

INDUSTRY STANDARDS

MECHANICAL PROPERTIES

When strength requirements are moderate, low-carbon steel is used. High-strength fasteners are made from medium-high carbon or alloy steels and are heat treated to develop desired properties.

Most fasteners are covered by specifications that define required mechanical properties such as tensile strength, yield strength, proof load and hardness.











- **Tensile Strength:** The maximum tensile stress in pounds per sq in. which a material is capable of sustaining, as developed by a tension test.
- **Yield Strength:** The stress at which a material exhibits a specified deviation from the proportionality of stress to strain. The deviation is expressed in terms of strain, and in the offset method, usually a strain of 0.2% is specified.
- **Proof Load:** The point to which a material may be stressed without evidence of permanent deformation.
- **Hardness:** The resistance of a material to plastic deformation. Usually measured in steels by the Brinell, Rockwell, or Vickers indentation-hardness test methods.

HEAT PROPERTIES

Heat treatment covers various techniques that may be used to develop certain end-product characteristics. Customary procedures for fasteners include:

- **Stress Relieving:** A thermal cycle involving heating to a suitable temperature, usually 1000/1200°F, holding long enough to reduce residual stresses from either cold deformation or thermal treatment, and then cooling slowly enough to minimize the development of new residual stresses.
- **Annealing:** A thermal cycle involving heating to and holding at a suitable temperature and then cooling at a suitable rate, for such purposes as reducing hardness, improving machinability, facilitating cold working, producing a desired microstructure, or obtaining desired mechanical or other properties.
- **Case Hardening:** A term descriptive of one or more processes of hardening steel in which the outer portion, or case, is made substantially harder than the inner portion, or core.
- **Quenching and Tempering:** Quenching is a thermal process used to increase the hardness and strength of steel. Tempering improves ductility and toughness but reduces the quenched hardness.

ASTM & SAE HEAD MARKINGS FOR BOLTS

	ASTM-A307 GR A	• Low or Medium Carbon Steel
	ASTM-A307 GR B	• Low or Medium Carbon Steel
	ASTM-J429 GR 5	• Medium Carbon Steel Quenched & Tempered
	ASTM-A193 GR B7	• Chrom-Moly Steel Quenched & Tempered
	ASTM-A325 Type 1	• Medium Carbon Steel Quenched & Tempered
	18-8 18 Chromium 8 Nickel	• "300" Series Stainless Steel Same Material as T-304
	ASTM-T 304 or ASTM F 593	• "300" Series Stainless Steel • Either Marking May Appear
	ASTM-T 316 or ASTM F 593	• "300" Series Stainless Steel • Either Marking May Appear
	ASTM-A193 Gr B8	• Solution Treated 304 - 304L Stainless Steel
	ASTM-A193 GR B8M	• Solution Treated 316 - 316L Stainless Steel