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# Belts Drives and its Types

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A B S T R A C T

In this paper, we'll go over the many sorts of belt drives, how they're used, and how they work. Power is transferred from one shaft to another using belt drives. This is one of the simplest and least expensive methods of transferring electricity in a machine. To solve these issues, use the best belt materials available, such as leather, plastic, cotton, and rubber. In the field of mechanical engineering, various machines are driven by belt drives, and when the belt is stretched unevenly on two sides, it causes many problems such as slip and creep in the machine's performance. To solve such problems, and to choose the right belt for the particular machine for the task, read on. The cost of energy in manufacturing has a significant impact on a product's final cost. This document provides a comprehensive explanation.

Keywords: Belts, Belt drives, Conveyor, Creep, Materials.

## 1. INTRODUCTION

Belts are used to transfer power from one shaft to another through pulleys that rotate at the same or different speeds. The amount of energy transmitted is determined by the following variables:

1. The belt's velocities.
2. The amount of tension applied to the pulleys by the belt.
3. The belt's arc of contact with the smaller pulley.
4. The circumstances under which the belt is worn.
    - The shafts should be properly aligned to ensure uniform tension across the belt section, it should be noted.
    - The pulleys should not be too close together in order for the arc of contact on the smaller pulley to be as large as possible; nevertheless, the pulleys should not be too far apart in order for the belt to weigh heavily on the shafts, increasing the bearing friction load.
    - The tight side of the belt should be at the bottom, so that whatever sag is present on the loose side will increase the arc of contact at the pulleys.
    - The loose side of the belt should be at the top, so that whatever sag is present on the loose side will increase the arc of contact at the pulleys.
    - When using flat belts, the maximum distance between the shafts should not exceed 10 meters, and the minimum distance should not be less than 3.5 times the larger pulley's diameter.

The driver pulley is responsible for transferring power, while the driven pulley is responsible for receiving it. Below is a diagram of a simple two-pulley belt drive system. Automobiles, home appliances such as washing machines, toys, and other similar things all employ belt drive. Two or more pulleys are coupled with a belt in tension in a belt drive system.

The figure depicts a belt drive. Because of the frictional grip between the belt and the pulley surface, mechanical power or rotary motion is conveyed from the driving pulley to the driven pulley. Slack side refers to the portion of the belt with the least tension, whereas tight side refers to the portion with the most stress. It is made up of two pulleys that are connected by an unending belt. The difference in tension between the slack and tight sides determines the belt's effective pulling force, which causes the driven pulley to rotate. Because the tight and slack sides of the belt have different tensions depending on the angle of contact, the belt drives must be set up so that the slack side comes above the pulleys and the tight side comes below.

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In the event of wide belts and large pulleys, it can supply great power at high speeds (373 kW at 51 m/s). However, because these wide-belt-large-pulley drives are bulky, take up a lot of space, and require high tension, resulting in high loads, they're not well suited to close-centers applications. As a result, V-belts have largely replaced flat belts for short-distance power transmission, and longer-distance power transmission is rarely done with belts at all. Leather or fabric were used to make flat belts in the past. Individual electric motors are currently used in industry machines, for example. Flat belts were commonly employed in line shafting to convey power in factories in the 19th and early 20th centuries. Flat belts are still in use today, but not nearly as much as they were when line shafts were employed. The flat belt is a simple power transmission technology that worked effectively in its day. The flat-belt was the most frequent type of belt.

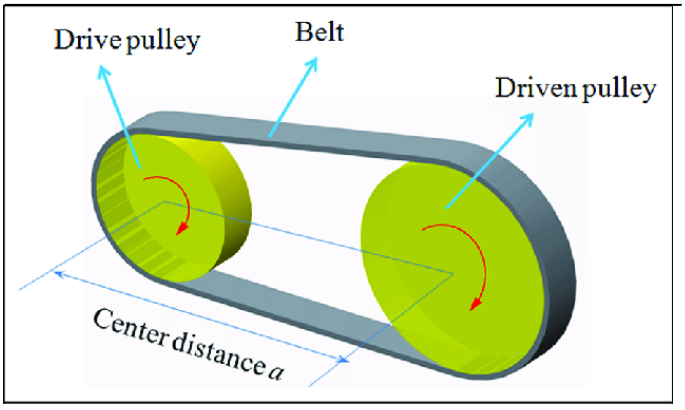


**Fig.1.1:** Belt Drive

## 2. BELT DRIVE

Two or more pulleys are coupled with a belt in tension in a belt drive system. One pulley (driving pulley) drives the belt, while the other pulley is driven by the belt (driven pulley). A belt transmits power between at least two pulleys in a belt drive. Because the speed of belt drives is often lowered, the smaller of the two pulleys is used as the driving pulley. Below is a diagram of a simple two-pulley belt drive system. The driver pulley is responsible for transferring power, while the driven pulley is responsible for receiving it. Automobiles, home appliances such as washing machines, toys, and other similar things all employ belt drive.

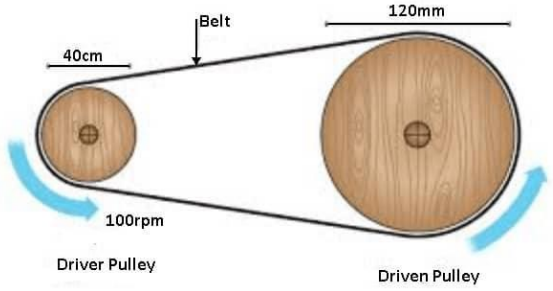


**Fig. 2.1: Belt Drive Consist of two pulleys**

### *2.1 Working Principle of Belt Drive*

The powered pulley will revolve in the opposite direction if the belt is attached in the opposite direction. The friction between the belts and pulleys causes the pulling action. The pulled action is absorbed by the driven pulley, which rotates in the same direction as the driver pulley. Because of friction, when the driver's pulley rotates, the belt is pulled. The other side of the belt, known as the slack side, will be loose. The more friction there is, the better the power transmission and the lower the possibility of slippage. Belt drive power transmission capacity is determined by the co-officiant of friction between the belt and the pulley, belt velocity, wrap angle, and belt unit mass. When the distance between two pulleys is greater, one side of the belt is under stress, which is referred to as the tight side.

Because of friction, when the driver's pulley rotates, the belt is pulled. The pulled action is absorbed by the driven pulley, which rotates in the same direction as the driver pulley. The powered pulley will revolve in the opposite direction if the belt is attached in the opposite direction. The friction

between the belts and pulleys causes the pulling action. The more friction there is, the better the power transmission and the lower the possibility of slippage. Belt drive power transmission capacity is determined by the co-officiant of friction between the belt and the pulley, belt velocity, angle of wrap, and belt unit mass. When the distance between two pulleys is greater, one side of the belt is under stress, which is referred to as the tight side. The other side of the belt, known as the slack side, will be loose.

***2.2 Types of Belt:***

Belt has been categorized into four types which are:

- Flat belt
- V belt and
- Circular belt
- Timing belt

***A. Flat Belt:***

This is a type of rectangular cross-section belt that is employed when low power and high speed are required.

- The shaft distance is usually between 5 and 10 meters.
- Friction between the belt and the pulley delivers power through a flat belt.
- The flat belt's pulleys rotate in the same direction.
- The flat belt has a 98 percent efficiency rating.
- This belt produces very little noise.

***B. V belt:***

- V belts have a trapezoidal cross-section. B. V belt:
- V belts are employed for moderate speed and high power when the shaft distance is less than 2 meters.
- Multiple drives are conceivable with a belt.

***C. Circular belt:***

- It has a circular cross-section and is used where there is more than a 5-meter shaft distance and high power transmission is necessary.
- Circular belts are also utilized where lower initial tension is required and there is no vibration or noise.

***D. Timing belt:***

- This is an alternate type of belt.
- Timing belts are mainly used inside (internal combustion type) the system to transmit power.
- Timing belts are a positive drive.
- It is a precise and reliable type of belt.

## 3. TYPES OF BELT DRIVES

The following are the 5 main types of Belt Drives:

1. Open belt drive.
2. Crossbelt drive.
3. Stepped cone pulley or speed cone drive.
4. Fast and loose pulleys.
5. Jockey pulley drive.

***A.*** *Open Belt Drive*

• The belt is used in these types of belt drives when two parallel shafts must revolve in the same direction.

• When the shafts are far apart, the lower side of the belt should be tight, and the top side should be slack; this is because if the upper side becomes slack, it would droop owing to its own weight, increasing the arc of contact.

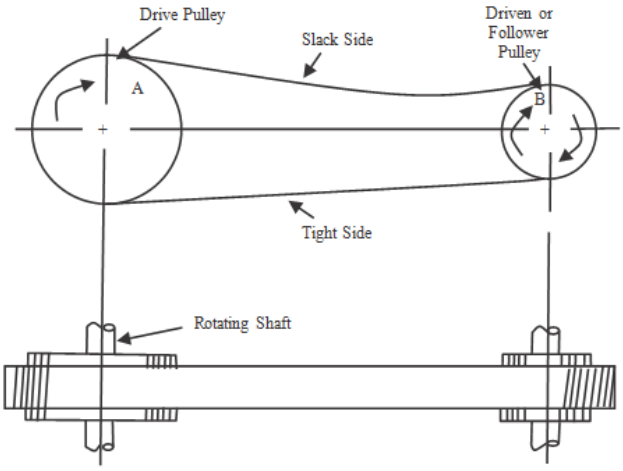


**Fig.3.1 Open Belt Drive**

***B.*** *Cross Belt Drive*

• When two parallel shafts have to rotate in the opposite direction, this form of belt drive is used
• The shafts must be set at a maximum distance from each other and operated at extremely low speeds to minimize excessive wear at the junction where the belts intersect.

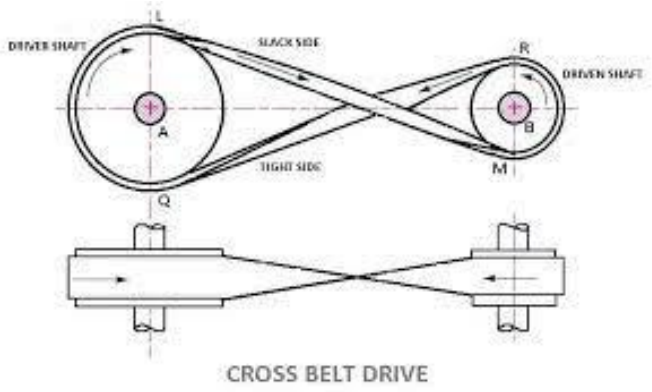


**Fig.3.2 Cross Belt Drive**

C. Stepped Cone Pulley or Speed Cone Drive

A stepped cone pulley also known for a speed cone is showing in the fig.

• These belt drives are employed in machine tools where the speed of the driven shaft must be altered often, such as a lathe or a drilling machine.

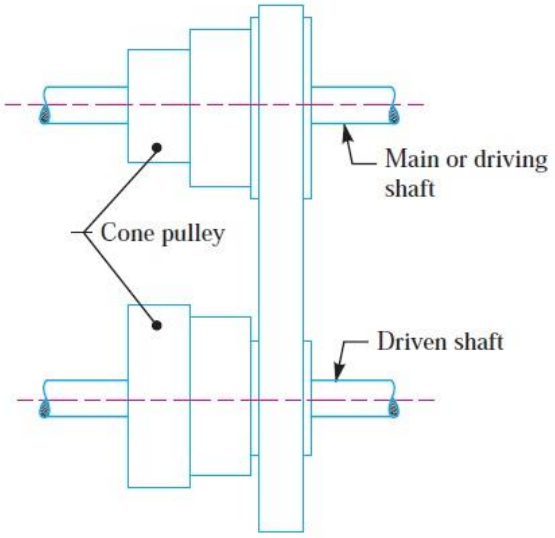


**Fig.3.3:** *Stepped Cone Pulley or Speed Cone Drive*

• As seen in fig. 1, a stepped cone pulley is an integrated casting with three or more pulleys of varying sizes adjacent to one another.
• On the driven shaft, one set of stepped cone pulley is attached in reverse. One pair of pulleys will be wrapped in an unending belt.
• The speed of the driven shaft can be adjusted by transferring the belt from one pair of pulleys to the other.
•When the driving and driven pulleys are shifted on various pairs of pulleys, the same belt will operate.

### *D. Fast and Loose Pulley Drive*

A fast and loose pulley drive is showing in fig.
• When the driven or machine shaft must be started or stopped at any time without interfering with the driving shaft, this form of belt drive is employed.
• A fast pulley is a pulley that is keyed to the machine shaft and runs at the same speed as the machine shaft.
• A loose pulley is incapable of delivering any power since it runs freely over the machine shaft.
• When the driven shaft must be halted, a sliding bar with belt forks is used to press the belt onto the unfastened pulley.

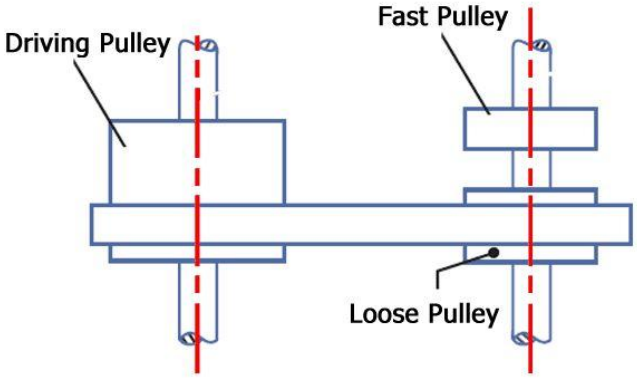


**Fig.3.4:** *Fast and Loose Pulley Drive*

***E.*** Jockey Pulley Drive

- In an open belt drive arrangement, if the center distance is small, or if the driven pulleys are very small, then the arc of contact of the belt with the driven pulley will be very small, which reduces the tensions in the belt, or if the required tension of the belt cannot be obtained by other means, an idler pulley, called jockey pulley is placed on the slack side of the belt as shown in fig.
- Which increases the arc of contact and thus the tension which results in increased power transmission.

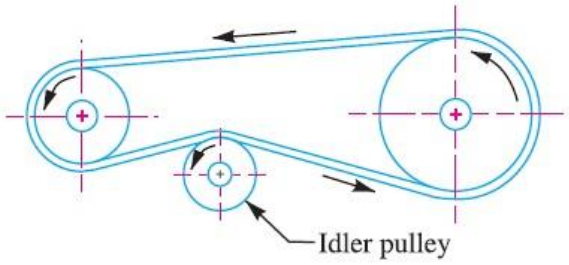


**Fig.3.5:** *Jockey Pulley Drive*

## 4. Conclusion

For power transmission, belts and chains are utilized. Belts and chains are utilized to transmit electricity because they are inexpensive and can accommodate enormous center distances. They're inexpensive and may accept big center distances. The angle of contact is crucial. Transmission of energy Belts are still used in a variety of sectors and applications, from textiles to manufacturing. In today's industry, belts are still a necessary equipment. Even yet, they are less obvious than in the past because they are often hidden by the machine frame and execute their function 'undercover.' Timing belt systems, likewise, continue to power the majority of automobiles on the road. The belt system is expected to be a crucial device that enhances our lives for many years to come, whether it is moving a fridge ahead during production or keeping all of our automobile engine valves running well as we commute to work.

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