



Design of Keys Formulas

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List of 31 Design of Keys Formulas

Design of Keys 2

Design of Kennedy Key

1) Compressive Stress in Kennedy Key

$$\left[\sigma_{
m c} = \sqrt{2} \cdot rac{Mt_{
m k}}{d_{
m s} \cdot b_{
m k} \cdot l}
ight]$$

Open Calculator 🗗

ex
$$114.035 {
m N/mm^2} = \sqrt{2} \cdot rac{635000 {
m N*mm}}{45 {
m mm} \cdot 5 {
m mm} \cdot 35 {
m mm}}$$

2) Diameter of Shaft given Compressive Stress in Kennedy Key

$$\left[d_{s} = \sqrt{2} \cdot rac{Mt_{k}}{\sigma_{c} \cdot b_{k} \cdot l}
ight]$$

Open Calculator 🗗

$$= \times \sqrt{40.09043} \text{mm} = \sqrt{2} \cdot \frac{635000 \text{N*mm}}{128 \text{N/mm}^2 \cdot 5 \text{mm} \cdot 35 \text{mm}}$$

3) Diameter of Shaft given Shear Stress in Kennedy Key

$$\mathbf{f} \mathbf{c} \mathbf{c} \mathbf{c} = rac{\mathrm{Mt_k}}{\sqrt{2} \cdot au \cdot \mathrm{b_k} \cdot \mathrm{l}}$$

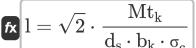
Open Calculator

$$=$$
 $40.15317 ext{mm} = rac{635000 ext{N*mm}}{\sqrt{2} \cdot 63.9 ext{N/mm}^2 \cdot 5 ext{mm} \cdot 35 ext{mm}}$





4) Length of Kennedy Key given Compressive Stress in Key



Y

Open Calculator

5) Length of Kennedy Key given Shear Stress in Key

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

Open Calculator

$$= \frac{635000 \text{N*mm}}{\sqrt{2} \cdot 45 \text{mm} \cdot 5 \text{mm} \cdot 63.9 \text{N/mm}^2}$$

6) Shear Stress in Kennedy Key

Open Calculator

$$au = rac{\mathrm{Mt_k}}{\sqrt{2} \cdot \mathrm{d_s} \cdot \mathrm{b_k} \cdot \mathrm{l}}$$

 $extbf{ex} egin{aligned} extbf{57.0175N/mm}^2 &= rac{635000 ext{N*mm}}{\sqrt{2} \cdot 45 ext{mm} \cdot 5 ext{mm} \cdot 35 ext{mm}} \end{aligned}$

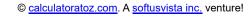
7) Torque Transmitted by Kennedy Key given Compressive Stress in Key

$$\mathbf{M} \mathbf{t}_{k} = \mathbf{\sigma}_{\mathrm{c}} \cdot \mathbf{d}_{\mathrm{s}} \cdot \mathbf{b}_{\mathrm{k}} \cdot rac{1}{\sqrt{2}}$$

Open Calculator

$$ag{712763.6 ext{N*mm}} = 128 ext{N/mm}^2 \cdot 45 ext{mm} \cdot 5 ext{mm} \cdot rac{35 ext{mm}}{\sqrt{2}}$$







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

 $Mt_k = au \cdot \sqrt{2} \cdot d_s \cdot b_k \cdot l$

Open Calculator 🗗

Open Calculator 🚰

- $\boxed{711649.9 \text{N*mm} = 63.9 \text{N/mm}^2 \cdot \sqrt{2} \cdot 45 \text{mm} \cdot 5 \text{mm} \cdot 35 \text{mm}}$
- 9) Width of Key given Compressive Stress in Key
- $b_k = \sqrt{2} \cdot rac{Mt_k}{d_s \cdot \sigma_c \cdot 1}$
- = $4.454492 ext{mm} = \sqrt{2} \cdot rac{635000 ext{N*mm}}{45 ext{mm} \cdot 128 ext{N/mm}^2 \cdot 35 ext{mm}}$

Design of Splines

10) Major Diameter of Spline given Mean Radius

fx $D=4\cdot R_{
m m}-d$

Open Calculator

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

11) Mean Radius of Splines 🖸

 $m R_m = rac{D+d}{4}$

Open Calculator

 $28 ext{mm} = rac{60 ext{mm} + 52 ext{mm}}{4}$



12) Mean Radius of Splines given Torque Transmitting Capacity

 $\left| {{
m{R}}_{
m{m}}} = rac{{{
m{M}}_{
m{t}}}}{{{
m{p}}_{
m{m}} \cdot {
m{A}}}}
ight|$

Open Calculator 🗗

 $ext{ex} 28.08005 ext{mm} = rac{224500 ext{N*mm}}{6.5 ext{N/mm}^2 \cdot 1230 ext{mm}^2}$

13) Minor Diameter of Spline given Mean Radius

fx $d = 4 \cdot R_m - D$

Open Calculator

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

14) Permissible Pressure on Splines given Torque Transmitting Capacity

 $\left| \mathbf{p}_{\mathrm{m}} = rac{\mathrm{M_{t}}}{\mathrm{A} \cdot \mathrm{R_{m}}}
ight|$

Open Calculator

 $\mathbf{ex} = 6.518583 \mathrm{N/mm^2} = rac{224500 \mathrm{N^*mm}}{1230 \mathrm{mm^2 \cdot 28mm}}$

15) Torque Transmitting Capacity of Splines

 $\mathbf{K} \mathbf{M}_{\mathrm{t}} = \mathbf{p}_{\mathrm{m}} \cdot \mathbf{A} \cdot \mathbf{R}_{\mathrm{m}}$

Open Calculator 🗗

 $= 223860 \mathrm{N*mm} = 6.5 \mathrm{N/mm^2 \cdot 1230 mm^2 \cdot 28 mm}$



16) Torque Transmitting Capacity of Splines given Diameter of Splines

 $\mathbf{M}_{\mathrm{t}} = \left(rac{1}{8}
ight) \cdot p_{\mathrm{m}} \cdot l_{\mathrm{h}} \cdot n \cdot \left(\left(D^{2}
ight) - d^{2}
ight)$

Open Calculator 🚰

 $283920\text{N*mm} = \left(\frac{1}{8}\right) \cdot 6.5\text{N/mm}^2 \cdot 65\text{mm} \cdot 6 \cdot \left(\left((60\text{mm})^2\right) - (52\text{mm})^2\right)$

17) Total Area of Splines

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

Open Calculator

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

18) Total Area of Splines given Torque Transmitting Capacity

 $egin{aligned} oldsymbol{A} = rac{M_t}{p_m \cdot R_m} \end{aligned}$

Open Calculator

 $ext{ex} 1233.516 ext{mm}^2 = rac{224500 ext{N*mm}}{6.5 ext{N/mm}^2 \cdot 28 ext{mm}}$

Design of Square and Flat Keys

19) Compressive Stress in Key

 $\sigma_{
m c} = 4 \cdot rac{
m M_t}{
m d_s \cdot l \cdot h}$

Open Calculator

 $ext{ex} 126.7019 ext{N/mm}^2 = 4 \cdot rac{224500 ext{N*mm}}{45 ext{mm} \cdot 35 ext{mm} \cdot 4.5 ext{mm}}$







Open Calculator 2

Open Calculator

Open Calculator

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fx $\sigma_{
m c} = 2 \cdot au$

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

21) Force on Key

 $m F = 2 \cdot rac{M_t}{d_s}$

20) Compressive Stress in Square Key due to Transmitted Torque

 $= 2 \cdot \frac{224500 \text{N*mm}}{45 \text{mm}}$

22) Height of Key given Compressive Stress in Key

 $\left| \mathbf{h} = 4 \cdot rac{M_{t}}{d_{s} \cdot l \cdot \sigma_{s}}
ight|$

= $4.454365 ext{mm} = 4 \cdot rac{224500 ext{N*mm}}{45 ext{mm} \cdot 35 ext{mm} \cdot 128 ext{N/mm}^2}$

23) Length of Key given Compressive Stress in Key

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

224500N*mm $= 4 \cdot \frac{2210001 \cdot 10001}{45 \mathrm{mm} \cdot 128 \mathrm{N/mm^2} \cdot 4.5 \mathrm{mm}}$



24) Length of Key given Shear Stress

 $1 = \frac{F'}{b_k \cdot \tau}$

Open Calculator

9980N = $31.23631 \mathrm{mm} = \frac{33001 \mathrm{V}}{5 \mathrm{mm} \cdot 63.9 \mathrm{N/mm}^2}$

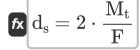
25) Shaft Diameter given Compressive Stress in Key

 $\left| extbf{d}_{ ext{s}} = 4 \cdot rac{ ext{M}_{ ext{t}}}{\sigma_{ ext{c}} \cdot ext{l} \cdot ext{h}}
ight|$

Open Calculator

= $44.54365 ext{mm} = 4 \cdot rac{224500 ext{N*mm}}{128 ext{N/mm}^2 \cdot 35 ext{mm} \cdot 4.5 ext{mm}}$

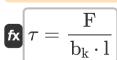
26) Shaft Diameter given Force on Key



Open Calculator 🚰

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

27) Shear Stress in given Force on Key



Open Calculator

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





28) Shear Stress in Key given Torque Transmitted 🖸

 $au = 2 \cdot rac{ ext{M}_{ ext{t}}}{ ext{b}_{ ext{k}} \cdot ext{l} \cdot ext{d}_{ ext{s}}}$

Open Calculator

 $ext{ex} 57.01587 ext{N/mm}^2 = 2 \cdot rac{224500 ext{N*mm}}{5 ext{mm} \cdot 35 ext{mm} \cdot 45 ext{mm}}$

29) Torque Transmitted by Keyed Shaft given Force on Keys

 $M_{
m t} = F \cdot rac{d_{
m s}}{2}$

Open Calculator

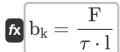
 $= 224550 \text{N*mm} = 9980 \text{N} \cdot \frac{45 \text{mm}}{2}$

30) Torque Transmitted by Keyed Shaft given Stress in Key

 $M_{
m t} = \sigma_{
m c} \cdot d_{
m s} \cdot l \cdot rac{h}{4}$

Open Calculator

31) Width of Key given Shear Stress in Key



= $4.46233 ext{mm} = rac{9980 ext{N}}{63.9 ext{N}/ ext{mm}^2 \cdot 35 ext{mm}}$



Variables Used

- A Total Area of Splines (Square Millimeter)
- **b**_k Width of Key (Millimeter)
- **d** Minor Diameter of Spline Key Shaf (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)
- Length of Key (Millimeter)
- In 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
- pm Permissible Pressure on Splines (Newton per Square Millimeter)
- R_m Mean Radius of Spline of Shaft (Millimeter)
- σ_c Compressive Stress in Key (Newton per Square Millimeter)
- τ Shear Stress in Key (Newton per Square Millimeter)





Constants, Functions, Measurements used

- 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: 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





Check other formula lists

- Design against Fluctuating Load Formulas
- Design of Bevel Gear Formulas
- Design of Chain Drives
 Formulas
- Design of Cotter Joint Formulas
- Design of Coupling Formulas
- Design of Flywheel Formulas
- Design of Friction Clutches
 Formulas
- Design of Helical Gears Formulas

- Design of Keys Formulas
- Design of Knuckle Joint Formulas
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