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Joint Geometry and Dimensions Formulas

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List of 27 Joint Geometry and Dimensions Formulas

Joint Geometry and Dimensions

1) Cross Section Area of Socket End Resisting Shear Failure

Open Calculator

fx $$A = (d_4 - d_2) \cdot c$$

ex $$880\text{mm}^2 = (80\text{mm} - 40\text{mm}) \cdot 22\text{mm}$$

2) Cross Section Area of Socket of Cotter Joint Prone to Failure

Open Calculator

fx $$A = \frac{\pi}{4} \cdot \left(d_1^2 - d_2^2\right) - t_c \cdot (d_1 - d_2)$$

ex $$837.584\text{mm}^2 = \frac{\pi}{4} \cdot \left((54\text{mm})^2 - (40\text{mm})^2\right) - 14\text{mm} \cdot (54\text{mm} - 40\text{mm})$$

3) Cross Section Area of Spigot of Cotter Joint Prone to Failure

Open Calculator

fx $$A_s = \frac{\pi \cdot d_2^2}{4} - d_2 \cdot t_c$$

ex $$696.6371\text{mm}^2 = \frac{\pi \cdot (40\text{mm})^2}{4} - 40\text{mm} \cdot 14\text{mm}$$

4) Diameter of Rod of Cotter Joint given Socket Collar Diameter

Open Calculator

fx $$d = \frac{d_4}{2.4}$$

ex $$33.33333\text{mm} = \frac{80\text{mm}}{2.4}$$

5) Diameter of Rod of Cotter Joint given Spigot Collar Diameter

Open Calculator

fx $$d = \frac{d_3}{1.5}$$

ex $$32\text{mm} = \frac{48\text{mm}}{1.5}$$

6) Diameter of Rod of Cotter Joint given Thickness of Cotter

Open Calculator

fx $$d = \frac{t_c}{0.31}$$

ex $$45.16129\text{mm} = \frac{14\text{mm}}{0.31}$$

7) Diameter of Rod of Cotter Joint given Thickness of Spigot Collar

Open Calculator

fx $$d = \frac{t_1}{0.45}$$

ex $$28.88889\text{mm} = \frac{13\text{mm}}{0.45}$$

8) Diameter of Socket Collar given Rod Diameter

Open Calculator

fx $d_4 = 2.4 \cdot d$

ex $74.4\text{mm} = 2.4 \cdot 31\text{mm}$

9) Diameter of Socket Collar of Cotter Joint given Bending Stress in Cotter

Open Calculator

fx $d_4 = \dfrac{4 \cdot b^2 \cdot \sigma_b \cdot \frac{t_c}{L} - d_2}{2}$

ex $109.0915\text{mm} = \dfrac{4 \cdot (48.5\text{mm})^2 \cdot 98\text{N/mm}^2 \cdot \frac{14\text{mm}}{50000\text{N}} - 40\text{mm}}{2}$

10) Diameter of Socket Collar of Cotter Joint given Compressive Stress

Open Calculator

fx $d_4 = d_2 + \dfrac{L}{t_c \cdot \sigma_{c1}}$

ex $68.80184\text{mm} = 40\text{mm} + \dfrac{50000\text{N}}{14\text{mm} \cdot 124\text{N/mm}^2}$

11) Diameter of socket collar of cotter joint given shear stress in socket

Open Calculator

fx $d_4 = \dfrac{L}{2 \cdot c \cdot \tau_{so}} + d_2$

ex $85.45455\text{mm} = \dfrac{50000\text{N}}{2 \cdot 22\text{mm} \cdot 25\text{N/mm}^2} + 40\text{mm}$

12) Diameter of Spigot Collar given Rod Diameter

Open Calculator

fx $d_3 = 1.5 \cdot d$

ex $46.5\text{mm} = 1.5 \cdot 31\text{mm}$

13) Diameter of Spigot of Cotter Joint given Bending Stress in Cotter

Open Calculator

fx $d_2 = 4 \cdot b^2 \cdot \sigma_b \cdot \frac{t_c}{L} - 2 \cdot d_4$

ex $98.18296\text{mm} = 4 \cdot (48.5\text{mm})^2 \cdot 98\text{N/mm}^2 \cdot \frac{14\text{mm}}{50000\text{N}} - 2 \cdot 80\text{mm}$

14) Diameter of Spigot of Cotter Joint given Compressive Stress

Open Calculator

fx $d_2 = d_4 - \frac{L}{t_c \cdot \sigma_{c1}}$

ex $51.19816\text{mm} = 80\text{mm} - \frac{50000\text{N}}{14\text{mm} \cdot 124\text{N/mm}^2}$

15) Diameter of Spigot of Cotter Joint given Shear Stress in Spigot

Open Calculator

fx $d_2 = \frac{L}{2 \cdot a \cdot \tau_{sp}}$

ex $40.91653\text{mm} = \frac{50000\text{N}}{2 \cdot 23.5\text{mm} \cdot 26\text{N/mm}^2}$

16) Inside Diameter of Socket of Cotter Joint given Shear Stress in Socket

Open Calculator

$$d_2 = d_4 - \frac{L}{2 \cdot c \cdot \tau_{so}}$$

$$34.54545\text{mm} = 80\text{mm} - \frac{50000\text{N}}{2 \cdot 22\text{mm} \cdot 25\text{N/mm}^2}$$

17) Minimum Diameter of Spigot in Cotter Joint Subjected to Crushing Stress

Open Calculator

$$d_2 = \frac{L}{\sigma_c \cdot t_c}$$

$$28.34467\text{mm} = \frac{50000\text{N}}{126\text{N/mm}^2 \cdot 14\text{mm}}$$

18) Minimum Rod Diameter in Cotter Joint given Axial Tensile Force and Stress

Open Calculator

$$d = \sqrt{\frac{4 \cdot L}{\sigma t_{rod} \cdot \pi}}$$

$$35.68248\text{mm} = \sqrt{\frac{4 \cdot 50000\text{N}}{50\text{N/mm}^2 \cdot \pi}}$$

19) Thickness of Cotter given Compressive Stress in Socket

Open Calculator

$$t_c = \frac{L}{(d_4 - d_2) \cdot \sigma_{cso}}$$

$$10\text{mm} = \frac{50000\text{N}}{(80\text{mm} - 40\text{mm}) \cdot 125\text{N/mm}^2}$$

20) Thickness of Cotter given Compressive Stress in Spigot

Open Calculator

$$t_c = \frac{L}{\sigma_{c1} \cdot d_2}$$

$$10.08065\text{mm} = \frac{50000\text{N}}{124\text{N/mm}^2 \cdot 40\text{mm}}$$

21) Thickness of Cotter given Shear Stress in Cotter

Open Calculator

$$t_c = \frac{L}{2 \cdot \tau_{co} \cdot b}$$

$$21.47766\text{mm} = \frac{50000\text{N}}{2 \cdot 24\text{N/mm}^2 \cdot 48.5\text{mm}}$$

22) Thickness of Cotter given Tensile Stress in Socket

Open Calculator

$$t_c = \frac{\left(\frac{\pi}{4} \cdot \left(d_1^2 - d_2^2\right)\right) - \frac{L_{cot}}{\sigma_t so}}{d_1 - d_2}$$

$$65.48297\text{mm} = \frac{\left(\frac{\pi}{4} \cdot \left((54\text{mm})^2 - (40\text{mm})^2\right)\right) - \frac{5000\text{N}}{42.8\text{N/mm}^2}}{54\text{mm} - 40\text{mm}}$$

23) Thickness of Cotter Joint

Open Calculator

fx $t_c = 0.31 \cdot d$

ex $9.61\text{mm} = 0.31 \cdot 31\text{mm}$

24) Thickness of Cotter Joint given Bending Stress in Cotter

Open Calculator

fx $t_c = (2 \cdot d_4 + d_2) \cdot \left(\frac{L}{4 \cdot b^2 \cdot \sigma_b} \right)$

ex $10.84502\text{mm} = (2 \cdot 80\text{mm} + 40\text{mm}) \cdot \left(\frac{50000\text{N}}{4 \cdot (48.5\text{mm})^2 \cdot 98\text{N/mm}^2} \right)$

25) Thickness of Spigot Collar when Rod Diameter is Available

Open Calculator

fx $t_1 = 0.45 \cdot d$

ex $13.95\text{mm} = 0.45 \cdot 31\text{mm}$

26) Width of Cotter by Bending Consideration

Open Calculator

fx $b = \left(3 \cdot \frac{L}{t_c \cdot \sigma_b} \cdot \left(\frac{d_2}{4} + \frac{d_4 - d_2}{6} \right) \right)^{0.5}$

ex $42.68674\text{mm} = \left(3 \cdot \frac{50000\text{N}}{14\text{mm} \cdot 98\text{N/mm}^2} \cdot \left(\frac{40\text{mm}}{4} + \frac{80\text{mm} - 40\text{mm}}{6} \right) \right)^{0.5}$

27) Width of Cotter by Shear Consideration

Open Calculator

$$b = \frac{V}{2 \cdot \tau_{co} \cdot t_c}$$

$$35.41667\text{mm} = \frac{23800\text{N}}{2 \cdot 24\text{N/mm}^2 \cdot 14\text{mm}}$$

Variables Used

- **a** Gap between End of Slot to End of Spigot *(Millimeter)*
- **A** Cross Sectional Area of Socket *(Square Millimeter)*
- **A_s** Cross Sectional Area of Spigot *(Square Millimeter)*
- **b** Mean Width of Cotter *(Millimeter)*
- **c** Axial Distance From Slot to End of Socket Collar *(Millimeter)*
- **d** Diameter of Rod of Cotter Joint *(Millimeter)*
- **d_1** Outside Diameter of Socket *(Millimeter)*
- **d_2** Diameter of Spigot *(Millimeter)*
- **d_3** Diameter of Spigot Collar *(Millimeter)*
- **d_4** Diameter of Socket Collar *(Millimeter)*
- **L** Load on Cotter Joint *(Newton)*
- **L_{cot}** Load at Cotter Joint *(Newton)*
- **t_1** Thickness of Spigot Collar *(Millimeter)*
- **t_c** Thickness of Cotter *(Millimeter)*
- **V** Shear Force on Cotter *(Newton)*
- **σ_b** Bending Stress in Cotter *(Newton per Square Millimeter)*
- **σ_c** Crushing Stress induced in Cotter *(Newton per Square Millimeter)*
- **σ_{c1}** Compressive Stress in Spigot *(Newton per Square Millimeter)*
- **σ_{cso}** Compressive Stress In Socket *(Newton per Square Millimeter)*
- **$\sigma_t$so** Tensile Stress In Socket *(Newton per Square Millimeter)*
- **σt_{rod}** Tensile Stress in Cotter Joint Rod *(Newton per Square Millimeter)*
- **τ_{co}** Shear Stress in Cotter *(Newton per Square Millimeter)*
- **τ_{so}** Shear Stress in Socket *(Newton per Square Millimeter)*

- τ_{sp} Shear Stress in Spigot *(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: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Stress** in Newton per Square Millimeter (N/mm²)
  Stress Unit Conversion

Check other formula lists

- **Forces and Loads on Joint Formulas**
- **Joint Geometry and Dimensions Formulas**
- **Strength and Stress Formulas**

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