



# Design of Knuckle Joint Formulas

Calculators!

Examples!

Conversions!

Bookmark calculatoratoz.com, unitsconverters.com

Widest Coverage of Calculators and Growing - 30,000+ Calculators!

Calculate With a Different Unit for Each Variable - In built Unit Conversion!

Widest Collection of Measurements and Units - 250+ Measurements!

Feel free to SHARE this document with your friends!

Please leave your feedback here...





# List of 45 Design of Knuckle Joint Formulas

# Design of Knuckle Joint &

#### Eye 🗗

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

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

Open Calculator 🗗

$$ext{ex} = rac{32 \cdot 450000 ext{N*mm}}{\pi \cdot (37 ext{mm})^3}$$

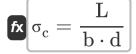
2) Bending Stress in Knuckle Pin given Load, Thickness of Eyes and Pin Diameter

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

$$extbf{ex} egin{aligned} 90.2275 ext{N/mm}^2 &= rac{32 \cdot rac{45000 ext{N}}{2} \cdot \left(rac{44.3 ext{mm}}{4} + rac{26.6 ext{mm}}{3}
ight)}{\pi \cdot (37 ext{mm})^3} \end{aligned}$$



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



Open Calculator 🚰

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

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

fx 
$$\sigma_{c} = rac{L}{2 \cdot a \cdot d}$$

Open Calculator

$$=$$
  $22.86121 \mathrm{N/mm^2} = rac{45000 \mathrm{N}}{2 \cdot 26.6 \mathrm{mm} \cdot 37 \mathrm{mm}}$ 

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

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

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



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

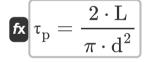
 $au_{
m e} = rac{
m L}{
m b\cdot (d_o-d)}$ 

Open Calculator

- $oxed{ex} 23.62329 ext{N/mm}^2 = rac{45000 ext{N}}{44.3 ext{mm} \cdot (80 ext{mm} 37 ext{mm})}$
- 7) Shear Stress in Fork of Knuckle Joint given Load, Outer Diameter of Eye and Pin Diameter
- $au_{
  m f} = rac{
  m L}{2 \cdot {
  m a} \cdot ({
  m d}_{
  m o} {
  m d})}$

Open Calculator

- $ext{ex} 19.67127 ext{N/mm}^2 = rac{45000 ext{N}}{2 \cdot 26.6 ext{mm} \cdot (80 ext{mm} 37 ext{mm})}$
- 8) Shear Stress in Pin of Knuckle Joint given Load and Pin Diameter



Open Calculator

 $ext{ex} \left[ 20.92614 ext{N/mm}^2 = rac{2 \cdot 45000 ext{N}}{\pi \cdot (37 ext{mm})^2} 
ight]$ 



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

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

Open Calculator 🗗

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

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

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

Open Calculator

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

#### 11) Tensile Stress in Rod of Knuckle Joint

 $\left| \mathbf{\sigma}_{\mathrm{t}} 
ight| = rac{4 \cdot \mathrm{L}}{\pi \cdot \mathrm{d}_{\mathrm{r}1}^2}$ 

Open Calculator

 $ext{ex} 59.621 ext{N/mm}^2 = rac{4 \cdot 45000 ext{N}}{\pi \cdot (31 ext{mm})^2}$ 



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

$$b = 4 \cdot \left( 2 \cdot rac{
m M_b}{
m L} - rac{
m a}{3} 
ight)$$

Open Calculator 🚰

13) 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

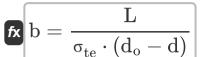
14) Thickness of Eye End of Knuckle Joint given Shear Stress in Eye 🛂

$$\mathbf{f}\mathbf{x} b = rac{L}{ au_{
m e} \cdot (d_{
m o} - d)}$$

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



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



Open Calculator 🗗

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

# 16) Thickness of Eye of Knuckle Joint given Rod Diameter

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

Open Calculator

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

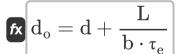
### Fork 🛂

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

fx  $m d_o = 2 \cdot d$ 

Open Calculator 🗗

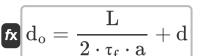
### 18) Outer Diameter of Eye of Knuckle Joint given Shear Stress in Eye



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



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

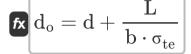


Open Calculator 🗗

$$= \frac{430001}{2 \cdot 25 \text{N/mm}^2 \cdot 26.6 \text{mm}} + 37 \text{mm}$$

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

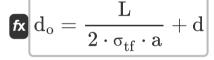
45000N



Open Calculator

$$ext{ex} \left[ 59.57336 ext{mm} = 37 ext{mm} + rac{45000 ext{N}}{44.3 ext{mm} \cdot 45 ext{N/mm}^2} 
ight]$$

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



$$\mathbf{ex} \ 68.91942 \mathrm{mm} = rac{45000 \mathrm{N}}{2 \cdot 26.5 \mathrm{N/mm^2 \cdot 26.6 mm}} + 37 \mathrm{mm}$$



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

$$a=3\cdot\left(2\cdotrac{ ext{M}_{ ext{b}}}{ ext{L}}-rac{ ext{b}}{4}
ight)$$

Open Calculator 🗗

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

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

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

Open Calculator

$$extbf{ex} \ 26.44916 ext{mm} = 3 \cdot \left( rac{\pi \cdot \left( 37 ext{mm} 
ight)^3 \cdot 90 ext{N/mm}^2}{16 \cdot 45000 ext{N}} - rac{44.3 ext{mm}}{4} 
ight)$$

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

$$\mathbf{f}\mathbf{x} egin{bmatrix} \mathbf{a} = rac{L}{2 \cdot \sigma_{c} \cdot \mathbf{d}} \end{bmatrix}$$

$$=$$
  $20.27027 ext{mm} = rac{45000 ext{N}}{2 \cdot 30 ext{N/mm}^2 \cdot 37 ext{mm}}$ 



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

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

Open Calculator 🗗

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

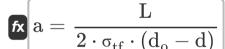
### 26) Thickness of Fork Eye of Knuckle Joint given Shear Stress in Fork

 $\left| \mathbf{a} 
ight| \mathbf{a} = rac{\mathrm{L}}{2 \cdot \mathrm{ au_f} \cdot (\mathrm{d_o} - \mathrm{d})} \, .$ 

Open Calculator

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

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



Open Calculator 🚰

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



#### Pin 🗗

#### 28) Diameter of Knuckle Pin given Bending Moment in Pin

$$\mathrm{d} = \left(rac{32\cdot\mathrm{M_b}}{\pi\cdot\sigma_\mathrm{b}}
ight)^{rac{1}{3}}$$

Open Calculator

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

#### 29) Diameter of Knuckle Pin given Bending Stress in Pin

$$\mathrm{d} = \left(rac{32 \cdot rac{L}{2} \cdot \left(rac{b}{4} + rac{a}{3}
ight)}{\pi \cdot \sigma_{b}}
ight)^{rac{1}{3}}$$

Open Calculator

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

$$\mathbf{f}\mathbf{x} \, \mathrm{d} = rac{\mathrm{L}}{\sigma_\mathrm{c} \cdot \mathrm{b}}$$

$$=$$
  $33.86005 ext{mm} = rac{45000 ext{N}}{30 ext{N/mm}^2 \cdot 44.3 ext{mm}}$ 





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

 $\mathbf{f} \mathbf{k} = rac{\mathrm{L}}{2 \cdot \mathbf{\sigma_c} \cdot \mathbf{a}}$ 

Open Calculator

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

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

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

Open Calculator

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

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

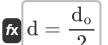
fx  $d = \sqrt{rac{2 \cdot L}{\pi \cdot au_p}}$ 

Open Calculator 🗗

 $oxed{ex} 35.14005 \mathrm{mm} = \sqrt{rac{2 \cdot 45000 \mathrm{N}}{\pi \cdot 23.2 \mathrm{N/mm^2}}}$ 



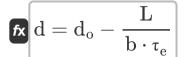
#### 34) Diameter of Pin of Knuckle Joint given Outer Diameter of Eve



Open Calculator

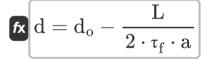
 $40\text{mm} = \frac{80\text{mm}}{2}$ 

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



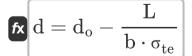
Open Calculator

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



Open Calculator

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



Open Calculator

 $ext{ex} \left[ 57.42664 ext{mm} = 80 ext{mm} - rac{45000 ext{N}}{44.3 ext{mm} \cdot 45 ext{N/mm}^2} 
ight]$ 







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

 $\mathbf{K} \, \mathrm{d} = \mathrm{d_o} - rac{\mathrm{L}}{2 \cdot \mathrm{\sigma_{tf}} \cdot \mathrm{a}}$ 

Open Calculator

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

fx  $d_1 = 1.5 \cdot d$ 

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

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



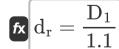
Open Calculator 🗗

Open Calculator

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

# Rod 🛂

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

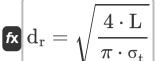


Open Calculator

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



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



Open Calculator 🗗

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

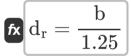
# 43) Enlarged Diameter of Rod of Knuckle Joint near Joint

fx  $D_1 = 1.1 \cdot d_r$ 

Open Calculator

 $= 39 \mathrm{mm} = 1.1 \cdot 35.45455 \mathrm{mm}$ 

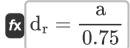
#### 44) Rod Diameter of Knuckle Joint given Thickness of Eye



Open Calculator 🗗

=  $35.44 \mathrm{mm} = rac{44.3 \mathrm{mm}}{1.25}$ 

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



Open Calculator

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





#### 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<sub>1</sub> Diameter of Knuckle Pin Head (Millimeter)
- **D**<sub>1</sub> Enlarged Diameter of Knuckle Joint Rod (Millimeter)
- **d**<sub>o</sub> Outer Diameter of Eye of Knuckle Joint (*Millimeter*)
- **d**<sub>r</sub> Diameter of Knuckle Joint (Millimeter)
- d<sub>r1</sub> Diameter of Rod of Knuckle Joint (Millimeter)
- Length of Knuckle Pin in Eye End (Millimeter)
- L Load on Knuckle Joint (Newton)
- M<sub>b</sub> Bending Moment in Knuckle Pin (Newton Millimeter)
- σ<sub>b</sub> Bending Stress in Knuckle Pin (Newton per Square Millimeter)
- σ<sub>c</sub> Compressive Stress in Knuckle Pin (Newton per Square Millimeter)
- σ<sub>t</sub> Tensile Stress in Knuckle Joint Rod (Newton per Square Millimeter)
- σ<sub>te</sub> Tensile Stress in Eye of Knuckle Joint (Newton per Square Millimeter)
- σ<sub>tf</sub> Tensile Stress in Fork of Knuckle Joint (Newton per Square Millimeter)
- Te Shear Stress in Eye of Knuckle Joint (Newton per Square Millimeter)
- Tf Shear Stress in Fork of Knuckle Joint (Newton per Square Millimeter)
- Tp 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





#### **Check other formula lists**

- Design of Cotter Joint Formulas
- Design of Knuckle Joint Formulas
- Packing Formulas
- Retaining Rings and Circlips
   Formulas

- Riveted Joints Formulas
- Seals Formulas
- Threaded Bolted Joints Formulas
- Welded Joints Formulas

Feel free to SHARE this document with your friends!

#### **PDF** Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

7/18/2024 | 5:12:29 AM UTC

Please leave your feedback here...



