

Welding Terms Glossary

Advanced Squarewave: The advanced AC output available from certain types of power sources. The wave is much more square than the conventional Squarewave power source. It also has expanded balance control to 90% electrode negative (max penetration) and the ability to control arc frequency (arc direction). Some have the additional ability to adjust the amount of current in the electrode negative and electrode positive cycles independently.

Air Carbon Arc Cutting: A cutting process by which metals are melted by the heat of an arc using a carbon electrode. Molten metal is forced away from the cut by a blast of forced air.

Alternating Current (AC): An electrical current that reverses its direction at regular intervals, such as 60 cycles alternating current (AC), or 60 hertz (Hz).

Amperage: The measurement of the amount of electricity flowing past a given point in a conductor per second. Current is another name for amperage.

Annealing: The opposite of hardening. A heat treating process used to soften a metal and relieve internal stresses.

Anodize: To anodize aluminum is to coat the metal by either chemical or electrical means. The coating provides improved corrosion and wear resistance. The thickness of this coating depends upon the length of the treatment. This coating is often removed from the area to be welded. This coating can be reapplied after welding.

Arc: The physical gap between the end of the electrode and the base metal. The physical gap causes heat due to resistance of current flow and arc rays.

Arc Length: Distance or air space between the tip of the electrode and the work.

Arc Voltage: Measured across the welding arc between the electrode tip and the surface of the weld pool.

Asymmetric Waveform: The output waveform of a welding power source that has the ability to modify both the amplitude and duration of the positive and negative half cycles of alternating current.

Autogenous Weld: When a TIG weld is made without the addition of filler metal.

Automatic Welding (AU): Uses equipment which welds without the constant adjusting of controls by the welder or operator. Equipment controls joint alignment by using an automatic sensing device.

Axis of Weld: Can be thought of as an imaginary line through the center of a weld, lengthwise.

Back Gouging: The removal of weld metal and base metal from the other side (root side) of a weld joint. When this gouged area is welded, complete penetration of the weld joint is assured.

Balanced Wave: An alternating current waveform that has equal negative and positive polarity current values.

Bevel Angle: An angle formed between a plane, perpendicular to the surface of the base metal and the prepared edge of the base metal. This angle refers to the metal that has been removed.

Butt Joint: A weldment where the material surfaces and joining edges are in or near the same plane.

Carbide Precipitation: Occurs when austenitic stainless steel is heated within a temperature range of 800°–1600° F, 427°– 870° C for a critical period of time. Carbon moves from a solid solution to grain boundaries and combines with chromium. The metal adjacent to the grain boundaries is left with less chromium and is said to be sensitized. Corrosion resistance is therefore reduced in the grain boundary region.

Carbon Arc Gouging: A cutting process by which metals are melted by the heat of an arc using a carbon electrode. Molten metal is forced away from the cut by a blast of forced air.

Cerium Tungsten: GTAW tungsten electrode with small amount of the rare earth and nonradioactive ceria added. Improves arc starting and provides for use of wider current range.

Characteristics: Special qualities or properties. For instance, some welding machines have certain internal characteristics which allow a welder to perform more welding applications than with other welding machines.

Circuit: The complete path or route traveled by the electrical current. A circuit for GTAW can include the welding machine, weld cables, torch assembly, arc, base metal and work clamp with cable.

Cold Lap: See preferred term Incomplete Fusion.

Conductor: An electrical path where current will flow with the least amount of resistance. Most metals are good electrical conductors.

Constant Current (CC) Welding Machine: These welding machines have limited maximum short circuit current. They have a negative volt-amp curve and are often referred to as “droopers”. The voltage will change with different arc lengths while only slightly varying the amperage, thus the name constant current or variable voltage.

Constant Voltage (CV), Constant Potential (CP) Welding Machine: “Potential” and “voltage” are basically the same in meaning. This type of welding machine output maintains a relatively stable, consistent voltage regardless of the amperage output. It results in a relatively flat volt-amp curve as opposed to the drooping volt-amp curve of a typical GTAW (TIG) welding machine.

Consumable Insert: Preplaced filler metal that is completely fused into the joint root and becomes part of the weld.

Contact: An electrical switch that is used to energize or de-energize output terminals of a welding machine. In some types of welding machines they can be of solid state design, with no moving parts and thus no arcing of contact points.

Corner Joint: Produced when the weld members meet at approximately 90° to each other in the shape of an “L”.

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

Current: Another name for amperage. The amount of electricity flowing past a point in a conductor every second.

Current Density: The amount of current per square inch of cross-sectional area in an electrode. For any electrode diameter, find the current density by dividing the current value by the electrode cross-sectional area in square inches.

Cycle: One cycle equals 360 electrical degrees. For alternating current, current flow is in one direction through a circuit for 180° and in the opposite direction for the other 180°. For 60 cycle power, a cycle is repeated 60 times per second. Some welding machines, especially outside the United States, require 50 cycle (hertz) power. Hertz stands for cycles per second.

Defect: One or more discontinuities that exceed the acceptance criteria as specified for a weld.

Depth of Fusion: The depth or distance that deposited weld metal extends into the base metal or the previous pass.

Direct Current: Flows in one direction and does not reverse its direction of flow as does alternating current.

Direct Current Electrode Negative (DCEN): The specific direction of current flow through a welding circuit when the electrode lead is connected to the negative terminal and the work lead is connected to the positive terminal of a DC welding machine.

Direct Current Electrode Positive (DCEP): The specific direction of current flow through a welding circuit when the electrode lead is connected to a positive terminal and the work lead is connected to a negative terminal to a DC welding machine.

Discontinuity: Any change in a metal's typical structure. It is the lack of consistence in mechanical, metallurgical or physical characteristics. Discontinuities are found in all metals and welds because they have some degree of inconsistency in them. However, this is acceptable as long as the discontinuities do not exceed the acceptance criteria of the weld or metal in question. If a discontinuity exceeds the acceptance criteria, they are defects and must be repaired.

Distortion: The warpage of a metal due to the internal residual stresses remaining after welding from metal expansion (during heating), and contraction (during cooling).

Duty Cycle: The number of minutes out of a 10-minute time period an arc welding machine can be operated at maximum rated output. An example would be 60% duty cycle at 300 amps. This would mean that at 300 amps the welding machine can be used for 6 minutes and then must be allowed to cool with the fan motor running for 4 minutes. (Some imported welding machines are based on a 5-minute cycle).

Edge Joint: A joint that occurs when the surfaces of the two pieces of metal to be joined are parallel or nearly parallel, and the weld is made along their edges.

Electrode Extension: While welding, the length of electrode extending beyond the end of the gas cup. Also referred to as electrical stickout.

Electron: A very small atomic particle which carries a negative electrical charge. Electrons can move from one place to another in atomic structures. It is electrons that move when electrical current flows in an electrical conductor.

Etching: When a weld specimen is cut through a weld, an acid or similar solution can be applied to the weld area to bring out the features of the weld. These include the deposited weld metal, heat affected zone, penetration and weld profile. Many different etching solutions and techniques exist for the various kinds of metals.

Excessive Melt-Through: A weld defect occurring in a weld joint when weld metal no longer fuses the base metals being joined. Rather, the weld metal falls through the weld joint or "burns through". Also referred to as excess penetration.

Face: The surface of the weld as seen from the side of the joint on which the weld was made.

Face Rotation: Can be thought of as an imaginary line from the axis of the weld through the center of the welds face. This face rotation angle along with the axis angle determine the actual welding position. Face rotation is measured in a clockwise direction starting from the 6 o'clock position. A weld with the face rotation at 12 o'clock would have the face rotation at 180°.

Ferrous: Refers to a metal that contains primarily iron, such as steel, stainless steel and cast iron.

Filler Metal: The metal added when making a welded, brazed, or soldered joint.

Fillet Weld: A weld that is used to join base metal surfaces that are approximately 90° to each other, as used on T-joint, corner joint or lap joint. The cross sectional shape of a fillet weld is approximately triangular.

Fit-Up: Often used to refer to the manner in which two members are brought together to be welded, such as the actual space or any clearance or alignment between two members to be welded. Proper fit-up is important if a good weld is to be made. Tacking, clamping or fixturing is often done to ensure proper fit-up. Where it applies, base metal must be beveled correctly and consistently. Also, any root openings or joint angles must be consistent for the entire length of a joint. An example of poor fit-up can be too large of a root opening in a V-groove butt weld.

Flat Position: When welding is done from the top side of a joint, it is in the flat position if the face of the weld is approximately horizontal. Sometimes referred to as downhand welding. The axis angle can be from 0° – 15° in either direction from a horizontal surface. Face rotation can be from 150° – 210° .

Flux Cored Arc Welding (FCAW): An arc welding process which melts and joins metals by heating them with an arc between a continuous, consumable tubular electrode wire (consumable) and the workpiece. Shielding is obtained from a flux contained within the electrode's tubular core. Depending upon the type of flux-cored wire, added shielding may or may not be provided from externally supplied gas or gas mixture.

Freeze Lines: The lines formed across a weld bead. They are the result of the weld pool freezing. In appearance they sometimes look as if one tiny weld was continuously laid upon another.

Frequency: The number of double directional changes made by an alternating current in one second. Usually referred to as "hertz per second" or "cycles per second". In the United States, the frequency or directional change of alternating current is usually 60 hertz. Some Advanced Squarewave power sources allow the arc frequency to be adjusted. As arc frequency is increased the arc becomes more directional.

Gas Metal Arc Welding (GMAW): An arc welding process which joins metals by heating them with an arc. The arc is between a continuously fed solid filler wire (consumable) electrode and the workpiece. Externally supplied gas or gas mixtures provide shielding for GMAW. Sometimes called MIG welding (Metal Inert Gas) or MAG welding (Metal Active Gas).

Gas Nozzle: That part of the GTAW torch that directs the shielding gas flow over the weld area. Made of ceramic, glass, or metal in various styles.

Gas Tungsten Arc Welding (GTAW): Sometimes called TIG welding (Tungsten Inert Gas), it is a welding process which joins metals by heating them with a tungsten electrode which should not become part of the completed weld. Filler metal is sometimes used and argon inert gas or inert gas mixtures are used for shielding.

Groove Angle: When a groove is made between two materials to be joined together, the groove angle represents the total size of the angle between the two beveled edges and denotes the amount of material that is to be removed.

Ground Connection: A safety connection from a welding machine frame to the earth. Often used for grounding an engine driven welding machine where a cable is connected from a ground stud on the welding machine to a metal stake placed in the ground. See Work Connection for the difference between work connection and ground connection.

Ground Lead: When referring to the connection from the welding machine to the work, see preferred term Work Lead.

Heat Affected Zone (HAZ): The portion of a weldment that has not melted, but has changed due to the heat of welding. The HAZ is between the weld deposit and the unaffected base metal. The physical make-up or mechanical properties of this zone are different after welding.

Heat Sink: A good weld needs a certain amount of base metal to absorb the high heat input from the welding arc area. The more base metal, or the thicker the base metal, the better heat sink effect. If this heat sink is not present, too much heat will stay in the weld area, and defects can occur.

High Frequency: Covers the entire frequency spectrum above 50,000 Hz. Used in GTAW welding for arc ignition and stabilization.

Horizontal Position: Occurs when the axis of the weld is from 0° – 15° from the horizontal, and the face rotation is from either 80° – 150° or 210° – 280° for groove welds, or from either 125° – 150° or 210° – 235° for fillet welds.

Impedance: In electricity, impedance will slow down, but not stop, amperage flowing in a circuit. It is the resistance in an alternating current circuit. Impedance is the combination of the natural resistance to current flow in any conductor and the inductive or capacitive reactance in an electric circuit. It is brought about by the building and collapsing field of alternating current. This building and collapsing induces a counter electro motive force (CEMF) (voltage) that holds back, but does not stop, current flow.

Included Groove Angle: See preferred term Groove Angle.

Incomplete Fusion: Molten filler metal rolling over a weld edge but failing to fuse to the base metal. Also referred to as cold lap.

Inductance: Inductance (an inductor) will slow down the changes in current, as if the electrons were sluggish.

Inert Gas: A gas that will not combine with any known element. At present 6 are known; argon, helium, xenon, radon, neon, and krypton. Only argon and helium are used as shielding gases for welding.

Inverter: Power source which increases the frequency of the incoming primary power, thus providing for a smaller size machine and improved electrical characteristics for welding, such as faster response time and more control for waveshaping and pulse welding.

Joint Design: A cross-sectional design and the given measurements for a particular weld. Generally includes included angles, root opening, root face, etc.

Joint Root: That part of a joint that comes closes together where the weld is to be made. This maybe an area of the joint or just a line or point of that joint.

Lanthanum Tungsten: GTAW tungsten electrode with small amount of the rare earth and nonradioactive lanthana added. Improves arc starting and provides for use of wider current range.

Lap Joint: A joint that is produced when two or more members of a weldment overlap one another.

Lift Arc: An arc starting method built into the GTAW power source to allow contact type starts. Tungsten contamination is virtually eliminated.

Load Voltage: Measured at the output terminals of a welding machine while a welder is welding. It includes the arc voltage (measured while welding), and the voltage drop through connections and weld cables.

Machine Welding (ME): Uses equipment which welds with the constant adjusting and setting of controls by a welder or operator.

Microprocessor: One or more integrated circuits that can be programmed with stored instructions to perform a variety of functions.

Nonferrous: Refers to a metal that contains no iron, such as aluminum, copper, bronze, brass, tin, lead, gold, silver, etc.

Open Circuit Voltage (OCV): As the name implies, no current is flowing in the circuit because the circuit is open. The voltage is impressed upon the circuit, however, so that when the circuit is completed, the current will flow immediately. For example, a welding machine that is turned on but not being used for welding at the moment will have an open circuit voltage applied to the cables attached to the output terminals of the welding machine.

Output Control: An electrical switch that is used to energize or de-energize output terminals of a welding machine. In some types of welding machines they can be of solid state design, with no moving parts and thus no arcing of contact points.

Overhead Position: When the axis angle is from 0° – 80° and the face rotation is from 0° – 80° or 280° – 360° for groove welds or from 0° – 125° or 235° – 360° for fillet welds, the weld position is considered to be in the overhead position.

Parameters: The welding settings on a welding machine such as voltage and amperage, normally read on a volt meter and an amp meter. It may also include things as travel speed, electrode size, torch angle, electrode extension and weld joint position and preparation.