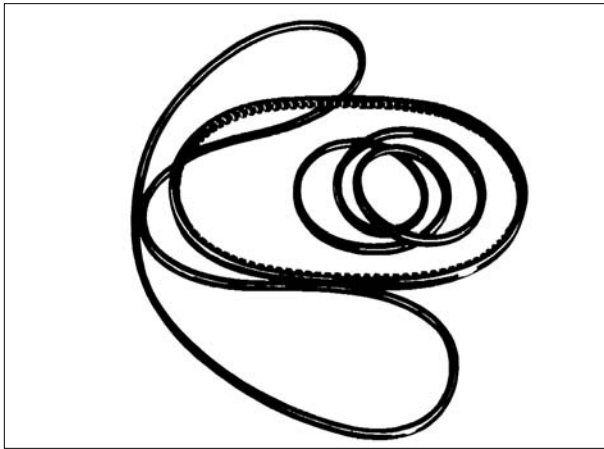
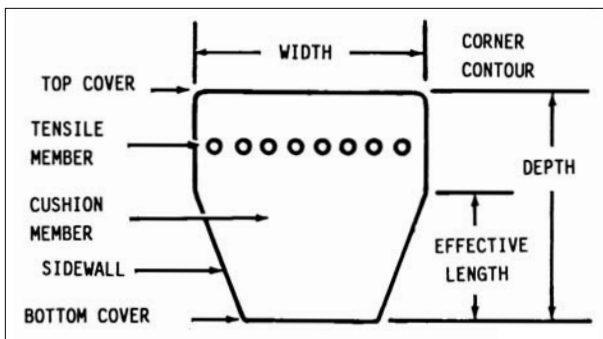




The function of a drive belt is to transfer rotation (torque) from the powered pulley to one or more driven pulleys. The belt must be designed and manufactured to transfer this torque efficiently and reliably. It should also be designed to slip or break if upper torque limits are exceeded in order to prevent possible damage to other components.

Additional Design Considerations

During the development of a new John Deere machine, engineers test various belt designs to ensure that the one selected has the specified requirements.



The above illustration shows the important areas of a typical V-belt cross-section. Each area plays an important role in how the belt will perform for the function and application. The top section of the belt is the tension section. It is rubber and stretches as the belt forms around the sheave.

The bottom section is called the compression section because it compresses when wedged into and shaped around the sheave.

The center section of the belt is the strength section. It neither compresses nor stretches, but the cords located in this area give the belt its tensile strength. Without these cords, a V-belt would be pulled apart.

The complete belt is covered by a cover section of tough fabric and rubber which protects the inner parts.

In addition to being able to transfer torque efficiently, then slip or break to protect machine components, the factors listed below are taken into consideration when designing and selecting a drive belt:

- Additional idlers and multiple sheaves and pulleys cause unique wear characteristics as well as altering stress points
- Unusual heat generated by pressure and stress forces when a belt is operating will further cure a belt to the point that it fails prematurely
- Lateral stress is an engineering consideration
- Sidewall material is selected with regard to friction coefficients, wear factors, and weather resistance

Many belts are tested in a given application and environment before selecting the best belt for a new machine.

Belt Failure Rate Monitored

Belt failure rate is monitored in the field to determine if performance is satisfactory or if a change in type or design is required.

Same Quality as Original Equipment

To ensure that the machine continues to perform properly, it is important that replacement belts have the same high quality and design as the original equipment belts. With John Deere replacement belts, this is assured.

SOURCES OF WEAR

V-belts transmit power by friction and a wedging action between the sides of the belt and the inside walls of the sheave groove. This is where to look for signs of wear.

All belts and sheaves wear in use. Normal wear can be recognized as even wear — both on the belt and the sides of the sheave. It is unusual wear that you should look for and correct.

Many belts are reported as being defective, but, upon closer examination, the failure has been traced to a bad sheave, misaligned drive, or some other fault of a mechanical component of the machine.

MECHANICAL INTERFERENCE

One of the chief advantages of V-belt drives is ease of inspection. Watching and listening can detect signs of normal wear.

A belt striking against the belt guard produces an audible “ticking” sound that warns of rubbing contact. This contact can produce rapid wear of the fabric on wrapped belts and will greatly shorten the life of the belt. While the noise of nearby equipment might drown out the “ticking,” routine visual inspection for bent or damaged belt guards will also reveal belt-guard contact. Of course, the belt will probably be frayed — another sign of rubbing.

SHEAVE MISALIGNMENT

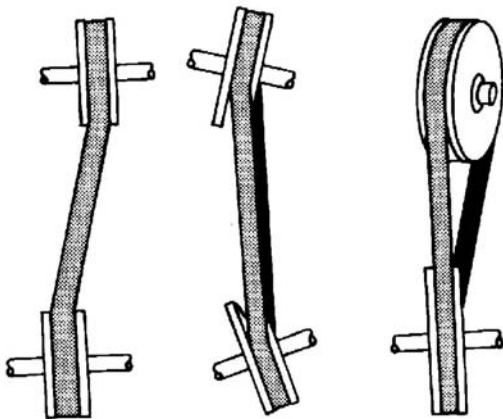


Fig. 1 – Misaligned sheaves

Sheave misalignment is another problem to watch for during routine inspection. While the misalignment illustrated in Fig. 1 is exaggerated, it does indicate another common cause of shortened belt life.

Sheaves are usually out of line because the drive and driven shafts are not parallel. However, even perfectly parallel shafts do not guarantee sheave alignment.

Fig. 1 shows the most common types of misalignment - all caused by the shafts not being parallel.

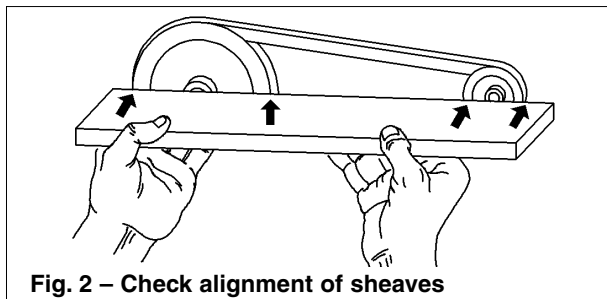


Fig. 2 – Check alignment of sheaves

Possibly the best way to check alignment is to use a straight edge between the sides of the sheaves (Fig. 2).

The straight edge should touch the sheaves at the four arrows. Then rotate each sheave and note whether the contact of either sheave with the straight edge is disturbed. If so, a shaft is bent or a sheave is wobbling.

Another method is to sight across the edge of the sheave groove in line with the belt. Harmful misalignment will show up as a bend in the belt at the point where it enters or leaves the sheave grooves.

V-belts, because of their flexibility, can tolerate more misalignment than other types of power drives. But there is a point beyond which they should not be misaligned if they are to deliver the service they are designed to give.

MISMATCHED BELTS

In multiple drives, the belts must be accurately matched so that the load is evenly distributed among the belts. If the load isn't evenly distributed, the shorter belts will do all the work.

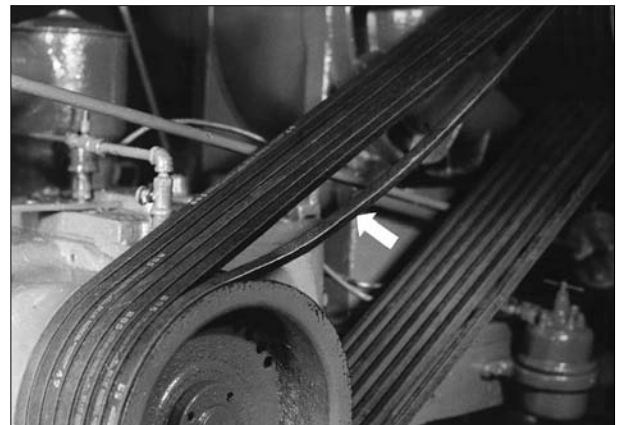


Fig. 3 – Mismatched belts

Fig. 3 shows mismatched belts. This drive has seven new belts, but one (arrow) is getting a “free ride.” Although all belts are new, the outside belt is obviously longer and not pulling its share of the load.

When watching for possible mismatching, look for sagging belts on the tight side of the drive — the side on which the belts approach the motor. If they are even on this side (though not even on the slack side) the belts are pulling their fair share of the load.

To ensure proper belt matching, V-belts are marked with belt size numbers.

WORN BELTS

All belts and sheaves wear to some degree after they have been in use. As wear occurs the belts ride lower in the sheave grooves. Since center distance has to be increased to compensate for the wear, a worn belt is “longer” than a new belt. (The worn belt also stretches in use.)

It is important, therefore, to **replace the entire set on multiple-belt drives** even though only one belt might fail. If only one belt is replaced, the replacement will in effect be “shorter” than the other belts.

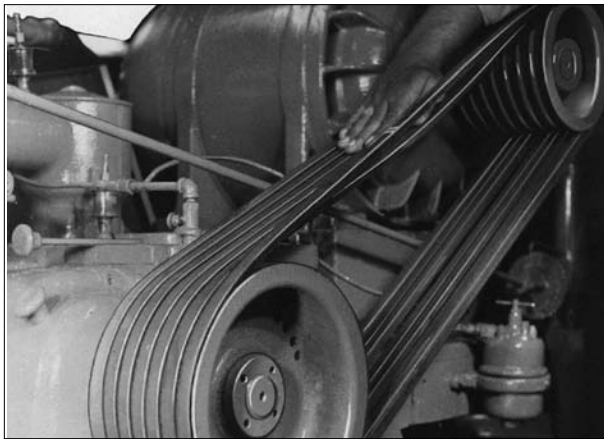


Fig. 4 – Replacing only one belt in a set means overloading the new belt and underloading the others

In Fig. 4 only the broken belt has been replaced. Because the old belts are worn and stretched, the new belt is pulling most of the load. And, since seven belts are obviously needed to meet the horsepower requirements of the application, the overload will considerably shorten the life of the new belt.

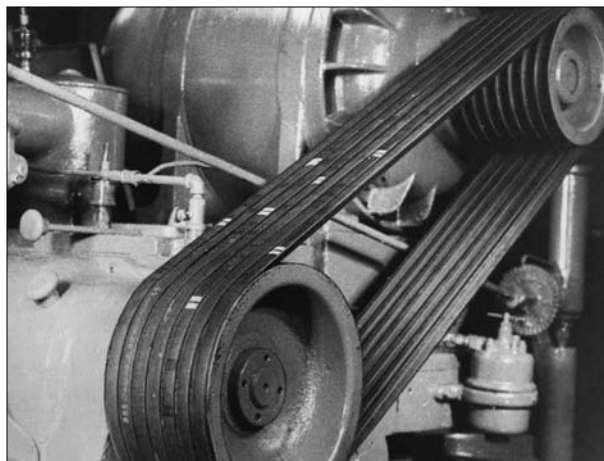


Fig. 5 – Replace all belts in a set at one time as shown

In Fig. 5 all belts in the set have been replaced and each belt is carrying an equal share of the load. When belts pull together like this, they’ll give the service they’re designed to provide.

Replacing all belts on a multiple drive when only one has failed is insurance against forced downtime and lost production.

BELT TENSION

Too little tension will cause slippage or slip-and-grab, causing the belt to break. If the belt does not break, slip will cause excessive cover wear, burned spots, and overheating.

Too much tension will cause belt heating and excessive stretch as well as damage to drive components such as sheaves and shafts. The extra tightness will also place a heavier load on the bearings.

Remember that V-belts should ride on the sides of standard sheaves, not on the bottom of the groove. Tension on a new belt should be watched during the first 24 hours of operation. This is when the initial seating and stretch occurs.

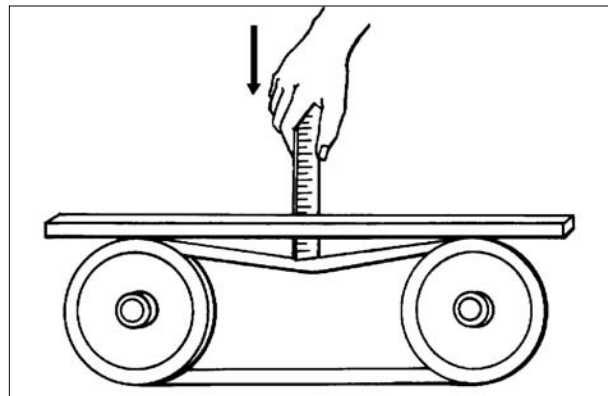
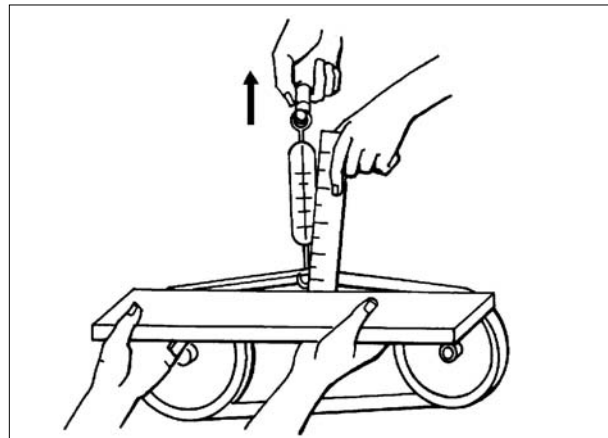


Fig. 6 – Checking belt tension

Belt tension is often checked by deflecting the belt on one side with a spring scale (Fig. 6, top). By measuring the deflection at a certain pounds pull, actual belt tension is found. **The recommended tension is given in the machine operator's manual.**

Another method is to depress the belt halfway between the sheaves using a ruler at right angles to a straightedge (Fig. 6, bottom)

Tension on Banded V-Belts

On banded V-belts, the only special consideration is that the entire belt must be deflected uniformly. This can be done by placing a rigid bar, which will extend across the width of the belt, between the tension tester and the belt.

Tension on Quarter-Turn Drives

On these drives, adjust tension so that when the drive is running, the middle belt on the slack side of the drive will not sag below its groove in the sheave on the vertical shaft.

CAUTION: *Never attempt to adjust a belt while it is operating. Keep hands, feet, and clothing away.*

BELT SLIP

While loose belts usually cause slippage, the cause may be overload. If belt tension is acceptable but the belt still slips, overload is the likely problem.

Never attempt to correct slip by using a belt dressing. While reducing slip, the dressing may soften and deteriorate the V-belt.

BELT SQUEAK

Squeak often occurs at idling speeds. It produces a sound very much like the chirping of a bird or a dry bearing and is most prevalent when pressed-steel pulleys are used. Squeak is not unique to certain makes or types of belts. But it is most likely to occur on cold, damp mornings or under dusty conditions.

Squeak itself is harmless, but is frequently mistaken for belt slippage. Consequently, belts are often tightened to a point where they or the bearings are damaged.

Never apply belt dressing or oil as a means of eliminating this noise.

BELT SQUEAL

Squeal is a high-pitched howl or rasping sound that occurs during acceleration or when the belt is near or at overload. It definitely means the belt is slipping and should be investigated. The cause is usually a lack of belt tension.

If the squeal persists after the belts have been checked and tensioned, the drive itself should be checked for overloading. Again, never use belt dressing as a substitute for retensioning the belt.

SHEAVE GROOVE WEAR



Fig. 7 – Irregular sheave grooves

In the four-groove sheave shown in Fig. 7, grooves (1) and (2) are worn much more than the others. This wear allows the belts in the worn grooves to ride lower than the rest of the belts and creates the same effect as mismatched belts.

Also, it causes what is termed “differential driving” — a condition where the belts operate at different speed ratios between the drive and driven units. In such a drive, the belts actually “fight” each other because some of them are trying to travel faster than others.

The wedging principle of V-belt drives makes it vital to keep the sheave groove sidewalls perfectly straight.

When the groove walls are dished out, the belt's wedging action is reduced. The gripping power is reduced and — in extreme cases — slippage occurs and belt life is greatly shortened.

When mismatched belts are spotted in a multiple drive, the sheave grooves should be examined for excessive wear. On banded V-belts, if the tie band is separating from the belts, this may also mean worn sheave grooves.

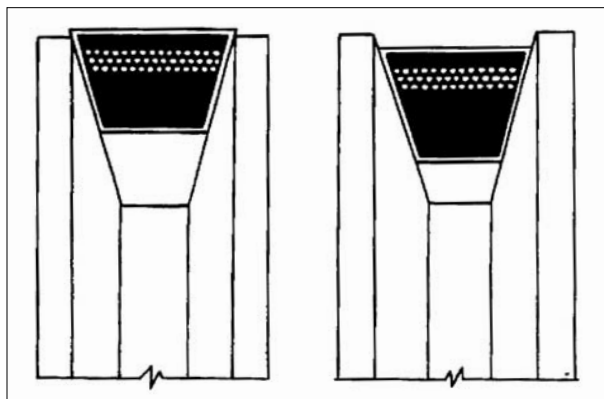


Fig. 8 – Correct position of V-belt in sheave groove (R.M.A. standard sheave)

Because of slight variations in V-belts and sheave grooves, the riding position of new belts in new sheaves will vary. In a standard sheave, it will vary from 1/16-inch (1.6 mm) above the top of the grooves to 1/16-inch (1.6 mm) below the top (Fig. 8). However, for a given multiple-groove sheave, the riding positions of the belts should be uniform.

A new belt that rides lower than the other belts in a drive may mean that the sheave groove sidewall is “dished out” (Fig. 9).

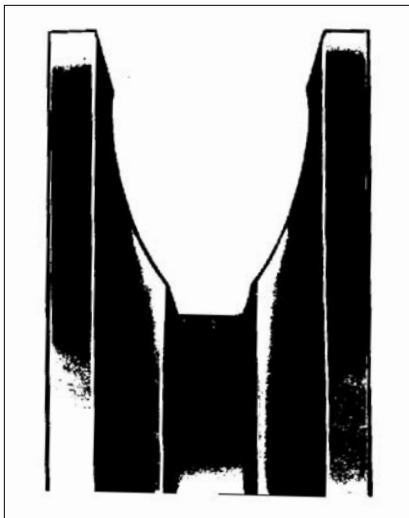


Fig. 9 – Sheave grooves “dished out” by wear (replace sheaves)

SHINY SHEAVE GROOVE BOTTOMS

In standard sheaves, a shiny groove bottom is a sign that the belt, or sheave, or both are badly worn and the belt is bottoming in the groove. This causes the belt to lose its grip and waste power.

Worn sheaves or shiny sheave groove bottoms will usually show up first on the smaller sheave of the installation.

WOBBLING SHEAVES

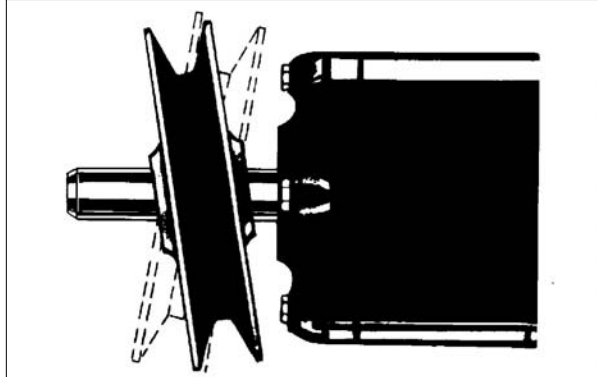


Fig. 10 – Wobbling sheave

Wobbling sheaves are another cause of shortened belt life. A wobbling sheave (Fig. 10) whips the belt from side to side, subjecting it to a lateral strain that produces rapid sheave and belt wear. A wobbling sheave also transmits vibrations to the machine.

DAMAGED SHEAVES

Sometimes sheaves are damaged as shown in Fig. 11. Cast sheaves may become chipped; pressed steel sheaves can get bent.

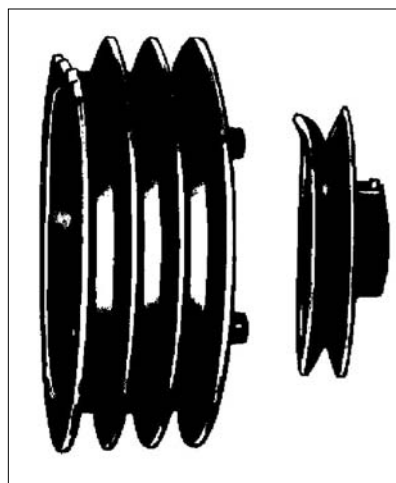


Fig. 11 – Damaged sheaves

Regardless of the type of damage to the sheave, damaged sheaves always produce rapid belt wear. The only way to prevent short belt life is to correct the sheave condition immediately.

OVERHEATED BELTS

V-belts are composed mainly of rubber — and heat is the natural enemy of rubber.

When the drive is open or ventilated, the temperature is usually not sufficient to affect the belts.

Under field conditions, belts operating in temperatures of less than 180°F (84°C) are not materially affected. Temperatures in excess of 180°F (84°C) may harden the belt, causing it to crack and stretch. To prevent this, be sure that screens and shields are kept clean for full ventilation.

Fig. 12 shows a belt damaged by excessive heat. It appears cracked or checked on the bottom edge and should be replaced.

**OILY OR GREASY BELT**

Fig. 13 – Belt ruined by oil and grease soaking

Oil or grease, if allowed to soak into the rubber, (Fig. 13) causes a V-belt made of natural rubber — or synthetics — to become soft, to swell, and to deteriorate very rapidly.

When oil or grease is found on a belt, wipe it off with a clean cloth dampened with a detergent solution. Then wipe dry with a clean dry cloth.

For naturally oily or greasy operations, oil-resistant belts can be installed.

CAUTION: *Never try to clean a belt while it is operating.*

BROKEN CORDS

A belt found turned over in the pulley groove should be replaced. Flip-over usually means one or more of the cords in the strength section is broken.

Broken cords can result from prying belts into sheaves without loosening the idler mounting bolts.

The proper method of installing a V-belt is to loosen the mounting bolts, slide the drive forward, and drop the belt over the sheave.

CAUTION: *Keep all belt guards and shields in place.*

SIGNS OF IMPROPER V-BELT INSTALLATION

- Belt stretched beyond take-up
- Belt slips
- Belt fails rapidly for no visible reason
- Belt rolls over
- Belt cut on bottom

STORAGE

Proper belt storage is important for both new belts and for those on the machine

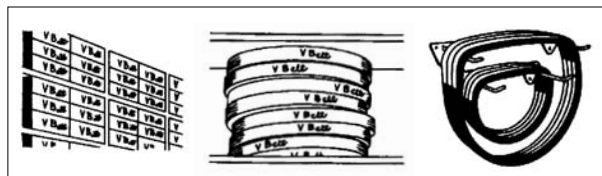


Fig. 16 – Storing belts in the shop

Storage in the Shop

New belts should be stored as follows to keep them factory-fresh:

- Store belts in a clean, cool, and dry place. Shrinkage or deterioration may occur if belts are piled on damp floors or stored near radiators
- Keep belts away from heat and direct sunlight
- Do not place in bins for long periods. This might distort the shape of the belt
- Do not hang belts on small pegs or nails. Heavy belts could be weakened due to distortion. To prevent this, hang belts across two pegs (Fig. 16)
- Do not break matched sets — keep intact

Storage on the Machine

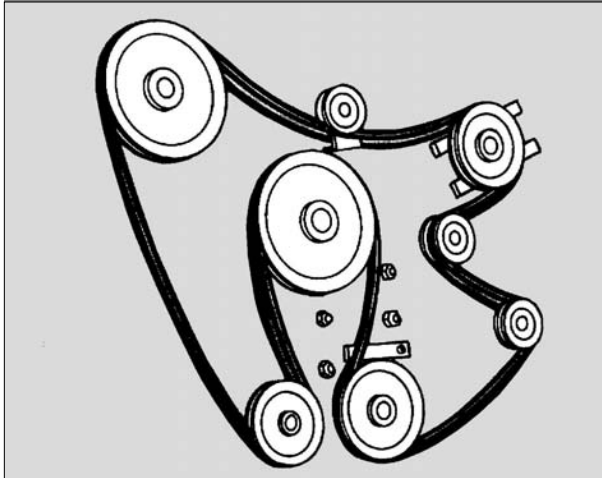


Fig. 17 – Loosen all belts if stored on the machine in off seasons

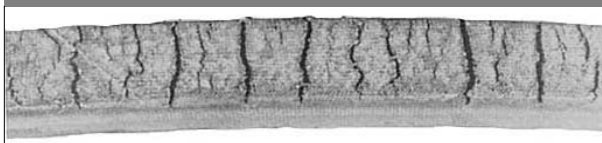
If a machine is stored for a long period, observe these rules:

- If belts are not removed, relieve belt tension by loosening all tighteners (Fig. 17). This is necessary to prevent the belt from “setting” or developing unequal stresses that might lead to early failure
- If possible, remove all belts. Thoroughly clean them, then store in a cool, clean, and dry place
- If the belts are removed, coat sheave grooves with an anti-rust compound or grease prior to storage. Be sure to remove such rust preventives before installing the belts and starting the machine. Sheave grooves can also be protected with a section of discarded belt tied in place
- Protect all movable or sliding parts of variable-speed drives by lubricating thoroughly to prevent corrosion due to moisture

WEAR ON V-BELTS

How to Spot Belt Wear

Base Cracking



Excessive cross-cracking on the base of a belt having little or no side wear is normal damage for belts that have run a long time at light load.

Normal wear characteristics.

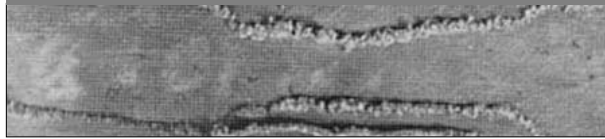
Fabric Rupture



Fabric rupture can be caused by operating a belt over badly worn sheaves, too much tension that forces the belt down into the grooves, or foreign objects falling into the sheave groove while the drive is operating.

Check the condition of the sheaves. Avoid prying belts onto sheaves.

Cover Tear



Damage caused by the belt accidentally coming into contact with some part of the machine, tearing the cover.

Damage is due to belts running too loose, allowing them to “throw-out” centrifugally so that they rub on parts of the machine. Proper belt tension prevents this from happening.

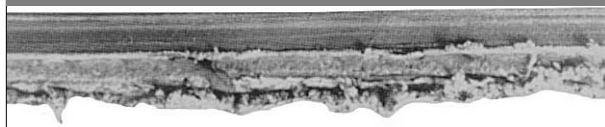
Slip Burn



The driven pulley stalled from an overload or improper belt tension.

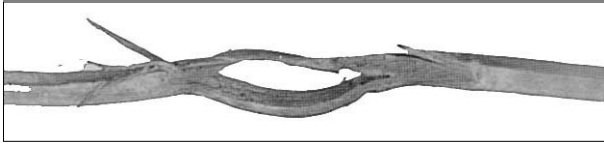
Check belt tension more often. Turn drives over by hand to make sure they are free. Clear machine of any loads before stopping to avoid overloading drives when starting up again.

Gouged Edge



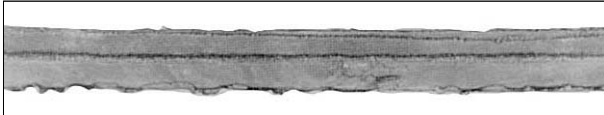
Except for the gouged edge, the entire circumference of the belt is in new condition. Either a damaged sheave or interference with some part of the machine causes damage.

Check the condition of the sheaves. Make sure the belt does not rub on any part of the machine while the machine is operating.

Ruptured Cords

The general appearance of the belt indicates that it has been properly tensioned. Apparently the drive is locked and the belt slipped on the sheave, resulting in a burned or ruptured area.

Prevent drives from locking by checking the tension of any belts in the drive train. Avoid overloading and plugging the machine. Never attempt to run a plugged machine without first cleaning it out. Shut off engine first. Lubricate the machine at the specified intervals to prevent bearing seizure.

Worn Sides

A badly worn belt results from long operation without enough tension. The sides are worn and the entire circumference is slightly burned.

Check belt tension more often. Also check sheaves for misalignment.

WEAR ON BANDED V-BELTS

Banded V-Belts have some wear problems which are unique.

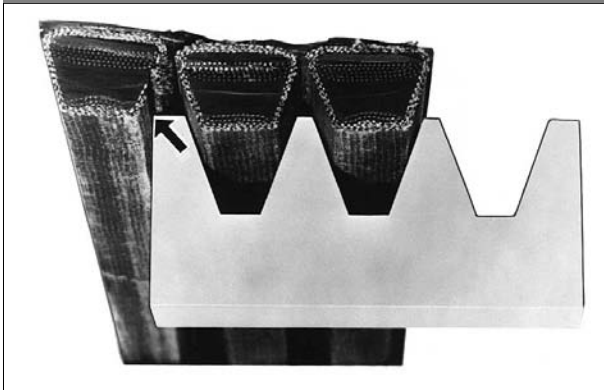
One Belt Riding Outside of Sheave Grooves

Fig. 18 – Banded V-belt riding outside of sheave grooves

Trouble Area and Observation

Banded belt with one strand riding outside sheave grooves (Fig. 18).
NOTE: Distinct groove in side-wall of outside belt.

Cause

Possible mis-alignment, lack of tension or foreign object forced belt from sheave grooves.

Remedy

Properly align drive, retension and remove any interference.

NOTE: If above belt were permitted to run in this position, progressive damage would result as shown in following illustration (Fig. 19)

Separation of all Belts From Band

Fig. 19 – Separation of all belts from band trouble area

Trouble Area and Observation

Belts have separated completely from tie band (Fig. 19).

Cause

Riding outside of sheave grooves.

Remedy

Proper maintenance of drive with installation of belt.

Bottom of Belts Cracking



Fig. 20 – Bottom of belts cracking

Trouble Area and Observation

Bottom of belts cracking (Fig. 20).

Cause

Belt running on too-small sheaves. Belt slipping causing heat build-up and gradual hardening of undercord. Extended use.

Remedy

Consider minimum diameters for drives, drive and idler sheaves, and pulleys.

Top of Band Frayed



Fig. 21 – Top of band frayed or damaged

Trouble Area and Observation

Top of tie band frayed or damaged. (Fig. 21)

Cause

Obstruction on machine interfering with normal operation of belt.

Remedy

Realign drive and remove obstruction.

Band Separating From Belts

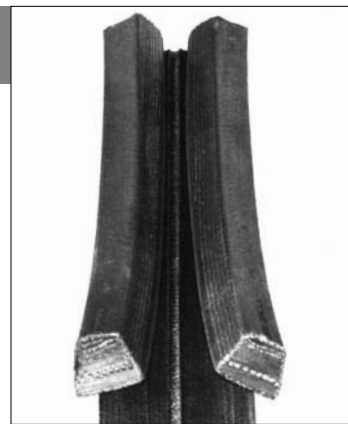


Fig. 22 – Band separating from belts

Trouble Area and Observation

Tie band separating from belts (Fig. 22).

Cause

Worn sheaves.

Remedy

Gauge sheave grooves and replace with standard-groove sheaves.

Holes or Blisters in Tie Band



Fig. 23 – Holes or blisters in tie band

Trouble Area and Observation

Large holes or blisters appear on tie band (Fig. 23).

Cause

Trash and foreign material accumulating between belts.

Remedy

Shield drive.

WEAR ON FLAT BELTS

Common wear on flat belts is shown in Figs. 24 and 25.

Flat Belt Tears

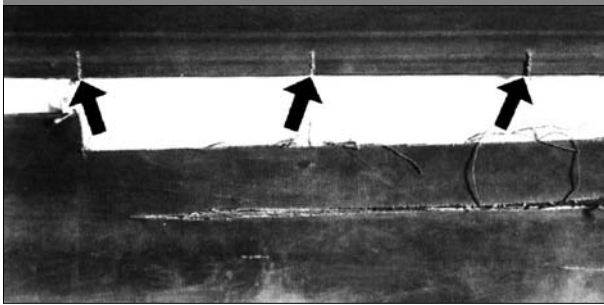


Fig. 24 – Flat belt tears — damaged belt

An improperly aligned tightener pulley caused this flat drive belt to climb the inner edge of the engine drive pulley, tearing the edge of the belt (Fig. 24). One of these tears eventually caused the belt to tear completely through.

Check belt and pulley alignment to prevent unnecessary wear on the edge of the belt.

Flat Belt Burn

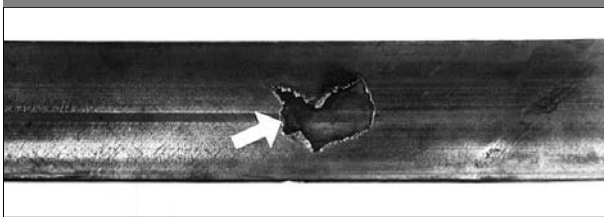


Fig. 25 – Flat belt burn — damaged belt

The shiny appearance and the badly burned area (Fig. 25) were caused by operating this drive belt too loosely. Note the notch in the edge of the belt (arrow) where it slid sideways against the flange of the drive pulley while slipping and burning the center section. Similar damage can result from attempting to unload a machine with power without first cleaning it out.

Check belt tension periodically to prevent this type of belt damage.

MAINTENANCE OF V-BELTS

- Listen for “ticking” sounds — they mean interference with belts
- Replace all belts in a matched set at one time
- V-belts stretch most during their first 24 hours of operation. Check tension and keep belts tight
- Never attempt to correct belt slippage by using a belt dressing
- If belts slip even when properly tensioned, check for overload, worn sheave grooves, or oil or grease on belts
- Never pry a V-belt or force it into the sheave groove. Loosen the tightener before installing the belt
- A belt, which has operated while rolled over in the sheave groove, is probably damaged — replace it
- Store belts in a cool, dry place. If stored on a machine, be sure to relieve all belt tension
- Never attempt to check or adjust belts while the machine is running

MAINTENANCE OF FLAT BELTS

Many of the maintenance tips for V-belts also apply to flat belts. Here are some other rules:

- Some flat belts, usually leather or canvas, may require belt dressings to prevent deterioration
- Flat belts normally need more tension than V-belts
- Pulley alignment is even more important with flat belts than for V-belts because flat belts can run off the pulley more easily
- To install flat belts, move the power unit forward, place the belt on the pulleys, and back up carefully to tighten the belt. Start the belt slowly to make sure it is running straight before increasing the speed
- Never force a belt off a moving pulley