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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

Eye

1) Bending Stress in Knuckle Pin given Bending Moment in Pin

Open Calculator

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

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

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

Open Calculator

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

ex $$90.2275\text{N/mm}^2 = \frac{32 \cdot \frac{45000\text{N}}{2} \cdot \left(\frac{44.3\text{mm}}{4} + \frac{26.6\text{mm}}{3}\right)}{\pi \cdot (37\text{mm})^3}$$

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

Open Calculator

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

ex $$27.45409\text{N/mm}^2 = \frac{45000\text{N}}{44.3\text{mm} \cdot 37\text{mm}}$$

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

Open Calculator

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

ex $$22.86121\text{N/mm}^2 = \frac{45000\text{N}}{2 \cdot 26.6\text{mm} \cdot 37\text{mm}}$$

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

Open Calculator

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

ex $$448687.5\text{N*mm} = \frac{45000\text{N}}{2} \cdot \left(\frac{44.3\text{mm}}{4} + \frac{26.6\text{mm}}{3}\right)$$

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

Open Calculator

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

ex $$23.62329\text{N/mm}^2 = \frac{45000\text{N}}{44.3\text{mm} \cdot (80\text{mm} - 37\text{mm})}$$

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

Open Calculator

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

ex $$19.67127\text{N/mm}^2 = \frac{45000\text{N}}{2 \cdot 26.6\text{mm} \cdot (80\text{mm} - 37\text{mm})}$$

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

Open Calculator

fx $$\tau_p = \frac{2 \cdot L}{\pi \cdot d^2}$$

ex $$20.92614\text{N/mm}^2 = \frac{2 \cdot 45000\text{N}}{\pi \cdot (37\text{mm})^2}$$

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

Open Calculator

$$\sigma_{te} = \frac{L}{b \cdot (d_o - d)}$$

$$23.62329\text{N/mm}^2 = \frac{45000\text{N}}{44.3\text{mm} \cdot (80\text{mm} - 37\text{mm})}$$

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

Open Calculator

$$\sigma_{tf} = \frac{L}{2 \cdot a \cdot (d_o - d)}$$

$$19.67127\text{N/mm}^2 = \frac{45000\text{N}}{2 \cdot 26.6\text{mm} \cdot (80\text{mm} - 37\text{mm})}$$

11) Tensile Stress in Rod of Knuckle Joint

Open Calculator

$$\sigma_t = \frac{4 \cdot L}{\pi \cdot d_{r1}^2}$$

$$59.621\text{N/mm}^2 = \frac{4 \cdot 45000\text{N}}{\pi \cdot (31\text{mm})^2}$$

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

Open Calculator

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

ex $$44.53333\text{mm} = 4 \cdot \left(2 \cdot \frac{450000\text{N*mm}}{45000\text{N}} - \frac{26.6\text{mm}}{3} \right)$$

13) 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 $$44.09888\text{mm} = 4 \cdot \left(\frac{\pi \cdot (37\text{mm})^3 \cdot 90\text{N/mm}^2}{16 \cdot 45000\text{N}} - \frac{26.6\text{mm}}{3} \right)$$

14) Thickness of Eye End of Knuckle Joint given Shear Stress in Eye

Open Calculator

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

ex $$43.60465\text{mm} = \frac{45000\text{N}}{24\text{N/mm}^2 \cdot (80\text{mm} - 37\text{mm})}$$

15) Thickness of Eye End of Knuckle Joint given Tensile Stress in Eye

Open Calculator

fx $$b = \frac{L}{\sigma_{te} \cdot (d_o - d)}$$

ex $$23.25581\text{mm} = \frac{45000\text{N}}{45\text{N/mm}^2 \cdot (80\text{mm} - 37\text{mm})}$$

16) Thickness of Eye of Knuckle Joint given Rod Diameter

Open Calculator

fx $$b = 1.25 \cdot d_{r1}$$

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

Fork

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

Open Calculator

fx $$d_o = 2 \cdot d$$

ex $$74\text{mm} = 2 \cdot 37\text{mm}$$

18) Outer Diameter of Eye of Knuckle Joint given Shear Stress in Eye

Open Calculator

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

ex $$79.32506\text{mm} = 37\text{mm} + \frac{45000\text{N}}{44.3\text{mm} \cdot 24\text{N/mm}^2}$$

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

Open Calculator

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

ex $$70.83459\text{mm} = \frac{45000\text{N}}{2 \cdot 25\text{N/mm}^2 \cdot 26.6\text{mm}} + 37\text{mm}$$

20) Outer Diameter of Eye of Knuckle Joint given Tensile Stress in Eye

Open Calculator

fx $$d_o = d + \frac{L}{b \cdot \sigma_{te}}$$

ex $$59.57336\text{mm} = 37\text{mm} + \frac{45000\text{N}}{44.3\text{mm} \cdot 45\text{N/mm}^2}$$

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

Open Calculator

fx $$d_o = \frac{L}{2 \cdot \sigma_{tf} \cdot a} + d$$

ex $$68.91942\text{mm} = \frac{45000\text{N}}{2 \cdot 26.5\text{N/mm}^2 \cdot 26.6\text{mm}} + 37\text{mm}$$

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

Open Calculator

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

ex $$26.775\text{mm} = 3 \cdot \left(2 \cdot \frac{450000\text{N*mm}}{45000\text{N}} - \frac{44.3\text{mm}}{4} \right)$$

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

Open Calculator

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

ex $$26.44916\text{mm} = 3 \cdot \left(\frac{\pi \cdot (37\text{mm})^3 \cdot 90\text{N/mm}^2}{16 \cdot 45000\text{N}} - \frac{44.3\text{mm}}{4} \right)$$

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

Open Calculator

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

ex $$20.27027\text{mm} = \frac{45000\text{N}}{2 \cdot 30\text{N/mm}^2 \cdot 37\text{mm}}$$

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

Open Calculator

fx $$a = 0.75 \cdot d_{r1}$$

ex $$23.25\text{mm} = 0.75 \cdot 31\text{mm}$$

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

Open Calculator

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

ex $$20.93023\text{mm} = \frac{45000\text{N}}{2 \cdot 25\text{N/mm}^2 \cdot (80\text{mm} - 37\text{mm})}$$

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

Open Calculator

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

ex $$19.7455\text{mm} = \frac{45000\text{N}}{2 \cdot 26.5\text{N/mm}^2 \cdot (80\text{mm} - 37\text{mm})}$$

Pin

28) Diameter of Knuckle Pin given Bending Moment in Pin

Open Calculator

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

ex $$37.06722\text{mm} = \left(\frac{32 \cdot 450000\text{N*mm}}{\pi \cdot 90\text{N/mm}^2} \right)^{\frac{1}{3}}$$

29) Diameter of Knuckle Pin given Bending Stress in Pin

Open Calculator

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

ex $$37.03115\text{mm} = \left(\frac{32 \cdot \frac{45000\text{N}}{2} \cdot \left(\frac{44.3\text{mm}}{4} + \frac{26.6\text{mm}}{3} \right)}{\pi \cdot 90\text{N/mm}^2} \right)^{\frac{1}{3}}$$

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

Open Calculator

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

ex $$33.86005\text{mm} = \frac{45000\text{N}}{30\text{N/mm}^2 \cdot 44.3\text{mm}}$$

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

Open Calculator

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

ex $$28.19549\text{mm} = \frac{45000\text{N}}{2 \cdot 30\text{N/mm}^2 \cdot 26.6\text{mm}}$$

32) Diameter of Pin of Knuckle Joint given Diameter of Pinhead

Open Calculator

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

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

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

Open Calculator

fx $$d = \sqrt{\frac{2 \cdot L}{\pi \cdot \tau_p}}$$

ex $$35.14005\text{mm} = \sqrt{\frac{2 \cdot 45000\text{N}}{\pi \cdot 23.2\text{N/mm}^2}}$$

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

Open Calculator

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

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

35) Diameter of Pin of Knuckle Joint given Shear Stress in Eye

Open Calculator

fx $$d = d_o - \frac{L}{b \cdot \tau_e}$$

ex $$37.67494\text{mm} = 80\text{mm} - \frac{45000\text{N}}{44.3\text{mm} \cdot 24\text{N/mm}^2}$$

36) Diameter of Pin of Knuckle Joint given Shear Stress in Fork

Open Calculator

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

ex $$46.16541\text{mm} = 80\text{mm} - \frac{45000\text{N}}{2 \cdot 25\text{N/mm}^2 \cdot 26.6\text{mm}}$$

37) Diameter of Pin of Knuckle Joint given Tensile Stress in Eye

Open Calculator

fx $$d = d_o - \frac{L}{b \cdot \sigma_{te}}$$

ex $$57.42664\text{mm} = 80\text{mm} - \frac{45000\text{N}}{44.3\text{mm} \cdot 45\text{N/mm}^2}$$

38) Diameter of Pin of Knuckle Joint given Tensile Stress in Fork

Open Calculator

fx $$d = d_o - \frac{L}{2 \cdot \sigma_{tf} \cdot a}$$

ex $$48.08058\text{mm} = 80\text{mm} - \frac{45000\text{N}}{2 \cdot 26.5\text{N/mm}^2 \cdot 26.6\text{mm}}$$

39) Diameter of Pinhead of Knuckle Joint given Diameter of Pin

Open Calculator

fx $$d_1 = 1.5 \cdot d$$

ex $$55.5\text{mm} = 1.5 \cdot 37\text{mm}$$

40) Length of Pin of Knuckle Joint in Contact with Eye End

Open Calculator

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

ex $$40.54054\text{mm} = \frac{45000\text{N}}{30\text{N/mm}^2 \cdot 37\text{mm}}$$

Rod

41) Diameter of Rod of Knuckle Joint given its Enlarged Diameter near Joint

Open Calculator

fx $$d_r = \frac{D_1}{1.1}$$

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

42) Diameter of Rod of Knuckle Joint given Tensile Stress in Rod

Open Calculator

fx $$d_r = \sqrt{\frac{4 \cdot L}{\pi \cdot \sigma_t}}$$

ex $$33.85138\text{mm} = \sqrt{\frac{4 \cdot 45000\text{N}}{\pi \cdot 50\text{N/mm}^2}}$$

43) Enlarged Diameter of Rod of Knuckle Joint near Joint

Open Calculator

fx $$D_1 = 1.1 \cdot d_r$$

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

44) Rod Diameter of Knuckle Joint given Thickness of Eye

Open Calculator

fx $$d_r = \frac{b}{1.25}$$

ex $$35.44\text{mm} = \frac{44.3\text{mm}}{1.25}$$

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

Open Calculator

fx $$d_r = \frac{a}{0.75}$$

ex $$35.46667\text{mm} = \frac{26.6\text{mm}}{0.75}$$

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_r Diameter of Knuckle Joint *(Millimeter)*
- d_{r1} 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)*
- σ_t Tensile Stress in Knuckle Joint Rod *(Newton per Square Millimeter)*
- σ_{te} Tensile Stress in Eye of Knuckle Joint *(Newton per Square Millimeter)*
- σ_{tf} Tensile Stress in Fork of Knuckle Joint *(Newton per Square Millimeter)*
- τ_e Shear Stress in Eye of Knuckle Joint *(Newton per Square Millimeter)*
- τ_f Shear Stress in Fork of Knuckle Joint *(Newton per Square Millimeter)*
- τ_p Shear Stress in Knuckle Pin *(Newton per Square Millimeter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- 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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