V-Belt Design Hints

A guide to longer V-Belt life

Design Hints
Properties

This table is provided to assist in specifying an Optibelt drive element for a particular drive application.	Temperature resistant from ... to ... (°C)			Oil resistant		Electrically conducting (after testing)	S=C plus Set Constant M=S Matched Set	API Approval No. 1B-0002 No. 1B-0002.1	Mining approval	Smooth running	Permanent stretch	
	Standard construction	Special construction XHR	Special construction XCR	Standard construction	Special construction XOR						Standard construction	Special Construction
SK Wedge Belts	- 40 +70	- 35 +90	- 70 +70	condi tional	Good	Yes	Yes	Yes in addition: 5V/15N* 8V/25N*	Yes	Medium/ good	Low	Very low
Super TX M=S Moulded Cogged Raw Edge Belts	- 30 +90		- 40 +80	condi tional		Yes	Yes	Yes		Good	Very low	
Marathon 1, Marathon 2 M=S Fan Belts	- 30 +90		- 40 +80	condi tional		No	M2 yes			Good	Very low	
VB Classical V-Belts	- 40 +70	- 35 +90	- 70 +70	condi tional	Good	Yes	Yes	A/13; B/17; C/22; D32	Yes	Medium/ good	Low	Very low
KB Kraftbands	- 40 +70	- 35 +90	- 70 +70	condi tional		Yes		A/HA**; B/HB**; C/HC; D/HD; 3V/9J**; 5V/15J**; 8V/25J		Good	Low	Very low
DK Double V-Belts	- 40 +70	- 35 +90	- 70 +70	condi tional		Yes				Medium	Low	
Super VX Variable Speed Belts	- 30 +80		- 40 +80	condi tional		Yes				Very good	Very low	
RB Ribbed Belts	- 30 +90			condi tional		condi tional				Very good	Low	
ZR Timing Belts	- 30 +85	- 30 +120	- 50 +80	condi tional	Good	Yes				Very good	Low	
RR Polyurethane Round Section Belting	- 40 +120			condi tional		No				Medium	High	
Optimat-OE Open Ended V-Belting, Punched DIN 2216	- 20 +70			condi tional		No					High	
PKR Endless V-Belts with Patterned Top Surfaces	- 30 +70			condi tional		Yes					Low	Very low
Optimax-HF High Capacity Flat Belts	- 20 +110			condi tional		No		* also with Aramid ** also with raw- edged belts		Very good	Low	

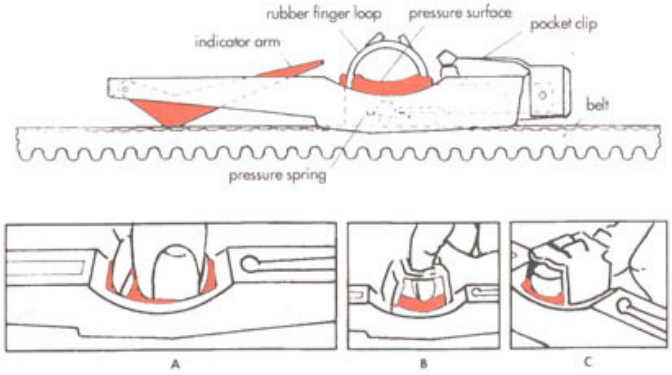
Design Hints
Properties

Recommended max. belt speed m/s	Efficiency	Behaviour under shock loading	Vibration behaviour	Speed regulatiobn by adjustable pulleys	Synchronous running	Recommended max. speed ratio	Use with outside idler pulleys		Maintnenance	Main Areas of Application There are a number of areas of application and uses to which a specific type of belt cannot be clearly allotted. Here, the choice of belt must be decided from case to case
							Standard Construction	Special Construction		
< 42	Up to 97%	Good	Low	Possible	No	Up to 1:10	Limited	Good	Low	Plate compressors, mixers, rotary printing machines, extruders, screw compressors, web machines, axial flow fans, rotary compressors
Varies with profile < 42	Up to 97%	Good	Low	Possible	No	Up to 1:12	Limited	Good	Low	Fans, pumps, mixers, crushers, special machines, lathes and drills, grinding machines
< 42	Up to 97%	Good	Low	Possible	No	Up to 1:12	condi tional		Maintenance-free	Automobiles, generators, water pumps, fans
< 30	Up to 97%	Good	Low	Possible	No	Up to 1:12	condi tional	Good	Low	Pumps, presses, breakers, circular saws, pillar drills, planing machines, concrete mixers, compressors, lawn mowers, aerators
Varies with profile < 42	Up to 97%	Very good	Very low	Not possible	No	Up to 1:15	condi tional	Good	Low	Fans, shredders, road millers, extruders, rotary lawn mowers, stone breakers, saw mills, vibration rollers, parcel conveyors, mixers
< 30	Up to 95%	Good	Low	Not possible	No	Up to 1:5	Very good	Very good	Low	Special drives with reversing facility, looms, sweepers, harvesters
Varies with profile < 42	Up to 95%	Good	Low	Good	No	Up to 1:12 with 2 adj. pulleys	condi tional	Good	Low	Special drives, compacting units, multicolour offset printing machines, adjustable pulley sets, threshing drum drives, spoolers
Varies with profile < 60	Up to 96%	Good	Very Low	Not possible	No	Up to 1:35	Good		Low	Offset machines, washing machines, milling machines, polishers, hub assemblies, main spindle drives
Varies with profile < 80	Up to 98%	Sensitive	Speed dependant	Not possible	Yes	Up to 1:10	Good		Maintenance-free	Copiers, mixers, swivel arm robots, gripper drives, belt sanders, camshaft drives, brush drives, x-ray equipment, coating machines, cameras, plotters, conveyor drives
< 20	Up to 95%	Good	Low	Not possible	No	Up to 1:10	Good		Frequent tightening	Special machines
< 20	Up to 90%	Good	Medium	Possible	No	Up to 1:10	condi tional		Frequent tightening	Where installation conditions are difficult
Varies with profile < 20	Up to 95%	Good	Low	Possible	No	Up to 1:10	condi tional	Good	Low	Conveyor systems in the timber industry, in cement works, in agriculture, in the ceramics industry in the glass industry, in ariports
< 20	Up to 95%	Good	Very low	Not possible	No	Up to 1:12	Very good		Low	Water Turbines, sawmills, shredders, screws compressors, roller drives, chuck drives, floor cleaning equipment, hammer mills, mult-position drives

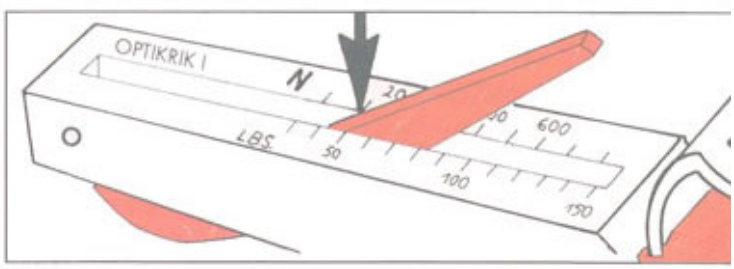
Design Hints

Tensioning for Optibelt Belts

This simplified tensioning method should be used for installation and maintenance tensioning of the belt when the important technical data is unavailable and the optimum tension cannot be calculated. This method requires only knowledge of the small pulley diameter and the belt section and construction. The gauges themselves may be used to set tensions also when the technical data is known and the optimum tension can be calculated.



1. Select the gauge appropriate to the belt section and construction being tensioned. See notes below the simplified tensioning table.
2. The illustration at left shows three ways to hold the gauges so that pressure is applied to the black pad only.
3. Position the gauge on one of the belts on the drive in the middle of an accessible span length. Take care to ensure that the gauge is only in contact with one of the belts, and the indicator is pushed down into the gauge body. Align the gauge so that its body is parallel with the sides of the belt.
4. Push slowly and firmly on the black pad. When a CLICK is heard, and /or felt, stop immediately and remove the gauge carefully to avoid disturbing the indicator arm.
5. Read the gauge to judge the tension as follows.
6. Turn the gauge sideways to ascertain the exact point where the surface of the black indicator crosses the scale.
7. Mark this point mentally or with a thumbnail and turn the gauge to read the scale.
8. Check the tension found against the simplified tensioning table. Tighten or slacken the belt, as necessary.



Design Hints

Tensioning for Optibelt V-Belts

Section	Diameter of the smallest pulley (mm)	Static Tension (N)					
		Red Power		**S=C Plus/Standard**		**Super TX M=S**	
		Initial installation New Belts	Refitting Old Belts	Initial installation	Retension after running	Initial Installation	Retension after running
	≤ 71	250	200	200	150	250	200
SPZ; 3V/9N;	> 71 ≤ 90	300	250	250	200	300	250
XPZ; 3VX/9NX	> 90 ≤ 125	400	300	350	250	400	300
	> 125*						
	≤ 100	400	300	350	250	400	300
SPA;	> 100 ≤ 140	500	400	400	300	500	400
XPA	> 140 ≤ 200	600	450	500	400	600	450
	> 200*						
	≤ 160	700	550	650	500	700	550
SPB; 5V/15N;	> 160 ≤ 224	850	650	700	550	850	650
XPB; 5VX/15NX	> 224 ≤ 355	1000	800	900	700	1000	800
	> 355*						
	≤ 250	1400	1100	1000	800	1400	1100
SPC;	> 250 ≤ 355	1600	1200	1400	1100	1600	1200
XPC	> 355 ≤ 560	1900	1500	1800	1400	1900	1500
	> 560*						
	≤ 50	-	-	90	70	120	90
Z/10;	> 50 ≤ 71			120	90	140	110
ZX10/X10	> 71 ≤ 100			140	110	160	130
	> 100*						
	≤ 80	-	-	150	110	200	150
A/13;	> 80 ≤ 100			200	150	250	200
AX/X13	> 100 ≤ 132			300	250	400	300
	> 132*						
	≤ 125	-	-	300	250	450	350
B/17;	> 125 ≤ 160			400	300	500	400
BX17/X17	> 160 ≤ 200			500	400	600	450
	> 200*						
	≤ 200	-	-	700	500	800	600
C/22;	> 200 ≤ 250			800	600	900	700
CX/X22	> 250 ≤ 355			900	700	1000	800
	> 355*						

* Belt tension for these pulleys must be calculated.

Tension Gauges:

Optikrik 0	Range: 70 – 150 N
Optikrik I	Range: 150 – 600 N
Optikrik II	Range: 500 – 1400 N
Optikrik III	Range: 1300 – 3100 N

The static tension values shown are calculated for maximum power transmission capability per belt and should be applied only when accurate drive data is not available.

Calculation limitations

Wedge belts	Belt speed v = 5 to 42 m/s
Classical belts	Belt speed v = 5 to 30 m/s

Design Hints
Installation, Maintenance and Storage

Correct design of drives using V-Belts ensures long belt life and a high degree of operating safety. Premature failure can often be traced back to faulty installation or maintenance, thus the following recommendations are very important.

- **Safety**
  Before beginning any maintenance it is extremely important that all drive motors and other drive components are completely turned off. Care should be taken that these cannot be switched on again while work is taking place. This will ensure the safety of maintenance workers.

- **Pulleys**
  The grooves should be in good condition, free from scores or sharp edges, and all dimensions should conform to the relevant standard.

- **Alignment**
  Shafts and pulleys should be correctly aligned prior to belt installation. We recommend a maximum tolerance of +/- 1/2° in both planes.

- **Multiple V-Belt Drives**
  For multiple V-Belt drives it is necessary to assemble the belts in matched sets either by measurement or by examination of the manufacturers code numbers or other markings. It may also be necessary to remeasure the belts if they have been stored for any length of time. Optibelt V-Belts in S=C plus and Optibelt Super TX M=S construction may be used in matched sets without the need to reference code marks, measurement, or remeasurement after storage.

- **Installation of the V-Belts**
  The drive centre distance should be reduced prior to the installation of the belts so that they may be be fitted without undue force. The severe stresses placed upon V-Belts if they are forced over the pulley flanges can damage the cover fabric and the high quality, low stretch tension members.

- **Belt Tensioning**
  The drive should be tensioned (see initial installation) correctly and retensioned (see re-tension) after between 30 minutes and 4 hours at full load, to compensate for the small initial belt stretch and "bedding" into the pulley grooves.

- **Idler Pulleys**
  Where possible the use of idler pulleys should be avoided. If for design reasons, such an arrangement is necessary, then an inside idler should be used in preference to an outside idler. For other details refer to our technical manual.

- **Maintenance**
  It is recommended that V-Belt drives should be regularly inspected for the loss of belt tension, unusual heat build-up or wear. Retension or replace when necessary. Should an individual belt in a matched set require replacement for any reason, a complete new set must be fitted. Belts from different manufacturers must not be mixed on the same drive. Optibelt V-Belts need no special attention. Belt dressings must not be used.

- **Summary**
  The physical properties of correctly stored V-Belts will not change over a period of many years (see also DIN7716). In poor storage conditions and with incorrect handling, rubber products are, however, subject to changes in their physical properties.

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

- **Temperature**
  The storage temperature should be between +15°C and 25°C. Normally lower temperatures are not detrimental to V-Belts. Since, however, they become very stiff at low temperatures, before fitment they should be warmed to a temperature of approximately 20°C to avoid ruptures and cracks. Radiators and their supply lines should be guarded and the distance between a radiator and the stored V-Belts must be at least three feet.

- **Light**
  V-Belts should be protected against light, especially direct sunlight and high intensity artificial light having a high ultra violet content (ozone formation) such as naked fluorescent tubes. Illumination utilizing conventional light bulbs is advisable. Where possible windows should be painted with a red or orange protective paint. Under no circumstances should blue be used.

- **Ozone**
  In order to counteract the harmful effects of ozone, warehouses should not contain any ozone producing applications, for example fluorescent lights, mercury vapor lights or high voltage electrical equipment. Combustion gases and vapors which may lead to the formation of ozone by photo chemical processes must be avoided or eliminated.

- **Moisture**
  Damp store rooms are unsuitable. Care must be taken to ensure that condensation does not occur. The most favourable relative air humidity is 65%.

- **Storage**
  Because stresses can promote both permanent deformation and the formation of cracks, care must be taken to ensure that V-Belts are stored without stress, i.e. without tension, pressure or any other form of deformation. If V-Belts are stored horizontally and stacked upon each other, it is recommended that the stack height does not exceed 300mm to avoid deformation. If, 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 section.

- **Cleaning**
  Contaminated V-Belts can be cleaned using a 10:1 glycerine-spirit mixture. Petrol, diesel and turpentine amongst others should not be used. In addition, sharp edged objects, wire brushes, emery paper etc. must not be used; such action is damaging.

Design Hints
Problems – Causes – Remedies

Problems	Causes	Remedies
Belt breaking after fitting	Forcing belt over pulley when fitting, damaging cord and cover	Reduce drive centre distance to fit belt
	Ingress of a foreign body, i.e. a stone, during running	Fit an effective guard
	Insufficient belts, or wrong section, for drive	Check drive details and fit correct number or section of belts
	Drive stalled	Ascertain cause and put right
Cuts and splits in the base of the belt	Outside idler pulley in use	Replace with inside idler pulley on the slack side of the drive. Increase the size of the existing idler. Use Optibelt special construction
	Pulley diameter too small	Redesign using recommended minimum pulley pitch diameters. Use Optibelt special construction such as Optibelt Super TX M=S
	Ambient temperature too high (above +70°C)	Ensure good ventilation and protect the belts from direct heat. Use Optibelt-XHR special construction (extra heat resistant)
	Ambient temperature too low (below -40°C)	Warm area surrounding drive. Use Optibelt-XCR special contruction. (extra cold resistant)
	Abnormal belt slip	Check drive design to ensure correct number of belts, redesign if necessary. Check drive tension
	Contamination by oil or chemicals	Protect drive from contamination. Use Optibelt-XOR special construction special
Severe belt vibration	Drive has insufficient belts	Check drive design and modify if necessary
	Centre distance longer than recommended	Shorten centres. Use an inside idler on the slack side of the drive. Redesign using Optibelt-KB Kraftbands.
	High shock loading	Use Optibelt-KB Kraftbands. Use an inside idler pulley in the slack side. Refer to our engineers for recommendation of special construction
	Too low belt tension	Correct
	Unbalanced pulleys	Balance pulleys
Belts cannot be retensioned	Insufficient allowance for stretch in drive design	Modify drive to allow more take-up
	Excessive stretch caused by insufficient belts or wrong belt section for drive	Recalculate drive design and modify
	Incorrect belt length	Use a shorter belt
	Belts from different manufacturers used on same drive	For use as a matched set, belts must be from one manufacturer.

Design Hints
Problems – Causes – Remedies

Problems	Causes	Remedies
Belts turn over in pulleys	Poor drive alignment	Realign
	Incorrect pulley groove section or excessive wear in grooves	Renew pulleys
	Excessive belt flap	Use an inside idler on drives slack side or Optibelt-KB Kraftbands
	Low belt tension	Retension
	Worn out belts	Renew belts
	Ingress of foreign body	Use an effective belt guard
Excessive wear on belt flanks	Incorrect pulley groove angle	Renew or remachine pulleys
	Incorrect pulley section	Renew pulleys
	Excessive wear in pulley grooves	Renew or remachine pulleys
	Poor drive alignment	Realign
	Small pulley diameter below recommended minimum	Redesign using correct pulley diameters. Use a special constuction such as Optibelt Super TX M=S
	Belt catching on protruding parts	Remove protrusions or move drive away
Excessive noise	Poor drive alignment	Realign
	Incorrect belt tension	Retension
	Overloaded drive	Check drive details and redesign if necessary
	Unbalanced pulleys	Balance pulleys
Belt swelling or softening	Contamination by oil or other chemicals	Protect drive from contamination. Use Optibelt-XOR (extra oil resistant) or Optibelt Super TX M=S construction. Clean pulley grooves with petrol or alcohol before fitting new belts
Unusual belt stretch	Worn or badly machined pulley grooves	Remachine or renew pulleys
	Used belts mixed with new belts on the drive	Replace with a completely new set of belts
	Belts from different manufacturers used on the same drive	Belts must be from one manufacturer