Articles & Stories

SOLID WIRE VERSUS FLUX CORED WIRE-WHEN TO USE THEM AND WHY

Comparing the Advantages of GMAW and FCAW

Gas metal arc welding (GMAW) and flux cored arc welding (FCAW) possess different characteristics that welding operators must evaluate when selecting them for welding applications. To achieve the best results, consider the following factors: thickness of the material, proper shielding gas, wire feed speed and voltage settings, location of the work site and weld appearance. There is no "one-size-fits-all" welding solution and all of the above variables will affect the operator's decision to use solid or flux cored wire. This article will help the novice or occasional welding operators such as farmers, ranchers, motorsports enthusiasts and home hobbyists, understand the basics of solid and flux cored wire and how to maximize the advantages of each.

Solid Wire/MIG Basics

MIG power sources use a continuous solid wire electrode for filler metal and require a shielding gas delivered from a pressurized gas bottle. Mild steel solid wires are usually plated with copper to prevent oxidation, aid in electrical conductivity and help increase the life of the welding contact tip. The shielding gas protects the molten weld pool from contaminants present in the surrounding atmosphere. The most common shielding gas combination is 75 percent Argon and 25 percent CO2. While using solid wire outdoors, the operator should use caution and prevent any wind from blowing the shielding gas coverage away from the welding arc. Windshields may need to be used.

Flux Cored Wire Basics

There are two types of flux cored wires: gas shielded and self shielded. Gas shielded flux cored wires require external shielding gas and the slag is easy to remove. The operator may want to consider using gas shielded flux cored wires when welding on thicker metals or in out-of-position applications. Gas shielded flux cored wires have a flux coating that solidifies more quickly than the molten weld material. As a result, it creates a "shelf" to hold the molten pool when welding overhead or vertically up. Self shielding flux cored wire does not require external shielding gas; the weld pool is protected by gas generated when flux from the wire is burned. As a result, self shielding flux cored wire is more portable because it does not require an external gas tank.

WHAT TO CONSIDER WHEN CHOOSING SOLID OR FLUX CORED WIRE

Appearance

Many welding operators believe that weld appearance is an important factor. When you are working on materials less than 3/16 inches down to thin sheet metal (24 ga.), solid wire will produce a clean looking weld. For example, a short circuit transfer with .030-inch solid wire set at 18-19 volts with 160-170 amps and using 75 percent Argon and 25 percent CO2 shielding gas will usually produce little spatter, create a smaller heat affected area and reduce chances of burn-through. As a result, many automotive enthusiasts who specialize in bodywork or those who work with thinner applications prefer solid wire in their operations.

Location

The welder must also consider the location of the work site when choosing between solid and flux cored wire. There are certain environments such as windy locations, where solid wire or gas shielded flux cored wire cannot be used; exposing the shielding gas to wind can compromise the weld integrity. Typically the loss of shielding gas will produce porosity visible in the weld bead.

On the other hand, self shielded flux cored wire is ideal for welding outdoors or in windy conditions. The operator does not have to set up windshields to protect the shielding gases from being blown away because the shielding gas is generated from the burning flux. Since self shielded flux cored wire does not require external shielding gas, it is also more portable than solid wire. This portability is ideal in agricultural applications where field equipment can break down far from the shop. If you are welding thicker metals (16 ga. and above), self shielded flux cored wire also provides excellent penetration.

Thickness, Type of Application and Parameter Settings

Many novice operators attempt to use "a-one-size-fits-all" wire and shielding gas combination for multiple applications. The most common wire and gas combinations (for solid wire) are .035-inch diameter wire used with a 75 percent Argon and 25 percent CO2 shielding gas. When welding thicker material, however, consideration needs to be given to welding power source output, as well as welding wire diameter. If the .035-inch wire is selected for thicker materials, and the power source is one that is plugged into a 115-volt circuit, the resulting amperage output may not be sufficient to make quality welds. The chance of "cold lap" or "lack of fusion" may increase.

Attempting to use too small of a solid wire for thicker applications (such as on A-frames of an automobile), increases the chance of lower

penetration in the root, and could require more than one welding pass. Misapplication of the solid wire (even though strong enough) may also not provide adequate penetration on thicker material.

Although more expensive than solid wire, flux cored wire could help you gain productivity. Flux cored wire typically has the ability to handle the welding of dirtier materials that may have higher levels of rust, mill scale, or oil. Although cleaning is always the proper method of preparing the steel, flux cored wires contain de-oxidizing elements that trap these contaminants in the weld pool and hold them in the slag coverage typically preventing the associated weld problems found when welding "dirtier" steels. Flux cored wire also increases penetration on the side walls and offers the advantage of better deposition rates (the amount of weld metal deposited in a given time period, measured in pounds per hour) when compared to solid wire. Although the operator is initially spending more on materials for flux cored wire, the savings are realized in the decreased production time.

Which is better, solid wire or flux cored wire?
Neither wire is superior over the other. They simply have different properties, which work better on certain applications. As far as performance is concerned, both types of wire produce sound welds with good weld bead appearances when applied correctly and used within the proper parameter settings. Solid wire provides deep penetration in the root and usually has little spatter. Flux cored wire has a larger ball type transfer and produces low spatter levels. In addition, flux cored wire produces a rounder penetration profile with excellent sidewall fusion.

As far as user appeal, both solid wire and flux cored wire are relatively easy to use and are ideal for novice and occasional welders working in automotive, farming and home hobby applications. Operator appeal on solid wire may be better on thinner applications because there is no slag to remove; it is ready to paint; and the weld beads may be more aesthetically pleasing.

Conclusion
The most important thing to remember is not to fall into the "one-size-fits-all" mindset. Solid wire, self shielded flux cored wire and gas shielded flux cored wire all work well provided they are applied correctly. The type of wire you choose will be contingent upon the location of the work site, thickness of the application, proper shielding gas combination and the type of equipment available. The operator should always clean the work piece prior to welding to ensure optimum weld quality and prevent impurities from becoming trapped in the weld bead. In order to achieve the best possible results, the operator must be willing to make adjustments based on the worksite variables and consider having both solid and flux cored wire available.