

[Technical Calculations] Selection of Timing Belts 2

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at:
http://fawos.misumi.jp/FA_WEB/pulley_sea/

[Step 5] Determining Belt Width

(1) Calculate an approx. belt width using the following formula, and then select a belt width (Bw':mm) that is the nearest value to the approximated value.

$$Bw' = \frac{Pd}{Ps \cdot Km} \times Wp$$

Pd: Design Power
Ps: Reference Transmission Capacity Use the Reference Transmission Capacity Table on P.2827~2835.
Km: Engagement Correction Coefficient (Table 13)
Wp: Reference Belt Width (Table 14)

Table 13. Engagement Correction Coefficient (Km)

No. of Teeth Engaged Zm	More than 6	5	4	3	2
Km	1.0	0.8	0.6	0.4	0.2

Table 14. Reference Belt Width (Wp)

Type of Belt	MXL	XL	L	H	S2M	S3M	S5M	S8M	S14M	MTS8M
Reference Belt Width	6.4	25.4	25.4	25.4	4	6	10	60	120	60

$$\text{No. of Teeth Engaged (Zm)} = \frac{Zd \cdot \theta}{360^\circ}$$

$$\theta = 180^\circ - \frac{57.3(Dp - dp)}{C}$$

Zd: No. of Teeth of Small Pulley
Dp: Pitch Diameter of Large Pulley (mm)
C: Inter-shaft Distance (mm)
dp: Pitch Diameter of Small Pulley (mm)

(2) Check if Design Power (Pd) satisfies the following formula. (If not, select the belt width of one size larger again.)

Table 15. Width Correction Coefficient (Kb)

Type of Belt	Belt Width		Width Correction Coefficient Kb	Type of Belt	Belt Width		Width Correction Coefficient Kb	Type of Belt	Belt Width		Width Correction Coefficient Kb	
	Nominal	mm			Nominal	mm			Nominal	mm		
MXL	019	4.8	0.72	S2M	040	4	1.00	P2M	40	4	1.00	
	025	6.4	1.00		060	6	1.59		60	6	1.59	
	037	9.5	1.57		100	10	2.84		100	10	1.78	
	050	12.7	2.18		060	6	1.00		150	15	2.84	
XL	025	6.4	0.15	S3M	100	10	1.79	P3M	100	10	1.00	
	031	7.9	0.21		150	15	2.84		150	15	1.59	
	037	9.5	0.28		100	10	1.00		150	15	1.00	
	050	12.7	0.42		150	15	1.59		250	25	1.79	
L	050	12.7	0.42	S5M	250	25	2.84	P5M	150	15	1.59	
	075	19.1	0.71		150	15	0.21		150	15	1.00	
	100	25.4	1.00		250	25	2.84		100	10	1.00	
	150	38.1	1.56		150	15	0.21		150	15	1.60	
H	075	19.1	0.71	S8M	400	40	0.63	P8M	150	15	1.60	
	100	25.4	1.00		300	30	0.45		200	20	2.30	
	150	38.1	1.56		400	40	0.29		250	25	2.90	
	200	50.8	2.14		600	60	0.45		150	15	1.60	
T5				MTS8M				S14M				
T10												

Pd < Ps · Km · Kb

Pd: Design Power
Ps: Reference Transmission Capacity
Km: Engagement Correction Coefficient
Kb: Width Correction Coefficient (Table 15)

Reference Belt Width Tolerance (Unit: mm)

Belt Width	Belt Length			
	351 or Less	351 to 840	840 to 1680	1680 or More
10 or Less	+0.3 -0.6	+0.3 -0.6	+0.3 -0.6	+0.6 -0.6
10 to 40	+0.6 -0.6	+0.6 -0.6	+0.6 -0.6	+0.6 -0.6
40 to 50	+0.6 -0.6	+0.6 -0.6	+1.0 -1.0	+1.0 -1.3

[Step 6] Check if Inter-Shaft Distance Adjustment Range is Larger than that in Table 16

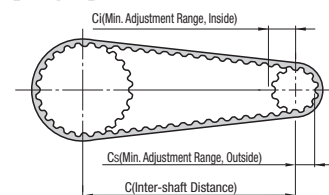


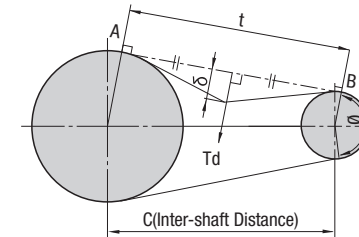
Table 16. Minimum Inter-Axial Distance Adjustment Range

Belt Length	Length Tolerance	Inter-Shaft Distance Tolerance	MXL		XL		L		H		S2M		S3M		S5M		S8M		S14M		MTS8M		P2M		P3M		P5M		P8M		T5		T10	
			Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs		
Less than 150	±0.35	±0.18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
150 to 250	±0.41	±0.21	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
250 to 380	±0.46	±0.23	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
380 to 500	±0.51	±0.26	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
500 to 750	±0.60	±0.30	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
750 to 1000	±0.66	±0.33	3	15	5	15	10	15	15	15	10	3	15	5	15	5	15	5	15	5	15	5	15	5	15	5	15	5	15	5	15	5	15	
1000 to 1250	±0.76	±0.38	15	15	15	15	15	15	15	15	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
1250 to 1500	±0.82	±0.41	25	25	25	25	25	25	25	25	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1500 to 1750	±0.86	±0.43	25	25	25	25	25	25	25	25	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
1750 to 2000	±0.92	±0.46	30	30	30	30	30	30	30	30	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Cautions on Use of Belt

How to Extend Belt

When the belt is too taut, its service life can be shortened, while when it is not taut enough, the belt may (jump off) the groove of the pulley due to an activating torque or shock load. Keep the belt stationary and optimize its tautness. The warp load necessary to provide the optimum tautness can be calculated from values representing the belt, its width and the span in equation A below.



$$Td = \frac{Ti + \frac{t \times Y}{Lp}}{16} \dots \dots \dots \text{Equation A}$$

Td: Load N Needed for Deflection d at the Center of Span t

Ti: Initial Tension N From Table 17
Y: Correction Coefficient From Table 17
δ: Deflection (mm) δ=0.016t
t: Span Length (mm) $t = \sqrt{C^2 - \frac{(Dp - dp)^2}{4}}$
Lp: Length of the Belt (mm)
C: Inter-shaft Distance (mm)
dp: Diameter of the Pitch Circle of the Small Pulley (mm)
Dp: Diameter of the Pitch Circle of the Large Pulley (mm)

Table 17. Initial Tension (Ti) and Correction Coefficient (Y)

Type	Ti-Y	Belt Nominal Width (mm)										Type	Ti-Y	Belt Nominal Width (mm)			
		019	025	031	037	050	075	100	150	200	60			100	150	250	
MXL	Ti	9.8	13.7	-	21.6	29.9	-	-	-	-	-	P2M	Ti	13	-	-	-
	N	5.8	8.2	-	12.9	18.0	-	-	-	-	-		N	9.8	-	-	-
XL	Ti	-	29	37	44	67	-	-	-	-	P3M	Ti	-	46	74	-	
	N	-	18	25	32	51	-	-	-	-		N	-	34	55	-	
L	Ti	-	-	-	-	76	125	175	273	-	P5M	Ti	-	147	225.4	-	
	N	-	-	-	-	52	87	123	191	-		N	-	107.8	166.6	-	
H	Ti	-	-	-	-	-	293	421	646	889	P8M	Ti	-	-	294	509.6	
	N	-	-	-	-	-	222	312	486	668		N	-	-	225.4	382.2	
Coefficient Y		-	-	-	-	-	44.1	75.5	107	165	Coefficient Y		-	56.9	82.4	-	
Coefficient Y		-	-	-	-	-	142	205	317	423	Coefficient Y		-	-	135	239	

Type	Ti-Y	Belt Nominal Width (mm)							
		40	60	100	150	250	300	400	600
S2M	Ti	7.8	12.7	22.6	-	-	-	-	-
	N	5.9	9.8	16.7	-	-	-	-	-
Coefficient Y		9.8	15.7	27.4	-	-	-	-	-
S3M	Ti	-	26	46	73	-	-	-	-
	N	-	20	34	54	-	-	-	-
Coefficient Y		-	26.5	46.1	75.5	-	-	-	-
S5M	Ti	-	-	77	124	221	-	-	-
	N	-	-	58	93	166	-	-	-
Coefficient Y		-	-	52.8	85.5	151.0	-	-	-
S8M	Ti	-	-	-	294	510	628	873	-
	N	-	-	-	226	382	470	657	-
Coefficient Y		-	-	-	98	196	235	333	-
S14M	Ti	-	-	-	-	-	1226	1912	-
	N	-	-	-	-	-	1108	1726	-
Coefficient Y		-	-	-	-	-	686	1059	-

Type	Ti-Y	Belt Nominal Width (mm)							
		100	150	200	250	300	400	500	
T5	Ti	37.3	59	85	106	-	-	-	
	N	24.5	39	59	74	-	-	-	
Coefficient Y		16.7	26.5	38.2	47.5	-	-	-	
T10	Ti	-	162	235	294	363	500	628	
	N	-	108	157	196	245	333	422	
Coefficient Y		-	71.6	104.9	130.4	163.8	222.6	281.5	

Notes on Operation

- Be careful to avoid the ingress of foreign particles. When solid foreign particles enter during operation, it can scratch the belt and adversely affect the engagement of the belt and the pulley. In some cases, the pulley may disengage, land on the teeth of the pulley, and be cut.
- Avoid Adhesion of oil. Oil on the rubber timing belt may wet and expand it, drastically shortening its service life. (a) Take special care when using solvent type oil. (b) A small amount of lubricant or grease, however, rarely causes a trouble.
- Do not use the belt in a humid atmosphere.
- Please use a well-ventilated safety cover.
- The service life of the belt, when used at a high temperature (80°C or more), can be drastically shortened.