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Friction Devices Formulas

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List of 26 Friction Devices Formulas

Friction Devices 🔗

Pivot Bearing 🔗

1) Frictional Torque on Conical Pivot Bearing by Uniform Pressure 🔗

Open Calculator 🔗

fx $T = \dfrac{\mu_f \cdot W_t \cdot D_s \cdot h_s}{3}$

ex $2.4 \text{N*m} = \dfrac{0.4 \cdot 24\text{N} \cdot 0.5\text{m} \cdot 1.5\text{m}}{3}$

2) Frictional Torque on Conical Pivot Bearing by Uniform Wear 🔗

Open Calculator 🔗

fx $T = \dfrac{\mu_f \cdot W_t \cdot D_s \cdot \cos ec\frac{\alpha}{2}}{2}$

ex $2.379418 \text{N*m} = \dfrac{0.4 \cdot 24\text{N} \cdot 0.5\text{m} \cdot \cos ec\frac{30.286549°}{2}}{2}$

3) Frictional Torque on Flat Pivot Bearing by Uniform Pressure 🔗

Open Calculator 🔗

fx $T = \dfrac{2}{3} \cdot \mu_f \cdot W_t \cdot R$

ex $21.12 \text{N*m} = \dfrac{2}{3} \cdot 0.4 \cdot 24\text{N} \cdot 3.3\text{m}$

4) Frictional Torque on Truncated Conical Pivot Bearing by Uniform Pressure ⟳

fx $$T = \frac{2}{3} \cdot \mu_f \cdot W_t \cdot \frac{r_1^3 - r_2^3}{r_1^2 - r_2^2}$$

Open Calculator ⟳

ex $$67.65714 \text{N*m} = \frac{2}{3} \cdot 0.4 \cdot 24\text{N} \cdot \frac{(8\text{m})^3 - (6\text{m})^3}{(8\text{m})^2 - (6\text{m})^2}$$

5) Mean Radius of Collar ⟳

fx $$R_c = \frac{R_1 + R_2}{2}$$

Open Calculator ⟳

ex $$0.04\text{m} = \frac{0.050\text{m} + 0.03\text{m}}{2}$$

6) Pressure over Bearing Area of Flat Pivot Bearing ⟳

fx $$p_i = \frac{W_t}{\pi \cdot R^2}$$

Open Calculator ⟳

ex $$0.701509\text{Pa} = \frac{24\text{N}}{\pi \cdot (3.3\text{m})^2}$$

7) Torque Required to Overcome Friction at Collar ⟳

fx $$T = \mu_c \cdot W_l \cdot R_c$$

Open Calculator ⟳

ex $$0.1696\text{N*m} = 0.16 \cdot 53\text{N} \cdot 0.02\text{m}$$

8) Total Frictional Torque on Conical Pivot Bearing Considering Uniform Pressure 🔗

Open Calculator 🔗

fx $$T = \mu_f \cdot W_t \cdot D_s \cdot \cos ec \frac{\alpha}{3}$$

ex $$3.172558 N*m = 0.4 \cdot 24N \cdot 0.5m \cdot \cos ec \frac{30.286549°}{3}$$

9) Total Frictional Torque on Conical Pivot Bearing Considering Uniform Wear when Slant Height of Cone 🔗

Open Calculator 🔗

fx $$T = \frac{\mu_f \cdot W_t \cdot h_s}{2}$$

ex $$7.2N*m = \frac{0.4 \cdot 24N \cdot 1.5m}{2}$$

10) Total Frictional Torque on Flat Pivot Bearing Considering Uniform Wear 🔗

Open Calculator 🔗

fx $$T = \frac{\mu_f \cdot W_t \cdot R}{2}$$

ex $$15.84N*m = \frac{0.4 \cdot 24N \cdot 3.3m}{2}$$

11) Total Frictional Torque on Truncated Conical Pivot Bearing Considering Uniform Wear

fx $$T = \mu_f \cdot W_t \cdot \frac{r_1 + r_2}{2}$$

ex $$67.2\text{N*m} = 0.4 \cdot 24\text{N} \cdot \frac{8\text{m} + 6\text{m}}{2}$$

12) Total Vertical Load Transmitted to Conical Pivot Bearing for Uniform Pressure

fx $$W_t = \pi \cdot \left(\frac{D_s}{2} \right)^2 \cdot p_i$$

ex $$1.963495\text{N} = \pi \cdot \left(\frac{0.5\text{m}}{2} \right)^2 \cdot 10\text{Pa}$$

Screw and Nut

13) Force at Circumference of Screw given Helix Angle and Coefficient of Friction

fx $$F = W \cdot \left(\frac{\sin(\psi) + \mu_f \cdot \cos(\psi)}{\cos(\psi) - \mu_f \cdot \sin(\psi)} \right)$$

ex $$63.89666\text{N} = 60\text{kg} \cdot \left(\frac{\sin(25°) + 0.4 \cdot \cos(25°)}{\cos(25°) - 0.4 \cdot \sin(25°)} \right)$$

14) Force at Circumference of Screw given Helix Angle and Limiting Angle 🗗

fx $F = W_l \cdot \tan(\psi + \Phi)$

Open Calculator 🗗

ex $40.66833N = 53N \cdot \tan(25° + 12.5°)$

15) Helix Angle 🗗

fx $\psi = a\tan\left(\dfrac{L}{C}\right)$

Open Calculator 🗗

ex $0.054805° = a\tan\left(\dfrac{0.011m}{11.5m}\right)$

16) Helix Angle for Multi-Threaded Screw 🗗

fx $\psi = a\tan\left(\dfrac{n \cdot P_s}{\pi \cdot d}\right)$

Open Calculator 🗗

ex $89.865° = a\tan\left(\dfrac{16 \cdot 5m}{\pi \cdot 0.06m}\right)$

17) Helix Angle for Single Threaded Screw 🗗

fx $\psi = a\tan\left(\dfrac{P_s}{\pi \cdot d}\right)$

Open Calculator 🗗

ex $87.84102° = a\tan\left(\dfrac{5m}{\pi \cdot 0.06m}\right)$

18) Lead of Screw 🔗

Open Calculator 🔗
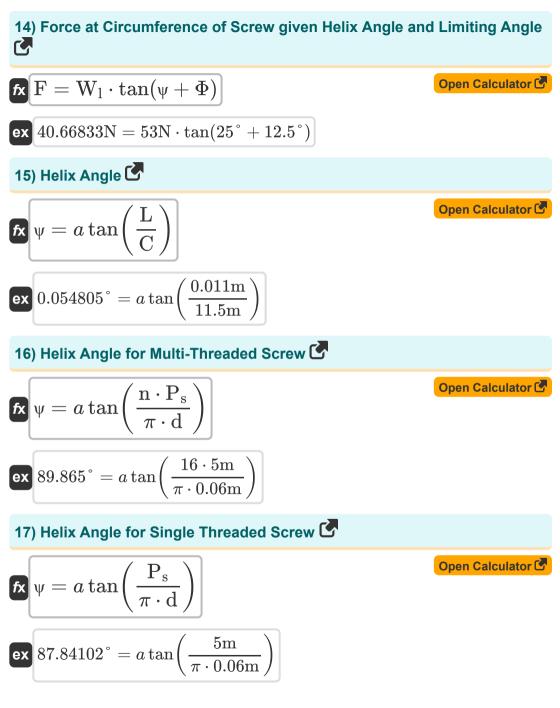
fx $L = P_s \cdot n$

ex $80m = 5m \cdot 16$

19) Torque Required to Overcome Friction between Screw and Nut 🔗

Open Calculator 🔗

fx $T = W_l \cdot \tan(\psi + \Phi) \cdot \dfrac{d}{2}$

ex $1.22005\text{N*m} = 53\text{N} \cdot \tan(25° + 12.5°) \cdot \dfrac{0.06m}{2}$

20) Torque Required to Overcome Friction between Screw and Nut while Lowering Load 🔗

Open Calculator 🔗

fx $T = W_l \cdot \tan(\Phi - \psi) \cdot \dfrac{d}{2}$

ex $-0.352495\text{N*m} = 53\text{N} \cdot \tan(12.5° - 25°) \cdot \dfrac{0.06m}{2}$

Screw Jack 📱

21) Efficiency of Screw Jack when Screw Friction as well as Collar Friction Considered 📱

fx $\eta = \dfrac{W \cdot \tan(\psi) \cdot d}{W_l \cdot \tan(\psi + \Phi) \cdot d + \mu_c \cdot W_l \cdot R_c}$

Open Calculator 📱

ex $0.643257 = \dfrac{60\text{kg} \cdot \tan(25°) \cdot 0.06\text{m}}{53\text{N} \cdot \tan(25° + 12.5°) \cdot 0.06\text{m} + 0.16 \cdot 53\text{N} \cdot 0.02\text{m}}$

22) Efficiency of Screw Jack when only Screw Friction is Considered 📱

fx $\eta = \dfrac{\tan(\psi)}{\tan(\psi + \Phi)}$

Open Calculator 📱

ex $0.607704 = \dfrac{\tan(25°)}{\tan(25° + 12.5°)}$

23) Force Required to Lower Load by Screw Jack given Weight of Load 📱

fx $F = W_l \cdot \dfrac{\mu_f \cdot \cos(\psi) - \sin(\psi)}{\cos(\psi) + \mu_f \cdot \sin(\psi)}$

Open Calculator 📱
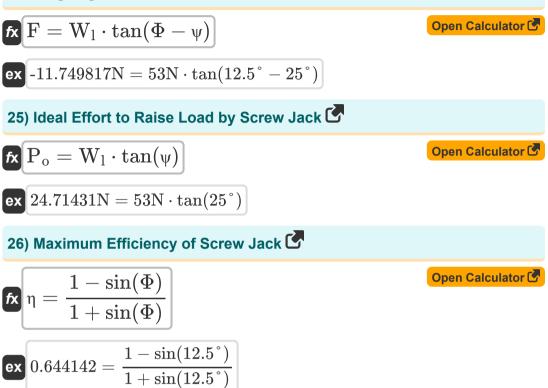
ex $-2.961852\text{N} = 53\text{N} \cdot \dfrac{0.4 \cdot \cos(25°) - \sin(25°)}{\cos(25°) + 0.4 \cdot \sin(25°)}$

24) Force Required to Lower Load by Screw Jack given weight of load and Limiting angle ⤤

Open Calculator ⤤

fx $F = W_1 \cdot \tan(\Phi - \psi)$

ex $-11.749817N = 53N \cdot \tan(12.5° - 25°)$

25) Ideal Effort to Raise Load by Screw Jack ⤤

Open Calculator ⤤

fx $P_o = W_1 \cdot \tan(\psi)$

ex $24.71431N = 53N \cdot \tan(25°)$

26) Maximum Efficiency of Screw Jack ⤤

Open Calculator ⤤

fx $\eta = \dfrac{1 - \sin(\Phi)}{1 + \sin(\Phi)}$

ex $0.644142 = \dfrac{1 - \sin(12.5°)}{1 + \sin(12.5°)}$

Variables Used

- **C** Circumference of Screw *(Meter)*
- **d** Mean Diameter of Screw *(Meter)*
- **D_s** Shaft Diameter *(Meter)*
- **F** Force Required *(Newton)*
- **h_s** Slant Height *(Meter)*
- **L** Lead of Screw *(Meter)*
- **n** Number of Threads
- **p_i** Pressure Intensity *(Pascal)*
- **P_o** Ideal Effort *(Newton)*
- **P_s** Pitch *(Meter)*
- **R** Radius of Bearing Surface *(Meter)*
- **r_1** Outer Radius of Bearing Surface *(Meter)*
- **R_1** Outer Radius of Collar *(Meter)*
- **r_2** Inner Radius of Bearing Surface *(Meter)*
- **R_2** Inner Radius of Collar *(Meter)*
- **R_c** Mean Radius of Collar *(Meter)*
- **T** Total Torque *(Newton Meter)*
- **W** Weight *(Kilogram)*
- **W_l** Load *(Newton)*
- **W_t** Load Transmitted Over Bearing Surface *(Newton)*
- **α** Semi Angle of Cone *(Degree)*
- **η** Efficiency

- **μ$_c$** Coefficient of Friction For Collar

- **μ$_f$** Coefficient of Friction

- **Φ** Limiting Angle of Friction *(Degree)*

- **ψ** Helix Angle *(Degree)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant

- Function: **atan**, atan(Number)
  Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.

- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.

- Function: **cosec**, cosec(Angle)
  The cosecant function is a trigonometric function that is the reciprocal of the sine function.

- Function: **sec**, sec(Angle)
  Secant is a trigonometric function that is defined ratio of the hypotenuse to the shorter side adjacent to an acute angle (in a right-angled triangle); the reciprocal of a cosine.

- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.

- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.

- Measurement: **Length** in Meter (m)
  Length Unit Conversion ⎋

- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion ⎋

- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion ⬀

- Measurement: **Force** in Newton (N)
  Force Unit Conversion ⬀

- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion ⬀

- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion ⬀

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