

Holding down material for cutting

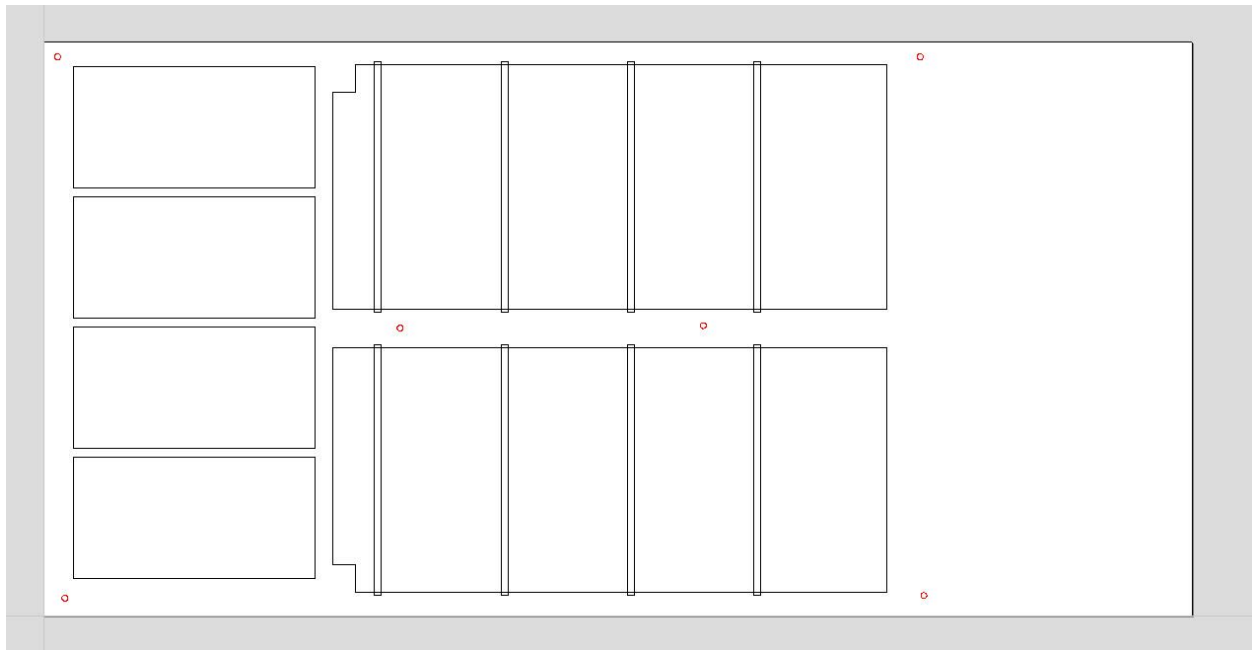
Choosing the right hold-down method for your project can be challenging, but it is an important part of project planning. Not only does the work piece need to be held securely, but you need to be aware of what will happen to parts as they are cut from the surrounding material. Small parts can be caught by the cutter and thrown across the room, causing serious injury or damage.

The following information is a brief overview of different methods to help you get started.

Screws

If you have a spoilboard set up, you can screw the workpiece directly to the table. This is a quick and easy method that works well for most materials. However, this requires careful planning to make sure that all the screws are clear of the cut path.

With larger jobs you may want to create a hold down toolpath based on the location of other toolpaths in the file. This will create clearance holes for the screws in locations that you know are safe. When using an end mill for drilling, there is very little lateral force on the piece so less holding power is needed. One clamp on each end of the material is enough.



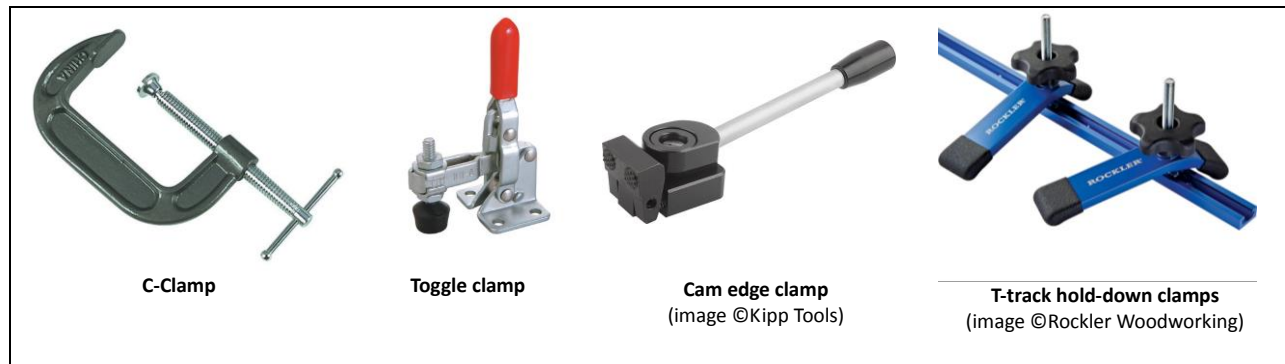
Shown here: In our CAD/CAM software, we used the circle vector tool to place several hole locations around the parts. The drilling toolpath is saved as a separate part file so it can be run first. Then the material is screwed down through these holes, and the main cut file can be run safely.

T-track tables and rails

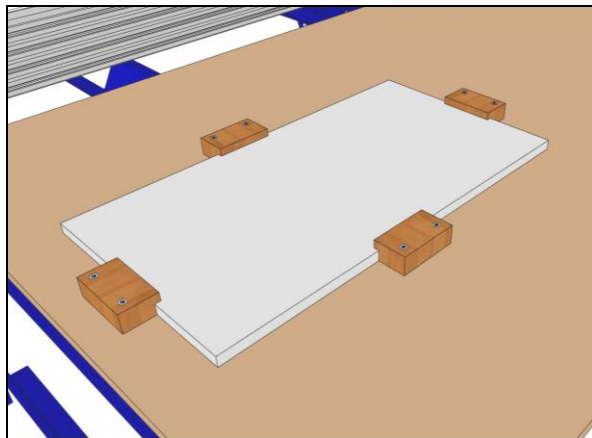
The Shopbot Buddy and Desktop Tools have an aluminum table base that is ideal for setting up moveable clamps and fixtures. On full-size machines, you can set up your own system using T-track rails (available from woodworking supply stores), inlaid into the MDF deck. If you use this method, be sure that the rails sit low enough below the surface that they are out of the way when through-cutting.

Clamps

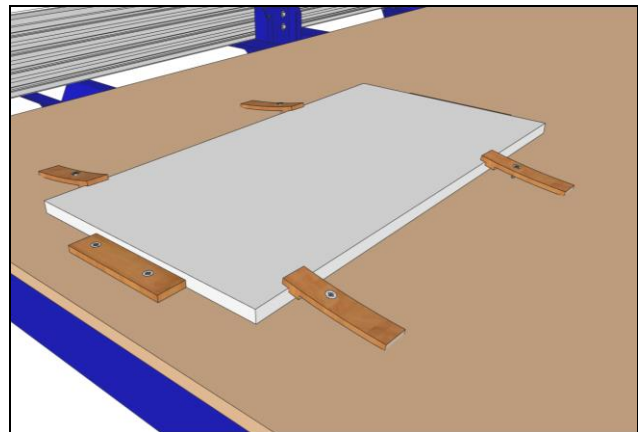
Whether you are working with a metal T-track table or a spoilboard, there are a variety of clamps that you can use to secure your material. Clamps offer strong holding power and are ideal when you do not have excess material to drive screws into. However, they require careful planning to avoid running the tool into the clamps.



You can also create clamps using scraps of wood. Here are two examples:



A block of wood with a *rabbet* (groove on one side) can be used on each side. The rabbet height should be slightly less than the material height, allowing it to pull down tightly when screwed in place.



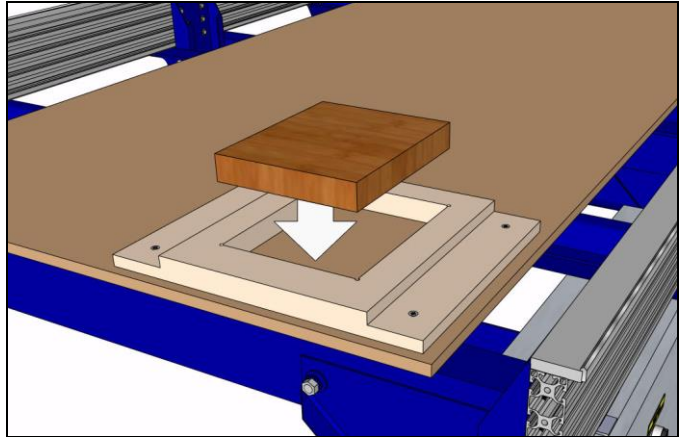
A thin, slightly flexible strip of wood can be used on varying material thicknesses. Glue a smaller strip across it, which will butt against the material to prevent slipping.

Press-fit jigs

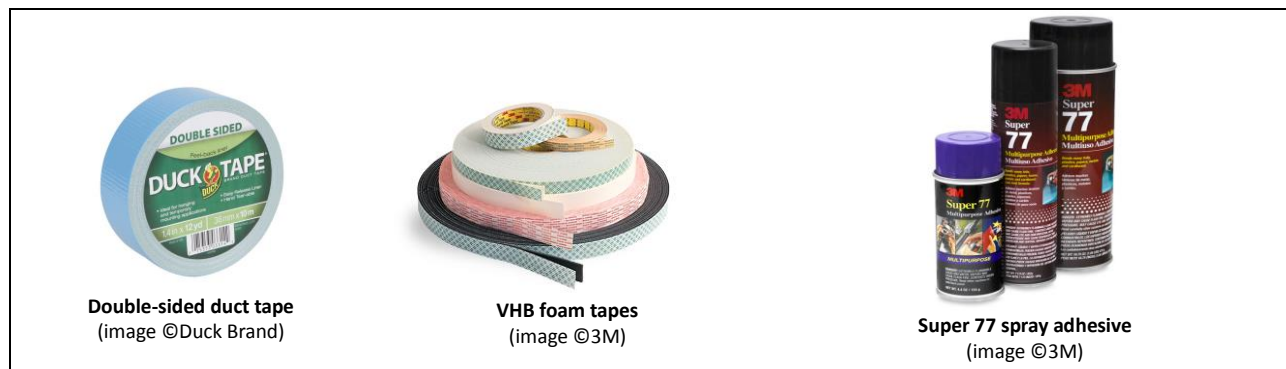
A tight press-fit jig provides good holding power and can be made quickly and accurately using your Shopbot.

This is a good solution for holding small work pieces, extra-thick stock, or if the material has already been cut to its final size and there is no room for screws.

Shown here: two pieces of MDF have been glued together and pocketed out to hold this piece of hardwood. The jig is screwed to the table, then the workpiece is pressed in.



Adhesives



Double-sided duct tape
(image ©Duck Brand)

VHB foam tapes
(image ©3M)

Super 77 spray adhesive
(image ©3M)

Adhesives can be more difficult to work with, but they offer some advantages over other methods. This can work well for thin materials that cannot be held by a press-fit jig. More surface area = more holding power, so small projects will require additional hold-downs.

To use tape adhesive, both the table and work piece must be clean, flat, and dust-free. If you plan to cut all the way through the material, keep the tape away from the planned toolpath if possible (it may gum up the cutter, reducing cut quality for the rest of the part).

For spray adhesive, we recommend a 3M product called Super 77 which forms an extremely strong bond within minutes. To avoid damaging your table, bond the workpiece to a scrap board that is clean and flat, then clamp or screw this board to your table. Some people prefer to glue a layer of paper between the workpiece and support board. This can weaken the bond, but it makes removal easier. Try both methods on some scrap so that you can compare for yourself.

Vacuum hold-down systems

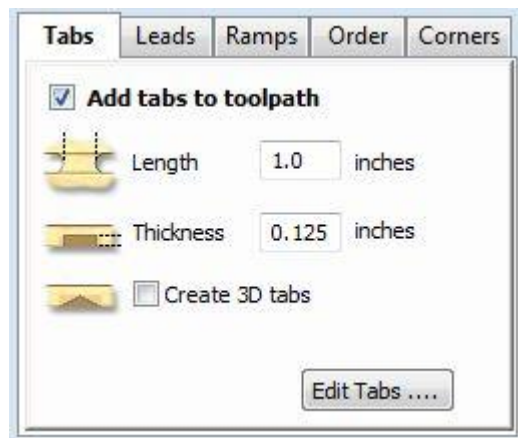
A well-sealed vacuum system can be one of the most convenient and effective hold-down methods. It is ideal for repetitive cutting of plywood and other large sheet materials.

Shopbot offers several kits for full-table vacuum systems on our Gantry tools. For other models (or small projects) it is possible to build your own. This document is only meant as an introduction to hold-down systems, so we won't get into the details of that here. There are many resources online for both commercially available and DIY vacuum systems. A google search for "CNC vacuum hold-down" will get you started.

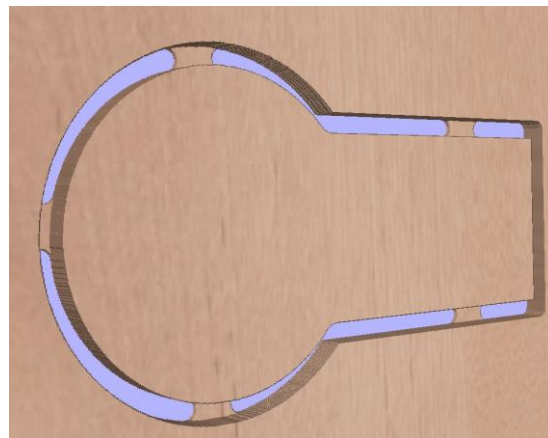
Holding small parts within the material

Once you secure your material, you still need to consider what will happen to parts as you cut them out. Large parts may shift as they are cut free, leading to a small gouge or notch along the edge. Smaller parts can be destroyed or thrown by the cutter.

There are two ways that you can handle this from within the software. The first option is to create tabs, or leftover "bridges" of material between the part and its surrounding area. Most CAM programs will have an automated feature for this. The feature for Partworks/ V-Carve Pro / Aspire is shown here.



Adding tabs in V-Carve Pro



Example of tabs on a part

A second option is to leave an "onion skin," or very thin layer of material at the bottom of a profile cut. Just set the final cut depth at slightly less than the thickness of your material (typically .010" - .030", depending on material and size). The advantage is that the onion skin provides better hold and can be easier to trim/sand away than a series of thick tabs. However, if there is a lot of variance in the thickness of your material, or if your table is not flat, then you may end up cutting too deep or too shallow and this method will not work correctly.