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Design of Cotter Joint Formulas

Calculators!

Examples!

Conversions!

List of 45 Design of Cotter Joint Formulas

Design of Cotter Joint

Forces and Loads on Joint

1) Force on Cotter given Shear Stress in Cotter

Open Calculator

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

ex $32592\text{N} = 2 \cdot 14\text{mm} \cdot 48.5\text{mm} \cdot 24\text{N/mm}^2$

2) Load Taken by Cotter Joint Rod given Tensile Stress in Rod

Open Calculator

fx $$L = \frac{\pi \cdot d^2 \cdot \sigma t_{rod}}{4}$$

ex $$37738.38\text{N} = \frac{\pi \cdot (31\text{mm})^2 \cdot 50\text{N/mm}^2}{4}$$

3) Load Taken by Socket of Cotter Joint given Compressive Stress

Open Calculator

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

ex $70000\text{N} = 125\text{N/mm}^2 \cdot (80\text{mm} - 40\text{mm}) \cdot 14\text{mm}$

4) Load Taken by Socket of Cotter Joint given Shear Stress in Socket

Open Calculator

fx $L = 2 \cdot (d_4 - d_2) \cdot c \cdot \tau_{so}$

ex $44000\text{N} = 2 \cdot (80\text{mm} - 40\text{mm}) \cdot 22\text{mm} \cdot 25\text{N/mm}^2$

5) Load Taken by Socket of Cotter Joint given Tensile Stress in Socket

Open Calculator

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

ex $$35848.59\text{N} = 42.8\text{N/mm}^2 \cdot \left(\frac{\pi}{4} \cdot \left((54\text{mm})^2 - (40\text{mm})^2 \right) - 14\text{mm} \cdot (54\text{mm} - 40\text{mm}) \right)$$

6) Load Taken by Spigot of Cotter Joint given Compressive Stress in Spigot Considering Crushing Failure

Open Calculator

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

ex $$69440\text{N} = 14\text{mm} \cdot 40\text{mm} \cdot 124\text{N/mm}^2$$

7) Load Taken by Spigot of Cotter Joint given Shear Stress in Spigot

Open Calculator

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

ex $$48880\text{N} = 2 \cdot 23.5\text{mm} \cdot 40\text{mm} \cdot 26\text{N/mm}^2$$

8) Maximum Load taken by Cotter Joint given Spigot Diameter, Thickness and Stress

Open Calculator

fx $$L = \left(\frac{\pi}{4} \cdot d_2^2 - d_2 \cdot t_c \right) \cdot (\sigma_t sp)$$

ex $$31696.99\text{N} = \left(\frac{\pi}{4} \cdot (40\text{mm})^2 - 40\text{mm} \cdot 14\text{mm} \right) \cdot 45.5\text{N/mm}^2$$

Joint Geometry and Dimensions

9) Cross Section Area of Socket End Resisting Shear Failure

Open Calculator

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

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

10) 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 $$837.584\text{mm}^2 = \frac{\pi}{4} \cdot \left((54\text{mm})^2 - (40\text{mm})^2\right) - 14\text{mm} \cdot (54\text{mm} - 40\text{mm})$$

11) 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 $$696.6371\text{mm}^2 = \frac{\pi \cdot (40\text{mm})^2}{4} - 40\text{mm} \cdot 14\text{mm}$$

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

16) Diameter of Socket Collar given Rod Diameter

Open Calculator

fx $$d_4 = 2.4 \cdot d$$

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

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

20) Diameter of Spigot Collar given Rod Diameter

Open Calculator

fx $$d_3 = 1.5 \cdot d$$

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

21) 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 $$98.18296\text{mm} = 4 \cdot (48.5\text{mm})^2 \cdot 98\text{N/mm}^2 \cdot \frac{14\text{mm}}{50000\text{N}} - 2 \cdot 80\text{mm}$$

22) Diameter of Spigot of Cotter Joint given Compressive Stress

Open Calculator

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

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

23) 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 $$40.91653\text{mm} = \frac{50000\text{N}}{2 \cdot 23.5\text{mm} \cdot 26\text{N/mm}^2}$$

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

27) Thickness of Cotter given Compressive Stress in Socket

Open Calculator

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

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

28) Thickness of Cotter given Compressive Stress in Spigot

Open Calculator

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

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

29) Thickness of Cotter given Shear Stress in Cotter

Open Calculator

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

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

30) Thickness of Cotter given Tensile Stress in Socket

Open Calculator

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

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

31) Thickness of Cotter Joint

Open Calculator

fx $$t_c = 0.31 \cdot d$$

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

32) 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 $$10.84502\text{mm} = (2 \cdot 80\text{mm} + 40\text{mm}) \cdot \left(\frac{50000\text{N}}{4 \cdot (48.5\text{mm})^2 \cdot 98\text{N/mm}^2}\right)$$

33) Thickness of Spigot Collar when Rod Diameter is Available

Open Calculator

fx $$t_1 = 0.45 \cdot d$$

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

34) 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 $$42.68674\text{mm} = \left(3 \cdot \frac{50000\text{N}}{14\text{mm} \cdot 98\text{N/mm}^2} \cdot \left(\frac{40\text{mm}}{4} + \frac{80\text{mm} - 40\text{mm}}{6}\right)\right)^{0.5}$$

35) Width of Cotter by Shear Consideration

Open Calculator

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

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

Strength and Stress

36) Bending Stress in Cotter of Cotter Joint

Open Calculator

fx $$\sigma_b = \left(3 \cdot \frac{L}{t_c \cdot b^2}\right) \cdot \left(\frac{d_2 + 2 \cdot d_4}{12}\right)$$

ex $$75.91516\text{N/mm}^2 = \left(3 \cdot \frac{50000\text{N}}{14\text{mm} \cdot (48.5\text{mm})^2}\right) \cdot \left(\frac{40\text{mm} + 2 \cdot 80\text{mm}}{12}\right)$$

37) Compressive Stress in Socket of Cotter Joint given Diameter of Spigot and of Socket Collar

Open Calculator

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

ex $$89.28571\text{N/mm}^2 = \frac{50000\text{N}}{(80\text{mm} - 40\text{mm}) \cdot 14\text{mm}}$$

38) Compressive Stress in Spigot of Cotter Joint Considering Crushing Failure

Open Calculator

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

ex $$89.28571\text{N/mm}^2 = \frac{50000\text{N}}{14\text{mm} \cdot 40\text{mm}}$$

39) Compressive Stress of Spigot

Open Calculator

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

ex $$89.28571\text{N/mm}^2 = \frac{50000\text{N}}{14\text{mm} \cdot 40\text{mm}}$$

40) Shear Stress in Cotter given Cotter Thickness and Width

Open Calculator

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

ex $$36.81885\text{N/mm}^2 = \frac{50000\text{N}}{2 \cdot 14\text{mm} \cdot 48.5\text{mm}}$$

41) Shear Stress in Socket of Cotter Joint given Inner and Outer Diameter of Socket

Open Calculator

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

ex $$28.40909\text{N/mm}^2 = \frac{50000\text{N}}{2 \cdot (80\text{mm} - 40\text{mm}) \cdot 22\text{mm}}$$

42) Shear Stress in Spigot of Cotter Joint given Diameter of Spigot and Load

Open Calculator

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

ex $$26.59574\text{N/mm}^2 = \frac{50000\text{N}}{2 \cdot 23.5\text{mm} \cdot 40\text{mm}}$$

43) Tensile Stress in Rod of Cotter Joint

Open Calculator

$$\sigma t_{rod} = \frac{4 \cdot L}{\pi \cdot d^2}$$

$$66.24555 \text{N/mm}^2 = \frac{4 \cdot 50000\text{N}}{\pi \cdot (31\text{mm})^2}$$

44) Tensile Stress in Socket of Cotter Joint given Outer and Inner Diameter of Socket

Open Calculator

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

$$59.69551 \text{N/mm}^2 = \frac{50000\text{N}}{\frac{\pi}{4} \cdot \left((54\text{mm})^2 - (40\text{mm})^2\right) - 14\text{mm} \cdot (54\text{mm} - 40\text{mm})}$$

45) Tensile Stress in Spigot of Cotter Joint given Diameter of Spigot, Thickenss of Cotter and Load

Open Calculator

$$(\sigma_t sp) = \frac{L}{\frac{\pi \cdot d_2^2}{4} - d_2 \cdot t_c}$$

$$71.77338 \text{N/mm}^2 = \frac{50000\text{N}}{\frac{\pi \cdot (40\text{mm})^2}{4} - 40\text{mm} \cdot 14\text{mm}}$$

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)*
- $\sigma_t sp$ Tensile Stress In Spigot *(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

- Design of Clamp and Muff Coupling Formulas
- Design of Cotter Joint Formulas
- Design of Knuckle Joint Formulas
- Packing Formulas
- Retaining Rings and Circlips Formulas
- Riveted Joints Formulas
- Seals Formulas
- Welded Joints Formulas