THREAD MEASURING WIRE FORMULAS

Best Size Wires

* Wires which touch the thread at the pitch diameter are known as "Best Size" Wires. Such wires are used because the measurements of pitch diameter are least affected by errors that may be present in the angle of the thread. The diameter of the measuring wires is represented by the letter G.

The approximate formula for Best Size Wires is:	$G = \dfrac{secant\ a}{2n}$
For 60° threads Best Size Wires	$G = \dfrac{.57735}{n}$ or .57735p
For 55° threads Best Size Wires	$G = \dfrac{.56369}{n}$ or .56369p
For 53° - 8 threads Best Size Wires	$G = .55902p$
For 47 1/2° threads Best Size Wires	$G = .54626p$
For 40° threads Best Size Wires	$G = \dfrac{.53208}{n}$ or .532089p
For 29° threads Best Size Wires	$G = \dfrac{.51645}{n}$ or .51645p

Unsymmetrical Threads

$$E = M + \frac{1}{n\,(\tan a1 + \tan a2)} - G\left(1 + \cos ec\frac{a_1 + a_2}{2} \cos\frac{a_1 - a_2}{2}\right)$$

$$G = \frac{\tan\frac{(a_1 + a_2)}{2} \sec a_1}{n\,(\tan a1 + \tan a2)} \qquad \textbf{Where} \quad \begin{array}{l} a_1 = \text{Large Angle} \\ a_2 = \text{Small Angle} \end{array}$$

For Modified Buttress 45° and 7° $G = \dfrac{.54147}{n}$

On 29° and 40° worm threads, the addendum above the pitch diameter is $\dfrac{.3183}{n}$

The thread depth of $\dfrac{.6866}{n}$ provides a clearance of $\dfrac{.50}{n}$ at the bottom of the thread.

Symbols for Basic Dimensions and Wire Measurement

Major Diameter = D
Corresponding Radius = d
Pitch Diameter = E
Corresponding Radius = e
Minor Diameter = K
Corresponding Radius = k
Angle of thread = A
One half angle of thread = a
Number of turns per inch = N
Number of threads per inch = n
Lead L = 1/N
pitch p = 1/n
Helix Angle = s
Tangent of helix angle
S = L/3.14159xE

Width or basic flat at top, crest or root = F
Depth of Basic truncation = f
Depth of Sharp V thread = H
Depth of American Nation or unified thread form = h
Length of engagement = Q
Included angle of taper = Y
One half included angle of taper = y
Measurement over wires – MOW = M
Wire Diameter = G
Corresponding radius = g

Approximate Formulas for Measured Pitch Diameter

The following approximate formulas for computing the pitch diameter, from the measurement over wires, should be used only for screws having lead angles from 0° to 5°. These formulas neglect the effect of lead angle and give results which show the screw to be larger than the true condition. The formulas are for any wire size which will fit in the thread.

Designation	Included Angle	Thread Depth	Formula for Finding Pitch Diameter With 3 Wire Method
Unified & National	60°	$\dfrac{.649519}{n}$	$E = M - \dfrac{(3G - .86603)}{n}$
USA Standard Taper Pipe (3 wires)	60°	$\dfrac{.8}{n}$	$E = 1.00049M - \dfrac{(3.00049G - .86603)}{n}$
Sharp V	60°	$\dfrac{.8660254}{n}$	$E = M - \dfrac{(3G - .86603)}{n}$
International Metric	60°	$\dfrac{.649519}{n}$	$E = M - \dfrac{(3G - .86603)}{n}$
Whitworth	55°	$\dfrac{.64033}{n}$	$E = M - \dfrac{(3.16568G - .96049)}{n}$
British Association	47 1/2°	.6p	$E = M - (3.4829G - 1.13634p)$
Lowenherz	53° - 8	.75p	$E = M - (3.23594G - p)$
Acme Screws	29°	$\dfrac{1}{2n}$	$E = M - \dfrac{(4.9939G - 1.933357)}{n}$
Acme Taps	29°	$\dfrac{1}{2n}$	$E = M - \dfrac{(4.9939G - 1.933357)}{n}$
29° Worm	29°	$\dfrac{.6866}{n}$	Use wire $\dfrac{.5149}{n}$ to come flush with top of thread
40° Worm	40°	$\dfrac{.6866}{n}$	Use wire $\dfrac{.51234}{n}$ to come flush with top of thread

Approximate Formulas for Basic Measurement Over Wires

When cutting or grinding a screw thread, it is desirable to know what the measurement over wires would be for a screw of the theoretical basic size. The following approximate formulas are the same as those above, but transposed and referred to the basic outside diameter of the screw. The same qualifications apply.

Designation	Included Angle	Formula for Finding Measurement Over Wires
Unified & National	60°	$M = D - \dfrac{1.51555}{n} + 3G$
American Standard Pipe	60°	$M = \dfrac{E - \dfrac{.8660254}{n} + 3.00049G}{1.00049}$
Sharp V [2]	60°	$M = D - \dfrac{1.73205}{n} + 3G$
International Metric	60°	$M = D - 1.51553p + 3G$
Whitworth	55°	$M = D - \dfrac{1.60082}{n} + 3.16568G$
British Association	47 1/2°	$M = D - 1.73634p + 3.4829G$
Lowenherz	53° - 8	$M = D - 1.75p + 3.23594G$
Acme Screws, Taps and 29° Worms	29°	$M = D - \dfrac{2.43334}{n} + 4.9939\,G$
29° Worm	29°	$M = D$ (with $\dfrac{.5149}{n}$ wires)
40° Worm	40°	$M = D$ (with $\dfrac{.51234}{n}$ wires) Also $M = D - \dfrac{2.01034}{n} + 3.9238G$