# V-Belt and Quick Detachable Sheave Installation and Maintenance

# Introduction

Properly designed and installed V-belts and sheaves are virtually maintenance-free; an occasional retensioning is all that's needed to keep them running smoothly. Because V-belt drives require so little attention, it's worth your time to follow the "common sense" guidelines in this manual. The payoff is maximum belt and sheave life, increased uptime, and efficient, uninterrupted equipment service.

# V-Belt Installation

Caution: Before doing any inspection or maintenance on belt drives, turn the equipment off and lock out the power source.

**Remove old belts**

Remove the drive guard, loosen the take-up, and shorten the center distance between sheaves. This way, the old belts can be removed easily and the new belts can be installed without damage.

**Inspect and service drive elements**

Remove rust and dirt from take-up rails, and lubricate as necessary. Inspect and replace damaged machine elements such as worn bearings and bent shafts. Check bearings for oil.

**Inspect and clean sheaves; replace worn or damaged sheaves**

Worn sheave grooves are one of the principal causes of premature belt failure. Inspect sheaves carefully!

• Clean dirty, dusty, or rusty sheaves. They will impair the drive's efficiency and wear out the belt cover.

Feel sheave grooves (wear gloves or use a rag) for nicks or burrs, and file them smooth.

• Belts should ride in sheave grooves so that the top of the belt is just above the highest point of the sheave. If the grooves are worn to the point where the belt bottoms out (a clue: check for shiny groove bottoms), the belts will slip and burn.

*Note: 4L, A and AX V-belts will run lower in combo sheaves designed to accommodate 4L, 5L, A, B, AX, and BX belts. However, the belts should still not bottom out.*

• If the groove walls are "dished out," the bottom corners of the belt will quickly wear off and cause rapid failure. Check groove wear by sight, touch, or with a sheave gauge. If grooves are "dished out" 1/32" or more — replace the sheave!

**10 Point V-Belt Installation Check List**

1. Turn equipment OFF and lock out power source.

2. Shorten center distance and remove old belts.

3. Inspect and service take-up rails, bearings, and shafts.

4. Inspect and clean sheaves; replace worn and damaged sheaves.

5. Check and correct sheave alignment.

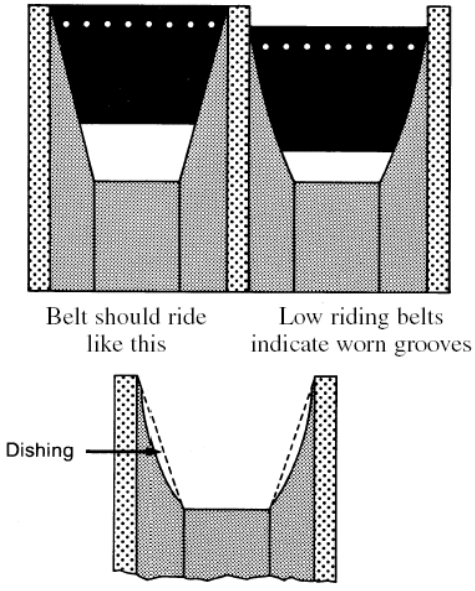
6. Select replacement belts.

7. Lay belts over sheaves; rotate until belts' slack is on the same side.

8. Check final sheave alignment.

9. Increase center distance until belts won't slip under a full load.

10. Inspect belt drive in 24-48 hours.



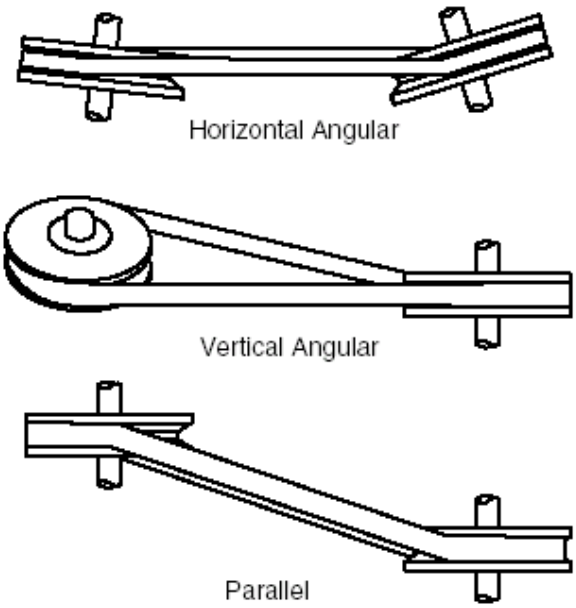

"Dishing" of groove sidewalls shortens belt life

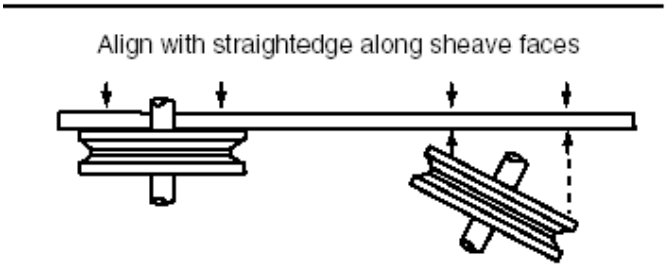
## Check and correct sheave alignment

Misaligned sheaves will accelerate wear of belt sidewalls, which will shorten both belt and sheave life. Misalignment can also cause belts to roll over in the sheave, or throw all the load to one side of the belt – breaking or stretching the tensile cord.

Check for the types of sheave and shaft misalignment shown below. Correct alignment by placing a steel straightedge across the sheave faces so it touches all four points of contact.

## Types of sheave and shaft misalignment




## Select replacement belts

**• Don't mix used and new belts on a drive**

Used belts will ride lower in the pulley groove due to sidewall wear and normal stretch. New belts will ride higher in the pulley, travel faster, and operate at higher tension. Running used and new belts together will overload and damage the new belts.

**• Don't mix belts from different manufacturers**

Because dimensions and constructions vary among manufacturers, running such "mismatched belts" won't give full service life.

**• Use matched sets**

A matched set of belts is necessary to assure equal distribution of the load. With some manufacturers, length codes are necessary to match belts within a given size. Observe proper guidelines if your belts have matching numbers.

All Dayton V-belts have been manufactured by a process eliminating the need for matching numbers. All belts of a given size will match with all others of that size. This simplifies ordering, reduces inventory levels, and assures you'll have a matched set of belts on hand.

**• Use correct type and cross section belt**

Match the correct belt cross section to the corresponding sheave groove — A to A, 3V to 3V, etc. Don't use a B section belt in a 5V pulley, or vice versa. The correct cross section should be included in the part number stamped on the sheave. If there is no part number stamped on the sheave, contact your Grainger representative to replace with Dayton brand Quick Detachable Sheaves.

Don't replace A or B section belts with 4L or 5L fractional horsepower (FHP) belts. The dimensions are similar, but FHP belts can't handle the horsepower requirements of a heavy-duty application.

## Install new belts and adjust the slack

Always shorten the center distance of the drive until the belts can be laid over the sheaves. Never pry or force a belt onto the drive with a pry bar or by rolling. Rolling, or cranking, is looping the belt over one pulley, then lining up the belt with the inside groove edge of the other pulley, and then turning the pulleys to roll, or crank, the belt into place. This will almost certainly damage the tensile cord and the fabric cover. Although the damage may not be visible, belt life will be drastically reduced. Failed belts installed in this manner are easy to spot by the split cover and compression section.

Work the belts by hand to move slack so it is on the same side for all belts. This assures all belts start under equal strain. Now, move the pulleys apart until the belts are seated in the grooves and the slack is taken up.

## Tensioning V-Belt

The key to long, efficient, trouble-free belt operation is proper tension. If belts are too loose, the result is slippage, rapid belt and sheave wear, and loss of productivity. Conversely, too much tension puts excess strain on belts, bearings, and shafts, and causes premature wear of these components. Follow this tensioning guideline: the proper tension for a V-belt is the lowest tension at which the belt won't slip or squeal under peak load.

Note: Never use belt dressing to stop belts from slipping. Tighten the belts and/or check for worn sheave grooves.

To tension belts, adjust the center distance until the belts appear fairly taut. Run the drive for about 15 minutes to seat the belts, and apply full load. If the belts slip or squeal, apply more tension. When the drive is in motion, a slight sag on the slack side is normal.

An alternate method of tensioning is to use the simplified force/deflection method, as follows:

### Force/deflection method

1. Identify belt type (cross section) either by belt number or measure belt top width and thickness as found in the Grainger Catalog.

2. Measure the outside diameter of the smallest sheave.

3. Measure the span length "L" of your drive (center to center) (see Figure 1).

4. At the center of the span, apply a force perpendicular to the belt. Measure the force required to deflect the belt 1/64" per inch of span length. For example, for a 100" span, the deflection would be 100/64, or approximately 1 1/2" inches.

5. Compare the force required to the recommended ranges in the tables provided. Tighten or loosen the belt to bring it into the recommended range.

6. When you install new belts, tighten them to "initial tension" forces shown in the tables. This tension will drop during the run-in period.

7. Inspect the belt drive after 24-48 hours. During the run-in period, the initial stretch is taken out of the belts and the belts seat lower in the sheaves. Check belt tension to assure it falls within the range of values in the table.

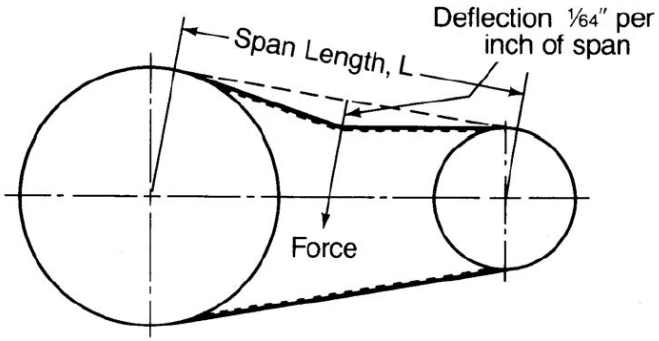



**Figure 1**

### V-Belt Tensioning

| | | Recommended Deflection Force (Lb) | | |
|---|---|---|---|---|
| V-Belt Type | Small Sheave Dia Range (Inches) | Initial Installation | Retensioning | |
| | | | Max | Min |
| 3L | 1.5 – 2.0 | 1.4 | 1.1 | 0.8 |
| | 2.1 – 2.7 | 1.9 | 1.4 | 1.1 |
| | 2.8 – 4.0 | 2.5 | 2.0 | 1.5 |
| 4L | 2.0 – 2.5 | 2.1 | 1.6 | 1.2 |
| | 2.6 – 3.5 | 2.4 | 1.8 | 1.4 |
| | 3.6 – 5.0 | 3.1 | 2.3 | 1.8 |
| 5L | 3.0 – 3.5 | 3.2 | 2.5 | 1.9 |
| | 3.6 – 4.5 | 4.1 | 3.2 | 2.4 |
| | 4.6 – 6.0 | 5.1 | 3.9 | 3.0 |
| A | - 3.0 | 3.6 | 3.1 | 2.4 |
| | 3.1 - 4.0 | 4.2 | 3.6 | 2.8 |
| | 4.1 - 5.0 | 5.2 | 4.6 | 3.5 |
| | 5.1 - | 6.1 | 5.3 | 4.1 |
| B | - 4.6 | 7.3 | 6.4 | 4.9 |
| | 4.7 – 5.6 | 8.7 | 7.5 | 5.8 |
| | 5.7 – 7.0 | 9.3 | 8.1 | 6.2 |
| | 7.1 - | 10.0 | 8.8 | 6.8 |
| C | - 7.0 | 12.5 | 10.7 | 8.2 |
| | 7.1 – 9.0 | 15.0 | 13.0 | 10.0 |
| | 9.1 – 12.0 | 18.0 | 16.3 | 12.5 |
| | 12.1 - | 19.5 | 16.9 | 13.0 |
| AX | - 3.0 | 5.1 | 4.4 | 3.4 |
| | 3.1 - 4.0 | 5.5 | 4.8 | 3.7 |
| | 4.1 - 5.0 | 6.0 | 5.2 | 4.0 |
| | 5.1 - | 6.7 | 5.9 | 4.5 |
| BX | - 4.6 | 10.0 | 8.7 | 6.7 |
| | 4.7 – 5.6 | 11.0 | 9.5 | 7.3 |
| | 5.7 – 7.0 | 11.5 | 9.9 | 7.6 |
| | 7.1 - | 12.0 | 10.1 | 7.8 |
| CX | - 7.0 | 18.0 | 15.6 | 12.0 |
| | 7.1 – 9.0 | 19.5 | 16.9 | 13.0 |
| | 9.1 – 12.0 | 20.0 | 17.6 | 13.5 |
| | 12.1 - | 21.0 | 18.2 | 14.0 |
| 3VX | 2.2 – 2.5 | 4.8 | 4.2 | 3.2 |
| | 2.65 – 4.75 | 5.7 | 4.9 | 3.8 |
| | 5.0 – 6.5 | 7.2 | 6.2 | 4.8 |
| | 6.9 - | 8.7 | 7.5 | 5.8 |
| 5VX | - 5.5 | 15.0 | 13.0 | 10.0 |
| | 5.9 – 8.0 | 19.0 | 16.9 | 13.0 |
| | 8.5 – 10.9 | 21.0 | 18.2 | 14.0 |
| | 11.8 - | 22.0 | 19.5 | 15.0 |

*Note: For banded belts, multiply the force in the table by the number of belts in the band.*

## Poly-V Drives

### Installation

Clean rust and dirt from Poly-V sheaves; replace worn or damaged sheaves. Sheave alignment is very important, and should be checked with a straightedge as shown on page 3.

Never force or pry a Poly-V belt over the sheaves. Reduce the center distance and lay the belts over the sheaves.

### Tensioning

Measure the outside diameter of the smallest sheave. Measure span length ("L" in Figure 2) and apply a force perpendicular to the belt. Measure the force required to deflect the belt 1/64" per inch of span. Multiply the number of ribs by the force "F" per rib in the chart, compare this to the force required, and loosen or tighten the belt as needed.

Run the drive briefly to seat the belt, and recheck the tension. At least one sheave should be freely rotating during the tensioning procedure.

**Poly V-Belt Tensioning**

| Belt Cross Section | Small Sheave Diameter Range | Force "F" Lbs./Rib |
|---|---|---|
| J | 1.32 - 1.67 | 0.4 |
| | 1.77 - 2.20 | 0.5 |
| | 2.36 - 2.95 | 0.6 |

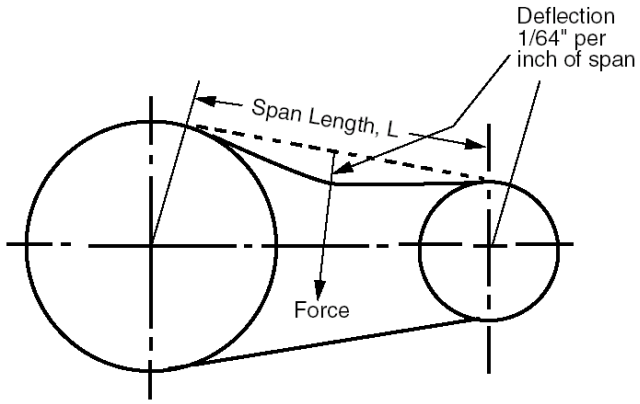



**Figure 2**

**Belt Storage Tips**

Under proper conditions, belts can be stored for many years without shortening belt life. Follow these guidelines.

- Store belts in a cool, dry, dust-free area, away from radiators and direct sunlight. Temperatures below 85°F and relative humidity below 70% are recommended.
- Store belts away from ozone-producing unguarded fluorescent lights, mercury vapor lights, and high voltage electrical equipment.
- Don't store belts near chemicals, oils, solvents, lubricants, or acids.
- Belts can be coiled on shelves or hung on pegs. Avoid sharp bends and stresses that can cause permanent deformation and cracks. Stack belts no higher than 12" to prevent damage to bottom belts. When hanging, coil longer belts to prevent distortion from belt weight.

**Sheave installation and removal**

**To install quick detachable sheaves:**
The conventional mounting position for quick detachable sheaves is with the bushing flange located toward the bearing. The reverse mounting position is with the flange of the bushing toward the open end of the shaft. For either position:

1. Make sure the sheave bore and the tapered cone surface of the bushing are clean and free from paint, dirt, and lubricants. Do not use lubricants to install bushing assemblies. Loosely assemble the bushing in the sheave, and insert the cap screws finger tight.

2. Slip the loosely assembled unit onto the shaft and position it for proper belt alignment.

3. Tighten down the hollow head setscrews in the flange on the key, snug enough to keep it in the desired position on the shaft.

4. Tighten the cap screws alternately and progressively to about half the recommended torque values in the table below. Check alignment and sheave run out (wobble) and correct as necessary. Continue to tighten the cap screws alternately and progressively to the torque values below. To increase leverage, use a wrench or length of pipe.

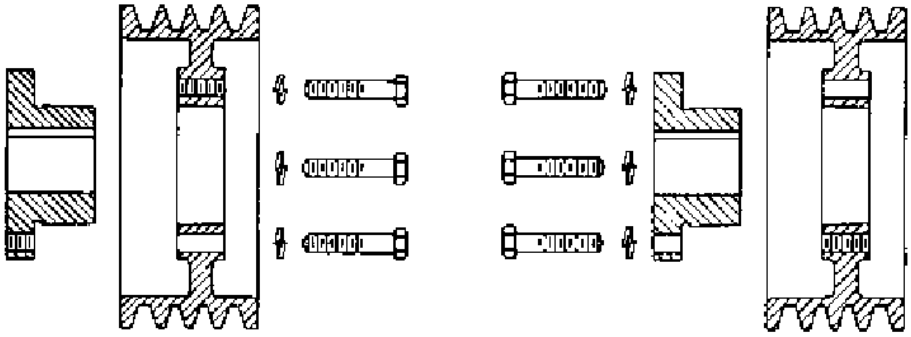
5. Tighten the setscrew on the key to hold it securely in place during operation.

NOTE:
Don't allow the sheave to be drawn in contact with the bushing flange. There should be a 1/8" to 1/4" gap when properly mounted.

**To remove:**
1. Loosen and remove all mounting cap screws. Insert two or three of the cap screws in the tapped removal holes in the sheave. Start with the screw opposite the bushing saw slot and progressively and alternately tighten each screw until the cone grip is broken between the sheave and the bushing.

2. Remove the sheave and bushing from the shaft. If the bushing won't slip off the shaft, wedge a screwdriver blade in the saw slot to loosen.

**Quick Detachable Sheave Mounting Positions**



**Torque Values for Tightening QD Bushings**

| QD Bushing | Wrench Torque (In.Lbs.) |
|---|---|
| SH | 108 |
| SDS | 108 |
| SD | 108 |
| SK | 180 |
| SF | 360 |
| E | 720 |

# V-Belt Troubleshooting Guide

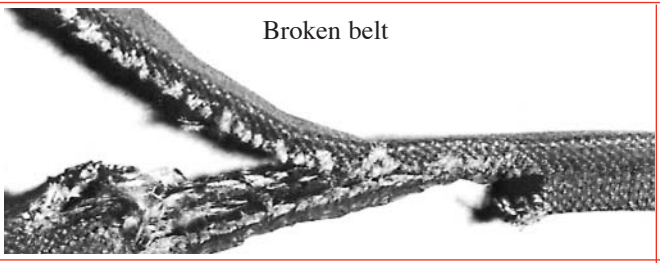
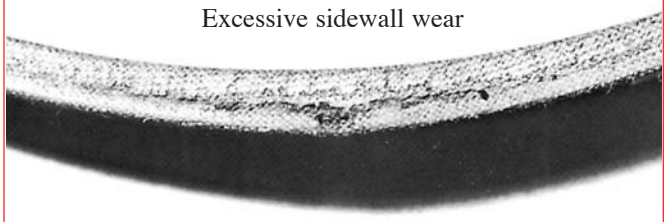
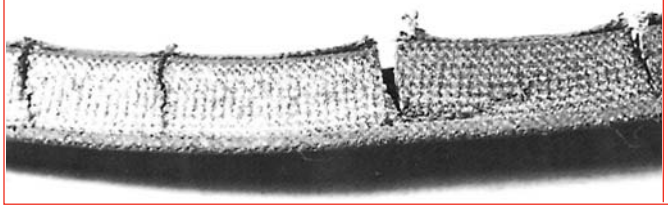
| Problem | Cause | Solution |
|---|---|---|
| **Short Belt Life** | | |
| Rapid failure with no visible reason | Worn sheave grooves (Check with groove gauge) | Replace with Dayton quick detachable sheaves |
| | Tensile cords damaged through improper installation | Replace all belts with a new set of Dayton belts, properly installed |
| | Underdesigned drive | Redesign drive |
| | Wrong type or cross section belt | Replace all belts with correct type Dayton belts, properly installed |
| | Sheave diameter too small | Redesign drive |
| | Foreign substance caught between belts and sheave | Shield the drive |
| Soft, sticky, swollen sidewalls. Low adhesion between plies | Oil or grease on belt or sheave | Clean belts and sheaves with degreasing agent or detergent and water. Remove source of oil or grease |
| Dry, hard sidewalls. Low adhesion between plies. | High temperature | Remove heat source. Improve ventilation |
| Deterioration of rubber | Belt dressing | Don't use belt dressing. Clean belts and sheaves with degreasing agent or detergent and water. Tension belts properly |
| Rapid sidewall wear | Worn or damaged sheaves | Replace with Dayton quick detachable sheaves |
| Broken belts | Foreign object in drive | Shield drive |
| Spin burns | Belts slip under starting or stalling load | Retension drive |
| | Sheave diameter too small | Redesign drive |
| | Load miscalculated – drive underdesigned | Redesign drive |
| Cracked bottom | Sheave diameter too small | Redesign drive |
| | Back side idler too small | Replace with an inside idler on slack side, or redesign |
| | Slippage | Retension drive |
| | High temperature | Remove heat source. Improve ventilation |
| Cut bottom | Belt ran off sheave | Check tension and alignment |
| | Foreign object in drive | Shield drive |
| | Improper installation | Replace all belts with a new set of Dayton belts, properly installed |
| Extreme cover wear, worn corners | Belt rubs against guard or other obstruction | Remove obstruction or realign drive |
| | Improper tension | Retension drive |
| | Dirt on belt | Clean belt, shield drive |
| | Sheaves rusted, sharp corners or burrs on sheaves | Repair or replace with Dayton quick detachable sheaves |
| | Sheaves misaligned | Align sheaves |
| **Improper Driver Speed** | | |
| Incorrect driver to driven ratio | Design error | Redesign drive |

| Problem | Cause | Solution |
|---|---|---|
| **Belt Stretch** | | |
| Belts stretch unequally | Misaligned drive | Realign drive |
| | Tensile cord broken from improper installation | Replace all belts with a new set of Dayton belts, properly installed |
| Belts stretch equally | Insufficient take-up allowance | Check take-up and folllow guidelines |
| | Overloaded or underdesigned drive | Redesign drive |
| **Belt Turnover** | | |
| | Foreign material in grooves | Shield drive |
| | Misaligned sheaves | Realign sheaves |
| | Worn sheave grooves (Check with groove gauge) | Replace with Dayton quick detachable sheaves |
| | Tensile cord broken from improper installation | Replace all belts with a new set, properly installed |
| | Belt undertensioned | Retension drive |
| | Incorrectly placed flat idler pulley | Position idler on slack side of drive, as close as possible to driver sheave |
| **Belt Noise** | | |
| | Belt slip | Retension |
| | Misaligned sheaves | Realign sheaves |
| | Wrong belt type | Replace cogged belt with wrapped belt |
| **Belt Vibration** | | |
| | Incorrectly placed flat idler pulley | Position idler on slack side of drive, as close as possible to drive sheave |
| | Distance between shafts too long | Install idler |
| | Belts too loose | Retension drive |
| **Severe Slippage** | | |
| | Spin burns | Retension drive |
| | Too few belts | Redesign drive |
| | Arc of contact too small | Install back side idler on slack side, or use timing belt |
| | Oil or water on belt | Clean belts and sheaves, shield drive |
| **Installation Problems** | | |
| Belts too long or short at installation | Design and/or belt selection error | Check design and selection |
| Belts mismatched at installation | Mixed used and new belts | Replace all belts with new Dayton belts |
| | Mixed belts from different manufacturers | Replace all belts with Dayton belts |
| | Worn sheave grooves | Replace sheaves |
| **Hot Bearings** | | |
| Drive overtensioned | Worn sheave grooves, belts bottom out | Replace with Dayton quick detachable sheaves |
| Sheave diameter too small | Design error | Redesign drive |
| Bad bearings | Underdesigned or poor maintenance | Check bearing design and maintenance |
| Drives undertensioned | Belts slip and cause heat build-up | Retension drive |
| Sheaves too far out on shaft | Design error or obstruction | Place sheaves as close to bearings as possible |

# Troubleshooting Examples

Here are some examples of belt failures.
If you've encountered similar problems, check below for probable causes and solutions.

## V-Belts

| Problem | Probable Cause | Solution |
|---|---|---|
| Broken belt  | Foreign object in drive | Shield drive |
| Excessive sidewall wear  | Worn or damaged sheaves | Replace sheaves |
| Cracked bottom  | Sheave diameter too small | Redesign drive |
| | Back side idler diameter too small | Replace with an inside idler on slack side, or redesign |
| | Slippage | Retension drive |
| | High temperature | Remove heat source. Improve ventilation |

For more information contact your Grainger representative.
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