AWS A2.4:2020
An American National Standard

Standard Symbols for Welding, Brazing, and Nondestructive Examination

American Welding Society®

AWS A2.4:2020
An American National Standard

Approved by the
American National Standards Institute
January 9, 2020

Standard Symbols for Welding, Brazing, and Nondestructive Examination

8th Edition

Supersedes AWS A2.4:2012

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 establishes a method for specifying certain welding, brazing, and nondestructive examination information by means of symbols, including the examination method, frequency, and extent. Detailed information and examples are provided for the construction and interpretation of these symbols.

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Foreword

This foreword is not part of this standard but is included for informational purposes only.

Joining processes and examination methods cannot take their proper place as fabricating tools unless means are provided for conveying information from the designer to joining and inspection personnel. The symbols in this publication are intended to be used to facilitate communication from the designer to fabrication and inspection personnel. Statements such as "to be welded throughout" or "to be completely welded," on a drawing have the effect of transferring the design responsibility from the designer to production personnel, who cannot be expected to know design requirements. In the interest of safety, using a general statement is dangerous as the welder is not expected to know the requirements of the weld.

This standard does not dictate welding tolerances, dimensions or design requirements. Information presented herein is to show how to convey this information.

The symbols presented in this standard were developed to provide the means for placing welding, brazing, and nondestructive examination information on two-dimensional drawings. In practice, many users will need only a few of the symbols, and, if they desire, can select only the parts of the system that fit their needs. Applicability to three dimensional digital models is being researched and will be covered more extensively in future editions.

The publication AWS A2.4 came into existence in 1976 as a result of combining and superseding two earlier documents, A2.0, *Standard Welding Symbols*, and A2.2, *Nondestructive Testing Symbols*. Both of these early documents had their origins in work done jointly by the American Welding Society and the American Standards Association (ASA) Sectional Committee Y32. AWS A2.0 was first published in 1947 and was revised in 1958 and 1968. AWS A2.2 first appeared in 1958 and was revised in 1969.

The evolution of AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Testing*, is shown below:

ANSI/AWS A2.4-76	*Symbols for Welding and Nondestructive Testing*;
ANSI/AWS A2.4-79	*Symbols for Welding and Nondestructive Testing, Including Brazing*;
ANSI/AWS A2.4-86	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*;
ANSI/AWS A2.4-93	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*;
ANSI/AWS A2.4-98	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*;
AWS A2.4:2007	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*;
AWS A2.4:2012	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*;
AWS A2.4:2020	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*.

This eighth edition of AWS A2.4 includes the following revised content:

- Detailed usage for flare groove welds.
- Diameter symbol, Ø, is now no longer a part of the plug weld symbol as it was in the previous edition. However, it is still needed when designating the plug dimension on the welding symbol.
- The use of the contour symbol without a designated mechanical postweld finishing method previously meant that the contour of the weld had to be obtained by welding only. This requirement no longer applies and now allows the contour of the weld to be achieved by any method (e.g., welding or mechanical) as seen fit at the work site. The flat contour symbol is now limited to fillet welds, while the flush symbol is used for other welds, such as groove, plug, and slot.

- Combination groove weld symbol designating two different edge shapes. This is a major change in which one groove weld symbol may be drawn backward (e.g., flare bevel and bevel) to demonstrate actual configuration of the weld joint.
- The use of multiple subreference lines to designate a groove weld extending around a joint where there is no clear point where the joint transitions from one joint type to another.
- Spot and seam welds—the ability to designate size or strength by placing a value to the left of the weld symbol has been modified. The dimension to the left of the weld symbol will only designate the size of the weld. If strength is needed, this information will be required to be specified as a note in the tail of the welding symbol.
- Flash and upset welding symbols are no longer supported; therefore, the welding symbol if needed is recommended to be a reference line and arrow with either "FW" or "UW" designated in the tail of the welding symbol.
- Figures now have new number designations to reflect the clause in which they are referenced.
- The clause for the symbol for nondestructive examination has been rewritten and expanded.

Revisions to the 2020 edition are identified by underlines as well as vertical lines in the margin next to the figures.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS A2 Committee on Definitions and Symbols, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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Standard Symbols for Welding, Brazing, and Nondestructive Examination

1. General Requirements

1.1 Scope. This standard presents a system for indicating welding, brazing, and nondestructive examination requirements. The system includes provisions for the graphical representation of welds, brazes, and nondestructive examination methods with conventions for specifying, at a minimum, the location and extent of their application. Optional elements and supplementary symbols provide a means for specifying additional requirements. Requirements not detailed on the symbol used for welding, brazing, or nondestructive examination shall be provided or referenced elsewhere on the drawing.

Both figures and illustrations are used to depict the use of symbols. Figures are referenced by number within this document to show the correct format and application of symbols used to convey welding, brazing, and nondestructive examination information. An illustration is an un-numbered graphical representation of an example application described within the associated text without providing additional technical requirements. Figures and illustrations are not intended to represent recommended welding, brazing, nondestructive examination, or design practices.

The clause addressing brazing uses the same symbols and conventions as for welding, with the addition of the scarf symbol. The clause addressing symbols for nondestructive examination represents nondestructive examination methods as discussed in the latest edition of AWS B1.10M/B1.10, *Guide for the Nondestructive Examination of Welds*.

The limitations included in specifications and codes are also beyond the scope of this standard.

1.2 Units of Measurement. This standard does not require units of measure. Therefore, no equivalents or conversions are contained except when they are cited in examples.

1.3 Safety. Safety and health issues and concerns are beyond the scope of this standard and therefore are not addressed herein.

Safety and health information is available from the following sources:

American Welding Society:

(1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

(2) AWS Safety and Health Fact Sheets

(3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

(1) Safety Data Sheets supplied by materials manufacturers

(2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies

Work performed in accordance with this standard may involve the use of materials that have been deemed hazardous, and may involve operations or equipment that may cause injury or death. This standard does not purport to address all safety and health risks that may be encountered. The user of this standard should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.

2. Normative References

The document listed below is referenced within this publication and is mandatory to the extent specified herein. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments or revisions of the publication may not apply since the relevant requirements may have changed.

American Welding Society (AWS) document:

AWS A3.0M/A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*.

3. Terms and Definitions

AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*, provides the basis for terms and definitions used herein. However, the following terms and definitions are included below to accommodate usage specific to this document.

examination method designation. A letter designation incorporated into a symbol for nondestructive examination to specify the examination method. See Table A6.

supplementary symbol. A graphic character incorporated into a symbol for welding, brazing, or nondestructive examination to communicate additional requirements. See Figures 4.2 and 17.2.

weld symbol. A graphic character connected to the reference line of a welding symbol specifying the joint geometry or weld type. See also **welding symbol**.

welding symbol. A graphical representation of the specifications for producing a welded joint. See also **weld symbol**.

4. Basic Welding Symbols

4.1 Distinction Between *Weld Symbol* and *Welding Symbol*. As defined in AWS A3.0M/A3.0, there is a distinction between the terms weld symbol and welding symbol. The weld symbol indicates the type of weld and, when used, is a part of the welding symbol.

4.2 Basis of Reference. In the present system, the joint is the basis of reference. The arrow side is the side of the joint to which the arrow of the welding symbol points. The other side is the side of the joint opposite the arrow side.

4.3 Weld Symbols. Weld symbols shall be as shown in Figure 4.1. The symbols shall be drawn in contact with the reference line.

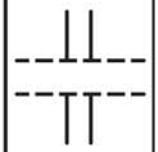
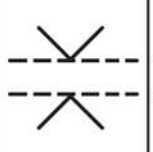
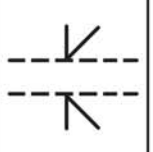
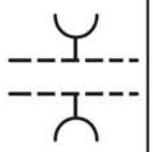
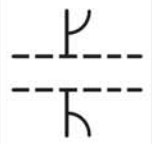
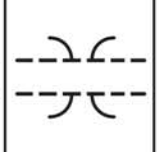
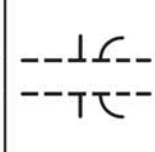
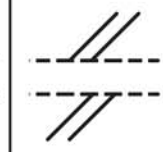
4.4 Supplementary Symbols. Supplementary symbols to be used in connection with welding symbols shall be as shown in Figure 4.2.

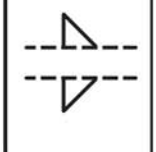
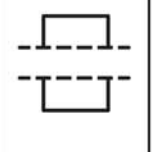
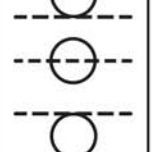
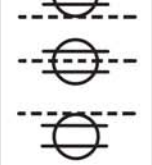
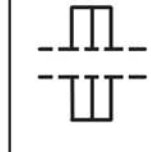
4.5 Welding Symbols. A welding symbol may consist of several elements (see Figure 4.3). Only a horizontal reference line and the arrow are required elements (see D4.5 in Annex D for commentary on use of just a reference line and arrow). Additional elements may be included to convey specific welding information. Alternatively, welding information may be conveyed by other means such as by drawing notes or details, specifications, standards, codes, or other drawings that eliminate the need to include the corresponding elements in the welding symbol.

The tail of the symbol is used for designating additional information such as a specification, process, strength for certain welds, identification of the filler metal or electrode, peening, backgouging, or other operations or references necessary for making the weld or braze.

All elements, when used, shall have specific locations within the welding symbol as shown in Figure 4.3. Mandatory requirements regarding each element in a welding symbol refer to the location of the element and should not be interpreted as a necessity to include the element in every welding symbol.

4.6 Welding Symbol Placement. The arrow of the welding symbol shall point to a line, location, or area that conclusively identifies the joint, location, or area to be welded.

GROOVE							
SQUARE	V	BEVEL	U	J	FLARE-V	FLARE-BEVEL	SCARF [a]
							

FILLET	PLUG OR SLOT	STUD	SPOT OR PROJECTION	SEAM	BACK OR BACKING	SURFACING	EDGE
							

[a] Used for brazed joints only (see Clause 16).

Figure 4.1—Weld Symbols

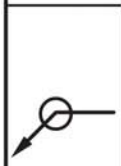
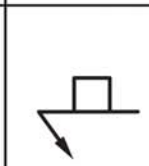
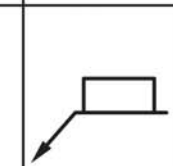
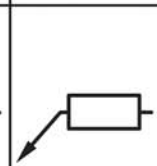
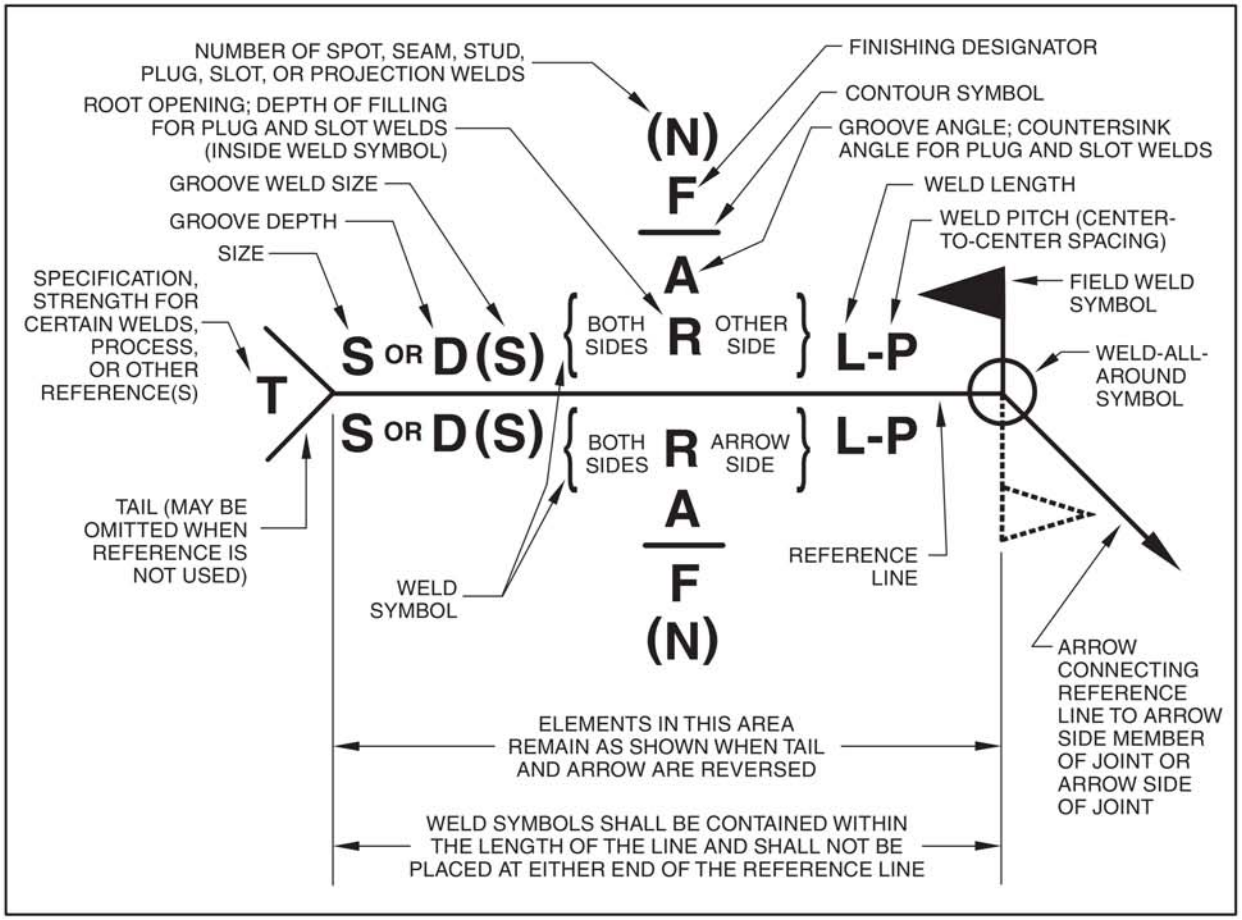
WELD-ALL-AROUND	FIELD WELD	MELT-THROUGH	CONSUMABLE INSERT (SQUARE)	BACKING (RECTANGLE)	SPACER (RECTANGLE)	CONTOUR		
						FLUSH OR FLAT	CONVEX	CONCAVE
								

Figure 4.2—Supplementary Symbols



Note: See D4.5 in Annex D for commentary on Figure 4.3.

Figure 4.3—Standard Location of the Elements of a Welding Symbol

5. Joint Types

The basic welding joint types—butt, corner, T-, lap, and parallel—are shown in Figure 5.1. Joint type designators are shown in Annex A, Table A1.

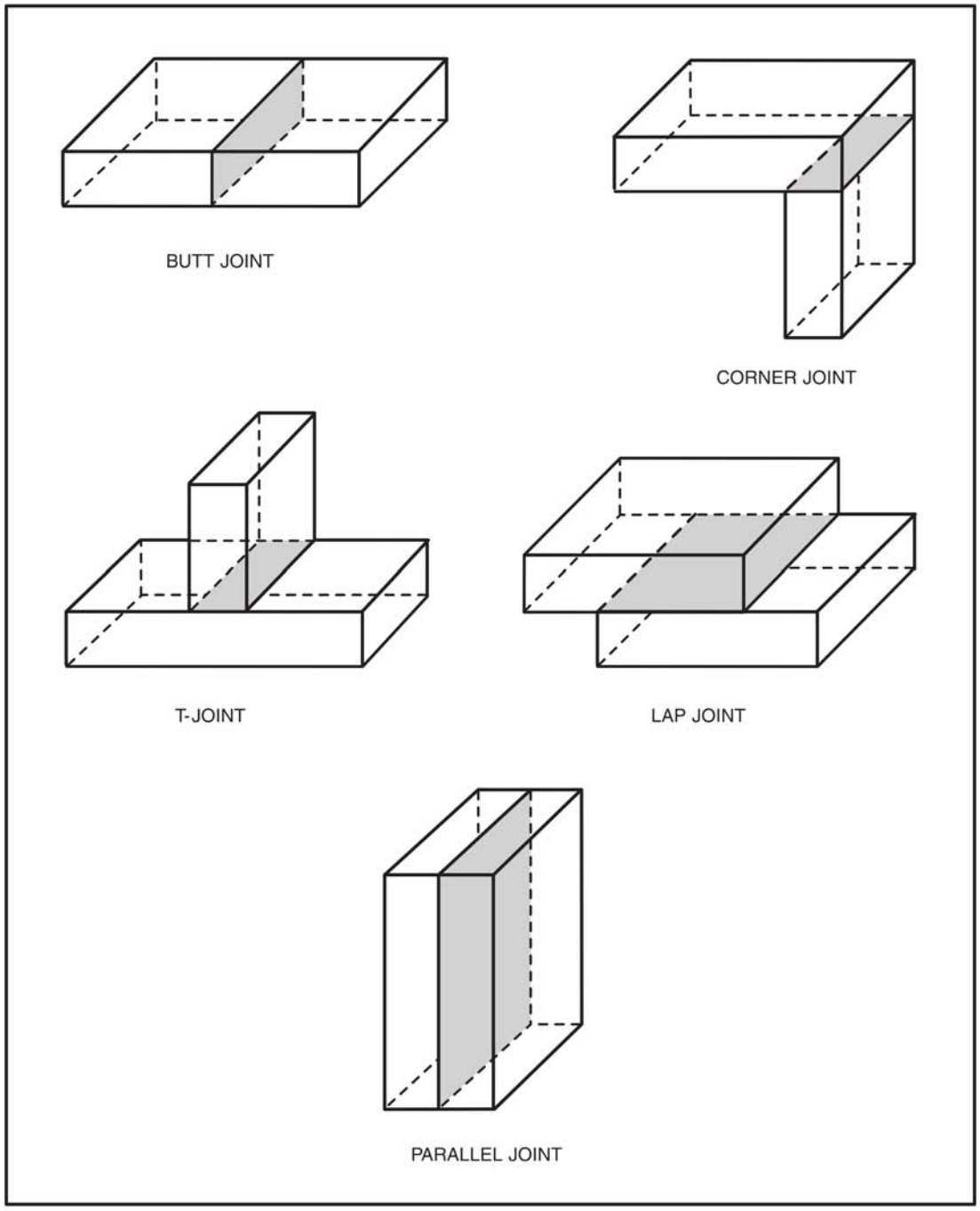
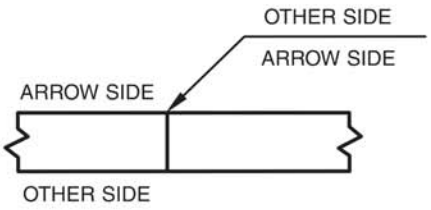


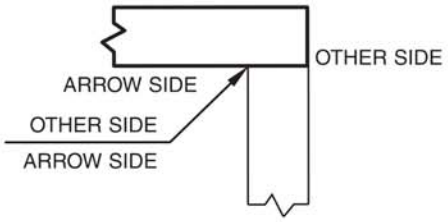
Figure 5.1—Joint Types

6. General Provisions for Welding Symbols

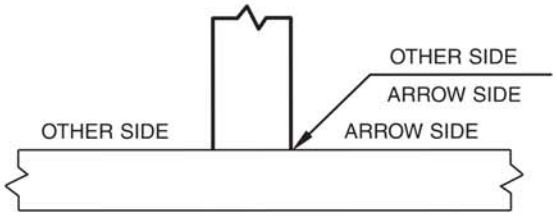
6.1 Arrow Location Significance. Information applicable to the arrow side of a joint shall be placed below the reference line. Information applicable to the other side of a joint shall be placed above the reference line.



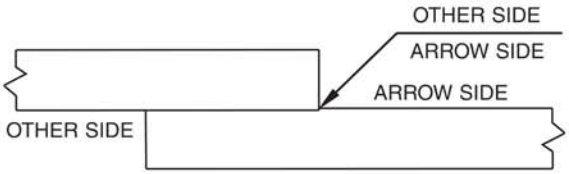
(A) BUTT JOINT



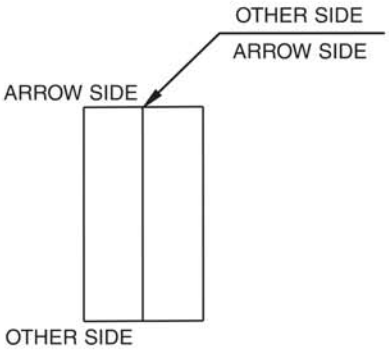
(B) CORNER JOINT



(C) T-JOINT



(D) LAP JOINT



(E) PARALLEL JOINT

6.1.1 Fillet, Groove, and Edge Weld Symbols. For these symbols, the arrow shall contact the outer surface of one of the joints, and this side shall be considered the arrow side of the joint. The side opposite the arrow side of the joint shall be considered the other side of the joint (see Figure 6.1).

6.1.2 Plug, Slot, Spot, Projection, and Seam Weld Symbols. For these symbols, the arrow shall contact the outer surface of one of the joint members at the center-line of the desired weld. The member toward which the arrow points shall be considered the arrow-side member. The other joint member shall be considered the other-side member (see the figures cited in Clauses 9 through 12).

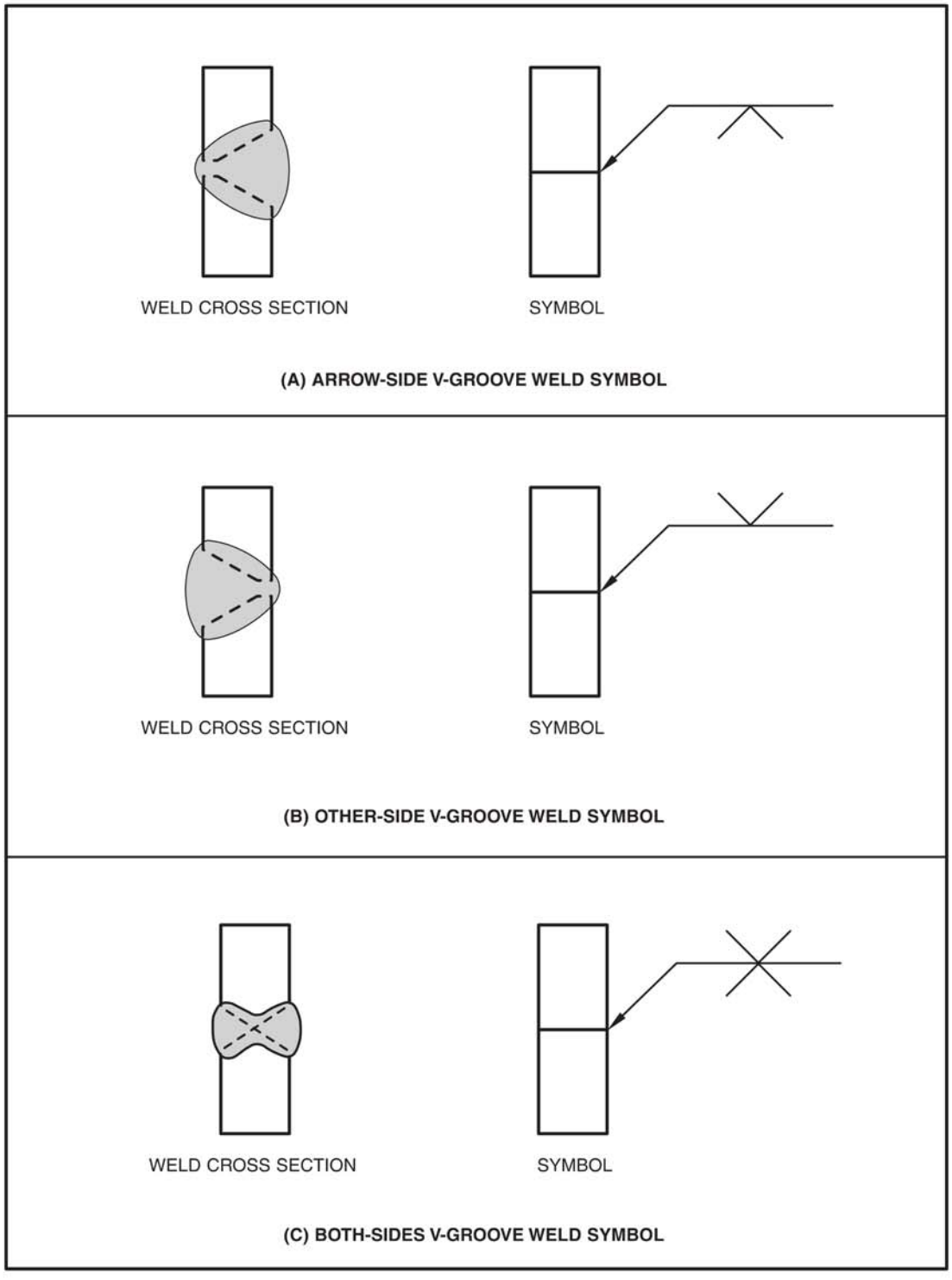


Figure 6.1—Application of Weld Symbols to Indicate the Arrow Side, the Other Side, and Both Sides

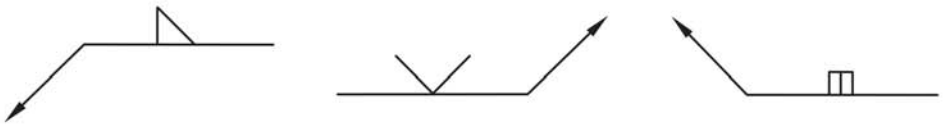
6.1.3 Symbols with No Side Significance. Some weld symbols have no arrow-side or other-side significance, although supplementary symbols used in conjunction with them may have such significance (see 11.1.1.3 and 12.1.1.3).

6.1.4 Arrow-Side Only Symbols. Stud and surfacing welds are applied on a surface rather than at a joint and shall be shown only as arrow-side welds.

6.2 Weld Location with Respect to the Joint

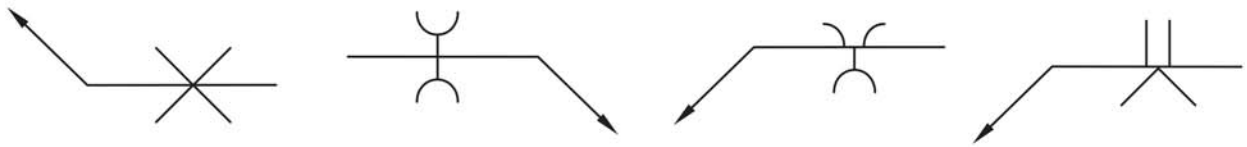
6.2.1 Arrow Side. Welds on the arrow side of the joint shall be specified by placing the weld symbol below the reference line (see 6.1.1).

6.2.2 Other Side. Welds on the other side of the joint shall be specified by placing the weld symbol above the reference line (see 6.1.1).

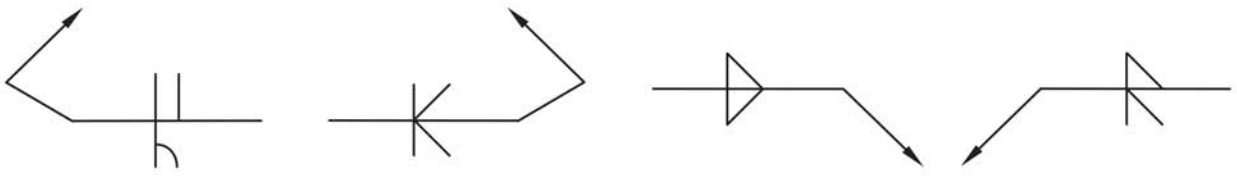


6.2.3 Both Sides. Welds on both sides of the joint shall be specified by placing weld symbols both below and above the reference line.

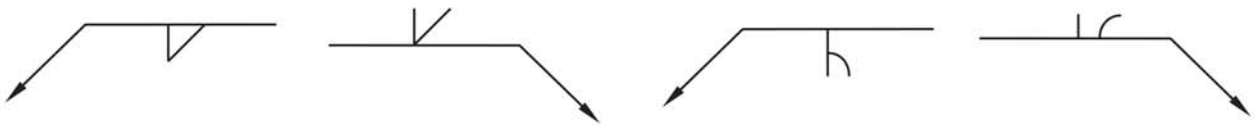
6.2.3.1 Symmetrical Weld Symbols. If the weld symbols used on both sides of the reference line have axes of symmetry perpendicular to the reference line, these axes of the symbols shall be directly aligned across the reference line. Staggered intermittent welds are an exception.



6.2.3.2 Nonsymmetrical Weld Symbols. If either of the weld symbols used lacks an axis of symmetry perpendicular to the reference line, the leftmost points of contact with the reference line shall be aligned. Staggered intermittent welds are an exception.



6.3 Specific Weld Symbol Orientation. Fillet, bevel-groove, J-groove, and flare-bevel-groove weld symbols shall be drawn with the perpendicular leg always to the left.



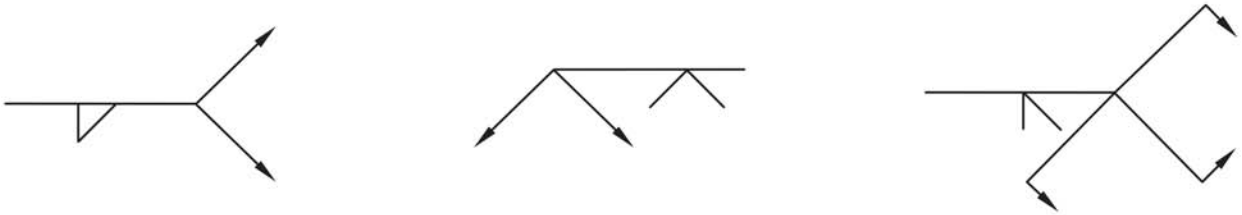
6.4 Break in the Arrow

6.4.1 Groove Welds. When only one joint member is to be prepared (e.g., bevel-groove, J-groove, flare-bevel), the arrow shall have one break and point toward that member (see Figure 6.2). The arrow need not be broken if it is apparent which member is to be prepared (see Figure 6.3). It shall not be broken if there is no preference as to which member is to be prepared. A broken arrow need not be used for joints where combined welds are to be specified and it is apparent which member is to be prepared.

6.4.2 Fillet Welds. The arrow may or may not be broken to indicate fillet weld locations [see Figure 6.4(A)].

6.5 Combination Weld Symbols. For joints requiring more than one weld type, a symbol shall be used to specify each weld (see 7.14 and Figure 6.3).

6.6 Multiple Arrows. Two or more arrows may be used with a single reference line to point to locations where identical welds are specified [see Figures 6.4(A) and 6.5].



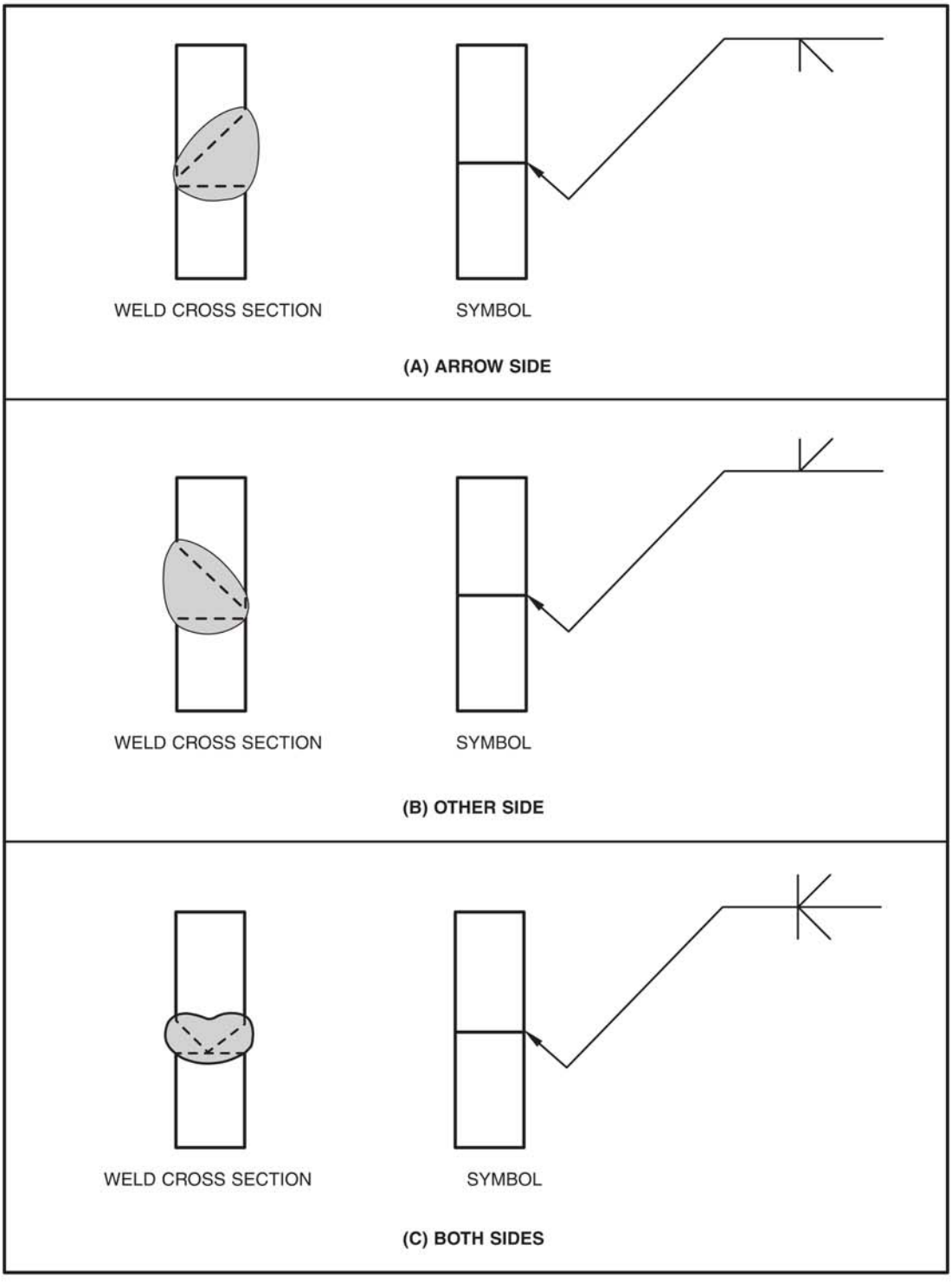


Figure 6.2—Application of the Break in the Arrow of the Welding Symbol

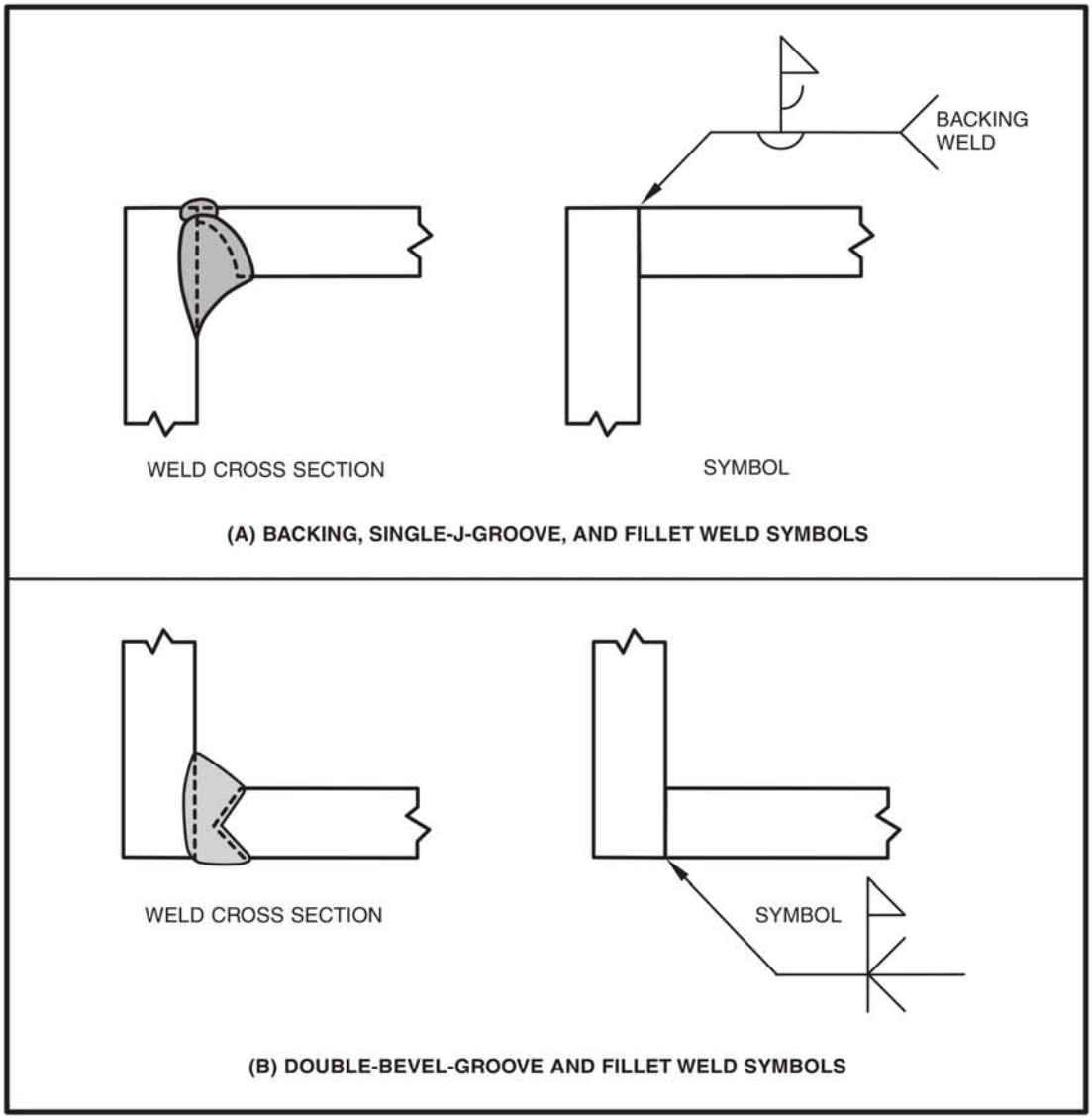


Figure 6.3—Application of Combination Weld Symbols

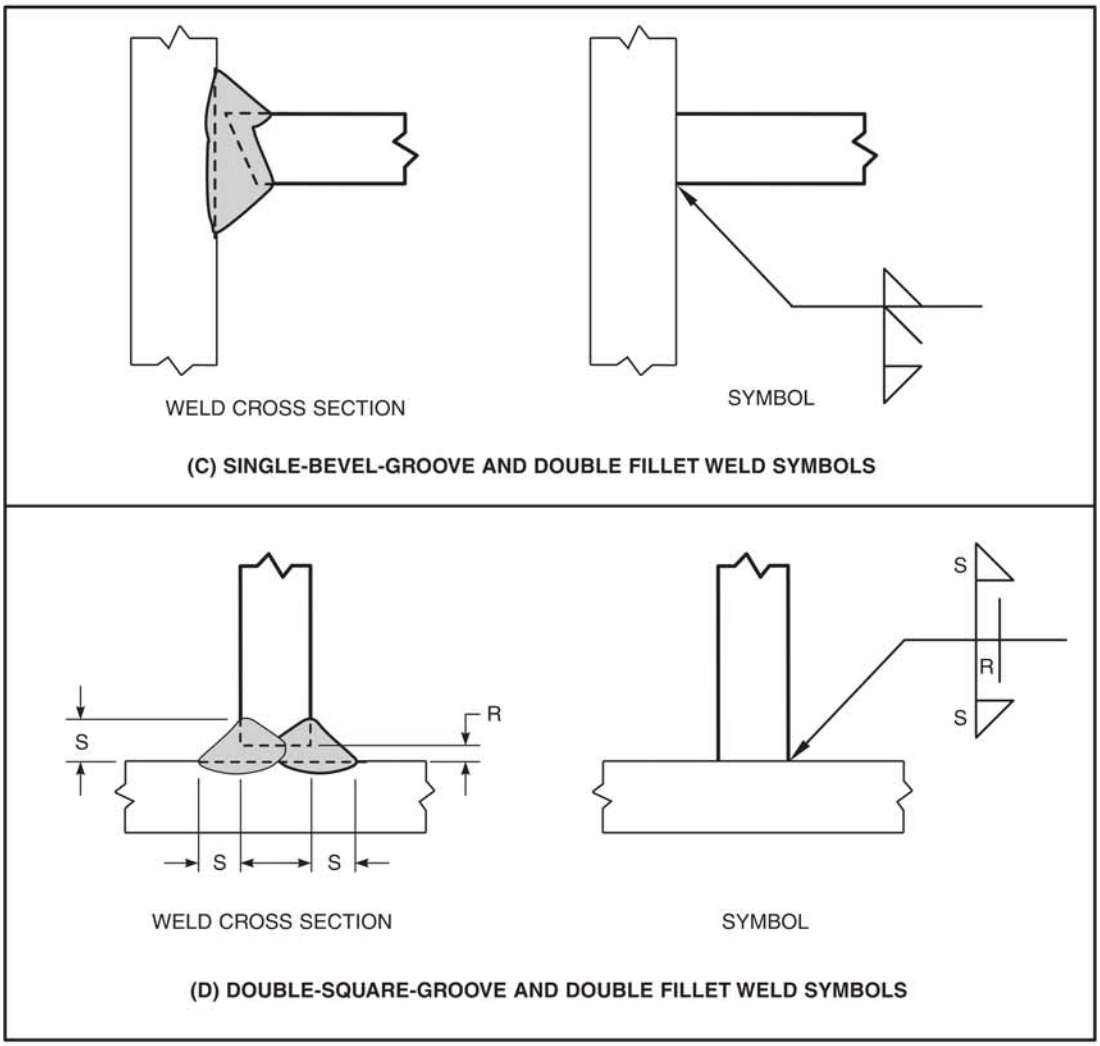


Figure 6.3 (Continued)—Application of Combination Weld Symbols

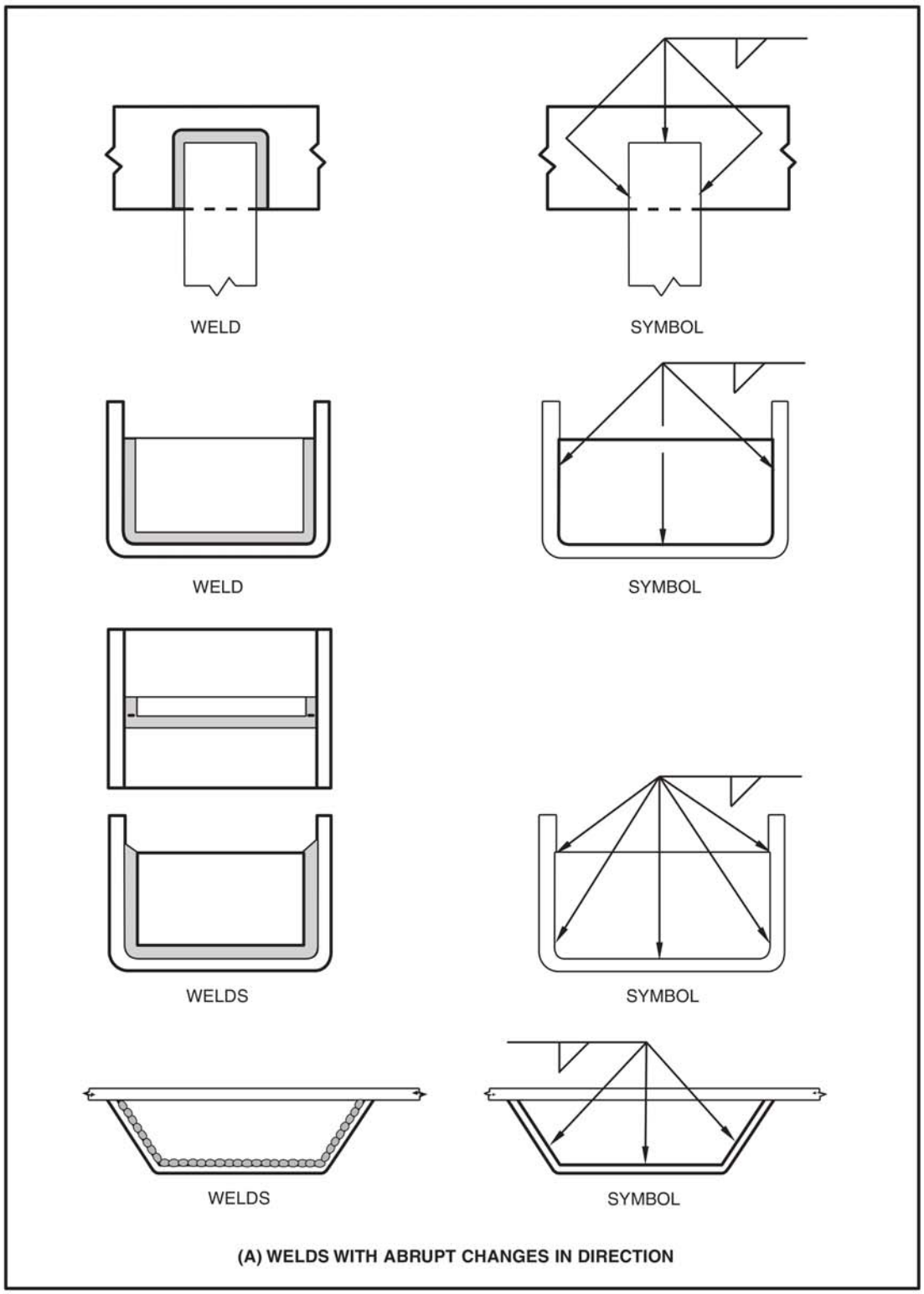


Figure 6.4—Application of the Symbol for the Specification of the Extent of Welding

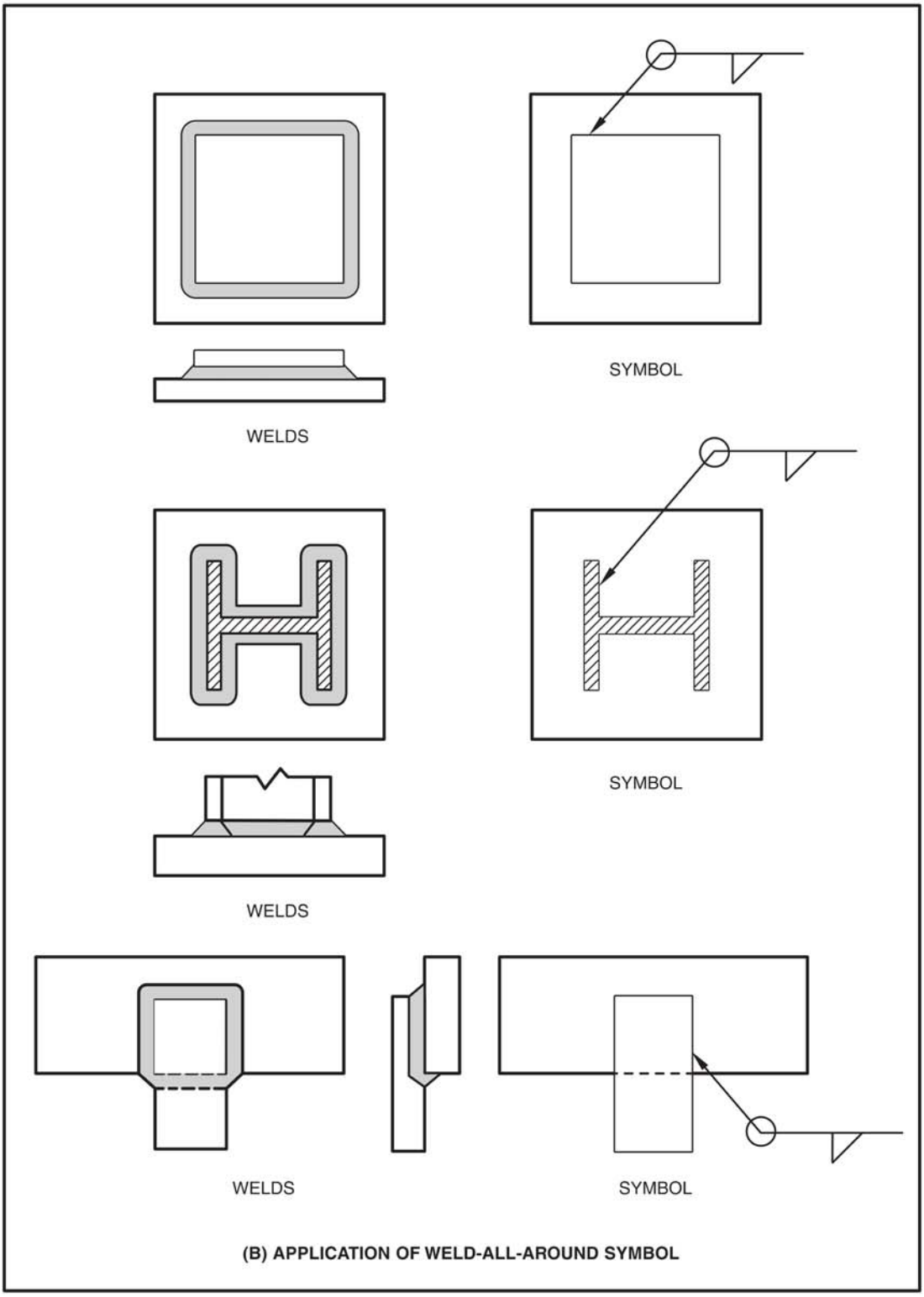


Figure 6.4 (Continued)—Application of the Symbol for the Specification of the Extent of Welding

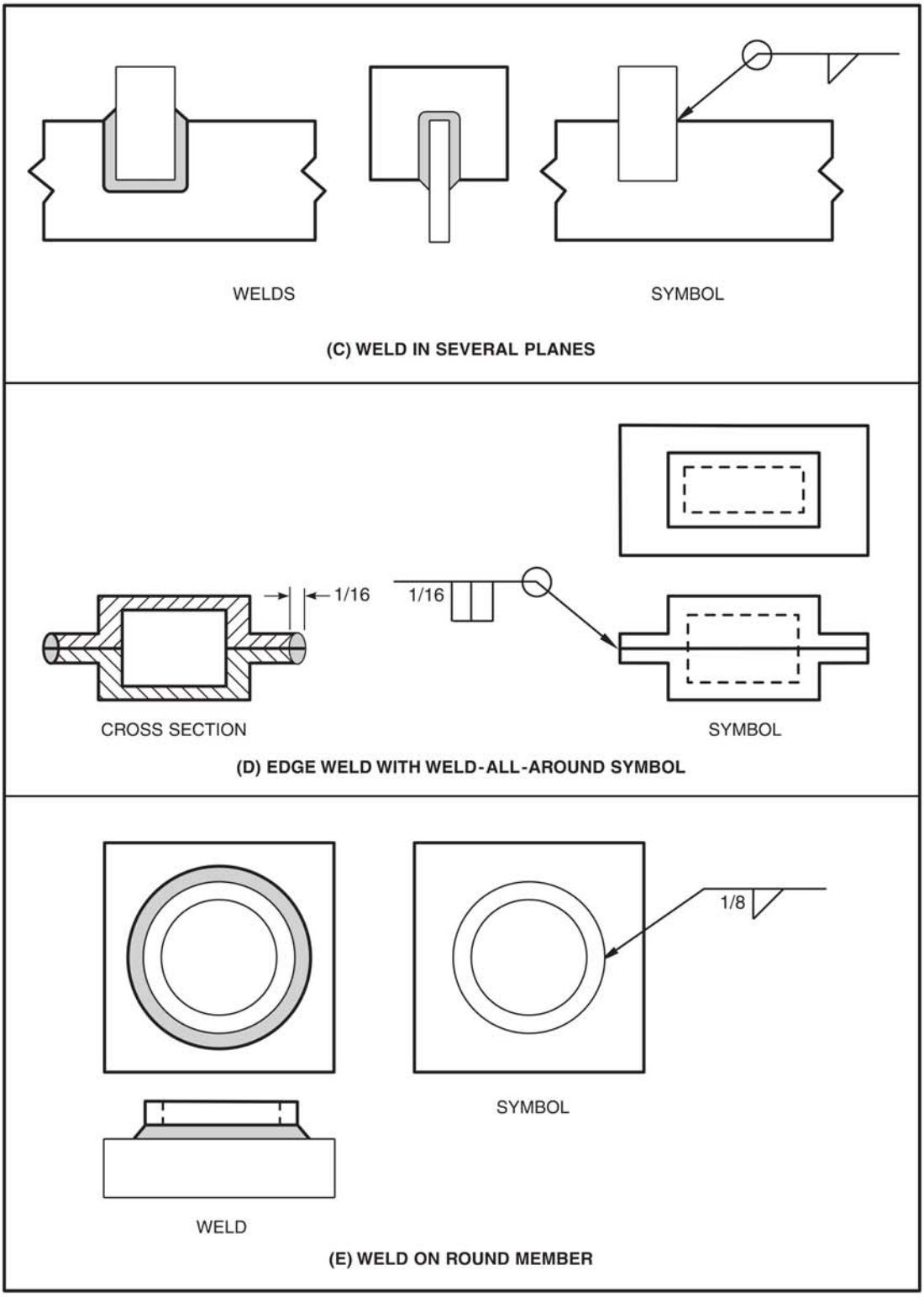


Figure 6.4 (Continued)—Application of the Symbol for the Specification of the Extent of Welding

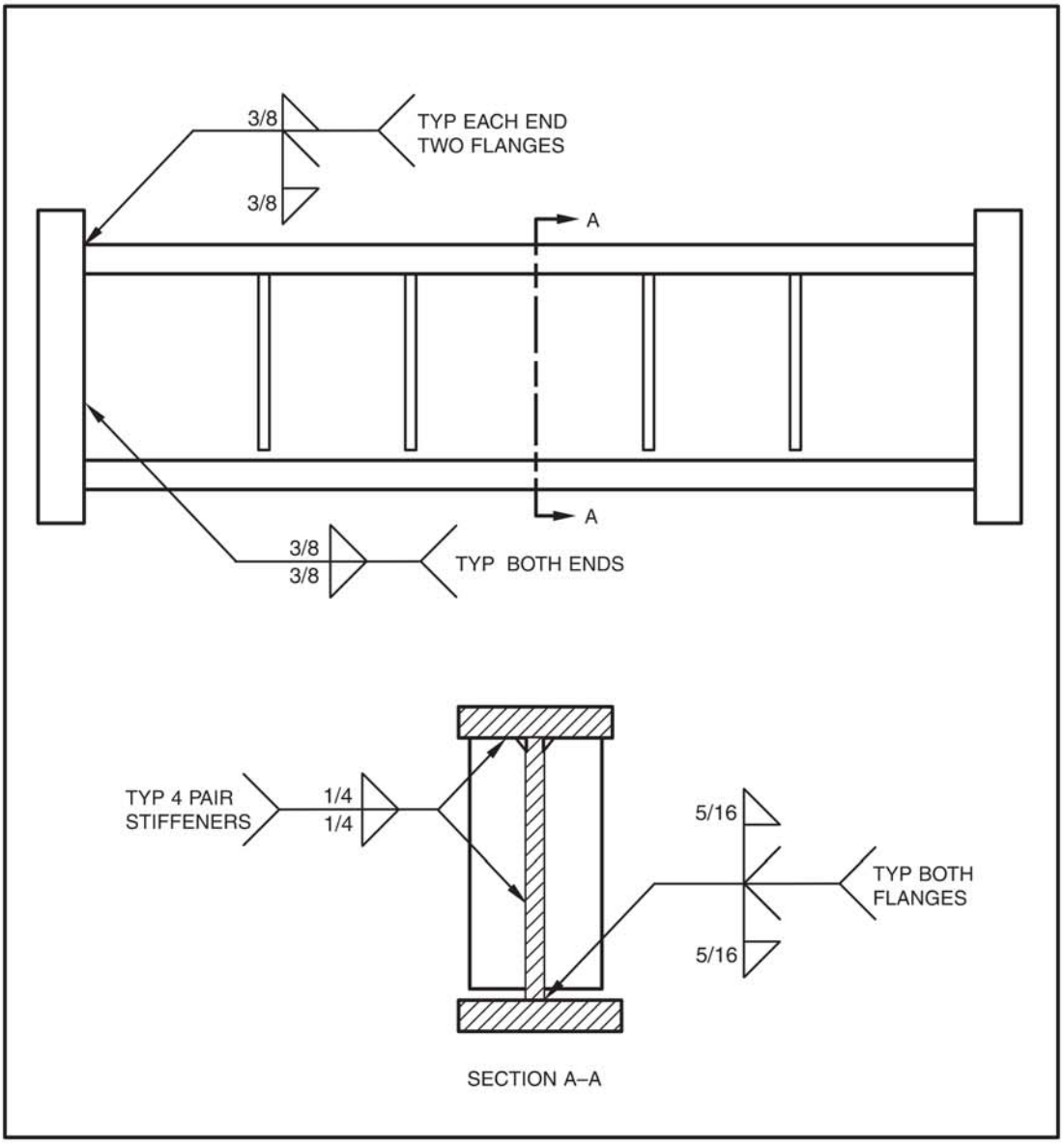
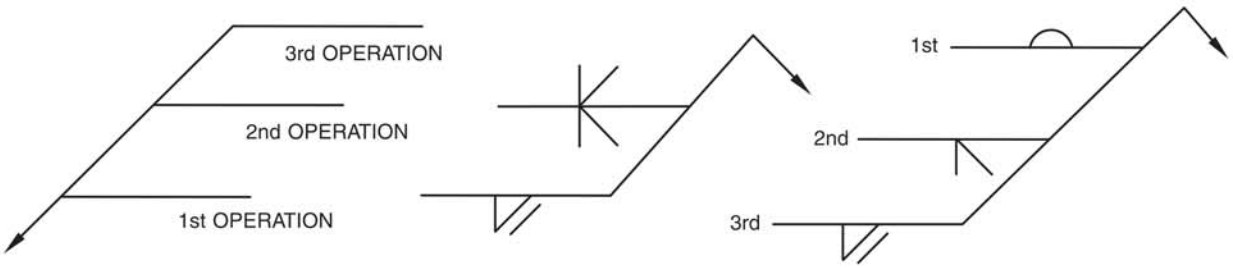


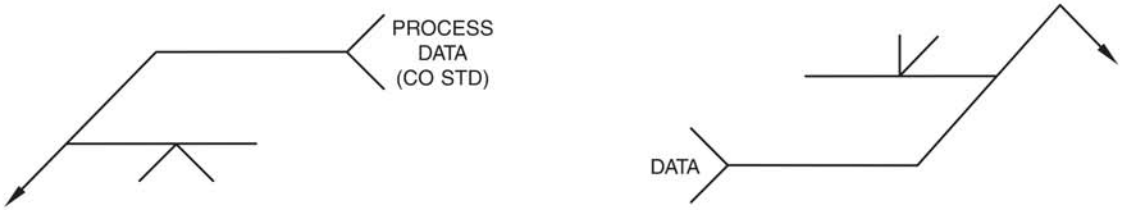
Figure 6.5—Application of the "TYPICAL" Welding Symbol

6.7 Multiple Reference Lines

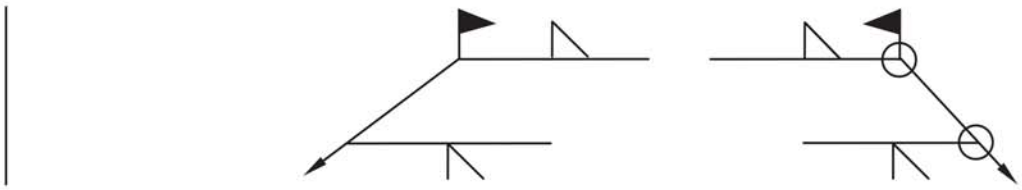
6.7.1 Sequence of Operations. Two or more reference lines may be used to indicate a sequence of operations. The first operation is specified on the reference line nearest the arrow. Subsequent operations are specified sequentially on additional reference lines.



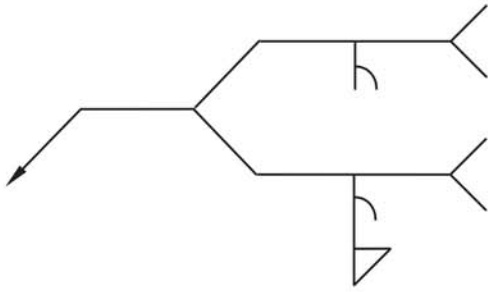
6.7.2 Supplementary Data. The tail of additional reference lines may be used to specify data supplementary to welding symbol information.



6.7.3 Symbols on Multiple Reference Lines. Symbols (including supplementary symbols) shall be placed on the reference line for each operation to which they are applicable.



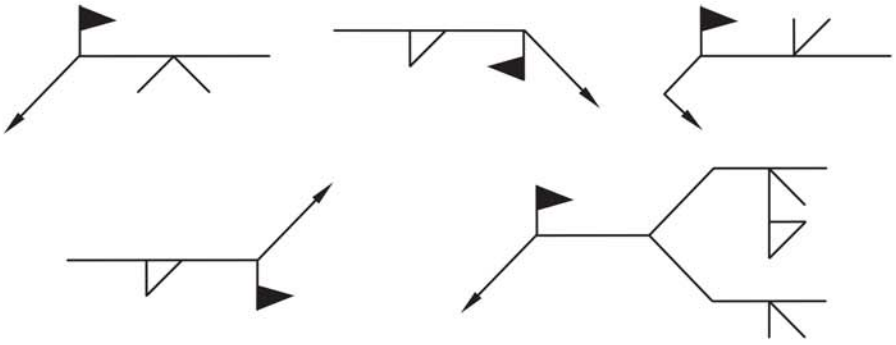
6.8 Welded Connections with Multiple Joint Types. Welds extending around joints with no abrupt changes in direction (e.g., pipe, round bar) where the joint transitions from one type to another (including combination welds) may be described with the use of multiple subreference lines. Individual weld symbols or combination weld symbols shall be placed on their own subreference lines connected to a single reference line.



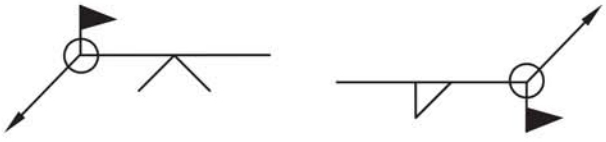
Source: Adapted from AWS D14.9:2013, *Specification for the Welding of Hydraulic Cylinders*, Figures 2(a) and 2(b), American Welding Society.

Unlike the rules for multiple reference lines outlined in 6.7.1, the sequence of welding with respect to the subreference lines is undetermined.

6.9 Field Weld Symbol. A flag is used to specify a field weld. The flag shall be placed at a right angle to, and on either side of, the reference line at the junction with the arrow (see Annex D6.9). The flag may point in either direction.



6.9.1 Field Weld and Weld-All-Around Symbols. When required, the field weld symbol and the weld-all-around symbol can be applied to the same location.



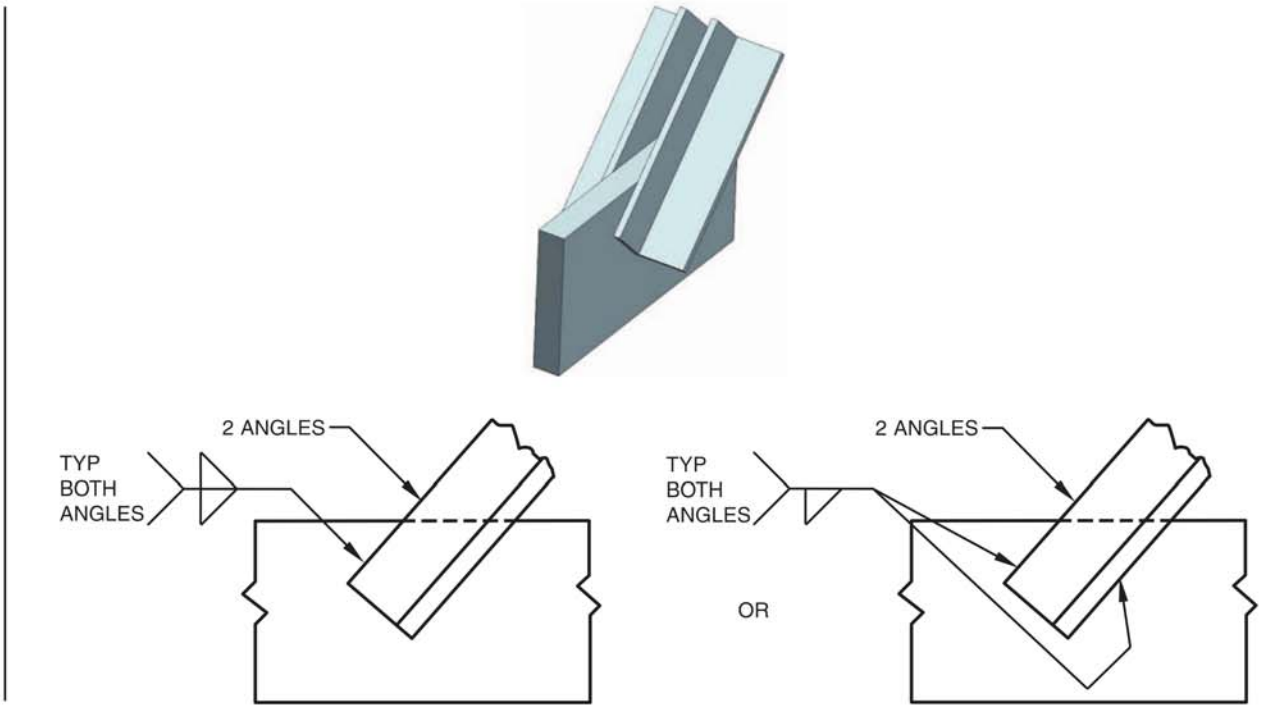
6.10 Extent of Welding Denoted by Symbols

6.10.1 Weld Continuity. Unless otherwise indicated, welding symbols shall denote continuous welds.

6.10.2 Changes in the Direction of Welding. Welding symbols apply only between abrupt changes in the direction of welding or to the extent of hatching or dimension lines (see Figure 6.6), except when the weld-all-around symbol is used [see Figure 6.4(B), (C), and (D)].

Additional welding symbols or multiple arrows shall be used to specify the welds required for any abrupt changes in direction. When it is desirable to use multiple arrows on a welding symbol, the arrows shall originate from a single reference line [see Figure 6.4(A)], or from the first reference line in the case of a multiple reference line symbol. See Annex D6.10.2 for applications involving square and rectangular tubing.

6.10.3 Hidden Members. When the welding of a hidden member is to be the same as a visible member, it may be specified. If the welding of a hidden member is to be different from a visible member, specific information for the welding of both shall be specified. If needed for clarification, auxiliary illustrations or views shall be provided.



6.10.4 Weld Location Specified. A weld having a length less than the available joint length and where the location is significant shall have the location specified on the drawing [see Figure 6.6(C)].

6.10.5 Weld Location Not Specified. A weld having a length less than the available joint length and where the location is not significant may be specified without indicating the location [see Figure 6.6(D)].

6.11 Weld-All-Around Symbol

6.11.1 Welds in Multiple Directions or Planes. A continuous weld, whether a single or combined type, extending around a series of connected joints, may be specified by the addition of the weld-all-around symbol at the junction of the arrow and reference line.

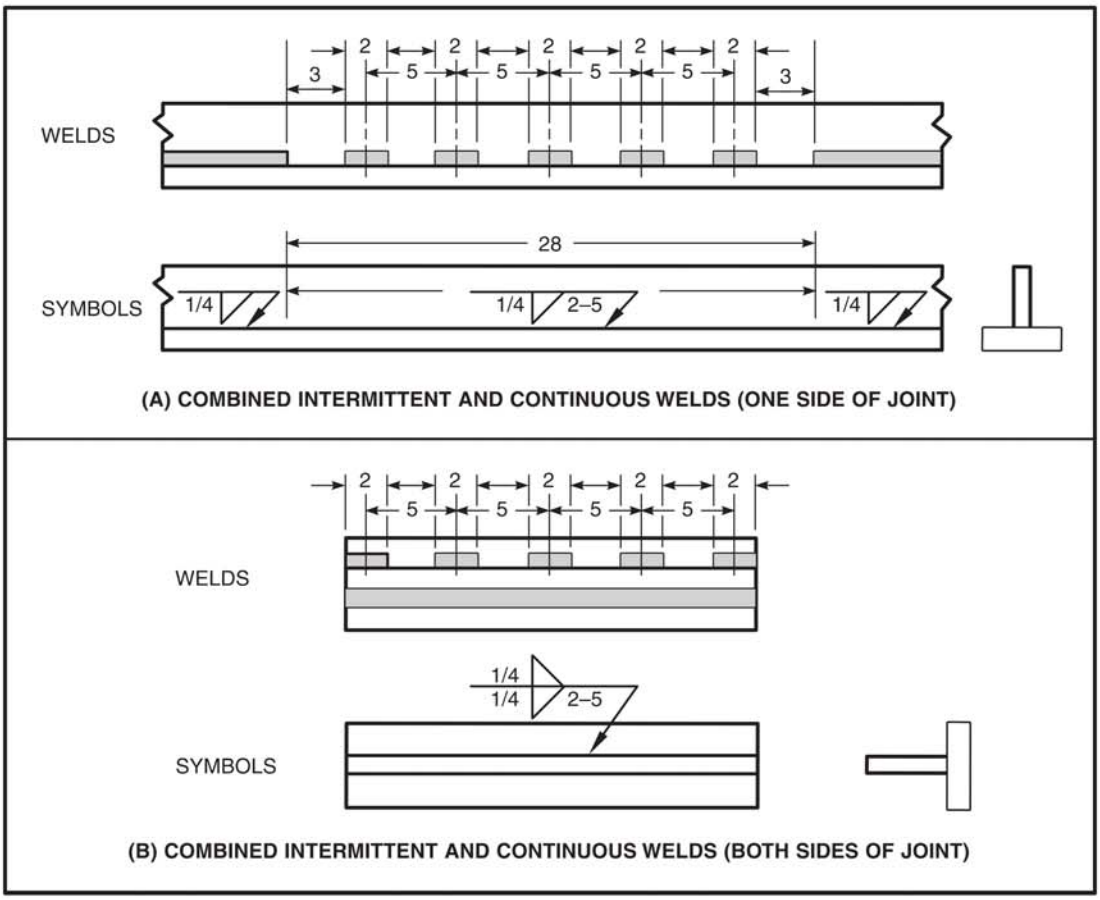


Figure 6.6—Application of the Location and Extent of Fillet Welds

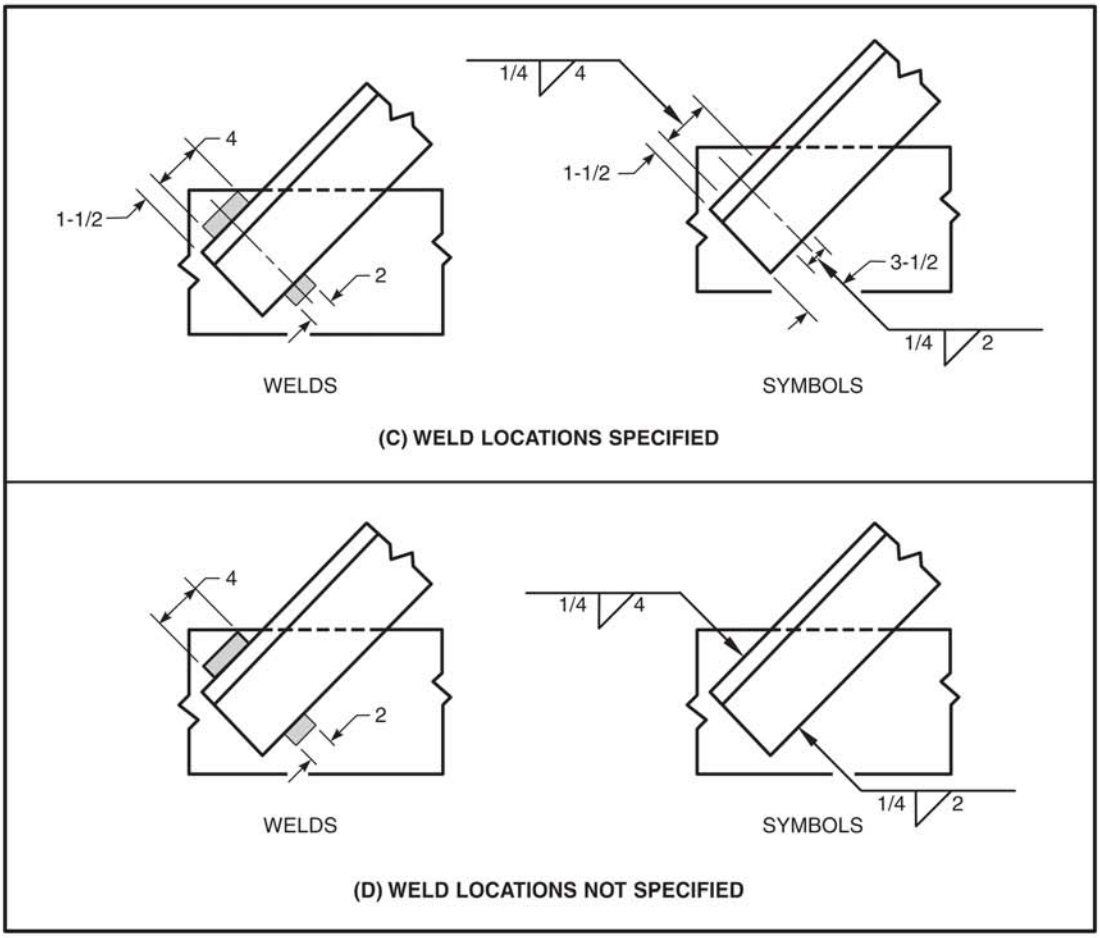
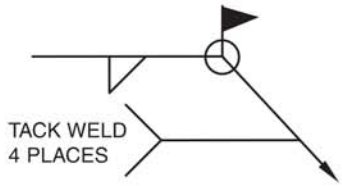


Figure 6.6 (Continued)—Application of the Location and Extent of Fillet Welds

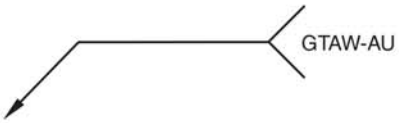
The weld joint configuration shall be consistent with the elements of the welding symbol for all locations where a single weld-all-around symbol applies. The series of joints may involve different operations, directions, and may lie in more than one plane [see Figure 6.4(B), (C), (D), and Annex D6.11.1].



6.11.2 Circumferential Welds. Welds extending around circumferential joints with no abrupt change in direction (e.g., pipe, round bar) are excluded from the requirement regarding changes in direction and do not require the weld-all-around symbol to specify a continuous weld [see Figure 6.4(E)].

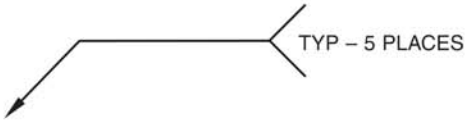
6.12 Tail of the Welding Symbol

6.12.1 Welding and Allied Process Specification. The welding or allied process to be used may be specified by placing the appropriate letter designations from Table A2, Table A3, or Table A4 in the tail of the welding symbol. An auxiliary suffix from Table A5 may be used.



6.12.2 References. Specifications, codes, or any other applicable documents may be specified by placing the reference in the tail of the welding symbol. Information contained in the referenced document need not be repeated in the welding symbol.

6.12.3 Welding Symbols Designated "TYPICAL." Repetitions of identical welding symbols on a drawing may be avoided by designating a single welding symbol as "TYPICAL" (usually abbreviated "TYP") and pointing the arrow to the representative joint (see Figure 6.5). The user shall provide additional information to completely identify all applicable joints (see Annex D6.12.3).



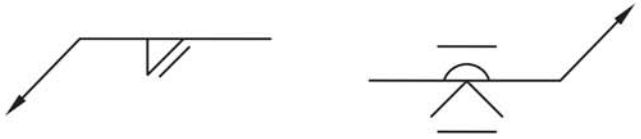
6.12.4 Designation of Special Types of Welds. When the basic weld symbols are inadequate to indicate the desired weld, the weld shall be specified by a cross section, detail, or other data with a reference thereto in the tail of the welding symbol. This may be necessary for skewed joints (see 7.13 and 8.7).

6.12.5 Omission of the Tail. When no references are required, the tail may be omitted from the welding symbol.

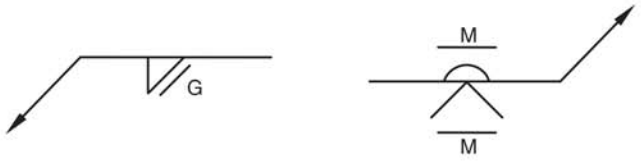
6.12.6 Drawing Notes. Drawing notes may be used to provide information pertaining to the welds. Such information need not be repeated in the welding symbols.

6.13 Contour Symbols

6.13.1 Contours Obtained by Any Method. Welds to be contoured flush, flat, convex, or concave by welding or any method of mechanical finishing shall be specified by adding the flush, flat, convex, or concave contour symbol, respectively, to the welding symbol.



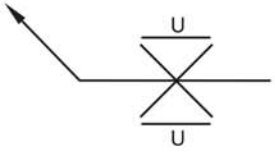
6.13.2 Contours Obtained by a Specific Mechanical Finishing Method. When a specific mechanical finishing method is required, the appropriate designator shall be added to the contour symbol as shown below. Finishing designators do not specify the quality of finish.



C = CHIPPING
G = GRINDING
H = HAMMERING

M = MACHINING
P = PLANISHING
R = ROLLING

6.13.3 Contours Obtained by an Unspecified Mechanical Finishing Method. When welds are required to be mechanically finished but the method of finishing is unspecified, the designator "U" shall be added to the appropriate contour symbol.



U = UNSPECIFIED

6.14 Melt-Through Symbol. The melt-through symbol shall be used only when complete joint penetration plus visible root reinforcement is required in welds made from one side (see Figure 6.7).

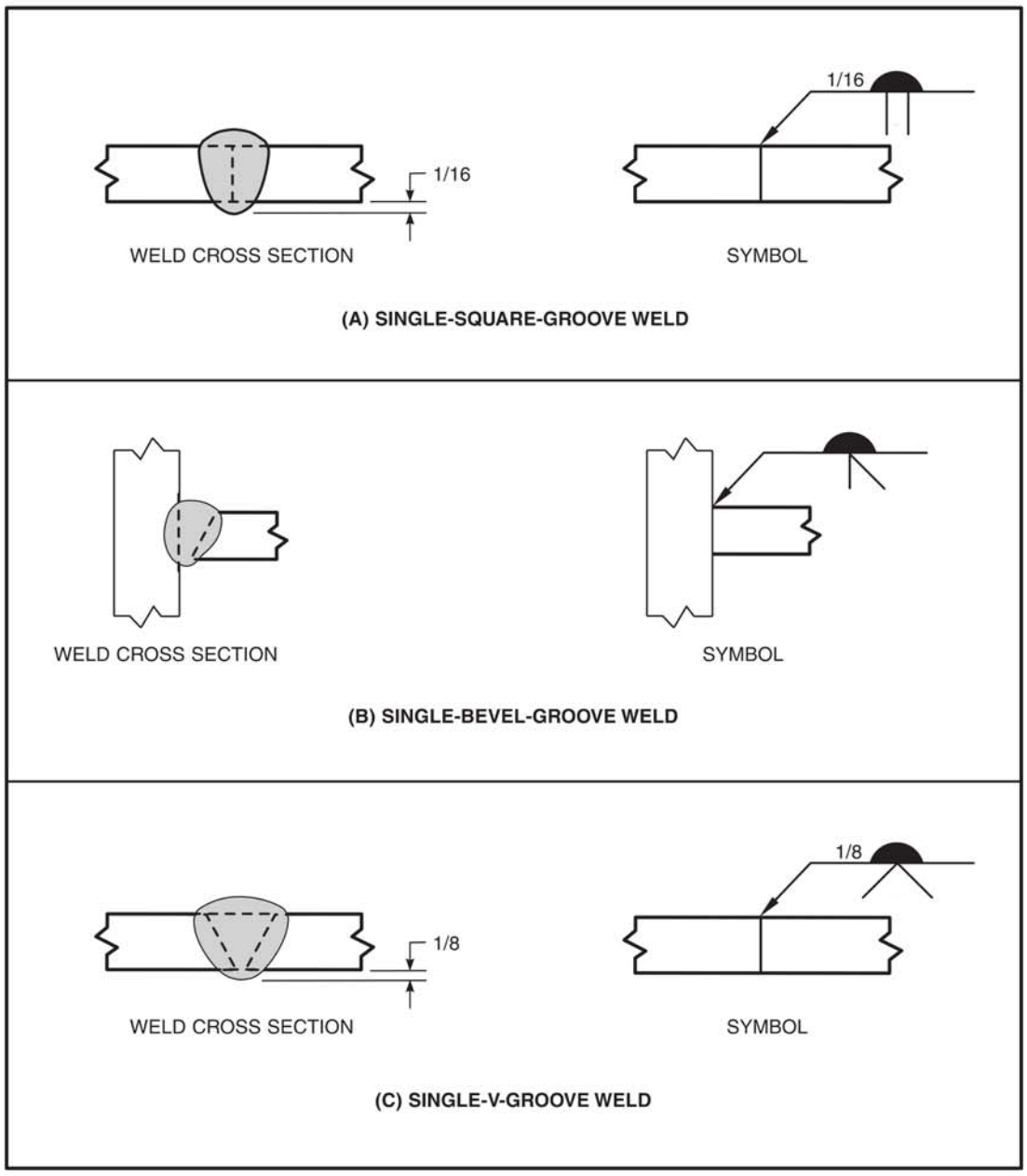


Figure 6.7—Application of the Melt-Through Symbol

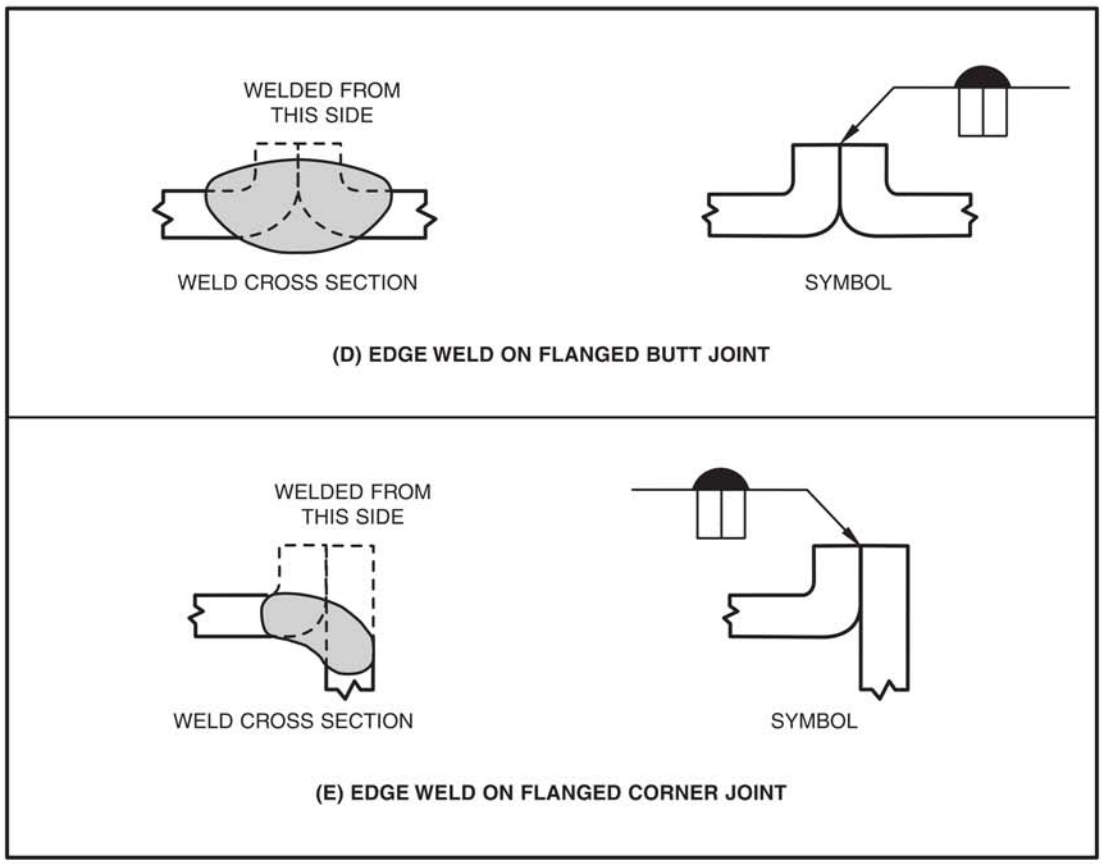


Figure 6.7 (Continued)—Application of the Melt-Through Symbol

6.14.1 Melt-Through Symbol Location. The melt-through symbol shall be placed on the side of the reference line opposite the weld symbol (see Figure 6.7).

6.14.2 Melt-Through Dimensions. The height of the root reinforcement may be specified by placing the required dimension to the left of the melt-through symbol [see Figure 6.7(A) and (C)]. The height of the root reinforcement may be left unspecified [see Figure 6.7(B)].

6.15 Melt-Through with Edge Welds

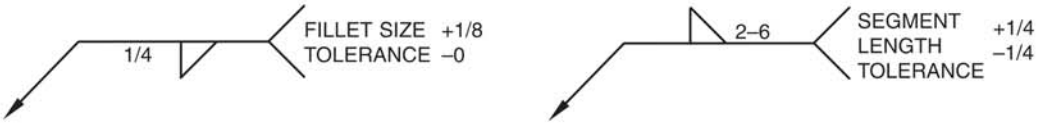
6.15.1 Melt-Through with Edge Welds on Flanged Butt Joints. Edge welds requiring complete joint penetration shall be specified by the edge weld symbol with the melt-through symbol placed on the opposite side of the reference line. The details of the flanges are considered part of the drawing and are not specified by the welding symbol [see Figure 6.7(D)].

6.15.2 Melt-Through with Edge Welds on Flanged Corner Joints. Edge welds requiring complete joint penetration shall be specified by the edge weld symbol with the melt-through symbol placed on the opposite side of the reference line. The details of the flange are considered part of the drawing and are not specified by the welding symbol [see Figure 6.7(E)].

6.16 Method of Drawing Symbols. Symbols may be drawn mechanically, electronically, or by freehand. Symbols intended to appear in publications or to be of high precision should be drawn with the dimensions and proportions given in Annex B or Annex C.

6.17 U.S. Customary and SI Units. The primary system of measurement for the drawings shall be used on welding symbols. Dual units shall not be used on welding symbols. If it is desired to show conversions from SI to U.S. Customary Units or vice versa, conversions may be included on the drawing, e.g., a table. For guidance on drafting standards, refer to the ASME Y14 standards. For guidance on the use of SI Units, refer to AWS A1.1, *Metric Practice Guide for the Welding Industry.*

6.18 Weld Dimension Tolerance. When a tolerance is applicable to a weld symbol dimension, it may be shown in the tail of the welding symbol or specified by a drawing note, table, code, or specification. In all cases, a reference shall be made to the dimension to which the tolerance applies.

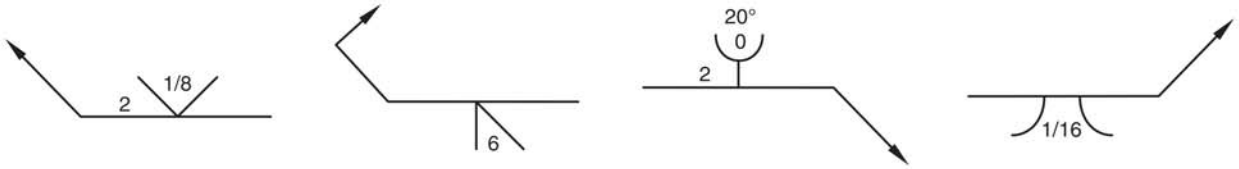


6.19 Changes in Joint Geometry During Welding. A welding symbol with a single reference line is intended to specify the joint geometry to be established prior to the start of welding. Changes in the joint geometry of groove welds resulting from the specified welding operations (e.g., backgouging and backing welds) are not to be included as a part of the welding symbol (see Annex D6.19).

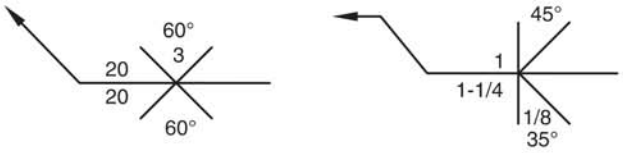
7. Groove Welds

7.1 General

7.1.1 Single-Groove Dimensions. Groove weld dimensions shall be specified on the same side of the reference line as the weld symbol [see Figure 7.1(A) and (F)].

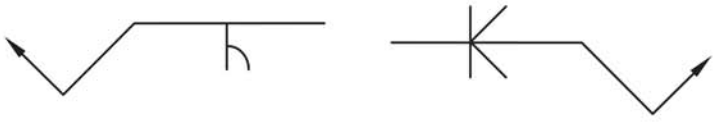


7.1.2 Double-Groove Dimensions. Each groove of a double-groove joint may be dimensioned; however, the root opening need appear only once (see Figure 7.2).

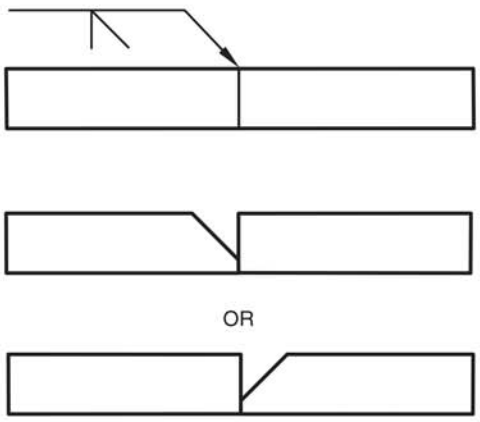


7.1.3 Broken Arrow and Straight Arrow

7.1.3.1 Broken Arrow. A broken arrow is used, when necessary, to specify which member is to have a bevel-, J-, or flare-bevel-groove edge shape for single- or double-bevel, J-, or flare-bevel-groove welds [see 6.4.1 and Figure 7.1(B)].



7.1.3.2 Straight Arrow for Single-Groove Welds. A straight arrow is used when either member may have the desired edge shape for single-bevel-, single-J-, or single-flare-bevel-groove welds.



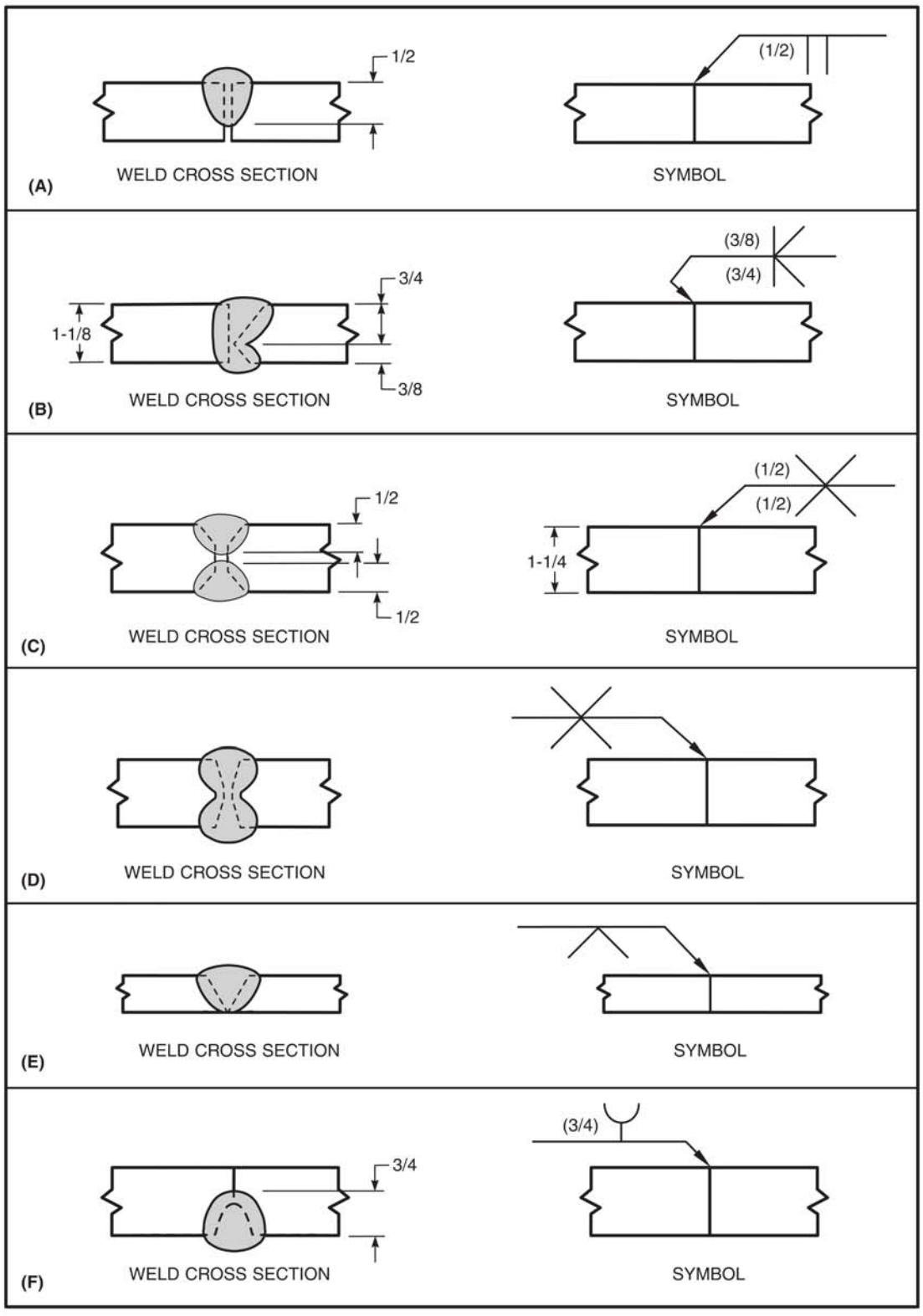


Figure 7.1—Application of Groove Weld Size, Groove Depth Not Specified

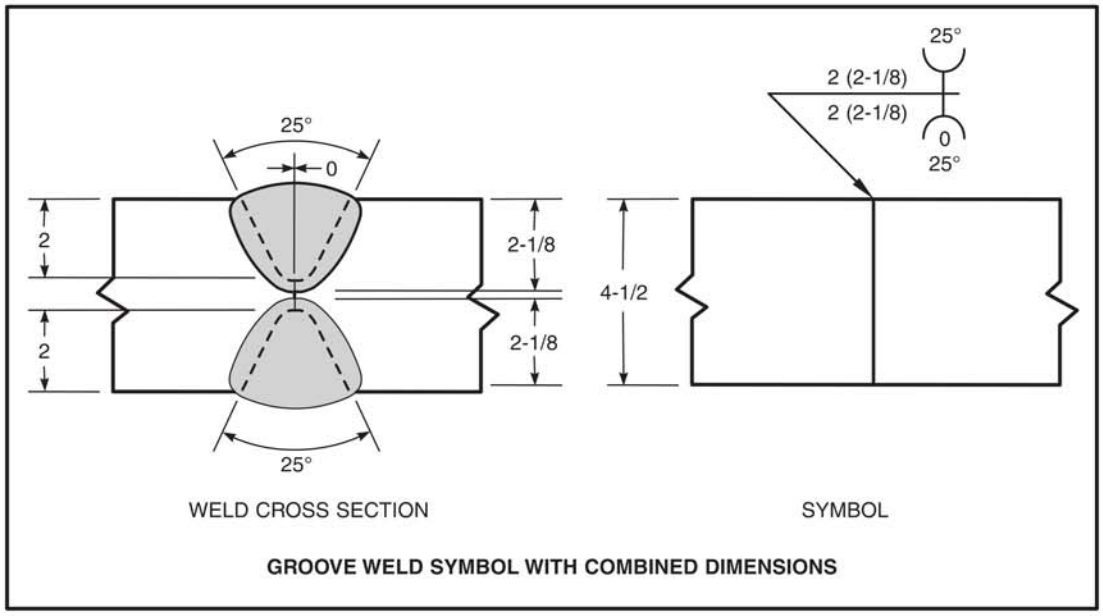
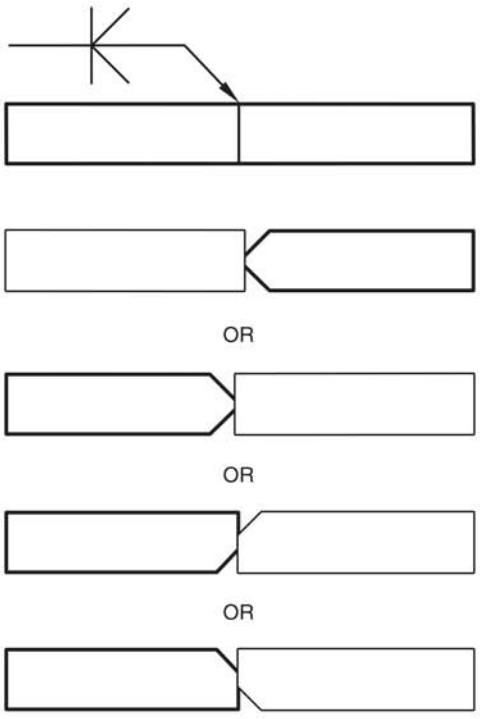


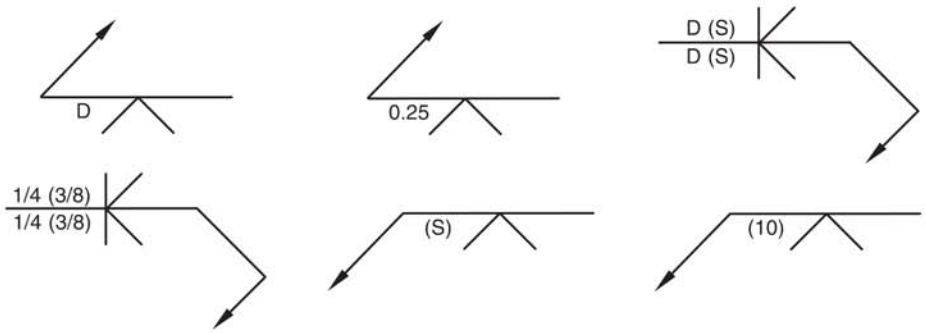
Figure 7.2—Application of Dimensions to the Groove Weld Symbol

7.1.3.3 Straight Arrow for Double-Groove Welds. A straight arrow is used when either or both members may have the desired edge shape for double-bevel-, double-J-, or double-flare-bevel groove welds. The edge shape may be in one member on the arrow side of the joint and in the second member on the other side of the joint.



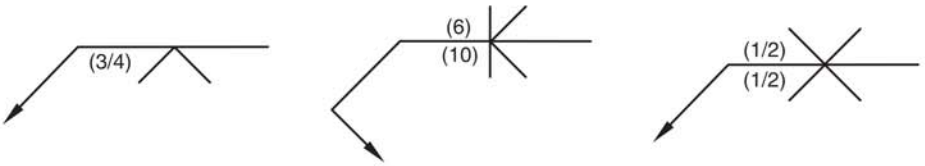
7.2 Groove Depth and Groove Weld Size

7.2.1 Location. When used, the groove depth, "D", and the groove weld size, "(S)", shall be placed to the left of the weld symbol [see Figure 7.1(A), (B), (C), and (F) and Figures 7.2 through 7.4].

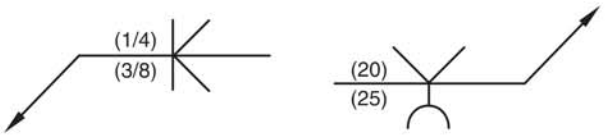


7.2.2 Complete Joint Penetration. Omitting the groove depth, "D", and groove weld size, "(S)", dimensions from the welding symbol requires a groove weld extending through the thickness of the joint [see Figures 7.1(D), 7.1(E), and 7.7, as well as Annex D7.2.2].

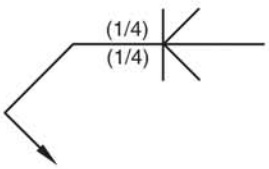
7.2.3 Partial Joint Penetration Welds, Groove Weld Size Specified, Groove Depth Not Specified. Groove weld size, "(S)", extending only partly through the joint shall be specified in parentheses to the left of the weld symbol [see Figure 7.1(A), (C), and (F)].



7.2.4 Complete Joint Penetration Double-Groove Welds, Groove Weld Size Specified, Groove Depth Not Specified. The size of nonsymmetrical groove welds (arrow side versus other side) extending completely through the joint shall be specified in parentheses to the left of the weld symbol [see Figure 7.5(B) and (C)].



The size of symmetrical groove welds (arrow side versus other side) that extend completely through the joint may be specified in parentheses to the left of the weld symbol [see Figure 7.5(A)].



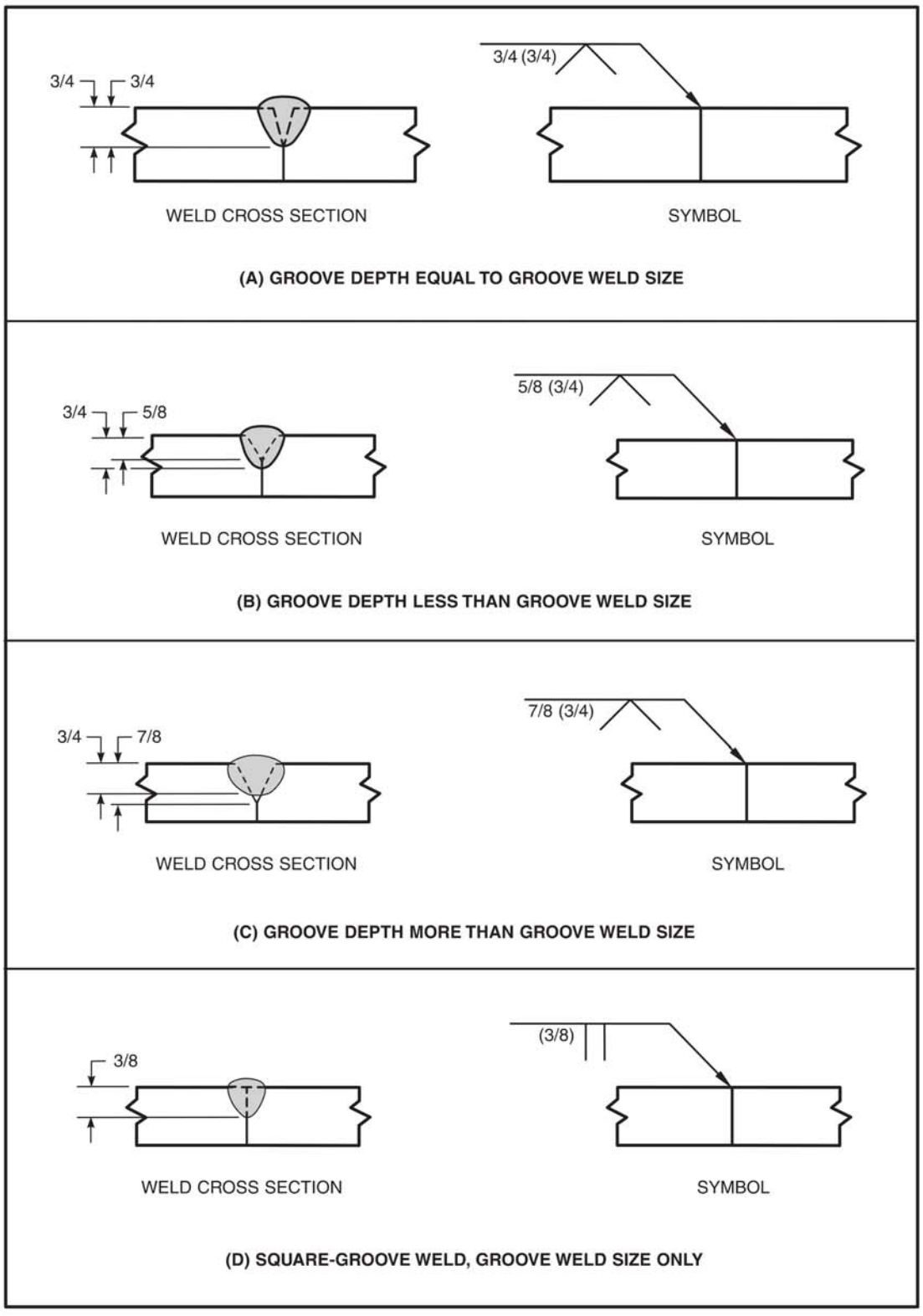


Figure 7.3—Application of Groove Weld Size Related to Groove Depth

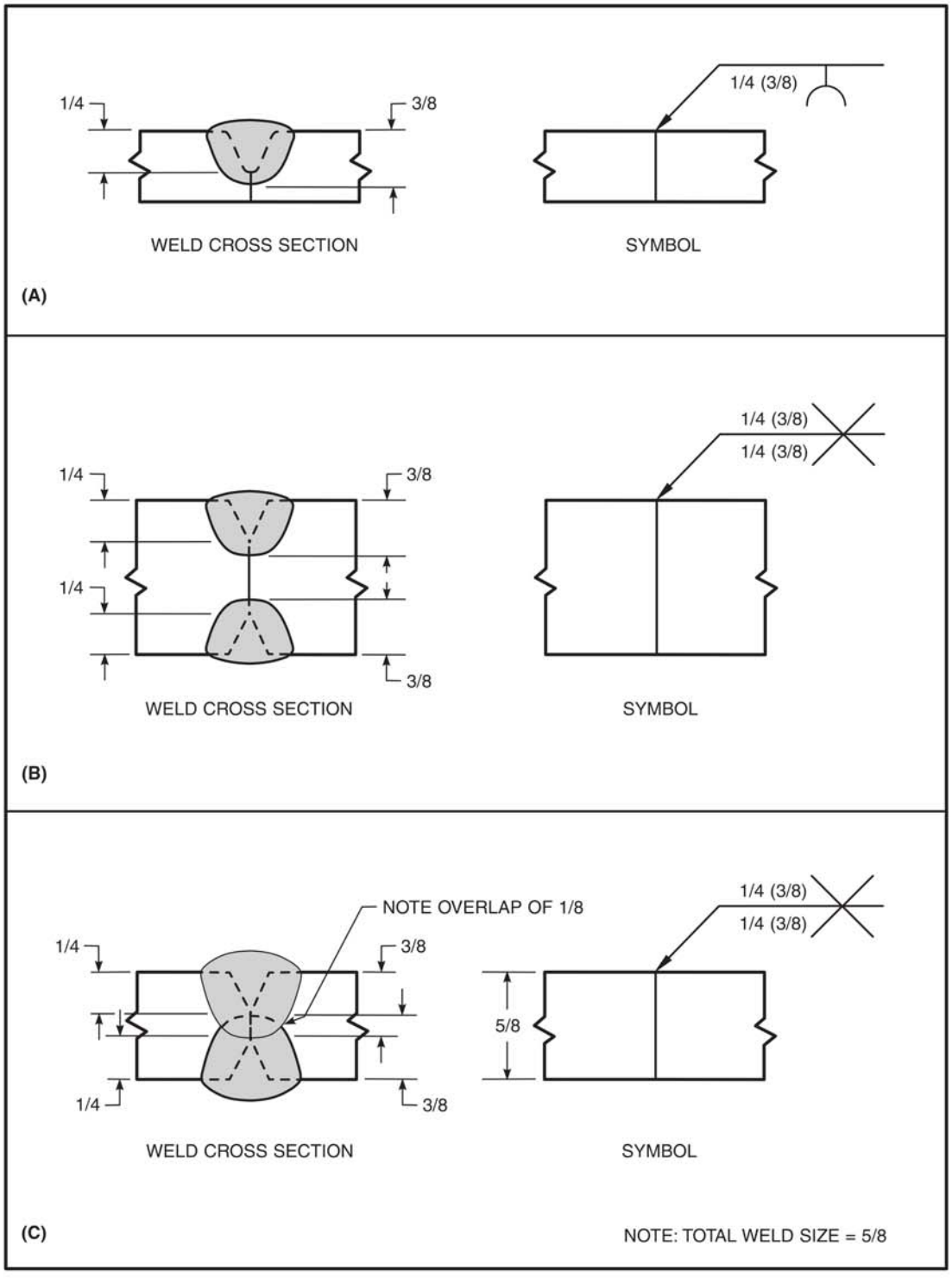


Figure 7.4—Specification of Groove Depth and Groove Weld Size

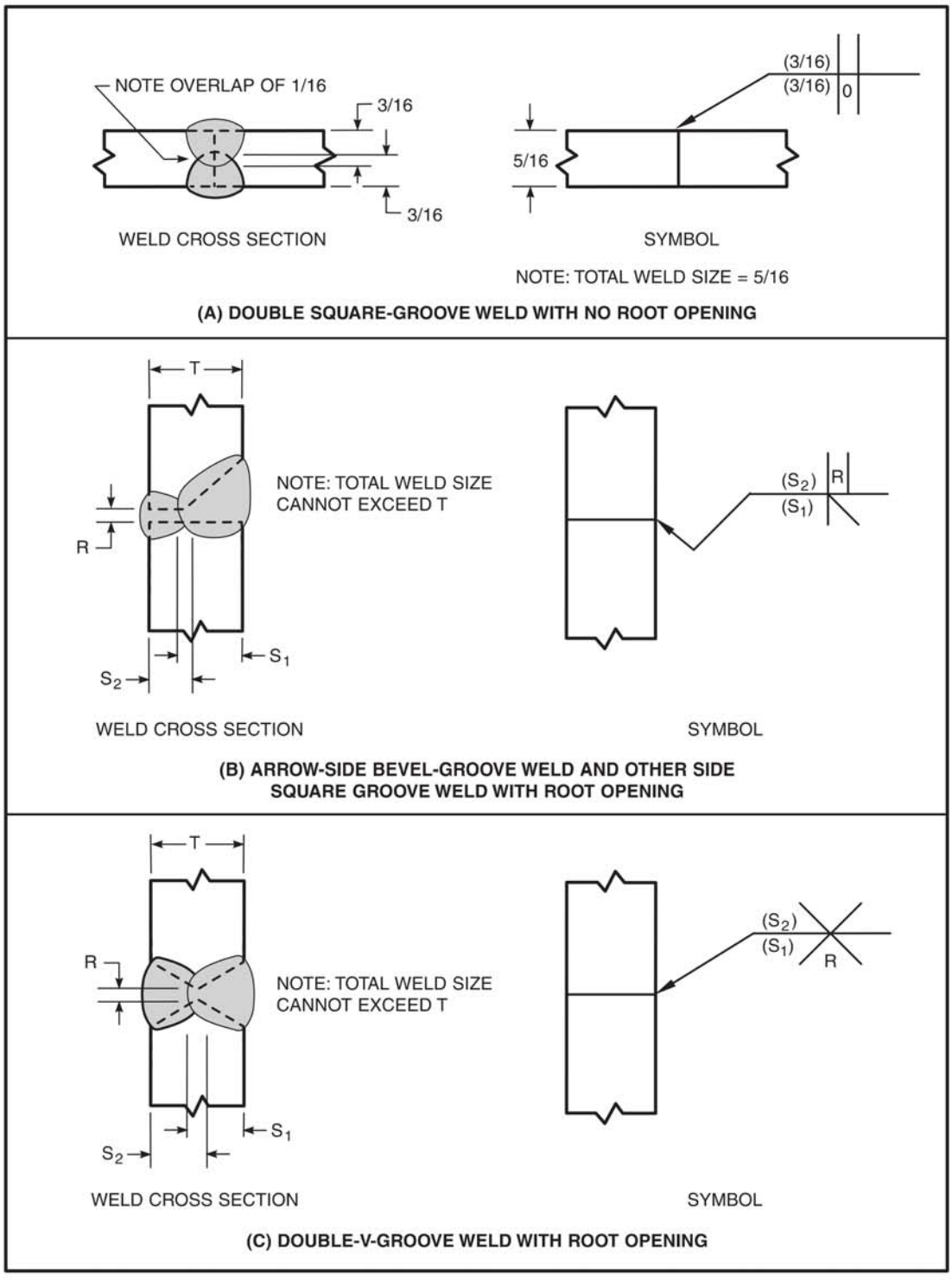
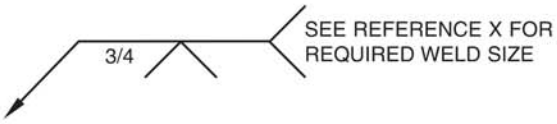
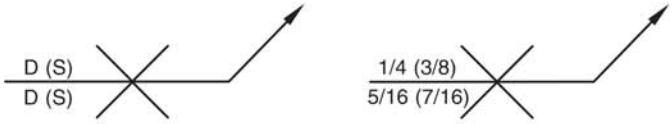


Figure 7.5—Application of Symbols for Groove Weld Size Only

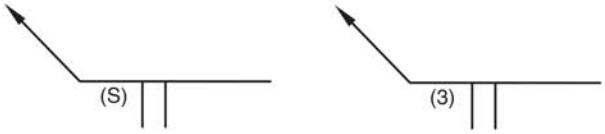
7.2.5 Groove Depth Specified, Groove Weld Size Specified Elsewhere. A dimension not in parentheses placed to the left of a groove weld symbol specifies the groove depth only.



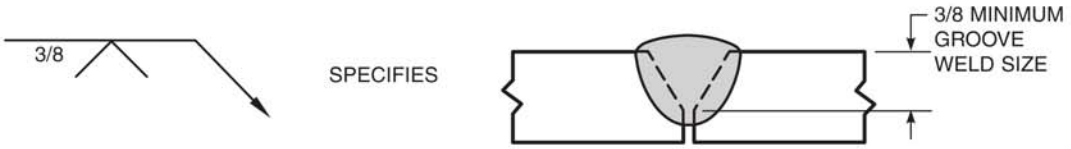
7.2.6 Groove Depth and Groove Weld Size Specified. The groove depth, "D", and groove weld size, "(S)", are located to the left of the weld symbol as "D (S)" [see Figures 7.3(A), (B), and (C) and 7.6(B)].



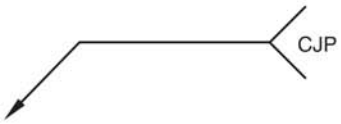
Square groove welds are an exception where the groove depth, D, is not applicable [see Figures 7.3(D) and 7.6(A)].



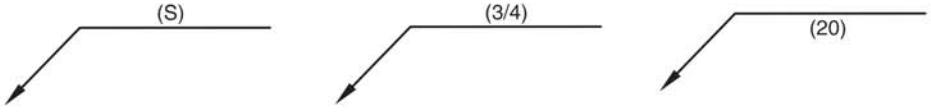
7.2.7 Groove Depth Specified, Groove Weld Size Not Specified. A welding symbol with a groove depth, "D", specified, and the groove weld size, "(S)", not included and not specified elsewhere, requires a groove weld size not less than the groove depth.



7.2.8 Joint Geometry Not Specified, Complete Joint Penetration Required. Optional joint geometry with complete joint penetration (CJP) required is specified by placing the letters "CJP" in the tail of the welding symbol and omitting the weld symbol (see Figure 7.7).



7.2.9 Joint Geometry Not Specified, Groove Weld Size Specified. For optional joint geometry, the groove weld size is specified by placing dimension "(S)" on the arrow side or the other side of the reference line as required, but omitting the weld symbol (see Figure 7.8).



7.2.10 Flare-Groove Welds. Flare-groove welds are a special case that do not conform to all the accepted conventions associated with other types of groove welds (see Annex D7.2.10).

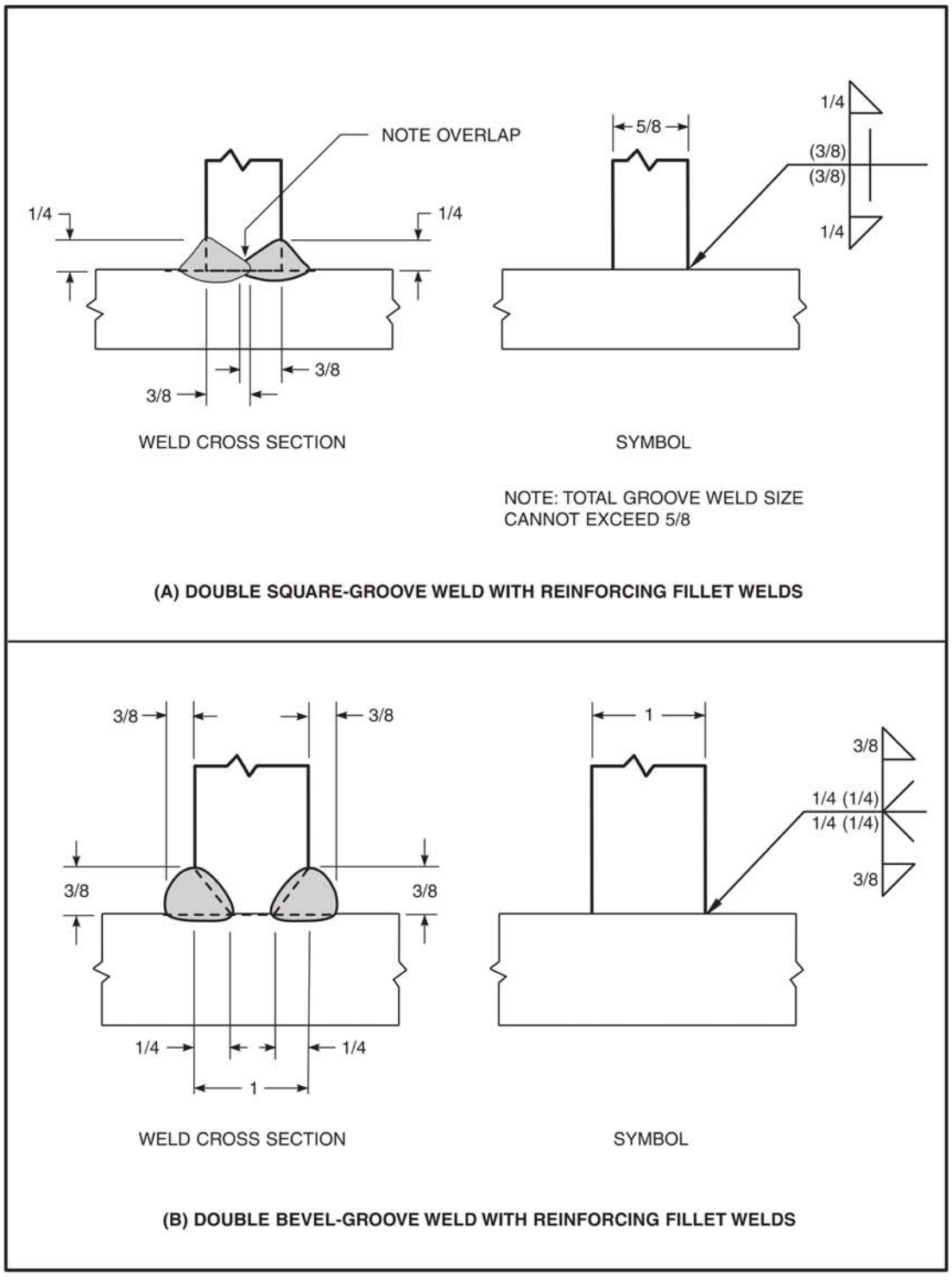


Figure 7.6—Application of Symbols for Combined Groove and Fillet Welds

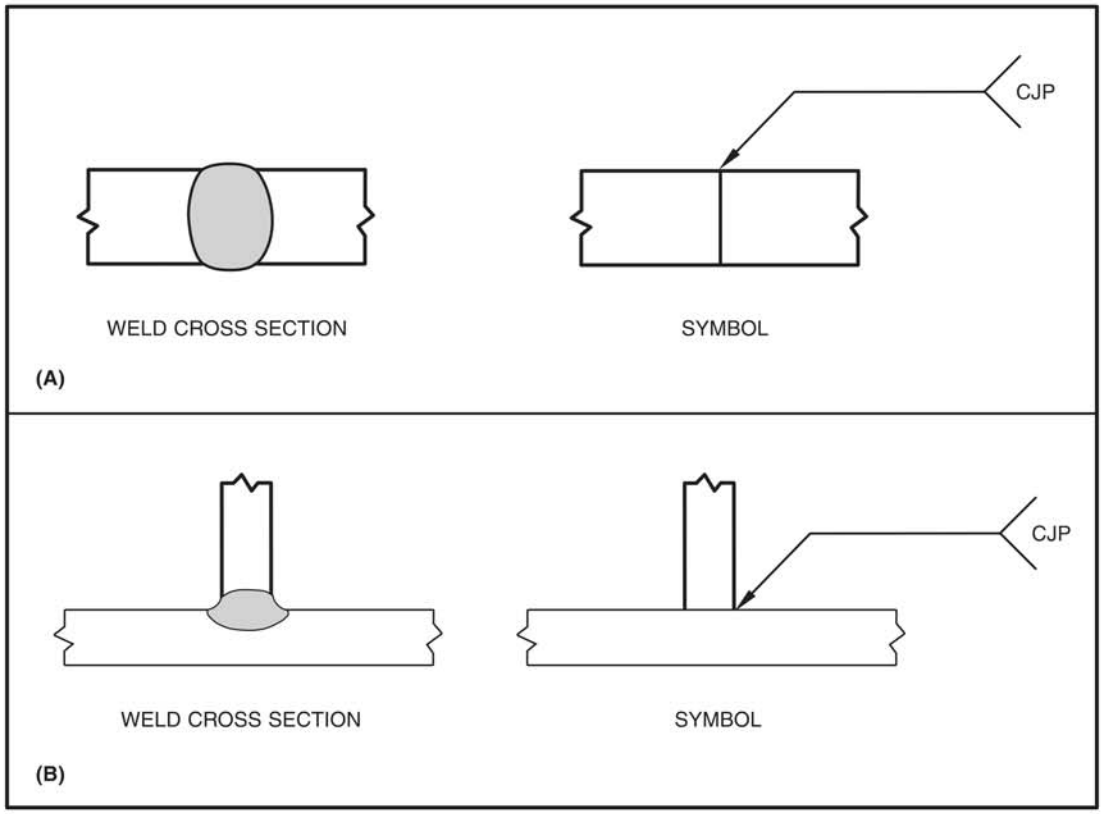


Figure 7.7—Application of Symbols for Complete Joint Penetration with Joint Geometry Optional

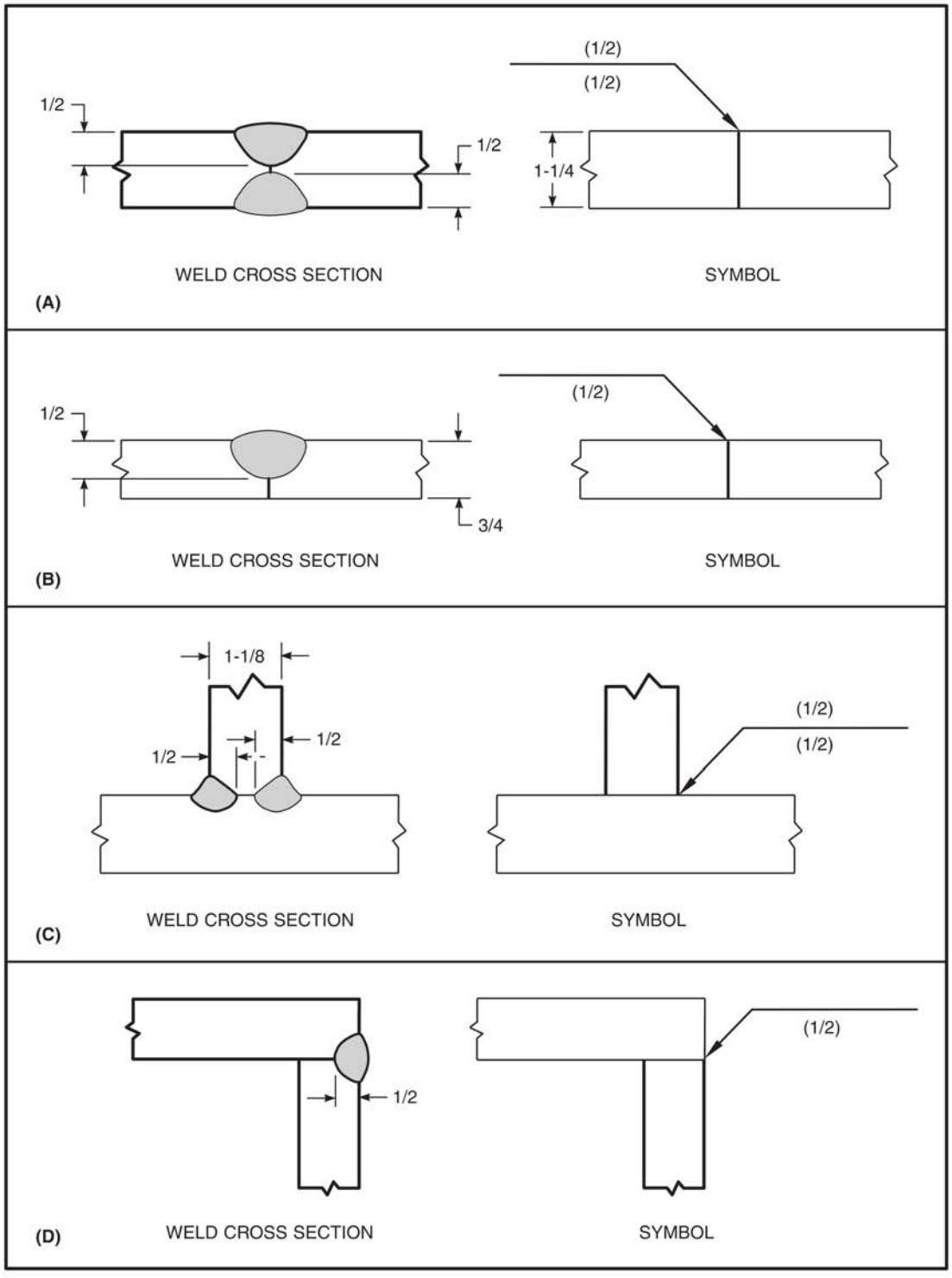


Figure 7.8—Application of Partial Joint Penetration with the Joint Geometry Optional

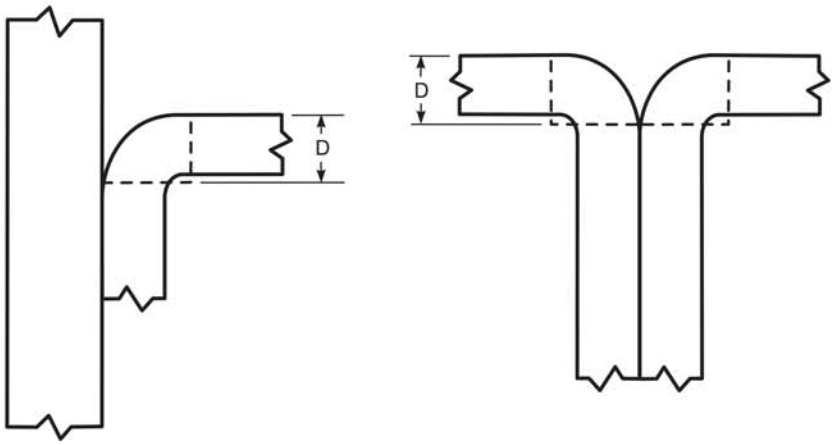
7.2.10.1 A flare-bevel groove weld joint is formed between a member with a curved surface and a surface of a planar member [see Figure 7.9(B), (D), (E), (F), (G), and (H)].

7.2.10.1.1 Flare-bevel groove weld joints may be designated as partial joint penetration welds [see Figure 7.9(B), (D), (E), (F), and (G)] or complete joint penetration welds [see Figure 7.9(H)].

7.2.10.2 A flare-V-groove weld joint occurs from the side-by-side longitudinal contact between two curved surfaces [see Figure 7.9(A) and (C)].

7.2.10.3 A flare-bevel groove and another groove type (e.g., bevel) edge shape can form a combination groove weld [see Figure 7.9(I)].

7.2.10.4 The groove depth "D" is the distance from the point of tangency to the top of the member [see Figure 7.9(A), (B), and (C)]. It is not mandatory to designate "D" on the welding symbol as the depth dimension is an inherent feature of the flare groove joint type.



FLARE-BEVEL-GROOVE FLARE-V-GROOVE

7.2.10.5 The groove weld size "(S)" [see Figure 7.9(A)–(G)] is measured from the outside surface.

7.2.10.6 Omitting the groove depth "D" and groove weld size "(S)" in a flare bevel groove weld [see Figure 7.9(H)] or a combination joint [see Figure 7.9(I)] indicates complete joint penetration as with other groove welds.

7.2.10.7 Welds designed to be less than flush with the outside surface of the joint require further information such as a note in the tail or reference to a specific welding procedure [see 6.12.4 and Figure 7.9(J)].

7.3 Groove Dimensions

7.3.1 Root Opening. The root opening of groove welds shall be specified inside the weld symbol and only on one side of the reference line (see Figure 7.10).

7.3.2 Groove Angle. The groove angle of groove welds shall be specified above or below the weld symbol as appropriate (see Figure 7.11).

7.3.3 Radii and Root Faces. The groove radii and the root faces of U- and J-groove welds shall be specified by a cross section, detail, or other data with reference thereto in the tail of the welding symbol (see 6.12).

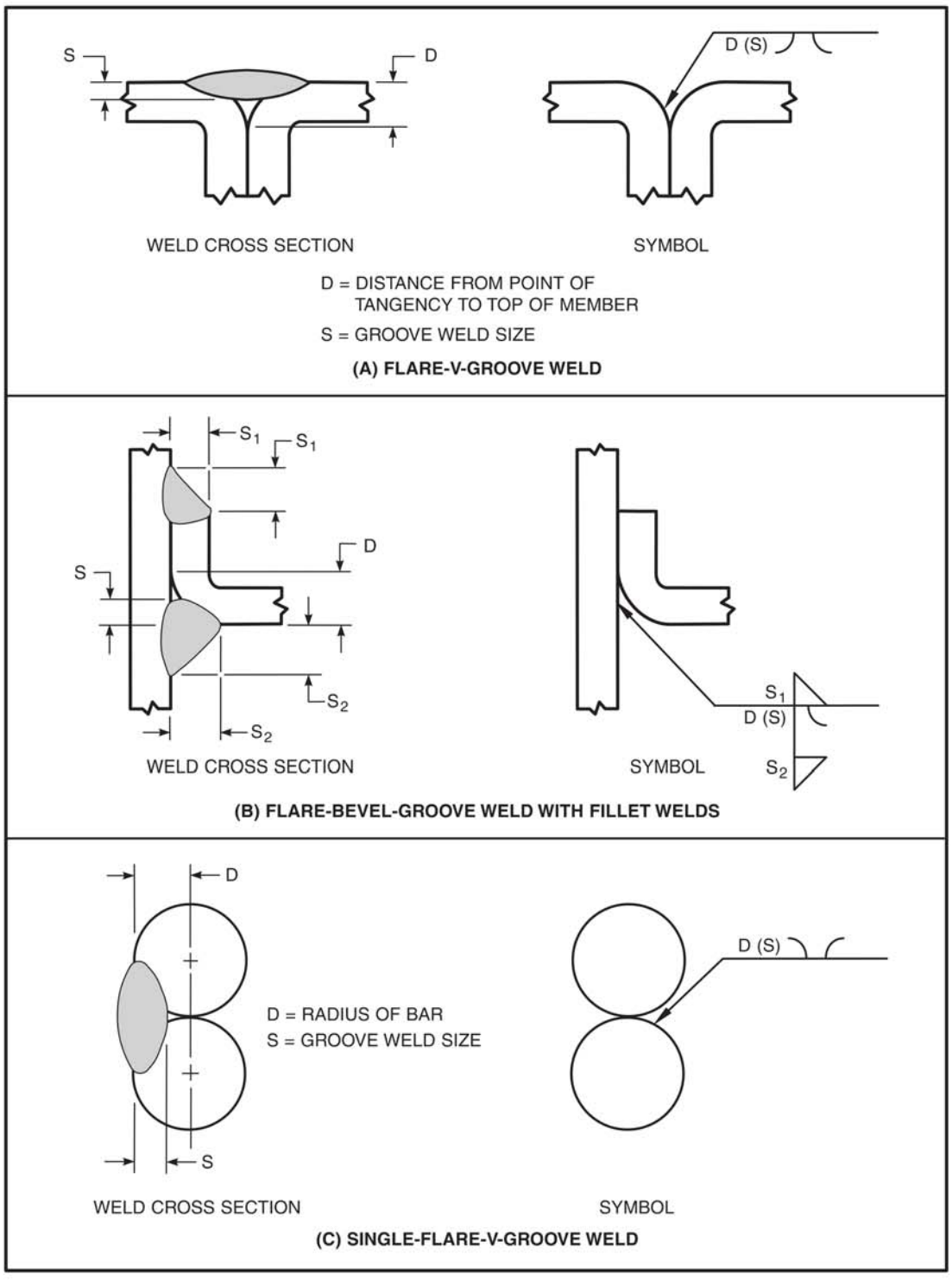


Figure 7.9—Application of Flare-Bevel and Flare-V-Groove Weld Symbols

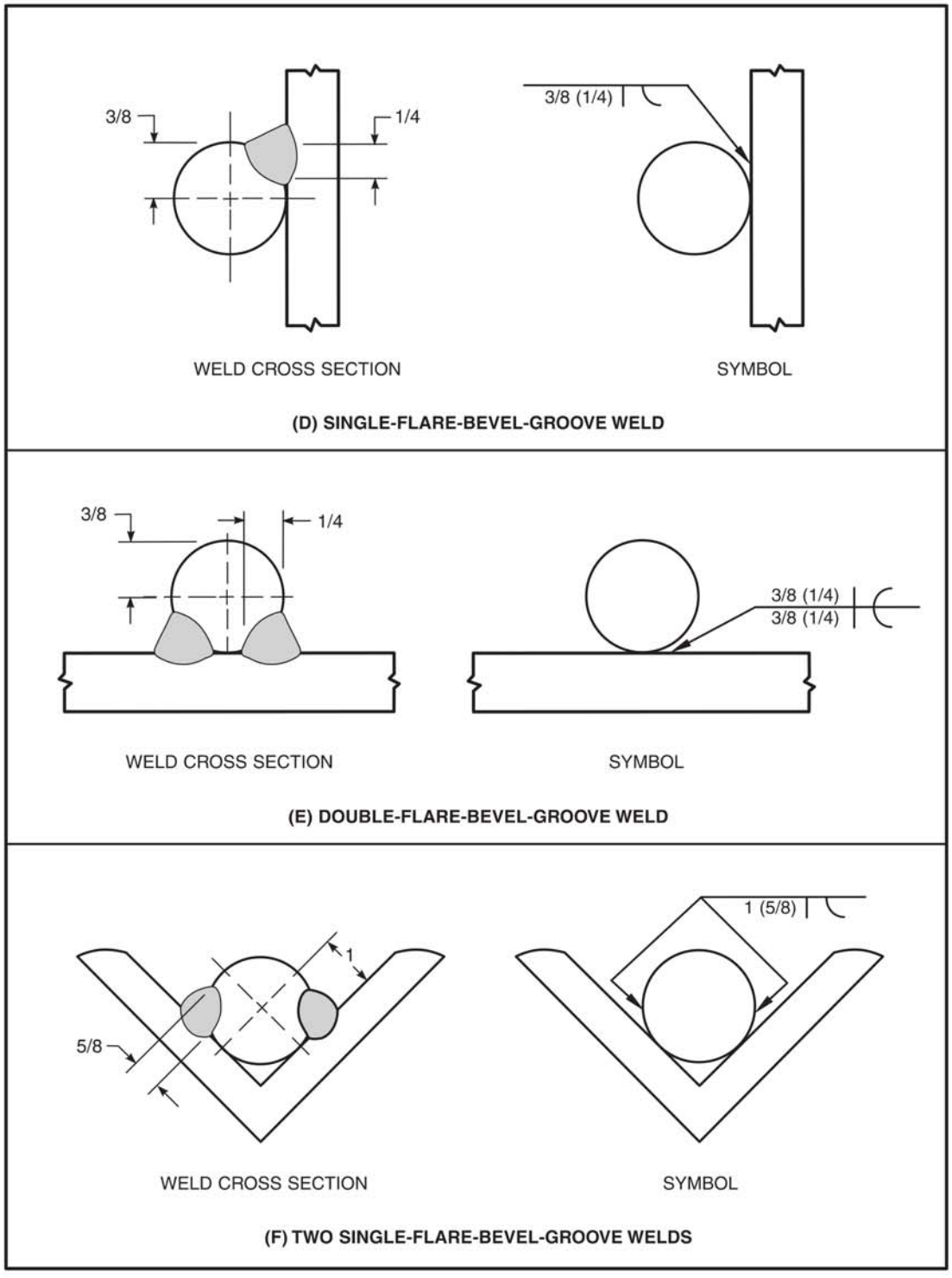


Figure 7.9 (Continued)—Application of Flare-Bevel and Flare-V-Groove Weld Symbols

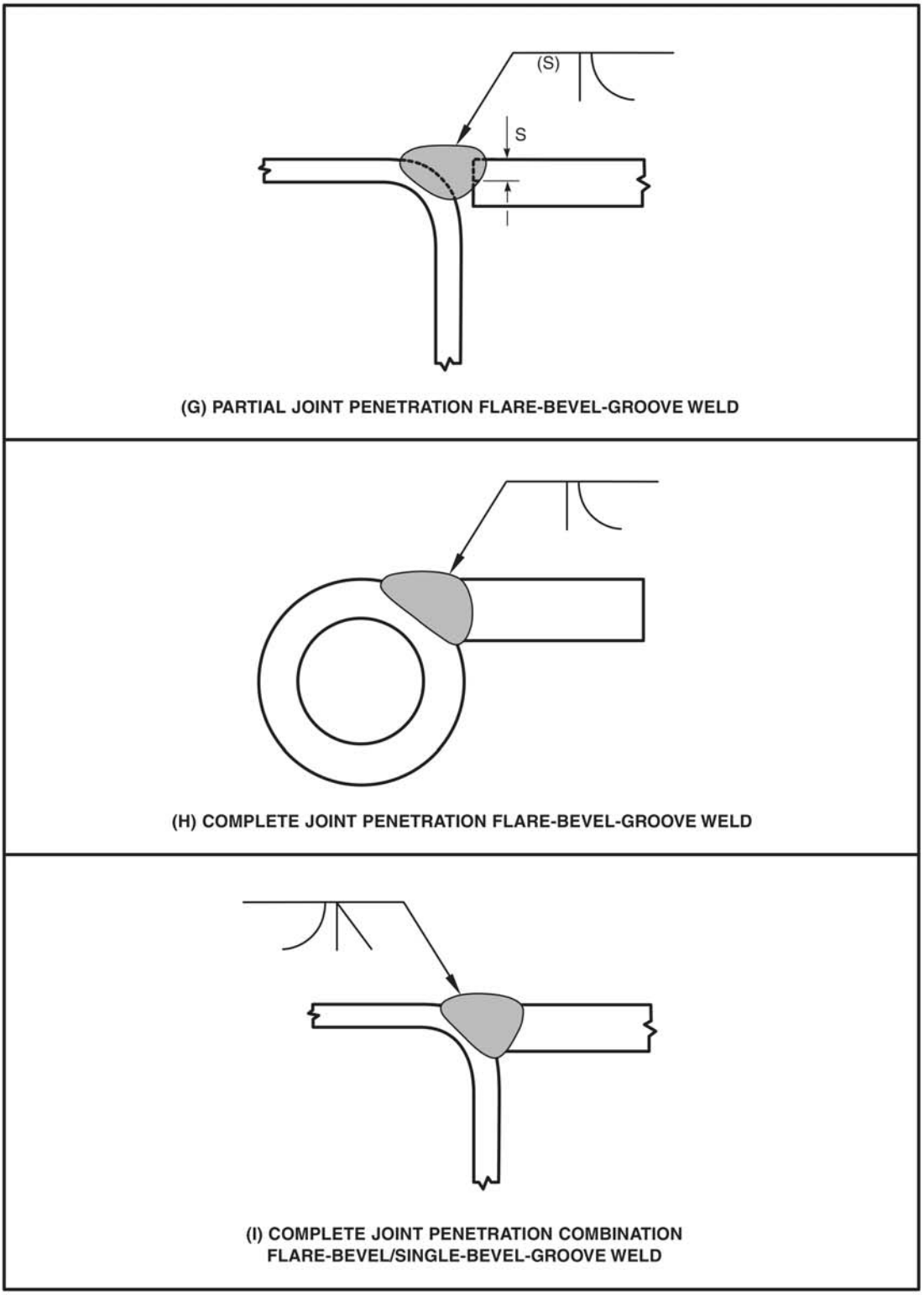


Figure 7.9 (Continued)—Application of Flare-Bevel and Flare-V-Groove Weld Symbols

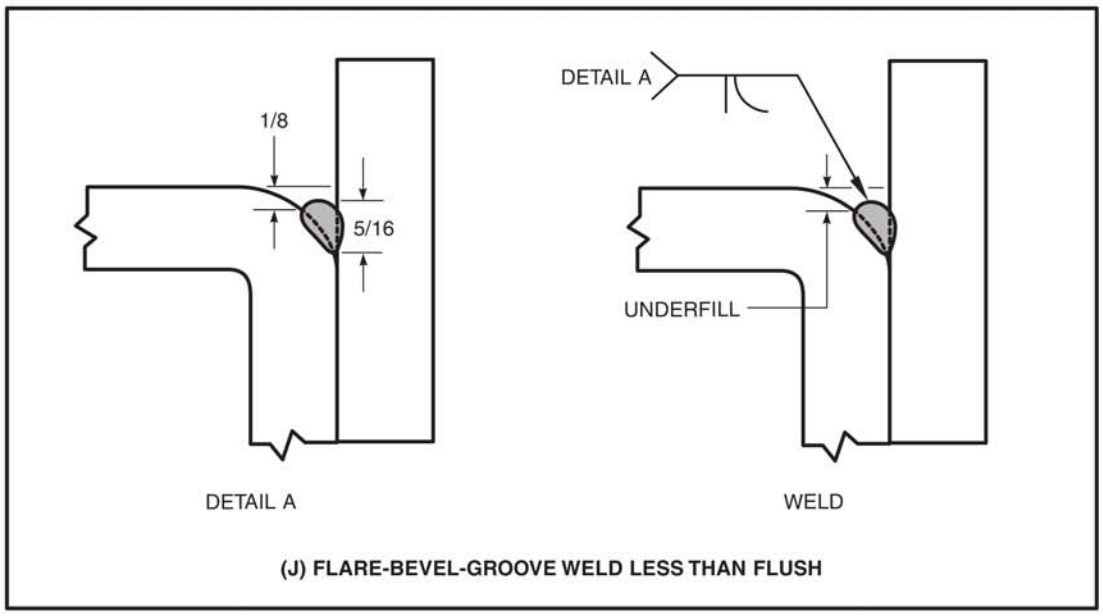


Figure 7.9 (Continued)—Application of Flare-Bevel and Flare-V-Groove Weld Symbols

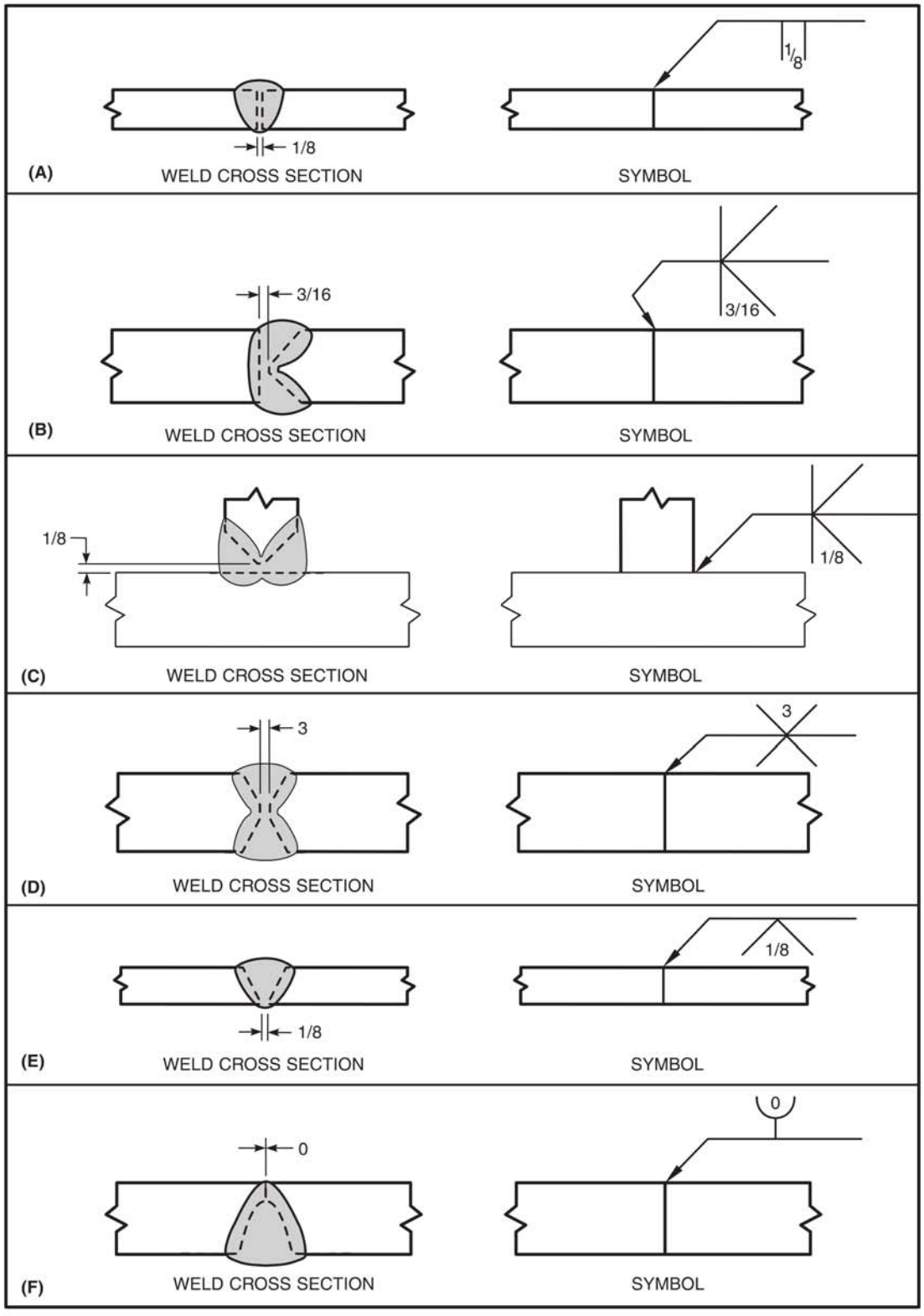


Figure 7.10—Application of the Root Opening of Groove Welds

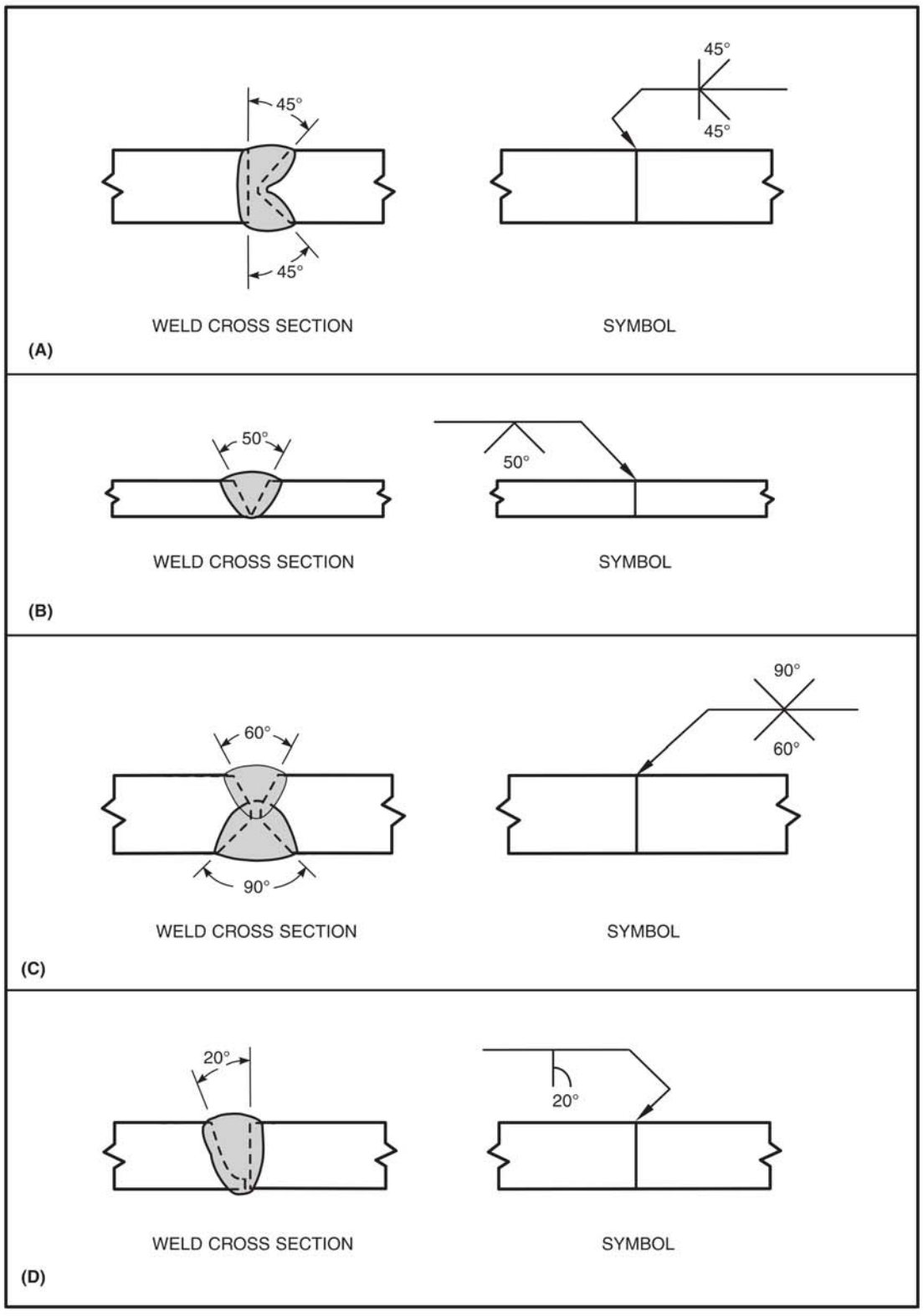
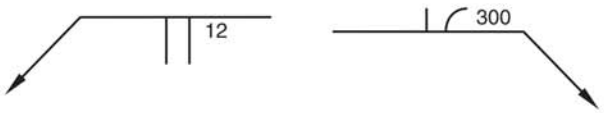


Figure 7.11—Application of the Groove Angle of Groove Welds

7.4 Groove Weld Length

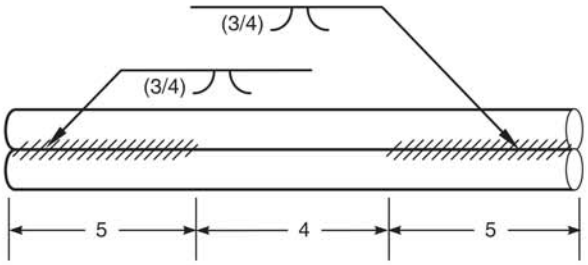
7.4.1 Location. The groove weld length, when indicated on the welding symbol, shall be specified to the right of the weld symbol [see Figure 7.12(A) and (C)].



7.4.1.1 Full Length. When a groove weld is to extend for the full length of the joint between abrupt changes of direction, no length dimension need be specified to the right of the weld symbol [see Figure 7.12(B)].

7.4.1.2 Specific Lengths. Specific groove weld lengths and their locations may be specified by symbols in conjunction with dimension lines (see Figure 7.12).

7.4.1.3 Hatching. Hatching may be used to graphically depict groove welds.

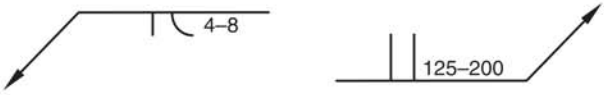


7.4.2 Changes in the Direction of Welding. Symbols for groove welds involving abrupt changes in direction of welding shall be in accordance with 6.10.2 (see Figure 7.13).

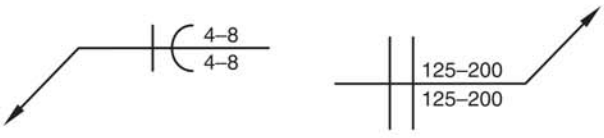
7.5 Intermittent Groove Welds

7.5.1 Pitch. The pitch of intermittent groove welds shall be the distance between the centers of adjacent weld segments on one side of the joint [see Figure 7.14(A)].

7.5.2 Pitch Dimension Location. The pitch of intermittent groove welds shall be specified to the right of the length dimension following a hyphen [see Figure 7.14(A)].



7.5.3 Chain Intermittent Groove Welds. Dimensions of chain intermittent groove welds shall be specified on both sides of the reference line. The segments of chain intermittent groove welds are approximately opposite one another across the joint [see Figure 7.14(B)].



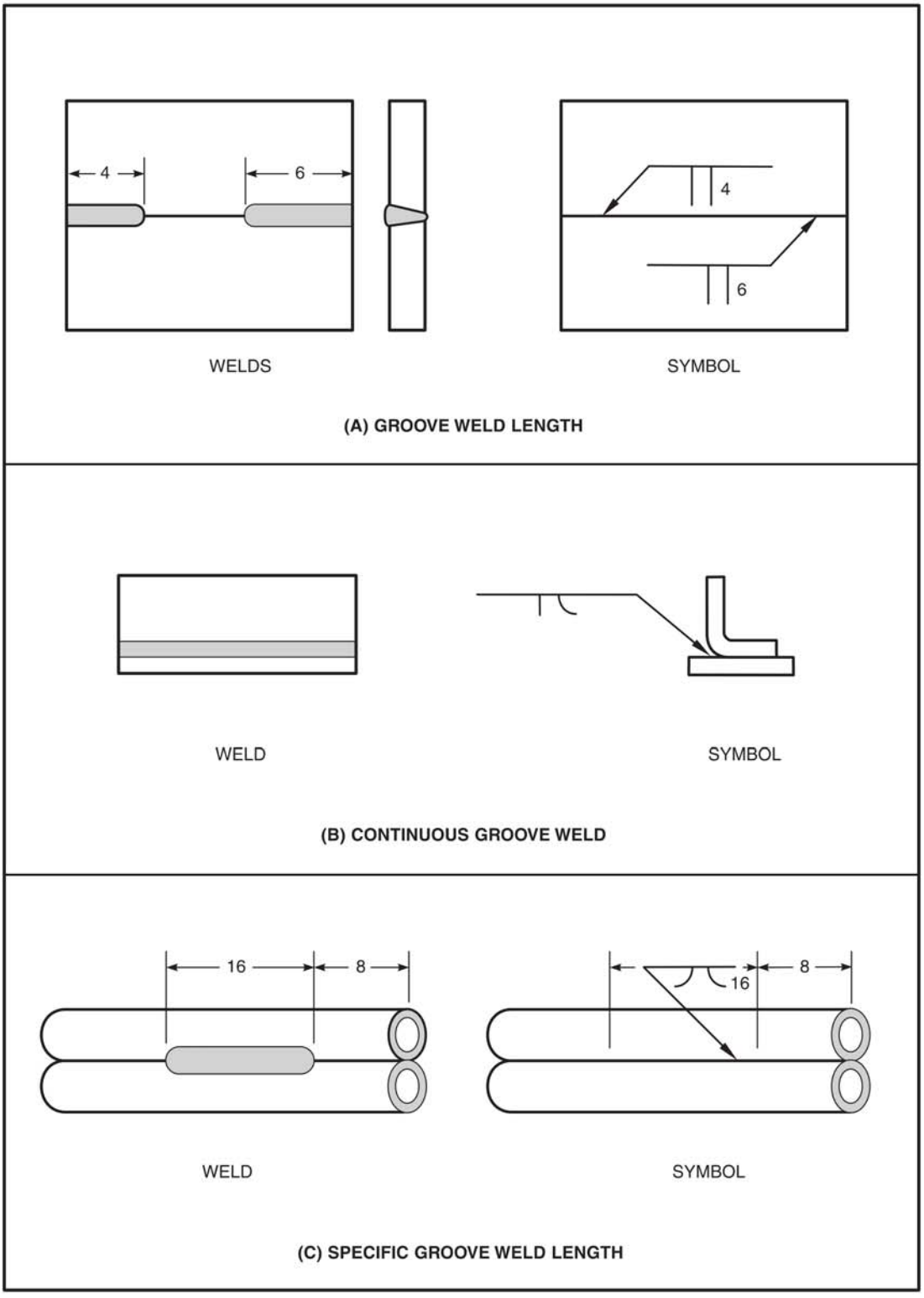


Figure 7.12—Application of the Weld Length of Groove Welds

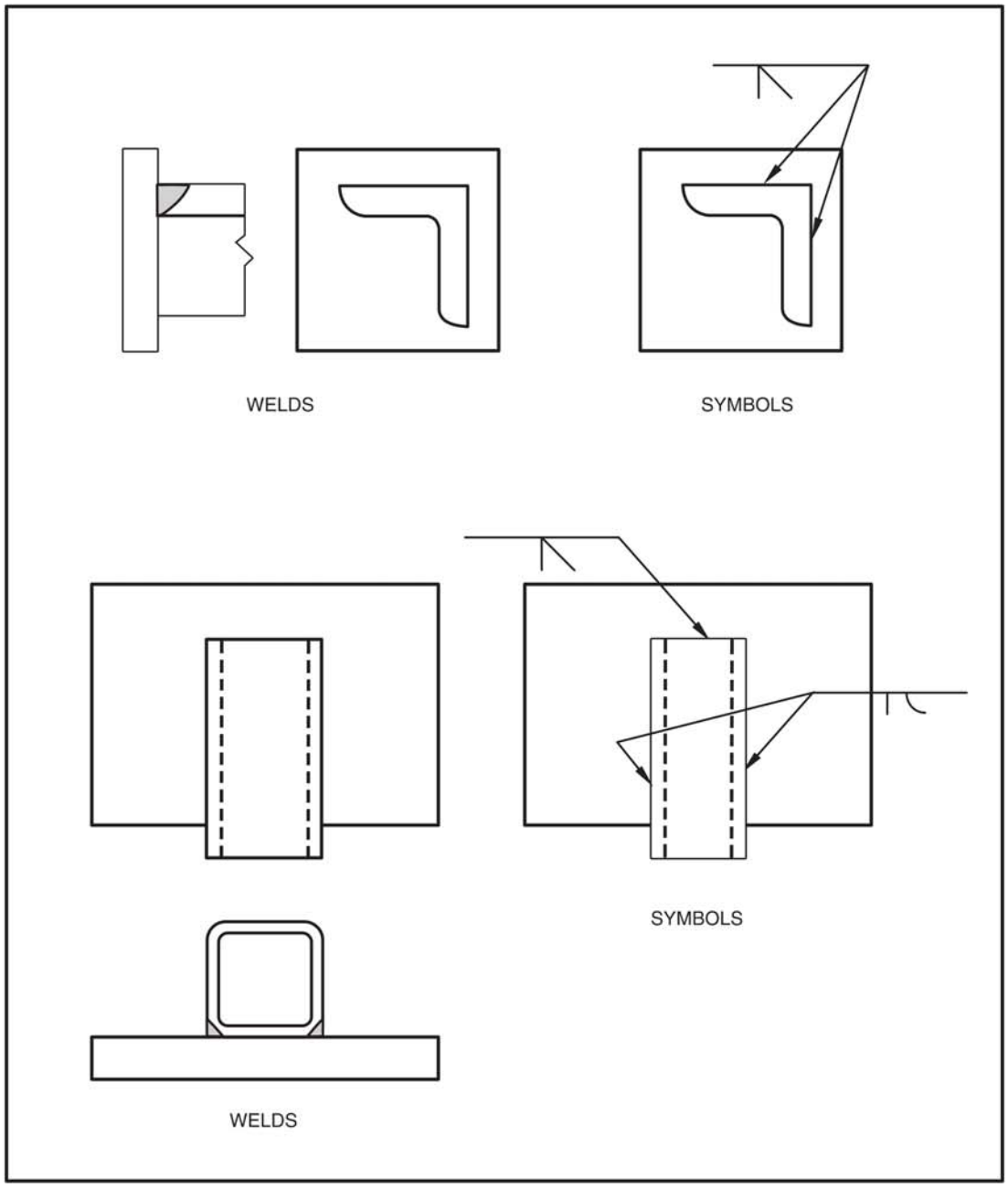


Figure 7.13—Application of the Extent of Welding of Groove Welds

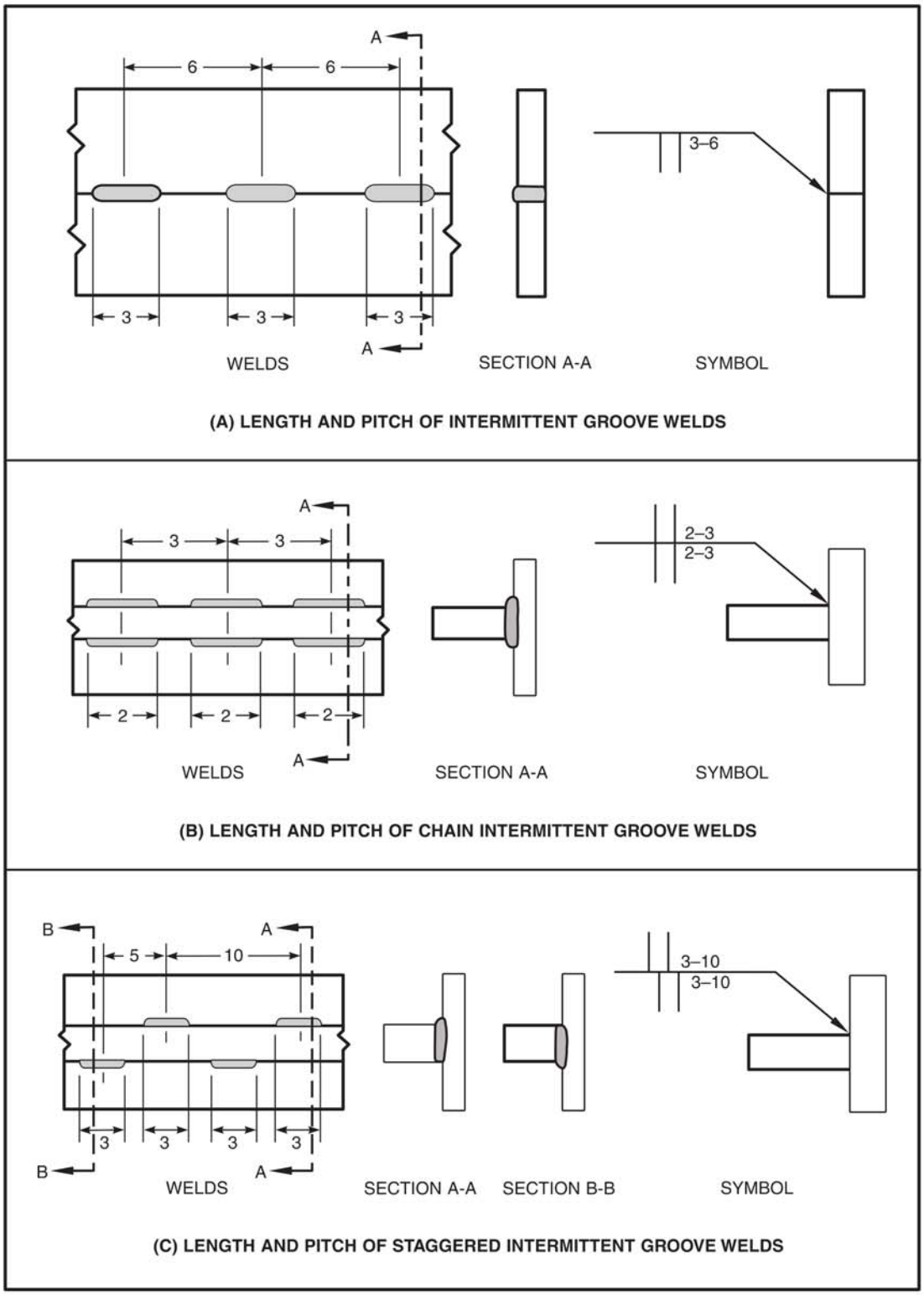


Figure 7.14—Application of Intermittent Groove Welds

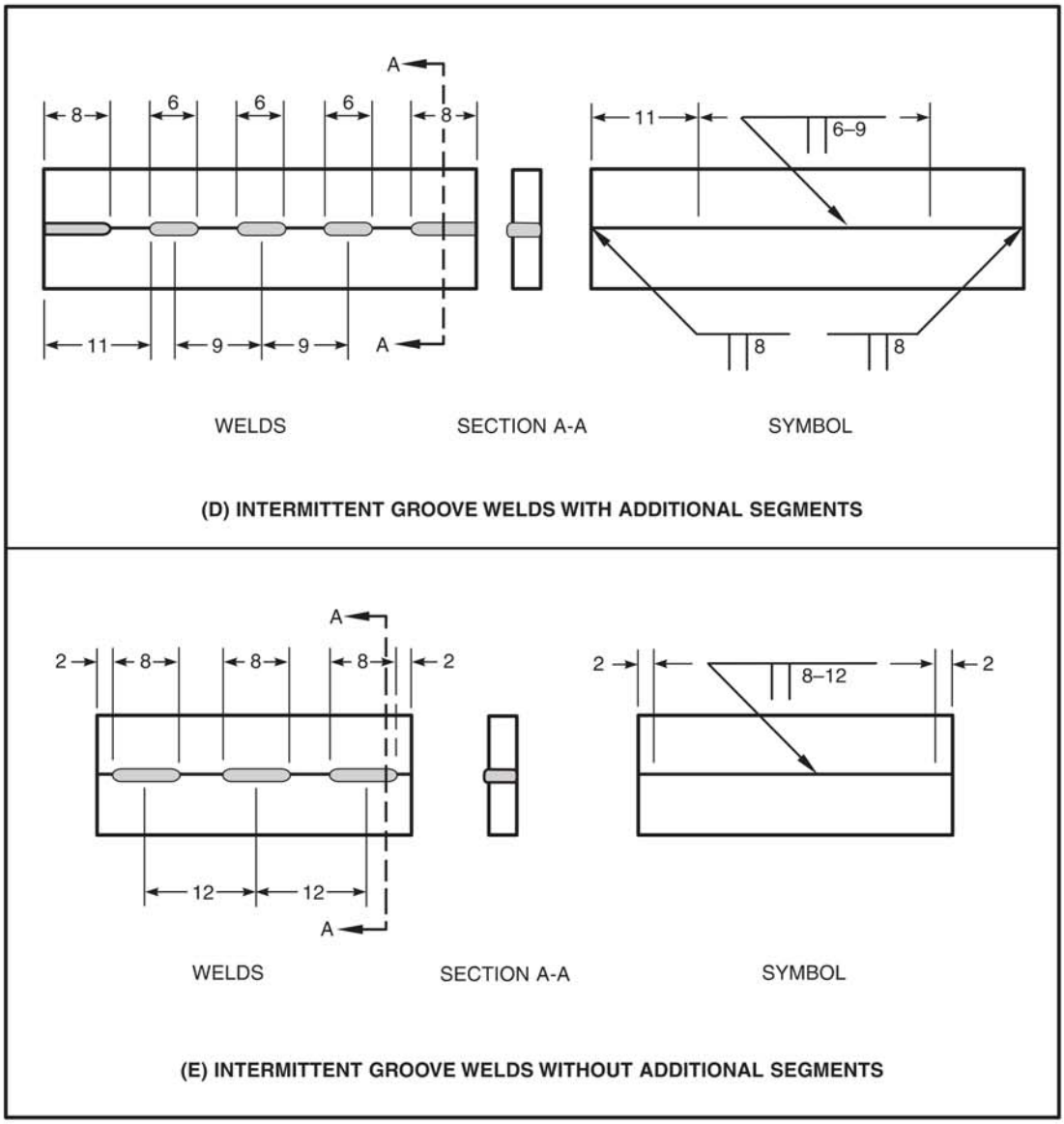


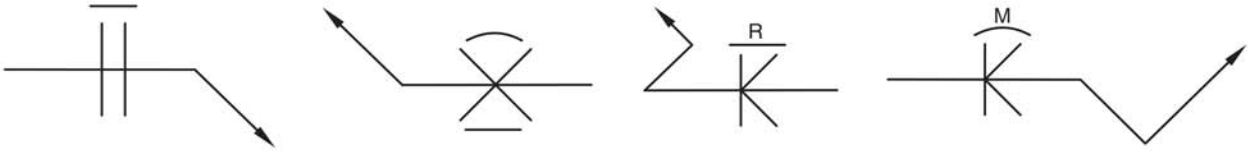
Figure 7.14 (Continued)—Application of Intermittent Groove Welds

7.5.4 Staggered Intermittent Groove Welds. Dimensions of staggered intermittent groove welds shall be specified on both sides of the reference line, and the groove weld symbols shall be offset on opposite sides of the reference line. The segments of staggered intermittent groove welds shall be symmetrically spaced on both sides of the joint [see Figure 7.14(C)].

7.5.5 Extent of Welding. In the case of intermittent groove welds, unless otherwise specified, the unwelded lengths at the ends of the joint shall not exceed the unwelded distance between weld segments. Additional weld lengths intended at the ends of the joint shall be specified by separate welding symbols and dimensioned on the drawing [see Figure 7.14(D)]. When specific unwelded lengths are intended at the ends of the joint, the unwelded lengths shall be dimensioned on the drawing [see Figure 7.14(E)].

7.5.6 Location of Intermittent Welds. When the location of intermittent welds is not obvious, such as on a circular weld joint, it may be necessary to provide specific segment locations by using dimension lines (see 7.4.1.2) or hatching (see 7.4.1.3).

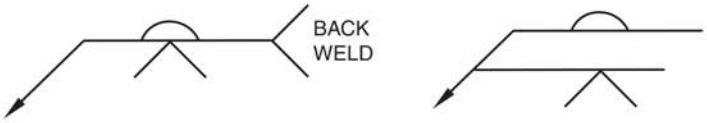
7.6 Groove Weld Contour and Finish. Groove welds to be contoured flush or convex shall be in accordance with 6.13 (see Figure 7.15).



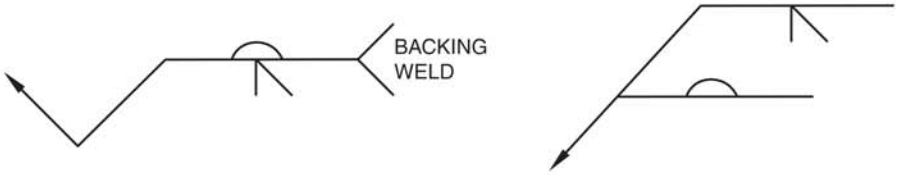
7.7 Back and Backing Welds

7.7.1 General. The back and backing weld symbols are identical. The sequence of welding determines which designation applies. The back weld is made after the groove weld, and the backing weld is made before the groove weld (see 7.7.2 and 7.7.3).

7.7.2 Back Weld Symbol. The back weld symbol is placed on the side of the reference line opposite a groove weld symbol. When a single reference line is used, "back weld" shall be specified in the tail of the welding symbol. Alternately, if multiple reference lines are used, the back weld symbol shall be placed on a reference line subsequent to the reference line specifying the groove weld [see Figure 7.16(A)].



7.7.3 Backing Weld Symbol. The backing weld symbol is placed on the side of the reference line opposite a groove weld symbol. When a single reference line is used, "backing weld" shall be specified in the tail of the welding symbol. Alternately, if multiple reference lines are used, the backing weld symbol shall be placed on a reference line prior to the reference line specifying the groove weld [see Figure 7.16(B) and (C)].



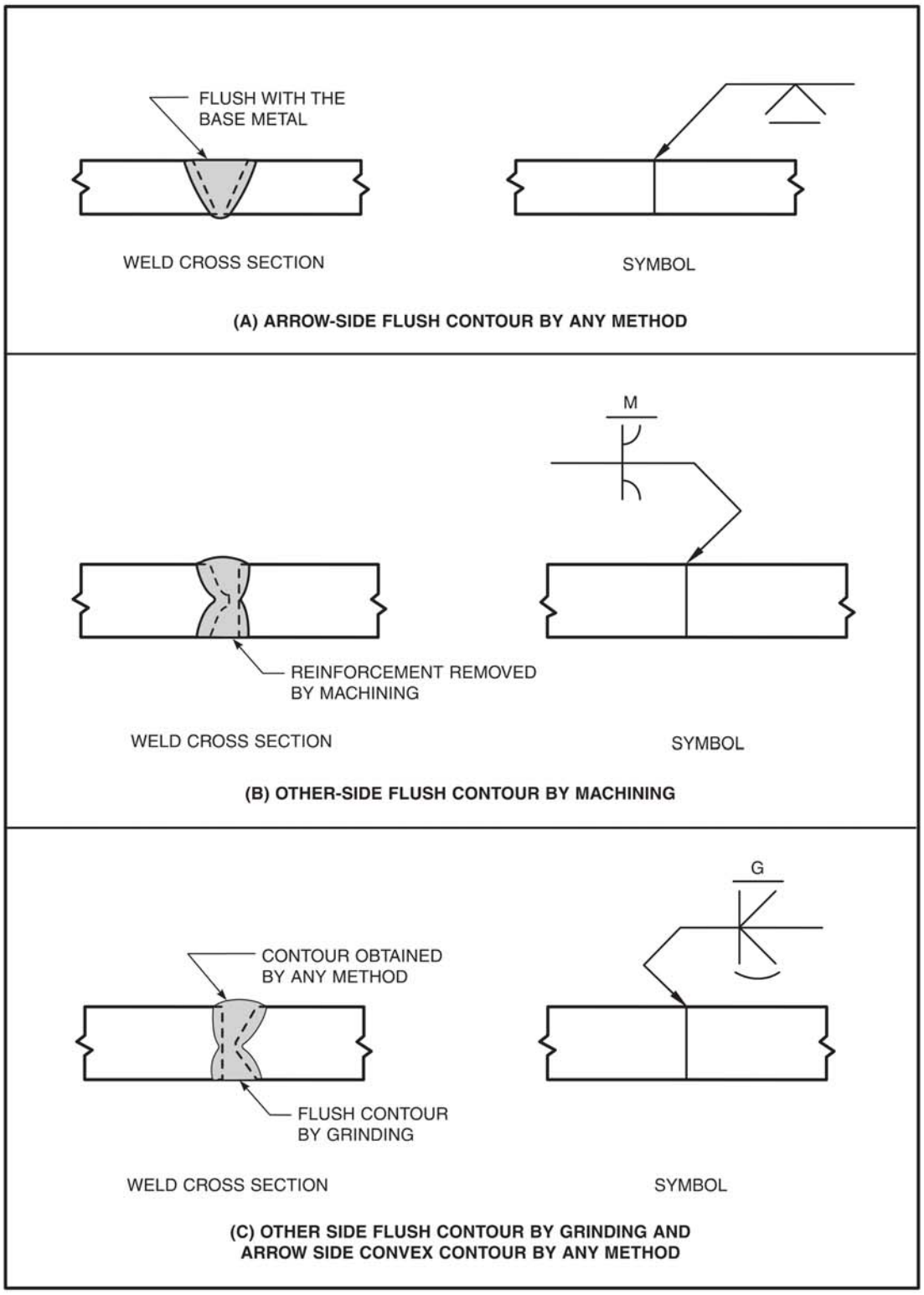


Figure 7.15—Application of the Flush and Convex Contour Symbols

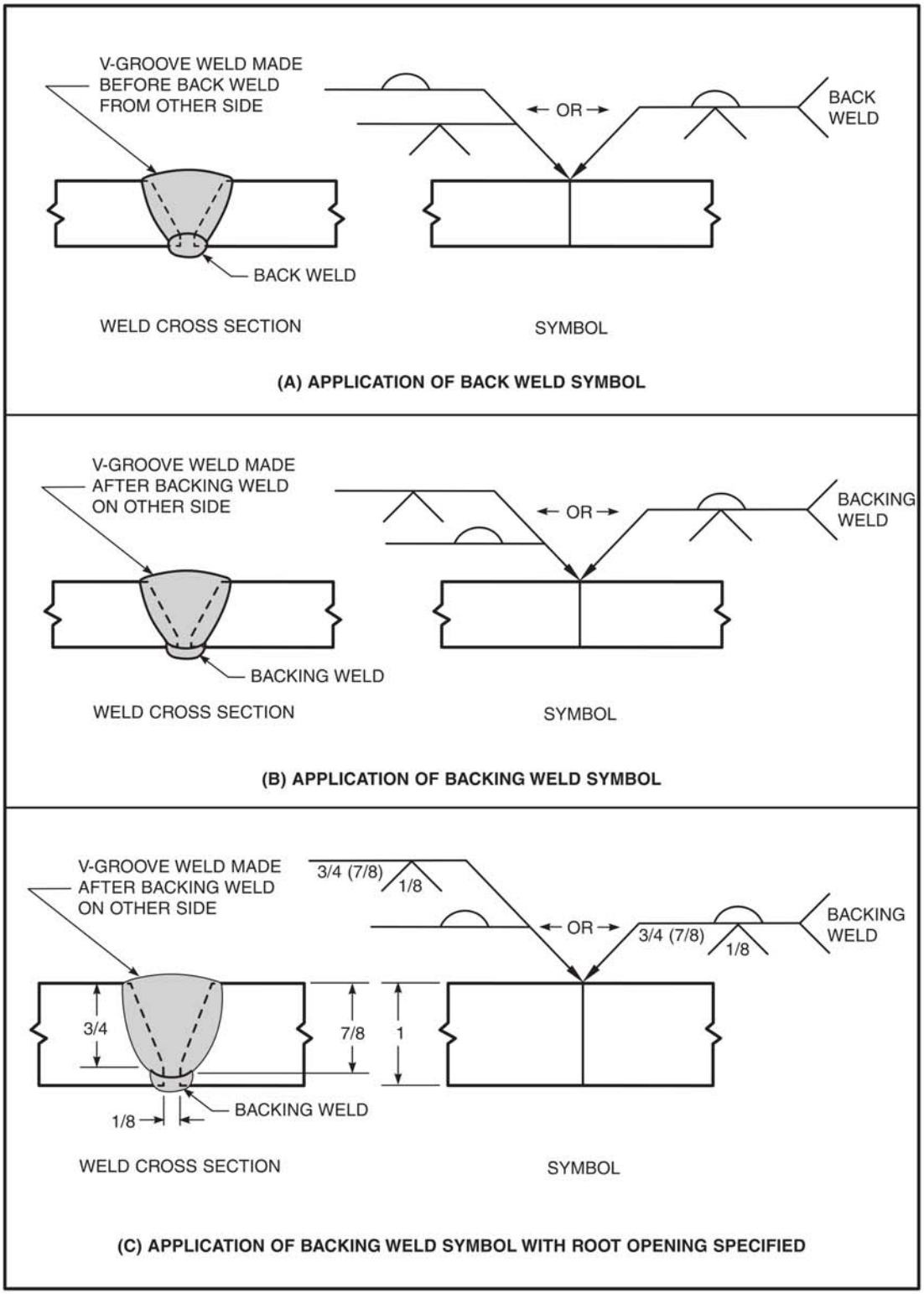
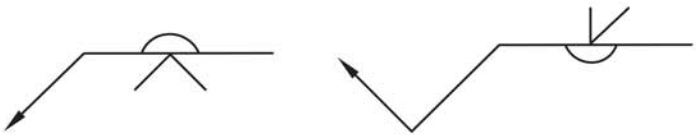
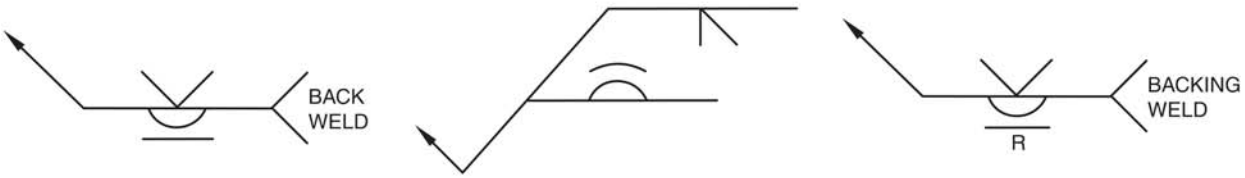


Figure 7.16—Application of Back or Backing Weld Symbol

7.7.4 Back or Backing Weld Symbol. If the back or backing weld symbol is used on a single reference line without being identified in the tail, either a back or backing weld may be made.

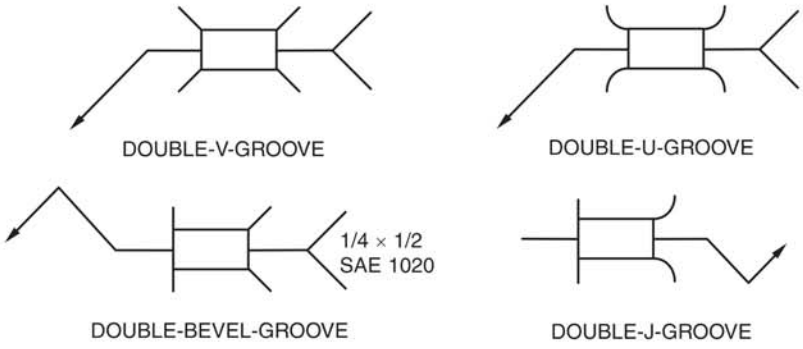


7.7.5 Contour and Finish of Back or Backing Welds. Backing welds to be contoured flush or convex shall be specified using the appropriate contour symbols described in 6.13.

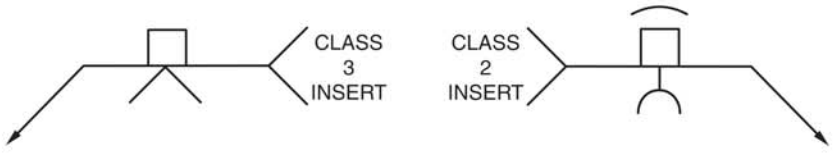


7.8 Joints with Backing. A joint with backing is specified by placing the backing symbol on the side of the reference line opposite the groove weld symbol. If the backing is to be removed after welding, an "R" shall be placed in the backing symbol [see Figure 7.17(A)]. The material and the dimensions of the backing shall be specified in the tail of the welding symbol or on the drawing.

7.9 Joints with Spacers. A joint with a required spacer is specified with the groove weld symbol modified to show a rectangle within it [see Figure 7.17(B)]. In case of multiple reference lines, the rectangle shall appear on the reference line nearest to the arrow [see Figure 7.17(C)]. The material and the dimensions of the spacer shall be specified in the tail of the welding symbol or on the drawing.



7.10 Consumable Inserts. Consumable inserts shall be specified by placing the consumable insert symbol on the side of the reference line opposite the groove weld symbol (see Figure 7.18). The AWS consumable insert class may be placed in the tail of the welding symbol (for the AWS insert classes, see AWS A5.30/A5.30M, *Specification for Consumable Inserts*).



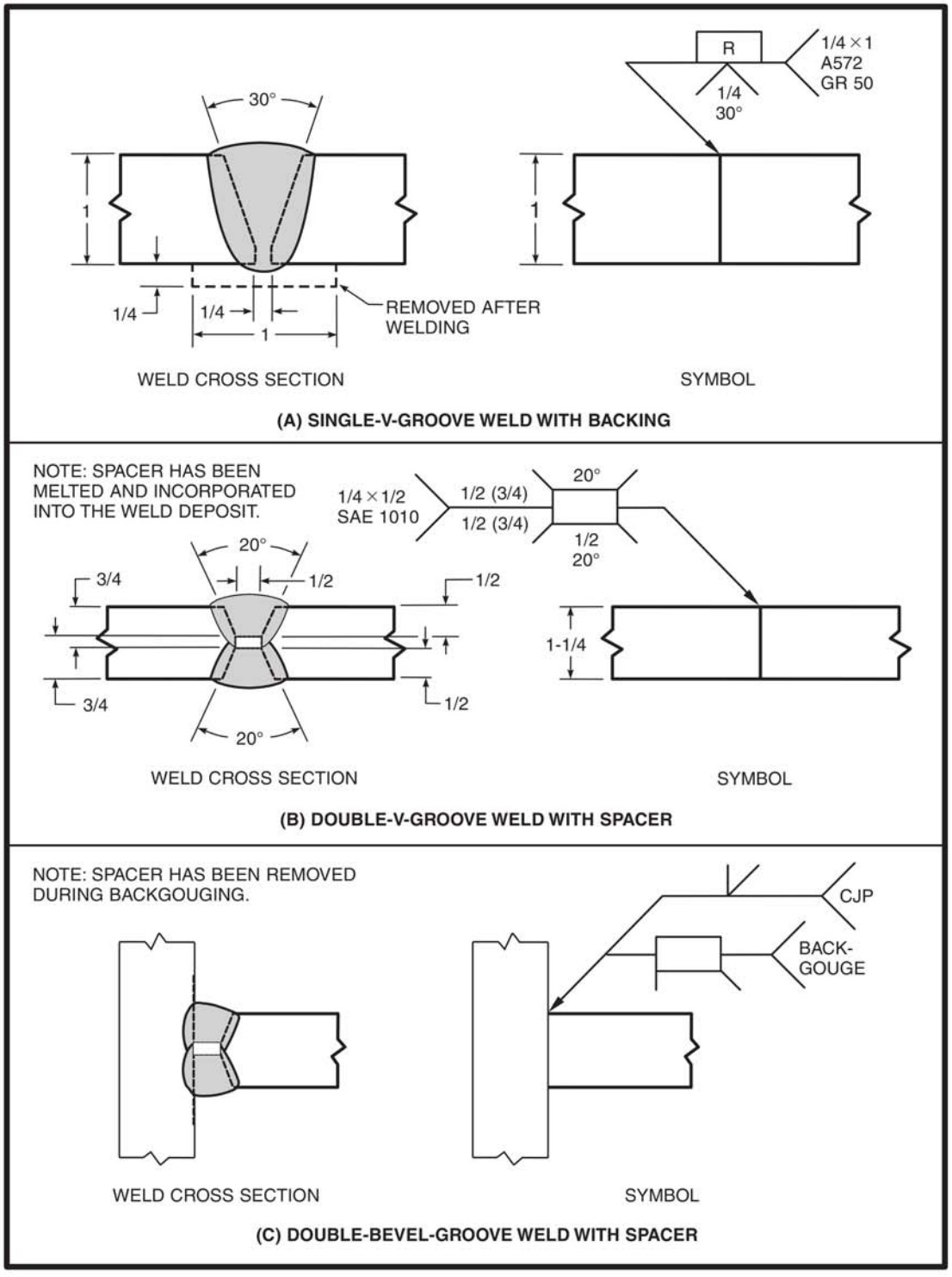


Figure 7.17—Application of Joints with Backing or Spacers

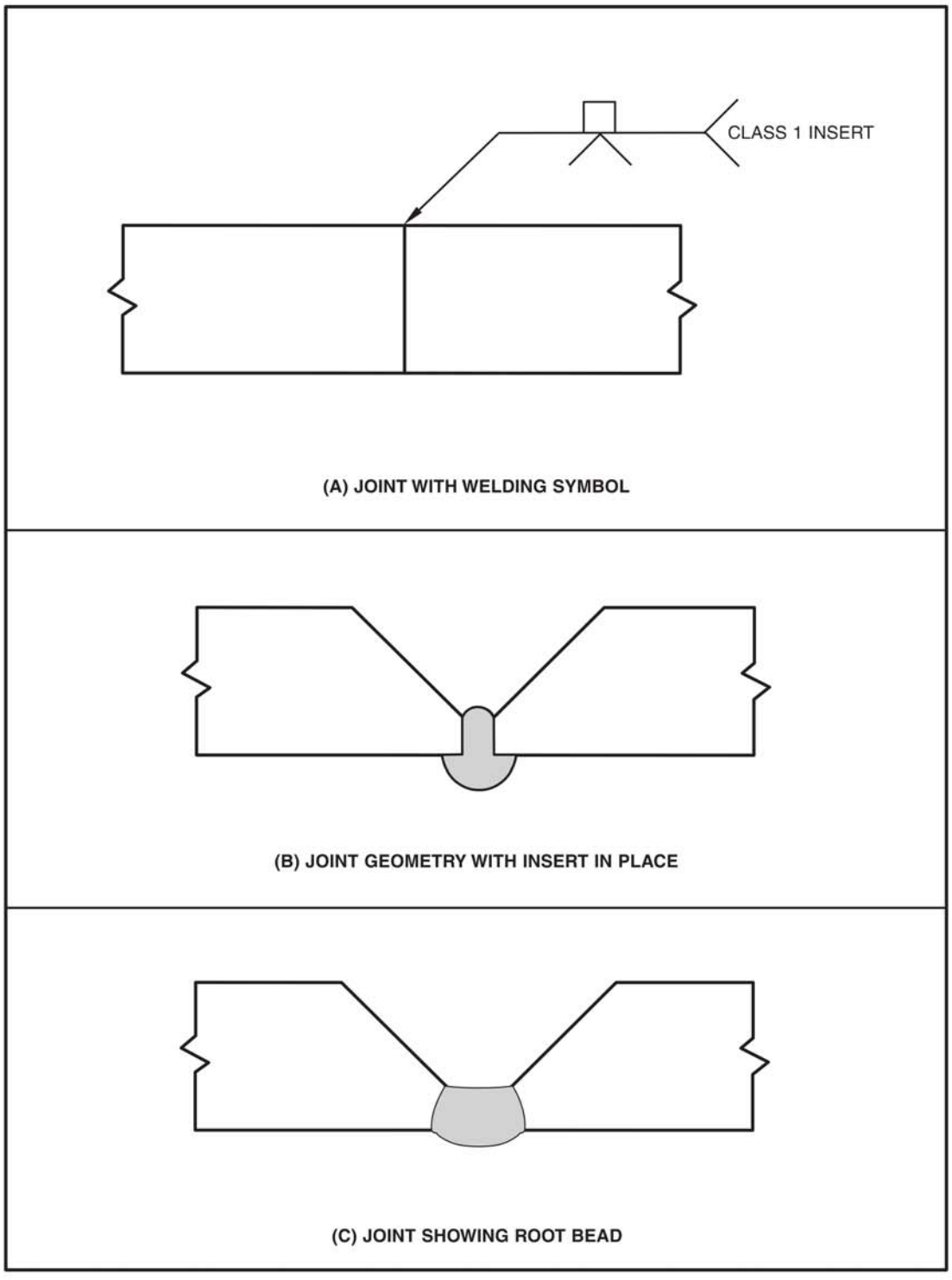
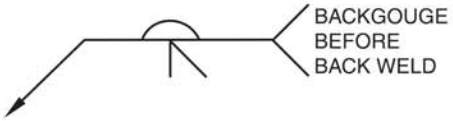


Figure 7.18—Application of Consumable Insert Symbol

7.11 Groove Welds with Backgouging. Along with other joint details, the welding symbol shall include a reference to backgouging in the tail. In the case of nonsymmetrical double-groove welds, the symbol shall show the required groove depth for each side of the joint [see Figure 7.19(A)], together with the required groove angles. Figure 7.19(B) shows a single-sided groove weld with a root face along with the groove depth dimension. In the case of single-groove welds without a root face or symmetrical double-groove welds without a root face, the welding symbol need not include the groove depth dimension [see 7.2.2 and Figure 7.19(C)].



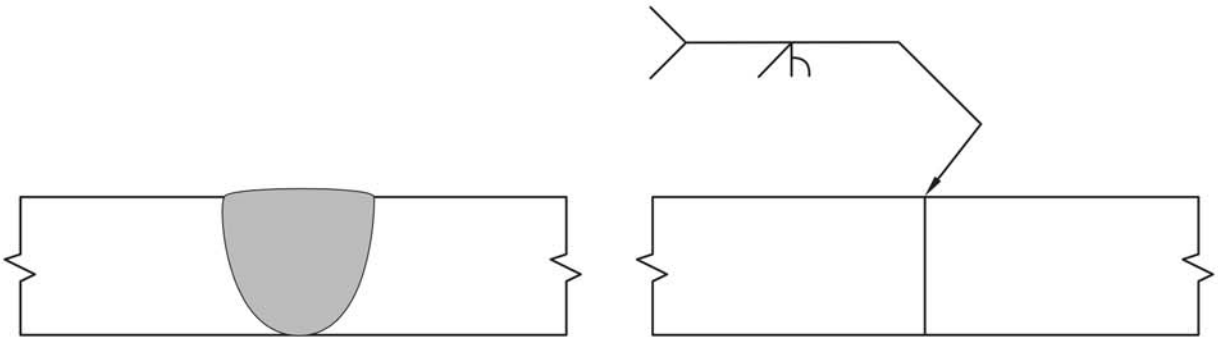
7.12 Seal Welds. When the intent of the weld is to fulfill a sealing function only, the weld shall be specified in the tail of the welding symbol as a seal weld (see Annex D7.12).

7.13 Skewed Joints. When the angle between the fusion faces is such that the identification of the weld type and proper weld symbol is in question, the detail of the desired joint, weld configuration, and dimensions shall be shown on the drawing (see 8.7 and Figure 7.20).

7.14 Combination Groove Weld Symbols

7.14.1 A combination of J-, flare-bevel, or bevel-groove weld symbols is permissible where there are two different edge shapes in a single joint. The welding symbol can include a combination J-, flare-bevel, or bevel-groove weld symbol to represent two different edge preparations (see Annex D7.14).

Specification of edge shape for one or both sides shall be indicated in the tail if not apparent.



Source: Adapted from AWS D14.9:2013, *Specification for the Welding of Hydraulic Cylinders*, Figures 3, American Welding Society.

7.14.2 Groove welds extending around joints where the joint transitions from one type to another (including combination welds) may be shown using multiple subreference lines (see Figure 7.21). Individual weld symbols or combination weld symbols shall be placed on their own subreference lines connected to a single reference line.

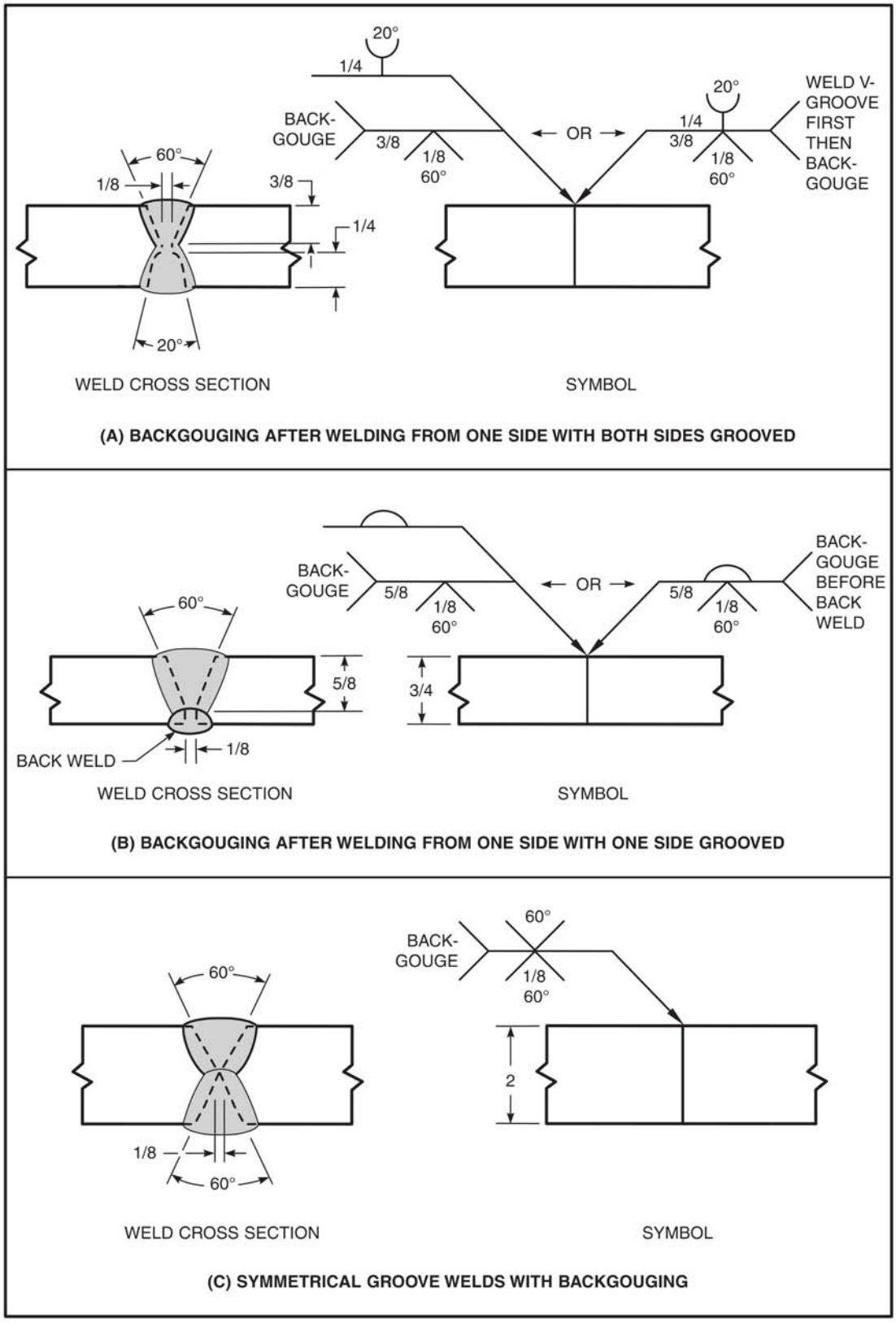


Figure 7.19—Application of the Symbol for Groove Welds with Backgouging

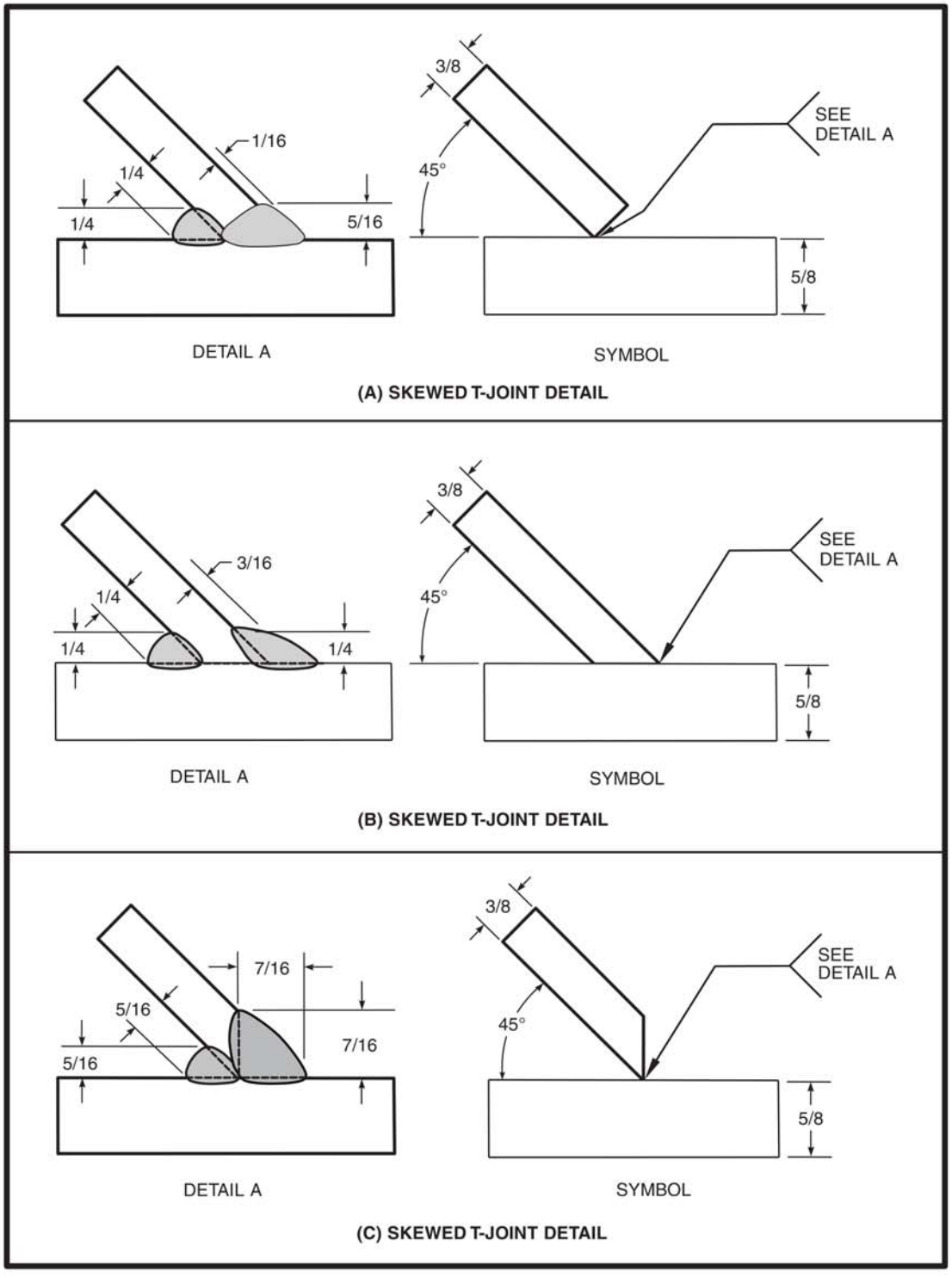


Figure 7.20—Application of Skewed Joint

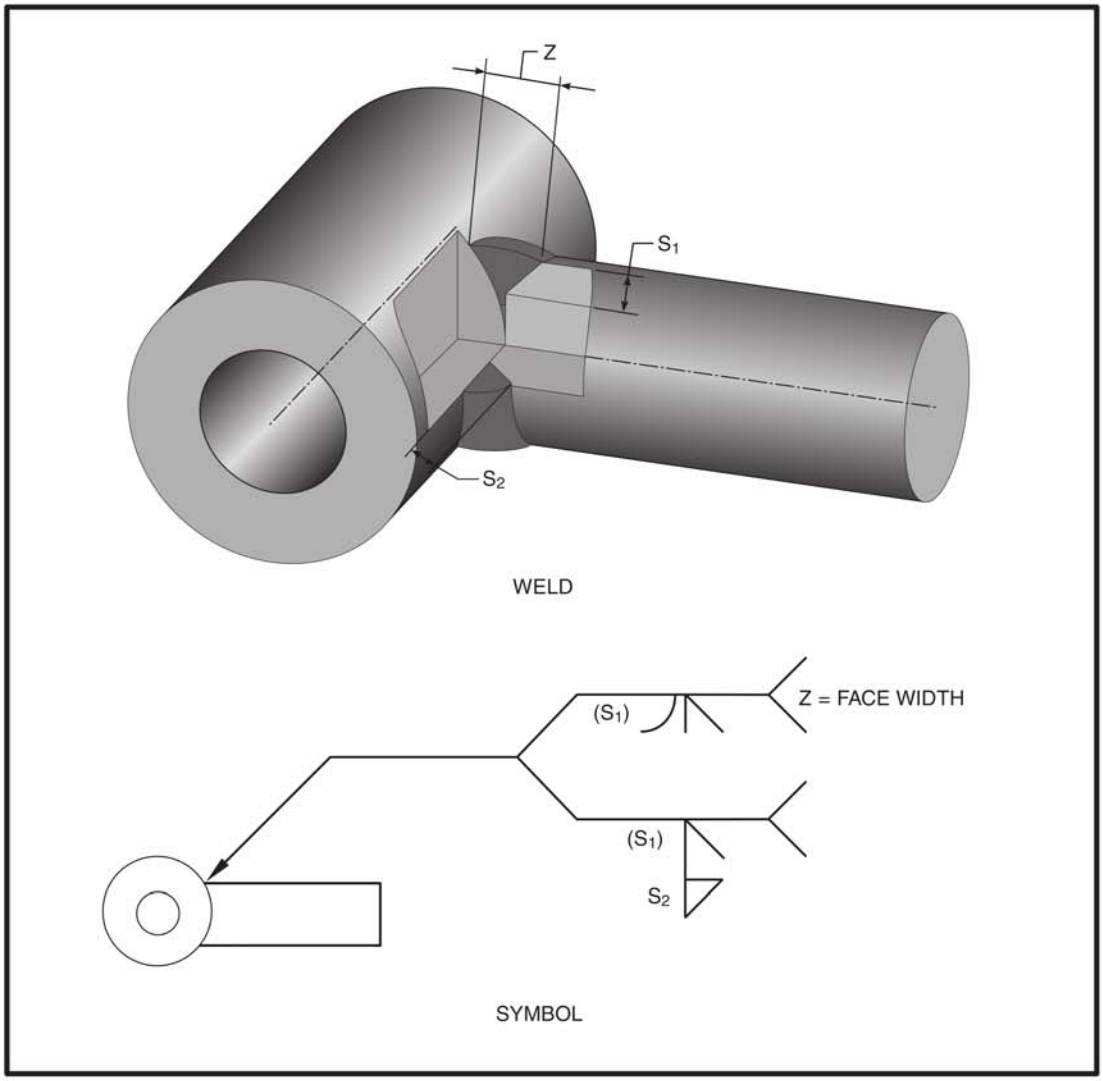
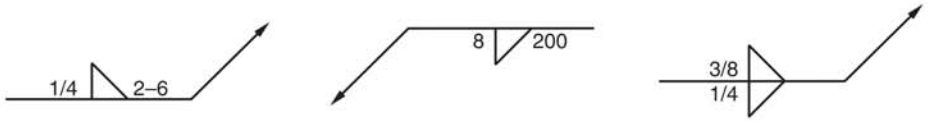


Figure 7.21—Application of Combination Weld Symbols and Multiple Reference Lines

8. Fillet Welds

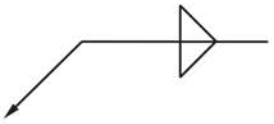
8.1 General

8.1.1 Dimension Location. Fillet weld dimensions shall be shown on the same side of the reference line as the weld symbol [see Figure 8.1(A), (B), (C), (D), and (F), Figure 8.2, and Figure 8.3(B) and (C)].



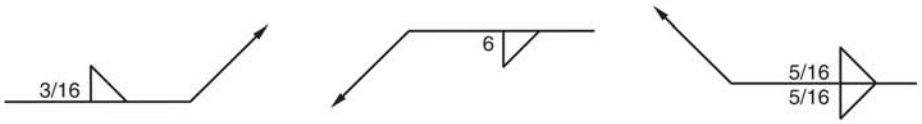
8.1.2 Double Fillet Welds. Fillet weld dimensions on both sides of a joint shall be specified whether the dimensions are identical or different [see Figure 8.1(B) and (C) and Figure 8.3(B) and (C)].

8.1.3 Drawing Notes. Fillet weld dimensions covered by drawing notes need not be repeated on the welding symbols in accordance with 6.12.6.

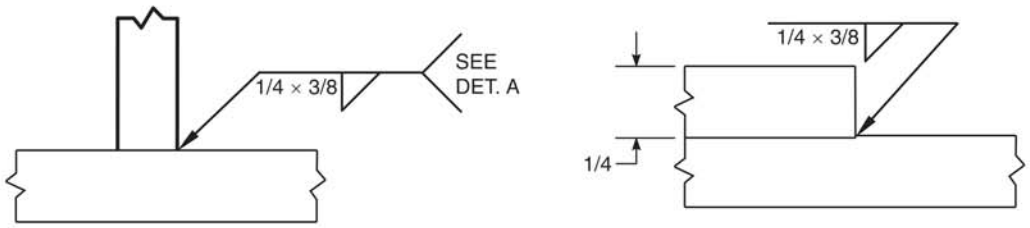


8.2 Fillet Weld Size

8.2.1 Location. The fillet weld size, "S", shall be specified to the left of the weld symbol [see Figure 8.1(A), (B), (C), and (D)].

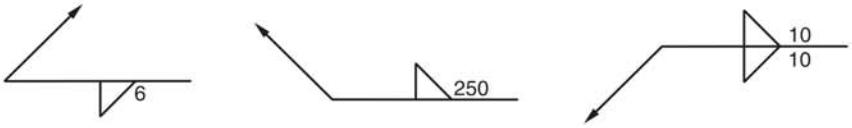


8.2.2 Unequal Legs. The fillet weld size, "S", with unequal legs shall be specified to the left of the weld symbol. Weld orientation is not specified by the symbol and shall be shown on the drawing if needed to ensure clarity [see Figure 8.1(D)].



8.3 Fillet Weld Length

8.3.1 Location. The fillet weld length, when indicated on the welding symbol, shall be specified to the right of the weld symbol [see Figure 8.1(F)].



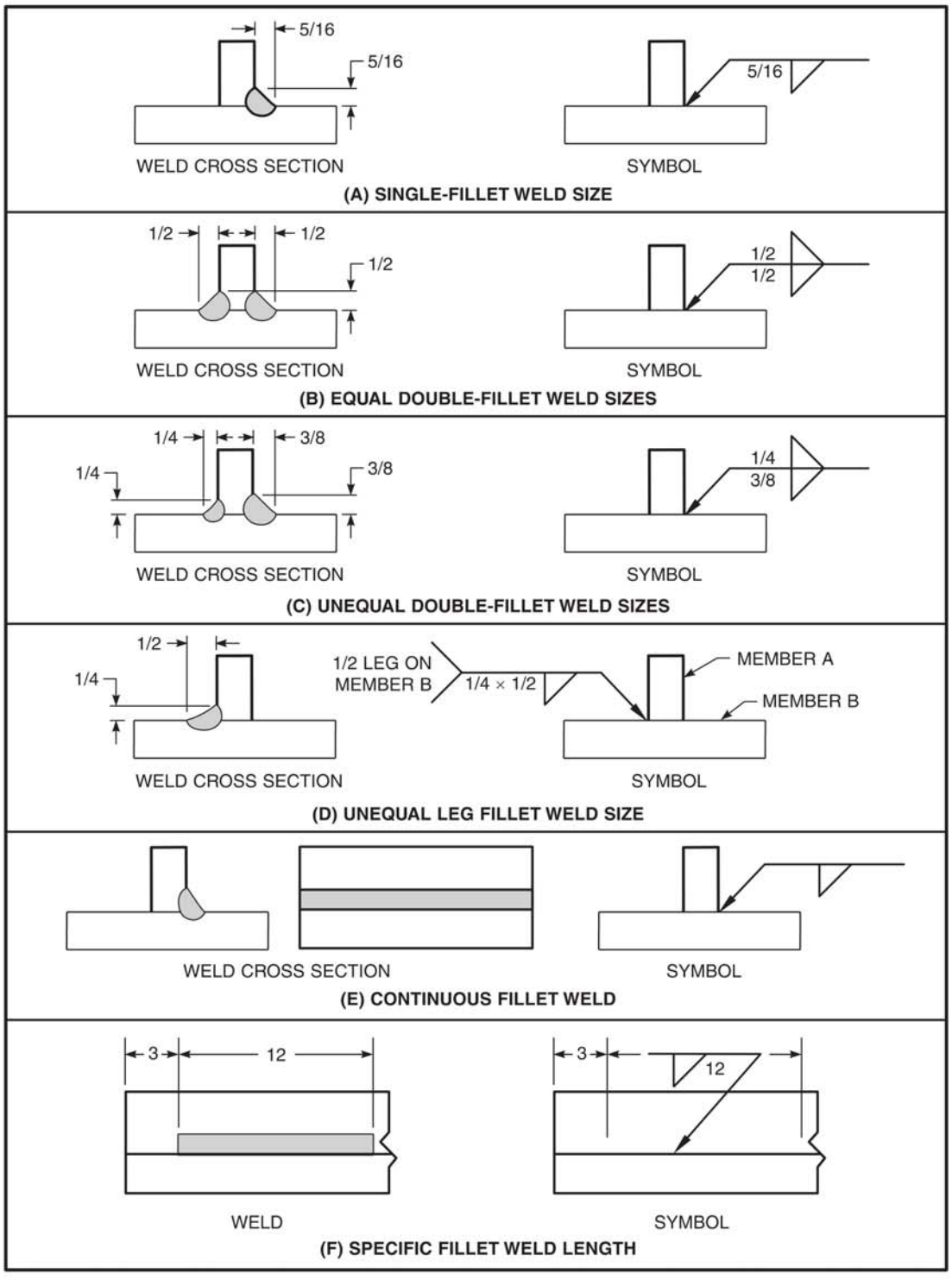


Figure 8.1—Application of the Symbols for Fillet Weld Size and Length

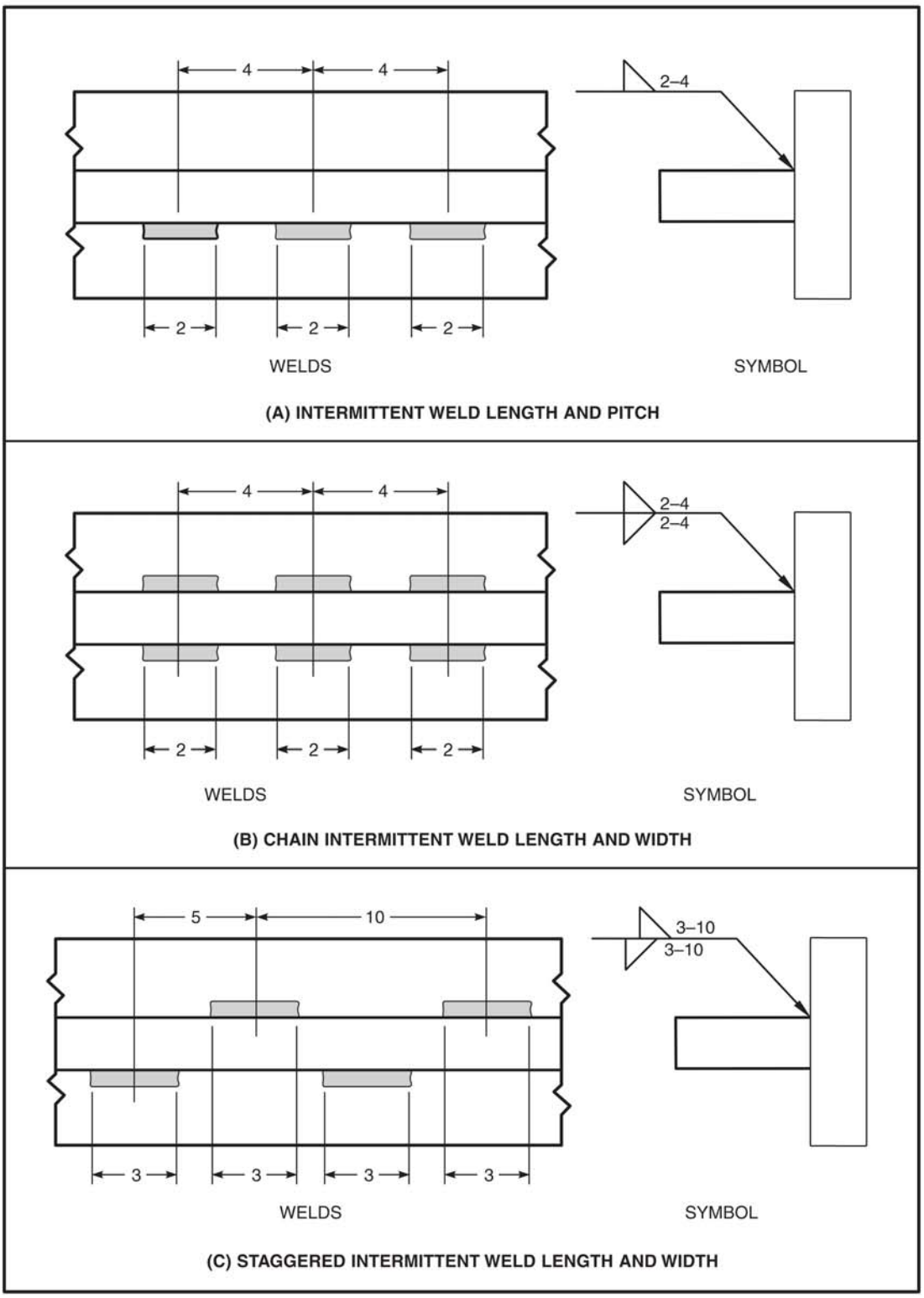


Figure 8.2—Application of the Intermittent Fillet Weld Symbol

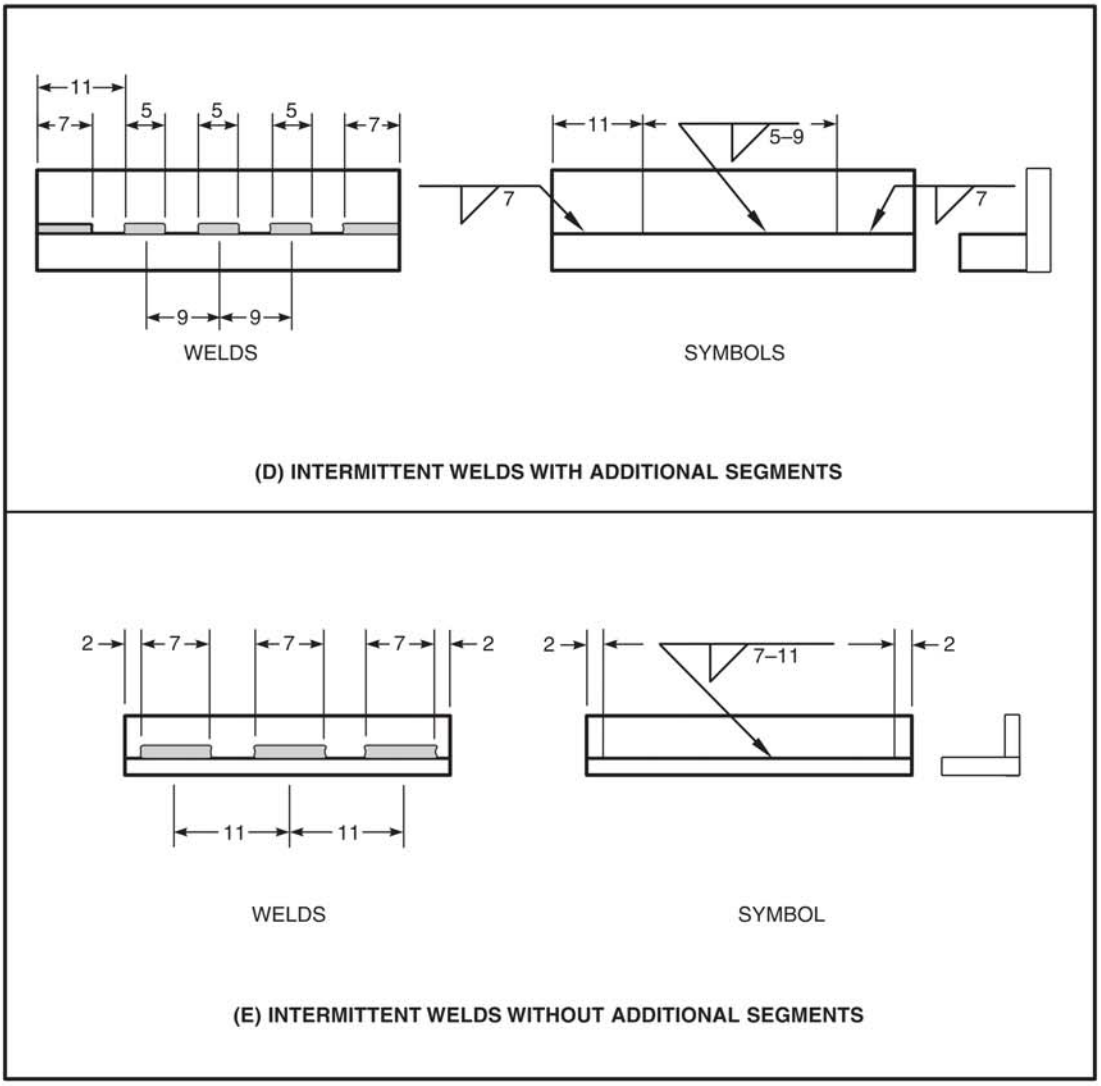


Figure 8.2 (Continued)—Application of the Intermittent Fillet Weld Symbol

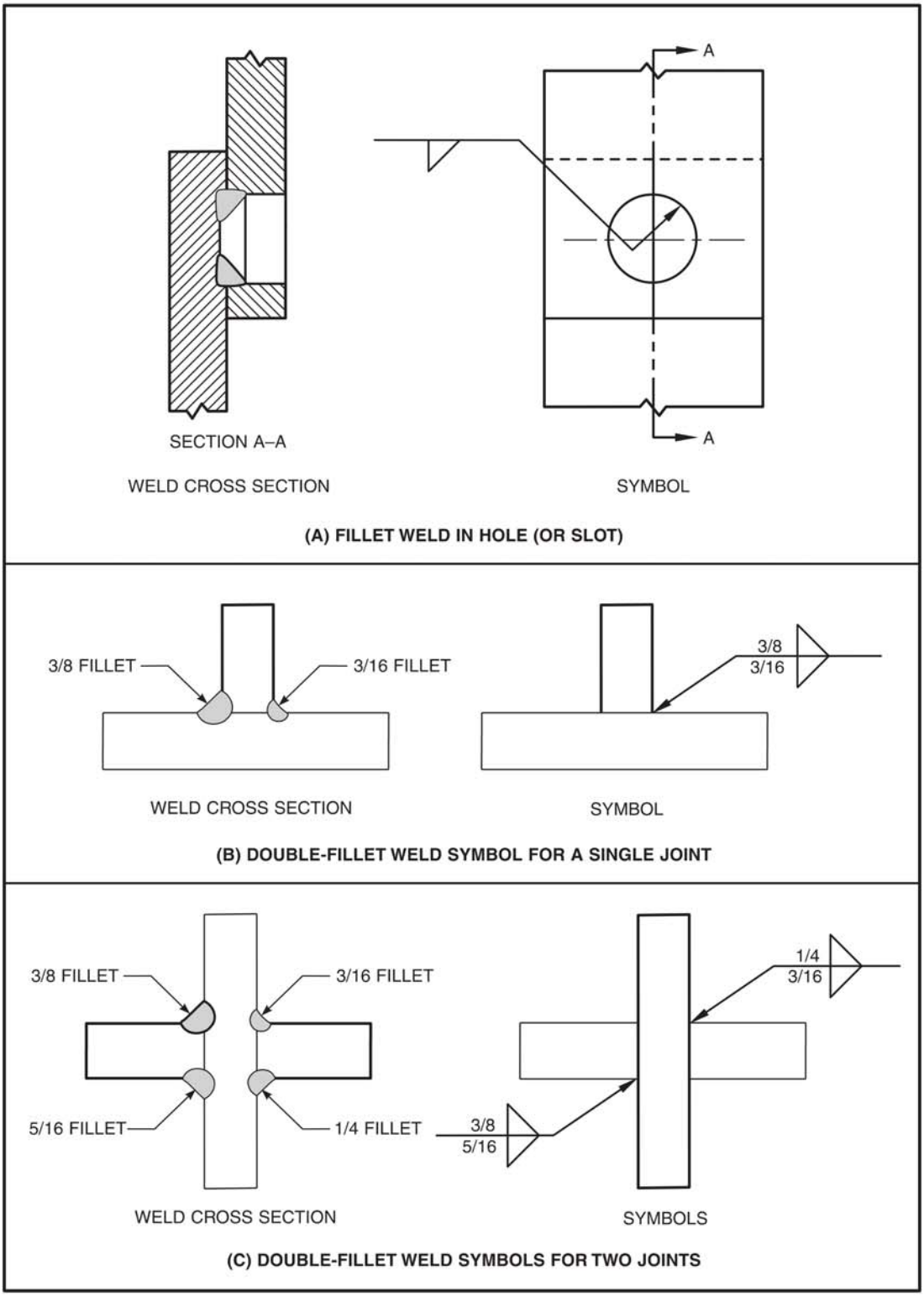
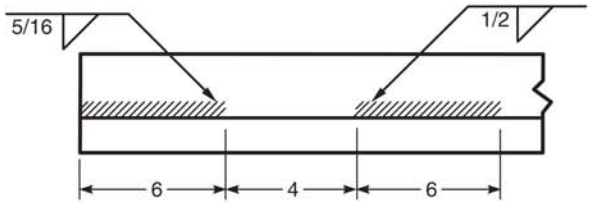


Figure 8.3—Application of the Fillet Weld Symbol

8.3.1.1 Full Length. When a fillet weld extends for the full length of the joint between abrupt changes of direction, no length dimension need be specified to the right of the weld symbol [see Figure 8.1(E)].

8.3.1.2 Specific Lengths. Specific fillet weld lengths, and their locations, may be specified by symbols in conjunction with dimension lines [see Figures 6.6(C) and 8.1(F)].

8.3.1.3 Hatching. Hatching may be used to graphically depict fillet welds.



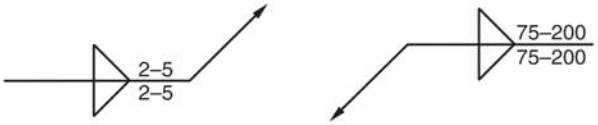
8.3.2 Changes in Direction of Welding. Symbols for fillet welds involving abrupt changes in the direction of welding shall be in accordance with 6.10.2 [see Figure 6.4(A)].

8.4 Intermittent Fillet Welds

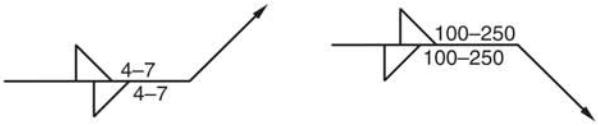
8.4.1 Pitch. The pitch of intermittent fillet welds shall be the distance between the centers of adjacent weld segments on one side of the joint [see Figure 8.2(A)].

8.4.2 Pitch Dimension Location. The pitch of intermittent fillet welds shall be specified to the right of the length dimension following a hyphen (see Figure 8.2).

8.4.3 Chain Intermittent Fillet Welds. Dimensions of chain intermittent fillet welds shall be specified on both sides of the reference line. The segments of chain intermittent fillet welds shall be opposite one another across the joint [see Figure 8.2(B)].



8.4.4 Staggered Intermittent Fillet Welds. The dimensions of staggered intermittent fillet welds shall be specified on both sides of the reference line, and the fillet weld symbols shall be offset on opposite sides of the reference line. The segments of staggered intermittent fillet welds shall be symmetrically spaced on both sides of the joint [see Figure 8.2(C)].

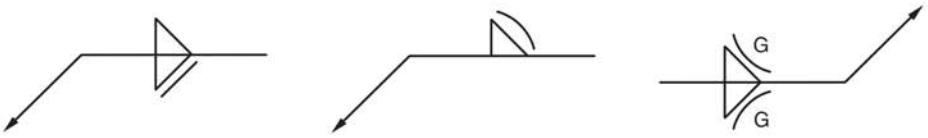


8.4.5 Extent of Welding. In the case of intermittent fillet welds, unless otherwise specified, the unwelded lengths at the ends of the joint shall not exceed the unwelded distance between weld segments. Additional weld lengths intended at the ends of the joint shall be specified by separate welding symbols and dimensioned on the drawing [see Figure 8.2(D)]. When specific unwelded lengths are intended at the ends of the joint, the unwelded lengths shall be dimensioned on the drawing [see Figure 8.2(E)].

8.4.6 Location of Intermittent Welds. When the location of intermittent welds is not obvious, such as on a circular weld joint, it may be necessary to provide specific segment locations by dimension lines (see 8.3.1.2) or by hatching (see 8.3.1.3).

8.5 Fillet Welds in Holes and Slots. Fillet welds in holes and slots shall be specified by the use of fillet weld symbols [see Figure 8.3(A)].

8.6 Fillet Weld Contour and Finish. Fillet welds to be contoured flat, convex, or concave shall be in accordance with 6.13.



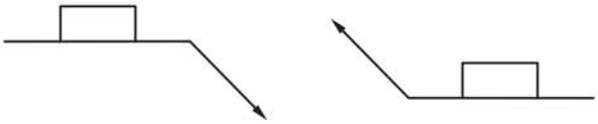
8.7 Skewed Joints. When the angle between the fusion faces is such that the identification of the weld type and proper weld symbol are in question, the detail of the desired joint, weld configuration, and dimensions shall be shown on the drawing (see 7.13 and Figure 7.20).

9. Plug Welds

9.1 General

9.1.1 Arrow-Side Holes. Holes in the arrow-side member of a joint to be plug welded shall be specified by placing the plug weld symbol below the reference line [see Figure 9.1(A)].

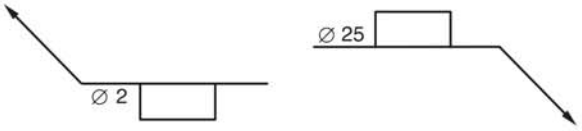
9.1.2 Other-Side Holes. Holes in the other-side member of a joint to be plug welded shall be specified by placing the plug weld symbol above the reference line [see Figure 9.1(B)].



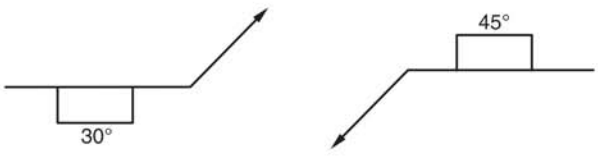
9.1.3 Dimensions. Plug weld dimensions shall be specified on the same side of the reference line as the weld symbol (see Figure 9.2).

9.1.4 Fillet Welds in Holes. The plug weld symbol shall not be used to designate fillet welds in holes (see 8.5).

9.2 Plug Weld Size. The plug weld size shall be specified to the left of the plug weld symbol and shall be preceded by the diameter symbol, Ø, shown (see Figure 9.2). Plug weld size is the diameter of the hole at the faying surface.



9.3 Countersink Angle. When a countersink angle is required in a joint, the angle dimension shall be specified on the same side of the reference line as the weld symbol. The included countersink angle of plug welds shall be specified above or below the plug weld symbol as appropriate [see Figure 9.2(B) and (E)].



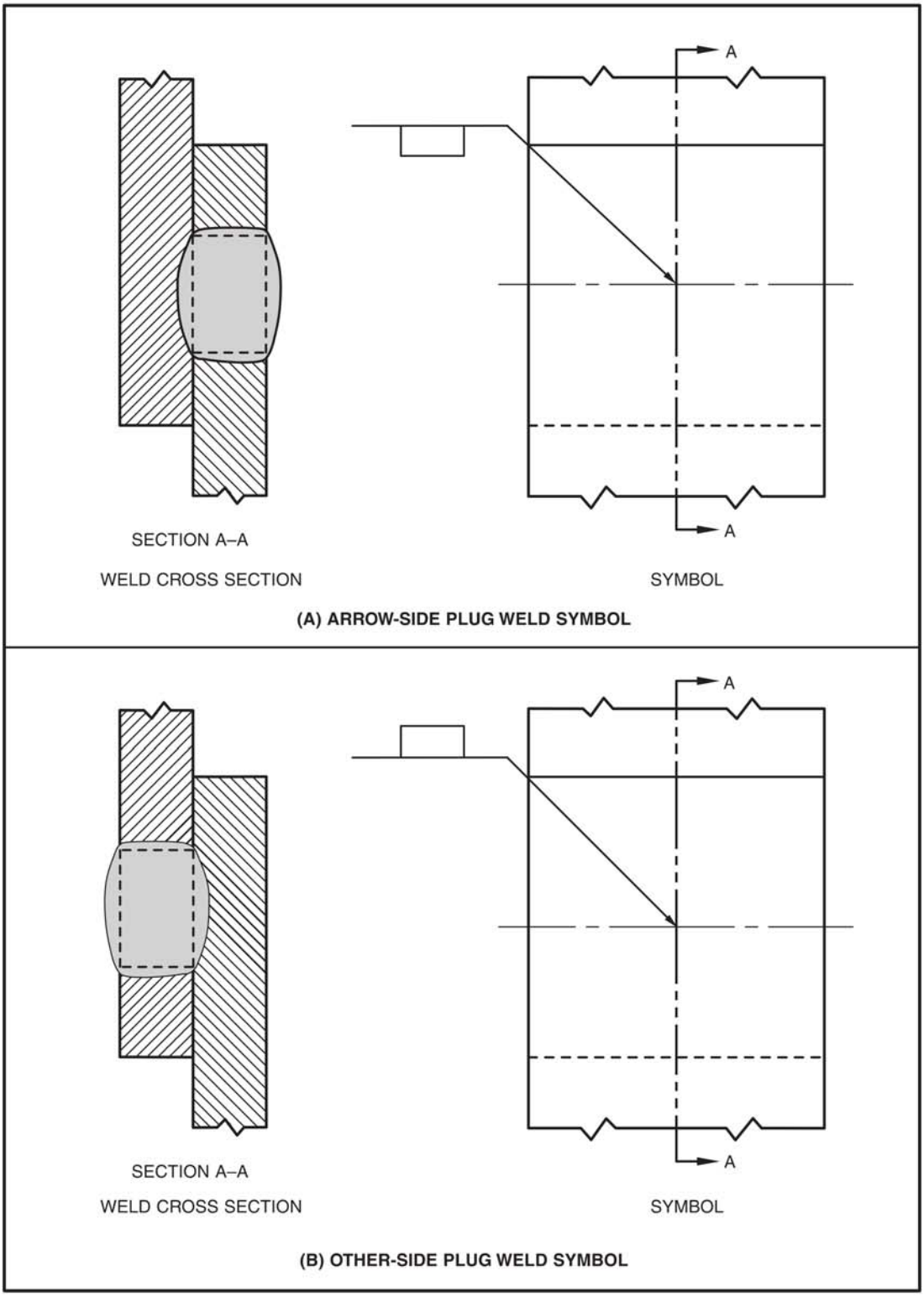


Figure 9.1—Application of the Plug Weld Slot

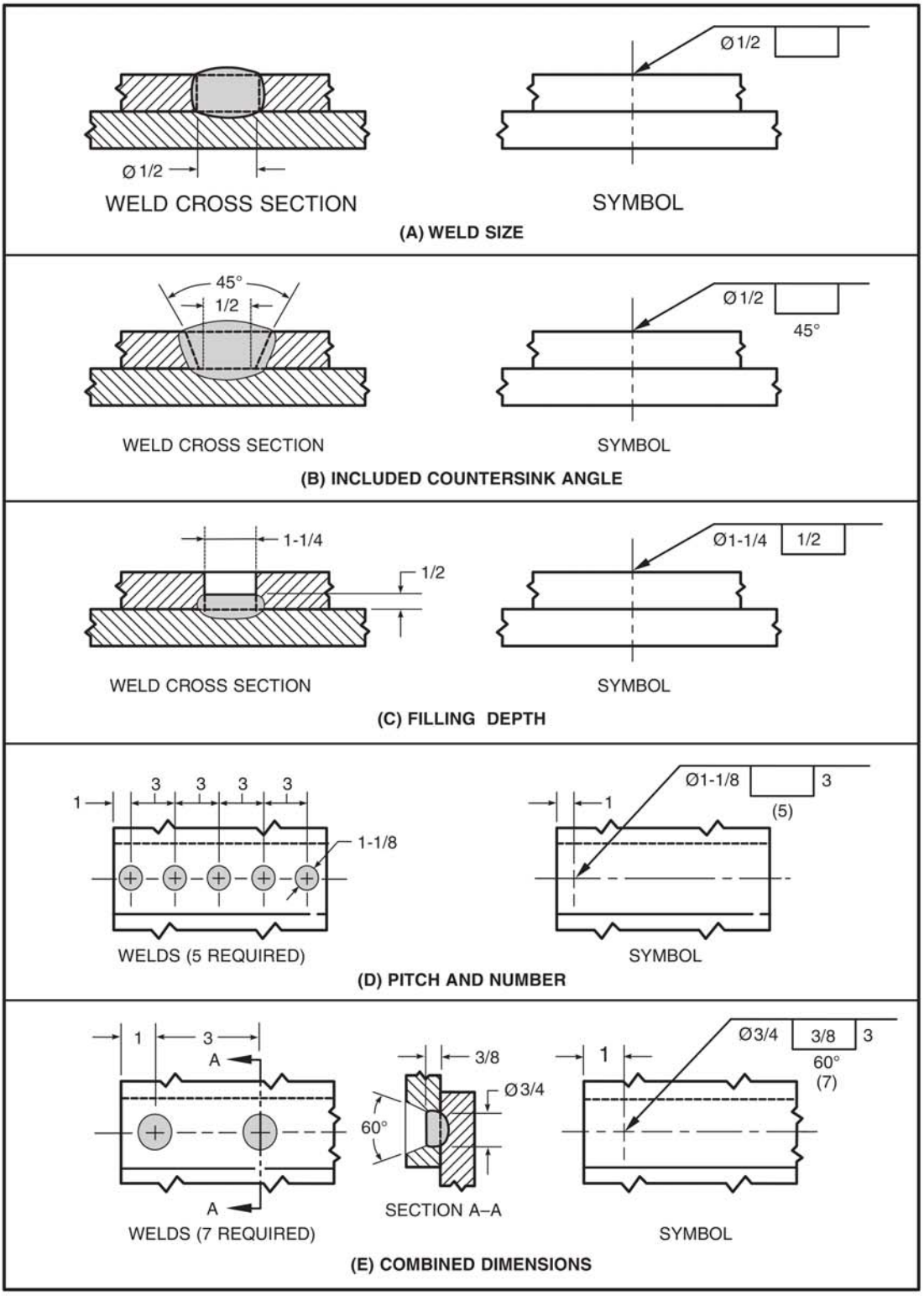


Figure 9.2—Application of Information to the Plug Weld Symbols

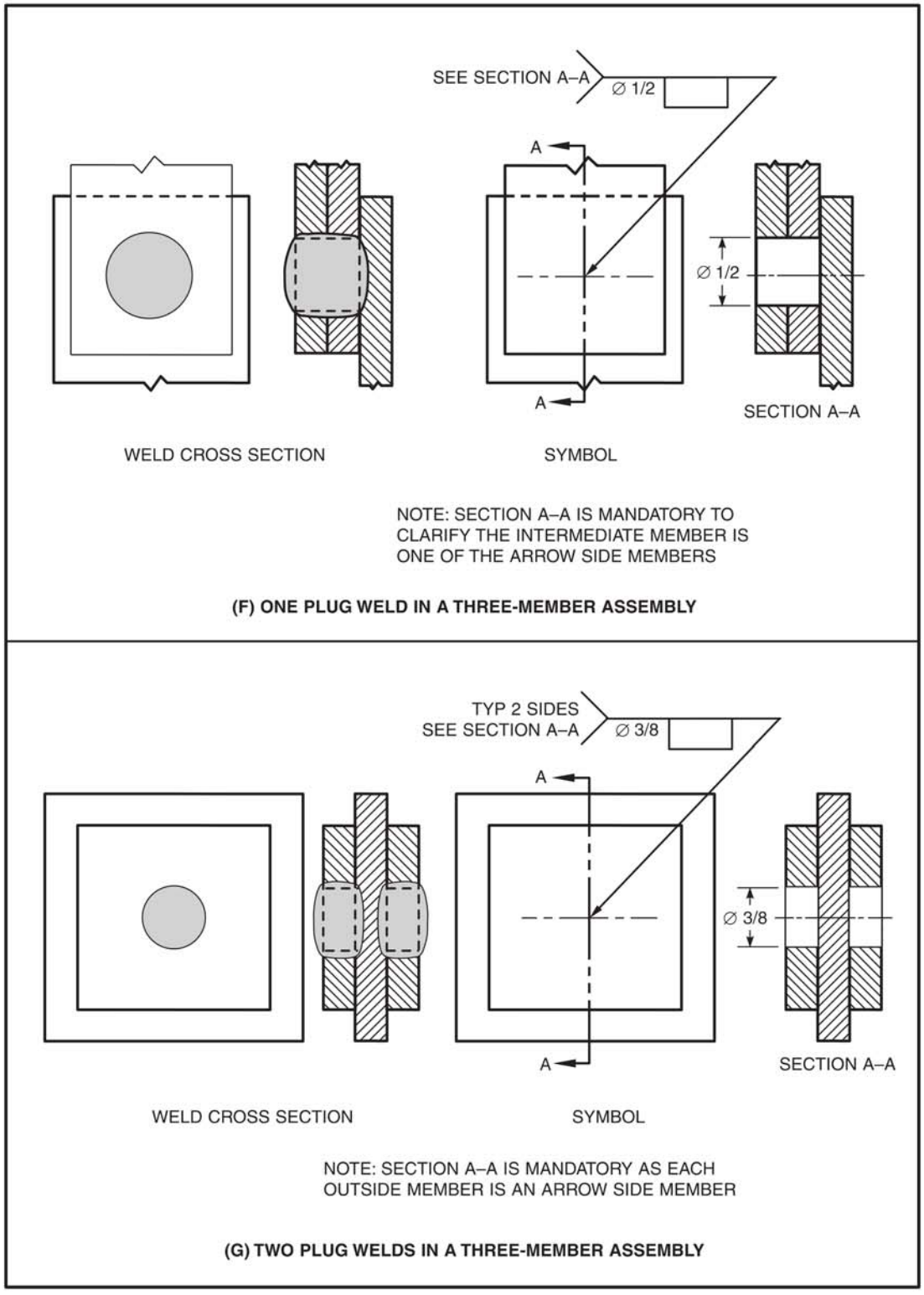
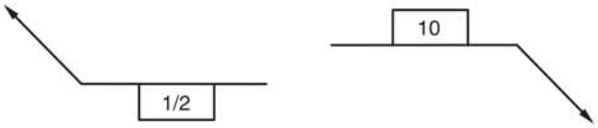
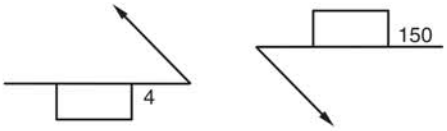


Figure 9.2 (Continued)—Application of Information to the Plug Weld Symbols

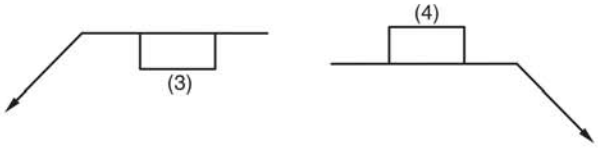
9.4 Depth of Filling. When the depth of filling is less than complete, it shall be specified inside the plug weld symbol [see Figure 9.2(C) and (E)]. The omission of a depth dimension shall specify complete filling [see Figure 9.2(A), (B), (D), (F), and (G)].



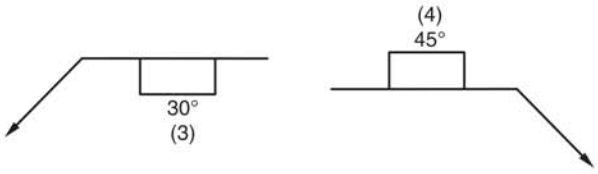
9.5 Plug Weld Spacing. The plug weld pitch (center-to-center distance) in a straight line shall be specified to the right of the plug weld symbol [see Figure 9.2(D) and (E)]. Plug weld spacing in any configuration other than a straight line shall be dimensioned on the drawing.



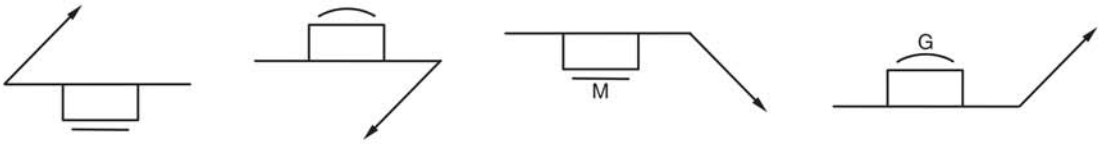
9.6 Number of Plug Welds. When a definite number of plug welds is desired in a joint, the number shall be specified in parentheses on the same side of the reference line as the weld symbol. The number shall be either above or below the weld symbol, as appropriate [see Figure 9.2(D)].



When the welding symbol also includes the countersink angle, the number of plug welds shall be placed either above (for other side) or below (for arrow side) the countersink angle, as appropriate [see Figure 9.2(E)].



9.7 Plug Weld Contour and Finish. Plug welds to be contoured flush or convex shall be in accordance with 6.13.



9.8 Joints Involving Three or More Members. Plug welding symbols may be used to specify the welding of two or more members to another member. A section view of the joint shall be provided to clarify which members require penetration [see Figure 9.2(F) and (G)].

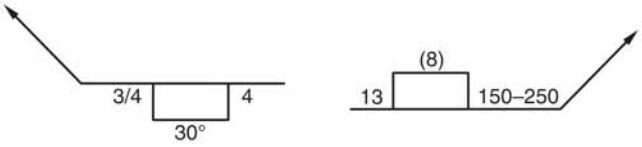
10. Slot Welds

10.1 General

10.1.1 Arrow-Side Slots. Slots in the arrow-side member of a joint to be slot welded shall be specified by placing the slot weld symbol below the reference line [see Figure 10.1(A)].

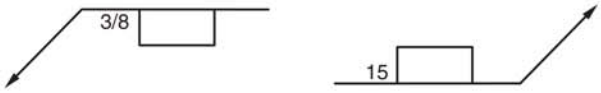
10.1.2 Other-Side Slots. The slots in the other-side member of a joint to be slot welded shall be specified by placing the slot weld symbol above the reference line [see Figure 10.1(B)].

10.1.3 Dimensions. Slot weld dimensions shall be specified on the same side of the reference line as the weld symbol (see Figure 10.2).

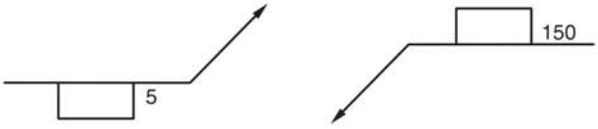


10.1.4 Fillet Welds in Slots. The slot weld symbol shall not be used to specify fillet welds in slots (see 8.5).

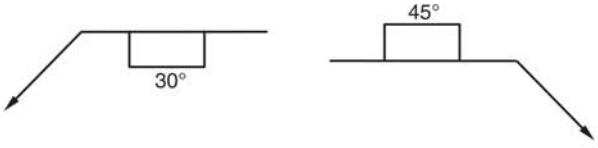
10.2 Slot Weld Width. The width of a slot weld shall be specified to the left of the weld symbol (see Figure 10.2). The slot weld width is the dimension of the slot, measured in the direction of the minor axis at the faying surface.



10.3 Slot Weld Length. Slot weld length shall be specified to the right of the weld symbol (see Figure 10.2). Slot weld length is the dimension of the slot, measured in the direction of the major axis at the faying surface.



10.4 Countersink Angle. When a countersink angle is required in a joint, the angle dimension shall be specified on the same side of the reference line as the weld symbol. The countersink included angle of slot welds shall be specified either above or below the slot weld symbol, as appropriate [see Figure 10.2(A)].



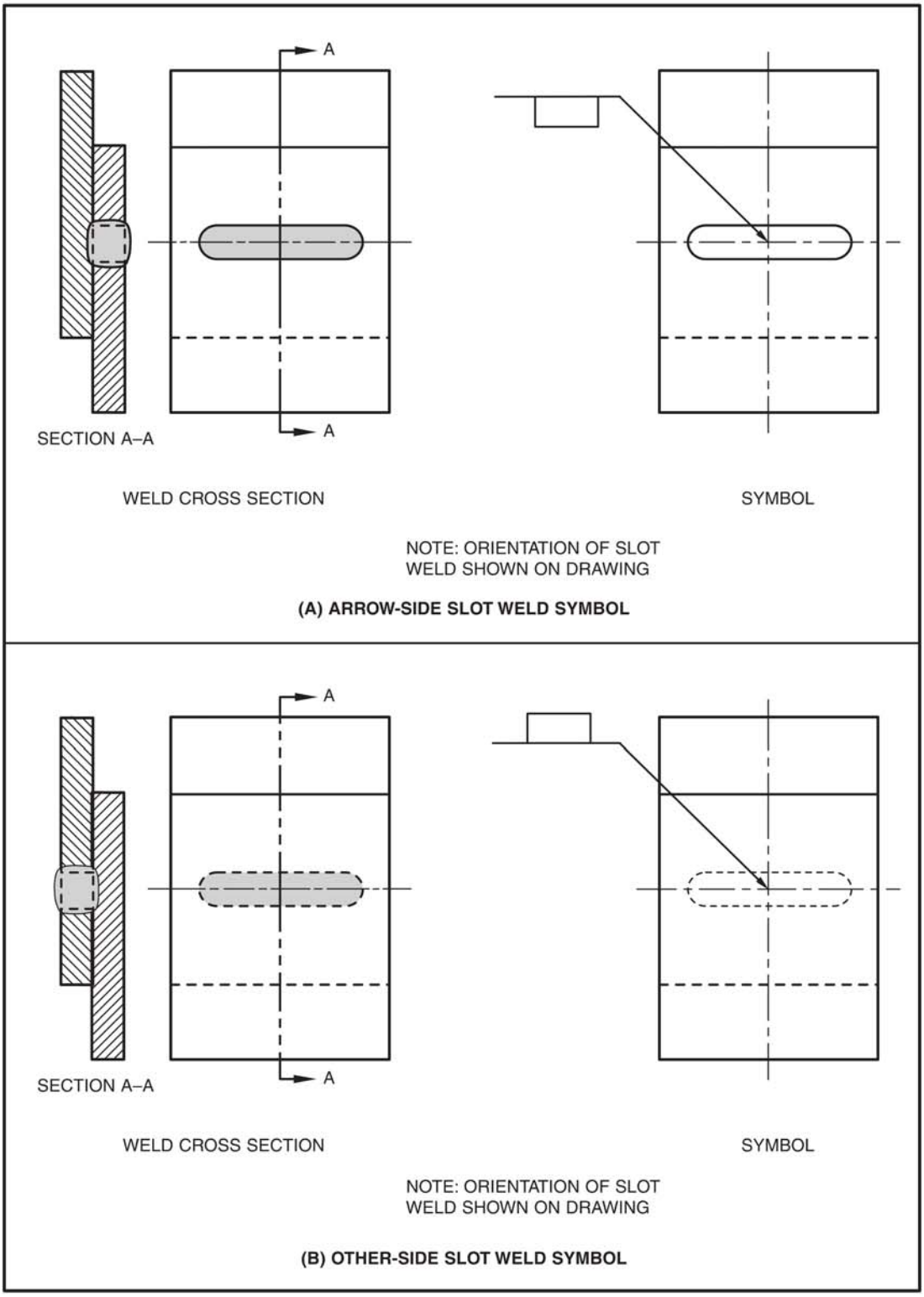


Figure 10.1—Application of the Slot Weld Symbol

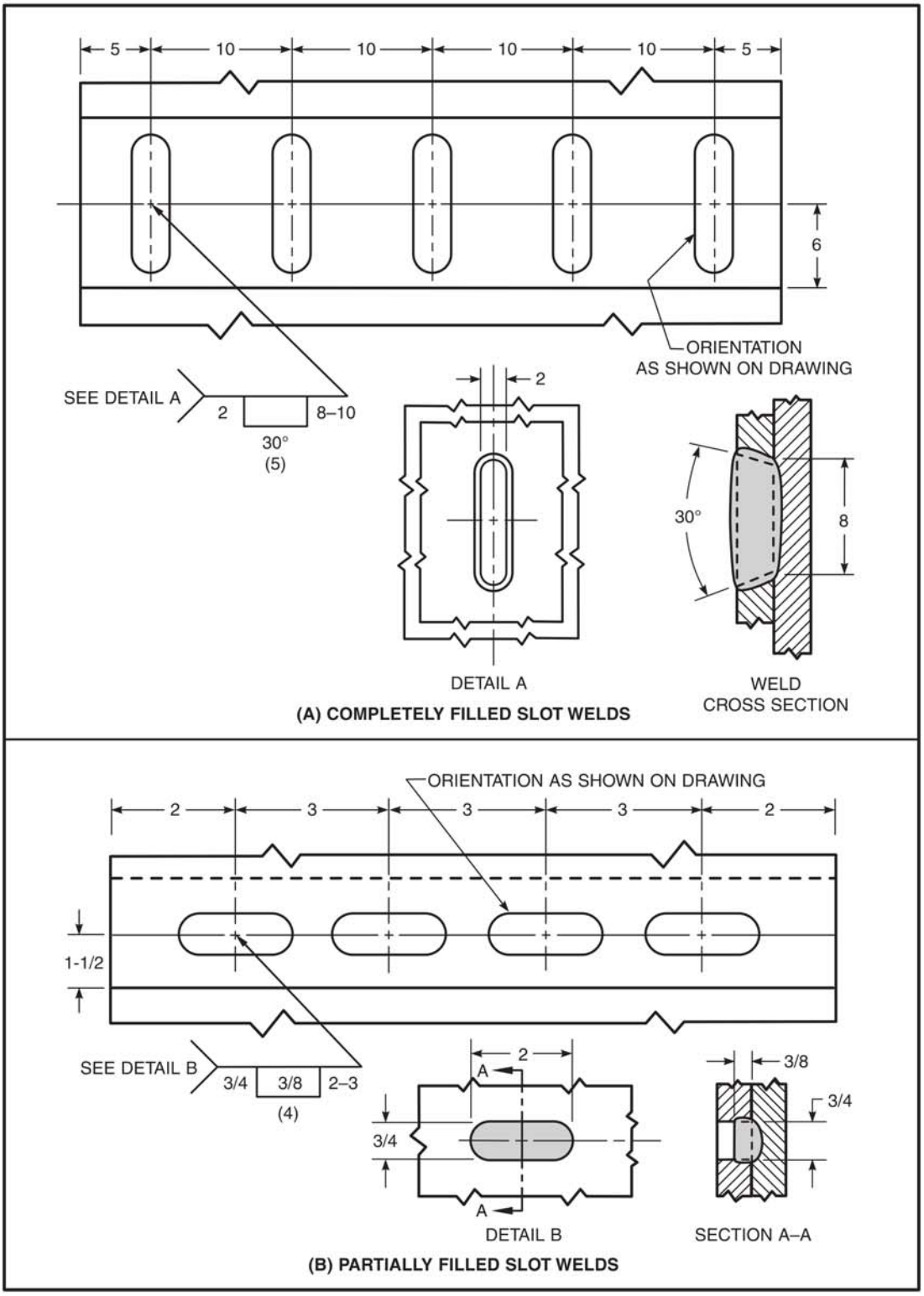


Figure 10.2—Application of Information to the Slot Weld Symbols

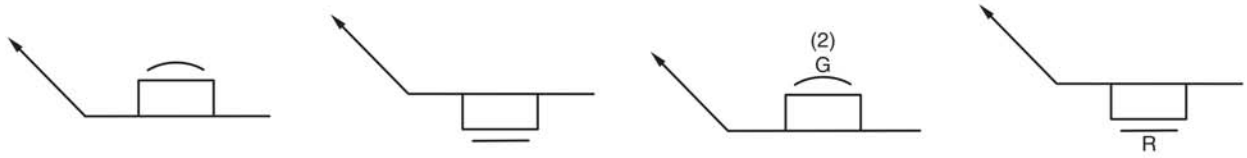
10.5 Depth of Filling. A depth of filling less than complete shall be specified inside the slot weld symbol [see Figure 10.2(B)]. The omission of the depth dimension shall specify complete filling [see Figure 10.2(A)].

10.6 Slot Weld Spacing. The slot weld pitch (center-to-center distance) in a straight line shall be specified to the right of the length dimension following a hyphen (see Figure 10.2).

10.7 Number of Slot Welds. When a definite number of slot welds is desired in a joint, the number shall be specified in parentheses on the same side of the reference line as the weld symbol. The number shall be either above or below the weld symbol, as appropriate (see Figure 10.2). When the countersink angle is also included in the welding symbol, the number of slot welds shall be placed above (for other side) or below (for arrow side) the countersink angle, as appropriate [see Figure 10.2(A)].

10.8 Slot Weld Location and Orientation. The slot weld location and orientation shall be specified on the drawing.

10.9 Slot Weld Contour and Finish. Slot welds to be contoured flush or convex shall be in accordance with 6.13.



11. Spot Welds

11.1 General

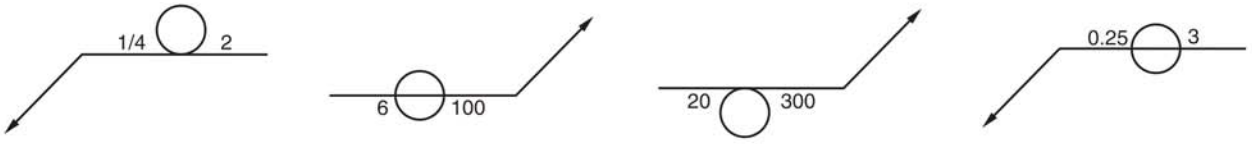
11.1.1 Arrow-Side or Other-Side Significance. The spot weld symbol, relative to its location on the reference line, may or may not have arrow-side member or other-side member significance (see 6.1.2, 6.1.3, and Figure 11.1).

11.1.1.1 Arrow-Side Member. For those welding processes in which arrow-side member significance is applicable, the arrow-side member shall be indicated by placing the spot weld symbol below the reference line with the arrow pointing to this member [see Figure 11.1(A)].

11.1.1.2 Other-Side Member. For those welding processes in which other-side member significance is applicable, the other-side member shall be indicated by placing the spot weld symbol above the reference line [see Figure 11.1(B)].

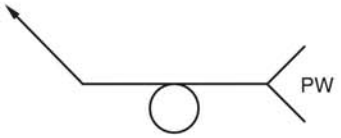
11.1.1.3 No Side Significance. For those welding processes in which no arrow-side or other-side significance is applicable, the spot weld symbol shall be centered on the reference line [see 6.1.3 and Figure 11.1(C)].

11.1.2 Dimension Location. Dimensions shall be specified on the same side of the reference line as the spot weld symbol, or all dimensions shall be shown on either side when the spot weld symbol has no arrow-side or other-side significance (see Figures 11.1 and 11.2).



11.1.3 Welding Process Reference. The process reference shall be indicated in the tail of the welding symbol (see 6.12.1 and Figures 11.1 and 11.2).

11.1.4 Projection Welds. The projection weld symbol is the same as the spot weld symbol but requires the projection welding process be referenced in the tail of the welding symbol. The weld symbol shall be placed above, below, or on the reference line to designate which member carries the projection or embossment in accordance with the location conventions given in 6.1.2 (see Figure 11.3).



11.2 Spot Weld Size or Strength. Spot welds may be specified by either size (weld diameter) or strength.

11.2.1 Size. Spot welds may be specified by size (weld diameter) to the left of the spot weld symbol [see Figure 11.2(A)].

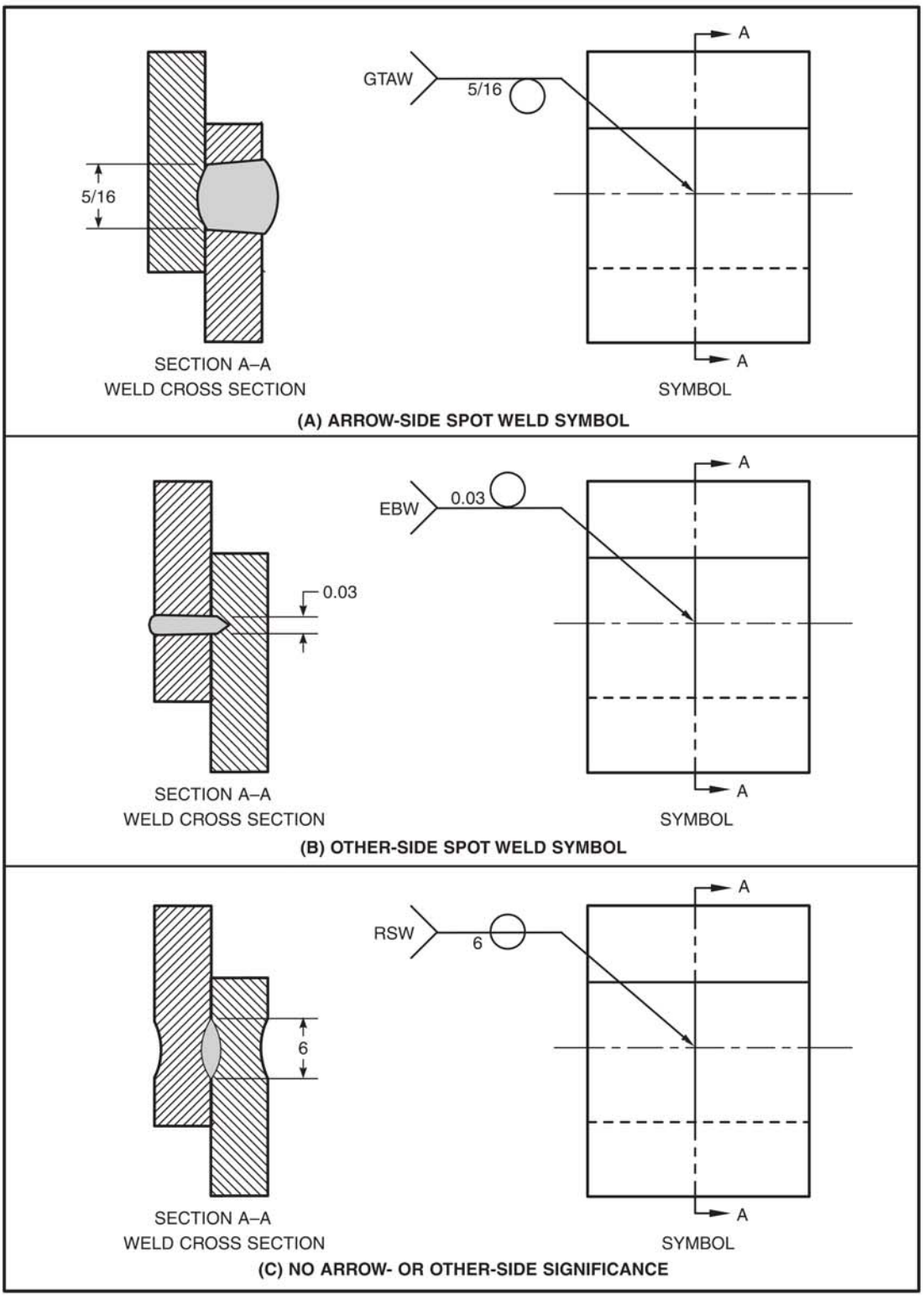


Figure 11.1—Application of the Spot Weld Symbol

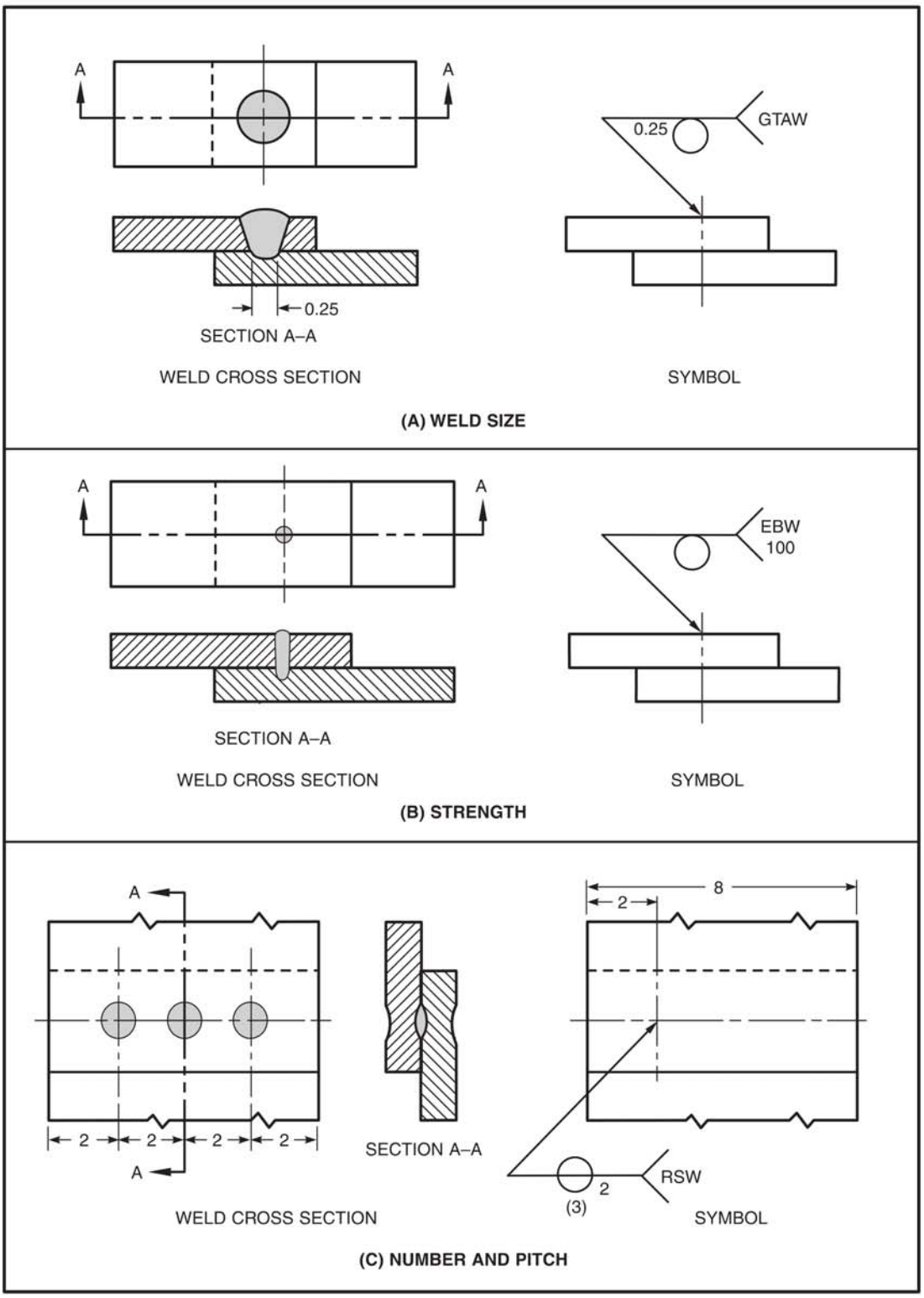


Figure 11.2—Application of Information to the Spot Weld Symbol

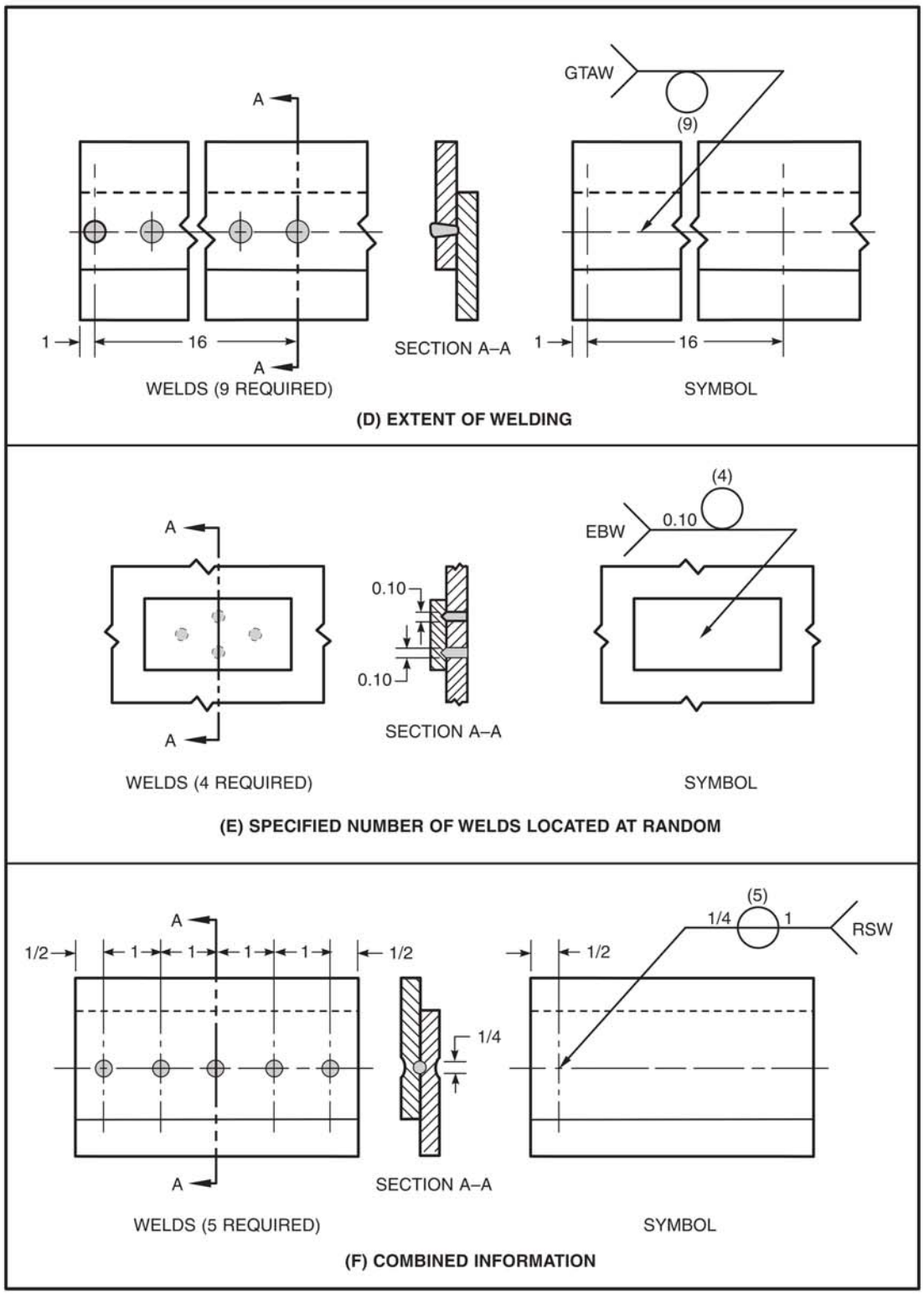


Figure 11.2 (Continued)—Application of Information to the Spot Weld Symbol

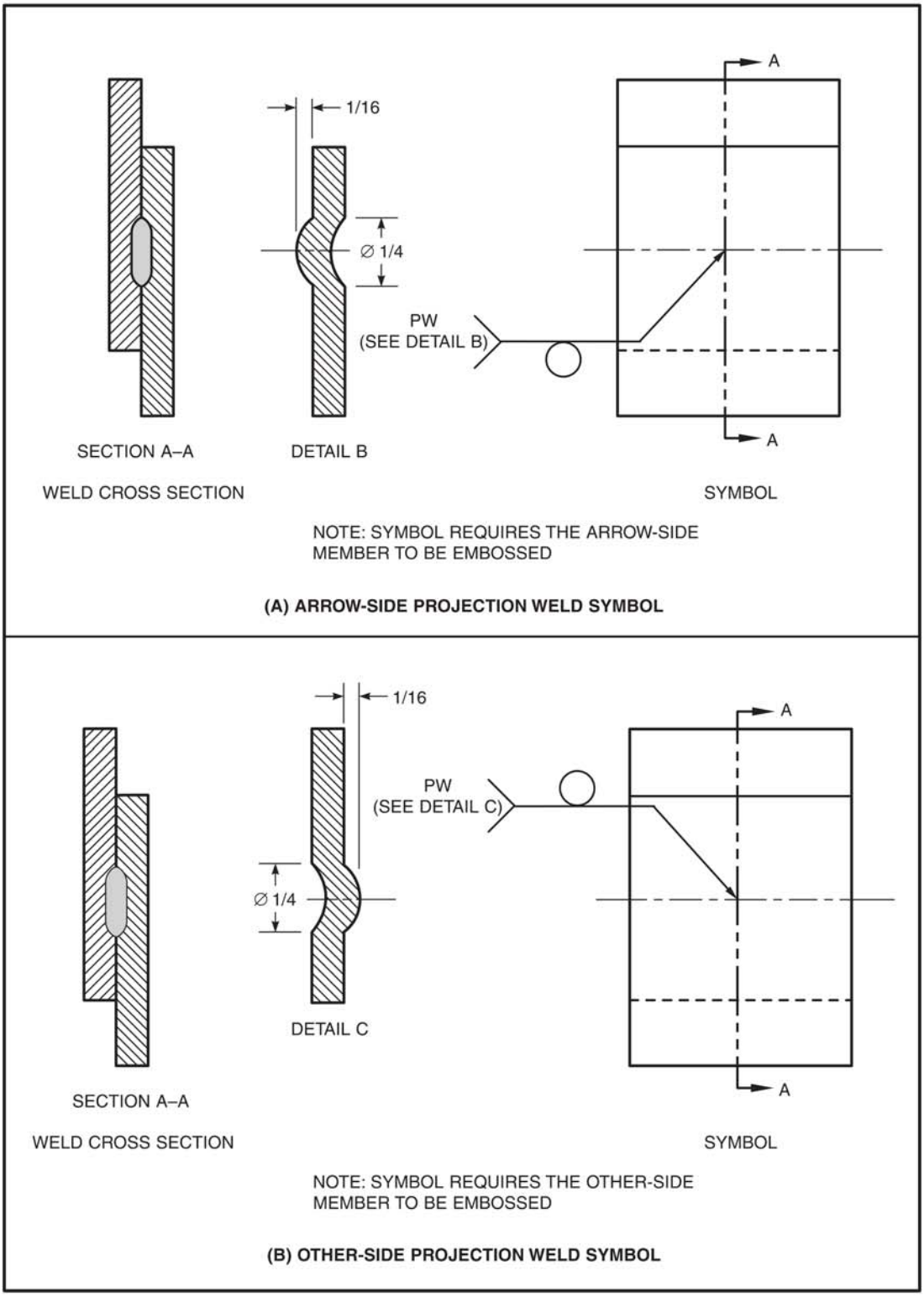
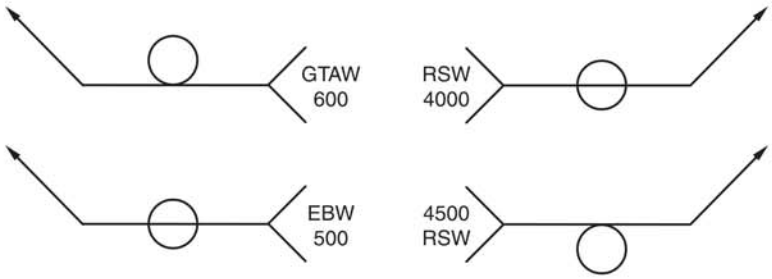


Figure 11.3—Application of the Projection Weld Symbol

11.2.2 Strength. Spot welds may be specified by strength (force) as a note in the tail of the symbol [see Figure 11.2(B)].

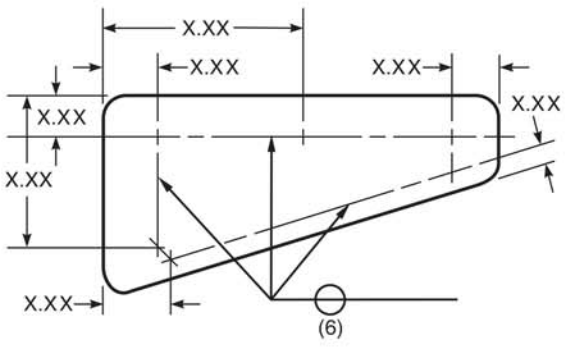


11.3 Spot Weld Spacing. The spot weld pitch (center-to-center distance) in a straight line shall be specified to the right of the weld symbol [see Figure 11.2(C)].

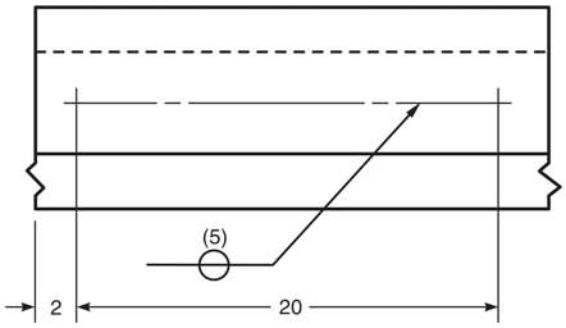
11.4 Number of Spot Welds

11.4.1 Number Specified. When a definite number of spot welds is desired in a joint, the number shall be specified in parentheses on the same side of the reference line as the spot weld symbol. The number may be designated either above or below the weld symbol when there is no arrow- or other-side significance and the symbol is centered on the reference line [see Figure 11.2(C), (D), (E), and (F)].

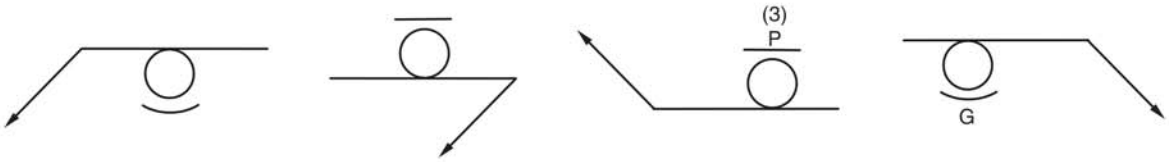
11.4.2 Grouped Spot Welds. A group of spot welds may be located on a drawing by intersecting centerlines. The arrow shall point to at least one of the centerlines passing through each weld location. When spot welds are to be randomly located in a group, the area in which they are to be applied shall be clearly indicated [see Figure 11.2(E)].



11.5 Extent of Spot Welding. When spot welds extend less than the distance between abrupt changes in the direction of welding, or less than the full length of the joint (see 6.10), the desired extent shall be dimensioned on the drawing [see Figure 11.2(D)].



11.6 Spot Weld Contour and Finish. Spot welds to be contoured flush or convex shall be in accordance with 6.13.



11.7 Multiple-Member Spot Welds. When one or more members are included between the two outer members in a spot welded joint, the spot weld symbol for the two outer members shall be used (see Figure 11.4).

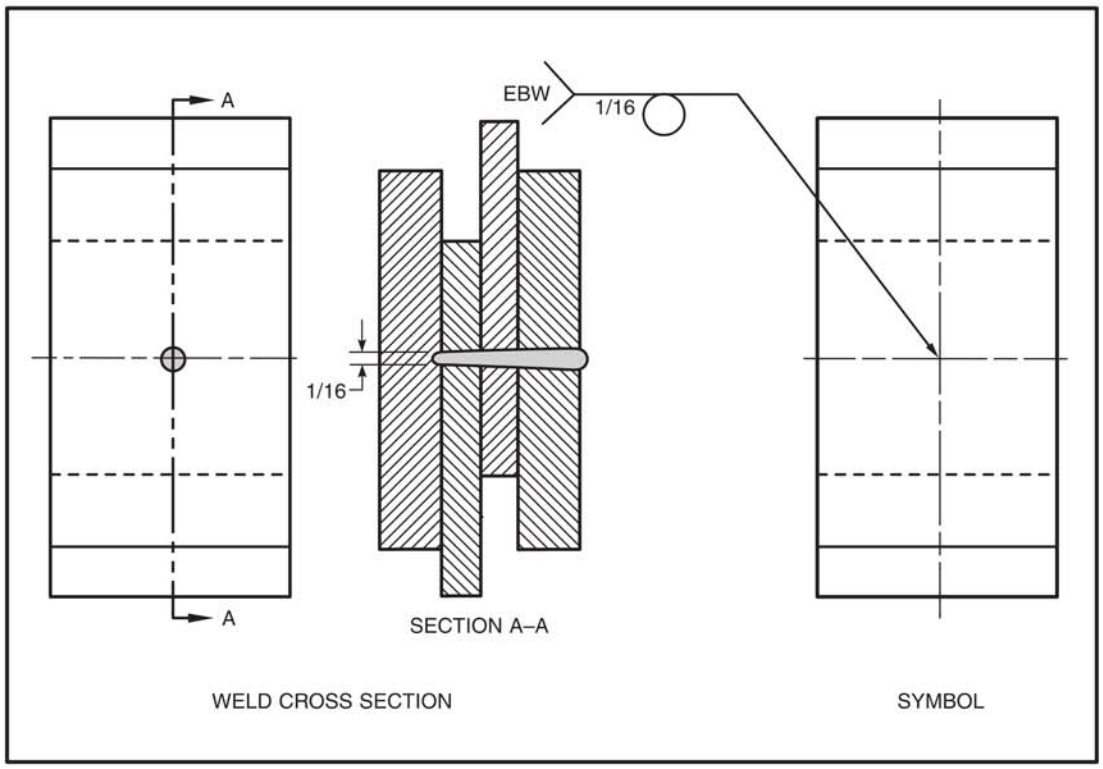


Figure 11.4—Application of Multiple-Member Spot Weld

12. Seam Welds

12.1 General

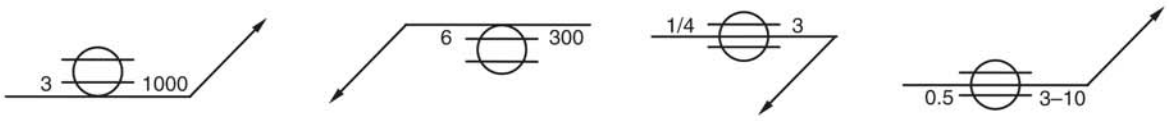
12.1.1 Arrow-Side, Other-Side Significance. The seam weld symbol, relative to its location on the reference line, may or may not have arrow-side member or other-side member significance (see 6.1.2, 6.1.3, and Figure 12.1).

12.1.1.1 Arrow-Side Member. For those welding processes in which arrow-side member significance is applicable, the arrow-side member shall be indicated by placing the seam weld symbol below the reference line with the arrow pointing to this member [see Figure 12.1(A)].

12.1.1.2 Other-Side Member. For those welding processes in which other-side significance is applicable, the other-side member shall be indicated by placing the seam weld symbol above the reference line [see Figure 12.1(B)].

12.1.1.3 No Side Significance. For those welding processes in which no arrow-side or other-side significance is applicable, the seam weld symbol shall be centered on the reference line [see 6.1.3 and Figure 12.1(C)].

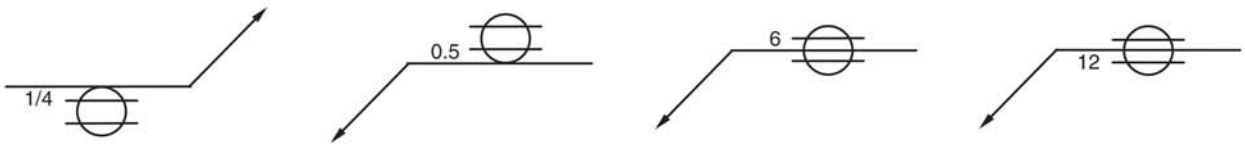
12.1.2 Dimension Location. Dimensions shall be shown on the same side of the reference line as the weld symbol, or all dimensions shall be shown on either side when the seam weld symbol has no arrow-side or other-side significance [see Figure 12.2(A) and (C)].



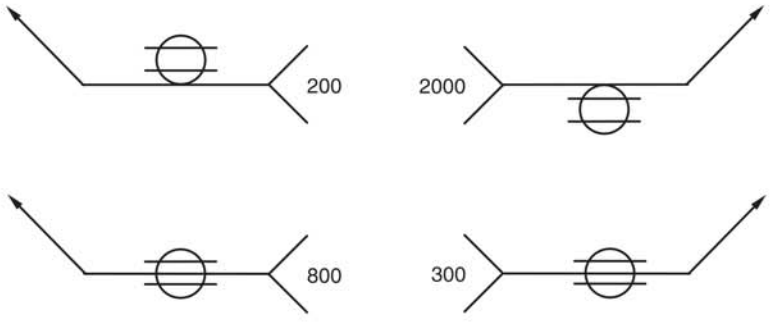
12.1.3 Welding Process Reference. The process reference shall be indicated in the tail of the welding symbol (see 6.12.1 and Figures 12.1 through 12.3).

12.2 Seam Weld Size or Strength. Seam welds may be specified by either size (weld width) or strength.

12.2.1 Size. Seam welds may be specified by size (weld width) to the left of the seam weld symbol [see Figure 12.2(A) and (C)].



12.2.2 Strength. Seam welds may be specified by strength (force) as a note in the tail of the symbol [see Figure 12.2(B)].



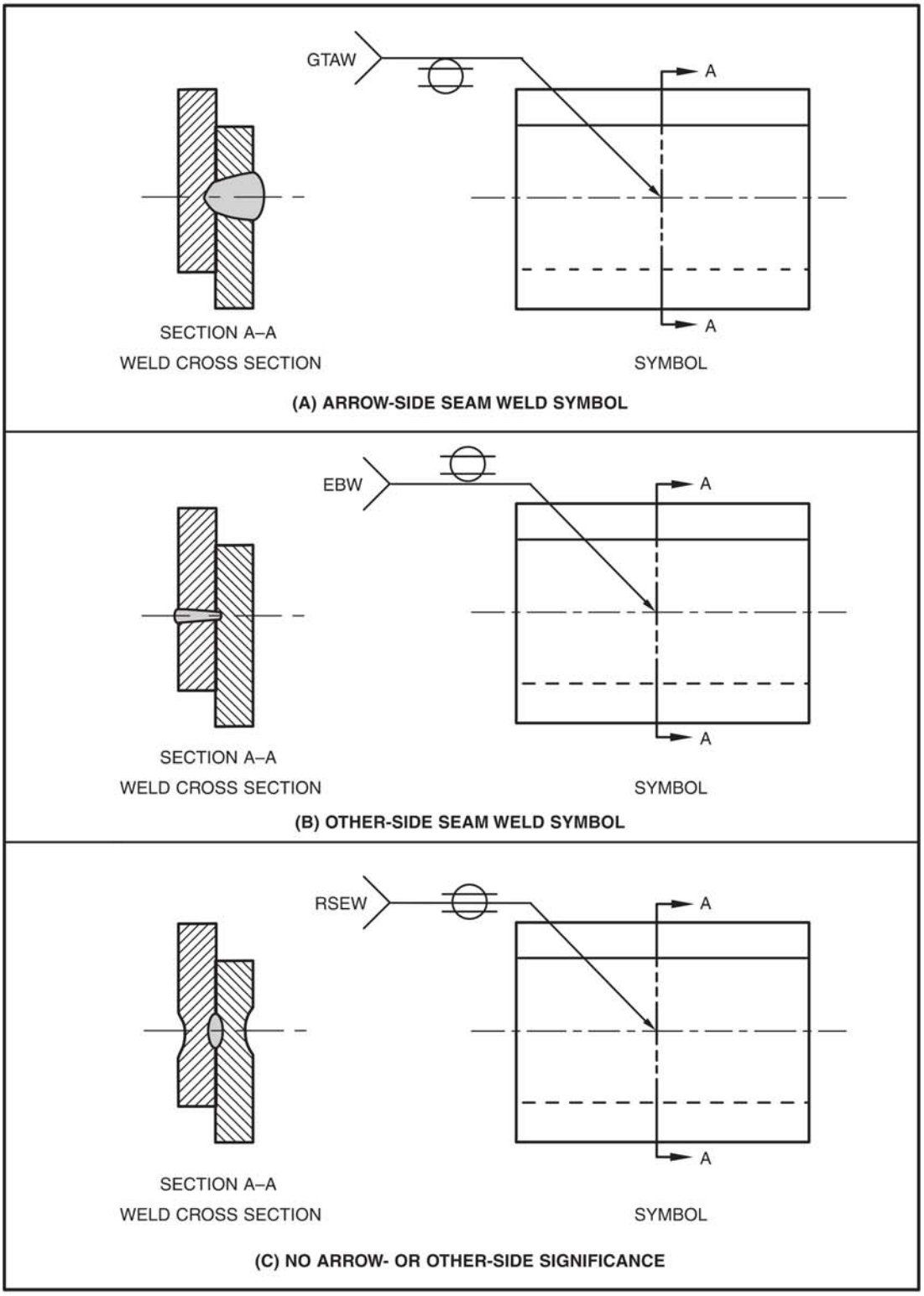


Figure 12.1—Application of the Seam Weld Symbol

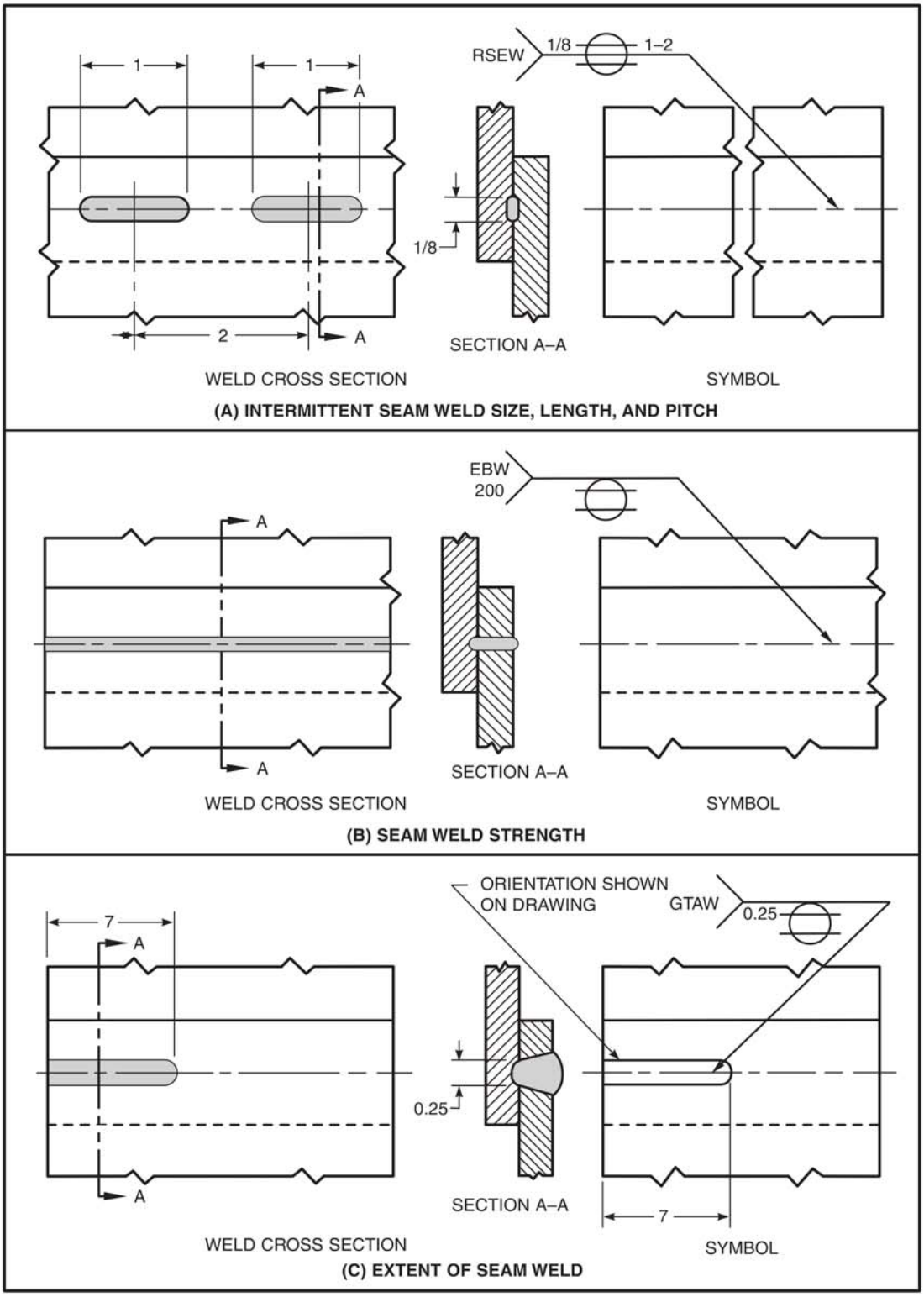


Figure 12.2—Application of Information to the Seam Weld Symbol

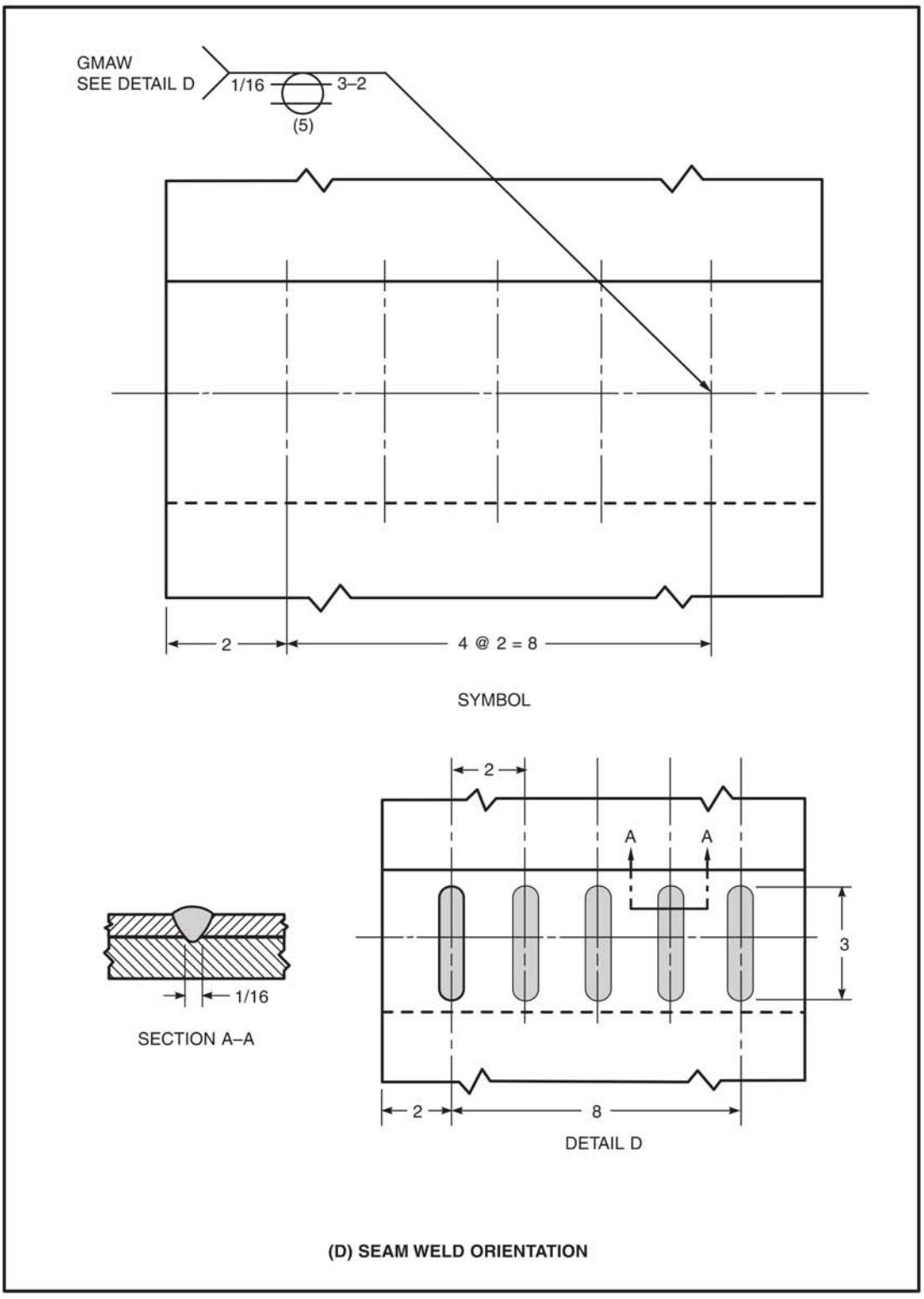


Figure 12.2 (Continued)—Application of Information to the Seam Weld Symbol

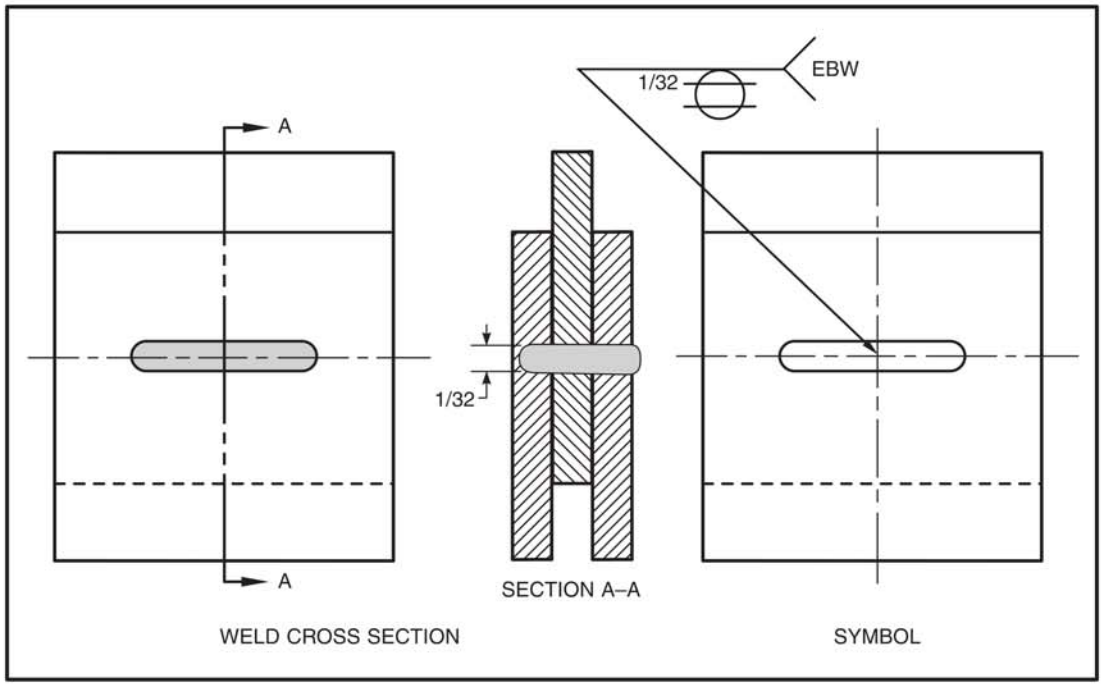


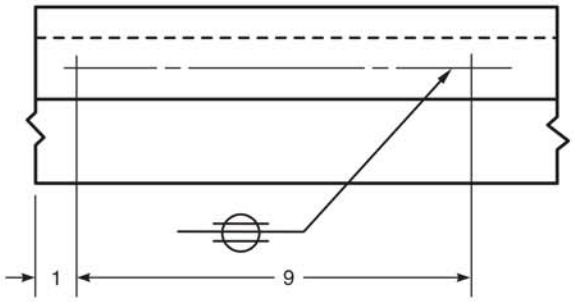
Figure 12.3—Application of Multiple-Member Seam Weld

12.3 Seam Weld Length

12.3.1 Dimension Location. The seam weld length shall be specified to the right of the weld symbol [see Figure 12.2(A) and (D)].

12.3.2 Abrupt Changes. When a seam weld extends the full distance between abrupt changes in the direction of welding (see 6.10), no length dimension need be specified on the welding symbol.

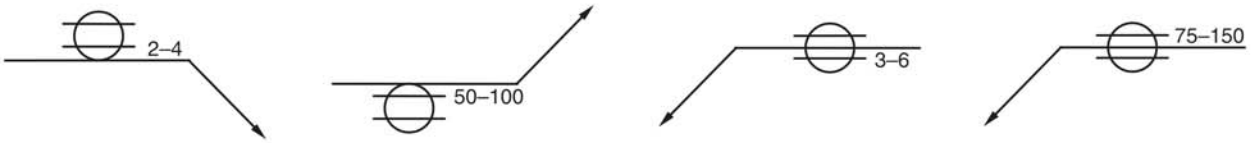
12.3.3 Specific Lengths. When a seam weld extends less than the distance between abrupt changes in the direction of welding or less than the full length of the joint, the extent shall be dimensioned on the drawing [see 6.10 and Figure 12.2(C)].



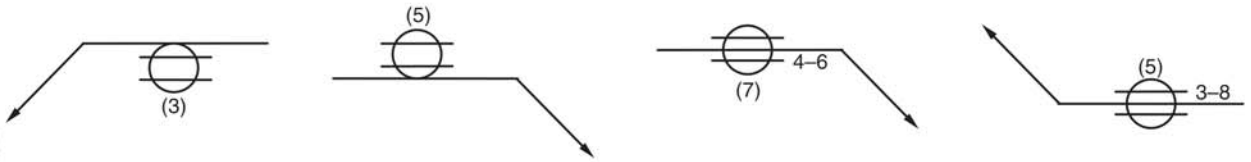
12.4 Dimensions of Intermittent Seam Welds

12.4.1 Pitch. The pitch of intermittent seam welds shall be specified as the distance between centers of the weld segments [see Figure 12.2(A) and (D)].

12.4.2 Pitch Dimension Location. The pitch of intermittent seam welds shall be specified to the right of the length dimension following a hyphen [see Figure 12.2(A) and (D)].



12.5 Number of Seam Welds. When a definite number of seam welds is desired in a joint, the number shall be specified in parentheses on the same side of the reference line as the weld symbol. The number shall be either above or below the weld symbol, as appropriate [see Figure 12.2(D)].

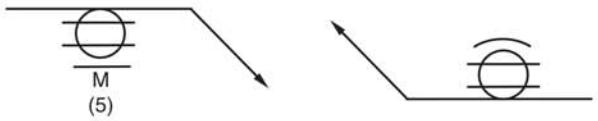


12.6 Seam Weld Orientation

12.6.1 Intermittent Welds. Unless otherwise indicated, intermittent seam welds shall be interpreted as having length and pitch measured parallel to the weld axis [see Figure 12.2(A)].

12.6.2 Showing Orientation. When the seam weld orientation is not as in 12.6.1, a detailed drawing shall be used to specify the weld orientation [see Figure 12.2(D)].

12.7 Seam Weld Contour and Finish. Seam welds to be contoured flush or convex shall be in accordance with 6.13.



12.8 Multiple-Member Seam Welds. When one or more members are included between the two outer members in a seam welded joint, the seam weld symbol for the two outer members shall be used (see Figure 12.3).

13. Edge Welds

13.1 General. The edge weld symbol is used to specify edge welds on parallel joints and flanged butt or flanged corner joints. The full thickness of the joining members shall be fused. Edge dimensions of the joining members are considered part of the drawing and are not specified by the welding symbol (see Figure 13.1).

13.2 Edge Weld Size. When specified, the edge weld size shall be indicated by a dimension placed to the left of the edge weld symbol and on the same side of the reference line [see Figure 13.1(A)]. If a specific edge weld size is not required, the dimension may be omitted [see Figure 13.1(B)].

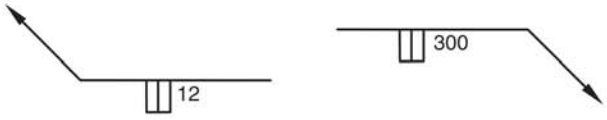
13.3 Single- and Double-Edge Welds. Single-edge welds may be specified on parallel, flanged butt, and flanged corner joints [see Figure 13.1(B), (C), and (D)]. Double-edge welds are only applicable to parallel joints [see Figure 13.1(A)]. An edge weld may be combined with a flare-V or flare-bevel groove weld if welds are required on both sides of a flanged butt or flanged corner joint [see 7.2.10 and Figure 13.1(J) and (K)].

13.4 Edge Welds Requiring Complete Joint Penetration. Edge welds requiring complete joint penetration shall be specified for either flanged butt or flanged corner joints by the edge weld symbol with the melt-through symbol placed on the opposite side of the reference line [see Figure 13.1(E), (F), and (I)]. No size specification for the edge weld is necessary when combined with the melt-through symbol.

13.5 Edge Welds on Joints with More Than Two Members. Edge welds can be specified for parallel joints, flanged butt joints, or flanged corner joints having more than two members by using the edge weld symbol in the same manner as for joints having two members [see Figure 13.1(G), (H), and (I)].

13.6 Edge Weld Length

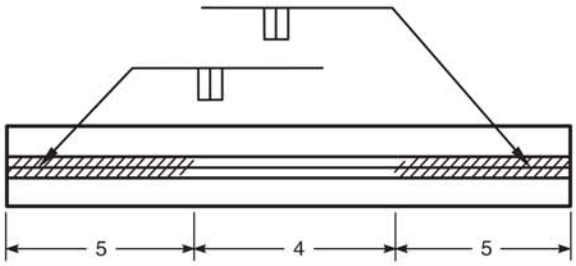
13.6.1 Location. The edge weld length, when indicated on the welding symbol, shall be specified to the right of the weld symbol [see Figure 13.2(A) and (C)].



13.6.1.1 Full Length. When an edge weld is to extend for the full length of the joint between abrupt changes of direction, no length dimension need be specified on the welding symbol [see Figure 13.2(B)].

13.6.1.2 Specific Lengths. Specific edge weld lengths and their locations may be specified by symbols in conjunction with dimension lines [see Figure 13.2(C)].

13.6.1.3 Hatching. Hatching may be used to graphically depict edge welds.



13.6.2 Changes in the Direction of Welding. Symbols for edge welds involving abrupt changes in direction of welding shall be in accordance with 6.10.2.

13.7 Intermittent Edge Welds

13.7.1 Pitch. The pitch of intermittent edge welds shall be the distance between the centers of adjacent weld segments on one side of the joint (see Figure 13.3).

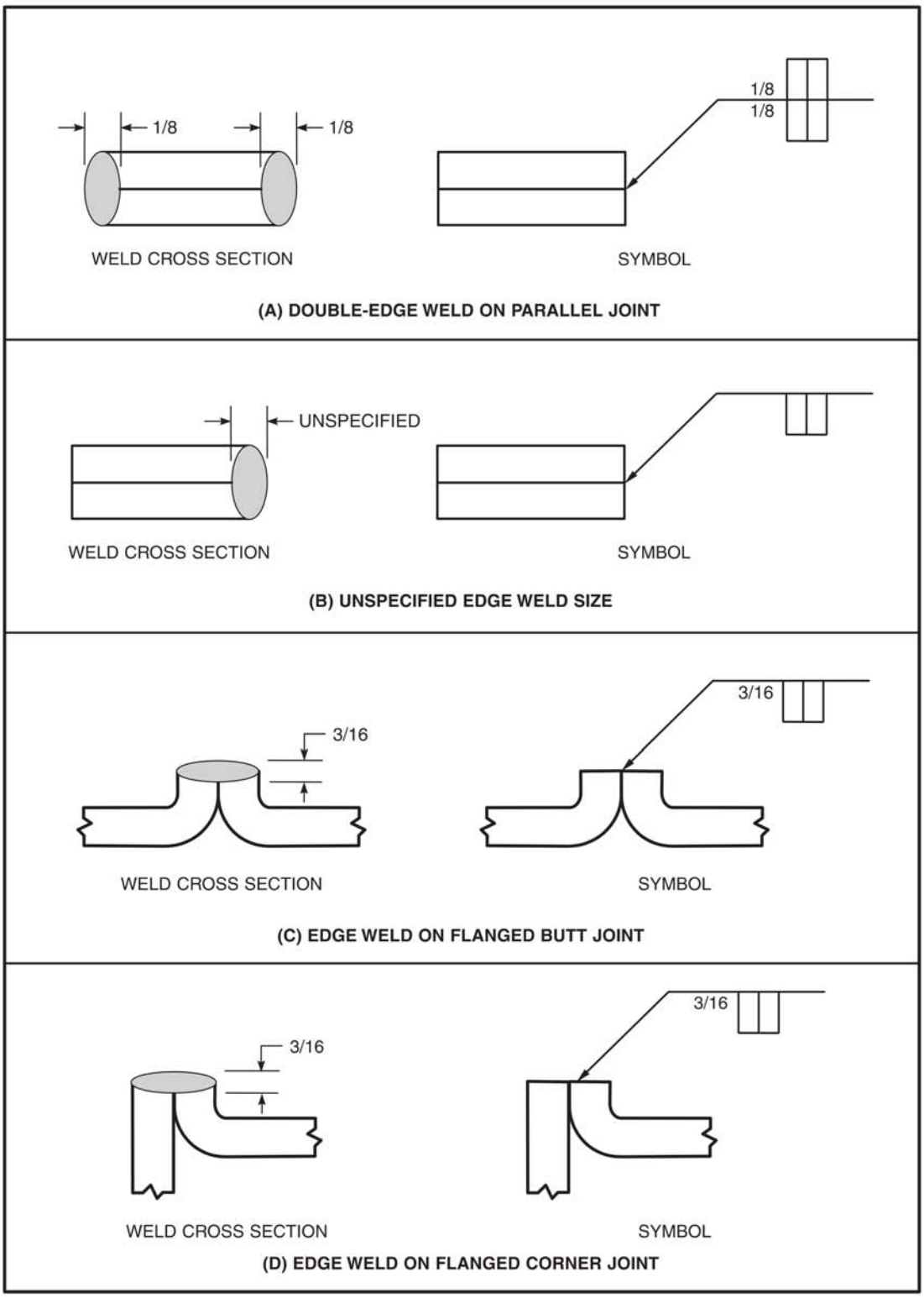


Figure 13.1—Application of the Edge Weld Symbol

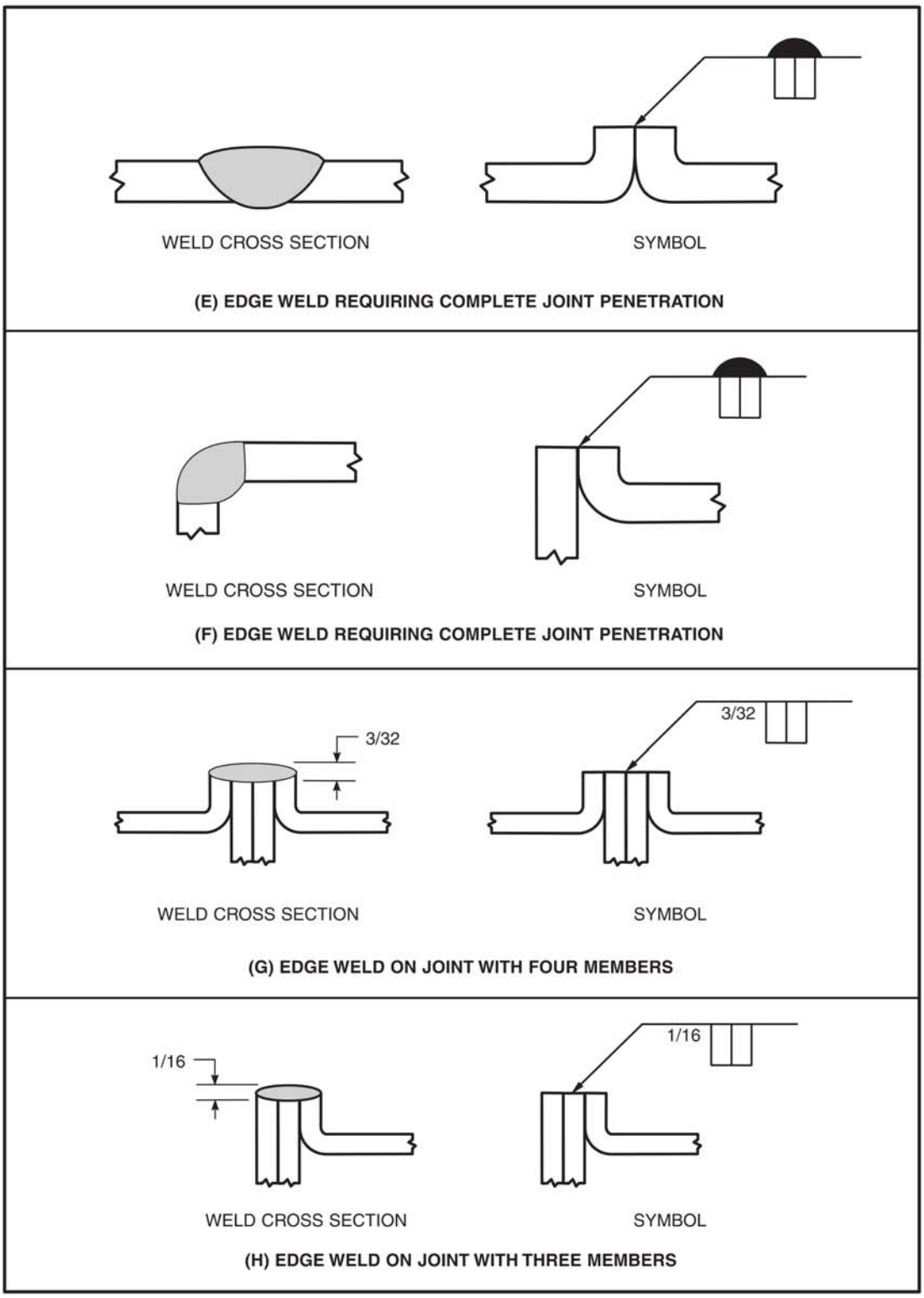


Figure 13.1 (Continued)—Application of the Edge Weld Symbol

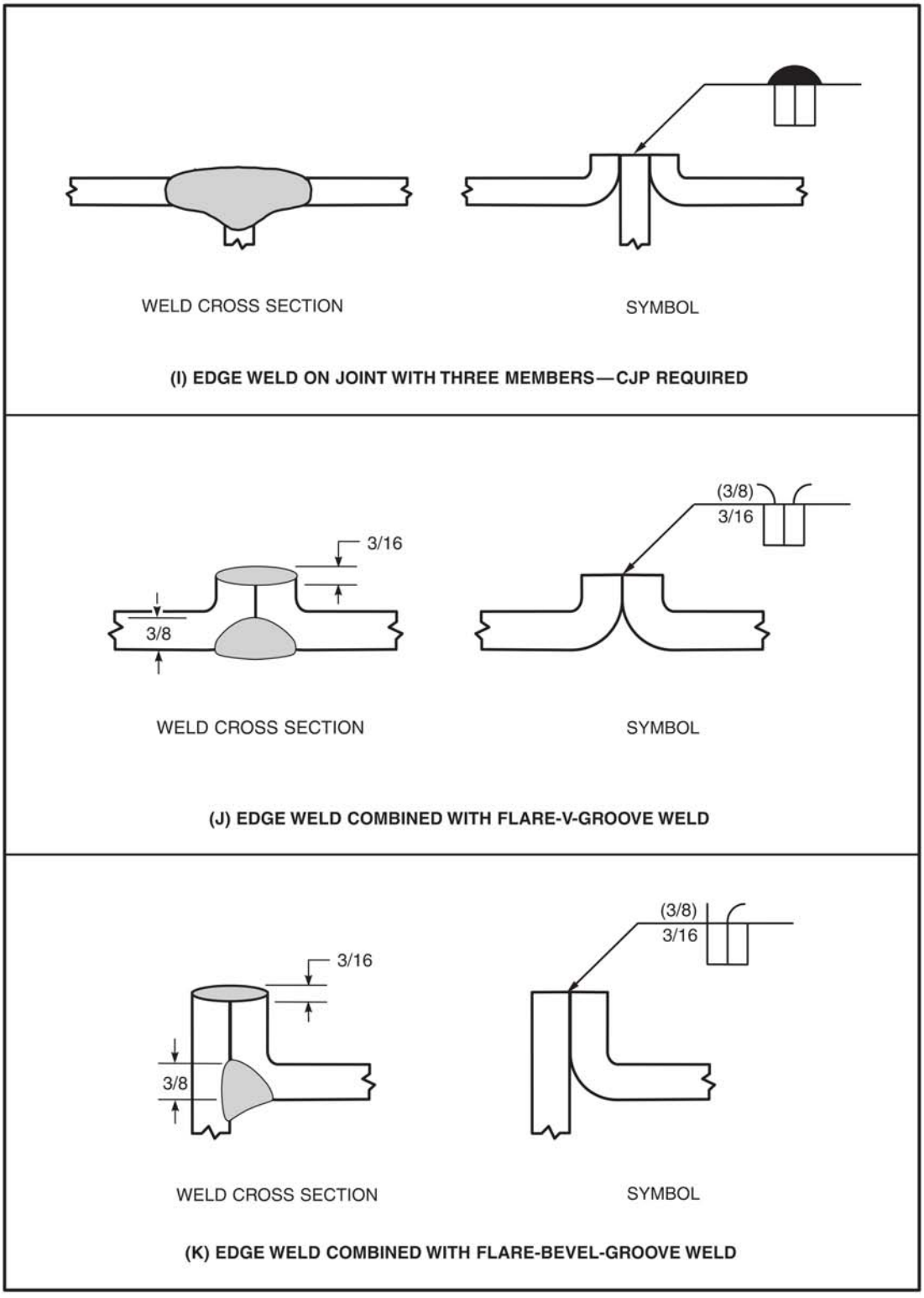


Figure 13.1 (Continued)—Application of the Edge Weld Symbol

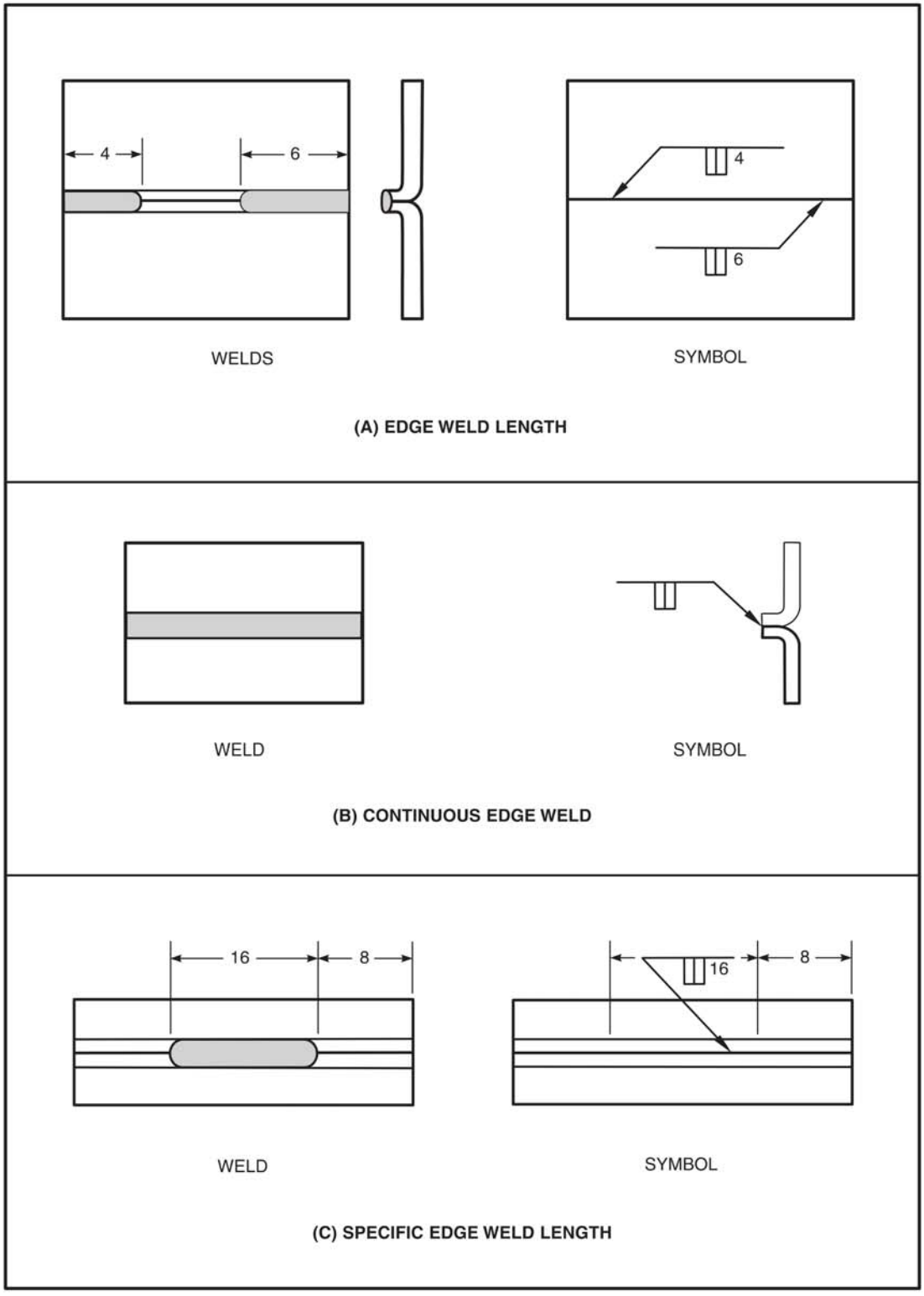


Figure 13.2—Application of the Length of Welding of Edge Welds

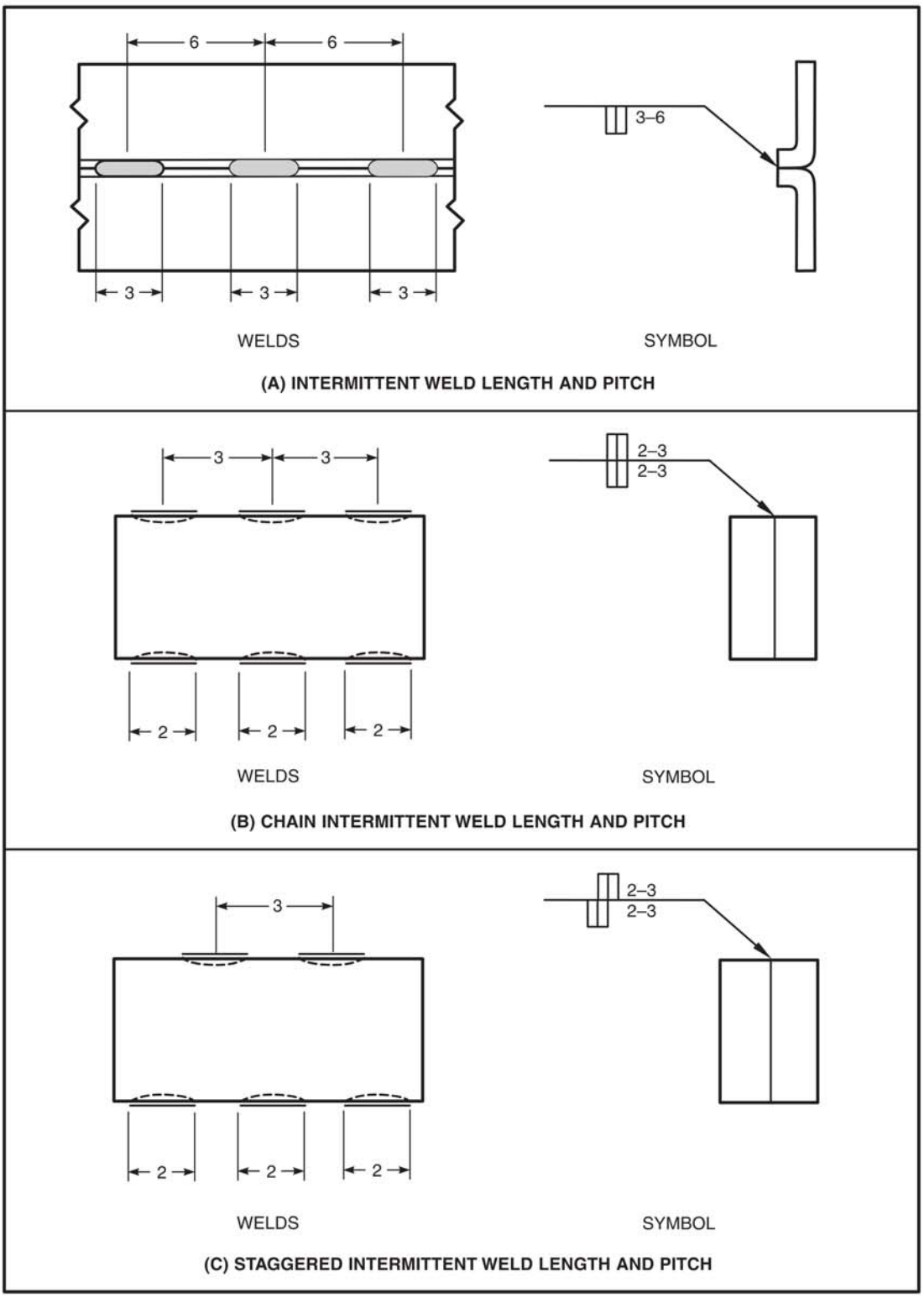


Figure 13.3—Application of Intermittent Edge Welds

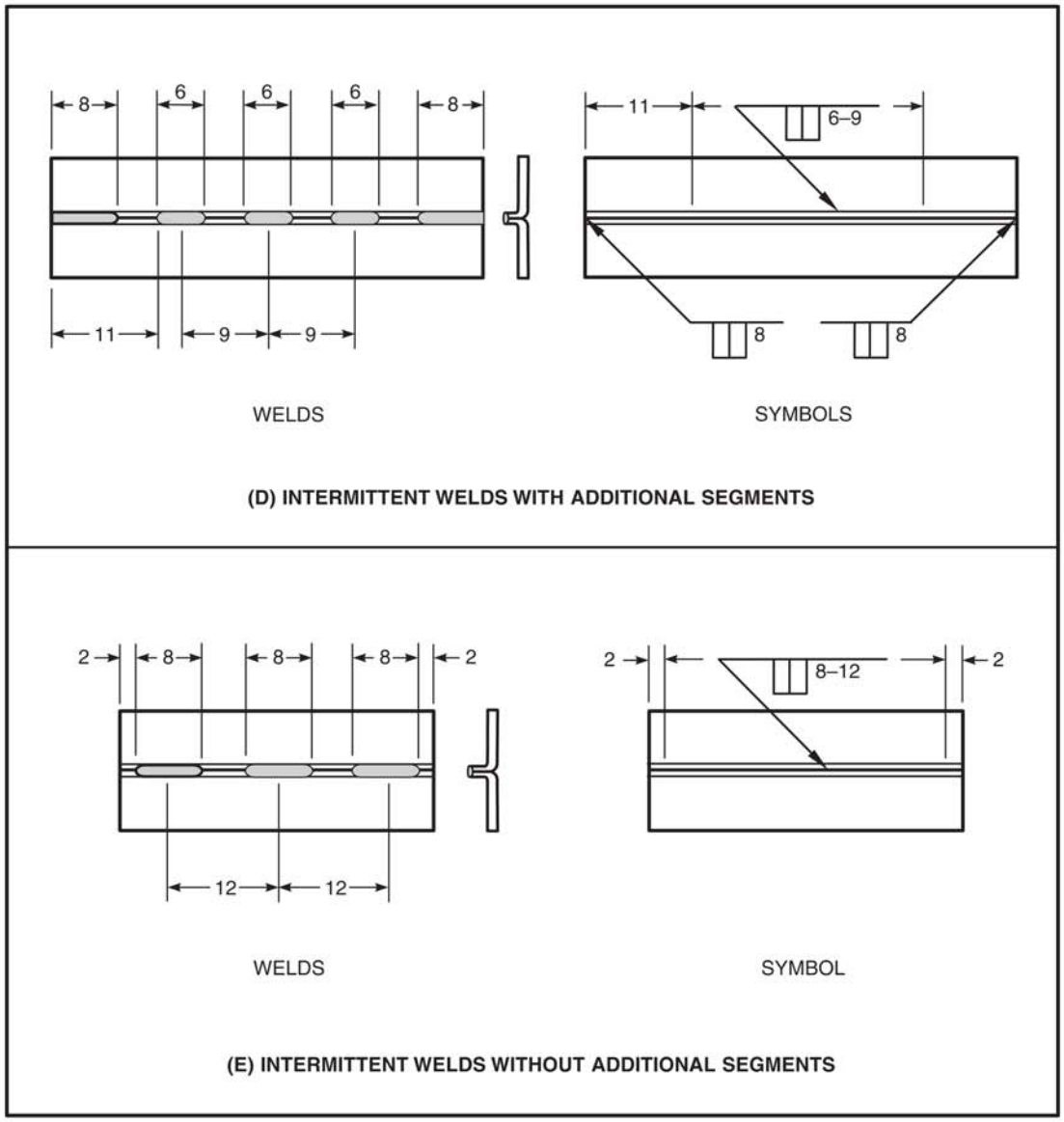
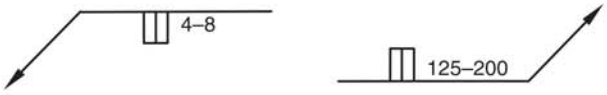
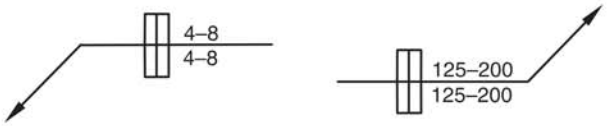


Figure 13.3 (Continued)—Applications of Intermittent Edge Welds

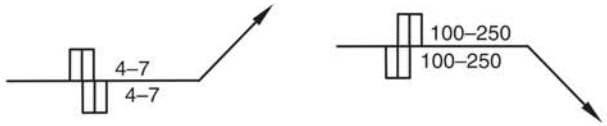
13.7.2 Pitch Dimension Location. The pitch of intermittent edge welds shall be specified to the right of the length dimension following a hyphen (see Figure 13.3).



13.7.3 Chain Intermittent Edge Welds. The dimensions of chain intermittent edge welds shall be specified on both sides of the reference line. The segments of chain intermittent edge welds shall be opposite one another across the joint [see Figure 13.3(B)].



13.7.4 Staggered Intermittent Edge Welds. The dimensions of staggered intermittent edge welds shall be specified on both sides of the reference line and the edge weld symbols shall be offset on opposite sides of the reference line. The segments of staggered intermittent edge welds shall be spaced symmetrically on both sides of the joint [see Figure 13.3(C)].

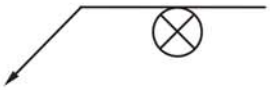


13.7.5 Extent of Welding. In the case of intermittent edge welds, unless otherwise specified, the unwelded lengths at the ends of the joint shall not exceed the unwelded distance between weld segments. Additional weld lengths intended at the ends of the joint shall be specified by separate welding symbols and dimensioned on the drawing [see Figure 13.3(D)]. When specific unwelded lengths are intended at the ends of the joint, the unwelded lengths shall be dimensioned on the drawing [see Figure 13.3(E)].

13.7.6 Location of Intermittent Welds. When the location of intermittent welds is not obvious, it may be necessary to provide specific segment locations by the use of dimension lines [see Figure 13.3(D) and (E)] or by hatching (see 13.6.1.3).

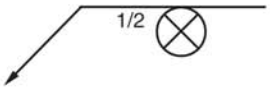
14. Stud Welds

14.1 Side Significance. The stud weld symbol has arrow-side significance only. The symbol shall be placed below the reference line and the arrow shall point clearly to the surface to which the stud is to be welded.

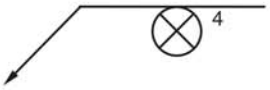


14.2 Dimension Location. Dimensions shall be placed on the same side of the reference line as the stud weld symbol (see Figure 14.1).

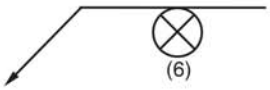
14.3 Stud Size. The stud size shall be specified to the left of the weld symbol (see Figure 14.1). Size may refer to the nominal diameter, thread pitch diameter, or weld end cross section of the stud.



14.4 Stud Weld Spacing. The stud weld pitch (center-to-center distance) in a straight line shall be specified to the right of the weld symbol (see Figure 14.1). Stud weld spacing in any configuration other than a straight line shall be dimensioned on the drawing.



14.5 Number of Stud Welds. The number of stud welds shall be specified in parentheses below the stud weld symbol (see Figure 14.1).



14.6 Location of First and Last Stud Welds. The location of the first and the last stud weld in each single line shall be specified on the drawing (see Figure 14.1).

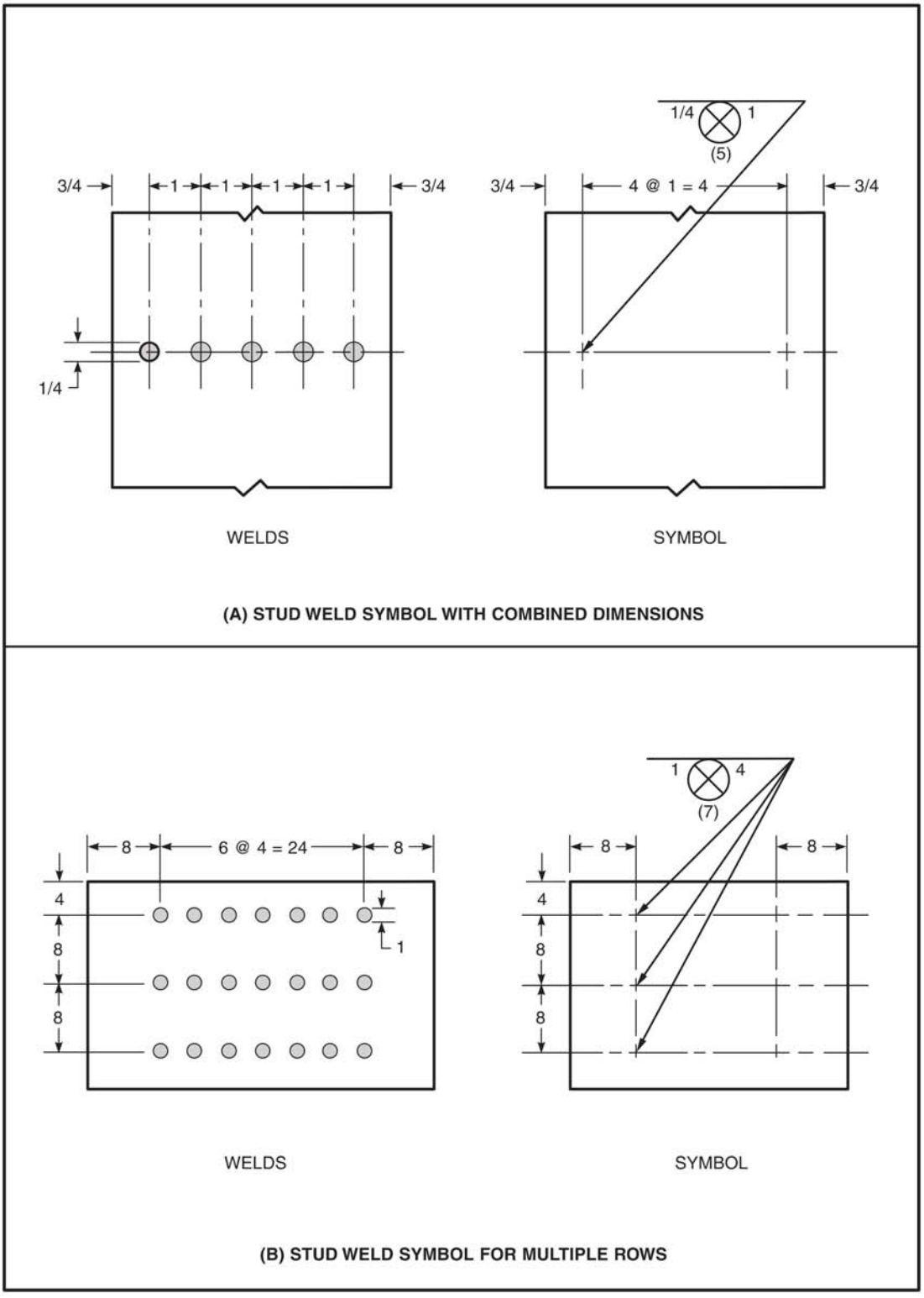
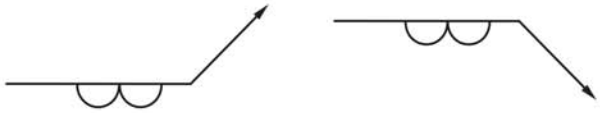


Figure 14.1—Application of the Stud Weld Symbol

15. Surfacing Welds

15.1 Use of the Surfacing Weld Symbol

15.1.1 Symbol Application. Surfacing, whether by single- or multiple-pass welds, shall be specified by the surfacing weld symbol (see Figure 15.1).



15.1.2 Arrow-Side Significance. The surfacing weld symbol does not indicate the welding of a joint and has arrow-side significance only. The symbol shall be placed below the reference line and the arrow shall point clearly to the surface on which the surfacing weld is to be deposited (see Figure 15.1).

15.1.3 Dimension Location. Dimensions used in conjunction with the surfacing weld symbol shall be placed on the same side of the reference line as the weld symbol [see Figure 15.1(A) and (C)].

15.2 Surfacing Weld Size (Thickness)

15.2.1 Size (Thickness). The size (thickness) of a surfacing weld shall be specified by placing the dimension of the required thickness to the left of the weld symbol [see Figure 15.1(A) and (C)].

15.2.2 Multiple Layer. Multiple-layer surfacing welds may be specified by using multiple reference lines with the required size (thickness) of each layer placed to the left of the weld symbols. The direction of welding may be specified by an appropriate note in the tail of the welding symbol or indicated on the drawing [see Figure 15.1(C)].

15.2.3 Unspecified Size (Thickness). When no specific thickness of a surfacing weld is required, the size dimension need not be included in the welding symbol [see Figure 15.1(B)].

15.3 Extent, Location, and Orientation of Surfacing Welds

15.3.1 Entire Area. No dimension other than size (thickness) is necessary to specify surfacing of the entire area of a plane or curved surface [see Figure 15.1(A)].

15.3.2 Portion of Area. When only a portion of a surface is to receive a surfacing weld, the extent, location, and orientation shall be shown on the drawing [see Figure 15.1(B) and (C)].

15.3.3 Direction of Welding. The direction of welding may be specified by a note in the tail of the welding symbol or indicated on the drawing.

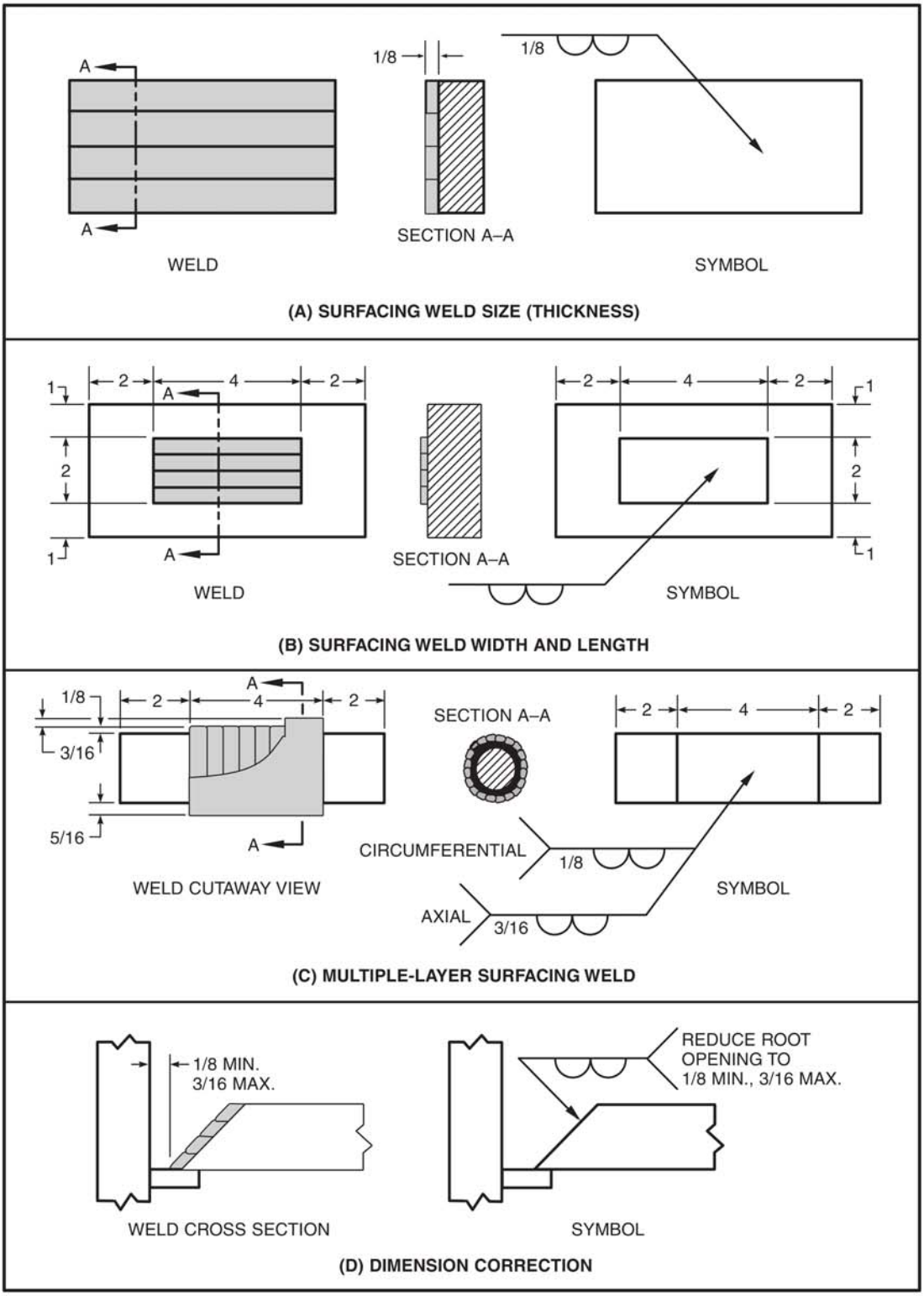
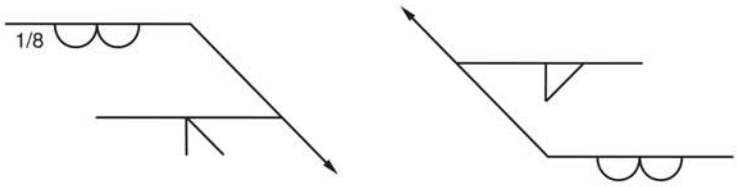


Figure 15.1—Application of the Surfacing Weld Symbol

15.3.4 Additional Welding Details. Additional requirements, such as a welding procedure specification, not otherwise specified on the welding symbol, may be given in the tail.

15.4 Surfacing a Previous Weld. Multiple reference lines may be used to specify a surfacing weld on the surface of a previously made weld (see 6.7).



15.5 Surfacing to Adjust Dimensions. The surfacing weld symbol may be used to specify a surfacing weld to correct assembly problems such as excessive root openings [see Figure 15.1(D)].

16. Symbols for Brazing

16.1 General. Brazing uses the same symbols and conventions as for welding, with the addition of the scarf symbol (as shown in Figure 4.1).

16.1.1 The braze process reference shall be indicated in the tail of the symbol.

16.1.2 If no special preparation other than cleaning is required, only the arrow, reference line, and tail with process need be used [see Figure 16.1(A), (B), and (C)].

16.2 Application of Symbols. The application of the scarf symbol along with conventional welding symbols to brazed joints is illustrated in Figure 16.1(D) through (J). When using welding symbols for brazing, the elements for braze joint clearance, length of overlap, and bevel angle replace weld root opening, weld length, and groove depth respectively, see Figure 16.1(D) through (F).

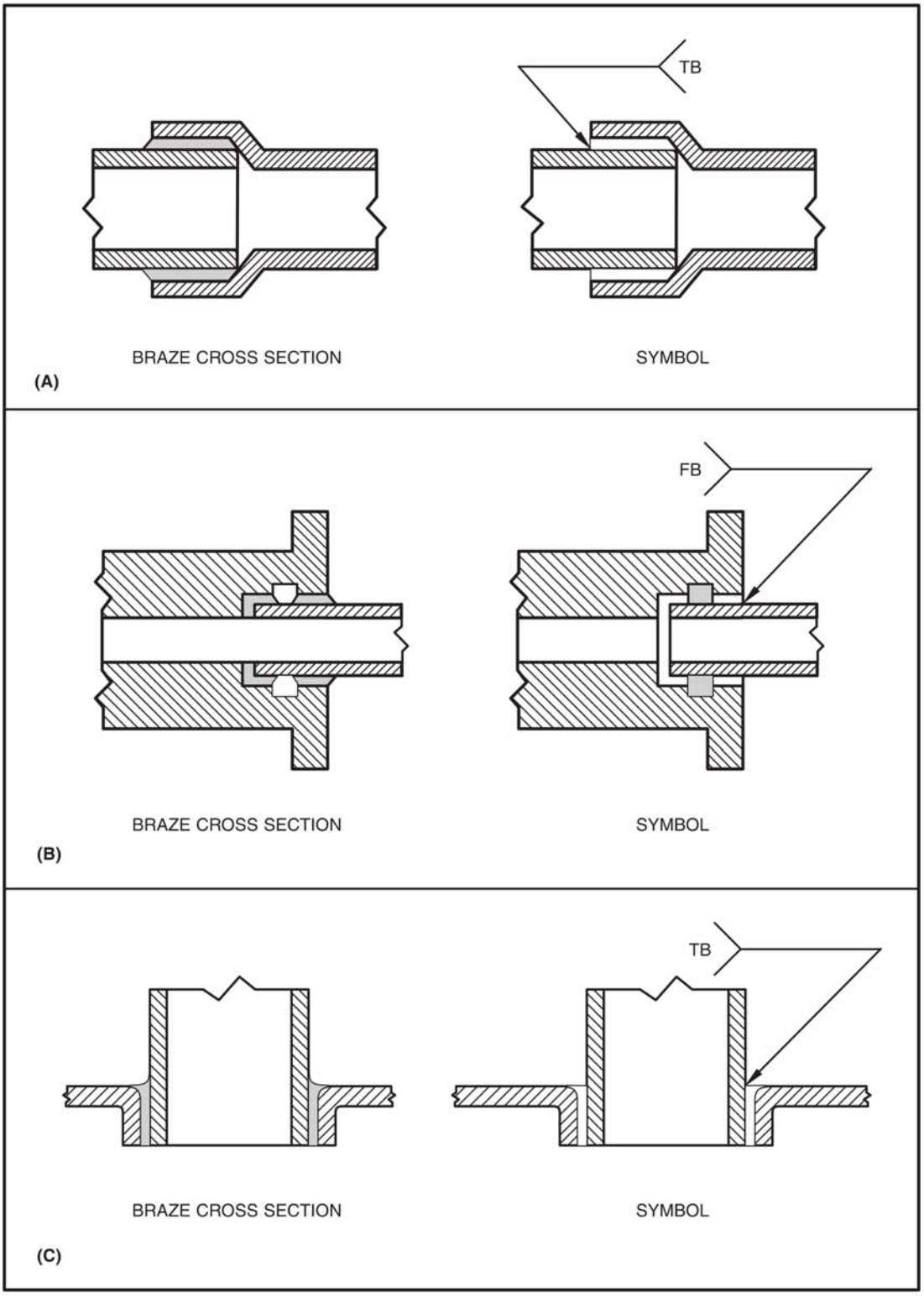
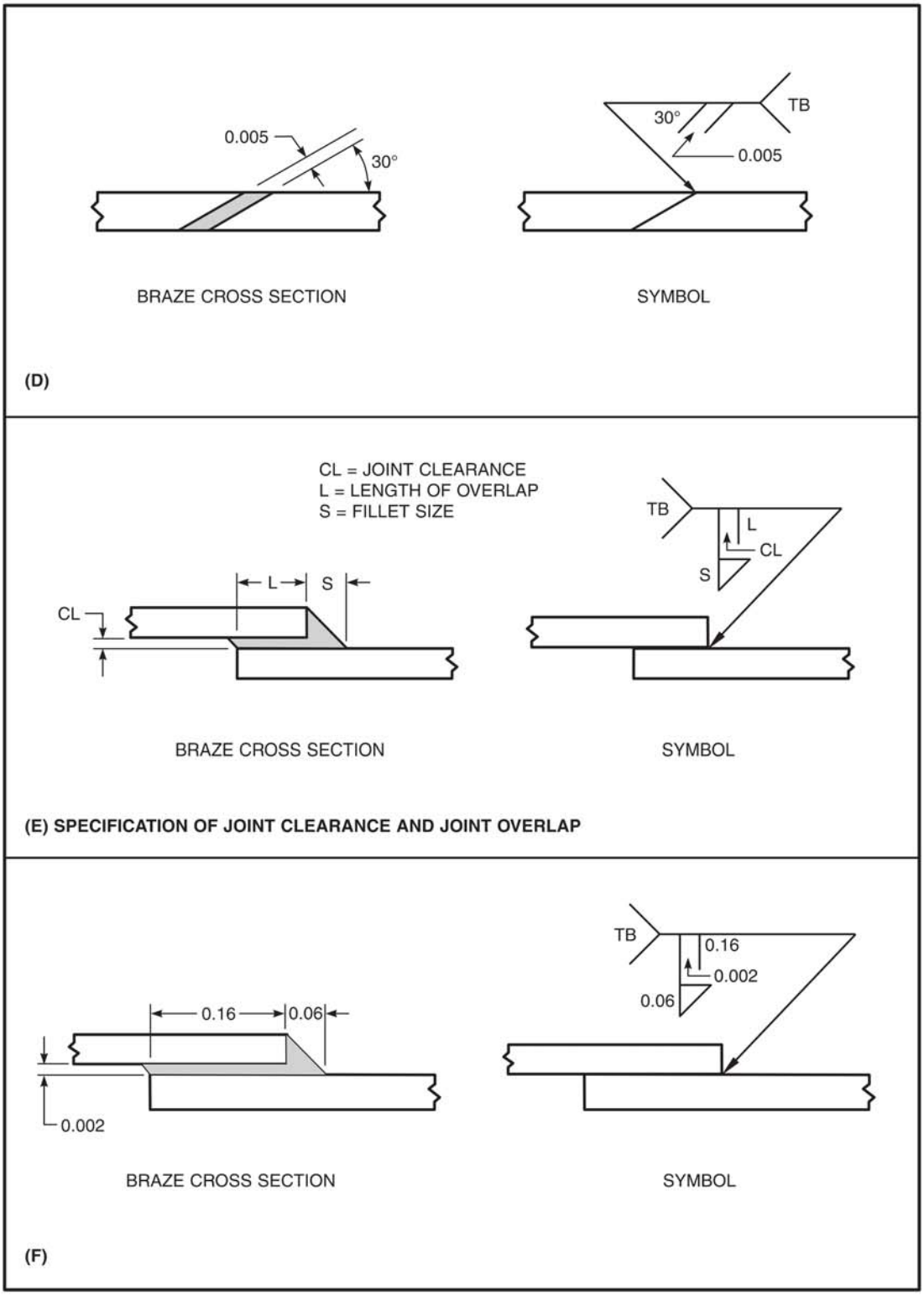
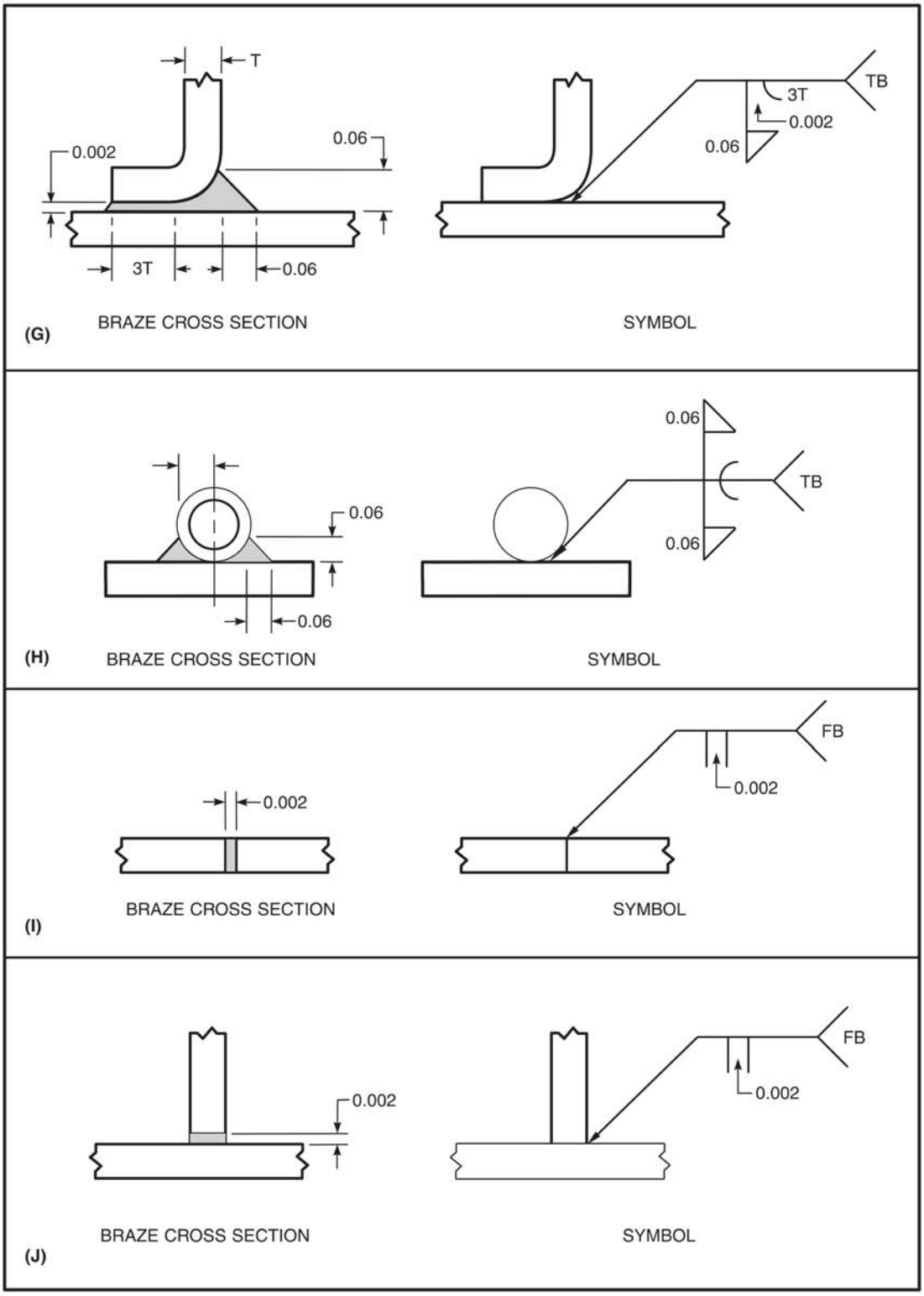


Figure 16.1—Application of Symbols for Brazing



Notes:
1. The shaded area in the braze cross section denotes brazing filler metal.
2. The fillet is a braze weld.

Figure 16.1 (Continued)—Application of Symbols for Brazing



Notes:
1. The shaded area in the braze cross section denotes brazing filler metal.
2. The fillet is a braze weld.

Figure 16.1 (Continued)—Application of Symbols for Brazing

17. Symbols for Nondestructive Examination

17.1 General. A symbol for nondestructive examination may consist of several elements (see Figure 17.1). Only a horizontal reference line, arrow, and examination method(s) are required elements. Additional elements may be included to convey specific nondestructive examination information. Alternatively, examination information may be conveyed by other means such as drawing notes, details, or references to specifications, standards and codes, eliminating the need to include the corresponding elements in the symbol.

The tail of the symbol is used for designating additional information such as specifications or other references necessary for conducting the examination.

All elements, when used, shall have specific locations within the examination symbol as shown in Figure 17.1. Mandatory requirements regarding each element in an examination symbol refer to the location of the element and should not be interpreted as a necessity to include the element in every symbol.

17.2 Elements. The symbol for nondestructive examination consists of several elements (see Figure 17.1):

(1) Reference line

(2) Arrow

(3) Examination method (i.e., letter designations)

(4) Supplementary symbols

(5) Extent and number of examinations

(6) Tail (specifications, codes, notes, or other references)

17.3 Examination Method Letter Designations. When nondestructive examination methods are specified by use of letter designations, they shall be as shown in Table A6.

17.4 Supplementary Symbols. Where supplementary symbols are used, they shall be as shown in Figure 17.2 and used in accordance with 17.9.

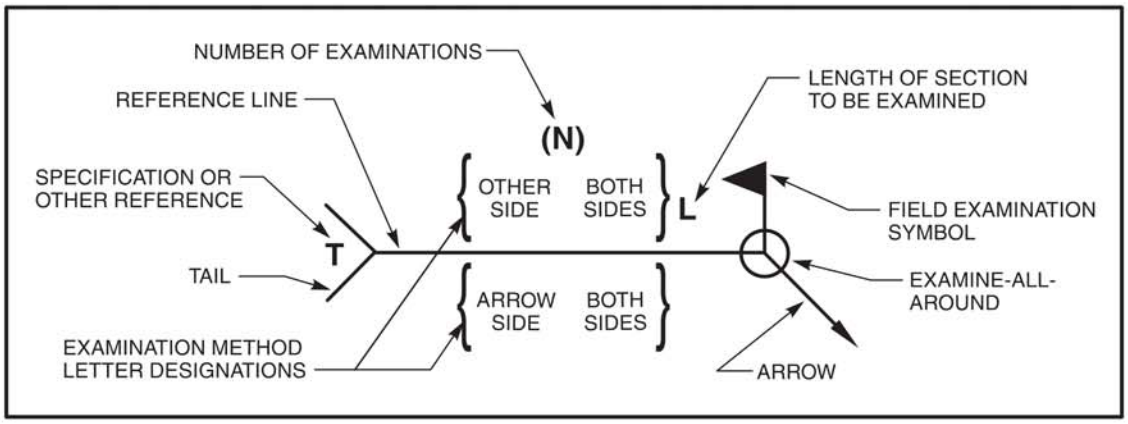


Figure 17.1—Standard Location of the Elements in the Symbol for Nondestructive Examination

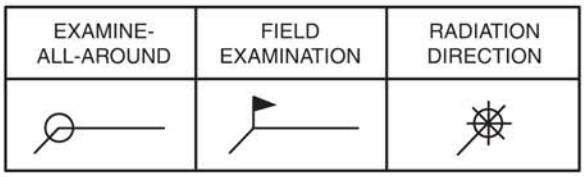
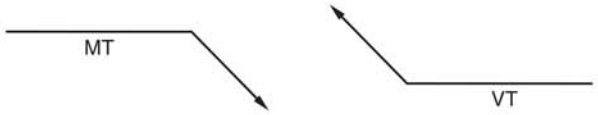


Figure 17.2—Supplementary Symbols for Nondestructive Examination

17.5 Location Significance of the Elements

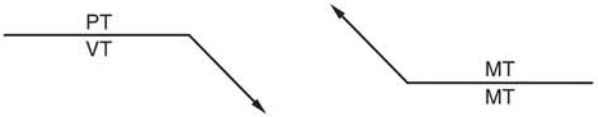
17.5.1 Placement of the Arrow. The arrow shall connect the reference line to the part to be examined. The side of the part to which the arrow points shall be considered the arrow side. The side opposite the arrow side of the part shall be considered the other side.

17.5.2 Location on the Arrow Side. Examinations to be made on the arrow side of the part shall be specified by placing the letter designation for the selected examination method below the reference line [see Figure 17.3(A)].



17.5.3 Location on the Other Side. Examinations to be made on the other side of the part shall be specified by placing the letter designation for the selected examination method above the reference line [see Figure 17.3(B)]

17.5.4 Location on Both Sides. Examinations to be made on both sides of the part shall be specified by placing the letter designation for the selected examination method on both sides of the reference line [see Figure 17.3(C)].



17.5.5 Location Centered on the Reference Line. When the letter designation has no arrow- or other-side significance, or there is no preference from which side the examination is to be made, the letter designation shall be centered on the reference line.

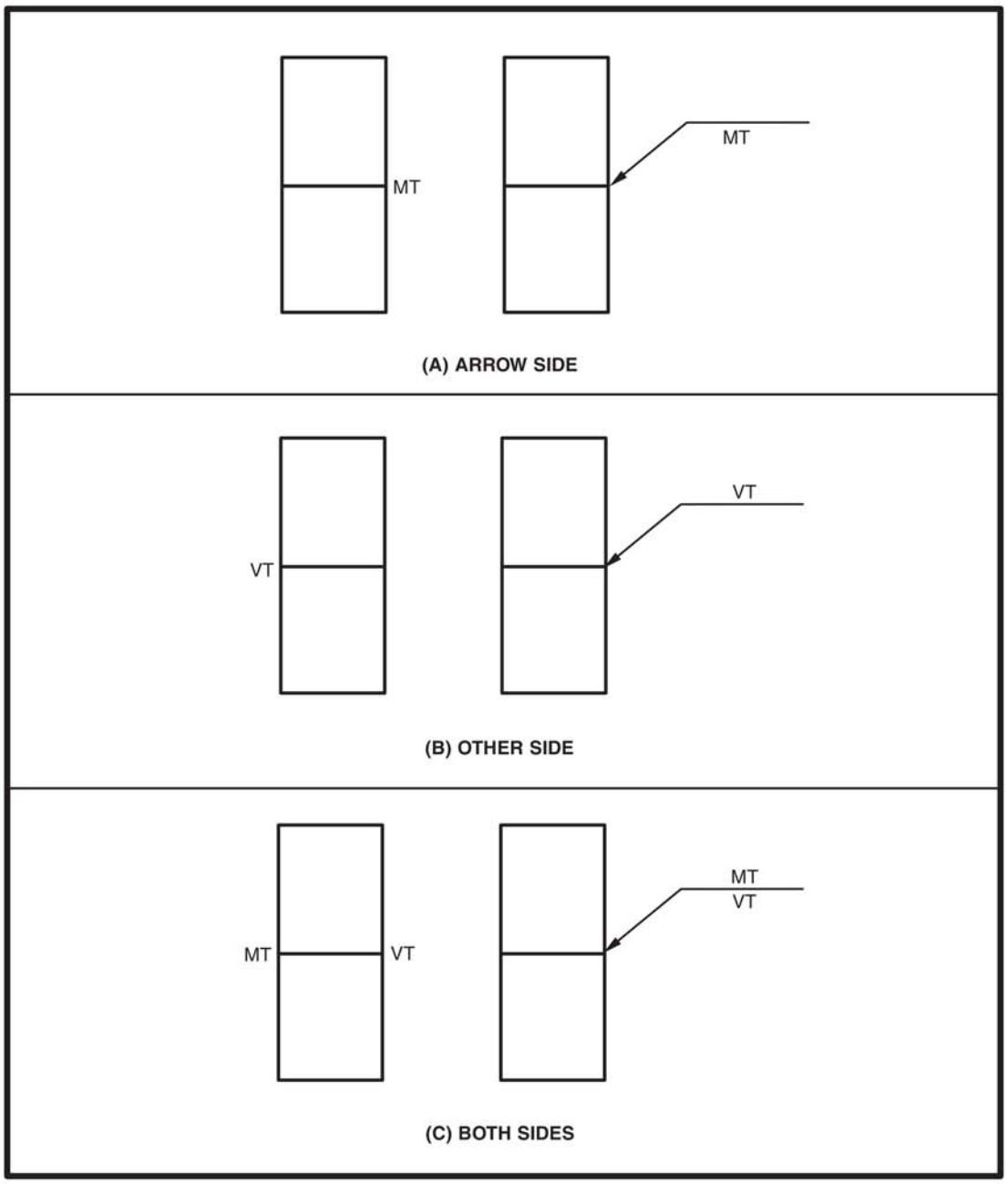
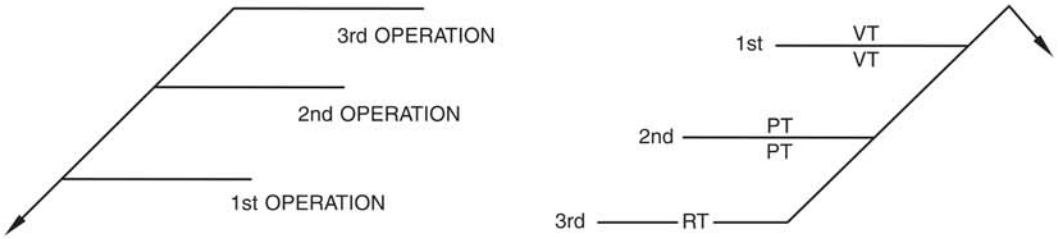


Figure 17.3—Application of Symbol for Nondestructive Examination to Indicate Arrow Side, Other Side, and Both Sides

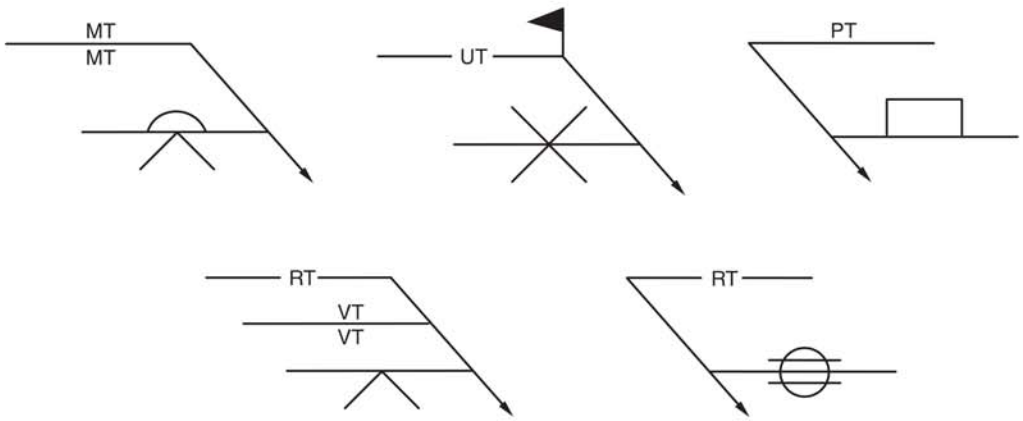
17.5.6 Examination Combinations. More than one examination method may be specified for the same part by placing the combined letter designations of the selected examination methods in the appropriate positions relative to the reference line. Letter designations for two or more examination methods, to be placed on the same side of the reference line or centered on the reference line, shall be separated by a plus sign.

17.6 Multiple Reference Lines

17.6.1 Sequence of Operations. Two or more reference lines may be used to indicate a sequence of operations. The first operation is specified on the reference line nearest the arrow. Subsequent operations are specified sequentially on additional reference lines.



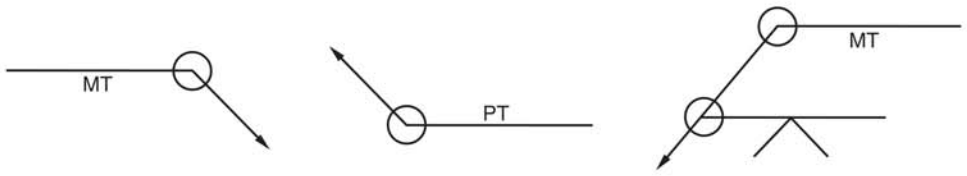
17.7 Welding Symbols and Symbols for Nondestructive Examination. Symbols for nondestructive examination and welding symbols may be combined.



17.8 U.S. Customary and SI Units. When it is required to specify dimensions with symbols for nondestructive examination, the primary system of measurement for the drawing shall be used. Dual dimensioning shall not be used on symbols for nondestructive examination. If it is required to include conversions from SI to U.S. Customary Units or vice versa, conversions may be included on the drawing, e.g., a table. For guidance in drafting standards, refer to the ASME Y14 standards. For guidance on the use of SI Units, refer to AWS A1.1, *Metric Practice Guide for the Welding Industry.*

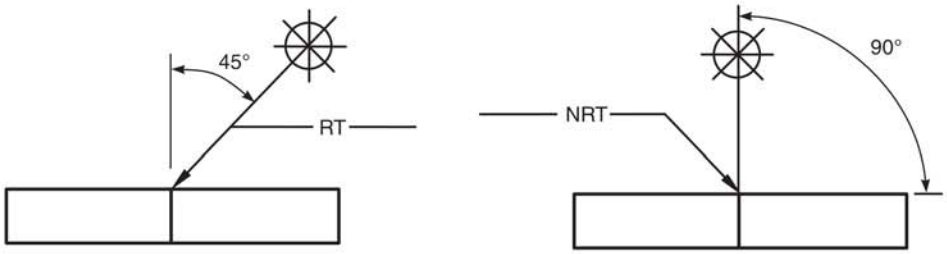
17.9 Supplementary Symbols for Nondestructive Examination

17.9.1 Examine-All-Around Symbol. Examinations required all around a weld, joint, or part shall be specified by placing the examine-all-around symbol at the junction of the reference line and arrow for each operation to which it is applicable.

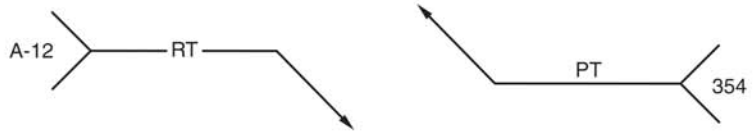


17.9.2 Field Examination Symbol. Examinations required to be conducted in the field (not in a shop or at the place of initial construction) shall be specified by placing the field examination symbol at the junction of the arrow and reference lines.

17.9.3 Radiation Direction Symbol. The direction of penetrating radiation may be specified by use of the radiation direction symbol drawn at the required angle on the drawing and the angle indicated, in degrees, to ensure no misunderstanding.



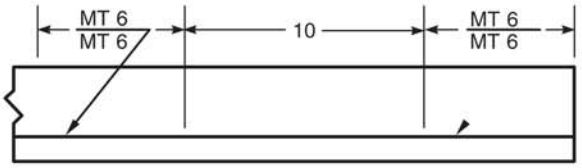
17.10 Specifications, Codes, and References. Information applicable to the examination specified and not otherwise provided may be placed in the tail of the symbol for nondestructive examination.



17.11 Extent, Location, and Orientation of Symbols for Nondestructive Examination

17.11.1 Specifying the Length of the Section to be Examined. To specify the examination of welds or parts where only a portion of the length of a section need be considered, the length dimension shall be placed to the right of the letter designation.

17.11.2 Location Shown. To specify the exact location of a section to be examined, as well as the length, dimension lines shall be used.



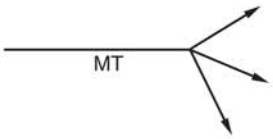
17.11.3 Full-Length Examination. When the full length of a part is to be examined, no length dimension or percentage designation need be included in the symbol for nondestructive examination.

17.11.4 Partial Examination. When less than 100% of the length of a weld or part is to be examined, the length to be examined is specified by placing the appropriate percentage to the right of the letter designation. The selected procedure may be specified by reference in the tail of the symbol for nondestructive examination.

17.12 Number of Examinations

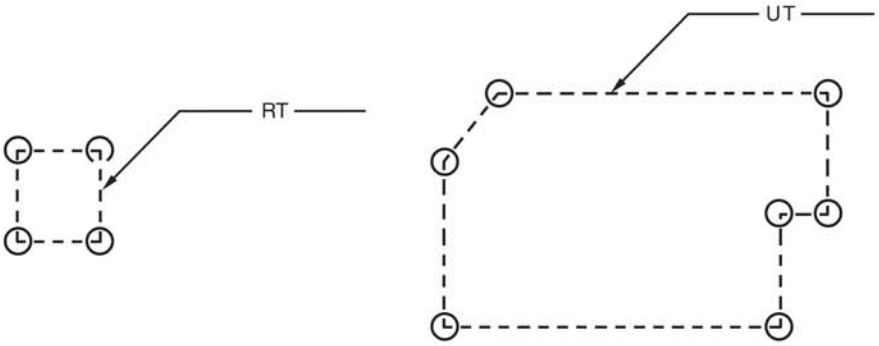
17.12.1 Random Locations. To specify a number of examinations to be conducted on a joint or part at random locations, the number of required examinations shall be placed in parentheses either above or below the letter designation away from the reference line.

17.12.2 Specific Locations. Where specific locations are required, separate symbols may be used. Alternatively, additional arrows may be added to the reference line to identify the examination locations.



17.13 Examination of Areas. The nondestructive examination of areas shall be specified by one of the following methods:

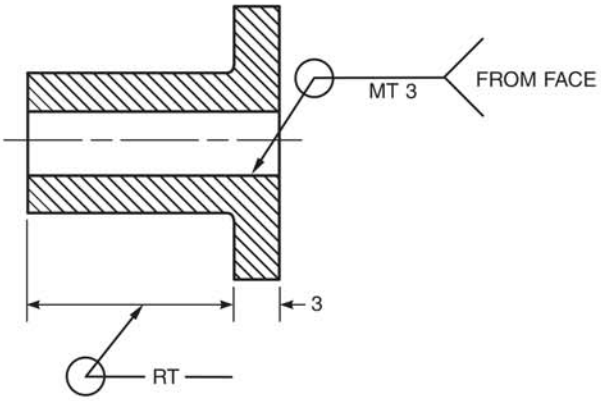
17.13.1 Plane Areas. To specify the nondestructive examination of an area represented as a plane on the drawing, the area to be examined shall be enclosed by straight, broken lines with a circle at each change in direction. The letter designations for the nondestructive examinations required shall be used in connection with these lines. When necessary, these enclosures shall be located by coordinate dimensions.



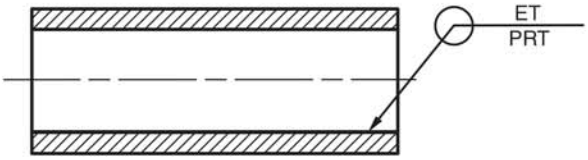
17.13.2 Areas of Revolution. For nondestructive examination of areas of revolution, the area shall be specified by using the examine-all-around symbol and the appropriate dimensions as illustrated.

(1) Magnetic particle examination of the bore of the flange for a specified distance from the right face all the way around the circumference.

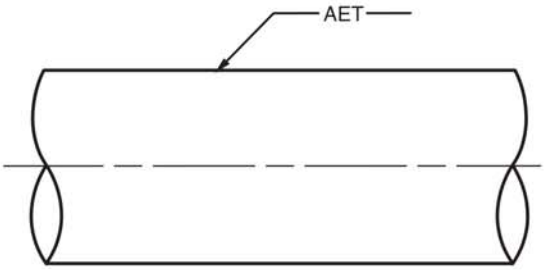
(2) Radiographic examination of an area of revolution where dimensions are not specified on the drawing.



The symbol shown below specifies an area of revolution subject to an internal proof examination and an external eddy current examination. As no dimensions are given, the entire surface is to be examined.



17.13.3 Acoustic Emission Testing. Acoustic emission examination (AET) is generally applied to all or a large portion of a component such as a pressure vessel or pipe. The symbol below represents the application of AET to the component without specific reference to the location of sensors.



Annex A (Normative)

Tables

This annex is part of this standard and includes mandatory elements for use with this standard.

Table A1
Joint Type Designators

Designator	Joint Type
B	Butt
C	Corner
L	Lap
P	Parallel
T	T-

Source: Adapted from AWS A3.0:2001, *Standard Welding Terms and Definitions*, Table 6, American Welding Society.

Table A2
Letter Designations of Welding, Joining, and Allied Processes

Process	Letter Designation
adhesive bonding	AB
arc gouging	AG
arc welding	AW
arc stud welding	SW
carbon arc welding	CAW
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 circuiting 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
controlled-atmosphere brazing	B-CA
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
electron beam braze welding	EBBW
exothermic braze welding	EXBW
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
narrow gap electroslag welding	ESW-NG
oxyfuel gas welding	OFW
air acetylene welding	AAW
oxyacetylene welding	OAW
oxyhydrogen welding	OHW
pressure gas welding	PGW
percussion welding	PEW
plastics welding	
electrofusion welding	EFW
extrusion welding	EW
flow fusion welding	FFW
hot gas welding	HGW
heated tool welding	HTW
infrared welding	IRW
radio frequency welding	RFW
spin welding	SPW
ultrasonic welding	USW
vibration welding	VW
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

(Continued)

Table A2 (Continued)
Letter Designations of Welding, Joining, and Allied Processes

Process	Letter Designation	Process	Letter Designation
oxyfuel gas cutting	OFC	plasma arc gouging	PAG
oxyacetylene cutting	OFC-A	thermal spraying	THSP
oxyhydrogen gas cutting	OFC-H	arc spraying	ASP
oxynatural gas cutting	OFC-N	flame spraying	FLSP
oxypropane cutting	OFC-P	powder flame spraying	FLSP-P
oxygen arc cutting	OAC	wire flame spraying	FLSP-W
oxygen lance cutting	OLC	high velocity oxyfuel spraying	HVOF
thermal gouging	TG	plasma spraying	PSP
carbon arc gouging	CAG	vacuum plasma spraying	VPSP
oxygen gouging	OG	thermite welding	TW

Source: Reproduced from AWS A3.0M/A3.0:2020, *Standard Welding Terms and Definitions*, Table A1, American Welding Society.

Table A3
Alphabetical Cross-Reference to Table A2 by Process

Process	Letter Designation	Process	Letter Designation
adhesive bonding	AB	forge welding	FOW
air carbon arc cutting	CAC-A	friction stir welding	FSW
arc braze welding	ABW	friction welding	FRW
arc cutting	AC	furnace brazing	FB
arc gouging	AG	furnace soldering	FS
arc spraying	ASP	gas metal arc cutting	GMAC
arc stud welding	SW	gas metal arc welding	GMAW
arc welding	AW	gas shielded flux cored arc welding	FCAW-G
braze welding	BW	gas tungsten arc cutting	GTAC
brazing	B	gas tungsten arc welding	GTAW
controlled-atmosphere brazing	B-CA	heated tool welding	HTW
carbon arc cutting	CAC	high energy beam cutting	HEBC
carbon arc gouging	CAG	high energy beam welding	HEBW
carbon arc welding	CAW	high vacuum electron beam welding	EBW-HV
coextrusion welding	CEW	high velocity oxyfuel spraying	HVOF
cold welding	CW	high-frequency seam welding	RSEW-HF
consumable guide electroslag welding	ESW-CG	high-frequency upset welding	UW-HF
diffusion brazing	DFB	hot gas welding	HGW
diffusion welding	DFW	hot isostatic pressure welding	HIPW
dip brazing	DB	hot pressure welding	HPW
dip soldering	DS	induction brazing	IB
direct drive friction welding	FRW-DD	induction seam welding	RSEW-I
electrofusion welding	EFW	induction soldering	IS
electrogas welding	EGW	induction upset welding	UW-I
electron beam braze welding	EBBW	induction welding	IW
electron beam brazing	EBB	inertia friction welding	FRW-I
electron beam cutting	EBC	infrared brazing	IRB
electron beam welding	EBW	infrared soldering	IRS
electroslag welding	ESW	infrared welding	IRW
exothermic braze welding	EXBW	iron soldering	INS
exothermic brazing	EXB	laser beam air cutting	LBC-A
explosion welding	EXW	laser beam braze welding	LBBW
extrusion welding	EW	laser beam brazing	LBB
flame spraying	FLSP	laser beam cutting	LBC
flash welding	FW	laser beam evaporative cutting	LBC-EV
flow fusion welding	FFW	laser beam inert gas cutting	LBC-IG
flux cored arc welding	FCAW	laser beam oxygen cutting	LBC-O
flux cutting	OC-F		

(Continued)

Table A3 (Continued)
Alphabetical Cross-Reference to Table A2 by Process

Process	Letter Designation	Process	Letter Designation
laser beam welding	LBW	pulsed gas tungsten arc welding	GTAW-P
magnetically impelled arc welding	MIAW	radio frequency welding	RFW
mash seam welding	RSEW-MS	resistance brazing	RB
medium vacuum electron beam welding	EBW-MV	resistance seam welding	RSEW
metal power cutting	OC-P	resistance soldering	RS
narrow gap electroslag welding	ESW-NG	resistance spot welding	RSW
nonvacuum electron beam welding	EBW-NV	resistance welding	RW
oxyacetylene cutting	OFC-A	roll welding	ROW
oxyacetylene welding	OAW	self-shielded flux cored arc welding	FCAW-S
oxyfuel gas cutting	OFC	series submerged arc welding	SAW-S
oxyfuel gas welding	OFW	shielded metal arc cutting	SMAC
oxygen arc cutting	OAC	shielded metal arc welding	SMAW
oxygen cutting	OC	short circuiting gas metal arc welding	GMAW-S
oxygen gouging	OG	soldering	S
oxygen lance cutting	OLC	solid-state welding	SSW
oxyhydrogen gas cutting	OFC-H	spin welding	SPW
oxyhydrogen welding	OHW	submerged arc welding	SAW
oxynatural gas cutting	OFC-N	thermal cutting	TC
oxypropane cutting	OFC-P	thermal gouging	TG
percussion welding	PEW	thermal spraying	THSP
plasma arc cutting	PAC	thermite welding	TW
plasma arc gouging	PAG	torch brazing	TB
plasma arc welding	PAW	torch soldering	TS
plasma spraying	PSP	ultrasonic soldering	USS
powder flame spraying	FLSP-P	ultrasonic welding	USW
pressure gas welding	PGW	upset welding	UW
pressure-controlled resistance welding	EW-PC	vacuum plasma spraying	VPSP
projection welding	PW	wave soldering	WS
pulsed gas metal arc welding	GMAW-P	wire flame spraying	FLSP-W

Source: Reproduced from AWS A3.0M/A3.0:2020, *Standard Welding Terms and Definitions*, Table A2, American Welding Society.

Table A4
Alphabetical Cross-Reference to Table A2 by Letter Designation

Letter Designation	Process	Letter Designation	Process
AB	adhesive bonding	DFW	diffusion welding
ABW	arc braze welding	DS	dip soldering
AC	arc cutting	EBB	electron beam brazing
AG	arc gouging	EBBW	electron beam braze welding
AHW	atomic hydrogen welding	EBC	electron beam cutting
ASP	arc spraying	EBW	electron beam welding
AW	arc welding	EBW-HV	high vacuum electron beam welding
B	brazing	EBW-MV	medium vacuum electron beam welding
B-CA	controlled-atmosphere brazing	EBW-NV	nonvacuum electron beam welding
BW	braze welding	EFW	electrofusion welding
CAC	carbon arc cutting	EGW	electrogas welding
CAC-A	air carbon arc cutting	ESW	electroslag welding
CAG	carbon arc gouging	ESW-CG	consumable guide electroslag welding
CAW	carbon arc welding	ESW-NG	narrow gap electroslag welding
CEW	coextrusion welding	EW	extrusion welding
CW	cold welding	EXB	exothermic brazing
DB	dip brazing	EXBW	exothermic braze welding
DFB	diffusion brazing	EXW	explosion welding

(Continued)

Table A4 (Continued)
Alphabetical Cross-Reference to Table A2 by Letter Designation

Letter Designation	Process	Letter Designation	Process
FB	furnace brazing	OC-P	metal powder cutting
FCAW	flux cored arc welding	OFC	oxyfuel gas cutting
FCAW-G	gas shielded flux cored arc welding	OFC-A	oxyacetylene cutting
FCAW-S	self-shielded flux cored arc welding	OFC-H	oxyhydrogen gas cutting
FFW	flow fusion welding	OFC-N	oxynatural gas cutting
FLSP	flame spraying	OFC-P	oxypropane cutting
FLSP-P	powder flame spraying	OFW	oxyfuel gas welding
FLSP-W	wire flame spraying	OG	oxygen gouging
FOW	forge welding	OHW	oxyhydrogen welding
FRW	friction welding	OLC	oxygen lance cutting
FRW-DD	direct drive friction welding	PAC	plasma arc cutting
FRW-I	inertia friction welding	PAG	plasma arc gouging
FS	furnace soldering	PAW	plasma arc welding
FSW	friction stir welding	PEW	percussion welding
FW	flash welding	PGW	pressure gas welding
GMAC	gas metal arc cutting	PSP	plasma spraying
GMAW	gas metal arc welding	PW	projection welding
GMAW-P	pulsed gas metal arc welding	RB	resistance brazing
GMAW-S	short circuiting gas metal arc welding	RFW	radio frequency welding
GTAC	gas tungsten arc cutting	ROW	roll welding
GTAW	gas tungsten arc welding	RS	resistance soldering
GTAW-P	pulsed gas tungsten arc welding	RSEW	resistance seam welding
HEBC	high energy beam cutting	RSEW-HF	high-frequency seam welding
HEBW	high energy beam welding	RSEW-I	induction seam welding
HGW	hot gas welding	RSEW-MS	mash seam welding
HIPW	hot isostatic pressure welding	RSW	resistance spot welding
HPW	hot pressure welding	RW	resistance welding
HTW	heated tool welding	RW-PC	pressure-controlled resistance welding
HVOF	high velocity oxyfuel spraying	S	soldering
IB	induction brazing	SAW	submerged arc welding
INS	iron soldering	SAW-S	series submerged arc welding
IRB	infrared brazing	SMAC	shielded metal arc cutting
IRS	infrared soldering	SMAW	shielded metal arc welding
IRW	infrared welding	SPW	spin welding
IS	induction soldering	SSW	solid-state welding
IW	induction welding	SW	arc stud welding
LBB	laser beam brazing	TB	torch brazing
LBBW	laser beam braze welding	TC	thermal cutting
LBC	laser beam cutting	TG	thermal gouging
LBC-A	laser beam air cutting	THSP	thermal spraying
LBC-EV	laser beam evaporative cutting	TS	torch soldering
LBC-IG	laser beam inert gas cutting	TW	thermite welding
LBC-O	laser beam oxygen cutting	USS	ultrasonic soldering
LBW	laser beam welding	USW	ultrasonic welding
MIAW	magnetically impelled arc welding	UW	upset welding
OAC	oxygen arc cutting	UW-HF	high-frequency upset welding
OAW	oxyacetylene welding	UW-I	induction upset welding
OC	oxygen cutting	VPSP	vacuum plasma spraying
OC-F	flux cutting	WS	wave soldering

Source: Reproduced from AWS A3.0M/A3.0:2020, *Standard Welding Terms and Definitions*, Table A3, American Welding Society.

Table A5
Suffixes for Application Mode of Welding, Joining, and Allied Processes

Application Mode	Letter Designation
Adaptive control	-AD
Automatic	-AU
Manual	-MA
Mechanized	-ME
Robotic	-RO
Semiautomatic	-SA

Note: Application mode designator is added to a process designator in the following format: XXXX-YY, where XXXX is the process designator and YY is the application mode designator. For example, manual gas tungsten arc welding is designated as GTAW-MA.

Source: Reproduced from AWS A3.0M/A3.0:2020, *Standard Welding Terms and Definitions*, Table A4, American Welding Society.

Table A6
Examination Method Letter Designations

Examination Method	Letter Designation
Acoustic emission	AET
Electromagnetic	ET
Leak	LT
Magnetic particle	MT
Neutron radiographic	NRT
Penetrant	PT
Proof	PRT
Radiographic	RT
Ultrasonic	UT
Visual	VT

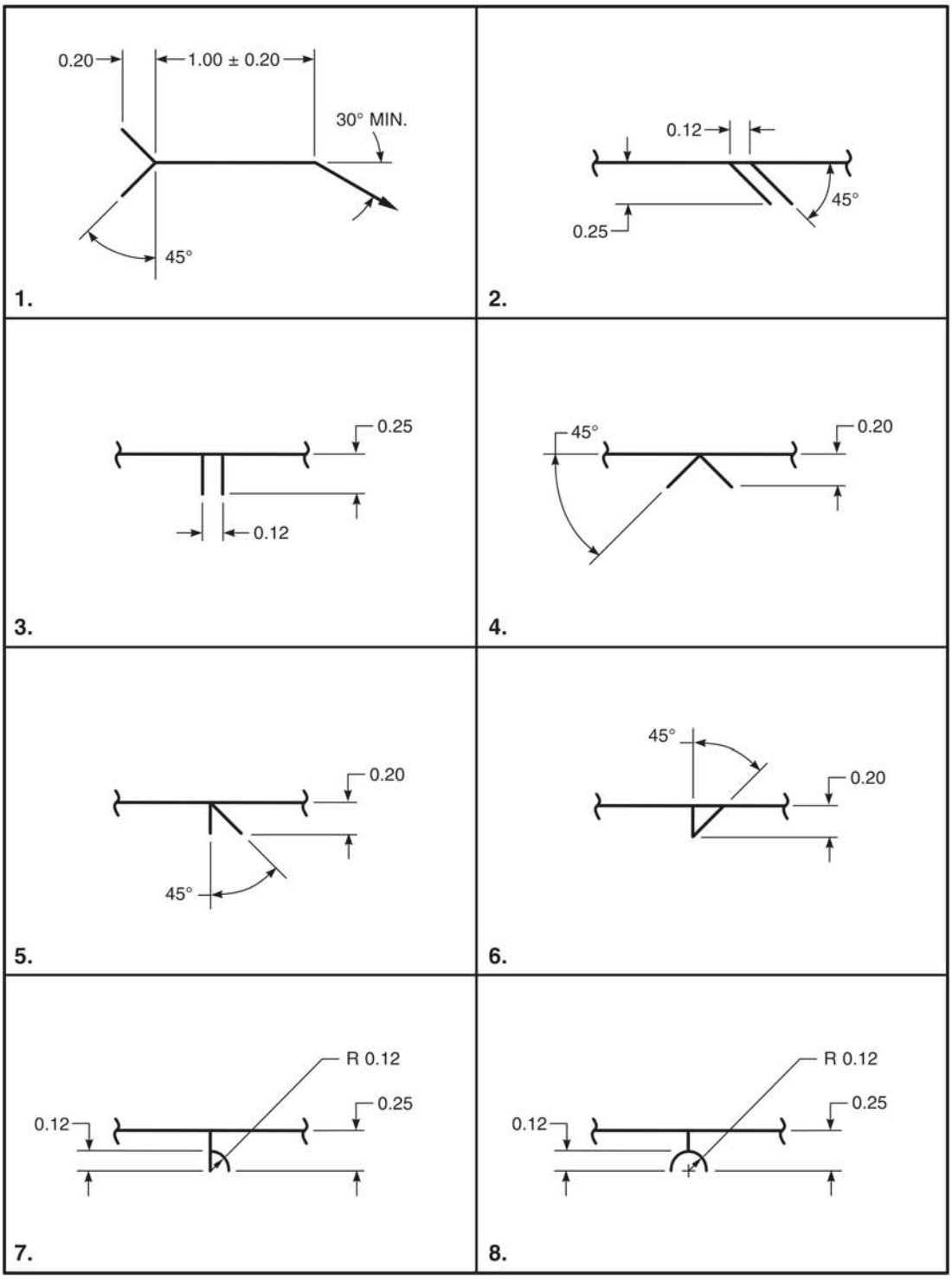
Source: Reproduced from AWS B1.10M/B1.10:2016, *Guide for the Nondestructive Examination of Welds*, Annex B2, American Welding Society

Annex B (Informative)
Design of Standard Symbols (U.S. Customary Units)

This annex is not part of this standard but is included for informational purposes only.

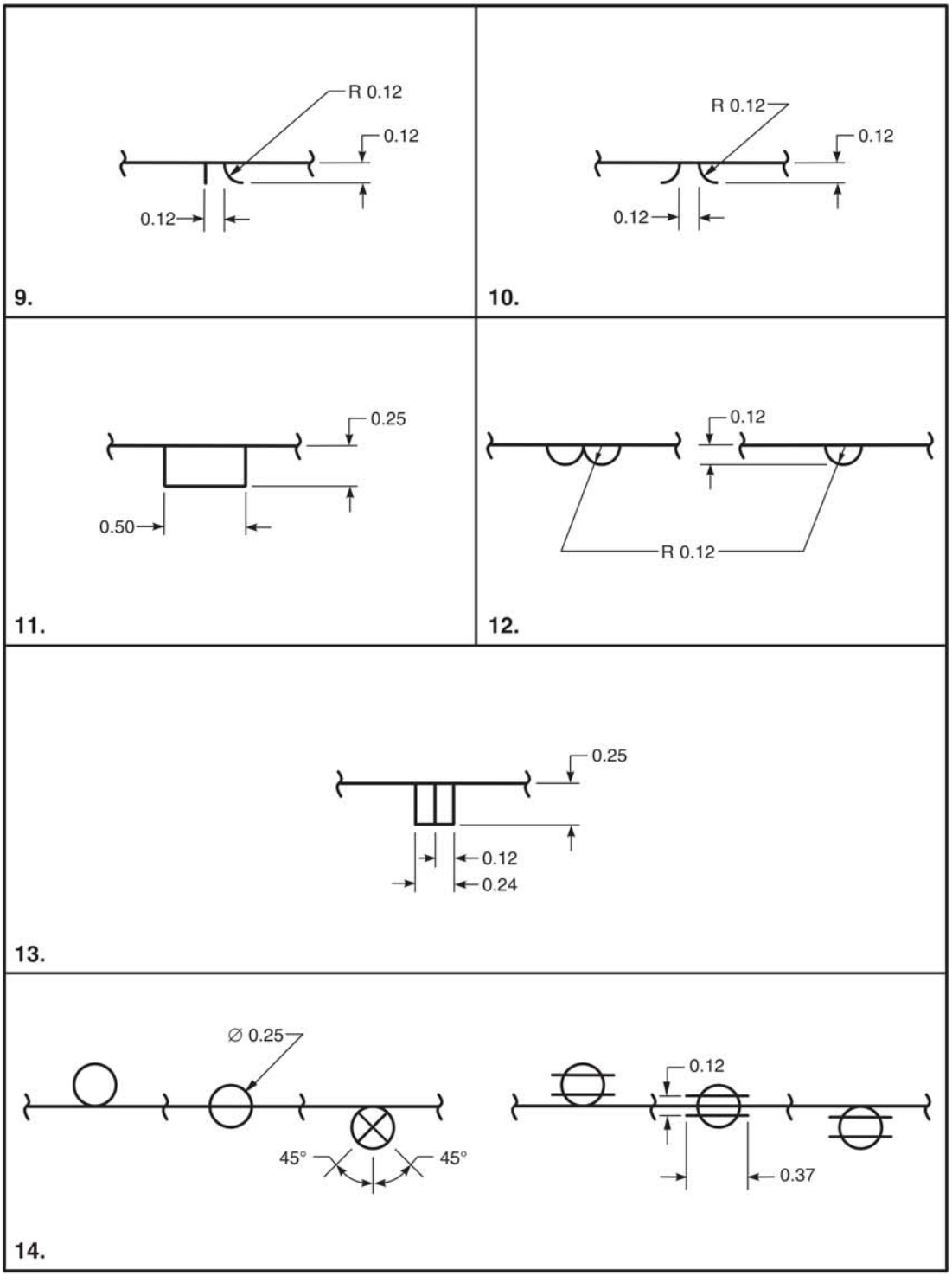
The dimensions shown in this annex are provided for reference purposes to keep the scale of the welding symbols consistent across the drawing. The font size chosen for the numerical and text portions of the welding symbols shall be easily read, consistent with the text provided in the remainder of the drawing, and shall not overflow the field into which the required information needs to be provided as shown throughout the examples provided by this document.

Design of Standard Symbols (U.S. Customary Units)



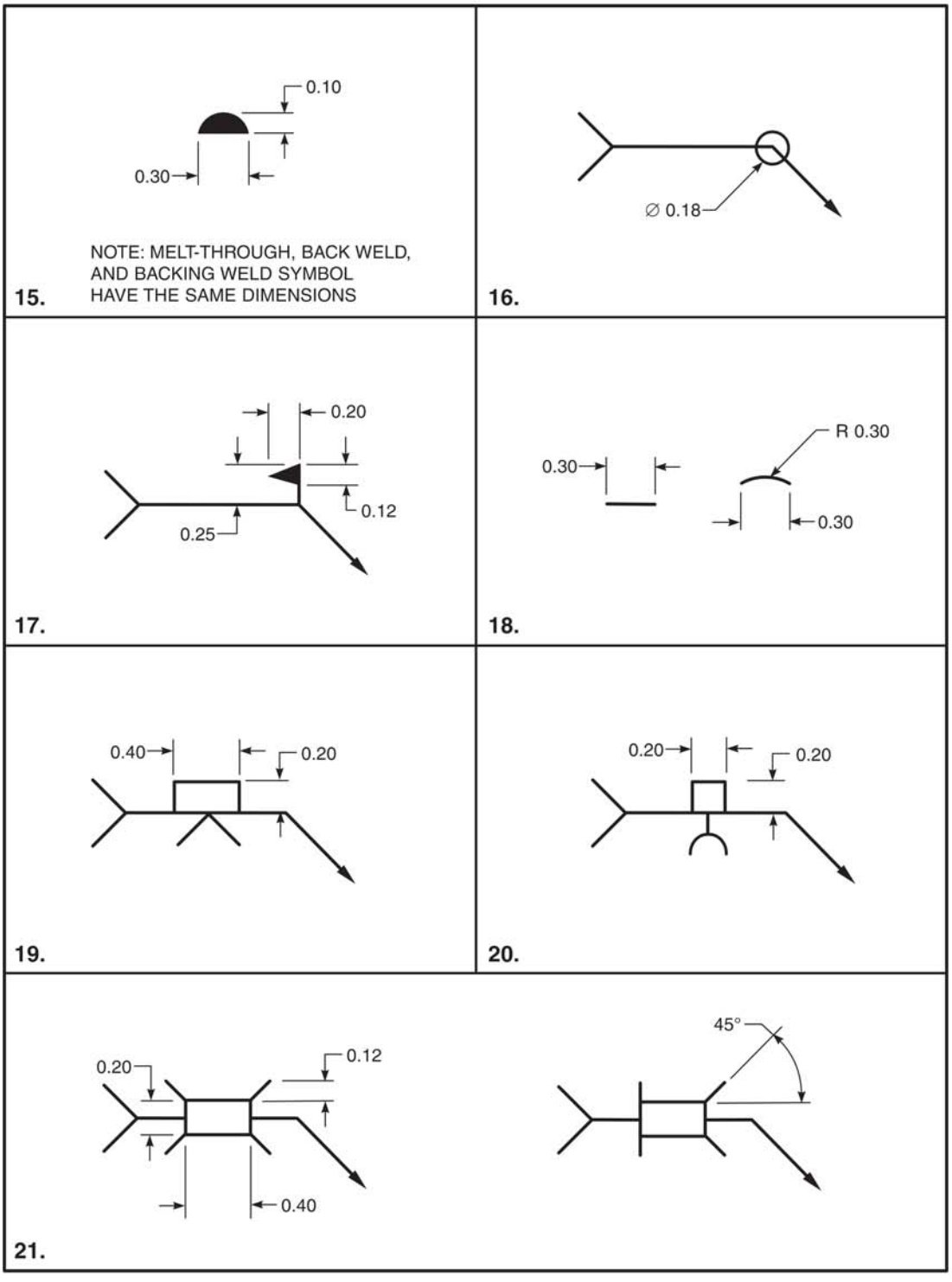
Notes:
1. Unless otherwise specified, tolerances shall be ±0.04 in or ±1°, as applicable.
2. All radii are minimum dimensions.

Design of Standard Symbols (U.S. Customary Units) (Continued)



Notes:
1. Unless otherwise specified, tolerances shall be ±0.04 in or ±1°, as applicable.
2. All radii are minimum dimensions.

Design of Standard Symbols (U.S. Customary Units) (Continued)



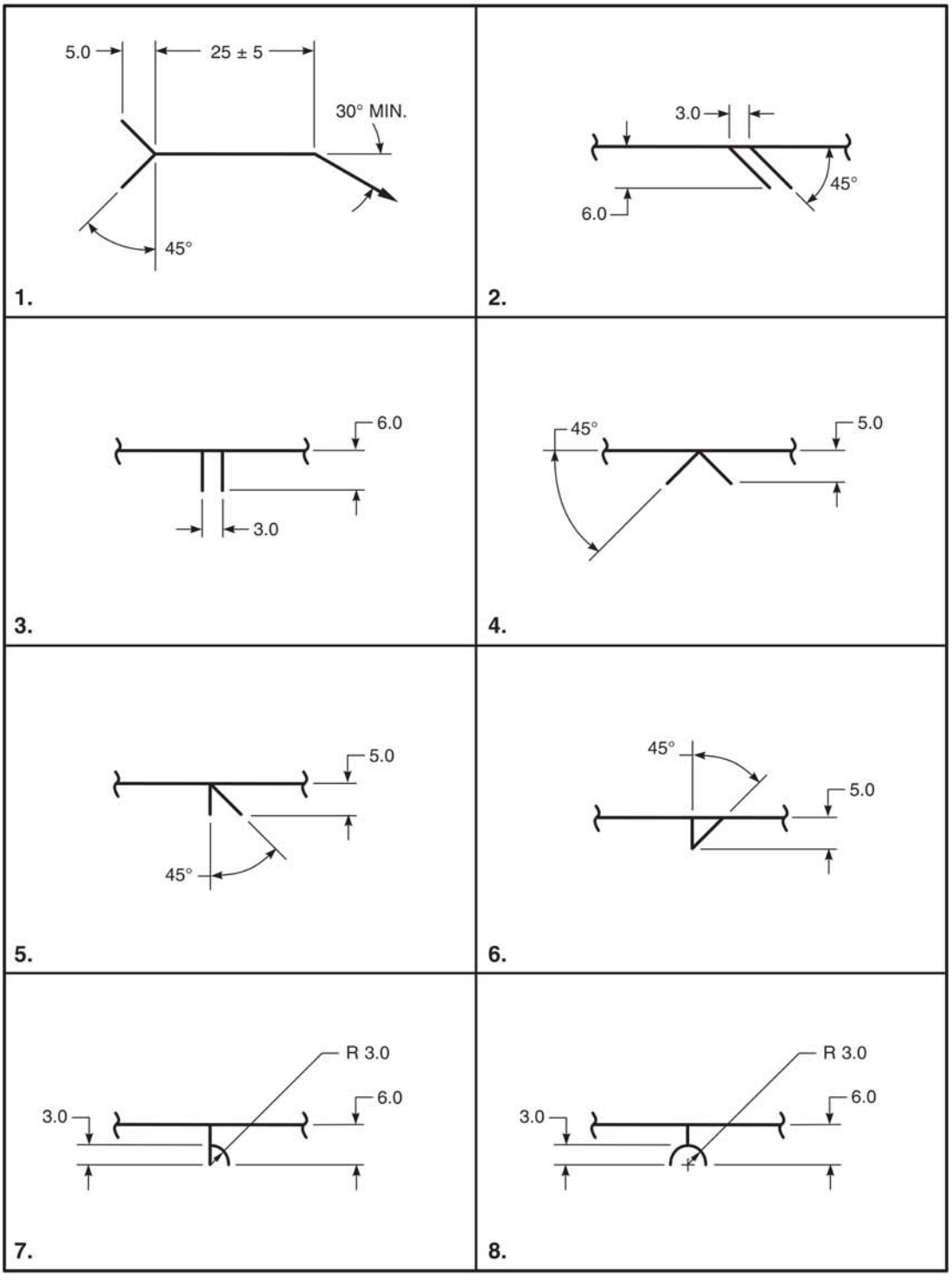
Notes:
1. Unless otherwise specified, tolerances shall be ±0.04 in or ±1°, as applicable.
2. All radii are minimum dimensions.

Annex C (Informative)
Design of Standard Symbols (SI Units)

This annex is not part of this standard but is included for informational purposes only.

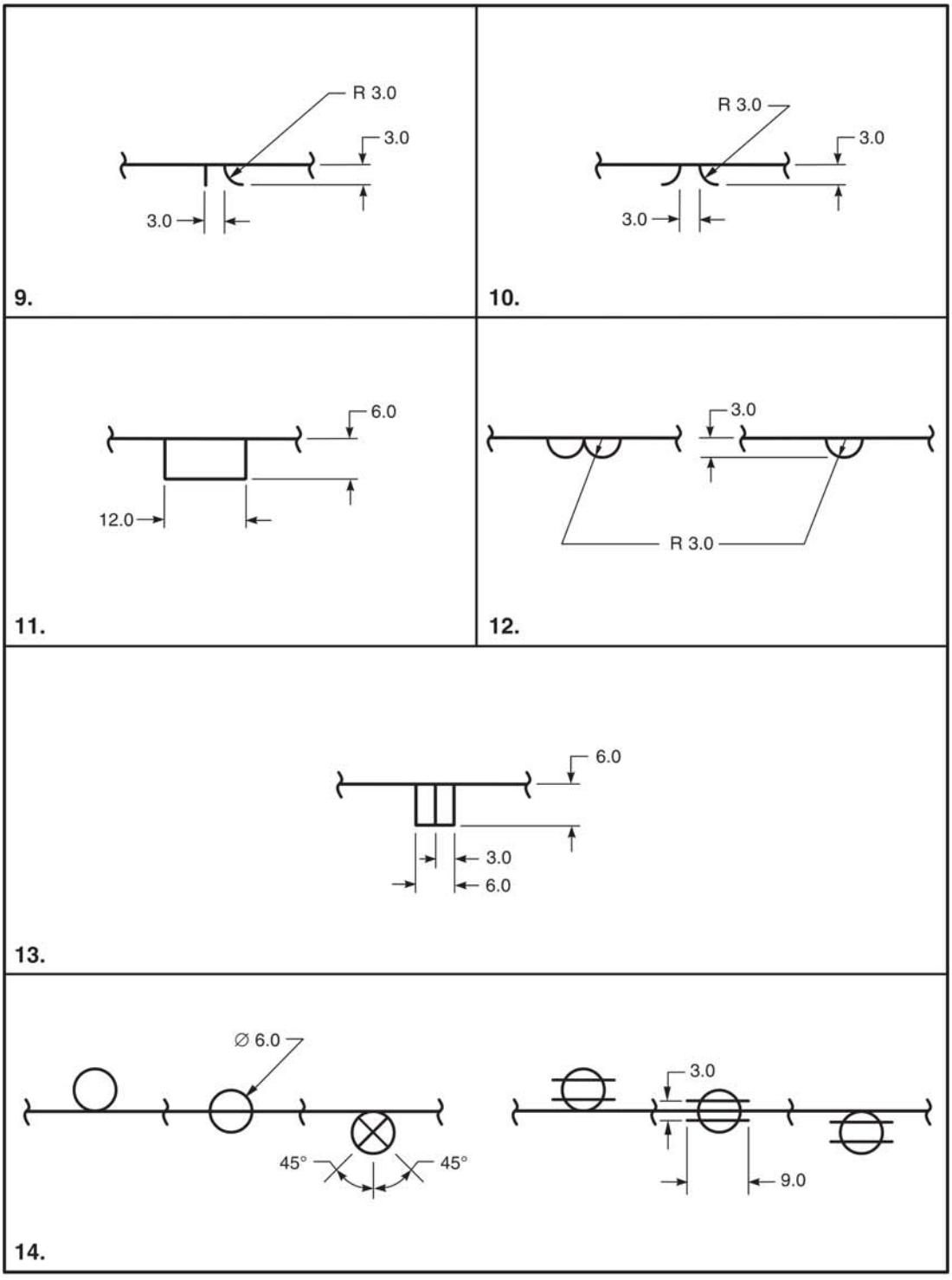
The dimensions shown in this annex are provided for reference purposes to keep the scale of the welding symbols consistent across the drawing. The font size chosen for the numerical and text portions of the welding symbols shall be easily read, consistent with the text provided in the remainder of the drawing and shall not overflow the field into which the required information needs to be provided as shown throughout the examples provided by this document.

Design of Standard Symbols (SI Units)



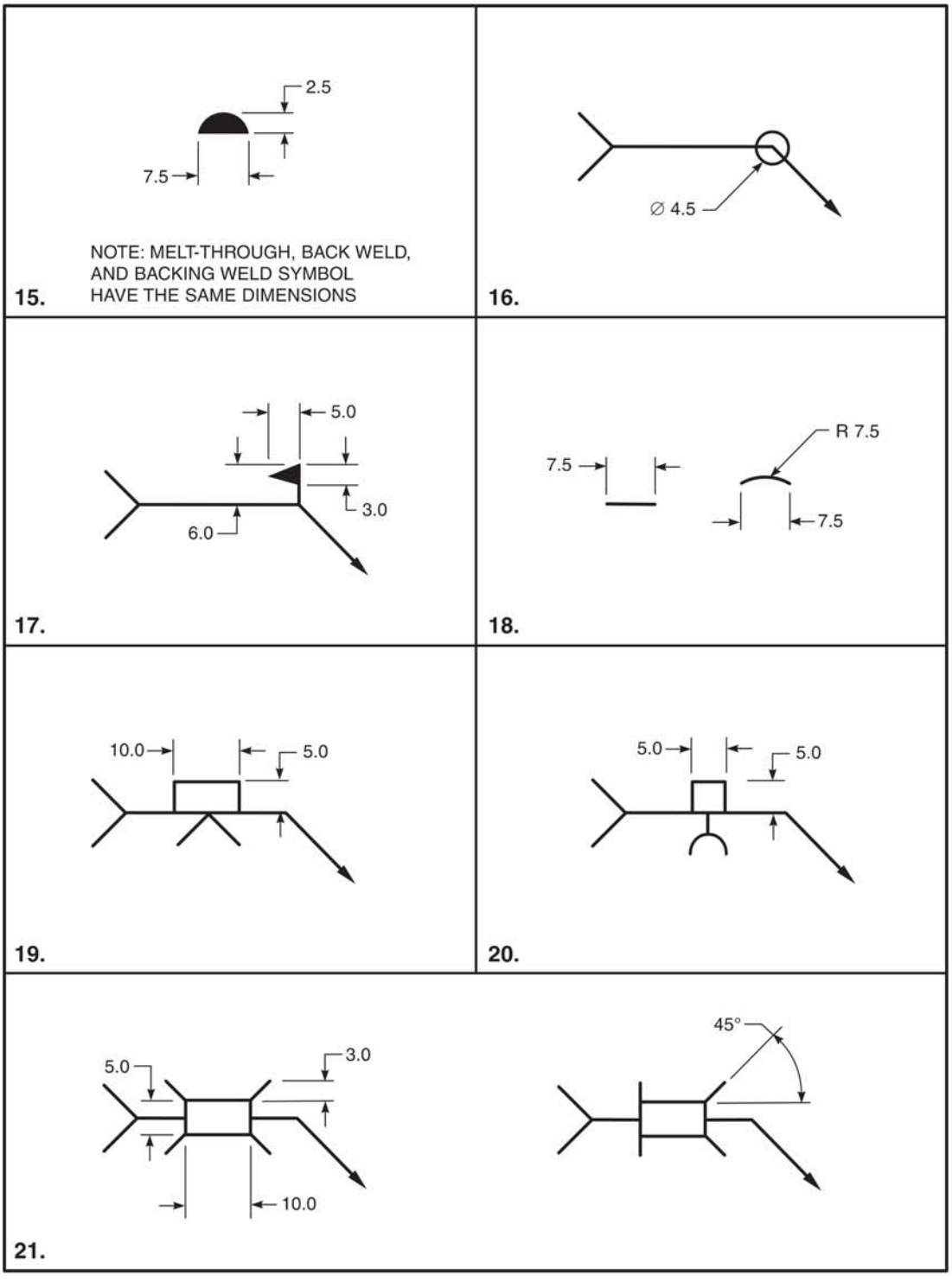
Notes:
1. Unless otherwise specified, tolerances shall be ±1 mm or ±1°, as applicable.
2. All radii are minimum dimensions.

Design of Standard Symbols (SI Units) (Continued)



Notes:
1. Unless otherwise specified, tolerances shall be ±1 mm or ±1°, as applicable.
2. All radii are minimum dimensions.

Design of Standard Symbols (SI Units) (Continued)



Notes:
1. Unless otherwise specified, tolerances shall be ±1 mm or ±1°, as applicable.
2. All radii are minimum dimensions.

Annex D (Informative)

Commentary on AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*

This annex is not part of this standard but is included for informational purposes only.

NOTE: Numbered subclauses in this annex relate to similarly numbered subclauses in the text of AWS A2.4, e.g., D6.9 is a commentary on 6.9 in the text.

D4.5 Welding Symbols. Figure 4.3 provides the generic appearance of a welding symbol. The letters S, D, A, R, L, P, and N within the figure are used as placeholders for specific numerical values used within the symbol to specify sizes for the features of the weld or welds indicated by the symbol. Letters such as these would not normally appear on finished drawings.

In addition to letters reflecting numerical values, the letter F is used as a placeholder for the letters corresponding to finishing designators as provided in 6.13.2 and 6.13.3, and the letter T refers to detailed process or specification references that may be shown in the tail of the welding symbol as provided in 6.12.

While 4.5 states the minimum required elements in a welding symbol are a reference line and arrow, it is good practice to include a weld symbol or other details to adequately communicate design intent; however, it is not a requirement. A welding symbol with only a reference line and an arrow and no other requirements will delegate welding details to the discretion of the fabricator. The end result may not meet the design intent.

D6.9 Field Weld Symbol. Welds are designated to be made in the field by the addition of the field weld symbol when the welding symbols are added to a drawing. It should be understood, however, that the placing of field weld symbols on drawings at the design stage does not preclude further discussion by the parties involved nor different decisions regarding where the welding will be done. If changes are made, the drawings should be revised and the field weld symbols should be added or deleted, as appropriate.

D6.10.2 Changes in the Direction of Welding. Abrupt changes in direction of welding are often accompanied by changes in the nature and direction of loading. As part of weldment design, the identification of an abrupt change in the direction of welding for a given application is beyond the scope of this standard. It may require changes to welding type or procedure(s) to produce welds that will perform safely and effectively in service. Welding techniques such as boxing or hold-backs may be necessary to satisfy design requirements. For these reasons, where an abrupt change in the direction of welding exists, it shall be addressed by using separate welding symbols to either side of the change, multiple arrow lines, or the all-around symbol. This determination should be made by the appropriate technical authority responsible for weldment design.

Square and Rectangular Tubing. The use of square and rectangular tubing has resulted in numerous applications involving joints in which the axes of the tubes are perpendicular such as a branch-to-header or a T-connection. The tubes are often of equal size, see Figure D1. It is intended that welds extend around the outside surface of the branch tube or stem of the T. The welds are usually fillet or square-groove on two of the opposite sides and flare-bevel-groove on the other two opposite sides.

The weld-all-around symbol is not appropriate to specify the welds described as the joints are not all of the same type and the welds may differ in size. Instead, two welding symbols should be used, each with two arrows pointing to the specific joints intended, one to specify the fillet or square-groove welds and the second to specify the flare-bevel-groove welds, as shown in Figure D1.

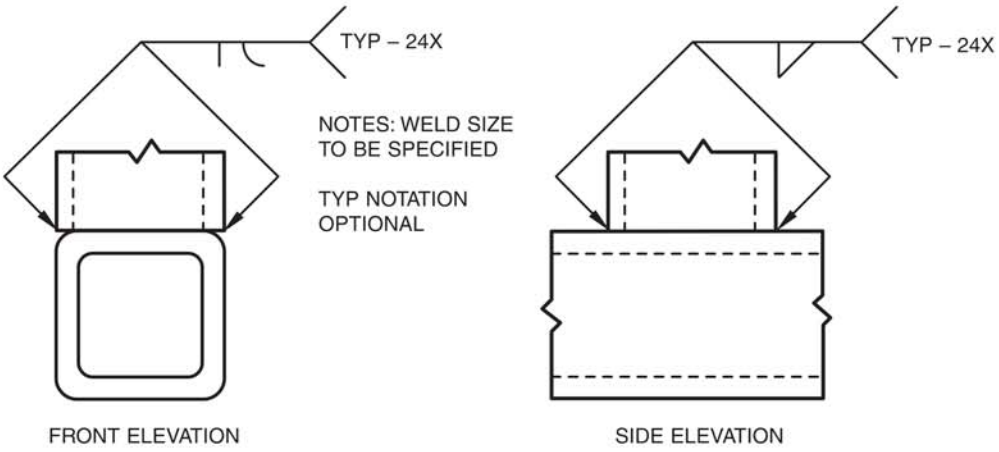


Figure D1—Examples of the Welding of Tubing

D6.11.1 Weld-All-Around Symbol—Welds in Multiple Directions or Planes. A continuous weld is one that has no breaks in its length and does not change in size, geometry, or weld type. Such a weld, extending around a series of connected joints and ending at the point of origin, may be specified by adding the weld-all-around symbol. The joint may require welding in different directions and positions and the welds may lie in more than one plane. The most common applications involve either fillet welds or square-groove welds and are often intended to provide a gas or liquid seal in addition to or in lieu of carrying the loads imposed on the joints. The weld-all-around symbol should not be used in place of the double-fillet or symmetrical double-groove weld symbols for specifying welds on both sides of the same thickness of base metal.

D6.12.3 Welding Symbols Designated "TYPICAL." The "TYPICAL" designation is intended as an alternative to repeating identical welding symbols many times on the same drawing, but only when the joints represented are identical in all details. The "TYPICAL" notation, usually abbreviated "TYP," is added to the tail of the welding symbol and all applicable joints shall be completely identified, e.g., "TYP at four stiffeners."

Misuse of the "TYPICAL" designation has caused many instances of confusion and fabrication errors by failing to completely identify all applicable joints or by identifying joints that might be similar but not identical. If more extensive information is required, it may be stated in a separate drawing note with a reference in the tail of the welding symbol.

D6.19 Changes in Joint Geometry During Welding. Groove weld joint geometry is sometimes changed as a result of specified welding operations. These changes in joint geometry are not to be included in the welding symbol. For example, a welding symbol could specify a V-groove weld on the arrow side of a joint and a square-groove weld on the other side of the joint with backgouging to sound metal, from the other side of the joint, using air carbon arc cutting. With the V-groove weld completed, the backgouging operation would be expected to produce a weld groove that could be described as a U-groove. This change in geometry, from a square-groove to a U-groove, is not to be specified in the welding symbol (see Figure D2).

D7.2.2 Complete Joint Penetration. Complete joint penetration is defined as a groove weld condition in which weld metal extends through the joint thickness. The simplest way of specifying a groove weld with complete joint penetration is to show no dimensions to the left of the groove weld symbol. This is the intent of 7.2.2. There are other ways by which complete joint penetration can be specified, including:

(1) Use of nonsymmetrical and symmetrical double-groove welds (7.2.4),

(2) Inclusion of CJP in the tail of the welding symbol (7.2.8),

(3) Back or backing welds (7.7), and

(4) Joints with backing (7.8).

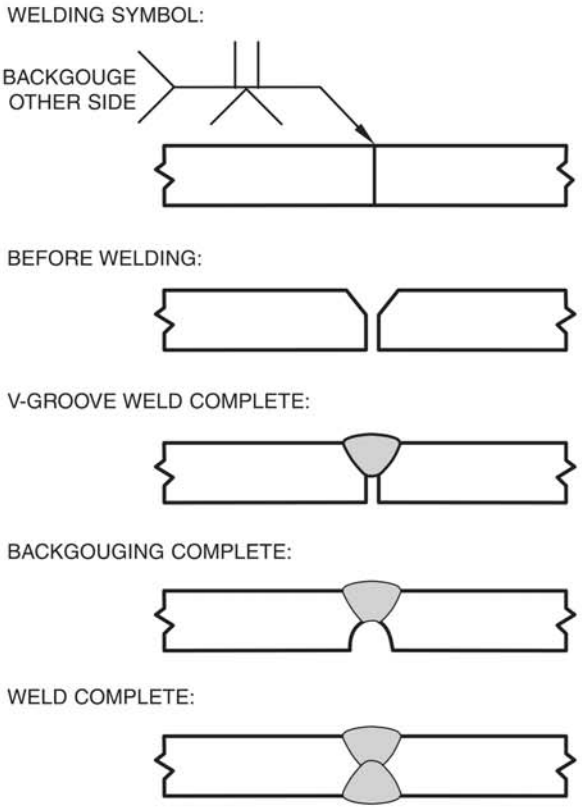


Figure D2—Changes in Joint Geometry During Welding

The provision in 7.2.8 is included for use on design drawings where there is insufficient information available as to what equipment might be used or, in some cases, what company or organization might do the work. For example, the design drawings might be completed prior to the job being submitted for bids. In these situations, it is considered good practice to require the successful bidder to submit construction drawings complete with detailed welding symbols for review. The other methods identified above require knowledge of the specific welding situation and also the requirements of any codes or specifications that might apply.

D7.2.10 Flare-Groove Welds. Although flare-groove welds are included in the section on groove welds, they are special cases as they do not conform to all of the accepted conventions associated with other groove weld types. The dimensions corresponding to "groove depth" and "groove angle" in a normal groove weld are functions of the curvature of the base metal in a flare-groove weld and therefore beyond the usual controls of either the designer or the welder.

Of even greater importance is the concept of complete joint penetration, which is not attainable in many flare- groove welds since the fusion occurs along the surface of one or both members rather than through the thickness. The rate of curvature on one or both members is such that the actual obtainable weld size is usually only some fraction of the radius (see Figure D3).

D7.12 Seal Welds. The primary function of a weld may be to contain fluids or gases; however, it will not perform this function if it cracks as a result of stresses caused by handling, storage, shipping, vibrations, temperature changes, and so forth. For these reasons, a seal weld may require careful consideration regarding weld size as well as the type. A welding symbol with only "SEAL WELD" in the tail and no other requirements will delegate welding details to the discretion of the fabricator. The end result may not meet the design intent.

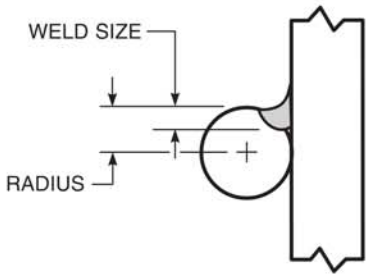


Figure D3—Example of a Flare Groove Weld

D7.14 Combination Groove Weld Symbols. This standard uses ideographic weld symbols that approximate actual weld joint conditions. Combination groove weld symbols are used to better represent nonsymmetrical geometry for certain joint preparations. Any combination of groove weld symbols on the same side of a reference line will result in one element being reversed. Expanding the options for a designer to accurately convey design intent justifies this departure from weld symbol convention of 6.3.

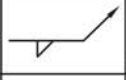
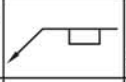
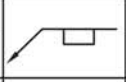
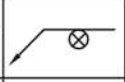
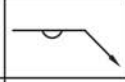
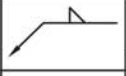
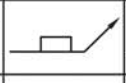
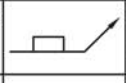
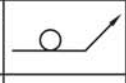
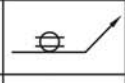
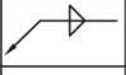
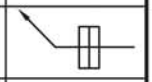
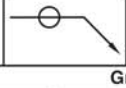
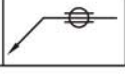
Annex E (Informative)
Welding Symbol Chart

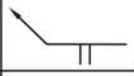
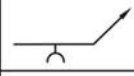
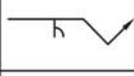
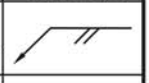
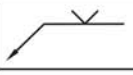
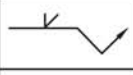
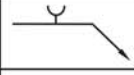
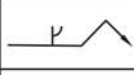
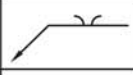
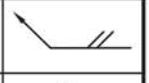
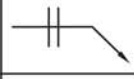
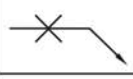
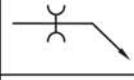
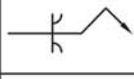
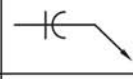
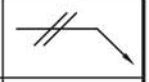
This annex is not part of this standard but is included for informational purposes only.

The welding symbol chart included in AWS A2.4 is intended to provide basic information and often-used symbols in a convenient form as a shop or drafting room aid. The chart is published separately from, but concurrently with, AWS A2.4 in wall size and desk size formats. Over the years, the chart has been reproduced and distributed by other sources both with and without the permission of AWS. Consequently, many obsolete and error-filled versions are in existence. The reader is advised and cautioned that the only complete and approved version is in the latest edition of AWS A2.4.

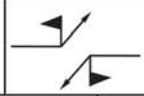
American Welding Society Welding Symbol Chart

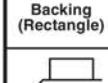
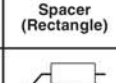
Basic Weld Symbols and Their Location Significance within the Welding Symbol

Location Significance	Fillet	Plug	Slot	Spot or Projection	Stud	Seam	Back or Backing	Surfacing	Edge
Arrow Side									
Other Side					Not Used			Not Used	
Both Sides		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	
No Arrow Side or Other Side Significance	Not Used	Not Used	Not Used		Not Used		Not Used	Not Used	Not Used

Location Significance	Groove							Scarf for Brazed Joint
	Square	V	Bevel	U	J	Flare-V	Flare-Bevel	
Arrow Side								
Other Side								
Both Sides								
No Arrow Side or Other Side Significance	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used

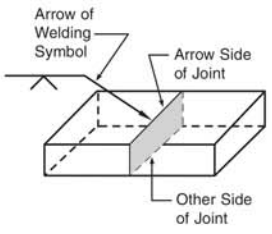
Supplementary Symbols

Weld-All-Around	Field Weld	Melt-Through	Consumable Insert (Square)
			

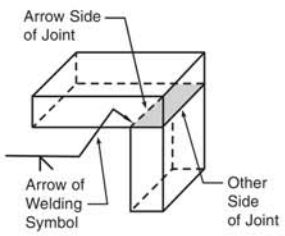
Backing (Rectangle)	Spacer (Rectangle)	Contour		
		Flush or Flat	Convex	Concave
				

Basic Joint Types
Identification of Arrow Side and Other Side Joint

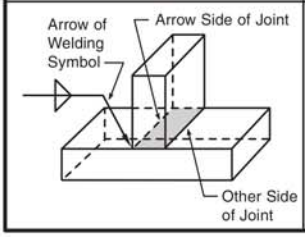
Butt Joint



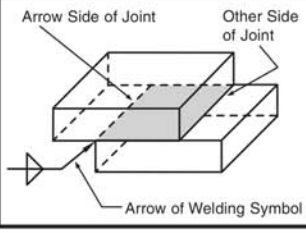
Corner Joint



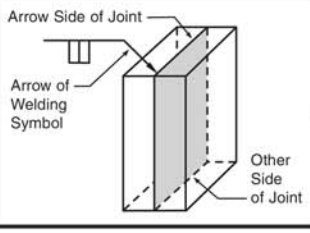
T-Joint



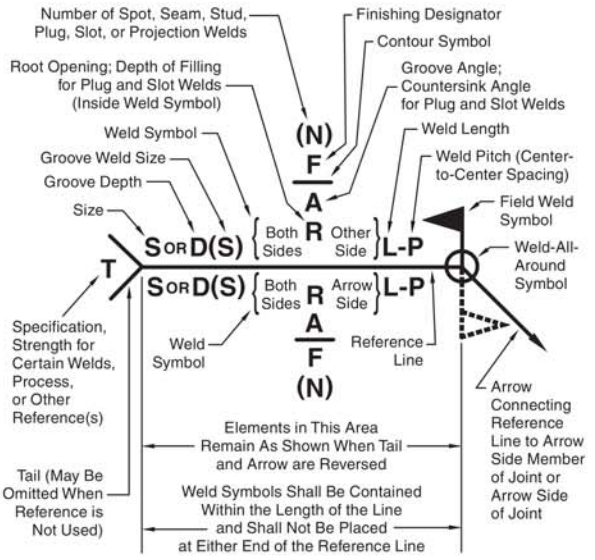
Lap Joint



Parallel Joint



Standard Location of the Elements of a Welding Symbol



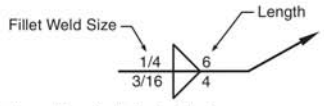
Letter Designations

Where letter designations are to be included in the tail of the welding symbol, refer to Annex A (Normative) Tables of AWS A2.4:2020.

American Welding Society Welding Symbol Chart

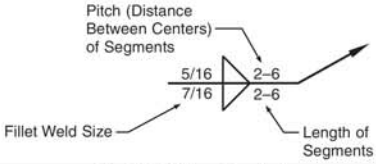
Typical Welding Symbols

Double-Fillet Welding Symbol

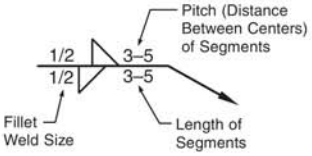


Omission of Length Indicates that Weld Extends Between Abrupt Changes in Direction or as Dimensioned

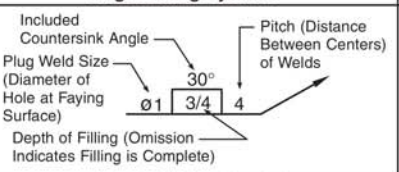
Chain Intermittent Fillet Welding Symbol



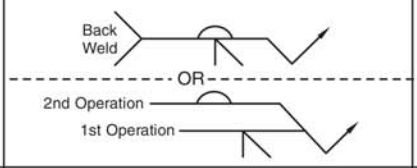
Staggered Intermittent Fillet Welding Symbol



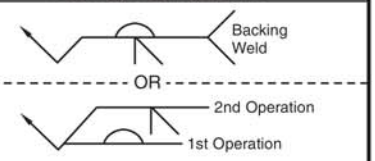
Plug Welding Symbol



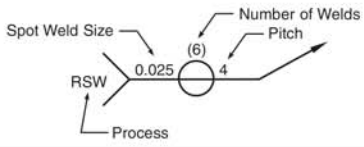
Back Welding Symbol



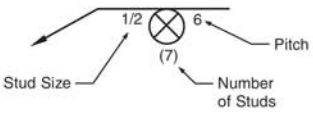
Backing Welding Symbol



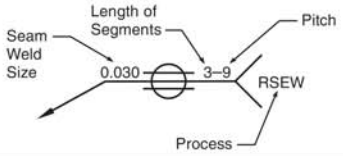
Spot Welding Symbol



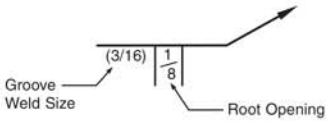
Stud Welding Symbol



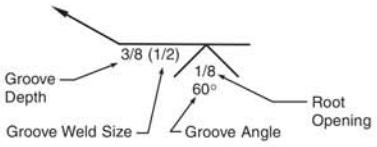
Seam Welding Symbol



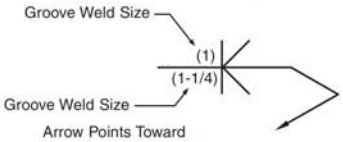
Square-Groove Welding Symbol



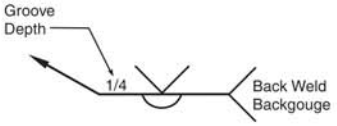
V-Groove Welding Symbol



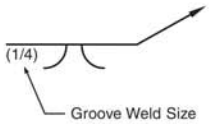
Double-Bevel-Groove Welding Symbol



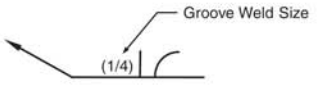
Symbol with Backgouging



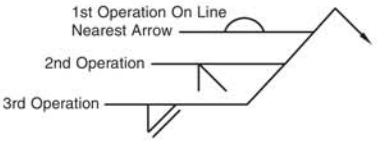
Flare-V-Groove Welding Symbol



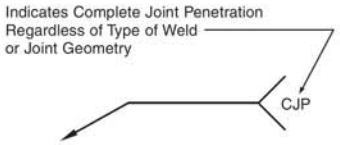
Flare-Bevel-Groove Welding Symbol



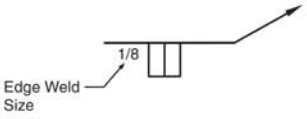
Multiple Reference Lines



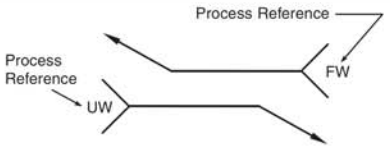
Complete Joint Penetration



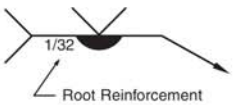
Edge Welding Symbol



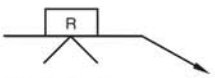
Welding Process Reference



Melt-Through Symbol



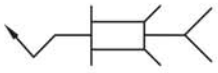
Joint with Backing



'R' Indicates Backing Removed After Welding

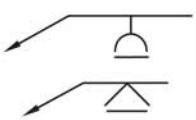
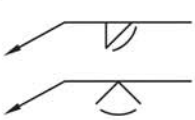
Joint with Spacer

With Modified Groove Weld Symbol



Double-Bevel Groove

Contour Symbols

Flush	Flat	Convex	Concave
			

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Annex F (Informative)

ISO 2553 Welding Symbols

This annex is not part of this standard but is included for informational purposes only.

The American Welding Society's A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, presents a system for indicating welding, brazing, and nondestructive examination requirements. Another system, developed by the International Organization for Standardization (ISO), ISO 2553, *Welding and allied processes — Symbolic representation on drawings — Welded joints*, originates outside of the United States and like AWS A2.4 is widely used. The welding symbols are very similar to AWS A2.4; nevertheless, the two systems have differences that can cause interpretation difficulties for the unacquainted user.

The global marketplace has resulted in a need for fabricators and users/developers of drawings to become aware of the ISO welding symbols. This annex serves as an introduction to the ISO welding symbols and is not intended to replace the ISO document. The user is cautioned to refer to the primary document as required by contract and specification.

F1. Terms and Definitions

In addition to weld and welding symbols, ISO 2553 uses terms and definitions that may differ from those in AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*. Caution should be exercised when converting ISO requirements to standard AWS usage.

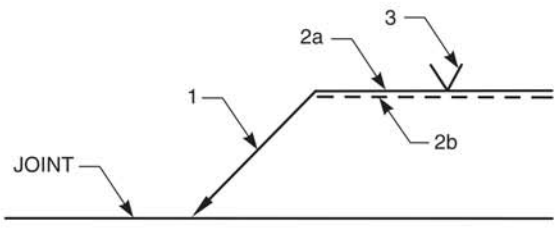
F2. Units of Measure

ISO 2553 requires metric units whereas AWS A2.4 allows either U.S. Customary or metric units to be used on drawings.

F3. Reference Line

The ISO 2553 standard provides two systems for reference lines, termed "System A" and "System B," which differ in how the arrow side and other side are indicated.

The ISO 2553 System A welding symbol has dual horizontal lines consisting of one continuous reference line and one dashed identification line.



1. ARROW LINE
2a. REFERENCE LINE (CONTINUOUS LINE)
2b. IDENTIFICATION LINE (DASHED LINE)
3. WELDING SYMBOL

The dashed identification line is used to indicate the other side of the joint. Information applicable to the arrow side of a joint is placed on the solid reference line. Information applicable to the other side of a joint is placed on the dashed identification line. CAUTION: The dashed identification line may be drawn above or below the solid reference line; a symbol placed on the solid reference line is always applicable to the arrow side of the joint and a symbol on the dashed identification line is always applicable to the other side of the joint, regardless of whether the dashed identification line is placed above or below the solid reference line.

The ISO 2553 System B welding symbol functions similarly to the AWS A2.4 welding symbol. It has a single continuous reference line, with the symbol below the reference line indicating the weld on the arrow side, and the symbol above the reference line indicating the weld on the other side.

Examples of these systems are given in Figure F1:

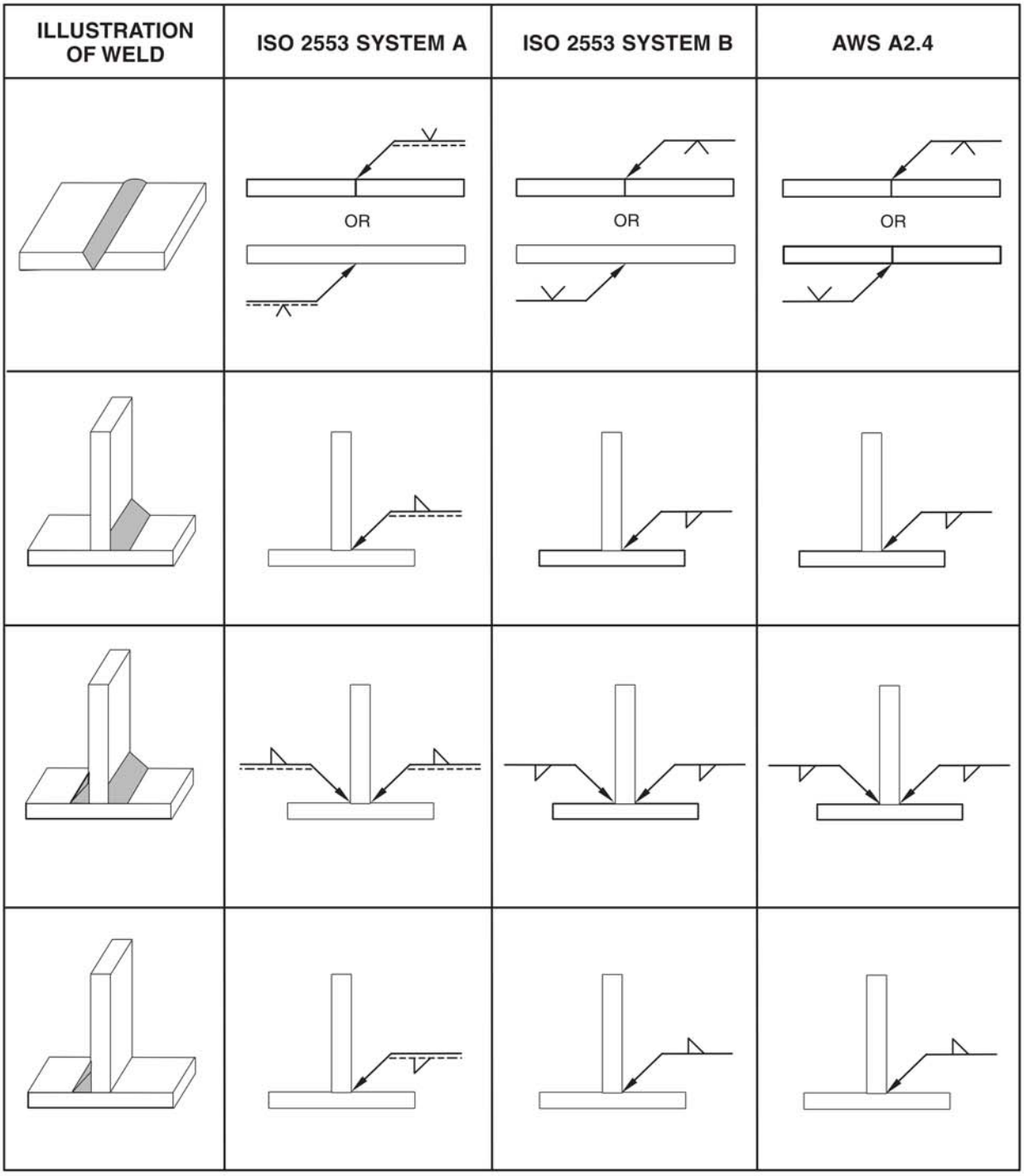
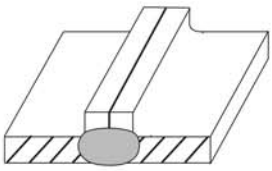
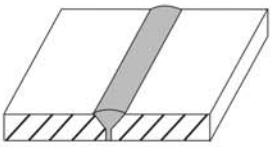
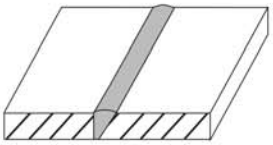
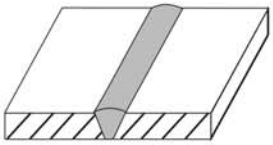
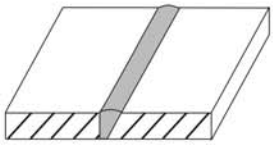
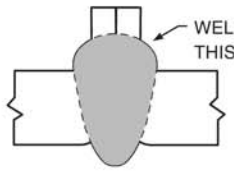
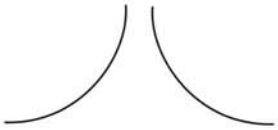
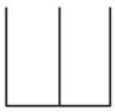
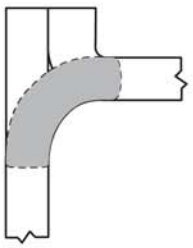
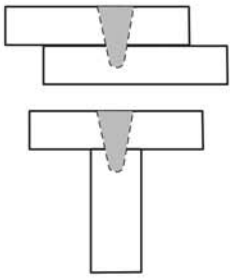


Figure F1—Comparison of ISO and AWS Welding Symbols

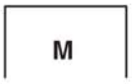
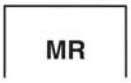
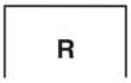
F4. Weld Symbols

The following figure illustrates some differences between ISO and AWS weld symbols. Where a reasonable comparison exists between the two standards for a particular configuration, both are given. In several cases, ISO 2553 provides symbols that have no direct counterpart in AWS A2.4. In these cases, "no symbol" is shown in the AWS A2.4 column.

WELD EXAMPLE	ISO 2553	AWS A2.4
	 BUTT WELD BETWEEN PLATES WITH RAISED EDGES	 FLARE-V-GROOVE
	 SINGLE-V BUTT WELD WITH BROAD FACE ROOT	(NO SYMBOL)
	 SINGLE BEVEL BUTT WELD WITH BROAD FACE ROOT	(NO SYMBOL)
	 STEEP-FLANKED SINGLE V BUTT WELD	(NO SYMBOL)[a] [a]USE COMPARABLE V GROOVE SYMBOL WITH DIMENSION INFORMATION
	 STEEP-FLANKED SINGLE BEVEL BUTT WELD	(NO SYMBOL)[b] [b]USE COMPARABLE BEVEL GROOVE SYMBOL WITH DIMENSION INFORMATION

WELD EXAMPLE	ISO 2553	AWS A2.4
	 FLANGED BUTT/CORNER WELD	 EDGE WELD
		
	 STAKE WELD	(NO SYMBOL)[c] [c] USE COMPARABLE SPOT OR SEAM WELD SYMBOL WITH PROCESS INFORMATION

Supplemental symbols are noted below. For the most part, ISO closely follows the AWS symbology; however, the additional symbol indicating the grinding of weld toes is new to U.S. fabricators.

ISO 2553	AWS A2.4
 TOES SHALL BE BLENDED SMOOTH	(NO SYMBOL)
 BACKING (UNSPECIFIED)  PERMANENT BACKING	 BACKING
 REMOVABLE BACKING	 BACKING REMOVED AFTER WELDING

F5. Fillet Weld Symbols

Fillet weld dimensioning is an area where ISO 2553 is significantly different from AWS A2.4 as shown in Figure F2. ISO 2553 requires either "*a*" or "*z*" to be placed in front of the fillet weld size dimension to differentiate between welds measured by throat or leg. The fillet weld dimension preceded by the designator "*a*" represents a fillet weld defined by the throat dimension. The fillet weld dimension preceded by the designator "*z*" represents leg length. To convert the throat thickness to a leg length, use the following equation:

$$z = a\sqrt{2}$$

In AWS A2.4, the fillet weld size is always based on the leg dimension.

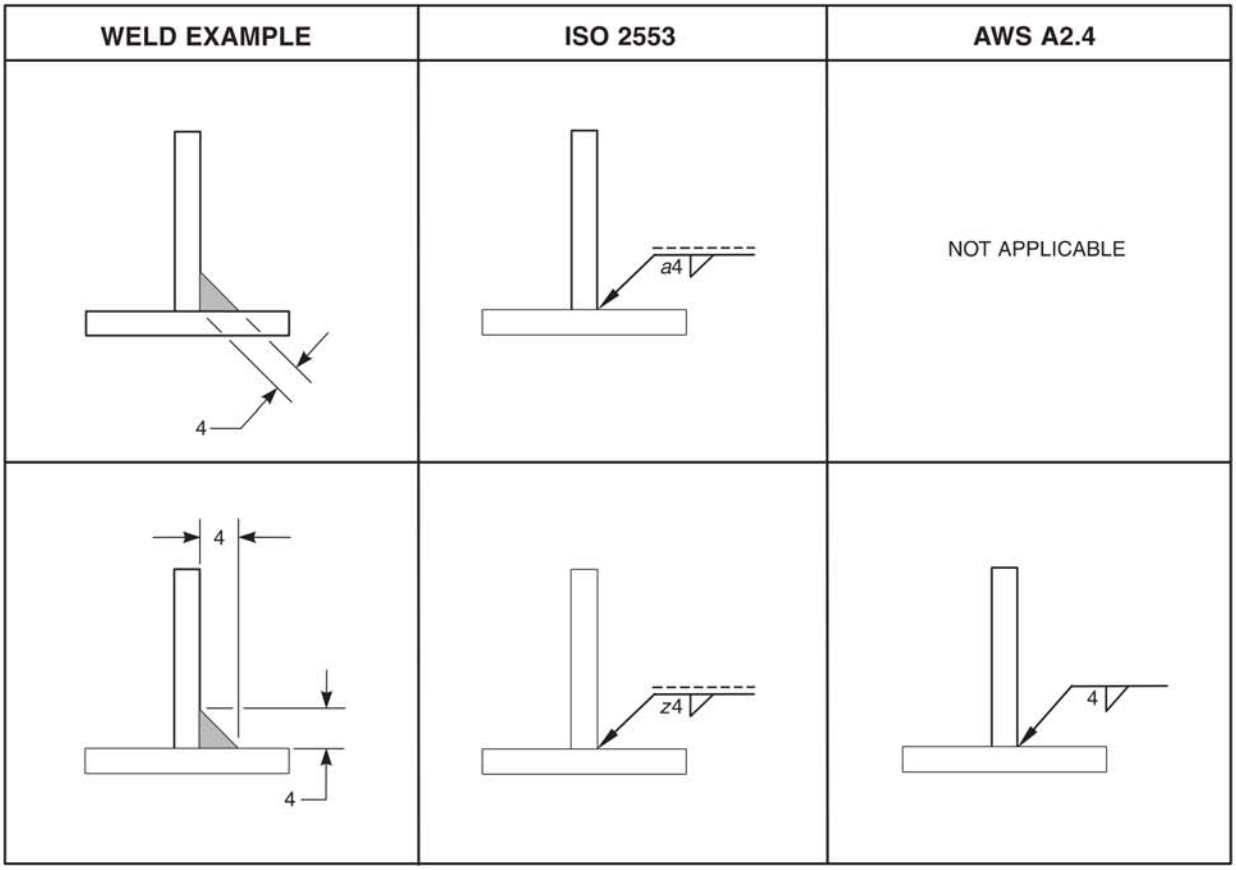
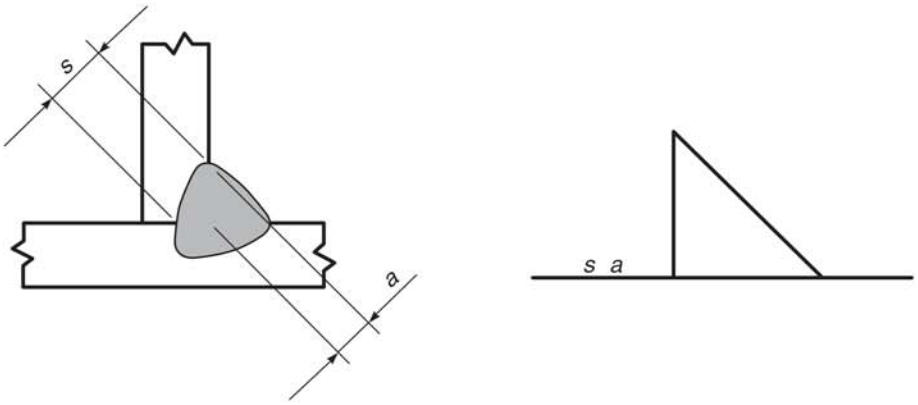


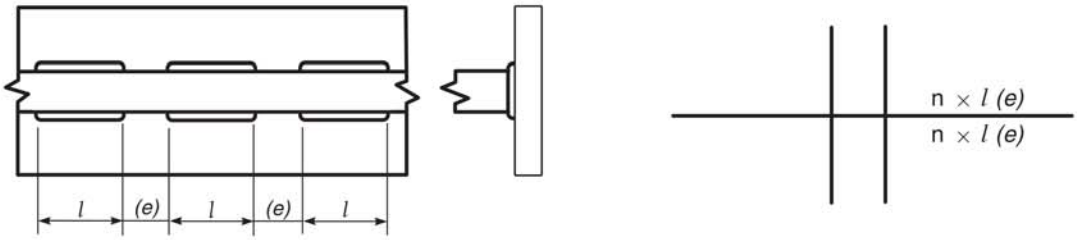
Figure F2—Comparison of the Fillet Weld with the Modifier "*a*" or "*z*"

In some instances, an additional dimension, indicated with the letter "s," may be included along with the throat size "a" to indicate the required deep penetration throat thickness as shown below:



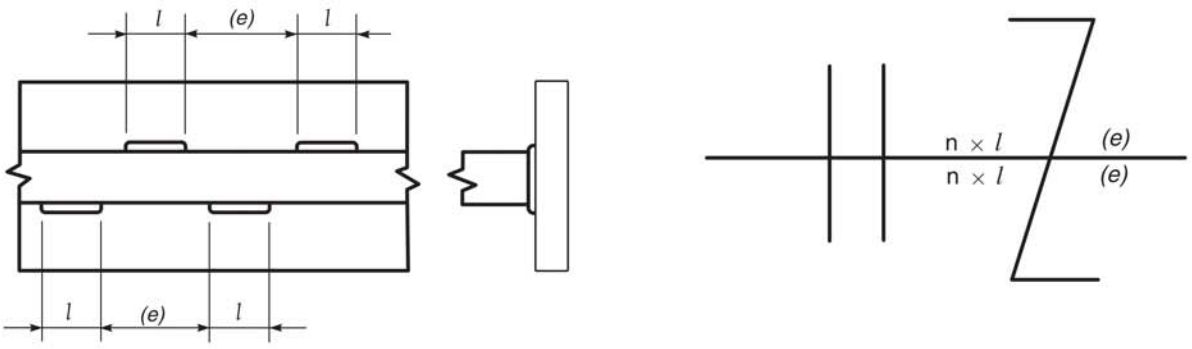
F6. Intermittent Welds

ISO 2553 defines intermittent welds by the number of weld elements, the nominal weld length elements, and a distance between the weld elements as shown:



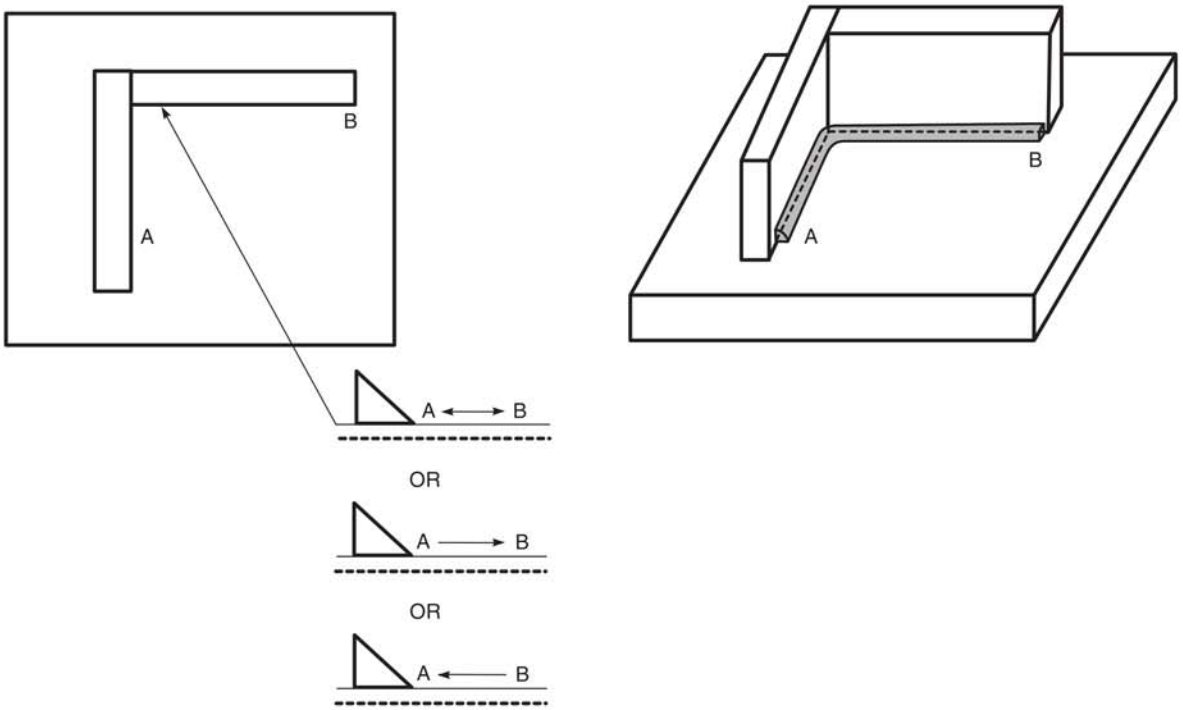
This is in contrast to AWS A2.4 which defines intermittent welds only using the length and pitch of the weld elements.

The symbolic representation of staggered intermittent welds also differs significantly. While AWS A2.4 indicates staggered welds by offsetting the weld symbol on the arrow side from the symbol on the other side, in ISO 2553 the symbols remain aligned but employ a separate "Z" symbol to indicate staggered welds as shown below. Note the distance between weld segments (in parentheses) is shown to the right of this symbol.



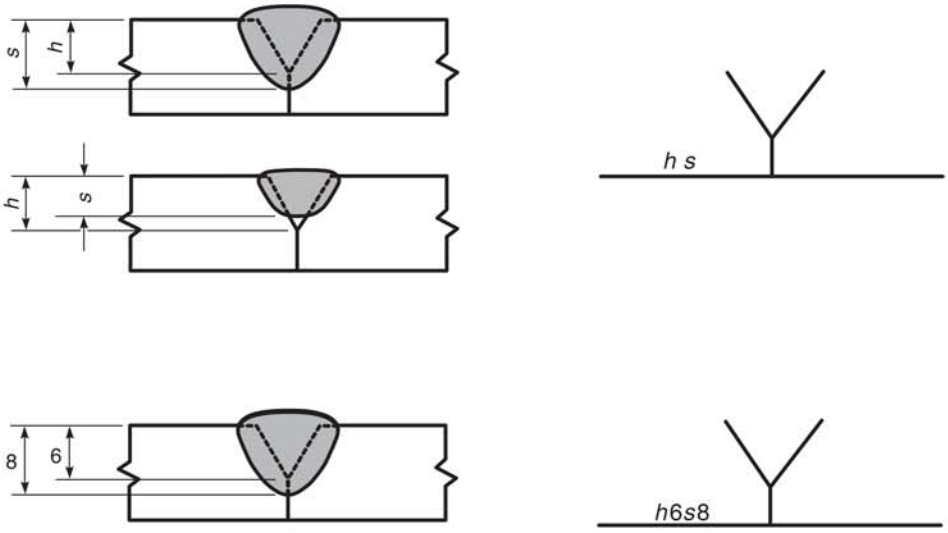
F7. Weld Between Two Points

ISO 2553 provides a means of designating a continuous weld of the same type extending between two points as shown below. The end points of the weld along with the joint to be welded shall be clearly indicated.



F8. Groove/Butt Weld Dimensions

To dimension groove/butt weld penetration depth (size) and preparation depth, ISO 2553 employs a slightly different standard than AWS A2.4. The letters "h" and "s" are used to represent the groove preparation depth and weld size respectively. The order of listing these dimensions is the same as AWS A2.4 — first preparation depth followed by weld size. ISO 2553 requires that the corresponding letter precede the value for the dimension. See examples below.



Annex G (Informative)
Informative References

This annex is not part of this standard but is included for informational purposes only.

AWS A1.1, *Metric Practice Guide for the Welding Industry*, American Welding Society.

AWS A5.30/A5.30M, *Specification for Consumable Inserts*

AWS B1.10M/B1.10, *Guide for the Nondestructive Examination of Welds*

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

ISO 2553, *Welding and allied processes — Symbolic representation on drawings — Welded joints*

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Annex H (Informative)

Requesting an Official Interpretation on an AWS Standard

This annex is not part of this standard but is included for informational purposes only.

H1. Introduction

The following procedures are here to assist standard users in submitting successful requests for official interpretations to AWS standards. Requests from the general public submitted to AWS staff or committee members that do not follow these rules may be returned to the sender unanswered. AWS reserves the right to decline answering specific requests; if AWS declines a request, AWS will provide the reason to the individual why the request was declined.

H2. Limitations

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees. 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.

H3. General Procedure for all Requests

H3.1 Submission. All requests shall be sent to the Managing Director, AWS Standards Development. For efficient handling, it is preferred that all requests should be submitted electronically through standards@aws.org. Alternatively, requests may be mailed to:

Managing Director
Standards Development
American Welding Society
8669 NW 36 St, # 130
Miami, FL 33166

H3.2 Contact Information. All inquiries shall contain the name, address, email, phone number, and employer of the inquirer.

H3.3 Scope. Each inquiry shall address one single provision of the standard unless the issue in question involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the request along with the edition of the standard (e.g., D1.1:2006) that contains the provision(s) the inquirer is addressing.

H3.4 Question(s). All requests shall be stated in the form of a question that can be answered 'yes' or 'no'. The request shall be concise, yet complete enough to enable the committee to understand the point of the issue in question. When the point is not clearly defined, the request will be returned for clarification. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annexes) that bear on the issue in question shall be cited.

H3.5 Proposed Answer(s). The inquirer shall provide proposed answer(s) to their own question(s).

H3.6 Background. Additional information on the topic may be provided but is not necessary. The question(s) and proposed answer(s) above shall stand on their own without the need for additional background information.

H4. AWS Policy on Interpretations

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 official interpretations are approved by the technical committee that is responsible for the standard. Communication concerning an official interpretation is directed through the AWS staff member who works with that technical committee. The policy requires that all requests for an official interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the procedures that must be followed, some requests for an official interpretation may take considerable time to complete.

H5. AWS Response to Requests

Upon approval by the committee, the interpretation is an official interpretation of the Society, and AWS shall transmit the response to the inquirer, publish it in the *Welding Journal*, and post it on the AWS website.

H6. 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.

List of AWS Documents on Definitions and Symbols

Designation	Title
A2.1-WC[a]	*Welding Symbol Chart Wall Size*
A2.1-DC[a]	*Welding Symbol Chart—Desk Size*
A2.1-WC XL[a]	*Welding Symbol Chart—X-Large Wall Size*
A2.4	*Standard Symbols for Welding, Brazing, and Nondestructive Examination*
A3.0M/A3.0	*Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*
A3.1	*Master Chart of Welding and Joining Processes*

[a] A reproduction of the charts is shown in Annex E. It should be understood that these charts are intended only as shop aids. The only complete and official presentation of the Standard Welding Symbols is in AWS A2.4.

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