

WELDING TERMINOLGY & DEFINITIONS

AC or Alternating Current: Electricity that reverses its direction periodically. For 60 cycle current, the current goes in one direction and then in the other direction 60 times in the same second, so that the current changes its direction 120 times in one second.

Alloying Elements: Chemical elements constituting an alloy; in steels, usually limited to the metallic elements added to modify the properties of the steel.

Arc Blow: Magnetic disturbance of the arc, resulting in a deflection from its normal path.

Arc Length: The distance from the end of the electrode to the point where the arc makes contact with the work surface.

Arc Voltage: The voltage across the welding arc.

As Welded: The condition of weld metal, welded joints and weldments after welding prior to any subsequent thermal or mechanical treatment.

Automatic Welding: Welding with equipment which performs the welding operation without adjustment of the controls by a welding operator. The equipment may or may perform the loading and unloading of the work.

Backing: A material or device placed against the back side of the joint, or at both sides of a weld in electroslag and electrogas welding, to support and retain molten weld metal. The material may be partially fused or remain unfused during welding and may be either metal or non-metal.

Back Gouging: The removal of weld and base metal by arc gouging or grinding from the other side of a partially welded joint to assure complete fusion and penetration upon subsequent welding from that side.

Backstep Sequence: A longitudinal sequence in which weld passes are made in the direction opposite to the progress of welding.

Bare Electrode: A filler metal electrode consisting of a single metal or alloy that has been produced into a wire, strip or bar form and that has had no coating or covering applied to it other than that which is incidental to its manufacture or preservation.

Base Metal: The metal to be welded.

Butt Joint: A joint between two members aligned approximately in the same plane.

Carbon: The addition of carbon to steel increases its ability to harden and adds strength and wear resistance.

Carbon Steel: Steel that owes its properties chiefly to the presence of carbon, without substantial amounts of other alloying elements; also termed "ordinary steel", "straight carbon steel"; "plain steel".

Cementite: A compound of iron and carbon known as "iron carbide", which has the approximate chemical formula of FeC_3 .

Chromium: Chromium raises the ultimate strength, hardness and toughness, and adds wear resistance to steel.

Cladding: A relatively thick layer of ($> 0.04"$) of different material applied by surface welding for the purpose of improving corrosion or heat resistance.

Coated Electrode: A filler-metal electrode, used in arc welding, consisting of a metal core wire with a relatively thick covering that provides protection for the molten metal and stabilizes the arc.

Cobalt: Cobalt is seldom used in steels other than high speed, as it increases the red hardness, permitting the use of higher cutting speeds. It also adds some hardness.

Concavity: The maximum distance from the face of a concave fillet weld perpendicular to a line joining the weld toes.

Convexity: The maximum distance from the face of a convex fillet weld perpendicular to a line joining the weld toes.

Crater: A depression at the termination of a weld bead.

Depth of Fusion: The distance that fusion extends into the base metal or previous pass from the surface melted during welding.

DC or Direct Current: Electric current that flows only in one direction. In welding an arc process wherein the power supply at the arc is direct current.

Exothermic: Produces heat.

Fatigue: The tendency for a metal to break under conditions of repeated cyclic stressing considerably below the ultimate tensile strength.

Fillet-Weld: A weld of approximately triangular cross-section joining two surfaces approximately at right angles to each other in a lap joint, tee point or corner joint.

Flame Hardening: A process of hardening a ferrous alloy by heating it above the transformation range by means of a high temperature flame, and the cooling as required.

Flat Position: The welding position used to weld from the upper side of the joint; the face of the weld is approximately horizontal.

Flux: Material used to prevent, dissolve or facilitate removal of oxides and other undesirable surface substances.

Flux Cored Arc Welding: (FCAW) An arc welding process that produces coalescence of metals by heating them with an arc between a continuous filler metal (consumable) electrode and the work. Shielding is provided by a flux contained within the tubular electrode. Additional shielding may or may not be obtained from an externally supplied gas or gas mixture.

Free Machining: The property that makes machining easy because of the forming of small chips, a characteristic imparted to steel by sulfur, to brass by lead, to aluminum alloys by lead and bismuth and to nickel alloys by sulfur or carbon etc.

Gas Metal Arc Welding: (GMAW) An arc welding process that produces coalescence of metals by heating them with an arc between a continuous filler metal (consumable) electrode and the work. Shielding is obtained entirely from an externally supplied gas or gas mixture.

Gas Tungsten Arc Welding: (GTAW) An arc welding process that produces coalescence of metals by heating them with an arc between a tungsten (non-consumable) electrode and the work. Shielding is obtained from a gas or a gas mixture. Pressure may or may not be used and filler metal may or may not be used. (This process has sometimes been called TIG welding, a non-preferred term.)

Grain Refiner: Any material added to a liquid metal for the purpose of producing a finer grain size in the subsequent casting, or of retaining fine grains in the heat treatment of wrought structures.

Groove Weld: A weld made in the groove between two members to be joined.

Hardening: Any process for increasing the hardness of metal by suitable treatment, usually involving heating and cooling.

Heat-Affected Zone: That portion of the base metal which has not been melted, but whose properties or microstructure have been altered by the heat of welding, brazing, soldering or cutting.

High-Alloy Steel: Steel containing large percentages of elements other than carbon.

High Carbon Steel: Steel containing 0.45% carbon or more.

Horizontal Position: a) fillet weld – The position in which welding is performed on the upper side of an approximately horizontal surface and against an approximately vertical surface.

b) groove weld- The position of welding in which the weld axis lies in an approximately horizontal plane and the weld face lies in an approximately vertical plane.

Impact Test: Determination of the resistance of a material to breaking by impact. The test is measured by breaking the material by a single blow.

Joint Penetration: The depth a weld extends from its face into a joint, exclusive of reinforcement.

Lap Joint: A joint between to overlapping members.

Low Carbon Steel: Steel Containing 0.20% or less carbon. Also known as mild steel.

Manganese: Manganese helps to make the steel sound, increases the depth of hardening and makes it easier to work.

Manual Welding: A welding operation performed and controlled completely by hand.

MIG Welding (Gas Metal Arc Welding/GMAW): An arc welding process wherein coalescence is produced by heating with an electric arc between a filler metal (consumable) electrode and the work. Shielding is obtained from a gas, gas mixture (which may contain an inert gas) or a mixture of a gas and a flux.

Molybdenum: Molybdenum increases red hardness, wear resistance, hardness depth and inclines the steel to oil or air-harden.

Nickel: Nickel adds toughness and wear resistance to steel when used in conjunction to other alloys such as chromium.

Nitriding: A process of case hardening in which a ferrous alloy, usually of special composition, is heated in an atmosphere of ammonia or in contact with nitrogenous material to produce surface hardening by the absorption of nitrogen, without quenching.

Normalizing: A process in which a ferrous alloy is heated to a suitable temperature above the transformation range and is subsequently cooled in still air at room temperature.

Open-Circuit Voltage: The voltage between the output terminal of the welding machine when no current is flowing in the welding circuit.

Overhead Position: The position in which welding is performed from the underside of the joint.

Overlap: Protrusion of weld metal beyond the bond at the toe of the weld.

Pass (also: Weld Pass): A single progression of a welding or surfacing operation along a joint, weld deposit or substrate. The result of a pass is a weld bead, layer or spray deposit.

Peening: Mechanical working of metal by means of hammer blows.

Penetration: The distance the fusion zone extends below the surface of the part or parts being welded.

Plug Weld: A circular weld made through a hole in one member of a joint to fuse it to another member.

Porosity: Gas pockets or voids in metal.

Post-heating: A process used immediately after welding, whereby heat is applied to the weld zone either for tempering or for providing a controlled rate of cooling in order to avoid a hard or brittle structure.

Pre-heating: The application of heat to the base metal immediately before welding, brazing, soldering, thermal spraying, or cutting.

Puddle: Is that portion of a weld that is molten at the place the heat is supplied.

Radiography: The use of radiant energy in the form of X-rays or gamma rays for the non-destructive examination of metals.

Reverse Polarity: The arrangement of arc welding leads wherein the work is the negative pole and the electrode is the positive pole in the arc circuit.

Root Opening: A separation at the joint root between the workpieces.

Root Penetration: The depth that a weld extends into the root joint.

Seal Weld: Threaded joint sealed, without thread compound, by back welding.

Semiautomatic Arc Welding: Arc welding with equipment that controls only the filler metal feed. The advance of the welding is manually controlled.

Shielded Metal Arc Welding (SMAW): An arc welding process wherein coalescence is produced by heating with an electrode arc between covered metal electrodes and the work. Shielding is obtained from decomposition of the electrode covering. Pressure is not used and filler metal is obtained from the electrode.

Silicon: Silicon is used primarily to assist in hot working of steel, adding hardness penetration, making the steel stronger and tougher.

Slag Inclusion: Non-metallic solid material entrapped in between weld metal and base metal.

Spatter: In arc and gas welding; the metal particles expelled during welding and which do not form a part of the weld.

Straight Polarity: The arrangement of the arc welding leads wherein the work is the positive pole and the electrode is the negative pole of the arc circuit.

Stress Relieving: A process of reducing residual stresses in a metal object by heating the object to a suitable temperature and holding for a sufficient time.

Stringer Bead: A type of weld bead made without appreciable transverse oscillation.

Submerged Arc Welding: (SAW) A bare metal electrode(s) method of welding where the arc and molten metal are shielded by a granular fusible blanket of material on the work piece.

Tack Weld: A weld (generally short) made to hold parts of a weldment in proper alignment until the final welds are made.

Tempering: A process of re-heating quench-hardened or normalized steel to a temperature below the transformation range followed by any desired rate of cooling.

Tensile Strength: The value obtained by dividing the maximum load observed during tensile straining by the specimen cross-sectional area before straining. Also called “ultimate strength”.

Tungsten: Adds red hardness, wear resistance, retards grain growth and therefore adds toughness. It must be added in quite large quantities to be effective.

Tungsten Electrode: A non-filler metal electrode used in arc welding or cutting made principally of tungsten.

Underbead Crack: A crack in the heat affected zone not extending to the surface of the base metal.

Undercut: A groove melted into the base metal adjacent to the toe of the weld and left unfilled by weld metal.

Vanadium: Retards grain growth, increases toughness, may add red hardness and permits higher hardening or quenching temperatures.

Vertical Position: The position of welding in which the weld axis is approximately vertical.

Weaving: A technique of depositing weld metal in which the electrode is oscillated. **Weld:** A localized coalescence of metals or non-metals produced either by heating the materials to welding temperature, with or without the application of pressure, or by the application of pressure alone, and with or without the use of filler material.

Weld Face: The exposed surface of a weld on the side from which welding was done.

Weld Metal: That portion of a weld, which had been melted during welding.

Weld Pool: The localized volume of molten metal in a weld prior to its solidification as weld metal.

Weld Root: The points, as shown in cross section, at which the back of the weld intersects the base metal surfaces.

Weld Toe: The junction of the weld face and the base metal.

Welding Procedure: The detailed methods and practices involved in the production of a weldment.

Weldment: An assembly whose component parts are joined by welding.

Whipping: A term applied to an inward and upward movement of the electrode that is employed in vertical welding to avoid undercut.

Yield Strength: The stress at which a material exhibits a specified deviation from proportionality of stress to strain. An offset of 0.2% is used for many metals such as aluminum base and manganese base alloys, while a 0.5% total elongation local is frequently used for copper base alloys.