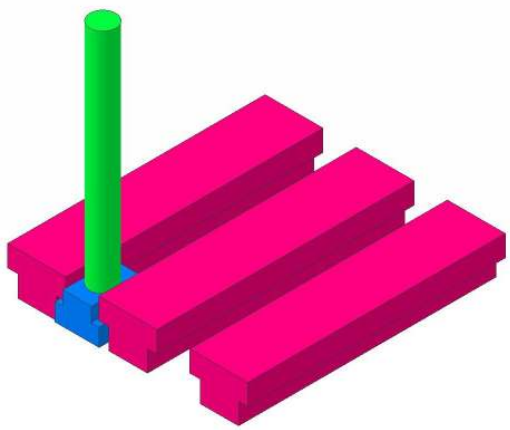
Making A T-nut, version 1.1

By R. G. Sparber

If you have a machine with T-slots, then owning T-nuts is a must. The T-nut slides into the T-slot and provides an anchor port for clamping things to the table. It is an extremely versatile system that has been around for a long time.



This article will present the general approach to making T-nuts. No pictures of the machining are provided. I made my T-nuts before I decided to write up the process and have no need to make more. Sorry guys.

The first step is to carefully measure your T-slot. The goal is to make a T-nut that freely slides in the T-slot and can tolerate some metal shavings without jamming. But if the T-nut is too

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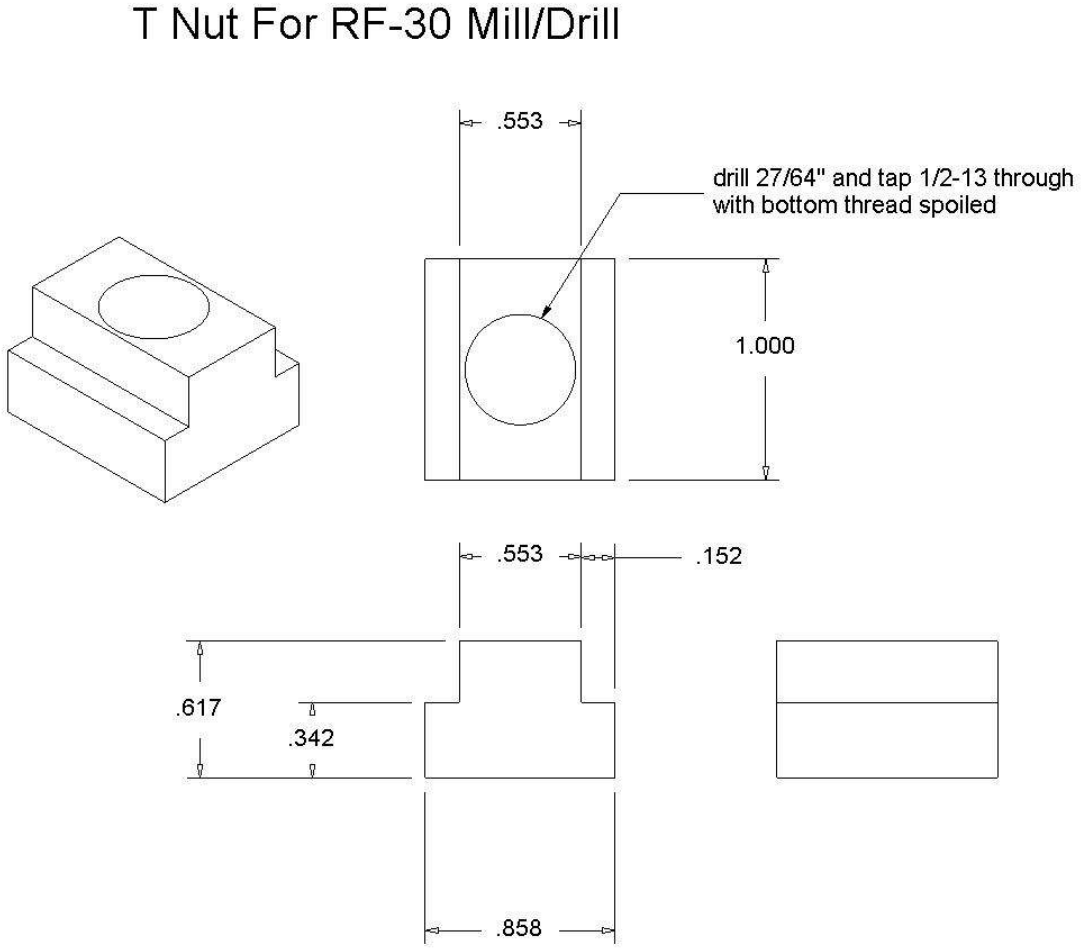
small, it will put excessive stress on the overhang part of the T-slot. Then you run the risk of breaking off this overhang.

I subtracted 0.04" from each width of the T-slot and used these values to define my T-nut. This gives me 0.02" of clearance all around and seemed to work well. The only exception is that the top of the T nut when put under tension should not extend above the table surface. If it did, you could not use it to clamp things directly to the table.

If you have a T-nut that freely slides in the T-slot, so much the better. Just copy its dimensions.

When done with your measurements, draw up a sketch.
The sketch can be hand drawn on a scrap of paper or drafted with a Computer Aided Design (CAD) tool. I use Alibre PE. It lets me draw the cross section of the part, extrude it out to 3 dimensions, and then add features like the threaded hole. It then outputs the shop drawing shown below. I simply had to tell it which dimensions to show and it did the math.



The important bit is that all dimensions and shapes are clear and accurate. Now would be a good time to take the dimensions off of the plans and verify them on the T-slot.

I will call the part that extends out from the T-nut its "ears".

Note that the tapped hole in the center of the T-nut has very little metal along the flanks. This is not a strength problem because the bottom of the T-nut has plenty of metal. However, care must be taken to center this hole to prevent the threaded stud from hitting the sides of the T-slot.

I have placed two of my homemade T-nuts on the bar of 1018 steel used as source material. The closer you can get in size, the less machining is needed. If you have a small hobby mill, you might be able to cut the T-nuts from aluminum bar stock like 6061.

A common approach in making T-nuts is to machine the cross section along the length of the bar. Then drill and tap the holes. There will be plenty of metal to grab during the process.

The first step is to machine the bar to the height and width of the T-nut. Measure the height of the bar, subtract off the height of the T-nut, and divide by 2. That is how much you should take from the top and bottom surface. Cutting the same amount from opposite faces of the bar minimizes warp. Repeat this process for the width. Deburr the bar and paint the top with layout fluid.

Next mark the centerline of the bar and the location of each ear. You will be cutting identical steps on each side to form these

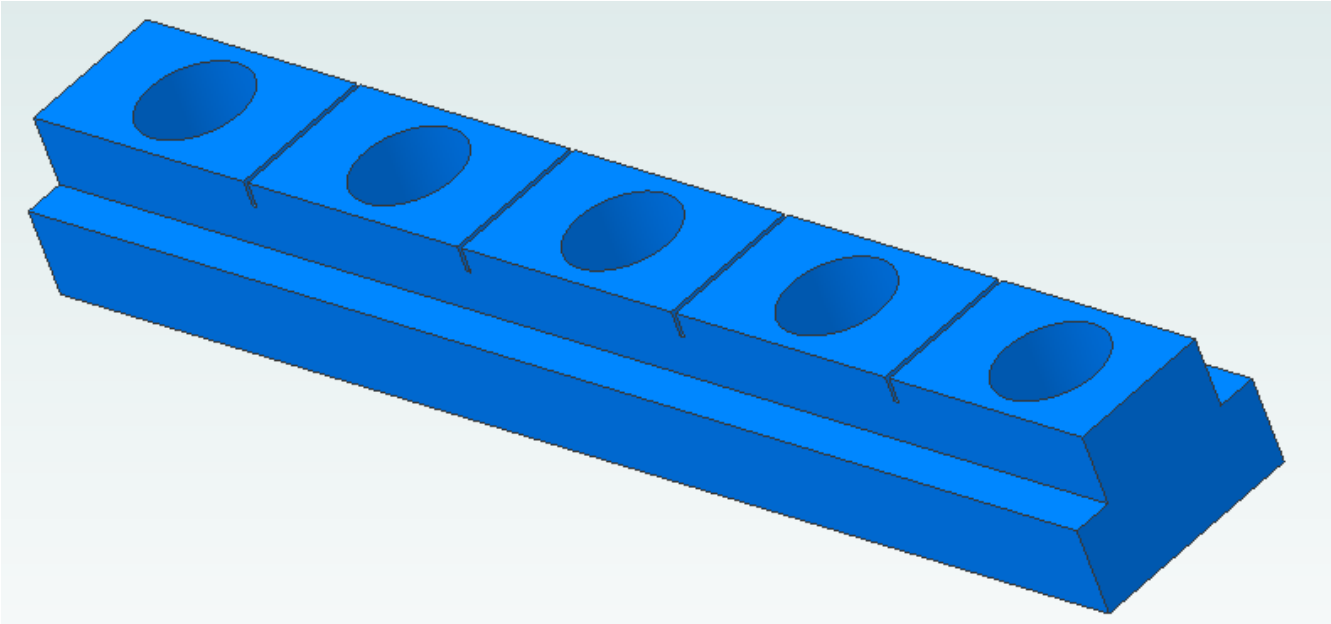
ears. Take roughing cuts until you are within about 0.02" of the layout line. Set the final height of the cutter and make your finish cut on both sides. This will insure that the tops of both ears are at the same height. Don't forget to lock all mill axes that are not being moved.

You now have a T-nut "ingot". You can save it for the day you need some odd length or odd threaded hole or you can complete the task now. If saving the bar, just remove it and deburr all surfaces.

One of the T-nuts that holds down my vise is extra long. It has the standard 1/2-13 tapped hole near one end plus a 1/4-20 hole near the other. A 1/2" length of 1/4" threaded rod has been screwed in to provide a handle. It is then easier to pull this T-nut from under the vise once the hold down bolt is removed.

Assuming you want to make T-nuts now, leave the bar in the mill vise.

Scribe lines that define the length of the T-nut leaving room at the end for a saw cut and clean up. I leave about 0.02". Repeat as necessary for each T-nut. Next, mark the location of the threaded hole in each T-nut.



I could drill the hole in one pass but it would be rough on the drill and on my mill. Instead I "step drill", using a 1/4" drill and follow with the 27/64".

A spotting drill is used first to provide a cone shaped space for the tip of the drill. You can see the spotting drill in this picture of an unrelated part being drilled.

Do lock your Y and X axes before drilling. The cutting force can move an unlocked table.

If you have a means of precisely locating the drill along the center line, then it may make sense to mount a drill and use it at all locations before changing it out. Otherwise you will stay at one location and cycle between drills. Either way, the work will go quickly because the holes are all in the same bar. No need to clamp separate chunks of metal. On the other hand, some prefer to cut up the bar first and then use stops on the vise to located the T-nut blanks for each operation. You can then stay with one drill and cycle through the blanks.

When done drilling, we are ready to run the tap. We don't want the thread to be cut passable all the way through. There are two choices: don't run the tap all the way through or do run the tap all the way through and then spoil the thread. I chose to do the latter.

After tapping all holes, remove the bar from the mill and deburr as needed.

We need to spoil the thread at the bottom of the T-nut. This prevents the threaded rod from screwing through the T-nut and into the bottom of the T-slot. That can cause the T-nut to jack up and break out the T-slot.

If you made the T-nut from aluminum and own both a ball peen hammer and a soft face hammer, here is a neat way to spoil the thread. Fit the rounded end of the ball peen hammer's head into the hole with the bar on a solid surface. Strike the flat face of the ball peen hammer's head with the soft face hammer. I used my lead hammer. Do not use a hardened face hammer or you run the

risk of chipping one or both hammer faces. The spoiled thread ends up looking more like it was countersunk and looks great.

If you made the T-nut from steel, then you can use a cold chisel to cut across the bottom edge of the thread. It works as well as using the ball peen hammer but won't look as nice.

Slice off each nut on your bandsaw. I chose to finish the ends on my belt sander but you could do a better job by side milling.

I find it rather satisfying to use T-nuts I made myself. Add in the enjoyment of the work and the money saved and you have a very good deal indeed.

Acknowledgements

Thanks to Malcolm of the gingery_machine yahoo site for pointing out that the T-nut must not extend above the table.
Thanks to Dave of the same yahoo group for pointing out an alternate way prevent the thread from going all the way through the part.

Thanks to Larry Rudd who spotted that I had used a wrong picture 3 years after initial publication. Sharp eyes!

What's Next?

I welcome your comments and questions. All of us are smarter than any one of us.

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