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Design of Knuckle Joint Formulas

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List of 45 Design of Knuckle Joint Formulas

Design of Knuckle Joint ⌖

Diameter of Pin of Knuckle joint ⌖

1) Diameter of Knuckle Pin given Bending Moment in Pin ⌖

Open Calculator ⌖

$$fx \quad d = \left(\frac{32 \cdot M_b}{\pi \cdot \sigma_b} \right)^{\frac{1}{3}}$$

$$ex \quad 38.23545mm = \left(\frac{32 \cdot 450000N*mm}{\pi \cdot 82N/mm^2} \right)^{\frac{1}{3}}$$

2) Diameter of Knuckle Pin given Bending Stress in Pin ⌖

Open Calculator ⌖

$$fx \quad d = \left(\frac{32 \cdot \frac{L}{2} \cdot \left(\frac{b}{4} + \frac{a}{3} \right)}{\pi \cdot \sigma_b} \right)^{\frac{1}{3}}$$

$$ex \quad 38.70179mm = \left(\frac{32 \cdot \frac{50000N}{2} \cdot \left(\frac{40mm}{4} + \frac{26mm}{3} \right)}{\pi \cdot 82N/mm^2} \right)^{\frac{1}{3}}$$

3) Diameter of Pin of Knuckle Joint given Compressive Stress in Eye End Portion of Pin ⟳

fx $d = \dfrac{L}{\sigma_c \cdot b}$

ex $41.66667 \text{mm} = \dfrac{50000 \text{N}}{30 \text{N/mm}^2 \cdot 40 \text{mm}}$

4) Diameter of Pin of Knuckle Joint given Compressive Stress in Fork End Portion of Pin ⟳

fx $d = \dfrac{L}{2 \cdot \sigma_c \cdot a}$

ex $32.05128 \text{mm} = \dfrac{50000 \text{N}}{2 \cdot 30 \text{N/mm}^2 \cdot 26 \text{mm}}$

5) Diameter of Pin of Knuckle Joint given Diameter of Pinhead ⟳

fx $d = \dfrac{d_1}{1.5}$

ex $40 \text{mm} = \dfrac{60 \text{mm}}{1.5}$

6) Diameter of Pin of Knuckle Joint given Load and Shear Stress in Pin 🔗

Open Calculator 🔗

$$fx \quad d = \sqrt{\frac{2 \cdot L}{\pi \cdot \tau_{pin}}}$$

$$ex \quad 37.04086mm = \sqrt{\frac{2 \cdot 50000N}{\pi \cdot 23.2N/mm^2}}$$

7) Diameter of Pin of Knuckle Joint given Outer Diameter of Eye 🔗

Open Calculator 🔗

$$fx \quad d = \frac{d_o}{2}$$

$$ex \quad 40mm = \frac{80mm}{2}$$

8) Diameter of Pin of Knuckle Joint given Shear Stress in Eye 🔗

Open Calculator 🔗

$$fx \quad d = d_o - \frac{L}{b \cdot \tau_{eye}}$$

$$ex \quad 27.91667mm = 80mm - \frac{50000N}{40mm \cdot 24N/mm^2}$$

9) Diameter of Pin of Knuckle Joint given Shear Stress in Fork ⤤

fx
$$d = d_o - \frac{L}{2 \cdot \tau_{fork} \cdot a}$$

Open Calculator ⤤

ex
$$41.53846mm = 80mm - \frac{50000N}{2 \cdot 25N/mm^2 \cdot 26mm}$$

10) Diameter of Pin of Knuckle Joint given Tensile Stress in Eye ⤤

fx
$$d = d_o - \frac{L}{b \cdot (\sigma_t eye)}$$

Open Calculator ⤤

ex
$$52.22222mm = 80mm - \frac{50000N}{40mm \cdot 45N/mm^2}$$

11) Diameter of Pin of Knuckle Joint given Tensile Stress in Fork ⤤

fx
$$d = d_o - \frac{L}{2 \cdot (\sigma_t fork) \cdot a}$$

Open Calculator ⤤

ex
$$43.71553mm = 80mm - \frac{50000N}{2 \cdot 26.5N/mm^2 \cdot 26mm}$$

12) Diameter of Pinhead of Knuckle Joint given Diameter of Pin ⤤

fx $d_1 = 1.5 \cdot d$

Open Calculator ⤤

ex $55.5mm = 1.5 \cdot 37mm$

13) Length of Pin of Knuckle Joint in Contact with Eye End ⤢

$$fx\ \ l = \frac{L}{\sigma_c \cdot d}$$

$$ex\ \ 45.04505\text{mm} = \frac{50000\text{N}}{30\text{N/mm}^2 \cdot 37\text{mm}}$$

Diameter of Rod of Knuckle Joint ⤢

14) Diameter of Rod of Knuckle Joint given its Enlarged Diameter near Joint ⤢

$$fx\ \ d_{rk} = \frac{D_1}{1.1}$$

$$ex\ \ 35.45455\text{mm} = \frac{39\text{mm}}{1.1}$$

15) Diameter of Rod of Knuckle Joint given Tensile Stress in Rod ⤢

$$fx\ \ d_{rk} = \sqrt{\frac{4 \cdot L}{\pi \cdot (\sigma_t \text{rod})}}$$

$$ex\ \ 35.68248\text{mm} = \sqrt{\frac{4 \cdot 50000\text{N}}{\pi \cdot 50\text{N/mm}^2}}$$

16) Enlarged Diameter of Rod of Knuckle Joint near Joint

fx $D_1 = 1.1 \cdot d_{rk}$

ex $34.1mm = 1.1 \cdot 31mm$

Open Calculator

17) Rod Diameter of Knuckle Joint given Thickness of Eye

fx $d_{rk} = \dfrac{b}{1.25}$

ex $32mm = \dfrac{40mm}{1.25}$

Open Calculator

18) Rod Diameter of Knuckle Joint given Thickness of Fork Eye

fx $d_{rk} = \dfrac{a}{0.75}$

ex $34.66667mm = \dfrac{26mm}{0.75}$

Open Calculator

Outer Diameter of Eye of Knuckle Joint

19) Outer Diameter of Eye of Knuckle Joint given Diameter of Pin

fx $d_o = 2 \cdot d$

ex $74mm = 2 \cdot 37mm$

Open Calculator

20) Outer Diameter of Eye of Knuckle Joint given Shear Stress in Eye ↗

Open Calculator ↗

fx $$d_o = d + \frac{L}{b \cdot \tau_{eye}}$$

ex $$89.08333mm = 37mm + \frac{50000N}{40mm \cdot 24N/mm^2}$$

21) Outer Diameter of Eye of Knuckle Joint given Shear Stress in Fork ↗

Open Calculator ↗

fx $$d_o = \frac{L}{2 \cdot \tau_{fork} \cdot a} + d$$

ex $$75.46154mm = \frac{50000N}{2 \cdot 25N/mm^2 \cdot 26mm} + 37mm$$

22) Outer Diameter of Eye of Knuckle Joint given Tensile Stress in Eye ↗

Open Calculator ↗

fx $$d_o = d + \frac{L}{b \cdot (\sigma_t eye)}$$

ex $$64.77778mm = 37mm + \frac{50000N}{40mm \cdot 45N/mm^2}$$

23) Outer Diameter of Eye of Knuckle Joint given Tensile Stress in Fork ↗

Open Calculator ↗

fx $$d_o = \frac{L}{2 \cdot (\sigma_t fork) \cdot a} + d$$

ex $$73.28447mm = \frac{50000N}{2 \cdot 26.5N/mm^2 \cdot 26mm} + 37mm$$

Stresses in Knuckle joint 🔗

24) Bending Stress in Knuckle Pin given Bending Moment in Pin 🔗

$$fx \quad \sigma_b = \frac{32 \cdot M_b}{\pi \cdot d^3}$$

$$ex \quad 90.49143 \text{N/mm}^2 = \frac{32 \cdot 450000 \text{N*mm}}{\pi \cdot (37\text{mm})^3}$$

25) Bending Stress in Knuckle Pin given Load, Thickness of Eyes and Pin Diameter 🔗

$$fx \quad \sigma_b = \frac{32 \cdot \frac{L}{2} \cdot \left(\frac{b}{4} + \frac{a}{3}\right)}{\pi \cdot d^3}$$

$$ex \quad 93.84296 \text{N/mm}^2 = \frac{32 \cdot \frac{50000\text{N}}{2} \cdot \left(\frac{40\text{mm}}{4} + \frac{26\text{mm}}{3}\right)}{\pi \cdot (37\text{mm})^3}$$

26) Compressive Stress in Pin Inside Eye of Knuckle Joint given Load and Pin Dimensions 🔗

$$fx \quad \sigma_c = \frac{L}{b \cdot d}$$

$$ex \quad 33.78378 \text{N/mm}^2 = \frac{50000\text{N}}{40\text{mm} \cdot 37\text{mm}}$$

27) Compressive Stress in Pin Inside Fork of Knuckle Joint given Load and Pin Dimensions 🔗

Open Calculator ⚡

$$fx \quad \sigma_c = \frac{L}{2 \cdot a \cdot d}$$

$$ex \quad 25.98753 \text{N/mm}^2 = \frac{50000\text{N}}{2 \cdot 26\text{mm} \cdot 37\text{mm}}$$

28) Max Bending Moment in Knuckle Pin given Load, Thickness of Eye and Fork 🔗

Open Calculator ⚡

$$fx \quad M_b = \frac{L}{2} \cdot \left(\frac{b}{4} + \frac{a}{3} \right)$$

$$ex \quad 466666.7\text{N*mm} = \frac{50000\text{N}}{2} \cdot \left(\frac{40\text{mm}}{4} + \frac{26\text{mm}}{3} \right)$$

29) Shear Stress in Eye of Knuckle Joint given Load, Outer Diameter of Eye and its Thickness 🔗

Open Calculator ⚡

$$fx \quad \tau_{eye} = \frac{L}{b \cdot (d_o - d)}$$

$$ex \quad 29.06977 \text{N/mm}^2 = \frac{50000\text{N}}{40\text{mm} \cdot (80\text{mm} - 37\text{mm})}$$

30) Shear Stress in Fork of Knuckle Joint given Load, Outer Diameter of Eye and Pin Diameter

Open Calculator

$$fx \quad \tau_{\text{fork}} = \frac{L}{2 \cdot a \cdot (d_o - d)}$$

$$ex \quad 22.36136 \text{N/mm}^2 = \frac{50000 \text{N}}{2 \cdot 26 \text{mm} \cdot (80 \text{mm} - 37 \text{mm})}$$

31) Shear Stress in Pin of Knuckle Joint given Load and Pin Diameter

Open Calculator

$$fx \quad \tau_{\text{pin}} = \frac{2 \cdot L}{\pi \cdot d^2}$$

$$ex \quad 23.25127 \text{N/mm}^2 = \frac{2 \cdot 50000 \text{N}}{\pi \cdot (37 \text{mm})^2}$$

32) Tensile Stress in Eye of Knuckle Joint given Load, Outer Diameter of Eye and its Thickness

Open Calculator

$$fx \quad (\sigma_t \text{eye}) = \frac{L}{b \cdot (d_o - d)}$$

$$ex \quad 29.06977 \text{N/mm}^2 = \frac{50000 \text{N}}{40 \text{mm} \cdot (80 \text{mm} - 37 \text{mm})}$$

33) Tensile Stress in Fork of Knuckle Joint given Load, Outer Diameter of Eye and Pin Diameter ⤴

Open Calculator ⤴

$$fx \quad (\sigma_t \text{fork}) = \frac{L}{2 \cdot a \cdot (d_o - d)}$$

$$ex \quad 22.36136 \text{N/mm}^2 = \frac{50000 \text{N}}{2 \cdot 26 \text{mm} \cdot (80 \text{mm} - 37 \text{mm})}$$

34) Tensile Stress in Rod of Knuckle Joint ⤴

Open Calculator ⤴

$$fx \quad (\sigma_t \text{rod}) = \frac{4 \cdot L}{\pi \cdot d_{rk}^2}$$

$$ex \quad 66.24555 \text{N/mm}^2 = \frac{4 \cdot 50000 \text{N}}{\pi \cdot (31 \text{mm})^2}$$

Thickness of Eye End of Knuckle Joint ⤴

35) Thickness of Eye End of Knuckle Joint given Bending Moment in Pin ⤴

Open Calculator ⤴

$$fx \quad b = 4 \cdot \left(2 \cdot \frac{M_b}{L} - \frac{a}{3} \right)$$

$$ex \quad 37.33333 \text{mm} = 4 \cdot \left(2 \cdot \frac{450000 \text{N*mm}}{50000 \text{N}} - \frac{26 \text{mm}}{3} \right)$$

36) Thickness of Eye End of Knuckle Joint given Bending Stress in Pin 🗗

Open Calculator 🗗

fx $$b = 4 \cdot \left(\frac{\pi \cdot d^3 \cdot \sigma_b}{16 \cdot L} - \frac{a}{3} \right)$$

ex $$30.57708 \text{mm} = 4 \cdot \left(\frac{\pi \cdot (37\text{mm})^3 \cdot 82\text{N/mm}^2}{16 \cdot 50000\text{N}} - \frac{26\text{mm}}{3} \right)$$

37) Thickness of Eye End of Knuckle Joint given Shear Stress in Eye 🗗

Open Calculator 🗗

fx $$b = \frac{L}{\tau_{\text{eye}} \cdot (d_o - d)}$$

ex $$48.44961 \text{mm} = \frac{50000\text{N}}{24\text{N/mm}^2 \cdot (80\text{mm} - 37\text{mm})}$$

38) Thickness of Eye End of Knuckle Joint given Tensile Stress in Eye 🗗

Open Calculator 🗗

fx $$b = \frac{L}{(\sigma_t \text{eye}) \cdot (d_o - d)}$$

ex $$25.83979 \text{mm} = \frac{50000\text{N}}{45\text{N/mm}^2 \cdot (80\text{mm} - 37\text{mm})}$$

39) Thickness of Eye of Knuckle Joint given Rod Diameter 🗗

Open Calculator 🗗

fx $$b = 1.25 \cdot d_{\text{rk}}$$

ex $$38.75 \text{mm} = 1.25 \cdot 31\text{mm}$$

Thickness of Fork Eye of Knuckle Joint 🔗

40) Thickness of Fork Eye of Knuckle Joint given Bending Moment in Pin 🔗

Open Calculator 🔗

fx $a = 3 \cdot \left(2 \cdot \dfrac{M_b}{L} - \dfrac{b}{4} \right)$

ex $24\text{mm} = 3 \cdot \left(2 \cdot \dfrac{450000\text{N*mm}}{50000\text{N}} - \dfrac{40\text{mm}}{4} \right)$

41) Thickness of Fork Eye of Knuckle Joint given Bending Stress in Pin 🔗

Open Calculator 🔗

fx $a = 3 \cdot \left(\dfrac{\pi \cdot d^3 \cdot \sigma_b}{16 \cdot L} - \dfrac{b}{4} \right)$

ex $18.93281\text{mm} = 3 \cdot \left(\dfrac{\pi \cdot (37\text{mm})^3 \cdot 82\text{N/mm}^2}{16 \cdot 50000\text{N}} - \dfrac{40\text{mm}}{4} \right)$

42) Thickness of Fork Eye of Knuckle Joint given Compressive Stress in Pin Inside Fork End 🔗

Open Calculator 🔗

fx $a = \dfrac{L}{2 \cdot \sigma_c \cdot d}$

ex $22.52252\text{mm} = \dfrac{50000\text{N}}{2 \cdot 30\text{N/mm}^2 \cdot 37\text{mm}}$

43) Thickness of Fork Eye of Knuckle Joint given Rod Diameter

fx $a = 0.75 \cdot d_{rk}$

Open Calculator

ex $23.25mm = 0.75 \cdot 31mm$

44) Thickness of Fork Eye of Knuckle Joint given Shear Stress in Fork

fx $a = \dfrac{L}{2 \cdot \tau_{fork} \cdot (d_o - d)}$

Open Calculator

ex $23.25581mm = \dfrac{50000N}{2 \cdot 25N/mm^2 \cdot (80mm - 37mm)}$

45) Thickness of Fork Eye of Knuckle Joint given Tensile Stress in Fork

fx $a = \dfrac{L}{2 \cdot (\sigma_t fork) \cdot (d_o - d)}$

Open Calculator

ex $21.93945mm = \dfrac{50000N}{2 \cdot 26.5N/mm^2 \cdot (80mm - 37mm)}$

Variables Used

- **a** Thickess of Fork Eye of Knuckle Joint *(Millimeter)*
- **b** Thickess of Eye of Knuckle Joint *(Millimeter)*
- **d** Diameter of Knuckle Pin *(Millimeter)*
- **d_1** Diameter of Knuckle Pin Head *(Millimeter)*
- **D_1** Enlarged Diameter of Knuckle Joint Rod *(Millimeter)*
- **d_o** Outer Diameter of Eye of Knuckle Joint *(Millimeter)*
- **d_{rk}** Diameter of Rod of Knuckle Joint *(Millimeter)*
- **l** Length of Knuckle Pin in Eye End *(Millimeter)*
- **L** Load on Knuckle Joint *(Newton)*
- **M_b** Bending Moment in Knuckle Pin *(Newton Millimeter)*
- **σ_b** Bending Stress in Knuckle Pin *(Newton per Square Millimeter)*
- **σ_c** Compressive Stress in Knuckle Pin *(Newton per Square Millimeter)*
- **$\sigma_t eye$** Tensile Stress in Eye of Knuckle Joint *(Newton per Square Millimeter)*
- **$\sigma_t fork$** Tensile Stress in Fork of Knuckle Joint *(Newton per Square Millimeter)*
- **$\sigma_t rod$** Tensile Stress in Knuckle Joint Rod *(Newton per Square Millimeter)*
- **τ_{eye}** Shear Stress in Eye of Knuckle Joint *(Newton per Square Millimeter)*
- **τ_{fork}** Shear Stress in Fork of Knuckle Joint *(Newton per Square Millimeter)*
- **τ_{pin}** Shear Stress in Knuckle Pin *(Newton per Square Millimeter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion 🔗
- Measurement: **Force** in Newton (N)
  Force Unit Conversion 🔗
- Measurement: **Torque** in Newton Millimeter (N*mm)
  Torque Unit Conversion 🔗
- Measurement: **Stress** in Newton per Square Millimeter (N/mm²)
  Stress Unit Conversion 🔗

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