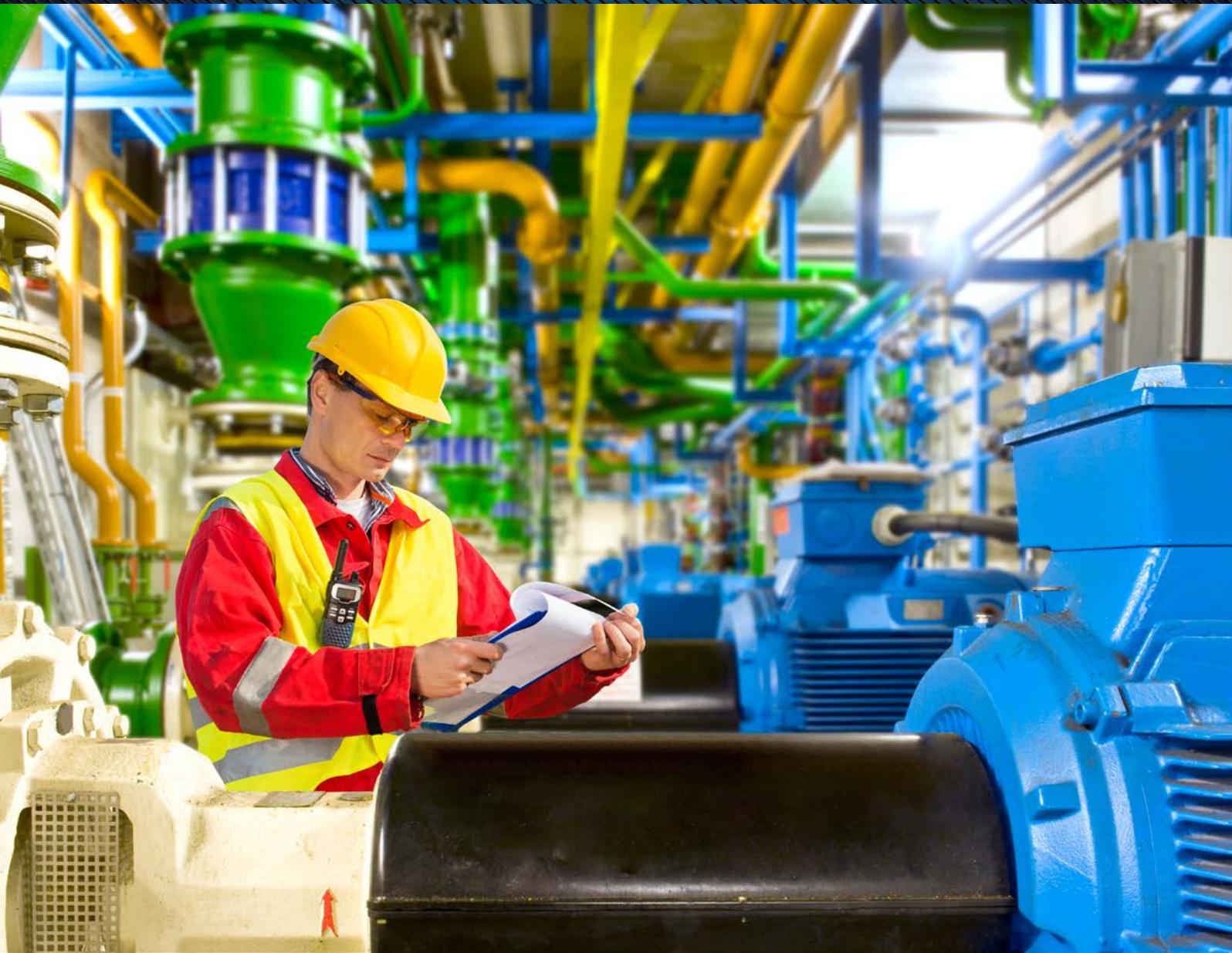




**PREVENTIVE MAINTENANCE  
OF INDUSTRIAL BELT DRIVES**



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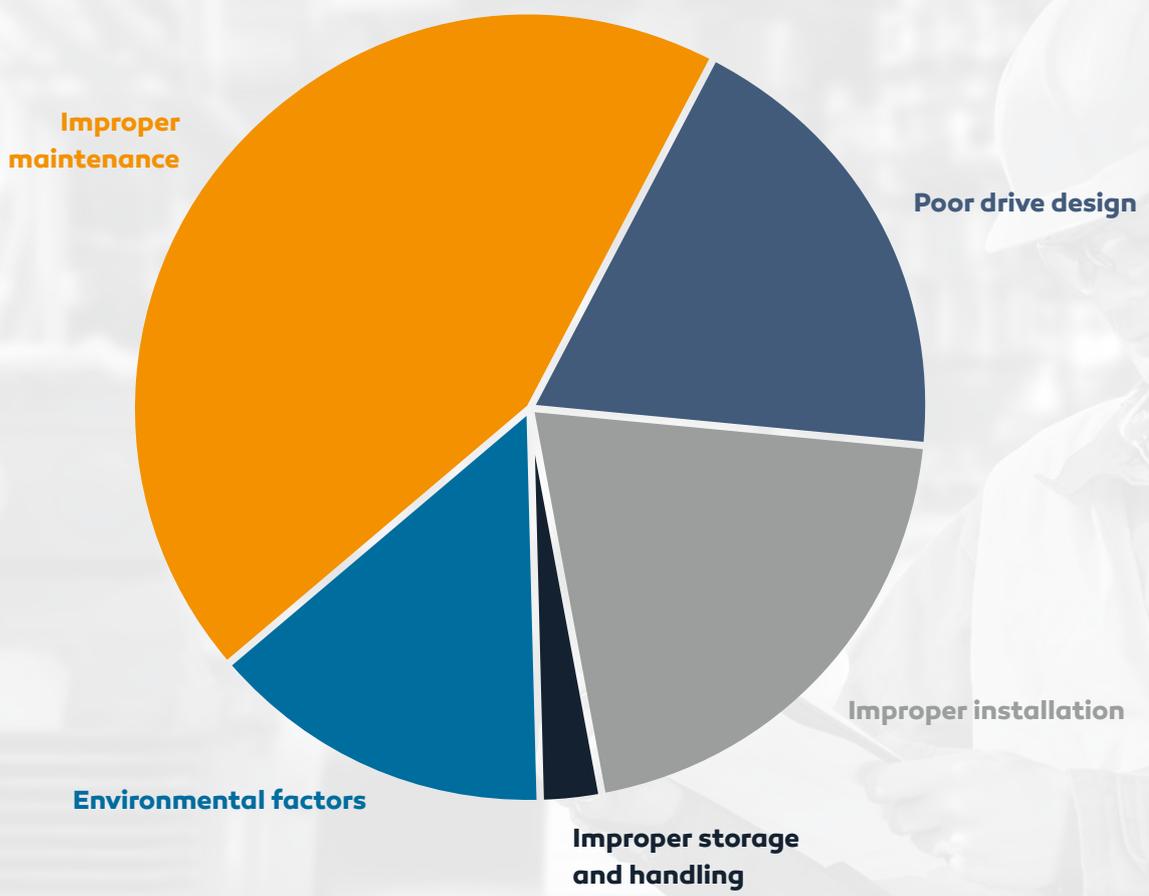
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## WHY PREVENTIVE MAINTENANCE

Maintenance and repair downtime is inevitable, but unintended downtime is expensive. Every single minute of it is directly reflected in your bottom line. Fortunately, when it comes to belt drives, unplanned production standstills can often be prevented by taking the right approaches to inspection, maintenance and replacement.

This manual has been designed as a guide to help you properly install and maintain TEXROPE® industrial belts – reducing costly downtime and improving productivity.



## INVEST IN INSPECTION AND PREVENTIVE MAINTENANCE

The potential for long service life is built into every TEXROPE® belt. When coupled to a good preventive maintenance programme, your belt drives will run trouble-free for a long period of time. Preventive maintenance prevents expensive failure and ensures productivity. That makes it a clever investment.

All aspects of a good preventive maintenance programme will be dealt with in the different sections of this manual. Let's start with some important basics.

### ■ SOURCES OF DRIVE PROBLEMS

**Improper maintenance** is the leading cause of belt drive problems. Too much or too little belt tension, worn pulleys and pulley misalignment are key indicators of poor maintenance. Regular inspection and maintenance to ensure proper alignment, correct tensioning and prompt detection of signs of abnormal wear are needed to keep a belt drive performing as it was designed.

**Poor drive design** accounts for 20% of early belt drive failures. The drive may not have been designed properly by choosing the wrong belt/pulley combination for example. Or changes could have been made that increased the load or the speed of the equipment.

Another major cause that can lead to premature belt drive failure is **improper installation**. Belt drive performance and life span depend on proper belt and pulley installation.

**Improper storage and handling** is an additional cause of belt drive problems. There's a right way and a wrong way to store belts until they are ready for use.

# INTRODUCTION

## ■ BEFORE STARTING MAINTENANCE WORK

Before starting any maintenance work, it is extremely important that all machine components are in a safe (neutral) position to avoid accidental movements during the operations. In addition, safety recommendations of the manufacturer are to be strictly observed.

The following additional precautions add to the safety of belt drive inspection and maintenance:

- ☑ Always have **trained personnel** working on your belt drives.
- ☑ Make sure that the **power** to the drive is completely **off**.  
Inspecting the drive usually also involves watching the machine running – but never touch it before it stops.
- ☑ Wear **proper clothing** and use **personal protective equipment** before working on the machine.
- ☑ Maintain a **safe access to the drives**. Floors should be clean and free of oil and debris to ensure good footing and balance of the operator whilst working on the machine.
- ☑ Every belt drive must be completely **guarded while in operation**. Guards should only be removed for purpose of maintenance or repair.

## ■ WHEN TO INSPECT A BELT DRIVE

Deciding how often to inspect or replace belt drives isn't always easy. Belt wear and service life depend on a variety of factors, including the original drive design, pulley alignment, installation tension, maintenance practices and environmental factors.

A general recommendation is to do a quick visual and listening inspection every 2 weeks for critical drives and once a month for normal drives. A complete shutdown inspection should be completed every 3 to 6 months.



*Look and listen for any unusual vibration or sound while observing the guarded drive in operation.*

## ■ QUICK INSPECTIONS

A good way to begin preventive maintenance is making periodic belt drive inspection a normal part of your maintenance rounds. The aim of these quick inspections is to verify the general condition of the drive and identify any irregularities.

### **Look and listen**

Look and listen for any unusual vibration or sound while observing the guarded drive in operation. A well-designed and maintained drive will operate smoothly and quietly.

### **Guard inspection**

Inspect the guard for looseness or damage. Keep it free of debris and grime build-up. Any accumulation of material on the guard will act as insulation and could cause the drive to run hotter. Temperature is an important factor of belt performance and durability that may seriously reduce belt life. Meshed or grilled guards are therefore preferred because they allow for air circulation and heat escape.

### **Oil and grease**

Also look for oil or grease dripping from the guard. This may indicate over-lubricated bearings. Oil and grease attack rubber compounds, causing them to swell and distort. This will lead to early belt failure.

### **Attachments**

Finally, check motor mounts for proper tightness. Check take-up slots or rails to see that they are clean and lightly lubricated.

### **Did you know?**

- ▶ When a belt drive is excessively noisy, the belt is often incorrectly blamed. With V- or V-ribbed belt drives, it is easy to eliminate the belt as the problem by spraying it with **soapy water** while the drive is running. If the noise goes away or decreases, the belt is part of the problem. If you still hear the same noise, the problem is likely to be due to other drive components.
- ▶ To determine if centre distance variation exists, turn off the drive and tightly tie a **piece of string** from the driveR to the driveN shaft. Start up the drive and note if the string stretches almost to the point of breaking, or goes slack. If either is the case, the problem could be centre distance variation.
- ▶ If no electronic laser alignment device is available, you can use a **long straight edge** to quickly check drive alignment. Simply lay the straight edge across the pulley faces and note the point of contact (or lack of contact). Remember to check whether pulleys are identical before starting.

# INTRODUCTION

## ■ COMPLETE SHUTDOWN INSPECTIONS

Thorough belt drive inspection should also be part of the greater preventive maintenance plan. Even though belt drives don't require the constant lubrication of chain drives or entail the mechanical problems associated with gear drives, optimum belt drive performance depends on regular inspections and proper maintenance actions.

A drive shutdown for a thorough inspection of belts, pulleys and related drive components is required to identify signs of impending failure, and replace components before they fail.

Here's a checklist for performing a safe and efficient shutdown inspection:

### Step 1

Turn off the power to the drive. Lock the control box and tag it with a warning sign "Down for maintenance. Do not turn power on".

### Step 2

Place all machine components in a safe (neutral) position. Any other component that could inadvertently move during the procedure must also be blocked in place to prevent this movement (e.g. fan blades to prevent freewheeling).

### Step 3

Remove and inspect the guard. Check it for signs of wear or rubbing against drive components. Clean the guard to prevent it from becoming insulated and closed to ventilation. Also clean off any grease or oil that may have been spilled onto it from over-lubricated bearings.

### Step 4

Inspect the belt(s) for wear or damage. Mark a point on the belt (or on one of the belts on a multiple drive) and work your way around the belt(s). When rotating drives manually to ensure correct tracking of the belt, use a wrench to turn the pulley to protect fingers from getting trapped between the belt and pulley. Rotation of large synchronous drives by pulling on the belt is particularly hazardous where entrapment of fingers between pulley flanges and the belt can result in immediate amputation of the finger(s).

Use an infra-red thermometer to check the belt(s) for excessive heat. Belts do warm up while operating, but temperatures must not exceed certain limits. Check the temperature range of the belt you are using. If belts are too hot, troubleshooting may be needed or you may need to replace with a belt better suited for the given operating temperature range.

***How to detect and correct problems on the V-belt drive***  
– read more on page 20

***How to detect and correct problems on the synchronous belt drive***  
– read more on page 27

If a belt shows obvious signs of wear or damage, it will need to be replaced.

***How to properly remove and install a V-belt***  
– read more on page 13

***How to properly remove and install a synchronous belt***  
– read more on page 14

## Step 5

If belts have been removed from the drive, inspect the pulleys for wear or damage. Wear is not always obvious. Use TEXROPE® pulley gauges to check V-grooves. For synchronous belt drives, check the pulley diameters over the width of the pulley to ensure they are consistent and meet the tolerances. Always check pulleys for proper alignment and mounting. Misalignment reduces belt drive performance and service life. Correcting misalignment is not always easy, so laser tools such as the TEXROPE® ATX laser alignment device can be very helpful.

***How to quickly detect and correct pulley misalignment***  
– read more on page 11

If a pulley shows obvious signs of wear or damage, it will need to be replaced.

***How to properly install pulleys***  
– read more on page 11

## Step 6

Inspect the other drive components such as bearings, shafts, motor mounts and take-up rails. Always examine bearings for proper alignment and lubrication. Check motor mounts for correct tightness. Be sure take-up rails are free of debris, obstructions, dirt or rust.

## Step 7

Inspect the static conductive earthing system (if used) and replace components as needed.

## Step 8

Always ensure proper belt tension: check the belt tension and adjust as needed. This may seem a difficult task but in fact the opposite is true. There is an easy tool to facilitate tension measurement, TEXROPE® TMC-1 sonic tension meter.

***How to apply the correct belt tension***  
– read more on page 15

## Step 9

In a final step it is necessary to re-check the position and alignment of the pulleys because they may have been moved during the maintenance work.

## Step 10

Re-install the guard.

## Step 11

Turn the power on and re-start the drive. Before you put the drive back into normal operation, have a “test run” to check whether everything functions normally. Make any verifications necessary and take corrective action if needed.

## PROPER BELT DRIVE INSTALLATION IS KEY

Correct installation is crucial to ensure best performance and life span of your belt drives. The best performance and life span of your belt drives can only be obtained when belts and pulleys are correctly selected and installed.

### BELT TYPE SELECTION

#### ■ SELECT THE APPROPRIATE BELT TYPE

The first key decision before installation is to choose the correct belt type for your application. The belt type is an important aspect to take into account, as it allows major cost savings. By entering your drive's parameters in the TEXROPE® TDD Pro™ drive design software, you automatically receive the best price/performance belt drive solution for your particular application.

Several belt types are possible when equipping V-belt drives.

Classical-section belts are ideal for replacing belts in older existing applications.

Narrow-section belts, both wrapped and raw-edge, can be used to decrease space requirements and reduce drive costs.

In terms of power transmission, efficiency and service life, raw-edge belts offer by far the best solution. Their optimally shaped moulded notch profile reduces the bending stress, thereby reducing the heat generated by rapid flexing which is one of the causes of premature belt failure, and provides excellent flexibility for bending around small diameter pulleys. Weight and space can be reduced thus also substantially reducing drive costs. Indeed small diameter pulleys will also host conventional wrapped belts, but create higher efficiency losses with these belts than with the innovative raw-edge equivalent.

In synchronous belt drives, there are two common belt tooth profiles: trapezoidal (imperial pitch) and curvilinear (metric pitch). If you're looking for a high-quality solution in the lower or middle performance range, a trapezoidal-toothed belt is the right choice.

The curvilinear tooth profile is a more advanced design with higher performance capabilities than trapezoidal-toothed belts. With curvilinear-toothed belts, synchronous belt drives are more efficient and economical. The tooth design distributes stress more evenly from the base to the top of the tooth, resulting in the ability to transmit higher torque with less tooth jump. HTD® profile pulleys can host all TEXROPE® curvilinear-toothed synchronous belts.

More information about these and other TEXROPE® belts can be found on page 33 of this manual.

## PULLEY INSTALLATION

### ■ ENSURE CORRECT PULLEY MOUNTING

It is extremely important that pulleys are installed and aligned properly. Any pulley must be correctly assembled, and bolts or setscrews tightened to the correct torque.

Most pulleys are attached to the shaft with a tapered bushing which fits a mating tapered bore in the pulley. This type of system consists of a bushing, a pulley and often a setscrew and key. Bushings come in several diameters. This allows a reduction in the parts inventory required in your plant because one bushing can be used with a number of different size pulleys.

#### **Taper bushes**

To install, insert the bushing into the pulley. Match holes (not threads) and slip the entire unit onto the shaft. Put screws into the holes that are threaded in the pulley only. Align the pulleys and tighten the screws. As the bushing is wedged inward, it contacts and grips the shaft.

For recommended wrench torque values to tighten taper bushes, please consult the taper bush manufacturer's recommendations.

## PULLEY ALIGNMENT

### ■ PROPER ALIGNMENT INCREASES BELT DRIVE PERFORMANCE

Noise, wear on pulleys, belts and bearings, vibrations and in the end ... machine downtime may all be caused by pulley misalignment. Properly aligned pulleys have a lot of advantages:

- ☑ Lower energy consumption
- ☑ Less wear and tear on pulleys, belts and bearings
- ☑ Less noise and vibrations
- ☑ Increased belt, pulley and bearing life
- ☑ Higher reliability of the entire belt drive

Therefore, pulley inspection is a major element of preventive maintenance of belt drives.



*Any pulley must be correctly assembled, and bolts or setscrews tightened to the correct torque.*

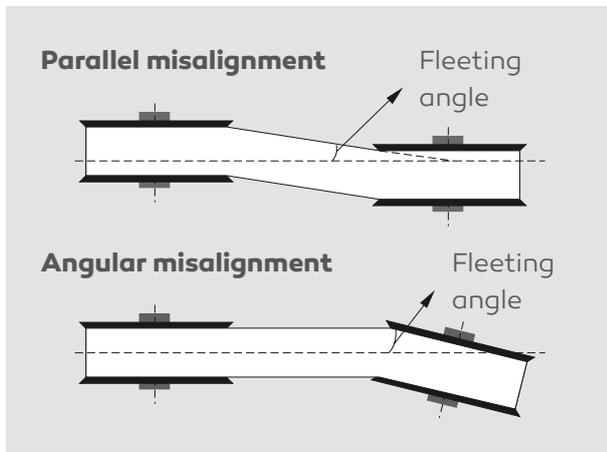
# INSTALLATION

## What causes pulley misalignment

The main causes of misalignment are:

- ▶ The motor shafts and driven machine shafts are not parallel (angular misalignment)
- ▶ The shafts are parallel, but the pulleys are improperly located on the shafts and lie in different planes (parallel misalignment)
- ▶ The pulleys are tilted due to improper mounting

Basically, any degree of misalignment will reduce the performance and service life of your belt drive. If a new belt is installed without correcting the misalignment, then failure begins all over again causing comebacks.



## Alignment tolerances

As a general rule, the deviation on pulley alignment on V-belt drives should not exceed  $1/2^\circ$  or 5 mm per 500 mm of drive centre distance. Alignment for V-ribbed and synchronous belts should be controlled within  $1/4^\circ$  or 2.5 mm per 500 mm of drive centre distance.

Maximum deviation of pulley alignment	Per 500 mm of drive centre distance	
	(°)	(mm)
V-belts	1/2	5
V-ribbed belts	1/4	2.5
Synchronous belts	1/4	2.5

## How to quickly detect and correct pulley misalignment

Correcting misalignment is not always easy, so laser tools such as the TEXROPE® ATX laser alignment device can be very helpful. This instrument identifies both parallel and angular misalignment. You can attach it in no time: after removing the magnetic plate, it magnetically attaches to the inner or outer face of the pulley. The two magnet targets are to be mounted on the other pulley. Once activated, the laser light beam projected on the target pulley spreads an optical light path which allows you to determine and correct misalignment. Once the line lies in the slots of the targets, the pulleys are in the right position.

! More information about this tool can be found on page 49 of this manual.

## V-BELT INSTALLATION

### ■ PROPER INSTALLATION CAN PROLONG THE LIFE OF V-BELTS

V-belt drives run longer and perform better if they are given the proper care and attention during installation, and in particular, during the following 24-hour running-in period. This is a most critical time for V-belts.

The best practices provided here give you a standardised procedure for correctly installing a V-belt. This procedure provides general guidelines and is intended to support any technical literature that may have been supplied by the equipment manufacturer.

#### Step 1

After the power has been turned off, isolated (i.e. locked) and the guard removed, loosen the motor mounting bolts. Move the motor until the belt is slack and it can be removed without prising. Never prise off a belt!

#### Step 2

Remove the old belts. Check them for unusual wear (see also page 20). Excessive wear may indicate problems with the drive design or maintenance procedures.

#### Step 3

Select the correct replacement belt (see also page 10).

#### Step 4

You can clean belts and pulleys with a rag slightly dampened with a light, non-volatile solvent. Avoid soaking or brushing the solvent on the belt. Do not sand or scrape the belt with a sharp object to remove grease or debris. Belts must be dry before using on a drive.

#### Step 5

Inspect the pulleys for wear and damage. TEXROPE® pulley gauges make it easy to see if grooves are worn (see also page 50). If more than 0.4 mm of wear can be seen, the pulley should be replaced. Make sure the pulleys are properly aligned (see also page 12).

#### Step 6

Inspect the other drive components such as bearings and shafts for alignment, wear, lubrication,...

#### Step 7

Install the new belt or belt set. Replace all belts on multiple belt drives. Do not mix old and new belts. Older belts do not retain tension as well as new belts. If you mix belts, the load may be carried only by the new belts. This can result in premature failure. Also, never mix belts from different manufacturers. Belts with different origins may have different characteristics that can cause the belts to work against each other, resulting in unusual strain and short service life.

#### Step 8

Take up the centre distance on the drive, rotate the drive for a few revolutions until proper tension is obtained on the tension tester (see also page 15). Some long belts may appear to hang unevenly when installed. It is normal for belts within match tolerances to create noticeable differences in deflection. This “catenary effect” is a curve made by a cord of uniform weight suspended between two points. This appearance will change with proper run-in and tensioning.

#### Step 9

Secure the motor mounting bolts to the correct torque.

# INSTALLATION

## Step 10

Replace the guard.

## Step 11

Let the belts run in for a while. This process consists of starting the drive, letting it run under full load, and then stopping, checking and re-tensioning to recommended values. Running the belts under full load allows them to seat themselves in the grooves. If possible, let the drive run for about 24 hours. Even letting them run overnight, or over a lunch break, is better than nothing. This run-in period will reduce the future need for re-tensioning.

## Step 12

During start-up, look and listen for unusual noise or vibration. It is a good idea to shut down the machine and check the bearings and motor. Use an infra-red thermometer to measure their temperature. If they are hot, the belt tension may be too high. Or the bearing may be misaligned or improperly lubricated.

## SYNCHRONOUS BELT INSTALLATION

### ■ GOOD TECHNIQUES TO INSTALL SYNCHRONOUS BELTS

Synchronous belt drives provide many maintenance advantages that help in your daily struggle to reduce equipment repairs and hold downtime to the lowest possible level if they are given the proper care and attention during installation.

The best practices provided here give you a standardised procedure for correctly installing a synchronous belt. This procedure provides general guidelines and is intended to support any technical literature that may have been supplied by the equipment manufacturer.

#### Step 1

After the power has been turned off, isolated (i.e. locked) and the guard removed, loosen the motor mounting bolts. Move the motor until the belt is slack and it can be removed without prising. Never prise off a belt!

#### Step 2

Remove the old belt and check it for unusual wear (see also page 27). Excessive wear may indicate problems with the drive design or maintenance procedures.

#### Step 3

Select the correct replacement belt (see also page 10).

#### Step 4

Pulleys can be cleaned with a rag slightly dampened with a light, non-volatile solvent. Do not sand or scrape the pulley with a sharp object to remove grease or debris. Pulleys must be dry before using on a drive.

## Step 5

Inspect the pulleys for unusual or excessive wear. Make sure the pulleys are properly aligned (see also page 12).

## Step 6

Check the other drive components such as bearings and shafts for alignment, wear, lubrication,...

## Step 7

Install the new belt over the pulleys. Do not prise or use force.

## Step 8

Take up the centre distance on the drive until proper tension is obtained on the tension tester (see also page 15). Rotate the drive for a few revolutions and re-check the tension.

## Step 9

Secure the motor mounting bolts to the correct torque. Make sure all drive components are secure since any change in drive centres during operation will result in poor belt performance.

## Step 10

Although belts will not require further tensioning, we recommend starting up the drive and observing performance. Look and listen for any unusual noise or vibration. It is a good idea to shut down the machine and check the bearings and the motor. Use an infra-red thermometer to measure their temperature. If they are hot, the belt tension may be too high. Or the bearings may be misaligned or improperly lubricated.

## BELT TENSION

### ■ TAKE THE RIGHT STEPS TO ENSURE PROPER TENSION

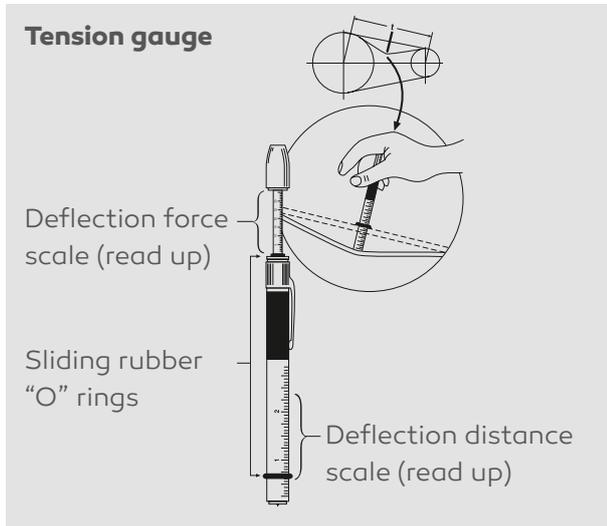
Improper belt tension, either too low or too high, can cause belt drive problems. If V-belts are under-tensioned, they can slip. Slippage generates heat and will result in cracking and belt failure. If synchronous belts are under-tensioned, they can jump teeth resulting in loss of synchronisation. For both types of belts, a tension that is set too high will shorten belt life due to overstretching of the tensile member. Therefore, the correct tension of a belt in a drive – whether it's a V-belt or a synchronous belt – is crucial.

#### How to apply the correct belt tension

Checking and adjusting the correct belt tension may seem a difficult task. But in fact the opposite is true. There is an easy tool to facilitate tension measurement, TEXROPE® TMC-1 sonic tension meter. This fully electronic measuring device provides a practical and accurate method to check belt tension. Simply hold the meter next to the belt span and strum the belt to make it vibrate. Belts, like strings, vibrate under tension at a particular natural frequency based on mass, tension and span length. When you press the button, the meter will analyse the sound waves from the belt through the sensor, process the input signals and display the tension measurement digitally, providing a fast and precise reading every single time. Belt pre-tension data can be determined by using the TEXROPE® TDD Pro™ drive design software.

! More information about this tool can be found on page 49 of this manual.

# INSTALLATION



You can also apply the force deflection method. This method is not as accurate as using an electronic device, but it is a good way to check tension and prevent belt drive problems. The conventional TEXROPE® tension gauge used for the force deflection method consists of a calibrated spring with two scales: one to measure the deflection and another to measure the applied force. The general procedure is as follows:

- ☑ Measure the span length in millimetre. The span length is the distance from where the belt exits one pulley to where it enters the next pulley.
- ☑ The calculated deflection should be positioned with the lower ring on the deflection distance scale. The upper ring should be on the zero position of the deflection force scale.
- ☑ Put the tension gauge perpendicular to the span and in the middle of the span. Exercise enough pressure to the gauge to deflect the belt by the amount indicated by the lower ring. A straight edge, laid across the pulleys, can help accuracy of reading.

- ☑ The upper ring will slide up the upper scale and indicates the deflection force. Read just underneath the ring. Remember to slide the ring downwards before using the gauge again.
- ☑ Belt pre-tension data can be determined by using the TEXROPE® TDD Pro™ drive design software. If installation tension values for a specific V-belt drive are not available, the table on page 17 can be used to determine generic tension values based on the V-belt cross section. As synchronous belt drives are more sensitive to proper belt tensioning, there are no similar quick reference tension tables for them.
- ☑ Compare the deflection force with the range of forces recommended. If less than the minimum recommended deflection force, the belts should be tightened. If more than the maximum recommended deflection force, the belts should be loosened.

In tensioning a TEXROPE® multiple V-belt, multiply the deflection force (shown in the table) by the number of belts in the multiple V-belt. The tension gauge can be applied as indicated above to deflect the entire multiple V-belt, providing a small board or metal plate is placed on top of the band so that “all belts” are deflected uniformly.

! More information about this tool can be found on page 49 of this manual.

# INSTALLATION

Belt section	Small pulley diameter (mm)	Recommended deflection force* (N)	
		min.	max.
<b>Wrapped classical-section V-belts</b>			
Z	60 - 67	6	8
	71 - 80	7	9
	85 - 100	8	11
	106 - 140	9	12
	150 - 224	10	14
A	60 - 80	7	12
	85 - 90	9	13
	95 - 106	10	15
	112 - 180	13	20
B	80 - 106	11	17
	112 - 118	14	20
	125 - 140	15	23
	150 - 170	19	27
	180 - 1250	22	33
C	150 - 170	21	33
	180	24	35
	190	26	38
	200 - 212	30	45
	224 - 265	33	50
	280 - 400	38	58
D	300 - 335	51	73
	355 - 400	56	82
	425 - 560	65	99
<b>Wrapped narrow-section V-belts</b>			
SPZ/3V/9J	56 - 67	7	10
	71	8	11
	75 - 80	9	13
	85 - 95	10	15
	100 - 125	12	17
	132 - 180	13	19
SPA	80 - 95	12	16
	100 - 125	14	21
	132 - 200	19	28
	212 - 250	20	30
SPB/5V/15J	112 - 150	23	36
	160 - 200	29	44
	212 - 280	36	50
	300 - 400	38	58
SPC	180 - 236	40	60
	250 - 355	51	75
	375 - 530	60	90
8V/25J	317 - 431	76	113
	457 - 610	88	133

Belt section	Small pulley diameter (mm)	Recommended deflection force* (N)	
		min.	max.
<b>Raw-edge V-belts</b>			
XPZ/3VX	56	7	11
	60 - 63	8	13
	67 - 71	9	14
	75 - 80	10	15
	85 - 95	11	16
	100 - 125	13	19
XPA	132 - 180	16	24
	80 - 125	18	27
	132 - 200	22	31
XPB/5VX	112 - 118	24	36
	125 - 140	27	41
	150 - 170	30	47
	180 - 200	36	53
	212 - 280	38	55
	300 - 400	41	64
XPC	180 - 236	50	75
	250 - 355	65	95
	375 - 530	80	110

\* This recommendation is for uncritical drive configurations; for critical drives individual design calculations are required.

## DIAGNOSING AND RESOLVING BELT DRIVE PROBLEMS

Belts, like any other mechanical component, don't last forever. When a belt has reached the end of its service life, it can fracture or break, indicating that it can no longer perform the function it was designed to do in the drive system.

This type of failure can also occur for other reasons. The drive could be under-designed, subject to extreme shock loads or contaminated by debris.

Time is the key differentiator. If the belt fails in this manner after years of service, consider it "normal" failure. If it is failing more often than expected, the cause is abnormal wear. In that case, corrective actions need to be taken.



### POOR BELT DRIVE PERFORMANCE

#### ■ HOW TO DETECT A POORLY PERFORMING BELT DRIVE

A poorly performing belt drive is costly to the end-user. It may slow the production cycle due to hours of additional maintenance time, or the service life may be below the expected level. The equipment may operate inefficiently, consuming too much energy and raising energy costs. Poorly performing drives will raise the end-user's operational costs.

Signs of a poorly performing drive are:

- ▶ Premature failure
- ▶ Higher than usual maintenance
- ▶ Frequent replacement
- ▶ Noise
- ▶ Vibration
- ▶ High temperature

Potential problems that can cause loss of performance in belt drives include e.g. pulley misalignment, worn pulleys and improper belt tensioning. If belt drives are properly maintained but still perform below the expected level, the drive may not be properly designed. It may have been improperly sized for the application. Or the application may have changed over time, placing requirements such as higher speed or throughput on the equipment not intended in the original design. Whatever the cause, the solution is to re-assess and optimise the drive.

## Improving drive performance

Simple improvements made at minimal costs can improve belt drive performance. Here are some examples:

- ☑ Increase the pulley diameters
- ☑ Increase the number of belts, or use a wider belt
- ☑ Add vibration dampening to the system
- ☑ Improve the guard ventilation to reduce operating temperature
- ☑ Make sure pulley and back idler diameters are above the minimum recommended diameters
- ☑ Use premium belts rather than general purpose types
- ☑ Replace worn pulleys
- ☑ Keep pulleys properly aligned
- ☑ Always place an idler on the span with the lowest tension
- ☑ Re-tension newly installed friction belts after a 4-24 hour run-in period
- ☑ Review proper belt installation and maintenance procedures

## Designing a new, better-performing drive

If further improvement is needed, it's time to re-design the drive. TEXROPE® TDD Pro™ software can help you to design your belt drive. Engineering assistance with belt drive systems is also available from TEXROPE®. We are keen to work with you during an onsite plant survey to find specific options for improving productivity, reducing downtime and discovering cost and energy saving potential at your machine park.

! More information about this software and engineering assistance can be found on pages 50 and 51 of this manual.

# PROBLEM DIAGNOSIS

## V-BELT DRIVE TROUBLESHOOTING

### ■ HOW TO INSPECT AND DIAGNOSE A FAULTY V-BELT DRIVE

It pays to inspect V-belt drives on a regular basis. Inspecting and replacing V-belts before they fail will reduce costly downtime and production delays.

#### What to look for

If you are replacing V-belts, take time to examine the old belts, pulleys and related drive components. They provide all the clues you need to determine whether your drive is functioning properly. Use below information to pinpoint the cause of the problem and take the needed corrective measures. You will be rewarded with better-performing, longer-lasting drives.

#### Premature belt failure

BROKEN BELT(S)	
PROBLEM	SOLUTION
1. Under-designed drive	1. Re-design drive using TEXROPE® TDD Pro™ software
2. Belt rolled or prised onto pulley	2. Use drive take-up when installing
3. Object falling into drive	3. Provide adequate guard or drive protection
4. Severe shock load	4. Re-design to accommodate shock load using TEXROPE® TDD Pro™ software

BELT FAILS TO CARRY LOAD (SLIP); NO VISIBLE REASON	
PROBLEM	SOLUTION
1. Under-designed drive	1. Re-design drive using TEXROPE® TDD Pro™ software
2. Damaged tensile member	2. Follow correct installation procedure
3. Worn pulley grooves	3. Check for groove wear, replace as needed
4. Centre distance movement	4. Check drive for centre distance movement during operation

EDGE CORD FAILURE	
PROBLEM	SOLUTION
1. Pulley misalignment	1. Check and correct alignment
2. Damaged tensile member	2. Follow installation procedure

BELT DELAMINATION OR UNDERCORD SEPARATION	
PROBLEM	SOLUTION
1. Pulleys too small	1. Check drive design, replace with larger pulleys
2. Back idler too small	2. Increase back idler to acceptable diameter

# PROBLEM DIAGNOSIS

## Severe or abnormal belt wear

WEAR ON BELT TOP SURFACE	
PROBLEM	SOLUTION
1. Rubbing against guard	1. Replace or repair guard
2. Idler malfunction	2. Replace idler

WEAR ON BELT TOP CORNER	
PROBLEM	SOLUTION
1. Belt-to-pulley fit incorrect (belt too small for groove)	1. Use correct belt-to-pulley combination

WEAR ON BELT SIDEWALLS	
PROBLEM	SOLUTION
1. Belt slip	1. Re-tension
2. Pulley misalignment	2. Check and correct alignment
3. Worn pulleys	3. Replace pulleys
4. Incorrect belt	4. Replace with correct belt size

WEAR ON BELT BOTTOM CORNERS	
PROBLEM	SOLUTION
1. Belt-to-pulley fit incorrect	1. Use correct belt-to-pulley combination
2. Worn pulleys	2. Replace pulleys

WEAR ON BELT BOTTOM SURFACE	
PROBLEM	SOLUTION
1. Belt bottoming on pulley groove	1. Use correct belt/pulley match
2. Worn pulleys	2. Replace pulleys
3. Debris in pulleys	3. Clean pulleys

UNDERCORD CRACKING	
PROBLEM	SOLUTION
1. Pulley diameter too small	1. Use larger diameter pulleys
2. Belt slip	2. Re-tension
3. Back idler too small	3. Use larger diameter back idler
4. Improper storage	4. Do not coil belt too tightly, kink or bend; avoid heat and direct sunlight

# PROBLEM DIAGNOSIS

## BURN OR HARDENING ON BELT BOTTOM SURFACE OR SIDEWALLS

PROBLEM	SOLUTION
1. Belt slip	1. Re-tension
2. Worn pulleys	2. Replace pulleys
3. Under-designed drive	3. Re-design drive using TEXROPE® TDD Pro™ software
4. Shaft movement	4. Check drive for centre distance movement during operation

## EXTENSIVE HARDENING OF BELT EXTERIOR

PROBLEM	SOLUTION
1. Hot drive environment	1. Improve ventilation to drive

## BELT SURFACE FLAKING, STICKY OR SWOLLEN

PROBLEM	SOLUTION
1. Oil or chemical contamination	1. Do not use belt dressing; eliminate sources of oil, grease or chemical contamination

### Belt turns over or comes off the drive

#### INVOLVES SINGLE OR MULTIPLE BELTS

PROBLEM	SOLUTION
1. Shock loading or vibration	1. Check drive design; use TEXROPE® multiple belts
2. Debris in pulleys	2. Clean pulleys and shield drive
3. Pulley misalignment	3. Check and correct alignment
4. Worn pulley grooves	4. Replace pulleys
5. Damaged tensile member	5. Use correct installation and belt storage procedure
6. Incorrectly placed flat idler pulley	6. Carefully place flat idler on slack side of drive as close as possible to driveR pulleys
7. Mismatched belt set	7. Replace with new set of matched belts; do not mix old and new belts
8. Poor drive design	8. Check for centre distance stability and vibration dampening; re-design using TEXROPE® TDD Pro™ software

### Belt stretches beyond available take-up

#### MULTIPLE BELTS STRETCH UNEQUALLY

PROBLEM	SOLUTION
1. Misaligned drive	1. Re-align and re-tension drive
2. Debris in pulleys	2. Clean pulleys
3. Broken tensile member	3. Replace all belts; install properly
4. Mismatched belt set	4. Install matched belt set

## SINGLE BELTS STRETCH EVENLY

PROBLEM	SOLUTION
1. Insufficient take-up allowance	1. Check take-up and use allowance specified by manufacturer
2. Grossly overloaded or under-designed drive	2. Re-design drive using TEXROPE® TDD Pro™ software
3. Broken tensile member	3. Replace belt; install properly

### Belt noise

#### SQUEALING OR CHIRPING NOISE

PROBLEM	SOLUTION
1. Belt slip	1. Re-tension
2. Contamination	2. Clean belt and pulleys

#### SLAPPING NOISE

PROBLEM	SOLUTION
1. Loose belts	1. Re-tension
2. Mismatched set	2. Install matched belt set
3. Pulley misalignment	3. Check and correct alignment so all belts share load equally

#### RUBBING SOUND

PROBLEM	SOLUTION
1. Guard interference	1. Repair, replace or re-design guard

#### GRINDING SOUND

PROBLEM	SOLUTION
1. Damaged bearings	1. Replace, align and lubricate

#### UNUSUALLY LOUD DRIVE

PROBLEM	SOLUTION
1. Incorrect belt	1. Use correct belt size; use correct belt tooth profile for pulleys on synchronous drive
2. Worn pulleys	2. Replace pulleys
3. Debris in pulleys	3. Clean pulleys, improve shielding, remove rust, paint or dirt from grooves; replace when damaged

# PROBLEM DIAGNOSIS

## Unusual vibration

BELTS FLAPPING	
PROBLEM	SOLUTION
1. Belts under-tensioned	1. Re-tension
2. Mismatched belts	2. Install new matched set
3. Pulley misalignment	3. Check and correct alignment

EXCESSIVE VIBRATION IN DRIVE SYSTEM	
PROBLEM	SOLUTION
1. Incorrect belt	1. Use correct belt section in pulley
2. Poor machine or equipment design	2. Check structure and brackets for adequate strength
3. Pulley out of round	3. Replace pulley
4. Loose drive components	4. Check machine components and guards, motor mounts, motor pads, bushings, brackets and framework for stability, adequate strength, proper maintenance and proper installation

## Problems with joined belts

TIE BAND SEPARATION	
PROBLEM	SOLUTION
1. Worn pulleys	1. Replace pulleys
2. Improper groove spacing	2. Use standard groove pulleys

TOP OF TIE BAND FRAYED, WORN OR DAMAGED	
PROBLEM	SOLUTION
1. Interference with guard	1. Check guard
2. Malfunctioning or damaged back idler	2. Repair or replace back idler

JOINED BELT COMES OFF THE DRIVE	
PROBLEM	SOLUTION
1. Debris in pulleys	1. Clean grooves; use single belts to prevent debris from being trapped in grooves

ONE OR MORE 'RIBS' RUN OUTSIDE OF PULLEY	
PROBLEM	SOLUTION
1. Misaligned drive	1. Re-align drive
2. Under-tensioned	2. Re-tension

## Problems with pulleys

BROKEN OR DAMAGED PULLEY	
PROBLEM	SOLUTION
1. Incorrect pulley installation	1. Do not tighten bushing bolts beyond recommended torque values
2. Foreign objects falling into drive	2. Use adequate drive guard
3. Excessive rim speeds	3. Keep pulley rim speeds below maximum recommended values
4. Incorrect belt installation	4. Do not prise belts onto pulleys

SEVERE, RAPID GROOVE WEAR	
PROBLEM	SOLUTION
1. Excessive belt tension	1. Re-tension; check drive design
2. Sand, debris or contamination	2. Clean and shield drive as well as possible

## Problems with other drive components

BENT OR BROKEN SHAFT	
PROBLEM	SOLUTION
1. Extreme belt over-tension	1. Re-tension
2. Over-designed drive	2. Check drive design, may need to use smaller or fewer belts
3. Accidental damage	3. Re-design drive guard
4. Machine design error	4. Check machine design

DAMAGED GUARD	
PROBLEM	SOLUTION
1. Accidental damage or poor guard design	1. Repair, re-design for durability

## Hot bearings

BELT OVER-TENSIONED	
PROBLEM	SOLUTION
1. Worn grooves	1. Replace pulleys, tension drive properly
2. Improper tension	2. Re-tension

PULLEYS TOO SMALL	
PROBLEM	SOLUTION
1. Motor manufacturer's pulley diameter recommendation not followed	1. Re-design drive using TEXROPE® TDD Pro™ software

# PROBLEM DIAGNOSIS

## POOR BEARING CONDITION

PROBLEM	SOLUTION
1. Bearing under-designed	1. Check bearing design
2. Bearing not properly maintained	2. Replace, align and lubricate bearing

## PULLEYS TOO FAR OUT ON SHAFT

PROBLEM	SOLUTION
1. Error or obstruction problem	1. Place pulleys as close as possible to bearings; remove obstructions

## BELT SLIPPAGE

PROBLEM	SOLUTION
1. Drive under-tensioned	1. Re-tension

### Performance problems

## INCORRECT DRIVEN SPEEDS

PROBLEM	SOLUTION
1. Design error	1. Use correct driveR/driveN pulley size for desired speed ratio
2. Belt slip	2. Re-tension

## SYNCHRONOUS BELT DRIVE TROUBLESHOOTING

### ■ HOW TO SPOT AND CORRECT PROBLEMS ON THE SYNCHRONOUS BELT DRIVE

An effective preventive maintenance programme saves time and money. Inspecting and replacing synchronous belts before they fail will reduce costly downtime and production delays.

#### What to look for

Identifying the cause of synchronous belt drive failure can be challenging. In this section, we will diagnose some of the most common synchronous belt drive problems, so you will be prepared to correct them and take preventive measures in the future.

#### Severe or abnormal belt wear

TENSION LOSS	
PROBLEM	SOLUTION
1. Weak support structure	1. Reinforce structure
2. Excessive pulley wear	2. Use alternative pulley material
3. Fixed (non-adjustable) centres	3. Use inside idler for belt adjustment
4. Excessive debris	4. Remove debris, check guard
5. Excessive load	5. Re-design drive for increased capacity using TEXROPE® TDD Pro™ software
6. Subminimal diameter	6. Re-design drive for larger diameters using TEXROPE® TDD Pro™ software
7. Belt, pulleys or shafts running too hot	7. Check for conductive heat transfer from prime mover
8. Unusual belt degradation	8. Reduce ambient drive temperature to +85°C (185°F) maximum

EXCESSIVE BELT EDGE WEAR	
PROBLEM	SOLUTION
1. Damage due to handling	1. Follow proper handling instructions
2. Flange damage	2. Repair flange or replace pulley
3. Belt too wide	3. Use proper width pulley
4. Belt under-tensioned	4. Re-tension
5. Rough flange surface finish	5. Replace or repair flange (to eliminate abrasive surface)
6. Improper tracking	6. Check and correct alignment
7. Belt hitting drive guard or bracketry	7. Remove obstruction or use inside idler

# PROBLEM DIAGNOSIS

## TENSILE BREAK

PROBLEM	SOLUTION
1. Excessive shock load	1. Re-design drive for increased capacity using TEXROPE® TDD Pro™ software
2. Subminimal diameter	2. Re-design drive for larger diameters using TEXROPE® TDD Pro™ software
3. Improper belt handling and storage prior to installation	3. Follow proper handling and storage procedures
4. Debris or foreign object in drive	4. Remove object and check guard
5. Extreme pulley run-out	5. Replace pulley

## BELT CRACKING

PROBLEM	SOLUTION
1. Subminimal diameter	1. Re-design drive for larger diameters using TEXROPE® TDD Pro™ software
2. Back idler	2. Use inside idler or increase diameter of back idler
3. Extreme low temperature at start-up	3. Pre-heat drive environment
4. Extended exposure to harsh chemicals	4. Protect drive
5. Misaligned bushing/pulley assembly	5. Install bushing as per instructions

## PREMATURE TOOTH WEAR

PROBLEM	SOLUTION
1. Too low or too high belt tension	1. Re-tension
2. Belt running partly off unflanged pulley	2. Check and correct alignment
3. Misaligned drive	3. Check and correct alignment
4. Incorrect belt profile for pulley	4. Use proper belt/pulley combination
5. Worn pulley	5. Replace pulley
6. Rough pulley teeth	6. Replace pulley
7. Damaged pulley	7. Replace pulley
8. Pulley not to dimensional specification	8. Replace pulley
9. Belt hitting drive bracketry or other structure	9. Remove obstruction or use idler
10. Excessive load	10. Re-design drive for increased capacity using TEXROPE® TDD Pro™ software
11. Insufficient hardness of pulley material	11. Use a more wear-resistant pulley
12. Excessive debris	12. Remove debris, check guard
13. Misaligned bushing/pulley assembly	13. Install bushings as per instructions

TOOTH SHEAR	
PROBLEM	SOLUTION
1. Excessive shock loads	1. Re-design drive for increased capacity using TEXROPE® TDD Pro™ software
2. Less than 6 teeth in mesh	2. Re-design drive using TEXROPE® TDD Pro™ software
3. Extreme pulley run-out	3. Replace pulley
4. Worn pulley	4. Replace pulley
5. Back idler	5. Use inside idler
6. Incorrect belt profile for pulley	6. Use proper belt/pulley combination
7. Misaligned drive	7. Check and correct alignment
8. Belt under-tensioned	8. Re-tension

## Belt noise

UNUSUAL NOISE	
PROBLEM	SOLUTION
1. Misaligned drive	1. Check and correct alignment
2. Too low or too high belt tension	2. Re-tension
3. Back idler	3. Use inside idler
4. Worn pulley	4. Replace pulley
5. Belt guide flange	5. Replace guide flange
6. Belt speed too high	6. Re-design drive using TEXROPE® TDD Pro™ software
7. Incorrect belt profile for pulley	7. Use proper belt/pulley combination
8. Subminimal diameter	8. Re-design drive for larger diameters using TEXROPE® TDD Pro™ software
9. Excess load	9. Re-design drive for increased capacity using TEXROPE® TDD Pro™ software

## Problems with pulleys

FLANGE FAILURE	
PROBLEM	SOLUTION
1. Belt forcing flange off	1. Correct alignment or properly secure flange to pulley

# PROBLEM DIAGNOSIS

## UNUSUAL PULLEY WEAR

PROBLEM	SOLUTION
1. Pulley has too little wear resistance (e.g. plastic, soft metals, aluminium)	1. Use alternative pulley material
2. Misaligned drive	2. Check and correct alignment
3. Excessive debris	3. Remove debris, check guard
4. Excessive load	4. Re-design drive for increased capacity using TEXROPE® TDD Pro™ software
5. Too low or too high belt tension	5. Re-tension
6. Incorrect belt profile for pulley	6. Use proper belt/pulley combination

### Performance problems

## BELT TRACKING PROBLEMS

PROBLEM	SOLUTION
1. Belt running partly off unflanged pulley	1. Check and correct alignment
2. Centres exceed 8 times small pulley diameter and both pulleys are flanged	2. Correct parallel alignment to set belt to track on both pulleys
3. Excessive belt edge wear	3. Check and correct alignment

## EXCESSIVE TEMPERATURE: BELT, BEARINGS, HOUSINGS, SHAFTS,...

PROBLEM	SOLUTION
1. Misaligned drive	1. Check and correct alignment
2. Too low or too high belt tension	2. Re-tension
3. Incorrect belt profile for pulley	3. Use proper belt/pulley combination

## SHAFTS OUT OF SYNCHRONISATION

PROBLEM	SOLUTION
1. Design error	1. Use correct pulley sizes
2. Incorrect belt	2. Use correct belt with correct tooth profile for grooves

## VIBRATION

PROBLEM	SOLUTION
1. Incorrect belt profile for pulley combination	1. Use proper belt/pulley combination
2. Too low or too high belt tension	2. Re-tension
3. Bushing or key loose	3. Check and re-install as per instructions

## INCORRECT DRIVEN SPEEDS

PROBLEM	SOLUTION
1. Design error	1. Re-design drive using TEXROPE® TDD Pro™ software

## HOW TO PROPERLY STORE AND HANDLE BELTS

At times premature belt failure can be traced to improper belt storage that damaged the belt before it was installed on the drive. Therefore, good preventive maintenance should not be limited to the actual belt drive operating on equipment, but should also include proper storage procedures. By following a few common sense steps, good quality belts will retain their initial serviceability.

### Recommended

- ☑ Store your belts in a cool and dry environment with no direct sunlight. Ideally, below +30°C (+86°F) and 70% relative humidity.
- ☑ When stacked on shelves, the stacks should be small enough so that the belts at the bottom of the stack are not damaged by the weight of the rest of the belts.
- ☑ When stored in containers, limit the contents of the container for the same reason.

### Not recommended

- ☑ Do not store belts near radiators or heaters or in the air flow from heating devices.
- ☑ Do not store belts near any devices that generate ozone (e.g. fluorescent lights or certain electric devices).
- ☑ Do not store belts where they are exposed to solvents or chemicals.
- ☑ Do not store belts in a configuration that would result in bend diameters less than the minimum recommended pulley diameter for normal bends and less than 1.2 times the minimum recommended diameters for reverse bends (see also pages 41 and 46/47).

# BELT STORAGE AND HANDLING

## Methods of storage

Storage procedures are different depending on the belt type.

Below suggestions will help you retain serviceability and dimensions for all belt types.

### V-belts, V-ribbed belts, joined V-belts

- ☑ May be stored by hanging on a wall rack if they are hung on a “saddle” (or large diameter tubular bracket) with a diameter at least as large as the minimum recommended pulley diameter.
- ☑ Long V-belts can also be stacked to save space, provided that they are correctly coiled.

### Variable-speed belts

- ☑ Are more sensitive to distortion than most other belts, so hanging them from a wall rack is not recommended. These belts should be stored on shelves.

### Synchronous belts

- ☑ May be stored in a nested configuration: nests are formed by laying a belt on its side on a flat surface and placing as many belts inside the first belt as possible without undue force.
- ☑ When nests are formed, do not bend the belts to a diameter that is smaller than the minimum recommended pulley diameter.

Belt section	Belt length (mm)	Coils	Loops
Z, SPZ, A, AA, SPA, B, SPB, 3V	< 1500	0	1
	1500 - 3000	1	3
	3000 - 4600	2	5
	> 4600	3	7
BB, C, SPC, 5V, 19	< 1900	0	1
	1900 - 3700	1	3
	3700 - 6000	2	5
	> 6000	3	7
CC, D	< 3000	0	1
	3000 - 6100	1	3
	6100 - 8400	2	5
	8400 - 10600	3	7
	> 10600	4	9
DD, E, 8V	< 4600	0	1
	4600 - 6900	1	3
	6900 - 9900	2	5
	9900 - 12200	3	7
	> 12200	4	9

## PREMIUM SOLUTIONS BY TEXROPE®

TEXROPE® is a premier industrial belt manufacturer who helps original equipment manufacturers, plant managers and maintenance engineers improve operational efficiency and boost productivity. Discover our wide variety of technically advanced belts and tools and learn more about our customer-tailored preventive maintenance and cost saving options.

### TEXROPE® BELTS

#### ■ A COMPLETE RANGE OF HIGH-PERFORMANCE BELTS

TEXROPE® offers a complete range of premium high-performance industrial drive belts. Depending on your application you can choose from a variety of rubber or polyurethane synchronous belts, V-belts in all sections and lengths, and specialty belts for specific use.



Detailed product information per belt can be found by going to [www.texrope.com/en/products](http://www.texrope.com/en/products) or by scanning the QR code for immediate access.

## ■ V-BELTS – ALL SECTIONS AT A GLANCE

### V-belts

WRAPPED CLASSICAL-SECTION BELTS		
	Width (mm)	Height (mm)
Z	10	6
A	13	8
B	17	11
C	22	14
D	32	19
E	38	25
25	25	16

WRAPPED NARROW-SECTION BELTS		
	Width (mm)	Height (mm)
SPZ/3V	10	8
SPA	13	10
SPB/5V	16	13
SPC	22	18
19	19	15

RAW-EDGE BELTS		
	Width (mm)	Height (mm)
XPZ/3VX	10	8
XPA	13	10
XPB/5VX	16	13
XPC	22	18

### Multiple V-belts

WRAPPED CLASSICAL-SECTION MULTIPLE BELTS				
	Pitch (mm)	Width (mm)	Height (mm)	Available number of ribs
B	19.05	17	10	2 → 5
C	25.40	22	12	2 → 5
D	36.50	32	19	3 → 5

## WRAPPED NARROW-SECTION MULTIPLE BELTS

	Pitch (mm)	Width (mm)	Height (mm)	Available number of ribs
SPB	19.00	16	13	2 → 16
SPC	25.50	22	18	2 → 12
9J/3V	10.30	10	8	2 → 30
15J/5V	17.50	16	13	2 → 16
25J/8V	28.60	26	23	3 → 5

## Double V-belts

	Width (mm)	Height (mm)
AA	12.7	10.3
BB	16.7	13.5
CC	22.2	18.2
DD	31.8	25.4

## Variable-speed belts

		Top width (mm)	Thickness (mm)	Angle (α°)
ISO 1604	W16	17	6	28
	W20	21	7	
	W25	26	8	
	W31.5	33	10	
	W40	42	13	
	W50	52	16	
	W63	65	20	
	W80	83	26	
	W100	104	32	
VNN		13	6	26
		22	8	
		28	8	
		37	10	28
		47	13	
		55	16	

## Flat belts

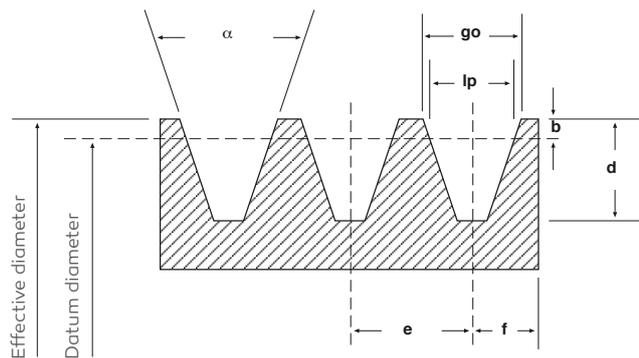
	Approximate thickness (mm)	Available slab widths (mm)
Type I	1.9	15 - 600
Type II	2.2	15 - 600
Type III	4.2	15 - 300* * < 4000 mm: 600 mm width

## V-ribbed belts

	Pitch (mm)	Height (mm)
PJ	2.34	3.50
PL	4.70	9.50
PM	9.40	16.50

## V-BELTS – TECHNICAL DATA

### Groove dimension nomenclature for V-belts



GROOVE DIMENSIONS AND TOLERANCES ACCORDING TO ISO 4183, DIN 2211 AND DIN 2217 ENGINEERING STANDARDS								
Belt section	Datum width ( $l_p$ ) (mm)	Datum diameter (mm)	Groove angle ( $\alpha$ )	$g_o$ (mm)	$d$ (mm)	$e$ (mm)	$f^*$ (mm)	$b$ (mm)
Z**, SPZ***, XPZ	8.5	63 to 80	$34^\circ \pm 1^\circ$	9.72	11 (+0.25/-0)	$12 \pm 0.3$	$8 \pm 0.6$	2
		> 80	$38^\circ \pm 1^\circ$	9.88				
A**, SPA***, XPA	11	90 to 118	$34^\circ \pm 1^\circ$	12.68	13.75 (+0.25/-0)	$15 \pm 0.3$	$10 \pm 0.6$	2.75
		> 118	$38^\circ \pm 1^\circ$	12.89				
B**, SPB***, SPB Multi, XPB	14	140 to 190	$34^\circ \pm 1^\circ$	16.14	17.5 (+0.25/-0)	$19 \pm 0.4$	$12.5 \pm 0.8$	3.5
		> 190	$38^\circ \pm 1^\circ$	16.41				
C, SPC***, SPC Multi, XPC	19	224 to 315	$34^\circ \pm 1/2^\circ$	21.94	24 (+0.25/-0)	$25.5 \pm 0.5$	$17 \pm 1$	4.8
		> 315	$38^\circ \pm 1/2^\circ$	22.31				
D** (mm)	27	355 to 500	$36^\circ \pm 1/2^\circ$	32	28 (min.)	$37 \pm 0.6$	$24 (\pm 2)$	8.1
		> 500	$38^\circ \pm 1/2^\circ$					
E** (mm)	32	500 to 630	$36^\circ \pm 1/2^\circ$	40	33 (min.)	$44.5 \pm 0.7$	$29 (\pm 2)$	12
		> 630	$38^\circ \pm 1/2^\circ$					
25	21	$\leq 355$	$34^\circ \pm 1/2^\circ$	25	22 (+0.6/-0)	$29 \pm 0.5$	$19 \pm 1$	6.3
		> 355	$38^\circ \pm 1/2^\circ$					

Tolerances on datum diameters can be calculated by applying the tolerance (+ 1.6 /- 0%) to the nominal value of the datum diameter in mm.

\* These tolerances have to be taken into account when aligning the pulleys.

\*\* According to DIN 2217.

\*\*\* According to DIN 2211 and ISO 4183.

## GROOVE DIMENSIONS AND TOLERANCES FOR WRAPPED CLASSICAL-SECTION MULTIPLE BELTS ACCORDING TO RMA ENGINEERING STANDARDS

Belt section	Effective diameter (mm)	Groove angle ( $\alpha$ ) $\pm 1/2^\circ$	$g_o$ (mm)	$d$ (mm) $\pm 0.79$	$e^*$ (mm) $\pm 0.6$	$f$ (mm)
B Multi	< 180	34°	16.18 $\pm$ 0.13	14.73	19.05	12.7 (+3.8/-0)
	> 180	38°	16.51 $\pm$ 0.13			
C Multi	< 200	34°	22.33 $\pm$ 0.18	19.81	25.4	17.48 (+3.8/-0)
	200 to 315	36°	22.53 $\pm$ 0.18			
D Multi	> 315	38°	22.73 $\pm$ 0.18	26.67	36.53	22.23 (+6.35/-0)
	< 355	34°	31.98 $\pm$ 0.18			
	355 to 450	36°	32.28 $\pm$ 0.18			
	> 450	38°	32.59 $\pm$ 0.18			

\* Summation of the deviations from "e" for all grooves in any pulley shall not exceed  $\pm 1.2$  mm.

## GROOVE DIMENSIONS AND TOLERANCES FOR WRAPPED NARROW-SECTION MULTIPLE BELTS ACCORDING TO ISO 5290 ENGINEERING STANDARDS

Belt section	Effective diameter (mm)	Groove angle ( $\alpha$ ) $\pm 1/4^\circ$	$g_o$ (mm) $\pm 0.13$	$d$ (mm) (+ 0.25/-0)	$e^*$ (mm) $\pm 0.4$	$f$ (mm)
9J Multi	< 90	36°	8.9	8.9	10.3	9 (+2.4/-0)
	90 to 150	38°				
	151 to 300	40°				
	> 300	42°				
15J Multi	< 250	38°	15.2	15.2	17.5	13 (+3.2/-0)
	250 to 400	40°				
	> 400	42°				
25J Multi	< 400	38°	25.4	25.4	28.6	19 (+6.3/-0)
	400 to 560	40°				
	> 560	42°				

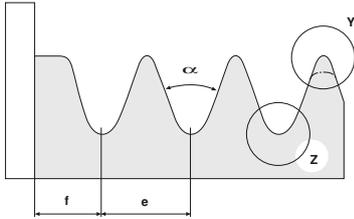
\* Summation of the deviations from "e" for all grooves in any pulley shall not exceed  $\pm 0.5$  mm for 9J and 15J,  $\pm 0.8$  mm for 25J.

**GROOVE DIMENSIONS AND TOLERANCES FOR RAW-EDGE AND WRAPPED NARROW-SECTION SINGLE AND MULTIPLE BELTS ACCORDING TO RMA ENGINEERING STANDARDS**

Belt section	Datum width (mm)	Effective diameter (mm)	Groove angle ( $\alpha$ ) $\pm 1/4^\circ$	go (mm) $\pm 0.13$	d (mm) min.	e* (mm) $\pm 0.4$	f (mm)	b (mm)
3V, 3VX, 3V Multi	8.45	< 90	36°	8.89	8.6	10.32	8.73 (+2.4/-0)	0.65
		90 to 150	38°					
		151 to 300	40°					
		> 300	42°					
5V, 5VX, 5V Multi	14.4	< 250	38°	15.24	15	17.46	12.7 (+3.2/-0)	1.25
		250 to 400	40°					
		> 400	42°					
8V Multi	23.65	< 400	38°	25.4	25.1	28.58	19.05 (+6.3/-0)	2.54
		400 to 560	40°					
		> 560	42°					

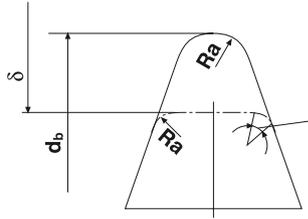
\* Summation of the deviations from "e" for all grooves in any pulley shall not exceed  $\pm 0.79$  mm.

## Groove dimension nomenclature for V-ribbed belts



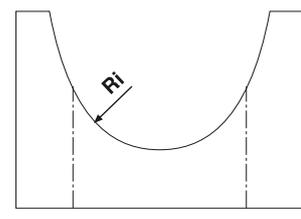
Groove dimension

Detail Y: Groove top



The design of the groove top may not exceed indicated minimum and maximum values (depending on pulley manufacture).

Detail Z: Groove bottom



The groove bottom design may not exceed the indicated Ri value (depending on pulley manufacture).

### GROOVE DIMENSIONS AND TOLERANCES FOR V-RIBBED BELTS ACCORDING TO DIN 7867 AND ISO 9981 ENGINEERING STANDARDS

Belt section	Groove angle (α)	e* (mm)	Ri (mm) max.	Ra (mm) min.	f (mm) min.
PJ	40 ± 1/2°	2.34 ± 0.03	0.4	0.2	1.8
PL	40 ± 1/2°	4.7 ± 0.05	0.4	0.4	3.3
PM	40 ± 1/2°	9.4 ± 0.08	0.75	0.75	6.4

\* Summation of the deviations from "e" for all grooves in any pulley shall not exceed ± 0.3 mm.

## Minimum recommended idler diameters

	Belt section	Minimum O.D. of grooved inside idler		Minimum O.D. of flat outside idler	
		(mm)	(inch)	(mm)	(inch)
Wrapped classical-section belts	Z	60	2.36	90	3.54
	A	85	3.35	110	4.33
	B	112	4.41	160	6.3
	C	160	6.3	220	8.66
	D	300	11.81	350	13.78
	E	500	19.69	600	23.62
Wrapped narrow-section belts	SPZ/3V	71	2.8	120	4.72
	SPA	100	3.94	160	6.3
	SPB/5V	160	6.3	250	9.84
	SPC	250	9.84	350	13.78
Raw-edge belts	XPZ/3VX	56	2.2	85	3.35
	XPA	80	3.15	120	4.72
	XPB/5VX	112	4.41	168	6.61
	XPC	180	7.09	270	10.63
Wrapped classical-section multiple belts	B	137	5.39	180	7.09
	C	228	8.98	300	11.81
	D	330	12.99	430	16.93
Wrapped narrow-section multiple belts	SPB	160	6.3	250	9.84
	SPC	250	9.84	400	15.75
	9J/3V	71	2.8	108	4.25
	15J/5V	160	6.3	250	9.84
	25J/8V	317	12.48	445	17.52
Double V-belts	AA	85	3.35	-	-
	BB	112	4.41	-	-
	CC	160	6.3	-	-
	DD	330	12.99	-	-
V-ribbed belts	PJ	20	0.79	32	1.26
	PL	75	2.95	115	4.53
	PM	180	7.09	270	10.63

# SUPPORT

## Minimum installation and take-up allowance

V-BELTS																
Datum length (mm)	Minimum installation allowance (mm)															Minimum take-up allowance (mm) All sections
	XPZ/3VX, SPZ/3V	XPA, SPA	XPB/5VX, SPB/5V	SPC	9J/3V Multi	15J/5V Multi	25J/8V Multi	Z	A	A Multi	B	B Multi, SPB Multi	C	C Multi, SPC Multi	D	
420 - 1199	15	20	-	-	30	-	-	15	20	30	25	35	40	50	-	25
1200 - 1999	20	25	25	-	35	55	-	20	20	30	30	40	40	50	50	35
2000 - 2749	20	25	25	35	35	55	85	20	25	35	30	40	40	50	50	40
2750 - 3499	20	25	25	35	35	55	85	-	25	35	30	40	40	50	50	45
3500 - 4499	20	25	25	35	35	55	85	-	25	35	30	40	50	60	55	55
4500 - 5499	-	25	25	35	-	55	90	-	25	35	40	50	50	60	60	65
5500 - 6499	-	-	35	40	-	60	90	-	25	35	40	50	50	60	60	85
6500 - 7999	-	-	35	40	-	60	90	-	-	-	40	50	50	60	65	95
8000 -	-	-	35	45	-	60	100	-	-	-	-	50	50	60	65	110

V-RIBBED BELTS				
Effective length (mm)	Minimum installation allowance (mm)			Minimum take-up allowance (mm) All sections
	PJ	PL	PM	
- 500	10	-	-	10
501 - 1000	15	-	-	20
1001 - 1500	15	25	-	25
1501 - 2000	20	25	-	35
2001 - 2500	20	30	40	40
2501 - 3000	-	30	40	45
3001 - 4000	-	35	45	60
4001 - 5000	-	-	45	65
5001 - 6000	-	-	50	70
6001 - 7500	-	-	55	85
7501 - 9000	-	-	65	100
9001 -	-	-	70	115

## ■ SYNCHRONOUS BELTS – ALL SECTIONS AT A GLANCE

### Rubber synchronous belts

BELTS WITH TRAPEZOIDAL TOOTH PROFILE			
	Pitch (mm)	T (mm)	B (mm)
XL	5.08	1.27	2.30
L	9.525	1.91	3.50
H	12.70	2.29	4.00
XH	22.225	6.36	11.40

BELTS WITH CURVILINEAR TOOTH PROFILE			
	Pitch (mm)	T (mm)	B (mm)
5M	5.0	2.1	3.8
8M	8.0	3.4	5.6 / 6.0
14M	14.0	6.0	10.0

DOUBLE-SIDED BELTS WITH TRAPEZOIDAL TOOTH PROFILE			
	Pitch (mm)	T (mm)	B (mm)
XL	5.08	1.27	3.00
L	9.525	1.91	4.50
H	12.70	2.29	5.80

DOUBLE-SIDED BELTS WITH CURVILINEAR TOOTH PROFILE			
	Pitch (mm)	T (mm)	B (mm)
5M	5.0	2.1	5.5
8M	8.0	3.4	8.0
14M	14.0	5.8	14.6

OPEN-END BELTS			
	Pitch (mm)	T (mm)	B (mm)
XL	5.08	1.27	2.30
L	9.525	1.91	3.50
H	12.70	2.29	4.00
8M	8.00	3.40	6.10
14M	14.00	5.60	10.00

# SUPPORT

## BELTS WITH V-RIBBED BACKING

	Pitch (mm)	T (mm)	B (mm)
8M	8.0	3.4	7.4
14M	14.0	6.0	11.5

### Polyurethane synchronous belts

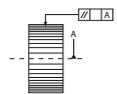
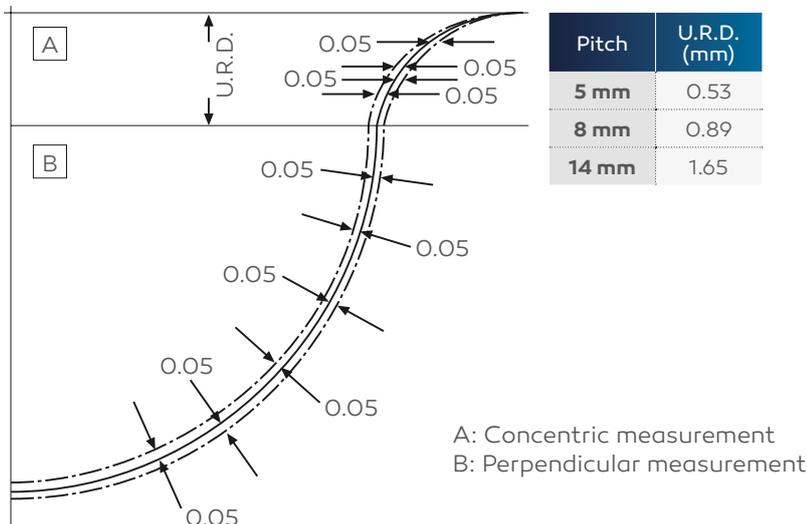
		Pitch (mm)	T (mm)	B (mm)	Belt/Sleeve	Roll stock	
	T	T 2.5	2.50	0.70	1.30	x	
		T 5	5.00	1.20	2.20	x	x
		T 10	10.00	2.50	4.50	x	x
		T 20	20.00	5.00	8.00		x
	AT(L)	AT(L) 5	5.00	1.20	2.70	AT5: x	x
		AT(L) 10	10.00	2.50	4.50	AT10: x	x
		AT(L) 20	20.00	5.00	8.00		x
	DL	DL-T5	5.00	1.20	3.30	x	
		DL-T10	10.00	2.50	6.80		
	HTD®	HTD5M	5.00	2.10	3.60		
		HTD8M	8.00	3.40	6.00		x
		HTD(L)14M	14.00	6.00	10.00		
	HPL®	HPL14M	14.00	6.00	10.00		x
	STD	STD5M	5.00	1.90	3.30		x
		STD8M	8.00	3.00	5.10		
	Trapezoidal	XL	5.08	1.27	2.29		
		L	9.525	1.91	3.56		
		H	12.70	2.29	4.06		x
		XH	22.225	6.35	11.18		
	Flat	F(L)8	-	-	2.00		x
		F(L)12	-	-	3.20		
	Wide	WH	12.70	2.29	4.06		
		WT10	10.00	2.50	4.50		x
		GMT3	3.00	1.20	2.80		
			Pitch (mm)	T (mm)	B (mm)	Roll stock	Integral V-guide
	Self-tracking	TV5	5.00	1.20	5.00	x	K6
		AT(L)	5.00	1.20	5.50		K6
		T10VS	10.00	2.50	6.00		K6
		T10V	10.00	2.50	8.50		K13
		AT10V	10.00	2.50	8.50		K13
		HV	12.70	2.30	8.30		A-section

## ■ SYNCHRONOUS BELTS – TECHNICAL DATA

### Pulley bore/face diameter tolerance specifications

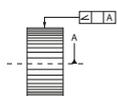
TEXROPE® recommends that pulleys are precision made to close tolerances. Inaccurate manufacture or reboring may result in poor drive performance. Permissible tolerances for bore and for outside diameter are shown in the tables on this page. Working surface should be free from surface defects and be to 3.2 µm or better.

### Pulley tolerance band



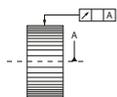
#### Helix angle

Grooves should be parallel to the axis of the bore within 0.01 mm per 10 mm.



#### Draft

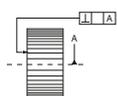
The maximum permissible draft is 0.01 mm per 10 mm of face width, but it must not exceed the outside diameter tolerance.



#### Eccentricity

Allowable amount from pulley bore to outside diameter is shown below.

Outside diameter (mm)	Total eccentricity
Up to 203	0.1
Over 203	0.005 per 10 mm of diameter (may not exceed the tolerance on face diameter)



#### Parallelism

Bore of pulley to be perpendicular to vertical faces of pulley within 0.01 mm per 10 mm of radius with a maximum of 0.51 mm T.I.R.

## Recommended maximum outside diameters for cast-iron pulleys

Maximum shaft speed (rpm)	Maximum allowable pulley diameter	
	(mm)	(inch)
500	1260	49.6
750	840	33.07
1000	630	24.8
1250	504	19.84
1500	420	16.53
1750	360	14.17
2000	315	12.4
2500	252	9.92
3000	210	8.27
4000	157	6.18
5000	126	4.96
6000	105	4.13
8000	79	3.11
10000	63	2.48

## Minimum recommended pulley sizes

RUBBER SYNCHRONOUS BELTS			
	Belt section	Min. recommended pulley size (n° of grooves)	Min. back idler diameter (mm)
Belts with trapezoidal tooth profile	XL	10	25
	L	10	45
	H	14	85
	XH	18	190
Belts with curvilinear tooth profile	5M	14	35
	8M	22	85
	14M	28	190
Double-sided belts with trapezoidal tooth profile	XL	10	10*
	L	10	10*
	H	14	14*
Double-sided belts with curvilinear tooth profile	5M	14	14*
	8M	22	22*
	14M	28	28*
Open-end belts	XL	10	25
	L	10	45
	H	14	85
	8M	22	85
	14M	28	190

\* N° of grooves.

POLYURETHANE SYNCHRONOUS BELTS			
	Belt section	Min. recommended pulley size (n° of grooves)	Min. back idler diameter (mm)
Endless belts	T2.5	12	20
	T5	10	30
	T10	14	80
	AT5	15	60
	AT10	15	120
	DL-T5	10	16
	DL-T10	14	45
Open-end belts	T5	10	30
	T10	14	80
	T10-HF	12	100
	T20	15	120
	AT5	15	60
	AT10	15	120
	ATL10	25	150
	ATL10-HF	20	130
	AT20	18	180
	ATL20	30	250
	HTD5	16	80
	HTD8	20	120
	HTD14	28	200
	HTDL14	36	200
	HPL14	34	250
	STD5	14	60
	STD8	20	120
	XL	10	28
	L	10	60
	H	14	80
XH	18	150	

## Installation and tensioning allowance

Belt section	Belt length	Min. standard installation allowance (flanged pulleys removed for installation)	Min. installation allowance (one pulley flanged)	Min. installation allowance (both pulleys flanged)	Min. tensioning allowance (any drive)
	(mm)	(mm)	(mm)	(mm)	(mm)
XL	90 - 127	0.5	12.2	18.5	0.5
	128 - 254	0.75	12.5	18.75	0.75
	255 - 508	1	12.7	19	0.75
	509 - 1016	1.3	13	19.3	1
	1017 - 1500	1.8	13.5	19.8	1.3
L	90 - 127	0.5	16.8	22.1	0.5
	128 - 254	0.75	17	22.4	0.75
	255 - 508	1	17.3	22.6	0.75
	509 - 1016	1.3	17.6	22.9	1
	1017 - 1524	1.8	18.1	23.4	1.3
	1525 - 1700	3.1	19.4	24.7	2.1
H	90 - 127	0.5	16.8	24.9	0.5
	128 - 254	0.75	17	25.2	0.75
	255 - 508	1	17.3	25.4	0.75
	509 - 1016	1.3	17.6	25.7	1
	1017 - 1524	1.8	18.1	26.2	1.3
	1525 - 4318	3.1	19.4	27.5	2.1
XH	90 - 127	0.5	29.5	49.3	0.5
	128 - 254	0.75	29.8	49.6	0.75
	255 - 508	1	30	49.8	0.75
	509 - 1016	1.3	30.3	50.1	1
	1017 - 1524	1.8	30.8	50.6	1.3
	1525 - 4445	3.1	32.1	51.9	2.1
5M	- 500	1	14.5	20	0.8
	501 - 1000	1.3	14.8	20.3	0.8
	1001 - 1500	1.8	15.3	20.8	1
	1501 - 1800	2.3	15.8	21.3	1.3
8M	- 500	1	22.6	33.8	0.8
	501 - 1000	1.3	22.9	34.1	0.8
	1001 - 1500	1.8	23.4	34.6	1
	1501 - 2260	2.3	23.9	35.1	1.3
	2261 - 3020	2.8	24.4	35.6	1.3
	3021 - 4020	3.6	25.2	36.4	1.3
	4021 - 4780	4.3	25.9	37.1	1.3
14M	- 500	1	36.6	59.2	0.8
	501 - 1000	1.3	36.9	59.5	0.8
	1001 - 1500	1.8	37.4	60	1
	1501 - 2260	2.3	37.9	60.5	1.3
	2261 - 3020	2.8	38.4	61	1.3
	3021 - 4020	3.6	39.2	61.8	1.3
	4021 - 4780	4.3	39.9	62.5	1.3

## TEXROPE® TOOLS

### ■ IMPROVE THE EFFICIENCY OF YOUR BELT DRIVES

TEXROPE® offers not only premium products. We deliver professional support from the initial choice and design of an appropriate drive, over its installation to its maintenance. However, correct belt drive installation and maintenance also require that you use specialised tools. Discover our professional tools that can improve the efficiency of your belt drives.



Detailed product information per tool can be found by going to [www.texrope.com/en/products/texrope-tools](http://www.texrope.com/en/products/texrope-tools) or by scanning the QR code for immediate access.

#### TEXROPE® TENSION METER TMC-1



Looking for a tension measuring device that is easy to handle and extremely accurate? Use the TEXROPE® TMC-1 tension meter. This fully electronic measuring device analyses sound waves from the belt through the sensor. It processes the input signals and displays the accurate tension measurement digitally. The perfect output for correct belt installation tension, which is essential for the optimum performance and reliability of your V-, V-ribbed and synchronous belt drives. Belt pre-tension data can be determined by using the TEXROPE® TDD Pro™ drive design software.

**Safety notice:** TEXROPE® TMC-1 should not be used in explosive risk areas

#### TEXROPE® TENSION GAUGE



Measuring static belt tension with the TEXROPE® tension gauge is a good way to prevent belt drive problems. It allows you to verify whether installation is correct and make periodic checks on belt tension.

#### TEXROPE® LASER ALIGNMENT DEVICE ATX



How can you measure misalignment, fast and accurately? The TEXROPE® ATX laser alignment device is the answer. Mounted in a few seconds, the laser line projected onto the targets allows you to quickly ascertain and correct misalignment. It identifies parallel as well as angular misalignment between the pulleys and is suitable for pulley diameters of 60 mm and larger. It can be used on both horizontally and vertically mounted machines.

**Safety notice:** TEXROPE® ATX should not be used in explosive risk areas

## TEXROPE® BELT MEASURING TOOL



How to measure classical and narrow-section V-belts? Use the TEXROPE® belt measuring tool. This solid metal device measures V-belts with pitch lengths between 540 and 2500 mm (60% of all industrial belts on the market).

## TEXROPE® BELT AND PULLEY GAUGES



How to identify classical and narrow-section belt profiles? How to check pulley groove angles and groove wear? And, last but not least, how to determine the type of a multiple belt pulley (standard or joined)? The TEXROPE® belt and pulley gauges give you the right answer in a jiffy - before a belt-to-pulley mismatch or excessive wear leads to unwanted belt drive problems.

## TEXROPE® DRIVE DESIGN SOFTWARE TDD PRO™



Looking for a professional and easy resource to select and maintain belt drive systems? Do you want to create multiple 'virtual' belt drive designs without wasting time or money? TEXROPE® TDD Pro™ offers you an all-in-one flexible drive design software solution for V-belt and synchronous belt drives.

- ✓ Time-saving: returns all possible drive designs that meet the given parameters
- ✓ Reliable: ensures obtaining a belt drive suited to your application
- ✓ Handy: easily print, email and create PDFs of your design specifications



Online drive design assistance is available in our TEXROPE® TDD Pro™ drive design software. Visit our website or scan the QR code and download still today.

## TEXROPE® ONSITE PLANT SURVEYS

### ■ COST AND ENERGY SAVINGS GAINED FROM YOUR BELT DRIVES

TEXROPE® has many years of experience in developing tailored drive optimisation solutions for the specific requirements of your industry. Our belt drive specialists are happy to undertake a thorough audit of your current belt drives, to find specific options for increasing capacity, reducing downtime and discovering cost and energy saving potential at your machine park.

During an onsite plant survey, they check the belt drives in your machine park from pulley to pulley and everything in between, in order to:

- ☑ Evaluate current belt drive efficiencies
- ☑ Identify problem drives and develop a programme to increase their reliability, e.g. by determining ways to reduce maintenance costs or developing targeted preventive maintenance programmes
- ☑ Calculate energy savings that could be gained by replacing problem belt drives or chain drives with energy-efficient ones
- ☑ Recommend longer-lasting products that will enhance productivity and improve equipment reliability

Based on this inspection, you get concrete action plans to drive down costs at your facility.



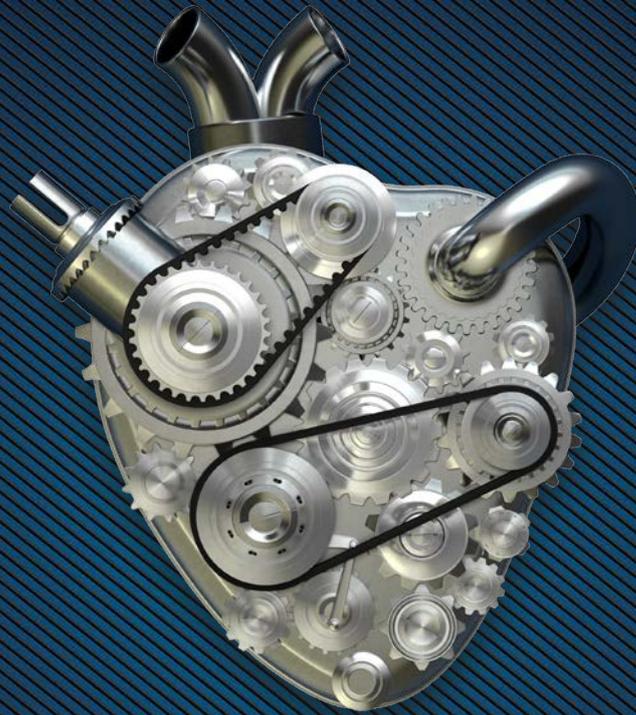
Request an expertise to screen your machine park and get detailed action plans to drive down costs. Visit our website or scan the QR code to enter your details and we will contact you.



Visit our website or scan the QR code to discover how to save energy and CO<sub>2</sub> emissions, maintenance costs and total drive costs by converting V-belt drives to synchronous belt drives.

# TEXROPE®

## AT THE HEART OF YOUR MACHINERY



### ■ OUR PREMIUM BELTS MAKE THE DIFFERENCE IN THE LONG RUN

TEXROPE® is a **premier industrial belt manufacturer** who helps original equipment manufacturers, plant managers and maintenance engineers **improve operational efficiency and boost productivity**, offering them **technically advanced belts** as well as **customer-tailored preventive maintenance and cost saving options**. Since our founding in 1968, the power to perform is our first priority. We have your best interests at heart to keep your business pumping.

[www.texrope.com](http://www.texrope.com)

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TEXROPE® products are not designed or intended for aircraft use.

THE POWER TO PERFORM

**TEXROPE®**