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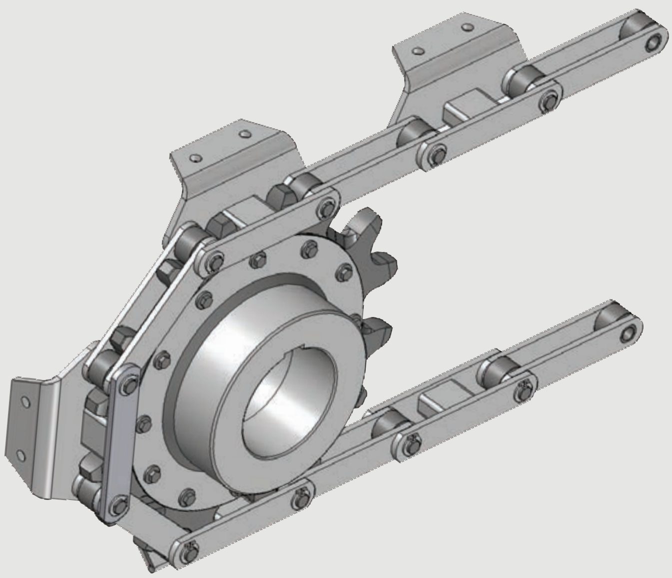
KettenWulf

Conveyor chains and sprockets



Product technology
and innovation

Content

The KettenWulf Group worldwide

The company's headquarters in Kückelheim

For over 85 years, KettenWulf, as an expanding global company, has stood for quality, reliability and flexibility. More than 1200 employees develop, produce and market customized solutions in the field of conveying and drive technology at ten locations across Europe, America and Asia. All around the globe, KettenWulf is your strategic partner when it comes to delivering optimal product quality.

As an international company with worldwide operations, our employees are always at your service to meet your unique business needs and to provide you with industry leading technical support.

Trust, loyalty and commitment – these are the values KettenWulf stands for. As a medium-sized, family-run company, cultivating a strong, personalized partnership with both our customers and suppliers is our highest priority.

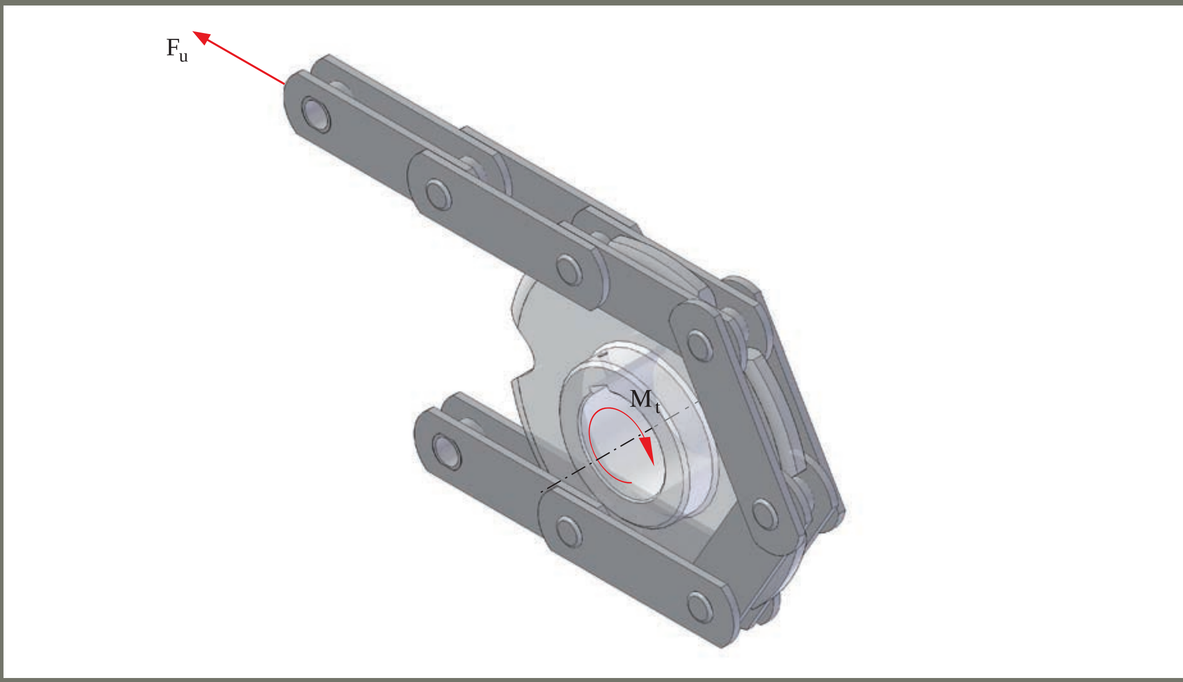
Illustration top right:
Production site in Sieperting, Germany

Illustration center right:
KettenWulf in Ferlach, Austria

Illustration bottom right:
The Chinese production and distribution site in Hangzhou

The following pages provide you with the basic information on how to calculate different types of conveyor chains. This will enable you to identify the right chain for your specific application on your own. Of course, it will be our pleasure to support you during this process. Please feel free to contact us with any questions or queries you may have. Our proficient staff will gladly assist you in finding the optimal product solution for your needs.

Calculation of conveyor chains



Formula symbols and units for the calculation of chains

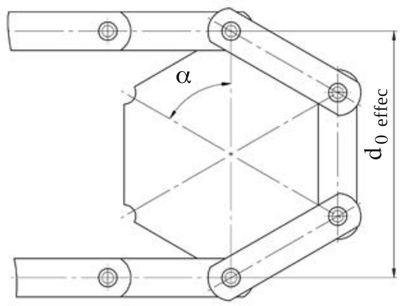
Angle of elevation	γ	°
Angular velocity	ω	sec^{-1}
Bearing area	A_f	mm²
Bearing pressure	p_r	N/mm²
Bending stress	σ_b	N/mm²
Breaking load	F_B	N
Bulk density	ρ	kg/m³
Bush outer diameter	d_3	mm
Bush radius	r	mm
Case height	h	m
Chain link numeric factor	K	
Chain speed	v	m/s
Center distance	a	mm/m
Circumferential force	F_u	N
Conveyor capacity	Q	t/h
Cross section surface of transported material	A	m²
Distance between objects	l_a	m
Dynamic chain pull	F_{dyn}	N
Fatigue notch factor	f_{kerb}	
Friction coefficient of the chain	μ_k	
Friction coefficient of the rollers	μ_z	
Gravitational acceleration	g	m/s²
Height of link plate	g	mm
Height of pan	h_1	m
Hole pressure	p_L	N/mm²
KettenWulf works standard	KWN	
Length of bush	l_2	mm
Leverage of rolling friction	f_k	mm
Loaded length of conveyor chain	l	m
Material coefficient	μ_f	
Number of links	X	Piece
Number of teeth	Z	Piece
Power	P	kW
Permissible bending stress	$\sigma_{b\,all}$	N/mm²
Permissible hole pressure	$p_{L\,all}$	N/mm²
Permissible shearing stress	τ_{all}	N/mm²
Permissible surface bearing pressure	pr_{all}	N/mm²
Permissible tensile stress	$\sigma_{z\,all}$	N/mm²
Pin diameter	d_1	mm
Pin surface	A_b	mm²
Pitch	p	mm
Pitch angle	α	°
Pitch circle diameter	d_0	mm
Repose angle during movement	β_{dyn}	°
Resisting torque	W	mm³
Roller length	l_3	mm
Roller radius	R	mm
Rotational speed	n	min^{-1}
Safety factor	ν	
Sagging of chain	f	m
Shearing stress	τ	N/mm²
Slack pull force	F_S	N
Speed variation	Δv	m/s
Surface measure of bush	c	mm
Tensile strength	R_m	N/mm²
Tensile stress	σ_z	N/mm²
Thickness of link plate	s	mm
Torque	M_t	Nm
Torque deviation	ΔM_t	Nm
Total chain pull	F	N
Transmission ratio	i	
Weight of material conveyed per meter of chain	G_f	kg/m
Weight of material conveyed per roller	G_{Rolle}	kg
Weight of the chain	q	kg/m
Weight per unit load	G_{st}	kg
Width of bulk material	b	m
Width of inner link	b_2	mm
Width of pan	B_1	m

Chain drive kinematics: Polygon Effect

Kinematics

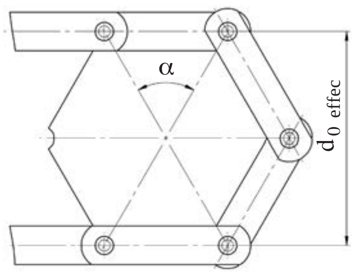
Sprocket position

1



Sprocket position A

2



Sprocket position B

The illustrations 1 and 2 show the rotation of the sprocket by half angular pitch α from sprocket position A into sprocket position B. The chain pin centers lie on the same constant circle, the so-called pitch circle d_0.

The connection line between the centers of each chain joint is straight so that the chain forms a polygon. As the sprocket starts rotating, the pin cannot follow this straight line because its movement is defined by the effective pitch circle diameter d_0. But as both illustrations clearly show, this effective pitch circle diameter varies between d_0 and $d_0 \cdot \cos\left(\frac{\alpha}{2}\right)$, thus permanently changing the motions in the chain drive. Consequently, the motions of the chain drive change continuously.

Speed differential

Chain speed parameters

With the introduction of the geometric relations, the parameters for the chain drive can be calculated as follows:

$$v = \frac{d_0 \cdot \pi \cdot n}{60 \cdot 1000}$$

$$\alpha = \frac{360°}{Z}$$

d_0	mm	Pitch circle diameter
n	min^{-1}	Driving speed
v	m/s	Chain speed
Z		Number of teeth
α	°	Pitch angle

While the sprocket is in position A (illustration 1), the full pitch circle diameter d_0 is effective and hence we also have v_{max}. As the rotation of the sprocket continues, the effective pitch circle diameter progressively decreases up to $d_0 \cdot \cos\left(\frac{\alpha}{2}\right)$ with the speed dropping from v_{max} to v_{min}.

$$v_{min} = \frac{d_0 \cdot \cos\left(\frac{\alpha}{2}\right) \cdot \pi \cdot n}{60 \cdot 1000}$$

v_{min}	in m/s	Minimum chain speed

Hence the speed of the chain drive varies between:

$$v_{max} = v$$

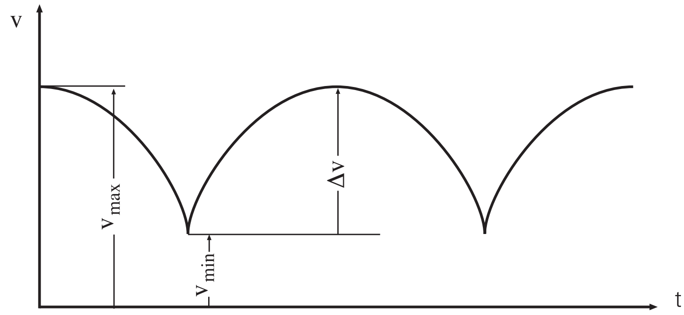
$$v_{min} = v \cdot \cos\left(\frac{\alpha}{2}\right)$$

Thus, a speed fluctuation results amounting to:

$$\Delta v = v_{max} - v_{min}$$

v_{max}	m/s	maximum chain speed
Δv	m/s	Speed differential

3



Torque deviation

Besides changes in speed, the polygon effect also causes variations in torque.
The torque is derived as follows:

Sprocket position A:

$$M_t = F \cdot \frac{d_0}{2 \cdot 1000}$$

Sprocket position B:

$$M_t = F \cdot \frac{d_0 \cdot \cos\left(\frac{\alpha}{2}\right)}{2 \cdot 1000}$$

Hence:

$$M_{t\ max} = M_t$$

$$M_{t\ min} = M_t \cdot \cos\left(\frac{\alpha}{2}\right)$$

Thus, the torque variation / differential:

$$\Delta M_t = M_{t\ max} - M_{t\ min}$$

F	N	Total chain pull
M_t	Nm	Torque
$M_{t\ min}$	Nm	Minimum torque
$M_{t\ max}$	Nm	Maximum torque
ΔM_t	Nm	Torque deviation

Sample calculation

Impact of the polygon effect

given: p = 160 mm; Z = 5 teeth; d_0 = 272.2 mm; n = 105 min^{-1}; F = 100 000 N

$$v = v_{max} = \frac{d_0 \cdot \pi \cdot n}{60 \cdot 1000}$$

$$v = v_{max} = 1.5\ m/s$$

$$\alpha = \frac{360°}{Z}$$

$$\alpha = 72°$$

$$v_{min} = v_{max} \cdot \cos\left(\frac{\alpha}{2}\right)$$

$$v_{min} = 1.2\ m/s$$

$$\Delta v = v_{max} - v_{min}$$

$$\Delta v = 0.3\ m/s$$

$$M_t = M_{t\ max} = \frac{d_0 \cdot F}{2 \cdot 1000}$$

$$M_t = M_{t\ max} = 13610\ Nm$$

$$M_{t\ min} = M_{t\ max} \cdot \cos\left(\frac{\alpha}{2}\right)$$

$$M_{t\ min} = 11010.5\ Nm$$

$$\Delta M = M_{t\ max} - M_{t\ min}$$

$$\Delta M = 2600\ Nm$$

When dimensioning the chain drive, one should always consider the polygon effect with respect to chain speed, torque and strand length. In order to keep the polygon effect as low as possible, the following aspects should be taken into account:

Speed and torque differential cause an irregular motion of the chain while in operation. This mainly depends on the number of teeth of the sprocket (see fig. 4), i.e.

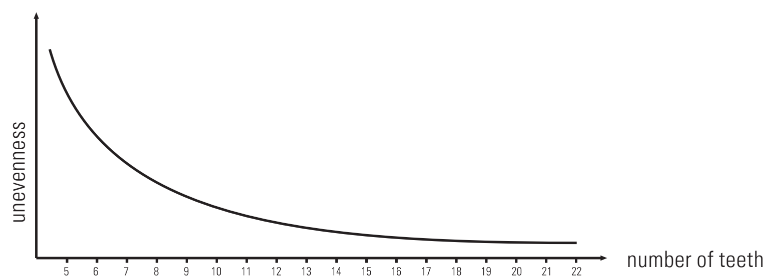
Small number of teeth → high degree of irregular motion of the chain
Large number of teeth → low degree of irregular motion of the chain

For sprockets with more than 19 teeth, the degree of irregular motion is of no practical importance. However, this does not imply that one cannot use sprockets with less than 19 teeth. The speed and torque differentials can be minimized by keeping the speed lower for sprockets with a small number of teeth.

The innovative and patented KettenWulf polygon compensation system allows our customers to use sprockets with a small number of teeth at a reduced polygon effect. Please see page 77 for further information.

Degree of unevenness dependent upon the number of teeth

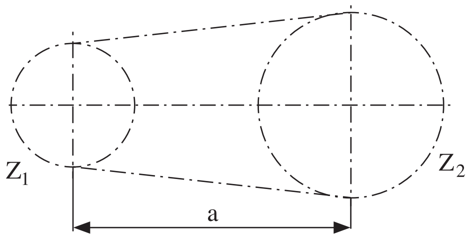
4



Chain Length – Center distance

Calculation of the number of chain links

1



For sprockets with an even number of teeth the calculation of the number of chain links X is:

Calculation of the chain length

$$X = 2 \cdot \frac{a}{p} + Z$$

a	mm	Center distance
p	mm	Pitch
X		Number of links

For sprockets with an odd number of teeth the calculation of the number of chain links X is:

$$X = 2 \cdot \frac{a}{p} + \frac{Z_1 + Z_2}{2} + \frac{K \cdot p}{a}$$

Z_1	Number of teeth – small sprocket
Z_2	Number of teeth – large sprocket
K	Link number factor

$$K = \left(\frac{Z_2 - Z_1}{2 \cdot \pi}\right)^2$$

Sample calculation

Sample calculation for determining the number of chain links

given: a = 2000 mm; Z_1 = 21; Z_2 = 72; p = 40 mm;

$$X = 2 \cdot \frac{a}{p} + \frac{Z_1 + Z_2}{2} + \frac{K \cdot p}{a}$$

Hence: $X = 147.81$

Selected: 148 links

The center distance can be calculated using the following formula:

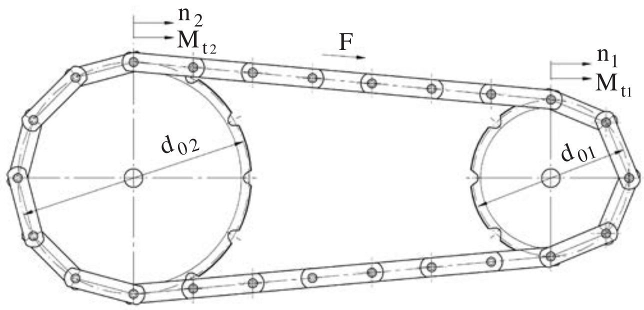
Calculation of the center distance a in mm with a given number of links X

$$a = \frac{p}{4}\left[X - \frac{Z_1 + Z_2}{2} + \sqrt{\left(X - \frac{Z_1 + Z_2}{2}\right)^2 - 8 \cdot K}\right]$$

Chain Drive Mechanics – Definition of the operational characteristics

Chain drive calculation

1



In general, every chain drive is a wrap drive which is similar to a belt drive. However, the wrap drive has the decisive advantage that its force is not transmitted through frictional resistance but by positive fitting, and therefore without slippage.

Different pitch diameters mean that each drive has a different speed and a different torque.

Illustration 1 shows the relation between chain pull F, torque M_t, pitch circle diameter d_0 and drive speed n.

The torque M_t of the sprockets is calculated as follows:

Torque

$$M_{t1} = \frac{d_{01}}{2 \cdot 1000} \cdot F$$

$$M_{t2} = \frac{d_{02}}{2 \cdot 1000} \cdot F$$

M_{t1}	Nm	Torque of sprocket 1
M_{t2}	Nm	Torque of sprocket 2

The force which acts on the chain is the same at the different diameters of both sprockets so that the chain pull F is:

Chain pull

$$F = \frac{M_{t1} \cdot 2 \cdot 1000}{d_{01}} = \frac{M_{t2} \cdot 2 \cdot 1000}{d_{02}}$$

The chain speed v is obtained by means of the pitch circle diameter d_0 and the drive speed n:

Chain speed

$$v = \frac{d_0 \cdot \pi \cdot n}{60 \cdot 1000}$$

The transmission ratio i of a chain drive can be expressed by:

Transmission ratio

$$i = \frac{d_{02}}{d_{01}} = \frac{Z_2}{Z_1} = \frac{M_{t2}}{M_{t1}} = \frac{n_1}{n_2}$$

i	Transmission ratio

Given these relations, the power P which is transmitted by a chain drive, is the product of chain pull and chain speed.

Transmitted power

$$P = \frac{F \cdot v}{1000}$$

$$P = \frac{2 \cdot M_{t1}}{d_{01}} \cdot \frac{d_{01} \cdot \pi \cdot n_1}{60 \cdot 1000} = \frac{2 \cdot M_{t2}}{d_{02}} \cdot \frac{d_{02} \cdot \pi \cdot n_2}{60 \cdot 1000}$$

$$P = \frac{M_{t1} \cdot \pi \cdot n_1}{30 \cdot 1000} = \frac{M_{t2} \cdot \pi \cdot n_2}{30 \cdot 1000}$$

P	kW	Transmitted power
n_1	min^{-1}	Drive speed of sprocket 1
n_2	min^{-1}	Drive speed of sprocket 2

If the power is specified, the chain pull F is:

Chain pull

$$F = 1000 \cdot \frac{P}{v}$$

the drive torque M_{t1} and the output torque M_{t2} are:

Drive and output torque

$$M_{t1} = \frac{P \cdot 30 \cdot 1000}{\pi \cdot n_1}$$

$$M_{t2} = \frac{P \cdot 30 \cdot 1000}{\pi \cdot n_2}$$

Calculation of conveyor chains – Definition of the operational characteristics

The first step in dimensioning a chain drive is to collect all available data of the installation where the chain will operate. Apart from construction data such as drive power, chain speed, chain pitch, type of roller, etc., the ambient conditions such as moisture or temperature should be considered as well. To facilitate the collection of all these relevant data, KettenWulf has developed a practical checklist which we gladly provide on request.

Based on these data and the respective chain pull, a chain can either be selected from the catalogue or designed according to customer specifications.

After this preselection, the chain load needs to be recalculated. By comparing the admissible load with the actual load, one can easily detect any possible weak points of the chain.

Should the strength test find that the selected chain does not correspond to the admissible load, it is possible to choose a bigger chain, a different type of chain or even to modify the material and construction of the chain.

Additional customer requirements, such as a stainless steel configuration or the mounting of special attachments can be considered as well.

In summary, the final selection of a chain mainly depends on the following parameters:

» Type of chain
» Drive power
» Chain speed
» Configuration with / without roller
» Roller load
» Ambient conditions
» Center distance
» Sprocket diameter
» Horizontal direction of travel
» Vertical direction of travel

Some of these data are interdependent, meaning that not all parameters can be freely chosen. For example, neither the sprocket diameter nor the number of sprocket teeth nor the desired chain pitch can be determined at discretion since the latter results from the first two parameters.

The adequate dimensioning of the chain shall ensure that the load on the chain never causes failures due to exceeding the limit of elasticity. For this reason, we have listed the admissible load along with each type of chain in this catalogue . These admissible loads also imply a security factor according to DIN standards of 6 – 7 to determine the breaking load of each chain.
If one considers all these aspects and maintains the proper operation of the chain at all times, the service life of the chain is only subject to wear.

Calculation of chains – Dimensioning of conveyor chains

Acting forces on conveyor chains

The required total chain pull F is generally calculated as follows:

Total chain pull

$$F = F_u + F_s + F_{dyn}$$

F_u	in N	Circumferential force
F_s	in N	Sagging force
F_{dyn}	in N	Dynamic chain pull

F_{dyn} is a dynamic force component which results from the centrifugal force on the sprocket; F_s is a force component which results from the sagging of the chain.

The chain speeds of bush conveyor chains are usually so low that the dynamic conditions need not to be taken into account. Moreover, the chain strands mostly lie on a certain support system, which prevents the chain from sagging. For this reason it is sufficient to use only the circumferential force F_u, which then can be equated with the total chain pull.

The calculation of the power to be transmitted by the chain is then simply carried out by using the maximum available driving power and chain speed on the shaft, hence the torque being available at motor overload:

Circumferential force

$$F_u = 1000 \cdot \frac{P}{v}$$

P	kW	Power
v	m/s	Chain speed

Sagging force

$$F_s = \frac{q \cdot a^2}{8 \cdot f} \cdot g$$

g	m/s^2	Acceleration due to gravity
f	m	Greatest chain sag
q	kg/m	Weight of the chain
a	m	Center distance

Dynamic chain pull

$$F_{dyn} = \frac{\omega^2 \cdot p}{20 \cdot 1000} \left(2 \cdot a \cdot q + G_f \cdot l\right)$$

$$\omega = \frac{2 \cdot v}{d_0 \cdot 1000}$$

l	m	Loaded length of conveyor chain
G_f	kg/m	Weight of material conveyed per meter of chain
p	mm	Pitch
ω	sec^{-1}	Angular velocity

Possible roller types for conveyor chains

Bush conveyor chains are available with and without rollers.

Roller type

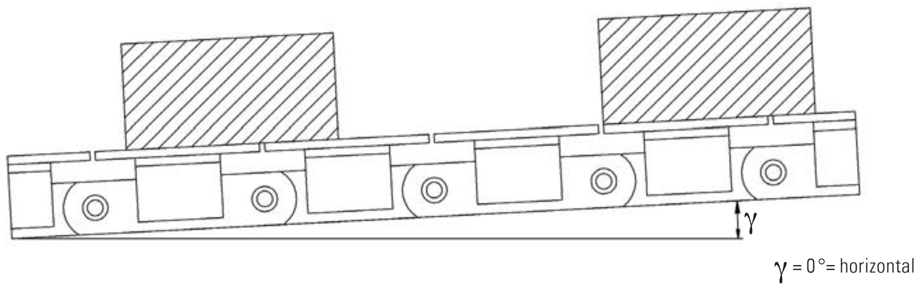
- Conveyor chains without rollers:
  Operating a chain without rollers has the advantage of the lowest possible chain weight.
- Conveyor chains with support rollers:
  The use of support rollers significantly reduces the chain pull.
- Conveyor chains with protection rollers:
  Protection rollers are used to reduce the wear of bushing and sprocket. Please note that protection rollers do not have the same function as support rollers.
- Conveyor chains with flanged rollers:
  Flanged rollers serve the same purpose as support rollers. In addition, the flange helps secure the chain in the guide rail.

Roller load

The roller load is needed to calculate the surface pressure between bush and roller.

Calculating the circumferential force on conveyor chains without rollers

1



Chain without rollers, horizontal conveyor

$$F_u = 1.1\mu_k (2 \cdot a \cdot q + l \cdot G_f) \cdot g$$

γ	i °	Angle of inclination
μ_k		Friction coefficient of the chain

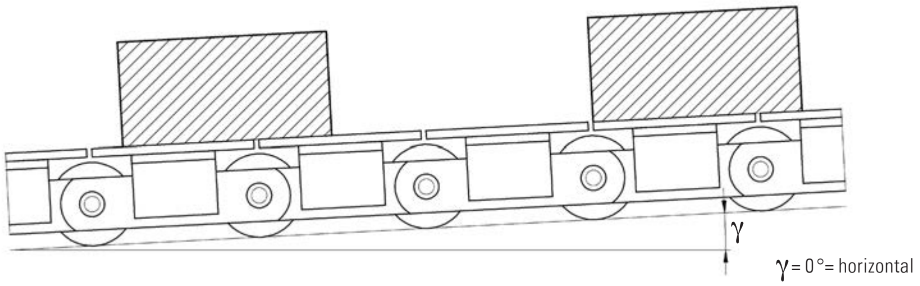
Chain without rollers, inclined conveyor

$$F_u = 1.1\left[a \cdot q\left(2\mu_k \cdot \cos\gamma + \sin\gamma\right) + l \cdot G_f\left(\mu_k \cdot \cos\gamma + \sin\gamma\right)\right] \cdot g$$

- Friction coefficient of the chain (depending on the chain wear)
  μ_k = 0.33 without lubrication (chain - steel trough)
  μ_k = 0.25 with lubrication (chain - steel trough)

Calculating the circumferential force on conveyor chains with rollers

2



Chain with rollers, horizontal conveyor

$$F_u = 1.1\left(2\cdot a\cdot q + 1\cdot G_f\right)\cdot\left(\frac{f_k}{R}+\frac{r}{R}\cdot\mu_z\right)\cdot g$$

f_k	mm	Lever arm of rolling friction
R	mm	Roller radius
r	mm	Bush radius
μ_z		Friction coefficient of the rollers

Chain with rollers, inclined conveyor

$$F_u = 1.1\left\{a\cdot q\cdot\left[2\left(\frac{f_k}{R}+\frac{r}{R}\cdot\mu_z\right)\cdot\cos\gamma+\sin\gamma\right]+1\cdot G_f\left[\left(\frac{f_k}{R}+\frac{r}{R}\cdot\mu_z\right)\cdot\cos\gamma+\sin\gamma\right]\right\}\cdot g$$

» Lever arm of the rolling friction depending on the material combination (raceway/ roller):
f_k = 0.5 mm (steel on steel)

» Friction coefficient of the rollers depending on the roller bearing support and operating conditions:
μ_z = 0.1 – 0.3 (for friction bearings)

Calculation of chains – Calculating the weight of material conveyed

Types of material conveyed

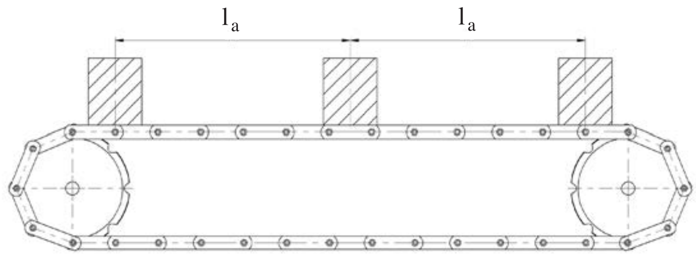
Weight of material conveyed

$$G_f = \frac{Q}{3.6 \cdot v}$$

Q	t/h	Conveyor capacity
G_f	kg/m	Weight of material conveyed per meter of chain

Unit load

1

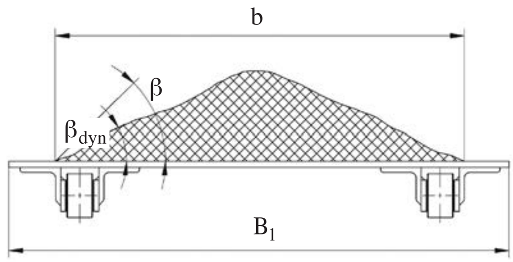


$$G_f = \frac{G_{st}}{l_a}$$

G_{st}	kg	Weight per unit of the unit load
l_a	m	Distance between the pieces of each other

Bulk cargo apron conveyor

2



$$G_f = A \cdot \rho$$

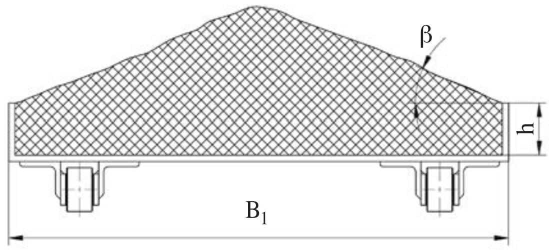
$$A = \frac{b}{2} \cdot \left(\frac{b}{2} \cdot \tan \beta_{dyn}\right)$$

$$G_f = \frac{b^2}{4} \cdot \rho \cdot \tan \beta_{dyn}$$

A	m^2	Cross section surface of the transported material
ρ	kg/m^3	Bulk density
β_{dyn}	°	Repose angle in action
b	m	Width of bulk cargo

Bulk cargo case conveyor

3



$$G_f = A \cdot \rho$$

$$G_f = B_1\left(h + \frac{B_1 \cdot \tan \beta_{dyn}}{4}\right) \cdot \rho$$

h	m	Case height
B_1	m	Width of trough

Guide values for dry bulk cargos

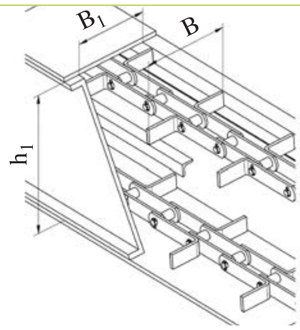
Guide values for dry bulk cargos

Bulk cargo	Bulk cargo density ρ in kg/m³	Max. angle of inclination δ in ° ≈	Repose angle, stationary β in ° ≈	Repose angle, in motion β_{dyn} in ° ≈
Ash and slag	700	18	50	25
Brown coal	700	15 … 20	50	35
Minerals (Cu – Pb)	2400	18 … 20	40	30
Oats, barley	620	14	35	25
Quicklime	1200	15 … 20	35	15
Dry lime	500	15 … 18	50	15
Grit	1470	18 … 20	45	30
Coke	490	15 … 18	50	30
Pit coal	830	17 … 20	45	20
Clay, loam	1800	15 … 20	45	25
Flour	910	12 … 15	55	35
Corn, rye, rice	735	15	35	15
Sand	1800	12 … 15	45	20
Sawdust (wood)	210	20 … 30	40	0
Cement	1470	10 … 12	50	35

Calculation of chains – Dimensioning trough conveyor chains

Area of application

1



The design of trough conveyor chains is generally based on bush conveyor chains according to DIN 8165 and DIN 8167, but is adapted to meet the requirements of bulk material handling.

This type of chain is used for all applications where granular, dustlike or other bulk material has to be conveyed.

Typically, the trough conveyor chain attachments are L-shaped for horizontal conveyors and U-shaped for inclined conveyors. Constructions are depicted on pages 38 to 39.

Horizontal conveyance

Chain pull

$$F_u = 1.1(2 \cdot a \cdot q \cdot \mu_k + l \cdot G_f \cdot \mu_f) \cdot g$$

μ_f coefficient of material

Rising conveyance

$$F_u = 1.1\left[a \cdot q\left(2\mu_k \cdot \cos\gamma + \sin\gamma\right) + l \cdot G_f\left(\mu_f \cdot \cos\gamma + \sin\gamma\right)\right] \cdot g$$

Weight of material conveyed

Weight of material conveyed

$$G_f = B_1 \cdot h_1 \cdot z_1 \cdot z_2 \cdot \gamma$$ or $$G_f = \frac{Q}{3.6 \cdot v}$$

h_1 m Height of pan

» Coefficient indicating the amount of bulk material residue which remains on the chain
z_2 = 0.8 – 0.9 chunky material conveyed
z_2 = 0.6 – 0.9 granular material conveyed
z_2 = 0.4 – 0.8 dustlike material conveyed

» Loss value indicating the reduction of capacity due to the chain components
z_1 = 0.95

» Material friction coefficient (depending on material conveyed)
μ_f = 0.7 sand – steel trough
μ_f = 0.8 coke – steel trough
μ_f = 0.32 grain – steel trough

» Friction coefficient of the chain (depending on the chain wear)
μ_k = 0.33 without lubrication (chain–steel trough)
μ_k = 0.25 with lubrication (chain–steel trough)

Calculation of chains – Recalculation

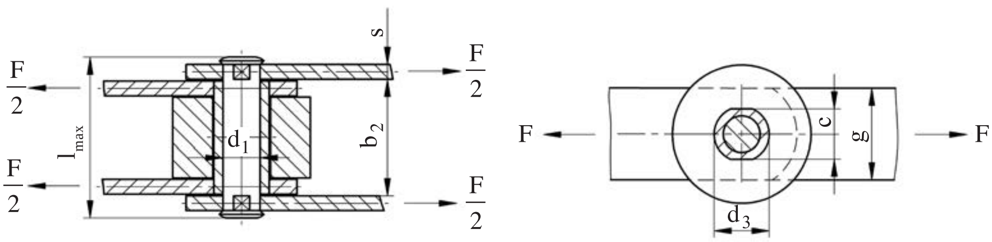
Reason

After preselecting the chain based on the total chain pull (see pages 13 to 18) a recalculation is necessary to determine the actual load on each individual chain component. These actual loads are then compared to the admissible loads. If the admissible values are exceeded, a larger chain needs to be chosen.

It is also possible to modify the design or the material of the chain components to achieve a higher admissible load. We will be pleased to help you find the best solution for your chain. Please contact us!

Strength calculation

1



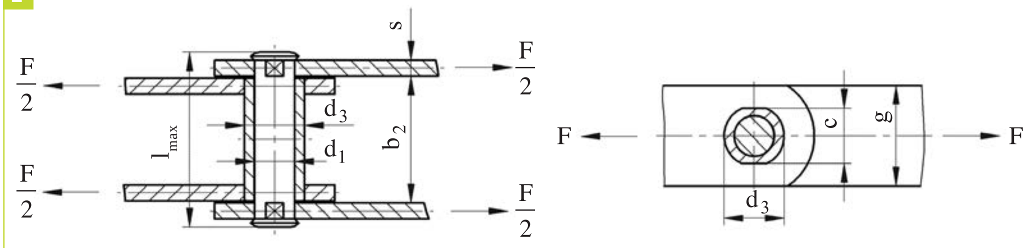
The verifying calculation of the conveyor chain is based on the following criteria:

Proofs of strength

- Tensile stress/link plate breaking load
- Shearing stress/pin breaking load
- Pin bending stress
- Link plate hole pressure/pin
- Link plate hole pressure/bush
- Bush surface bearing pressure/pin
- Roller surface bearing pressure/bush

Calculating the link plate tensile stress/ breaking load

2



Tensile stress σ_z using the sizes F, g, c and s shown in Fig. 2 is calculated as:

Tensile stress link plate

$$\sigma_z = \frac{F}{2 \cdot (g - c) \cdot s} \cdot \frac{1}{f_{notch}}$$

σ_z	N/mm^2	Tensile stress
F	N	Total chain pull
g	mm	Width of link plate
c	mm	Surface measure of bush
s	mm	Thickness of link plate
f_{notch}		Fatigue notch factor

The minimum breaking load F_B of the link plate is calculated as follows:

Breaking load link plate

$$F_B = 2 \cdot (g - c) \cdot s \cdot R_m \cdot f_{notch}$$

R_m	N/mm^2	Tensile strength
F_B	N	Breaking load

Security ν against breakage of the link plate is calculated at minimum tensile strength R_m of the plate material used:

$$\nu = \frac{R_m}{\sigma_z}$$

ν	Safety value

The proof of strength should not only be made for breakage but, in addition, through check of the plastic elongation. By this, security ν against plastic elongation with the permissible 0.2 % offset yield stress $\sigma_{z\,0.2\,perm}$ or permissible yield point $\sigma_{z\,Re\,perm}$ result in:

$$\nu = \frac{\sigma_{z\,0.2\,perm}}{\sigma_z}$$ or $$\nu = \frac{\sigma_{z\,Re\,perm}}{\sigma_z}$$

» The following additional notch effect factors need to be allowed for in the check calculation of the link plates:
f_{notch} = 0.85 when using an area hole
f_{notch} = 0.95 when using a round hole

Calculating the shearing stress/ breaking load of the pin

The shearing stress τ and the safety against shearing are calculated using the shear strength of the pin material:

Shearing stress of the pin

$$\tau = \frac{F}{2 \cdot A_b}$$

$$A_b = \frac{d_1^2 \cdot \pi}{4}$$

d_1	mm	Pin diameter
A_b	mm^2	Pin surface
τ	N/mm^2	Shearing stress

The minimum breaking load F_B of the pin is calculated as follows:

Breaking load of the pin

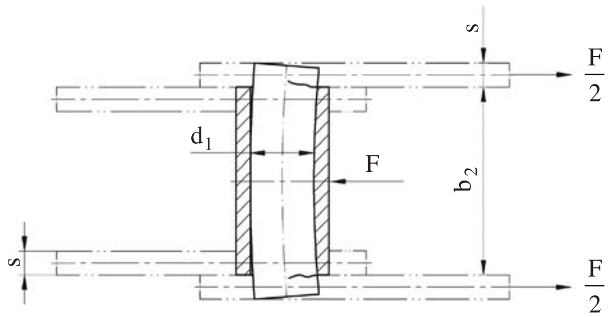
$$F_B = 2 \cdot A_b \cdot \tau_{perm}$$

The pin safety ν against shearing is calculated by means of the permissible shearing stress τ_{all} :

$$\nu = \frac{\tau_{perm}}{\tau}$$

Calculating the bending stress

3



Bending stress

The bending stress acc. to Fig. 3 considers the bending of the pin on the assumed length between the bearing points in the outer link plates. The bending stress is calculated following the allowances of the conveyor chains to DIN with the sizes F, b_2, s and W.

Bending stress of the pin

$$\sigma_b = \frac{F \cdot (b_2 + 2s)}{8 \cdot W}$$

$$W = \frac{\pi \cdot d_1^3}{32}$$

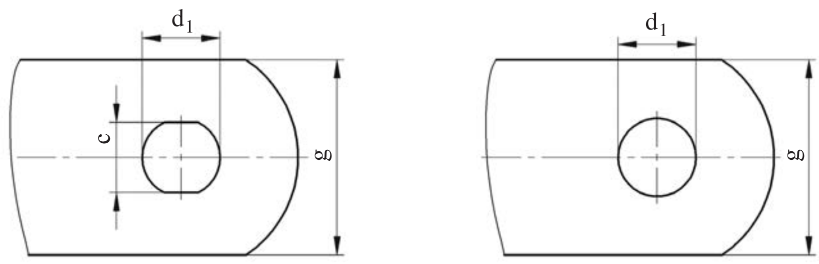
b_2	mm	Width of inner link
s	mm	Thickness of link plate
W	mm^3	Resisting torque
σ_b	N/mm^2	Bending stress

The safety against bending results from the permissible bending stress of the pin material and the bending stress:

$$\nu = \frac{\sigma_{b\,perm}}{\sigma_b}$$

Calculating the hole pressure of link plate/ pin

4



Hole pressure link plate/pin

The hole pressure is calculated from the chain pull and the projected pin surface of the pin pressed into the link plate. A distinction is drawn between round hole and flat hole.

For a flat hole pressure p_L is calculated as follows:

Calculation

$$p_L = \frac{F}{2 \cdot c \cdot s}$$

p_L in N/mm^2 Hole pressure

and for a round hole:

$$p_L = \frac{F}{2 \cdot d_1 \cdot s}$$

The safety factor is calculated using the permissible hole pressure of the link plate material $p_{L\,zul}$:

$$\nu = \frac{p_{L\,perm}}{p_L}$$

Calculating the hole pressure of link plate/ bush

The hole pressure between link plate and bush is calculated in the same way as the hole pressure for link plate and pin.

Bearing pressure

The bearing pressure is understood as the pressure between pin and bush or roller and bush on each chain joint. The bearing pressure is a major criterion for wear and hence for the service life of a chain.

The joint wear depends on many factors, for instance:

Joint wear

- Chain pull
- Chain speed
- Number of teeth
- Center distance
- Chain materials
- Chain lubrication
- Ambient conditions

(see also definition of the operational characteristics on page 12)

Calculating the bearing pressure of bush/ pin

The bearing pressure is calculated from the total chain pull, the pin diameter, and the supporting length of bush:

Bearing pressure bush/ pin

$$p_r = \frac{F}{A_f} \leq p_{r\,perm}$$

$$A_f = l_2 \cdot d_1$$

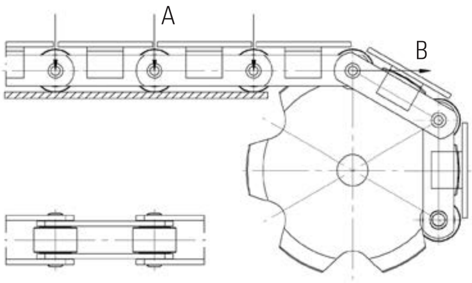
F	N	Total chain pull
A_f	mm^2	Bearing area
p_r	N/mm^2	Bearing pressure (bush/pin)
d_1	mm	Pin diameter
l_2	mm	Length of bush

The permissible bearing pressure $p_{r\,perm}$ for standard chains should be based on value stated in DIN 8165 and DIN 8167 which are at approx. 21 N/mm^2 to 28 N/mm^2. Even a higher pressure is admissible depending on application and selected materials.

Calculating the bearing pressure of roller/ bush

Chain with inboard rollers

5



For this type of chain, aside from the vertical roller load one also has to consider the load on the roller when it is entering the sprocket (approx. 60 % – 80 % of the chain pull).

» Load case A:
Roller load from the weight of material conveyed

Bearing pressure/ bush

$$p_r = \frac{G_{roll.} \cdot g}{A_f}$$

$$A_f = l_3 \cdot d_3$$

$G_{roll.}$	kg	Weight of material conveyed per roller
d_3	mm	Bush of outer diameter
l_3	mm	Roller length

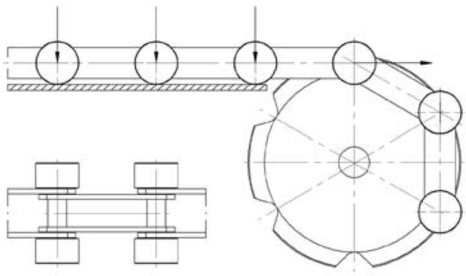
» Load case B:
Roller load based on the total chain pull when the chain is entering the sprocket

$$p_r = \frac{(0.6 - 0.8) \cdot F}{A_f}$$

F	N	Total chain pull

Calculating the bearing pressure – chain with outboard roller

6



Chain with exterior rollers

In the case of chains with outboard rollers, there is no additional load on the rollers when entering the sprocket because the bush engages the sprocket.

The same conditions between bush and pin apply for rollers that are loaded in the sprocket, with respect to surface bearing pressure.

The following load reference value at normal lubrication and operating conditions applies for rollers which are perpendicularly loaded under rotary motion:

Steel, hardened:	$p_{r\ perm} = 8\ N/\ mm^2$

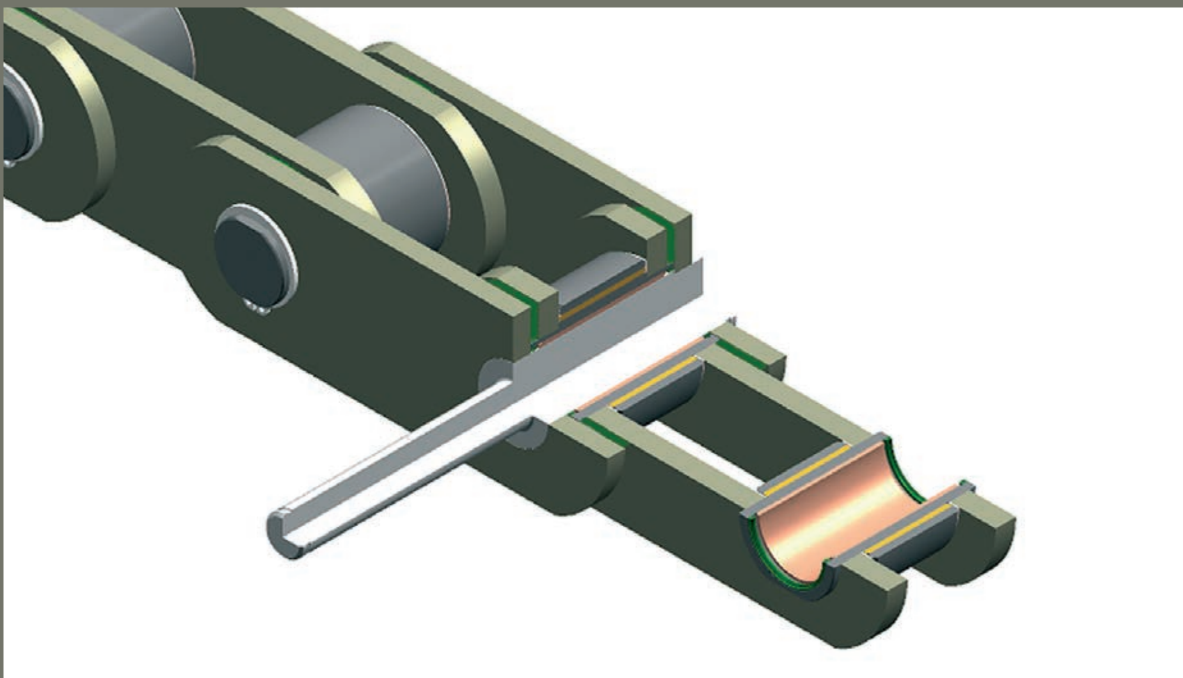
For rollers that are made of other materials or have slide or ball bearings the specific admissible loads have to be determined in accordance with the respective operating conditions.

KettenWulf is one of the leading manufacturers of high-quality conveyor and transport chains. Our products are used in a wide variety of applications and across a broad range of industries: for instance in the automotive industry, for instance, the bulk material industry, and the wood industry.

Since each customer's demands differ from those of others, KettenWulf specializes in providing customized product solutions in the conveyor chains sector. Our engineers and technicians develop special conveyor and transport chains which are optimized for your specific applications.

KettenWulf conveyor chains

Low-maintenance and lubrication-free chains offer economic and ecological advantages as well as a significant cost reduction in terms of maintenance and repair. The illustration shows lubrication-free technology for the escalator industry.



Customized precision for all industries

KettenWulf develops and produces special conveyor and transport chains in all designs and dimensions for all applications and industries. Moreover, we manufacture standard chains according to DIN, ISO and ANSI specifications. In addition, our product range also includes Galle chains, draw bench chains, block link chains as well as articulated gear racks for locks and dams. Pinion and rack drives and bush chains according to DIN 8164 are also available.

Figure 1:
Non back-bending chain for the cement industry

Figure 2:
Conveyor chain for the paint shop line in automotive manufacturing

1


2


Figure 3:
Galle chain for locks and dams

Figure 4:
Double-strand chain for the transport of paper rolls

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Figure 5:
Conveyor chain for rollercoasters

Figure 6:
Step chain for escalators

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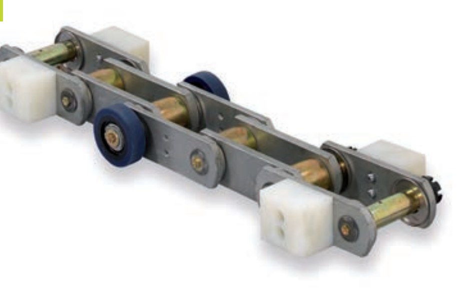

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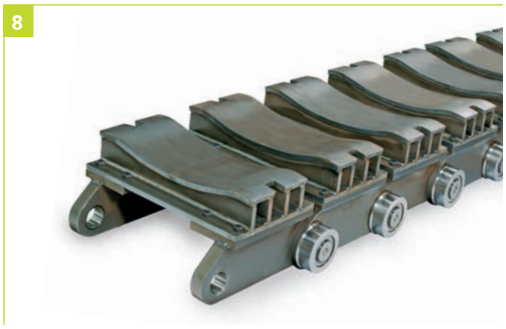
Figure 7:
Slat conveyor chain for the final assembly line in automotive manufacturing

Figure 8:
Coil transport chain for steel mills

7

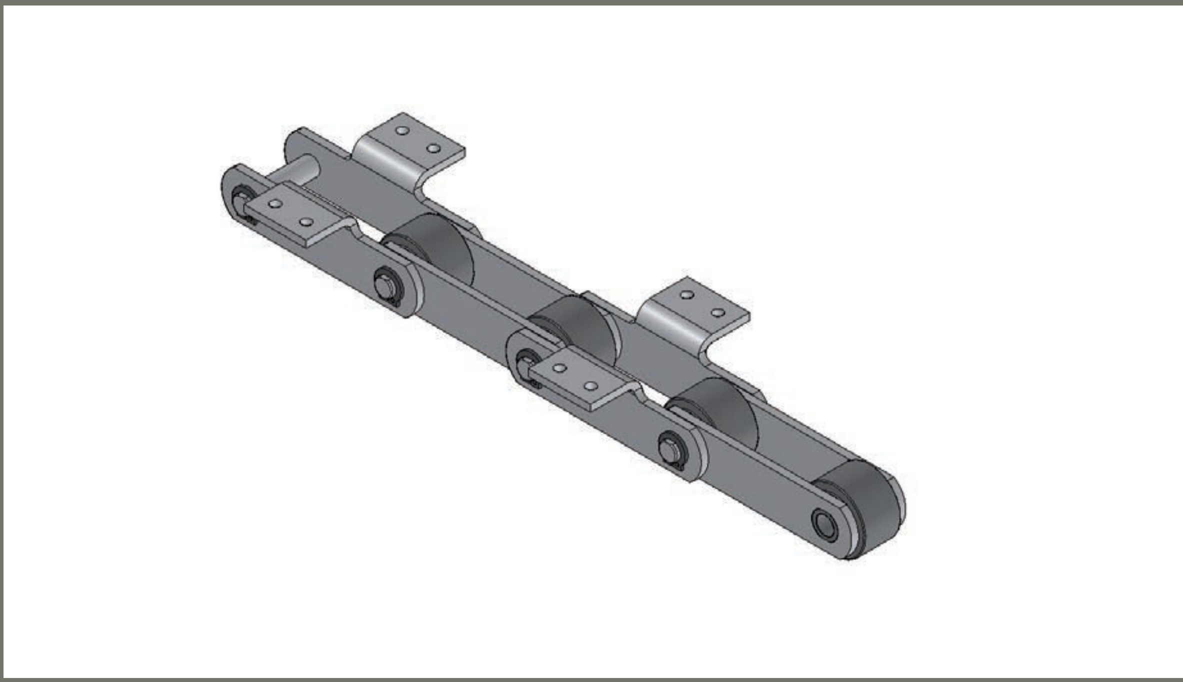

8


Chains which have a joint consisting of pins and link plates at specific intervals – "the pitch" are called "articulated chains". The main elements of these chains are link plates and joint parts.

To improve the articulation and reduce the wear on the joint, the links of the majority of chains are equipped with a bush and, often, additionally with a roller. These types of chain are referred to as "bush conveyor chains".

The broad range of applications for articulated chains has led to the development of various construction types and configurations after pitch. You will find a selection of the most common types of these chains on the following pages. Although our core competence lies in the manufacture of customized chains, we supply all types of conveyor chains, including other dimensions.

Standard conveyor chains



Standard conveyor chains and special chains

Besides standard conveyor chains, KettenWulf focuses on the production of special chains according to customer specification, including conveyor and transport chains of all types, in all dimensions, for every purpose and application. We look forward to receiving your inquiry.

Figure 1:
Conveyor chains with solid pins,
› FV configuration, DIN 8165
› ISO configuration M, DIN 8167

Figure 2:
Deep-link chain with full-pin,
› FVT configuration, DIN 8165
› ISO configuration MT, DIN 8167

Figure 3:
Conveyor chains with hollow pin,
› formerly DIN 8165
› ISO configuration MC, DIN 8168

Figure 4:
Trough conveyor chains based on
› DIN 8165/ 8167

Figure 5:
Conveyor chains with solid pin, bush-conveyor chains,
› DIN 8175

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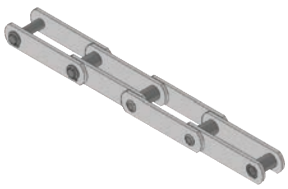

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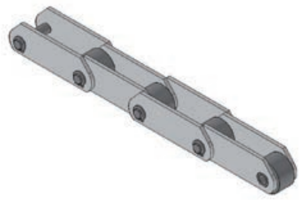

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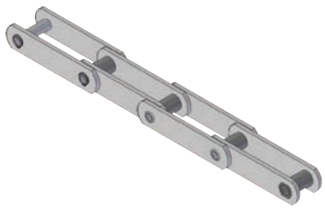

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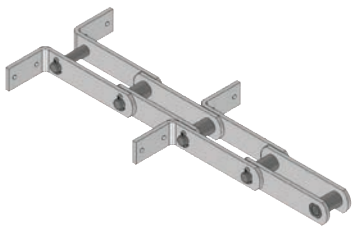

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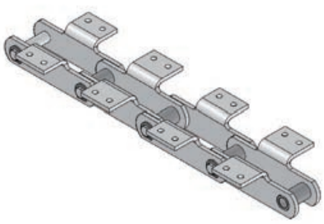
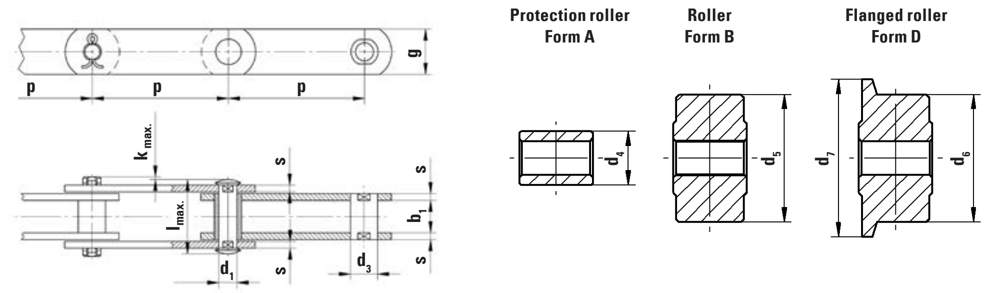


Conveyor chains with solid pin, FV configuration, DIN 8165

1



Technical specifications for bush conveyor chains, FV configuration, DIN 8165

Type of chain	Breaking load	Permissible tensile force	Bearing area	Permissible bearing pressure	Pitch										Inner width	Pin	Bush ø	Protection roller ø	Roller ø	Flanged roller ø		Height of link plate	Thickness of link plate	Excess connecting pin length	Length of pin
	$N_{min.}$	N	~ cm²	N/cm²	p										b_1	d_1	d_3	d_4	d_5	d_6	d_7	g	s	$k_{max.}$	$l_{max.}$
FV 40	40000	6700	2.5	2680	40	63	100	-	-	-	-	-	-	-	18	10	15	20	32	40	48	25	3	3.5	37
FV 63	63000	10500	3.7	2840	-	63	100	125	160	-	-	-	-	-	22	12	18	26	40	50	60	30	4	4.5	46
FV 90	90000	15000	5.0	3000	-	63	100	125	160	200	250	-	-	-	25	14	20	30	48	63	73	35	5	4.5	53
FV 112	112000	18700	6.8	2750	-	-	100	125	160	200	250	-	-	-	30	16	22	32	55	72	87	40	6	4.5	63
FV 140	140000	23400	8.6	2720	-	-	100	125	160	200	250	315	-	-	35	18	26	36	60	80	95	45	6	6	68
FV 180	180000	30000	12.3	2440	-	-	-	125	160	200	250	315	400	-	45	20	30	42	70	100	120	50	8	7	86
FV 250	250000	41700	18.7	2230	-	-	-	125	160	200	250	315	400	-	55	26	36	50	80	125	145	60	8	8	98
FV 315	315000	52500	25.8	2040	-	-	-	-	160	200	250	315	400	-	65	30	42	60	90	140	170	70	10	8	117
FV 400	400000	66700	30.7	2170	-	-	-	-	160	200	250	315	400	-	70	32	44	60	100	150	185	70	12	10	131
FV 500	500000	83400	38.2	2180	-	-	-	-	160	200	250	315	400	500	80	36	50	70	110	160	195	80	12	10	141
FV 630	630000	105000	48.7	2160	-	-	-	-	-	200	250	315	400	500	90	42	56	80	120	170	210	100	12	10	153

» Materials

Link plates: Steel with a tensile strength of min. 600 N/mm²

Pins and bushes: Case-hardened steel

Double-strand configurations

Typ	Sp	ME	LW	d_8	c	f
FV 40	500	506	475	15	1	3
FV 63	500	507	468	18	1.5	3.5
FV 90	500	509	463	20	2	4.5
FV 112	500	510	455	22	2.5	5
FV 140	500	512	452	26	3	6
FV 180	500	520	441.5	30	3	10
FV 250	500	523	434	36	3.5	11.5
FV 315	500	529	422	42	3.5	14.5
FV 400	500	533	412	44	3.5	16.5
FV 500	500	535	404	50	3.5	17.5
FV 630	500	535	394	56	4.5	17.5

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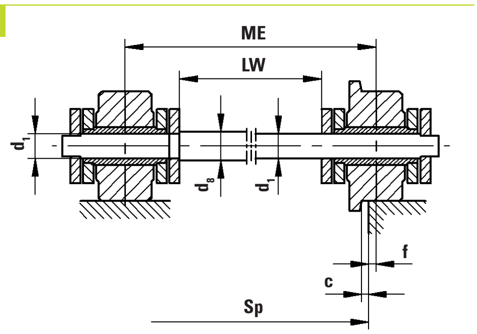
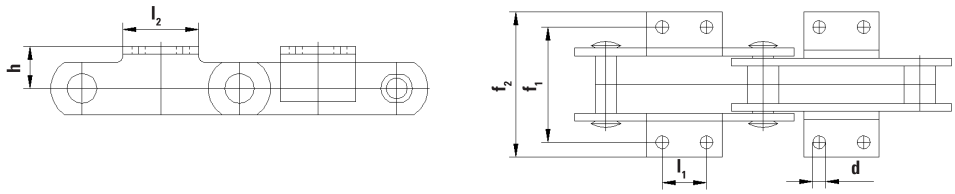


» Other dimensions available on request. Please contact us!

Attachments for conveyor chains with solid pin, FV configuration, DIN 8165

3



Technical specifications for bush conveyor chains, FV configuration, DIN 8165

Description acc. to DIN 8165		Pitch p 63	100	125	160	200	250	315	400	500	Bore ø d	Chain center to fastening hole center ½ f_1	Chain center to end outside ½ f_2	Chain center to upper edge ∆ h	Attachment dimensions
FV 40	l_1 Bore hole	1 Bore	30	-	-	-	-	-	-	-	6.6	25	50	20	25 x 25 x 3
	l_2 Att. length	30	50	-	-	-	-	-	-	-					
FV 63	l_1 Bore hole	1 Bore	30	40	50	-	-	-	-	-	9.0	34	55	30	30 x 30 x 3
	l_2 Att. length	40	50	60	70	-	-	-	-	-					
FV 90	l_1 Bore hole	-	30	40	50	60	65	-	-	-	9.0	40	65	35	40 x 40 x 4
	l_2 Att. length	-	50	60	70	80	85	-	-	-					
FV 112	l_1 Bore hole	-	30	40	50	65	80	-	-	-	11	50	70	40	40 x 40 x 5
	l_2 Att. length	-	50	65	75	90	105	-	-	-					
FV 140	l_1 Bore hole	-	30	40	50	65	80	100	-	-	11	50	85	45	50 x 50 x 5
	l_2 Att. length	-	55	65	75	90	105	125	-	-					
FV 180	l_1 Bore hole	-	-	35	50	65	80	100	100	-	14	64	95	45	50 x 50 x 6
	l_2 Att. length	-	-	65	80	95	110	130	130	-					
FV 250	l_1 Bore hole	-	-	1 Bore	50	65	80	100	100	-	14	69	115	55	65 x 65 x 7
	l_2 Att. length	-	-	50	80	95	110	130	130	-					
FV 315	l_1 Bore hole	-	-	-	1 Bore	65	80	100	100	-	14	85	130	60	70 x 70 x 9
	l_2 Att. length	-	-	-	50	95	110	130	130	-					
FV 400	l_1 Bore hole	-	-	-	1 Bore	60	80	100	100	-	18	95	145	65	80 x 80 x 10
	l_2 Att. length	-	-	-	50	100	120	140	140	-					
FV 500	l_1 Bore hole	-	-	-	1 Bore	50	80	100	100	100	18	100	150	70	80 x 80 x 10
	l_2 Att. length	-	-	-	50	90	120	140	140	140					
FV 630	l_1 Bore hole	-	-	-	-	1 Bore	70	100	100	100	18	115	175	80	100 x 100 x 10
	l_2 Att. length	-	-	-	-	50	110	140	140	140					

» The attachments can be either bent or welded, mounted on one or both sides.

Conveyor chains with solid pin, ISO configuration M, DIN 8167

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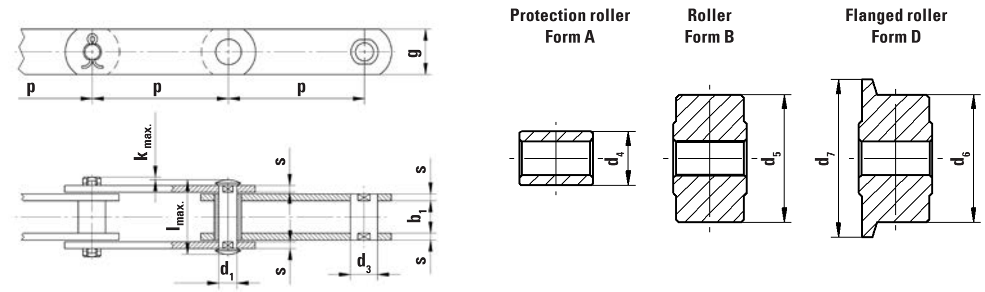

Technical specifications for bush conveyor chain, ISO configuration M, DIN 8176

Type of chain	Breaking load	Permissible tensile force	Bearing area	Permissible bearing area pressure	Pitch															Inner width	Pin ø	Bush ø	Protection roller ø	Roller ø	Flanged roller ø		Height of link plate	Thickness of link plate	Excess connecting pin length	Length of pin
	N min.	N	~ cm²	N/cm²	p															b_1	d_1	d_3	d_4	d_5	d_6	d_7	g	s	$k_{max.}$	$l_{max.}$
M 20	20000	2850	1.3	2160	40	50	63	80	100	125	160	-	-	-	-	-	-	-	-	16	6	9	12.5	25	25	30	18	2.5	7	35
M 28	28000	4000	1.8	2290	-	50	63	80	100	125	160	200	-	-	-	-	-	-	-	18	7	10	15	30	30	36	20	3	8	40
M 40	40000	5700	2.4	2400	-	-	63	80	100	125	160	200	250	-	-	-	-	-	-	20	8.5	12.5	18	36	36	42	25	3.5	9	45
M 56	56000	8000	3.3	2430	-	-	63	80	100	125	160	200	250	-	-	-	-	-	-	24	10	15	21	42	42	50	30	4	10	52
M 80	80000	11400	4.7	2440	-	-	-	80	100	125	160	200	250	315	-	-	-	-	-	28	12	18	25	50	50	60	35	5	12	62
M 112	112000	16000	6.8	2370	-	-	-	80	100	125	160	200	250	315	-	-	-	-	-	32	15	21	30	60	60	70	40	6	14	73
M 160	160000	22850	9.4	2440	-	-	-	-	100	125	160	200	250	315	400	-	-	-	-	37	18	25	36	70	70	85	50	7	16	85
M 224	224000	32000	12.6	2540	-	-	-	-	-	125	160	200	250	315	400	500	-	-	-	43	21	30	42	85	85	100	60	8	18	98
M 315	315000	45000	17.5	2570	-	-	-	-	-	-	160	200	250	315	400	500	630	-	-	48	25	36	50	100	100	120	70	10	21	112
M 450	450000	64300	24.6	2620	-	-	-	-	-	-	-	200	250	315	400	500	630	800	-	56	30	42	60	120	120	140	80	12	25	135
M 630	630000	90000	34.6	2610	-	-	-	-	-	-	-	-	250	315	400	500	630	800	1000	66	36	50	70	140	140	170	100	14	30	154
M 900	900000	128600	49.3	2610	-	-	-	-	-	-	-	-	250	315	400	500	630	800	1000	78	44	60	85	170	170	210	120	16	37	180

» Materials

Link plates: Steel with a tensile strength of min. 600 N/mm²

Pins and bushes: Case-hardened steel

Double-strand configurations

Type	Sp	ME	LW	d_8	c	f
M 20	500	506	479	7	1	3
M 28	500	507	475	8.5	1	3.5
M 40	500	507	471	10	1	3.5
M 56	500	509	467	12	1.5	4.5
M 80	500	510	460	15	2	5
M 112	500	510	452	18	2.5	5
M 160	500	511	444	21	3	5.5
M 224	500	514	437	25	3	7
M 315	500	515	424	30	3	7.5
M 450	500	516	408	35	3.5	8
M 630	500	522	396	42	3.5	11
M 900	500	527	381	50	3.5	13.5

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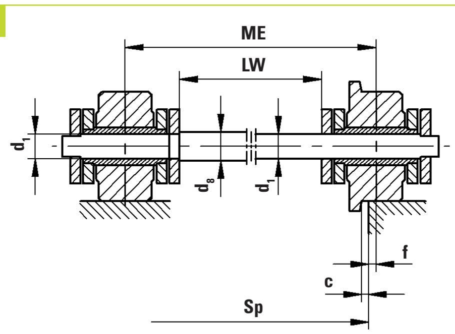
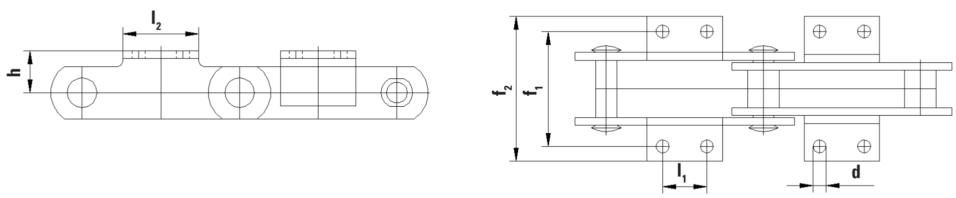


» Other dimensions available on request. Please contact us!

Attachments for conveyor chains with solid pin, ISO configuration M, DIN 8176

3



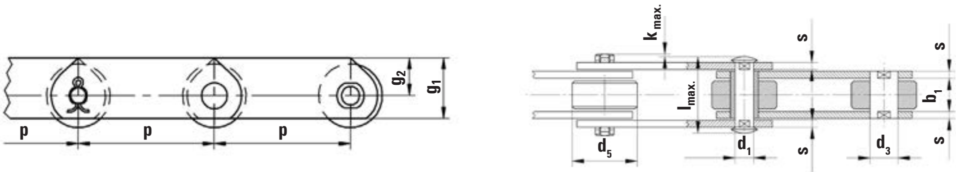
Technical specifications for bush conveyor chain, ISO configuration M, DIN 8176

Description acc. to DIN 8167		Pitch p 40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	Bore ø d	Chain center to fastening hole center ½ f_1	Chain center to end outside ½ f_2	Chain center to upper edge ∆ h	Attachment dimensions
M 20	l_1 Bore hole	1 Bore	1 Bore	20	35	50	50	50	-	-	-	-	-	-	-	-	6.5	27	42	16	25 x 25 x 3
	l_2 Att. length	14	14	35	50	65	65	65	-	-	-	-	-	-	-	-					
M 28	l_1 Bore hole	-	1 Bore	1 Bore	25	40	65	65	65	-	-	-	-	-	-	-	9	32	50	20	30 x 20 x 3
	l_2 Att. length	-	20	20	45	60	85	85	85	-	-	-	-	-	-	-					
M 40	l_1 Bore hole	-	-	1 Bore	20	40	65	65	65	65	-	-	-	-	-	-	9	35	56	25	30 x 30 x 3
	l_2 Att. length	-	-	20	40	60	85	85	85	85	-	-	-	-	-	-					
M 56	l_1 Bore hole	-	-	1 Bore	1 Bore	25	50	85	85	85	-	-	-	-	-	-	11	44	70	30	40 x 40 x 4
	l_2 Att. length	-	-	22	22	50	75	110	110	110	-	-	-	-	-	-					
M 80	l_1 Bore hole	-	-	-	1 Bore	1 Bore	50	85	125	125	125	-	-	-	-	-	11	48	80	35	40 x 40 x 4
	l_2 Att. length	-	-	-	22	22	75	110	150	150	150	-	-	-	-	-					
M 112	l_1 Bore hole	-	-	-	1 Bore	1 Bore	35	65	100	100	100	-	-	-	-	-	14	55	92	40	50 x 50 x 6
	l_2 Att. length	-	-	-	28	28	65	95	130	130	130	-	-	-	-	-					
M 160	l_1 Bore hole	-	-	-	-	1 Bore	1 Bore	50	85	145	145	145	-	-	-	-	14	62	100	45	50 x 50 x 6
	l_2 Att. length	-	-	-	-	30	30	80	115	175	175	175	-	-	-	-					
M 224	l_1 Bore hole	-	-	-	-	-	1 Bore	1 Bore	65	125	190	190	190	-	-	-	18	70	114	55	60 x 60 x 8
	l_2 Att. length	-	-	-	-	-	35	35	100	160	225	225	225	-	-	-					
M 315	l_1 Bore hole	-	-	-	-	-	-	1 Bore	50	100	155	155	155	155	-	-	18	80	125	65	70 x 70 x 9
	l_2 Att. length	-	-	-	-	-	-	35	85	135	190	190	190	190	-	-					
M 450	l_1 Bore hole	-	-	-	-	-	-	-	1 Bore	85	155	240	240	240	240	-	18	90	140	75	70 x 70 x 9
	l_2 Att. length	-	-	-	-	-	-	-	40	125	195	280	280	280	280	-					
M 630	l_1 Bore hole	-	-	-	-	-	-	-	-	1 Bore	100	190	300	300	300	300	24	115	190	90	100 x 100 x 12
	l_2 Att. length	-	-	-	-	-	-	-	-	50	150	240	350	350	350	350					
M 900	l_1 Bore hole	-	-	-	-	-	-	-	-	1 Bore	65	155	240	240	240	240	30	140	240	110	120 x 120 x 15
	l_2 Att. length	-	-	-	-	-	-	-	-	60	125	215	300	300	300	300					

» The attachments can be either bent or welded, mounted on one or both sides.

Conveyor chains with solid pin, FVT configuration, DIN 8165

1



Technical specifications for conveyor chains with solid pin, FVT configuration, DIN 8165

Type of chain	Breaking load N min.	Permissible tensile force N	Bearing area ~ cm²	Permissible bearing area pressure N/cm²	Pitch p										Inner width b_1	Pin ø d_1	Bush ø d_3	Roller ø d_5	Height of link plate g_1	g_2	Thickness of link plate s	Excess connecting pin length $k_{max.}$	Length of pin $l_{max.}$
FVT 40	40000	6700	2.5	2680	40	63	100	-	-	-	-	-	-	-	18	10	15	32	35	22	3	3.5	37
FVT 63	63000	10500	3.7	2840	-	63	100	125	160	-	-	-	-	-	22	12	18	40	40	25	4	4.5	46
FVT 90	90000	15000	5.0	3000	-	63	100	125	160	200	250	-	-	-	25	14	20	48	45	27.5	5	4.5	53
FVT 112	112000	18700	6.8	2750	-	-	100	125	160	200	250	-	-	-	30	16	22	55	50	30	6	4.5	63
FVT 140	140000	23400	8.6	2720	-	-	100	125	160	200	250	315	-	-	35	18	26	60	60	37.5	6	6	68
FVT 180	180000	30000	12.3	2440	-	-	-	125	160	200	250	315	400	-	45	20	30	70	70	45	8	7	86
FVT 250	250000	41700	18.7	2230	-	-	-	125	160	200	250	315	400	-	55	26	36	80	80	50	8	8	98
FVT 315	315000	52500	25.8	2040	-	-	-	-	160	200	250	315	400	-	65	30	42	90	90	55	10	8	117
FVT 400	400000	66700	30.7	2170	-	-	-	-	160	200	250	315	400	-	70	32	44	100	90	55	12	10	131
FVT 500	500000	83400	38.2	2180	-	-	-	-	160	200	250	315	400	500	80	36	50	110	100	60	12	10	141
FVT 630	630000	105000	48.7	2160	-	-	-	-	-	200	250	315	400	500	90	42	56	120	120	70	12	10	153

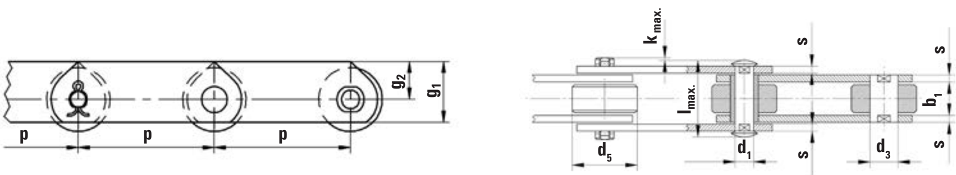
» Materials

Link plates: Steel with a tensile strength of min. 600 N/mm²

Pins and bushes: Case-hardened steel

Conveyor chains with solid pin, ISO configuration MT, DIN 8167

1



Technical specifications for conveyor chains with solid pin, ISO configuration MT, DIN 8167

Type of chain	Breaking load	Permissible tensile force	Bearing area	Permissible bearing area pressure	Pitch												Inner width	Pin ø	Bush ø	Roller ø	Height of link plate		Thickness of link plate	Excess connecting pin length	Length of pin
	N min.	N	~ cm²	N/cm²	p												b_1	d_1	d_3	d_5	g_1	g_2	s	$k_{max.}$	$l_{max.}$
MT 20	20000	2850	1.3	2160	40	50	63	80	100	125	160	-	-	-	-	-	16	6	9	25	25	16	2.5	7	35
MT 28	28000	4000	1.8	2290	-	50	63	80	100	125	160	200	-	-	-	-	18	7	10	30	30	20	3	8	40
MT 40	40000	5700	2.4	2400	-	-	63	80	100	125	160	200	250	-	-	-	20	8.5	12.5	36	35	22.5	3.5	9	45
MT 56	56000	8000	3.3	2430	-	-	63	80	100	125	160	200	250	-	-	-	24	10	15	42	45	30	4	10	52
MT 80	80000	11400	4.7	2440	-	-	-	80	100	125	160	200	250	315	-	-	28	12	18	50	50	32.5	5	12	62
MT 112	112000	16000	6.8	2370	-	-	-	80	100	125	160	200	250	315	-	-	32	15	21	60	60	40	6	14	73
MT 160	160000	22850	9.4	2440	-	-	-	-	100	125	160	200	250	315	-	-	37	18	25	70	70	45	7	16	85
MT 224	224000	32000	12.6	2540	-	-	-	-	-	125	160	200	250	315	400	-	43	21	30	85	90	60	8	18	98
MT 315	315000	45000	17.5	2570	-	-	-	-	-	-	160	200	250	315	400	-	48	25	36	100	100	65	10	21	112
MT 450	450000	64300	24.6	2620	-	-	-	-	-	-	-	200	250	315	400	500	56	30	42	120	120	80	12	25	135
MT 630	630000	90000	34.6	2610	-	-	-	-	-	-	-	-	250	315	400	500	66	36	50	140	140	90	14	30	154
MT 900	900000	128600	49.3	2610	-	-	-	-	-	-	-	-	250	315	400	500	78	44	60	170	180	120	16	37	180

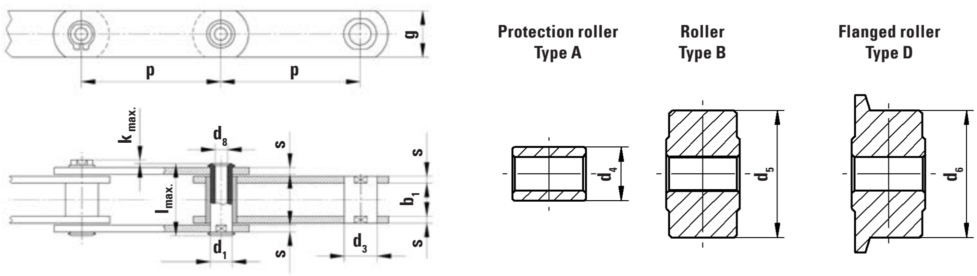
» Materials

Link plates: Steel with a tensile strength of min. 600 N/mm^2

Pins and bushes: Case-hardened steel

Conveyor chains with hollow pin, formerly DIN 8165

1



Technical specifications for hollow-pin chains, formerly DIN 8165

Breaking load	Permissible tensile force	Bearing area	Permissible bearing area pressure	Pitch											Inner width	Pin ø	Hollow pin inner ø	Bush ø	Protection roller ø	Roller ø		Flanged roller ø		Height of link plate		Thickness of link plate	Connecting pin excess length	Length of pin
																				DIN	KWN	DIN	KWN	inner	outer			
N min.	N	~ cm²	N/cm²	p											b_1	d_1	d_8	d_3	d_4	d_5	d_5	d_6	d_6	g	g	s	$k_{max.}$	$l_{max.}$
40000	5710	3.6	1586	63	80	100	125	160	-	-	-	-	-	-	22	12	8	18	26	50	40	63	50	30	30	4	3.5	41
49000	7000	4.9	1428	63	80	100	125	160	-	-	-	-	-	-	25	14	10	20	30	63	48	78	60	35	35	5	4.5	51
90000	12850	8.5	1515	-	80	100	125	160	200	-	-	-	-	-	35	18	12	26	36	80	60	100	75	45	45	6	5.0	66
100000	14285	12.2	1170	-	-	100	125	160	200	250	-	-	-	-	45	20	14	30	42	100	70	125	85	50	50	8	5.5	84
170000	24285	18.5	1315	-	-	100	125	160	200	250	-	-	-	-	55	26	18	36	50	125	80	155	100	60	60	8	7.5	96
250000	35700	25.5	1400	-	-	-	125	160	200	250	315	-	-	-	65	30	20	42	60	140	90	175	110	70	60	10	9.0	115
315000	45000	37.4	1200	-	-	-	-	160	200	250	315	400	-	-	80	36	26	50	70	160	110	200	140	80	70	12	10.5	138
440000	62850	52.1	1200	-	-	-	-	-	200	250	315	400	500	-	100	42	30	60	80	180	130	220	160	100	90	12	12.5	160
600000	85700	77.5	1100	-	-	-	-	-	-	250	315	400	500	1000	125	50	36	70	90	200	150	240	180	120	100	15	13.5	195
900000	128570	108.0	1160	-	-	-	-	-	-	250	315	400	500	1000	150	60	42	80	100	224	170	274	210	150	130	15	16.5	222

Conveyor chains with hollow pin, ISO configuration MC, DIN 8168

Technical specifications for hollow-pin chains, ISO configuration MC, DIN 8168

Type of chain	Breaking load	Permissible tensile force	Bearing area	Permissible bearing area pressure	Pitch										Inner width	Pin ø	Hollow pin inner ø	Bush ø	Protection roller ø	Roller ø	Flanged roller ø	Height of link plate	Thickness of link plate	Connecting pin excess length	Length of pin
	N min.	N	~ cm²	N/cm²	p										b_1	d_1	d_8	d_3	d_4	d_5	d_6	g	s	$k_{max.}$	$l_{max.}$
MC 28	28000	4000	3.6	1090	63	80	100	125	160	-	-	-	-	-	20	13	8.2	17.5	25	36	42	25	3.5	2.5	42
MC 56	56000	8000	5.1	1560	-	80	100	125	160	200	250	-	-	-	24	15.5	10.2	21	30	50	60	35	4	3	48
MC 112	112000	16000	9.9	1610	-	-	100	125	160	200	250	315	-	-	32	22	14.3	29	42	70	85	50	6	3	67
MC 224	224000	32000	18.6	1720	-	-	-	-	160	200	250	315	400	500	43	31	20.3	41	60	100	120	70	8	3	90

» Materials

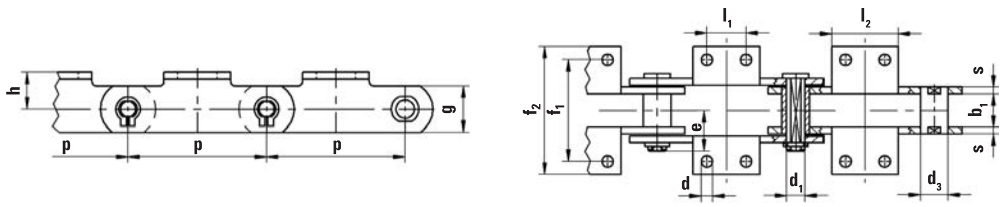
Link plates: Steel with a tensile strength of min. 600 N/mm²

Pins and bushes: Case-hardened steel

Conveyor chains with solid pin, heavy-duty configuration acc. to DIN 8175

Conveyor chains according to this standard are specifically employed in the bulk cargo industry.

1



Technical specification for bush-conveyor chains, heavy achievement acc. to DIN 8175

Type of chain	Breaking load	Bearing area	Pitch	Inner width	Pin ø	Bush ø	Chain center/pin end	Height of link plate	Thickness of link plate	Chain center to upper angle edge	Chain center to outer end	Chain center to center fastening hole center	Hole spacing	Bore ø	Attachment length
	N min.	~ cm^2	p	b_1	d_1	d_3	e	g	s	h	1/2 f_2	1/2 f_1	l_1	d	l_2
F 200	200000	9.3	160	30	20	32	46	50	8	50	78	62	50	11	80
F 315	315000	16.5	160	45	26	40	57	65	9	60	97.5	74	47	14	80
F 400	400000	17.0	160	45	26	40	59	70	10	60	97.5	74	47	14	80
F 500	500000	20.9	160	60	26	40	70	80	10	80	105	85	40	18	80
F 800	800000	25.3	160	60	30	44	72	90	12	90	105	85	40	18	80

» Materials

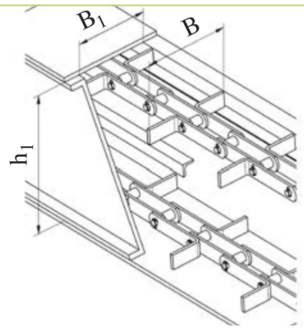
Link plates: Steel of min. 600 N/mm² tensile strength

Pins and bushes: Case hardening steel

Configurations of Trough Conveyor Chains

DIN 8165 and DIN 8167 are applicable for these types of chains. Other dimensions are available on request. The different configurations are shown below. The dimensions B, ME and RA are determined according to customer specifications.

1

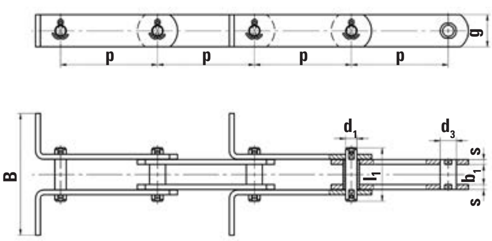


Single-strand configurations

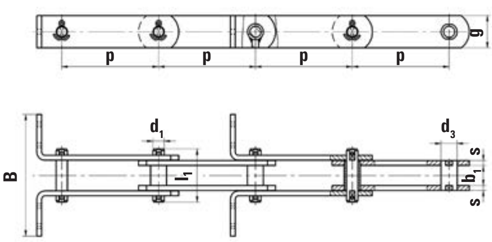
Type A (L-shaped)

Type B (L-shaped)
Trough conveyor chain with cleaning device welded under the bush and mounting holes. Spacing and dimensions of mounting holes and cleaning device according to customer specifications.

A



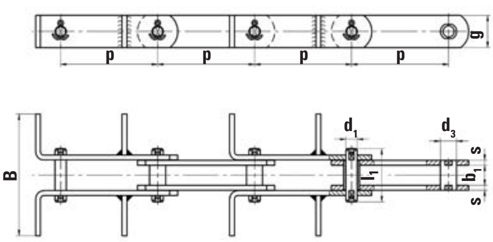
B



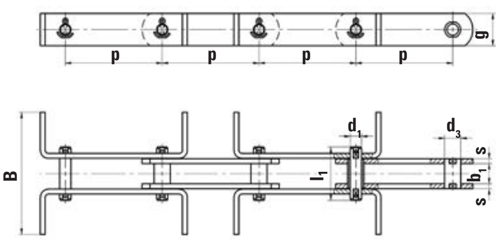
Type C
Trough conveyor chain with bent and welded scrapers

Type D (U-shaped)
Trough conveyor chain with double bent scrapers

C

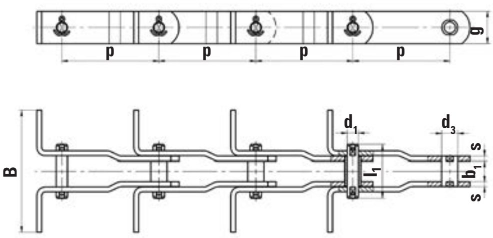


D



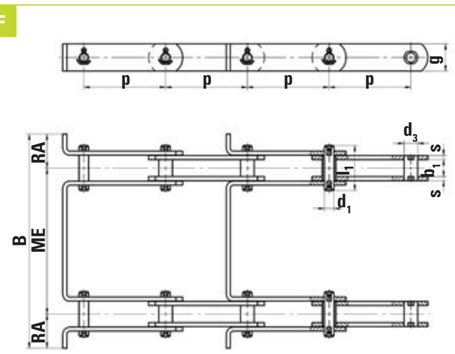
Type E
Trough conveyor chain with offset link plates and bent scrapers

E

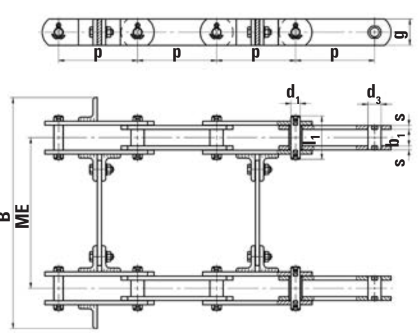


Double-strand configurations

F



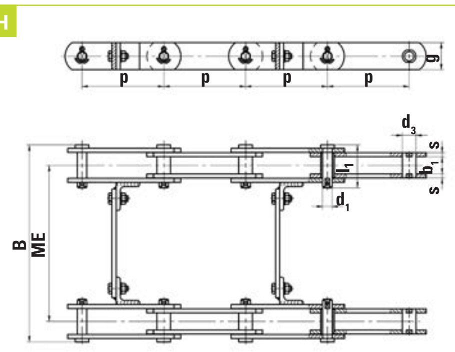
G



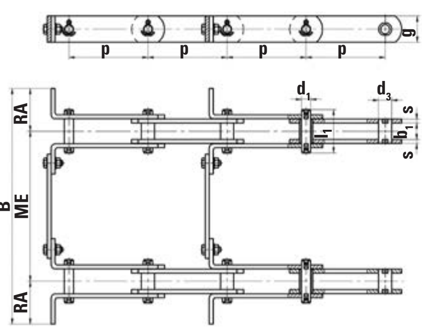
Type F
Double-strand trough conveyor chain with bent scrapers

Type G
Double-strand trough conveyor chain with welded angles; screwed scrapers with loose fit

H



I



Type H
Double-strand trough conveyor chain with welded angles and screwed scrapers

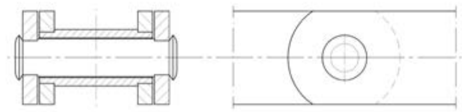
Type I
Double-strand trough conveyor chain with bent and screwed scrapers

Securing of pins according to factory standard

The pins of the conveyor chains can be secured in different ways. The most common types are depicted below.

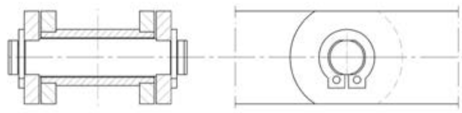
Securing types for chain links

1



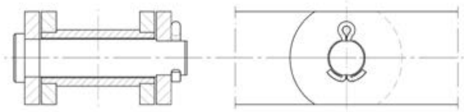
riveted on both sides

2



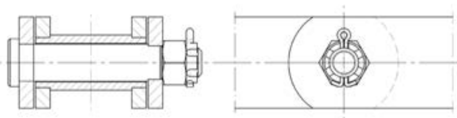
with a circlip on both sides

3



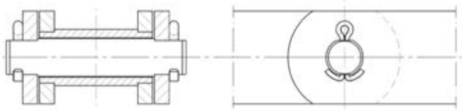
head pin with cotter pin

4



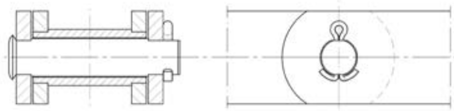
Head pin with screw nut

5



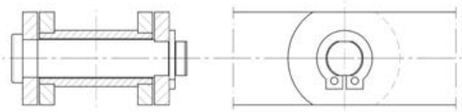
cottered on both sides

6



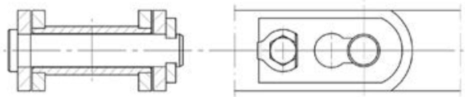
riveted and cottered

7



head pin with circlip

8

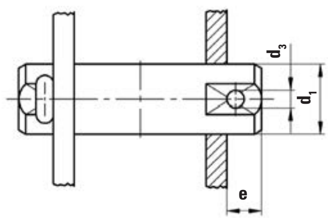


head pin with horn plate

Securing types for cotter pins according to KWN 038

Pin ø	Cotter hole ø	Excess length	Cotter pin	Pin ø	Cotter hole ø	Excess length	Cotter pin
d_1	d_3	e	DIN 94	d_1	d_3	e	DIN 94
6	2	4	2x12	21	6.3	11	6.3x36
7	2.5	5	2.5x16	22	6.3	11	6.3x36
8	2.5	5	2.5x16	24	6.3	11	6.3x40
10	3.2	6	3.2x20	25	6.3	11	6.3x40
11	3.2	6	3.2x22	26	6.3	11	6.3x40
12	4	8	4x22	28	6.3	11	6.3x45
13	4	8	4x25	30	6.3	11	6.3x45
14	4	8	4x25	32	8	15	8x50
15	4	8	4x28	34	8	15	8x50
16	5	9	5x28	36	8	15	8x56
17	5	9	5x28	38	8	15	8x56
18	5	9	5x32	42	8	15	8x63
20	5	9	5x32	44	8	15	8x63

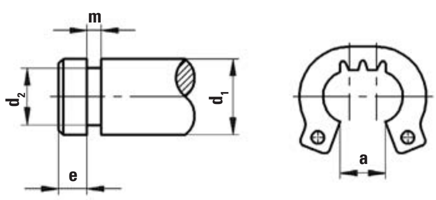
9



Securing types for circlips according to KWN 006

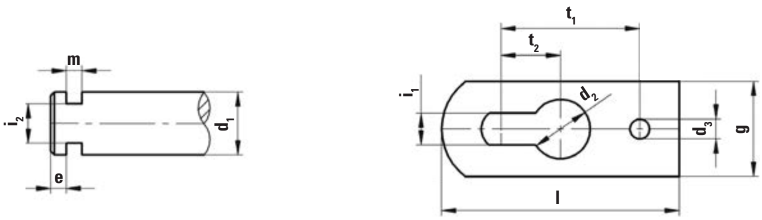
Pin ø d_1	Opening width a	Groove ø d_2	Width of keyway m	Circlip thickness s	Excess length e
8	6.5	6-	1.8+	1.5	4.3
10	7.6	7.2-	1.8+	1.5	4.3
12	9.8	9.4-	1.8+	1.5	4.8
14	11.4	10.9-	2.4+	2	5.9
16	16.4	12.7-	3.0+	2.5	7.5
18	14	13.8-	3.5+	3	8.5
20	16.	15-	3.5+	3	9.5
22	18	17.5-	3.5+	3	9.5
26	24	20-	3.5+	3	10.0
30	23.5	23-	4.5+	4	11.5
36	32.4	30-	4.5+	4	13.0
39	32.4	32.5-	5.5+	5	14.0
40	32.7	32.5-	4.5+	4	13.0
42	3.4	35.5-	4.5+	4	13.0
50	42.6	41.5-	5.5+	5	15.5
60	50.5	50-	5.5+	5	15.5

10



Securing by horn plates according to KWN 005

11

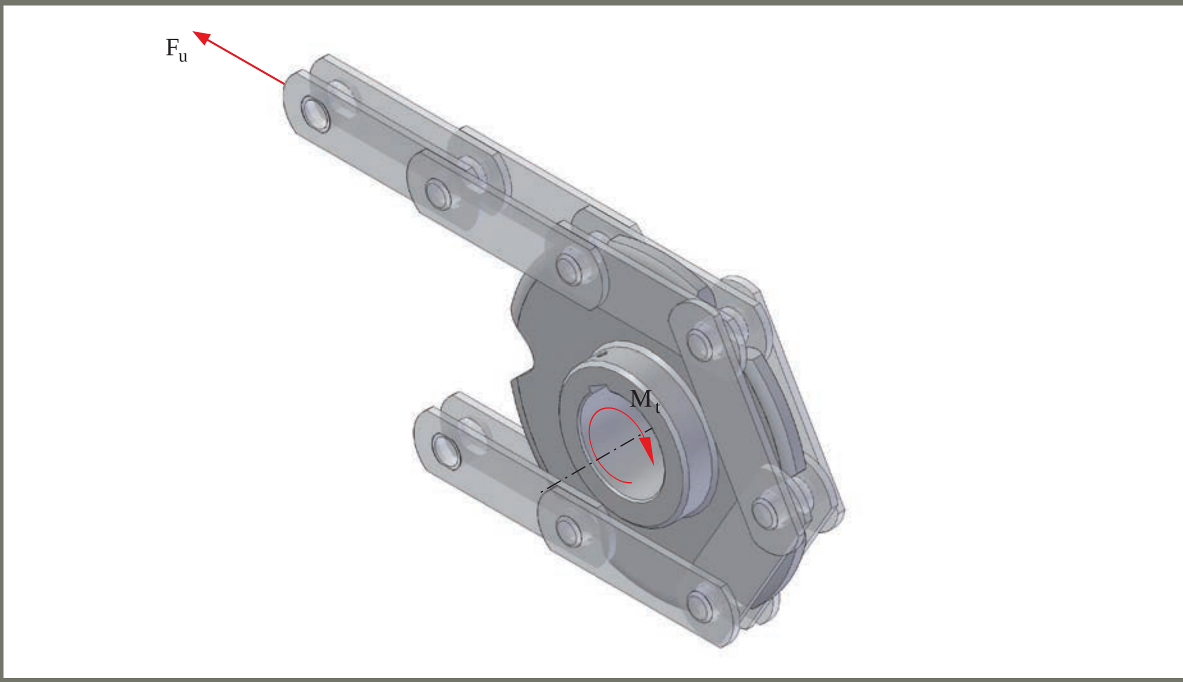


Pin ø d_1	Width of keyway m	Excess length e	Square measure axle i_2	Height g	Thickness s	Length l	Center axle to center security bore t_1	Center axle to center assembly bore t_2	Square measure horn plate i_1	Assembly bore ø d_2	Security bore ø d_3
14	4.2+	4.0	10-	30	4	65	31.5	11.5	10+	15	9
18	5.3+	5	13.5-	40	5	78	40	17	13.5+	19	9
20	6.3+	6	15-	40	6	89	50	20	15+	21	11
24	6.3+	6	16.3-	45	6	92	50	17	16.3+	25	11
26	6.3+	6	18-	45	6	112	65	30	18+	27.5	13
30	8.5+	8.0	22.2-	50	8	119	70	30	22.2+	31.5	13
36	10.5+	10.0	26.2-	60	10	135	80	40	26.2+	37.5	17
42	10.5+	10.0	29-	70	10	142	80	35	29+	44	17
44	10.5+	10.0	36.4-	70	10	165	100	45.5	36.4+	46	17
50	12.5+	12.0	38-	80	12	200	120	45	38+	52	21
60	12.5+	12.0	45-	100	12	220	130	50	45+	62	21

The following pages contain technical information about sprockets, including information about the toothing geometry as well as the calculation of the hub dimensions.

The different types of sprockets illustrated and the corresponding tables with standard dimensions and pitch circle diameters are designed to facilitate the selection of the sprocket configuration that is most suitable for your application. We will be pleased to assist you at any time – please contact us for further information.

Calculation of sprockets



Formula symbols and units for the calculation of sprockets

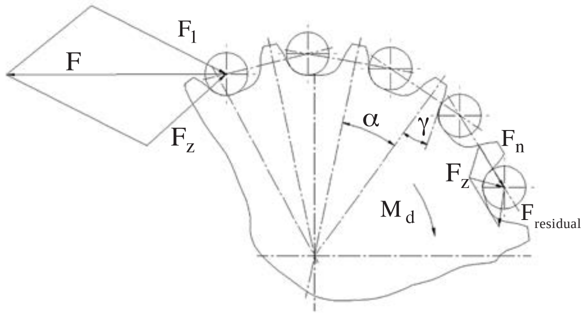
Adjustment factor	f	
Bore diameter	dB	mm
Bush diameter	d_3	mm
Driving speed	n	min^{-1}
Feather key width	b	mm
Fitting length	l	mm
Flank angle	γ	°
Force on chain tooth	F_z	N
Groove angle	β	°
Height of link plate	g	mm
Height of tooth head	h_k	mm
Hub depth of keyway	t_2	mm
Hub diameter	dN	mm
Hub length	NL	mm
Inner width of the chain	b_1	mm
Length of tooth flank	h_3	mm
Module	m	mm
Number of teeth	z	Piece
Number of teeth factor	n / z_1	
Number of teeth in contact	$Z_{contact}$	Piece
Permissible surface pressure	p_{all}	N/mm^2
Pitch	p	mm
Pitch angle	α	°
Pitch circle diameter	d_0	mm
Power	P	kW
Rim chamfer radius	r_4	mm
Rim diameter	d_s	mm
Roller bed angle	X	°
Roller bed radius	r_1	mm
Roller/bush diameter	d_1	mm
Root circle diameter	d_f	mm
Sagging force	F_s	N
Shaft diameter	d_w	mm
Shaft keyway depth	t_1	mm
Stress factor	c	
Surface pressure factor	K	
Tooth flank diameter	r_2	mm
Tooth gap clearance	u / S_1	mm
Tooth width	B_1	mm
Top diameter	d_a	mm
Total chain pull	F	N
Wrap angle	κ	°

Power transmission between sprocket and chain

Basic information

The power transmission between sprocket tooth and roller or bush is form-fit. The chain pull F, the force of the sprocket tooth F_z and the force of the chain link that is already engaged in the sprocket F_1 act on the incoming roller chain.

1



The force of the sprocket tooth acting on the incoming chain roller is:

Force distribution on the sprocket

$$F_z \geq F \cdot \left(\frac{\sin \alpha}{\sin(\alpha + \gamma)} \right)$$

F_z	N	Force at the sprocket tooth
F	N	Total chain pull
α	°	Pitch angle
γ	°	Angle of pressure

Style of the tooth design for conveyor sprockets

The flank angle γ is the decisive measure in the mechanics of power transmission between chain and sprocket. The number of teeth for transmitting the chain pulls increases with increasing flank angle. This reduces the load on the individual tooth as well as on the chain roller and chain bush. As a result, the wear is diminished on both sprocket and chain link. The flank angle largely determines the form of the tooth.

The largest possible tooth will have the largest flank angle, which represents the contour of the pinion and rack drive system. Choosing the smallest possible tooth and hence the largest possible flank angle entails the constraint that the chain must not jump the sprocket teeth. Indeed, this would be the case if the unused residual force on the sprocket was greater than the sagging force of the return strand. Thus, the sagging force F_s has to be greater than the residual force.

Calculation of the support

$$F_s \geq F \cdot \left(\frac{\sin \gamma}{\sin(\alpha + \gamma)} \right)^{z_{contact}}$$

F_s	N	Backup tensile force

Number of teeth in contact

$$z_{contact} = \frac{\kappa \cdot z}{360°}$$

κ	°	Angle of contact

Having selected the correct flank angle, the optimal toothing can be determined within the limits of the lowest possible stress between tooth and roller as well as avoidance of overjump between chain and sprocket tooth.

Sample calculation

Sample calculation of the force distribution

given: F = 10000 N; z = 18; γ = 32.75° ; κ = 160°;

Pitch angle:	$\alpha = \frac{360°}{z}$	α = 20.0°
Opening angle:	$\beta = \left(\frac{\alpha}{2} + \gamma\right) \cdot 2$	β = 85.0°
Force between roller and tooth:	$F_z \geq F \cdot \left(\frac{\sin\alpha}{\sin(\alpha+\gamma)}\right)$	F_Z = 4296.724 N
Number of teeth in contact:	$Z_{contact} = \frac{\kappa \cdot z}{360°}$	$Z_{contact}$ = 8 teeth
Residual force in the last tooth:	$F_S \geq F \cdot \left(\frac{\sin\gamma}{\sin(\alpha+\gamma)}\right)^{Z_{contact}}$	$F_S \geq$ 455,093 N ($F_{residual}$)

The sagging force must be greater than or equal to the residual force to prevent the chain from jumping off the sprocket.

Design of the toothing for roller chain sprockets

Since most roller chain drives operate at very high speeds, it is necessary to consider the contact impact between roller and tooth. The intensity of this impact depends on the drive geometry. One can say that the higher angular velocity and the greater pitch and flank angle are, the higher the contact impact will be. It decreases for sprockets with a high number of teeth. For roller chain drives, tooth forms according to DIN 8196 should be chosen.

Design of the toothing for pinion and rack drives

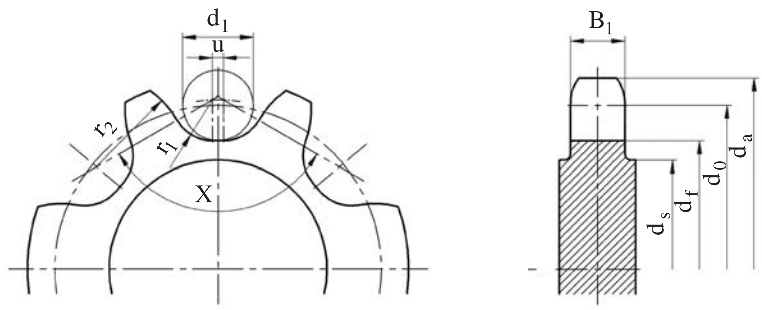
The pinion and rack drive guarantees an even power transmission which is free of play. While rotating, the pinion generates an evolvent curve. The tooth form is designed according to the equidistant of the respective evolvent curve. The precision of the pinion and rack drive depends on the accuracy of the equidistant and the pitch accuracy. By means of computer calculation, a tooth flank accuracy of 0.01 mm can be realized.

Toothing of sprockets for roller chains according to KWN 001

Scope and purpose

This standard is used for calculating the tooth profile dimensions for the toothing of roller chain sprockets.

1



Calculation

Pitch circle diameter

$$d_0 = \frac{p}{\sin \frac{180°}{z}}$$

p	mm	Chain pitch
z		Number of teeth

Root circle diameter

$$d_f = d_0 - d_1$$ (tolerance field h11)

d_1	mm	Roller/ bush diameter

Top diameter

$d_a = d_0 + (0.5 \div 0.6) \cdot d_1$ for z = 7 – 12

$d_a = d_0 + (0.6 \div 0.7) \cdot d_1$ for z = 13 – 25

$d_a = d_0 + (0.7 \div 0.8) \cdot d_1$ For z ≥ 25

Rim diameter

$$d_s = d_0 - p$$

Pitch angle

$$\alpha = \frac{360°}{z}$$

z_1	Number of teeth factor

Tooth flank diameter

$$r_2 = 0.008 \cdot d_1 \cdot (z_1^2 + 180)$$

Number of teeth factor

Teeth	Z_1
1 – 6	6
7 – 12	8
13 – ∞	12

Roller bed radius

$$r_1 = 0.505 \cdot d_1 + 0.069 \cdot \sqrt[3]{d_1}$$

Roller bed angle

Teeth	X
1 – 6	115°
7 – 12	120°
13 – ∞	125°

Tooth width

$$B_1 = 0.9 \cdot b_1$$

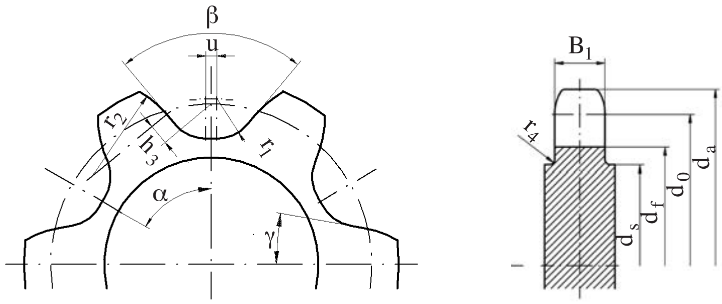
b_1	mm	Inner width of chain

Toothing of the sprockets for conveyor chains according to KWN 015

Scope and purpose

This factory standard was developed in consideration of the optimal force distribution between chain and sprocket. It can be applied if the technical parameters of the power transmission are known.

1



Calculation

$$d_0 = \frac{p}{\sin \frac{180°}{z}}$$

Pitch circle diameter

$d_f = d_0 - d_1$ (tolerance field h11)

Root circle diameter

$d_a = d_0 + 0.4 \cdot d_1$ Chain with roller
$d_a = d_0 + 0.6 \cdot d_1$ Chain with protection roller
$d_a = d_0 + 0.8 \cdot d_1$ Chain without roller

Top diameter

$$d_s = \frac{p}{\tan\left(\frac{\alpha}{2}\right)} - g - 2 \cdot r_4$$

Recess diameter

$r_1 = 0.51 \cdot d_1$

Roller bed radius

$r_2 = 0.8 \cdot p$

Tooth flank diameter

$$\alpha = \frac{360°}{z}$$

Pitch angle

$$\beta = \left(\frac{\alpha}{2} + \gamma\right) \cdot 2$$

Opening angle

calculated
by KettenWulf

Flank angle

$B_1 = 0.9 \cdot b_1$

Tooth width

$u = 0.02 \cdot p$

Tooth gap clearance

$h_3 = 0.3 \cdot d_1$

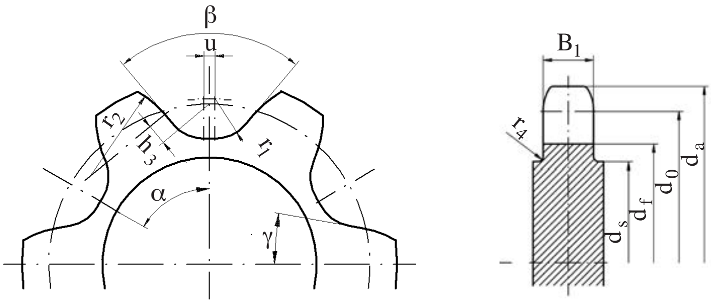
Length of tooth profile

Toothing of the sprockets for conveyor chains according to KWN 017

Scope and purpose

This factory standard is used to calculate the profile dimensions of bush conveyor chains for the toothing of bush conveyor chain sprockets. It is used as the standard toothing for the gearing of bush conveyor chain sprockets.

1



Calculation

Pitch circle diameter

$$d_0 = \frac{p}{\sin \frac{180°}{z}}$$

Root circle diameter

$d_f = d_0 - d_1$ (tolerance zone h11)

Top diameter

$d_a = d_0 + 0.4 \cdot d_1$ Chain with roller
$d_a = d_0 + 0.6 \cdot d_1$ Chain with protection roller
$d_a = d_0 + 0.8 \cdot d_1$ Chain without roller

Recess diameter

$$d_s = \frac{p}{\tan\left(\frac{\alpha}{2}\right)} - g - 2 \cdot r_4$$

Roller bed radius

$r_1 = 0.51 \cdot d_1$

Tooth flank diameter

$r_2 = 0.8 \cdot p$

Pitch angle

$$\alpha = \frac{360°}{z}$$

Flank angle

$$\gamma = \frac{\beta}{2} - \frac{180°}{z}$$

Opening angle

Number of teeth	β
6 – 11	74°
12 – 29	56°
> 29	38°

Tooth width

$B_1 = 0.9 \cdot b_1$

Tooth gap clearance

$u = 0.02 \cdot p$

Length of tooth profile

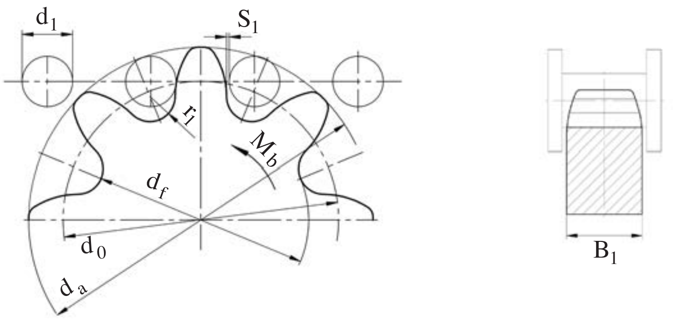
$h_3 = 0.3 \cdot d_1$

Toothing of the sprockets according to KWN 016

Scope and purpose

This factory standard is used for the design of lantern pinion sprockets.

1



Calculation

$$d_0 = \frac{z \cdot p}{\pi}$$

Pitch circle diameter

$$d_f = d_0 - 2 \cdot (0.15 \cdot m + r_1)$$

Root circle diameter

$$d_a = d_0 + 2 \cdot h_k$$

Top diameter

$$r_1 = 0.5 \cdot d_1$$

Radius of tooth gaps

$$m = \frac{p}{\pi}$$

Module

$$B_1 = 3.3 \cdot m$$

Tooth width

$$S_1 = 0.04 \cdot m$$

Tooth gap clearance

Calculation of the tooth form

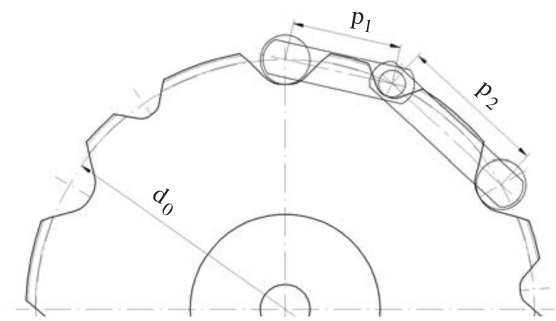
» The tooth geometry is calculated using a program that KettenWulf has specially developed for this purpose.

Sprockets with different pitches

Area of application

If chain links with different pitches are used, the sprockets have to be manufactured accordingly. One tooth of the sprocket corresponds to a double pitch of the chain. Adjustment factor f and the tooth number factor n are stated in the table below.

1



Calculation

Pitch circle diameter (different pitches)

$$d_0 = n \cdot \sqrt{(p_1 + p_2)^2 - f \cdot p_1 \cdot p_2}$$

p_1	mm	Small pitch
p_2	mm	Large pitch
f		Adjustment factor
n		Number of teeth factor

Example for calculation

Example

given: z = 6; p_1 = 80 mm; p_2 = 120 mm

$$d_0 = 2 \cdot \sqrt{(80 + 120)^2 - 0.26794 \cdot 80 \cdot 120}$$

$$d_0 = 2 \cdot \sqrt{(40000 - 2572)}$$

$$d_0 = 2 \cdot 193.46$$

$$d_0 = 386.92 \text{ mm}$$

Values for n and f

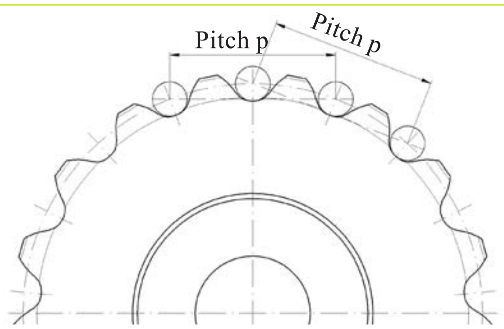
Teeth	n	f	Teeth	n	f	Teeth	n	f
3	1.15473	1.00000	13	4.17858	0.05816	23	7.34394	0.01870
4	1.41422	0.58578	14	4.49396	0.05014	24	7.66130	0.01712
5	1.70126	0.38196	15	4.80973	0.04370	25	7.97873	0.01580
6	2.00000	0.26794	16	5.12583	0.03840	26	8.29624	0.01454
7	2.30477	0.19802	17	5.44220	0.03410	27	8.61378	0.01346
8	2.61312	0.15224	18	5.75877	0.03038	28	8.93140	0.01252
9	2.92380	0.12062	19	6.07553	0.02724	29	9.24907	0.01163
10	3.23606	0.09788	20	6.39245	0.02462	30	9.56677	0.01096
11	3.54946	0.08104	21	6.70951	0.02228	-	-	-
12	3.86370	0.06814	22	7.02668	0.02032	-	-	-

Sprockets with protection pitch

Area of application

In the case of larger pitches there is the possibility of increasing the service life using sprockets with protection pitch. This is understood as a sprocket that is milled using a pitch of e.g. 6.5 which corresponds to a sprocket with 13 teeth. This means that only a single tooth will engage at every second revolution. Hence, the service life can be doubled.

1



Pitch diameters for sprockets with protection pitch

Protection pitch	Number of teeth	Pitch p							
		100	125	160	200	250	315	400	500
	z	Pitch circle diameter							
5.5	11	184.97	231.21	295.95	369.93	462.41	582.64	739.86	924.83
6.5	13	215.18	268.98	344.29	430.36	537.95	677.82	860.73	1075.91
7.5	15	245.86	307.32	393.37	491.72	614.65	774.46	983.44	1229.30
8.5	17	276.82	346.03	442.92	553.65	692.06	871.99	1107.29	1384.11
9.5	19	307.98	384.97	492.76	615.95	769.94	970.13	1231.91	1539.89
10.5	21	339.26	424.08	542.82	678.53	848.16	1068.68	1357.06	1696.32
11.5	23	370.65	463.31	593.04	741.30	926.62	1167.55	1482.60	1853.25
12.5	25	402.11	502.63	643.37	804.21	1005.27	1266.64	1608.43	2010.54
13.5	27	433.62	542.03	693.79	867.24	1084.05	1365.91	1734.49	2168.11
14.5	29	465.18	581.48	744.29	930.36	1162,95	1465.32	1860.72	2325.90
15.5	31	496.77	620.97	794.84	993.55	1241.94	1564,84	1987.10	2483.87
16.5	33	528.40	660.50	845.44	1056.80	1321.00	1664,45	2113.59	-
17.5	35	560.05	700.06	896.07	1120.09	1400.11	1764,14	2240.18	-
18.5	37	591.71	739.64	946.74	1183.43	1479.28	1863.90	2366.85	-
19.5	39	623.40	779.25	997.44	1246.80	1558.49	1963.70	2493.59	-
20.5	41	655.10	818.87	1048.15	1310.19	1637.74	2063.55	-	-
21.5	43	686.81	858.51	1098.89	1373.62	1717.02	2163.44	-	-
22.5	45	718.53	898.16	1149.65	1437.06	1796.32	2263.37	-	-
23.5	47	750.26	937.83	1200.42	1500.52	1875.65	2363.32	-	-
24.5	49	782.00	977.50	1251.20	1564.00	1955.00	2463.30	-	-
25.5	51	813.75	1017.18	1302.00	1627.49	2034.37	-	-	-
26.5	53	845.50	1056.88	1352.80	1691.00	2113.75	-	-	-
27.5	55	877.26	1096.57	1403.61	1754.52	2193.15	-	-	-
28.5	57	909.02	1136.28	1454.44	1818.05	2272.56	-	-	-
29.5	59	940.79	1175.99	1505.27	1881.58	2351.98	-	-	-

Calculation of shaft or bore diameters

Calculation

Area of application

The shaft diameter can be roughly calculated using the formula mentioned below. Please note that bending stresses are being accounted for by minor permissible torsional stresses. The torsional stresses permissible for the individual materials require different factors c, which are listed for various materials in the following table.

Drive shaft calculation (approximate)

$$d_w \approx c \cdot \sqrt[3]{\frac{P}{n}} \; [\text{mm}]$$

P	kW	Power
n	min^{-1}	Driving speed
c		Stress factor

Stress factors for various materials

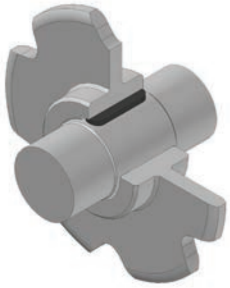
	St 37 - 42	St 50 - 60	Heat-treated steels
τ_{tperm}	150 N/mm²	200 N/mm²	250 N/mm²
c	150	135	120

Shaft diameters for various rotation speeds and capacities

Shaft	Rotation speed n in min^{-1}											
	112	140	180	225	280	355	450	560	710	900	1125	1400
d_w	Power P in kW											
25	0.7	0.9	1.1	1.4	1.8	2.3	2.9	3.6	4.5	5.7	7.1	8.9
28	1.0	1.2	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8.0	10.0	12.5
35	2.0	2.4	3.1	3.9	4.9	6.2	7.8	9.8	12.4	15.7	19.6	24.4
38	2.5	3.1	4.0	5.0	6.2	7.9	10.0	12.5	15.8	20.1	25.1	31.2
45	4.1	5.2	6.7	8.3	10.4	13.1	16.7	20.7	26.3	33.3	41.7	51.9
48	5.0	6.3	8.1	10.1	12.6	16.0	20.2	25.2	31.9	40.5	50.6	62.9
55	7.6	9.5	12.2	15.2	18.9	24.0	30.4	37.9	48.0	60.9	76.1	94.7
60	9.8	12.3	15.8	19.8	24.6	31.2	39.5	49.2	62.3	79.0	98.8	122.9
65	12.5	15.6	20.1	25.1	31.3	39.6	50.2	62.5	79.2	100.5	125.6	156.3
70	15.6	19.5	25.1	31.4	39.0	49.5	62.7	78.1	99.0	125.5	156.8	195.2
80	23.3	29.1	37.5	46.8	58.3	73.9	93.6	116.5	147.7	187.3	234.1	291.3
85	28.0	34.9	44.9	56.2	69.9	88.6	112.3	139.8	177.2	224.6	280.8	349.4
90	33.2	41.5	53.3	66.7	83.0	105.2	133.3	165.9	210.4	266.7	333.3	414.8
95	39.0	48.8	62.7	78.4	97.6	123.7	156.8	195.1	247.4	313.6	392.0	487.9
100	45.5	56.9	73.2	91.4	113.8	144.3	182.9	227.6	288.6	365.8	457.2	569.0
110	60.6	75.7	97.4	121.7	151.5	192.0	243.4	302.9	384.1	486.9	608.6	757.4
120	78.7	98.3	126.4	158.0	196.7	249.3	316.0	393.3	498.7	632.1	790.1	983.3
125	88.9	111.1	142.9	178.6	222.3	281.8	357.2	444.5	563.6	714.4	893.1	1111.4
130	100.0	125.0	160.7	200.9	250.0	317.0	401.8	500.1	634.0	803.7	1004.6	1250.1
140	124.9	156.1	200.7	250.9	312.3	395.9	501.9	624.6	791.8	1003.7	1254.7	1561.4
150	153.6	192.0	246.9	308.6	384.1	487.0	617.3	768.2	973.9	1234.6	1543.2	1920.4
160	186.5	233.1	299.7	374.6	466.1	591.0	749.2	932.3	1182.0	1498.3	1872.9	2330.7
170	223.6	279.6	359.4	449.3	559.1	708.9	898.6	1118.2	1417.8	1797.2	2246.5	2795.6
180	265.5	331.9	426.7	533.3	663.7	841.5	1066.7	1327.4	1683.0	2133.3	2666.7	3318.5

Types of shaft/ sprocket power transmission

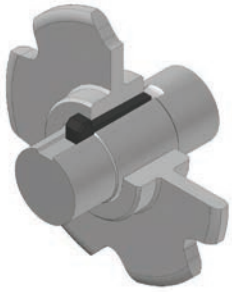
Feather key acc. to DIN 6885



By inserting a feather key into a corresponding groove, form-fit between shaft and sprocket is established.
The torque is transferred through surface pressure onto the face surfaces of the springs.

» Cost-efficient connection
» Simple production
» Suitable for changing torques
» No securing against axial displacement

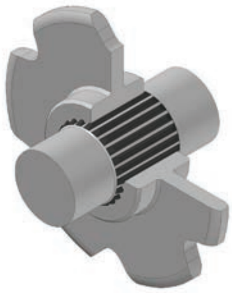
Fitting key acc. to DIN 6686 - 6687



Taper keys produce pressing between shaft and sprocket by a 1:100 taper. Correct wedging up transfers the torque through friction closure alone, i.e. in a force-locked manner.

» Cost-efficient connection
» Simple production
» Simple installation
» Securing against axial displacement

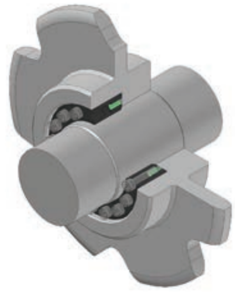
Inner toothing acc. to DIN 5480



Power transmission is generated by an inner toothing on the sprocket standardized to DIN 5480 and the corresponding opposite toothing on the shaft.

» High torques possible
» Suitable for changing torques
» Elaborate production
» No complex securing against axial displacement

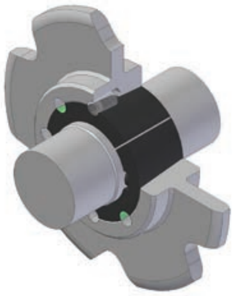
Inner mounting set/ outer mounting set



By tightening the tensioning screws, a rigid connection between shaft and sprocket is established by tightening a set with conical annular springs.

» Exact concentricity
» Simple installation
» Securing against axial displacement
» Price-intensive type of connection

Taperlock bushes



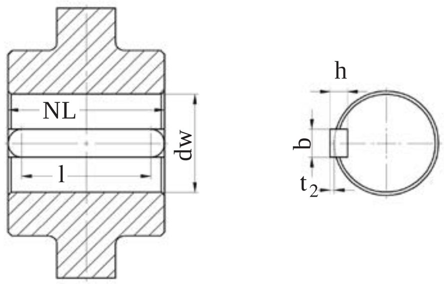
This type of connection consists of a conical bush which is pressed into a corresponding conical hole in the sprocket by means of tensioning screws thus producing a rigid connection between sprocket and axle.

» Cheaper than mounting set connections
» Exact concentricity
» Simple installation
» Securing against axial displacement

Calculation of the hub length

Calculation

1



The hub length of sprockets with taper keys cannot be accurately calculated because the developing frictional force depends too much on the friction coefficient between shaft and hub as well as the magnitude of the driving-in force. Experience shows that standardized taper keys transfer the full torque possible at permissible stress on the hub and shaft respectively.

Calculation of the taper key (approximate)

$$l \approx 1.5 \cdot d_w$$

l	mm	Fitting length

For feather keys, the required length l can be determined more accurately using the following formula:

Calculation of the feather key length

$$l \approx \frac{0.736 \cdot P}{n} \cdot K \cdot \frac{1}{\left(\frac{d_w + t_2}{10}\right) \cdot \left(\frac{t_2}{10}\right)}$$

$$K = \frac{7162 \cdot 2}{p_{perm}}$$

t_2	mm	Hub groove depth
K		Surface pressure factor
p_{perm}	N/mm²	Permissible surface pressure
P	kW	Power on
n	min⁻¹	Drive speed

Chart for permissible surface pressure p_{zul} and factor K

Values for p_{all} and K

Material	GG 22	St 52-3	C 45
$p_{perm} \approx$	55	90	95
K	260	160	150

The required hub length results from the calculated values for the fitting length l of the feather keys respectively. Using the values calculated, one obtains:

Calculation of hub length

$$NL = l + b + (3 \text{ bis } 5\text{ mm})$$

for round-ended keys

$$NL = l + (3 \text{ bis } 5\text{ mm})$$

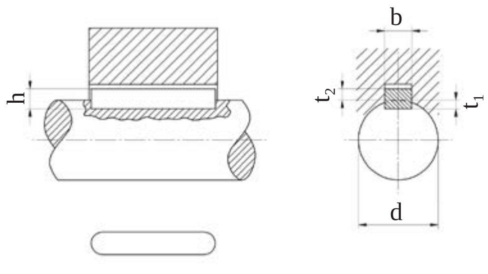
for square-ended keys

b	mm	Feather key width

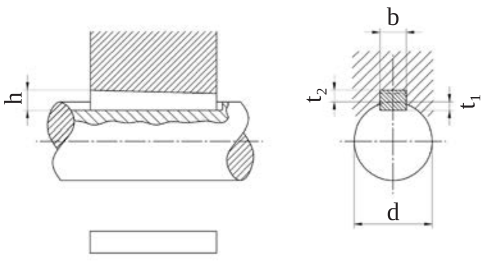
Dimensions for feather keys (DIN 6885, DIN 6886, DIN 6887)

Construction types according to DIN

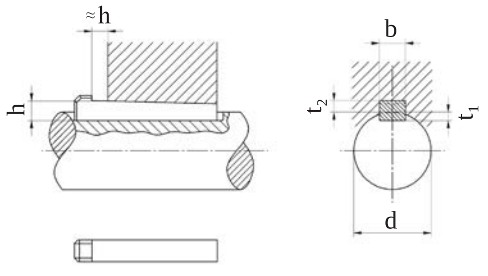
DIN 6885



DIN 6886



DIN 6687



Groove dimensions according to DIN

Shaft ø	Integral key cross-section	Shaft keyway depth		Hub keyway depth DIN 6885		Hub keyway depth DIN 6886		Hub keyway depth DIN 6887	
over - up to	b x h	t_1	allwd. dev. +	t_2	allwd. dev. +	t_2	allwd. dev. +	t_2	allwd. dev. +
6 - 8	2 x 2	1.2	0.1	1	0.1	0.5	0.1	–	–
8 - 10	3 x 3	1.8	0.1	1.4	0.1	0.9	0.1	–	–
10 - 12	4 x 4	2.5	0.1	1.8	0.1	1.2	0.1	1.2	0.1
12 - 17	5 x 5	3	0.1	2.3	0.1	1.7	0.1	1.7	0.1
17 - 22	6 x 6	3.5	0.1	2.8	0.1	2.2	0.1	2.2	0.1
22 - 30	8 x 7	4	0.2	3.3	0.2	2.4	0.2	2.4	0.2
30 - 38	10 x 8	5	0.2	3.3	0.2	2.4	0.2	2.4	0.2
38 - 44	12 x 8	5	0.2	3.3	0.2	2.4	0.2	2.4	0.2
44 - 50	14 x 9	5.5	0.2	3.8	0.2	2.9	0.2	2.9	0.2
50 - 58	16 x 10	6	0.2	4.3	0.2	3.4	0.2	3.4	0.2
58 - 65	18 x 11	7	0.2	4.4	0.2	3.4	0.2	3.4	0.2
65 - 75	20 x 12	7.5	0.2	4.9	0.2	3.9	0.2	3.9	0.2
75 - 85	22 x 14	9	0.2	5.4	0.2	4.4	0.2	4.4	0.2
85 - 95	25 x 14	9	0.2	5.4	0.2	4.4	0.2	4.4	0.2
95 - 110	28 x 16	10	0.2	6.4	0.2	5.4	0.2	5.4	0.2
110 - 130	32 x 18	11	0.2	7.4	0.2	6.4	0.2	6.4	0.2
130 - 150	36 x 20	12	0.3	8.4	0.3	7.1	0.3	7.1	0.3
150 - 170	40 x 22	13	0.3	9.4	0.3	8.1	0.3	8.1	0.3
170 - 200	45 x 25	15	0.3	10.4	0.3	9.1	0.3	9.1	0.3
200 - 230	50 x 28	17	0.3	11.4	0.3	10.1	0.3	10.1	0.3
230 - 260	56 x 32	20	0.3	12.4	0.3	11.1	0.3	11.1	0.3
260 - 290	63 x 32	20	0.3	12.4	0.3	11.1	0.3	11.1	0.3
290 - 330	70 x 36	22	0.3	14.4	0.3	13.1	0.3	13.1	0.3
330 - 380	80 x 40	25	0.3	15.4	0.3	14.1	0.3	14.1	0.3
380 - 440	90 x 45	28	0.3	17.4	0.3	16.1	0.3	16.1	0.3
440 - 500	100 x 50	31	0.3	19.5	0.3	18.1	0.3	18.1	0.3

Types of sprockets

Sprockets cut from the solid

1

Sprocket with
one-sided hub

Sprocket with
symmetrical hub

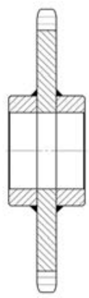
Sprocket with
asymmetrical hub

Sprocket disk

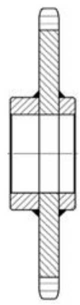
Sprockets in welded design – hub welded on

2

Sprocket with
one-sided hub



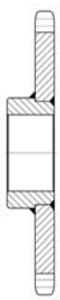
Sprocket with
symmetrical hub



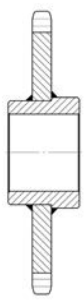
Sprocket with
asymmetrical hub

Sprockets in welded design – hub welded in

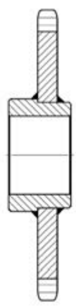
3



Sprocket with
one-sided hub



Sprocket with
symmetrical hub

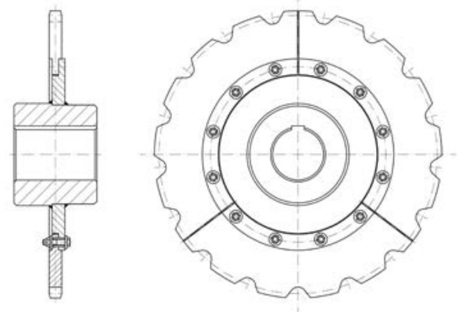


Sprocket with
asymmetrical hub

Types of sprockets

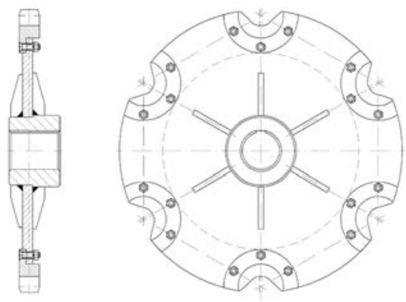
Sprockets with bolted tooth segments or tooth jackets

4



Sprocket with flanged hub and three-parted attachable tooth segments

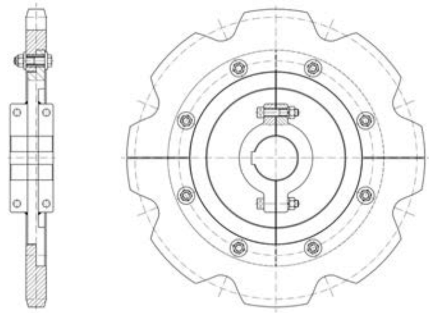
5



Sprocket with attachable tooth gaps

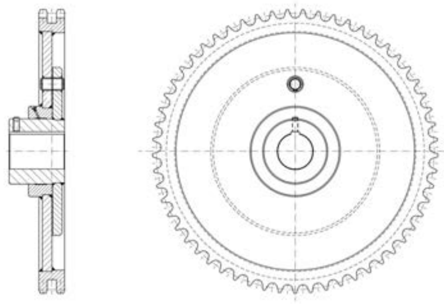
Sprockets in split design or with shear pin

6



Split-type sprocket

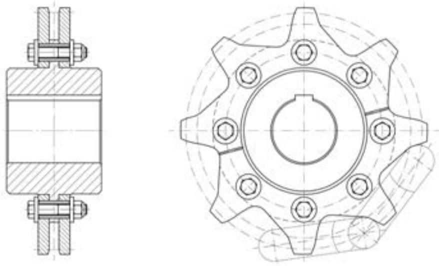
7



Sprocket with shear pin

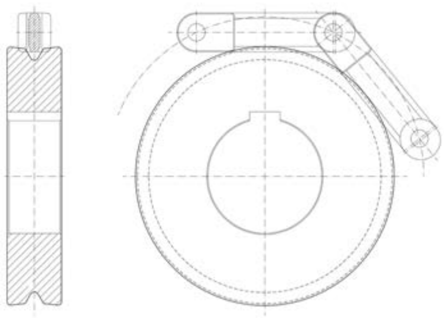
Sprockets or return sprockets for forked link chains

8



Sprocket with 2-part detachable, two-parted tooth segments

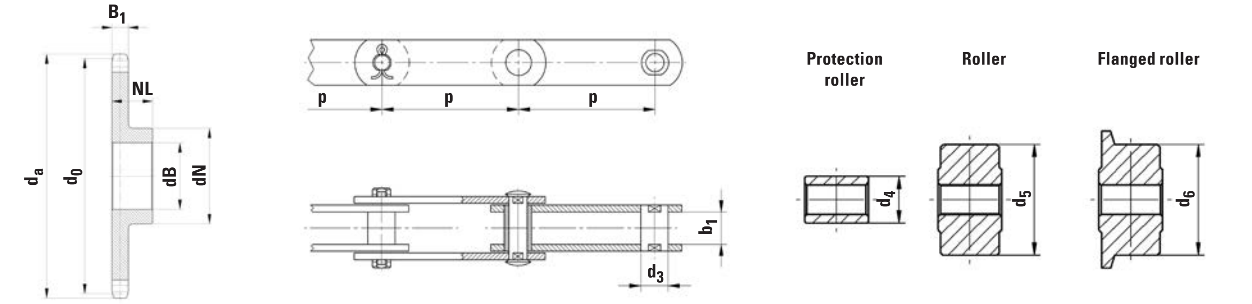
9



Untoothed return wheel with rail groove for fork link chain

Standard sprockets for conveyor chains according to DIN 8165

1



Standard sprockets for conveyor chains according to DIN 8165

Type of chain	Chain dimensions	Pitch	Number of teeth	Pitch circle ø	Tip circle ø d_a acc. to roller type				Hub ø	Hub length	Width	Width for flanged roller	Bore ø	Weight
		p	Z	d_0	d_3	d_4	d_5	d_6	dN	NL	B_1	B_1	dB	≈ kg
			6	80.00	92	92	93	96	40	40	16	11	20	0.8
			8	104.53	117	117	117	121	70	45	16	11	25	1.8
		40	10	129.44	141	141	142	145	80	45	16	11	25	2.6
			12	154.55	167	167	167	171	90	50	16	11	25	3.9
			15	192.39	204	204	205	208	100	60	16	11	25	6.1
	$b_1 = 18$		6	126.00	138	138	139	142	80	50	16	11	25	2.7
	$d_3 = 15$		8	164.63	177	177	177	181	90	50	16	11	25	4.2
FV 40	$d_4 = 20$	63	10	203.87	216	216	217	220	90	60	16	11	25	6.1
	$d_5 = 32$		12	243.41	255	255	256	259	110	60	16	11	25	8.9
	$d_6 = 40$		15	303.01	315	315	316	319	110	65	16	11	25	12.5
			6	200.00	212	212	213	216	100	50	16	11	25	5.8
			8	261.31	273	273	274	277	110	60	16	11	25	9.8
		100	10	323.61	336	336	336	340	110	65	16	11	25	13.7
			12	386.37	398	398	399	402	120	70	16	11	25	19.3
			15	480.97	493	493	494	497	130	75	16	11	25	28.7
			6	126.00	140	142	142	146	75	50	20	14	25	2.8
			8	164.63	179	180	181	185	95	60	20	14	30	5.2
		63	10	203.87	218	219	220	224	110	60	20	14	30	7.8
			12	243.41	258	259	259	263	110	65	20	14	30	10.3
			15	303.01	317	319	319	323	120	70	20	14	30	15.4
			6	200.00	214	216	216	220	100	60	20	14	25	7.2
			8	261.31	276	277	277	281	110	65	20	14	30	11.4
	$b_1 = 22$	100	10	323.61	338	339	340	344	120	70	20	14	30	17.0
	$d_3 = 18$		12	386.37	401	402	402	406	120	70	20	14	30	22.5
FV 63	$d_4 = 26$		15	480.97	495	497	497	501	130	75	20	14	30	33.8
	$d_5 = 40$		6	250.00	264	266	266	270	110	65	20	14	30	10.7
	$d_6 = 50$		8	326.64	341	342	343	347	120	70	20	14	30	17.2
		125	10	404,51	419	420	421	425	130	75	20	14	30	25.5
			12	482.96	497	499	499	503	130	80	20	14	30	34.6
			15	601.22	616	617	617	621	150	90	20	14	30	53.8
			6	320.00	334	336	336	340	120	70	20	14	30	16.7
			8	418.10	433	434	434	438	130	80	20	14	30	27.4
		160	10	517.77	532	533	534	538	130	85	20	14	30	39.4
			12	618.19	633	634	634	638	150	90	20	14	30	56.3
			15	769.56	784	785	786	790	170	100	20	14	30	86.7

Standard sprockets for conveyor chains according to DIN 8165

Type of chain	Chain dimensions	Pitch p	Number of teeth Z	Pitch circle ø d_0	Tip circle ø d_a acc. to roller type d_3	d_4	d_5	d_6	Hub ø dN	Hub length NL	Width B_1	Width for Flanged roller B_1	Bore ø dB	Weight ≈ kg
			6	126.00	142	144	145	151	70	60	20	17	30	2.8
			8	164.63	181	183	184	190	100	65	20	17	30	5.8
		63	10	203.87	220	222	223	229	120	65	20	17	30	8.8
			12	243.41	259	261	263	269	120	75	20	17	30	11.8
			15	303.01	319	321	322	328	130	75	20	17	30	16.6
			6	200.00	216	218	219	225	100	60	20	17	40	6.8
			8	261.31	277	279	281	287	120	70	20	17	40	12.2
		100	10	323.61	340	342	343	349	130	75	20	17	40	17.9
			12	386.37	402	404	406	412	130	75	20	17	40	23.4
			15	480.97	497	499	500	506	150	80	20	17	40	36.1
	$b_1 = 25$		6	250.00	266	268	269	275	120	65	20	17	40	11.1
	$d_3 = 20$		8	326.64	343	345	346	352	130	75	20	17	40	18.1
FV 90	$d_4 = 30$	125	10	404.51	421	423	424	430	140	80	20	17	40	26.6
	$d_5 = 48$		12	482.96	499	501	502	508	140	80	20	17	40	35.2
	$d_6 = 63$		15	601.22	617	619	620	626	160	85	20	17	40	54.0
			6	320.00	336	338	339	345	120	70	20	17	40	16.4
			8	418.10	434	436	437	443	140	80	20	17	40	28.0
		160	10	517.77	534	536	537	543	150	85	20	17	40	41.2
			12	618.19	634	636	637	643	150	90	20	17	40	55.9
			15	769.56	786	788	789	795	170	100	20	17	40	86.3
			6	400.00	416	418	419	425	140	80	20	17	40	26.2
			8	522.63	539	541	542	548	150	85	20	17	40	41.9
		200	10	647.21	663	665	666	672	150	90	20	17	40	60.5
			12	772.74	789	791	792	798	160	100	20	17	40	85.3
			15	961.95	978	980	981	987	200	120	20	17	40	137.6
			6	200.00	218	219	222	229	110	60	27	21	40	8.5
			8	261.31	279	281	283	290	120	70	27	21	40	14.5
		100	10	323.61	341	343	346	352	140	80	27	21	40	23.0
			12	386.37	404	406	408	415	140	80	27	21	40	30.5
			15	480.97	499	500	503	510	150	90	27	21	40	46.4
			6	250.00	268	269	272	279	120	70	27	21	40	13.5
			8	326.64	344	346	349	355	140	80	27	21	40	23.4
		125	10	404.51	422	424	427	433	140	80	27	21	40	32.9
			12	482.96	501	502	505	512	150	85	27	21	40	46.0
			15	601.22	619	620	623	630	160	85	27	21	40	68.5
	$b_1 = 30$		6	320.00	338	339	342	349	130	75	27	21	40	21.3
	$d_3 = 22$		8	418.10	436	437	440	447	150	85	27	21	40	36.3
FV 112	$d_4 = 32$	160	10	517.77	535	537	540	547	150	85	27	21	40	51.8
	$d_5 = 55$		12	618.19	636	637	640	647	160	90	27	21	40	72.7
	$d_6 = 78$		15	769.56	787	789	792	798	180	90	27	21	40	110.3
			6	400.00	418	419	422	429	130	80	27	21	40	31.4
			8	522.63	540	542	545	551	150	90	27	21	40	53.3
		200	10	647.21	665	666	669	676	160	90	27	21	40	78.8
			12	772.74	790	792	795	802	170	95	27	21	40	110.6
			15	961.95	980	981	984	991	200	100	27	21	40	171.1
			6	500.00	518	519	522	529	140	90	27	21	40	48.3
			8	653.28	671	672	675	682	160	100	27	21	40	81.6
		250	10	809.02	827	828	831	838	160	100	27	21	40	119.5
			12	965.93	984	985	988	995	180	110	27	21	40	170.8
			15	1202.43	1220	1222	1224	1231	210	130	27	21	40	267.4

Standard sprockets for conveyor chains according to DIN 8165

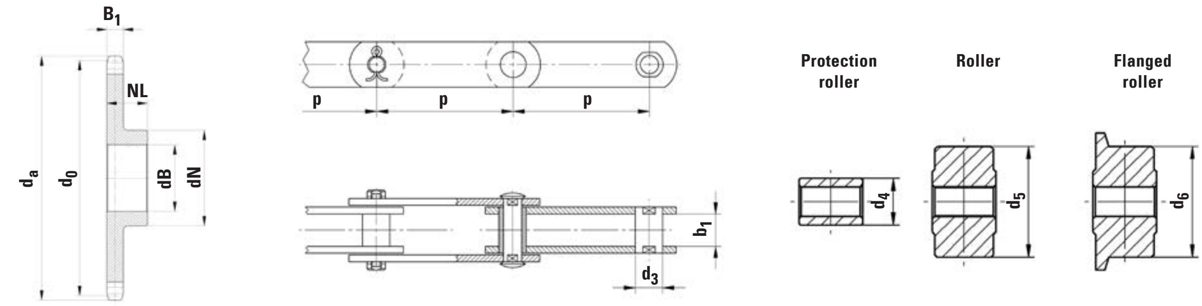
Type of chain	Chain dimen-sions	Pitch	Number of teeth	Pitch circle ø	Tip circle ø d_a acc. to roller type				Hub ø	Hub length	Width	Width for Flanged roller	Bore ø	Weight
		p	Z	d_0	d_3	d_4	d_5	d_6	dN	NL	B_1	B_1	dB	≈ kg
			6	200.00	221	222	224	232	100	65	32	24	40	9.3
			8	261.31	282	283	285	293	120	75	32	24	40	16.5
		100	10	323.61	344	345	348	356	150	85	32	24	40	27.2
			12	386.37	407	408	410	418	150	85	32	24	40	36.0
			15	480.97	502	503	505	513	150	90	32	24	40	52.8
			6	250.00	271	272	274	282	130	75	32	24	40	16.1
			8	326.64	347	348	351	359	150	85	32	24	40	27.6
		125	10	404.51	425	426	429	437	160	90	32	24	40	40.5
			12	482.96	504	505	507	515	160	90	32	24	40	54.3
			15	601.22	622	623	625	633	180	95	32	24	40	83.0
	$b_1 = 35$		6	320.00	341	342	344	352	130	80	32	24	40	24.4
	$d_3 = 26$		8	418.10	439	440	442	450	160	90	32	24	40	42.8
FV 140	$d_4 = 36$	160	10	517.77	539	539	542	550	160	90	32	24	40	61.2
	$d_5 = 60$		12	618.19	639	640	642	650	180	95	32	24	40	87.0
	$d_6 = 80$		15	769.56	790	791	794	802	210	95	32	24	40	133.0
			6	400.00	421	422	424	432	130	85	32	24	50	35.8
			8	522.63	543	544	547	555	160	95	32	24	50	62.4
		200	10	647.21	668	669	671	679	160	100	32	24	50	91.8
			12	772.74	794	794	797	805	180	100	32	24	50	129.9
			15	961.95	983	984	986	994	210	110	32	24	50	202.1
			6	500.00	521	522	524	532	140	90	32	24	50	54.9
			8	653.28	674	675	677	685	160	100	32	24	50	93.4
		250	10	809.02	830	831	833	841	180	105	32	24	50	142.1
			12	965.93	987	988	990	998	210	110	32	24	50	203.6
			15	1202.43	1223	1224	1226	1234	230	110	32	24	50	309.0
			6	250.00	274	275	278	290	120	85	41	33	40	18.9
			8	326.64	351	352	355	367	120	90	41	33	40	30.4
		125	10	404.51	429	430	433	445	130	95	41	33	40	46.1
			12	482.96	507	508	511	523	140	95	41	33	40	64.6
			15	601.22	625	626	629	641	180	100	41	33	40	102.2
			6	320.00	344	345	348	360	120	90	41	33	40	29.3
			8	418.10	442	443	446	458	140	95	41	33	40	49.8
	$b_1 = 45$	160	10	517.77	542	543	546	558	150	100	41	33	40	75.0
	$d_3 = 30$		12	618.19	642	643	646	658	160	105	41	33	40	105.7
FV 180	$d_4 = 42$		15	769.56	794	795	798	810	180	105	41	33	40	161.5
	$d_5 = 70$		6	400.00	424	425	428	440	130	95	41	33	50	44.6
	$d_6 = 100$		8	522.63	547	548	551	563	150	100	41	33	50	75.7
		200	10	647.21	671	672	675	687	170	105	41	33	50	115.7
			12	772.74	797	798	801	813	180	105	41	33	50	162.1
			15	961.95	986	987	990	1002	210	110	41	33	50	251.0
			6	500.00	524	525	528	540	140	95	41	33	50	68.3
			8	653.28	677	678	681	693	160	105	41	33	50	116.4
		250	10	809.02	833	834	837	849	180	110	41	33	50	177.5
			12	965.93	990	991	994	1006	210	110	41	33	50	252.9

Standard sprockets for conveyor chains according to DIN 8165

Type of chain	Chain dimensions	Pitch	Number of teeth	Pitch circle ø	Tip circle ø d_a acc. to roller type				Hub ø	Hub length	Width	Width for flanged roller	Bore ø	Weight
		p	Z	d_0	d_3	d_4	d_5	d_6	dN	NL	B_1	B_1	dB	≈ kg
			6	250.00	279	280	282	300	130	95	49	39	40	22.7
			8	326.64	355	357	359	377	170	100	49	39	40	40.3
		125	10	404.51	433	435	437	455	180	105	49	39	40	59.6
			12	482.96	512	513	515	533	180	110	49	39	40	81.6
			15	601.22	630	631	633	651	210	120	49	39	40	127.3
			6	320.00	349	350	352	370	150	100	49	39	40	37.0
			8	418.10	447	448	450	468	180	105	49	39	40	63.0
	$b_1 = 55$	160	10	517.77	547	548	550	568	190	110	49	39	40	93.5
	$d_3 = 36$		12	618.19	647	648	650	668	190	115	49	39	40	129.0
FV 250	$d_4 = 50$		15	769.56	798	800	802	820	230	120	49	39	40	200.9
	$d_5 = 80$		6	400.00	429	430	432	450	170	110	49	39	60	56.8
	$d_6 = 125$		8	522.63	551	553	555	573	190	110	49	39	60	93.7
		200	10	647.21	676	677	679	697	200	115	49	39	60	140.3
			12	772.74	802	803	805	823	210	115	49	39	60	195.8
			15	961.95	991	992	994	1012	230	120	49	39	60	300.0
			6	500.00	529	530	532	550	180	110	49	39	60	85.3
		250	8	653.28	682	683	685	703	200	115	49	39	60	142.7
			10	809.02	838	839	841	859	210	120	49	39	60	214.4
			12	965.93	995	996	998	1016	230	120	49	39	60	302.4
			6	320.00	354	356	356	376	150	110	58	44	60	41.4
			8	418.10	452	454	454	474	180	115	58	44	60	71.3
		160	10	517.77	551	554	554	574	180	120	58	44	60	105.6
			12	618.19	652	654	654	674	200	125	58	44	60	150.4
			15	769.56	803	806	806	826	210	130	58	44	60	228,5
	$b_1 = 65$		6	400.00	434	436	436	456	150	115	58	44	60	62.6
	$d_3 = 42$		8	522.63	556	559	559	579	180	120	58	44	60	107.4
FV 315	$d_4 = 60$	200	10	647.21	681	683	683	703	210	125	58	44	60	165.2
	$d_5 = 90$		12	772.74	806	809	809	829	230	130	58	44	60	234.1
	$d_6 = 140$		15	961.95	996	998	998	1018	250	135	58	44	60	357.6
			6	500.00	534	536	536	556	180	120	58	44	60	99.1
		250	8	653.28	687	689	689	709	210	125	58	44	60	168.1
			10	809.02	843	845	845	865	230	135	58	44	60	256.2
			12	965.93	1000	1002	1002	1022	250	140	58	44	60	362.1

Standard sprockets for conveyor chains according to DIN 8167

1



Standard sprockets for conveyor chains according to DIN 8167

Type of chain	Chain dimensions	Pitch p	Number of teeth Z	Pitch circle ø d_0	Tip circle ø d_a acc. to roller type d_3	d_4	d_5	d_6	Hub ø dN	Hub length NL	Width B_1	Width for flanged roller B_1	Bore ø dB	Weight ≈ kg
			6	80.00	87	88	90	90	50	40	14	10	20	1.0
			8	104.53	112	112	115	115	75	40	14	10	25	1.8
		40	10	129.44	137	137	139	139	75	40	14	10	25	2.4
			12	154.55	162	162	165	165	80	45	14	10	25	3.4
			15	192.39	200	200	202	202	90	45	14	10	25	4.9
			6	100.00	107	108	110	110	75	45	14	10	25	1.9
			8	130.66	138	138	141	141	75	45	14	10	25	2.6
		50	10	161.80	169	169	172	172	75	45	14	10	25	3.4
			12	193.19	200	201	203	203	80	50	14	10	25	4.8
			15	240.49	248	248	250	250	90	50	14	10	25	7.0
	$b_1 = 16$		6	126.00	133	134	136	136	85	50	14	10	30	2.9
	$d_3 = 9$		8	164.63	172	172	175	175	85	50	14	10	30	3.9
M 20	$d_4 = 12{,}5$	63	10	203.87	211	211	214	214	85	50	14	10	30	5.3
	$d_5 = 25$		12	243.41	251	251	253	253	90	60	14	10	30	7.5
	$d_6 = 25$		15	303.01	310	311	313	313	100	65	14	10	30	11.3
			6	160.00	167	168	170	170	85	50	14	10	30	3.8
			8	209.05	216	217	219	219	85	50	14	10	30	5.5
		80	10	258.89	266	266	269	269	90	50	14	10	30	7.6
			12	309.10	316	317	319	319	95	60	14	10	30	11.1
			15	384.78	392	392	395	395	110	65	14	10	30	17.1
			6	200.00	207	208	210	210	100	60	14	10	40	6.0
			8	261.31	269	269	271	271	100	60	14	10	40	8.6
		100	10	323.61	331	331	334	334	100	60	14	10	40	11.9
			12	386.37	394	394	396	396	110	65	14	10	40	16.9
			15	480.97	488	488	491	491	120	70	14	10	40	25.4

Standard sprockets for conveyor chains according to DIN 8167

Type of chain	Chain dimensions	Pitch	Number of teeth	Pitch circle ø	Tip circle ø d_a acc. to roller type				Hub ø	Hub length	Width	Width for flanged roller	Bore ø	Weight
		p	Z	d_0	d_3	d_4	d_5	d_6	dN	NL	B_1	B_1	dB	≈ kg
		50	6	100.00	108	109	112	112	63	50	16	11	20	1.9
			8	130.66	139	140	143	143	75	50	16	11	25	2.9
			10	161.80	170	171	174	174	75	50	16	11	25	3.9
			12	193.19	201	202	205	205	80	60	16	11	25	5.5
			15	240.49	248	249	252	252	90	60	16	11	25	8.1
		63	6	126.00	134	135	138	138	80	50	16	11	25	2.9
			8	164.63	173	174	177	177	85	50	16	11	30	4.2
			10	203.87	212	213	216	216	85	50	16	11	30	5.7
			12	243.41	251	252	255	255	90	60	16	11	30	8.2
			15	303.01	311	312	315	315	90	60	16	11	30	11.5
	$b_1 = 18$	80	6	160.00	168	169	172	172	85	50	16	11	25	4.1
	$d_3 = 10$		8	209.05	217	218	221	221	85	50	16	11	30	5.9
M 28	$d_4 = 15$		10	258.89	267	268	271	271	90	50	16	11	30	8.3
	$d_5 = 30$		12	309.10	317	318	321	321	90	60	16	11	30	11.9
	$d_6 = 30$		15	384.78	393	394	397	397	100	65	16	11	30	18.1
		100	6	200.00	208	209	212	212	95	60	16	11	30	6.4
			8	261.31	269	270	273	273	100	60	16	11	30	9.3
			10	323.61	332	333	336	336	100	60	16	11	40	12.8
			12	386.37	394	395	398	398	100	70	16	11	40	18.2
			15	480.97	489	490	493	493	110	75	16	11	40	27.5
		125	6	250.00	258	259	262	262	100	65	16	11	30	9.3
			8	326.64	335	336	339	339	110	65	16	11	40	14.2
			10	404.51	413	414	417	417	110	65	16	11	40	20.0
			12	482.96	491	492	495	495	120	75	16	11	40	28.6
			15	601.22	609	610	613	613	140	80	16	11	40	44.0
		63	6	126.00	136	137	140	140	80	50	18	12	25	3.1
			8	164.63	175	175	179	179	85	50	18	12	30	4.5
			10	203.87	214	215	218	218	85	50	18	12	30	6.2
			12	243.41	253	254	258	258	90	60	18	12	30	8.9
			15	303.01	313	314	317	317	100	65	18	12	30	13.4
		80	6	160.00	170	171	174	174	85	50	18	12	25	4.4
			8	209.05	219	220	223	223	85	50	18	12	30	6.5
			10	258.89	269	270	273	273	90	60	18	12	30	9.6
			12	309.10	319	320	323	323	100	60	18	12	30	13.1
			15	384.78	395	396	399	399	110	65	18	12	30	20.4
	$b_1 = 20$	100	6	200.00	210	211	214	214	100	60	18	12	30	7.2
	$d_3 = 12{,}5$		8	261.31	271	272	276	276	100	60	18	12	30	10.4
M 40	$d_4 = 18$		10	323.61	334	334	338	338	100	65	18	12	40	14.6
	$d_5 = 36$		12	386.37	396	397	401	401	110	70	18	12	40	20.6
	$d_6 = 36$		15	480.97	491	492	495	495	130	75	18	12	40	32.0
		125	6	250.00	260	261	264	264	110	65	18	12	30	10.6
			8	326.64	337	337	341	341	120	65	18	12	40	16.1
			10	404.51	415	415	419	419	120	75	18	12	40	23.4
			12	482.96	493	494	497	497	130	75	18	12	40	32.2
			15	601.22	611	612	616	616	140	85	18	12	40	48.7
		160	6	320.00	330	331	334	334	120	70	18	12	40	16.0
			8	418.10	428	429	433	433	130	75	18	12	40	25.5
			10	517.77	528	529	532	532	130	80	18	12	40	36.6
			12	618.19	628	629	633	633	140	85	18	12	40	51.1
			15	769.56	780	780	784	784	160	90	18	12	40	77.9

Standard sprockets for conveyor chains according to DIN 8167

Type of chain	Chain dimensions	Pitch	Number of teeth	Pitch circle ø	Tip circle ø d_a acc. to roller type				Hub ø	Hub length	Width	Width for flanged roller	Bore ø	Weight
		p	Z	d_0	d_3	d_4	d_5	d_6	dN	NL	B_1	B_1	dB	≈ kg
			6	126.00	138	139	143	143	75	50	22	16	25	3.3
			8	164.63	177	177	181	181	85	50	22	16	30	5.1
		63	10	203.87	216	216	221	221	100	50	22	16	30	7.7
			12	243.41	255	256	260	260	110	65	22	16	30	11.6
			15	303.01	315	316	320	320	110	70	22	16	30	16.4
			6	160.00	172	173	177	177	85	50	22	16	30	4.9
			8	209.05	221	222	226	226	85	50	22	16	30	7.5
		80	10	258.89	271	271	276	276	100	50	22	16	30	11.2
			12	309.10	321	322	326	326	110	65	22	16	40	16.3
			15	384.78	397	397	402	402	120	70	22	16	40	24.6
	$b_1 = 24$		6	200.00	212	213	217	217	90	60	22	16	30	7.6
	$d_3 = 15$		8	261.31	273	274	278	278	90	60	22	16	40	11.3
M 56	$d_4 = 21$	100	10	323.61	336	336	340	340	110	65	22	16	40	17.3
	$d_5 = 42$		12	386.37	398	399	403	403	110	70	22	16	40	23.7
	$d_6 = 42$		15	480.97	493	494	498	498	120	80	22	16	40	36.8
			6	250.00	262	263	267	267	110	70	22	16	40	12.1
			8	326.64	339	339	343	343	120	65	22	16	40	18.5
		125	10	404.51	417	417	421	421	130	80	22	16	40	28.4
			12	482.96	495	496	500	500	130	80	22	16	40	37.9
			15	601.22	613	614	618	618	150	100	22	16	40	60.0
			6	320.00	332	333	337	337	120	70	22	16	40	18.3
			8	418.10	430	431	435	435	130	80	22	16	40	29.9
		160	10	517.77	530	530	535	535	130	85	22	16	40	43.1
			12	618.19	630	631	635	635	150	90	22	16	40	61.5
			15	769.56	782	782	786	786	170	100	22	16	40	94.3

			6	160.00	174	175	180	180	85	50	25	18	30	5.6
			8	209.05	223	224	229	229	90	50	25	18	30	8.7
		80	10	258.89	273	274	279	279	100	60	25	18	40	13.2
			12	309.10	323	324	329	329	120	65	25	18	40	19.2
			15	384.78	399	400	405	405	130	70	25	18	40	28.7
			6	200.00	214	215	220	220	100	60	25	18	40	8.7
			8	261.31	276	276	281	281	100	60	25	18	40	13.4
		100	10	323.61	338	339	344	344	110	65	25	18	40	20.1
			12	386.37	401	401	406	406	120	70	25	18	40	28.2
			15	480.97	495	496	501	501	130	75	25	18	40	42.6
	$b_1 = 28$		6	250.00	264	265	270	270	100	65	25	18	40	12.7
	$d_3 = 18$		8	326.64	341	342	347	347	120	65	25	18	40	21.0
M 80	$d_4 = 25$	125	10	404.51	419	420	425	425	140	80	25	18	40	33.1
	$d_5 = 50$		12	482.96	497	498	503	503	140	80	25	18	40	44.3
	$d_6 = 50$		15	601.22	616	616	621	621	160	85	25	18	40	67.5
			6	320.00	334	335	340	340	110	70	25	18	40	20.0
			8	418.10	433	433	438	438	130	80	25	18	40	34.0
		160	10	517.77	532	533	538	538	140	85	25	18	40	50.4
			12	618.19	633	633	638	638	150	90	25	18	40	70.3
			15	769.56	784	785	790	790	170	100	25	18	40	107.8
			6	400.00	414	415	420	420	130	80	25	18	40	31.6
			8	522.63	537	538	543	543	140	85	25	18	40	51.2
		200	10	647.21	662	662	667	667	150	90	25	18	40	76.1
			12	772.74	787	788	793	793	160	100	25	18	50	106.5
			15	961.95	976	977	982	982	180	120	25	18	50	165.2

Standard sprockets for conveyor chains according to DIN 8167

Type of chain	Chain dimensions	Pitch	Number of teeth	Pitch circle ø	Tip circle ø d_a acc. to roller type				Hub ø	Hub length	Width	Width for flanged roller	Bore ø	Bore
		p	Z	d_0	d_3	d_4	d_5	d_6	dN	NL	B_1	B_1	dB	≈ kg
			6	160.00	177	178	184	184	62	40	28	21	25	5.7
			8	209.05	226	227	233	233	90	50	28	21	40	9.6
		80	10	258.89	276	277	283	283	100	60	28	21	40	14.8
			12	309.10	326	327	333	333	120	65	28	21	40	21.4
			15	384.78	402	403	409	409	130	70	28	21	40	32.2
			6	200.00	217	218	224	224	100	60	28	21	30	9.9
			8	261.31	278	279	285	285	100	60	28	21	40	15.1
		100	10	323.61	340	342	348	348	120	75	28	21	40	23.9
			12	386.37	403	404	410	410	130	75	28	21	40	32.9
			15	480.97	498	499	505	505	140	80	28	21	40	49.4
			6	250.00	267	268	274	274	110	65	28	21	30	15.0
			8	326.64	343	345	351	351	120	70	28	21	40	23.9
	$b_1 = 32$	125	10	404.51	421	423	429	429	130	75	28	21	40	35.6
	$d_3 = 21$		12	482.96	500	501	507	507	130	80	28	21	40	48.9
M 112	$d_4 = 30$		15	601.22	618	619	625	625	150	85	28	21	40	74.8
	$d_5 = 60$		6	320.00	337	338	344	344	120	75	28	21	40	23.5
	$d_6 = 60$		8	418.10	435	436	442	442	140	75	28	21	40	38.4
		160	10	517.77	535	536	542	542	150	80	28	21	40	57.1
			12	618.19	635	636	642	642	160	85	28	21	40	79.6
			15	769.56	786	788	794	794	180	90	28	21	40	121.1
			6	400.00	417	418	424	424	130	75	28	21	40	34.9
			8	522.63	539	541	547	547	150	80	28	21	40	58.0
		200	10	647.21	664	665	671	671	160	80	28	21	40	85.6
			12	772.74	790	791	797	797	170	95	28	21	40	121.5
			15	961.95	979	980	986	986	200	100	28	21	40	186.7
			6	500.00	517	518	524	524	140	90	28	21	40	53.9
			8	653.28	670	671	677	677	160	95	28	21	40	89.2
		250	10	809.02	826	827	833	833	160	100	28	21	40	131.3
			12	965.93	983	984	990	990	180	110	28	21	40	186.6
			15	1202.43	1219	1220	1226	1226	210	130	28	21	40	290.2

			6	200.00	220	222	228	228	100	60	33	24	30	11.4
			8	261.31	281	283	289	289	100	60	33	24	40	17.6
		100	10	323.61	344	345	352	352	110	65	33	24	40	26.4
			12	386.37	406	408	414	414	120	70	33	24	40	37.1
			15	480.97	501	503	509	509	140	80	33	24	40	57.4
	$b_1 = 37$		6	250.00	270	272	278	278	110	65	33	24	40	17.0
	$d_3 = 25$		8	326.64	347	348	355	355	110	65	33	24	40	26.9
M 160	$d_4 = 36$	125	10	404.51	425	426	433	433	120	70	33	24	40	40.3
	$d_5 = 70$		12	482.96	503	505	511	511	130	80	33	24	40	57.0
	$d_6 = 70$		15	601.22	621	623	629	629	150	85	33	24	40	87.1
			6	320.00	340	342	348	348	120	75	33	24	40	27.1
			8	418.10	438	440	446	446	140	80	33	24	40	45.0
		160	10	517.77	538	539	546	546	150	85	33	24	40	66.9
			12	618.19	638	640	646	646	160	90	33	24	40	93.3
			15	769.56	790	791	798	798	180	95	33	24	40	141.9

Standard sprockets for conveyor chains according to DIN 8167

Type of chain	Chain dimensions	Pitch	Number of teeth	Pitch circle ø	Tip circle ø d_a acc. to roller type				Hub ø	Hub length	Width	Width for flanged roller	Bore ø	Weight
		p	Z	d_0	d_3	d_4	d_5	d_6	dN	NL	B_1	B_1	dB	≈ kg
M 160	$b_1 = 37$, $d_3 = 25$, $d_4 = 36$, $d_5 = 70$, $d_6 = 70$	200	6	400.00	420	422	428	428	130	75	33	24	40	40.5
			8	522.63	543	544	551	551	150	85	33	24	40	68.0
			10	647.21	667	669	675	675	160	90	33	24	40	101.3
			12	772.74	793	794	801	801	170	100	33	24	50	142.0
			15	961.95	982	984	990	990	210	110	33	24	50	221.1
		250	6	500.00	520	522	528	528	140	80	33	24	40	61.5
			8	653.28	673	675	681	681	160	90	33	24	40	103.0
			10	809.02	829	831	837	837	180	105	33	24	50	156.6
			12	965.93	986	988	994	994	200	120	33	24	50	223.1
M 224	$b_1 = 43$, $d_3 = 30$, $d_4 = 42$, $d_5 = 85$, $d_6 = 85$	125	6	250.00	274	277	284	284	110	65	38	28	40	19.4
			8	326.64	351	354	361	361	120	65	38	28	40	31.2
			10	404.51	429	432	439	439	130	70	38	28	40	46.7
			12	482.96	507	510	517	517	140	80	38	28	40	66.0
			15	601.22	625	628	635	635	180	95	38	28	40	104.2
		160	6	320.00	344	347	354	354	120	70	38	28	40	30.5
			8	418.10	442	445	452	452	140	80	38	28	40	51.2
			10	517.77	542	545	552	552	150	85	38	28	40	76.1
			12	618.19	642	645	652	652	160	90	38	28	40	106.3
			15	769.56	794	797	804	804	180	95	38	28	40	161.7
		200	6	400.00	424	427	434	434	130	80	38	28	40	46.7
			8	522.63	547	550	557	557	150	85	38	28	40	77.4
			10	647.21	671	674	681	681	170	90	38	28	40	116.5
			12	772.74	797	800	807	807	180	100	38	28	50	163.3
			15	961.95	986	989	996	996	210	110	38	28	50	251.3
		250	6	500.00	524	527	534	534	140	85	38	28	40	70.7
			8	653.28	677	680	687	687	160	90	38	28	40	117.5
			10	809.02	833	836	843	843	180	105	38	28	50	178.4
			12	965.93	990	993	1000	1000	210	120	38	28	50	255.8
M 315	$b_1 = 48$, $d_3 = 36$, $d_4 = 50$, $d_5 = 100$, $d_6 = 100$	160	6	320.00	349	350	360	360	150	100	43	31	50	38.6
			8	418.10	447	448	458	458	180	115	43	31	60	64.8
			10	517.77	547	548	558	558	180	115	43	31	60	91.0
			12	618.19	647	648	658	658	200	115	43	31	60	126.2
			15	769.56	798	800	810	810	210	120	43	31	60	187.2
		200	6	400.00	429	430	440	440	150	100	43	31	60	54.4
			8	522.63	551	553	563	563	180	115	43	31	60	92.4
			10	647.21	676	677	687	687	180	115	43	31	60	133.0
			12	772.74	802	803	813	813	200	115	43	31	60	185.5
			15	961.95	991	992	1002	1002	220	120	43	31	60	280.5
		250	6	500.00	529	530	540	540	180	110	43	31	60	85.1
			8	653.28	682	683	693	693	210	115	43	31	60	140.4
			10	809.02	838	839	849	849	210	115	43	31	60	203.1
			12	965.93	995	996	1006	1006	220	125	43	31	60	284.0

Sprockets – pitch circle diameter

Pitch circle diameter

Number of teeth	Pitch p										
	40	63	80	100	125	160	200	250	315	400	500
z	Pitch circle diameter										
5	68.05	107.18	136.10	170.13	212.66	272.21	340.26	425.33	535.91	680.52	850.65
6	80.00	126.00	160.00	200.00	250.00	320.00	400.00	500.00	630.00	800.00	1000.00
7	92.19	145.20	184.38	230.48	288.10	368.76	460.95	576.19	726.00	921.91	1152.38
8	104.53	164.63	209.05	261.31	326.64	418.10	522.63	653.28	823.13	1045.25	1306.56
9	116.95	184.20	233.90	292.38	365.48	467.81	584.76	730.95	921.00	1169.52	1461.90
10	129.44	203.87	258.89	323.61	404.51	517.77	647.21	809.02	1019.36	1294.43	1618.03
11	141.98	223.62	283.96	354.95	443.68	567.91	709.89	887.37	1118.08	1419.79	1774.73
12	154.55	243.41	309.10	386.37	482.96	618.19	772.74	965.93	1217.07	1545.48	1931.85
13	167.14	263.25	334.29	417,86	522.32	668.57	835.72	1044.65	1316.25	1671.43	2089.29
14	179.76	283.12	359.52	449.40	561.74	719.03	898.79	1123.49	1415.60	1797.58	2246.98
15	192.39	303.01	384.78	480.97	601.22	769.56	961.95	1202.43	1515.07	1923.89	2404.87
16	205.03	322.93	410.07	512.58	640.73	820.13	1025.17	1281.46	1614.64	2050.33	-
17	217.69	342.86	435.38	544.22	680.27	870.75	1088.44	1360.55	1714.29	2176.88	-
18	230.35	362.80	460.70	575.88	719.85	921.40	1151.75	1439.69	1814.01	2303.51	-
19	243.02	382.76	486.04	607.55	759.44	972.09	1215.11	1518.88	1913.79	2430.21	-
20	255.70	402.72	511.40	639.25	799.06	1022.79	1278.49	1598.11	2013.62	-	-
21	268.38	422.70	536.76	670.95	838.69	1073.52	1341.90	1677.38	2113.49	-	-
22	281.07	442.68	562.13	702.67	878.33	1124.27	1405.33	1756.67	2213.40	-	-
23	293.76	462.67	587.52	734.39	917.99	1175.03	1468.79	1835.99	2313.34	-	-
24	306.45	482.66	612.90	766.13	957.66	1225.81	1532.26	1915.32	2413.31	-	-
25	319.15	502.66	638.30	797.87	997.34	1276.60	1595.75	1994.68	-	-	-
26	331.85	522.66	663.70	829.62	1037.03	1327.40	1659.25	2074.06	-	-	-
27	344.55	542.67	689.10	861.38	1076.72	1378.21	1722.76	2153.45	-	-	-
28	357.26	562.68	714.51	893.14	1116.43	1429.02	1786.28	2232.85	-	-	-
29	369.96	582.69	739.93	924.91	1156.13	1479.85	1849.81	2312.27	-	-	-
30	382.67	602.71	765.34	956.68	1195.85	1530.68	1913.35	2391.69	-	-	-
31	395.38	622.72	790.76	988.45	1235.56	1581.52	1976.90	2471.13	-	-	-
32	408.09	642.74	816.18	1020.23	1275.29	1632.37	2040.46	-	-	-	-
33	420.80	662.77	841.61	1052.01	1315.01	1683.22	2104.02	-	-	-	-
34	433.52	682.79	867.04	1083.80	1354.74	1734.07	2167.59	-	-	-	-
35	446.23	702.82	892.47	1115.58	1394.48	1784.93	2231.16	-	-	-	-
36	458.95	722.84	917.90	1147.37	1434.21	1835.79	2294.74	-	-	-	-
37	471.67	742.87	943.33	1179.16	1473.95	1886.66	2358.33	-	-	-	-
38	484.38	762.90	968.77	1210.96	1513.70	1937.53	2421.91	-	-	-	-
39	497.10	782.93	994.20	1242.75	1553.44	1988.40	2485.50	-	-	-	-
40	509.82	802.97	1019.64	1274.55	1593.19	2039.28	-	-	-	-	-
41	522.54	823,00	1045.08	1306.35	1632.94	2090.16	-	-	-	-	-
42	535.26	843.03	1070.52	1338.15	1672.69	2141.04	-	-	-	-	-
43	547.98	863.07	1095.96	1369.95	1712.44	2191.92	-	-	-	-	-
44	560.70	883.11	1121.40	1401.75	1752.19	2242.81	-	-	-	-	-
45	573.42	903.14	1146.85	1433.56	1791.95	2293.69	-	-	-	-	-
46	586.15	923.18	1172.29	1465.36	1831.71	2344.58	-	-	-	-	-
47	598.87	943.22	1197.74	1497.17	1871.46	2395.47	-	-	-	-	-
48	611.59	963.26	1223.18	1528.98	1911.22	2446.37	-	-	-	-	-
49	624.32	983.30	1248.63	1560.79	1950.98	2497.26	-	-	-	-	-
50	637.04	1003.34	1274.08	1592.60	1990.75	-	-	-	-	-	-

Sprockets are a decisive factor for the performance and life of any chain system. A result, KettenWulf relies on the production of our own sprockets to guarantee the quality of our products.

Of course our product line also includes form sprockets of any type of DIN/ISO/ANSI tooth systems, individual solutions with optimal tooth forms and sprocket sizes. Whether you need sprockets manufactured from superior materials or induction-hardened teeth – KettenWulf always has the right solution for you.

As a comprehensive supplier, KettenWulf also offers completely attended drive shafts ready for installation. The production of special parts such as planetary axles and housing covers completes our product program.

KettenWulf sprockets – components – special parts

KettenWulf sprockets

For all chains, KettenWulf also provides the matching sprockets. Besides sprockets with toothing according to DIN standards, we can also manufacture sprockets with optimized tooth forms and milled surfaces. Sprockets made of high-grade materials, heat-treated and with induction hardened teeth are part of our standard production program.

Our production range includes all sprocket designs such as sprockets with one-sided hubs and sprockets with two-sided hubs, split-type sprockets with detachable tooth segments or tooth gaps, shear-pin sprockets, pinion sprockets or sprockets with our patented noise dampening system.

Figure 1:
Sprocket with detachable tooth gaps

Figure 2:
Double sprocket intermediate gaps

1

2

Figure 3:
Triple sprocket

Figure 4:
Sprocket with intermediate and lightening holes

3

4

Figure 5:
Sprocket with saw toothing.

Figure 6:
Pinion sprocket

5

6

Figure 7:
Sprocket with segmented rim and intermediate gaps

Figure 8:
Sprocket with patented noise dampening system

7

8

Components and special parts

We always stay on the cutting edge of our business. As a result, we take advantage of our vast experience and in-depth expertise that we have gained throughout the years to promote new, promising industries. This enables us to advance into new markets such as the renewable energy industry. Likewise, we are able to offer our customers this extensive know-how so as to develop a product solution perfectly geared to meet their individual requirements.

As a leader in conveyor and drive technology, KettenWulf has established itself as a supplier of special components. Apart from manufacturing drive and tail shafts, we also mount complete drive shaft systems consisting of axle, sprockets and bearings. These shafts are completely assembled at our factory and delivered to our customers as a ready-to-install package. Special parts such as planetary axles or housing covers are further examples of our vast product range.

Figure 1:
Completely mounted drive shaft

Figure 2:
Drive shaft for the escalator industry

Figure 3:
Planetary axle for large gears

Figure 4:
Housing cover for large gears

Figure 5:
Drive shaft hydraulic engineering

Figure 6:
Drive shaft with bearing blocks

Figure 7:
Tail shaft for the bulk material handling industry

Figure 8:
Pinion rack

Production capabilities in sprocket manufacturing

Chipping

Turning

	max. diameter	max. length
CNC vertical lathe machine	1800 mm	1000 mm
CNC horizontal lathe machine with driven tools and steady rest	600 mm	2000 mm
CNC turning and milling center	800 mm	2000 mm
CNC double spindle with loading robot	200 mm	350 mm
CNC bar automatic lathe	70 mm	350 mm
Conventional lathe	1000 mm	2000 mm

Toothing

	max. diameter	max. length	module
Hobbing machine	2500 mm	600 mm	1 - 20
CNC hobbing machine	900 mm	400 mm	1 - 15
Profile milling machine, conventional	2500 mm	300 mm	1 - 20
CNC milling machine with CNC table	2500 mm	300 mm	each tooth space

Milling

	x-axis	y-axis	z-axis	c-axis
5-axis CNC machining center	2000 mm	1400 mm	1100 mm	1500 mm
Horizontal and vertical				

Boring

	diameter	max. length
Boring	up to 180 mm	600 mm

Broaching

	max. width	max. length
Broaching machine	3 - 20 mm	200 mm

Grooving

	max. width	max. length
Grooving machine	100 mm	750 mm

Grinding

	max. diameter	max. length
CNC cylindrical grinding machine	450 mm	1000 mm

Cutting

Sawing

	max. diameter	
Band saw	420 mm	

Flame cutting

	max. sheet size	max. strength
CNC flame-cutting table	2500 x 6000 mm	200 mm

Laser cutting/ plasma cutting

	max. sheet size	max. strength
Laser cutting system	3000 x 1500 mm	20 mm
Plasma cutting system	3000 x 1500 mm	35 mm

Assembling

Welding

	max. weight	max. diameter
Welding installation with round table	5000 kg	
Welding robot with rotating/tilting table	260 kg	1600 mm

Heat treatment

Induction hardening

	max. diameter	max. length
Induction hardening system	2000 mm	1000 mm
	260 kg	1600 mm

Case hardening/ tempering

	max. basket size	
Continuous furnace /chamber furnace	1100 x 800 x 600 mm	

Lubrication and maintenance have a huge impact on the service life of each chain system. The following pages provide you with general information on this important topic.

Lubrication and maintenance

Lubrication of a bush conveyor chain via the chain joint

Lubrication and maintenance of chains

Initial lubrication and anti-corrosion protection

Prior to final assembly, the chain joints of bush conveyor chains are greased with a standard lubricant. Afterwards, the chains are immersed into a special preservation bath or sprayed for anti-corrosion protection. Grease channels of chains which can be relubricated via the pins do not obtain any initial lubrication. This has to be done on site by the customer. Custom lubrication requirements or anti-corrosion treatments can be provided on request.

Relubrication

Chains are either manually or automatically lubricated. The lubricant should preferably be applied onto the non-loaded area of the chain. Manual lubrication can be done using a grease pump, brush, oil-dispensing can or spray can whereas drip oilers, mist and spray systems or other devices are used for automatic relubrication.

Selection of lubricants

The mostly complex operating conditions require a careful selection of the right lubricant. We recommend consulting a specialist lubricant company.

Maintenance

We recommend a regular cleaning schedule for the chain adapted to its specific operation conditions. Only through regular cleaning can dirt particles be removed that cause abrasion-related wear.

Figure 1:
First lubrication of a chain pin

Figure 2:
Initial lubrication of a bush / roller

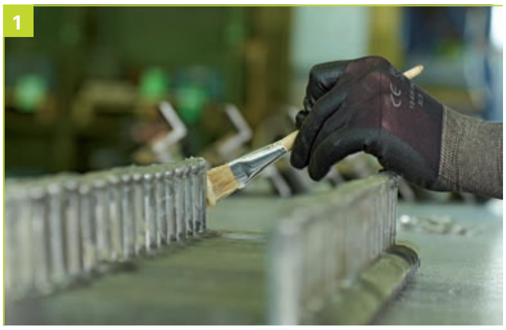


Figure 3 and 4:
Anti-corrosion bath

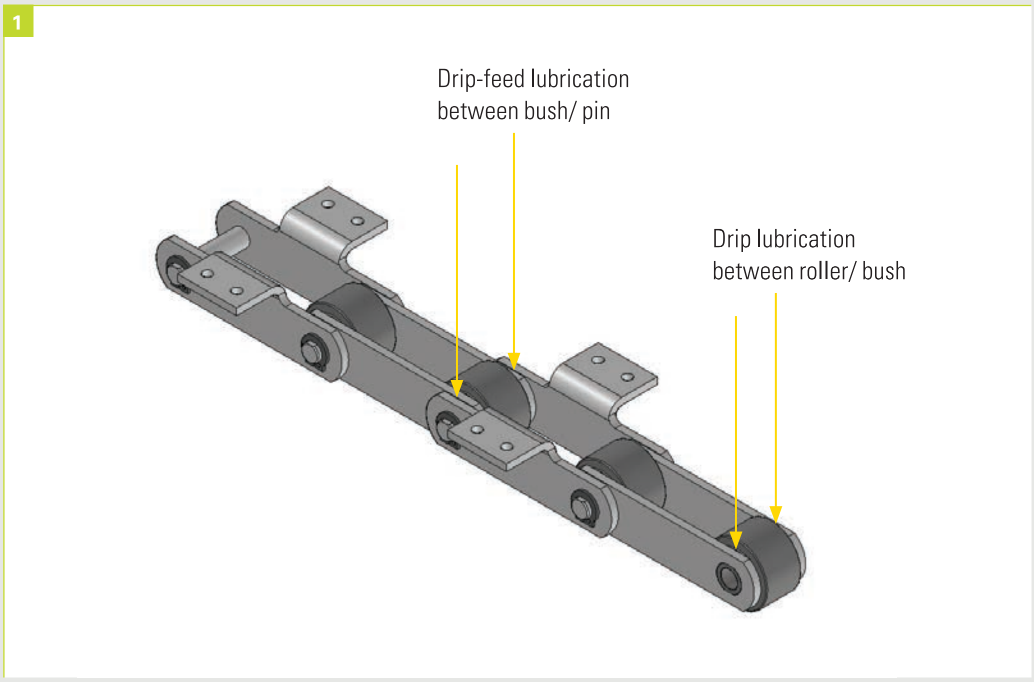
Standard types of lubrication for conveyor chains

Oil lubrication

Oil lubrication is generally carried out automatically via a special device while the chain is in operation. The intensity can be regulated by adjusting the flow rate of the device accordingly. This type of lubrication has the advantage that it is very simple; however, one has to ensure that the lubricant fully enters the chain joint. It is also possible that dirt particles get into the joint along with the lubricant, which then can lead to an increased wear of the chain.

Moreover, the oil can wet the guiding rail, which can have a negative impact on chains with rollers in particular. Due to the oily surface, it might be that the rollers slide in the rail instead of rotating regularly.

Figure 1:
Oil lubrication

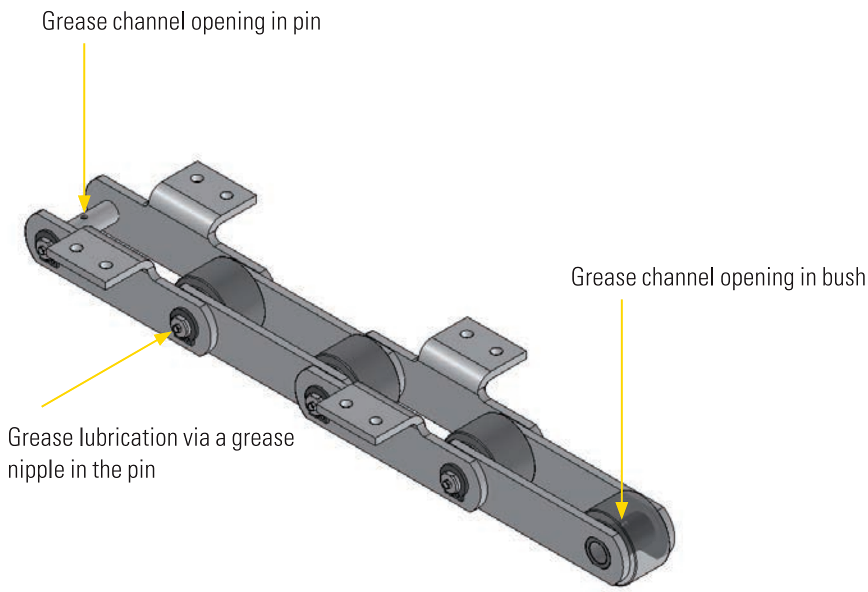


Grease lubrication

Another type of lubrication is the lubrication via grease channels in the pins or bushes of the chain. By means of a grease gun the lubricant is applied into the chain joints via a grease nipple. This method guarantees an optimal lubrication of the chain joints with the lubricant directly covering the friction areas in the joint. Furthermore, this way of lubrication is beneficial in that any dirt , which has penetrated into the chain joints, is transported outward by the lubricant. Should it not be possible to stop the chain drive for relubrication, the chain can also be relubricated during operation using an automatic greasing device.

Figure 2:
Grease lubrication

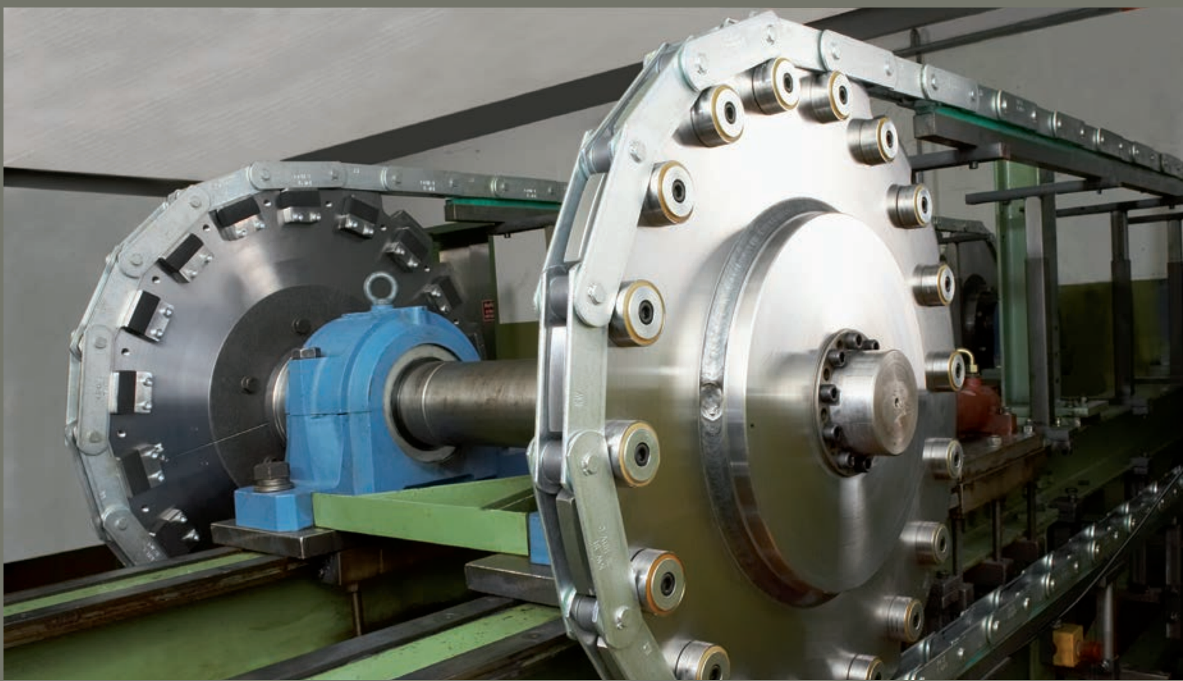
2



Our research and development department constantly improves our products and develops individual solutions for you. The following pages give you selected examples of our innovation activities.

Innovation and development

Testing different types of noise absorption dampening systems on sprocktes



Polygon compensation

Using our patented polygon compensation system we offer you the option of reducing the polygon effect caused by the fluctuations of the effective pitch circle diameter.

You have the option

- of reducing the polygon effect at the same required space for drive and deflection and the same pitch
- of using a larger pitch at the same required space for drive and deflection and thereby saving costs
- of reducing the required space for drive and deflection by reducing the number of teeth (min. Z=6)

Please contact us for further information.

1

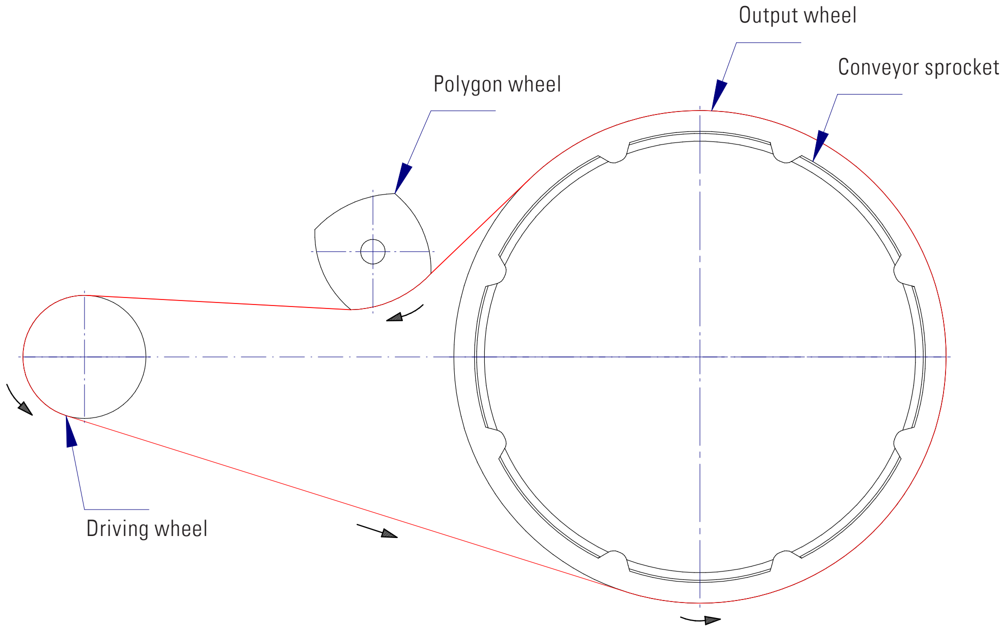


Figure 1:
Schematical illustration of the drive system.

Low-maintenance and lubrication-free chain technology

Low-maintenance chain technology

We have developed various sealing systems particularly for chains operating in abrasive or corrosive media. These sealing systems protect the chain joints against any kind of damaging, external influences which can enter the chain joint. This ensures a good lubrication of the chain joints over a long period of time. Therefore, the service life of the chain increases considerably at a simultaneous reduction of the relubrication intervals and the costs incurred, e.g. costs for the lubricant, its disposal and relubrication costs. Please contact us for further information about possible areas of operation for low-maintenance chain technology.

1

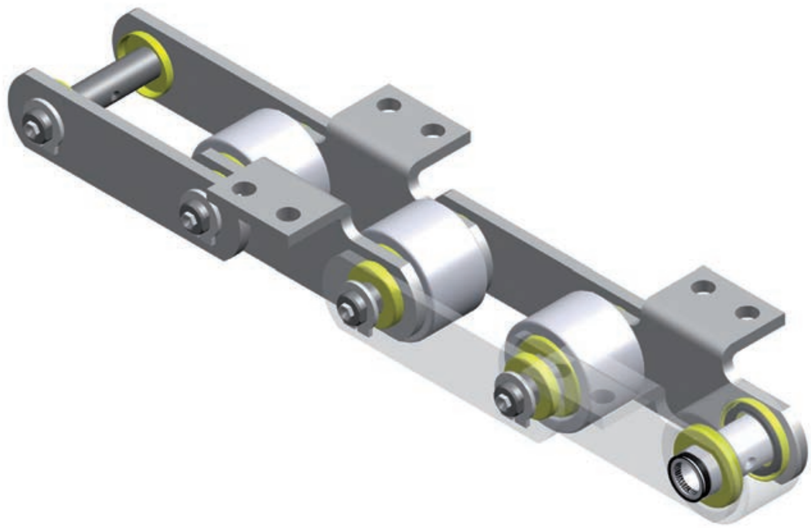


Figure 1:
Low-maintenance bush conveyor chain with patented gasket seal

Lubrication-free chain technology

Depending on the operating conditions, it is also possible to use chains which do not require any re-lubrication. This is achieved either by using special slide bearings or by coating the chain joints.

Due to the large number of possible types of slide bearings and coating materials we have carried out comprehensive testing in our corporate research and development department. This experience enables us to find the optimal product solution for your specific application.

2

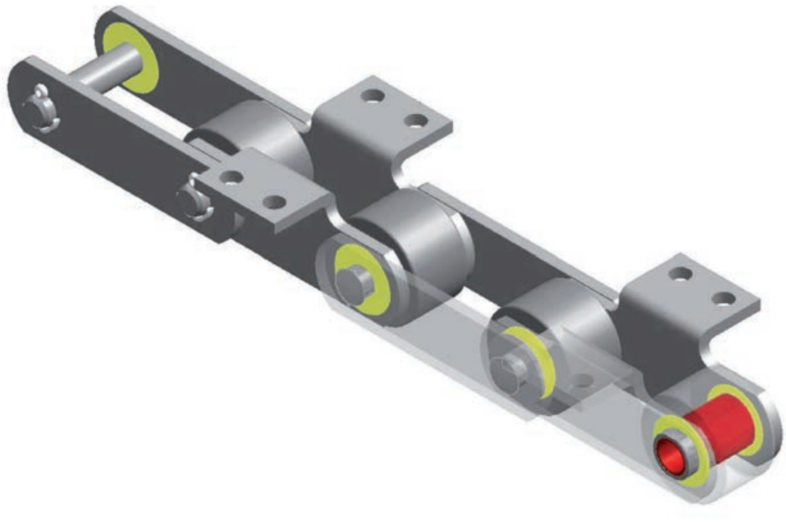


Figure 2:
Lubrication-free bush conveyor chain

Low-maintenance and lubrication-free technology

This technology combines the low-maintenance and lubrication-free approach. The sealing system protects the chain joints against abrasive and corrosive media and, in addition, selected slide bearings and/ or special coatings are utilized. This combination has the advantage of shielding the chain joint completely from external influences and thus makes a major contribution to extending the service life of the lubrication-free chains in aggressive environments.

3

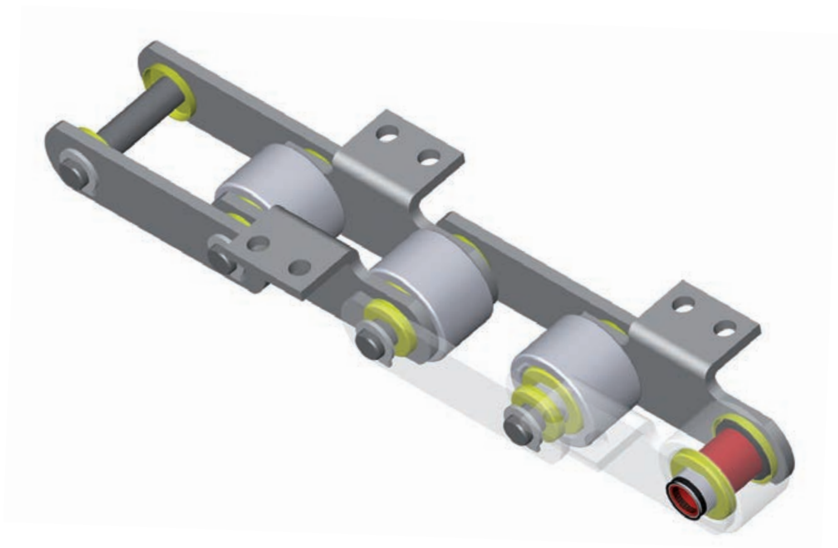


Figure 3:
Lubrication-free bush conveyor chain with patented sealing system

Sandwich sealing – the optimal sealing system

With the sandwich sealing, KettenWulf has developed a high-performance sealing system which has proven successful in various applications and industries over the years. The sealing system consists of an inner and outer cover with an integrated sealing element. The sandwich sealing can be used for both the low-maintenance and lubrication-free technology and is further characterized by the following advantages:

- The covers are made of stainless steel with a high surface quality; they are largely media-resistant and an optimal, low-friction contact for the sealing elements, which thus reach a long service life.
- The covers act as a labyrinth and protect the sealing elements against mechanical damages due to external influences
- The integrated sealing elements guarantee an optimal sealing effect

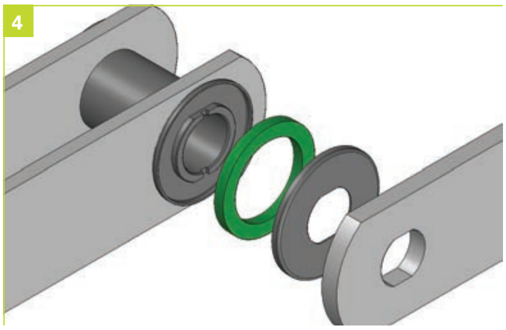
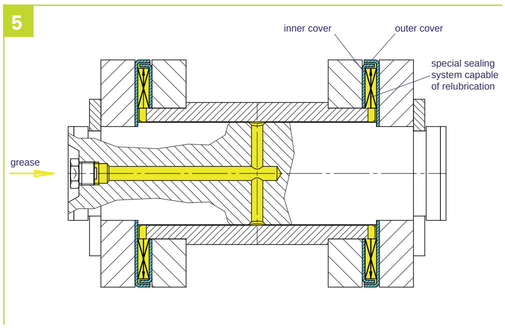


Figure 4:
Sandwich sealing system for lubrication-free chain joints



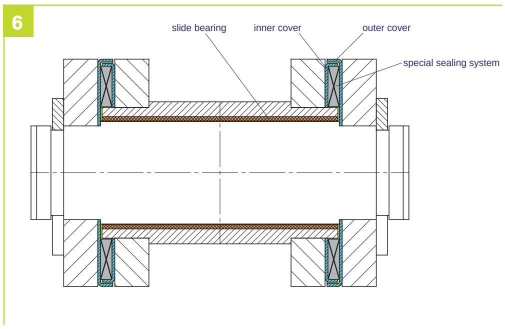


Figure 5:
Sandwich sealing system for low-maintenance chain technology with the possibility of relubrication

Figure 6:
Sandwich sealing system for lubrication-free chain technology

Design examples

Low-maintenance chain technology with inboard rollers

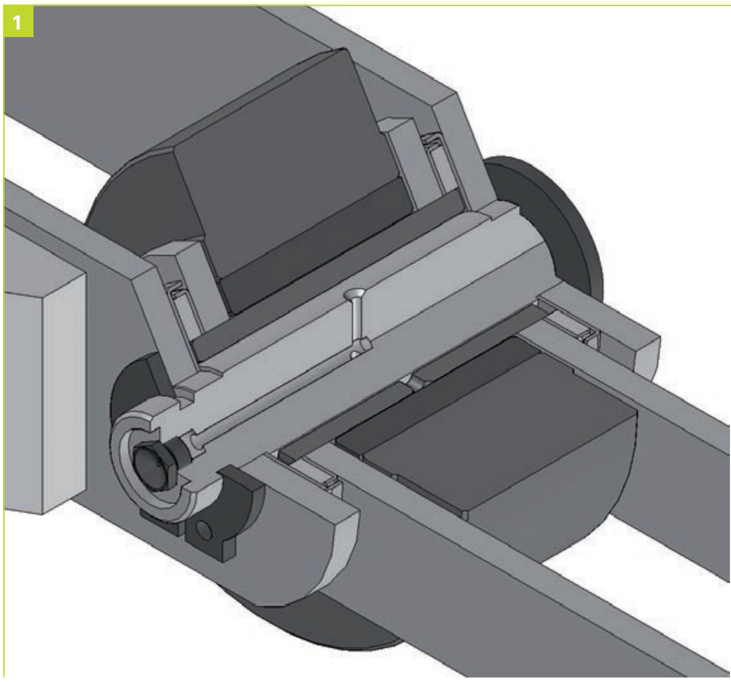


Figure 1:
Rollers with self-lubricating slide bearings. Sandwich sealing system between bush/ pin and capable of relubrication via grease nipples.

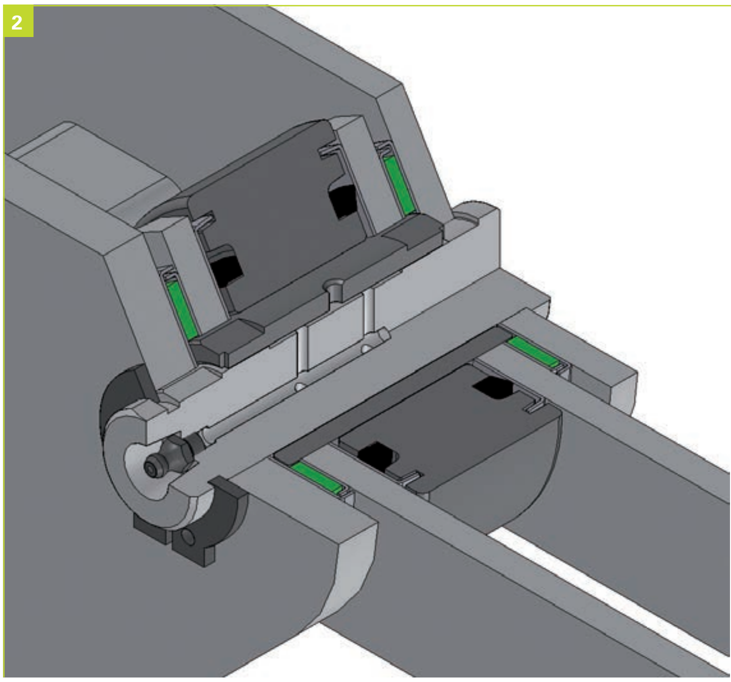


Figure 2:
Rollers with sealing. Sandwich sealing system between bush / pin. Capable of relubrication via grease nipples.

Lubrication-free chain technology with inboard rollers

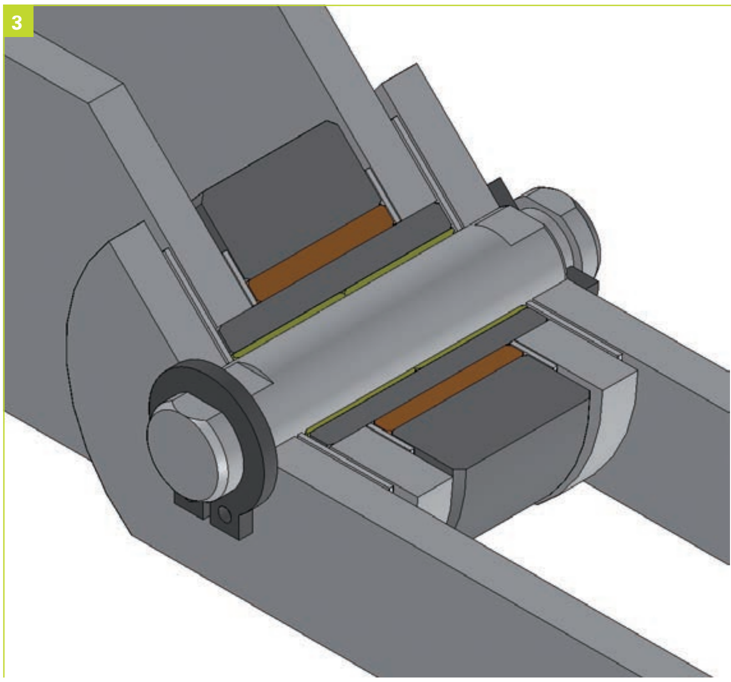


Figure 3:
Chain joint roller/ bush and bush/ pin with self-lubricating slide bearings.

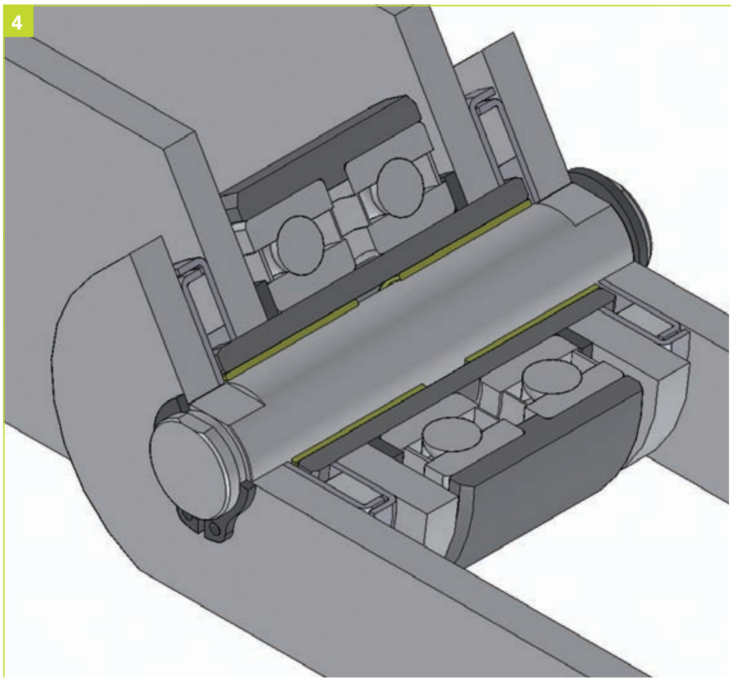


Figure 4:
Rollers with ball bearings and life-time lubrication. Chain joint bush / pin with self-lubricating slide bearings.

Low-maintenance and lubrication-free chain technology with outboard rollers

Figure 5:
Outboard roller and chain joints protection rollers / bush and bush / pin in lubrication-free configuration.

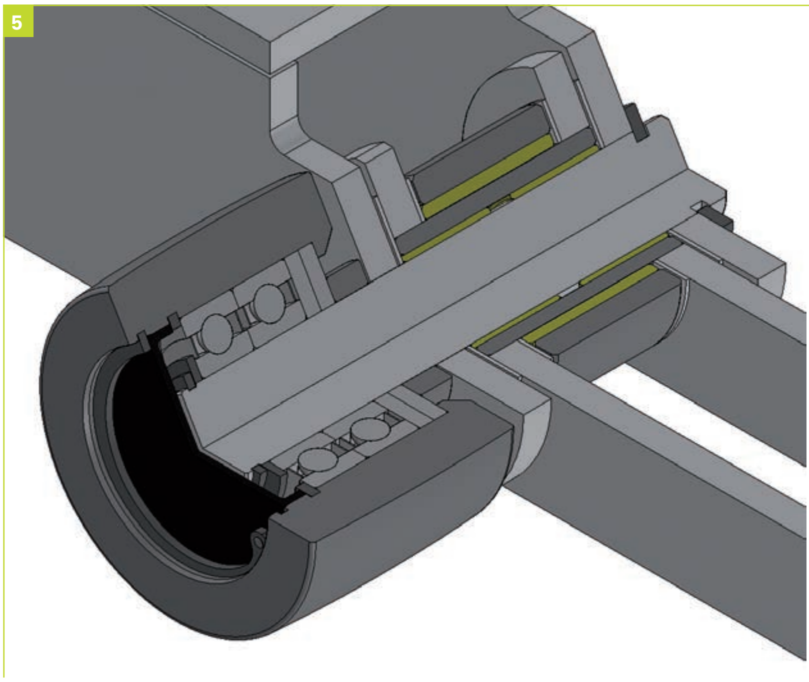
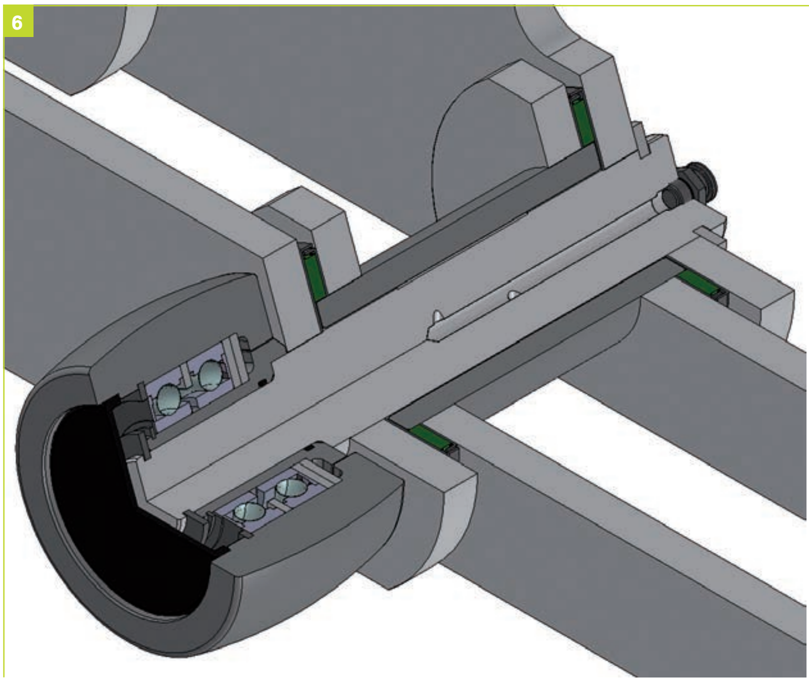


Figure 6:
Lubrication-free outboard roller. Chain joint bush / pin with sandwich sealing system; capable of relubrication via grease nipples.

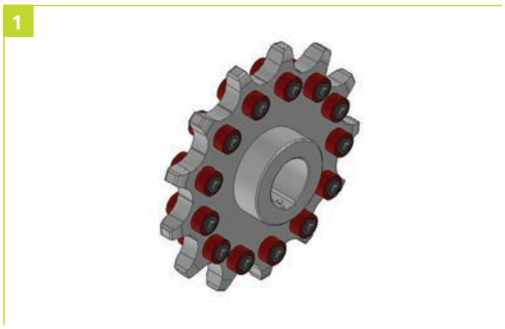


Sprockets with noise dampening system

Types of noise dampening systems

The noise that occurs while the chain engages into the sprocket is disturbing and annoying. To decrease this noise efficiently and to improve the working conditions, KettenWulf has developed different noise dampening systems. These systems see to it that the chain joints are smoothly guided into the tooth gap, which leads to a considerable noise reduction. The selection of the most suitable noise dampening system depends on the respective application.

Figure 1 and 2: **Sprocket with patented noise dampening system**

1


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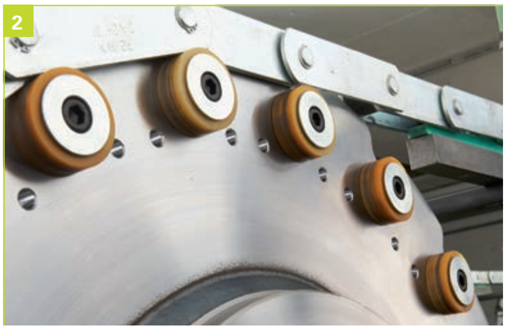


Figure 3 and 4: **Sprocket with special round noise dampers**

3

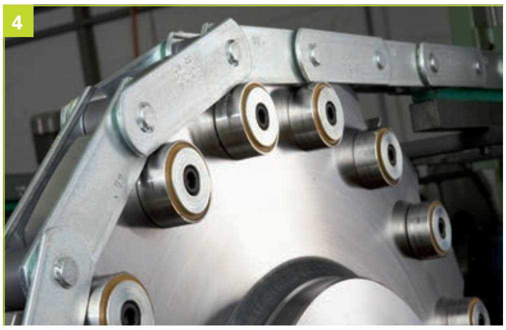

4


Figure 5 and 6: **Sprocket with special rectangular noise dampers**

5


6


We deliver only the best quality products. To ensure this, we only use the latest machines and manufacturing methods. In addition, both our quality management and R&D department are engaged in the constant improvement of our product quality.
To assure the same degree of high quality of our products at all levels, virtually all production steps are carried out in-house.

Latest production technology for the highest quality

Round parts are manufactured with highest precision on CNC machines.

Quality certified according to DIN EN ISO 9001:2008

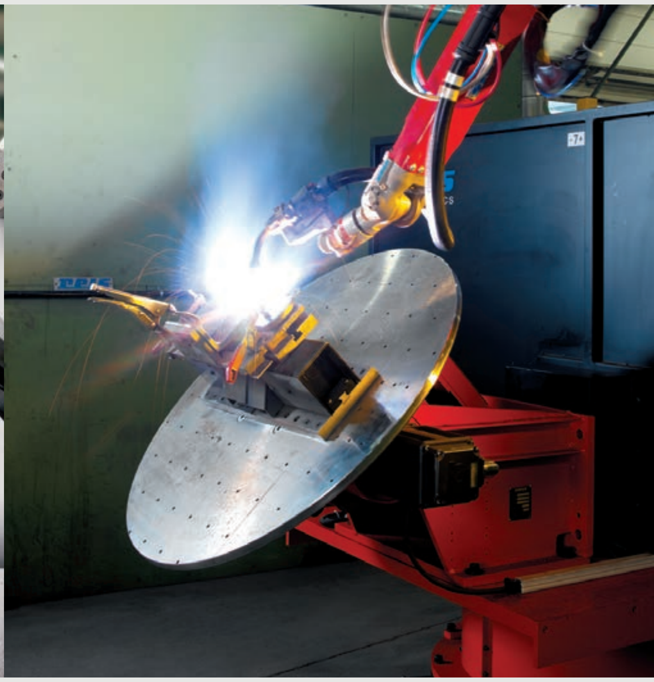
Customer satisfaction and confidence are the corner stones of the KettenWulf Group's mission statement. To ensure consistent high product quality KettenWulf has obtained certification to prove the compliance of its quality management system with the strict requirements of DIN EN ISO 9001:2008.

Laser cutting: For the manufacture of plates requiring the highest degree of precision, KettenWulf uses laser cutting technology. Additionally, this technology also allows for the production of link plate components with complex contours.

Heat treatment: According to their area of operation, KettenWulf chains and sprockets undergo different heat treatment processes such as case hardening, quenching and tempering or induction hardening in-house. Heat treatment leads to a higher wear resistance of the chain joints and thus increases the service life of the chain. Induction hardened tooth gaps significantly reduce the wear caused by the continuous interaction between chain and sprocket and hence ensure a trouble-free operation of the entire system over a long period of time.

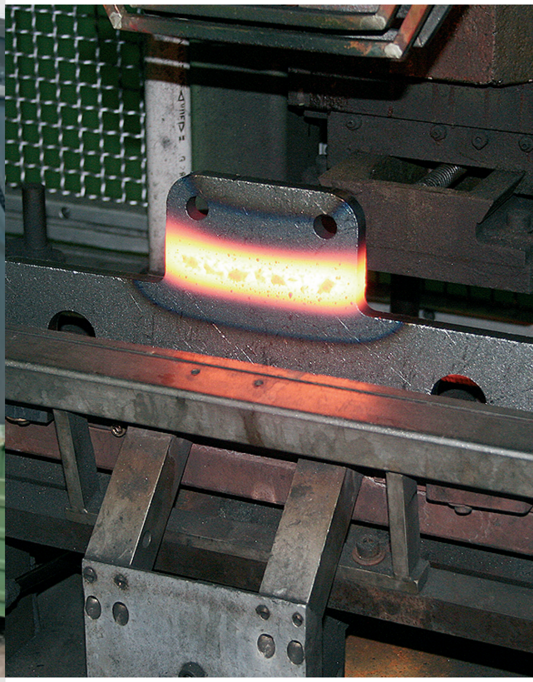
Quality in all production processes





Mechanical machining: KettenWulf utilizes state-of-the-art CNC technology for mechanical processing. This enables us not only to lathe bushes, pins, and rollers, but also to mill link plates, sprocket teeth, and bore holes with the highest degree of precision. Thanks to these flexible production capacities, the manufacture of variable designs according to customer specification can be realized promptly and without any problems. In addition, all bushes, pins and rollers can be ground to a fine tolerance after heat treatment with precise grinders to ensure a perfect fit.

Welding technology: All welding is carried out by our own certified welding shop using the latest MIG and MAG technologies. In order to ensure a consistent, high quality of our chains and sprockets, we use partially and fully-automated welding equipment.



Punching: Modern punching technology allows for an efficient serial production of link plates and attachments. All tools used for punching are designed and produced in the company's own tool shop. This way a high pitch accuracy of the chains can be guaranteed. For further quality improvement all link plates and attachment are shot-peened after punching.

Metal forming: To bend chain attachments the bending zones of all parts are initially induction heated. This method prevents micro-cracks in the link plate and thus increases the service life of the entire chain significantly.

Final assembly: During the last production step the individual chain components are assembled using hydraulically operated presses. Not until passing the final quality inspection are the products released for shipment.

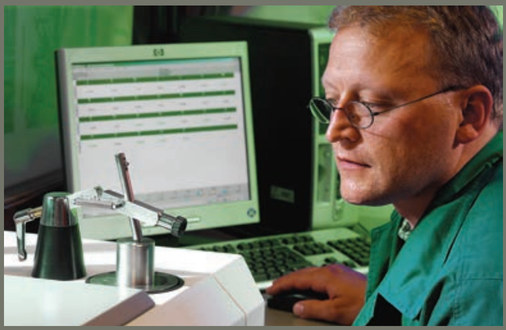
The high frequency pulsator measures the fatigue strength of materials, components or chains.

From the first inspection of the raw material to the final inspection of the finished product: every production process at KettenWulf is subject to a consistent and thorough quality assurance. We inspect important product properties such as wear behavior, fatigue strength or breaking load by using state-of-the-art testing equipment and techniques. For instance, fatigue strength is measured by means of a high frequency pulsator; breaking load tests of up to 3000kN, hardness testing to HRC, HV and HB, spectral analysis or Charpy impact tests can be carried out.

Quality management

Breaking load tests of up to 3000kN can be carried out in our vast testing laboratory.

By means of spectral analysis the alloying components of the raw materials are analyzed.



For further information please visit our website at www.kettenwulf.com or request the following company brochures:

» Focus on the KettenWulf Group
» Chains and sprockets for the bulk material handling industry
» Chains and sprockets for the automotive industry
» Chains and sprockets for the steel and aluminium industries
» Chains and sprockets for the wood industry
» KettenWulf roller chains

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