Arc Welding Steel

Contents

General Observations

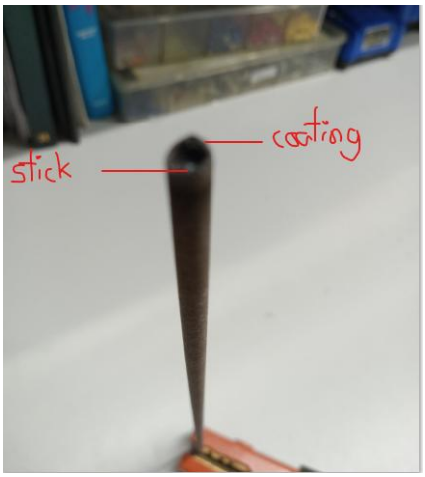
After TIG welding, stick welding is pretty easy. There is a lot less to worry about. The main skill you need to learn is getting the arc started which just takes some practice. Also you'll be using a wire brush much more than TIG, cleaning up after the weld is done.

Getting the Arc Started

Probably the hardest part for me was that I had to hold the stick about a foot above the table which made it hard to do a precise 'bounce' off the metal as my arm was in an awkward position (I later figured out to put the stick in the 45 degree clamp slot instead of the 90 which makes this easier.) As the stick burns down, it becomes easier and easier because you can rest your elbow on the table.

Another adjustment from TIG welding is that the stick burns down as you weld so you need to continuously lower your hand as the weld progresses to prevent the arc from stopping because the stick was too far from the metal.

The other point to note is that the stick coating sometimes does not burn down as quickly as the stick. This results in the stick being slightly recessed inside the coating as shown below. This makes it hard to re-start the arc because the coating holds the rod too high. You need to break the coating off – either by banging the stick on the metal, or breaking it off with your fingers – before you can get the arc started.



Initial Welds

Here is my very first weld on a piece of 1/8” steel. Certainly not an example of great welding but I was happy to have gotten the hang of starting the arc.

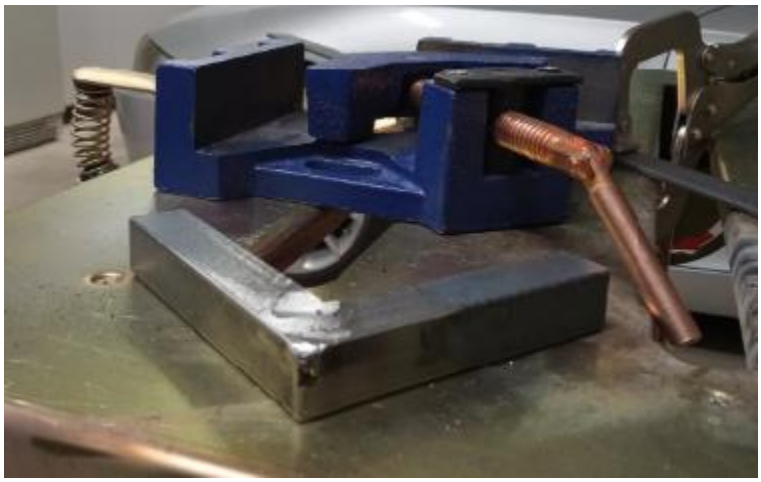
I then did a bunch of other welds (below left) and after turning the bar over I could observe that most of them penetrated pretty well (below right.) I did these all at 100A DC per the Miller weld calculator recommendation which said 110-165, but I can only get 100A using a 110VAC outlet.

Not a bad start, but clearly I need more practice.

Angled Corner Weld

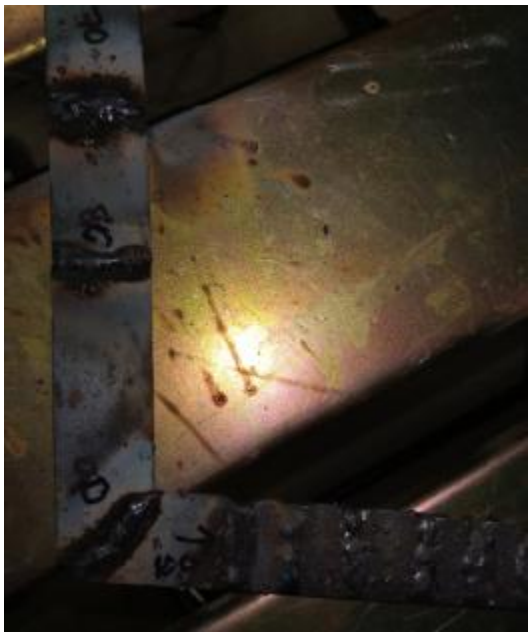
I figured I'd try my luck welding an angled corner and try to use the corner fixture that has so far been useless for brazing and TIG. As you can see below the fixture actually works for stick welding! This was done at 100A DC.

After a lot of grinding and polishing I was able to clean up the messy, but solid welds as shown below.



Dropping the Current

After looking at the back of the Miller calculator card, I noticed that they show example weld pictures of various problems and the solutions. Because my welds were very wide with a lot of splatter, it recommended that I decrease the amperage and keep the stick closer to the metal. I then ran welds at 90, 80, 70, 60, 50, and 40 amps as show below (before cleaning.)




Here are the same welds after cleaning with a wire brush.


The 60-80 welds came out the best. 50 was marginal. 40 was definitely too low as it barely got any penetration. So it seems that my welder works well at about ½ of the Miller settings for some reason.

Outside Corner and Fillet Welds

I then tried 60A on these. The outside corner came out OK, but the fillet is a little weak. Looking back at the calculator (for TIG) it shows that fillet welds take more current than corner welds so I probably need to bump it up to 70A or so.

Note that the fixturing magnets (which were useless for TIG welding aluminum) are now coming in handy.

Recommended Amperage

Going back to a chart I found while learning TIG welding. This (although this is a TIG chart – not a stick chart) 80-110 seems to contradict the Miller weld calculator (110-165A) and is more in line with I have found experimenting with my welder.

Steel Thickness (mm)	Filler Rod (mm)	Tungsten (mm)	 Practice beads  Closed root butt joint	 Fillet joint	 Open root butt joint (gap is half of material thicknesss)  Lap joint  Outside corner joint
			Amps	Amps	Amps
0.8	1.0	1.0 or 1.6 [1]	25	30	20
1.0	1.0	1.0 or 1.6 [1]	30	35	25
1.2	1.0	1.6	35	45	30
1.5	1.0	1.6	45	55	40
2.0	1.0 or 1.6 [2]	1.6	60	75	55
3.0	1.6	1.6	90	110	80

So it looks like a better solution is to bump the 60 up to 70-80 (to get better penetration) and the fillet up to 90-100A.

I can probably use the Miller chart and simply use about 60% of the amperage specified in the chart for my welder.

Initial Project

My first project stick welding was to build a bracket to better organize and secure the metal stock in my work space.

You can see the full details here: Metal Holder Project.

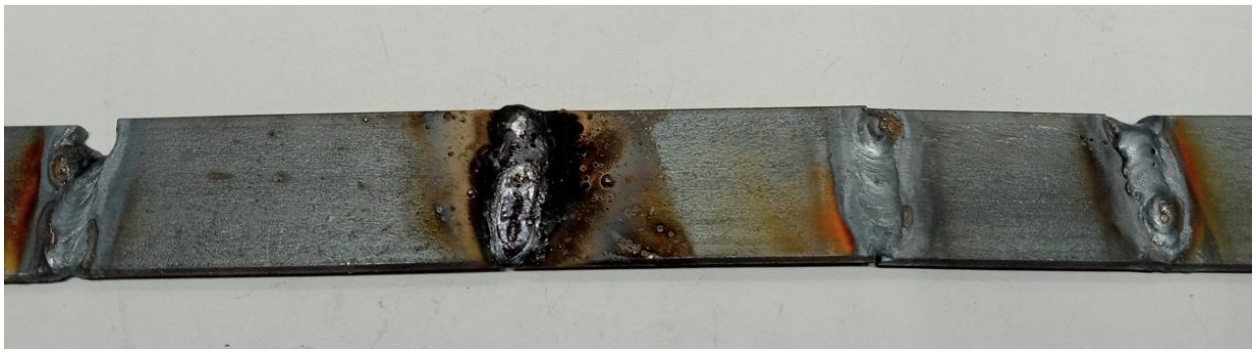
Difference between Stick and TIG

Here is a quick visual difference between welding steel with a stick vs. TIG.

The welds (from left to right) are as follows:

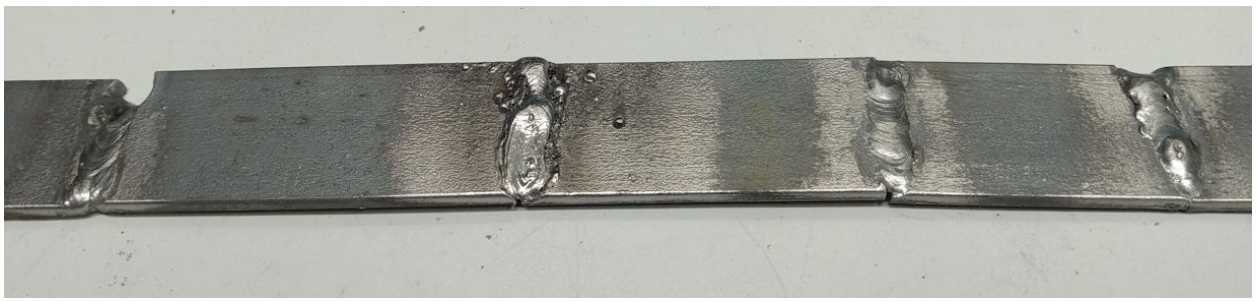
- My first attempt to weld steel with TIG (at 90ADC which was too high causing the metal to melt and drop on the floor.)
- Stick welding (at 60ADC.)
- 2nd attempt to weld steel with TIG (at 60ADC.)
- 3rd attempt to weld steel with TIG (at 60ADC) AND filling an 1/8” gap at the top between the edges.

Welds front – no cleaning (note how much cleaner the TIG is than the stick weld)



Welds back

Welds front – after cleaning with wire wheel



Note that the stick weld took about ten times longer to clean.