

Welding Basics - Fact Sheet

As you begin your journey as a welder, know that making a good weld takes practice. There are a lot of tips and tricks that you will acquire along the way. This lesson will give you the five basic essentials to making a good weld. Think about these before and during a weld, and then reflect on them while inspecting your weld bead. These five basics are historically taught for SMAW and GMAW welding.

Five Basics

1. Welding Machine Settings
2. Distance (arc length/wire stick-out)
3. Angle (work and travel)
4. Speed (travel speed)
5. Manipulation

Welding Machine Settings

How a welding machine is set is imperative to a good weld. Observe welding machine settings charts based on material thickness, electrode type, and electrode diameter.

- GMAW welders use volts and wire feed speed settings
- SMAW welders use amperage settings

Distance

- Distance refers to the arc length while welding
- With GMAW, this can mean the distance from the contact tube to the base metal (electrode stick out), but voltage has an effect on arc length while welding
 - Distance or arc length is directly related to the heat of the arc
- Lengthening the arc results in hotter arc and a wider, more flat bead
- Shortening the arc results in a cooler arc and a narrower, more built up bead

GMAW Distance

- Distance refers to the arc length while welding and is directly related to the heat of the arc:
 - Lengthening the arc results in hotter arc and a wider, more flat bead
 - Shortening the arc results in a cooler arc and a narrower, more built up bead
- The distance from the contact tube of the welding gun to the base metal (electrode “stick out”)
 - voltage has an effect on arc length while welding



SMAW Distance

- Distance refers to the arc length while welding
- With SMAW, this means the distance from the electrode's core wire to the base metal
- Distance or arc length is directly related to the heat of the arc
 - Lengthening the arc results in hotter arc and a wider, more flat bead
 - Shortening the arc results in a cooler arc and a narrower, more built up bead

Angle

- There are two types of angles that deal with welding:
 - **Work angle** is the angle of the electrode in relation to the weld joint
 - **Travel angle** is the angle of the electrode in relation to the direction of travel
- Work angles should be adjusted so there are equal amounts of weld metal on either side of the joint
- Work angles are typically 90 degrees or 45 degrees depending on the joint design and position
- Travel angles typically range 0-30 degrees and can be either a push or drag angle depending on the welding process and position
 - Push angle: top of electrode or torch is tipped away from the direction of travel
 - Pull angle: top of electrode or torch is tipped toward the direction of travel
- Work and travel angles directly affect penetration
- Off-center work angles will result in shallow penetration and the weld metal will penetrate off-center of the joint
 - Too-low travel angles will result in shallow penetration and risk slag inclusions in SMAW

Speed

- Travel speed directly affects penetration and is measured in inches per minute
- Travel speed required is dependent on the electrode type and diameter, joint type and position, and the size of the desired weld; or is specified on a procedure
- **Watch the puddle** to determine travel speed
- Maintain a speed that effectively melts the base metal to the desired depth of penetration and adds weld metal to the desired size
- If the ripple pattern is long and the bead is narrow, the travel speed may be too fast.
- If the bead is wide and paired with undercut or overlap, the travel speed may be too slow.



Manipulation

- There are many ways in which an electrode can be manipulated
- Welding a straight stringer bead, using little or no manipulation, is ideal
- Unnecessary or improper manipulation techniques may result in:
 - Uneven or excessive heat distribution
 - Uneven penetration
 - Slag inclusions (SMAW)
- Weaving is a very common manipulation technique
- Weaving is used to make bigger welds, usually as a cover pass on top of stringer beads
- Weaving is typically used welding in the vertical position
- Weaving in the horizontal or overhead position is not recommended (think gravity!)

