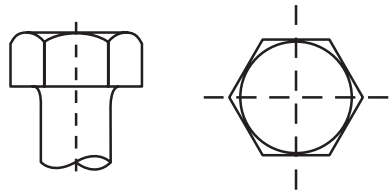
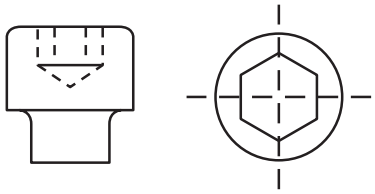
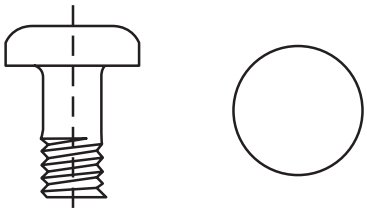
Bolts / Screws

1 Head Types

Sketch	Title	Comments
	Hexagon Head	The most common head on bolt products and also seen on many screw products. Can come in several versions.
	Cap Head	Normally incorporating a recess and usually associated with very high tensile products, eg: socket head cap screws.
	Pan Head (Round)	Predominantly used on screw products where a flat bearing surface is required or conversely, where a countersunk is not required.
	Countersunk Head (Flat)	Most common usage is on screw products where a flush fit is required on the surface, eg: door hinges and timber joinery or into steel applications, e.g. : manhole cover plates.

2 Thread Types

A thread is a ridge of uniform section in the form of a helix on the internal or external surface of a cylinder (IFI description) or it could be described as a sloping plane curled around a cylinder.

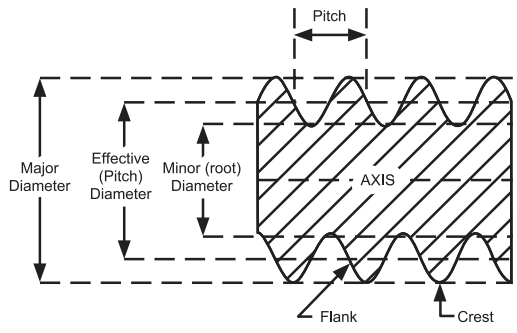
External threads are on bolts or screws.

Internal threads are on nuts.

There are many forms of threads but two types are in common use on fasteners.

2.1 Machine Screw Threads - used on bolts, setscrews, machine screws and designed to mate with preformed threads in nuts or tapped holes.

Basic Features: Major (nominal) diameter
Effective (pitch) diameter
Minor (root) diameter
Pitch
Flank
Crest



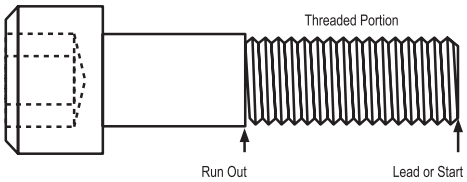
The major diameter can be measured with a simple calliper rule or slot gauge accurately enough to determine the nominal diameter. A bolt or screw is measured at the crests; a nut is measured at the thread roots.

The effective diameter, minor diameter, flank angle and pitch require specialist measurement equipment for technical accuracy. However, simple measurement at the thread crests will be accurate enough for most practical purposes in measuring pitch and determining thread designation.

Thread Angles
Machine screw threads are symmetrical – the angle on both flanks being the same – refer to illustration.

Unified and Metric
Flank angles for METRIC, UNC and UNF are 30°
∴ a total thread angle of 60°

All machine screw threaded products, bolts or screws have common technical terms when referring to the thread
- Lead or start of thread
- Threaded portion
- Thread run out



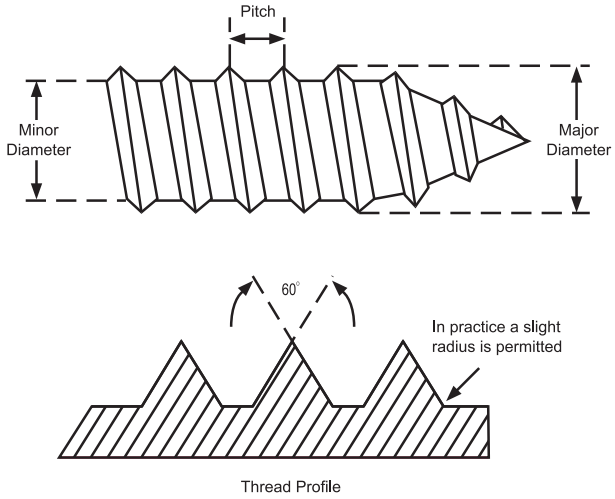
Lead – is the point at which the thread groove is visible on the point of the screw.

Threaded portion – is the total section of the screw on which there is a thread.

Thread run out – is the point at which the thread and the plain shank meet.

2.2 Spaced Threads – used on woodscrews, self-tapping screws, coach screws and Type 25 thread cutters. Designed to form its own thread, usually in a pre-drilled hole.

Basic Features: Major (nominal) diameter
Minor (root) diameter
Pitch



The major diameter can be measured with a simple calliper rule or slot gauge accurately enough to determine nominal diameter. The measurement is taken on the crests.

The minor diameter and the pitch require specialist measuring equipment for technical accuracy. However, simple measurement at the crests will be accurate enough for most practical purposes in measuring pitch and determining thread designation.

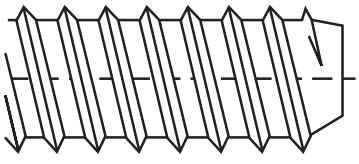
The diameter of imperial spaced threads is expressed as gauge or 'number'#.

The pitch of imperial spaced threads is expressed as threads per inch (TPI).

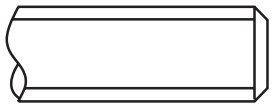
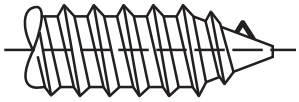
e.g.: a standard AB self-tapping screw, therefore, would be:-
6-20 where 6 is the gauge number and 20 is the TPI
or
10–16 where 10 is the gauge number and 16 is the TPI

Self Tapping Screws
Designed to form a matching thread in the materials being joined. Usually into pre-drilled or pre-punched holes in sheet metals (needle point or S point versions self pierce or self drill).

They are heat treated and hardened, are often used into spring steel clips or speed nuts and can also be used in aluminium castings, plywoods, soft and high impact plastics, zinc die castings.



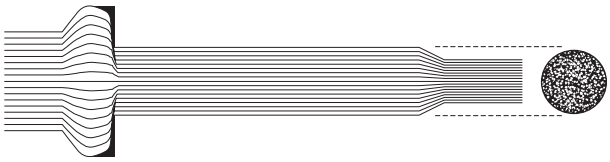
3 Point Types

Sketch	Title	Comments
	Chamfer Cut Point	The normal point found on most good quality hexagon bolts/set screws and cap screws. The chamfer is applied in a pointing station on a bolt-maker prior to ejection through the thread rolling plates.
	Drill Point	A point very similar to a standard drill and designed to drill then tap or form a thread whilst driving. Some are milled points, some pinch pointed in special cold headers.
	Type AB Point	When on a self-tapper, it is called "AB", on a woodscrew or coach screw is called "gimlet". A die produced point in the primary cold header, thread rolled leaving a thread start on the taper. This helps pull the screw into the hole and start the tapping groove.

4 Manufacturing of Bolts, Screws and Studs

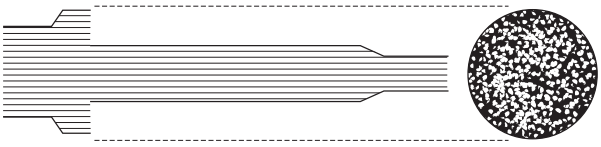
Cold Heading

Below is a cold headed part formed from the diameter of wire shown to the right. Unbroken metal flow lines (grain) greatly increase fatigue life and enhance load-carrying ability.



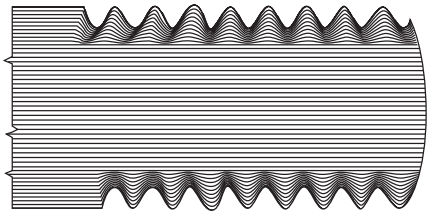
Machining

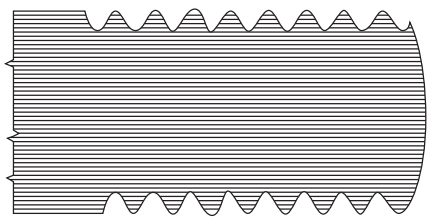
Illustrated below is a representation of a bolt produced by machining a large diameter bar or wire. Grain or metal flow lines are broken through the head and washer section, which creates planes of weakness.



Thread Rolling

No metal is cut away, the grain flow lines are unbroken and curve around the thread profiles. The cold rolling stresses the roots in compression, significantly increasing fatigue strength. Smooth roll dies create burnished roots and smooth flanks free from cutter tool marks, reducing potential galling and stress risers.



Thread Cutting

The grain flow lines are cut and planes of weakness are created.