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ROLL NO : B22ME052

DME LAB-4

FOS = 2

$$T = \frac{60\,(\text{Power})}{2\pi N} = \frac{\cancel{60}^{30} \times 50{,}000}{2\pi \times 1000} = 477.464829$$

$$\text{Torque} \approx 477.5$$

$$\text{Torque}_{\text{design}} = 477.5 \times \underset{(S.f)}{2} = 955 \text{ N.m}$$

Shaft Diameter (shear stress)

$$\tau = \frac{T}{J} r$$

$$\tau = \frac{T}{\frac{\pi}{32}(d_h^4 - d^4)} \quad \cancel{d/2}$$

put $d_h = 2d$

$$\tau = \frac{955 \times d}{\frac{\pi}{32}(16d^4 - d^4)}$$

$\sigma_{yt} = 400 \text{ N/mm}^2$

$\tau = 0.5\,\sigma_{yt}$

$$\tau = \frac{955 \times d}{\frac{\pi}{32} \cdot 15 d^4}$$

$$d = \left(\frac{955 \times 32}{15 \times \pi \times \frac{200}{2}} \right)^{1/3}$$

$$\tau = \frac{955 \times 32}{15 \times \pi \times d^3}$$

$$d = 1.86482209 \text{ mm}$$

$$d = \approx 1.865 \text{ mm}$$

Shaft =

→

$$\frac{200}{2} = \frac{955 \times d/2}{\frac{\pi}{32} d^4} \times 1000$$

$$d^3 = \frac{955 \times 32}{2 \times \pi \times 100} \times 1000$$

$$d \simeq 3.65 \text{ mm}$$

$$d = 36.5 \text{ mm}$$

$d_h = 7.3$ mm

$l_h = 5.475$ mm

$D = 10.95$ mm

$t = 1.825$ mm

$t_1 = 0.9125$ mm

$d_r = 5.475$ mm

$D_0 = 16.425$ mm

no of bolts = 3

Key

$b = 0.9125$ mm

$h =$

$d_h = 73$ mm

$l_h = 54.75$ mm

$D = 109.5$ mm

$t = 18.25$ mm

$t_1 = 9.125$ mm

$d_r = 54.75$ mm

$D_0 = 164.25$ mm

no of bolts = 4

Key

$b = 9.125$ mm

$h = 6.083$ mm

$l = 54.75$ mm

Standard.

Key = (12 × 8) – 5 depth.

2) Design of flange

$$t_f = d/2 = 36.5/2 \approx 18 \text{ mm}$$

$$T = T\Omega \times t_f \times \tau_c \times D/2$$

$$10^3 \times 477.5 = \pi \times 3d \times \frac{d}{2} \times \tau_c \times \frac{3d}{2}$$

$$10^3 \times 477.5 = \pi \times \frac{9}{4} \times d^3 \times \tau_c$$

$$\tau_c = \frac{477.5 \times 4 \times 10^3}{9 \times \pi \times (36.5)^3} = 1.389 \text{ N/mm}^2$$

$\tau_c \geq \tau_{allowable}$

3) Design of bolt

$$\tau = \frac{2T}{bld} = \frac{955 \times 1000}{9 \times 54 \times 36.5} = 53.83 \text{ N/mm}^2$$

Crushing Area

$$\sigma_c = \frac{hT}{dhl} = \frac{2 \times 955 \times 1000}{36.5 \times 54 \times 6} = 161.5 \text{ N/mm}^2$$