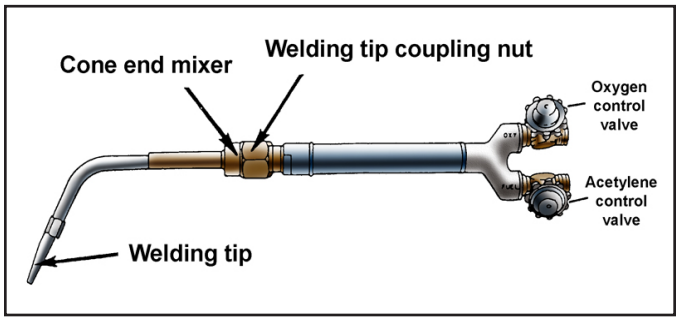
Lesson 2: Welding With Oxyacetylene

Oxyacetylene welding is another method commonly used in agricultural mechanics to melt and fuse two metals together. To be skilled at this process, welders must be familiar with the equipment and welding rods used. In addition, they should understand the methods used to improve weld quality and ways to avoid common problems that can occur. Because oxyacetylene welding can be hazardous, strict observation of the safety rules is critical. Your instructor must be present to demonstrate the step-by-step procedures for welding metal with oxyacetylene and guide you through them.

Differences Between the Welding Outfit and Cutting Outfit

In Agricultural Mechanics Unit for Agricultural Science I, you were introduced to the major parts and functions of the oxyacetylene cutting outfit. The components of an oxyacetylene welding outfit are the same as those in a cutting outfit except for differences in the torch and oxygen regulator. Unlike a cutting torch, a welding torch does not have an additional oxygen line to produce a cutting jet of oxygen. See Figure 2.1. The oxygen regulator used with the cutting outfit may be designed to work under higher pressure because of the volume of oxygen that can be used when cutting thicker pieces of metal. If different types of oxygen regulators are used in the shop for different applications, check with the instructor to be sure the regulator is designed for the work that is being done. With the acetylene regulator, the same one that is used for cutting can also be used for welding because the working pressure of acetylene should always be kept below 15 psi to avoid risk of fire and explosion.

Figure 2.1 – Parts of an Oxyacetylene Welding Torch



Use of a Welding Rod

Oxyacetylene welding can be done with or without the use of a welding (filler) rod. When the process is done without a welding rod, the base metal is used as filler and one piece is welded directly to another. An example of a joint that can be welded with this method is an edge joint made of thin metal. Many other types of joints will require the use of a welding rod to add metal and strengthen the weld.

Characteristics of Welding Rods

Like the electrodes used in arc welding, oxyacetylene welding rods are metal rods made of materials similar to various base metals. The rods can also contain other materials that strengthen the weld or provide other positive characteristics. They come in different diameters, from 1/16 in. to 3/8 in., and are generally 36 in. long. Welding rods are also identified by the American Welding Association (AWS) classification system. For example, in the classification number RG-45, the "R" indicates it is a welding rod, the "G" indicates it is used for gas welding, and "45" indicates it has a tensile strength of approximately 45,000 psi.

Only welding rods that have a classification number and are specifically designed for the procedure and conditions should be used. Substituting other types of metal or wire for welding rod is not acceptable because (1) the composition of the wire can vary greatly, (2) it can produce porous, substandard welds, and (3) it can include finishes or coatings that produce toxic fumes.

Factors in Weld Quality

Factors that can affect the quality of the weld include torch tip size, torch position, torch movement, and welding rod size. Knowing the correct adjustments and techniques for the job is important to making strong welds.

Torch Tip Size

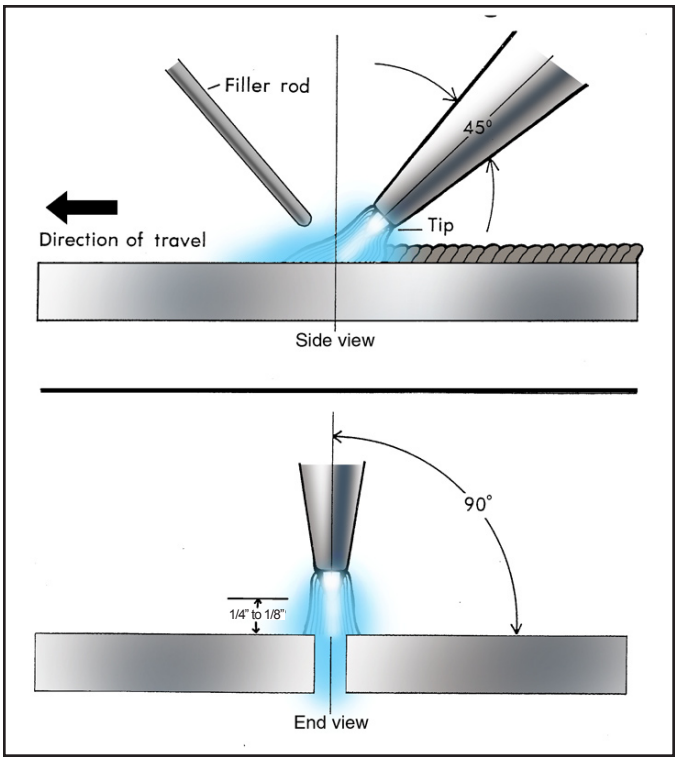
The size of a torch tip affects the width of the weld bead, the penetration of the weld, and the speed of movement. Follow the instructor's or manufacturer's

recommendations on the proper torch tip size to use for the work. Torch tips are also designed to work within a specific operating range that must be appropriate for the thickness of the metal. Some beginning welders may make the mistake of trying to adjust the torch flame to compensate for the wrong tip size. Welding with the wrong kind of flame can adversely affect weld quality. Avoid this pitfall by using the correct size tip.

Torch Position

Torch positioning has a great effect on the speed of melting and the size of the weld pool. Two key aspects of torch position are its angle and its distance from the work. The appropriate torch angle depends on the tip size, thickness of the metal, and welding conditions. The closer the torch is held at a right angle to the work, the more heat is transferred to the base metal. A 45-degree angle is often used. The usual distance for holding the inner cone of the flame from the work is 1/8 to 1/4 in. As the torch is moved closer to the work, the heating rate increases. It is also important to maintain the torch angle and distance consistently throughout the weld. See Figure 2.2.

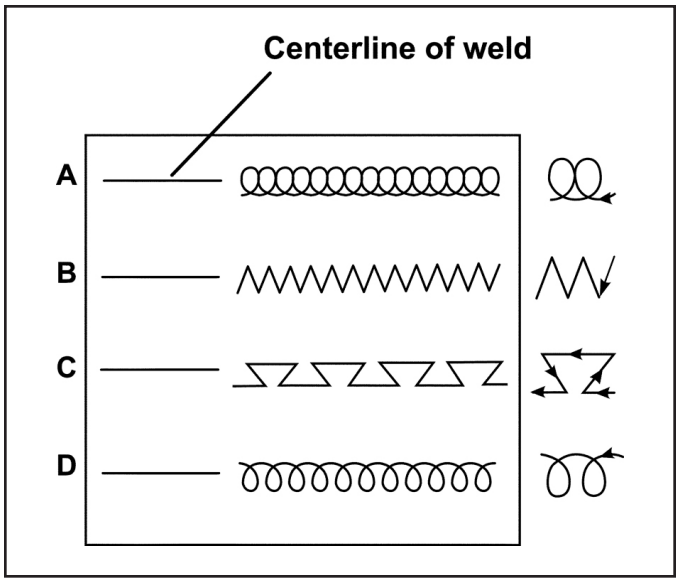
Figure 2.2 – Angle and Distance for Holding the Oxyacetylene Torch



Torch Movement

Another factor that affects weld quality is torch movement, which should be adjusted to suit the type and thickness of metal being welded. The basic torch movement in oxyacetylene welding is to move the torch forward along the centerline of the weld and also move in a pattern, such as circular or back and forth. See Figure 2.3. The cone of the flame should be kept in the weld pool during this motion and should be advanced about 1/16 in. each time.

Figure 2.3 – Torch Movement Patterns



In addition, two general methods for directing the flame can be used. These methods are called forehand welding and backhand welding. In forehand welding, the flame is pointed in the direction of travel and preheats the metal ahead of the weld pool. In backhand welding, the flame is pointed in the opposite direction of travel and postheats the metal behind the pool. The backhand technique helps relieve welding stress. Backhand welding is generally used for welding cast iron and thicker metal.

Welding Rod Size

Using a welding rod of the correct diameter is essential to produce a good-quality bead. A welding rod that is too small will not add enough filler material. A welding rod that is too large can remove too much heat from the weld pool too quickly, causing the pool to freeze and

trap the rod. As a general principle, as the welding rod decreases in diameter, it absorbs less heat, the weld pool becomes wider with deeper penetration, and buildup of filler is reduced. On thicker metal, for example, it may be necessary to use a smaller diameter rod to enhance penetration.

Common Welding Problems

Common welding problems include backfire, flashback, and improper flame adjustment. A welder should be able to recognize these problems as well as know the ways to avoid them.

Backfire

A backfire happens when the flame goes out and there is a loud pop or snapping sound. Possible causes of backfire include the following:

- The tip may be overheated due to overuse, getting too close to the work, or working in a hot corner.
- The torch may be operating at pressures that are too low for the tip being used.
- The tip may have touched the work.
- The tip may be loose or damaged.
- The tip may be dirty.

After a backfire, the torch should be shut down immediately and all possible causes checked and eliminated before relighting the torch. A backfire may cause a flashback, which is a dangerous problem.

Flashback

A flashback occurs when the flame burns back inside the tip, torch, hose, or regulator. When flashback occurs, a squealing or hissing sound is usually heard. It is a hazardous situation that can cause equipment damage and personal injury. Possible causes of flashback are the failure to purge the system (clear the lines) before use and overheating the torch tip.

If a flashback occurs, immediately turn off the oxygen torch valve and then the acetylene torch valve. If the fire might extend to the hoses, quickly shut off the acetylene cylinder valve, followed by the oxygen cylinder valve. Flashback indicates a serious problem with the equipment or its operation. An experienced operator or technician should inspect the equipment to determine whether it is safe to use or which parts must be repaired or replaced. The torch must be allowed to cool before investigating the problem.

Improper Flame Adjustment

Another common problem that can adversely affect weld quality is improper adjustment of the oxyacetylene flame for the application or type of metal.

- The carburizing (carbonizing) flame is low temperature and may add carbon to the cut or weld. With this flame, too much acetylene is present and three distinct parts of the flame are visible. In the case of steel, it will cause the weld pool to boil, appear cloudy, and produce brittle welds. It may, however, be used for some brazing or welding procedures.
- An oxidizing flame is high temperature and may add oxygen to the cut or weld. Too much oxygen is present in this flame, the flame is noisy, and the inner cone is shortened. It is not recommended for most operations because it will form oxides with many metals, which will produce brittle, low-strength welds. An oxidizing flame used on steel causes foaming and sparking of the weld pool, producing welds with low strength and ductility (pliancy).
- A neutral flame is an approximately even balance of acetylene and oxygen. It does not add carbon to the weld or burn it with oxygen. A neutral flame is the best choice for most welding and cutting tasks.

Summary

The oxyacetylene cutting outfit and the welding outfit are similar except for the design of the torch and oxygen cylinder regulator. Oxyacetylene welding can be performed with or without a welding rod, depending on the type of joint or thickness of the metal. Welding rods are classified by AWS and are similar in design to electrodes used in arc welding. Factors such as torch tip size, torch position, torch movement, and welding rod size have a big effect on weld quality. Common problems that occur in oxyacetylene welding are backfire, flashback, and improper flame adjustment for the application.

Credits

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