



Maintenance notes: Ensure that roller chains are properly tensioned

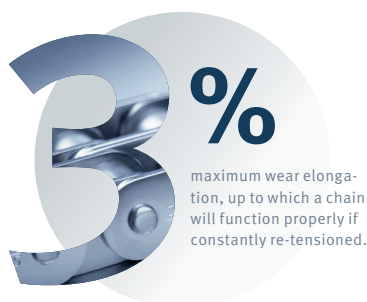
Ensuring the correct maintenance of chain drives **reduces the risk of downtimes** and **prolongs chain service life**, so regular visual inspections should be carried out. Particular attention should be paid to wear elongation, tension, lubrication and visible signs of wear.



Optimum slack and correct tensioning compensate for wear elongation

The technical run-in and wear characteristics of roller chains mean they are subject to continuous stretching (elongation). A chain will run properly if wear elongation does not exceed 3 %, depending on the application, and provided that it is constantly re-tensioned. If it is not, the slack thread will sag further and further, resulting in uneven running, higher wear and increased noise.

This applies especially to chains with low-maintenance bearings, because sintered materials and plastics react more rapidly to high loads and are subject to faster wear.



NOTE

Controlled re-tensioning of the chains has a very positive effect on chain life. Over-tensioning should be avoided just as much as excessive slack, in order to prevent an undue increase of bearing pressure. **Friction marks on the chain rollers are an indication that tension is too high.**

The results of incorrect chain tensioning

Correct tensioning and the use of chain guides reduce vibration and prolong chain service life.

What does “correct” chain tensioning mean in practice?

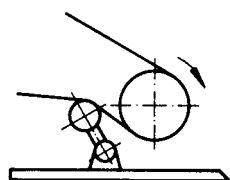
- For sprockets with a low number of teeth, the arc of contact of the chain around the sprocket should be as large as possible to ensure that the maximum number of teeth are in mesh.
- For sprockets with a high number of teeth ($z > 21$), the chain can be tensioned on the lower taut span side, away from the sprocket. This will reduce vibrations and, since the chain does not have to be tensioned against the force of gravity, less tensioning force is required.

If the slack span is too small, chain tension is too high. Increased pressure on the bearing causes strong friction, which can result in faster wear elongation. As well as the chain itself, other machine components will be also be subjected to higher loads, which will in turn shorten their service life.

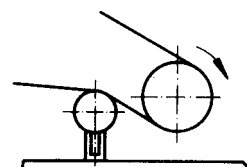
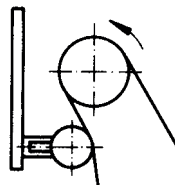
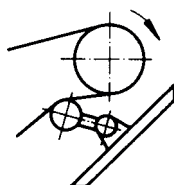
If the slack span is too large, chain tension is too low. This will not only result in higher noise emissions, but also in an increased risk of the chain jumping off the sprocket and breaking. Considerable transverse oscillations can occur in long, loose chain sections as a result of the superimposed pulse and natural frequencies of the drive.

NOTE

Maintaining the correct value for chain slack requires care, attention and regular monitoring. Incorrect chain tensioning inevitably leads to increased wear. The chain may also jump off the sprocket and cause further consequential damage.



Correct positioning
of chain tensioner



Correct chain drive layout

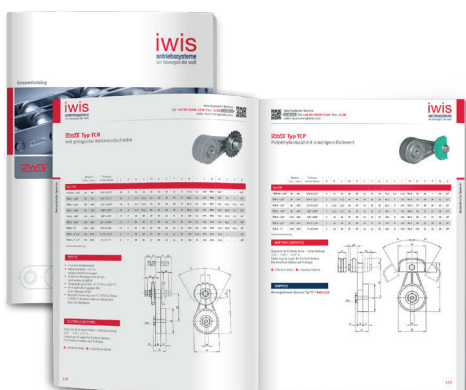
When designing a chain drive it is very often impossible to realize the theoretically best arrangement of the sprockets, which includes the direction of rotation. However, **horizontal arrangement of the shafts** is preferable, where the driven/taut span should be at the top and the slack span below.

The sag of the slack span should be approx. **1 % of the centre distance**. The mean centre distance can be assumed to be 30 – 60 pitches p .

Automatic chain tensioners

...compensate for chain elongation in machines and conveyor systems, thereby helping to prolong the service life of the chains fitted. iwis chain tensioners are made from high-quality materials. Different versions are available, depending on application.

For more detailed information, see our catalog catalog JWIS Precision chain systems: iwis.com/catalogs



Correct positioning of chain tensioner

The correct positioning of the chain tensioner is also important in determining wear elongation and service life of the chain drive.

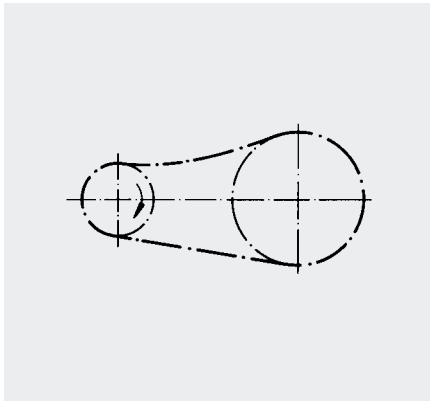
- **For sprockets with a low number of teeth** ($z_1 \leq 21$) the tensioner should be positioned to give the chain a larger arc of contact α ($\alpha \geq 120^\circ$) around the sprocket, so that as many sprocket teeth as possible can mesh with the chain.
- **For sprockets with a high number of teeth** ($z > 21$) the chain can be tensioned away from the sprocket, with an arc of contact value $\alpha \geq 90^\circ$. This will reduce vibrations and, since the chain does not have to be tensioned against the force of gravity, less tensioning force is required.
- With additional constructive measures, smaller wrap angles can also be achieved. (e.g. with guide rails, chain supports)

NOTE

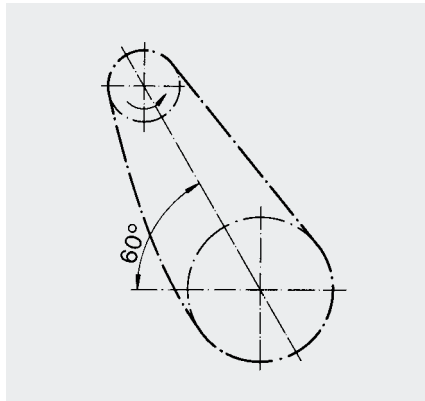
The tensioner should always be mounted on the slack side of the drive. If the driven chain side is at the bottom, only a short centre distance and minimum slack are permitted. In such cases, iwis push-pull chains are a possible alternative – contact us for more information!



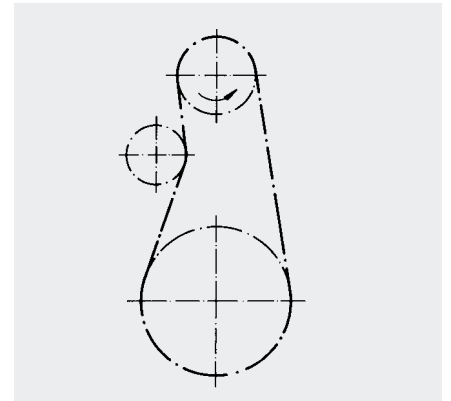
Other possible drive arrangements



Slack side at the top of the drive is only permissible with short centre distances and minimum slack.

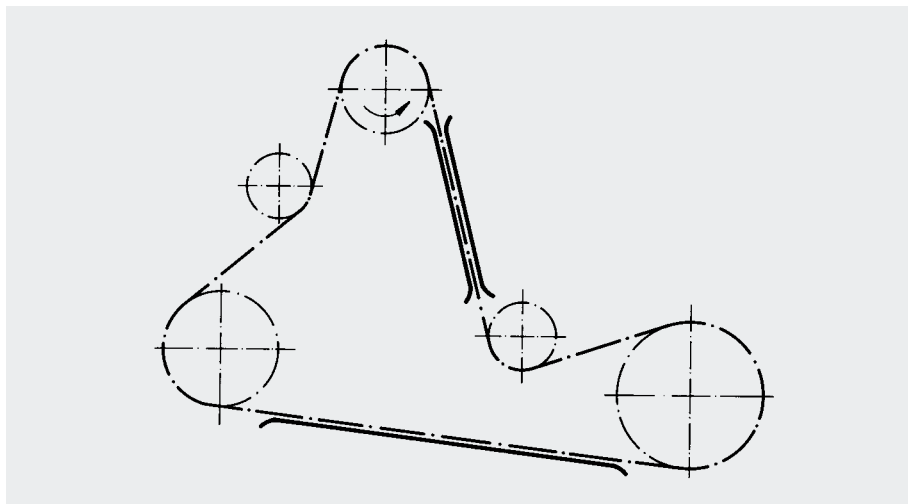


With drives arranged horizontally i.e. at an angle of at least 60°, no tensioners or guides are necessary.

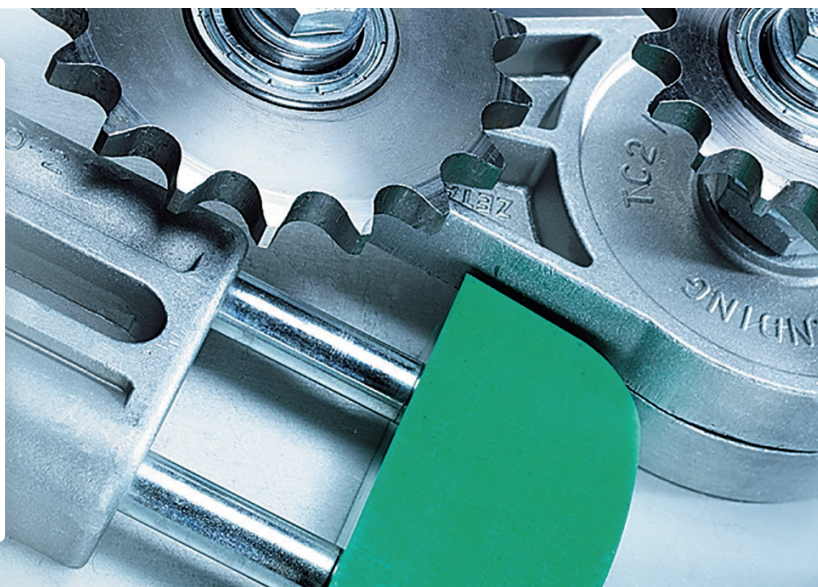
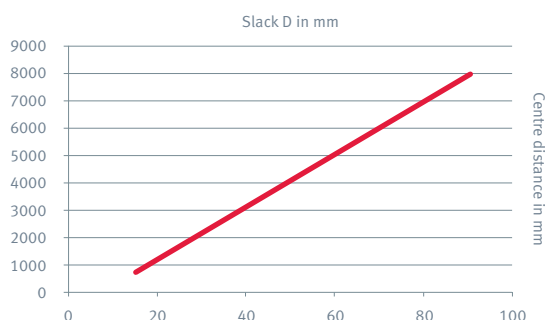


A chain that runs vertically should be fitted with a tensioning roller or blade.

Idler wheels can be used to adapt a drive to run in a restricted space. Where there are large centre distances, chain guides can be used to support loose, free-running sections of the chain strands.



The diagram below shows the relationship between centre distance and chain slack



In practice: determining the correct slack

Whereas belt drives rely on friction to transmit power, the sprocket teeth in a chain drive mesh with the gaps between the individual links. This form-locking connection allows strong forces to be transmitted with a low initial load, and also has a positive effect on the wear characteristics of other machine components, such as bearings.

Approx. 5% of the actual operating chain load can be used as a guideline for the **initial load** of a chain. If the operating load is unknown, 1% of the chain breaking strength stated in the iwiss catalogue (minimum value according to DIN or ISO) can be used as an alternative in most cases.

There are a few individual applications which require a chain drive with a high initial load, and where it is important to take initial load forces into account when configuring the chain. In such cases, please feel free to contact our Chain Engineering Team for advice, or design and configure your own chain drive by downloading our calculation program "Induket" at www.iwis.com.

In the case of chains running in parallel, both strands must be tensioned equally. The best solution is a common shaft for the right and left sprockets. If no automatic chain tensioning device is fitted, the chain must be adjusted by hand, either

- **Variant 1:** By adjusting the centre distance or
- **Variant 2:** In the case of long drives, by shortening the chain by removing individual links, provided that wear elongation is still relatively low.

CAUTION

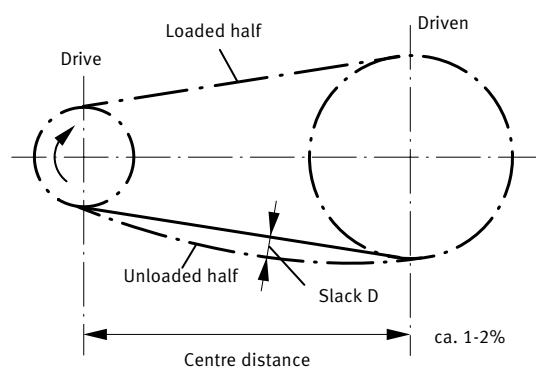
If cranked links (also known as "half links") are fitted, please note that this will reduce the static and dynamic strength of the chain. The breaking strength of the chain may be reduced by approx. 20 %.

Practical tip

The slack in drives running horizontally should be between 1 – 2 % of the length of the centre distance. To measure the slack, pull the loose thread taut with your fingers and measure the distance (slack D).

NOTE

When threaded bolts or screws are used, the condition of the thread must be monitored closely. Greased threads result in a higher initial load when tightening torque remains constant.





In theory: calculating the correct slack

Regardless of the practical tips, individual calculation of chain tension is recommended wherever possible. **The necessary slack for optimum tension in a chain drive is calculated as follows:**

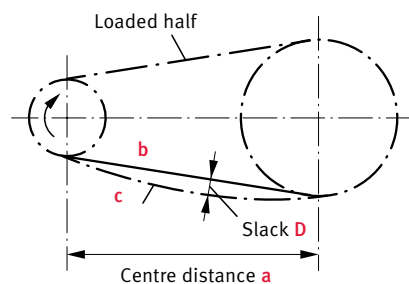
The contact points of the chain in the sprocket give the direct distance b . When the chain thread is pulled taut, this measurement approximately corresponds to the centre distance.

CALCULATION

According to the drawing: $c = b + \text{chain elongation}^*$
Assuming that $b \approx a$, the result is: $c = a + \text{chain elongation}^*$

$$\text{Slack } D = \frac{\sqrt{3 \cdot c^2 - 3 \cdot a^2}}{4}$$

* Elongation of the entire chain

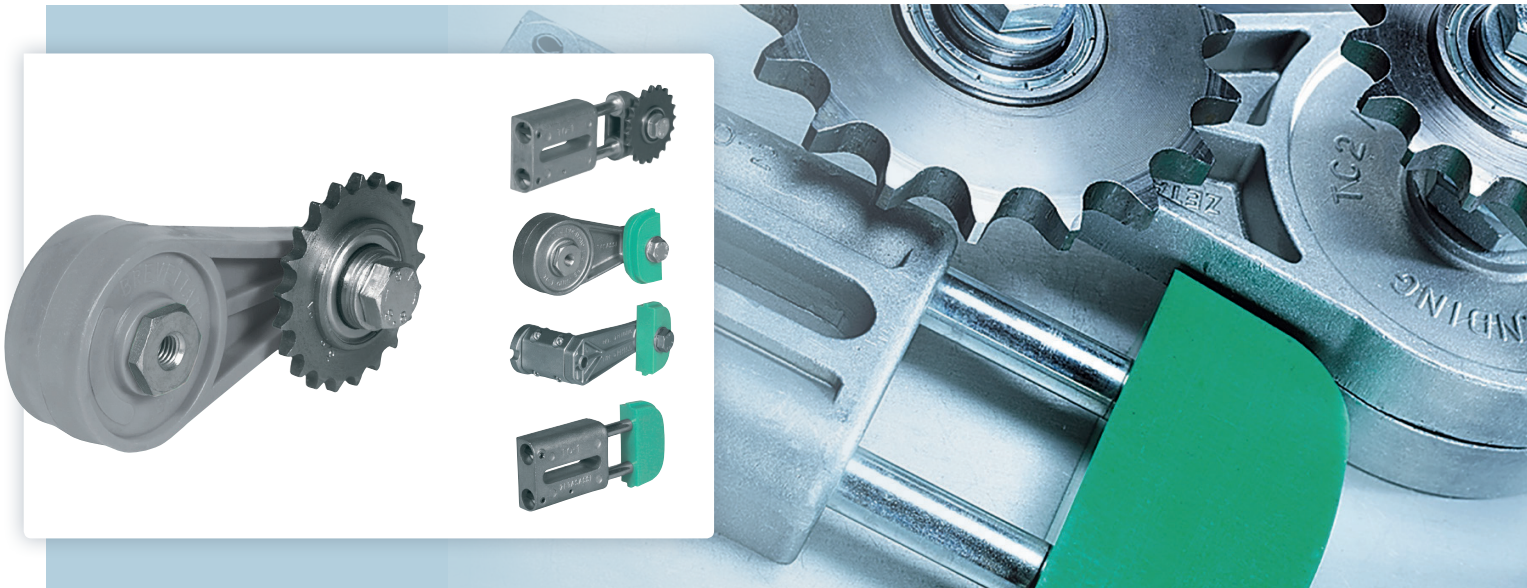


Chain pulling force as a function of chain weight and slack

q = tare weight [kg/m] (e.g. as stated in iwis catalogues)
 g = acceleration due to gravity = 9.81 [m/s²]
 a = centre distance [m]
 b = theoretical minimum length of slack thread [m]
 c = actual length of slack thread [m]
 D = chain slack [m]
 F = chain pulling force [N]

CALCULATION

$$\text{Chain tensile force } F = \frac{q \cdot g}{D} \cdot \frac{a^2}{8}$$



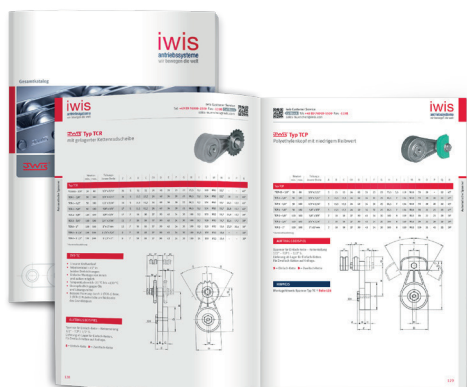
The right chain tensioner for every application

Chain tensioners help to create or maintain the correct tension in a chain drive. Besides optimum force and positioning, the selection of the appropriate chain tensioner is a vital factor in ensuring the longest possible chain service life.

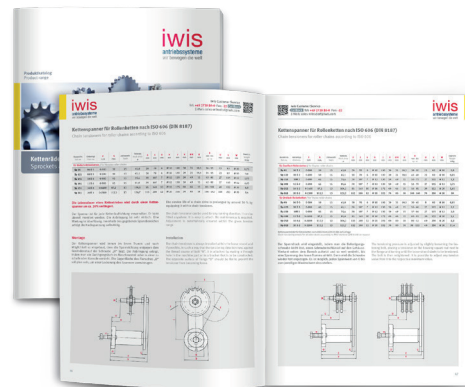
Permissible wear elongation:

- max. 3 % for standard drives
- approx. 2 % for high-performance drives
- approx. 1 % for specialist applications (synchronised running, positioning)

You will find a comprehensive range of chain tensioners in our **iwis catalogues: iwis.com/catalogs**



→ JWIS Precision chain systems for drive and conveyor purposes



→ Sprockets and drive components

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