Welding Terms

Weld Tech News

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WELD TECH NEWS is a newsletter for welders working primarily in maintenance and repair. Each issue contains useful information on materials (cast irons, steels, aluminum, copper alloys, etc.), welding products and welding techniques. By collecting each issue, the reader will soon have a handy reference manual covering all aspects of welding, brazing and soldering for maintenance repair.

WELDING TERMS

The following are some common welding words and terminology that the maintenance welder should be familiar with. They are excerpted from Jefferson’s Welding Encyclopedia 18th Edition. Some of these terms are industry standards as defined by Standard Welding Terms and Definitions ANSI/AWS A3.0-85. These terms will be noted by the following: STD. Both publications are available through the American Welding Society.

Abrasion - a grinding action caused by abrasive solids sliding, rolling or rubbing against a surface.

Acetylene - a hydrocarbon (C₂H₂): colorless, flammable gas shipped dissolved in a solvent. It has a garlic-like odor. The temperature of the oxyacetylene flame cannot be approached by any other gas.

Age hardening - a term applied to a property exhibited by some of the light alloys, such as aluminum or magnesium, of hardening at ordinary temperatures after solution treatment or cold work.

Air carbon arc cutting (AAC) - an arc cutting process that melts base metals by the heat of a carbon arc and removes the molten metal by a blast of air. STD

Alloy - a substance with metallic properties and composed of two or more chemical elements of which at least one is a metal. STD

Alternating current - a current which reverses directions at regularly recurring intervals.

Ampere - a unit of electrical current used to state the rate of flow of electricity through a circuit.
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Annealing - a treatment process in which a material in the solid state is heated, then cooled at a slow rate.

Arc - an electric arc is formed when two conductors of an electric current are brought together forming electrical contact, then separated, with sufficient voltage available to maintain the current of electricity through the intervening gaseous medium.

Arc length - the distance from the tip of the welding electrode to the adjacent surface of the weld pool. STD

Arc welding (AW) - a group of welding processes that produce coalescence of workpiece by heating them with an arc. STD

B.H.N. - abbreviation for Brinnell hardness number.

Backhand welding - a welding technique in which the welding torch or gun is directed opposite to the progress of welding. STD

Backstep sequence - a longitudinal sequence in which weld passes are made in the direction opposite to the progress of welding. STD

Base metal - the metal that is welded, brazed, soldered, or cut. STD

Brass - the generic term for alloys consisting essentially of copper and zinc.

Brazing - a group of welding processes that produce coalescence of materials by heating them to the brazing temperature in the presence of a filler metal having a liquidus above 450°C (840°F) and below the solidus of the base metal. The filler metal is distributed between the closely fitted faying surfaces of the joint by capillary action. STD

Brinnell test for hardness - a test for determining the hardness of metals by applying a known load to the surface of the material to be tested with a hardened steel ball of known diameter.

Bronze - a large group of copper, zinc, and tin alloys.

Buildup - a surfacing variation in which surfacing material is deposited to achieve the required dimensions. STD

Butt joint - a joint between two members aligned approximately in the same plane. STD

Carbon - the addition of carbon to iron produces steel; carbon is the principal hardening agent in steel.
Carbon steel - a steel containing various percentages of carbon. The classification "carbon steel" is generally accepted for all commercial irons and plain steels.

Carburizing flame - a reducing oxyfuel gas flame in which there is an excess of fuel gas, resulting in a carbon rich zone extending around and beyond the cone. STD

Case hardening - involves either carburizing or nitriding the surface of iron-base alloys to increase wear resistance.

Cast Iron - a large family of alloys, generally containing more than 2% carbon and between 1% and 3% silicon. Unlike steels, they are not malleable when solid, and most have low ductility and very poor resistance to impact loading.

Cast steel - any object made by pouring molten steel into a mold.

Cold crack - a crack which develops after solidification is complete. STD

Constant current power source (CC) - an arc welding power source with a volt-ampere relationship yielding a small welding current change from a large arc voltage change. STD This type of power supply is used with shielded metal arc welding (SMAW), and gas tungsten arc welding (GTAW).

Constant voltage power source (CV) - an arc welding power source with a volt-ampere relationship yielding a large welding current change from a small arc voltage change. STD

A constant voltage power source is capable of providing a range of variations in welding current while maintaining nearly constant voltage. Constant voltage (sometimes called constant potential) has a relatively flat volt-ampere curve. The self-regulating feature provided by the constant voltage machines make it easier for welding operators to maintain a constant arc length with GMAW (M1G).

Contact tube - a device that transfers current to a continuous electrode. STD

Contact tube setback (GMAW and FCAW) - the distance from the contact tube to the end of the gas nozzle. STD

Covered electrode - a composite filler metal electrode consisting of a core of a bare electrode or metal cored electrode to which a covering sufficient to provide a slag layer on the weld metal has been applied. The covering may contain materials providing such functions as shielding from the atmosphere, deoxidation, and arc stabilization, and can serve as a source of metallic additions to the weld. STD

DC or D-C - abbreviation for direct current.
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DCEN or DC(-) - abbreviation for direct current electrode negative. (DCSP)

DCEP or DC(+) - abbreviation for direct current electrode positive. (DCRP)

Deposition rate - the weight of material deposited in a unit of time. STD

Dilution - the change in chemical composition of a welding filler metal caused by the admixture of the base metal or previous weld metal in the weld bead. It is measured by the percentage of base metal or previous weld metal in the weld bead. STD

Direct current electrode negative (DCEN) - the arrangement of direct current arc welding leads in which the electrode is the negative pole and workpiece is the positive pole of the welding arc. STD The term "straight polarity" has been used to describe this type of current.

Direct current electrode positive (DCEP) - the arrangement of direct current arc welding leads in which the electrode is the positive pole and the workpiece is the negative pole of the welding arc. STD The term "reverse polarity" has been used to describe this type of current.

Distortion - the non-uniform expansion and contraction of weld metal and adjacent base metal during the heating and cooling cycle of the welding process.

Ductility - the property of a material that allows it to undergo some reasonable degree of irreversible permanent plastic deformation without fracturing.

Duty cycle - the percentage of time during an arbitrary test period that a power source or its accessories can be operated at rated output without overheating. STD

Electrode - a component of the electrical circuit that terminates at the arc, molten conductive slag, or base metal. STD

Electrode extension (FCAW, SMAW, SAW) - the length of electrode extending beyond the end of the contact tube. STD

Elongation - the amount of permanent extension in the vicinity of a fracture in the tension test; usually expressed in percentage of original gauge length.

Filler metal - the metal or alloy to be added in making a welded, brazed, or soldered joint. STD

Fillet weld - a weld of approximately triangular cross section joining two surfaces approximately at right angles to each other in a lap joint, T-joint, or corner joint. STD
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**Flame hardening** - a process used to harden steel or other ferrous metals. In this process, an oxyacetylene torch is used to heat the surface of the material to a high temperature, then a rapid quench is administered to produce a hard martensitic surface.

**Flame spraying** - a thermal spraying process in which an oxyfuel gas is the source of heat for melting the surfacing material. Compressed gas may or may not be used for atomizing and propelling the surfacing material to the substrate. **STD**

**Flux** - a material used to hinder or prevent the formation of oxides and other undesirable substances in molten metal and on solid metal surfaces, and to dissolve or otherwise facilitate the removal of such substances. **STD**

**Flux cored arc welding (FCAW)** - an arc welding process that uses an arc between a continuous filler metal electrode and the weld pool. The process is used with shielding gas from a flux contained within the tubular electrode, with or without additional shielding form an externally supplied gas, and without the application of pressure. **STD**

**Flux cored electrode** - a composite tubular filler metal electrode consisting of a metal sheath and a core of various powdered materials, producing an extensive slag cover on the face of a weld bead. External shielding may be required. **STD**

**Fuel gas** - a gas such as acetylene, natural gas, hydrogen, propane, stabilized methyl acetylene propadiene, and other fuels normally used with oxygen in one of the oxyfuel processes and for heating. **STD**

**Fusion welding** - the melting together of filler metal and base metal, or of base metal only, to produce a weld. **STD**

**Galling** - adhesion or cohesion of localized areas of two bearing surfaces of metal, followed by the tearing out of small fragments from one or the other of the surfaces when they are separated.

**Galvanize** - to coat a metal with zinc to increase resistance to corrosion.

**Gas metal arc welding (GMAW)** - an arc welding process that uses an arc between a continuous filler metal electrode and the weld pool. The process is used with shielding from an externally supplied gas and without the application of pressure. **STD**

**Gas tungsten arc welding (GTAW)** - an arc welding process that uses an arc between a tungsten electrode (nonconsumable) and the weld pool. The process is used with shielding gas and without the application of pressure. **STD**
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**Globular transfer** - the transfer of molten metal in large drops from a consumable electrode across the arc. **STD**

**Hadfield steel** - a manganese steel with an approximate analysis of 12.5% manganese, 1.2% carbon. It is useful due to its work hardening under impact.

**Hardenability** - the relative ability of a steel to form martensite when quenched from a temperature above the upper critical temperature.

**Hardfacing** - a surfacing variation in which surfacing material is deposited to reduce wear. **STD** Hardfacing is the application of a hard, wear-resistant material to the surface of a workpiece by welding, spraying, or allied welding processes, to reduce wear or loss of material by abrasion, impact, erosion, galling and cavitation.

**Hard solder** - a nonstandard term for brazing filler metal.

**Heat-affected zone (HAZ)** - the portion of the base metal whose microstructure or mechanical properties have been altered by the heat of welding, brazing, soldering or thermal cutting. **STD**

**Heat treatment** - the post-welding introduction of heat to the weldment, to remove or improve conditions brought about by the heat of welding.

**Hot crack** - a crack formed at temperatures near the completion of solidification. **STD**

**Hydrogen embrittlement** - a condition that causes a loss of ductility and which exists in weld metal due to hydrogen absorption. In some metals the loss of ductility induces cracking.

**Inclusion** - entrapped particles of solid material, such as slag, flux, tungsten, or oxide occurring in metal or welds. **STD**

**Inert gas** - a gas that does not normally combine chemically with materials. **STD**

**Interpass temperature** - in a multipass weld, the temperature of the weld between weld passes. **STD**

**Inverter power supply** - a welding power supply that utilizes solid-state components to change the incoming 60 Hz power to a higher frequency, nominally 18 to 100 kHz. Changing the frequency results in greatly reduced size and weight of the transformer. Inverters can be used with all of the welding processes.

**Lap joint** - a joint between two overlapping members in parallel planes. **STD**
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**Low hydrogen** - hydrogen has a critical effect on the quality of weld deposits in steels. Under certain conditions the presence of hydrogen results in cracking. Hydrogen-induced cracking is also called underbead cracking, cold cracking, or delayed cracking. Cracking generally occurs at a temperature below 93 °C (200°F) immediately on cooling or after a period of several hours. The main source of hydrogen in welding is from moisture.

**Malleability** - a property of some metals that allows them to be hammered or rolled into thin sheets without rupture. Malleability is the property that permits the manufacture of sheets, bars, and forging, and permits fabrication by hammering and bending. Malleability is the direct opposite of brittleness.

**Manganese steel** - sometimes called high manganese steel or Hadfield steel, it can be identified by using a magnet. Carbon steel is magnetic; manganese steel is not.

**Martensite** - the hardest microstructure that can be formed in a carbon or alloy steel.

**Melting point** - the temperature at which a pure metal, compound, or eutectic changes from a solid to a liquid; the temperature at which the solid and liquid are in equilibrium.

**MIG welding** - a nonstandard term for gas metal arc welding and flux core arc welding.

**Neutral flame** - an oxyfuel gas flame that has characteristics neither oxidizing nor reducing. STD

**Nonferrous** - metals containing no ferrite or iron. Copper, brass, bronze, aluminum and lead are among the most common nonferrous metals.

**Oxidation** - the combination of a substance with oxygen; the chemical reaction between oxygen and other elements resulting in oxides. Oxidizing flame - an oxyfuel gas flame in which there is an excess of oxygen, resulting in an oxygen-rich zone extending around and beyond the cone. STD

**Oxyacetylene flame** - the flame produced by the combination of a mixture of oxygen and acetylene in various proportions. The proportions of these two gases affect the temperature of the flame; the temperature is controlled by varying the ratio of oxygen to acetylene.

**Oxyfuel gas cutting (OFC)** - a group of oxygen cutting processes that uses heat from an oxyfuel gas flame. STD

**Oxyfuel gas welding (OFW)** - a group of welding processes that produces coalescence of workpieces by heating them with an oxyfuel gas flame. The processes are used with or without the application of pressure and with or without filler metal. STD
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**Parent metal** - a nonstandard term for base metal.

**Peening** - the mechanical working of metals using impact blows. **STD** Peening tends to stretch the surface of the cold metal, thus reducing contraction stresses.

**Plasma arc** - the arc plasma forms as a result of the electrical heating of any gas to a very high temperature so that its atoms are ionized and conduct electricity. The energy of the arc is concentrated in a small area and thereby produces very rapid heating of the workpiece.

**Polarity** - see DCEN and DCEP.

**Power source** - an apparatus for supplying current and voltage suitable for welding, thermal cutting or spraying.

**Preheat** - the heat applied to the base metal or substrate to attain and maintain preheat temperature. **STD** Preheat is the application of heat to the workpiece prior to welding, brazing or cutting.

**Pulsed spray transfer** - a variation of spray transfer in which the welding power is cycled from a low level to a high level, at which point spray transfer is attained, resulting in a lower average voltage and current. **STD**

**Push angle** - the travel angle when the electrode is pointing in the direction of weld progression. This angle can also be used to partially define the position of guns, torches, rods, and beams. **STD**

**Quenching** - the sudden cooling of heated metal by immersion in oil, water, or some other liquid medium (e.g., glycol or liquid nitrogen), a molten salt, or by spraying with a jet of water or compressed air. The purpose of quenching is to produce desired weld strength properties in hardenable steel.

**Reducing flame** - an oxyfuel gas flame with an excess of fuel gas. **STD** Can also be referred to as a carburizing flame.

**Reverse polarity** - a nonstandard term for direct current electrode positive. (DCEP)

**Rockwell hardness test (HR)** - Rockwell hardness testing relates hardness to the depth of indentation under load.

**Self-shielded flux core arc welding (FCAW-S)** - a flux cored arc welding process variation in which shielding gas is obtained exclusively from the flux within the electrode. **STD**
Shielded metal arc welding (SMAW) - an arc welding process with an arc between a covered electrode and the weld pool. The process is used with shielding from the decomposition of the electrode covering, without the application of pressure, and with filler metal from the electrode. STD

Short circuit gas metal arc welding (GMAW-S) - a gas metal arc welding process variation in which the consumable electrode is deposited during repeated short circuits. STD A short circuiting arc is a method of metal transfer, sometimes referred to as short arc or dip transfer. The outstanding characteristic of short circuiting is the low heat input for thin metals.

Silicon bronze - a bronze or brass containing silicon, which gives it toughness and strength.

Slag inclusion - nonmetallic material entrapped in a weld.

Soft solder - a nonstandard term for solder.

Solder - the metal or alloy used as a filler metal in soldering, which has a liquidus not exceeding 840°F (450°C ) and below the solidus of the base metal. STD

Spray transfer - metal transfer in which molten metal from a consumable electrode is propelled axially across the arc in small droplets. STD

Stickout (GMAW, FCAW) - the length of unmelted electrode extending beyond the end of the contact tube.

Straight polarity - a nonstandard term for direct current electrode negative (DCEN).

Stress-relief cracking - intergranular cracking in the heat affected zone or weld metal as a result of the combined action of residual stresses and postweld exposure to an elevated temperature. STD

Tack weld - a weld made to hold the parts of a weldment in proper alignment until the final welds are made. STD

Tensile strength - the resistance to breaking exhibited by a material when it is subjected to a pulling stress.

Thermal conductivity - the property of a material that allows the passage of heat. Conduction is most often the mechanism involved in a weldment.

TIG welding - a nonstandard term for gas tungsten arc welding (GTAW).
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**Volt** - a measurement of electrical potential and electromotive force calculated between two points on a conducting wire carrying a constant current of one ampere, when the power dissipated between the points is one watt.

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