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Design procedure for V - Belt

Given :

Power to be transmitted, P in kW;
Diameter of driving wheel(or) smaller pulley d in mm;
Diameter of driven wheel(or) larger pulley D in mm;
Speed of driving wheel n_1 in rpm;
Speed of driven wheel n_2 in rpm;
Centre distance C in mm;
Service = 10 hrs/day Or .....

Procedure:

1. Select V belt section based on power and minimum diameter of pulley PSG 7.58

Data on Standard V - Belt Sections

Cross - section symbol	Usual load of drive kW	Recommended minimum pulley pitch diameter d_1 mm	Nominal top width W, mm	Nominal thickness T, mm	Weight per metre kgf
A	0.75 - 5	75	13	8	0.106
B	2 - 15	125	17	11	0.189
C	7.5 - 75	200	22	14	0.343
D	22 - 150	355	32	19	0.596
E	30 - 190	500	38	23	- -

If dia of smaller pulley is not given, take dia. d from the above table. (d ≥ min. dia pulley)

If centre distance is not given, assume

$$C_{max} = 2\,(D+d)$$ PSG 7.61

2. If diameter of driven wheel(or) larger pulley D in *mm is not given, calculate D-* (PSG 7.61)

$$D = d \times \frac{n_1}{n_2} \times \eta$$

$\eta = 0.98$ *or may be neglected*

Calculate

$$Speed\ ratio, i = \frac{D}{d} = \frac{n_1}{n_2}$$

3. Belt speed, S

$$S = \frac{\pi \times d \times n_1}{60 \times 1000} = \frac{\pi \times D \times n_2}{60 \times 1000} \quad m/s$$

4. Nominal pitch length of belt(PSG 7.61)

$$L = 2C + \frac{\pi}{2}(D+d) + \frac{(D-d)^2}{4C}$$

Correct the length to std. length (PSG7.58 to &7.60); And select the length correction factor F_c

5. Transmitting capacity, kW *based on belt section* PSG 7.62 – 1st & 2nd Table

Equivalent diameter of smaller pulley, d_e

Select small pulley factor (F_b) based on speed ratio, i **from PSG 7.62 II table**

$$d_e = d \times F_b$$

Calculate kW

Belt cross-section symbol	Formula	Maximum value of d_e in the formula mm
A	$kW = \left(0.45\,S^{-0.09} - \frac{19.62}{d_e} - 0.765 \times 10^{-4} S^2\right) S$	125
B	$kW = \left(0.79\,S^{-0.09} - \frac{50.8}{d_e} - 1.32 \times 10^{-4} S^2\right) S$	175
C	$kW = \left(1.47\,S^{-0.09} - \frac{142.7}{d_e} - 2.34 \times 10^{-4} S^2\right) S$	300
D	$kW = \left(3.22\,S^{-0.09} - \frac{506.7}{d_e} - 4.78 \times 10^{-4} S^2\right) S$	425
E	$kW = \left(4.58\,S^{-0.09} - \frac{952}{d_e} - 7.05 \times 10^{-4} S^2\right) S$	700

6. Find arc of contact(θ) arc of contact factor($F_{d)}$ -- PSG 7.68

$$\theta = 2\cos^{-1}\left(\frac{D-d}{2C}\right)$$

$$\text{(or) } \theta = 180 - 60\left(\frac{D-d}{C}\right)$$

Select arc of contact factor ($F_{d)}$

7. Select correction factor for service F_a PSG 7.69

By assuming 10 or 16 hrs service and type of duty

8 No of belts, n ---- *PSG 7.70*

$$n = \frac{P \times F_a}{kw \times F_c \times F_d}$$

9. Exact Centre Distance, C(PSG 7.61)

$$A = \frac{L}{4} - \frac{\pi\,(D+d)}{8}$$

$$B = \frac{(D-d)^2}{8}$$

$$C = A + \sqrt{A^2 - B}$$

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