Important Thread Measurement Formulas PDF

Formulas
Examples
with Units

List of 45
Important Thread Measurement Formulas

1) Three Wires System Method Formulas

1.1) ACME Thread Formulas

1.1.1) Diameter of measuring wires ACME threads Formula

Evaluate Formula

Formula

$$G = \frac{M - D + 1.933357 \cdot P}{4.9939}$$

Example with Units

$$1.4017\,mm = \frac{8.2\,mm - 7\,mm + 1.933357 \cdot 3\,mm}{4.9939}$$

1.1.2) Micrometer measurement per reading acme threads Formula

Evaluate Formula

Formula

$$M = D + 4.9939 \cdot G - P \cdot 1.933357$$

Example with Units

$$7.1926\,mm = 7\,mm + 4.9939 \cdot 1.2\,mm - 3\,mm \cdot 1.933357$$

1.1.3) Pitch diameter acme threads Formula

Evaluate Formula

Formula

$$D = M - \left(4.9939 \cdot G - 1.933357 \cdot P\right)$$

Example with Units

$$8.0074\,mm = 8.2\,mm - \left(4.9939 \cdot 1.2\,mm - 1.933357 \cdot 3\,mm\right)$$

1.1.4) Pitch of screw acme threads Formula

Evaluate Formula

Formula

$$P = \frac{D - M + 4.9939 \cdot G}{1.933357}$$

Example with Units

$$2.4789\,mm = \frac{7\,mm - 8.2\,mm + 4.9939 \cdot 1.2\,mm}{1.933357}$$

1.2) British Association Thread Formulas

1.2.1) Diameter of Measuring Wires British Threads Formula

Evaluate Formula

Formula

$$G = \frac{M - D + 1.13634 \cdot P}{3.4829}$$

Example with Units

$$1.3233\,mm = \frac{8.2\,mm - 7\,mm + 1.13634 \cdot 3\,mm}{3.4829}$$

1.2.2) Micrometer Measurement per Reading British Threads Formula

Evaluate Formula

Formula

$$M = D + 3.4829 \cdot G - 1.13634 \cdot P$$

Example with Units

$$7.7705\,mm = 7\,mm + 3.4829 \cdot 1.2\,mm - 1.13634 \cdot 3\,mm$$

1.2.3) Pitch diameter British thread Formula

Evaluate Formula

Formula

$$D = M - 3.4829 \cdot G + 1.13634 \cdot P$$

Example with Units

$$7.4295\,mm = 8.2\,mm - 3.4829 \cdot 1.2\,mm + 1.13634 \cdot 3\,mm$$

1.2.4) Pitch of Screw British Formula 📢

Formula

$$P = \frac{D + 3.4829 \cdot G - M}{1.13634}$$

Example with Units

$$2.622\,\text{mm} = \frac{7\,\text{mm} + 3.4829 \cdot 1.2\,\text{mm} - 8.2\,\text{mm}}{1.13634}$$

1.3) Lowenherz Thread Formulas 📢

1.3.1) Diameter of Measuring Wires Formula 📢

Formula

$$G = \frac{M + P - D}{3.23594}$$

Example with Units

$$1.2979\,\text{mm} = \frac{8.2\,\text{mm} + 3\,\text{mm} - 7\,\text{mm}}{3.23594}$$

1.3.2) Micrometer Measurement per Reading Lowenherz Formula 📢

Formula

$$M = D + 3.23594 \cdot G - P$$

Example with Units

$$7.8831\,\text{mm} = 7\,\text{mm} + 3.23594 \cdot 1.2\,\text{mm} - 3\,\text{mm}$$

1.3.3) Pitch Diameter Lowenherz Formula 📢

Formula

$$D = M - 3.23594 \cdot G + P$$

Example with Units

$$7.3169\,\text{mm} = 8.2\,\text{mm} - 3.23594 \cdot 1.2\,\text{mm} + 3\,\text{mm}$$

1.3.4) Pitch of Screw Lowenherz Formula 📢

Formula

$$P = D - M + 3.23594 \cdot G$$

Example with Units

$$2.6831\,\text{mm} = 7\,\text{mm} - 8.2\,\text{mm} + 3.23594 \cdot 1.2\,\text{mm}$$

1.4) Metric Thread Formulas 📢

1.4.1) Diameter of Wire used in Three Wire System Method Formula 📢

Formula

$$G_m = \frac{M - D + \frac{P \cdot \cot(\theta)}{2}}{1 + \csc(\theta)}$$

Example with Units

$$0.9588\,\text{mm} = \frac{8.2\,\text{mm} - 7\,\text{mm} + \frac{3\,\text{mm} \cdot \cot(60°)}{2}}{1 + \csc(60°)}$$

1.4.2) Ideal wire diameter in three wire system method Formula 📢

Formula

$$G_m = \left(\frac{P}{2}\right) \cdot \sec\left(\frac{\theta}{2}\right)$$

Example with Units

$$1.7321\,\text{mm} = \left(\frac{3\,\text{mm}}{2}\right) \cdot \sec\left(\frac{60°}{2}\right)$$

1.4.3) Micrometer reading from three wire system method Formula 📢

Formula

$$M = D + G_m \cdot (1 + \csc(\theta)) - \frac{P \cdot \cot(\theta)}{2}$$

Example with Units

$$9.8832\,\text{mm} = 7\,\text{mm} + 1.74\,\text{mm} \cdot (1 + \csc(60°)) - \frac{3\,\text{mm} \cdot \cot(60°)}{2}$$

1.4.4) Pitch diameter from three wire system method Formula 📤

Formula

$$D = M - \left(G_m \cdot (1 + cosec(\theta)) - \frac{P \cdot \cot(\theta)}{2} \right)$$

Example with Units

$$5.3168\,{mm} = 8.2\,{mm} - \left(1.74\,{mm} \cdot (1 + cosec(60°)) - \frac{3\,{mm} \cdot \cot(60°)}{2} \right)$$

1.4.5) Pitch of thread from three wire system method Formula 📤

Formula

$$P = \frac{D + G_m \cdot (1 + cosec(\theta)) - M}{\frac{\cot(\theta)}{2}}$$

Example with Units

$$8.8306\,{mm} = \frac{7\,{mm} + 1.74\,{mm} \cdot (1 + cosec(60°)) - 8.2\,{mm}}{\frac{\cot(60°)}{2}}$$

1.4.6) Pitch of thread given ideal wire diameter Formula 📤

Formula

$$P = \frac{2 \cdot G_m}{\sec\left(\frac{\theta}{2}\right)}$$

Example with Units

$$3.0138\,{mm} = \frac{2 \cdot 1.74\,{mm}}{\sec\left(\frac{60°}{2}\right)}$$

1.4.7) Thread Angle given Ideal Wire Diameter Formula 📤

Formula

$$\theta = 2 \cdot arcsec\left(\frac{2 \cdot G_m}{P}\right)$$

Example with Units

$$60.9006° = 2 \cdot arcsec\left(\frac{2 \cdot 1.74\,{mm}}{3\,{mm}}\right)$$

1.5) Sharp-V Thread Formulas 📤

1.5.1) Diameter of Wire used Sharp V Formula 📤

Formula

$$G = \frac{M - D + 0.86603 \cdot P}{3}$$

Example with Units

$$1.266\,{mm} = \frac{8.2\,{mm} - 7\,{mm} + 0.86603 \cdot 3\,{mm}}{3}$$

1.5.2) Micrometer Measurement per Reading Sharp V Formula 📤

Formula

$$M = D + 3 \cdot G - 0.86603 \cdot P$$

Example with Units

$$8.0019\,{mm} = 7\,{mm} + 3 \cdot 1.2\,{mm} - 0.86603 \cdot 3\,{mm}$$

1.5.3) Pitch Diameter Sharp V Formula 📤

Formula

$$D = M - 3 \cdot G + 0.86603 \cdot P$$

Example with Units

$$7.1981\,{mm} = 8.2\,{mm} - 3 \cdot 1.2\,{mm} + 0.86603 \cdot 3\,{mm}$$

1.5.4) Pitch of Screw Threads Sharp V Formula 📤

Formula

$$P = \frac{D + 3 \cdot G - M}{0.86603}$$

Example with Units

$$2.7713\,{mm} = \frac{7\,{mm} + 3 \cdot 1.2\,{mm} - 8.2\,{mm}}{0.86603}$$

1.6) Unified and National Threads Formulas ➦

1.6.1) Diameter of Wire used Unified and National Threads Formula ➦

Evaluate Formula ➦

Formula

$$G = \frac{M - D + 0.86603 \cdot P}{3}$$

Example with Units

$$1.266_{\,mm} = \frac{8.2_{\,mm} - 7_{\,mm} + 0.86603 \cdot 3_{\,mm}}{3}$$

1.6.2) Micrometer Measurement per Reading Formula ➦

Evaluate Formula ➦

Formula

$$M = D + 3 \cdot G - 0.86603 \cdot P$$

Example with Units

$$8.0019_{\,mm} = 7_{\,mm} + 3 \cdot 1.2_{\,mm} - 0.86603 \cdot 3_{\,mm}$$

1.6.3) Pitch diameter Unified national threads Formula ➦

Evaluate Formula ➦

Formula

$$D = M - 3 \cdot G + 0.86603 \cdot P$$

Example with Units

$$7.1981_{\,mm} = 8.2_{\,mm} - 3 \cdot 1.2_{\,mm} + 0.86603 \cdot 3_{\,mm}$$

1.6.4) Pitch of Screw Threads Formula ➦

Evaluate Formula ➦

Formula

$$P = \frac{D - M + 3 \cdot G}{0.86603}$$

Example with Units

$$2.7713_{\,mm} = \frac{7_{\,mm} - 8.2_{\,mm} + 3 \cdot 1.2_{\,mm}}{0.86603}$$

1.7) Unsymmetrical Threads Formulas ➦

1.7.1) Best size wire Formula ➦

Evaluate Formula ➦

Formula

$$G = P \cdot \left(\frac{\tan\left(\frac{a_1 + a_2}{2}\right) \cdot \sec(a_1)}{\tan(a_1) + \tan(a_2)} \right)$$

Example with Units

$$1.5_{\,mm} = 3_{\,mm} \cdot \left(\frac{\tan\left(\frac{0.5° + 0.2°}{2}\right) \cdot \sec(0.5°)}{\tan(0.5°) + \tan(0.2°)} \right)$$

1.7.2) Best wire size for modified buttress 45deg and 7deg Formula ➦

Evaluate Formula ➦

Formula

$$G = 0.54147 \cdot P$$

Example with Units

$$1.6244_{\,mm} = 0.54147 \cdot 3_{\,mm}$$

1.7.3) Micrometer reading per measurement Formula ➦

Evaluate Formula ➦

Formula

$$M = D_u - \left(\frac{P}{\tan(a_1) + \tan(a_2)} \right) + G \cdot \left(1 + \cos ec\left(\frac{a_1 + a_2}{2}\right) \cdot \cos\left(\frac{a_1 - a_2}{2}\right) \right)$$

Example with Units

$$8.2946_{\,mm} = 56.2_{\,mm} - \left(\frac{3_{\,mm}}{\tan(0.5°) + \tan(0.2°)} \right) + 1.2_{\,mm} \cdot \left(1 + \cos ec\left(\frac{0.5° + 0.2°}{2}\right) \cdot \cos\left(\frac{0.5° - 0.2°}{2}\right) \right)$$

1.7.4) Pitch diameter unsymmetrical threads Formula ➤

Formula

$$D_u = M + \left(\frac{P}{\tan(a_1) + \tan(a_2)} \right) - G \cdot \left(1 + \mathrm{cosec}\left(\frac{a_1 + a_2}{2} \right) \cdot \cos\left(\frac{a_1 - a_2}{2} \right) \right)$$

Example with Units

$$56.1054\,\mathrm{mm} = 8.2\,\mathrm{mm} + \left(\frac{3\,\mathrm{mm}}{\tan(0.5°) + \tan(0.2°)} \right) - 1.2\,\mathrm{mm} \cdot \left(1 + \mathrm{cosec}\left(\frac{0.5° + 0.2°}{2} \right) \cdot \cos\left(\frac{0.5° - 0.2°}{2} \right) \right)$$

1.7.5) Pitch for modified buttress 45deg and 7deg Formula ➤

Formula

$$P = \frac{G}{0.54147}$$

Example with Units

$$2.2162\,\mathrm{mm} = \frac{1.2\,\mathrm{mm}}{0.54147}$$

1.7.6) Pitch of Screw Unsymmetrical Threads Formula ➤

Formula

$$P = \left(D_u + G \cdot \left(1 + \mathrm{cosec}\left(\frac{a_1 + a_2}{2} \right) \cdot \cos\left(\frac{a_1 - a_2}{2} \right) \right) - M \right) \cdot \left(\tan(a_1) + \tan(a_2) \right)$$

Example with Units

$$3.0012\,\mathrm{mm} = \left(56.2\,\mathrm{mm} + 1.2\,\mathrm{mm} \cdot \left(1 + \mathrm{cosec}\left(\frac{0.5° + 0.2°}{2} \right) \cdot \cos\left(\frac{0.5° - 0.2°}{2} \right) \right) - 8.2\,\mathrm{mm} \right) \cdot \left(\tan(0.5°) + \tan(0.2°) \right)$$

1.8) USA Standard Taper Pipe Thread Formulas ➤

1.8.1) Diameter of Wire used USA Standard Taper Pipe Formula ➤

Formula

$$G = \frac{1.00049 \cdot M - D + 0.86603 \cdot P}{3.00049}$$

Example with Units

$$1.2672\,\mathrm{mm} = \frac{1.00049 \cdot 8.2\,\mathrm{mm} - 7\,\mathrm{mm} + 0.86603 \cdot 3\,\mathrm{mm}}{3.00049}$$

1.8.2) Micrometer Reading per Measurement USA Standard Taper Pipe Formula ➤

Formula

$$M = \frac{D + 3.00049 \cdot G - 0.86603 \cdot P}{1.00049}$$

Example with Units

$$7.9986\,\mathrm{mm} = \frac{7\,\mathrm{mm} + 3.00049 \cdot 1.2\,\mathrm{mm} - 0.86603 \cdot 3\,\mathrm{mm}}{1.00049}$$

1.8.3) Pitch Diameter USA Standard Taper Pipe Formula ➤

Formula

$$D = 1.00049 \cdot M - \left(3.00049 \cdot G - 0.86603 \cdot P \right)$$

Example with Units

$$7.2015\,\mathrm{mm} = 1.00049 \cdot 8.2\,\mathrm{mm} - \left(3.00049 \cdot 1.2\,\mathrm{mm} - 0.86603 \cdot 3\,\mathrm{mm} \right)$$

1.8.4) Pitch of Screw USA Standard Taper Formula ➤

Formula

$$P = \frac{D - 1.00049 \cdot M + 3.00049 \cdot G}{0.86603}$$

Example with Units

$$2.7673\,\mathrm{mm} = \frac{7\,\mathrm{mm} - 1.00049 \cdot 8.2\,\mathrm{mm} + 3.00049 \cdot 1.2\,\mathrm{mm}}{0.86603}$$

1.9) Whitworth Thread Formulas

1.9.1) Diameter of Wire Formula

Formula	Example with Units	Evaluate Formula
$$G = \frac{M - D + 0.96049 \cdot P}{3.16568}$$	$$1.2893_{mm} = \frac{8.2_{mm} - 7_{mm} + 0.96049 \cdot 3_{mm}}{3.16568}$$	

1.9.2) Micrometer Reading per Measurement Whitworth Formula

Formula	Example with Units	Evaluate Formula
$M = D + 3.16568 \cdot G - 0.96049 \cdot P$	$7.9173_{mm} = 7_{mm} + 3.16568 \cdot 1.2_{mm} - 0.96049 \cdot 3_{mm}$	

1.9.3) Pitch diameter whitworth Formula

Formula	Example with Units	Evaluate Formula
$D = M - 3.16568 \cdot G + 0.96049 \cdot P$	$7.2827_{mm} = 8.2_{mm} - 3.16568 \cdot 1.2_{mm} + 0.96049 \cdot 3_{mm}$	

1.9.4) pitch of screw threads whitworth Formula

Formula	Example with Units	Evaluate Formula
$$P = \frac{D - M + 3.16568 \cdot G}{0.96049}$$	$$2.7057_{mm} = \frac{7_{mm} - 8.2_{mm} + 3.16568 \cdot 1.2_{mm}}{0.96049}$$	

2) Two Wires System Method Formulas

2.1) Diameter of wire used in measurement over wires method Formula

Formula	Example with Units	Evaluate Formula
$G_o = M + 0.866 \cdot P - D$	$3.798_{mm} = 8.2_{mm} + 0.866 \cdot 3_{mm} - 7_{mm}$	

2.2) Micrometer reading from measurement over wires method Formula

Formula	Example with Units	Evaluate Formula
$M = D - \left(0.866 \cdot P - G_o \right)$	$8.212_{mm} = 7_{mm} - \left(0.866 \cdot 3_{mm} - 3.81_{mm} \right)$	

2.3) Pitch diameter from measurement over wires method Formula

Formula	Example with Units	Evaluate Formula
$D = M + 0.866 \cdot P - G_o$	$6.988_{mm} = 8.2_{mm} + 0.866 \cdot 3_{mm} - 3.81_{mm}$	

2.4) Pitch of thread from measurement over wires method Formula

Formula	Example with Units	Evaluate Formula
$$P = \frac{D + G_o - M}{0.866}$$	$$3.0139_{mm} = \frac{7_{mm} + 3.81_{mm} - 8.2_{mm}}{0.866}$$	

Variables used in list of Thread Measurement Formulas above

- a_1 Large Angle *(Degree)*
- a_2 Small Angle *(Degree)*
- D Pitch Diameter *(Millimeter)*
- D_u Thickness of Screw *(Millimeter)*
- G Wire Diameter *(Millimeter)*
- G_m Wire Diameter Metric Thread *(Millimeter)*
- G_o Diameter of Wire Two Wire Method *(Millimeter)*
- M Micrometer Reading *(Millimeter)*
- P Screw Pitch *(Millimeter)*
- θ Thread Angle *(Degree)*

Constants, Functions, Measurements used in list of Thread Measurement Formulas above

- Functions: **arcsec**, arcsec(x)
  Inverse trigonometric secant – Unary function.
- Functions: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Functions: **cosec**, cosec(Angle)
  The cosecant function is a trigonometric function that is the reciprocal of the sine function.
- Functions: **cot**, cot(Angle)
  Cotangent is a trigonometric function that is defined as the ratio of the adjacent side to the opposite side in a 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: **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: **Angle** in Degree (°)
  Angle Unit Conversion

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