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Friction Devices Formulas

Calculators! Examples! Conversions!

List of 27 Friction Devices Formulas

Friction Devices

Pivot Bearing

1) Frictional Torque on Conical Pivot Bearing by Uniform Pressure

Open Calculator

fx $$T = \frac{\mu_{friction} \cdot W_t \cdot D_{shaft} \cdot h_{Slant}}{3}$$

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

2) Frictional Torque on Conical Pivot Bearing by Uniform Wear

Open Calculator

fx $$T = \frac{\mu_{friction} \cdot W_t \cdot D_{shaft} \cdot \cos ec\frac{\alpha}{2}}{2}$$

ex $$2.379418\text{N*m} = \frac{0.4 \cdot 24\text{N} \cdot 0.5\text{m} \cdot \cos ec\frac{0.5286\text{rad}}{2}}{2}$$

3) Frictional Torque on Flat Pivot Bearing by Uniform Pressure

Open Calculator

fx $$T = \frac{2}{3} \cdot \mu_{friction} \cdot W_t \cdot R$$

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

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

Open Calculator

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

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

Open Calculator

fx $$R_{collar} = \frac{R_1 + R_2}{2}$$

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

6) Pressure over Bearing Area of Flat Pivot Bearing

Open Calculator

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

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

7) Torque Required to Overcome Friction at Collar

Open Calculator

fx $$T = \mu_{collar} \cdot W_{load} \cdot R_{collar}$$

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

$$T = \mu_{friction} \cdot W_t \cdot D_{shaft} \cdot \cos ec\frac{\alpha}{3}$$

$$3.172558\text{N*m} = 0.4 \cdot 24\text{N} \cdot 0.5\text{m} \cdot \cos ec\frac{0.5286\text{rad}}{3}$$

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

Open Calculator

$$T = \frac{\mu_{friction} \cdot W_t \cdot h_{Slant}}{2}$$

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

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

Open Calculator

$$T = \frac{\mu_{friction} \cdot W_t \cdot R}{2}$$

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

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

Open Calculator

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

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

Open Calculator

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

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

Open Calculator

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

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

Open Calculator

fx $$F = W_{load} \cdot \tan(\psi + \Phi)$$

ex $$40.66833N = 53N \cdot \tan(25^{\circ} + 12.5^{\circ})$$

15) Helix Angle

Open Calculator

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

ex $$0.054805^{\circ} = a\tan\left(\frac{0.011m}{11.5m}\right)$$

16) Helix Angle for Multi-Threaded Screw

Open Calculator

fx $$\psi = a\tan\left(\frac{n \cdot P_{screw}}{\pi \cdot d}\right)$$

ex $$89.865^{\circ} = a\tan\left(\frac{16 \cdot 5m}{\pi \cdot 0.06m}\right)$$

17) Helix Angle for Single Threaded Screw

Open Calculator

fx $$\psi = a\tan\left(\frac{P_{screw}}{\pi \cdot d}\right)$$

ex $$87.84102^{\circ} = a\tan\left(\frac{5m}{\pi \cdot 0.06m}\right)$$

18) Lead of Screw

Open Calculator

fx $L = P_{screw} \cdot n$

ex $80m = 5m \cdot 16$

19) Torque Required to Overcome Friction between Screw and Nut

Open Calculator

fx $T = W_{load} \cdot \tan(\psi + \Phi) \cdot \frac{d}{2}$

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

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

Open Calculator

fx $T = W_{load} \cdot \tan(\Phi - \psi) \cdot \frac{d}{2}$

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

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

Open Calculator

fx $T = W_{load} \cdot \tan(\Phi - \psi) \cdot \frac{d}{2}$

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

Screw Jack

22) Efficiency of Screw Jack when Screw Friction as well as Collar Friction Considered

Open Calculator

fx $$\eta = \frac{W \cdot \tan(\psi) \cdot d}{W_{load} \cdot \tan(\psi + \Phi) \cdot d + \mu_{collar} \cdot W_{load} \cdot R_{collar}}$$

ex $$0.643257 = \frac{60kg \cdot \tan(25^{\circ}) \cdot 0.06m}{53N \cdot \tan(25^{\circ} + 12.5^{\circ}) \cdot 0.06m + 0.16 \cdot 53N \cdot 0.02m}$$

23) Efficiency of Screw Jack when only Screw Friction is Considered

Open Calculator

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

ex $$0.607704 = \frac{\tan(25^{\circ})}{\tan(25^{\circ} + 12.5^{\circ})}$$

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

Open Calculator

fx $$F = W_{load} \cdot \frac{\mu_{friction} \cdot \cos(\psi) - \sin(\psi)}{\cos(\psi) + \mu_{friction} \cdot \sin(\psi)}$$

ex $$-2.961852N = 53N \cdot \frac{0.4 \cdot \cos(25^{\circ}) - \sin(25^{\circ})}{\cos(25^{\circ}) + 0.4 \cdot \sin(25^{\circ})}$$

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

Open Calculator

fx $$F = W_{load} \cdot \tan(\Phi - \psi)$$

ex $$-11.749817N = 53N \cdot \tan(12.5^{\circ} - 25^{\circ})$$

26) Ideal Effort to Raise Load by Screw Jack

Open Calculator

fx $$P_o = W_{load} \cdot \tan(\psi)$$

ex $$24.71431N = 53N \cdot \tan(25^{\circ})$$

27) Maximum Efficiency of Screw Jack

Open Calculator

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

ex $$0.644142 = \frac{1 - \sin(12.5^{\circ})}{1 + \sin(12.5^{\circ})}$$

Variables Used

- **C** Circumference of Screw *(Meter)*
- **d** Mean Diameter of Screw *(Meter)*
- D_{shaft} Shaft Diameter *(Meter)*
- **F** Force Required *(Newton)*
- h_{Slant} Slant Height *(Meter)*
- **L** Lead of Screw *(Meter)*
- **n** Number of Threads
- p_i Pressure Intensity *(Pascal)*
- P_o Ideal Effort *(Newton)*
- P_{screw} 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_{collar} Mean Radius of Collar *(Meter)*
- **T** Total Torque *(Newton Meter)*
- **W** Weight *(Kilogram)*
- W_{load} Load *(Newton)*
- W_t Load Transmitted Over Bearing Surface *(Newton)*
- **α** Semi Angle of Cone *(Radian)*
- **η** Efficiency

- μ_{collar} Coefficient of Friction for Collar
- $\mu_{friction}$ 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 Radian (rad), Degree (°)
  Angle Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

Check other formula lists

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6/17/2024 | 7:59:19 AM UTC

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