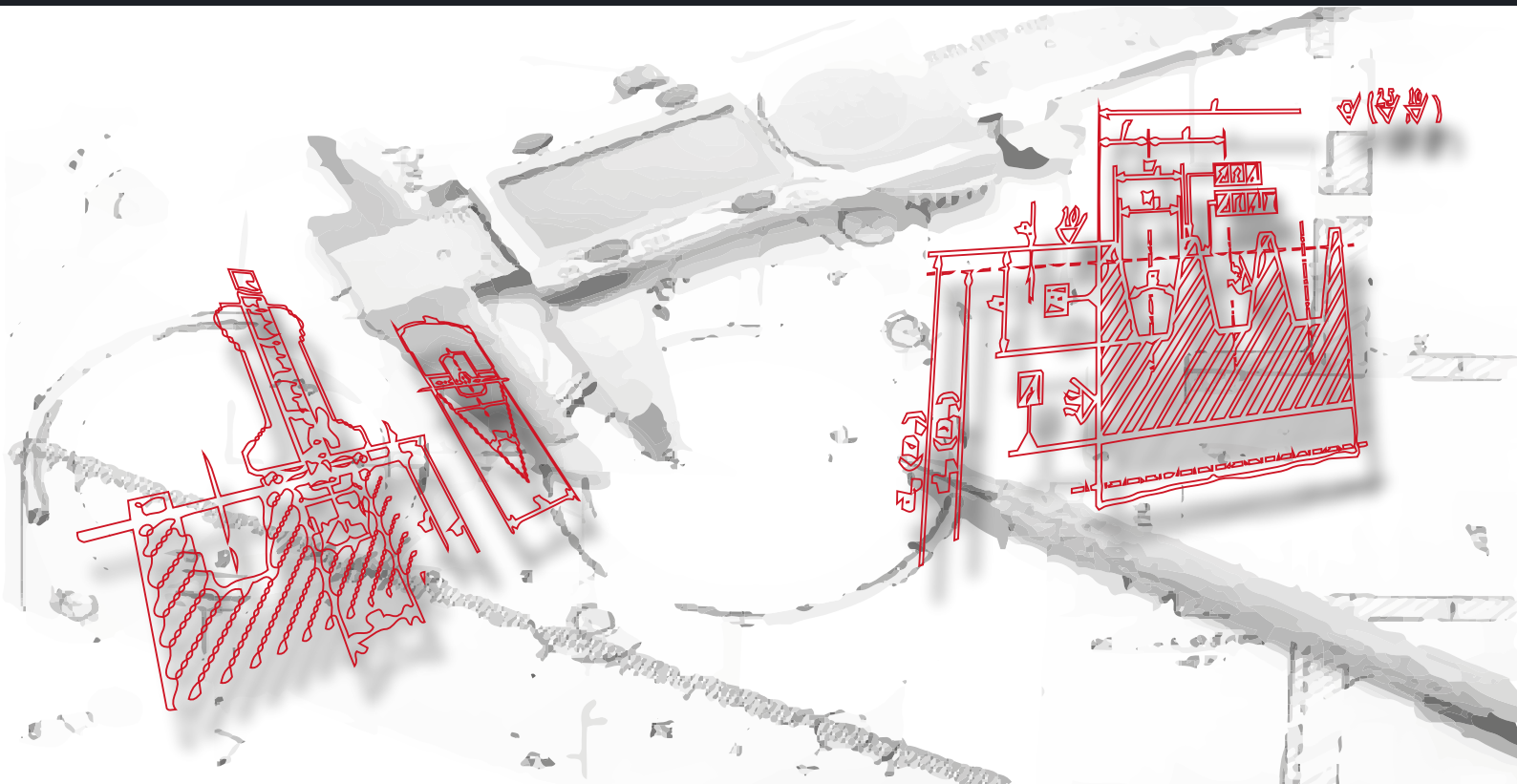
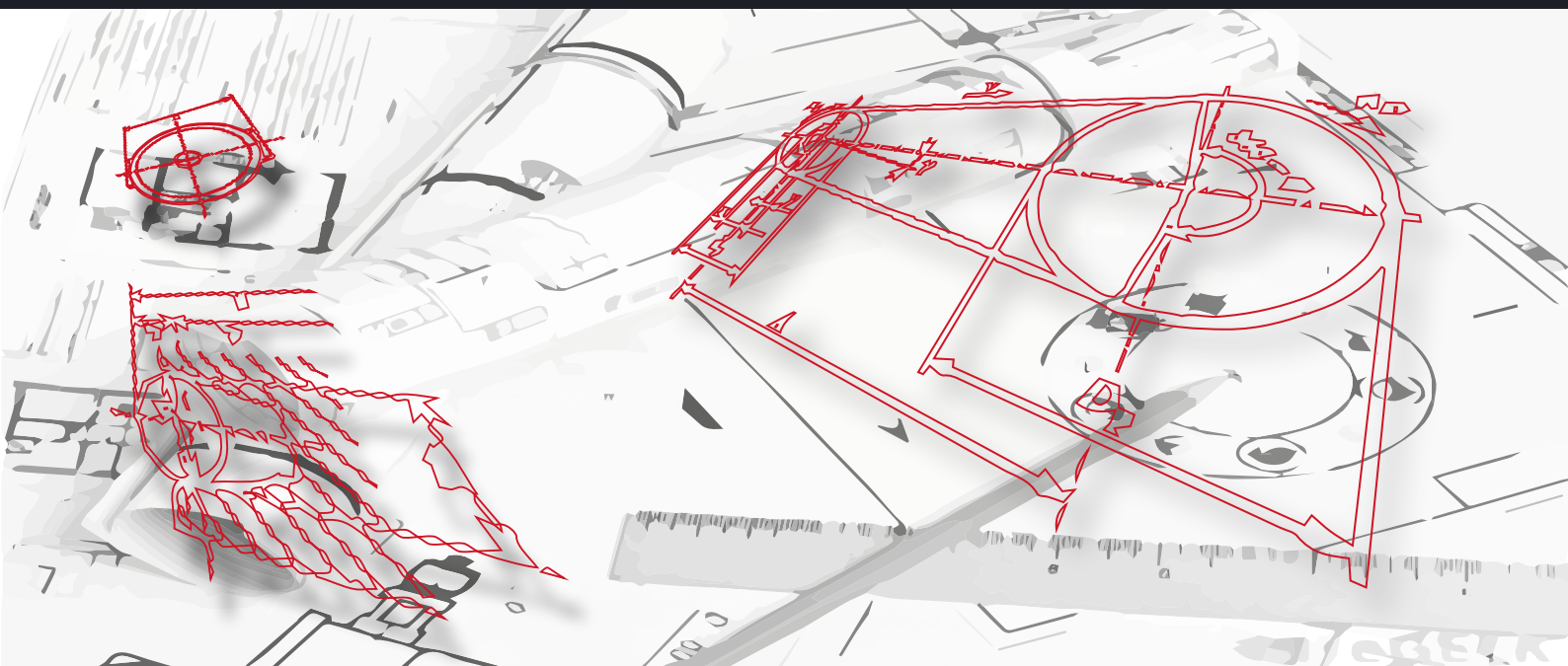


ENGINEERS GUIDE



General purpose belt gearings with v-belts produced by Sanok Rubber Company SA used in the construction on machines and devices





**GENERAL PURPOSE BELT GEARINGS
WITH V-BELTS PRODUCED BY SANOK RUBBER COMPANY SA
USED IN THE CONSTRUCTION ON MACHINES AND DEVICES**

ENGINEERS GUIDE

EDITION 5th - REVISED, 2017

BY:

Eng. WOJCIECH STAREGO, MSc

Spis treści

1 General Information

Introduction	1
Advantages of gearings with V-belts	1
Factors influencing belt durability	1
Rules of correct gearing utilization with V-belts	3
Typical failures of V-belts and their reasons	4

2 V-belts of general purpose used in belts drives of machine and devices

V-belts produced by Sanok Rubber Company SA	6
Narrow-profile V-belts (narrow) produced by Sanok Rubber Company SA	7
Normal profile V-belts (classical) produced by Sanok Rubber Company SA	11
Power bands produced by Sanok Rubber Company SA	17

3 Calculations of gearing with V-belts produced by Sanok Rubber Company SA

Number of belts in the gearing	21
Guidelines to choose V-belt profile	21
Coefficient of work conditions k_r	23
Coefficient of work conditions k_ϕ	25
Coefficient of length k_L	26
Rated powers N_1 transferred by one V-belt	28
Formulas and markings	40
Example of belt gearing calculations with two pulleys	41

4 Grooved pulleys

Grooved pulleys for single belts	45
Grooved pulleys for power bands	50

5 Tension of belts

Tension belt control by measurement of tie rod belt deflection	53
Tension belt control by measurement of revolutions	55
Tension belt control by measurement of static axial force	56
Designation of axial load in dynamic state	56

General Information

Introduction

Engineers Guide discusses, used in engineering industry, V-belts gearings produced by Sanok Rubber Company SA was developed in order to provide hints in correct gearing parameters selection. Following information create basic guidelines regarding product usage but do not exempt from the duty to fulfill rules of machines and devices designing as well as health and safety regulations.

Following handbook includes suggestions of correct gearing handling and maintenance, specification of narrow profile, normal profile and power bands produced by Sanok Rubber Company SA used to drive gearings in engineering industry, as well as information necessary for correct stating:

- size and number of belts to transmit required power;
- dimensions of belt pulleys;
- length of belt and axle base;
- conditions of work and maintenance;
- conditions of storage.

V-belts produced by Sanok Rubber Company SA fulfill requirements of producers of automotive vehicles, mining industry, engineering industry, railroad and many others. This product is manufactured over 40 years and production process is continuously modernized. Usage of quality management system (Certificate RW TUV from Essen for compliance of Sanok Rubber Company SA quality system with standard EN ISO 9001), ensure obtaining excellent product which fulfill its designation without any reservations. Sanok Rubber Company SA V-belts are designed to fulfill expectations of the most demanding users.

Production process includes many groups of V-belts, which are used in industry drives, agricultural drives, automotive industry drives and many others. Standard offer of Sanok Rubber Company SA includes following V-belts:

- narrow profile (narrow);
- normal profile (normal);
- power bands;
- wide profile;
- variator;
- two-side action;
- flat drive belts;
- microbelts.

At the request of customers we also produce not typical V-belts of dimensions and properties agreed individually.

To deliver our products directly to our customers, distribution network of specialized distributors was created, who possess full range of V-belts. List of distributors is given on the last page.

Advantages of gearings with V-belts

Belt gearing with V-belts guarantee quiet, calm and smooth operation. Its advantage is a possibility to smooth sudden load changes as well as damping of vibrations. Simple and cheap construction (without body and without lubrication) do not require special service and special maintenance what reduce costs of operation. Used up V-belts can be quickly and easily exchanged without prolongation of machine downtime. Belt gearings with V-belts give possibility to move power at long distances as well as big freedom in selection of axle base of pulleys.

The ration can be easily changed by usage of pulleys with number of grooves of different diameters and by moving a belt from one groove to other ones. The advantage of belt gearing is that drive is not transferred during overloads of short duration, what protects other mechanisms of drive from excessive overloads what could lead to their damage. Belt gearings are not very sensitive at imperfections of mutual setting of pulley axis. Belt drives give possibility for power distribution i.e. drives transferring from one shaft to other ones.

Czynniki wpływające na trwałość pasa

a) Number of belts in one set

Belt gearing is designed for optimal number of used belts. If the number of belts in one set decrease, lifetime of remain belts lowers disproportionately. If for example: according to calculations drive requires usage of 10 belts, and if one belt will be removed, lifetime of remain belts decreases not by 10% but by 30%.

b) Belt tension

For excellent drive transferring and for reaching required belts durability a very important factor is to ensure correct belts tension. Belts should be tensioned as appearing slippage at the pulley not exceed 1%.

Too small tension causes excessive belts slippage at belt pulley; too big tension – decrease belt lifetime as well as quicker bearings wear in propulsion machinery and driven machinery.

During machines transportation and during storage is required to lower belts tension.

As the tension was correct it is recommended its calculation, performing and controlling according to methods described in chapter 5.

c) Correct belt pulley selection

Important factor of reliability and equal operation of V-belts is exact fulfilling of conditions specified for belt pulleys:

- belts should work at grooved pulleys of dimensions fitted to belt section, as only side (working) walls of belt were in contact with walls of pulley grooves;
- pulley grooves should be smooth, without deformations, snagging and contaminations, particularly grease and oils. Surface coincides of groove pulleys should not be painted.
- all grooves edges of belt pulleys should be rounded of radius $r > 1 \text{ mm}$;
- minimal recommended diameter of pulley for given belt section should be observed unless compactness of gear is going to be reached at all costs, even at the expense of reduced efficiency and lowering of belt lifetime;
- all wheel belts should be balanced statically (degree of quality Q in accordance to VDI 2060); additionally for wheel belts which peripheral speed exceed 30 m/s, or if a ratio of diameter to width of pulley rim $d_{p/s} < 4$ while $v > 20 \text{ m/s}$, should be balanced dynamically (degree of quality Q 6.3);
- with respect to belt lifetime is recommended to use pulleys of big diameters, for which belt speed should be between **25-30 m/s**;
- grooved pulleys should be made according to recommendations included in chapter 4.

d) Belts coupling in belt units

In order to transfer a power which increase a power transferred by one belt, special units are used which consist of a few single belts of the same section and the same length, completed in one unit or power bands are used. In determining number of belts in a gearing it is necessary to remember, that in most favorable conditions works single belt. In multibelt gearing all dimension differences particular belts and grooves at pulleys create parasitic circulating power and increase belts slippages what negatively affect gearing efficiency and belts lifetime. In comparison with belt units better conditions of power transferring possess power bands.

In multibelt drives, to ensure comparable tension of each single belt is necessary to use selected belts with respect to length tolerance. Tolerance of length in belt unit is considerably lower in relation to tolerance of belts which do not work in the same set. Sanok Rubber Company SA produce also belts of small length tolerance (with marking $L=L$), which do not require complementing in belt units. In case of damage of one belt is necessary to exchange whole belt unit. Belts of different producers should not be joined in one belt unit.

Power bands must not be used at pulleys of belt units.

e) Usage of tension rollers

In a gearing, where is not possible to strain a belt by changing a distance between driving machine and driven machine, a tension roller can be used for belt tension. Other phenomenon, which require usage of tension roller are vibration of long belt tie rod of small tension or short tie rod during rapid load changes.

Each usage of rollers increase frequency of belt inflection and introduce additional bending stresses, what shorten its lifetime.

Tension rollers can be placed outside and inside of belt. Tension rollers placed outside of a belt cause belt deflection in the opposite direction then during normal operation, what seriously shorten belt lifetime. So is decisively recommended to use tension rollers from inside of belt.

Dimensions of grooves of internal rollers should be the same as dimensions of grooves for work pulleys. For power bands and normal profile belts is allowed to use flat internal rollers. Diameter of internal roller should be bigger or equal minimal diameter recommended for given belt section. Internal roller decrease angle of wrap, so is necessary to place it as close as possible to a big pulley.

External rollers must be flat and must possess diameter bigger or equal 1,5 of minimal diameter, recommended for given belt section. External roller increases wrap angle, so it must be placed as close as possible to small pulley.

External and internal tension rollers should be placed from the passive tie rod side (loose); this exclude change of gearing rotation.

f) Cleanliness

Belt gearing is sensitive for chemical influence of environment, its temperature and humidity, as well as lubricants and pollutions. In case a gearing operate in an environment of increased pollution, then it should be protected by special covers. Power bands require special protection from environmental pollution.

Oils and lubricants cause decreasing of coupling between belt and pulley as well chemically affect at belt causing its quick destruction.

Minor pollutions like dust and sand cause quicker grinding of side walls of belt and pulley. Big pollutions like stones can cause destruction (snagging) of belt pulley or belt rapture.

Belt gearing should be screened and protected from direct influence of environmental conditions.

g) Storage of belts

Properly stored V-belts do not lose their properties rods for years. Rubber products stored in adverse conditions together with bad handling change physical properties. These changes are caused by influence of oxygen, ozone, extremely unfavorable temperatures, light, humidity or solvents.

Storehouse should be dry and free of dust. Belts should not be stored together with such materials like: solvents, fuel, lubricants, acids and other chemicals.

Low temperatures of storage are not usually harmful for V-belts, but because they are getting rigid in low temperatures, is necessary to heat them until +20°C. Belts should be protected from direct influence of heat sources.

V-belts should be protected from light, mainly from direct solar radiation as well as strong artificial light with large share of ultraviolet as for example not covered fluorescent lamps (ozone is created). To protect from harmful ozone influence, storage compartments can't possess appliances which create ozone, for example: fluorescent light sources, mercury lamps, electrical high voltage devices, etc.

Compartments of big humidity are not good for storage of V-belts. Relative humidity of air is best for V-belts if is lower 65%.

Pay attention to store belts in not-tensioned state as well as not distorted state. If there are stored in a hanging position, then the mandrel the belts are hanged should have diameter at least 10 times bigger than belt thickness.

Rules of correct gearing utilization with V-belts

After a gearing was mounted and belts were adjusted generally belt gearing do not require any maintenance work. To ensure satisfactory and error-free belt gearing operation as well as long lifetime of belts, following hints should be observed:

- while designing a gearing possibility of changing the distance between pulley belts must be taken into account in order to facilitate belt installation and then its tensioning in order to achieve required slippage (taking into account 1,5% possibility of total extension of belt length during its operation, as well as 1% tolerance of belt length);
- pulley belts should be made in accordance to dimensions and requirements included in following handbook in chapter 1.3.c);
- grooves of pulley belts must be clean, without any damages and rust protective substances. Belt should be exactly set in grooves as its whole side surface was in contact with groove walls; is not acceptable a belt was in contact with pulley by its bottom surface (exception: special drives as for example flat-V-belt drives);
- earlier exchange of broken (used-up) belt pulleys protect from unexpected failures of belts and gearing;
- is not acceptable to use whenever substances which increase adhesion a belt to a pulley; this is superfluous and what's more harmful;
- belts should be mounted manually and while least groove pulleys spacing; using any auxiliary tools in forbidden;
- after exact belts setting inside their grooves, tension should be preliminary adjusted; then gearing should be steered for a short period of time without load, then tension should be corrected again;
- maximal non-parallelism of gearing pulleys axes must not be bigger then 1 mm by 100 mm axis length, and tolerance their mutual pulleys grooves displacement must not exceed 0,25% of distance between axis;

- during first hours of operation, belt will be lengthened; during this time correction of its tension is required. According to our experience, after first hour of belt operation under full load, belt is lengthened by 70% of total allowable extension, which is 1,5% of belt length – a gearing must be protected by protective shield;
- tension of belts during normal operation should be periodically checked and adjusted;
- in multi-belts gearings only belt units should be used which consist of specially completed belts in accordance to required length tolerance;
- while one of belts in belt unit is broken, whole belt unit must be replaced by new one;
- in case of V-belts pollution they should be cleaned by glycerin-spirit mixture in a ratio 1:10, other chemical substances should be avoided.

Following sharp objects must not be used to clean belts: wire brush, abrasive paper, etc, because mechanical damages take place at the belt surface.

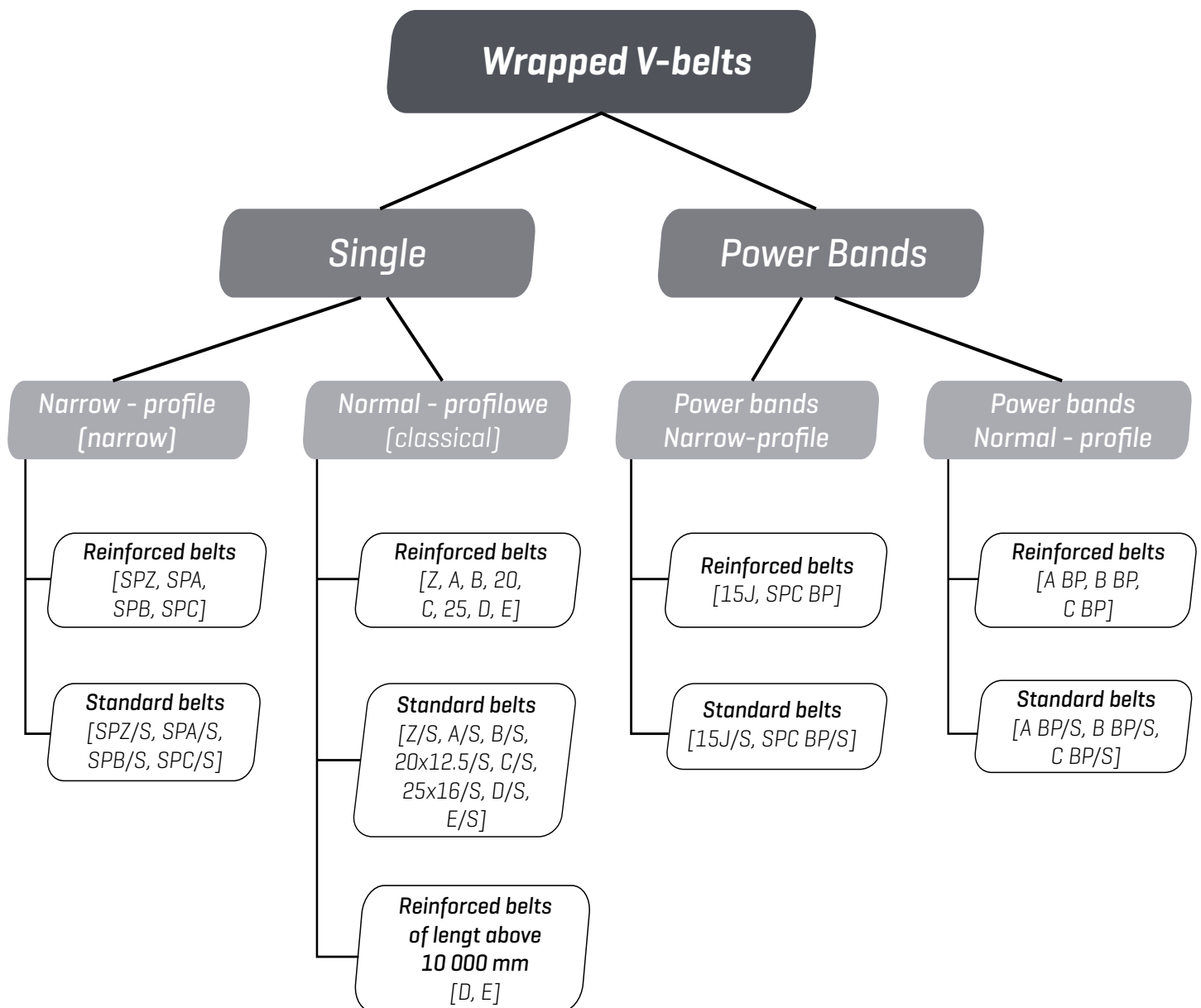
Typical failures of V-belts and their reasons.

Rodzaj uszkodzenia	Prawdopodobne przyczyny
Belt rupture after short period of operation	<ul style="list-style-type: none"> • belt tearing during mounting on pulley; • drive blockage with respect to failure of driven machine or foreign body entrapped inside the drive; • poorly calculated drive with too small number of belts (poorly calculated coefficient of conditions of operation k_T);
One sided over-usage of belt at its side wall	<ul style="list-style-type: none"> • too big not-parallelism of belt pulleys axis;
Earlier usage of side surfaces at whole length of belts.	<ul style="list-style-type: none"> • too big torque (mainly for drives with big start-up torque during driving machine start-up and big resistance torque during start-up of driven machine is necessary to use equipment ensuring soft start); • improper angle or excessive usage of groove of pulley; • too small belt tension; • too often short-term overloads of gearing with respect to failure of driving machine; • too small number of belts; • lack of parallelism of belt pulleys setting; • minimal pulley diameter is exceeded; • surface of grooves possess to big roughness;
Local usage of side surfaces	<ul style="list-style-type: none"> • too small belt tension; • blockage of driven machine pulley with respect to bearing failure;
Grooves at side surface at whole belt length.	<ul style="list-style-type: none"> • belt friction because with contact with part of a machine; • belt works in used-up groove of pulley; • improper groove cross-section;
Transversal belt breakage at the bottom side.	<ul style="list-style-type: none"> • usage of external tension roller instead of internal; • too small diameter of tension roller; • excessive or too small temperature of operation; • too big slippage; • chemical influences; • excessive belt tension;
Indurations and ruptures of a wrap.	<ul style="list-style-type: none"> • strong influence of dust; • too big ambient temperature; • influence of chemicals;
Detachment of cloth wrap and symptoms of rubber bulging.	<ul style="list-style-type: none"> • reason of long-term influence of oil, grease or other chemicals at a belt;

Strong vibration	<ul style="list-style-type: none"> • base of axle bigger than is recommended; • big shock load; • too small belt tension; • non balanced grooved pulleys; • overloaded drive; • angle of groove is not correct;
Twisting of belts	<ul style="list-style-type: none"> • lack of coaxiality in pulleys setting; • not correct belt or groove profile; • excessive vibration; • too small belt tension; • penetration of foreign material into grooves; • overloaded drive;
Falling of belts from pulleys after short period of operation	<ul style="list-style-type: none"> • too small belt tension • too small frequency of control and adjustment of belt tension;
Too loud operation of gearing	<ul style="list-style-type: none"> • belt pulleys are not set coaxial; • too small belt tension; • overloaded drive; • grooved pulleys not balanced;
Uneven belts stretching	<ul style="list-style-type: none"> • faulty belts grooves; • used belts do not create a set of belts; • a few belts from a belt unit were replaced by new ones; • unit of belts composed of from belts of different producers;
Excessive heating of bearings	<ul style="list-style-type: none"> • bearings not lubricated; • grooved pulleys not balanced; • too big tension;
Lowering of speed of driven pulley.	<ul style="list-style-type: none"> • check relationship between diameters of pulleys and their speeds; • too small tension;
Different tension of single belts working in belt unit.	<ul style="list-style-type: none"> • belts do not create a set of belts or do not possess marking L=L; • different pitch diameters of particular grooves in belt pulley; • usage of belts of different quality in one set as well as belts; • coming from different producers; • a few belts from a belt unit were replaced by new ones.

V-belts of general purpose used in belts drives of machines and devices.

V-belts produced by Sanok Rubber Company SA

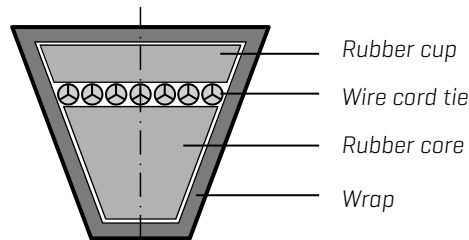


Rys.2.1 Types of V-belts produced by Sanok Rubber Company SA, used in engineering industry.

Narrow profile V-belts (narrow) produced by Sanok Rubber Company SA

Structure and advantages

Narrow-profile V-belts produced by Sanok Rubber Company SA with proven technology, specially developed construction (drawing 2.2) and composition suitably chosen raw materials create reliable element of industry drives as well automotive drives.



Draw. 2.2. Structure of narrow-profile belt (narrow).

Used for production of these belts high quality neoprene, polyester cord and cotton fabric ensure for them durability for temperature and oils.

On custom request antistatic version of belts is also possible.

Cord is impregnated and covered by special rubber mixture what ensure homogeneity of connection between cord and core as well as rubber overlay. Gummed wrapping made of special fabric increase its resistance for abrasion of the surface, big flexibility and fatigue strength. V-belts are continuously tested by static and dynamic control measuring devices. Functioning and continuous development and quality system in our plants ensure to get product of full traceability and repeatability.

Properties of narrow-profile V-belts:

- transmitted powers are highly bigger in relation to powers transmitted by classical V-belts of the same width of the pitch. Thanks to saved installation space costs of complete drive are approximately 30% lower in relation to drive with classical belts;
- a ratio of height to width of belt is approximately 1:1,2;
- lower mass of a belt (in relation to classical belts) lower centrifugal force, what let to increase belt speed until 40 m/s;
- big outside surface of a belt in relation to its cross section improves heat transferring;
- can work at temperatures in a range from -35oC to +100oC;
- minimal diameters of belt pulleys (for proper gearing operation) are bigger for classical belts.

Structural variations and their markings

Narrow-profile V-belts produced by Sanok Rubber Company SA were specially constructed to use in engineering industry. An area of application start from low-loaded drives like rotation pumps until highly-loaded milling drives and stones crushers.

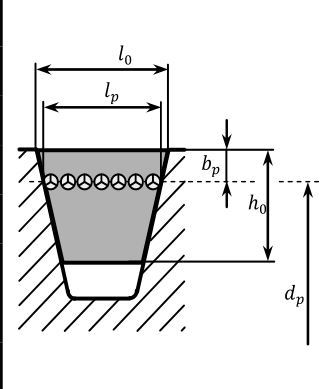
They are produced according to standard PN-ISO 4184.

According to decisions of ISO TC41 committee, narrow-profile belt got marking SPZ, SPA, SPB, SPC (SP—marking of narrow profile, Z; A; B; C, - marking of belt section).

Two structural variations of narrow-profile belts are produced by Sanok Rubber Company SA:

- basic belt version of this profile are reinforced belts marked by symbols: SPZ, SPA, SPB, SPC, (overprint at a belt in yellow color);
- second version of narrow-profile belts are belts of standard type. This is a version, of which belts possess lifetime approximately 25% lower in relation to belts of reinforced version. These belts are marked by following symbols: SPZ/S, SPB/S, SPC/S (overprint at a belt in green color).

Table 2.1. Dimensions of narrow-profile belts.

		Dimensions in millimeters				
		Narrow belt ISO, DIN marking	SPZ	SPA	SPB	SPC
		approximate upper width l_o	9,7	12,7	16,3	22
belt width l_p	8,5	11	14	19		
belt high h_o	8	10	13	18		
height under pitch line b_p	2	2,8	3,5	4,8		
minimal pulley pitch diameter d_{pmin}	63	90	140	224		
1 m belt mass [kg] \approx	0,08	0,14	0,22	0,42		
Acceptable belt speed [m/s]	40					

Determining of the length

Standards ISO and DIN take pitch width l_p (effective) as a basic value for V-belts and grooves standardization. This is width of V-belt, which is unchanged when V-belt is bent at an angle 90° . Pitch length L_p is then belt length measured at the height of its pitch width. So this dimension should be considered as reliable in determine the belt length. Then, determining the length of belt is necessary to pay attention on kind of pitch length and possibly calculate it, using for our belts calculation factors stated in table 2.2.

According to standards, gradation in length (pitch length) is realized in accordance to series of prime numbers R40. Actual production program of Sanok Rubber Company SA covers a lot of lengths behind this series. Accurate information can be find in catalogs of V-belts issued by Sanok Rubber Company SA.

Table 2.2. Recommended length of narrow-profile belts*

Dimensions in millimeters

 SPZ			 SPA			 SPB		 SPC	
L_p			L_p			L_p		L_p	
537	875	1212	723	1232	3750	1250	4000	1800	6700
562	887	1237	757	1250	4000	1320	4250	2240	7100
587	900	1250	782	1320	4250	1400	4500	2360	7500
612	912	1320	832	1400	4500	1500	4750	2500	8000
637	925	1400	857	1500	4750	1600	5000	2650	8500
662	937	1500	882	1600	5000	1700	5300	2800	9000
687	947	1600	932	1700		1800	5600	3000	9500
700	962	1700	957	1800		1900	6000	3150	10000
712	987	1800	957	1900		2000		3350	
719	1000	1900	982	2000		2120		3550	
721	1012	2000	1007	2120		2240		3750	
737	1037	2120	1032	2240		2360		4000	
762	1062	2240	1057	2360		2500		4250	
787	1087	2360	1082	2500		2650		4500	
800	1112	3000	1107	2650		2800		4750	
812	1125		1132	2800		3000		5000	
825	1137		1157	3000		3150		5300	
837	1162		1180	3150		3350		5600	
850	1187		1182	3350		3550		6000	
862*	1200		1207	3550		3750		6300	

 Deviations of pitch length L_p - according to table 2.3.

 Acceptable difference of L_p length working in belt unit – according to table 2.3.

*Accurate information of currently produced belts length can be found from V-belt catalogs issued by Sanok Rubber Company SA

Lengths marked in bold are from series of normal digits R40 i zalecane są przez Sanok Rubber Company SA

$$L_z \gg L_p + 13 \text{ mm}$$

$$L_w \gg L_p - 37 \text{ mm}$$

$$L_z \gg L_p + 18 \text{ mm}$$

$$L_w \gg L_p - 45 \text{ mm}$$

$$L_z \gg L_p + 22 \text{ mm}$$

$$L_w \gg L_p - 60 \text{ mm}$$

$$L_z \gg L_p + 30 \text{ mm}$$

$$L_w \gg L_p - 75 \text{ mm}$$

 L_z - external length of belt

 L_p - pitch length of belt

 L_w - internal length of belt

Mass of 1m: ~ 0,08 kg

Mass of 1m: ~ 0,14 kg

Mass of 1m: ~ 0,22 kg

Mass of 1m: ~ 0,42 kg

w zakresie:

1240-3000 mm
1240-5000 mm
1250-6000 mm
2050-10000 mm

It is possible to manufacture a belt of any length at customer request after an earlier agreement with Sanok Rubber Company SA.

Table 2.3. Deviation of pitch length L_p for narrow-profile belts.

Dimensions in millimeters

Belt section	SPZ, SPZ/S	SPA, SPA/S	SPB, SPB/S	SPC, SPC/S	Acceptable length differences L_p between belts operating in one unit
Tolerance	Length range				
± 6	537-630				2
± 8	631-800	732-800			2
± 10	801-1000	801-1000			2
± 13	1001-1250	1001-1250	1250		2
± 16	1251-1600	1251-1600	1251-1600		2
± 20	1601-1737	1601-2000	1601-2000	1800-2000	2
± 25		2001-2500	2001-2500	2001-2500	4
± 32		2501-2932			4
L=L	1738-3000	2933-5000	2501-6096	2501-10000	
Belt length tolerance in version L=L					
± 2	1738-3000	2933-3150	2501-3150	2501-3150	4
± 3		3151-5000	3151-5000	3151-5000	6
± 5			5001-6096	5001-8000	10
± 8				8001-10000	16

Narrow-profile belts according to standard ISO i DIN

Narrow-profile V-belts produced by Sanok Rubber Company SA conform requirements of Standard ISO 4184, which conforms requirements of DIN standard 7753 Part 1. These belts correspond in their construction and properties narrow-profile V-belts in accordance to USA standard RMA/MPTA. In USA three sections of narrow V-belts are standardized. These belts are: 3V/9N, 5V/15N, 8V/25N.

3V/9N belt correspond approximately to SPZ belt, 5V/15N belt correspond approximately to SPB belt. For 8V/25N there is not comparable narrow V-belt according to ISO.

Belt 3V/9N as well as belt 5V/15N can without any problem work in belt pulleys of belts SPZ-Z/10 and SPB-B17 (drawing 4.1, f). It is not recommended reverse use without correction of groove profile (drawing 4.1, g; h).

Example of belt marking according to RMA/MPTA:

belt 3V 800

- 3 - 3/8" upper belt width,
- V - belt marking - single narrow-profile belt
- 800 - outside length in inches divided by 10 (1 inch = 25.4 mm)
- outside length of belt in mm:
- $L_{zew} = (800 \times 25,4 \text{ mm})/10 = 2032 \text{ mm}$

belt 9N 2032

- 9 - upper belt width in mm,
- N - marking of single narrow-profile belt (in case of power bands instead of N letter J is stated)
- 2032 - outside length of belt in mm

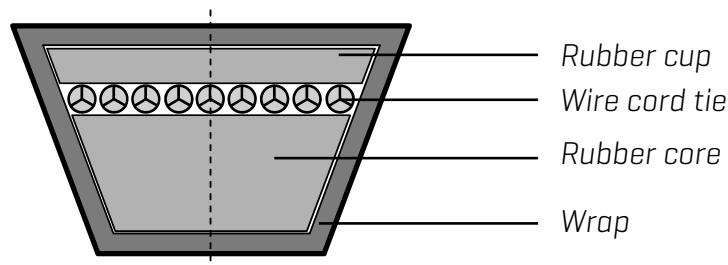
Order Example:

1. single V-belts for example belt of SPZ section and pitch length $L_p = 950\text{mm}$:
V-belt SPZ – 950 pieces
2. V-belts for operation in one unit; for example unit of 3 belts of SPZ section and pitch length $L_p=950\text{mm}$:
pas klinowy 3 SPZ - 950, ilość sztuk.

Normal profile V-belts (classical) produced by Sanok Rubber Company SA

Structure and advantages

Classical V-belts are manufactured by the same method as narrow-profile V-belts. Through to use of proven manufacturing technology, the best raw materials, special construction, we give a user perfect V-belt able to transfer big powers with optimal lifetime and security.



Draw. 2.3. Structure of normal-profile (classical) belt

Properties of normal-profile V-belts:

- the ratio of height to width is 1:1,6;
- maximal speed of belt can't exceed 30m/s;
- minimal, recommended belt pulley diameter is lower for in comparison to narrow-profile belts;
- work temperature depends on belt structure.

Classical V-belts are manufactured for industry mainly as spare parts. For new drives is recommended – with respect of costs and gearing size – almost always drive unit with narrow V-belts. Only with special drives, as for example flat-belt drives, drives with small diameters of belt pulleys, classical belts are used.

Structural variations and their markings

Classical V-belts produced by Sanok Rubber Company SA are produced according to requirements stated in Standard PN-ISO 4184 (with the exception for profiles 20 and 25), which are manufactured in accordance to Stomil Sanok ZN-71 standard).

Three construction variations of normal-profile belts are produced in Sanok Rubber Company SA, of section Z, A, B, 20, C, 25, D, E.

Basic version are belts marked by symbols Z, A, B, 20, C, 25, D, E (overprint in yellow color at the belt). This is reinforced version, produced in a range of lengths 500-10000 mm, which can operate in temperature range from -35°C to +100°C.

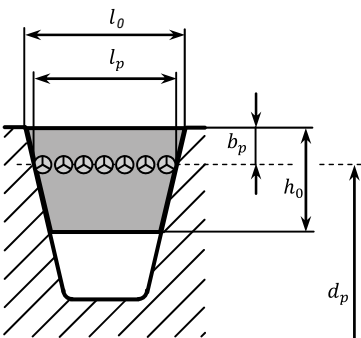
Second versions are belts of standard type; these belts possess 25% lower lifetime in relation to reinforced version. They are marked by following symbols: Z/S, A/S, B/S, 20x12.5/S, C/S, 25x16/S, D/S, E/S (overprint in green color at the belt).

Third versions are reinforced belts marked by symbols: D, E (overprint in yellow color at the belt). These belts are manufacture solely in a range of length 10000 – 18000 mm). Tie rod in these kinds of belts create viscose cord fabric. They can operate in a temperature range from -30°C to +60°C.

According to ISO length of narrow-profile and classical profile belts produced by Sanok Rubber Company SA is determined by the length of the pitch.

Table 2.4. Dimensions of normal-profile belts.

Dimensions in millimeters



Classical belt	ISO marking	Z	A	B	-	C	-	D	E
	DIN marking	10	13	17	20	22	25	32	40
approximate upper width l_0		10	13	17	20	22	25	32	40
pitch width l_p		8,5	11	14	17	19	21	27	32
belt height h_0		6	8	11	12,5	14	16	20	23
height under pitch line b_p		2,5	3,3	4,2	4,8	5,7	6,3	8,1	9,6
min. pulley length diameter $d_{p\ min.}$		50	71	112	160	180	250	355	500
1 m belt mass [kg] \approx		0,07	0,12	0,20	0,27	0,37	0,44	0,69	1,03
acceptable belt speed [m/s]		30							

Belts marking according to Standards ISO and DIN

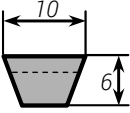
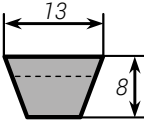
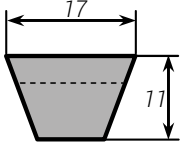
Classical V-belts produced by Sanok Rubber Company SA are manufactured in accordance to Standard ISO 4184. Additionally sections 20 and 25 are manufactured in accordance to Standard DIN 2215, which is not stated in ISO, and which with the reasons of convertibility and efficiency should be avoided.

DIN standard as a base of belt marking assumes upper width of belt; internationally belt is marked by letter, for example belt no 17 is marked by letter B. Standard ISO 4184 assumes pitch length (effective length) for measurement of length of narrow-profile and normal-profile belts. According to DIN, internal length of belt is in force to state its length. So, stating the length of a belt is necessary to pay attention on type of gauge length and possibly calculate it using converting factors stated in table 2.5.

According to standards, gradation in length (pitch length) is realized in accordance to series of prime numbers R40. Actual production program of Sanok Rubber Company SA covers a lot of lengths behind this series. Accurate information can be find in catalogs of V-belts issued by Sanok Rubber Company SA.

Table 2.5. Recommended length of normal-profile length*

Dimensions in millimeters

 Z		 A			 B		
L_p		L_p			L_p		
500	1500	500	1400	4500	630	1190	3350
530	1600	530	1500	4750	670	1250	3550
560	1700	560	1600	5000	710	1259	3750
582	1800	600	1700		750	1260	4000
600	1900	630	1800		800	1320	4250
630	2000	670	1900		820	1400	4500
670	2120	710	2000		865	1500	4750
710	2240	750	2120		870	1600	5000
750	2360	800	2240		890	1700	5300
800	2500	850	2360		945	1800	5600
850	2650	900	2500		970	1900	6000
900	2800	950	2650		990	2000	6300
950	3000	1000	2800		1000	2120	6700
1000		1040	3000		1020	2240	7100
1060		1060	3150		1060	2360	7500
1120		1120	3350		1100	2500	8000
1180		1180	3550		1120	2650	8500
1250		1210	3750		1145	2800	9000
1320		1250	4000		1165	3000	9500
1400		1320	4250		1180	3150	10000

 Deviation of pitch length L_p - according to table 2.6

 Acceptable difference of L_p - length working in belt unit - according to table 2.6.

*Accurate information of currently produced belts length can be found from V-belt catalogs issued by Sanok Rubber Company SA

Lengths marked in bold are from series of normal digits R40 are recommended by Sanok Rubber Company SA

$L_z \gg L_p + 16 \text{ mm}$ $L_w \gg L_p - 24 \text{ mm}$	$L_z \gg L_p + 20 \text{ mm}$ $L_w \gg L_p - 30 \text{ mm}$	$L_z \gg L_p + 26 \text{ mm}$ $L_w \gg L_p - 44 \text{ mm}$
L_w - internal length of belt	L_p - pitch length of belt	L_z - external length of belt
Mass of 1 mb: ~ 0,07 kg	Mass of 1 mb: ~ 0,12 kg	Mass of 1 mb: ~ 0,20 kg
with the range of:		
1210-3000 mm	1220-5000 mm	1260-10000 mm
It is possible to manufacture a belt of any length at customer request after an earlier agreement with Sanok Rubber Company SA.		

Tabela 2.5. Recommended length of normal-profile belts* - continued.

Dimensions in millimeters

 20		 C		 25	
L_p		L_p		L_p	
1190	4000	1320	4250	1320	4250
1320	4250	1400	4500	1400	4500
1400	4500	1500	4750	1500	4750
1500	4750	1600	5000	1600	5000
1600	5000	1700	5300	1700	5300
1700	5300	1800	5600	1800	5600
1800	5600	1900	6000	1900	6000
1900	6000	2000	6300	2000	6300
2000	6300	2120	6700	2120	6700
2120	6700	2240	7100	2240	7100
2240	7100	2360	7500	2360	7500
2360	7500	2500	8000	2500	8000
2500	8000	2650	8500	2650	8500
2650	8500	2800	9000	2800	9000
2800	9000	3000	9500	3000	9500
3000	9500	3150	10000	3150	10000
3150	10000	3350		3350	
3350		3550		3550	
3550		3750		3750	
3750		4000		4000	

Deviation of pitch length L_p - according to table 2.6

Acceptable difference of L_p - length working in belt unit - according to table 2.6.

*Accurate information of currently produced belts length can be found from V-belt catalogs issued by Sanok Rubber Company SA

Lengths marked in bold are from series of normal digits R40 are recommended by Sanok Rubber Company SA

$L_z \gg L_p + 30 \text{ mm}$ $L_w \gg L_p - 48 \text{ mm}$	$L_z \gg L_p + 36 \text{ mm}$ $L_w \gg L_p - 54 \text{ mm}$	$L_z \gg L_p + 39 \text{ mm}$ $L_w \gg L_p - 61 \text{ mm}$
L_w - internal length of belt	L_p - pitch length of belt	L_z - external length of belt
Mass of 1 m: ~ 0,27 kg	Mass of 1 m: ~ 0,37 kg	Mass 1 m: ~ 0,44 kg

with the range of:

1260-10000 mm	1260-10000 mm	1320-10000 mm
----------------------	----------------------	----------------------

It is possible to manufacture a belt of any length at customer request after an earlier agreement with Sanok Rubber Company SA.

Table 2.5. Recommended length of normal-profile length*- continued

Dimensions in millimeters

 D		 E	
L_p		L_p	
2000	5000	4500	
2120	5300	4750	
2240	5600	5000	
2360	6000	5300	
2500	6300	5600	
2650	6700	6000	
2800	7100	6300	
3000	7500	6700	
3150	8000	7100	
3350	8500	7500	
3550	9000	8000	
3750	9500	8500	
4000	10000	9000	
4250		9500	
4500		10000	
4750			
Deviation of pitch length L_p - according to table 2.6 Acceptable difference of L_p - length working in belt unit - according to table 2.6. *Accurate information of currently produced belts length can be found from V-belt catalogs issued by Sanok Rubber Company SA Lengths marked in bold are from series of normal digits R40 are recommended by Sanok Rubber Company SA			
$L_z \gg L_p + 50 \text{ mm}$ $L_w \gg L_p - 70 \text{ mm}$		$L_z \gg L_p + 57 \text{ mm}$ $L_w \gg L_p - 88 \text{ mm}$	
L_z - external length of belt L_p - pitch length of belt		L_w - internal length of belt	
Mass of 1 m: ~ 0,69 kg		Mass of 1 m: ~ 1,03 kg	
with the range of:			
2000-10000 mm		4400-10000 mm	
It is possible to manufacture a belt of any length at customer request after an earlier agreement with Sanok Rubber Company SA.			

Table 2.6. Deviations of pitch length L_p for normal-profile belts

wymiary w milimetrach

Belt section	Z	A	B	C	D	E		20	25
Tolerance	Lenght range						Tolerance	Length range	
+11 - 6	500	500					+5 - 10	1190-1250	1250
+13 - 6	501-630	501-630	630				+6 - 12	1251-1400	1251-1400
+15 - 7	631-800	631-800	631-800				+7 - 14	1401-1600	1401-1600
+17 - 8	801-1000	801-1000	801-1000				+8 - 16	1601-2000	1601-2000
+19 - 10	1001-1250	1001-1250	1001-1250				+9 - 18	2001-2279	2001-2279
+23 - 11	1251-1600	1251-1600	1251-1600	1251-1600			+10 - 20	2280-2650	2280-2650
+27 - 13	1601-2000	1601-2000	1601-2000	1601-2000	2000		+11 - 22	2651-2811	2651-2811
+31 - 16		2001-2360	2001-2500	2001-2500	2011-2500		+12 - 24	2812-3150	2812-3150
+37 - 18			2501-2800						
L = L			2801-10000	2501-10000	2501-10000	4400-10000		3151-10000	2862-10000
+112 - 56					10001-15500	10001-15500			
+140 - 70					12501-16000	12501-16000			
+170 - 85					16001-20000	16001-20000			
Belt tolerances for belts in version L=L									
±4	2001-3000	2361-3150	2801-3150	2501-3150	2501-3150		±4		2862-3150
±6		3151-5000	3151-5000	3151-5000	3151-5000	4400-5000	±6	3151-5000	3151-5000
±10			5001-8000	5001-8000	5001-8000	5001-8000	±10	5001-8000	5001-8000
±16			8001-10000	8001-10000	8001-10000	8001-10000	±16	8001-10000	8001-10000
Acceptable differences of L_p length between belts operating in one unit									
2	do 1250					2	do 1180		
4	1251-2000					4	1181-1900		
8	2001-3150					8	1901-3150		
12	3151-5000					12	3151-5000		
20	5001-8000					20	5001-8000		
32	8001-12500					32	8001-10000		
48	12501-20000								

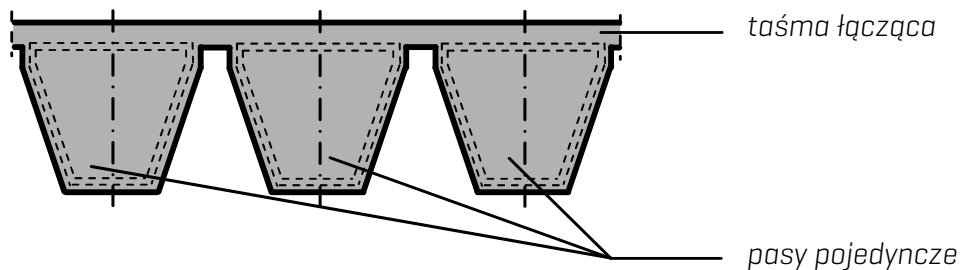
Order example:

- single V-belts for example B profile V-belt of pitch length $L_p = 2360$ mm:
B profile V-belt - 2360 pieces
- V-belts for operation in one unit for exam-ple 3-belt unit of profile and pitch length $L_p = 2360$ mm:
3B profile V-belt - 2360 pieces.

Power bands produced by Sanok Rubber Company SA

Structure and advantages

Power bands create permanent connection, connecting band, 2,3,4 or 5 single belts of given section, drawing 2.4. They can be built from narrow belts or classical belts. In case of necessity of usage bigger number of rib then 5, sets of power bands should be used according to table 4.6.



Draw. 2.4. Power band

Power bands, by using connection band, create permanent, longitudinally flexible, and transversely rigid drive element of one-belt characteristics.

Some demands related with drive task can't be solved by single working belts or even by a unit of V-belts. During side shock load and/or during pulsing operation (for example compressor, internal combustion engine, etc.) single V-belts have a tendency to vibration. This may lead to belt twisting inside a groove and its damage or jumping from pulley belt. Such failures can be avoided by using power bands, because their connecting band possess higher transversal rigidity and simultaneously protect from belt vibration.

Power bands are mainly used for improvement of operating conditions in drives during:

- pulsating run;
- side shock load;
- big axle base in connection with small pulley belts;
- vertical shafts;
- flat-V-belt drives;
- clutch drives;
- transport technology.

They are successfully used in engineering industry with vibrators, splitters, road machines, compressors, fans, lathes, grinders and milling machines.

Power bands should operate on groove wheels made according to hints included in chapter 4.

While using power bands general rule is obligatory – avoid direct contact of belt with foreign materials like stones, collected dust, sawdust, etc. In conditions like mentioned above, drive must be protected by shield.

Belts marking

Standardization committee ISO TC41/SCI used for power bands with narrow belts American standard RMA/ MPTA as a base. So far profiles markings 3V, 5V, 8V was changed to markings 9J, 15J and 25J. In case of power bands with normal profile marking of single belts A, B, C, D and E was changed to markings: AJ, BJ, CJ, DJ and EJ.

Structural variations and their markings

Power bands are produced by Sanok Rubber Company SA according to ZN-Stomil Sanok-65 standard and are marked 15J, A BP; B BP; C BP which correspond ISO markings 15J; AJ; BJ; CJ.

These belts can work in temperature range from -30°C to +60°C awhile belt speed do not exceed 30 m/s.

Determining a length

In international Standard ISO 5290 nominal effective width of belt pulley groove w_e was established as a base value for normalization of belt pulley groove and belonging to them power bands. Effective width of groove this is the biggest groove width measured at rectilinear groove walls. For all measuring pulleys and mostly for working pulleys mass-produced this concept coincides with real upper width of groove. In connection of this, location of pitch diameter d_p (effective diameter) is stated as approximate value. To calculate dimensions and power of gearing effective pulley diameter is used. Minimal calculated differences in ratio and rotating frequency do not have any practical influence. Effective length L_e is a belt length measured at the height of its effective width w_e . So, effective length L_e should be considered as plausible for determining the length of power bands. With respect to lack of compatibility regarding measuring length stating length of power bands, while stating the length is necessary to pay attention at kind of measuring length and possibly calculate it, using for our belts calculating factors given in table 2.7. Calculation of gearings with power bands should be done according to example stated in chapter 3.8.

According to standards, gradation in length (effective length) is performed according to series of normal numbers R40. Actual production program of Sanok Rubber Company SA covers a lot of lengths from outside of this series. Exact information can be found in catalogues of V-belts issued by Sanok Rubber Company SA

Table 2.7. Recommended length of power bands*

Dimensions in millimeters

Belt Section	e	Approximate dimensions		
		w ≈	H ₁ ≈	H ≈
15J	17,5	15,5	16,7	11,7
A BP	15,88	13,3	10,1	6,2
B BP	19,05	16,7	13,5	8,6
C BP	25,4	23,0	17,0	11,8
SPC BP	25,4	22,6	23,0	17,7

15J	A BP	B BP		C BP	SPC BP
L_e	L_e	L_e		L_e	L_p
2360	1320	1500	4750	2000	2240
2500	1400	1600	5000	2120	2500
2650	1500	1700	5300	2240	4250
2800	1600	1800	5600	2360	4500
3000	1700	1900	6000	2500	5000
3150	1800	2000		2650	5600
3350	1900	2120		2800	6000
3550	2000	2240		3000	6700
3750	2120	2360		3150	
4000	2240	2500		3350	
4250	2360	2650		3550	
4500	2500	2800		3750	
4750	2650	3000		4000	
5000	2800	3150		4250	
5300	3000	3350		4500	
5600		3550		4750	
6000		3750		5000	
		4000			
		4250			
		4500			

Deviations of length **L_e** : ± 0,5%; **L_p** : ± 0,5%.

Acceptable difference of **L_e** or **L_p** length working in belt unit - according to table 2.8.

*Accurate information of currently produced belts length can be found from V-belt catalogs issued by Sanok Rubber Company SA

Lengths marked in bold are from series of normal digits R40 are recommended by Sanok Rubber Company SA

L_w » L_e - 71 mm	L_w » L_e - 36 mm	L_w » L_e - 52 mm	L_w » L_e - 68 mm	L_w » L_p - 74 mm
<i>L_w</i> - internal length of belt, <i>L_e</i> - effective length of belt, <i>L_p</i> - pitch length of belt				
Mass of 1m of belt ~ 0,28 kg	Mass of 1m of belt ~ 0,17 kg	Mass of 1m of belt ~ 0,27 kg	Mass of 1m of belt ~ 0,45 kg	Mass of 1m of belt ~ 0,53 kg
In the range of:				
1500-6000 mm	1250-3000 mm	1250-10000 mm	2000-5000 mm	2000-6700 mm

It is possible to manufacture a belt of any length at customer request after earlier agreement with Sanok Rubber Company

Table 2.8. Deviations of effective lengths of power bands

Dimensions in millimeters

Belt section	range of lengths L_e or L_p	Deviations of lengths L_e lub L_p	Accessible differences of lengths L_e or L_p between belts working in one unit
15J, A BP, B BP, C BP, SPC BP	<i>do 1345</i>	$\pm 0,5\%$	4
	1346 – 2690		6
	2691 – 6000		10
	6001 – 10000		16

Example of ordering:

Because there is not international consistency in the scope of determining the length of power bands, and assortment is reached, power bands produced by Sanok Rubber Company SA should be ordered in accordance to following example:

- a) single power bands, for example power bands consisting of 3 tie rods of 15J section and effective length $L_e = 3000$ mm:

Order is: **V-belt 3 - 15J – 3000 pieces**

- b) power bands working in a unit for drive; power bands is required of section B BP consisting of 18 tie rods and of effective length $L_e = 4250$ mm. Generally 4 power bands are required:

2 pcs with 4 ribs and 2 pcs with 5 ribs (look table 4.6)

Order is:

1 unit consisting of:
2 pieces of power bands 4 B BP - 4250 L_e
2 pieces of power bands 5 B BP - 4250 L_e

Calculating of gearing with V-belts produced by Sanok Rubber Company SA

Number of belts in the gearing

To obtain optimal conditions of power transferring, high gearing reliability and required belt lifetime is necessary to design a gearing at a base of calculations, which idea is to get optimal belt section and number of belts which should be used in considered gearing.

Required number of belts to transfer the power is calculated from a formula:

$$z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$$

z - ilość wymaganych pasów w przekładni

[wyliczoną wartość zaokrąglamy w górę do liczby całkowitej];

N - moc przenoszona przez przekładnię;

N_1 - moc przenoszona przez jeden pas;

k_ϕ - współczynnik kąta opasania;

k_T - współczynnik warunków pracy;

k_L - współczynnik długości pasa.

To determine values of correction coefficients is necessary to know basic technical data of gearing:

- kind of driving and driven gearing;
- required transferred power [kW];
- revolutions of driving machine [r.p.m.];
- revolutions of driven machine [r.p.m.];
- conditions of work of gearing.

For intermediate value of power transferred by single belt and coefficients, they should be calculated by means of linear interpolation.

Guidelines to choose V-belt profile

By means of below diagrams there is a possibility to choose suitable section of V-belt, taking into account economy and the size of structure.

For new drives is recommended – with respect of economy aspects and size of the gearing – almost always drive unit with narrow-profile (narrow) belts. Only with special drives, like for example flat V-belt drives, drives with maximally small belt pulleys diameters, normal-profile, classical belts are used (classical).

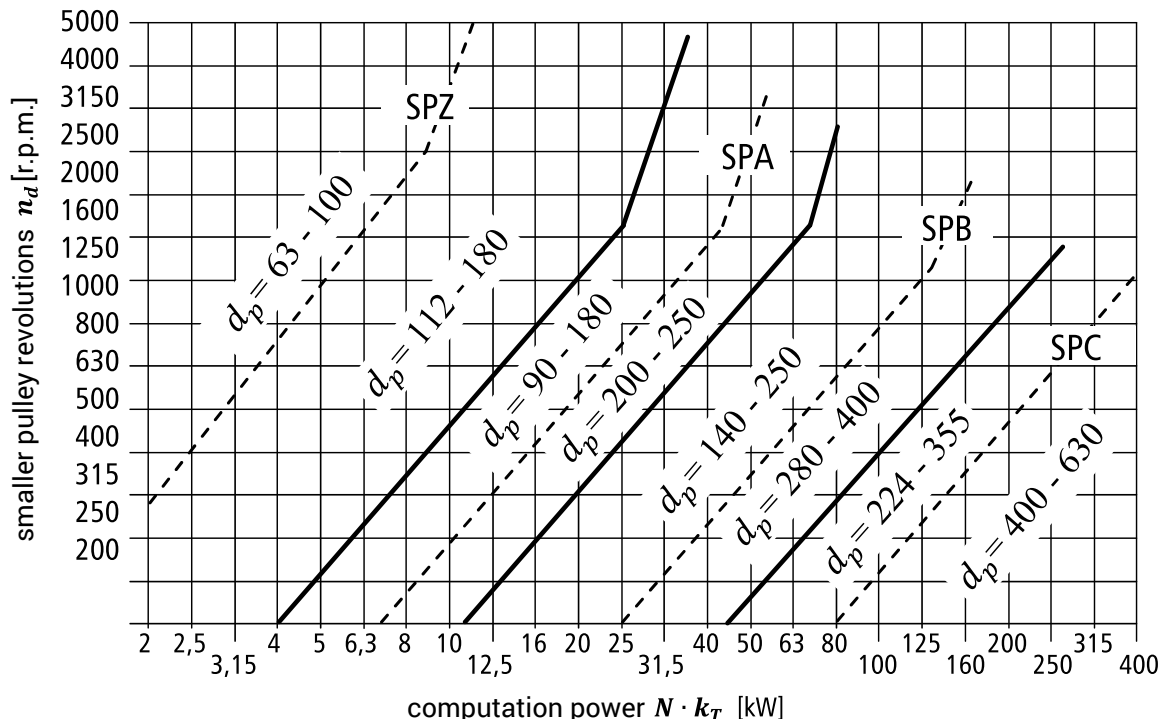
Size of used section depends on rotating speed of smaller pulley (n_d [r.p.m.]) and computational power ($N_o = N \cdot k_T$ [kW]).

Taking into account optimal conditions of power transferring as well as economy, is possible to obtain, by using big belt pulleys for which belt speed there is in a range (25-30) m/s. Experience has shown that minimal diameter of belt pulleys should be avoided.

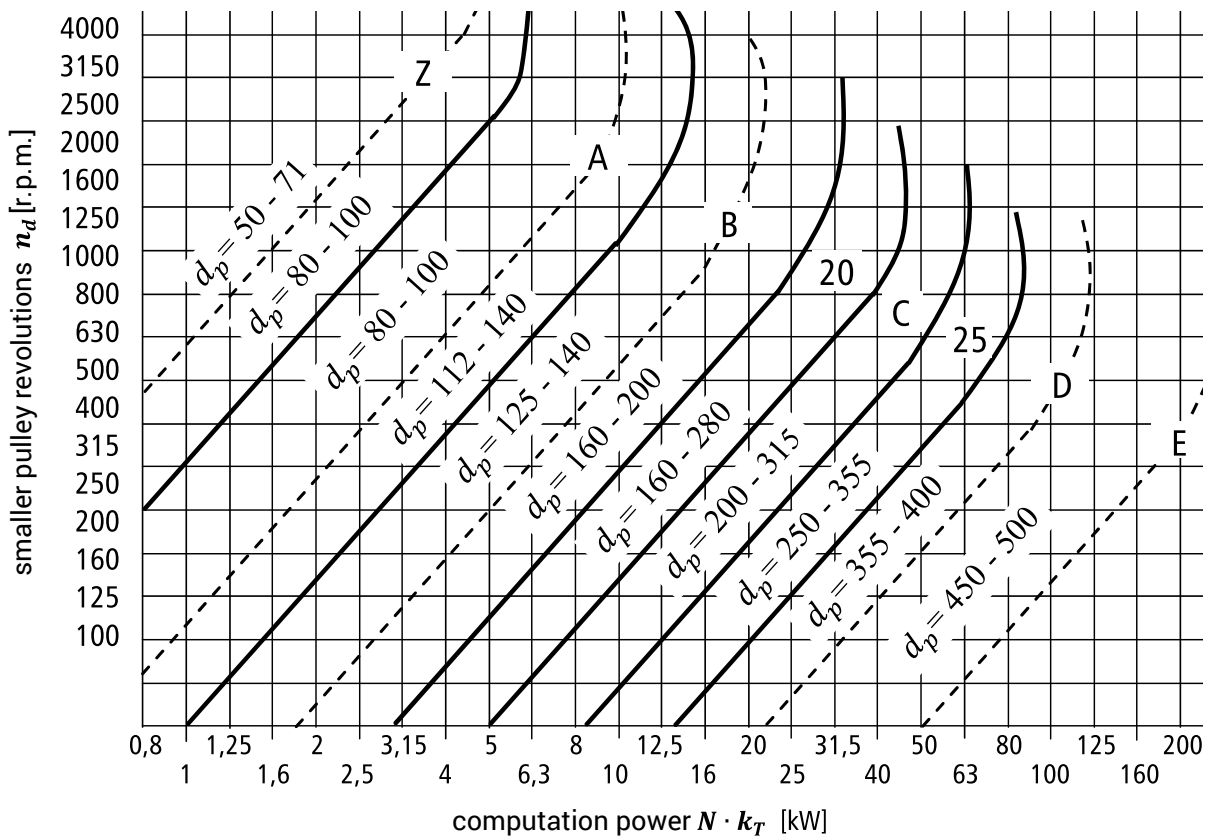
While selecting diameter of small pulley (d_p) is necessary to remember, that decreasing of diameter, while stated other parameters, leads to increasing of circumferential force, what increase loading of bearings and shafts.

Narrow-profile belts are characterized by the fact that they possess bigger possibility of power transferring in relation to normal-profile belts, but they require bigger minimal diameters. Limit allowable value of belt speed must be observed, which for narrow profiles possess value 40 m/s and for classical belts possess value 30 m/s.

If in the used graph of belt section selection the point of intersection is near the line dividing two sections, good drive can be get using both sections. The gearing must be calculated using both sections and then chosen more economical gearing, which better suits stated requirements.



Draw. 3.1. Diagram of section value preselection of narrow – profile belt.



Draw. 3.1. Diagram of section value preselection of normal – profile belt.

Coefficient of work conditions k_T

Coefficient of work conditions k_T takes into account time of operation and type of driving and driven machine. Is obligatory exclusively for belts with two pulley belts and does not take into account other conditions of gearing operation, like: drives with tension rollers, extremely adverse work conditions (for example caustic dust, high temperatures or adverse influent of other factors).

Because brief description of each probable combination: driving machine – work conditions – driven machine, is not possible, so suggested values of k_T coefficient must be treated only as guidelines. In special case, for example increased initial torque, increase frequency of starts, operation with extraordinary shock loads, during considerable inertness of rotated masses, value of k_T coefficient must be increased.

Problem of size of gearing load is in many cases very complex. Inattention to the fact is very often a reason of wrong load valuation what consequently leads to faulty determination of design parameters of a gearing. In light of the analysis of the load, correct statement is that the same gearing in different load conditions can be used to transfer different loads.

Values of k_T coefficient, for example machines, are stated at the next page.

Tabela 3.1 Wartość współczynnika k_T dla przykładowych maszyn

Examples of driven machines	Examples of driving machines					
	AC motors and 3-phases induction motors of normal torque (of value maximum 2x of nominal torque) for example synchronous motors and 1-phase with auxiliary booting phase, 3-phase induction motors operated by star/delta switch or slip ring starter, shunt dc motor, internal combustion engines and turbines of above 600 revolutions/minute			AC motors and induction motors of high torque (of value maximum 2x of nominal torque) for example 1-phase motors of high torque, serial and serial-shunt DC motors, combustion engines and turbines of above 600 revolutions/minute		
	Values of work coefficient k_T					
	For day time of work [h]			For day time of work [h]		
	to 10	from 10 to 16	above 16	to 10	from 10 to 16	above 16
Low-power drives: blowers and extractors, fluid mixers, pumps and centrifugal turbines, belt conveyors for light materials, fans of power not bigger then 7,5 kW;	1,0	1,1	1,2	1,1	1,2	1,3
Middle-power drives: printing machines, agitators for cakes, metal processing machines (lathes, grinders), transmissions, three-cylinder (or more) pumps and compressors, washing machines, presses, stamping plants, shears, generators, chain and belt conveyors for heavy materials, revolving and vibration screens, fans and pumps of power above 7,5 kW;	1,1	1,2	1,3	1,2	1,3	1,4
High-power drives: displacement blowers, machines: brick, paper and fabric, hammer mills, log saws, 1-cylinder and 2-cylinder pumps and compressors, briquette presses, conveyors: bucket, scrapper and worm, atomizers, exciters;	1,2	1,3	1,4	1,4	1,5	1,6
Very high-power drives: cranes and lifters, calenders for rubber, stone splitters, mills: ball, rod and pipe.	1,3	1,4	1,5	1,5	1,6	1,8

Coefficient of angle k_ϕ

Because value N_1 was determined for small pulley with wrap angle 180° , then coefficient of angle k_ϕ revesis value of power N_1 , in case wrap angle is less than 180° .

Table 3.2 Value of coefficient k_ϕ

$\frac{D_p - d_p}{A}$	Wrap angle $\phi \approx$	Coefficient of angle k_ϕ
0,00	180°	1,00
0,05	177°	0,99
0,10	174°	0,99
0,15	171°	0,98
0,20	169°	0,97
0,25	166°	0,97
0,30	163°	0,96
0,35	160°	0,95
0,40	157°	0,94
0,45	154°	0,93
0,50	151°	0,93
0,55	148°	0,92
0,60	145°	0,91
0,65	142°	0,90
0,70	139°	0,89
0,75	136°	0,88
0,80	133°	0,87
0,85	130°	0,86
0,90	127°	0,85
0,95	123°	0,83
1,00	120°	0,82
1,05	117°	0,81
1,10	113°	0,80
1,15	110°	0,78
1,20	106°	0,77
1,25	103°	0,75
1,30	99°	0,73
1,35	95°	0,72
1,40	91°	0,70
1,45	87°	0,68
1,50	83°	0,65

Coefficient of length k_L

Coefficient of length k_L takes into account frequency of bent frequency of used belt. This value depends on section as well as pitch length of a belt.

Table 3.3 Value of k_L coefficient for narrow-profile belts

Belt SPZ		Belt SPA		Belt SPB		Belt SPC	
L_p	k_L	L_p	k_L	L_p	k_L	L_p	k_L
630	0,82	800	0,81	1250	0,82	2240	0,83
710	0,84	900	0,83	1400	0,84	2500	0,86
800	0,86	1000	0,85	1600	0,86	2800	0,88
900	0,88	1120	0,87	1800	0,88	3150	0,90
1000	0,90	1250	0,89	2000	0,90	3550	0,92
1120	0,93	1400	0,91	2240	0,92	4000	0,94
1250	0,94	1600	0,93	2500	0,94	4500	0,96
1400	0,96	1800	0,95	2800	0,96	5000	0,98
1600	1,00	2000	0,96	3150	0,98	5600	1,00
1800	1,01	2240	0,98	3550	1,00	6300	1,02
2000	1,02	2500	1,00	4000	1,02	7100	1,04
2240	1,05	2800	1,02	4500	1,04	8000	1,06
2500	1,07	3150	1,04	5000	1,06	9000	1,08
2800	1,09	3550	1,06	5600	1,08	10000	1,10
3150	1,11	4000	1,08	6300	1,10	11200	1,12
3550	1,13	4500	1,09	7100	1,12	12500	1,14
				8000	1,14		

Table 3.4 Value of k_L coefficient for classical-profile belts

Belt Z		Belt A		Belt B		Belt 20	
L_p	k_L	L_p	k_L	L_p	k_L	L_p	k_L
424	0,87	662	0,81	942	0,81	950	0,77
449	0,88	742	0,82	1042	0,84	1050	0,79
474	0,89	832	0,85	1142	0,86	1170	0,80
494	0,90	932	0,87	1292	0,88	1300	0,82
524	0,91	1032	0,89	1442	0,90	1450	0,84
554	0,93	1152	0,91	1642	0,93	1650	0,87
584	0,94	1282	0,93	1842	0,95	2050	0,91
624	0,95	1432	0,96	2042	0,98	2300	0,93
654	0,96	1632	0,99	2282	1,00	2550	0,96
704	0,97	1732	1,00	2592	1,03	2850	0,98
734	0,99	1832	1,01	2842	1,05	3200	1,00
824	1,00	2032	1,03	3192	1,07	3600	1,03
924	1,03	2272	1,06	3592	1,10	4050	1,06
1024	1,06	2532	1,09	4042	1,13	4550	1,08
1144	1,08	2832	1,11	4542	1,15	5050	1,12
1274	1,11	3182	1,13	5042	1,18	5650	1,14
1424	1,14	4032	1,20	5642	1,20	6350	1,18
1624	1,17	5032	1,25	6342	1,23	8050	1,24

Belt C		Belt 25		Belt D		Belt E	
L_p	k_L	L_p	k_L	L_p	k_L	L_p	k_L
1461	0,81	1314	0,76	3230	0,86	4834	0,91
1661	0,84	1516	0,79	3630	0,89	5084	0,92
1861	0,85	1864	0,82	4080	0,91	5384	0,94
2061	0,88	2064	0,84	4580	0,93	5684	0,95
2301	0,91	2304	0,86	5080	0,96	6084	0,96
2561	0,93	2564	0,88	5680	0,98	6384	0,97
2861	0,95	2864	0,91	6380	1,00	6784	0,99
3211	0,97	3214	0,93	7180	1,03	7184	1,00
3611	0,98	3614	0,95	7580	1,05	7584	1,01
3811	1,00	4064	0,98	8080	1,06	8084	1,02
4061	1,02	4564	1,00	8580	1,07	8584	1,03
4561	1,04	5064	1,03	9080	1,08	9084	1,05
5061	1,07	5664	1,05	9580	1,10	9584	1,06
5661	1,09	6364	1,08	10080	1,11	10084	1,07
6361	1,12	7164	1,11	11280	1,14	11284	1,10
7161	1,15	8064	1,13	12580	1,17	12584	1,12
8061	1,18	10064	1,19	14080	1,20	14084	1,15
10061	1,23	12564	1,25	16080	1,22	16084	1,18

Rated powers N_1 transferred by one V-belt.

Table 3.5. Rated power N_1 transferred by one belt of SPZ (9,7x8) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																							
		200	400	700	800	950	1 200	1 450	1 600	2 000	2 400	2 800	3 200	3 600	4 000	4 500	5 000	5 500	6 000						
		Nominal power value N_1 [kW]																							
63	1	0,20	0,35	0,54	0,60	0,68	0,81	0,93	1,00	1,17	1,32	1,45	1,56	1,66	1,74	1,81	1,85	1,87	1,85						
	1,05	0,21	0,37	0,58	0,64	0,73	0,88	1,01	1,09	1,27	1,44	1,59	1,73	1,84	1,94	2,04	2,11	2,15	2,16						
	1,2	0,22	0,39	0,61	0,68	0,78	0,94	1,08	1,17	1,38	1,57	1,74	1,89	2,03	2,15	2,27	2,37	2,43	2,47						
	1,5	0,23	0,41	0,65	0,72	0,83	1,00	1,16	1,25	1,48	1,69	1,88	2,06	2,21	2,35	2,50	2,63	2,72	2,77						
	>3	0,24	0,43	0,68	0,76	0,88	1,06	1,23	1,33	1,58	1,81	2,03	2,22	2,40	2,56	2,74	2,88	3,00	3,08						
71	1	0,25	0,44	0,70	0,78	0,90	1,08	1,25	1,35	1,59	1,81	2,00	2,18	2,33	2,46	2,59	2,68	2,73	2,74						
	1,05	0,26	0,46	0,74	0,82	0,95	1,04	1,32	1,43	1,69	1,93	2,15	2,34	2,51	2,67	2,82	2,94	3,02	3,05						
	1,2	0,27	0,49	0,77	0,87	1,00	1,20	1,40	1,51	1,79	2,05	2,29	2,51	2,70	2,87	3,05	3,20	3,30	3,36						
	1,5	0,28	0,51	0,81	0,91	1,04	1,26	1,47	1,59	1,90	2,18	2,43	2,67	2,88	3,08	3,28	3,45	3,58	3,67						
	>3	0,29	0,53	0,85	0,95	1,09	1,33	1,55	1,68	2,00	2,30	2,58	2,83	3,07	3,28	3,51	3,71	3,86	3,98						
80	1	0,31	0,55	0,88	0,99	1,14	1,38	1,60	1,73	2,05	2,34	2,61	2,85	3,06	3,24	3,42	3,56	3,64	3,66						
	1,05	0,32	0,57	0,92	1,03	1,19	1,44	1,67	1,81	2,15	2,47	2,75	3,01	3,24	3,45	3,65	3,81	3,92	3,97						
	1,2	0,33	0,59	0,96	1,07	1,24	1,50	1,75	1,89	2,25	2,59	2,90	3,18	3,43	3,65	3,89	4,07	4,20	4,27						
	1,5	0,34	0,61	0,99	1,11	1,28	1,56	1,82	1,97	2,36	2,71	3,04	3,34	3,61	3,86	4,12	4,33	4,48	4,58						
	>3	0,35	0,64	1,03	1,15	1,33	1,62	1,90	2,06	2,46	2,84	3,18	3,51	3,80	4,05	4,35	4,58	4,77	4,89						
90	1	0,37	0,67	1,09	1,21	1,40	1,70	1,98	2,14	2,55	2,93	3,26	3,57	3,84	4,07	4,30	4,46	4,55	4,56						
	1,05	0,38	0,69	1,12	1,26	1,45	1,76	2,06	2,23	2,65	3,05	3,41	3,73	4,02	4,27	4,53	4,71	4,83	4,87						
	1,2	0,39	0,71	1,16	1,30	1,50	1,82	2,13	2,31	2,76	3,17	3,55	3,90	4,21	4,48	4,76	4,97	5,11	5,17						
	1,5	0,40	0,74	1,19	1,34	1,55	1,88	2,20	2,39	2,86	3,30	3,70	4,06	4,39	4,68	4,99	5,23	5,39	5,48						
	>3	0,41	0,76	1,23	1,38	1,60	1,95	2,28	2,47	2,96	3,42	3,84	4,23	4,58	4,89	5,22	5,48	5,68	5,79						
100	1	0,43	0,79	1,28	1,44	1,66	2,02	2,36	2,55	3,05	3,49	3,90	4,26	4,58	4,85	5,10	5,27	5,35	5,32						
	1,05	0,44	0,81	1,32	1,48	1,71	2,08	2,43	2,64	3,15	3,62	4,05	4,43	4,76	5,05	5,34	5,53	5,63	5,63						
	1,2	0,45	0,83	1,35	1,52	1,76	2,14	2,51	2,72	3,25	3,74	4,19	4,59	4,95	5,26	5,57	5,79	5,92	5,94						
	1,5	0,46	0,85	1,39	1,56	1,81	2,20	2,58	2,80	3,35	3,86	4,33	4,76	5,13	5,46	5,80	6,05	6,20	6,25						
	>3	0,47	0,87	1,43	1,60	1,86	2,27	2,66	2,88	3,46	3,99	4,48	4,92	5,32	5,67	6,03	6,30	6,48	6,56						
112	1	0,51	0,93	1,52	1,70	1,97	2,40	2,80	3,04	3,62	4,16	4,64	5,06	5,42	5,72	5,99	6,14	6,16	6,05						
	1,05	0,52	0,95	1,55	1,74	2,02	2,46	2,88	3,12	3,73	4,28	4,78	5,23	5,61	5,92	6,22	6,40	6,45	6,36						
	1,2	0,53	0,98	1,59	1,78	2,07	2,52	2,95	3,20	3,83	4,41	4,93	5,39	5,79	6,13	6,45	6,65	6,73	6,66						
	1,5	0,54	1,00	1,63	1,83	2,12	2,58	3,03	3,28	3,93	4,53	5,07	5,55	5,98	6,33	6,68	6,91	7,01	6,97						
	>3	0,55	1,02	1,66	1,87	2,17	2,65	3,10	3,37	4,04	4,65	5,21	5,72	6,16	6,54	6,91	7,17	7,29	7,28						
125	1	0,59	1,09	1,77	1,99	2,30	2,80	3,28	3,55	4,24	4,85	5,40	5,88	6,27	6,58	6,83	6,92	6,84	6,57						
	1,05	0,60	1,11	1,81	2,03	2,35	2,86	3,35	3,63	4,34	4,98	5,55	6,04	6,46	6,78	7,06	7,18	7,12	6,88						
	1,2	0,61	1,13	1,84	2,07	2,40	2,93	3,43	3,72	4,44	5,10	5,69	6,21	6,64	6,99	7,29	7,44	7,41	7,19						
	1,5	0,62	1,15	1,88	2,11	2,45	2,99	3,50	3,80	4,54	5,22	5,93	6,37	6,83	7,19	7,52	7,69	7,69	7,50						
	>3	0,63	1,17	1,91	2,15	2,50	3,05	3,58	3,88	4,65	5,35	5,98	6,53	7,01	7,40	7,75	7,95	7,97	7,81						
140	1	0,68	1,26	2,06	2,31	2,68	3,26	3,82	4,13	4,92	5,63	6,24	6,75	7,16	7,45	7,64	7,60	7,34	6,81						
	1,05	0,69	1,28	2,09	2,35	2,73	3,32	3,89	4,21	5,02	5,75	6,38	6,92	7,35	7,66	7,87	7,86	7,62	7,12						
	1,2	0,70	1,30	2,13	2,39	2,77	3,39	3,96	4,30	5,13	5,87	6,53	7,08	7,53	7,86	8,10	8,12	7,90	7,43						
	1,5	0,71	1,32	2,17	2,43	2,82	3,45	4,04	4,38	5,23	6,00	6,67	7,25	7,72	8,07	8,33	8,37	8,18	7,74						
	>3	0,72	1,34	2,20	2,47	2,87	3,51	4,11	4,46	5,33	6,12	6,81	7,41	7,90	8,27	8,56	8,63	8,47	8,04						
160	1	0,80	1,49	2,44	2,73	3,17	3,86	4,51	4,88	5,80	6,60	7,24	7,81	8,19	8,40	8,41	8,11	7,47	6,45						
	1,05	0,81	1,51	2,47	2,78	3,22	3,92	4,59	4,97	5,90	6,72	7,42	7,97	8,37	8,61	8,64	8,37	7,75	6,76						
	1,2	0,82	1,53	2,51	2,82	3,27	3,98	4,66	5,05	6,00	6,84	7,56	8,13	8,56	8,81	8,88	8,62	8,03	7,07						
	1,5	0,83	1,55	2,54	2,86	3,32	4,05	4,74	5,13	6,11	6,97	7,70	8,30	8,74	9,02	9,11	8,88	8,31	7,37						
	>3	0,84	1,57	2,58	2,90	3,37	4,11	4,81	5,21	6,21	7,09	7,85	8,46	8,93	9,22	9,34	9,14	8,60	7,68						
180	1	0,92	1,71	2,81	3,15	3,65	4,45	5,19	5,61	6,63	7,50	8,20	8,71	9,01	9,08	8,81	8,11	6,93	5,22						
	1,05	0,93	1,74	2,84	3,19	3,70	4,51	5,26	5,69	6,74	7,63	8,35	8,88	9,20	9,29	9,04	8,36	7,21	5,53						
	1,2	0,94	1,76	2,88	3,23	3,75	4,57	5,34	5,77	6,84	7,75	8,49	9,04	9,38	9,49	9,28	8,62	7,49	5,84						
	1,5	0,95	1,78	2,92	3,28	3,80	4,63	5,41	5,86	6,94	7,87	8,63	9,21	9,57	9,70	9,51	8,88	7,77	6,15						
	>3	0,96	1,80	2,95	3,32	3,85	4,69	5,49	5,94	7,04	8,00	8,78	9,37	9,75	9,90	9,74	9,14	8,06	6,45						
v [m/s]		5			10			15			20			25			30			35			40		
		Belt pulley - balancing						static						dynamic											

$$\text{Required number of belts in a gearing } z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

N_1 – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Tabela 3.6. Rated power N_i transferred by one belt of SPA (12,7x10) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																							
		200	400	700	800	950	1 200	1 450	1 600	2 000	2 400	2 800	3 200	3 600	4 000	4 500	5 000	5 500	6 000						
		Nominal power value N_i [kW]																							
90	1	0,43	0,75	1,17	1,30	1,48	1,76	2,02	2,16	2,49	2,77	3,00	3,16	3,26	3,29	3,24	3,07	2,77	2,34						
	1,05	0,45	0,80	1,25	1,39	1,59	1,90	2,18	2,34	2,72	3,05	3,32	3,53	3,67	3,76	3,76	3,64	3,40	3,03						
	1,2	0,47	0,85	1,34	1,49	1,70	2,04	2,35	2,53	2,96	3,33	3,64	3,90	4,09	4,22	4,28	4,22	4,04	3,72						
	1,5	0,50	0,89	1,42	1,58	1,81	2,18	2,52	2,71	3,19	3,60	3,96	4,27	4,50	4,68	4,80	4,80	4,67	4,41						
	>3	0,52	0,94	1,50	1,67	1,92	2,32	2,69	2,90	3,42	3,88	4,29	4,63	4,92	5,14	5,32	5,37	5,31	5,10						
100	1	0,53	0,94	1,49	1,65	1,89	2,27	2,61	2,80	3,27	3,67	3,99	4,25	4,42	4,50	4,48	4,31	3,97	3,46						
	1,05	0,55	0,99	1,57	1,75	2,00	2,41	2,78	2,99	3,50	3,94	4,32	4,61	4,83	4,96	5,00	4,89	4,61	4,15						
	1,2	0,57	1,03	1,65	1,84	2,11	2,54	2,95	3,17	3,73	4,22	4,64	4,98	5,25	5,43	5,52	5,46	5,24	4,84						
	1,5	0,60	1,08	1,73	1,93	2,22	2,68	3,11	3,36	3,96	4,50	4,96	5,35	5,66	5,89	6,04	6,04	5,88	5,53						
	>3	0,62	1,13	1,81	2,02	2,33	2,82	3,28	3,54	4,19	4,78	5,29	5,72	6,08	6,35	6,56	6,62	6,51	6,22						
112	1	0,64	1,16	1,86	2,07	2,38	2,86	3,31	3,57	4,18	4,71	5,15	5,49	5,72	5,85	5,83	5,61	5,16	4,47						
	1,05	0,67	1,21	1,94	2,16	2,49	3,00	3,48	3,75	4,41	4,99	5,47	5,86	6,14	6,31	6,35	6,18	5,80	5,17						
	1,2	0,69	1,26	2,02	2,26	2,60	3,14	3,65	3,94	4,64	5,27	5,79	6,23	6,55	6,77	6,87	6,76	6,43	5,86						
	1,5	0,71	1,30	2,10	2,35	2,71	3,28	3,82	4,12	4,87	5,54	6,12	6,60	6,97	7,23	7,39	7,34	7,06	6,55						
	>3	0,74	1,35	2,18	3,44	2,82	3,42	3,98	4,30	5,11	5,82	6,44	6,96	7,38	7,69	7,91	7,91	7,70	7,24						
125	1	0,77	1,40	2,25	2,52	2,90	3,50	4,06	4,38	5,15	5,80	6,34	6,76	7,03	7,16	7,09	6,75	6,11	5,14						
	1,05	0,79	1,45	2,33	2,61	3,01	3,64	4,23	4,56	5,38	6,08	6,67	7,13	7,45	7,62	7,61	7,33	6,74	5,83						
	1,2	0,82	1,50	2,42	2,70	3,12	3,78	4,40	4,75	5,61	6,36	6,99	7,49	7,86	8,08	8,13	7,90	7,37	6,52						
	1,5	0,84	1,54	2,50	2,80	3,23	3,92	4,56	4,93	5,84	6,63	7,31	7,86	8,28	8,54	8,65	8,48	8,01	7,21						
	>3	0,86	1,59	2,58	2,89	3,34	4,06	4,73	5,12	6,07	6,91	7,63	8,23	8,69	9,01	9,17	9,06	8,64	7,91						
140	1	0,92	1,68	2,71	3,03	3,49	4,23	4,91	5,29	6,22	7,01	7,64	8,11	8,39	8,48	8,27	7,69	6,71	5,28						
	1,05	0,94	1,72	2,79	3,12	3,60	4,37	5,07	5,48	6,45	7,29	7,97	8,48	8,81	8,94	8,79	8,27	7,34	5,79						
	1,2	0,96	1,77	2,87	3,21	3,71	4,50	5,24	5,66	6,68	7,56	8,29	8,85	9,22	9,40	9,31	8,85	7,98	6,66						
	1,5	0,99	1,82	2,95	3,31	3,82	4,64	5,41	5,84	6,91	7,84	8,61	9,22	9,64	9,86	9,83	9,42	8,61	7,35						
	>3	1,01	1,86	3,03	3,40	3,93	4,78	5,58	6,03	7,14	8,12	8,94	9,56	10,05	10,32	10,35	10,00	9,25	8,05						
160	1	1,11	2,04	3,30	3,70	4,27	5,17	6,01	6,47	7,60	8,53	9,24	9,72	9,94	9,87	9,34	8,28	6,62	4,31						
	1,05	1,13	2,08	3,38	3,79	4,38	5,31	6,17	6,66	7,83	8,80	9,57	10,09	10,35	10,33	9,89	8,85	7,25	5,00						
	1,2	1,15	2,13	3,46	3,88	4,49	5,45	6,34	6,84	8,06	9,08	9,89	10,46	10,77	10,79	10,38	9,43	7,88	5,70						
	1,5	1,18	2,18	3,55	3,98	4,60	5,59	6,51	7,03	8,29	9,36	10,21	10,83	11,18	11,25	10,90	10,01	8,52	6,39						
	>3	1,20	2,22	3,63	4,07	4,71	5,73	6,68	7,21	8,52	9,63	10,53	11,20	11,60	11,72	11,42	10,58	9,15	7,08						
180	1	1,30	2,39	3,89	4,36	5,04	6,10	7,07	7,62	8,90	9,93	10,67	11,09	11,15	10,81	9,78	7,99	5,38	1,88						
	1,05	1,32	2,44	3,97	4,45	5,15	6,23	7,24	7,80	9,13	10,21	11,00	11,46	11,56	11,27	10,29	8,57	6,02	2,57						
	1,2	1,34	2,49	4,05	4,54	5,25	6,37	7,41	7,99	9,37	10,49	11,32	11,83	11,98	11,73	10,81	9,15	6,65	3,26						
	1,5	1,37	2,53	4,13	4,64	5,36	6,51	7,57	8,17	9,60	10,76	11,64	12,20	12,39	12,19	11,33	9,72	7,29	3,95						
	>3	1,39	2,58	4,21	4,73	5,47	6,65	7,74	8,35	9,83	11,04	11,96	12,56	12,81	12,65	11,85	10,30	7,92	4,64						
200	1	1,49	2,75	4,47	5,01	5,79	7,00	8,10	8,72	10,13	11,22	11,92	12,19	11,98	11,25	9,50	6,75	2,89	-						
	1,05	1,51	2,79	4,55	5,10	5,89	7,14	8,27	8,90	10,37	11,49	12,24	12,56	12,40	11,71	10,02	7,33	3,52	-						
	1,2	1,53	2,84	4,63	5,19	6,00	7,27	8,44	9,08	10,60	11,77	12,56	12,93	12,81	12,17	10,54	7,91	4,16	-						
	1,5	1,55	2,89	4,71	5,29	6,11	7,41	8,61	9,27	10,83	12,05	12,89	13,30	13,23	12,63	11,06	8,48	4,79	-						
	>3	1,58	2,93	4,79	5,38	6,22	7,55	8,77	9,45	11,06	12,32	13,21	13,67	13,64	13,09	11,58	9,06	5,43	-						
224	1	1,71	3,17	5,16	5,77	6,67	8,05	9,30	9,97	11,51	12,59	13,15	13,13	12,45	11,04	8,15	3,87	-	-						
	1,05	1,73	3,21	5,24	5,87	6,78	8,19	9,46	10,16	11,74	12,86	13,47	13,49	12,86	11,50	8,67	4,44	-	-						
	1,2	1,75	3,26	5,32	5,96	6,89	8,33	9,63	10,34	11,97	13,14	13,79	13,86	13,28	11,96	9,19	5,02	-	-						
	1,5	1,78	3,30	5,40	6,05	6,99	8,46	9,80	10,53	12,20	13,42	14,12	14,23	13,69	12,42	9,71	5,60	-	-						
	>3	1,80	3,35	5,48	6,14	7,10	8,60	9,96	10,71	12,43	13,69	14,44	14,60	14,11	12,89	10,23	6,17	-	-						
250	1	1,95	3,62	5,88	6,59	7,60	9,15	10,53	11,26	12,85	13,84	14,13	13,62	12,22	9,83	5,29	-	-	-						
	1,05	1,97	3,66	5,97	6,68	7,71	9,29	10,69	11,44	13,08	14,12	14,45	13,99	12,64	10,29	5,81	-	-	-						
	1,2	1,99	3,71	6,05	6,77	7,82	9,43	10,86	11,63	13,31	14,39	14,77	14,36	13,05	10,75	6,33	-	-	-						
	1,5	2,02	3,75	6,13	6,87	7,93	9,56	11,03	11,81	13,54	14,67	15,10	14,73	13,47	11,21	6,85	-	-	-						
	>3	2,04	3,80	6,21	6,96	8,04	9,70	11,19	12,00	13,77	14,95	15,42	15,10	13,88	11,67	7,36	-	-	-						
v [m/s]		5			10			15			20			25			30			35			40		
Belt pulley - balancing				static						dynamic															

$$\text{Required number of belts in a gearing } z \geq \frac{N \cdot k_T}{N_i \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

N_i – rated power transferred by one belt;

k_T – coefficient of working conditions, see the table 3.1.;

Table 3.7. rated power N_1 transferred by one belt of SPB (16,3x13) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																
		200	400	700	800	950	1 200	1 450	1 600	1 800	2 000	2 200	2 400	2 800	3 200	3 600	4 000	4 500
		Nominal power value N_1 [kW]																
140	1	1,08	1,92	3,02	3,35	3,83	4,55	5,19	5,54	5,95	6,31	6,62	6,86	7,15	7,17	6,89	6,28	5,00
	1,05	1,12	2,02	3,19	3,55	4,06	4,84	5,55	5,93	6,39	6,80	7,15	7,44	7,84	7,95	7,77	7,25	6,10
	1,2	1,17	2,12	3,36	3,74	4,29	5,14	5,90	6,32	6,83	7,29	7,69	8,03	8,52	8,73	8,65	8,23	7,20
	1,5	1,22	2,21	3,53	3,94	4,52	5,43	6,25	6,71	7,27	7,78	8,23	8,61	9,20	9,51	9,52	9,20	8,30
	>3	1,27	2,31	3,70	4,13	4,76	5,72	6,61	7,10	7,71	8,26	8,76	9,20	9,89	10,29	10,40	10,18	9,39
160	1	1,37	2,47	3,92	4,37	5,01	5,98	6,86	7,33	7,89	8,38	8,80	9,13	9,52	9,53	9,10	8,21	6,36
	1,05	1,41	2,57	4,10	4,57	5,24	6,28	7,21	7,72	8,33	8,87	9,33	9,71	10,20	10,31	9,98	9,18	7,46
	1,2	1,46	2,66	4,27	4,76	5,47	6,57	7,56	8,11	8,77	9,36	9,87	10,30	10,89	11,09	10,86	10,16	8,55
	1,5	1,51	2,76	4,44	4,96	5,70	6,86	7,92	8,50	9,21	9,85	10,41	10,88	11,57	11,87	11,74	11,13	9,65
	>3	1,56	2,86	4,61	5,15	5,93	7,15	8,27	8,89	9,65	10,33	10,94	11,47	12,25	12,65	12,61	12,11	10,75
180	1	1,65	3,01	4,82	5,37	6,16	7,38	8,46	9,05	9,74	10,34	10,83	11,21	11,62	11,49	10,77	9,40	6,68
	1,05	1,70	3,11	4,99	5,57	6,40	7,67	8,82	9,44	10,18	10,83	11,38	11,80	12,30	12,27	11,65	10,37	7,77
	1,2	1,75	3,20	5,16	5,76	6,63	7,97	9,17	9,83	10,62	11,32	11,91	12,39	12,98	13,05	12,52	11,35	8,87
	1,5	1,80	3,30	5,33	5,96	6,86	8,26	9,53	10,22	11,06	11,80	12,44	12,97	13,66	13,83	13,40	12,32	9,97
	>3	1,85	3,40	5,50	6,15	7,09	8,55	9,88	10,61	11,50	12,29	12,98	13,56	14,35	14,61	14,28	13,30	11,07
200	1	1,94	3,54	5,69	6,35	7,30	8,74	10,02	10,70	11,50	12,18	12,72	13,11	13,41	13,01	11,83	9,77	5,85
	1,05	1,99	3,64	5,86	6,55	7,53	9,04	10,37	11,09	11,94	12,67	13,25	13,69	14,10	13,79	12,71	10,75	6,95
	1,2	2,03	3,74	6,03	6,75	7,76	9,33	10,73	11,48	12,38	13,15	13,79	14,28	14,78	14,57	13,59	11,72	8,04
	1,5	2,08	3,84	6,21	6,94	7,99	9,62	11,08	11,87	12,82	13,64	14,33	14,86	15,46	15,36	14,46	12,70	9,14
	>3	2,13	3,93	6,38	7,14	8,23	9,91	11,43	12,26	13,26	14,13	14,86	15,45	16,14	16,14	15,34	13,68	10,24
224	1	2,28	4,18	6,73	7,52	8,63	10,33	11,81	12,59	13,49	14,21	14,76	15,10	15,14	14,22	12,23	9,04	3,18
	1,05	2,32	4,28	6,90	7,71	8,86	10,62	12,17	12,98	13,93	14,70	15,29	15,69	15,83	15,00	13,11	10,01	4,28
	1,2	2,37	4,37	7,07	7,91	9,10	10,92	12,52	13,37	14,37	15,19	15,83	16,27	16,51	15,78	13,98	10,99	5,38
	1,5	2,42	4,47	7,24	8,10	9,33	11,21	12,87	13,76	14,80	15,68	16,37	16,86	17,19	16,57	14,86	11,96	6,47
	>3	2,47	4,57	7,41	8,30	9,56	11,50	13,23	14,15	15,24	16,16	16,90	17,44	17,87	17,35	15,74	12,94	7,57
250	1	2,64	4,86	7,84	8,75	10,04	11,99	13,66	14,51	15,47	16,19	16,68	16,89	16,44	14,69	11,48	6,63	-
	1,05	2,69	4,96	8,01	8,94	10,27	12,28	14,01	14,90	15,91	16,68	17,21	17,47	17,13	15,47	12,36	7,61	-
	1,2	2,74	5,05	8,18	9,14	10,50	12,57	14,37	15,29	16,35	17,17	17,75	18,06	17,81	16,25	13,23	8,58	-
	1,5	2,79	5,15	8,35	9,33	10,74	12,87	14,72	15,68	16,78	17,66	18,28	18,65	18,49	17,03	14,11	9,56	-
	>3	2,83	5,25	8,52	9,53	10,97	13,16	15,07	16,07	17,22	18,15	18,82	19,23	19,17	17,81	14,99	10,53	-
280	1	3,05	5,63	9,09	10,14	11,62	13,82	15,65	16,56	17,52	18,17	18,48	18,43	17,13	14,04	8,92	1,55	-
	1,05	3,10	5,73	9,26	10,33	11,85	14,11	16,01	16,95	17,96	18,65	19,01	19,01	17,81	14,82	9,80	2,53	-
	1,2	3,15	5,83	9,43	10,53	12,08	14,41	16,36	17,34	18,39	19,14	19,55	19,60	18,49	15,60	10,68	3,50	-
	1,5	3,20	5,93	9,60	10,72	12,32	14,70	16,72	17,73	18,83	19,63	20,09	20,18	19,18	16,38	11,56	4,48	-
	>3	3,25	6,02	9,77	10,92	12,55	14,99	17,07	18,12	19,27	20,12	20,62	20,77	19,86	17,16	12,43	5,45	-
315	1	3,53	6,53	10,51	11,71	13,40	15,84	17,79	18,70	19,56	20,00	19,97	19,44	16,71	11,47	3,40	-	-
	1,05	3,58	6,62	10,68	11,91	13,63	16,13	18,15	19,09	20,00	20,49	20,51	20,03	17,39	12,25	4,28	-	-
	1,2	3,63	6,72	10,85	12,11	13,86	16,43	18,50	19,48	20,44	20,97	21,05	20,61	18,07	13,03	5,16	-	-
	1,5	3,68	6,82	11,02	12,30	14,09	16,72	18,85	19,87	20,88	21,46	21,58	21,20	18,76	13,81	6,04	-	-
	>3	3,73	6,92	11,19	12,50	14,32	17,01	19,21	20,26	21,32	21,95	22,12	21,78	19,44	14,59	6,91	-	-
355	1	4,08	7,53	12,10	13,46	15,33	17,99	19,96	20,78	21,39	21,42	20,79	19,46	14,45	5,91	-	-	-
	1,05	4,12	7,63	12,27	13,65	15,57	18,28	20,31	21,17	21,83	21,91	21,33	20,05	15,13	6,69	-	-	-
	1,2	4,17	7,73	12,44	13,85	15,80	18,57	20,67	21,56	22,27	22,39	21,87	20,63	15,81	7,47	-	-	-
	1,5	4,22	7,82	12,61	14,04	16,03	18,86	21,02	21,95	22,71	22,88	22,40	21,22	16,50	8,25	-	-	-
	>3	4,27	7,92	12,78	14,24	16,26	19,16	21,37	22,34	23,15	23,37	22,94	21,80	17,18	9,03	-	-	-
400	1	4,68	8,64	13,82	15,34	17,39	20,17	22,02	22,62	22,76	22,07	20,46	17,87	9,37	-	-	-	-
	1,05	4,73	8,74	13,99	15,53	17,62	20,46	22,37	23,01	23,19	22,55	21,00	18,46	10,05	-	-	-	-
	1,2	4,78	8,84	14,16	15,73	17,85	20,75	22,72	23,40	23,63	23,04	21,54	19,04	10,74	-	-	-	-
	1,5	4,83	8,94	14,33	15,92	18,09	21,05	23,08	23,79	24,07	23,53	22,07	19,63	11,42	-	-	-	-
	>3	4,87	9,03	14,50	16,12	18,32	21,34	23,43	24,18	24,51	24,02	22,61	20,21	12,10	-	-	-	-
v [m/s]		5	10	15	20	25	30	35	40									
Belt pulley - balancing				static				dynamic										

$$\text{Required number of belts in a gearing: } z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

N_1 – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Table 3.8. rated power N_1 transferred by one belt of SPC (22x18) - SPC BP section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																				
		200	300	400	500	600	700	800	950	1 200	1 450	1 600	1 800	2 000	2 200	2 400	2 800	3 200				
Nominal power value N_1 [kW]																						
224	1	2,90	4,08	5,19	6,23	7,21	8,13	8,99	10,19	11,89	13,22	13,81	14,35	14,58	14,47	14,01	11,89	8,01				
	1,05	3,02	4,26	5,43	6,53	7,57	8,55	9,47	10,76	12,61	14,09	14,77	15,43	15,78	15,79	15,44	13,57	9,93				
	1,2	3,14	4,44	5,67	6,83	7,92	8,97	9,95	11,33	13,33	14,95	15,73	16,51	16,98	17,11	16,88	15,25	11,85				
	1,5	3,26	4,26	5,91	7,13	8,28	9,39	10,43	11,90	14,05	15,82	16,69	17,59	18,17	18,43	18,32	16,92	13,77				
	>3	3,38	4,80	6,15	7,43	8,64	9,81	10,91	12,47	14,77	16,69	17,65	18,66	19,37	19,75	19,76	18,60	15,68				
250	1	3,50	4,95	6,31	7,60	8,81	9,95	11,02	12,51	14,61	16,21	16,92	17,52	17,70	17,44	16,69	13,60	8,12				
	1,05	3,62	5,13	6,55	7,89	9,17	10,37	11,50	13,07	15,33	17,08	17,88	18,59	18,90	18,76	18,13	15,28	10,04				
	1,2	3,74	5,31	6,79	8,19	9,53	10,79	11,98	13,64	16,05	17,95	18,83	19,67	20,10	20,08	19,57	16,96	11,96				
	1,5	3,86	5,49	7,03	8,49	9,89	11,21	12,46	14,21	16,77	18,82	19,79	20,75	21,30	21,40	21,01	18,64	13,88				
	>3	3,98	5,67	7,27	8,79	10,25	11,63	12,94	14,78	17,49	19,69	20,75	21,83	22,50	22,72	22,45	20,32	15,80				
280	1	4,18	5,94	7,59	9,15	10,62	12,01	13,31	15,10	17,60	19,44	20,20	20,75	20,75	20,13	18,86	14,11	6,10				
	1,05	4,30	6,12	7,83	9,45	10,98	12,43	13,79	15,67	18,32	20,31	21,16	21,83	21,95	21,45	20,30	15,79	8,02				
	1,2	4,42	6,30	8,07	9,75	11,34	12,85	14,27	16,24	19,04	21,18	22,12	22,91	23,15	22,77	21,73	17,47	9,93				
	1,5	4,54	6,48	8,31	10,05	11,70	13,27	14,75	16,81	19,76	22,05	23,07	23,99	24,35	24,09	23,17	19,15	11,85				
	>3	4,66	6,66	8,55	10,35	12,06	13,69	15,23	17,38	20,48	22,92	24,03	25,07	25,54	25,41	24,61	20,83	13,77				
315	1	4,97	7,08	9,07	10,94	12,70	14,36	15,90	18,01	20,88	22,87	23,58	23,91	23,47	22,18	19,98	12,53	-				
	1,05	5,09	7,26	9,31	11,24	13,06	14,78	16,38	18,58	21,60	23,74	24,54	24,99	24,67	23,50	21,42	14,20	-				
	1,2	5,21	7,44	9,55	11,54	13,42	15,20	16,86	19,15	22,32	24,60	25,50	26,07	25,87	24,82	22,86	15,88	-				
	1,5	5,33	7,62	9,79	11,84	13,78	15,62	17,34	19,72	23,04	25,47	26,46	27,15	27,07	26,14	24,30	17,56	-				
	>3	5,45	7,80	10,03	12,14	14,14	16,04	17,82	20,29	23,76	26,34	27,42	28,23	28,26	27,46	25,74	19,24	-				
355	1	5,87	8,37	10,72	12,94	15,02	16,96	18,76	21,17	24,34	26,29	26,80	26,62	25,37	22,94	19,22	-	-				
	1,05	5,99	8,55	10,96	13,24	15,38	17,38	19,24	21,74	25,06	27,16	27,76	27,70	26,57	24,26	20,66	-	-				
	1,2	6,11	8,73	11,20	13,54	15,74	17,80	19,72	22,31	25,78	28,03	28,72	28,78	27,77	25,58	22,10	-	-				
	1,5	6,23	8,91	11,44	13,84	16,10	18,22	20,20	22,88	26,50	28,90	29,68	29,86	28,97	26,90	23,54	-	-				
	>3	6,35	9,09	11,68	14,14	16,46	18,64	20,68	23,45	27,22	29,77	30,64	30,94	30,17	28,22	24,98	-	-				
400	1	6,86	9,80	12,56	15,15	17,56	19,79	21,84	24,52	27,83	29,46	29,53	28,42	25,81	21,54	15,48	-	-				
	1,05	6,98	9,98	12,80	15,45	17,92	20,21	22,32	25,09	28,55	30,33	30,49	29,50	27,01	22,86	16,91	-	-				
	1,2	7,10	10,16	13,04	15,75	18,28	20,63	22,80	25,66	29,27	31,20	31,45	30,58	28,21	24,18	18,35	-	-				
	1,5	7,22	10,34	13,28	16,04	18,64	21,05	23,28	26,23	29,99	32,07	32,41	31,66	29,41	25,50	19,79	-	-				
	>3	7,34	10,52	13,52	16,34	19,00	21,47	23,76	26,80	30,70	32,94	33,37	32,74	30,60	26,82	21,23	-	-				
450	1	7,96	11,37	14,56	17,54	20,29	22,81	25,07	27,94	31,15	32,06	31,33	28,69	23,95	16,89	-	-	-				
	1,05	8,08	11,55	14,80	17,83	20,65	23,23	25,55	28,51	31,87	32,93	32,29	29,77	25,15	18,21	-	-	-				
	1,2	8,20	11,73	15,04	18,13	21,01	23,65	26,03	29,08	32,59	33,80	33,25	30,85	26,34	19,53	-	-	-				
	1,5	8,32	11,91	15,28	18,43	21,37	24,07	26,51	29,65	33,31	34,67	34,21	31,92	27,54	20,85	-	-	-				
	>3	8,44	12,09	15,52	18,73	21,73	24,48	26,99	30,22	34,03	35,54	35,16	33,00	28,74	22,17	-	-	-				
500	1	9,04	12,91	16,52	19,86	22,92	25,67	28,09	31,04	33,85	33,58	31,70	26,94	19,35	-	-	-	-				
	1,05	9,16	13,09	16,76	20,16	23,28	26,09	28,57	31,61	34,57	34,45	32,66	28,02	20,54	-	-	-	-				
	1,2	9,28	13,27	17,00	20,46	23,64	26,51	29,05	32,18	35,29	35,31	33,62	29,10	21,74	-	-	-	-				
	1,5	9,40	13,45	17,24	20,76	24,00	26,93	29,53	32,75	36,01	36,18	34,57	30,18	22,94	-	-	-	-				
	>3	9,52	13,63	17,48	21,06	24,36	27,35	30,01	33,32	36,73	37,05	35,53	31,26	24,14	-	-	-	-				
560	1	10,32	14,74	18,82	22,56	25,93	28,90	31,43	34,29	36,18	33,83	30,05	21,90	-	-	-	-	-				
	1,05	10,44	14,92	19,06	22,86	26,29	29,32	31,91	34,86	36,90	34,70	31,01	22,98	-	-	-	-	-				
	1,2	10,56	15,09	19,30	23,16	26,65	29,74	32,39	35,43	37,62	35,57	31,97	24,06	-	-	-	-	-				
	1,5	10,68	15,27	19,54	23,46	27,01	30,16	32,87	36,00	38,34	36,44	32,93	25,14	-	-	-	-	-				
	>3	10,80	15,45	19,78	23,76	27,37	30,58	33,35	36,57	39,06	37,31	33,89	26,22	-	-	-	-	-				
630	1	11,80	16,82	21,42	25,58	29,25	32,37	34,88	37,37	37,52	31,74	24,96	-	-	-	-	-	-				
	1,05	11,92	17,00	21,66	25,88	29,61	32,79	35,36	37,94	38,24	32,61	25,92	-	-	-	-	-	-				
	1,2	12,04	17,18	21,90	26,18	29,96	33,21	35,84	38,51	38,96	33,48	26,88	-	-	-	-	-	-				
	1,5	12,16	17,36	22,14	26,48	30,32	33,63	36,32	39,07	39,68	34,35	27,84	-	-	-	-	-	-				
	>3	12,28	17,54	22,38	26,78	30,68	34,04	36,80	39,64	40,40	35,22	28,79	-	-	-	-	-	-				
v [m/s]		10			15			20			25			30			35			40		
Belt pulley - balancing		static						dynamic														

$$\text{Required number of belts in a gearing } z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

N_1 – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Table 3.9. Power transferred N_T transferred by one belt of Z (10x6) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																																		
		200	400	700	800	950	1 200	1 450	1 600	2 000	2 400	2 800	3 200	3 600	4 000	4 500	5 000	5 500	6 000																	
		Nominal power value N_T [kW]																																		
50	1	0,062	0,11	0,16	0,18	0,21	0,25	0,28	0,30	0,35	0,40	0,44	0,47	0,50	0,53	0,55	0,57	0,57	0,57																	
	1,05	0,064	0,11	0,17	0,19	0,21	0,25	0,29	0,31	0,36	0,41	0,45	0,49	0,52	0,54	0,57	0,59	0,59	0,59																	
	1,2	0,066	0,11	0,18	0,19	0,22	0,26	0,30	0,32	1,38	0,42	0,47	0,50	0,54	0,56	0,59	0,61	0,61	0,61																	
	1,5	0,068	0,12	0,18	0,20	0,23	0,27	0,31	0,33	0,39	0,44	0,48	0,52	0,55	0,58	0,61	0,63	0,63	0,63																	
	>3	0,070	0,12	0,19	0,21	0,24	0,28	0,32	0,34	0,40	0,45	0,50	0,54	0,57	0,60	0,63	0,65	0,65	0,65																	
56	1	0,08	0,14	0,21	0,23	0,27	0,32	0,37	0,40	0,47	0,54	0,59	0,65	0,69	0,73	0,78	0,81	0,83	0,83																	
	1,05	0,08	0,14	0,22	0,24	0,28	0,33	0,38	0,41	0,49	0,55	0,62	0,67	0,72	0,76	0,80	0,83	0,85	0,86																	
	1,2	0,08	0,14	0,23	0,25	0,29	0,34	0,40	0,43	0,50	0,57	0,64	0,69	0,74	0,79	0,83	0,86	0,88	0,89																	
	1,5	0,08	0,15	0,23	0,26	0,30	0,36	0,41	0,44	0,52	0,59	0,66	0,72	0,77	0,81	0,86	0,89	0,91	0,92																	
	>3	0,09	0,15	0,24	0,27	0,31	0,37	0,42	0,46	0,54	0,61	0,68	0,74	0,79	0,84	0,88	0,92	0,94	0,95																	
63	1	0,09	0,17	0,27	0,30	0,34	0,41	0,48	0,51	0,61	0,70	0,78	0,85	0,91	0,97	1,03	1,07	1,10	1,11																	
	1,05	0,10	0,17	0,27	0,31	0,35	0,42	0,49	0,53	0,63	0,72	0,80	0,88	0,94	1,00	1,06	1,11	1,14	1,15																	
	1,2	0,10	0,18	0,28	0,32	0,36	0,44	0,51	0,55	0,65	0,75	0,83	0,91	0,98	1,04	1,10	1,14	1,17	1,19																	
	1,5	0,10	0,19	0,29	0,33	0,38	0,45	0,53	0,57	0,67	0,77	0,86	0,94	1,01	1,07	1,13	1,18	1,21	1,23																	
	>3	0,11	0,19	0,30	0,34	0,39	0,47	0,54	0,59	0,69	0,79	0,88	0,97	1,04	1,10	1,17	1,22	1,25	1,26																	
71	1	0,11	0,20	0,33	0,37	0,42	0,51	0,59	0,64	0,76	0,88	0,98	1,07	1,15	1,22	1,29	1,35	1,38	1,39																	
	1,05	0,12	0,21	0,34	0,38	0,44	0,53	0,61	0,66	0,79	0,91	1,01	1,11	1,19	1,27	1,34	1,39	1,43	1,44																	
	1,2	0,12	0,22	0,35	0,39	0,45	0,54	0,63	0,69	0,82	0,94	1,05	1,14	1,23	1,31	1,39	1,44	1,48	1,48																	
	1,5	0,13	0,23	0,36	0,40	0,46	0,56	0,66	0,71	0,84	0,97	1,08	1,18	1,27	1,35	1,43	1,49	1,52	1,53																	
	>3	0,13	0,23	0,37	0,42	0,48	0,58	0,68	0,73	0,87	1,00	1,11	1,22	1,31	1,39	1,48	1,54	1,57	1,58																	
80	1	0,14	0,25	0,40	0,44	0,51	0,62	0,72	0,78	0,93	1,07	1,20	1,31	1,41	1,49	1,57	1,63	1,65	1,65																	
	1,05	0,14	0,25	0,41	0,46	0,53	0,64	0,75	0,81	0,97	1,11	1,24	1,36	1,46	1,54	1,63	1,68	1,71	1,71																	
	1,2	0,15	0,26	0,42	0,47	0,55	0,66	0,77	0,84	1,00	1,15	1,28	1,40	1,51	1,60	1,68	1,74	1,77	1,76																	
	1,5	0,15	0,27	0,44	0,49	0,56	0,68	0,80	0,86	1,03	1,18	1,32	1,45	1,56	1,65	1,74	1,80	1,83	1,82																	
	>3	0,15	0,28	0,45	0,50	0,58	0,71	0,82	0,89	1,06	1,22	1,36	1,49	1,60	1,70	1,79	1,86	1,88	1,88																	
90	1	0,16	0,29	0,47	0,53	0,61	0,74	0,86	0,94	1,12	1,28	1,43	1,56	1,67	1,77	1,85	1,90	1,90	1,86																	
	1,05	0,17	0,30	0,49	0,54	0,63	0,77	0,89	0,97	1,16	1,33	1,48	1,62	1,73	1,83	1,91	1,96	1,97	1,93																	
	1,2	0,17	0,31	0,50	0,56	0,65	0,79	0,93	1,00	1,20	1,37	1,53	1,67	1,79	1,89	1,98	2,03	2,03	1,99																	
	1,5	0,18	0,32	0,52	0,58	0,67	0,82	0,96	1,03	1,23	1,42	1,58	1,73	1,85	1,95	2,04	2,09	2,10	2,06																	
	>3	0,18	0,33	0,54	0,60	0,69	0,84	0,99	1,07	1,27	1,46	1,63	1,78	1,91	2,01	2,11	2,16	2,17	2,12																	
100	1	0,18	0,34	0,54	0,61	0,71	0,86	1,00	1,09	1,30	1,49	1,65	1,80	1,92	2,01	2,09	2,11	2,08	2,00																	
	1,05	0,19	0,35	0,56	0,63	0,73	0,89	1,04	1,13	1,34	1,54	1,71	1,86	1,99	2,08	2,16	2,19	2,16	2,07																	
	1,2	0,20	0,36	0,58	0,65	0,75	0,92	1,07	1,16	1,39	1,59	1,77	1,93	2,05	2,15	2,23	2,26	2,23	2,14																	
	1,5	0,20	0,37	0,60	0,67	0,78	0,95	1,11	1,20	1,43	1,64	1,83	1,99	2,12	2,22	2,31	2,34	2,30	2,21																	
	>3	0,21	0,38	0,62	0,70	0,80	0,98	1,14	1,24	1,48	1,69	1,89	2,05	2,19	2,29	2,38	2,41	2,38	2,28																	
112	1	0,21	0,39	0,63	0,71	0,82	1,00	1,17	1,26	1,51	1,72	1,91	2,06	2,19	2,27	2,32	2,30	2,21	2,03																	
	1,05	0,22	0,40	0,65	0,73	0,85	1,03	1,21	1,31	1,56	1,78	1,97	2,14	2,26	2,35	2,40	2,38	2,29	2,10																	
	1,2	0,23	0,42	0,68	0,76	0,88	1,07	1,25	1,35	1,61	1,84	2,04	2,21	2,34	2,43	2,48	2,46	2,36	2,18																	
	1,5	0,23	0,43	0,70	0,78	0,91	1,10	1,29	1,40	1,66	1,90	2,11	2,28	2,42	2,51	2,57	2,54	2,44	2,25																	
	>3	0,24	0,44	0,72	0,81	0,94	1,14	1,33	1,44	1,72	1,96	2,17	2,35	2,49	2,59	2,65	2,63	2,52	2,32																	
v [m/s]		5					10					15					20					25					30					35				
		Belt pulley - balancing					static										dynamic																			

Required number of belts in a gearing
$$z \geq \frac{N \cdot k_T}{N_T \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

N_T – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle. see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Table 3.10. Rated power N_1 transferred by one belt of A (13x8) - A BP section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																			
		200	400	700	800	950	1 200	1 450	1 600	2 000	2 400	2 800	3 200	3 600	4 000	4 500	5 000	5 500	6 000		
Nominal power value N_1 [kW]																					
71	1	0,14	0,23	0,35	0,39	0,44	0,51	0,58	0,61	0,70	0,77	0,82	0,80	0,87	0,87	0,85	0,78	0,69	0,58		
	1,05	0,14	0,24	0,36	0,40	0,45	0,53	0,60	0,64	0,72	0,80	0,85	0,89	0,90	0,90	0,87	0,81	0,71	0,58		
	1,2	0,15	0,25	0,38	0,41	0,47	0,55	0,62	0,66	0,75	0,82	0,88	0,92	0,94	0,93	0,90	0,84	0,74	0,60		
	1,5	0,15	0,26	0,39	0,43	0,48	0,56	0,64	0,68	0,77	0,85	0,91	0,95	0,97	0,97	0,93	0,87	0,76	0,62		
	>3	0,16	0,27	0,40	0,44	0,50	0,58	0,68	0,70	0,80	0,88	0,94	0,98	1,00	1,00	0,96	0,89	0,79	0,63		
80	1	0,18	0,31	0,47	0,52	0,60	0,71	0,81	0,87	1,01	1,12	1,22	1,29	1,34	1,37	1,36	1,31	1,21	1,06		
	1,05	0,18	0,32	0,49	0,54	0,62	0,73	0,84	0,90	1,04	1,16	1,26	1,34	1,39	1,41	1,41	1,35	1,25	1,10		
	1,2	0,19	0,33	0,51	0,56	0,64	0,76	0,87	0,93	1,08	1,20	1,30	1,38	1,43	1,46	1,45	1,40	1,29	1,13		
	1,5	0,20	0,34	0,52	0,58	0,66	0,78	0,90	0,96	1,11	1,24	1,35	1,43	1,48	1,51	1,50	1,45	1,34	1,17		
	>3	0,20	0,35	0,54	0,60	0,68	0,81	0,92	0,99	1,15	1,28	1,39	1,47	1,53	1,56	1,55	1,49	1,38	1,21		
90	1	0,22	0,39	0,61	0,68	0,77	0,93	1,07	1,15	1,34	1,50	1,64	1,75	1,83	1,87	1,88	1,82	1,70	1,50		
	1,05	0,23	0,40	0,63	0,70	0,80	0,96	1,10	1,19	1,38	1,56	1,70	1,81	1,89	1,94	1,94	1,88	1,76	1,55		
	1,2	0,24	0,41	0,65	0,72	0,83	0,99	1,14	1,23	1,43	1,61	1,76	1,87	1,96	2,00	2,01	1,95	1,81	1,60		
	1,5	0,24	0,43	0,67	0,75	0,85	1,02	1,18	1,27	1,48	1,66	1,82	1,94	2,02	2,07	2,07	2,01	1,87	1,66		
	>3	0,25	0,44	0,69	0,77	0,88	1,05	1,21	1,31	1,53	1,71	1,87	2,00	2,09	2,14	2,14	2,07	1,93	1,71		
100	1	0,26	0,47	0,74	0,83	0,95	1,14	1,32	1,42	1,66	1,87	2,05	2,19	2,28	2,34	2,33	2,25	2,07	1,80		
	1,05	0,27	0,48	0,77	0,85	0,98	1,18	1,36	1,47	1,72	1,94	2,12	2,26	2,36	2,42	2,42	2,33	2,15	1,87		
	1,2	0,28	0,50	0,79	0,88	1,01	1,22	1,41	1,52	1,78	2,01	2,19	2,34	2,44	2,50	2,50	2,41	2,22	1,93		
	1,5	0,29	0,52	0,82	0,91	1,05	1,26	1,45	1,57	1,84	2,07	2,27	2,42	2,52	2,58	2,58	2,48	2,29	1,99		
	>3	0,30	0,53	0,84	0,94	1,08	1,30	1,50	1,62	1,89	2,14	2,34	2,49	2,60	2,66	2,66	2,56	2,36	2,05		
112	1	0,31	0,56	0,90	1,00	1,15	1,39	1,61	1,74	2,04	2,30	2,51	2,68	2,78	2,83	2,79	2,64	2,37	1,96		
	1,05	0,32	0,58	0,93	1,04	1,19	1,44	1,67	1,80	2,11	2,38	2,60	2,77	2,88	2,93	2,89	2,74	2,45	2,03		
	1,2	0,34	0,60	0,96	1,07	1,23	1,49	1,72	1,86	2,18	2,46	2,69	2,86	2,98	3,03	2,99	2,83	2,54	2,10		
	1,5	0,35	0,62	0,99	1,11	1,27	1,54	1,78	1,92	2,25	2,54	2,78	2,96	3,08	3,13	3,09	2,92	2,62	2,17		
	>3	0,36	0,64	1,02	1,14	1,31	1,59	1,84	1,98	2,33	2,62	2,87	3,05	3,17	3,22	3,18	3,01	2,70	2,24		
125	1	0,37	0,67	1,07	1,19	1,37	1,66	1,92	2,07	2,44	2,74	2,98	3,16	3,26	3,28	3,17	2,91	2,48	1,87		
	1,05	0,38	0,69	1,10	1,23	1,42	1,72	1,99	2,15	2,52	2,84	3,09	3,27	3,37	3,39	3,28	3,01	2,57	1,93		
	1,2	0,39	0,71	1,14	1,28	1,47	1,77	2,06	2,22	2,61	2,93	3,19	3,38	3,49	3,51	3,39	3,12	2,66	2,00		
	1,5	0,41	0,74	1,18	1,32	1,52	1,83	2,13	2,29	2,69	3,03	3,30	3,49	3,60	3,62	3,50	3,22	2,74	2,06		
	>3	0,42	0,76	1,22	1,36	1,57	1,89	2,19	2,36	2,78	3,12	3,40	3,60	3,72	3,74	3,62	3,32	2,83	2,13		
140	1	0,43	0,78	1,26	1,41	1,62	1,96	2,28	2,45	2,87	3,22	3,48	3,65	3,72	3,67	3,44	2,99	2,31	1,37		
	1,05	0,45	0,81	1,30	1,46	1,68	2,03	2,36	2,54	2,97	3,33	3,60	3,78	3,85	3,80	3,56	3,10	2,39	1,42		
	1,2	0,46	0,84	1,35	1,51	1,74	2,10	2,43	2,62	3,07	3,44	3,72	3,91	3,98	3,93	3,68	3,20	2,47	1,46		
	1,5	0,48	0,86	1,39	1,56	1,79	2,17	2,51	2,71	3,17	3,56	3,85	4,03	4,11	4,06	3,80	3,31	2,55	1,51		
	>3	0,49	0,89	1,43	1,60	1,85	2,24	2,59	2,79	3,27	3,67	3,97	4,16	4,24	4,19	3,92	3,41	2,63	1,56		
160	1	0,51	0,94	1,51	1,69	1,95	2,36	2,73	2,94	3,42	3,80	4,06	4,19	4,17	3,98	3,48	2,67	1,51	-		
	1,05	0,53	0,97	1,56	1,75	2,02	2,44	2,82	3,04	3,54	3,93	4,20	3,34	4,31	4,12	3,60	2,77	1,57	-		
	1,2	0,55	1,00	1,62	1,81	2,09	2,52	2,92	3,14	3,66	4,07	4,35	4,48	4,46	4,25	3,73	2,86	1,62	-		
	1,5	0,57	1,03	1,67	1,87	2,15	2,60	3,02	3,24	3,78	4,20	4,49	4,63	4,60	4,39	3,85	2,95	1,67	-		
	>3	0,58	1,07	1,72	1,93	2,22	2,69	3,11	3,35	3,90	4,33	4,63	4,78	4,75	4,53	3,97	3,05	1,73	-		
180	1	0,59	1,09	1,76	1,97	2,27	2,74	3,16	3,40	3,93	4,32	4,54	4,58	4,40	4,00	3,13	1,81	-	-		
	1,05	0,61	1,12	1,82	2,04	2,35	2,83	3,27	3,52	4,07	4,47	4,70	4,74	4,56	4,14	3,24	1,87	-	-		
	1,2	0,63	1,16	1,88	2,10	2,43	2,93	3,38	3,63	4,20	4,62	4,86	4,90	4,71	4,28	3,34	1,94	-	-		
	1,5	0,66	1,20	1,94	2,17	2,51	3,03	3,50	3,75	4,34	4,77	5,02	5,06	4,87	4,42	3,45	2,00	-	-		
	>3	0,68	1,24	2,00	2,24	2,59	3,12	3,61	3,87	4,48	4,92	5,18	5,22	5,02	4,56	3,56	2,06	-	-		
v [m/s]		5			10			15			20			25		30		35		40	
Belt pulley - balancing						static						dynamic									

$$\text{Required number of belts in a gearing } z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

N_1 – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Table 3.11. Rated power N_1 transferred by one belt of B (17x11) - B BP section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																	
		200	400	700	800	950	1 200	1 450	1 600	1 800	2 000	2 200	2 400	2 800	3 200	3 600	4 000	4 500	5 000
		Nominal power value N_1 [kW]																	
112	1	0,39	0,66	1,00	1,10	1,25	1,40	1,64	1,75	1,85	1,94	2,01	2,07	2,12	2,08	1,94	1,70	1,24	0,58
	1,05	0,40	0,68	1,04	1,14	1,29	1,51	1,70	1,79	1,91	2,01	2,08	2,14	2,19	2,15	2,01	1,76	1,28	0,60
	1,2	0,41	0,71	1,07	1,18	1,33	1,56	1,75	1,86	1,97	2,08	2,15	2,21	2,27	2,22	2,08	1,82	1,32	0,62
	1,5	0,43	0,73	1,11	1,22	1,38	1,61	1,81	1,92	2,04	2,14	2,23	2,29	2,34	2,30	2,14	1,88	1,37	0,64
	>3	0,44	0,75	1,14	1,26	1,42	1,66	1,87	1,98	2,10	2,21	2,30	2,36	2,41	2,37	2,21	1,94	1,41	0,66
125	1	0,48	0,84	1,30	1,44	1,64	1,93	2,19	2,33	2,50	2,64	2,76	2,85	2,96	2,94	2,80	2,51	1,93	1,09
	1,05	0,50	0,87	1,35	1,49	1,69	2,00	2,27	2,41	2,59	2,73	2,86	2,95	3,06	3,04	2,90	2,60	2,00	1,13
	1,2	0,52	0,90	1,39	1,54	1,75	2,07	2,35	2,50	2,67	2,83	2,95	3,05	3,16	3,15	2,99	2,69	2,07	1,17
	1,5	0,53	0,93	1,44	1,59	1,81	2,13	2,42	2,58	2,76	2,92	3,05	3,15	3,27	3,25	3,09	2,78	2,14	1,21
	>3	0,55	0,96	1,48	1,64	1,86	2,20	2,50	2,66	2,85	3,01	3,15	3,25	3,37	3,35	3,19	2,86	2,21	1,24
140	1	0,59	1,05	1,64	1,82	2,08	2,47	2,82	3,00	3,23	3,42	3,58	3,70	3,85	3,83	3,63	3,24	2,45	1,29
	1,05	0,61	1,09	1,70	1,89	2,15	2,56	2,91	3,11	3,34	3,54	3,70	3,83	3,98	3,96	3,76	3,35	2,53	1,33
	1,2	0,54	1,12	1,76	1,95	2,22	2,64	3,01	3,21	3,45	3,66	3,83	3,96	4,11	4,09	3,88	3,47	2,62	1,38
	1,5	0,66	1,16	1,81	2,01	2,30	2,73	3,11	3,32	3,56	3,78	3,95	4,09	4,25	4,23	4,01	3,58	2,70	1,42
	>3	0,68	1,20	1,87	2,08	2,37	2,81	3,21	3,42	3,68	3,90	4,08	4,22	4,38	4,36	4,14	3,69	2,79	1,47
160	1	0,74	1,32	2,09	2,32	2,66	3,17	3,62	3,86	4,15	4,40	4,60	4,75	4,89	4,80	4,46	3,82	2,59	0,81
	1,05	0,76	1,37	2,16	2,40	2,75	3,28	3,75	4,00	4,30	4,55	4,76	4,91	5,06	4,97	4,61	3,96	2,68	0,84
	1,2	0,79	1,41	2,23	2,48	2,84	3,39	3,87	4,13	4,44	4,70	4,92	5,08	5,23	5,14	4,77	4,09	2,77	0,87
	1,5	0,82	1,46	2,31	2,57	2,94	3,50	4,00	4,27	4,59	4,86	5,08	5,25	5,40	5,31	4,92	4,23	2,86	0,90
	>3	0,84	1,51	2,38	2,65	3,03	3,61	4,13	4,40	4,73	5,01	5,24	5,41	5,58	5,48	5,08	4,36	2,95	0,93
180	1	0,88	1,59	2,53	2,81	3,22	3,85	4,39	4,68	5,02	5,30	5,52	5,67	5,76	5,52	4,92	3,92	2,04	-
	1,05	0,91	1,64	2,61	2,91	3,33	3,98	4,55	4,85	5,20	5,49	5,71	5,87	5,96	5,71	5,09	4,06	2,12	-
	1,2	0,94	1,70	2,70	3,01	3,45	4,11	4,70	5,01	5,37	5,67	5,91	6,07	6,16	5,91	5,27	4,19	2,19	-
	1,5	0,98	1,76	2,79	3,11	3,56	4,25	4,85	5,17	5,55	5,86	6,10	6,27	6,36	6,10	5,44	4,33	2,26	-
	>3	1,01	1,81	2,88	3,21	3,67	4,38	5,01	5,34	5,73	6,05	6,29	6,47	6,56	6,29	5,61	4,47	2,33	-
200	1	1,02	1,85	2,96	3,30	3,77	4,50	5,13	5,46	5,83	6,13	6,35	6,47	6,43	5,95	4,98	3,47	0,73	-
	1,05	1,06	1,92	3,06	3,41	3,91	4,66	5,31	5,65	6,04	6,35	6,57	6,70	6,66	6,16	5,16	3,56	0,76	-
	1,2	1,10	1,98	3,16	3,53	4,04	4,82	5,49	5,84	6,24	6,56	6,79	6,93	6,88	6,37	5,33	3,71	0,78	-
	1,5	1,13	2,05	3,27	3,64	4,17	4,97	5,67	6,03	6,45	6,78	7,01	7,15	7,11	6,58	5,51	3,84	0,81	-
	>3	1,17	2,11	3,37	3,76	4,30	5,13	5,85	6,22	6,65	6,99	7,24	7,42	7,33	6,79	5,68	3,96	0,83	-
224	1	1,19	2,17	3,47	3,86	4,42	5,36	5,97	6,33	6,73	7,02	7,19	7,25	6,95	6,05	4,47	2,14	-	-
	1,05	1,24	2,24	3,59	4,00	4,58	5,44	6,18	6,55	6,96	7,26	7,49	7,55	7,20	6,27	4,63	2,21	-	-
	1,2	1,28	2,32	3,71	4,13	4,73	5,63	6,39	6,77	7,20	7,55	7,74	7,80	7,49	6,48	4,79	2,28	-	-
	1,5	1,32	2,40	3,83	4,27	4,89	5,81	6,60	7,00	7,48	7,80	8,00	8,06	7,73	6,69	4,94	2,36	-	-
	>3	1,36	2,47	3,95	4,40	5,04	6,00	6,81	7,22	7,71	8,05	8,25	8,31	7,97	6,90	5,10	2,43	-	-
250	1	1,37	2,50	4,00	4,46	5,10	6,04	6,82	7,20	7,63	7,87	7,97	7,89	7,14	5,60	3,12	-	-	-
	1,05	1,42	2,59	4,14	4,62	5,28	6,25	7,00	7,49	7,89	8,15	8,24	8,16	7,43	5,79	3,23	-	-	-
	1,2	1,47	2,68	4,28	4,77	5,46	6,47	7,30	7,74	8,16	8,42	8,52	8,44	7,68	5,99	3,34	-	-	-
	1,5	1,52	2,77	4,42	4,93	5,63	6,68	7,58	8,00	8,43	8,70	8,80	8,71	7,93	6,19	3,45	-	-	-
	>3	1,57	2,85	4,56	5,08	5,81	6,89	7,82	8,25	8,69	8,97	9,07	8,99	8,18	6,38	3,56	-	-	-
280	1	1,58	2,89	4,61	5,13	5,85	6,90	7,76	8,13	8,46	8,60	8,53	8,22	6,80	4,26	-	-	-	-
	1,05	1,64	2,99	4,77	5,31	6,06	7,14	8,03	8,41	8,76	8,90	8,83	8,51	7,04	4,41	-	-	-	-
	1,2	1,69	3,09	4,93	5,49	6,26	7,42	8,30	8,69	9,05	9,20	9,12	8,80	7,27	4,56	-	-	-	-
	1,5	1,75	3,19	5,10	5,67	6,47	7,66	8,57	8,97	9,35	9,50	9,42	9,08	7,56	4,71	-	-	-	-
	>3	1,80	3,29	5,26	5,85	6,67	7,91	8,84	9,26	9,64	9,80	9,72	9,37	7,80	4,86	-	-	-	-
v [m/s]		5	10	15	20	25	30	35	40										
Belt pulley - balancing				static				dynamic											

$$\text{Required number of belts in a gearing } z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

N_1 – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Table 3.12. Rated power N_1 , transferred by one belt of 20 (20x12,5) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																	
		200	300	400	500	600	700	800	950	1 200	1 450	1 600	1 800	2 000	2 200	2 400	2 800	3 200	3 600
		Nominal power value N_1 [kW]																	
160	1	0,89	1,23	1,54	1,84	2,11	2,37	2,62	2,96	3,46	3,88	4,09	4,32	4,48	4,58	4,61	4,44	3,94	3,07
	1,05	0,92	1,27	1,60	1,90	2,19	2,45	2,71	3,06	3,58	4,02	4,23	4,47	4,64	4,74	4,77	4,60	4,08	3,18
	1,2	0,95	1,32	1,65	1,97	2,26	2,54	2,80	3,17	3,70	4,15	4,37	4,62	4,79	4,90	4,93	4,75	4,22	3,29
	1,5	0,98	1,36	1,71	2,03	2,33	2,62	2,89	3,27	3,82	4,29	4,52	4,77	4,95	5,06	5,09	4,91	4,36	3,40
	>3	1,01	1,40	1,76	2,09	2,41	2,70	2,98	3,37	3,95	4,42	4,66	4,92	5,11	5,22	5,26	5,07	4,50	3,50
180	1	1,10	1,54	1,94	2,32	2,68	3,02	3,35	3,80	4,47	5,03	5,31	5,62	5,84	5,97	6,01	5,77	5,06	3,84
	1,05	1,14	1,59	2,01	2,40	2,77	3,13	3,46	3,93	4,62	5,21	5,50	5,81	6,04	6,18	6,22	5,97	5,24	3,97
	1,2	1,18	1,64	2,08	2,48	2,87	3,23	3,58	4,06	4,78	5,38	5,68	6,01	6,25	6,39	6,43	6,17	5,42	4,11
	1,5	1,22	1,70	2,14	2,57	2,96	3,34	3,70	4,20	4,94	5,56	5,87	6,21	6,45	6,60	6,64	6,37	5,59	4,24
	>3	1,26	1,75	2,21	2,65	3,06	3,44	3,81	4,33	5,09	5,73	6,05	6,40	6,65	6,81	6,85	6,57	5,77	4,38
200	1	1,31	1,84	2,33	2,80	3,24	3,66	4,06	4,62	5,44	6,13	6,47	6,83	7,08	7,22	7,22	6,81	5,77	4,03
	1,05	1,36	1,90	2,42	2,90	3,36	3,79	4,20	4,78	5,63	6,34	6,70	7,07	7,33	7,51	7,52	7,05	5,97	4,17
	1,2	1,40	1,97	2,50	3,00	3,47	3,92	4,34	4,94	5,83	6,56	6,92	7,31	7,62	7,77	7,77	7,28	6,17	4,31
	1,5	1,45	2,03	2,58	3,09	3,58	4,05	4,49	5,10	6,02	6,77	7,15	7,59	7,87	8,02	8,20	7,57	6,38	4,45
	>3	1,50	2,10	2,66	3,19	3,70	4,17	4,63	5,27	6,21	6,99	7,42	7,83	8,12	8,27	8,28	7,81	6,58	4,60
224	1	1,56	2,20	2,80	3,37	3,90	4,42	4,90	5,58	6,57	7,43	7,82	8,22	8,47	8,55	8,46	7,70	6,02	3,42
	1,05	1,62	2,28	2,90	3,48	4,04	4,57	5,07	5,77	6,80	7,69	8,09	8,50	8,76	8,85	8,75	7,96	6,23	3,54
	1,2	1,67	2,35	3,00	3,60	4,18	4,72	5,24	5,97	7,03	7,95	8,36	8,79	9,05	9,15	9,05	8,23	6,45	3,66
	1,5	1,73	2,43	3,09	3,72	4,31	4,88	5,41	6,16	7,26	8,20	8,64	9,08	9,35	9,44	9,34	8,50	6,66	3,78
	>3	1,78	2,51	3,19	3,84	4,45	5,03	5,59	6,36	7,54	8,46	8,91	9,36	9,64	9,74	9,64	8,77	6,87	3,90
250	1	1,83	2,59	3,30	3,97	4,61	5,22	5,79	6,59	7,79	8,70	9,12	9,51	9,70	9,67	9,40	8,06	5,49	1,62
	1,05	1,89	2,68	3,41	4,11	4,77	5,40	5,99	6,82	8,06	9,00	9,43	9,84	10,04	10,01	9,73	8,34	5,68	1,68
	1,2	1,96	2,77	3,53	4,25	4,93	5,58	6,19	7,05	8,33	9,30	9,75	10,17	10,38	10,34	10,05	8,62	5,87	1,73
	1,5	2,02	2,86	3,64	4,39	5,09	5,76	6,40	7,28	8,60	9,61	10,07	10,51	10,72	10,68	10,38	8,90	6,07	1,79
	>3	2,09	2,95	3,76	4,53	5,25	5,95	6,60	7,55	8,87	9,91	10,39	10,84	11,05	11,02	10,71	9,18	6,26	1,85
280	1	2,14	3,03	3,86	4,66	5,41	6,12	6,79	7,75	9,06	10,04	10,45	10,78	10,83	10,57	9,98	7,70	3,71	-
	1,05	2,21	3,13	4,00	4,82	5,60	6,33	7,02	8,02	9,37	10,39	10,82	11,16	11,21	10,94	10,33	7,96	3,84	-
	1,2	2,28	3,24	4,13	4,98	5,79	6,54	7,26	8,29	9,69	10,74	11,18	11,53	11,58	11,31	10,68	8,23	3,97	-
	1,5	2,36	3,34	4,27	5,14	5,97	6,76	7,54	8,56	10,00	11,09	11,55	11,91	11,96	11,68	11,02	8,50	4,10	-
	>3	2,43	3,45	4,40	5,31	6,16	6,97	7,78	8,83	10,32	11,44	11,91	12,28	12,34	12,04	11,37	8,77	4,23	-
315	1	2,49	3,53	4,51	5,44	6,32	7,14	7,95	9,00	10,43	11,42	11,78	11,93	11,70	11,03	9,90	6,04	-	-
	1,05	2,57	3,66	4,67	5,63	6,54	7,43	8,23	9,31	10,80	11,82	12,19	12,35	12,11	11,42	10,25	6,25	-	-
	1,2	2,66	3,78	4,83	5,82	6,76	7,68	8,51	9,63	11,16	12,22	12,60	12,76	12,51	11,80	10,59	6,46	-	-
	1,5	2,75	3,90	4,99	6,01	6,98	7,93	8,78	9,94	11,53	12,62	13,01	13,18	12,92	12,19	10,94	6,68	-	-
	>3	2,84	4,03	5,15	6,20	7,20	8,18	9,06	10,26	11,89	13,02	13,42	13,60	13,33	12,57	11,28	6,89	-	-
355	1	2,89	4,10	5,24	6,32	7,33	8,31	9,18	10,34	11,85	12,74	12,94	12,77	12,04	10,71	8,71	2,46	-	-
	1,05	2,99	4,25	5,43	6,54	7,63	8,60	9,50	10,70	12,26	13,19	13,39	13,21	12,46	11,08	9,01	2,55	-	-
	1,2	3,09	4,39	5,61	6,76	7,88	8,89	9,82	11,06	12,68	13,63	13,84	13,66	12,88	11,45	9,32	2,63	-	-
	1,5	3,19	4,53	5,79	6,98	8,14	9,18	10,14	11,43	13,09	14,08	14,30	14,10	13,30	11,83	9,62	2,72	-	-
	>3	3,29	4,68	5,98	7,20	8,40	9,47	10,46	11,79	13,50	14,52	14,75	14,55	13,72	12,20	9,92	2,81	-	-
v [m/s]		5	10	15	20	25	30	35	40										
Belt pulley - balancing		static						dynamic											

Required number of belts in a gearing $z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$

where:

N – power transferred by a gearing;

N_1 – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Table 3.13. Rated power N_i transferred by one belt of C (22x14) - C BP section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																							
		200	300	400	500	600	700	800	950	1 200	1 450	1 600	1 800	2 000	2 200	2 400	2 600	2 800	3 200						
		Nominal power value N_i [kW]																							
180	1	1,12	1,54	1,92	2,27	2,59	2,89	3,17	3,55	4,07	4,46	4,62	4,76	4,78	4,70	4,50	4,17	3,70	2,33						
	1,05	1,16	1,60	1,99	2,35	2,68	3,00	3,26	3,67	4,22	4,62	4,79	4,92	4,95	4,86	4,65	4,31	3,83	2,41						
	1,2	1,20	1,65	2,06	2,43	2,76	3,10	3,30	3,80	4,36	4,77	4,95	5,09	5,12	5,03	4,81	4,40	3,96	2,49						
	1,5	1,24	1,70	2,12	2,51	2,87	3,20	3,51	3,92	4,50	4,93	5,11	5,25	5,28	5,19	4,97	4,60	4,09	2,57						
	>3	1,28	1,76	2,19	2,59	2,96	3,30	3,62	4,05	4,64	5,08	5,27	5,42	5,45	5,36	5,13	4,75	4,22	2,65						
200	1	1,39	1,92	2,41	2,87	3,30	3,69	4,07	4,58	5,29	5,84	6,07	6,28	6,34	6,26	6,02	5,61	5,01	3,23						
	1,05	1,44	1,99	2,50	2,97	3,41	3,82	4,21	4,74	5,48	6,04	6,29	6,50	6,57	6,48	6,23	5,80	5,19	3,34						
	1,2	1,48	2,06	2,58	3,07	3,53	3,95	4,35	4,90	5,66	6,25	6,50	6,72	6,79	6,70	6,44	6,00	5,36	3,46						
	1,5	1,53	2,12	2,67	3,17	3,64	4,08	4,49	5,00	5,85	6,45	6,71	6,94	7,01	6,92	6,65	6,20	5,54	3,57						
	>3	1,58	2,19	2,75	3,27	3,76	4,21	4,64	5,22	6,03	6,66	6,93	7,16	7,23	7,14	6,86	6,39	5,71	3,68						
224	1	1,70	2,37	2,99	3,58	4,12	4,64	5,12	5,78	6,71	7,45	7,75	8,00	8,06	7,92	7,57	6,93	6,08	3,57						
	1,05	1,76	2,45	3,10	3,70	4,27	4,80	5,30	5,98	6,94	7,71	8,02	8,28	8,35	8,20	7,83	7,17	6,30	3,69						
	1,2	1,82	2,54	3,20	3,83	4,41	4,96	5,47	6,18	7,18	7,97	8,29	8,56	8,63	8,48	8,09	7,46	6,51	3,82						
	1,5	1,88	2,62	3,31	3,95	4,56	5,12	5,65	6,38	7,45	8,23	8,56	8,84	8,91	8,75	8,36	7,70	6,72	3,94						
	>3	1,94	2,70	3,41	4,08	4,70	5,29	5,83	6,58	7,69	8,49	8,83	9,12	9,19	9,03	8,62	7,94	6,93	4,07						
250	1	2,03	2,85	3,62	4,33	5,00	5,64	6,23	7,04	8,21	9,04	9,38	9,63	9,62	9,34	8,75	7,85	6,56	2,93						
	1,05	2,11	2,95	3,74	4,48	5,18	5,83	6,45	7,28	8,50	9,36	9,71	9,96	9,95	9,66	9,06	8,12	6,79	3,03						
	1,2	2,18	3,05	3,87	4,64	5,35	6,03	6,66	7,58	8,78	9,67	10,03	10,30	10,29	9,99	9,36	8,40	7,02	3,14						
	1,5	2,25	3,15	4,00	4,79	5,53	6,23	6,88	7,82	9,07	9,99	10,36	10,63	10,62	10,31	9,67	8,67	7,25	3,24						
	>3	2,32	3,25	4,12	4,94	5,71	6,43	7,10	8,07	9,36	10,30	10,69	10,97	10,96	10,64	9,97	8,94	7,52	3,34						
280	1	2,42	3,40	4,32	5,19	6,00	6,76	7,52	8,49	9,81	10,72	11,06	11,22	11,04	10,48	9,50	8,08	6,13	-						
	1,05	2,50	3,52	4,48	5,37	6,21	7,00	7,78	8,78	10,15	11,10	11,44	11,61	11,42	10,84	9,83	8,36	6,35	-						
	1,2	2,59	3,64	4,63	5,55	6,42	7,24	8,04	9,08	10,49	11,47	11,83	12,00	11,81	11,21	10,16	8,64	6,56	-						
	1,5	2,67	3,76	4,78	5,73	6,63	7,52	8,30	9,37	10,83	11,84	12,21	12,39	12,19	11,57	10,49	8,92	6,77	-						
	>3	2,76	3,88	4,93	5,92	6,84	7,76	8,57	9,67	11,17	12,22	12,60	12,79	12,58	11,94	10,82	9,20	6,99	-						
315	1	2,86	4,04	5,14	6,17	7,14	8,09	8,92	10,05	11,53	12,46	12,72	12,67	12,14	11,08	9,43	7,11	4,16	-						
	1,05	2,96	4,18	5,32	6,39	7,43	8,37	9,24	10,40	11,93	12,89	13,16	13,11	12,56	11,46	9,76	7,41	4,31	-						
	1,2	3,06	4,32	5,50	6,60	7,68	8,65	9,55	10,75	12,33	13,33	13,60	13,56	12,99	11,85	10,09	7,66	4,45	-						
	1,5	3,16	4,46	5,68	6,82	7,93	8,93	9,86	11,10	12,73	13,76	14,05	14,00	13,41	12,23	10,42	7,90	4,60	-						
	>3	3,26	4,60	5,86	7,03	8,16	9,21	10,17	11,45	13,14	14,20	14,49	14,44	13,83	12,62	10,75	8,15	4,75	-						
355	1	3,36	4,75	6,05	7,27	8,45	9,50	10,46	11,73	13,31	14,12	14,19	13,73	12,59	10,70	7,98	4,32	-	-						
	1,05	3,47	4,91	6,26	7,57	8,74	9,83	10,83	12,14	13,77	14,61	14,68	14,21	13,03	11,07	8,26	4,47	-	-						
	1,2	3,59	5,08	6,47	7,82	9,04	10,16	11,19	12,55	14,23	15,10	15,18	14,69	13,47	11,44	8,53	4,63	-	-						
	1,5	3,71	5,25	6,69	8,08	9,33	10,49	11,56	12,95	14,70	15,59	15,67	15,17	13,91	11,81	8,81	4,78	-	-						
	>3	3,82	5,41	6,90	8,33	9,62	10,82	11,92	13,36	15,16	16,09	16,17	15,65	14,35	12,19	9,09	4,93	-	-						
400	1	3,91	5,54	7,06	8,52	9,82	11,02	12,10	13,48	15,04	15,53	15,24	14,08	11,95	8,75	4,34	-	-	-						
	1,05	4,04	5,73	7,30	8,81	10,17	11,41	12,52	13,95	15,56	16,07	15,77	14,57	12,36	9,05	4,49	-	-	-						
	1,2	4,18	5,93	7,60	9,11	10,51	11,79	12,94	14,42	16,08	16,61	16,30	15,06	12,78	9,36	4,64	-	-	-						
	1,5	4,32	6,12	7,84	9,41	10,85	12,17	13,37	14,89	16,61	17,15	16,83	15,55	13,20	9,66	4,80	-	-	-						
	>3	4,45	6,31	8,09	9,70	11,19	12,56	13,79	15,36	17,13	17,70	17,36	16,04	13,61	9,97	4,95	-	-	-						
450	1	4,51	6,40	8,20	9,81	11,29	12,63	13,80	15,23	16,59	16,47	15,57	13,29	9,64	4,44	-	-	-	-						
	1,05	4,67	6,62	8,48	10,16	11,69	13,07	14,28	15,76	17,17	17,04	16,12	13,75	9,98	4,59	-	-	-	-						
	1,2	4,83	6,85	8,77	10,50	12,08	13,51	14,76	16,29	17,75	17,62	16,66	14,22	10,31	4,75	-	-	-	-						
	1,5	4,99	7,07	9,05	10,84	12,48	13,95	15,24	16,82	18,33	18,19	17,20	14,68	10,65	4,90	-	-	-	-						
	>3	5,15	7,30	9,34	11,18	12,87	14,39	15,72	17,35	18,91	18,77	17,75	15,14	10,98	5,06	-	-	-	-						
v [m/s]		5			10			15			20			25			30			35			40		
Belt pulley - balancing		static						dynamic																	

Required number of belts in a gearing $z \geq \frac{N \cdot k_T}{N_i \cdot k_\phi \cdot k_L}$

where:

N – power transferred by a gearing;

N_i – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T

– coefficient of working conditions, see the table 3.1.;

k_L

– coefficient of the belt length, see the table 3.3.

Table 3.14. Rated power N_1 transferred by one belt of 25 (25x16) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																		
		200	250	300	400	500	600	700	800	950	1 200	1 450	1 600	1 800	2 000	2 200	2 400	2 600	2 800	
		Nominal power value N_1 [kW]																		
250	1	2,35	2,81	3,26	4,10	4,89	5,61	6,29	6,91	7,79	8,91	9,64	9,88	9,94	9,68	9,07	8,08	6,65	4,82	
	1,05	2,43	2,91	3,38	4,25	5,06	5,81	6,51	7,15	8,06	9,22	9,98	10,22	10,28	10,01	9,38	8,37	6,88	4,99	
	1,2	2,51	3,01	3,49	4,39	5,23	6,01	6,73	7,44	8,33	9,53	10,31	10,57	10,63	10,35	9,70	8,65	7,12	5,16	
	1,5	2,59	3,11	3,60	4,54	5,40	6,20	6,95	7,68	8,61	9,84	10,65	10,91	10,98	10,69	10,02	8,93	7,35	5,33	
	>3	2,67	3,21	3,72	4,68	5,57	6,40	7,17	7,92	8,88	10,15	10,98	11,25	11,32	11,02	10,33	9,21	7,63	5,50	
280	1	2,84	3,42	3,98	5,03	6,00	6,91	7,80	8,58	9,62	10,99	11,85	12,09	12,06	11,59	10,65	9,18	7,10	4,47	
	1,05	2,94	3,54	4,12	5,20	6,21	7,15	8,07	8,88	9,96	11,38	12,27	12,52	12,48	12,00	11,02	9,50	7,35	4,62	
	1,2	3,04	3,66	4,26	5,38	6,42	7,44	8,35	9,18	10,29	11,76	12,68	12,94	12,90	12,40	11,39	9,82	7,64	4,78	
	1,5	3,14	3,78	4,39	5,55	6,63	7,68	8,62	9,48	10,63	12,14	13,09	13,36	13,33	12,81	11,76	10,14	7,89	4,93	
	>3	3,24	3,90	4,53	5,73	6,84	7,92	8,89	9,78	10,96	12,53	13,50	13,78	13,75	13,21	12,13	10,46	8,14	5,09	
315	1	3,42	4,12	4,80	6,08	7,28	8,44	9,47	10,42	11,67	13,26	14,15	14,31	14,03	13,13	11,57	9,27	6,14	2,20	
	1,05	3,54	4,27	4,97	6,30	7,58	8,73	9,80	10,78	12,07	13,72	14,64	14,81	14,52	13,59	11,97	9,59	6,35	2,27	
	1,2	3,66	4,41	5,14	6,51	7,83	9,03	10,13	11,14	12,48	14,18	15,14	15,30	15,00	14,05	12,37	9,92	6,57	2,35	
	1,5	3,77	4,55	5,30	6,72	8,09	9,32	10,46	11,50	12,89	14,64	15,63	15,80	15,49	14,51	12,78	10,24	6,78	2,43	
	>3	3,89	4,70	5,47	6,93	8,34	9,61	10,79	11,87	13,29	15,11	16,12	16,30	15,98	14,96	13,18	10,56	7,00	2,50	
355	1	4,06	4,91	5,73	7,27	8,75	10,09	11,31	12,42	13,87	15,60	16,36	16,29	15,51	13,87	11,28	7,65	2,85	-	
	1,05	4,21	5,08	5,93	7,57	9,06	10,44	11,71	12,86	14,35	16,14	16,94	16,86	16,06	14,35	11,67	7,91	2,95	-	
	1,2	4,35	5,25	6,13	7,82	9,36	10,79	12,10	13,29	14,83	16,69	17,51	17,43	16,60	14,84	12,06	8,18	3,05	-	
	1,5	4,49	5,43	6,33	8,08	9,67	11,14	12,49	13,72	15,32	17,23	18,08	18,00	17,14	15,32	12,46	8,44	3,15	-	
	>3	4,63	5,60	6,53	8,33	9,97	11,49	12,89	14,16	15,80	17,78	18,65	18,57	17,68	15,81	12,85	8,71	3,24	-	
400	1	4,78	5,79	6,75	8,63	10,32	11,88	13,30	14,57	16,16	17,89	18,28	17,77	16,12	13,25	9,04	3,31	-	-	
	1,05	4,95	5,99	6,99	8,93	10,68	12,29	13,76	15,08	16,73	18,52	18,92	18,39	16,69	13,71	9,35	3,42	-	-	
	1,2	5,12	6,19	7,23	9,23	11,04	12,71	14,23	15,58	17,29	19,14	19,56	19,01	17,25	14,18	9,67	3,54	-	-	
	1,5	5,28	6,39	7,51	9,53	11,40	13,12	14,69	16,09	17,85	19,77	20,20	19,63	17,81	14,64	9,98	3,65	-	-	
	>3	5,45	6,60	7,74	9,83	11,76	13,54	15,15	16,60	18,42	20,39	20,83	20,25	18,37	15,10	10,30	3,77	-	-	
450	1	5,57	6,75	7,92	10,05	12,01	13,80	15,40	16,80	18,47	19,98	19,62	18,37	15,32	10,56	3,85	-	-	-	
	1,05	5,76	6,98	8,20	10,40	12,43	14,28	15,94	17,38	19,12	20,68	20,31	19,01	15,86	10,93	3,99	-	-	-	
	1,2	5,96	7,22	8,47	10,75	12,85	14,76	16,47	17,97	19,76	21,38	20,99	19,65	16,39	11,30	4,12	-	-	-	
	1,5	6,15	7,50	8,75	11,10	13,27	15,24	17,01	18,55	20,41	22,08	21,68	20,29	16,93	11,67	4,26	-	-	-	
	>3	6,35	7,73	9,02	11,45	13,69	15,73	17,55	19,14	21,05	22,78	22,36	20,93	17,46	12,03	4,39	-	-	-	
500	1	6,35	7,74	9,02	11,44	13,65	15,63	17,38	18,85	20,50	21,54	20,05	17,74	12,80	5,48	-	-	-	-	
	1,05	6,57	8,00	9,34	11,84	14,13	16,18	17,98	19,51	21,22	22,29	20,75	18,36	13,25	5,67	-	-	-	-	
	1,2	6,79	8,27	9,65	12,24	14,60	16,73	18,59	20,17	21,93	23,05	21,45	18,98	13,70	5,86	-	-	-	-	
	1,5	7,01	8,54	9,97	12,64	15,08	17,27	19,20	20,82	22,65	23,80	22,15	19,60	14,14	6,05	-	-	-	-	
	>3	7,24	8,81	10,28	13,04	15,56	17,82	19,80	21,48	23,37	24,55	22,85	20,22	14,59	6,25	-	-	-	-	
560	1	7,27	8,85	10,32	13,07	15,54	17,72	19,57	21,06	22,54	22,63	19,21	15,20	7,21	-	-	-	-	-	
	1,05	7,57	9,16	10,68	13,52	16,08	18,34	20,26	21,80	23,33	23,42	19,88	15,73	7,51	-	-	-	-	-	
	1,2	7,82	9,47	11,04	13,98	16,63	18,96	20,94	22,54	24,11	24,22	20,55	16,26	7,76	-	-	-	-	-	
	1,5	8,08	9,78	11,40	14,43	17,17	19,58	21,62	23,27	24,90	25,01	21,23	16,79	8,01	-	-	-	-	-	
	>3	8,33	10,08	11,76	14,89	17,71	20,20	22,31	24,01	25,69	25,80	21,90	17,32	8,26	-	-	-	-	-	
v [m/s]	5	10			15			20	25			30	35	40						
Belt pulley - balancing				static					dynamic											

Required number of belts in a gearing $z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$

where:

N – power transferred by a gearing;

N_1 – rated power transferred by one belt;

k_r – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Tabela 3.15. Rated power N_i , transferred by one belt of D (32x20) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																	
		100	150	200	250	300	400	500	600	700	800	950	1 100	1 200	1 300	1 450	1 600	1 800	2 000
		Nominal power value N_i [kW]																	
355	1	3,01	4,20	5,31	6,36	7,35	9,24	10,90	12,39	13,70	14,83	16,15	16,98	17,25	17,26	16,77	15,63	12,97	8,92
	1,05	3,11	4,35	5,50	6,58	7,65	9,56	11,28	12,82	14,18	15,35	16,71	17,58	17,85	17,86	17,36	16,17	13,43	9,23
	1,2	3,22	4,50	5,69	6,81	7,91	9,88	11,66	13,25	14,66	15,86	17,28	18,17	18,45	18,47	17,94	16,72	13,88	9,54
	1,5	3,32	4,64	5,87	7,03	8,17	10,20	12,04	13,68	15,13	16,38	17,84	18,76	19,06	19,07	18,53	17,26	14,33	9,85
	>3	3,43	4,79	6,06	7,25	8,43	10,52	12,42	14,12	15,61	16,90	18,40	19,36	19,66	19,67	19,11	17,81	14,78	10,16
400	1	3,66	5,14	6,25	7,88	9,13	11,45	13,55	15,42	17,07	18,46	20,06	20,99	21,20	21,06	20,15	18,31	14,28	8,26
	1,05	3,79	5,32	6,75	8,16	9,45	11,85	14,02	15,96	17,66	19,11	20,76	21,72	21,94	21,80	20,85	18,95	14,78	8,55
	1,2	3,91	5,50	6,98	8,43	9,76	12,25	14,49	16,50	18,26	19,75	21,46	22,45	22,68	22,54	21,56	19,59	15,28	8,84
	1,5	4,04	5,68	7,21	8,70	10,08	12,64	14,96	17,04	18,85	20,40	22,16	23,19	23,42	23,27	22,26	20,23	15,78	9,13
	>3	4,17	5,86	7,48	8,98	10,40	13,04	15,44	17,57	19,45	21,04	22,86	23,92	24,16	24,01	22,97	20,87	16,28	9,41
450	1	4,37	6,17	7,90	9,50	11,02	13,85	16,40	18,67	20,63	22,25	24,01	24,84	24,84	24,35	22,62	19,59	13,34	4,23
	1,05	4,52	6,38	8,17	9,83	11,40	14,33	16,98	19,32	21,35	23,03	24,84	25,71	25,71	25,20	23,41	20,28	13,80	4,38
	1,2	4,68	6,60	8,45	10,16	11,79	14,82	17,55	19,97	22,07	23,81	25,68	26,58	26,58	26,05	24,20	20,96	14,27	4,53
	1,5	4,83	6,81	8,72	10,49	12,17	15,30	18,12	20,62	22,79	24,58	26,52	27,45	27,44	26,90	24,99	21,64	14,73	4,68
	>3	4,98	7,03	9,00	10,82	12,56	15,78	18,69	21,28	23,51	25,36	27,36	28,32	28,31	27,75	25,78	22,33	15,20	4,83
500	1	5,08	7,18	9,21	11,09	12,88	16,20	19,17	21,78	23,99	25,76	27,50	28,02	27,61	26,54	23,59	18,88	9,59	-
	1,05	5,25	7,48	9,53	11,48	13,33	16,77	19,84	22,54	24,82	26,66	28,46	29,00	28,57	27,47	24,42	19,54	9,92	-
	1,2	5,43	7,73	9,85	11,86	13,78	17,33	20,51	23,30	25,66	27,56	29,42	29,98	29,54	28,39	25,24	20,20	10,26	-
	1,5	5,61	7,98	10,17	12,25	14,23	17,90	21,18	24,06	26,50	28,45	30,38	30,96	30,50	29,32	26,06	20,86	10,59	-
	>3	5,79	8,23	10,49	12,64	14,68	18,46	21,85	24,82	27,34	29,35	31,34	31,94	31,47	30,25	26,89	21,52	10,92	-
560	1	5,91	8,43	10,76	12,97	15,07	18,95	22,38	25,32	27,73	29,55	31,04	30,85	29,67	27,58	22,58	15,13	-	-
	1,05	6,12	8,72	11,14	13,42	15,60	19,61	23,16	26,21	28,70	30,59	32,13	31,92	30,71	28,54	23,37	15,66	-	-
	1,2	6,33	9,02	11,51	13,88	16,12	20,27	23,94	27,09	29,67	31,62	33,21	33,00	31,74	29,51	24,15	16,18	-	-
	1,5	6,53	9,31	11,89	14,33	16,65	20,93	24,72	27,98	30,64	32,65	34,30	34,08	32,78	30,47	24,94	16,71	-	-
	>3	6,74	9,60	12,26	14,78	17,17	21,59	25,50	28,86	31,61	33,68	35,38	35,16	33,82	31,43	25,73	17,24	-	-
630	1	6,88	9,82	12,54	15,13	17,57	22,05	25,94	29,18	31,68	33,38	34,19	32,65	30,15	26,37	18,06	6,25	-	-
	1,05	7,12	10,16	12,98	15,65	18,18	22,82	26,84	30,19	32,79	34,54	35,38	33,79	31,21	27,29	18,69	6,47	-	-
	1,2	7,36	10,50	13,42	16,18	18,80	23,59	27,75	31,21	33,90	35,71	36,58	34,93	32,26	28,21	19,32	6,69	-	-
	1,5	7,65	10,84	13,86	16,71	19,41	24,36	28,66	32,23	35,01	36,88	37,78	36,07	33,31	29,13	19,95	6,91	-	-
	>3	7,89	11,19	14,29	17,24	20,02	25,13	29,56	33,25	36,11	38,04	38,97	37,21	34,37	30,05	20,58	7,12	-	-
710	1	8,01	11,38	14,55	17,54	20,35	25,45	29,76	33,18	35,59	36,87	36,35	32,52	27,88	21,42	7,99	-	-	-
	1,05	8,29	11,78	15,05	18,15	21,06	26,34	30,80	34,34	36,84	38,16	37,62	33,66	28,86	22,17	8,27	-	-	-
	1,2	8,57	12,17	15,56	18,76	21,78	27,23	31,84	35,50	38,08	39,44	38,90	34,79	29,83	22,92	8,54	-	-	-
	1,5	8,85	12,57	16,07	19,37	22,49	28,12	32,88	36,66	39,32	40,73	40,17	35,93	30,81	23,67	8,82	-	-	-
	>3	9,13	12,97	16,58	19,99	23,20	29,01	33,92	37,82	40,57	42,02	41,44	37,07	31,78	24,41	9,10	-	-	-
800	1	9,22	13,11	16,76	20,18	23,39	29,08	33,72	37,13	39,14	39,55	36,76	29,26	21,32	10,78	-	-	-	-
	1,05	9,55	13,57	17,34	20,89	24,20	30,10	34,90	38,43	40,51	40,94	38,04	30,29	22,07	11,16	-	-	-	-
	1,2	9,87	14,03	17,93	21,59	25,02	31,12	36,08	39,73	41,88	42,32	39,33	31,31	22,81	11,53	-	-	-	-
	1,5	10,19	14,48	18,51	22,30	25,84	32,13	37,26	41,03	43,25	43,70	40,61	32,33	23,55	11,91	-	-	-	-
	>3	10,51	14,94	19,10	23,00	26,66	33,15	38,44	42,33	44,61	45,08	41,90	33,36	24,30	12,28	-	-	-	-
v [m/s]		5	10	15	20	25	30	35	40										
Belt pulley - balancing				static				dynamic											

Required number of belts in a gearing $z \geq \frac{N \cdot k_T}{N_i \cdot k_\phi \cdot k_L}$

where:

N – power transferred by a gearing;

N_i – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Table 3.16. Rated power N_1 transferred by one belt of E (40x23) section

d_p [mm]	i or $1/i$	Smaller pulley speed n_d [rpm]																	
		100	150	200	250	300	350	400	500	600	700	800	950	1 100	1 200	1 300	1 450	1 600	1 700
		Nominal power value N_1 [kW]																	
500	1	6,12	8,60	10,86	12,97	14,96	16,81	18,55	21,65	24,21	26,21	27,57	28,32	27,30	25,53	22,82	16,82	8,29	1,04
	1,05	6,33	8,90	11,24	13,42	15,48	17,40	19,20	22,40	25,06	27,12	28,54	29,31	28,25	26,43	23,62	17,41	8,58	1,08
	1,2	6,54	9,20	11,61	13,88	16,00	17,99	19,85	23,16	25,91	28,04	29,50	30,30	29,21	27,32	24,41	17,99	8,87	1,12
	1,5	6,76	9,50	11,99	14,33	16,52	18,58	20,49	23,92	26,75	28,96	30,46	31,28	30,16	28,21	25,21	18,58	9,16	1,15
	>3	6,97	9,79	12,37	14,78	17,04	19,16	21,14	24,67	27,60	29,87	31,43	32,27	31,11	29,10	26,01	19,17	9,45	1,19
560	1	7,23	10,33	13,09	15,67	18,10	20,38	22,49	26,25	29,30	31,59	33,03	33,40	31,35	28,49	24,31	15,35	2,84	-
	1,05	7,62	10,69	13,54	16,22	18,73	21,09	23,28	27,16	30,33	32,69	34,18	34,57	32,45	29,48	25,16	15,89	2,94	-
	1,2	7,87	11,05	14,00	16,77	19,37	21,80	24,07	28,08	31,35	33,80	35,34	35,74	33,55	30,48	26,01	16,43	3,04	-
	1,5	8,13	11,41	14,46	17,31	20,00	22,51	24,85	29,00	32,37	34,90	36,49	36,90	34,64	31,48	26,85	16,96	3,14	-
	>3	8,39	11,77	14,91	17,86	20,63	23,22	25,64	29,91	33,40	36,01	37,65	38,07	35,74	32,47	27,70	17,50	3,24	-
630	1	8,75	12,32	15,65	18,77	21,69	24,42	26,95	31,36	34,83	37,26	38,52	37,92	33,94	29,17	22,56	8,85	-	-
	1,05	9,05	12,75	16,19	19,42	22,45	25,27	27,89	32,45	36,05	38,56	39,86	39,24	35,12	30,19	23,35	9,16	-	-
	1,2	9,36	13,18	16,74	20,08	23,21	26,13	28,83	33,55	37,27	39,87	41,21	40,57	36,31	31,21	24,13	9,47	-	-
	1,5	9,66	13,61	17,28	20,73	23,96	26,98	29,77	34,65	38,49	41,17	42,56	41,89	37,50	32,23	24,92	9,78	-	-
	>3	9,97	14,04	17,83	21,39	24,72	27,83	30,71	35,74	39,70	42,47	43,90	43,22	38,68	33,25	25,71	10,09	-	-
710	1	10,31	14,56	18,52	22,23	25,69	28,89	31,83	36,85	40,58	42,87	43,52	41,02	33,74	25,91	15,44	-	-	-
	1,05	10,67	15,07	19,17	23,01	26,59	29,90	32,94	38,13	42,00	44,37	45,05	42,45	34,92	26,81	15,98	-	-	-
	1,2	11,03	15,58	19,82	23,78	27,48	30,91	34,06	39,42	43,42	45,87	46,57	43,89	36,10	27,72	16,52	-	-	-
	1,5	11,39	16,09	20,46	24,56	28,38	31,92	35,17	40,71	44,84	47,37	48,09	45,32	37,28	28,62	17,06	-	-	-
	>3	11,75	16,59	21,11	25,34	29,28	32,93	36,28	42,00	46,26	48,87	49,61	46,76	38,46	29,53	17,60	-	-	-
800	1	12,05	17,05	21,70	26,03	30,05	33,73	37,05	42,53	46,26	47,96	47,38	41,59	29,06	16,46	-	-	-	-
	1,05	12,47	17,64	22,46	26,94	31,10	34,90	38,35	44,02	47,87	49,64	49,03	43,05	30,07	17,04	-	-	-	-
	1,2	12,89	18,24	23,21	27,85	32,15	36,08	39,64	45,51	49,49	51,32	50,69	44,50	31,09	17,61	-	-	-	-
	1,5	13,31	18,83	23,97	28,76	33,20	37,26	40,94	47,00	51,11	52,99	52,35	45,96	32,10	18,19	-	-	-	-
	>3	13,74	19,43	24,73	29,67	34,25	38,44	42,23	48,48	52,73	54,67	54,00	47,41	33,12	18,76	-	-	-	-
900	1	13,96	19,76	25,15	30,14	34,71	38,84	42,49	48,20	51,48	51,95	49,21	38,19	17,65	-	-	-	-	-
	1,05	14,45	20,45	26,03	31,19	35,92	40,20	43,98	49,89	53,28	53,77	50,93	39,53	18,27	-	-	-	-	-
	1,2	14,94	21,14	26,91	32,24	37,13	41,55	45,46	51,57	55,08	55,58	52,65	40,87	18,88	-	-	-	-	-
	1,5	15,42	21,84	27,79	33,30	38,35	42,91	46,95	53,26	56,88	57,40	54,37	42,20	19,50	-	-	-	-	-
	>3	15,91	22,53	28,67	34,35	39,56	44,27	48,43	54,94	58,68	59,20	56,09	43,54	20,12	-	-	-	-	-
1000	1	15,84	22,44	28,52	34,11	39,17	43,66	47,52	53,12	55,45	54,00	48,19	30,08	-	-	-	-	-	-
	1,05	16,40	23,22	29,52	35,31	40,54	45,19	49,18	54,97	57,39	55,88	49,87	31,13	-	-	-	-	-	-
	1,2	16,95	24,00	30,52	36,70	41,91	46,71	50,84	56,83	59,33	57,77	51,56	32,18	-	-	-	-	-	-
	1,5	17,50	24,79	31,51	37,69	43,28	48,24	52,51	58,69	61,27	59,66	53,24	33,23	-	-	-	-	-	-
	>3	18,06	25,57	32,51	38,88	44,65	49,77	54,17	60,55	63,21	61,55	54,93	34,28	-	-	-	-	-	-
1120	1	18,07	25,58	32,47	38,71	44,26	49,04	52,98	57,94	58,42	53,62	42,77	-	-	-	-	-	-	-
	1,05	18,71	26,48	33,60	40,06	45,81	50,76	54,83	59,97	60,46	55,49	44,27	-	-	-	-	-	-	-
	1,2	19,34	27,37	34,74	41,42	47,38	52,47	56,69	61,99	62,51	57,37	45,77	-	-	-	-	-	-	-
	1,5	19,97	28,27	35,88	42,72	48,90	54,19	58,54	64,03	64,59	59,25	47,26	-	-	-	-	-	-	-
	>3	20,61	29,16	37,01	44,12	50,45	55,91	60,39	66,06	66,59	61,13	48,76	-	-	-	-	-	-	-
v [m/s]		5	10	15	20	25	30	35	40										
Belt pulley - balancing				static				dynamic											

$$\text{Required number of belts in a gearing } z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$$

where:

N – power transferred by a gearing;

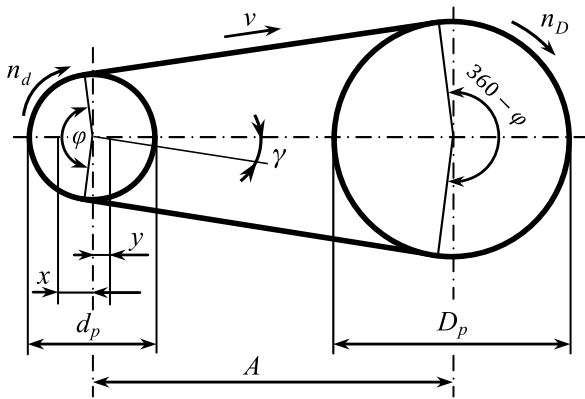
N_1 – rated power transferred by one belt;

k_ϕ – coefficient of wrap angle, see the table 3.2.;

k_T – coefficient of working conditions, see the table 3.1.;

k_L – coefficient of the belt length, see the table 3.3.

Formulas and markings



Rys. 3.3. Pas zespolony

Wrap angle

- approximate: ϕ from table 3.2.; for $\frac{D_p - d_p}{A}$

- or: $\phi \approx 180^\circ - 60^\circ \frac{D_p - d_p}{A}$

- exact: $\cos \frac{\phi}{2} = \frac{D_p - d_p}{2A}$

Rotation of belt: $v = \frac{n_d \cdot d_p}{19100} = \frac{n_D \cdot D_p}{19100}$

Number of belts: $z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L}$

Formulas:

Ratio:

$$i = \frac{n_c}{n_b}$$

Big pulley diameter

- when small pulley works as driving pulley:

$$D_p = i \cdot d_p$$

- when big pulley works as driving pulley:

$$D_p = \frac{d_p}{i}$$

Axle base:

- recom: $0,7(D_p + d_p) < A_0 < 2(D_p + d_p)$

- calc. for known: $L_p: A \approx p + \sqrt{p^2 - q}$

where: $p = 0,25L_p - 0,393(D_p + d_p)$

$$q = 0,125(D_p - d_p)^2$$

Changing of base axle:

- for belt tension: $x \geq 0,03L_p$

- for belt mounting: $y \geq 0,015L_p$

Belt pitch length:

- approx.:

$$L_p \approx 2A + 1,57(D_p + d_p) + \frac{(D_p - d_p)^2}{4A}$$

- exact:

$$L_p = 2A \cdot \sin \frac{\phi}{2} + \frac{\pi}{2}(D_p + d_p) + \frac{\gamma \cdot \pi}{180^\circ} \cdot (D_p - d_p)$$

Markings:

A - gearing base axle [mm]

A_0 - preliminary base axle [mm]

k_T - coefficient of work conditions,

k_ϕ - coefficient of small wrap angle,

k_L - coefficient of length

d_p - pitch diameter of small pulley [mm]

D_p - pitch diameter of big pulley [mm]

i - gearing ratio

L_p - pitch diameter [mm]

n_b - prędkość obrotowa koła biernego (napędzanego) [rpm]

n_c - prędkość obrotowa koła czynnego (napędzającego) [rpm]

n_d - prędkość obrotowa małego koła [rpm]

n_D - prędkość obrotowa dużego koła [rpm]

N - moc przenoszona przez przekładnię [kW]

N_1 - moc znamionowa dla jednego pasa [kW]

v - belt speed [m/s]

z - number of belts in a gearing [pcs.]

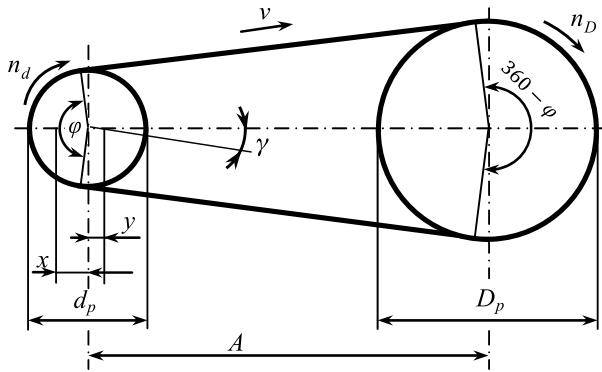
ϕ - wrap angle of smaller pulley [°]

γ - displacement angle of belt centrelines of pulley grooves $\gamma = 90^\circ - \frac{\phi}{2}$ [°]

x - minimal distance required for belt tension [mm]

y - min. distance required for belt mounting [mm]

Example of belt bearing calculations with two pulleys



Draw. 3.4. Diagram of belt gearing

Driving machine: 3-phase induction motor started by star/delta switch
power: $N = 10 \text{ kW}$, rotations: $n_c = 2920 \text{ rpm}$.

Driving machine: fan, rotations: $n_b = 1950 \text{ rpm}$.

Gearing parameters: daily time of operation: $T = 10 - 16$ hours,
pulleys diameter and base axle - optimal.

$$n_c > n_b \Rightarrow n_c = n_d, d_c = d_p; n_b = n_D, d_b = D_p$$

Coefficient of work conditions k_T

k_T from table 3.1.

For motor with star/delta start up, $T = 10 - 16$ h
And fan of power above 7,5 kW

$$k_T = 1,2$$

Calculation power N_o

$$N_o = N \cdot k_T$$

$$N_o = 10 \cdot 1,2 = 12 \text{ kW}$$

Belt section

Fig. 3.1.; 3.2.

For $N_o = 12 \text{ kW}$, $n_d = 2920 \text{ rpm}$, optimal pulley diameter,
SPZ was chosen, and diameter of small pulley $d_p = 160 \text{ mm}$

Belt speed v

$$v = \frac{n_d \cdot x \cdot d_p}{19100}$$

$$v = \frac{2920 \cdot 160}{19100} = 24,5 \text{ m/s}$$

dla SPZ, $v_{\max} = 40 \text{ m/s}$

Ratio i

$$i = \frac{n_c}{n_b}$$

$$i = \frac{2920}{1950} = 1,5$$

Diameter of big pulley D_p

For gearing with small active pulley:

$$D_p = i \cdot d_p$$

$$D_p = 1,5 \cdot 160 = 240 \text{ mm}$$

Preliminary axle base A_o

$$A_{max} = 2(D_p + d_p)$$

$$A_{max} = 2 \cdot (240 + 160) = 800 \text{ mm}$$

$$A_{max} = 0,7(D_p + d_p)$$

$$A_{max} = 0,7 \cdot (240 + 160) = 280 \text{ mm}$$

assumed: $A_o = 540 \text{ mm}$

Belt length L_p

- approximate

$$L_p \approx 2A + 1,57(D_p + d_p) + \frac{(D_p - d_p)^2}{4A}$$

$$L_p \approx 2 \cdot 540 + 1,57(240 + 160) + \frac{(240 - 160)^2}{4 \cdot 540} = 1711 \text{ mm}$$

- exact

$$L_p = 2A \cdot \sin \frac{\varphi}{2} + \frac{\pi}{2} (D_p - d_p) + \frac{\gamma \cdot \pi}{180^\circ} \cdot (D_p - d_p)$$

assumed: $L_p = 1700 \text{ mm}$

final belt length was taken from the table 2.2

Base axle A

$$A \approx p + \sqrt{p^2 - q}$$

$$A \approx 267,80 + \sqrt{267,80^2 - 800} = 534 \text{ mm}$$

where: $p = 0,25L_p - 0,393(D_p + d_p)$

$$p = 0,25 \cdot 1700 - 0,393 \cdot (240 + 160) = 267,80$$

$$q = 0,125 \cdot (D_p - d_p)^2$$

$$q = 0,125 \cdot (240 - 160)^2 = 800 \text{ mm}^2$$

Axis shift

$$x \geq 0,03 L_p$$

$$x \geq 0,03 \cdot 1700 = 51 \text{ mm}$$

$$y \geq 0,015 L_p$$

$$y \geq 0,015 \cdot 1700 = 25,5 \text{ mm}$$

Coefficient of work conditions k_T

k_T was determined in point 1 z tabeli 3.1.

$$k_T = 1,2$$

Coefficient of angle wraps k_ϕ

For:
$$\frac{D_p - d_p}{A} = \frac{240 - 160}{534} = 0,15$$

k_ϕ and approximate value of angle ϕ from table 3.2 $k_\phi = 0,98$

$$\cos \frac{\phi}{2} = \frac{(D_p - d_p)}{2A} \quad \phi = 171^\circ$$

Coefficient of belt length k_L

k_L from table 3.3

For SPZ belt $L_p = 1700$ mm
 $k_L = 1.005$

Nominal power N_1

N_1 from table 3.5

For SPZ belt, $d_p = 160$ mm, $i = 1.5$, $n_d = 2920$ obr/min,
 using linear interpolation
 $N_1 = 7.88$ kW

Required number of belts in gearing z

$$z \geq \frac{N \cdot k_T}{N_1 \cdot k_\phi \cdot k_L} \quad z \geq \frac{10 \cdot 1,2}{7,88 \cdot 0,98 \cdot 1,005} \geq 1,55$$

Calculated z value should be rounded up to integer number

Two SPZ belts were assumed of length $L_p = 1700$ mm

Static force in belt tie T_s

$$T_s = \frac{500(2,02 - k_\phi) \cdot N \cdot k_T}{k_\phi \cdot z \cdot v} + c \cdot v^2 \quad T_s = \frac{500 \cdot (2,02 - 0,98) \cdot 10 \cdot 1,2}{0,98 \cdot 2 \cdot 24,5} + 0,08 \cdot 24,5^2 = 178N$$

c - from fig.5.2; for the belt SPZ: $c=0,08$

Minimal axis force in static state N_s

$$N_s = 2T_s \cdot \sin \frac{\phi}{2} \cdot z \quad N_s = 2 \cdot 178 \cdot \sin \frac{171}{2} \cdot 2 = 710 N$$

Tie deflection value U_p

$$U_p = \frac{U \cdot L}{100} \quad U_p = \frac{2,5 \cdot 532,4}{100} = 13,3 \text{ mm}$$

where U - z fig. 5.2.

$$L = A \cdot \sin \frac{\phi}{2} \quad L = 534 \cdot \sin \frac{171}{2} = 532,4 \text{ mm}$$

Control force q exerted at belt from the table 5.2. $q = 25 N$

NOTE: Belt tension should be periodically checked and adjusted mainly during first hours of gearing operation, when its length is extended mostly. Incorrect belt tension or lack its correction is the most frequent reason of belt usage. (More information in chapter "5. Tension of belts").

MEMO:

A large grid of dashed lines for writing, consisting of 20 columns and 30 rows of squares.

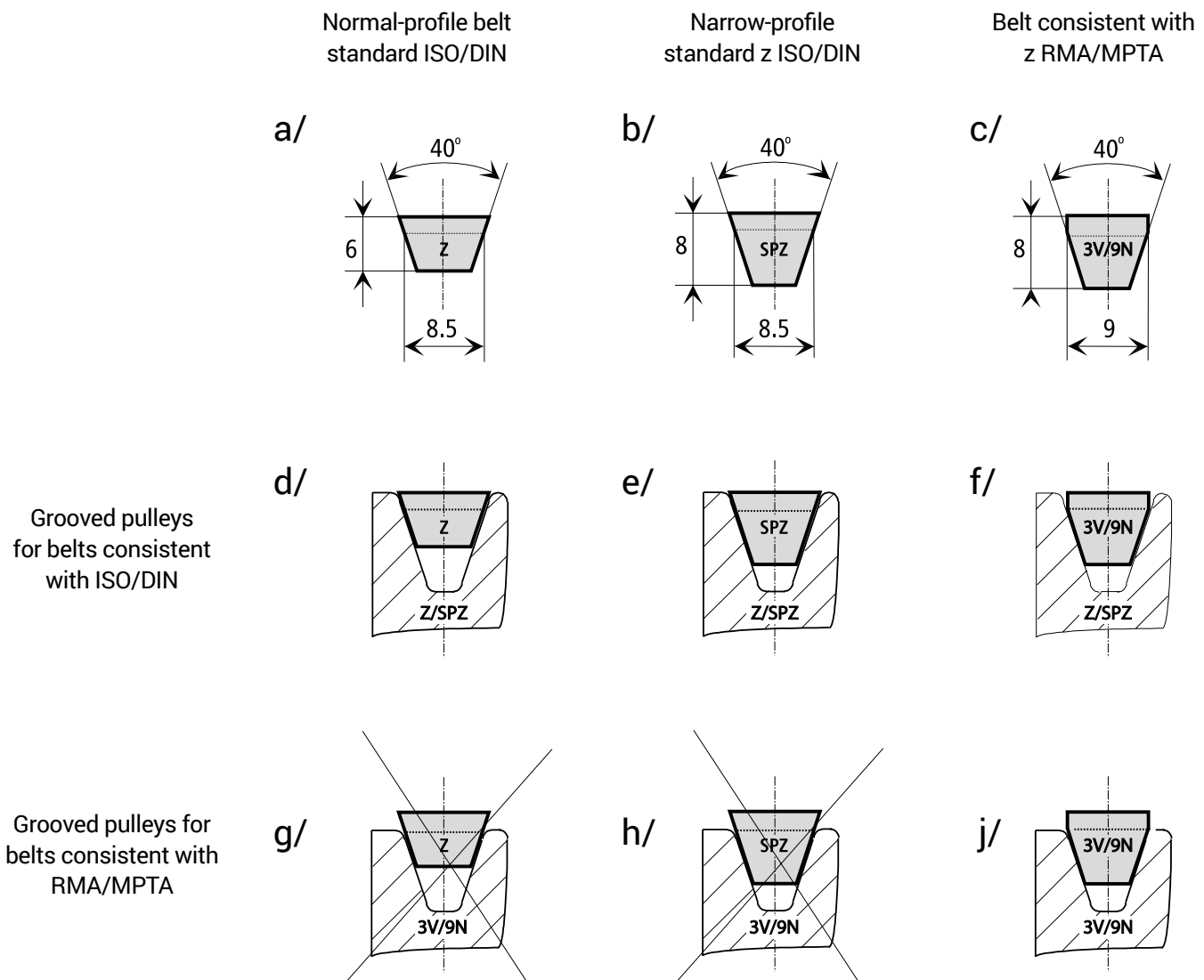
Grooved pulleys

Grooved pulleys for single belts

Belt pulleys are the main part of belt drive. They are simply name grooved pulleys. Basic standard which standardize pulleys for single belts is international standard ISO 4183.

Grooved pulleys for narrow V-belts can also be used for classical belts of the same pitch width l_p (w_p) with respect of rationalizing of V-belt drives, for belts of size Z, A, B and C, the same pulleys as for SPZ, SPA, SPB and SPC should be used. These belts, for a given section size, possess the same pitch width, angle, but they vary in height (drawing 4.1 a;b).

Rules regarding correct pulley selection are included in point 1.3.c

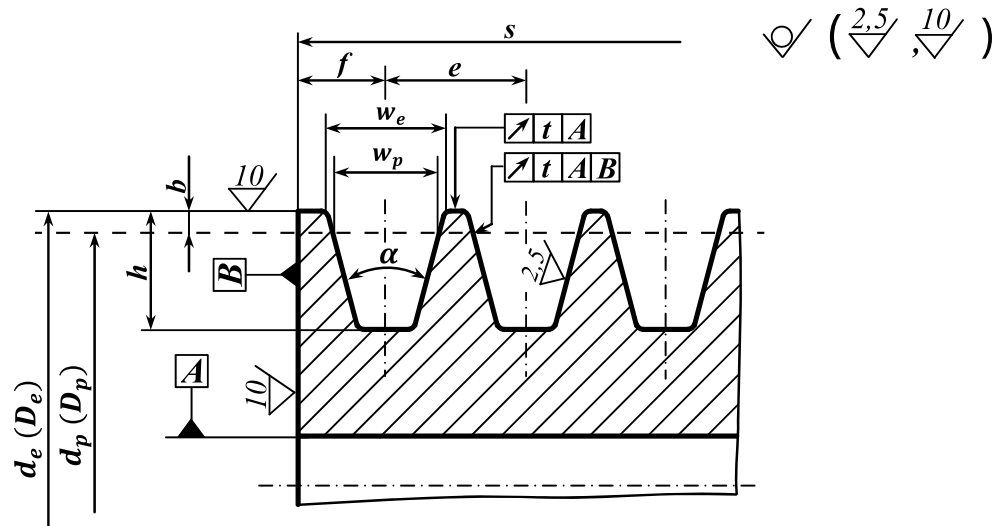


Rys. 4.1. Differences in dimensions of belts and pulley wheels according to DIN and RMA/MPTA

Belts according to RMA/MPTA of section size 3V/9N and 5V/15N can easily work in pulleys designed for belts SPZ-Z/10 and SPB-B/17. Nevertheless, reversal usage is not recommended without profile correction as upper width of grooves of American pulleys is lower in relation to ISO/DIN equivalents. So narrow V-belts SPZ or SPB are destroyed at a 2/3 height of belt walls what leads to lowering their lifetime (drawing 4.1 g and h).

Narrow SPB belt the production of Sanok Rubber Company SA is so designed, that can freely work in belt wheels suited for 5V/15N belts.

Dimensions



Draw. 4.2. Pulley for single belts

Table 4.1 Grooved pulleys dimensions for narrow and classical belts

		Dimensions in millimeters							
Narrow belt: ISO and DIN marking		SPZ	SPA	SPB	-	SPC	-	-	-
Classical belt	ISO marking	Z	A	B	-	C	-	D	E
	DIN marking	10	13	17	20	22	25	32	40
Pitch width w_p		8,5	11	14	17	19	21	27	32
Approximate upper width w_e		9,7	12,7	16,3	20	22	25	32	40
Groove height under dividing line b		2	2,8	3,5	5,1	4,8	6,3	8,1	9,6
Minimal groove depth h_{min}		11	13,8	17,5	18	23,8	22	28	33
Pulley pitch e		$12^{\pm 0,3}$	$15^{\pm 0,3}$	$19^{\pm 0,4}$	$23^{\pm 0,4}$	$25,5^{\pm 0,5}$	$29^{\pm 0,5}$	$37^{\pm 0,6}$	$44,5^{\pm 0,7}$
Edge pitch f		$8^{\pm 0,6}$	$10^{\pm 0,8}$	$12,5^{\pm 0,8}$	$15^{\pm 0,8}$	$17^{\pm 1}$	$19^{\pm 1}$	$24^{\pm 2}$	$29^{\pm 2}$
max. Σ of deviations e w kole		$\pm 0,6$	$\pm 0,6$	$\pm 0,8$	$\pm 0,8$	$\pm 1,0$	$\pm 1,0$	$\pm 1,2$	$\pm 1,4$
$d_{p min}$	Classical profile	63	90	140	-	224	-	-	-
	Narrow profile	50	71	112	160	180	250	355	500
Pitch diameter d_p	$\alpha = 34^\circ$	<80	<118	<190	<250	<315	<355	-	-
	$\alpha = 36^\circ$	-	-	-	-	-	-	<500	<630
	$\alpha = 38^\circ$	>80	>180	>190	>250	>315	>355	>500	>630
acceptable deviations α		$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$
Belt pulley rim width s for belts $s = (z - 1) \cdot e + 2f$	1	16	20	25	30	34	38	48	58
	2	28	35	44	53	59,5	67	85	105,5
	3	40	50	63	76	85	96	122	147
	4	52	65	82	99	110,5	125	159	191,5
	5	64	80	101	122	136	154	196	236
	6	76	95	120	145	161,5	183	233	280,5
	7	88	110	139	168	187	212	270	325
	8	100	125	158	191	212,5	241	307	369,5
	9	112	140	177	214	238	270	344	414
	10	124	155	169	237	263,5	299	381	458,5

Tabela 4.1 Wymiary kół rowkowych dla asów wąskich i klasycznych

wymiary w milimetrach

Narrow belt ISO and DIN	SPZ	SPA	SPB	-	SPC	-	-	-	Range of pitch diameter		Runout Tolerance <i>t</i>	
	ISO marking	A	B	-	C	-	D	E	<i>d_p</i>			
Classical belt	DIN marking	10	13	17	20	22	25	32	40	min	max	
Pitch diameter <i>d_p</i>	50*									50	50,8	0,2
	56*									56	56,9	
	63									63	64,0	
	71	71*								71	72,1	
	80	80								80	81,3	
	90	90								90	91,4	
	100	100								100	101,6	
	112	112								112	113,8	0,3
		118		112* (118)*						118	119,9	
	125	125		125						125	127,0	
				132 (132)*						132	134,1	
	140	140		140						140	142,2	
	150	150		150						150	152,4	
	160	160		160	160					160	162,6	
	180		(170)	(170)	180		180*			170	172,7	0,4
	190	190		190			190*			180	182,9	
	200	200		200	200		200*			190	193,0	
			(212)	(212)			212*			200	203,2	
	224	224		224	224		224			212	215,4	
			236	236			236			224	227,6	
	250	250		250	250		250	250		236	239,8	
										250	254,0	
	280	280		280	280		280	280		280	284,5	0,5
	300	300		300			300			300	304,8	
	315	315		315	315		315	315		315	320,0	
	355	355		355	355		355	355	355	355	360,7	
	400	400		400	400		400	400	400	400	406,4	
	450	450		450	450		450	450	450	450	457,2	0,6
	500	500		500	500		500	500	500	500	508,0	
	560	560		560	560		560	560	560	560	569,0	
	630	630		630	630		630	630	630	630	640,1	
	710		710	710	710		710	710	710	710	710	721,4
		800	800	800		800	800	800	800	800	812,8	
		900	900	900		900	900	900	900	900	914,4	
		1000	1000	1000		1000	1000	1000	1000	1000	1016,0	
					1120	1120	1120	1120	1120	1120	1137,9	1,0
					1250	1250	1250	1250	1250	1250	1270,0	
					1400	1400	1400	1400	1400	1400	1422,4	
					1600	1600	1600	1600	1600	1600	1625,6	
					1800	1800	1800	1800	1800	1800	1828,8	1,2
					2000	2000	2000	2000	2000	2000	2032,0	
Acceptable deviations of grooves pitch diameters in one pulley	0,4				0,6				-			

Diameters marked in bold take precedence in new constructions

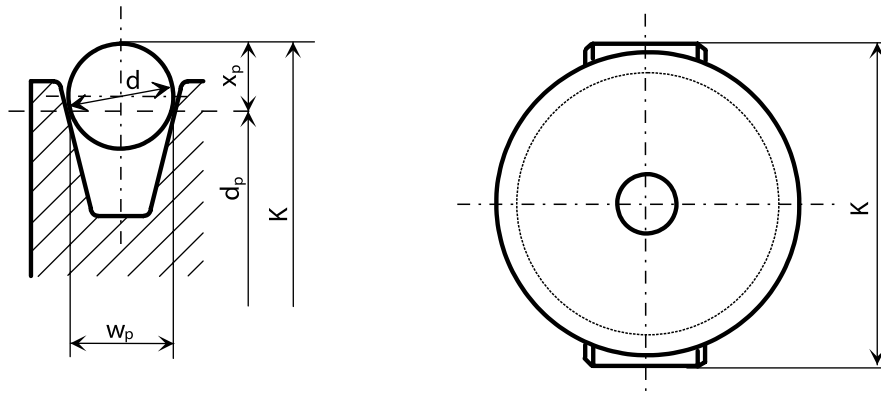
Diameters marked with * regard only classical V-belts

Diameters above 2000 mm should be chosen in accordance with series of normal digits R20.

Measurement of geometrical quantities

Pitch diameter measurement

- measurement is performed with the aid of measuring cylinders of diameter d in a way shown at draw.4.3.



Draw. 4.3. Pitch diameter measurement with the aid of measuring cylinders.

Diameter K is measured. Pitch diameter d_p is then calculated at the base of following formula:

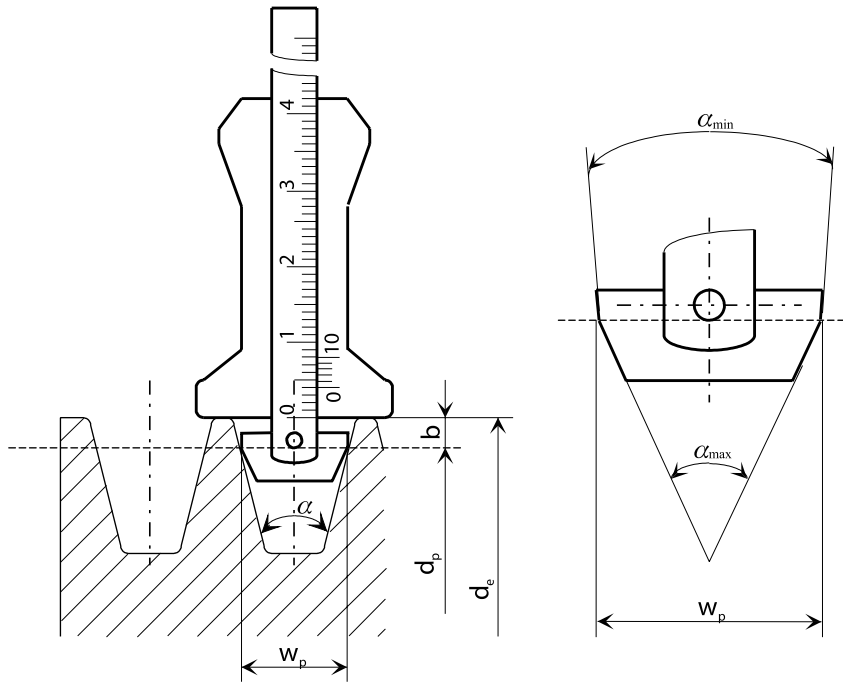
$$d_p = K - 2x_p$$

Table 4.3 Measured values of grooved pulleys for single belts.

Dimensions in millimeters								
Narrow-profile ISO i DIN mark.	SPZ	SPA	SPB	-	SPC	-	-	-
Classical profile	Z	A	B	-	C	-	D	E
ISO marking	10	13	17	20	22	25	32	40
DIN marking								
Diameter of measuring cylinder d	$9^{+0}_{-0,036}$	$11,6^{+0}_{-0,043}$	$14,7^{+0}_{-0,110}$	$18^{+0}_{-0,110}$	$20^{+0}_{-0,130}$	$22,2^{+0}_{-0,130}$	$28,5^{+0}_{-0,130}$	$38,8^{+0}_{-0,160}$
Approximate correction dimension $2x_p$	12	15	19	24	26	29	37	44

In case of pulleys of machined outside cylindrical surface and big diameter, instead of measurement with the aid of measuring cylinders, external diameter d_e can be measured, then dimension b can be measured with the aid of depth gauge according to drawing 4.4. then effective diameter d_p can be calculated at a base of following formula:

$$d_p = d_e - 2b$$



Rys. 4.4. Depth gauge for measurement of **b** dimension

Pitch diameters concentration checking

- Checking is performed by usage of depth gauge according to Figure 4.4. Dimension **b** is measured at whole circumference of each groove.

Angle of groove profile checking

- Angle of groove profile checking is performed by different gauge in accordance to the Figure 4.5.

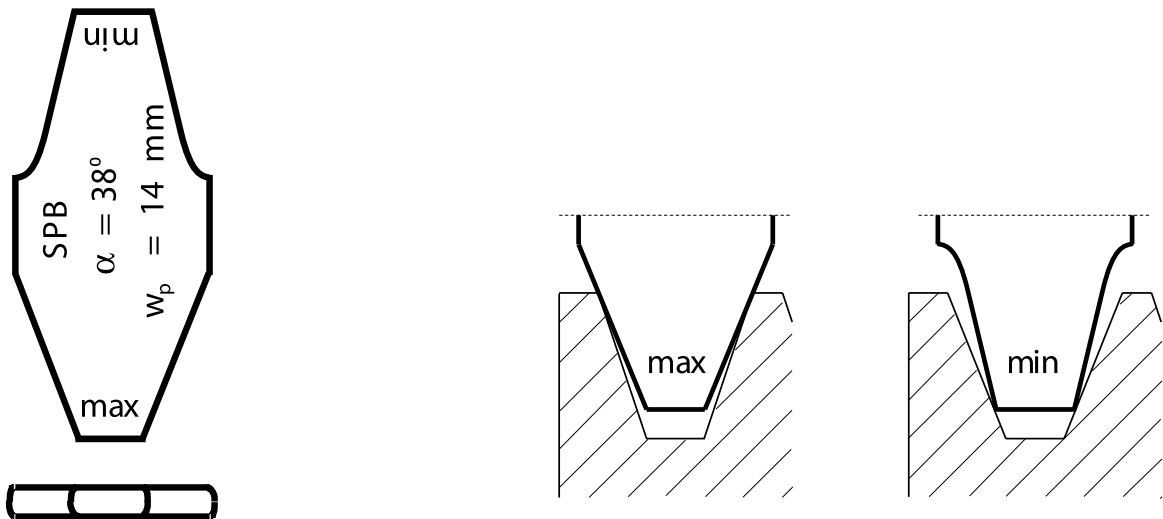


Fig. 4.5. Angle of groove profile checking

Grooved pulley for power bands

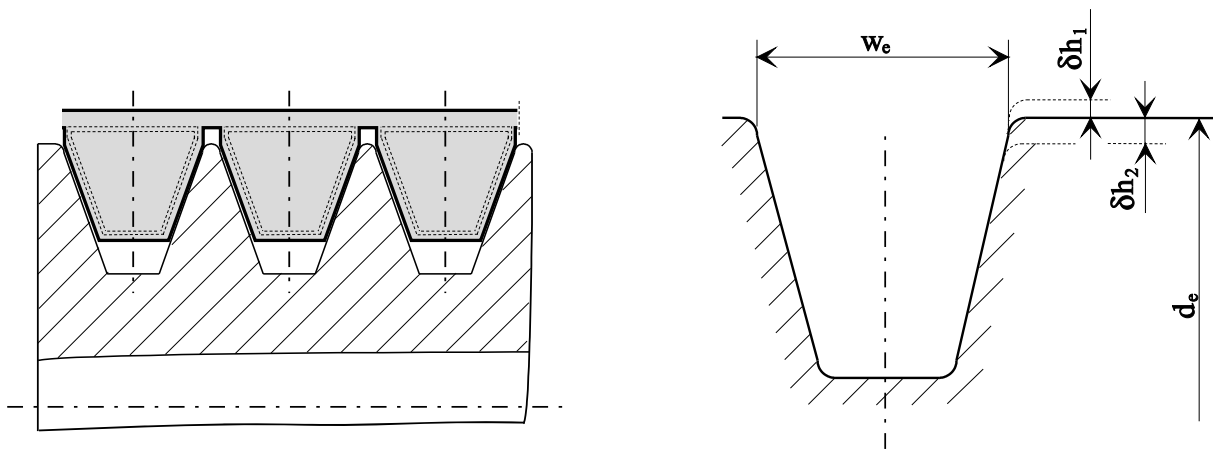
Belt pulleys for power bands of narrow profile are normalized in accordance to standard ISO 5290, and for power bands of classical profile in accordance to standard ISO 5291.

In international ISO standard effective (upper) nominal groove width w_e of belt pulley was determined as a base value for groove normalization of belt pulley and adherent power bands. Effective groove width is a biggest groove width measured at rectilinear groove walls. For all measuring wheels and mostly for working pulleys mass-produced this concept coincides with real upper groove width. Pitch diameter d_p location (effective) is given only as a approximate value. For determination of gearing dimensions and power, effective (outside) dimension of wheel is used. Minimal calculation differences in a ratio and rotational frequency do not have any practical influence.

General rules regarding belt pulleys are included in point 1.3.c.

Power bands can work only on belt pulleys made in accordance to dimensions shown in table 4.4.

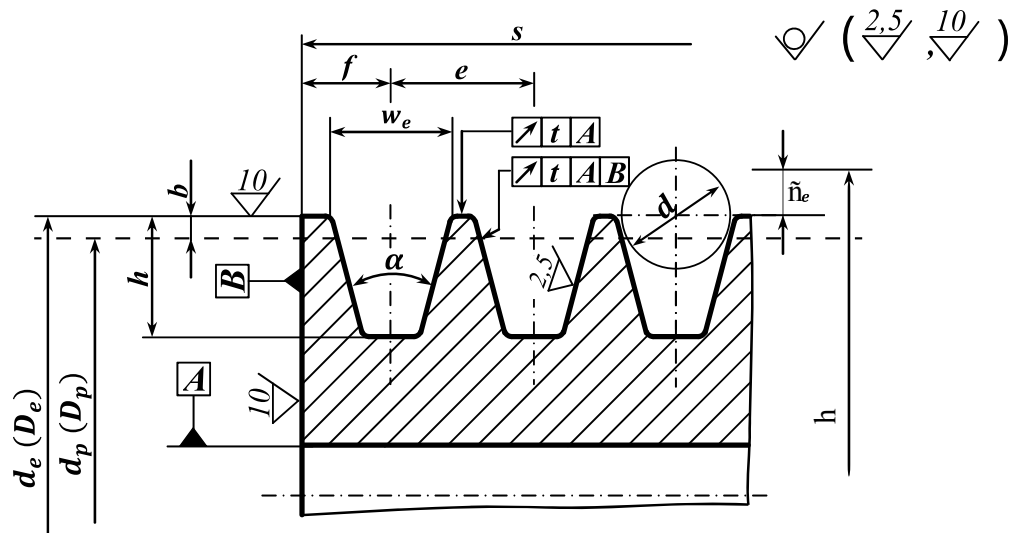
Power bands can't be used at pulleys for belts units, because dimensions of these wheels are different (compare table 4.1 and 4.4).



Rys. 4.6. Deviations of groove depth in relations to effective diameter.

Values δh_1 i δh_2 were chosen in this way, outside wheel diameter does not come into contact with connecting tape (what can cause separation of connection tape from belts), and simultaneously guarantee such groove depth which ensure good power transferring.

Dimensions



Draw. 4.7. Pulley for power bands

Table 4.4 Grooved pulleys dimensions for power bands

dimension in millimeters

		15J	AJ	BJ	CJ	-
Power bands	ISO marking	15J	AJ	BJ	CJ	-
	RMA marking	5V/15J	-	-	-	-
	Sanok RC marking	15J	A BP	B BP	C BP	SPC BP
pitch width w_e		15,2	13	16,5	22,4	22,4
Max. value of deviation δ_1		0,25	0,2	0,25	0,3	0,3
Max. Value of deviation δ_2		0,4	0,35	0,4	0,45	0,45
Groove height b		1,3	1,5	2	3	3
Min. groove depth h_{min}		15,2	12	14	19	23
Pulley pitch e		$17,5^{+0,25}$	$15,88^{+0,3}$	$19,05^{+0,4}$	$25,4^{+0,5}$	$25,4^{+0,5}$
Edge pitch f_{min}		13	9	11,5	16	16
max. Σ deviations e in a pulley		$\pm 0,5$	$\pm 0,6$	$\pm 0,8$	± 1	± 1
Min. effective diameter d_{emin}		180	80	130	210	250
Effective diameter d_e	$\alpha = 34^\circ$	-	<125	<195	<325	<325
	$\alpha = 38^\circ$	<250	>125	>195	>325	>325
	$\alpha = 40^\circ$	250 - 400	-	-	-	-
	$\alpha = 42^\circ$	>400	-	-	-	-
acceptable deviations α		$\pm 0,25^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$	$\pm 0,5^\circ$
Diameter of measuring cylinder d		$14,7^{+0}_{-0,043}$	$11,6^{+0}_{-0,043}$	$14,7^{+0}_{-0,043}$	$20,7^{+0}_{-0,052}$	$14,7^{+0}_{-0,052}$
Approximate correction dimension $2x_e$	$\alpha = 34^\circ$	16	9	11	15	15
	$\alpha = 38^\circ$		9	12	16	16
	$\alpha = 40^\circ$		-	-	-	-
	$\alpha = 42^\circ$		-	-	-	-

Table 4.5 Tolerance of radial and axial runout for power bands

Dimension in millimeters

Effective diameter d_e	Runout tolerance	
	radial t_1	axial t_2
$d_e < 125$	0,2	0,3
$125 < d_e < 315$	0,3	0,4
$315 < d_e < 710$	0,4	0,6
$710 < d_e < 1000$	0,6	0,8
$1000 < d_e < 1250$	0,8	1,0
$1250 < d_e < 1600$	1,0	1,2
$1600 < d_e < 2500$	1,2	1,2

Tabela 4.6 Summary of power bands in belt unit and widths of pulley rim

Dimensions in millimeters

Number of grooves	Belts setting	15J	A BP	B BP	C BP i SPC BP
		width of pulley s for grooves number $s = (z-1) \cdot e + 2f$			
2	2	43,5	33,88	45,05	61,40
3	3	61,0	49,76	64,1	86,8
4	4	78,50	65,64	83,15	112,20
5	5	96,00	81,52	102,2	137,60
6	3/3	113,50	97,40	121,25	163,00
7	3/4	131,00	113,28	140,30	188,40
8	4/4	148,50	129,16	159,35	213,80
9	5/4	166,00	145,04	178,40	239,20
10	5/5	183,50	160,92	197,45	264,60
11	4/3/4	201,00	176,80	216,50	290,00
12	4/4/4	218,50	192,68	235,55	315,40
13	4/5/4	236,00	208,56	254,60	340,80
14	5/4/5	253,50	224,44	273,65	366,20
15	5/5/5	271,00	240,32	292,70	391,60
16	4/4/4/4	288,50	256,20	311,75	417,00
17	4/4/5/4	306,00	272,08	330,80	442,40
18	5/4/4/5	323,50	287,96	349,85	467,80
19	5/4/5/5	341,00	303,84	368,90	493,20
20	5/5/5/5	358,50	319,72	387,95	518,60
21	4/4/5/4/4	376,00	335,60	407,00	544,00
22	5/4/4/4/5	393,50	351,48	426,05	569,40
23	5/4/5/4/5	411,00	367,36	445,10	594,80
24	5/5/4/5/5	428,50	383,24	464,15	620,20
25	5/5/5/5/5	446,00	399,12	483,20	645,60
26	5/4/4/4/4/5	463,50	415,00	502,25	671,00
27	5/5/4/4/4/5	481,00	430,88	521,30	696,40
28	5/5/4/4/5/5	498,50	446,76	540,35	721,80
29	5/5/5/4/5/5	516,00	462,64	559,40	747,20
30	5/5/5/5/5/5	533,50	478,52	578,45	772,60
31	5/4/4/5/4/4/5	551,00	494,40	597,50	798,00
32	5/5/4/4/4/5/5	568,50	510,28	616,55	823,40
33	5/5/5/4/4/5/5	586,00	526,16	635,60	848,80
34	5/5/5/4/5/5/5	603,50	542,04	654,65	874,20
35	5/5/5/5/5/5/5	621,00	557,92	673,70	899,60
36	5/5/4/4/4/4/5/5	638,50	573,80	692,75	925,00
37	5/5/5/4/4/4/5/5	656,00	589,68	711,80	950,40
38	5/5/5/4/4/5/5/5	673,50	605,56	730,85	975,80
39	5/5/5/5/4/5/5/5	691,00	621,44	749,90	1001,20
40	5/5/5/5/5/5/5/5	708,50	637,32	768,95	1026,60

Tension of belts

For ideal power transferring and to achieving required belts lifetime, correct belts tensioning is a very important factor. Too small or too big tension often leads to earlier belt destruction. Excessive belt tension also cause quicker bearings damage in driving machine as well as in driven machine. Was found that, commonly known way of belt tensioning checking, a method often called “pressure with the thumb”, is not accurate enough to determine optimal belt tension. Excessive or too small belt tension can be avoided if a tension is calculated, performed and controlled in accordance to below described methods, or in accordance to design intentions stated in Operation and Maintenance Manual of a gearing.

After a gearing is mounted and belt tensioning is adjusted, belt gearing practically do not require maintenance. **During first hours of operation tensioning of belts must be observed and according to experience, after approximately 0,5 – 4 hours of operation under full load – all belts must be tightened.**

In this way initial tensile was taken into account. After 24 hours of operation tension of belts must be checked again and then corrected in case of necessity. Next control intervals can be significantly extended; after hundreds and even after thousands hours of operation, belts should be tensioned.

Tension belt control by measurement of tie rod belt deflection

This method allows for indirect determining static force in tie belt T_s by measurement of deflection of belt measuring distance under control force action. Static force T_s is a minimal force existing in tie belt which allows for transferring of nominal force in a drive while slippage not exceeding allowable value.

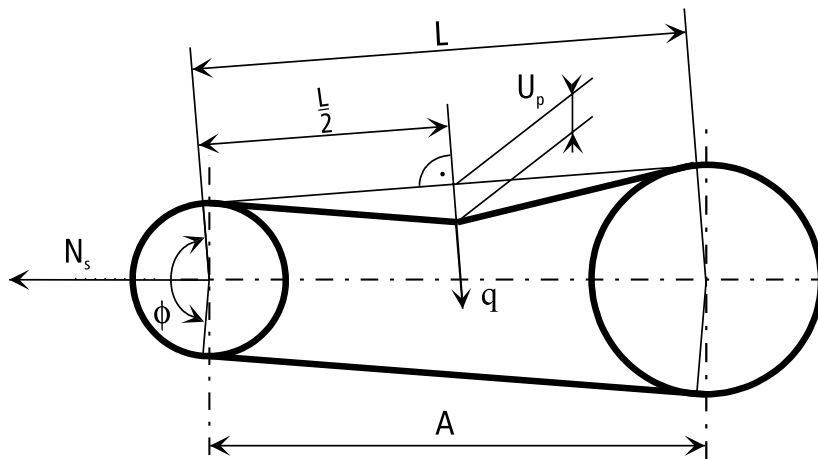
This method can be used for belts of sections: SPZ, SPA, SPB, SPC, Z, A, B, 20, C, 25, D.

T_s - minimal force existing in tie belt in static state	_____	[N],
N_s - minimal axis force in static state	_____	[N],
U - belt deflection at a distance 100 mm measuring length of a belt	_____	[mm],
U_p - deflection value of measuring distance of a belt	_____	[mm],
L - measuring distance length	_____	[mm],
q - control force exerted at a belt	_____	[N],
c - constant for centrifugal force calculation	_____	[kg/m],
A - axle base	_____	[mm],
N - power transferred by gearings	_____	[kW],
v - belt speed	_____	[m/s],
k_T - coefficient of work condition,		
k_ϕ - coefficient of wrap angle,		
ϕ - wrap angle of smaller wheel	_____	[o].

To correctly determine parameters of tension control, perform the following steps::

1. Calculate static force T_s existing in tie belt:

$$T_s = \frac{500(2,02 - k_\phi) \cdot N \cdot k_T}{k_\phi \cdot z \cdot v} + c \cdot v^2$$



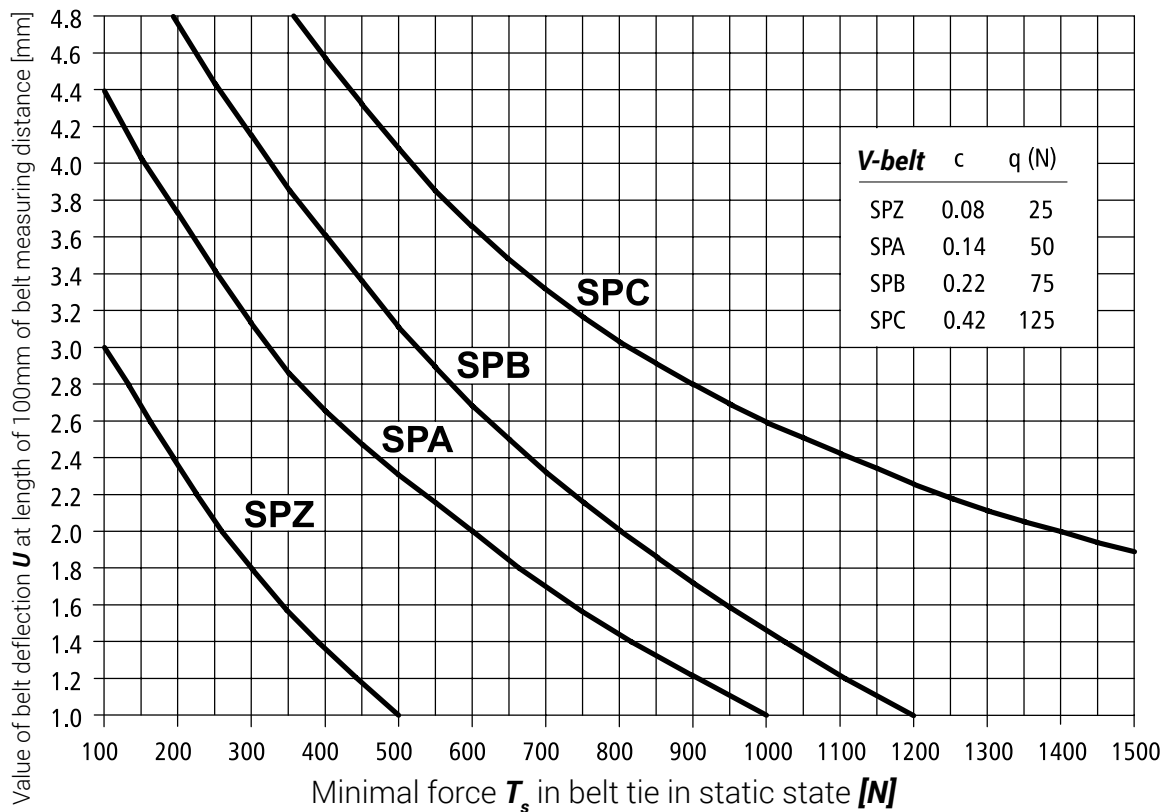
Draw. 5.1. Belt tension control by measurement of tie belt deflection

2. Determine deflection value at length U of 100 mm of belt measuring distance at the base of belt tension curve from drawings 5.2. or 5.3..
3. Calculate deflection value U_p for existing length of measuring distance L .

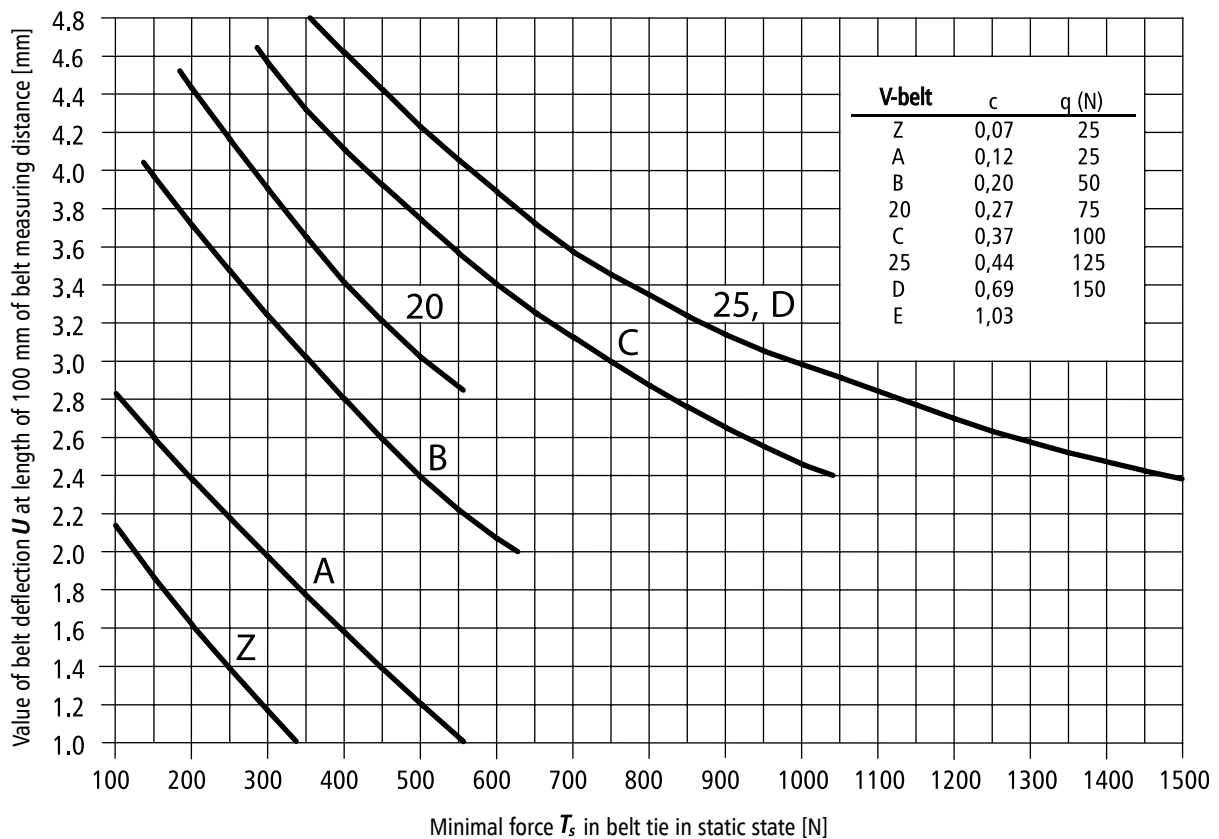
$$U_p = \frac{U \cdot L}{100}$$

$$L = A \cdot \sin \frac{\phi}{2}$$

Control force q determined from Draw. 5.2. or 5.3. in the middle of measuring distance L , must be applied perpendicular to belt tie in accordance to above drawing, then tie deflection value U_p must be measured; in case of necessity tension should be corrected.



Rys. 5.2. Zależność ugięcia U od siły Ts dla pasów wąskich



Draw. 5.3. Relation between deflection U and force T_s for classical belts

Tension belt control by measurement of revolutions

By usage of this method belts tension is controlled by calculating belts slippage on pulley. Active pulley revolutions are measured (driving wheel) as well as passive pulley revolutions (driven wheel) during idle run and under load and then slippage is calculated at the base of following formula:

$$s = \left(1 - \frac{n_{cj} / n_{bj}}{n_{co} / n_{bo}} \right) \cdot 100\%$$

where:

s - slippage [%]

n_{cj} - active pulley revolutions during idle run _____ [rpm]

n_{bj} - passive pulley revolutions during idle run _____ [rpm]

n_{co} - active pulley revolutions during load run _____ [rpm]

n_{bo} - passive pulley revolutions during load run _____ [rpm]

During normal load slippage should not exceed 1%. Small tension or longer load is unacceptable with a slippage above 2% because it adversely affects belts lifetime.

Tension belt control by measurement of static axial force

Direct measurement of static axial force is very exact method in order to set correct belt tension. Static axial force is calculated at the base of following formula:

$$N_s = 2T_s \cdot \sin \frac{\varphi}{2} \cdot z$$

This belt tension control method is not suitable for usage if we don't have measuring instruments for direct static axial force measurement N_s .

Designation of axial load in dynamic state

In case of drives with internal combustion engines, turbines or highly-loaded drives like calander drives, splitters or mill machinery determination of dynamic load of bearings is required - i.e. existing loads of shafts and bearings in a drive.

Exact calculation of dynamic axial force will save unnecessary costs which may appear with respect of:

- earlier bearings usage;
- shaft cracking;
- oversized bearings and shafts.

Shafts and bearings in a drive with two pulleys are loaded by the same net dynamic force, but - which is obvious - directed in the opposite direction. Using tension rollers, value and direction of net dynamic force is almost always different at each pulley.

If value as well as direction of dynamic force must be determined, graphic solution is recommended by parallelogram of force: dynamic force T_c loading the axle and forces in active belt ties as well as dynamic force T_b loading the axle and forces in passive belt ties.

If dynamic axial force is only to be calculated, then calculation can be done by the following formula for $N_{s\ dyn}$.

Axe load coming from forces in active ties

$$T_c \approx \frac{1020 \cdot N \cdot k_T}{k_\phi \cdot v}$$

Axe load coming from forces in passive ties

$$T_b \approx \frac{1020 \cdot (1,02 - k_\phi) \cdot N \cdot k_T}{k_\phi \cdot v}$$

T_c - dynamic axe load coming from forces in active ties _____ [N]

T_b - dynamic axe load coming from forces in passive ties _____ [N]

$N_{s\ dyn}$ - resultant dynamic force _____ [N]

N - power transferred by a gearing _____ [kW]

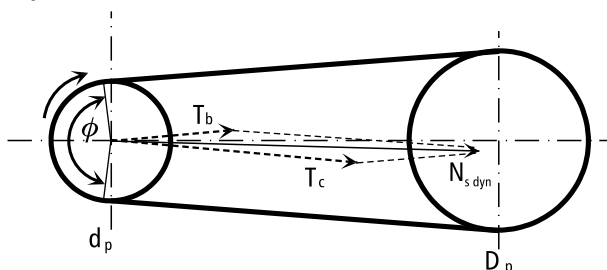
v - belt speed _____ [m/s]

k_T - coefficient of work conditions

k_ϕ - coefficient of wrap angle of small pulley

ϕ - wrap angle of smaller pulley _____ [°]

Graphic Solution:



Rys. 5.4. Parallelogram of dynamic forces in belt gearing.

Formula solution:

$$N_{s\ dyn} \approx \sqrt{T_c^2 + T_b^2 - 2T_c \cdot T_b \cdot \cos \varphi}$$

Producer:

SANOK RUBBER COMPANY S.A.
ul. Przemyska 24
38 - 500 Sanok
Tel.: +48 13 46 54 444
Fax: +48 13 46 54 455



Distribution:

Stomil Sanok Dystrybucja Sp. z o.o.
Bogucin k. Poznania
ul. Gnieźnieńska 99
62-006 Kobylnica
Tel.: (+48) 61 875 97 93 /94
Fax: (+48) 61 875 95 73



Branch Bielsko-Biała
ul. Księdza Józefa Londzina 29
43-382 Bielsko-Biała
Tel.: +48 33 811 70 71
Fax: +48 33 811 70 72

Branch Olsztynek
ul. Mrongowiusza 29
11-015 Olsztynek
Tel./Fax: (+48) 89 519 15 86

Branch Piekoszów k. Kielc
ul. Czarnowska 56
26-065 Piekoszów
Tel./Fax: (+48) 41 346 42 95

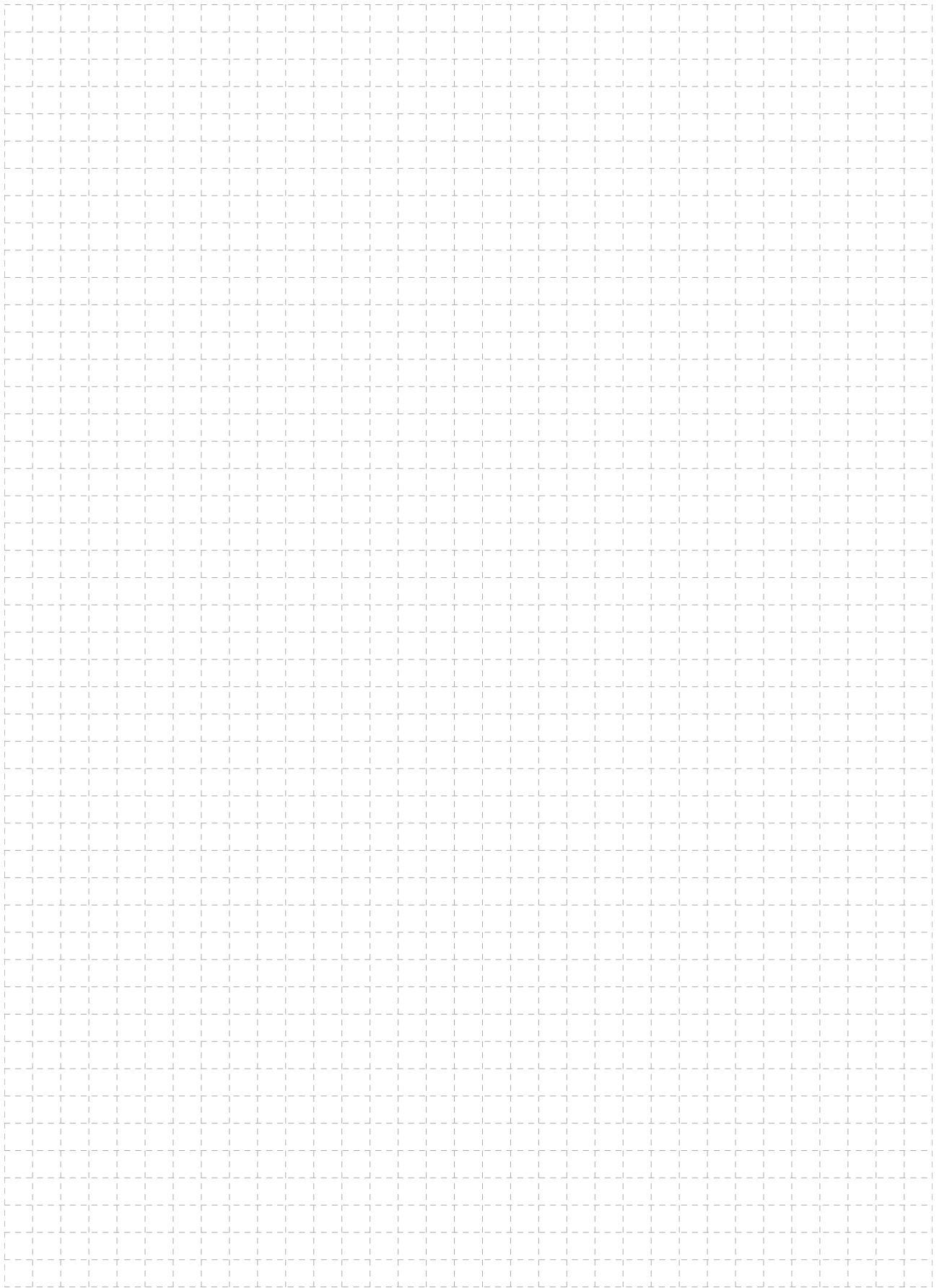
Branch Dębica
ul. Świętosława 123
39-200 Dębica
Tel.: +48 14 681 54 23
Fax: +48 14 681 54 09

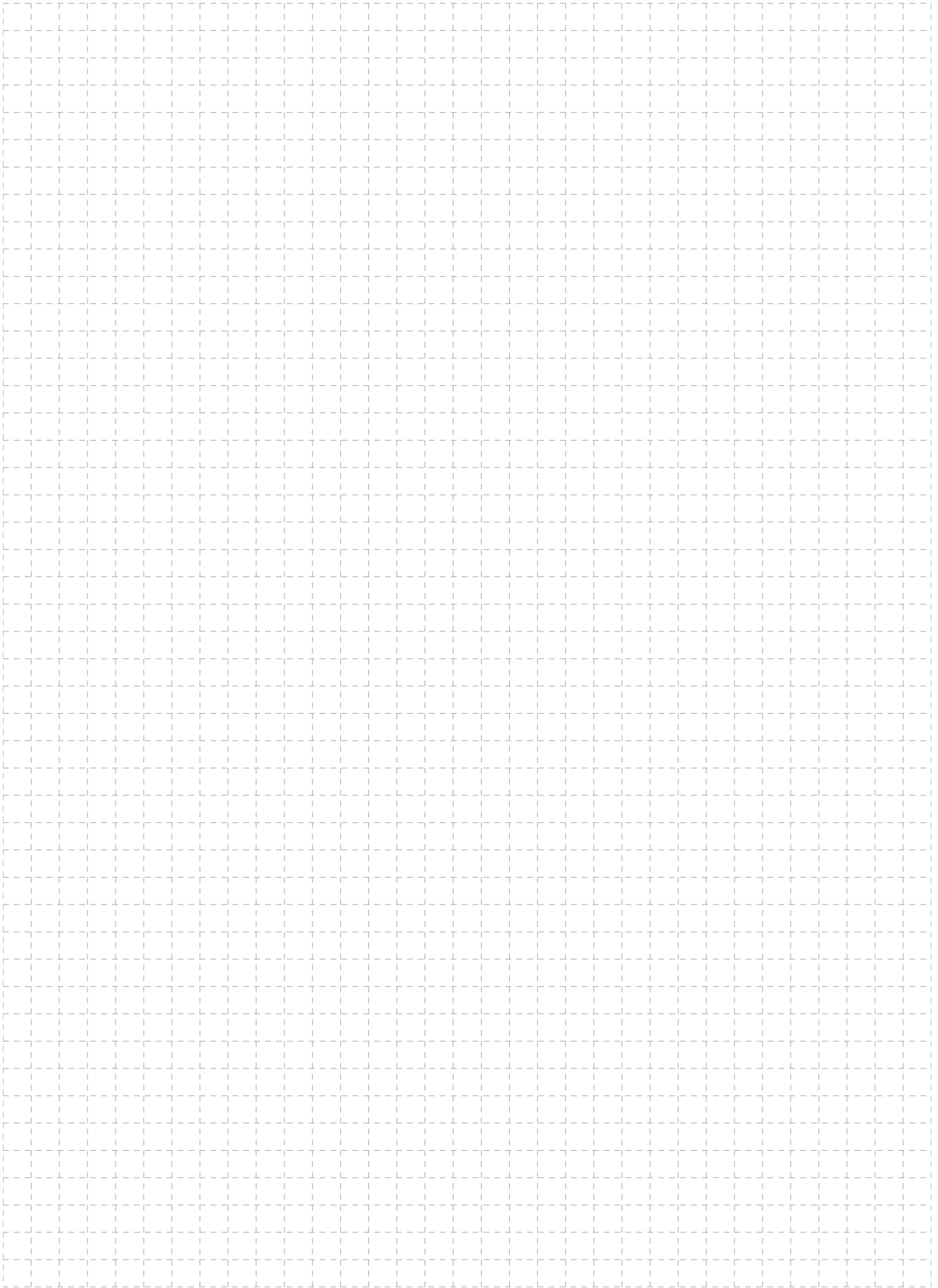
Stomil Sanok Ukraina
33013, Równie, Ukraina
ul. Kn. Wołodimira, 75/36
Tel./Fax: + 380 362 62 34 40

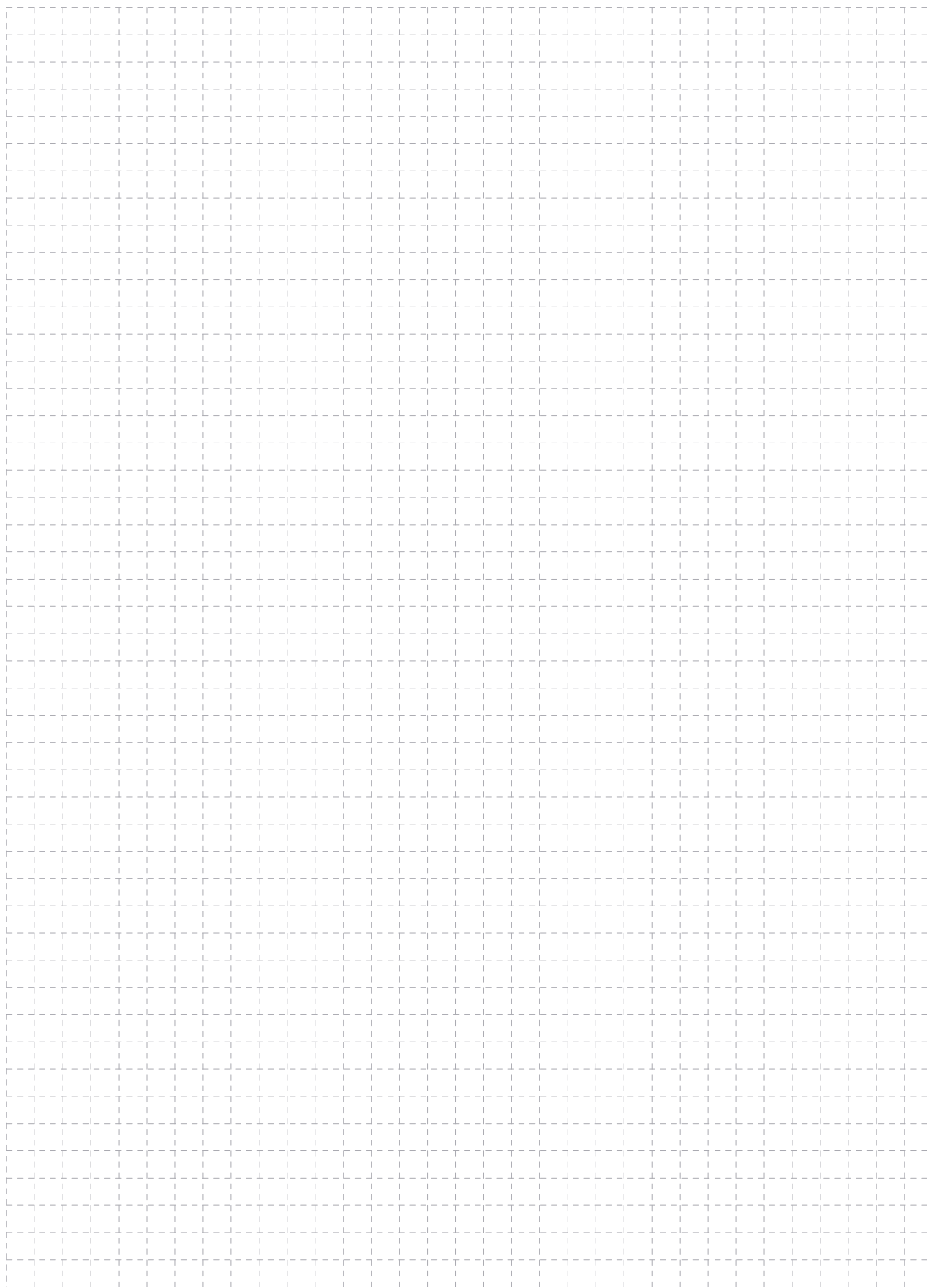


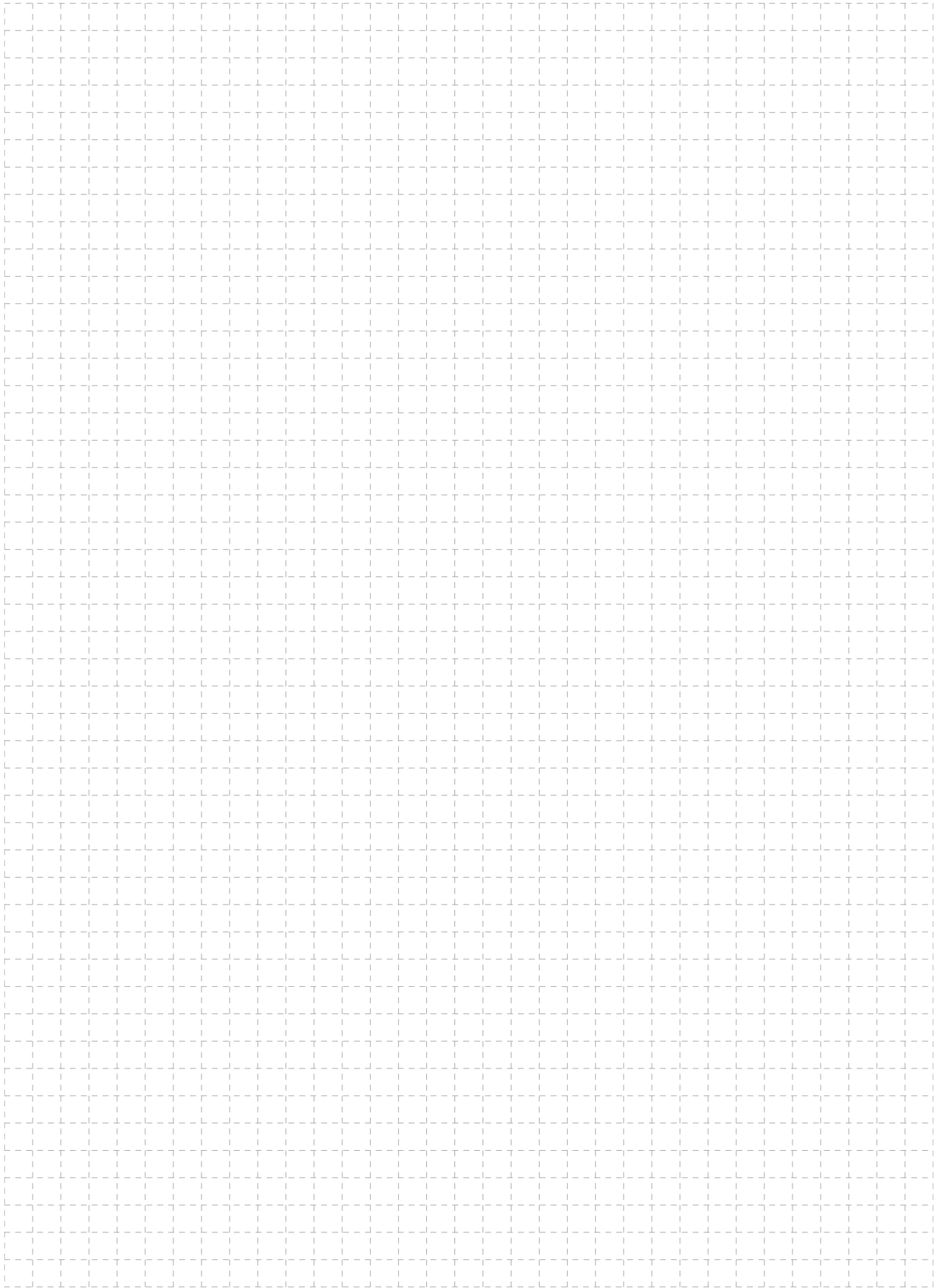
Stomil Sanok Rus
107553, Moskwa, Rosja
ul. Amurskaya, d. 2, str. 2
Tel. +7 495 781 84 95
Fax: +7 495 781 84 96

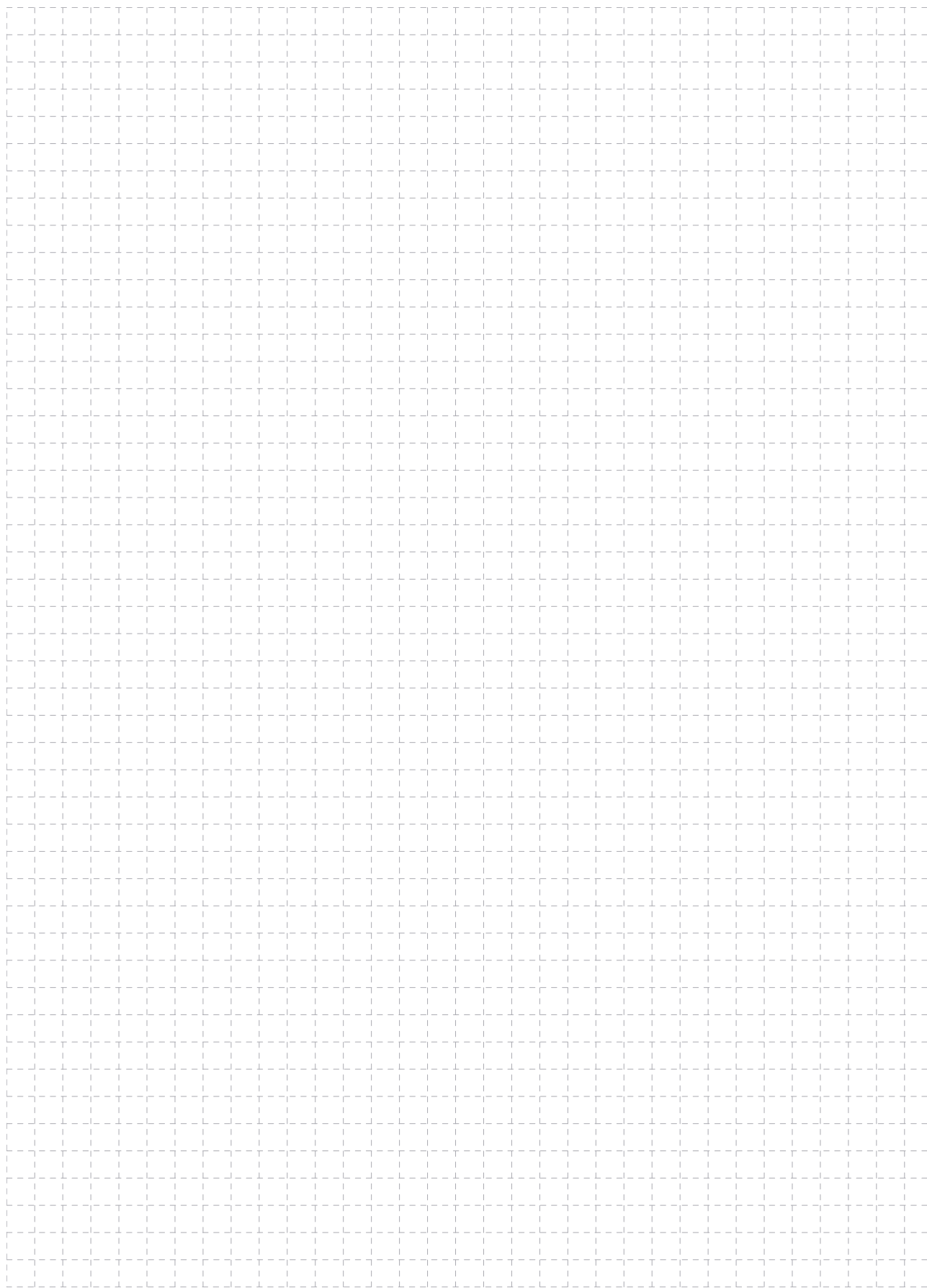












visit:
www.sanokrubber.pl



Sanok Rubber Company S.A.
ul.Przemyska 24
38-500 Sanok

©Sanok Rubber Company S.A. 2017