Knuckle Joint

↳ Its used to Connect two rods under the action of tensile loads.

Parts = Solid.
Rod.

Knuckle Pin.

Single eye $_n$ end.
(on rod)

Double (fork end)

Various Properties

Diameter of rod. = d.

Diameter of Pin = $d_1 = d$, Dia of Pin head (d_3) = 1.5 d.

Outer dia of eye, $d_2 = 2d$.

Thickness of eye (t) = 1.25 d.

Thickness of Pin head (t_2) = 0.5 d

Thickness of fork (t_1) = 0.75 d

Design of knuckle joint : (Rod design)

① Failure of Solid rod in tension.

$$P = \frac{\pi}{4} d^2 \sigma_t$$

knuckle pin design

Failure of knuckle Pin by double shear.

$$P = 2 \times \frac{\pi}{4} d_1^2 \cdot \tau \rightarrow \text{shear stress.}$$

Failure of knuckle Pin by bending.

$$\sigma_b = \frac{\frac{P}{2}\left(\frac{t_1}{3} + \frac{t}{4}\right)}{\frac{\pi d_1^3}{32}}$$

Single eye (or) rod end design

Failure of single eye in tension.

$$P = (d_2 - d_1) t \cdot \sigma_t$$

Failure of single eye in double shear.

$$P = 2 \frac{(d_2 - d_1)t}{2} \times \tau = (d_2 - d_1) t \cdot \tau$$

Failure of single eye in crushing.

$$P = d_1 t \cdot \sigma_c \rightarrow \text{allowable stress in crushing.}$$

Fork end design:

Failure of fork end in tension.

$$P = (d_2 - d_1) t_1 \times 2 \, \sigma_t.$$

Failure of fork end in double shear

$$P = (d_2 - d_1) t \times 2 \times \tau .$$

Failure of fork end in crushing.

$$P = d_1 \, t_1 \times 2 \times \sigma_c.$$

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①   A knuckle joint is transmit a force of 140kN allowable stresses in tension, shear and Compression are, 75 N/mm², 65N/mm², 140 N/mm². Design a. joint.

$\rightarrow$ <u>Gin:</u> $P = 140 \, kN$ • $140 \times 10^3 N.$

$$\sigma_t = 75 \, N/mm^2$$

$$\sigma_c = 140 \, N/mm^2$$

$$\tau = 65 \, N/mm^2$$

∴ <u>Soln:</u> $\rightarrow$ $d^2 = P \times \dfrac{4}{\pi} \times \dfrac{1}{\sigma_t}$

$$d = 48.75 \simeq \boxed{50 \, mm}$$