Distance of initial tension =0.5 % of L **(PSG7.61)**

Actual centre distance =713+ (0.5/100) x2880 = 727.4 mm = 730 mm

STEP 8-WIDTH OF THE PULLEY

Width of the pulley = (n-1) e+2f=2x10 (e=0)

= 20mm

SPECIFICATION:

Type of belt =A2845-IS2494

Diameter of motor pulley =100mm

Diameter of drum pulley =735mm

Centre distance =730mm

Width of pulley =20mm

No of belts =1

Questions from Anna University Exam

A motor of power 2 kW running at a speed of 1400 rpm transmits power to an air blower running at560 rpm. The motor pulley diameter is 200 mm. The center distance may be 1000 mm. Design asuitable V-belt drive. [AU, N/D 2012]

Design a V-belt drive to the following specifications: Power to be transmitted = 75 kW; Speed ofdriving wheel = 1440 rpm; Speed of driven wheel = 400 rpm; Diameter of driving wheel = 300 mm;Center distance = 2500 mm; Service = 16 hours/day. [AU, M/J 2013]

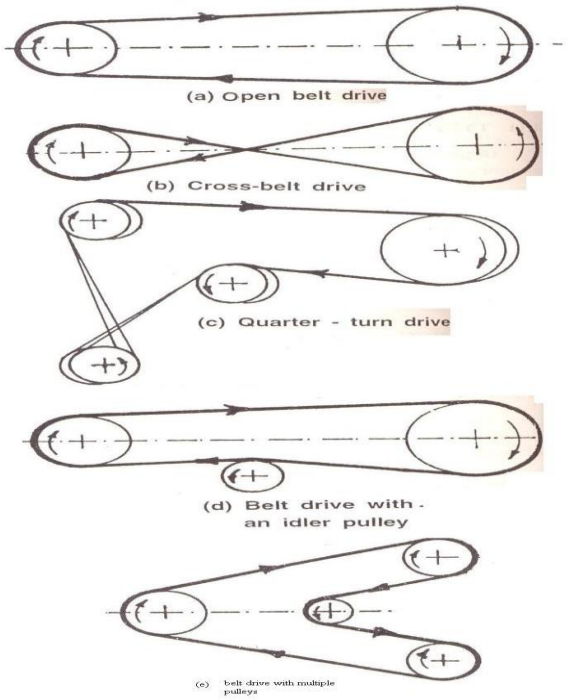
1.13 FLAT BELT DRIVES:

1.13.1 TYPES OF FLAT BELTS

1. **Open belt drive.**

The shafts of the driving and driven members are kept parallel and the direction of rotation of both pulleys is same. The line joining the centers of the pulleys may be horizontal, vertical or inclined.fig(a).

2. **Cross or twist belt drive.**
   Directions of rotations of pulleys are opposite. fig(b).
3. **Quaterturn drive.**
   The axes of the pulleys are arranged at right angles to each other. The drive is sometimes provided with a n idler pulley so as to maintain the required arc of contact. fig(c).
4. **Belt drive with idler pulley.**
   fig(d).
5. **Belt drives with many pulleys.**
   fig(e).



Types of Belt-drives

State the law of belting.

Law of belting states that the centre line of the belt when approaches the pulley must lie in the mid plane of that pulley which should be perpendicular to the axis of the pulley. Otherwise the belt will run off the pulley.

Explain the term crowing of the pulley.

Pulleys are provided a slight conical shapes (or) convex shapes in their rim's outer surface in order to prevent the belt from running off the pulley due to centrifugal force. This is known as crowning of the pulley. Usually crowing height may be 1/96 of the pulley face width.

Why are belt drives called as flexible drives?

In belt drives, slight deviation of shaft axes from their parallel position will not affect their function much whereas this is very dangerous fault as in gear drives. also the belt pulleys are freed from some critical parameters similar to gear module and hence the slight change of pulley diameters will have no effect on engagement. So the belt drives are considered as flexible drives.

What is meant by ply of belt?

Flat belts are made of thin strips and laminated one over the other in order to get thick belt. These thin strips or sheets are called as plies of the belt. Usually flat belts are made of 3 ply,4ply,5ply,6ply and 8 ply etc and 4 ply belt is thicker than 3 ply belt and so on.

Why tight-side of the belt should be at the bottom side of the pulley?

If the tight side of the belt is bottom side of the pulley, and the slag side is at top side, then sag caused by the self weight of the belt, for long centre distance drive will increase the arc of contact of the belt with pulley and hence the effect of power transmission is increased. This is the reason.

Briefly explain initial tension in belts.

The motion of the belt and pulleys is governed by a firm grip between the belt and pulley. In order to increase this grip for proper power transmission, the belt is tightened up. at this stage, even pulleys are not running i.e., at rest, the belt is subjected to some tensions called as initial tensions.

Explain briefly about creep in belts.

Since tensions produced by the belt on the two sides of the pulley are not equal, the belt moves with a very negligible velocity, due to the difference of two tensions. This slow movement of the belt over the pulley is known as creep of belt and it is generally neglected.

1.13.2 DESIGN PROCEDURE FOR FLAT BELTS:

STEP-1-DETERMINE MAXIMUM OR DESIGN POWER:

Design power = Rated power (i.e. given power) x service factor (i.e. load correction factor) x Arc of contact factor

Select load correction factor from **(PSG7.53)**

Arc of contact factor **(PSG7.54)**

STEP-2-TYPE OF BELT:

Select belt from ……. **(PSG7.52)**

STEP-3- BELT RATING:

Calculate the power transmitting capacity per mm width for the above belt.

STEP-4- CALCULATION OF WIDTH:

STEP-5- BELT LENGTH:

STEP-6- FIND OUT PULLEY DIMENSIONS:

Example.1.3.Select a flat belt to drive a mill at 250 Rpm from a 10kW, 730 Rpm motor. Centre distance is to be around 2 m. The mill shaft pulley is of 1m diameter.

Given:

Rated power =10kW

Speed of driving pulley ‘n_1’ =730 Rpm

Speed of driven pulley’n_2’ =250Rpm

‘D’ =1m=1000mm

‘d’ = ?

Solution:

STEP-1-DESIGN POWER

Service factor =1.3 (assuming heavy duty intermittent loads) **(PSG7.53)**

The arc of contact θ =180° – $\frac{(\quad)}{\quad}$ 60° **(PSG7.54)**

D=1 m = 1000 mm ;

We know that,

$\frac{1}{2}$ = _ ; d = $\frac{250}{730}$1000 = 342.46 mm = 345 mm

The arc of contact θ = 180° – $\frac{(1000-345)}{2000}$ 60° = 160.4°

Arc of contact factor =1.08 **(PSG7.54)**

Design power = 10x1.3x1.08 = 14.04 kW.

STEP-2-TYPE OF BELT DRIVE

Let us select 'Dunlop Fort 979 g fabric belting'.

Belt speed = _ $_{601000}$ = $\frac{345730}{601000}$ = 13.2 m/s

Let us Select 6 ply belt **(PSG7.52)**

STEP-3- BELT RATING

Belt capacity =0.0289Kw per mm width per ply at 180° arc of contact and at 10 m/s **(PSG7.54)**

=0.0289x$\frac{13.2}{10}$x$\frac{160.4}{180}$x6 =0.204 kW per mm width.

STEP-4- WIDTH OF BELT

Total width of belt =$\frac{\text{design power}}{\text{belt rating}}$ =$\frac{14.04}{0.204}$= 69 mm

Next standard belt width = 112 mm **(PSG7.52)**

STEP-5- LENGTH OF BELT

Length of belt L=2C+ $\frac{(D+d)}{2}$ + $(D-d)^2/4C$ **(PSG7.53)**

= 2X2+$\frac{(1+0.345)}{2}$+$(1-0.345)^2/4X2$

=6.166m =6166mm.

Length after standard deductions for initial tension (i.e after reducing 1% of L)

=6166x0.99=6104mm = 6100 mm.

Pulley width = 112+13 = 125 mm.

SPECIFICATION:-

Dunlop Fort 949 g fabric belting of 112 mm width

Pulley width =125 mm

Length of belt =6100mm

Example.1.4.A stone crushing machine receives power from a motor rated at 50kW at 1800 Rpm by means of flat belts. The pulley diameters are 200 mm and 700 mm centre distance between the two pulleys is 4000 mm design the belt drives if the direction of rotation of two pulleys are opposite to each other.

GIVEN :-

Power P = 50kW

Centre distance 'C' = 4000 mm

Diameter of smaller pulley 'd' =200mm

Diameter of larger pulley 'D' =700mm

Solution:

STEP-1-DESIGN POWER

Design power = Rated power (i.e. given power) x service factor (i.e. load correction factor) x Arc of contact factor

Service factor =1.5 **(PSG7.53)**

The arc of contact 'θ' $=180° + \frac{(}{} 60°$ $=180° + \frac{700+200)}{4000} 60°$ =193.5°

Arc of contact factor =0.96 **(PSG7.54)**

Design power= 50x1.5x0.96 = 72kW

STEP-2-TYPE OF BELT

Belt speed = $\frac{}{601000} = \frac{2001800}{601000}$ = 18.8 m/s

For belt speed of 18.8 m/s and small pulley diameter of 200 mm.

The No of plies required = 4 plies. **(PSG7.52)**

Since the power is moderately high power, Dunlop Fort 949g fabric belting may be selected.

STEP-3- BELT RATING

Belt capacity =0.0289Kw per mm width per ply at 180° arc of contact and at 10 m/s **(PSG7.54)**

$$=0.0289 \times \frac{18.8}{10} \times \frac{193.5}{180} \times 4$$

=0.234 kW per mm width for 4 plies and arc of contact of 193.5° and belt speed of 18.8 m/s

STEP-4- WIDTH OF BELT

Belt width required $= \frac{\text{design power}}{\text{belt rating}} = \frac{72}{0.234} = 307.6$ mm

Since the width calculated is not available, let us select next higher ply belt, say 5 ply belt

Belt capacity $=0.0289 \times \frac{18.8}{10} \times \frac{193.5}{180} \times 5$

=0.2925 kW per mm width

Belt width required $= \frac{\text{design power}}{\text{belt rating}} = \frac{72}{0.2925} = 246.2$ mm

Next standard belt width = 250 mm **(PSG7.52)**

Pulley width =250+25=275mm

Next standard width of pulley=280mm **(PSG7.55)**

STEP-5- LENGTH OF CROSS BELT

Length of belt $L = 2C + \frac{(D+d)}{2} + (D+d)^2/4C$ **(PSG7.53)**

$$= 2X4 + \frac{(0.7+0.2)}{2} + (0.7-0.2)^2/4X4$$

=9.464m=9464mm.

Length after standard deductions for initial tension (i.e after reducing 1% of L)

=9464x0.99=9370mm

SPECIFICATION:

Material of belt =Dunlop fort 949g fabric belting

Material of the pulley =Cast iron

Type of drive =Cross belt drive

Length of belt =9370mm

Width of belt =250mm

No of plies =5

Width of pulleys =280 mm

Diameter of the motor pulley =200mm

Diameter of machine pulley =700mm

Centre distance =4000mm.

Ex 1.3 Select a flat belt to drive a mill at 250 rpm from a 10 kW, 730 rpm motor. centre distance is to around 2 m. the mill shaft pulley is of 1 m diameter.

Select a flat belt to drive a mill of 250 rpm from a 10 kW, 730 rpm motor. Center distance is to be around 2 m. The mill shaft pulley is of 1 m diameter. [AU, M/J 2011]

Design a flat belt drive for the following data: Power to be transmitted = 22.5 kW; driver speed = 740 rpm; speed ratio = 3; distance between the pulleys = 3 m; larger pulley diameter = 1.2 m. [AU, N/D 2011]

A flat belt drive is to design to drive a flour mill. The driving power requirement of the mill is 22.5 kW at 750 rpm with a speed reduction of 3.0. The distance between the shaft is 3 m. Diameter of the mill pulley is 1.2 m. Design and make a neat sketch of the drive. [AU, M/J 2012]