The side walls must also be reinforced at a height of approx. 25 mm in the area of the belt, in order to avoid any potential damage to the walls of the oven from the belt pins.

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These are the main factors that require different clearances (list is not exhaustive)

1. Centre of distance of the conveyor
2. Temperature changes
3. Support
4. Inner width of the chains and width of the sprocket teeth
5. The guide (e.g. plates, sprockets)
6. Location of the load on the belt
7. Load level or change of load
8. Deflections

The following lateral movements must not be constrained:

1. Chain on sprocket
2. Hinge assembly between the chains
3. Between chain and pin ends
4. Distance between chains for duplex chains

If the hinged steel belt is not installed at the specified chain centre-to-centre distance, the pins may move much further out and the lateral clearance will need to be increased accordingly.

Note that for welded semi-circular side wings, clearance from the sprocket hub/shaft is required (see Figure 16).

For example, for a pitch 38.1 stainless steel hinged steel belt (1), a sprocket with number of teeth 6 (2) allows a maximum diameter of $\text{Ø } 32$, as otherwise a collision is possible during deflection (3).

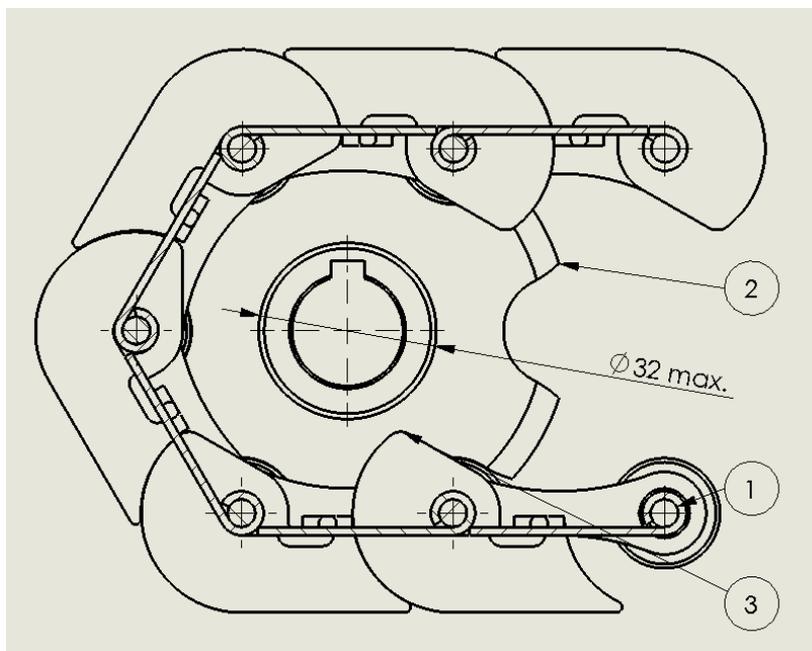


Figure 16 Dimensions of the sprocket hub

These clearances also apply to the covers.

Please note: We also supply nominal widths greater than those specified in the catalogue, and also different configurations. For these special versions, the specified tolerances and

Technical Guide to Hinged Steel Belts

length dimensions can only be a rough guideline. We will be happy to provide you with assembly drawings for your configuration.

Polygonal effect

After the rotational movement around the angle α , the sprocket moves from position A to position B. The centre point of the chain pins is on a circle, the pitch diameter D_0 . However, the connection between each chain joint is a straight line. This means that the chain forms a polygon.

During the movement process, the pin cannot follow the straight line, instead running through the effective pitch diameter. The effective pitch diameter varies between D_0 in position B and $D_0 \cdot \cos(\alpha)$ in position A.

This causes the chain to make an up and down movement. This effect, called the polygonal effect, produces a fluctuating belt speed and fluctuating torque at constant drive or angular speed.

As a rule, the greater the number of teeth, the lower the polygon effect and the greater the pitch diameter. Please also refer to Figure 12: Design of slide rail transitions to the shaft.

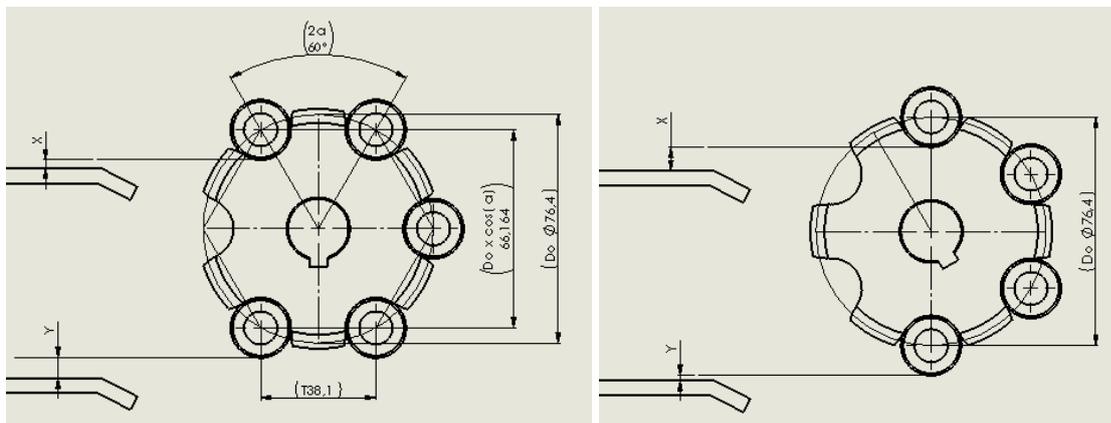


Figure 17 Polygonal effect of sprocket position A

and sprocket position B

3 Delivery

3.1 Delivery types

The belts are usually delivered on Euro pallets or, in the case of industrial baking ovens, on special transport frames. The belts are wrapped in plastic to protect them against dirt and moisture, and the correct direction is shown (see appendix).



Figure 18 Example of a packaged hinged steel belt on a Euro pallet



Figure 19 Example of packaging on special transport frame, e.g. for oven belts

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Chain strands are always shipped with an odd number of links with inner plates at both ends. Connection links are used to close and connect the hinged steel belt segments. Hinged steel belt are usually shipped with an odd number of links.

Where hinged steel belt are manufactured with carriers, the belt strands are numbered, because the carrier distances continue over the strands if possible.

For overseas deliveries, a different type of packaging can also be ordered if required.

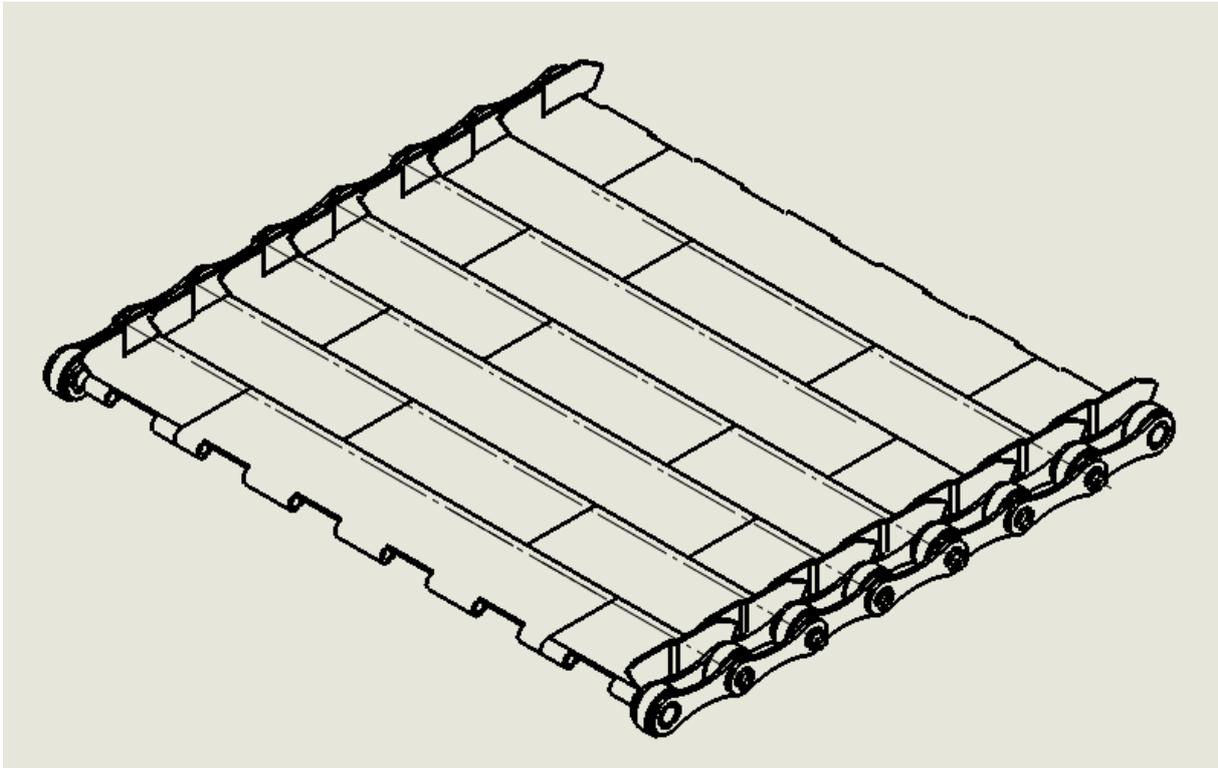


Figure 20 Hinged steel belt strand with inner plates at beginning and end

3.2 Checking the delivery note

To ensure that any incorrect delivery or transport damage is found as quickly as possible, please check that the number and type of articles are correct in the delivery note included in delivery. If contrary to expectation this is not the case, please contact us to arrange for possible replacement purchases.

3.3 Checking for storage and transport damage

Check for issues such as

- Packaging for cracks, dents or other visible damage
- Corrosion of parts
- Bent side wings
- Free movement of hinge components
- Free movement of chain components
- Free movement of rollers

Before installation, any damage found must be remedied.

Please contact us as soon as possible to order any replacements required.

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4 Installation

The following section first sets out the individual steps required during installation, in particular first-time installation, of a hinged steel belt in the conveyor. It then describes the actual insertion, as well as the subsequent phases.

4.1 Description of individual test and work steps

Connecting the hinged steel belt strands with a connection link

The following illustrations show how to connect the shipped hinged steel belt strands, where the parts are named as follows:

- 1 Split pin
- 2 Locking spring
- 3 Outer plate (cover plate)
- 4 Connection link pin
- 5 Outer plate with pressed-in hollow pin
- 6 Hinge components
- 7 Hinge eye of a hinge component

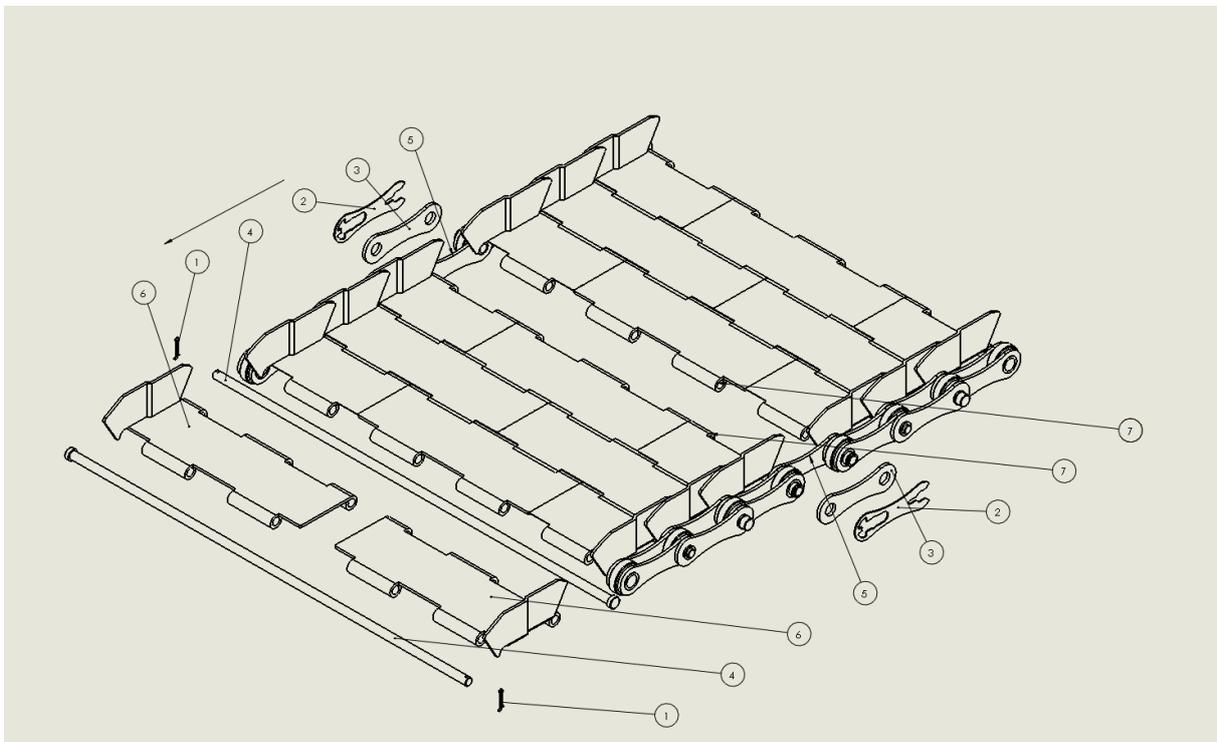


Figure 21 Step 1: Insert outer plate with pressed-in hollow pin

Step 1:

First insert the outer plates with pressed-in hollow pins from the inside out through the end links (inner links) on the hollow pin chain for the hinged steel belt to be connected.

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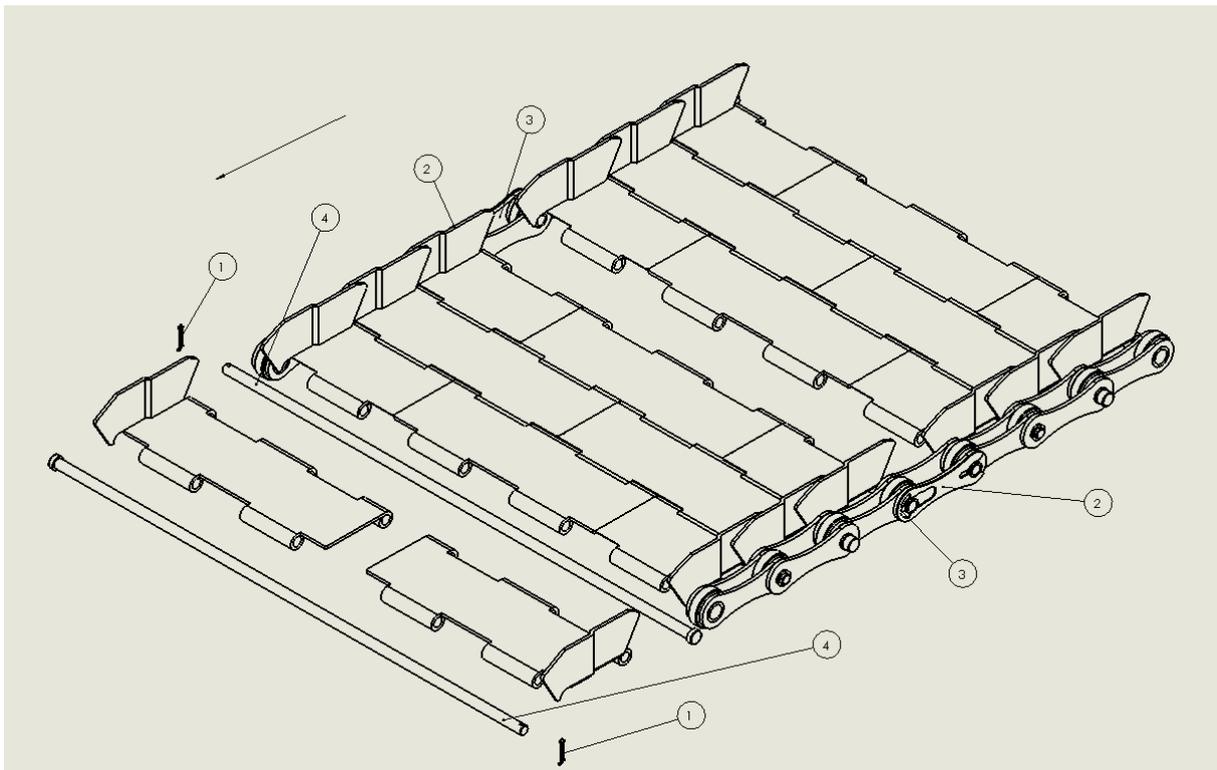


Figure 22 Step 2: Assemble outer plate and locking spring

Step 2:

Press the outer plate (3) onto the outer chain side on the previously assemble outer plate with pressed-in hollow pin (5).

The outer plates (3) must be pressed in until the recesses in the hollow pin, which are used to assemble the locking spring (2), are free.

Now run the locking spring (2) with the cut-outs over the outer plate with pressed-in hollow pin (5) and mount in the recesses in the hollow pin with a pair of pliers.

Ensure that the closed part of the locking spring (2) is mounted in the direction of conveyance.

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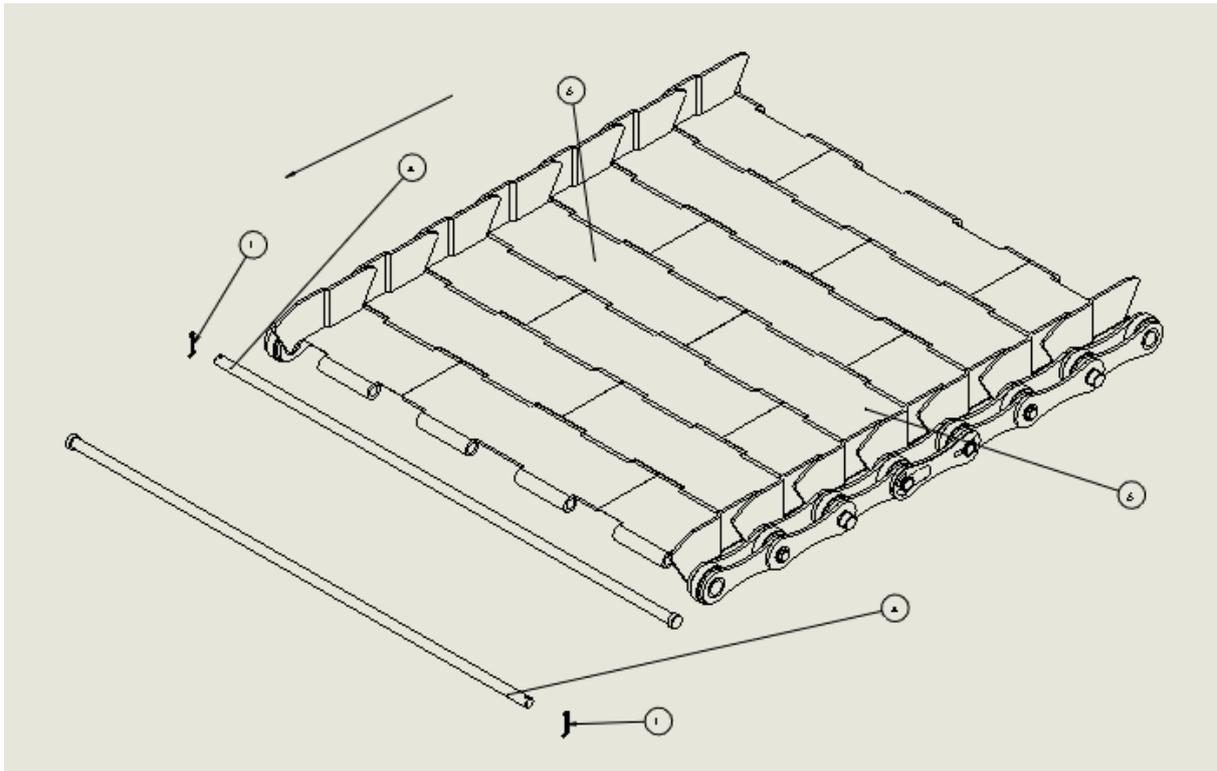


Figure 23 Step 3: Insert hinge components (6)

Step 3:

Insert the hinge components (6) between the ends to be connected and the assembled chain locks (2/3/5).

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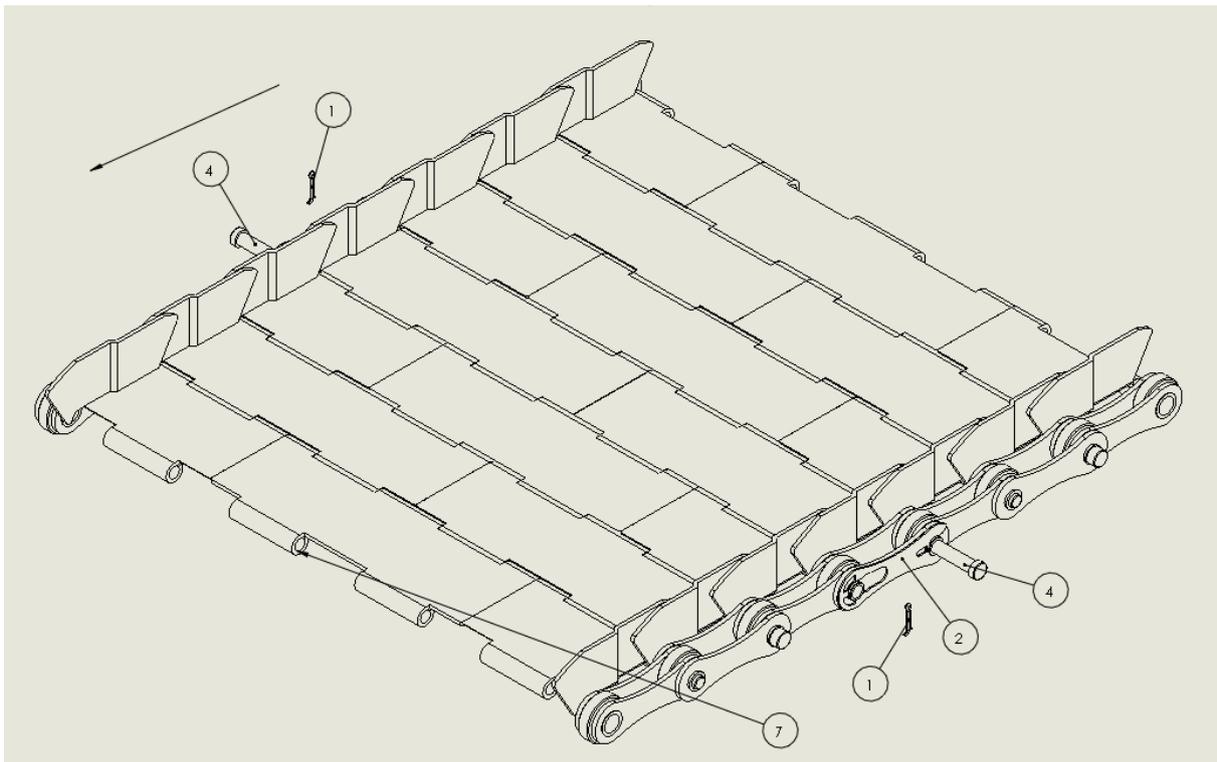


Figure 24 Step 4: Insert connection link pins

Step 4:

Insert the pins (4) through the hollow pins for the chain locks (5) and the hinge component eyes (7) into the connection link.

Care must be taken here to ensure that the pin heads are mounted alternately (see hinged steel belt).

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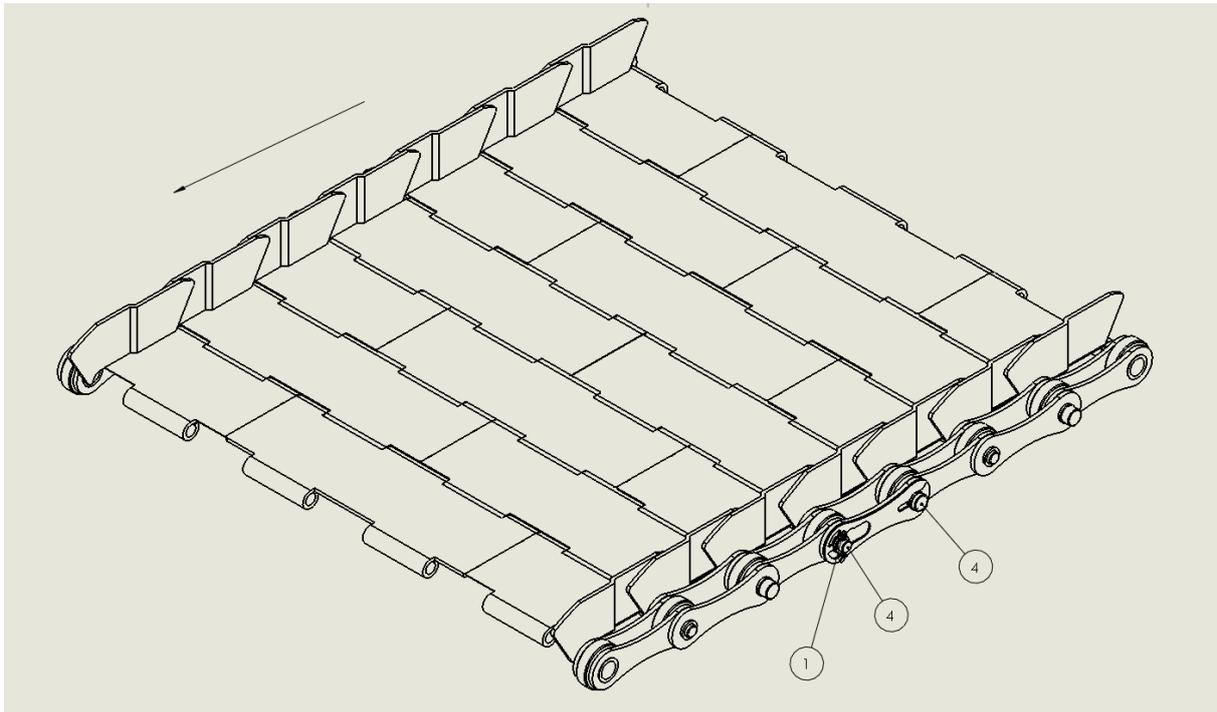


Figure 25 Step 5: Mount split pins

Step 5:
 Secure the pin ends with the split pins.

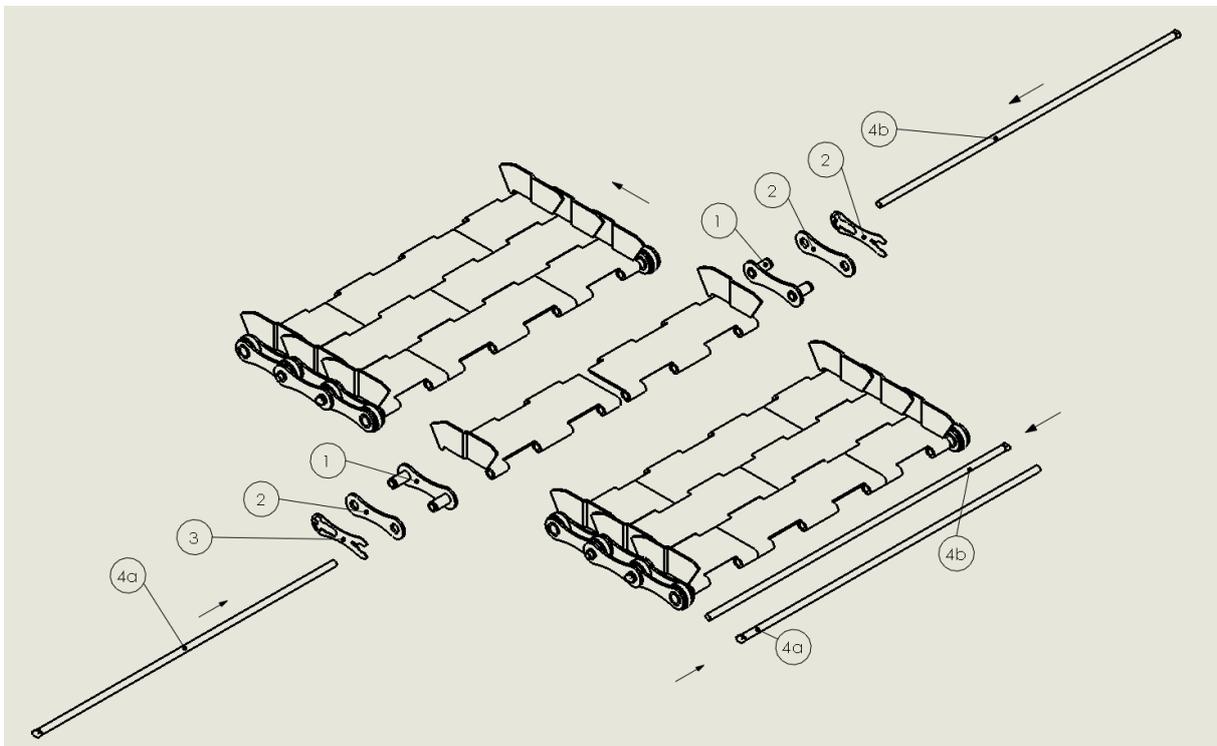


Figure 26 Hinged steel belt connection with spring steel pins (4a/4b)

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Adjusting the chain tension

Because the drive chains for the hinged steel belt become elongated by tensile forces and wear in the bearing areas during operation, they must be retensioned regularly.

The hinged steel belt with the drive chains should not be tensioned too tightly, as this will cause increased wear.

If the conveyor tensioning distance is insufficient, the hinged steel belt must be shortened as required.

If the wear is so far advanced that the function of the hinged steel belt is in question (e.g. the chain pitch has elongated to the extent that the chain tries to run on the sprocket), the hinged steel belt and drive wheels must be replaced.

To check the tension of the hinged steel belt, let the conveyor run back about 500 mm until a drive chain roller is perpendicular to the centre of the shaft. This tensions the hinged steel belt in the lower run and the chain sag is in the upper run, so the tension can be measured in the upper run.

Switch the hinged steel belt conveyor off and secure it against accidental startup.

Place a ruler about 400 mm in length on the chain rollers and check dimension X. The dimension X must be min 2 mm and max 5 mm.

$X < 2 \text{ mm}$ → The belt tension is too high.

$X > 5 \text{ mm}$ → The belt tension is too low.

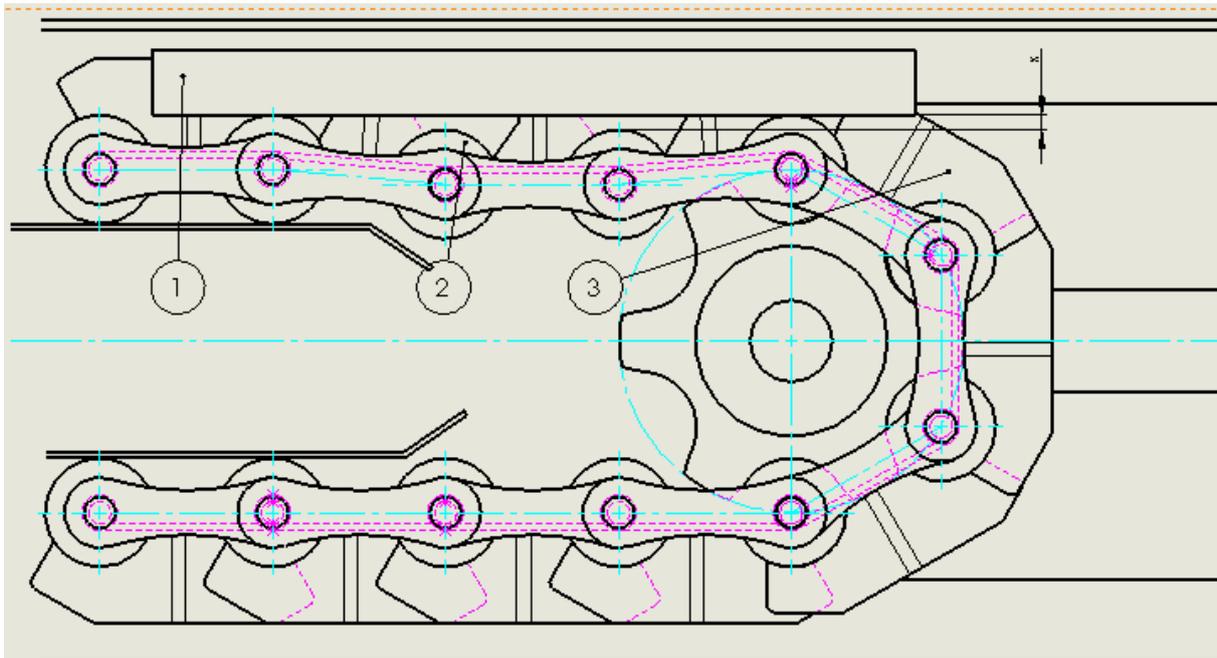


Figure 27 Adjusting the chain tension

Where

- 1 Ruler or profile bar
- 2 Roller
- 3 Side wings

And X represents the distance to be measured in the upper run.

Theoretical calculation of chain sag = 0.02 x centre of distance (chain pitch). Tensioning station distance at least 2 x chain pitch.

If the belt is too long or too short even though the belt tension is set to the minimum/maximum, the belt must be shortened or lengthened.

Checking chain or hinged steel belt elongation

$$\text{Chain elongation [\%]} = \frac{\text{Measured length [mm]}}{\text{Nominal length [mm]}} * 100\% - 100\%$$

where at least 6 links should be measured in the stretched state (light load, to ensure that chain play is not a factor). The chain elongation measurement should be carried out before lubrication. The length of the chain can also be checked using the rollers, in which case allowance must be made for the roller diameter in the calculation. The chain elongation must not be greater than 3%.

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Checking the alignment of the sprockets

The shafts are adjusted in parallel with spirit levels and laser distance measurement. In addition, the sprockets must be aligned. The goal of the check and adjustment is to ensure that the hinged steel belt can float between the sprockets on both the drive and output side, in order to avoid increased wear.

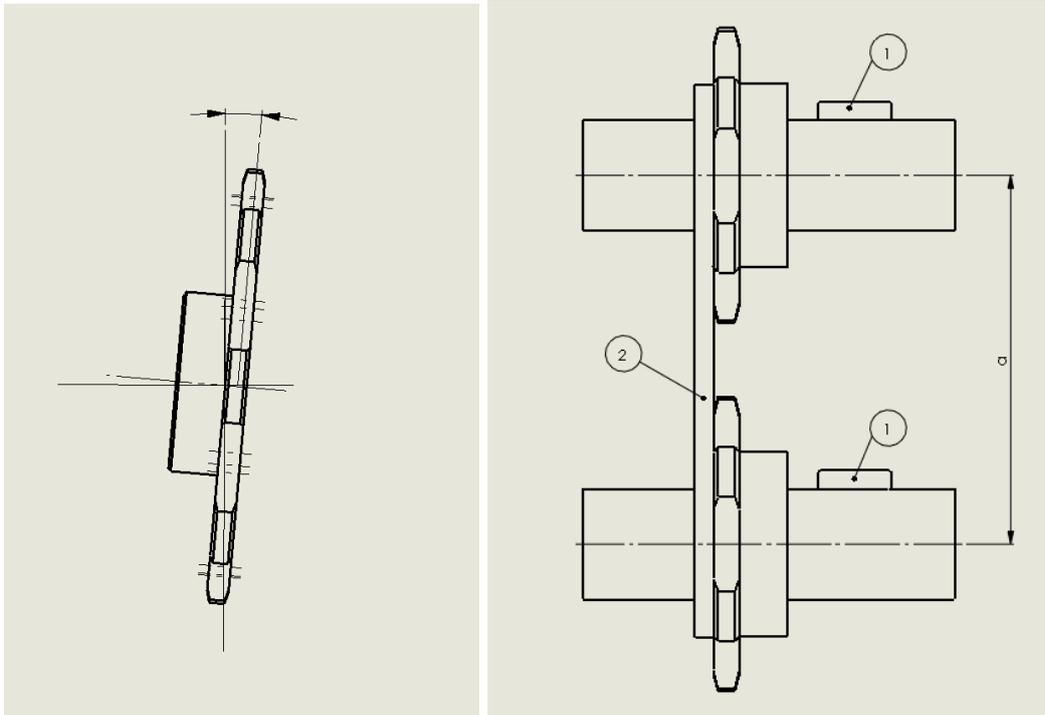


Figure 28 Aligning the sprockets and parallel installation of the shafts

Where

- 1 Spirit level and
- 2 Edge ruler.

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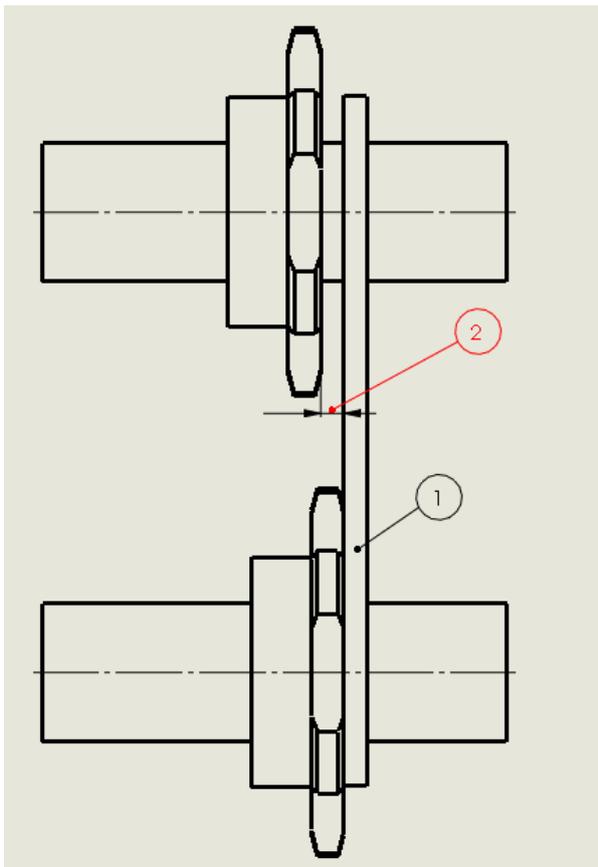


Figure 29 Measuring the alignment of the sprockets with a ruler or laser

where

- 1 Edge ruler and
- 2 Gap

Checking the chain run

The chain run check shows whether the hinged steel belt chains are optimally adjusted. Because several chains are engaged together on the hinged steel belt, this must be taken into account.

The sprockets must be installed at a distance of the specified chain centre-to-centre distance, as otherwise the protruding pins may be further out than may have been intended in the design. In addition, conditions such as strong thermal expansion for example may strain pins or compress hinge plates, which can lead to damage.

Check the following at a minimum:

- Do each of the chains have lateral play on the sprockets on both sides?
- Are the chains bent in one direction before or after the sprocket?
- When running, are the chains always on the same side on the sprocket and not floating from one side to the other?
- Are the chains running onto the sprocket?
- Is the chain skipping the sprocket?
- Is the belt being pulled askew as a result of excessive shaft torsion or incorrect assembly of the belt?
- Do the belt's chains have play towards the pin ends and belt?
- Are there chain links or hinged belt links that are stiff due to tension?

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- Are there weld beads or other materials adhering to the slide rails?
- Are the slide rail transitions even?
- Are the slide rails too heavily run in, so that the belt is forcibly guided?
- Are there inlet slopes or inlet radii installed at the beginning and end of the slide rails?
- For baking oven belts, the chain rollers should not rest on the entire length and should not be guided on rails
- Is the running surface of the roller completely blank during continuous operation?

If any of these tests is not passed, the cause must be clarified and remedied immediately.

Assessing chain lubrication

If the chain tension is too high, it gives rise to a high level of wear because the lubricating film cannot be re-established in the almost unloaded state and therefore runs dry quickly, or the chain link can lose the joint function.

When assessing whether chain lubrication is sufficient, there are indirect and direct tests that are possible for one or the other application:

- **Noise:** If the noise level of the chain increases, a fall in the lubricating effect can be assumed
- **Motor load bearing capacity:** If the motor power consumption increases, this is also a sign that chain lubrication is insufficient. The reverse also applies: If power consumption decreases immediately after lubrication, the lubrication was not sufficient
- **Turning the roller:** If turning the roller results in a scratching noise and is no longer running smoothly, lubrication is no longer sufficient (only suitable for chain experts)
- **Disassemble a locking spring link and assess whether there is still a lubricating film.** This is the ideal type of inspection, because lubrication is assessed directly.

Inspecting the chain components

For the chain, checking the following components can be helpful:

- Are there cracked or missing plates? The inner plate is most likely to crack
- Are there scratches, blank points or abrasions on the plate/chain pin/roller?
- Are chain bushings or pins twisted towards the chain plate?
- Are there broken chain bushings or pins?

If any of these tests is not passed, the cause must be clarified and remedied immediately.

Inspecting the sprockets

The following should be checked for the sprockets:

- Are there cracked or missing chain teeth?
- Are there visible scratches, blank points or abrasions on the tooth surfaces or tooth flanks?
- Are sprockets still fixed on the pin?

If any of these tests is not passed, the cause must be clarified and remedied immediately.

Cleaning

Depending on the application, the entire hinged steel belt must be cleaned. The sprockets and slide rails must also be cleaned. For conveyors, there are also parts between the upper and lower runs to be removed from time to time.

Cleaning with petroleum or similar agents is not advisable, as it does not fully evaporate and will prevent lubrication of the components.

After cleaning, wear and corrosion protection may need to be applied.

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Documentation of operation, maintenance and repairs

In the event of damage, it is always important to clarify the cause. This is in order to achieve improved wear behaviour as a result of the operating conditions and maintenance and inspection intervals preventing further damage from occurring.

Use of the entire system and maintenance and inspection must therefore be documented and archived clearly and transparently. The following points should be included:

- Power consumption
- Current operating parameters (belt load, environmental parameters such as temperature/humidity/etc.)
- Operating mode (reversing / continuous operation)
- Accumulated operating time
- Lubrication information (frequency/amount)
- Cleaning information (frequency/type)
- Unusual incidents during operation (reason for crash, downtime etc.)
- Repairs (type, spare parts)
- Date and employee who carried out the work for any queries

4.2 Inserting the hinged steel belt

Having set out each of the required steps, the insertion of the belt into the conveyor will now be explained.

For fast and low-risk insertion, the shipped hinged steel belt is usually inserted into a specific assembly fixture. This fixture is very conveyor-specific, and must therefore be made by the conveyor manufacturer.

If there is no such fixture in place, belt assembly can also be done without it, albeit it with a little more caution.

Before installation, check the conveyor and adjust if necessary

1. Correct assembly of the drive/deflection shafts
2. Alignment of the sprockets
3. Horizontal installation of the drive/deflection shafts
4. Entire structure of the conveyor (see section titled Requirements for the conveyor)
5. Free movement of the chains and hinged steel belt links
6. The installation can be carried out as shown below
7. The connection link can now be assembled
8. The chain tension is then adjusted

When installing baking ovens, please note that the surface of the hinged steel belt must be cleaned with a solvent after installing the belts and before putting the oven into operation to ensure that the anti-corrosion oil is removed.

For conveyors with spring assemblies or cylinders, the calculated pre-tension guide value must be set and checked during assembly of the hinged steel belt.

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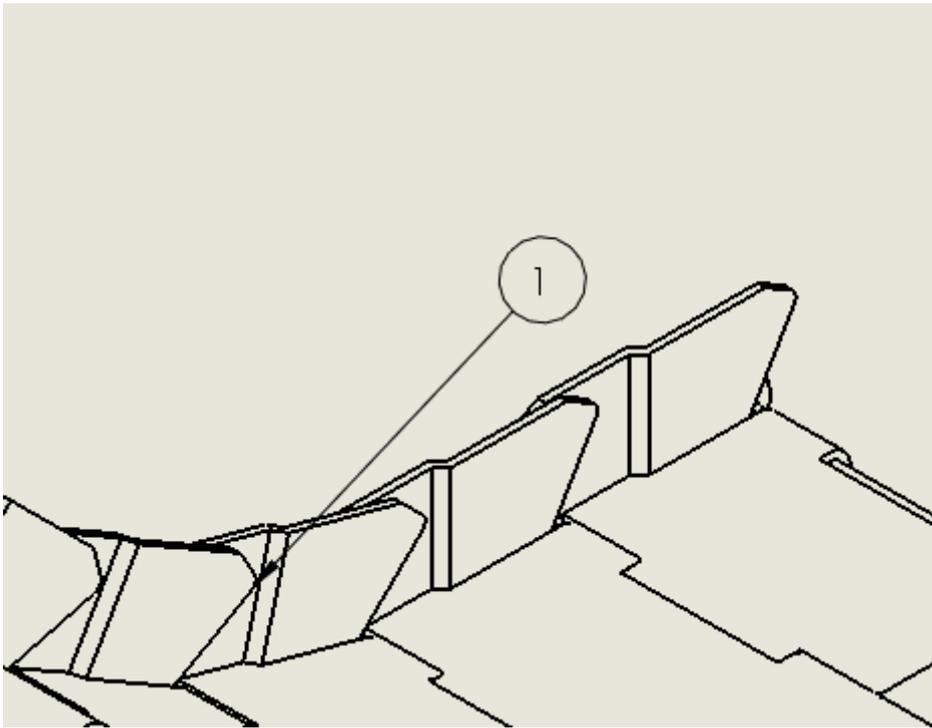


Figure 30 Collision point 1 on falling below the minimum curve radius

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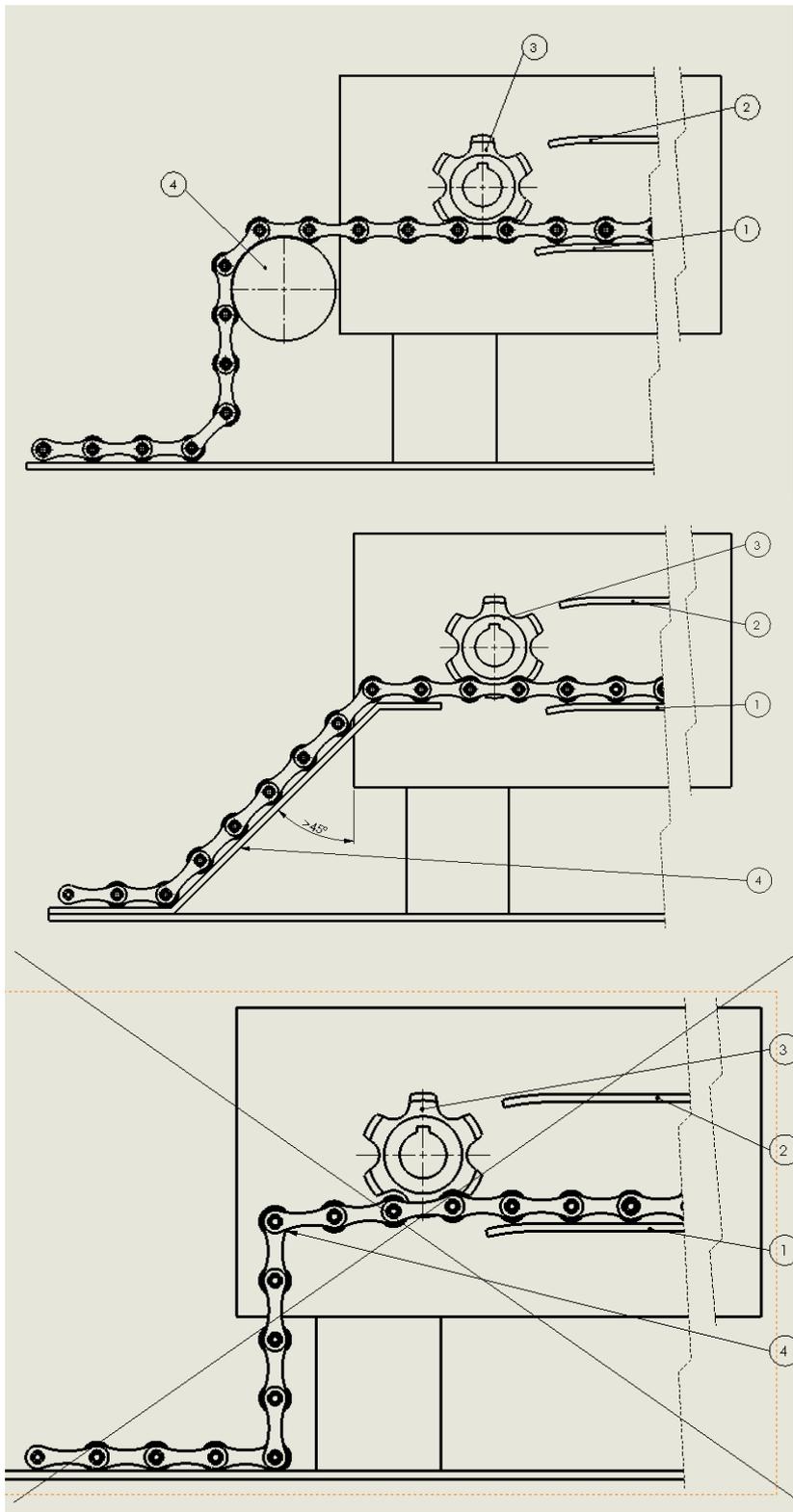


Figure 31 Suggested installation for a hinged steel belt, feeding of the belt

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4.3 Test run

After insertion of the belt comes the first major test, which must be carried out with great care and caution.

Procedure for first test (without loading, at room temperature)

1. Drive and free movement of the shafts has been tested in advance and corrected as required
2. Check the installation direction of the belt. Direction of conveyance of the belt = direction of conveyance of the conveyor (see enclosed worksheet in the appendix)
3. Check to ensure that the connection link or links are assembled correctly
4. Check the adjustment of chain tension
5. Check that the hinged steel belt and chain cannot drag or catch
6. Check the chain lubrication or lubrication equipment for function
7. Switch on the drive, selecting a low speed to begin with

If problems occur, they are usually caused by the belts and belt deflections, so it is advisable to keep a close eye on these areas.

1. Keep an ear out for noises that may be due to lack of lubrication or poor transitions in the guide or belt support
2. Pay attention to vibration of the chain and the system as a whole
3. There should be no areas with strained hinged steel belts (e.g. hoods) or stiff links
4. It is important to ensure that the belt does not run lopsided on one side, and instead “floats” between the sprockets

The stresses in the tests are then increased:

1. Belt speed
2. Environmental factors (e.g. the increase in oven temperature in baking ovens)
3. Belt loading

If the outcome of the testing is positive, it can be assumed for the time being that operation of the hinged steel belt without any great risk of damage is possible.

4.4 First phase of continuous operation

After the initial running-in of the belt with the chain and the sprockets, slide rails etc., the parts are retracted in succession and the belt is elongated. This elongation must be corrected in the initial period by adjusting the chain tension to ensure that the belt is not too loose, in the worst case causing skipping of the chain on the sprocket.

In this phase, it is also important to monitor chain lubrication and define the lubrication interval.

4.5 Continuous operation

During continuous operation, the system is usually stable, which means that the elongation occurring in the first phase does not continue, with the belt length instead remaining stable. Effects caused by process variations during application, usually when switching on or off, are of course not covered by this statement.

4.6 Storage and transport

When storing and transporting the hinged steel belt, ensure that it is dry and protected from environmental influences (e.g. dust, heat, moisture) and damage.

It may be a good idea to preserve the components with oil, wrap them in plastic with desiccant to minimise condensate and include the delivery note for each part.

If the belts are stored for an extended period (longer than 1 year), the lubrication and the links must be checked for free movement, and it must be restored if possible.

Any damage must be repaired before use or the parts replaced (see also section titled Checking for storage and transport damage).

4.7 Replacing the hinged steel belt

If the belt, chain or sprocket need to be replaced, all parts should generally be replaced together. Otherwise sprockets run in through the old chain, for example, will cause the new chain to wear out faster. The same applies to the slide rails and belt support.

Use only original spare parts. Only original spare parts are fully compatible with each other and guarantee the required functionality. No warranty can be provided for damage caused by the use of non-original parts.

When removing the hinged steel belt, note the following:

Adjustment of the components is the same as with a new belt. See previous section.

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5 Maintenance plan, preventive maintenance

To ensure full functionality of the hinged steel belts, the following points should be noted in each phase of the service life.

This maintenance and servicing work should also be documented (see section titled Documentation of operation...).

Before ordering

| Description | Inspection and maintenance | Interval |
|-------------------|-------------------------------|-----------|
| Chain lubrication | Determine initial lubrication | Once only |

Initial assembly / test run (see section above)

In the first phase, the following work is also required in addition to the points set out for continuous operation

| Description | Inspection and maintenance | Interval |
|-------------------|---|--|
| Chain lubrication | Check chain lubrication after week 6, frequency of lubrication, determine the frequency of inspection and the amount of lubricant | 1st week after start of operation daily, week 2 to 6 twice per week |
| Chain tension | If chain elongation is above 3%, the hinged steel belt and sprockets should be replaced. | 1st week after start of operation daily, week 2 to 6 twice per week |

In continuous operation

| Description | Inspection and maintenance | Interval |
|------------------------------------|--|----------------------------------|
| Temperature | An operating temperature of max 300 °C must not be exceeded. | |
| | At temperatures below 0 °C, the special precautionary measures that may be required to prevent freezing or entry of parts between the chain links must be taken, to ensure that they are not “demolished” by the sprockets perpendicular to the direction of conveyance. | |
| Startup of the hinged steel belt | The tolerance for the angularity of the guide track to the drive chain should not exceed $\pm 3^\circ$. Drive and deflection pins must be aligned at right angles to the system. | |
| Chain tension and chain elongation | Chain sag = 0.02 x centre of distance. Tensioning station distance at least 1.5 x chain pitch. If chain elongation is above 3%, the hinged steel belt and sprockets should be replaced. | Twice per month |
| Chain lubrication | Lubrication and inspection of quantity and frequency depend on the operating conditions. | Twice per month or as determined |
| | | |

Technical Guide to Hinged Steel Belts

| Description | Inspection and maintenance | Interval |
|-------------------|---|----------|
| Guide chains | Check for function, cleanliness and lubrication. | Monthly |
| | Damaged chain links | |
| | Heavily worn rollers | |
| Hinged steel belt | Check for function and cleanliness (replace any damaged hinge components). | Monthly |
| | Hinge component hoods, chain links that are no longer running, broken pins, abraded side wings / hinge components, elongated hinge eyes, severely bent hinge plates see pitch | |
| | Heavily worn hinge eyes | |
| | Pins protruding excessively to the right/left | |
| | Heavily run in wear strips / slide rails | |
| | When unloaded, the belt does not run back and forth between the sprockets. | |
| | Check whether conveyed parts are accumulating between the upper run and lower run | |
| | Increased noise level during the run | |
| | Abraded pin heads | |
| | Side wings abraded – cover may be chafing. | |
| | Parts jammed in side wings | |
| | Side wings overstretched upwards during assembly, note minimum deflection radius | |
| | Radii overstretched downwards, limited opening of hinge eyes. | |
| | For hinged steel belts with semi-circular side wings (pitch 38.1 stainless steel, pitch 63 heavy-duty and pitch 100), check the interfering contours (guide rail and sprocket). | |
| | All maintenance and servicing work must be clearly documented. | |
| | Inspection of the side wing and carrier weld seams | |
| | Damage to carriers | |
| | Cleaning of the belt / chain / sprockets / slide rails | |

6 Troubleshooting, possible causes and remedies

| | Problem | Where is the problem occurring? | Cause | Prevention / repair |
|-----|-------------------|--|---|--|
| 1. | Unusual noises | Chain - slide rail | Soiling | Clean |
| 2. | | Chain - sprocket | Pairing does not fit after installation | Replace sprocket or chain |
| 3. | | | Too much wear | Replace sprocket or chain |
| 4. | | | | Replace sprocket with hardened version |
| 5. | | Sprocket - housing | Housing catching | Secure and adjust housing |
| 6. | | Chain | Overload | Reduce load |
| 7. | | | Too little lubrication | Increase lubrication or lubrication frequency |
| 8. | | | Rollers broken or missing | Replace hinged steel belt and adjust maintenance intervals |
| 9. | | | Lubrication not effective | Different lubricant and/or increase lubrication interval |
| 10. | | Chain - housing | Housing catching | Secure and adjust housing |
| 11. | | Hinged steel belt | Overload | Reduce load |
| 12. | | | Hinge eyes are raised | Replace section |
| 13. | | Hinged steel belt - housing | Housing catching | Secure and adjust housing |
| 14. | Strong vibrations | Hinged steel belt with chain | Load fluctuations | Change drive or drive control system |
| 15. | | | System resonance | Change belt speed |
| 16. | | | | Change chain tension |
| 17. | | | | Change number of teeth for sprockets |
| 18. | | Sprockets | Sprockets out of position | Adjust shafts or sprockets or replace |
| 19. | | | Sprockets with impact | Replace |
| 20. | | | Number of teeth too low | Replace |
| 21. | | Slide rail | Transition to sprocket too high | Adjust arrangement |
| 22. | | Chain | Roller(s) broken | Replace |
| 23. | Jolting | Chain - sprocket - slide rails | Particles between the components | Clean |
| 24. | | Chain | Excessive chain sag at lower run | Increase chain tension or support |
| 25. | | | Insufficient lubrication | Shorten lubrication interval |

Technical Guide to Hinged Steel Belts

| | Problem | Where is the problem occurring? | Cause | Prevention / repair |
|-----|----------------------------|--|---|--|
| 26. | | Sprocket | Wear on sprocket, chain not running properly | Replace sprocket, check belt tension |
| 27. | Chain wrapping on sprocket | Chain - sprocket | Elongation due to crash | Check elongation of all chain links / replace |
| 28. | | | Elongation due to chain wear | Check elongation of all chain links, shorten inspection interval, adjust chain tension |
| 29. | | | Wear of sprocket teeth | Check elongation of all chain links, shorten inspection interval, replace sprockets and hinged steel belt if necessary |
| 30. | Excessive abrasion | Chain outer plates | Cover catching | Secure and adjust cover, replace any affected chain plates |
| 31. | | Chain inner plates | Shafts not parallel, sprockets not aligned | Re-align shafts and sprockets |
| 32. | | Sprocket | Cover catching | Secure and adjust cover, replace any affected |
| 33. | | Sprocket on side of chain teeth | Shafts not parallel, sprockets not aligned | Re-align shafts and sprockets |
| 34. | | Sprocket - tooth head | Chain elongation | |
| 35. | | | Toothing error | |
| 36. | | Sprocket - tooth flanks | Material strength too low | Replace with hardened sprockets |
| 37. | | Hinge eyes down | Belt load too high | Reduce belt load or replace with stronger belt, replace any hinges affected |
| 38. | | | Support not smooth enough | Smooth support, replace any hinges affected |
| 39. | | Side wings | Cover catching | Secure and adjust cover, align side wings, replace any affected hinges |
| 40. | | | Side wing bent by conveyed material | Secure and adjust cover, align side wings, replace any affected hinges |
| 41. | | | Side wing overstretched upwards during assembly | Align, replace any hinges affected |

Technical Guide to Hinged Steel Belts

| | Problem | Where is the problem occurring? | Cause | Prevention / repair |
|-----|---------------------------------|--|--|---|
| 42. | | | Side wing damaged during transport | Align, replace any hinges affected |
| 43. | Rust | Hinge plates | Operation in corrosive environment | Replace any hinges affected |
| 44. | | Chain | Operation in corrosive environment | Improve cover / use improved lubricant / replace chain with different materials |
| 45. | | | Lack of lubrication | Shorten lubrication interval, replace any hinges affected |
| 46. | Chain plates breaking | Chain plates | Overload due to load impact | Replace with stronger chain |
| 47. | | | Defective chain | Replace with correct chain |
| 48. | Chain break | | Brittle fracture | Prevent one-off overload, replace hinged steel belt |
| 49. | | | Fatigue fracture | Reduce continuous overload and replace hinged steel belt and/or replace with stronger hinged steel belt |
| 50. | Elongation of chain plate bores | | Continuous overload | Reduce continuous overload and replace hinged steel belt and/or replace with stronger hinged steel belt |
| 51. | Chain plates falling off | | Overload of chain in axial direction (demolition due to freezing or similar) | Change design of sprocket / change hollow pin riveting / replace with stronger chain |
| 52. | | | Chain run is not correct | Adjust sprockets, replace any affected |
| 53. | Chain bushing / roller broken | | Occurs rarely | Send to us for analysis |
| 54. | Chain links stiff | | Lack of lubrication | Shorten lubrication interval |
| 55. | Hinge plates uneven | Hinge plates | Hinge eyes raised due crash, overload or similar. | Replace affected hinges, check chain elongation along entire chain. |
| 56. | Other problems | | | Please consult us |
| 57. | Chain jumping over | Chain | Chain tension not correctly set | Adjust chain tension, measure chain elongation along entire chain, replace hinged steel belt if necessary |

Technical Guide to Hinged Steel Belts

| | Problem | Where is the problem occurring? | Cause | Prevention / repair |
|-----|----------------|--|------------------------------------|---|
| 58. | | | Chain elongation due to chain wear | Replace hinged steel belt |
| 59. | | | Overloaded chain | Reduce load (usually one-off event, e.g. jammed part), replace hinged steel belt, otherwise review design |
| 60. | Broken chain | Drive motor | Overloaded chain | Reduce load (usually one-off event, e.g. jammed part), install overload protection, otherwise review design |
| 61. | | Chain | Insufficient lubrication | Shorten lubrication interval and adjust quantity |

Replacement of individual parts is always possible. If the number of parts affected is high, full replacement of for example the hinged steel belt including the chain makes sense. In this case, it can be assumed that the whole belt is affected and it is only a matter of time before all parts fail, even though the problem may have been remedied.

7 Support

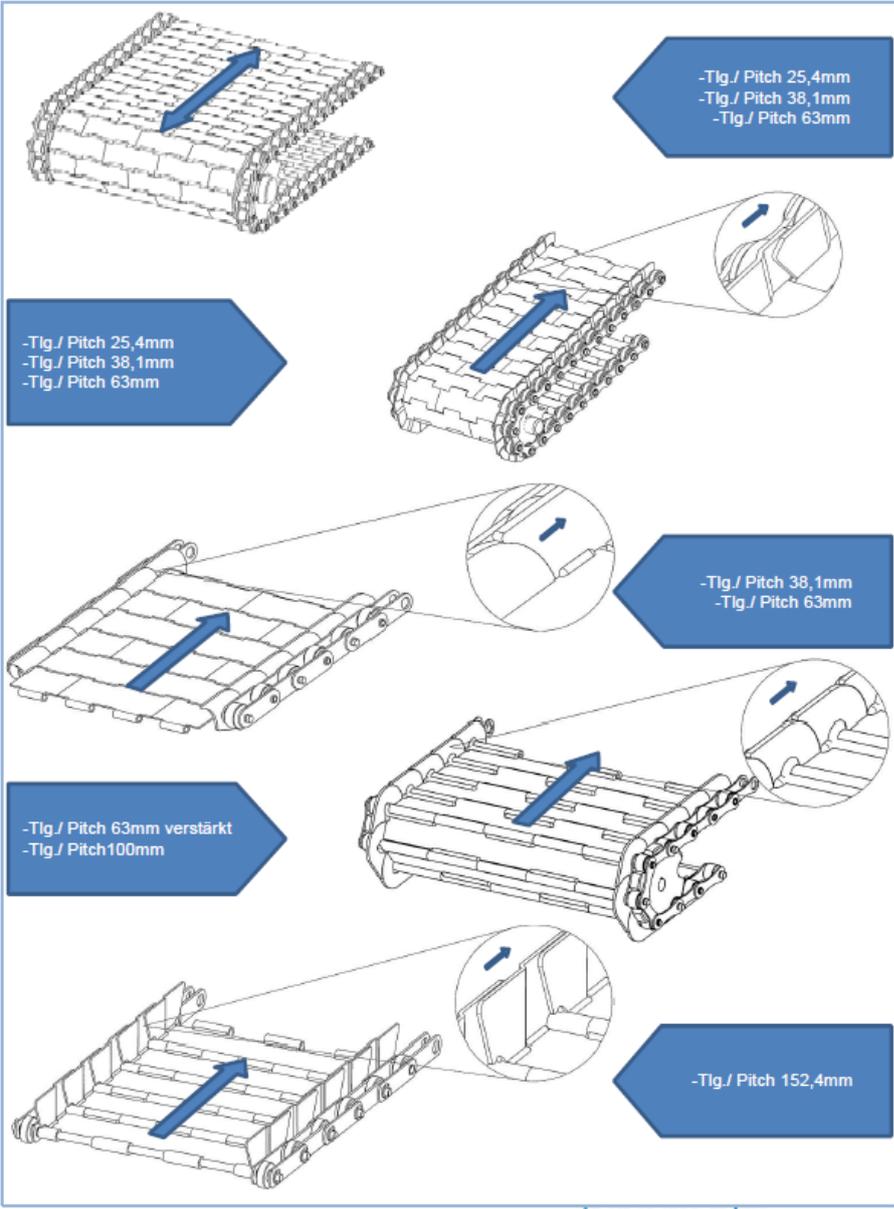
If you need assistance, feel free to contact us through your local ALLERT sales representative, who can be found at

<http://www.allert-oberndorf.eu/en/service/vertrieb-ansprechpartner/>

8 Appendix

8.1 Direction of conveyance information sheet

| | | |
|--|---|---|
|  Befestigungstechnik Spezial-Förderketten | Förderrichtung Transporting direction | Nr.: F006 Revision-Nr.: 0 Seite 1 von 1 |
|--|---|---|



The diagrams illustrate various hinged steel belt configurations with their respective transport directions and pitch specifications:

- Top-left:** Belt with staggered links. Callout: -Tlg./ Pitch 25,4mm, -Tlg./ Pitch 38,1mm, -Tlg./ Pitch 63mm.
- Middle-left:** Belt with staggered links. Callout: -Tlg./ Pitch 25,4mm, -Tlg./ Pitch 38,1mm, -Tlg./ Pitch 63mm.
- Middle-right:** Belt with staggered links. Callout: -Tlg./ Pitch 38,1mm, -Tlg./ Pitch 63mm.
- Bottom-left:** Belt with staggered links. Callout: -Tlg./ Pitch 63mm verstärkt, -Tlg./ Pitch 100mm.
- Bottom-right:** Belt with wide links. Callout: -Tlg./ Pitch 152,4mm.

Kurt Allert GmbH & Co. KG Telefon: +49 (0) 74 23-87 70-0
 Aulhausen 38 Telefax Zentrale: +49 (0) 74 23-87 70-87
 D-78727 Obendorf a.N.

Figure 32 Leaflet F006 included in delivery