Number of revolutions for the generator = 100 rev/min.

Lower for generator = 0.5 kW.

Safety factor = 2.0

Length of lever = 2000mm =2m.

Diameter of large pulley (d1) = 400mm.

Diameter of small pulley (d2) = 60mm.

Number of revolutions of small pulley = 100 rev/min.

Number of revolutions of large pulley = 15 rev/min.

Pulling tension (T) = 47.75 Nm.

(T1 – T2) = 1591.67 N.

Power of large pulley (Pl) = 500.037 W.

Efficiency = $\frac{Power output}{Power input}$ = $\frac{500.037 }{500}$

 =1.000074

 =100%.

1. BELT CALCULATION.
2. Velocity of belt.

V =$π\frac{\left(d\_{1}+t\right) n\_{1}}{60}$

But we have

t - Pulley thickness t = 4mm.

V = $π\frac{\left(40 ×10^{-2} + 4×10^{-3}\right)18}{60}$

V = 0.381 m/s

1. Capacity.

We design center distance between two pulleys to be 50m. And assuming the coefficient of friction to be 0.4.

Capacity = $e^{μθ\_{2}}$

$θ$ 2 = $π- [2sin^{-1}(\frac{D-d}{2c})]\frac{π}{180}$

 =$ π- \left[2sin^{-1}\left(\frac{400-70}{2 ×500}\right)\right]\frac{π}{180}$

$θ$ 2 = 2.5

Capacity = $e^{0.4 ×2.5}$

Capacity = 2.718

1. Constant K.

K = $\frac{e^{μϑ}-1}{e^{μϑ}}$

K = $\frac{2.718-1}{2.718}$

K = 0.63

1. Centrifugal stress.

c = $\frac{mv^{2}}{g}×10^{6}$

But w = $10×10^{6}$

v= 0.381 m/s

g= 9.8 x 103

Sc = $\frac{10 ×10^{-6} × 0.831^{3}× 10^{6}}{9.8 × 10^{5}}$

Sc = $1.5×10^{4}$ N/mm2

1. Belt Width

Power transmitted per mm2

 = $(\frac{s\_{1}-Sc}{1000})KV$

 But S1 = 1.75 N/mm2

 =$\frac{\left(1.75-1.5\right)0.63×0.361 }{1000}$

 = 5.63 x 10-5Kw/mm2

 Area of cross section of belt

 A= $\frac{Power transmitted}{Power Per Unit area}$

 A = $\left(\frac{257.15}{5.68×10^{-5}}\right)mm^{2}$

 A = 4.53 x 106mm2

 Area of cross section of belt.

A = $b×t$

b = width of belt.

b = $\frac{A}{t}$

b = $\left(\frac{4.53×10^{3}}{4mm}\right)mm^{2}$

b = $1.13×10^{3}mm$

1. Length of Belt.

L=$\sqrt{4C^{2}- \left(D-d\right)^{2}}+\frac{\left(Dθ\_{2}+dθ\_{3}\right)}{2}$

$θ$ 2 = $π+ \left[2sin^{-1}\left(\frac{D-d}{2c}\right)\right]\frac{π}{180}$

 =$ π+ \left[2sin^{-1}\left(\frac{400-70}{2 ×500}\right)\right]\frac{π}{180}$

$θ$ 2 = 3.84

L=$\sqrt{4×500^{2}- \left(400-70\right)^{2}}+\frac{\left(400×3.84+70×25\right)}{2}$

L = 1793.23mm

1. Initial Tension

2$\sqrt{T\_{O }}$ = $\sqrt{T\_{1}}$ + $\sqrt{T\_{2}}$

But T1 = S1D

 T1=$(1.75×4.53×10^{3})$

 T1 = 7.9275 x 103

 T2

$\left(\frac{\left(S\_{1}-S\_{C}\right)}{\left(S\_{2}-S\_{C}\right)}\right)=e^{θμ}$

$\frac{S\_{1}-S\_{C}}{e^{θμ}}=S\_{2}-S\_{C}$

$S\_{2}=\frac{S\_{1}-S\_{C}}{e^{θμ}}+S\_{C}$

$s\_{2}=\frac{1.75-1.5×10^{4}}{2.718}+1.5×10^{-4}$

S2 = 0.644N/mm2

 T2 = S2A

 =$0.644×4.53×10^{6}$

 T2 =2.917x106N