

Glossary for Welding Know-How

A

- acceptable weld:** A weld that meets the applicable requirements.
- acetone:** A colorless, flammable, volatile liquid used as a paint remover and as a solvent for oils and other organic compounds. Used in acetylene cylinders to saturate the monolithic filler material to stabilize the acetylene.
- acetylene feather:** The intense white, feathery-edged portion adjacent to the cone of a carburizing oxyacetylene flame.
- actual throat:** The shortest distance between the weld root and the face of a fillet weld.
- adhesion:** A state of being stuck together. The joining together of parts that are normally separate.
- AISI:** The American Iron and Steel Institute.
- aluminum:** One of the chemical elements, a silvery, lightweight, easily worked metal that resists corrosion.
- ampere:** A unit of electrical current measuring the rate of flow of electrons through a circuit. One ampere is equivalent to the current produced by one volt applied across a resistance of one ohm.
- annealing:** A process of heating then cooling metal to acquire desired qualities such as ductility.
- anode:** The positive terminal of an electrical source.
- alloy:** A substance with metallic properties, composed of two or more chemical elements of which at least one is a metal.
- alloying element:** Elements added in a large enough percentage to change the characteristics of the metal. Such elements may be chromium, manganese, nickel, tungsten, or vanadium; these elements are added to produce specific physical properties such as hardness, toughness, ductility, strength, resistance to corrosion, or resistance to wear.
- alloy steel:** A plain carbon steel to which another element, other than iron and carbon, has been added in a percentage large enough to alter its characteristics.
- alternating current (AC):** An electric current that reverses its direction periodically.

- alternative fuels:** Propane, methylacetylene propadiene (MPS), natural gas, or fuel gases, other than acetylene, used for welding or cutting.
- arc blow:** The deflection of an arc from its normal path because of magnetic forces.
- arc force:** The axial force developed by an arc plasma.
- arc gap:** A nonstandard term used for the arc length.
- arc gouging:** Thermal gouging that uses an arc cutting process variation to form a bevel or groove.
- arc plasma:** A gas that has been heated by an arc to at least a partially ionized condition, enabling it to conduct electric current.
- arc spraying:** A thermal spraying process using an arc between two consumable electrodes of surfacing materials as a heat source and a compressed gas to atomize and propel the surfacing material to the substrate.
- arc strike:** A discontinuity resulting from an arc, consisting of any localized re-melted metal, heat-affected metal, or change in the surface profile of any metal object.
- arc time:** The time during which an arc is maintained in making an arc weld.
- arc welding:** Arc welding is a group of welding processes in which fusion is produced by heating with an electric arc or arcs with or without the application of pressure and with or without the use of filler metal.
- arc voltage:** The voltage across the arc.
- as welded:** The condition of weld metal, welded joint, and weldments after welding, but prior to any subsequent thermal or mechanical treatment.
- ASTM:** The American Society for Testing and Materials.
- austenite:** One of the basic steel microstructures wherein carbon is dissolved in iron. Austenite forms at elevated temperatures.
- autogenous weld:** A fusion weld made without using a filler material.
- AWS:** The American Welding Society.
- axis of a weld:** A line through the length of a weld, perpendicular to and at the geometric center of its cross-section.

B

- back bead:** A weld bead resulting from a back weld pass. Back beads are made *after* the primary weld is completed.
- back fire:** The momentary recession of the flame into the welding tip, or cutting tip followed by immediate reappearance or complete extinction of the flame, accompanied by a loud popping report.
- backgouging:** The removal of weld metal and base metal from the weld root side of a welded joint to facilitate complete fusion and complete joint penetration upon subsequent welding from that side.
- backhand welding:** A welding technique in which the welding torch or gun is directed

opposite to the progress of welding.

backing: Material or device placed against the back side of a joint to support and retain molten weld-metal. The material may be partially fused or remain unfused during welding and may be either metal or nonmetal (metal strip, asbestos, carbon, copper, inert gas, ceramics).

backing bead: A weld bead resulting from a backing pass. Backing beads are completed *before* welding the primary weld.

backing pass: A weld pass made to provide a backing for the primary weld.

backing ring: Backing in the form of a ring, generally used in the welding of pipe.

backing strip: Non-standard term used to describe a backing on the root side of the weld in the form of a strip.

back-step sequence: A longitudinal sequence in which weld passes are made in the direction opposite weld progression, usually used to control distortion.

back weld: A weld made at the back of a single groove weld.

bainite: A steel microstructure that is harder than pearlite, cementite, or ferrite, and more ductile than martensite.

base material: The material that is welded, brazed, soldered, or cut.

base metal: The metal or alloy that is welded, brazed, soldered, or cut.

bead weld: A term used for surfacing welds.

bevel: An edge preparation, the angular edge shape.

bevel angle: The angle between the bevel of a joint member and a plane perpendicular to the surface of the member.

body-centered cubic (BCC): One of the common types of unit cells described as a cube with an atom at each of the eight corners and a single atom at the center of the cell. This arrangement is typical of the ferritic form of iron. Among the common BCC metals are iron, carbon steel, chromium, molybdenum, and tungsten.

boxing: The continuation of a fillet weld around a corner of a member as an extension of the principle weld.

braze: A weld produced by heating an assembly to the brazing temperature using filler metals having a liquidus above 840°F (450°C) 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.

braze metal: The filler metal used to make the joint of a brazed socket having a liquidus above 850°F (450°C).

braze welding: A welding process that uses a filler metal with a liquidus above 840°F (450°C) and below solidus of the base metal. The base metal is not melted. Unlike brazing, in braze welding the filler metal is not distributed in the joint by capillary action.

brazing: A group of welding processes that produces coalescence of materials by heating them to the brazing temperature in the presence of a filler metal having a liquidus above 850°F (450°C) 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.

brazing filler metal: The metal or alloy used as a filler metal in brazing, which has liquidus above 850°F (450°C) and below the solidus of the base metal.

Brinell hardness test: A common testing method using a ball penetrator. The diameter of the indentation is converted to units of Brinell hardness number (BHN).

buckling: Bending or warping caused by the heat of welding.

buttering: A surfacing variation that deposits surfacing metal on one or more surfaces to provide metallurgically compatible weld metal for the subsequent completion of the weld.

butting member: A joint member that is prevented by the other member from movement in one direction perpendicular to its thickness dimension.

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

C

capacitor: A device consisting of two or more conducting plates separated from one another by an insulating material and used for storing an electrical charge.

capillary action: The force by which liquid in contact with a solid is distributed between closely fitted faying surfaces of the joint to be brazed or soldered.

carbon: A nonmetallic chemical element that occurs in many inorganic and all organic compounds. Carbon is found in diamond and graphite, and is a constituent of coal, petroleum, asphalt, limestone, and other carbonates. In combination, it occurs as carbon dioxide and as a constituent of all living things. Adjustment of the amount of carbon in iron produces steel.

carbon steel: A steel containing various percentages of carbon. Low-carbon steel contains a maximum of 0.15% carbon; mild steel contains 0.15% to 0.35% carbon; medium-carbon steel contains 0.35% to 0.60% carbon; high-carbon steel contains from 0.60% to 1.0% carbon.

carburizing flame: A reducing oxygen-fuel gas flame in which there is an excess of fuel gas, resulting in a carbon-rich zone extending around and beyond the inner cone of the flame.

cast iron: A family of alloys, containing more than 2% carbon and between 1% and 3% silicon. Cast irons are not malleable when solid, and most have low ductility and poor resistance to impact loading. There are four basic types of cast iron gray, white, ductile, and malleable.

cathode: The negative terminal of a power supply; the electrode when using direct current electrode negative (DCEN).

caulking: Plastic deformation of weld and adjacent base metal surfaces by mechanical means to seal or obscure discontinuities.

cementite: A very hard form of low-temperature steel that contains more than 0.8% carbon. Cementite occurs in steel that has not been previously heat treated or in steel that has been cooled slowly after being transformed into austenite.

chain intermittent weld: An intermittent weld on both sides of a joint where the weld increments on one side are approximately opposite those on the other side.

- Charpy V-notch test:** An impact test used to determine the notch toughness of materials.
- chill plate:** A piece of metal placed behind material being welded to correct overheating.
- chill ring:** A non-standard term for a backing ring.
- chromium:** A lustrous, hard, brittle, steel-gray metallic element used to harden steel alloys, in production of stainless steel, and as a corrosion resistant plating.
- cladding:** A surfacing variation that deposits or applies surfacing material usually to improve corrosion or heat resistance.
- coalescence:** The growing together or growth into one body of the materials being welded.
- coefficient of thermal expansion:** The increase in length per unit length for each degree a metal is heated.
- cohesion:** Cohesion is the result of a perfect fusion and penetration when the molecules of the parent material and the added filler materials thoroughly integrate as in a weld.
- cold crack:** A crack that develops after solidification is complete.
- cold work:** Cold working refers to forming, bending, or hammering a metal well below the melting point. Cold working of metals causes hardening, making them stronger but less ductile.
- cold soldered joint:** A joint with incomplete coalescence caused by insufficient application of heat to the base metal during soldering.
- complete fusion:** Fusion over the entire fusion faces and between all adjoining weld beads.
- complete joint penetration:** A root condition in a groove weld in which weld metal extends through the joint thickness.
- composite:** A material consisting of two or more discrete materials with each material retaining its physical identity.
- composite electrode:** A generic term for multi-component filler metal electrodes in various physical forms such as stranded wires, tubes, or covered wire.
- concavity:** The maximum distance from the face of a concave fillet weld perpendicular to a line joining the weld toes. A concave fillet weld will have a face that is contoured below a straight line between the two toes of a fillet weld.
- conductor:** A device, usually a wire, used to connect or join one circuit or terminal to another.
- cone:** The conical part of an oxygen-fuel gas flame adjacent to the tip orifice.
- constant-current (CC) power source:** An arc welding power source with a volt-ampere relationship yielding a small welding current change from a large arc voltage change.
- constant-voltage (CV) power source:** An arc welding power source with a volt-ampere relationship yielding a large welding current change from a small arc voltage change.
- constricted arc:** A plasma arc column that is shaped by the constricting orifice in the nozzle of the plasma arc torch or plasma spraying gun.
- consumable electrode:** An electrode that provides filler metal, therefore is consumed in the

arc welding process.

consumable insert: Filler metal that is placed at the joint root before welding, and is intended to be completely fused into the joint root to become part of the completed weld.

contact resistance: Resistance to the flow of electric current between two work-pieces or an electrode and the work-piece.

contact tube: A device that transfers current to a continuous electrode.

contact tube setback: The distance from the contact tube to the end of the gas nozzle. This term is used in gas metal arc and gas shielded flux cored arc welding.

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

corner joint: A joint between two members located approximately at right angles to each other in the form of an *L*.

corrosive flux: A flux with a residue that chemically attacks the base metal. It may be composed of inorganic salts and acids, organic salts and acids, or activated rosin.

cosmetic pass: A weld pass made primarily to enhance appearance.

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 atmosphere, deoxidation, and arc stabilization, and can serve as a source of metallic additions to the weld.

cover plate: A removable pane of colorless glass, plastics coated glass, or plastics that covers the filter plate and protects it from weld spatter, pitting, or scratching.

crack: A fracture-type discontinuity characterized by a sharp tip and high ratio of length and width to opening displacement.

cracking a valve: Rapidly opening and closing a valve to clear the orifice of unwanted foreign material.

crater: A depression in the weld face at the termination of a weld bead.

crater crack: Radial cracks formed in a weld crater as the weld pool solidifies and shrinks.

crystalline structure: The orderly arrangement of atoms in a solid in a specific geometric pattern. Sometimes called a lattice structure.

cutting attachment: A device for converting an oxygen-fuel gas welding torch into an oxygen-fuel cutting torch.

cutting head: The part of a cutting attachment to which the cutting torch or tip may be attached.

cutting tip: An attachment to an oxygen cutting torch from which the gases exit.

cycle: The duration of alternating current represented by the current increase from an initial value to a maximum in one direction then to a maximum in the reverse direction and its return to the original initial value.

cylinder manifold: A multiple header for interconnection of gas sources with distribution

points.

D

defect: A discontinuity or discontinuities that by nature or accumulated effect render a part or product unable to meet minimum applicable acceptance standards or specifications. The term designates rejection.

deposited metal: Filler metal that has been added during welding, brazing, or soldering.

deposition rate: The weight of filler material deposited in a unit of time.

depth of bevel: The perpendicular distance from the base metal surface to the root edge or the beginning of the root face.

depth of fusion: The distance that fusion extends into the base metal or previous bead from the surface melted during welding.

diode: Diodes are check valves for electricity. They will pass current in only one direction, from plus to minus, and are used to convert AC to DC.

dip brazing (DB): A brazing process that uses heat from a molten salt or metal bath. When a molten salt is used, the bath may act as a flux. When a molten metal is used, the bath provides the filler metal.

direct current electrode negative (DCEN): The arrangement of direct current arc welding cables in which the electrode is the negative pole and the workpiece is the positive pole of the welding arc.

direct current electrode positive (DCEP): The arrangement of direct current arc welding cables in which the electrode is the positive pole and the workpiece is the negative pole of the welding arc.

discontinuity: An interruption of the typical structure of a material, such as a lack of homogeneity in its mechanical, metallurgical, or physical characteristics. A discontinuity is not necessarily a defect.

distortion: Non-uniform expansion and contraction of metal caused by heating and cooling during the welding process.

downhill: Welding in a downward progression.

drag: During thermal cutting, the offset distance between the actual and straight line exit points of the gas stream or cutting beam measured on the exit surface of the base metal.

drag angle: The travel angle when the electrode is pointing in a direction opposite to the progression of welding. This angle can also be used to partially define the positions of guns, torches, and rods.

ductility: The tendency to stretch or deform appreciably before 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. Most welding machines are rated in intervals of ten minutes meaning that a duty cycle of 50% means the machine can be operated at a given amperage setting for five continuous minutes without damage to the equipment. 60% would give six minutes; 70% would give seven minutes.

E

- edge joint:** A joint between the edges of two or more parallel or nearly parallel members.
- edge preparation:** The preparation of the edges of the joint members, by cutting, cleaning, plating, or other means.
- effective throat:** The minimum distance, minus any convexity, between the weld root and the face of a fillet weld.
- electrode:** A component of the electrical welding circuit that terminates at the arc, molten conductive slag, or base metal.
- electrode angle:** The angle of the electrode in relationship to the surface of the material being welded; the electrode's perpendicular angle to the metals' surface leaning toward the direction of travel.
- electrode classification:** A means of identifying electrodes by their usability, flux coverings, and chemical make up. The American Welding Society has published a series of specifications for consumables used in welding processes.
- electrode extension:** In gas metal arc welding, flux cored arc welding, electrogas welding, and submerged arc welding, it is the length of electrode extending beyond the end of the contact tube. In gas tungsten arc welding and plasma arc welding, it is the length of the tungsten extending beyond the end of the collet.
- electrode holder:** A device used for mechanically holding and conducting current to an electrode during welding or cutting.
- electrode lead:** The electrical conductor between the source of arc welding current and the electrode holder.
- elongation:** The amount of permanent extension in the vicinity of a fracture in a tension test; usually expressed in a percentage of original gauge length.
- eutectic composition:** The composition of an alloy system that has two descending liquidus curves; the lowest possible melting point for that mixture of metals.

F

- face bend test:** A test in which the weld face is on the convex surface of a specified bend radius.
- face-centered cubic (FCC):** One of the common types of unit cells in which atoms are located on each corner and the center of each face of a cube. Among the common FCC metals are aluminum, copper, nickel, and austenitic stainless steel. This arrangement is typical of the austenitic form of iron.
- face reinforcement:** Weld reinforcement on the side of the joint from which welding was done.
- fatigue strength:** Ability of a material to withstand repeated loading.
- faying surface:** The mating surface of a member that is in contact with or in close proximity to another member to which it is to be joined.
- ferrite:** A form of low-temperature steel that contains a very small percentage of carbon.

Ferrite occurs in steel that has not been previously heat treated or in steel that has been cooled slowly after being transformed to austenite.

filler material: The material, metal, or alloy to be added in making a welded, brazed, or soldered joint.

filler metal: The metal also known as brazing filler metal, consumable insert, diffusion aid, filler material, solder, welding electrode, welding filler metal, welding rod, and welding wire.

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.

fillet weld break test: A test in which the specimen is loaded so that the weld root is in tension.

fillet weld leg: The distance from the joint root to the toe of the fillet weld.

fillet weld size: For equal-leg fillet welds, the leg lengths of the largest isosceles right triangle that can be inscribed within the fillet weld cross-section. For unequal leg fillet welds, the leg lengths of the right triangle can be inscribed within the fillet weld cross-section.

filter plate: An optical material that protects the eyes against excessive ultraviolet, infrared, and visible radiation. Also called filter glass or filter lens.

filter plate shade: Refers to the lens darkness number, which indicates the darkness of the lens.

5F: A welding test position designation for a circumferential fillet weld applied to a joint in pipe, with its axis approximately horizontal, in which the weld is made in the horizontal, vertical, and overhead welding positions. The pipe remains fixed until the welding of the joint is complete.

5G: A welding test position designation for a circumferential groove weld applied to a joint in a pipe with its axis horizontal, in which the weld is made in the flat, vertical, and overhead welding positions. The pipe remains fixed until the welding of the joint is complete.

fixture: A device designed to hold and maintain parts in proper relation to each other.

flame propagation rate: The speed at which flame travels through a mixture of gases.

flare-V-groove weld: A weld in a groove formed by two members with curved surfaces.

flashback: A recession of the flame into or back of the mixing chamber of the oxygen fuel gas torch or flame spraying gun.

flashback arrester: A device to limit damage from a flashback by preventing propagation of the flame from beyond the location of the arrester.

flat welding position: The welding position used to weld from the upper side of the joint at a point where the weld axis is approximately horizontal, and the weld face lies in an approximately horizontal plane.

flaw: An undesirable blemish or discontinuity in a weld such as a crack or porosity.

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.

- 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.
- flux cutting (FOC):** An oxygen cutting process that uses heat from an oxyfuel gas flame with a flux in the flame to aid cutting.
- forehand welding:** A welding technique in which the welding torch or gun is directed toward the progress of welding.
- fuel gas:** A gas such as acetylene, natural gas, hydrogen, propane, stabilized methylacetylene propadiene, and other fuels normally used with oxygen in one of the oxyfuel processes and for heating.
- furnace brazing (FB):** A brazing process in which the work-pieces are placed in a furnace and heated to the brazing temperature.
- furnace soldering (FS):** A soldering process in which the work-pieces are placed in a furnace and heated to the soldering temperature.
- fusible plug:** A metal alloy plug that closes the discharge channel of a gas cylinder and is designed to melt at a predetermined temperature permitting the escape of gas.
- fusion:** The joining of base material, with or without filler material, by melting them together.
- fusion face:** A surface of the base metal that will be melted during welding.
- fusion welding:** Any welding process that uses fusion of the base metal to make the weld.
- fusion zone:** The area of base metal as determined on the cross-section of a weld.

G

- gas cylinder:** A portable container used for transportation and storage of compressed gas.
- gas nozzle:** A device at the exit end of the torch or gun that directs shielding gas.
- gas regulator:** A device for controlling the delivery of gas at some substantially constant pressure.
- globular transfer:** In arc welding, the transfer of molten metal in large drops from a consumable electrode across the arc.
- GMAW:** The welding process Gas Metal Arc Welding; non-standard terms for this process are MIG (metal inert gas), MAG (metal active gas), wire feed, hard wire welding.
- goggles:** Protective glasses equipped with filter plates set in a frame that fits snugly against the face and used primarily with oxygen fuel gas welding processes.
- groove angle:** The total included angle of the groove between workpieces.
- groove face:** The surface of a joint member included in the side of the groove from root to toe.
- groove radius:** The radius used to form the shape of a J- or U-groove weld.
- groove weld:** A weld made in a groove between the workpieces. See welding symbols.
- groove weld size:** The joint penetration of a groove weld. Also groove throat or effective

throat.

ground connection: An electrical connection of the welding machine frame to the earth for safety.

GTAW: The Gas Tungsten Arc Welding process; non-standard terms are Heliarc™, and TIG (tungsten inert gas).

H

hardfacing: A surfacing variation in which hard material is deposited to reduce wear.

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

hexagonal close packed (HCP): A unit cell in which two hexagons (six-sided shapes) form the top and bottom of the prism. An atom is located at the center and at each point of the hexagon. Three atoms, one at each point of a triangle, are located between the top and bottom hexagons. Among the common HCP metals are zinc, cadmium, and magnesium.

high carbon steel: See carbon steel.

horizontal welding position: In a fillet weld, the welding position in which the weld is on the upper side of an approximately horizontal surface and against an approximately vertical surface. In a groove weld, the welding position in which the weld face lies in an approximately vertical plane and the weld axis at the point of welding is approximately horizontal.

hydrogen: The lightest chemical element, colorless, odorless, and tasteless. It is found in combination with other elements in most organic compounds and many inorganic compounds. Hydrogen combines readily with oxygen in the presence of heat, and forms water.

I

impact strength: The ability of a material to resist shock, dependent on both strength and ductility of the material.

inclusion: Entrapped foreign solid material, such as slag, flux, tungsten, or oxide.

incomplete fusion: A weld discontinuity in which fusion did not occur between weld metal and fusion faces or adjoining weld beads.

incomplete joint penetration: A joint root condition in a groove weld in which weld metal does not extend through the joint thickness.

inert gas: A gas that normally does not combine chemically with other elements or compounds.

infrared radiation: Electromagnetic energy with wave lengths 770 to 12,000 nanometers.

injector torch: An injector-type torch is used to increase the effective use of fuel gases supplied at pressures of 2 psi (14 kPa), or lower. The oxygen is supplied at pressures ranging from 10 to 40 psi (70 to 275 kPa), the pressure increasing to match the tip size. The relatively high velocity of the oxygen flow is used to aspirate or draw in more fuel

gas than would normally flow at the low supply pressures of the fuel gases.

intermittent weld: A weld in which the continuity is broken by recurring unwelded spaces.

interpass temperature: In a multipass weld, the temperature of the weld area between weld passes.

inverter power supply: A welding power supply with solid-state electrical components that change the incoming 60 Hz power to a higher frequency. Changing the frequency results in greatly reducing the size and weight of the transformer. Inverter power supplies can be used with all arc welding processes.

iron carbide: A binary compound of carbon and iron; it becomes the strengthening constituent in steel.

iron soldering: A soldering process in which the heat required is obtained from a soldering iron.

iron carbon phase diagram: A graphical means of identifying different structures of steel and percentages of carbon occurring in steel at various temperatures.

isothermal transformation diagram: A graph that identifies different austenitic transformation products that occur over a period of cooling time at isothermal conditions. Also referred to as I-T diagram and T-T-T diagram meaning time-temperature-transformation diagram.

Izod test: A test performed on a specimen of metallic material to evaluate resistance to failure at a discontinuity and evaluate the resistance of a comparatively brittle material during extension of a crack. The test is performed using a small bar of round or square cross-section held as a cantilevered beam in a gripping anvil of a pendulum machine. The specimen is broken by a single overload impact of the swinging pendulum, and the energy absorbed in breaking the specimen is recorded by a stop pointer moved by the pendulum.

J

J-groove weld: A type of groove weld where one side of the joint forms a *J*.

joint: The junction of members or the edges of members that are to be joined or have been joined.

joint clearance: The distance between the faying surfaces of a joint in brazing or soldering.

joint design: The shape, dimensions, and configuration of the joint.

joint efficiency: The ratio of strength of a joint to the strength of the base metal expressed in percent.

joint filler: A metal plate inserted between the splice member and thinner joint member to accommodate joint members of dissimilar thickness in a spliced butt joint.

joint geometry: The shape and dimensions of a joint in cross-section prior to welding.

joint penetration: The distance the weld metal extends from the weld face into a joint, exclusive of weld reinforcement.

joint root: That portion of a joint to be welded where the members approach closest to each other. In cross-section, the joint root may be either a point, a line, or an area.

joint spacer: A metal part, such as a strip, bar, or ring, inserted in the joint root to serve as a backing and to maintain the root opening during welding.

joint type: A weld joint classification based on five basic joint configurations such as a butt joint, corner joint, edge joint, lap joint, and T-joint.

K

kerf: The width of a cut produced during a cutting process.

keyhole welding: A technique in which a concentrated heat source penetrates partially or completely through a workpiece, forming a hole (or keyhole) at the leading edge of the weld pool. As the heat source progresses, the molten metal fills in behind the hole to form the weld bead.

killed steel: A molten steel that has been held in a ladle, furnace, or crucible until no more gas is evolved and the metal is perfectly quiet.

L

lamellar tear: A subsurface terrace and step-like crack in the base metal with a basic orientation parallel to the wrought surface. Such items are caused by tensile stresses in the through-thickness direction of the base metals when they have been weakened by the presence of small dispersed, planar shaped, nonmetallic inclusions parallel to the metal surface.

lamination: A type of discontinuity with separation or weakness generally aligned parallel to the worked surface of a metal.

lap joint: A joint between two overlapping members in parallel planes.

laser: A device that produces a concentrated, coherent light beam by stimulated electronic or molecular transitions to lower energy levels. Laser is an acronym for *Light Amplification by Stimulated Emission of Radiation*.

laser beam cutting (LBC): A thermal cutting process that severs metal by locally melting or vaporizing with the heat from a laser beam.

laser beam welding: A welding process that produces coalescence with the heat from a laser beam impinging on the joint. The process is used without a shielding gas and without the application of pressure.

lens shade: See filter plate shade.

linear discontinuity: A discontinuity with a length that is substantially greater than its width.

liquidus: The lowest temperature at which a metal or an alloy is completely liquid.

longitudinal crack: A crack with its major axis orientation approximately parallel to the weld axis.

M

macroetch test: A test in which a specimen is prepared with a fine finish, etched, and examined under low magnification.

- manganese:** A gray-white nonmagnetic metallic element resembling iron, except it is harder and more brittle. Manganese can be alloyed with iron, copper, and nickel, for commercial alloys. In steel it increases hardness, strength, wear resistance, and other properties. Manganese is also added to magnesium-aluminum alloys to improve corrosion resistance.
- manifold:** See cylinder manifold.
- manual welding:** Welding with the torch, gun, or electrode holder held and manipulated by hand. Accessory equipment, such as part motion devices and manually controlled filler material feeders may be used.
- MAPP[®] gas:** A trade name for a fuel gas methacetylene-propadiene.
- martensite:** A very hard, brittle microstructure of steel produced when steel is rapidly quenched after being transformed into austenite.
- mechanized welding:** Welding with equipment that requires manual adjustment of the equipment controls in response to visual observation of the welding with the torch, gun, or electrode holder held by a mechanical device.
- medium steel:** Refer to carbon steel.
- melt-through:** Visible root reinforcement produced in a joint welded from one side.
- metal:** A class of chemical elements that are good conductors of heat and electricity, usually malleable, ductile, lustrous, and more dense than other elemental substances.
- metal-cored electrode:** A composite tubular filler metal electrode consisting of a metal sheath and a core of various powdered materials.
- metal electrode:** A filler or non-filler metal electrode used in arc welding or cutting, which consists of a metal wire or rod that has been manufactured by any method and that is either bare or covered with a suitable covering or coating.
- metallic bond:** The principal atomic bond that holds metals together.
- metallurgy:** The science explaining the properties, behavior, and internal structure of metals.
- methylacetylene propadiene:** A family of alternative fuel gases that are mixtures of two or more gases (propane, butane, butadiene, methylacetylene, and propadiene). Methylacetylene propadiene is used for oxyfuel cutting, heating, brazing, and soldering.
- microstructure:** A term use to describe the structure of metals. Visual examination of etched metal surfaces and fractures reveal some configurations in etched patterns that relate to structure, but magnification of minute details yields considerably more information. Microstructures are examined with low-power magnifying glass, optical microscope, or electron microscope.
- microetch test:** A test in which the specimen is prepared with a polished finish, etched, and examined under high magnification.
- mild steel:** Refer to carbon steel.
- mixing chamber:** That part of a welding or cutting torch in which a fuel gas and oxygen are mixed.
- modulus of elasticity:** The ratio of stress to strain in material; also referred to as Young's modulus.

molybdenum: A hard, silver-white metal, a significant alloying element in producing engineering steels, corrosion resistant steels, tool steels, and cast irons. Small amounts alloyed in steel promote uniform hardness and strength.

multipass welding: A weld requiring more than one pass to ensure complete and satisfactory joining of the metal pieces.

multiple welding position: An orientation for a non-rotated circumferential joint requiring welding in more than one welding position, as in welding a pipe or tube in a fixed position. (5F, 5G position is pipe on a horizontal plane and not moved or turned during welding; 6F, 6G position is pipe at 45° off the horizontal plane and not moved or turned during welding).

N

NEMA: The National Electrical Manufacturers' Association.

neutral flame: An oxyfuel gas flame that has characteristics neither oxidizing nor reducing.

nitrogen: A gaseous element that occurs freely in nature and constitutes about 78% of earth's atmosphere. Colorless, odorless, and relatively inert, although it combines directly with magnesium, lithium, and calcium when heated with them. Produced either by liquefaction and fractional distillation of air, or by heating a water solution of ammonium nitrate.

non-consumable electrode: An electrode that does not provide filler metal, as used in the GTAW process.

non-corrosive flux: A soldering flux that in either its original or residual form does not chemically attack the base metal. It usually is composed of rosin-based materials.

non-destructive examination: The act of determining the suitability of some material or component for its intended purpose using techniques that do not affect its serviceability.

normalizing: The process of heating a metal above a critical temperature and allowing it to cool slowly under room temperature conditions to obtain a softer and less distorted material.

O

ohm: A unit of electrical resistance. An ohm is equal to resistance of a circuit in which a potential difference of one volt produces a current of one ampere.

open-circuit voltage: The voltage between the output terminals of the power source when no current is flowing to the torch or gun.

open root joint: An unwelded joint without backing or consumable insert.

overlap: The protrusion of weld metal beyond the weld toe or weld root.

oxidizing flame: An oxyfuel flame in which there is an excess of oxygen, resulting in an oxygen-rich zone extending around and beyond the cone.

oxygen: A colorless, odorless, tasteless, gaseous chemical element, the most abundant of all elements. Oxygen occurs free in the atmosphere, forming 1/5 of its volume, and in combination in water, sandstone, limestone, etc.; it is very active being able to combine with nearly all other elements and is essential to life.

oxygen lance: A length of pipe used to convey oxygen to the point of cutting in oxygen lance cutting.

oxyhydrogen cutting (OFC-H): An alternative fuel gas cutting process that uses hydrogen as the fuel source.

oxyhydrogen welding (OHW): An alternative fuel gas welding process that uses hydrogen as the fuel source.

oxynatural gas cutting (OFC-N): An alternative fuel gas cutting process that uses natural gas as the fuel source.

oxypropane cutting (OFC-P): An alternative fuel gas cutting process that uses propane gas as the fuel source.

P

parent metal: A non-standard term referring to the base metal.

partial joint penetration weld: A joint root condition in a groove weld in which incomplete joint penetration exists.

pass: A single progression of welding along a joint, resulting in a weld bead or layer.

pearlite: A mixture of ferrite and cementite that contains approximately 0.8% carbon. Pearlite occurs in low-temperature steel that has not been previously heat treated or in steel that has been cooled slowly after being transformed into austenite.

peening: The mechanical working of metals using impact blows.

penetration: A non-standard term used in describing depth of fusion, joint penetration, or root penetration.

phase diagram: A graph that identifies alloy phases occurring at various temperatures and percentages of alloying elements. Also referred to as an equilibrium diagram.

phase transitions: When metals or metal alloys go from solid to liquid or the reverse, this is a phase transition. Iron phase transitions are: at room temperature to 1,670°F (910°C) iron is body-center cubic, 1670°F (910°C) to 2535°F (1388°C) iron is face-center cubic, and 2535°F (1390°C) the melting point of iron to 2800°F (1538°C) iron is again body-center cubic. These changes are also called allotropic transformations.

phosphorous: A highly reactive, toxic, non-metallic element used in steel, glass, and pyrotechnics. It is almost always found in combination with other elements such as minerals or metal ores. Found in steel and cast iron as an impurity. In steel it is reduced to 0.05% or less otherwise phosphorous causes embrittlement and loss of toughness, however small amounts in low-carbon steel produce a slight increase in strength and corrosion resistance.

pilot arc: A low-current arc between the electrode and the constricting nozzle of the plasma arc torch to ionize the gas and facilitate the start of the welding arc.

plasma arc cutting (PAC): An arc cutting process that uses a constricted arc and removes the molten metal with a high-velocity jet of ionized gas issuing from the constricting orifice.

plasma arc welding (PAW): An arc welding process that uses a constricted arc between a

non-consumable electrode and the weld pool or between the electrode and the constricting nozzle. Shielding is obtained from the ionized gas issuing from the torch, and may be supplemented by an auxiliary source of shielding gas.

plug weld: A weld made in a circular hole in one member of a joint fusing that member to another member.

polarity: The condition of being positive or negative with respect to some reference point or object. In welding the terminals of the power supply are designated negative and positive. Which terminal is hooked to the electrode determines polarity.

porosity: A discontinuity formed by gas entrapment during solidification or in a thermal spray deposit.

positive pressure torch: The positive pressure torch requires that gases be delivered at pressures above 2 psi (14 kPa). In the case of acetylene, the pressure should be between 2 and 15 psi (14 to 103 kPa). Oxygen is generally supplied at approximately the same pressure for welding.

post-flow time: The time interval from current shut off to either shielding gas or cooling water shut off.

postheating: The application of heat to an assembly after welding, brazing, soldering, thermal spraying, or thermal cutting.

power factor: The ratio of true power (watts) to the apparent power (volts times amperes). The power factor is equal to the cosine of the angle of lag between the alternating current and voltage wave.

power source: An apparatus for supplying current and voltage suitable for welding, thermal cutting, or thermal spraying.

precipitate: To cause to become insoluble, with heat or a chemical reagent, and separate out from a solution.

precipitation hardening: A multiphase heat treatment process that strengthens alloys by causing phases to precipitate at various temperatures and cooling rates.

preflow time: The time interval between start of shielding gas flow and arc starting.

preform: Brazing or soldering filler metal fabricated in a shape or form for a specific application.

preheat: The heat applied to the base metal or substrate to attain and maintain preheat temperature.

pressure regulator: A device designed to maintain a nearly constant supply pressure. Regulators may be attached to pressurized cylinders, gas generators, or pipe lines to reduce pressure as desired to operate equipment.

prequalified welding procedure specification: A welding procedure specification that complies with the stipulated conditions of a particular welding code or specification and is therefore acceptable for use under that code or specification without a requirement for qualification testing.

primary windings: The windings connected to and receiving power from an electrical circuit.

- procedure qualification:** The demonstration that welds made by a specific procedure can meet prescribed standards.
- process:** A grouping of basic operational elements used in welding, thermal cutting, brazing, or thermal spraying.
- protective atmosphere:** A gas or vacuum envelope surrounding the workpieces, used to prevent or reduce the formation of oxides and other detrimental surface substances, and to facilitate their removal.
- pulsed-power welding:** An arc welding process variation in which the power is cyclically programmed to pulse so that effective but short duration values of power can be utilized. Such short duration values are significantly different from the average value of power. Equivalent terms are pulsed-voltage or pulsed-current welding.
- purging:** The removing of any unwanted gas or vapor from a container, chamber, hose, torch, or furnace.
- push angle:** The travel angle when the electrode is pointing in the direction of the weld progression. This angle can also be used to partially define the positions of welding guns.

Q

- qualification:** A specific set of procedures designed to test a weldor's ability; followed by a weldor qualification test. After passing a particular qualification test a weldor is then qualified to weld to the variables of that qualification.
- quenching:** The sudden cooling of heated metal by immersion in water, oil, or other liquid. The purpose of quenching is to produce desired strength properties in hardenable steel.

R

- reactor:** A device used in arc welding circuits to minimize or smooth irregularities in the flow of the welding current; also called an *inductor*.
- reducing flame:** An oxyfuel flame with an excess of fuel gas.
- residual stress:** Stress present in a joint member or material that is free of external forces or thermal gradients.
- resistance brazing (RB):** A brazing process using heat from the resistance to electric current flow in a circuit of which the workpieces are a part.
- resistance soldering (RS):** A soldering process using heat from the resistance to electric current flow in a circuit of which the workpieces are a part.
- resistance welding (RW):** A group of welding processes that with the application of pressure produces coalescence of the faying surfaces with the heat obtained from resistance of the workpieces to the flow of the welding current in a circuit of which the workpieces are a part.
- resistor:** A device with measurable, controllable, or known electrical resistance used in electronic circuits or in arc welding circuits to regulate the arc amperes.
- Rockwell hardness test:** The most common hardness testing method. This procedure uses a minor load to prevent surface irregularities from affecting results. There are nine different

Rockwell hardness tests corresponding to combinations of three penetrators and three loads.

root bead: A weld bead that extends into or includes part or all of the joint root.

root bend test: A test in which the weld root is on the convex surface of a specified bend radius.

root face: That portion of the groove face within the joint root.

root opening: A separation at the joint root between the workpieces.

root penetration: The distance the weld metal extends into the joint root.

root reinforcement: Weld reinforcement opposite the side from which welding was done.

runoff weld tab: Additional material that extends beyond the end of the joint, on which the weld is terminated.

S

SAE: The Society of Automotive Engineers.

safety disc: A disc in the back side of a high pressure cylinder valve designed to rupture and release gas to the atmosphere preventing cylinder rupture if the cylinder is mishandled.

seal weld: Any weld designed primarily to provide a specific degree of tightness against leakage.

seam weld: A continuous weld made between or upon overlapping members, in which coalescence may start and occur on the faying surfaces, or may have proceeded from the outer surface of one member. The continuous weld may consist of a single weld bead or a series of overlapping spot welds.

semiautomatic: Pertaining to the manual control of a process with equipment that controls one or more of the process conditions automatically.

shear: To tear or wrench by shearing stress; to cut through using a cold cutting tool when shearing metal.

shear strength: The characteristic of a material to resist shear forces.

shielding gas: Protective gas used to prevent or reduce atmospheric contamination.

short-circuiting transfer: Metal transfer in which molten metal from a consumable electrode is deposited during repeated short circuits.

side bend test: A test in which the side of a transverse section of the weld is on the convex surface of a specified bend radius.

silicon: A non-metallic element resembling graphite in appearance, used extensively in alloys. It is the second most common element on earth. Silicon is usually found in the oxide (silicate) form. Silicon contributes to the strength of low-alloy steels and increases hardenability along with performing the valuable function of a deoxidizer, eliminating trapped gas.

silicon rectifier: A silicon semiconductor device that acts like a check valve for electricity and is used to change alternating current to direct current.

- single-phase:** A generator or circuit in which only one alternating current voltage is produced.
- 6F:** A welding test position designation for a circumferential fillet weld applied to a joint in pipe, with its axis approximately 45° from horizontal, in which the weld is made in flat, vertical, and overhead welding positions. The pipe remains fixed until welding is completed.
- 6G:** A welding test position designation for a circumferential groove weld applied to a joint in pipe, with its axis approximately 45° from horizontal, in which the weld is made in the flat, vertical, and overhead welding positions. The pipe remains fixed until welding is completed.
- 6GR:** A welding test position designation for a circumferential groove weld applied to a joint in pipe, with its axis approximately 45° from horizontal, in which the weld is made in the flat, vertical, and overhead positions. A restriction ring is added adjacent to the joint to restrict access to the weld. The pipe remains fixed until welding is completed.
- slag:** A nonmetallic product resulting from the mutual dissolution of flux and non-metallic impurities in some welding and brazing processes.
- slope:** A term used to describe the shape of the static volt-ampere curve of a constant-voltage welding machine. Slope is caused by impedance and is usually introduced by adding substantial amounts of inductance to the welding power circuit. As more inductance is added to a welding circuit, there is a steeper slope to the volt-ampere curve. The added inductance limits the available short-circuit current and slows the rate of response of the welding machine to changing arc conditions.
- slot weld:** A weld made in an elongated hole in one member of a joint fusing that member to another member. The hole may be open at one end.
- slugging:** The unauthorized addition of metal, such as a length of rod, to a joint before welding or between passes, often resulting in a weld with incomplete fusion.
- 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.
- soldering:** A group of welding processes that produce coalescence of materials by heating them to the soldering temperature and by using a filler metal having a liquidus not exceeding 840°F (450°C) and below the solidus of the base metals. The filler metal is distributed between closely fitted faying surfaces of the joint by capillary action.
- soldering iron:** A soldering tool having an internally or externally heated metal bit usually made of copper.
- solder interface:** The interface between solder metal and the base metal in a soldered joint.
- solder metal:** That portion of a soldered joint that has melted during soldering.
- solidus:** The highest temperature at which a metal or an alloy is completely solid.
- solutionizing:** The process of dispersing one or more liquid, gaseous, or solid substances in another, usually a liquid, so as to form a homogeneous mixture.
- spacer strip:** A metal strip or bar prepared for a groove weld and inserted in the joint root to serve as a backing and to maintain the root opening during welding. It can also bridge an exceptionally wide root opening due to poor fit.

- spatter:** The metal particles expelled during fusion welding that do not form a part of the weld.
- spheroidizing:** A stress relieving method of long-term heating of high-carbon steel at or near the lower transformation temperature, followed by slow cooling to room temperature.
- spliced joint:** A joint in which an additional workpiece spans the joint and is welded to each member.
- spool:** A filler metal package consisting of a continuous length of welding wire in coil form wound on a cylinder (called a barrel) which is flanged at both ends. The flange contains a spindle hole of smaller diameter than the inside diameter of the barrel.
- spot weld:** A weld made between or upon overlapping members in which coalescence may start and occur on the faying surfaces or may proceed from the outer surface of one member. The weld cross-section is approximately circular.
- spray transfer:** Metal transfer in which molten metal from a consumable electrode is propelled axially across the arc in small droplets.
- stack cutting:** Thermal cutting of stacked metal plates arranged so that all the plates are severed by a single cut.
- staggered intermittent weld:** An intermittent weld on both sides of a joint with the weld increments on one side alternating with respect to those on the other side.
- standoff distance:** The distance between a welding nozzle and the workpiece.
- steel:** A material composed primarily of iron, less than 2% carbon, and (in an alloy steel) small percentages of other alloying elements.
- step-down transformer:** A transformer that reduces the incoming voltage.
- step-up transformer:** A transformer that increases the incoming voltage.
- stickout:** In GTAW, the length of the tungsten electrode extending beyond the end of the gas nozzle. In GMAW and FCAW, the length of the unmelted electrode extending beyond the end of the contact tube.
- strain:** Distortion or deformation of a metal structure due to stress.
- stress:** A force causing or tending to cause deformation in metal. A stress causes strain.
- stringer bead:** A type of weld bead made without appreciable weaving motion.
- stub:** The short length of filler metal electrode, welding rod, or brazing rod that remains after its use for welding or brazing.
- stud welding (SW):** A general term for joining a metal stud or similar part to a workpiece. Welding may be accomplished by arc, resistance, friction, or other process with or without external gas shielding.
- submerged arc welding (SAW):** An arc welding process that uses an arc or arcs between a bare metal and the weld pool. Molten metal is shielded by a blanket of granular flux on the workpieces. The process is used without pressure and with filler metal from the electrode and sometimes from a supplemental source (welding rod, flux, or metal granules).

substrate: Any material to which a thermal spray deposit is applied.

sulfur: A pale yellow, odorless, brittle, nonmetallic element found underground either in the solid state or as a molten sulfur.

surface preparation: The operation necessary to produce a desired or specified surface condition.

surfacing: The application by welding, brazing, or thermal spraying of a layer of material to a surface to obtain desired properties or dimensions, as opposed to making a joint.

surfacing material: The material that is applied to a base metal or substrate during surfacing.

surfacing weld: A weld applied to a surface, as opposed to making a joint, to obtain desired properties or dimensions.

sweat soldering: A soldering process variation in which workpieces that have been pre-coated with solder are reheated and assembled into a joint without the use of additional solder (also called *sweating*).

T

tack weld: A weld made to hold the parts of a weldment in proper alignment until the final welds are made.

tensile strength: The resistance to breaking exhibited by a material when subjected to a pulling stress. Measured in lb/in² or kPa.

tension test: A test in which a specimen is loaded in tension until failure occurs.

theoretical throat: The distance from the beginning of the joint root perpendicular to the hypotenuse of the largest right triangle that can be inscribed within the cross-section of a fillet weld. This dimension is based on the assumption that the root opening is equal to zero.

thermal conductivity: The ability of a material to transmit heat.

thermal cutting (TC): A group of cutting processes that severs or removes metal by localized melting, burning, or vaporizing of the workpieces.

thermal expansion: The expansion of materials caused by heat input.

thermal spraying (THSP): A group of processes in which finely divided metallic or nonmetallic surfacing materials are deposited in a molten or semi-molten condition on a substrate to form a thermal spray deposit. The surfacing material may be in the form of powder, rod, cord, or wire.

thermal stress relieving: A process of relieving stresses by uniform heating of a structure or a portion of a structure, followed by uniform cooling.

three-phase power: A generator or circuit delivering three voltages that are 1/3 of a cycle apart in reaching maximum value. Three-phase current is usually used for circuits of 220 volts or more.

time temperature transformation (TTT): See isothermal transformation diagram definition.

tinning: A non-standard term for pre-coating.

- 3F:** A welding test position designation for a linear fillet weld applied to a joint in which the weld is made in the vertical welding position.
- 3G:** A welding test position designation for a linear groove weld applied to a joint in which the weld is made in the vertical welding position.
- T-joint:** A joint between two members located approximately at right angles to each other in the form of a *T*.
- torch brazing (TB):** A brazing process that uses heat from a fuel gas flame.
- torch oscillation:** Moving a torch in a back and forth motion.
- torch soldering (TS):** A soldering process that uses heat from a fuel gas flame.
- torsion:** The stress produced in a body, such as a rod or wire, by turning or twisting one end while the other is held firm or twisting in the opposite direction.
- transferred arc:** A plasma arc established between the electrode of the plasma arc torch and the workpiece.
- transverse crack:** A crack with its major axis oriented approximately perpendicular to the weld axis.
- travel angle:** The angle less than 90° between the electrode axis and a line perpendicular to the weld axis, in a plane determined by the electrode axis and the weld axis. This angle can also be used to partially define the positions of welding guns, torches, rods, and beams.
- travel angle pipe:** The angle of less than 90° between the electrode axis and a line perpendicular to the weld axis at its point of intersection with the extension of the electrode axis, in a plane determined by the electrode axis and a line tangent to the pipe surface at the same point. This angle can also be used to partially define the positions of welding guns, torches, rods, and beams.
- ultimate tensile strength:** The final measurement of material placed in tension at the point of breaking.
- tungsten electrode:** A non-filler metal electrode used in arc welding, arc cutting, and plasma spraying, made principally of tungsten.
- 2F pipe:** A welding test position designation for a circumferential fillet weld applied to a joint in pipe, with its axis approximately vertical, in which the weld is made in the horizontal welding position.
- 2F plate:** A welding test position designation for a linear fill weld applied to a joint in which the weld is made in the horizontal welding position.
- 2FR:** A welding test position designation for a circumferential fillet weld applied to a joint in pipe, with its axis approximately horizontal, in which the weld is made in the horizontal welding position by rotating the pipe about its axis.
- 2G pipe:** A welding test position designation for a circumferential groove weld applied to a joint in a pipe, with its axis approximately vertical, in which the weld is made in the horizontal welding position.
- 2G plate:** A welding test position designation for a linear groove weld applied to a joint in which the weld is made in the horizontal welding position.

U

U-groove weld: A type of groove weld.

under-bead crack: A crack in the heat-affected zone generally not extending to the surface of the base metal.

undercut: A groove melted into the weld face or root surface and extending below the adjacent surface of the base metal.

Underfill: A condition in which the weld face or root surface extends below the adjacent surface of the base metal.

uphill: Welding with an upward progression.

V

vertical welding position: The welding position in which the weld axis, at the point of welding, is approximately vertical, and the weld face lies in an approximately vertical plane.

vertical up: A nonstandard term for uphill welding.

V-groove weld: A type of groove weld.

volt: A unit of electrical force or potential.

W

waster plate: A piece of metal used to initiate thermal cutting.

watt: A unit of electric power equal to voltage multiplied by amperage. One horsepower is equal to 746 watts.

wave soldering (WS): An automatic soldering process where workpieces are passed through a wave of molten solder.

weave bead: A type of weld bead made with transverse oscillation.

weld: A localized coalescence of metal or nonmetals produced either by heating the materials to the welding temperature, with or without the application of pressure, or by the application of pressure alone, with or without the use of filler material.

weldability: The capacity of material to be welded under imposed fabrication conditions into a specific suitably designed structure and to perform satisfactorily in the intended service.

weld axis: A line through the length of the weld, perpendicular to and at the geometric center of its cross-section.

weld bead: A weld resulting from a pass.

weld crack: A crack located in the weld metal or heat-affected zone.

welder: Weldor is the preferred spelling. for one who performs manual or semi-automatic welding, as opposed to welder being a machine used for welding.

weldor performance qualification: The demonstration of a weldor's ability to produce welds meeting prescribed standards.

- weld face:** The exposed surface of a weld on the side from which welding was done.
- weld groove:** A channel in the surface of a workpiece or an opening between two joint members that provides space to contain a weld.
- welding:** A joining process that produces coalescence of materials by heating them to the welding temperature with or without the application of pressure, or by the application of pressure alone with or without the use of filler metal.
- welding arc:** A controlled electrical discharge between the electrode and the workpiece that is formed and sustained by the establishment of a gaseous, conductive medium called an arc plasma.
- welding electrode:** A component of the welding circuit through which current is conducted and that terminates at the arc, molten conductive slag, or base metal.
- welding filler metal:** The metal or alloy to be added in making a weld joint that alloys with the base metal to form weld metal in a fusion welded joint.
- welding helmet:** A device equipped with a filter plate designed to be worn on the head to protect eyes, face, and neck from arc radiation, radiated heat, spatter, or other harmful matter expelled during some welding and cutting processes.
- welding leads:** The workpiece lead (cables) and electrode lead (cables) of an arc welding circuit.
- welding operator:** One who operates adaptive control, automatic, mechanized, or robotic welding equipment.
- welding positions:** The relationship between the weld pool, joint, joint members, and welding heat source during welding.
- welding power source:** An apparatus for supplying current and voltage suitable for welding.
- welding procedure:** The detailed methods and practices involved in the production of a weldment.
- welding procedure qualification record (WPQR):** A record of welding variables used to produce an acceptable test weldment and the results of tests conducted on the weldment of a qualified welding procedure specification.
- welding procedure specification (WPS):** A document providing the required welding variables for a specific application to assure repeatability by properly trained weldors and welding operators.
- welding rectifier:** A device, usually a semiconductor diode, in a welding power source for converting alternating current to direct current.
- welding rod:** A form of welding filler metal, normally packaged in straight lengths, that does not conduct the welding current.
- welding schedule:** A written statement, usually in tabular form, specifying values of parameters and welding sequence for performing a welding operation.
- welding sequence:** The order of making welds in a weldment.
- welding symbol:** A graphical representation of a weld.
- welding tip:** That part of an oxyfuel gas welding torch from which the gases issue.

- welding transformer:** A transformer used for supplying current for welding.
- welding wire:** A form of welding filler metal, normally packaged as coils or spools, that may or may not conduct electrical current depending upon the welding process with which it is used.
- weld interface:** The interface between weld metal and base metal in a fusion weld, between base metals in a solid-state weld without filler metal, or between filler metal and base metal in a solid-state weld with filler metal.
- weld interval:** The total of heat and cool times and upslope time used in making one multiple-impulse weld (resistance welding).
- weld joint mismatch:** Misalignment of the joint members.
- weldment:** An assembly whose component parts are joined by welding.
- weld metal:** The portion of a fusion weld that has been completely melted during welding.
- weld metal area:** The area of weld metal as measured on the cross-section of a weld.
- weld pass:** A single progression of welding along a joint. The result of a pass is a weld bead or layer.
- weld pass sequence:** The order in which the weld passes are made.
- weld penetration:** A nonstandard term for joint penetration and root penetration.
- weld pool:** The localized volume of molten metal in a weld prior to its solidification as a weld metal.
- weld puddle:** A nonstandard term for weld pool.
- weld reinforcement:** Weld metal in excess of the quantity required to fill a joint.
- weld root:** The points, shown in a cross-section, at which the root surface intersects the base metal surfaces.
- weld symbol:** A graphical character connected to the welding symbol indicating the type of weld.
- weld tab:** Additional material that extends beyond either end of the joint, on which the weld is started or terminated.
- weld toe:** The junction of the weld face and the base material.
- wetting:** The phenomenon whereby a liquid filler metal or flux spreads and adheres in a thin continuous layer on a solid base metal.
- wiped joint:** A joint made with solder having a wide melting range and with the heat supplied by the molten solder poured onto the joint. The solder is manipulated with a hand-held cloth or paddle to obtain the required size and contour.
- wire feed speed:** The rate at which wire is consumed in arc cutting, thermal spraying, or welding.
- work angle:** The angle less than 90° between a line perpendicular to the major work-piece surface and a plane determined by the electrode axis and the weld axis. In a T-joint or a corner joint the line is perpendicular to the non-butting member. This angle can also be

used to partially define the positions of guns, torches, rods, and beams.

work hardening: Also called cold working; the process of forming, bending, or hammering a metal well below the melting point to improve strength and hardness.

workpiece: The part that is welded, brazed, soldered, thermal cut, or thermal sprayed.

work-piece lead: The electrical conductor between the arc welding current source and work-piece connection.

wrought iron: A material composed almost entirely of iron, with very little or no carbon.

Y

yield strength: The load at which a material will begin to yield, or permanently deform. Also referred to as yield point.

Young's modulus: A ratio between the stress applied and the resulting elastic strain; the slope of a metal's elastic limit curve; a relative measure of a material's stiffness.