Published on *Mechanical Engg Simple Notes ,Solved problems and Videos* (https://mechdiploma.com)

A leather belt is required to transmit 7.5 kW from a pulley.....

Question:
A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter running at 250 rpm. The angle of contact is 165o and the co-efficient of friction between the belt and the pulley is 0.35. If the safe working stress for the leather belt is 2 MPa, density of leather is 1050 kg/m3 and the thickness of belt is 10 mm, determine the width of belt, taking centrifugal tension into account.

Answer:

We know that velocity of the belt,

$$v = \frac{\pi . d . N}{60} = \frac{\pi \times 1.2 \times 250}{60} = 15.71 \text{ m/s}$$

and Power Transmitted (P)

$$P = (T_1 - T_2) v$$

$$7.5 \times 10^3 = (T_1 - T_2) 15.71$$

$$\therefore T_1 - T_2 = 7500/15.71 = 477.4 \text{ N} \quad \ldots\ldots (i)$$

We know that

$$\frac{T_1}{T_2} = e^{\mu\theta} \quad \therefore \frac{T_1}{T_2} = e^{0.35 \times 165 \times \pi/180}$$

$$\therefore \frac{T_1}{T_2} = 2.75 \quad \ldots\ldots (ii)$$

from eqn (i) and (ii)

$$T_1 = 751.8 \text{ N}, \text{ and } T_2 = 274.4 \text{ N}$$

We know that mass of the belt per meter length,

$$m = \text{Area} \times \text{length} \times \text{density} = b t l \rho$$

$$= b \times 0.01 \times 1 \times 1050 = 10.5\, b \text{ kg}$$

$\therefore$ Centrifugal Tension,

$$T_c = m . v^2 = 10.5\, b (15.71)^2 = 2591.44\, b \text{ N}$$

and Max. Tension in the belt,

$$T = \sigma . b . t = 2 \times 10^6 \times b \times 0.01$$

$$= 20000\, b \text{ N}$$

We know that,

$$T = T_1 + T_c$$

$$\therefore 20000 b = 751.8 + 2591.44 b$$

$$\therefore 20000 b - 2591.44 b = 751.8$$

$$\therefore 17408.56 b = 751.8$$

$$\therefore b = \frac{751.8}{17408.56} \quad \therefore b = 0.04319 \text{ m}$$

$$= 43.19 \text{ mm}.$$