



FASTENER REFERENCE GUIDE

Fastener Types

BOLTS



Hex Bolts, as referred to as hex cap screws, often used to make a bolted joint with a nut and washer. Commonly used in machinery and construction. Typically have a six sided, hexagon head. Fully threaded bolts are often referred to as tap bolts.



Carriage Bolts, have smooth, domed heads with a square section underneath that pulls into the material to prevent spinning during installation. Some carriage bolts have ribbed necks in place of square necks.



Lag Bolts, or lag screws, are large wood screws with hex heads. Typically used for wood construction.

NUTS



Are used to fasten machine threaded fasteners in through-hole applications. Lock nuts are used to prevent mating parts from loosening.

SCREWS



Machine Screws, are fully threaded and used with a threaded nut or in a tapped hole. Some machine screws are referred to as stove bolts.



Socket Screws, have machine screw threads with an Allen drive (internal hex socket). Not all sockets are fully threaded.



Sheet Metal Screws, have sharp points and angular threads, and are designed to be driven directly into sheet metal and softer materials like fiberglass, plastic or wood.



Wood Screws, have large threads and a smooth shank for pulling two pieces of material together. They can be used in wood and other soft materials.

WASHERS



Flat washers spread the load over a larger surface area when tightening a bolt, screw or nut. Lock washers prevent loosening of a bolted assembly.

Fastener Head Styles



FLAT

Countersunk head with a flat top.



ROUND

A domed head..



TRUSS

Extra wide round.



SOCKET CAP

Cylindrical head, typically knurled.



OVAL

Countersunk head with a round



HEX

Hexagonal head.



BUTTON

Rounded head with socket



PAN

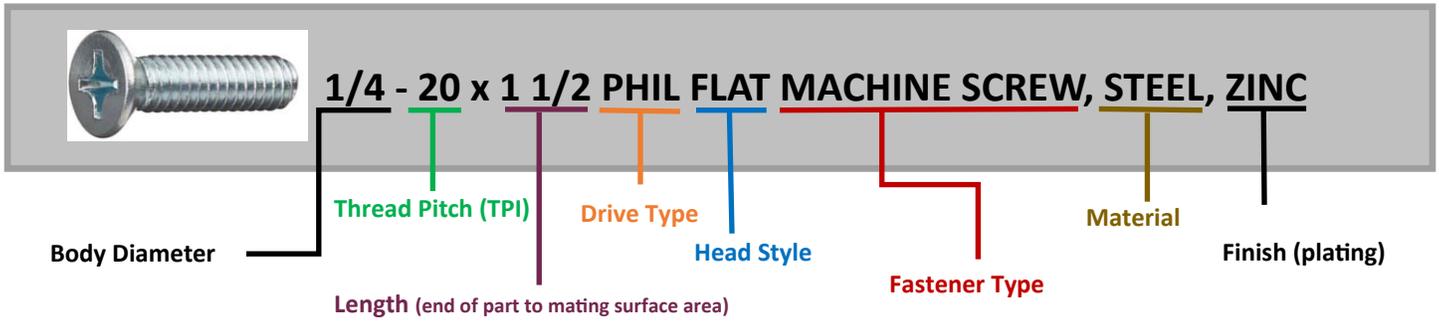
Rounded head with short verti-



HEX WASHER

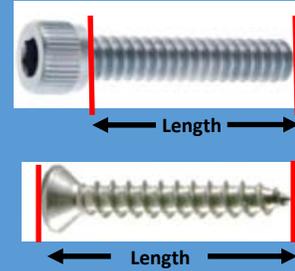
Hex head with built in washer.

Understanding Fastener Descriptions



Measuring Length

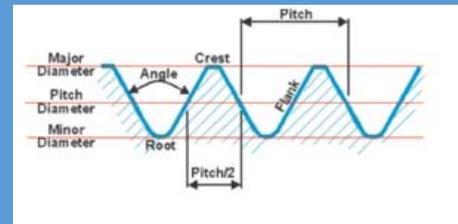
Fastener length is measured from where the material surface is assumed to be, to the end of the fastener. For fasteners where the head usually sits above the surface, the measurement is from directly under the head to the end of the fastener.



Understanding Thread Pitch and TPI

Threads Per Inch, commonly referred to TPI is the number of threads per inch on a threaded fastener. Typically there is a coarse pitch (most common) and fine thread pitch for machine screw threads.

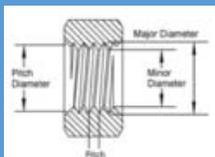
TPI is measured in Threads Per Inch (US Standard) or as Thread Pitch in mm (Metric standard).



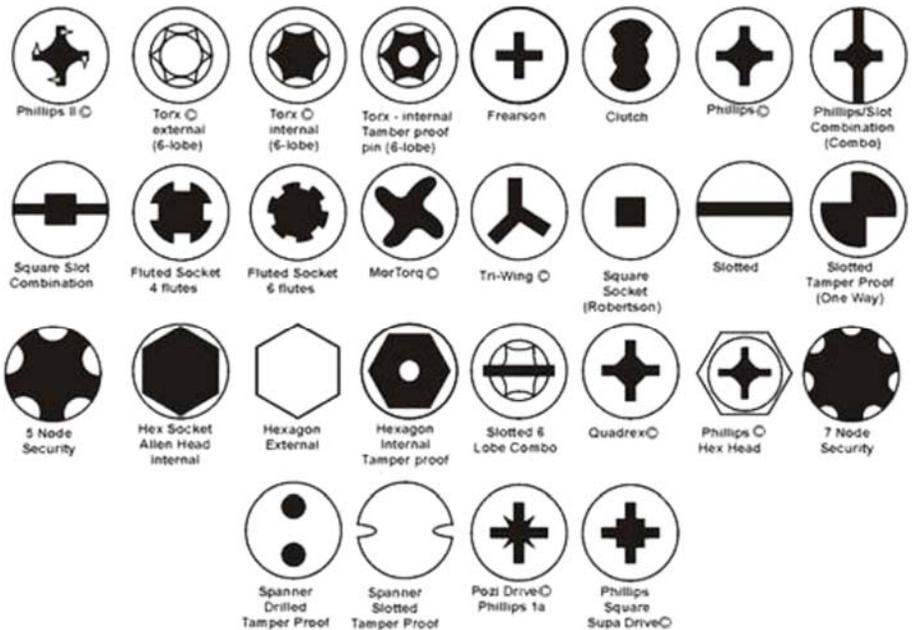
Part Diameters

Diameters of external thread fasteners are determined by the major diameter of the part. For sizes below 1/4", diameters are identified by industry standard numeric sizes. For example, #8 is a 0.164 diameter, #10 is a 0.190 diameter part.

Diameters of female or internal fasteners are determined by the mating external threaded part.



Fastener Drive Types



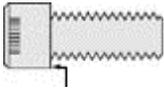
Glossary of Terms

Allowance: An intentional difference between the material limits of mating parts, either in the minimum clearance or maximum interference between the parts.

Angularity: The angle between the axes of two fastener surfaces.

Anvil: The part of an installation tool nose assembly used to swage the collar of a lock bolt fastener. Commonly known as a swaging anvil.

Band Anneal: Induction heat treatment used on certain rivets and High-Strength Hexert® inserts.

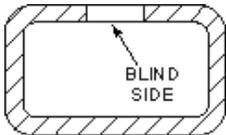


Bearing Surface: The area that carries load across the face of the material.



Binding Head: One with a rounded top surface, slightly tapered sides and a flat bearing surface, a portion of which may be undercut adjacent to the shank.

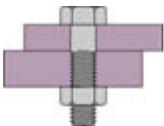
Blind Fastener: A fastener that can be placed with access to only one side of an application.



Blind Side: The side of the joint, which cannot be accessed (e.g. the inside surface of a tubular or box section).

Body: In blind fasteners, the portion of the rivet that expands into the parent material. In threaded fasteners, the unthreaded portion of the fastener under the head.

Body Diameter: The diameter of the unthreaded portion of a threaded shank.

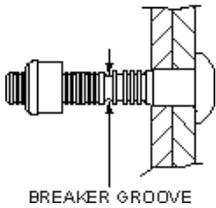


Bolt: An externally threaded fastener that requires a nut to secure the fastened joint.

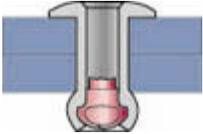
Boss: Protuberance on a plastic part designed to add strength and/or facilitate fastening or

alignment.

Bottom up: Rivet tool pointing up.



Breaker Groove: A weakened groove in the stem or pin of a fastener allowing breakage at a pre-determined load.

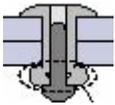


Break stem: A fastener, which is installed by gripping and pulling the end of the mandrel/stem. As installation is completed, the end of the stem fractures at the breaker groove and is discarded, leaving the head of the stem in the fastener body.

Broach (with reference to Avdel® Speed Fastening™ System): The action of pulling the mandrel through the speed fastener in order to place it.

Broach Load (with reference to Avdel® Speed Fastening™ System): The force required to pull the mandrel through the speed fastener in order to place it.

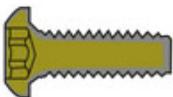
BSW - Whitworth Thread: An imperial thread form standard, no longer in mainstream use. It is covered by British Standard BS 84.



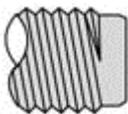
Bulbing: The physical action of the fastener body swelling (expanding radially) against the rear face of the joint when placed. Generally found in break stem fasteners and threaded inserts.



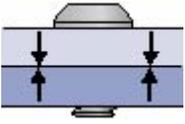
Button Head: For threaded fasteners, one with a low, rounded top surface and a large, flat bearing surface.



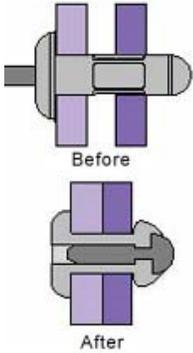
Case Hardened: Heat treated fastener in which the surface is harder than the core.



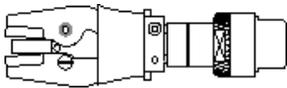
Chamfer point: A truncated cone point, the end of which is approximately flat and perpendicular to the fastener axis. On threaded fasteners, chamfer points generally have included angles of 45° to 90° and a point diameter equal to or slightly less than the minor diameter.



Clamp Load: The total load across the joint interface in service. This may vary during service life.



Clench: The ability of a fastener to draw together and hold together initially separated joint material components, during the installation process (i.e. "gap closing" ability).

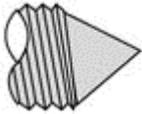


Collar Cropper/Splitter

An installation tool attachment that removes collars from lock bolt fasteners.

Cold form: Creating components by using forces greater than the material's elastic limit to create extrusions and upsets.

Complete Hole Fill: Fasteners with this feature will expand to fill irregular, slotted, oversized or misaligned holes.



Cone Point: Sharp, conical end of a fastener designed to perforate the application material or align the fastener during assembly.

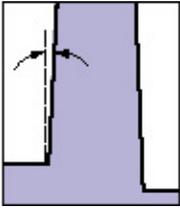
Continuous Feed: Automatic feeding of parts with no operator interjection except for keeping the feeder bowl full.



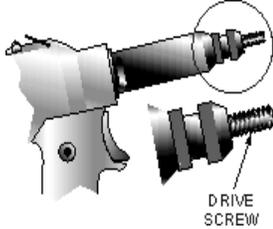
Countersunk Head: One that is designed to be flush with the surface after installation.

Crack: A clean, crystalline fracture which passes through or across the grain boundaries without inclusion of foreign elements.

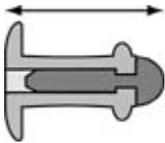
Creep: Permanent deformation of a material caused by time, temperature and pressure.



Draft Angle: The amount of slope in the boss hole and/or outside edge, measured from a line perpendicular to the bottom of the boss.



Drive Screw: The male threaded part in the nose of a threaded insert installation tool, which engages the female thread of inserts OR a type of fastener with a high helix angle that is installed into a hole with a press or hammer.



Elongation: The stretching of a fastener along its axis by an applied load.

Endurance Limit/ Strength: The maximum alternating stress that a fastener can withstand for a specified number of stress cycles without failure.

Fatigue Strength: The ability of a fastener to resist fracture when subjected to cyclic variations in stress.

Fillers: Inert additives or reinforcements that are added to a polymer to change one or more of its characteristics such as strength or wear resistance.



Fillister Head: One with a rounded top, cylindrical sides, and flat bearing surface.



Fillet/Fillet Radius: Concave junction at two intersecting surfaces of a fastener. Often used to describe the junction between the head and the shank of a threaded fastener (under head fillet).

Fit: The resulting range of tightness, which may occur due to the application of tolerances and allowances in the mating joint members.

Flange: A disc shaped rim formed on the end of a cylindrical object, often related to the head geometry of a fastener or the collar of a lock bolt.

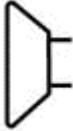
Flank Angle: See thread profile



Flat Head: One with a level surface and a conical bearing surface; available in various nominal head angles.



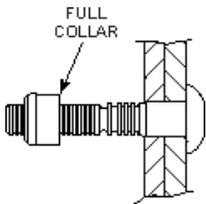
Flat Trim Head: A flat head with a smaller diameter and lower head height than a standard flat head. TrimFit® fasteners have this type of head.



Flat Undercut Head: A standard flat head undercut to 70% of the basic head height.

Follower Spring (with reference to Avdel® Speed Fastening System): A spring placed on a mandrel after the fasteners have been loaded. The follower spring assists in moving the fasteners through the nosepiece as the last few rivets are placed.

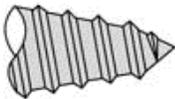
Free Standing: A stand-alone installation system, which includes a frame.



Full Collar: A standard full height lock bolt collar.

Full Diameter Body/Full-Size Body: an unthreaded portion of a fastener whose diameter is within the dimensional limits of the threaded portion.

Gap Closing: See clench.



Gimlet Point: A threaded cone point usually with a point angle of 45° to 50°. It is used on many thread-forming screws.

Grip: The thickness of all of the materials or parts that the fastener is designed to secure when assembled.

Grip Range: The minimum and maximum thickness of all of the materials or parts that the fastener is designed to secure when assembled.

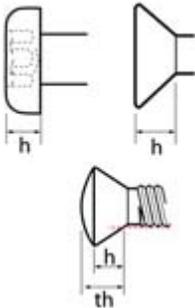


Half Collar: A reduced height lock bolt collar used to minimize collar protrusion. Note: will reduce tensile performance. Compare to full collar.

Hardening: Changing the strength characteristics of a fastener through heat treatment or work hardening. See case hardening, induction hardening, and through hardening

Header Point: A chamfered point produced on the blank during the heading operation, before the threads are rolled.

Head form/Head Style: The characteristics of the fastener head. Head styles include large flange, low profile, countersunk, pan, truss, hex, hex flange and socket head.

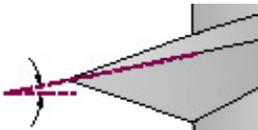


Head Height:

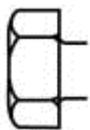
for a flat surface: the overall distance, measured parallel to the fastener axis, from the top to the bearing surface.

for a conical bearing surface: the overall distance, measured in a line parallel to the fastener axis, from the top to the intersection of the bearing surface with the extended major diameter cylinder on a threaded fastener, or with the shank on an unthreaded fastener.

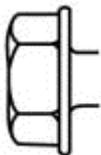
for flat and oval undercut heads: the distance measured to the intersection of the bearing surface with the undercut. For oval heads and undercut oval heads, the overall distance is referred to as total head height.



Helix Angle: The angle between the helix of the thread and a line perpendicular to the axis of the screw.



Hexagon Head/Hex Head: One with a flat or indented top surface, six flat sides, and a flat bearing surface.



Hexagon Washer Head/Hex Washer Head: A hex head with an integral, formed washer at the base of the hexagon. The washer diameter may be equal to or greater than the width across the corners.



Hexagon Flange Head/Hex Flange Head: Hex head with a integral circular collar connected to the base of the hexagon by a conic section. Normally, the flanged diameter is larger than the width across the corners of the hexagon.

Hole Size: The size of the opening into which the fastener will be inserted.

Hydra-pneumatic (also hydro-pneumatic): The use of an air over oil intensification system to generate pressure for the placement of rivets.



Induction Hardened: A heat-treated fastener that has undergone a selective hardening process, using induction coils, to further strengthen a part of the fastener.

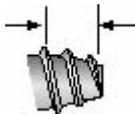
Jaws:

1. The part of the nosepiece that opens to permit a fastener to protrude for placement.
 2. The part of the tool that grips the mandrel to expand the rivet.
-

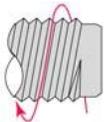
Knurls: Ridges on the exterior surface of a fastener that provide increased torque-to-turn resistance or other performance enhancement. Also called splines.



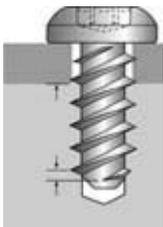
Lead-in Chamfer: The tapered end of a fastener which helps ease insertion.



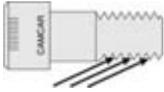
Lead Thread: The thread length from where it starts to where it becomes full size. This distance on machine screws is usually one-half the screw diameter.



Left-Hand Thread: Opposite of standard threads (right-hand threads), receding threads wind in a counter-clockwise direction when the fastener is viewed axially. All left-hand threads are designated LH.



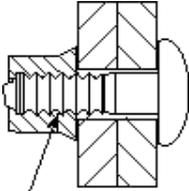
Length of Engagement: The length of full-sized fastener threads that engage in the nut material. The length of the lead thread is not counted in the length of engagement, since its reduced size minimizes any performance benefits. The length of engagement is usually expressed in relationship to the nominal diameter of the screw (e.g. 2 to 2-1/2 diameters of engagement).



Load Flank: For threaded fasteners, the top portion of each thread which applied the preload or load pressure to the mating threads.

Lock bolt: A two-piece fastener designed to provide high strength and vibration resistance. Access is required to both sides of the joint and installation is achieved by swaging the collar onto the locking grooves of the pin.

Locked Stem: The stem, or mandrel, is locked in the fastener shell during placement. Eliminates the risk of the stem vibrating loose from the rivet head.



Locking Grooves

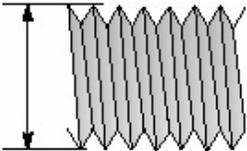
A set of grooves on the pin of a lock bolt fastener, into which the collar is swaged.

LOCKING GROOVES

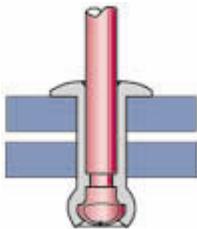


Magazine-Fed (with reference to Avdel® Speed Fastening System): Refers to a number of speed fasteners, which may be handled and loaded into an installation tool as a single item.

Shown in photograph, left to right: pre-loaded mandrel; empty mandrel; pod.



Major diameter: The outside or largest diameter of an outside thread.



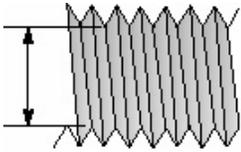
Mandrel:

A specially processed steel rod onto which the magazine of speed fasteners is loaded. Also the stem/nail section of a break stem fastener.

Maximum Grip: The largest recommended thickness of joint material for a fastener.

Mechanically Locked Stem: The stem or mandrel is locked in the fastener shell during placement via a mechanical system. This eliminates the risk of the stem vibrating loose from

the fastener head and the problems associated with loose stems.



Minor diameter: The inside or smallest diameter of an external thread.

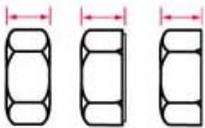
Nail Point: A sharp, pyramidal end generally having a point angle of 30° to 45°, which is produced by a pinching operation. It is designed for piercing wood and other resilient materials.

Nominal diameter: The major diameter of a screw or, in TRI-ROUNDULAR™ fasteners, the "C" dimensions. This designation is used for the purpose of general identification.

Nose: The working mechanism that grips the fastener to set it.

Nose Assembly/Nose Equipment: A kit of parts fitted to an installation tool. The nose assembly must be matched to a specific fastener as it influences its installation and performance.

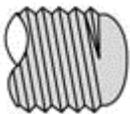
Nose Tip: The interchangeable front most part of a nose assembly. The nose tip must be matched to a specific fastener as it influences its installation and performance.



Nut Thickness: The overall distance from the top of the nut to the bearing surface, measured parallel to the axis of the nut.



Oval Head: One with a rounded top surface and a conical bearing surface, with a head angle of nominally 82° (90° for metric).



Oval Point: A radius point; sometimes referred to as a round point.

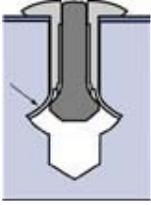


Pan Head: One with a flat bearing surface and a flat top surface rounding into a cylindrical side surface. On recessed pan heads, the top surface is semi-elliptical, rounding into a cylindrical side surface.

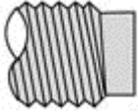
Passivation/Passivated: A process to remove contaminants from the surface of stainless steel. Also a name for the chromatic process applied to some metallic finishes to enhance corrosion resistance.

Peak Drive Torque: Amount of force required to pull the members of a joint together; the point

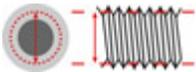
at which clamp begins to generate.



Peel-Type Tail: A rivet body which is designed to split open on the blind side of the joint during the installation process to provide a large blind side bearing area in soft materials.



Pilot point: A cylindrical point with a diameter somewhat smaller than the shank diameter, which aids alignment and starting during installation. Also called a dog point.



Pitch Cylinder: For threaded fasteners, a cylinder parallel to the fastener axis whose diameter is equidistant between the major and minor diameters.

Pitch Diameter: On straight threads, the diameter of the pitch cylinder.

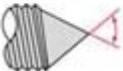
PLC (Programmable Logic Controller): Typically used to control the sequence of events required to step a machine through its functions.

Pod: A magazine of speed fasteners contained within a strip of bonded paper tape.

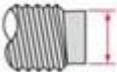
Point: For threaded fasteners, a conical or cylindrical configuration at the end of the shank on a headed fastener, or each end of a headless fastener. Point types include pilot, gimlet, and nail.



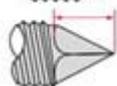
Point Angle: The slope of the end configuration.



Point Diameter: The distance measured at the extreme end of the fastener. It may sometimes be designated as "chamfer diameter" or "pilot diameter" on respective point types.



Point Length: The distance measured parallel to the axis of the fastener from the extreme end. It may sometimes be designated as "chamfer length" or "pilot length" on respective point types.



Proof load: Amount of load a fastener can withstand before permanent plastic deformation will

occur.

Pulling Force: The axial force the tool applies during the installation of rivets.



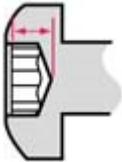
Pull Grooves: A set of grooves on a rivet or lock bolt stem to enhance the grip of the tool when pulling.

Pull-Out: The minimum force required to laterally remove a fastener from the parent material.

Push-Out: The minimum force required to displace a threaded insert through and out of the parent material.



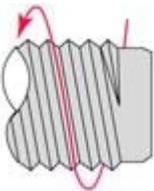
Radial Stress (hoop stress): Forces that propagate from the fastener towards the outside diameter of the joint.



Recess Depth: The distance measured parallel to the fastener axis from the head surface/maximum diameter of the drive system recess to the bottom of that recess.

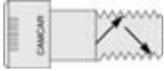
Reference Dimension: A measurement without tolerance used for informational purposes only.

Repetition Riveter: Any Speed Fastening™ riveting system.



Right Hand Thread: Standard thread design; winds clockwise in a receding direction.

Rockwell Hardness Test: Test designed to measure the hardness of the fastener, based on an alphanumeric scale. The higher the number, the harder the fastener. Rockwell tests are utilized to test for decarburization and carburization and to determine the amount of resistance to permanent deformation during the testing procedure. They also ensure that heat treating was performed to specification.



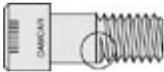
Root: The base of the V thread. This is the weakest point on a threaded fastener because it has the smallest cross-sectional area.



Round Head: One with a semi-elliptical top surface and a flat bearing surface. This term is also used to describe a fastener head designed without a driving surface or recess.

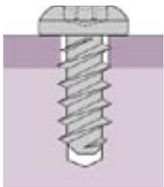


Round Washer Head: A round head with an integral washer at its base.



Run out Thread: The thread section that is between the last scratch of thread and the fillet or body.

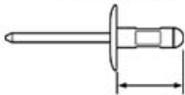
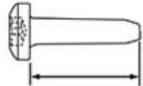
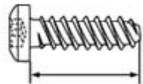
Sems: Fastener with captivated washer or other secondary element.



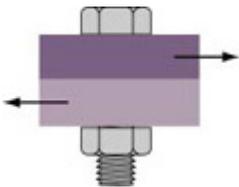
Screw: An externally threaded fastener that does not require a nut to secure the fastened joint.



Seam: A narrow, non-crystalline discontinuity, which is usually inherent on the raw material. Seams are usually straight or smooth curved line-discontinuities running parallel to the product axis.

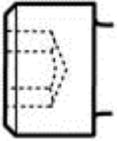


Shank: The portion of a fastener under the head.



Shear: Force that tends to divide an object along a plane parallel to the opposing stresses. Usually measured in lbf/in², psi, MPa or N/m²

Shear Strength: Resistance to transverse loading. Usually defined as a force in Newton's (N) or pounds (lb).



Socket Head: One with a flat chamfered top surface with a smooth or knurled side surface, and a flat bearing surface. A hexagon or spline (formerly known as “fluted”) socket is formed in the center of the top surface.

Soft set: Mechanical action of pulling the rivet tight to the nose piece prior to riveting.



Speed Fastening System: A speed fastening installation tool into which a magazine of fasteners is loaded. This system facilitates very rapid installation rates.

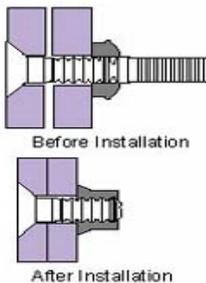


Splines: Ridges on the exterior surface of a fastener that provide increased torque-to-turn resistance or other performance enhancement. Also called knurls.

Split-tail: See peel-type tail

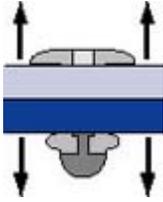
Stem: The part of a break stem fastener that is retained within the body. Also known as the mandrel.

Stem Retention: The force required to separate the stem from the body of an uninstalled break stem fastener.



Swaging: The action of permanently radially-deforming the collar of a lock bolt onto the pin.

Tail jaws: In Speed Fastening™ tools, the part that grips the mandrel to pull it through the rivet.

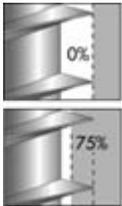


Tensile Strength: The amount of longitudinal load/elongation a fastener can withstand without failure of the fastener or joint. Measured in lbf/in², psi, MPa or N/m²

Tensile Strength Area: Those used to calculate the tensile strength of an externally threaded fastener, so that the fastener strength is consistent with the material strength. It corrects for the notch and helix effects of the threads, and is a function of the pitch and minor diameters.

Thermoplastic: Polymers characterized by their ductility (fillers may be added to increase stiffness or other characteristics). Thermoplastics can be re-melted and reformed several times without degrading the material.

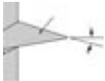
Thermo set: Polymer characterized by extreme stiffness; the initial molding process causes a chemical reaction that "cures" the material, so the resin cannot be reprocessed.



Thread Engagement: The amount of thread tooth that is filled by the application material. This measurement is usually expressed as a percentage and is used to determine optimal hole size.

Threaded Fastener: Any screw/bolt (external threads), nut (internal threads), or combination with machine/standard or engineered threads. Does not include custom stamped or formed components with internal and/or external threads.

Threaded Insert: A fastener that provides load-bearing threads in materials too thin or brittle to accept regular standard fasteners.



Thread Profile/Thread Angle: The angle between the flank of the thread and a line perpendicular to the screw axis.



Through Hardened: Heat treated fastener with uniform hardness from the surface to the core.

TIR Approved: A European standard used by the Vehicle Inspectorate — Executive Agency. It is an approved bonding scheme enabling goods vehicles to travel between countries approved by their respective Customs Authorities. The bonding scheme ensures that all load compartments, once sealed (using TIR approved fasteners), cannot have anything added or taken from them without breaking seals or leaving obvious traces of structural damage.

Torque-To-Turn: Typically the torque required to rotate an installed fastener in the application material. Usually used in reference to threaded inserts and clinch fasteners; may also be called Unsupported Torque Resistance.

Torsion: Twisting force applied to a fastener.



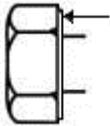
Truss Head: One with a rounded top surface and a flat bearing surface; the diameter of the truss head is larger in comparison to the fastener size than the diameter of the corresponding round head.

Ultimate Tensile Stress: The peak longitudinal load that can be applied to a fastener, divided by the original cross-sectional area. Usually measured in lbf/in², psi, MPa or N/m².

Ultimate Torque: The amount of force at which a threaded fastener begins to strip or otherwise fail in a joint, or strip the threads of an insert or nut. For threaded inserts and clinch fasteners, it may also be referred to as Supported Torque.

UNC (Unified Coarse Thread): An inch thread form (60°) standard defined by ANSI/ASME. Usually used in reference to machine screws. ASME B1.1 and British Standard BS 1580 cover it.

UNF (Unified Fine Thread): An imperial thread form standard defined by ANSI/ASME. Usually used in reference to machine screws. ASME B1.1 and British Standard BS1580 cover it.



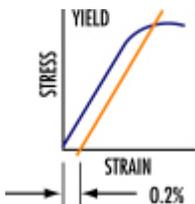
Washer Face: A circular boss on the bearing surface of a cap screw or nut. The only bolt that has a washer face is the heavy hex structural bolt.

Washer Head: One with a circular collar to provide a large flat bearing surface (see hex washer head and round washer head for examples).

Wedge Tensile Test: Procedure that induces a bending stress under the head of a bolt, screw or nut, used to demonstrate ductility and the integrity of the head-to-shank junction.

Work Hardening/Cold Working: An increase in metal hardness which is the result of forming processes such as elongation, rolling, heading, etc. This is particularly pronounced in steels, copper and aluminum alloys.

Work piece: The parts to be riveted.



Yield Strength: Measures the resistance of material to plastic deformation. When a fastener is stretched, yield strength is the point where the fastener will not return to its original length following testing. It is measured in terms of pounds per square inch (psi) or megapascals (MPa). Yield strength is often determined by the offset method illustrated to the left.