

# Engineering Data

## Definition of Terms Applying to Taps

### ALLOWANCE

Minimum clearance between two mating parts; the prescribed variations from the basic size.

### ANGLE OF THREAD

The angle included between the sides of the thread measured in an axial plane.

### AXIS

The imaginary straight line that forms the longitudinal centerline of the tool or threaded part.

### BACK TAPER

A gradual decrease in the diameter of the thread form on a tap from the chamfered end of the land towards the back which creates a slight radial relief in the threads.

### BASE OF THREAD

The bottom section of the thread; the greatest section between the two adjacent roots.

### BASIC SIZE

The theoretical or nominal standard size from which all variations are derived by application of allowances and tolerances.

### CHAMFER

The tapering of the threads at the front end of each land of a tap by cutting away and relieving the crest of the first few teeth to distribute the cutting action over several teeth; *Taper taps* are chamfered 7-10 threads; *plug taps* are chamfered 3-5 threads; *semi-bottoming (or modified bottoming) taps* are chamfered 2-2.5 threads; *bottoming taps* are chamfered 1-2 threads; *taper pipe taps* are chamfered 2-3.5 threads.

### CHAMFER RELIEF

The gradual decrease in land height from cutting edge to heel on the chamfered portion, to provide clearance for the cutting action as the tap advances.

### CREST

The top surface joining the two sides or flanks of the thread; the crest of an external thread is at its major diameter, while the crest of an internal thread is at its minor diameter.

### CUTTING FACE

The leading side of the land in the direction of cutting rotation on which the chip forms.

### FLUTE

The longitudinal channels formed in a tap to create cutting edges on the thread profile, and to provide chip spaces and cutting fluid passages.

### HEEL

The edge of the land opposite the cutting edge.

### HEIGHT OF THREAD

The distance, measured radially, between the crest and the base of a thread.

### HELIX ANGLE

The angle made by the advance of the thread as it wraps around an imaginary cylinder.

### HOOK

The undercut on the face of the teeth.

### HOOK ANGLE

The inclination of a concave cutting face, usually specified either as Chordal Hook or Tangential Hook.

**Chordal Hook Angle:** The angle between the chord passing through the root and crest of a thread form at the cutting face, and a radial line through the crest at the cutting edge.

**Tangential Hook Angle:** The angle between a line tangent to a hook cutting face at the cutting edge and a radial line to the same point.

### INTERRUPTED THREAD TAP

A tap having an odd number of lands with alternate teeth along the thread helix removed. In some cases alternate teeth are removed only for a portion of the thread length.

### LAND

The part of the tap body which remains after the flutes are cut, and on which the threads are finally ground. The threaded section between the flutes of a tap.

### LEAD

The axial distance a tap will advance along its axis in one complete turn. On a single start, the lead and the pitch are identical; on a double start, the lead is twice the pitch.

### MAJOR DIAMETER

Commonly known as the "outside diameter." It is the largest diameter of the thread.

### MINOR DIAMETER

Commonly known as the "root diameter." It is the smallest diameter of the thread.

### PERCENT OF THREAD

One-half the difference between the basic major diameter and the actual minor diameter of an internal thread, divided by the basic thread height, expressed as a percentage.

### PITCH

The distance from any point on a screw thread to a corresponding point on the next thread, measured parallel to the axis and on the same side of the axis. The pitch equals one divided by the number of threads per inch.



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### PITCH DIAMETER

On a straight thread, the pitch diameter is the diameter of the imaginary co-axial cylinder...the surface of which would pass through the thread profiles at such points as to make the width of the groove equal to one-half of the basic pitch. On a perfect thread this occurs at the point where the widths of the thread and groove are equal. On a taper thread, the pitch diameter at a given position on the thread axis is the diameter of the pitch cone at that position.

### RAKE

The angular relationship of the straight cutting face of a tooth with respect to a radial line through the crest of the tooth at the cutting edge. *Positive rake* means that the crest of the cutting face is angularly ahead of the balance of the cutting face of the tooth. *Negative rake* means that the crest of the cutting face is angularly behind the balance of the cutting face of the tooth. *Zero rake* means that the cutting face is directly on a radial line.

### RELIEF (or Thread Relief)

The removal of metal from behind the cutting edge to provide clearance and reduce friction between the part being threaded and the threaded land.

### ROOT

The bottom surface joining the sides of two adjacent threads, and is identical with or immediately adjacent to the cylinder or cone from which the thread projects.

### SPIRAL FLUTE

A flute with uniform axial lead in a spiral path around the axis of a tap.

### SPIRAL POINT

The angular fluting in the cutting face of the land at the chamfered end; formed at an angle with respect to the tap axis of opposite hand to that of rotation. Its length is usually greater than the chamfer length and its angle with respect to the tap axis is usually made great enough to direct the chips ahead of the taps cutting action.

### STRAIGHT FLUTE

A flute that forms a cutting edge lying in an axial plane.

### TOLERANCE

In producing a tap to given specifications, tolerance is: (a.) the total permissible variation of a size; (b.) the difference between the limits of size.

## Chamfers for Thread Cutting Taps

The tap chamfer is the tapering of the threads to distribute cutting action over several teeth. The type of hole to be tapped has much to do with the chamfer style of that tap that's best suited. Some holes go all the way through; some, while not through-holes, are relatively deep; some are quite shallow (a little deeper than diameter). Each of these three kinds of holes - through, deep-bottoming blind, and shallow bottoming - has a tap chamfer best suited to threading requirements.



**Taper Taps** - This style, with a **7-10 thread chamfer**, has the longest chamfer of the three to distribute action over the maximum number of teeth; and the taper also acts as a guide in starting the cutting action in the hole. Taper style taps start the thread square with the workpiece. Taper taps are commonly used in through holes and in materials where a tapered guide is necessary.



**Plug Taps** - This style, with a **3-5 thread chamfer**, is most widely used in through holes and where there is sufficient room at the bottom in blind holes.

**Semi (or Modified) Bottoming Taps** - This style, with a **2 to 2.5 thread chamfer**, should be used whenever possible in difficult material applications in blind holes, when threads are not required to the bottom of the hole.



**Bottoming Taps** - This style, designed with a **1 to 2 thread chamfer**, is made with just enough chamfer for starting in the hole; as the name implies, it is designed to thread blind holes to the bottom.

**NOTE:** Taper, plug and bottoming taps as a set, in a given size (for example: 1/4-20 NC) are identical as to size, length and vital measurements; the difference is in the chamfered threaded portion at the point. As a rule, such taps when used by hand are furnished in sets of three of a given size...namely, taper, plug and bottoming (and should be used in that order).