For proper power transmission and for achieving an acceptable belt service life, the correct belt tension is of the utmost importance.
Too low or too high belt tension will lead to the premature failure of the belts. Over tensioning often leads to bearing failure on the driver or the driven machine. Experience has shown that unscientific belt tensioning methods, such as the "thumb pressure method", are not suitable for applying the optimum tension to the drive for maximum efficiency. It is therefore recommended that for each drive the required static belt tension "T" is calculated using the formulas by Optibelt. This tension is the lowest possible required by a drive to transmit the highest power level from the drive, taking account of the normal amount of slip.
Once the belt has been fitted and the initial tension has been applied, it should be checked using an Optibelt tension gauge.
The belt should be monitored regularly during the first hours of operation. Experience has shown that the first re-tensioning should be carried out after approximately 30 minutes to four hours operating under full load. In doing so, the initial stretch is absorbed.
After approximately 24 hours of operation, it is often recommended to check the drive and re-tension the belts if necessary, particularly when not continuously run under full load. The time between checks can be significantly increased then. Also see our installation and maintenance advice on pages 158 to 159.
Too high or too low tension of the drive will be avoided if the belt tension is calculated, set and checked using one of the following methods.

I. Checking the belt tension by span deflection

This method provides an indirect measurement of the calculated or actual static belt tension. It is applicable for belt sections SPZ, SPA, SPB, SPC, 3V/9N, 5V/15N, Z/10, A/13, B/17, 20, C/22, 25, D/32, XPZ, XPA, XPB, XPC, 3VX, 5VX, ZX/X10, AX/X13, BX/X17, CX/X22.

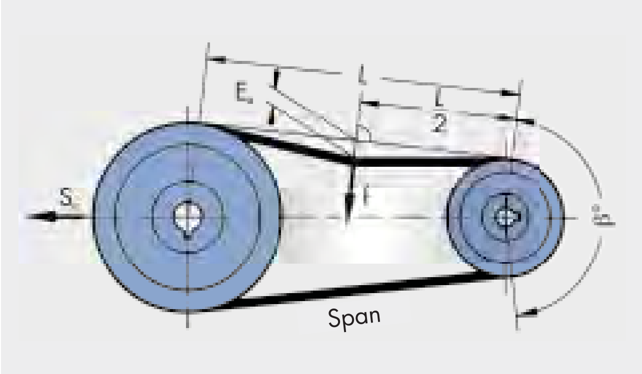
E	=	belt deflection per 100 mm span length	[mm]
E_a	=	belt deflection for a given span length	[mm]
f	=	load used to set belt tension	[N]
k	=	constant for calculation of centrifugal force	
L	=	drive span length	[mm]
S_a	=	minimum static shaft load	[N]
T	=	minimum static tension per belt	[N]

1. Calculation of the static belt tension using the following formula:

$$T \approx \frac{500 \cdot (2.04 - c_1) \cdot P_B}{c_1 \cdot z \cdot v} + k \cdot v^2$$

During new installation, the drive is to be tensioned with 1.3 T.

2. Determine the belt deflection per 100 mm span length E from the belt tension/deflection diagrams 8 to 11.



3. Calculate the belt deflection for a given span length E_a for the actual drive span length L.

$$E_a \approx \frac{E \cdot L}{100}$$

$$L = a_{nom} \cdot \sin\frac{\beta}{2}$$

Apply test load "f" (taken from diagrams 8 to 11 for the appropriate belt profile) to the centre of, and perpendicular to, the span as illustrated above. Measure the deflection and if necessary adjust the centres until the correct belt tension is achieved.

II. Checking the belt tension via speed measurement

This method checks belt tension using the theoretical slip. The speed of the driver and driven pulleys are measured first in an unloaded condition and then under load.

S	=	slip	[%]
n_{1L}	=	driver pulley speed, no load	[rpm]
n_{2L}	=	driven pulley speed, no load	[rpm]
n_{1B}	=	driver pulley speed, under load	[rpm]
n_{2B}	=	driven pulley speed, under load	[rpm]

Formula for calculating the slip:

$$S = \left(1 - \frac{n_{1L}/n_{2L}}{n_{1B}/n_{2B}}\right) \cdot 100$$

At the rated loading, the slip should not exceed 1 %. The belt service life is considerably shortened due to incorrectly low tension or overloading with a slip of over 2 %.

Diagram 8: Belt tension characteristics for optibelt SK high performance wedge belts DIN 7753 Part 1

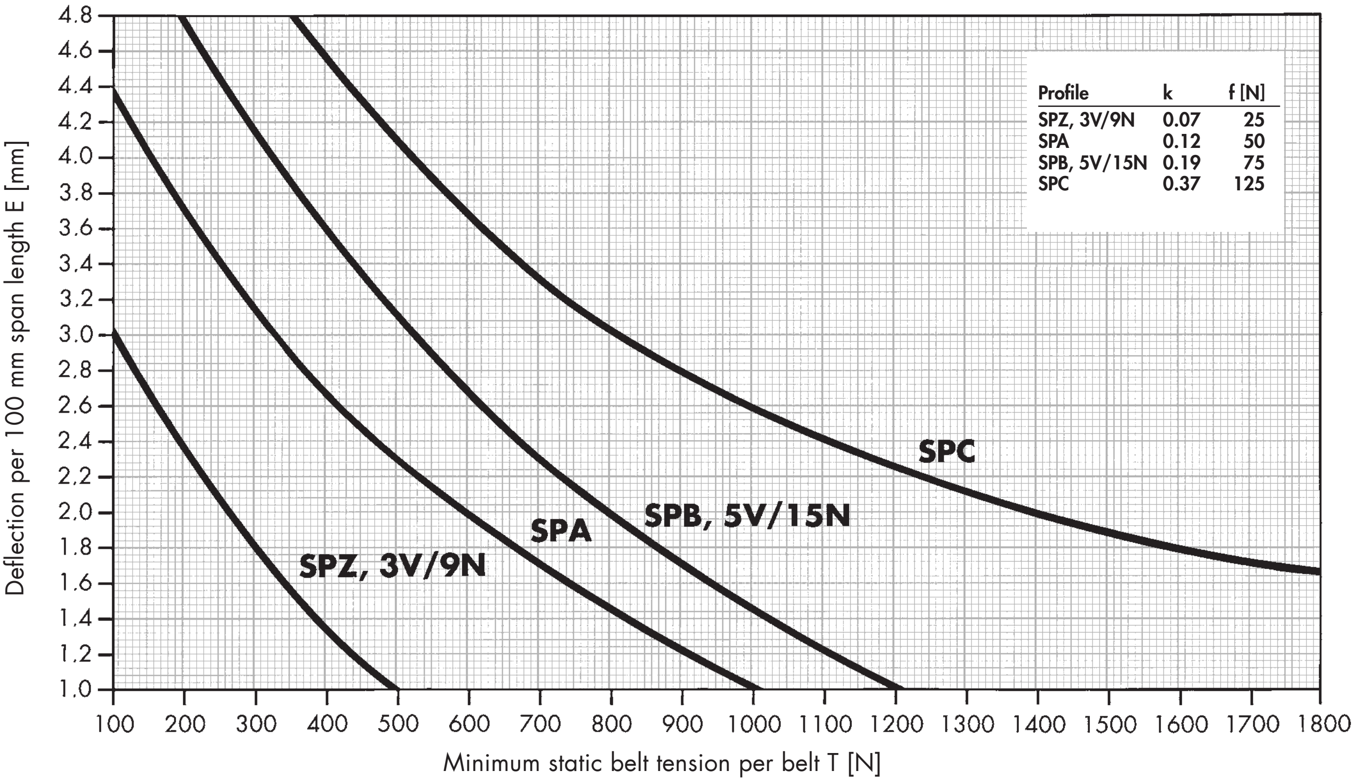


Diagram 9: Belt tension characteristics for optibelt VB classic V-belts DIN 2215

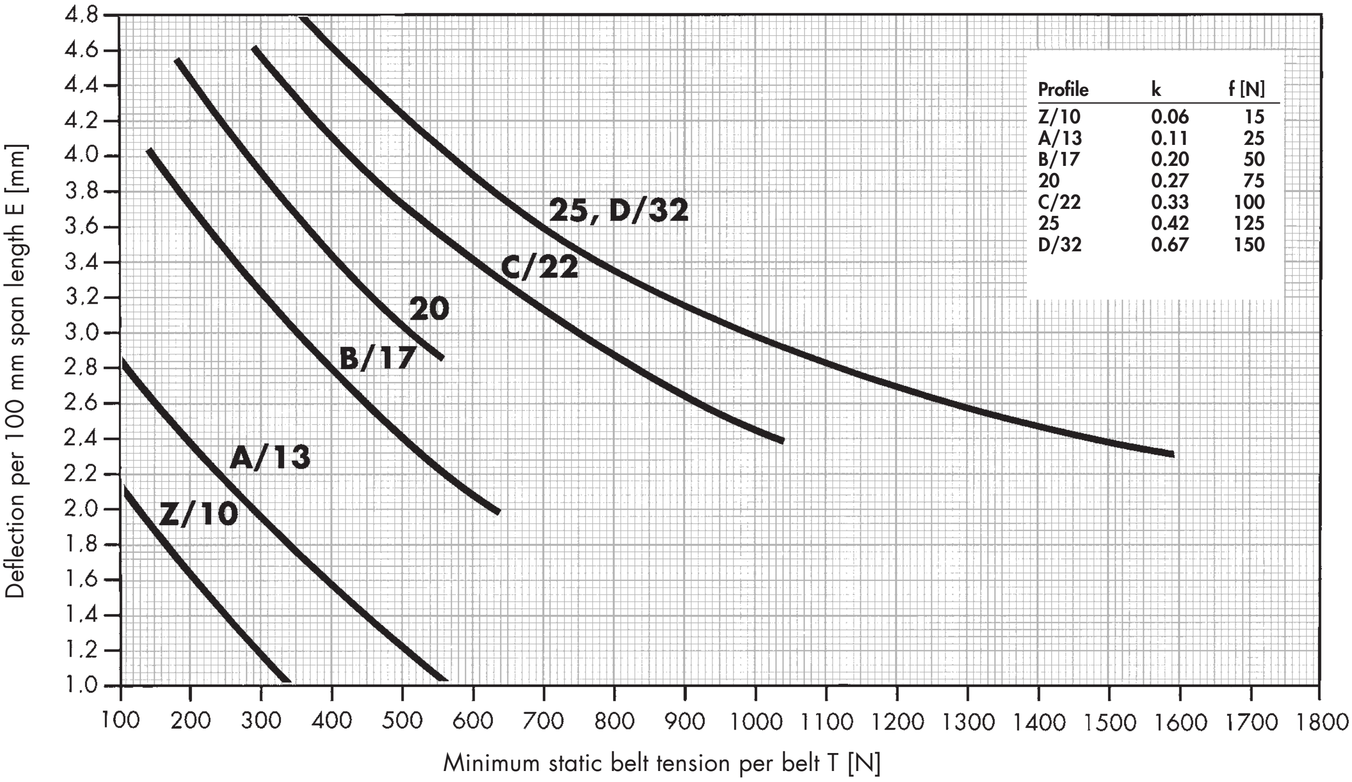


Diagram 10: Belt tension characteristics for optibelt X-POWER M=S wedge belts – raw edge, cogged

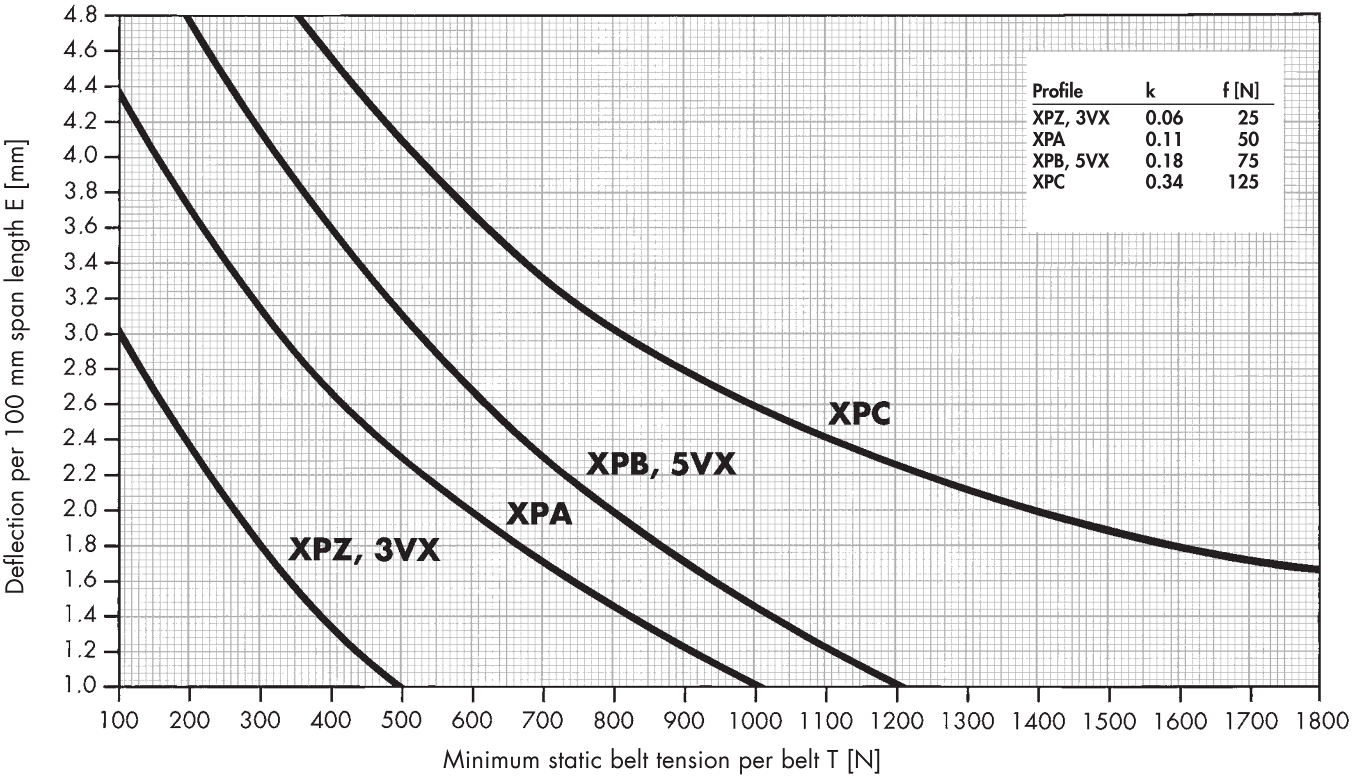
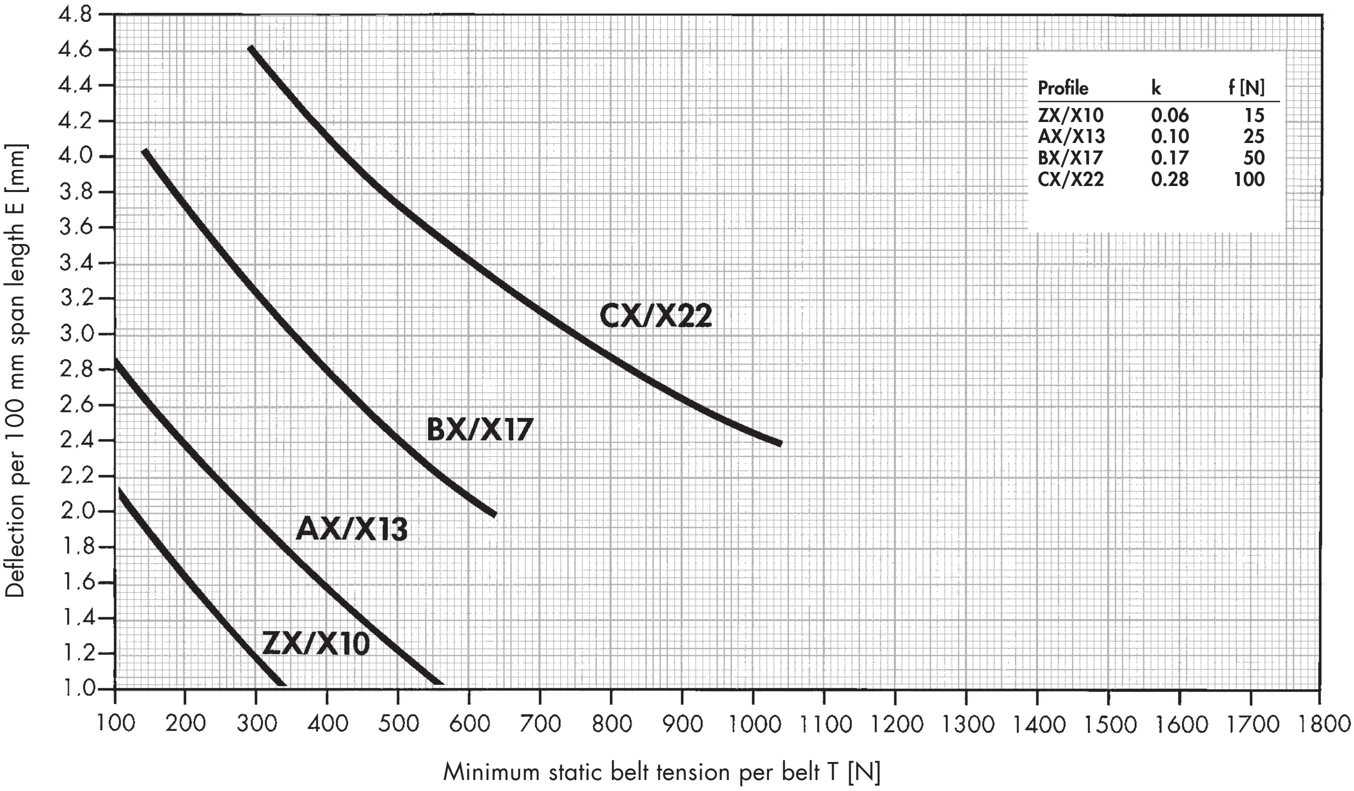


Diagram 11: Belt tension characteristics for optibelt SUPER TX M=S V-belts – raw edge, cogged



III. Belt tensioning via "length addition value" method

It has become evident that span deflection methods are not ideal for checking the tension of kraftbands of all profiles, and of individual belts. The following, very simple method for the setting and checking of belt tension is therefore recommended:

Example:
P_B = 1136 kW
c_1 = 0.97
v = 25.91 m/s

Drive arrangement with one set comprising:
2 optibelt KB kraftbands 4-8V 3750/25J 9525 L_a
2 optibelt KB kraftbands 5-8V 3750/25J 9525 L_a

1. Calculation of the static belt tension "T":

$$T \approx \frac{500 \cdot (2.04 - c_1) \cdot P_B}{c_1 \cdot z \cdot v} + k \cdot v^2$$

$$T \approx \frac{500 \cdot (2.04 - 0.97) \cdot 1136}{0.97 \cdot 18 \cdot 25.91} + 0.69 \cdot 25.91^2 = \mathbf{1807\ N}$$

2. Measure the setting length "M" of the kraftband or the single belt, on the top surface of the kraftband or on the belt top surface when not tensioned. However the belt can be measured when fitted to the drive, provided that it is completely **without** tension.

3. Procedure
   a) Install the kraftband or the single belt on the pulleys. Provisionally tighten the belt in order to seat it into the pulley grooves.
   b) Next, completely slacken the kraftband or the single belt.
   c) Mark two lines on the top of the belt, with distance "M". The lines must be marked on the free span length, not where the belt is on the pulley ("M" should ideally be 1000 mm minimum or a multiple of it).

   Important: The longer the measured profile, the more accurate the tension setting will be.

4. Calculate the length additional value "A" using the formula:

$$A = \frac{M \cdot R}{1000}$$

R = stretch factor from table 84 page 149

"M" selected 4000 mm

$$A = \frac{4000 \cdot 5.5}{1000} = 22.0\ \text{mm}$$

5. Tighten the kraftband or the single belt until the length calculated under point 4 is reached. The drive is now correctly tensioned.

Tighten the kraftband until the length additional value is reached. This will set the correct tension.

6. If the drive has to be re-tensioned, the belts have to be slackened first so that they can be re-measured completely free of tension. After that, the procedure described in paragraphs 3 to 5 applies.

At initial installation, the static belt tension must be multiplied by 1.3.

DESIGN SUPPORT

BELT TENSION FOR OPTIBELT V-BELTS AND optibelt KB KRAFTBANDS

Table 84: Length addition per 1000 mm belt length

Profile – Kraftband	3V/9J	5V/15J	8V/25J	SPZ	SPA	SPB	SPC	A/HA	B/HB	C/HC	D/HD
Profile – Single belt	3V/9N	5V/15N	8V/25N	SPZ	SPA	SPB	SPC	A/13	B/17	C/22	D/32
Minimum static belt tension per rib/single belt T [N]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	0.8			0.8	0.8			0.8			
75	1.2			1.2	1.0			1.0			
100	1.6			1.6	1.3			1.3			
125	2.1			2.1	1.6			1.6			
150	2.6			2.6	1.9			1.9	0.8		
175	3.0			3.0	2.2			2.2	0.9		
200	3.5			3.5	2.5			2.5	1.1		
225	4.0			4.0	2.8			2.8	1.2		
250	4.5			4.5	3.0			3.0	1.4		
275	4.9			4.9	3.3			3.3	1.5		
300	5.3	1.3		5.3	3.6	1.3		3.6	1.6	1.6	
350	6.4	1.7		6.4	4.2	1.7		4.2	1.8	1.8	
400	7.6	2.0		7.6	4.7	2.0		4.7	2.0	2.1	
450	8.7	2.4		8.7	5.3	2.4		5.3	2.2	2.3	
500	10.0	2.7		10.0	5.8	2.7		5.8	2.5	2.5	
550		3.1				3.1			2.7	2.7	
600		3.4				3.4	2.0		3.0	2.9	2.0
650		3.8				3.8	2.2		3.2	3.1	2.2
700		4.1				4.1	2.4		3.5	3.4	2.4
800		4.8				4.8	2.8		4.2	3.8	2.7
900		5.5				5.5	3.3		4.8	4.2	2.9
1000		6.2				6.2	3.7		5.3	4.7	3.3
1100		6.9				6.9	4.1			5.1	3.6
1200		7.6	2.9			7.6	4.5			5.5	3.9
1300		8.3	3.3			8.3	5.0				4.2
1400		9.0	3.7			9.0	5.4				4.5
1500		9.7	4.1			9.7	5.8				4.8
1600		10.4	4.6			10.4	6.3				5.1
1700		11.1	5.0			11.1	6.8				5.5
1800		11.8	5.5			11.8	7.3				5.8
1900			6.0				7.8				
2000			6.5				8.3				
2100			7.0				8.8				
2200			7.5				9.3				
2300			8.0				9.8				
2400			8.6								
2500			9.6								
2600			10.6								
2700			11.7								
2800			12.8								
2900			13.5								
3000			14.2								
3100			14.9								
3200			15.6								
3300			16.3								
Factor k for kraftbands	0.12	0.25	0.69	0.12	0.16	0.25	0.55	0.16	0.27	0.45	0.85
Factor k for single belts	0.07	0.19	0.57	0.07	0.12	0.19	0.37	0.11	0.20	0.33	0.67

Intermediate values may be determined by linear interpolation.
The values only apply to drives with V-grooved pulleys.
Values for V-flat drives on request.

DESIGN SUPPORT
CALCULATING THE AXIAL LOAD/SHAFT LOAD UNDER DYNAMIC CONDITIONS

Using drives that have electric motors as drive machines and are/or will be designed according to DIN 2211 Part 3, ensures that the dynamic stress that occurs can be absorbed by the appropriate shafts and bearings of the motor.

However drives with
- electric motors out with the DIN standards for the determined dependencies of pulley diameter and power,
- combustion engines,
- turbines as well as
- heavy duty drives such as stone crushers, calenders or heavily loaded mills

have been found to require determination of the dynamic bearing load, i.e. the loads that occur for shafts and bearings on the input or output drive units.
Precise calculation of the "Dynamic axial load" prevents unnecessary costs due to

- premature failure of the bearing,
- breaking of the shaft,
- over dimensioned bearings and shafts.

In the case of 2-pulley drives, the driver and driven shafts and the bearings are subjected to the same dynamic axial force, but in opposite directions. When idlers are employed, the magnitude and the direction of the axial force are almost always different on each pulley. If the magnitude and direction of the dynamic axial force is to be determined, a graphical solution, using a vector diagram for the dynamic forces in the tight side S_1 and the slack side S_2, is recommended.
If only the magnitude of the dynamic axial force has to be determined, this can be achieved using the formula for "$S_{a\,dyn}$". Both procedures will be illustrated in the following example.
Data from the calculation examples given on pages 85 to 87
P_B = 171.6 kW c_1 = 1.00
v = 21.76 m/s β = 170°

Dynamic tension on the tight side during belt operation

$$S_1 \approx \frac{1020 \cdot P_B}{c_1 \cdot v}$$

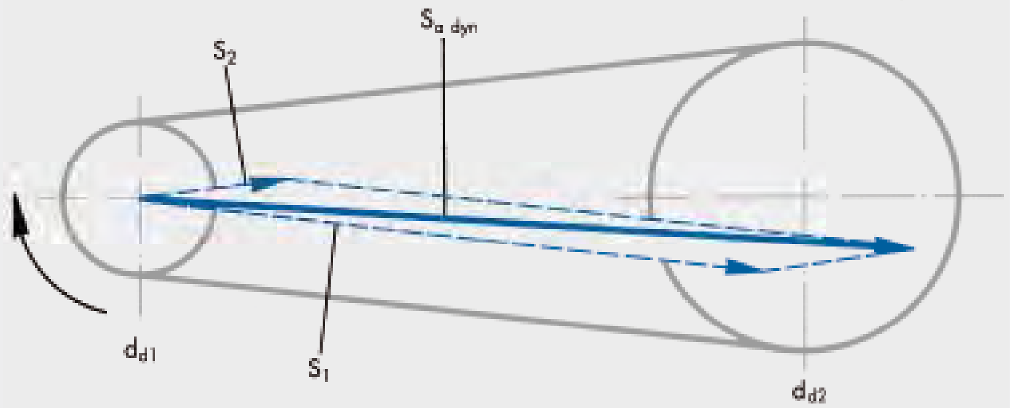
$$S_1 \approx \frac{1020 \cdot 171.6}{1.0 \cdot 21.76} \approx \mathbf{8044\ N}$$

Dynamic tension on the slack side during belt operation

$$S_2 \approx \frac{1000 \cdot (1.02 - c_1) \cdot P_B}{c_1 \cdot v}$$

$$S_2 \approx \frac{1000 \cdot (1.02 - 1.0) \cdot 171.6}{1.0 \cdot 21.76} \approx \mathbf{158\ N}$$

A) Graphical solution



B) Solution using the formula $S_{a\,dyn}$

Axial load under dynamic conditions

$$S_{a\,dyn} \approx \sqrt{S_1^2 + S_2^2 - 2\,S_1 \cdot S_2 \cdot \cos\beta}$$

$$S_{a\,dyn} \approx \sqrt{8044^2 + 158^2 - 2 \cdot 8044 \cdot 158 \cdot 0.9848} \approx \mathbf{8200\,N}$$

DESIGN SUPPORT
TECHNICAL TOOLS
FREQUENCY METER / TENSION TESTER optibelt TT

The optibelt TT frequency tension tester is an appliance that is used to check the tension of drive belts by means of measuring frequency. Thanks to a compact design, this product offers universal application possibilities in machine construction, in the automotive industry and many other technical applications.
The optibelt TT can even be effortlessly used in difficult-to-reach places so that the tension values of V-belts, ribbed belts and timing belts can be easily and quickly checked.
After start up, the device is immediately ready for obtaining data. The measuring head is held over the belt to be tested (two red LED light points help to position it). The belt is made to vibrate by striking it with a finger or an object.
The optibelt TT begins recording data and displays the result in Hertz [Hz].
The condition, colour and type of the belt have no effect upon the measurement.
The sample calculation below uses the data from the CAP calculation on page 88.

Calculation of frequency

$$f = \sqrt{\frac{T \cdot 10^6}{4 \cdot k \cdot L^2}}$$

$$f = \sqrt{\frac{1484\ \text{N} \cdot 10^6}{4 \cdot 0.377 \frac{\text{kg}}{\text{m}} \cdot 2189.3^2\ \text{mm}^2}} = 14.33\ \text{Hz} \approx 14.3\ \text{Hz}$$

Calculation of static belt tension

$$T = 4 \cdot 10^{-6} \cdot k \cdot L^2 \cdot f^2$$

$$T = 4 \cdot 10^{-6} \cdot 0.377 \frac{\text{kg}}{\text{m}} \cdot 2189.3^2\ \text{mm}^2 \cdot 14.33^2\ \text{Hz}^2 = 1484.24\ \text{N} \approx 1484\ \text{N}$$

T ≙ belt tension [N]
k ≙ meter weight [kg/m]
L ≙ belt length [mm]
f ≙ frequency [Hz]

Advantages of optibelt TT

- Two trouble-free measuring methods:
  EM: electro magnetic wave
  AC: acceleration, integrated
- Usable also for long centre distances by all-time wide frequency range:
  AC: 1 - 10 Hz
  EM: 6 - 600 Hz
- Easy handling of the measuring head: two red LED points on the belt help to find the correct position
- For hard accessible belt span: measuring head on flexible goose-neck (EM) or with 250 mm cable (AC)
- Safe meter-reading by big display: width 43 mm and height 58 mm, illuminated and colored
- Long running time and environment-friendly by high capacity, rechargeable battery (USB) and changeability
- Chargeable via USB
- No interference in loud and bright environments
- Automatic switch-off function

The optibelt TT:
A guarantee for longer durability of your V-belts, ribbed belts, and timing belts!

DESIGN SUPPORT
TECHNICAL TOOLS
FREQUENCY METER / TENSION TESTER optibelt TT LINE

Advantages of optibelt TT DATA

- Comfortable input and selection of belt drive data on touch screen; show own company logo on start display
- Use own belt drive data and general belt set values from optibelt TT database and span length calculation
- Simultaneous display: set, measuring values; simple descision to okay / not okay: select and register tolerances
- Save measurement results and new belt drive data in optibelt TT DATA: Micro SD slot including Micro SD card
- PC synchronisation for database administration with optibelt TT DATA software: USB cable, Micro SD card; optibelt TT DATA update
- Use data from CAP 7.0 in optibelt TT DATA: Send belt drive identification and set values to TT DATA software

Advantages of optibelt TT RFID

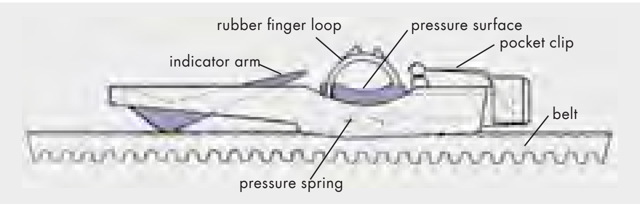
- Integrated optibelt TT RFID Reader loads belt drive data directly from the machine: RFID LABEL with data set
- RFID database administration on optibelt TT RFID or, more comfortable on PC: optibelt TT DATA/RFID software
- RFID LABEL data in- and output with optibelt TT RFID or with PC: optional USB RFID Reader Dongle
- RFID LABEL with free print area for address data of machine and user; adhesive backside, on paper rolls
- Print and data input of RFID LABEL with RFID printer: Data e-mailing, RFID LABEL by post
- Easy mounting of RFID LABEL on the machine: 6 mm thick, adhesive and screwable RFID PLATE

Follow soon!

DESIGN SUPPORT
TECHNICAL TOOLS
optibelt OPTIKRIK TENSION GAUGES

This gauge offers a simple method of belt tensioning.

It helps e. g. mechanics during the maintenance of belt drives when technical data is not known and the optimum tension therefore cannot be calculated. This method requires only knowledge of the diameter of the small pulley and the belt profile. The Optibelt tension gauge is used to directly read the belt tension. By reducing or increasing the belt tension the desired value is achieved.
For different tensioning values, optibelt OPTIKRIK 0, I, II, III with corresponding measurement ranges are available.



Instructions for use

1. The gauge is placed in the middle between the two pulleys on the back of the belt, in the case of sets of belts ideally on the belt in the middle. (Before doing so, please press the indicator completely into the gauge body.)
2. Place the gauge loosely on the belt to be measured and slowly press a finger onto the pressure surface.
3. Try not to touch the gauge with more than one finger during the measuring process.
4. When you feel or hear a definite "click", immediately release the pressure, the indicator arm stays in the measured position.
5. Carefully lift the gauge without moving the indicator arm. Read the belt tension (see fig.). Read the measurement at the exact point where the top of the indicator arm crosses the scale.
6. Reduce or increase the belt tension according to the measurement result until it is within the desired tension level.

DESIGN SUPPORT

BELT TENSION FOR WRAPPED OPTIBELT V-BELTS

Profile	Diameter of the small pulley [mm]	Static belt tension [N]						
		optibelt RED POWER 3		Standard (wrapped)		optibelt BLUE POWER		
		Initial installation new V-belts	Initial installation existing V-belts	Initial installation	Operation after running in	Diameter of the small pulley	Initial installation new V-belts	Operation after running in
SPZ; 3V/9N	≤ 71 > 71 ≤ 90 > 90 ≤ 125 > 125*	250 300 400	200 250 300	200 250 350	150 200 250	–	–	–
SPA	≤ 100 > 100 ≤ 140 > 140 ≤ 200 > 200*	400 500 600	300 400 450	350 400 500	250 300 400	–	–	–
SPB; 5V/15N	≤ 160 > 160 ≤ 224 > 224 ≤ 355 > 355*	700 850 1000	550 650 800	650 700 900	500 550 700	≤ 180 > 180 ≤ 236 > 236 ≤ 400 > 400*	780 1100 1500	600 850 1100
SPC	≤ 355 > 355 ≤ 560 > 560*	1400 1600 1900	1100 1200 1500	1000 1400 1800	800 1100 1400	≤ 280 > 280 ≤ 375 > 375 ≤ 700 > 700*	1600 2500 3100	1200 1900 2400
Z/10	> 50 ≤ 71 > 71 ≤ 100 > 100*	–	–	120 140	90 110	–	–	–
A/13	≤ 80 > 80 ≤ 100 > 100 ≤ 132 > 132*	–	–	150 200 300	110 150 250	–	–	–
B/17	≤ 125 >125 ≤ 160 >160 ≤ 200 >200*	–	–	300 400 500	250 300 400	–	–	–
C/22	≤ 200 > 200 ≤ 250 > 250 ≤ 355 > 355*	–	–	700 800 900	500 600 700	–	–	–
D/32	≤ 355 > 355*	–	–	1000 1200	750 900	–	–	–
8V	Check of belt tension via length addition value							

* Tension values for these pulleys must be calculated.

Tension gauges:

optibelt OPTIKRIK 0 Measuring range: 70 - 150 N
optibelt OPTIKRIK I Measuring range: 150 - 600 N
optibelt OPTIKRIK II Measuring range: 500 - 1400 N
optibelt OPTIKRIK III Measuring range: 1300 - 3100 N

The tension values (static belt tension) are reference values, if no exact drive data is available. These values are given for maximum power transmission (per belt).

Calculation basis

Wedge belts speed v = 5 to 42 m/s
Classic V-belts speed v = 5 to 30 m/s

DESIGN SUPPORT

BELT TENSION FOR RAW EDGE OPTIBELT V-BELTS

Profile	Diameter of the small pulley [mm]	Static belt tension [N] optibelt SUPER X-POWER M=S optibelt SUPER E-POWER M=S optibelt SUPER TX M=S	
		Initial installation	Operation after running in
XPZ; 3VX/9NX	≤ 71 > 71 ≤ 90 > 90 ≤ 125 > 125*	250 300 400	200 250 300
XPA	≤ 100 > 100 ≤ 140 > 140 ≤ 200 > 200*	400 500 600	300 400 450
XPB; 5VX/15NX	≤ 160 > 160 ≤ 224 > 224 ≤ 355 > 355*	700 850 1000	550 650 800
XPC	≤ 250 > 250 ≤ 355 > 355 ≤ 560 > 560*	1400 1600 1900	1100 1200 1500
ZX/X10	≤ 50 > 50 ≤ 71 > 71 ≤ 100 > 100*	120 140 160	90 110 130
AX/X13	≤ 80 > 80 ≤ 100 > 100 ≤ 132 > 132*	200 250 400	150 200 300
BX/X17	≤ 125 >125 ≤ 160 >160 ≤ 200 >200*	450 500 600	350 400 450
CX/X22	≤ 200 > 200 ≤ 250 > 250 ≤ 355 > 355*	800 900 1000	600 700 800
DX/X32	≤ 355 > 355*	1000 1200	750 900

* Tension values for these pulleys must be calculated.

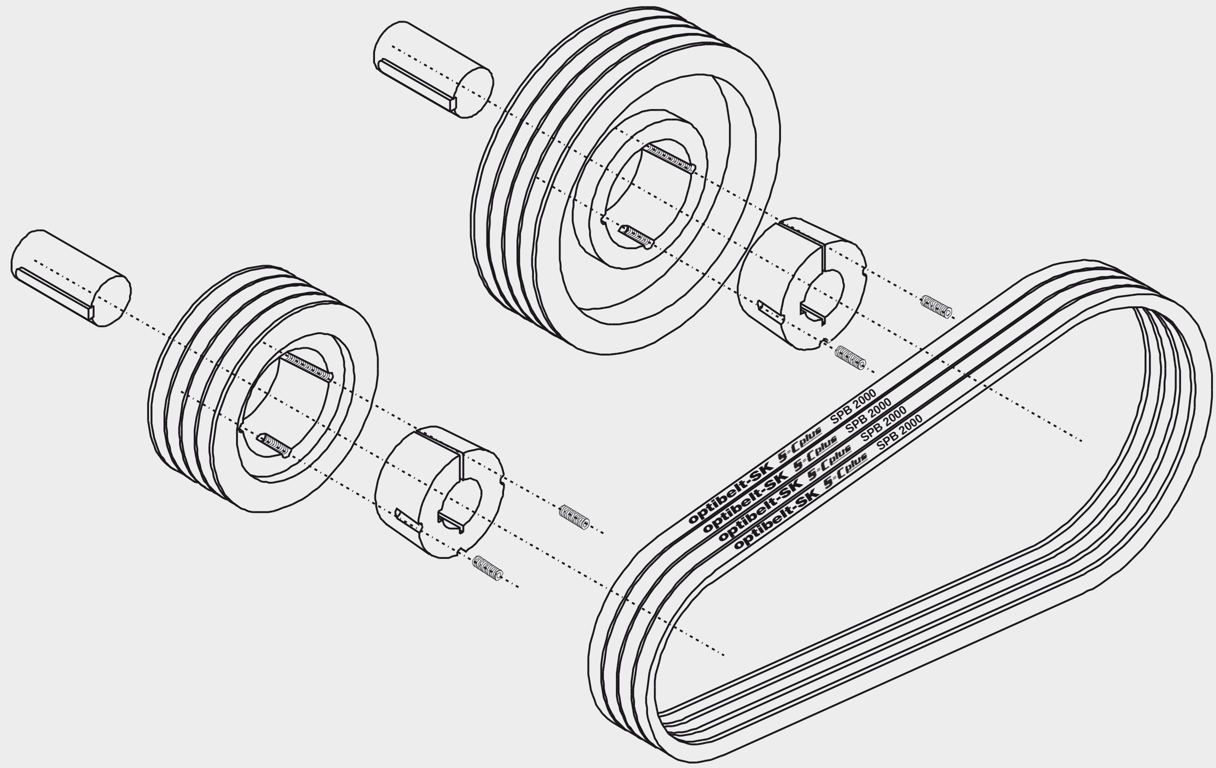
Tension gauges:

optibelt OPTIKRIK 0	Measuring range: 70 - 150 N
optibelt OPTIKRIK I	Measuring range: 150 - 600 N
optibelt OPTIKRIK II	Measuring range: 500 - 1400 N
optibelt OPTIKRIK III	Measuring range: 1300 - 3100 N

The tension values (static belt tension) are reference values, if no exact drive data is available. These values are given for maximum power transmission (per belt).

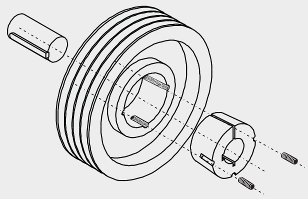
Calculation basis

Wedge belts	speed v = 5 to 42 m/s
Classic V-belts	speed v = 5 to 30 m/s



optibelt-SK S=C plus SPB 2000
optibelt-SK S=C plus SPB 2000
optibelt-SK S=C plus SPB 2000
optibelt-SK S=C plus SPB 2000

Safety: Before starting any maintenance work, it is extremely important that any machine components are in a safe position which cannot be changed during maintenance work. In addition, safety recommendations of the manufacturer are to be strictly observed.

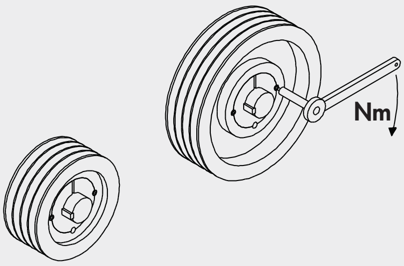


optibelt KS V-GROOVED PULLEY WITH TAPER BUSH

The V-grooved pulleys are to be checked for damage and correct dimensions before installation.

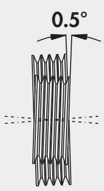
Installation

1. All shiny surfaces like bore and tapered surface of the taper bush as well as the tapered bore of the pulley have to be cleaned and degreased. Insert taper bush in hub and align all connecting bores. Half tapped holes have to face half plain bores.
2. Stud screws (TB 1008-3030) and/or cap head screws (TB 3525-5050) should be slightly greased and screwed in. Do not yet tighten the screws.
3. Clean and degrease the shaft. Push pulley with taper bush to the desired position on the shaft. See alignment of the V-grooved pulley.
4. When using a key, it has to be inserted in the hub of the shaft first. Between key and bore hub there needs to be a certain tolerance.
5. With a socket wrench according to DIN 911 stud screws and/or cap head screws have to be tightened equally using the tightening torque stated in the table.
6. After a short operating time (0.5 to 1 hour) check tightening torque of the screws and correct if necessary.
7. In order to prevent the entering of foreign substances, fill empty connection bores with grease.



TAPER BUSHES, SCREW TIGHTENING TORQUE

Dimension	Wrench size	Number of screws	Tightening torque [Nm]
TB 1008, 1108	3	2	5.7
TB 1210, 1215, 1310, 1610, 1615	5	2	20.0
TB 2012	6	2	31.0
TB 2517	6	2	49.0
TB 3020, 3030	8	2	92.0
TB 3525, 3535	10	3	115.0
TB 4040	12	3	172.0
TB 4545	14	3	195.0
TB 5050	14	3	275.0

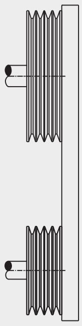


HORIZONTAL ALIGNMENT OF SHAFTS

Motor and drive shafts are to be aligned using a spirit level, if necessary.

Note!

Maximum shaft deviation 0.5°



VERTICAL ALIGNMENT OF THE V-GROOVED PULLEYS

The alignment of the V-grooved pulleys is checked before and after tightening the taper bushes with an alignment rail.

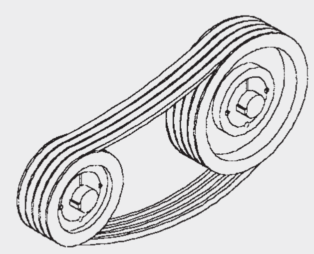
Note!

Check whether the face widths of the V-grooved pulleys have the same sizes. A possible deviation of the face width has to be taken into account. With a symmetrical face set-up, the distance of the parallel, to the smaller face is half the deviation.

INITIAL INSTALLATION

Always install the V-belts without force. Installations using screw drivers, crowbars etc. cause external and internal damage to the belt. V-belts installed under force might only run for several days. A proper installation of the belt saves time and money.

If the installation space is too small, the V-grooved pulleys with belts should be slid onto the shafts.

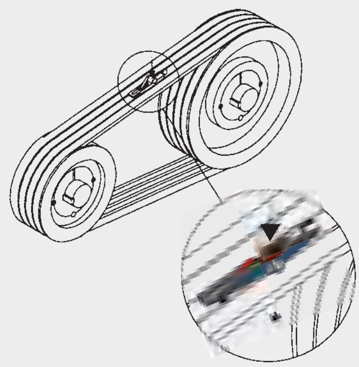


BELT TENSION

Use belt tensioning values according to Optibelt recommendations. Set the belt tension with parallel motor and machine shafts. Operate the belt for some rotations and check the belt tension again. In our experience, belt tension should be checked again after an operating time of about 0.5 to 4 hours and then be corrected, if necessary.

For further information about belt tensioning see page 151/152.

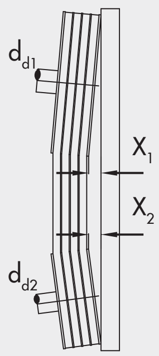
*** optibelt OPTIKRIK**



ALLOWED SHAFT DEVIATION

After applying the initial installation tension, the distances X_1, X_2 between the two pulleys d_{d1}, d_{d2} and the alignment rail on axis level should be measured, alternatively with the optibelt LASER POINTER. The maximum allowed values for the distance X from the table should not be exceeded, depending on the diameter d_d. Depending on the pulley diameter, the intermediate values for X should be interpolated.

Pulley diameter d_{d1}, d_{d2}	Maximum allowed deviation X_1, X_2
112 mm	0.5 mm
224 mm	1.0 mm
450 mm	2.0 mm
630 mm	3.0 mm
900 mm	4.0 mm
1100 mm	5.0 mm
1400 mm	6.0 mm
1600 mm	7.0 mm



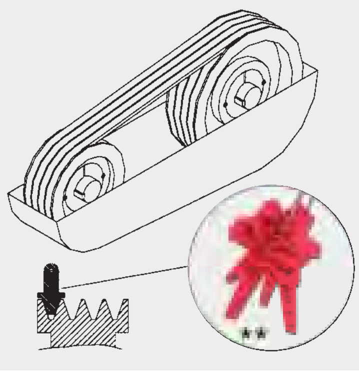
DRIVE CHECKING

We recommend checking the drive regularly, e.g. after each 3 to 6 months. V-grooved pulleys are to be checked for wear and consistency. Use the Optibelt profile and V-groove gauge tools.

When changing V-grooved pulleys with taper bushes (see fig. on page 160) the following aspects have to be observed:

1. Loosen all screws. Unscrew out one or two screws depending on the bush size, grease them and screw them into the set bores.
2. Tighten the screw or screws equally until the bush releases from the hub and the pulley can be moved freely on the shaft.
3. Remove the pulley with the bush from the shaft.

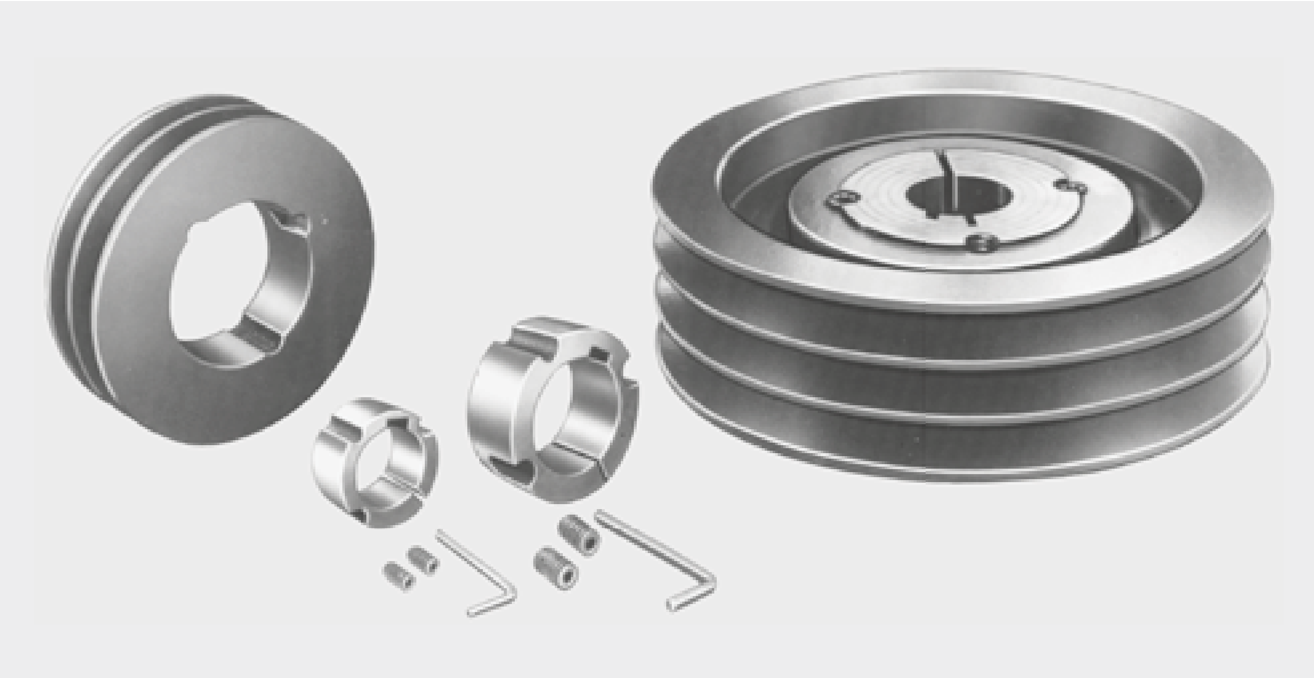
**** Profile and V-groove gauge**

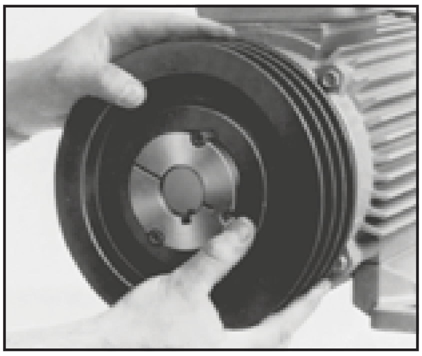


DESIGN SUPPORT

INSTALLATION AND MAINTENANCE SUPPORT

V-GROOVED PULLEYS WITH TAPER BUSHES

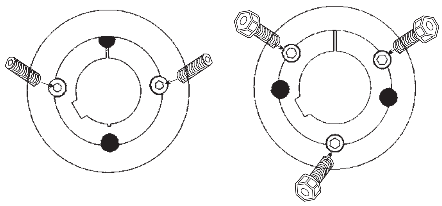


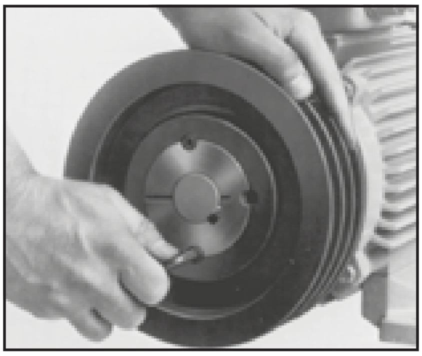


Installation

Dimension TB 1008-3030

Dimension TB 3525-5050

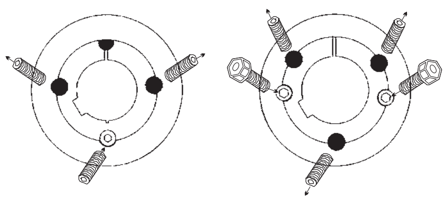


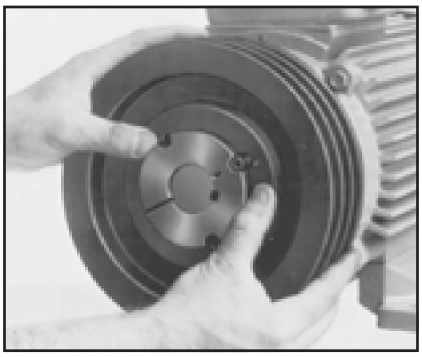


Removal

Dimension TB 1008-3030

Dimension TB 3525-5050





- **General note**
  Properly stored V-belts retain their properties for many years (see also DIN 7716). However, when stored under adverse conditions or handled incorrectly, the physical properties of most rubber products will be impaired. This can be the consequence for example of the effects of oxygen, ozone, extreme temperatures, light, moisture or solvents.

- **Storage area**
  The storage area should be dry and dust-free. V-belts must not be stored close to chemicals, solvents, fuels, lubricants and acids etc.

- **Temperature**
  V-belts should be stored at temperatures between +15 °C and +25 °C. Lower temperatures usually have no negative effect on the V-belts. However, since belts become very stiff at low temperatures, they should be warmed to approximately +20 °C before installation to avoid breaking and cracking.
  Radiators and supply pipes should be screened. V-belts should be stored at least 1 m away from heat sources.

- **Light**
  V-belts should be protected against light, especially direct sunlight and strong artificial light with high ultra-violet radiation (ozone formation) such as naked fluorescent tubes. Illumination using appropriate lamps is recommended.

- **Ozone**
  In order to counteract the harmful effects of ozone, storages should not contain any appliances that generate ozone, e.g. fluorescent lights, mercury vapour lamps or high voltage electrical equipment. Combustion gases and vapours which could lead to the formation of ozone by photo-chemical processes must be avoided or eliminated.

- **Moisture**
  Damp storage areas are unsuitable. Care must be taken to ensure that condensation does not develop. The most favourable relative air humidity is below 65%.

- **Proper storage**
  Because stress can promote both permanent deformation and cracking, care must be taken to ensure that V-belts are stored without stress i.e. without tension, compression or any other form of pressure.
  If V-belts have to be stored horizontally and stacked on top of each other, it is recommended that the stack height does not exceed 300 mm in order to avoid permanent deformation. If, in order to save space, V-belts are hung, the diameter of the cylinder on which the belts rest should be at least ten times the height of the belt profile.

optibelt S=C Plus, optibelt SUPER E-POWER M=S, optibelt SUPER X-POWER M=S and optibelt SUPER TX M=S belts do not need to be stored in sets as they can be used in sets without measuring.

- **Cleaning**
  Dirty V-belts can be cleaned using a 1:10 mixture of glycerine and methyl spirits or with brake cleaner. Petrol, benzene, turpentine and the like should not be used. In addition, sharp objects, wire brushes, emery paper etc. must be avoided under all circumstances, as these can cause damage to the belt.

DESIGN SUPPORT
PROPERTIES

This table is intended to simplify the selection of the suitable Optibelt drive element according to the specific drive conditions. Detailed information is given in the according chapters of this manual.	Temperature resistance from … to … [°C]		Oil resistance		Electrically conductive	S=C Plus SetConstant[1)] M=S Matched Sets[2)]	Mining industry approval	Smooth running	Permanent stretch	
	Standard design	Special design XHR	Standard design	Special design					Standard design	Special design
optibelt SK / optibelt SK KB high performance wedge belts/kraftbands	–40 +70	–30 +90	good	excellent	yes	yes[1)]	yes	medium/ good	low	very low
optibelt RED POWER 3 / optibelt KB RED POWER 3 high performance wedge belts/kraftbands	–30 +100		good		yes	yes[1)]		good	very low	
optibelt BLUE POWER / optibelt KB BLUE POWER high performance wedge belts/kraftbands	– 30 +100		good		yes			excel- lent	very low	
optibelt SUPER X-POWER M=S / optibelt KBX / optibelt SUPER TX M=S raw edge, cogged V-belts	–30 +90		good		yes	yes[2)]		good	very low	
optibelt SUPER E-POWER M=S	– 40 +120		limited		yes			good	very low	
optibelt MARATHON 1, optibelt MARATHON 2 M=S automotive V-belts	–30 +90		good		yes	yes[2)]		good	very low	
optibelt VB classic V-belts	–40 +70	–30 +90	limited	excellent	yes	yes[1)]	yes	medium/ good	low	very low
optibelt DK double-sided V-belts	–35 +85		good		yes			medium	low	
optibelt VARIO POWER variable speed belts	–30 +90		good		yes			excel- lent	very low	
optibelt RB ribbed belts	–30 +90	– 30 +120	good		• PJ PK, PL special construc- tions			excel- lent	low	

• after testing/examination

DESIGN SUPPORT
PROPERTIES

Recommended max. belt speed m/s	Efficiency	Behaviour under shock loading	Vibration tendency	Synchronous	Recommended max. speed ratio	Suitable for outside idlers		Maintenance	**Main application areas** For some application areas and applications different belt types are suitable. The suitable belt is then determined individually for each case.
						Standard construction	Special construction		
≤ 42	up to 97%	good	low	no	up to 1 : 10	no	yes	low	Compressors, mixers, rotary print machines, extruders, screw compressors, weaving machines, axial fans, rotary pumps
≤ 55*	up to 97%	good	low	no	up to 1 : 10	yes		maintenance-free	Fans, pumps, mixers, mills, special machines, lathes and drilling machines, grinding machines
≤ 50*	up to 97%	limited	low	no	up to 1 : 10	yes			Medium to large, heavy to very heavy drives in the machine building industry
depends on profile ≤ 55*	up to 97%	good	low	no	up to 1 : 12	no	yes	optibelt SUPER X-POWER: low maintenance	Fans, pumps, mixers, mills, special machines, lathes and drilling machines, grinding machines
≤ 55*	up to 97%	good	low	no	up to 1 : 12	no	yes	low maintenance	Fans, pumps, mixers, mills, special machines, lathes and drilling machines, grinding machines
≤ 42	up to 97%	good	low	no	up to 1 : 12	no	yes	low maintenance	Motor vehicles, generators, water pumps, fans
≤ 30	up to 97%	good	low	no	up to 1 : 12	no	yes	low	Pumps, presses, crushers, disk saws, box column drilling machines, plane machines, concrete mixers, compactors, lawn mowers, aerators, baling presses, shredders
≤ 30	up to 95%	good	low	no	up to 1 : 5	yes		low	Special drives with changing rotary directions, weaving looms, sweepers, harvesters
depends on profile ≤ 42	up to 95%	good	low	no	up to 1 : 12 for 2 variable speed pulleys	no	yes	low	Special drives, compact units, snow mobile drives, multi-colour offset printing machines, variable speed pulley sets, threshing drum drives, winding machines, lathes
depends on profile ≤ 60	up to 96%	good	very low	no	up to 1 : 35	yes		low	Offset machines, washing machines, milling machines, electric floor polishers, auxiliaries, main spindle drives

* v > 42 m/s. Please contact our Application Engineering Department.

This table is intended to simplify the selection of the suitable Optibelt drive element according to the specific drive conditions. Detailed information is given in the according chapters of this manual.	Temperature resistance from … to … [°C]		Oil resistance	Electrically conductive	Smooth running	Permanent stretch
	Standard design	Special design XHR and XCR	Standard design			
optibelt OMEGA, optibelt OMEGA HP + optibelt OMEGA HL timing belts	– 30 +100	– 40 +140	limited	yes•	medium/good	none
optibelt ZR timing belts	– 30 +100	– 30 +140	limited	yes	medium	none
optibelt ALPHA polyurethane timing belts	–30 +80		good	no	medium	none
optibelt RR round belts	–10 +80		good	no	medium	high
optibelt KK V-belting	–10 +80		good	no	medium	high
optibelt OPTIMAT OE open-ended V-belts, DIN 2216, punched	–20 +70		limited	no	medium	high
optibelt PKR endless timing belts with patterned top surface	–30 +70		limited	yes	medium	low
optibelt OPTIMAX HF endless high performance flat belts	– 20 +110		limited	no	excellent	low

• partly after testing/examination

DESIGN SUPPORT
PROPERTIES

Recommended max. belt speed m/s	Efficiency	Behaviour with shock loads	Vibration behaviour	Synchronous running	Recommended max. conversion	Suitable for outside idlers		Maintenance	**Main application areas** For some application areas and applications different belt types are suitable. The suitable belt is then determined individually for each case.
						Standard design	Special design		
depends on profile ≤ 80	up to 98 %	sensitive	depends on speed	yes	up to 1 : 10	yes	yes	maintenance-free	Textile machines, spinning machines, weaving machines, printing machines, paper machines, woodworking machines, machine tools, linear units, roller conveyors, ski systems, packaging machines, gate and door openers, lifting devices, mixers, extruders, compressors
depends on profile ≤ 80	up to 98 %	sensitive	depends on speed	yes	up to 1 : 10	yes	yes	maintenance-free	Copying machines, household appliances, swivel arm robots, gripper drives, belt grinders, camshaft drives, brush drives, clocks, X-Ray devices, enveloping machines, cameras, plotters, slot machines, main machines and feeders, feed drives, material feed, printers
depends on profile ≤ 80	up to 98 %	sensitive	depends on speed	yes	up to 1 : 10	yes	yes	maintenance-free	Cameras, plotters, printers, slot machines, main machines and feeders, feed drives, material feed, test conveyance, flight models
≤ 20	up to 95 %	good	low	no	up to 1 : 10	yes	yes	frequent retensioning	Special machinery
≤ 20	up to 95 %	good	low	no	up to 1 : 10	yes	yes	frequent retensioning	Packaging machines, conveyor units, enamelling lines, accumulating conveyor
≤ 20	up to 90 %	good	medium	no	up to 1 : 10	limited		frequent retensioning	Where installation conditions are difficult
depends on profile ≤ 20	up to 95 %	good	low	no	up to 1 : 10	limited	yes	low	Conveyor units in the wood industry, in concrete factories, in the agricultural industry, ceramic industry, glass industry, at airports, in seaports and inland ports
≤ 70	up to 95 %	good	very low	no	up to 1 : 12	yes		low	Water turbines, emergency power generators, saw gates, hackers, screw compressors, roller drives, transmission drives, conical drives, cross cutters, floor cleaners, multi-drives, crushers, close belts, hammer mills

Problem	Causes	Remedies
Belt failure shortly after installation (belt snaps)	Forced installation, causing damage to the tension cord	Follow installation instructions for easy installation
	Entry of foreign objects during operation	Fit protective guard
	Drive undersized, not enough belts	Check drive design and determine new dimensions
	Drive jammed	Remove cause
Breaks and cracks in the base of the belt (brittleness)	Outside idler pulley in use that does not comply with the positioning and sizes recommended by us	Observe Optibelt recommendations, e.g. increase the diameter; replace with an inside idler on the slack side of the drive; use optibelt RED POWER 3 or an Optibelt special design
	Pulley diameter too small	Re-design using recommended minimum pulley diameters; use an Optibelt special design, or optibelt SUPER X-POWER M=S, optibelt SUPER TX M=S
	Excessive heat	Remove or screen heat source; improve ventilation; use optibelt SUPER X-POWER M=S, optibelt SUPER TX M=S or V-belt with aramid cord construction
	Excessive cold	Warm the belt before operation; use Optibelt special design (extra cold resistant)
	Excessive belt slip	Re-tension drive according to installation instructions; check drive design and re-design if necessary
	Contamination by chemicals	Protect drive from contamination source; use Optibelt special design
Severe belt vibration	Drive underdimensioned	Check drive design and modify if necessary
	Centre distance significantly longer than recommended	Shorten centre distance; use an inside idler in the drive slack side; re-design using optibelt KB kraftbands
	High shock load	Use optibelt KB kraftbands; use an inside idler in the drive slack side; use an Optibelt special construction
	Belt tension too low	Correct tension
	Unbalanced V-pulleys	Balance pulleys
Belts cannot be re-tensioned	Insufficient allowance for centre distance in drive design	Modify drive to allow for the Optibelt recommended adjustment
	Excessive stretch caused by inadequate performance	Carry out drive calculation and re-design
	Incorrect belt length	Use shorter belts

Should other problems occur, please contact our Application Engineering Department. They will require comprehensive technical details in order to provide you with solutions.

Problem	Causes	Remedies
Belts turning over	Poor drive alignment	Realign pulleys
	Incorrect belt/pulley groove profile	Match belt and pulley groove profile
	Excessive wear in pulley grooves	Renew pulleys
	Excessive vibration	Use an inside idler on drive slack side; use optibelt KB kraftbands
	Belt tension too low	Re-tension drive
	Foreign matter in the pulley grooves	Remove foreign matter and screen drive
Excessive wear on belt edges	Starting torque too high	Check drive design and re-design
	Incorrect pulley groove angle	Re-machine or replace pulleys
	Excessive pulley groove wear	Replace pulleys
	Incorrect belt/pulley groove profile	Match belt and pulley groove profile
	Poor pulley alignment	Realign pulleys
	Pulley diameter below recommended minimum	Increase pulley diameter (re-design drive); use Optibelt special constructions, optibelt SUPER X-POWER M=S or optibelt SUPER TX M=S
	Belt tension too low	Check tension and re-tension
	Belt rubbing against or catching on protruding parts	Remove protruding parts; re-position drive
Excessive running noise	Poor pulley alignment	Realign pulleys
	Belt tension too low	Check tension and re-tension
	Drive overloaded	Check drive design and re-design if necessary
Belt swelling or softening and sticky	Contamination by oil, grease, chemicals	Protect drive from contamination source; use optibelt SUPER X-POWER M=S or optibelt SUPER TX M=S or Optibelt special design 05; clean pulley grooves with petrol, alcohol or brake cleaner before installation of new belts
Uneven belt stretch	Worn or badly manufactured pulley grooves	Replace pulleys
	Used belts mixed with new belts on the drive	Replace with a completely new set of belts
	Belts from different manufacturers used on same drive	Belt sets must comprise belts from one manufacturer only – optibelt S=C Plus, optibelt SUPER TX M=S, optibelt SUPER X-POWER M=S

Should other problems occur, please contact our Application Engineering Department. They will require comprehensive technical details in order to provide you with solutions.

DESIGN SUPPORT
LENGTH MEASUREMENT CONDITIONS AND CONVERSION FACTORS

Belt length measurement
The belt is placed over two identically sized measuring pulleys of the groove design shown in the following drawings. The dimensions are given in the tables 85 to 91 on pages 169/170.

By moving to the adjustable pulley the force Q is applied on the belt. Before measuring the drive centre distance a, the belt should be rotated three times under load. This ensures that the belt is well seated in the pulley, an essential pre-condition for the accuracy of the resulting measurement.

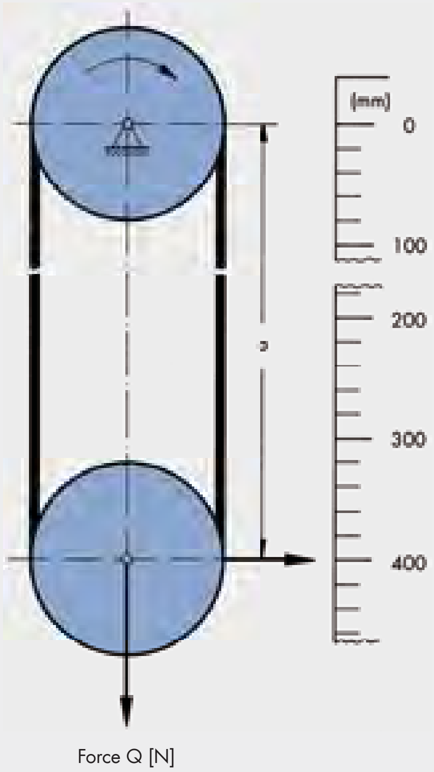
The length is obtained by adding the diameter of the pulley to twice the drive centre distance a.

$$L_d = 2\,a + U_d$$

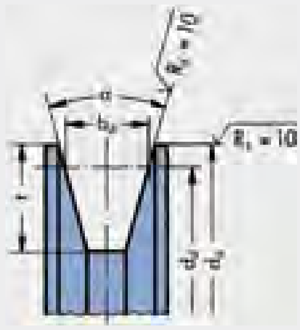
$$L_a = 2\,a + U_a$$

Length conversion factors are given in the tables on pages 169/170 and 173/174.

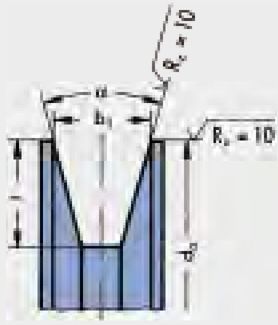
Arrangement for measuring belt length



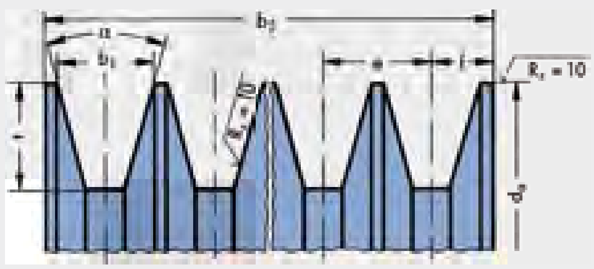
Measuring pulley for wedge belts DIN 7753 Part 1 and classic V-belts DIN 2215



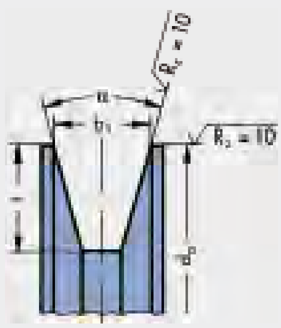
Measuring pulley for wedge belts ARPM/MPTA



Measuring pulley for kraftbands



Measuring pulley for double-sided V-belts



DESIGN SUPPORT
LENGTH MEASUREMENT CONDITIONS AND CONVERSION FACTORS

Table 85: optibelt SK high performance wedge belts
optibelt SUPER X-POWER M=S wedge belts – raw edge, cogged
optibelt SUPER E-POWER M=S high performance wedge belts – raw edge, cogged
Measuring pulleys and force according to DIN 7753 Part 1 and ISO 4183

Profile	Datum circumference U_d $= d_d \cdot \pi$	Datum diameter d_d ± 0.05	Outside diameter d_a ± 0.05	Datum width b_d	Groove angle α° ± 10′	Groove depth t_{min}	Measuring force Q [N]	Outside length L_a [mm]	Inside length L_i [mm]
SPZ; XPZ	300	95.49	100	8.50	36	11	360	$L_a \approx L_d + 13$ $L_a \approx L_i + 51$	$L_i \approx L_d - 38$ $L_i \approx L_a - 51$
SPA; XPA	450	143.24	149	11.00	36	14	560	$L_a \approx L_d + 18$ $L_a \approx L_i + 63$	$L_i \approx L_d - 45$ $L_i \approx L_a - 63$
SPB; XPB	600	190.99	198	14.00	36	18	900	$L_a \approx L_d + 22$ $L_a \approx L_i + 82$	$L_i \approx L_d - 60$ $L_i \approx L_a - 82$
SPC; XPC	1000	318.31	328	19.00	36	24	1500	$L_a \approx L_d + 30$ $L_a \approx L_i + 113$	$L_i \approx L_d - 83$ $L_i \approx L_a - 113$

Table 86: optibelt SK high performance wedge belts
optibelt SUPER X-POWER M=S wedge belts – raw edge, cogged
optibelt SUPER E-POWER M=S high performance wedge belts – raw edge, cogged
Measuring pulleys and force according to ARPM/MPTA

Profile	Outside circumference U_a $= d_a \cdot \pi$	Outside diameter d_a ± 0.13	Upper groove width b_1 ± 0.13	Groove angle α° ± 15′	Groove depth t_{min}	Measuring force Q [N]	Inside length L_i [mm]
3V/9N; 3VX/9NX	300	95.50	8.90	38	9.00	445	$L_i \approx L_a - 42$
5V/15N; 5VX/15NX	600	191.00	15.24	38	15.00	1000	$L_i \approx L_a - 71$
8V/25N	1000	318.30	25.40	38	25.50	2225	$L_i \approx L_a - 120$

Table 87: optibelt VB classic V-belts
optibelt SUPER TX M=S classic V-belts – raw edge, cogged
Measuring pulleys and force according to DIN 2215 und ISO 4183

Profile	Datum circumference U_d $= d_d \cdot \pi$	Datum diameter d_d ± 0.05	Outside diameter d_a ± 0.05	Datum width b_d	Groove angle α° ± 10′	Groove depth t_{min}	Measuring force Q [N]	Outside length L_a [mm]	Datum length L_d [mm]
5	70	22.28	24.88	4.20	32	5	30	$L_a \approx L_i + 19$ $L_a \approx L_d + 8$	$L_d \approx L_i + 11$ $L_d \approx L_a - 8$
Y/6	90	28.65	31.85	5.30	32	6	40	$L_a \approx L_i + 25$ $L_a \approx L_d + 10$	$L_d \approx L_i + 15$ $L_d \approx L_a - 10$
8	140	44.56	48.56	6.70	32	8	80	$L_a \approx L_i + 31$ $L_a \approx L_d + 12$	$L_d \approx L_i + 19$ $L_d \approx L_a - 12$
Z/10; ZX/X10	180	57.30	62.30	8.50	34	10	110	$L_a \approx L_i + 38$ $L_a \approx L_d + 16$	$L_d \approx L_i + 22$ $L_d \approx L_a - 16$
A/13; AX/X13	300	95.50	102.10	11.00	34	12	200	$L_a \approx L_i + 50$ $L_a \approx L_d + 20$	$L_d \approx L_i + 30$ $L_d \approx L_a - 20$
B/17; BX/X17	400	127.32	135.72	14.00	34	15	300	$L_a \approx L_i + 69$ $L_a \approx L_d + 29$	$L_d \approx L_i + 40$ $L_d \approx L_a - 29$
20	520	165.52	175.12	17.00	34	18	750	$L_a \approx L_i + 79$ $L_a \approx L_d + 31$	$L_d \approx L_i + 50$ $L_d \approx L_a - 31$
C/22; CX/X22	700	222.82	234.22	19.00	34	20	750	$L_a \approx L_i + 88$ $L_a \approx L_d + 30$	$L_d \approx L_i + 58$ $L_d \approx L_a - 30$
25	800	254.65	267.25	21.00	34	22	750	$L_a \approx L_i + 100$ $L_a \approx L_d + 39$	$L_d \approx L_i + 60$ $L_d \approx L_a - 39$
D/32	1000	318.31	334.52	27.00	36	28	1400	$L_a \approx L_i + 126$ $L_a \approx L_d + 51$	$L_d \approx L_i + 75$ $L_d \approx L_a - 51$
E/40	1800	572.96	596.96	32.00	36	36	1800	$L_a \approx L_i + 157$ $L_a \approx L_d + 77$	$L_d \approx L_i + 80$ $L_d \approx L_a - 77$

DESIGN SUPPORT
LENGTH MEASUREMENT CONDITIONS AND CONVERSION FACTORS

Table 88: optibelt KB kraftbands with high performance wedge belts
Measuring pulleys and force

Profile	Outside circumference $U_a = d_a \cdot \pi$	Outside diameter d_a ± 0.13	Upper groove width b_1 ± 0.13	Groove angle α° ± 15′	Groove depth t_{min}	Groove pitch e	Tolerance e[1]	Σ Tol. e[2]	Force per rib Q [N]	Inside length L_i [mm]
3V/9J	300	95.50	8.90	38	9.00	10.30	± 0.25	± 0.5	445	$L_i \approx L_a -$ 42
5V/15J	600	191.00	15.20	38	15.00	17.50	± 0.25	± 0.5	1000	$L_i \approx L_a -$ 71
8V/25J	1000	318.30	25.40	38	25.50	28.60	± 0.40	± 0.8	2225	$L_i \approx L_a -$ 120

Table 89: optibelt KB kraftbands
Measuring pulleys and force

Profile	Datum circumference $U_d = d_d \cdot \pi$	Datum diameter d_d ± 0.13	Outside diameter d_a ± 0.13	Datum width b_d	Groove angle α° ± 15′	Groove depth t_{min}	Groove pitch e	Tolerance e[1]	Σ Tol. e[2]	Force per rib Q [N]	Datum length L_d [mm]
SPZ	300	95.49	100.00	8.50	36	11.00	12.00	± 0.30	± 0.5	360	$L_d \approx L_a -$ 13
SPA	450	143.24	149.00	11.00	36	14.00	15.00	± 0.30	± 0.5	560	$L_d \approx L_a -$ 18
SPB	600	190.99	198.00	14.00	36	18.00	19.00	± 0.40	± 0.8	900	$L_d \approx L_a -$ 22
SPC	1000	318.31	328.00	19.00	36	24.00	25.50	± 0.40	± 0.8	1500	$L_d \approx L_a -$ 30

Table 90: optibelt KB kraftbands with classic V-belts
Measuring pulleys and force

Profile	Outside circumference $U_a = d_a \cdot \pi$	Outside diameter d_a ± 0.13	Upper groove width b_1 ± 0.13	Groove angle α° ± 15′	Groove depth t_{min}	Groove pitch e	Tolerance e[1]	Σ Tol. e[2]	Force per rib Q [N]	Inside length L_i [mm]
A/HA	254	80.85	12.45	32	12.50	15.88	± 0.38	± 0.8	300	$L_i \approx L_a -$ 36
B/HB	381	121.28	16.00	32	14.50	19.05	± 0.38	± 0.8	450	$L_i \approx L_a -$ 62
C/HC	635	202.13	22.33	34	20.00	25.40	± 0.38	± 0.8	850	$L_i \approx L_a -$ 75
D/HD	889	282.96	31.98	34	28.00	36.53	± 0.38	± 0.8	1000	$L_i \approx L_a -$ 111

1) Tolerance for the medium distance e between two adjacent grooves
2) Sum of all deviations from the nominal size e for all groove distances on one pulley must not exceed the given values.

Table 91: optibelt DK double-sided V-belts
Measuring pulleys and force according to ISO 5289

Profile	Outside circumference $U_a = d_a \cdot \pi$	Outside diameter d_a	Upper groove width b_1	Groove angle α° ± 20′	Groove depth t_{min}	Measuring force Q [N]
AA/HAA	300	95.49	12.60	34	8	300
BB/HBB	400	127.32	16.20	34	10	450
CC/HCC	600	190.99	22.30	34	14	850
DD/HDD	900	286.48	32.00	34	20	1400
22 x 22	600	190.99	22.30	34	14	750
25 x 22	942	300.00	25.00	34	22	1200

Table 92: Endless wedge belts DIN 7753 Part 1

Profile	Datum length [mm]	Length tolerance [mm] Allowed deviation of the datum lengths		Set tolerances [mm] Allowed deviation between datum lengths L_d of the belts in one and the same set on multi-grooved belt drives			
		Optibelt		Optibelt		DIN 7753/ISO 4184	
		wrapped	DIN 7753	wrapped	raw edge	wrapped	raw edge
SPZ/XPZ SPA/XPA SPB/XPB SPC/XPC	> 630 ≤ 900	DIN	± 6 to ± 9	2	2	2	2
	> 900 ≤ 1 250	DIN	± 9 to ± 12	2	4	2	4
	> 1 250 ≤ 2 000	± 2	± 12 to ± 20	± 2	6	2	6
	> 2 000 ≤ 3 150	± 2	± 20 to ± 32	± 2	6	4	6
	> 3 150 ≤ 5 000*	± 2	± 32 to ± 50	± 2	10*	6	10*
	> 5 000 ≤ 8 000	± 4	± 50 to ± 80	± 4		10	
	> 8 000 ≤ 10 000	± 6	± 80 to ± 100	± 6		16	
	> 10 000 ≤ 12 500	± 8	± 100 to ± 125	± 8			

Table 93: Classic V-belts DIN 2215

Profile	Datum length [mm]	Length tolerance [mm] Allowed deviation of the datum lengths		Set tolerances [mm] Allowed deviation between datum lengths L_d of the belts in one and the same set on multi-grooved belt drives			
		Optibelt		Optibelt		DIN 2215/ISO 4184	
		wrapped	DIN 2215	wrapped	raw edge	wrapped	raw edge
5 Y/6 8 Z/10; ZX/X10 A/13; AX/X13 B/17; BX/X17 20 C/22; CX/X22 25 D/32 E/40	≤ 250	DIN	+ 8/– 4	2		2	2
	> 250 ≤ 315	DIN	+ 9/– 4	2		2	2
	> 315 ≤ 400	DIN	+ 10/– 5	2		2	2
	> 400 ≤ 500	DIN	+ 11/– 6	2		2	2
	> 500 ≤ 630	DIN	+ 13/– 6	2	2	2	2
	> 630 ≤ 800	DIN	+ 15/– 7	2	2	2	2
	> 800 ≤ 900	DIN	+ 17/– 8	2	2	2	2
	> 900 ≤ 1 250	DIN	+ 19/– 10	4	4	4	4
	> 1 250 ≤ 1 600	± 2	+ 23/– 11	± 2	4	4	4
	> 1 600 ≤ 2 000	± 2	+ 27/– 13	± 2	4	4	4
	> 2 000 ≤ 2 500	± 2	+ 31/– 16	± 2	6	8	8
	> 2 500 ≤ 3 150	± 2	+ 37/– 18	± 2	8	8	8
	> 3 150 ≤ 4 000*	± 2	+ 44/– 22	± 2	8*	12	12*
	> 4 000 ≤ 5 000	± 2	+ 52/– 26	± 2		12	
	> 5 000 ≤ 6 300	± 4	+ 63/– 32	± 4		20	
	> 6 300 ≤ 8 000	± 4	+ 77/– 38	± 4		20	
	> 8 000 ≤ 10 000	± 6	+ 93/– 46	± 6		32	
	> 10 000 ≤ 12 500	± 8	+ 112/– 56	± 8		32	
	> 12 500 ≤ 15 000	DIN	+ 140/– 70	DIN		48	
	> 15 000 ≤ 20 000	DIN	+ 170/– 85	DIN		48	

* Maximum production length for raw edge V-belts ≤ 3550 mm

optibelt S=C Plus and optibelt M=S V-belts can be used in sets without measuring.

Table 94: Endless wedge belts ARPM/MPTA

Profile	Length designation	Outside length [mm]	Length tolerance [mm] Allowed deviation from outside lengths Replace complete belt sets!		Set tolerance [mm] Allowed deviation between the outside lengths La of the belts in one and the same set on multi-grooved belt drives Replace complete belt sets!		
			Optibelt wrapped	ARPM/MPTA	Optibelt wrapped	Optibelt raw edge	ARPM/MPTA
3V/9N 3VX/9NX 5V/15N 5VX/15NX 8V/25N	265 ≤ 500	673 ≤ 1270	acc. ARPM/MPTA	± 8	4	4	4
	530	1346	± 2	± 10	± 2	4	4
	560	1422	± 2	± 10	± 2	6	6
	600 ≤ 800	1524 ≤ 2032	± 2	± 10	± 2	6	6
	800 ≤ 1000	2032 ≤ 2540	± 2	± 13	± 2	6	6
	1000 ≤ 1060	2540 ≤ 2692	± 2	± 15	± 2	6	6
	1120 ≤ 1400	2845 ≤ 3556	± 2	± 15	± 2	10*	10
	1500 ≤ 1900	3810 ≤ 4826	± 2	± 20	± 2		10
	2000 ≤ 2360	5080 ≤ 5994	± 4	± 20	± 4		10
	2500 ≤ 3000	6350 ≤ 7620	± 4	± 20	± 4		16
	3150 ≤ 3750	8001 ≤ 9525	± 6	± 25	± 6		16
	4000	10160	± 8	± 25	± 8		16
	4250 ≤ 4500	10795 ≤ 11430	± 8	± 30	± 8		16
	4750 ≤ 5000	12065 ≤ 12700	± 12	± 30	± 12		24

Table 95: Double-sided V-belts

Profile	Reference length [mm]	Length tolerance [mm] Allowed deviation of the reference lengths	Set tolerance [mm] Allowed deviation between the reference length of the double-sided V-belts in one and the same set on multi-grooved belt drives
AA/HAA BB/HBB CC/HCC DD/HDD 22 x 22 25 x 22	1250 < 1320	+ 8/– 16	4
	1320 < 1700	+ 9/– 18	4
	1700 < 2120	+ 11/– 22	5
	2120 < 2650	+ 13/– 26	6.3
	2650 < 3350	+ 15/– 30	8
	3350 < 4250	+ 18/– 36	10
	4250 < 5300	+ 22/– 44	12.5
	5300 < 6700	+ 26/– 52	16
	6700 < 8500	+ 32/– 64	20
	8500 < 10000	+ 39/– 78	25

Table 96: Kraftbands with high performance wedge belts and classic V-belts

Profile	Length and set tolerances
3V/9J; 3VX/9JX 5V/15J; 5VX/15JX 8V/25J	see table 94, ARPM/MPTA
SPZ; SPA; SPB; SPC	see table 92, DIN/ISO
A/HA B/HB C/HC D/HD	DIN/ASAE

* Maximum production length for raw edge V-belts ≤ 3550 mm

optibelt SK high performance wedge belts DIN 7753 Part 1

Profile	Cross-section b x h ≈	Bottom belt width b_u ≈	Nominal width b_d	Belt length: Nominal length	Belt length: Outside length L_a	Belt length: Pitch length L_d	Belt length: Inside length L_i	Recommended minimum pulley diameter [mm]		Meter weight [≈ kg/m]
SPZ	9.7 x 8	4.2	8.5	Nominal length L_d	$L_a \approx L_d + 13$ $L_a \approx L_i + 51$	–	$L_i \approx L_d - 38$ $L_i \approx L_a - 51$	Nominal diameter d_d	63	0.074
SPA	12.7 x 10	5.8	11.0		$L_a \approx L_d + 18$ $L_a \approx L_i + 63$	–	$L_i \approx L_d - 45$ $L_i \approx L_a - 63$		90	0.123
SPB	16.3 x 13	7.3	14.0		$L_a \approx L_d + 22$ $L_a \approx L_i + 82$	–	$L_i \approx L_d - 60$ $L_i \approx L_a - 82$		140	0.195
SPC	22.0 x 18	9.6	19.0		$L_a \approx L_d + 30$ $L_a \approx L_i + 113$	–	$L_i \approx L_d - 83$ $L_i \approx L_a - 113$		224	0.377

optibelt SK high performance wedge belts ARPM/MPTA

3V/9N	9.0 x 8	4.2	–	Outside length L_a	–	$L_d \approx L_a - 4$*	$L_i \approx L_a - 42$	Outside diameter d_a	67	0.074
5V/15N	15.0 x 13	7.3	–		–	$L_d \approx L_a - 11$*	$L_i \approx L_a - 71$		151	0.195
8V/25N	25.0 x 23	9.6	–		–	–	$L_i \approx L_a - 120$		315	0.575

* The conversion factor L_d to L_a is used when a profile according to DIN 7753 Part 1 is to be replaced by the corresponding profile according to ARPM/MPTA.

optibelt SUPER X-POWER M=S wedge belts – raw edge, cogged – DIN 7753 Part 1
optibelt SUPER E-POWER M=S high performance wedge belts – raw edge, cogged – DIN 7753 Part 1

XPZ	9.7 x 8	4.2	8.5	Nominal length L_d	$L_a \approx L_d + 13$ $L_a \approx L_i + 51$	–	$L_i \approx L_d - 38$ $L_i \approx L_a - 51$	Nominal diameter d_d	56	0.065
XPA	12.7 x 10	5.8	11.0		$L_a \approx L_d + 18$ $L_a \approx L_i + 63$	–	$L_i \approx L_d - 45$ $L_i \approx L_a - 63$		71	0.111
XPB	16.3 x 13	7.3	14.0		$L_a \approx L_d + 22$ $L_a \approx L_i + 82$	–	$L_i \approx L_d - 60$ $L_i \approx L_a - 82$		112	0.183
XPC	22.0 x 18	9.6	19.0		$L_a \approx L_d + 30$ $L_a \approx L_i + 113$	–	$L_i \approx L_d - 83$ $L_i \approx L_a - 113$		180	0.340

optibelt SUPER X-POWER M=S wedge belts – raw edge, cogged – ARPM/MPTA
optibelt SUPER E-POWER M=S high performance wedge belts – raw edge, cogged – ARPM/MPTA

3VX/9NX	9.0 x 8	4.2	–	Outside length L_a	–	$L_d \approx L_a - 4$*	$L_i \approx L_a - 42$	Outside diameter d_a	56	0.065
5VX/15NX	15.0 x 13	7.3	–		–	$L_d \approx L_a - 11$*	$L_i \approx L_a - 71$		112	0.183

* The conversion factor L_d to L_a is used when a profile according to DIN 7753 Part 1 is to be replaced by the corresponding profile according to ARPM/MPTA.

optibelt SUPER TX M=S V-belts – raw edge, cogged

ZX/X10	10.0 x 6	5.9	8.5	Nominal length L_d	$L_a \approx L_i + 38$ $L_a \approx L_d + 16$	–	$L_i \approx L_d - 22$ $L_i \approx L_a - 38$	Nominal diameter d_d	40	0.062
AX/X13	13.0 x 8	7.5	11.0		$L_a \approx L_i + 50$ $L_a \approx L_d + 20$	–	$L_i \approx L_d - 30$ $L_i \approx L_a - 50$		63	0.099
BX/X17	17.0 x 11	9.4	14.0		$L_a \approx L_i + 69$ $L_a \approx L_d + 29$	–	$L_i \approx L_d - 40$ $L_i \approx L_a - 69$		90	0.165
CX/X22	22.0 x 14	12.3	19.0		$L_a \approx L_i + 88$ $L_a \approx L_d + 30$	–	$L_i \approx L_d - 58$ $L_i \approx L_a - 88$		140	0.276

optibelt VB classic V-belts DIN 2215

5	5.0 x 3	2.8	4.2	Nominal length L_d	$L_a \approx L_i + 19$ $L_a \approx L_d + 8$	$L_d \approx L_i + 11$ $L_d \approx L_a - 8$	–	Nominal diameter d_d	20	0.018
Y/6	6.0 x 4	3.3	5.3		$L_a \approx L_i + 25$ $L_a \approx L_d + 10$	$L_d \approx L_i + 15$ $L_d \approx L_a - 10$	–		28	0.026
8	8.0 x 5	4.5	6.7		$L_a \approx L_i + 31$ $L_a \approx L_d + 12$	$L_d \approx L_i + 19$ $L_d \approx L_a - 12$	–		40	0.042
Z/10	10.0 x 6	5.9	8.5		$L_a \approx L_i + 38$ $L_a \approx L_d + 16$	$L_d \approx L_i + 22$ $L_d \approx L_a - 16$	–		50	0.064
A/13	13.0 x 8	7.5	11.0		$L_a \approx L_i + 50$ $L_a \approx L_d + 20$	$L_d \approx L_i + 30$ $L_d \approx L_a - 20$	–		71	0.109
B/17	17.0 x 11	9.4	14.0		$L_a \approx L_i + 69$ $L_a \approx L_d + 29$	$L_d \approx L_i + 40$ $L_d \approx L_a - 29$	–		112	0.196
20	20.0 x 12.5	11.4	17.0		$L_a \approx L_i + 79$ $L_a \approx L_d + 31$	$L_d \approx L_i + 50$ $L_d \approx L_a - 31$	–		160	0.266
C/22	22.0 x 14	12.3	19.0		$L_a \approx L_i + 88$ $L_a \approx L_d + 30$	$L_d \approx L_i + 58$ $L_d \approx L_a - 30$	–		180	0.324
25	25.0 x 16	14.0	21.0		$L_a \approx L_i + 100$ $L_a \approx L_d + 39$	$L_d \approx L_i + 60$ $L_d \approx L_a - 39$	–		250	0.420
D/32	32.0 x 20	18.2	27.0		$L_a \approx L_i + 126$ $L_a \approx L_d + 51$	$L_d \approx L_i + 75$ $L_d \approx L_a - 51$	–		355	0.668
E/40	40.0 x 25	22.8	32.0		$L_a \approx L_i + 157$ $L_a \approx L_d + 77$	$L_d \approx L_i + 80$ $L_d \approx L_a - 77$	–		500	0.958

TABLES
CONVERSION FACTORS

optibelt KB kraftbands with high performance wedge belts to ISO 5290/ARPM/MPTA

Profile	Height h ≈	Bottom belt width b_u ≈ of the single belt	Belt length				Recommended minimum pulley diameter [mm]		Meter weight per rib [≈ kg/m]
			Nominal length	Outside length L_a	Datum length L_d	Inside length L_i			
3V/9J	9.9	4.2	Outside length L_a	–	–	$L_i \approx L_a - 42$	Outside diameter d_a	84	0.122
5V/15J	15.1	7.3		–	–	$L_i \approx L_a - 71$		191	0.252
8V/25J	25.5	9.6		–	–	$L_i \approx L_a - 120$		355	0.693

optibelt KB kraftbands with high performance wedge belts

SPZ	10.5	5.4	Datum length L_d	$L_a \approx L_d + 13$	–	–	Datum diameter d_d	80	0.120
SPA	12.5	7.0		$L_a \approx L_d + 18$	–	–		112	0.166
SPB	15.6	8.8		$L_a \approx L_d + 22$	–	–		180	0.261
SPC	22.6	9.3		$L_a \approx L_d + 24$	–	–		250	0.555

optibelt KB kraftbands with classic V-belts

A	9.9	7.5	Datum length L_d	$L_a \approx L_i + 36$	$L_d \approx L_i + 30$	–	Datum diameter d_d	80	0.163
B	13.0	9.4		$L_a \approx L_i + 62$	$L_d \approx L_i + 40$	–		125	0.266
C	16.2	12.3		$L_a \approx L_i + 75$	$L_d \approx L_i + 58$	–		200	0.447
D	22.4	18.2		$L_a \approx L_i + 111$	$L_d \approx L_i + 75$	–		355	0.798

optibelt KB kraftbands according to USA standard ASAE S 211. ...

HA	9.9	7.5	Outside length L_a	–	–	$L_i \approx L_a - 36$	Outside diameter d_a	80	0.163
HB	13.0	9.4		–	–	$L_i \approx L_a - 62$		125	0.266
HC	16.2	12.3		–	–	$L_i \approx L_a - 75$		200	0.447
HD	22.4	18.2		–	–	$L_i \approx L_a - 111$		355	0.798

The width of the kraftband is dependent upon the number of ribs.

optibelt DK double-sided V-belts to DIN 7722 / ISO 5289

Profile	Cross-section b x h ≈	Bottom belt width b_u ≈	Nominal length	Belt length	Recommended minimum pulley diameter [mm]		Meter weight [≈ kg/m]
AA/HAA	13 x 10	–	Reference length	Reference length ≈ centre length – 4	Outside diameter d_a	80	0.150
BB/HBB	17 x 13	–		Reference length ≈ centre length – 8		125	0.250
CC/HCC	22 x 17	–		Reference length ≈ centre length + 3		224	0.440
DD/HDD	32 x 25	–		Reference length = centre length		355	0.935

optibelt DK double-sided V-belts – special profiles

22 x 22	22 x 22	–	Reference length	Reference length = centre length	Outside diameter d_a	280	0.511
25 x 22	25 x 22	–		Reference length = centre length		280	0.625

optibelt MARATHON 1 / optibelt MARATHON 2 M=S automotive V-belts

Profile	Cross-section b x h ≈	Bottom belt width b_u ≈	Nominal width b_d	Belt length			Recommended minimum pulley diameter [mm]	Meter weight [≈ kg/m]
				Nominal length	v L_d	Inside length L_i		
AVX 10/9.5	10 x 8	4.9	8.5	Outside length L_a	$L_d \approx L_a - 18$	$L_i \approx L_a - 51$	According to agreement and check with automotive industry	0.076
AVX 13/12.5	13 x 10	5.8	11.0		$L_d \approx L_a - 18$	$L_i \approx L_a - 63$		0.118
15A	16.6 x 10.4	9.2	–		$L_d \approx L_a - 0$	$L_i \approx L_a - 65$	76	0.139
17A	18.2 x 10.8	10.6	–		$L_d \approx L_a - 10$	$L_i \approx L_a - 68$	76	0.157
20A	21.4 x 12.4	12.6	–		$L_d \approx L_a - 20$	$L_i \approx L_a - 78$	89	0.236

CONVEYOR ELEMENTS
PRODUCT DESCRIPTION

Optibelt has developed a series of conveyor elements for the economical conveyance of goods in a varied range of applications.

- optibelt PKR — endless V-belts DIN 2215 with patterned top surfaces
- optibelt PKR — endless V-belts DIN 2215 with light coloured fabric cover and patterned top surfaces within the standard belt height
- optibelt KB — kraftbands with patterned top surfaces
- optibelt optimat PKR — open-ended V-belts DIN 2216 with patterned top surfaces
- optibelt optimat FK — open-ended conveyor belts, punched
- optibelt optimax HF — high performance flat belts

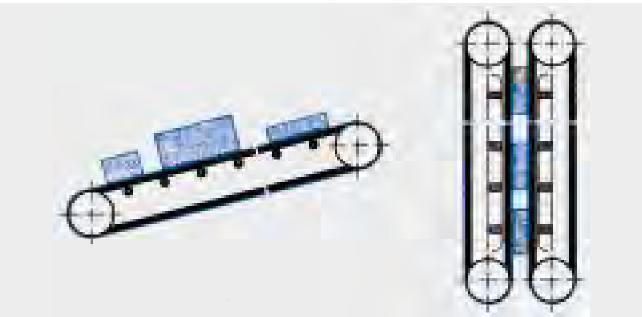
Construction/Quality
Optibelt conveyor elements consist of the basic belt and the top surface. These parts are specially connected via vulcanisation. The variety of applications required constructions with numerous patterns available in different qualities. Both pattern and surface quality should be adapted to the individual application.

Table 97

Type/ Colour	Temperature resistance [°C]	Hardness (Shore A)	Oil resist-ance	Loss of colour
SBR-NR/light	–40 to + 70	≈ 55*/65**	no	no
CR/black	–25 to +100	≈ 65	limited	yes

CR/black is available as standard. We would be pleased to inform you about the production of the other constructions.
SBR = Styrene-Butadiene-Rubber
NR = Natural Rubber
CR = Chloroprene Rubber
* ≈ 55 for top surfaces above the standard height
** ≈ 65 for top surfaces within the standard height

Properties
Special surfaced belts are used instead of expensive conventional type conveyor belts. They run individually, or in sets arranged adjacent to each other, transporting goods horizontally, or inclined up or down. Vertical conveying is also possible if the belts are arranged top surface to top surface, gripping the goods between them.



Applications areas
Here are just a few examples of the wide range of applications in which Optibelt conveyor belts are used successfully.

For the conveyance of:
- doors, cupboard parts, veneer and plastic panels in the woodworking industry
- body parts and sharp-edged sheet metal in the automotive industry
- cardboard and boxes in the packaging industry
- roof tiles, concrete slabs and block paving stones
- tiles
- flat glass
- postal items
- bowling balls on bowling lanes

In addition to the conveyance options, these belts are also used for
- labelling and sealing of tins and jars in the canning industry
- lifting, chopping and sorting of beet, potatoes, salad, cauliflower, Brussels sprouts and other vegetables in the agricultural industry

Due to their single belt characteristics and high surface load, optibelt KB kraftbands with patterned top surfaces are especially suitable in conveyor systems and lifting platforms for:
- the conveyance of cargo containers
- loading and clearing of airplanes and railway wagons
- stowing and unloading of ship cargos

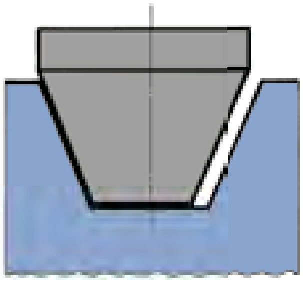
optibelt KB with top surface

Drive and guide pulleys

The drive and guide pulleys should be V-grooved pulleys. The minimum diameters should be selected according to the standard recommendations for V-belts and kraftbands. See the chapter on V-grooved pulleys.
Due to the relatively low transporting speed (experience has shown that it is usually less than 1 m/s) and the resulting low flex rate, pulley diameters can be reduced to approximately 10% below the recommended minimum. With greater reduction, there is danger that the top surface separates from the V-belt base.
The driver pulley should be arranged at the discharge end of the conveyor so that the goods are pulled along.

Support idlers/tracks

In most cases, support idlers or tracks are required to prevent the belt from sagging under load.
Support idlers may be flat faced or V-grooved pulleys. The dimensions of the pulley grooves should support the base of the conveyor belt in the base of the groove so only one edge can run on the groove flank, and thus cannot get stuck in the groove.



The diameter and the number of support idlers required depend on the length of the conveying span and the weight and size of the goods to be conveyed.
Supporting tracks, generally made of plastic, are either flat or with a key seat to improve guidance of the conveyor belt. As with the support idlers, the grooves must have an adequate width.

Adjustment of the drive centre distance allowances

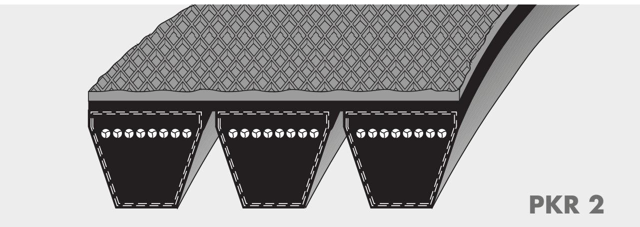
The tables on pages 82 to 84 show the drive centre distance allowances for special purpose conveyor belts and kraftbands.

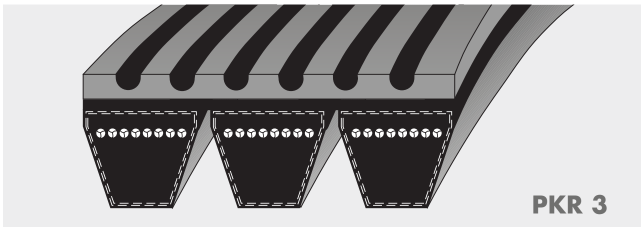
Tensioning options

An adequate belt tension is essential to the reliable operation of the conveyor system. Tension is applied by adjusting the drive centre distance or, when the centres are fixed, by tension idlers.

When idlers are employed, they should be arranged inside the belt if possible, as otherwise the alternating flexing of the belt will reduce its service life.

optibelt KB KRAFTBANDS WITH PATTERNED TOP SURFACE





Pattern type	Top surface height standard [mm]	Top surface height maximum [mm]	Pitch [mm]	Groove width [mm]
PKR 0	3	5	–	–
PKR 1	3	5	10	–
PKR 2	3	5	–	–
PKR 3	5	–	–	3.7

Type/Colour	Temperature resistance [°C]	Hardness (Shore A)	Oil resistance	Loss of colour
SBR-NR/light	–40 to + 70	≈ 55	no	no
CR/black	–25 to +100	≈ 65	limited	yes

SBR = Styrene-Butadiene-Rubber
NR = Natural Rubber
CR = Chloroprene Rubber

Table 98

Profile	Cross-sectional dimensions of the belt [mm]	Kraftband height without top surface [mm]	Length designation	Length [mm]	Maximum production length [mm]	Pattern type PKR 0	PKR 1	PKR 2	PKR 3
3V/9J	9 x 8	9.9	500 ≤ 1 400	1 400 ≤ 3 556 L_a	4 250	•	•	•	–
5V/15J	15 x 13	15.1	500 ≤ 3 550	1 400 ≤ 9 017 L_a	10 000	•	•	•	–
8V/25J	25 x 23	25.5	1 000 ≤ 4 750	2 540 ≤ 12 065 L_a	15 000	•	•	•	–
SPB	16.3 x 13	15.6	–	2 400 ≤ 6 000 L_d	6 000	•	•	•	–
A/HA	13 x 8	9.9	–	1 400 ≤ 5 000 L_i	8 000	•	•	•	–
				2 850 ≤ 8 000 L_i	on request	–	–	–	•
B/HB	17 x 11	13.0	–	1 400 ≤ 7 100 L_i	10 000	•	•	•	–
C/HC	22 x 14	16.2	–	2 286 ≤ 7 100 L_i	12 000	•	•	•	–

L_a = outside length; L_i = inside length; L_d = datum length

Product Range: see pages 38/39. Minimum order quantities: on request.

CONVEYOR ELEMENTS

optibelt PKR ENDLESS V-BELTS AND
optibelt KB KRAFTBANDS WITH PATTERNED TOP SURFACE

Table 99

Pattern types	Top surface height standard [mm]	Top surface height maximum [mm]	Pitch [mm]	Groove width [mm]
PKR 0	3	5	–	–
PKR 1	3	5	10	–
PKR 2	3	5	–	–
PKR 5	5	–	13	–

Table 100

Type/Colour	Temperature resistance [°C]	Hardness (Shore A)	Oil resistance	Loss of colour
SBR-NR/light	–40 to + 70	≈ 55*/65**	no	no
CR/black	–25 to +100	≈ 65	limited	yes

SBR = Styrene-Butadiene-Rubber
NR = Natural Rubber   * ≈ 55 for top surfaces above the standard height
CR = Chloroprene Rubber ** ≈ 65 for top surfaces within the standard height

Table 101

Top surfaces **above** the standard height							Top surfaces 3 or 5 mm above the standard height	
			Pattern Type				Minimum order quantities for V-belts with patterned top surface **PKR 0; PKR 1; PKR 2; PKR 5**	
Profile	Standard height [mm]	Standard insight length range [mm]	PKR 0	PKR 1	PKR 2	PKR 5	**for standard range** (as listed on pages 30 to 33)	**for non-standard length ranges** (sizes not included in this manual)
A/13	8.0	1200 ≤ 5000[1)]	•	•	•	–	18 pieces	31 pieces
B/17	11.0	1200 ≤ 2000[1)] 2001 ≤ 7100[1)]	• •	• •	• •	– –	15 pieces 15 pieces	50 pieces 42 pieces
20	12.5	1850 ≤ 2000[2)] 2001 ≤ 8000[2)]	• •	• •	• •	– –	13 pieces 13 pieces	21 pieces 36 pieces
C/22	14.0	1850 ≤ 2000[2)] 2001 ≤ 10000[2)]	• •	• •	• •	– –	12 pieces 12 pieces	57 pieces 48 pieces
25	16.0	1850 ≤ 2000[2)] 2001 ≤ 10000[2)]	• •	• •	• •	– –	11 pieces 11 pieces	51 pieces 42 pieces
D/32	20.0	2850 ≤ 12500[2)] 2850 ≤ 12500[2)]	• –	• –	• –	– •[3)]	9 pieces 8 pieces	22 pieces 8 pieces
E/40	25.0	–	–	–	–	–	on request	on request

1) Maximum production length on request
2) Maximum production length 21,000 mm
3) Only available in CR/black
Profile Z/10 on request

Table 102

Top surfaces **within** the standard height			
Standard insight length range [mm]	Pattern Type PKR 0	Pattern Type PKR 2	Minimum quantity
3550 ≤ 10000[1)]	•	•	10
2850 ≤ 21000[1)]	•	•	10
3550 ≤ 21000[1)]	•	•	8
3550 ≤ 21000[1)]	•	•	8
2850 ≤ 21000[1)]	•	•	8
2850 ≤ 21000[1)]	•	•	6
4000 ≤ 21000[1)]	•	•	5

When ordering please give the overall height of the V-belt including top surface. For this purpose, you need the designation of the profile described as follows:

Profile B/17 – top surface within the standard height = 17 x 11
Profile B/17 – with additional 3 mm top surface = 17 x 14
Profile B/17 – with additional 5 mm top surface = 17 x 16

CONVEYOR ELEMENTS

optimat PKR OPEN-ENDED V-BELTS DIN 2216 WITH PATTERNED TOP SURFACE

PKR 0 PKR 1 PKR 2

Table 103

Profile	PKR 0 CR/red-brown		PKR 0 SBR-NR/light		PKR 1		PKR 2	
	S	P	S	P	S	P	S	P
Z/10	•	•	–	–	–	–	–	–
A/13	•	•	•	•	•	•	•	•
B/17	•	•	•	•	•	•	•	•
C/22	•	•	•	•	•	•	•	•
25	•	•	•	•	•	•	•	•
D/32	•	•	•	•	•	•	–	–

S = standard; P = polyester

Table 104

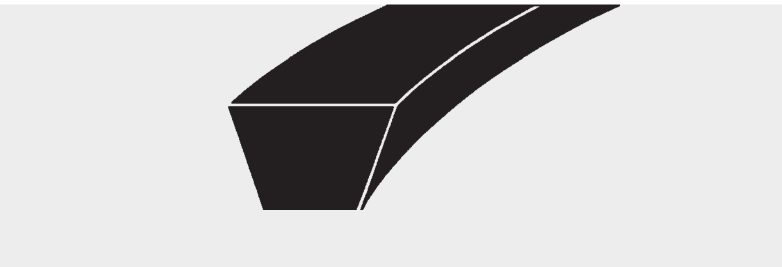
Pattern types	Top surface height		Pitch
	standard [mm]	max. [mm]	[mm]
PKR 0	2	3	–
PKR 1 A/13; B/17; C/22	3	3	10
PKR 1 25; D/32	5	5	10
PKR 2	3	–	–

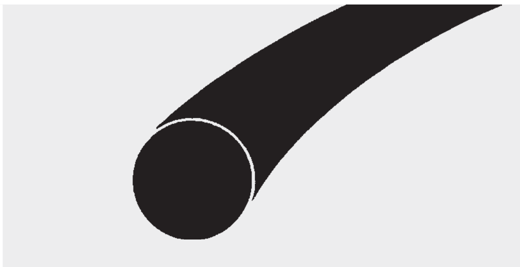
Table 105

Type/Colour	Temperature resistance [°C]	Hardness (Shore A)	Oil resistance	Loss of colour
PKR 0				
CR/red brown	–25 to +100	≈ 50	limited	no
SBR-NR/light	–40 to + 70	≈ 45	no	no
PKR 1 and PKR 2				
NR/red brown	–40 to + 70	≈ 48	no	no
SBR-NR/light	–40 to + 70	≈ 45	no	no
CR/red brown	–25 to +100	≈ 50	limited	no
CR/black	–25 to +100	≈ 68	limited	yes

CONVEYOR ELEMENTS

optibelt RR ROUND BELTS, optibelt KK PLASTIC BELTS





Profile	Width x Height [mm]	Roll length [m]
8	8 x 5	50
Z/10	10 x 6	50
A/13	13 x 8	50
B/17	17 x 11	50
C/22	22 x 14	25

Diameter [mm]	Roll length [m]	Weight [≈ kg/m]
2	200	0.004
3	200	0.009
4	200	0.016
5	200	0.024
6	100	0.035
7	100	0.048
8	100	0.064
10	100	0.096
12	50	0.132
15	50	0.211

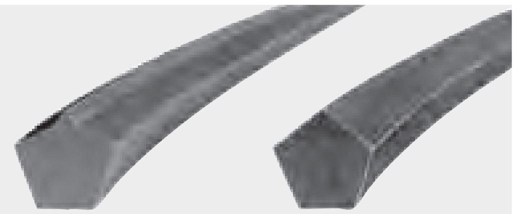
optibelt RR round belts and optibelt KK plastic belts are especially suitable as conveyor elements in the food industry, ceramic industry, and for applications in contact with oil and chemicals.
They can also be used as drive elements for specific capacity ranges.
Optibelt supplies different qualities that can be easily distinguished due to their different colours.

Minimum lengths for endless connection:

Round belts:		200 mm
V-belts:	Profile Z/10 to A/13:	300 mm
	Profile B/17:	500 mm
	Profile C/22:	700 mm

optibelt KK PLASTIC V-BELTS WITH PATTERNED TOP SURFACE (WHITE, 92 SHORE A)
PLASTIC V-BELTS WITH POINTED ROOF PROFILE

Supergrip Linatex HV-2-Laminate



Form 1 Form 2

Profile	Width x Height [mm]	Roll length [m]
8	8 x 5	50
Z/10	10 x 6	50
A/13	13 x 8	50
B/17	17 x 11	50
C/22	22 x 14	25

Form	Profile	Roll length [m]
1	A/13	25
2	A/13	25
1	B/17	25
2	B/17	25
1	C/22	25
2	C/22	25

ANNEX
OVERVIEW OF STANDARDS

Federal Republic of Germany

DIN 109 Sheet 1 – Drive Elements; Circumferential Speeds
DIN 109 Sheet 2 – Drive Elements; Centre Distances for V-Belt Drives
DIN 111 – Pulleys for Flat Transmission Belts; Dimensions, Nominal Torques
DIN 111 Sheet 2 – Pulleys for Flat Transmission Belts; Classification for Electrical Machines
DIN 2211 Sheet 1 – Grooved Pulleys for Narrow V-Belts; Dimensions, Materials
DIN 2211 Sheet 2 – Grooved Pulleys for Narrow V-Belts; Inspections of Grooves
DIN 2211 Sheet 3 – Grooved Pulleys for Narrow V-Belts; Classification for Electrical Machines
DIN 2215 – Endless V-Belts, Classical Profiles; Minimum Datum Diameter of the Pulleys, Internal and Datum Belt Length
DIN 2216 – Open-Ended V-Belts; Dimensions
DIN 2217 Sheet 1 – V-Belt Pulleys for Classical Profiles; Dimensions, Materials
DIN 2217 Sheet 2 – V-Belt Pulleys for Classical Profiles; Inspections of Grooves
DIN 2218 – Endless V-Belts, Classic Profiles for Mechanical Engineering; Calculation of Drives, Performance Data
DIN 7716 – Rubber Products; Requirements for Storage, Cleaning and Maintenance
DIN 7719 Part 1 – Endless Wide V-Belts for Industrial Speed Changers; Belts and Groove Profiles for Corresponding Pulleys
DIN 7719 Part 2 – Endless Wide V-Belts for Industrial Speed Changers; Measurement of Centre Distance Variations
DIN 7721 Part 1 – Synchronous Belt Drives, Metric Pitch; Synchronous Belts
DIN 7721 Part 2 – Synchronous Belt Drives, Metric Pitch; Tooth Space Profile of Synchronous Pulleys
DIN 7722 – Endless Hexagonal Belts for Agricultural Machines and Groove Profiles of Corresponding Pulleys
DIN 7753 Part 1 – Endless Narrow V-Belts for Mechanical Engineering; Dimensions
DIN 7753 Part 2 – Endless Narrow V-Belts for Mechanical Engineering; Drive Calculation, Performance Data
DIN 7753 Part 3 – Endless Narrow V-Belts for the Automotive Industry; Dimensions
DIN 7753 Part 4 – Endless Narrow V-Belts for the Automotive Industry; Fatigue Testing
DIN 7867 – V-Ribbed Belts and Pulleys
DIN/ISO 5290 – Grooved Pulleys for Joined Narrow V-Belts; Groove Profiles 9J; 15J; 20J; 25J
DIN 22100-7 – Articles from Synthetics for Use in Underground Mines, Paragraph 5.4 – V-Belts
DIN EN 60695-11-10 – Fire Hazard Testing

ISO – International Organization for Standardization

ISO 22 – Widths of Flat Transmission Belts and Corresponding Pulleys
ISO 63 – Flat Belt Drives; Lengths
ISO 99 – Diameter of the Belt Pulleys for Flat Belts
ISO 100 – Bulging Height of the Belt Pulleys for Flat Belts
ISO 155 – Belt Pulleys; Limiting Values for Adjustment of Centre Distances
ISO 254 – Quality, Finish and Balance of Belt Pulleys
ISO 255 – Pulleys for Classical V-Belts and Narrow V-Belts; Geometric Testing of Grooves
ISO 1081 – Vocabulary from V-Belts, V-Ribbed Belts and Pulleys
ISO 1604 – Endless Speed Changer Belts and Pulleys for Mechanical Engineering
ISO 1813 – Electrical Conductivity of V-Belts, Kraftbands, V-Ribbed Belts, Wide V-Belts and Double Profile V-Belts
ISO 2230 – Please Consult DIN 7716
ISO 2790 – Narrow V-Belt Drives for the Automotive Industry; Dimensions
ISO 3410 – Endless Speed Changer Belts and Pulleys for Agricultural Machinery
ISO 4183 – Grooved Pulleys for Classical V-Belts and Narrow V-Belts
ISO 4184 – Classical V-Belts and Narrow V-Belts; Lengths
ISO 5256 – Synchronous Belt Drives; Belt Tooth Pitch Code
Part 1 MXL; XL; L; H; XH; XXH
Part 2 MXL; XXL Metric Dimensions
ISO 5287 – Narrow V-Belt Drives for the Automotive Industry; Fatigue Test
ISO 5288 – Vocabulary from Timing Belt Drives
ISO 5289 – Endless Double Profile V-Belts and Pulleys for Agricultural Machinery
ISO 5290 – Grooved Pulleys for Joined Narrow V-Belts; Profiles: 9J; 15J; 20J; 25J
ISO 5291 – Grooved Pulleys for Joined Classical V-Belts; Profiles: AJ; BJ; CJ; DJ
ISO 5292 – Industrial V-Belt Drives; Calculations of the Performance Data and Centre Distance
ISO 5295 – Timing Belts; Calculations of the Performance Data and Centre Distance – "Inch Pitch"
ISO 8370-1 – Dynamic Test to Determine Pitch Zone Location with V-Belts
ISO 8370-2 – Dynamic Test to Determine Pitch Zone Location with V-Ribbed Belts
ISO/DIS 8419 – Belt Drives; Joined Narrow V-Belts; Lengths in Effective System; 9N/J, 15N/J, 25N/J
ISO 9010 – Synchronous Belt Drives – Automotive Belts
ISO 9011 – Synchronous Belt Drives – Automotive Pulleys
ISO 9563 – Antistatic Endless Synchronous Belts; Electrical Conductibility; Characteristics and Testing Method
ISO 9980 – Belt Drives; V-Belt Pulleys, Geometric Inspection of Grooves
ISO 9981 – Belt Drives – Pulleys and V-Ribbed Belts for the Automotive Industry; PK Profile
ISO 9982 – Belt Drives; Pulleys and V-Ribbed Belts for Industrial Requirements; Geometric Data PH, PJ, PK, PL, PM
ISO 11749 – Belt Drives – V-Ribbed Belts for the Automotive Industry, Fatigue Testing
ISO 12046 – Synchronous Belt Drives – Automotive Belts – Physical Characteristics
ISO 13050 – Synchronous Belt Drives – Metric Pitch, Curvilinear Profile Systems G, H, R and S, Belts and Pulleys
ISO 17396 – Synchronous Belt Drives – Metric Pitch, Trapezoidal Profile Systems T and AT, Belts and Pulleys
ISO 19347 – Synchronous belt drives -- Imperial pitch trapezoidal profile system -- Belts and pulleys

USA

RMA/ARPM IP-20 – Classical V-Belts and Sheaves (A; B; C; D; Cross Profiles)
RMA/ARPM IP-21 – Double (Hexagonal) Belts (AA; BB; CC; DD Cross Profiles)
RMA/ARPM IP-22 – Narrow Multiple V-Belts (3V; 5V; and 8V Cross Profiles)
RMA/ARPM IP-23 – Single V-Belts (2L; 3L; 4L; and 5L Cross Profiles)
RMA/ARPM IP-24 – Synchronous Belts (MXL; XL; L; H; XH; and XXH Belt Profiles)
RMA/ARPM IP-25 – Variable Speed V-Belts (12 Cross Profiles)
RMA/ARPM IP-26 – V-Ribbed Belts (PH; PJ; PK; PL; and PM Cross Profiles)
RMA/ARPM IP-27 – Curvilinear Toothed Synchronous Belts (8M – 14M Pitches)
ASAE S 211.... – V-Belt Drives for Agricultural Machines
SAE J636b – V-Belts and Pulleys
SAE J637 – Automotive V-Belt Drives

DATA SHEET
FOR THE CALCULATION/CHECKING OF DRIVES

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Company

(stamp)

For test	☐	New drive	☐
For initial production	☐	Existing drive	☐
For series production	☐	Usage ____________ belts/year	

Fitted with:

Number	Size	Manufacturer

Prime Mover

Type (e.g. electric motor, diesel engine 3 cyl.) ____________________

Size of starting torque (e.g. MA = 1.8 MN) ____________________

Method of starting (e.g. star delta) ____________________

Operational hours per day ____________________ hours

Number of starts __________ per hour ☐ per day ☐

Rational reverses __________ per minute ☐ per hour ☐

*Power: P normal ____________________ kW

P maximum ____________________ kW

or maximum torque __________ Nm at n_1 __________ r.p.m.

*Speed n_1 ____________________ r.p.m.

Position of shafts: horizontal ☐ vertical ☐

angled ☐ ∡ __________ °

Maximum allowable shaft loading $S_{a\ max}$ __________ N

*Datum or outside diameter of pulley:

d_{d1} __________ mm d_{a1} __________ mm

$d_{d1\ min}$ __________ mm $d_{a1\ min}$ __________ mm

$d_{d1\ max}$ __________ mm $d_{a1\ max}$ __________ mm

Pulley face width $b_{2\ max}$ __________ mm

Driven Machine

Type (e.g. lathe, compressor) ____________________

Start: loaded ☐ unloaded ☐

Nature of load: constant ☐ pulsating ☐

shock ☐

Rating: P normal ____________________ kW

P maximum ____________________ kW

or maximum torque __________ Nm at n_2 __________ r.p.m.

Speed n_2 ____________________ r.p.m.

$n_{2\ min}$ ____________________ r.p.m.

$n_{2\ max}$ ____________________ r.p.m.

Maximum allowable shaft loading $S_{a\ max}$ __________ N

Datum or outside diameter of pulley:

d_{d2} __________ mm d_{a2} __________ mm

$d_{d2\ min}$ __________ mm $d_{a2\ min}$ __________ mm

$d_{d2\ max}$ __________ mm $d_{a2\ max}$ __________ mm

Pulley face width $b_{2\ max}$ __________ mm

Speed ratio i __________ i_{min} __________ i_{max} __________

•Centre distance a __________ mm a_{min} __________ mm a_{max} __________ mm

Tension/guide pulleys: inside ☐ in drive slack side ☐

outside ☐ in drive tight side ☐

d_d __________ mm V-pulley ☐ movable ☐ (e.g. spring loaded) __________

d_a __________ mm flat pulley ☐ fixed ☐

Operating Conditions: Ambient temperature __________ °C minimum

__________ °C maximum

Exposure to oil ☐ (e.g. oil mist, droplets) __________

water ☐ (e.g. spray) __________

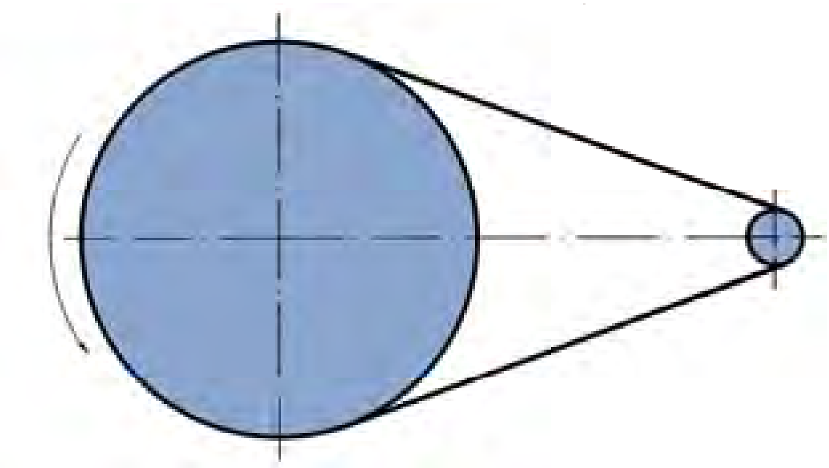
acid ☐ (type, concentration, temperature) __________

dust ☐ (type) __________

* required
• optional

Special conditions: Where the drive is subjected to unusual conditions, e.g. inside or outside idler pulleys, 3- or multi-pulley drives, as well as drives with reverse rotational direction, drawings are required. Please use the back of this data sheet for sketches.

Details about the drive:



DATA SHEET
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Company

(stamp)

For one off use ☐ New drive ☐
For series production ☐ Existing drive ☐
Usage ________ belts/year

Fitted with:

Number	Section/Length	Top surface	Manufacturer

Prime Mover

Type (e.g. geared motor) ____________
Size of starting torque (e.g. MA = 1.8 MN) ____________
Method of starting (e.g. star delta) ____________
Start under load ☐
unloaded ☐
Operational hours per day ____ ________ hours
Number of starts ________ per hour ☐ per day ☐
Power: P normal ________ kW
P maximum ________ kW
or maximum torque ________ Nm at n_1 ________ r.p.m.
Rotational speed n_1 ________ r.p.m.
Rotational speed n_2 ________ r.p.m.
Conveying speed min. ________ m/min
max. ________ m/min
Continuously variable yes ☐
no ☐
Maximum allowable shaft loading $S_{a\ max}$ ________ N
Datum or outside diameter of the driver pulley:
d_{d1} ________ mm d_{a1} ________ mm
$d_{d1\ min}$ ________ mm $d_{a1\ min}$ ________ mm
$d_{d1\ max}$ ________ mm $d_{a1\ max}$ ________ mm
Datum or outside diameter of the guide pulleys:
d_{d2} ________ mm d_{a2} ________ mm
$d_{d2\ min}$ ________ mm $d_{a2\ min}$ ________ mm
$d_{d2\ max}$ ________ mm $d_{a2\ max}$ ________ mm
Speed ratio i ________ i_{min} ________ i_{max} ________
Position of shafts: horizontal ☐ vertical ☐
angled ☐ ∡ ________ °
Overall width of the system ________ mm
Drive centre distance a ____ mm a_{min} ____ mm a_{max} ____ mm
Allowance for tensioning − ________ mm + ________ mm
Tension/guide pulleys: inside ☐
outside ☐
d_d ________ mm d_a ________ mm

Supporting pulleys V-pulleys ☐ flat pulleys ☐
Bearings plain ☐ ball ☐
Number ________ pieces
d_d ________ mm d_a ________ mm
Spacing t ________ pieces
Support rails flat ☐ V-grooved ☐
Material (e.g. steel, plastic) ________

Conveyed Material

Type (e.g. concrete slabs) ________
Condition of the corners round ☐
sharp ☐
Conditions of the contact surface rough ☐
smooth ☐
Conveyed horizontally ☐ vertically ☐
inclined ☐ ∡ ________ °
downwards ☐ upwards ☐
Dimensions l x w x h [mm] ________ x ________ x ________
Motion continuous ☐ cycled ☐
collected ☐

Operating Conditions

Ambient temperature ________ °C minimum
________ °C maximum
Exposure to oil ☐ (e.g. oil mist) ________
water ☐ (e.g. spray) ________
acid ☐ (type, concentration, temperature) ________
dust ☐ (type) ________
In the open air yes ☐
no ☐

The back of this data sheet is provided for sketches of the drive arrangement. Please include the dimensions of all the pulleys and idlers used in the proposed design.