



Synchronous Belts - Part III

PA NOTE

Introduction

This is the last in our series of PA Notes on synchronous belts. It covers general application parameters and maintenance and troubleshooting procedures as well as brief reviews of PowerGrip® Twin Power timing belts and Poly Chain belts.

Design Parameters

As we discussed in the second PA Note, synchronous belts have different operating characteristics than V or flat belts. As a result of these differences, the following design parameters are peculiar to synchronous belts and should be remembered:

1. **Idlers.** Use of idlers is a fairly common practice with V-belt drives. However, for synchronous belt drives, Gates recommends that idlers be used only when needed to provide a means of belt take-up on fixed center drives, to avoid obstructions in the drive area, or to increase belt wrap on the small pulley of a high speed ratio drive (backside idlers). Idlers should be no smaller than the smallest loaded pulley in the system. Spring loaded idlers are not recommended.
2. **Debris.** As previously mentioned, debris entrapment is a greater concern with synchronous belts than with V-belts. More care must be taken to provide adequate shielding to drives in environments where debris is likely. Completely enclosing a synchronous belt drive may be acceptable. This is because synchronous belts generate less heat through drive operation than V-belts and eliminating air circulation around the drive is not a critical consideration, except in extremely high temperature environments. However, regular drive maintenance should not be jeopardized by the installation of a permanent encasement.
3. **Service Factors.** In designing synchronous drives using the Gates Design Catalog, it is obvious that the Service Factors for comparable drives are higher for synchronous belts than for V-belts. The Service Factor reflects the degree to which certain drive conditions influence belt life. The same drive conditions affect different belt types differently. Any degree of shock or vibratory loads, such as those characteristic of piston compressors or diesel engines, will have a greater affect on synchronous belts than on V-belts. The positive drive characteristic of synchronous belts prohibits them from slipping to absorb momentary peak loads. This is reflected in the form of a higher Service Factor.
4. **Installation and maintenance.** As with any belt drive, proper drive installation is crucial to ensure satisfactory synchronous belt performance. In this regard, the importance of drive tensioning cannot be over-emphasized. You should ensure that the recommended shaft adjustment is provided for belt installation and tensioning. Center distance adjustments, as well as recommended tensions, are listed in the design catalog. Once installed, tension must be maintained or all benefits of proper drive design are lost.



5. **Alignment.** Drive alignment is more important to synchronous belts than with other belt drives. Tracking problems as well as accelerated belt and pulley wear, caused by misalignment, will lead to premature drive failure. We recommend that pulley alignment, both angular and parallel, be maintained to within 1/4 degree.
6. **Pulley Dimensions.** Proper pulley dimensions are crucial to satisfactory drive performance. All pulley dimensions should be within the RMA or manufacturer's engineering specification tolerances. Any degree of pulley wear or dimensional variation is greatly amplified in their effects on belt wear and life. Pulleys should be inspected at regular maintenance intervals for corrosion and wear.

Troubleshooting

No one has trouble recognizing a problem drive. The real difficulty lies in recognizing the cause and cure of a particular problem. The problems covered here have many possible causes; a few of the most common ones will be discussed.

1. **Noise.** Noise problems are commonly caused by drive misalignment or improper tensioning. The noise created by a drive increases with belt speed. Thus, the problem is generally associated with high speed applications. If proper tensioning and alignment do not reduce the noise level, the next possible cause is improper pulley dimensions. Verify that all pulley dimensions are according to RMA or manufacturer's specifications.
2. **Ratcheting.** Ratcheting is the synchronous belt equivalent to slipping and occurs when the belt teeth slide completely out of the pulley grooves. Although there may be no visible evidence of damage, the designed capabilities of the belt are destroyed after it has ratcheted. Ratcheting is caused by either improper tensioning, excessive loads, or inadequate bracketry that allows the center distance to give when a load is applied. When a belt ratchets, the load requirements should be re-evaluated and a new belt installed with the correct static tension.
3. **Unusual Wear.** As discussed earlier, the smallest amount of pulley wear is greatly magnified in its effect on belt wear. Thus, if unusual belt wear occurs, the obvious first step is to inspect the pulleys. Small amounts of pulley wear can be hard to detect but excessive wear is obvious with visual inspection. All dimensions should be within specifications. The best pulley material for minimizing wear is grey or ductile cast iron. When a softer material is used, wear may be accelerated. Abrasive environment, drive misalignment, and improper tensioning will all lead to rapid belt and pulley wear.
4. **Belt Breakage.** Belt breakage can be caused by excessive shock loading or severe misalignment. In the section covering belt construction, we mentioned that the fiberglass cord used in the standard belt is not capable of handling the type of load imposed by severe shocks. An alternative construction belt will normally be recommended under these conditions. When a drive is severely misaligned, the belt tension and load is concentrated on one side of the belt. Tensile failure at that point will initiate breakage. Occasionally, a belt will be jerked apart by one extreme, momentary peak load that exceeds the ultimate strength of the cord material. The only remedy for this problem is to change to a larger pitch and/or wider belt to increase belt strength.

In the troubleshooting process, be aware of the normal mode of synchronous belt failure. The end of the useful life of a synchronous belt is characterized by even tooth facing wear and eventually tooth separation. Any other type of



belt failure indicates an underlying drive problem. For drive problems not covered here or persistent difficulties, contact Gates Product Application for an individual evaluation.

Synchro-Power Twin Tooth Timing Belts

The need for synchronized reverse rotation or serpentine drives has led to the development of double-sided timing belts. The Gates PowerGrip® Twin Power® timing belts have the proven ability to transmit 100% of the Horsepower Rating load from either the front or backside of the belt. Combinations of loads can be taken from both sides as long as the total load does not exceed the Horsepower Rating of the belt. A special feature of Gates Twin Power belts, which ensures equal capability on both sides, is the highly wear resistant nylon fabric facing covering both the inside and outside teeth.

Ratings for Twin Power timing belts are the same as those for the conventional PowerGrip® timing belts and are listed in the Design Manual. The ratings are based on the size and speed of the driveR pulley, or the smallest loaded pulley where there is only one driveN shaft. To maintain the rated capacity for any pulley in the system, it is very important that at least six teeth be in complete contact. Product Application can assist you in designing your more difficult serpentine applications.

Standard construction for the Twin Power belts is the same as for conventional timing belts. Special constructions are available on a made-to-order basis by contacting Product Application.

Poly Chain

This series of PA Notes started with the history of the first synchronous belt. So, it seems appropriate to close with a brief note about the latest and most significant development in synchronous power technology - the Poly Chain belt.

Poly Chain belts out-perform any synchronous belts sold today and, in addition to the advantages over chain and other belt systems, they offer the following advantages over rubber HTD and STPD belts:

- Approximately twice the load-life capacity, resulting in more compact drives.
- Excellent abrasion and wear resistance.
- Resistance to a wide range of chemicals.
- Somewhat improved temperature operating range.
- Better ability to withstand shock loads or load surges.

Poly Chain belts are now available to solve many of the previously unsolvable synchronous drive requirements. Belt sizes not currently available can be produced for qualifying OEM customers with the acquisition of new tooling.

Conclusion



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The information contained in this series of PA Notes can be a valuable tool for both you and your customers. Recent developments prove that Gates synchronous belt technology is second to none. Knowledge is another powerful tool made available through Gates Product Application Department. Call for assistance with any unusual drive design or problems.