

**AWS A3.0M/A3.0:2010**  
**An American National Standard**



# **Standard Welding Terms and Definitions**

**Including Terms for Adhesive  
Bonding, Brazing, Soldering,  
Thermal Cutting, and  
Thermal Spraying**



**American Welding Society**

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An American National Standard**

**Approved by the  
American National Standards Institute  
July 1, 2009**

# **Standard Welding Terms and Definitions**

**Including Terms for Adhesive Bonding, Brazing,  
Soldering, Thermal Cutting, and Thermal Spraying**

**12th Edition**

**Supersedes AWS A3.0:2001**

Prepared by the  
American Welding Society (AWS) A2 Committee on Definitions and Symbols

Under the Direction of the  
AWS Technical Activities Committee

Approved by the  
AWS Board of Directors

## **Abstract**

This standard is a glossary of the technical terms used in the welding industry. Its purpose is to establish standard terms to aid in the communication of welding information. Since it is intended to be a comprehensive compilation of welding terminology, nonstandard terms used in the welding industry are also included. All terms are either standard or nonstandard. They are arranged in word-by-word alphabetical sequence.



**American Welding Society**

550 N.W. LeJeune Road, Miami, FL 33126

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American Welding Society

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## Foreword

This foreword is not part of AWS A3.0M/A3.0:2010, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*, but is included for informational purposes only.

The A2 Committee on Definitions and Symbols was formed by the American Welding Society to establish standard terms and definitions to aid in the communication of welding information. This publication is the major product of work done by the Subcommittee on Definitions in support of that purpose.

The first AWS document containing welding definitions was prepared by the Committee of Definitions and Chart and approved by the Executive Committee as Tentative Definitions of Welding Terms and Master Chart of Welding Processes, on January 18, 1940. A revision was approved by the AWS Board of Directors on May 7, 1942.

The next revision, bearing the designation A3.0, was called *Standard Welding Terms and Their Definitions*. This revision, published in 1949, listed the terms alphabetically.

During the late 1950s, the Committee was reorganized as the AWS Committee on Definitions and Symbols, and after several years' work, produced A3.0-61, *AWS Definitions, Welding and Cutting*. Subsequent revisions were published in 1969, 1976, 1980, 1985, 1989, and 1994.

In 2001, the title of the document was changed to *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*, to align with the objectives of the Society and the scope of the publication.

The present publication, A3.0M/A3.0:2010, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*, defines over 1400 terms, with 60 illustrations to support and clarify the definitions, as well as classification charts and corollary information related to welding and allied processes. This latest revision includes significant enhancements to terms relating to brazing, resistance welding, and soldering. Hybrid processes have been addressed for the first time. New process groupings include high energy beam welding (HEBW) and thermal gouging (TG). The Master Chart of Processes has been revised to classify the latest process developments and enhancements.

Revisions to the 2001 edition are identified by a vertical line in the margin next to the text (see Clause 1, Scope).

Figures in this edition have been relocated to Annex B to comply with the new document style. The committee does not consider this numbering change as justification for the use of vertical lines to denote this revision. Figures in Annex B of this standard are examples and are not intended to represent all possible conceptual variations.

It must be understood that the Definitions Subcommittee cannot be the ultimate judge in terms of the preferability, acceptability, or correctness of any term for a specific situation. Such determinations are left to the discretion and opinion of the welding terminology user. There is one exception: when the use of a nonstandard term may endanger personal safety, that term is defined as both nonstandard and incorrect. The Definitions Subcommittee has neither the authority nor the desire to dictate welding terminology, but considers it within its province to establish standard terms and nonstandard terms.



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# Standard Welding Terms and Definitions

## Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying

### 1. Scope

The purpose of this document is to establish standard terms and definitions to aid in the communication of information related to welding, adhesive bonding, brazing, soldering, thermal cutting, and thermal spraying. The standard terms and definitions published in this document should be used in the oral and written language associated with these related processes.

Whenever A3.0 is mentioned in this document, it refers to the latest edition, A3.0M/A3.0:2010.

When terms from A3.0 are included in the glossary of other documents, it is intended that the definitions be identical to those in A3.0, except that the references may be changed if appropriate.

It is one of the goals of the Definitions Subcommittee that A3.0 encompass all terms, not adequately defined in the dictionary, directly related to welding or allied fields. Both standard and nonstandard jargon, as well as dialect and vernacular terms, are accepted for inclusion in A3.0.

Since this document is a comprehensive compilation of terminology, nonstandard terms are included with cross-references to the corresponding standard terms. **Boldface** type indicates standard terms, lightface type indicates nonstandard terms. Terms for standard welding processes and for standard welding process variations are followed by their standard letter designations.

For the user's convenience, a vertical line in the margin next to a term indicates that a revision, i.e., modification, addition, or correction, has been made. A single line denotes a minor change to an existing definition. A double line denotes a new term or a major change. Terms for standard processes and standard process variations are followed by their standard letter designation. All terms are arranged in word-by-word alphabetical sequence.

The principles applied by the Definitions Subcommittee for the creation of terms and definitions in A3.0 are described in Informative Annex C.

This standard makes use of both the International System of Units (SI) and U.S. Customary Units. The latter are shown within brackets ([ ]) or in appropriate columns in tables and figures. The measurements may not be exact equivalents; therefore, each system must be used independently.

Safety and health issues and concerns are beyond the scope of this standard, and therefore are not fully addressed herein. Safety and health information is available from other sources, including, but not limited to, ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, and applicable federal and state regulations.

### 2. Normative References

The following standards contain provisions which, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply.

American Welding Society (AWS) document:<sup>1</sup>

AWS A1.1, *Metric Practice Guide for the Welding Industry*; and

Other document:

*Webster's Third New International Dictionary of the English Language, Unabridged*.<sup>2</sup>

<sup>1</sup> AWS standards are published by the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

<sup>2</sup> *Webster's Third New International Dictionary of the English Language, Unabridged* is published by Merriam-Webster, Incorporated, Springfield, MA. It is available at most bookstores.

### 3. Terms and Definitions

For the purposes of this document, the following definitions apply:

**definition.** A statement of the meaning of a word or word group. The statement may also describe the interrelationship with other terms and association with other relevant information such as tables and figures.

**nonstandard term.** A word or expression used colloquially that is provided as a link to the standard term in AWS A3.0. When used in AWS A3.0, nonstandard terms are shown in lightface type.

**standard term.** A word or expression recognized in AWS A3.0 as the preferred terminology for use in oral and written language. When used in AWS A3.0, standard terms are shown in **boldface** type.

**term.** A word or expression directly related to welding or allied areas which has a meaning more specialized or restricted than that given in the dictionary (see Clause 2).

### 4. Glossary

**1F, pipe.** 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 the flat welding position by rotating the pipe about its axis. See Figure B.20(A).

**1F, plate.** A welding test position designation for a linear fillet weld applied to a joint in which the weld is made in the flat welding position. See Figure B.18(A).

**1G, pipe.** A welding test position designation for a circumferential groove weld applied to a joint in pipe, in which the weld is made in the flat welding position by rotating the pipe about its axis. See Figure B.19(A).

**1G, plate.** A welding test position designation for a linear groove weld applied to a joint in which the weld is made in the flat welding position. See Figure B.17(A).

**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. See Figure B.20(B).

**2F, plate.** A welding test position designation for a linear fillet weld applied to a joint in which the weld is made in the horizontal welding position. See Figure B.18(B).

**2FR, pipe.** 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. See Figure B.20(C).

**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. See Figure B.19(B).

**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. See Figure B.17(B).

**3F, plate.** 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. See Figure B.18(C).

**3G, plate.** 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. See Figure B.17(C).

**4F, pipe.** A welding test position designation for a circumferential fillet weld applied to a joint in pipe, with its axis vertical, in which the weld is made in the overhead welding position. See Figure B.20(D).

**4F, plate.** A welding test position designation for a linear fillet weld applied to a joint in which the weld is made in the overhead welding position. See Figure B.18(D).

**4G, plate.** A welding test position designation for a linear groove weld applied to a joint in which the weld is made in the overhead welding position. See Figure B.17(D).

**5F, pipe.** 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. See Figure B.20(E).

**5G, pipe.** 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. See Figure B.19(C).

**6F, pipe.** 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 complete. See Figure B.20(F).

**6G**, *pipe*. 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 complete. See Figure B.19(D).

**6GR**, *pipe*. 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. A restriction ring is added, adjacent to the joint, to restrict access to the weld. The pipe remains fixed until welding is complete. See Figure B.19(E).

## A

**abrasion soldering**. A soldering process variation during which surface wetting is enhanced by abrading the faying surfaces.

**abrasive blasting**. A method of cleaning or surface roughening by a forcibly projected stream of abrasive particles.

**absorptive lens**. A filter lens designed to attenuate the effects of transmitted and reflected light. See also **filter plate**.

**accelerating potential**, *electron beam welding and cutting*. The potential imparting velocity to the electrons.

**acceptable weld**. A weld meeting the applicable requirements.

**acetylene feather**. The intense white, feathery-edged portion adjacent to the cone of a carburizing oxyacetylene flame. See Figure B.40.

**acid core solder**. A solder wire or bar containing acid flux as a core.

**activated rosin flux**. A rosin-based flux containing an additive that increases wetting by the solder.

**active flux**, *submerged arc welding*. A flux formulated to produce a weld metal composition dependent on the welding parameters, especially arc voltage. See also **alloy flux** and **neutral flux**.

**actual throat**. The shortest distance between the weld root and the face of a fillet weld. See Figure B.25. See also **effective throat** and **theoretical throat**.

**adaptive control**, *adj*. Pertaining to process control that senses changes in conditions and directs the equipment to take appropriate action. See Table A.4. See also **automatic**, **manual**, **mechanized**, **robotic**, and **semiautomatic**.

**adaptive control brazing (B-AD)**. See **adaptive control process**.

**adaptive control process (XXXX-AD)**. An operation with a control system sensing changes in conditions and automatically directing the equipment to take appropriate action. See **adaptive control brazing**, **adaptive control soldering**, **adaptive control thermal cutting**, **adaptive control thermal spraying**, and **adaptive control welding**. See Table A.4. See also **automatic process**, **manual process**, **mechanized process**, **robotic process**, and **semiautomatic process**.

**adaptive control soldering (S-AD)**. See **adaptive control process**.

**adaptive control thermal cutting (TC-AD)**. See **adaptive control process**.

**adaptive control thermal spraying (TS-AD)**. See **adaptive control process**.

**adaptive control welding (W-AD)**. See **adaptive control process**.

**adhesive**. A polymeric material having chemical and physical properties differing from those of the base materials, placed at their faying surfaces, to join the materials together as a result of the attractive forces of this polymeric material.

**adhesive bond**. An attraction, generally physical in nature, between an adhesive and the base materials.

**adhesive bonding (AB)**. A joining process in which an adhesive, placed between faying surfaces, solidifies to produce an adhesive bond.

**agglomerated flux**, *submerged arc welding*. A granular flux produced by baking a pelletized mixture of powdered ingredients and bonding agents at a temperature sufficient to remove the water, followed by processing to produce the desired particle size. See also **bonded flux** and **fused flux**.

**air acetylene welding (AAW)**. An oxyfuel gas welding process using an air-acetylene flame. The process is used without the application of pressure. This is an obsolete or seldom used process. See Table A.5.

**air cap**. A nonstandard term for the **nozzle** of a flame spraying gun for wire or ceramic rod.



**air carbon arc cutting (CAC-A).** A carbon arc cutting process variation removing molten metal with a jet of air.

**air carbon arc cutting torch.** A device used to transfer current to a fixed cutting electrode, position the electrode, and direct the flow of air.

**air feed.** A thermal spraying process variation in which an air stream carries the powdered surfacing material through the gun and into the heat source.

**aligned discontinuities.** Three or more discontinuities aligned approximately parallel to the weld axis, spaced sufficiently close together to be considered a single intermittent discontinuity.

**aligned porosity.** A localized array of porosity oriented in a line.

**alloy.** A substance with metallic properties and composed of two or more chemical elements of which at least one is a metal.

**alloy flux, submerged arc welding.** A flux containing ingredients reacting with the filler metal to establish a desired alloy content in the weld metal. See also **active flux** and **neutral flux**.

**alloy powder.** Powder prepared from a homogeneous molten alloy or from the solidification product of such an alloy. See also **powder blend**.

**angle of bevel.** See **bevel angle**.

**arc.** See **welding arc**.

**arc blow.** The deflection of an arc from its normal path due to magnetic forces.

**arc braze welding (ABW).** A braze welding process variation using an electric arc as the heat source. See also **carbon arc braze welding**.

arc chamber. A nonstandard term for **plenum chamber**.

**arc cutter.** See **thermal cutter**. See also **oxygen cutting operator**.

**arc cutting (AC).** A group of thermal cutting processes severing or removing metal by melting with the heat of an arc between an electrode and the workpiece.

**arc cutting gun.** A device used to transfer current to a continuously fed cutting electrode, guide the electrode, and direct the shielding gas.

**arc cutting operator.** See **thermal cutting operator**. See also **oxygen cutter**.

**arc cutting torch.** See **air carbon arc cutting torch**, **gas tungsten arc cutting torch**, and **plasma arc cutting torch**.

**arc force.** The axial force developed by arc plasma.

arc gap. A nonstandard term when used for **arc length**.

arc gas. A nonstandard term when used for **orifice gas**.

**arc gouging.** Thermal gouging using an arc cutting process variation to form a bevel or groove.

**arc length.** The distance from the tip of the welding electrode to the adjacent surface of the weld pool.

arc oxygen cutting. A nonstandard term for **oxygen arc cutting**.

**arc plasma.** A gas heated by an arc to at least a partially ionized condition, enabling it to conduct an electric current.

**arc seam weld.** A seam weld made by an arc welding process. See Figures B.14(A) and B.14(B).

**arc seam weld size.** See **seam weld size**.

**arc spot weld.** A spot weld made by an arc welding process. See Figures B.14(G) and B.14(H).

**arc spot weld size.** See **spot weld size**.

**arc sprayer.** See **thermal sprayer**.

**arc spraying (ASP).** 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 spraying operator.** See **thermal spraying operator**.

**arc strike.** A discontinuity resulting from an arc, consisting of any localized remelted metal, heat-affected metal, or change in the surface profile of any metal object.

**arc stud welding (SW).** An arc welding process using an arc between a metal stud, or similar part, and the other workpiece. The process is used without filler metal, with or without shielding gas or flux, with or without partial shielding from a ceramic or graphite ferrule surrounding the stud, and with the application of pressure after the faying surfaces are sufficiently heated.

**arc time.** The time during which an arc is maintained in making an arc weld.

**arc voltage, arc welding.** The electrical potential between the electrode and workpiece.

**arc welding (AW).** A group of welding processes producing coalescence of workpieces by melting them with an arc. The processes are used with or without the application of pressure and with or without filler metal.

**arc welding deposition efficiency.** The ratio of the weight of filler metal deposited in the weld metal to the weight of filler metal melted, expressed in percent.

**arc welding electrode.** A component of the welding circuit through which current is conducted and that terminates at the arc.

**arc welding gun.** A device used to transfer current to a continuously fed consumable electrode, guide the electrode, and direct the shielding gas. See Figure B.38.

**arc welding torch.** A device used to transfer current to a fixed welding electrode, position the electrode, and direct the shielding gas. See Figures B.35 and B.36.

**arm.** A beam extending from the frame of a resistance welding machine to transmit electrode force and sometimes conduct welding current.

**as-brazed, *adj.*** Pertaining to the condition of brazements prior to subsequent thermal, mechanical, or chemical treatments.

**assembly.** One or more components, members, or parts fit in preparation for joining.

**assist gas.** A gas used to blow molten metal away to form the kerf in laser beam inert gas cutting, or to blow vaporized metal away from the beam path in laser beam evaporative cutting.

**as-soldered, *adj.*** Pertaining to the condition of solderments prior to subsequent thermal, mechanical, or chemical treatments.

**as-welded, *adj.*** Pertaining to the condition of weldments prior to subsequent thermal, mechanical, or chemical treatments.

**atomic hydrogen welding (AHW).** An arc welding process using an arc between two metal electrodes in a shielding atmosphere of hydrogen and without the application of pressure. This is an obsolete or seldom used process. See Table A.5.

**autogenous weld.** A fusion weld made without filler metal.

**automatic, *adj.*** Pertaining to process control with equipment requiring only occasional or no observation and no manual adjustments during its operation. See Table A.4. See also **adaptive control, manual, mechanized, robotic,** and **semiautomatic.**

**automatic arc welding current.** The current in the welding circuit during the making of a weld, but excluding upslope, downslope, and crater fill current. See Figures B.53 and B.54.

**automatic arc welding downslope time.** The time during which the current is changed continuously from final taper current or welding current to final current. See Figure B.53.

**automatic arc welding upslope time.** The time during which the current changes continuously from the initial current to the welding current. See Figure B.53.

**automatic arc welding weld time.** The time interval from the end of start time or end of upslope to beginning of crater fill time or beginning of downslope. See Figures B.53 and B.54.

**automatic brazing (B-AU).** See **automatic process.**

**automatic gas cutting.** A nonstandard term for **automatic oxygen cutting.**

**automatic process (XXXX-AU).** An operation performed with equipment requiring occasional or no observation and no manual adjustment during its operation. Variations of this term are **automatic brazing, automatic soldering, automatic thermal cutting, automatic thermal spraying,** and **automatic welding.** See Table A.4. See also **adaptive control process, manual process, mechanized process, robotic process,** and **semiautomatic process.**

**automatic soldering (S-AU).** See **automatic process.**

**automatic thermal cutting (TC-AU).** See **automatic process.**

**automatic thermal spraying (TS-AU).** See **automatic process.**

**automatic welding (W-AU).** See **automatic process.**

**auxiliary enlarger.** A nonstandard term for **auxiliary magnifier.**

**auxiliary magnifier.** An additional lens used to magnify the field of vision.

**axis of weld.** See **weld axis.**

## B

**back bead.** A weld bead resulting from a back weld pass.

**back cap.** A device used to exert pressure on the collet in a gas tungsten arc welding torch and create a seal to prevent air from entering the back of the torch. See Figure B.36.

**back weld.** A weld made at the back of a single groove weld. See Figure B.24(C).

**back weld pass.** A weld pass resulting in a back weld.

**backfire.** The momentary recession of the flame into the torch, potentially causing a flashback or sustained backfire. It is usually signaled by a popping sound, after which the flame may either extinguish or reignite at the end of the tip. See also **flashback** and **sustained backfire**.

**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. See Figure B.21. See also **drag angle**, **forehand welding**, **push angle**, **travel angle**, and **work angle**.

**backing.** A material or device placed against the back side of the joint adjacent to the joint root, or at both sides of a joint in electroslag and electrogas welding, to support and shield molten weld metal. The material may be partially fused or remain unfused during welding and may be either metal or nonmetal. See Figures B.8(D), B.12, and B.37.

**backing bead.** A weld bead resulting from a backing weld pass.

backing filler metal. A nonstandard term for **consumable insert**.

**backing gas.** Backing in the form of a shielding gas employed primarily to provide a protective atmosphere.

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

**backing shoe.** A barrier device used in electroslag and electrogas welding to contain the weld without being fused. See Figure B.37. See also **moving shoe** and **stationary shoe**.

**backing weld.** Backing in the form of a weld. See Figure B.24(D).

**backing weld pass.** A weld pass resulting in a backing weld.

**backstep sequence.** A longitudinal sequence in which weld passes are made in the direction opposite to the progress of welding. See Figure B.23(A).

**backup, flash and upset welding.** A locating device used to transmit all or a portion of the upset force to the workpieces or to aid in preventing the workpieces from slipping during upsetting.

**backup electrode.** An electrode having a large electrode face opposing the welding force.

**balling up, brazing and soldering.** The formation of globules of molten filler metal or flux due to insufficient base metal wetting.

**bare electrode.** A filler metal electrode produced as a wire, strip, or bar with no coating or covering except one incidental to its manufacture or preservation.

**bare metal arc welding (BMAW).** An arc welding process using an arc between a bare or lightly coated electrode and the weld pool. The process is used without shielding, without the application of pressure, and filler metal is obtained from the electrode. This is an obsolete or seldom used process. See Table A.5.

**base material.** The material being welded, brazed, soldered, or cut. See also **base metal** and **substrate**.

**base metal.** The metal or alloy being welded, brazed, soldered, or cut. See also **base material** and **substrate**.

**base metal test specimen.** A test specimen composed wholly of base metal.

**base metal zone (BMZ).** The portion of base metal adjacent to a weld, braze or solder joint or thermal cut and unaffected by welding, brazing, soldering, or thermal cutting. See Figure B.24(G). See also **heat-affected zone** and **weld metal zone**.

base plate. A nonstandard term when used for **base metal**.

**bead.** See **weld bead**.

bead weld. A nonstandard term for **surfacing weld**.

**beam divergence.** The expansion of a beam's cross section as the beam emanates from its source.

**bend test.** A test in which a specimen is bent to a specified bend radius. See also **face bend test**, **root bend test**, and **side bend test**.

berry formation. A nonstandard term for **nozzle accumulation**.

**bevel.** An angular edge shape. See Figures B.6 and B.7.

**bevel angle.** The angle between the bevel of a joint member and a plane perpendicular to the surface of the member. See Figure B.6.

**bevel edge shape.** A type of edge shape in which the prepared surface or surfaces lies at some angle other than perpendicular to the material surface. See Figures B.7(B) and B.7(C).

**bevel face.** The prepared surface of a bevel edge shape. See Figures B.6(G) and B.6(H). See also **groove face** and **root face**.

**bevel radius.** The radius used to form a J-edge shape. See Figures B.6(B) and B.6(E).

**bevel-groove weld.** A type of groove weld. See Figures B.8(B) and B.9(B).

**bit.** Part of the soldering iron, usually made of copper, provided to directly transfer heat, and sometimes soldering filler metal, to the joint.

blacksmith welding. A nonstandard term when used for **forge welding**.

**blanket brazing.** A brazing process variation employing a flexible, resistance-heated blanket(s) as the heat source.

**blasting.** See **abrasive blasting**.

**blind joint.** A joint, no portion of which is visible.

**block brazing (BB).** A brazing process employing heated blocks as the heat source. This is an obsolete or seldom used process. See Table A.5.

**block sequence.** A combined longitudinal and cross-sectional sequence for a continuous multiple-pass weld in which separated segments are completely or partially welded before intervening segments are welded. See Figure B.23(B). See also **cascade sequence**, **cross-sectional sequence**, **progressive block sequence**, and **selective block sequence**.

blowhole. A nonstandard term when used for **porosity**.

**blowpipe.** See **brazing blowpipe**, **soldering blowpipe**, and **welding blowpipe**.

**bond.** See **covalent bond**, **ionic bond**, **mechanical bond**, and **metallic bond**.

bond bar. A nonstandard term for **bond specimen**.

bond cap. A nonstandard term for **bond specimen**.

**bond coat, thermal spraying.** A preliminary (or prime) coat of material applied to improve adherence of the subsequent thermal spray deposit.

**bond line, thermal spraying.** The cross section of the interface between a thermal spray deposit and the substrate. See Figure B.31(B).

**bond specimen, thermal spraying.** The test specimen on which a thermal spray deposit has been applied to determine bond strength and thermal spray deposit strength.

**bond strength, thermal spraying.** The unit force required to separate a thermal spray deposit from the substrate.

**bonded flux, submerged arc welding.** A granular flux produced by baking a pelletized mixture of powdered ingredients and bonding agents at a temperature

below its melting point, but high enough to create a chemical bond, followed by processing to produce the desired particle size. See also **agglomerated flux** and **fused flux**.

bonding. A nonstandard term when used for **brazing**, **soldering**, and **welding**.

**bonding force.** The attractive force holding atoms together.

bottle. A nonstandard term when used for **gas cylinder**.

**boxing.** The continuation of a fillet weld around a corner of a member as an extension of the principal weld. See Figure B.23(F).

**braze, n.** A bond produced as a result of heating an assembly to the brazing temperature using a brazing filler metal distributed and retained between the closely fitted faying surfaces of the joint by capillary action. See Figure B.31(A).

**braze, v.** The act of brazing.

**braze interface.** The boundary between braze metal and base material in a brazed joint. See Figure B.31(A).

**braze metal.** The portion of a braze that has been melted during brazing. See Figure B.31(A).

**braze welding (BW).** A joining process in which the brazing filler metal is deposited in the joint without capillary action or melting of the base material. See also **arc braze welding**, **carbon arc braze welding**, **electron beam braze welding**, **exothermic braze welding**, **flow welding**, and **laser beam braze welding**.

**brazeability.** The capacity of a material to be brazed under the imposed fabrication conditions into a specific, suitably designed structure capable of performing satisfactorily in the intended service.

**brazed joint.** A joint that has been brazed.

**brazement.** An assembly joined by brazing.

**brazer.** One who performs manual or semiautomatic brazing.

**brazing (B).** A group of joining processes producing the bonding of materials by heating them to the brazing temperature in the presence of a brazing filler metal having a liquidus above 450°C [840°F] and below the solidus of the base metal. The brazing filler metal is distributed and retained between the closely fitted faying surfaces of the joint by capillary action. See Figures A.1, A.3, and A.6.

brazing alloy. A nonstandard term for **brazing filler metal**.

**brazing blowpipe.** A device used to obtain a small, accurately directed flame for fine work. A portion of any flame is blown to the desired location by the blowpipe, which is usually mouth operated.

**brazing filler metal.** The metal or alloy to be added in making a brazed joint. The filler metal has a liquidus above 450°C [840°F] and below the solidus of the base material. See also **brazing foil**, **brazing filler metal paste**, **brazing powder**, **brazing rod**, **brazing rope**, **brazing sheet**, **brazing strip**, **brazing tape**, and **brazing wire**.

**brazing filler metal paste.** Brazing filler metal in the form of a paste consisting of finely divided brazing filler metal with a flux or neutral carrier.

**brazing foil.** Brazing filler metal in thin sheet form.

**brazing flux.** A flux used for brazing. See **noncorrosive flux**. See also **soldering flux** and **welding flux**.

**brazing operator.** One who operates automatic or mechanized brazing equipment.

**brazing paste.** A nonstandard term when used for **brazing filler metal paste**.

**brazing powder.** Brazing filler metal in the form of finely divided particles.

**brazing procedure.** The detailed methods and practices involved in the production of a brazement. See also **brazing procedure specification**.

**brazing procedure qualification record (BPQR).** A record of brazing variables used to produce an acceptable test brazement and the results of tests conducted on the brazement to qualify a brazing procedure specification.

**brazing procedure specification (BPS).** A document specifying the required brazing variables for a specific application.

**brazing rod.** A form of solid or flux cored brazing filler metal supplied in straight lengths that may include a flux coating.

**brazing rope.** Brazing powder held in an extruded form by a plastic binder.

**brazing sheet.** Brazing powder held in sheet form by a plastic binder.

**brazing shim.** A nonstandard term for **brazing foil**.

**brazing strip.** A long, narrow form of brazing foil or brazing sheet.

**brazing symbol.** A graphical representation of the specifications for producing a brazed joint. For examples

and rules for their application, refer to AWS A2.4, *Standard Symbols for Welding, Brazing, and Non-destructive Examination*.

**brazing tape.** Brazing strip with an applied adhesive.

**brazing technique.** Details of the brazing operation controlled by the brazer or brazing operator.

**brazing temperature.** The base material temperature(s) at which a braze can be accomplished.

**brazing wire.** A solid or flux cored form of brazing filler metal supplied on coils or spools.

**brittle nugget.** A nonstandard term when used to describe a faying plane failure of a weld in a peel test.

**bronze welding.** A nonstandard term when used for **braze welding**.

**buildup.** A surfacing variation in which surfacing material is deposited to achieve the required dimensions. See also **buttering**, **cladding**, and **hardfacing**.

**buildup sequence.** A nonstandard term for **cross-sectional sequence**.

**burnback time.** A nonstandard term for **meltback time**.

**burner.** A nonstandard term when used for **oxyfuel gas cutter**.

**burning.** A nonstandard term when used for **oxyfuel gas cutting**.

**burning in.** A nonstandard term for **flow welding**.

**burnoff rate.** A nonstandard term when used for **melting rate**.

**burn-through.** A hole or depression in the root bead of a single-groove weld due to excess penetration.

**burn-through.** A nonstandard term when used for **melt-through**.

**burn-through weld.** A nonstandard term for an **arc seam weld** or **arc spot weld**.

**butt joint.** A joint type in which the butting ends of one or more workpieces are aligned in approximately the same plane. See Figures B.1(A), B.2(A), B.3, B.10(A), B.10(B), B.10(D), B.51(A), and B.51(B). See also **skewed joint**.

**butt weld.** A nonstandard term for a **weld** in a butt joint.

**buttering.** A surfacing variation depositing surfacing metal on one or more surfaces to provide metallurgically compatible weld metal for the subsequent completion of the weld. See also **buildup**, **cladding**, and **hardfacing**.

**butting member.** A joint member prevented, by the other member, from movement in one direction perpendicular to its thickness dimension. For example, both members of a butt joint, or one member of a T-joint or corner joint. See Figure B.11. See also **non-butting member**.

**button.** Part of a weld, including all or part of the nugget, torn out in the destructive testing of projection, seam, or spot welds.

## C

cap. A nonstandard term for the final **layer** of a groove weld.

cap, *resistance welding*. A nonstandard term for **electrode cap**.

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

**carbon arc braze welding (CABW).** A braze welding process variation using an arc between a carbon electrode and the base metal as the heat source.

**carbon arc brazing (CAB).** A brazing process using heat from a carbon arc. This is an obsolete or seldom used process. See Table A.5.

carbon arc brazing. A nonstandard term when used for **twin carbon arc brazing**.

**carbon arc cutting (CAC).** An arc cutting process employing a carbon electrode. See also **air carbon arc cutting**.

**carbon arc gouging (CAG).** A thermal gouging process using heat from a carbon arc and the force of compressed air or other nonflammable gas. See also **oxygen gouging** and **plasma arc gouging**.

**carbon arc welding (CAW).** An arc welding process using an arc between a carbon electrode and the weld pool. The process is used with or without shielding and without the application of pressure. See also **gas carbon arc welding**, **shielded carbon arc welding**, and **twin carbon arc welding**.

**carbon electrode.** A nonfiller metal electrode used in arc welding and cutting, consisting of a carbon or graphite rod, which may be coated with copper or other materials.

carbonizing flame. A nonstandard term for **carburizing flame**.

**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. See Figure B.40(D). See also **neutral flame**, **oxidizing flame**, and **reducing flame**.

**carrier gas.** The gas used to transport powdered material from the feeder or hopper to a thermal spraying gun or a thermal cutting torch.

**cascade sequence.** A combined longitudinal and cross-sectional sequence in which weld beads are made in overlapping layers. See Figure B.23(C). See also **block sequence**, **continuous sequence**, and **cross-sectional sequence**.

caulk weld. A nonstandard term for **seal weld**.

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

**ceramic rod flame spraying.** A thermal spraying process variation in which the surfacing material is in rod form.

**chain intermittent weld.** An intermittent weld on both sides of a joint in which the weld segments on one side are approximately opposite those on the other side. See Figure B.23(G).

chemical flux cutting. A nonstandard term for **flux cutting**.

**chemical-bath dip brazing.** A dip brazing process variation using a chemical compound also serving as a flux. See also **metal-bath dip brazing** and **salt-bath dip brazing**.

chill ring. A nonstandard term when used for **backing ring**.

chill time. A nonstandard term when used for **quench time**.

**circular electrode.** A rotatable electrode with the contacting surface at the periphery through which welding current and force are applied to the workpieces. See **resistance welding electrode**.

**clad brazing sheet.** A metal sheet on which one or both sides are clad with brazing filler metal. See also **clad metal**.

**clad metal.** A laminar composite consisting of a metal or alloy, with a metal or alloy of different chemical composition applied to one or more sides by casting, drawing, rolling, surfacing, chemical deposition, or electroplating.

**cladding.** A surfacing variation depositing or applying surfacing material usually to improve corrosion or

heat resistance. See also **buildup**, **buttering**, and **hardfacing**.

**cluster porosity.** A localized array of porosity having a random geometric distribution.

CO<sub>2</sub> welding. A nonstandard term when used for **flux cored arc welding** or **gas metal arc welding** with carbon dioxide shielding gas.

**coalescence.** The growing together or growth into one body of the materials being joined.

coated electrode. A nonstandard term for **covered electrode** or **lightly coated electrode**.

coating. A nonstandard term when used for **thermal spray deposit**.

coating density. A nonstandard term when used for **spray deposit density ratio**.

**coextrusion welding (CEW).** A solid-state welding process producing a weld by heating to the welding temperature and forcing the workpieces through an extrusion die.

**coil with support.** A filler metal packaging configuration in which the wire or strip is wound around a cylinder without flanges. See Figure B.42(B). See also **coil without support** and **spool**.

**coil without support.** A filler metal packaging configuration in which the wire is coiled without an internal support and appropriately bound to maintain its shape. See also **coil with support** and **spool**.

**cold brazed joint.** A brazed joint with incomplete metallic bonding due to insufficient heating of the base material during brazing.

**cold crack.** A crack occurring in a metal at or near ambient temperatures. Cold cracks can occur in base metal (BMZ), heat-affected (HAZ), and weld metal zones (WMZ). See also **hot crack**.

cold lap. A nonstandard term when used for **incomplete fusion** or **overlap**, *fusion welding*.

**cold soldered joint.** A soldered joint with incomplete metallic bonding due to insufficient heating of the base material during soldering.

**cold welding (CW).** A solid-state welding process in which pressure is used to produce a weld at room temperature with substantial deformation at the weld. See also **diffusion welding**, **forge welding**, and **hot pressure welding**.

**collar.** The reinforcing metal of a nonpressure thermite weld.

**collaring, thermal spraying.** Adding a shoulder to a shaft or similar component as a protective confining wall for the thermal spray deposit. See Figures B.43(A) and B.43(B).

**collet, gas tungsten arc welding, plasma arc cutting, plasma arc welding, and thermal spraying.** A mechanical clamping device used to hold the electrode in position within the welding, cutting or spraying torch. See Figure B.36.

**commutator-controlled welding.** A resistance spot or projection welding variation in which multiple welds are produced sequentially as controlled by a commutating device activated when the contactor is closed.

companion panel. A nonstandard term when used for **spray tab**.

**complete fusion.** Fusion over the entire fusion faces and between all adjoining weld beads. See Figure B.28. See also **incomplete fusion**.

**complete joint penetration (CJP).** A groove weld condition in which weld metal extends through the joint thickness. See Figure B.26. See also **complete joint penetration weld**, **incomplete joint penetration**, **joint penetration**, and **partial joint penetration weld**.

**complete joint penetration weld.** A groove weld in which weld metal extends through the joint thickness. See Figures B.26(F) and B.26(G). See also **complete joint penetration**, **incomplete joint penetration**, **joint penetration**, and **partial joint penetration weld**.

**composite.** A material consisting of two or more discrete materials with each material retaining its physical identity. See also **clad metal**, **composite electrode**, and **composite thermal spray deposit**.

**composite electrode.** A generic term for multicomponent filler metal electrodes in various physical forms such as stranded wires, tubes, and covered wire. See also **covered electrode**, **flux cored electrode**, **metal cored electrode**, and **stranded electrode**.

**composite thermal spray deposit.** A thermal spray deposit made with two or more dissimilar surfacing materials that may be formed in layers.

**concave fillet weld.** A fillet weld having a concave face. See Figure B.25(B).

**concave root surface.** The configuration of a groove weld exhibiting underfill at the root surface. See Figure B.27(F).

**concavity.** The maximum distance from the face of a concave fillet weld perpendicular to a line joining the weld toes. See Figure B.25(B).

**concurrent heating.** The application of supplemental heat to a structure during welding or cutting.

**cone.** The conical part of an oxyfuel gas flame adjacent to the tip orifice. See Figure B.40.

connection. A nonstandard term when used for a welded, brazed, or soldered **joint**.

**constant current power source.** An arc welding power source with a volt-ampere relationship yielding a small welding current change from a large arc voltage change. See also **welding power source**.

**constant voltage power source.** An arc welding power source with a volt-ampere relationship yielding a large welding current change from a small arc voltage change. See also **welding power source**.

**constricted arc.** A plasma arc column shaped by the constricting orifice in the nozzle of the plasma arc torch or plasma spraying gun.

**constricting nozzle.** A device at the exit end of a plasma arc torch or plasma spraying gun, containing the constricting orifice. See Figure B.35.

**constricting orifice.** The hole in the constricting nozzle of the plasma arc torch or plasma spraying gun through which the arc plasma passes. See Figure B.35.

**constricting orifice diameter.** See Figure B.35.

**constricting orifice length.** See Figure B.35.

**consumable electrode.** An electrode providing filler metal.

**consumable guide electroslag welding (ESW-CG).** An electroslag welding process variation in which filler metal is supplied by an electrode and its guiding member. See Figure B.37(B).

**consumable insert.** Filler metal placed at the joint root before welding, and intended to be completely fused into the joint root to become part of the weld. See Figure B.13(E).

**contact resistance, resistance welding.** Resistance to the flow of electric current through faying surfaces of workpieces, an electrode and workpiece, or mating surfaces of components in the secondary circuit.

**contact tip.** A tubular component of an arc welding gun delivering welding current to, and guiding, a continuous electrode. See Figures B.38 and B.39.

**contact tip setback, flux cored arc welding and gas metal arc welding.** The distance from the contact tip to the end of the gas nozzle. See Figure B.38(A). See also **electrode setback**.

contact tube. A nonstandard term when used for **contact tip**.

contact tube setback. A nonstandard term when used for **contact tip setback**.

continuous feed. A nonstandard term when used for **melt-in feed**.

**continuous sequence.** A longitudinal sequence in which each weld bead is made continuously from one end of the joint to the other. See also **backstep sequence, block sequence, and cascade sequence**.

**continuous wave laser.** A laser having an output operating in a continuous rather than a pulsed mode. A laser operating with a continuous output for a period greater than 25 milliseconds is regarded as a continuous wave laser.

**continuous weld.** A weld extending continuously from one end of a joint to the other. Where the joint is essentially circular, it extends completely around the joint.

**convex fillet weld.** A fillet weld having a convex weld face. See Figure B.25(A).

**convex root surface.** The configuration of a groove weld exhibiting root reinforcement at the root surface. See Figure B.27(E).

**convexity.** The maximum distance from the face of a convex fillet weld perpendicular to a line joining the weld toes. See Figure B.25(A).

**cool time, resistance welding.** The duration between successive heat times in multiple-impulse welding. See Figures B.48(B) and B.49.

copper brazing. A nonstandard term when used for **brazing** with a copper **brazing filler metal**.

**cord, thermal spraying.** Surfacing material in the form of a plastic tube filled with powder extruded to a compact, flexible cord with characteristics similar to a wire.

**cored solder.** A solder wire or bar containing flux as a core.

**corner joint.** A joint type in which butting or nonbutting ends of one or more workpieces converge approximately perpendicular to one another. See Figures B.1(B), B.2(B), B.10(C), and B.10(E). See also **skewed joint**.



corner-flange weld. A nonstandard term when used for an **edge weld** in a **flanged corner joint**.

**corona, resistance welding.** The region of a resistance weld where joining is the result of solid-state welding.

**corrective lens.** A lens ground to the wearer's individual corrective prescription.

**corrosive flux, brazing and soldering.** A flux with a residue chemically attacking the base metal. It may be composed of inorganic salts and acids, organic salts and acids, or activated rosin.

**cosmetic weld bead.** A weld bead used to enhance appearance.

**cosmetic weld pass.** A weld pass resulting in a cosmetic weld bead.

**covalent bond.** A primary bond arising from the reduction in energy associated with overlapping half-filled orbitals of two atoms.

**cover bead.** A weld bead resulting from a cover pass.

cover lens. A nonstandard term for a **cover plate**.

**cover pass.** A weld pass or passes resulting in the exposed layer of a multipass weld on the side from which welding was done.

**cover plate.** A removable pane of colorless glass, plastic-coated glass, or plastic covering the filter plate and protecting it from weld spatter, pitting, or scratching.

**covered electrode.** A composite filler metal electrode consisting of a bare or metal cored electrode with a flux covering sufficient to provide a slag layer and/or alloying elements. See also **lightly coated electrode**.

**crack.** A fracture-type discontinuity characterized by a sharp tip and high ratio of length and width to opening displacement. See Figure B.33.

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

**crater crack.** A crack initiated and localized within a crater. See Figure B.33.

**crater fill current.** The current value during crater fill time. See Figure B.54.

**crater fill time.** The time interval following weld time but prior to meltback time during which arc voltage or current reach a preset value greater or less than welding values. Weld travel may or may not stop at this point. See Figure B.54.

**crater fill voltage.** The arc voltage value during crater fill time. See Figure B.54.

**cross wire welding.** A projection welding joint design in which the localization of the welding current and force is achieved by the contact of intersecting wires.

**cross-sectional sequence.** The order in which the weld passes of a multiple-pass weld are made with respect to the cross section of the weld. See Figures B.23(B)–(E). See also **block sequence**, **cascade sequence**, and **continuous sequence**.

crushed slag. A nonstandard term when used for **recycled slag** for *submerged arc welding*.

cup. A nonstandard term when used for **gas nozzle**.

**cutter.** See **thermal cutter**. See also **oxygen cutting operator**.

**cutting.** See **thermal cutting**.

**cutting attachment.** A device for converting an oxyfuel gas welding torch into an oxyfuel gas cutting torch.

cutting blowpipe. A nonstandard term for **oxyfuel gas cutting torch**.

**cutting electrode.** A nonfiller metal electrode used in arc cutting. See also **carbon electrode**, **metal electrode**, and **tungsten electrode**.

**cutting head.** The part of a cutting machine in which a cutting torch or tip is incorporated.

cutting nozzle. A nonstandard term for **cutting tip**.

**cutting operator.** See **thermal cutting operator**. See also **oxygen cutter**.

**cutting tip.** The part of an oxyfuel gas cutting torch from which the gases issue. See Figure B.41.

**cutting torch.** See **air carbon arc cutting torch**, **gas tungsten arc cutting torch**, **oxyfuel gas cutting torch**, and **plasma arc cutting torch**.

**cycle.** The duration of one waveform period.

**cylinder.** See **gas cylinder**.

**cylinder manifold.** A header for interconnection of multiple 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 rejectability. See also **discontinuity** and **flaw**.

delayed crack. A nonstandard term when used for **cold crack** or **underbead crack**.

deposit. A nonstandard term when used for **thermal spray deposit**.

deposit sequence. A nonstandard term when used for **weld pass sequence**.

**deposited metal**, *brazing, soldering, and welding*. Filler metal added during brazing, soldering or welding.

**deposited metal**, *surfacing*. Surfacing metal added during surfacing.

**deposition efficiency**. See **arc welding deposition efficiency** and **thermal spraying deposition efficiency**.

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

deposition sequence. A nonstandard term when used for **weld pass sequence**.

**depth of bevel**. The perpendicular distance from the base metal surface to the root edge or the beginning of the root face. See Figure B.6.

**depth of fusion**. The distance that fusion extends into the base metal or previous bead from the surface melted during welding. See Figure B.30. See also **joint penetration**.

**detonation flame spraying**. A thermal spraying process variation in which the controlled explosion of a mixture of fuel gas, oxygen, and powdered surfacing material is utilized to melt and propel the surfacing material to the substrate.

die. A nonstandard term when used for **resistance welding die**.

die welding. A nonstandard term when used for **cold welding** and **forge welding**.

**differential thermal expansion**. Dimensional effects resulting from differences in expansion coefficients and/or thermal gradients within a workpiece or assembly.

**diffusion aid**. A solid filler metal applied to the faying surfaces to assist in diffusion welding.

diffusion bonding. A nonstandard term for **diffusion brazing** and **diffusion welding**.

**diffusion brazing (DFB)**. A brazing process using a brazing filler metal or an in situ liquid phase that diffuses with the base material(s) to produce joint properties approaching those of the base material(s). Pressure may or may not be applied. See Figures A.1 and A.6. See Tables A.1, A.2, and A.3.

**diffusion welding (DFW)**. A solid-state welding process producing a weld by the application of pressure at ele-

vated temperature with no macroscopic deformation or relative motion of the workpieces. A solid filler metal may be inserted between the faying surfaces. See also **cold welding**, **diffusion aid**, **forge welding**, and **hot pressure welding**.

**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. See Figure B.24(L).

**dip brazing (DB)**. A brazing process using heat from a molten bath. See also **chemical-bath dip brazing**, **metal-bath dip brazing**, and **salt-bath dip brazing**.

**dip feed**, *gas tungsten arc welding, oxyfuel gas welding and plasma arc welding*. A process variation in which filler metal is intermittently fed into the leading edge of the weld pool.

**dip soldering (DS)**. A soldering process using heat from a metal, oil, or salt bath in which it is immersed. See **metal-bath dip soldering**, **oil-bath dip soldering**, and **salt-bath dip soldering**. See also **wave soldering**.

dip transfer. A nonstandard term when used for **dip feed** or **short circuiting transfer**.

**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. See Figure B.34(B).

**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. See Figure B.34(A).

direct current reverse polarity. A nonstandard term for **direct current electrode positive**.

direct current straight polarity. A nonstandard term for **direct current electrode negative**.

**direct drive friction welding (FRW-DD)**. A variation of friction welding in which the energy required to make the weld is supplied to the welding machine through a direct motor connection for a preset period of the welding cycle. See Figure B.45. See also **inertia friction welding**.

**direct welding**, *resistance welding*. A secondary circuit configuration in which welding current and force are applied to workpieces by directly opposed electrodes. See Figures B.47(A) – B.47(C).

**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. See also **defect** and **flaw**.

**dissolution, brazing.** Dissolving of the base material into the filler metal or the filler metal into the base material.

**double arcing.** A condition in which the welding or cutting arc of a plasma arc torch does not pass through the constricting orifice but transfers to the inside surface of the nozzle. A secondary arc is simultaneously established between the outside surface of the nozzle and the workpiece.

**double-bevel edge shape.** A type of bevel edge shape having two prepared surfaces adjacent to opposite sides of the material. See Figure B.7(C).

**double-bevel groove.** A double-sided weld groove formed by the combination of a butting member having a double-bevel edge shape abutting a planar surface of a companion member. See Figure B.9(B).

**double-bevel-groove weld.** A weld in a double-bevel-groove welded from both sides. See Figure B.9(B).

**double-flare-bevel groove.** A double-sided weld groove formed by the combination of a butting member having a round edge shape and a planar surface of a companion member. See Figure B.9(F).

**double-flare-bevel-groove weld.** A weld in a double-flare-bevel groove welded from both sides. See Figure B.9(F).

**double-flare-V groove.** A double-sided weld groove formed by the combination of butting members having round edge shapes. See Figure B.9(G).

**double-flare-V-groove weld.** A weld in a double-flare-V-groove welded from both sides. See Figure B.9(G).

**double-groove weld, fusion welding.** A groove weld made from both sides. See Figures B.9, B.24(C), and B.24(D).

**double-J edge shape.** A type of edge shape having two prepared surfaces adjacent to opposite sides of the material. See Figure B.9(D).

**double-J groove.** A double-sided weld groove formed by the combination of a butting member having a double-J edge shape abutting a planar surface of a companion member. See Figure B.9(D).

**double-J-groove weld.** A weld in a double-J groove welded from both sides. See Figure B.9(D).

**double-spliced butt joint.** See **spliced joint**. See Figure B.3(B).

**double-square-groove weld.** A weld in a square groove welded from both sides. See Figure B.9(A).

**double-U groove.** A double-sided weld groove formed by the combination of butting members having double-J edge shapes. See Figure B.9(E).

**double-U-groove weld.** A weld in a double-U groove welded from both sides. See Figure B.9(E).

**double-V groove.** A double-sided weld groove formed by the combination of butting members having double-bevel edge shapes. See Figure B.9(C).

**double-V-groove weld.** A weld in a double-V groove welded from both sides. See Figure B.9(C).

**double-welded joint, fusion welding.** A joint welded from both sides. See Figures B.9, B.24(C), and B.24(D).

**dovetailing, thermal spraying.** A method of surface roughening involving angular undercutting to interlock the thermal spray deposit. See Figure B.43(C).

downhand. A nonstandard term for **flat welding position**.

**downhill, adv.** Welding with a downward progression.

**downslope time.** See **automatic arc welding downslope time** and **resistance welding downslope time**.

**drag, 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. See Figure B.41.

**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 position of guns, torches, rods, and beams. See Figure B.21. See also **backhand welding**, **push angle**, **travel angle**, and **work angle**.

**drop-through.** An undesirable sagging or surface irregularity, usually encountered when brazing or welding near the solidus of the base metal, caused by overheating with rapid diffusion or alloying between the filler metal and the base metal.

**dross, thermal cutting.** The remaining solidified, oxidized metallic material adhering to the workpiece adjacent to the cut surface.

**drum.** A cylindrical filler metal package used to contain a continuous length of wound or coiled filler metal wire.

**duty cycle.** The percentage of time during a specified test period that a power source or its accessories can be operated at rated output without overheating. The test periods for arc welding and resistance welding are ten (10) minutes and one (1) minute, respectively.

**dwelt time**, *thermal spraying*. The length of time that the surfacing material is exposed to the heat zone of the thermal spraying gun.

**dwelt time**, *welding*. The time during which the energy source pauses at any point in each oscillation.

**dynamic electrode force**, *resistance welding*. The actual force applied to the workpieces by the electrodes during welding. See also **electrode force**, **static electrode force**, and **theoretical electrode force**.

## E

**edge effect**, *thermal spraying*. Loosening of the bond between the thermal spray deposit and the substrate at the edge of the thermal spray deposit.

**edge joint**. A joint type in which the nonbutting ends of one or more workpieces lie approximately parallel. See Figures B.1(E) and B.2(E). See also **skewed joint**.

**edge loss**, *thermal spraying*. Thermal spray deposit lost as overspray beyond the edge of the workpiece.

**edge preparation**. The preparation of the edges of the joint members, by cutting, cleaning, plating, or other means.

edge preparation. A nonstandard term when used for **edge shape**.

**edge shape**. The shape of the edge of the joint member. See Figure B.7.

**edge weld**. A weld in an edge joint, a flanged butt joint or a flanged corner joint in which the full thickness of the members are fused. See Figures B.10(A) through B.10(C), B.13(A), and B.25(H).

**edge weld size**. The weld metal thickness measured from the weld root. See Figure B.25(H).

edge-flange weld. A nonstandard term for an **edge weld** in a flanged butt joint.

**effective throat**. The minimum distance from the fillet weld face, minus any convexity, and the weld root. In the case of a fillet weld combined with a groove weld, the weld root of the groove weld shall be used. See Figures B.25(A)–(D) and B.25(I)–(K). See also **actual throat** and **theoretical throat**.

electric arc spraying. A nonstandard term for **arc spraying**.

electric bonding. A nonstandard term when used for **surfacing** by thermal spraying.

electric brazing. A nonstandard term for **arc brazing** and **resistance brazing**.

**electrode**. A component of the secondary circuit terminating at the arc, molten conductive slag, or base metal. See **consumable electrode**, **cutting electrode**, **nonconsumable electrode**, **resistance welding electrode**, **tungsten electrode**, and **welding electrode**.

**electrode adapter**, *resistance welding*. A device used to adapt an electrode to an electrode holder.

**electrode cap**. A replaceable electrode adapter tip used for resistance spot welding.

**electrode extension**, *carbon arc cutting*. The length of electrode extending beyond the electrode holder or cutting torch.

**electrode extension**, *flux cored arc welding, electrogas welding, gas metal arc welding, and submerged arc welding*. The length of electrode extending beyond the end of the contact tip. See Figure B.38.

**electrode extension**, *gas tungsten arc welding and plasma arc welding*. The length of tungsten electrode extending beyond the end of the collet. See Figures B.35 and B.36.

**electrode face**, *resistance welding*. The surface of a resistance welding electrode that contacts the workpiece.

**electrode force**, *resistance welding*. The force applied by the electrodes to the workpieces in making spot, seam, or projection welds. See also **dynamic electrode force**, **static electrode force**, and **theoretical electrode force**.

electrode gap. A nonstandard term for **arc length**.

**electrode holder**, *resistance welding*. A device used for mechanically holding and conducting current to an electrode or electrode adapter.

**electrode indentation**, *resistance welding*. A depression formed on the surface of the workpiece by an electrode.

**electrode lead**. A secondary circuit conductor transmitting energy from the power source to the electrode holder, gun, or torch. See Figures B.34 and B.36.

**electrode life**, *resistance welding*. The endurance of a welding electrode, normally expressed in terms of the number and/or length of welds produced between required servicing or replacement.

**electrode mushrooming**, *resistance welding*. The enlargement of the electrode face due to the heat and pressure of welding.

**electrode pickup**, *resistance welding*. Contamination of the electrode by the base metal or its coating during welding.

**electrode setback.** The distance the electrode is recessed behind the constricting orifice of the plasma arc torch or thermal spraying gun, measured from the outer face of the constricting nozzle. See Figure B.35. See also **contact tip setback**.

**electrode skid.** A surface discontinuity resulting from electrode skidding.

**electrode skidding, *resistance welding*.** The transverse movement of the electrode with respect to the workpiece resulting from the application of electrode force.

electrode tip. A nonstandard term when used for **electrode cap** or **electrode face**.

**electrogas welding (EGW).** An arc welding process using an arc between a continuous filler metal electrode and the weld pool, employing approximately vertical welding progression with backing to confine the molten weld metal. The process is used with or without an externally supplied shielding gas and without the application of pressure.

**electron beam braze welding (EBBW).** A braze welding process variation employing a defocused or oscillating electron beam as the heat source. See Figures A.1 and A.6. See Tables A.1, A.2, and A.3.

**electron beam brazing (EBB).** A brazing process using heat from a slightly defocused or oscillating electron beam. See Figures A.1 and A.6. See Tables A.1, A.2, and A.3.

**electron beam cutting (EBC).** A thermal cutting process severing metals by melting them with the heat from a concentrated beam, composed primarily of high-velocity electrons, impinging on the workpiece.

**electron beam cutting operator.** See **thermal cutting operator**.

**electron beam gun.** A device for producing and accelerating electrons. Typical components include the emitter (also called the *filament* or *cathode*) heated to produce electrons via thermionic emission, a cup (also called the grid or grid cup), and the anode.

**electron beam gun column.** The electron beam gun plus auxiliary mechanical and electrical components that may include beam alignment, focus, and deflection coils.

**electron beam welding (EBW).** A welding process producing coalescence with a concentrated beam, composed primarily of high-velocity electrons, impinging on the joint. The process is used without shielding gas and without the application of pressure. See also **high vacuum electron beam welding**, **medium vacuum**

**electron beam welding**, and **nonvacuum electron beam welding**.

**electroslag welding (ESW).** A welding process producing coalescence of metals with molten slag, melting the filler metal and the surfaces of the workpieces. The weld pool is shielded by this slag, which moves along the full cross section of the joint as welding progresses. The process is initiated by an arc that heats the slag. The arc is then extinguished by the conductive slag, which is kept molten by its resistance to electric current passing between the electrode and the workpieces. See also **electroslag welding electrode** and **consumable guide electroslag welding**. See Figure B.37.

**electroslag welding electrode.** A filler metal component of the welding circuit through which current is conducted from the electrode guiding member to the molten slag.

**elongated porosity.** A form of porosity having a length greater than its width that lies approximately parallel to the weld axis.

**emissive electrode.** A filler metal electrode consisting of a core of a bare electrode or a composite electrode to which a very light coating has been applied to produce a stable arc.

end return. A nonstandard term for **boxing**.

**erosion, *brazing*.** The condition in which the base metal thickness has been reduced by dissolution.

**exhaust booth.** A mechanically ventilated, semi-enclosed area in which an air flow across the work area is used to remove fumes, gases, and solid particles.

**exothermic braze welding (EXBW).** A braze welding process variation using an exothermic chemical reaction as heat source with the brazing filler metal provided as a reaction product. See Figures A.1 and A.6. See Tables A.1, A.2, and A.3.

**exothermic brazing (EXB).** A brazing process using an exothermic chemical reaction as the heat source for the joint in which the brazing filler metal has been preplaced. See Figures A.1 and A.6. See Tables A.1, A.2, and A.3.

**explosion welding (EXW).** A solid-state welding process producing a weld by high velocity impact of the workpieces as the result of controlled detonation.

**expulsion, *resistance welding*.** The ejection of molten metal during welding, either at the faying surface or the contact point(s) of the electrode face. See also **surface expulsion**.

**expulsion point**, *resistance welding*. The amount of welding current above which expulsion occurs for a given set of welding conditions.

**extension**, *resistance welding*. The distance the workpiece or electrode projects from a resistance welding die, clamp, chuck, or electrode holder.

## F

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

**face crack**. See Figure B.33.

**face feed**, *brazing and soldering*. Manual or mechanical application of filler metal to the preheated joint.

**face of weld**. See **weld face**.

**face reinforcement**. Weld reinforcement on the side of the joint from which welding was done. See Figures B.24(A) and B.24(C). See also **root reinforcement**.

**face shield**. A device positioned in front of the eyes and over all or a portion of the face to protect the eyes and face. See also **hand shield** and **welding helmet**.

**faying surface**. The mating surface of a workpiece in contact with or in close proximity to another workpiece to which it is to be joined. See Figure B.30(D).

**feather**. See **acetylene feather**.

feed rate, *thermal spraying*. A nonstandard term for **spraying rate**.

**Ferrite Number (FN)**. An arbitrary, standardized value designating the ferrite content of an austenitic or duplex ferritic-austenitic stainless steel weld metal based on its magnetic properties. The term is always a proper noun and is always capitalized. Ferrite Number should not be confused with percent ferrite; the two are not equivalent.

**ferrule**, *arc stud welding*. A ceramic device surrounding the stud base to contain the molten metal and shield the arc.

**field weld**. A weld made at a location other than a shop or the place of initial construction.

fill bead. A nonstandard term when used for **intermediate weld bead**.

fill pass. A nonstandard term when used for **intermediate weld pass**.

**fill weld**. A fusion weld made with filler metal.

**filler**. See **joint filler**.

filler bead. A nonstandard term when used for **intermediate weld bead**.

**filler material**. The material to be added in making a brazed, soldered, or welded joint. See also **brazing filler metal**, **consumable insert**, **diffusion aid**, **filler metal**, **solder**, **welding electrode**, **welding filler metal**, **welding rod**, and **welding wire**.

**filler metal**. The metal or alloy to be added in making a brazed, soldered, or welded joint. See also **brazing filler metal**, **consumable insert**, **diffusion aid**, **filler material**, **filler metal powder**, **soldering filler metal**, **welding electrode**, **welding filler metal**, **welding rod**, and **welding wire**.

**filler metal powder**. Filler metal in particle form.

**filler metal start delay time**. The time interval from arc initiation to the start of filler metal feeding. See Figure B.54.

**filler metal stop delay time**. The time delay interval from beginning of downslope time to the stop of filler metal feeding. See Figure B.53.

filler pass. A nonstandard term when used for **intermediate weld pass**.

filler wire. A nonstandard term for **welding wire**.

**fillet**, *brazing and soldering*. The radiussed portion of the braze metal or solder metal adjacent to the joint.

**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. See Figures B.10(F), B.15(F), B.18, B.20, B.21(B), B.23(G), B.23(H), B.24(E), B.24(J), B.24(P), B.25(A)–(E), B.25(I), and B.30(B).

**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. See Figures B.24(E) and B.25(A)–(E).

**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 largest right triangle that can be inscribed within the fillet weld cross section. See Figures B.25(A)–(E).

**fillet weld throat**. See **actual throat**, **effective throat**, and **theoretical throat**.

filter glass. A nonstandard term for **filter plate**.

filter lens. A nonstandard term for a round **filter plate**.