Belt, Rope and Chain Drives

1. Introduction:

The belts or ropes are used to transmit power from one shaft to another by means of pulleys which rotate at the same speed or at different speeds. The amount of power transmitted depends upon the following factors:

1. The velocity of the belt.
2. The tension under which the belt is placed on the pulleys.
3. The arc of contact between the belt and the smaller pulley.
4. The conditions under which the belt is used.

It may be noted that

(a) The shafts should be properly in line to insure uniform tension across the belt section.
(b) The pulleys should not be too close together, in order that the arc of contact on the smaller pulley may be as large as possible.
(c) The pulleys should not be so far apart as to cause the belt to weigh heavily on the shafts, thus increasing the friction load on the bearings.
(d) A long belt tends to swing from side to side, causing the belt to run out of the pulleys, which in turn develops crooked spots in the belt.
(e) 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.
(f) In order to obtain good results with flat belts, the maximum distance between the shafts should not exceed 10 metres and the minimum should not be less than 3.5 times the diameter of the larger pulley.

2. Selection of a Belt Drive:

Following are the various important factors upon which the selection of a belt drive depends:

1. Speed of the driving and driven shafts,  2. Speed reduction ratio,
3. Power to be transmitted,  4. Centre distance between the shafts,
5. Positive drive requirements,  6. Shafts layout,
7. Space available, and  8. Service conditions.

3. Types of Belt Drives:

The belt drives are usually classified into the following three groups:

1. Light drives: These are used to transmit small powers at belt speeds up to about 10 m/s, as in agricultural machines and small machine tools.
2. Medium drives. These are used to transmit medium power at belt speeds over 10 m/s but up to 22 m/s, as in machine tools.
3. **Heavy drives.** These are used to transmit large powers at belt speeds above 22 m/s, as in compressors and generators.

4. **Types of Belts:**
   (a) Flat belt.
   (b) V-belt.
   (c) Circular belt.

   Though there are many types of belts used these days, yet the following are important from the subject point of view:
   1. **Flat belt.** The flat belt, as shown in Fig.1 (a), is mostly used in the factories and workshops, where a moderate amount of power is to be transmitted, from one pulley to another when the two pulleys are not more than 8 metres apart.
   2. **V-belt.** The V-belt, as shown in Fig.1 (b), is mostly used in the factories and workshops, where a moderate amount of power is to be transmitted, from one pulley to another, when the two pulleys are very near to each other.
   3. **Circular belt or rope.** The circular belt or rope, as shown in Fig.1 (c), is mostly used in the factories and workshops, where a great amount of power is to be transmitted, from one pulley to another, when the two pulleys are more than 8 meters apart.

![Fig.1. Types of belts.](image)

5. **Types of Flat Belt Drives:**

   The power from one pulley to another may be transmitted by any of the following types of belt drives:
   1. **Open belt drive.** The open belt drive, as shown in Fig.2, is used with shafts arranged parallel and rotating in the same direction. In this case, the driver \( A \) pulls the belt from one side (i.e. lower side \( RQ \)) and delivers it to the other side (i.e. upper side \( LM \)). Thus the tension in the lower side belt will be more than that in the upper side belt. The lower side belt (because of more tension) is known as **tight side** whereas the upper side belt (because of less tension) is known as **slack side**, as shown in Fig.2.
Fig. 2. Open belt drive.