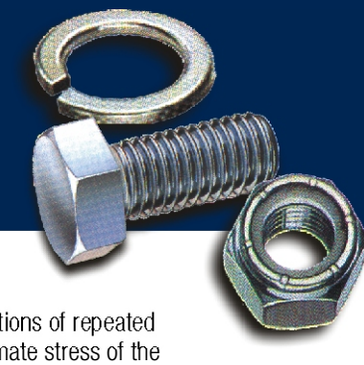
GLOSSARY OF FASTENER TERMS



1. **Alloy**
   Denotes high strength steel. A material possessing metallic properties, consisting of two or more elements of which one must be a metal

2. **Bolt**
   An externally threaded fastener, designed to hold components together in assembled parts and normally tightened or released by torquing a nut.

3. **Carbon Steel**
   Any steel made by combining carbon with iron. The amount of carbon, expressed in % determines whether the steel is low, medium or high carbon.

4. **Case Harden**
   Hardening a ferrous alloy so that the outer portion is made substantially harder than the inner portion.

5. **Corrosion**
   Gradual chemical or electrochemical attack on metal by atmosphere, moisture or other agents, such as salt and acids

6. **Cut Threads**
   Made by using a thread cutting die or by lathe cutting. The thread is formed by removing the metal from the full shank diameter by producing the grooves. These grooves are not radiused thus producing stress concentrations. Cut threads are much weaker in strength and produce about 30% less holding power than rolled threads

7. **Elastic Limit**
   The maximum stress that can be applied to a body that will allow it to regain its original dimensions after removal. It is the maximum stress that can be applied with no significant measurable after-effects. Once this value has been exceeded for a particular body, the body becomes permanently elongated and will not return to its original dimensions.

8. **Elongation**
   The change in length of a piece of material that has been stretched beyond its elastic limit or to its breaking point, expressed as a per cent. Elongation and reduction of area are means of determining the ductility of steel.

9. **Fatigue**
   A cause of failure takes place under conditions of repeated flexure or fluctuating stress below the ultimate stress of the material. Fatigue failure generally occurs at loads which applied statically would produce little perceptible effect. The fracture is usually progressive and in most cases you can see how it occurred.

   In the loading of a metal part, the maximum stress occurs at the surface so performance in service under repeated stress directly depends on the surface stress range and surface properties. Failure often starts at a small, even microscopic, crack or discontinuity and spreads with each repetition of stress. The faces of the crack rub together, producing a sort of burnished appearance. When the service conditions are such that the stress varies, being from low to high, the rate of the growth of the crack may vary. This gives rise to rub mark zones which are usually distinguished by “beach marks” or an “oyster shell” appearance. Local stress concentrations produced by nicks, notches, or scratches caused by using the “wrong” side of a flat washer against the fillet of a bolt head are nuclei (starting points) for progressive fatigue failure. Other stress breaks start because of tool marks, rough surfaces, quenching and grinding cracks, proof fillets, as well as inclusions in the metal, corrosion etc

10. **Galvanize**
    To treat steel with a molten bath or electrodeposited zinc to prevent rusting through the establishment of a sacrificial anode. The zinc rusts first, therefore protecting the substrate metal. Hot dip coatings are very thick

11. **Heat Treating**
    An operation involving the heating and cooling of metal in certain time cycles to obtain specific desirable conditions or properties.

12. **Non-Ferrous**
    An element or material not containing iron e.g. brass, aluminium, copper.

13. **Pitch**
    The number of threads in one inch of the threaded length of a bolt or screw expressed as threads per inch (TPI). The pitch of one thread is the distance that a nut would advance on a bolt when turned one full turn. In Metric, the pitch is determined by measuring the distance between the crest on one thread to the adjacent thread. This value is expressed in millimeters (mm).

14. **Proof Load**
    The load just under the yield strength, that can be applied to a bolt without causing permanent set greater than 0.0005”. This is the maximum SAFE load that a bolt can support. Torque values are established taking proof load into consideration.

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15. **Rockwell Hardness Test**
A method of determining hardness by measuring the comparative depth of two carefully controlled indentations, one superimposed on the other. For heat treated steel, a cone shaped diamond penetrator is used and the Rockwell Hardness value is expressed on a C-Scale. Softer materials are evaluated using the A and B scales.

16. **Rolled Threads**
Formed by rolling the reduced diameter of the shank between a stationary die and a reciprocating die. The grain of the steel is not broken and subsequently rolled threads offer a much greater resistance to shear and improve fatigue life over cut threads.

17. **Shear**
Force exerted 90 degrees to the center line or length of the bolt that tends to cut the bolt into two or more pieces.

18. **Shear Strength**
The amount of force usually expressed in psi, required to shear the bolt into two pieces. This is referred to as single shear and usually has a value of about 67% of the tensile strength. Double shear, where shearing forces are applied at two points along the shank of the body, would cut the bolt into three pieces. Double shear strength is usually 175% of the tensile strength.

19. **Stainless**
a) Trade name given to alloy steel that is corrosion and heat resistant
b) Steel is called stainless when it contains 4% chromium or more
c) Two common stainless steels are:
    i) 18-8 contains 18% chromium and 8% nickel. Resists most corrosive agents in industrial applications (typically type 304).
    ii) 316 stainless has higher nickel content and contains molybdenum. Commonly used in applications where food, drugs, medicines and liquids, or any other material for human consumption that may come in contact with the fastener.
d) Stainless steel is significantly lower in strength than SAE Grade 5.

20. **Tapped Hole**
A threaded hole. Another name is “blind hole”, where nuts are not used.

21. **Tensile Strength**
The load, usually expressed in pounds per inch (psi), required to cause failure in tension (stretch). The tensile strength, in pounds, of a given bolt size is obtained by multiplying the psi tensile strength by the stressed area. In metric the value is measured in Mega Pascals (MPa).

23. **Thread Length**
The standard formula for determining the length of thread on a bolt is twice the diameter plus ¼” (for bolts up to 6” in length). For bolts over 6” in length the tread length is twice the diameter plus ½”. In shorter sizes, where the standard formula for thread length is as long as or longer than the length of the shank, the bolt will be treaded to the head (commonly called a set screw).

24. **Torque**
The amount of twisting force, or twisting movement (expressed in inch-pounds or foot-pounds), applied to the nut, when a nut is used, or applied to the head of a bolt when it is being threaded into a tapped hole. Twelve inch-pounds or one foot-pound of torque would be created by exerting one pound pull on a point of a wrench handle exactly 12” from the center of the bolt.

25. **Torsion**
Radial force that is applied to the head or threads of a bolt, when a nut is being tightened, that applies a twisting force to the bolt due to the frictional forces encountered by the mating of the threads as the bolt stretches.

26. **Washer Face**
A circular boss on the underside of the bolt head or on surface of a nut which acts as a bearing surface to evenly distribute the loads on the surface of the clamped materials. Also prevents the sharp, hex edges from digging into the work surface causing an increase in friction.

27. **Yield Strength**
The load (usually expressed in psi), that is necessary to stretch the bolt to the point where, after the load is removed, the bolt will not return to its previous length. It is an established fact that when any steel is stretched 0.2% of its original length, or 0.002” for each inch of loaded length, or more, permanent set will occur. The Yield Strength, in pounds, for any given size and grade of bolt is also called yield point.

THOMAS WARBURTON
Established 1858