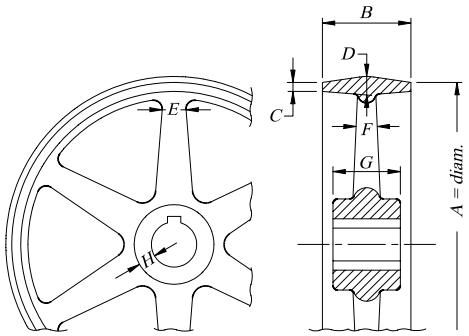
Table 10 – Dimensions of flat pulleys, mm



A	B	C	D	E	F	G	H
152	102	3	5	19	11	76	10
152	152	3	5	19	11	89	13
152	203	3	5	19	11	89	13
152	305	3	5	19	11	102	13
203	102	3	5	21	11	76	10
203	152	3	5	21	11	89	13
203	203	4	6	27	14	114	13
203	305	4	6	27	14	140	13
254	102	3	5	24	14	76	13
254	152	4	6	27	14	89	13
254	203	4	6	27	14	114	13
254	305	4	6	33	16	140	16
305	102	4	6	25	11	83	13
305	152	4	6	44	13	102	13
305	203	4	6	44	13	127	16
305	305	5	8	38	19	165	16
356	102	4	6	34	13	89	13
356	152	4	6	34	13	114	16
356	203	5	8	33	14	127	16
356	305	5	8	43	21	165	16
406	102	4	6	35	14	89	13
406	203	5	8	37	16	127	16
406	305	6	9	37	16	165	19
406	406	6	9	48	24	210	22
457	102	5	8	33	14	102	16
457	203	6	9	38	17	140	19
457	305	6	9	34	17	184	22
457	508	6	10	57	32	229	22
508	102	5	8	35	16	102	16
508	203	5	8	35	16	127	19
508	305	6	9	41	19	178	19
508	508	7	11	57	29	254	25
559	102	5	8	38	16	102	16
559	203	5	8	38	16	127	19
559	305	6	9	44	21	165	22
559	508	7	11	64	32	279	29
610	102	6	9	40	17	102	16
610	203	6	9	40	17	140	19

6.5 Pulley diameters

In designing belt drives, it should be recognized that the use of larger pulley diameters will result in lower bearing loads and can result in the use of smaller and less expensive belt cross-sections. The largest possible pulley allowed by space limitations should be used so as to reduce required effective belt pull or friction force. Pulley diameters for rubber belts should conform to Table 2. Table 7 also specifies the minimum and recommendable pulleys diameters for nylon cord belts.

6.6 Markings

6.6.1 The following information shall be engraved or embossed on the pulley:

1) Classification of pulley
2) Diameter and width of the pulley
3) Manufacturer's name and/or its trademark

6.6.2 The following information shall be marked on the packaging:

1) Classification of pulley
2) Diameter and width of the pulley
3) Manufacturer's name, trademark, and address

7 Recommended Design Practices

7.1 Belt selection

7.1.1 The type of rubber belt to be used and the number of ply can be determined by using Table 2 given the belt speed and the pulley diameter.

7.1.2 The appropriate cross section to be used for nylon cord belts can be determined by using the belt selection chart presented in Figure 2.

7.2 Length calculations

7.2.1 The approximate belt length for an open two-pulley drive (Figure 3) may be calculated using the formula

$$L = 2C + \frac{\pi}{2}(D_L + D_S) + \frac{(D_L - D_S)^2}{4C} \quad \text{.....[Eq. 1]}$$

Where:

L = length of the belt (mm)
C = distance between centers of pulleys (mm)
D_L = diameter of the large pulley (mm)
D_S = diameter of the small pulley (mm)

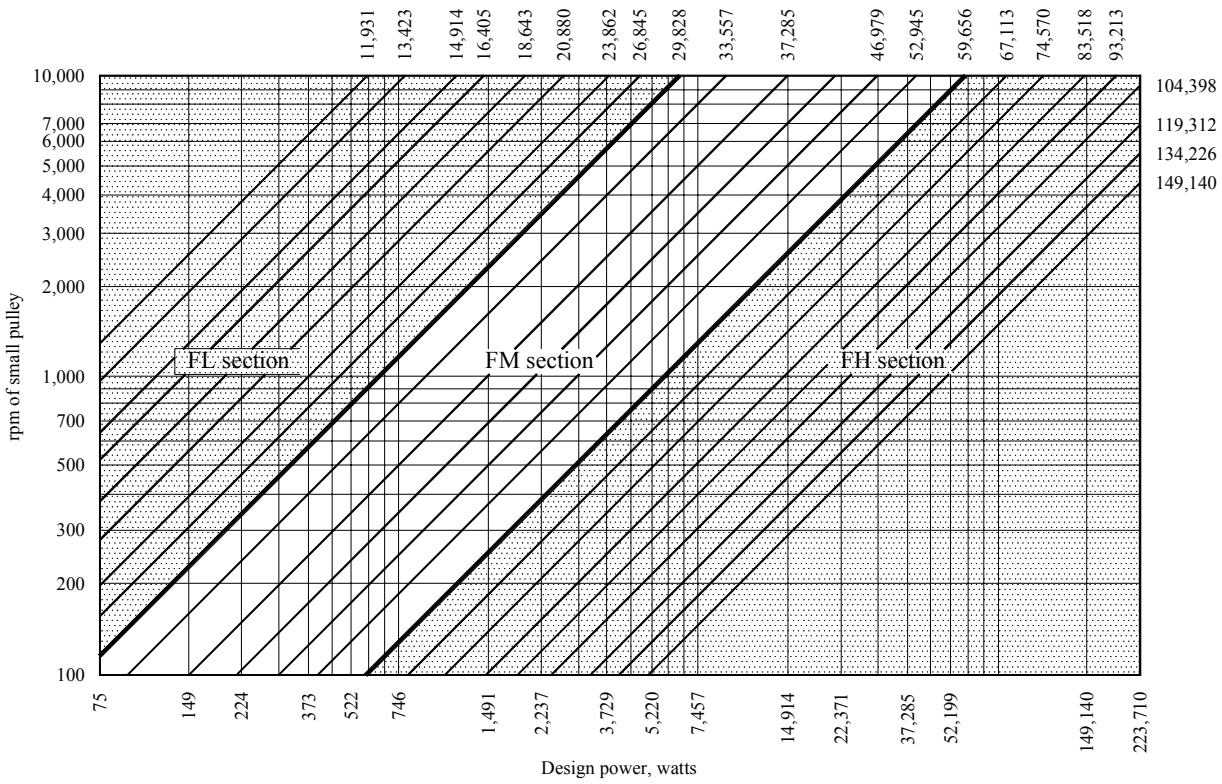


Figure 2 – Flat cord belt selection chart

7.2.2 For endless belts, if this calculation results in a length that is not of standard length, the next longer standard length should be used and necessary correction for center distance should be made. The center distance can be calculated from the formula:

$$C = \frac{b + \sqrt{b^2 - 32(D_L - D_S)^2}}{16} \quad \text{.....[Eq. 2]}$$

Where:

$b = 4L_S - 6.28(D_L + D_S)$

L_s = available belt standard length

7.2.3 For crossed belts (Figure 4), the approximate belt length may be calculated using the formula

$$L = 2C + \frac{\pi}{2}(D_L + D_S) + \frac{(D_L + D_S)^2}{4C} \quad \text{.....[Eq. 3]}$$

Where

L = length of the belt (mm)

C = distance between centers of pulleys (mm)

D_L = diameter of the large pulley (mm)

D_S = diameter of the small pulley (mm)

7.2.3 To determine the belt length when more than two pulleys are used on a drive (Figure 5), lay out the pulleys in terms of their effective diameters to scale in the position desired when a new belt is applied and first brought to driving tension. The length of the belt shall be the sum of the tangents and the connecting arcs around the effective diameters of the pulleys. The length of the connecting arcs can be calculated by the formula

$$Length\ of\ arc = \frac{D \times A}{115} \quad \text{.....[Eq. 4]}$$

Where

D = the diameter of the pulley

A = the angle in degrees subtended by the arc of belt contact on the pulley

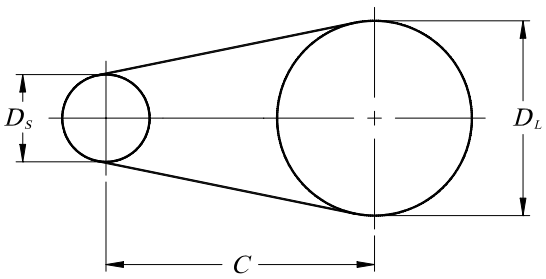


Fig. 3 – Flat belt drive with two pulleys

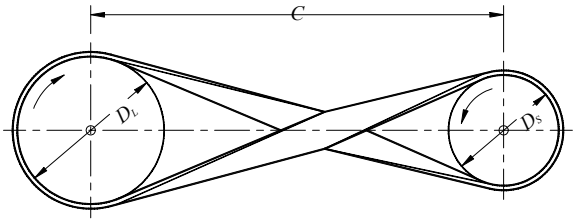


Fig. 4 – Crossed belt

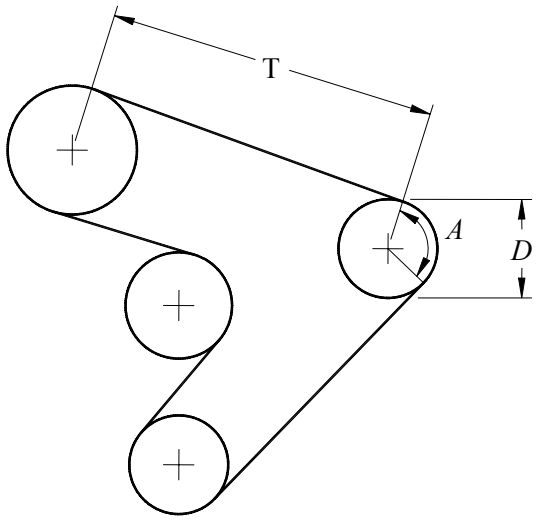


Fig 5 – Flat belt drive with more than two pulleys

7.3 Correction for arc of contact

Correction for arc of contact for small pulley is determined from Table 11, the arc of contact being given by the approximate formula:

$$Arc\,of\,contact = 180 - \frac{60(D_L - D_S)}{C} \quad \text{.....[Eq.5]}$$

Where:

D_L = diameter of the large pulley
D_S = diameter of the small pulley
C = center distance of drive**.**

7.4 Power rating

The power rating for rubber belts are given in Table 1. Power ratings for nylon cord belts are given in Tables 4-6. The width of belts in millimeters can be calculated by the formula:

$$W = \frac{H \times S}{K \times C} \quad \text{.....[Eq. 6]}$$

Where

W = belt width in millimeters
H = actual power transmitted, or if not, the nameplate power rating
$\boldsymbol{S}$ = service factor from Table 12
K = power rating of belt in watts per millimeter of belt width from Table 1
C = arc of contact factor from Table 11

Table 11 – Arc of contact factor for *C*

Arc of contact*, deg	Factor, *C*	Arc of contact*, deg	Factor, *C*
180	1.00	132	0.87
174	0.99	126	0.85
168	0.97	120	0.83
162	0.96	114	0.80
156	0.94	108	0.78
150	0.92	102	0.75
144	0.90	96	0.72
138	0.88	90	0.69

* For small pulley

Table 12 – Service factors, *S*

Application	Squirrel –cage ac motor		Wound rotor a-c motor (slip ring)	Single-phase capacity motor	d-c shunt-wound motor	Diesel engine, 4 or more cyl, above 700 rpm
	Normal torque, line start	High torque				
Agitators	1.0-1.2	1.2-1.4	1.2	-	-	-
Compressors	1.2-1.4	-	1.4	1.2	1.2	1.2
Belt conveyors	-	1.4	-	-	1.2	-
Screw conveyors	-	1.8	-	-	1.6	-
Crushing machinery	-	1.6	1.4	-	-	1.4-1.6
Fans, centrifugal	1.2		1.4	-	1.4	1.4
Fans, propeller	1.4	2.0	1.6	-	1.6	1.6
Generators and exciters	1.2	-	-	-	1.2	2.0
Line shafts	1.4	-	1.4	1.4	1.4	1.6
Machine tools	1.0-1.2	-	1.2-1.4	1.0	1.0-1.2	-
Pumps, centrifugal	1.2	1.4	1.4	1.2	1.2	-
Pumps, reciprocating	1.2-1.4	-	1.4-1.6	-	-	1.8-2.0

8 Connectors

Table 13 specifies the sizes of plate and diameter of bolt for belts using bolted plate fastener.

Table 13 – Plate size based on belt width

Size of plate	Belt width, mm	Diameter of bolt, mm
0	38-51	6
1 small	64-102	6
1 large	127-152	7
2 small	178	8
3 small	254-406	10
3 large	432-508	10
4	533-610	11
5	Above 610	13

9 Safety

9.1 Enclosing the drive with covers is recommended for safety and to avoid foreign materials from getting in contact with the drive.

9.2 Make drive inspection on a periodic basis. Drives should be inspected for the tightness of the belts, keys and setscrews. Condition of the belt should also be inspected.

9.3 Use belts with proper markings.

9.4 Use proper keys as specified in PAES 304:2000

Annex A
(Informative)

Example of flat rubber belt drive selection

A.1 Given parameters

Assume a normal-torque squirrel-cage ac motor for a centrifugal-fan drive. The motor speed is 1,725 rpm and the pulley diameter is 127 mm. The power transmitted at the given rpm is 2,983 W. The arc of contact is 160°. Select the appropriate flat belt and the corresponding pulley to be used.

A.2 Belt speed

The belt speed is approximated as:

$$V = \frac{\pi \times D_S \times n_S}{1{,}000}$$

Where:

V is the belt speed
D_S is the diameter of the small pulley
N_S is the rpm of the small pulley

$$V = \frac{\pi \times D_S \times n_S}{1{,}000} = \frac{\pi \times 127\,\text{mm} \times 1{,}725\,\text{rpm}}{1{,}000} = 688.24\,\text{m/min}$$

A.3 Belt selection

A.3.1 The appropriate belt for the given pulley diameter and the approximated belt speed is a 3 ply, Fabric belt (from Table 2).

A.3.2 The power rating for a 3 ply, fabric belt, and at the computed belt speed is obtained from Table 1. The value is obtained by interpolating values of *K* between 79 and 97 m/min. This will result in a *K* value equal to 88.26 watts/mm.

A.3.3 The arc correction factor, *C,* is equal to 0.93 (from Table 11) and the service factor, *S,* is equal to 1.2 (from Table 12).

A.3.4 The width of the belt is computed as:

$$W = \frac{H \times S}{K \times C} = \frac{(2{,}983\,\mathrm{W} \times 1.2)}{(88.26\,\mathrm{W/mm} \times 0.93)} = 43.61\,\mathrm{mm}$$

Therefore, use a 44 mm width belt.

A.4 Pulley width

Using Table 9, the width of pulley to be used is computed as:

$$\mathrm{B} = \text{belt width} + \text{allowance} = 44\,\mathrm{mm} + 25\,\mathrm{mm} = 69\,\mathrm{mm}$$