

Standard Symbols for Welding, Brazing, and Nondestructive Examination



American Welding Society®



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Standard Symbols for Welding, Brazing, and Nondestructive Examination

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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. Detailed information and examples are provided for the construction and interpretation of these symbols. This system provides a means of specifying welding or brazing operations as well as nondestructive examination, including the examination method, frequency, and extent.



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Personnel

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J. P. Christein, Vice Chair	<i>Huntington Ingalls Industries—Newport News Shipbuilding</i>
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C. Lander	<i>St. John Inspection Services</i>
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W. F. Qualls	<i>Consultant</i>
J. J. Vagi	<i>Engineering Consultant</i>
J. L. Warren	<i>CNH America, LLC</i>
B. D. Worley	<i>GE Aviation, Dayton—Elano Division</i>

Advisors to the AWS A2 Committee on Definitions and Symbols

J. E. Greer	<i>Moraine Valley College</i>
L. J. Siy	<i>Consultant</i>

AWS A2C Subcommittee on Symbols

J. P. Christein, Chair	<i>Huntington Ingalls Industries—Newport News Shipbuilding</i>
J. J. Gullotti, Vice Chair	<i>Electric Boat Corporation</i>
S. N. Borrero, Secretary	<i>American Welding Society</i>
C. K. Ford	<i>Hobart Institute of Welding Technology</i>
C. Lander	<i>St. John Inspection Services</i>
P. M. Newhouse	<i>BC Hydro Engineering—Quality Assurance</i>
J. L. Warren	<i>CNH America, LLC</i>
B. D. Worley	<i>GE Aviation, Dayton—Elano Division</i>

Advisors to the AWS A2C Subcommittee on Symbols

L. J. Barley	<i>OTC—Daihen</i>
D. M. Beneteau	<i>Centerline (Windsor) Limited</i>
B. Galliers	<i>General Electric Aviation</i>
R. L. Holdren	<i>Applications Technologies Company, LLC</i>
L. J. Siy	<i>Consultant</i>

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Foreword

This foreword is not part of AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, 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 among the design, fabrication, and inspection personnel. Statements such as “to be welded throughout” or “to be completely welded,” in effect, transfer the design responsibility from the designer to production personnel, who cannot be expected to know design requirements.

The symbols presented in this standard provide the means for placing welding, brazing, and nondestructive examination information on 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.

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	<i>Symbols for Welding and Nondestructive Testing;</i>
ANSI/AWS A2.4-79	<i>Symbols for Welding and Nondestructive Testing, Including Brazing;</i>
ANSI/AWS A2.4-86	<i>Standard Symbols for Welding, Brazing, and Nondestructive Examination;</i>
ANSI/AWS A2.4-93	<i>Standard Symbols for Welding, Brazing, and Nondestructive Examination;</i>
ANSI/AWS A2.4-98	<i>Standard Symbols for Welding, Brazing, and Nondestructive Examination;</i> and
AWS A2.4:2007	<i>Standard Symbols for Welding, Brazing, and Nondestructive Examination.</i>

This seventh edition of AWS A2.4 has undergone extensive formatting modifications locating the figures closer to their referencing clauses. Numerous figures and clauses were revised and new figures added for clarification purposes. Several illustrations were added with the intent of making the standard more user-friendly. For example, Figures 47 and 48 have been added to illustrate the application of intermittent edge welds, which had previously lacked illustration. In addition, a new Informative Annex F, *ISO 2553 Welding Symbols*, was added to introduce users to ISO welding symbols. This introduction is educational and not intended to replace the official ISO document. Many of the modifications made were the result of comments and suggestions from the users of this standard.

This new edition also contains some revised technical content. For user clarity, the depth of groove placeholder “S” has been replaced by “D”, and the groove weld size “(E)” has been replaced by “(S)” throughout the standard for groove welds. The history behind the “(E)” was to designate effective throat dimension for the groove weld size. These letter modifications will not alter the meaning of the groove welding symbol. Letters only reflect a placeholder for a numerical value and thus will not change the meaning of any existing or future use of the groove welding symbol. In addition, this letter modification will line up with the AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*, methodology. Another change introduced is the standardization of the term “Depth of Groove” throughout the standard. In past revisions, “Depth of Bevel” was used randomly in place of “Depth of Groove.” This change was made since a bevel weld symbol is only one symbol of the groove weld symbol family.

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

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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.

The figures included with the text are intended to show how the correct format and applications of symbols may be used to convey welding, brazing, and nondestructive examination information. They are not intended to represent recommended welding, brazing, nondestructive examination, or design practice.

The clause addressing brazing uses the same symbols that are used for welding. The clause on nondestructive examination symbols establishes the symbols to be used on drawings to specify nondestructive examination for determining the suitability of components. The nondestructive examination symbols included in this standard represent nondestructive examination methods as discussed in the latest edition of AWS B1.10M/B1.10, *Guide for the Nondestructive Examination of Welds*. Definitions and the details for the use of the various nondestructive examination methods are found in AWS B1.10M/B1.10.

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) Material 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 standards listed below contain provisions that, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

American Welding Society (AWS) standards:¹

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

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

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

3. Terms and Definitions

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

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

Soldering, Thermal Cutting, and Thermal Spraying, provides the basis for terms and definitions used herein.

4. Basic Welding Symbols

4.1 Distinction between Weld Symbol and Welding Symbol. This standard makes 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 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 1. The symbols shall be drawn in contact with the reference line.

GROOVE							
SQUARE	SCARF	V	BEVEL	U	J	FLARE-V	FLARE-BEVEL

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

Note: The reference line is shown as a dashed line for illustrative purposes.

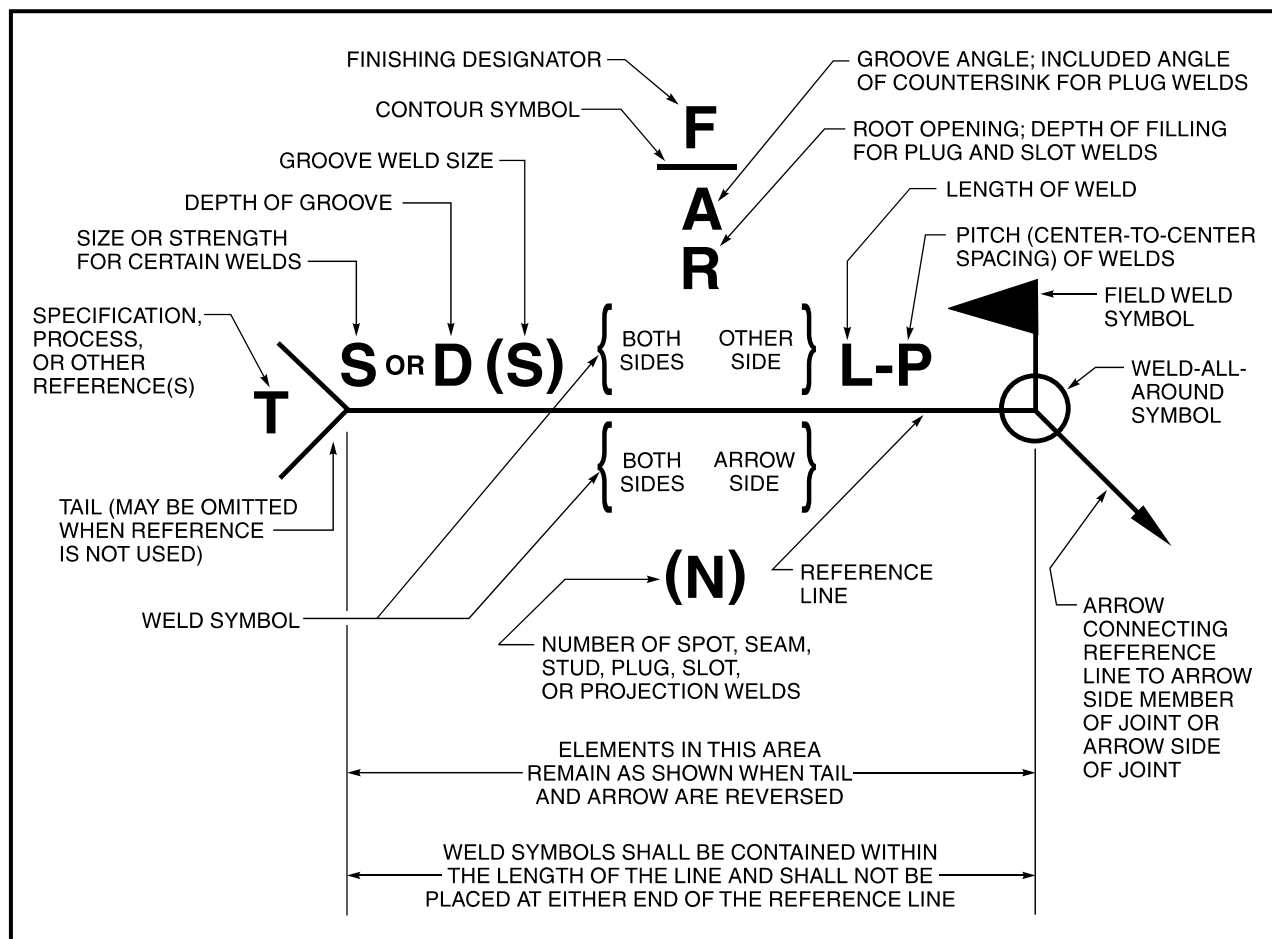
Figure 1—Weld Symbols

4.4 Supplementary Welding Symbols. Supplementary symbols to be used in connection with welding symbols shall be as shown in Figure 2.

4.5 Welding Symbols. A welding symbol may consist of several elements (see Figure 3). Only a horizontal reference line and the arrow are required elements. Additional

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

Figure 2—Supplementary Symbols



Note: See D4.5 in Annex D for commentary on Figure 3.

Figure 3—Standard Location of the Elements of a Welding Symbol

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 specification, process, 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 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 Placement of the Welding Symbol. 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.

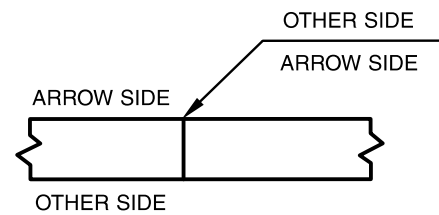
4.7 Illustrations. The examples given, including the dimensions, are illustrative only and are intended to demonstrate the proper application of drafting practices. They are not intended to represent design practices or to replace code or specification requirements.

5. Joint Types

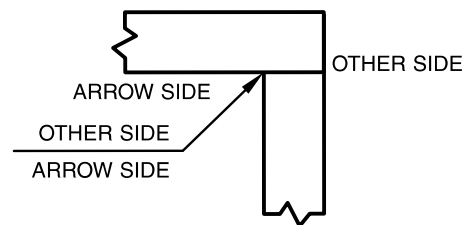
The basic welding joint types—butt, corner, T-, lap, and edge—are shown in Figure 4. Joint type designators are shown in Annex A, Table A.1.

6. General Provisions for Welding Symbols

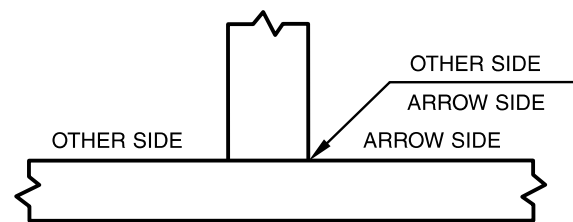
6.1 Location Significance of the Arrow. Information applicable to the arrow side of a joint shall be placed below the reference line. Information applicable to the other side of a joint shall be placed above the reference line.



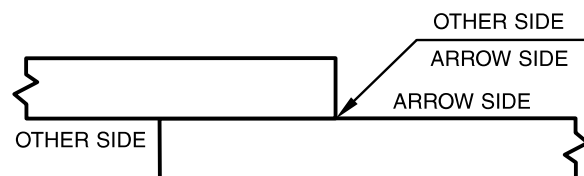
(A) BUTT JOINT



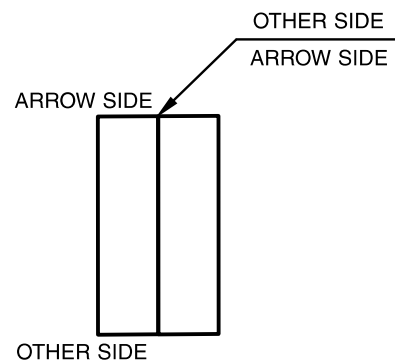
(B) CORNER JOINT



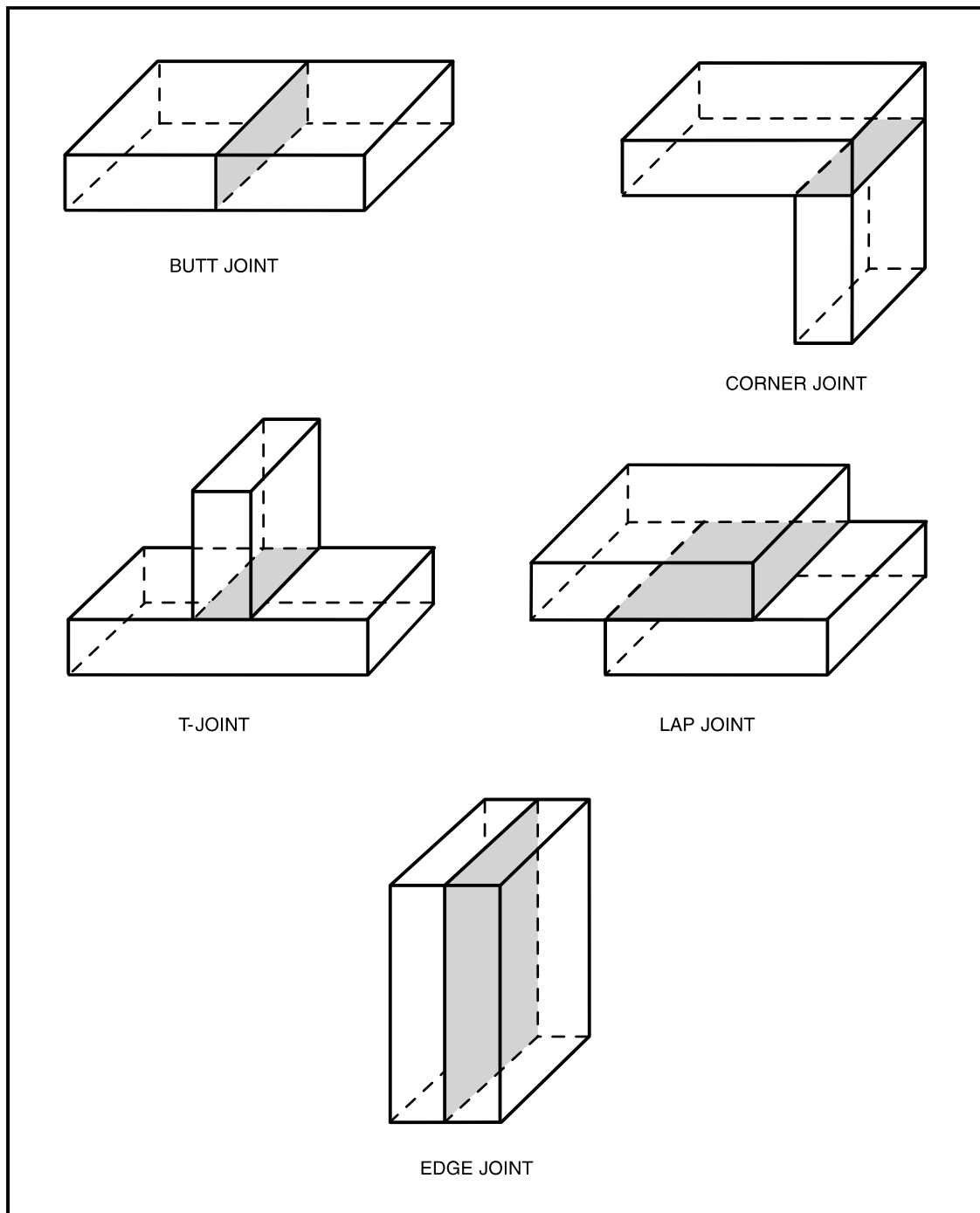
(C) T-JOINT



(D) LAP JOINT



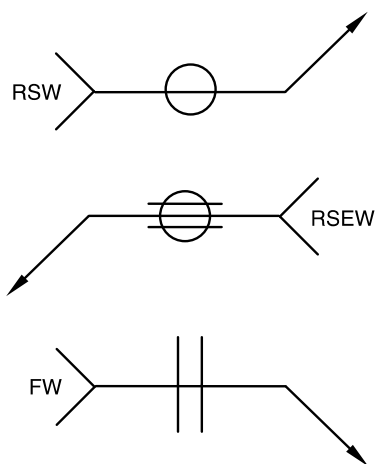
(E) EDGE JOINT

**Figure 4—Joint Types**

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 5).

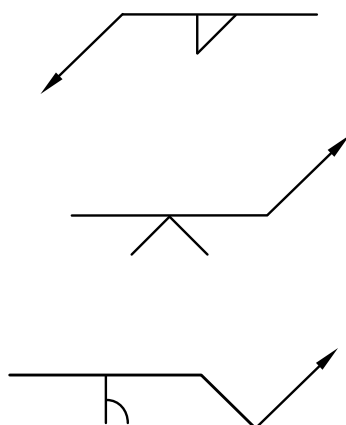
6.1.2 Plug, Slot, Spot, Projection, and Seam Weld Symbols. For these symbols, the arrow shall contact the outer surface of one of the joint members at the center-line of the desired weld. The member toward which the arrow points shall be considered the arrow-side member. The other joint member shall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

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 11.1.2 and 11.1.4).

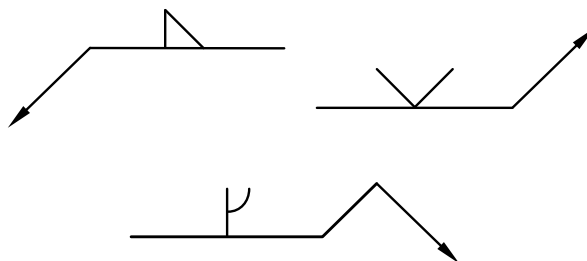


6.2 Location of the Weld with Respect to the Joint

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).

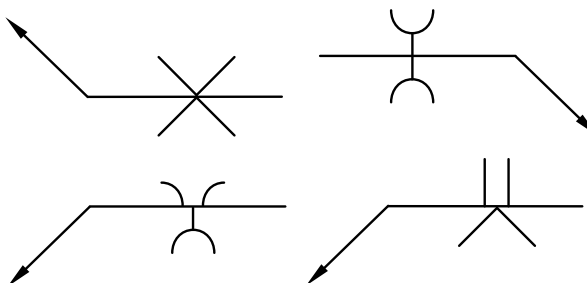


6.2.2 Other Side. Welds on the other side of the joint shall be specified by placing the weld symbol above the reference line (see 6.1.1).

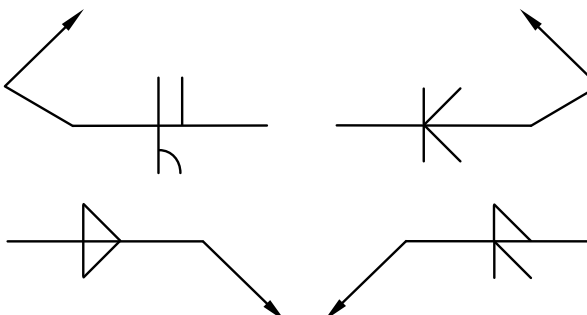


6.2.3 Both Sides. Welds on both sides of the joint shall be specified by placing weld symbols both below and above the reference line.

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



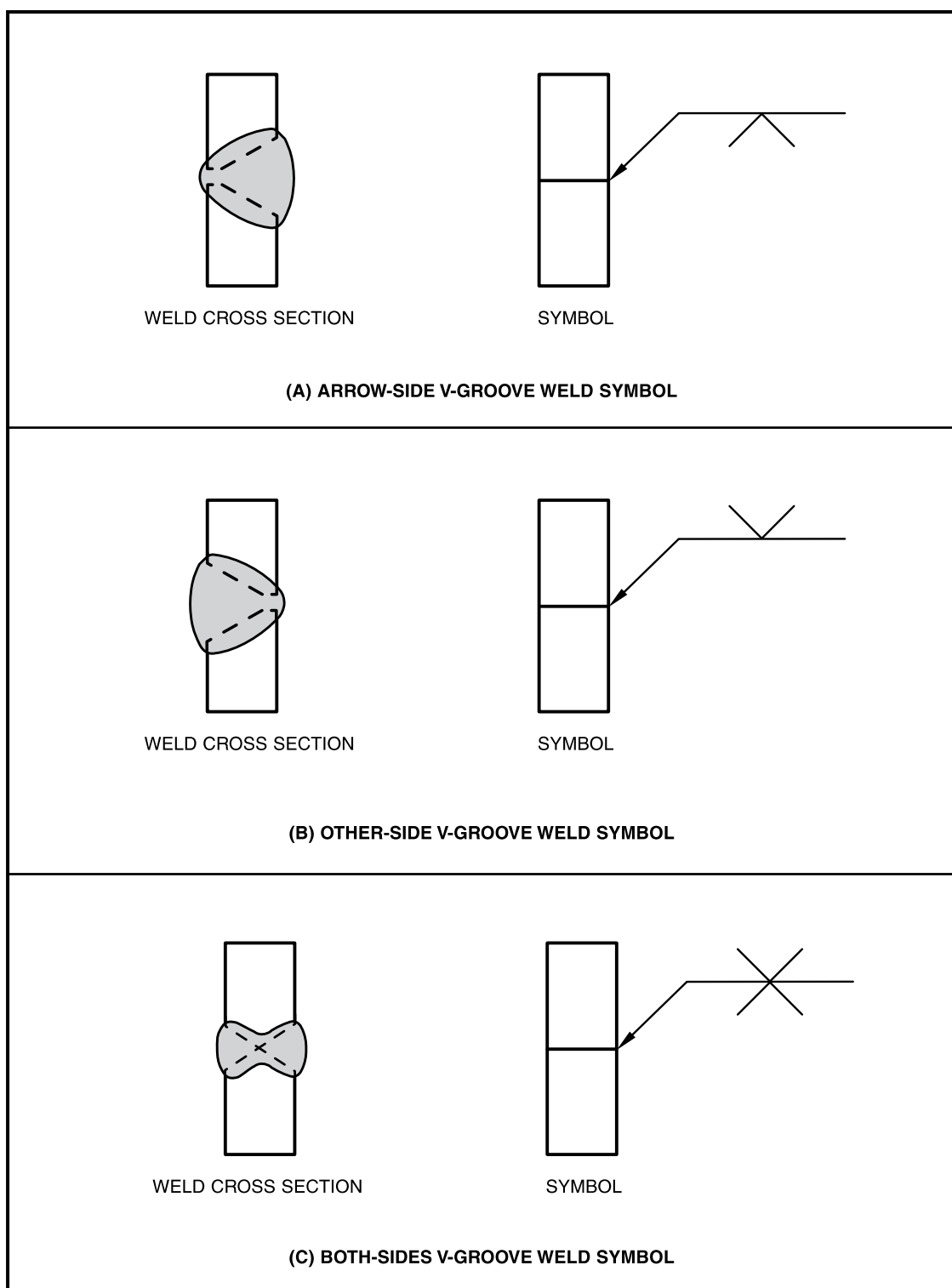
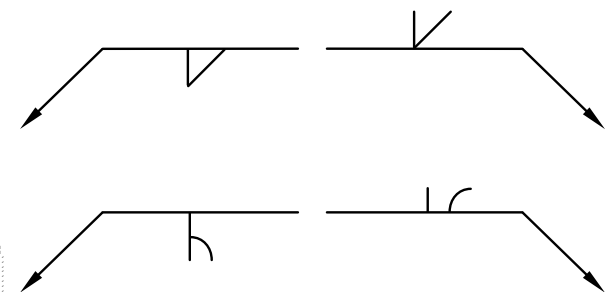


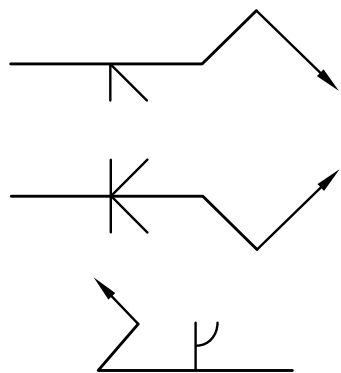
Figure 5—Application of Weld Symbols to Indicate the Arrow Side, the Other Side, and Both Sides

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



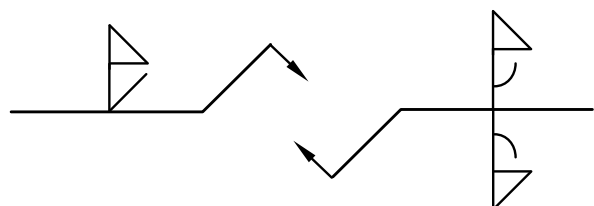
6.4 Break in the Arrow

6.4.1 Groove Welds. When only one joint member is to have a bevel-groove, J-groove, or both, the arrow shall have one break and point toward that member (see Figure 6). The arrow need not be broken if it is apparent which member is to have the bevel- or J-groove (see Figure 7). It shall not be broken if there is no preference as to which member is to have the bevel- or J-groove. 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 beveled.

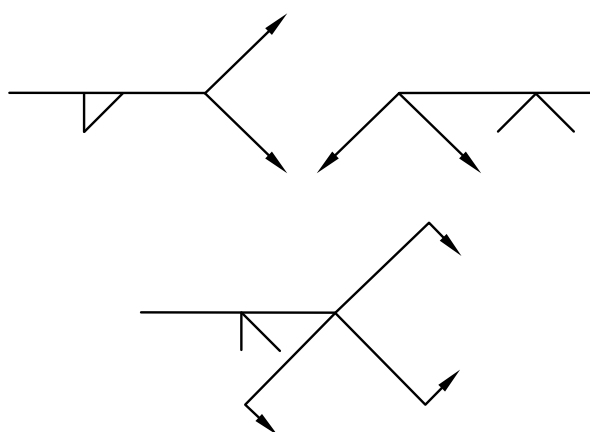


6.4.2 Fillet Welds. The arrow may or may not be broken to indicate fillet weld locations [see Figure 8(A)].

6.5 Combination Weld Symbols. For joints requiring more than one weld type, a symbol shall be used to specify each weld (see Figure 7).

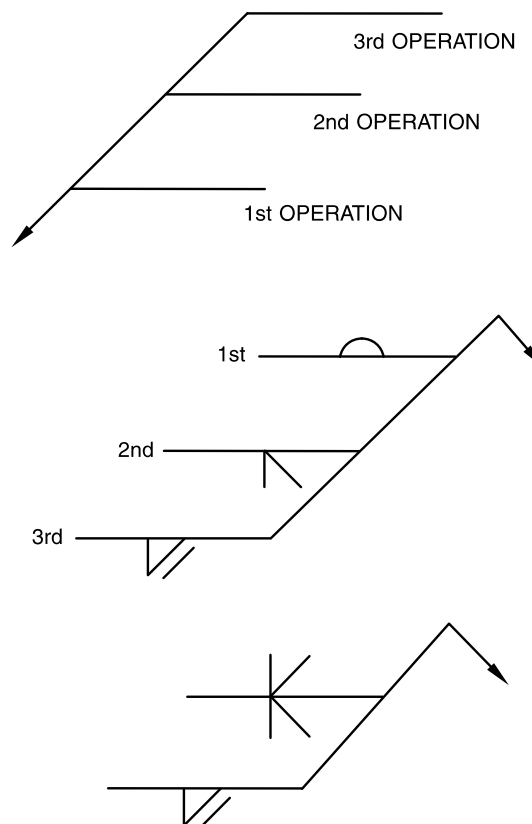


6.6 Multiple Arrow Lines. Two or more arrows may be used with a single reference line to point to locations where identical welds are specified [see Figures 8(A) and 9].



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.



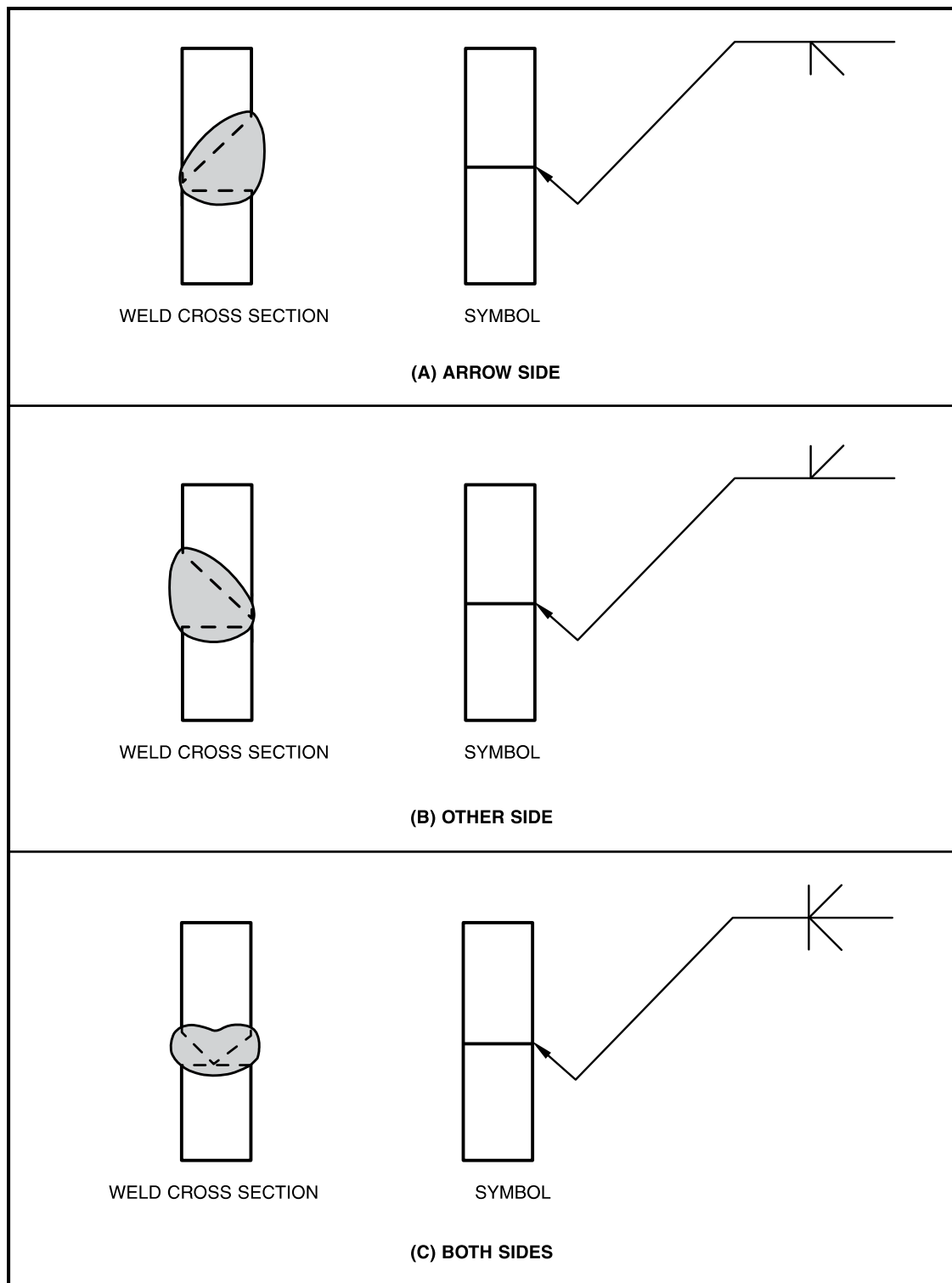


Figure 6—Applications of the Break in the Arrow of the Welding Symbol

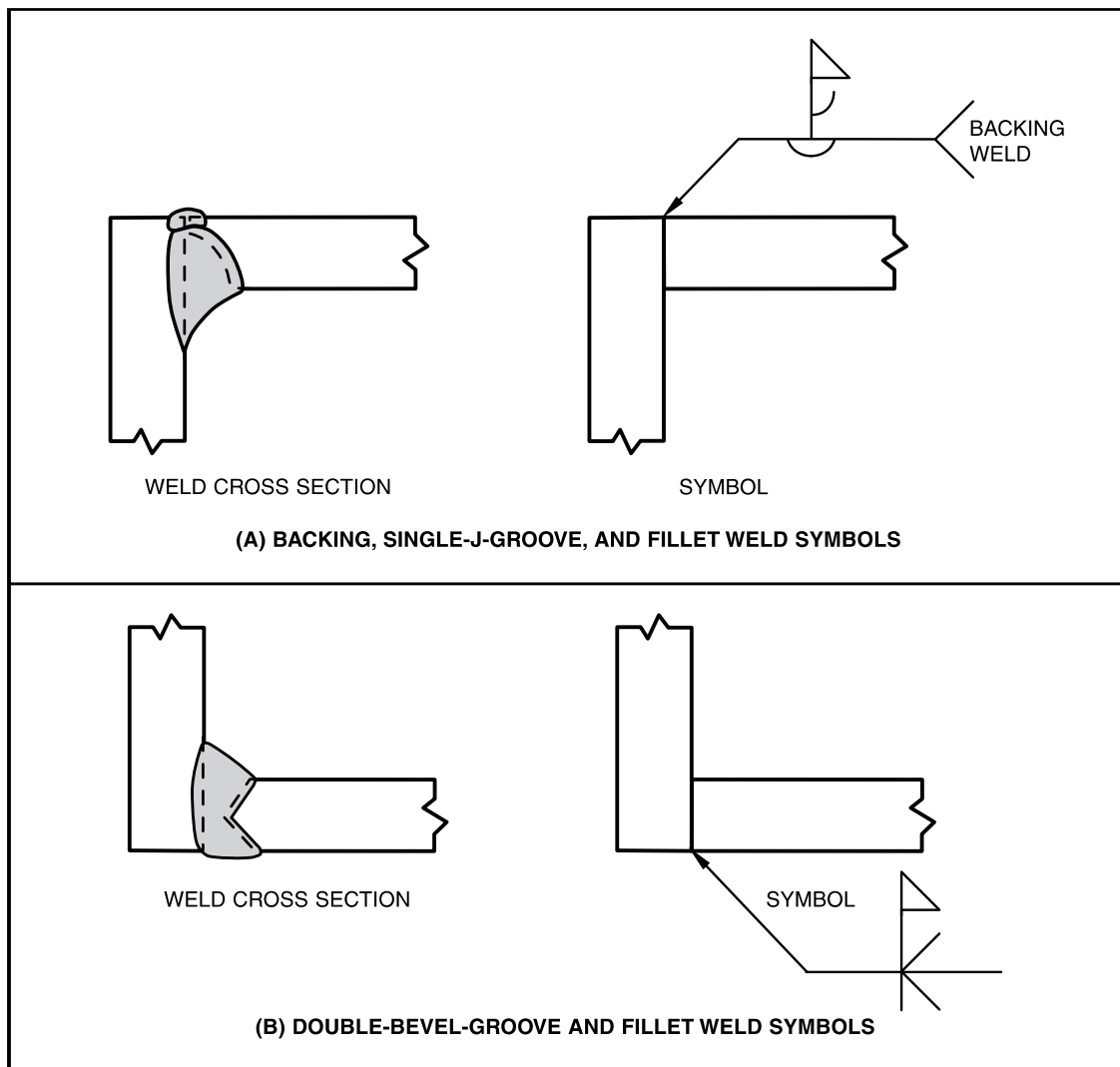


Figure 7—Combination Weld Symbols

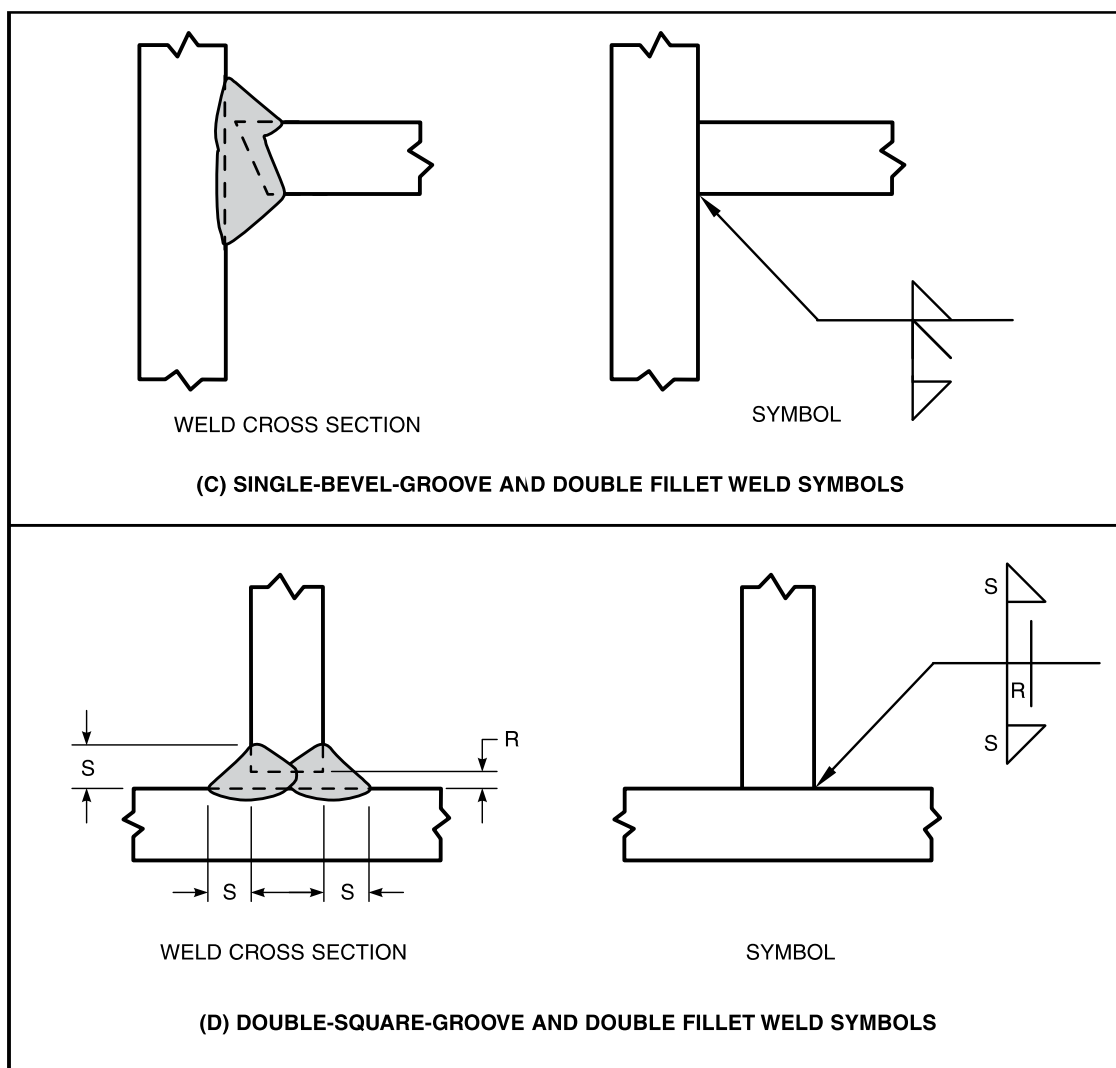


Figure 7 (Continued)—Combination Weld Symbols

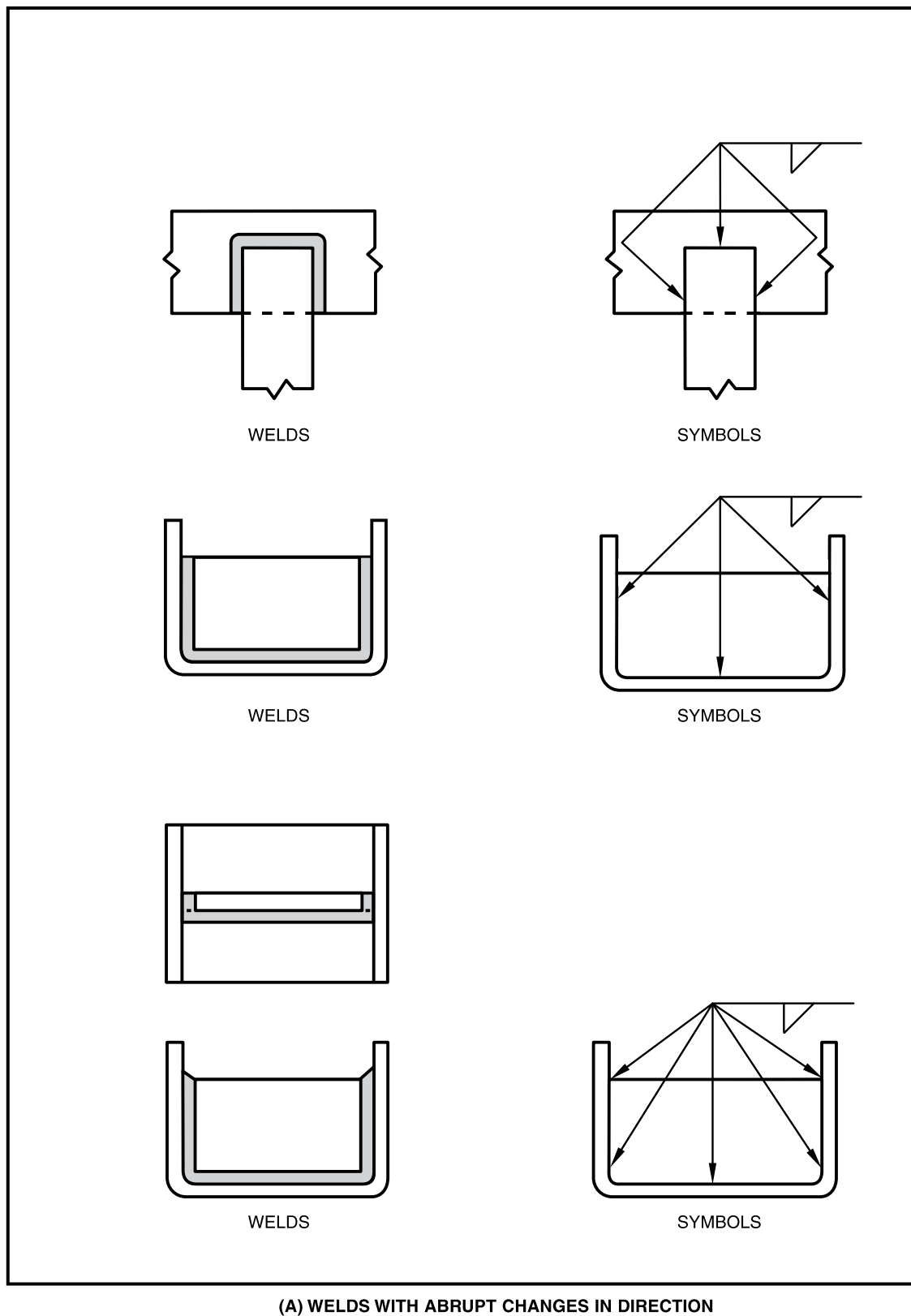


Figure 8—Application of the Symbol for the Specification of the Extent of Welding

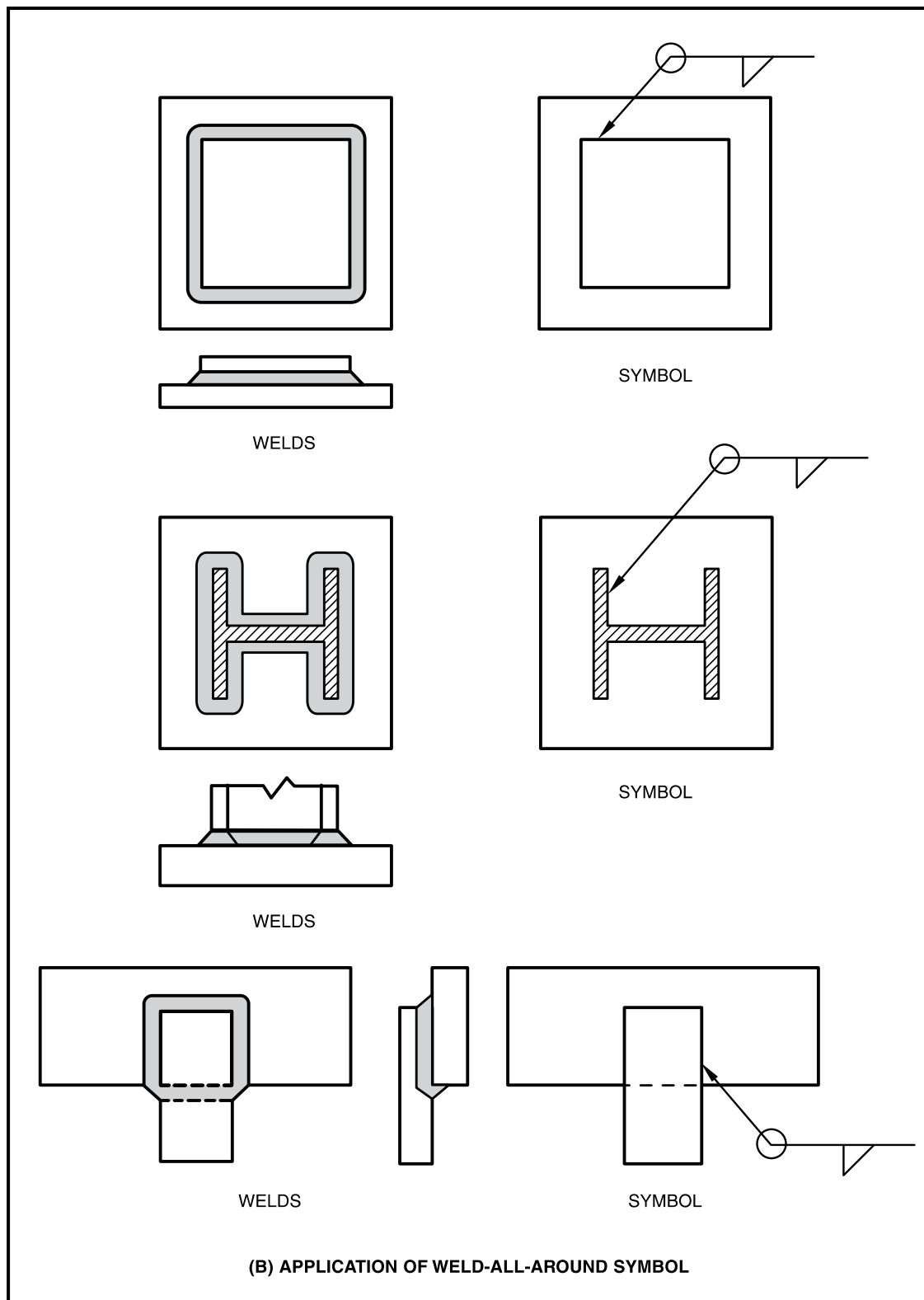


Figure 8 (Continued)—Application of the Symbol for the Specification of the Extent of Welding

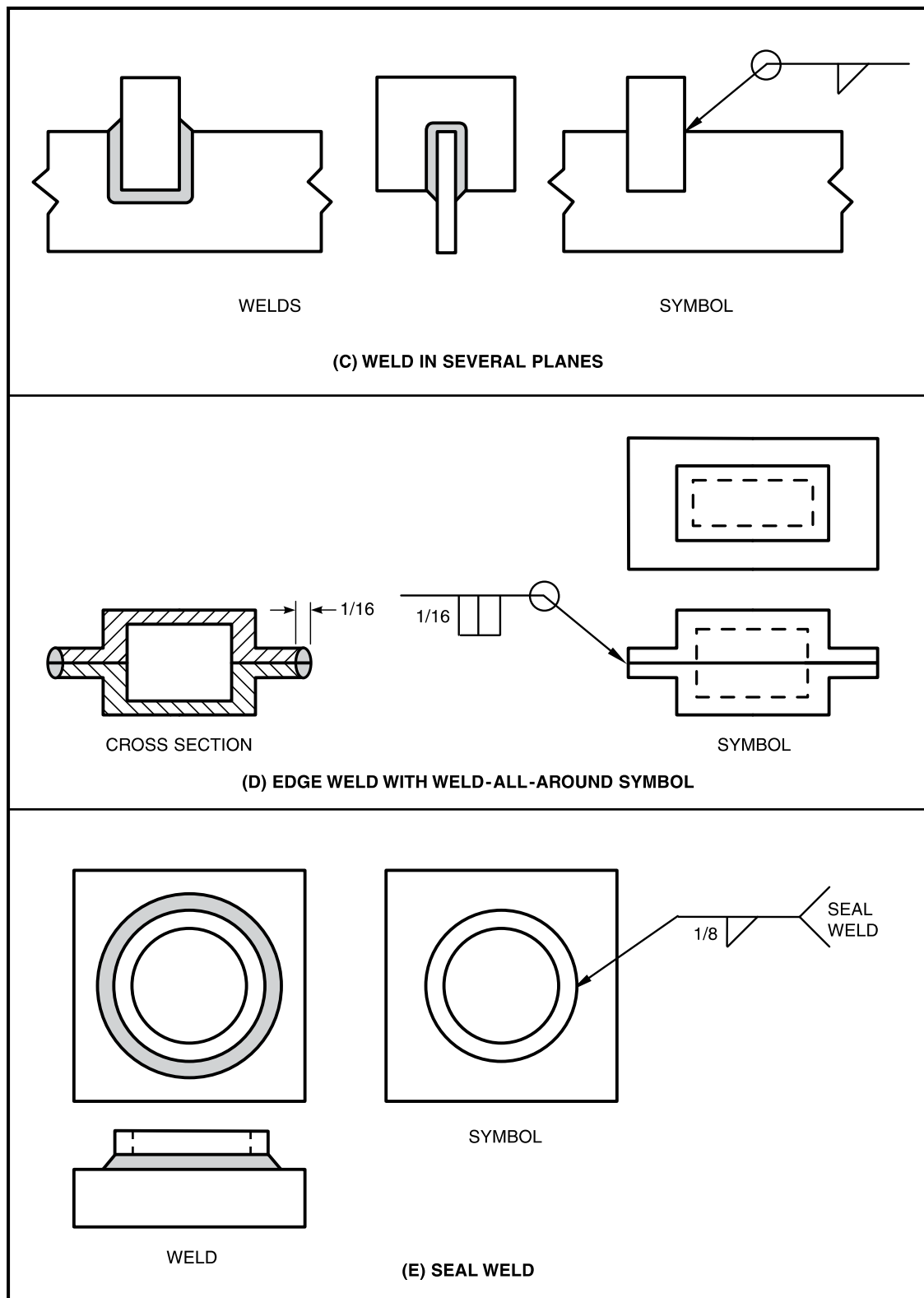


Figure 8 (Continued)—Application of the Symbol for the Specification of the Extent of Welding

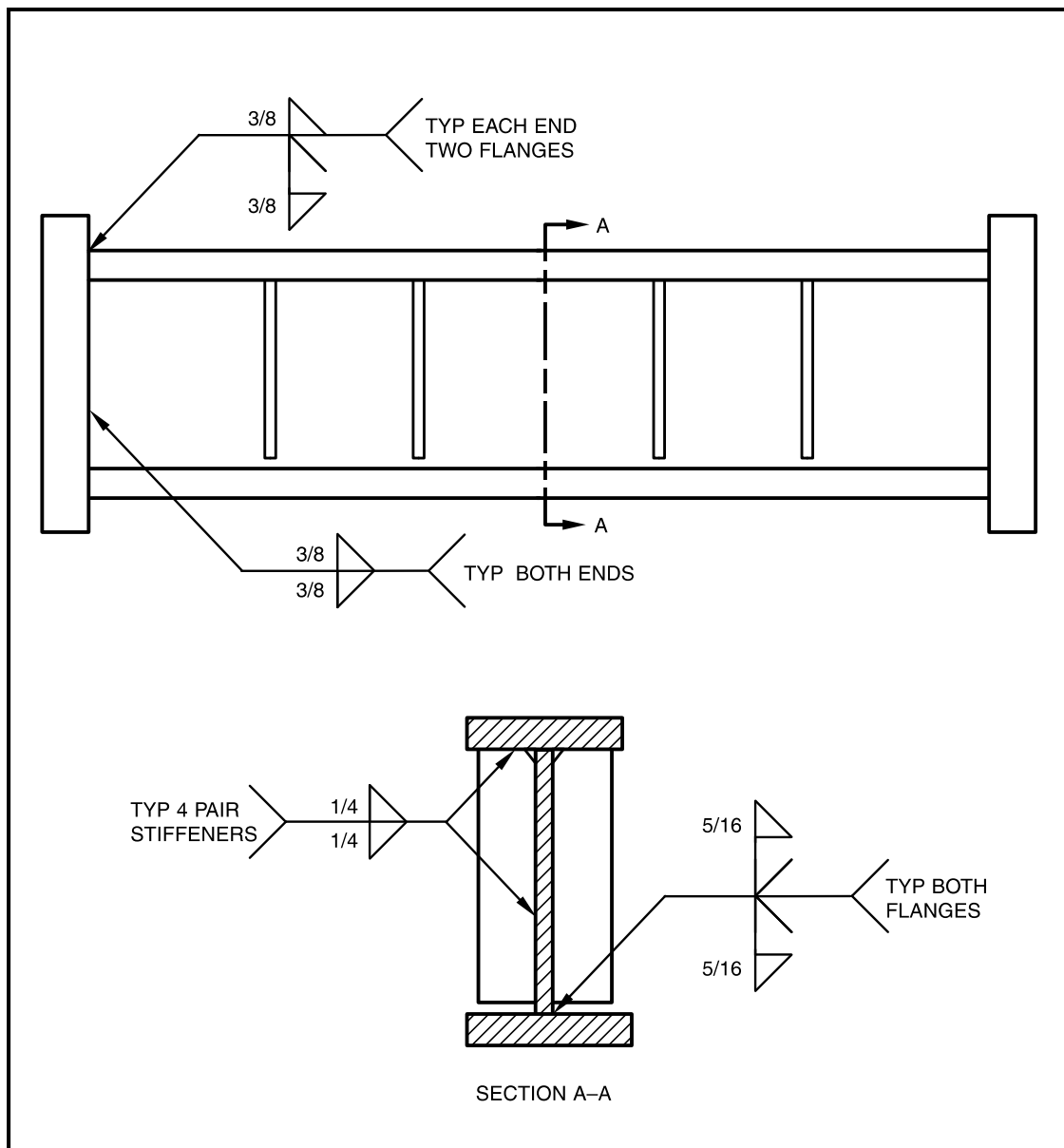
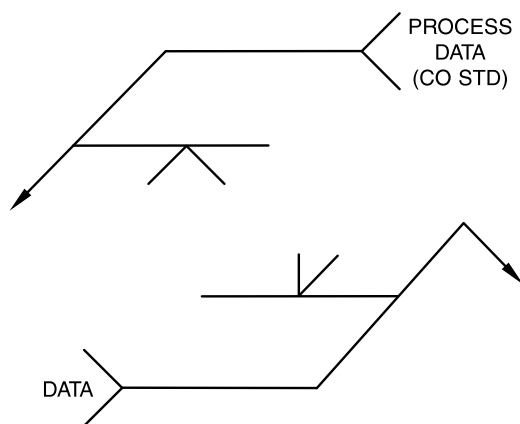
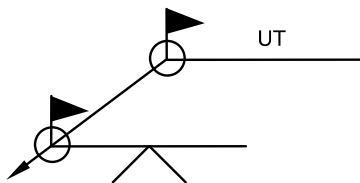


Figure 9—Application of the “TYPICAL” Welding Symbol

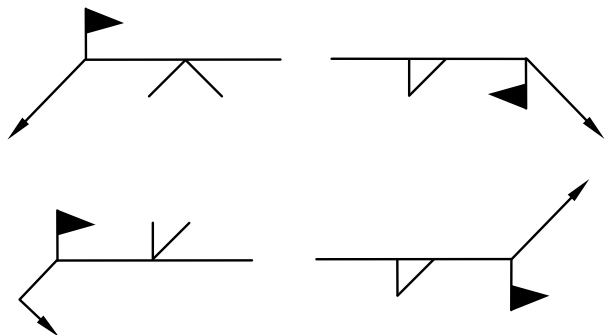
6.7.2 Supplementary Data. The tail of additional reference lines may be used to specify data supplementary to welding symbol information.



6.7.3 Field Weld and Weld-All-Around Symbols. When required, the weld- (or examine-) all-around symbol shall be placed at the junction of the arrow and the reference line for each operation to which it is applicable. The field weld symbol may also be applied to the same location.



6.8 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 D6.8). The flag may point in either direction.



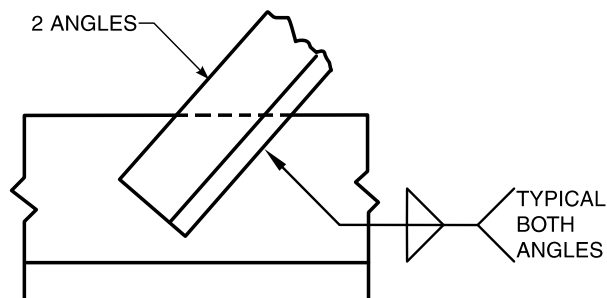
6.9 Extent of Welding Denoted by Symbols

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

6.9.2 Changes in the Direction of Welding. Welding symbols apply only between any changes in the direction of welding or to the extent of hatching or dimension lines (see Figure 10), except when the weld-all-around symbol is used [see Figure 8(B), (C), and (D)].

Additional welding symbols or multiple arrows shall be used to specify the welds required for any 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 8(A)], or from the first reference line in the case of a multiple reference line symbol. See Annex D6.9.2 for applications involving square and rectangular tubing.

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



6.9.4 Weld Location Specified. A weld having a length less than the available joint length and whose location is significant shall have the location specified on the drawing [see Figure 10(C)].

6.9.5 Weld Location Not Specified. A weld having a length less than the available joint length and that is not critical with respect to its location may be specified without indicating the location [see Figure 10(D)].

6.10 Weld-All-Around Symbol

6.10.1 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. 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

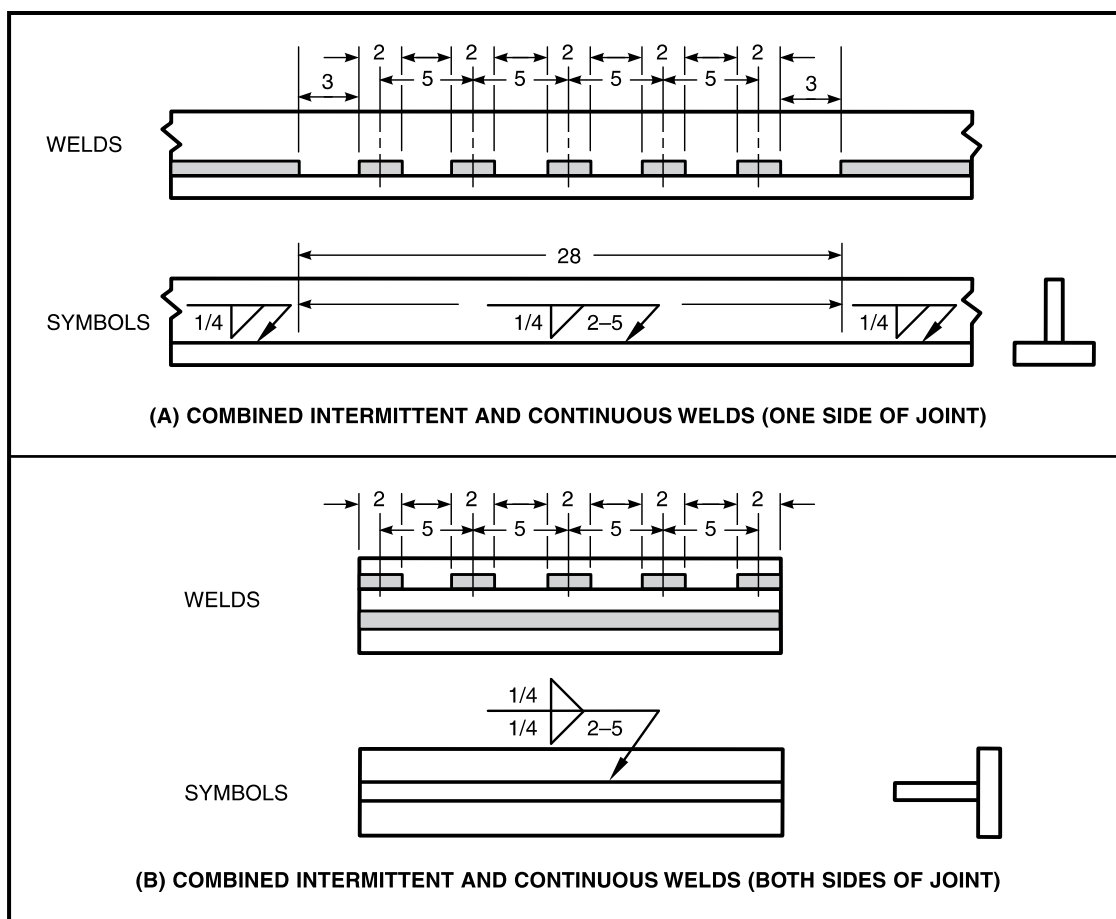


Figure 10—Specification of the Location and Extent of Fillet Welds

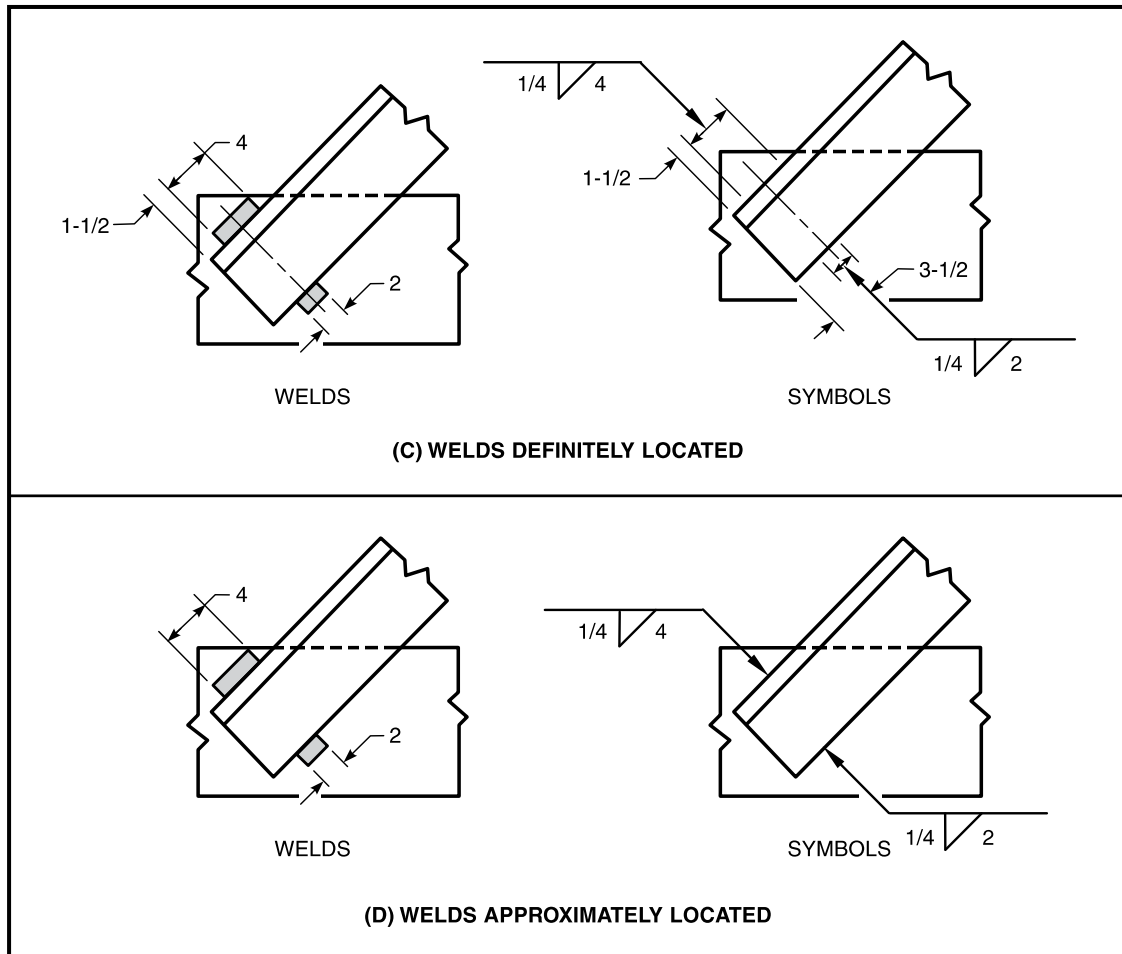


Figure 10 (Continued)—Specification of the Location and Extent of Fillet Welds

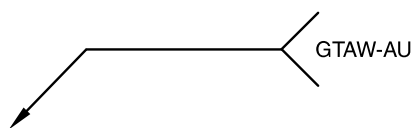
involve different directions and may lie in more than one plane [see Figure 8(B), (C), (D), and Annex D6.10.1].

6.10.2 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 8(E)].

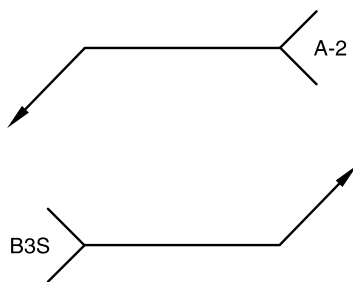
6.11 Tail of the Welding Symbol

6.11.1 Welding and Allied Process Specification.

The welding and allied process to be used may be specified by placing the appropriate letter designations from Table A.2, Table A.3, or Table A.4 in the tail of the welding symbol. An auxiliary suffix from Table A.5 may be used.

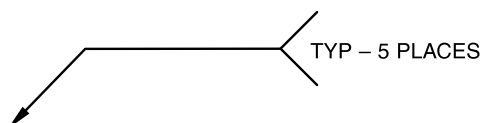


6.11.2 References. Specifications, codes, or any other applicable documents may be specified by placing the reference in the tail of the welding symbol. Information contained in the referenced document need not be repeated in the welding symbol.

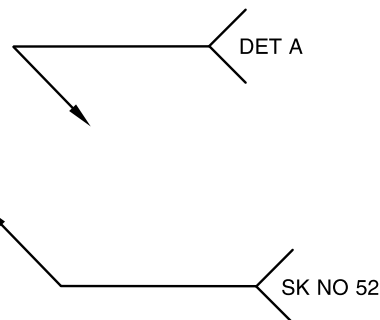


6.11.3 Welding Symbols Designated "TYPICAL."

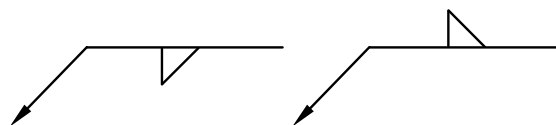
Repetitions of identical welding symbols on a drawing may be avoided by designating a single welding symbol as "TYPICAL" (usually abbreviated "TYP") and pointing the arrow to the representative joint (see Figure 9). The user shall provide additional information to completely identify all applicable joints (see Annex D6.11.3).



6.11.4 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).



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

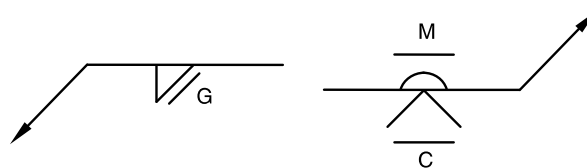


6.11.6 Drawing Notes. Drawing notes may be used to provide information pertaining to the welds. Such information need not be repeated in the welding symbols.

6.12 Contour Symbols

6.12.1 Contours Obtained by Welding. Welds to be made with approximately flush, flat, convex, or concave contours without the use of mechanical finishing shall be specified by adding the flush, flat, convex, or concave symbol to the welding symbol. Finishing designators are not to be used when the required weld contour is to be obtained by welding.

6.12.2 Contours Obtained by Postweld Finishing. Finishing designators are not to be used to specify the degree of finish.

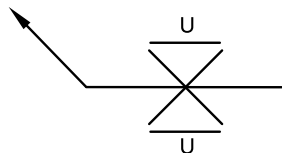


C = CHIPPING
G = GRINDING
H = HAMMERING
M = MACHINING

P = PLANISHING
R = ROLLING
U = UNSPECIFIED

6.12.3 Symbol for Finishing Method Unspecified.

Welds to be finished approximately flush, flat, convex, or concave with the method unspecified shall be indicated by adding the letter “U” to the appropriate contour symbol.



6.13 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 11).

6.13.1 Melt-Through Symbol Location. The melt-through symbol shall be placed on the side of the reference line opposite the weld symbol (see Figure 11).

6.13.2 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 11). The height of the root reinforcement may be unspecified.

6.14 Melt-Through with Edge Welds

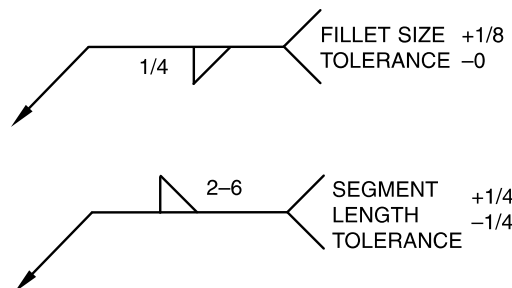
6.14.1 Melt-Through with Edge Welds on Flanged Butt Joints. Edge welds requiring complete joint penetration shall be specified by the edge weld symbol with the melt-through symbol placed on the opposite side of the reference line. The details of the flanges are considered part of the drawing and are not specified by the welding symbol [see Figure 11(D)].

6.14.2 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 11(E)].

6.15 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.

6.16 U.S. Customary and SI Units. The same system that is the standard 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, a table of conversions may be included on the drawing. For guidance on drafting standards, refer to ASME Y14, *Standards for Engineering Drawing & Related Practices*. For guidance on the use of SI Units, refer to AWS A1.1, *Metric Practice Guide for the Welding Industry*.

6.17 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.



6.18 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 D6.18).

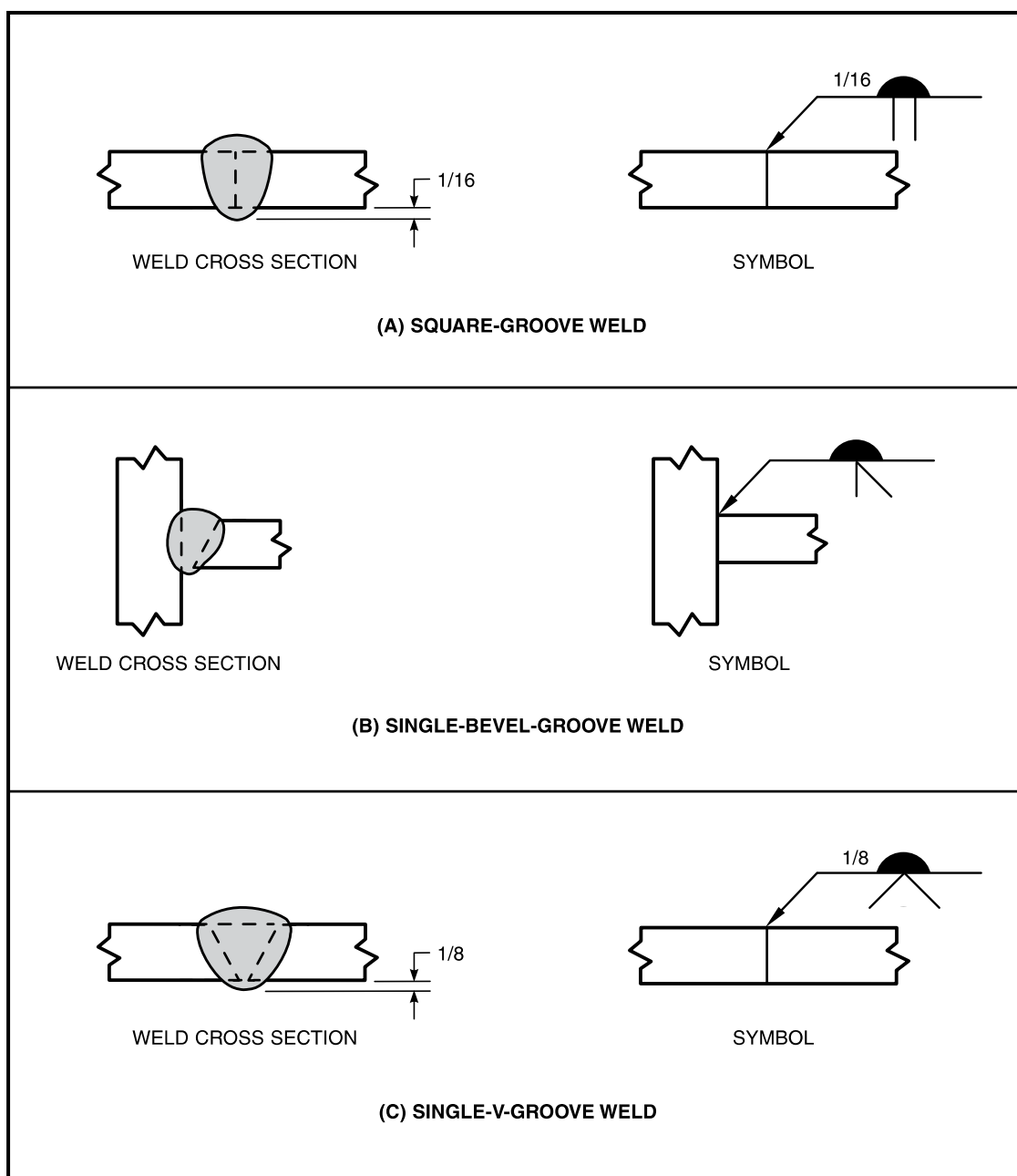


Figure 11—Application of the Melt-Through Symbol

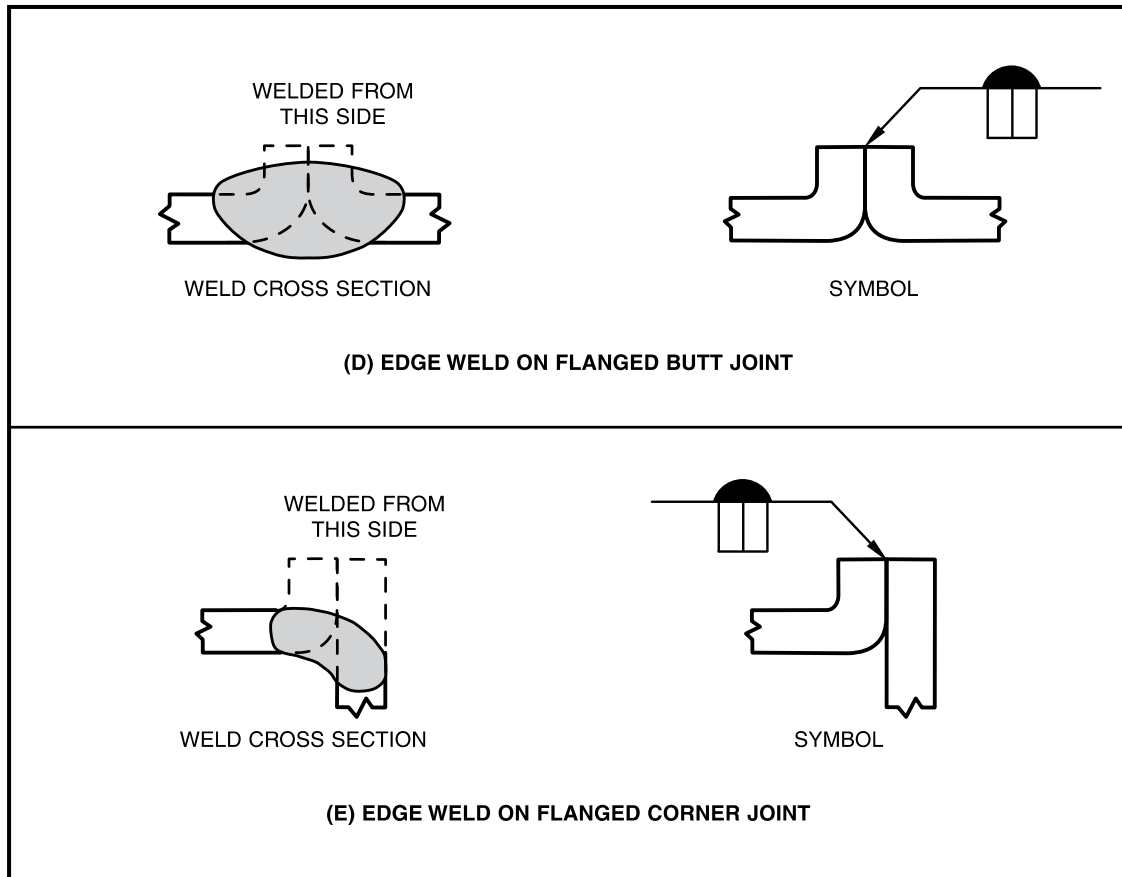
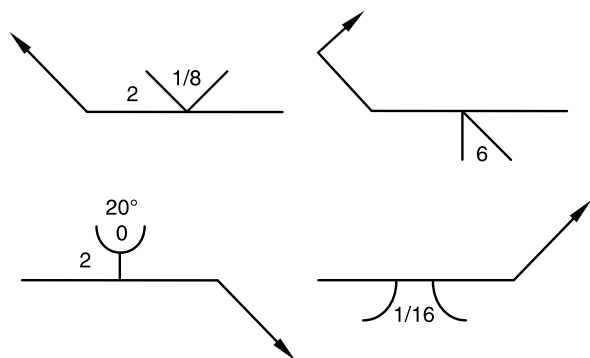


Figure 11 (Continued)—Application of the Melt-Through Symbol

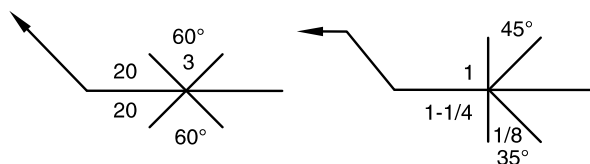
7. Groove Welds

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 12(A) and (F)].

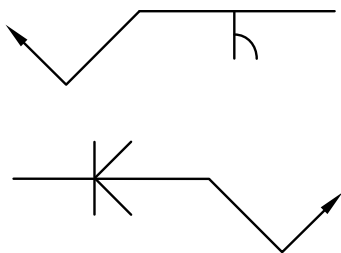


7.1.2 Double-Groove Dimensions. Each groove of a double-groove joint shall be dimensioned; however, the root opening need appear only once (see Figure 13).



7.1.3 Broken Arrow and the Straight Arrow

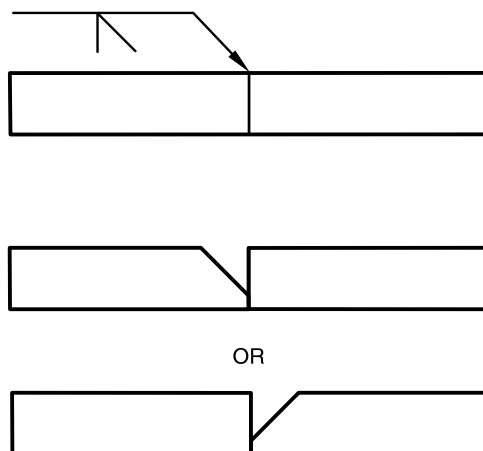
7.1.3.1 Broken Arrow. A broken arrow is used, when necessary, to specify which member is to have a bevel- or J-groove edge shape for single- or double-bevel and single- or double-J-groove welds [see 6.4.1 and Figure 12(B)].



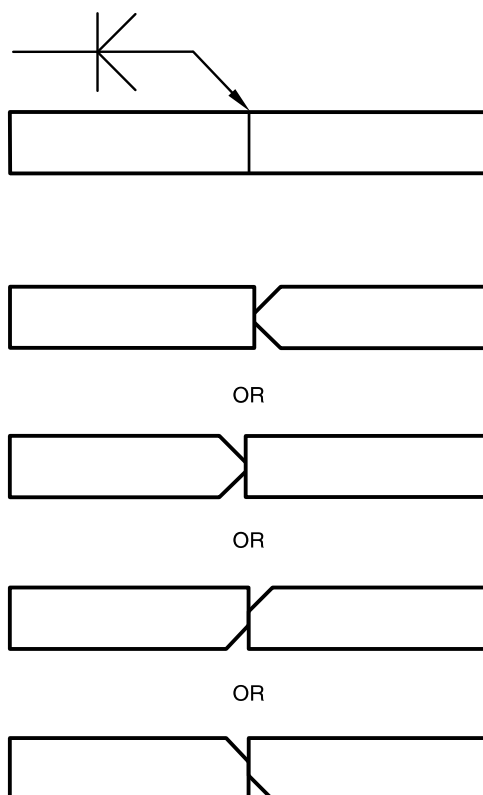
7.1.3.2 Straight Arrow for Single-Groove Welds.

A straight arrow is used when either member may have

the desired edge shape for single-bevel- or single-J-groove welds.



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- or double-J-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.



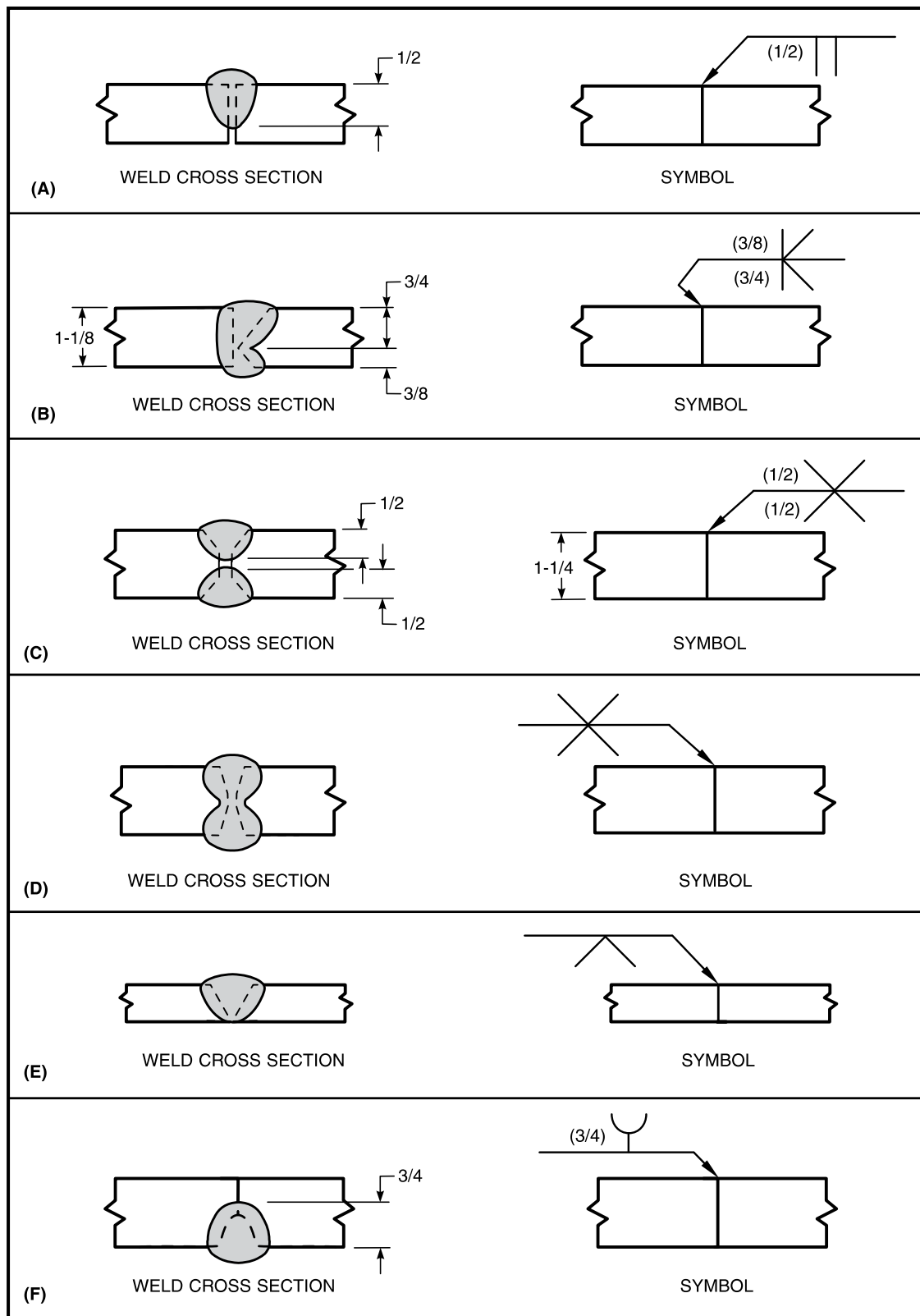


Figure 12—Specification of Groove Weld Size, Depth of Groove Not Specified

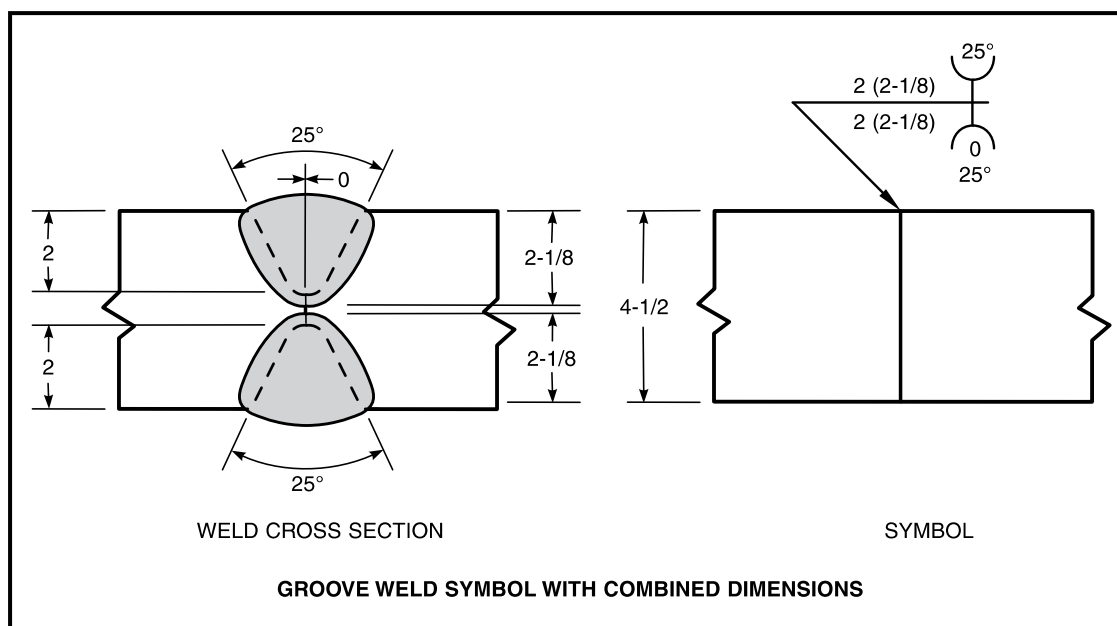
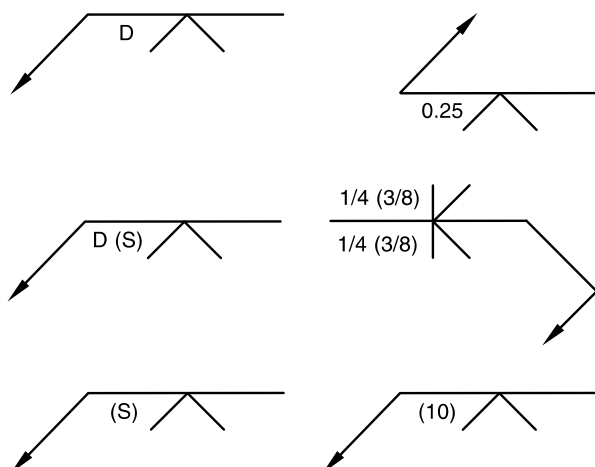


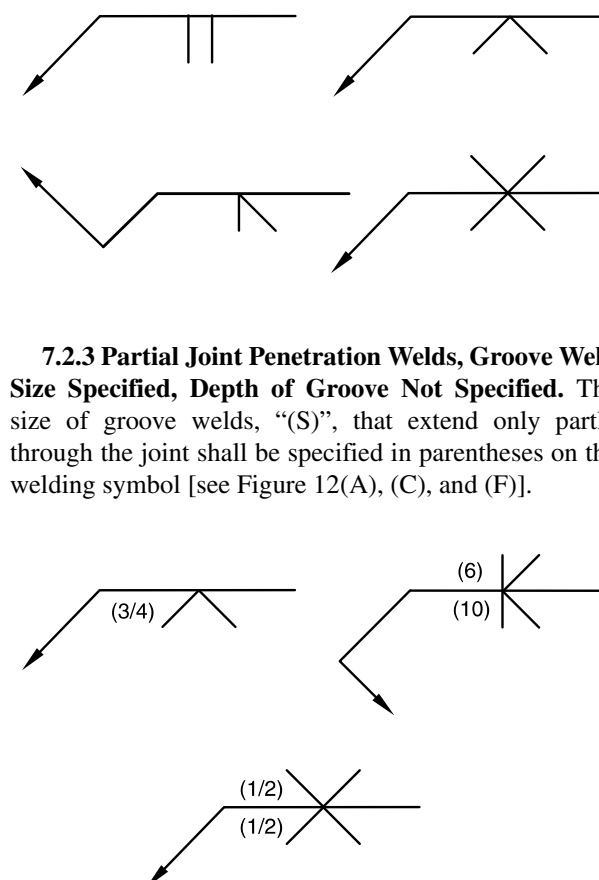
Figure 13—Application of Dimensions to the Groove Weld Symbol

7.2 Depth of Groove and Groove Weld Size

7.2.1 Location. When used, the depth of groove, “D”, and the groove weld size, “(S)”, shall be placed to the left of the weld symbol [see Figure 12(A), (B), (C), and (F) and Figures 13 through 15].



7.2.2 Complete Joint Penetration. Omitting the depth of groove, “D”, and groove weld size, “(S)”, dimensions from the welding symbol requires a groove weld that extends through the thickness of the joint [see Figure 12(D) and (E), Figures 18 and 19, as well as Annex D7.2.2].



7.2.3 Partial Joint Penetration Welds, Groove Weld Size Specified, Depth of Groove Not Specified. The size of groove welds, “(S)”, that extend only partly through the joint shall be specified in parentheses on the welding symbol [see Figure 12(A), (C), and (F)].

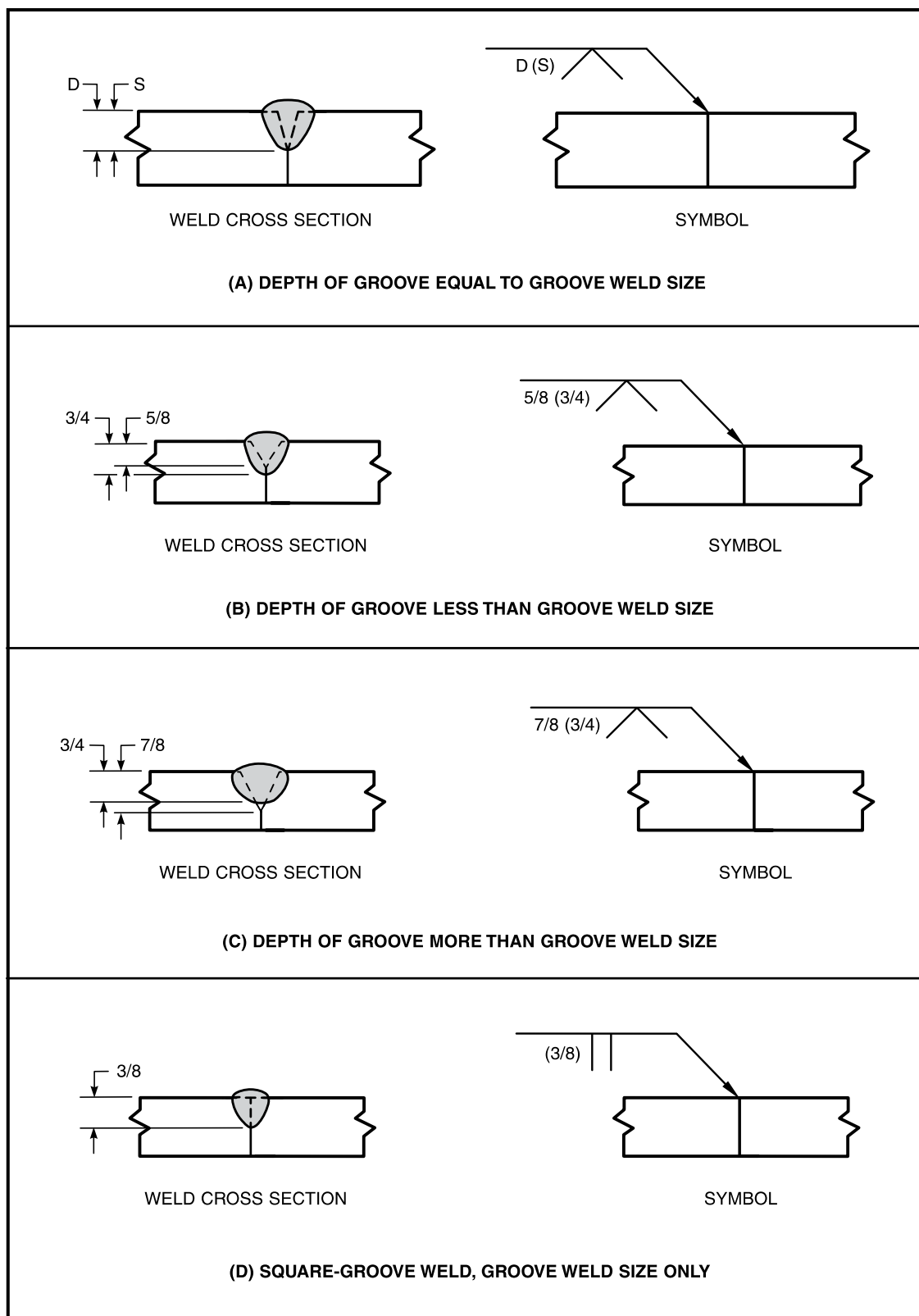


Figure 14—Specification of Groove Weld Size, (S), Related to Depth of Groove, D

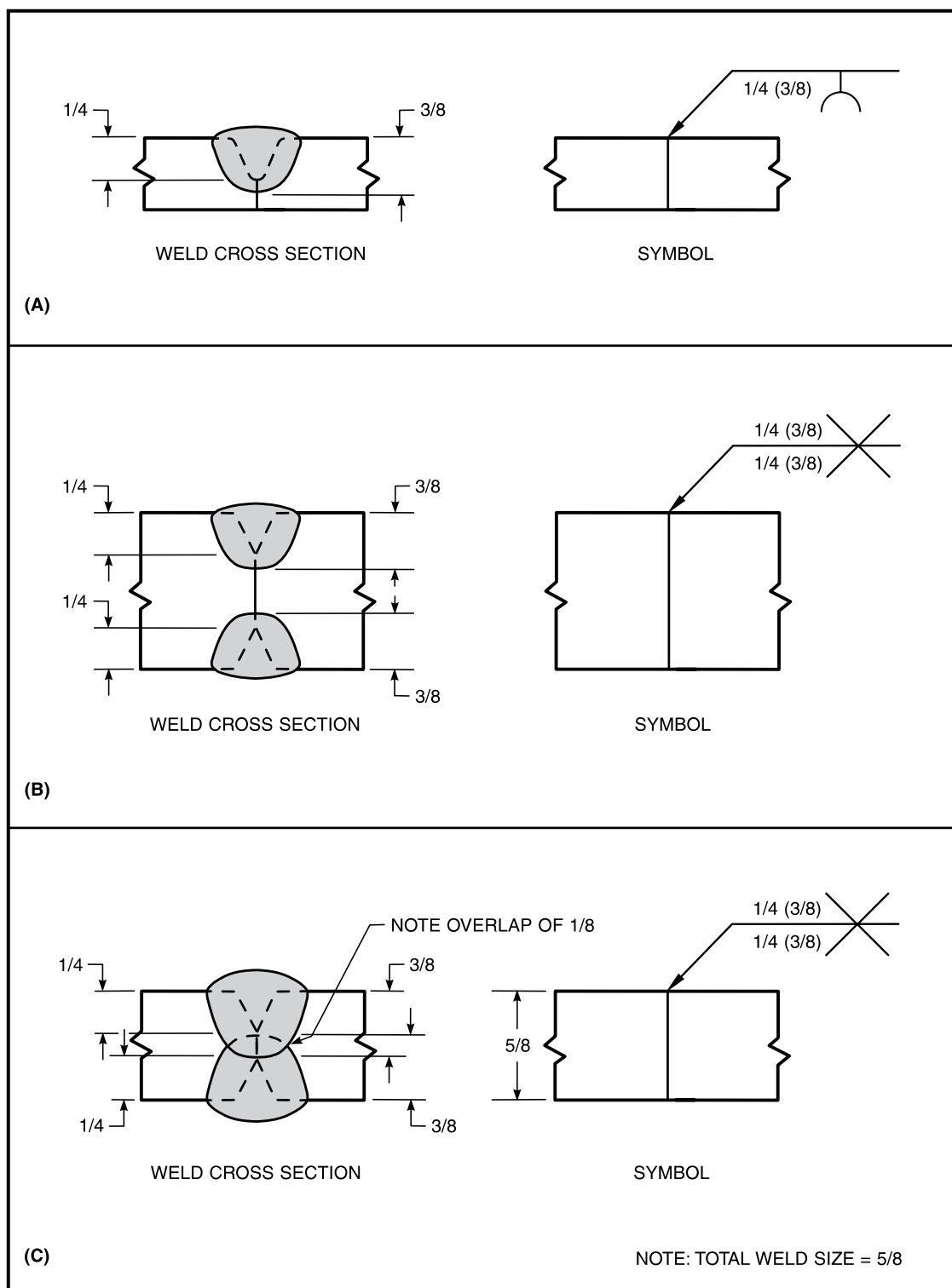
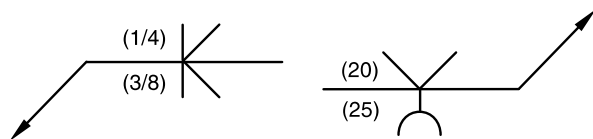
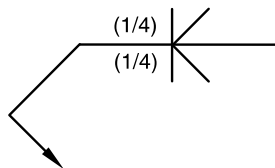


Figure 15—Specification of Depth of Groove and Groove Weld Size

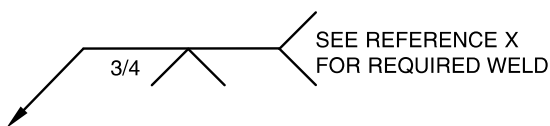
7.2.4 Complete Joint Penetration Double-Groove Welds, Groove Weld Size Specified, Depth of Groove Not Specified. The size of nonsymmetrical groove welds (arrow side versus other side) that extend completely through the joint shall be specified in parentheses on the welding symbol [see Figure 16(B) and (C)].



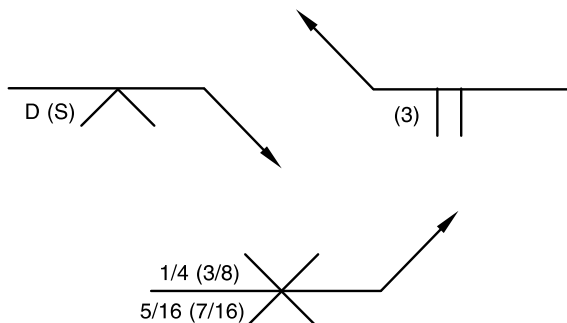
The size of symmetrical groove welds (arrow side versus other side) that extend completely through the joint may be specified in parentheses on the welding symbol [see Figure 16(A)].



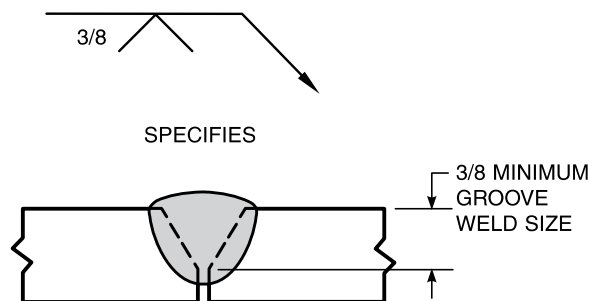
7.2.5 Depth of Groove Specified, Groove Weld Size Specified Elsewhere. A dimension not in parentheses placed to the left of a groove weld symbol specifies the depth of groove only.



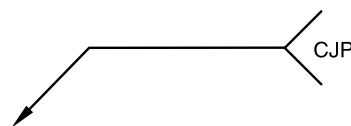
7.2.6 Depth of Groove and Groove Weld Size Specified. The depth of groove, “D”, and groove weld size, “(S)”, are located to the left of the weld symbol as “D (S)”. For square groove welds, only the groove weld size, “(S)”, is shown (see Figures 14 and 17).



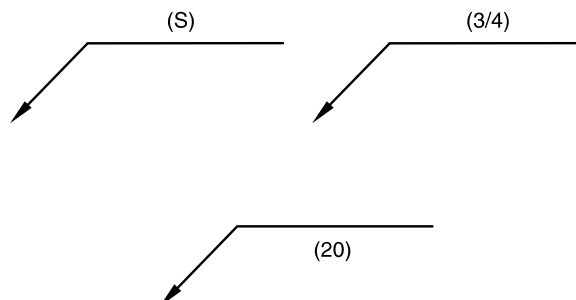
7.2.7 Depth of Groove Specified, Groove Weld Size Not Specified. A welding symbol with a depth of groove, “D”, specified, and the groove weld size, “(S)”, not included and not specified elsewhere, may be used to specify a groove weld size not less than the depth of groove.



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 18).



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 19).



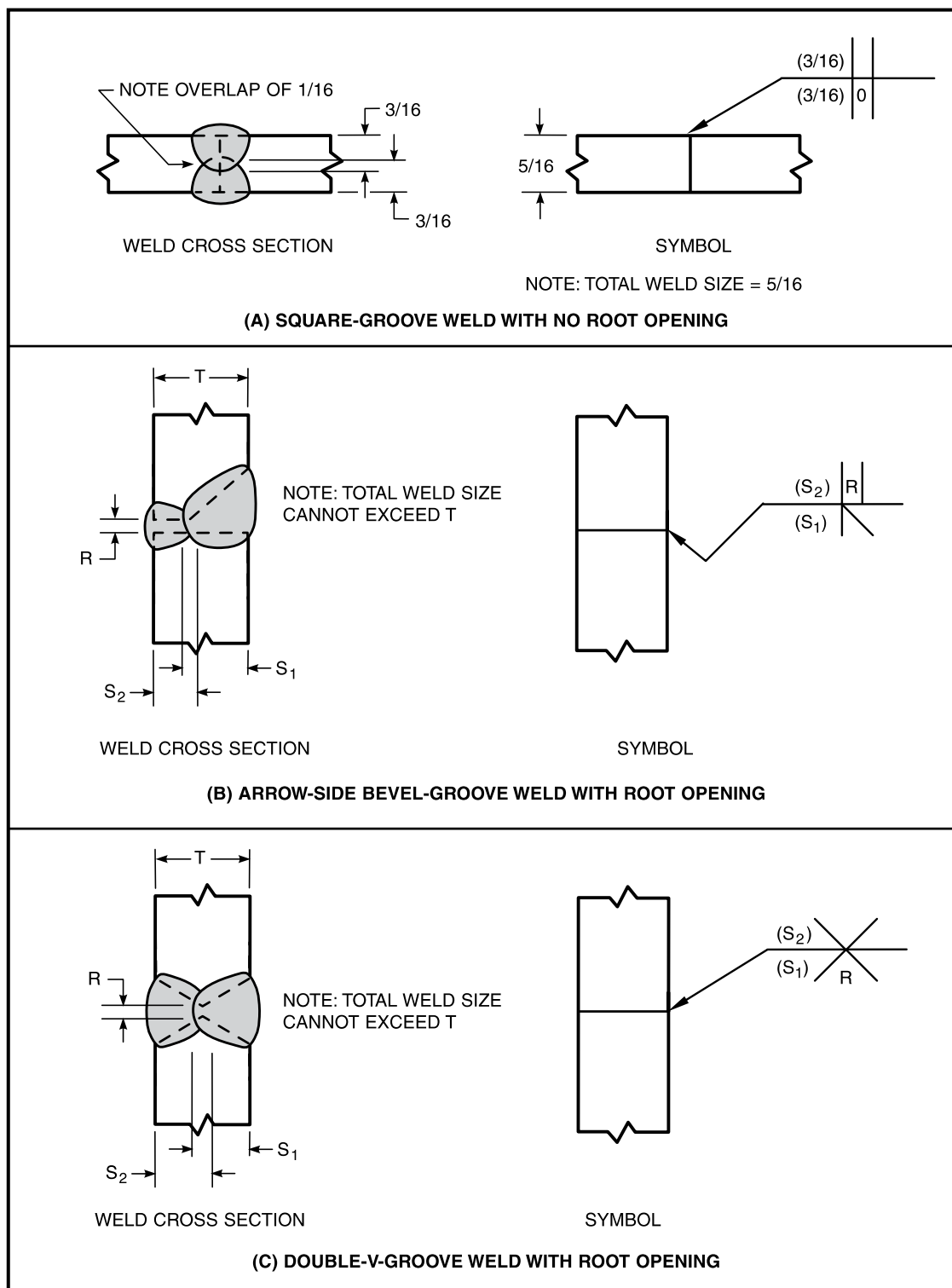


Figure 16—Application of Symbols for the Specification of Groove Weld Size Only

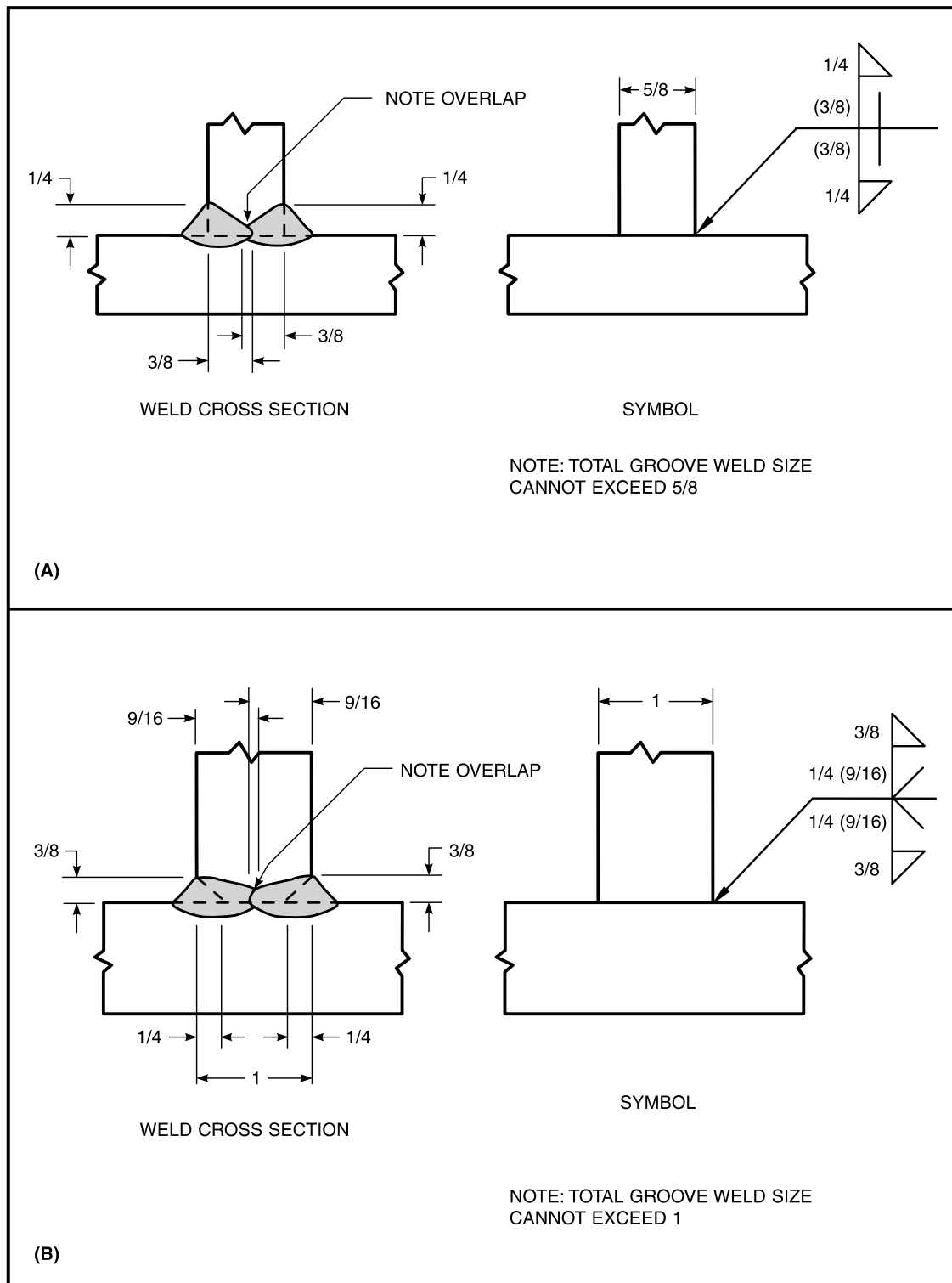
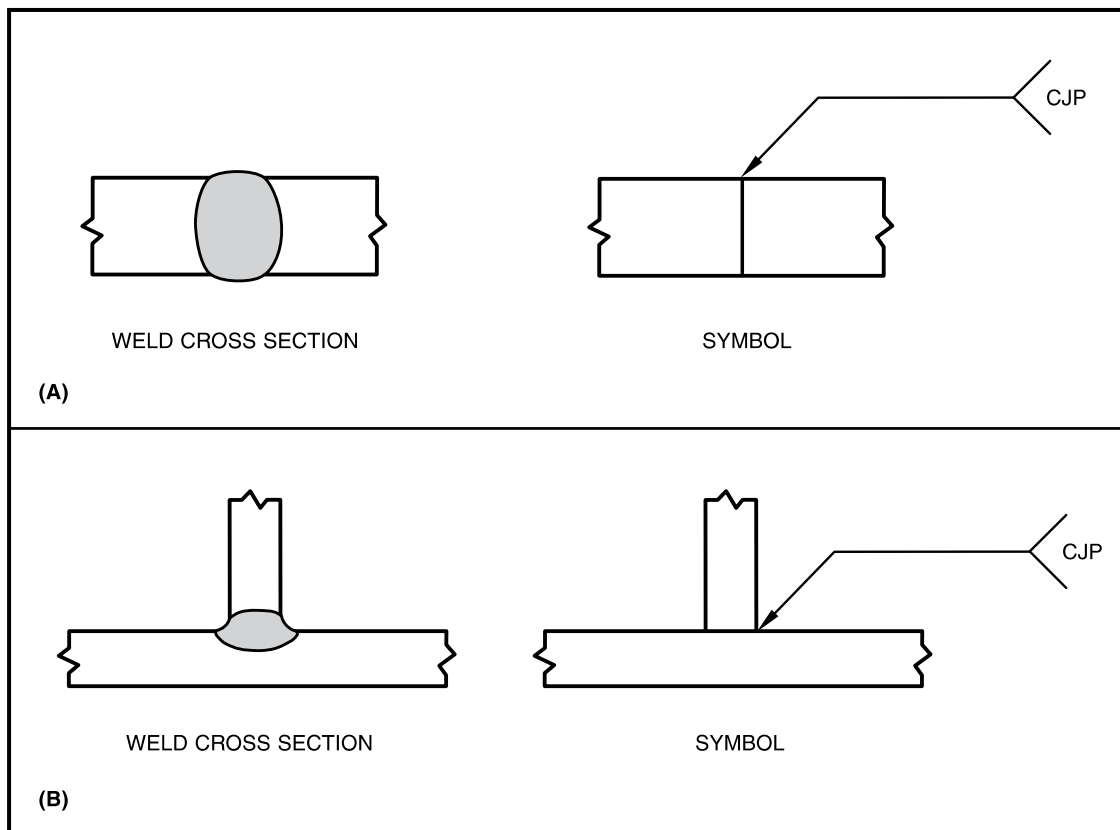


Figure 17—Application of Symbols for Combined Groove and Fillet Welds



**Figure 18—Application of Symbols for Complete Joint Penetration
with Joint Geometry Optional**

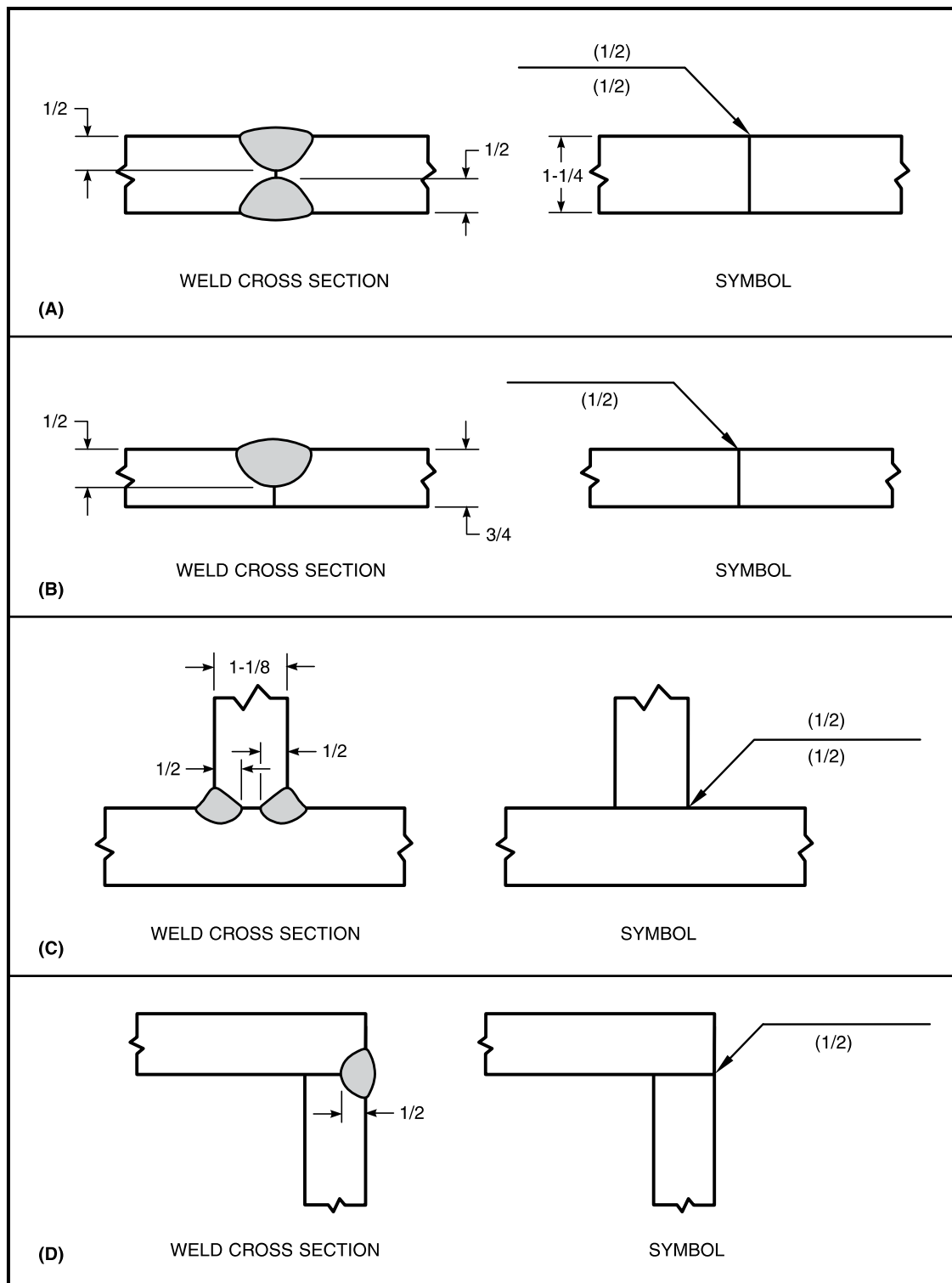


Figure 19—Partial Joint Penetration with the Joint Geometry Optional

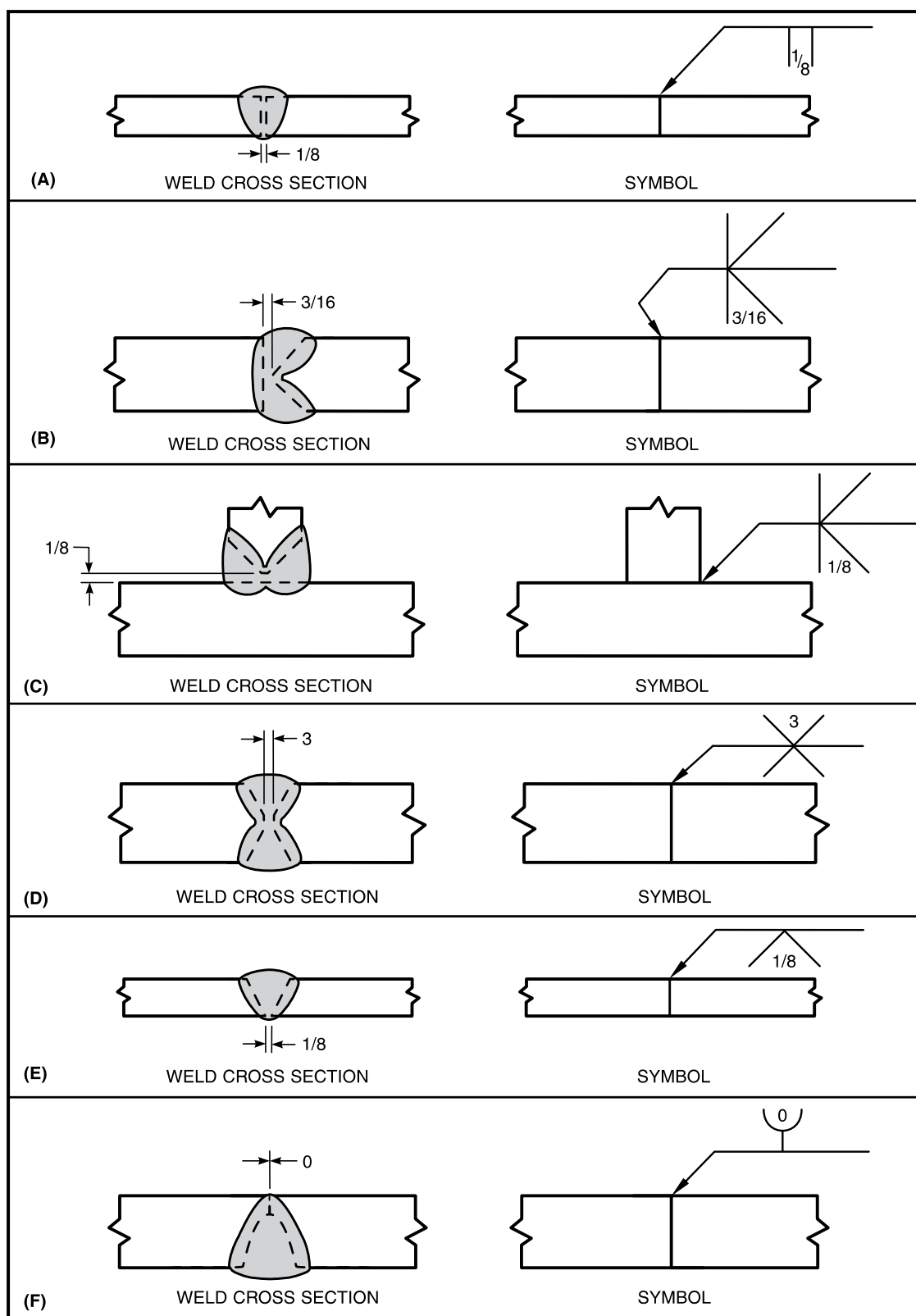


Figure 20—Specification of the Root Opening of Groove Welds

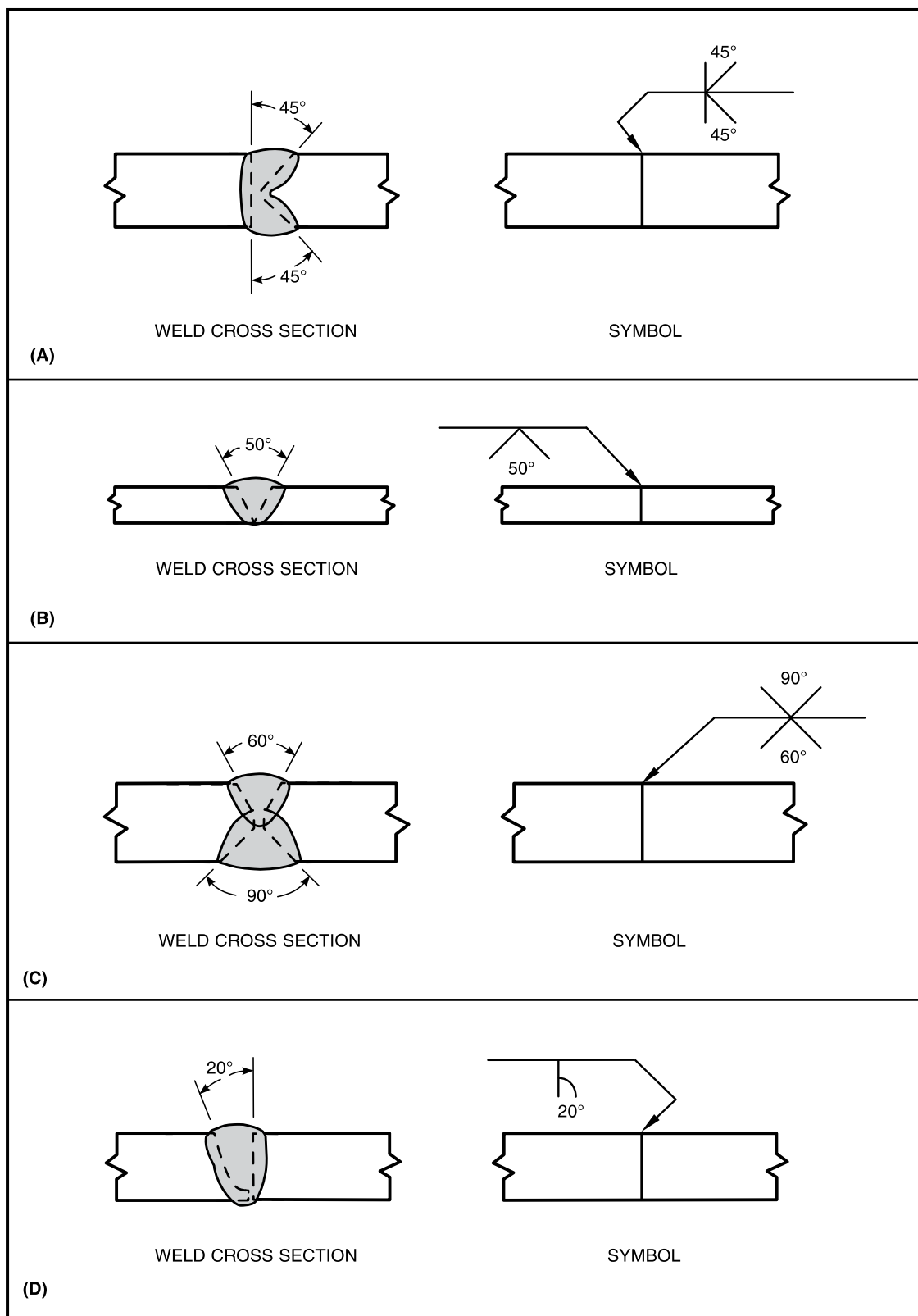
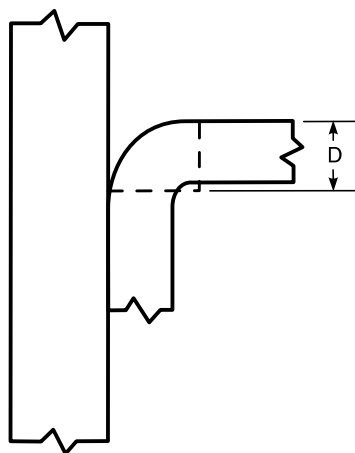
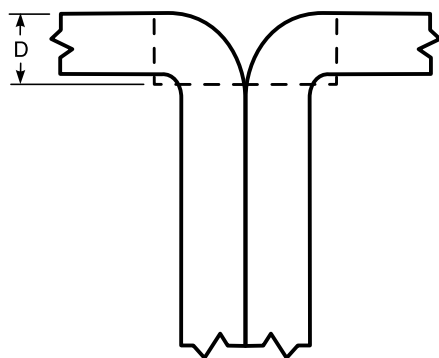


Figure 21—Specification of the Groove Angle of Groove Welds

7.2.10 Flare Groove Welds. Dimension “D” of flare groove welds is considered as extending only to the tangent point indicated below by dimension lines (see Figure 22 and Annex D7.2.10).



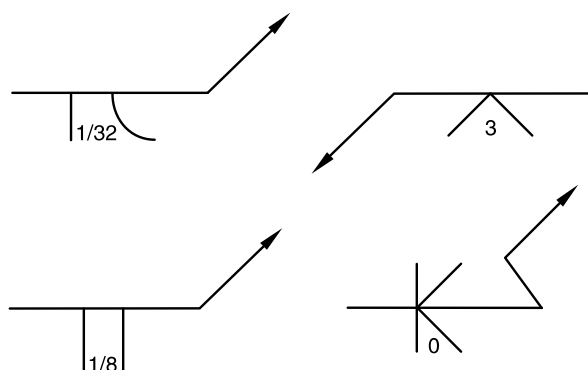
FLARE-BEVEL-GROOVE



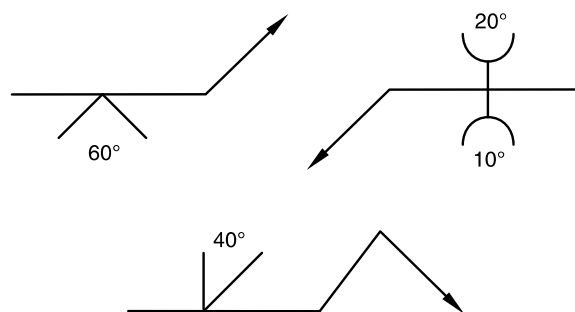
FLARE-V-GROOVE

7.3 Groove Dimensions

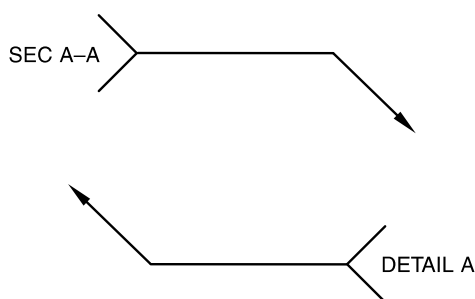
7.3.1 Root Opening. The root opening of groove welds shall be specified inside the weld symbol and only on one side of the reference line (see Figure 20).



7.3.2 Groove Angle. The groove angle of groove welds shall be specified outside the weld symbol (see Figure 21).

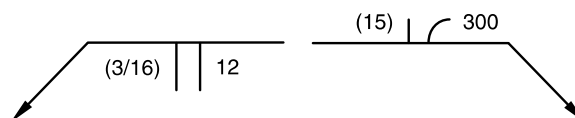


7.3.3 Radii and Root Faces. The groove radii and the root faces of U- and J-groove welds shall be specified by a cross section, detail, or other data with reference thereto in the tail of the welding symbol (see 6.11).



7.4 Length of Groove Welds

7.4.1 Location. The length of a groove weld, when indicated on the welding symbol, shall be specified to the right of the weld symbol [see Figure 23(A) and (C)].



7.4.1.1 Full Length. When a groove weld is to extend for the full length of the joint, no length dimension need be specified on the welding symbol [see Figure 23(B)].

7.4.1.2 Specific Lengths. Specific lengths of groove welds and their locations may be specified by symbols in conjunction with dimension lines [see Figure 23(C)].

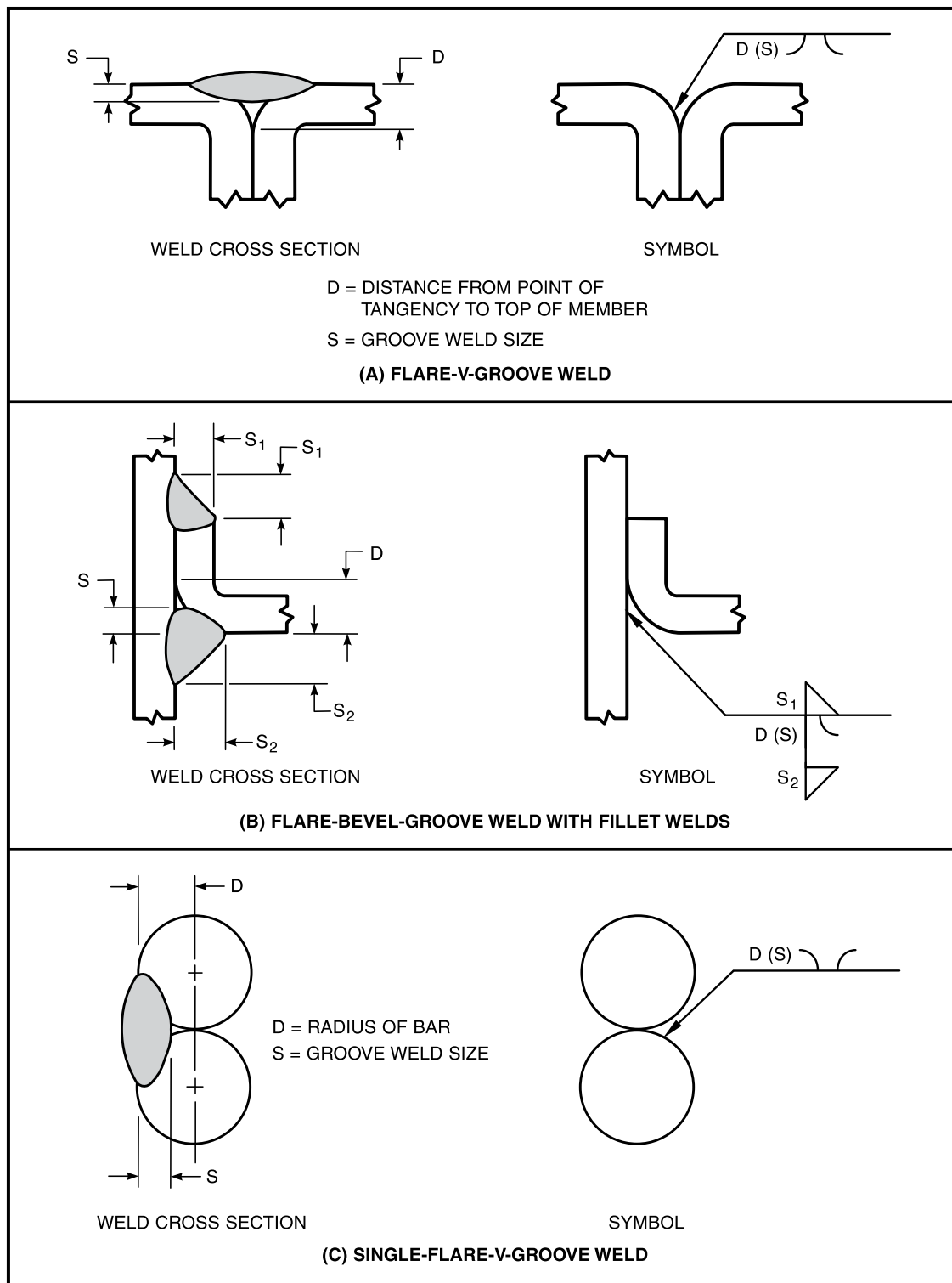


Figure 22—Applications of Flare-Bevel and Flare-V-Groove Weld Symbols

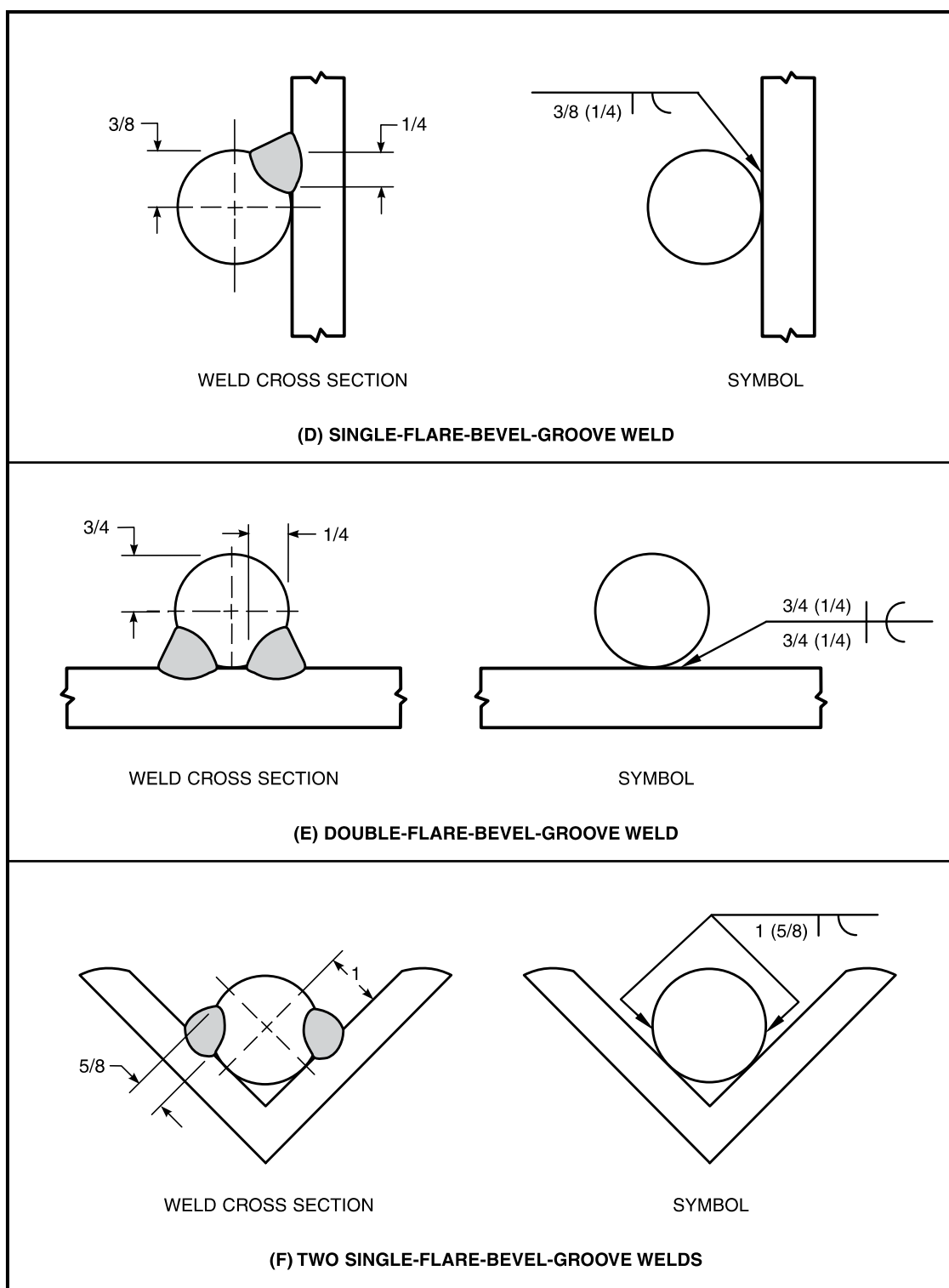


Figure 22 (Continued)—Applications of Flare-Bevel and Flare-V-Groove Weld Symbols

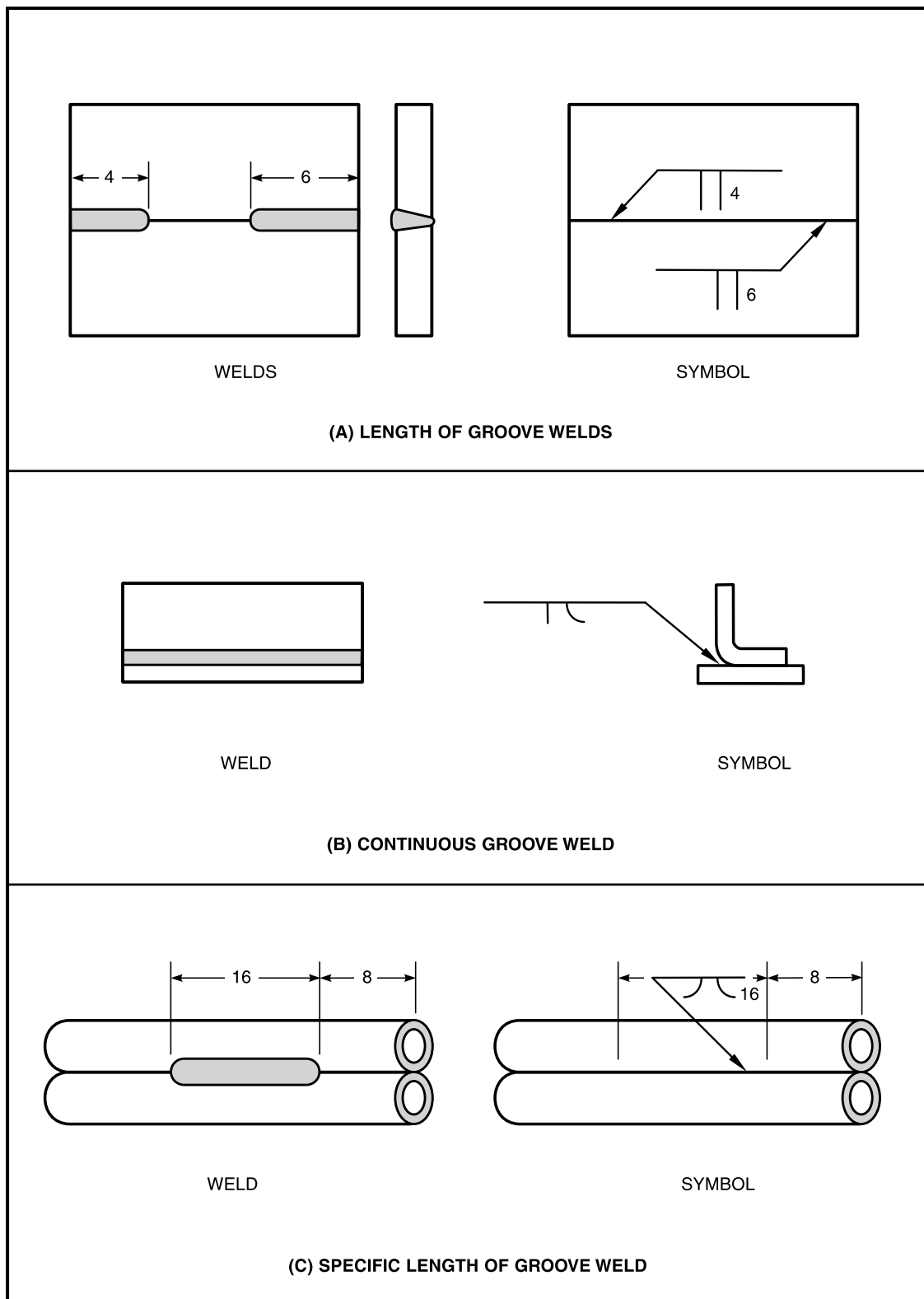
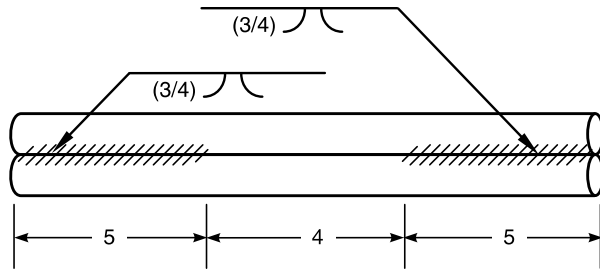


Figure 23—Specification of the Length of Welding of Groove Welds

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

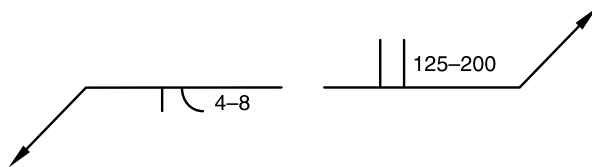


7.4.2 Changes in the Direction of Welding. Symbols for groove welds involving changes in direction of welding shall be in accordance with 6.9.2 (see Figure 24).

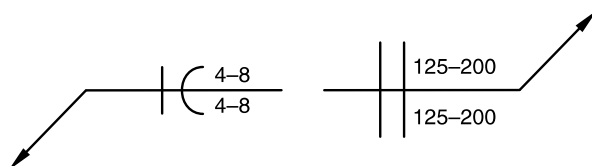
7.5 Intermittent Groove Welds

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 25(A)].

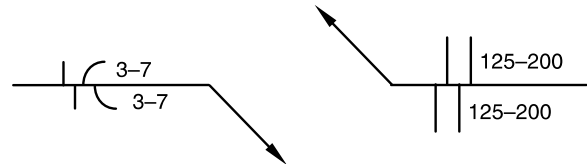
7.5.2 Pitch Dimension Location. The pitch of intermittent groove welds shall be specified to the right of the length dimension following a hyphen [see Figure 25(A)].



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 25(B)].



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 as shown below. The segments of staggered intermittent groove welds shall be symmetrically spaced on both sides of the joint [see Figure 25(C)].

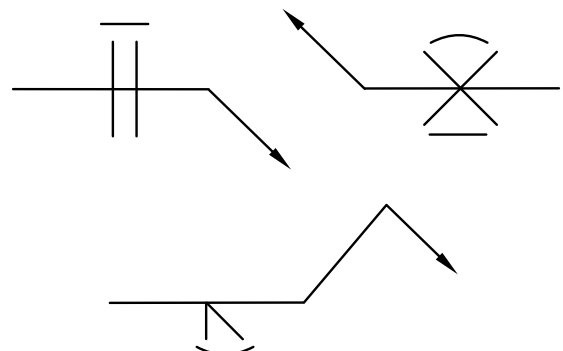


7.5.5 Extent of Welding. In the case of intermittent groove welds, additional weld lengths that are intended at the ends of the joint shall be specified by separate welding symbols and dimensioned on the drawing [see Figure 25(D)]. When no weld lengths are intended at the ends of the joint, the unwelded lengths should not exceed the clear distance between weld segments and should be so dimensioned on the drawing [see Figure 25(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 will 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 Contours and Finishing of Groove Welds

7.6.1 Contours Obtained by Welding. Groove welds that are to be welded with approximately flush or convex faces without postweld finishing shall be specified by adding the flush or convex contour symbol to the welding symbol [see 6.12 and Figure 26(A)].



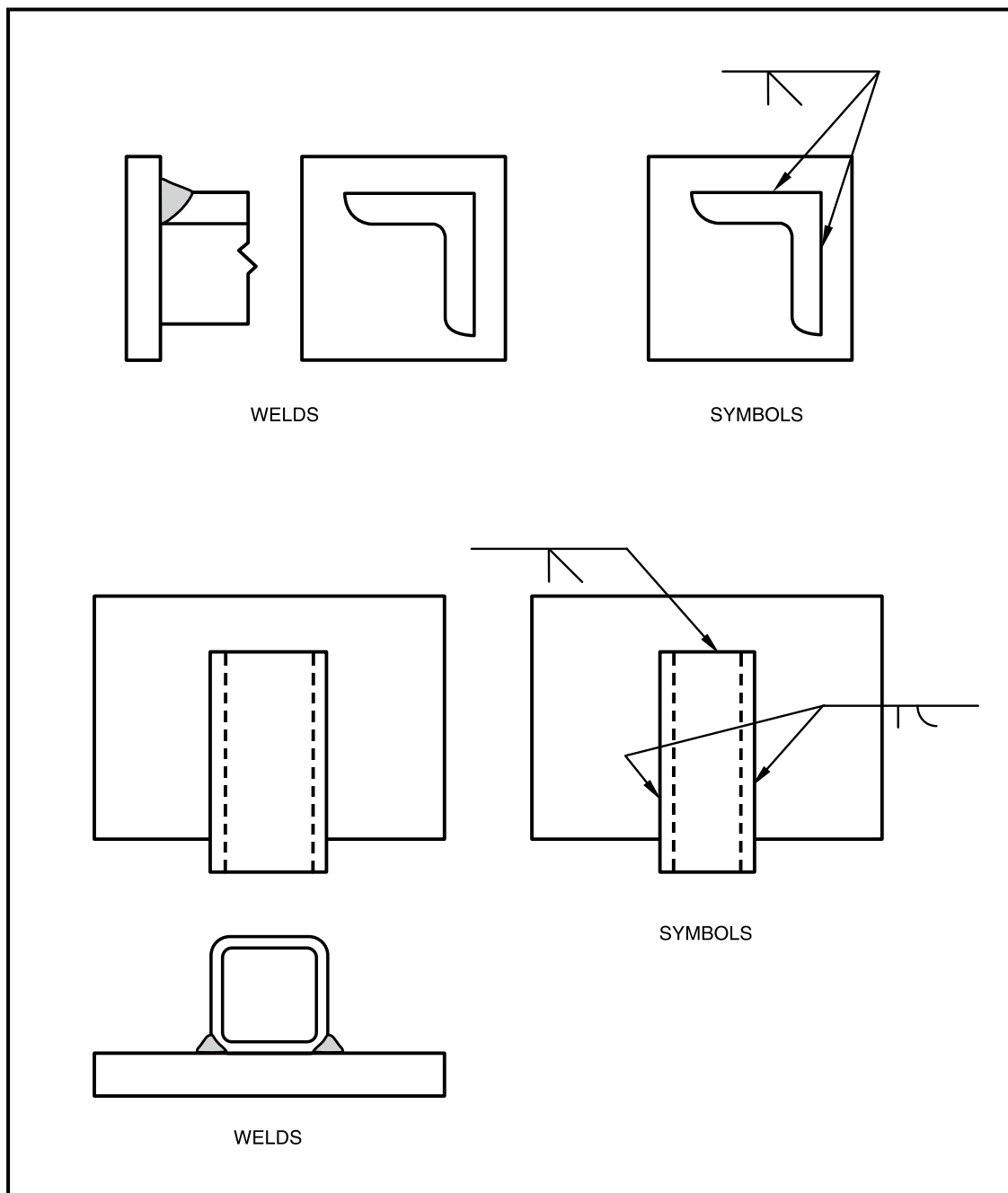


Figure 24—Specification of the Extent of Welding of Groove Welds

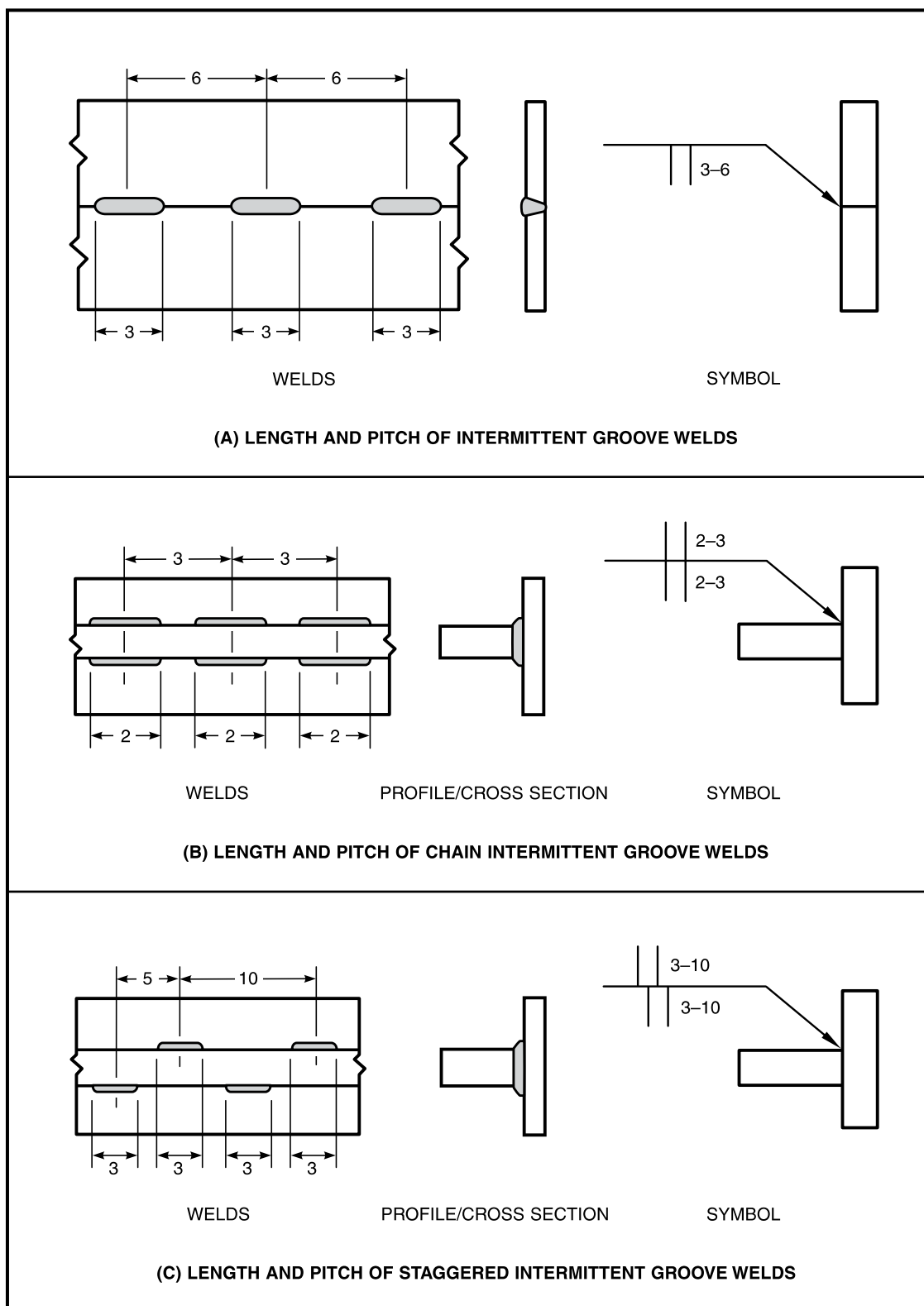


Figure 25—Applications of Intermittent Groove Welds

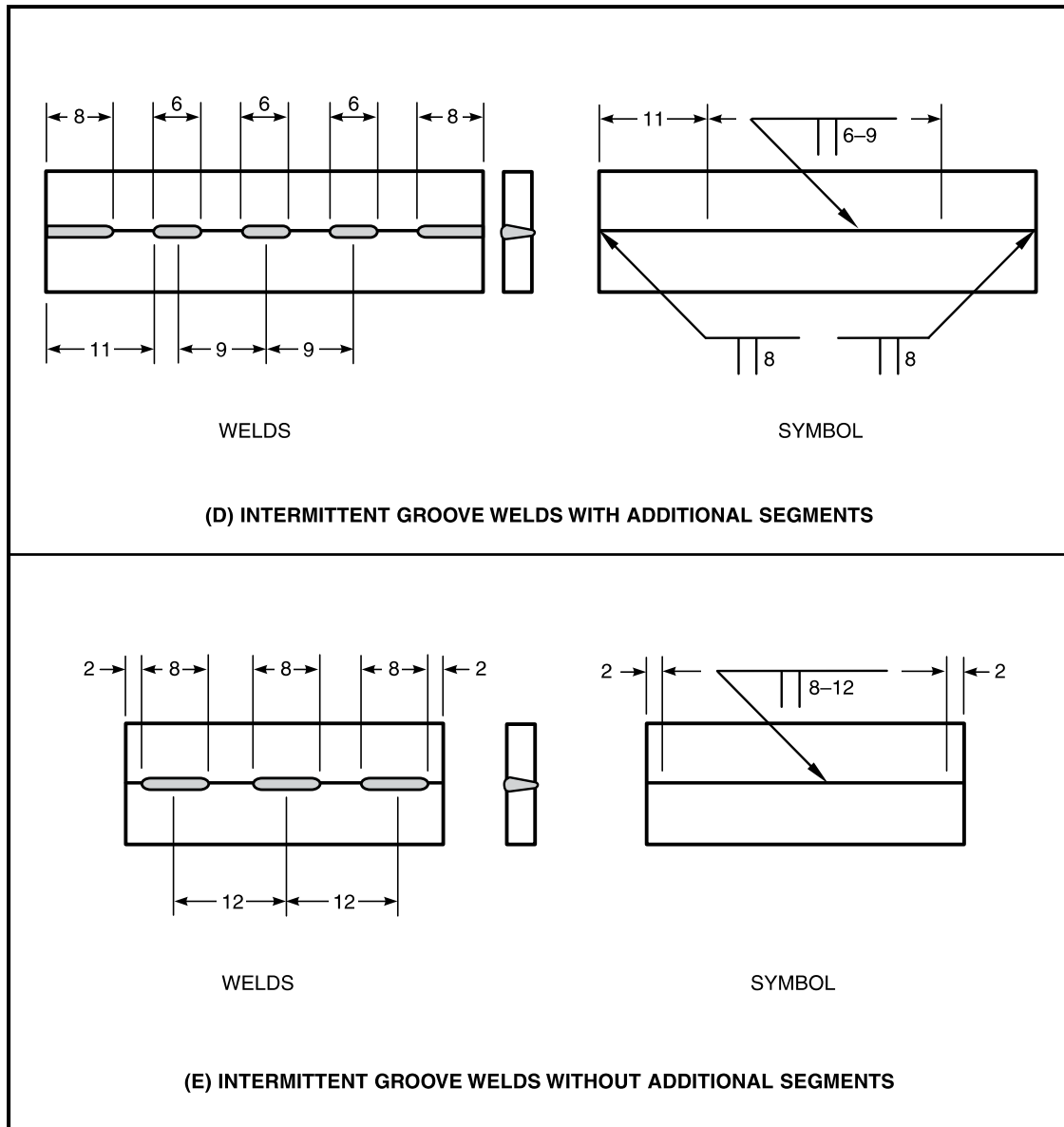


Figure 25 (Continued)—Applications of Intermittent Groove Welds

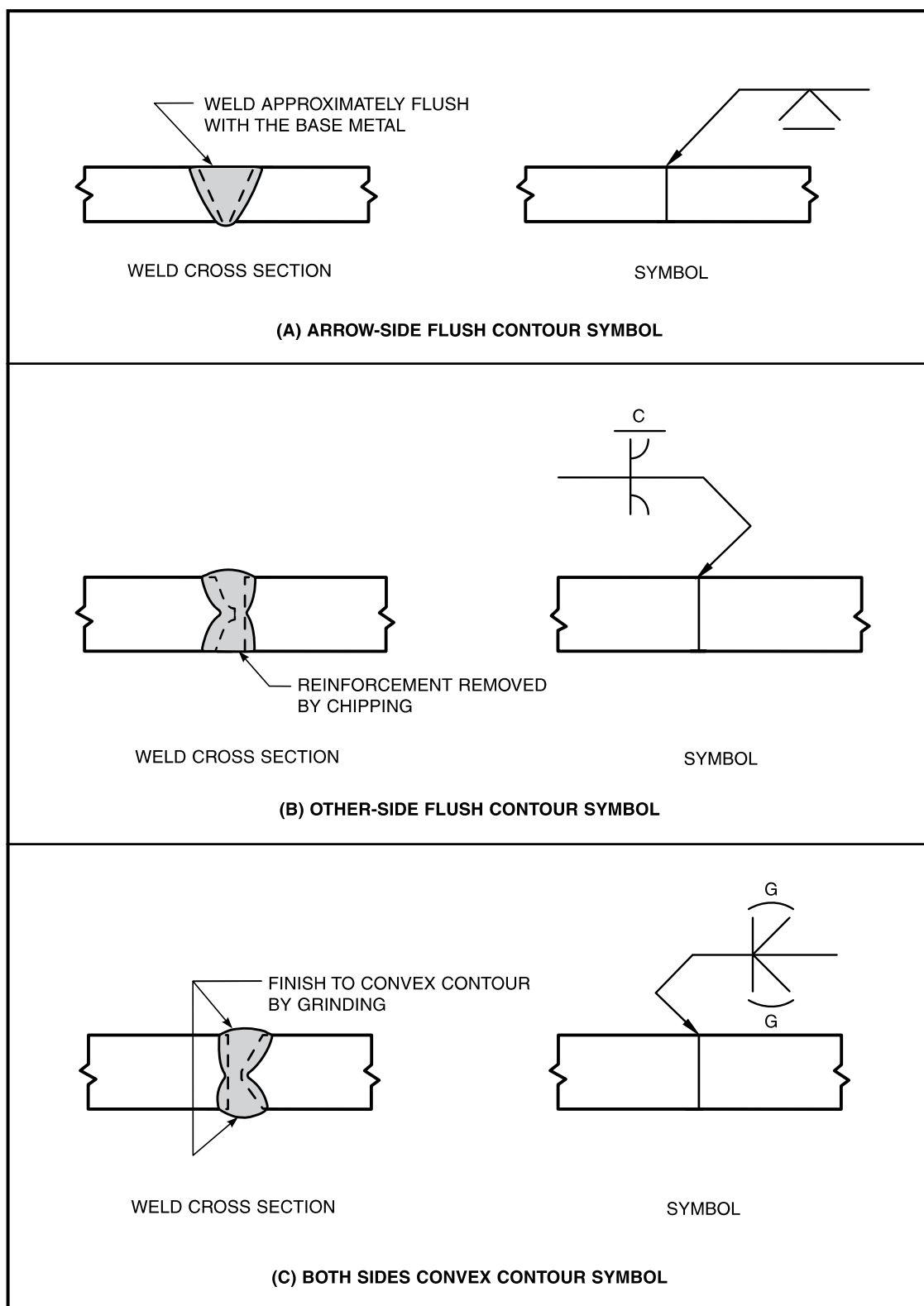
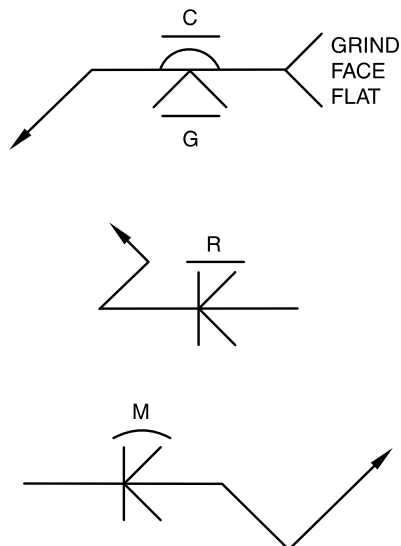


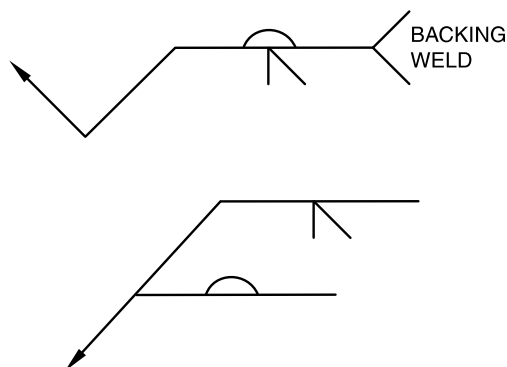
Figure 26—Application of the Flush and Convex Contour Symbols

7.6.2 Contours Obtained by Postweld Finishing.

Groove welds whose faces are to be finished flush or convex by postweld finishing shall be specified by adding both the appropriate contour symbol and finishing designator to the welding symbol. Welds that require a flat, but not flush surface, require an explanatory note in the tail of the welding symbol [see 6.12.2 and Figure 26(B) and (C)].



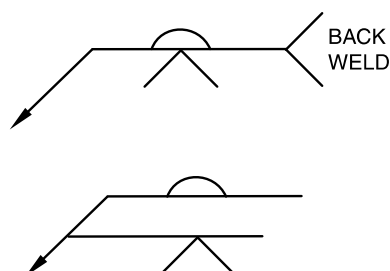
7.7.3 Backing Weld Symbol. The backing weld symbol is placed on the side of the reference line opposite a groove weld symbol. When a single reference line is used, “backing weld” shall be specified in the tail of the welding symbol. Alternately, if multiple reference lines are used, the backing weld symbol shall be placed on a reference line prior to the reference line specifying the groove weld [see Figure 27(B) and (C)].



7.7 Back and Backing Welds

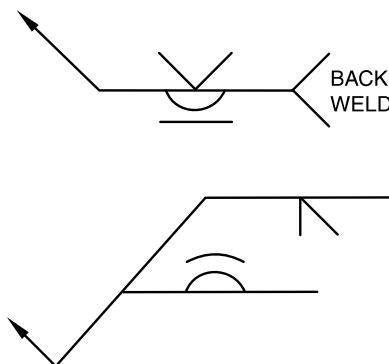
7.7.1 General. The back and backing weld symbols are identical. The sequence of welding determines which designation applies. The back weld is made after the groove weld, and the backing weld is made before the groove weld (see 7.7.2 and 7.7.3).

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 27(A)].



7.7.4 Contour and Finishing of Back or Backing Welds

7.7.4.1 Contours Obtained by Welding. Back or backing welds that are to be welded with approximately flush or convex faces without postweld finishing shall be specified by adding the flush or convex contour symbol to the welding symbol (see 6.12).



7.7.4.2 Contours Obtained by Postweld Finishing. Back or backing welds that are to be finished approximately flush or convex by postweld finishing

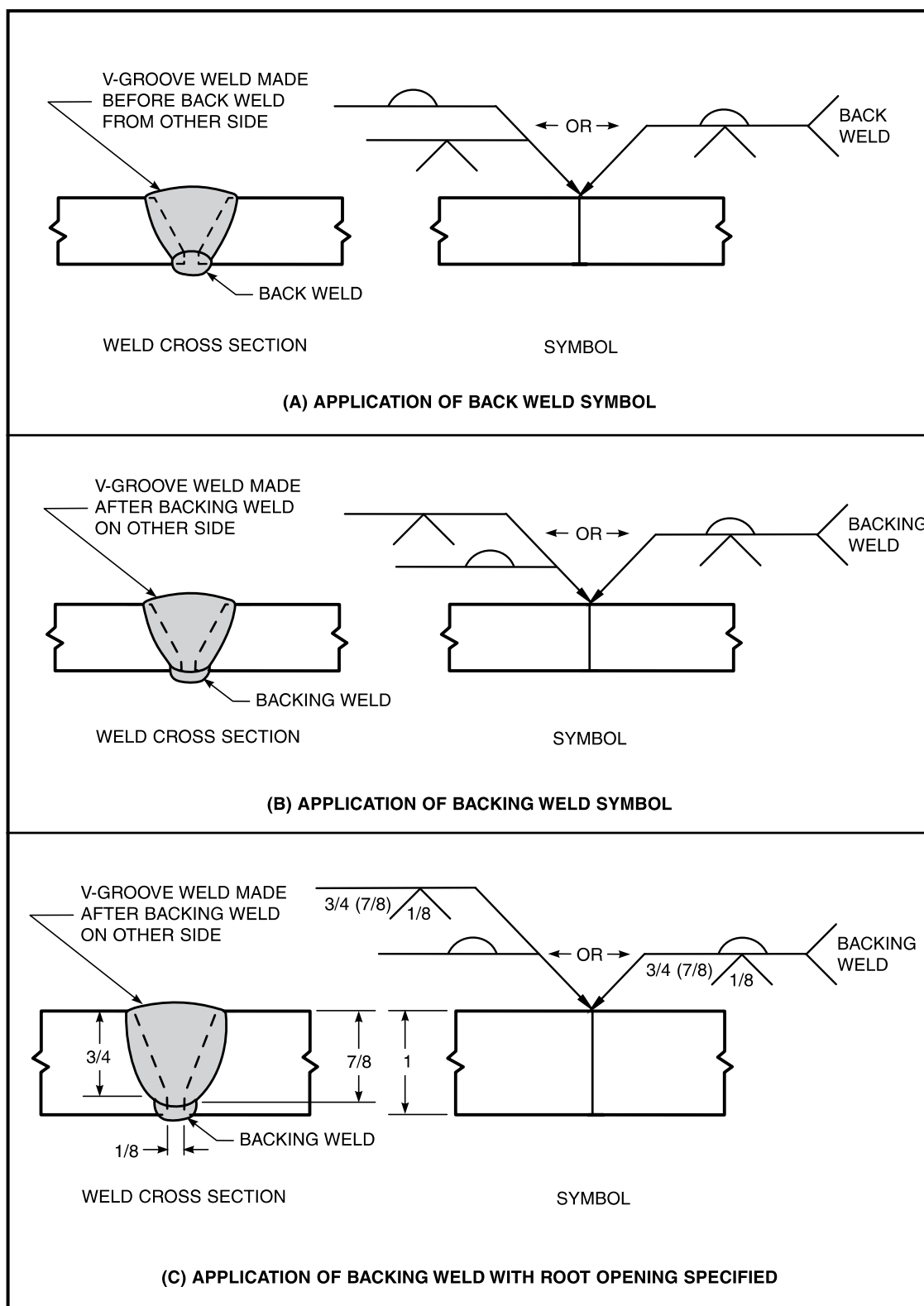
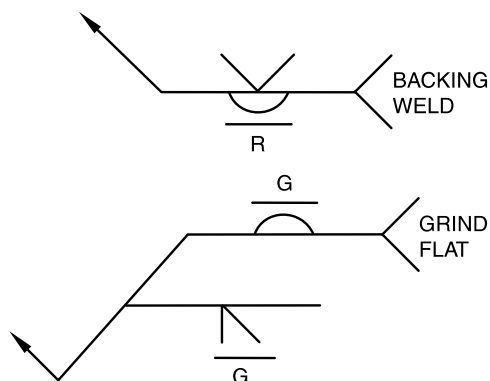
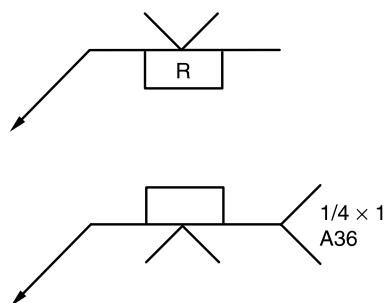


Figure 27—Application of Back or Backing Weld Symbol

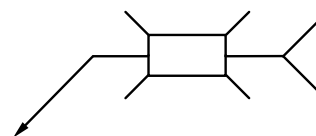
shall be specified by adding the appropriate contour symbol and finishing designator to the welding symbol (see 6.12.2 and 6.12.3). Welds that require a flat but not flush surface require an explanatory note in the tail of the welding symbol.



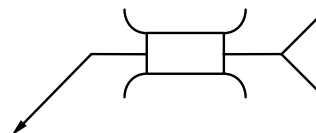
7.8 Joints with Backing. A joint with backing is specified by placing the backing symbol on the side of the reference line opposite the groove weld symbol. If the backing is to be removed after welding, an “R” shall be placed in the backing symbol [see Figure 28(A)]. The material and the dimensions of the backing shall be specified in the tail of the welding symbol or on the drawing.



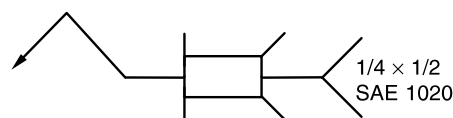
7.9 Joints with Spacers. A joint with a required spacer is specified with the groove weld symbol modified to show a rectangle within it [see Figure 28(B)]. In case of multiple reference lines, the rectangle shall appear on the reference line nearest to the arrow [see Figure 28(C)]. The material and the dimensions of the spacer shall be specified in the tail of the welding symbol or on the drawing.



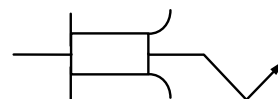
DOUBLE-V-GROOVE



DOUBLE-U-GROOVE

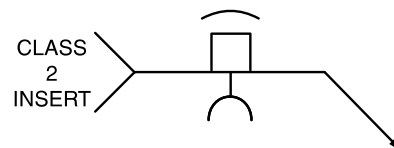
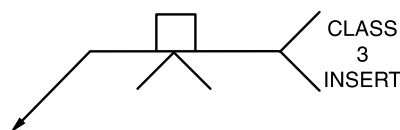


DOUBLE-BEVEL-GROOVE



DOUBLE-J-GROOVE

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 29). The AWS consumable insert class shall be placed in the tail of the welding symbol (for the AWS insert classes, see AWS A5.30/A5.30M, *Specification for Consumable Inserts*).



7.11 Groove Welds with Backgouging. Along with other joint details, the welding symbol shall include a

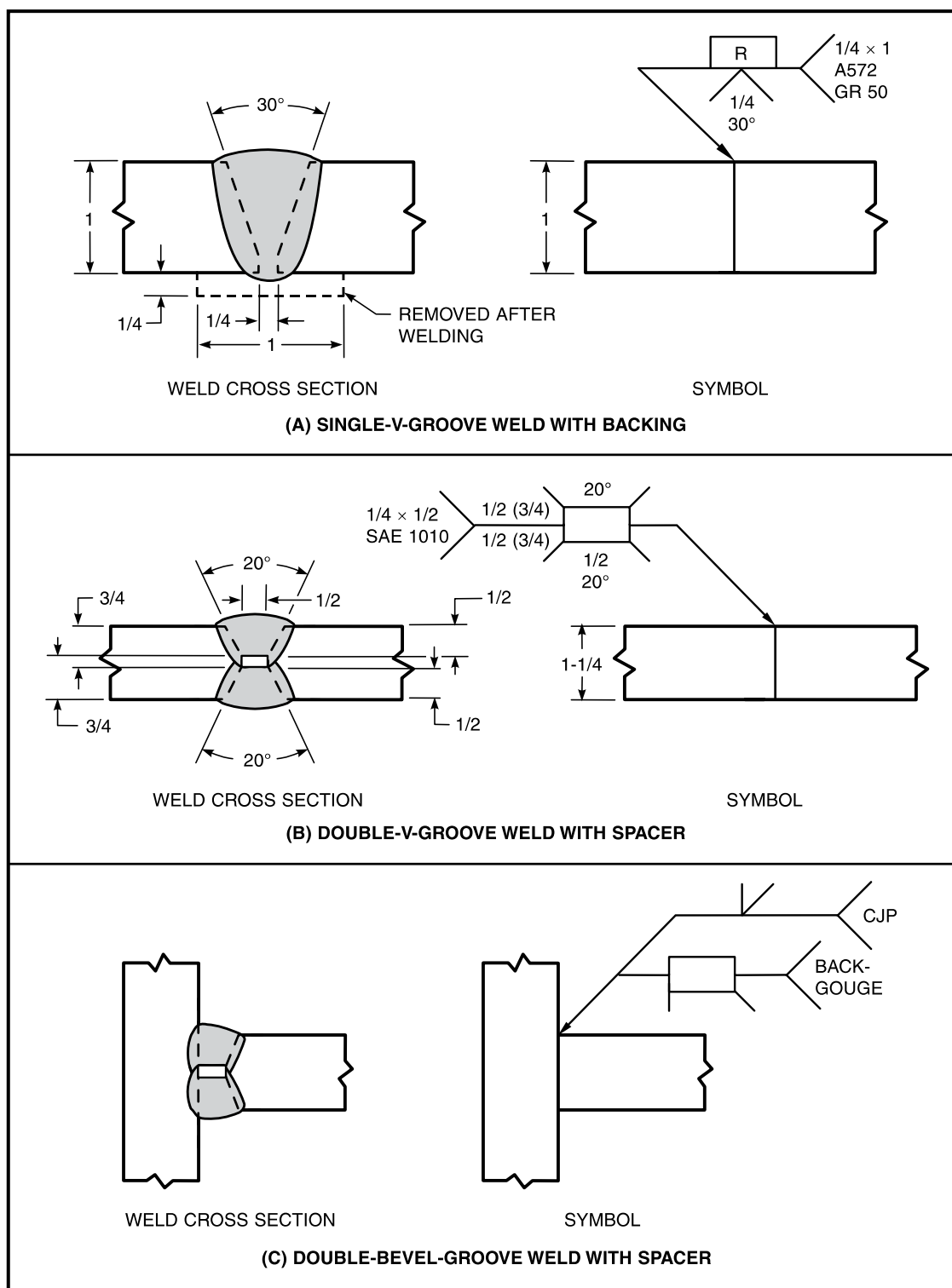


Figure 28—Joints with Backing or Spacers

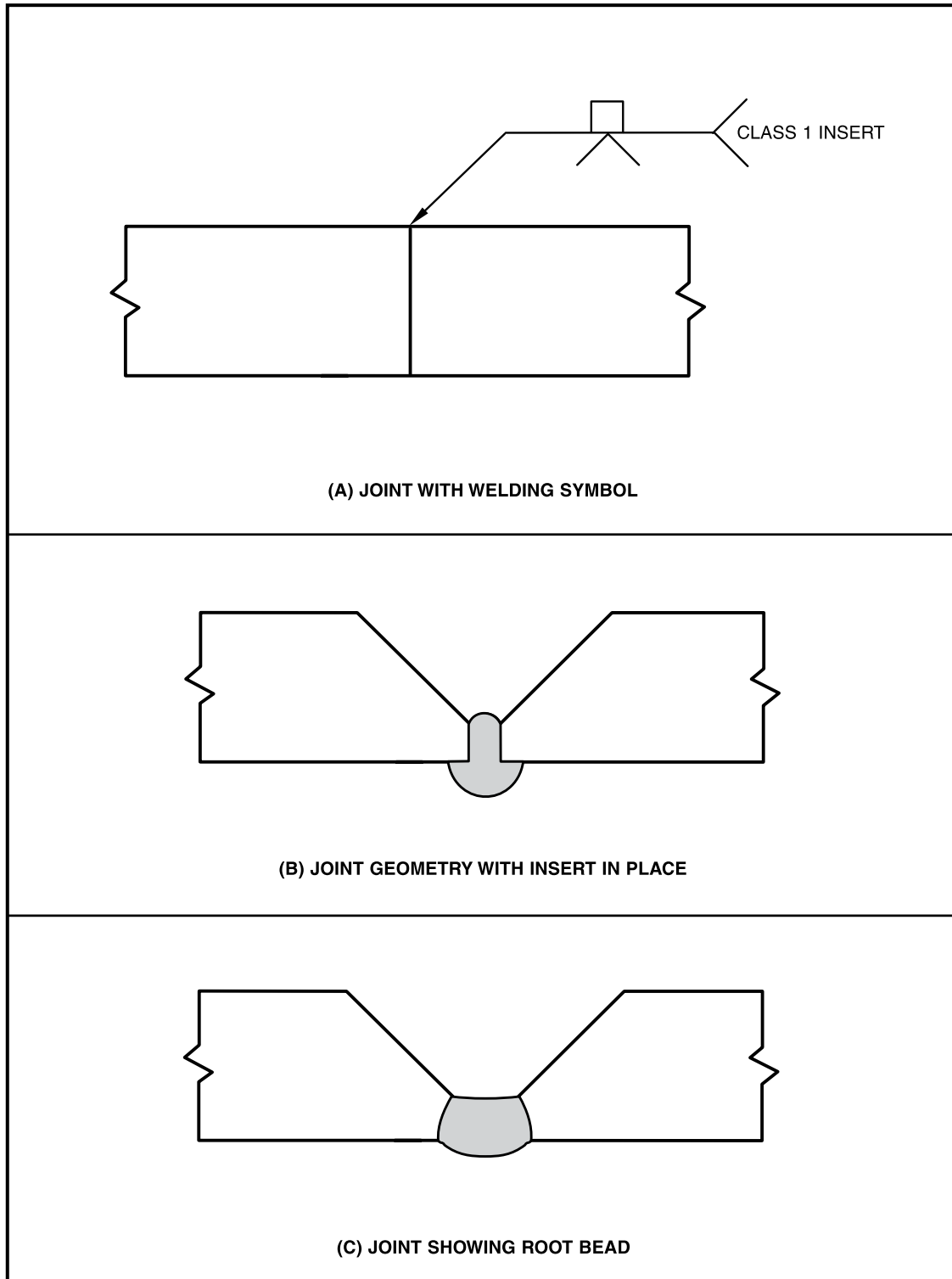
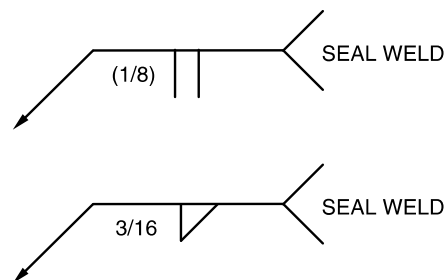


Figure 29—Application of Consumable Insert Symbol

reference to backgouging in the tail. In the case of non-symmetrical double-groove welds, the symbol shall show the required depth of groove for each side of the joint [see Figure 30(A)], together with the required groove angles. 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 depth of groove dimension [see 7.2.2 and Figure 30(B) and (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, hence, the proper weld symbol is in question, the detail of the desired joint and weld configuration shall be shown on the drawing with all necessary dimensions (see Figure 31).

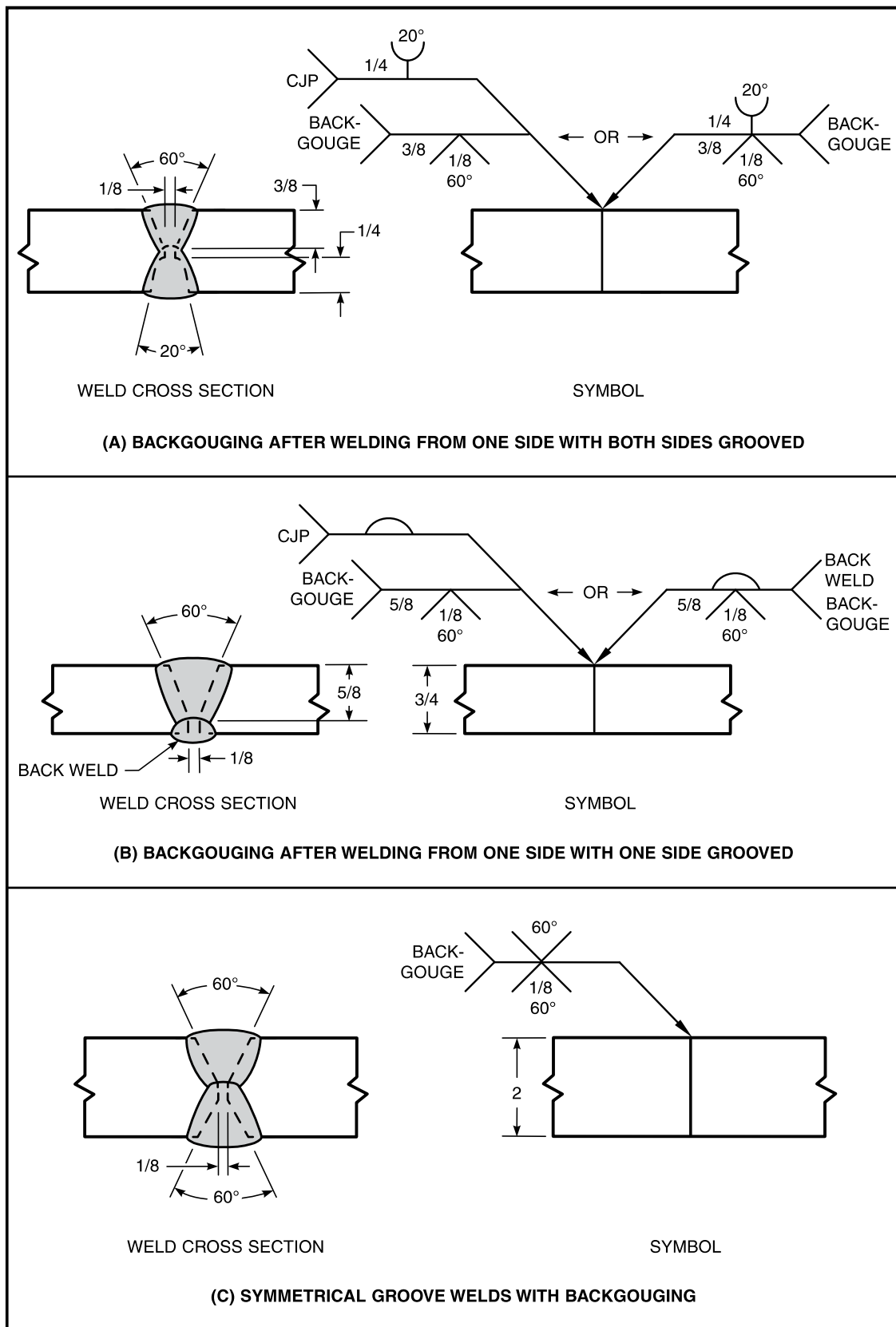


Figure 30—Application of the Symbol for Groove Welds with Backgouging

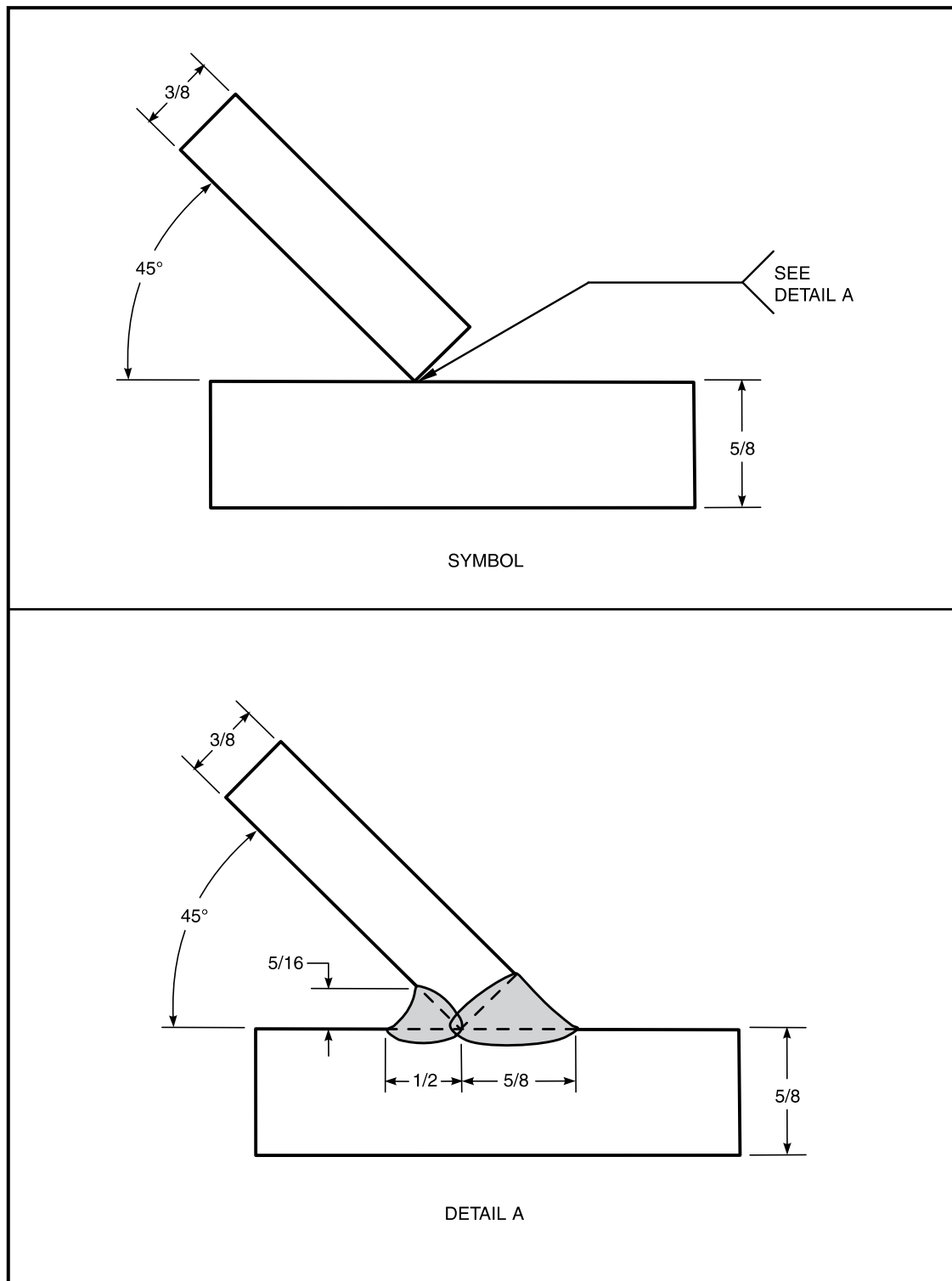
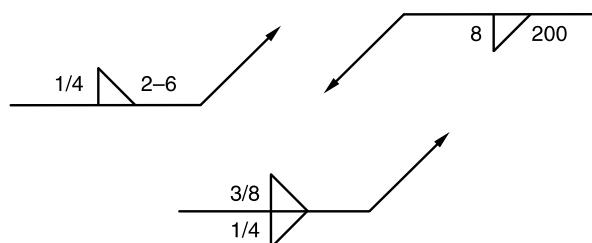


Figure 31—Skewed Joint

8. Fillet Welds

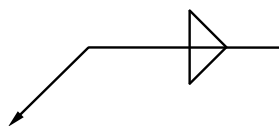
8.1 General

8.1.1 Dimension Location. The dimensions of fillet welds shall be shown on the same side of the reference line as the weld symbol (see Figures 32 through 34).



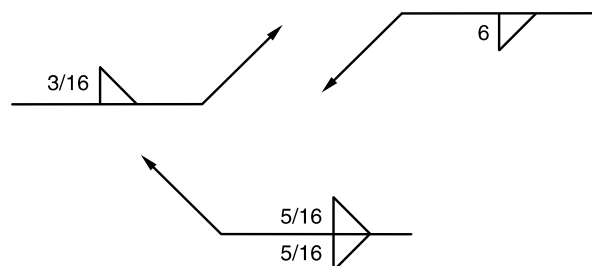
8.1.2 Double Fillet Welds. The dimensions of fillet welds on both sides of a joint shall be specified whether the dimensions are identical or different [see Figure 32(B) and (C) and Figure 34(B) and (C)].

8.1.3 Drawing Notes. Dimensions of fillet welds covered by drawing notes need not be repeated on the welding symbols in accordance with 6.11.6.

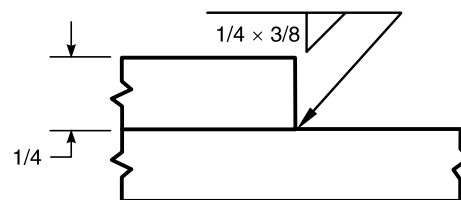
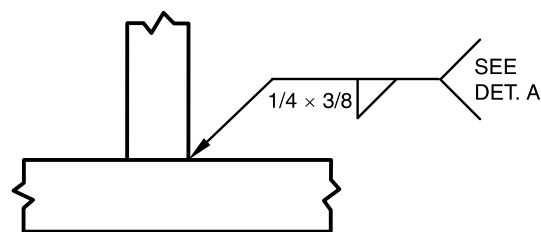


8.2 Size of Fillet Welds

8.2.1 Location. The fillet weld size, “S”, shall be specified to the left of the weld symbol [see Figure 32(A), (B), (C), and (D)].

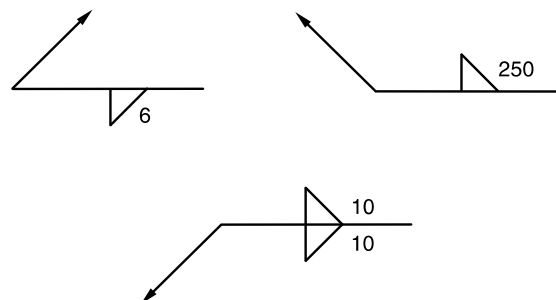


8.2.2 Unequal Legs. The size of a fillet weld, “S”, with unequal legs shall be specified to the left of the weld symbol as shown below. Weld orientation is not specified by the symbol and shall be shown on the drawing to ensure clarity [see Figure 32(D)].



8.3 Length of Fillet Welds

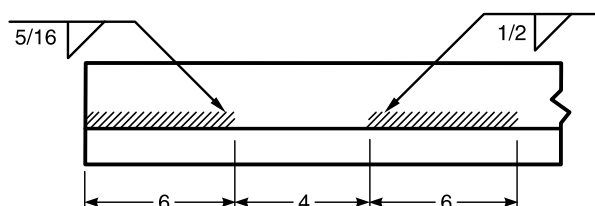
8.3.1 Location. The length of a fillet weld, when indicated on the welding symbol, shall be specified to the right of the weld symbol [see Figure 32(F)].



8.3.1.1 Full Length. When a fillet weld extends for the full length of the joint, no length dimension need be specified on the welding symbol [see Figure 32(A), (B), (C), (D), and (E)].

8.3.1.2 Specific Lengths. Specific lengths of fillet welds, and their location, may be specified by symbols in conjunction with dimension lines [see Figures 10(C) and 32(F)].

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



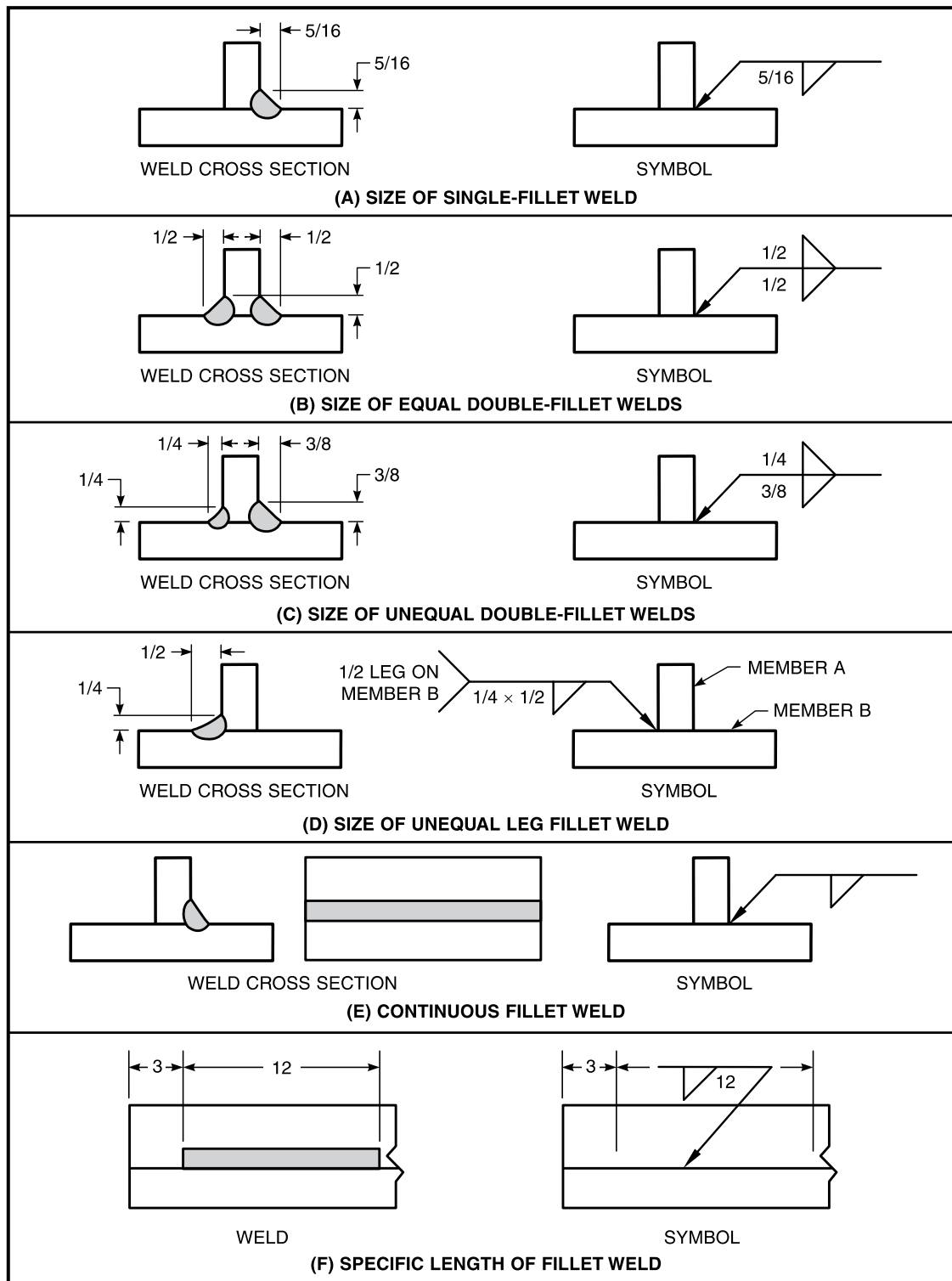


Figure 32—Application of the Symbols for the Size and Length of Fillet Welds

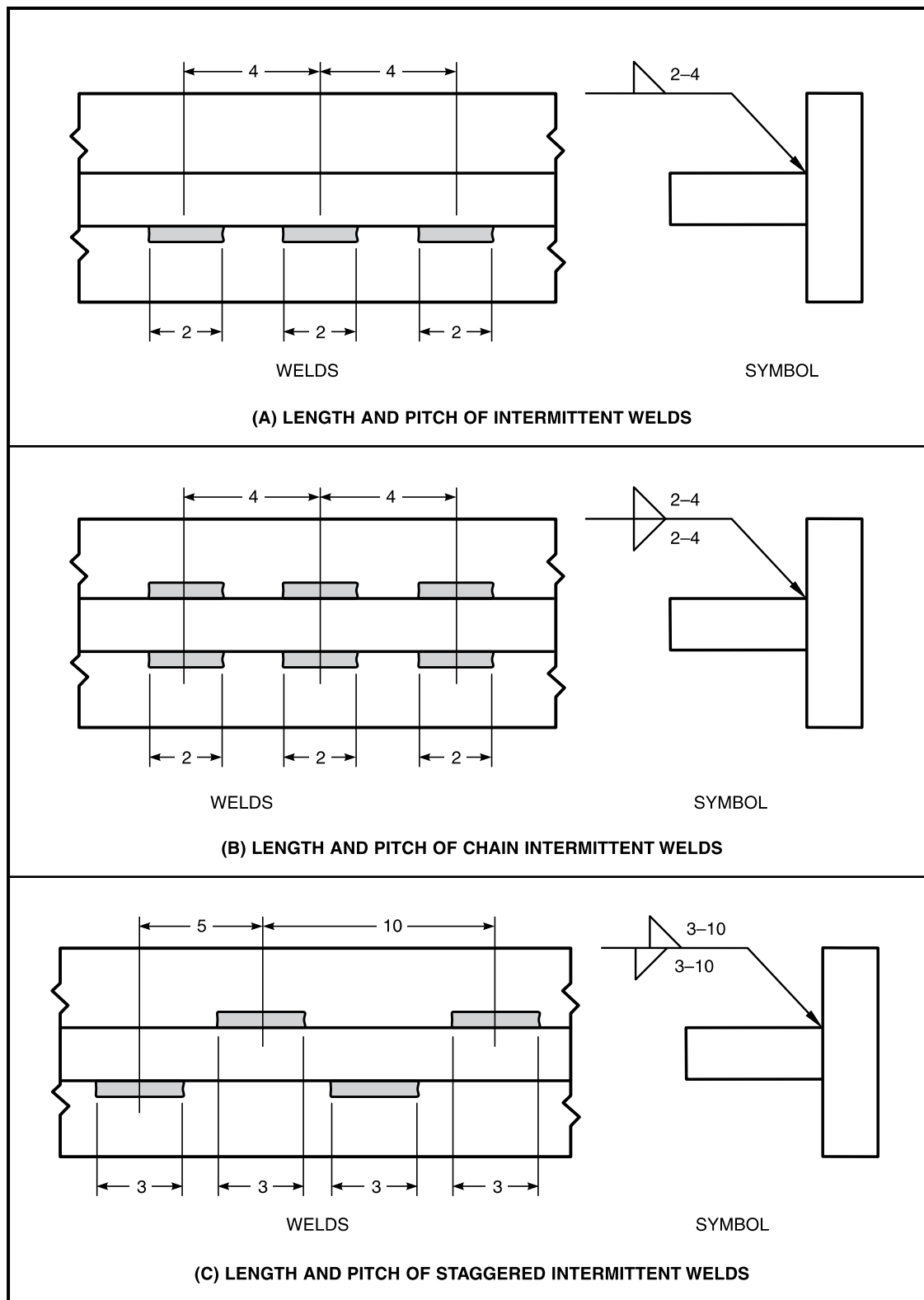


Figure 33—Application of the Intermittent Fillet Weld Symbol

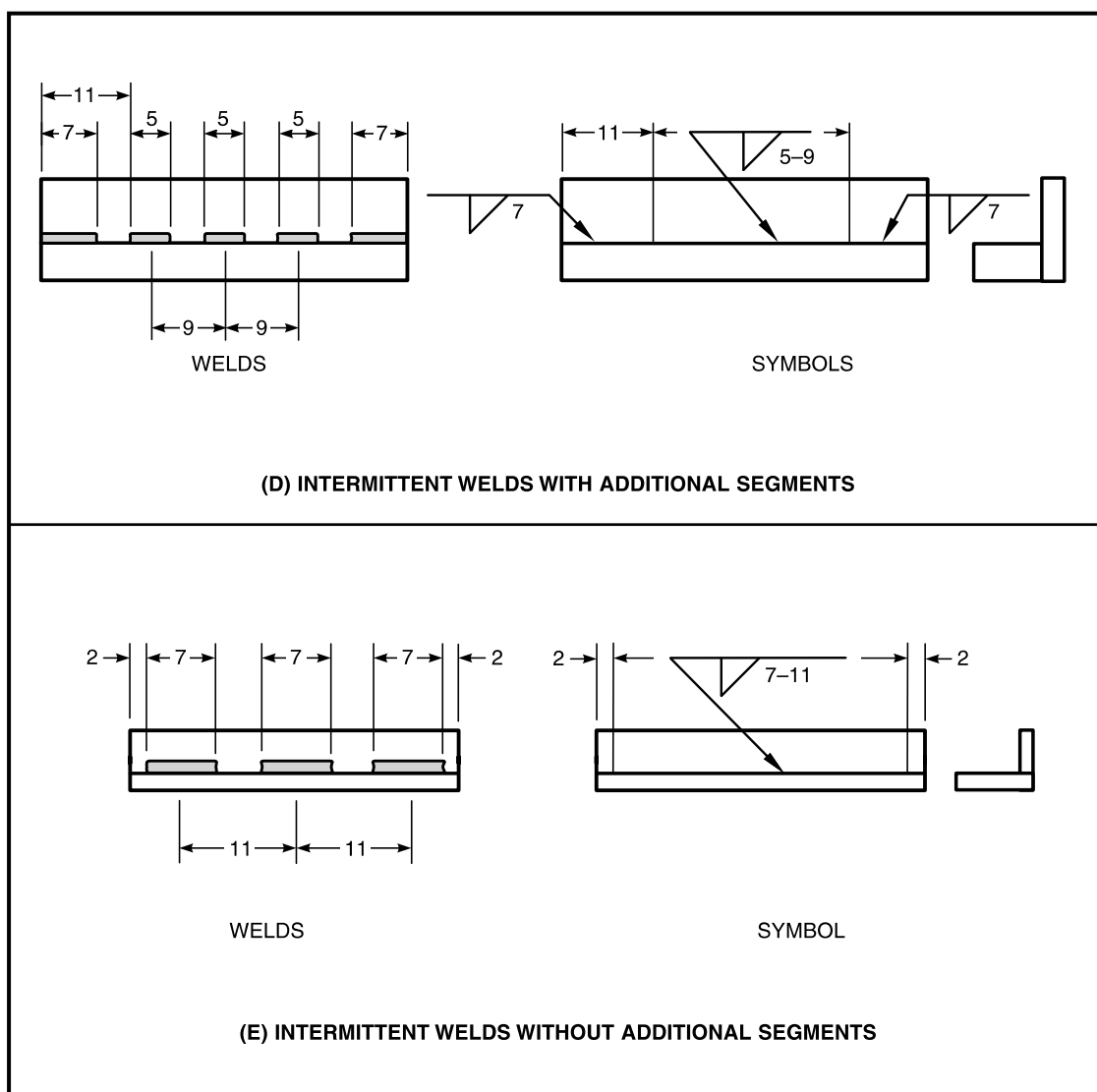


Figure 33 (Continued)—Application of the Intermittent Fillet Weld Symbol

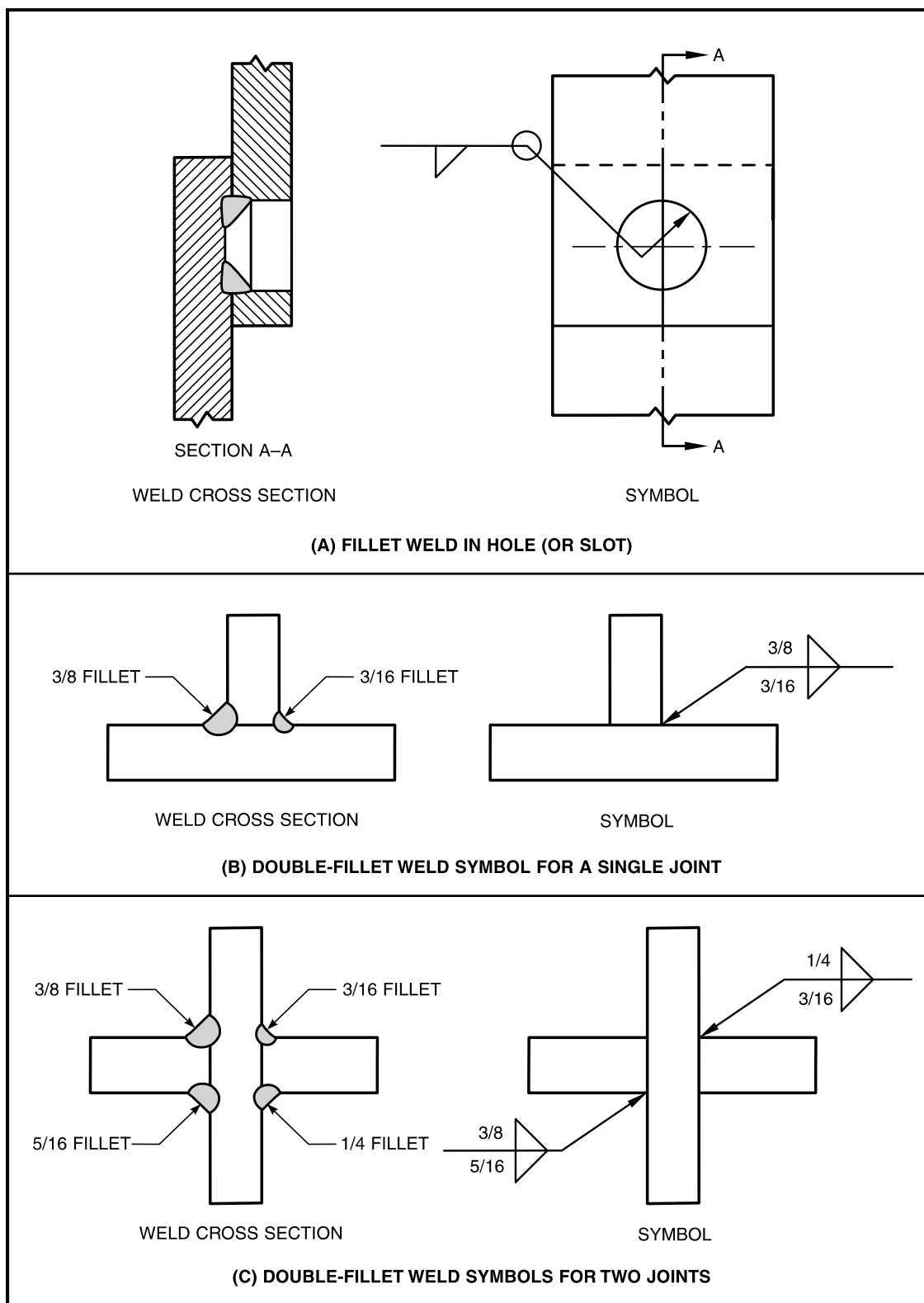


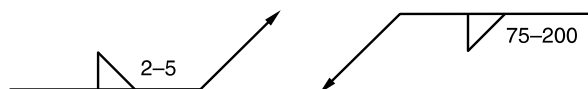
Figure 34—Application of the Fillet Weld Symbol

8.3.2 Changes in Direction of Welding. Symbols for fillet welds involving changes in the direction of welding shall be in accordance with 6.9.2 [see Figure 8(A)].

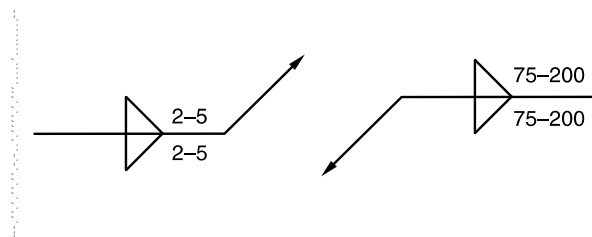
8.4 Intermittent Fillet Welds

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 33(A)].

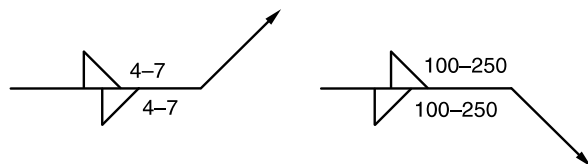
8.4.2 Pitch Dimension Location. The pitch of intermittent fillet welds shall be specified to the right of the length dimension following a hyphen (see Figure 33).



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 33(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 as shown below. The segments of staggered intermittent fillet welds shall be symmetrically spaced on both sides of the joint [see Figure 33(C)].



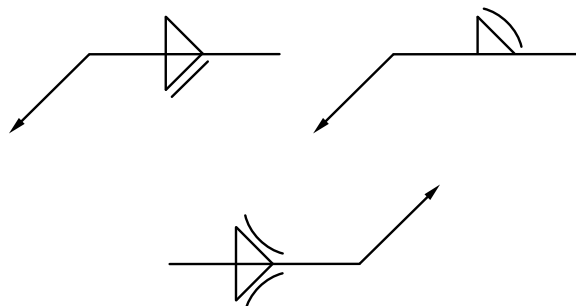
8.4.5 Extent of Welding. In the case of intermittent fillet welds, additional weld lengths that are intended at the ends of the joint shall be specified by separate welding symbols and dimensioned on the drawing [see Figure 33(D)]. When no weld lengths are intended at the ends of the joint, the unwelded lengths should not exceed the clear distance between weld segments and be so dimensioned on the drawing [see Figure 33(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 will be necessary to provide specific segment locations by dimension lines (see 8.3.1.2) or by hatching (see 8.3.1.3).

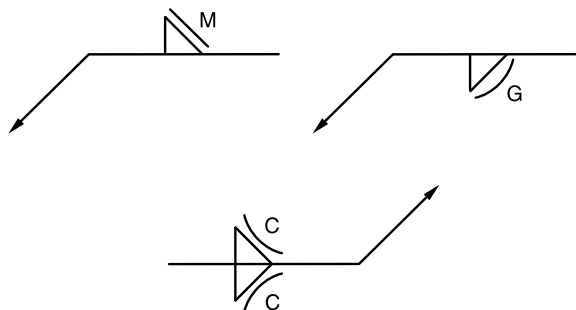
8.5 Fillet Welds in Holes and Slots. Fillet welds in holes and slots shall be specified by the use of fillet weld symbols [see Figure 34(A)].

8.6 Contours and Finishing of Fillet Welds

8.6.1 Contours Obtained by Welding. Fillet welds that are to be welded with approximately flat, convex, or concave faces without postweld finishing shall be specified by adding the flat, convex, or concave contour symbol to the welding symbol (see 6.12.1).



8.6.2 Contours Obtained by Postweld Finishing. Fillet welds that are to be finished approximately flat, convex, or concave by postweld finishing shall be specified by adding both the appropriate contour symbol and finishing designator to the welding symbol (see 6.12.2).

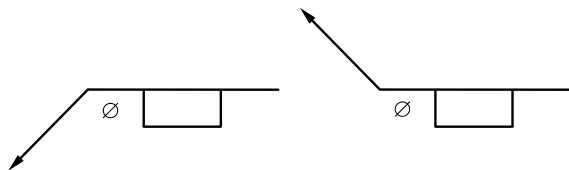


8.7 Skewed Joints. When the angle between the fusion faces is such that the identification of the weld type and thus the proper weld symbol may be in question, the detail of the desired joint and weld configuration shall be shown on the drawing (see 7.13 and Figure 31).

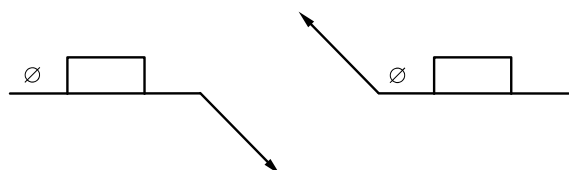
9. Plug Welds

9.1 General

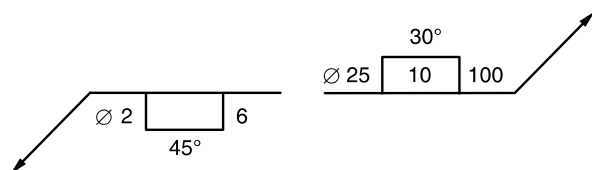
9.1.1 Arrow-Side Holes. Holes in the arrow-side member of a joint to be plug welded shall be specified by placing the plug weld symbol below the reference line [see Figure 35(A)].



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 35(B)].

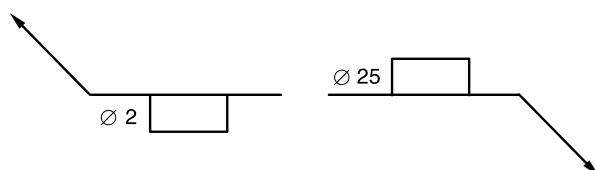


9.1.3 Dimensions. Dimensions of plug welds shall be specified on the same side of the reference line as the weld symbol (see Figure 36).

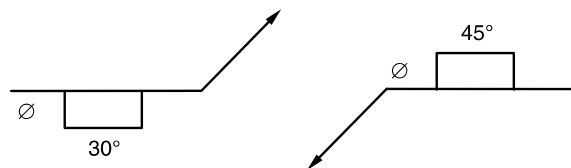


9.1.4 Fillets in Holes. The plug weld symbol shall not be used to designate fillet welds in holes (see 8.5).

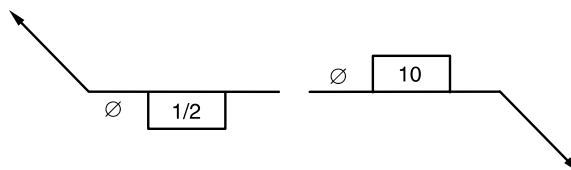
9.2 Plug Weld Size. The plug weld size shall be specified to the left of the plug weld symbol and shall be preceded by the diameter symbol, Ø, shown [see Figure 36(A), (E), (F), and (G)]. Plug weld size is the diameter of the hole at the faying surface.



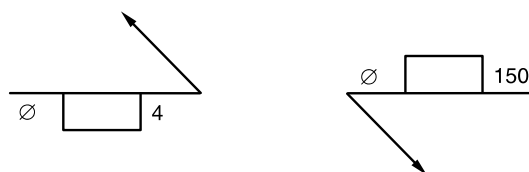
9.3 Angle of Countersink. The included angle of countersink of plug welds shall be located on the same side of the reference line and above or below the plug weld symbol as appropriate [see Figure 36(B) and (E)].



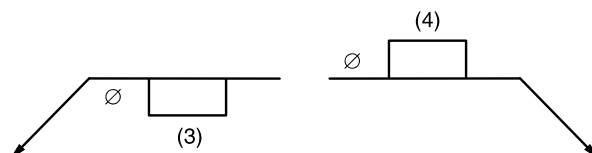
9.4 Depth of Filling. When the depth of filling is less than complete, it shall be specified inside the plug weld symbol [see Figure 36(C) and (E)]. The omission of a depth dimension shall specify complete filling [see Figure 36(A), (B), (D), (F), and (G)].



9.5 Spacing of Plug Welds. The pitch (center-to-center distance) of plug welds in a straight line shall be specified to the right of the plug weld symbol [see Figure 36(D) and (E)]. The spacing of plug welds 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 36(D)]. When the welding symbol also includes the angle of countersink, the number of plug welds shall be placed either above or below the angle of countersink, as appropriate [see Figure 36(E)].



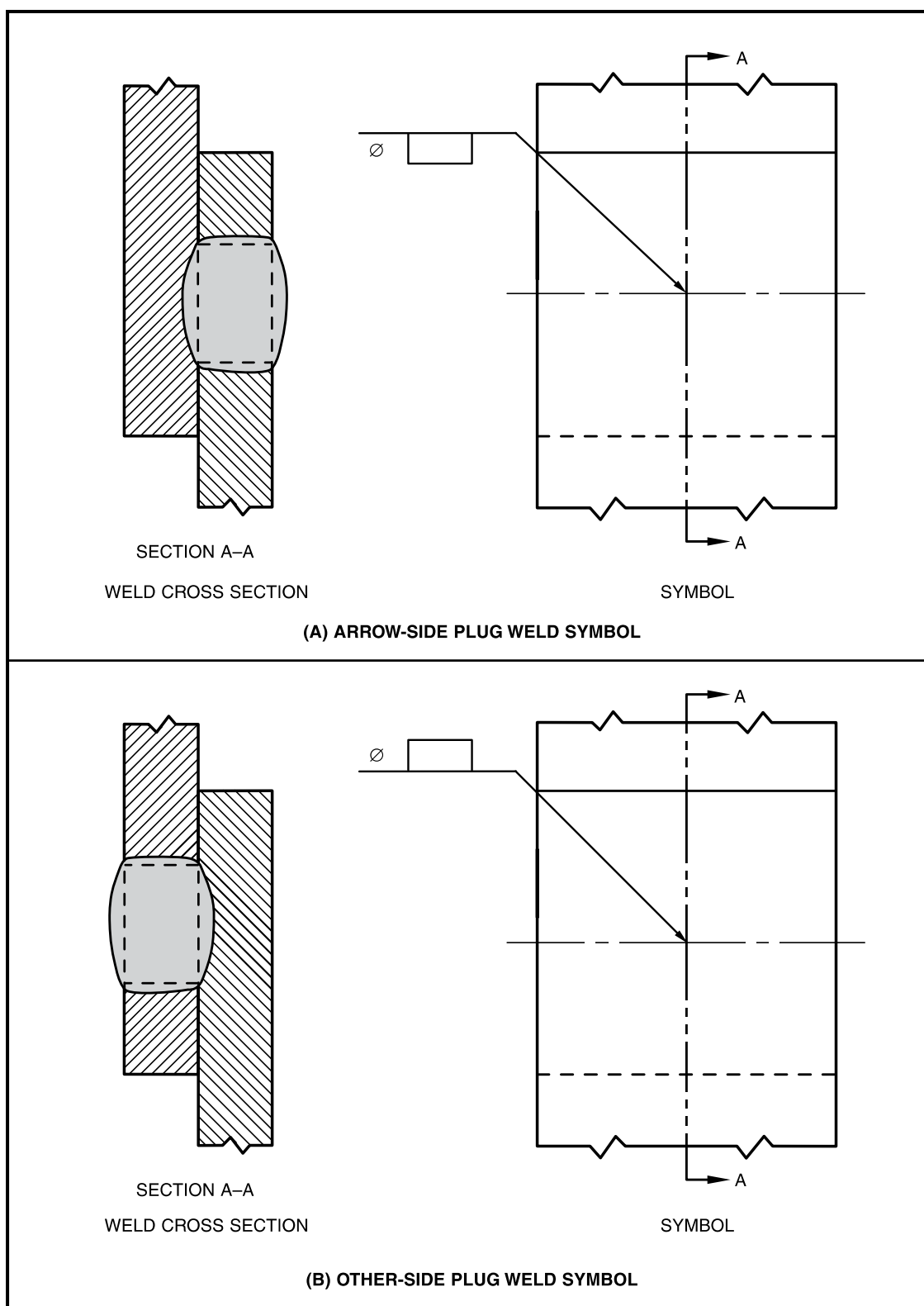


Figure 35—Application of the Plug Weld Symbol

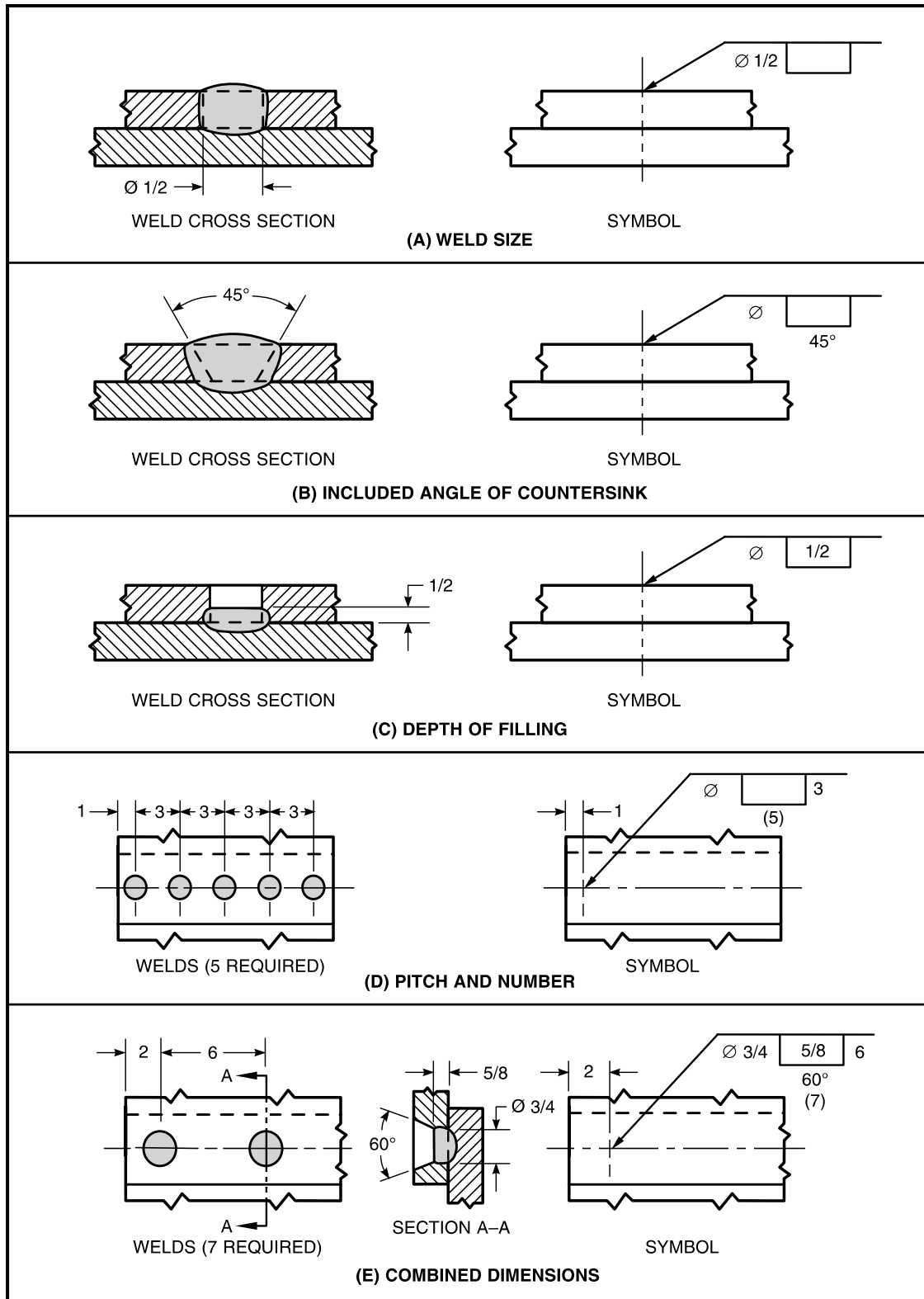


Figure 36—Application of Information to Plug Weld Symbols

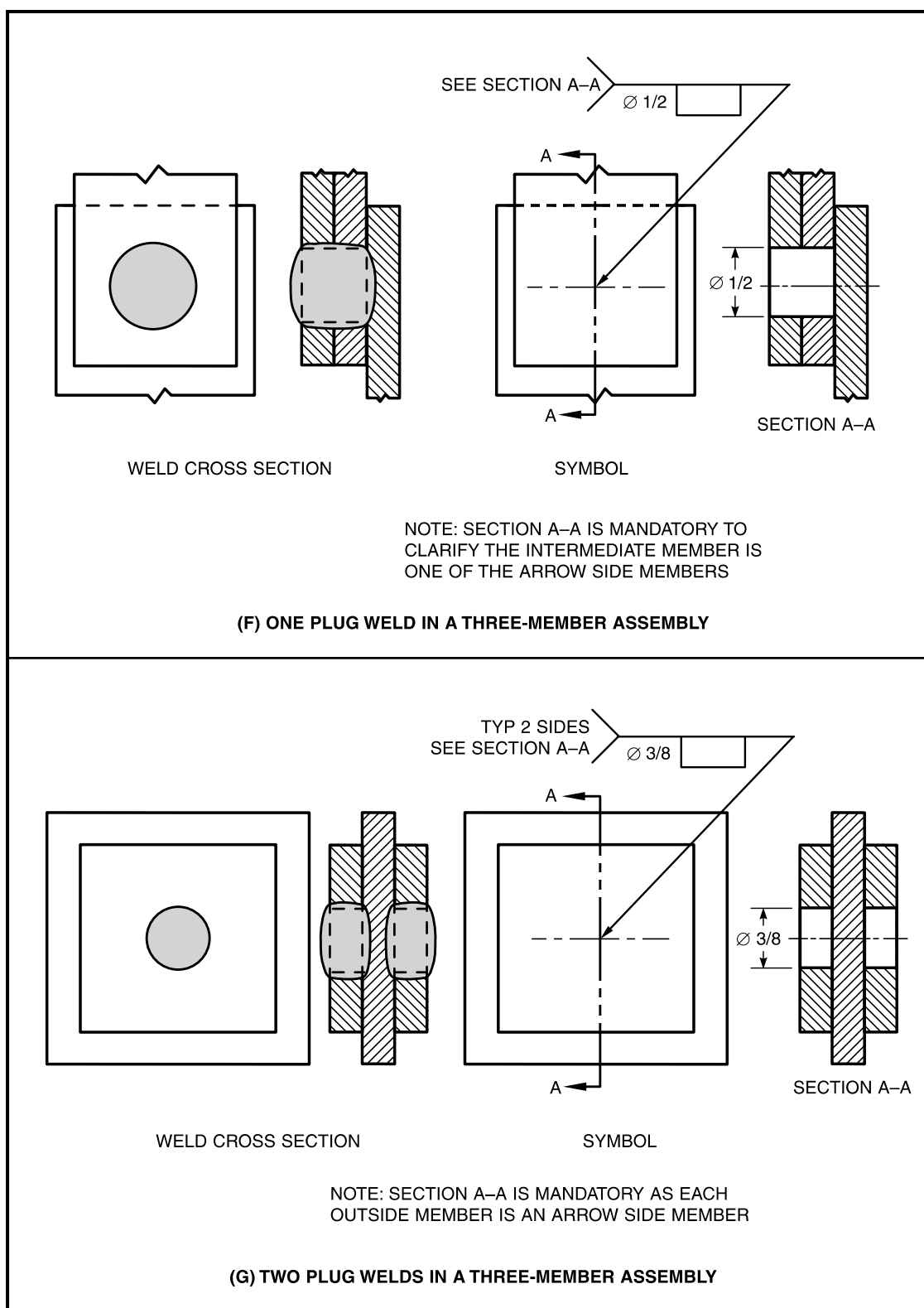
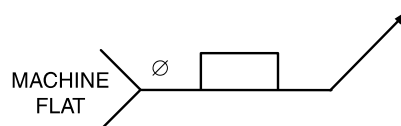
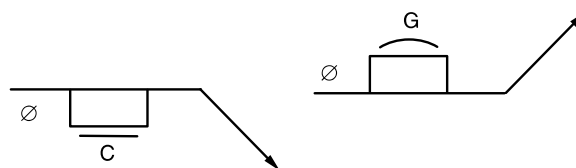
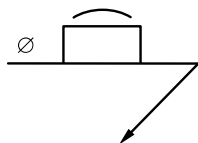
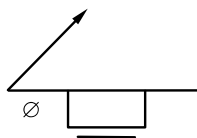


Figure 36 (Continued)—Application of Information to Plug Weld Symbols

9.7 Contours and Finishing of Plug Welds

9.7.1 Contours Obtained by Welding. Plug welds that are to be welded with approximately flush or convex faces without postweld finishing shall be specified by adding the flush or convex contour symbol to the welding symbol (see 6.12.1).



9.7.2 Contours Obtained by Postweld Finishing.

Plug welds whose faces are to be finished approximately flush or convex by postweld finishing shall be specified by adding both the appropriate contour symbol and finishing designator to the welding symbol (see 6.12.2). Welds that require a flat but not flush surface require an explanatory note in the tail of the welding symbol.

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 36(F) and (G)].

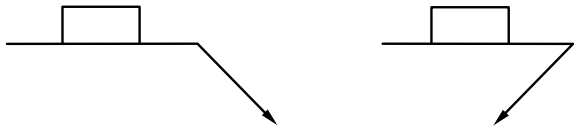
10. Slot Welds

10.1 General

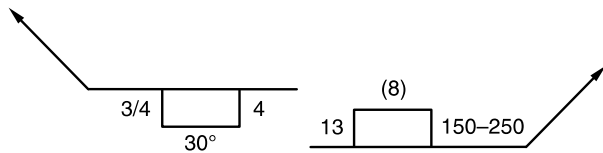
10.1.1 Arrow-Side Slots. Slots in the arrow-side member of a joint to be slot welded shall be specified by placing the slot weld symbol below the reference line [see Figure 37(A)].



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 37(B)].

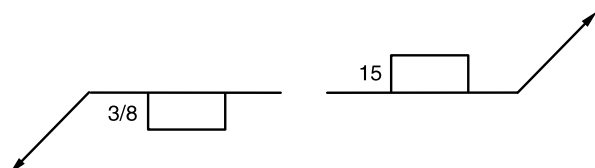


10.1.3 Dimensions. The dimensions of slot welds shall be specified on the same side of the reference line as the weld symbol (see Figure 38).

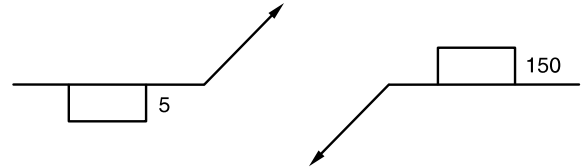


10.1.4 Fillets in Slots. The slot weld symbol shall not be used to specify fillet welds in slots (see 8.5).

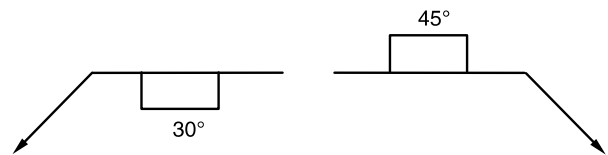
10.2 Width of Slot Welds. The width of a slot weld shall be specified to the left of the weld symbol (see Figure 38). The slot weld width is the dimension of the slot, measured in the direction of the minor axis at the faying surface.



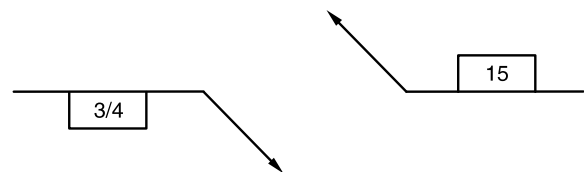
10.3 Length of Slot Welds. The length of slot welds shall be specified to the right of the weld symbol (see Figure 38). Slot weld length is the dimension of the slot, measured in the direction of the major axis at the faying surface.



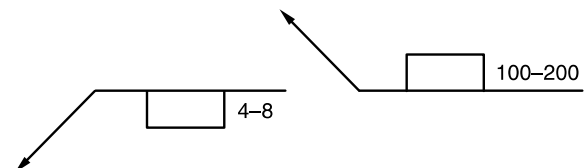
10.4 Angle of Countersink. The countersink included angle of slot welds shall be specified either above or below the slot weld symbol, as appropriate [see Figure 38(A)].



10.5 Depth of Filling. A depth of filling less than complete shall be specified inside the slot weld symbol [see Figure 38(B)]. The omission of the depth dimension shall specify complete filling [see Figure 38(A)].



10.6 Spacing of Slot Welds. The pitch (center-to-center distance) of slot welds in a straight line shall be specified to the right of the length dimension following a hyphen (see Figure 38).



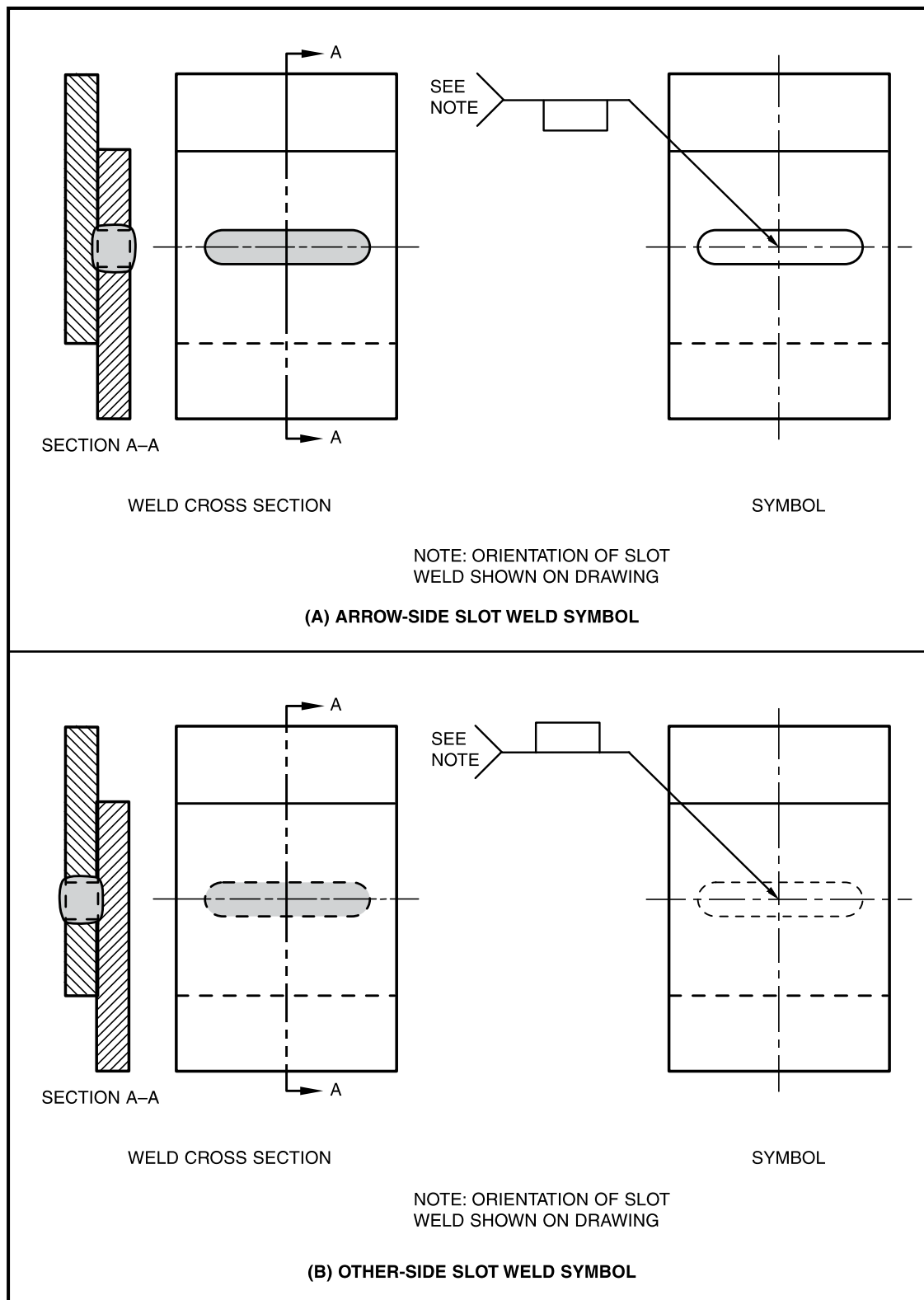


Figure 37—Application of the Slot Weld Symbol

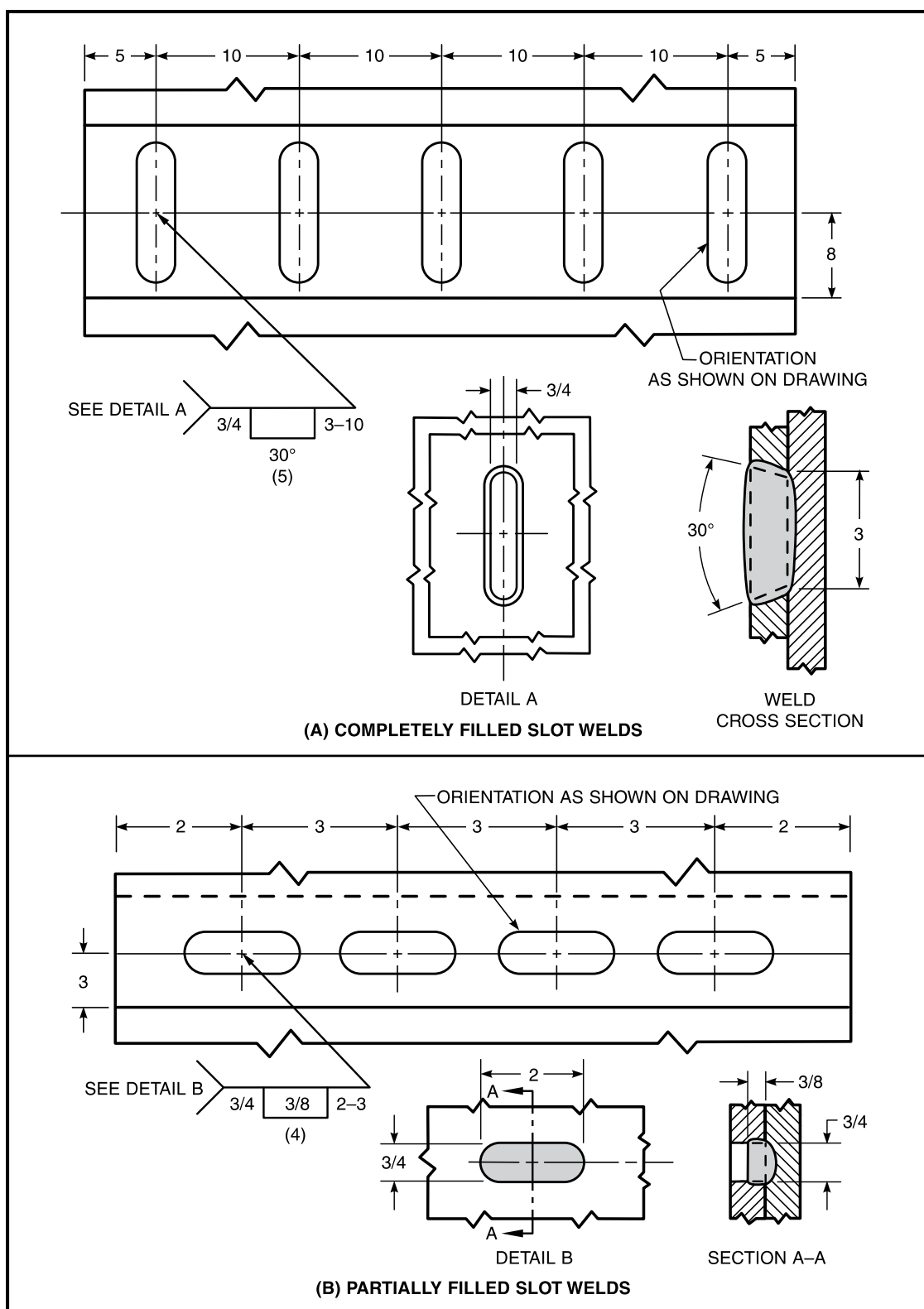
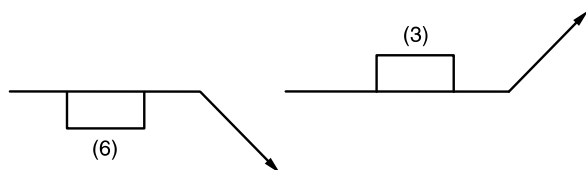


Figure 38—Application of Information to Slot Weld Symbols

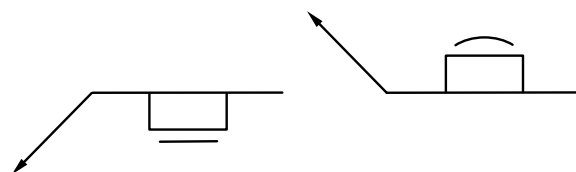
10.7 Number of Slot Welds. When a definite number of slot welds is desired in a joint, the number shall be specified in parentheses on the same side of the reference line as the weld symbol. The number shall be either above or below the weld symbol, as appropriate (see Figure 38). When the angle of countersink is also included in the welding symbol, the number of slot welds shall be placed above or below the angle of countersink, as appropriate [see Figure 38(A)].



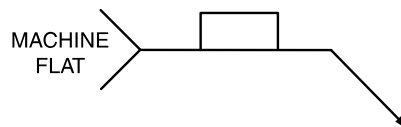
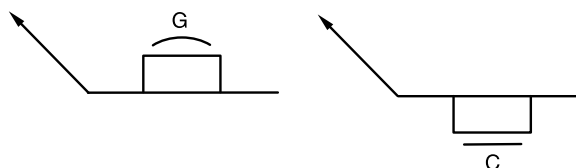
10.8 Location and Orientation of Slot Welds. The location and orientation of slot welds shall be specified on the drawing.

10.9 Contours and Finishing of Slot Welds

10.9.1 Contours Obtained by Welding. Slot welds that are to be welded with approximately flush or convex faces without postweld finishing shall be specified by adding the flush or convex contour symbol to the welding symbol (see 6.12.1).



10.9.2 Contours Obtained by Postweld Finishing. Slot welds whose faces are to be finished approximately flush or convex by postweld finishing shall be specified by adding both the appropriate contour symbol and finishing designator to the welding symbol (see 6.12.2). Welds that require a flat but not flush surface require an explanatory note in the tail of the welding symbol.



11. Spot Welds

11.1 General

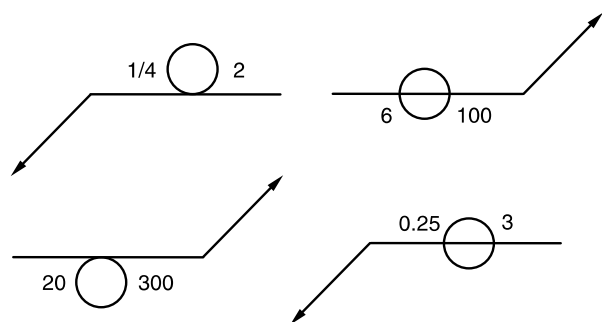
11.1.1 Arrow-Side or Other-Side Significance. The spot weld symbol, relative to its location on the reference line, may or may not have arrow-side member or other-side member significance (see 6.1.2, 6.1.3, and Figure 39).

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 39(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 39(B)].

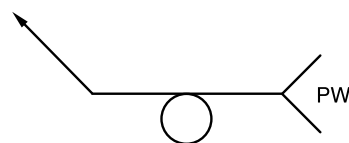
11.1.1.3 No Side Significance. For those welding processes in which no arrow-side or other-side significance is applicable, the spot weld symbol shall be centered on the reference line [see 6.1.3 and Figure 39(C)].

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 39 and 40).



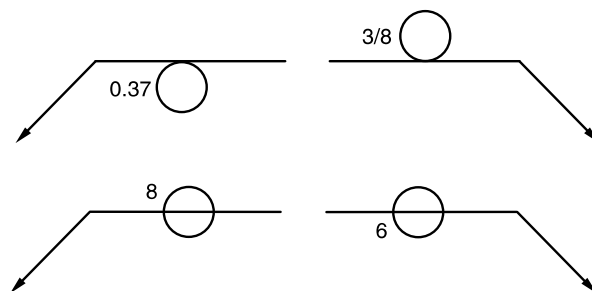
11.1.3 Welding Process Reference. The process reference shall be indicated in the tail of the welding symbol (see 6.11.1 and Figures 39 and 40).

11.1.4 Projection Welds. The projection weld symbol shall be used with the projection welding process reference in the tail of the welding symbol. The projection weld symbol shall be placed above or below (not centered on) the reference line to designate which member receives the embossment in accordance with the location conventions given in 6.1.2 (see Figure 41).

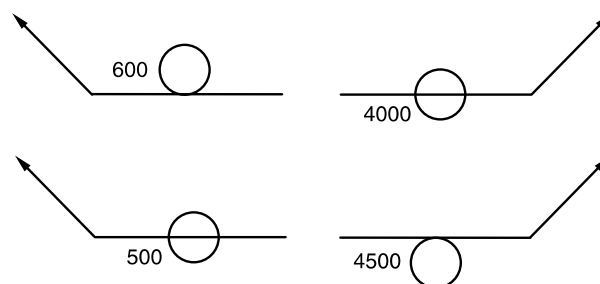


11.2 Size or Strength of Spot Welds. Spot welds shall be specified by either size or strength to the left of the spot weld symbol.

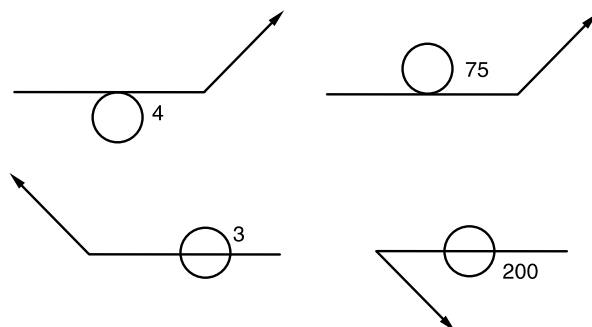
11.2.1 Size. The size of a spot weld shall be specified, in inches or millimeters, as the diameter of the weld at the faying surfaces of the members [see Figure 40(A)].



11.2.2 Strength. The shear strength of a spot weld shall be specified in pounds or newtons [see Figure 40(B)].



11.3 Spacing of Spot Welds. The pitch (center-to-center distance) of spot welds in a straight line shall be specified to the right of the weld symbol [see Figure 40(C)].



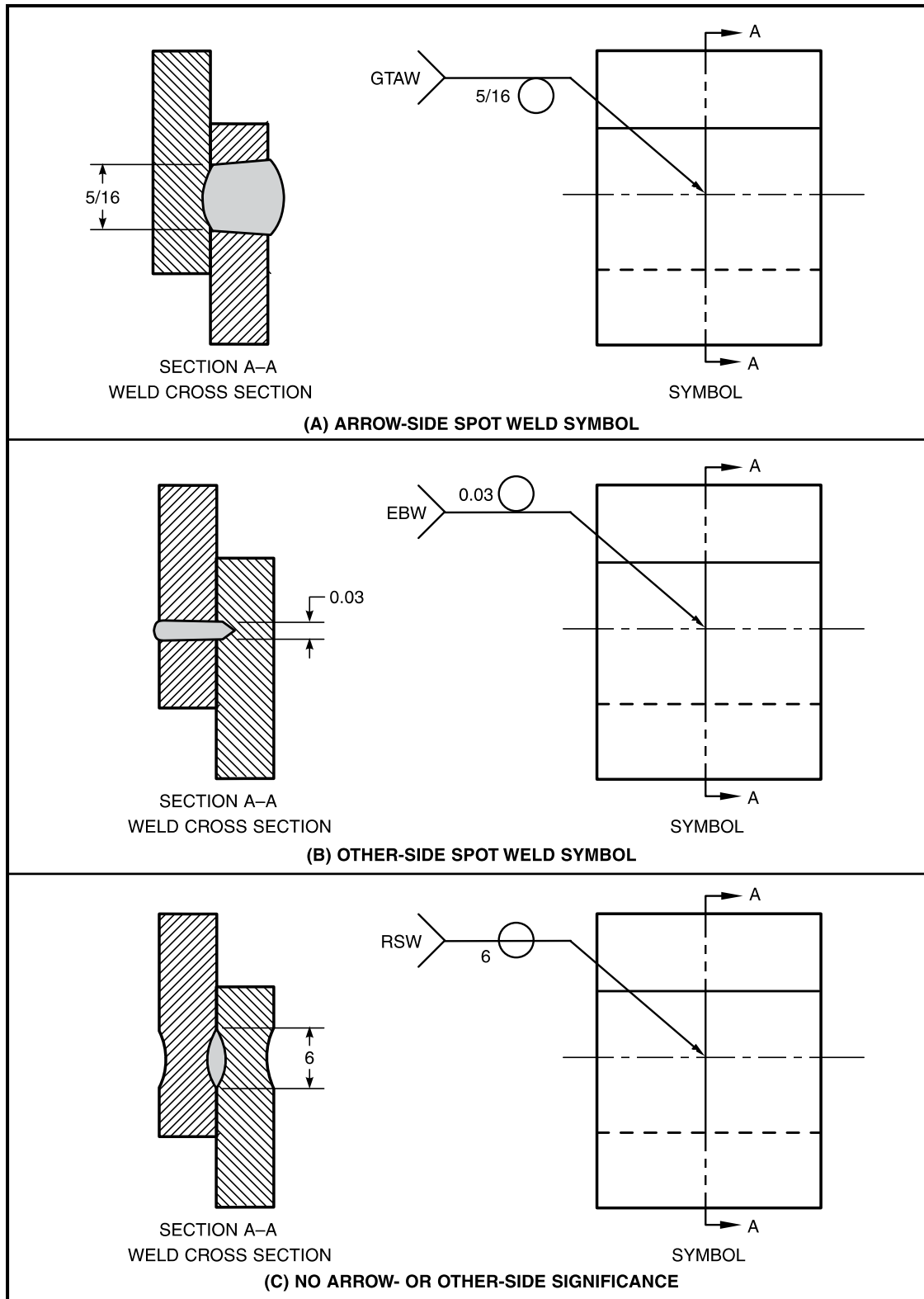


Figure 39—Application of the Spot Weld Symbol

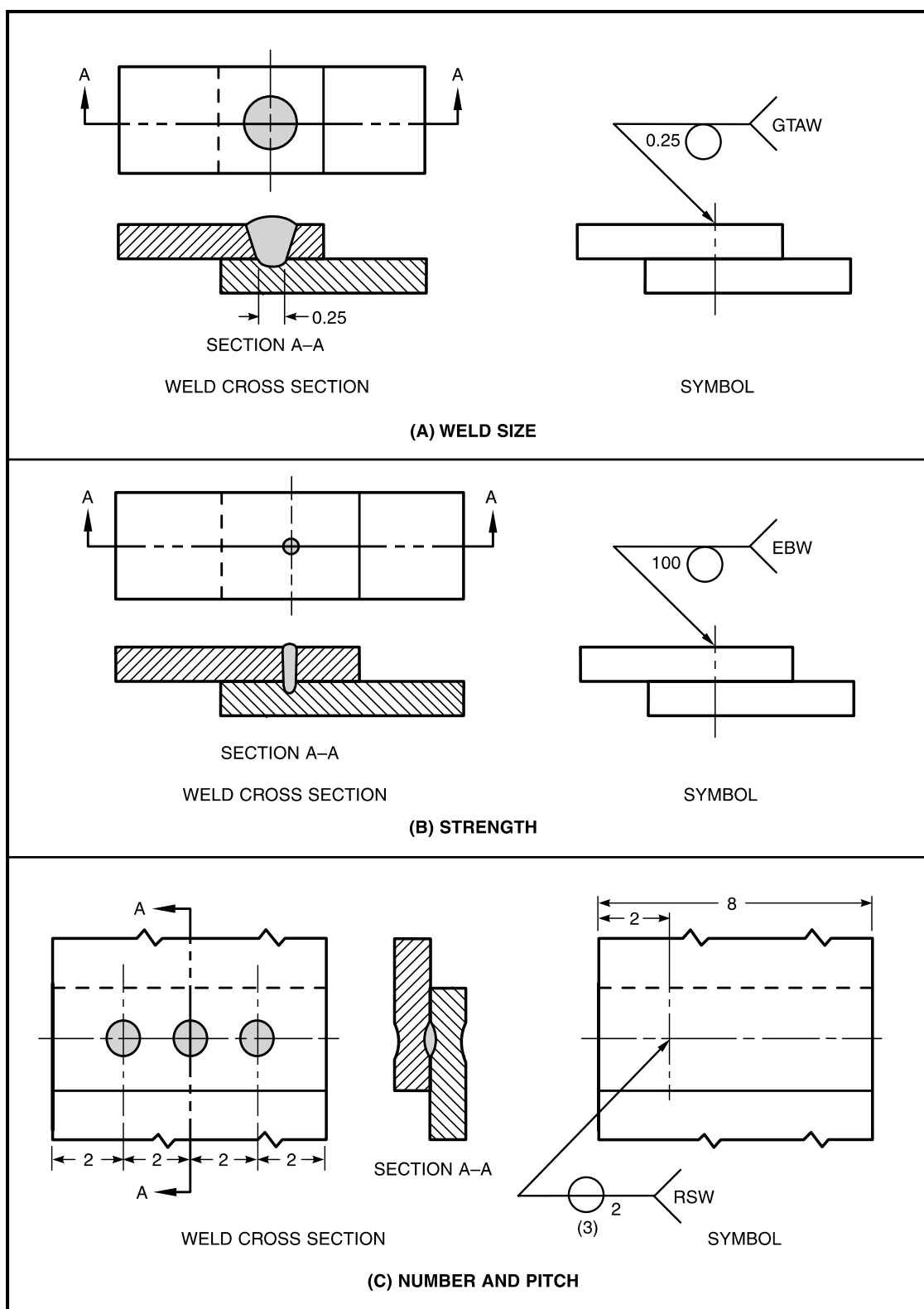


Figure 40—Application of Information to the Spot Weld Symbol

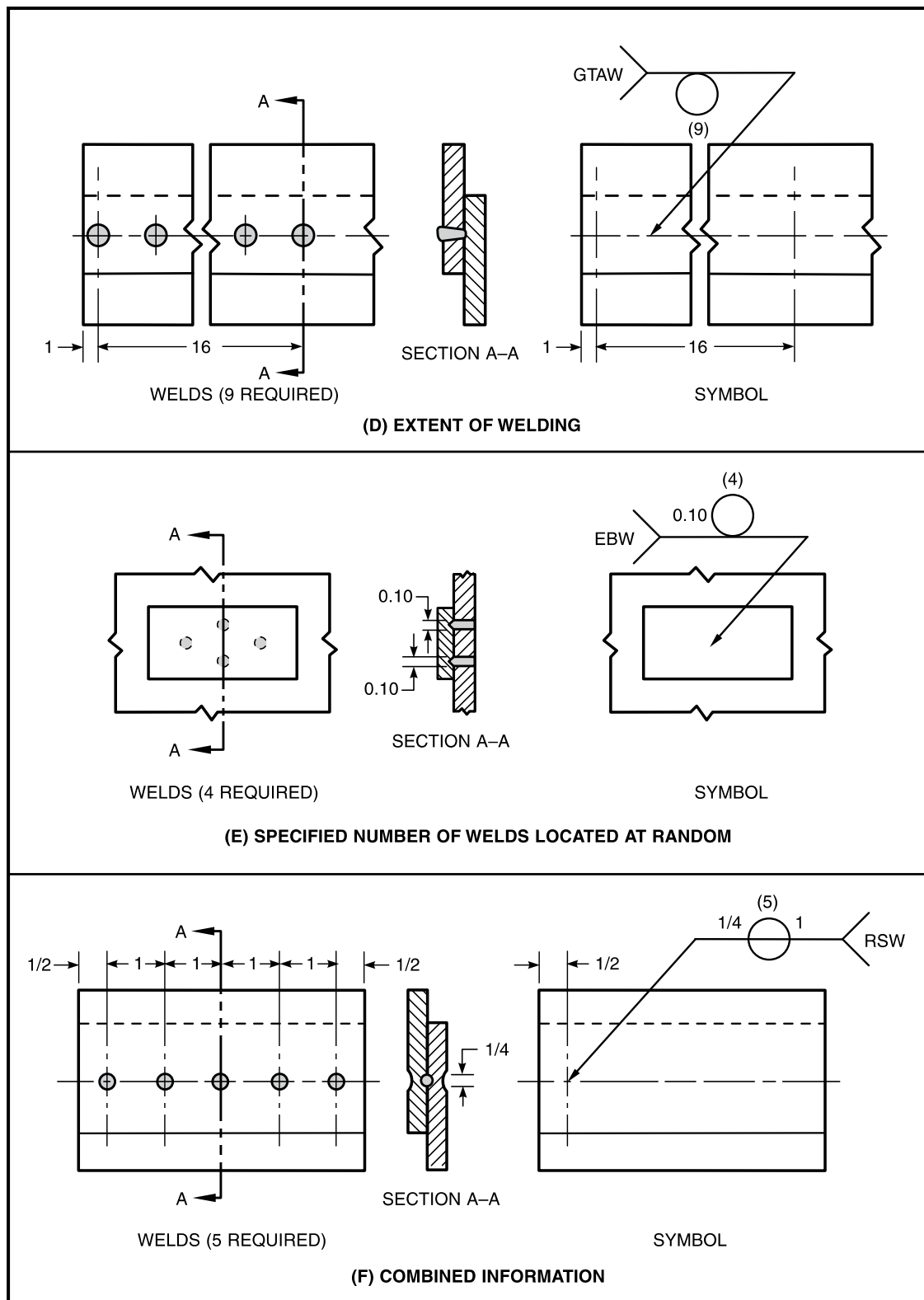


Figure 40 (Continued)—Application of Information to the Spot Weld Symbol

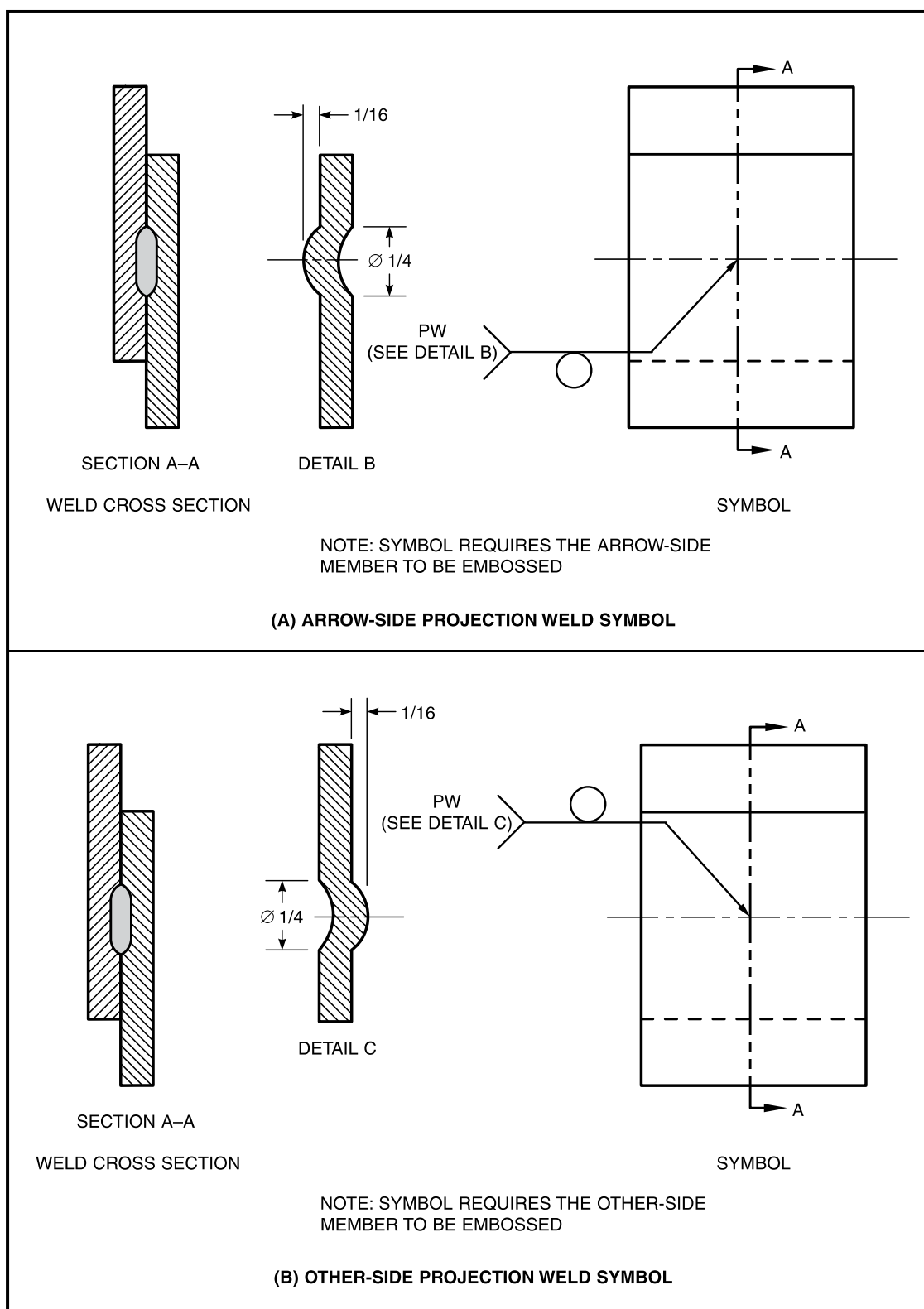
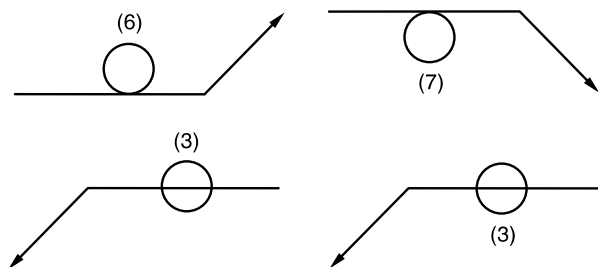


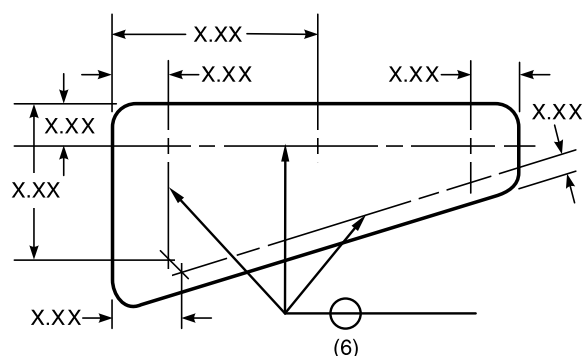
Figure 41—Application of the Projection Weld Symbol

11.4 Number of Spot Welds

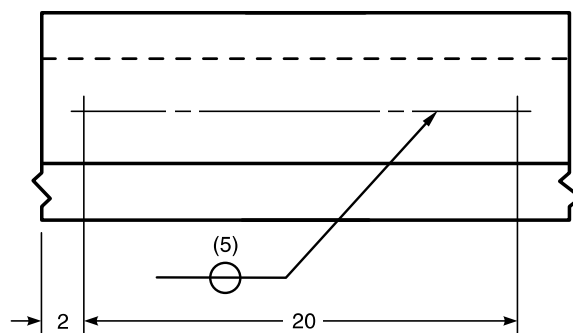
11.4.1 Number Specified. When a definite number of spot welds is desired in a joint, the number shall be specified in parentheses on the same side of the reference line as the spot weld symbol. The number may be either above or below the weld symbol when there is no other-side-member significance and the symbol is centered on the reference line [see Figure 40(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 40(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 6.9), the desired extent shall be dimensioned on the drawing [see Figure 40(D)].

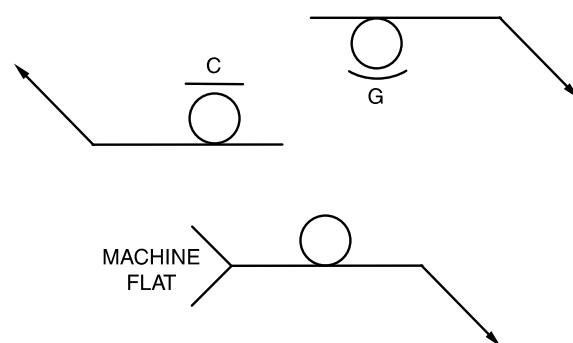


11.6 Contours and Finishing of Spot Welds

11.6.1 Contours Obtained by Welding. When the exposed surface of either member in a spot welded joint is to be welded with approximately a flush or convex face without postweld finishing, that surface shall be specified by adding the flush or convex contour symbol to the welding symbol (see 6.12.1).



11.6.2 Contours Obtained by Postweld Finishing. Spot welds whose faces are to be finished approximately flush or convex by postweld finishing shall be specified by adding both the appropriate contour symbol and finishing designator to the welding symbol (see 6.12.2). Welds that require a flat but not flush surface require an explanatory note in the tail of the welding symbol.



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 42).

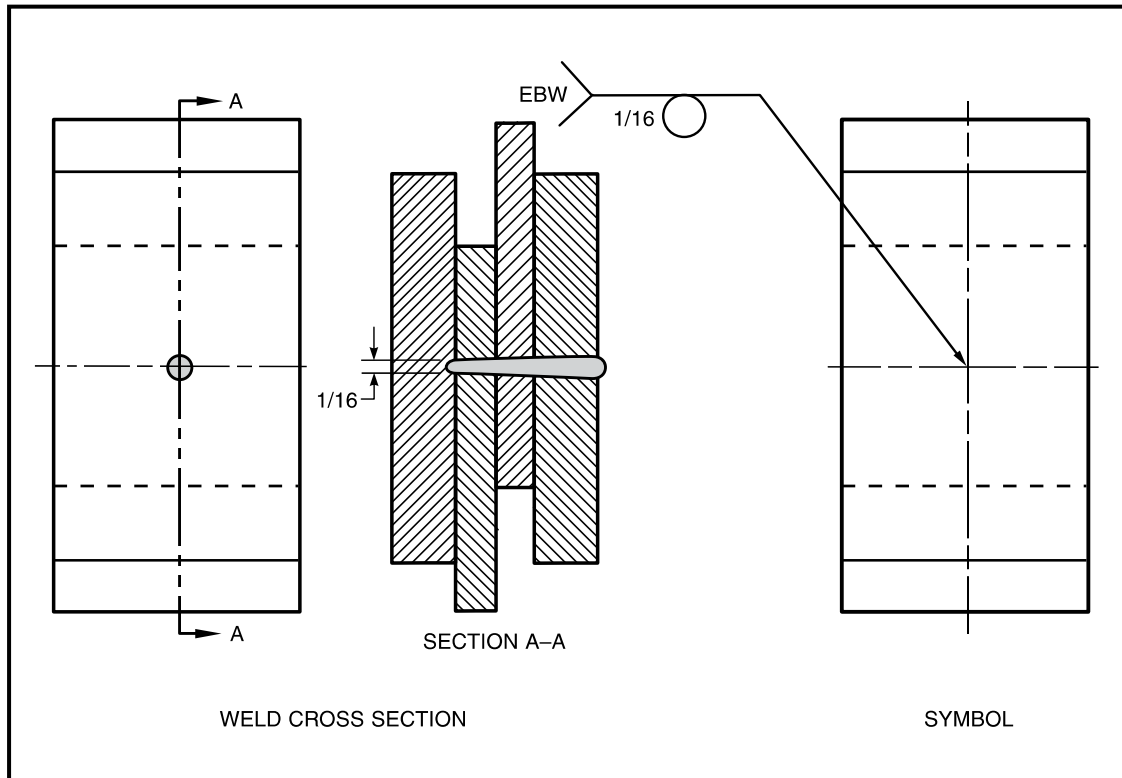


Figure 42—Multiple-Member Spot Weld

12. Seam Welds

12.1 General

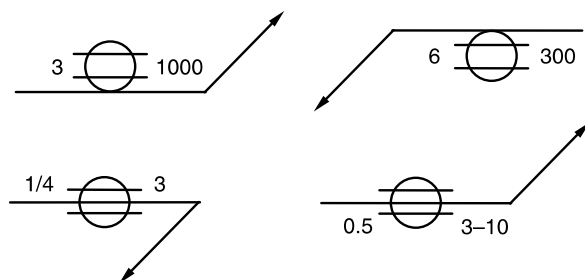
12.1.1 Arrow-Side, Other-Side Significance. The seam weld symbol, relative to its location on the reference line, may or may not have arrow-side member or other-side member significance (see 6.1.2, 6.1.3, and Figure 43).

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 43(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 43(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 43(C)].

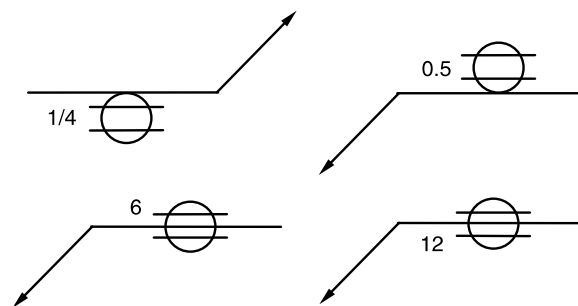
12.1.2 Dimension Location. Dimensions shall be shown on the same side of the reference line as the weld symbol, or all dimensions shall be shown on either side when the seam weld symbol has no arrow-side or other-side significance (see Figure 44).



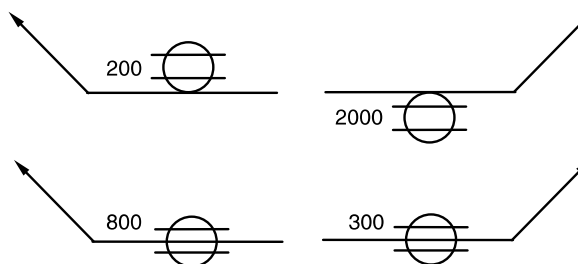
12.1.3 Welding Process Reference. The process reference shall be indicated in the tail of the welding symbol (see 6.11.1 and Figures 43 through 45).

12.2 Size and Strength of Seam Welds. Seam welds shall be specified by either size or strength to the left of the seam weld symbol.

12.2.1 Size. The size of a seam weld shall be specified, in inches or millimeters, as the width of the weld at the faying surfaces of the members [see Figure 44(A), (C), and (D)].

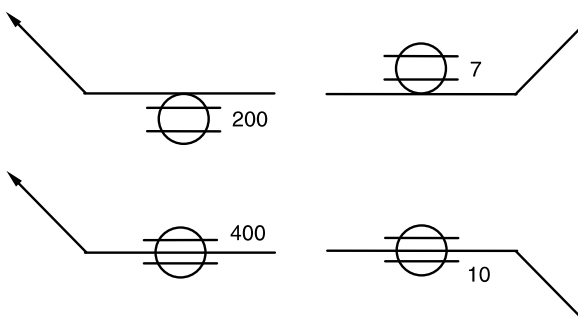


12.2.2 Strength. The shear strength of a seam weld shall be specified in pounds per linear inch or in newtons per millimeter [see Figure 44(B)].



12.3 Length of Seam Welds

12.3.1 Dimension Location. The length of a seam weld shall be specified to the right of the weld symbol [see Figure 44(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 6.9), no length dimension need be specified on the welding symbol.

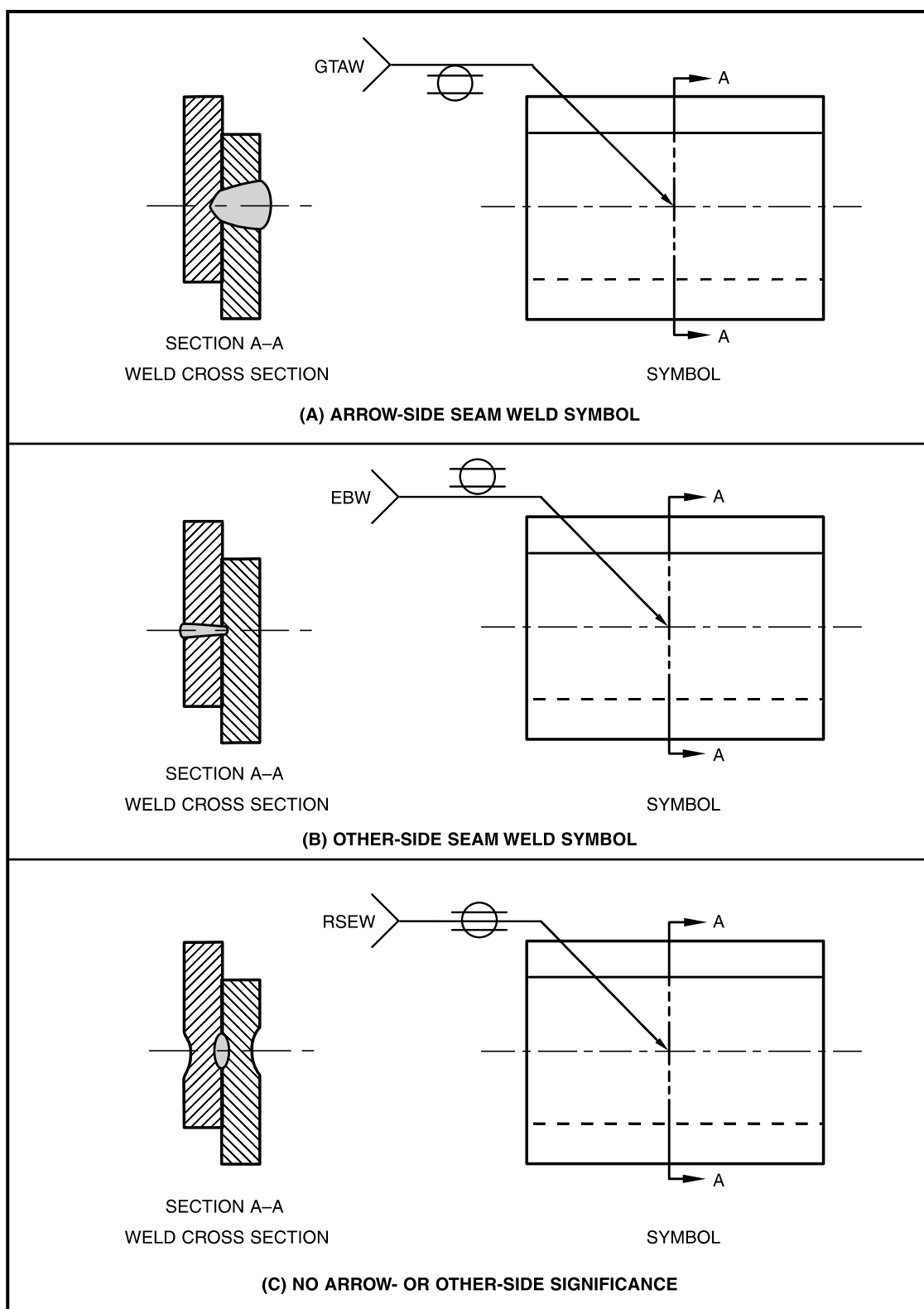


Figure 43—Application of the Seam Weld Symbol

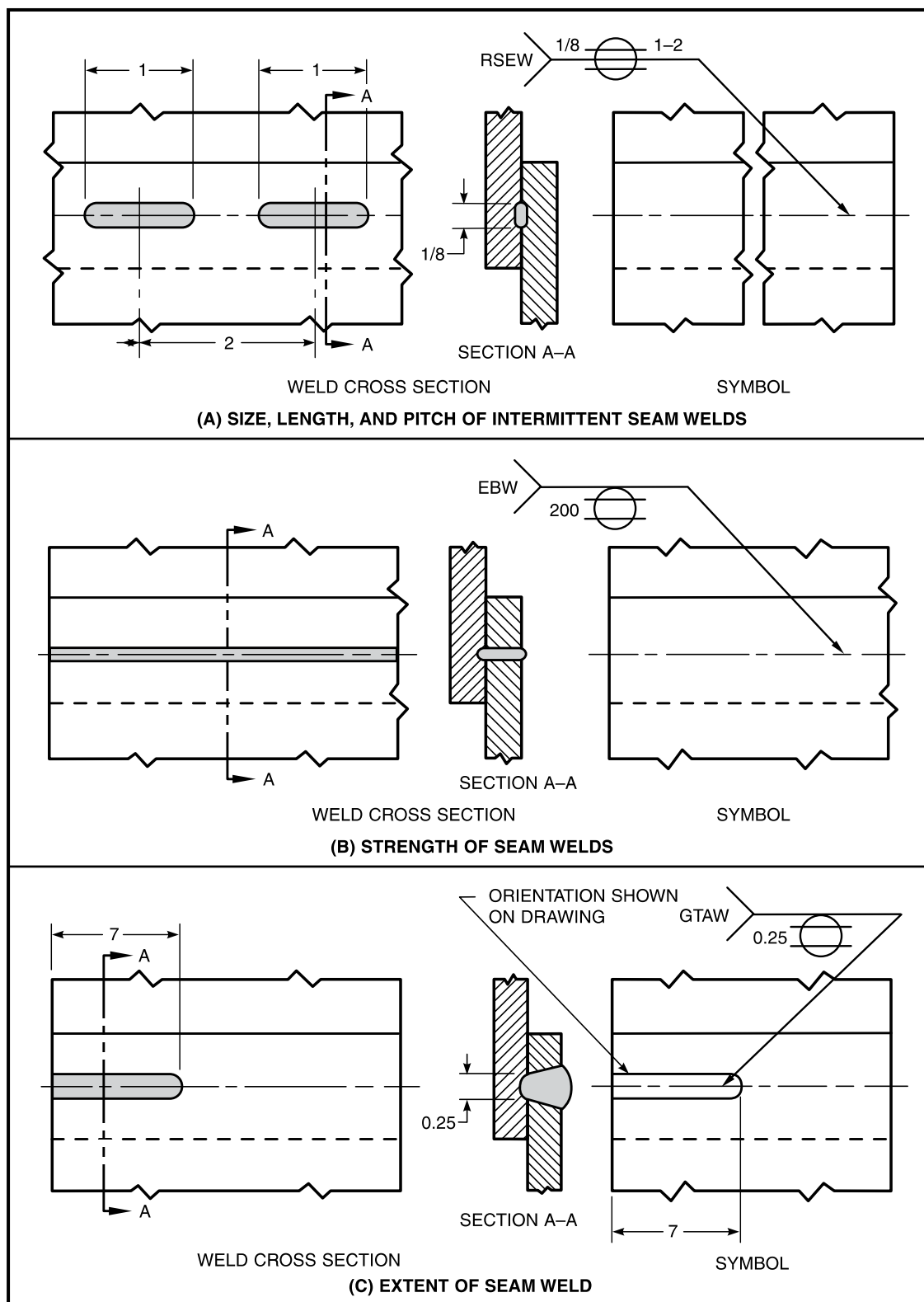


Figure 44—Application of Information to the Seam Weld Symbol

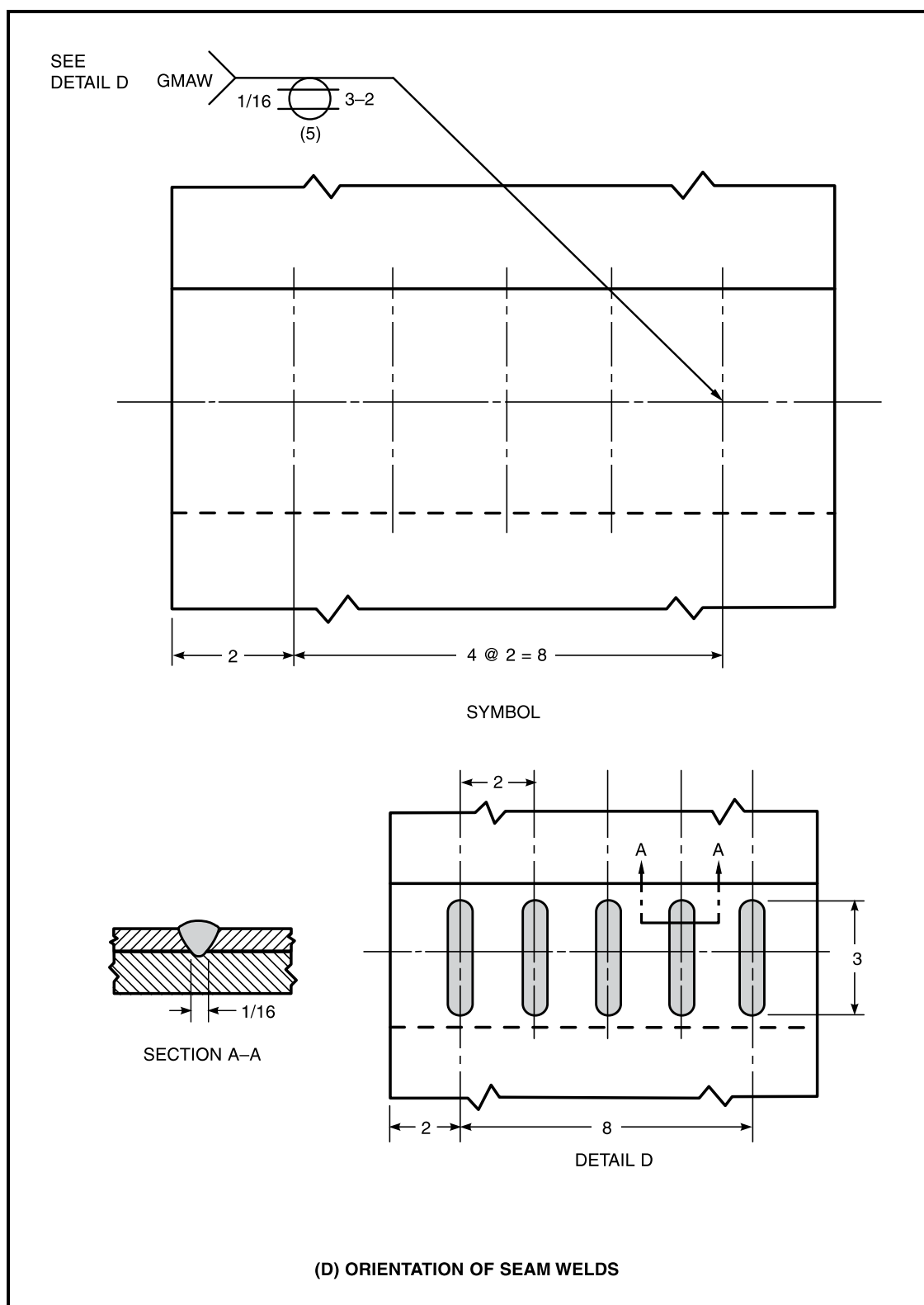


Figure 44 (Continued)—Application of Information to the Seam Weld Symbol

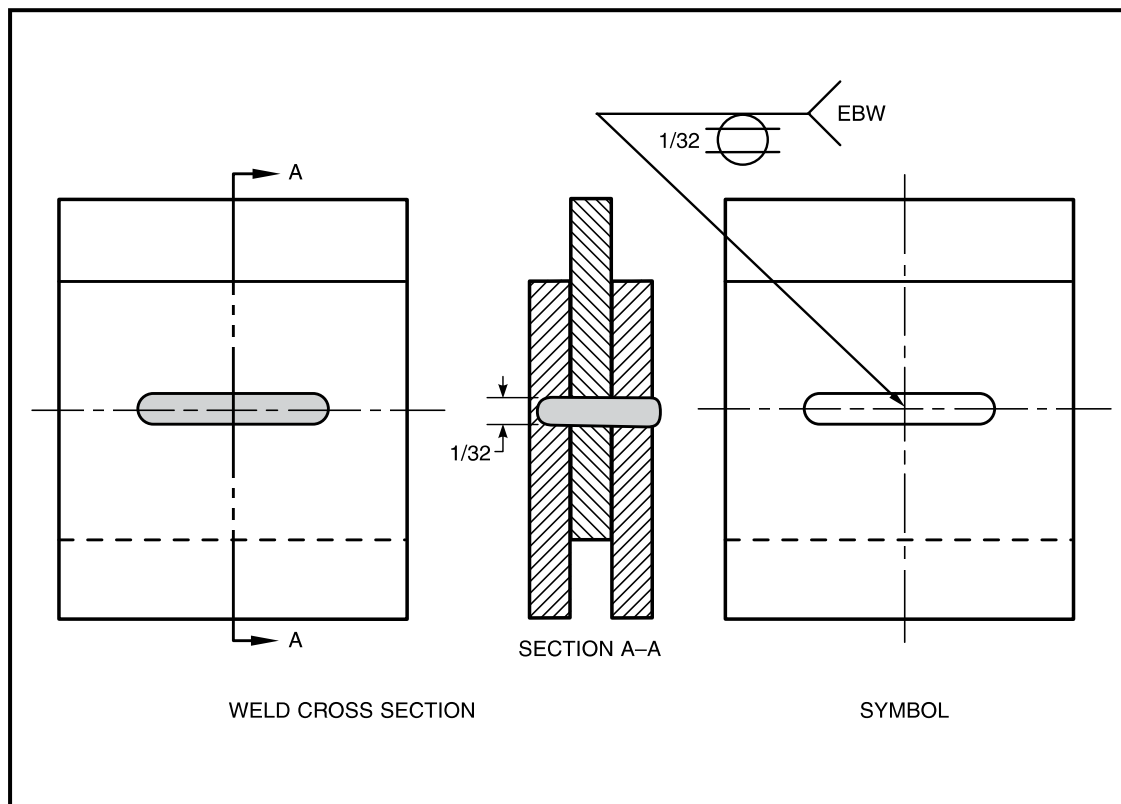
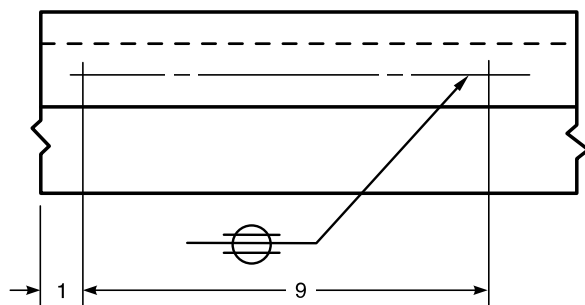


Figure 45—Multiple-Member Seam Weld

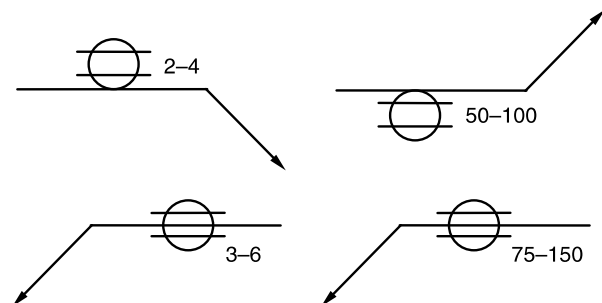
12.3.3 Specific Lengths. When a seam weld extends less than the distance between abrupt changes in the direction of welding or less than the full length of the joint, the extent shall be dimensioned on the drawing [see 6.9 and Figure 44(C)].



12.4 Dimensions of Intermittent Seam Welds

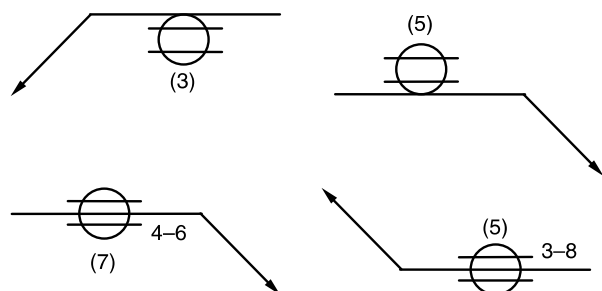
12.4.1 Pitch. The pitch of intermittent seam welds shall be specified as the distance between centers of the weld segments [see Figure 44(A) and (D)].

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 44(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 44(D)].



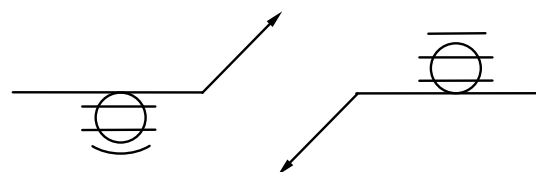
12.6 Orientation of Seam Welds

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 44(A)].

12.6.2 Showing Orientation. When the orientation of seam welds is not as in 12.6.1, a detailed drawing shall be used to specify the weld orientation [see Figure 44(D)].

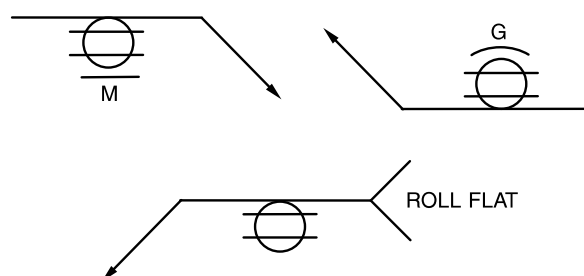
12.7 Contours and Finishing of Seam Welds

12.7.1 Contours Obtained by Welding. When the exposed surface of either member in a seam welded joint is to be welded with approximately a flush or convex face without postweld finishing, that surface shall be specified by adding the flush or convex contour symbol to the welding symbol (see 6.12.1).



12.7.2 Contours Obtained by Postweld Finishing.

Seam welds whose faces are to be finished approximately flush or convex by postweld finishing shall be specified by adding both the appropriate contour symbol and finishing designator to the welding symbol (see 6.12.2). Welds that require a flat but not flush surface require an explanatory note in the tail of the welding symbol.



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 45).

13. Edge Welds

13.1 General. The edge weld symbol is used to specify edge welds on edge joints and flanged butt or flanged corner joints. The full thickness of the joint members shall be fused. Flange dimensions are considered part of the drawing and are not specified by the welding symbol [see Figure 46].

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 46(A)]. If a specific edge weld size is not required, the dimension may be omitted [see Figure 46(B)].

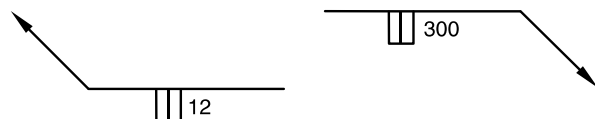
13.3 Single- and Double-Edge Welds. Single-edge welds may be specified on edge, flanged butt, and flanged corner joints [see Figure 46(B), (C), and (D)]. Double-edge welds are only applicable to edge joints [see Figure 46(A)]. An edge weld may be combined with a flare-bevel or flare-V groove weld if welds are required on both sides of a flanged butt or flanged corner joint [see 7.2.10 and Figure 46(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 46(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 edge 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 46(G), (H), and (I)].

13.6 Length of Edge Welds

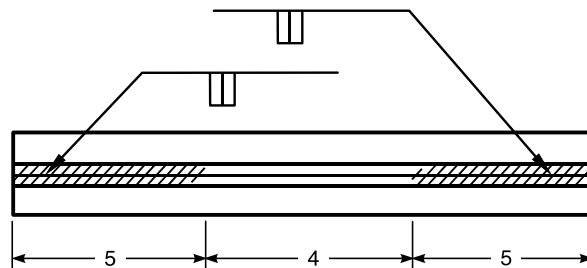
13.6.1 Location. The length of an edge weld, when indicated on the welding symbol, shall be specified to the right of the weld symbol [see Figure 47(A) and (C)].



13.6.1.1 Full Length. When an edge weld is to extend for the full length of the joint, no length dimension need be specified on the welding symbol [see Figure 47(B)].

13.6.1.2 Specific Lengths. Specific lengths of edge welds and their location may be specified by symbols in conjunction with dimension lines [see Figure 47(C)].

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

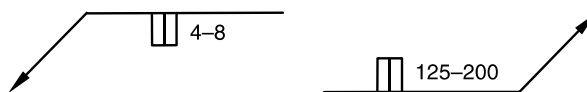


13.6.2 Changes in the Direction of Welding. Symbols for edge welds involving changes in direction of welding shall be in accordance with 6.9.2.

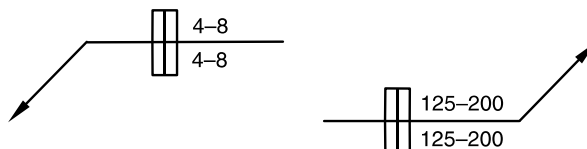
13.7 Intermittent Edge Welds

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 48).

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 48).



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 48(B)].



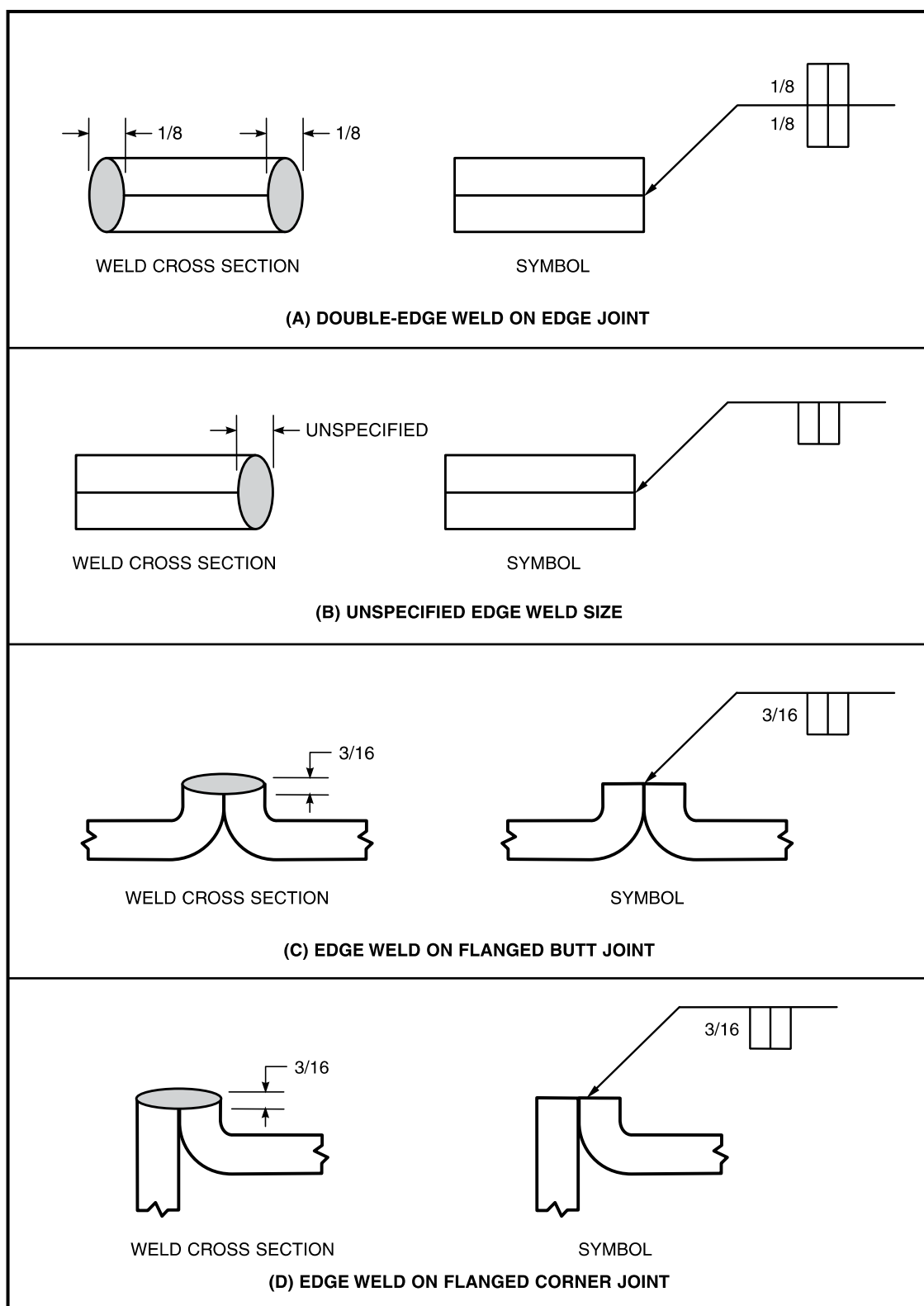


Figure 46—Application of the Edge Weld Symbol

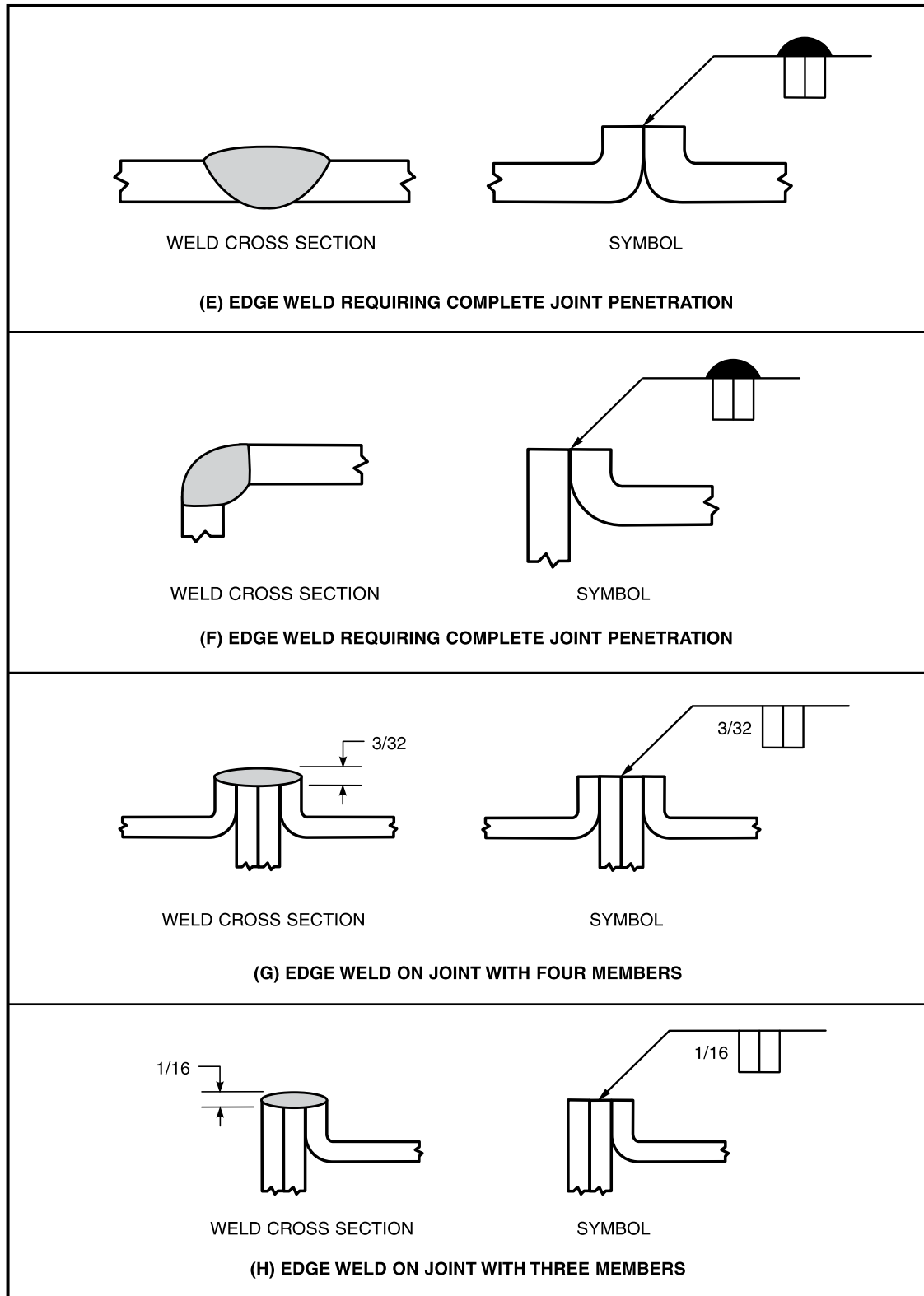


Figure 46 (Continued)—Application of the Edge Weld Symbol

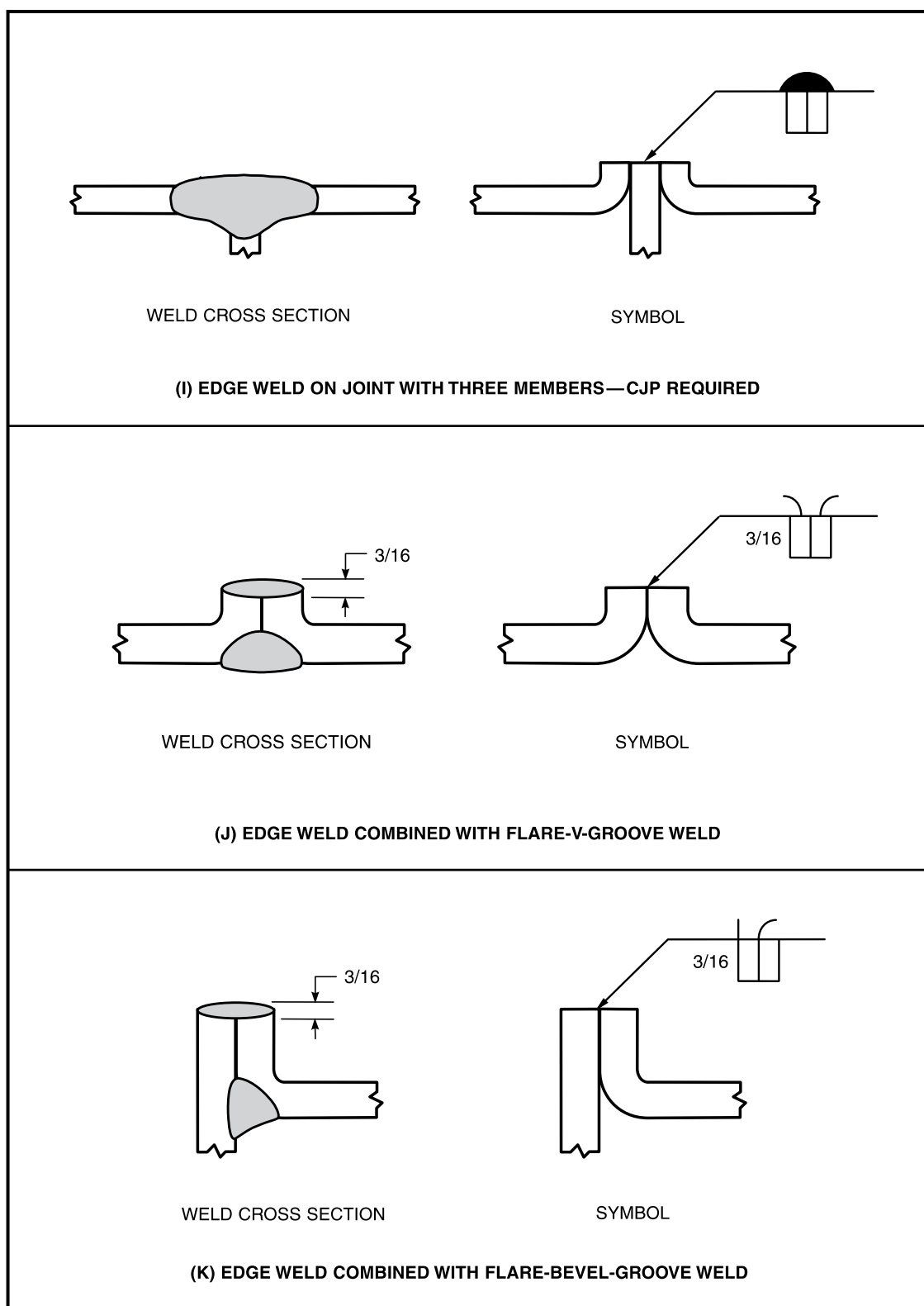


Figure 46 (Continued)—Application of the Edge Weld Symbol

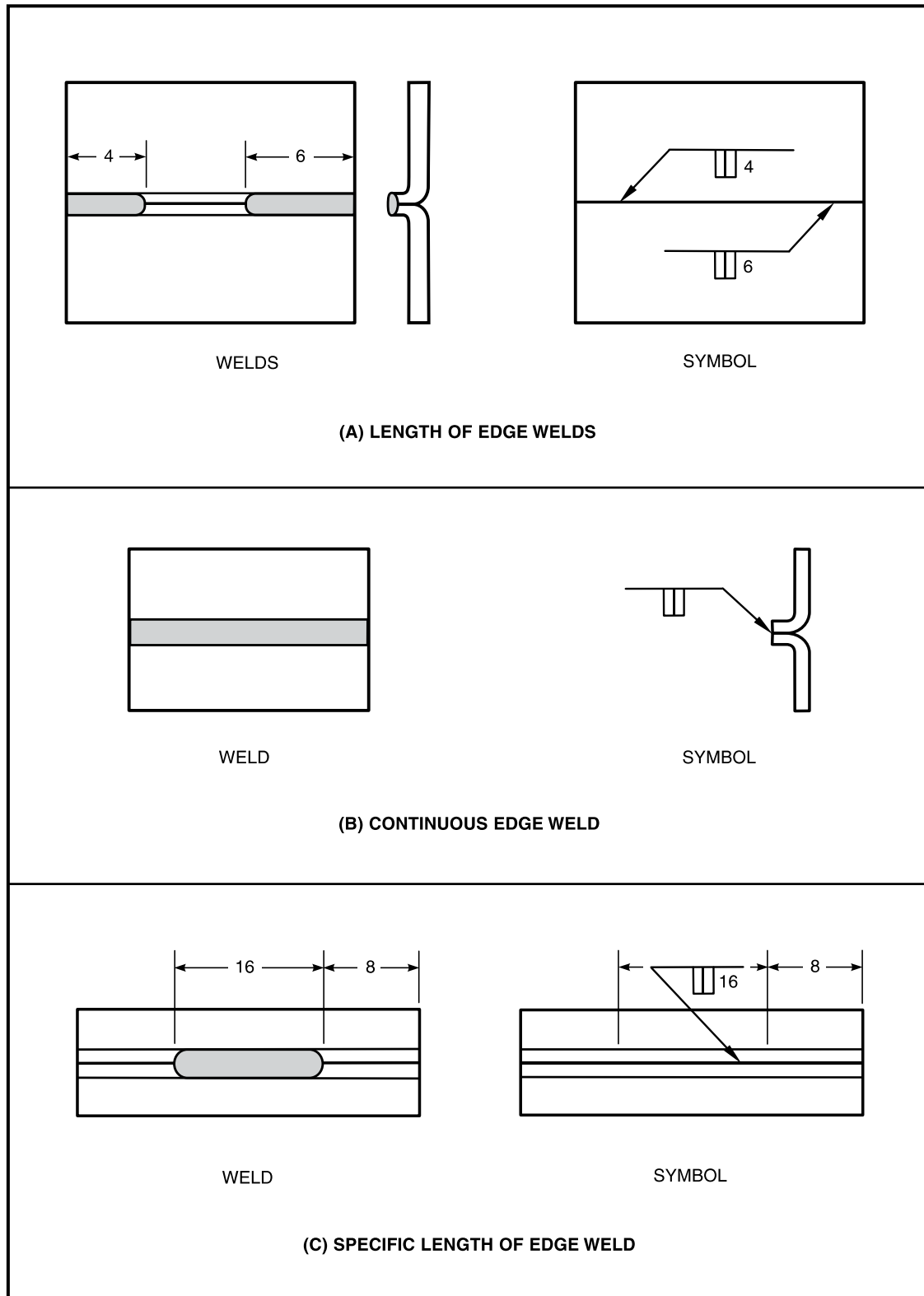


Figure 47—Specification of the Length of Welding of Edge Welds

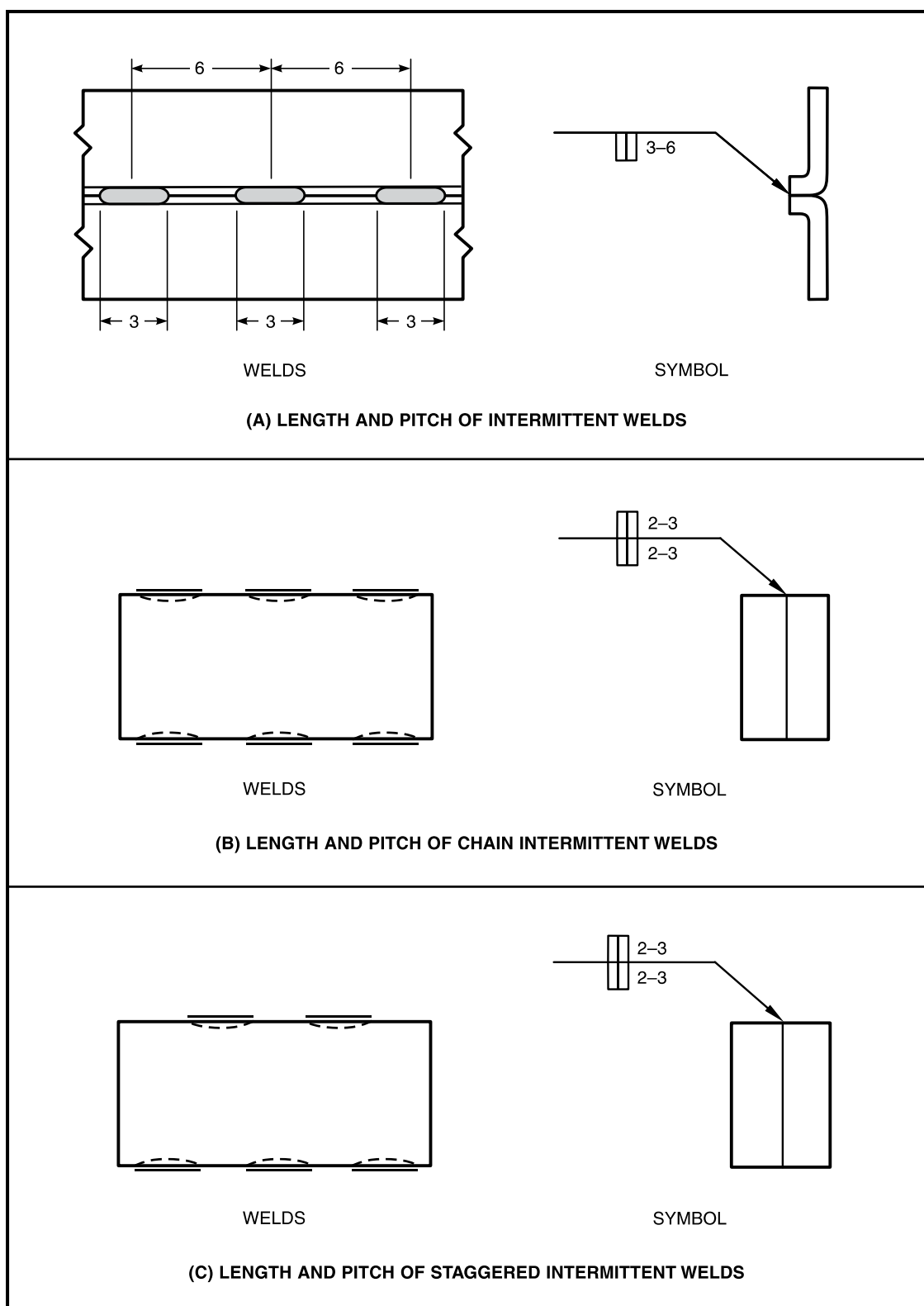


Figure 48—Applications of Intermittent Edge Welds

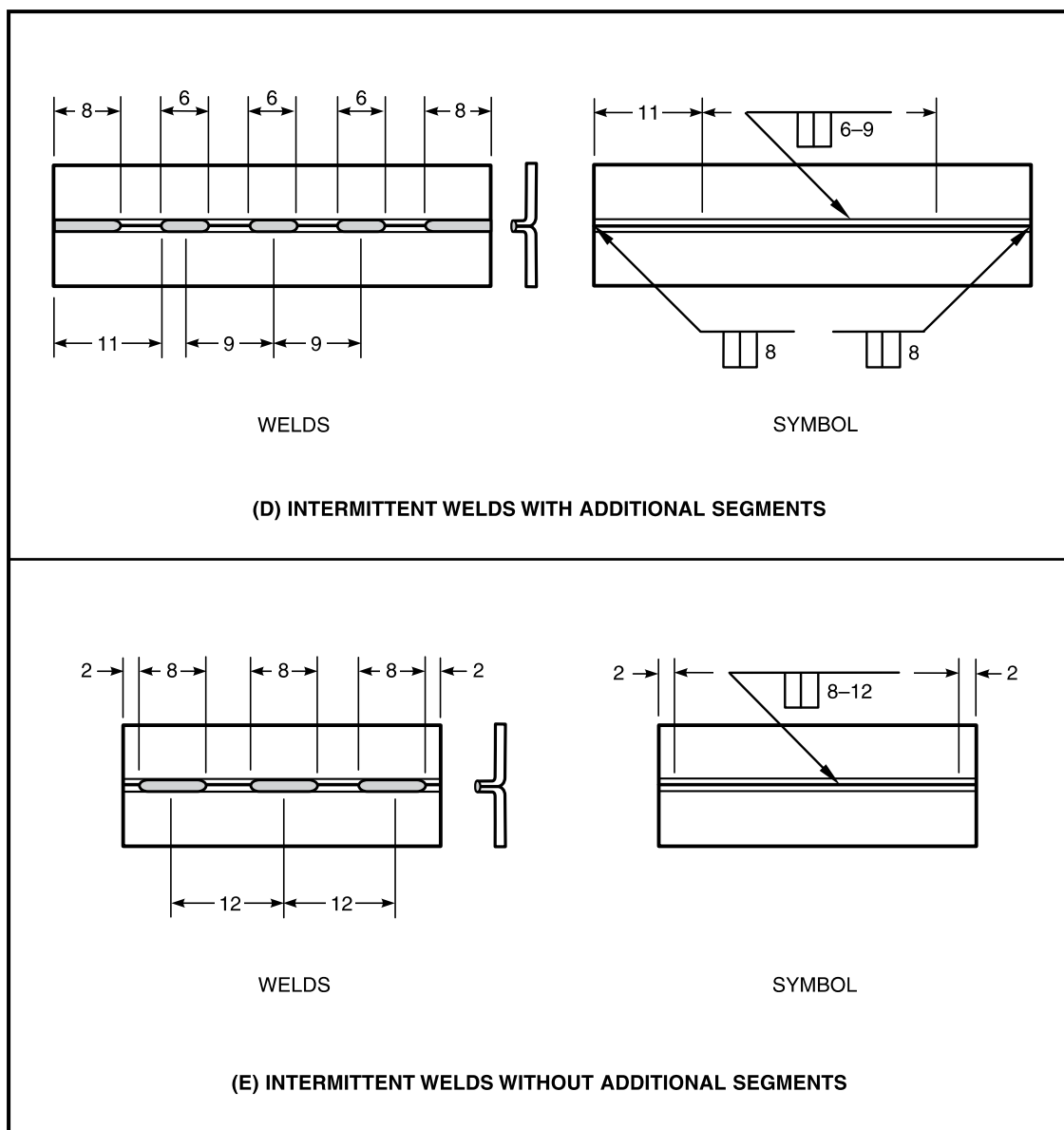
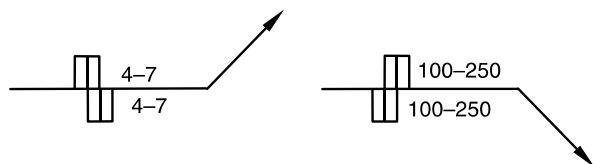


Figure 48 (Continued)—Applications of Intermittent Edge Welds

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 48(C)].

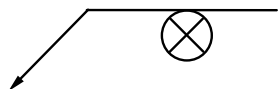


13.7.5 Extent of Welding. In the case of intermittent edge welds, additional weld lengths that are intended at the ends of the joint shall be specified by separate welding symbols and dimensioned on the drawing [see Figure 48(D)]. When no weld lengths are intended at the ends of the joint, the unwelded lengths should not exceed the clear distance between weld segments and should be so dimensioned on the drawing [see Figure 48(E)].

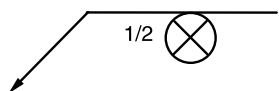
13.7.6 Location of Intermittent Welds. When the location of intermittent welds is not obvious, it will be necessary to provide specific segment locations by the use of dimension lines [see Figure 48(D) and (E)] or by hatching (see 13.6.1.3).

14. Stud Welds

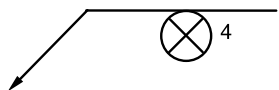
14.1 Side Significance. The stud weld symbol has arrow-side significance only. The symbol shall be placed below the reference line, and the arrow shall point clearly to the surface to which the stud is to be welded.



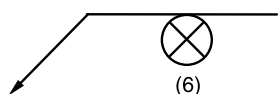
14.2 Stud Size. The required diameter of the stud shall be specified to the left of the weld symbol (see Figure 49).



14.3 Spacing of Stud Welds. The pitch (center-to-center distance) of stud welds in a straight line shall be specified to the right of the weld symbol (see Figure 49). The spacing of stud welds in any configuration other than a straight line shall be dimensioned on the drawing.



14.4 Number of Stud Welds. The number of stud welds shall be specified in parentheses below the stud weld symbol (see Figure 49).



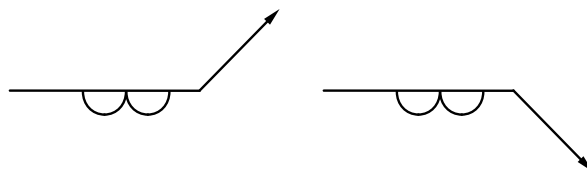
14.5 Dimension Location. Dimensions shall be placed on the same side of the reference line as the stud weld symbol (see Figure 49).

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 49).

15. Surfacing Welds

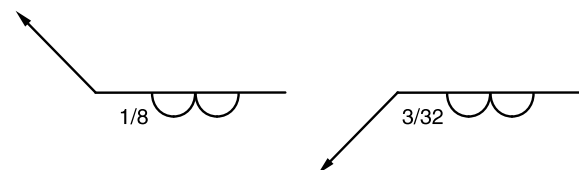
15.1 Use of the Surfacing Weld Symbol

15.1.1 Symbol Application. Surfacing, whether by single- or multiple-pass welds, shall be specified by the surfacing weld symbol (see Figure 50).



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 50).

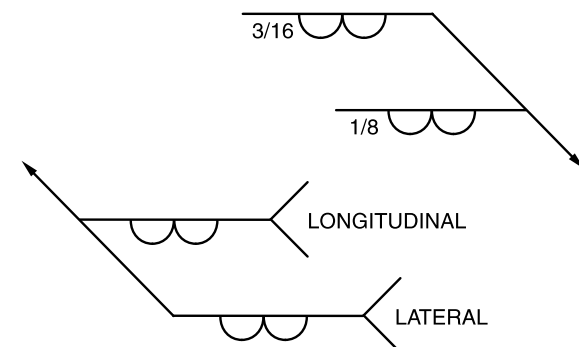
15.1.3 Dimension Location. Dimensions used in conjunction with the surfacing weld symbol shall be placed on the same side of the reference line as the weld symbol [see Figure 50(A) and (C)].



15.2 Size (Thickness) of Surfacing Welds

15.2.1 Minimum 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 50(A) and (C)]. The direction of welding may be specified by a note in the tail of the welding symbol or indicated on the drawing.

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 50(C)].



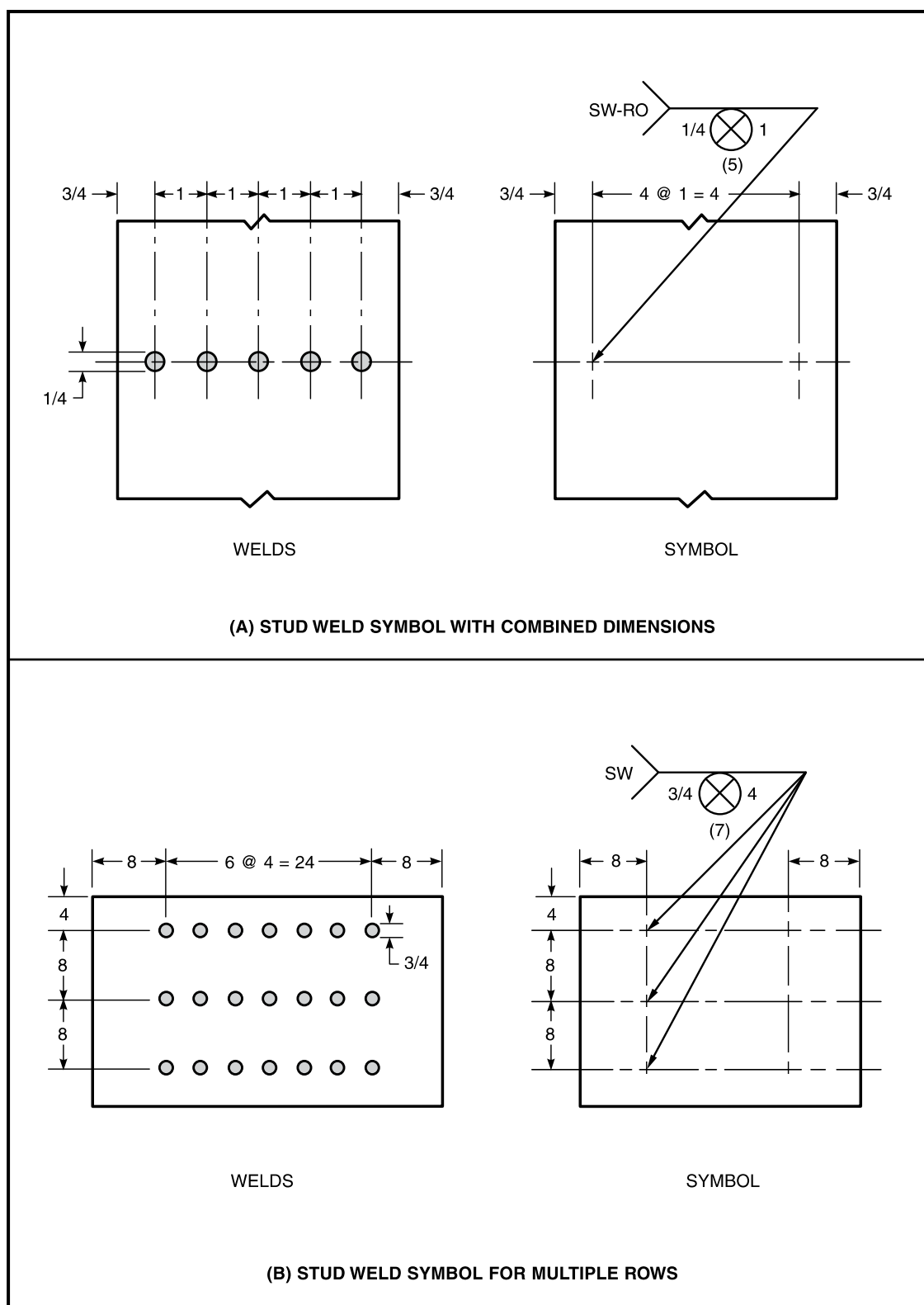


Figure 49—Application of the Stud Weld Symbol

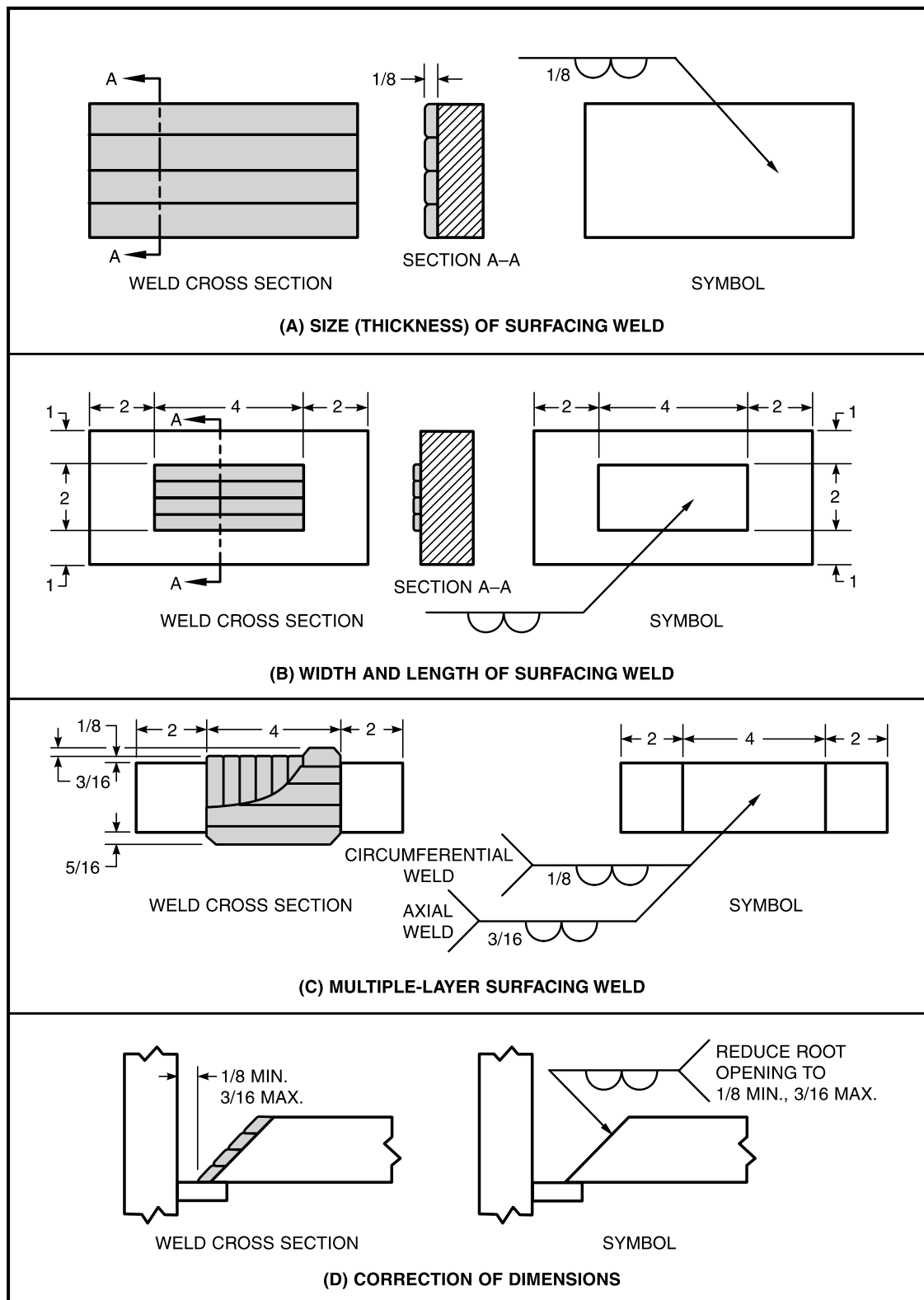


Figure 50—Application of the Surfacing Weld Symbol

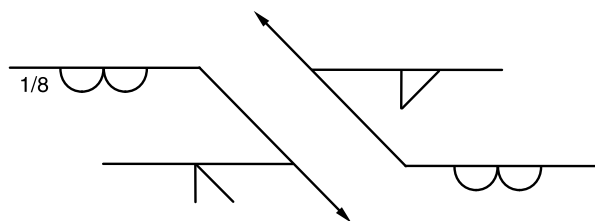
15.2.3 Unspecified Size (Thickness). When no specific thickness of a surfacing weld is required, the size dimension need not be included in the welding symbol [see Figure 50(B)].

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 50(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 50(B) and (C)].

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 50(D)].

16. Brazing Symbols

16.1 General. All drawings of assemblies requiring brazing shall have adequate brazing symbols designating the designer's requirements for the brazement. This will convey the designer's thoughts to the fabricating shop. When limited or no information is conveyed on a drawing by a brazing symbol, the fabricating shop can use their initiative when brazing, and this may result in the failure of the brazement in service.

16.2 Braze Fillet. It should be noted that the fillet weld symbol can be used only when the assembly is in the flat position and usually only when torch brazing. A fillet size is impossible to maintain, as gravity takes over when the joint is vertical or in any other position than perfectly flat and horizontal.

16.3 Special Preparation Not Specified. All symbols used for welding may also be used for brazing, where suitable. If no other special preparation other than cleaning is required, only the arrow and the reference line need be used, with the process indicated in the tail [see Figure 51(A), (B) and (C)].

16.4 Application of Symbols. The application of conventional weld symbols (as shown in Figure 1) to brazed joints is illustrated in Figure 51[(D) through (J)]. Figure 51(E), (F), (G), (I), and (J) also depicts how joint clearance can be indicated.

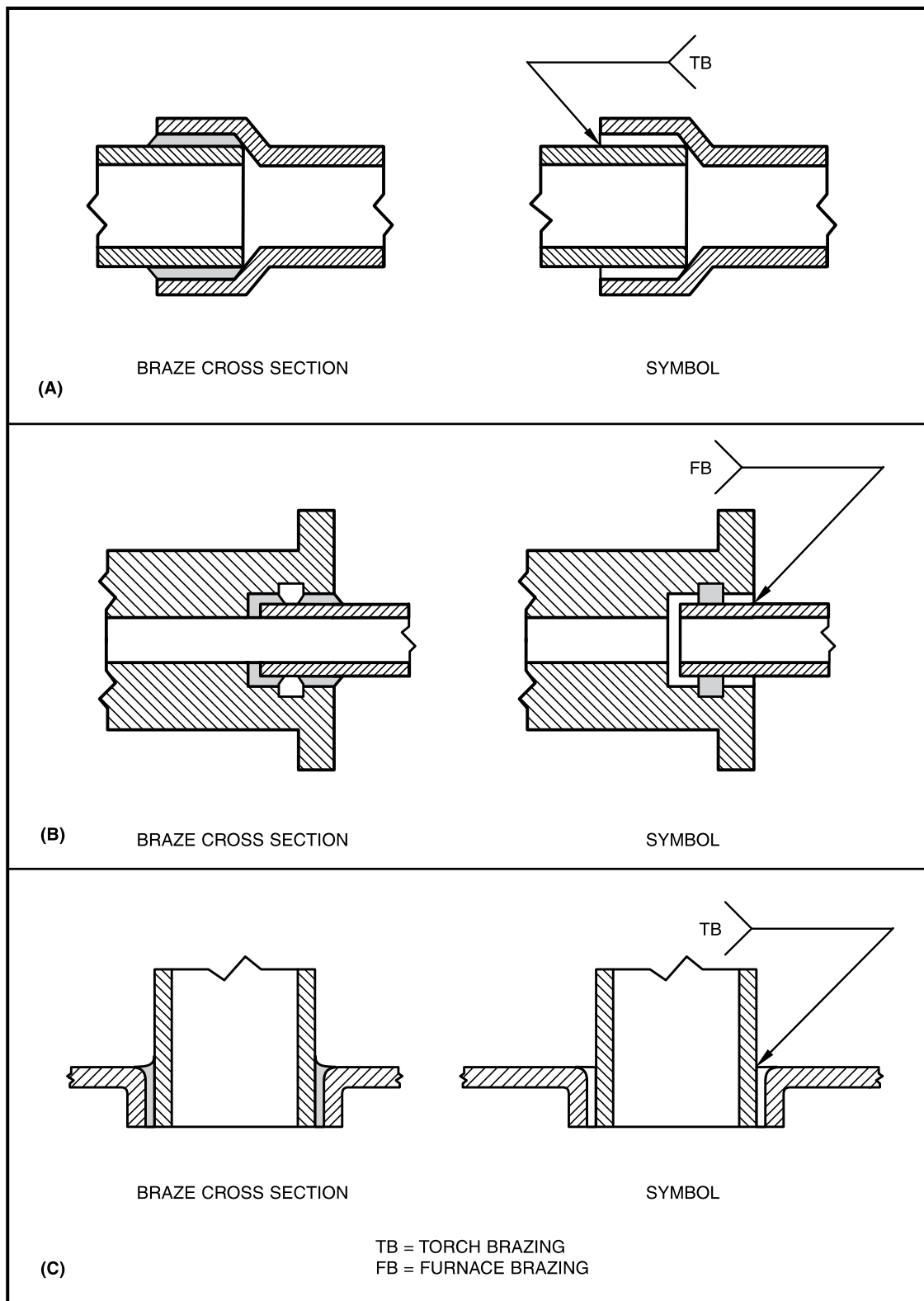
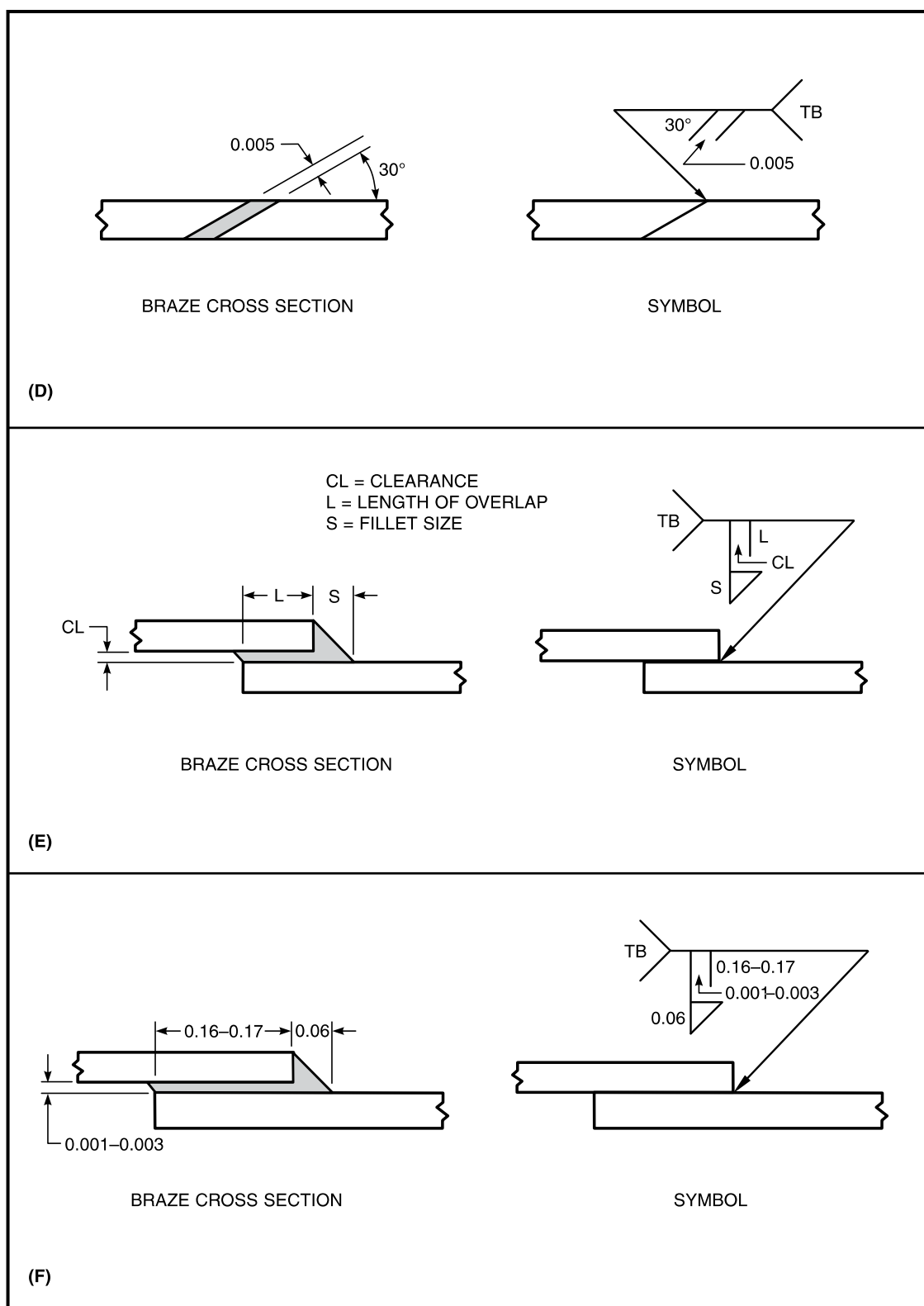
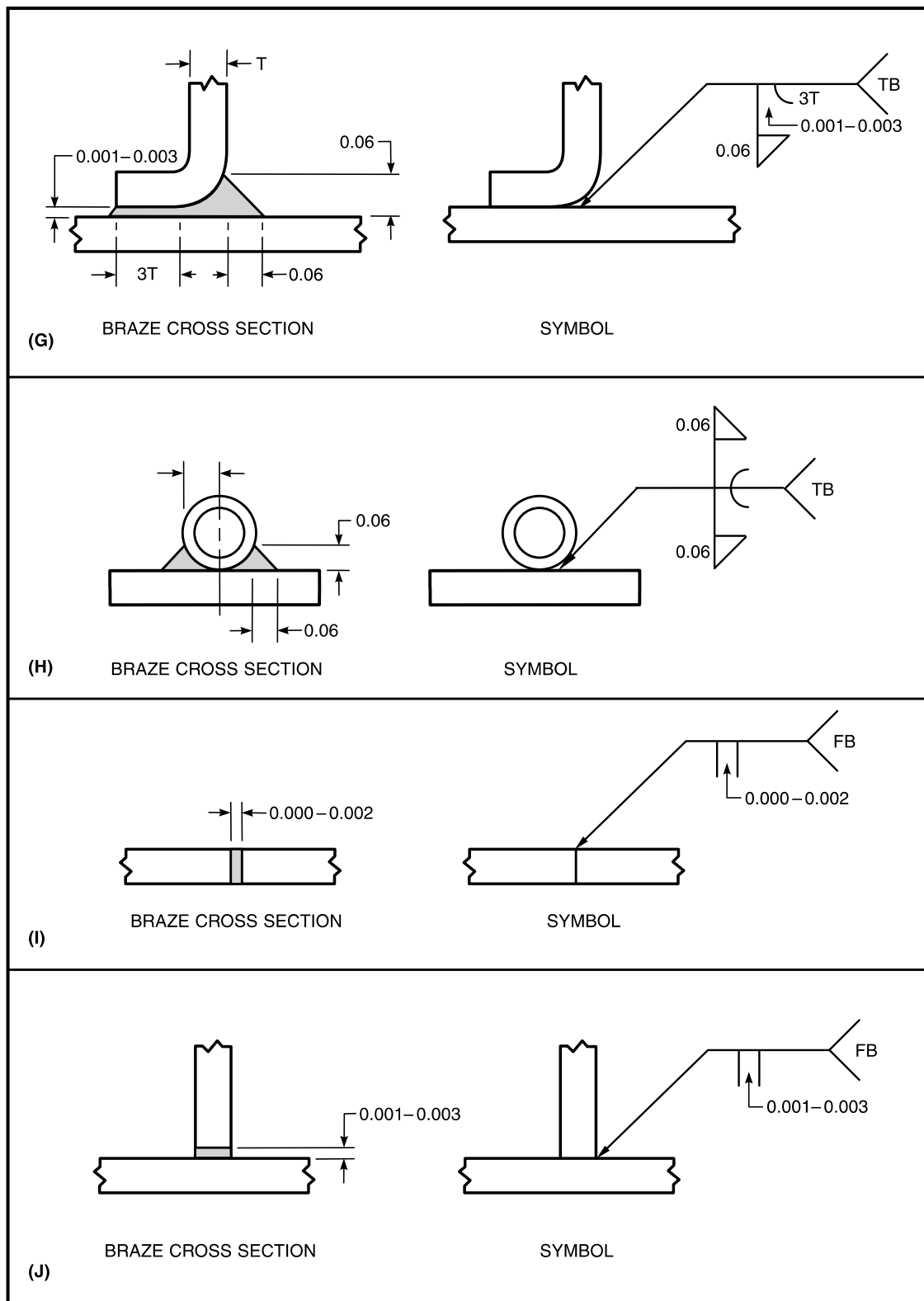


Figure 51—Application of Brazing Symbols



NOTE: The shaded area in the braze cross section denotes brazing filler metal.

Figure 51 (Continued)—Application of Brazing Symbols



NOTE: The shaded area in the braze cross section denotes brazing filler metal.

Figure 51 (Continued)—Application of Brazing Symbols

17. Nondestructive Examination Symbols

17.1 Elements. The nondestructive examination symbol consists of the following elements:

- (1) Reference line
- (2) Arrow
- (3) Examination method letter designations
- (4) Extent and number of examinations
- (5) Supplementary symbols
- (6) Tail (specifications, codes, or other references)

17.2 Examination Method Letter Designations. Non-destructive examination methods shall be specified by use of the letter designations shown in Table A.6.

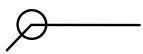
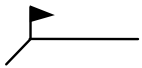
EXAMINE ALL AROUND	FIELD EXAMINATION	RADIATION DIRECTION
		

Figure 52—Supplementary Nondestructive Examination Symbols

17.3 Supplementary Symbols. Supplementary symbols to be used in nondestructive examination symbols shall be as shown in Figure 52.

17.4 Standard Location of the Elements. The elements of a nondestructive examination symbol shall have standard locations with respect to each other, as shown in Figure 53.

17.5 General Provisions for Nondestructive Examination Symbols

17.5.1 Location Significance 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.

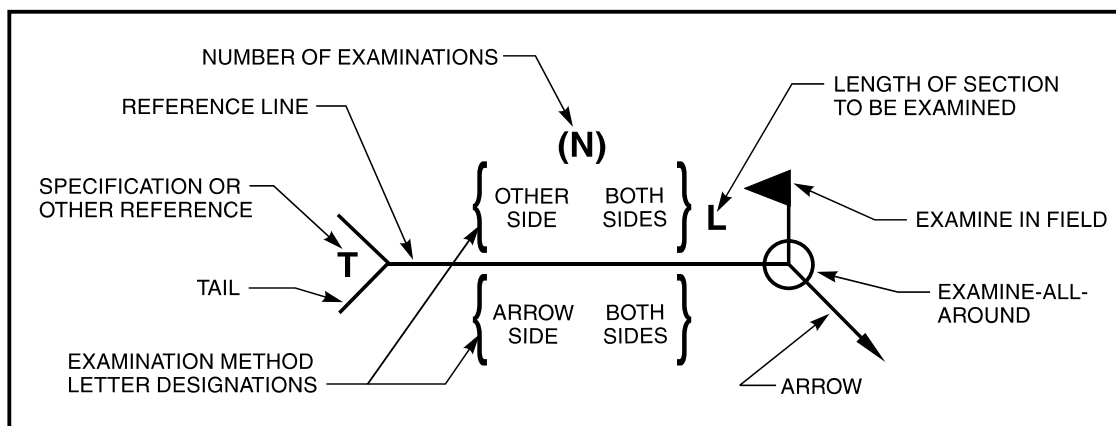
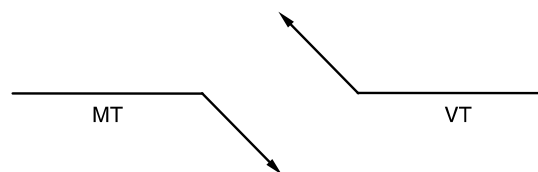
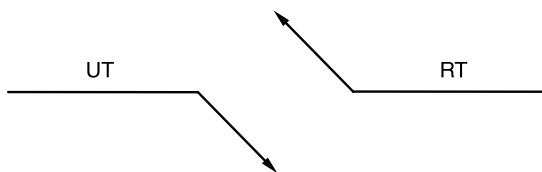
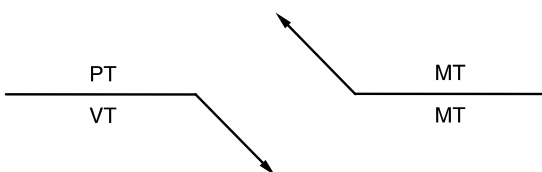


Figure 53—Standard Location of the Elements in the Nondestructive Examination Symbol

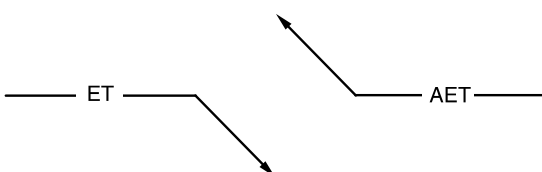
17.5.3 Location on the Other Side. Examinations to be made on the other side of the part shall be specified by placing the letter designation for the selected examination method above the reference line.



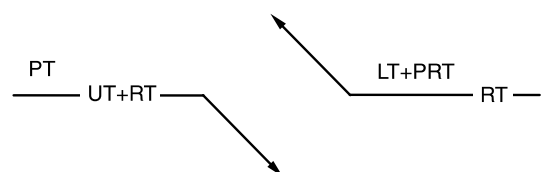
17.5.4 Location on Both Sides. Examinations to be made on both sides of the part shall be specified by placing the letter designation for the selected examination method on both sides of the reference line.



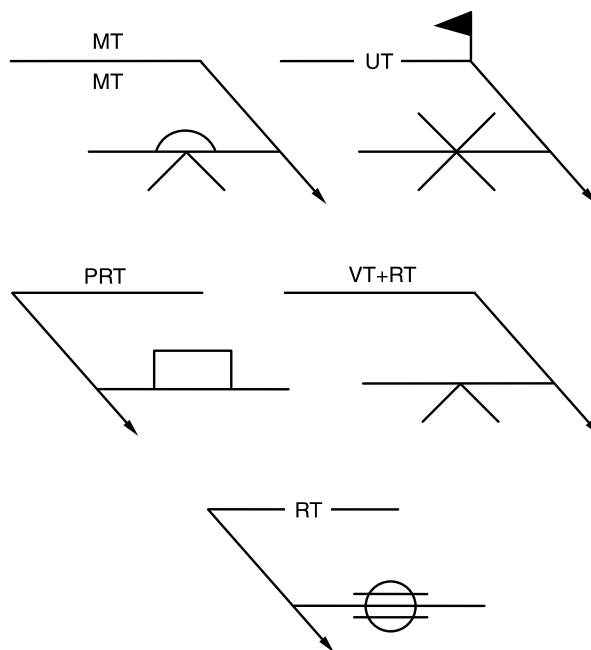
17.5.5 Location Centered on the Reference Line. When the letter designation has no arrow- or other-side significance, or there is no preference from which side the examination is to be made, the letter designation shall be centered on the reference line.



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.



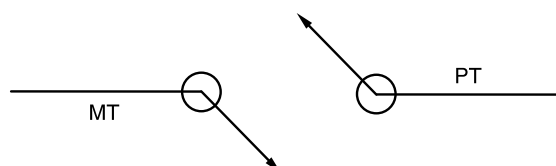
17.6 Welding and Nondestructive Examination Symbols. Nondestructive examination symbols and welding symbols may be combined.



17.7 U.S. Customary and SI Units. When it is required to specify dimensions with nondestructive examination symbols, the same system of units that is standard for the drawing shall be used. Dual dimensioning shall not be used on nondestructive examination symbols. If it is required to include conversions from SI to U.S. Customary units or vice versa, a table of conversions may be included on the drawing. For guidance in drafting standards, refer to the ASME Y14, *Standards for Engineering Drawing & Related Practices*. For guidance on the use of SI units, refer to AWS A1.1, *Metric Practice Guide for the Welding Industry*.

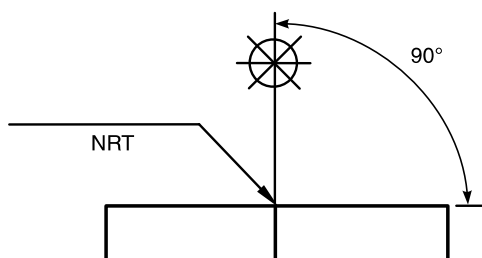
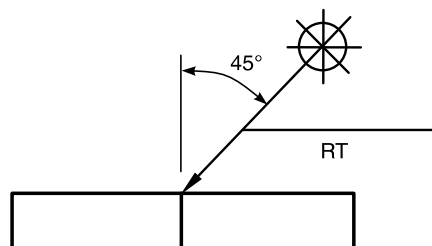
17.8 Supplementary Nondestructive Examination Symbols

17.8.1 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 arrow and reference lines.

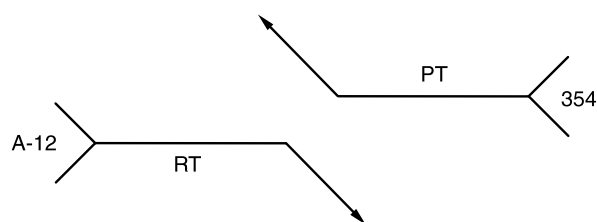


17.8.2 Field Examination Symbol. Examinations required to be conducted in the field (not in a shop or at the place of initial construction) shall be specified by placing the field examination symbol at the junction of the arrow and reference lines.

17.8.3 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.

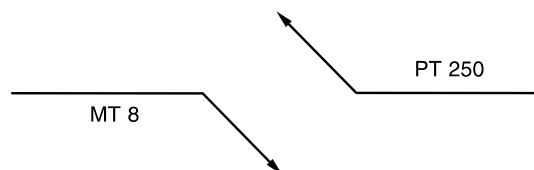


17.9 Specifications, Codes, and References. Information applicable to the examination specified and that is not otherwise provided may be placed in the tail of the nondestructive examination symbol.

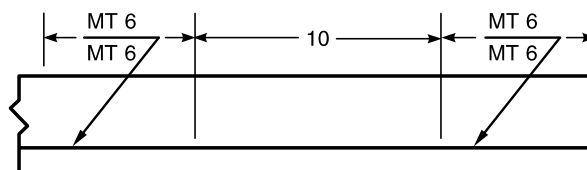


17.10 Extent, Location, and Orientation of Nondestructive Examination Symbols

17.10.1 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.

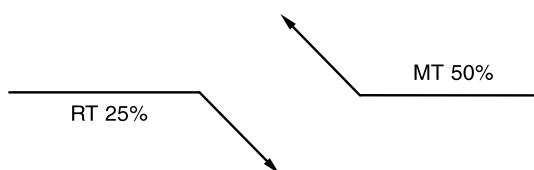


17.10.2 Location Shown. To specify the exact location of a section to be examined, as well as the length, dimension lines shall be used.

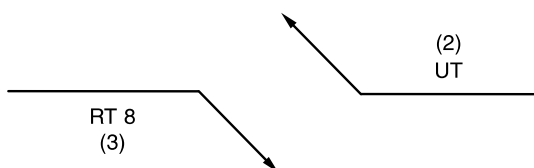


17.10.3 Full-Length Examination. When the full length of a part is to be examined, no length dimension need be included in the nondestructive examination symbol.

17.10.4 Partial Examination. When less than 100% of the length of a weld or part is to be examined, with locations to be determined by a specified procedure, 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 nondestructive examination symbol.

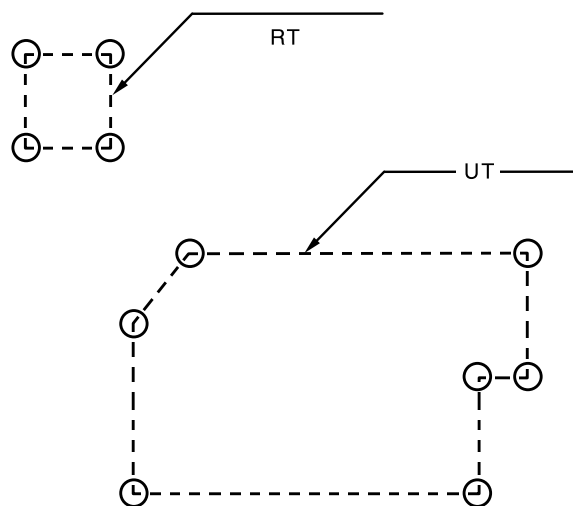


17.11 Number of Examinations. To specify a number of examinations to be conducted on a joint or part at random locations, the number of required examinations shall be placed in parentheses either above or below the letter designation away from the reference line.



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

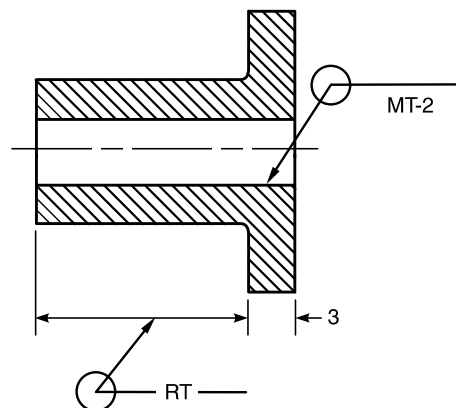
17.12.1 Plane Areas. To specify the nondestructive examination of an area represented as a plane on the drawing, the area to be examined shall be enclosed by straight, broken lines with a circle at each change in direction. The letter designations for the nondestructive examinations required shall be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



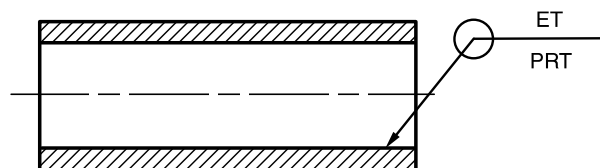
17.12.2 Areas of Revolution. For nondestructive examination of areas of revolution, the area shall be specified by using the examine-all-around symbol and the appropriate dimensions. The illustration presented below specifies the following:

(1) Magnetic particle examination of the bore of the flange for a distance of 2 in [51 mm] from the right-hand face, all the way around the circumference.

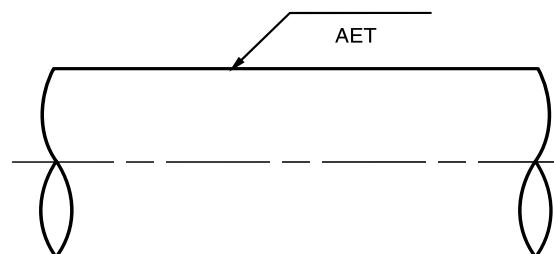
(2) Radiographic examination of an area of revolution where dimensions were not available on the drawing.



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 length is to be examined.



17.12.3 Acoustic Emission. 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 AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, and includes mandatory elements for use with this standard.

Table A.1
Joint Type Designators

Designator	Joint Type
B	Butt
C	Corner
T	T-Joint
L	Lap
E	Edge

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

Table A.2
Letter Designations of Welding, Brazing, and Allied Processes and Their Variations

Process	Letter Designation	Process	Letter Designation
adhesive bonding	AB	percussion welding	PEW
arc welding	AW	resistance welding	RW
arc stud welding	SW	flash welding	FW
atomic hydrogen welding	AHW	pressure-controlled resistance welding	RW-PC
bare metal arc welding	BMAW	projection welding	PW
carbon arc welding	CAW	resistance seam welding	RSEW
gas carbon arc welding	CAW-G	high-frequency seam welding	RSEW-HF
shielded carbon arc welding	CAW-S	induction seam welding	RSEW-I
twin carbon arc welding	CAW-T	mash seam welding	RSEW-MS
electrode gas welding	EGW	resistance spot welding	RSW
flux cored arc welding	FCAW	upset welding	UW
gas shielded flux cored arc welding	FCAW-G	high-frequency upset welding	UW-HF
self-shielded flux cored arc welding	FCAW-S	induction upset welding	UW-I
gas metal arc welding	GMAW	soldering	S
pulsed gas metal arc welding	GMAW-P	dip soldering	DS
short circuit gas metal arc welding	GMAW-S	furnace soldering	FS
gas tungsten arc welding	GTAW	induction soldering	IS
pulsed gas tungsten arc welding	GTAW-P	infrared soldering	IRS
magnetically impelled arc welding	MAW	iron soldering	INS
plasma arc welding	PAW	resistance soldering	RS
shielded metal arc welding	SMAW	torch soldering	TS
submerged arc welding	SAW	ultrasonic soldering	USS
series submerged arc welding	SAW-S	wave soldering	WS
brazing	B	solid-state welding	SSW
block brazing	BB	coextrusion welding	CEW
carbon arc brazing	CAB	cold welding	CW
twin carbon arc brazing	TCAB	diffusion welding	DFW
diffusion brazing	DFB	hot isostatic pressure welding	HIPW
dip brazing	DB	explosion welding	EXW
electron beam brazing	EBB	forge welding	FOW
exothermic brazing	EXB	friction welding	FRW
furnace brazing	FB	direct drive friction welding	FRW-DD
induction brazing	IB	friction stir welding	FSW
infrared brazing	IRB	inertia friction welding	FRW-I
laser beam brazing	LBB	hot pressure welding	HPW
resistance brazing	RB	roll welding	ROW
torch brazing	TB	ultrasonic welding	USW
brazing welding	BW	thermal cutting	TC
arc brazing	ABW	arc cutting	AC
carbon arc brazing	CABW	carbon arc cutting	CAC
electron beam brazing	EBBW	air carbon arc cutting	CAC-A
exothermic braze welding	EXBW	gas metal arc cutting	GMAC
flow brazing	FLB	gas tungsten arc cutting	GTAC
flow welding	FLOW	plasma arc cutting	PAC
laser beam braze welding	LBBW	shielded metal arc cutting	SMAC
consumable guide electroslag welding	ESW-CG	high energy beam cutting	HEBC
electroslag welding	ESW	electron beam cutting	EBC
high energy beam welding	HEBW	laser beam cutting	LBC
electron beam welding	EBW	laser beam air cutting	LBC-A
high vacuum electron beam welding	EBW-HV	laser beam evaporative cutting	LBC-EV
medium vacuum electron beam welding	EBW-MV	laser beam inert gas cutting	LBC-IG
nonvacuum electron beam welding	EBW-NV	laser beam oxygen cutting	LBC-O
laser beam welding	LBW	oxygen cutting	OC
induction welding	IW	flux cutting	OC-F
oxyfuel gas welding	OFW	metal powder cutting	OC-P
air acetylene welding	AAW	oxyfuel gas cutting	OFC
oxyacetylene welding	OAW	oxyacetylene cutting	OFC-A
oxyhydrogen welding	OHW	oxyhydrogen gas cutting	OFC-H
pressure gas welding	PGW	oxynatural gas cutting	OFC-N

Table A.2 (Continued)
Letter Designations of Welding, Brazing, and Allied Processes and Their Variations

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

Source: Adapted from AWS A3.0M/A3.0:2010, *Standard Welding Terms and Definitions*, Table A.1, Miami: American Welding Society.

Table A.3
Alphabetical Cross-Reference to Table A.2 by Process

Process	Letter Designation	Process	Letter Designation
adhesive bonding.....	AB	forge welding.....	FOW
air acetylene welding.....	AAW	friction stir welding.....	FSW
air carbon arc cutting.....	CAC-A	friction welding.....	FRW
arc braze welding.....	ABW	furnace brazing.....	FB
arc cutting.....	AC	furnace soldering.....	FS
arc spraying.....	ASP	gas carbon arc welding.....	CAW-G
arc stud welding.....	SW	gas metal arc cutting.....	GMAC
arc welding.....	AW	gas metal arc welding.....	GMAW
atomic hydrogen welding.....	AHW	gas shielded flux cored arc welding.....	FCAW-G
bare metal arc welding.....	BMAW	gas tungsten arc cutting.....	GTAC
block brazing.....	BB	gas tungsten arc welding.....	GTAW
braze welding.....	BW	high energy beam cutting.....	HEBC
brazing.....	B	high energy beam welding.....	HEBW
carbon arc braze welding.....	CABW	high vacuum electron beam welding.....	EBW-HV
carbon arc brazing.....	CAB	high velocity oxyfuel spraying.....	HVOF
carbon arc cutting.....	CAC	high-frequency seam welding.....	RSEW-HF
carbon arc gouging.....	CAG	high-frequency upset welding.....	UW-HF
carbon arc welding.....	CAW	hot isostatic pressure welding.....	HIPW
coextrusion welding.....	CEW	hot pressure welding.....	HPW
cold welding.....	CW	induction brazing.....	IB
consumable guide electroslag welding.....	ESW-CG	induction seam welding.....	RSEW-I
diffusion brazing.....	DFB	induction soldering.....	IS
diffusion welding.....	DFW	induction upset welding.....	UW-I
dip brazing.....	DB	induction welding.....	IW
dip soldering.....	DS	inertia friction welding.....	FRW-I
direct drive friction welding.....	FRW-DD	infrared brazing.....	IRB
electrode gas welding.....	EGW	infrared soldering.....	IRS
electron beam braze welding.....	EBBW	iron soldering.....	INS
electron beam brazing.....	EBB	laser beam air cutting.....	LBC-A
electron beam cutting.....	EBC	laser beam braze welding.....	LBBW
electron beam welding.....	EBW	laser beam brazing.....	LBB
electroslag welding.....	ESW	laser beam cutting.....	LBC
exothermic braze welding.....	EXBW	laser beam evaporative cutting.....	LBC-EV
exothermic brazing.....	EXB	laser beam inert gas cutting.....	LBC-IG
explosion welding.....	EXW	laser beam oxygen cutting.....	LBC-O
flame spraying.....	FLSP	laser beam welding.....	LBW
flash welding.....	FW	magnetically impelled arc welding.....	MIAW
flow brazing.....	FLB	mash seam welding.....	RSEW-MS
flow welding.....	FLOW	medium vacuum electron beam welding.....	EBW-MV
flux cored arc welding.....	FCAW	metal powder cutting.....	OC-P
flux cutting.....	OC-F	nonvacuum electron beam welding.....	EBW-NV

Table A.3 (Continued)
Alphabetical Cross-Reference to Table A.2 by Process

Process	Letter Designation	Process	Letter Designation
oxyacetylene cutting.....	OFC-A	resistance welding	RW
oxyacetylene welding	OAW	roll welding.....	ROW
oxyfuel gas cutting	OFC	self-shielded flux cored arc welding	FCAW-S
oxyfuel gas welding.....	OFW	series submerged arc welding.....	SAW-S
oxygen arc cutting	OAC	shielded carbon arc welding	CAW-S
oxygen cutting	OC	shielded metal arc cutting.....	SMAC
oxygen gouging	OG	shielded metal arc welding	SMAW
oxygen lance cutting.....	OLC	short circuit gas metal arc welding.....	GMAW-S
oxyhydrogen gas cutting.....	OFC-H	soldering	S
oxyhydrogen welding	OHW	solid-state welding.....	SSW
oxynatural gas cutting.....	OFC-N	submerged arc welding.....	SAW
oxypropane cutting	OFC-P	thermal cutting.....	TC
percussion welding	PEW	thermal gouging.....	TG
plasma arc cutting.....	PAC	thermal spraying	THSP
plasma arc gouging.....	PAG	thermite welding.....	TW
plasma arc welding	PAW	torch brazing	TB
plasma spraying	PSP	torch soldering	TS
pressure gas welding.....	PGW	twin carbon arc brazing	TCAB
pressure-controlled resistance welding.....	RW-PC	twin carbon arc welding	CAW-T
projection welding	PW	ultrasonic soldering	USS
pulsed gas metal arc welding.....	GMAW-P	ultrasonic welding	USW
pulsed gas tungsten arc welding.....	GTAW-P	upset welding.....	UW
resistance brazing	RB	vacuum plasma spraying	VPSP
resistance seam welding	RSEW	wave soldering	WS
resistance soldering	RS	wire flame spraying	FLSP-W
resistance spot welding.....	RSW		

Source: Reproduced from AWS A3.0M/A3.0:2010, *Standard Welding Terms and Definitions*, Table A.2, Miami: American Welding Society.

Table A.4
Alphabetical Cross-Reference to Table A.2 by Letter Designation

Letter Designation	Process	Letter Designation	Process
AAW.....	air acetylene welding	DB	dip brazing
AB.....	adhesive bonding	DFB	diffusion brazing
ABW.....	arc braze welding	DFW	diffusion welding
AC.....	arc cutting	DS	dip soldering
AHW.....	atomic hydrogen welding	EBB	electron beam brazing
ASP.....	arc spraying	EBBW	electron beam braze welding
AW.....	arc welding	EBC	electron beam cutting
B	brazing	EBW	electron beam welding
BB	block brazing	EBW-HV	high vacuum electron beam welding
BMAW.....	bare metal arc welding	EBW-MV.....	medium vacuum electron beam welding
BW.....	braze welding	EBW-NV	nonvacuum electron beam welding
CAB	carbon arc brazing	EGW.....	electrode gas welding
CABW.....	carbon arc braze welding	ESW.....	electroslag welding
CAC	carbon arc cutting	ESW-CG.....	consumable guide electroslag welding
CAC-A.....	air carbon arc cutting	EXB	exothermic brazing
CAG.....	carbon arc gouging	EXBW	exothermic braze welding
CAW.....	carbon arc welding	EXW	explosion welding
CAW-G	gas carbon arc welding	FB	furnace brazing
CAW-S.....	shielded carbon arc welding	FCAW.....	flux cored arc welding
CAW-T.....	twin carbon arc welding	FCAW-G.....	gas shielded flux cored arc welding
CEW	coextrusion welding	FCAW-S	self-shielded flux cored arc welding
CW.....	cold welding		

Table A.4 (Continued)
Alphabetical Cross-Reference to Table A.2 by Letter Designation

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

Source: Reproduced from AWS A3.0M/A3.0:2010, *Standard Welding Terms and Definitions*, Table A.3, Miami: American Welding Society.

Table A.5
Suffixes for Optional Use in Applying
Welding, Brazing, and Allied Processes

Process	Letter Designation
Adaptive Control	AD
Automatic	AU
Manual	MA
Mechanized	ME
Robotic	RO
Semiautomatic	SA

Source: Reproduced from AWS A3.0M/A3.0:2010, Standard Welding Terms and Definitions, Table A.4, Miami: American Welding Society.

Table A.6
Examination Method
Letter Designations

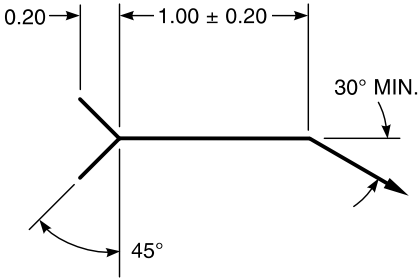
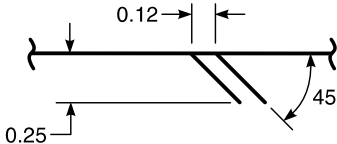
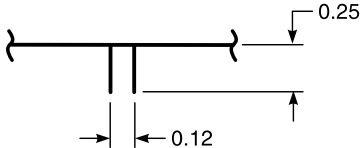
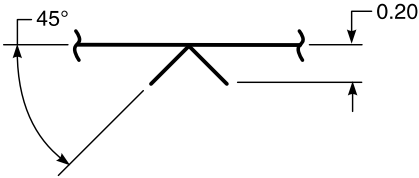
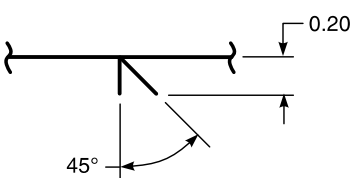
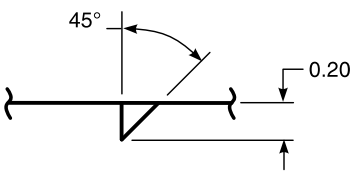
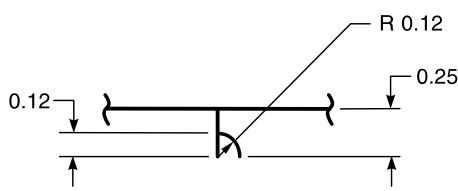
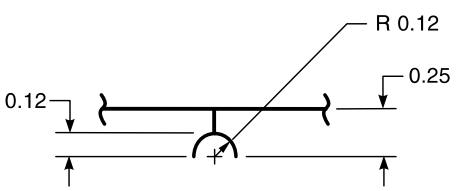
Examination Method	Letter Designation
Acoustic emission	AET
Electromagnetic	ET
Leak	LT
Magnetic particle	MT
Neutron radiographic	NRT
Penetrant	PT
Proof	PRT
Radiographic	RT
Ultrasonic	UT
Visual	VT

Annex B (Informative)

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

This annex is not part of AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, but is included for informational purposes only.

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

 1.	 2.
 3.	 4.
 5.	 6.
 7.	 8.

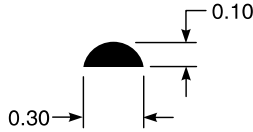
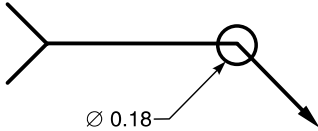
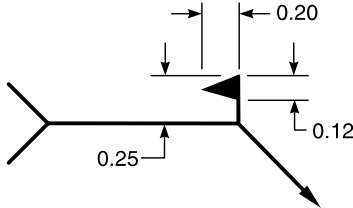
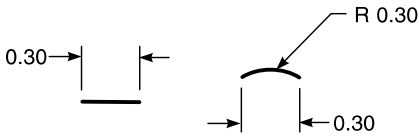
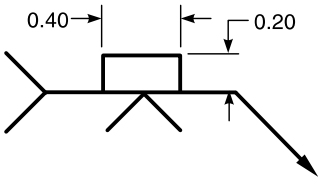
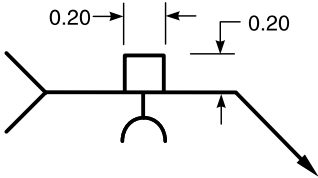
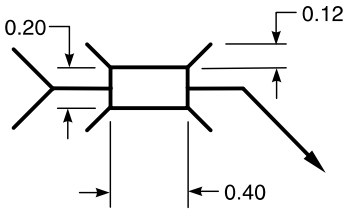
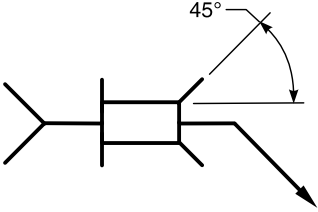
Notes:

1. Unless otherwise specified, tolerances shall be ± 0.04 in or $\pm 1^\circ$, as applicable.
2. All radii are minimum dimensions.

9.	10.
11.	12.
13.	
14.	

1. Unless otherwise specified, tolerances shall be ± 0.04 in or $\pm 1^\circ$, as applicable.
2. All radii are minimum dimensions.

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

 15. NOTE: MELT-THROUGH, BACK WELD, AND BACKING WELD SYMBOL HAVE THE SAME DIMENSIONS	 16.
 17.	 18.
 19.	 20.
 21. 	

Notes:

1. Unless otherwise specified, tolerances shall be ± 0.04 in or $\pm 1^\circ$, as applicable.
2. All radii are minimum dimensions.

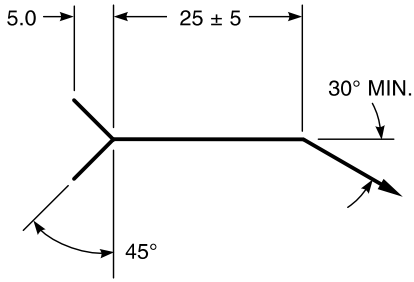
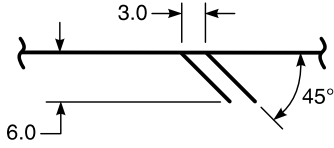
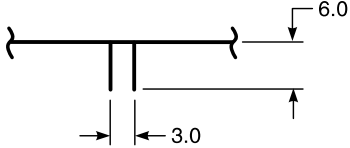
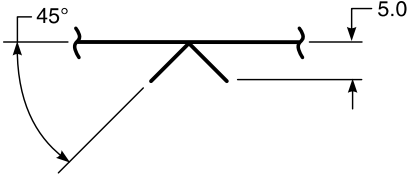
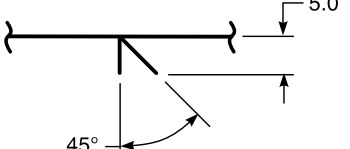
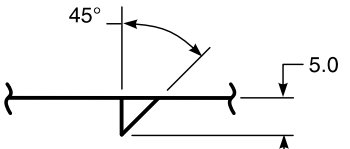
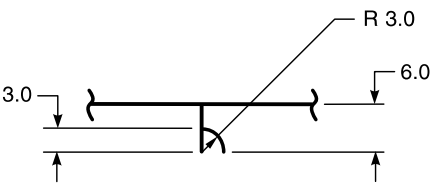
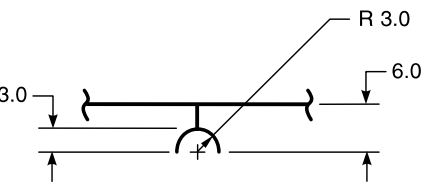
Annex C (Informative)

Design of Standard Symbols (SI Units)

This annex is not part of AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, but is included for informational purposes only.

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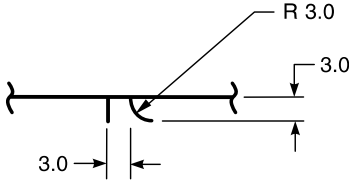
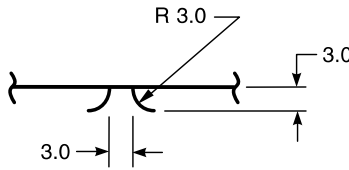
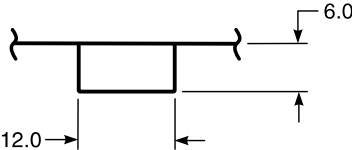
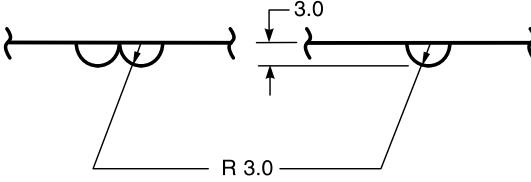
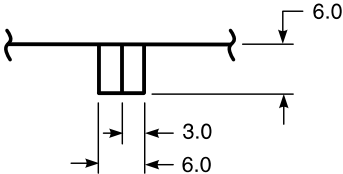
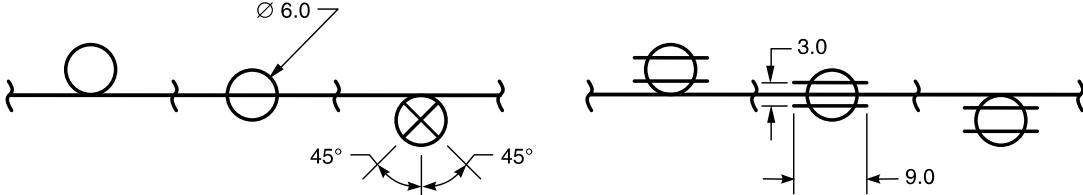
Design of Standard Symbols (SI Units)

 1.	 2.
 3.	 4.
 5.	 6.
 7.	 8.

Notes:

1. Unless otherwise specified, tolerances shall be ± 1 mm or $\pm 1^\circ$, as applicable.
2. All radii are minimum dimensions.

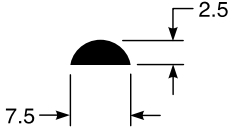
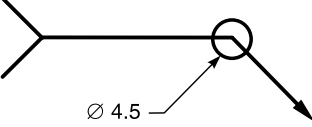
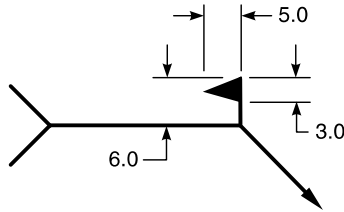
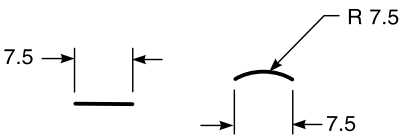
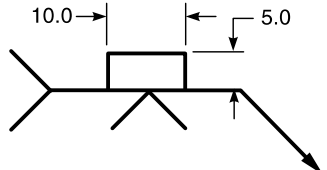
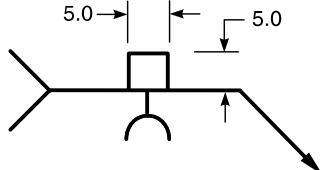
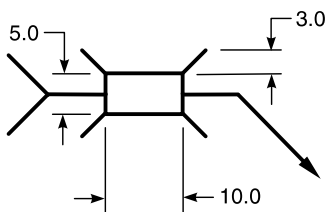
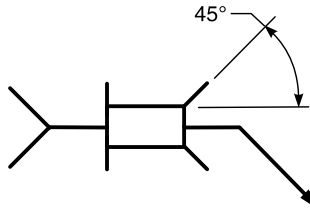
Design of Standard Symbols (SI Units) (Continued)

 9.	 10.
 11.	 12.
 13.	
 14.	

Notes:

1. Unless otherwise specified, tolerances shall be ± 1 mm or $\pm 1^\circ$, as applicable.
2. All radii are minimum dimensions.

Design of Standard Symbols (SI Units) (Continued)

 15. NOTE: MELT-THROUGH, BACK WELD, AND BACKING WELD SYMBOL HAVE THE SAME DIMENSIONS	 16.
 17.	 18.
 19.	 20.
 21. 	

Notes:

1. Unless otherwise specified, tolerances shall be ± 1 mm or $\pm 1^\circ$, 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 AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, 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., D6.8 is a commentary on 6.8 in the text.

D4.5 Welding Symbols. Figure 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. These letters are used consistently throughout this document but are by no means mandatory or meant to apply to other documents that may use these or other letters as similar placeholders. 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 6.12.2, 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 6.11.

D6.8 Field Weld Symbols. 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.

D6.9.2 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 as a branch-to-header or a T-connection. The tubes are often of equal size, see Figure D.1. 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 D.1.

D6.10.1 Weld-All-Around Symbol. 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.

D6.11.3 Welding Symbols Designated “TYPICAL.” The “TYPICAL” designation is intended as an

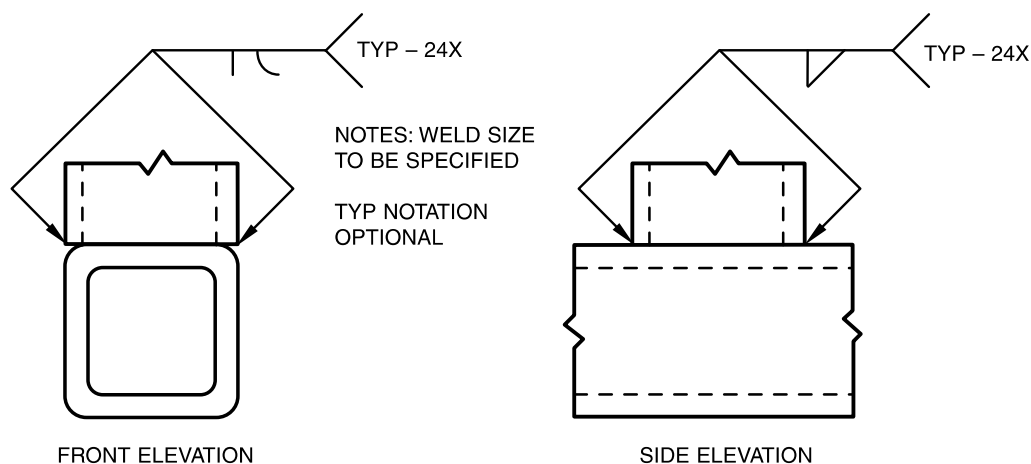


Figure D.1—Examples of the Welding of Tubing

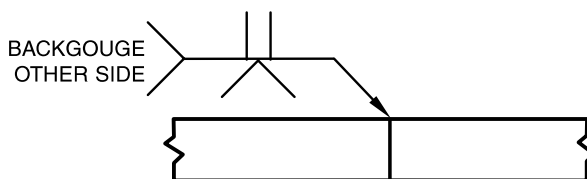
alternative to repeating identical welding symbols many times on the same drawing, but only when the joints represented are identical in all details. The “TYPICAL” notation, usually abbreviated “TYP,” is added to the tail of the welding symbol, and all applicable joints shall be completely identified, 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.

D6.18 Changes in Joint Geometry During Welding.

Joint geometry of groove welds 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 D.2).

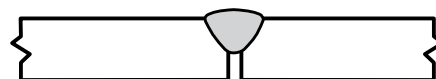
WELDING SYMBOL:



BEFORE WELDING:



V-GROOVE WELD COMPLETE:



BACKGOUGING COMPLETE:



WELD COMPLETE:



Figure D.2—Changes in Joint Geometry During Welding

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).

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 types of groove welds. The dimensions corresponding to “depth of groove” 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 D.3).

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 dimensions of the groove as well as the type. It should be recognized that a welding symbol with only “SEAL WELD” in the tail and no other requirements will relegate such welding to the discretion of the fabrication shop, whose judgment and welding practice may not ensure the service performance of the joint as expected by the designer.

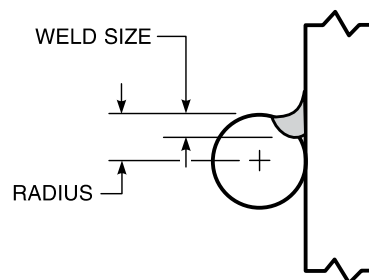


Figure D.3—Example of a Flare Groove

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Annex E (Informative)

Welding Symbol Chart

This annex is not part of AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, but is included for informational purposes only.

The welding symbol chart included in AWS A2.4:2012 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 both wall size and desk size formats. Over the years, the chart has been repro-

duced 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		
No Arrow Side or Other Side Significance	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used

Supplementary Symbols				Standard Location of the Elements of a Welding Symbol					
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		Edge Joint		Letter Designations			
						Where letter designations are to be included in the tail of the welding symbol, refer to Annex A (Normative) Tables of AWS A2.4:2012 © 2012 American Welding Society 550 N.W. LeJeune Road Miami, FL 33126 www.aws.org			

American Welding Society Welding Symbol Chart

Typical Welding Symbols			
Double-Fillet Welding Symbol Fillet Weld Size Length Omission of Length Indicates that Weld Extends Between Abrupt Changes in Direction or as Dimensioned	Chain Intermittent Fillet Welding Symbol Pitch (Distance Between Centers) of Segments Fillet Weld Size Length of Segments	Staggered Intermittent Fillet Welding Symbol Pitch (Distance Between Centers) of Segments Fillet Weld Size Length of Segments	
Plug Welding Symbol Included Angle of Countersink Plug Weld Size (Diameter of Hole at Root) Pitch (Distance Between Centers) of Welds Depth of Filling (Omission Indicates Filling is Complete)	Back Welding Symbol Back Weld 2nd Operation 1st Operation	Backing Welding Symbol Backing Weld 2nd Operation 1st Operation	
Spot Welding Symbol Spot Weld Size Number of Welds Pitch RSW Process	Stud Welding Symbol Stud Size Pitch Number of Studs RSEW Process	Seam Welding Symbol Seam Weld Size Length of Segments Pitch RSEW Process	
Square-Groove Welding Symbol Groove Weld Size Root Opening	V-Groove Welding Symbol Depth of Groove Groove Weld Size Groove Angle Root Opening	Double-Bevel-Groove Welding Symbol Groove Weld Size Root Opening Arrow Points Toward Member to be Beveled	
Symbol with Backgouging Depth of Groove Back Weld Backgouge	Flare-V-Groove Welding Symbol Groove Weld Size	Flare-Bevel-Groove Welding Symbol Groove Weld Size	
Multiple Reference Lines 1st Operation On Line Nearest Arrow 2nd Operation 3rd Operation	Complete Joint Penetration Indicates Complete Joint Penetration Regardless of Type of Weld or Joint Geometry CJP	Edge Welding Symbol Edge Weld Size	
Flash or Upset Welding Symbol Process Reference FW	Melt-Through Symbol Root Reinforcement	Joint with Backing 'R' Indicates Backing Removed After Welding	
Joint with Spacer Double-Bevel Groove	Contour Symbols		
	Flush 	Flat 	Convex
		Flat 	Concave

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Annex F (Informative)

ISO 2553 Welding Symbols

This annex is not part of AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, 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, *Welded, Brazed and Soldered Joints — Symbolic Representation on Drawings*, 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

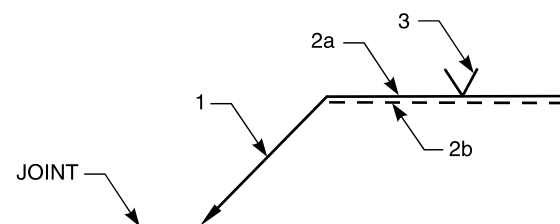
In addition to weld and welding symbols, ISO 2553 uses terms and definitions that may differ from those in AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*. Caution should be exercised when converting ISO requirements to standard AWS usage.

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.

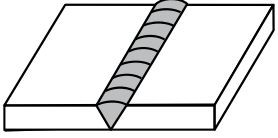
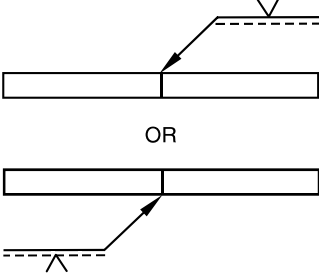
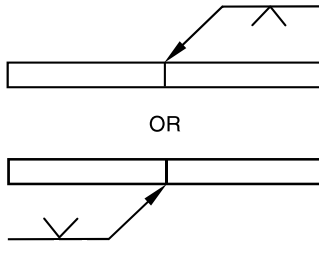
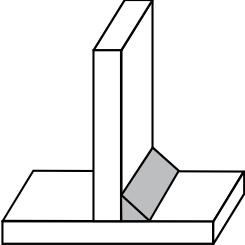
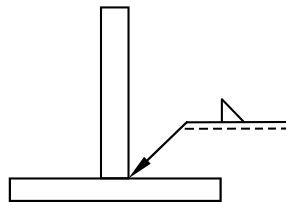
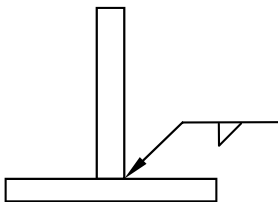
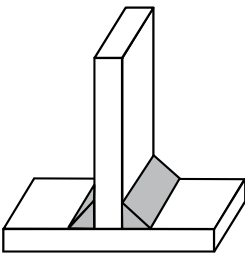
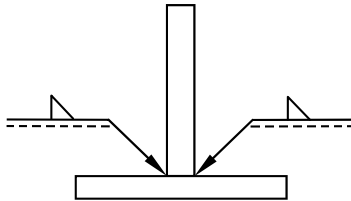
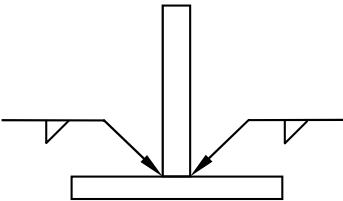
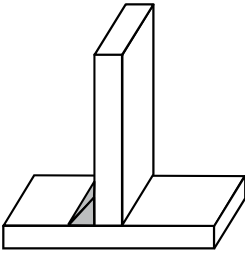
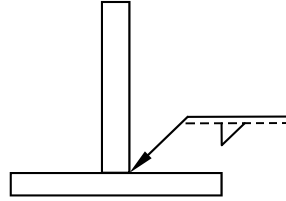
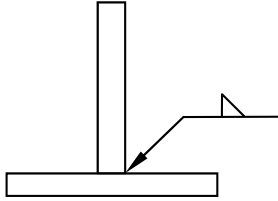
F3. Reference Line

In contrast to AWS A2.4, the ISO 2553 welding symbol has dual horizontal lines consisting of one continuous reference line and one dashed identification line. The representation from ISO 2553 is as shown:



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

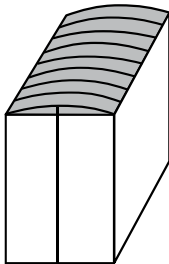
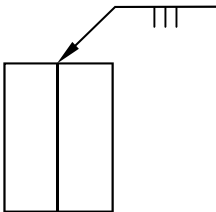
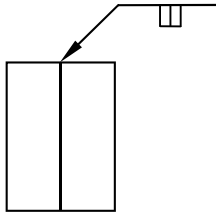
The dashed identification line is used to indicate the other side of the joint. Information applicable to the arrow side of a joint is placed on the solid reference line. Information applicable to the other side of a joint is placed on the dashed identification line. CAUTION: The dashed identification 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. Some typical examples are provided:

ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
	 OR	 OR
		
		
		

F4. Weld Symbols

Many of the ISO 2553 weld symbols are identical to those in AWS A2.4. One difference is found with the

“Edge” weld symbol (see illustration below). Curiously, ISO does not consider that the edge weld can be put on other than the arrow side and does not use the dashed identification line in this instance.

ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
		

The following table examines the difference between ISO and comparable AWS weld symbols. Where no exact comparisons exist, the table notes the difference. While there are examples of AWS symbols for

which there are no comparable ISO symbols, it is not the intent of this document to explore every case. Reference and identification lines have been omitted for clarity.

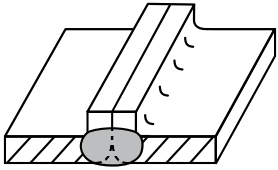
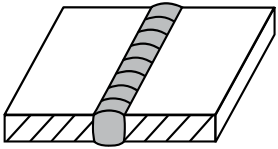
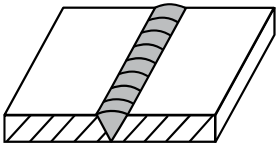
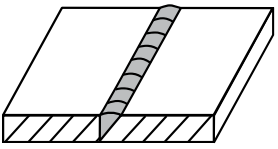
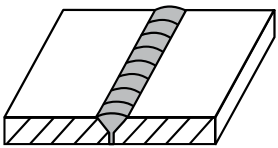
ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
	 BUTT WELD BETWEEN PLATES WITH RAISED EDGES	(NO SYMBOL)
	 SQUARE BUTT WELD	 SQUARE-GROOVE
	 SINGLE-V BUTT WELD	 SINGLE V-GROOVE
	 SINGLE BEVEL BUTT WELD	 SINGLE-BEVEL-GROOVE
	 SINGLE-V BUTT WELD WITH BROAD FACE ROOT	(NO SYMBOL)

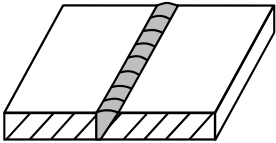
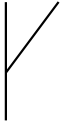
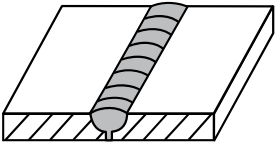
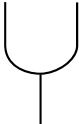
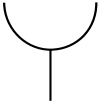
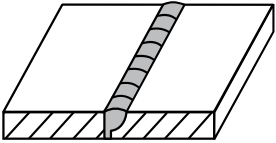
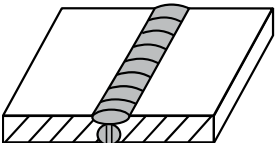
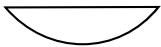
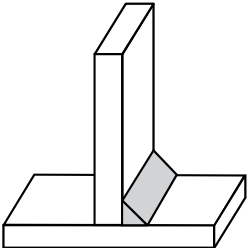
ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
	 SINGLE BEVEL BUTT WELD WITH BROAD FACE ROOT	(NO SYMBOL)
	 SQUARE-U BUTT WELD WITH PARALLEL OR SLOPING SIDES	 U-GROOVE
	 SINGLE-J BUTT WELD	 J-GROOVE
	 BACKING RUN	 BACK OR BACKING
	 FILLET WELD	 FILLET

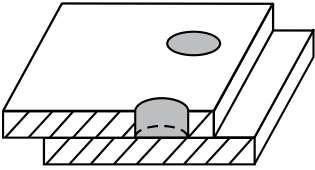
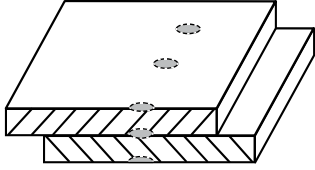
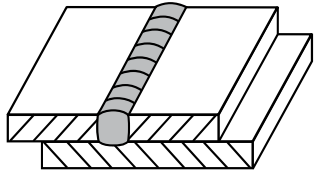
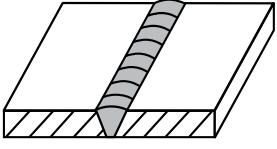
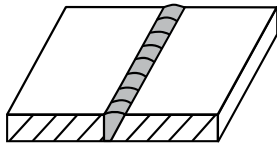
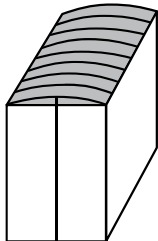
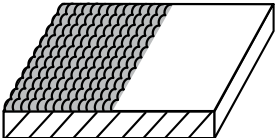
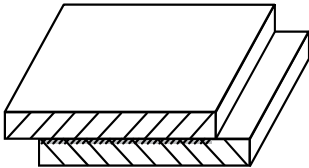
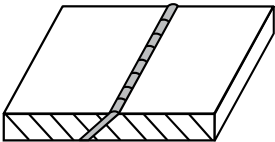
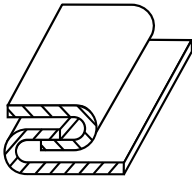
ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
	 PLUG WELD	 PLUG
	 SPOT WELD	 SPOT
	 SEAM WELD	 SEAM
	 STEEP-FLANKED SINGLE BEVEL BUTT WELD	(NO SYMBOL) ¹ ¹ USE COMPARABLE V GROOVE SYMBOL WITH DIMENSION INFORMATION
	 STEEP-FLANKED SINGLE BEVEL BUTT WELD	(NO SYMBOL) ² ² USE COMPARABLE BEVEL GROOVE SYMBOL WITH DIMENSION INFORMATION

ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
	 EDGE WELD	 EDGE
	 SURFACING	 SURFACING
	 SURFACE JOINT	(NO SYMBOL)
	 INCLINED JOINT	 SCARF
	 FOLD JOINT	(NO SYMBOL)

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	ISO 2553	AWS A2.4
 FLAT (USUALLY FINISHED FLUSH)	 FLUSH OR FLAT	 TOES SHALL BE BLENDED SMOOTHLY	(NO SYMBOL)
 CONVEX	 CONVEX	 PERMANENT BACKING STRIP USED	 BACKING (RECTANGLE)
 CONCAVE	 CONCAVE	 REMOVABLE BACKING STRIP USED	 BACKING (RECTANGLE) REMOVED AFTER WELDING

F5. Fillet Weld Symbols

The dimensioning of fillet welds is another area where ISO 2553 is significantly different from AWS A2.4. 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 dimen-

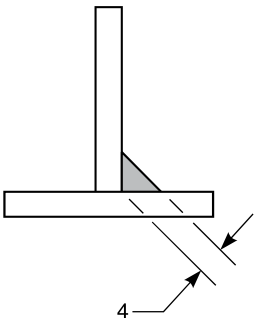
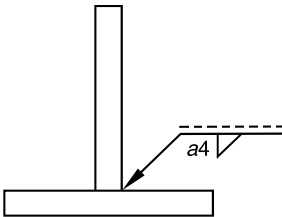
sion preceded by the designator “*z*” represents leg length. To convert the throat thickness to a leg length, use the following equation:

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

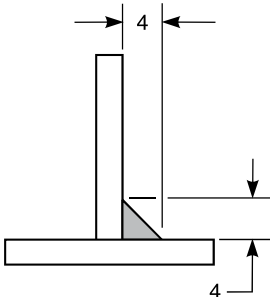
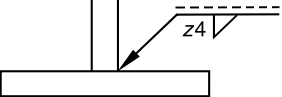
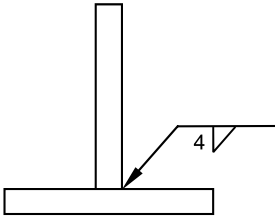
In AWS A2.4, the fillet weld size is always the leg dimension.

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Comparison of the fillet weld with the modifier “a”:

ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
		NOT APPLICABLE

Comparison of the fillet weld with the modifier “z”:

ILLUSTRATION OF WELD	ISO 2553	AWS A2.4
		

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Annex G (Informative)

Informative References

This annex is not part of AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, but is included for informational purposes only.

ASME Y14, *Standards for Engineering Drawing & Related Practices*. New York: ASME International.

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

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Annex H (Informative)

Guidelines for the Preparation of Technical Inquiries

This annex is not part of AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, but is included for informational purposes only.

H1. Introduction

The American Welding Society (AWS) Board of Directors has adopted a policy whereby all official interpretations of AWS standards are handled in a formal manner. Under this policy, all interpretations are made by the committee that is responsible for the standard. Official communication concerning an interpretation is directed through the AWS staff member who works with that committee. The policy requires that all requests for an interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some interpretations may require considerable time.

H2. Procedure

All inquiries shall be directed to:

Managing Director
Technical Services Division
American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

All inquiries shall contain the name, address, and affiliation of the inquirer, and they shall provide enough information for the committee to understand the point of concern in the inquiry. When the point is not clearly defined, the inquiry will be returned for clarification. For efficient handling, all inquiries should be typewritten and in the format specified below.

H2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry

along with the edition of the standard that contains the provision(s) the inquirer is addressing.

H2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be to obtain an interpretation of a standard's requirement or to request the revision of a particular provision in the standard.

H2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to understand the point of the inquiry. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annex) that bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

H2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry or provide the wording for a proposed revision, if this is what the inquirer seeks.

H3. Interpretation of Provisions of the Standard

Interpretations of provisions of the standard are made by the relevant AWS technical committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the portion of the standard addressed by the inquiry. The subcommittee reviews the inquiry and the proposed reply to determine what the response to the inquiry should be. Following the subcommittee's development of the response, the inquiry and the response are presented to the entire committee for review and approval. Upon approval by the committee, the interpretation is an official

interpretation of the Society, and the secretary transmits the response to the inquirer and to the *Welding Journal* for publication.

H4. Publication of Interpretations

All official interpretations will appear in the *Welding Journal* and will be posted on the AWS web site.

H5. 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.

H6. AWS Technical Committees

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees or to consideration of revisions to existing provisions on the basis of new data or technology. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on (1) specific engineering problems, (2) requirements of standards applied to fabrications outside the scope of the document, or (3) points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest.

List of AWS Documents on Definitions and Symbols

Designation	Title
A2.1-WC ^a	<i>Welding Symbol Chart (Wall Size)</i>
A2.1-DC ^a	<i>Welding Symbol Chart (Desk Size)</i>
A2.4	<i>Standard Symbols for Welding, Brazing, and Nondestructive Examination</i>
A3.0M/A3.0	<i>Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying</i>
A3.1	<i>Master Chart of Welding and Joining Processes</i>

^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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