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

Approved American National Standard
ANSI

AWS A3.0M/A3.0:2010
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

International Standard Book Number: 978-0-87171-763-4
American Welding Society
550 N.W. LeJeune Road, Miami, FL 33126

Statement on the Use of American Welding Society Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society (AWS) are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute (ANSI). When AWS American National Standards are either incorporated in, or made part of, documents that are included in federal or state laws and regulations, or the regulations of other governmental bodies, their provisions carry the full legal authority of the statute. In such cases, any changes in those AWS standards must be approved by the governmental body having statutory jurisdiction before they can become a part of those laws and regulations. In all cases, these standards carry the full legal authority of the contract or other document that invokes the AWS standards. Where this contractual relationship exists, changes in or deviations from requirements of an AWS standard must be by agreement between the contracting parties.

AWS American National Standards are developed through a consensus standards development process that brings together volunteers representing varied viewpoints and interests to achieve consensus. While the AWS administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its standards.

AWS disclaims liability for any injury to persons or to property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this standard. AWS also makes no guarantee or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this standard available, AWS is neither undertaking to render professional or other services for or on behalf of any person or entity, nor is AWS undertaking to perform any duty owed by any person or entity to someone else. Anyone using these documents should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. It is assumed that the use of this standard and its provisions are entrusted to appropriately qualified and competent personnel.

This standard may be superseded by the issuance of new editions. Users should ensure that they have the latest edition.

Publication of this standard does not authorize infringement of any patent or trade name. Users of this standard accept any and all liabilities for infringement of any patent or trade name items. AWS disclaims liability for the infringement of any patent or product trade name resulting from the use of this standard.

Finally, the AWS does not monitor, police, or enforce compliance with this standard, nor does it have the power to do so.

On occasion, text, tables, or figures are printed incorrectly, constituting errata. Such errata, when discovered, are posted on the AWS web page (www.aws.org).

Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the appropriate technical committee. Such requests should be addressed to the American Welding Society, Attention: Managing Director, Technical Services Division, 550 N.W. LeJeune Road, Miami, FL 33126 (see Annex E). With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. These opinions are offered solely as a convenience to users of this standard, and they do not constitute professional advice. Such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

This standard is subject to revision at any time by the AWS A2 Committee on Definitions and Symbols. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are required and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS A2 Committee on Definitions and Symbols and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS A2 Committee on Definitions and Symbols to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

This page is intentionally blank.

Personnel

AWS A2 Committee on Definitions and Symbols

B. B. Grimmett, *Chair*	*Areva NP*
J. P. Christein, *Vice Chair*	*Northrop Grumman Shipbuilding—Newport News*
A. M. Alonso, *Secretary*	*American Welding Society*
L. J. Barley	*Consultant*
D. M. Beneteau	*CenterLine (Windsor) Limited*
C. K. Ford	*Hobart Institute of Welding Technology*
B. C. Galliers	*General Electric Aviation*
J. A. Grantham	*Welding & Joining Management Group*
J. J. Gullotti	*Electric Boat Corporation*
C. Lander	*St. John Inspection Services*
R. L. Holdren	*Application Technologies Company, LLC*
P. M. Newhouse	*BC Hydro Engineering*
W. F. Qualls	*Consultant*
L. J. Siy	*Consultant*
J. J. Vagi	*Engineering Consultant*
J. L. Warren	*CNH America, LLC*
K. R. Willens	*Kenal Associates*
B. D. Worley	*Unison Industries—Elano Division*

Advisors to the AWS A2 Committee on Definitions and Symbols

J. E. Greer	*Moraine Valley College*
A. J. Kathrens	*Canadian Welding Bureau*

Special Contributor

R. L. Peaslee	*Wall Colmonoy Corporation*

AWS A2B Subcommittee on Definitions

R. L. Holdren, *Chair*	*Applications Technologies Company, LLC*
B. B. Grimmett, *Vice Chair*	*Areva NP*
A. M. Alonso, *Secretary*	*American Welding Society*
L. J. Barley	*Consultant*
D. M. Beneteau	*CenterLine (Windsor) Limited*
B. C. Galliers	*General Electric Aviation*
J. A. Grantham	*Welding & Joining Management Group*
W. F. Qualls	*Consultant*
J. J. Vagi	*Engineering Consultant*
K. R. Willens	*Kenal Associates*

Advisors to the AWS A2B Subcommittee on Definitions

A. B. Cedilote	*WABCO*
A. T. Cullison	*American Welding Society*
C. K. Ford	*Hobart Institute of Welding Technology*
J. E. Greer	*Moraine Valley College*
M. F. Smith	*Sandia National Laboratories*
B. D. Worley	*Unison Industries—Elano Division*

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.

This page is intentionally blank.

Table of Contents

Page No.

List of Tables

List of Figures

Figure **Page No.**

This page is intentionally blank.

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:[1]

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

Other document:

Webster's Third New International Dictionary of the English Language, Unabridged.[2]

[1] AWS standards are published by the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126.

[2] *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 soldered ments 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 Nondestructive 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 **nonbutting 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_2 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 elevated 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.

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

dwell 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**.

filter plate. An optical material protecting the eyes against excessive ultraviolet, infrared, and visible radiation.

final current. The current after downslope but prior to current shut-off. See Figure B.53.

final taper current. The current at the end of the taper interval prior to downslope. See Figure B.53.

fines. Particles of flux or filler metal having a size smaller than a particular mesh size.

firecracker welding. A shielded metal arc welding process variation employing a length of covered electrode placed along the joint in contact with the workpieces during welding. The stationary electrode is consumed as the arc travels the length of the electrode. This is an obsolete or seldom used process variation.

fisheye. A discontinuity, attributed to the presence of hydrogen in the weld, observed on the fracture surface of a weld in steel consisting of a small pore or inclusion surrounded by an approximately round, bright area.

fit, *v.* The act of bringing together the workpiece(s) in preparation for joining.

fitter. One who fits the workpiece(s) in preparation for joining.

fitup. The as-fit joint geometry.

fixture. A device designed to maintain the fit workpiece(s) in the proper relationship.

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

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

flame sprayer. See **thermal sprayer**. See also **thermal spraying operator**.

flame spraying (FLSP). A thermal spraying process in which an oxyfuel gas flame is the source of heat for melting the surfacing material. Compressed gas may or may not be used for atomizing and propelling the surfacing material to the substrate.

flame spraying operator. See **thermal spraying operator**. See also **thermal sprayer**.

flame. See **carburizing flame**, **neutral flame**, **oxidizing flame**, and **reducing flame**.

flange weld. A nonstandard term for a **weld** in a flanged joint.

flanged butt joint. A form of a butt joint in which at least one of the members has a flanged edge shape at the joint. See Figures B.2(A), B.10(A), B.10(B), B.10(D), and B.27(D).

flanged corner joint. A form of a corner joint in which the butting member has a flanged edge shape at the joint, and an edge weld is applicable. See Figures B.2(B), B.10(C), B.10(E), and B.27(B).

flanged edge joint. A form of an edge joint in which at least one of the members has a flanged edge shape at the joint. See Figure B.2(E).

flanged edge shape. A type of edge shape produced by forming the member. See Figure B.7(F).

flanged joint. A form of one of the five basic joint types in which at least one of the joint members has a flanged edge shape at the weld joint. See Figures B.2, B.10, B.27(B), and B.27(D).

flanged lap joint. A form of a lap joint in which at least one of the members has a flanged edge shape at the joint, and an edge weld is not applicable. See Figure B.2(D).

flanged T-joint. A form of a T-joint in which the butting member has a flanged edge shape at the joint, and an edge weld is not applicable. See Figures B.2(C) and B.10(F).

flare-bevel-groove weld. A weld in the groove formed between a joint member with a curved surface and another with a planar surface. See Figures B.8(H), B.9(F), B.10(F), and B.26(H).

flare-groove weld. A weld in the groove formed between a joint member with a curved surface and another with a planar surface, or between two joint members with curved surfaces. See Figures B.8(H), B.8(I), B.9(F), B.9(G), B.10(D), and B.10(F). See also **flare-bevel-groove weld** and **flare-V-groove weld**.

flare-V-groove weld. A weld in a groove formed by two members with curved surfaces. See Figures B.8(H), B.9(G), and B.10(D).

flash, *arc stud welding*. Molten metal displaced from the weld joint and contained by a ferrule.

flash, *flash welding*. Molten metal displaced from the weld joint by expulsion or extrusion.

flash butt welding. A nonstandard term for **flash welding**.

flash coat, *brazing and soldering*. A thin metallic coating, usually less than 0.005 mm [0.0002 in] thick, applied to the workpiece(s) to promote joining.

flash time. Period of the flash welding cycle during which flashing action occurs. See Figure B.51.

flash welding (FW). A resistance welding process producing a weld at the faying surfaces of butting members by the rapid upsetting of the workpieces after a controlled period of flashing action.

flashback. The recession of the flame through the torch and into the hose, regulator, and/or cylinder, potentially causing an explosion. See also **backfire** and **sustained backfire**.

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

flashing action. The phenomenon in flash welding wherein points on the faying surfaces are melted and explosively ejected.

flashover, *electron beam welding*. Undesirable arcing occurring within the electron beam gun.

flat position. See **flat welding position**.

flat position, *brazing*. The position used to braze from the upper side of the joint resulting in the face of the braze being oriented approximately horizontal.

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. See Figures B.16(A) through (C), B.17(A), B.18(A), B.19(A), and B.20(A).

flaw. An undesirable discontinuity. See also **defect**.

flood cooling, *resistance seam welding*. The application of liquid coolant directly on the workpieces and electrodes.

flow brazing (FLB). A brazing process using heat from the brazing filler metal poured over the joint. This is an obsolete or seldom used process. See also **flow welding** and **wave soldering**. See Figures A.1 and A.6. See also Tables A.1, A.2, A.3, and A.5.

flow brightening, *soldering*. Bonding of a soldering filler metal coating on a base metal to improve its finish. See also **precoating**.

flow welding (FLOW). A braze welding process variation using molten filler metal poured over the fusion faces as the heat source. This is an obsolete or seldom used process. See Table A.5. See also **flow brazing**.

flowability, *brazing and soldering*. The ability of molten filler metal to be drawn into the joint or spread over the surface of the base material.

flux. A material applied to the workpiece(s) before or during joining or surfacing to cause interactions that remove oxides and other contaminants, improve wetting, and affect the final surface profile. Welding flux may also affect the weld metal chemical composition. See also **brazing flux**, **soldering flux**, **and welding flux**.

flux coated rod, *brazing*. Brazing rod coated with flux.

flux cored arc welding (FCAW). An arc welding process using an arc between a continuous filler metal electrode and the weld pool. The process is used with shielding gas from a flux contained within the tubular electrode, with or without additional shielding from an externally supplied gas, and without the application of pressure. See also **flux cored electrode**, **gas shielded flux cored arc welding**, and **self-shielded flux cored arc welding**.

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.

flux cored soldering filler metal. Soldering filler rod or wire containing a flux. See also **acid core solder**.

flux cover, *metal-bath dip brazing and dip soldering*. A layer of molten flux over the molten filler metal bath.

flux cutting (OC-F). An oxygen cutting process using heat from an oxyfuel gas flame, with a flux in the flame to aid cutting.

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

focal point. A nonstandard term for **focal spot**.

focal spot. In a high energy beam, the location having the smallest cross-sectional area, and, consequently, the highest energy density.

follow-up, *resistance welding*. The ability of the moveable electrode to maintain specified electrode force and contact with the workpiece as metal movement occurs.

forehand welding. A welding technique in which the welding torch or gun is directed toward the progress of welding. See Figure B.21. See also **push angle**, **travel angle**, and **work angle**.

forge force. A compressive force applied to the weld, causing plastic deformation.

forge welding (FOW). A solid-state welding process producing a weld by heating the workpieces to the welding temperature and applying sufficient blows to cause permanent deformation at the faying surfaces. See also **cold welding**, **diffusion welding**, and **hot pressure welding**.

forge-delay time, *resistance welding*. The duration between a preselected point in the welding cycle and the initiation of the forging force. See Figure B.49.

forging speed, *friction welding*. The relative velocity of the workpieces at the instant the forge force is applied.

freezing point. A nonstandard term when used for **liquidus** and **solidus**.

friction soldering. A nonstandard term for **abrasion soldering**.

friction speed, *friction welding*. The relative velocity of the workpieces at the time of initial contact. See Figures B.44 and B.45.

friction stir welding (FSW). A variation of friction welding producing a weld by the friction heating and plastic material displacement caused by a rapidly rotating tool traversing the weld joint.

friction upset distance. The decrease in length of workpieces during the time of friction welding force application. See Figures B.44 and B.45.

friction welding (FRW). A solid-state welding process producing a weld under the compressive force contact of workpieces rotating or moving relative to one another to produce heat and plastically displace material from the faying surfaces. See Figures B.31(D), B.44, and B.45. See also **direct drive friction welding**, **friction stir welding**, and **inertia friction welding**.

friction welding force. The compressive force applied to the faying surfaces during the time there is relative movement between the workpieces from the start of welding until the application of the forge force. See Figures B.44 and B.45.

fuel gas. A gas, when mixed with air or oxygen and ignited, producing heat for cutting, joining, or thermal spraying.

full fillet weld. A fillet weld equal in size to the thickness of the thinner member joined.

full penetration. A nonstandard term for **complete joint penetration**.

furnace brazing (FB). A brazing process in which assemblies are heated to the brazing temperature in a furnace.

furnace soldering (FS). A soldering process using heat from a furnace or oven.

fused flux, *submerged arc welding.* A granular flux produced by mixing the ingredients followed by melting, cooling to the solid state and processing to produce the desired particle size. See also **agglomerated flux** and **bonded flux**.

fused thermal spray deposit. A self-fluxing thermal spray deposit subsequently heated to coalescence within itself and with the substrate using the spray-fuse thermal spraying technique.

fused zone. A nonstandard term for **fusion zone**.

fusing. A nonstandard term for **fusion**.

fusion, *fusion welding*. The melting together of filler metal and base metal, or of base metal only, to produce a weld. See also **depth of fusion**.

fusion face. A surface of the base metal melted during welding. See Figure B.30.

fusion line. A nonstandard term for **weld interface**.

fusion welding. Any welding process using fusion of the base metal to make the weld. See Figures A.1, A.3, and A.4.

fusion zone. The area of base metal melted as determined on the cross section of a weld. See Figure B.30.

G

gap. A nonstandard term when used for **arc length**, **joint clearance**, and **root opening**.

gas brazing. A nonstandard term for **torch brazing**.

gas carbon arc welding (CAW-G). A carbon arc welding process variation employing a shielding gas. This is an obsolete or seldom used process. See Table A.5.

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

gas cutter. A nonstandard term for **oxygen cutter**.

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

gas cylinder. A portable container used for transportation and storage of compressed gas.

gas generator. Equipment producing a gas for joining or cutting.

gas gouging. A nonstandard term for **oxygen gouging**.

gas laser. A laser in which the lasing medium is a gas.

gas lens. One or more fine mesh screens located in the gas nozzle to produce a stable stream of shielding gas. This device is primarily used for gas tungsten arc welding.

gas metal arc cutting (GMAC). An arc cutting process employing a continuous consumable electrode and a shielding gas.

gas metal arc welding (GMAW). An arc welding process using an arc between a continuous filler metal electrode and the weld pool. The process is used with shielding from an externally supplied gas and without the application of pressure. See also **pulsed gas metal arc welding** and **short circuit gas metal arc welding**. See Figures B.38(A) and B.39.

gas nozzle. A device at the exit end of the torch or gun that directs shielding gas. See Figures B.35, B.36, B.38(A), B.39(A), and B.39(C).

gas pocket. A nonstandard term for **porosity**.

gas regulator. A device for controlling the delivery of gas at some substantially constant pressure.

gas shielded arc welding. A group of processes including **electrogas welding**, **flux cored arc welding**, **gas metal arc welding**, **gas tungsten arc welding**, and **plasma arc welding**.

gas shielded flux cored arc welding (FCAW-G). A flux cored arc welding process variation in which shielding gas is supplied through the gas nozzle in addition to that obtained from the flux within the electrode.

gas torch. A nonstandard term when used for **cutting torch** and **welding torch**.

gas tungsten arc cutting (GTAC). An arc cutting process employing a single tungsten electrode with gas shielding.

gas tungsten arc cutting torch. A device used to transfer current to a fixed cutting electrode, position the electrode, and direct the flow of shielding gas.

gas tungsten arc welding (GTAW). An arc welding process using an arc between a tungsten electrode (nonconsumable) and the weld pool. The process is used with shielding gas and without the application of pressure. See also **hot wire welding** and **pulsed gas tungsten arc welding**. See Figure B.36.

gas tungsten arc welding torch. A device used to transfer current to a fixed welding electrode, position the electrode, and direct the flow of shielding gas. See Figure B.36.

gas welding. A nonstandard term for **oxyfuel gas welding**.

getter. A material, such as hot titanium or zirconium, used to purify vacuum or inert gas atmospheres by absorbing or reacting with impurities.

globular arc. A nonstandard term for **globular transfer**.

globular transfer, *gas metal arc welding*. The transfer of molten metal in large drops from a consumable electrode across the arc. See Figure B.39(A). See also **short circuiting transfer** and **spray transfer**.

goggles. Protective glasses equipped with filter plates set in a frame fitting snugly against the face and used primarily with oxyfuel gas processes.

gouging. See **thermal gouging**.

governing metal thickness, *resistance welding*. The workpiece thickness on which the required weld nugget size and depth of fusion are based.

gradated thermal spray deposit. A composite thermal spray deposit composed of mixed materials in successive layers progressively changing in composition from the substrate to the surface of the thermal spray deposit.

groove and rotary roughening, *thermal spraying.* A method of surface preparation in which grooves are made and the original surface is roughened and spread. See Figure B.43(D). See also **knurling**, **rotary roughening**, and **threading and knurling**.

groove angle. The included angle between the groove faces of a weld groove. See Figure B.6. See also **bevel angle**.

groove face. Any surface in a weld groove prior to welding**.** See Figure B.5. See also **bevel face** and **root face**.

groove radius. A nonstandard term when used for **bevel radius**.

groove weld. A weld in a weld groove on a workpiece surface, between workpiece edges, between workpiece surfaces, or between workpiece edges and surfaces. See Figures B.8, B.9, B.17, B.19, and B.21(A).

groove weld size. The joint penetration of a groove weld. See Figure B.26.

ground clamp. A nonstandard and incorrect term for **workpiece connection**.

ground connection. An electrical connection of the welding machine frame to the earth for safety. See Figure B.34. See also **workpiece connection** and **workpiece lead**.

ground lead. A nonstandard and incorrect term for **workpiece lead**.

gun. See **arc cutting gun**, **arc welding gun**, **electron beam gun**, **resistance welding gun**, **soldering gun**, and **thermal spraying gun**.

gun extension. The extension tube attached in front of the thermal spraying gun to permit spraying within confined areas or deep recesses.

H

hammer welding. A nonstandard term for **cold welding** and **forge welding**.

hammering, *resistance spot welding*. Excessive electrode impact on the surface of the workpiece during the welding cycle.

hand shield. A protective device used in arc cutting, arc welding, and thermal spraying, for shielding the eyes, face, and neck. It is equipped with a filter plate and is designed to be held by hand.

hand soldering. A nonstandard term when used for **manual soldering**.

hard solder. A nonstandard term for silver-based **brazing filler metal**.

hard surfacing. A nonstandard term for **hardfacing**.

hardfacing. A surfacing variation in which surfacing material is deposited to reduce wear. See also **buildup**, **buttering**, and **cladding**.

head. See **cutting head** and **welding head**.

heat balance. The various material, joint, and welding conditions determining the welding heat pattern in the joint.

heat input. The energy applied to the workpiece during welding. See also **heat input rate**.

heat input rate. The heat input per unit length of weld. See also **heat input**.

heat pattern. The shape of the heat distribution in a material resulting from the application of heat.

heat time. The duration of any one impulse in multiple-impulse welding or resistance seam welding. See Figures B.48(B) and B.49.

heat-affected zone (HAZ). The portion of base metal whose mechanical properties or microstructure have been altered by the heat of welding, brazing, soldering, or thermal cutting. See Figure B.24(G). See also **base metal zone** and **weld metal zone**.

heat-affected zone crack. A crack occurring in the heat-affected zone. See Figure B.33.

heating gate. The opening in a thermite mold through which the workpieces are preheated.

heating pattern. A description of the manner in which some heat source is applied for joining, cutting, thermal spraying, preheating, postheating, or thermal forming to produce a heat pattern.

heating torch. A device for directing the heating flame produced by the controlled combustion of fuel gases.

helmet. See **welding helmet**.

hermetically sealed container. A container closed in a manner to provide a nonpermeable barrier to the passage of air or gas in either direction.

high energy beam cutting (HEBC). A group of thermal cutting processes severing or removing material by localized melting, burning or vaporizing of the workpieces using beams having high energy densities.

high energy beam welding (HEBW). A group of welding processes using beams of energy with sufficient density to produce the coalescence of workpieces. The processes are applied with and without the application of pressure and with or without the application of filler metal. See Figure A.1.

high pulse current, *pulsed power welding*. The current during the high pulse time producing the high heat level. See Figure B.53.

high pulse time, *pulsed power welding*. The duration of the high pulse current. See Figure B.53.

high vacuum electron beam welding (EBW-HV). An electron beam welding process variation in which welding is accomplished at a pressure of 10^{-4} to 10^{-1} pascals [approximately 10^{-6} to 10^{-3} torr].

high velocity oxyfuel spraying (HVOF). A thermal spraying process using a high pressure oxyfuel mixture to heat and propel a powdered surfacing material to a substrate.

high-frequency resistance welding. A group of resistance welding process variations using welding current of at least 10 kHz to concentrate the welding heat at the desired location. See Figure B.52. See also **high-frequency seam welding**, **high-frequency upset welding**, and **induction welding**.

high-frequency seam welding (RSEW-HF). A resistance seam welding process variation in which welding current of at least 10 kHz is supplied through electrodes into the workpieces. See Figure B.52(C). See also **high-frequency resistance welding** and **induction seam welding**.

high-frequency upset welding (UW-HF). An upset welding process variation in which welding current of at least 10 kHz is supplied through electrodes into the workpieces. See Figures B.52(A), B.52(B), and B.52(D). See also **high-frequency resistance welding** and **induction upset welding**.

high-low. A nonstandard term for **weld joint mismatch**.

hold time, *projection welding, resistance seam welding, and resistance spot welding*. The duration of electrode force application at the end of the welding cycle to permit solidification of the weld. See Figures B.49 and B.50.

hollow bead. A nonstandard term when used for **elongated porosity** occurring in a root bead.

hood. A nonstandard term when used for **welding helmet**.

horizontal fixed position, *pipe*. A nonstandard term when used for **multiple welding position** designated as **5G**.

horizontal position. See **horizontal welding position**.

horizontal rolled position, *pipe*. A nonstandard term when used for the **flat welding position** designated as **1G**.

horizontal welding position, *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. See Figures B.16(B), B.18(B), B.20(B), and B.20(C).

horizontal welding position, *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. See Figures B.16(A), B.16(C), B.17(B), and B.19(B).

horn. An extension of the arm of a resistance welding machine transmitting the electrode force, usually conducts the welding current, and may support the workpiece.

horn spacing. A nonstandard term for **throat height**.

hot crack. A crack occurring in a metal during solidification or at elevated temperatures. Hot cracks can occur in both heat-affected (HAZ) and weld metal zones (WMZ). See also **cold crack**.

hot isostatic pressure welding (HIPW). A diffusion welding process variation producing coalescence of metals by heating and applying hot inert gas under pressure.

hot pass, *pipe*. A nonstandard term when used for the **weld pass** subsequent to the root pass.

hot pressure welding (HPW). A solid-state welding process producing a weld with heat and application of pressure sufficient to produce macro deformation of the workpieces. See also **cold welding**, **diffusion welding**, and **forge welding**.

hot start current. A very brief current pulse at arc initiation to stabilize the arc quickly. See Figure B.53.

hot wire welding. A variation of a fusion welding process in which a filler metal wire is resistance heated by current flowing through the wire as it is fed into the weld pool.

hybrid welding. The combination of two or more welding processes applied concurrently to produce a weld bead or nugget.

hydrogen brazing. A nonstandard term when used for **brazing** in a hydrogen atmosphere.

hydromatic welding. A nonstandard term for **pressure-controlled resistance welding**.

I

impulse, *resistance welding*. A group of pulses occurring on a regular frequency separated only by an interpulse time. See Figures B.48 through B.50.

inclined position. A nonstandard term when used for the **multiple welding position** designated as **6G**.

inclined position with restriction ring. A nonstandard term when used for the **multiple welding position** designated as **6GR**.

included angle. A nonstandard term when used for **groove angle**.

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

incomplete coalescence, *solid-state welding*. A weld discontinuity in which complete joining of joint faying surfaces has not been achieved.

incomplete fusion (IF). A weld discontinuity in which fusion did not occur between the weld metal and the fusion faces or the adjoining weld beads. See Figure B.29. See also **complete fusion**.

incomplete joint penetration (IJP). A joint root condition in a groove weld in which weld metal does not extend through the joint thickness. See Figure B.26. See also **complete joint penetration**, **complete joint penetration weld**, **joint penetration**, and **partial joint penetration weld**.

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

indirect welding, *projection welding*, *resistance seam welding*, and *resistance spot welding*. A secondary circuit variation in which the welding current is directed to the weld zone through the workpieces from application points away from the weld zone. See Figures B.47(D) through (G).

induction brazing (IB). A brazing process using heat from the resistance of the assembly to the induced electric current.

induction coil. Electrical conductor transmitting high-frequency energy from an induction power source to a metallic workpiece to create localized heating. See Figure B.52 (E).

induction power source. An electrical device used to convert line frequency into high frequency for induction heating.

induction seam welding (RSEW-I). A resistance seam welding process variation in which high-frequency welding current is induced in the workpieces. See also **high-frequency resistance welding** and **high-frequency seam welding**.

induction soldering (IS). A soldering process in which the heat required is obtained from the resistance of the workpieces to induced electric current.

induction upset welding (UW-I). An upset welding process variation in which high-frequency welding current is induced in the workpieces. See Figure B.52(E). See also **high-frequency resistance welding** and **high-frequency upset welding**.

induction welding (IW). A resistance welding process variation in which heat results from the resistance of the workpieces to the flow of induced high-frequency welding current, with or without the application of pressure. See Figure B.52(E).

induction work coil. The inductor used when welding, brazing, or soldering with induction heating equipment. See Figure B.52(E).

inert gas. A gas that does not react chemically with materials. See also **protective atmosphere**.

inert gas metal arc welding. A nonstandard term for **gas metal arc welding**.

inert gas tungsten arc welding. A nonstandard term for **gas tungsten arc welding**.

inertia friction welding (FRW-I). A variation of friction welding in which the energy required to make the weld is supplied primarily by the stored rotational kinetic energy of the welding machine. See Figure B.44. See also **direct drive friction welding**.

infrared brazing (IRB). A brazing process using heat from infrared radiation.

infrared radiation. Electromagnetic energy with wave lengths from 770 nanometers to 12,000 nanometers [7,700 Å to 120,000 Å].

infrared soldering (IRS). A soldering process in which the heat required is furnished by infrared radiation.

initial current. The current after starting, but before establishment of welding current. See Figure B.53.

insulating nozzle, *self-shielded flux cored arc welding.* A device at the exit end of the welding gun protecting the contact tip from spatter and possibly increasing the electrode extension while maintaining a shorter stickout. See Figure B.38(B).

interface. See **braze interface**, **solder interface**, **thermal spray deposit interface**, and **weld interface**.

intergranular penetration. The penetration of liquid metal along the grain boundaries of a base metal.

intermediate flux. A soldering flux with a residue that generally does not attack the base metal. The original composition may be corrosive.

intermediate weld bead. A weld bead resulting from an intermediate weld pass.

intermediate weld pass. A single progression of welding along a joint subsequent to the root pass(es) and prior to the cover pass(es).

intermittent weld. A weld in which continuity is interrupted by recurring unwelded spaces. See Figures B.23(G) through (I).

interpass temperature, *thermal spraying*. In multipass thermal spraying, the temperature of the thermal spray area between thermal spray passes.

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

interpulse time, *resistance welding*. The time between successive pulses of current within the same impulse. See Figure B.48.

interrupted spot welding. A nonstandard term when used for **multiple-impulse welding**.

ionic bond. A primary bond arising from the electrostatic attraction between two oppositely charged ions.

iron soldering (INS). A soldering process in which the heat required is obtained from a soldering iron.

J

J-edge shape. An edge shape formed by the combination of a bevel with a bevel radius. See Figures B.7(D) and B.7(E).

J-groove weld. A type of groove weld. See Figures B.8(F) and B.9(D).

joining. Any process used for connecting materials. See Figures A.1 though A.6.

joint. The junction of the workpiece(s) that are to be joined or have been joined. See Figures B.1 and B.2.

joint brazing procedure. A nonstandard term when used for **brazing procedure specification**.

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

joint clearance, *brazing and soldering*. The distance between the faying surfaces of a joint.

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

joint efficiency. The ratio of the strength of a joint to the strength of the base metal.

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. See Figure B.3(B).

joint geometry. The shape, dimensions, and configuration of a joint prior to joining.

joint opening. A nonstandard term for **root opening**.

joint penetration. The distance the weld metal extends from the weld face into a joint, exclusive of weld reinforcement. See Figure B.26. See also **groove weld size**.

joint recognition. A function of an adaptive control determining changes in joint geometry during welding and directing the welding equipment to take appropriate action. See also **joint tracking** and **weld recognition**.

joint remelt temperature, *brazing and soldering*. The temperature to which a brazed or soldered joint must be raised in order to remelt the braze metal or solder metal. The joint remelt temperature may be higher than the original process temperature.

joint root. The 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. See Figure B.4.

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. See Figure B.24(F).

joint tracking. A function of an adaptive control determining changes in joint location during welding and directing the welding machine to take appropriate action. See also **joint recognition** and **weld recognition**.

joint type. A weld joint classification based on the relative orientation of the members being joined. The five basic joint types are the butt, corner, edge, lap, and T-joints. See Figures B.1 and B.2.

joint welding sequence. See **welding sequence**.

K

kerf. The gap produced by a cutting process. See Figure B.41.

keyhole welding. A technique in which a concentrated heat source penetrates partially or completely through a workpiece, forming a hole (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.

keying. A nonstandard term for **mechanical bond**.

knee. The supporting structure of the lower arm or platen of a resistance welding machine.

knurling, *thermal spraying*. A method of surface roughening in which the surface is upset with a knurling tool. See also **groove and rotary roughening**, **rotary roughening**, and **threading and knurling**. See Figure B.43(E).

L

lack of fusion. A nonstandard term for **incomplete fusion**.

lack of penetration. A nonstandard term for **incomplete joint penetration**.

lamellar tear. A subsurface terrace and step-like crack in the base metal with a basic orientation parallel to the wrought surface caused by tensile stresses in the through-thickness direction of the base metals weakened by the presence of small dispersed, planar-shaped, nonmetallic inclusions parallel to the metal surface. See Figure B.33(B).

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

lance. See **oxygen lance** and **oxygen lance cutting**.

land. A nonstandard term for **root face**.

lap joint. A joint type in which the nonbutting ends of one or more workpieces overlap approximately parallel to one another. See Figures B.1(D), B.2(D), and B.52(C). See also **skewed joint**.

laser. A device producing a concentrated coherent light beam by stimulated electronic or molecular transitions to lower energy levels. Laser is an acronym for "light amplification by simulated emission of radiation."

laser beam air cutting (LBC-A). A laser beam cutting process variation melting the workpiece and using an air jet to remove molten and vaporized material.

laser beam braze welding (LBBW). A braze welding process variation using a laser beam as the heat source.

laser beam brazing (LBB). A brazing process using a laser beam as the heat source.

laser beam cutting (LBC). A thermal cutting process severing metal by locally melting or vaporizing it with the heat from a laser beam. The process is used with or without assist gas to aid the removal of molten and vaporized material. See also **laser beam air cutting**, **laser beam evaporative cutting**, **laser beam inert gas cutting**, and **laser beam oxygen cutting**.

laser beam cutting operator. See **thermal cutting operator**.

laser beam diameter. The diameter of a laser beam circular cross section at a specified location along the laser beam axis.

laser beam evaporative cutting (LBC-EV). A laser beam cutting process variation vaporizing the workpiece, with or without an assist gas, typically inert gas, to aid the removal of vaporized material.

laser beam expander. A combination of optical elements that will increase the diameter of a laser beam.

laser beam inert gas cutting (LBC-IG). A laser beam cutting process variation melting the workpiece and using an inert assist gas to remove molten and vaporized material.

laser beam oxygen cutting (LBC-O). A laser beam cutting process variation using heat from the chemical reaction between oxygen and the base metal at elevated temperatures. The necessary temperature is maintained with a laser beam.

laser beam splitter. An optical device using controlled reflection to produce two beams from a single incident beam.

laser beam welding (LBW). A welding process producing coalescence with the heat from a laser beam impinging on the joint.

lasing gas. A gaseous lasing medium.

lasing medium. A material emitting coherent radiation by virtue of stimulated electronic or molecular transitions to lower energy.

layer. A stratum of weld metal consisting of one or more weld beads. See Figures B.23(D) and (E).

layer level wound. A nonstandard term for **level wound**.

layer wound. A nonstandard term for **level wound**.

lead angle. A nonstandard term for **travel angle**.

lead burning. A nonstandard term when used for the **welding** of lead.

leg of a fillet weld. See **fillet weld leg**.

lens. See **filter lens**.

level wound. Spooled or coiled filler metal wound in distinct layers with adjacent turns touching. See also **random wound**.

lightly coated electrode, *shielded metal arc welding*. A filler metal electrode consisting of a metal wire with a light coating applied subsequent to the drawing operation, primarily for stabilizing the arc. This is an obsolete or seldom used term. See also **covered electrode**.

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

linear indication. A test result in which a discontinuity in the material being tested is displayed as a linear or aligned array.

linear porosity. A nonstandard term when used for **aligned porosity**.

liquation. The partial melting of compositional heterogeneities such as banding or inclusion stringers in heated base metal or heat-affected zones.

liquation, *brazing*. The separation of a low-melting constituent of a brazing filler metal from the remaining constituents, usually apparent in brazing filler metals having a wide melting range.

liquidus. The lowest temperature at which a metal is completely liquid.

local preheating. Preheating a specific portion of a structure.

local stress relief heat treatment. Stress relief heat treatment of a specific portion of a structure.

locked-up stress. A nonstandard term for **residual stress**.

long electrode extension, *electrogas welding, flux cored arc welding, gas metal arc welding, and submerged arc welding.* An increased length of electrode extension for the purpose of increasing electrical resistance

to assure enhanced flux activation to provide adequate shielding (FCAW-S) or increased weld deposition rate. See Figure B.38(B).

longitudinal bend specimen. See **longitudinal weld test specimen**.

longitudinal crack. A crack approximately parallel to the joint axis or the weld axis.

longitudinal sequence. The order in which the weld passes of a continuous weld are made with respect to its length. See also **backstep sequence**, **block sequence**, **cascade sequence**, **continuous sequence**, and **random sequence**. See Figure B.23(A) through (C).

longitudinal tension specimen. See **longitudinal weld test specimen**.

longitudinal weld test specimen. A weld test specimen with its major axis parallel to the weld axis. See also **transverse weld test specimen**.

low pulse current, *pulsed power welding*. The current during the low pulse time producing the low heat level. See Figure B.52.

low pulse time, *pulsed power welding*. The duration of the low current pulse. See Figure B.52.

M

machine. A nonstandard term when used for **mechanized**.

machine brazing. A nonstandard term for **mechanized brazing**.

machine welding. A nonstandard term when used for **mechanized welding**.

macroetch test. A test in which a specimen is prepared with a fine finish, etched, and examined using no magnification or low magnification.

macroexamination. A metallographic examination in which a surface is examined using no magnification or low magnification.

magnetically impelled arc welding (MIAW). An arc welding process in which an arc is created between the butted ends of tubes and propelled around the weld joint by a magnetic field, followed by an upsetting operation.

manifold. See **cylinder manifold**.

manual, *adj*. Pertaining to the control of a process with the torch, gun, or electrode holder held and manipulated by hand. Accessory equipment, such as part motion devices and handheld material feeders may be used. See Table A.4. See also **adaptive control**, **automatic**, **mechanized**, **robotic**, and **semiautomatic**.

manual brazing (B-MA). See **manual process**.

manual gun, *resistance welding*. A resistance welding gun configured for manipulation by hand. See also **manual transgun**.

manual process (XXXX-MA). An operation with the torch, gun, or electrode holder held and manipulated by hand. Accessory equipment, such as part motion devices and handheld filler material feeders may be used. Variations of this term are **manual brazing**, **manual soldering**, **manual thermal cutting**, **manual thermal spraying**, and **manual welding**. See Table A.4. See also **adaptive control process**, **automatic process**, **mechanized process**, **robotic**, and **semiautomatic process**.

manual soldering (S-MA). See **manual process**.

manual thermal cutting (TC-MA). See **manual process**.

manual thermal spraying (TS-MA). See **manual process**.

manual transgun, *resistance welding*. A transgun configured for manipulation by hand. See also **manual gun**.

manual welding (W-MA). See **manual process**.

mash resistance seam welding. A nonstandard term for **mash seam welding**.

mash seam welding (RSEW-MS). A resistance seam welding process variation producing a solid-state weld using electrodes extending beyond the joint overlap. The resulting joint thickness is less than the original assembled thickness. See Figure B.30(G).

mask, *thermal spraying*. A device for protecting a substrate surface from the effects of blasting or adherence of a thermal spray deposit.

mechanical bond, *thermal spraying*. The adherence of a thermal spray deposit to a roughened surface by the mechanism of particle interlocking.

mechanically mixed flux, *submerged arc welding.* A flux produced by intentionally mixing two or more types of fluxes.

mechanized, *adj*. Pertaining to the control of a process with equipment that requires manual adjustment by an operator in response to visual observation, with the torch, gun, wire guide assembly, or electrode holder held by a mechanical device. See Table A.4. See also

adaptive control, **automatic**, **manual**, **robotic**, and **semiautomatic**.

mechanized brazing (B-ME). See **mechanized process**.

mechanized process (XXXX-ME). An operation with equipment requiring manual adjustment by an operator in response to visual observation, with the torch, gun, wire guide assembly, or electrode holder held by a mechanical device. See **mechanized brazing**, **mechanized soldering**, **mechanized thermal cutting**, **mechanized thermal spraying**, and **mechanized welding**. See Table A.4. See also **adaptive control process**, **automatic process**, **manual process**, **robotic process**, and **semiautomatic process**.

mechanized soldering (S-ME). See **mechanized process**.

mechanized thermal cutting (TC-ME). See **mechanized process**.

mechanized thermal spraying (TS-ME). See **mechanized process**.

mechanized welding (W-ME). See **mechanized process**.

medium vacuum electron beam welding (EBW-MV). An electron beam welding process variation in which welding is accomplished at a pressure of 10^{-1} pascal to 3×10^{3} pascal [approximately 10^{-3} torr to 25 torr].

meltback time. The time interval at the end of crater fill time to arc outage during which electrode feed is stopped. See Figure B.54.

melt-in feed, *gas tungsten arc welding, oxyfuel gas welding and plasma arc welding*. A process variation in which filler metal is preplaced or continuously fed into the leading edge of the weld pool.

melting range. The temperature range between solidus and liquidus.

melting rate. The weight or length of electrode, wire, rod, or powder melted in a unit of time.

melt-through. Visible root reinforcement in a joint welded from one side. See Figure B.27. See also **root reinforcement** and **root surface**.

metal. An opaque, lustrous, elemental chemical substance that is a good conductor of heat and electricity, usually malleable, ductile, and more dense than other elemental substances.

metal-bath dip brazing. A dip brazing process variation in which the components to be joined are placed in a bath of molten brazing filler metal. See also **chemical-bath dip brazing** and **salt-bath dip brazing**.

metal-bath dip soldering. A dip soldering variation using heat from a bath of molten soldering filler metal. See also **oil-bath dip soldering** and **salt-bath dip soldering**. See also **wave soldering**.

metal cored electrode. A composite tubular filler metal electrode consisting of a metal sheath and a core of various powdered materials, producing no more than slag islands on the face of a weld bead.

metal electrode. A filler or nonfiller metal electrode used in arc welding and cutting that consists of a metal wire or rod manufactured by any method and either bare or covered.

metal powder cutting (OC-P). An oxygen cutting process using heat from an oxyfuel gas flame, with iron or other metal powder to aid cutting.

metal transfer mode*, gas metal arc welding.* The manner in which molten metal travels from the end of a consumable electrode across the welding arc to the workpiece. See also **globular transfer**, **pulsed spray transfer**, **rotational spray transfer**, **short circuiting transfer**, and **spray transfer**.

metallic bond. The primary bond holding metals together, arising from the increased spacing of valence electrons when an aggregate of metal atoms are in close proximity. See also **bonding force**, **covalent bond**, **ionic bond**, and **mechanical bond**.

metallizing. A nonstandard term when used for **thermal spraying** or the application of a metal coating.

metallurgical bond. A nonstandard term when used for **metallic bond**.

microetch test. A test in which the specimen is prepared with a polished finish, etched, and examined under high magnification.

microexamination. A metallographic examination in which a prepared surface is examined at high magnification.

MIG welding. A nonstandard term for **flux cored arc welding** or **gas metal arc welding**.

mismatch. See **weld joint mismatch**.

mixed zone. The portion of the weld metal consisting of a mixture of base metal and filler metal. See also **unmixed zone**.

mixing chamber. The part of a welding or cutting torch in which a fuel gas and oxygen are mixed.

molding shoe. A nonstandard term for **backing shoe**.

molten weld pool. A nonstandard term for **weld pool**.

moving shoe. A backing shoe sliding along the joint during welding. See also **stationary shoe**.

multipass weld. A fusion weld produced by more than one progression of the arc, flame or energy source along the joint.

multiple welding position. An orientation for a nonrotated circumferential joint requiring welding in more than one welding position. See **5F**, **5G**, **6F**, **6G**, and **6GR**.

multiple-impulse welding. A resistance welding process variation in which welds are made by more than one impulse. See Figure B.49.

multiport nozzle. A constricting nozzle of the plasma arc torch containing two or more orifices located in a configuration to achieve some control over the arc shape.

N

narrow gap welding. A nonstandard term for **narrow groove welding**.

narrow groove welding. A variation of a welding process using multiple-pass welding with filler metal. The use of a small root opening, with either a square groove or a V-groove and a small groove angle, yields a weld with a high ratio of depth to width.

neutral flame. An oxyfuel gas flame that is neither oxidizing nor reducing. See Figure B.40(B). See also **carburizing flame**, **oxidizing flame**, and **reducing flame**.

neutral flux, *submerged arc welding*. A flux formulated to produce a weld metal composition that is not dependent on the welding parameters, especially arc voltage. See also **active flux** and **alloy flux**.

nonbutting member. A joint member free to move in any direction perpendicular to its thickness dimension. For example, both members of a lap joint, or one member of a T-joint or corner joint. See Figure B.11. See also **butting member**.

nonconsumable electrode. An electrode that does not provide filler metal. See Figures B.35 and B.36.

noncorrosive flux, *brazing and soldering*. A flux in either its original or residual form that does not chemically attack the base metal.

nondestructive evaluation. A nonstandard term when used for **nondestructive examination**.

nondestructive examination (NDE)**.** The act of determining the suitability of a material or a component for its intended purpose using techniques not affecting its serviceability.

nondestructive inspection. A nonstandard term when used for **nondestructive examination**.

nondestructive testing. A nonstandard term when used for **nondestructive examination**.

nonsynchronous initiation. The closing of the resistance welding contactor without regard to the polarity reversal of the power supply.

nonsynchronous timing. A nonstandard term for **nonsynchronous initiation**.

nontransferred arc. An arc established between the electrode and the constricting nozzle of the plasma arc torch or thermal spraying gun. The workpiece is not in the electrical circuit. See also **transferred arc**.

nonvacuum electron beam welding (EBW-NV). An electron beam welding process variation in which welding is accomplished at atmospheric pressure.

nozzle. See **constricting nozzle**, **gas nozzle**, and **insulating nozzle**.

nozzle, *arc spraying*. A device at the exit end of the gun that directs the atomizing air or other gas.

nozzle, *flame spraying*. A device at the exit end of the gun that directs and forms the flow shape of atomized spray particles and the accompanying air or other gases.

nozzle accumulation. Filler metal or surfacing material deposited on the inner surface and on the exit end of the nozzle.

nugget. The weld metal zone in a spot, seam, or projection weld.

nugget size. A nonstandard term when used for **projection weld size**, **resistance weld size**, or **seam weld size**.

O

off time. The interval between welding cycles when operating in a repeat mode. See Figure B.50.

oil-bath dip soldering. A dip soldering variation using heat from a bath of heated oil. See also **metal-bath dip soldering** and **salt-bath dip soldering**.

open butt joint. A nonstandard term when used for a **butt joint** with a root opening and with no backing. See also **open root joint**.

open circuit voltage. The voltage between the output terminals of the power source when the rated primary voltage is applied and no current is flowing in the secondary circuit.

open groove. A nonstandard term for **open root joint**.

open joint. A nonstandard term for **open root joint**.

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

orifice. See **constricting orifice**.

orifice gas. The gas directed into the plasma arc torch or thermal spraying gun to surround the electrode. It becomes ionized in the arc to form the arc plasma and issues from the constricting orifice of the nozzle as a plasma jet. See Figure B.35.

orifice throat length. The length of the constricting orifice in the plasma arc torch or thermal spraying gun.

oscillation. An alternating pattern of motion relative to the direction of travel in a welding, brazing, soldering, thermal cutting, or thermal spraying process device. See also **weaving** and **whipping**.

oven soldering. A nonstandard term for **furnace soldering**.

overhang. A nonstandard term when used for **extension**.

overhead position. See **overhead welding position**.

overhead welding position. The welding position in which welding is performed from the underside of the joint. See Figures B.16(A) through (C), B.17(D), B.18(D), and B.20(D).

overlap, *fusion welding*. The protrusion of weld metal beyond the weld toe or weld root. See Figures B.32(C) and B.32(D).

overlap, *resistance seam welding*. The portion of the preceding weld nugget remelted by the succeeding weld. See Figure B.14(D) and B.30(E).

overlap. A nonstandard term when used for **incomplete fusion**.

overlaying. A nonstandard term when used for **surfacing**.

overspray, *thermal spraying*. The portion of the thermal spray deposit not deposited on the workpiece.

oxidizing flame. An oxyfuel gas flame in which there is an excess of oxygen, resulting in an oxygen-rich zone extending around and beyond the cone. See Figure B.40(C). See also **carburizing flame**, **neutral flame**, and **reducing flame**.

oxyacetylene cutting (OFC-A). An oxyfuel gas cutting process variation employing acetylene as the fuel gas.

oxyacetylene welding (OAW). An oxyfuel gas welding process employing acetylene as the fuel gas. The process is used without the application of pressure. See Figure B.40.

oxyfuel gas cutter. One who performs oxyfuel gas cutting.

oxyfuel gas cutting (OFC). A group of oxygen cutting processes using heat from an oxyfuel gas flame. See also **oxyacetylene cutting**, **oxyhydrogen cutting**, **oxynatural gas cutting**, and **oxypropane cutting**.

oxyfuel gas cutting torch. A device used for directing the preheating flame produced by the controlled combustion of fuel gases and to direct and control the cutting oxygen.

oxyfuel gas spraying. A nonstandard term for **flame spraying**.

oxyfuel gas welding (OFW). A group of welding processes producing coalescence of workpieces by heating them with an oxyfuel gas flame. The processes are used with or without the application of pressure and with or without filler metal.

oxyfuel gas welding torch. A device used in oxyfuel gas welding, torch brazing, and torch soldering for directing the heating flame produced by the controlled combustion of fuel gases.

oxygas cutting. A nonstandard term for **oxyfuel gas cutting**.

oxygen arc cutting (OAC). An oxygen cutting process using an arc between the workpiece and a consumable tubular electrode through which oxygen is directed to the workpiece.

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

oxygen cutting (OC). A group of thermal cutting processes severing or removing metal by means of the chemical reaction between oxygen and the base metal at elevated temperature. The necessary temperature is maintained by the heat from an arc, an oxyfuel gas flame, or another source.

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

oxygen gouging (OG). Thermal gouging using an oxygen cutting process variation to form a bevel or groove.

oxygen grooving. A nonstandard term for **oxygen gouging**.

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

oxygen lance cutting (OLC). An oxygen cutting process employing oxygen supplied through a consumable lance. Preheat to start the cutting is obtained by other means.

oxygen lancing. A nonstandard term for **oxygen lance cutting**.

oxyhydrogen cutting (OFC-H). An oxyfuel gas cutting process variation employing hydrogen as the fuel gas.

oxyhydrogen welding (OHW). An oxyfuel gas welding process employing hydrogen as the fuel gas. The process is used without the application of pressure.

oxynatural gas cutting (OFC-N). An oxyfuel gas cutting process variation employing natural gas as the fuel gas.

oxypropane cutting (OFC-P). An oxyfuel gas cutting process variation employing propane as the fuel gas.

P

parallel gap welding. A nonstandard term when used for **series welding** with closely spaced electrodes.

parallel welding, *resistance welding*. A secondary circuit variation in which the welding current is conducted through the workpieces in parallel electrical paths to form multiple resistance spot, seam, or projection welds simultaneously. See Figures B.46(A) and B.46(B).

parent metal. A nonstandard term for **base metal** or **substrate**.

partial joint penetration weld. A groove weld in which incomplete joint penetration exists. See Figures B.26(A) through B.26(E) and B.26(H) through B.26(J). See also **complete joint penetration**, **complete joint penetration weld**, **incomplete joint penetration**, and **joint penetration**.

pass. See **thermal spraying pass** and **weld pass**.

pass sequence. See **weld pass sequence**.

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

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

paste solder. A nonstandard term when used for **soldering filler metal paste**.

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

peel test. A destructive testing method mechanically separating a lap joint by peeling.

peening. The mechanical working of metals using impact blows.

penetration. A nonstandard term when used for **depth of fusion**, **joint penetration**, or **root penetration**.

penetration-enhancing flux, *gas tungsten arc welding.* A material applied to the base metal surface adjacent to the weld joint prior to gas tungsten arc welding resulting in increased weld penetration.

percent ferrite. A nonstandard term when used for **Ferrite Number**.

percussion welding (PEW). A welding process producing coalescence with an arc resulting from a rapid discharge of electrical energy. Pressure is applied percussively during or immediately following the electrical discharge.

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.

piping porosity. A form of porosity having a length greater than its width that lies approximately perpendicular to the weld face.

plasma. See **arc plasma**.

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

plasma arc cutting torch. A device used to transfer current to a fixed cutting electrode, position the electrode, and direct the flow of shielding gas and orifice gas. See Figure B.35.

plasma arc gouging (PAG). A thermal gouging process using heat from a constricted arc and the force of an orifice gas. See also **carbon arc gouging** and **oxygen gouging**. See Figure A.2.

plasma arc welding (PAW). An arc welding process employing a constricted arc between a nonconsumable electrode and the weld pool (transferred arc) or between the electrode and the constricting nozzle (nontransferred arc). Shielding is obtained from the ionized gas issuing from the torch, which may be supplemented by an auxiliary source of shielding gas. The process is used without the application of pressure. See also **hot wire welding**.

plasma arc welding torch. A device used to transfer current to a fixed welding electrode, position the electrode, and direct the flow of shielding gas and orifice gas. See Figure B.35.

plasma sprayer. See **thermal sprayer**. See also **thermal spraying operator**.

plasma spraying (PSP). A thermal spraying process in which a nontransferred arc is used to create an arc plasma for melting and propelling the surfacing material to the substrate. See also **vacuum plasma spraying**.

plasma spraying operator. See **thermal spraying operator**. See also **thermal sprayer**.

platen, *resistance welding*. A component of the secondary circuit with a flat mounting surface to which electrodes, fixtures, or electrode holders are attached, and which transmits the electrode or upset force.

platen spacing. The distance between adjacent platen surfaces in a resistance welding machine.

plenum. See **plenum chamber**.

plenum chamber. The space between the electrode and the inside wall of the constricting nozzle of the plasma arc torch or thermal spraying gun. See Figure B.35.

plug weld. A weld made in a circular hole in one member of a joint fusing that member to another member. A fillet-welded hole is not to be construed as conforming to this definition. See Figure B.15(E).

plug weld size. The diameter of the weld metal in the plane of the faying surfaces.

poke welding. A nonstandard term for **push welding**.

polarity. See **direct current electrode negative** and **direct current electrode positive**.

porosity. Cavity-type discontinuities formed by gas entrapment during solidification or in a thermal spray deposit.

portable gun, *resistance welding*. A nonstandard term when used for a **manual gun**.

portable transgun, *resistance welding*. A nonstandard term when used for a **manual transgun**.

position. See **welding position**.

position of welding. See **welding position**.

positional usability. A measure of the relative ease of application of a welding filler metal to make a sound weld in a given welding position and progression.

postflow time. The time interval from current shut-off to either the shielding gas or the cooling water shut-off. See Figures B.53 and B.54.

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

postweld interval, *resistance welding*. The duration from the end of the weld interval through the hold time. See Figure B.49.

powder alloy. A nonstandard term for **alloy powder**.

powder blend. A mixture of two or more alloy, metal, or nonmetal powders. See also **alloy powder**.

powder composite. Two or more different materials combined to form a single particle, formed by either chemical coating or mechanical agglomeration.

powder cutting. A nonstandard term for **flux cutting** and **metal powder cutting**.

powder feed gas. A nonstandard term for **carrier gas**.

powder feed rate. The quantity of powder fed to a thermal spraying gun or a cutting torch per unit of time.

powder feeder. A device for supplying powdered material for thermal cutting, thermal spraying or welding.

powder flame spraying. A flame spraying process variation in which the surfacing material is in powder form. See also **flame spraying**.

power density. The power per unit area.

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

power supply. A nonstandard term when used for **power source**.

precoating, *brazing and soldering*. The application of a filler metal to components prior to assembly and joining. See also **flow brightening**.

preflow time. The time interval between start of shielding gas flow and arc starting. See Figures B.53 and B.54.

preform, *brazing and soldering*. Filler metal in a shape suitable for preplacement within or adjacent to the joint prior to application of heat.

preheat, *n.* The heat applied to the workpiece(s) to attain and maintain the preheat temperature prior to joining, thermal cutting, or thermal spraying.

preheat, *v.* The act of applying heat to the workpiece(s) prior to joining, thermal cutting, or thermal spraying.

preheat current, *resistance welding*. An impulse or series of impulses occurring prior to and separated from the welding current. See Figure B.49.

preheat temperature, *brazing and soldering*. The temperature of the base material in the volume surrounding the joint immediately before brazing or soldering is started.

preheat temperature, *thermal cutting*. The temperature of the base material in the volume surrounding the point of thermal cutting immediately before thermal cutting is started.

preheat temperature, *thermal spraying*. The temperature of the substrate in the volume surrounding the point of thermal spraying immediately before thermal spraying is started. In a multipass thermal spraying, it is also the temperature immediately before the second and subsequent passes are started.

preheat temperature, *welding*. The temperature of the base material in the volume surrounding the point of welding immediately before welding is started. In a multipass weld, it is also the temperature immediately before the second and subsequent passes are started.

preheat time, *resistance welding*. The duration of preheat current flow during the preweld interval. See Figure B.49.

prequalified welding procedure specification (PWPS). A welding procedure specification in compliance with the stipulated conditions of a particular welding code or specification and therefore acceptable for use under that code or specification without a requirement for qualification testing.

pressure gas welding (PGW). An oxyfuel gas welding process producing a weld simultaneously over the entire faying surfaces. The process is used with the application of pressure and without filler metal.

pressure welding. A nonstandard term when used for **cold welding**, **diffusion welding**, **forge welding**, **hot pressure welding**, **pressure gas welding**, and **solid-state welding**.

pressure-controlled resistance welding (RW-PC). A resistance welding process variation in which a number of spot or projection welds are made with several electrodes functioning progressively under the control of a pressure-sequencing device.

pretinning. A nonstandard term for **precoating**.

preweld interval, *resistance welding*. The elapsed time between the initiation of the squeeze time and the beginning of the weld time or weld interval time. See Figure B.49.

procedure. The detailed elements of a process or method used to produce a specific result.

procedure qualification. The demonstration that the use of prescribed joining processes, materials, and techniques will result in a joint exhibiting specified soundness and mechanical properties.

procedure qualification record (PQR). See **brazing procedure qualification record** and **welding procedure qualification record**.

process. A grouping of basic operational elements used in brazing, soldering, thermal cutting, thermal spraying, or welding. See Figures A.1 and A.2.

progressive block sequence. A block sequence in which successive blocks are completed progressively along the weld, either from one end to the other or from an intermediate location of the weld toward either end. See also **selective block sequence**.

projection weld size. The nugget dimension(s) in the plane of the faying surfaces. See Figure B.25(F).

projection welding (PW). A resistance welding process in which the weld size, shape, and placement is determined by the presence of a projection, embossment, or intersection in one overlapping member which serves to localize the applied heat and force. See **cross wire welding**. See Figure B.30(F).

protective atmosphere. A gas or vacuum envelope present during joining, thermal cutting, or thermal spraying used to prevent or reduce the formation of oxides and other detrimental surface substances and facilitate their removal. See also **backing gas**, **inert gas**, **reducing atmosphere**, and **shielding gas**.

puddle. A nonstandard term when used for **weld pool**.

puddle weld. A nonstandard term for an **arc spot weld** or **plug weld**.

pull gun technique. A nonstandard term for **backhand welding**.

pulsation welding. A nonstandard term for **multiple-impulse welding**.

pulse, *resistance welding*. A single-polarity half cycle of alternating welding current. See Figures B.48 and B.49.

pulse start delay time. The time interval from current initiation to the beginning of current pulsation. See Figure B.53.

pulse time, *resistance welding*. The duration of a pulse. See Figure B.48 and B.49.

pulsed gas metal arc welding (GMAW-P). A gas metal arc welding process variation in which the current is pulsed. See also **pulsed power welding**.

pulsed gas tungsten arc welding (GTAW-P). A gas tungsten arc welding process variation in which the current is pulsed. See also **pulsed power welding**.

pulsed laser. A laser whose output is controlled to produce a pulse whose duration is 25 milliseconds or less.

pulsed power welding. An arc welding process variation in which the welding power source is programmed to cycle between low and high power levels.

pulsed spray transfer, *gas metal arc welding.* A variation of spray transfer in which the welding power is cycled from a low level to a high level, at which point spray transfer is attained, resulting in a lower average voltage and current. See also **globular transfer**, **short circuiting transfer**, and **spray transfer**.

pulsed spray welding. An arc welding process variation in which pulsed spray transfer occurs.

purge. The introduction of a gas to remove contaminants from a system or provide backing during welding.

push angle. The travel angle when the electrode is pointing in the direction of weld progression. This angle can also be used to partially define the position of guns, torches, rods, and beams. See Figure B.21. See also **drag angle**, **forehand welding**, **travel angle**, and **work angle**.

push welding. A resistance welding process variation in which spot or projection welds are produced by manually applying force to one electrode.

Q

qualification. See **procedure qualification** and **welder performance qualification**.

quench time, *resistance welding*. The duration from the end of the weld interval or downslope time to the beginning of the temper time, during which no current flows through the workpieces and the weld is rapidly cooled by the electrodes. See Figure B.49.

R

random intermittent welds. Intermittent welds on one or both sides of a joint in which the weld segments are made without regard to spacing.

random sequence. A longitudinal sequence in which the weld bead segments are made at random.

random wound. Spooled or coiled filler metal not wound in distinct layers. See also level wound.

rate of deposition. See **deposition rate**.

rate of flame propagation. See **flame propagation rate**.

reaction soldering. A soldering process variation in which a reactive flux is used.

reaction stress. A stress that cannot exist in a member if the member is isolated as a free body without connection to other parts of the structure.

reactive flux, *soldering*. Flux containing constituents reacting with the workpiece(s) during heating to contribute filler metal.

reactor. A device used in arc welding circuits to minimize irregularities in the flow of the welding current.

reconditioned flux, *submerged arc welding*. Virgin or recycled flux processed for use or reuse. The processing may include screening for particle sizing, removal of magnetic particles and baking to remove moisture.

recrushed slag. A nonstandard term when used for **recycled slag**.

recycled flux, *submerged arc welding.* Unfused granular flux remaining after welding that has been recovered for reuse. See also **virgin flux**.

recycled slag, *submerged arc welding*. Fused slag remaining after welding that has been recovered and processed for reuse.

reduced section tension test. A test in which a transverse section of the weld is located in the center of the reduced section of the specimen.

reducing atmosphere. A type of protective atmosphere that dissociates metal oxides at elevated temperatures.

reducing flame. An oxyfuel gas flame with an excess of fuel gas. See Figure B.40(D). See also **carburizing flame**, **neutral flame**, **oxidizing flame**, and **reducing atmosphere**.

reflow soldering. A soldering process in which the filler metal, normally in the form of a paste or preform, is applied to the joint prior to the application of heat.

reflowing. A nonstandard term when used for **flow brightening**.

remelt temperature, *brazing and soldering*. The temperature necessary to melt braze metal or solder metal in a completed joint. See also **joint remelt temperature**.

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 the electric current flow in a circuit that includes the assembly.

resistance butt welding. A nonstandard term for **flash welding** and **upset welding**.

resistance seam weld size. See **seam weld size**.

resistance seam welding (RSEW). A resistance welding process producing a weld at the faying surfaces of overlapped parts progressively along a length of a joint. The weld may be made with overlapping weld nuggets, a continuous weld nugget, or by forging the joint as it is heated to the welding temperature by resistance to the flow of the welding current. See Figures B.14(D), B.23(I), B.30(D), and B.52. See also **high-frequency seam welding** and **induction seam welding**.

resistance soldering (RS). A soldering process using heat from the resistance to the flow of electric current in a circuit containing the workpiece(s).

resistance spot weld size. See **spot weld size**.

resistance spot welding (RSW). A resistance welding process producing a spot weld. See Figures B.14(E), B.14(F), B.30(D), and B.46-50.

resistance welding (RW). A group of welding processes producing coalescence of the faying surfaces with the heat obtained from the resistance of the workpieces to the flow of the welding current in a circuit of which the workpieces form part and by the application of pressure. See Figure A.1.

resistance welding control. The device, usually electronic, determining the welding sequence and timing with regard to the welding current waveforms, electrode or platen force or movement, and other operational conditions of a resistance welding machine.

resistance welding current. The current in the secondary circuit during the weld interval or weld time. See Figures B.42, B.49 and B.50.

resistance welding die. A resistance welding electrode matching the contour of the workpiece to clamp or shape the workpieces and conduct welding current.

resistance welding downslope time. The time during which the welding current is continuously decreased. See Figure B.49.

resistance welding electrode. The part of a secondary circuit responsible for the transmission of welding current and force to the workpieces. The electrode may be in the form of a rotating wheel, rotating roll, bar, cylinder, plate, clamp, or modification thereof.

resistance welding gun. A device used to apply electrode force and transfer welding current to the workpieces. It may be manipulatable or an element of a welding machine. See also **manual gun**, **manual transgun**, **servogun**, and **robot gun**.

resistance welding time. The duration of welding current flow through the workpieces in single-impulse welding. See Figure B.50. See also **weld interval**.

resistance welding upslope time. The time during which the welding current continuously increases from the beginning of the welding interval. See Figure B.49.

resistance welding voltage. The voltage between the resistance welding electrodes, measured across the workpieces.

resistance welding weld time. The duration of welding current flow through the workpieces in single-impulse welding. See Figure B.50. See also **weld interval**.

retaining shoe. A nonstandard term for **backing shoe**.

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

robot gun. A resistance welding gun adapted for manipulation by a robot.

robotic, *adj*. Pertaining to process control with equipment that moves along a controlled path using controlled parameters with no manual intervention once a cycle is initiated. See Table A.4. See also **adaptive control**, **automatic**, **manual**, **mechanized**, and **semiautomatic**.

robotic brazing (B-RO). See **robotic process**.

robotic process (XXXX-RO). An operation with equipment that moves along a controlled path using controlled parameters with no manual intervention once a cycle is initiated. See **robotic brazing**, **robotic soldering**, **robotic thermal cutting**, **robotic thermal spraying**, **and robotic welding**. See Table A.4. See also **adaptive control process**, **automatic process**, **manual process**, **mechanized process**, and **semiautomatic process**.

robotic soldering (S-RO). See **robotic process**.

robotic thermal cutting (TC-RO). See **robotic process**.

robotic thermal spraying (TS-RO). See **robotic process**.

robotic welding (W-RO). See **robotic process.**

roll spot welding. A resistance seam welding process variation producing spot welds at intervals using one or more circular electrodes that are rotated continuously or intermittently.

roll welding (ROW). A solid-state welding process producing a weld by the application of heat and sufficient pressure with rolls to cause deformation at the faying surfaces. See also **forge welding**.

rollover. A nonstandard term when used for **overlap**, *fusion welding*.

root. A nonstandard term when used for **joint root** or **weld root**.

root bead. A weld bead extending into or including 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 crack. See Figure B.33.

root edge. A root face of zero width. See Figure B.5.

root face. The portion of the groove face within the joint root. See Figure B.5.

root face extension. An extension of the base metal adjacent to the root face in a bevel or J-edge shape beyond the bevel or bevel radius, respectively, to provide for improved weld penetration control or joint root access. See Figure B.13(D).

root gap. A nonstandard term for **root opening**.

root of joint. See **joint root**.

root of weld. See **weld root**.

root opening. A separation at the joint root between the workpieces. See Figures B.6(A), B.6(E), and B.25(D).

root pass. A weld pass made to produce a root bead.

root penetration. The distance the weld metal extends into the joint root. See Figure B.26.

root radius. A nonstandard term for **bevel radius**.

root reinforcement. Weld reinforcement opposite the side from which welding was done. See Figure B.24(A). See also **face reinforcement**.

root shielding gas. A nonstandard term for **backing gas**.

root surface. The exposed surface of a weld opposite the side from which welding was done. See Figures B.24(B), B.27(E), and B.27(F).

root surface crack. See Figure B.33.

root surface underfill. See **underfill**. See Figure B.32(E).

rotary roughening, *thermal spraying*. A method of surface roughening in which a revolving tool is pressed against the surface being prepared, while either the work or the tool, or both, move. See Figure B.43(D). See also **groove and rotary roughening**, **knurling**, and **threading and knurling**.

rotational spray transfer, *gas metal arc welding.* A variation of spray transfer in which a longer electrode extension and specialized gas mixtures are used to produce a helical pattern of very fine droplets.

rough threading, *thermal spraying*. A method of surface roughening consisting of cutting threads with the sides and tops of the threads jagged and torn.

round edge shape. A type of edge shape in which the surface is curved. See Figure B.7(G).

rub soldering. A nonstandard term when used for **abrasion soldering**.

runoff weld tab. Additional material extending beyond the end of the joint, on which the weld is terminated. See also **starting weld tab** and **weld tab**.

S

salt-bath dip brazing. A variation of chemical-bath dip brazing using heat from a molten salt bath. See also **metal-bath dip brazing**.

salt-bath dip soldering. A dip soldering variation using heat from a molten salt bath. See **metal-bath dip soldering** and **oil-bath dip soldering**.

sandwich brazement. A brazed assembly consisting of layers of dissimilar materials joined using preplaced brazing filler metal.

scarf. A nonstandard term for **bevel**.

scarf groove. A groove formed by the assembly of butting members having single-bevel edge shapes with parallel groove faces. See Figure B.13(B).

scarf joint. A nonstandard term for **scarf groove**.

seal coat, *thermal spraying*. Material applied to infiltrate and close the pores of a thermal spray deposit.

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

seal-bonding material, *thermal spraying*. A material partially forming, in the as-sprayed condition, a metallic bond with the substrate.

seam. A nonstandard term when used for **joint**.

seam weld. A continuous weld produced between overlapping members with coalescence initiating and occurring at faying surfaces proceeding from the outer surface of one member. The weld can consist of either a weld bead, multiple overlapping nuggets, or a single nugget formed by the simultaneous application of

resistance heating and forging force along the weld joint. See Figures B.14 and B.52(C). See also **arc seam weld** and **resistance seam welding**.

seam weld size. The nugget width in the plane of the faying surfaces. See Figures B.25(F) and B.25(G).

secondary circuit. The portion of the welding circuit conducting current between output terminals of the power source and electrodes or between electrodes and the workpiece.

secondary current path, *resistance welding*. The electrical path through which the welding current passes.

selective block sequence. A block sequence in which successive blocks are completed in an order selected to control residual stresses and distortion. See also **progressive block sequence**.

self-fluxing alloy, *thermal spraying*. A surfacing material wetting the substrate and coalescing when heated to its melting point, with no flux other than the boron and silicon contained in the alloy.

self-shielded flux cored arc welding (FCAW-S). A flux cored arc welding process variation in which shielding gas is obtained exclusively from the flux within the electrode.

semiautomatic, *adj*. Pertaining to the manual application of a process with equipment controlling one or more of the process conditions. See Table A.4. See also **adaptive control**, **automatic**, **manual**, **mechanized**, and **robotic**.

semiautomatic brazing (B-SA). See **semiautomatic process**.

semiautomatic process (XXXX-SA). An operation performed manually with equipment controlling one or more of the process conditions. See **semiautomatic brazing**, **semiautomatic soldering**, **semiautomatic thermal cutting**, **semiautomatic thermal spraying**, and **semiautomatic welding**. See Table A.4. See also **adaptive control process**, **automatic process**, **manual process**, **mechanized process, and robotic process**.

semiautomatic soldering (S-SA). See **semiautomatic process**.

semiautomatic thermal cutting (TC-SA). See **semiautomatic process**.

semiautomatic thermal spraying (TS-SA). See **semiautomatic process**.

semiautomatic welding (W-SA). See **semiautomatic process**.

semiblind joint. A joint in which a portion of the joint is not visible.

sequence time. A nonstandard term when used for **welding cycle**.

series submerged arc welding (SAW-S). A submerged arc welding process variation in which the arc is established between two consumable electrodes meeting just above the surface of the workpieces, which are not part of the welding current circuit.

series welding. A resistance welding secondary circuit variation in which the welding current is conducted through electrodes and workpieces in a series electrical path to form multiple resistance, spot, seam, or projection welds simultaneously. See Figures B.46(C) and B.46(D). See also **parallel welding**.

servogun. A resistance welding gun incorporating an electric, hydraulic, or pneumatic servoactuator to generate electrode force.

set down. A nonstandard term when used for **upset distance**.

setback. See **contact tip setback** and **electrode setback**.

shadow mask, *thermal spraying*. A device partially shielding an area of the workpiece, producing a feathered edge of the thermal spray deposit.

sheet separation, *resistance welding*. The distance between faying surfaces adjacent to the weld once a spot, seam, or projection weld has been produced.

shielded carbon arc welding (CAW-S). A carbon arc welding process variation using shielding from the combustion of solid material fed into the arc, or from a blanket of flux on the workpieces, or both. This is an obsolete or seldom used process.

shielded metal arc cutting (SMAC). An arc cutting process employing a covered electrode.

shielded metal arc welding (SMAW). An arc welding process with an arc between a covered electrode and the weld pool. The process is used with shielding from the decomposition of the electrode covering, without the application of pressure, and with filler metal from the electrode. See also **firecracker welding**.

shielding gas. A gas used to produce a protective atmosphere. See also **backing gas** and **inert gas**.

short arc. A nonstandard term when used for **short circuiting transfer**.

short circuit gas metal arc welding (GMAW-S). A gas metal arc welding process variation in which the consumable electrode is deposited during repeated short circuits.

short circuiting arc welding. A nonstandard term for **short circuit gas metal arc welding**.

short circuiting transfer, *gas metal arc welding*. Metal transfer in which molten metal from a consumable electrode is deposited during repeated short circuits. See Figure B.39(B). See also **globular transfer** and **spray transfer**.

shoulder. A nonstandard term when used for **root face**.

shrinkage stress. Residual stress resulting from the contraction of materials upon cooling from joining, thermal cutting, or thermal spraying.

shrinkage void. A cavity-type discontinuity formed as a metal contracts during solidification.

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.

sidewall. A nonstandard term when used for **bevel face** or **groove face**.

sieve analysis. A method of determining particle size distribution, usually expressed as the weight percentage retained upon each of a series of standard screens of decreasing mesh size.

silver alloy brazing. A nonstandard term when used for **brazing** with a silver-based brazing filler metal.

silver soldering. An incorrect term for brazing or soldering with a silver-containing filler metal.

single welded joint, *fusion welding*. A joint welded from one side only. See Figure B.8.

single-bevel edge shape. A type of bevel edge shape having one prepared surface. See Figure B.7(B).

single-bevel groove. A weld groove formed by the combination of a butting member having a bevel edge shape and a planar surface of a companion member or a butting member with a square edge shape and a skewed surface of a nonbutting member. See Figure B.8(B).

single-bevel-groove weld. A weld in a single-bevel groove welded from one side. See Figure B.8(B).

single-flare-bevel groove. A 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.8(H).

single-flare-bevel-groove weld. A weld in a single-flare-bevel groove welded from one side. See Figure B.8(H).

single-flare-V groove. A weld groove formed by the combination of butting members having round edge shapes. See Figure B.8(I).

single-flare-V-groove weld. A weld in a single-flare-V groove welded from one side. See Figure B.8(I).

single-groove weld, *fusion welding*. A groove weld made from one side only. See Figure B.8.

single-impulse welding. A resistance welding process variation in which spot, projection, or upset welds are produced with a single impulse of welding current. See Figure B.50.

single-J edge shape. A type of J-edge shape having one prepared surface. See Figure B.7(D).

single-J groove. A weld groove formed by the combination of a butting member having a single-J edge shape abutting a planar surface of a companion member. See Figure B.8(F).

single-J-groove weld. A weld in a single-J groove welded from one side. See Figure B.7(D).

single-port nozzle. A constricting nozzle of the plasma arc torch containing one orifice, located below and concentric with the electrode.

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

single-spliced joint. See **spliced joint**. See Figure B.3(A).

single-square-groove weld. A weld in a square groove welded from one side. See Figure B.8(A).

single-U groove. A weld groove formed by the combination of two butting members having single-J edge shapes. See Figure B.8(G).

single-U-groove weld. A weld in a single-U groove welded from one side. See Figure B.8(G).

single-V groove. A V-shaped weld groove formed by the combination of (a) butting members having single-bevel edge shapes, (b) butting and nonbutting members having planar surfaces arranged to form a groove, or (c) a V-shaped groove in the surface of a member. See Figures B.8(C) through (E).

single-V-groove weld. A weld in a single-V groove welded from one side. See Figures B.8(C) through (E).

size of weld. See **weld size**.

skewed joint. A variation of any one of the five basic joint types in which the members are oriented at angles different than the typical orthogonal angles.

See **skewed butt joint**, **skewed corner joint**, **skewed edge joint**, **skewed lap joint**, and **skewed T-joint**.

skip weld. A nonstandard term for **intermittent weld**.

skull, *brazing and soldering*. The unmelted residue from a filler metal resulting from either incomplete melting or an inadequate protective atmosphere.

slag. A nonmetallic product resulting from the mutual dissolution of flux and nonmetallic impurities in some welding and brazing processes.

slag inclusion. A discontinuity consisting of slag entrapped in weld metal or at the weld interface.

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. A fillet-welded slot is not to be construed as conforming to this definition. See Figure B.15(D).

slot weld size. The width and length of the weld metal in the plane of the faying surfaces.

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.

smoothing bead. A weld bead made to correct an undesirable weld surface contour. See also **cosmetic weld bead**.

smoothing pass. A weld pass resulting in a smoothing bead. See also **cosmetic weld pass**.

soft solder. A nonstandard term for **soldering filler metal**.

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

solder, *v.* The act of soldering.

solder. A nonstandard term when used for **soldering filler metal**.

solder interface. The boundary between solder metal and base material in a soldered joint. See Figure B.31(A).

solder metal. The portion of a soldered joint melted during soldering.

solder paste. A nonstandard term when used for **soldering filler metal paste**.

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

soldering (S). A group of joining processes in which the workpiece(s) and solder are heated to the soldering temperature to form a soldered joint. See Figures A.1, A.3, and A.6.

soldering blowpipe. A device used to divert a portion of a flame for fine work, such as jewelry. Using this device, the flame is blown to the desired location, usually by mouth.

soldering filler metal. The metal or alloy to be added in making a soldered joint. The filler metal has a liquidus below 450°C (840°F).

soldering filler metal paste. Paste consisting of a filler metal powder, a flux, and a neutral carrier.

soldering flux. A flux used for soldering. See **acid core solder**, **activated rosin flux**, **intermediate flux**, **noncorrosive flux**, and **reaction flux**. See also **brazing flux** and **welding flux**.

soldering gun. An electrically heated soldering iron with a pistol grip.

soldering iron. A tool for manual soldering used to heat the workpiece(s) by thermal conduction from the tip, which is heated by internal electrical resistance or external flame.

soldering temperature. The temperature to which the base material is heated to enable the solder to wet the base material and form a soldered joint.

solderment. An assembly joined by soldering.

solid-state welding (SSW). A group of welding processes producing coalescence by the application of pressure without melting any of the joint components. See Figures A.1, A.3, and A.5.

solidus. The highest temperature at which a metal is completely solid.

spacer. See **joint spacer**.

spacer strip. A nonstandard term when used for **joint spacer**.

spatter. The metal particles expelled during fusion welding that do not form a part of the weld.

spatter loss. Metal lost due to spatter.

spiking, *electron beam welding and laser beam welding*. A condition where the joint penetration is nonuniform and changes abruptly over the length of the weld.

spit. A nonstandard term when used for **expulsion** and **flash**.

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

splice member. The workpiece spanning the joint in a spliced joint. See Figures B.3(A) and B.3(B).

spliced butt joint. See **spliced joint**. See Figures B.3(A) and B.3(B).

spliced joint. A joint in which an additional workpiece spans the joint and is welded to each joint member. See Figures B.3(A) and B.3(B). See also **splice member**.

split layer technique. A welding technique resulting in layers having more than one weld bead. See Figure B.23(D).

split pipe backing. A pipe segment used as a backing for welding butt joints in round bars. See Figure B.12.

spool. A filler metal packaging configuration in which the wire is wound around a cylinder (called a barrel), which is flanged at both ends. The flanges contain a spindle hole centered inside the barrel. See Figure B.42(A). See also **coil without support** and **coil with support**.

spot weld. A weld produced between or upon overlapping members with coalescence initiating and occurring at faying surfaces or proceeding from the outer surface of one member. The weld typically has a round cross section in the plane of the faying surfaces. See Figures B.14(E), B.14(F), B.14(G), and B.14(H). See also **arc spot weld** and **resistance spot welding**.

spot weld size. The diameter of the nugget in the plane of the faying surfaces. See Figures B.25(F), B.25(G), and B.30(D).

spray arc. A nonstandard term for **spray transfer**.

spray deposit. See **thermal spray deposit**.

spray deposit density ratio. See **thermal spray deposit density ratio**.

spray tab, *thermal spraying*. A small piece of additional material thermally sprayed concurrently with the workpiece, and used to evaluate the quality of the thermal spray deposit.

spray transfer, *gas metal arc welding*. Metal transfer in which molten metal from a consumable electrode is propelled axially across the arc in small droplets. See Figure B.39(C). See also **globular transfer** and **short circuiting transfer**.

sprayer. See **thermal sprayer**. See also **spraying operator**.

spray–fuse. A thermal spraying technique in which the deposit is reheated to fuse the particles and form a metallurgical bond with the substrate.

spraying booth. An exhaust booth where thermal spraying is performed.

spraying operator. See **thermal spraying operator**. See also **sprayer**.

spraying rate, *thermal spraying*. The rate at which surfacing material passes through the gun.

spraying sequence, *thermal spraying*. The order in which layers of materials are applied, such as overlapped, superimposed, or at various angles.

square edge shape. A type of edge shape in which the prepared surface lies perpendicular to the material surface. See Figure B.7(A).

square groove. A weld groove formed by the combination of a butting member having a square edge shape and a planar surface of a companion member. See Figures B.8(A) and B.9(A).

square groove weld. A weld in a square groove. See Figures B.8(A) and B.9(A).

squeeze time, *resistance welding*. The time between the initiation of the welding cycle and first application of current in spot, seam, or projection and some types of upset welds. See Figures B.49 and B.50.

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 in which the weld segments on one side are alternated with respect to those on the other side. See Figure B.23(H).

standard welding procedure specification (SWPS). A welding procedure specification qualified according to the requirements of AWS B2.1, approved by AWS, and made available for production welding by companies or individuals other than those performing the qualification test.

standoff distance. The distance between a nozzle and the workpiece. See Figures B.35, B.36, and B.38.

standoff distance, *explosion welding*. The distance between two plates to be joined.

start current. The current value during the start time interval. See Figure B.54.

start time. The time interval prior to the weld time during which arc voltage and current reach a preset value greater or less than welding values. See Figure B.54.

starting weld tab. Additional material extending beyond the beginning of the joint, on which the weld is started. See also **runoff weld tab** and **weld tab**.

static electrode force, *resistance welding.* The force exerted by electrodes on the workpieces under welding conditions, but without welding current flowing or movement between the welding electrodes. See also **dynamic electrode force** and **theoretical electrode force**.

stationary shoe. A backing shoe remaining in a fixed position during welding. See also **moving shoe**.

step brazing. A brazing process variation in which successive joints of an assembly are produced without melting previously brazed joints.

step soldering. A soldering process variation in which successive joints of an assembly are soldered without melting previously soldered joints.

stepback sequence. A nonstandard term for **backstep sequence**.

stick electrode. A nonstandard term for **covered electrode**.

stick electrode welding. A nonstandard term for **shielded metal arc welding**.

stickout, *gas metal arc welding and gas-shielded flux cored arc welding*. The length of unmelted electrode extending beyond the end of the gas nozzle. See Figure B.38. See also **electrode extension**.

stickout, *gas tungsten arc welding*. The length of tungsten electrode extending beyond the end of the gas nozzle. See Figure B.36. See also **electrode extension**.

stitch weld. A nonstandard term for **intermittent weld**.

stopoff, *brazing and soldering*. A material applied to surfaces adjacent to a joint to limit the spread of filler metal or flux.

stored energy welding. A resistance welding process variation in which the welding current is produced from electrical energy that is accumulated electrostatically, electromagnetically, or electrochemically at a low rate and released at a relatively high rate.

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

stranded electrode. A composite filler metal electrode consisting of stranded wires that may mechanically enclose materials to improve properties, stabilize the arc, or provide shielding.

stress-corrosion cracking. Failure of metals by cracking under the combined actions of corrosion and stress, residual or applied. In brazing, the term applies to the cracking of stressed base metal due to the presence of a liquid filler metal.

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

stress-relief heat treatment. Uniform heating of a structure or a portion thereof to a sufficient temperature to relieve the major portion of the residual stresses, followed by uniform cooling.

strike. See **arc strike**.

stringer bead. A weld bead formed without appreciable weaving. See Figure B.22(A). See also **weave bead**.

strongback. A device attached to the members of a weld joint to maintain their alignment during welding.

stub. The short length of filler metal electrode, welding rod, or brazing rod remaining after its use for welding or brazing.

stud arc welding. A nonstandard term for **arc stud welding**.

stud welding. 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. See also **arc stud welding**.

submerged arc welding (SAW). An arc welding process using an arc or arcs between a bare metal electrode or electrodes and the weld pool. The arc and molten metal are 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). See also **hot wire welding** and **series submerged arc welding**.

substrate. A workpiece onto which a coating is applied.

suck-back. A nonstandard term when used for **underfill** at the root surface.

surface expulsion, *resistance welding*. Expulsion occurring between the electrode and the workpiece.

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

surface roughening, *thermal spraying*. A group of methods for producing irregularities on a surface. See also **dovetailing**, **groove and rotary roughening**,

rotary roughening, **rough threading**, and **threading and knurling**.

surfacing. The application by welding, brazing, or thermal spraying of a layer, or layers, of material to a surface to obtain desired properties or dimensions, as opposed to making a joint. See also **buildup**, **buttering**, **cladding**, and **hardfacing**.

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

surfacing metal. The metal or alloy 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. See Figures B.15(C) and B.30(C).

susceptor. An inductively heated component positioned near a joint to aid in heating.

sustained backfire. The recession of the flame into the torch body with continued burning characterized by an initial popping sound followed by a squealing or hissing sound, potentially burning through the torch body. See also **backfire** and **flashback**.

sweat soldering. A nonstandard term for **soldering**.

sweating. A nonstandard term for **soldering**.

synchronous timing, *resistance welding*. The initiation of each half cycle of welding transformer primary current on an accurately timed delay with respect to the polarity reversal of the power supply.

T

tab. See **runoff weld tab**, **starting weld tab**, and **weld tab**.

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

tack welder. One who performs manual or semiautomatic welding to produce tack welds.

tacker. A nonstandard term for **tack welder**.

tap. A nonstandard term when used for **transformer tap**.

taper delay time. The time interval after upslope during which the maximum welding current or high pulse current is constant. See Figure B.53.

taper time. The time interval when current increases or decreases continuously from the welding current to final taper current. See Figure B.53.

temper time, *resistance welding*. The time following quench time during which a current is passed through the weld for heat treating. See Figure B.49.

temporary weld. A weld made to attach a piece or pieces to a weldment for temporary use in handling, shipping, or working on the weldment.

tension test. A test in which a specimen is loaded in tension until failure occurs. See also **reduced section test specimen**.

test coupon. A weldment, brazement, or solderment used for procedure or performance qualification testing.

test specimen. A sample of a test coupon subjected to testing.

theoretical electrode force, *resistance welding*. The calculated force, neglecting friction and inertia, developed by the mechanical system of a resistance welding device. See also **dynamic electrode force** and **static electrode force**.

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. See Figures B.25(A)-(D). See also **actual throat** and **effective throat**.

thermal cutter. One who performs manual or semiautomatic thermal cutting. Variations of this term are **arc cutter** and **oxygen cutter**. See also **thermal cutting operator**.

thermal cutting (TC). A group of cutting processes severing or removing metal by localized melting, burning, or vaporizing of the workpieces. See also **arc cutting**, **high energy beam cutting**, and **oxygen cutting**.

thermal cutting operator. One who operates automatic, mechanized, or robotic thermal cutting equipment. Variations of this term are **arc cutting operator**, **electron beam cutting operator**, **laser beam cutting operator**, and **oxygen cutting operator**. See also **thermal cutter**.

thermal gouging (TG). A thermal cutting process variation removing metal by melting or burning the entire removed portion, to form a bevel or groove. See also **arc gouging**, **backgouging**, and **oxygen gouging**.

thermal spray deposit. The coating or layer of surfacing material applied by a thermal spraying process. See Figure B.31(B).

thermal spray deposit density ratio. The ratio of the density of the thermal spray deposit to the theoretical density of the surfacing material, usually expressed as percent of theoretical density.

thermal spray deposit interface. The boundary between the thermal spray deposit and the substrate.

thermal spray deposit strength. The tensile strength of a thermal spray deposit.

thermal spray deposit stress. The residual stress in a thermal spray deposit resulting from rapid cooling of molten or semimolten particles as they impinge on the substrate.

thermal spray pass. A single progression of the thermal spraying gun across the substrate surface.

thermal sprayer. One who performs semiautomatic thermal spraying. Variations of this term are **arc sprayer**, **flame sprayer**, and **plasma sprayer**.

thermal spraying (THSP). A group of processes in which finely divided metallic or nonmetallic surfacing materials are deposited in a molten or semimolten condition on a substrate to form a thermal spray deposit. The surfacing material may be in the form of powder, rod, cord, or wire. See also **arc spraying**, **flame spraying**, and **plasma spraying**.

thermal spraying deposition efficiency. The ratio of the weight of thermal spray deposit to the weight of surfacing material sprayed, expressed as a percentage.

thermal spraying gun. A device for heating, feeding, and directing the flow of surfacing material.

thermal spraying operator. One who operates automatic, mechanized, or robotic thermal spraying equipment. Variations of this term are **arc spraying operator**, **flame spraying operator**, and **plasma spraying operator**.

thermal stress. Stress in a material or assembly resulting from nonuniform temperature distribution or differential thermal expansion.

thermite crucible. The vessel in which the thermite reaction takes place.

thermite mixture. A mixture of metal oxide and finely divided aluminum with the addition of alloying metals as required.

thermite mold. A mold formed around the workpieces to receive molten metal.

thermite reaction. The chemical reaction between metal oxide and aluminum producing superheated molten metal and a slag containing aluminum oxide.

thermite welding (TW). A welding process producing coalescence of metals by heating them with superheated liquid metal from a chemical reaction between a metal oxide and aluminum, with or without the application of pressure. Filler metal is obtained from the liquid metal.

thermocompression bonding. A nonstandard term for **hot pressure welding**.

threading and knurling, *thermal spraying*. A method of surface roughening in which spiral threads are prepared, followed by upsetting with a knurling tool. See Figure B.43(E). See also **groove and rotary roughening**, **knurling**, and **rotary roughening**.

throat area, *resistance welding*. The region bounded by the physical components of the secondary circuit of a welding machine.

throat crack. A crack in the throat of a fillet weld. See Figure B.33.

throat depth, *resistance welding*. The distance from the centerline of the electrodes or platens to the nearest point of interference for flat sheets.

throat height, *resistance welding*. The minimum distance between the arms of the welding machine throughout the throat area.

throat length. A nonstandard term when used for **constricting orifice length**.

throat of a groove weld. A nonstandard term for **groove weld size**.

throat opening. A nonstandard term for **throat height**.

tie-in, *n., fusion welding*. The junction of weld metal and base metal or prior weld metal where fusion is intended.

tie-in, *v., fusion welding*. To manipulate the welding process at the junction of the weld metal and base metal or weld metal to facilitate fusion.

TIG welding. A nonstandard term for **gas tungsten arc welding**.

tinning. A nonstandard term when used for **precoating** for soldering.

tip. See **cutting tip** and **welding tip**.

tip skid. A nonstandard term for **electrode skidding**.

T-joint. A joint type in which the butting end of a workpiece is aligned approximately perpendicular with either its surface or the surface of a nonbutting workpiece. See Figures B.1(C), B.2(C), and B.10(F). See also **skewed joint**.

toe crack. A crack observed at the weld toe. See Figures B.32(A) and B.33(A).

toe of weld. See **weld toe**.

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

torch brazing (TB). A brazing process using heat from a fuel gas flame.

torch soldering (TS). A soldering process using heat from a fuel gas flame.

torch tip. See **cutting tip** and **welding tip**.

transfer tape. A nonstandard term when used for **brazing tape**.

transferred arc. A plasma arc established between the electrode of the plasma arc torch and the workpiece. See also **nontransferred arc**.

transformer tap. Connections to a transformer winding used to vary the transformer turns ratio, thereby controlling welding voltage and current.

transgun. A resistance welding gun with an integral, closely coupled resistance welding transformer.

transverse bend specimen. See **transverse weld test specimen**.

transverse crack. A crack with its major axis oriented approximately perpendicular to the weld axis. See Figure B.33(A).

transverse tension specimen. See **transverse weld test specimen**.

transverse weld test specimen. A weld test specimen with its major axis perpendicular to the weld axis. See also **longitudinal weld test specimen**.

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

travel angle, *pipe*. The angle 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 position of guns, torches, rods, and beams. See Figure B.21. See also **drag angle**, **push angle**, and **work angle**.

travel start delay time. The time interval from arc initiation to the start of the torch, gun, or workpiece travel. See Figure B.53.

travel stop delay time. The time interval from beginning of downslope time or crater fill time to shut-off of torch, gun, or workpiece travel. See Figure B.53.

tubular joint. A joint between two or more members, at least one of which is tubular.

tungsten electrode. A nonfiller metal electrode used in arc welding, arc cutting, and plasma spraying, made principally of tungsten.

tungsten inclusion. A discontinuity consisting of tungsten entrapped in weld metal.

twin carbon arc brazing (TCAB). A brazing process using heat from an arc between two carbon electrodes. This is an obsolete or seldom used process. See Table A.5.

twin carbon arc welding (CAW-T). A carbon arc welding process variation using an arc between two carbon electrodes and no shielding. This is an obsolete or seldom used process.

type of joint. See **joint type**.

U

U-groove weld. A type of groove weld. See Figures B.8(G) and B.9(E).

ultrasonic coupler, *ultrasonic soldering and ultrasonic welding*. Elements through which ultrasonic vibration is transmitted from the transducer to the tip.

ultrasonic soldering (USS). A soldering process variation in which high-frequency vibratory energy is transmitted through molten solder to remove undesirable surface films and thereby promote wetting of the base metal. This operation is usually accomplished without flux.

ultrasonic welding (USW). A solid-state welding process producing a weld by the local application of high-frequency vibratory energy as the workpieces are held together under pressure.

ultra-speed welding. A nonstandard term for **commutator-controlled welding**.

underbead crack. A heat-affected zone crack in steel weldments arising from the occurrence of a crack-susceptible microstructure, residual or applied stress, and the presence of hydrogen. See Figures B.32(B) and B.33(A).

undercut. A groove melted into the base metal adjacent to the weld toe or weld root and left unfilled by weld metal. See Figures B.32(C) and B.32(D).

underfill. A groove weld condition in which the weld face or root surface is below the adjacent surface of the base metal. See Figures B.32(E) and B.32(F).

unfused flux, *submerged arc welding*. Flux not melted during welding.

unmixed zone. A thin boundary layer of weld metal, adjacent to the weld interface, solidified without mixing with the remaining weld metal. See also **mixed zone**.

uphill, *adv.* Welding with an upward progression.

upset. Bulk deformation of a workpiece(s) resulting from the application of pressure, with or without added heat, expressed in terms of increase in transverse section area, reduction in length, reduction in thickness, or reduction of the cross wire weld stack height.

upset butt welding. A nonstandard term for **upset welding**.

upset distance. The total reduction in the axial length of the workpieces from the initial contact to the completion of the weld. In flash welding, the upset distance is equal to the platen movement from the end of flash time to the end of upset. See Figures B.44 and B.45.

upset force. The force exerted at the faying surfaces during upsetting.

upset time. The portion of a welding cycle during which upset occurs.

upset welding (UW). A resistance welding process producing a weld over the entire area of faying surfaces or progressively along a butt joint. See Figures B.15(A), B.31(C), and B.52. See also **high-frequency upset welding** and **induction upset welding**.

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

usability. A measure of the relative ease of application of a welding filler metal to make a sound weld.

V

vacuum brazing. A nonstandard term for various **brazing** processes taking place in a chamber or retort below atmospheric pressure.

vacuum plasma spraying (VPSP). A thermal spraying process variation using a plasma spraying gun confined to a stable enclosure that is partially evacuated.

vertical position. See **vertical welding position**.

vertical position, *pipe welding*. A nonstandard term when used for the pipe **welding test position** designated as **2G**.

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. See Figures B.16(A)–(C), B.17(C), and B.18(C).

vertical-down. A nonstandard term for **downhill**.

vertical-up. A nonstandard term for **uphill**.

V-groove weld. A type of groove weld. See Figures B.8(C), B.8(D), and B.9(C).

virgin flux, *submerged arc welding*. Unused flux produced using new raw materials. See also **recycled flux**.

voltage regulator. An automatic electrical control device for maintaining a constant voltage supply to the primary of a welding transformer.

W

wash pass. A nonstandard term when used for a **cosmetic weld pass**, **cover pass**, or **smoothing pass**.

waster plate, *oxyfuel gas cutting*. A carbon steel plate placed on an alloy workpiece at the torch side to provide the necessary iron to facilitate cutting of the alloy workpiece.

water wash. The forcing of exhaust air and fumes from a spray booth through water so the vented air is free of thermal sprayed particles or fumes.

wave soldering (WS). A soldering process using heat from a bath of filler metal in which the filler metal is flowed against the joint by an induced wave action. See also **dip soldering**.

wax pattern, *thermite welding*. Wax molded around the workpieces to the form desired for the completed weld.

weave bead. A weld bead formed using weaving. See Figure B.22(B). See also **stringer bead**.

weaving. A welding technique in which the thermal source is oscillated transversely as it progresses along the weld path. See also **oscillation** and **whipping**.

weld, *n.* A localized coalescence of metals 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 and with or without the use of filler material.

weld, *v.* The act of welding.

weld axis. A line through the length of the weld, perpendicular to and at the geometric center of its cross section. See Figures B.16(A), B.16(B), and B.21.

weld bead. A weld resulting from a weld pass. See Figures B.22, B.23(D), and B.23(E). See also **stringer bead** and **weave bead**.

weld bonding. A welding process variation in which the weld strength is augmented by adhesive at the faying surfaces.

weld brazing. Brazing using heat from a welding process such that the preplaced brazing filler metal is melted to form a braze augmenting the weld by increasing joint strength or creating a seal between spot or intermittent welds.

weld brazing. A nonstandard term when used for **resistance brazing**.

weld crack. A crack located in the weld metal or heat-affected zone. See Figure B.33.

weld dam. A metallic or nonmetallic object placed at the end of a weld groove to contain the molten metal and facilitate complete cross-sectional filling of the weld groove. See also **weld tab**.

weld dam. A nonstandard term when used for **backing shoe**.

weld face. The exposed surface of a weld on the side from which welding was done. See Figures B.24(A) and B.24(E).

weld face underfill. See **underfill**. See Figures B.32(E) and B.32(F).

weld gauge. A device designed for measuring the shape and size of welds.

weld groove, *fusion welding.* A channel in the surface of a workpiece or an opening between two joint members providing space to contain weld metal.

weld interface. The boundary 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. See Figures B.30 and B.31.

weld interval, *resistance welding*. The sum of heat and cool times to produce a multiple-impulse weld. See Figure B.49. See also **weld time**.

weld joint mismatch. Misalignment of the joint members. See Figure B.13(C).

weld line. A nonstandard term for **weld interface**.

weld metal. Metal in a fusion weld consisting of that portion of the base metal and filler metal melted during welding. See also **mixed zone** and **unmixed zone**.

weld metal crack. A crack occurring in the weld metal zone. See Figure B.33.

weld metal zone (WMZ). The portion of the weld area consisting of weld metal. See Figure B.24(G). See also **base metal zone** and **heat-affected zone**.

weld pass. A single progression of welding along a joint. The result of a weld pass is a weld bead or layer.

weld pass sequence. The order in which the weld passes are made. See **cross-sectional sequence** and **longitudinal sequence**.

weld penetration. A nonstandard term for **joint penetration** or **root penetration**.

weld pool. The localized volume of molten metal in a weld prior to its solidification as weld metal.

weld puddle. A nonstandard term for **weld pool**.

weld recognition. A function of an adaptive control determining changes in the shape of the weld pool or the weld metal during welding, and directing the welding machine to take appropriate action. See also **joint recognition** and **joint tracking**.

weld reinforcement. Weld metal in excess of the quantity required to fill a weld groove. See also **convexity**, **face reinforcement**, and **root reinforcement**.

weld root. The points, shown in cross section, at which the weld metal intersects the base metal and extends furthest into the weld joint. See Figures B.24(B) through B.24(E), B.24(H) through (K), and B.24(M) through (P).

weld seam. A nonstandard term for **joint**, **seam weld**, **weld**, or **weld joint**.

weld shoe. A nonstandard term when used for **backing shoe**.

weld size. See **edge weld size**, **fillet weld size**, **groove weld size**, **plug weld size**, **projection weld size**, **seam weld size**, **slot weld size**, and **spot weld size**.

weld symbol. A graphic character connected to the reference line of a brazing or welding symbol specifying the joint geometry or weld type.

weld tab. Additional material extending beyond either end of the joint, on which the weld is started or terminated. See **runoff weld tab** and **starting weld tab**.

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

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

weld toe. The junction of the weld face and the base metal. See Figures B.24(A) and B.24(E).

weld voltage. See **arc voltage**.

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

welder. One who performs manual or semiautomatic welding.

welder certification. Written verification that a welder has produced welds meeting a prescribed standard of welder performance.

welder performance qualification. The demonstration of a welder's or welding operator's ability to produce welds meeting prescribed standards.

welder registration. The act of registering a welder certification or a photostatic copy of the welder certification.

welding. A joining process producing coalescence of materials by heating them to the welding temperature, with or without the application of pressure or by the application of pressure alone, and with or without the use of filler metal. See Figures A.1 and A.3 through A.5.

welding arc. A controlled electrical discharge between the electrode and the workpiece formed and sustained by the establishment of a gaseous conductive medium, called an arc plasma.

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

welding current. See **automatic arc welding current** and **resistance welding current**.

welding cycle. The complete series of events involved in the making of a weld. See Figures B.49, B.50, B.53, and B.54.

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. See also **arc welding electrode**, **bare electrode**, **carbon electrode**, **composite electrode**, **covered electrode**, **electroslag welding electrode**, **emissive electrode**, **flux cored electrode**, **lightly coated electrode**, **metal cored electrode**, **metal electrode**, **resistance welding electrode**, **stranded electrode**, and **tungsten electrode**.

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

welding flux, *submerged arc welding.* A granular material comprised of metallic and nonmetallic constituents applied during welding to provide atmospheric shielding and cleaning of the molten weld metal and influence the profile of the solidified weld metal. This material may also provide filler metal and affect the weld metal composition. See **active flux**, **agglomerated flux**, **alloy flux**, **bonded flux**, **fused flux**, **mechanically mixed flux**, **neutral flux**, **reconditioned flux**, **recycled flux**, and **virgin flux**.

welding force. See **dynamic electrode force**, **electrode force**, **forge force**, **friction welding force**, **static electrode force**, **theoretical electrode force**, and **upset force**.

welding generator. A generator used for supplying current for welding.

welding ground. A nonstandard and incorrect term for **workpiece connection**.

welding head. The part of a welding machine in which a welding gun or torch is incorporated.

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 hood. A nonstandard term for **welding helmet**.

welding leads. The workpiece lead and the electrode lead of an arc welding circuit. See Figure B.34.

welding machine. Equipment used to perform the welding operation. For example, spot welding machine, arc welding machine, and seam welding machine.

welding operator. One who operates adaptive control, automatic, mechanized, or robotic welding equipment.

welding position. The relationship between the weld pool, joint, joint members, and welding heat source during welding. See Figures B.16 through B.20. See also **flat welding position**, **horizontal welding**

position, **overhead welding position**, and **vertical welding position**.

welding power source. An apparatus for supplying current and voltage suitable for welding. See also **constant current power source**, **constant voltage power source**, **welding generator**, **welding rectifier**, and **welding transformer**.

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

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 to qualify a welding procedure specification.

welding procedure specification (WPS). A document providing the required welding variables for a specific application to assure repeatability by properly trained welders and welding operators.

welding rectifier. A device 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. See Figure B.36.

welding schedule. A written statement, usually in tabular form, specifying values of parameters and the welding sequence for performing a welding operation.

welding sequence. The order of making welds in a weldment.

welding symbol. A graphical representation of the specifications for producing a welded joint. See also **weld symbol**. For examples and rules for their application, refer to AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*.

welding technique. Details of the welding operation controlled by the welder or welding operator.

welding test position. The orientation of a weld joint for welding procedure or welder qualification testing. See also **welding test position designation**.

welding test position designation. A symbol representation for a fillet weld or a groove weld, the joint orientation and the welding test position. See **1F**, **2F**, **2FR**, **3F**, **4F**, **5F**, **6F**, **1G**, **2G**, **3G**, **4G**, **5G**, **6G**, and **6GR**.

welding tip. A nonstandard term when used for **resistance welding electrode** for resistance spot welding.

welding tip, *oxyfuel gas welding*. The part of an oxyfuel gas welding torch from which gases issue.

welding torch. See **gas tungsten arc welding torch**, **oxyfuel gas welding torch**, and **plasma arc welding torch**.

welding transformer. A transformer converting input power into useable levels of voltage and current for welding at a rated duty cycle.

welding voltage. See **arc voltage**, **open circuit voltage**, and **resistance welding voltage**.

welding wheel. A nonstandard term for **circular electrode**.

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. See Figure B.36. See also **welding electrode** and **welding rod**.

weldment. An assembly joined by welding.

weldor. A nonstandard term for **welder**.

wetting, *brazing and soldering*. The phenomenon whereby a liquid filler metal or flux spreads and adheres in a thin continuous layer on a solid surface.

whipping. A welding technique in which the thermal source is oscillated longitudinally as it progresses along the weld path. See also **oscillation** and **weaving**.

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 handheld cloth or paddle so as to obtain the required size and contour.

wire feed speed. The rate at which wire is consumed in arc cutting, thermal spraying, or welding.

wire flame spraying (FLSP-W). A thermal spraying process variation in which the surfacing material is in wire form.

wire straightener. A device used for controlling the cast and helix of coiled wire to enable it to be easily fed through the wire feed system.

work angle. The angle less than 90° between a line perpendicular to the major workpiece 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 nonbutting member. This angle can also be used to partially define the position of guns, torches, rods, and beams. See Figure B.21. See also **drag angle**, **push angle**, and **travel angle**.

work angle, *pipe*. The angle less than 90° between a line perpendicular to the cylindrical pipe surface at the point of intersection of the weld axis and the extension of the electrode axis, and a plane determined by the electrode axis and a line tangent to the pipe at the same point. In a T-joint, the line is perpendicular to the nonbutting member. This angle can also be used to partially define the position of guns, torches, rods, and beams. See Figure B.21(C). See also **drag angle**, **push angle**, and **travel angle**.

work coil. See **induction work coil**.

work connection. A nonstandard term for **workpiece connection**.

work lead. A nonstandard term for **workpiece lead**.

workpiece. An assembly, component, member, or part in the process of being manufactured.

workpiece connection. A nonstandard term when used for **workpiece connector**.

workpiece connector. A device used to provide an electrical connection between the workpiece and the workpiece lead. See Figure B.34.

workpiece lead. A secondary circuit conductor transmitting energy from the power source to the workpiece connector. See Figure B.34.

wormhole porosity. A nonstandard term when used for **piping porosity**.

This page is intentionally blank.

Annex A (Normative)

Process, Classifications, and Designations

This annex is 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*, and includes mandatory elements for use with this standard.

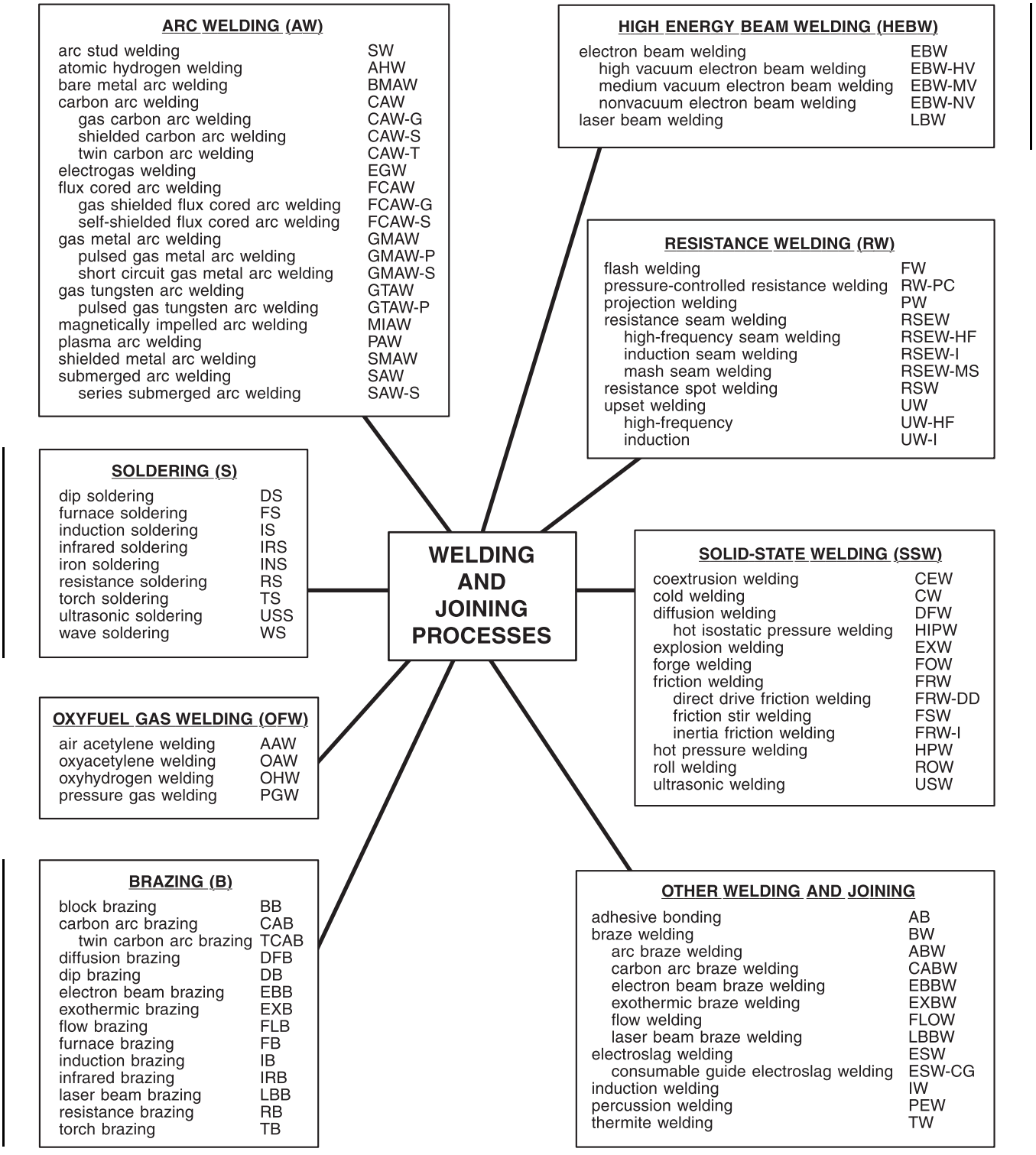


Figure A.1—Master Chart of Welding and Joining Processes

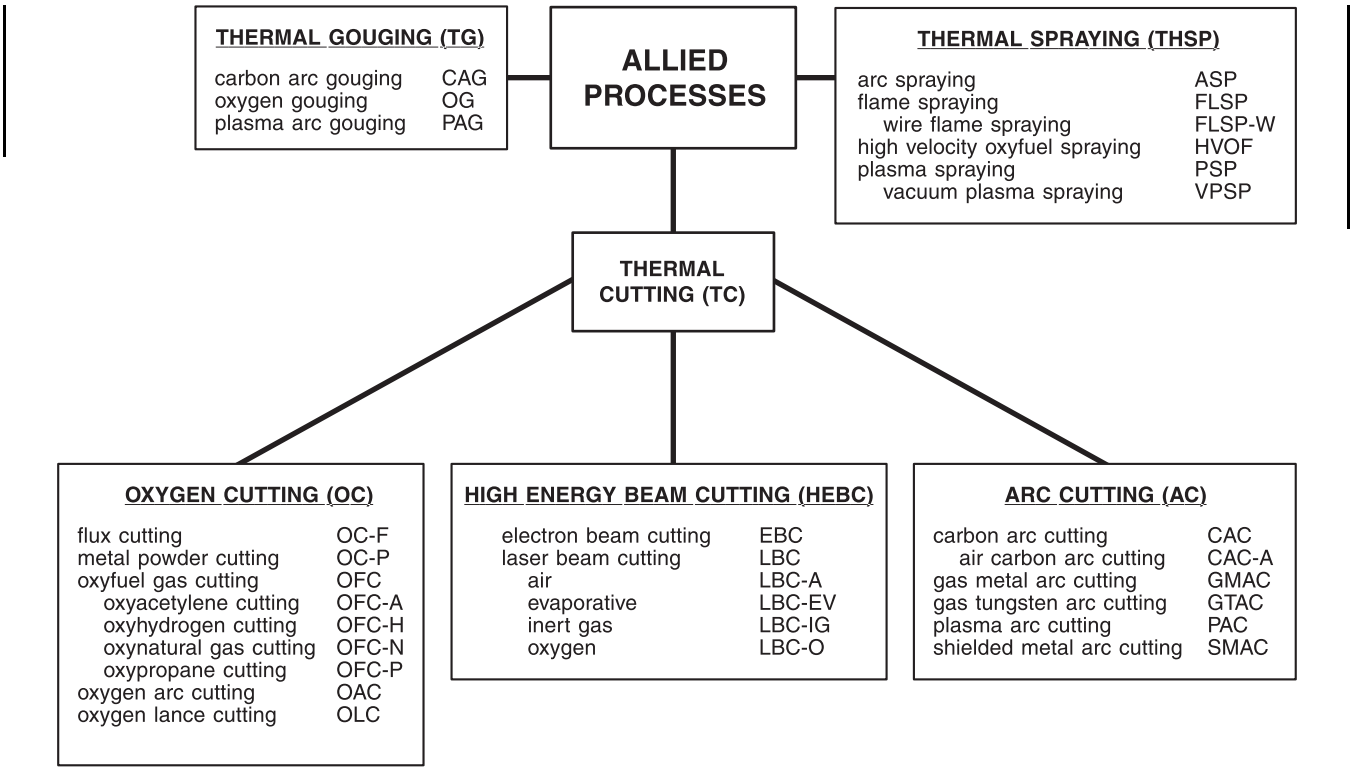


Figure A.2—Master Chart of Allied Processes

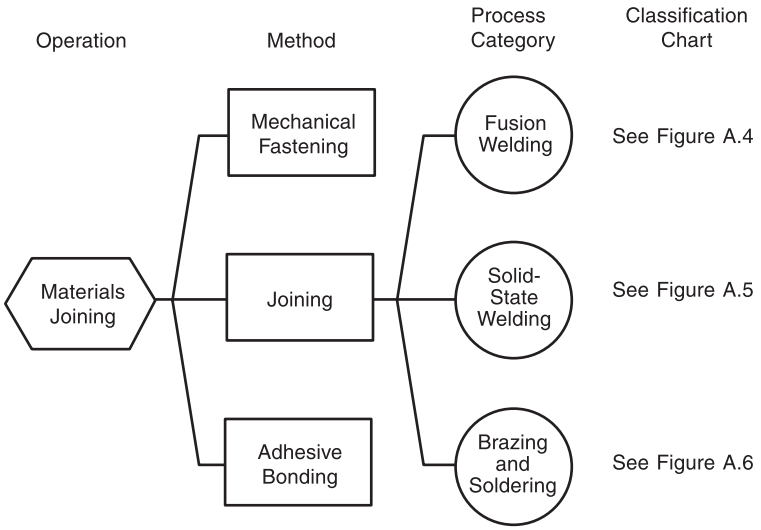
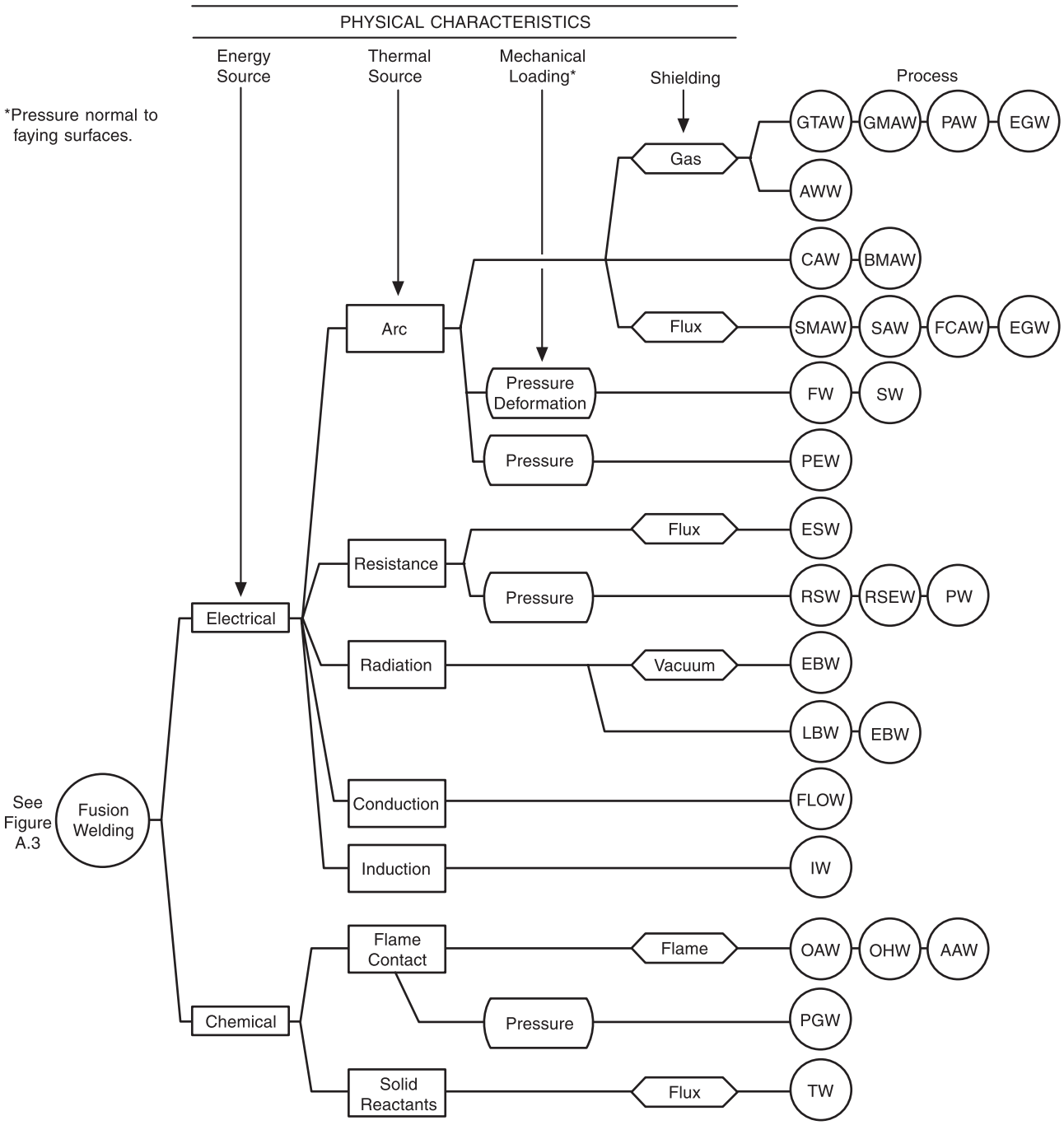
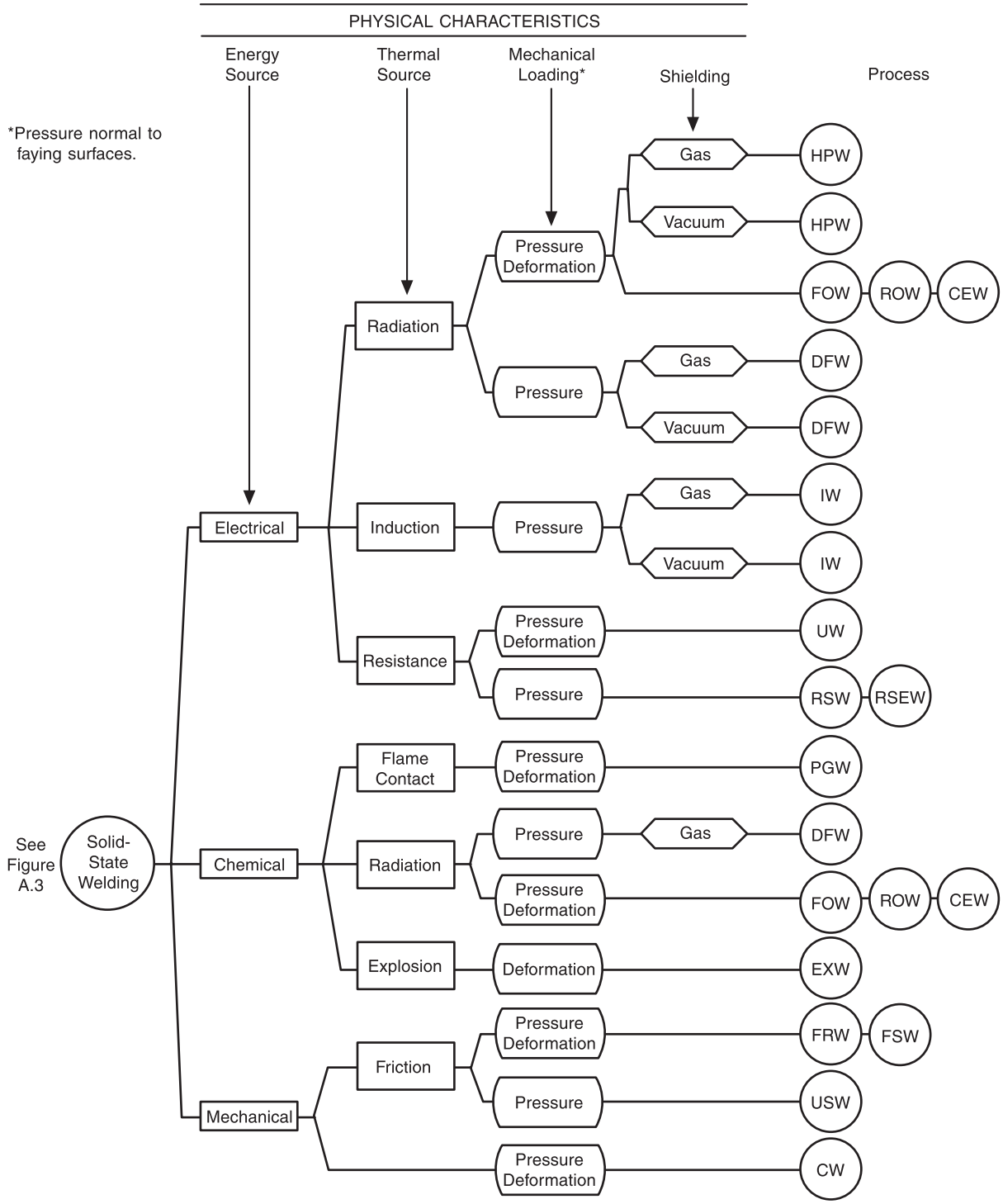


Figure A.3—Joining Method Chart



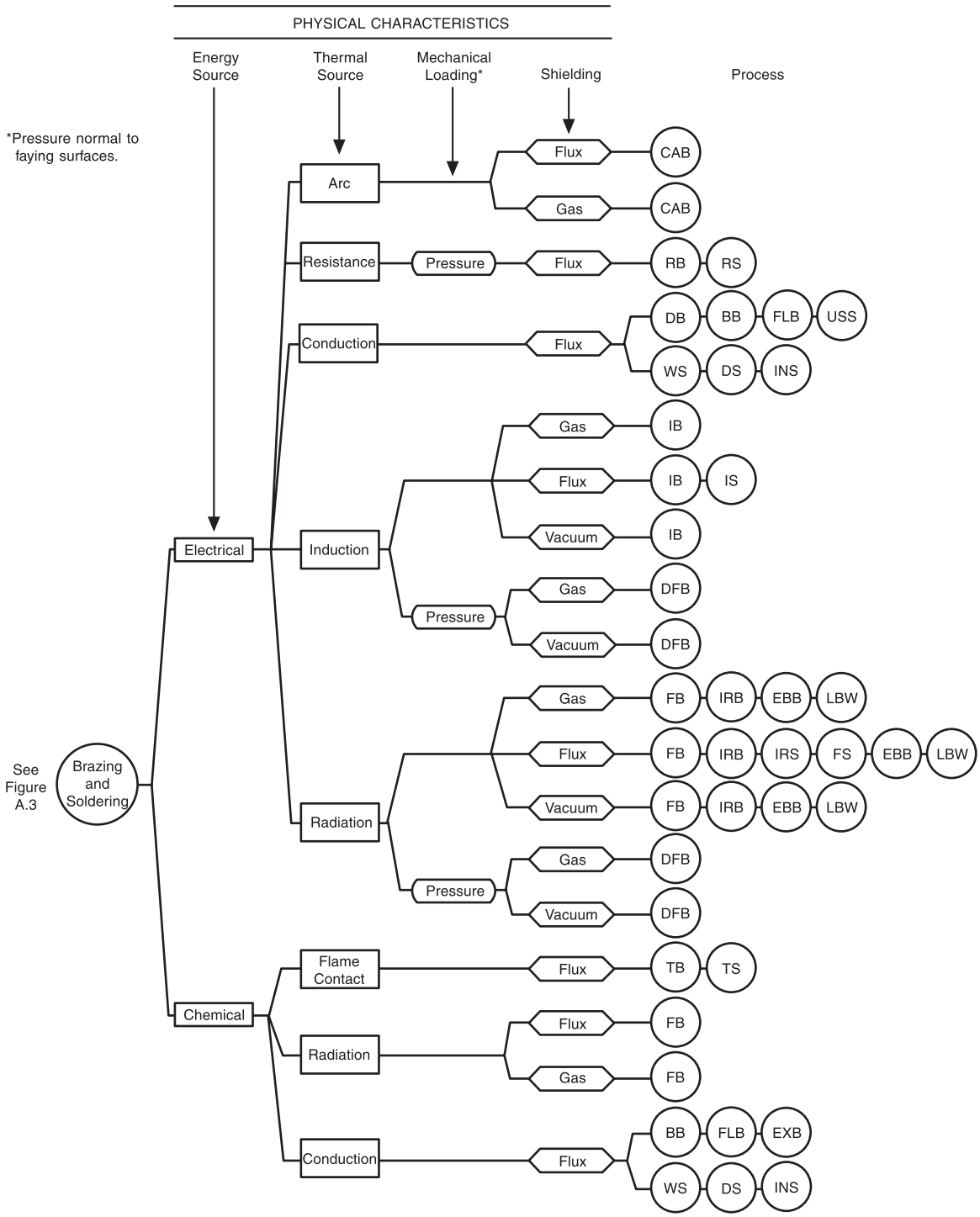
Designation	Welding Process	Designation	Welding Process	Designation	Welding Process
AAW	air acetylene welding	FW	flash welding	PGW	pressure gas welding
AHW	atomic hydrogen welding	GMAW	gas metal arc welding	PW	projection welding
BMAW	bare metal arc welding	GTAW	gas tungsten arc welding	RSEW	resistance seam welding
CAW	carbon arc welding	IW	induction welding	RSW	resistance spot welding
EBW	electron beam welding	LBW	laser beam welding	SAW	submerged arc welding
EGW	electrogas welding	OAW	oxyacetylene welding	SMAW	shielded metal arc welding
ESW	electroslag welding	OHW	oxyhydrogen welding	SW	stud arc welding
FLOW	flow welding	PAW	plasma arc welding	TW	thermite welding
FCAW	flux cored arc welding	PEW	percussion welding		

Figure A.4—Fusion Welding Classification Chart



Designation	Welding Process	Designation	Welding Process	Designation	Welding Process
CEW	coextrusion welding	FRW	friction welding	RSEW	resistance seam welding
CW	cold welding	FSW	friction stir welding	RSW	resistance spot welding
DFW	diffusion welding	HPW	hot pressure welding	ROW	roll welding
EXW	explosion welding	IW	induction welding	USW	ultrasonic welding
FOW	forge welding	PGW	pressure gas welding	UW	upset welding

Figure A.5—Solid-State Welding Classification Chart



Designation	Joining Process	Designation	Joining Process	Designation	Joining Process
AB	arc brazing	FS	furnace soldering	RB	resistance brazing
BB	block brazing	FLB	flow brazing	RS	resistance soldering
CAB	carbon arc brazing	IB	induction brazing	TB	torch brazing
DB	dip brazing	IS	induction soldering	TS	torch soldering
DS	dip soldering	IRB	infrared brazing	USS	ultrasonic soldering
DFB	diffusion brazing	IRS	infrared soldering	WS	wave soldering
FB	furnace brazing	INS	iron soldering		

Figure A.6—Brazing and Soldering Classification Chart

Table A.1
Letter Designations of Welding, Joining, and Allied Processes

Process	Letter Designation
adhesive bonding	AB
arc welding	AW
arc stud welding	SW
atomic hydrogen welding	AHW
bare metal arc welding	BMAW
carbon arc welding	CAW
gas carbon arc welding	CAW-G
shielded carbon arc welding	CAW-S
twin carbon arc welding	CAW-T
electrogas welding	EGW
flux cored arc welding	FCAW
gas shielded flux cored arc welding	FCAW-G
self-shielded flux cored arc welding	FCAW-S
gas metal arc welding	GMAW
pulsed gas metal arc welding	GMAW-P
short circuit gas metal arc welding	GMAW-S
gas tungsten arc welding	GTAW
pulsed gas tungsten arc welding	GTAW-P
magnetically impelled arc welding	MIAW
plasma arc welding	PAW
shielded metal arc welding	SMAW
submerged arc welding	SAW
series submerged arc welding	SAW-S
brazing	B
block brazing	BB
carbon arc brazing	CAB
twin carbon arc brazing	TCAB
diffusion brazing	DFB
dip brazing	DB
electron beam brazing	EBB
exothermic brazing	EXB
furnace brazing	FB
induction brazing	IB
infrared brazing	IRB
laser beam brazing	LBB
resistance brazing	RB
torch brazing	TB
braze welding	BW
arc braze welding	ABW
carbon arc braze welding	CABW
electron beam braze welding	EBBW
exothermic braze welding	EXBW
flow brazing	FLB
flow welding	FLOW
laser beam braze welding	LBBW
consumable guide electroslag welding	ESW-CG
electroslag welding	ESW
high energy beam welding	HEBW
electron beam welding	EBW
high vacuum electron beam welding	EBW-HV
medium vacuum electron beam welding	EBW-MV
nonvacuum electron beam welding	EBW-NV
laser beam welding	LBW
induction welding	IW
oxyfuel gas welding	OFW
air acetylene welding	AAW
oxyacetylene welding	OAW
oxyhydrogen welding	OHW
pressure gas welding	PGW
percussion welding	PEW
resistance welding	RW
flash welding	FW
pressure-controlled resistance welding	RW-PC
projection welding	PW
resistance seam welding	RSEW
high-frequency seam welding	RSEW-HF
induction seam welding	RSEW-I
mash seam welding	RSEW-MS
resistance spot welding	RSW
upset welding	UW
high-frequency upset welding	UW-HF
induction upset welding	UW-I
soldering	S
dip soldering	DS
furnace soldering	FS
induction soldering	IS
infrared soldering	IRS
iron soldering	INS
resistance soldering	RS
torch soldering	TS
ultrasonic soldering	USS
wave soldering	WS
solid-state welding	SSW
coextrusion welding	CEW
cold welding	CW
diffusion welding	DFW
hot isostatic pressure welding	HIPW
explosion welding	EXW
forge welding	FOW
friction welding	FRW
direct drive friction welding	FRW-DD
friction stir welding	FSW
inertia friction welding	FRW-I
hot pressure welding	HPW
roll welding	ROW
ultrasonic welding	USW
thermal cutting	TC
arc cutting	AC
carbon arc cutting	CAC
air carbon arc cutting	CAC-A
gas metal arc cutting	GMAC
gas tungsten arc cutting	GTAC
plasma arc cutting	PAC
shielded metal arc cutting	SMAC
high energy beam cutting	HEBC
electron beam cutting	EBC
laser beam cutting	LBC
laser beam air cutting	LBC-A
laser beam evaporative cutting	LBC-EV
laser beam inert gas cutting	LBC-IG
laser beam oxygen cutting	LBC-O
oxygen cutting	OC
flux cutting	OC-F
metal powder cutting	OC-P
oxyfuel gas cutting	OFC
oxyacetylene cutting	OFC-A
oxyhydrogen gas cutting	OFC-H
oxynatural gas cutting	OFC-N

Table A.1 (Continued)
Letter Designations of Welding, Joining, and Allied Processes

Process	Letter Designation
oxypropane cutting	OFC-P
oxygen arc cutting	OAC
oxygen lance cutting	OLC
thermal gouging	TG
carbon arc gouging	CAG
oxygen gouging	OG
plasma arc gouging	PAG
thermal spraying	THSP
arc spraying	ASP
flame spraying	FLSP
wire flame spraying	FLSP-W
high velocity oxyfuel spraying	HVOF
plasma spraying	PSP
vacuum plasma spraying	VPSP
thermite welding	TW

Table A.2
Alphabetical Cross-Reference to Table A.1 by Process

Process	Letter Designation
adhesive bonding	AB
air acetylene welding	AAW
air carbon arc cutting	CAC-A
arc braze welding	ABW
arc cutting	AC
arc spraying	ASP
arc stud welding	SW
arc welding	AW
atomic hydrogen welding	AHW
bare metal arc welding	BMAW
block brazing	BB
braze welding	BW
brazing	B
carbon arc braze welding	CABW
carbon arc brazing	CAB
carbon arc cutting	CAC
carbon arc gouging	CAG
carbon arc welding	CAW
coextrusion welding	CEW
cold welding	CW
consumable guide electroslag welding	ESW-CG
diffusion brazing	DFB
diffusion welding	DFW
dip brazing	DB
dip soldering	DS
direct drive friction welding	FRW-DD
electrogas welding	EGW
electron beam braze welding	EBBW
electron beam brazing	EBB
electron beam cutting	EBC
electron beam welding	EBW
electroslag welding	ESW
exothermic braze welding	EXBW
exothermic brazing	EXB
explosion welding	EXW
flame spraying	FLSP
flash welding	FW
flow brazing	FLB
flow welding	FLOW
flux cored arc welding	FCAW
flux cutting	OC-F
forge welding	FOW
friction stir welding	FSW
friction welding	FRW
furnace brazing	FB
furnace soldering	FS
gas carbon arc welding	CAW-G
gas metal arc cutting	GMAC
gas metal arc welding	GMAW
gas shielded flux cored arc welding	FCAW-G
gas tungsten arc cutting	GTAC
gas tungsten arc welding	GTAW
high energy beam cutting	HEBC
high energy beam welding	HEBW
high vacuum electron beam welding	EBW-HV
high velocity oxyfuel spraying	HVOF
high-frequency seam welding	RSEW-HF
high-frequency upset welding	UW-HF
hot isostatic pressure welding	HIPW
hot pressure welding	HPW
induction brazing	IB
induction seam welding	RSEW-I
induction soldering	IS
induction upset welding	UW-I
induction welding	IW
inertia friction welding	FRW-I
infrared brazing	IRB
infrared soldering	IRS
iron soldering	INS
laser beam air cutting	LBC-A
laser beam braze welding	LBBW
laser beam brazing	LBB
laser beam cutting	LBC
laser beam evaporative cutting	LBC-EV
laser beam inert gas cutting	LBC-IG
laser beam oxygen cutting	LBC-O
laser beam welding	LBW
magnetically impelled arc welding	MIAW
mash seam welding	RSEW-MS
medium vacuum electron beam welding	EBW-MV
metal powder cutting	OC-P
nonvacuum electron beam welding	EBW-NV

Table A.2 (Continued)
Alphabetical Cross-Reference to Table A.1 by Process

Process	Letter Designation
oxyacetylene cutting	OFC-A
oxyacetylene welding	OAW
oxyfuel gas cutting	OFC
oxyfuel gas welding	OFW
oxygen arc cutting	OAC
oxygen cutting	OC
oxygen gouging	OG
oxygen lance cutting	OLC
oxyhydrogen gas cutting	OFC-H
oxyhydrogen welding	OHW
oxynatural gas cutting	OFC-N
oxypropane cutting	OFC-P
percussion welding	PEW
plasma arc cutting	PAC
plasma arc gouging	PAG
plasma arc welding	PAW
plasma spraying	PSP
pressure gas welding	PGW
pressure-controlled resistance welding	RW-PC
projection welding	PW
pulsed gas metal arc welding	GMAW-P
pulsed gas tungsten arc welding	GTAW-P
resistance brazing	RB
resistance seam welding	RSEW
resistance soldering	RS
resistance spot welding	RSW
resistance welding	RW
roll welding	ROW
self-shielded flux cored arc welding	FCAW-S
series submerged arc welding	SAW-S
shielded carbon arc welding	CAW-S
shielded metal arc cutting	SMAC
shielded metal arc welding	SMAW
short circuit gas metal arc welding	GMAW-S
soldering	S
solid-state welding	SSW
submerged arc welding	SAW
thermal cutting	TC
thermal gouging	TG
thermal spraying	THSP
thermite welding	TW
torch brazing	TB
torch soldering	TS
twin carbon arc brazing	TCAB
twin carbon arc welding	CAW-T
ultrasonic soldering	USS
ultrasonic welding	USW
upset welding	UW
vacuum plasma spraying	VPSP
wave soldering	WS
wire flame spraying	FLSP-W

Table A.3
Alphabetical Cross-Reference to Table A.1 by Letter Designation

Letter Designation	Process
AAW	air acetylene welding
AB	adhesive bonding
ABW	arc braze welding
AC	arc cutting
AHW	atomic hydrogen welding
AAW	air acetylene welding
AB	adhesive bonding
ABW	arc braze welding
ASP	arc spraying
AW	arc welding
B	brazing
BB	block brazing
BMAW	bare metal arc welding
BW	braze welding
CAB	carbon arc brazing
CABW	carbon arc braze welding
CAC	carbon arc cutting
CAC-A	air carbon arc cutting
CAG	carbon arc gouging
CAW	carbon arc welding
CAW-G	gas carbon arc welding
CAW-S	shielded carbon arc welding
CAW-T	twin carbon arc welding
CEW	coextrusion welding
CW	cold welding
DB	dip brazing
DFB	diffusion brazing
DFW	diffusion welding
DS	dip soldering
EBB	electron beam brazing
EBBW	electron beam braze welding
EBC	electron beam cutting
EBW	electron beam welding
EBW-HV	high vacuum electron beam welding
EBW-MV	medium vacuum electron beam welding
EBW-NV	nonvacuum electron beam welding
EGW	electrogas welding
ESW	electroslag welding
ESW-CG	consumable guide electroslag welding
EXB	exothermic brazing
EXBW	exothermic braze welding
EXW	explosion welding
FB	furnace brazing
FCAW	flux cored arc welding
FCAW-G	gas shielded flux cored arc welding
FCAW-S	self-shielded flux cored arc welding

Table A.3 (Continued)
Alphabetical Cross-Reference to Table A.1 by Letter Designation

Process	Letter Designation
FLB	flow brazing
FLOW	flow welding
FLSP	flame spraying
FLSP-W	wire flame spraying
FOW	forge welding
FRW	friction welding
FRW-DD	direct drive friction welding
FRW-I	inertia friction welding
FS	furnace soldering
FSW	friction stir welding
FW	flash welding
GMAC	gas metal arc cutting
GMAW	gas metal arc welding
GMAW-P	pulsed gas metal arc welding
GMAW-S	short circuit gas metal arc welding
GTAC	gas tungsten arc cutting
GTAW	gas tungsten arc welding
GTAW-P	pulsed gas tungsten arc welding
HEBC	high energy beam cutting
HEBW	high energy beam welding
HIPW	hot isostatic pressure welding
HPW	hot pressure welding
HVOF	high velocity oxyfuel spraying
IB	induction brazing
INS	iron soldering
IRB	infrared brazing
IRS	infrared soldering
IS	induction soldering
IW	induction welding
LBB	laser beam brazing
LBBW	laser beam braze welding
LBC	laser beam cutting
LBC-A	laser beam air cutting
LBC-EV	laser beam evaporative cutting
LBC-IG	laser beam inert gas cutting
LBC-O	laser beam oxygen cutting
LBW	laser beam welding
MIAW	magnetically impelled arc welding
OAC	oxygen arc cutting
OAW	oxyacetylene welding
OC	oxygen cutting
OC-F	flux cutting
OC-P	metal powder cutting
OFC	oxyfuel gas cutting
OFC-A	oxyacetylene cutting
OFC-H	oxyhydrogen gas cutting
OFC-N	oxynatural gas cutting
OFC-P	oxypropane cutting
OFW	oxyfuel gas welding
OG	oxygen gouging
OHW	oxyhydrogen welding
OLC	oxygen lance cutting
PAC	plasma arc cutting
PAG	plasma arc gouging
PAW	plasma arc welding
PEW	percussion welding
PGW	pressure gas welding
PSP	plasma spraying
PW	projection welding
RB	resistance brazing
ROW	roll welding
RS	resistance soldering
RSEW	resistance seam welding
RSEW-HF	high-frequency seam welding
RSEW-I	induction seam welding
RSEW-MS	mash seam welding
RSW	resistance spot welding
RW	resistance welding
RW-PC	pressure-controlled resistance welding
S	soldering
SAW	submerged arc welding
SAW-S	series submerged arc welding
SMAC	shielded metal arc cutting
SMAW	shielded metal arc welding
SSW	solid-state welding
SW	arc stud welding
TB	torch brazing
TC	thermal cutting
TCAB	twin carbon arc brazing
TG	thermal gouging
THSP	thermal spraying
TS	torch soldering
VPSP	vacuum plasma spraying
TW	thermite welding
USS	ultrasonic soldering
USW	ultrasonic welding
UW	upset welding
UW-HF	high-frequency upset welding
UW-I	induction upset welding
WS	wave soldering

Table A.4
Suffixes for Optional Use in Applying Welding, Joining, and Allied Processes

Process	Letter Designation
Adaptive control	AD
Automatic	AU
Manual	MA
Mechanized	ME
Robotic	RO
Semiautomatic	SA

Table A.5
Obsolete or Seldom Used Processes

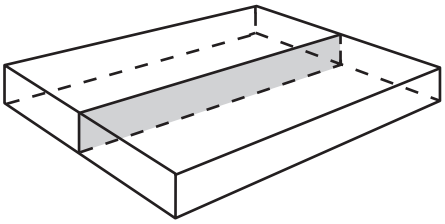
Welding Process or Variation	Letter Designation
air acetylene welding	AAW
atomic hydrogen welding	AHW
bare metal arc welding	BMAW
block brazing	BB
carbon arc brazing	CAB
flow brazing	FLB
flow welding	FLOW
gas carbon arc welding	CAW-G
shielded carbon arc welding	CAW-S
twin carbon arc brazing	TCAB
twin carbon arc welding	CAW-T

This page is intentionally blank.

Annex B (Normative)

Figures

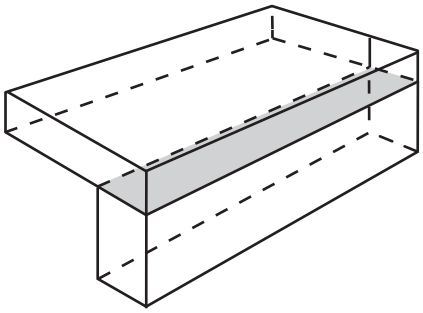
This annex is part of AWS A3.0M/A3.0:2010, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*, and includes mandatory elements for use with this standard.



APPLICABLE WELDS

BEVEL-GROOVE	SQUARE GROOVE
FLARE-BEVEL-GROOVE	U-GROOVE
FLARE-V-GROOVE	V-GROOVE
J-GROOVE	BRAZE

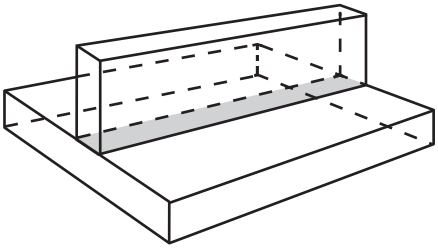
(A) BUTT JOINT



APPLICABLE WELDS

FILLET	V-GROOVE
BEVEL-GROOVE	PLUG
FLARE-BEVEL-GROOVE	SLOT
FLARE-V-GROOVE	SPOT
J-GROOVE	SEAM
SQUARE-GROOVE	PROJECTION
U-GROOVE	BRAZE

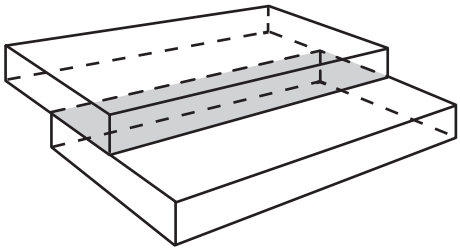
(B) CORNER JOINT



APPLICABLE WELDS

FILLET	SLOT
BEVEL-GROOVE	SPOT
FLARE-BEVEL-GROOVE	SEAM
J-GROOVE	PROJECTION
SQUARE-GROOVE	BRAZE
PLUG	

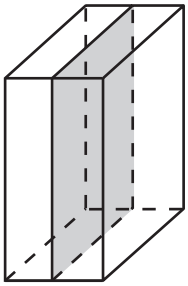
(C) T-JOINT



APPLICABLE WELDS

FILLET	SLOT
BEVEL-GROOVE	SPOT
FLARE-BEVEL-GROOVE	SEAM
J-GROOVE	PROJECTION
PLUG	BRAZE

(D) LAP JOINT



APPLICABLE WELDS

BEVEL-GROOVE	V-GROOVE
FLARE-BEVEL-GROOVE	EDGE
FLARE-V-GROOVE	SEAM
J-GROOVE	SPOT
SQUARE-GROOVE	PROJECTION
U-GROOVE	BRAZE

(E) EDGE JOINT

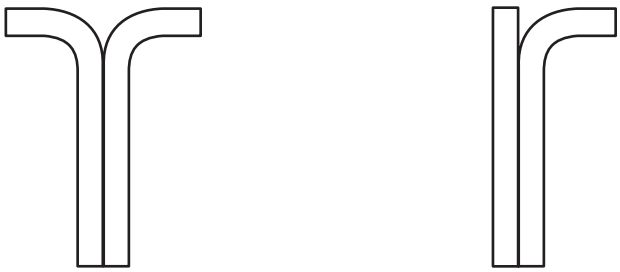
Figure B.1—Joint Types

(A) FLANGED BUTT JOINTS

(B) FLANGED CORNER JOINT

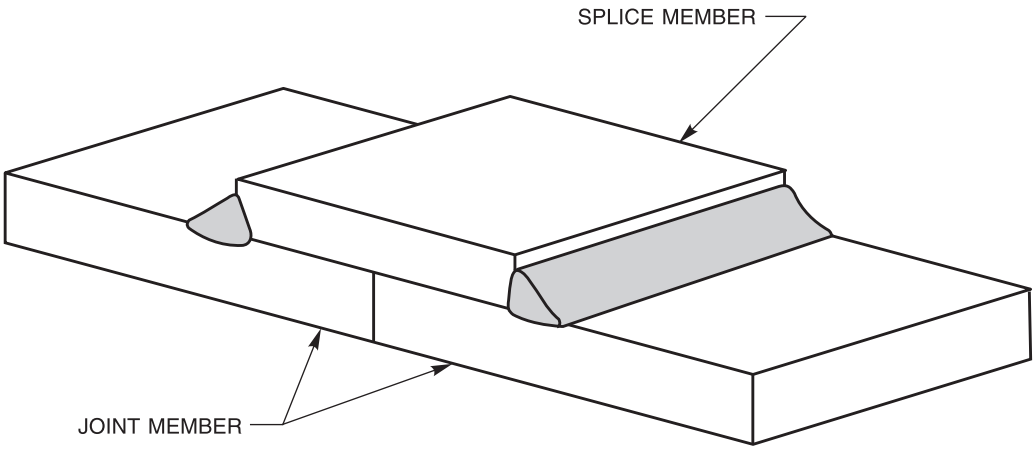
(C) FLANGED T-JOINT

(D) FLANGED LAP JOINTS

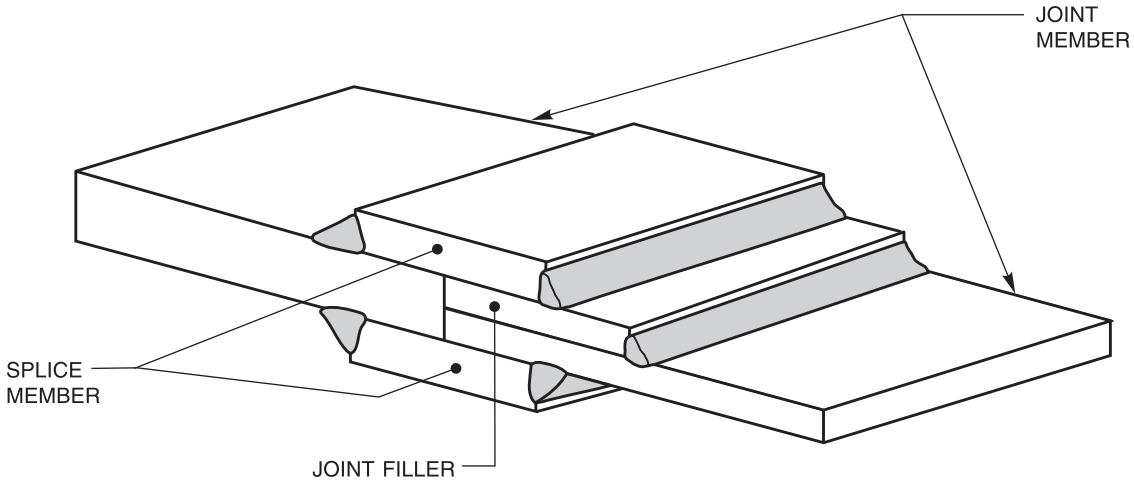


(E) FLANGED EDGE JOINTS

Figure B.2—Flanged Joints

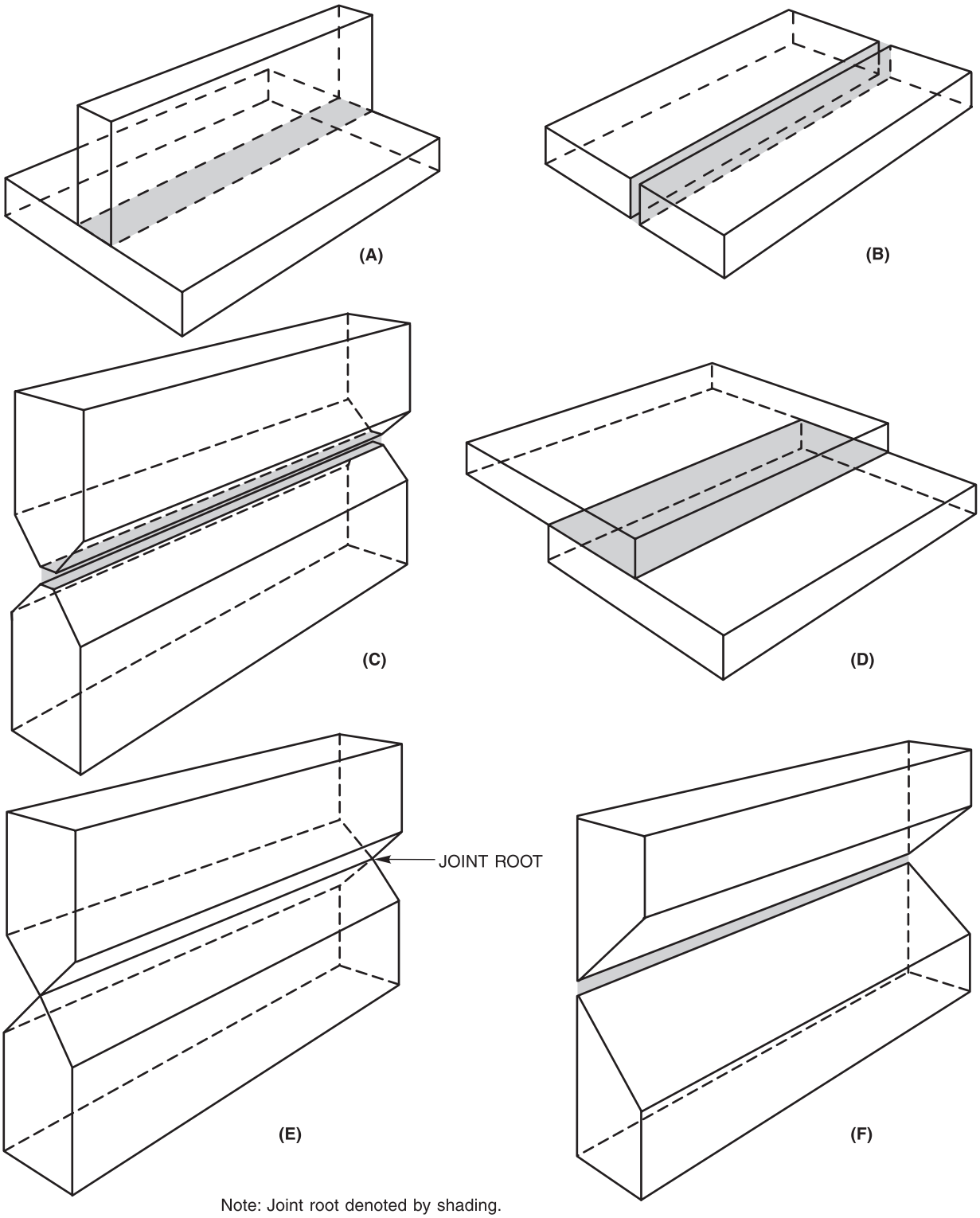


(A) SINGLE-SPLICED BUTT JOINT



(B) DOUBLE-SPLICED EDGE JOINT WITH JOINT FILLER

Figure B.3—Spliced Butt Joints



Note: Joint root denoted by shading.

Figure B.4—Joint Root

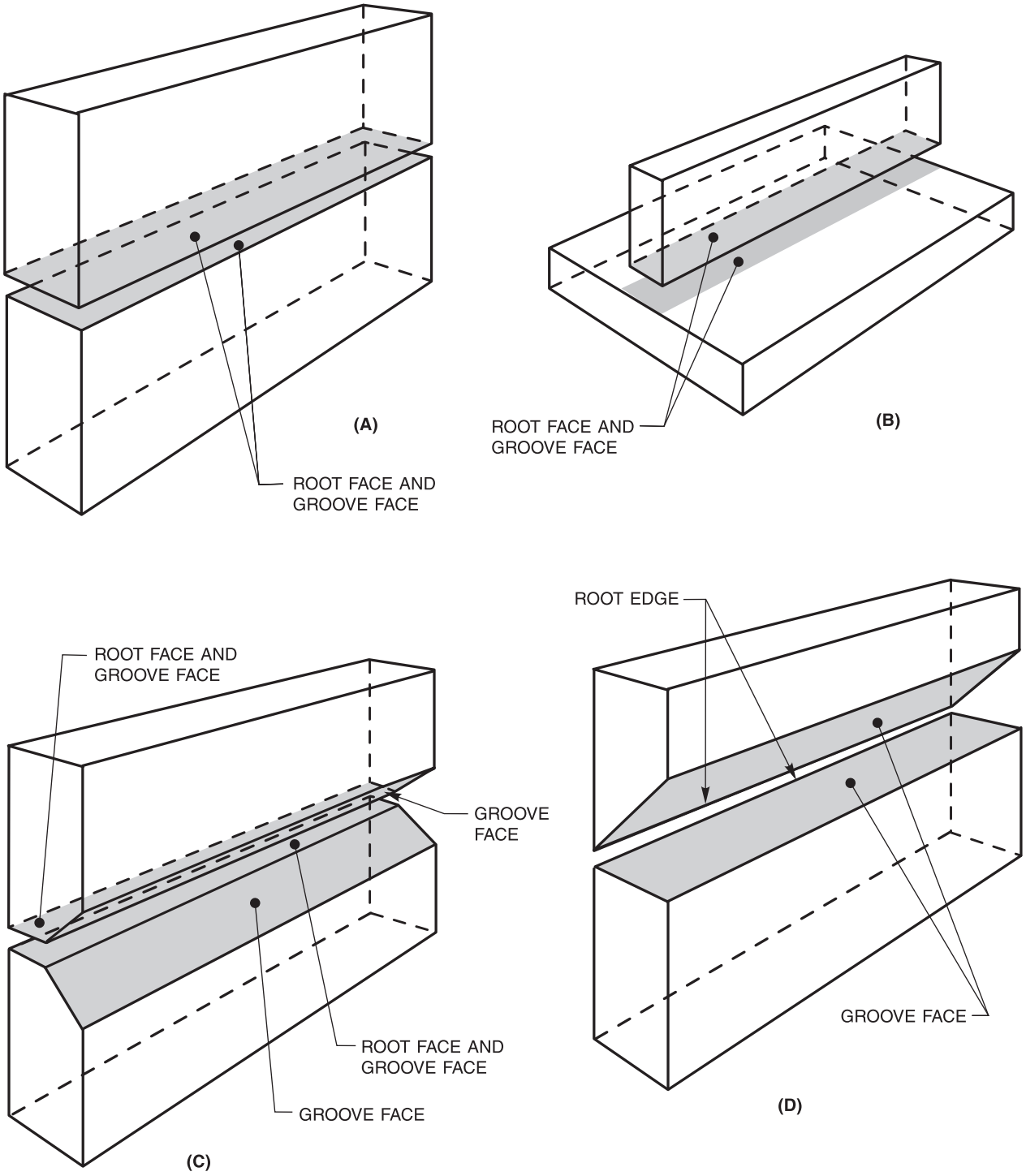


Figure B.5—Groove Face, Root Edge, and Root Face

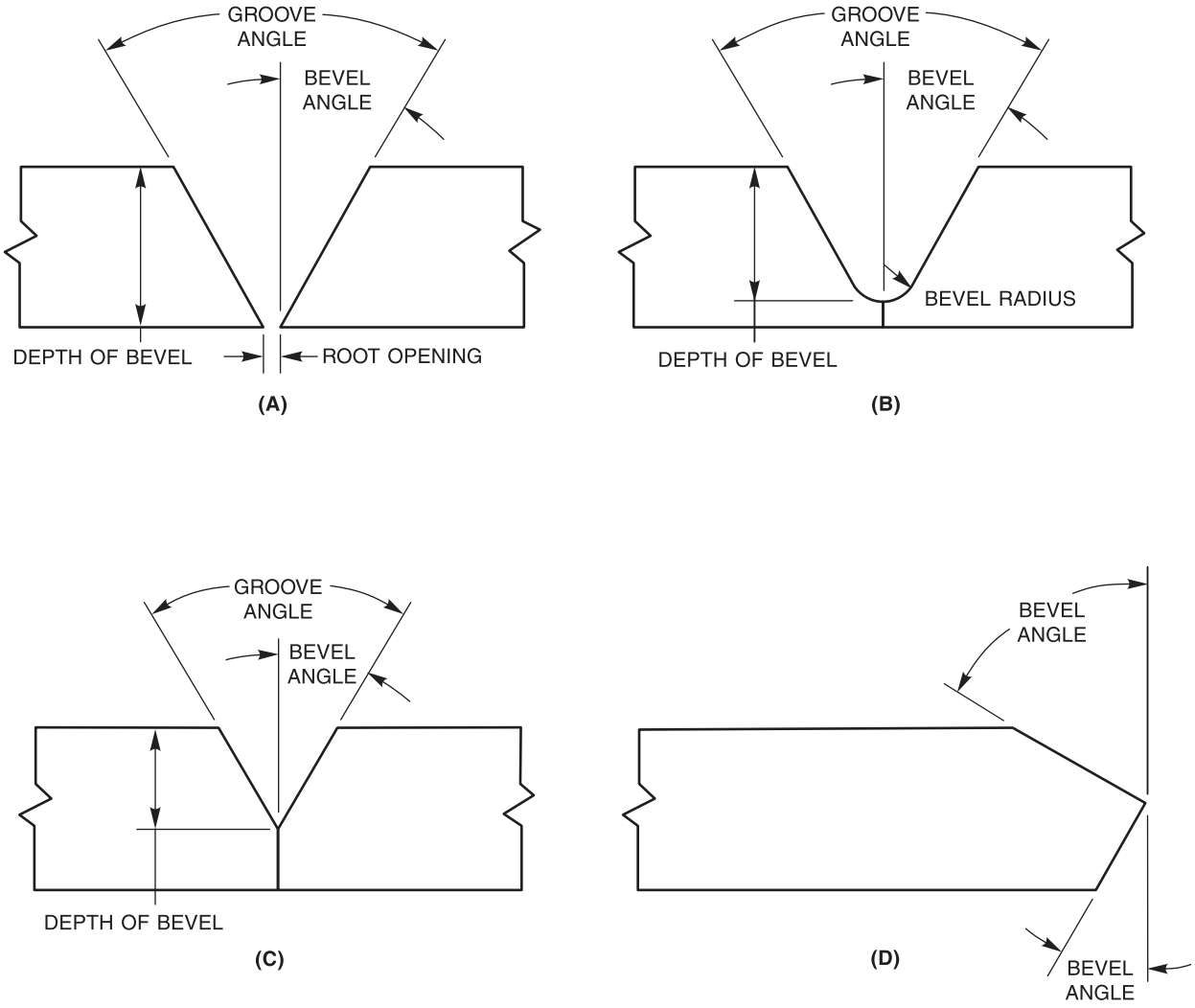


Figure B.6—Bevel Angle, Bevel Face, Depth of Bevel, Groove Angle, Bevel Radius, and Root Opening

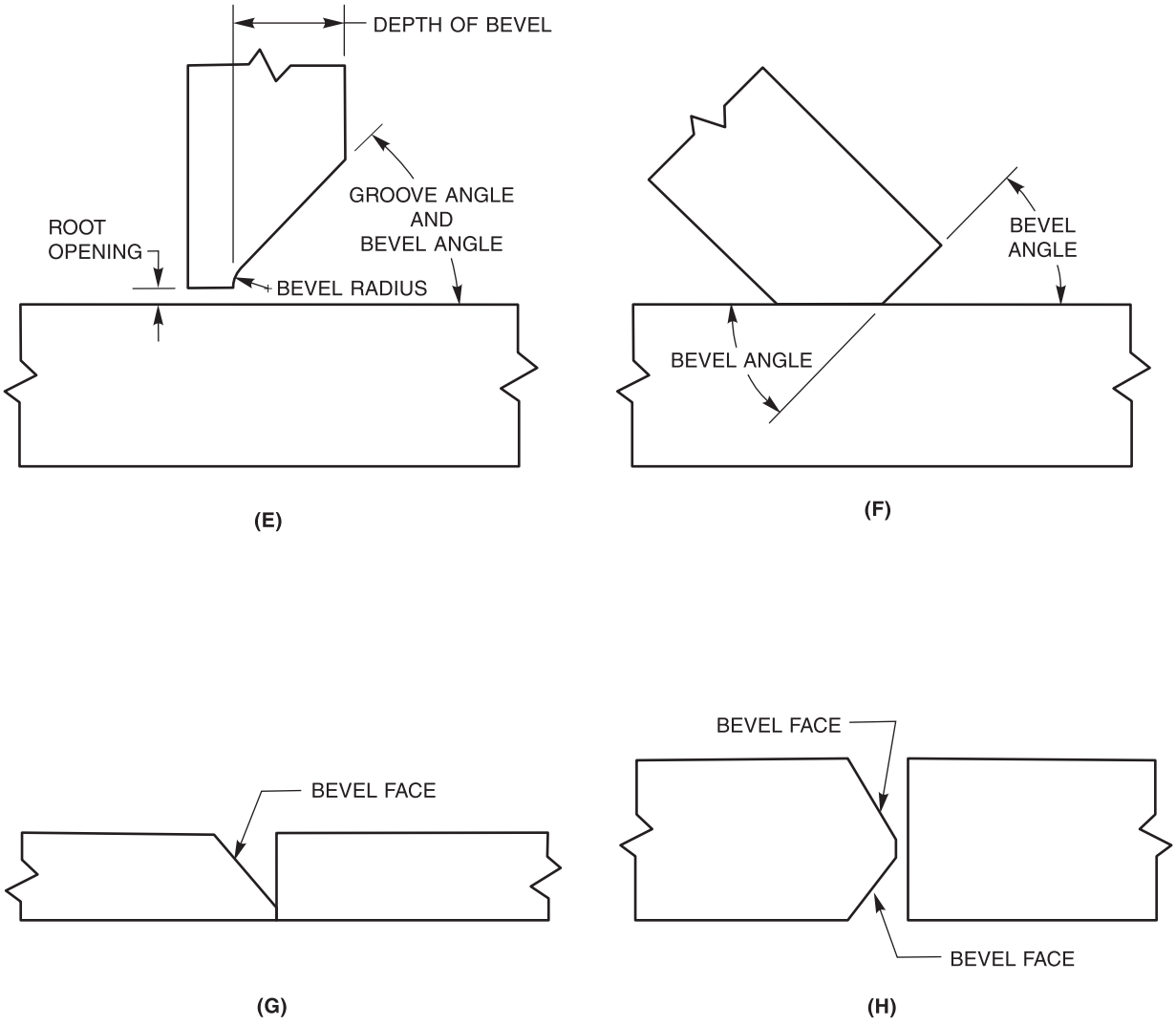
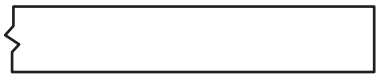


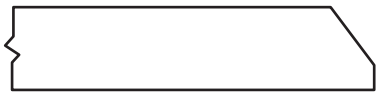
Figure B.6 (Continued)—Bevel Angle, Bevel Face, Depth of Bevel, Groove Angle, Bevel Radius, and Root Opening



(A) SQUARE EDGE SHAPE

APPLICABLE WELDS

DOUBLE-BEVEL-GROOVE	SINGLE-J- GROOVE
DOUBLE-BEVEL-FLARE-GROOVE	SQUARE-GROOVE
DOUBLE-J-GROOVE	EDGE
SINGLE-BEVEL-GROOVE	FILLET
SINGLE-FLARE-BEVEL-GROOVE	BRAZE



(B) SINGLE-BEVEL EDGE SHAPE

APPLICABLE WELDS

SINGLE-BEVEL-GROOVE
SINGLE-V-GROOVE
BRAZE

(C) DOUBLE-BEVEL EDGE SHAPE

APPLICABLE WELDS

DOUBLE-BEVEL-GROOVE
DOUBLE-V-GROOVE

(D) SINGLE-J EDGE SHAPE

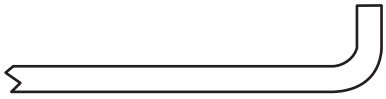
APPLICABLE WELDS

SINGLE-J-GROOVE
SINGLE-U-GROOVE

(E) DOUBLE-J EDGE SHAPE

APPLICABLE WELDS

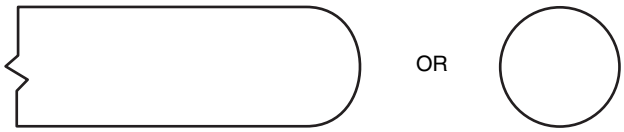
DOUBLE-J-GROOVE
DOUBLE-U-GROOVE



(F) FLANGED EDGE SHAPE

APPLICABLE WELDS

SINGLE-FLARE-BEVEL-GROOVE	PROJECTION
SINGLE-FLARE-V-GROOVE	SEAM
EDGE	SPOT
FILLET	BRAZE

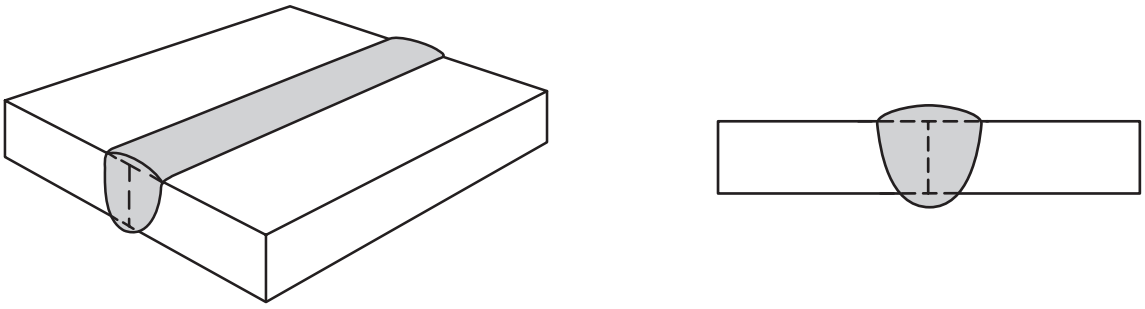


(G) ROUND EDGE SHAPE

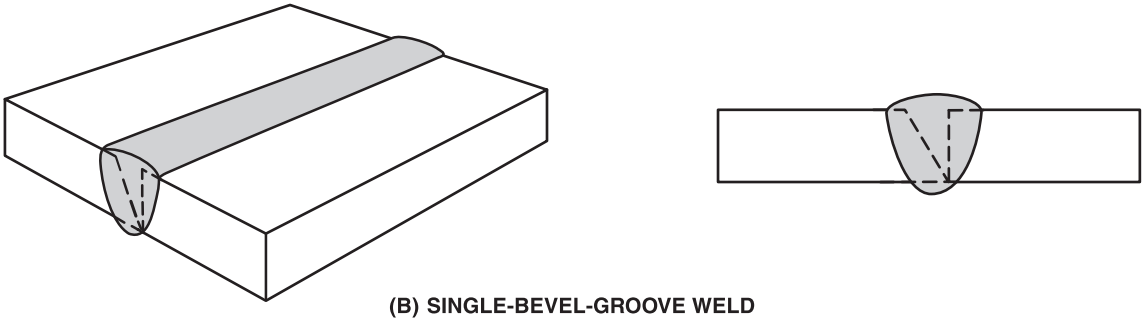
APPLICABLE WELDS

DOUBLE-FLARE-BEVEL GROOVE
DOUBLE-FLARE-V-GROOVE
BRAZE

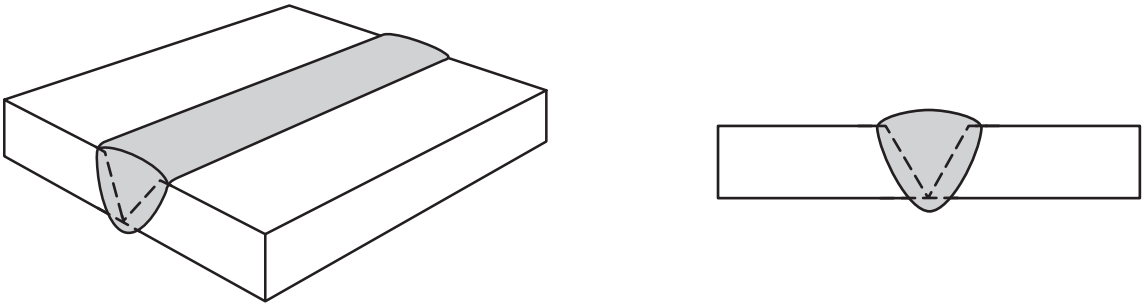
Figure B.7—Edge Shapes



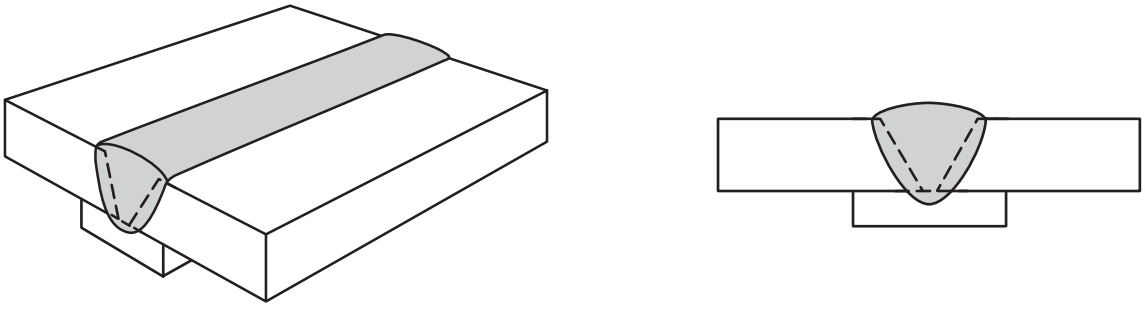
(A) SINGLE-SQUARE-GROOVE WELD



(B) SINGLE-BEVEL-GROOVE WELD

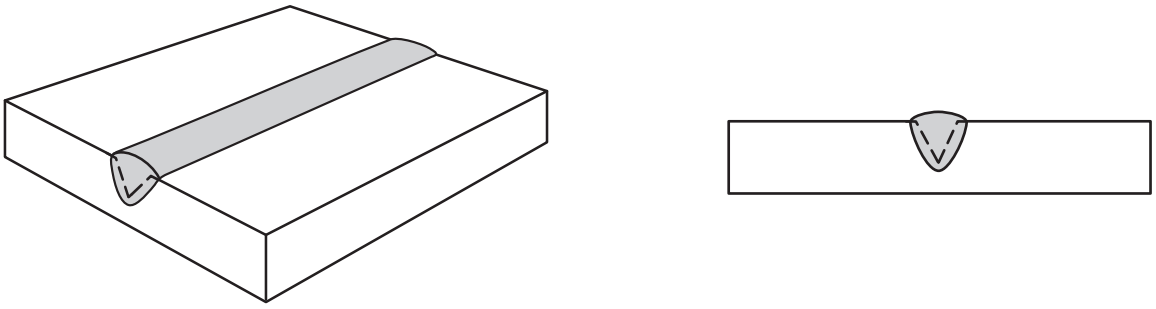


(C) SINGLE-V-GROOVE WELD

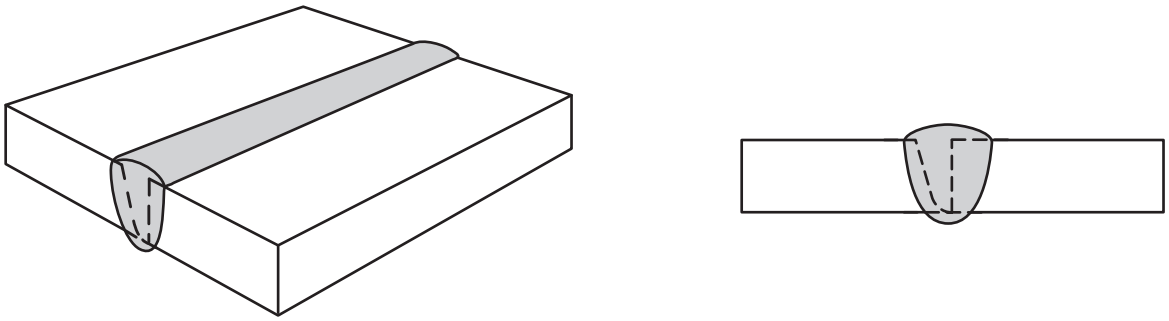


(D) SINGLE-V-GROOVE WELD WITH BACKING

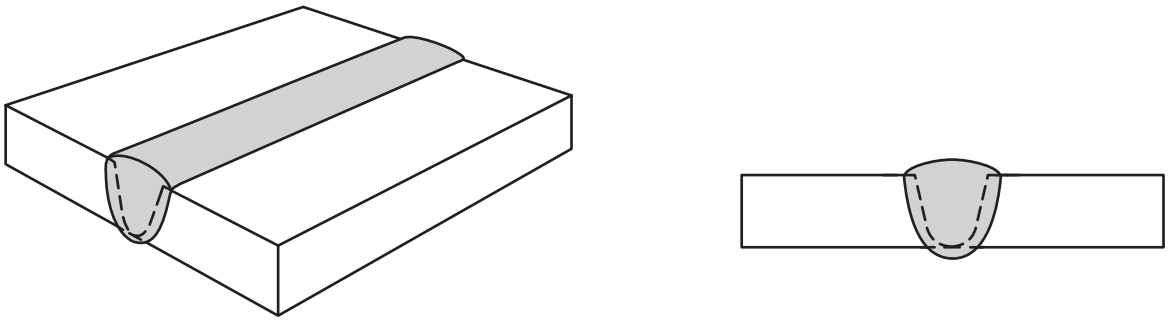
Figure B.8—Single-Groove Welds



(E) SINGLE-V-GROOVE WELD ON A SURFACE

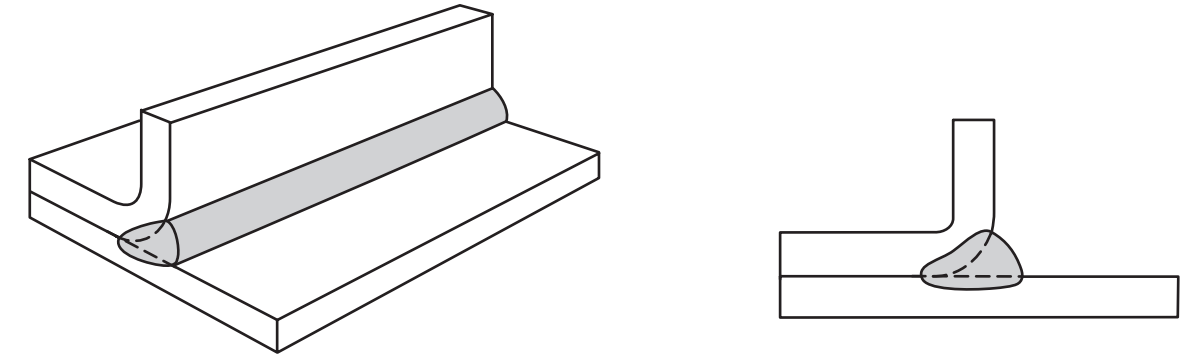


(F) SINGLE-J-GROOVE WELD

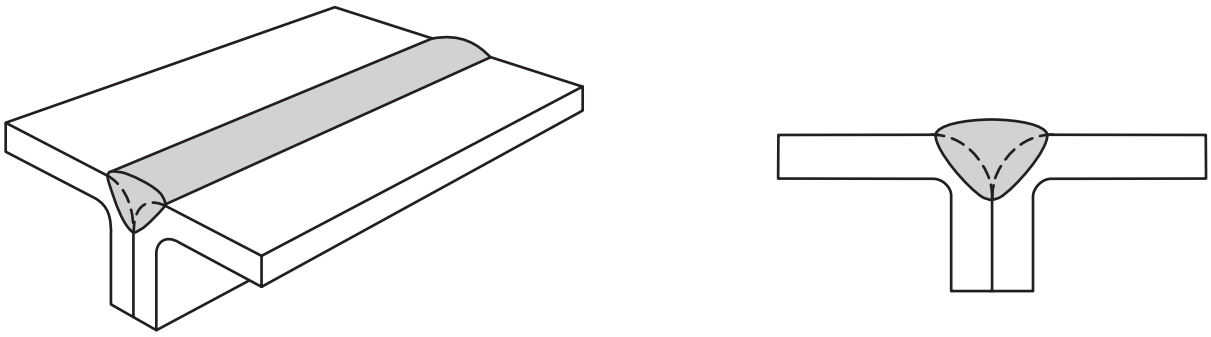


(G) SINGLE-U-GROOVE WELD

Figure B.8 (Continued)—Single-Groove Welds

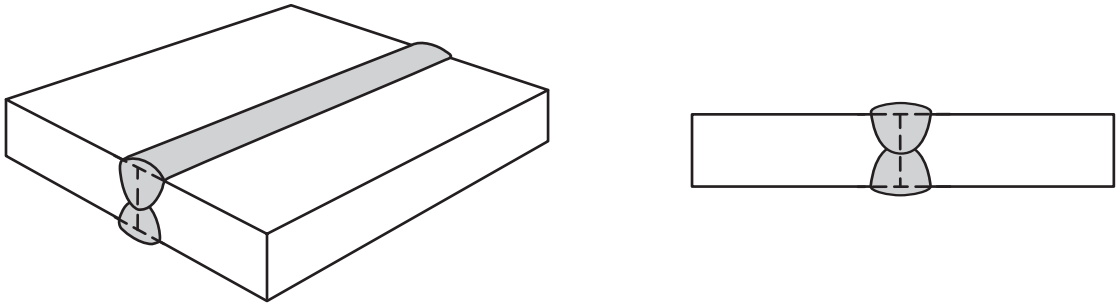


(H) SINGLE-FLARE-BEVEL-GROOVE WELD

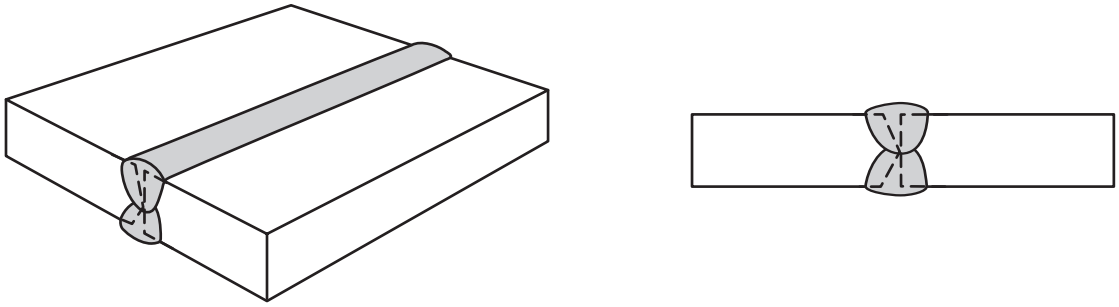


(I) SINGLE-FLARE-V-GROOVE WELD

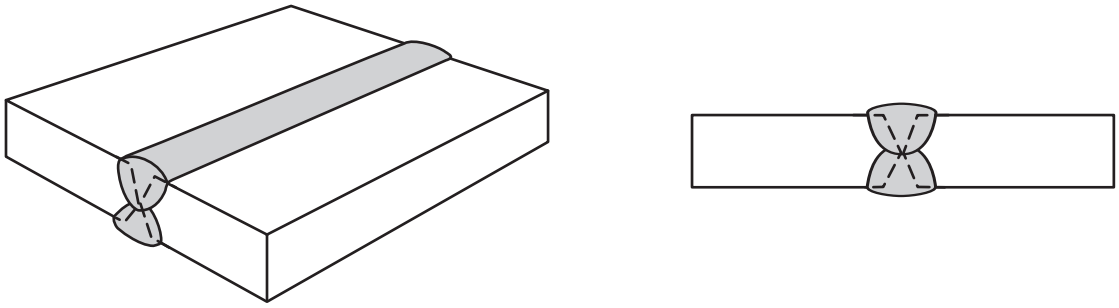
Figure B.8 (Continued)—Single-Groove Welds



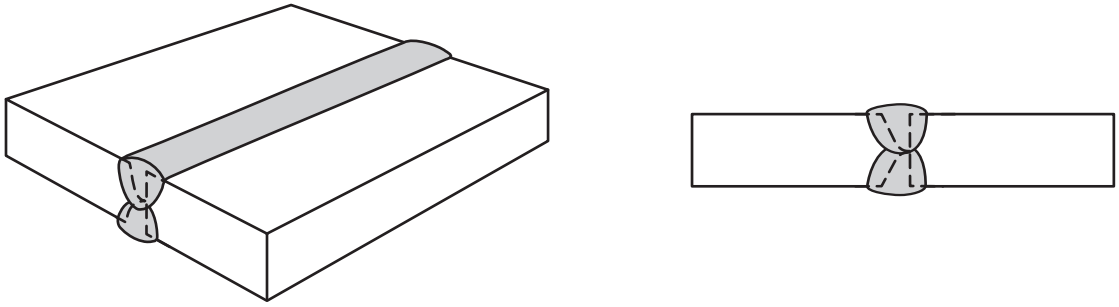
(A) DOUBLE-SQUARE-GROOVE WELD



(B) DOUBLE-BEVEL-GROOVE WELD

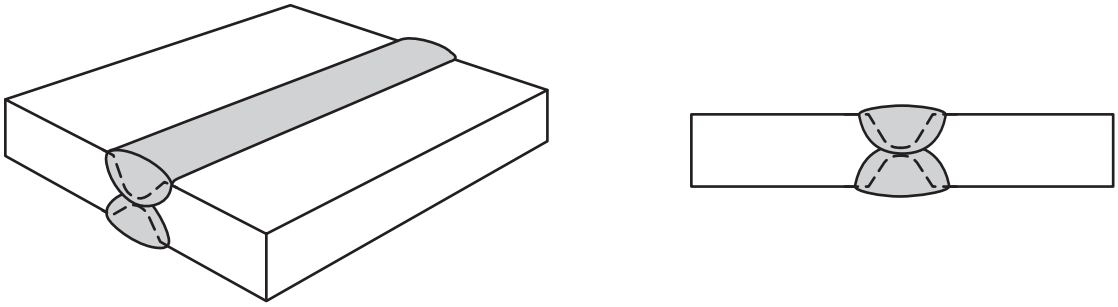


(C) DOUBLE-V-GROOVE WELD

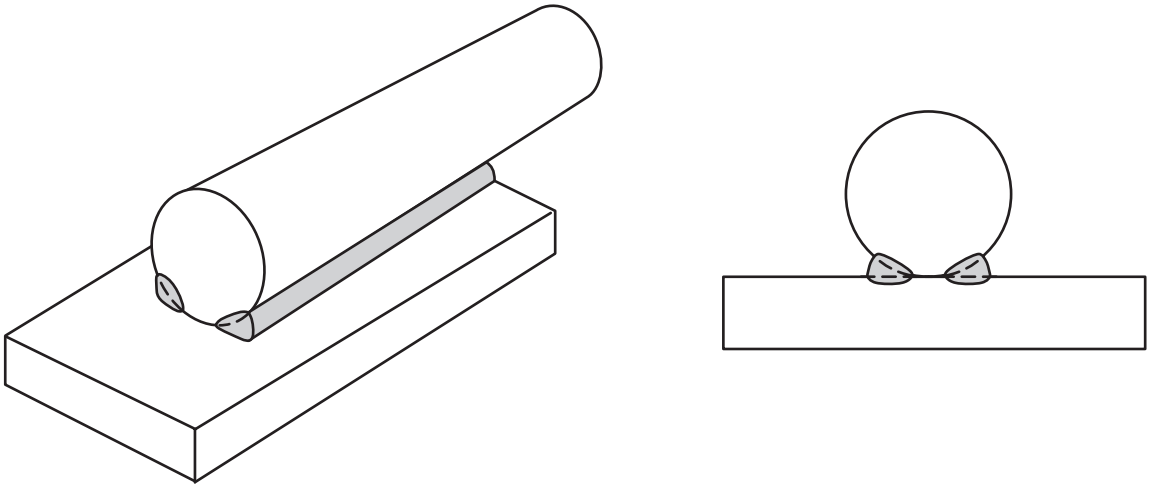


(D) DOUBLE-J-GROOVE WELD

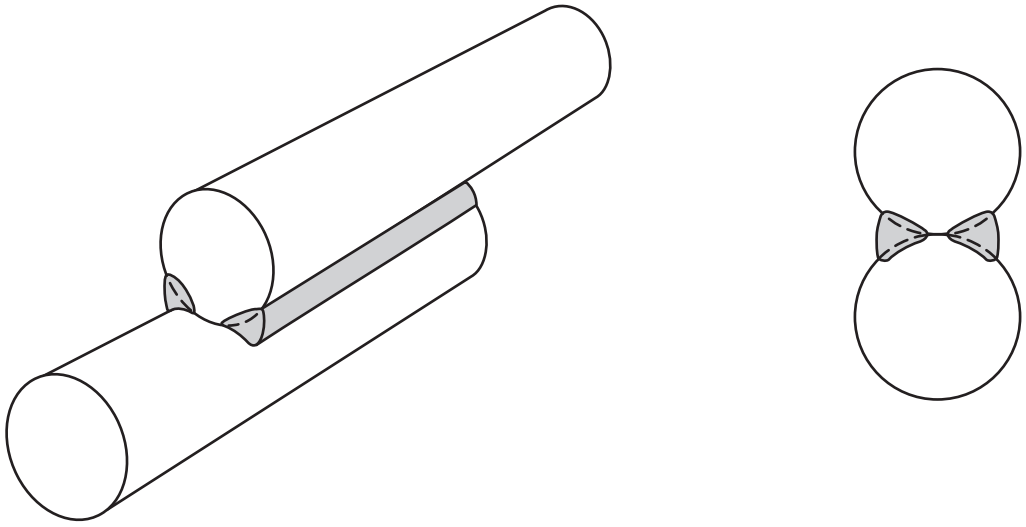
Figure B.9—Double-Groove Welds



(E) DOUBLE-U-GROOVE WELD

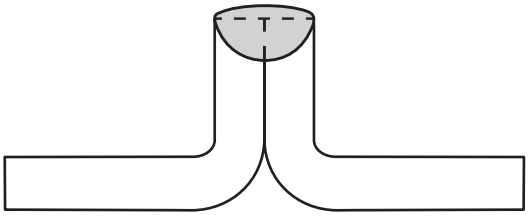


(F) DOUBLE-FLARE-BEVEL-GROOVE WELD

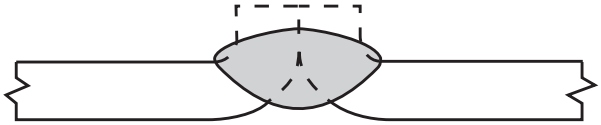


(G) DOUBLE-FLARE-V-GROOVE WELD

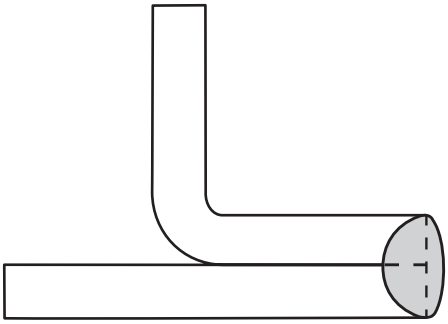
Figure B.9 (Continued)—Double-Groove Welds



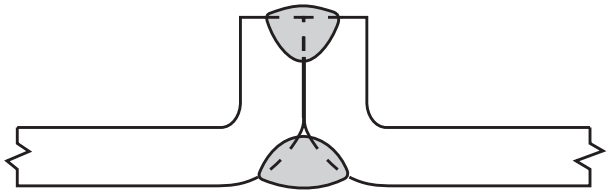
(A) EDGE WELD IN A FLANGED BUTT JOINT



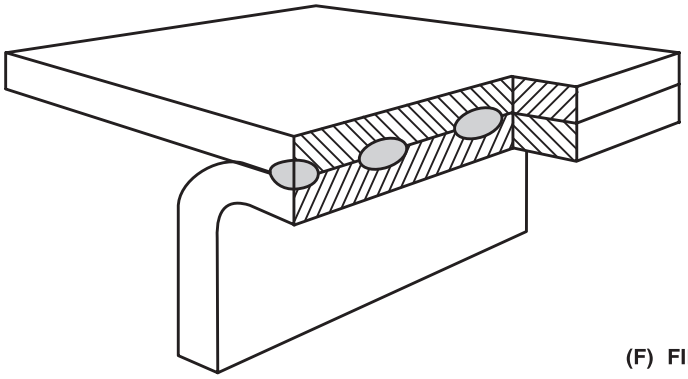
(B) EDGE WELD WITH MELT-THROUGH
IN A FLANGED BUTT JOINT



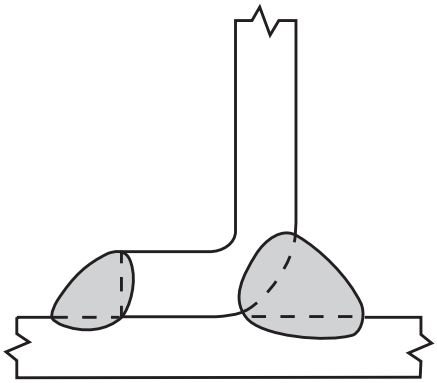
(C) EDGE WELD IN A FLANGED CORNER JOINT



(D) SQUARE-GROOVE WELD AND FLARE-V-GROOVE WELD
IN A FLANGED BUTT JOINT



(E) RESISTANCE SPOT WELDS
IN A FLANGED CORNER JOINT



(F) FILLET WELD AND FLARE-BEVEL-GROOVE WELD
IN A FLANGED T-JOINT

Figure B.10—Welds in Flanged Joints

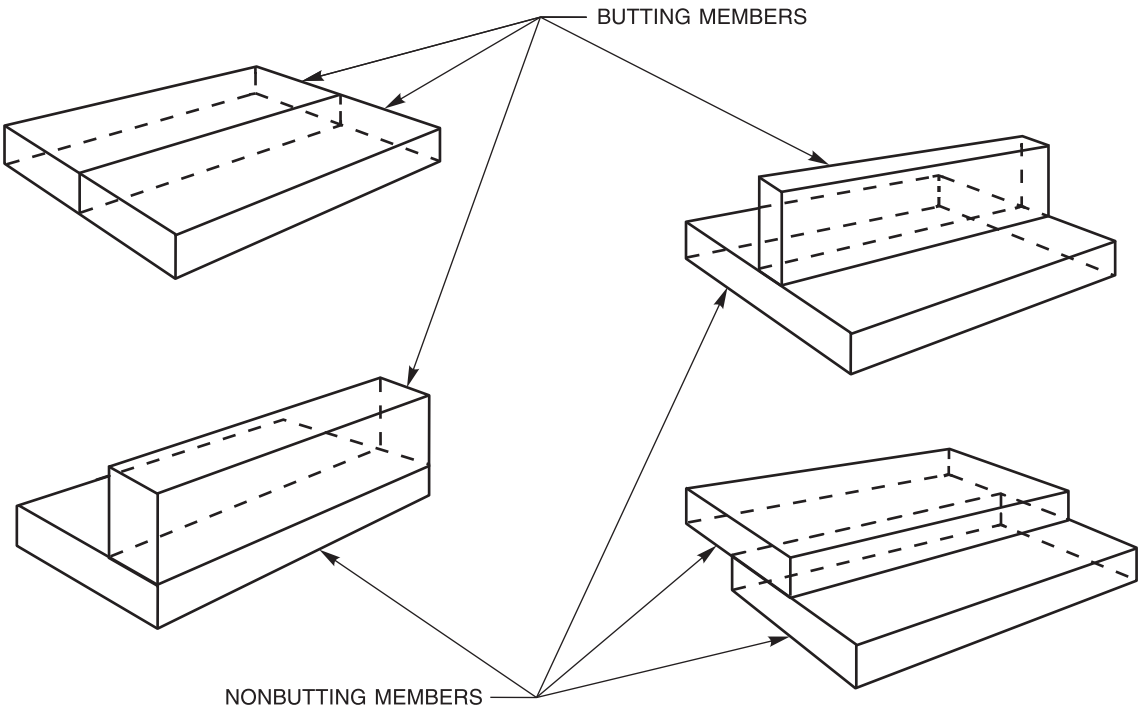


Figure B.11—Butting and Nonbutting Member or Members

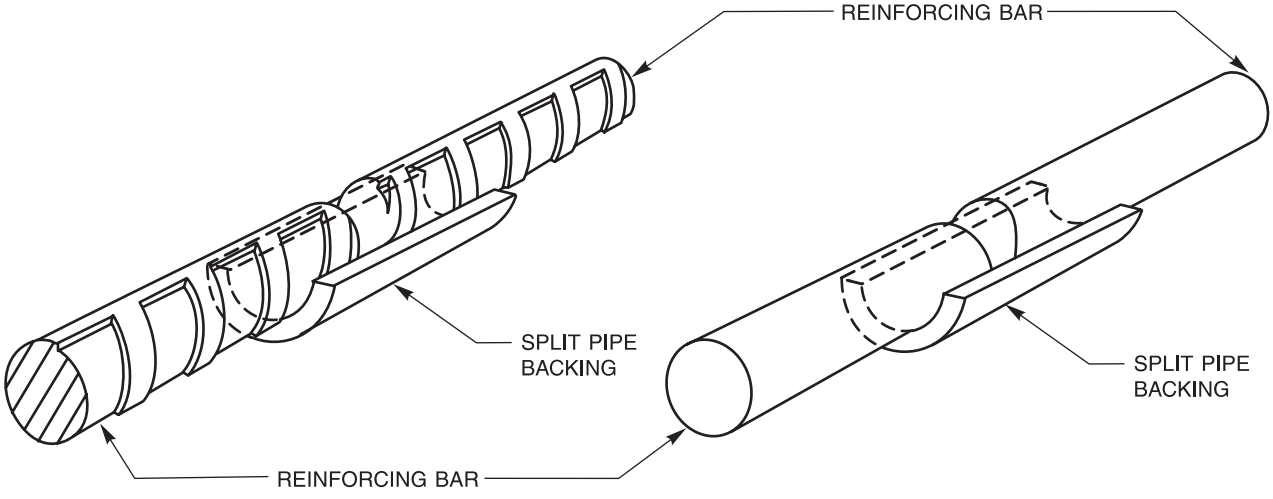


Figure B.12—Split Pipe Backing

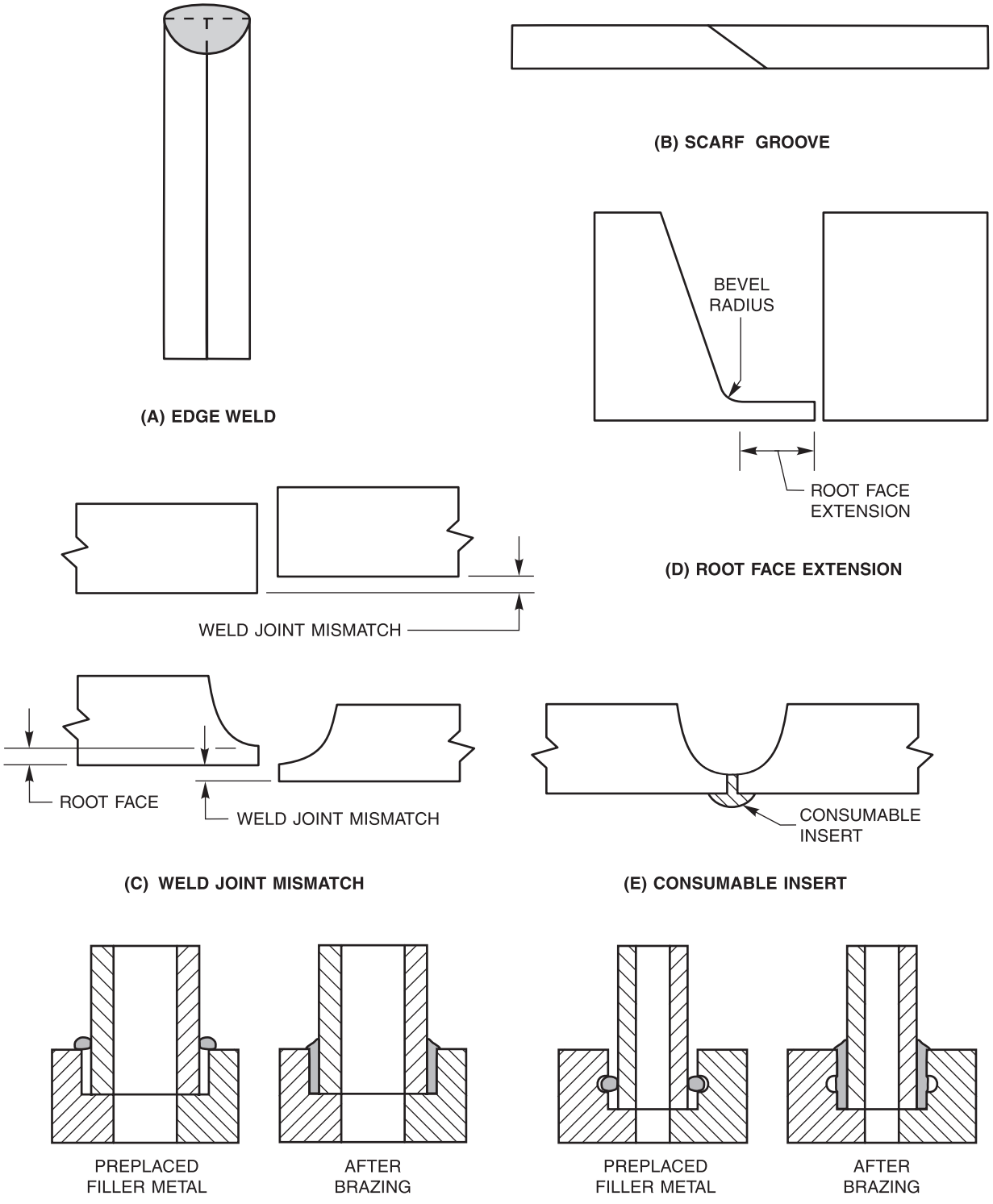


Figure B.13—Edge Weld, Scarf Groove, Weld Joint Mismatch, Root Face Extension, Consumable Insert, and Preplaced Filler Metal in a Brazed Joint

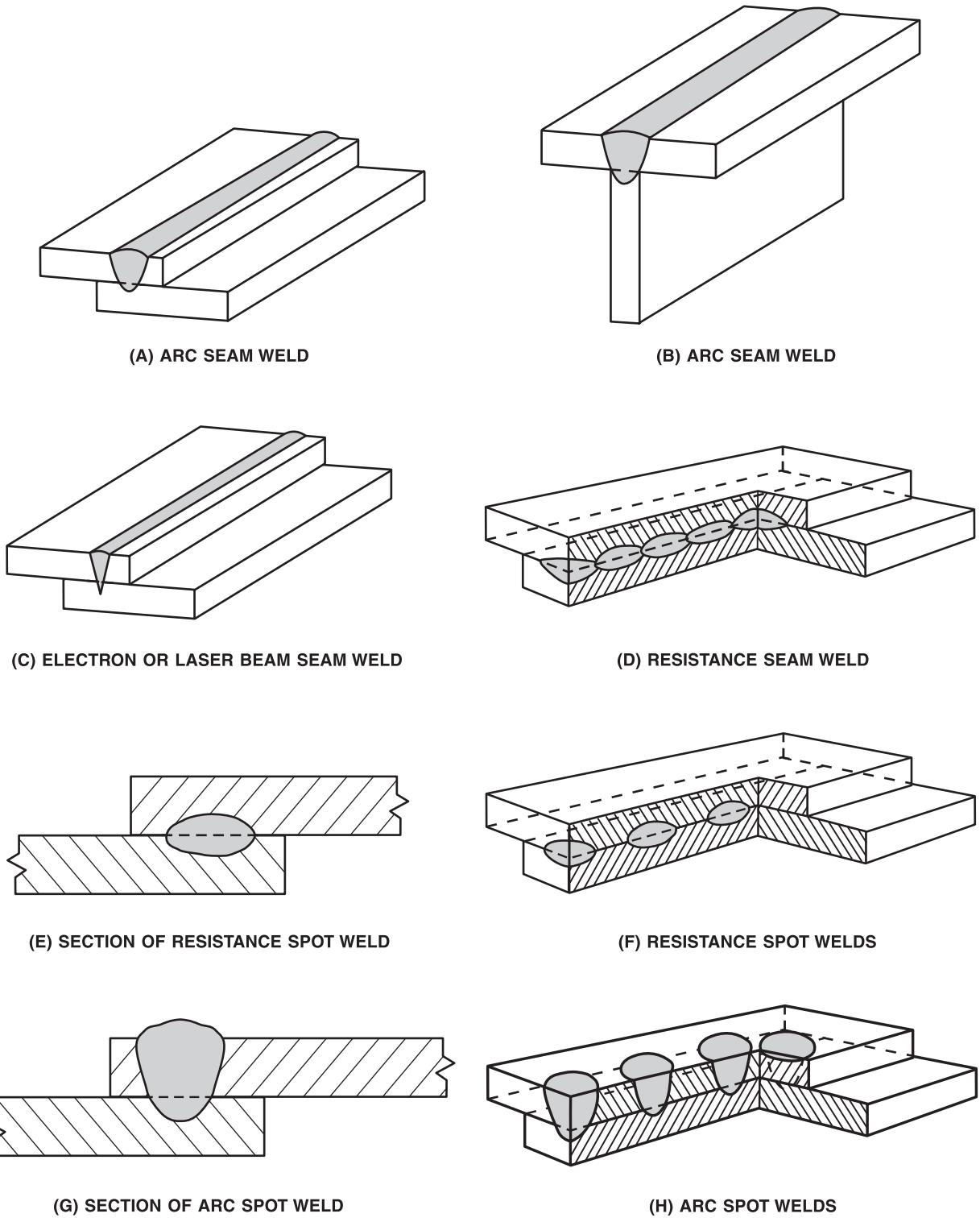


Figure B.14—Seam Welds and Spot Welds

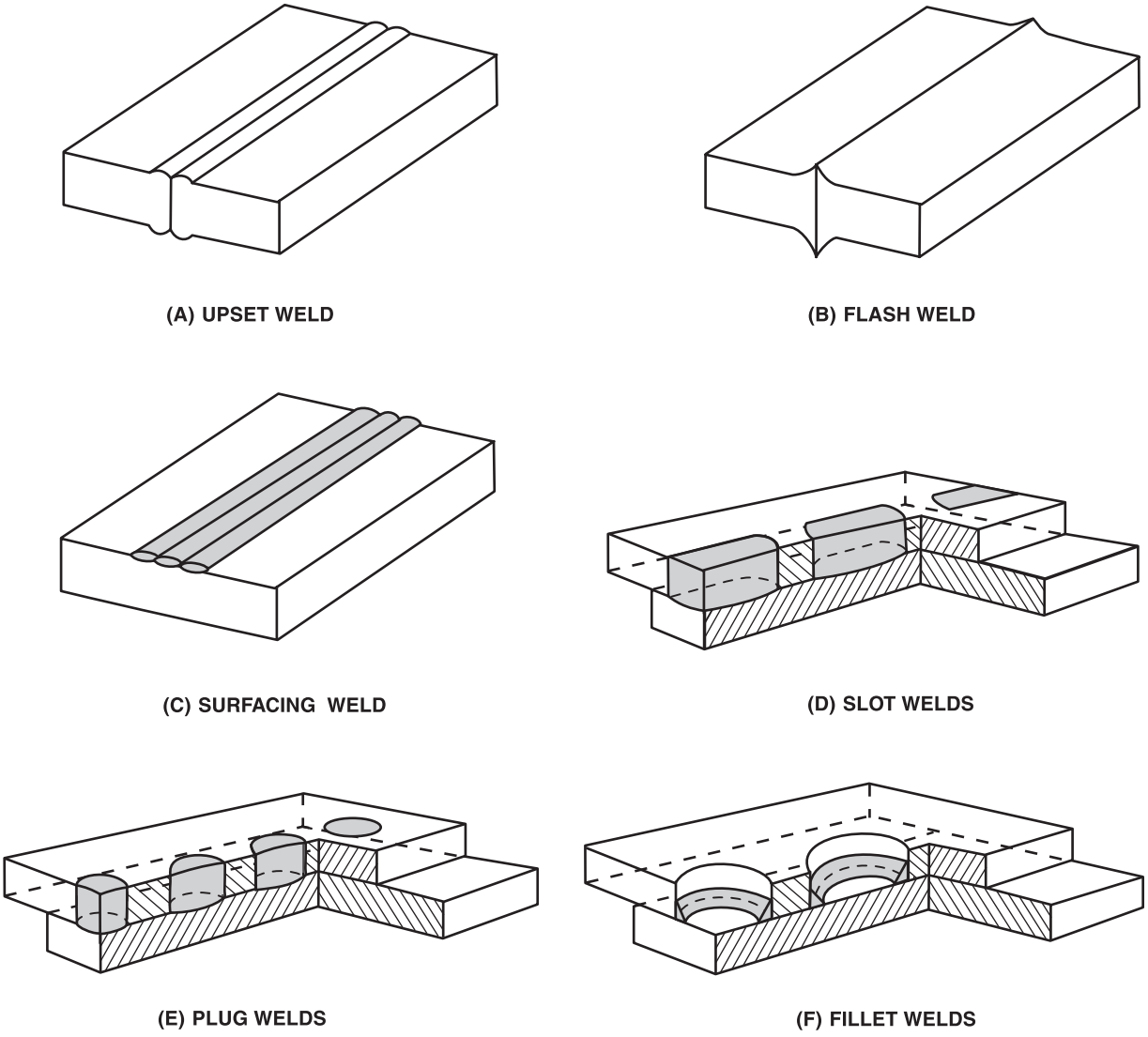
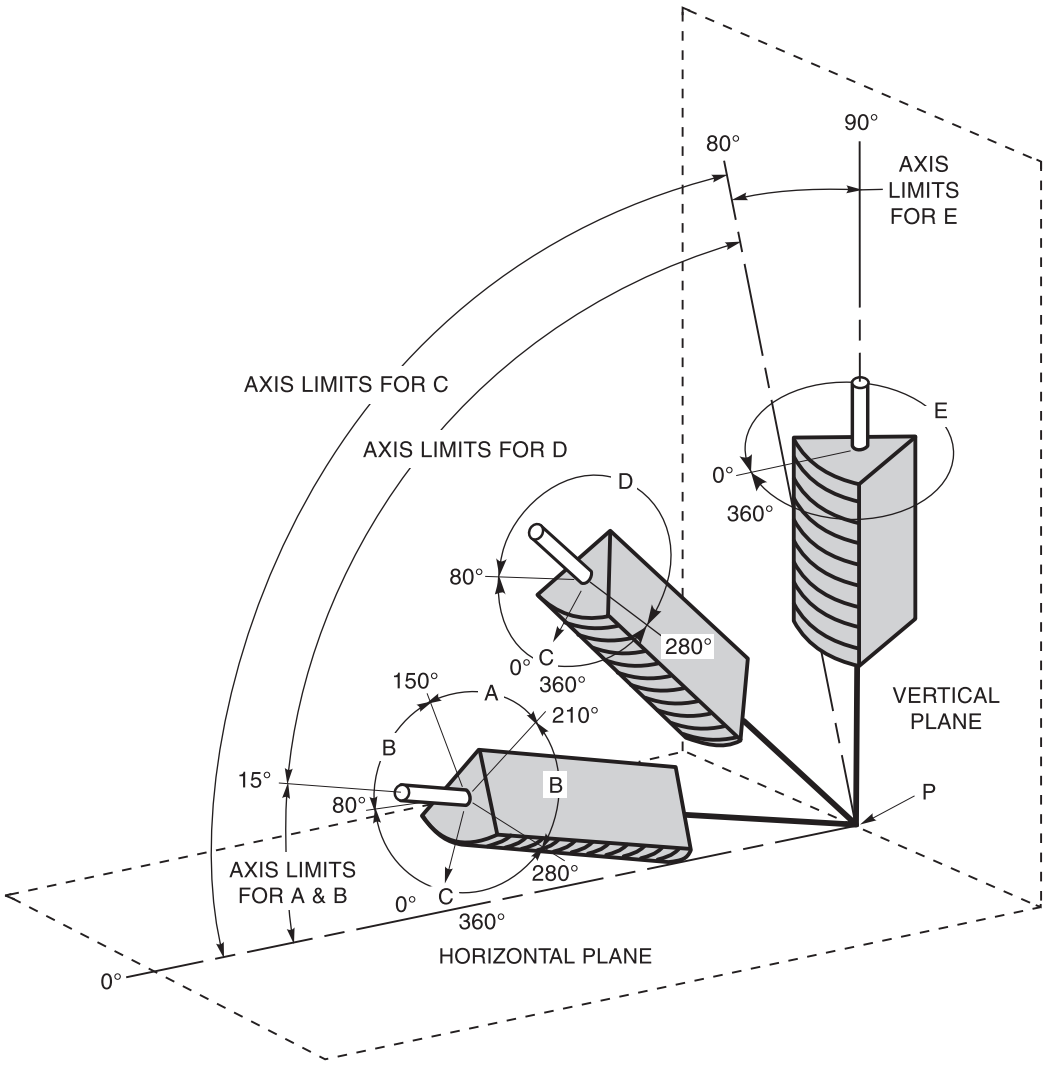


Figure B.15—Various Weld Types

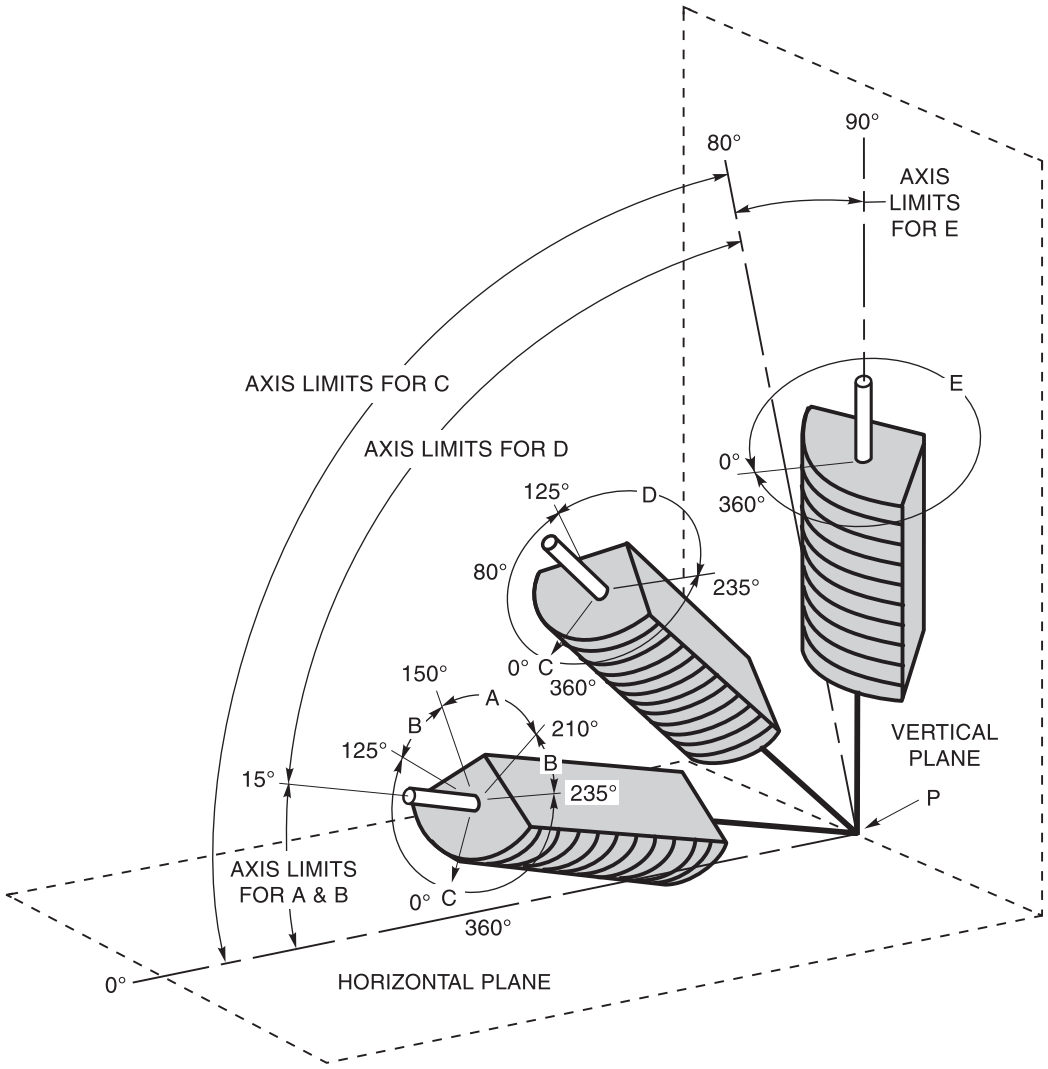
Tabulation of Positions of Groove Welds			
Position	Diagram Reference	Inclination of Axis	Rotation of Face
Flat	A	0° to 15°	150° to 210°
Horizontal	B	0° to 15°	80° to 150° 210° to 280°
Overhead	C	0° to 80°	0° to 80° 280° to 360°
Vertical	D E	15° to 80° 80° to 90°	80° to 280° 0° to 360°



Notes:
1. The horizontal reference plane is always taken to lie below the weld under consideration.
2. The inclination of the weld axis is measured from the horizontal reference plane toward the vertical reference plane.
3. The angle of rotation of the weld face is determined by a line perpendicular to the weld face which passes through the weld axis. The reference position (0°) of rotation of the weld face invariably points in the direction opposite to that in which the axis angle increases. When looking at point P, the angle of rotation of the weld face is measured in a clockwise direction from the reference position (0°).

Figure B.16A—Welding Position Diagram for Groove Welds in Plate

Tabulation of Positions of Fillet Welds			
Position	Diagram Reference	Inclination of Axis	Rotation of Face
Flat	A	0° to 15°	150° to 210°
Horizontal	B	0° to 15°	125° to 150° 210° to 235°
Overhead	C	0° to 80°	0° to 125° 235° to 360°
Vertical	D E	15° to 80° 80° to 90°	125° to 235° 0° to 360°



Notes:
1. The horizontal reference plane is always taken to lie below the weld under consideration.
2. The inclination of the weld axis is measured from the horizontal reference plane toward the vertical reference plane.
3. The angle of rotation of the weld face is determined by a line perpendicular to the weld face which passes through the weld axis. The reference position (0°) of rotation of the weld face invariably points in the direction opposite to that in which the axis angle increases. When looking at point P, the angle of rotation of the weld face is measured in a clockwise direction from the reference position (0°).

Figure B.16B—Welding Position Diagram for Fillet Welds in Plate

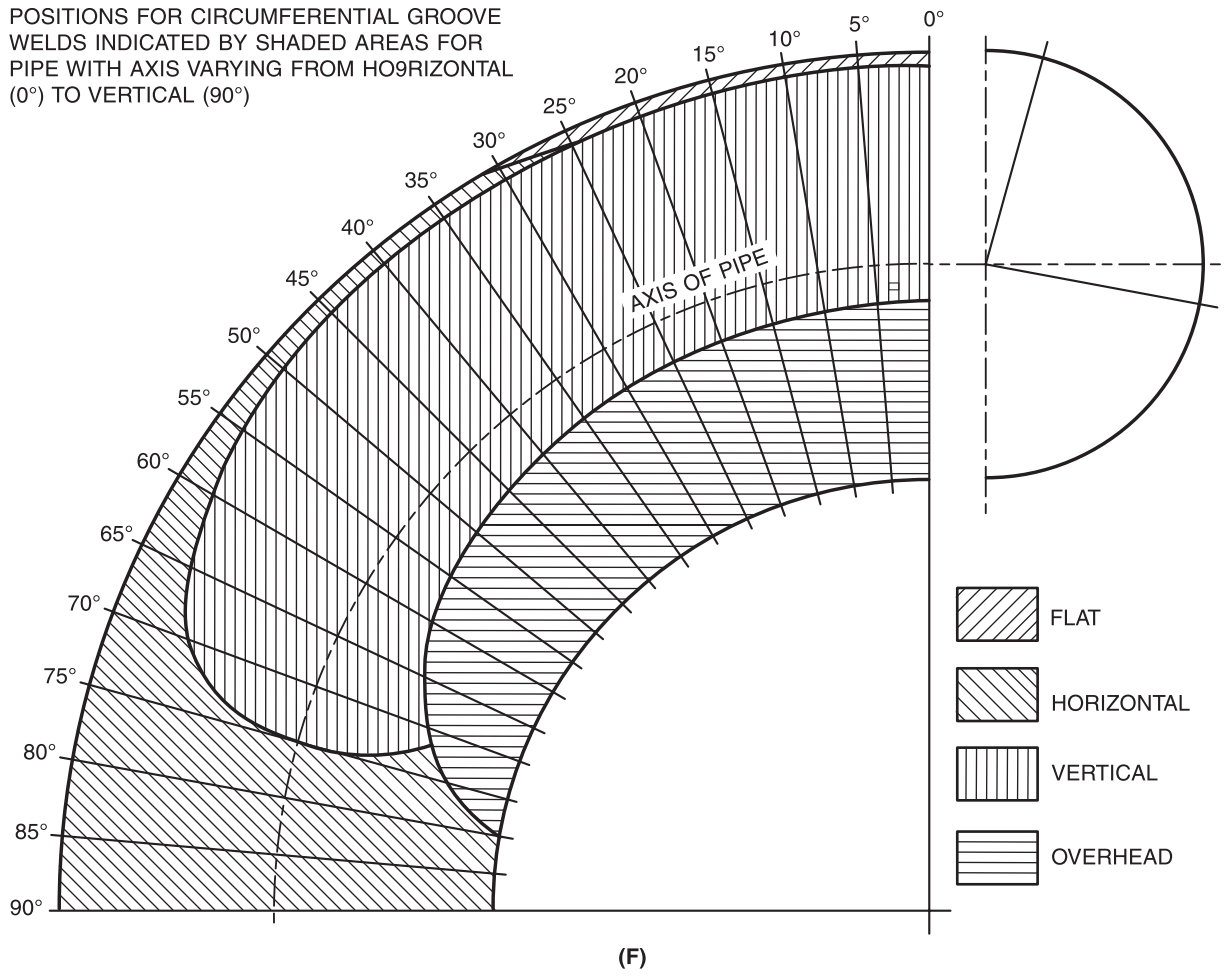
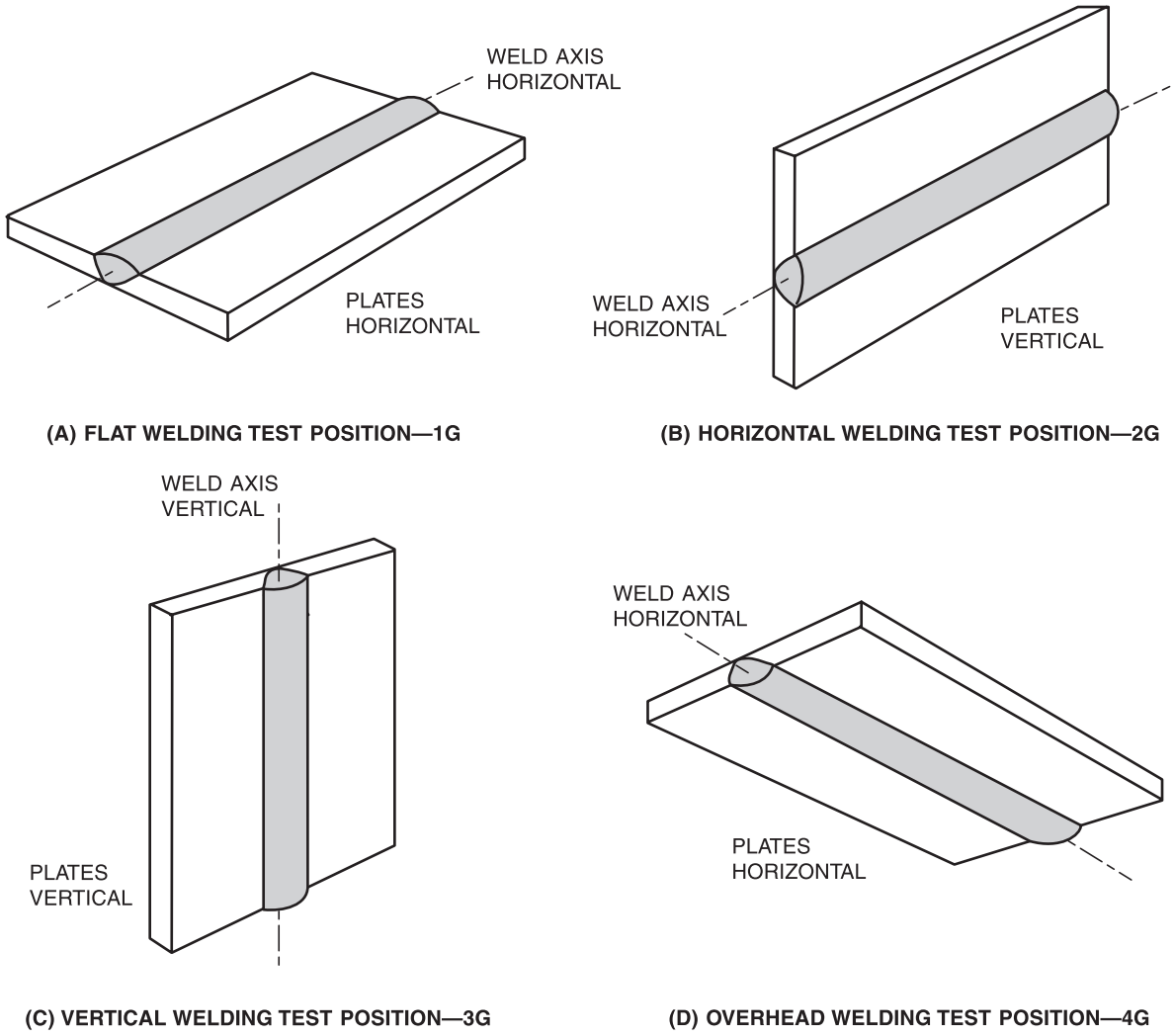


Figure B.16C—Welding Position Diagram for Groove Welds in Pipe



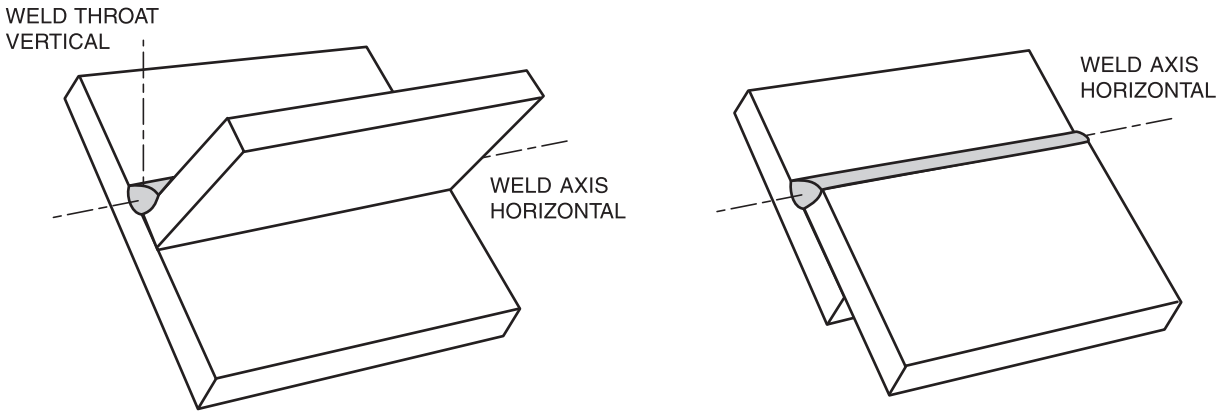
(A) FLAT WELDING TEST POSITION—1G

(B) HORIZONTAL WELDING TEST POSITION—2G

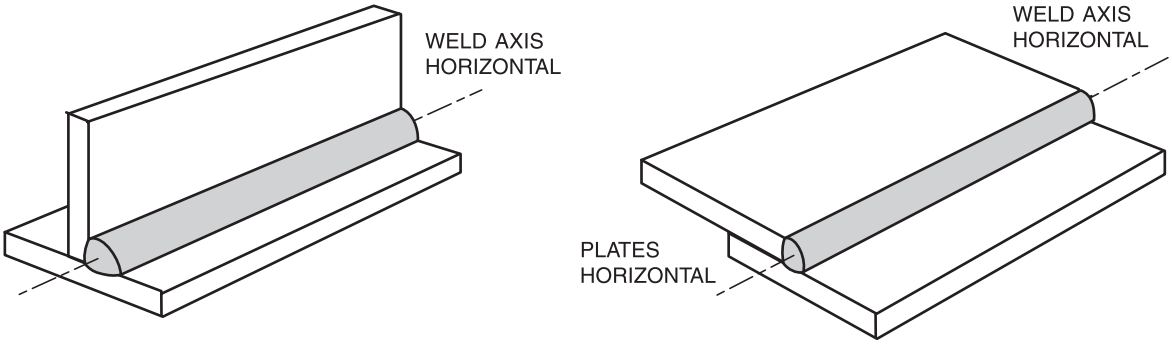
(C) VERTICAL WELDING TEST POSITION—3G

(D) OVERHEAD WELDING TEST POSITION—4G

Figure B.17—Welding Test Positions and Their Designations for Groove Welds in Plate



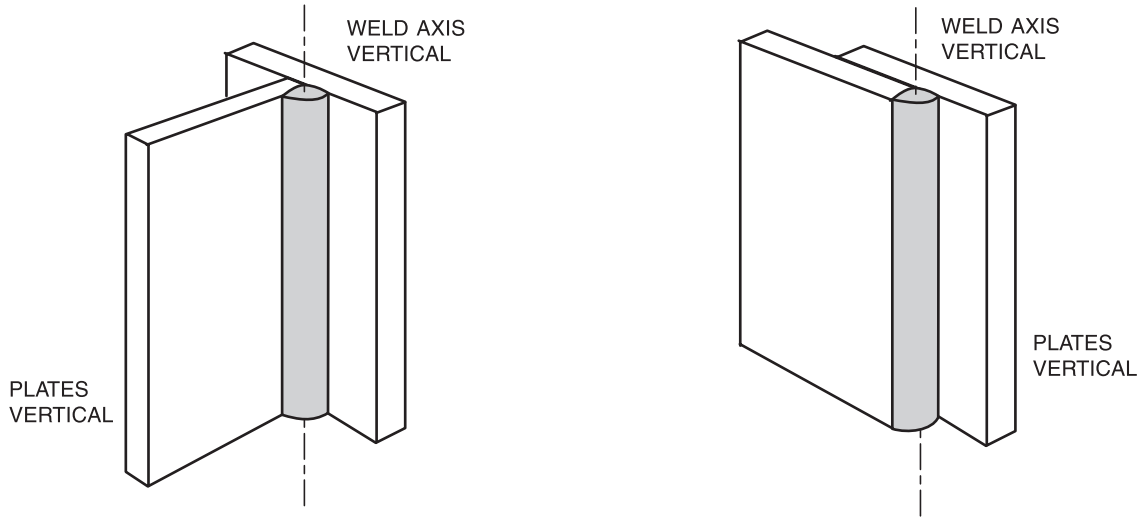
(A) FLAT WELDING TEST POSITION—1F



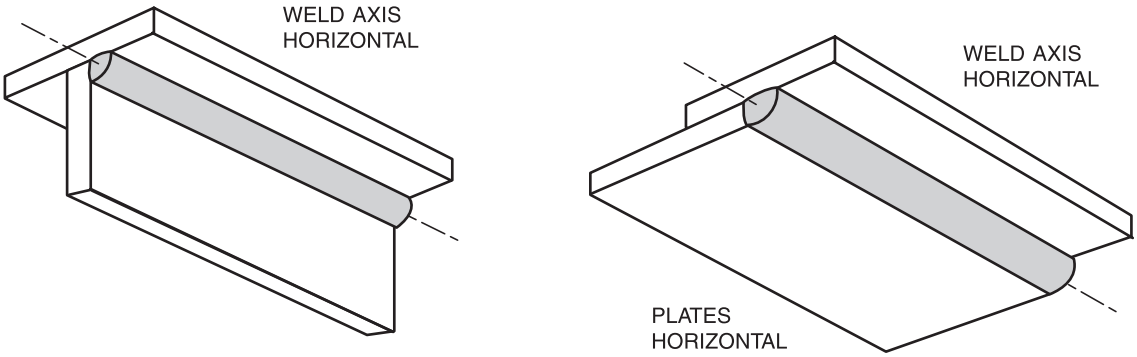
Note: One plate must be horizontal.

(B) HORIZONTAL WELDING TEST POSITION—2F

Figure B.18—Welding Test Positions and Their Designations for Fillet Welds in Plate



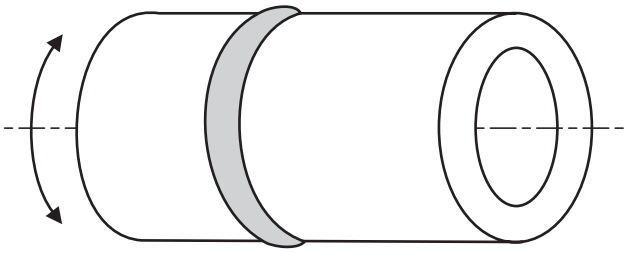
(C) VERTICAL WELDING TEST POSITION—3F



Note: One plate must be horizontal.

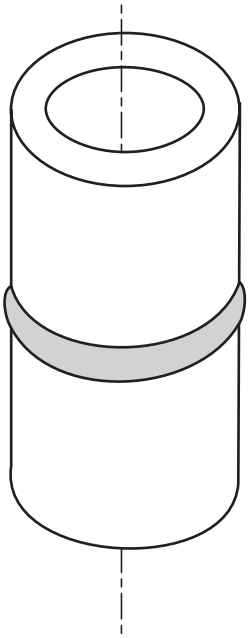
(D) OVERHEAD WELDING TEST POSITION—4F

Figure B.18 (Continued)—Welding Test Positions and Their Designations for Fillet Welds in Plate



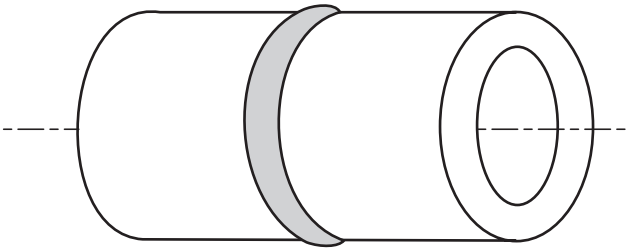
PIPE HORIZONTAL AND ROTATED.
WELD FLAT. DEPOSIT FILLER METAL
AT OR NEAR THE TOP.

(A) FLAT WELDING TEST POSITION—1G



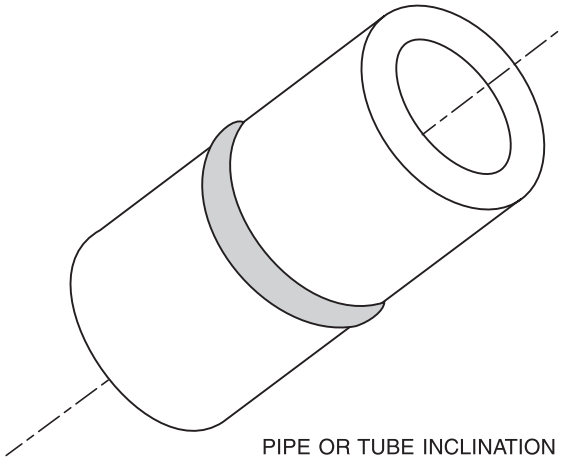
PIPE OR TUBE VERTICAL AND
NOT ROTATED DURING WELDING.
WELD HORIZONTAL.

(B) HORIZONTAL WELDING TEST POSITION—2G



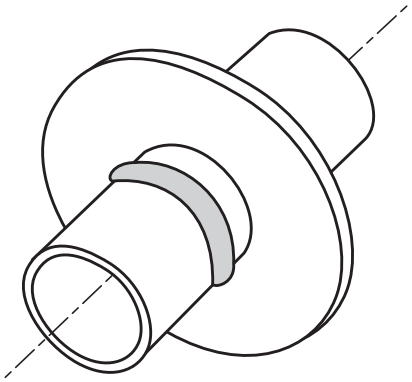
PIPE HORIZONTAL AND FIXED.
WELD FLAT, VERTICAL, AND OVERHEAD.

(C) MULTIPLE WELDING TEST POSITION—5G



PIPE OR TUBE INCLINATION
FIXED AND NOT ROTATED
DURING WELDING.

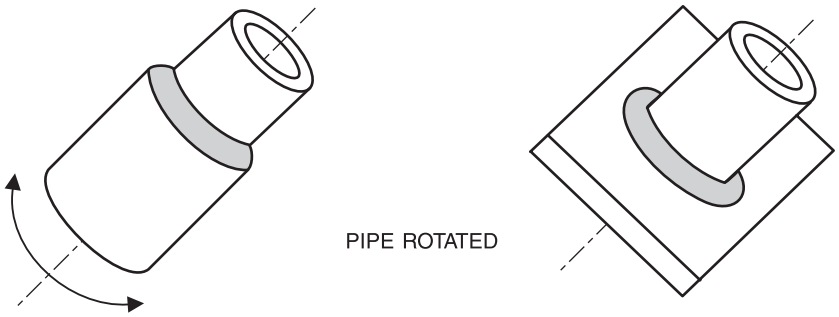
(D) MULTIPLE WELDING TEST POSITION—6G



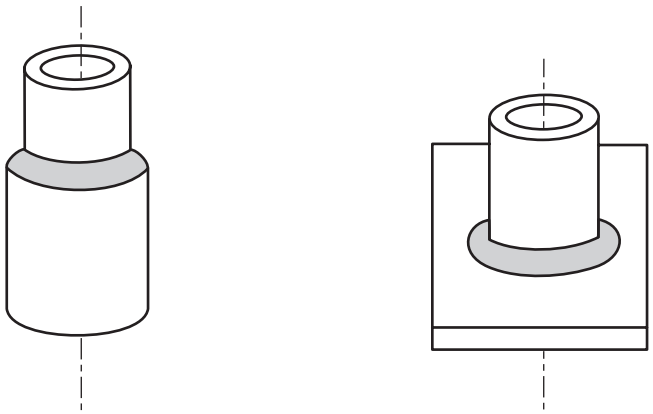
PIPE OR TUBE INCLINATION FIXED
AND NOT ROTATED DURING WELDING.

**(E) MULTIPLE WELDING TEST POSITION
WITH RESTRICTION RING—6GR**

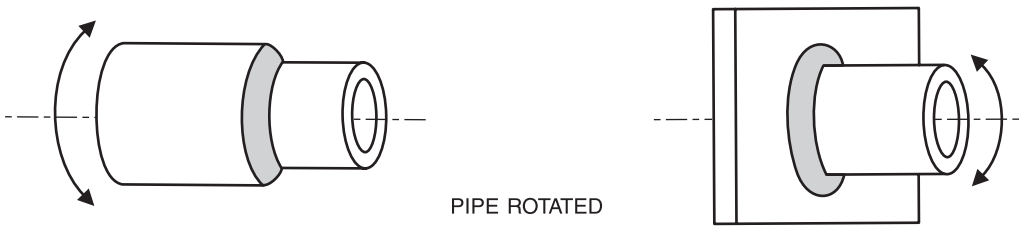
Figure B.19—Welding Test Positions and Their Designations for Groove Welds in Pipe



(A) FLAT WELDING TEST POSITION—1F

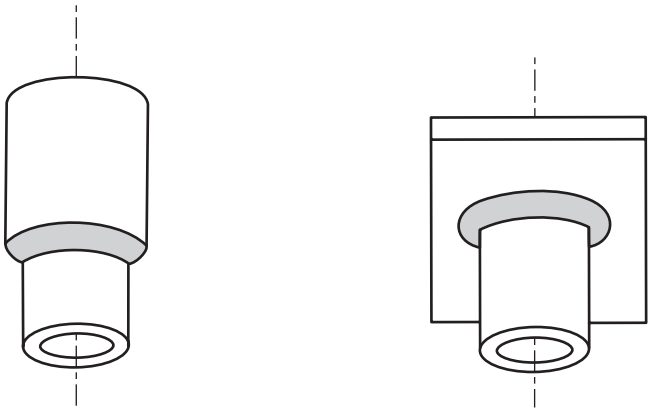


(B) HORIZONTAL WELDING TEST POSITION—2F



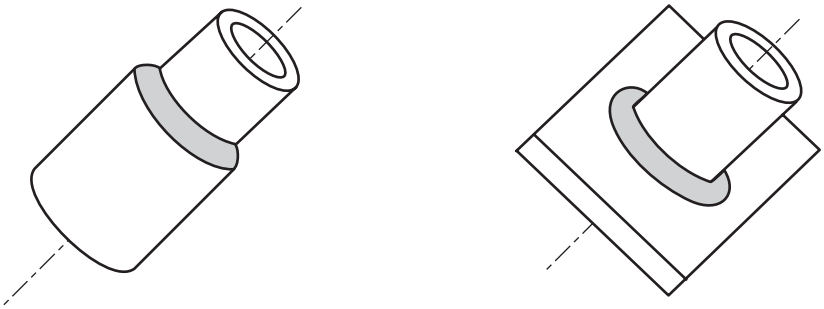
(C) HORIZONTAL WELDING TEST POSITION—2FR

Figure B.20—Welding Test Positions and Their Designations for Fillet Welds in Pipe



(D) OVERHEAD WELDING TEST POSITION—4F

(E) MULTIPLE WELDING TEST POSITION—5F



(F) MULTIPLE WELDING TEST POSITION—6F

Figure B.20 (Continued)—Welding Test Positions and Their Designations for Fillet Welds in Pipe

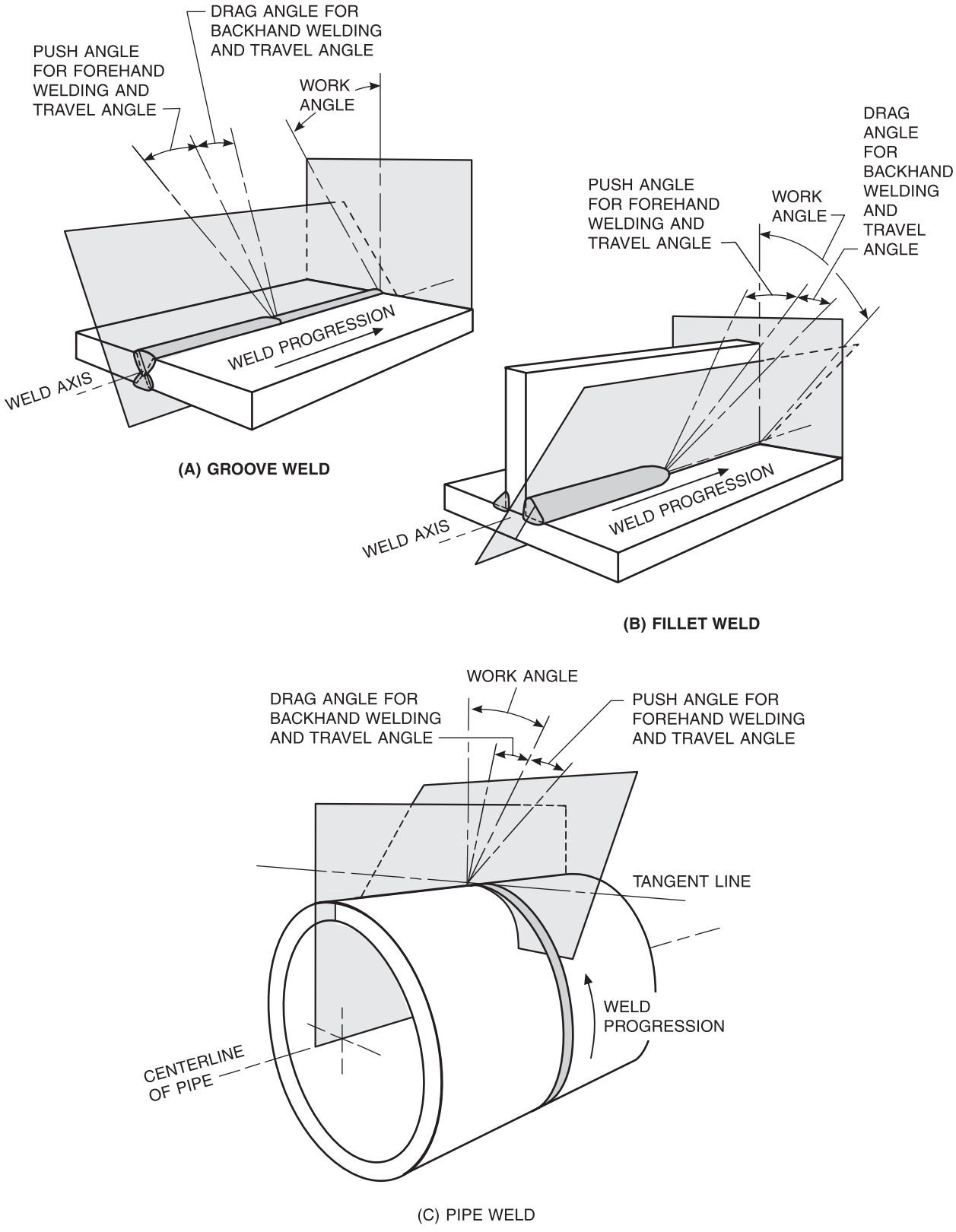
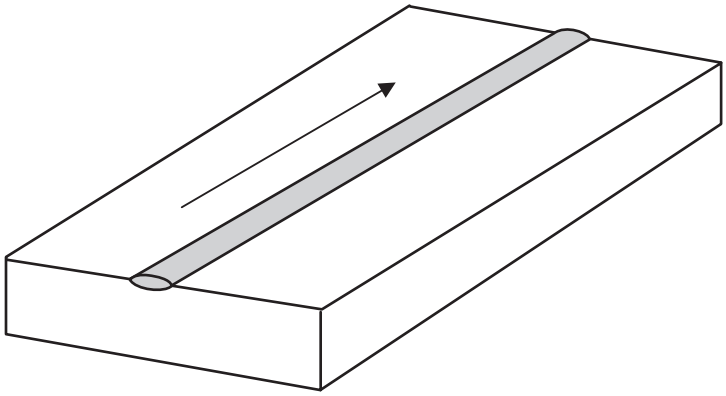
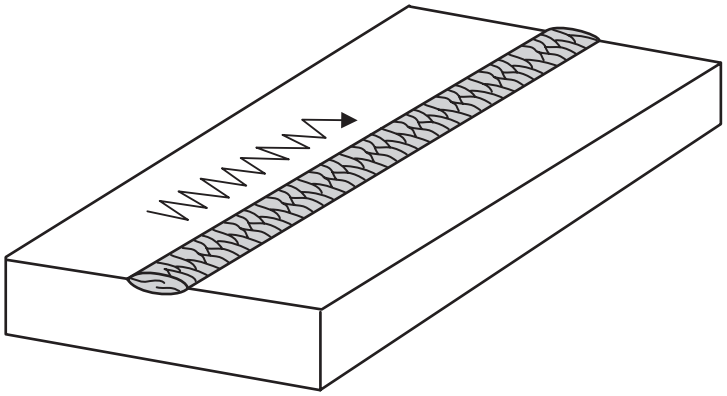


Figure B.21—Position of Beam, Filler Material, Gun, or Torch



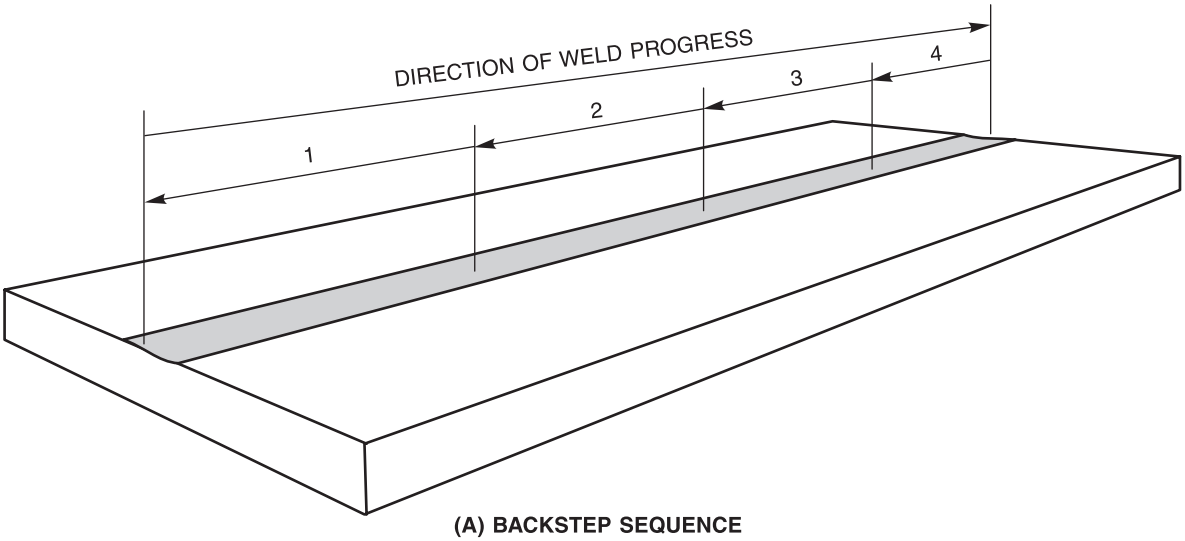
(A) STRINGER BEAD



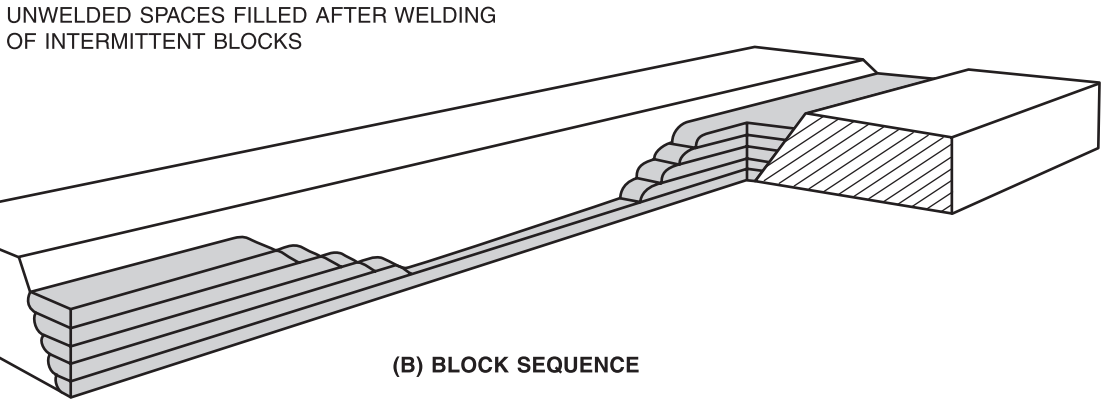
(B) WEAVE BEAD

Note: The arrows adjacent to the weld beads indicate the approximate motion of the electrode, flame, or other energy source relative to the workpiece.

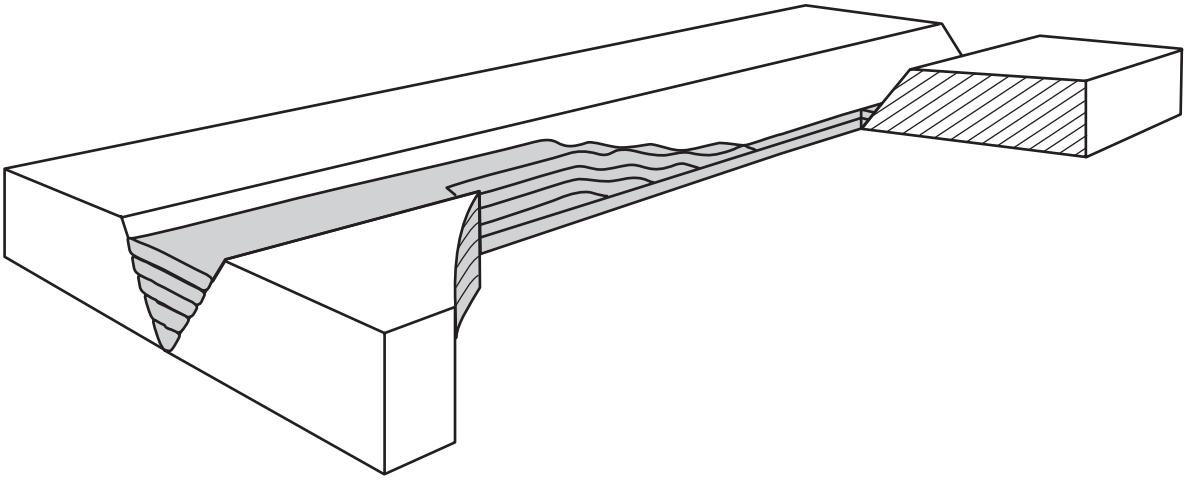
Figure B.22—Weld Bead Types



(A) BACKSTEP SEQUENCE

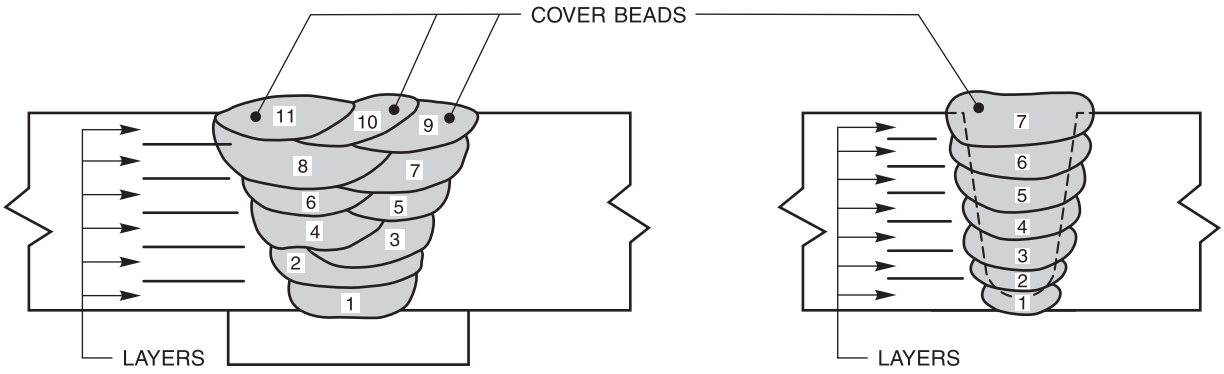


(B) BLOCK SEQUENCE



(C) CASCADE SEQUENCE

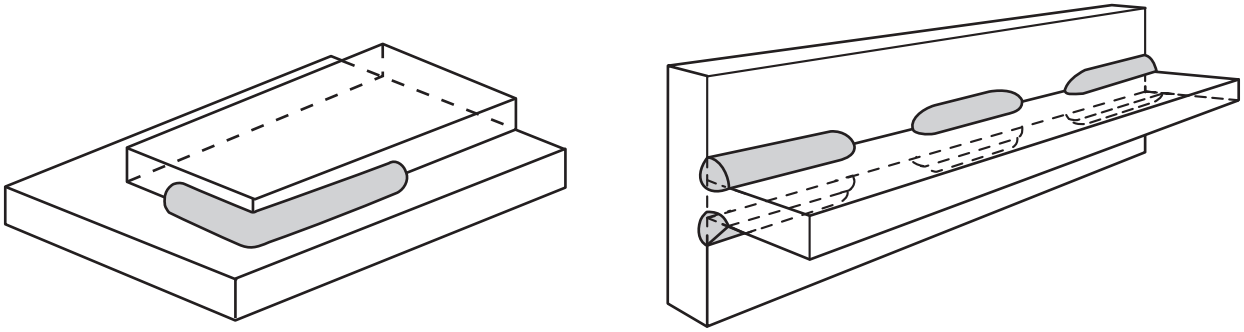
Figure B.23—Welding Application Nomenclature



(D) CROSS-SECTIONAL SEQUENCE*

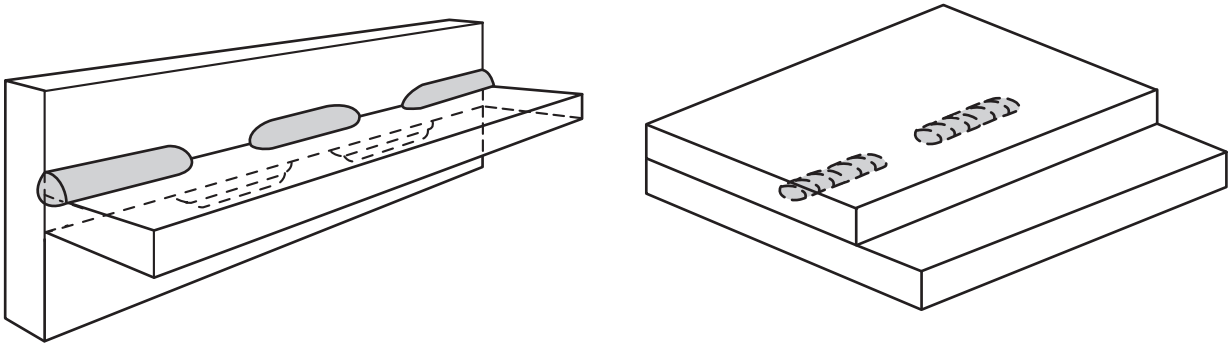
(E) CROSS-SECTIONAL SEQUENCE*

*Each weld bead is numbered sequentially.



(F) BOXING

(G) CHAIN INTERMITTENT FILLET WELD



(H) STAGGERED INTERMITTENT FILLET WELD

(I) INTERMITTENT SEAM WELD

Figure B.23 (Continued)—Welding Application Nomenclature

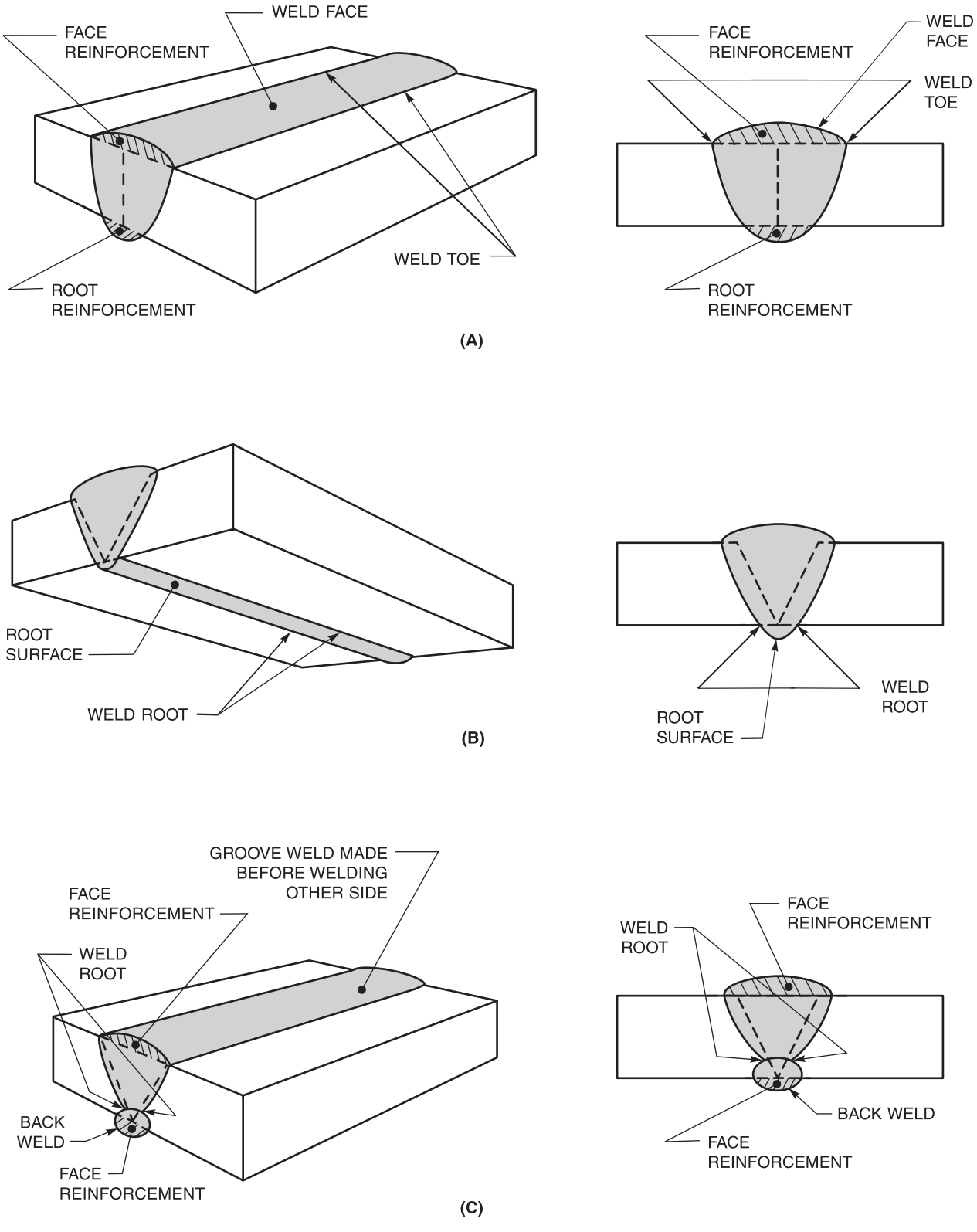


Figure B.24—Parts of a Weld

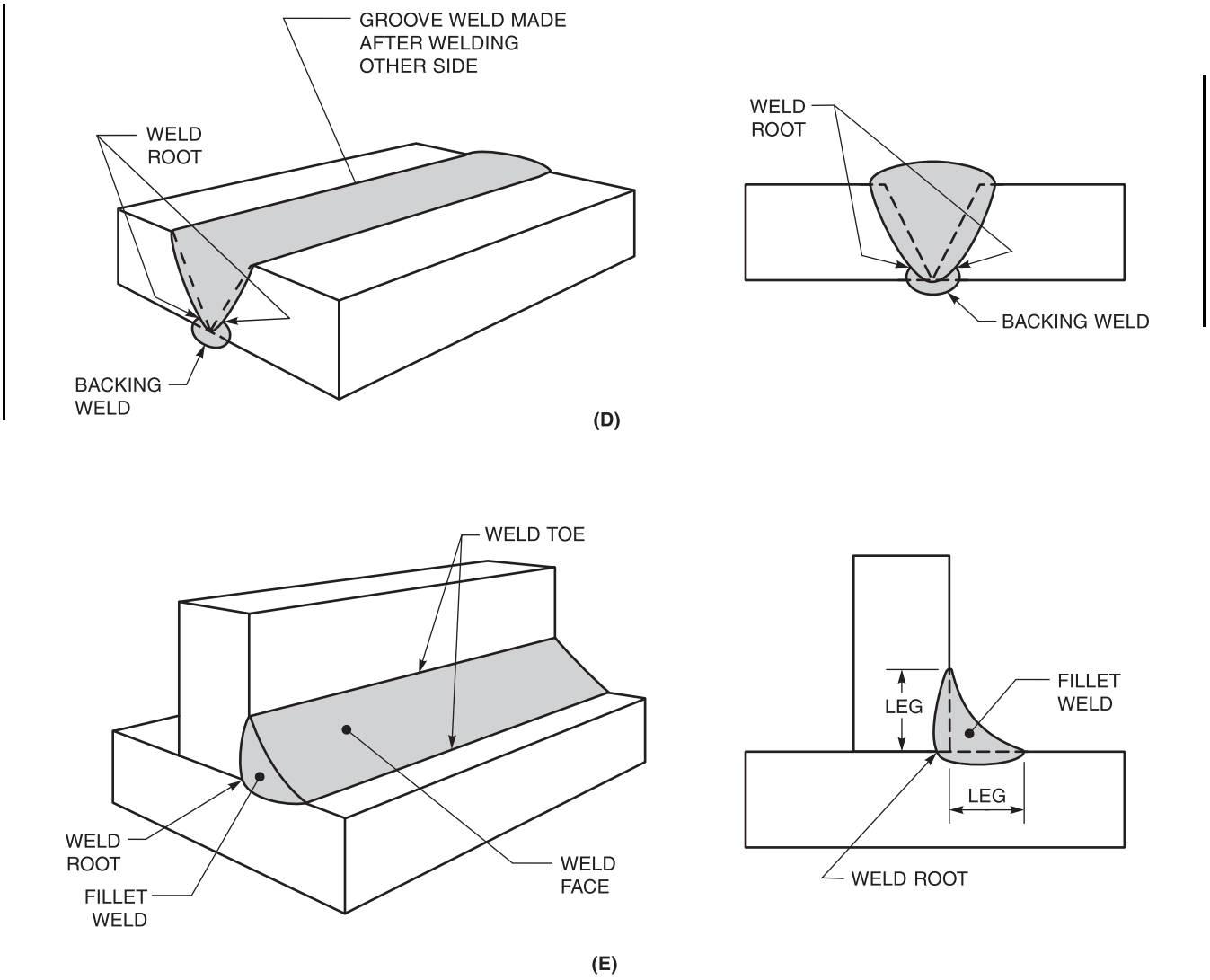
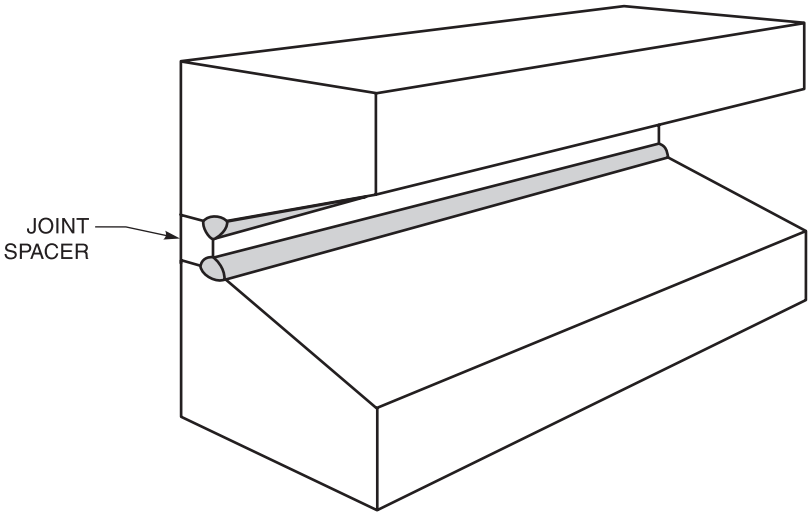
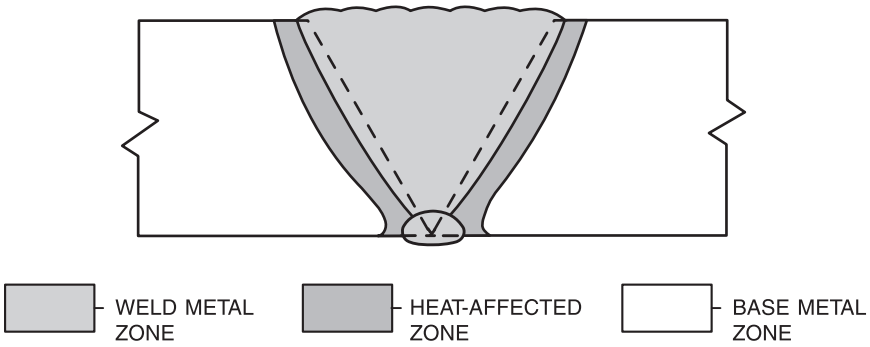


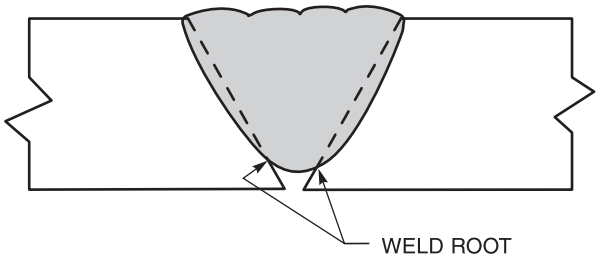
Figure B.24 (Continued)—Parts of a Weld



(F)

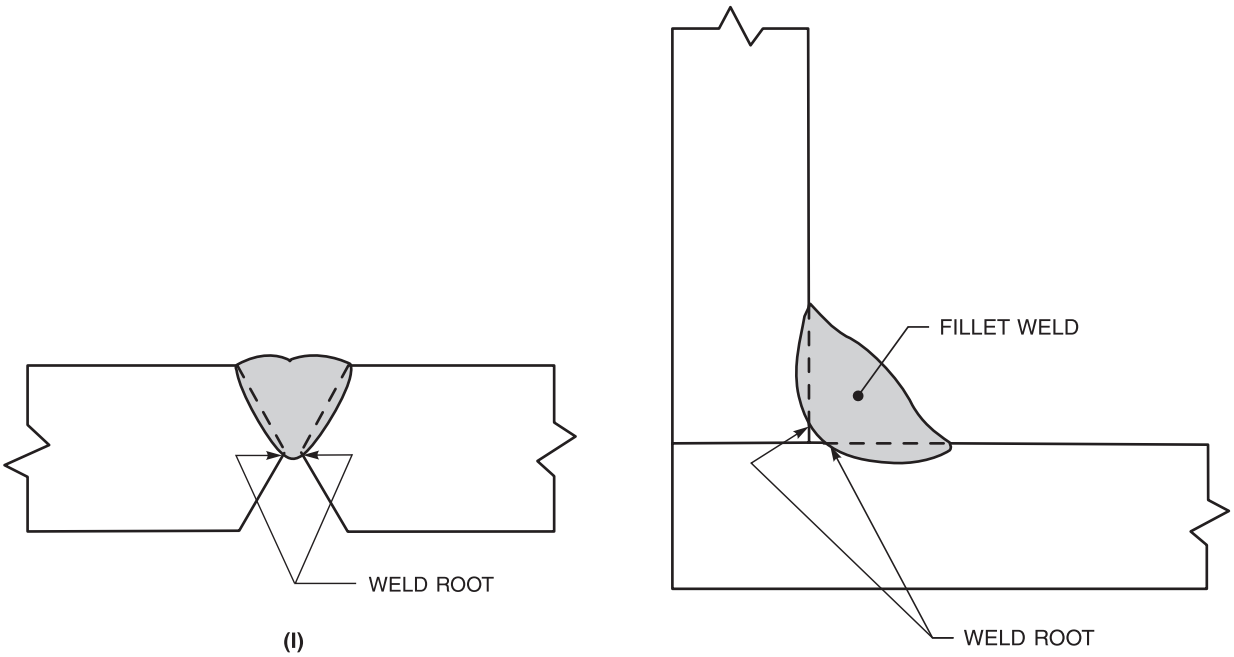


(G)

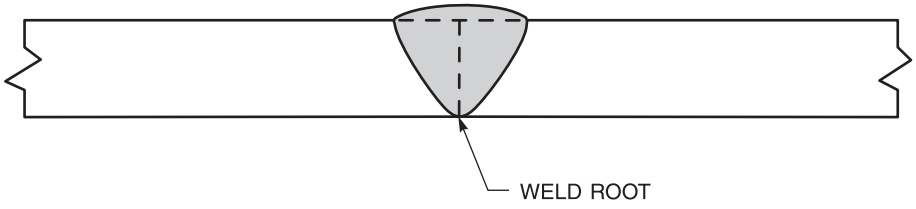


(H)

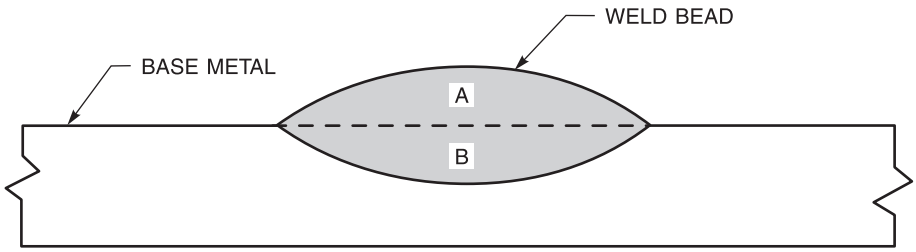
Figure B.24 (Continued)—Parts of a Weld



(I) (J)



(K)

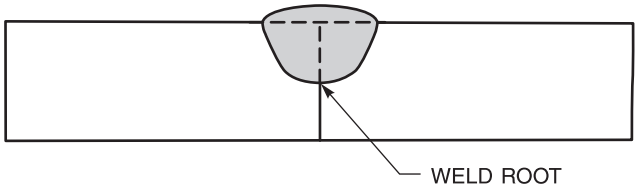


CALCULATION OF BASE METAL DILUTION FROM CROSS-SECTIONAL AREA OF WELD BEAD

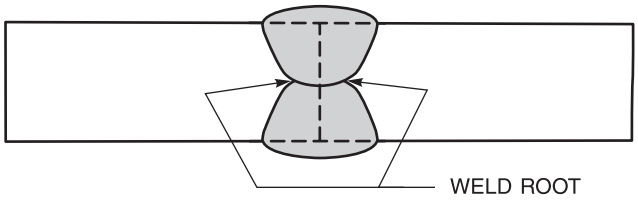
$$\% \text{ DILUTION} = \frac{B}{A + B} \times 100$$

(L)

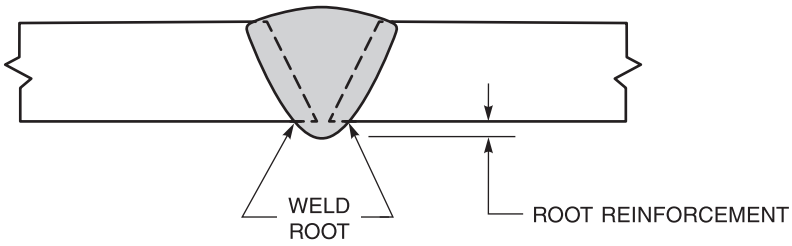
Figure B.24 (Continued)—Parts of a Weld



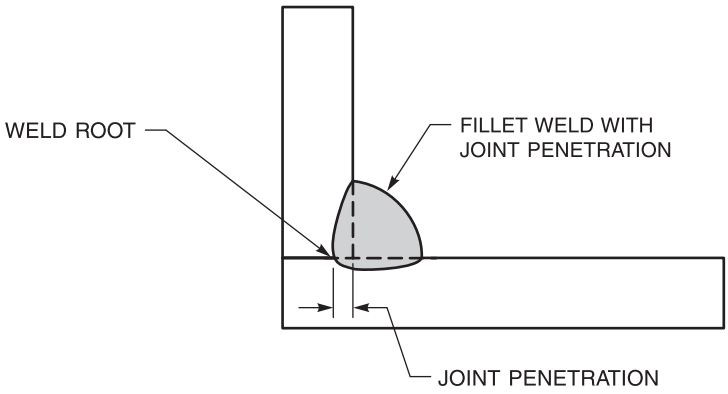
(M) SINGLE-SQUARE-GROOVE WELD



(N) DOUBLE-SQUARE-GROOVE WELD

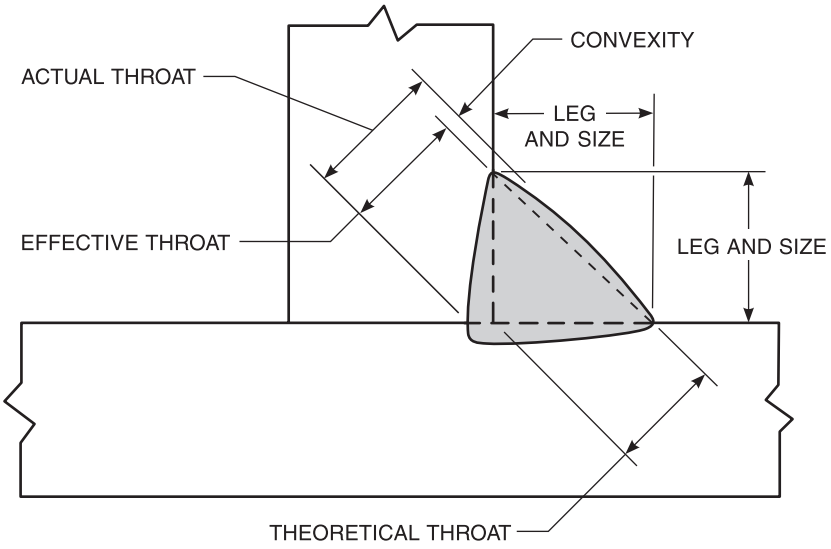


(O) SINGLE-GROOVE WELD WITH ROOT REINFORCEMENT

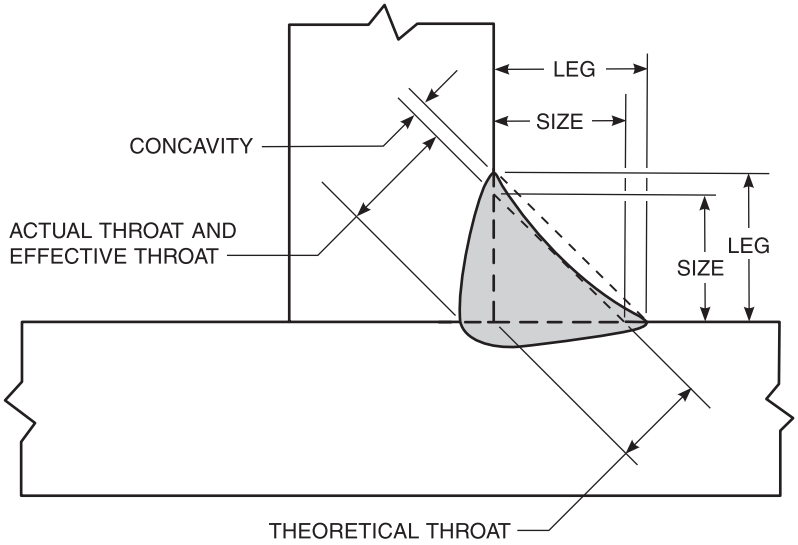


(P) FILLET WELD WITH JOINT PENETRATION

Figure B.24 (Continued)—Parts of a Weld

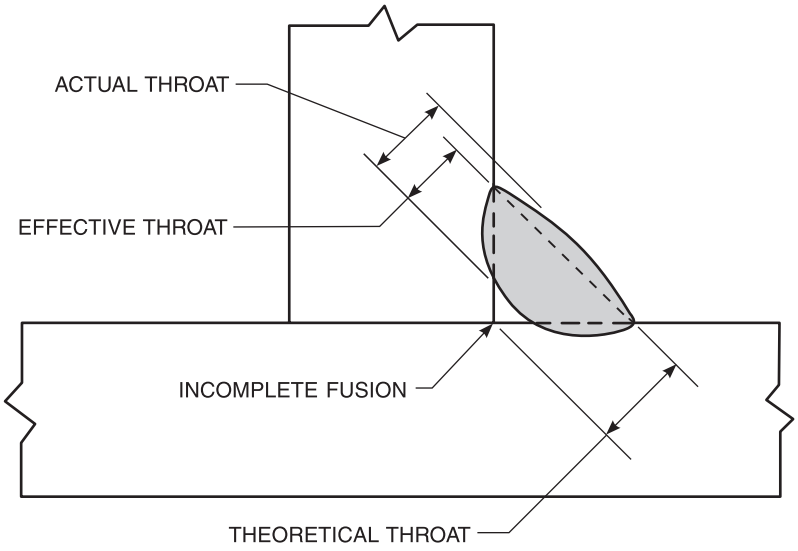


(A) CONVEX FILLET WELD

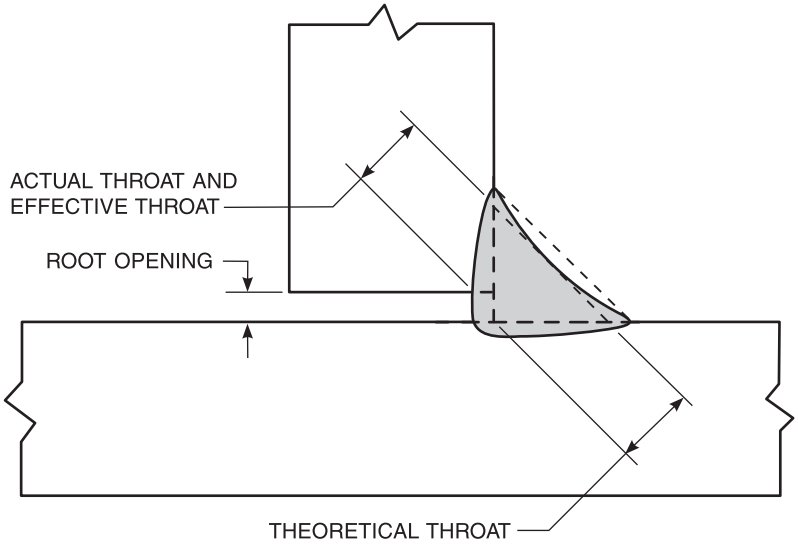


(B) CONCAVE FILLET WELD

Figure B.25—Weld Sizes

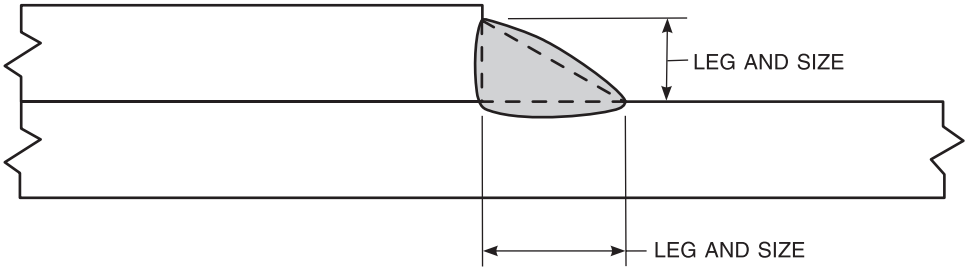


(C) FILLET WELD WITH INCOMPLETE FUSION

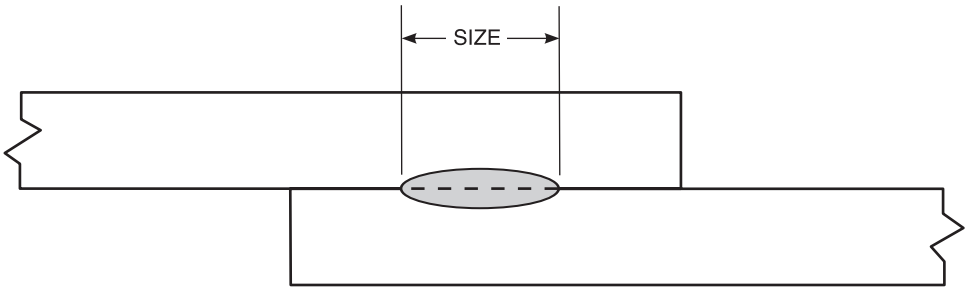


(D) T-JOINT WITH ROOT OPENING

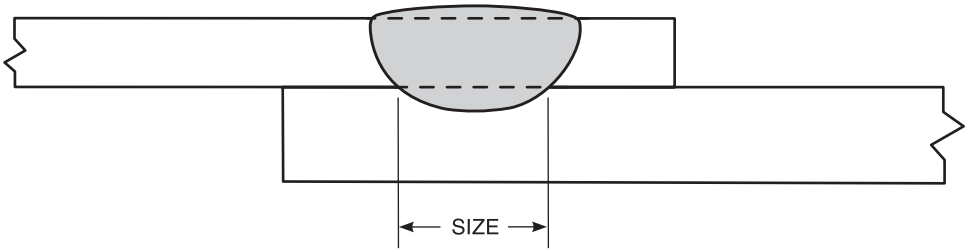
Figure B.25 (Continued)—Weld Sizes



(E) UNEQUAL LEG FILLET WELD

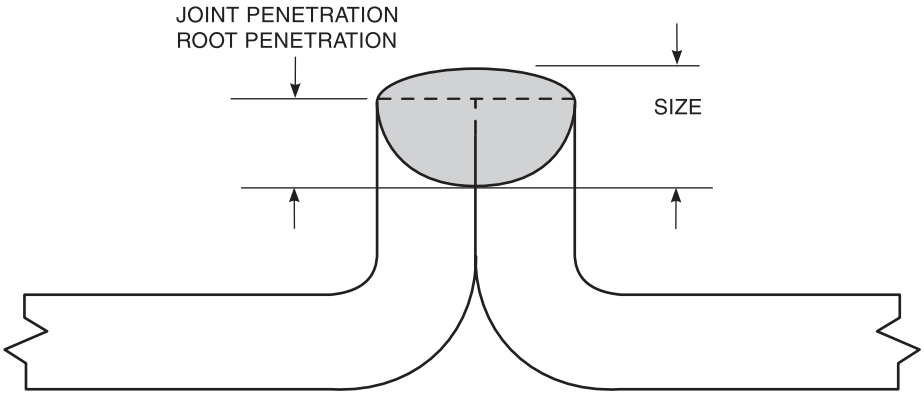


(F) SIZE OF SEAM OR SPOT WELD

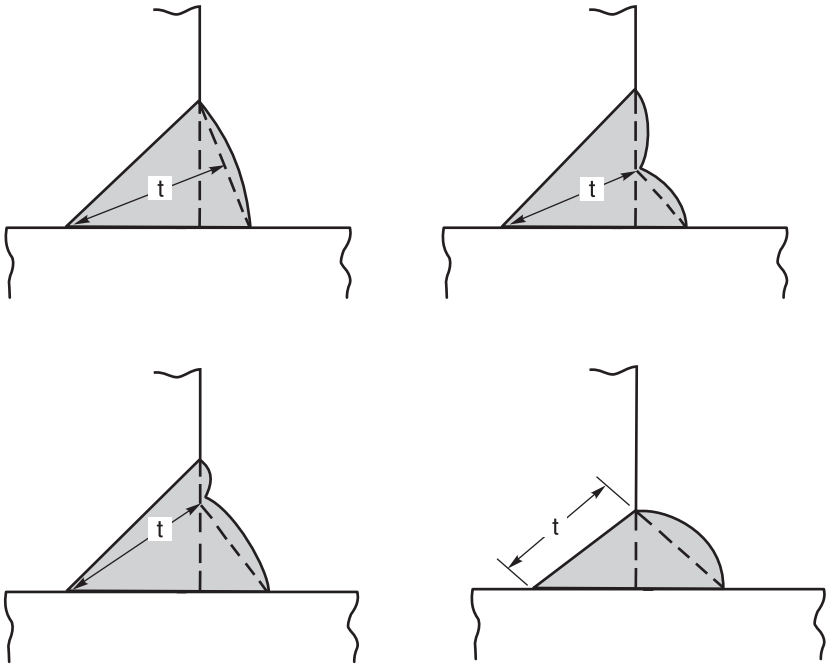


(G) ARC SEAM OR ARC SPOT WELD SIZE

Figure B.25 (Continued)—Weld Sizes



(H) EDGE WELD SIZE



(I) EFFECTIVE THROATS FOR PARTIAL JOINT PENETRATION GROOVE WELDS WITH REINFORCING FILLET WELDS

Figure B.25 (Continued)—Weld Sizes

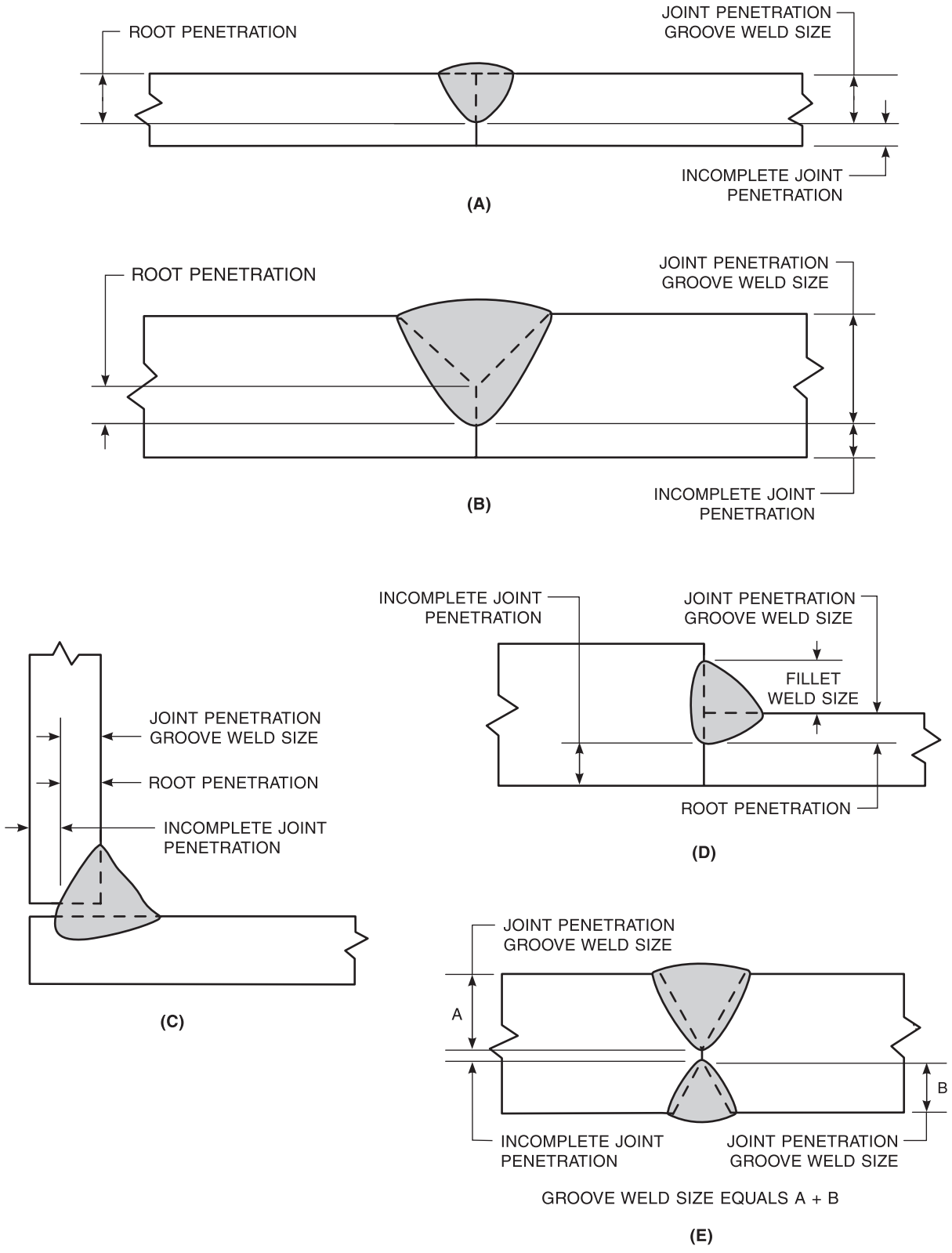


Figure B.26—Groove Weld Size and Joint Penetration

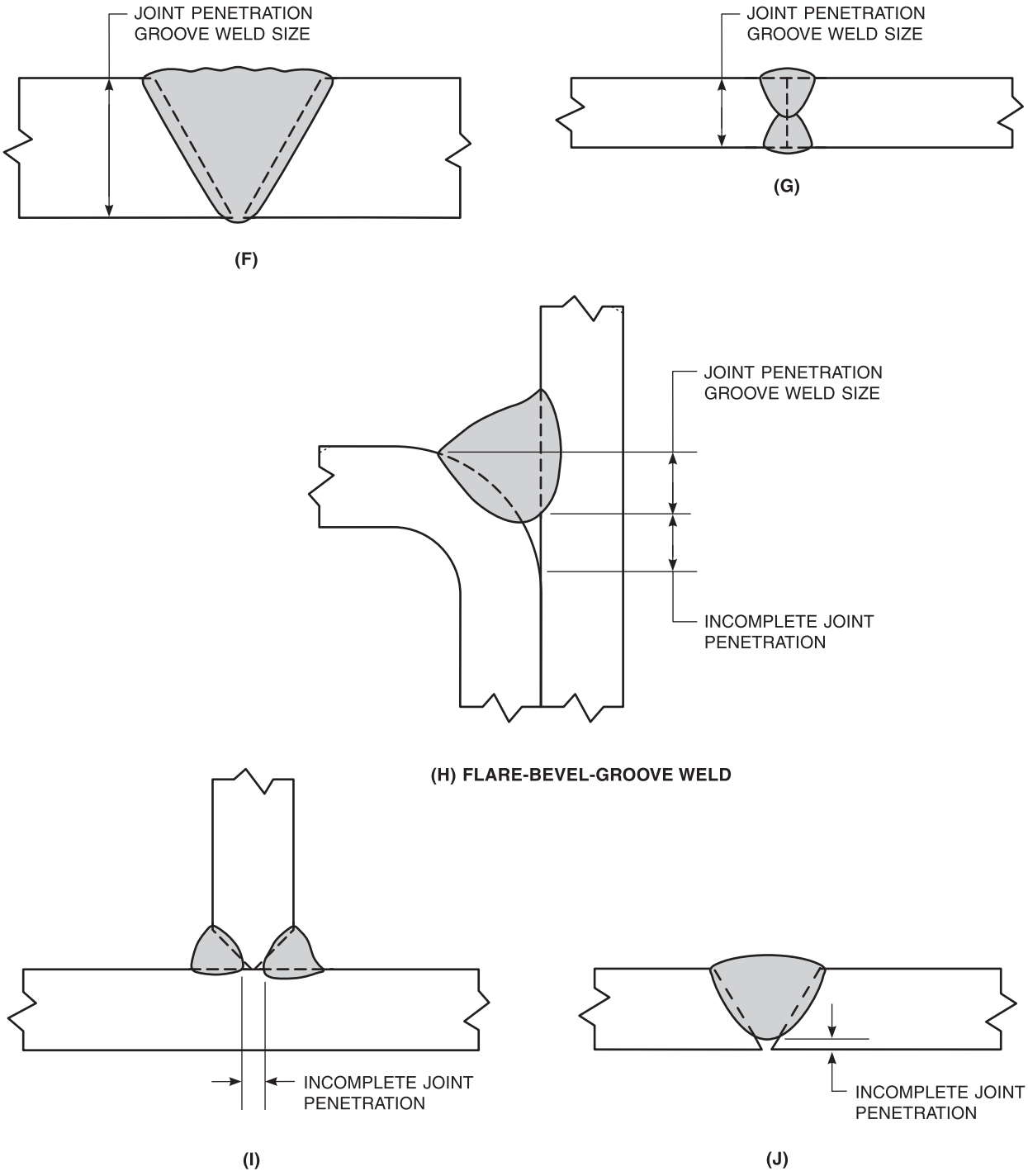


Figure B.26 (Continued)—Groove Weld Size and Joint Penetration

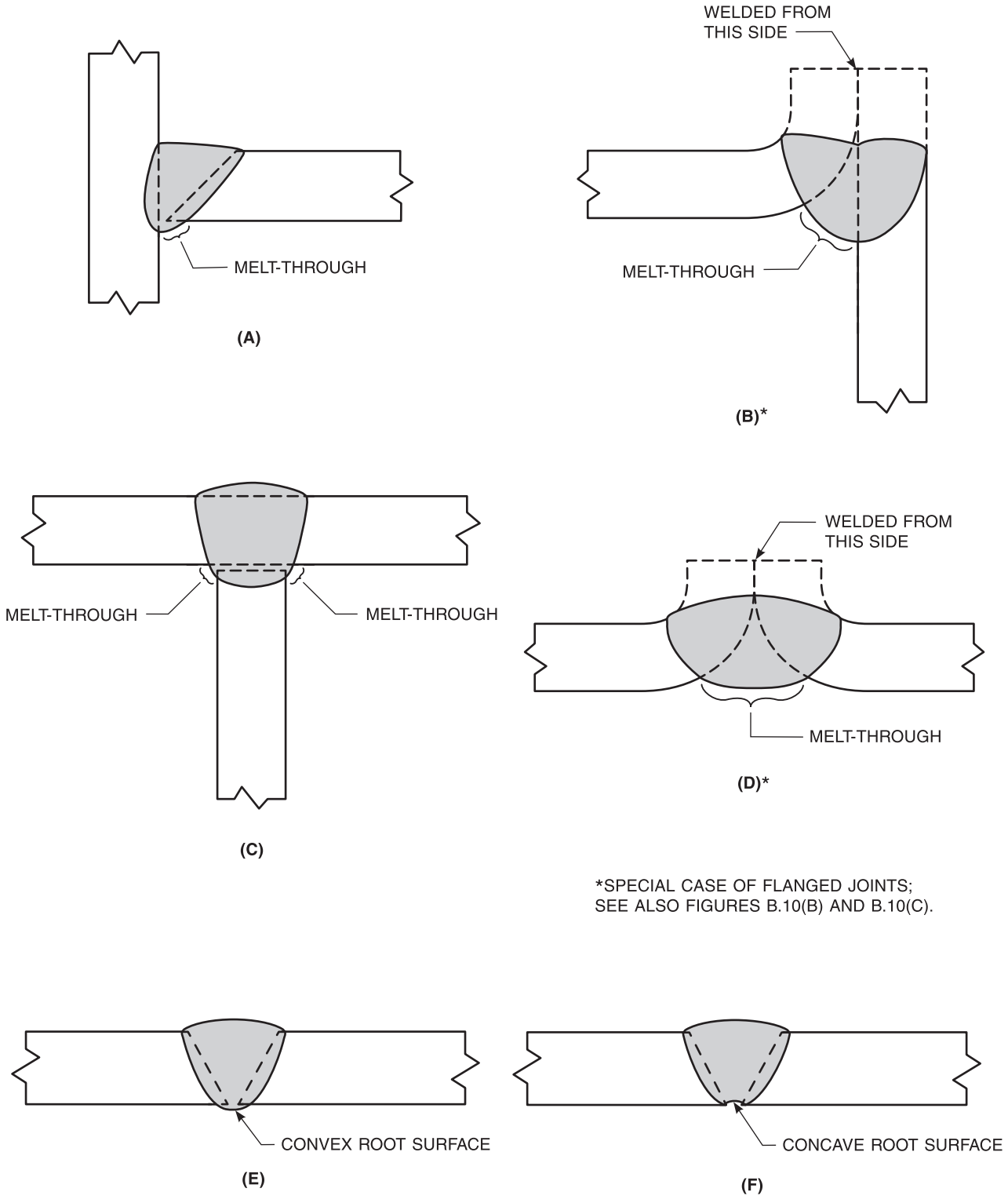


Figure B.27—Melt-Through and Root Surface Profile

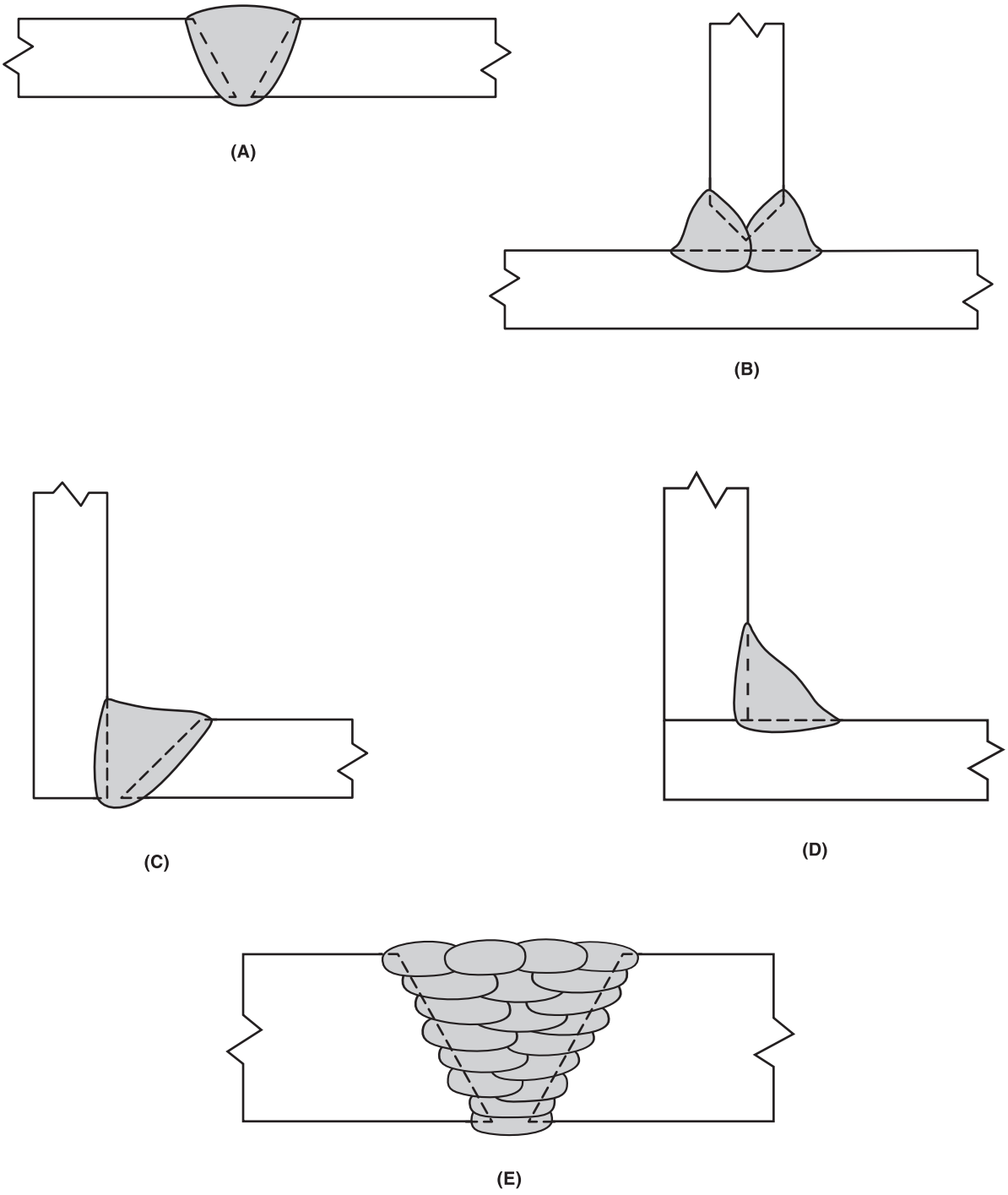


Figure B.28—Complete Fusion

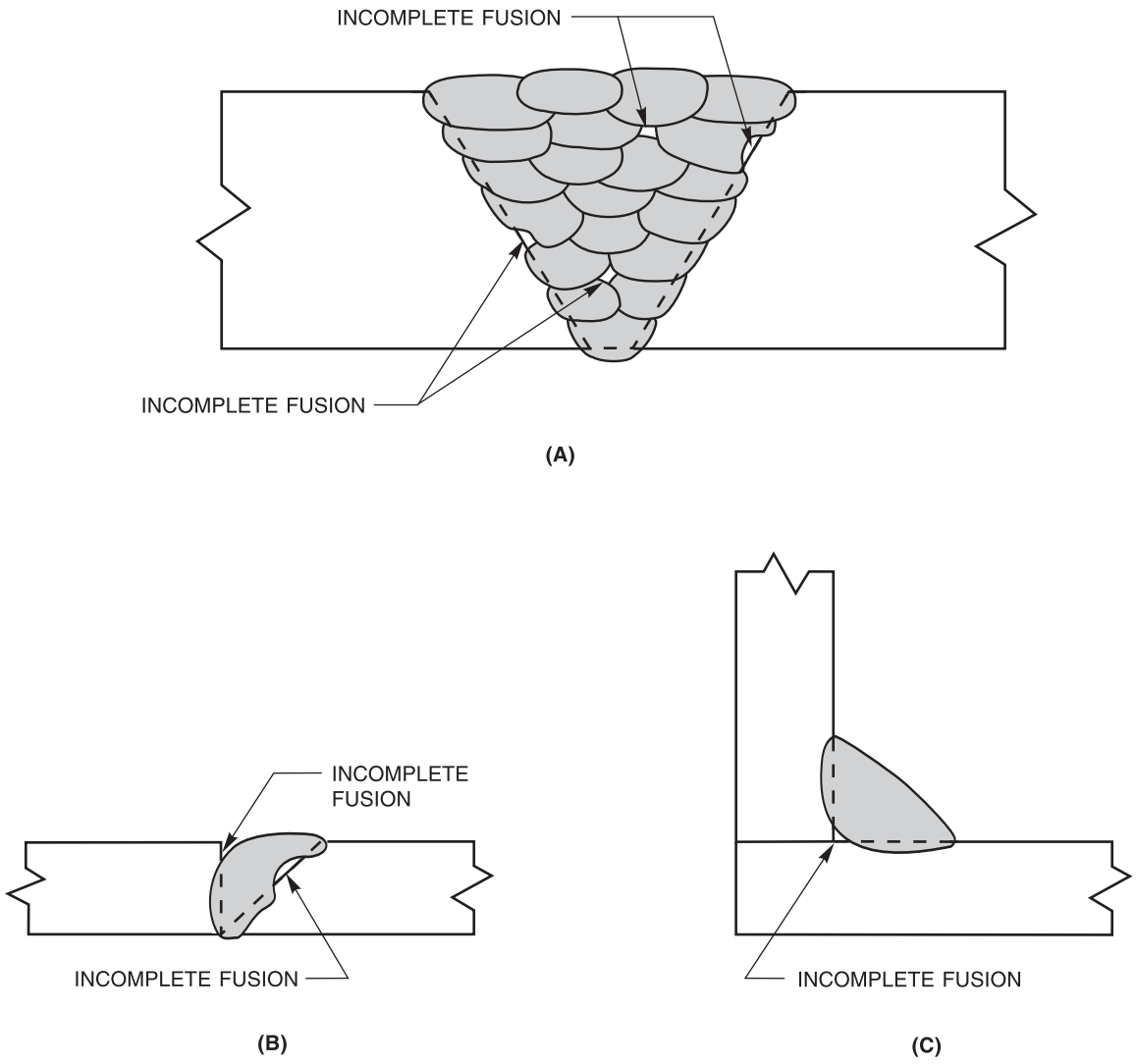
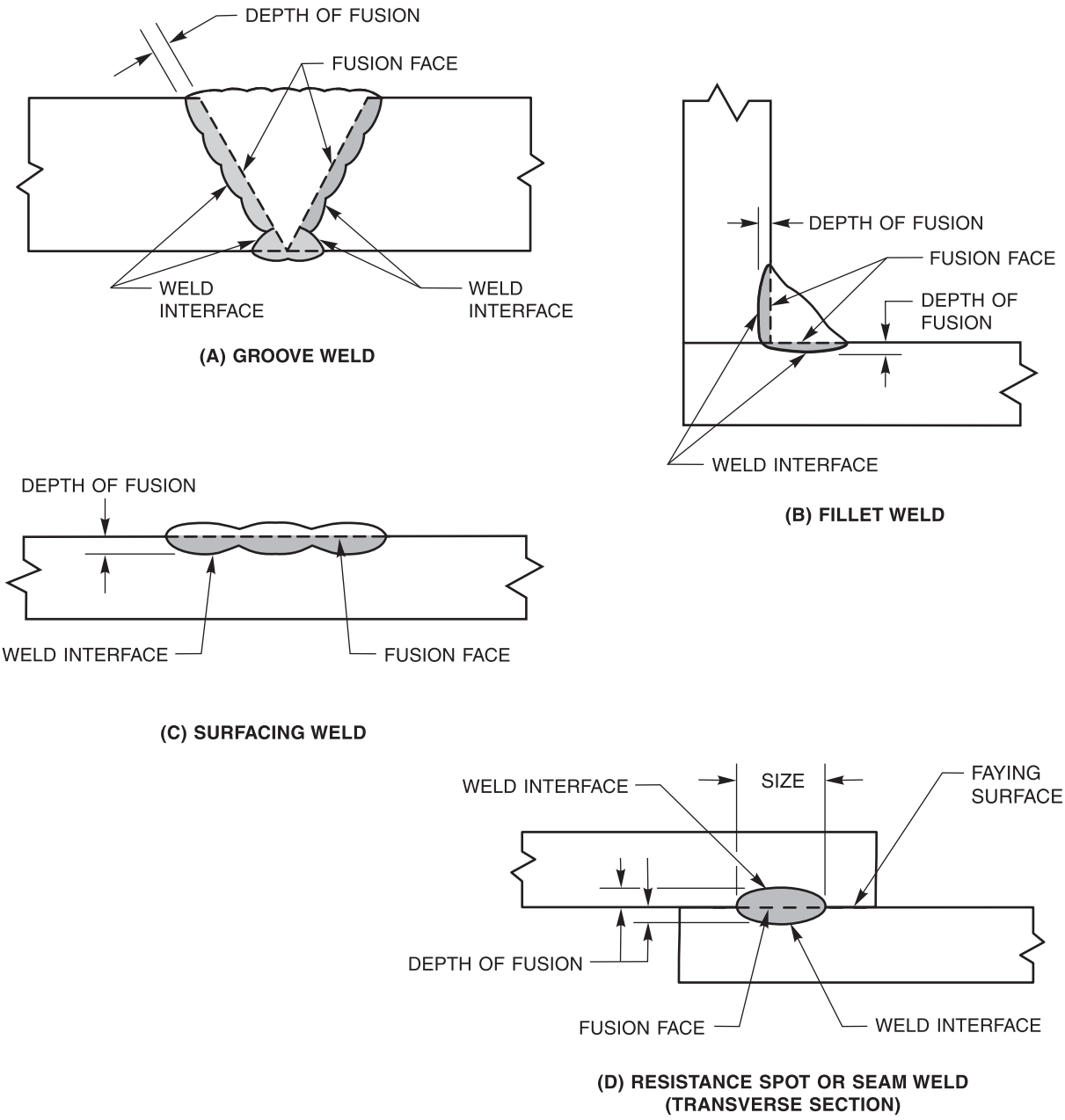
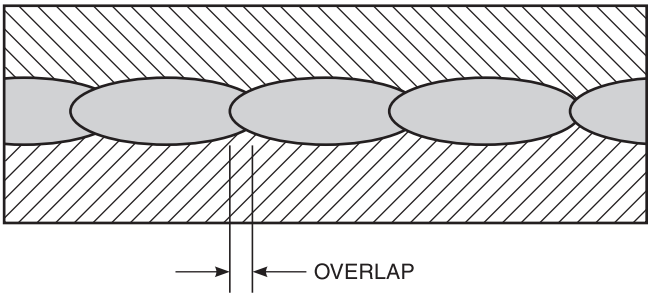


Figure B.29—Incomplete Fusion

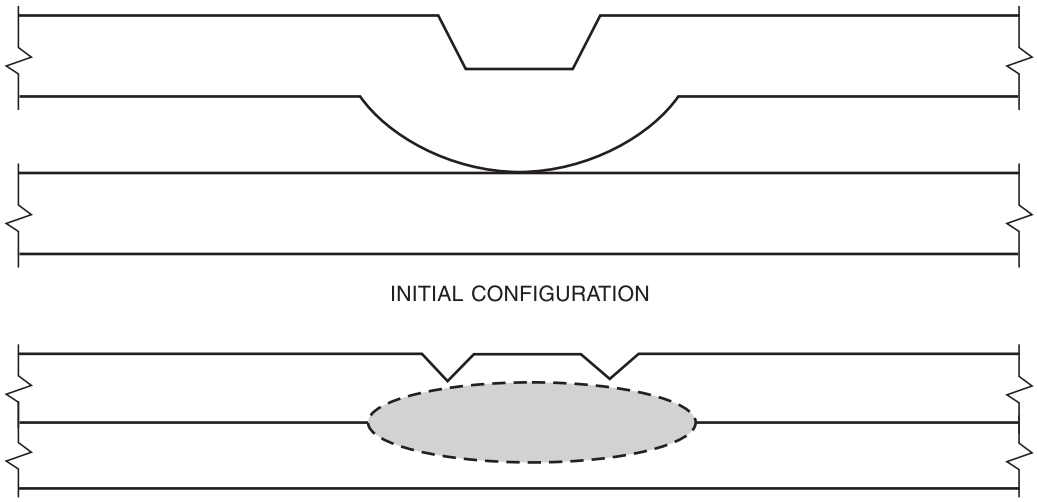


Note: Fusion zones indicated by shading.

Figure B.30—Fusion Welds (Transverse Section)

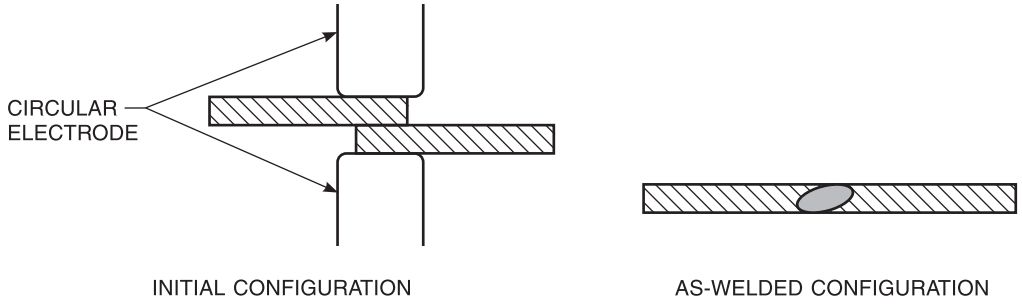


(E) RESISTANCE SEAM WELD (LONGITUDINAL SECTION)



Source: Detail F reproduced from AWS C1.1M/C1.1:2000 (R2006), *Recommended Practices for Resistance Welding*, Figure 23, Miami: American Welding Society.

(F) EXAMPLE OF A PROJECTION WELD



(G) EXAMPLE OF A MESH SEAM WELD

Figure B.30 (Continued)—Fusion Welds (Transverse Section)

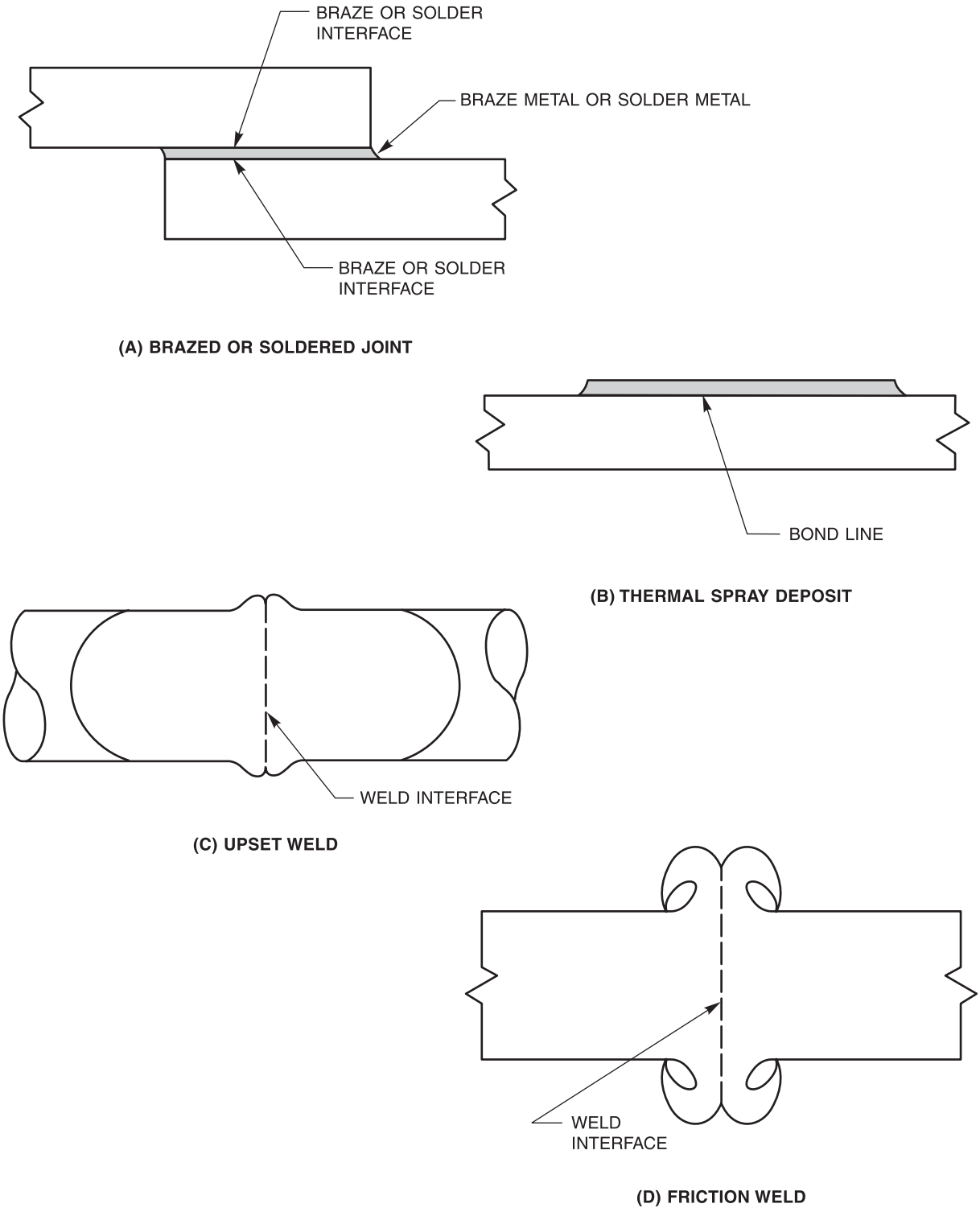


Figure B.31—Joining Without Fusion

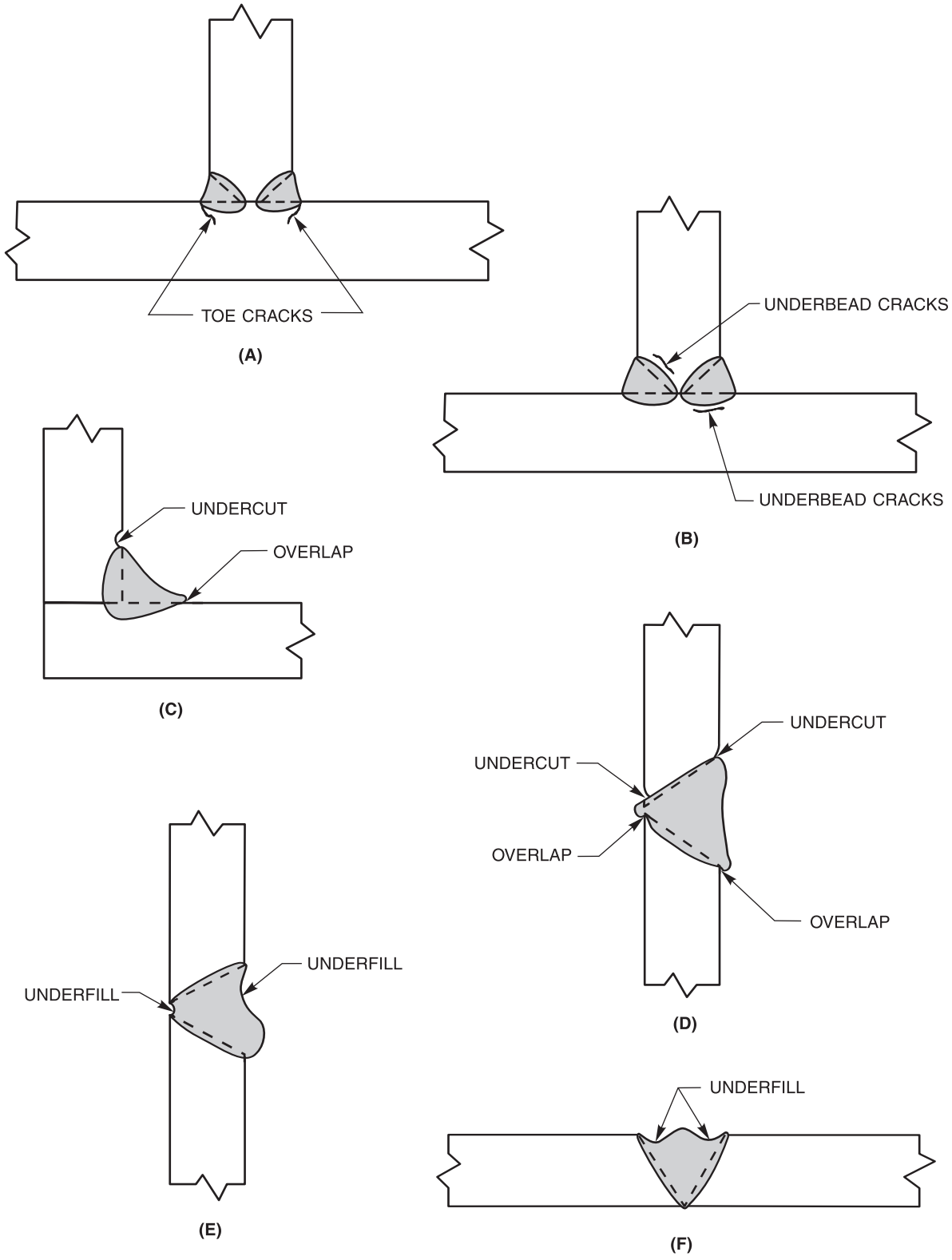


Figure B.32—Weld Discontinuities

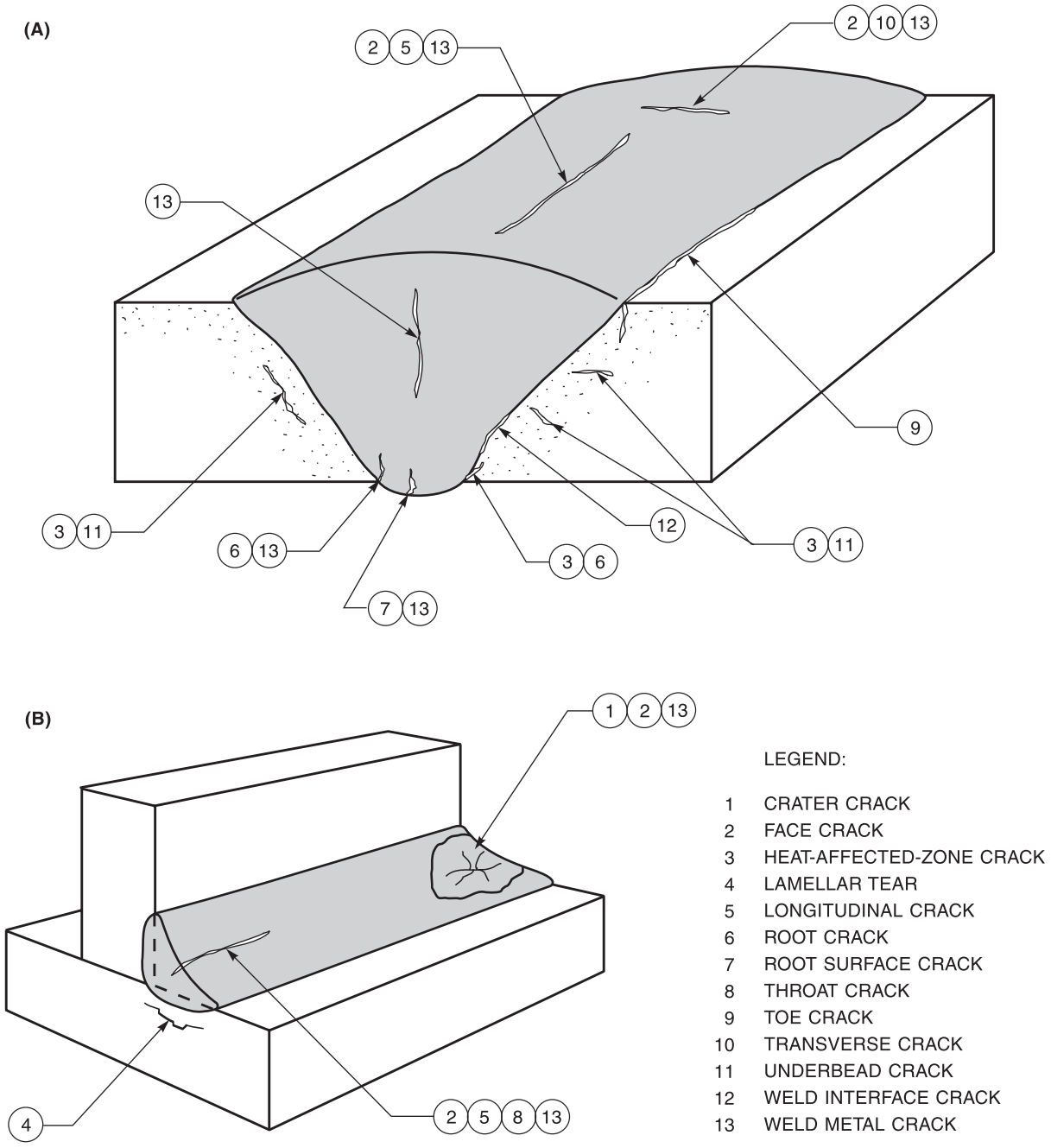
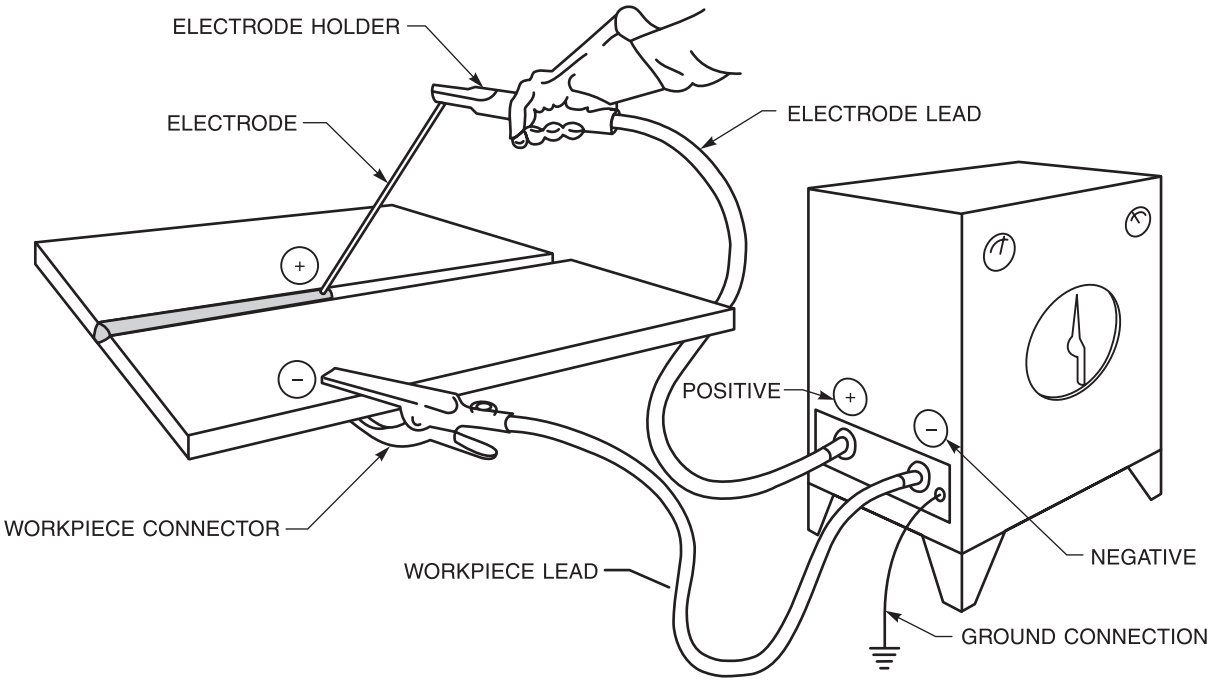
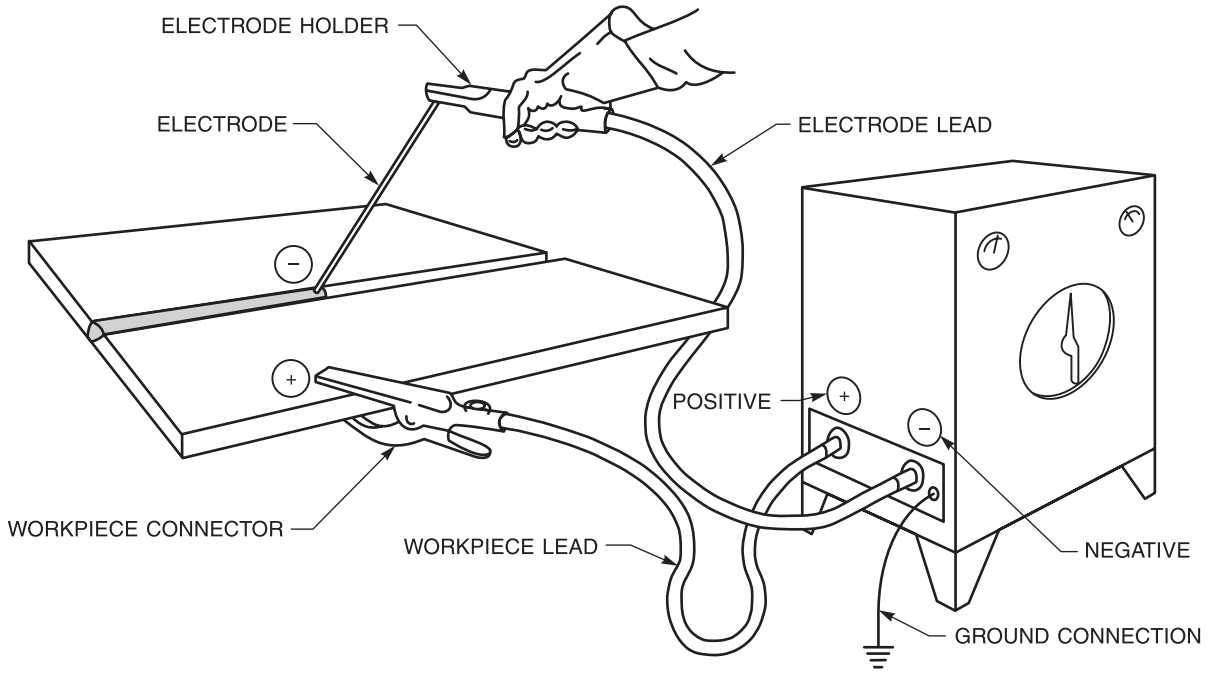


Figure B.33—Crack Types



(A) DIRECT CURRENT ELECTRODE POSITIVE



(B) DIRECT CURRENT ELECTRODE NEGATIVE

Figure B.34—Welding Current Polarity

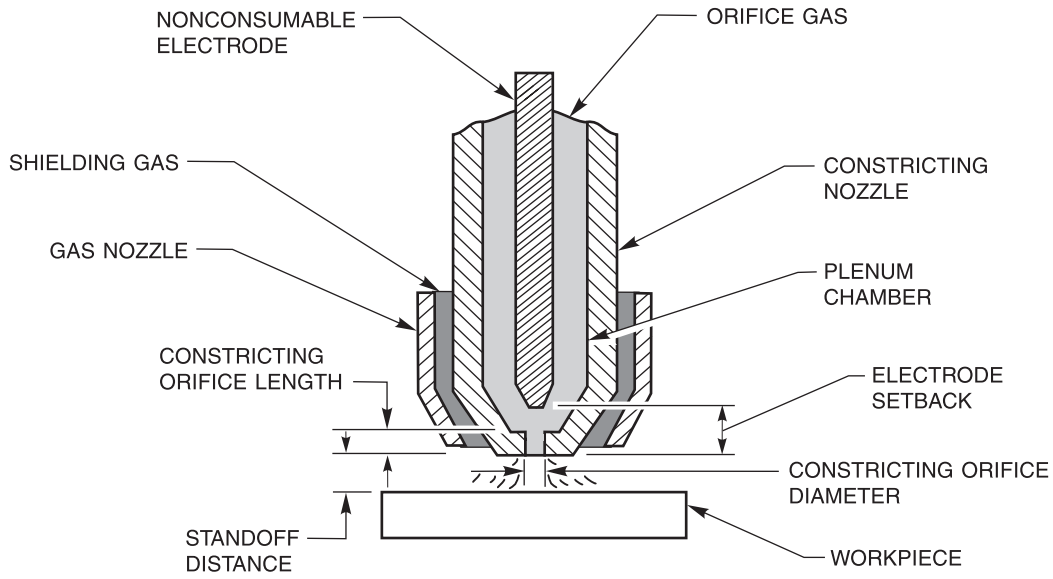


Figure B.35—Plasma Arc Torch Nomenclature

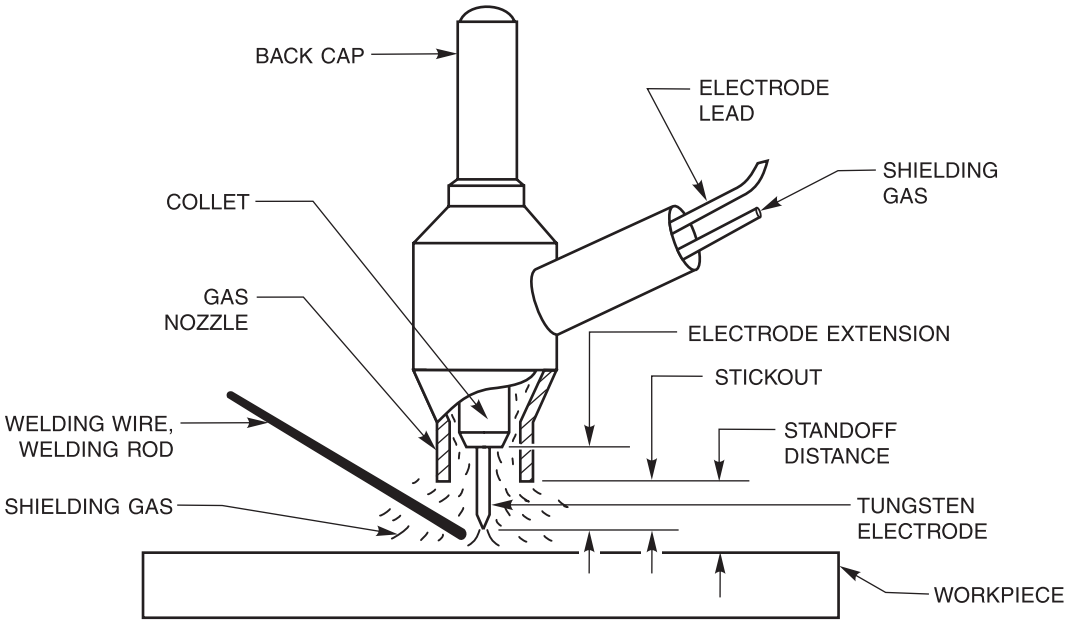
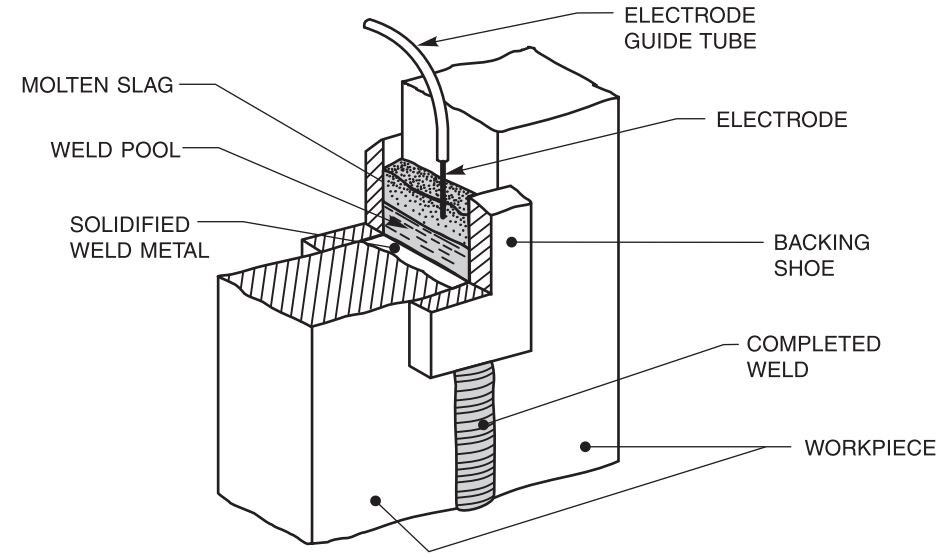
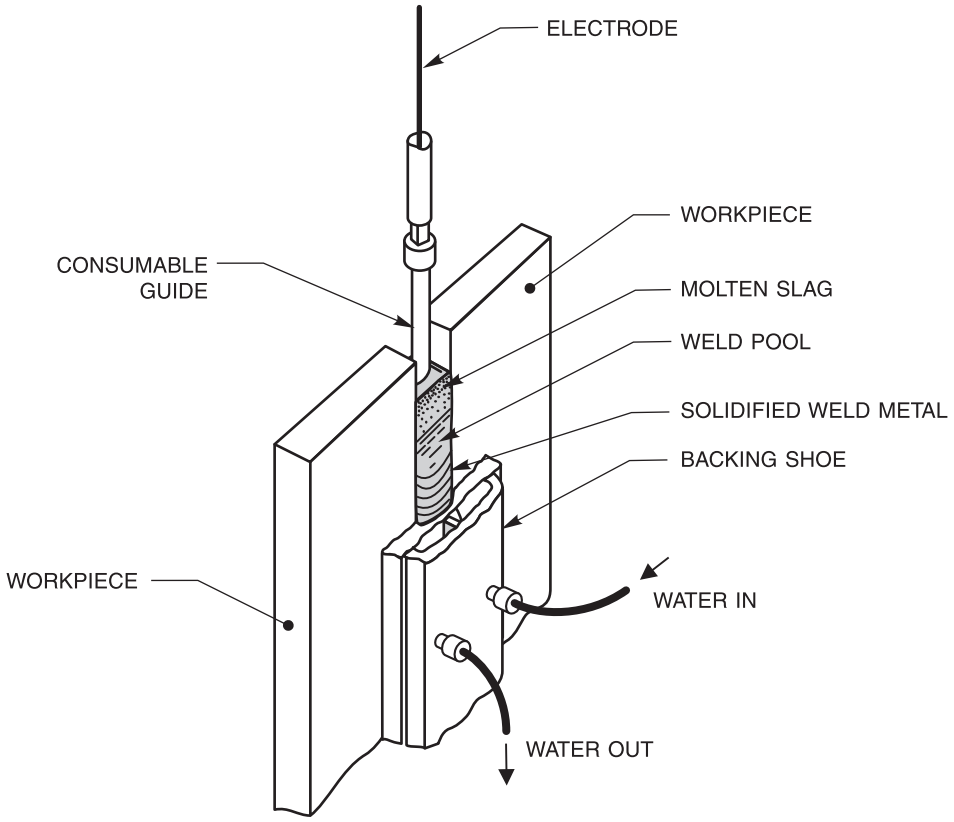


Figure B.36—Gas Tungsten Arc Welding Torch Nomenclature

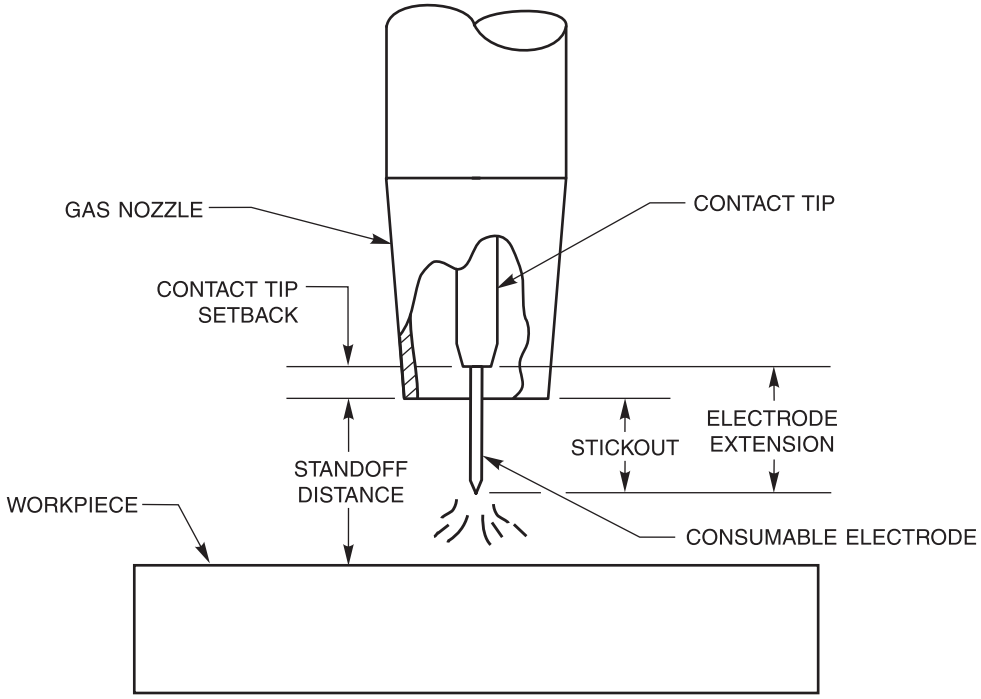


(A) ELECTROSLAG WELDING NOMENCLATURE

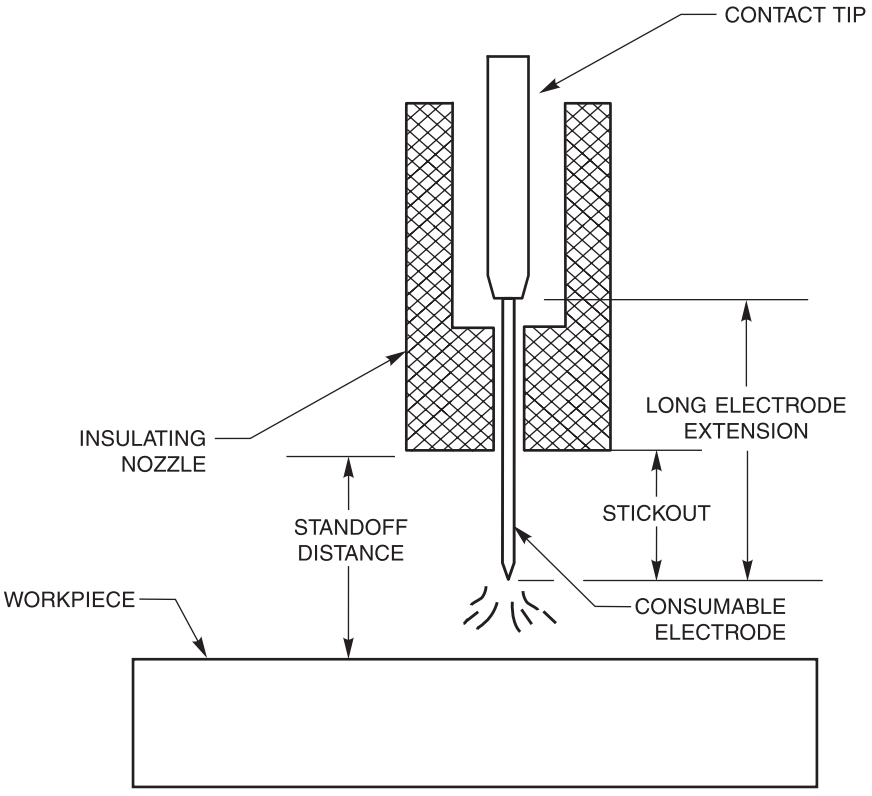


(B) CONSUMABLE GUIDE ELECTROSLAG WELDING NOMENCLATURE

Figure B.37—Electroslag Welding Process Nomenclature



(A) ELECTRODE EXTENSION WITH A GAS NOZZLE



(B) LONG ELECTRODE EXTENSION WITH AN INSULATING NOZZLE

Figure B.38—Gas Metal Arc and Flux Cored Arc Welding Gun Nomenclature

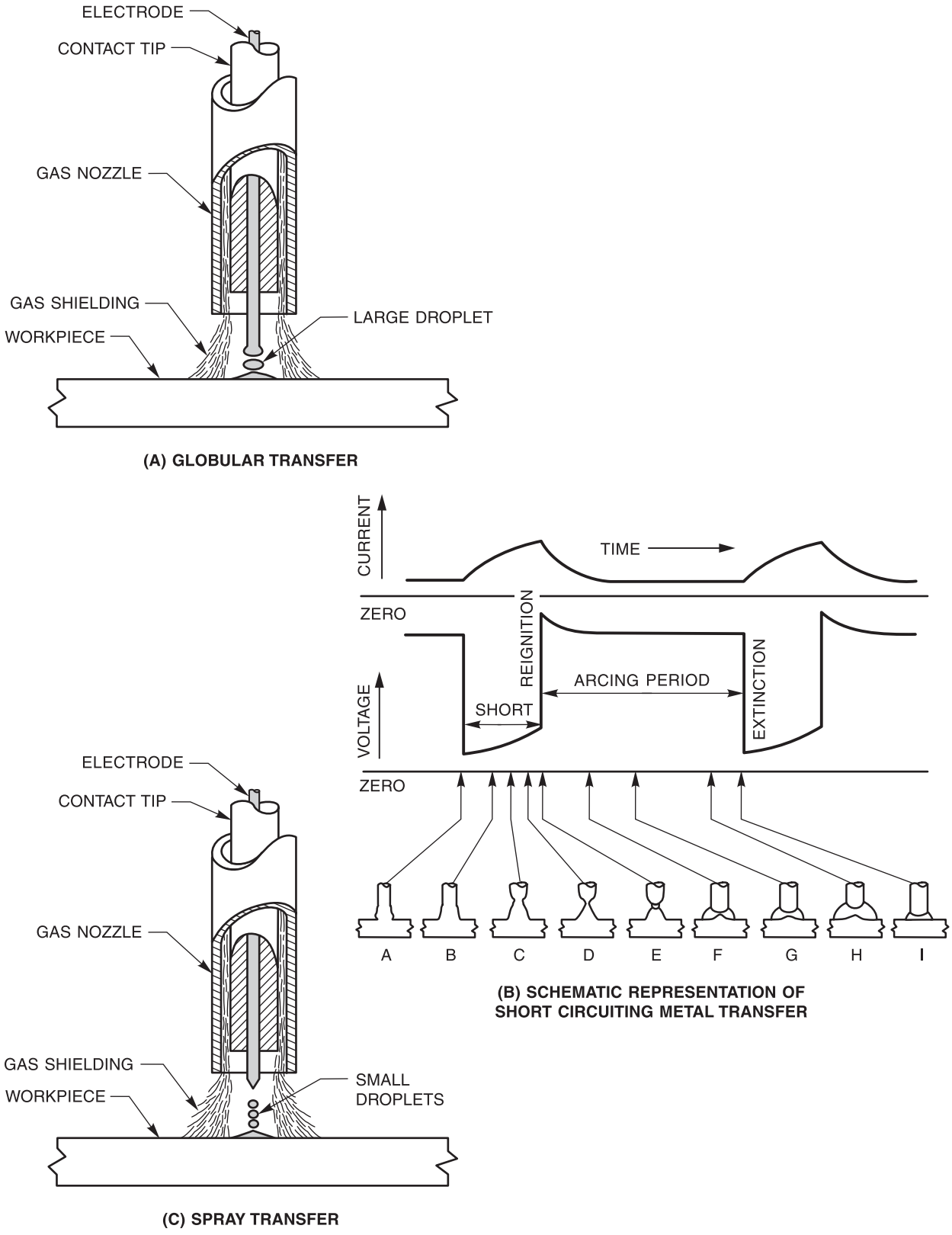
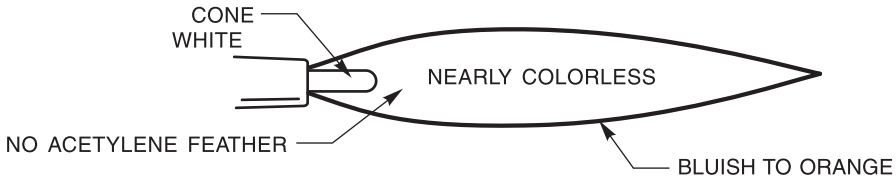
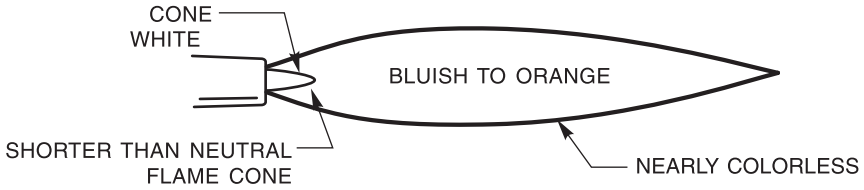


Figure B.39—Metal Transfer in Gas Metal Arc Welding

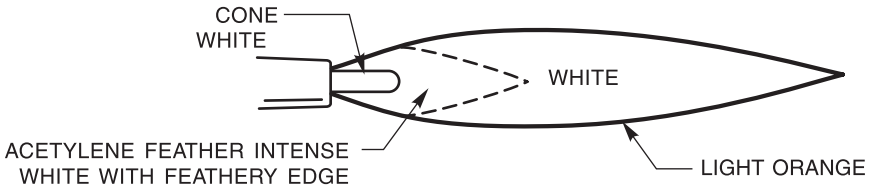
(A) PURE ACETYLENE FLAME



(B) NEUTRAL FLAME



(C) OXIDIZING FLAME



(D) CARBURIZING (REDUCING) FLAME

Figure B.40—Oxyacetylene Flame Types

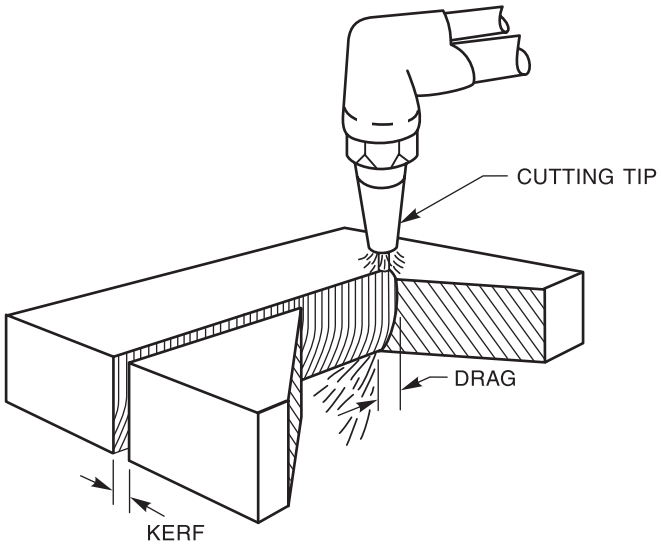


Figure B.41—Oxygen Cutting

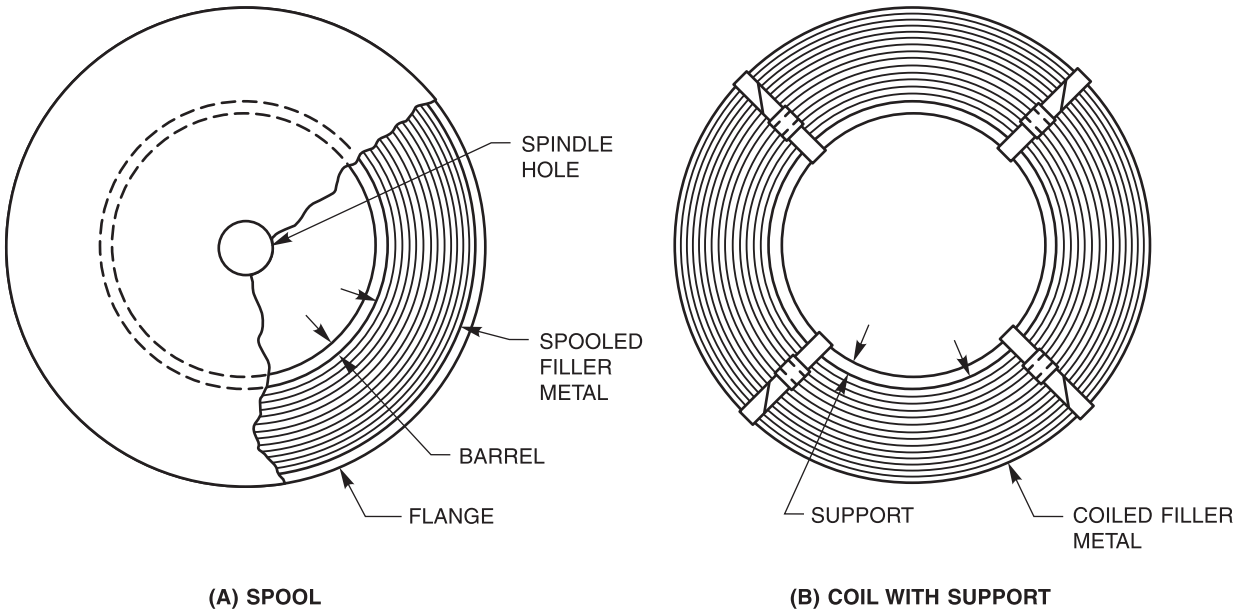


Figure B.42—Filler Metal Packaging

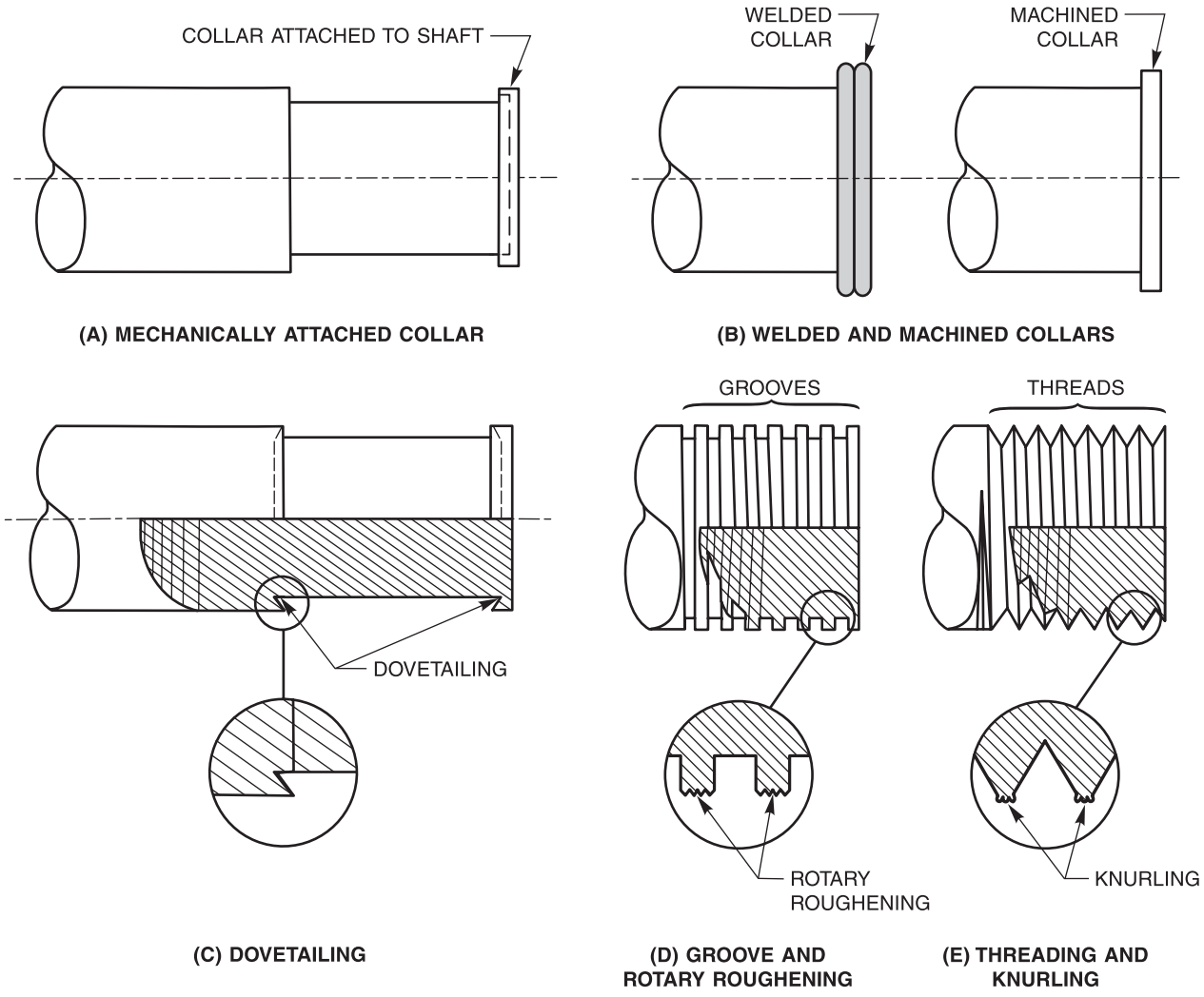


Figure B.43—Thermal Spraying Surface Preparation

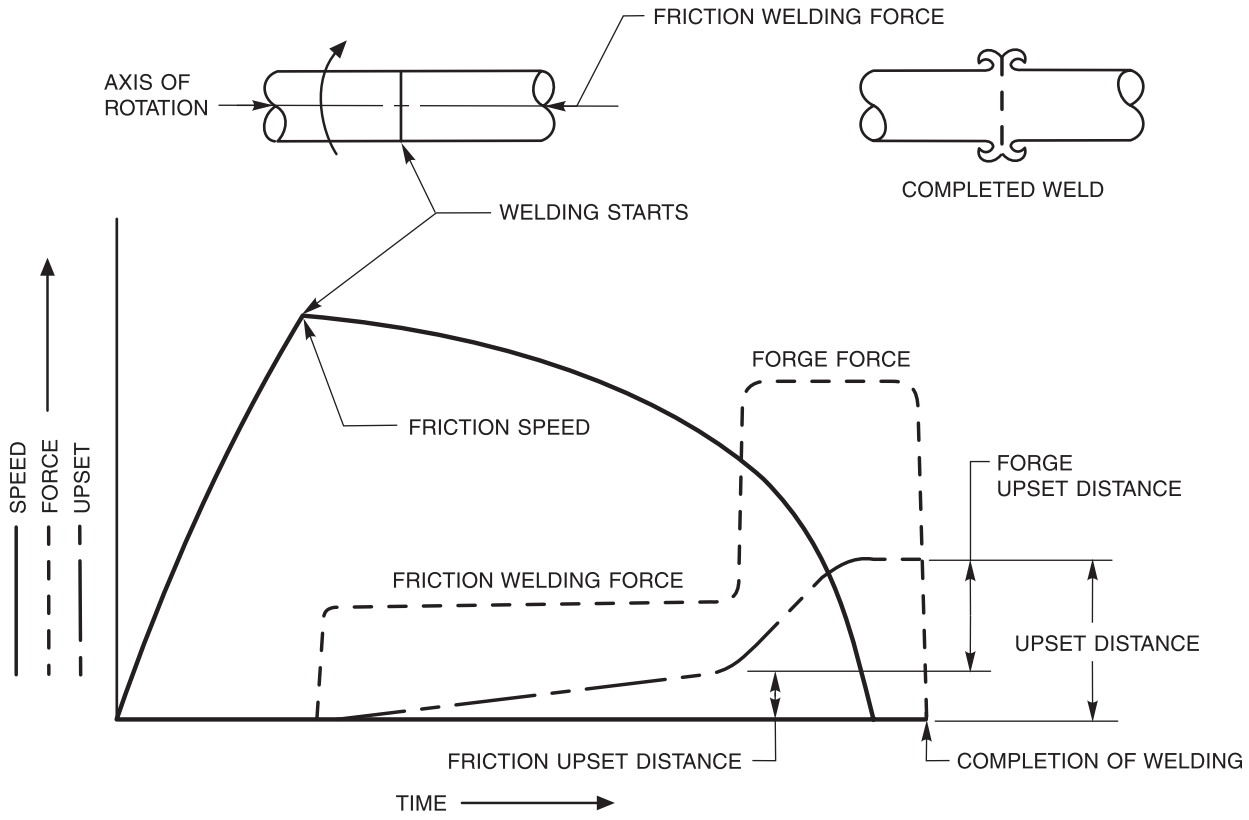


Figure B.44—Generalized Diagram of Inertia Friction Welding

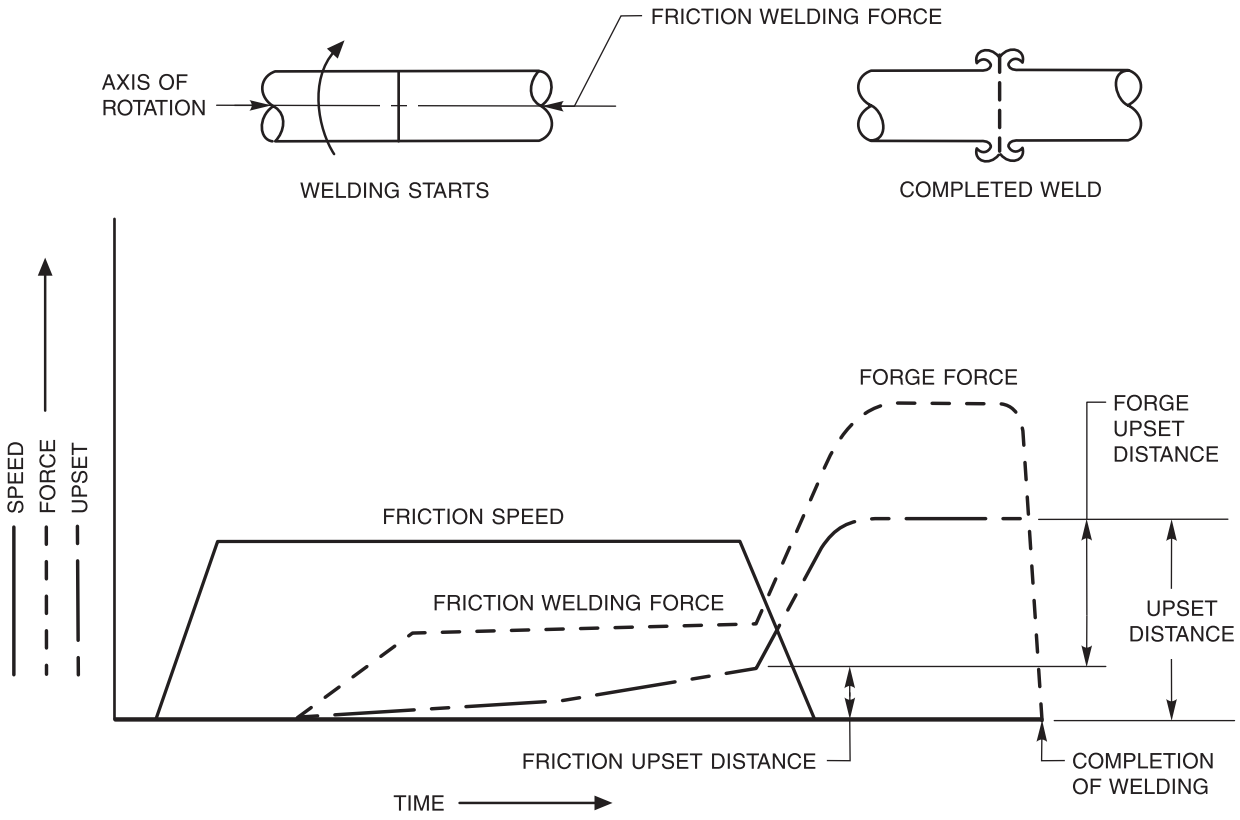


Figure B.45—Generalized Diagram of Direct Drive Friction Welding

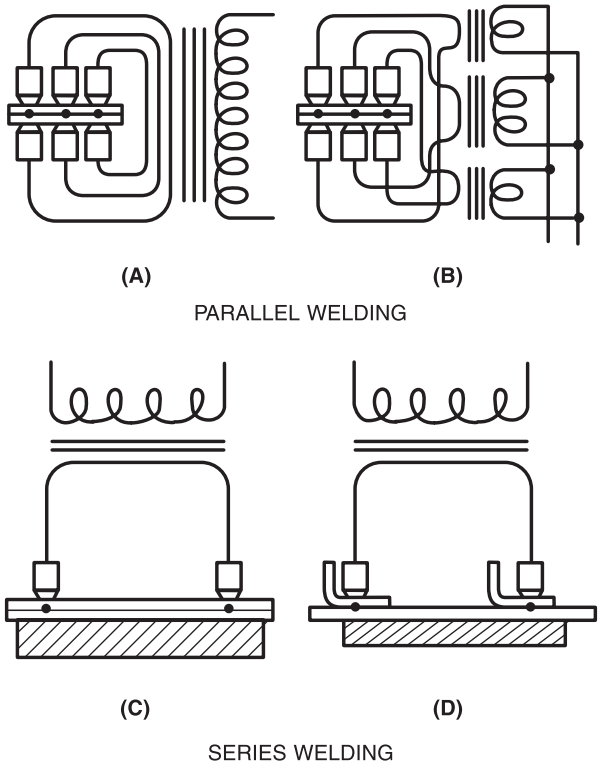


Figure B.46—Typical Arrangements for Multiple Spot Welding

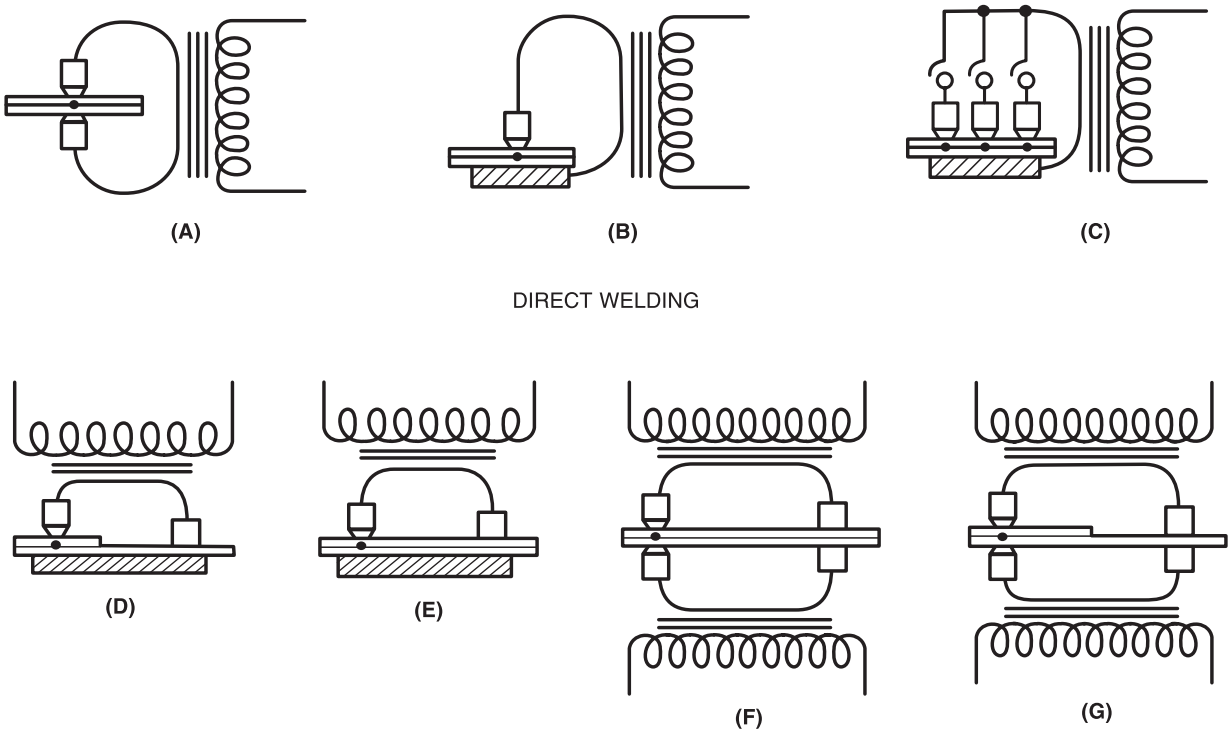


Figure B.47—Typical Arrangements for Single Spot Welds

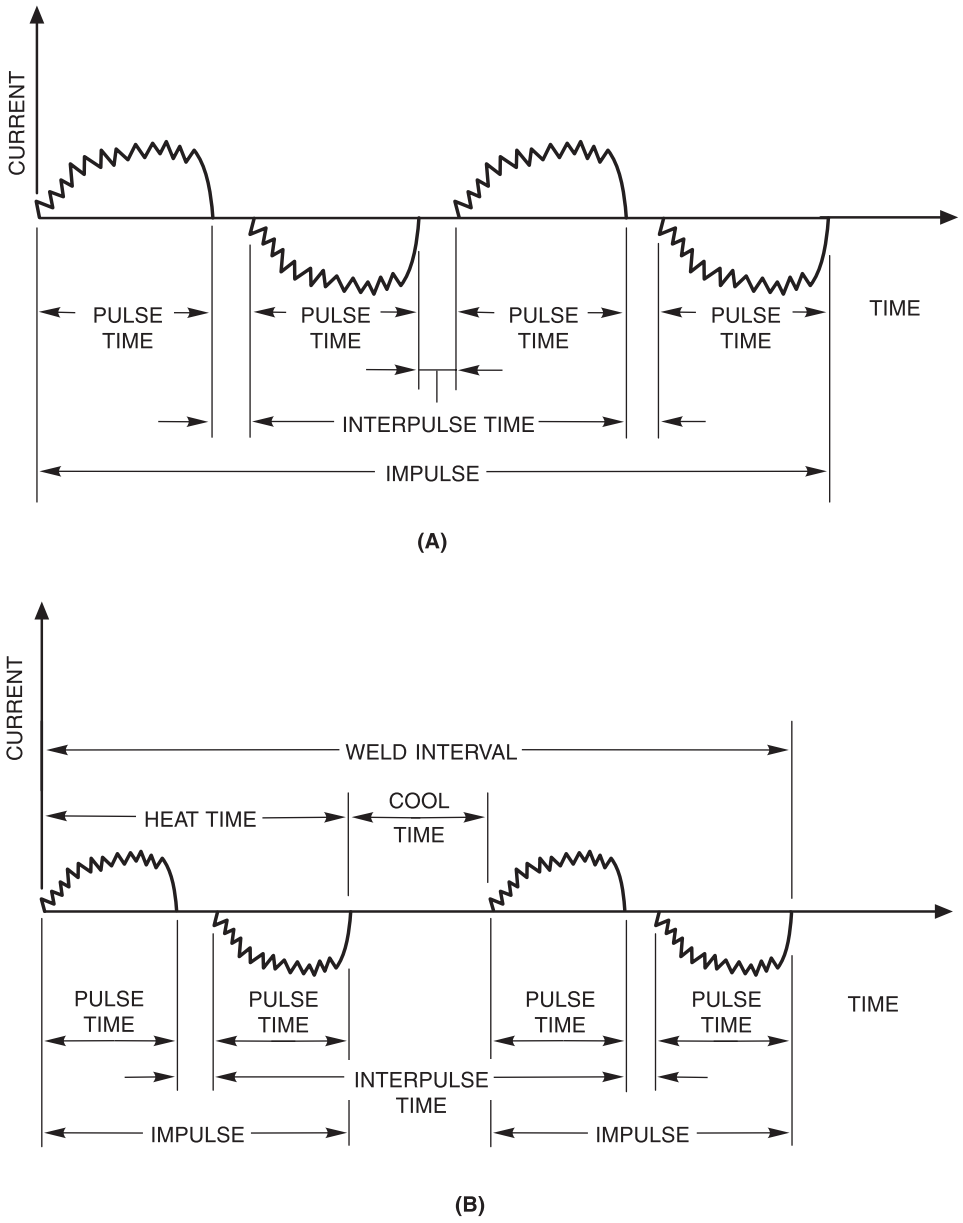


Figure B.48—Resistance Welding Current Characteristics for Frequency Converter Equipment

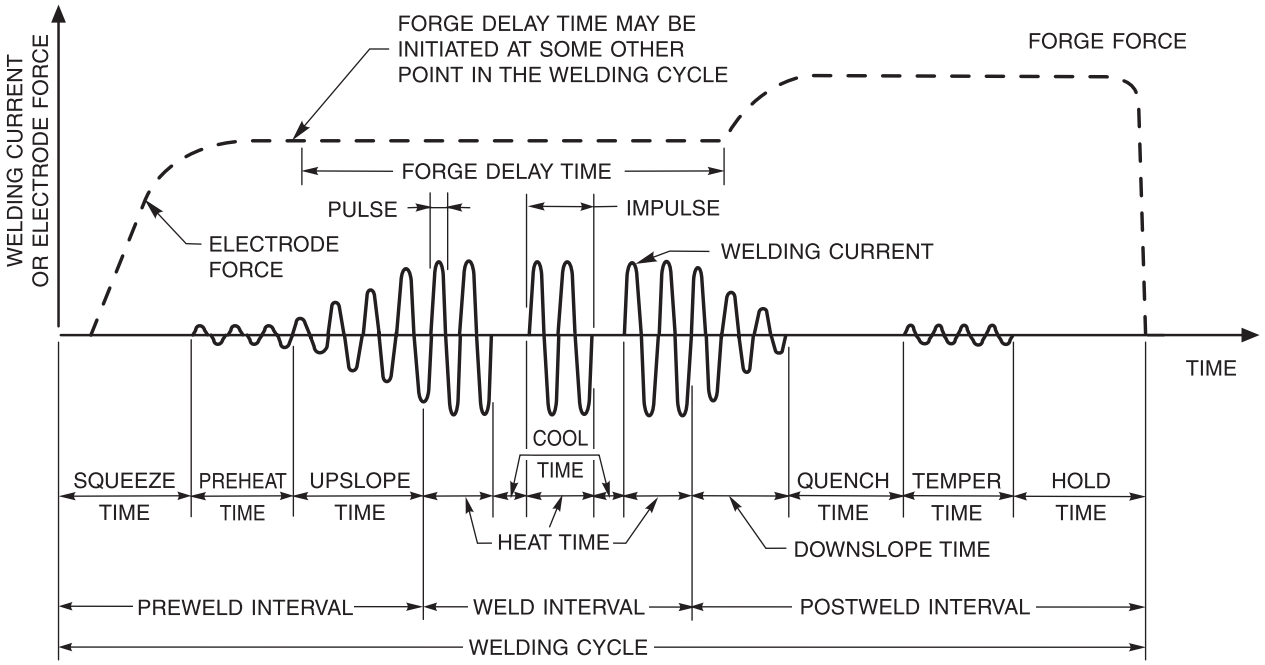


Figure B.49—Example of a Multiple-Impulse Resistance Spot Welding Schedule

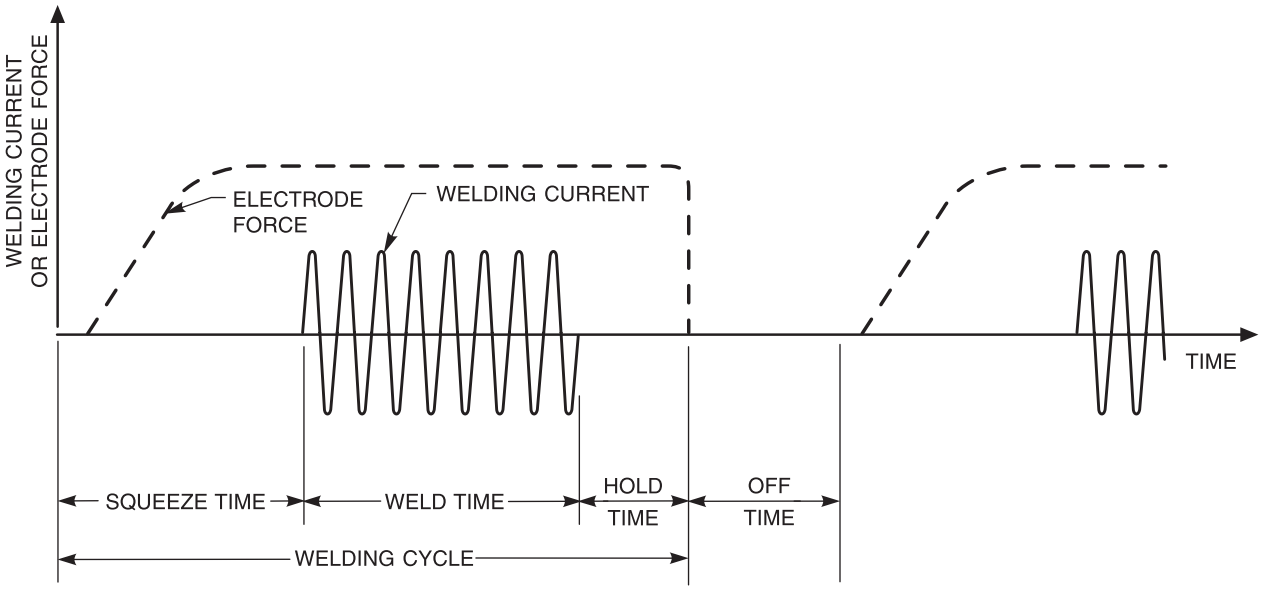
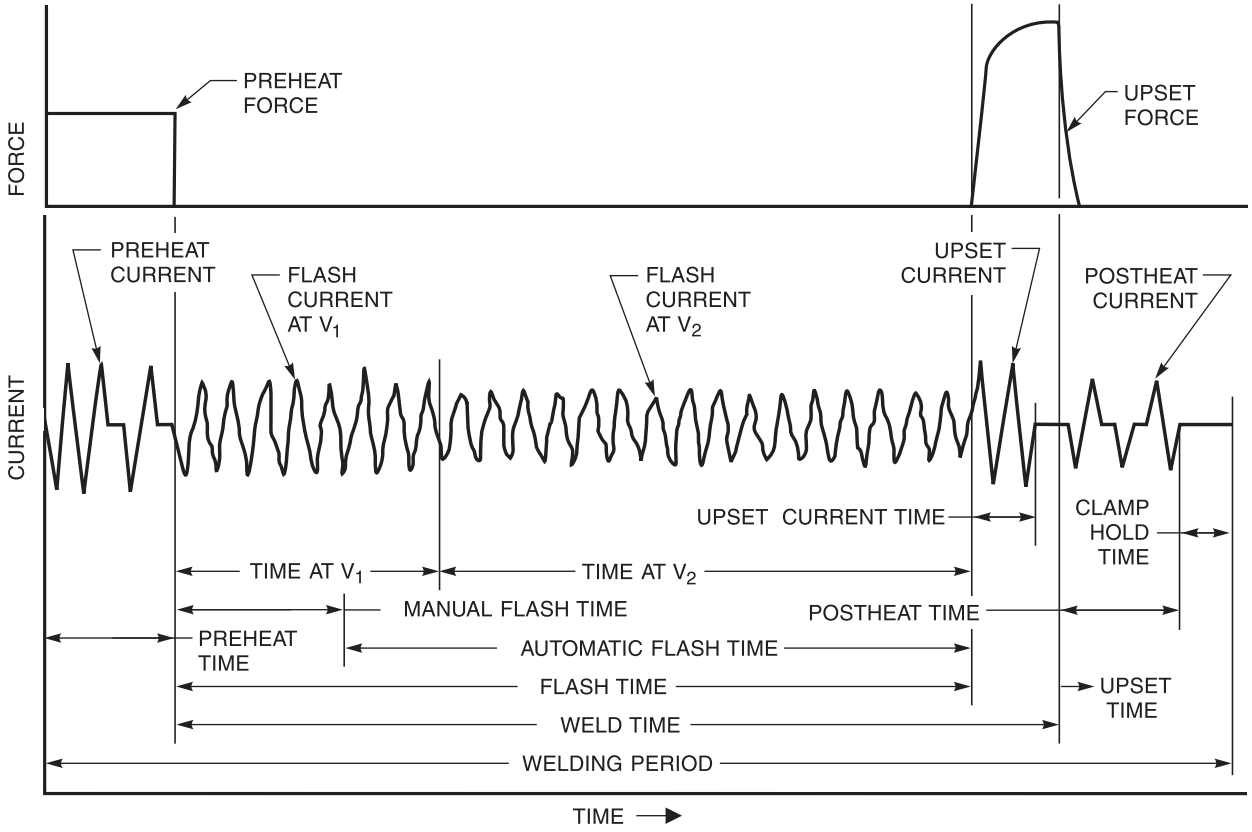
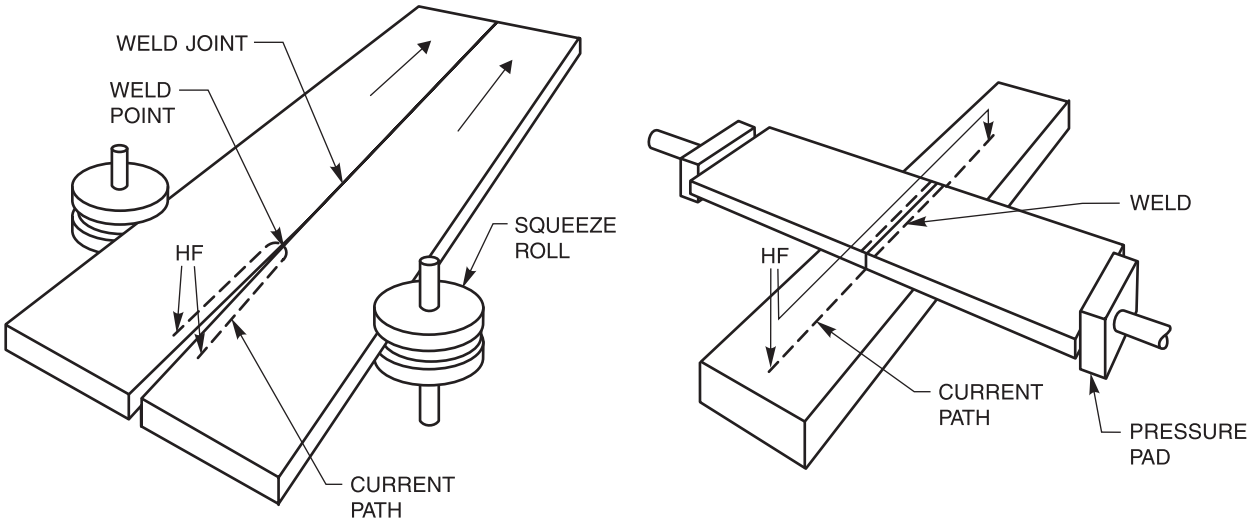


Figure B.50—Example of a Single-Impulse Resistance Spot Welding Schedule



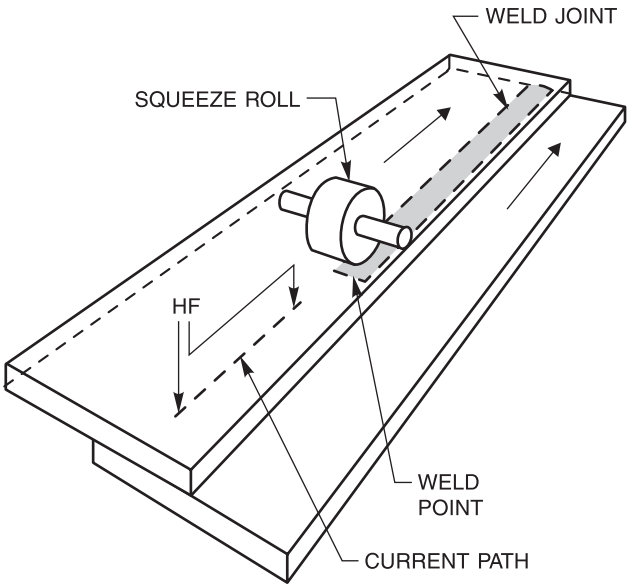
Source: Reproduced from AWS C1.1M/C1.1:2000 (R2006), *Recommended Practices for Resistance Welding*, Figure 28, Miami: American Welding Society.

Figure B.51—Electro-Mechanical Synchronization in a Typical Flash Welding Cycle



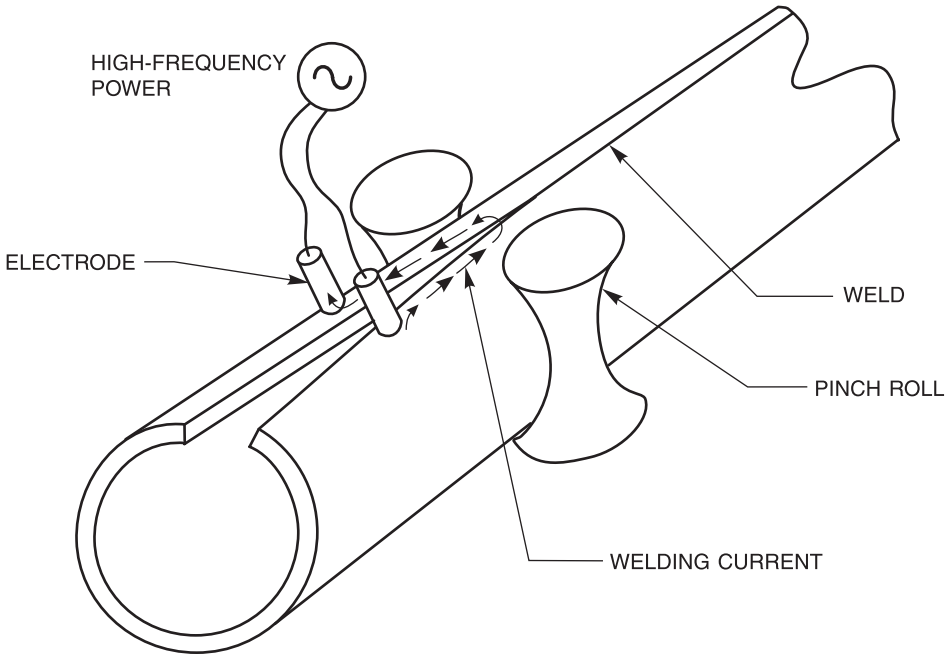
(A) BUTT JOINT MADE BY HIGH-FREQUENCY UPSET WELDING

(B) BUTT JOINT MADE BY HIGH-FREQUENCY UPSET WELDING

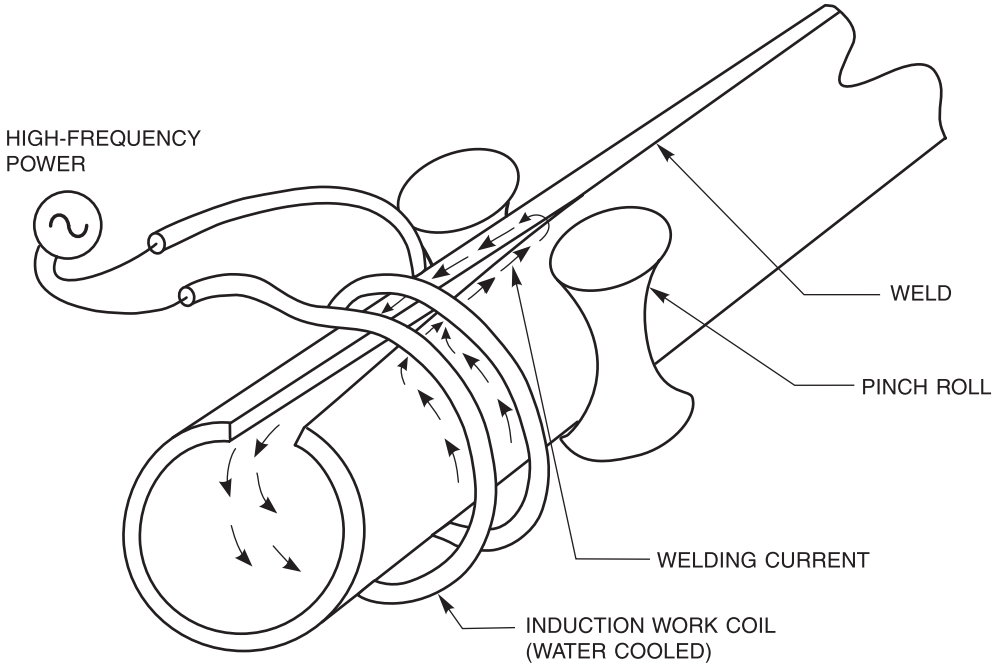


(C) LAP JOINT MADE BY HIGH-FREQUENCY SEAM WELDING

Figure B.52—High-Frequency Resistance Welding



(D) HIGH FREQUENCY UPSET WELDING OF TUBE



(E) INDUCTION UPSET WELDING OF TUBE

Figure B.52 (Continued)—High-Frequency Resistance Welding

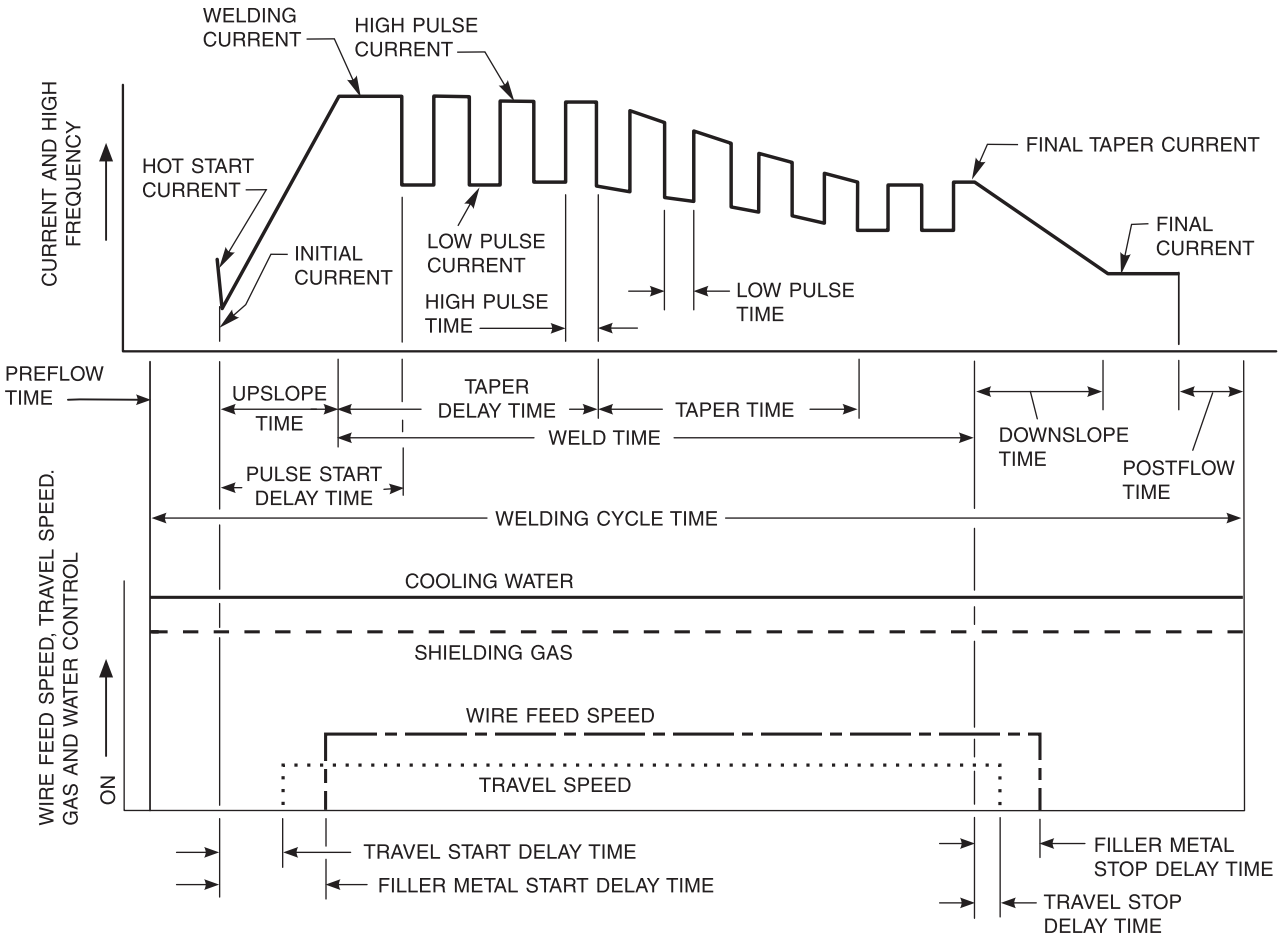


Figure B.53—Typical GTAW or PAW Program for Automatic Welding

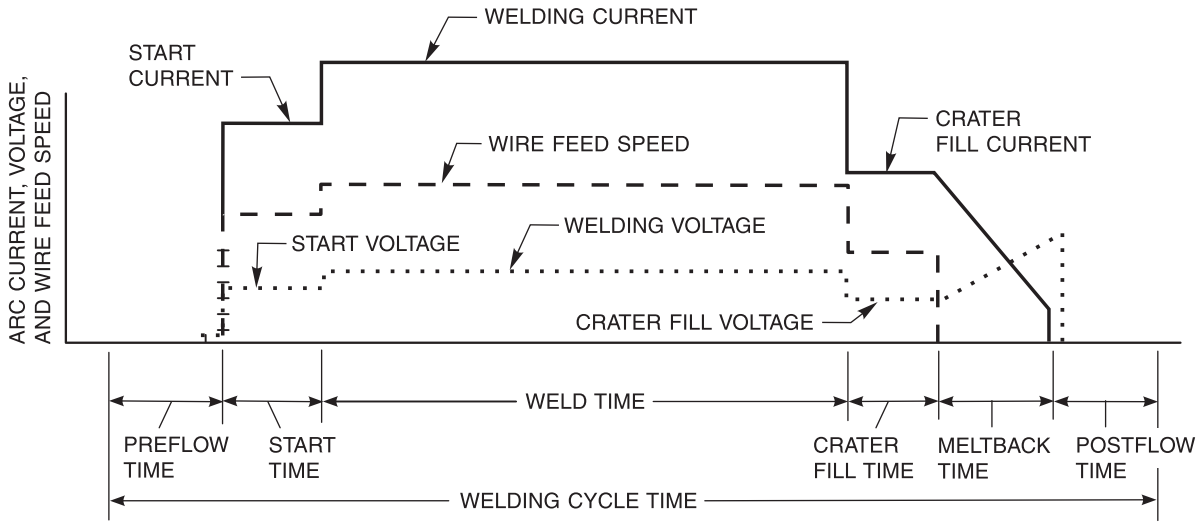


Figure B.54—Typical GMAW, FCAW, and SAW Program for Automatic Welding

This page is intentionally blank.

Annex C (Informative)

Principles of A3.0M/A3.0 Style

This annex 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.

C1. Selection and Construction of Terminology

A3.0 encompasses 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 considered for inclusion in A3.0. This clause presents the Subcommittee policy governing this consideration.

C1.1 Incorporated Terms. Any term which conforms to the definition given in Clause 3, and

(1) Which does not conflict with other established A3.0 terminology;

(2) Whose meaning as related to welding is not clear from a combination of dictionary and/or A3.0 definitions (i.e. multiple-word terms). Examples are: **automatic welding**, **contact tip**, **root surface**, **shielding gas**, and **workpiece connector**.

(3) Process delimited terms have been incorporated where consistent industry usage makes their continued use preferable.

C1.2 Terms Not Normally Incorporated

(1) Terms which violate fundamental dictates of logic or grammar;

(2) Are adequately defined in the English dictionary;

(3) Terms consisting of word combinations, where the definitions of their elements (found in either the dictionary or in A3.0) make the meaning of the combination clear;

(4) In the case of synonyms, the Subcommittee selects one of those synonyms as the standard term, while the remainder become nonstandard terms;

(5) Iteration of standard terms. Example: The term *joint* is defined; other forms such as joints, joining, joined, and join are not. The term *weldability* is defined; other forms such as weldable and unweldable are not.

C1.3 Format. The format of the presented terms is such that:

(1) Only one term is defined in a single location;

(2) Standard terms are printed in **boldface** type. The use of **boldface** type is restricted to standard terms when they are:

(a) The term being defined,

(b) Given in a definition cross-reference,

(c) The standard term given in the definition of a nonstandard term. Examples: **weld reinforcement**, TIG welding, **furnace brazing**.

(3) Standard terms are shown in lightface type when used within a definition, except when included as a cross-reference.

(4) Multiple word terms are hyphenated at the discretion of the Committee based on common application and historical precedence.

C1.4 Arrangement

(1) Terms are arranged in accordance with the dictionary method. That is, the terms are listed alphabetically word-by-word, beginning with the first letter of the first word and continuing across hyphens and spaces to the second and subsequent words.

(2) Terms should not be included as groups; however, if an exception is made, each term within the group is also listed in alphabetical order.

C1.5 Committee Decisions. For various factors, such as entrenched use, disagreement among our own members, pressure from those with parochial interests, or human fallibility, the Definitions Subcommittee has to find compromise between the sometimes incompatible characteristics of good welding terminology. Where there is no clear superiority between competing versions of a given term or its definition, the Definitions Subcommittee has no choice but to make a somewhat arbitrary decision. The significant Definitions Subcommittee decisions are recorded here to inform the reader as to the logic applied in arriving at the approved A3.0 terms.

C1.5.1 *bonding*. The Definitions Subcommittee discourages the use of the term "bonding" for "welding." We reserve the term *bonding* for the joining and allied processes, where either an adhesive bond or a mechanical bond is predominant at the interface created by the process actions, i.e., adhesive bonding, brazing, soldering, and thermal spraying. When an atomic bond between the atoms at that interface is predominant, the resulting joint is called a *weld*, and the process that produced that joint is called *welding*, without regard to whether the weld interface is created as a result of fusion or in the solid state. The interatomic bond existing between metal atoms at the weld interface of a fusion weld is no different than that at the weld interface of a solidstate weld.

C1.5.2 *diffusion welding*. Diffusion welding is consistent with international custom. The translation of that joining process from any language of the industrial nations into English has for many years been diffusion welding—not diffusion bonding. The replacement by the British Standards Institution (*Welding Terms and Symbols*, BS499, Part 1. Glossary for welding, brazing, and thermal cutting, 1983) of diffusion bonding by diffusion welding means that *diffusion welding*, rather than "diffusion bonding," is now universally accepted as a part of standard welding terminology.

The origin of the term *diffusion bonding* is unknown, but its widest proliferation may be found in the aircraft and associated industries. Welds sometime fail—of course, unwelded structures also are not immune to failure—and the resulting prejudice has been a contributing cause of welding not reaching its full potential in aircraft construction. It was thought by some that if diffusion welding were given a different name, the aversion to welding would be overcome. It was not, but welding terminology remains plagued by the term *diffusion bonding* and a multitude of corollary terms spawned by the bonding fad.

C1.5.3 *gas tungsten arc welding* (or *gas metal arc welding*) versus TIG (or MIG). The Definitions Subcommittee prefers the terms *gas metal arc welding and gas tungsten arc welding*, with modifiers to denote the variations of the processes. In this case, we have made an exception and chosen not to join the reputed majority, in the hope that logic will ultimately prevail. The gas tungsten arc welding process was originally used with an inert gas as the arc shielding atmosphere. The term *tungsten inert gas (TIG)* became popular. The later application of non-inert, i.e., active, gases for arc shielding rendered the term *TIG* inaccurate. To remove that discrepancy, the term *tungsten active gas (TAG)* has been proposed by some. With that terminology, the welding of stainless steel with argon is referred to as a "TIG welding process," and if hydrogen is added to the argon shielding gas, the welding process becomes "TAG." If the latter gas mixture is used for welding a noble metal, the welding process would then revert to "TIG." Thus the name of the welding process depends not only on the composition of the shielding gas but also on the base metal composition. Such terminology is no more logical than making the name of the shielded metal arc welding process dependent upon the type of electrode covering and the composition of the base metal. The proponents of TIG cite its simplicity, brevity, and ease of pronunciation. Tungsten inert gas, by itself, is rather meaningless. Only when the word "welding" is added, is the term complete and may be legitimately compared with gas tungsten arc welding. The term *TIGW* then loses some of its cited advantages.

Arguments similar to those made in support of GTAW, also apply to gas metal arc welding (GMAW) versus metal inert gas welding (MIGW). Both GTAW and GMAW are part of a coherent letter designation system that has been developed by the Definitions Subcommittee for all of the welding and allied processes. Haphazard changes cannot be made without damage to the letter designation system as a whole. That fact is seldom considered by those of the TIG-MIG school.

C1.5.4 *welder.* The use of the term *welder* to indicate the person who does the welding originated in the early days of welding and has been reaffirmed by the American Welding Society since the 1969 edition. To distinguish the welder from the machine used to perform the welding, the term *welding machine* was introduced for the latter. On the other hand, it has been claimed by some that welding terminology would be improved by substitution of the term "welder" for the term "welding machine" and the term "weldor" for the term "welder." That has the advantage of greater simplicity (but not much); and the written terms are clearly distinguishable. However, that ignores the spoken language. While a conscious effort to emphasize the second vowel can make the difference between "welder" and "weldor" clear, the precision of enunciation is often not sufficient to clearly indicate to the listener which is which. No such confu-

sion is possible with "welder" and "welding machine." In addition, those who pronounce "welder" differently than "weldor" are not conforming with the English language. The two words are, according to the dictionary, phonetically identical.

C1.5.5 *workpiece*. The use of the term *workpiece* to indicate the part to be welded, brazed, soldered, thermal cut, or thermal sprayed, has not always been popularly received. Webster's Third New International Dictionary offers a single meaning for the term "workpiece" - that being a piece of work in process of manufacture. Other terms that could be considered synonymous such as component, member, and part, include numerous meanings and usages, most of which do not specify particular meanings that reference manufacturing.

C2. Definition Style and Format

C2.1 Purpose. Definitions should:

(1) Include as many uses as possible, while still retaining clarity and accuracy, but should not be extended to every nuance of meaning.

(2) Eliminate unnecessary words.

(3) Have only one clearly applicable definition that accurately reflects the term's use in the welding world.

(4) Not be intended to replace portions of textbooks or specifications, but rather, are intended to ensure that the meaning of each term used in those documents is clear and is the same for all readers.

C2.2 Essential Elements. The essential elements of a term and definition are the term, a period, and one succinct and technically correct sentence to convey the fact or concept represented by the term. The term and basic definition are complete in one sentence when a simple verb such as "is" or "means" is substituted for the period. The definition does not repeat the complete term. A term and basic definition form a genus-species-differentia classical definition whenever possible. Example: **liquidus**. The term *liquidus* is one species of the genus *temperature*. The remainder of the definition is the differentia that distinguishes this species from all other species, e.g., solidus and preheat temperature, within the temperature genus. A second example: **soldering iron**. This example is comparable to the first, with "soldering iron" being the species and "soldering tool" the genus.

Letter designations for standard welding processes shall be included after the standard term and shall be printed in **boldface** and enclosed in parentheses. Letter designations for other standard terminology shall be included after the standard term and will be enclosed in parentheses but not printed in **boldface**. Examples: **electroslag welding (ESW)**, **heat-affected zone (HAZ)**.

When more appropriate, a definition by extension, which defines a term by enumeration of its parts or of the species for which it is the genus, is used. Example: **composite electrode**.

Supplementary information, in the form of complete sentences, may be included after the basic definition. However, developing this into an encyclopedic discussion is avoided. Unless required for clarity, handbook information and requirements of standards are not included. Example: (the last sentence is not acceptable) **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. See the latest edition of AWS A4.2, *Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal*.

All cross-references to figures and tables begin with the word, "See." All cross-references to terms begin with the words, "See also," except as explained in C2.3. Cross-references are stated in the order of figures, tables, and terms, which are stated in alphabetical order.

C2.3 Format. Definitions include only defined terms (in either A3.0 or the dictionary), multiple-word partial terms, primary terms, and complete terms; not secondary or single-word partial terms.

All standard terms are completely defined, and the definition does not consist of only a cross-reference to another term, except as follows:

(1) Where context makes the meaning of a partial term clear, the partial term is defined by cross referencing the complete term.

(2) Example of a single-word partial term: **cylinder**. See **gas cylinder**. Example of a multiple-word partial term: **welding torch**.

(3) Where two forms of the same term are in common use and both are acceptable, the secondary form is defined by a cross-reference to the primary form, which has a complete definition. Example: **weld face**.

(4) When the meaning of a term is self evident, but a figure is useful, the term is defined by a cross-reference to a figure. Example: **weld metal crack**.

(5) A multiple-word term is stated as it is normally written, accompanied by a definition of the basic term as

a cross-reference to the multiple-word term. Examples: **arc welding deposition efficiency**, **deposition efficiency**.

Abbreviations are not used in definitions. This includes letter designations of the welding and allied processes.

Units of measurement are not included in definitions.

The definition of a nonstandard term starts with the phrase, "A nonstandard term for," when the term has no use as a standard term, or, with the phrase, "A nonstandard term when used for," when the term is nonstandard for the stated purpose, but is a standard term when used for other purposes. In each case, the introductory phrase is followed by the appropriate standard term or a description of the term use. Examples using the first phrase: diffusion bonding, globular arc, and hydrogen brazing. Examples using the second phrase: bottle, lead burning, and metallizing.

Nonstandard terms are not used or cross-referenced in definitions.

Terms are categorized as either standard or nonstandard. No other designation, such as preferred or nonpreferred, acceptable or nonacceptable, correct or incorrect is used, except that when the misuse of a term may endanger personal safety, the term is identified as both nonstandard and incorrect. Example: ground lead.

A term that has limited and clearly definable applicability includes the area of applicability, in italic type, preceded by a comma, immediately following the term. If either the term or definition reveals the application area, the italicized expression is omitted. An example of the former: **accelerating potential**. Examples of the latter: **arc plasma**.

No term has more than one definition, except for terms that may be delimited to more than one application. Example: **horizontal welding position**. Where a verb is commonly used and treated as a noun, the term is stated in the form of a gerund (ending in "ing") and the definition is expressed accordingly. A verb is stated in the infinitive form and identified as such by placing a comma and the letter *v* in italic type after the term. Definitions of verbs begin with the word "to" and are expressed accordingly.

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

braze, *v.* The act of brazing.

A term that is an adjective is identified as such by placing a comma and *adj.* in italic type after the term. The definition is an adjectival phrase, and is not a complete sentence. Example: **as-welded**, *adj.*

A term that is a noun is stated in the singular form.

C2.4 Committee Decisions. The word "deposit," or any of its derivatives, is used only in connection with the terms **filler metal** or **surfacing metal**. Use with such terms as **weld metal**, **weld bead**, **weld**, etc., is nonstandard.

Definitions of terms describing weld conditions shall limit the use of wording indicating acceptability or rejectability of those conditions to those words necessary to accurately define those terms.

Annex D (Informative)
Modifications to A3.0M/A3.0 from A3.0:2001

This annex 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.

New Terms/Definitions

adaptive control process (XXX-AD)
arm
as-soldered
assembly
automatic process (XXX-AU)
backup electrode
balling up, *brazing and soldering*
blanket brazing
brazed joint
brazing alloy
brazing filler metal paste
brazing foil
brazing flux
brazing paste
brazing powder
brazing rod
brazing rope
brazing strip
brazing symbol
brazing wire
brazing shim
brazing tape
cap, *resistance welding*
carbon arc brazing (CAB)
carbon arc gouging (CAG)
chemical-bath dip brazing
circular electrode
cold brazed joint
differential thermal expansion
dissolution, *brazing*
dynamic electrode force, *resistance welding*
electrode adapter, *resistance welding*
electrode face, *resistance welding*
electrode holder, *resistance welding*
electrode life, *resistance welding*
electrode mushrooming, *resistance welding*
electrode pickup, *resistance welding*
electrode skidding, *resistance welding*
electrode tip
electron beam brazing (EBB)
expulsion, *resistance welding*
face feed, *brazing and soldering*
fillet, *brazing and soldering*
flash, *arc stud welding*
flash, *flash welding*
flash coat, *brazing and soldering*
flat position, *brazing*
flowability, *brazing and soldering*
focal spot
flux coated rod, *brazing*
flux cored soldering filler metal
freezing point
gas generator
hand soldering
heat input
heat input rate
heat pattern
heating pattern
hybrid welding
incomplete coalescence, *solid-state welding*
indentation, *resistance welding*
indirect welding, *projection welding, resistance seam welding, resistance spot welding*
induction coil
induction power source
joint brazing procedure
joint remelt temperature, *brazing and soldering*
laser beam brazing (LBB)
liquation, *brazing*
machine brazing
manual gun, *resistance welding*
manual transgun, *resistance welding*

manual process (XXX-MA)
mechanized process (XXX-ME)
metal-bath dip soldering
noncorrosive flux, *brazing and soldering*
oil-bath dip soldering
off time
parallel welding, *resistance welding*
paste braze
paste solder
paste soldering filler metal
plasma arc gouging (PAG)
portable gun, *resistance welding*
portable transgun, *resistance welding*
power density
precoating, *brazing and soldering*
preform, *brazing and soldering*
preheat, *v.*
reactive flux, *soldering*
reflow soldering
remelt temperature, *brazing and soldering*
resistance welding time
robot gun
robotic process (XXX-RO)
rub soldering
salt-bath dip soldering
sandwich brazement
semiautomatic process (XXX-SA)
servogun
skewed joint
skull, *brazing and soldering*
solder
solder paste
soldering filler metal
soldering filler metal paste
soldering flux
soldering temperature
solderment
standoff distance, *explosion welding*
static electrode force, *resistance welding*
stopoff, *brazing and soldering*
susceptor
sustained backfire
sweat soldering
sweating
theoretical electrode force, *resistance welding*
throat area, *resistance welding*
throat depth, *resistance welding*
throat height, *resistance welding*
transfer tape
transgun
weld brazing
weld gauge
welding flux
welding flux, *submerged arc welding*
wetting, *brazing and soldering*
workpiece connector

Modified Terms/Definitions

abrasion soldering
absorptive lens
adaptive control
adaptive control brazing (B-AD)
adaptive control soldering (S-AD)
adaptive control thermal cutting (TC-AD)
adaptive control thermal spraying (TS-AD)
adaptive control welding (W-AD)
as-brazed
as-welded
automatic
automatic brazing (B-AU)
automatic soldering (S-AU)
automatic thermal cutting (TC-AU)
automatic thermal spraying (TS-AU)
automatic welding (W-AU)
backfire
backing shoe
backup, *flash and upset welding*
bit
block brazing (BB)
block sequence
bond coat, *thermal spraying*
bonding force
braze, *n.*
brazeability
braze interface
brazement
braze welding (BW)
brazing (B)
brazing filler metal
brazing sheet
brazing technique
brazing temperature
brittle nugget
butt joint
chain intermittent weld
coil with support
coil without support
cold crack
cold soldered joint
commutator-controlled welding
contact resistance, *resistance welding*
cool time, *resistance welding*
copper brazing
corner joint
corona, *resistance welding*
covered electrode

resistance welding die
resistance welding electrode
resistance welding gun
resistance welding upslope time
resistance welding voltage
resistance welding weld time
robotic, *adj.*
robotic brazing (B-RO)
robotic soldering (S-RO)
robotic thermal cutting (TC-RO)
robotic thermal spraying (TS-RO)
robotic welding (W-RO)
roll spot welding
salt-bath dip brazing
scarf groove
seam
seam weld
seam weld size
secondary circuit
semiautomatic, *adj.*
semiautomatic brazing (B-SA)
semiautomatic soldering (S-SA)
semiautomatic thermal cutting (TC-SA)
semiautomatic thermal spraying (TS-SA)
semiautomatic welding (W-SA)
semiblind joint
series welding
set down
sheet separation, *resistance welding*
shielding gas
shrinkage stress
shrinkage void
silver alloy brazing
silver soldering
single-impulse welding
soft solder
solder, *n.*
solder interface
soldering (S)
soldering blowpipe
soldering gun
soldering iron
solidus
spool
spot weld
spot weld size
staggered intermittent weld
step brazing
step soldering
stored energy welding
substrate
surface expulsion, *resistance welding*
test coupon
thermal spray deposit interface
thermal stress
tinning
tip skid
T-joint
toe crack
upset
upset time
upset welding (UW)
wave soldering (WS)
weld bonding
weld brazing
weld interface
weld interval, *resistance welding*
weld symbol
welding technique
welding transformer
welding wheel
weldment
whipping
workpiece
workpiece lead

Terms/Definitions with Editorial Changes

2FR, pipe
3F, plate
3G, plate
5F, pipe
5G, pipe
6F, pipe
6G, pipe
6GR, pipe
accelerating potential, *electron beam welding and cutting*
acceptable weld
activated rosin flux
active flux, *submerged arc welding*
air acetylene welding (AAW)
air carbon arc cutting (CAC-A)
alloy flux, *submerged arc welding*
arc braze welding (ABW)
arc cutting (AC)
arc force
arc gouging
arc plasma
arc stud welding (SW)
arc welding (AW)
atomic hydrogen welding (AHW)
bare electrode
bare metal arc welding (BMAW)
base material

base metal
base metal zone (BMZ)
blowpipe
braze metal
buttering
butting member
button
capillary action
carbon arc braze welding (CABW)
carbon arc brazing
carbon arc cutting (CAC)
carbon arc welding (CAW)
cascade sequence
cladding
coextrusion welding (CEW)
constricted arc
consumable electrode
consumable insert
contact tip
continuous wave laser
continuous weld
cord, *thermal spraying*
corrosive flux, *brazing and soldering*
cover plate
deposited metal, *brazing, soldering, and welding*
deposited metal, *surfacing*
diffusion welding (DFW)
double-groove weld, *fusion welding*
double-welded joint, *fusion welding*
electrode indentation, *resistance welding*
electrogas welding (EGW)
electron beam cutting (EBC)
electron beam gun
electron beam welding (EBW)
electroslag welding (ESW)
explosion welding (EXW)
ferrule, *arc stud welding*
filter plate
firecracker welding
fisheye
fitter
flame spraying operator
flow welding (FLOW)
flux cored arc welding (FCAW)
flux cutting (OC-F)
forge welding (FOW)
friction stir welding (FSW)
friction upset distance
friction welding (FRW)
fused thermal spray deposit
fusion face
fusion welding
gas carbon arc welding (CAW-G)
gas metal arc cutting (GMAC)
gas metal arc welding (GMAW)
gas tungsten arc cutting (GTAC)
gas tungsten arc welding (GTAW)
goggles
gradated thermal spray deposit
heat balance
heat time
hermetically sealed container
high energy beam cutting (HEBC)
high energy beam welding (HEBW)
high pulse current, *pulsed power welding*
hood
horn
hot isostatic pressure welding (HIPW)
hot pressure welding (HPW)
incomplete fusion
infrared brazing (IRB)
insulating nozzle, s*elf-shielded flux cored arc welding*
joint recognition
joint root
joint tracking
joint type
lamellar tear
laser
laser beam air cutting (LBC-A)
laser beam braze welding (LBBW)
laser beam cutting (LBC)
laser beam evaporative cutting (LBC-EV)
laser beam inert-gas cutting (LBC-IG)
laser beam oxygen cutting (LBC-O)
laser beam splitter
laser beam welding (LBW)
lasing medium
level wound
linear discontinuity
low pulse current, *pulsed power welding*
metal electrode
metal powder cutting (OC-P)
mixing chamber
moving shoe
multiport nozzle
narrow groove welding
nonbutting member
orifice gas
oscillation
overspray, *thermal spraying*
oxyacetylene cutting (OFC-A)
oxyacetylene welding (OAW)
oxyfuel gas cutting (OFC)
oxyfuel gas welding (OFW)
oxygen arc cutting (OAC)
oxygen cutting (OC)
oxygen gouging (OG)
oxygen lance cutting (OLC)

oxyhydrogen cutting (OFC-H)
oxyhydrogen welding (OHW)
oxynatural gas cutting (OFC-N)
oxypropane cutting (OFC-P)
peel test
penetration-enhancing flux, *gas tungsten arc welding*
percussion welding (PEW)
plasma arc cutting (PAC)
plasma arc welding (PAW)
plasma sprayer
platen spacing
postflow time
preheat current, *resistance welding*
prequalified welding procedure specification (PWPS)
pressure gas welding (PGW)
random wound
reconditioned flux, *submerged arc welding*
resistance seam welding (RSEW)
roll welding (ROW)
root bead
root face
rough threading, *thermal spraying*
runoff weld tab
seal-bonding material, *thermal spraying*
self-fluxing alloy, *thermal spraying*
series submerged arc welding (SAW-S)
shadow mask, *thermal spraying*
shielded carbon arc welding (CAW-S)
shielded metal arc cutting (SMAC)
single welded joint, *fusion welding*
single-groove weld, *fusion welding*
single-port nozzle
smoothing pass
solder metal
solid-state welding (SSW)
splice member
split layer technique
spray tab, *thermal spraying*
start current
start time
starting weld tab
stationary shoe
stress-corrosion cracking
stub
submerged arc welding (SAW)
surfacing material
surfacing metal
thermal cutter
thermal cutting (TC)
thermal cutting operator
thermal gouging (TG)
thermal spraying deposition efficiency
thermite reaction
thermite welding (TW)
torch brazing (TB)
torch soldering (TS)
transformer tap
twin carbon arc brazing (TCAB)
twin carbon arc welding (CAW-T)
ultrasonic welding (USW)
unfused flux, *submerged arc welding*
unmixed zone
vacuum brazing
virgin flux, *submerged arc welding*
water wash
weaving
weld dam
weld groove, *fusion welding*
weld metal zone (WMZ)
weld recognition
weld tab
weldability
welding
welding arc
welding leads
welding tip, *oxyfuel gas welding*
work angle, *pipe*

Terms Changed from Standard to Nonstandard

electrode tip
joint brazing procedure
paste brazing filler metal
paste solder
sweat soldering
workpiece connection

Terms Changed to Obsolete or Seldom Used

lightly coated electrode, *shielded metal arc welding*
shielded carbon arc welding (CAW-S)
twin carbon arc welding (CAW-T)

Deleted Terms (Also see **New Terms** for changes in delimiters)

arm, *resistance welding*
balling up
circular electrode, *resistance seam welding*
doped solder
dynamic electrode force
electrode holder
electrode mushrooming

This page is intentionally blank.

Annex E (Informative)

Guidelines for the Preparation of Technical Inquiries

This annex 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.

E1. Introduction

The American Welding Society (AWS) Board of Directors has adopted a policy whereby all official interpretations of AWS standards are handled in a formal manner. Under this policy, all interpretations are made by the committee that is responsible for the standard. Official communication concerning an interpretation is directed through the AWS staff member who works with that committee. The policy requires that all requests for an interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some interpretations may require considerable time.

E2. Procedure

All inquiries shall be directed to:

Managing Director
Technical Services Division
American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

All inquiries shall contain the name, address, and affiliation of the inquirer, and they shall provide enough information for the committee to understand the point of concern in the inquiry. When the point is not clearly defined, the inquiry will be returned for clarification. For efficient handling, all inquiries should be typewritten and in the format specified below.

E2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry along with the edition of the standard that contains the provision(s) the inquirer is addressing.

E2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be to obtain an interpretation of a standard's requirement or to request the revision of a particular provision in the standard.

E2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to understand the point of the inquiry. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annex) that bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

E2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry or provide the wording for a proposed revision, if this is what the inquirer seeks.

E3. Interpretation of Provisions of the Standard

Interpretations of provisions of the standard are made by the relevant AWS technical committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the portion of the standard addressed by the inquiry. The subcommittee reviews the inquiry and the proposed reply to determine what the response to the inquiry should be. Following the subcommittee's development of the response, the inquiry and the response are presented to the entire committee for review and approval. Upon approval by the committee, the interpretation is an official

interpretation of the Society, and the secretary transmits the response to the inquirer and to the *Welding Journal* for publication.

E4. Publication of Interpretations

All official interpretations will appear in the *Welding Journal* and will be posted on the AWS web site.

E5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning AWS standards should be limited to questions of a general nature or to matters directly related to the use of the standard. The *AWS Board Policy Manual* requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS standard with the information that such an interpretation can be obtained only through a written request. Headquarters staff cannot provide consulting services. However, the staff can refer a caller to any of those consultants whose names are on file at AWS Headquarters.

E6. AWS Technical Committees

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees or to consideration of revisions to existing provisions on the basis of new data or technology. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on (1) specific engineering problems, (2) requirements of standards applied to fabrications outside the scope of the document, or (3) points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest.

List of AWS Documents on Arc Welding and Cutting

Designation	Title
A2.1-WC	*Welding Symbol Chart (Wall Size)*
A2.1-DC	*Welding Symbol Chart (Desk Size)*
A2.4	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*
A3.0	*Standard Welding Terms and Definitions Including Terms for Brazing, Soldering, Thermal Cutting, and Thermal Spraying*

This page is intentionally blank.