King Power Synchronous Belt (KPS II)

1. Product Introduction

KPS II was developed based on the new material and new technology developed for KPS, featuring reduction in belt tension changes and improvement of power transmission capacity, and enables energy-saving, space-saving, and high accuracy.

Features

■ High transmission capacity — It has a high transmission capacity of 1.5 to 5 times that of rubber STS, with a smaller belt width than STS, enabling space-saving and resource-saving of power transmission devices.

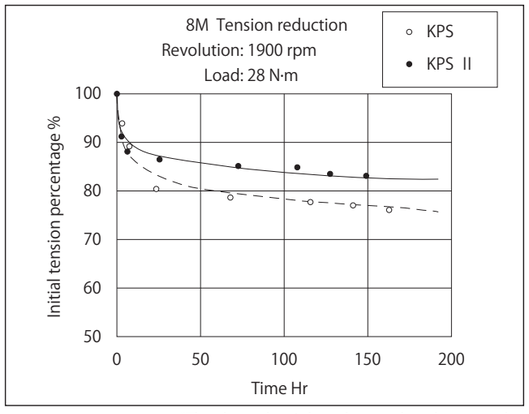
■ General-purpose — The compatibility with rubber STS and the previous KPS allows utilization of STS standard pulleys in stock.

■ Clean activity — The abrasion-resistant polyurethane has little rubber piece fracture, enabling a clean power transmission device to be designed.

■ Low noise — The noise is lower than chain power transmission by 3 dB to 5 dB.

■ Ozone resistance — It employs polyurethane, which has higher ozone resistance than that of chloroprene rubber.

<Belt tension reduction comparison>



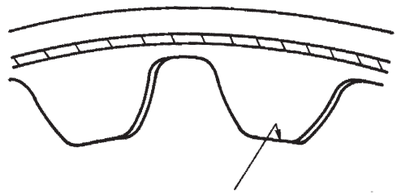
*The above data is based on our bench test results.

Mesh Theory of KPS II

Bando KPS II performs the following unique meshing.

The tip of the belt tooth and the bottom of the pulley are in contact.

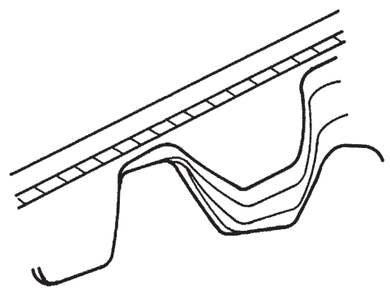
KPS II meshes with the tip of the belt tooth in close contact with the bottom of the pulley. As a result, the force applied on the belt is dispersed and becomes uniform. In addition, the cords mesh in a mostly perfect circle condition, which eliminates cord bending (polygonal phenomenon) and significantly reduces cord fatigue, resulting in an extended belt service life.
The pulley has an arc-shaped bottom and side face, allowing smooth close contact with the belt.



KPS II meshing condition

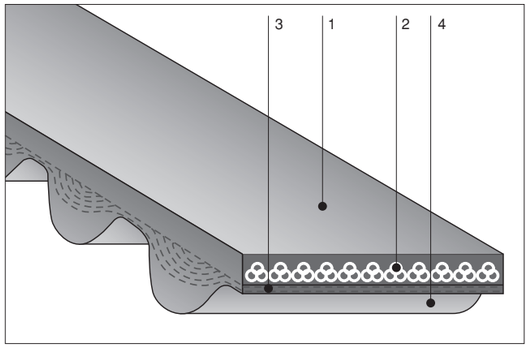
The tooth profile smooths meshing.

For synchronous belts, the tooth section needs to be enlarged as one method of increasing transmission capability. However, with the previous synchronous belts, enlarging the tooth profile causes interference between the teeth and the pulley, resulting in a reduced service life.
KPS II has an arc-shaped tooth profile; hence, enlarging the belt tooth section does not cause interference with the pulley, achieving smooth meshing.



Condition at the start of meshing of KPS II

Structure



1. Back face rubber 2. Cord 3. Special fiber 4. Tooth rubber

Belt dimensions and indication method

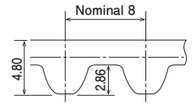
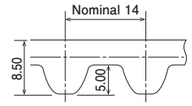
Belt type	Dimension (mm)	Belt indication method
8M		600 KPS II 8M 1000 Belt width (60mm) Belt type (Type 8M) Belt pitch length (1000mm)
14M		800 KPS II 14M 1400 Belt width (80mm) Belt type (Type 14M) Belt pitch length (1400mm)

Table of standard effective lengths

KPS II 8M					
Belt designation	Nominal pitch length (mm)	No. of teeth	Belt designation	Nominal pitch length (mm)	No. of teeth
KPS II 8M 640	640	80	KPS II 8M 1120	1120	140
KPS II 8M 680	680	85	KPS II 8M 1152	1152	144
KPS II 8M 720	720	90	KPS II 8M 1200	1200	150
KPS II 8M 760	760	95	KPS II 8M 1280	1280	160
KPS II 8M 800	800	100	KPS II 8M 1360	1360	170
KPS II 8M 848	848	106	KPS II 8M 1440	1440	180
KPS II 8M 896	896	112	KPS II 8M 1520	1520	190
KPS II 8M 944	944	118	KPS II 8M 1600	1600	200
KPS II 8M 1000	1000	125	KPS II 8M 1696	1696	212
KPS II 8M 1024	1024	128	KPS II 8M 1792	1792	224
KPS II 8M 1032	1032	129	KPS II 8M 1960	1960	245
KPS II 8M 1056	1056	132			

KPS II 14M					
Belt designation	Nominal pitch length (mm)	No. of teeth	Belt designation	Nominal pitch length (mm)	No. of teeth
KPS II 14M 994	994	71	KPS II 14M 1568	1568	112
KPS II 14M 1120	1120	80	KPS II 14M 1652	1652	118
KPS II 14M 1190	1190	85	KPS II 14M 1708	1708	122
KPS II 14M 1260	1260	90	KPS II 14M 1890	1890	135
KPS II 14M 1400	1400	100	KPS II 14M 1960	1960	140
KPS II 14M 1470	1470	105	KPS II 14M 2380	2380	170

Belt standard widths

(Nominal width: belt width (mm) × 10)

Nominal width	150	250	400	600	800	1000	1200
Belt width (mm)	15	25	40	60	80	100	120
8M	○	○	○	○			
14M		○	○	○	○	○	○

Note 1) For other belt widths than standard belt widths, please contact us.
Note 2) For pulleys, please use our standard STS pulleys (→ **P. 131**).

Belt dimensional tolerance

Effective length

(Unit: mm)

KPS II 8M		KPS II 14M	
Effective length	Tolerance	Effective length	Tolerance
754 or less	±0.42	1182 or less	±0.63
Over 754 to 994 or less	±0.63	Over 1182 to 1462 or less	±0.67
Over 994 to 1274 or less	±0.67	Over 1462 to 1702 or less	±0.78
Over 1274 to 1694 or less	±0.78	Over 1702 to 1972 or less	±0.98
Over 1694 to 1964 or less	±0.98	1972 or more	±1.45

Note) The effective length tolerance is the tolerance of center distance in length measurement.

Belt width

(Unit: mm)

Belt nominal width	Effective length classification		
	840 or less	841~1680	1680 or more
400 or less	+0.8 -0.8	+0.8 -1.2	+0.8 -1.2
Over 400 to 500 or less	+0.8 -1.2	+1.2 -1.2	+1.2 -1.6
Over 500 to 750 or less	+1.2 -1.6	+1.6 -1.6	+1.6 -2.0
Over 750 to 1000 or less	+1.6 -1.6	+1.6 -2.0	+2.0 -2.0
Over 1000	+2.4 -2.4	+2.8 -2.8	+3.2 -3.2

2. How to Design KPS II

Step 1. Determining conditions required for the design

① Machine type
② Transmission power, or rated power of the driving machine
③ Degree of load fluctuation
④ Daily operating hours
⑤ Pinion revolution
⑥ Speed ratio $\left(\frac{\text{No. of teeth of large pulley}}{\text{No. of teeth of pinion}}\right)$
⑦ Temporary center distance
⑧ Pulley diameter restriction
⑨ Operating environment (high temperature, low temperature, oil, water, dirt, acid, alkali)

Step 2-1 Calculating the design power

Calculate the design power with Formula 1.

Formula 1

$$Pd = Pt \times (Ko + Ki + Kr)$$

Pd : Design power (kW)
Pt : Transmission power (kW)
Ko : Load correction factor **(Table 1 → Table below)**
Ki : Idler correction factor **(Table 2 → P. 32)**
Kr : Speed-up ratio correction factor **(Table 3 → P. 32)**

Note 1) For transmission power, it is ideal to use the load of the driven machine; however, if it is unknown, use the rated power of the driving machine. If torque or horsepower is used for indication, convert it into watt or kilowatt using Formula 2.

Formula 2

$$Pt = \frac{Tr \times n}{9550}$$

Pt : Transmission power (kW)
n : Revolution (rpm)
Tr : Load torque (N•m)
1PS=0.7355(kW)

Table 1 Load correction factor (Ko)

Machine using the product Note 2) When your driven machine cannot be found in the table, use the load correction factor of a machine with a similar start-up load or shock load.	Driving machine					
	Those with the maximum output 300% or less of the rating			Those with the maximum output over 300% of the rating		
	AC motor (standard motor, synchronous motor) DC motor (shunt-wound) Engine with two or more cylinders			Special motor (high torque) DC motor (direct-wound) Single-cylinder engine Operation by line shaft or clutch		
	Operating hours			Operating hours		
	3~5hr/day	8~10hr/day	16~24hr/day	3~5hr/day	8~10hr/day	16~24hr/day
● Exhibition apparatuses ● Projectors ● Measuring instruments ● Medical equipment	1.0	1.2	1.4	1.2	1.4	1.6
● Vacuum cleaners ● Sewing machines ● Office machinery ● Woodworking lathes ● Band-sawing machines	1.2	1.4	1.6	1.4	1.6	1.8
● Light-duty belt conveyors ● Packaging machines ● Sieves	1.3	1.5	1.7	1.5	1.7	1.9
● Liquid stirring machines ● Drill presses ● Lathes ● Screw cutting machines ● Circular sawing machines ● Planing machines ● Laundry machines ● Papermaking machines (not including pulper) ● Printing machines	1.4	1.6	1.8	1.6	1.8	2.0
● Stirring machines (cement, viscous substances) ● Belt conveyors (ore, coal, sand) ● Grinding machines ● Shaping machines ● Boring machines ● Milling machines ● Compressors (centrifugal type) ● Vibrating sieves ● Fiber machines (warping machines, winders) ● Rotary compressors ● Compressors (reciprocating type)	1.5	1.7	1.9	1.7	1.9	2.1
● Conveyors (aprons, pans, buckets, elevators) ● Extraction pumps ● Rinsing machines ● Fans, blowers (centrifugal type, suction, exhaust) ● Generators ● Exciters ● Hoists ● Elevators ● Rubber processing machines (calenders, rolls, extruders) ● Fiber machines (weaving machines, spinning machines, yarn-twisting machines, pirn winders)	1.6	1.8	2.0	1.8	2.0	2.2
● Centrifugal separators / conveyors (flight, screw) ● Hammer mills ● Papermaking machines (pulper, beaders)	1.7	1.9	2.1	1.9	2.1	2.3
● Ceramic industry machines (bricks, clay kneading machines) ● Propellers for mines ● Forced air blowers	1.8	2.0	2.2	2.0	2.2	2.4

Table 2 Idler correction factor

Idler installation location	Ki
- No idlers	0.0
- Installed from the inside on the slack side	0.0
- Installed from the inside on the tight side	0.1

KPS II cannot be used by installing an idler from outside.

Table 3 Speed-up ratio correction factor

Speed-up ratio	Kr
1.00~1.24	0.0
1.25~1.74	0.1
1.75~2.49	0.2
2.50~3.49	0.3
3.50 or more	0.4

Step 2-2 Calculating the design power when there are sudden stops or sudden accelerations

Under conditions of sudden stop and sudden acceleration, an abnormal torque may be applied to the belt due to the inertial force of the machine; check with Formula 3 in advance, and if the width falls short, it needs to be corrected.
Compare the Pd calculated in **Step 2-1 (→ P. 31)** and the Pdq calculated next and use the larger value as the design power.

Formula 3

$$Trq = \frac{\Sigma GD^2 \times (n_1 - n_2)}{38.2 \times t} \quad (N\cdot m)$$

From Formula 2, $Ptq = \frac{Trq \times n}{9550}$ (kW)

$$Pdq = Ptq \times Kq \quad (kW)$$

Trq : Rotational torque at the time of a sudden stop or sudden acceleration (N•m)
GD^2 : Flywheel effect (kgf•m^2)
(Sum total of GD^2 on the opposite side to the brake)
$n_1 - n_2$: Difference in revolution (opposite side to the brake) (rpm)
t : Time to change from n_1 to n_2 (S)
Pdq : Design power (kW)
Kq : Correction factor **(table below)**

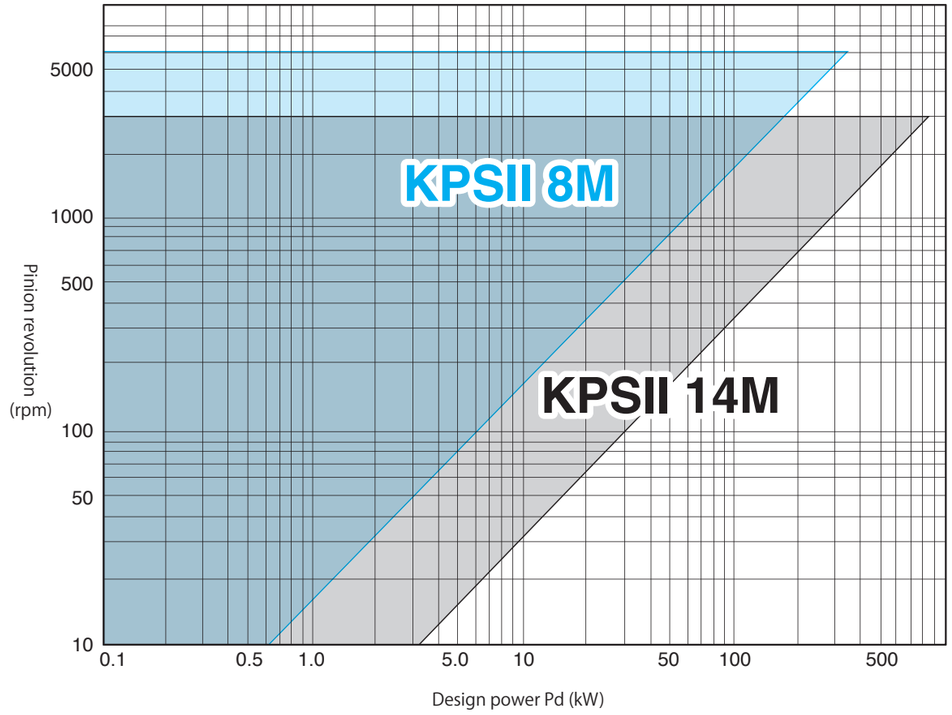
Correction factor Kq by rotation at the time of a sudden stop or sudden acceleration

revolutions/day	1	2	3~4	5~10	11~15
Kq	1.0	1.2	1.3	1.5	1.6
revolutions/day	16~25	26~40	41~60	61~100	101~
Kq	1.7	1.8	1.9	2.0	2.1

Step 3 Selecting a belt type

Obtain a belt type based on design power and pinion revolution from **Fig. 1**.
If an obtained type is close to the line of intersection of two types, design both belt types as a trial and choose the one that matches the purpose of the design and that is the more economical.

Fig. 1 Belt type selection diagram



Step 4 Selecting a pulley diameter

Select an appropriate pulley diameter from Formula 4, taking the restriction of the power transmission space etc. into consideration.

Formula 4

$$Z_2 = \frac{n_1}{n_2} \times Z_1$$

$$\text{Speed ratio} = \frac{n_1}{n_2}$$

Z_1: Number of teeth of pinion
Z2: No. of teeth of large pulley
n_1: Pinion revolution (rpm)
n2: Large pulley revolution (rpm)

For relations among the number of teeth of pulleys, pulley diameter, and pitch diameter, refer to the **"List of pulley diameters" (→ P. 39 to P. 40)**. Calculate an unlisted number of teeth of a pulley with Formula 5.

Formula 5

$$dp = pt(Z) / \pi$$
$$do = pt(Z) / \pi - 2a$$

dp : Pulley pitch diameter (mm)
do : Pulley outside diameter (mm)
pt : Pulley tooth pitch (mm)
z : No. of teeth of pulley
2a : Difference between pulley pitch diameter and pulley outside diameter **(Table 4)**

Table 4 Difference between pulley pitch diameter and pulley outside diameter (2a) (Unit: mm)

Belt type	8M	14M
2a	1.372	2.794

When you determine a pulley diameter, check the following items:

- Check on the minimum number of teeth of a pulley

Generally, when a pulley with a small number of teeth is used, the flex fatigue of the belt increases, reducing the belt service life.
Hence, please use a pulley with a larger number of teeth than the ones shown in **Table 5** at least.

Table 5 Minimum number of teeth of pulleys

Pinion revolution (rpm)	Belt type	
	8M	14M
870 or less	18(45.84)	22(98.04)
Over 870 to 1160 or less	18(45.84)	22(98.04)
Over 1160 to 1750 or less	20(50.93)	24(106.95)
Over 1750 to 3500 or less	22(56.02)	26(115.86)
Over 3500 to 4500 or less	22(56.02)	26(115.86)
Over 4500 to 5500 or less	24(61.12)	

Note) The parentheses ( ) indicate pitch diameter (mm).

- Check on the belt speed

KPS II can be used at a belt speed up to 30 m/s. When the belt speed exceeds 30 m/s, reduce the pulley diameter.
Calculate the belt speed from Formula 6.

Formula 6

$$V = \frac{dp \times n}{19100}$$

V : Belt speed (m/s)
dp : Pulley pitch diameter (mm)
n : Revolution (rpm)

Step 5 Selecting an effective length

Calculate a rough effective length with Formula 7 and select an effective length L' that is closest to this value from the **"Table of standard effective lengths" (→ P. 30)**.

Formula 7

$$L' = 2C + 1.57(Dp + dp) + \frac{(Dp - dp)^2}{4C}$$

L' : Rough effective length (mm)
C : Center distance (mm)
Dp : Large pulley pitch diameter (mm)
dp : Pinion pitch diameter (mm)

Backcalculate the center distance at that time from the pitch length L of the selected belt using Formula 8.

Formula 8

$$C = \frac{B + \sqrt{B^2 - 2(Dp - dp)^2}}{4}$$

$$B = Lp - 1.57(Dp + dp)$$

Lp : Belt pitch length (mm)

Step 6 Determining the belt width

(1) **Determination of basic power rating**
From the "Table of basic power ratings" (→ P. 37 to P. 38), obtain the transmission capacity per basic belt width.
Please note that here **8M is the basic power rating per width of 15 mm, and 14M is** the basic power rating per width of 40 mm.

(2) **Mesh correction factor Km**
From Formula 9, calculate the number of meshed teeth of the pinion, and from **Table 6**, obtain the mesh correction factor.

Formula 9

$$Zm = Z \times \frac{\theta_1}{360}$$

$$\Theta_{11} = 180 - \frac{57.3(Dp-dp)}{C}$$

Zm : Number of meshed teeth of pinion
Z : Number of teeth of pinion
θ_1 : Angle of contact of pinion (°)
Dp : Large pulley pitch diameter (mm)
dp : Pinion pitch diameter (mm)

Table 6 Mesh correction factor Km

Number of meshed teeth Zm	Km
6 or more	1.00
5	0.80
4	0.60
3	0.40
2	0.20

(3) **Correction factor by effective length Kl**
From **Table 8 (→ P. 35)**, obtain the correction factor by effective length.

(4) **Correction factor by use of a pinion Kp**
From **Table 7**, obtain the correction factor by use of a pinion.

Table 7 Correction factor by use of a pinion Kp

8M	Kp	14M	Kp
22	1.00	28	1.00
21	0.97	26	0.98
20	0.89	25	0.96
19	0.81	24	0.94
18	0.72	23	0.91
		22	0.89

(5) **Corrected power rating Pc**
From Formula 10, obtain the corrected power rating.

Formula 10

$$Pc = Pr \cdot K\ell \cdot Km \cdot Kp$$

Pc : Corrected power rating (kW)
Pr : Basic power rating (kW)
Kl : Length correction factor
Km : Mesh correction factor
Kp : Correction factor by use of a pinion

(6) **Calculation of belt width**
From Formula 11, obtain the correction factor of the belt width Kb.

Formula 11

$$Kb = \frac{Pd}{Pc}$$

Kb : Width correction factor
Pd : Design power (kW)
Pc : Corrected power rating (kW)

From **Tables 10 and 11 (→ P. 36)**, obtain the belt width for the width correction factor Kb obtained from Formula 11.

Table 8 Table of length correction factors Kl

Belt type	No. of teeth	Length correction factor Kl
KPS II 8M 640	80	0.76
680	85	0.78
720	90	0.80
760	95	0.82
800	100	0.84
848	106	0.86
896	112	0.88
944	118	0.90
1000	125	0.92
1024	128	0.93
1032	129	0.93
1056	132	0.94
1120	140	0.96
1152	144	0.97
1200	150	0.99
1280	160	1.01
1360	170	1.03
1440	180	1.05
1520	190	1.07
1600	200	1.09
1696	212	1.11
1792	224	1.13
1960	245	1.17

Belt type	No. of teeth	Length correction factor Kl
KPS II 14M 994	71	0.84
1120	80	0.89
1190	85	0.92
1260	90	0.95
1400	100	1.00
1470	105	1.02
1568	112	1.05
1652	118	1.08
1708	122	1.09
1890	135	1.14
1960	140	1.16
2380	170	1.25

Step 7 Checking the adjustment range of the center distance

From Table 9, obtain the installation range and the tension range of the belt.

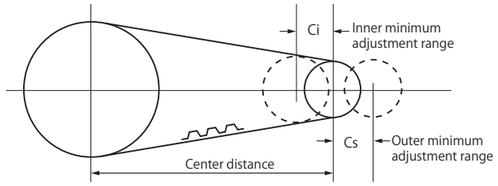


Table 9 Table of the adjustment range of center distance (Unit: mm)

Effective length	Minimum adjustment range	
	Ci	Cs
500 or less	8M:15 14M:15	3
501～990		5
991 or more		10

Note: When the center distance is fixed and no idler is used

When the center distance is fixed and no idler is used for reasons such as reduction in assembly manhour or unavailability of a space of idlers, the resulting combination of ① effective length tolerance, ② pulley outside diameter tolerance, and ③ center distance tolerance causes troubles such as that the belt cannot be appropriately tensioned or the belt cannot be fit. Such a design requires the setting of special standards; please contact us in advance.

Table 10 Table of belt width correction factors for KPS II Type 8M

Width correction factor Kb	Belt width (mm)	Belt nominal width
~ 1.00	15	150
1.01 ~ 1.67	25	250
1.68 ~ 2.67	40	400
2.68 ~ 4.00	60	600

Table 11 Table of belt width correction factors for KPS II Type 14M

Width correction factor Kb	Belt width (mm)	Belt nominal width
~ 0.63	25	250
0.64 ~ 1.00	40	400
1.01 ~ 1.50	60	600
1.51 ~ 2.00	80	800
2.01 ~ 2.50	100	1000
2.51 ~ 3.00	120	1200

Table of basic power ratings for KPS II Type 8M (per width of 15 mm and length of 1200 mm)

(Unit: kW)

Pinion revolution (rpm) \ No. of teeth of pinion	18	20	22	24	26	28	30	35	40	45	50	55	60	72	84	120
Pitch diameter (mm)	45.84	50.93	56.02	61.12	66.21	71.30	76.39	89.13	101.86	114.59	127.32	140.06	152.79	183.35	213.90	305.58
100	0.44	0.47	0.50	0.54	0.57	0.61	0.65	0.74	0.84	0.95	1.05	1.16	1.27	1.52	1.77	2.53
150	0.62	0.67	0.72	0.77	0.82	0.88	0.93	1.08	1.23	1.38	1.53	1.69	1.84	2.21	2.58	3.68
200	0.78	0.85	0.92	0.99	1.06	1.13	1.21	1.40	1.60	1.80	2.00	2.20	2.40	2.88	3.36	4.80
250	0.94	1.03	1.11	1.20	1.29	1.38	1.47	1.72	1.97	2.21	2.46	2.70	2.95	3.54	4.13	5.90
300	1.09	1.19	1.30	1.40	1.51	1.62	1.73	2.02	2.33	2.62	2.91	3.20	3.49	4.18	4.88	6.97
350	1.24	1.36	1.48	1.60	1.73	1.86	1.99	2.33	2.68	3.01	3.35	3.68	4.02	4.82	5.62	8.03
400	1.38	1.52	1.66	1.80	1.94	2.09	2.24	2.63	3.03	3.41	3.79	4.16	4.54	5.45	6.36	9.07
450	1.52	1.67	1.83	1.99	2.15	2.32	2.49	2.92	3.37	3.80	4.22	4.64	5.06	6.07	7.08	10.10
500	1.66	1.82	2.00	2.17	2.35	2.54	2.73	3.21	3.72	4.18	4.64	5.11	5.57	6.68	7.80	11.12
550	1.79	1.97	2.16	2.36	2.56	2.76	2.97	3.50	4.05	4.56	5.07	5.57	6.08	7.29	8.50	12.13
600	1.92	2.12	2.33	2.54	2.76	2.98	3.20	3.79	4.39	4.94	5.49	6.03	6.58	7.90	9.21	13.13
650	2.04	2.26	2.49	2.72	2.95	3.19	3.44	4.07	4.72	5.31	5.90	6.49	7.08	8.49	9.90	14.11
700	2.16	2.40	2.64	2.89	3.15	3.40	3.67	4.35	5.05	5.69	6.32	6.95	7.58	9.09	10.59	15.09
750	2.28	2.54	2.80	3.06	3.34	3.61	3.90	4.63	5.38	6.05	6.73	7.40	8.07	9.67	11.28	16.06
800	2.40	2.67	2.95	3.24	3.53	3.82	4.12	4.90	5.71	6.42	7.13	7.84	8.56	10.26	11.96	17.02
850	2.52	2.81	3.10	3.40	3.71	4.03	4.35	5.18	6.03	6.79	7.54	8.29	9.04	10.84	12.63	17.97
900	2.63	2.94	3.25	3.57	3.90	4.23	4.57	5.45	6.36	7.15	7.94	8.73	9.52	11.41	13.30	18.91
950	2.74	3.07	3.40	3.74	4.08	4.43	4.79	5.72	6.68	7.51	8.34	9.17	10.00	11.99	13.97	19.85
1000	2.86	3.19	3.54	3.90	4.26	4.63	5.01	5.99	6.99	7.87	8.74	9.61	10.48	12.55	14.63	20.77
1100	3.07	3.45	3.83	4.22	4.62	5.03	5.45	6.52	7.63	8.58	9.52	10.47	11.42	13.68	15.93	22.60
1200	3.28	3.69	4.11	4.54	4.97	5.42	5.87	7.04	8.25	9.28	10.31	11.33	12.35	14.79	17.22	24.40
1300	3.49	3.93	4.38	4.85	5.32	5.80	6.30	7.56	8.87	9.98	11.08	12.18	13.27	15.89	18.50	26.16
1400	3.69	4.16	4.65	5.15	5.66	6.18	6.71	8.08	9.49	10.67	11.84	13.02	14.19	16.98	19.75	27.89
1500	3.88	4.39	4.92	5.45	6.00	6.56	7.13	8.59	10.10	11.35	12.60	13.85	15.09	18.06	20.99	29.58
1600	4.07	4.62	5.18	5.75	6.33	6.93	7.53	9.09	10.70	12.03	13.35	14.67	15.99	19.12	22.22	31.25
1700	4.26	4.84	5.43	6.04	6.66	7.29	7.94	9.59	11.30	12.70	14.10	15.49	16.87	20.17	23.43	32.88
1800	4.44	5.06	5.68	6.33	6.99	7.66	8.34	10.09	11.90	13.37	14.84	16.30	17.75	21.21	24.62	
1900	4.62	5.27	5.93	6.61	7.31	8.01	8.73	10.58	12.49	14.03	15.57	17.10	18.62	22.24	25.80	
2000	4.79	5.48	6.18	6.89	7.62	8.37	9.12	11.07	13.07	14.69	16.29	17.89	19.48	23.25	26.96	
2100	4.97	5.68	6.42	7.17	7.94	8.72	9.51	11.55	13.66	15.34	17.01	18.68	20.33	24.26	28.10	
2200	5.13	5.89	6.66	7.44	8.25	9.06	9.90	12.03	14.24	15.99	17.73	19.46	21.18	25.25	29.23	
2300	5.30	6.09	6.89	7.71	8.55	9.41	10.28	12.51	14.81	16.63	18.44	20.23	22.02	26.23	30.34	
2400	5.46	6.28	7.12	7.98	8.86	9.75	10.66	12.98	15.38	17.27	19.14	21.00	22.84	27.20	31.43	
2500	5.62	6.48	7.35	8.25	9.16	10.09	11.03	13.45	15.95	17.90	19.84	21.76	23.66	28.15	32.51	
2600	5.78	6.67	7.58	8.51	9.46	10.42	11.40	13.92	16.51	18.53	20.53	22.51	24.48	29.10	33.57	
2700	5.93	6.86	7.80	8.77	9.75	10.75	11.77	14.38	17.07	19.15	21.22	23.26	25.28	30.03		
2800	6.08	7.04	8.02	9.02	10.04	11.08	12.14	14.84	17.62	19.77	21.90	24.00	26.08	30.95		
2900	6.23	7.22	8.24	9.28	10.33	11.41	12.50	15.29	18.18	20.38	22.57	24.73	26.87	31.86		
3000	6.38	7.41	8.46	9.53	10.62	11.73	12.86	15.75	18.72	20.99	23.24	25.46	27.64	32.75		
3200	6.66	7.76	8.88	10.02	11.19	12.37	13.57	16.64	19.81	22.20	24.56	26.89	29.18			
3400	6.94	8.11	9.29	10.51	11.74	13.00	14.27	17.53	20.88	23.39	25.86	28.29	30.68			
3600	7.21	8.44	9.70	10.98	12.29	13.62	14.96	18.40	21.94	24.56	27.13	29.66	32.14			
3800	7.47	8.77	10.10	11.45	12.83	14.22	15.64	19.26	22.98	25.71	28.39	31.01				
4000	7.73	9.09	10.49	11.91	13.35	14.82	16.31	20.11	24.01	26.84	29.61	32.32				
4200	7.97	9.40	10.87	12.36	13.87	15.41	16.97	20.95	25.02	27.95	30.82					
4400	8.21	9.71	11.24	12.80	14.39	15.99	17.62	21.77	26.02	29.05	32.00					
4600	8.44	10.01	11.61	13.24	14.89	16.56	18.26	22.59	27.00	30.12						
4800	8.67	10.30	11.97	13.66	15.38	17.13	18.89	23.39	27.97	31.18						
5000	8.89	10.59	12.32	14.08	15.87	17.68	19.52	24.18	28.92							
5500	9.41	11.27	13.17	15.10	17.05	19.03	21.03	26.10	31.23							

indicates that use within this marked range causes a reduced belt endurance time; pay due attention at the time of design.

Table of basic power ratings for KPS II Type 14M (per width of 40 mm and length of 1400 mm)

(Unit: kW)

Pinion revolution (rpm) \ No. of teeth of pinion	22	24	26	28	30	32	34	36	38	40	45	50	55	60	84	120
Pitch diameter (mm)	98.04	106.95	115.86	124.78	133.69	142.60	151.52	160.43	169.34	178.25	200.54	222.82	245.10	267.38	374.33	534.76
100	3.30	3.60	3.90	4.20	4.52	4.83	5.16	5.48	5.82	6.15	6.92	7.69	8.46	9.23	12.92	18.46
150	4.69	5.12	5.56	6.02	6.48	6.95	7.42	7.91	8.40	8.90	10.01	11.12	12.24	13.35	18.68	26.68
200	6.00	6.57	7.15	7.75	8.35	8.97	9.60	10.24	10.89	11.55	13.00	14.44	15.88	17.33	24.25	34.62
250	7.25	7.96	8.68	9.42	10.17	10.93	11.71	12.51	13.32	14.14	15.90	17.67	19.43	21.20	29.66	42.33
300	8.46	9.30	10.16	11.04	11.93	12.84	13.77	14.72	15.68	16.66	18.74	20.82	22.90	24.98	34.95	49.85
350	9.64	10.61	11.60	12.62	13.65	14.71	15.79	16.89	18.01	19.14	21.53	23.92	26.31	28.70	40.14	57.21
400	10.78	11.88	13.01	14.16	15.34	16.55	17.77	19.02	20.29	21.59	24.28	26.97	29.66	32.35	45.23	64.43
450	11.89	13.12	14.39	15.68	17.00	18.35	19.72	21.12	22.54	23.99	26.98	29.97	32.96	35.95	50.24	71.51
500	12.98	14.34	15.74	17.17	18.63	20.12	21.64	23.19	24.76	26.36	29.65	32.94	36.22	39.50	55.17	78.45
550	14.05	15.54	17.07	18.63	20.23	21.86	23.53	25.23	26.95	28.71	32.29	35.86	39.43	43.00	60.04	85.28
600	15.09	16.71	18.37	20.07	21.81	23.58	25.39	27.24	29.12	31.03	34.89	38.75	42.61	46.46	64.83	91.98
650	16.12	17.87	19.66	21.49	23.37	25.28	27.24	29.23	31.26	33.32	37.47	41.61	45.75	49.87	69.56	98.56
700	17.13	19.00	20.93	22.89	24.91	26.96	29.06	31.20	33.38	35.59	40.02	44.44	48.85	53.25	74.22	105.02
750	18.13	20.13	22.18	24.28	26.43	28.62	30.86	33.15	35.48	37.84	42.55	47.24	51.92	56.59	78.82	111.36
800	19.11	21.23	23.41	25.64	27.93	30.27	32.65	35.08	37.55	40.07	45.05	50.01	54.96	59.90	83.36	117.59
850	20.07	22.32	24.63	26.99	29.42	31.89	34.42	36.99	39.61	42.28	47.53	52.76	57.97	63.17	87.85	123.69
900	21.03	23.40	25.83	28.33	30.89	33.50	36.17	38.88	41.65	44.47	49.98	55.48	60.96	66.41	92.27	129.67
950	21.97	24.46	27.02	29.65	32.34	35.09	37.90	40.76	43.68	46.64	52.42	58.17	63.91	69.62	96.64	135.53
1000	22.89	25.51	28.20	30.96	33.78	36.67	39.62	42.62	45.68	48.80	54.83	60.85	66.83	72.80	100.94	141.26
1050	23.81	26.55	29.37	32.26	35.21	38.24	41.32	44.47	47.67	50.94	57.23	63.50	69.73	75.94	105.19	146.87
1100	24.72	27.58	30.52	33.54	36.63	39.79	43.01	46.30	49.65	53.06	59.60	66.12	72.61	79.05	109.38	
1150	25.61	28.59	31.66	34.81	38.03	41.33	44.69	48.12	51.61	55.16	61.96	68.73	75.45	82.13	113.51	
1200	26.49	29.60	32.79	36.07	39.42	42.85	46.35	49.92	53.55	57.25	64.30	71.31	78.27	85.19	117.59	
1250	27.37	30.60	33.91	37.32	40.80	44.36	48.00	51.71	55.49	59.33	66.62	73.87	81.07	88.21	121.60	
1300	28.23	31.58	35.02	38.55	42.17	45.86	49.64	53.48	57.40	61.39	68.92	76.41	83.83	91.20	125.55	
1350	29.09	32.56	36.12	39.78	43.52	47.35	51.26	55.25	59.30	63.43	71.21	78.92	86.58	94.17	129.45	
1400	29.94	33.52	37.21	40.99	44.87	48.83	52.87	57.00	61.19	65.47	73.47	81.42	89.30	97.10	133.28	
1450	30.78	34.48	38.29	42.20	46.20	50.29	54.47	58.73	63.07	67.48	75.72	83.89	91.99	100.00	137.05	
1500	31.61	35.43	39.36	43.39	47.53	51.75	56.06	60.46	64.93	69.49	77.96	86.35	94.66	102.88		
1550	32.43	36.37	40.42	44.58	48.84	53.19	57.64	62.17	66.78	71.47	80.17	88.78	97.30	105.72		
1600	33.24	37.30	41.47	45.76	50.14	54.63	59.20	63.87	68.62	73.45	82.37	91.20	99.92	108.53		
1650	34.05	38.22	42.52	46.92	51.44	56.05	60.76	65.56	70.44	75.41	84.55	93.59	102.51	111.32		
1700	34.85	39.14	43.55	48.08	52.72	57.46	62.30	67.23	72.25	77.36	86.72	95.96	105.08	114.07		
1750	35.64	40.05	44.58	49.23	53.99	58.86	63.83	68.90	74.05	79.29	88.86	98.31	107.63	116.79		
1800	36.43	40.95	45.60	50.37	55.26	60.26	65.35	70.55	75.84	81.22	91.00	100.64	110.14	119.49		
1850	37.20	41.84	46.61	51.50	56.52	61.64	66.87	72.19	77.61	83.12	93.11	102.95	112.64	122.15		
1900	37.97	42.73	47.61	52.63	57.76	63.01	68.37	73.82	79.38	85.02	95.21	105.24	115.10	124.78		
1950	38.74	43.60	48.61	53.74	59.00	64.37	69.86	75.44	81.12	86.90	97.29	107.51	117.55	127.38		
2000	39.50	44.47	49.59	54.85	60.23	65.73	71.34	77.05	82.86	88.77	99.35	109.76	119.96	129.95		
2100	40.99	46.19	51.55	57.04	62.66	68.40	74.26	80.23	86.30	92.46	103.43	114.19	124.71	134.99		
2200	42.46	47.89	53.47	59.20	65.06	71.04	77.15	83.37	89.69	96.11	107.44	118.54	129.36			
2400	45.33	51.19	57.23	63.42	69.75	76.21	82.80	89.51	96.32	103.24	115.26	126.97				
2600	48.10	54.40	60.87	67.51	74.30	81.23	88.29	95.47	102.76	110.15	122.80					
2800	50.78	57.50	64.41	71.49	78.73	86.11	93.62	101.26	109.00	116.85	130.05					
3000	53.38	60.51	67.85	75.35	83.02	90.84	98.79	106.86	115.05	123.33						
3200	55.89	63.43	71.17	79.10	87.19	95.43	103.80	112.29	120.89	129.58						
3400	58.32	66.25	74.40	82.73	91.22	99.86	108.64	117.53								
3600	60.67	68.99	77.52	86.24	95.12	104.15	113.31									
3800	62.93	71.63	80.54	89.64	98.89	108.29										
4000	65.13	74.18	83.46	92.91	102.53	112.28										

indicates that use within this marked range causes a reduced belt endurance time; pay due attention at the time of design.

List of pulley diameters for KPS II Type 8M

(Unit: mm)

No. of teeth	Pitch diameter	Outside diameter
18	45.84	44.46
19	48.38	47.01
20	50.93	49.56
21	53.48	52.10
22	56.02	54.65
23	58.57	57.20
24	61.12	59.74
25	63.66	62.29
26	66.21	64.84
27	68.75	67.38
28	71.30	69.93
29	73.85	72.48
30	76.39	75.02
31	78.94	77.57
32	81.49	80.12
33	84.03	82.66
34	86.58	85.21
35	89.13	87.75
36	91.67	90.30
37	94.22	92.85
38	96.77	95.39
39	99.31	97.94
40	101.86	100.49
41	104.41	103.03
42	106.95	105.58
43	109.50	108.13
44	112.05	110.67
45	114.59	113.22
46	117.14	115.77
47	119.68	118.31
48	122.23	120.86
49	124.78	123.41
50	127.32	125.95
51	129.87	128.50
52	132.42	131.04
53	134.96	133.59
54	137.51	136.14
55	140.06	138.68
56	142.60	141.23
57	145.15	143.78
58	147.70	146.32
59	150.24	148.87
60	152.79	151.42
61	155.34	153.96
62	157.88	156.51
63	160.43	159.06
64	162.97	161.60
65	165.52	164.15
66	168.07	166.70
67	170.61	169.24
68	173.16	171.79
69	175.71	174.34
70	178.25	176.88
71	180.80	179.43
72	183.35	181.97
73	185.89	184.52
74	188.44	187.07
75	190.99	189.61
76	193.53	192.16
77	196.08	194.71
78	198.63	197.25
79	201.17	199.80
80	203.72	202.35
81	206.26	204.89
82	208.81	207.44
83	211.36	209.99
84	213.90	212.53
85	216.45	215.08
86	219.00	217.63
87	221.54	220.17
88	224.09	222.72
89	226.64	225.26
90	229.18	227.81
91	231.73	230.36
92	234.28	232.90
93	236.82	235.45
94	239.37	238.00
95	241.92	240.54
96	244.46	243.09
97	247.01	245.64
98	249.56	248.18
99	252.10	250.73
100	254.65	253.28
101	257.19	255.82
102	259.74	258.37
103	262.29	260.92
104	264.83	263.46
105	267.38	266.01
106	269.93	268.55
107	272.47	271.10
108	275.02	273.65
109	277.57	276.19
110	280.11	278.74
111	282.66	281.29
112	285.21	283.83
113	287.75	286.38
114	290.30	288.93
115	292.85	291.47
116	295.39	294.02
117	297.94	296.57
118	300.48	299.11
119	303.03	301.66
120	305.58	304.21
121	308.12	306.75
122	310.67	309.30
123	313.22	311.84
124	315.76	314.39
125	318.31	316.94
126	320.86	319.48
127	323.40	322.03
128	325.95	324.58
129	328.50	327.12
130	331.04	329.67
131	333.59	332.22
132	336.14	334.76
133	338.68	337.31
134	341.23	339.86
135	343.77	342.40
136	346.32	344.95
137	348.87	347.50
138	351.41	350.04
139	353.96	352.59
140	356.51	355.14
141	359.05	357.68
142	361.60	360.23
143	364.15	362.77
144	366.69	365.32
145	369.24	367.87
146	371.79	370.41
147	374.33	372.96
148	376.88	375.51
149	379.43	378.05
150	381.97	380.60

King Power Synchronous Belt (KPS II)
How to Design

List of pulley diameters for KPS II Type 14M

(Unit: mm)

No. of teeth	Pitch diameter	Outside diameter
22	98.04	95.24
23	102.50	99.70
24	106.95	104.16
25	111.41	108.61
26	115.86	113.06
27	120.32	117.52
28	124.78	121.98
29	129.23	126.44
30	133.69	130.90
31	138.15	135.35
32	142.60	139.81
33	147.06	144.27
34	151.52	148.72
35	155.97	153.18
36	160.43	157.63
37	164.88	162.09
38	169.34	166.55
39	173.80	171.00
40	178.25	175.46
41	182.71	179.92
42	187.17	184.37
43	191.62	188.83
44	196.08	193.28
45	200.54	197.74
46	204.99	202.20
47	209.45	206.65
48	213.90	211.11
49	218.36	215.57
50	222.82	220.02
51	227.27	224.48
52	231.73	228.94
53	236.19	233.39
54	240.64	237.85
55	245.10	242.30
56	249.56	246.76
57	254.01	251.22
58	258.47	255.67
59	262.92	260.13
60	267.38	264.59
61	271.84	269.04
62	276.29	273.50
63	280.75	277.96
64	285.21	282.41
65	289.66	286.87
66	294.12	291.32
67	298.57	295.78
68	303.03	300.24
69	307.49	304.69
70	311.94	309.15
71	316.40	313.61
72	320.86	318.06
73	325.31	322.52
74	329.77	326.98
75	334.23	331.43
76	338.68	335.89
77	343.14	340.34
78	347.59	344.80
79	352.05	349.26
80	356.51	353.71
81	360.96	358.17
82	365.42	362.63
83	369.88	367.08
84	374.33	371.54
85	378.79	375.99
86	383.25	380.45
87	387.70	384.91
88	392.16	389.36
89	396.61	393.82
90	401.07	398.28
91	405.53	402.73
92	409.98	407.19
93	414.44	411.65
94	418.90	416.10
95	423.35	420.56
96	427.81	425.01
97	432.26	429.47
98	436.72	433.93
99	441.18	438.38
100	445.63	442.84
101	450.09	447.30
102	454.55	451.75
103	459.00	456.21
104	463.46	460.67
105	467.92	465.12
106	472.37	469.58
107	476.83	474.03
108	481.28	478.49
109	485.74	482.95
110	490.20	487.40
111	494.65	491.86
112	499.11	496.32
113	503.57	500.77
114	508.02	505.23
115	512.48	509.68
116	516.94	514.14
117	521.39	518.60
118	525.85	523.05
119	530.30	527.51
120	534.76	531.97
121	539.22	536.42
122	543.67	540.88
123	548.13	545.34
124	552.59	549.79
125	557.04	554.25
126	561.50	558.70
127	565.96	563.16
128	570.41	567.62
129	574.87	572.07
130	579.32	576.53
131	583.78	580.99
132	588.24	585.44
133	592.69	589.90
134	597.15	594.36
135	601.61	598.81
136	606.06	603.27
137	610.52	607.72
138	614.97	612.18
139	619.43	616.64
140	623.89	621.09
141	628.34	625.55
142	632.80	630.01
143	637.26	634.46
144	641.71	638.92
145	646.17	643.38
146	650.63	647.83
147	655.08	652.29
148	659.54	656.74
149	663.99	661.20
150	668.45	665.66

Step 1. Determining conditions required for the design

- Driving machine: Servo motor 3.75 kW
- Driven machine: Belt conveyor (8- to 10-hours/day operation)
- Revolution of driving shaft: 300 rpm
- Driving pulley diameter ϕ85 mm to ϕ100 mm
- Speed-up ratio: 1.294 (deceleration)
- Center distance 340 mm ± 15 mm

Step 2. Calculating the design power

① Obtain the load correction factor from **Table 1 (→ P. 31)**.
② From Formula 1**(→ P. 31)**, calculate the design power.
Pd = 3.75 × (1.7 + 0.0) = 6.38

Step 3. Selecting a belt type

From the design power of 6.38 kW and the revolution of driving shaft of 300 rpm from **Fig. 1 Belt type selection diagram (→ P. 32)**, select Type 8M.

Step 4. Selecting a pulley diameter

① Due to the restriction of the driving pulley diameter, select 34 as the number of teeth of the 8M pulley **(→ P. 39)** and check if it is the minimum number of teeth of a pulley in **Table 5 (→ P. 33)** or more (in this case 18 teeth or more).
② From Formula 4**(→ P. 33)**, calculate the number of teeth of the driven pulley.
- Speed-up ratio = 1.294 (deceleration)

$Z_2 = 34 \times 1.294 = 44$

Step 5. Selecting an effective length

① Calculate a rough effective length with Formula 7 **(→ P. 33)** and select an effective length that is closest to this value from the **"Table of standard effective lengths" (→ P. 30)**.

$$L' = 2 \times 340 + 1.57(112.05 + 86.58) + \frac{(112.05-86.58)^2}{4 \times 340}$$
$$= 992.33 \rightarrow 1000$$

② From belt pitch length Lp = 1000 and Formula 8 **(→ P. 33)**, backcalculate the center distance at that time.

$$C = \frac{688.15 + \sqrt{688.15^2 - 2(112.05-86.58)^2}}{4}$$
$$= 343.84$$

Step 6. Determining the belt width

① From **"Table of basic power ratings for KPS II 8M (per width of 15 mm)" (→ P. 37)**, obtain the basic power rating with 34 teeth of the pinion and at 300 rpm.
② From Formula 9 **(→ P. 34)**, calculate the angle of contact of the pulley and from **Table 6 (→ P. 34)**, obtain the mesh correction factor.

$$\Theta_{11} = 180 - \frac{57.3\,(112.05\text{-}86.58)}{343.84} = 175.8^\circ$$

$$Z_m = 34 \times \frac{175.8}{360} = 16.6 \rightarrow Km = 1.0$$

③ From **Table 8 (→ P. 35)**, obtain the correction factor by effective length.
④ From **Table 7 (→ P. 34)**, obtain the correction factor by use of a pinion.
⑤ From Formula 10 **(→ P. 34)**, obtain the corrected power rating.
Pc = 1.97 × 1.00 × 0.92 × 1.00 = 1.81
⑥ From Formula 11 **(→ P. 34)**, obtain the correction factor of the belt width Kb.

$$K_b = \frac{6.38}{1.81} = 3.52$$

⑦ From **Table 10 "Table of 8M belt width correction factors" (→ P. 36)**, obtain the belt width.

Step 7. Checking the adjustment range of the center distance

From **Table 9 (→ P. 35)**, obtain the inner and outer adjustment ranges of the center distance.

Examination result

- Belt 600 KPS II 8M 1000
- Driving pulley 34 S8M 0600
- Driven pulley 44 S8M 0600
- Center distance 343.8 mm
  - Inner adjustment range: 15 mm
  - Outer adjustment range: 15 mm

Load correction factor Ko = 1.7
Design power Pd = 6.38 kW

Belt type: 8M

No. of teeth of driving pulley: 34
Driving pulley pitch diameter: 86.58 mm

No. of teeth of driven pulley: 44
Driving pulley pitch diameter: 112.05 mm

Effective length: KPS II 8M 1000
(Pitch length 1000 mm)

Center distance: 343.84 mm

Basic power rating Pr = 1.97 kW

Mesh correction factor Km = 1.00

Length correction factor K = 0.92
Pinion correction factor Kp = 1.00

Corrected power rating Pc = 1.81 kW
Belt width correction factor Kb = 3.67

Belt width: 60 mm
Belt nominal width: 600

Inner adjustment range (Ci): 15 mm
Outer adjustment range (Cs): 10 mm