Important Design of Knuckle Joint Formulas PDF



List of 45

Important Design of Knuckle Joint Formulas

1) Eye Formulas 🗂

1.1) Bending Stress in Knuckle Pin given Bending Moment in Pin Formula 🕝



Example with Units

Evaluate Formula (

$$\sigma_b = \frac{32 \cdot M_b}{\pi \cdot d^3} \qquad 90.4914 \, \text{N/mm}^2 = \frac{32 \cdot 450000 \, \text{N*mm}}{3.1416 \cdot 37 \, \text{mm}^3}$$

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



Example with Units

Evaluate Formula (

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

$$\sigma_{b} = \frac{32 \cdot \frac{L}{2} \cdot \left(\frac{b}{4} + \frac{a}{3}\right)}{\pi \cdot d^{3}} \qquad 90.2275 \, \text{N/mm}^{2} = \frac{32 \cdot \frac{45000 \, \text{N}}{2} \cdot \left(\frac{44.3 \, \text{mm}}{4} + \frac{26.6 \, \text{mm}}{3}\right)}{3.1416 \cdot 37 \, \text{mm}^{3}}$$

1.3) Compressive Stress in Pin Inside Eye of Knuckle Joint given Load and Pin Dimensions Formula 🕝

Example with Units

Evaluate Formula (

$$\sigma_{c} = \frac{L}{b \cdot d}$$

Formula Example with Units
$$\sigma_c = \frac{L}{b \cdot d} \qquad 27.4541 \, \text{N/mm}^2 = \frac{45000 \, \text{N}}{44.3 \, \text{mm} \cdot 37 \, \text{mm}}$$

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

Formula

Example with Units

Evaluate Formula

$$\sigma_{\rm c} = \frac{\rm L}{2 \cdot a \cdot d}$$

$$\sigma_{c} = \frac{L}{2 \cdot a \cdot d} \qquad 22.8612 \, \text{N/mm}^{2} = \frac{45000 \, \text{N}}{2 \cdot 26.6 \, \text{mm} \cdot 37 \, \text{mm}}$$

1.5) Max Bending Moment in Knuckle Pin given Load, Thickness of Eye and Fork Formula 🕝

Evaluate Formula (

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

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

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



Example with Units $\tau_{e} = \frac{L}{b \cdot (d_{o} - d)}$ $23.6233 \, \text{N/mm}^{2} = \frac{45000 \, \text{N}}{44.3 \, \text{mm} \cdot (80 \, \text{mm} - 37 \, \text{mm})}$ Evaluate Formula (

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

Formula 🕝 Evaluate Formula

Example with Units

Evaluate Formula

Evaluate Formula (

Evaluate Formula

 $\tau_{f} = \frac{L}{2 \cdot a \cdot (d_{o} - d)} \left| 19.6713 \,\text{N/mm}^{2} = \frac{45000 \,\text{N}}{2 \cdot 26.6 \,\text{mm} \cdot (80 \,\text{mm} - 37 \,\text{mm})} \right|$

1.8) Shear Stress in Pin of Knuckle Joint given Load and Pin Diameter Formula 🕝

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

 $\sigma_{te} = \frac{L}{b \cdot (d_0 - d)} \left[23.6233 \,\text{N/mm}^2 = \frac{45000 \,\text{N}}{44.3 \,\text{mm} \cdot (80 \,\text{mm} - 37 \,\text{mm})} \right]$

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

 $\sigma_{tf} = \frac{L}{2 \cdot a \cdot \left(\, d_{_{0}} - d \, \right)} \left[\begin{array}{c} 19.6713 \, \text{N/mm}^{2} \end{array} \right. = \frac{45000 \, \text{N}}{2 \cdot 26.6 \, \text{mm} \, \cdot \left(\, 80 \, \text{mm} \, - \, 37 \, \text{mm} \, \right)}$

1.11) Tensile Stress in Rod of Knuckle Joint Formula C

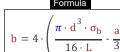
Evaluate Formula (

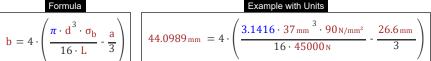
1.12) Thickness of Eye End of Knuckle Joint given Bending Moment in Pin Formula 🕝

Formula

Example with Units $b = 4 \cdot \left(2 \cdot \frac{M_b}{L} - \frac{a}{3} \right) \left| \quad 44.5333 \, \text{mm} \right| = 4 \cdot \left(2 \cdot \frac{450000 \, \text{N*mm}}{45000 \, \text{N}} - \frac{26.6 \, \text{mm}}{3} \right) \right|$ Evaluate Formula 🕝

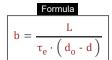
1.13) Thickness of Eye End of Knuckle Joint given Bending Stress in Pin Formula 🕝





Evaluate Formula [7]

1.14) Thickness of Eye End of Knuckle Joint given Shear Stress in Eye Formula 🕝



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

$$43.6047 \text{ mm} = \frac{45000 \text{ N}}{24 \text{ N/mm}^2 \cdot \left(80 \text{ mm} - 37 \text{ mm} \right)}$$



Evaluate Formula (

1.15) Thickness of Eye End of Knuckle Joint given Tensile Stress in Eye Formula 🕝

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

Formula Example with Units
$$b = \frac{L}{\sigma_{te} \cdot \left(d_o - d \right)} \quad 23.2558 \, \text{mm} = \frac{45000 \, \text{N}}{45 \, \text{N/mm}^2 \cdot \left(80 \, \text{mm} - 37 \, \text{mm} \right)}$$







2) Fork Formulas (7)

2.1) Outer Diameter of Eye of Knuckle Joint given Diameter of Pin Formula 🕝





2.2) Outer Diameter of Eye of Knuckle Joint given Shear Stress in Eye Formula C

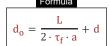
$$d_{o} = d + \frac{L}{b \cdot \tau_{e}}$$

Formula Example with Units
$$d_{o} = d + \frac{L}{b \cdot \tau_{e}}$$

$$79.3251 \, \text{mm} = 37 \, \text{mm} + \frac{45000 \, \text{N}}{44.3 \, \text{mm} \cdot 24 \, \text{N/mm}^{2}}$$

Evaluate Formula [

2.3) Outer Diameter of Eye of Knuckle Joint given Shear Stress in Fork Formula 🕝





2.4) Outer Diameter of Eye of Knuckle Joint given Tensile Stress in Eye Formula 🗂

Formula Example with Units
$$d_o = d + \frac{L}{b \cdot \sigma_{te}} \qquad 59.5734 \, \text{mm} = 37 \, \text{mm} + \frac{45000 \, \text{N}}{44.3 \, \text{mm} \cdot 45 \, \text{N/mm}^2}$$

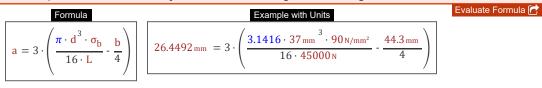
2.5) Outer Diameter of Eye of Knuckle Joint given Tensile Stress in Fork Formula

Formula Example with Units
$$d_o = \frac{L}{2 \cdot \sigma_{tf} \cdot a} + d \qquad \boxed{ 68.9194 \, \text{mm} = \frac{45000 \, \text{N}}{2 \cdot 26.5 \, \text{N/mm}^2 \cdot 26.6 \, \text{mm}} + 37 \, \text{mm} }$$

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



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



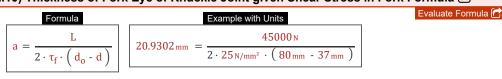
2.8) Thickness of Fork Eye of Knuckle Joint given Compressive Stress in Pin Inside Fork End Formula

Formula Example with Units
$$a = \frac{L}{2 \cdot \sigma_c \cdot d} \qquad 20.2703 \, \text{mm} = \frac{45000 \, \text{N}}{2 \cdot 30 \, \text{N/mm}^2 \cdot 37 \, \text{mm}}$$

2.9) Thickness of Fork Eye of Knuckle Joint given Rod Diameter Formula



2.10) Thickness of Fork Eye of Knuckle Joint given Shear Stress in Fork Formula



Evaluate Formula (

Evaluate Formula (

Evaluate Formula (

Evaluate Formula C

Evaluate Formula (

2.11) Thickness of Fork Eye of Knuckle Joint given Tensile Stress in Fork Formula 🕝

Formula
$$a = \frac{L}{a}$$

Example with Units
$$19.7455 \, \text{mm} = \frac{45000 \, \text{N}}{10000 \, \text{N}}$$

Evaluate Formula (

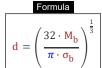
Evaluate Formula

Evaluate Formula

 $a = \frac{L}{2 \cdot \sigma_{tf} \cdot (d_0 - d)} \left[19.7455 \,_{mm} = \frac{45000 \,_{N}}{2 \cdot 26.5 \,_{N/mm^2} \cdot (80 \,_{mm} - 37 \,_{mm})} \right]$

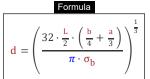
3) Pin Formulas 🕝

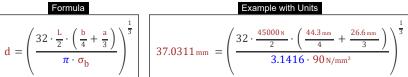
3.1) Diameter of Knuckle Pin given Bending Moment in Pin Formula 🕝





3.2) Diameter of Knuckle Pin given Bending Stress in Pin Formula 🕝





3.3) Diameter of Pin of Knuckle Joint given Compressive Stress in Eye End Portion of Pin Formula 🕝





Evaluate Formula (

3.4) Diameter of Pin of Knuckle Joint given Compressive Stress in Fork End Portion of Pin Formula 🕝



Formula Example with Units
$$d = \frac{L}{2 \cdot \sigma_c \cdot a} \qquad 28.1955 \, \text{mm} = \frac{45000 \, \text{N}}{2 \cdot 30 \, \text{N/mm}^2 \cdot 26.6 \, \text{mm}}$$

Evaluate Formula [

3.5) Diameter of Pin of Knuckle Joint given Diameter of Pinhead Formula C









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

Example with Units

 $d = \sqrt{\frac{2 \cdot L}{\pi \cdot \tau_p}} \qquad 35.14 \, \text{mm} = \sqrt{\frac{2 \cdot 45000 \, \text{N}}{3.1416 \cdot 23.2 \, \text{N/mm}^2}}$

3.7) Diameter of Pin of Knuckle Joint given Outer Diameter of Eye Formula 🕝



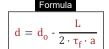
Formula Example with Units $d = \frac{d_0}{2}$ $40 \text{ mm} = \frac{80 \text{ mm}}{2}$

3.8) Diameter of Pin of Knuckle Joint given Shear Stress in Eye Formula [7]



Example with Units $d = d_o - \frac{L}{b \cdot \tau_e} \qquad 37.6749 \, \text{mm} = 80 \, \text{mm} - \frac{45000 \, \text{N}}{44.3 \, \text{mm} \cdot 24 \, \text{N/mm}^2}$

3.9) Diameter of Pin of Knuckle Joint given Shear Stress in Fork Formula 🕝



Example with Units $d = d_0 - \frac{L}{2 \cdot \tau_f \cdot a} \qquad 46.1654_{mm} = 80_{mm} - \frac{45000_{N}}{2 \cdot 25_{N/mm^2} \cdot 26.6_{mm}}$

3.10) Diameter of Pin of Knuckle Joint given Tensile Stress in Eye Formula 🕝



3.11) Diameter of Pin of Knuckle Joint given Tensile Stress in Fork Formula 🕝 Evaluate Formula C

Formula
$$d = d_0 - \frac{L}{2 \cdot \sigma_{tf} \cdot a}$$

Example with Units $d = d_o - \frac{L}{2 \cdot \sigma_{tf} \cdot a} \left| \quad | \quad 48.0806 \, \text{mm} \ = 80 \, \text{mm} \ - \frac{45000 \, \text{N}}{2 \cdot 26.5 \, \text{N/mm}^2 \cdot 26.6 \, \text{mm}} \right|$

3.12) Diameter of Pinhead of Knuckle Joint given Diameter of Pin Formula 🕝



Evaluate Formula

3.13) Length of Pin of Knuckle Joint in Contact with Eye End Formula C



Example with Units Evaluate Formula 🕝

Evaluate Formula

Evaluate Formula

Evaluate Formula

Evaluate Formula

4) Rod Formulas 🕝

4.1) Diameter of Rod of Knuckle Joint given its Enlarged Diameter near Joint Formula 🕝



4.2) Diameter of Rod of Knuckle Joint given Tensile Stress in Rod Formula



4.3) Enlarged Diameter of Rod of Knuckle Joint near Joint Formula



4.4) Rod Diameter of Knuckle Joint given Thickness of Eye Formula

Formula Example with Units
$$d_r = \frac{b}{1.25}$$

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

4.5) Rod Diameter of Knuckle Joint given Thickness of Fork Eye Formula 🕝



Evaluate Formula (

Evaluate Formula [

Evaluate Formula (

Evaluate Formula (

Evaluate Formula (

Variables used in list of Design of Knuckle Joint Formulas above

- 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)
- 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)
- 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_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)
- T_e Shear Stress in Eye of Knuckle Joint (Newton per Square Millimeter)
- T_f Shear Stress in Fork of Knuckle Joint (Newton per Square Millimeter)
- T_p Shear Stress in Knuckle Pin (Newton per Square Millimeter)

Constants, Functions, Measurements used in list of Design of Knuckle Joint Formulas above

- constant(s): pi,
 3.14159265358979323846264338327950288
 Archimedes' constant
- Functions: 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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