Welding

Welding Symbols

A weldment is fabricated by welding together a collection of metal shapes, cut to particular configurations. During welding, the several parts are held securely together, often by clamping or jigging. The welds must be precisely specified on working drawings, and this is done by using the welding symbol, shown in Fig. 6.1, as standardized. The arrow of this symbol points to the joint to be welded. The body of the symbol contains as many of the following elements as are deemed necessary:

- Reference line
- Arrow
- Basic weld symbols as in Fig. 6.2
- Dimensions and other data
- Supplementary symbols
- Finish symbols
- Tail
- Specification or process

The arrow side of a joint is the line, side, area, or near member to which the arrow points. The side opposite the arrow side is the other side.

Figures 6.3 to 6.6 illustrate the types of welds used most frequently by designers. For general machine elements most welds are fillet welds, though butt welds are used a great deal in designing pressure vessels. Of course, the parts to be joined must be arranged so that there is sufficient clearance for the welding operation. If unusual joints are required because of insufficient clearance or because of the section shape, the design may be a poor one and the designer should begin again and endeavor to synthesize another solution.

Since heat is used in the welding operation, there are metallurgical changes in the parent metal in the vicinity of the weld. Also, residual stresses may be introduced because of clamping or holding or, sometimes, because of the order of welding. Usually these residual stresses are not severe enough to cause concern; in some cases a light heat treatment after welding has been found helpful in relieving them. When the parts to be welded are thick, a preheating will also be of benefit. If the reliability of the component is to be quite high, a testing program should be established to learn what changes or additions to the operations are necessary to ensure the best quality.

Figure 6.1

The AWS standard welding symbol showing the location of the symbol elements.

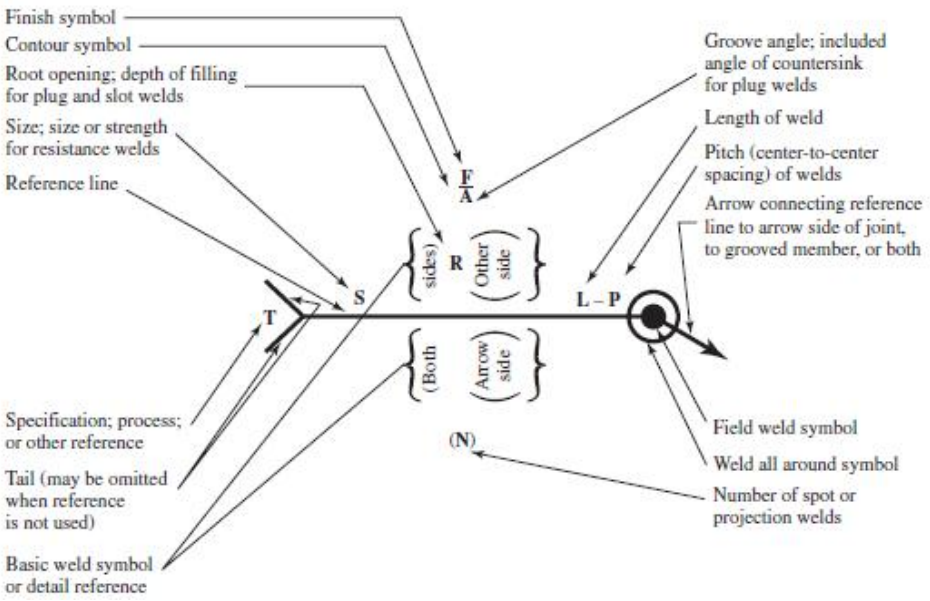


Figure 6.2

Arc- and gas-weld symbols.

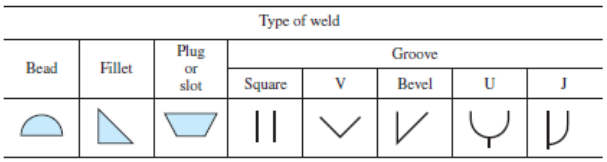


Figure 6.3

Fillet welds. (*a*) The number indicates the leg size; the arrow should point only to one weld when both sides are the same. (*b*) The symbol indicates that the welds are intermittent and staggered 60 mm along on 200-mm centers.

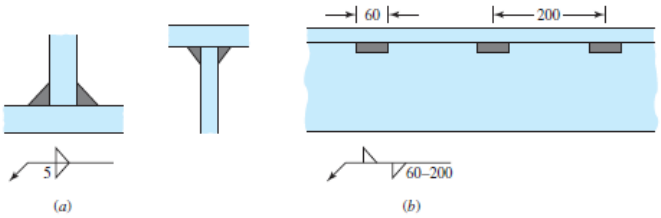


Figure 6.4

The circle on the weld symbol indicates that the welding is to go all around.

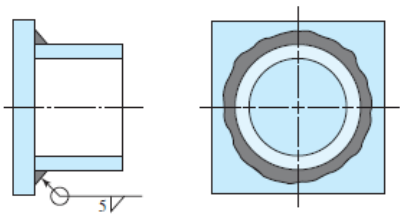


Figure 6.5

Butt or groove welds: (*a*) square butt-welded on both sides; (*b*) single V with 60° bevel and root opening of 2 mm; (*c*) double V; (*d*) single bevel.

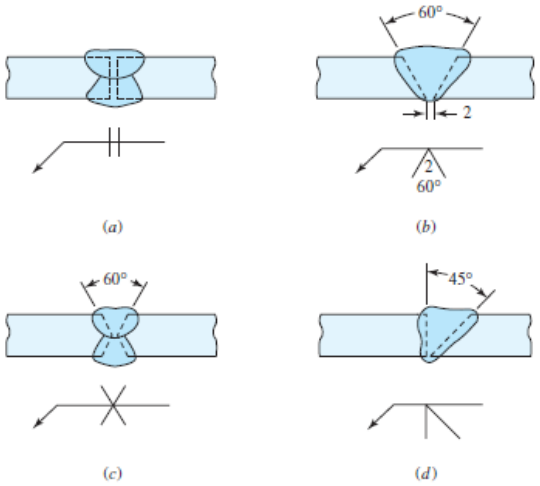
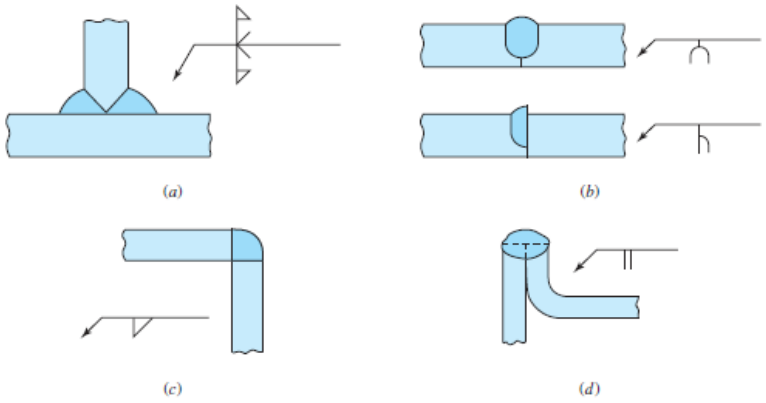


Figure 6.6

Special groove welds: (*a*) T joint for thick plates; (*b*) U and J welds for thick plates; (*c*) corner weld (may also have a bead weld on inside for greater strength but should not be used for heavy loads); (*d*) edge weld for sheet metal and light loads.

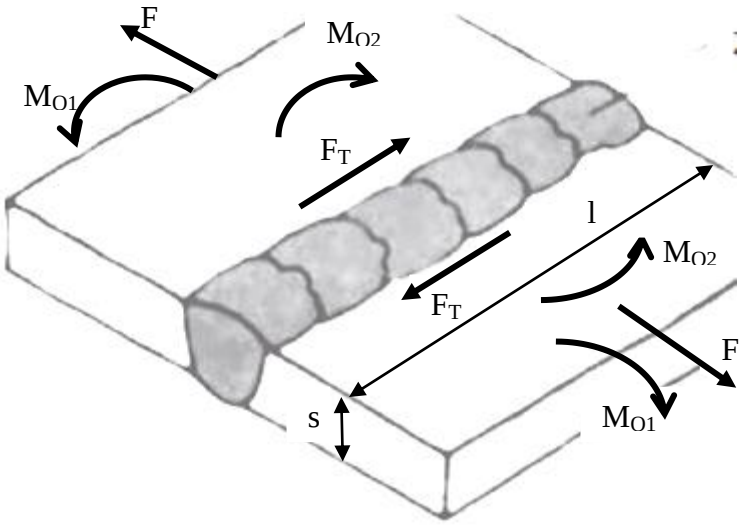


Groove Welds

Area of groove welds

l – calculation length of groove welds
l_w –length of groove welds (length dimension of weld on drawing)

$\alpha_\perp$ – correction's coefficient
R_e- yield stress of weld´s material
n – safety coefficient of welds



The particular stress in welds

Fillet Welds

Area of fillet welds

l - calculation length of fillet welds
l_w –length of fillet welds (length dimension of weld on drawing)

The every outside loads produced in fillet welds only shear stress.

For perpendicular stress

For individual stress

β – size´s coefficient of welds, $\beta = 1{,}3 - 0{,}042.a$ - for a ≤ 7mm, $\beta = 1$ - for a >7mm

The general equation for stress in fillet welds