previous weld deposits before welding over them. Some of the common types of groove welds performed on butt joints in the flat position are shown in *Figure 5-36.*

Fillet Weld

Fillet welds are used to make tee and lap joints. The electrode should be held at an angle of 45° to the plate surface. The electrode should be tilted at an angle of about 15° in the direction of welding. Thin plates should be welded with little or no weaving motion of the electrode and the weld is made in one pass. Fillet welding of thicker plates may require two or more passes using a semicircular weaving motion of the electrode. *[Figure 5-37]*

Lap Joint Weld

The procedure for making fillet weld in a lap joint is similar to that used in the tee joint. The electrode is held at about a 30° angle to the vertical and tilted to an angle of about 15° in the direction of welding when joining plates of the same thickness. *[Figure 5-38]*

Vertical Position Welding

Vertical positing welding includes any weld applied to a surface inclined more than 45° from the horizontal. Welding in the vertical position is more difficult than welding in the flat position because of the force of gravity. The molten metal has the tendency to run down. To control the flow of molten metal, the voltage and current adjustments of the welding machine must be correct.

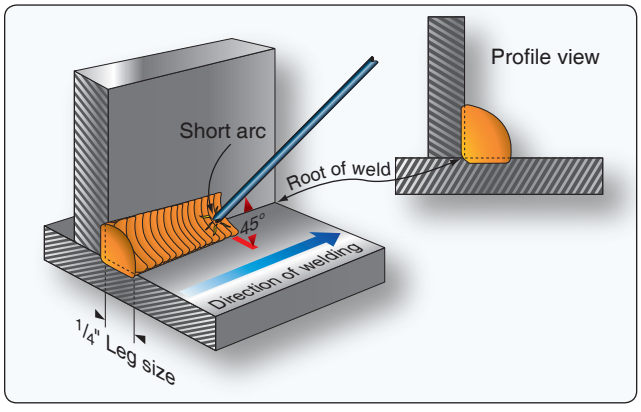

Figure 5-37. *Tee joint fillet weld.*

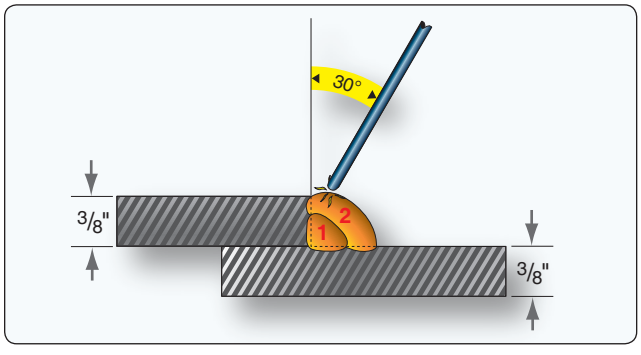

Figure 5-38. *Typical lap joint fillet weld.*

The current setting, or amperage, is less for welding in the vertical position than for welding in the flat position for similar size electrodes. Additionally, the current used for welding upward should be set slightly higher than the current used for welding downward on the same work piece. When welding up, hold the electrode 90° to the vertical, and weld moving the bead upward. Focus on welding the sides of the joint and the middle takes care of itself. In welding downward, with the hand below the arc and the electrode tilted about 15° upward, the weld should move downward.

Overhead Position Welding

Overhead position welding is one of the most difficult in welding since a very short arc must be constantly maintained to control the molten metal. The force of gravity tends to cause the molten metal to drop down or sag from the plate, so it is important that protective clothing and head gear be worn at all times when performing overhead welding.

For bead welds in an overhead position, the electrode should be held at an angle of 90° to the base metal. In some cases where it is desirable to observe the arc and the crater of the weld, the electrode may be held at an angle of 15° in the direction of welding.

When making fillet welds on overhead tee or lap joints, a short arc should be held, and there should be no weaving of the electrode. The arc motion should be controlled to secure good penetration to the root of the weld and good fusion to the plates. If the molten metal becomes too fluid and tends to sag, the electrode should be whipped away quickly from the center ahead of the weld to lengthen the arc and allow the metal to solidify. The electrode should then be returned immediately to the crater of the weld and the welding continued.

Anyone learning or engaged in arc welding should always have a good view of the weld puddle. Otherwise there is no way to ensure that the welding is in the joint and keeping the arc on the leading edge of the puddle. For the best view, the welder should keep their head off to the side and out of the fumes so they can see the puddle.

Expansion and Contraction of Metals

The expansion and contraction of metal is a factor taken into consideration during the design and manufacturing of all aircraft. It is equally important to recognize and allow for the dimensional changes and metal stress that may occur during any welding process.