

Inspecting & Maintaining

Belt Drives

Similar to many other components, belts are relatively maintenance-free when they are selected, installed and tensioned properly.

But there are some things that technicians can do to ensure everything is in working order. They should check belts, pulleys, idlers and tensioners during every preventive maintenance cycle.

The Gates Corporation outlined what technicians should look for.

- ◆ Glazed V-belt sidewalls indicate that the belt is slipping in the pulleys. This is a result of too little tension.

- ◆ Deep bottom cracks may result from high heat conditions inside the engine compartment.

- ◆ A V-belt that is falling apart in layers could be the victim of oil contamination.

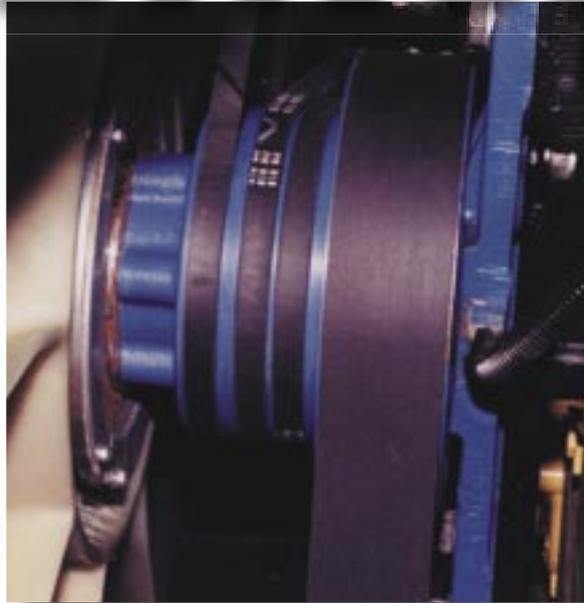
- ◆ Pitted or streaked sidewalls are the result of a foreign object in the pulley or a rough pulley wall surface.

- ◆ V-belt tensile break also can result from too much belt tension or excessive and continual shock loads to the drive.

- ◆ Tensile damage can occur when a belt is forced

or pried on during installation, but it may not be noticed until the belt actually breaks.

- ◆ The ribs of serpentine belts should be checked for deep or excessive cracks. If belt ribs have more



Drive misalignment can create belt tracking problems, excessive wear, chirping noises and belt stability problems.

than three cracks per inch, 80% of the belt's service life is gone.

Because engines have different duty cycles, Gates does not recommend a mileage interval for replacing belts. But when in doubt, replace the belt.

Belt and replacement labor charges are less expensive than a service call on the highway.

Belt tensioners may show symptoms of possible failure in the range of 80,000 to 100,000 miles. With the engine running, the movement of the tensioner arm

should not exceed 1/2" on either side of the center. Excessive movement indicates the damping system may have failed, according to Gates.

Also, inspect the tensioner for resistance to movement, and replace it if necessary.

In addition, make sure to manually rotate the pulley to check for noise, resistance and looseness. Use a straight edge or a laser instrument to check for proper alignment of all the pulleys in the drive system.

When you know what to inspect on your customer's belt drive system, it is easier to identify the root cause of most problems. Because there are many things that may go wrong with the belt drive system, you must use caution when diagnosing a failure.

According to Gates Corporation, the two most common causes of belt failure are engine compartment heat and a tensioner that has lost its spring force.

Heat from higher under-hood temperatures generated by the latest, low-emissions engines will reduce belt service life significantly, unless the belt is designed for this operating condition.

Do you know what factors contribute to a worn or failed belt drive system?

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Bob Johnston, director, field service, Freightliner LLC, explained that on most older, manually-tensioned V-belt and multi-ribbed serpentine belt drives, the most common belt failure is heat aging caused by slippage.

“This heat aging condition will result in cracking of the belt’s undercord, chunking of the ribs and loss of the belt’s flex capability,” he said.

Belt tensioners apply a constant force to a belt, thus compensating for belt length changes resulting from stretch, wear or any possible changes in accessory drive operating loads. A tensioner at or near failure will allow the belt to slip, which in turn affects the performance of the accessory drives.

The tensioner for the belt drive accessory system can fail for several reasons including misalignment, loss of damping, pulley bearing failure and internal spring wear, among other reasons.

Johnston added that many fan drives are designed to require high horsepower capacity from the belts, and in a high horsepower requirement, the tension requirement is high to prevent slippage.

“On auto-tensioned drives, a tensioner controls the belt tension. When it fails, the belts can fly off prematurely or jump ribs into a misaligned condition,” he said.

Drive misalignment can create belt tracking

Service Secret

Bob Johnston, director, field service, Freightliner LLC, defines the proper maintenance procedures that you should adhere to when a belt drive systems fails or wears.

- ◆ Inspect the pulleys for abnormal wear and misalignment; replace and realign them if necessary.
- ◆ Inspect the tensioners for smooth arm travel without sticking or binding, case alignment and smooth idler movement. A tensioner and its idler always should be replaced together as a unit.
- ◆ On manually-tensioned drives, you need to check the belt tension often. This may mean several times in the first 5000 miles of the drive. When you notice tension loss, return the belt back to the required tension quickly.

problems, excessive wear, chirping noises and belt stability problems. It can occur when excessive wear enlarges the pivot shaft in the spring housing, according to Gates. The tensioner then becomes unstable and cannot handle shock loads properly.

When damping is lost, vibration increases and the service life of the belt, tensioner and other drive components is reduced greatly. The flat spring in some

tensioners will wear down because of excessive vibration and friction. This scrapes away the teflon rust inhibitors on the spring and can cause the tensioner arm to lock up and lose its damping efficiency.

The spacing between the coils of a round spring tensioner eliminates metal-to-metal contact, flex fatigue failure, noise and contamination, which often cause a flat spring to lock up or seize the tensioner, according to Gates.

When the pulleys become worn, they can cause excessive pilling, noise, belt slip, belt turnover, irregular belt wear and reduced belt life.

Although a worn pulley may be evident visually, it’s best to use a sheave gauge for complete inspection. Insert the proper gauge into the groove and if the wear is excessive, replace it. A frequent source of V-belt drive trouble is a worn pulley that can cause excessive belt wear and tension differences, according to Gates.

Worn pulleys create instability in the drive, which can cause the belt to flip or turn over. During routine maintenance, make sure that you remove all oil and grease with a solvent, remove any rust with a wire

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brush and dress down burrs with a small file as they may accelerate belt wear, according to Gates.

Because proper maintenance of belt tension is essential for optimal performance of accessory belt drive systems, there are certain things you should be aware of.

Jim Zwald, product manager, automotive replacement products, Goodyear Tire & Rubber Co., said that belts can experience a breakdown in proper tension and can roll or flip completely off a drive.

“Changes in belt tension are caused by three primary factors: Improper installation, tensioner wear and improper belt length,” he said.

Low belt tension leads to belt slip, noise, excessive wear, high belt temperatures and shortened belt life. Conversely, belt tension that is too high causes shortened bearing life from excessive hub loads, belt stretch, increased belt temperatures and premature belt failure, according to Gates.

“Because tension levels in a belt normally will decrease with use over time, new belts typically are installed with as much as twice the tension level necessary to prevent slippage. The tension decay properties of a belt are designed to provide minimal tension loss with a decay rate that is both gradual and predictable,” according to Gates.

Tech Tip

Improper belt installation is a common cause of premature belt failure. According to the Technology & Maintenance Council (TMC), one of the outermost belt ribs is placed outside the pulley groove, causing a belt rib to run without a supporting or aligning pulley groove.

The belt rib begins separating from the joined strands. If it is left unattended, the cover often will separate, causing the entire belt to unravel. In this case, the belt’s life has been limited severely and proper care should be taken to replace it immediately, according to TMC.

Ensure all the ribs of the replacement belt fit into the pulley grooves. Run the engine and then with the engine off and battery disconnected, inspect the belt for proper installation.

Johnston explained that slippage burns the belt and quickly reduces its tension and load carrying capacity. “Auto-tensioned drives eliminated most of the tension issues because they don’t require as much tension to carry all loads, which reduces wear on the belt, the pulleys, accessory bearings, etc,” he said.

“A substantial reduction in belt tension that occurs over a short period of time suggests that other problems

may exist. Causes for belt tension loss can be divided into one of two categories: Either the belt length has become too long or the drive length has become too short,” said Gates.

According to the Technology & Maintenance Council (TMC), the belt length can be defined in terms of the belt pitch length, outside or inside the belt circumference, or in terms of the belt effective length.

The effective length system of measurement takes into account belt tension as well as belt and pulley geometry when determining belt length. This is the preferred system of belt measurement for vehicle engine applications, according to TMC. A belt’s effective length typically measures from 0.2” to 1” less than the outside circumference of the belt.

Drive effective length is the ideal belt effective length for a particular drive layout, said TMC. The drive effective length changes when accessory locations or pulley effective diameters are altered.

Gates went on to explain why either condition may exist.

◆ Belt length is too long. Belt stretch is the permanent elongation of the belt’s tensile cords, which oc-



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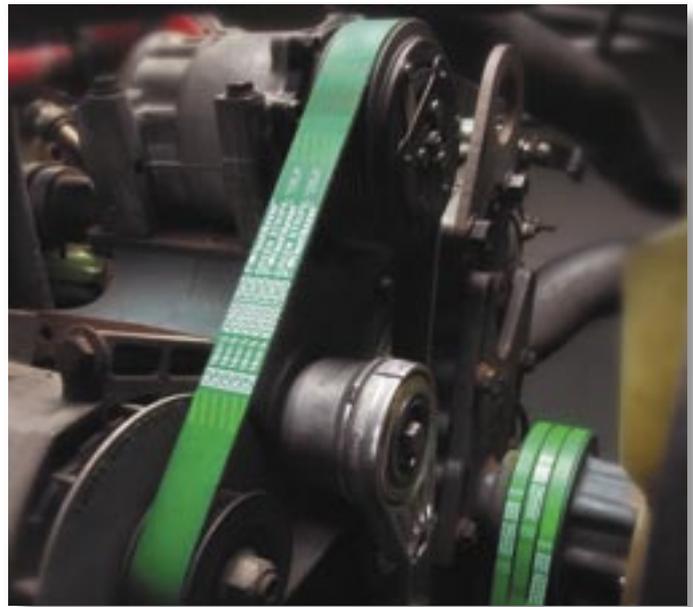
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curs only under conditions of excessive belt tensile load. In a properly designed and functioning belt drive, tensile forces rarely exceed 10% of belt breaking strength, however, if there is excessive shock loading or severe belt span vibration present, the belts can achieve peak tensions one and a half to two times their normal operating levels.

For most belts, permanent belt stretch is possible if tensions exceed 15% to 20% of the belt's breaking strength or are greater than 350 lbs. to 450 lbs. per inch of belt width. Belt stretch also can result if the belt is overtensioned during installation.

◆ Drive length is too short. Belt tension will decrease when the drive effective length becomes shorter as a result of pulley wear, bent brackets, loose mounting bolts or worn mounting holes, slots and bushings. Pulley wear and worn mounting holes or bushings typically occur over an extended period of time. However, severe engine vibration, loose bolts and a dusty or dirty operating environment can accelerate belt wear rapidly.

Zwald concurred, adding "Belts typically experience unexpected wear when they come in contact with foreign material such as road debris, oil and moisture.



Because tension levels in a belt normally will decrease with use over time, new belts typically are installed with as much as twice the tension level necessary to prevent slippage.

When foreign material becomes wedged between the belt and pulley area, belt flip typically occurs."

He added that tension breakdown is a major problem. "Improper initial tensioning can cause belt drive failure. This primarily happens with two pulley drives, when the proper two-step tensioning and seating process is not followed," he said.

"With poly-V serpentine belt applications, a loss of spring idler tension in the tensioner unit can occur. This is primarily a normal wear pattern based on time and number of miles in service. Proper tension is as important to belts as air pressure is to tires," Zwald said.

Johnston explained that changes in belt tension can occur when power is transferred by a belt with tension.

"Belts need to be tensioned to a level that will allow them to carry the loads encountered in all of the truck's duty cycles. A fan clutch engaging and disengaging puts very high loads on a belt and the tension must be there to absorb the load," he said.

"The belt's tensile cords respond to heat and will stretch when the belt is new. When elasticity loss occurs, the belt no longer can be tensioned properly and then needs to be replaced," Johnston explained.

"On auto-tensioned drives, the belt is very closely designed with the



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tensioner and drive geometry. When a belt stretches beyond its acceptable limits, it loses the tension required to function properly," he said.

When a belt drive system fails, it's vital that you inspect the system's individual components, looking for worn or damaged parts. "If you discover that there is wear or damage, replace the drive system, including all of its components," Zwald said.

"In all instances, the belt should be replaced when installing a new drive system. If a roadside breakdown occurs, an old belt can be reinstalled so you can get the vehicle to a service establishment," he said.

While your customer's vehicle is in for routine service, it may be a good idea to check the belt to make sure everything is in working order.

Although belts generally are maintenance-free, you must take the proper care to ensure they are installed and tensioned properly.

Who To Contact

For more information on belts, you may contact the following companies directly, or use the FREE Reader Service Card in this issue. Other companies offering information on belts can be found in the **Truck Parts & Service Aftermarket Buyers' Guide & Directory** as well as in Buyers' Guide section on our Internet web site at www.truckpartsandservice.com.

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