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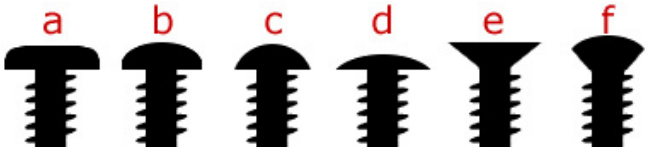
Machine Screw Information

Machine screws

Materials available include Steel, Stainless steel and Brass.

Countersunk machine screw (Measure: total length).
A Countersunk machine screws is designed to fit flush with the surface of the fastened material for a smooth safe finish.
Raised Countersunk machine screw.
A raised head on a countersunk machine screw giving a slightly rounded top for a more finished look.
Pan head machine screw (Measure: from under head).
A domed head machine screw sits on the surface of the material to be fastened, has a flat underside and can be used with washers.
Cheese Head machine Screw (Measure: from under head).
Head style: Slotted. A Cheese head machine screw sits on the surface of the material to be fastened and have a flat underside, can be used with washers.
Round Head machine screw (Measure: from under head).
Head style: Slotted. A Round head machine screw sits on the surface of the material to be fastened and have a flat underside, can be used with washers.

Shapes of screw head



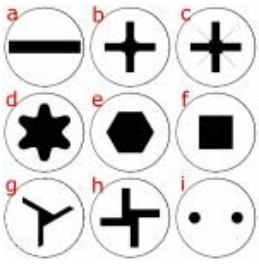
(a) Pan, (b) Button, (c) Round, (d) Truss, (e) Flat, (f) Oval

- *Pan head*: a low disc with chamfered outer edge.
- *Button* or *dome head*: cylindrical with a rounded top.
- *Round*: dome-shaped, commonly used for machine screws.
- *Truss*: lower-profile dome designed to prevent tampering.
- *Flat* or *Countersunk*: conical, with flat outer face and tapering inner face allowing it to sink into the material, very common for wood screws.
- *Oval*: countersunk with a rounded top.
- *Cheese head*: disc with cylindrical outer edge, height approximately half the head diameter.
- *Fillister head*: cylindrical, but with a slightly convex top surface.
- *Socket head*: cylindrical, relatively high, with different types of sockets (hex, square Torx, etc.)
- *Mirror screw head*: countersunk head with a tapped hole to receive a separate screw-in chrome-plated cover, used for attaching mirrors.

Headless machine screws, called "setscrews" or "grubscrews", are also used. They either have a socket or a slot.

Types of machine screw drive
Modern machine screws employ a wide variety of drive designs, each requiring a different kind of tool to drive in or extract them. The most common screw drives are the slotted and Phillips; hex, Robertson, and torx are also common in some

applications. Some types of drive are intended for automatic assembly in mass-production of such items as automobiles. More exotic screw drive types may be used in situations where tampering is undesirable, such as in electronic appliances that should not be serviced by the home repairperson.



(a) Slotted, (b) Phillips, (c) Pozidriv, (d) Torx, (e) Hex, (f) Robertson, (g) Tri-Wing, (h) Torq-Set, (i) Spanner

- *Slot* head has a single slot, and is driven by a flat-bladed screwdriver. The slotted screw is common in woodworking applications, but is not often seen in applications where a power driver would be used, due to the tendency of a power driver to slip out of the head and potentially damage the surrounding material.
- *Cross-head*, *cross-point* or *Phillips* screw has a "+"-shaped slot and is driven by a cross-head screwdriver, designed originally for use with mechanical screwing machines. The Phillips screw drive has slightly rounded corners in the tool recess, and was designed so the driver will slip out, or *cam out*, under strain to prevent over-tightening. The Phillips Screw Company was founded in Oregon in 1933 by Henry F. Phillips, who bought the design from J. P. Thompson. Phillips was unable to manufacture the design, so he passed the patent to the American Screw Company, who were the first to manufacture it.
- *Pozidriv* is patented, similar to cross-head but designed not to slip, or come out. It has four additional points of contact, and does not have the rounded corners that the Phillips screw drive has. Phillips screwdrivers will usually work in Pozidriv screws, but Pozidriv screwdrivers are likely to slip or tear out the screw head when used in Phillips screws. Pozidriv was jointly patented by the Phillips Screw Company and American Screw Company.
- *Torx* is a star-shaped or splined bit with six rounded points. These were found in early Apple Macintosh computers, to discourage home repairs. A "tamper-proof" type of Torx head has a small pin inside the socket.
- *Hexagonal or hex* screw head has a hexagonal hole and is driven by a hexagonal wrench, sometimes called an Allen key, or by a power tool with a hexagonal bit.
- *Robertson* head has a square hole and is driven by a special power-tool bit or screwdriver. The screw is designed to maximize torque transferred from the driver, and will not slip, or cam out. It is possible to hold a Robertson screw on a driver bit horizontally or even pendant, due to a slight wedge fit. Commonly found in Canada in carpentry and woodworking applications and in Canadian-manufactured electrical wiring items such as receptacles and switch boxes.
- *square-drive* head is an American clone of the Robertson that has a square hole without taper. Due to the lack of taper, the hole must oversize relative to the screwdriver, and is much more likely to strip than the Robertson.
- *Tri-Wing* screws have a triangular slotted configuration. They are for instance used by Nintendo on its Game Boys to discourage home repair.
- *Torx-Set* is an uncommon screw drive that may be confused with Phillips; however, the four legs of the contact area are offset in this drive type.
- *Spanner* drive uses two round holes opposite each other, and is designed to prevent tampering. Commonly seen in elevators in the United States.

Tamper resistant machine screw

tamper-resistant Torx driver
Many screw drives, including Phillips, Torx, and Hexagonal, are also manufactured in tamper-resistant form. These typically have a pin protruding in the centre of the bit, necessitating a special tool for extraction.

one-way slotted screw
The slotted screw drive also comes in a tamper-resistant one-way design with sloped edges; the screw can be driven in, but the bit slips out in the reverse direction.

Tools used
The hand tool used to drive in most screws is called a screwdriver. A power tool that does the same job is a power screwdriver; power drills may also be used with screw-driving attachments. Where the holding power of the screwed joint is critical, torque-measuring and torque-limiting screwdrivers are used to insure sufficient and not excess force is developed by the screw. The hand tool for driving cap screws and other types is called a spanner (UK usage) or wrench (US usage).

Machine Screw measurements
There are many systems for specifying the dimensions of machine screws, but in much of the world the ISO preferred series metric has displaced the many older systems. See also: Unified Thread Standard.

Metric machine screws
The diameter of a ISO preferred series machine screw is usually specified in millimetres (mm) prefixed by the capital letter M, as in "M6" for a 6 mm diameter screw.

The pitch of metric threads varies according to the diameter, but not absolutely regularly. Some examples: a M3 thread has a 0.5 mm pitch, M4 0.7 mm, M6: 1 mm, M10: 1.5 mm, M12: 1.75 mm, M14: 2 mm, M16: 2 mm, M18 to M22: 2.5 mm.

The diameter of a metric machine screw is the outer diameter of the thread. The tapped hole (or nut) into which the screw fits, has an internal diameter which is the size of the screw minus the pitch of the thread. Thus, an M6 screw, which has a pitch of 1 mm, is made by threading a 6 mm shaft, and the nut or threaded hole is made by tapping threads in a 5 mm hole.

Metric machine screw threads are also available in "fine pitch" versions, sometimes several pitches for one diameter (example: M18/fine in 1, 1.5 and 2 mm pitches). The fine thread series is deprecated and not recommended for use in new designs. The fine metric threads were once found in equipment made in the Far East, but that has changed with the standardisation of the ISO preferred thread series.

Non-metric machine screws
Before the metric system was common, many engineering companies had their own standard screw sizes. The first person to create a standard (in about 1841) was the English engineer Sir Joseph Whitworth. Whitworth screw sizes are still used, both for repairing old machinery and where a coarser thread than the metric fastener thread is required. This system had two thread sizes: coarse (BSW) and fine (BSF). The thread angle was 55°.

A later standard in the UK was the BA system, named after the British Association for Advancement of Science. Screws were described as "2BA", "4BA" etc., the odd numbers being rarely used. While not related to ISO metric screws, the sizes were actually defined in metric terms, a 0BA thread having a 1 mm pitch. These are still the most common threads in some niche applications. Certain types of fine machinery, such as moving-coil meters, tend to have BA threads wherever they are manufactured. Curiosly enough, even though every other fastener on a camera may use metric threads, the tripod socket will likely be a 1/4"-20 thread.

The USA has its own system, usually called the Unified Thread Standard. A version of this standard, called SAE for the Society of Automotive Engineers, was used in the American automobile industry. The SAE is still associated with inch based fasteners by the public even though the U.S. auto industry (and other heavy industries relying on SAE) switched to ISO preferred series fasteners back in the 1970s and afterwards.

Screws are described as 4-40, 6-32, 8-32, 10-32, 10-24, etc. (for numeric sizes, odd numbers are rare), or 1/4"-20, 1/4"-28, etc. (for inch unit sizes), with the first number giving shaft diameter (numeric or inches) and the second number being *threads per inch*.

These machine screws are sometimes found outside the USA in older model personal computers based on the IBM PC specification. Since the computer industry is now based in Asia (mostly Taiwan), the industry now uses metric fasteners. As more and more products are made outside the U.S. and then imported into the U.S., the use of inch based fasteners is declining, and it is only a matter of time before the inch fastener series is gone forever.

Other thread systems include BSP (British Steam Pipe; used for other purposes as well) and CEI (Cycle Engineers Institute, used on bicycles in Britain and possibly elsewhere), NPT and NPTF (coarse and fine pipe threads), and PG (German: "Panzer-Gewinde"), used in thin plate metal, such as for switches and nipples in electrical equipment housings.

History

In antiquity, the Greek mathematician Archytas of Tarentum (428 – 350 BC) was credited with the invention of the screw. By the 1st century BC, wooden screws were commonly used throughout the Mediterranean world in devices such as oil and wine presses. Metal screws did not appear in Europe until the 1400s.

The metal screw did not become a common woodworking fastener until machine tools for mass production it were developed at the end of the 18th century. The British engineer Henry Maudslay patented a screw-cutting lathe in 1797; a similar device was patented by David Wilkinson in the United States the next year.

Standardization of screw thread forms accelerated during WWII so that interchangeable parts could be produced by any of the Allied countries.