
A belt is required to transmit 10 kW from a motor running at 600 rpm.....

Question:
A belt is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density 0.001 gm/mm3 . Safe stress in the belt is not to exceed 2.5 N/mm2 , diameter of the driving pulley is 250 mm whereas the speed of the driven pulley is 200 rpm. The two shafts are 1.25 m apart. The coefficient of friction is 0.25, determine

(1) Angle of contact at driving pulley

(2) The width of the belt

Answer:

$P = 10 \times 10^3$ W, $N_1 = 600$ rpm, $d_1 = 250$ mm $= 0.25$ m

$\mu = 0.25$, $x = 1.25$ m, $\rho = 0.001$ gm/mm^3

$\sigma = 2.5$ N/mm^2, $N_2 = 200$ rpm

$$\frac{N_1}{N_2} = \frac{d_2}{d_1} \quad \therefore d_2 = 0.75 \text{ m}$$

$$\therefore r_2 = 0.375 \text{ m}$$

We have,

$$\sin\alpha = \frac{r_2 - r_1}{x} = \frac{0.375 - 0.125}{1.25}$$

$$\therefore \alpha = 11.53^\circ$$

$$\therefore 2\alpha = 23.07^\circ$$

$\therefore$ Angle of lap $\theta = 180 - 2\alpha$

$= 156.9^\circ$

$= 2.73$ rad

Velocity $v = \frac{\pi d_1 N_1}{60} = 7.85$ m/sec

Power $P = (T_1 - T_2) \cdot v$

$\therefore T_1 - T_2 = 1273.90$ ----(1)

Also, $\frac{T_1}{T_2} = e^{\mu\theta} = e^{0.25 \times 2.73} = 1.97$ ---(2)

from eqn (1) & (2) $T_1 = 1313.3$ N &

$T_2 = 667$ N

Now, $T_1 = \sigma \times b \times t = 2.5 \times b \times 12$

$\therefore b = 43.77$ mm

Note:- If Prob is solved considering m & T_c, give full credit