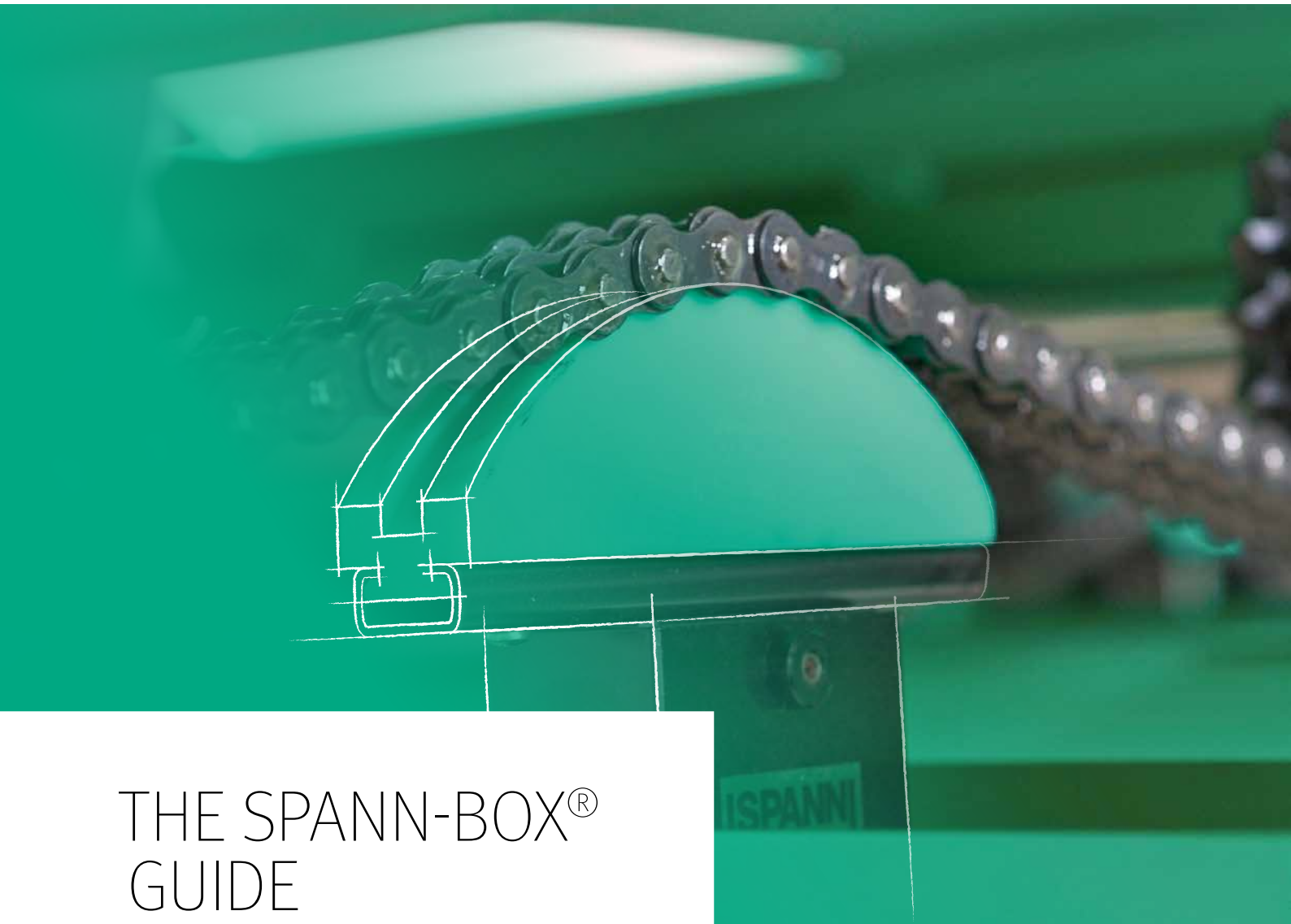
Endurance. Robustness. Technology.

Murtfeldt Plastics



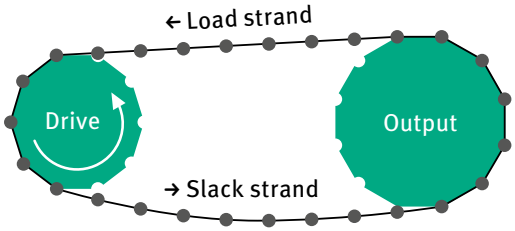
THE SPANN-BOX® GUIDE

Information on tensioning systems

CONTENTS

Chain tensioning systems – design and handling

Chains are among the decisive wear parts in many systems and machines. Their constant movement exposes them to very high loads, leading to an elongation of the chain links and thus an increasingly restless run. Murtfeldt chain tensioning systems keep chains reliably under tension and thus permit an optimal operating condition. The correct design and maintenance of chain drives significantly reduces the risk of failure and extends their service life.

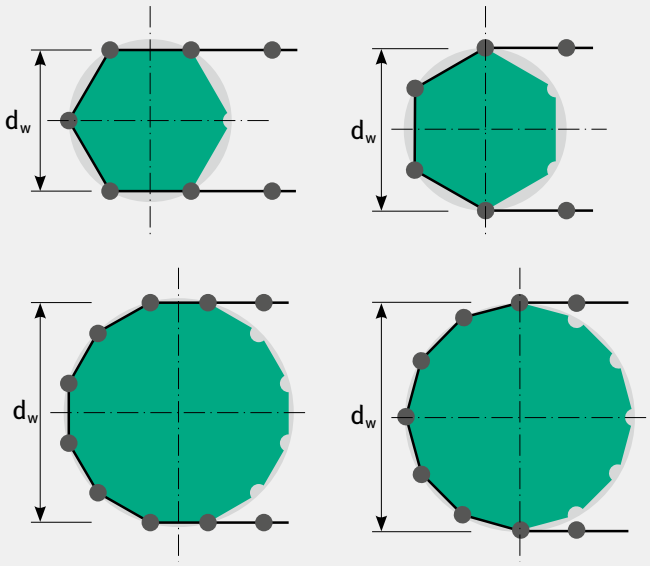


01

Basics of a chain drive – wear elongation

The chain is exposed to different loads when it revolves around the chain pulley. The force transmission takes place exclusively on the so-called driving side, in which the chain is pulled by the drive sprocket. On the opposite chain strand, the chain moves away from the drive sprocket and is relieved of load. This segment is referred to as the slack strand.

On the load strand, the chain moves towards the drive sprocket. Load transmission only takes place in this section of the chain. On the slack strand, the chain moves towards the driven gear.

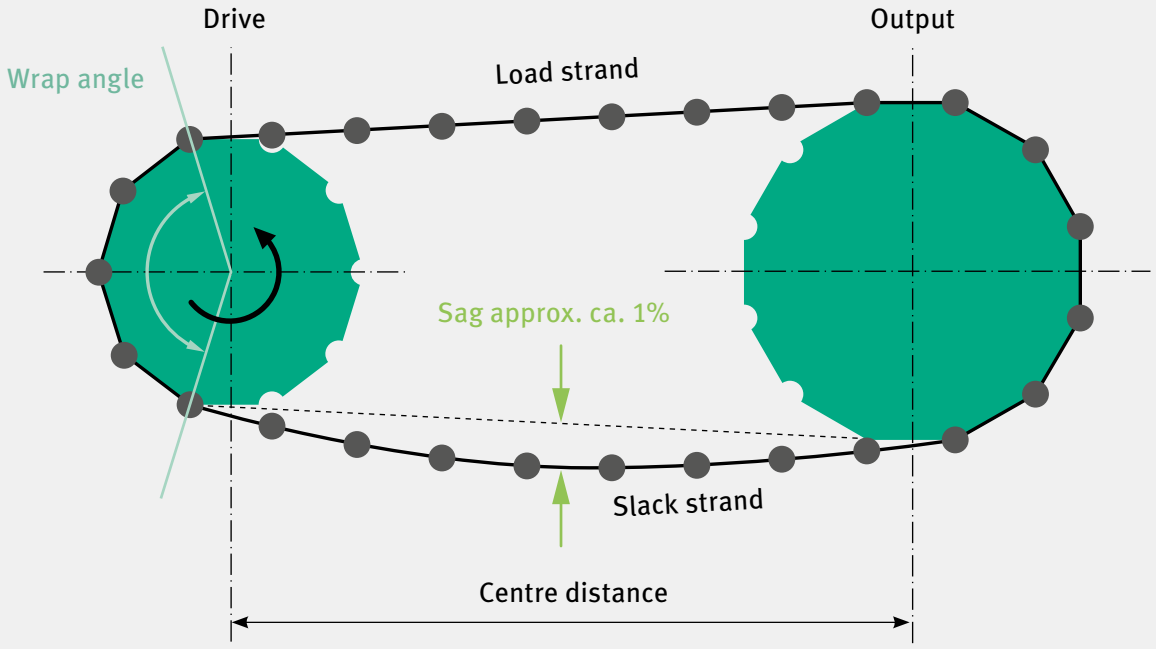


Polygon effect

A chain is wrapped around the sprockets in the form of a polygon. As a result, the effective diameter d_w of the wheel – and hence the speed of the chain fluctuates accordingly.

This non-uniformity of the chain's speed of progress is called the polygon effect, which can lead both to an uneven running of the chain and vibrations in the drive, as well as to high additional forces. It can thus lead to the chain being prematurely destroyed. The smaller the number of teeth on the sprocket, the greater the percentage speed difference.

Due to the polygon effect in the chain strand, the span lengths change periodically during operation, which is why a sag in the slack strand of the chain is vital. This sag should be between 1% and 3% of the centre distance to avoid any additional chain loads.



Permissible sag of roller chains:

3 % for simple gear drives

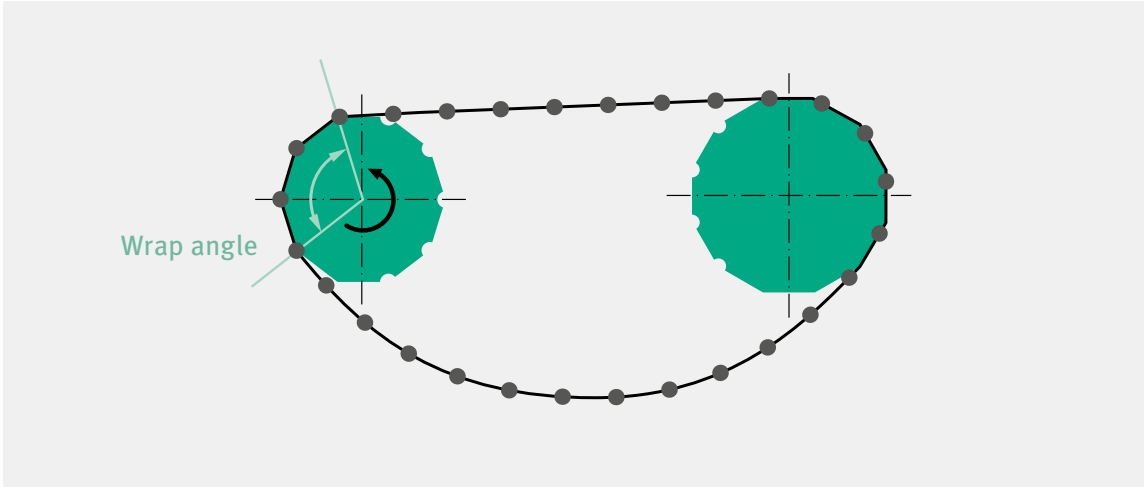
2 % for high-performance gear drives

1 % for special applications such as synchronous operation or positioning

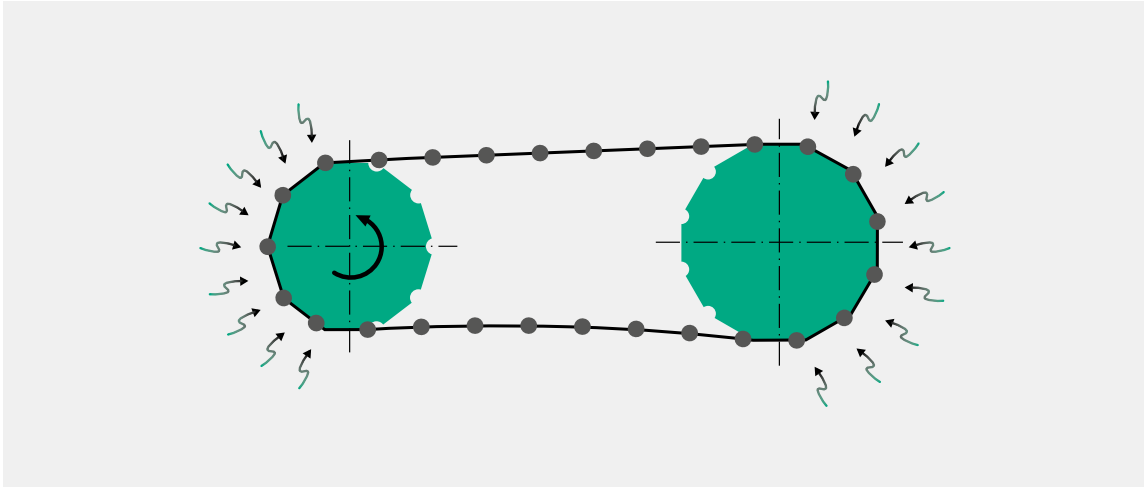
The running-in and wear behaviour of roller chains causes continuous elongation and thus an increasing sag over time. Since a roller chain can only tolerate a limited amount of elongation, compensation must be made for the elongation that does occur.

A chain can operate flawlessly despite elongation due to wear, provided it is continuously re-tensioned and thus continues to operate in its intended condition. In the absence of maintenance and re-tensioning of the chain, on the other hand, the sag in the slack strand increases even more, which makes the chain tension too low.

If the **chain tension is too low,** the wrap angle of the chain around the gearwheels will be reduced, so that the chain can skip of the sprocket. This skipping by the chain causes a deviation of the control times, for example in the positioning drives, and may lead to possible breaks. Besides an increased generation of noise, if the chain tension is too low it may also result in an unsteady running of the chain, which further promotes wear.



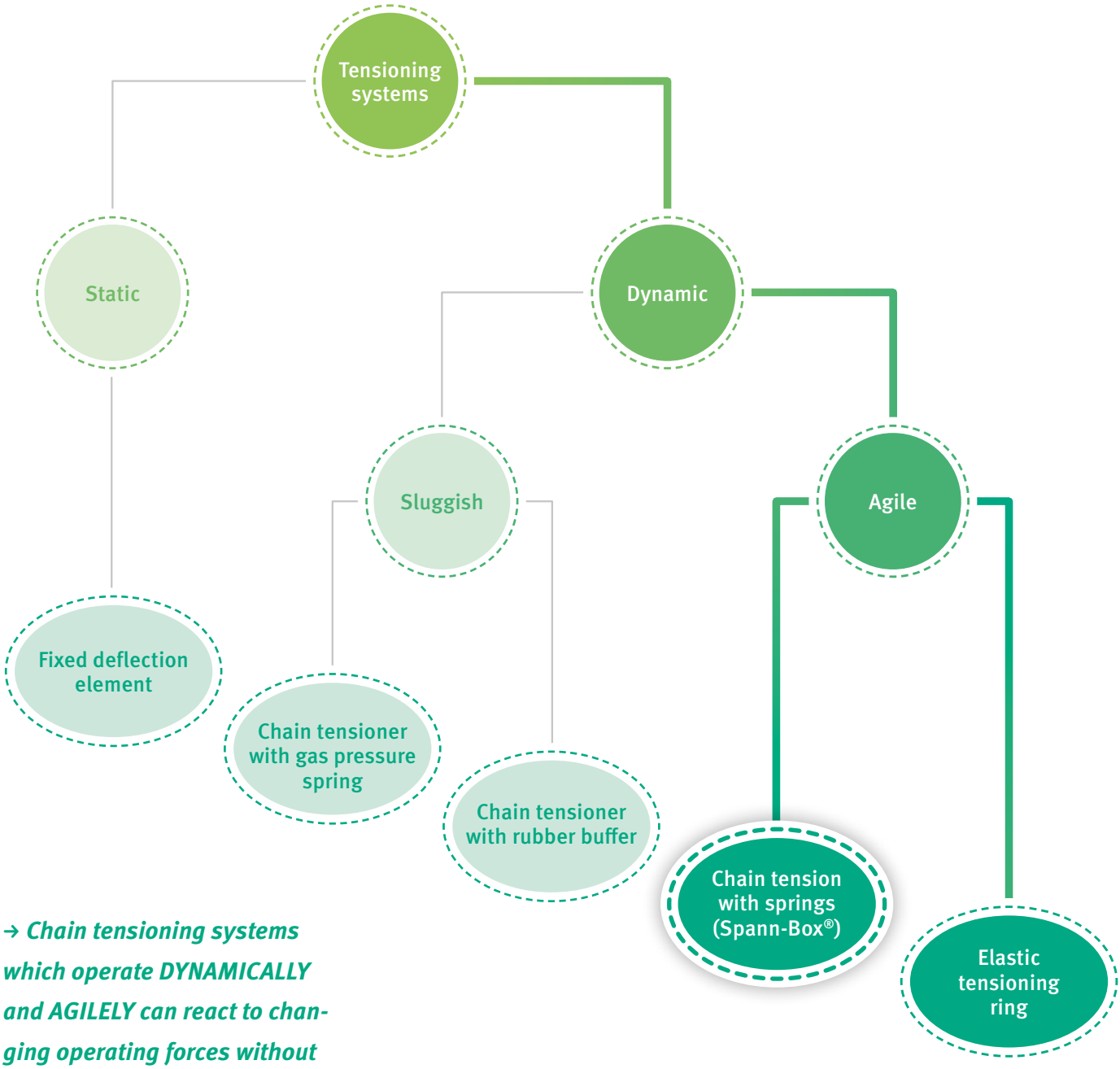
If the **chain tension is too high,** the increased joint surface pressure will cause increased friction in the chain joint and thus promote faster wear elongation of the chain. Due to the chain's high pulling power, other machine components besides the chain – such as the chain wheel, bearings, etc. will be exposed to greater stress, so that their operation life is shortened. Friction marks on the chain rollers are a sign of excessive tension.



An incorrectly set chain tension will inevitably lead to an increase in wear.

The chain tension must be set so that the chain is operated under dynamic pretension even in the slack strand. Chain tensioning systems can be used to ensure optimum operation. In addition to regulating the wrap angle, they can also prevent chain vibrations and compensate for the increasing elongation due to wear. This prevents the chain from skipping over the teeth of the sprocket and maximises the chain drive's operation life.

Chain tensioning systems can be differentiated as follows, based on their operating behaviour:

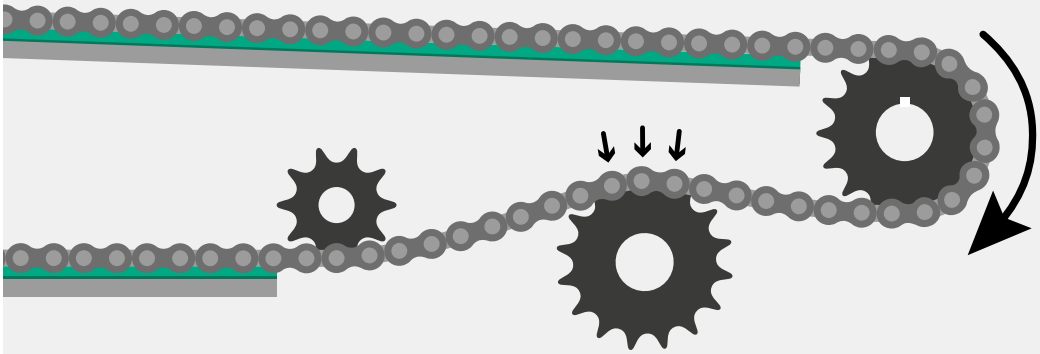


→ Chain tensioning systems which operate DYNAMICALLY and AGILELY can react to changing operating forces without any time delay and thus always ensure smooth running.

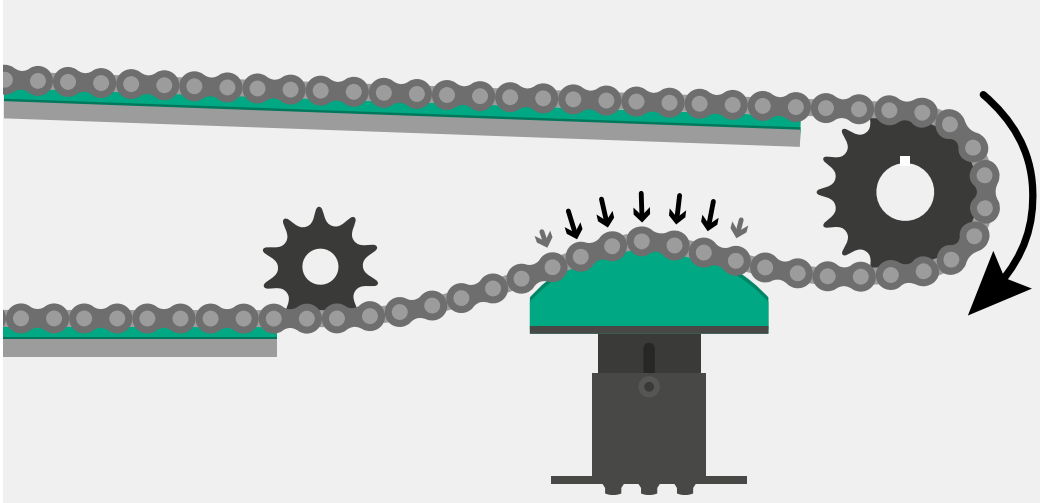
With a Murtfeldt automatic chain tensioner, a chain can be guided either over a sprocket or over a slide profile made of high-performance plastic. While sprockets are more suitable for high speeds (≥ 1 m/s), slide profiles do offer the following advantages:

ADVANTAGES OF A SLIDE PROFILE OVER A SPROCKET
As many rollers as possible lie on → Little to no polygon effect → Smoother running and reduced wear and tear
Protection of the chain joints
Safe chain guide
Less noise due to the damping properties of the slide profile
No corrosion

Chain tensioning system with sprocket



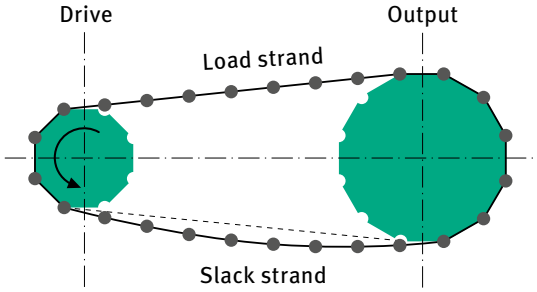
Chain tensioning system with slide profile



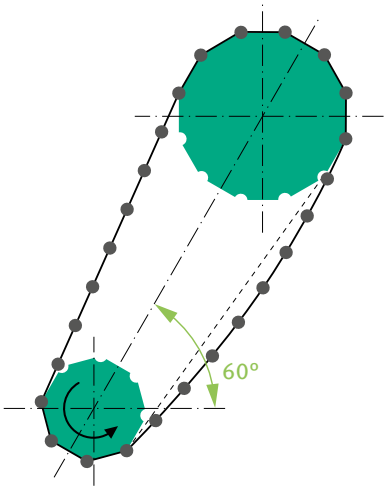
02

Drive arrangement

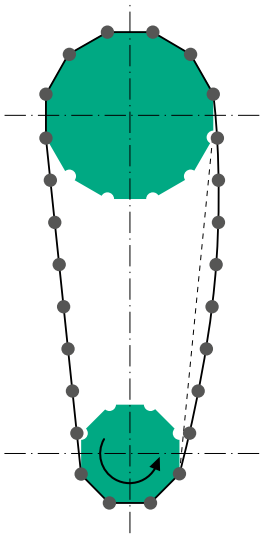
Various parameters must be considered for the optimal arrangement of a chain drive, such as the length of the chain, the force to be transferred and the available installation space. In general, a horizontal position of the sprocket axles is to be preferred, whereby the driving side should lie at the top and the slack strand at the bottom. In this case, loading in the longitudinal direction of the chain has a beneficial effect due to the influence of its own weight, and the chain is well inserted into the toothing. An upper slack strand is only permissible with short centre distances and low sag.



Horizontal arrangement with overhead driving side (favourable)



Arrangement with up to 60° inclination to the horizontal (favourable)



Vertical sprocket arrangement (unfavourable)

The tensile force of the chain is not decisive for the design of a chain tensioner; only the force acting perpendicularly on the chain tensioner is, for example through the chain's own weight.

An inclined arrangement of the sprocket wheel axis, up to a 60° inclination with respect to the horizontal, is likewise regarded as a favourable position. On the other hand, larger angles or a vertical arrangement represent unfavourable drive arrangements due to the poor engagement conditions of the lower chain wheel, in which auxiliary aids for providing the chain tension are needed. When designing a chain drive, the theoretically most favourable position of the sprockets relative to one another is often not feasible.

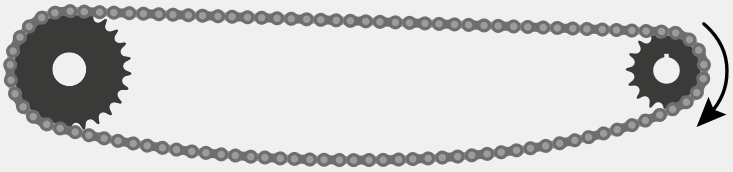
The correct position of the chain tensioner

By correctly positioning the chain tensioner, the elongation due to wear can be minimised and so the service life of the chain drive can be maximised. A chain tensioner should always be mounted in the slack strand. The installation of chain tensioning wheels and chain tensioners directly behind the drive sprocket is ideal for keeping the length of the slack strand being tensioned as short as possible.

Different drive arrangements

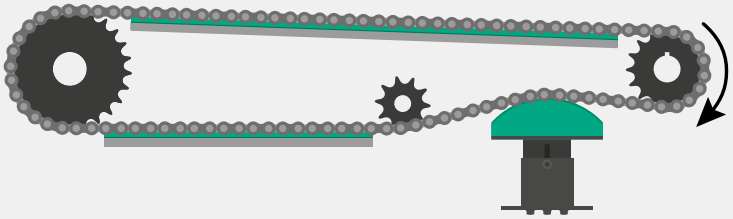
Chain drive without a chain tensioning system | disadvantage

- Uneven running
- Increasing slack in the slack side
- Rapidly increasing chain wear
- Increasing noise
- Vibrations that may cause the chain to skip and break



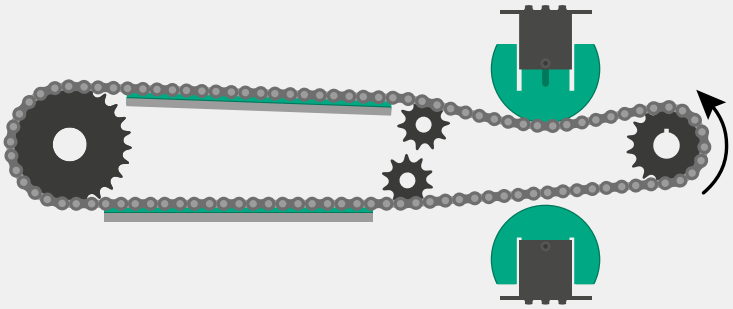
Chain drive with a chain tensioning system

Chain tensioner in the slack strand close behind the drive sprocket in combination with slide rails. ➔ Optimal and very efficient chain support or tensioning situation.



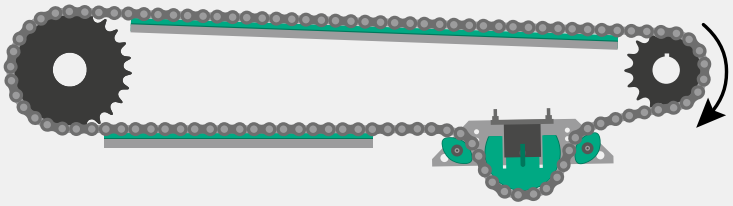
Reverse operation

Two Spann-Box® types near the drive. If the direction of drive changes, we recommend using two chain tensioners near the drive, as the driving side and slack strands change when the drive direction is reversed. We also recommend the use of a return profile for optimal guidance and increased robustness.



Omega tensioning unit as a ready-to-install system

The Omega Spann-Box® assembly provides twice the tensioning distance due to its double deflection. This solution is ideal for use on long chain strands that exhibit a large degree of sagging.



The weight of the chain in the slack strand to be tensioned should not be greater than the force of a spring that has already been slackened by 50%.

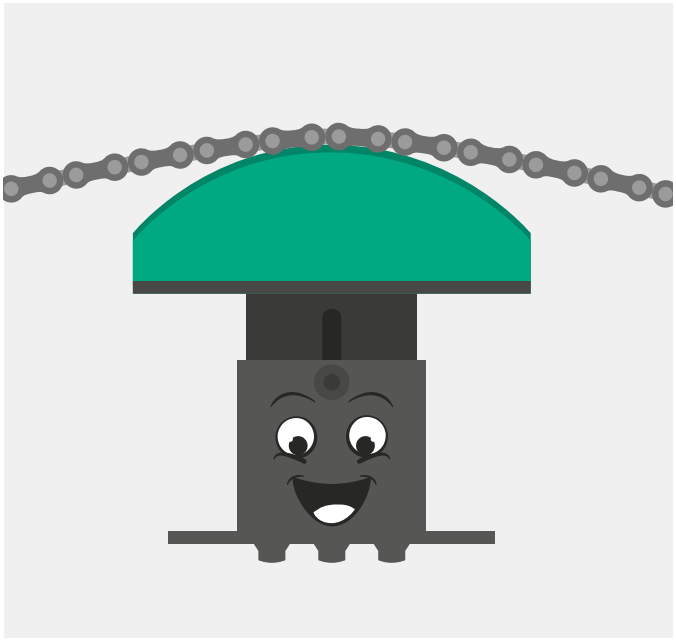
Specific weight of commonly used chains:

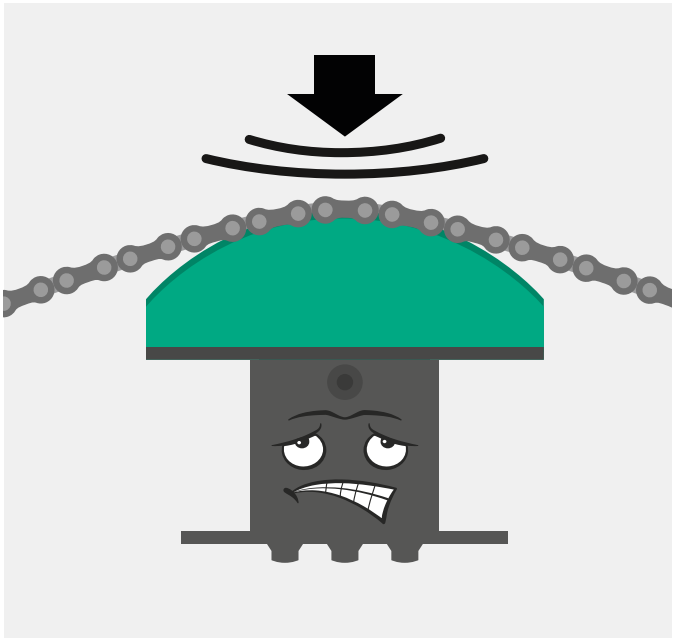
- ***10B-1 chain = 0,91 kg/m***
- ***12B-1 chain = 1,18 kg/m***
- ***16B-1 chain = 2,68 kg/m***

A combination of rigid deflection elements, slide rails and a dynamically acting Spann-Box® represents the optimum tensioning situation for a chain drive.

The challenge with reverse operation

The force transmission takes place exclusively on the load strand. This is where the maximum tensile force is present, so that there is no sag in this section of the chain and the chain is thus always fully tensioned. The resulting force acting perpendicularly on the chain tensioner is always greater than the maximum tensioning force of the Spann-Box®. Consequently, the chain tensioner located in the driving side is fully compressed, so that there is no longer any spring back effect. If this force acting on the Spann-Box® is too large, avoidable wear will occur – both on the chain tensioner and on the chain itself. An optimal position for the Spann-Box® is therefore crucial, especially in reverse operation.





Possible wear pattern due to overloading the Spann-Box®

03

Selection of the correct chain tensioning system

Murtfeldt tensioning systems operate in a freely swinging and thus elastic manner. This means that they do not act as a rigid deflection under load. They can be tensioned both inwards and outwards.

The following data are guideline values for the use of our chain and belt tensioners. **We always recommend taking an individual look at your application.**

Maximum drive speeds

The maximum possible speeds depend greatly on the operating time. The following applies for a long operating time: up to 1 m/s for standard slide profiles made of "S"® green, Spann-Box® types with sprocket wheels or slide profiles made of high-performance materials are available for higher speeds (up to 8 m/s).

	Designation/type	Maximum chain/belt speed
	Spann-Box® with slide profile	**max. 1 m/s**
	Spann-Box® size 0 with roller	**max. 3 m/s**
	Spann-Box® size 1 with roller	**max. 8 m/s**
	Spann-Box® size 1 type SR-L / SR-S with roller	**max. 6 m/s**
	Spann-Boy® TS with roller	**max. 6 m/s**
	Spann-Box® size 1 type K-L / K-S with sprocket	**max. 6 m/s**
	Spann-Boy® TS with sprocket	**max. 6 m/s**

The following applies to our clamping systems: Even if the tensioning distance is already fully utilised, the clamping force is not exhausted – as a rule, at least 50% of the initial force is still effective.

Permissible environmental conditions

Temperatures with the standard version:
-40°C bis 60°C with slide profile made of "S"® green

Temperatures with the special version:
-40°C bis 200°C with the right choice of plastic, as well as stainless steel springs and stainless-steel housing.

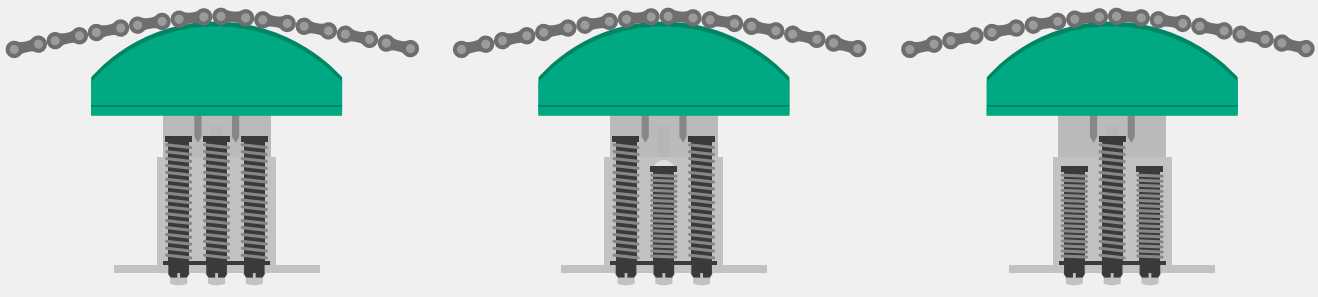
By selecting suitable materials for the slide profile and the housing, our Spann-Box® range also offers the possibility of **resistance to chemicals** and **corrosion**.

Tensioning distance and tensioning force

So that optimal force needed can be applied, we offer two different spring forces (light and heavy), as well as the chance to adjust the individually tensioning force by loosening particular springs.

Designation/type	Tensioning distance in mm	Spring version	Tensioning force 1 spring released	Tensioning force 2 springs released	Tensioning force 3 springs released
Mini-tensioner	16	light	–	19 – 13 N	–
		heavy	–	85 – 58 N	–
Spann-Box® size 0	40	light	58 – 32 N	–	–
		heavy	132 – 60 N	–	–
Spann-Boy® TS	40	light	65 – 33 N	190 – 96 N	–
		heavy	125 – 63 N		–
Spann-Box® size 1	40	light	58 – 32 N	116 – 64 N	174 – 96 N
		heavy	132 – 60 N	264 – 120 N	396 – 180 N
Spann-Box® size 30	40	light	58 – 32 N	116 – 64 N	174 – 96 N
		heavy	132 – 60 N	264 – 120 N	396 – 180 N
Spann-Box® size 2	60	light	148 – 82 N	296 – 164 N	444 – 246 N
		heavy	262 – 116 N	524 – 236 N	786 – 354 N

The tensioning force of our chain tensioners can be adjusted by loosening individual springs.



3 springs active | 2 springs active | 1 spring active

Optical control display

Murtfeldt tensioning systems of the Spann-Box® type feature a coloured scale. The tension status of the chain can be read off immediately; you can thus see whether the chain drive needs to be serviced.

Choice of slide profiles

By offering a choice of different geometries for the slide profiles, as well as guide rollers and sprockets, we provide solutions for a wide range of chain drives and tensioning situations.

Arc segment profile

- Mechanically most favourable slide profile shape
- Contacts multiple rollers at the same time
- Optimal chain protection

Semi-circular profile

- For 90° deflections
- Contact with only a few chain rollers
- Recommended in tight installation conditions

Return profile

- 180° deflection
- The 180° deflection enables double utilisation of the longer tensioning distance.

Block profile

- Suitable for particularly heavy chains and high inertial forces
- Slide profile and tension core made from one piece
- No screw connections
- High stability
- The 300 mm slide profile ensures support for many rollers in chains with a larger pitch

Elliptical profile

- Elliptical, 180° pivoted chain slide profile
- Use in chain drives with changing operating conditions
- When the angle of the chain drive is changed
- Ideal for highly dynamic chain drives

Roller/sprocket

- For small deflections
- At high chain speed (› 1 m/s)

Differences in the track profiles

Roller chains are usually tensioned on their rollers, which is why our slide profiles have a track profile. This can be made for simplex, duplex and triplex chains. For smaller chains, it is also possible to employ a U-profile.

U-profile | Simplex track profile | Duplex track profile | Triplex track profile

We can quickly and precisely meet almost any demand from a wide range of different tensioning systems. If you require a custom solution, our consulting service is always available to you (there are no obligations).

You can send us your technical details for optimum advice and selection using our **design questionnaire.** Please return the completed questionnaire to us by e-mail so that we can help you as quickly as possible.

You can find the design questionnaire and additional information on our chain tensioning systems at ***www.spann-box.de***

Parts of our chain tensioners for mechanical and plant engineering already feature smart components for **automated wear control.** Learn more about our tensioning systems with sensor technology at **Murtfeldt.de**

You can find a detailed list of the available products in our catalogue.
https://www.murtfeldt.de/en/services/downloads/main-catalogue/

04

Advantages of the Murtfeldt Spann-Box®

More dynamic response
to changes in chain movement

Reduced wear
on the chain joints

Automatic adjustment
in the event of a long chain length

Easy to assemble
with condition control

ADVANTAGES OF THE MURTFELDT TENSIONING SYSTEMS

- Quiet chain run
- Reduction of wear on the chain joints. Reduced working noise
- Automatic adjustment
- Compensation of chain and belt extension
- Use as chain and belt monitor
- Simple assembly and readjustment option
- Fast and reliable detection of the need for adjustment by sensor technology
- Much more dynamic response to changes in chain movement than versions with slow-reacting gas pressure springs or other damping elements
- Standard solutions are available for almost every tensioning situation

The only one to conform with the Machinery Directive (2006/42/EC)

ADVANTAGES OF THE MURTFELDT PLASTICS USED

- Excellent sliding properties lead to lower friction
- High wear resistance reduces maintenance intervals and new investments
- Temperature resistance
- High mechanical and chemical resistance
- Long service life

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