MEGADYNE

MAINTENANCE MANUAL

Synchronous & V-Belts

www.megadynegroup.com

Founded in 1957 in Mathi, Italy, Megadyne is a manufacturer of industrial belting for power transmission, product handling and linear positioning applications. Complementing our line of belting products we also market a line of *"Jason by Megadyne"* industrial and hydraulic hose. Our position in the industry as a global leader is due to our worldwide manufacturing, numerous fabrication and distribution locations and commitment to investment in product and process development.

WARNING: This document is recognized as a Maintenance Manual with its main intent to be product application/installation/trouble-shooting use training. While this is not a selling document, we do recognize some items include chemicals that are on the California Prop 65 list. The chemicals identified within rubber v and timing belts described through this manual include carbon black chemical ingredient within the belt material. Additionally references to metal pulleys could include lead. Both materials are identified in the California Prop 65 list effective August 30, 2018. For more information on CA Prop 65 visit www.P65Warnings.ca.gov. For specific warnings related to the identified chemical refer to the shipping label accompanying receipt of this product. Always wash your hand after handling belts, pulleys and sheaves.

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FOREWORD

The implementation of a preventative maintenance program including proper belt drive installation, tensioning procedures and best practices will increase productivity, reduce downtime and yield the additional benefit of improved workplace safety.

The majority of power transmission drive problems are attributed to improper installation and maintenance. This manual is intended to provide guidance in avoiding drive problems, extending drive life and maximizing performance while maintaining a safe working environment.

NOTE:
The metal components used with v-belt and synchronous belts are commonly referred to as pulleys. Where it's necessary to distinguish between the two, we refer to v-belt pulleys as "sheaves" and synchronous pulleys as "sprockets". Where the information is the same for both the term "pulleys" will be used.

WHY PREVENTIVE MAINTENANCE IS IMPORTANT

When compared to the cost of production downtime and the labor costs associated with a belt failure, the cost of a belt is relatively insignificant. Generally speaking, at any given production facility, 80% of the downtime related to power transmission belts can be found on 20% of the drives in the plant. In other words 80% of the drives are working fine, day in and day out. The remaining 20% are “problem drives” that are a constant headache, requiring frequent attention and replacement.

Additionally, it’s not uncommon for a large industrial facility to spend thousands of dollars annually to determine what type of replacement belt is needed for a particular drive. Worn belts are often difficult to identify as their part numbers sometimes become impossible to read after lengthy service.

LET US TROUBLE-SHOOT YOUR PROBLEM DRIVES

Megadyne is uniquely positioned to partner with you to keep production at a maximum and “problem drives” at a minimum. Megadyne is at your service to offer drive designs to eliminate the problem drives in your facility. We offer one of the widest selections in the industry of power transmission and product handling belts. We can provide a vast array of synchronous and non-synchronous product in rubber or polyurethane. Additionally, we can customize belts for any application imaginable.

Whether you have a low or high temperature application, a need for non-marking compound, electrical conductivity or resistance, silicone-free product, special backings, chemical resistance or ultra-high torque power transmission capability, Megadyne can provide a belt that will improve performance on your application.

Contact your Megadyne sales representative to work with you to trouble-shoot your problem drives.

WARNING: Failure to follow these instructions may result in personal injury or death!

Power transmission products are potentially dangerous. Failing to follow recommended application information and procedures for installation, care, maintenance and storage of products may result in serious bodily injury or death. Make sure that product selected for any application is recommended for that service. Always follow the recommendations of the original equipment manufacturer. Contact Megadyne for specific information.

• Before doing any maintenance work on power drives, **ALWAYS** switch off the power and lock-out the drive. A tag should be attached stating – Danger – **DO NOT OPERATE.**

• One should **ALWAYS** try to operate the equipment after shutdown to make sure you have locked-out the proper switchbox, ensuring that the switchbox is operating properly and also to release any stored energy.

• Use belt guards to provide protection for personnel from contact with drive components. **NEVER** test or operate belt drives without guards in place.

• **ALWAYS** wear gloves to protect from sharp edges and hot surfaces.

• **NEVER** wear loose or bulky clothing in close proximity to an unguarded drive where it could become entangled in the drive and cause injury to personnel.

WARNING: Failure to follow these instructions may result in personal injury or death!

• **ALWAYS** be aware of pinch points where hands and fingers can be injured, especially where the belt enters the sheave or sprocket.

• **ALWAYS** keep the area around the drive free of clutter and debris.

• **NEVER** re-use damaged pulleys. They should be replaced if not repairable.

• **ALWAYS** use static dissipating belts in conjunction with industry approved methods to dissipate electrical charges on drives used in hazardous atmospheres.

• **NEVER** use Megadyne belts for aircraft applications. Megadyne belts are not designed for or intended for use on aircraft propellers, rotors or accessory drives. Do not use on helicopters or private, commercial, ultralight or any other airborne aircraft application.

BELT STORAGE

Proper belt storage is the first step for good performance and long drive life. When belts are improperly stored they can be damaged and reduce performance and product life before they are even installed. Properly stored belts will not undergo significant changes in properties for several years. However, exposure to extreme environmental conditions will have a negative effect. Belts should be stored in dry conditions with protection from light, dirt and dust. Avoid high ozone concentrations, moisture, chemicals, solvents, fuels, lubricants, and acids.

Ensure that belts are stored in a stress-free way without excessive tension, pressure or other deformation as this could result in a permanent deformation or the occurrence of cracks. Belts must not be bent to avoid damage to the internal tensile reinforcements.

BELTS MUST BE STORED:

• In an environment between 40°F & 86 °F (5°C/30°C). Extreme temperatures, in particular higher temperatures can cause damage to the belt due to the deformation of the superficial structure. These effects can lead to reduced performance. Belts could swell and not run straight and smooth. Lower temperatures are also not suggested and cause an undesirable increase in stiffness of the belt.

• Away from equipment generating ozone, such as high voltage electrical machines or fluorescent light sources. Also combustion gases and vapors that can cause ozone should be avoided.

• In a dry place. Storage rooms must be kept free from moisture. The humidity must not exceed a maximum of 50%. Polyurethane and rubber belts have hygroscopic properties and will absorb moisture. This can cause deterioration of the compound and oxidation of steel tensile cord. Storage in excessively high humidity will reduce belt life.

BELTS MUST BE STORED:

• With original packaging intact until the belt is ready to be used. The packaging delivered by Megadyne is designed to provide protection from environmental conditions.

• In a way that protects against light, particularly against direct sunlight and artificial light with a high ultraviolet concentration.

• To ensure they are not crimped or bent in handling or storage. Belt damage occurs when bent to a diameter smaller than the minimum recommended pulley diameter for a particular belt. Use a crescent shaped saddle rather than a peg or hook to lessen the amount of bend when hanging v-belts from walls. Synchronous timing belts should never be hung from a peg. They are best stored laid flat on a shelf.

BEST PRACTICES

INSPECT PULLEYS

A stiff brush can be used to remove rust and dirt. Use a soft cloth to wipe off oil and grease.

For the sprockets used on synchronous timing belt drives the tolerance is normally minus zero, plus a few thousandths of an inch. If you can visually detect or feel any wear, it is worn beyond the tolerance range and should be replaced.

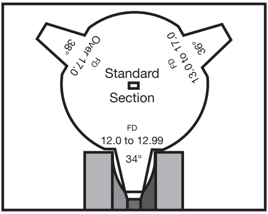
SHEAVE GAUGES/INSPECTION

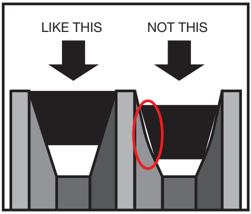
For V-belts select the proper sheave groove gauge and template for the sheave diameter. Insert the gauge in the groove and look for gaps that indicate dishing or other abnormal wear.

• You should not see a gap between the belt sidewall and the sheave sidewall.

• If more than a 1/16” gap is present the sheave should be replaced.

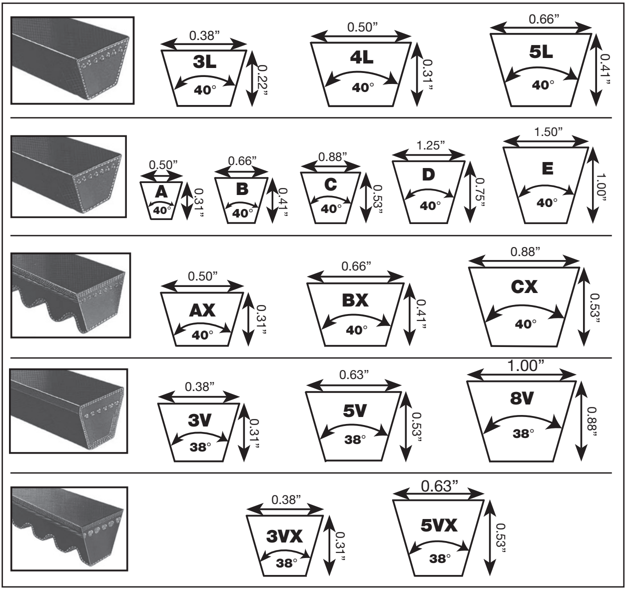
As a general rule, the worn sheave will most likely be the smallest sheave in the drive. This is referred to as the “critical” sheave, the most likely to slip. All life calculations and total drive performance is based on the critical sheave. On a typical speed reduction two sheave drive, the driver (critical) sheave will be replaced many more times than the driven sheave.





IDENTIFY THE CORRECT BELT

V-Belt - Always select the correct cross section of v-belt to match sheave grooves. Use a sheave groove gauge to determine the correct belt cross section. Use a v-belt gauge to verify v-belt cross section and length when markings are no longer legible on the belt back.

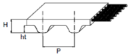


V-Belt Type	Identified By	Part Number Example		Approximate Outside Length
Fractional HP (FHP)	Effective Length	4L500	=	50"
Classical Multi-Plus	Standard Length Designation	A48	=	
Fractional HP	Effective Length	5L500	=	
Classical Multi-Plus	Standard Length Designation	B47	=	
Classical Cogged	Standard Length Designation	AX48	=	
Narrow Deep Wedge/ Cogged	Effective Length	5V500/5VX500	=	

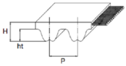
NOTE: Length information values in the above table are approximate. Industry standards require that to accurately measure a belt, it must be installed on a fixture with two pulleys of prescribed dimension and tensioned to a specific value. Accurate values cannot be measured by hand on a free length of belt.

SYNCHRONOUS BELT

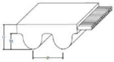
Confirm that belt pitch (distance between the teeth) and belt tooth profile (shape of the belt tooth) are compatible with those of the corresponding sprocket.



Trapezoidal



Parabolic



Curvilinear

Synchronous Belt Identification							
Belt Type / Pitch Code	Service Duty	in or mm	Pitch (P)		Tooth Height (h_t)	Belt Height (H)	Sprocket Compatibility
Trapezoidal							
MXL	mini-extra light	in	0.080		0.020	0.045	standard timing
XL	extra light	in	0.200	1/5	0.050	0.094	standard timing
L	light	in	0.375	3/8	0.075	0.140	standard timing
H	heavy	in	0.500	1/2	0.090	0.173	standard timing
XH	extra heavy	in	0.875	7/8	0.250	0.448	standard timing
XXH	extra extra heavy	in	1.250	1-¼	0.375	0.600	standard timing
Parabolic							
RPP® 3	high torque	mm	3		1.15	2.40	RPP® / HTD®
RPP® 5	high torque	mm	5		2.00	3.80	RPP® / HTD®
RPP® 8	high torque	mm	8		3.20	5.40	RPP® / HTD®
RPP® 14	high torque	mm	14		6.00	9.70	RPP® / HTD®
RPP® Silver2 8M	extra high torque	mm	8		3.20	5.40	RPP® / HTD®
RPP® Silver2 14M	extra high torque	mm	14		6.00	9.70	RPP® / HTD®
RPP® Gold 8M	super high torque	mm	8		3.20	5.40	RPP® / HTD®
RPP® Gold 14M	super high torque	mm	14		6.00	9.70	RPP® / HTD®
RPC Platinum 8M	ultra high torque	mm	8		3.46	5.40	RPP® / HTD® / Poly Chain®
RPC Platinum 14M	ultra high torque	mm	14		6.10	9.70	RPP® / HTD® / Poly Chain®

Synchronous Belt Identification						
Belt Type / Pitch Code	Service Duty	in or mm	Pitch (P)	Tooth Height (h_t)	Belt Height (H)	Sprocket Compatibility
Curvilinear						
HTD®/HTB® 3M	high torque	mm	3	1.22	2.41	HTD®
HTD®/HTB® 5M	high torque	mm	5	2.08	3.81	HTD®
HTD®/HTB® 8M	high torque	mm	8	3.4	6.0	HTD®
HTD®/HTB® 14M	high torque	mm	14	6.0	10.0	HTD®

Dual Sided Synchronous Belt Identification							
Belt Type / Pitch Code	Service Duty	in or mm	Pitch (P)		Tooth Height (h_t)	Belt Height (H)	Sprocket Compatibility
Trapezoidal							
DXL	extra light	in	0.200	1/5	0.050	0.120	standard timing
DL	light	in	0.375	3/8	0.075	0.180	standard timing
DH	heavy	in	0.500	1/2	0.090	0.232	standard timing
Parabolic							
DRPP5	high torque	mm	5		2.00	5.20	RPP® / HTD®
DRPP8	high torque	mm	8		3.20	7.80	RPP® / HTD®
DRPP14	high torque	mm	14		6.0	14.00	RPP® / HTD®
Curvilinear							
HTD®/HTB® 5M	high torque	mm	5		2.08	5.30	HTD®
HTD®/HTB® 8M	high torque	mm	8		3.4	8.10	HTD®
HTD®/HTB® 14M	high torque	mm	14		6.0	14.8	HTD®

Once the correct belts are identified, it is good practice for maintenance personnel to label each drive with the correct belt part number. When replacement belts are required it's as simple as obtaining the part number from the drive label. Additionally, the installation date and installation tension for each drive can be recorded on the label to further enhance your preventive maintenance program.

MATCHING V-BELTS

When using multiple grooved sheaves, be sure that all of the belts are the same brand. Always replace complete sets of v-belts even if only one is worn or damaged.

INSTALLING BELTS

After you correctly install and align the pulleys you can install the belts. Always move the drive unit to create slack so you can easily slip the belts onto the pulleys without force. Never force belts onto a drive with a tool such as a screwdriver or a wedge. Doing so may rupture the fabric cover or break the load-carrying cords inside the belt.

USING THE TENSION TESTER GUAGE

TENSION

Proper tension is essential for maximum belt life and efficiency. Improper belt tension is the leading cause of premature belt failure and increased costs. Under-tensioned belts lead to slippage, overheating, excessive pulley wear, rollover and noise, all of which lead to higher maintenance costs and inefficient power transmission.

Also, over-tensioning belts leads to premature wear of bearings, shafts and pulleys. The result is more frequent replacement of drive components and costly downtime.

USING THE TENSION TESTER GUAGE

1. With the drive stopped and locked out, measure the belt span length of the drive. Set the large rubber O-ring on the body of the tension gauge at the dimension equal to 1/16” for every inch of span length.

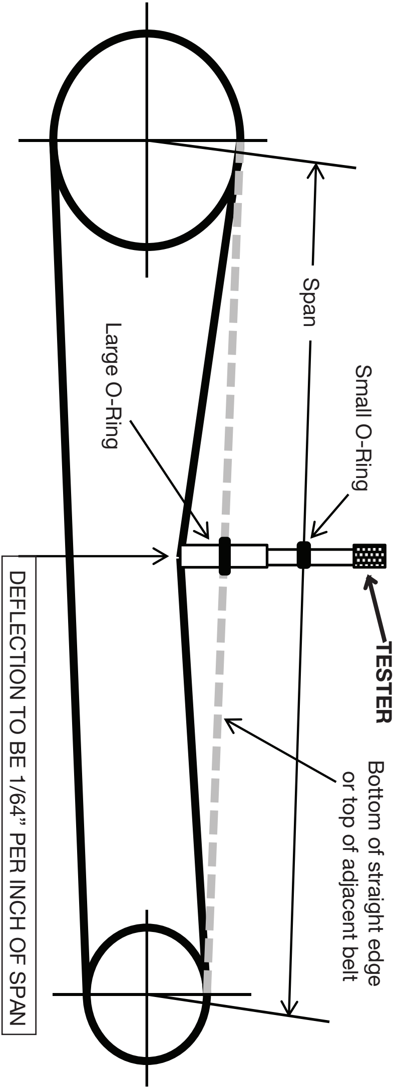
2. Set the O-Ring on the plunger at 0 against the body of the tension gauge.

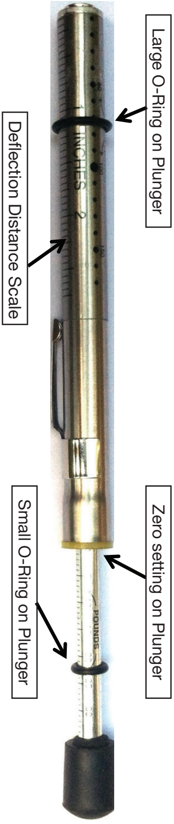
3. With the tension gauge perpendicular to the span, apply a force to the belt in the middle of the span. Deflect the belt until the bottom of the Large O-Ring is even with the top of the next belt or the bottom of a straight edge laid across the span length.

4. For v-belts, run the belts in until they seat and re-tension. Check again after 5-10 minutes. Re-check after 24 hours, then every 100 hours and periodically thereafter is recommended for maximum belt life.

NOTE: Proper tension is the lowest tension at which the belt won’t slip or jump teeth under peak conditions.

USING THE TENSION TESTER GUAGE





BELT INSTALLATION CHECKLIST

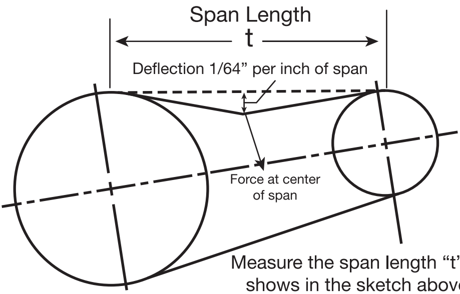
Belt Installation Checklist		
✓	1	*Cut off and lock out power source*
	2	*Observe all other safety procedures*
	3	*Follow recommendations of the manufacturer*
	4	*Remove the belt guard*
	5	*Loosen the motor mounts*
	6	*Shorten center distance*
	7	*Remove old belts*
	8	*Inspect wear patterns for possible troubleshooting*
	9	*Inspect pulleys, shafts, bearings and other components*
	10	*Inspect pulleys for wear and clean them*
	11	*Check pulleys for initial alignment*
	12	*Select proper replacement belt*
	13	*Install new belt*
	14	*Apply tension*
	15	*Re-check pulley alignment*
	16	*Replace belt guard*
	17	*Start drive and observe for noise, vibration, etc.*
	18	*Check drive after 24 hours - re-tension if necessary*

TENSIONING & INSTALLATION: V-BELTS

V-belt tensioning adjustment can be made using a tension tester gauge or other type spring scale, using the following procedure.

After seating the belts in the sheave groove and adjusting center distance so as to take up slack in the belts, further increase the tension until only a slight bow on the slack side is apparent while the drive is operating under load. Stop the drive and use the gauge to measure the necessary force to depress the belt or on multiple belt drives use one of the center belts, and deflect 1/64-inch for every inch of belt span (see sketch below).

For example, a deflection for a 50-inch belt span is 50/64ths, or 25/32-inch. The amount of force required to deflect the belt should compare with the deflection forces noted in the following tables. Also notice for V-belts the deflection forces vary from the initial "run-in" values, which are greater (reflecting higher run-in tensioning) to the "normal" values for after the run-in period.

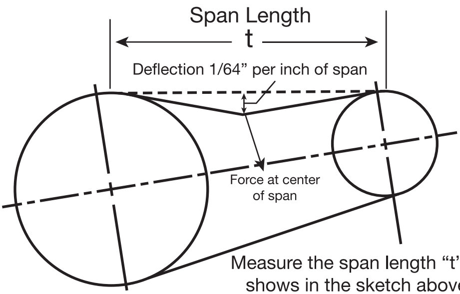


Measure the span length "t" as shows in the sketch above.

TENSIONING & INSTALLATION: V-BELTS

Simplified Tensioning Procedure Multi-Rib Deflection Force Table			
Belt Pitch Cross Section	**Small Sheave Diameter Range (inch)**	**Force "F" Lbs./Rib**	**Weight Kg/m/rib**
J	1.32 – 1.67	0.4	0.008
	1.77 – 2.20	0.5	
	2.36 – 2.95	0.6	
L	2.95 – 3.74	1.7	0.032
	3.94 – 4.92	2.1	
	5.20 – 6.69	2.5	
M	7.09 – 8.82	6.4	0.110
	9.29 – 11.81	7.7	
	12.40 – 15.75	8.8	

For drives with shock loading or other unusual conditions, the tension may have to be increased for proper operation of the drive. If the belt slips, tighten the belt. Utilization of this simplified tension procedure may not result in optimum belt life, due to the static tensions being less accurate than the static tension based on the Horsepower. For exact calculation consult Megadyne Application Engineering or refer to Megadyne Technical Manuals.



Measure the span length "t" as shows in the sketch above.

TENSIONING & INSTALLATION: V-BELTS

Simplified Tensioning Procedure V-Belt Deflection Force Table				
Belt Cross Section	Small Pulley Diameter Range (inch)	Deflection Force		Weight Kg/m
		Run-In (lbs.)	Normal (lbs.)	
A	3.0 – 3.6	3.375	2.25	0.13
	3.8 – 4.8	4.25	2.875	
	5.0 – 7.0	5.125	3.375	
AX	3.0 – 3.6	4.125	2.75	0.12
	3.8 – 4.8	5.0	3.25	
	5.0 – 7.0	6.0	4.0	
B	3.4 – 4.2	4.0	2.625	B = 0.19 *RB = 0.27/rib
	4.4 – 5.2	6.0	4.0	
	5.4 – 9.4	7.125	5.25	
BX	3.4 – 4.2	5.250	3.5	0.19
	4.4 – 5.2	7.125	4.75	
	5.4 – 9.4	9.0	6.0	
C	7.0 – 9.0	11.25	7.50	C = 0.33 *RC = 0.42/rib
	9.5 – 16.0	15.75	10.50	
CX	7.0 – 9.0	13.5	9.0	0.31
	9.5 – 16.0	17.5	11.75	
D	12.0 – 16.0	24.5	16.50	0.64
	18.0 – 22.0	33.0	22.0	
E	21.6 – 27.0	48.0	32.0	0.98
3V	3.4 – 4.2	6.0	4.0	3V = 0.08 *R3V = 0.12/rib
	4.2 – 10.6	7.0	5.0	
3VX	2.2 – 3.65	7.0	5.0	3VX = 0.07 *R3VX = 0.09/rib
	4.12 – 10.6	8.0	6.0	
5V	7.1 – 10.9	16.0	10.0	5V = 0.20 *R5V = 0.30/rib
	11.8 – 16.0	20.0	12.5	
5VX	4.4 – 10.9	18.0	12.0	5VX = 0.18 *R5VX = 0.23/rib
	11.8 – 16.0	22.0	15.0	
8V	12.5 – 17.0	36.0	22.5	8V = 0.59 *R8V = 0.70/rib
	18.0 – 22.4	40.0	25.0	
* RB, RC, R3V, R3VX, R5V, R5VX, R8V = Banded V-Belts				

For drives with shock loading or other unusual conditions, the tension may have to be increased for proper operation of the drive. If the belt slips, tighten the belt. Utilization of this simplified tension procedure may not result in optimum belt life, due to the static tension being less accurate than the static tension based on the Horsepower. For exact calculation consult Megadyne Application Engineering or Megadyne Technical Manuals.

TROUBLESHOOTING V-BELT DRIVES

PROBLEM	Rapid Belt Wear	Cover Wear	Belts turned over in sheave groove	Belt Slippage	Belt Squeal	Hardening & Premature Cracking	Loose Cover & Swell	Broken belts	Excessive Vibration	Incorrect length installed (too long)	Incorrect length installed (too short)	Cut Thru on Top (banded belts)
POSSIBLE CAUSE												
Improper V-Belt installation	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Sheave misalignment	✓	✓							✓			
Worn or damaged sheave grooves	✓	✓	✓	✓	✓	✓			✓			✓
Wrong belt cross section or type	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
Incorrect belt length	✓	✓		✓	✓	✓				✓	✓	
Insufficient take-up	✓	✓		✓	✓	✓				✓	✓	
Sheave diameter too small	✓	✓		✓	✓	✓		✓				
Rubbing belt guard	✓	✓										✓
Overloaded drive	✓	✓		✓	✓	✓		✓				
Belts improperly stored	✓					✓		✓				
Replacing one belt versus all belts	✓	✓		✓	✓	✓		✓	✓			
Broken cords	✓	✓	✓	✓	✓	✓		✓	✓			
Impulse and/or shock loads	✓	✓		✓	✓			✓				
Lack of tension	✓	✓	✓	✓	✓	✓						
Oily drive conditions				✓			✓					
Insufficient arc of contact	✓	✓		✓	✓	✓						
Excessive heat	✓	✓		✓	✓	✓						
Dirty environment	✓	✓										
Foreign material	✓	✓						✓				✓
Uneven tension distribution of multiple v-belts	✓	✓		✓	✓	✓			✓			
Improper drive design	✓	✓		✓	✓	✓		✓	✓			
Excessive tension	✓							✓				✓
CORRECTIVE ACTION												
Check guard clearance	✓	✓										✓
Correct sheave alignment	✓	✓							✓			
Check, replace sheaves	✓	✓	✓	✓	✓	✓			✓			✓
Check dimensions, install proper length	✓	✓	✓	✓	✓	✓			✓	✓	✓	
Re-design drive	✓	✓		✓	✓	✓		✓	✓	✓	✓	
Use larger diameter sheave	✓	✓		✓	✓	✓		✓				
Replace belts (do not pry onto sheaves)	✓	✓	✓	✓	✓	✓		✓	✓			
Reduce load	✓	✓		✓	✓			✓				
Replace complete set with same brand	✓	✓		✓	✓	✓		✓	✓			
Replace complete set with new v-belts	✓	✓		✓	✓	✓		✓	✓			
Increase tension	✓	✓	✓	✓	✓	✓						
Use banded v-belts	✓	✓	✓						✓			
Lubricate properly							✓					
Clean sheaves and belt				✓			✓					
Increase arc of contact on motor sheave	✓	✓		✓	✓	✓						
Provide ventilation	✓	✓		✓	✓	✓						
Heavier belt may be required	✓	✓		✓	✓	✓		✓				
Provide protection (use belt guard)	✓	✓						✓				✓
Install motor soft start	✓	✓		✓	✓	✓		✓				
Reduce tension	✓							✓				✓
Store properly	✓					✓		✓				

ISORAN® SYNCHRONOUS BELTS

SIMPLIFIED TENSIONING FOR ISORAN SYNCHRONOUS BELTS

Use the Belt Deflection Force Calculator graph that follows for calculation of the approximate static tension and deflection force for Megadyne RPP, RPP Silver 2, RPP Gold and RPC Platinum belts.

This simplified method is for determining recommended deflection force. As with all simplified methods, it may not result in optimum belt life. Our application engineers are available to perform the calculation for you if your drive life is critical.

This method is based on prime movers having an overload torque from 150% to 250% of rated torque. For normal torque motors, the tensions can be decreased by 10% (f x 0.9) and for high torque motors the tensions should be increased by 17% (f x1.17). Use rated motor power to determine static tension and deflection force.

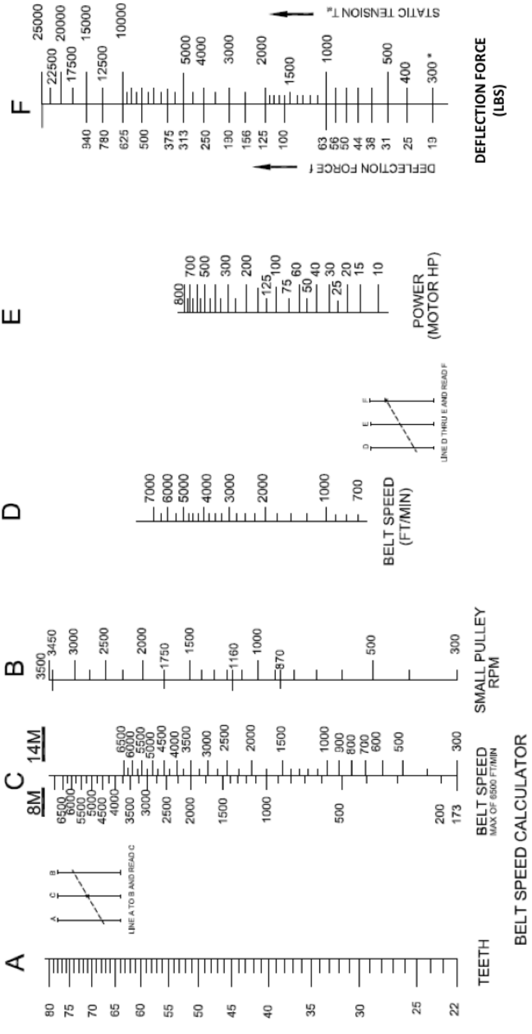
Static tension and deflection force value tolerances calculated by this method are approximately ± 25%.

To make calculations electronically, visit http://megadyne.productselectionpro.com and register to gain access to the Megadyne Product Selection Pro online software. This software will automatically calculate deflection force and distance values in addition to being a useful tool for drive design calculation.

If in doubt, refer to the appropriate Megadyne technical drive design manual or contact Megadyne Application Engineering.

NOTE: Synchronous belts are extremely sensitive to correct tension. Follow the tensioning procedure fully or request that Megadyne perform the calculation.

BELT DEFLECTION
FORCE CALCULATOR



TROUBLESHOOTING

SYNCHRONOUS DRIVES

	PROBLEM	Excessive drive noise	Excessive wear – pulley teeth	Belt over-riding flanges	Apparent belt elongation	Softening of belt surface	Cracks - top surface of the belt	Tensile member rupture	Laceration of the belt	Failure through traction or laceration of teeth	Abnormal wear – on belt side	Abnormal wear – at tooth root	Abnormal wear – tooth bottom	Abnormal wear – tooth side
POSSIBLE CAUSE	Belt excessively taut													✓
	Excessive Overloading	✓	✓					✓						✓
	Incorrect pulley diameter										✓	✓	✓	✓
	Oscillation of axes and/or bearing										✓			
	Flanges Bent										✓			
	Small pulley diameter below minimum									✓				
	Excessive moisture									✓				
	Driver pulley - less than six teeth in mesh								✓	✓				
	Sub-minimum pulley diameters	✓						✓						
	Exposure - excessively low temperature						✓							
	Exposure to oil/ high temperature					✓								
	Reduction of center distance - bearings not fixed				✓									
	Faulty installation or bent flange			✓										
	Belt excessively taut		✓											
	Pulley material insufficiently hard		✓											
	Pulleys misaligned	✓												
	Excessive Installation tension	✓												
CORRECTIVE ACTION	Reduce Center Distance	✓	✓											✓
	Use a wider belt		✓					✓						✓
	Replace pulley after checking diameter										✓	✓	✓	✓
	Correct pulley position + reinforce bearing										✓			
	Straighten Flanges										✓			
	Increase diameter of the pulley									✓				
	Eliminate moisture									✓				
	Driver pulley – increase teeth in mesh to at least 6								✓					
	Increase pulley diameters	✓						✓						
	Eliminate low temperature environment						✓							
	Eliminate high temperature and oil					✓								
	Correct center distance – strengthen bearing axes				✓									
	Correct, replace or repair flanges													
	Harden pulley surface or use harder material	✓												
	Align Pulleys properly	✓												

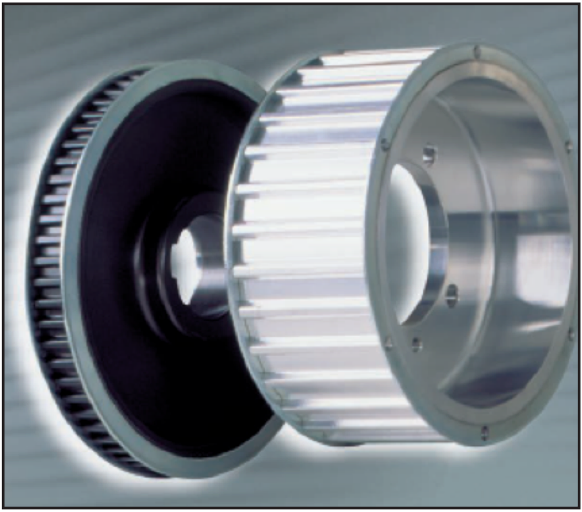
SYNCHRONOUS TIMING BELT SPROCKETS

1. On all two point drives, the minimum flanging requirement is two flanges on one sprocket or one flange on each sprocket on opposite sides.

2. On drives where the center distance is more than eight times the diameter of the small sprocket, both sprockets should be flanged on both sides.

3. On Vertical shaft drives, one sprocket should be flanged on both sides. All other sprockets in the system should be flanged on the bottom only.

4. On drives with more than two sprockets, the minimum flanging requirement is two flanges on every other sprocket or one flange on every sprocket, alternating sides around the system.



IDLER USAGE WITH SYNCHRONOUS DRIVES

Idlers in synchronous belt drives are only recommended when necessary to take up belt slack, apply installation tension, clear obstructions within a system or increase wrap on the smaller pulley. Idlers induce an additional bending force (especially outside idlers) and this accelerates wear. Every pulley in a drive wears on the belt and shortens service life.

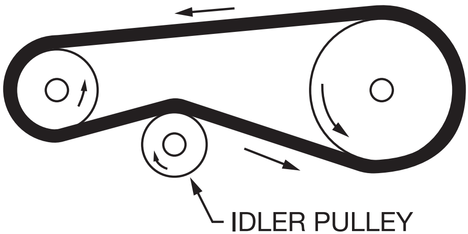
IDLER GUIDELINES:

- The idler diameter should not be smaller than the smallest driven pulley
- Idlers may be placed inside or outside the belt
- Inside placement is recommended as it does not backbend the belt
- Outside idlers must be flat faced (not crowned)
- Inside idlers must be toothed
- Idlers should be capable of being locked down after adjustment
- Backside idlers should be at least 40% larger than the smallest pulley in the drive and located as close to the driver as possible on the slack side of the drive.

INSIDE/OUTSIDE

Inside idlers are generally preferred over backside idlers from a belt fatigue standpoint. Both are commonly used with good success. Inside idlers should be toothed pulleys, but can be flat if the O.D. is equivalent to the pitch diameter of a 40-groove pulley. Backside idlers should be flat and uncrowned.

IDLER USAGE WITH SYNCHRONOUS DRIVES



TIGHT SIDE/SLACK SIDE

Idlers should be placed on the slack (non-load carrying) side, if possible. Their effect on belt fatigue is less on the slack side than on the tight (load-carrying) side. If spring-loaded idlers must be used, they should never be placed on the tight side. Also, note that drive direction reversals cause the tight and slack spans to reverse, potentially placing the idler on the tight side.

IDLER PLACEMENT

Synchronous drives are much less sensitive to idler placement and belt wrap angles than V-belt drives. The designer should make sure that at least 6 belt teeth are in mesh on load-carrying sprockets. For every tooth in mesh less than this (minimum of 2), 20% of the belt torque rating must be subtracted. To minimize potential for belt ratcheting, each loaded pulley in the system should also have a wrap angle of at least 60°. If a loaded sprocket has less than 6 teeth in mesh and 60° of wrap, idlers can be used to improve this condition. Non-loaded idlers have no tooth meshing or wrap angle restrictions.

SPRING-LOADED IDLERS

Using a spring to apply a predetermined force against a tensioning idler to obtain proper belt installation tension is acceptable as long as the idler can be locked down after belt installation.

ALIGNMENT

CHECK ALIGNMENT:

Proper alignment is essential for long belt life. Check belt alignment whenever you maintain or replace belts or whenever you remove or install pulleys.

SYNCHRONOUS BELT

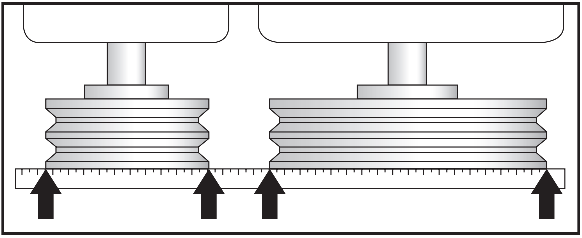
Synchronous belt should not be used where severe misalignment is inherent in the drive. Total misalignment of synchronous belt drives should be less than 1/16” per 12” of center distance.

V-BELT

V-belts are much less sensitive to perfect alignment than synchronous drives. Perfect alignment of sheaves is not critical to the operation of the drive. V-belt misalignment should be less than 1/10” per 12 inches of center distance.

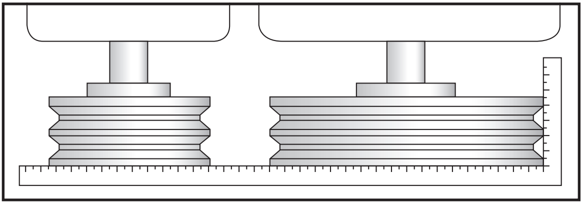
ALIGNMENT PROCEDURE:

Place a straight edge (or string) along the outside face of both pulleys. When properly aligned, the straight edge will contact each pulley evenly. The straight edge should touch the two outer edges of each pulley. Misalignment of pulleys and shafts will show up as a gap between the outside face of the pulley and the straight edge. The straight edge should touch the pulleys at the four points indicated. Ideally, one should always have four points of contact.



PROPER ALIGNMENT:

- Driver and Driven pulleys are parallel, both horizontally and vertically
- Driver and Driven pulleys are in a straight line
- Both pulleys should be mounted as near to the bearings as possible to reduce overhung weight



MISALIGNED PULLEYS:

- Misalignment leads to rapid belt and pulley wear, generates excessive noise and will shorten the life of both belt and pulley.
- Proper alignment in conjunction with adequate tension results in a belt drive that operates at its quietest level.

ALIGNMENT

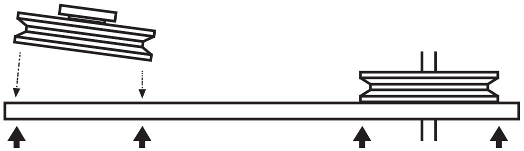
TYPES OF MISALIGNMENT

HORIZONTAL ANGULAR

shafts in same horizontal plane but not parallel

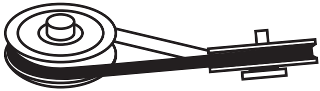
SOLUTION:

Loosen motor mounting bolts and rotate motor until all 4 points touch straightedge as shown in illustration below.



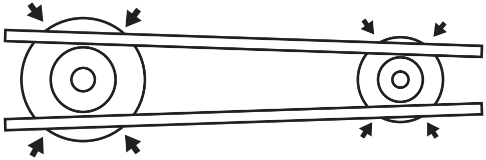
VERTICAL ANGULAR

shafts in same vertical plane but not parallel



SOLUTION:

Place straightedge about 1-1/4” radius from the outside diameter of both sheaves, a straightedge should make contact at the 4 points indicated. Motor base can be shimmed to correct alignment.



TYPES OF MISALIGNMENT

PARALLEL

shafts are parallel but the pulleys are not in the same plane

SOLUTION:

Reposition the pulley so the straightedge makes contact at the 4 points indicated.

MISALIGNED PULLEYS:

V-BELT

A misaligned V-belt drive will be noisier than a properly aligned v-belt drive due to the interference misalignment creates at the point where the belt enters the sheave.

SYNCHRONOUS BELT

It is normal for a synchronous drive to be somewhat louder than a v-belt drive but a misaligned synchronous belt drive will be much noisier than a properly aligned synchronous belt drive due to the even greater amount of interference that is created between the belt teeth and the sprocket grooves.

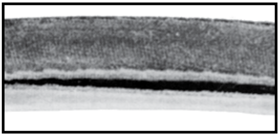
Do not attempt to align a synchronous drive to try to make the synchronous belt ride in the center of the sprocket. Synchronous belts normally operate in light contact with a flange on one side of the sprockets. Attempting to adjust alignment to force the belt to ride in the center of the sprocket may result in misalignment, additional wear and noise.

BELT GUARDS

It is important to use a belt guard to ensure safe and efficient operation of the drive. Periodically check the guard for wear and damage. Look for areas where the belt may make contact with the guard. Clean off any dirt, grease or oil to prevent it from becoming blocked and closed to ventilation.

CHARACTERISTICS OF A PROPERLY DESIGNED GUARD

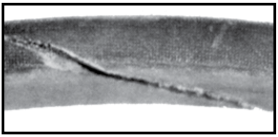
- Should completely enclose the drive
- Has grills or vents for good ventilation, synchronous belt drives do not require ventilation
- Grills and vents must be small enough to prevent debris entry
- Has accessible inspection doors or panels
- Can easily be removed and replaced if damaged
- Protects the drive from weather, debris and damage



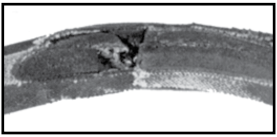
Exposure to Oil & Grease
Cause: Belt swelling, exterior softness and bottom envelope seam to open/split.
Remedy: Splash guards, don't over lubricate, clean belts/sheaves.

Weathering or "Crazing"
Cause: Belt drive elements, as well as aggravation by small sheaves.

Remedy: Check tension, provide drive protection and replace belt(s)



Cut Bottom & Sidewall
Cause: Belt being pried over sheave during installation, as cut above indicates.
Remedy: Use proper length belts and tension properly when installing.

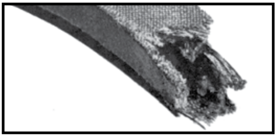


Severe Localized Wear
Cause: Spin burn caused by a frozen or locked drive sheave not able to turn freely.
Remedy: Determine that drive components turn freely and, if necessary, tighten belt.

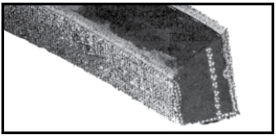
Rough Sheave Sidewalls
Cause: Constant slippage due to belt being misaligned on worn sheaves.

Remedy: Use correct belt size, Align or replace sheaves.

Broken Belt
Cause: Rough sheaves and dust build-up can both cause belt failure and severe envelope wear.
Remedy: Shield the drive

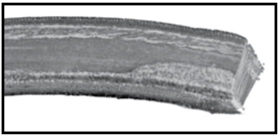


Snub Break
Cause: Cover wear indicates slippage and clean break reveals sudden snap due to non-proper drive tensioning
Remedy: Maintain proper drive tension



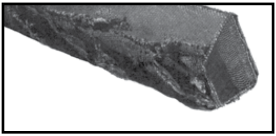
Abrasion
Cause: Sidewall wear a result of foreign material and rust in sheaves. Belt dropped to bottom of sheave groove.
Remedy: Dust guards to prevent abrasion.

FAILED BELT ANALYSIS - V-BELTS

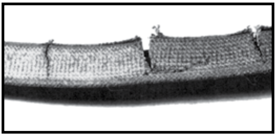


Worn Side Pattern
Cause: Worn or misaligned sheaves.
Remedy: Retension drive to stop slipping, realign sheaves (replace if needed) replace belt if incorrect size.

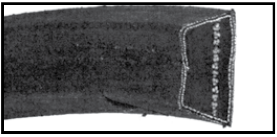
Oil Deterioration
Cause: Rubber softened by excessive oil exposure, causing deterioration.
Remedy: Splash guards to protect drive against oil.



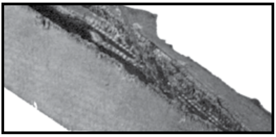
Cover Fabric Rupture
Cause: Fabric cover ruptured during installation due to belt being pried over belt sheave.
Remedy: Proper installation of belts.



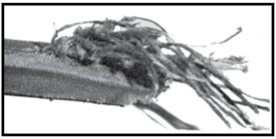
Base Cracking
Cause: Loose tensioning. Belt slippage causes heat build-up and gradual undercord hardening.
Remedy: New belt. Proper tensioning.



Distorted Belt
Cause: Distortion caused by broken cords or adhesion breakdown.
Remedy: Avoid prying on belts. Check sheaves for recommended diameters.



Ply Separation
Cause: Split along pitch line indicating belt ran on too small diameter of sheave.
Remedy: Install a (x) cogged type belt.



Ruptured Belt
Cause: Ruptured cords in the plies, caused by high shock load or foreign object between belt and sheave groove.
Remedy: Check tension, shield drive

Slip Burn
Cause: Belt slipping under starting or stalling load.
Remedy: Replace belt and tighten drives until slipping stops.

SYNCHRONOUS BELTS

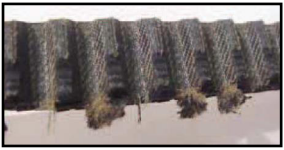
Clean Straight Break

Cause:	*Remedy:*
Mishandling	Avoid improper storage of the belts
Inadequate belt installation tension	Increase tension of the belts
Small pulley diameter	Increase diameter of the pulleys
Debris or foreign object in the drive	Remove debris and check the guard

TIMING BELTS IN RUBBER

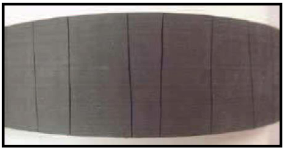
Tooth Separation

Cause:	*Remedy:*
Excessive tensioning	Reduce the tension



Belt Edge Wear

Cause:	*Remedy:*
Pulley misalignment	Check and set the pulleys alignment



Cracking from High Temp

Cause:	*Remedy:*
Excessive temperature	Reduce the temperature or change the compound of the belt

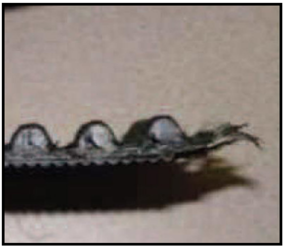
Tooth Root Cracks

Cause:	*Remedy:*
Shock load	Redesign the drive

FAILED BELT ANALYSIS

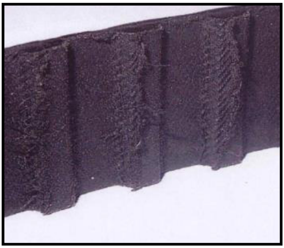
SYNCHRONOUS BELTS

TIMING BELTS IN RUBBER



Laceration of the Teeth

Cause:	*Remedy:*
Shock load	Redesign the drive



Abnormal Abrasion of the Truth

Cause:	*Remedy:*
Belt excessively taut	Reduce the center distance
Excessive overloading	Use a wider belt
Incorrect contour or diameter of pulley	Replace pulley after checking contour or diameter

Abnormal Wear of the Belt at the Tooth Root

Cause:	*Remedy:*
High belt land pressure	Reduce the pretension of the belt

Abnormal Wear of the Belt on the Side of the Tooth

Cause:	*Remedy:*
Low belt installation tension	Increase the tension

ULTIMATE SOLUTION

If all else fails and the information provided here does not resolve your drive issue, Megadyne is ready to assist you with a drive design calculation. The form below will help us create a drive design that can resolve your drive problems. Please fill in the blanks and email a copy to info-us@megadynegroup.com

BELT DRIVE DATA SHEET

Company:

Address:

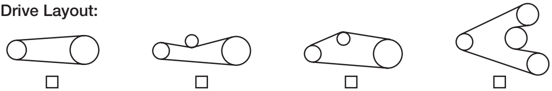
City: State: Zip:

Contact Name:

Telephone: E-Mail:

GENERAL INFORMATION

***Drive Layout:**



***What does the new drive do:**

Model/Project Name: ☐ New Design ☐ Existing Design

If Existing. Current Supplier? ***# of Units per Year?**

MOTOR DATA

Electric Torque: ☐ STD ☐ To 250% ☐ To 400%

Internal Combustion: ☐ =>8 ☐ =6 ☐ =<4 cylinders

***Power (hp)** ***Speed (rpm)**

Existing Pulley: Outside Diameter: # of Teeth: Pitch:

***Shaft Diameter (in.):**

DRIVEN DATA

***Speed (rpm)**

Existing Pulley: Outside Diameter: # of Teeth: Pitch:

***Shaft Diameter (in.):**

***Indicates minimum information required to perform drive calculation.** CONTINUED ON BACK

BELT DRIVE DATA SHEET (CONTINUED)

CENTER DISTANCE

***Desired Center Distance (in.):**

Minimum CD: Maximum CD:

OPERATING CONDITIONS

***Daily Duty Cycle (Select One):**

☐ Intermittent (8 hrs.) ☐ Normal (8-16 hrs.) ☐ Continuous (16+ hrs.)

Operating Temperature (°F): ____________________

☐ Oil ☐ Water ☐ Abrasives

Start-Up:

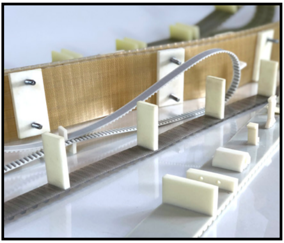
☐ Soft Start ☐ Clutch ☐ No Load ☐ Full Load

ADDITIONAL INFORMATION

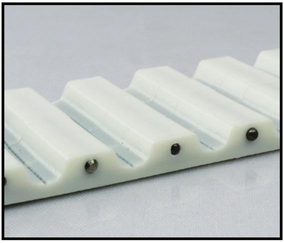
*Indicates minimum information required to perform drive calculation.

ADDITIONAL PRODUCTS

MXV

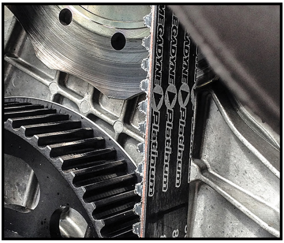


False Tooth

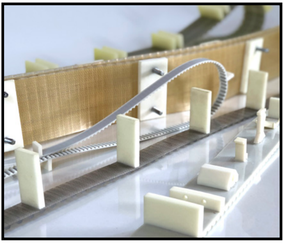


PPJ

Accu-Link



Platinum



Cleats

General Urethane

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