

Glossary

Material Terminology

ALLOY - Substance having metallic properties, composed of two or more chemical elements of which at least one is an elemental metal.

ANNEALING - Heating to and holding a suitable temperature and then cooling at a suitable rate. This reduces hardness, improves machinability and facilitates cold working.

ANODIZING - Anodizing is a process which forms a particularly structured and dense oxide layer which resists abrasion and thus protects the underlying metal. This layer is colorless, but it's possible to introduce a dye at one stage in the process to permanently color the surface.

COLD WORKING - Cold working applies to mechanical working performed at temperatures below the critical range, and results in a strain hardening of the metal. The strength and hardness as well as the elastic limit are increased, but the ductility decreases. There are two primary cold-working processes: cold-rolling and cold-drawing.

COLD-ROLLING - Cold rolling usually refers to the working of metal at room temperature. Materials have been hot-rolled to approximate sizes are pickled to remove any scale, then are passed through chilled finished rolls. This gives a smooth surface and also brings the pieces to accurate dimensions. The principal forms of cold-rolled stocks are sheets, bars, and rods.

COLD-DRAWING - Cold-drawing is used in the making of bright steel bar in round, square, hexagonal and flat sections, as well as seamless tubing and wire. Rods are drawn at room temperature through a die to achieve their final size and to provide better surface finish, closer tolerances, longer lengths, smaller diameters, or a different combination of mechanical properties from those possible through hot-finishing.

EXTRUSION - The extrusion process involves the forcing of metal through an opening in a die, causing the metal to take the shape of the die opening. Some metals such as lead, tin, and aluminum may be extruded cold, but generally metals are heated before the operation is begun. The principal advantage of the extrusion process is in its flexibility.

FERROUS/NON-FERROUS METALS - Ferrous refers to an iron content in the material. In general terms, metals that are not magnetic are considered non-ferrous. Most magnetic steel, steel alloys, and stainless steels contain enough iron to be considered ferrous. Reference to ferrous and non-ferrous metals is made when selecting tooling, grinding wheels, abrasives and saw blades.

HOT ROLLED - Hot rolled product is heated and rolled at high temperatures to impart the shape, chemical and mechanical properties required in the finished item.

TEMPERING - A process of re-heating hardened steel to a temperature below the transformation range and then cooling at any rate desired. The purpose is to decrease the hardness and increase the toughness.

ALLOY - Turning a bar gives it improved size, straightness, and concentricity together with freeing the product from decarburization, seams and other surface imperfections. Bars are then ground for a tighter tolerance and to ensure uniformity in size and finish. Lastly, bars are polished to a brilliant, bright finish. The TG&P process is often required in bars used for shafting and similar applications which need to be free of surface imperfections.

ALUMINUM - Aluminum alloys are strong, naturally soft, lightweight, ductile and malleable. Easy to machine, fabricate, join and work. Aluminum is non-toxic and electrically and thermally conductive.

ALUMINUM 2024 - A high-strength aluminum alloy, 2024 offers high strength and excellent fatigue resistance. Readily machined to a high finish and when annealed can be easily formed and may be heat treated. Because of its normally low corrosion resistance, 2024 with an anodized finish is more popular. Good where a favorable strength to weight ratio is required. Bar conforms to ASTM B211 & QQ-A-225/6. 2024 Plate conforms to ASTM B209 & QQ-A-250/4.

ALUMINUM 6061 - This extruded aluminum alloy is one of the most versatile heat treatable alloys in the aluminum family. Good mechanical properties, good corrosion resistance and medium strength. Commonly used where welding and brazing is required, and can be fabricated by many of the commonly used techniques. Yield strength is 40 ksi. Hardness is 95 Brinell. Melting range is 1080 deg. to 1205 deg. 6061-T651 Plate and 6061-T6 Sheet conform to ASTM B209, QQ-A-250/11 & AMS 4053.

ALUMINUM 6063 - Commonly referred to as "architectural alloy", this material has relatively high tensile properties, excellent finishing characteristics and high corrosion resistance. It is the alloy best suited for anodizing applications. It is often found in various interior and exterior architectural applications, such as windows, doors, store fronts, and assorted trim items.

ALUMINUM 7075 - One of the hardest aluminum alloys, this material is has good machinability and fair corrosion resistance.

BRASS - Brass resists atmospheric corrosion, water, and many salt water solutions. A high percentage of zinc makes it stronger and more durable than copper and bronze. It is easy to manufacture and maintains higher electrical characteristics.

BRASS CA360 - Brass grade 360 is a free cutting 1/2 hard brass and is the nonferrous alloy all others are compared to when machinability is questioned. It is an ideal metal for shop use where milling, drilling, tapping, knurling or turning is required. It is corrosion resistant and rustproof. It can also be plated, brazed and soldered. Some applications are use as valve stems, bolts, and marine hardware and pump shafts. Bar conforms to ASTM B16.

NAVAL BRASS CA464 - Naval Brass Alloy 464 has more corrosion resistance to sea water at elevated temperatures and still maintains good strength and rigidity. It possesses excellent capacity for hot-working and adapts well for hot forging and pressing. Can be drawn, formed bent, headed and upset. 464 can also be welded, brazed or soldered with ease. Some applications are use as valve stems, bolts, and marine hardware and pump shafts. Conforms to ASTM B21.

BRONZE - This copper and tin alloy is generally ductile and malleable. Its high copper content makes it more corrosion resistant than brass. It is also harder and stronger than copper.

PHOSPHOR BRONZE CA544 - Bronze 544 Alloy is a free cutting phosphor bronze material with a machinability of 85%. It has high strength, good corrosion resistance and also high fatigue properties. It has been used for bushings, shafts and bearings, valves, gears, terminals and many varieties of electrical parts. Has a Rockwell B of 80, tensile strength of 68ksi, yield strength of 57ksi and an elongation of 20%.

SILICON BRONZE CA655 - Silicon Bronze alloy 655 is a 1/2 hard, high strength bronze alloy with excellent corrosion resistance. It is typically used for marine hardware, fasteners and connections. It can be cold worked and hot formed. Ranks rather low on the machinability scale. Tensile strength - 78 ksi, Yield strength - 45 ksi, Elongation - 35%, Rockwell B scale - 85, Shear strength - 52 ksi.

BEARING BRONZE CA932 (SAE660) - Bronze 932, know as bearing bronze, has excellent load capacity and antifricition qualities. This alloy has good machining characteristics, resists many chemicals and is recommended for medium speed, medium load applications.

ALUMINUM BRONZE CA954 - Aluminum Bronze alloy 954 is similar to Ampco 18. It can be heat treated for higher hardness properties and improved tensile, yield, compression strength and fatigue values. Typically used as bearing material because of its resistance to wear, abrasion and fatigue, deformation and corrosion. Also used for wear plates, valve parts, liners, gears and more. Tensile strength - 90,000, yield strength - 35,000, elongation - 12%. Brinell hardness 170/180.

COPPER - Copper is corrosion resistant and highly ductile. Great for electrical applications.

COPPER 110 SHEET & PLATE - Cold Rolled Sheet Copper, electrolytic tough pitch, 1/8 to 1/4 hard. Rockwell f40-82.

COPPER CA110 - Copper 110 or 110 Electrolytic Tough Pitch (ETP) Copper has the highest electrical conductivity of any metal except for silver. Its high ductility makes it an excellent choice for drawing, forming or spinning applications. Some of its fabrication capabilities are cold-working, hot-working, soldering and welding. It also has excellent corrosion resistance.

FOILS - A flat-rolled product 0.0059 inches or less in thickness, regardless of width. Flat-rolled products thicker than foil (over 0.0059 inches) are classified as sheet or strip in accordance with steel industry terminology.

KEYSTOCK - Keystock is solid core bars used as keys to lock shaft components together by being inserted into machined slots. It is used to provide driving torque between shafts and pulleys, gears and sprockets. Often used for machinery, general maintenance and shop repairs. Material for steel is high quality, cold drawn low carbon C1018 steel. All keystock is supplied as oversized to assure a tight fit in keyways.

METAL BALLS - Precision balls for use in ball bearing and other roller applications.

PLASTICS:

ACETAL - Acetal (Copolymer) has high strength and low moisture absorption, stiffness with excellent dimensional stability and ease of machining. The resin certifies to ASTM D 4181 POM 211. It also meets ASTM D 6100 S-POM 0211, LP (Low Porosity), FDA CFR21, Section 177.2470 (a), (b), (c) and (d)(2) and is 3-A Dairy approved.

DELIRIN - Delrin® (Acetal homopolymer) offers slightly higher mechanical properties (but slightly lower chemical resistance) than Acetal copolymer. Thinner cross-sections benefit from the additional strength and rigidity of Delrin®. The resin certifies to ASTM D 4181 POM 111. It also meets ASTM D 6100 S-POM 0111 and FDA CFR 21 Section 177.2480.

NYLON 101 - Nylon 101 is tough, has a low coefficient of friction and good abrasion resistance. It reduces lubrication requirements and can eliminate galling and corrosion problems. The resin certifies to ASTM D 4066 PA 0114. It also meets LP410A, ASTM D 5989 S-PA 0113, FDA CFR 21 Section 177.1500 and is 3-A Dairy approved.

Glossary Cont.

TEFLON - Virgin Teflon® is essentially chemically inert up to 500°F. It also exhibits exceptionally low friction and retains its flexibility at low temperatures. It offers remarkable electrical stability over a wide range of frequency and environmental conditions. The resin certifies to ASTM D 1710 Type 1, Grade 1, Class A and it meets FDA CFR 21 177.1550. Mechanical Teflon® exhibits many of the same characteristics of Virgin Teflon®, but it is not suitable for use in electrical applications or food contact applications. The resin certifies to ASTM D 1710 Type 3, Grade 2, Class A.

UHMW - UHMW has a unique combination of wear and corrosion resistance, low-friction surface and impact strength. It is also resistant to chemical attack and moisture absorption. The resin certifies to ASTM d 4020. It also meets FDA CFR 21 Section 177.1520 2.1, 2.2 and is 3-A Dairy approved.

REINFORCING BARS (REBAR) - Grade 60.
Steel reinforcing bars help maintain integrity of concrete and stop cracking.

STAINLESS STEEL - Stainless steels are alloys of iron to which at least 10% chromium has been added to increase corrosion resistance. A 10% chromium steel will not rust when exposed to weather. To obtain greater corrosion resistance, more nickel and chromium are added to the alloy. Along with iron and chromium, all stainless steels contain some carbon. The carbon is added for the same purpose as in ordinary steels, to make steel stronger. Other alloying elements improve corrosion resistance, fabricability and variations in strength. These elements include nickel, molybdenum, copper, titanium, silicone, aluminum, sulfur and many others.

AUSTENITIC STAINLESS STEEL - The most common austenitic alloys are iron-chromium-nickel steels and are widely known as the 300 series. The austenitic stainless steels, because of their high chromium and nickel content, are the most corrosion resistant of the stainless group providing unusually fine mechanical properties. They cannot be hardened by heat treatment, but can be hardened significantly by cold-working. They are normally non-magnetic, but become slightly magnetic when cold-worked.

STAINLESS TYPE 303 - 303 SS has non-galling and non-seizing qualities which allow for easy machining and is better for lighter equipment if welding is not required. When cold worked it can become slightly magnetic. Free machining for heavier cuts in automatic machining operations. Corrosion resistant to atmospheric exposures, sterilizing solutions, most organic and many inorganic chemicals, most dyes, nitric acid and foods. Machinability is 70%.

STAINLESS TYPE 303 TURNED GROUND AND POLISHED (TGP) - When very close tolerances are required turning & center-less grinding is used. To achieve close tolerances the amount of metal removed in the final pass is very small. The TG&P process is often required in bars used for shafting & similar applications which need to be free of surface imperfections. To impart a very high polish to the surface, it is not uncommon to finish the bar with a burnishing pass through a two-roll rotary straightening machine. Non magnetic.

STAINLESS TYPE 304 - Type 304 is a low carbon, chromium - nickel alloy. It requires heavier equipment to machine, but is easier to weld than type 303 making it a very common stainless steel for fabrication. It offers excellent resistance to a wide range of corrosives and atmospheric exposures. Non magnetic.

STAINLESS TYPE 316 - Highest corrosion and pitting resistance of the standard stainless steels. Used in the paper, photographic and textile industries. Great for marine applications. Has a high temperature strength and is not hardenable by heat treatment. Non-magnetic.

STAINLESS TYPE 416 - 416 SS is a very free machining grade of heat treatable stainless steel. Useful corrosion resistance to natural food acids, basic salts, water & most atmospheres. Generally difficult to weld. Magnetic.

STAINLESS TYPE 630 (17-4 PH) - 17-4 PH provides the superior corrosion resistance of all the austenitic stainless steels, but in addition, is capable of being heat treated to various high strength levels with minimum distortion. It is generally furnished in the annealed condition for ease of machining. It develops high strength properties by aging at selected temperatures. Non magnetic.

STEEL - Steel is iron that is combined with other elements such as carbon, manganese and silicon. It falls into one of two families: carbon steel or alloy steel.

CARBON STEEL - Carbon steel is ordinary steel with 2% maximum of carbon, and no minimum content is specified or required for aluminum, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, or zirconium. Carbon steels harden only with surface (case) treatments. A four-numeral series is used to designate gradations of chemical composition of carbon steel. The first two digits indicate the grade of carbon steel. The last two numbers are intended to indicate the approximate middle of the carbon range.

A36 CARBON STEEL - Hot Rolled - A36 low carbon steel is a general purpose mild steel with excellent welding and forming capabilities. May be formed hot or cold. Galvanizing increases corrosive resistance. Conforms to ASTM A36.

1018 CARBON STEEL - Cold-Drawn - 1018 is a low-carbon steel which has good case hardening properties. An excellent steel when bending or cold forming is required and stresses are not too severe. It has good brazing and welding properties, but has poor corrosion resistance. C1018 has a smooth, clean cold-drawn surface. Yield strength - 50,000 +, with average machinability at 66%.

1045 CARBON STEEL - A medium carbon steel that is used in heat treating applications (quenching and tempering). It has an ability to be conventionally quenched, but is often used where the specifications are less stringent. It is also used in induction hardening applications. It is rated fair for brazing and welding, however it can be forged satisfactorily. It is commonly used as shaft material and not normally considered a screw machine steel.

12L14 CARBON STEEL - Cold Drawn - 12L14 is a leaded steel with a smooth cold finish (rolled) surface. It has ductility and provides a fine surface quality. Bending and crimping are easily done with 12L14. An excellent machinability makes it the most popular steel for turning on lathes. Has a yield strength of 60,000 psi, while machinability is rated at 195% with 325 surface feet per minute.

COLD ROLLED SHEET - Cold Roll Sheet is low carbon and commercial quality. This low cost steel sheet is soft enough to bend flat on itself in any direction without cracking, and is ductile enough for shallow drawing. The carbon is .10 max for improved welding and forming. It has closer thickness tolerances and better surface than pickled and oiled. Conforms to ASTM A1008.

ALLOY STEEL - Alloy steels contain added elements that cause the steel to exhibit enhanced properties when heat treated. A four-numeral series is used to designate gradations of chemical composition of alloy steel. The first two digits indicate the grade of alloy. The last two numbers are intended to indicate the approximate middle of the carbon range.

4140/41L40 ANNEALED ALLOY STEEL - 4140 and 41L40 are heat treatable, commercial-quality steels. The chromium content makes for deeper hardness penetration, while its molybdenum content allows uniformity of the hardness and strength. It has good wear resistance, along with excellent toughness and ductility while in the quenched and tempered condition. In the annealed condition it machines at 110 sfm. The lead added to the 41L40 raises the machinability to 145, and when annealed provides much the same properties as 4140.

4140/4142 HEAT TREATED B7 ALLOY STEEL - Pre-heat treated 4140 offers good hardness, penetration, strength, toughness, ductility and wear resistance. This is a general purpose alloy, normally .95% chromium & .20% molybdenum. Conforms to ASTM A193 Grade B7.

8620 ALLOY STEEL - Chromium-nickel-molybdenum steel. Its nickel content imparts good toughness and ductility, while the chromium and molybdenum increase hardness penetration and wear resistance. The alloy content permits hardening to a strong, tough core, with high-case hardness. It machines a 110 sfm and has good welding qualities.

ETD 150 CF ALLOY - This alloy steel has high tensile and yield strengths. It is used in car shafts, pinions, fasteners, axels and anyplace that needs heat-treated alloy parts. It has fair weldability.