Plasma Cutter Guides, Version 1.1

By R. G. Sparber

I proudly own a Bestarc BTC500DP (3rd generation) plasma cutter. It was on sale on Amazon for $160 plus tax. How could I refuse? It is a great machine.

I did have a few additional costs. Thinner leather gloves cost me $21, and a P100 particle respirator from 3M was an additional $30 including extra filters.

After a few minutes of discovery, I started thinking about attachments to make the cutter more versatile.

YouTube had many videos to give me ideas, but I didn't entirely like any of them. As with most inventions, I took bits I liked and added as necessary.

These two tools resulted after a few false starts. I will first present these successes, why they work, and, finally, why my false starts didn't work. Then, you will see the best path forward for improving my effort.

A Circle and Arc Cutting Guide

A magnet[2] anchors the pivot point. This magnet has a countersunk hole, and I use a flat head 6-32 screw so the magnet can sit flush on the stock.

A 1/4-inch diameter steel rod is clamped to the screw.
The clamp is lined with rubber, which provides enough friction to resist the force of the plasma torch movement yet still permits the rod to slide to adjust the radius of the cut.

A locking nut prevents the assembly from coming apart while I turn it.

The magnet requires periodic cleaning since it attracts metallic particles from the cutting process.

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[2] K&J Magnetics: RX033CS-P - Neodymium Ring Magnet

I positioned a pair of ball bearings inside wheels near the plasma cutter holder. These wheels are made from PVC because that was on hand. You can see the left wheel is already starting to melt. I will replace them with aluminum.

These wheels keep the plasma cutter holder parallel to the cut surface and minimize the plasma cutter's tilt.

The plasma cutter holder is 1-inch ID copper pipe, 1-inch long. The top edge has been rolled inward slightly to catch the plasma cutter shield, while the bottom edge is smooth. The wheels should prevent this edge from contacting the surface, but it might happen, and I don't want it to catch. A flat head 6-32 screw secures the pipe to the end of the 1/4-inch rod.

The plasma cutter rests in the plasma cutter holder and is free to turn as the guide rotates around the magnet's center. Think of a connecting arm on a steam engine.

This tool works because I can stick the magnet anywhere on a piece of steel, slide the rod to set the radius, and then hold a comfortable orientation on the plasma cutter while I scribe an arc or circle.

It won't work on aluminum unless I figure out a different pivot.

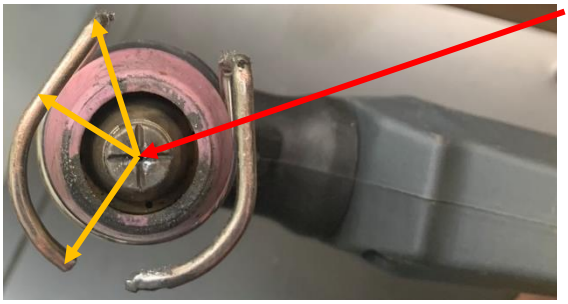
False Start: Arc Guide

The ¼-inch rod, clamp, and wheels worked well. The wing nut and plasma torch coupler did not. This coupler consists of a bar magnet with a hole in the center and a U-shaped piece of steel. A 6-32 flat head screw secures the magnet and U to the rod.

The wing nut made it easy to adjust the clamping force on the rod. Sadly, it tended to rotate and tighten as I pivoted my plasma torch. The rod would stop pivoting at some point, and the magnet would drag around as the torch moved. My fix was to use a locknut and let the screw pivot inside the magnet. I was able to adjust the clamping force so I could slide the rod as needed with no need of further adjustment.

Before you can appreciate why the torch coupler failed, we must look at the steel guide around the torch.

The guide is steel wire and clips on the ceramic nose cone. Note that the bottom of the guide does not form a circle.



This means that the distance from the center of the plasma to any outer contact point varies with the angle of the torch handle.

To scribe a radius, I would have to hold the torch so that I contact the same point on the guide as I go around. It is somewhere between awkward and impossible for me to do.

My coupler attempts to address this orientation problem by magnetically clipping to the flat part of the guide.

In theory, I could monitor that the coupler was in contact with the two vertical wires of the guide and know my radius was constant.

In practice, it was too awkward to constantly change the angle of the plasma cutter handle relative to me, monitor the coupler, and cut the arc.

My solution: remove the wire guide when cutting arcs to avoid dealing with it.

Going to the copper cylinder to capture just the cone, I avoid the handle angle requirement and need to monitor that I stay with the pivot rod.

I can then concentrate on only cutting the arc and get excellent results.

On long cuts, the copper cylinder gets warm but is not in danger of melting. The intense heat[3] of the plasma goes through the stock and out the back. A cut that did not go through would divert plasma back into the torch and could melt the copper cylinder. I have not seen this problem yet. A possible solution would be to cut holes in the walls of the cylinder to let the plasma out.

[3] Up to around 45,000 degrees Fahrenheit!

Straight Line Guide

Why make a tool when you already have it?

This cheap combination square is intended for layout work. Yet, it is the ideal guide for my plasma cutter when making straight cuts at 90° and 45°.

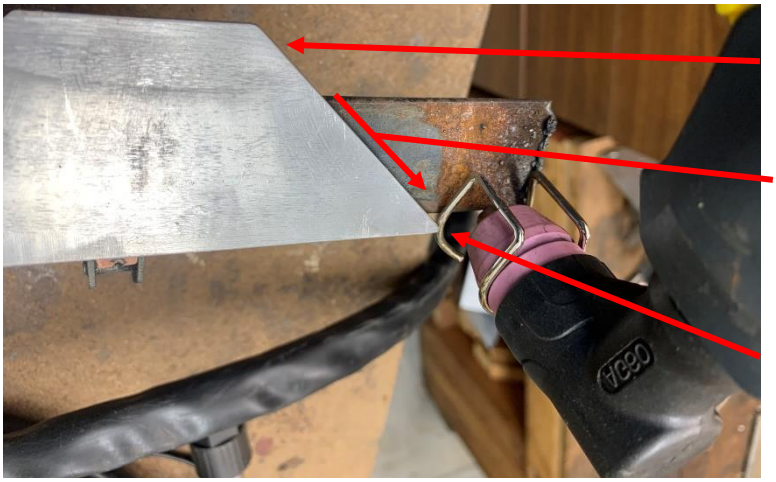
You can't appreciate the value of this tool until you see the shortcomings of the ones I tried and rejected.

False Start: Straight Line Guides

I had two pieces of extruded[4] aluminum 2-inch by 2-inch angle about 1/8th inch thick. I cut one with its ends at 45° and squared up the other.

[4] The inside corner is square so fits snuggly on angle stock.

In this example, I clamped the angled guide to a piece of bed rail. This gives me a square cut on the face perpendicular to you (blue arrow) and an angled cut on the visible face. I'm thinking that the two cuts must align since I'm not moving the guide.

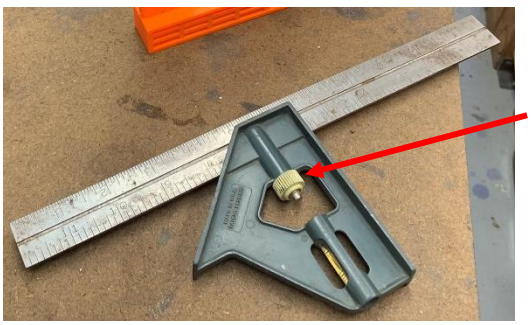


I would start with the torch off the stock with my guide providing alignment.
Then, I feed along the guide with the cutter's handle parallel to the guide's edge. That part worked nicely.

But at the end of the cut, I no longer had support from my guide, so the cut started to veer off course.

A similar problem occurs on the straight cut. I start with support from the guide, but it goes away at the end of the cut.

If I made one edge longer, it would block the other edge. I saw no way to clamp the guide and have both edges extend.



My lowly combination square gives me a generous edge at 90° or 45°. Furthermore, I can loosen the clamp and slide the blade as needed.

Do understand that this is a cheap square, and I can afford to damage it from the plasma's heat. My good square remains in my toolbox.

“ductape” from homemadetools.net built a similar guide for cutting arcs. He used thick fender washers for the wheels and secured them to the rod with spring pins.

“rhsharp” from homemadetools.net has a similar arc-cutting guide. Its wheels are steel with a taper[5]. This shape tolerates debris thrown off by the cutting process better than uniform-thickness wheels.

Jeff Kahn, a professional artist, has an extensive collection of templates made of wood. They are many feet long. Once secured on the stock, he can efficiently run the plasma cutter along the edge and duplicate the shape. See his website.

I welcome your comments and questions.

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Rick Sparber
Rgsparber.ha@gmail.com
Rick.Sparber.org

[5] Similar to the taper seen on the cutting wheels of pipe cutters.