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# Eye Formulas

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# List of 16 Eye Formulas

## Eye

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

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

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

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



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

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f\_img.jpg\)](#)

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



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

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

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

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



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

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

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a\_img.jpg\)](#)

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

## 11) Tensile Stress in Rod of Knuckle Joint

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

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd\_img.jpg\)](#)

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



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

[Open Calculator !\[\]\(eafc244b53721dd1ec133f0772f70fc7\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(10f8862fc183b400327470ea85afe9ae\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(35dc653d59570f8f891c312eeece91a2\_img.jpg\)](#)

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

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

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

[Open Calculator !\[\]\(b538fe54c1f3a7343e37e85cc2d00497\_img.jpg\)](#)

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

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







## Variables Used

- **a** Thickness of Fork Eye of Knuckle Joint (*Millimeter*)
- **b** Thickness of Eye of Knuckle Joint (*Millimeter*)
- **d** Diameter of Knuckle Pin (*Millimeter*)
- **d<sub>o</sub>** Outer Diameter of Eye of Knuckle Joint (*Millimeter*)
- **d<sub>r1</sub>** Diameter of Rod of Knuckle Joint (*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*)
- **τ<sub>e</sub>** Shear Stress in Eye of Knuckle Joint (*Newton per Square Millimeter*)
- **τ<sub>f</sub>** Shear Stress in Fork of Knuckle Joint (*Newton per Square Millimeter*)
- **τ<sub>p</sub>** Shear Stress in Knuckle Pin (*Newton per Square Millimeter*)



## Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288  
*Archimedes' constant*
- **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/mm<sup>2</sup>)  
*Stress Unit Conversion* 





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