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Belt Drive Options

2-5% Energy Savings from a Fan Belt? Yes!

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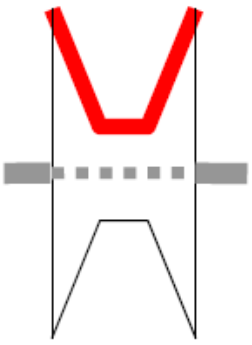
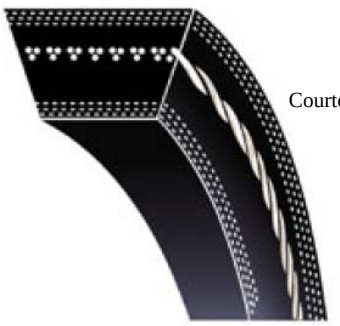
Belts are used to transmit power for a variety of reasons. A common application is to change the speed of the driven device. For example, if the driven pulley is larger than the driving pulley, the driven device speed is less. Sometimes belt drives are used to create a weak link or to isolate vibration. For example, a belt driven rock crusher may get jammed once in awhile – better to snap the belt than break the whole machine.



Pulley for V-Belt

Belts are found everywhere in industry, from office buildings to factories. The most common style is a V-belt, so-named because of the shape of the pulley (or sheave) it rides inside. The friction between the rubber belt surface and the metal sheave transmits the power. These units are inexpensive and are the workhorse of the belt drive market.



Courtesy: Gates Corp.

Standard V-Belt

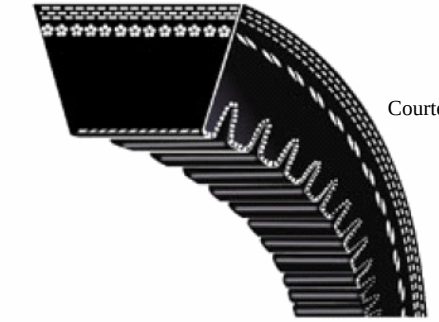
The opportunity for savings lies in the nature of how the V-belt works. The sides of the belt offer friction to the sheave. This simple arrangement works well but is not without some losses.

- **Slipping:** Friction drives of all types slip a little. They just do. The incremental slipping-grabbing sequence creates a friction loss.
- **Bending:** As the pulleys rotate the belt must bend- it's not much, but it does take some work to bend the belt back and forth.
- **Friction Release:** Work is done with the belt system while it is engaged with the pulleys. While it is moving in a straight line between pulleys, no work is done. As the belt straightens out, releasing from the pulley, there is sideways friction on the pulley that does some work but not the kind intended – it makes some more friction.
- **Bearing Loading:** To get proper tension, the belts must be tightened – this is usually done by sliding the motor or by adjusting a tensioner device – in any case the belt becomes tight and this same force is felt on the sheaves. The added load on the bearings creates additional friction at that point. Worn sheaves require excessive tightening of belts and create additional losses.

Combined, these losses can be as much as 5%. This figure varies by belt and application, but it is a good average. A new, properly tightened belt on a good sheave has less friction than a loose belt. Since belts stretch and are not continuously adjusted (other than some automatic tensioning systems) the losses will vary throughout the life of most belts. For most standard V-belts, a lifetime average of 5% loss is a good estimate.

Options

Cogged Belts. 1-2% Savings.
These address losses from bending. The ***notches*** in the bottom of the belt let it bend more easily. Other aspects of the V-belt system remain. The beauty of this option is that requires nothing more than a different belt choice – that's it! Pricing for cogged belts is the same as a standard V-belt, so this is No-Cost savings item. As you use up the standard V-belts in stock, migrate to cogged belts. Easy.



Courtesy: Gates Corp.

Cogged V-Belt System

Synchronous Belts. **5% Savings.**

These address losses from slipping, bending, friction release, and bearing loading. This design is not a V-belt at all and does not rely on friction. It is closer to a chain drive than a belt drive. It has the best improvement potential, but requires an investment…..in different sheaves. For this system to work there needs to be ***matching pulleys*** with ribs (like a sprocket) that engage the teeth in the belt. It needs to have sufficient tension to engage the teeth and prevent jumping, but operates on less tension – thus the load on the bearings is reduced. No slipping means no slipping losses. Like all belts there is some bending work, but that's about the extent of the losses.

Synchronous Belt Drive System

Getting Started. The supplier of the synchronous belts will also supply the pulleys and provide assistance in getting the right parts for you. Since a synchronous belt does not depend on friction, it is not made of rubber. In turn, it is not flexible and requires more attention during set up. Once properly aligned and tensioned, they are maintenance free. No additional tensioning is required during the life of the belt – and the life span of the belt is longer than regular V-belts.

Limitations

Cogged Belts can be used anywhere a standard V-belt is used.

Synchronous belt systems can be used in most common pump and fans, especially centrifugal equipment. They have a few limitations to be aware of.

- Since the belts don't stretch, they will transmit vibration.
- Since the belts don't slip, they are not suited to shock loads or where equipment could jam.
- Alignment and tensioning is much more critical than regular belts.
- These belts make a 'whine' that may be bothersome in some cases.

Economics

Cogged Belts cost the same as regular belts and last as long.

Synchronous Belts require an investment in the pulleys and set-up. Good economic return will apply to:

- Larger motor systems (e.g. 10 Hp and larger).
- Systems with high run hours.
- One estimate of the cost of switching to synchronous belt drives is 15-25 per Hp.
- Paybacks of a year or less are reported for high run time motors.