



Design of Knuckle Joint Formulas

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Examples!

Conversions!

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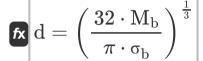


List of 45 Design of Knuckle Joint Formulas

Design of Knuckle Joint &

Diameter of Pin of Knuckle joint 🗗

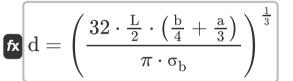
1) Diameter of Knuckle Pin given Bending Moment in Pin



Open Calculator 🗗

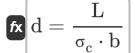
ex
$$38.23545 \mathrm{mm} = \left(\frac{32 \cdot 450000 \mathrm{N^*mm}}{\pi \cdot 82 \mathrm{N/mm^2}} \right)^{\frac{1}{3}}$$

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





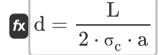
3) Diameter of Pin of Knuckle Joint given Compressive Stress in Eye End Portion of Pin



Open Calculator

$$ext{ex} egin{array}{c} 41.66667 ext{mm} = rac{50000 ext{N}}{30 ext{N}/ ext{mm}^2 \cdot 40 ext{mm}} \end{array}$$

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



Open Calculator

$$=$$
 $\frac{50000 ext{N}}{2 \cdot 30 ext{N/mm}^2 \cdot 26 ext{mm}}$

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

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

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

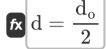


- 6) Diameter of Pin of Knuckle Joint given Load and Shear Stress in Pin 🛂
- $\left| \mathbf{f} \mathbf{x}
 ight| \mathrm{d} = \sqrt{rac{2 \cdot \mathrm{L}}{\pi \cdot au_\mathrm{pin}}} \, \left| \mathbf{f} \mathbf{x}
 ight|$

Open Calculator

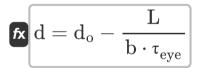
ex $37.04086 \mathrm{mm} = \sqrt{rac{2 \cdot 50000 \mathrm{N}}{\pi \cdot 23.2 \mathrm{N/mm^2}}}$

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



Open Calculator

- $40 \text{mm} = \frac{80 \text{mm}}{2}$
- 8) Diameter of Pin of Knuckle Joint given Shear Stress in Eye



Open Calculator

 $\mathbf{ex} \left[27.91667 \mathrm{mm} = 80 \mathrm{mm} - rac{50000 \mathrm{N}}{40 \mathrm{mm} \cdot 24 \mathrm{N/mm^2}}
ight]$

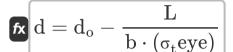


9) Diameter of Pin of Knuckle Joint given Shear Stress in Fork

Open Calculator 🗗

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

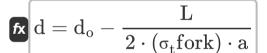
10) Diameter of Pin of Knuckle Joint given Tensile Stress in Eve



Open Calculator

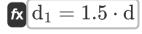
 $\mathbf{ex} = 52.2222 \mathrm{mm} = 80 \mathrm{mm} - \frac{50000 \mathrm{N}}{40 \mathrm{mm} \cdot 45 \mathrm{N/mm^2}}$

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



Open Calculator

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

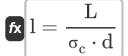


Open Calculator 🗗

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



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

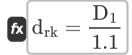


Open Calculator 🖸

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

Diameter of Rod of Knuckle Joint &

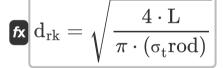
14) Diameter of Rod of Knuckle Joint given its Enlarged Diameter near Joint



Open Calculator

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

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



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



16) Enlarged Diameter of Rod of Knuckle Joint near Joint

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

Open Calculator 🗗

 $\texttt{ex} \ 34.1 \text{mm} = 1.1 \cdot 31 \text{mm}$

17) Rod Diameter of Knuckle Joint given Thickness of Eye

 $extbf{d}_{ ext{rk}} = rac{ ext{b}}{1.25}$

Open Calculator

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

fx $d_{
m rk} = rac{
m a}{0.75}$

Open Calculator 🗗

 $= \frac{34.66667 \text{mm}}{0.75}$

Outer Diameter of Eye of Knuckle Joint &

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

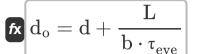
fx $d_{
m o} = 2 \cdot d$

Open Calculator

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



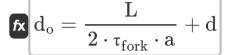
20) Outer Diameter of Eye of Knuckle Joint given Shear Stress in Eye



Open Calculator 🗗

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

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



Open Calculator

$$ext{ex} egin{aligned} 75.46154 ext{mm} &= rac{50000 ext{N}}{2 \cdot 25 ext{N/mm}^2 \cdot 26 ext{mm}} + 37 ext{mm} \end{aligned}$$

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

$$\mathrm{d}_\mathrm{o} = \mathrm{d} + rac{\mathrm{L}}{\mathrm{b} \cdot (\sigma_\mathrm{t} \mathrm{eye})}$$

Open Calculator

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

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

$$\mathbf{f} \mathbf{k} d_{\mathrm{o}} = rac{\mathrm{L}}{2 \cdot (\sigma_{\mathrm{t}} \mathrm{fork}) \cdot \mathrm{a}} + \mathrm{d}$$







Stresses in Knuckle joint 🗗

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

fx
$$\sigma_{
m b} = rac{32 \cdot {
m M_b}}{\pi \cdot {
m d}^3}$$

Open Calculator

$$ext{ex} egin{aligned} 90.49143 ext{N/mm}^2 &= rac{32 \cdot 450000 ext{N*mm}}{\pi \cdot (37 ext{mm})^3} \end{aligned}$$

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

$$\sigma_{
m b} = rac{32 \cdot rac{
m L}{2} \cdot \left(rac{
m b}{4} + rac{
m a}{3}
ight)}{\pi \cdot {
m d}^3}$$

Open Calculator

$$ext{ex} \left[93.84296 ext{N/mm}^2 = rac{32 \cdot rac{50000 ext{N}}{2} \cdot \left(rac{40 ext{mm}}{4} + rac{26 ext{mm}}{3}
ight)}{\pi \cdot \left(37 ext{mm}
ight)^3}
ight]$$

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

$$\sigma_{
m c} = rac{
m L}{
m b \cdot d}$$

$$ext{ex} = rac{50000 ext{N}}{40 ext{mm} \cdot 37 ext{mm}}$$



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

 $\left[\sigma_{
m c} = rac{
m L}{2 \cdot {
m a} \cdot {
m d}}
ight]$

Open Calculator

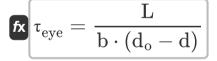
$$extbf{ex} 25.98753 ext{N/mm}^2 = rac{50000 ext{N}}{2 \cdot 26 ext{mm} \cdot 37 ext{mm}}$$

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

 $M_{
m b} = rac{
m L}{2} \cdot \left(rac{
m b}{4} + rac{
m a}{3}
ight)^2$

Open Calculator

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



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



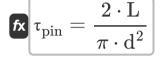
30) Shear Stress in Fork of Knuckle Joint given Load, Outer Diameter of Eye and Pin Diameter

 $au_{
m fork} = rac{
m L}{2 \cdot {
m a} \cdot ({
m d_o} - {
m d})}$

Open Calculator 🗗

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

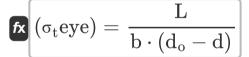
31) Shear Stress in Pin of Knuckle Joint given Load and Pin Diameter



Open Calculator

 $ext{ex} \ 23.25127 ext{N/mm}^2 = rac{2 \cdot 50000 ext{N}}{\pi \cdot (37 ext{mm})^2}$

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



Open Calculator 🖸

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

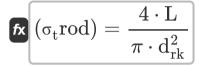
33) Tensile Stress in Fork of Knuckle Joint given Load, Outer Diameter of Eye and Pin Diameter

 $oldsymbol{\kappa} \left(\sigma_{
m t} {
m fork}
ight) = \overline{rac{
m L}{2 \cdot {
m a} \cdot ({
m d}_{
m o} - {
m d})}}$

Open Calculator 🗗

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

34) Tensile Stress in Rod of Knuckle Joint

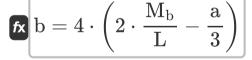


Open Calculator

 $extbf{ex} \left[66.24555 ext{N/mm}^2 = rac{4 \cdot 50000 ext{N}}{\pi \cdot \left(31 ext{mm}
ight)^2}
ight]$

Thickness of Eye End of Knuckle Joint &

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



Open Calculator



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

 $\mathbf{b} = 4 \cdot \left(rac{\pi \cdot \mathrm{d}^3 \cdot \sigma_\mathrm{b}}{16 \cdot \mathrm{L}} - rac{\mathrm{a}}{3}
ight)$

Open Calculator 🚰

 $oxed{ex} 30.57708 \mathrm{mm} = 4 \cdot \left(rac{\pi \cdot \left(37 \mathrm{mm}
ight)^3 \cdot 82 \mathrm{N/mm^2}}{16 \cdot 50000 \mathrm{N}} - rac{26 \mathrm{mm}}{3}
ight)$

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

 $b = rac{L}{ au_{
m eye} \cdot (d_{
m o} - d)}$ Open Calculator $oldsymbol{C}$

 $ext{ex} = rac{50000 ext{N}}{24 ext{N/mm}^2 \cdot (80 ext{mm} - 37 ext{mm})}$

 $b = \frac{L}{(\sigma_{t} \text{eve}) \cdot (d_{0} - d)}$

Open Calculator

= $25.83979 \mathrm{mm} = rac{50000 \mathrm{N}}{45 \mathrm{N/mm^2 \cdot (80 \mathrm{mm} - 37 \mathrm{mm})}}$

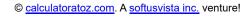
39) Thickness of Eye of Knuckle Joint given Rod Diameter

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

Open Calculator

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







Thickness of Fork Eye of Knuckle Joint &

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

$$\mathbf{f}\mathbf{x} = 3 \cdot \left(2 \cdot rac{\mathrm{M_b}}{\mathrm{L}} - rac{\mathrm{b}}{4}
ight)$$

Open Calculator 🗗

$$\mathbf{ex} \left[24 \mathrm{mm} = 3 \cdot \left(2 \cdot \frac{450000 \mathrm{N*mm}}{50000 \mathrm{N}} - \frac{40 \mathrm{mm}}{4} \right) \right]$$

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

$$\mathbf{fx} = 3 \cdot \left(rac{\pi \cdot \mathrm{d}^3 \cdot \sigma_\mathrm{b}}{16 \cdot \mathrm{L}} - rac{\mathrm{b}}{4}
ight)$$

Open Calculator 🗗

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

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

$$\left[\mathbf{a} = rac{\mathrm{L}}{2 \cdot \mathbf{\sigma_{\mathrm{c}} \cdot \mathrm{d}}}
ight]$$

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





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

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

- $23.25 \text{mm} = 0.75 \cdot 31 \text{mm}$
- 44) Thickness of Fork Eye of Knuckle Joint given Shear Stress in Fork
- $\left| \mathbf{a} = rac{L}{2 \cdot au_{\mathrm{fork}} \cdot (d_{\mathrm{o}} d)}
 ight|$

- Open Calculator
- $ext{ex} \ 23.25581 ext{mm} = rac{50000 ext{N}}{2 \cdot 25 ext{N} / ext{mm}^2 \cdot (80 ext{mm} 37 ext{mm})}$
- 45) Thickness of Fork Eye of Knuckle Joint given Tensile Stress in Fork
- fx $a = rac{L}{2 \cdot (\sigma_{t} \mathrm{fork}) \cdot (\mathrm{d}_{0} \mathrm{d})}$

- Open Calculator 🚰
- $ext{ex} \ 21.93945 ext{mm} = rac{50000 ext{N}}{2 \cdot 26.5 ext{N/mm}^2 \cdot (80 ext{mm} 37 ext{mm})}$



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)
- d₁ Diameter of Knuckle Pin Head (Millimeter)
- **D₁** Enlarged Diameter of Knuckle Joint Rod (Millimeter)
- do Outer Diameter of Eye of Knuckle Joint (Millimeter)
- d_{rk} Diameter of Rod of Knuckle Joint (Millimeter)
- I 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_teye Tensile Stress in Eye of Knuckle Joint (Newton per Square Millimeter)
- σ_tfork Tensile Stress in Fork of Knuckle Joint (Newton per Square Millimeter)
- σ_trod Tensile Stress in Knuckle Joint Rod (Newton per Square Millimeter)
- Teye Shear Stress in Eye of Knuckle Joint (Newton per Square Millimeter)
- Tfork Shear Stress in Fork of Knuckle Joint (Newton per Square Millimeter)
- Tpin 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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