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Design of Keys Formulas

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List of 32 Design of Keys Formulas

Design of Keys

Design of Kennedy Key

1) Compressive Stress in Kennedy Key

Open Calculator

fx $$\sigma_c = \sqrt{2} \cdot \frac{Mt_k}{d_s \cdot b_k \cdot l}$$

ex $$128.0285\text{N/mm}^2 = \sqrt{2} \cdot \frac{712763.6\text{N*mm}}{44.98998\text{mm} \cdot 5\text{mm} \cdot 35\text{mm}}$$

2) Diameter of Shaft given Compressive Stress in Kennedy Key

Open Calculator

fx $$d_s = \sqrt{2} \cdot \frac{Mt_k}{\sigma_c \cdot b_k \cdot l}$$

ex $$45\text{mm} = \sqrt{2} \cdot \frac{712763.6\text{N*mm}}{128\text{N/mm}^2 \cdot 5\text{mm} \cdot 35\text{mm}}$$

3) Diameter of Shaft given Shear Stress in Kennedy Key

Open Calculator

fx $$d_s = \frac{Mt_k}{\sqrt{2} \cdot \tau \cdot b_k \cdot l}$$

ex $$45.07042\text{mm} = \frac{712763.6\text{N*mm}}{\sqrt{2} \cdot 63.9\text{N/mm}^2 \cdot 5\text{mm} \cdot 35\text{mm}}$$

4) Length of Kennedy Key given Compressive Stress in Key

Open Calculator

fx $$l = \sqrt{2} \cdot \frac{Mt_k}{d_s \cdot b_k \cdot \sigma_c}$$

ex $$35.00779\text{mm} = \sqrt{2} \cdot \frac{712763.6\text{N*mm}}{44.98998\text{mm} \cdot 5\text{mm} \cdot 128\text{N/mm}^2}$$

5) Length of Kennedy Key given Shear Stress in Key

Open Calculator

fx $$l = \frac{Mt_k}{\sqrt{2} \cdot d_s \cdot b_k \cdot \tau}$$

ex $$35.06258\text{mm} = \frac{712763.6\text{N*mm}}{\sqrt{2} \cdot 44.98998\text{mm} \cdot 5\text{mm} \cdot 63.9\text{N/mm}^2}$$

6) Shear Stress in Kennedy Key

Open Calculator

fx $$\tau = \frac{Mt_k}{\sqrt{2} \cdot d_s \cdot b_k \cdot l}$$

ex $$64.01425\text{N/mm}^2 = \frac{712763.6\text{N*mm}}{\sqrt{2} \cdot 44.98998\text{mm} \cdot 5\text{mm} \cdot 35\text{mm}}$$

7) Torque Transmitted by Kennedy Key given Compressive Stress in Key

Open Calculator

fx $$\mathrm{Mt_k} = \sigma_c \cdot \mathrm{d_s} \cdot \mathrm{b_k} \cdot \frac{\mathrm{l}}{\sqrt{2}}$$

ex $$712604.9\mathrm{N*mm} = 128\mathrm{N/mm^2} \cdot 44.98998\mathrm{mm} \cdot 5\mathrm{mm} \cdot \frac{35\mathrm{mm}}{\sqrt{2}}$$

8) Torque Transmitted by Kennedy Key given Shear Stress in Key

Open Calculator

fx $$\mathrm{Mt_k} = \tau \cdot \sqrt{2} \cdot \mathrm{d_s} \cdot \mathrm{b_k} \cdot \mathrm{l}$$

ex $$711491.5\mathrm{N*mm} = 63.9\mathrm{N/mm^2} \cdot \sqrt{2} \cdot 44.98998\mathrm{mm} \cdot 5\mathrm{mm} \cdot 35\mathrm{mm}$$

9) Width of Key given Compressive Stress in Key

Open Calculator

fx $$\mathrm{b_k} = \sqrt{2} \cdot \frac{\mathrm{Mt_k}}{\mathrm{d_s} \cdot \sigma_c \cdot \mathrm{l}}$$

ex $$5.001113\mathrm{mm} = \sqrt{2} \cdot \frac{712763.6\mathrm{N*mm}}{44.98998\mathrm{mm} \cdot 128\mathrm{N/mm^2} \cdot 35\mathrm{mm}}$$

Design of Splines

10) Major Diameter of Spline given Mean Radius

Open Calculator

fx $$\mathrm{D} = 4 \cdot \mathrm{R_m} - \mathrm{d}$$

ex $$60\mathrm{mm} = 4 \cdot 28\mathrm{mm} - 52\mathrm{mm}$$

11) Mean Radius of Splines

Open Calculator

fx $$R_m = \frac{D + d}{4}$$

ex $$28\text{mm} = \frac{60\text{mm} + 52\text{mm}}{4}$$

12) Mean Radius of Splines given Torque Transmitting Capacity

Open Calculator

fx $$R_m = \frac{M_t}{p_m \cdot A}$$

ex $$28\text{mm} = \frac{224500\text{N*mm}}{5.139652\text{N/mm}^2 \cdot 1560\text{mm}^2}$$

13) Minor Diameter of Spline given Mean Radius

Open Calculator

fx $$d = 4 \cdot R_m - D$$

ex $$52\text{mm} = 4 \cdot 28\text{mm} - 60\text{mm}$$

14) Permissible Pressure on Splines given Torque Transmitting Capacity

Open Calculator

fx $$p_m = \frac{M_t}{A \cdot R_m}$$

ex $$5.139652\text{N/mm}^2 = \frac{224500\text{N*mm}}{1560\text{mm}^2 \cdot 28\text{mm}}$$

15) Torque Transmitting Capacity of Splines

Open Calculator

$$M_t = p_m \cdot A \cdot R_m$$

$$224500\text{N*mm} = 5.139652\text{N/mm}^2 \cdot 1560\text{mm}^2 \cdot 28\text{mm}$$

16) Torque Transmitting Capacity of Splines given Diameter of Splines

Open Calculator

$$M_t = \frac{p_m \cdot l_h \cdot n \cdot \left(D^2 - d^2\right)}{8}$$

$$224500\text{N*mm} = \frac{5.139652\text{N/mm}^2 \cdot 65\text{mm} \cdot 6 \cdot \left((60\text{mm})^2 - (52\text{mm})^2\right)}{8}$$

17) Total Area of Splines

Open Calculator

$$A = 0.5 \cdot (l_h \cdot n) \cdot (D - d)$$

$$1560\text{mm}^2 = 0.5 \cdot (65\text{mm} \cdot 6) \cdot (60\text{mm} - 52\text{mm})$$

18) Total Area of Splines given Torque Transmitting Capacity

Open Calculator

$$A = \frac{M_t}{p_m \cdot R_m}$$

$$1560\text{mm}^2 = \frac{224500\text{N*mm}}{5.139652\text{N/mm}^2 \cdot 28\text{mm}}$$

Design of Square and Flat Keys

19) Compressive Stress in Key

Open Calculator

$$\sigma_c = 4 \cdot \frac{M_t}{d_s \cdot l \cdot h}$$

$$126.7302\text{N/mm}^2 = 4 \cdot \frac{224500\text{N*mm}}{44.98998\text{mm} \cdot 35\text{mm} \cdot 4.5\text{mm}}$$

20) Compressive Stress in Square Key due to Transmitted Torque

Open Calculator

$$\sigma_c = 2 \cdot \tau$$

$$127.8\text{N/mm}^2 = 2 \cdot 63.9\text{N/mm}^2$$

21) Force on Key

Open Calculator

$$F = 2 \cdot \frac{M_t}{d_s}$$

$$9980\text{N} = 2 \cdot \frac{224500\text{N*mm}}{44.98998\text{mm}}$$

22) Height of Key given Compressive Stress in Key

Open Calculator

$$h = 4 \cdot \frac{M_t}{d_s \cdot l \cdot \sigma_c}$$

$$4.455357\text{mm} = 4 \cdot \frac{224500\text{N*mm}}{44.98998\text{mm} \cdot 35\text{mm} \cdot 128\text{N/mm}^2}$$

23) Length of Key given Compressive Stress in Key

Open Calculator

fx $$l = 4 \cdot \frac{M_t}{d_s \cdot \sigma_c \cdot h}$$

ex $$34.65278\text{mm} = 4 \cdot \frac{224500\text{N*mm}}{44.98998\text{mm} \cdot 128\text{N/mm}^2 \cdot 4.5\text{mm}}$$

24) Length of Key given Shear Stress

Open Calculator

fx $$l = \frac{F}{b_k \cdot \tau}$$

ex $$31.23631\text{mm} = \frac{9980\text{N}}{5\text{mm} \cdot 63.9\text{N/mm}^2}$$

25) Shaft Diameter given Compressive Stress in Key

Open Calculator

fx $$d_s = 4 \cdot \frac{M_t}{\sigma_c \cdot l \cdot h}$$

ex $$44.54365\text{mm} = 4 \cdot \frac{224500\text{N*mm}}{128\text{N/mm}^2 \cdot 35\text{mm} \cdot 4.5\text{mm}}$$

26) Shaft Diameter given Force on Key

Open Calculator

fx $$d_s = 2 \cdot \frac{M_t}{F}$$

ex $$44.98998\text{mm} = 2 \cdot \frac{224500\text{N*mm}}{9980\text{N}}$$

27) Shear Stress in given Force on Key

Open Calculator

fx $$\tau_{\text{flat key}} = \frac{F}{b_k \cdot l}$$

ex $$57.02857\text{N/mm}^2 = \frac{9980\text{N}}{5\text{mm} \cdot 35\text{mm}}$$

28) Shear Stress in Key given Torque Transmitted

Open Calculator

fx $$\tau_{\text{flat key}} = 2 \cdot \frac{M_t}{b_k \cdot l \cdot d_s}$$

ex $$57.02857\text{N/mm}^2 = 2 \cdot \frac{224500\text{N*mm}}{5\text{mm} \cdot 35\text{mm} \cdot 44.98998\text{mm}}$$

29) Shear Stress on Flat Key

Open Calculator

fx $$\tau_{\text{flat key}} = \frac{2 \cdot T}{b_k \cdot d_s \cdot l}$$

ex $$57.02857\text{N/mm}^2 = \frac{2 \cdot 224499.99458\text{N*mm}}{5\text{mm} \cdot 44.98998\text{mm} \cdot 35\text{mm}}$$

30) Torque Transmitted by Keyed Shaft given Force on Keys

Open Calculator

fx $$M_t = F \cdot \frac{d_s}{2}$$

ex $$224500\text{N*mm} = 9980\text{N} \cdot \frac{44.98998\text{mm}}{2}$$

31) Torque Transmitted by Keyed Shaft given Stress in Key

Open Calculator

fx $$M_t = \sigma_c \cdot d_s \cdot l \cdot \frac{h}{4}$$

ex $$226749.5\text{N*mm} = 128\text{N/mm}^2 \cdot 44.98998\text{mm} \cdot 35\text{mm} \cdot \frac{4.5\text{mm}}{4}$$

32) Width of Key given Shear Stress in Key

Open Calculator

fx $$b_k = \frac{F}{\tau_{\text{flat key}} \cdot l}$$

ex $$5\text{mm} = \frac{9980\text{N}}{57.02857\text{N/mm}^2 \cdot 35\text{mm}}$$

Variables Used

- **A** Total Area of Splines *(Square Millimeter)*
- b_k Width of Key *(Millimeter)*
- **d** Minor Diameter of Spline Key Shaft *(Millimeter)*
- **D** Major Diameter of Spline Key Shaft *(Millimeter)*
- d_s Diameter of Shaft using Key *(Millimeter)*
- **F** Force on Key *(Newton)*
- **h** Height of Key *(Millimeter)*
- **l** Length of Key *(Millimeter)*
- l_h Length of Hub on Keyed Shaft *(Millimeter)*
- M_t Transmitted Torque by Keyed Shaft *(Newton Millimeter)*
- Mt_k Transmitted Torque by Kennedy Key *(Newton Millimeter)*
- **n** Number of Splines
- p_m Permissible Pressure on Splines *(Newton per Square Millimeter)*
- R_m Mean Radius of Spline of Shaft *(Millimeter)*
- **T** Torque Transmitted by Shaft *(Newton Millimeter)*
- σ_c Compressive Stress in Key *(Newton per Square Millimeter)*
- τ Shear Stress in Key *(Newton per Square Millimeter)*
- $\tau_{\text{flat key}}$ Shear Stress *(Newton per Square Millimeter)*

Constants, Functions, Measurements used

- 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: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Newton per Square Millimeter (N/mm²)
  Pressure 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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