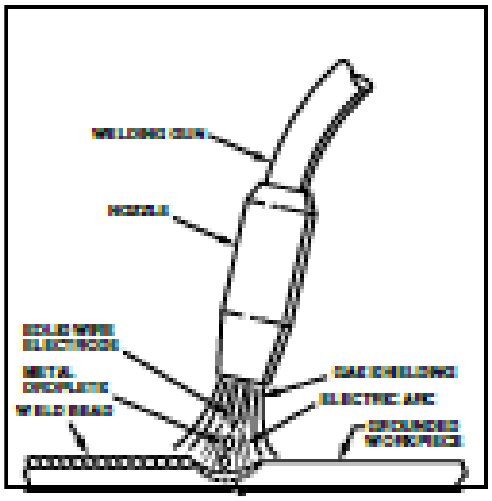
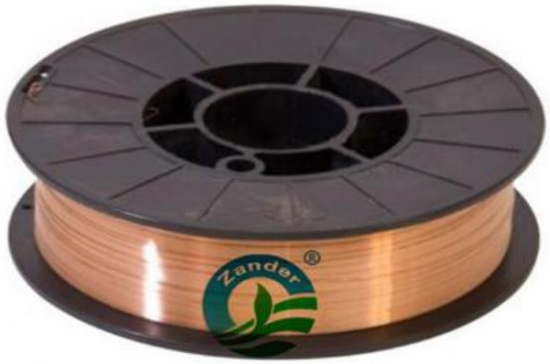
GMAW – Gas Metal Arc Welding





GMAW is semiautomatic process in which a continuous wire electrode is automatically fed through a welding gun. By simply positioning the gun near the work piece and pressing the trigger, you can initiate an arc and maintain the automatic feeding of the wire electrode while you weld until you release the trigger.

There are many types of wire electrodes available on the market. Two are very popular. Solid wire and Flux cored wire.

If Sloid wire is used as electrode wire the process is called MIG/ MAG (Metal Inert gas/ Metal active gas) welding depending on shielding gas is used.

If Flux core wire is used as electrode wire the process is called FCAW (Flux core arc welding).The solid wire and the gas may be 100% Co2 or mixture of 80% Argon and 20 % Co2 is used to protect the weld puddle from the contamination of atmosphere. However other combination of mixed gases are available in the market.

Flux core wires are different from solid wires in that they have a centre core filled with Flux. This flux melts and creates a protective shielding gas to protect molten weld puddle from contamination. This type of core wire does not require additional shielding gas. Any impurities in the weld are brought to the weld surface in the form of a thin covering called Slag that can be removed with a chipping hammer or chisel and cleaned off with a wire brush.

Equipment and Tools: Following equipment and tools are required for wire welding.

1. Power source welding machine complete with welding gun , automatic wire feeding unit with control cables , ground cable with earth clamp.
2. Shielding gas system that includes gas cylinder, regulator, flow meter, gas hose, and gas preheater for Co2 gas.
3. Wire cutter, chipping hammer and wire brush.
4. Proper protective clothing including helmet and gloves.

Techniques

To produce a good quality weld it is important to master the following wire welding techniques. However before stating welding, make sure the work piece is as clean as possible. Use clean cloth, wire brush, or sand paper to remove rust ,

dirt, paint, grease, oil, or any other contaminant. Do not use cleaning solvents because you run the risk of explosion or fire or illness from toxic vapors.

Wire polarity.

Check the wire manufacturer's instruction for wire polarity and set power source accordingly. If the power source is not set the proper polarity, proper quality of weld will not be obtained.

Normally solid wire requires DCEP (Dc current electrode positive) or else the weld may have lack of penetration, poor bead appearance due to excessive spatter.

Some FCAW wire requires DCEN (DC current electrode negative), otherwise the weld may be porous and produce slag that is difficult to remove.

Wire Feed speed and voltage

Select the proper wire feed speed /Amp and voltage based on the specification of wire electrode. Sometimes it may need fine tune to get desired weld bead. The best way to check wire feed speed and voltage setting is to perform some test weld on scrap metal and check the weld.

Do not use wire feed speed too high as it will cause too much metal to be deposited wasting filler metal or resulting possible burn through.

Do not use wire speed too Low because it will produce a weld that does not penetrate or fill the joint properly and may cause wire to burn back or melt at the tip.

Do not use voltage too high because it will produce flatter and wider bead which is porous and excessive spatter. In addition High Voltage can cause under cutting, a groove melted into the work piece that does not get properly filled with weld metal.

Do not use voltage too low or the weld bead will be narrow and lack of proper penetration and fusion.

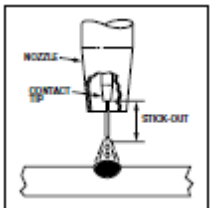
Initiating an Arc

To initiate an arc, simply position the gun close to the weld point and press the trigger.

Once the arc is initiated pay attention on the following key factors to achieve good quality of weld.

1. Electrode stick out
2. Electrode angle
3. Travel speed

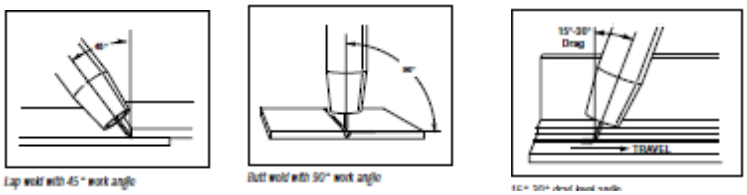
Electrode Stick Out



Electrode stick out is the length of un melted wire coming out of the contact tip of the welding gun. It affects the amount of current drawn by the wire and is important because it can affect the weld. Stick out depends on the wire diameter. For guide line 1.2 mm wire stick out 15 mm, for 0.8 mm wire stick out 12mm.

You can make slight adjustment of stick out to fine tune current. If stick out increases current will decrease and stick out decrease current will increase.

Electrode angle

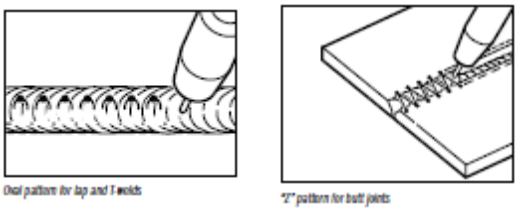


In wire welding be sure the position of the wire over the weld joint for maximum coverage. This involves paying special attention to the work angle and the travel angle.

The work angle is the angle at which the wire is pointing at the weld joint for Lap & T joint the work angle is 45 degree and for butt welding it should be 90 degree.

The travel angle is the angle of the wire as it travels along the weld path. For most wire welding application the angle is 15- 30 degree. For most application the travel angle is drag angle when the electrode is pointed in a direction that is opposite the arc travel.

Welding Gun manipulation



Manipulation of welding gun is another key factor of a good quality weld.

For Lap and T joints manipulating the gun creates a series of small ovals provides good welding coverage. Be careful not to move too far back into the weld puddle or else fusion problems may occur.

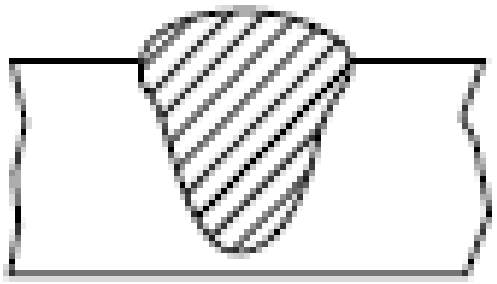
For but joint manipulating the gun in Z pattern while travelling along the work piece. This pattern is most effective because it produces a flatter weld, spreading the molten weld puddle evenly across the joint.

Travel speed

Travel speed is the rate at which you weld. During welding , watch the molten weld puddle and listen to the arc for evidence of travelling too fast or too slow. Moving at high travel speed or too fast causes insufficient penetration, plus you will hear popping sounds as the wire comes in contact with the cold metal just ahead of the puddle. Welding at low travel speed or moving too slow will cause the weld metal to pile up resulting in poor fusion.

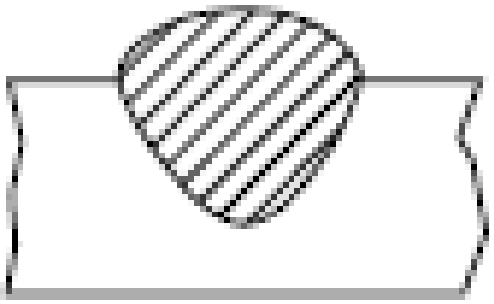
Shielding Gases and Their Welding Advantages

100% CO_2



provides broad penetration and reduces the chance of porosity

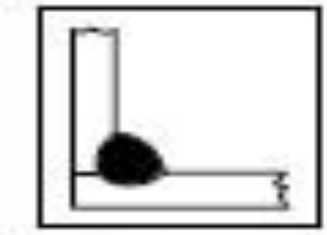
75-80% Ar/20-25% CO_2



allows high welding speeds without burn-through, and with minimal distortion and spatter

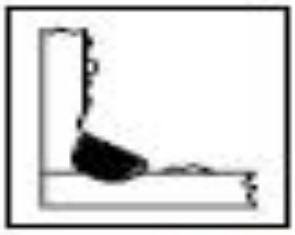
Examples of Good and Bad wire welds

GOOD WELD	BAD WELD	BAD WELD
Proper wire feed , voltage and travel speed	Proper wire feed speed too low	Proper wire feed speed too High



CROSS-SECTION

Weld Face



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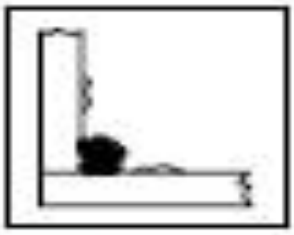

CROSS-SECTION

Weld Face

Smooth and well formed. Uniform Contour Good penetration and fusion	Wide and flat with excessive spatter Very irregular contour Under cut along the edges	Narrow and convex Irregular Contour. Slag may be difficult to remove