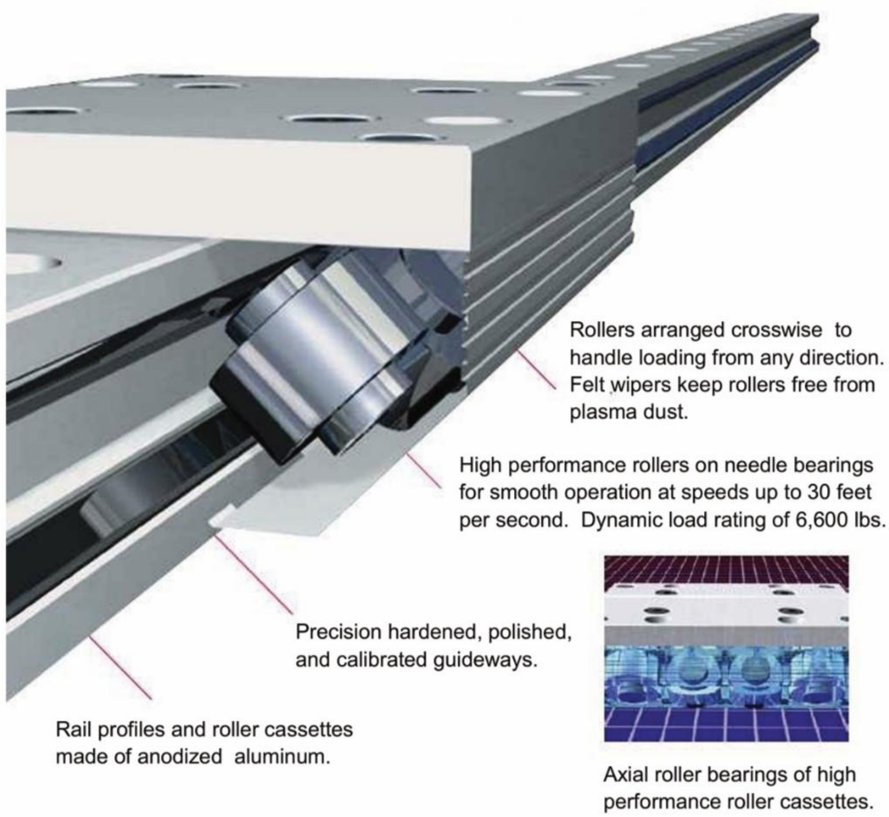
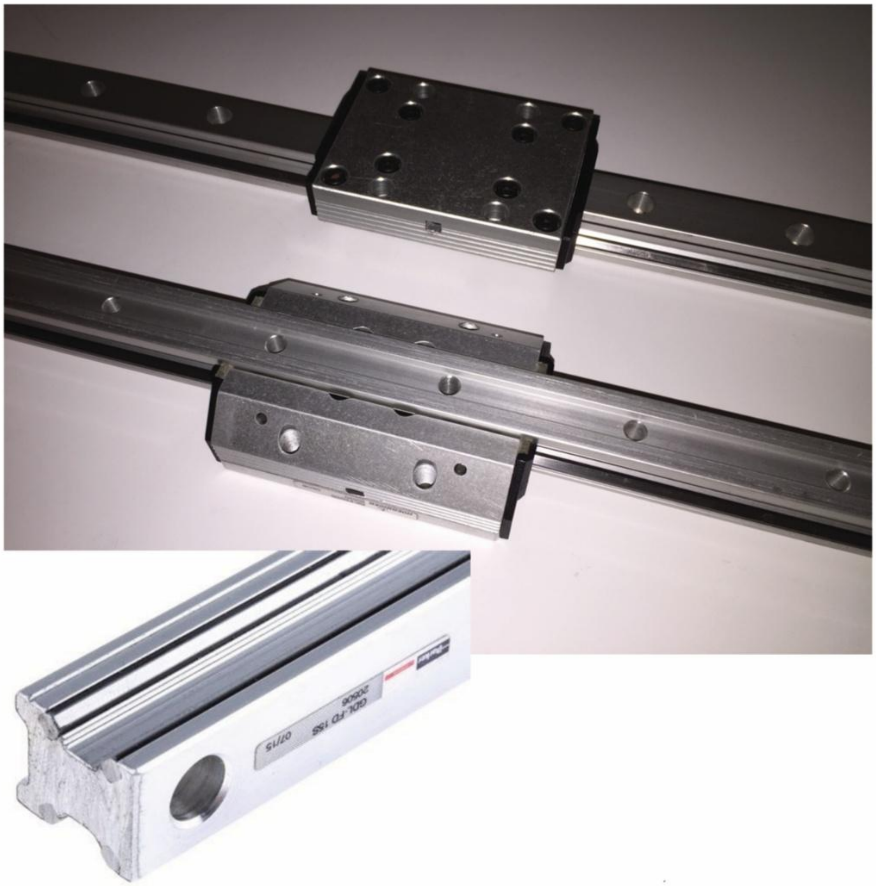
Small Capacity CNC Plasma Table

Build Notes for the Physical Table

Besides the computer, compressor, and plasma cutter, a CNC (computer numerical control) plasma cutting system is comprised of three parts: the physical table with two perpendicular axes, the electronics and motors, and software to create the designs and operate the machine. The physical table is quite simple in construction, requiring only two rolling carriages at right angles to each other, and guidance and drive mechanisms for each. The construction of such a table is well within the capabilities of most fabricators with access to a metal cutting saw, a milling machine, and welding equipment.

The great advantage of a small footprint table such as that covered in these plans is that the highest possible quality guides and rails can be used. Since the cost of high precision guides and rails increases exponentially with the amount of travel required, it would be impossibly expensive to include them on anything larger than a small table. By building a small table yourself, and eliminating the mark-up necessary to produce a sales profit, the cost of premium guide mechanisms can be absorbed. The resulting machine may cost you close to the price of a ready-made table, but it will be superior.



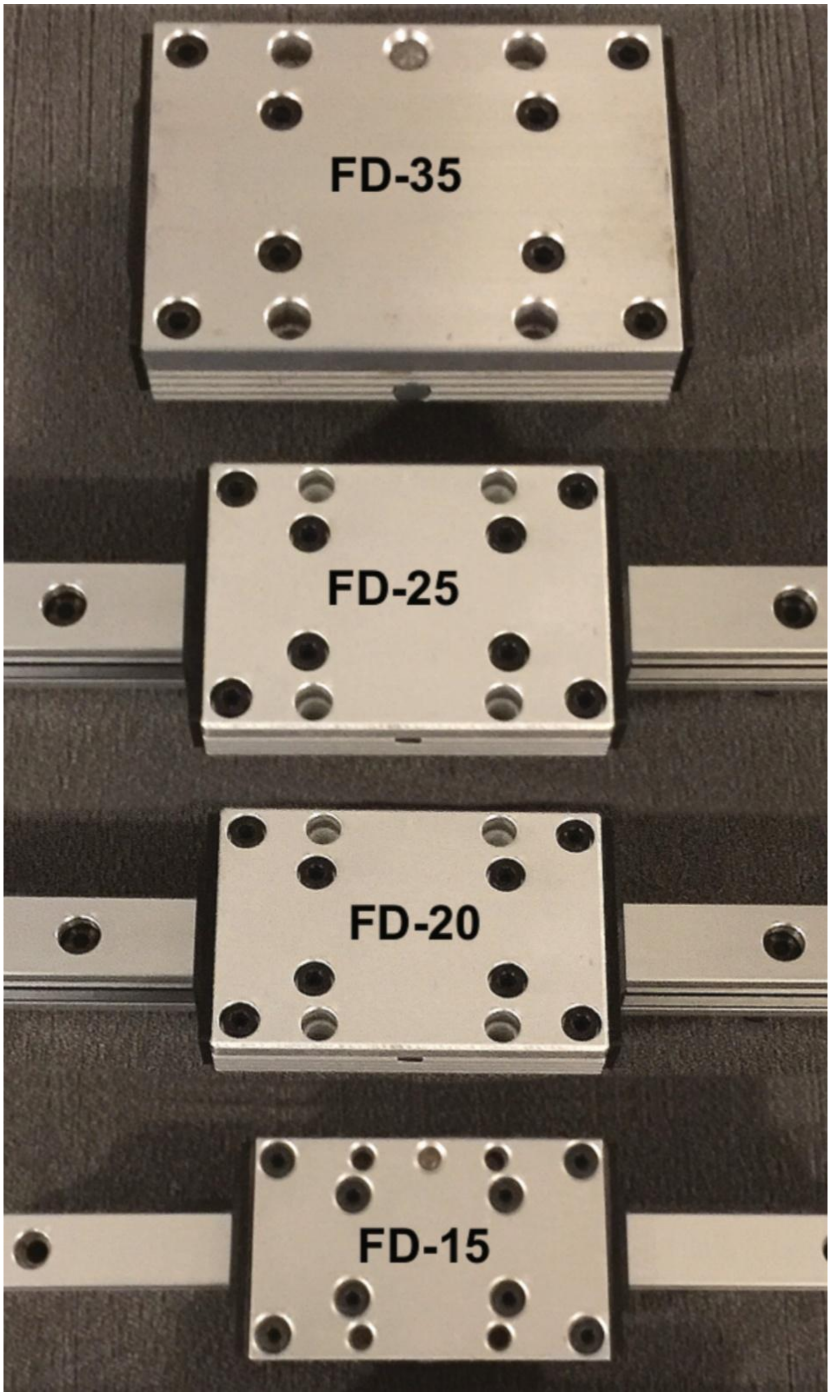


As might be expected, the cost of the above linear rails and roller cassettes is the most expensive part of the physical table. However, by limiting the size of the system and eliminating the manufacturer profit margin, you can complete your build for the same or possibly less cash outlay than a cheap ready-made unit.

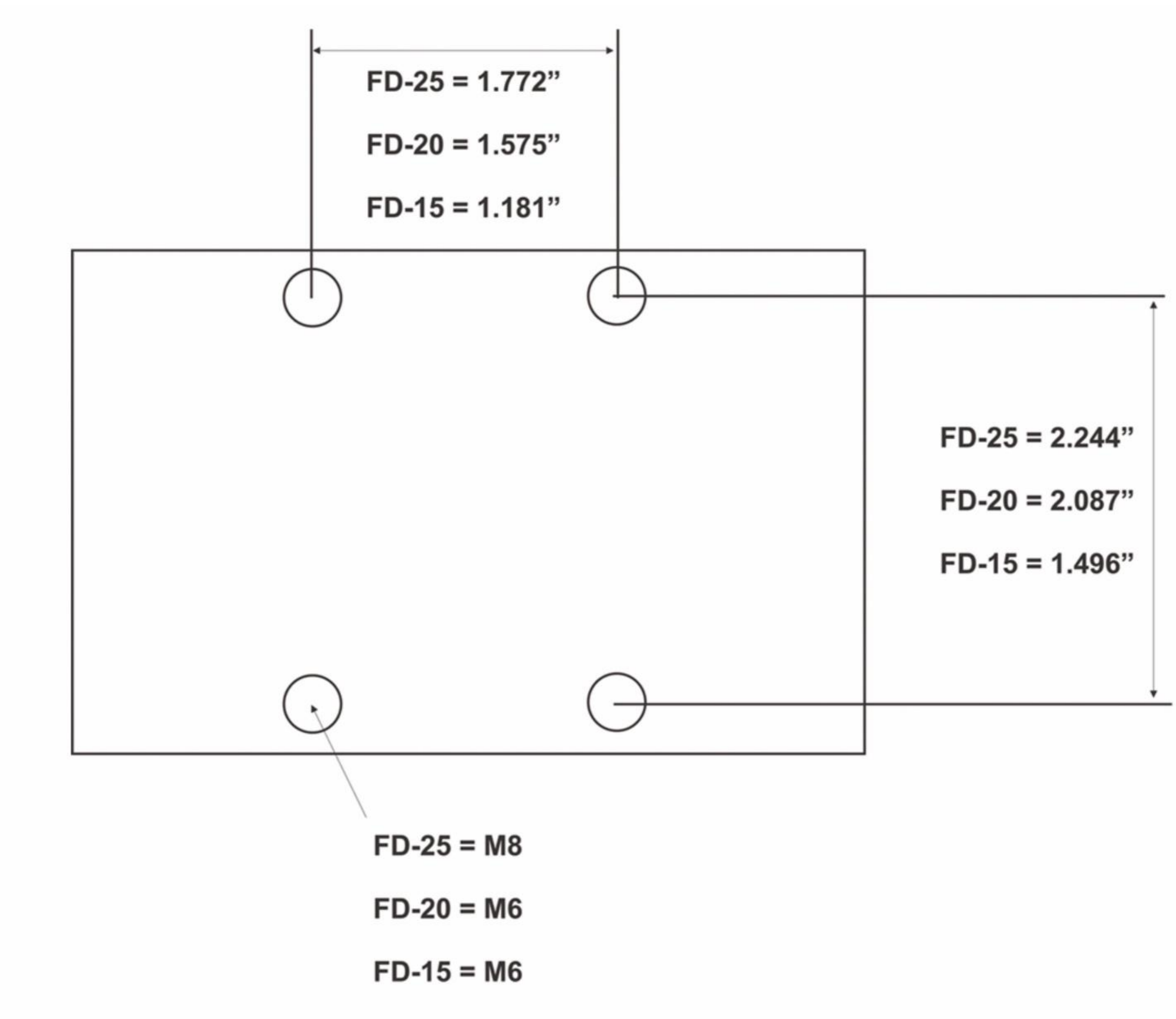
As a bonus, the build is greatly simplified by the fact that the rails and cassettes are entirely self contained, and need only to be bolted in place.

These linear rails and cassettes are getting harder to find. They are made in Austria, I believe, and are more common in Europe than in the USA. RS Components in the UK sells them, and I have ordered from them a couple of times in the past. Their inventory is not as good now as it was before Covid. I have also purchased them used on eBay from time to time.

Origa linear rails and cassettes come in several sizes, four of which are shown below. The number indicates the size of the rail used, i.e., FD-20 uses a 20 mm rail, etc. For our purposes, an FD-25 or FD-20 rail is best, with FD-25 being preferable. FD-15 is too small, and FD-35 is overkill.



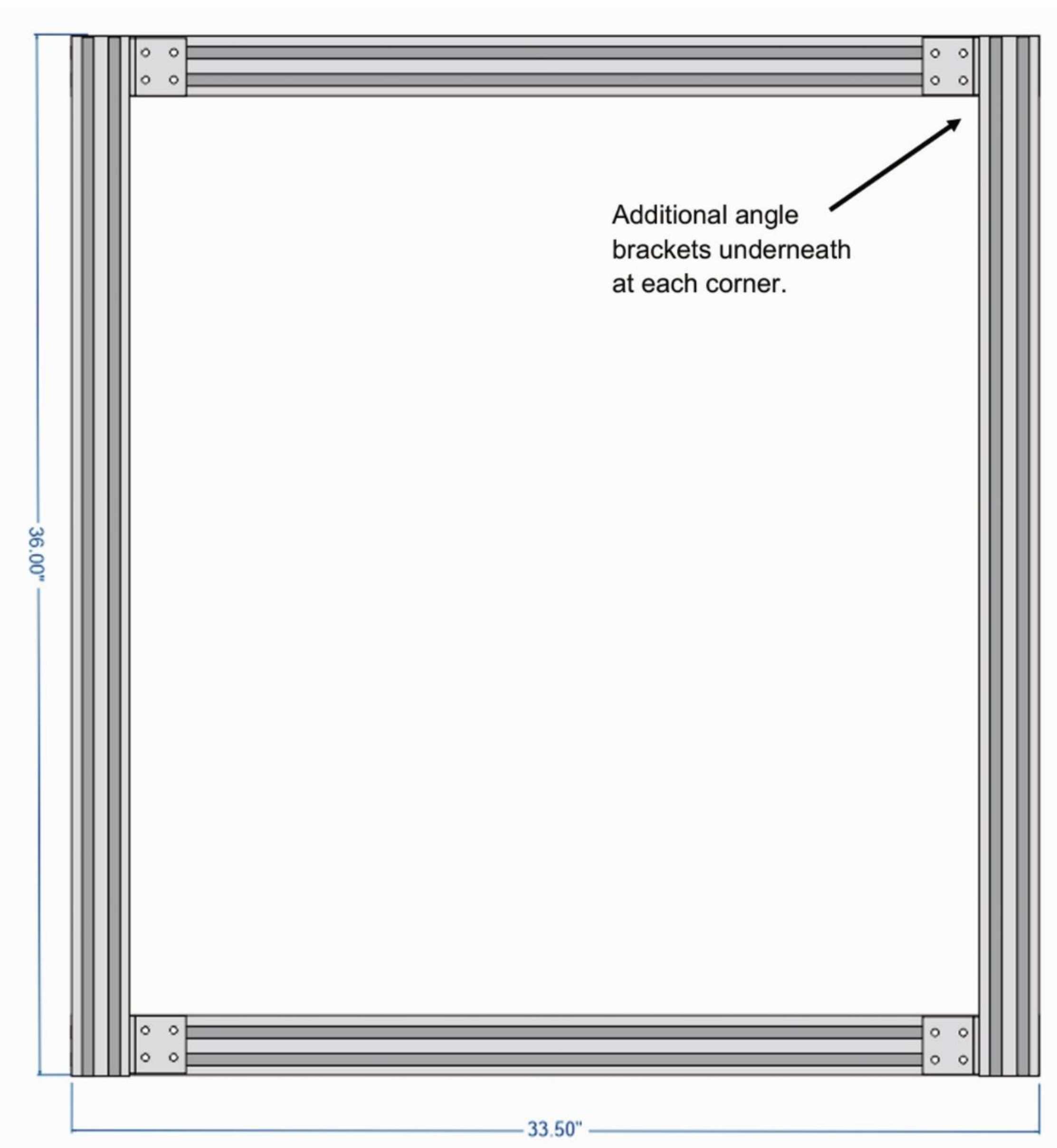
Roller Cassette Mounting Hole Spacing and Sizes



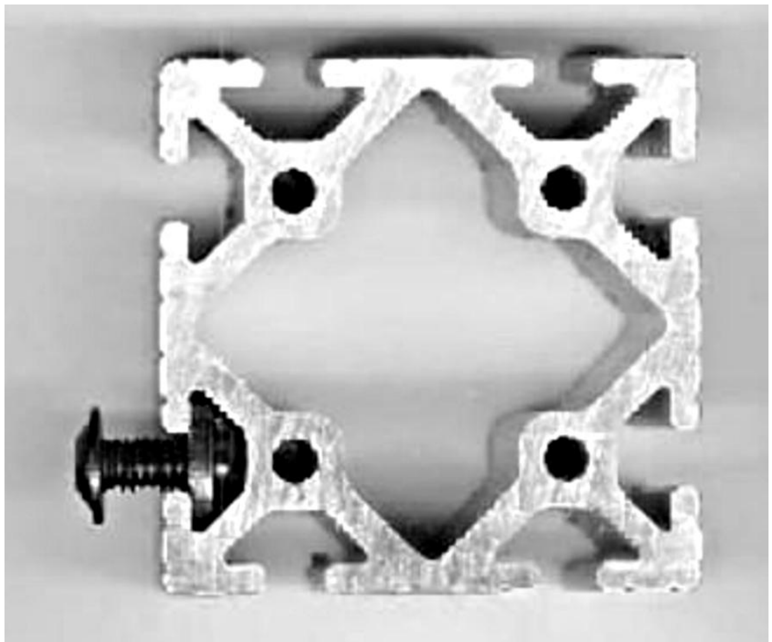
Naturally, the FD-15 rails, which are too small for our CNC machine, are the easiest to find. FD-20 is a bit scarcer, and FD-25 scarcer still. Nevertheless, the stuff is out there, and you don’t need that much of it.

SUPPORT TABLE: In keeping with the strategy of using commonly available “off-the shelf” components wherever possible, we will use a power tool support table sold at https://www.rockler.com under “work stands.” As of this writing it is priced at $149.95. Unlike other support tables we have seen, this unit is quite sturdy, with 1/8” thick steel legs. Not that they are needed, there are numerous holes in place that permit diagonal bracing if desired. Assembly takes about an hour, following the clear instructions provided with the table. The completed table is shown below. Note that a locking caster set is available for the table if you wish to increase its mobility.

You will assemble the 33 ½” x 36” framework shown below from 8020 aluminum extrusions. You can purchase these extrusions off the Internet already cut to length. The 8 hole angle brackets and fasters can be ordered at the same time. Note that there are 4 additional angle brackets underneath each corner, which cannot be seen in the overhead view.



The aluminum extrusions used for the framework can be purchased from the 8020 Company and TNutz, which has most of the same items at a lesser cost. Just Google them to find them on-line. The extrusion size is identified as “2020.” They have a 2” x 2” cross-section as shown below. The photo also shows how button head cap screws are used with t-nuts to secure brackets to the channels in the extrusions.

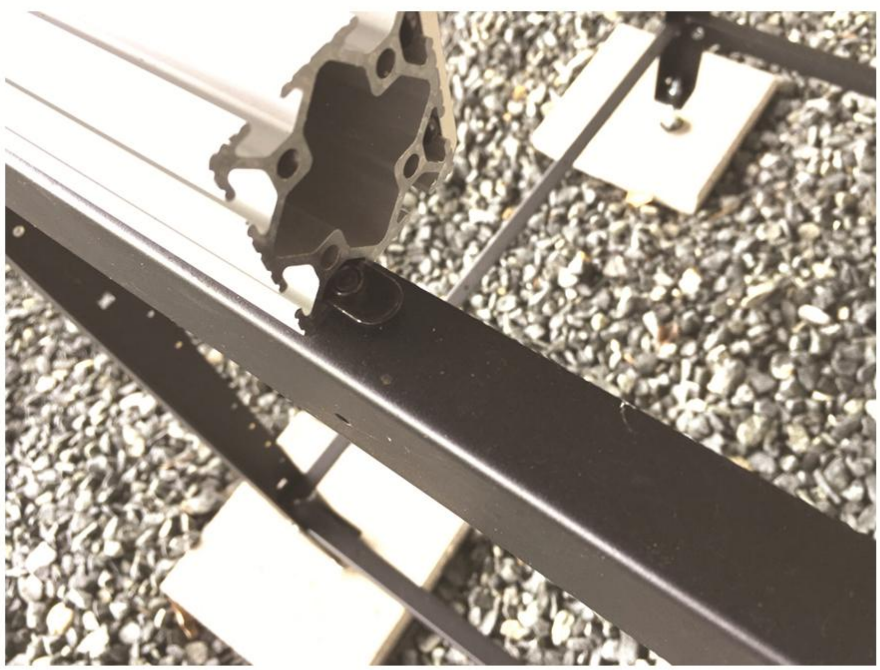


When you have finished assembling the Rockler table, enlarge the three holes in the top of each 24” end to 1/4”.

In each of the newly enlarged 1/4” holes, insert one of the 1/4-20 x 1/2” button head socket cap screws up from the bottom.

Screw one of the 1/4-20 T-nuts partially onto each button head cap screw, leaving about 1/4” gap underneath.

Slide one of the 30 1/2” extrusions onto each of the T-nuts on the end of the table.



When you have finished attaching the extrusions to both ends of the support table, it will look like this.

Using the 1/4-20 x 1/2" button head cap screws and T-nuts, attach an 8 hole angle bracket to the inside end of each extrusion as shown. Below. The edge of each bracket should be about 1/8" in from the end of the extrusion.

Your table will now look like this.

Insert 1/4-20 x 1/2" button head cap screws and T-nuts in each of the remaining 8 hole angle brackets as shown below.

At each corner of the table, attach the 8 hole angle brackets as shown below.

Note that by pre-assembling all the brackets, the 36” extrusions can simply be slid into place.

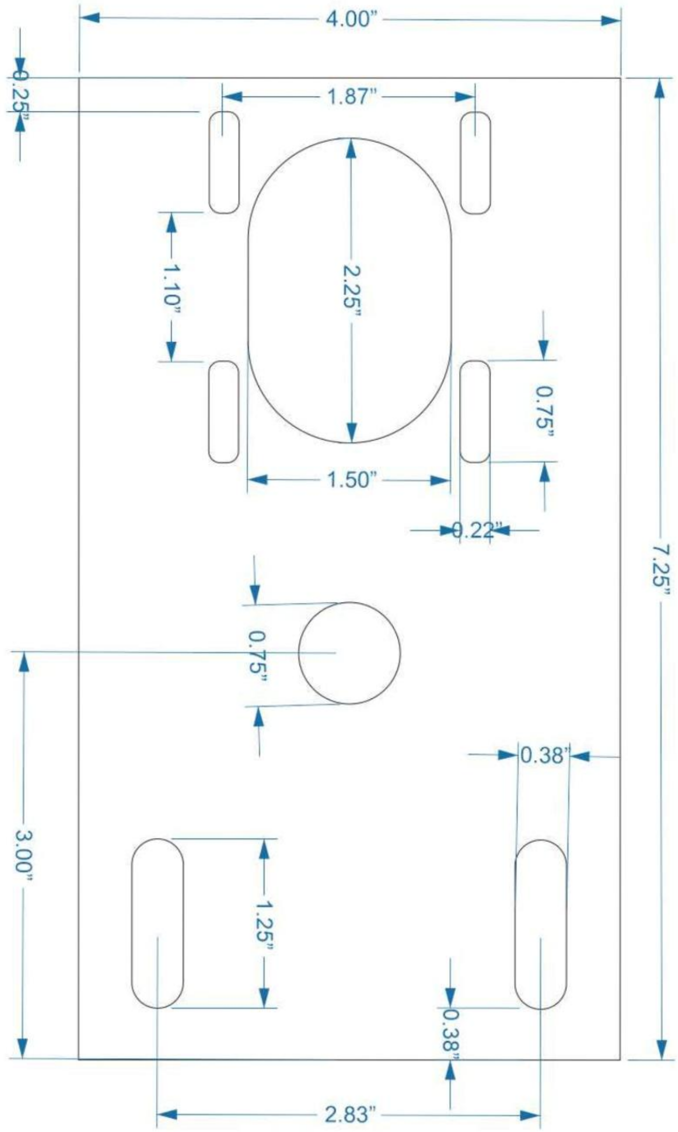
Tighten down all the button head cap screws, allowing the 36” extrusions to slightly overlap the 24” extrusions, as shown below.

Note that by pre-assembling all the brackets, the extrusions can simply be slid into place.

The basic plasma table structure is now complete.

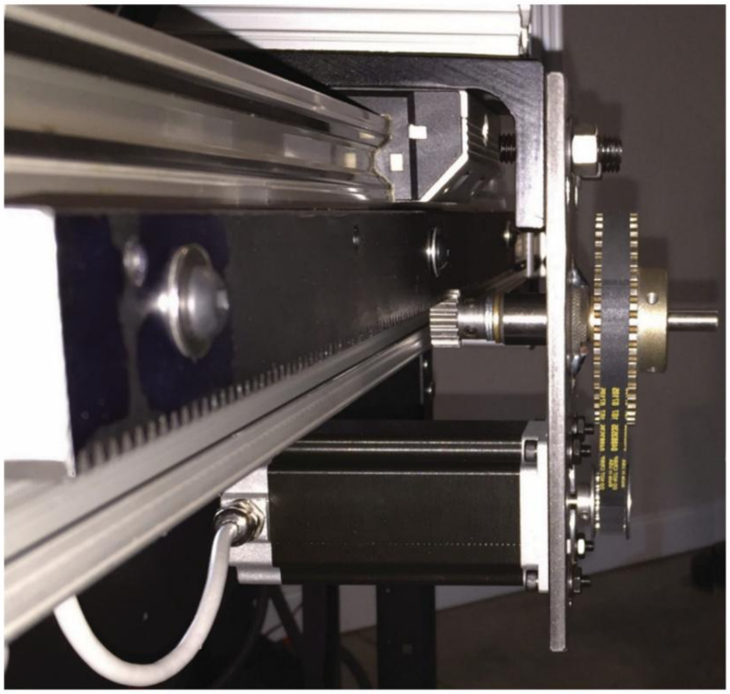
The motor mounts are fabricated from 3/16” cold roll steel bar with holes and slots cut out as shown in the image below. Each motor mount has a ¾” OD x ½” ID flanged drill bushing 1” long tack welded inside its ¾” hole as shown. This drill bushing will have a ½” OD x 5/16” ID flanged oil impregnated bushing pressed into each end.

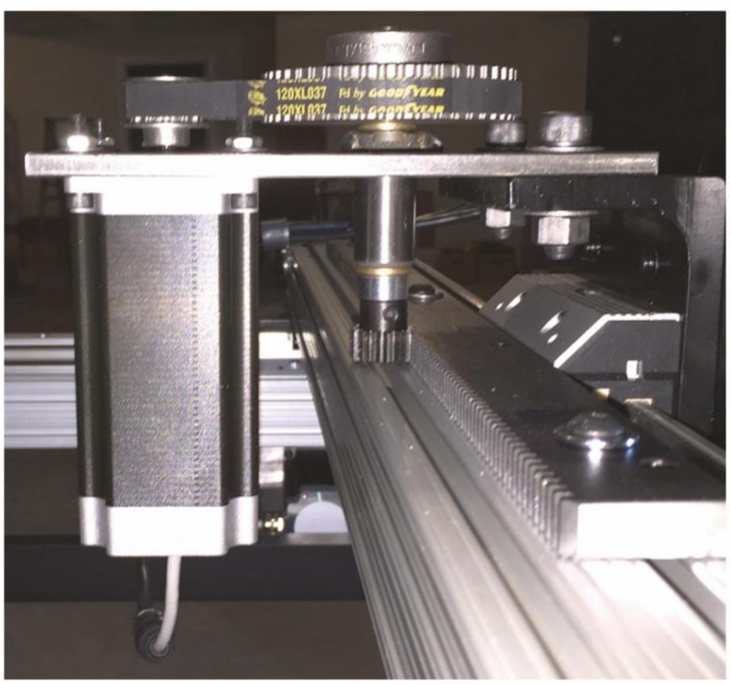
A 5/16” length of cold roll steel rod 4” long will have a 15 tooth spur gear on one end and an XL-48 timing pulley on the other as shown in several photos. The motor mount is pictured below. Since you don’t yet have a CNC plasma table, these can most easily be CNC laser-cut. If you furnish the dxf files to Send-Cut-Send they can make them at reasonable cost. Machining them would be too time consuming IMHO.



OVERVIEW OF MOTOR BRACKETS AND DRIVES:

Shown below are photos of the X (longitudinal) and Y (cross) axes. The fabrication of the four brackets than make up these assemblies comprise the bulk of the work in the project.





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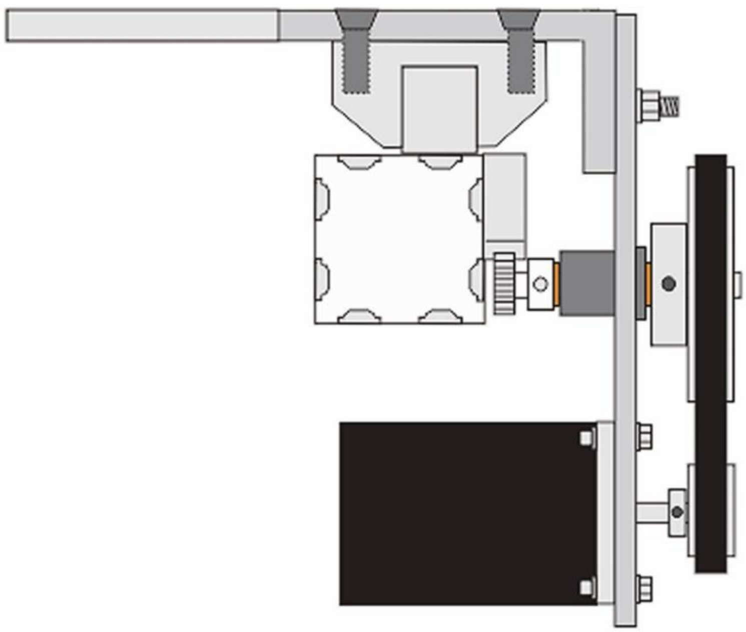
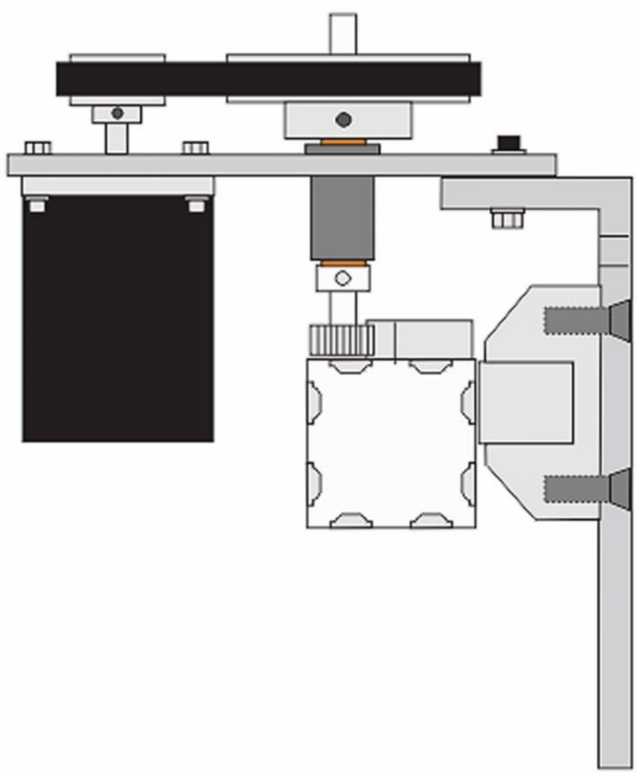
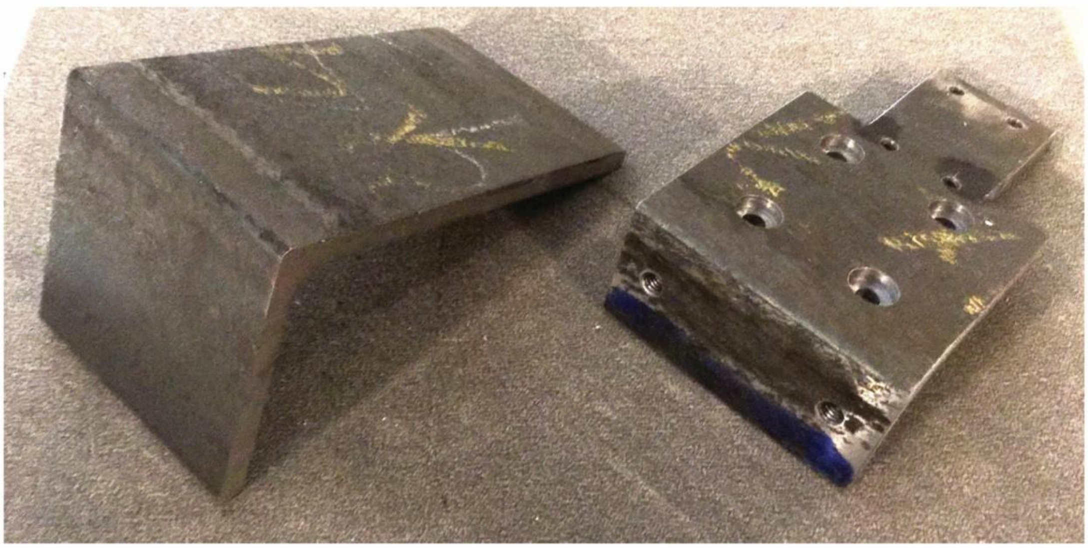


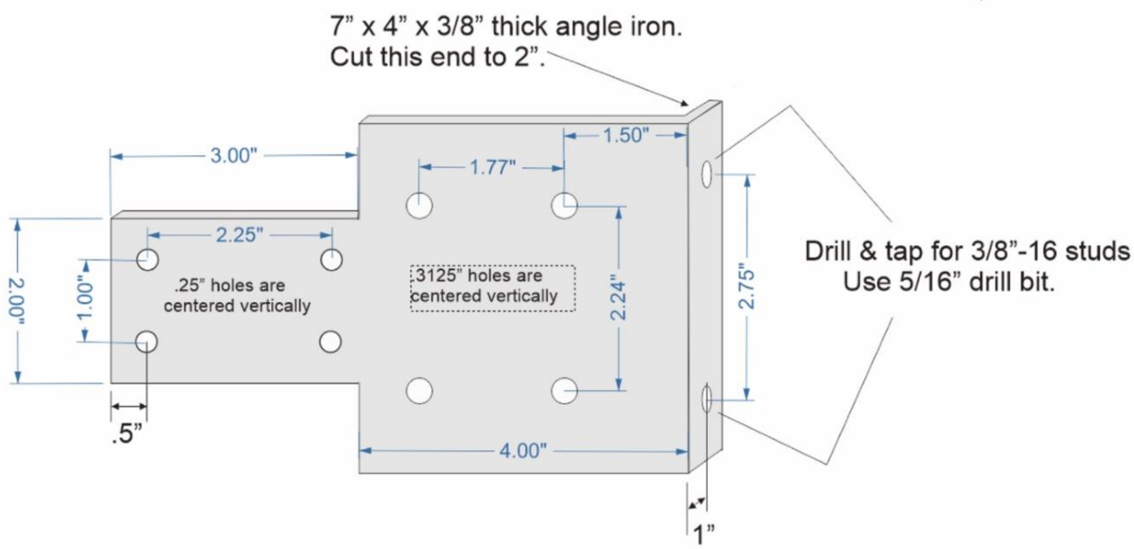


Gantry Support Bracket:

The gantry support bracket is fabricated from a 4" length of 4" x 7" x 3/8" thick angle iron. The 4" leg is cut to 2". Four holes are drilled to accommodate the linear cassette mounting holes. The diagram assumes that a Parker Origa FD-25 cassette is being used. The hole spacing and diameter may vary depending on what linear cassettes you use. The holes have been pocketed here, but flat heat socket head screws and countersunk holes can be used instead.

The four smaller holes on the narrowed end of the 7" leg are 1?4" in diameter to match the 8080 button head cap screws and t-nuts.

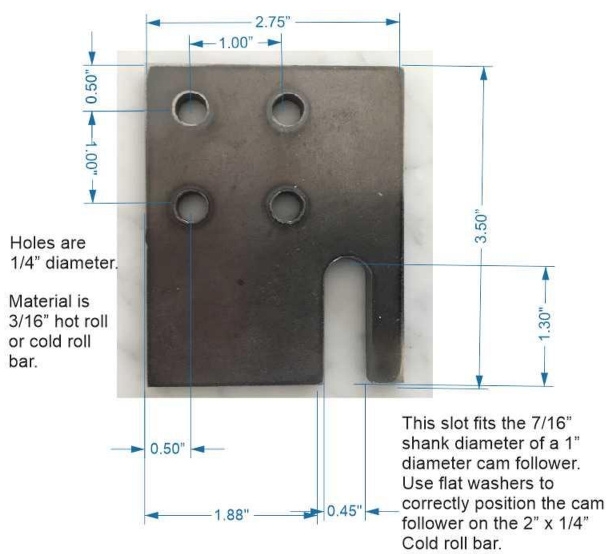




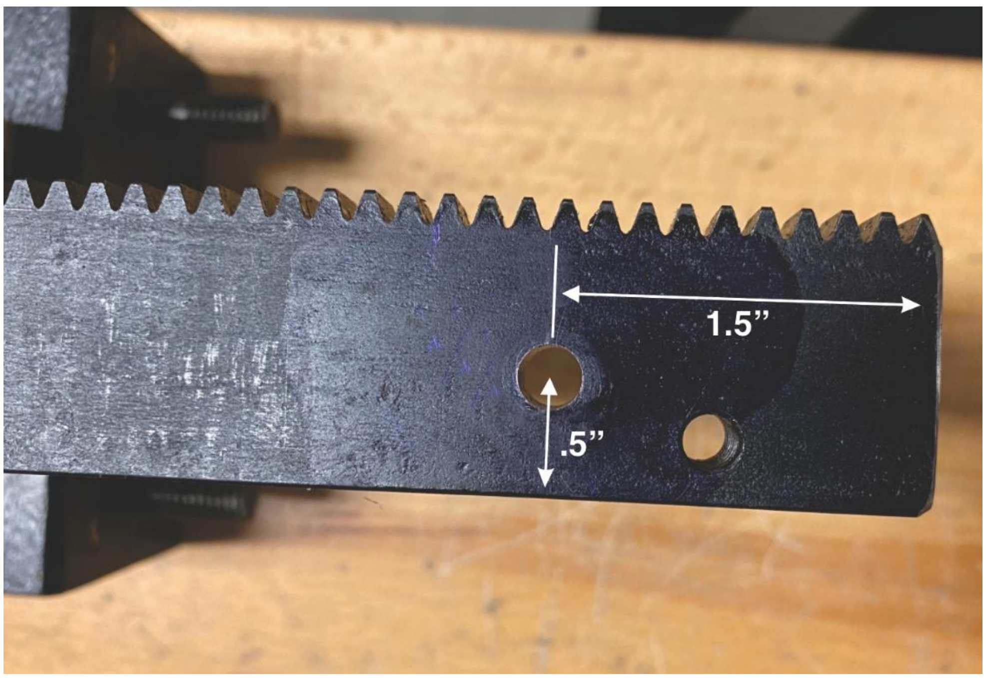
The two end holes can be simply drilled for 3/8" bolts instead of using studs.

The other L shaped bracket has the same bolt pattern as the one just shown. It does not have the necked down end and four small holes of the one just shown. A 3/8” hole is drilled in the bottom portion to accommodate a rack and pinion torch holder stud. I countersunk the four holes but you can machine them for flat head screws instead.

The bracket that supports the far end of the gantry is shown below. A 1” diameter cam follower with a 3” diameter stud fits in the slot. When you order the aluminum extrusion for the gantry, get the end holes taped for ¼-20 screws. The four holes in the bracket will attach to these end holes.



The gear rack I used came in 24” lengths from a company on eBay called “carol brent” which now goes by the name “Hubbard CNC.” They measure 10mm x 30mm. I have not seen them listed recently although the spur gears are. They were ideal as the 30mm dimension added rigidity and eliminated the bowing that usually comes from machining the teeth. The ends were also dressed so you could mount them end-to-end if desired (not necessary for this build). They came with drilled holes that weren’t suitable for the build, so I re-drilled them as shown. Gears and racks are 24 pitch, 14 ½ degree pressure angle.



The gear racks are attached to the grooves in the aluminum extrusions. If the holes you drill in the racks are precisely placed vertically, when they are secured to the extrusions they will ensure precise and consistent spur gear engagement.

That pretty much does it for these plans. They are not all-inclusive, but they should provide enough information for anyone with a bit of machine work experience. All of the hardware other than the gear racks is available from industrial supply houses, Amazon, eBay, etc. All the brackets could be made with common shop tools. A milling machine would help, and access to a laser cutting service would save considerable time on the motor mounts.