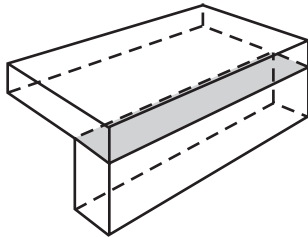
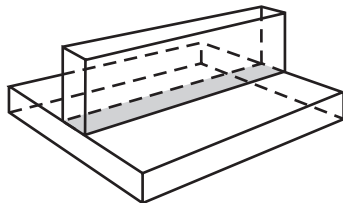


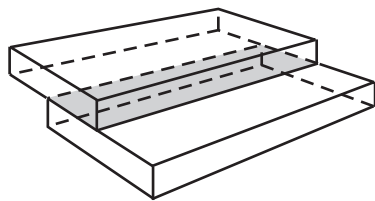
(A) BUTT JOINT



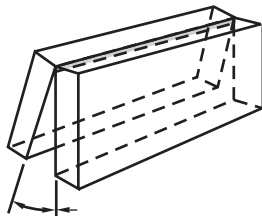
(B) CORNER JOINT



(C) T-JOINT



(D) LAP JOINT



(E) EDGE JOINT

APPLICABLE WELDS and WELD SYMBOL

Bevel-Groove	U-Groove
Flare-Bevel-Groove	V-Groove
Flare-V-Groove	Edge Weld
J-Groove	Scarf (for braze joint)
Square-Groove	

APPLICABLE WELDS and WELD SYMBOL

Fillet	Edge Weld
Bevel-Groove	Plug
Flare-Bevel-Groove	Slot
Flare-V-Groove	Spot
J-Groove	Seam
Square-Groove	Projection
U-Groove	V-Groove

APPLICABLE WELDS and WELD SYMBOL

Fillet	Slot
Bevel-Groove	Spot
Flare-V-Groove	Seam
J-Groove	Projection
Square-Groove	Plug

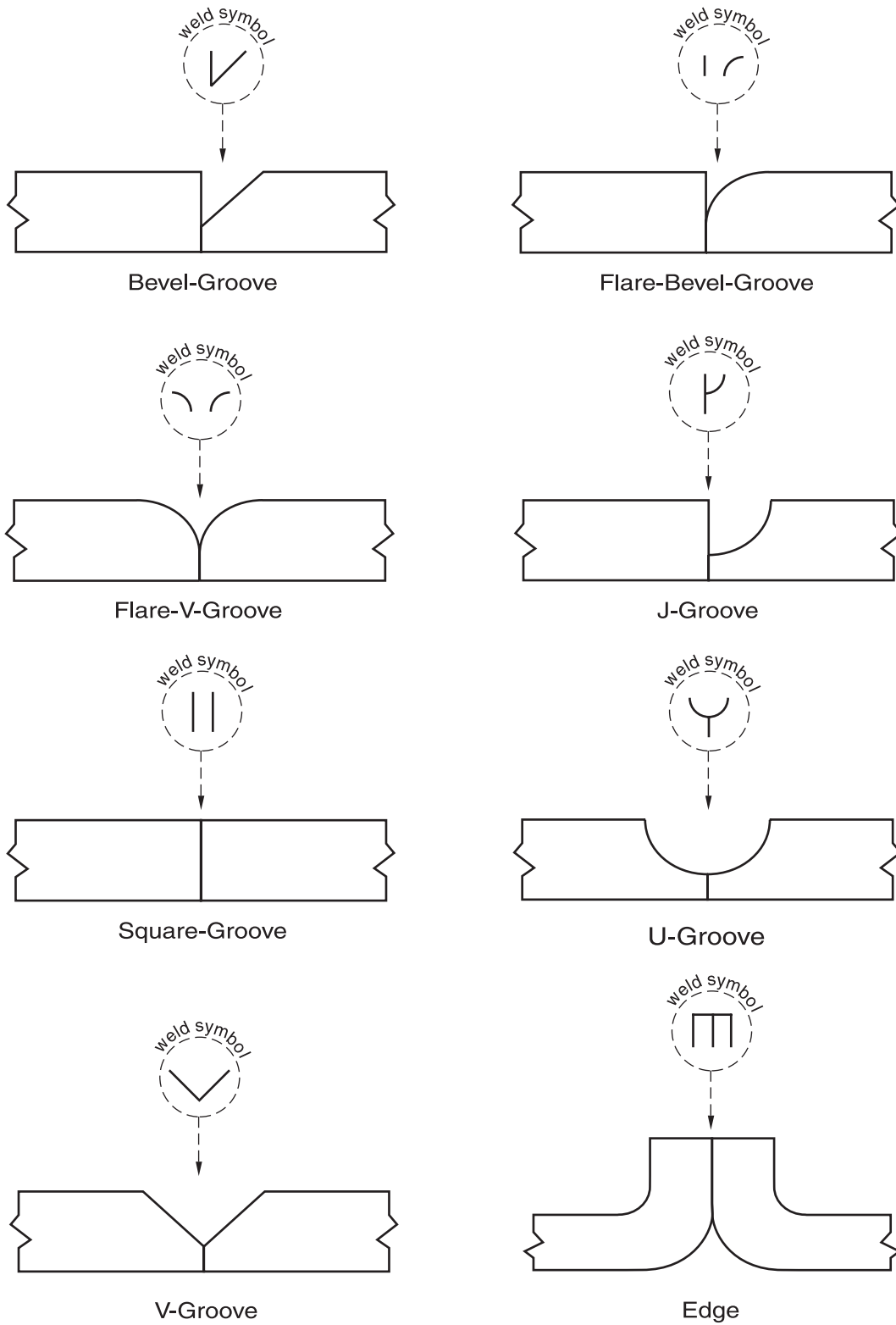
APPLICABLE WELDS and WELD SYMBOL

Fillet	Slot
Bevel-Groove	Spot
Flare-V-Groove	Seam
J-Groove	Projection
Square-Groove	*Braze
Plug	

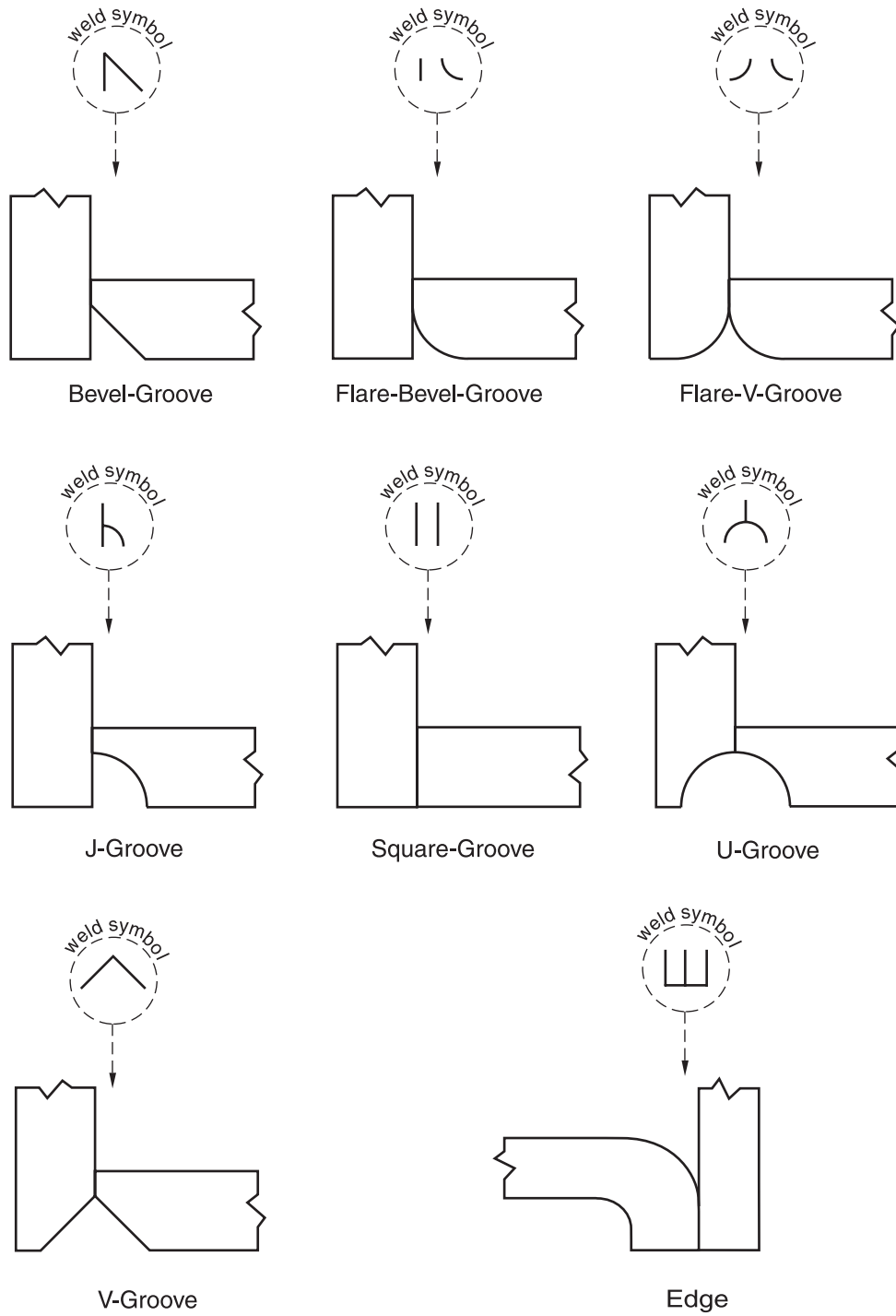
APPLICABLE WELDS and WELD SYMBOL

Bevel-Groove	U-Groove
Flare-Bevel-Groove	V-Groove
Flare-V-Groove	Edge
J-Groove	Seam
Square-Groove	

Figure 4.1—The Five Basic Types of Joints and Applicable Welds

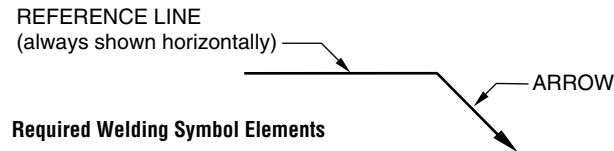


**Figure 4.6—Edge Shape Combinations for Butt Joint Variations**



**Figure 4.7—Edge Shape Combinations for Corner Joint Variations**

reference line of the welding symbol. The *welding symbol* (Figure 4.37) indicates the total symbol, including all information applied to it, to specify the weld(s) required. All *welding symbols* require a reference line and an arrow, and these are shown in Figure 4.35.



### Welding Symbol Elements

Except for the reference line and arrow, not all elements need be used unless required for clarity. A welding symbol may include the following elements:

- Reference Line (required element)
- Arrow (required element)
- Tail
- Basic weld symbol
- Dimensions and other data
- Supplementary symbols
- Finish symbols
- Specification, process, or other reference

**Figure 4.35—Reference Line and Arrow**

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

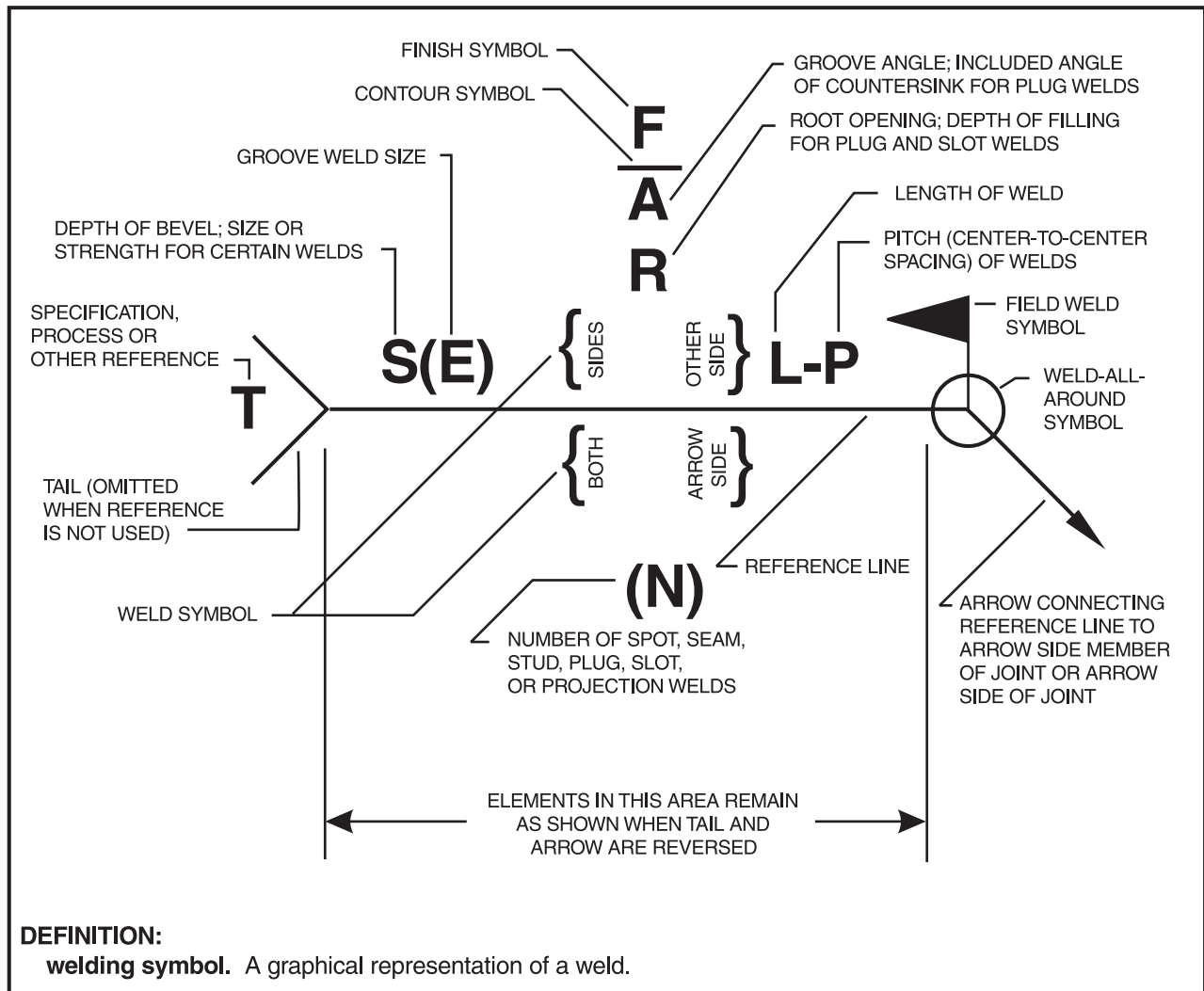
FILLET	PLUG OR SLOT	STUD	SPOT OR PROJECTION	SEAM	BACK OR BACKING	SURFACING	EDGE

NOTE: THE REFERENCE LINE IS SHOWN DASHED (---) FOR ILLUSTRATIVE PURPOSES.

**DEFINITION:**

**weld symbol.** A graphical character connected to the welding symbol indicating the type of weld.

**Figure 4.36—Weld Symbols**



**Figure 4.37—Standard Location of Elements of Welding Symbol**

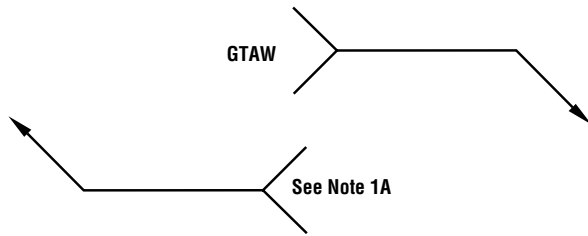
The *reference line* is always drawn horizontally. It is used to apply weld symbols and other data, and has a particular significance that remains the same regardless of any elements added to it. The lower side of the reference line is termed the *arrow side* and the upper side of the reference line is termed the *other side*. This convention is shown in Figure 4.38. The direction of the arrow creates no change in the significance of the reference line. Multiple reference lines may also be used with the basic weld symbols and are shown in Figure 4.39.

The *arrow* connects the reference line to the weld joint or area to be welded. It may be shown with or without a break, or with multiple arrows. *When the arrow is shown with a break, the broken arrow always breaks toward the*

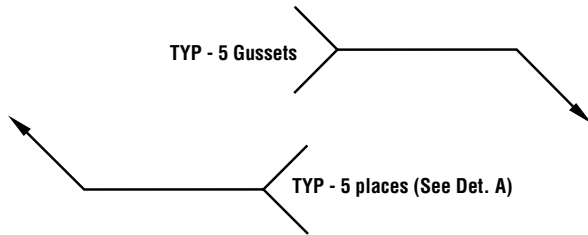
*member of the joint that is to be prepared or shaped, and is shown in Figure 4.40. Figure 4.40 also shows that multiple arrows may be added to show the same weld required in several different locations. Additional examples of multiple arrows are shown in Figure 4.58.*

Arrows point to a line or lines on the drawing which clearly identify the proposed joint or weld area. When possible the arrow should point to a solid line (object line, visible line) but the arrow may point to a dashed line (hidden line).

The *tail* of the welding symbol is used to indicate the welding and cutting processes, as well as the welding specifications, procedures, or the supplementary information to be used in making the weld. When the welding



**Figure 4.42—Examples of use of a Tail**



**Figure 4.43—Use of "Typical" Notes**

For fillet and groove symbols, the arrow always connects the welding symbol reference line to one side of the joint. That side is considered the arrow side of the joint, with the opposite side considered the other side of the joint. In addition, the perpendicular leg for fillet, bevel-groove, J-groove, and flare-bevel-groove symbols is always drawn to the left, as shown in Figure 4.45.

With plug, slot, spot, projection and seam weld symbols, the arrow connects the weld symbol reference line to the outer surface of one of the joint members, at the center line of the desired weld. The member toward which the arrow points is considered the arrow side member. The opposite member is considered to be the other side member. This is shown in Figure 4.46.

When only one member of a joint is to be prepared, such as for a bevel-groove, the arrow will have a break and point toward the member that must be prepared. Such joints will always be shown with a broken arrow when no joint details are given. If it is obvious which member is to be prepared, the arrow does not need to be broken. Figure 4.47 illustrates the broken arrow use.

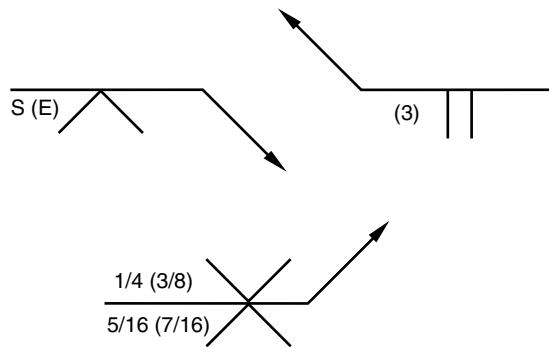
Basic Welding Symbols and Their Location Significance								
Location Significance	Fillet	Plug or Slot	Spot or Projection	Stud	Seam	Back or Backing	Surfacing	Edge
Arrow Side								
Other Side				Not Used			Not Used	
Both Sides		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	
No Arrow Side or Other Side Significance	Not Used	Not Used		Not Used		Not Used	Not Used	Not Used
Location Significance	Groove							Scarf for Brazed Joint
	Square	V	Bevel	U	J	Flare-V	Flare-Bevel	
Arrow Side								
Other Side								
Both Sides								
No Arrow Side or Other Side Significance		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used

**Figure 4.44—Reference Line Location for Basic Weld Symbols**

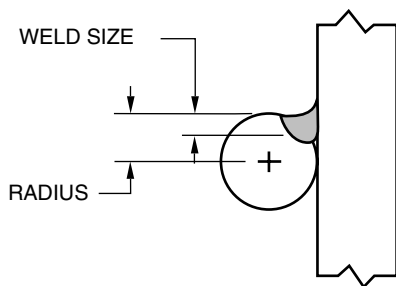
GROOVE			
SQUARE	SCARF	V	BEVEL
U	J	FLARE-V	FLARE BEVEL

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

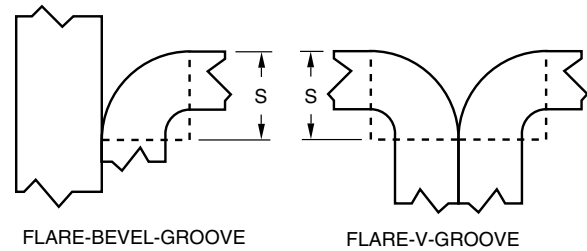
**Figure 4.82—Groove Weld Symbols**



**Figure 4.83—Depth of Bevel—Groove Weld Size**



**Figure 4.84—Flare Groove Size versus Radius**



**Figure 4.85—Flare Groove Depth of Bevel**

**Weld Size and Depth of Bevel Considerations**

Groove weld size may be smaller than the dimension given for depth of bevel (partial joint penetration); at other times it will equal the depth of bevel (complete joint penetration). Where double grooves are specified, the groove weld size can be larger than the depth of bevel on either side of the joint, and the welds will overlap beyond depth of bevel (complete joint penetration) (see Figures 4.86, 4.95, and 4.96).

The inspector may encounter a groove welding symbol with no depth of bevel or weld size specified. When these dimensions are left out of the welding symbol, complete joint penetration is required. This rule holds true for all single-groove welds, and those double-groove welds having symmetrical joint geometries, with double-groove prepared members having the same edge shape on both sides of each member [see Figures 4.87(D) and (E), 4.96(A), (B), and (D), and 4.97]. Asymmetrical groove welds that extend completely through the joint (complete joint penetration), require the use of groove weld size dimensions [see Figure 4.90(A) and (B)].

In some instances depth of bevel will not be specified by the welding symbol; only a groove weld size will appear. This groove weld dimensioning technique applies to groove welds that extend only partly through the joint (partial penetration) [see Figure 4.89(A), (C), and (F)].

At times, the type of groove welded joint, may not be specified on the drawing. Joint preparation becomes optional, and in some cases, determined by layout or fitting personnel. In these situations, the weld symbol is omitted. When no weld symbol is provided and the reference line and arrow point to the joint or weld area and the letters “CJP” are shown in the tail, this indicates complete joint penetration is required and joint geometry is optional (see Figure 4.92).

A second instance used to indicate optional joint geometry gives groove weld size only and also omits the weld

**backstep sequence**—A longitudinal sequence in which weld passes are made in the direction opposite to the progression of welding [see Figure 4.35(A)].

**bevel**—An angular edge shape.

**bevel angle**—The angle between the bevel of a joint member and a plane perpendicular to the surface of the member (see Figure 4.14). This dimension equals one-half of the groove or included angle when the edges of both members are prepared at the same angle. When only one member is prepared at an angle, this dimension is still indicated in the same position on the welding symbol for groove angle, but equals the total degree of preparation for the groove.

**bevel groove weld**—A type of groove weld in which the mating members of the joint have one single-bevel or double-bevel edge and one square edge preparation [see Figure 4.15(D1, D2)].

**block sequence**—A combined longitudinal and cross-sectional sequence for a continuous multiple-pass weld in which separated increments are completely or partially welded before intervening increments are welded [see Figure 4.35(B)].

**boxing**—The continuation of a fillet weld around a corner of a member as an extension of the principle weld (see Figure 4.34).

**buildup**—A surfacing variation in which surfacing material is deposited to achieve the required dimensions.

**butt joint**—A joint between two members aligned approximately in the same plane [see Figures 4.2(A), 4.3(A), 4.4, 4.5, upper left corner sketch, and 4.7].

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

**butting member**—A joint member that is prevented, by the other member, from movement in one direction perpendicular to its thickness dimension. For example, both members of a butt joint, or one member of a T-joint or corner joint (see Figure 4.5).

**cascade sequence**—A combined longitudinal and cross-sectional sequence in which weld passes are made in overlapping layers [see Figure 4.35(C)].

**chain intermittent fillet weld**—An intermittent weld on both sides of a joint in which the weld increments (lengths) on one side are approximately opposite those on the other side [see Figures 4.16(F) and 4.33].

**cladding**—A surfacing variation that deposits or applies surfacing material usually to improve corrosion or heat resistance.

**complete joint penetration**—A joint root condition in a groove weld in which weld metal extends completely through the joint thickness (see Figure 4.26).

**complete joint penetration weld**—A groove weld in which weld metal extends completely through the joint thickness (see Figure 4.26).

**concave fillet weld**—A fillet weld having a concave face (see Figure 4.27).

**concavity**—The maximum distance from the face of a concave fillet weld perpendicular to a line joining the weld toes (see Figure 4.27).

**convex fillet weld**—A fillet weld having a convex face (see Figure 4.27).

**convexity**—The maximum distance from the face of a convex fillet weld perpendicular to a line joining the weld toes (see Figure 4.27).

**corner joint**—A joint between two members located approximately at right angles to each other in the form of an L [see Figures 4.2(B), 4.3(B), and 4.8].

**depth of bevel**—the perpendicular distance from the base metal surface to the root edge or the beginning of the root face (see Figure 4.14).

**depth of fusion**—The distance that fusion extends into the base metal or previous bead from the surface melted during welding (see Figure 4.23).

**edge joint**—A joint between the edges of two or more parallel or nearly parallel members [see Figures 4.2(E), 4.3(E), and 4.11].

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

**edge shape**—The shape of the edge of the joint member (see Figures 4.3–4.11).

**edge weld**—A weld in an edge joint, a flanged butt joint or a flanged corner joint in which the full thickness of the members are fused [see Figure 4.20(A) and (B)].

**effective throat**—The minimum distance, minus any convexity, between the weld root and the face of a fillet weld (see Figure 4.27).

**face reinforcement**—Weld reinforcement on the side of the joint from which welding was done [see Figure 4.21(A)].