V856-E

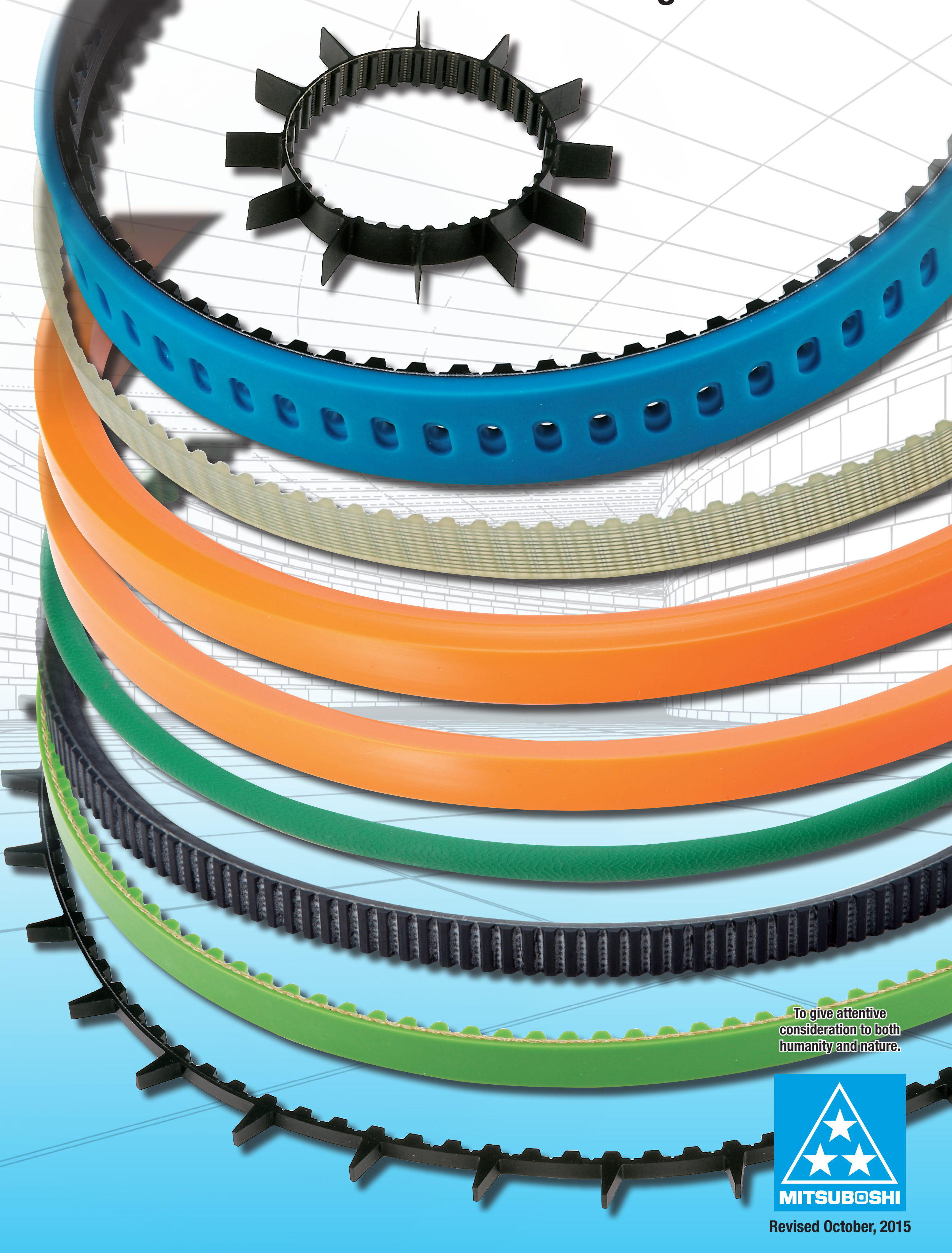
POLYURETHANE

High Functionality - High Precision - High Quality

Urethane belt

Design Manual

MITSUBOSHI®



To give attentive consideration to both humanity and nature.

High Functionality
High Precision
High Quality
Promise of Reliability

MITSUBOSHI

Revised October, 2015

To the Customer

Please read before use.

Precautions for Safe Use of Polyurethane Belts

When using the product, please read the catalog and design materials carefully, pay strict attention to the following items, and use the product correctly.
The levels of effect on safety for various items are classified as follows.

Symbol Mark and Classification Signal Word	Content Criteria
⚠ **Danger**	When improper handling could cause danger or damage leading to death or serious injury to the user, and the possibility of danger or damage is high.
⚠ **Warning**	When improper handling could cause danger or damage leading to death or serious injury to the user.
⚠ **Caution**	When improper handling could cause danger and could lead to bodily harm of the user and/or could cause only physical damage.

Application/Purpose

⚠ **Danger**	Provide separate safety equipment to prevent equipment from spinning, running, or stopping if belt breaks. This has a high probability of leading to death or serious injury of the user.
⚠ **Danger** 🚫	Do not use the belt for hoisting or towing. This has a high probability of leading to death or serious injury of the user due to falling or collision of the object.
⚠ **Warning**	If the belt drive equipment may generate static electricity, use an anti-static-type belt and provide a static charge eliminator mechanism on the equipment. Static electricity may cause fire or malfunction which may lead to death or serious injury of the user.
⚠ **Caution**	Do not use the belt as an insulator. Use as an insulator could lead to injury due to electric shock to the user. Belt insulation characteristics are different depending on the type, so please contact us with any questions.
⚠ **Caution**	Please use a belt compatible with the Food Hygiene Law for cases where the belt will be in direct contact with food. If a belt that is not compatible with the Food Hygiene Law is used, harmful substances such as oil could be transferred from the belt to the food and lead to injury of the end customer who eats the food.
⚠ **Caution**	Do not modify the belt. This could lead to loss of quality or performance of the belt and lead to injury of the user.

Function/Performance

⚠ **Caution**	The products in this catalog are primarily made of polyurethane elastomers. Use within the scope of the characteristics and physical properties to prevent trouble when using the belt. Otherwise, this could lead to early stage damage to the belt and injury of the user.
⚠ **Caution**	Do not use for anything other than the “Applications” noted in the catalog and design materials for each of the belts. This could lead to early stage damage to the belt and injury of the user.
⚠ **Caution**	If water, oil, chemicals, paint, and/or dust adhere to the belt or pulley, they could cause reduction in power transfer or lead to early failure, and this could lead to injury of the user.
⚠ **Caution**	Toothed belts may cause a lot of noise at high speed. In this case, please install a soundproof cover.

Storage/Transport

⚠ **Warning**	For belts that are heavy, store using appropriate jigs or stoppers to prevent them from falling over or moving. If a heavy belt falls over or moves, it could fall onto a user and could cause death or serious injury.
⚠ **Caution**	When transporting or handling a heavy belt or pulley, be sure to use transport tools and equipment that can handle the weight. Lifting by hand may cause injury to the lower back.
⚠ **Caution**	Do not bend the belt too far or transport or store with a heavy object on top of it. This could lead to early failure due to a kink or damage to the belt which in turn could lead to injury of the user.
⚠ **Caution**	Please store belts at a temperature of -10°C to 40°C with low humidity. Also, do not place the belt in direct sunlight while in storage. This could cause shrinking or relaxation of the belt and may make it unsuitable for use.

Installation/Use

⚠ **Danger**	Be sure to use safety covers on rotating parts, including the belt and pulleys. Failure to do so could lead to the user’s hair, gloves, or clothes getting caught in the belt or a pulley, and lead to death or serious injury. In addition, if a belt breaks or a pulley is damaged, it is highly likely that flying parts will hurt the user.
⚠ **Caution**	Be sure to adjust the pulley alignment to the parallelism/eccentricity noted in the catalog. Deviation in the alignment could lead to early failure of the belt or falling of the flange and injury of the user.
⚠ **Caution**	Do not cut the belt while under tension with a knife, scissors, or similar tool. The belt may break apart and cause injury to the user.
⚠ **Caution**	Make sure that the belt is correctly fitted into the grooves of the pulleys before use. If the belt is not correctly fitted into the grooves of the pulleys, it could lead to early failure of the belt and injury to the user.
⚠ **Caution**	The belt and pulleys may be extremely hot immediately after stopping. Wait until the belt and pulleys have cooled before touching to prevent injury of the user.
⚠ **Caution**	Set the tension of the belt in accordance with the data indicating the appropriate tension in the catalog and design materials. Inappropriate tension could lead to early failure of the belt or damage to the shaft.
⚠ **Caution**	If additional machining is performed on a pulley, be sure to perform the following. If these actions are not performed, it could lead to failure of the belt or pulleys or injury of the user. 1) Remove any burrs or sharp edges from the machined area. 2) Ensure dimensional accuracy after machining. 3) Ensure pulley strength after machining.
⚠ **Caution**	If attaching a flange to the pulley, make sure there is no foreign material on the mating area of the pulley body and flange. Also, if crimping, etc., make sure there is no play in the flange after attaching. Inappropriate attaching could lead to disengagement of the flange.

Maintenance/Inspection/Replacement

⚠ **Danger**	Please observe the following items when performing maintenance, inspecting, or replacing a belt. Failure to do so could lead to the user getting caught in the belt and very likely lead to death or serious injury. 1) Make sure the switch is turned OFF and the belt and pulleys have come to a full stop. 2) If there is possibility of the machine rotating when the belt is removed, be sure to secure the machine prior to starting work. 3) Make sure the switch will not unexpectedly be turned ON while work is being performed.
⚠ **Caution**	When replacing a belt or pulley, be sure to do so with an product equivalent to the one being used. If a different product is used, it could cause early failure which could lead to injury of the user.
⚠ **Caution**	Be sure to loosen the belt tension before replacing. Forcibly causing it to ride up over the flange or twisting it with a screwdriver, etc., could lead to early failure.
⚠ **Caution**	If multiple belts are being used, be sure to replace all of the belts at the same time. Failure to do so could lead to early failure of the belt and lead to injury of the user.

Handling of Used Products

⚠ **Warning**	Do not burn belts in an enclosed area. Doing so could lead to generation of toxic gas, which could lead to death or serious injury due to poisoning.
⚠ **Caution**	Do not burn belts even in open areas. Doing so could lead to generation of toxic gas, potentially leading to poisoning and injury.

CONTENTS

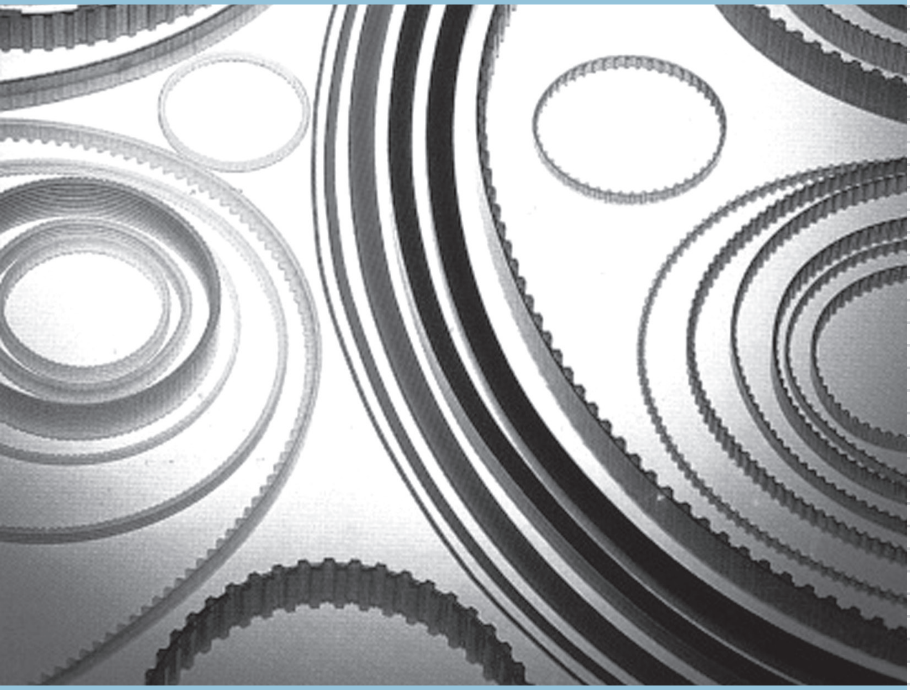
1. Properties

2. Design

1

Properties

Characteristics Section



1. Properties

Polyurethane Product Characteristics

Polyurethane Elastomer Characteristics

- Compared to regular rubber, polyurethane has the following characteristics:
  Durability, oil resistance, ozone resistance, tear resistance,
  vibration damping, high hardness, high elasticity and high adhesive strength
- In dry environments, readily withstands temperatures up to 80°C.
- In hot and humid environments, hydrolysis may occur, so do not use in hot baths/springs or with steam.
- Note that this material is weak with respect to acid bases or solvents.

Polyurethane Elastomer Physical Properties

Table 1 Casting Type

Item	Unit	Hardness		
		A80°	A85°	A90°
Specific gravity		1.10	1.10	1.10
100% modulus	MPa	3.14	4.90	7.75
Tensile strength	MPa	31.5	31.5	35.0
Elongation	%	430	440	450
Tear strength B-method	kN／m	39.2	69.6	96.1
Compression permanent strain B-method (70°C x 22 hours) JIS K6262	%	15	22	26
*Abrasion loss	mg/1000 times	150	100	100

*Use Taber wear test equipment with load of 9.8 N (H-18)
Other parameters should be based on JIS K6264-2

Table 2 Extrusion type

Item	Test method	Unit	Value
Specific gravity	JIS K6268		1.22
Hardness	JIS K6253	JIS A	88
5% modulus	JIS K6251	MPa	1.18
10% modulus	JIS K6251	MPa	1.77
100% modulus	JIS K6251	MPa	6.28
300% modulus	JIS K6251	MPa	10.9
Tensile strength	JIS K6251	MPa	24.5 or higher
Elongation at break	JIS K6251	%	400 or higher
Shear strength	JIS K6252	kN/m	0.88
Permanent elongation	JIS K6273	%	26 or less

Material Physical Properties Comparison of Casting Type Polyurethane with Other Materials

Fig. 1

▶ **Tensile stress**

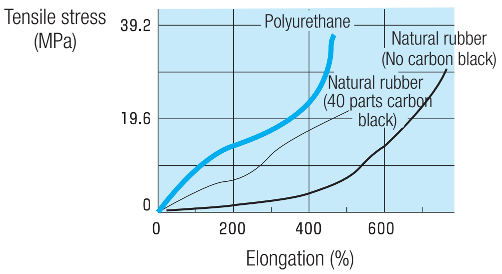


Fig. 2

▶ **Shear resistance**

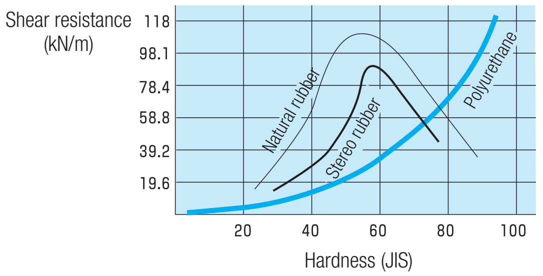


Fig. 3

▶ **Wear resistance**

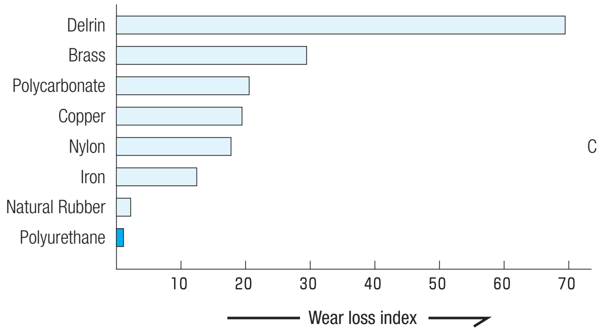
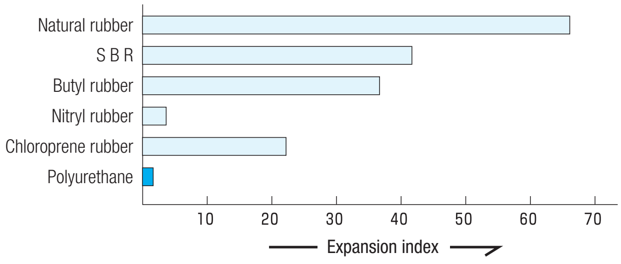


Fig. 4

▶ **Oil resistance**



Product Structure of Polyurethane Products

Molding Type

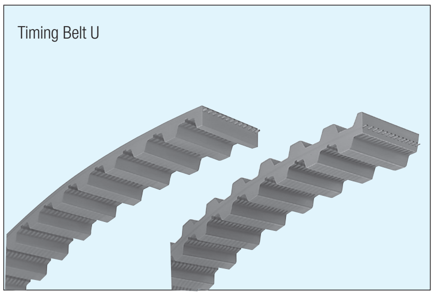
- PolyMax® ➔ Page 7
- RibStar® ➔ Belt U Page 11
- Machine Belt MB ➔ Page 13
- Specially Shaped Products ➔ Page 15
- Sleeve Roll ➔ Page 16

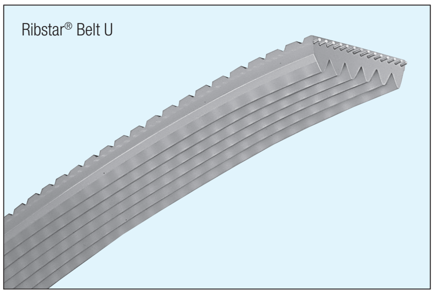
Extrusion Type (Plain Rope)

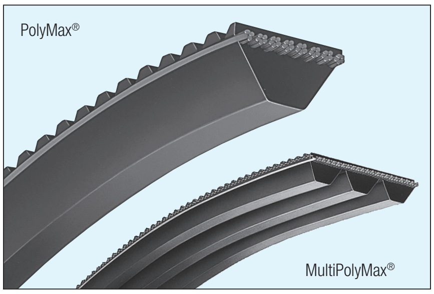
- Starrope, Super Starrope (round rope)
- Plain V Rope
- Plain Hexagonal Rope

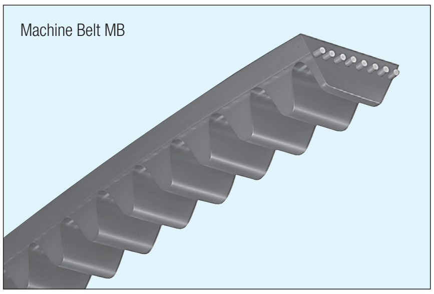
➔ Page 14

Molding Type (Thermosetting)

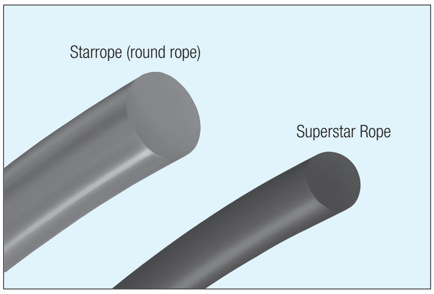

Timing Belt U

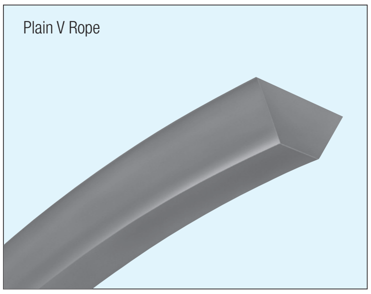

Ribstar® Belt U

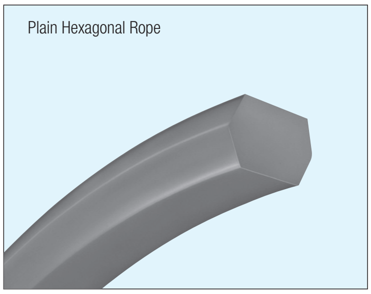

PolyMax®


Machine Belt MB

Extrusion Type (Plain Rope) (Thermoplastic)


Starrope (round rope)

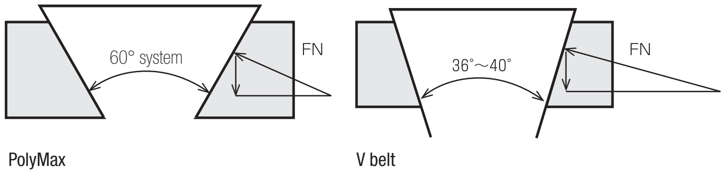

Plain V Rope


Plain Hexagonal Rope

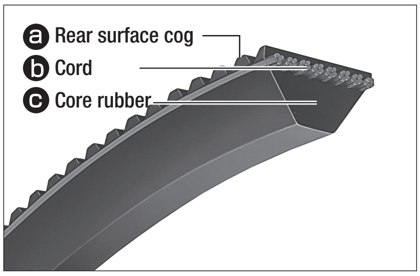
PolyMax®

By setting the belt angle to a wide 60° angle, the perpendicular pressure [FN] on the side wall surfaces of the belt and pulley is kept low, providing advantages such as ❶ reduced deformation of the belt and uniform force on the Cord and ➋ reduced belt and pulley wear.

Fig. 5 Side wall normal force comparison



Structure



ⓐ **Rear surface cog**	The material is polyurethane. The cog shape improves flexibility as well as heat dissipation.
ⓑ **Cord**	Polyester cord with special processing that has low elongation and is resistant to bending fatigue.
ⓒ **Core rubber**	Polyurethane with high wear resistance and a large friction coefficient.

Features

① Compact transfer with reduced costs as well

Drive is feasible with a small pulley and rotation ratio can be set high. Therefore, a reduction gear is not needed, enabling both cost reduction and space savings.

② High speed, high efficiency

Belt is lightweight with a high friction coefficient, enabling high speed and high efficient power transfer. Also enables low-vibration, smooth operation from uniform arrangement of Cord.

③ Superior weatherproofing and wear resistance

Primary material is polyurethane elastomer that has high ozone, ultraviolet light, and wear resistance.

Applications

■ PolyMax® Applicable Machinery

- Machines with low torque fluctuations that run continuously at high speed
- Machines that require resistance to ozone, direct sunlight, and other weather elements
- Machines where pulleys with very small diameters are preferred
- Machines that operate at close to constant angular speed while avoiding belt vibration
- Machines for which maintenance inspections are difficult

Table 3

Belt Profile	3M	5M	7M	11M
Primary applications	Office machines Textile machines Small high-speed tools	Air conditioner fans Machine tools Electrical tools Textile machines	Machine tools Fans Blowers Compressors	Machine tools Woodworking machinery Generators

■ Machinery for Which PolyMax® is Not Suited

- Machinery with high pulsating loads (machinery with abrupt fluctuations in peak torque)
  Belt may melt due to heat generation from belt slipping.
- Transfer equipment where water or oil will spill onto the belt
  This may dramatically lower the friction coefficient and cause the belt to slip.
- Operation in environments with acids, bases, or steam present
  The polyurethane elastomer will hydrolyze.

Standard Belt Sizes

Table 4 Belt cross section dimensions and names

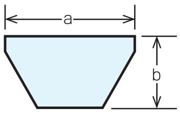
Type	3M	5M	7M	11M
Cross section dimensions (a x b)	2.8×2㎜	4.5×3.4㎜	7.5×5.5㎜	11×7㎜
	 a b			
Label example	5M 750 Belt outside circumference Belt type			

Table 6 Belt length tolerance (single type)

(Unit: mm)

Belt Length Tolerance	
Outside circumference	Tolerance
180～ 300	±2.5
307～ 710	±3.8
730～1,090	±5.1
1,120～1,500	±6.4
1,550～1,900	±7.6
1,950～2,300	±8.9

Table 5 Standard belt size table

Belt names	3M	5M	7M	11M
180	●			
185	●			
190	●			
195	●			
200	●			
206	●			
212	●			
218	●			
224	●			
230	●			
236	●			
243	●			
250	●			
258	●			
265	●			
272	●			
280	●	●		
290	●	●		
300	●	●		
307	●	●		
315	●	●		
325	●	●		
335	●	●		
345	●	●		
355	●	●		
365	●	●		
375	●	●		
387	●	●		
400	●	●		
412	●	●		
425	●	●		
437	●	●		
450	●	●		
462	●	●		
475	●	●		
487	●	●		
500	●	●	●	
515	●	●	●	
530	●	●	●	
545	●	●	●	
560	●	●	●	
580	●	●	●	
600	●	●	●	
615	●	●	●	
630	●	●	●	
650	●	●	●	
670	●	●	●	
690	●	●	●	
710	●	●	●	●
730	●	●	●	●
750	●	●	●	●
775		●	●	●
800		●	●	●
805		●		
825		●	●	●
850		●	●	●
875		●	●	●
900		●	●	●
925		●	●	●
950		●	●	●
975		●	●	●
1000		●	●	●
1030		●	●	●
1060		●	●	●
1090		●	●	●
1120		●	●	●
1150		●	●	●
1180		●	●	●
1220		●	●	●
1250		●	●	●
1280		●	●	●
1320		●	●	●
1360		●	●	●
1400		●	●	●
1450		●	●	●
1500		●	●	●
1550			●	●
1600			●	●
1650			●	●
1700			●	●
1750			●	●
1800			●	●
1850		●	●	●
1900			●	●
1950			●	●
2000			●	●
2060			●	●
2120			●	●
2180			●	●
2240			●	●
2300			●	●

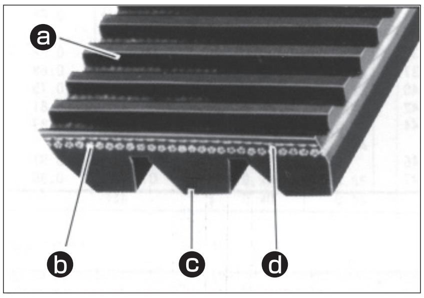
● Belt names are their standard outside circumference.

MultiPolyMax®

Suitable for machines that don't handle vibration generated by belt oscillation very well and cases where the drive shaft is vertical and the belt readily comes off (belt runs horizontally).

Design methodology is the same as for the single type described ahead. ➔ (Pages 19 to 22)
However, for power transfer capacity, please design based on the power transfer capacity for the durability time of 5,000 to 10,000 hours in the power transfer capacity table.

Structure



ⓐ Rear surface cog	The material is polyurethane. Flexibility improves depending on the cog shape. It also has a heat dissipation effect.
ⓑ Cord	Polyester cord with special processing that has low elongation and is resistant to bending fatigue.
ⓒ Core rubber	Polyurethane with high wear resistance and a large friction coefficient.
ⓓ Reinforcing fabric	Polyamide fiber increases rigidity in the crosswise direction and ensures stable driving.

Table 7 Belt cross section dimensions and names

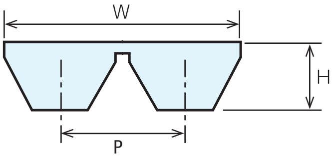
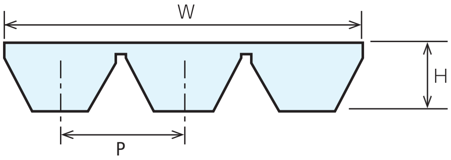
Number of ribs	2			3		
Belt Profile	5M	7M	11M	5M	7M	11M
W	9.8	15.6	24.4	15.1	24.1	37.6
H	3.4	5.3	7.0	3.4	5.3	7.0
P	5.3	8.5	13.2	5.3	8.5	13.2
Cross section dimensions	 W H P			 W H P		
Label	3R - 7M 1320 Belt outside circumference (mm) Belt Profile Number of ribs					

Table 8 Standard belt size table

Belt Size	5M	7M	11M
500	●	●	
515	●	●	
530	●	●	
545	●	●	
560	●	●	
580	●	●	
600	●	●	
615	●	●	
630	●	●	
650	●	●	
670	●	●	
690	●	●	
710	●	●	●
730	●	●	●
750	●	●	●
775	●	●	●
800	●	●	●
825	●	●	●
850	●	●	●
875	●	●	●
900	●	●	●
925	●	●	●
950	●	●	●
975	●	●	●
1000	●	●	●
1030	●	●	●
1060	●	●	●
1090	●	●	●
1120	●	●	●
1150	●	●	●
1180	●	●	●
1220	●	●	●
1250	●	●	●
1280	●	●	●
1320	●	●	●
1360	●	●	●
1400	●	●	●
1450	●	●	●
1500	●	●	●
1550		●	●
1600		●	●
1650		●	●
1700		●	●
1750		●	●
1800		●	●
1850	●	●	●
1900		●	●
1950		●	●
2000		●	●
2060		●	●
2120		●	●
2180		●	●
2240		●	●
2300		●	●

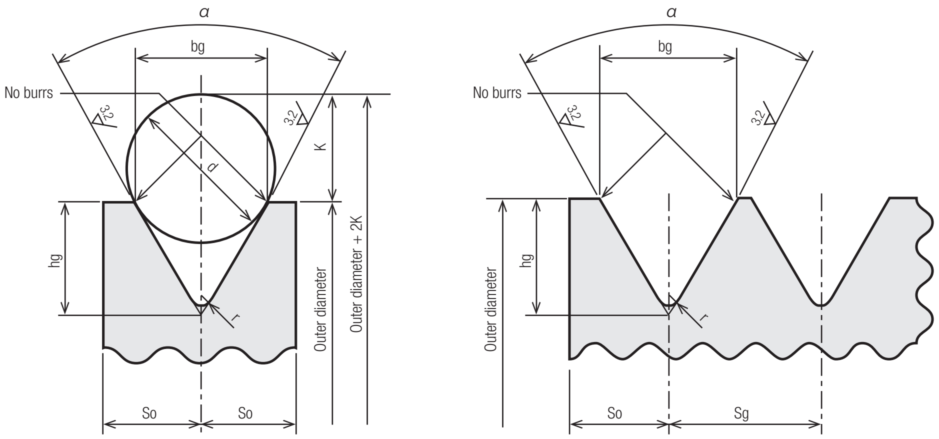
Belt Length Tolerance	
Outside circumference	Tolerance
500～ 710	±3.8
730～1090	±5.1
1120～1500	±6.4
1550～1900	±7.6
1950～2300	±8.9

Pulley Groove Dimensions

Table 10 PolyMax pulley groove dimensions

Belt Profile	Belt cross sectional dimensions width x height (mm)	(bg) Width at top of groove ± 0.05 (mm)	(Sg) Groove intervals +0.13, -0.05 (mm)	(So) Min interval from groove to edge of rim (mm)	(r) Max radius of bottom of groove (mm)	Angle of groove		(hg) Groove depth (mm)	(2K) Increase in outer diameter by 2 rods ±0.15 (mm)	(d) Diameter of rod ±0.02 (mm)
						Outer diameter span (mm)	(α) Angle of groove ±0°15' (degrees)			
3M	2.8×2	2.80	3.35	2.23	0.30	17~23 or less	60	2.42	4.15	3.0
						23<	62	2.33	4.16	
5M	4.5×3.4	4.50	5.30	3.45	0.40	26.5~32 or less	60	3.90	5.71	4.5
						32~67 or less	62	3.74	5.75	
						67<	64	3.60	5.79	
7M	7.5×5.5	7.10	8.50	5.65	0.60	42.5~76 or less	60	6.15	10.20	7.5
						76<	62	5.90	10.25	
11M	11×7	11.20	13.20	8.60	0.80	67~117 or less	60	9.70	15.10	11.5
						117<	62	9.31	15.19	

Fig. 6



Single-belt type

Multiple-belt type

Table 11 Pulley effective outer diameter +2K tolerance (Unit: mm)

Outer diameter span	Tolerance
≦25	±0.03
26~ 50	±0.05
51~125	±0.13
126~250	±0.25
251~500	±0.50
501≦	±1.00

- Make sure that the angle between the pulley shaft and the centerline of the groove angle is 90° ±0.5°.
- Make sure cumulative error of the groove pitch (Sg) is 0.35 mm or less.
- Outer diameter runout: 0.13 mm (*TIR) for a pulley diameter of up to 250 mm.
  If larger than 250, add 0.01 mm (TIR) for each additional 25 mm.
- Rim side surface runout: 0.03 mm (TIR) for each 25 mm of diameter for a pulley diameter of up to 500 mm.
  If larger than 500 mm, add 0.01 mm (TIR) for each 25 additional mm.

*TIR = the difference between the maximum and minimum value of the dial gauge (Total Indicator Runout or Reading)

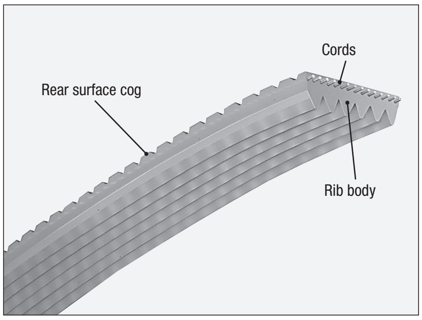
Ribstar® Belt U

Features

The Ribstar® Belt U is designed to take advantage of the high power transfer efficiency of V belts and the flexibility of flat belts.

The primary material, polyurethane, has superior wear resistance and oil resistance.

Structure



● **Rear surface cog**	The material is polyurethane. Flexibility improves depending on the cog shape. It also has a heat dissipation effect.
● **Cords**	Nylon cord with special processing for resistance to flexural fatigue.
● **Rib body**	Polyurethane with superior wear resistance, oil resistance, and ozone resistance.

Standard Belt Sizes

Belt names and cross section dimensions

Belt label method [display example]

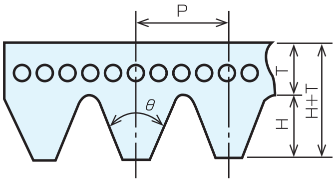
200 JBT 4

No. of ribs (4 ribs)
Belt shape (JBT shape)
Belt length (pitch length in inches x 10: 20 inches)

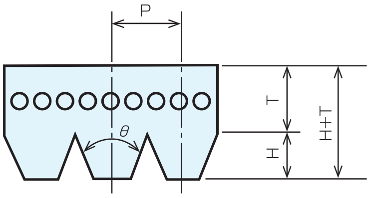
Table 12 Belt cross section dimensions

Belt shape / Cross section dimensions	JT	JBT	HB
Rib pitch P (mm)	2.34	2.40	1.6
Rib angle θ (degrees)	40	40	40
Rib height H (mm)	1.8	1.8	1.0
Base of rib - back surface thickness T (mm)	1.7	1.7	1.5
Total thickness H+T (mm)	3.5	3.5	2.5
Belt width W (mm)	No. of ribs x rib pitch		

Fig. 7



JT/JBT shape



HB shape

Table 13 JBT Profile standard belt size table

Number of ribs	Name	Pitch length (mm)
3 ribs 4 ribs 5 ribs 6 ribs	82	208
	84	213
	87	221
	89	226
	90	229
	97	246
	100	254
	102	259
	116	295
	123	312
	125	318
	130	330
3 ribs 4 ribs 5 ribs 6 ribs	135	343
	175	445
	179	455
	180	457
	212	538
	226	573
	229	582
	235	597
	245	622
	247	627
	337	856

- If you are looking for something other than JT Profile or HB Profile or a different number of ribs than those shown in the table, please contact our company.

Table 14 Difference between pulley pitch diameter and outer diameter

	2a
JT,JBT	0.76㎜
HB	0.51㎜

Pulley pitch diameter = pulley outer diameter + 2a

(See Page 12, Table 15 regarding 2a)

■ Pulley groove profile and groove dimensions

Fig. 8

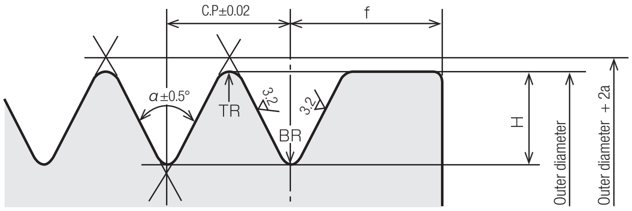


Table 15 RibStar pulley groove dimensions table **(Unit: mm)**

Belt Profile	(C.P) Rib groove pitch	(H) Rib groove depth	(α) Rib groove angle (°)	(TR) Radius of rounded part at rib tip	(BR) Radius of rounded part at rib base	2a	(f) Distance from groove center to pulley edge
JT	2.34	2.253	40	Min. 0.20	0.3	0.76	3.5
JBT	2.40	2.335	40	Min. 0.20	0.3	0.76	3.5
HB	1.60	1.525	40	Min. 0.15	0.2	0.51	1.9

Pulley width = (number of grooves - 1) x rib pitch + (f x 2)

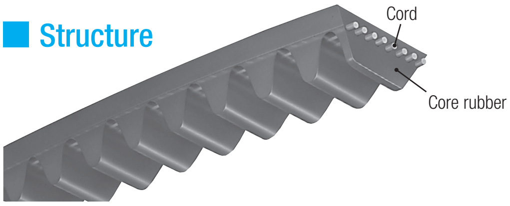
Machine Belt MB

The Mitsuboshi polyurethane machine belt MB is a small V belt for light load power transfer with a beautiful appearance.

Features

- Through the use of cogs and highly flexible material, this can be used with small pulleys. The minimum pulley diameter for a single cog is 18 mm.
- Wear resistance is particularly superior, enabling clean operation with low scattering of rubber.
- Has superior oil resistance.
- Friction coefficient is high, enabling power transfer with little slip.

Structure



- Cord: Polyester cord with special processing that has low elongation and is resistant to bending fatigue.
- Core rubber: The material is polyurethane. Flexibility improves depending on the cog shape.

Table 16 Belt types and cross section dimensions

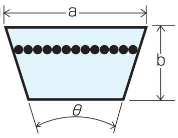
Belt type	Single cog
Belt Profile	MB
Top width a (mm)	6.0
Height b (mm)	4.0
Angle θ (°)	40
Cross section dimensions (a x b)	Cross section dimensions 
Display example	MB-360 Belt length (outer peripheral length mm) Belt shape

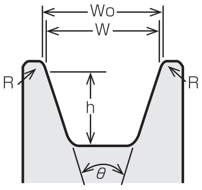
Table 17 Standard belt size table

Belt Profile	MB	
Belt type	Single cog	
a×b (mm)	6.0×4.0	
Belt length	250	420
	260	430
	270	440
	280	450
	290	460
	300	470
	310	480
	320	490
	330	500
	340	510
	345	520
	350	530
	360	540
	365	550
	370	560
	380	640
	385	760
	390	
	395	
	400	
	410	

Table 18 Pulley groove shape and groove dimensions

Pulley diameter	Minimum width (w)	Minimum height (h)	θ	R	Wo Reference (min)
16～30㎜	5.4	4.5	36°	0.8	5.6
30㎜ or higher	5.4	4.5	38°	0.8	5.6

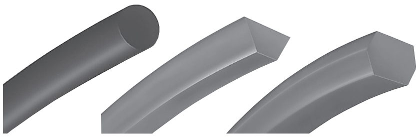
Fig. 9



Open-end Polyurethane Belts (Prene Rope)

There are three types of extrusion-type polyurethane belts: Starrope, prene V rope, and prene hexagonal rope.
Made only of polyurethane, so a belt can be obtained at a required length as needed using simple thermal welding.
In addition, Super Starrope with low elongation and high power transfer efficiency compared to conventional products has been added to the product lineup.

External appearance picture



Features

- Has superior wear resistance.
- Has superior oil resistance.
- Creating a joint using thermal welding is simple.
- Also enables design freedom for complex transfers such as multi-axial transfer and right angle transfer.
- Has high hardness, excellent elasticity, and superior weather resistance.

Table 19 Physical properties

Item	Test method	Unit	Super Starrope	Starrope
Specific gravity	JIS K6268		1.22	1.22
Hardness	JIS K6253	JIS A	92	88
5% modulus	JIS K6251	MPa	1.96	1.18
10% modulus	JIS K6251	〃	3.14	1.77
100% modulus	JIS K6251	〃	8.83	6.28
300% modulus	JIS K6251	〃	14.7	10.9
Tensile strength	JIS K6251	〃	32.4	24.5
Elongation at rupture	JIS K6251	%	400 or higher	400 or higher
Tear strength	JIS K6252	kN/m	0.93	0.88

Fig. 10 Tensile stress (low elongation ratio)

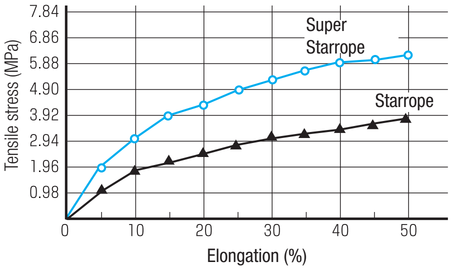


Table 20 Starrope/Super Starrope belt cross section dimensions ➔ (Fig. 11)

Belt shape	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 12	No. 15
d (mm)	2	3	4	5	6	7	8	9	10	12	15
Length of one reel (m)	200	200	200	200	100	100	100	100	100	50	50

Starrope

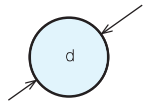


Fig. 11

Table 21 Prene V rope belt cross section dimensions ➔ (Fig. 12)

Belt shape / Dimensions		M	A	B
a	(mm)	10.0	12.5	16.5
b	(mm)	5.5	8.5	10.5
θ	degrees	40	40	40
Length of one reel (m)		100	50	50

Prene V Rope

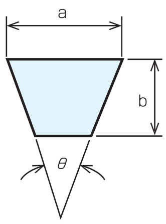


Fig. 12

Table 22 Prene hexagonal rope belt cross section dimensions ➔ (Fig. 13)

Belt shape / Dimensions		AA	BB
a	(mm)	12.5	16.5
b	(mm)	10.0	12.5
θ	degrees	40	40
Length of one reel (m)		50	50

Prene Hexagonal Rope

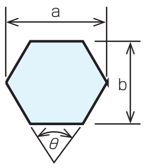


Fig. 13

Table 23 Prene V rope/prene hexagonal rope pulley dimensions ➔ (Fig. 14)

Belt shape / Dimensions		Prene V Rope			Prene Hexagonal Rope	
		M	A	B	AA	BB
b	(mm)	9.7	12.3	16.3	12.3	16.3
h	(mm)	9.0	12.5	15.0	12.5	15.0

The pulley dimensions of a V pulley are specified in JIS-B1854.

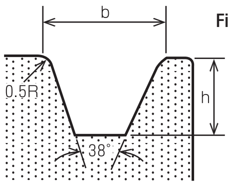


Fig. 14

Table 24 Starrope/Super Starrope pulley dimensions ➔ (Fig. 15)

Belt shape / Dimensions		No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 12	No. 15
a	(mm)	0.6	0.6	0.6	1.3	2.0	2.7	3.4	4.1	4.8	6.2	8.3
b	(mm)	2.9	4.3	5.7	7.1	8.6	10.0	11.4	12.9	14.3	17.1	21.4
h	(mm)	3.0	5.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	15.0	18.0

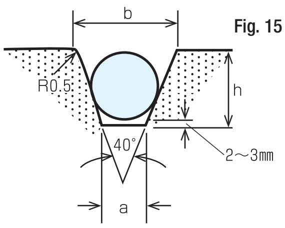


Fig. 15

Specially Shaped Products

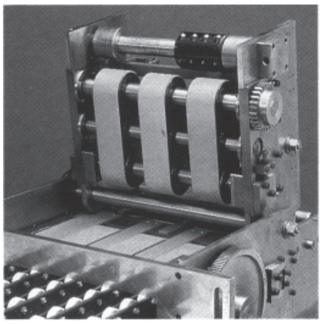
Features

1. Various shaped protuberances can be attached to the back surface of the belt.
   Use of a special mold* enables attaching a protuberance shaped optimally for items being transported on the back surface of the belt.
   As this is feasible without requiring post-processing or secondary processing, it is beneficial for short deadlines and cost reduction.
2. Can be provided with multiple functions.
   Through the use of special shapes, the belt can be used for multiple functions such as transport or positioning in addition to transfer functionality.
3. Resistant to detachment of protuberances.
   Integrated casting so protuberances do not easily detach.
4. Also can be colored with desired color.
   Uses urethane that can be colored, so it can be set to the color that you prefer.
5. Able to support large orders.
   These are cast using a metal mold so we can support large orders.

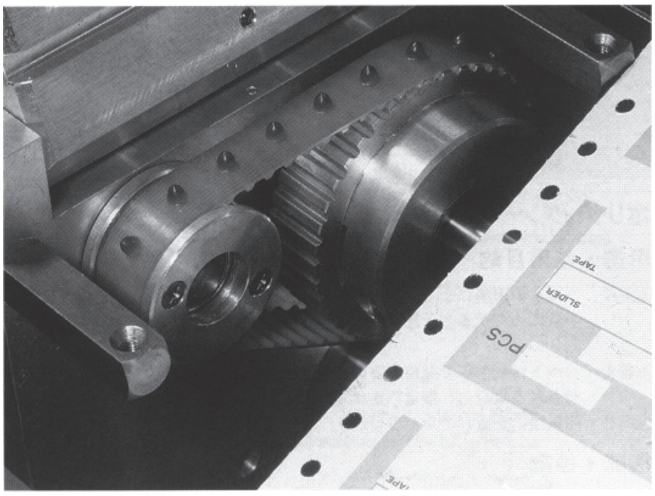
*Separate metal mold required.

Applications

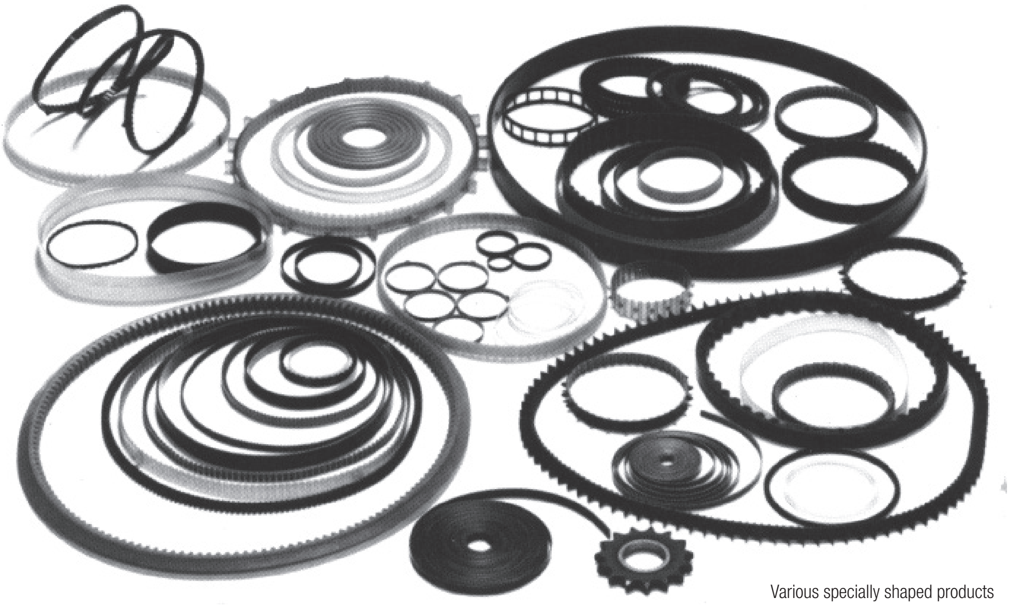
Computers, OA devices, Office equipment, Printers, Robots, Leisure devices, Money-changing machines, Vending machines, Medical devices, Textile machines, Automobiles, Household electronics, Packaging equipment, Optical devices, etc.



Transfer soft materials without scratches.
Two layer feeder belt



Belt for feeding computer paper with accurate paper feed



Various specially shaped products

Sleeve Roll

This press-fit-type roller covering and cushioning material is a brand-new concept, featuring a one-piece molding of flexible two-layer urethane.

Features

① Can easily be equipped by simply press-fitting onto a steel core or roller and also exhibits excellent grip.

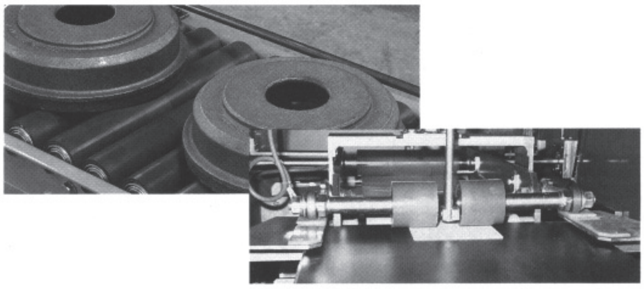
② Enameling on a steel core or roller (lining); eliminates labor required for replacing the reel using adhesives and is very economical.

③ Compared to rolls made of plastic or rubber, it has superior wear resistance and oil resistance.
It also has superior water resistance and weather resistance.

④ Using an integrated flexible and rigid two layer structure lessens impact, enables quiet transport on the back surface, and contributes to preventing noise and damage.
In addition, rust from rollers will not get on material being transported, providing superior cleanliness.

Applications

Flat carrier rollers Return rollers
Protection of material being transported Preventing adherence of rust on material surface Washing operation lines
Slate manufacturing lines Glass plate manufacturing lines Cathode ray tube manufacturing lines
Feed rollers Automatic warehouses Cardboard box transport lines
(Note) Please ask about use of drive rollers for transport.



Standard Size

Fig. 16

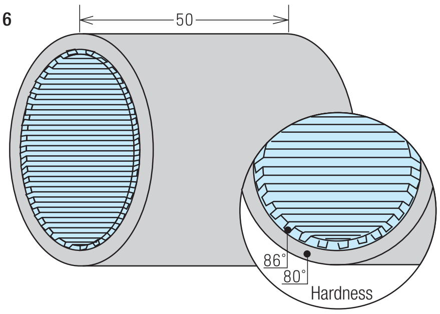


Table 25

Name	Application shaft diameter (mm)	Thickness (mm)	Width (mm)	Hardness (Hs°)	Stocked/not stocked
SR-36	38.0	5	50	80+86 (Exterior) (Interior)	Product stocked
SR-41	42.7				
SR-47	48.6				
SR-55	57.0				
SR-58	60.5				
SS-36	38.0	3			Product not stocked
SS-41	42.7				
SS-55	57.0				
SS-58	60.5				
SRD-36	38.0	5 (Shape of cog surface)			
SRD-41	42.7				
SRD-47	48.6				
SRD-55	57.0				
SRD-58	60.5				

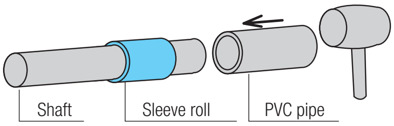
Size name
Example SR-50-47
└ Internal diameter (mm)
└ Width (mm)
└ Sleeve roll

Please contact a sales representative regarding order specifications.

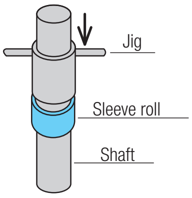
How to Attach

Fig. 17

(Example 1)



(Example 2)



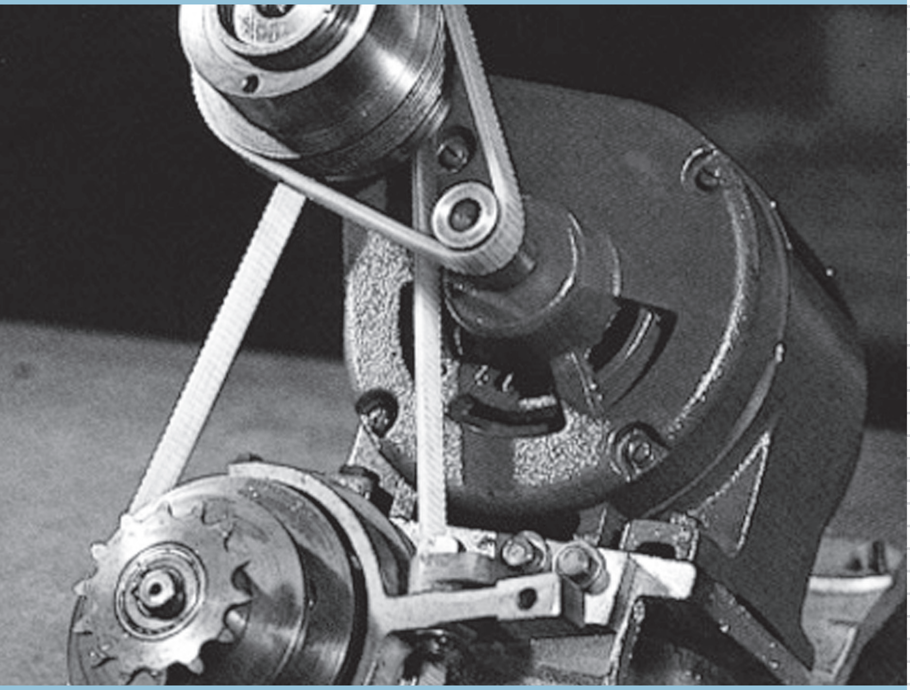
1. Use of a jig slightly larger than the shaft diameter (such as PVC pipe, etc.) makes it easy to insert.

2. Apply a small amount of solvent (thinner, acetone, alcohol etc.) to the inner surface of the sleeve roll to make it easy to insert.

2

Design

Design Section



2. Design Section

Design Procedure

Design Procedure 1

Determine the conditions required for design.

ⓐ Machine type

ⓑ Transfer power

For transfer of power, use of the actual load that is applied to the belt is ideal, but generally, the rated load of the motor is used.

ⓒ Rotational speed of the small pulley

ⓓ Rotational speed ratio $\left(\frac{\text{Large pulley diameter}}{\text{Small pulley diameter}}\right)$

ⓔ Tentative distance between shafts

ⓕ Operating environment (low temperature, oil, water, foreign material) Avoid use in high temperature, acidic, and basic environments.

Design Procedure 2

Select belt durability life.

Determine the durability life based on the machine it will be used on and conditions of operation.

Table 26 Ranking table for machine type and operating condition

Machine used on	Operating conditions	Rank
Lawnmower	Household use	A
	Office use	B
Woodworking machinery	Household use	A
	Office use (light load)	B
	Office use (heavy load)	C
Blower		A
Washing machine	Household use	A
	Office use	B
Dryer	Household use	A
	Office use	B
Light load office machine (Typewriter, etc.)	Household use	A
	Office use	A
Office machine (Computer, etc.)	Continuous use	C
Machine tools	Household use	A
	Office use (light load)	B
	Office use (heavy load)	C
Air Conditioner	Household use	B
	Office use	C
Fan	Household use	B
	Office use	C
Electric tools		A

● **Durability life**

A: 3,000 to 5,000 hours
B: 5,000 to 10,000 hours
C: 10,000 to 25,000 hours

Design Procedure 3

Determine design power.

● **How to determine design power (Pd)**

$$Pd=Pt \cdot Ko$$

However,
Pt: Transfer power (kW)
Ko: Load correction factor
➡ Table 27

Table 27 Load correction factor (Ko)

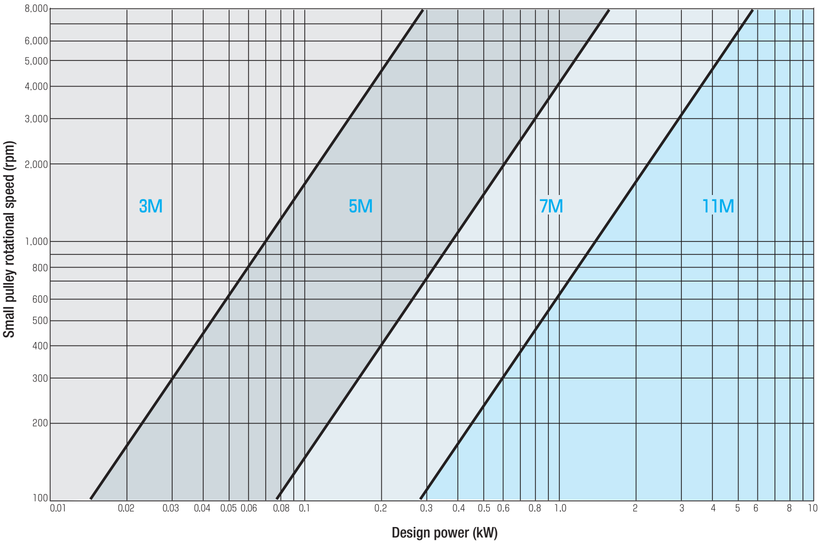
Motor Machine used on		Items where maximum output is less than or equal to 200% of rating	Items where maximum output is greater than 200% of rating
		AC motor Standard motor (normal torque) Cage type, synchronous	AC motor Specialty motor (high torque) Single phase, DC winding
		DC motor (AC winding)	DC motor (compound winding, DC winding) Operated by an engine, line shaft, or clutch
Low speed continuous use fan/blower	Small	1.0	1.1
	Large	1.3	1.4
Office machines		1.2	1.3
Pump	Centrifugal type	1.1	1.2
	Gear type	1.3	1.4
	Reciprocating-motion machine	1.5	1.6
Washing machines, dryers, dough mixers, DC generators, small compressors (rotary type), line shafts, rotary vibration sieving machines, printers, portable tools		1.3	1.4
Machine tools, piston type pumps, compressors, paper production mills		1.4	1.5
Textile machines, lawnmowers, mills (ball, roller), woodworking machines		1.5	1.6

Design Procedure 4

Select belt profile.

Based on the design power and rotational speed of the small pulley determined in ③, select the belt shape using the belt profile selection graph (Fig. 18).

Fig. 18 Belt profile selection graph



- If the belt profile falls on a borderline or close by, review the various conditions and select the belt profile with the overall lowest cost.

Design Procedure

5

Determine the large and small pulleys, standard belt, and distance between shafts.

❶ Determine the large and small pulleys.

● **How to determine the outer diameter (Do, do) of the large and small pulleys**

$$Do=Dp+k$$
$$(do=dp+k)$$
$$Dp=dp\,\frac{nd}{nD}$$

However,

k: Difference between pulley outer diameter and pitch diameter (see Table 28)

Dp: Large pulley pitch diameter (mm)

dp: Small pulley pitch diameter (mm)

nd: Small pulley rotational speed (rpm)

nD: Large pulley rotational speed (rpm)

Table 28 Difference between pulley outer diameter and pitch diameter (k)

Belt Profile	Value of k	
	Single type	Multiple type
3M	+0.5	—
5M	+0.9	−1.2
7M	+1.4	−1.5
11M	+2.1	−1.2

Use a pulley equal to or larger than the minimum pulley diameter for the small pulley.

➡ **(Table 29)**

Table 29 Minimum pulley outer diameter

Belt Profile	3M	5M	7M	11M
Minimum pulley diameter (mm)	17.0	26.5	42.5	67.0

❷ Determine the standard belt.

Using the tentative distance between shafts and large and small pulley outer diameters already determined, determine the effective circumference (Le') of a suggested belt.

● **How to determine the effective circumference (Le') of a suggested belt**

$$Le'=2C'+1.57\,(Do+do)+\frac{(Do-do)^2}{4C'}$$

However,

C': Tentative distance between shafts (mm)

Do: Large pulley outer diameter (mm)

do: Small pulley outer diameter (mm)

Select the standard belt with a length closest to the effective circumference of this suggested belt.

■ **Standard belt size table ➡ (Page 8, Table 5)**

❸ Determine the accurate distance between shafts.

② Determine the accurate distance between shafts using the following equation from the effective circumference of the standard belt selected.

● **How to determine distance between shafts (C)**

$$C=\frac{b+\sqrt{b^2-8\,(Do-do)^2}}{8}$$
$$b=2Le-\pi\,(Do+do)$$

However,

Le: Effective circumference of standard belt (mm)

Do: Large pulley diameter (mm)

do: Small pulley diameter (mm)

Design Procedure

6

Determine the number of belts.

❶ Determine the transfer capacity per belt.

● **How to determine corrected transfer capacity (Pc)**

$$Pc=Ps\cdot K\theta$$

However,

Ps: Standard transfer capacity (kW)

Kθ: Contact angle correction factor

● **How to determine standard transfer capacity (Ps)**

② Determine the standard transfer capacity from the transfer capacity table based on the small pulley rotational speed and small pulley outer diameter for the belt durability life selected in (2). ➡ **(Pages 23 to 26)**

● **How to determine contact angle correction factor (Kθ)**

Determine the small pulley contact angle (θ) from the following equation and obtain the contact angle correction factor from Fig. 19.

$$\theta=180^\circ-\frac{57.3\,(Do-do)}{C}$$

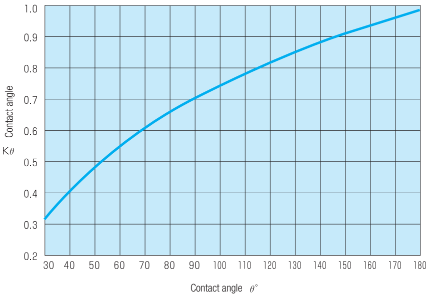
However,

Do: Large pulley outer diameter (mm)

do: Small pulley outer diameter (mm)

C: Distance between shafts (mm)

Fig. 19 Contact angle correction factor (Kθ)



❷ Determine the number of belts to use.

● **How to determine the number of belts to use (nb)**

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

However,

Pd: Design power (kW)

Pc: Corrected transfer capacity (kW)

Round up after the decimal to the next whole number for the number of belts to use.
If more than one belt, use a multi-type if at all possible.

Design Procedure

7

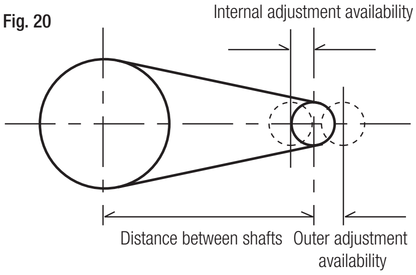
Confirm adjustment availability for distance between shafts.

Table 30 Adjustment availability of distance between shafts (Unit: mm)

Belt Profile	Belt length	Internal adjustment availability (minimum value)		Outer adjustment availability (Minimum value)
		Single belt type	Multiple belts or multi-type	
3M	180～ 300 307～ 750	4 (8) 6 (12)	5 (9) 7 (14)	7 (14) 10 (22)
5M	280～ 710 730～1,090 1,120～1,500	8 (16) 9 (18) 12 (23)	10 (20) 13 (26) 14 (28)	15 (30) 19 (38) 23 (46)
7M	500～ 700 730～1,090 1,120～1,500 1,550～1,900 1,950～2,300	8 (15) 9 (18) 12 (23) 14 (28) 17 (33)	10 (20) 13 (26) 14 (28) 17 (33) 19 (38)	15 (30) 19 (38) 23 (46) 27 (58) 30 (70)
11M	710～1,090 1,120～1,500 1,500～1,900 1,950～2,300	9 (18) 12 (23) 14 (28) 19 (38)	13 (25) 14 (28) 17 (33) 19 (38)	19 (38) 23 (46) 27 (58) 35 (70)

- When mounting the belts, shorten the distance between shafts to enable mounting without requiring force. In addition, proper tension must be provided to extend durability life of the belt.
- The number in ( ) is adjustment availability for cases where there are 3 or more shafts.

Fig. 20



Design Calculation Example

Design Procedure

1 Determine the conditions required for design.

ⓐ Machine type: Air conditioner equipment (industrial)
ⓑ Power transfer: 0.37 kW
ⓒ Small pulley rotational speed: 3,600 rpm
ⓓ Rotational speed ratio: 1.20 (reduction)
ⓔ Tentative distance between shafts: 100 mm

Design Procedure

2 Select belt durability life.

Based on the machine type and operation form for the machine in ①-a, select Rank C, which is 10,000 to 25,000 hours.

Design Procedure

3 Determine design power.

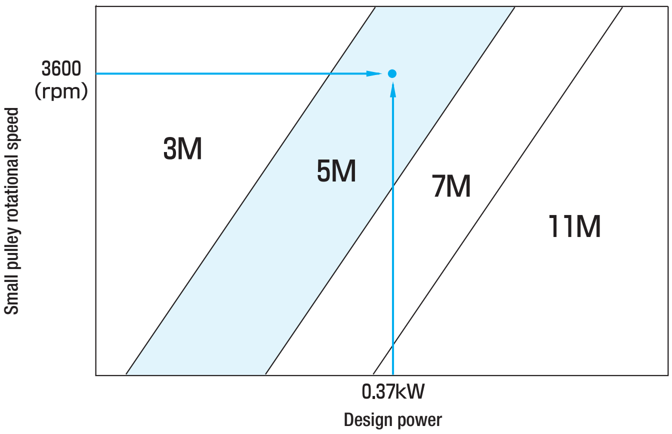
Power transfer (Pt) = 0.37 kW

Load correction factor (Ko) = 1.0 ➔ **(Page 19, Table 27)**

◆ **Design power (Pd) = Pt x Ko = 0.37 x 1.0**
= 0.37 kW

Design Procedure

4 Select belt profile.



Determine belt profile using the belt shape selection diagram.
Vertical axis gradations: The small pulley rotational speed of 3,600 rpm from design conditions ①
Horizontal axis gradations: Design power of 0.37 kW calculated in ③
Intersection of these
Determine the belt profile.

➔ **(Page 19, Fig. 18)**

● **Belt profile = 5M**

Design Procedure

5 Determine the large and small pulleys, standard belt, and distance between shafts.

❶ Determine the large and small pulley diameters.

Set the small pulley outer diameter (do) to the minimum pulley outer diameter (Page 20, Table 29)

Set to 35 mm, satisfying that described above.

Small pulley outer diameter (do) = 35 mm
Small pulley rotational speed (nd) = 3,600 rpm
Large pulley rotational speed (nD) = 3,000 rpm

◆ **Determine the large pulley outer diameter (Do).**

$$dp = do - k = 35 - 0.9 = 34.1\,\text{mm}$$

$$Dp = dp\,\frac{nd}{nD} = 34.1 \times \frac{3600}{3000} = 40.9\,\text{mm}$$

$$Do = Dp + k = 40.9 + 0.9 = 41.8 \fallingdotseq 42\,\text{mm}$$

➔ **(Value of k: Page 20, Table 28)**

❷ Determine the standard belt.

Tentative distance between shafts (C') = 100 mm
Large pulley outer diameter (Do) = 42 mm
Small pulley outer diameter (do) = 35 mm

◆ **Suggested belt effective circumference (Le¹)**

$$= 2C' + 1.57\,(Do + do) + \frac{(Do - do)^2}{4C'}$$

$$= 2 \times 100 + 1.57\,(42 + 35) + \frac{(42 - 35)^2}{4 \times 100}$$

$$\fallingdotseq 321.0\,\text{mm}$$

Select **5M-325**, the belt among the standard belt sizes with the closest effective circumference to that of this suggested belt.

➔ (Page 8, Table 5)

❸ Determine the accurate distance between shafts.

Large pulley outer diameter (Do) = 42 mm
Small pulley outer diameter (do) = 35 mm
Standard belt effective circumference (Le) = 325 mm

$$b = 2Le - \pi\,(Do + do) = 2 \times 325 - 3.14 \times (42 + 35) \fallingdotseq 408.2$$

◆ **Distance between shafts**

$$(C) = \frac{b + \sqrt{b^2 - 8\,(Do - do)^2}}{8} = \frac{408.2 + \sqrt{408.2^2 - 8 \times (42 - 35)^2}}{8} \fallingdotseq 101.99\,\text{mm} \rightarrow 102\,\text{mm}$$

Design Procedure

6 Determine the number of belts.

❶ Determine the corrected power transfer capacity.

Standard transfer capacity (Ps) = 0.43 kW

➡ (Page 24, Table 33)

◆ **Determine the correction factor (Kθ) based on the contact angle.**

Large pulley outer diameter (Do) = 42 mm
Small pulley outer diameter (do) = 35 mm
Distance between shafts (C) = 102 mm

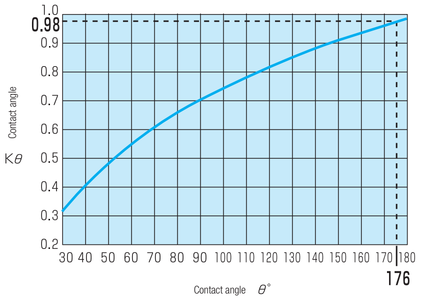
◆ **Contact angle (θ)** $=180^\circ-\dfrac{57(Do-do)}{C}$

$$=180^\circ-\frac{57(42-35)}{102.0}\fallingdotseq 176^\circ$$

From Fig. 19 on Page 20, the contact angle correction factor (Kθ) is 0.98.

◆ **Corrected power transfer capacity** $(Pc)=Ps\cdot K_\theta=0.43\times0.98$

$$\fallingdotseq 0.42\text{kW}$$



❷ Determine the number of belts to use.

Design power (Pd) = 0.37 kW
Corrected transfer capacity (Pc) = 0.42 kW

◆ **Number of belts to use** $(nb)=\dfrac{Pd}{Pc}=\dfrac{0.37}{0.42}$

$$=0.88\rightarrow 1\text{ belt}$$

Design Procedure

7 Confirm adjustment availability for distance between shafts.

From belt name 5M325

To inside 8 mm

To outside 15 mm

➡ (Page 20, Table 30)

Table 31 Adjustment availability of distance between shafts (Unit: mm)

Belt shape	Belt length	Internal adjustment availability (minimum value)		External adjustment availability (Minimum value)
		Single belt type	Multiple belts or multi-type	
3M	180～ 300 307～ 750	4 (8) 6 (12)	5 (9) 7 (14)	7 (14) 10 (22)
5M	**280～ 710** 730～1,090 1,120～1,500	**8 (16)** 9 (18) 12 (23)	**10 (20)** 13 (26) 14 (28)	**15 (30)** 19 (38) 23 (46)

Summary

Belt: 5M325
Pulley: Drive (small pulley) outer diameter 35 mm
Driven (large pulley) outer diameter 42 mm
Distance between shafts: $102^{+15}_{-8\text{mm}}$

3M Standard Transfer Capacity Table

Table 32 3M Theoretical Durability Life and Standard Transfer Capacity

● Durability life 3,000 to 5,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	17	18	19	20	21	22	23.5	25	26.5	28	30	31.5
1750	0.04	0.05	0.07	0.07	0.09	0.11	0.13	0.14	0.16	0.18	0.21	0.24
3450	0.04	0.07	0.09	0.12	0.14	0.17	0.21	0.24	0.27	0.32	0.36	0.41
1000	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.14	0.15
2000	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.15	0.18	0.20	0.24	0.27
3000	0.04	0.07	0.09	0.11	0.13	0.15	0.18	0.21	0.25	0.29	0.32	0.37
4000	0.04	0.07	0.10	0.13	0.15	0.18	0.22	0.26	0.30	0.35	0.40	0.46
5000	0.02	0.07	0.10	0.13	0.17	0.21	0.26	0.30	0.35	0.41	0.48	0.54
6000	0.01	0.06	0.10	0.14	0.18	0.24	0.29	0.34	0.40	0.46	0.54	0.62
7000	—	0.04	0.10	0.15	0.19	0.25	0.31	0.37	0.44	0.51	0.60	0.68
8000	—	0.02	0.09	0.14	0.20	0.26	0.33	0.40	0.48	0.56	0.63	0.75
9000	—	—	0.07	0.14	0.20	0.27	0.35	0.42	0.51	0.60	0.71	0.81
10000	—	—	0.06	0.13	0.20	0.28	0.36	0.44	0.54	0.63	0.75	0.87
11000	—	—	0.04	0.12	0.19	0.28	0.37	0.46	0.56	0.67	0.77	0.91
12000	—	—	0.01	0.10	0.18	0.28	0.38	0.47	0.58	0.70	0.83	0.96

● Durability life 5,000 to 10,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	17	18	19	20	21	22	23.5	25	26.5	28	30	31.5
1750	0.02	0.03	0.04	0.06	0.07	0.09	0.10	0.12	0.14	0.16	0.18	0.21
3550	—	0.02	0.05	0.07	0.10	0.13	0.15	0.18	0.22	0.26	0.29	0.34
1000	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13
2000	0.01	0.04	0.04	0.06	0.07	0.10	0.11	0.13	0.15	0.18	0.21	0.23
3000	—	0.03	0.05	0.07	0.09	0.12	0.14	0.17	0.20	0.24	0.27	0.31
4000	—	0.01	0.04	0.07	0.10	0.13	0.16	0.20	0.24	0.28	0.33	0.38
5000	—	—	0.03	0.07	0.10	0.14	0.18	0.22	0.27	0.32	0.38	0.43
6000	—	—	0.01	0.05	0.10	0.14	0.19	0.24	0.29	0.35	0.42	0.48
7000	—	—	—	0.04	0.08	0.14	0.19	0.25	0.32	0.38	0.46	0.53
8000	—	—	—	0.01	0.07	0.13	0.19	0.26	0.33	0.40	0.49	0.57
9000	—	—	—	—	0.04	0.12	0.19	0.26	0.34	0.42	0.51	0.60
10000	—	—	—	—	0.02	0.10	0.18	0.26	0.35	0.43	0.53	0.63
11000	—	—	—	—	—	0.09	0.17	0.25	0.35	0.44	0.55	0.65
12000	—	—	—	—	—	0.06	0.15	0.24	0.35	0.45	0.56	0.68

● Durability life 10,000 to 25,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	17	18	19	20	21	22	23.5	25	26.5	28	30	31.5
1750	—	—	0.01	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.16
3450	—	—	—	—	0.02	0.05	0.08	0.10	0.13	0.17	0.21	0.24
1000	0.01	0.01	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.10	0.11
2000	—	—	0.01	0.03	0.04	0.06	0.07	0.09	0.11	0.13	0.15	0.18
3000	—	—	—	0.01	0.03	0.06	0.08	0.10	0.13	0.15	0.19	0.22
4000	—	—	—	—	0.01	0.04	0.07	0.10	0.14	0.18	0.21	0.26
5000	—	—	—	—	—	0.02	0.06	0.10	0.14	0.18	0.24	0.28
6000	—	—	—	—	—	—	0.04	0.08	0.13	0.18	0.24	0.29
7000	—	—	—	—	—	—	0.01	0.06	0.12	0.18	0.24	0.30
8000	—	—	—	—	—	—	—	0.04	0.10	0.16	0.23	0.31
9000	—	—	—	—	—	—	—	—	0.07	0.15	0.22	0.30
10000	—	—	—	—	—	—	—	—	0.04	0.12	0.21	0.29

5M Standard Transfer Capacity Table

Table 33 5M Theoretical Durability Life and Standard Transfer Capacity

● Durability life 3,000 to 5,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	26.5	28	30	31.5	33.5	35.5	37.5	40	42.5	45	47.5	50
1160	0.13	0.15	0.18	0.21	0.26	0.29	0.24	0.38	0.43	0.49	0.54	0.60
1750	0.17	0.21	0.25	0.30	0.35	0.41	0.47	0.54	0.62	0.70	0.78	0.86
3450	0.26	0.33	0.42	0.51	0.60	0.71	0.82	0.94	1.08	1.23	1.38	1.52
1000	0.11	0.13	0.16	0.19	0.23	0.26	0.29	0.34	0.38	0.43	0.48	0.53
2000	0.18	0.23	0.28	0.33	0.40	0.46	0.53	0.60	0.69	0.78	0.87	0.96
3000	0.24	0.30	0.38	0.46	0.54	0.64	0.74	0.84	0.96	1.10	1.22	1.35
4000	0.28	0.37	0.46	0.56	0.68	0.79	0.92	1.06	1.22	1.38	1.55	1.72
5000	0.30	0.41	0.54	0.65	0.80	0.94	1.09	1.27	1.46	1.65	1.85	2.06
6000	0.33	0.46	0.60	0.74	0.90	1.08	1.25	1.45	1.68	1.91	2.15	2.38
7000	0.35	0.49	0.65	0.82	1.01	1.21	1.40	1.63	1.89	2.15	2.42	2.68
8000	0.35	0.51	0.70	0.89	1.10	1.32	1.54	1.79	2.09	2.38	2.67	2.98
9000	0.35	0.54	0.74	0.95	1.18	1.43	1.67	1.96	2.27	2.60	2.97	3.25
10000	0.35	0.54	0.77	1.00	1.27	1.53	1.79	2.10	2.45	2.81	3.16	3.51
11000	0.32	0.55	0.80	1.05	1.33	1.62	1.91	2.24	2.61	2.99	3.38	3.76
12000	0.30	0.55	0.82	1.09	1.40	1.71	2.02	2.37	2.77	3.17	3.57	3.99

● Durability life 5,000 to 10,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	26.5	28	30	31.5	33.5	35.5	37.5	40	42.5	45	47.5	50
1160	0.10	0.13	0.15	0.18	0.22	0.26	0.29	0.34	0.39	0.44	0.49	0.54
1750	0.13	0.17	0.21	0.26	0.31	0.36	0.41	0.48	0.55	0.62	0.70	0.77
3450	0.18	0.24	0.32	0.40	0.50	0.60	0.70	0.81	0.94	1.07	1.21	1.34
1000	0.10	0.12	0.14	0.17	0.20	0.23	0.26	0.30	0.35	0.39	0.43	0.48
2000	0.14	0.18	0.23	0.28	0.34	0.40	0.46	0.53	0.61	0.69	0.78	0.86
3000	0.17	0.23	0.30	0.38	0.46	0.54	0.63	0.73	0.85	0.96	1.08	1.20
4000	0.18	0.26	0.35	0.45	0.55	0.66	0.78	0.90	1.05	1.20	1.35	1.51
5000	0.18	0.28	0.40	0.51	0.64	0.77	0.91	1.07	1.24	1.43	1.60	1.79
6000	0.16	0.29	0.43	0.56	0.71	0.88	1.03	1.21	1.42	1.63	1.84	2.05
7000	0.13	0.28	0.44	0.60	0.78	0.96	1.14	1.35	1.58	1.82	2.06	2.30
8000	0.10	0.27	0.46	0.63	0.83	1.04	1.24	1.47	1.73	1.99	2.26	2.53
9000	0.05	0.25	0.46	0.65	0.88	1.10	1.32	1.58	1.87	2.16	2.45	2.74
10000	—	0.21	0.45	0.67	0.91	1.15	1.41	1.68	1.99	2.31	2.63	2.94
11000	—	0.18	0.43	0.68	0.94	1.21	1.47	1.77	2.11	2.45	2.79	3.13
12000	—	0.13	0.41	0.68	0.96	1.25	1.53	1.85	2.21	2.57	2.93	3.30

● Durability life 10,000 to 25,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	26.5	28	30	31.5	33.5	35.5	37.5	40	42.5	45	47.5	50
1160	0.07	0.09	0.12	0.15	0.18	0.21	0.24	0.29	0.33	0.38	0.42	0.47
1750	0.07	0.11	0.15	0.19	0.24	0.29	0.33	0.39	0.45	0.50	0.58	0.64
3450	0.03	0.10	0.18	0.26	0.35	0.43	0.52	0.63	0.74	0.85	0.97	1.09
1000	0.07	0.08	0.11	0.13	0.16	0.19	0.22	0.25	0.29	0.33	0.38	0.41
2000	0.07	0.11	0.16	0.21	0.26	0.31	0.37	0.43	0.50	0.57	0.65	0.72
3000	0.05	0.11	0.18	0.25	0.32	0.40	0.48	0.57	0.67	0.77	0.88	0.98
4000	—	0.10	0.18	0.27	0.38	0.47	0.57	0.69	0.82	0.95	1.08	1.21
5000	—	0.05	0.18	0.29	0.40	0.53	0.65	0.79	0.94	1.10	1.26	1.41
6000	—	—	0.15	0.28	0.43	0.57	0.71	0.87	1.05	1.23	1.41	1.60
7000	—	—	0.10	0.26	0.43	0.60	0.76	0.94	1.14	1.35	1.55	1.76
8000	—	—	0.04	0.23	0.42	0.61	0.79	0.99	1.22	1.45	1.68	1.90
9000	—	—	—	0.18	0.40	0.61	0.81	1.04	1.29	1.53	1.78	2.03
10000	—	—	—	0.13	0.38	0.60	0.82	1.07	1.34	1.60	1.88	2.14
11000	—	—	—	0.07	0.34	0.58	0.82	1.08	1.38	1.66	1.95	2.24
12000	—	—	—	—	0.27	0.55	0.81	1.09	1.40	1.71	2.01	2.31

7M Standard Transfer Capacity Table

Table 34 7M Theoretical Durability Life and Standard Transfer Capacity

● Durability life 3,000 to 5,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	42.5	45	47.5	50	53	56	60	63	67	71	75	80
870	0.34	0.40	0.46	0.53	0.60	0.69	0.79	0.90	1.02	1.14	1.26	1.42
1160	0.43	0.51	0.59	0.68	0.77	0.88	1.02	1.15	1.30	1.46	1.62	1.82
1750	0.58	0.70	0.82	0.95	1.09	1.25	1.44	1.63	1.86	2.09	2.31	2.61
3450	0.95	1.43	1.40	1.63	1.89	2.18	2.53	2.88	3.30	3.71	4.11	4.65
1000	0.38	0.45	0.52	0.60	0.68	0.78	0.89	1.01	1.15	1.29	1.42	1.60
2000	0.64	0.78	0.85	1.06	1.22	1.40	1.61	1.83	2.09	2.35	2.60	2.93
3000	0.86	1.06	1.26	1.46	1.69	1.95	2.26	2.57	2.94	3.31	3.66	4.14
4000	1.04	1.30	1.56	1.82	2.13	2.46	2.85	3.25	3.72	3.80	4.65	5.26
5000	1.20	1.52	1.83	2.16	2.52	2.92	3.40	3.88	4.45	5.02	5.57	6.30
6000	1.33	1.70	2.07	2.46	2.88	3.35	3.91	4.47	5.13	5.80	6.43	7.27
7000	1.44	1.87	2.30	2.73	3.21	3.74	4.38	5.02	5.76	6.51	7.22	8.16
8000	1.52	2.01	2.46	2.97	3.51	4.10	4.81	5.52	6.35	7.17	7.94	8.97
9000	1.59	2.13	2.66	3.19	3.78	4.44	5.21	5.99	6.88	7.80	8.61	9.71
10000	1.63	2.22	2.80	3.38	4.04	4.74	5.57	6.40	7.36	8.31	9.19	10.37

● Durability life 5,000 to 10,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	42.5	45	47.5	50	53	56	60	63	67	71	75	80
870	0.29	0.35	0.41	0.47	0.54	0.63	0.72	0.82	0.93	1.04	1.16	1.30
1160	0.36	0.43	0.52	0.60	0.69	0.79	0.91	1.04	1.18	1.33	1.48	1.67
1750	0.48	0.60	0.71	0.83	0.96	1.11	1.29	1.46	1.68	1.89	2.10	2.37
3450	0.73	0.94	1.15	1.38	1.62	1.89	2.21	2.54	2.91	3.30	3.67	4.16
1000	0.32	0.39	0.46	0.53	0.61	0.70	0.81	0.92	1.04	1.18	1.30	1.46
2000	0.52	0.66	0.79	0.92	1.07	1.24	1.43	1.63	1.88	2.11	2.35	2.66
3000	0.68	0.86	1.05	1.24	1.46	1.70	1.98	2.27	2.61	2.95	3.27	3.71
4000	0.79	1.03	1.27	1.52	1.80	2.11	2.47	2.85	3.27	3.71	4.13	4.69
5000	0.86	1.16	1.46	1.77	2.10	2.48	2.92	3.37	3.88	4.41	4.91	5.58
6000	0.91	1.27	1.63	1.98	2.38	2.81	3.32	3.84	4.44	5.05	5.62	6.38
7000	0.93	1.35	1.75	2.16	2.62	3.10	3.69	4.27	4.95	5.63	6.27	7.12
8000	0.93	1.40	1.85	2.31	2.81	3.36	4.01	4.66	5.40	6.15	6.85	7.80
9000	0.91	1.43	1.93	2.44	2.98	3.58	4.29	4.99	5.80	6.61	7.36	8.39
10000	0.85	1.42	1.98	2.52	3.12	3.77	4.53	5.29	6.15	7.01	7.80	8.83

● Durability life 10,000 to 25,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	42.5	45	47.5	50	53	56	60	63	67	71	75	80
870	0.22	0.28	0.33	0.39	0.46	0.53	0.62	0.70	0.80	0.91	1.01	1.14
1160	0.27	0.34	0.41	0.49	0.57	0.66	0.77	0.89	1.02	1.16	1.28	1.46
1750	0.33	0.44	0.54	0.66	0.77	0.91	1.07	1.23	1.42	1.61	1.80	2.04
3450	0.40	0.60	0.80	1.00	1.22	1.47	1.76	2.05	2.52	2.73	3.05	3.49
1000	0.24	0.31	0.37	0.43	0.51	0.59	0.69	0.79	0.91	1.02	1.13	1.28
2000	0.35	0.47	0.60	0.71	0.85	1.00	1.18	1.37	1.57	1.80	1.99	2.27
3000	0.40	0.57	0.75	0.93	1.12	1.34	1.59	1.85	2.15	2.46	2.74	3.13
4000	0.39	0.63	0.85	1.08	1.34	1.61	1.94	2.27	2.66	3.04	3.41	3.89
5000	0.34	0.64	0.92	1.20	1.51	1.85	2.24	2.63	3.09	3.55	4.00	4.57
6000	0.26	0.61	0.95	1.28	1.64	2.03	2.49	2.95	3.47	4.00	4.50	5.16
7000	0.13	0.55	0.95	1.32	1.74	2.18	2.69	3.21	3.80	4.39	4.94	5.68
8000	—	0.46	0.91	1.33	1.79	2.29	2.85	3.43	4.08	4.72	5.32	6.11
9000	—	0.33	0.83	1.31	1.81	2.35	2.97	3.59	4.29	4.98	5.62	6.45
10000	—	0.17	0.73	1.24	1.80	2.38	3.05	3.70	4.44	5.17	5.84	6.71

11M Standard Transfer Capacity Table

Table 35 11M Theoretical Durability Life and Standard Transfer Capacity

Durability life 3,000 to 5,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	67	71	75	80	85	90	95	100	106	112	118	125
690	1.07	1.24	1.39	1.60	1.81	2.02	2.25	2.48	2.74	3.02	3.31	3.63
870	1.31	1.51	1.70	1.96	2.23	2.49	2.76	3.05	3.38	3.72	4.08	4.47
1160	1.67	1.93	2.18	2.52	2.86	3.20	2.56	3.93	4.35	4.81	5.27	5.78
1750	2.36	2.74	3.10	3.59	4.09	4.58	5.10	5.63	6.25	6.91	7.58	8.31
3450	4.08	4.77	5.43	6.33	7.25	8.16	9.12	10.08	11.18	12.36	13.53	14.86
1000	1.47	1.70	1.92	2.21	2.52	2.81	3.13	3.44	3.82	4.21	4.61	5.07
2000	2.63	3.06	3.46	4.02	4.59	5.14	5.73	6.33	7.02	7.72	8.53	9.34
3000	3.65	4.27	4.85	5.65	6.47	7.25	8.09	8.97	9.93	10.96	12.06	13.24
4000	4.56	5.35	6.11	7.13	8.16	9.19	10.30	11.33	12.58	13.90	15.23	16.77
5000	5.38	6.33	7.25	8.46	9.78	10.96	12.21	13.53	15.00	16.62	18.17	19.93
6000	6.10	7.22	8.31	9.71	11.18	12.58	14.05	15.52	17.21	18.98	20.74	22.65
7000	6.74	8.02	9.19	10.81	12.43	13.98	15.59	17.21	19.12	21.04	22.95	25.01
8000	7.27	8.68	10.00	11.77	13.53	15.23	16.99	18.76	20.74	22.73	24.71	26.85

Durability life 5,000 to 10,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	67	71	75	80	85	90	95	100	106	112	118	125
690	0.97	1.12	1.27	1.46	1.67	1.87	2.07	2.30	2.55	2.81	3.77	3.38
870	1.18	1.36	1.55	1.79	2.04	2.29	2.55	2.81	3.12	3.45	3.78	4.16
1160	1.49	1.74	1.97	2.29	2.62	2.94	3.27	3.61	4.02	4.44	4.87	5.35
1750	2.07	2.44	2.77	3.24	3.71	4.16	4.66	5.16	5.73	6.34	6.96	7.65
3450	3.48	4.13	4.76	5.61	6.47	7.29	8.16	9.05	10.08	11.18	12.28	13.53
1000	1.32	1.53	1.74	2.02	2.30	2.58	2.88	3.18	3.52	3.90	4.27	4.70
2000	2.31	2.71	3.09	3.61	4.15	4.66	5.22	5.77	6.42	7.11	7.80	8.61
3000	3.14	3.72	4.27	5.02	5.78	6.52	7.30	8.09	9.05	10.00	10.96	12.06
4000	3.86	4.61	5.32	6.27	7.25	8.16	9.19	10.22	11.33	12.58	13.83	15.15
5000	4.48	5.38	6.24	7.43	8.53	9.71	10.89	12.06	13.46	14.86	16.33	17.95
6000	5.00	6.05	7.05	8.39	9.71	11.03	12.36	13.75	15.30	16.92	18.46	20.30
7000	5.44	6.62	7.72	9.19	10.74	12.14	13.68	15.15	16.84	18.61	20.30	22.14
8000	5.75	7.06	8.31	9.93	11.55	13.09	14.71	16.26	18.09	19.86	21.62	23.54

Durability life 10,000 to 25,000 h standard transfer capacity (Unit: kW)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)											
	67	71	75	80	85	90	95	100	106	112	118	125
690	0.82	0.96	1.10	1.28	1.47	1.65	1.85	2.05	2.27	2.52	2.76	3.04
870	0.99	1.16	1.33	1.55	1.79	2.01	2.25	2.49	2.77	3.07	3.38	3.72
1160	1.24	1.46	1.68	1.97	2.27	2.56	2.87	3.19	3.55	3.94	4.33	4.77
1750	1.68	2.01	2.32	2.74	3.18	3.60	4.04	4.49	5.02	5.57	6.13	6.76
3450	2.63	3.24	3.81	4.58	5.36	6.11	6.91	7.72	8.61	9.64	10.59	11.69
1000	1.10	1.30	1.49	1.74	2.01	2.26	2.53	2.81	3.13	3.46	3.81	4.19
2000	1.85	2.21	2.57	3.05	3.53	4.00	4.50	5.01	5.60	6.22	6.77	7.58
3000	2.42	2.95	3.46	4.14	4.83	5.50	6.28	6.93	7.72	8.61	9.49	10.52
4000	2.87	3.55	4.21	5.08	5.96	6.80	7.72	8.61	9.64	10.74	11.84	13.02
5000	3.20	4.04	4.82	5.87	6.92	7.94	8.97	10.08	11.25	12.58	13.83	15.23
6000	3.43	4.40	5.30	6.51	7.72	8.83	10.08	11.25	12.65	14.05	15.45	16.99
7000	3.54	4.63	5.65	7.00	8.31	9.56	10.89	12.21	13.68	15.23	16.70	18.24
8000	3.53	4.74	5.86	7.36	8.75	10.15	11.55	12.87	14.42	15.96	17.43	18.98

Reference Materials: Points to Remember Regarding Design and Use

Reference Material A

Belt tension

PolyMax® has a high transfer capacity relative to the cross-sectional area, so belt tension may feel higher than normal.

❶ Determine the belt span length.

The span length is the length of the belt not in contact with a pulley.

❷ Apply a deflection.

Apply the load calculated using the equation below at the center of the belt span length. Adjust the belt tension so that the deflection is 1 mm per 100 mm of span length.

Note that the load should be applied perpendicularly to the belt. (Fig. 21)

For single PolyMax®

Minimum force applied for deflection

$$F\delta'\text{min.} = \frac{1.12\times10^6 Pd}{do\cdot nd}(N)$$

Maximum force applied for deflection

$$F\delta\cdot\text{max.} = 1.5\cdot F\delta\text{min.}$$

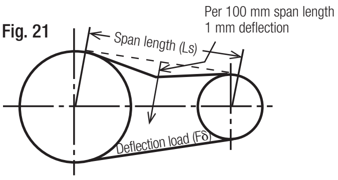
However,

Pd: Design power (kW)

do: Small pulley outer diameter (mm)

nd: Small pulley rotational speed (rpm)

Fig. 21



For Multi PolyMax®

Calculate the initial tension (To) and determine the load for applying deflection.

● How to determine initial tension (To)

$$To = 500\times\frac{2.5-K\theta}{K\theta}\times\frac{Pd}{nr\cdot V}+WV^2$$

However,

To: Initial tension per belt rib (N/rib)

Kθ: Contact angle correction factor ➲ (Page 20, Fig. 19)

Pd: Design power (kW)

nr: Number of belt ribs

V: Belt speed (m/sec) $V=\frac{\pi\times do\times nd}{60000}$

W: Belt unit mass (kg/m) (table to upper right)

Minimum force applied for deflection

$$F\delta'\text{min.} = \frac{To+\frac{Ls\times Y}{L}}{25}\times nr$$

Maximum force applied for deflection

$$F\delta'\text{max.} = \frac{1.5To+\frac{Ls\times Y}{L}}{25}\times nr$$

However,

Ls: Span length, Ls = V C- (D4~d)

Y: Constant based on belt shape (table to upper right)

L: Belt length (mm)

nr: Number of belt ribs

$$Ls=\sqrt{C^2-\frac{(D-d)^2}{4}}$$

Table 36 Belt unit mass and constants

Belt shape	W (kg／m)	Y
3M	0.0045	
5M	0.011	14.7
7M	0.028	38.2
11M	0.058	83.4

- Stretch new belts with maximum force.
- If using multiple single types, matched set belts are recommended. Set difference for matched sets is as follows. Note that use of belts with different lengths will reduce durability.
  Please be careful.

Table 37 Set difference for matched sets (Unit: mm)

Belt effective outer circumference	Set difference
≧500	0.4
515～1,000	0.8
1,030～1,500	1.4
1,550≦	1.8

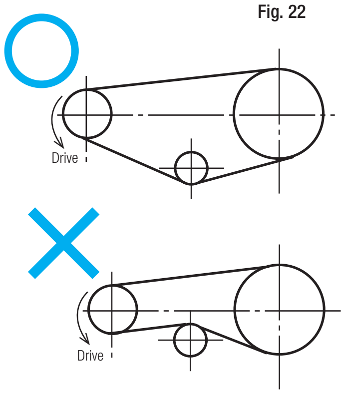
Multi-types are recommended when several belts are used.

Reference Material B

Using idler pulleys

- Idler pulleys do not work well with PolyMax® belts.
  If an idler pulley must be used,
  be sure to use it on the inside. (Fig. 22)
- Use the idler pulley on the belt side that is loose.

Fig. 22



Reference Material C

Belt handling
Notification items regarding use

❶ Belt Storage

PolyMax® has excellent resistance to ozone and direct sunlight, but it is recommended that the belts be stored in a hanging position in a cool, dry, and dark location so that they will not twist.

❷ Belt Installation/Replacement

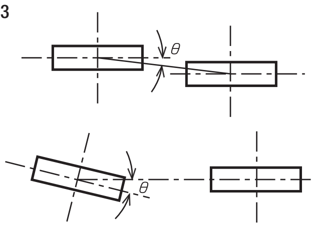
- Be sure to turn OFF the power and wait for the pulleys to stop before performing maintenance or inspection on a belt.
- For mounting, either shorten the distance between shafts or loosen an idler to replace a belt. Forcibly twisting may cause early failure.
- When replacing multiple belts, replace all belts with new ones at the same time.
  Use of new and old belts together may cause non-uniform elongation with load and reduce durability.
- Make sure the pulley is not worn.
- Multi-types are recommended when several belts are used.
- When multiple belts of a single type are used, a matched set is recommended.

❸ Belt Operation

- Use PolyMax® within an operating temperature range of -40°C to +80°C.
- If distance between shafts is fixed, be sure to pull the tension pulley used from the inside towards the outside.
- PolyMax® is made up of polyurethane with a high friction coefficient, but if water or oil is spilled onto it, the friction coefficient will drop. Be sure to protect the belt from oil and water.

- If pulley shaft parallelism and eccentricity are not accurate, belt life will shorten dramatically, so make sure pulley misalignment (θ in Fig. 23) is 1/3° or less.

Fig. 23



Design Procedure

Design Procedure 1

Determine the conditions required for design.

ⓐ Machine type

ⓑ Transfer power

For transfer of power, use of the actual load that is applied to the belt is ideal, but generally, the rated load of the motor is used.

ⓒ Rotational speed of the small pulley

ⓓ Operating hours per day

ⓔ Rotational speed ratio $\left(\frac{\text{Large pulley diameter}}{\text{Small pulley diameter}}\right)$

ⓕ Tentative distance between shafts

ⓖ Operating environment (low temperature, oil, water, foreign material)

Avoid use in high temperature, acidic, and basic environments.

Design Procedure 2

Determine design power.

● **How to determine design power (Pd)**

$$Pd=Pt\cdot Ko$$

However,
Pt: Transfer power (kW)
Ko: Load correction factor
➔ (Table 38)

Table 38 Load correction factor (Ko)

Follower machine		Motor					
Load fluctuation	Machine used on	Peak torque of 200% or less			Peak torque exceeds 200%		
		AC motor (normal torque, cage type synchronous transfer) DC motor			AC motor (high torque, single layer, DC winding) DC motor (compound winding, DC winding) Engine, line shaft, clutch		
		Operating hours per day			Operating hours per day		
		3～5	8～10	16～24	3～5	8～10	16～24
Minute	Stirring machines (fluid) Fans, blowers (small)	1.0	1.1	1.2	1.1	1.2	1.3
Small	Washing machines, generators, machine tools, printers	1.1	1.2	1.3	1.2	1.3	1.4
Medium	Plunger-pumps, textile machines, woodworking machinery	1.2	1.3	1.4	1.4	1.5	1.6
Large	Crushers Compressors Rolling mills	Use a V belt or a Maxstar Wedge belt.					

Design Procedure

3

Determine the large and small pulleys, standard belt, and distance between shafts.

❶ Determine the large and small pulleys.

- **How to determine the diameter of the large and small pulleys (Dp, dp)**

$$Dp=dp\frac{nd}{nD}$$

However,
nd: Small pulley rotational speed (rpm)
nD: Large pulley rotational speed (rpm)

❷ Determine the standard belt.

Using the tentative distance between shafts and large and small pulley outer diameters already determined, determine the suggested belt pitch circumference (Lp').

- **How to determine the pitch circumference (Lp) of a suggested belt**

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

However,
C': Tentative distance between shafts (mm)
Dp: Large pulley pitch diameter (mm)
dp: Small pulley pitch diameter (mm)

Select a standard belt with length closest to the pitch circumference of this suggested belt.

➡ **(Page 11, Table 13)**

❸ Determine the accurate distance between shafts.

② Determine the accurate distance between shafts (C) using the following equation based on the pitch circumference of the standard belt selected.

- **Distance between shafts (C) calculation method**

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

$$b=2Lp-\pi(Dp+dp)$$

However,
Dp: Large pulley pitch diameter (mm)
dp: Small pulley pitch diameter (mm)
Lp: Standard belt pitch circumference (mm)

- **Cases where distance between shafts is fixed**

When used with distance between shafts fixed, set distance between shafts with consideration that the belt will elongate 1.2 to 1.5%.

Design Procedure

4

Determine the number of ribs for the belt.

❶ Determine the transfer capacity per rib of the belt.

- **How to determine corrected transfer capacity (Pc) per rib**

$$Pc=Ps\cdot K\theta\cdot K\ell$$

However,
Ps: Standard transfer capacity (W) ➡ (Page 30, Table 41)
Kθ: Contact angle correction factor ➡ (Page 29, Table 39)
Kℓ: Length correction factor ➡ (Page 29, Table 40)

❷ Determine the number of belt ribs.

- **How to determine the number of ribs (n)**

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

However,
Pd: Design power (W)
Pc: Corrected transfer capacity (W)

Round up after the decimal to the next whole number for the number of belt ribs to use.

Table 39 Contact angle correction factor (Kθ)

$\frac{Dp-dp}{C}$	Small pulley contact angle θ (degree)	Correction factor Kθ
0.00	180	1.00
0.10	174	0.99
0.20	169	0.97
0.30	163	0.96
0.40	157	0.94
0.50	151	0.93
0.60	145	0.91
0.70	139	0.89
0.80	133	0.87
0.90	127	0.85
1.00	120	0.82
1.10	113	0.80
1.20	106	0.77
1.30	99	0.73
1.40	91	0.70
1.50	83	0.65

Table 40 Length correction factor (Kℓ)

Pitch length (mm)	Length correction factor
～245	0.90
250～360	1.00
370～520	1.08
530～740	1.15
750 or above	1.20

JBT Standard Transmission Capacity Table

Table 41 JBT shape standard transfer capacity per rib (Unit: W)

Small pulley rotational speed (rpm)	Small pulley pitch diameter (mm)							
	20	25	30	40	50	80	100	150
200							58.8	80.9
300						18.8	80.9	125.0
400					51.5	80.9	103.0	154.5
500				44.1	58.8	95.6	125.0	181.2
600				51.5	58.8	117.7	154.5	220.7
700			29.4	58.8	73.5	132.4	169.2	257.4
800		22.1	29.4	58.8	80.9	147.1	191.2	294.2
900		29.4	36.8	66.2	88.3	154.5	213.3	316.3
950	14.7	29.4	36.8	66.2	88.3	169.2	220.9	330.3
1,000	14.7	29.4	36.8	66.2	88.3	170.5	235.4	360.4
1,100	14.7	29.4	44.1	73.6	110.3	191.2	257.4	382.5
1,150	14.7	29.4	44.1	80.9	110.3	198.6	264.8	397.2
1,200	14.7	36.8	44.1	80.9	117.7	205.9	279.5	411.9
1,300	14.7	36.8	44.1	88.3	125.0	220.7	286.8	441.3
1,400	14.7	36.8	51.5	95.6	132.4	242.7	308.9	470.7
1,425	14.7	36.8	51.5	95.6	132.4	242.7	316.3	478.1
1,500	14.7	36.8	51.5	103.0	139.7	257.4	331.0	500.1
1,600	14.7	44.1	58.8	103.0	139.7	272.1	353.0	529.6
1,700	14.7	44.1	58.8	110.3	154.5	279.5	367.8	551.6
1,750	14.7	44.1	58.8	110.3	154.5	286.8	382.5	566.3
1,800	14.7	44.1	58.8	117.7	161.8	294.2	389.8	581.0
1,900	14.7	44.1	66.2	125.0	169.2	308.9	404.5	610.5
2,000	14.7	51.5	66.2	125.0	176.5	323.6	426.6	632.5
2,200	14.7	51.5	73.6	139.7	191.2	353.0	463.4	684.0
2,400	14.7	51.5	73.6	139.7	205.9	375.1	500.1	720.8
2,600	22.1	58.8	80.9	154.5	220.7	397.2	522.2	772.3
2,800	22.1	58.8	80.9	161.8	228.0	426.6	559.0	809.1
2,850	22.1	58.8	88.3	161.8	235.4	433.9	566.3	823.8
3,000	22.1	66.2	88.3	176.5	242.7	456.0	588.4	853.2
3,200	22.1	66.2	95.6	183.9	257.4	478.1	595.8	890.0
3,400	22.1	66.2	95.6	191.2	272.1	500.0	647.2	919.4
3,450	22.1	66.2	95.6	198.6	279.5	500.0	654.6	926.7
3,600	22.1	66.2	103.0	198.6	286.8	522.2	676.7	948.8
3,800	22.1	66.2	103.0	213.3	323.6	544.3	706.1	978.2
4,000	22.1	66.2	110.3	220.7	316.3	566.3	728.1	**992.9**
5,000	14.7	80.9	117.7	257.4	367.8	662.0	831.1	
6,000	14.7	88.3	139.7	294.2	419.2	735.5	**904.7**	
7,000	14.7	95.6	154.5	323.6	470.7	794.3		
8,000		95.6	161.8	353.0	500.1	**831.1**		
9,000		103.0	176.5	382.5	536.9			
10,000		103.0	176.5	397.2	559.0			

- Bold numbers indicate a belt speed of 30 m/sec or greater, so only use if a special design is required.

Design Procedure

Design Procedure

1

Determine the conditions required for design.

ⓐ Machine type

ⓑ Transfer power

For transfer of power, use of the actual load that is applied to the belt is ideal, but generally, the rated load of the motor is used.

ⓒ Rotational speed of the small pulley

ⓓ Rotational speed ratio $\left(\frac{\text{Large pulley diameter}}{\text{Small pulley diameter}}\right)$

ⓔ Tentative distance between shafts

ⓕ Operating environment (low temperature, oil, water, foreign material)
Avoid use in high temperature, acidic, and basic environments.

Design Procedure

2

Determine design power.

● **How to determine design power (Pd)**

$$Pd=Pt \cdot Ko$$

However,
Pt: Transfer power (W)
Ko: Load correction factor ➔ Table 42

Table 42 Load correction factor (Ko)

Operating conditions	Ko
Normal use	1.2
Large load fluctuations	1.4

Design Procedure

3

Determine the large and small pulleys, standard belt, and distance between shafts.

❶ **Determine the large and small pulleys.**

● **How to determine the outer diameter (Do, do) of the large and small pulleys**

$$Do=do\,\frac{nd}{nD}$$

However,
Nd: Small pulley rotational speed (rpm)
nD: Large pulley rotational speed (rpm)

Use a pulley equal to or larger than the minimum pulley diameter for the small pulley.

■Minimum pulley diameter ➔ (Table 43)

Table 43 Minimum pulley diameter

Belt type	Single cog
Minimum pulley diameter (mm)	18

❷ Determine the standard belt.

Using the tentative distance between shafts and large and small pulley outer diameters already determined, determine the outer circumference (Lo') of a suggested belt.

● **How to determine the outer circumference (Lo') of a suggested belt**

$$Lo'=2C'+1.57\,(Do+do)+\frac{(Do-do)^2}{4C'}$$

However,
C': Tentative distance between shafts (mm)
Do: Large pulley outer diameter (mm)
do: Small pulley outer diameter (mm)

Select a standard belt with length closest to the outer circumference of this suggested belt. ➔(Page 13, Table 17)

❸ Determine the accurate distance between shafts.

Using this standard belt outer circumference, determine the accurate distance between shafts (C) using the following equation.

● **How to determine distance between shafts (C)**

$$C=\frac{b+\sqrt{b^2-8\,(Do-do)^2}}{8}$$

$$b=2Lo-\pi\,(Do+do)$$

However,
Do: Large pulley outer diameter (mm)
do: Small pulley outer diameter (mm)
Lo: Standard belt outer circumference (mm)

Design Procedure

4

Determine the number of belts to use.

● **How to determine the number of belts to use (nb)**

$$nb=\frac{Pd}{Ps \cdot K_\theta}$$

However,
Pd: Design power (W)
Ps: Standard transfer capacity (W) ➔ (Page 31, Table 44)
Kθ: Contact angle correction factor ➔ (Page 31, Table 45)

As a basic rule, use only one belt.

Table 44 Standard transmission capacity table (Unit: W)

Small pulley rotational speed (rpm)	Small pulley outer diameter (mm)				
	16	18	20	25	30
1,000	6	8	10	15	20
1,500	8	12	16	22	32
2,000	10	16	20	30	42
3,000	18	24	32	46	62
4,000	22	32	42	62	84
5,000	28	40	52	76	105
6,000	34	46	62	92	126

Table 45 Contact angle correction factor (Kθ)

$\frac{Do-do}{C}$	Small pulley contact angle (θ°)	Correction factor (kθ)
0.00	180	1.00
0.20	169	0.97
0.40	157	0.94
0.60	145	0.91
0.80	133	0.87
1.00	120	0.82
1.20	106	0.77
1.40	91	0.70

Design Procedure

Design Procedure

1 Determine the transfer power required for design.

Plain rope transfer capacity changes with belt tension. Select the belt shape and belt tension with the elongation ratio that will achieve the necessary transfer capacity.

Design Procedure

2 Determine the small pulley diameter.

For the small pulley diameter, use something equal to or larger than the minimum recommended pulley diameter.

Table 46 Starrope minimum pulley diameter

Belt Profile Pulley diameter	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 12	No. 15
Minimum pitch diameter (mm)	15	20	30	40	50	60	70	85	95	120	150
Recommended minimum pitch diameter (mm)	20	30	40	55	70	85	100	120	135	140	180

Table 47 Super Starrope minimum pulley diameter

Belt Profile Pulley diameter	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 12	No. 15
Minimum pitch diameter (mm)	20	30	40	50	60	70	80	90	100	120	150
Recommended minimum pitch diameter (mm)	30	40	55	70	85	100	115	130	140	150	180

Table 48 Prene V rope minimum pulley diameter

Belt Profile Pulley diameter	M	A	B
Minimum pitch diameter (mm)	40	85	100
Recommended minimum pitch diameter (mm)	60	120	130

Table 49 Prene hexagonal rope minimum pulley diameter

Belt Profile Pulley diameter	AA	BB
Minimum pitch diameter (mm)	100	130
Recommended minimum pitch diameter (mm)	135	150

Design Procedure

3 Determine effective tension.

❶ Determine belt speed.

● **How to determine belt speed (V)**

$$V=\frac{dp\cdot nd}{19100}\ (m/sec)$$

However,
dp: Small pulley pitch diameter (mm)
nd: Small pulley rotational speed (rpm)

❷ Determine the contact angle correction factor.

● **How to determine the contact angle correction factor (Kθ)**

Determine the small pulley contact angle (θ°) and then read the correction factor from Table 50.

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

However,
Dp: Large pulley pitch diameter (mm)
dp: Small pulley pitch diameter (mm)
C: Distance between shafts (mm)

❸ Determine effective tension.

● **How to determine effective tension (Te)**

$$Te=\frac{1000\,Pt}{V\cdot K_\theta}\times\frac{1}{1000}\ (N)$$

However,
Pt: Transfer power (W)
V: Belt speed (m/sec)
Kθ: Contact angle correction factor ➡ (Table 50)

Table 50 Contact angle correction factor (Kθ)

Contact angle (°)	180°	175	170	165	160	150	140	130	120	110
Correction factor Kθ	1.00	0.99	0.98	0.97	0.95	0.92	0.89	0.84	0.80	0.78

Design Procedure

4 Select belt shape and elongation ratio.

Select a belt shape and elongation ratio from the allowable tension Ta table (Page 33, Tables 48 to 50) such that Ta > Te.

Table 51 Starrope allowable tension (Ta) (Unit: N)

Belt shape / Elongation ratio	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 12	No. 15
1%	0.39	0.88	1.57	0.25	3.63	4.90	6.37	8.14	9.81	14.4	22.6
2%	0.78	1.77	3.04	4.81	6.96	9.41	12.3	15.6	19.2	27.7	43.3
3%	1.18	2.55	4.51	7.16	10.2	13.9	18.2	23.0	28.4	41.8	64.1
4%	1.47	3.33	5.88	9.22	11.2	18.0	23.6	30.0	36.9	53.2	83.2
5%	1.86	4.12	7.35	12.5	16.6	22.6	29.4	37.5	46.2	66.5	104.0

Table 52 Super Starrope allowable tension (Ta) (Unit: N)

Belt shape / Elongation ratio	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 12	No. 15
1%	0.59	1.37	2.35	3.73	5.49	7.35	9.66	12.3	14.7	21.7	33.8
2%	1.18	2.64	4.66	7.26	10.5	14.1	18.4	23.4	28.8	41.5	65.0
3%	1.77	3.82	6.77	10.8	15.3	20.9	27.4	34.6	42.7	61.5	96.2
4%	2.26	5.08	8.83	13.8	16.8	27.1	35.5	45.0	55.3	79.7	125.0
5%	2.84	6.18	11.1	18.7	24.9	33.8	44.1	56.3	69.3	99.7	156.0

Table 53 Plain V rope allowable tension (Ta) (Unit: N)

Belt shape / Elongation ratio	M	A	B
1%	5.59	10.5	17.5
2%	10.8	20.3	33.6
3%	15.9	30.0	49.7
4%	20.7	38.9	64.4
5%	25.9	48.7	80.6

Table 54 Plain hexagonal rope allowable tension (Ta) (Unit: N)

Belt shape / Elongation ratio	AA	BB
1%	13.5	23.4
2%	26.1	45.2
3%	38.6	67.5
4%	50.2	87.1
5%	62.8	109

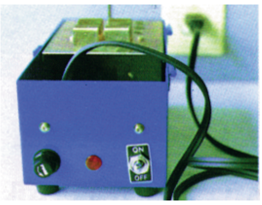
Note) 1. The values shown in the tables above are for use at room temperature.
2. The normal elongation ratio is 3 to 4%; please do not use at 5% or above.
3. When using the tables above, the shaft load is (2.5 x Ta) N.
4. Please set the belt speed to 10 m/sec or less.
5. Please do not store or use in high humidity areas.

Endless Operation Procedure

Prene rope has excellent melting characteristics when heated, so endless processing is simple. Use the Mitsuboshi Starrope Welding Machine "MS-3 Model" for the operations.

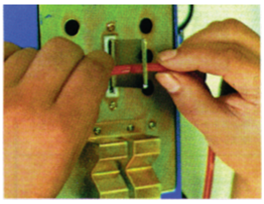
1 Prepare the rope

Cut the rope at the prescribed length such that the cross section is perpendicular to the longitudinal direction of the rope.



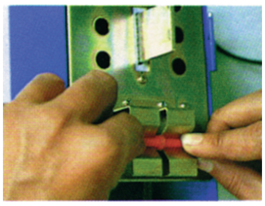
2 Prepare the welding machine

1. Connect the power cord to 100 V AC power.
2. When the warm-up lamp starts flashing, it is ready for use.



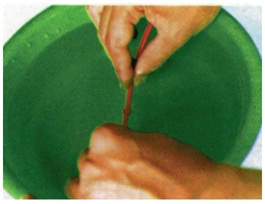
3 Perform the fusing

Lightly push both ends of the rope at right angles to the heated plate and wait for the cross section of the rope to melt.



4 Perform the bonding

After the rope has melted, remove from the heated plate and bond on top of the stand such that both ends of the rope remain straight.



5 Cool using water

After bonding, continue to press together and cool using water.

6 Remove any protruding parts

Remove any protruding parts from the rope bond area using nippers, etc.
Make sure the diameter is not smaller than the original rope diameter.

■Mitsuboshi Starrope Welding Machine (MS-3)
●Specifications
Heater capacity 100 V
Heated plate set temperature 230 ± 10°C
Time to reach set temperature: approximately six minutes

● Precautions for use

The heated plate is hot (approximately 230°C) during use, so be careful not to burn yourself. If a substance that melts and decomposes gets on the heated plate, bond strength will be reduced, so remove the substance by lightly and carefully scraping the heated plate using a wire brush or knife. The heated plate temperature is set to 230 ± 10°C, ● but if the temperature is too high (if bubbles form at the rope bond part), turn the temperature adjustment screw to the left. ● If the temperature is too low (rope does not melt within the standard melt time), turn the temperature adjustment screw to the right.

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