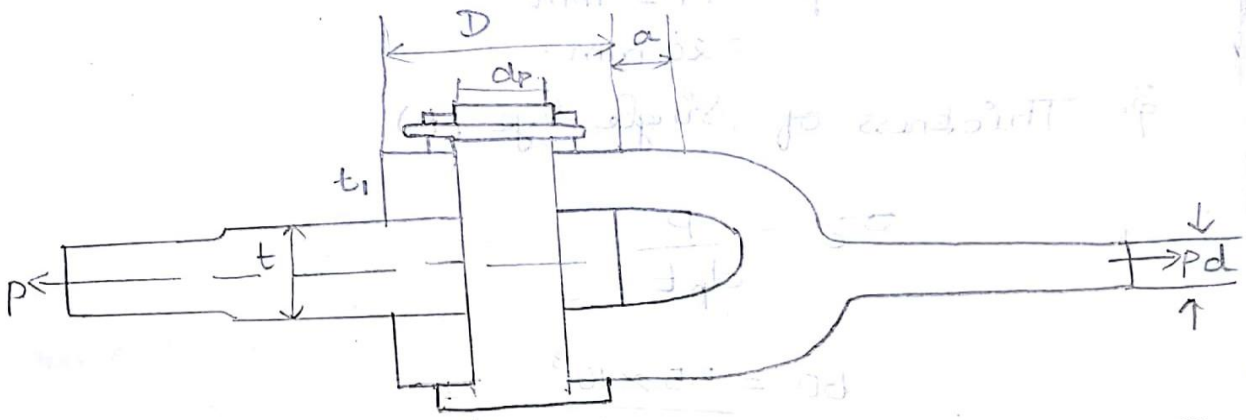
Knuckle Joints

Knuckle joints is used to connect two rods under the action of tensile loads.

1. Design a knuckle joint used to connect two rods under the action of tensile load of $55^{K}N$ Allowable crushing stress = 60 MPas. Allowable tensile stress 60 MPas, Shear stress 30 MPas.



Diameter of rod.

$$\sigma_t = \frac{P}{(\pi d^2/4)}.$$

$$60 = \frac{55 \times 10^3 \times 4}{\pi d^2}$$

$$d^2 = \frac{55 \times 10^3 \times 4}{\pi \times 60}.$$

$$d = 34.16 \text{ mm}.$$

19, 21, 29, 53, 54

2. Diameter of knuckle pin (d_p).

$$\tau = \frac{P}{[2(\pi d_p)^2/4]}$$

$$30 = \frac{55 \times 10^3 \times 4}{2 \times \pi^2 \times d_p^2}$$

$$d_p^2 = \frac{55 \times 10^3 \times 4}{2 \times \pi^2 \times 30}$$

$$d_p = 19.2 \text{ mm}$$

$$= 20 \text{ mm}.$$

3. Thickness of single eye (t).

$$\sigma_c = \frac{P}{d_p t}$$

$$60 = \frac{55 \times 10^3}{20 \times t}$$

$$t = \frac{55 \times 10^3}{20 \times 60}$$

$$= 45.83 \text{ mm}$$

$$t = 46 \text{ mm}$$

$$t = 1.25 d$$

$$= 34.16 \times 1.25$$

$$= 42.7$$

$$= 43 \text{ mm}$$

Thickness = 46 mm.

4. Thickness of fork (t_1).

$$\sigma_c = \frac{P}{2 d_p t_1}$$

$$60 = \frac{55 \times 10^3}{2 \times 20 \times t_1}$$

$$t_1 = \frac{55 \times 10^3}{2 \times 20 \times 60}$$

$$= 22.91$$

$$t_1 = 23 \text{ mm}$$

$$t_1 = 0.75 \times 34.16$$

$$= 25.62 \text{ mm}$$

$$= 26 \text{ mm}$$

$$t_1 = 26 \text{ mm}.$$

5. Outside diameter of eye (D).

$$\sigma_t = \frac{P}{(D - d_p) t}$$

$$60 = \frac{55 \times 10^3}{(D - 20) 46}$$

$$D - 20 = \frac{55 \times 10^3}{60 \times 46}$$

$$D = 40 \text{ mm}.$$

$$\tau = \frac{P}{(D - d_p) t}$$

$$(D - 20) = \frac{55 \times 10^3}{30 \times 46}$$

$$D = 60 \text{ mm}$$

Stress in the fork.

$$\sigma_t = \frac{P}{2(D-d_p)t_1}$$

$$= \frac{55 \times 10^3}{2(60-20)26}$$

$$= 26.44 \text{ MPas}$$

$$\sigma_t < 60 \text{ MPas}.$$

Design is safe.

$$\tau = \frac{P}{2(D-d_p)t_1}$$

$$\tau = \frac{55 \times 10^3}{2(60-20)26}$$

$$= 26.44 \text{ MPas}$$

$$\tau < 30 \text{ MPas}.$$

Design is safe.