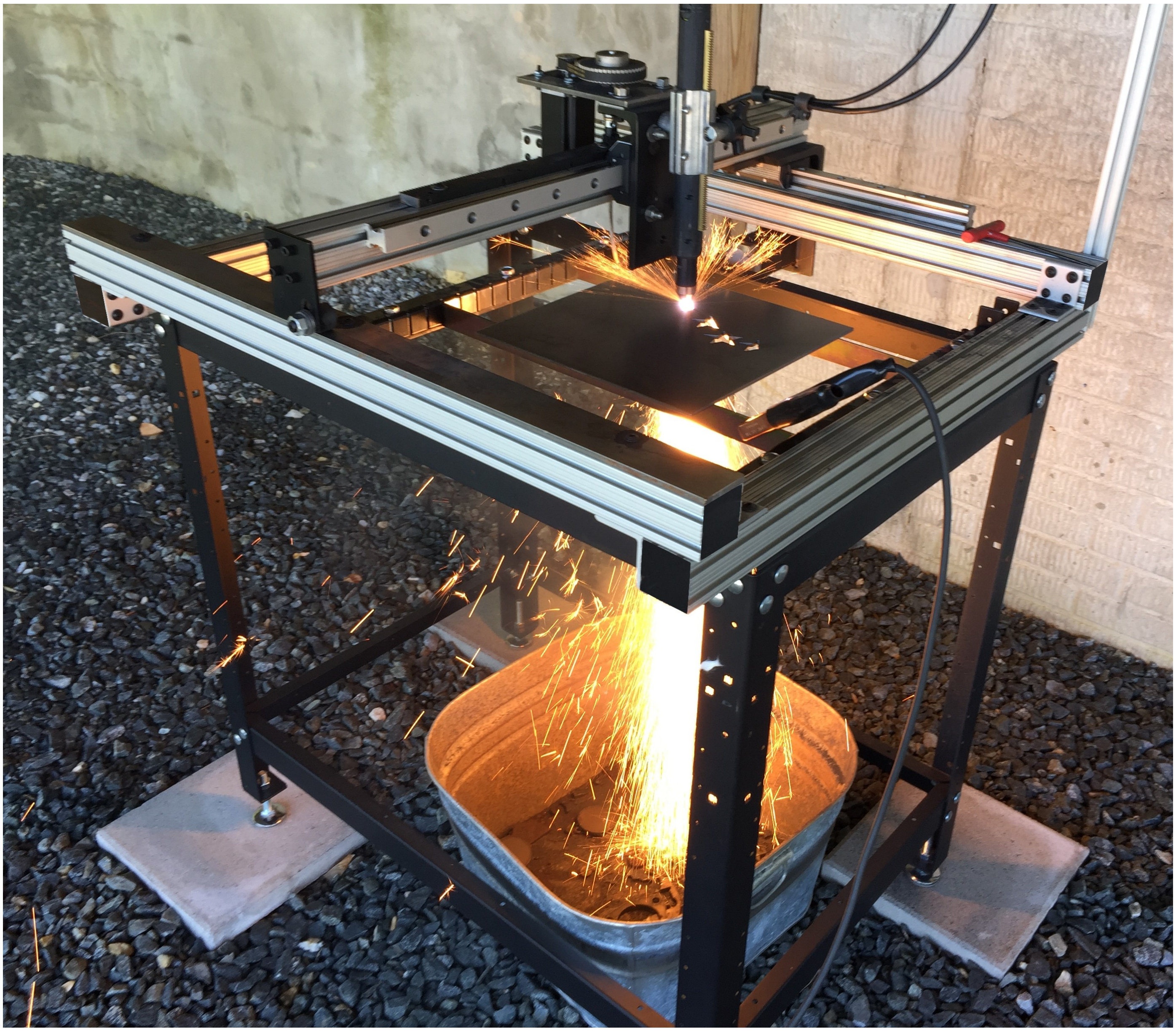
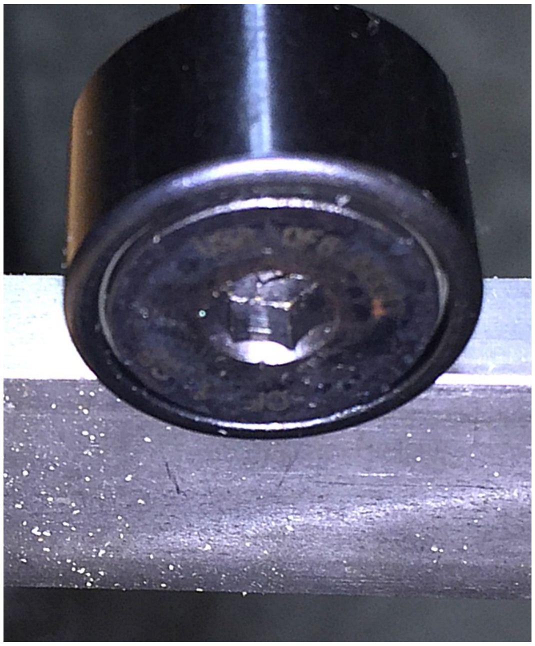
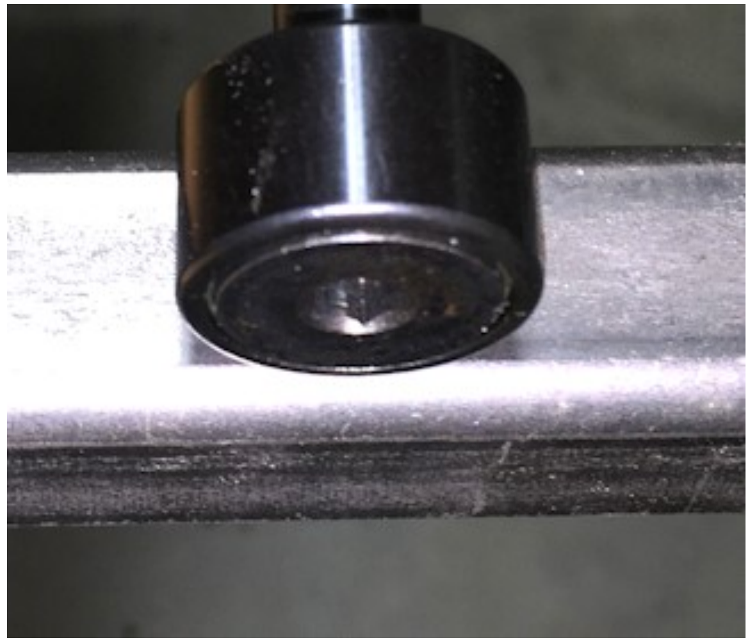
SUPER PRECISION CNC-READY PLASMA TABLE PLANS

FOR THE SMALL SHOP



What kind of guide system would you prefer for your plasma table?





Most low cost plasma tables use construction grade materials such as cold roll steel or rectangular tubing as a guide surface

BACKGROUND INFORMATION:

When my former company, Torchmate, first started selling CNC plasma cutting tables back in 1998, there were only a couple of manufacturers building low cost units. Now there are well over a hundred. Before you invest in a CNC machine, it is in your best interest to understand how this growth explosion took place, and the economics behind it.

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 actually quite simple in construction, requiring only two rolling beams 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.

CNC electronics are currently available from multiple sources at prices ranging from a few hundred to several thousand dollars, depending on the bells and whistles included. There is an on-going argument about whether stepper or servo motors are best for this application, with manufacturers claiming that whichever they sell is superior.

In the early years, small manufacturers of CNC plasma machines relied on commonly available drawing programs to produce shape designs, and separate software to drive the motors. As the market has matured, new software became available from some companies that performs both tasks. Still, using off-the shelf software wherever possible is still effective and perhaps the most economical approach.

Today, most small CNC machine manufacturers (as opposed to manufacturers of large, industrial machines) fabricate their own table, and combine it with CNC electronics and software from outside sources The point being that few such companies produce the entirety of their products in-house.

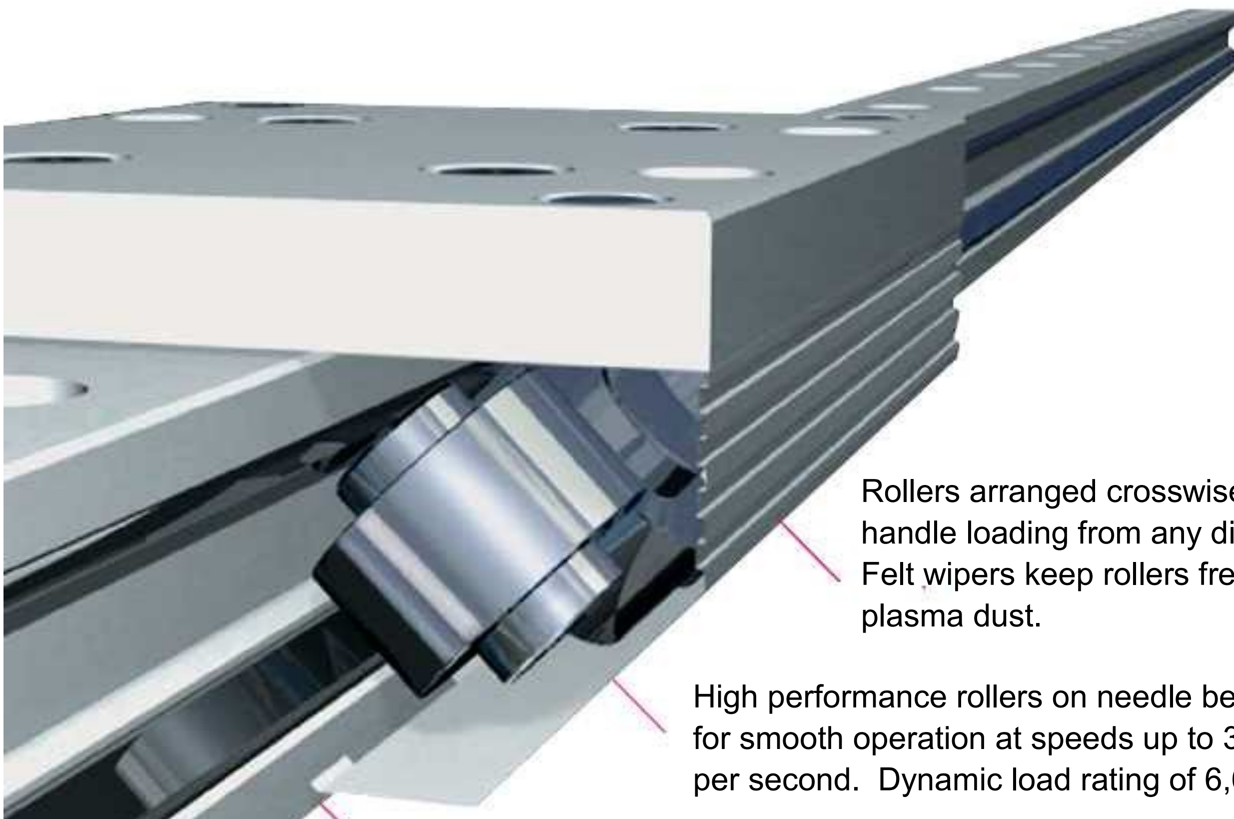
Because of the ease with which potential customers could fabricate their own physical table, manufacturers try to discourage this by making many of their parts internally. While this reduces the occurrence of people duplicating their design and making knock-off copies, it also increases costs.

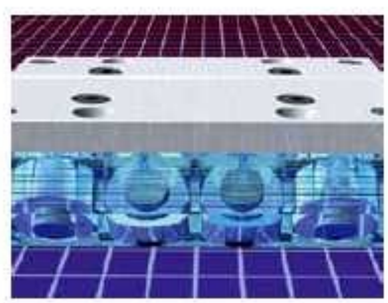
Consider the expense of making a bearing or a bolt in a small shop. Even if it could be done, the cost of the equipment necessary would be prohibitive. The same principle applies to making fabricated steel parts. Small CNC machine manufacturers generally use simple designs and inexpensive materials to permit them to make a profit.

Take a close look at the low-cost CNC tables on the market, and you will see that the vast majority use cam followers riding on a steel bar, or even rectangular tubing to guide their axes. The inherent slop, or play, in such a system requires them to be driven from both sides. Manufacturers play up the “dual-drive” aspect to make it seem like a desirable feature rather than a means of compensating for an lack of inherent precision.

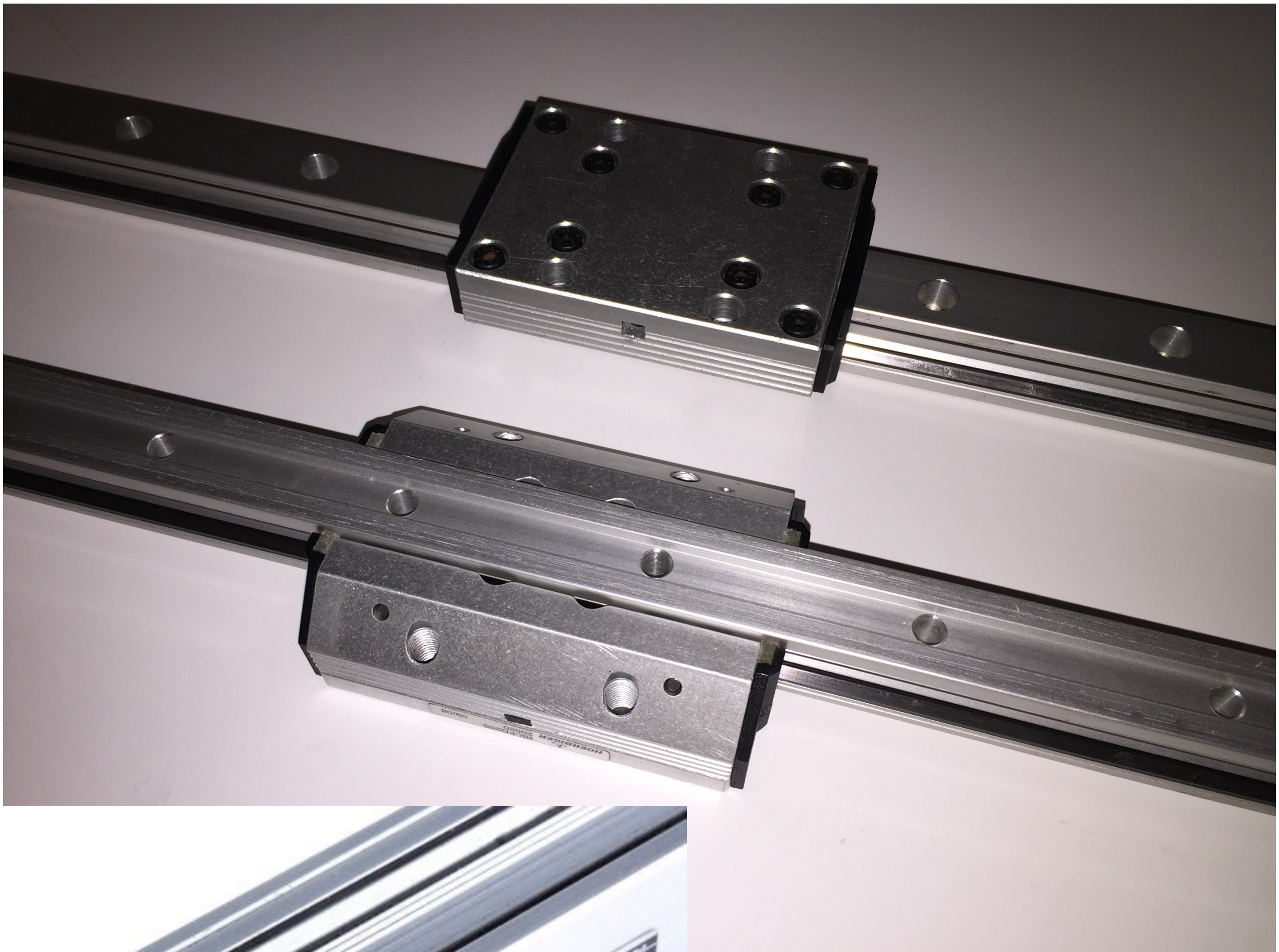
The great advantage of a small footprint table such as that covered in these plans is that the highest possible quality guides and rails can be used. Since the cost of high precision guides and rails increases exponentially with the amount of travel required, it would be impossibly expensive to include 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 far superior.

HIGH PRECISION GUIDANCE SYSTEM USED IN THE TABLE YOU WILL BUILD





Axial roller bearings of high performance roller cassettes.



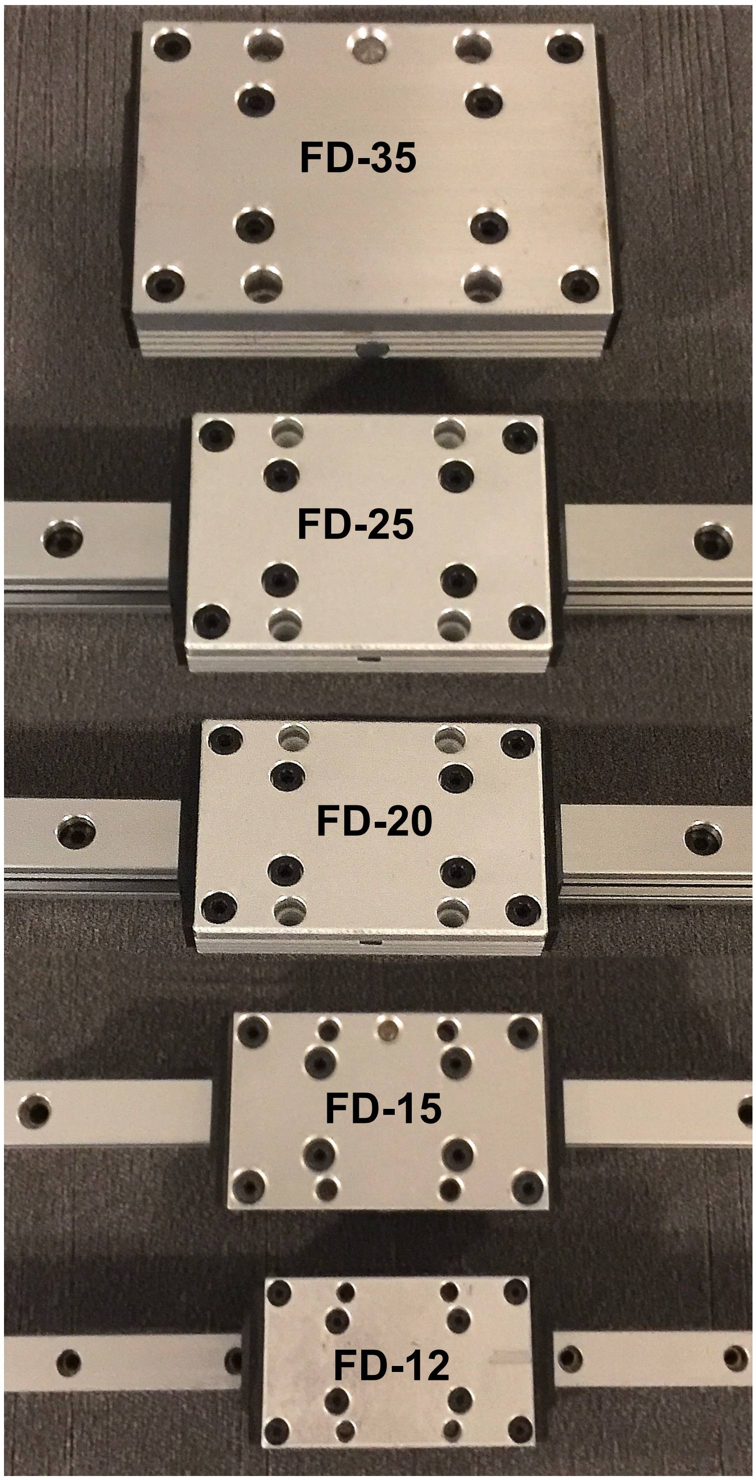
Compare this guidance system with those found on the low-cost plasma tables for sale by various small companies on the Internet which use a steel bar or steel tubing as a guide surface.

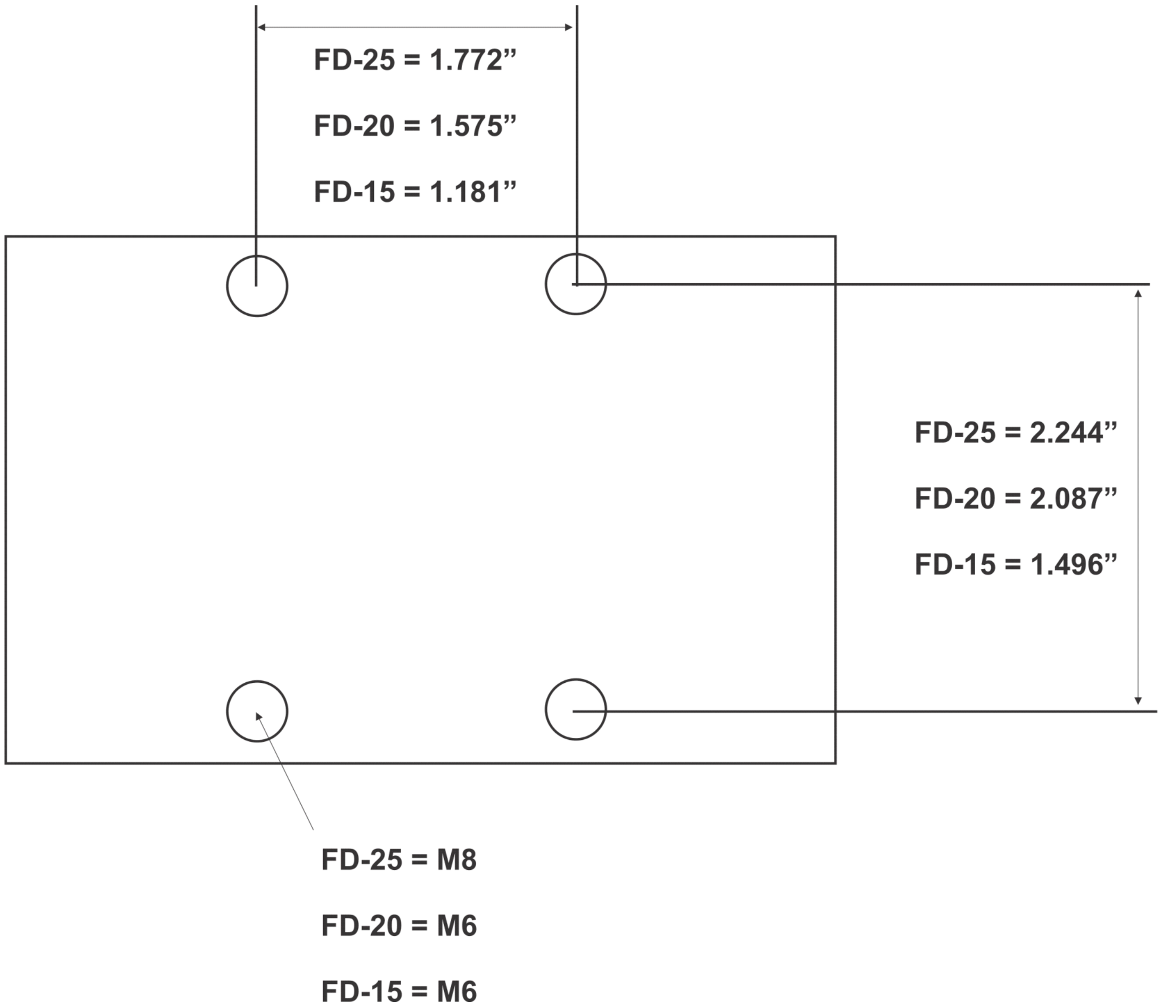
As might be expected, the cost of the above linear rails and roller cassettes is the most expensive part of the physical table. However, by limiting the size of the system and eliminating the manufacturer profit margin, you can complete your build for the same or possibly less cash outlay than a cheap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

Origa linear rails and cassettes come in several sizes, five 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 preferable if an automatic torch height control is to be used. With a rack and pinion torch holder an FD-15 is the lower size limit, and FD-35 is overkill.

These components are typically super expensive when purchased new from a distributor. However, they can be found both used and unused on e-Bay periodically from industrial surplus sources. They will either be referred to as Parker Origa or Hoerbiger Origa.




FD-25 = 1.772”
FD-20 = 1.575”
FD-15 = 1.181”
FD-25 = 2.244”
FD-20 = 2.087”
FD-15 = 1.496”
FD-25 = M8
FD-20 = M6
FD-15 = M6

ADVANTAGES OF A SMALL TABLE:

As stated above, a small table such as 2’ x 2’ permits the use of top quality components that would unreasonably drive up the price of a conventional sized machine. While the linear rails and roller cassettes for this machine cost close to $600, they would cost $3,000 or more for a 4’ x 8’ or 5’ x 10’ table.

Since the table we are going to construct can easily be mounted on locking casters, it can be readily rolled outdoors eliminating the tremendous problem of plasma dust in your shop. It also prevents your having to lay out additional money for a messy water table or exhaust system.

Unless you have a substantial manufacturing operation, you will usually be making small runs of average sized parts. These is no need for having to handle heavy 4’ x 8’ steel sheets, or monopolize a lot of floor space.

Even a 2’ x 2’ plasma table has more cutting area than most milling machines, and can produce two dimensional parts in less than 1/10th the time.

If you at some point feel that you need something larger, you can likely sell your machine for more than you have in it.

INTRODUCTION TO PLANS:

Since we are providing you with construction plans rather than trying to sell you a finished table, we will maximize the number of mass-produced, “off-the-shelf” components used in making your machine. This eliminates most of the work involved, with the majority of time spent merely bolting it together.

In fact, everything but 5 simple brackets will be purchased from Internet sources in ready-to use form. The brackets could be made in minutes with a CNC Plasma system, but since you don’t have one yet, you will need access to a cut-off saw, a milling machine, and a welder.

The appendix to the plans provides you with source information as well as approximate prices as of the publication date. We include full measured drawings, as well as photos where we feel it would be helpful. The entire project, other than painting the brackets, can probably be completed in a day.

We will also offer some suggestions as to where you can go to purchase the electronics and software to run the table.

SUPPORT TABLE:

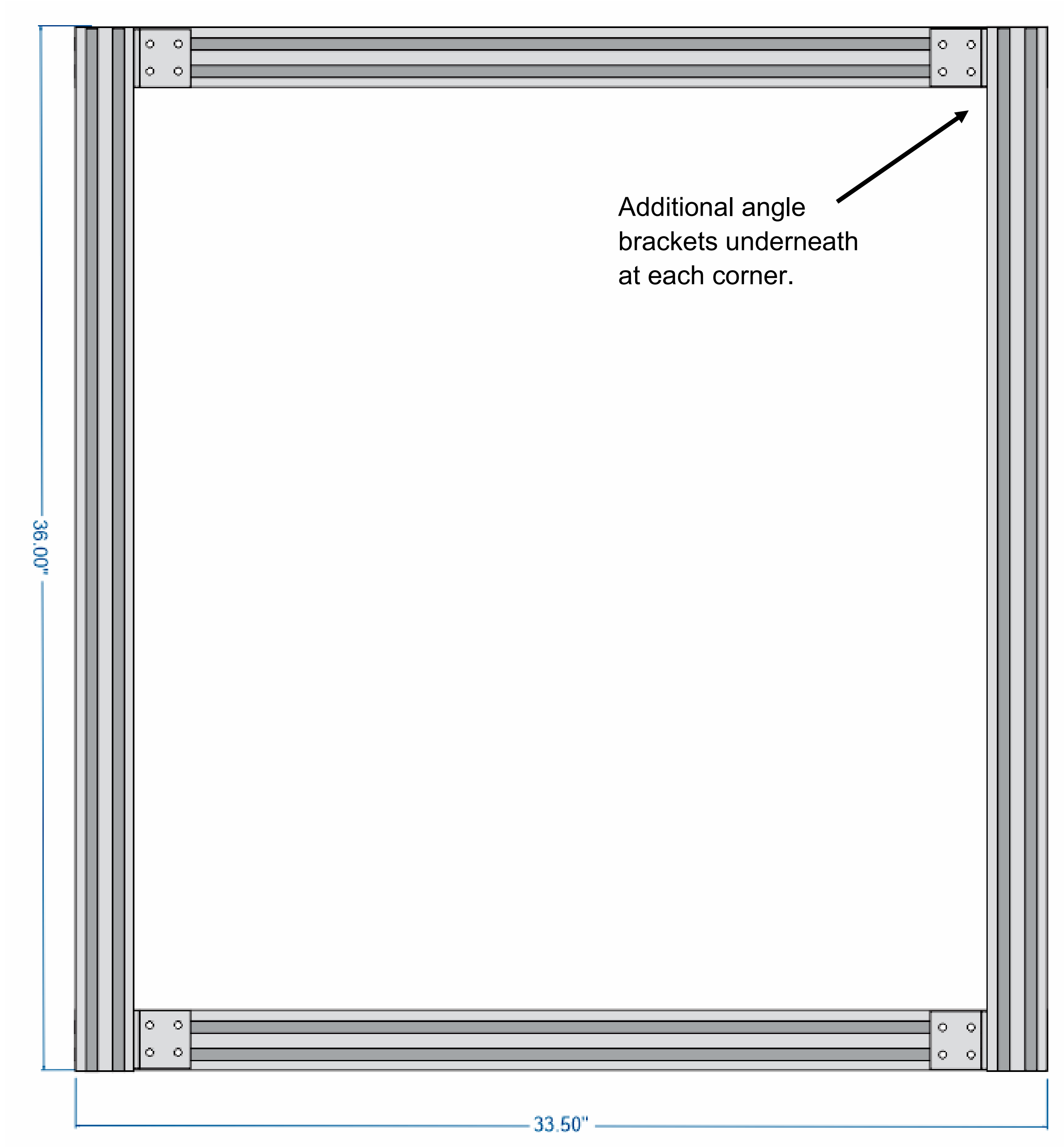
In keeping with our strategy of using commonly available “off-the shelf” components wherever possible, we will use a power tool support table sold by Rockler Woodworking & Hardware. It is available on-line at: **https://www.rockler.com/rockler-24-x-36-shop-stand** under part no. 48089. As of this writing 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, and also available on line at: **http://go.rockler.com/tech/48089-Steel-Stand-Instructions.pdf**

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 1/2” 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 this overhead view



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.

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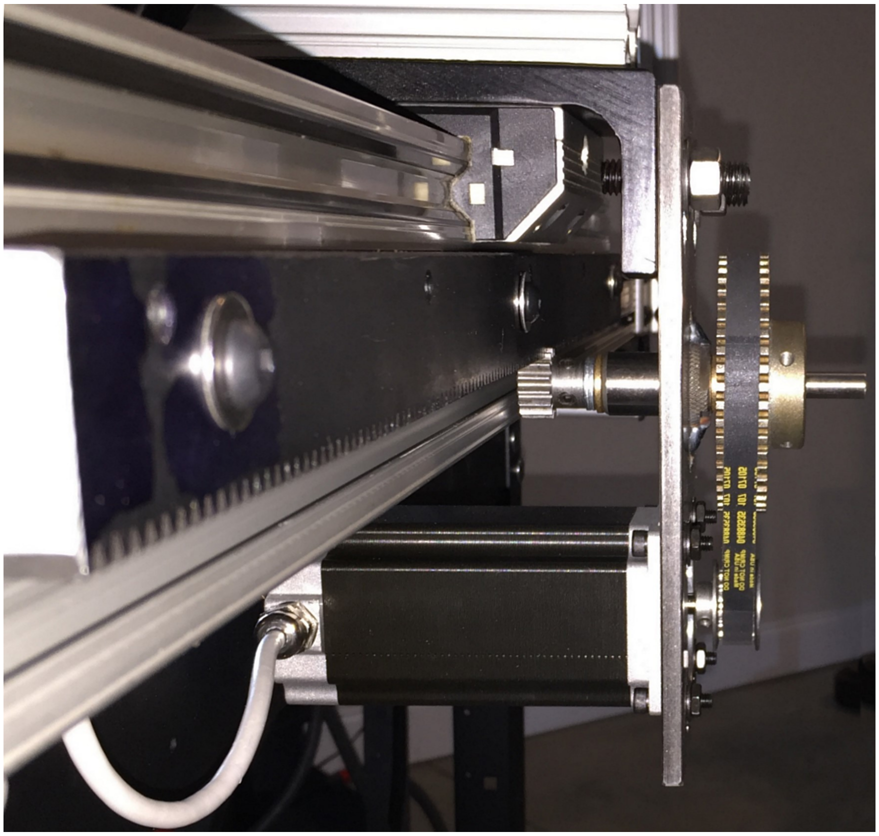
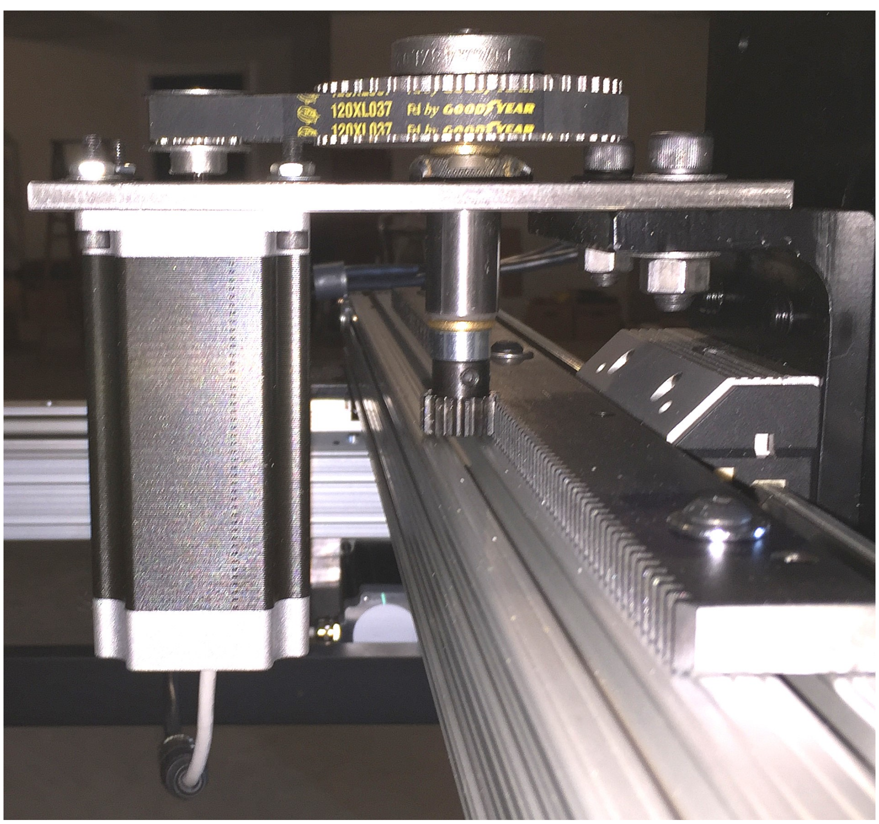
The basic plasma table structure is now complete.

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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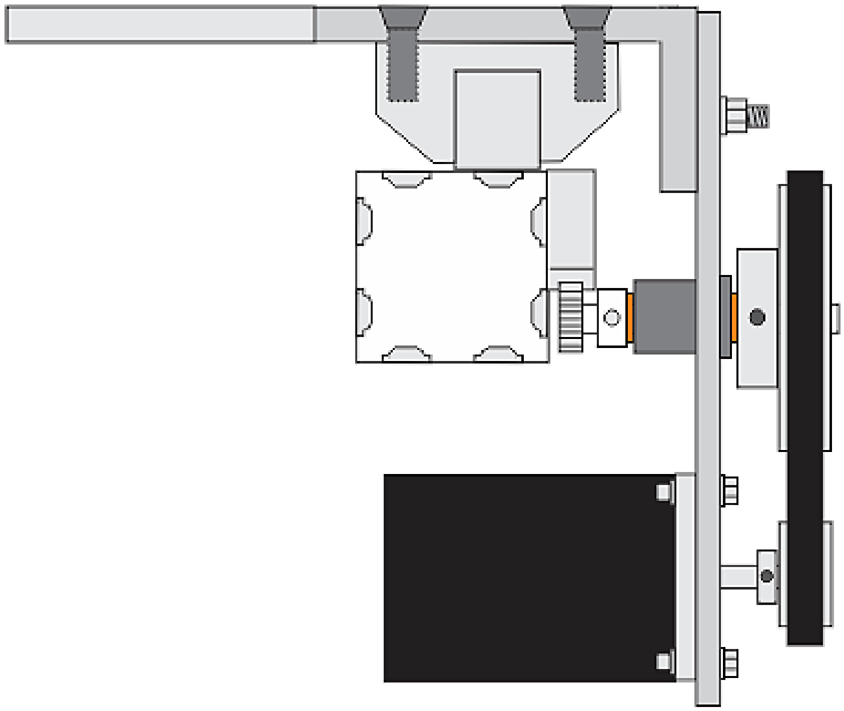

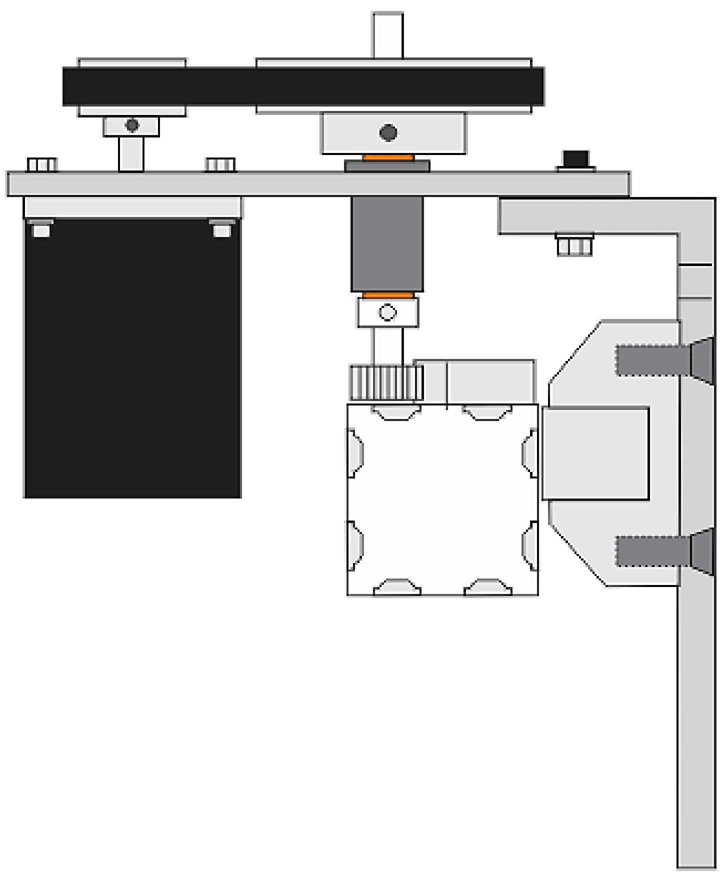

Gantry Support Bracket:

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.