

Reinforcing Bars

1. WELDING OF REINFORCING BARS

The American Welding Society has issued Bulletin D 12.1-61 giving the Recommended Practices for the Welding of Reinforcing Steel, and these should be followed. Table 1 of allowable stresses is adapted from the AWS bulletin.

Reinforcing steel may be spliced by butt welding two ends directly together, using either a single Vee or double Vee groove joint with an included groove angle of 45° to 60° , or a single bevel or double bevel groove joint with an included groove angle of 45° . These joints should have a root opening of $\frac{1}{8}$ " and a root face or land of $\frac{1}{8}$ ".

This butt welded joint may be made with the aid of an additional splice member, for example a plate or angle connected with longitudinal flare-bevel welds, see Figure 1, or a sleeve connected by transverse fillet welds around the sleeve and bar, see Figure 2. The

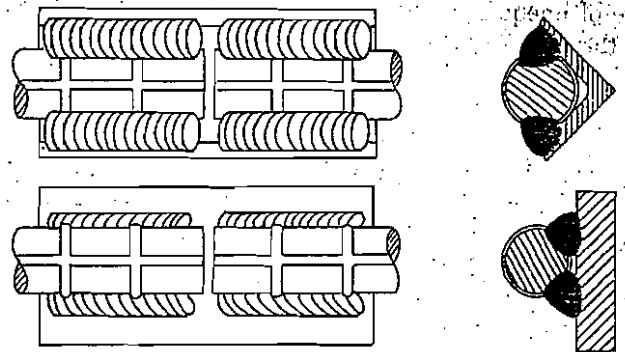


FIGURE 1

splice member should have a cross-sectional area equal to the strength of the connected bar.

Reinforcing steel may also be spliced by a lap joint, either lapped directly together or with an insert plate between the two bars. When the two bars have

TABLE 1—Allowable Stresses for Joints in Reinforcing Rods

Bevel & Vee groove welds in tension, compression, or shear	Flare-Vee groove & flare-bevel groove welds for any direction of force	Fillet welds for any direction of force
<p>Single-vee groove</p> <p>Double-vee groove</p> <p>Same as allowable for base metal</p>	<p>Throat</p> <p>Nominal size</p> <p>Flare-vee groove</p> <p>Nominal size</p> <p>Throat</p> <p>Flare-bevel groove</p> <p>Shear on throat of weld $\tau = 6800 \text{ psi}$</p>	<p>Leg of fillet</p> <p>Shear on throat of weld (minimum throat) $\tau = 13,600 \text{ psi}$ or force on weld $f = 9600 w \text{ lbs/lineal in.}$</p>

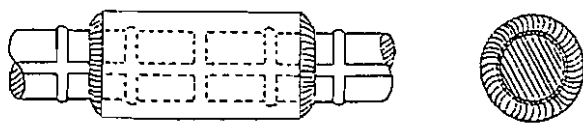


FIGURE 2

the same diameter, the nominal size of a flare-Vee groove weld is the radius of the bar. When the bars are of unequal diameter, the nominal size of the weld is the radius of the smaller bar. The nominal size of the flare-bevel groove weld is the radius of the bar.

In all of these cases, the nominal size is the throat on which the allowable shear stress of 6800 psi is applied. The actual required throat of the finished weld in a flare-Vee groove and flare-bevel groove weld should be at least $\frac{3}{4}$ the nominal size of the weld, which is the radius of the bar. The maximum gap between the bar and the splice plate should not exceed $\frac{1}{4}$ the diameter of the bar nor $\frac{3}{16}$ ".

In general, it is easier to butt weld larger reinforcing bars together than to use a splice joint with longitudinal connecting welds. On smaller bars, it might be easier to use the longitudinally welded lap joint, although the doubling up of the bars within the connection region might take too much of the cross-section of the concrete member.

Figure 3 illustrates a good method to butt weld a reinforcing bar lying in the horizontal position. A thin backing strap, about $\frac{1}{8}$ " thick, is tack welded to the bottom of the joint as shown in (a). After a portion of the groove weld is made, this backing strap is red hot and can easily be wrapped partially around the bar with the weldor's slag hammer as welding progresses, see (b) and (c). This provides just enough dam action to support the weld and yet does not interfere with the welding. Finally, the ends of this strap are tapped tight against the bar and the weld is completed, see (d).

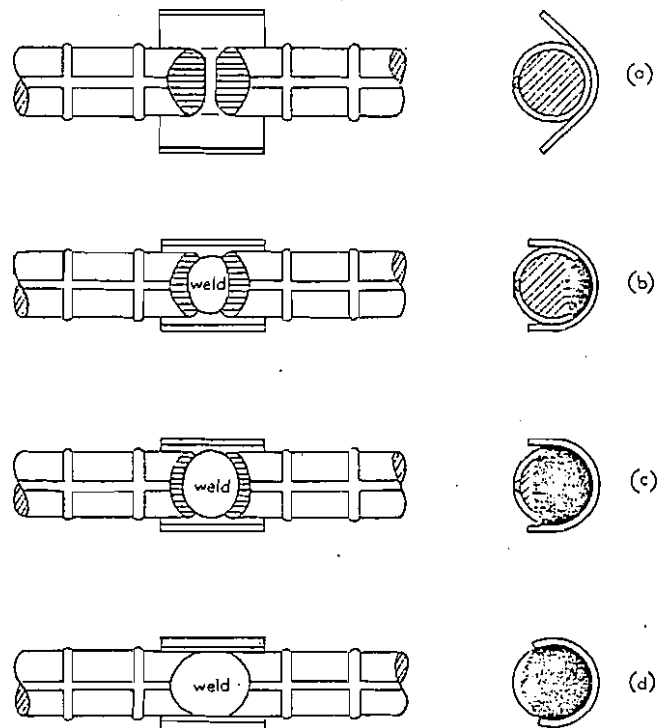


FIGURE 3

2. ROD MATERIAL AND WELDING PROCEDURE

Reinforcing bars are rolled from new steel produced in the open-hearth furnace, acid bessemer converter, electric furnace, or the basic oxygen process; or, they are re-rolled from discarded railroad rails or car axles.

It is necessary to obtain a Mill Report on the reinforcing bars to be welded; otherwise, they must be analyzed before setting up the welding procedure. See Table 2.

For manual welding, E60XX and E70XX electrodes should be used, and preferably be of the low-hydrogen type. Coverings of the low-hydrogen electrodes must be thoroughly dry when used.

TABLE 2—Recommended Welding Procedures for Reinforcing Rods of Various Analyses

C to .30 Mn to .60	C .31 to .35 Mn to .90	C .36 to .40 Mn to 1.30	C .41 to .50 Mn to 1.30	C .51 to .80 Mn to 1.30
Any E60xx or E70xx electrodes	Non low-hydrogen E60 or E70xx electrodes—	Low hydrogen E60xx to E70xx electrodes—	Low-hydrogen E60xx or E70xx electrodes—	Thermit or pressure gas welding
Preheat not required. If below 10°F, preheat to 100°F	Preheat to 100°F	Preheat to 200°F	Preheat to 400°F	Other procedures subject to procedure qualification or approval of the Engineer
	Low-hydrogen E60xx or E70xx electrodes Preheat not required. If below 10°F, preheat to 100°F		Could also use submerged-arc, thermit, or pressure gas welding	