Important Power Screws Formulas PDF

Formulas
Examples
with Units

List of 103
Important Power Screws Formulas

1) Acme Thread Formulas

1.1) Coefficient of Friction of Power Screw given Effort in Lowering Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$\mu = \frac{P_{lo} + W \cdot \tan(\alpha)}{W \cdot \sec(0.253) - P_{lo} \cdot \sec(0.253) \cdot \tan(\alpha)}$$

Example with Units

$$0.1453 = \frac{120\,\text{N} + 1700\,\text{N} \cdot \tan(4.5°)}{1700\,\text{N} \cdot \sec(0.253) - 120\,\text{N} \cdot \sec(0.253) \cdot \tan(4.5°)}$$

1.2) Coefficient of Friction of Power Screw given Effort in Moving Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$\mu = \frac{P_{li} - W \cdot \tan(\alpha)}{\sec\left(14.5 \cdot \frac{\pi}{180}\right) \cdot \left(W + P_{li} \cdot \tan(\alpha)\right)}$$

Example with Units

$$0.15 = \frac{402\,\text{N} - 1700\,\text{N} \cdot \tan(4.5°)}{\sec\left(14.5 \cdot \frac{3.1416}{180}\right) \cdot \left(1700\,\text{N} + 402\,\text{N} \cdot \tan(4.5°)\right)}$$

1.3) Coefficient of Friction of Power Screw given Torque Required in Lifting Load with Acme Thread Formula

Evaluate Formula

Formula

$$\mu = \frac{2 \cdot Mt_{li} - W \cdot d_m \cdot \tan(\alpha)}{\sec(0.253) \cdot \left(W \cdot d_m + 2 \cdot Mt_{li} \cdot \tan(\alpha)\right)}$$

Example with Units

$$0.1504 = \frac{2 \cdot 9265\,\text{N*mm} - 1700\,\text{N} \cdot 46\,\text{mm} \cdot \tan(4.5°)}{\sec(0.253) \cdot \left(1700\,\text{N} \cdot 46\,\text{mm} + 2 \cdot 9265\,\text{N*mm} \cdot \tan(4.5°)\right)}$$

1.4) Coefficient of Friction of Power Screw given Torque Required in Lowering Load with Acme Thread Formula

Evaluate Formula

Formula

$$\mu = \frac{2 \cdot Mt_{lo} + W \cdot d_m \cdot \tan(\alpha)}{\sec(0.253) \cdot \left(W \cdot d_m - 2 \cdot Mt_{lo} \cdot \tan(\alpha)\right)}$$

Example with Units

$$0.1504 = \frac{2 \cdot 2960\,\text{N*mm} + 1700\,\text{N} \cdot 46\,\text{mm} \cdot \tan(4.5°)}{\sec(0.253) \cdot \left(1700\,\text{N} \cdot 46\,\text{mm} - 2 \cdot 2960\,\text{N*mm} \cdot \tan(4.5°)\right)}$$

1.5) Efficiency of Acme Threaded Power Screw Formula

Evaluate Formula

Formula

$$\eta = \tan(\alpha) \cdot \frac{1 - \mu \cdot \tan(\alpha) \cdot \sec(0.253)}{\mu \cdot \sec(0.253) + \tan(\alpha)}$$

Example with Units

$$0.3328 = \tan(4.5°) \cdot \frac{1 - 0.15 \cdot \tan(4.5°) \cdot \sec(0.253)}{0.15 \cdot \sec(0.253) + \tan(4.5°)}$$

1.6) Effort Required in Lifting Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$P_{li} = W \cdot \left(\frac{\mu \cdot \sec((0.253)) + \tan(\alpha)}{1 - \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}\right)$$

Example with Units

$$402.0803\,\text{N} = 1700\,\text{N} \cdot \left(\frac{0.15 \cdot \sec((0.253)) + \tan(4.5°)}{1 - 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}\right)$$

1.7) Effort Required in Lowering Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$P_{lo} = W \cdot \left(\frac{\mu \cdot \sec((0.253)) - \tan(\alpha)}{1 + \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}\right)$$

Example with Units

$$128.0306\,\text{N} = 1700\,\text{N} \cdot \left(\frac{0.15 \cdot \sec((0.253)) - \tan(4.5°)}{1 + 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}\right)$$

1.8) Helix Angle of Power Screw given Effort Required in Lifting Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{P_{li} - W \cdot \mu \cdot \sec(0.253)}{W + P_{li} \cdot \mu \cdot \sec(0.253)}\right)$$

Example with Units

$$4.4974° = atan\left(\frac{402\,N - 1700\,N \cdot 0.15 \cdot \sec(0.253)}{1700\,N + 402\,N \cdot 0.15 \cdot \sec(0.253)}\right)$$

1.9) Helix Angle of Power Screw given Load and Coefficient of Friction Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{W \cdot \mu \cdot \sec(0.253) - P_{lo}}{W + \left(P_{lo} \cdot \mu \cdot \sec(0.253)\right)}\right)$$

Example with Units

$$4.7692° = atan\left(\frac{1700\,N \cdot 0.15 \cdot \sec(0.253) - 120\,N}{1700\,N + \left(120\,N \cdot 0.15 \cdot \sec(0.253)\right)}\right)$$

1.10) Helix Angle of Power Screw given Torque Required in Lifting Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{2 \cdot Mt_{li} - W \cdot d_m \cdot \mu \cdot \sec\left(0.253 \cdot \frac{\pi}{180}\right)}{W \cdot d_m + 2 \cdot Mt_{li} \cdot \mu \cdot \sec\left(0.253 \cdot \frac{\pi}{180}\right)}\right)$$

Example with Units

$$4.7999° = atan\left(\frac{2 \cdot 9265\,N*mm - 1700\,N \cdot 46\,mm \cdot 0.15 \cdot \sec\left(0.253 \cdot \frac{3.1416}{180}\right)}{1700\,N \cdot 46\,mm + 2 \cdot 9265\,N*mm \cdot 0.15 \cdot \sec\left(0.253 \cdot \frac{3.1416}{180}\right)}\right)$$

1.11) Helix Angle of Power Screw given Torque Required in Lowering Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{W \cdot d_m \cdot \mu \cdot \sec(0.253) - 2 \cdot Mt_{lo}}{W \cdot d_m + 2 \cdot Mt_{lo} \cdot \mu \cdot \sec(0.253)}\right)$$

Example with Units

$$4.4777° = atan\left(\frac{1700\,N \cdot 46\,mm \cdot 0.15 \cdot \sec(0.253) - 2 \cdot 2960\,N*mm}{1700\,N \cdot 46\,mm + 2 \cdot 2960\,N*mm \cdot 0.15 \cdot \sec(0.253)}\right)$$

1.12) Load on Power Screw given Effort Required in Lifting Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$W = P_{li} \cdot \frac{1 - \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}{\mu \cdot \sec((0.253)) + \tan(\alpha)}$$

Example with Units

$$1699.6607\,\text{N} = 402\,\text{N} \cdot \frac{1 - 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}{0.15 \cdot \sec((0.253)) + \tan(4.5°)}$$

1.13) Load on Power Screw given Effort Required in Lowering Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$W = P_{lo} \cdot \frac{1 + \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}{\mu \cdot \sec((0.253)) - \tan(\alpha)}$$

Example with Units

$$1593.3692\,\text{N} = 120\,\text{N} \cdot \frac{1 + 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}{0.15 \cdot \sec((0.253)) - \tan(4.5°)}$$

1.14) Load on Power Screw given Torque Required in Lifting Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$W = 2 \cdot Mt_{li} \cdot \frac{1 - \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}{d_m \cdot (\mu \cdot \sec((0.253)) + \tan(\alpha))}$$

Example with Units

$$1703.1534\,\text{N} = 2 \cdot 9265\,\text{N*mm} \cdot \frac{1 - 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}{46\,\text{mm} \cdot (0.15 \cdot \sec((0.253)) + \tan(4.5°))}$$

1.15) Load on Power Screw given Torque Required in Lowering Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$W = 2 \cdot Mt_{lo} \cdot \frac{1 + \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}{d_m \cdot (\mu \cdot \sec((0.253)) - \tan(\alpha))}$$

Example with Units

$$1708.8307\,\text{N} = 2 \cdot 2960\,\text{N*mm} \cdot \frac{1 + 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}{46\,\text{mm} \cdot (0.15 \cdot \sec((0.253)) - \tan(4.5°))}$$

1.16) Mean Diameter of Power Screw given Torque Required in Lowering Load with Acme Threaded Screw Formula

Evaluate Formula

Formula

$$d_m = 2 \cdot Mt_{lo} \cdot \frac{1 + \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}{W \cdot (\mu \cdot \sec((0.253)) - \tan(\alpha))}$$

Example with Units

$$46.2389\,\text{mm} = 2 \cdot 2960\,\text{N*mm} \cdot \frac{1 + 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}{1700\,\text{N} \cdot (0.15 \cdot \sec((0.253)) - \tan(4.5°))}$$

1.17) Torque Required in Lifting Load with Acme Threaded Power Screw Formula

Evaluate Formula

Formula

$$Mt_{li} = 0.5 \cdot d_m \cdot W \cdot \left(\frac{\mu \cdot \sec((0.253)) + \tan(\alpha)}{1 - \mu \cdot \sec((0.253)) \cdot \tan(\alpha)}\right)$$

Example with Units

$$9247.846\,\text{N*mm} = 0.5 \cdot 46\,\text{mm} \cdot 1700\,\text{N} \cdot \left(\frac{0.15 \cdot \sec((0.253)) + \tan(4.5°)}{1 - 0.15 \cdot \sec((0.253)) \cdot \tan(4.5°)}\right)$$

1.18) Torque Required in Lowering Load with Acme Threaded Power Screw Formula

Evaluate Formula

Formula

$$Mt_{lo} = 0.5 \cdot d_m \cdot W \cdot \left(\frac{(\mu \cdot \sec((0.253))) - \tan(\alpha)}{1 + (\mu \cdot \sec((0.253)) \cdot \tan(\alpha))}\right)$$

Example with Units

$$2944.7036\,\text{N*mm} = 0.5 \cdot 46\,\text{mm} \cdot 1700\,\text{N} \cdot \left(\frac{(0.15 \cdot \sec((0.253))) - \tan(4.5°)}{1 + (0.15 \cdot \sec((0.253)) \cdot \tan(4.5°))}\right)$$

2) Torque Requirement in Lowering Load using Square threaded Screws Formulas

2.1) Coefficient of Friction of Screw Thread given Load Formula

Evaluate Formula

Formula

$$\mu = \frac{P_{lo} + \tan(\alpha) \cdot W}{W - P_{lo} \cdot \tan(\alpha)}$$

Example with Units

$$0.1501 = \frac{120\,\text{N} + \tan(4.5°) \cdot 1700\,\text{N}}{1700\,\text{N} - 120\,\text{N} \cdot \tan(4.5°)}$$

2.2) Coefficient of Friction of Screw Thread given Torque Required in Lowering Load Formula

Evaluate Formula

Formula

$$\mu = \frac{2 \cdot Mt_{lo} + W \cdot d_m \cdot \tan(\alpha)}{W \cdot d_m - 2 \cdot Mt_{lo} \cdot \tan(\alpha)}$$

Example with Units

$$0.1553 = \frac{2 \cdot 2960\,\text{N*mm} + 1700\,\text{N} \cdot 46\,\text{mm} \cdot \tan(4.5°)}{1700\,\text{N} \cdot 46\,\text{mm} - 2 \cdot 2960\,\text{N*mm} \cdot \tan(4.5°)}$$

2.3) Effort Required in Lowering Load Formula

Evaluate Formula

Formula

$$P_{lo} = W \cdot \left(\frac{\mu - \tan(\alpha)}{1 + \mu \cdot \tan(\alpha)}\right)$$

Example with Units

$$119.7929\,\text{N} = 1700\,\text{N} \cdot \left(\frac{0.15 - \tan(4.5°)}{1 + 0.15 \cdot \tan(4.5°)}\right)$$

2.4) Helix Angle of Power Screw given Effort Required in Lowering Load Formula

Evaluate Formula

Formula

$$\alpha = a\tan\left(\frac{W \cdot \mu - P_{lo}}{\mu \cdot P_{lo} + W}\right)$$

Example with Units

$$4.4931° = a\tan\left(\frac{1700\,\text{N} \cdot 0.15 - 120\,\text{N}}{0.15 \cdot 120\,\text{N} + 1700\,\text{N}}\right)$$

2.5) Helix Angle of Power Screw given Torque Required in Lowering Load Formula

Evaluate Formula

Formula

$$\alpha = a\tan\left(\frac{\mu \cdot W \cdot d_m - \left(2 \cdot Mt_{lo}\right)}{2 \cdot Mt_{lo} \cdot \mu + \left(W \cdot d_m\right)}\right)$$

Example with Units

$$4.2015° = a\tan\left(\frac{0.15 \cdot 1700\,\text{N} \cdot 46\,\text{mm} - \left(2 \cdot 2960\,\text{N*mm}\right)}{2 \cdot 2960\,\text{N*mm} \cdot 0.15 + \left(1700\,\text{N} \cdot 46\,\text{mm}\right)}\right)$$

2.6) Load on power Screw given Effort Required in Lowering Load Formula

Evaluate Formula

Formula

$$W = \frac{P_{lo}}{\frac{\mu - \tan(\alpha)}{1 + \mu \cdot \tan(\alpha)}}$$

Example with Units

$$1702.9388\,\text{N} = \frac{120\,\text{N}}{\frac{0.15 - \tan(4.5°)}{1 + 0.15 \cdot \tan(4.5°)}}$$

2.7) Load on power Screw given Torque Required in Lowering Load Formula

Evaluate Formula

Formula

$$W = \frac{Mt_{lo}}{0.5 \cdot d_m \cdot \left(\frac{\mu - \tan(\alpha)}{1 + \mu \cdot \tan(\alpha)} \right)}$$

Example with Units

$$1826.3402\,\text{N} = \frac{2960\,\text{N*mm}}{0.5 \cdot 46\,\text{mm} \cdot \left(\frac{0.15 - \tan(4.5°)}{1 + 0.15 \cdot \tan(4.5°)} \right)}$$

2.8) Mean Diameter of Power Screw given Torque Required in Lowering Load Formula

Evaluate Formula

Formula

$$d_m = \frac{Mt_{lo}}{0.5 \cdot W \cdot \left(\frac{\mu - \tan(\alpha)}{1 + \mu \cdot \tan(\alpha)} \right)}$$

Example with Units

$$49.4186\,\text{mm} = \frac{2960\,\text{N*mm}}{0.5 \cdot 1700\,\text{N} \cdot \left(\frac{0.15 - \tan(4.5°)}{1 + 0.15 \cdot \tan(4.5°)} \right)}$$

2.9) Torque Required in Lowering Load on Power Screw Formula

Evaluate Formula

Formula

$$Mt_{lo} = 0.5 \cdot W \cdot d_m \cdot \left(\frac{\mu - \tan(\alpha)}{1 + \mu \cdot \tan(\alpha)} \right)$$

Example with Units

$$2755.237\,\text{N*mm} = 0.5 \cdot 1700\,\text{N} \cdot 46\,\text{mm} \cdot \left(\frac{0.15 - \tan(4.5°)}{1 + 0.15 \cdot \tan(4.5°)} \right)$$

3) Collar Friction Formulas

3.1) Coefficient of Friction at Collar of Screw according to Uniform Pressure Theory Formula

Evaluate Formula

Formula

$$\mu_{collar} = \frac{3 \cdot T_c \cdot \left(\left(D_o^2 \right) - \left(D_i^2 \right) \right)}{W \cdot \left(\left(D_o^3 \right) - \left(D_i^3 \right) \right)}$$

Example with Units

$$0.1441 = \frac{3 \cdot 10000\,\text{N*mm} \cdot \left(\left(100\,\text{mm}^2 \right) - \left(60\,\text{mm}^2 \right) \right)}{1700\,\text{N} \cdot \left(\left(100\,\text{mm}^3 \right) - \left(60\,\text{mm}^3 \right) \right)}$$

3.2) Coefficient of Friction at Collar of Screw according to Uniform Wear Theory Formula

Evaluate Formula

Formula

$$\mu_{collar} = \frac{4 \cdot T_c}{W \cdot \left(\left(D_o \right) + \left(D_i \right) \right)}$$

Example with Units

$$0.1471 = \frac{4 \cdot 10000\,\text{N*mm}}{1700\,\text{N} \cdot \left(\left(100\,\text{mm} \right) + \left(60\,\text{mm} \right) \right)}$$

3.3) Collar Friction Torque for Screw according to Uniform Pressure Theory Formula

Evaluate Formula

Formula

$$T_c = \frac{\mu_{collar} \cdot W \cdot \left({R_1}^3 - {R_2}^3 \right)}{\left(\frac{3}{2} \right) \cdot \left({R_1}^2 - {R_2}^2 \right)}$$

Example with Units

$$11951.1318\,\text{N*mm} = \frac{0.16 \cdot 1700\,\text{N} \cdot \left({54\,\text{mm}}^3 - {32\,\text{mm}}^3 \right)}{\left(\frac{3}{2} \right) \cdot \left({54\,\text{mm}}^2 - {32\,\text{mm}}^2 \right)}$$

3.4) Collar Friction Torque for Screw according to Uniform Wear Theory Formula

Evaluate Formula

Formula

$$T_c = \mu_{collar} \cdot W \cdot \frac{R_1 + R_2}{2}$$

Example with Units

$$11696\,\text{N*mm} = 0.16 \cdot 1700\,\text{N} \cdot \frac{54\,\text{mm} + 32\,\text{mm}}{2}$$

3.5) Load on Screw given Collar Friction Torque according to Uniform Pressure Theory Formula

Evaluate Formula

Formula

$$W = \frac{3 \cdot T_c \cdot \left({D_o}^2 - {D_i}^2 \right)}{\mu_{collar} \cdot \left({D_o}^3 - {D_i}^3 \right)}$$

Example with Units

$$1530.6122\,\text{N} = \frac{3 \cdot 10000\,\text{N*mm} \cdot \left({100\,\text{mm}}^2 - {60\,\text{mm}}^2 \right)}{0.16 \cdot \left({100\,\text{mm}}^3 - {60\,\text{mm}}^3 \right)}$$

3.6) Load on Screw given Collar Friction Torque according to Uniform Wear Theory Formula

Evaluate Formula

Formula

$$W = \frac{4 \cdot T_c}{\mu_{collar} \cdot \left(D_o + D_i \right)}$$

Example with Units

$$1562.5\,\text{N} = \frac{4 \cdot 10000\,\text{N*mm}}{0.16 \cdot \left(100\,\text{mm} + 60\,\text{mm} \right)}$$

4) Design of Screw and Nut Formulas

4.1) Axial Load on Screw given Direct Compressive Stress Formula

Evaluate Formula

Formula

$$W_a = \frac{\sigma_c \cdot \pi \cdot {d_c}^2}{4}$$

Example with Units

$$130231.5819\,\text{N} = \frac{94\,\text{N/mm}^2 \cdot 3.1416 \cdot {42\,\text{mm}}^2}{4}$$

4.2) Axial Load on Screw given Transverse Shear Stress Formula

Evaluate Formula

Formula

$$W_a = \left(\tau_s \cdot \pi \cdot d_c \cdot t \cdot z \right)$$

Example with Units

$$131102.4313\,\text{N} = \left(27.6\,\text{N/mm}^2 \cdot 3.1416 \cdot 42\,\text{mm} \cdot 4\,\text{mm} \cdot 9 \right)$$

4.3) Axial Load on Screw given Transverse Shear Stress at Root of Nut Formula

Evaluate Formula

Formula

$$W_a = \pi \cdot t_n \cdot t \cdot d \cdot z$$

Example with Units

$$131758.3959\,\text{N} = 3.1416 \cdot 23.3\,\text{N/mm}^2 \cdot 4\,\text{mm} \cdot 50\,\text{mm} \cdot 9$$

4.4) Axial Load on Screw given Unit Bearing Pressure Formula

Evaluate Formula

Formula

$$W_a = \pi \cdot z \cdot S_b \cdot \frac{\left(d^2\right) - \left(d_c^{\,2}\right)}{4}$$

Example with Units

$$129541.6881\,\text{N} = 3.1416 \cdot 9 \cdot 24.9\,\text{N/mm}^2 \cdot \frac{\left(50\,\text{mm}^2\right) - \left(42\,\text{mm}^2\right)}{4}$$

4.5) Bearing Area between Screw and Nut for One Thread Formula

Evaluate Formula

Formula

$$A = \pi \cdot \frac{\left(d^2\right) - \left(d_c^{\,2}\right)}{4}$$

Example with Units

$$578.053\,\text{mm}^2 = 3.1416 \cdot \frac{\left(50\,\text{mm}^2\right) - \left(42\,\text{mm}^2\right)}{4}$$

4.6) Core Diameter of Power Screw Formula

Evaluate Formula

Formula

$$d_c = d - p$$

Example with Units

$$42.2\,\text{mm} = 50\,\text{mm} - 7.8\,\text{mm}$$

4.7) Core Diameter of Screw given Direct Compressive Stress Formula

Evaluate Formula

Formula

$$d_c = \sqrt{\frac{4 \cdot W_a}{\pi \cdot \sigma_c}}$$

Example with Units

$$42.1237\,\text{mm} = \sqrt{\frac{4 \cdot 131000\,\text{N}}{3.1416 \cdot 94\,\text{N/mm}^2}}$$

4.8) Core Diameter of Screw given Torsional Shear Stress Formula

Evaluate Formula

Formula

$$d_c = \left(16 \cdot \frac{Mt_t}{\pi \cdot \tau}\right)^{\frac{1}{3}}$$

Example with Units

$$42.0001\,\text{mm} = \left(16 \cdot \frac{658700\,\text{N*mm}}{3.1416 \cdot 45.28\,\text{N/mm}^2}\right)^{\frac{1}{3}}$$

4.9) Core Diameter of Screw given Transverse Shear Stress in Screw Formula

Evaluate Formula

Formula

$$d_c = \frac{W_a}{\tau_s \cdot \pi \cdot t \cdot z}$$

Example with Units

$$41.9672\,\text{mm} = \frac{131000\,\text{N}}{27.6\,\text{N/mm}^2 \cdot 3.1416 \cdot 4\,\text{mm} \cdot 9}$$

4.10) Core Diameter of Screw given Unit Bearing Pressure Formula

Evaluate Formula

Formula

$$d_c = \sqrt{(d)^2 - \left(4 \cdot \frac{W_a}{S_b \cdot \pi \cdot z}\right)}$$

Example with Units

$$41.9012\,\text{mm} = \sqrt{(50\,\text{mm})^2 - \left(4 \cdot \frac{131000\,\text{N}}{24.9\,\text{N/mm}^2 \cdot 3.1416 \cdot 9}\right)}$$

4.11) Direct Compressive Stress in Screw Formula

Evaluate Formula

Formula

$$\sigma_c = \frac{W_a \cdot 4}{\pi \cdot d_c^2}$$

Example with Units

$$94.5546\,\text{N/mm}^2 = \frac{131000\,\text{N} \cdot 4}{3.1416 \cdot 42\,\text{mm}^2}$$

4.12) Helix Angle of Thread Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{L}{\pi \cdot d_m}\right)$$

Example with Units

$$4.3528° = atan\left(\frac{11\,\text{mm}}{3.1416 \cdot 46\,\text{mm}}\right)$$

4.13) Lead of Screw given Helix angle Formula

Evaluate Formula

Formula

$$L = \tan(\alpha) \cdot \pi \cdot d_m$$

Example with Units

$$11.3734\,\text{mm} = \tan(4.5°) \cdot 3.1416 \cdot 46\,\text{mm}$$

4.14) Lead of Screw given Overall Efficiency Formula

Evaluate Formula

Formula

$$L = 2 \cdot \pi \cdot \eta \cdot \frac{Mt_t}{W_a}$$

Example with Units

$$11.0577\,\text{mm} = 2 \cdot 3.1416 \cdot 0.35 \cdot \frac{658700\,\text{N*mm}}{131000\,\text{N}}$$

4.15) Mean Diameter of Power Screw Formula

Evaluate Formula

Formula

$$d_m = d - 0.5 \cdot p$$

Example with Units

$$46.1\,\text{mm} = 50\,\text{mm} - 0.5 \cdot 7.8\,\text{mm}$$

4.16) Mean diameter of Screw given Helix Angle Formula

Evaluate Formula

Formula

$$d_m = \frac{L}{\pi \cdot \tan(\alpha)}$$

Example with Units

$$44.4896\,\text{mm} = \frac{11\,\text{mm}}{3.1416 \cdot \tan(4.5°)}$$

4.17) Nominal Diameter of Power Screw Formula

Evaluate Formula

Formula

$$d = d_c + p$$

Example with Units

$$49.8\,\text{mm} = 42\,\text{mm} + 7.8\,\text{mm}$$

4.18) Nominal Diameter of Power Screw given Mean Diameter Formula

Evaluate Formula

Formula

$$d = d_m + (0.5 \cdot p)$$

Example with Units

$$49.9\,\text{mm} = 46\,\text{mm} + (0.5 \cdot 7.8\,\text{mm})$$

4.19) Nominal Diameter of Screw given Transverse Shear Stress at Root of Nut Formula

Evaluate Formula

Formula

$$d = \frac{W_a}{\pi \cdot t_n \cdot t \cdot z}$$

Example with Units

$$49.7122\,\text{mm} = \frac{131000\,\text{N}}{3.1416 \cdot 23.3\,\text{N/mm}^2 \cdot 4\,\text{mm} \cdot 9}$$

4.20) Nominal Diameter of Screw given Unit Bearing Pressure Formula

Evaluate Formula

Formula

$$d = \sqrt{\left(4 \cdot \frac{W_a}{S_b \cdot \pi \cdot z}\right) + \left(d_c\right)^2}$$

Example with Units

$$50.0828\,\text{mm} = \sqrt{\left(4 \cdot \frac{131000\,\text{N}}{24.9\,\text{N/mm}^2 \cdot 3.1416 \cdot 9}\right) + \left(42\,\text{mm}\right)^2}$$

4.21) Number of Threads in Engagement with Nut given Transverse Shear Stress Formula

Evaluate Formula

Formula

$$z = \frac{W_a}{\pi \cdot t \cdot \tau_s \cdot d_c}$$

Example with Units

$$8.993 = \frac{131000\,\text{N}}{3.1416 \cdot 4\,\text{mm} \cdot 27.6\,\text{N/mm}^2 \cdot 42\,\text{mm}}$$

4.22) Number of Threads in Engagement with Nut given Transverse Shear Stress at Root of Nut Formula

Evaluate Formula

Formula

$$z = \frac{W_a}{\pi \cdot d \cdot t_n \cdot t}$$

Example with Units

$$8.9482 = \frac{131000\,\text{N}}{3.1416 \cdot 50\,\text{mm} \cdot 23.3\,\text{N/mm}^2 \cdot 4\,\text{mm}}$$

4.23) Number of Threads in Engagement with Nut given Unit Bearing Pressure Formula

Evaluate Formula

Formula

$$z = 4 \cdot \frac{W_a}{\left(\pi \cdot S_b \cdot \left(\left(d^2\right) - \left(d_c^2\right)\right)\right)}$$

Example with Units

$$9.1013 = 4 \cdot \frac{131000\,\text{N}}{\left(3.1416 \cdot 24.9\,\text{N/mm}^2 \cdot \left(\left(50\,\text{mm}^2\right) - \left(42\,\text{mm}^2\right)\right)\right)}$$

4.24) Overall Efficiency of Power Screw Formula

Evaluate Formula

Formula

$$\eta = W_a \cdot \frac{L}{2 \cdot \pi \cdot Mt_t}$$

Example with Units

$$0.3482 = 131000\,\text{N} \cdot \frac{11\,\text{mm}}{2 \cdot 3.1416 \cdot 658700\,\text{N*mm}}$$

4.25) Pitch of Power Screw Formula

Evaluate Formula

Formula

$$p = d - d_c$$

Example with Units

$$8\,\text{mm} = 50\,\text{mm} - 42\,\text{mm}$$

4.26) Pitch of Screw given Mean Diameter Formula

Evaluate Formula

Formula

$$p = \frac{d - d_m}{0.5}$$

Example with Units

$$8\,\text{mm} = \frac{50\,\text{mm} - 46\,\text{mm}}{0.5}$$

4.27) Thread Thickness at Core Diameter of Screw given Transverse Shear Stress Formula

Evaluate Formula

Formula

$$t = \frac{W_a}{\pi \cdot \tau_s \cdot d_c \cdot z}$$

Example with Units

$$3.9969\,\text{mm} = \frac{131000\,\text{N}}{3.1416 \cdot 27.6\,\text{N/mm}^2 \cdot 42\,\text{mm} \cdot 9}$$

4.28) Thread Thickness at Root of Nut given Transverse Shear Stress at Root of Nut Formula

Evaluate Formula

Formula

$$t = \frac{W_a}{\pi \cdot d \cdot z \cdot t_n}$$

Example with Units

$$3.977\,\text{mm} = \frac{131000\,\text{N}}{3.1416 \cdot 50\,\text{mm} \cdot 9 \cdot 23.3\,\text{N/mm}^2}$$

4.29) Torsional Moment in Screw given Torsional Shear Stress Formula

Evaluate Formula

Formula

$$Mt_t = \tau \cdot \pi \cdot \frac{d_c^3}{16}$$

Example with Units

$$658694.7157\,\text{N*mm} = 45.28\,\text{N/mm}^2 \cdot 3.1416 \cdot \frac{42\,\text{mm}^3}{16}$$

4.30) Torsional Shear Stress of Screw Formula

Evaluate Formula

Formula

$$\tau = 16 \cdot \frac{Mt_t}{\pi \cdot \left(d_c^{\,3} \right)}$$

Example with Units

$$45.2804\,\text{N/mm}^2 = 16 \cdot \frac{658700\,\text{N*mm}}{3.1416 \cdot \left(42\,\text{mm}^{\,3} \right)}$$

4.31) Transverse Shear Stress at Root of Nut Formula

Evaluate Formula

Formula

$$t_n = \frac{W_a}{\pi \cdot d \cdot t \cdot z}$$

Example with Units

$$23.1659\,\text{N/mm}^2 = \frac{131000\,\text{N}}{3.1416 \cdot 50\,\text{mm} \cdot 4\,\text{mm} \cdot 9}$$

4.32) Transverse Shear Stress in Screw Formula

Evaluate Formula

Formula

$$\tau_s = \frac{W_a}{\pi \cdot d_c \cdot t \cdot z}$$

Example with Units

$$27.5784\,\text{N/mm}^2 = \frac{131000\,\text{N}}{3.1416 \cdot 42\,\text{mm} \cdot 4\,\text{mm} \cdot 9}$$

4.33) Unit Bearing Pressure for Thread Formula

Evaluate Formula

Formula

$$S_b = 4 \cdot \frac{W_a}{\pi \cdot z \cdot \left(d^2 - d_c^{\,2} \right)}$$

Example with Units

$$25.1803\,\text{N/mm}^2 = 4 \cdot \frac{131000\,\text{N}}{3.1416 \cdot 9 \cdot \left(50\,\text{mm}^{\,2} - 42\,\text{mm}^{\,2} \right)}$$

5) Torque Requirement in Lifting Load using Square Threaded Screw Formulas

5.1) Coefficient of Friction for Screw Thread given Efficiency of Square Threaded Screw Formula

Evaluate Formula

Formula

$$\mu = \frac{\tan\left(\alpha \right) \cdot \left(1 - \eta \right)}{\tan\left(\alpha \right) \cdot \tan\left(\alpha \right) + \eta}$$

Example with Units

$$0.1436 = \frac{\tan\left(4.5° \right) \cdot \left(1 - 0.35 \right)}{\tan\left(4.5° \right) \cdot \tan\left(4.5° \right) + 0.35}$$

5.2) Coefficient of Friction of Power Screw given Effort Required to Lift Load Formula

Evaluate Formula

Formula

$$\mu = \frac{P_{li} - W \cdot \tan\left(\alpha \right)}{W + P_{li} \cdot \tan\left(\alpha \right)}$$

Example with Units

$$0.1549 = \frac{402\,\text{N} - 1700\,\text{N} \cdot \tan\left(4.5° \right)}{1700\,\text{N} + 402\,\text{N} \cdot \tan\left(4.5° \right)}$$

5.3) Coefficient of Friction of Power Screw given Torque Required to Lift Load Formula

Evaluate Formula

Formula

$$\mu = \frac{\left(2 \cdot \frac{Mt_{li}}{d_m}\right) - W \cdot \tan(\alpha)}{W - \left(2 \cdot \frac{Mt_{li}}{d_m}\right) \cdot \tan(\alpha)}$$

Example with Units

$$0.1613 = \frac{\left(2 \cdot \frac{9265\,\text{N*mm}}{46\,\text{mm}}\right) - 1700\,\text{N} \cdot \tan(4.5°)}{1700\,\text{N} - \left(2 \cdot \frac{9265\,\text{N*mm}}{46\,\text{mm}}\right) \cdot \tan(4.5°)}$$

5.4) Efficiency of Square Threaded Power Screw Formula

Evaluate Formula

Formula

$$\eta = \frac{\tan(\alpha)}{\frac{\mu + \tan(\alpha)}{1 - \mu \cdot \tan(\alpha)}}$$

Example with Units

$$0.3401 = \frac{\tan(4.5°)}{\frac{0.15 + \tan(4.5°)}{1 - 0.15 \cdot \tan(4.5°)}}$$

5.5) Effort Required in Lifting load using Power Screw Formula

Evaluate Formula

Formula

$$P_{li} = W \cdot \left(\frac{\mu + \tan(\alpha)}{1 - \mu \cdot \tan(\alpha)}\right)$$

Example with Units

$$393.4375\,\text{N} = 1700\,\text{N} \cdot \left(\frac{0.15 + \tan(4.5°)}{1 - 0.15 \cdot \tan(4.5°)}\right)$$

5.6) Effort Required to Lift Load given Torque Required to Lift Load Formula

Evaluate Formula

Formula

$$P_{li} = 2 \cdot \frac{Mt_{li}}{d_m}$$

Example with Units

$$402.8261\,\text{N} = 2 \cdot \frac{9265\,\text{N*mm}}{46\,\text{mm}}$$

5.7) External Torque required to raise Load given Efficiency Formula

Evaluate Formula

Formula

$$Mt_t = W_a \cdot \frac{L}{2 \cdot \pi \cdot \eta}$$

Example with Units

$$655263.6371\,\text{N*mm} = 131000\,\text{N} \cdot \frac{11\,\text{mm}}{2 \cdot 3.1416 \cdot 0.35}$$

5.8) Helix Angle of Power Screw given Effort Required to Lift Load Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{P_{li} - W \cdot \mu}{P_{li} \cdot \mu + W}\right)$$

Example with Units

$$4.7736° = atan\left(\frac{402\,\text{N} - 1700\,\text{N} \cdot 0.15}{402\,\text{N} \cdot 0.15 + 1700\,\text{N}}\right)$$

5.9) Helix Angle of Power Screw given Torque Required to Lift Load Formula

Evaluate Formula

Formula

$$\alpha = \operatorname{atan}\left(\frac{2 \cdot Mt_{li} - W \cdot d_m \cdot \mu}{2 \cdot Mt_{li} \cdot \mu + W \cdot d_m}\right)$$

Example with Units

$$4.8^\circ = \operatorname{atan}\left(\frac{2 \cdot 9265\,\text{N*mm} - 1700\,\text{N} \cdot 46\,\text{mm} \cdot 0.15}{2 \cdot 9265\,\text{N*mm} \cdot 0.15 + 1700\,\text{N} \cdot 46\,\text{mm}}\right)$$

5.10) Load on Power Screw given Effort Required to Lift Load Formula

Evaluate Formula

Formula

$$W = \frac{P_{li}}{\frac{\mu + \tan(\alpha)}{1 - \mu \cdot \tan(\alpha)}}$$

Example with Units

$$1736.9975\,\text{N} = \frac{402\,\text{N}}{\frac{0.15 + \tan(4.5^\circ)}{1 - 0.15 \cdot \tan(4.5^\circ)}}$$

5.11) Load on Power Screw given Torque Required to Lift Load Formula

Evaluate Formula

Formula

$$W = \left(2 \cdot \frac{Mt_{li}}{d_m}\right) \cdot \left(\frac{1 - \mu \cdot \tan(\alpha)}{\mu + \tan(\alpha)}\right)$$

Example with Units

$$1740.5669\,\text{N} = \left(2 \cdot \frac{9265\,\text{N*mm}}{46\,\text{mm}}\right) \cdot \left(\frac{1 - 0.15 \cdot \tan(4.5^\circ)}{0.15 + \tan(4.5^\circ)}\right)$$

5.12) Load on Screw given Overall Efficiency Formula

Evaluate Formula

Formula

$$W_a = 2 \cdot \pi \cdot Mt_t \cdot \frac{\eta}{L}$$

Example with Units

$$131686.9961\,\text{N} = 2 \cdot 3.1416 \cdot 658700\,\text{N*mm} \cdot \frac{0.35}{11\,\text{mm}}$$

5.13) Maximum Efficiency of Square Threaded Screw Formula

Evaluate Formula

Formula

$$\eta_{max} = \frac{1 - \sin(\operatorname{atan}(\mu))}{1 + \sin(\operatorname{atan}(\mu))}$$

Example

$$0.7416 = \frac{1 - \sin(\operatorname{atan}(0.15))}{1 + \sin(\operatorname{atan}(0.15))}$$

5.14) Mean Diameter of Power Screw given Torque Required to Lift Load Formula

Evaluate Formula

Formula

$$d_m = 2 \cdot \frac{Mt_{li}}{P_{li}}$$

Example with Units

$$46.0945\,\text{mm} = 2 \cdot \frac{9265\,\text{N*mm}}{402\,\text{N}}$$

5.15) Torque Required to Lift Load given Effort Formula

Evaluate Formula

Formula

$$Mt_{li} = P_{li} \cdot \frac{d_m}{2}$$

Example with Units

$$9246\,\text{N*mm} = 402\,\text{N} \cdot \frac{46\,\text{mm}}{2}$$

5.16) Torque Required to Lift Load given Load Formula

Evaluate Formula

Formula

$$Mt_{li} = \left(W \cdot \frac{d_m}{2} \right) \cdot \left(\frac{\mu + \tan(\alpha)}{1 - \mu \cdot \tan(\alpha)} \right)$$

Example with Units

$$9049.0632\,\text{N*mm} = \left(1700\,\text{N} \cdot \frac{46\,\text{mm}}{2} \right) \cdot \left(\frac{0.15 + \tan(4.5°)}{1 - 0.15 \cdot \tan(4.5°)} \right)$$

6) Trapezoidal Thread Formulas

6.1) Coefficient of Friction of Power Screw given Efficiency of Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\mu = (\tan(\alpha)) \cdot \frac{1 - \eta}{\sec(0.253) \cdot \left(\eta + (\tan(\alpha))^2 \right)}$$

Example with Units

$$0.139 = (\tan(4.5°)) \cdot \frac{1 - 0.35}{\sec(0.253) \cdot \left(0.35 + (\tan(4.5°))^2 \right)}$$

6.2) Coefficient of Friction of Screw given Efficiency of Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\mu = \tan(\alpha) \cdot \frac{1 - \eta}{\sec(0.2618) \cdot (\eta + \tan(\alpha) \cdot \tan(\alpha))}$$

Example with Units

$$0.1387 = \tan(4.5°) \cdot \frac{1 - 0.35}{\sec(0.2618) \cdot (0.35 + \tan(4.5°) \cdot \tan(4.5°))}$$

6.3) Coefficient of Friction of Screw given Effort for Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\mu = \frac{P_{li} - \left(W \cdot \tan\left(\alpha \right) \right)}{\sec\left(0.2618 \right) \cdot \left(W + P_{li} \cdot \tan\left(\alpha \right) \right)}$$

Example with Units

$$0.1496 = \frac{402\,\text{N} - \left(1700\,\text{N} \cdot \tan\left(4.5° \right) \right)}{\sec\left(0.2618 \right) \cdot \left(1700\,\text{N} + 402\,\text{N} \cdot \tan\left(4.5° \right) \right)}$$

6.4) Coefficient of Friction of Screw given Effort in Lowering Load Formula

Evaluate Formula

Formula

$$\mu = \frac{P_{lo} + W \cdot \tan\left(\alpha \right)}{W \cdot \sec\left(0.2618 \right) - P_{lo} \cdot \sec\left(0.2618 \right) \cdot \tan\left(\alpha \right)}$$

Example with Units

$$0.145 = \frac{120\,\text{N} + 1700\,\text{N} \cdot \tan\left(4.5° \right)}{1700\,\text{N} \cdot \sec\left(0.2618 \right) - 120\,\text{N} \cdot \sec\left(0.2618 \right) \cdot \tan\left(4.5° \right)}$$

6.5) Coefficient of Friction of Screw given Torque Required in Lifting Load with Trapezoidal Thread Formula

Evaluate Formula

Formula

$$\mu = \frac{2 \cdot Mt_{li} - W \cdot d_m \cdot \tan\left(\alpha \right)}{\sec\left(0.2618 \right) \cdot \left(W \cdot d_m + 2 \cdot Mt_{li} \cdot \tan\left(\alpha \right) \right)}$$

Example with Units

$$0.1501 = \frac{2 \cdot 9265\,\text{N*mm} - 1700\,\text{N} \cdot 46\,\text{mm} \cdot \tan\left(4.5° \right)}{\sec\left(0.2618 \right) \cdot \left(1700\,\text{N} \cdot 46\,\text{mm} + 2 \cdot 9265\,\text{N*mm} \cdot \tan\left(4.5° \right) \right)}$$

6.6) Coefficient of Friction of Screw given Torque Required in Lowering Load with Trapezoidal Thread Formula

Evaluate Formula

Formula

$$\mu = \frac{2 \cdot Mt_{lo} + W \cdot d_m \cdot \tan\left(\alpha \right)}{\sec\left(0.2618 \right) \cdot \left(W \cdot d_m - 2 \cdot Mt_{lo} \cdot \tan\left(\alpha \right) \right)}$$

Example with Units

$$0.15 = \frac{2 \cdot 2960\,\text{N*mm} + 1700\,\text{N} \cdot 46\,\text{mm} \cdot \tan\left(4.5° \right)}{\sec\left(0.2618 \right) \cdot \left(1700\,\text{N} \cdot 46\,\text{mm} - 2 \cdot 2960\,\text{N*mm} \cdot \tan\left(4.5° \right) \right)}$$

6.7) Efficiency of Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\eta = \tan(\alpha) \cdot \frac{1 - \mu \cdot \tan(\alpha) \cdot \sec(0.2618)}{\mu \cdot \sec(0.2618) + \tan(\alpha)}$$

Example with Units

$$0.3322 = \tan(4.5°) \cdot \frac{1 - 0.15 \cdot \tan(4.5°) \cdot \sec(0.2618)}{0.15 \cdot \sec(0.2618) + \tan(4.5°)}$$

6.8) Effort Required in Lifting Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$P_{li} = W \cdot \left(\frac{\mu \cdot \sec((0.2618)) + \tan(\alpha)}{1 - \mu \cdot \sec((0.2618)) \cdot \tan(\alpha)} \right)$$

Example with Units

$$402.7102\,\text{N} = 1700\,\text{N} \cdot \left(\frac{0.15 \cdot \sec((0.2618)) + \tan(4.5°)}{1 - 0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°)} \right)$$

6.9) Effort Required in Lowering Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$P_{lo} = W \cdot \left(\frac{\mu \cdot \sec((0.2618)) - \tan(\alpha)}{1 + \mu \cdot \sec((0.2618)) \cdot \tan(\alpha)} \right)$$

Example with Units

$$128.6305\,\text{N} = 1700\,\text{N} \cdot \left(\frac{0.15 \cdot \sec((0.2618)) - \tan(4.5°)}{1 + 0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°)} \right)$$

6.10) Helix Angle of Screw given Effort Required in Lifting Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\alpha = a\tan\left(\frac{P_{li} - W \cdot \mu \cdot \sec(0.2618)}{W + \left(P_{li} \cdot \mu \cdot \sec(0.2618) \right)} \right)$$

Example with Units

$$4.4773° = a\tan\left(\frac{402\,\text{N} - 1700\,\text{N} \cdot 0.15 \cdot \sec(0.2618)}{1700\,\text{N} + \left(402\,\text{N} \cdot 0.15 \cdot \sec(0.2618) \right)} \right)$$

6.11) Helix Angle of Screw given Effort Required in Lowering Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{W \cdot \mu \cdot \sec\left(15 \cdot \frac{\pi}{180}\right) - P_{lo}}{W + \left(P_{lo} \cdot \mu \cdot \sec\left(15 \cdot \frac{\pi}{180}\right)\right)}\right)$$

Example with Units

$$4.7893° = atan\left(\frac{1700\,\text{N} \cdot 0.15 \cdot \sec\left(15 \cdot \frac{3.1416}{180}\right) - 120\,\text{N}}{1700\,\text{N} + \left(120\,\text{N} \cdot 0.15 \cdot \sec\left(15 \cdot \frac{3.1416}{180}\right)\right)}\right)$$

6.12) Helix Angle of Screw given Torque Required in Lifting Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{2 \cdot Mt_{li} - \left(W \cdot d_m \cdot \mu \cdot \sec\left(0.2618\right)\right)}{\left(W \cdot d_m\right) + \left(2 \cdot Mt_{li} \cdot \mu \cdot \sec\left(0.2618\right)\right)}\right)$$

Example with Units

$$4.5037° = atan\left(\frac{2 \cdot 9265\,\text{N*mm} - \left(1700\,\text{N} \cdot 46\,\text{mm} \cdot 0.15 \cdot \sec\left(0.2618\right)\right)}{\left(1700\,\text{N} \cdot 46\,\text{mm}\right) + \left(2 \cdot 9265\,\text{N*mm} \cdot 0.15 \cdot \sec\left(0.2618\right)\right)}\right)$$

6.13) Helix Angle of Screw given Torque Required in Lowering Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$\alpha = atan\left(\frac{\left(W \cdot d_m \cdot \mu \cdot \sec\left(0.2618\right)\right) - \left(2 \cdot Mt_{lo}\right)}{\left(W \cdot d_m\right) + \left(2 \cdot Mt_{lo} \cdot \mu \cdot \sec\left(0.2618\right)\right)}\right)$$

Example with Units

$$4.4978° = atan\left(\frac{\left(1700\,\text{N} \cdot 46\,\text{mm} \cdot 0.15 \cdot \sec\left(0.2618\right)\right) - \left(2 \cdot 2960\,\text{N*mm}\right)}{\left(1700\,\text{N} \cdot 46\,\text{mm}\right) + \left(2 \cdot 2960\,\text{N*mm} \cdot 0.15 \cdot \sec\left(0.2618\right)\right)}\right)$$

6.14) Load on Screw given Effort Required in Lifting Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$W = \frac{P_{li}}{\frac{\mu \cdot \sec\left(\left(0.2618\right)\right) + \tan\left(\alpha\right)}{1 - \mu \cdot \sec\left(\left(0.2618\right)\right) \cdot \tan\left(\alpha\right)}}$$

Example with Units

$$1697.0021\,\text{N} = \frac{402\,\text{N}}{\frac{0.15 \cdot \sec\left(\left(0.2618\right)\right) + \tan\left(4.5°\right)}{1 - 0.15 \cdot \sec\left(\left(0.2618\right)\right) \cdot \tan\left(4.5°\right)}}$$

6.15) Load on Screw given helix Angle Formula

Evaluate Formula

Formula

$$W = P_{lo} \cdot \frac{1 + \mu \cdot \sec((0.2618)) \cdot \tan(\alpha)}{(\mu \cdot \sec((0.2618)) - \tan(\alpha))}$$

Example with Units

$$1585.9382\,\text{N} = 120\,\text{N} \cdot \frac{1 + 0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°)}{(0.15 \cdot \sec((0.2618)) - \tan(4.5°))}$$

6.16) Load on Screw given Torque Required in Lifting Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$W = Mt_{li} \cdot \frac{1 - \mu \cdot \sec((0.2618)) \cdot \tan(\alpha)}{0.5 \cdot d_m \cdot ((\mu \cdot \sec((0.2618)) + \tan(\alpha)))}$$

Example with Units

$$1700.4893\,\text{N} = 9265\,\text{N*mm} \cdot \frac{1 - 0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°)}{0.5 \cdot 46\,\text{mm} \cdot ((0.15 \cdot \sec((0.2618)) + \tan(4.5°)))}$$

6.17) Load on Screw given Torque Required in Lowering Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$W = \frac{Mt_{lo}}{0.5 \cdot d_m \cdot \left(\frac{(\mu \cdot \sec((0.2618))) - \tan(\alpha)}{1 + (\mu \cdot \sec((0.2618))) \cdot \tan(\alpha))}\right)}$$

Example with Units

$$1700.8613\,\text{N} = \frac{2960\,\text{N*mm}}{0.5 \cdot 46\,\text{mm} \cdot \left(\frac{(0.15 \cdot \sec((0.2618))) - \tan(4.5°)}{1 + (0.15 \cdot \sec((0.2618))) \cdot \tan(4.5°))}\right)}$$

6.18) Mean Diameter of Screw given Torque in Lifting Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$d_m = \frac{Mt_{li}}{0.5 \cdot W \cdot \left(\frac{\mu \cdot \sec((0.2618)) + \tan(\alpha)}{1 - \mu \cdot \sec((0.2618)) \cdot \tan(\alpha)}\right)}$$

Example with Units

$$46.0132\,\text{mm} = \frac{9265\,\text{N*mm}}{0.5 \cdot 1700\,\text{N} \cdot \left(\frac{0.15 \cdot \sec((0.2618)) + \tan(4.5°)}{1 - 0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°)}\right)}$$

6.19) Mean Diameter of Screw given Torque in Lowering Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$d_m = \frac{Mt_{lo}}{0.5 \cdot W \cdot \left(\frac{\mu \cdot \sec((0.2618)) - \tan(\alpha)}{1 + \mu \cdot \sec((0.2618)) \cdot \tan(\alpha)} \right)}$$

Example with Units

$$46.0233\,\text{mm} = \frac{2960\,\text{N*mm}}{0.5 \cdot 1700\,\text{N} \cdot \left(\frac{0.15 \cdot \sec((0.2618)) - \tan(4.5°)}{1 + 0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°)} \right)}$$

6.20) Torque Required in Lifting Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$Mt_{li} = 0.5 \cdot d_m \cdot W \cdot \left(\frac{(\mu \cdot \sec((0.2618))) + \tan(\alpha)}{1 - (\mu \cdot \sec((0.2618)) \cdot \tan(\alpha))} \right)$$

Example with Units

$$9262.334\,\text{N*mm} = 0.5 \cdot 46\,\text{mm} \cdot 1700\,\text{N} \cdot \left(\frac{(0.15 \cdot \sec((0.2618))) + \tan(4.5°)}{1 - (0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°))} \right)$$

6.21) Torque Required in Lowering Load with Trapezoidal Threaded Screw Formula

Evaluate Formula

Formula

$$Mt_{lo} = 0.5 \cdot d_m \cdot W \cdot \left(\frac{(\mu \cdot \sec((0.2618))) - \tan(\alpha)}{1 + (\mu \cdot \sec((0.2618)) \cdot \tan(\alpha))} \right)$$

Example with Units

$$2958.5011\,\text{N*mm} = 0.5 \cdot 46\,\text{mm} \cdot 1700\,\text{N} \cdot \left(\frac{(0.15 \cdot \sec((0.2618))) - \tan(4.5°)}{1 + (0.15 \cdot \sec((0.2618)) \cdot \tan(4.5°))} \right)$$

Variables used in list of Power Screws Formulas above

- **A** Bearing Area between screw and nut *(Square Millimeter)*
- **d** Nominal diameter of screw *(Millimeter)*
- d_c Core diameter of screw *(Millimeter)*
- D_i Inner Diameter of Collar *(Millimeter)*
- d_m Mean Diameter of Power Screw *(Millimeter)*
- D_o Outer Diameter of Collar *(Millimeter)*
- **L** Lead of Power Screw *(Millimeter)*
- Mt_{li} Torque for lifting load *(Newton Millimeter)*
- Mt_{lo} Torque for lowering load *(Newton Millimeter)*
- Mt_t Torsional Moment on Screw *(Newton Millimeter)*
- **p** Pitch of power screw thread *(Millimeter)*
- P_{li} Effort in lifting load *(Newton)*
- P_{lo} Effort in lowering load *(Newton)*
- R_1 Outer Radius of Power Screw Collar *(Millimeter)*
- R_2 Inner Radius of Power Screw Collar *(Millimeter)*
- S_b Unit bearing pressure for nut *(Newton per Square Millimeter)*
- **t** Thread Thickness *(Millimeter)*
- T_c Collar Friction Torque for Power Screw *(Newton Millimeter)*
- t_n Transverse shear stress in nut *(Newton per Square Millimeter)*
- **W** Load on screw *(Newton)*
- W_a Axial load on screw *(Newton)*
- **z** Number of Engaged Threads
- **α** Helix angle of screw *(Degree)*
- **η** Efficiency of power screw
- η_{max} Maximum Efficiency of Power Screw
- **μ** Coefficient of friction at screw thread
- μ_{collar} Coefficient of Friction for Collar

Constants, Functions, Measurements used in list of Power Screws Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **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.*
- Functions: **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.*
- Functions: **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.*
- Functions: **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.*
- Functions: **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 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: **Angle** in Degree (°) *Angle Unit Conversion*
- Measurement: **Torque** in Newton Millimeter (N*mm) *Torque Unit Conversion*

- σ_c Compressive stress in screw *(Newton per Square Millimeter)*
- τ Torsional shear stress in screw *(Newton per Square Millimeter)*
- τ_s Transverse Shear Stress in Screw *(Newton per Square Millimeter)*

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

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