

[Technical Data] Selection of Transmission 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 2-c] For 2GT/3GT Series

• Design Power (Pd) = Transmission Power (Pt) × Overload Coefficient (Ks)

• Calculate the Transmission Power (Pt) from the motor rated power (Originally, it is ideal to calculate from the actual load applied to the belt)
• Normal Motor Load Factor (Ks)=Ko+Ki+Kr+Kh

Ko : Load Correction Factor (Table 8)
Ki : Idler Correction Factor (Table 9)
Kr : Speed Increase Correction Factor (Table 10)
Kh : Operation Time Correction Factor (Table 11)

<For Servo Motor Applications>

In the process of designing, apply Ko=2.5 for the rated torque and Ko=0.5 for the max. torque.

* If the max. torque is generated each time the belt system is started up or stopped, choose an applicable load correction factor Ko from the Table 8., "Load Correction Factors based on Frequency of Start/Stop (Ko) operation," and apply it to the above expression.

<For Spindle Motor Applications>

In the process of designing, apply Ko=2.2 for the rated output and the basic rotation speed.

Table 8. Load Correction Factor (Ko)

Type of Motor		I	II	III	
Peak Output/Basic Output		150% or Less	Over 150%-200% or Less	Over 250%	
AC Motor	Single-Phase	—	—	All Types	
	Squirrel Cage Type	2 Phase	—	All Types	
		4 Phase	—	37Kw or More	30Kw or Less
		6 Phase · 8 Phase	—	—	All Types
	Wound Field Type	4 Phase	—	—	15Kw or Less
		6 Phase	—	—	11Kw or Less
		8 Phase	—	—	5.5Kw or Less
Synchronous Motor		—	Standard Torque Type	High Torque Type	
DC Motor		Shunt	Wound Field	Series	
Hydraulic Motor		—	—	All Types	
Office Machinery	Printer · Fax Machine · Copy Machine	—	1.2	1.4	
Home Appliance	Juicer	—	1.4	1.6	
	Vacuum Cleaner	1	1.2	1.4	
Finance Equipment	Money Exchanger · Ticket Machine · Ticket Gates · Bank Teller Machine	1.3	1.4	1.5	
Food · Medicine · Medical Equipment	Bakery Equipment	1.2	1.4	1.6	
	Mixer · Granulator	1.4	1.6	1.8	
	Centrifuge	1.5	1.7	1.9	
	Medical Machinery · Measurement Equipment	1	1.2	1.4	
Machine Tool	Drill Press · Lathe	1.2	1.4	1.6	
	Milling Machine	1.3	1.5	1.7	
	Wood Lather	1.2	1.4	1.6	
Printing Book Making	Printer · Book Making Machine · Cutter	1.2	1.4	1.6	
Textile Machine	Textile · Knitting Machinery	1.3	1.5	1.7	
Sawing Machine	Sawing Machine – Home Use	—	1.2	1.4	
	Sawing Machine – Industrial	—	1.6	1.8	
Belt Conveyor · Packaging Machine	Belt Conveyor – Light Objects	1.1	1.3	1.5	
	Packaging Machine	1.2	1.4	1.6	
Film · Wire Making Machine	Calender · Extruder	1.4	1.6	1.8	
	Wire Making Machinery	1.4	1.6	1.8	

Table 9. Idler Correction Factor (Ki)

Idler Position	Inside	Outside
Loose Side of the Belt	0	+0.1
Tense Side of the Belt	+0.1	+0.2

Table 11. Operation Time Correction Factor (Kh)

Operation Time	Correction Factor
Less than 10 hours (Everyday)	0
10~16 Hours Continuous (Everyday)	+0.2
16~24 Hours Continuous (Everyday)	+0.4
300 Hours/Year or Less (Seasonal operations etc.)	-0.2

Table 13. Load Correction Factor based on Frequency of Start/Stop (Ko) operation

When the frequency of Start/Stop is less than 100 times per day	Ko=1.5
When the frequency of Start/Stop is 100 times or more but less than 1,000 times per day	Ko=2.0
When the frequency of Start/Stop is more than 1,000 times per day	Ko=2.5

Table 10. Speed Multiplication Correction Factor (Kr)

Speed Increase Ratio	Correction Factor
1 or More Less than 1.25	0
1.25 or More Less than 1.75	+0.1
1.75 or More Less than 2.5	+0.2
2.5 or More Less than 3.5	+0.3
3.5 or More	+0.4

Table 12. Special Motor Correction Factor (Kp)

Motor Type	Load Correction Factor
Servo Motor	Design as Kp=2.5 for Rated Output, and Kp=0.5 for Peak Output (Rational speed as applied speed)
Spindle Motor	Design as Kp=2.2 for Rated Output and Base Rotational Speed

[Step 2-d] For EV5GT/EV8YU Series

• Design Power (Pd) = Transmission Power (Pt) × Overload Factor (Ks)

• Calculate Transmission Power at Motor Rated Power Output. (It is ideal to calculate from the actual load applied to the belt.)
• Overload Factor (Ks)=Ko+Ki+Kr+Kh+Km

Ko : Load Correction Factor (Table 14)
Ki : Idler Correction Factor (Table 15)
Kr : Speed Multiplication Correction Factor (Table 16)
Kh : Operation Time Correction Factor (Table 17)
Km : Start/Stop Correction Factor (Table 18)

• When converting the torque (Tq) into transmission power (Pd), calculate the applicable values by using the following expressions.

Tq : Design Torque (N-m)
Tq : Transmission Torque
Ks : Overload Factor
Pd : Design Power (kW)
n : Speed (rpm)

Table 14. Load Correction Factor (Ko)

Prime Motor Type		Induction Motor	Spindle Motor	Servo Motor (Peak Output/Rated Output)		
				200% or Less	201~299%	300% or More
Robot	Scara Type	2.0	2.0	1.6	1.7	1.8
Injection Mold Machine	Mold Fastening · Ball Screw Drive	1.8	1.8	1.3	1.4	1.5
Machine Tool	Lathe · Drill Press	1.6	1.3	1.2	1.3	1.4
Machine Tool	Milling Machine	1.7	1.3	1.2	1.3	1.4
Conveyor		1.8	1.8	1.4	1.5	1.6
Medical Machinery · Measurement Equipment		1.5	1.5	1.1	0.1	0.2
Packaging Machine		1.6	1.5	1.1	0.1	0.2
Agitator · Mixer	Liquid	1.6	1.6	1.2	1.3	1.4
	Viscous Material	1.7	1.7	1.3	1.4	1.5
Drilling Machine · Granulator		1.8	1.8	1.4	1.5	1.6
Centrifuge		1.9	1.9	1.5	1.6	1.7
Mills	Ball · Rods	2.2	2.2	1.7	1.8	1.9
Printing Machine · Book Making Machine		2.0	2.0	1.6	1.7	1.8
Paper Making Machine	Calender · Dryer	2.0	2.0	1.6	1.7	1.8
Textile Machine		2.0	2.0	1.6	1.7	1.8
Wire Related	Wire Drawing & Twisting Machine	2.1	2.0	1.6	0.1	0.2
Woodworking Machine		1.7	1.7	1.2	1.3	1.4
Pump		2.0	2.0	1.6	1.7	1.8
Compressor	Reciprocating · Rotating	2.0	2.0	1.6	1.7	1.8
Fan · Blower	Axial Flow · Roots	2.0	1.8	1.3	1.4	1.5
Generator · Exciter		1.8	1.8	1.4	1.5	1.6
Rubber Industry Machinery · Lumber Mill Machinery		2.0	2.0	1.6	1.7	1.8

Table 15. Idler Correction Factor (Ki)

No Idler	0
Inside Idler	0.1×(Qty-1)
Outside Idler	0.1×(Qty-1)

Table 16. Speed Multiplication Correction Factor (Kr)

Operation Duration (Hours/Day)	Correction Factor
1 or More Less than 1.25	0
1.25 or More Less than 1.75	0.1
1.75 or More Less than 2.5	0.2
2.5 or More Less than 3.5	0.3
3.5 or More	0.4

Table 17. Operation Time Correction Factor (Kh)

Operation Duration (Hours/Day)	Correction Factor
≤8	0.1
8<16	0.2
16≤	0.3

Table 18. Start/Stop Correction Factor (Km)

Start/Stop Frequency (Times/Day)	Correction Factor
≤10	0.1
11<100	0.2
101<500	0.3
501<	0.4

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[Step 3] Temporarily Selecting the Type of Belt from Selection Guide Table

Table 19. Selection Guide Table 1 (MXL, XL, L, H, T5, T10)

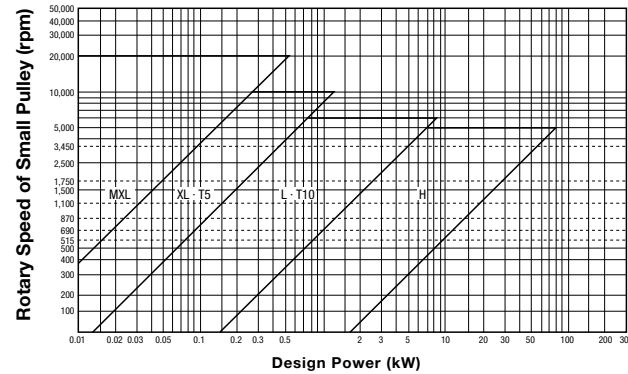


Table 20. Selection Guide Table 2 (S_M series)

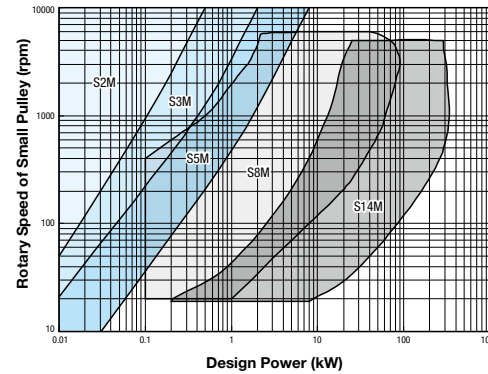


Table 21. Selection Guide Table 3 (P_M series)

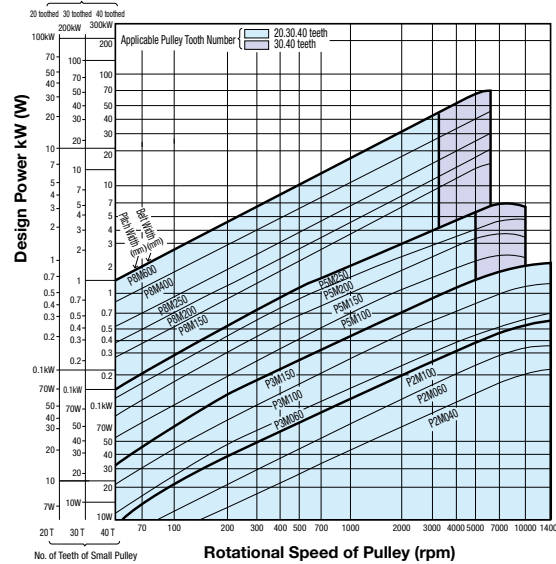


Table 22. Selection Guide Table 4 (MTS8M)

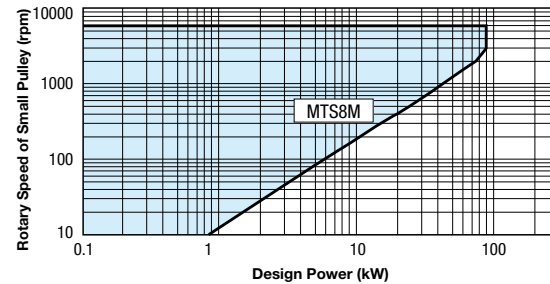


Table 23. Selection Guide Table 5 (UP_M series)

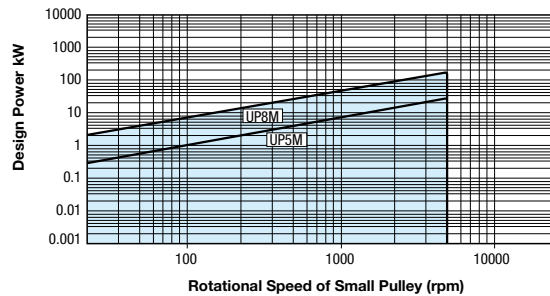


Table 24. Selection Guide Table (2GT-3GT series)

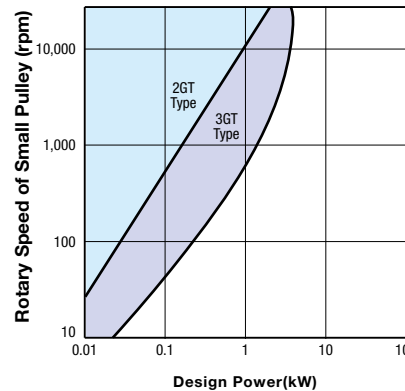
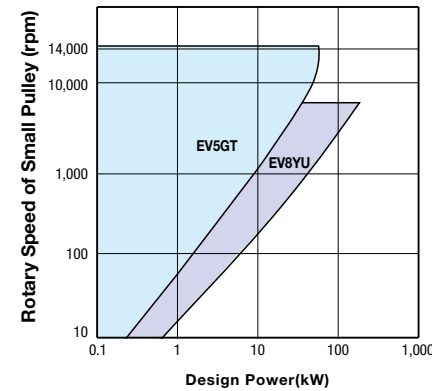


Table 25. Selection Guide Table (EV5GT-EV8YU series)



[Step 4] Determining Number of Teeth of Large and Small Pulley, Belt Length, Inter-Shaft Distance

- Select the number of teeth of large and small pulley from P.2261~2271, which can satisfy the predetermined speed ratio. (However, select the small pulley with number of teeth more than Min. Number of Teeth on Table 26.)

$$\text{Speed Ratio} = \frac{\text{Number of Teeth of Large Pulley}}{\text{Number of Teeth of Small Pulley}}$$

Table 26. Allowable min. number of teeth

Rotary Speed of Small Pulley (rpm)	Type of Belt, Minimum Number of Teeth																						
	MXL	XL	L	H	S2M	S3M	S5M	S8M	S14M	P2M	P3M	P5M	P8M	UP5M	UP8M	MTS8M	T5	T10	2GT	3GT	EV5GT	EV8YU	
900 or Less	12	11	14	16	16	16	16	24	-	14	14	18	22	18	22	24	12	16	12	14	18	26	26
Over 900 1200 or Less	15	11	14	18	16	16	20	25	40	14	14	20	24	20	24	24	14	18	14	14	20	28	28
Over 1200 1800 or Less	15	12	16	20	18	18	24	28	48	14	14	24	26	24	26	26	16	20	16	16	24	32	32
Over 1800 3600 or Less	16	16	19	24	20	20	24	30	-	16	18	28	28	28	28	28	18	22	18	20	28	36	36
Over 3600 4800 or Less	-	16	20	24	20	20	24	32	-	18	20	30	30	30	30	30	18	22	20	20	30	-	-
Over 4800 10000 or Less	-	-	-	-	20	20	26	-	-	20	28	40	-	40	-	-	-	-	-	-	-	-	-

- Determine approx. belt circum. length (Lp) in terms of temporary inter-shaft distance (C), diameter of large pulley (Dp) and diameter of small pulley (dp). (Calculate pulley diameter with P.D. dimensions.)

$$L_p = 2C + \frac{\pi(D_p + d_p)}{2} + \frac{(D_p - d_p)^2}{4C}$$

C : Temporary Inter-shaft Distance
Dp : Pitch Diameter of Large Pulley (mm)
dp : Pitch Diameter of Small Pulley (mm)
Lp : Approx. Belt Circum. Length (mm)

- Determine a belt circum. length (Lp) that is the nearest value to approx. belt circum. length referring to P.1459~1470, and then calculate the correct inter-shaft distance using the following formula.

$$C = \frac{b + \sqrt{b^2 - 8(D_p - d_p)^2}}{8}$$

$$b = 2L_p - \pi(D_p + d_p)$$

Dp : Pitch Diameter of Large Pulley (mm)
dp : Pitch Diameter of Small Pulley (mm)
Lp : Belt Circum. Length (mm)
C : Inter-shaft Distance

[Step 5] Determining Belt Width

- 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.

$$Bw' = \frac{P_d}{P_s \cdot K_m} \times W_p$$

Pd : Design Power
Ps : Reference Transmission Capacity.....Use the Reference Transmission Capacity Table on P.2261~2271.
Km : Engagement Correction Coefficient (Table 27)
Wp : Reference Belt Width (Table 28)

Table 27. 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
*Km	1.0	0.7	0.5	-	-

Table 28. 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

Type of Belt	P2M	P3M	P5M	P8M	T5	T10
Reference Belt Width	4	6	10	15	10	10

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

$$\theta = 180^\circ - \frac{57.3(D_p - d_p)}{C}$$

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

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

For belt types P□M and UP□M, substitute *Km for meshing compensation factor

- Pd < Ps · Km · Kb
 - 2GT · 3GT · EV5GT · EV8YU
 - Pd < Ps · Km · Kb · KL
- Pd : Design Power
Ps : Reference Transmission Capacity
Km : Engagement Correction Coefficient
Kb : Width Correction Coefficient (Table 29)
KL : Length Correction Coefficient (Table 30)

Table 29. Width Correction Coefficient (Kb)

Type of Belt	Nominal mm	Width Correction Coefficient Kb	Type of Belt	Nominal mm	Width Correction Coefficient Kb	Type of Belt	Nominal mm	Width Correction Coefficient Kb	Type of Belt	Nominal mm	Width Correction Coefficient Kb	
MXL	019	4.8	S2M	040	4	P2M	40	4	2GT	4	4	
	025	6.4		060	6		60	6		6	6	6
	037	9.5		100	10		100	10		9	9	9
	050	12.7		060	6		150	15		6	6	6
	025	6.4		100	10		100	10		9	9	9
XL	031	7.9	S3M	100	10	P3M	150	15	3GT	9	9	
	037	9.5		150	15		150	15		15	15	15
	050	12.7		100	10		150	15		9	9	9
	075	19.1		150	15		250	25		12	12	12
	050	12.7		250	25		100	10		15	15	15
L	075	19.1	S5M	150	15	P5M	150	15	EV5GT	15	15	
	100	25.4		150	15		150	15		15	15	15
	150	38.1		250	25		150	15		15	15	15
	075	19.1		250	25		250	25		15	15	15
	150	38.1		400	40		200	20		15	15	15
H	150	38.1	S8M	250	25	P8M	250	25	EV8YU	20	20	
	200	50.8		300	30		250	25		25	25	25
				400	40		150	15		15	15	15
				400	40		200	20		20	20	20
				600	60		250	25		25	25	25

Table 30. Length Correction Coefficient (KL)

Length Correction Coefficient (KL)	0.80	0.90	1.00	1.10	1.20
2GT Belt Length (mm)	130 or less	131~182	183~280	281~419	420 or less
3GT Belt Length (mm)	190 or less	191~260	261~400	401~599	600 or less
EV5GT Belt Length (mm)	440 or less	441~550	551~800	801~1100	1101 or less
EV8YU Belt Length (mm)	600 or less	601~900	901~1250	1251~1799	1800 or less

[Step 6] Check if Inter-Shaft Distance Adjustment Range is Larger than that in Table 30

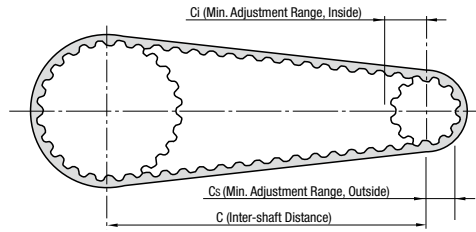


Table 31 Minimum Inter-Axial Distance Adjustment Range

Table with 14 columns for belt types (MXL, XL, L, H, S2M, S3M, S5M, S8M, S14M, MTS8M, P2M, P3M, P5M, P8M, T5, T10) and 14 rows for inter-shaft distance (Ci, Cs) for various belt lengths (150 to 2000).

Table with 14 columns for belt types (2GT, 3GT, EV5GT, EV8YU) and 14 rows for inter-shaft distance (Ci, Cs) for various belt lengths (150 to 2000).

■Precautions on Operation

- 1. Be careful to avoid the ingress of foreign particles.
2. Avoid Adhesion of oil.
3. Do not use the belt in a humid atmosphere.
4. Please use a well-ventilated safety cover.
5. The service life of the belt, when used at a high temperature (80°C or more), can be drastically shortened.

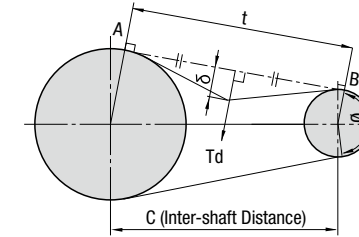
Reference Belt Width Tolerance (Unit: mm)

Table with 5 columns for belt length ranges (351 or Less, 351 to 840, 840 to 1680, 1680 or More) and 3 rows for belt width ranges (10 or Less, 10 to 40, 40 to 50).

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. Apply deflection load between max. value and recommended value.



Td = (Ti + t * Y) / 16 Equation A

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

Ti: Initial Tension N From Table 31 Lp: Length of the Belt (mm)
Y: Correction Coefficient From Table 31 C: Inter-shaft Distance (mm)
delta: Deflection (mm) delta = 0.016t dp: Diameter of the Pitch Circle of the Small Pulley (mm)
t: Span Length (mm) t = sqrt(C^2 - (Dp - dp)^2) / 4

Table 32. Initial Tension (Ti) and Correction Coefficient (Y)

Large table with 14 columns for belt types (MXL, XL, L, H, P2M, P3M, P5M, P8M) and 14 rows for initial tension (Ti) and coefficient (Y) for various belt widths (4.8 to 50.8).

Table with 14 columns for belt types (S2M, S3M, S5M, S8M, MTS8M, S14M) and 14 rows for initial tension (Ti) and coefficient (Y) for various belt widths (4 to 25).

Table with 14 columns for belt types (T5, T10) and 14 rows for initial tension (Ti) and coefficient (Y) for various belt widths (10 to 50).

Table with 14 columns for belt types (2GT, 3GT, EV5GT, EV8YU) and 14 rows for initial tension (Ti) and coefficient (Y) for various belt widths (4 to 25).

[Technical Data]

Selection of Transmission Timing Belts 10

-Transmission Capacity Table-

Table 53. Reference Transmission Capacity of EV5GT Ps -Belt Width 15mm- (W)

No. of Teeth of Small Pulley	Diameter of the Pitch Circle(mm)		14	16	18	20	22	24	26	28	30	32	36	40	44	48	54	60	72	80
	Rotary Speed of Small Pulley(rpm)		22.28	25.46	28.65	31.83	35.01	38.20	41.38	44.56	47.75	50.93	57.30	63.66	70.03	76.39	85.94	95.49	114.59	127.32
20	13	18	22	27	33	38	42	47	52	56	64	72	80	87	97	108	128	139		
40	24	33	41	50	61	70	79	88	96	104	120	136	150	163	183	203	240	263		
60	33	46	58	72	87	100	113	126	139	150	173	196	216	236	264	293	348	380		
100	50	71	91	113	136	157	178	199	219	237	273	310	343	374	419	465	552	604		
200	85	125	163	205	248	287	326	365	403	438	506	575	636	695	780	867	1031	1129		
300	115	173	228	289	350	407	464	520	574	625	723	823	912	996	1119	1244	1482	1623		
400	142	217	289	369	447	520	594	667	737	803	931	1060	1176	1285	1445	1607	1914	2096		
500	166	258	347	445	539	629	718	808	894	974	1131	1289	1430	1564	1759	1957	2333	2555		
600	188	297	402	518	627	733	839	944	1046	1141	1325	1511	1678	1836	2065	2298	2740	3002		
700	208	333	454	589	712	834	956	1077	1193	1302	1514	1728	1919	2101	2364	2632	3139	3439		
800	227	368	505	657	795	933	1069	1206	1337	1460	1699	1940	2156	2360	2657	2958	3529	3866		
870	239	392	540	704	851	1000	1147	1294	1436	1569	1826	2086	2319	2539	2858	3183	3797	4161		
900	244	402	554	724	875	1028	1180	1332	1478	1615	1880	2148	2388	2615	2944	3279	3912	4286		
1000	260	434	602	789	954	1122	1289	1456	1616	1767	2058	2352	2616	2865	3227	3593	4288	4698		
1160	284	483	675	890	1075	1268	1459	1649	1832	2004	2337	2672	2973	3257	3669	4087	4878	5343		
1200	289	495	693	915	1105	1304	1500	1696	1885	2062	2405	2751	3061	3353	3778	4209	5023	5502		
1400	315	551	780	1035	1251	1478	1704	1929	2145	2349	2742	3138	3493	3828	4314	4807	5736	6282		
1450	321	565	801	1065	1286	1521	1754	1986	2209	2419	2825	3233	3599	3945	4446	4954	5912	6474		
1600	338	605	863	1152	1391	1647	1901	2155	2397	2627	3070	3516	3914	4291	4837	5390	6430	7040		
1750	354	643	923	1237	1494	1771	2046	2320	2583	2831	3311	3793	4224	4631	5221	5817	6939	7583		
1800	358	655	943	1264	1527	1811	2093	2374	2644	2899	3390	3884	4326	4743	5347	5958	7106	7777		
2000	376	703	1020	1374	1659	1971	2280	2589	2884	3164	3703	4244	4728	5185	5846	6513	7765	8494		
2400	406	791	1165	1584	1911	2278	2641	3003	3349	3678	4309	4943	5509	6042	6812	7587	9034	9868		
2800	440	872	1301	1783	2151	2571	2986	3400	3795	4171	4892	5615	6259	6865	7737	8613	10238	11165		
3200	486	945	1429	1973	2380	2851	3318	3782	4225	4647	5455	6263	6982	7657	8594	9594	11379	12384		
3600	529	1011	1550	2155	2598	3120	3636	4150	4640	5107	5998	6888	7679	8419	9477	10531	12456	13522		
4000	571	1072	1665	2330	2808	3379	3944	4505	5041	5550	6522	7492	8350	9151	10291	11423	13466	14575		
5000	667	1202	1925	2738	3296	3986	4667	5343	5985	6597	7758	8910	9920	10854	12167	13450	15686	16815		
6000	760	1305	2153	3108	3737	4539	5330	6112	6853	7559	8889	10199	11335	12372	13803	15172	17429	18431		
7000	860	1382	2352	3445	4136	5044	5936	6817	7648	8438	9915	11358	12590	13695	15183	16561	18641	19343		
8000	960	1460	2524	3749	4495	5501	6487	7459	8370	9235	10835	12383	13677	14812	16285	17586	19259			
9000	1060	1540	2671	4023	4815	5912	6984	8037	9018	9946	11645	13265	14586	15706	17086	18212				
10000	1160	1620	2826	4266	5096	6277	7426	8550	9591	10570	12339	13998	15303	16361	17560					
12000	1320	1800	2541	3541	4266	5141	6041	6941	7841	8741	10041	11341	12641	13941	15241					
14000	1480	2000	2741	3741	4541	5441	6341	7241	8141	9041	10341	11641	12941	14241	15541					

* Endurance time will be reduced in [] marked area. Please avoid if possible. If the belt width changes, multiply the compensation factors Kb from Table 29.

Table 54. Reference Transmission Capacity of EV8YU Ps -Belt Width 20mm- (kW)

No. of Teeth of Small Pulley	Diameter of the Pitch Circle(mm)		20	22	24	26	28	30	32	34	36	38	40	44	48	54	60	64	72	80
	Rotary Speed of Small Pulley(rpm)		50.93	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	137.51	152.79	162.97	183.35	203.72
10	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.12	0.13	0.14	0.16	0.18		
20	0.07	0.08	0.09	0.10	0.10	0.11	0.13	0.13	0.14	0.15	0.16	0.18	0.20	0.23	0.26	0.28	0.32	0.36		
40	0.13	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.36	0.40	0.46	0.52	0.56	0.64	0.72		
60	0.18	0.21	0.23	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.48	0.54	0.60	0.69	0.78	0.84	0.96	1.08		
100	0.28	0.33	0.37	0.42	0.47	0.52	0.57	0.62	0.67	0.72	0.78	0.88	0.99	1.14	1.30	1.40	1.60	1.80		
200	0.52	0.60	0.69	0.79	0.89	0.99	1.10	1.20	1.29	1.39	1.52	1.73	1.96	2.27	2.58	2.79	3.19	3.60		
300	0.74	0.86	0.99	1.13	1.29	1.45	1.62	1.76	1.90	2.05	2.25	2.57	2.92	3.38	3.85	4.18	4.78	5.40		
400	0.94	1.10	1.28	1.47	1.67	1.89	2.12	2.30	2.50	2.70	2.97	3.40	3.86	4.48	5.12	5.56	6.37	7.20		
500	1.13	1.34	1.56	1.80	2.05	2.32	2.61	2.84	3.08	3.33	3.68	4.23	4.81	5.59	6.38	6.94	7.95	8.99		
600	1.32	1.57	1.83	2.12	2.42	2.75	3.10	3.38	3.67	3.97	4.38	5.04	5.75	6.68	7.64	8.31	9.53	10.78		
700	1.50	1.79	2.10	2.43	2.79	3.17	3.58	3.90	4.24	4.59	5.08	5.86	6.68	7.77	8.89	9.68	11.10	12.57		
800	1.68	2.00	2.36	2.74	3.15	3.59	4.05	4.43	4.81	5.22	5.78	6.66	7.61	8.86	10.14	11.04	12.67	14.34		
870	1.80	2.15	2.54	2.95	3.40	3.87	4.38	4.79	5.21	5.65	6.26	7.23	8.26	9.62	11.01	11.99	13.76	15.58		
900	1.85	2.21	2.61	3.04	3.50	4.00	4.52	4.94	5.38	5.83	6.47	7.47	8.54	9.95	11.39	12.40	14.23	16.11		
1000	2.02	2.42	2.86	3.34	3.85	4.40	4.99	5.46	5.94	6.45	7.15	8.27	9.46	11.03	12.63	13.75	15.78	17.88		
1160	2.28	2.74	3.26	3.81	4.41	5.05	5.73	6.27	6.83	7.42	8.24	9.54	10.92	12.75	14.60	15.91	18.26	20.68		
1200	2.34	2.82	3.35	3.92	4.54	5.20	5.91	6.47	7.06	7.66	8.51	9.86	11.29	13.17	15.09	16.45	18.87	21.37		
1400	2.63	3.21	3.83	4.50	5.22	5.99	6.82	7.48	8.16	8.86	9.86	11.43	13.11	15.30	17.54	19.11	21.93	24.83		
1450	2.73	3.31	3.94	4.64	5.39	6.19	7.05	7.72	8.43	9.16	10.20	11.82	13.56	15.83	18.15	19.78	22.69	25.68		
1600	2.95	3.59	4.29	5.06	5.88	6.77	7.72	8.47	9.24	10.05	11.20	12.99	14.91	17.41	19.96	21.75	24.95	28.23		
1750	3.17	3.87	4.63	5.47	6.37	7.34	8.39	9.20	10.05	10.93	12.19	14.15	16.25	18.98	21.75	23.71	27.18	30.75		
1800	3.24	3.96	4.75	5.61	6.53	7.53	8.61	9.44	10.31	11.22	12.52	14.54	16.69	19.50	22.35	24.36	27.93	31.58		
2000	3.52	4.32	5.19	6.14	7.17	8.29	9.48	10.41	11.37	12.38	13.82	16.06	18.46	21.56	24.71	26.94	30.85	34.86		
2400	4.06	5.01	6.05	7.19	8.43	9.76	11.20	12.30	13.45	14.65	16.39	19.07	21.93	25.61	29.34	31.97	36.55	41.21		
2800	4.57	5.66	6.88	8.20	9.64	11.20	12.87	14.15	15.48	16.87	18.90	22.00	25.31	29.55	33.82	36.82	41.99	47.22		
3200	5.05	6.29	7.67	9.18	10.82	12.59	14.50	15.95	17.46	19.03	21.35	24.86	28.60	33.35	38.12	41.46	47.14	52.83		
3600	5.50	6.89	8.43	10.12	11.96	13.95														

[Technical Data]

Selection of Transmission Timing Belts 13

-Allowable Tension Table-

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

Table 61. 2GT Allowable Tension Table: Per 4.0mm of Belt Width (Unit: N)

Speed of Small Pulley (rpm)	Pitch Circle Dia. (mm)	Number of Small Pulley Teeth																
		12	14	16	18	20	22	24	26	28	30	32	36	40	44	48	50	60
20	56.09	57.27	58.45	59.63	60.80	61.98	63.16	64.33	65.51	66.69	67.86	70.22	72.57	74.92	77.28	78.45	84.34	84.34
40	50.60	51.78	52.96	54.13	55.31	56.49	57.66	58.84	60.02	61.20	62.37	64.73	67.08	69.43	71.79	72.96	78.85	78.85
60	47.39	48.57	49.75	50.92	52.10	53.28	54.45	55.63	56.81	57.99	59.16	61.51	63.87	66.22	68.57	69.75	75.64	75.64
100	43.35	44.52	45.70	46.88	48.05	49.23	50.41	51.58	52.76	53.94	55.11	57.47	59.82	62.17	64.53	65.70	71.59	71.59
200	37.85	39.03	40.21	41.38	42.56	43.74	44.92	46.09	47.27	48.45	49.62	51.98	54.33	56.68	59.04	60.21	66.10	66.10
300	34.64	35.82	37.00	38.17	39.35	40.53	41.70	42.88	44.06	45.23	46.41	48.76	51.12	53.47	55.82	57.00	62.89	62.89
400	32.36	33.54	34.72	35.89	37.07	38.25	39.42	40.60	41.78	42.95	44.13	46.49	48.84	51.19	53.55	54.72	60.61	60.61
500	30.60	31.77	32.95	34.13	35.30	36.48	37.66	38.83	40.01	41.19	42.36	44.72	47.07	49.42	51.78	52.96	58.84	58.84
600	29.15	30.33	31.51	32.68	33.86	35.04	36.21	37.39	38.57	39.74	40.92	43.27	45.63	47.98	50.33	51.51	57.39	57.39
700	27.93	29.11	30.28	31.46	32.64	33.81	34.99	36.17	37.34	38.52	39.70	42.05	44.41	46.76	49.11	50.29	56.17	56.17
800	26.87	28.05	29.23	30.40	31.58	32.76	33.93	35.11	36.29	37.46	38.64	40.99	43.35	45.70	48.06	49.23	55.12	55.12
870	26.21	27.39	28.56	29.74	30.92	32.09	33.27	34.45	35.62	36.80	37.98	40.33	42.68	45.04	47.39	48.57	54.45	54.45
900	25.94	27.12	28.29	29.47	30.65	31.82	33.00	34.18	35.35	36.53	37.71	40.06	42.41	44.77	47.12	48.30	54.18	54.18
1000	25.11	26.28	27.46	28.64	29.81	30.99	32.17	33.34	34.52	35.70	36.87	39.22	41.57	43.93	46.29	47.46	53.35	53.35
1160	23.93	25.11	26.28	27.46	28.64	29.81	30.99	32.17	33.34	34.52	35.70	38.05	40.40	42.76	45.11	46.29	52.17	52.17
1200	23.66	24.84	26.01	27.19	28.37	29.54	30.72	31.90	33.08	34.25	35.43	37.78	40.14	42.49	44.84	46.02	51.90	51.90
1400	22.44	23.62	24.79	25.97	27.15	28.32	29.50	30.68	31.85	33.03	34.21	36.56	38.91	41.27	43.62	44.80	50.68	50.68
1450	22.16	23.34	24.52	25.69	26.87	28.05	29.22	30.40	31.58	32.75	33.93	36.28	38.64	40.99	43.34	44.52	50.40	50.40
1600	21.38	22.56	23.74	24.91	26.09	27.27	28.44	29.62	30.80	31.97	33.15	35.50	37.86	40.21	42.56	43.74	49.62	49.62
1750	20.67	21.85	23.03	24.20	25.38	26.56	27.73	28.91	30.09	31.26	32.44	34.79	37.15	39.50	41.85	43.03	48.92	48.92
1800	20.45	21.63	22.80	23.98	25.16	26.33	27.51	28.69	29.86	31.04	32.22	34.57	36.92	39.28	41.63	42.81	48.69	48.69
2000	19.61	20.79	21.97	23.14	24.32	25.50	26.67	27.85	29.03	30.21	31.38	33.74	36.09	38.44	40.80	41.97	47.86	47.86
2400	18.17	19.35	20.52	21.70	22.88	24.05	25.23	26.41	27.58	28.76	29.94	32.29	34.65	37.00	39.35	40.53	46.41	46.41
2800	16.95	18.13	19.30	20.48	21.66	22.83	24.01	25.19	26.36	27.54	28.72	31.07	33.42	35.78	38.13	39.31	45.19	45.19
3200	15.89	17.07	18.24	19.42	20.60	21.77	22.95	24.13	25.31	26.48	27.66	30.01	32.37	34.72	37.07	38.25	44.13	44.13
3600	14.96	16.13	17.31	18.49	19.67	20.84	22.02	23.20	24.37	25.55	26.73	29.08	31.43	33.79	36.14	37.32	43.20	43.20
4000	14.12	15.30	16.48	17.65	18.83	20.01	21.18	22.36	23.54	24.71	25.89	28.24	30.60	32.95	35.31	36.48	42.37	42.37
5000	12.36	13.53	14.71	15.89	17.06	18.24	19.42	20.59	21.77	22.95	24.12	26.48	28.83	31.18	33.54	34.71	40.60	40.60
6000	10.91	12.09	13.26	14.44	15.62	16.80	17.97	19.15	20.33	21.50	22.68	25.03	27.39	29.74	32.09	33.27	39.15	39.15
7000	9.69	10.87	12.04	13.22	14.40	15.57	16.75	17.93	19.10	20.28	21.46	23.81	26.17	28.52	30.87	32.05	37.93	37.93
8000	8.63	9.81	10.99	12.16	13.34	14.52	15.69	16.87	18.05	19.22	20.40	22.75	25.11	27.46	29.81	30.99	36.88	36.88
10000	6.86	8.04	9.22	10.40	11.57	12.75	13.93	15.10	16.28	17.46	18.63	20.99	23.34	25.69	28.05	29.22	35.11	35.11
12000	5.42	6.60	7.77	8.95	10.13	11.30	12.48	13.66	14.83	16.01	17.19	19.54	21.90	24.25	26.60	27.78	33.66	33.66
14000	4.20	5.38	6.55	7.73	8.91	10.08	11.26	12.44	13.61	14.79	15.97	18.32	20.67	23.03	25.38	26.56	32.44	32.44

* Try to avoid use of belts within the range enclosed with [] . Otherwise, the durable time might be shortened.
 * The above table is for 4.0mm of belt width. When the desired belt has the other width, multiply the value on the above table by the relevant width correction factor Kb provided on the Table 29.

Table 63. EV5GT Allowable Tension Table: Per 15.0mm of Belt Width (Unit: N)

Speed of Small Pulley (rpm)	Pitch Circle Dia. (mm)	Number of Small Pulley Teeth																
		14	16	18	20	22	24	26	28	30	32	36	40	44	48	54	60	72
20	569.50	672.00	745.30	816.20	899.70	942.90	978.90	1009.40	1033.20	1046.90	1067.20	1085.40	1088.20	1085.60	1079.30	1076.30	1063.30	1046.20
40	508.10	610.60	684.30	755.50	832.50	875.30	910.90	941.20	964.80	978.90	999.80	1018.20	1021.90	1020.30	1015.30	1013.20	1001.90	986.10
60	472.20	574.70	648.70	720.00	793.20	835.80	871.20	901.20	924.70	939.10	960.40	978.90	983.10	982.10	977.90	976.30	966.00	951.00
100	427.00	529.50	603.80	675.20	743.70	785.90	821.10	850.90	874.20	889.00	910.70	929.40	934.30	934.00	930.70	929.80	920.70	906.70
200	365.60	468.00	542.90	614.50	676.50	718.30	753.10	782.70	805.80	820.90	843.20	862.30	868.00	868.70	866.80	866.70	859.30	846.70
300	329.70	432.10	507.20	579.00	637.10	678.80	713.40	742.80	765.70	781.10	803.80	823.00	829.30	830.50	829.30	829.80	823.40	811.60
400	304.20	406.60	481.90	553.80	609.20	650.70	685.10	714.40	737.30	752.90	775.80	795.10	801.80	803.40	802.80	803.60	797.90	786.30
500	284.40	386.90	462.30	534.20	587.60	628.90	663.30	692.50	715.20	731.00	754.10	773.50	780.40	782.40	782.20	783.30	778.20	767.30
600	268.30	370.70	446.30	518.30	569.90	611.10	645.40	674.50	697.20	713.10	736.30	755.90	763.00	765.30	765.40	766.70	762.00	751.50
700	254.60	357.10	432.70	504.80	555.00	596.10	630.30	659.30	682.00	698.00	721.30	740.90	748.30	750.70	751.10	752.60	748.40	738.10
800	242.80	345.20	421.00	493.10	542.00	583.10	617.20	646.20	668.80	684.90	708.40	728.00	735.50	738.20	738.80	740.50	736.50	726.60
870	235.40	337.80	413.60	485.70	533.90	574.90	609.00	637.90	660.50	676.60	700.20	719.90	727.50	730.30	731.10	732.90	729.10	719.30
900	232.40	334.80	410.60	482.70	530.60	571.60	605.60	634.60	657.20	673.30	696.90	716.60	724.20	727.10	727.90	729.80	726.10	716.40
1000	223.00	325.50	401.40	473.50	520.40	561.30	595.30	624.20	646.80	663.00	686.60	706.40	714.20	717.10	718.20	720.20	716.80	707.20
1160	209.90	312.30	388.30	460.50	506.00	546.80	580.80	609.60	632.10	648.40	672.20	692.00	700.00	703.20	704.50	706.70	703.60	694.40
1200	206.90	309.30	385.30	457.50	502.70	543.50	577.40	606.30	628.80	645.10	668.90	688.70	696.70	700.00	701.40	703.60	700.60	691.50
1400	193.20	295.70	371.80	444.00	487.80	528.50	562.30	591.10	613.50	629.90	653.90	673.80	682.00	685.40	687.20	689.50	687.00	678.10
1450	190.10	292.60	368.70	441.00	484.40	525.10	558.90	587.60	610.10	626.50	650.50	670.40	678.60	682.10	683.90	686.30	683.80	675.10
1600	181.40	283.80	360.10	432.30	474.80	515.50	549.20	577.90	600.30	616.80	640.90	660.80	669.20	672.90	674.80	677.40	675.10	666.50
1750	173.50	275.90	352.20	424.50	466.10	506.70	540.40	569.10	591.50	608.00	632.20	652.20	660.70	664.40	666.60	669.20	667.20	658.80
1800	171.00	273.40	349.70	422.00	463.40	504.00	537.70	566.30	588.70	605.30	629.50	649.40	658.00	661.80	664.00	666.70	664.70	656.30
2000	161.60	264.10	340.40	412.80	453.20	493.70	527.30	556.00	578.30	594.90	619.20	639.20	647.90	651.80	654.20	657.10	655.40	647.20
2400	145.50	247.90	324.40	396														

Synchronous Belt Reference Information

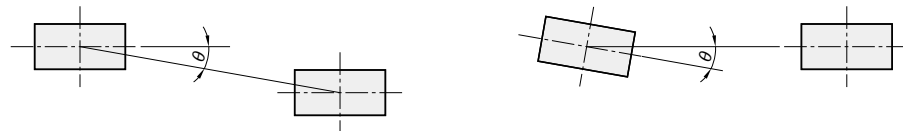
Synchronous Belt Replacement Signs

Early failures and countermeasures

Abnormal Phenomena	Cause	Measures
Abnormal Wear of Belt Side Faces	<ul style="list-style-type: none"> Pulley misalignment Pulley shafts misalignments Bent pulley flanges 	<ul style="list-style-type: none"> Realign Correct shaft misalignments Correct bent pulley flanges
Tooth Contact Pressure Surface Abnormal Wear	<ul style="list-style-type: none"> Overload Belt tension too high, too low 	<ul style="list-style-type: none"> Redesign with a wide belt or use larger belt pitch Adjust initial belt tension
Belt abnormal wear on pulley contacting area	<ul style="list-style-type: none"> Pulley tooth shape incorrect Belt tension too high 	<ul style="list-style-type: none"> Adjust initial belt tension Try to recreate belt systems by taking note of tooth tip radius
Broken/missing tooth	<ul style="list-style-type: none"> Pulley diameter too small Small pulley meshing 6 teeth or less Shock loading exists 	<ul style="list-style-type: none"> Redesign Increase small pulley tooth mesh or redesign Avoid shock loading on belt Increase belt width
Severed Core Wire	<ul style="list-style-type: none"> Overload Core wire decreased elasticity or corrosion Induction of foreign matter Excessive temperature 	<ul style="list-style-type: none"> Redesign Check belt storage and shipping history/condition Avoid shocks Provide a belt cover Lower environment temperature
Cracks on Backing Rubber	<ul style="list-style-type: none"> Usage in low temperature Pulley diameter too small 	<ul style="list-style-type: none"> Raise environment temp. Increase pulley diameter
Heat Degradation of Rubber	<ul style="list-style-type: none"> Rubber degradation due to high environment temperature 	<ul style="list-style-type: none"> Lower environment temperature
Rubber Swelling	<ul style="list-style-type: none"> Contact with oils Contact with water 	<ul style="list-style-type: none"> Avoid oil from contacting Avoid water from contacting
Abnormal Wear of Pulley Teeth	<ul style="list-style-type: none"> Overload Belt tension too high Pulley material too soft 	<ul style="list-style-type: none"> Redesign Adjust initial belt tension Apply surface hardening treatment on pulley or change pulley material
Pulley Circumference Wear	<ul style="list-style-type: none"> Pulley service life has been reached Belt tension too high (core wire visible on belt back side) 	<ul style="list-style-type: none"> Replace with a new pulley Replace with new pulley and belt, and use lower belt tension
Abnormal Sound	<ul style="list-style-type: none"> Belt tension too high Overload Pulley diameter too small Pulley tooth shape incorrect 	<ul style="list-style-type: none"> Realign Adjust initial belt tension Redesign Correct pulley tooth geometry
Apparent Belt Stretch	<ul style="list-style-type: none"> Shaft center distance too small Loose machine base 	<ul style="list-style-type: none"> Adjust to correct shaft distance Reinforce machine base

About Pulley Alignments

Misaligned pulleys may cause early belt failure and flange damages. Align as show below



•MXL/XL/L/H/S_M/MTS_M/T Series

Belt width (mm)	10	20	30≤
tanθ	5/1000	3/1000	2/1000

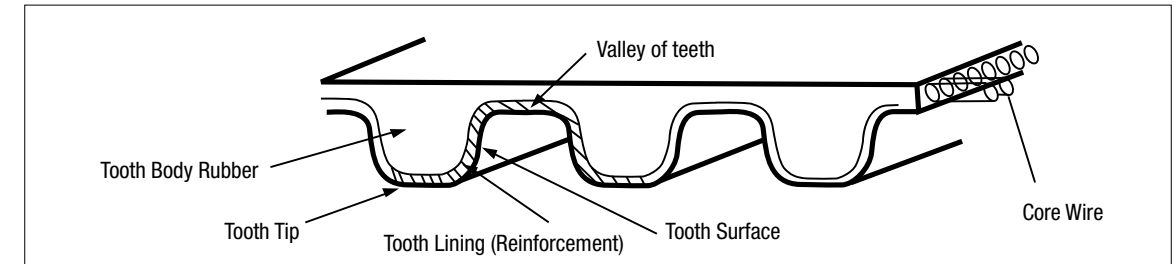
•P_M/UP_M

Belt width (mm)	≤30
tanθ	5/1000

•_GT/EV5GT/EV8YU

Belt width (mm)	≤20	20<40
tanθ	6/1000	3/1000

Names of Belt Components



Examples of Belt Replacement Signs

Examples	Condition
1. When belt tooth reinforcement fabric is worn and rubber/core wire are exposed When tooth surface/grooves are worn and rubber/core wire are exposed	
2. When the backing rubber shows cracks due to hardening	
3. When cracks reaching the rubber are seen at tooth base	
4. Belt side faces are damaged due to wear	
5. When missing tooth can be seen	
6. When excessive wear can be seen on belt back side	
7. When belt or core wire are broken	

These are belt replacement timing guides. Early or periodical replacements are recommended even the signs shown above are not yet visible.