Wedge Cutting Jig

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Legal Disclaimer

Special thanks to Fred Swift for letting me use his concept. I have added my own ideas and changes to it to make the jig as described in this PDF file. These plans are a follow-up from my video demonstrating the wedge cutting jig, please watch the video, subscribe to my channel, share, and opt-in for notifications from YouTube. Thank you.

This document describes the construction and use of the updated table saw jig for cutting wedges for scroll saw shells, and re-sawing short boards. The jig could also be used with a band saw. The updated jig has the following benefits over the original design:

1. The jig is easier to construct, and is capable of producing wedges that are tapered along their length or width.

2. Vacuum clamp eliminates the need to use a hot glue gun. It provides a stronger, more consistent clamping action that can actually be monitored with a gauge.

3. More accurate angles since there aren't any glue dots of variable thickness to cause error.

4. Both angle adjustments of the jig are micro-adjustable.

5. Can be used to re-saw short boards up to 6" wide.

6. Vacuum chuck does not pull out pieces of wood like hot glue dots can.

7. No acetone or alcohol is needed. Vacuum clamp uses the weight of the atmosphere for next-to-nothing electricity cost to run the pump.

Vacuum Sources

There are several ways to generate vacuum pressure, but I only recommend using an electric vacuum pump. Here are a few other sources with their advantages and disadvantages:

1. Shop-Vac. These machines have a lot of air flow, but not all that much vacuum pressure. They can more easily compensate for a leak, but they require more clamping area inside the gasket to make enough clamping force. No worries about sucking dust into the machine provided it has a filter already. Plumbing can be home-made fittings and/or duct tape thanks to the much higher flow rate easily overcoming any leaks. Flow rate and static pressure vary by model. The more powerful models move around 150 cfm, and have a static pressure around 5.5” mercury. Not recommended.

2. Pneumatic vacuum generator. These use compressed air and the venturi effect to produce a vacuum. They can produce almost as much vacuum pressure as an electric vacuum pump, but they need **lots** of high pressure air to do so. Unless you have a really large air compressor, you’ll need to run it continuously. These have the lowest vacuum volume flow rate, so vacuum pressure drops rapidly when clamping wood that is more porous and leaky. These devices have no moving parts, so aren’t likely to break down. Not recommended.

3. Electric vacuum pump - recommended. These are the units used by refrigeration and air conditioner industries. They produce the highest vacuum levels with a flow rate higher than a pneumatic generator, but lower than a shop vac. These need some kind of filter to prevent debris from getting into the pump. Relatively quiet.

4. Used refrigerator pump. If you are more resourceful, you could also use a compressor from an old refrigerator. I don’t know how the flow rate of those compare though. Good flow rate is needed to overcome inevitable vacuum leakage through the wood.

Some people might reason that they can tap into the intake of an air compressor to produce a very powerful vacuum. I haven’t tried it myself, but that seems like a good way to overheat a compressor and possibly ruin it.

The vacuum clamp

The body of the vacuum clamp needs to be made of some material that is very stiff, non-porous, and that adhesives can adhere to. I used a piece of maple which seems to be less leaky than other kinds of wood such as pine. I imagine that some other tight-grained wood such as cherry might also work well.

The clamp needs an air-tight seal around the clamp area. I use weather-strip tape that is spongy closed-cell PVC foam rubber that is self-adhesive. This tape is available in a variety of sizes, but the size I use is ½" wide x ¼" thick. I cut a groove around the clamp area for the tape to fit into that is the same width as, and about half of the tape thickness in depth. This causes the wood that you are clamping to rest on the surface of the vacuum clamp, and not fully crush the weather strip tape. This keeps the wood from caving in from the vacuum pressure by being in contact with the solid surface. I also include a piece of sandpaper glued to the clamp block to provide friction to prevent the wood from shifting around. The clamp will also need a hole drilled for a hose barb with male threads to connect the vacuum line. I use vinyl tubing with ¼" inside diameter. Use a hose barb to keep the connection from coming undone while in use. Vacuum leakage through the wooden clamp body may be reduced by sealing the wood with shellac or polyurethane if needed.

The area inside the weather strip tape should be as large as possible while still being able to completely cover it with a wedge blank. The clamp I made has an inside area of 2.75" x 10" = 27.5 square inches. The clamping force produced by the vacuum is approximately 1 pound per square inch for every 2" of mercury read by the gauge. A 20" mercury vacuum produces 10 pounds per square inch. Multiply this by the area inside the seal tape = 10 x 27.5 = 275 pounds of force. I tested this by putting the vacuum clamp on my table saw table, lifting up on the clamp I picked up one side of my saw from the floor. My workshop is 550 feet above sea level. Higher elevations such as Colorado should still be able to generate plenty of pressure to be useful, but the gauge will not read as high at higher elevations.

Plumbing

Most vacuum pumps are used for refrigeration and AC service, and have a ½" male fitting that will thread into ½" pipe fittings. Use Teflon tape on the connections. I connected a ½" cast iron tee to the pump with my gauge on the middle connection, and a steel nipple with ¼" inside diameter brass hose barb to connect a piece of ¼" ID vinyl tubing to the clamp. I bought a nice glycerin-filled vacuum gauge that reads 0-30" mercury for $15 through Amazon, it is very sensitive to pressure changes from leaks. Check the reading on the gauge each time before you make a cut to ensure the wood is held tight on the clamp. Avoid using wood that has cracks or holes; do not attempt to stop leaks in wedge blanks with tape.

Building the jig

The jig I made was only 5.5" tall before I nailed a piece of ½" plywood to the bottom because I used 2x6 lumber. Use 2x8 lumber in order to make it tall enough without needing the bottom layer of plywood. The plywood bottom gets in the way when adjusting one of the bolts. Here is a list of materials you'll need:

1. (4) 12" long pieces of good quality 2x8 lumber free of knots and defects.
2. (3) 3" steel hinges and mounting screws.
3. (4) 4" long screws.
4. (3) 4" long carriage bolts. Can use ¼ - 20, 5/16 -18, or 3/8 -16
5. (1) ¼" brass hose barb with male threaded end.
6. A piece of ¼" ID clear vinyl tubing

7. Fittings to connect tubing and gauge to pump.
8. Teflon tape
9. ¼” thick x ½” wide black pvc closed cell foam weatherstrip tape.
10. A piece of tight-grained wood such as cherry or maple 1”x4.5x12”

Steps to construct jig. Steps are numbered in pictures below.

1. Cut the 1x8 lumber into (4) 12” long pieces. Joint and plane all pieces flat, square, and parallel.
2. Rip pieces to 6” width. This is assuming that the maximum blade height on your table saw is 3”. If your blade height is different, then the boards should be no wider than twice this measurement minus ⅛ inch. 3 of these will be the body of the jig, and the last piece will be hinged for the fence side. From left to right, number the boards 1 to 4 on the top edge.
3. Measure the width of the flat area of the hinges not including the pin to determine the blade height for recessing the hinge on the front end between boards 3 and 4. Cut a wide shallow rabbet on both pieces to set the hinge. The inside edge will be used to keep the hinge axis square to the table. Pre-drill the holes for the mounting screws so the hinge is centered across the end.
4. Cut another recess on the left side of board 1 along the length and the hardwood board for the clamp, but this time make it wide enough to mount the entire hinge just below flush with the top surface of the body. Make another cut to acommodate the thicker hinge pin area so the hinges can lay flat on board 1.
5. Cut a recess along the right side of the length of the hardwood board to use for aligning the hinges. The hinge pin will be above the top edge of the hardwood.
6. Locate the 2 hinges for the left side, and carefully pre-drill for the mounting screws. Attach the 2 hinges near the ends of board 1.
7. Open the 2 left hinges and locate their position on the hardwood board keeping the edges of the hinges pressed against the inside

edge of the recess. Carefully pre-drill for the mounting screws, but only drill deep enough for the screws. Do not drill all the way through the hardwood.

8. Remove the hinges from board 1 and 3. Stack boards 1 to 3 together keeping the edges aligned. Clamp them all together tightly with a clamp or two. Use the long screws to fasten them together to make a solid block. Another option is to pre-drill and use lag bolts or carriage bolts instead - or nails. Counter-bore the heads below flush if you use bolts. Use enough fasteners to make sure it never falls apart. Leave a space in the center to drill a ½" hole for the tubing to pass through, and also around the adjustment bolt locations. If the fasteners poke through the other side then grind them flush.
9. Pre-drill holes for right side adjustment bolts in board 3 according to the size of carriage bolts you use. These should be no longer than the width of the jig body (about 4") The holes should be the next size smaller than the bolt so that they will form their own threads. These 2 holes should be close to the rear end of the jig near the top and bottom edges equal distance from the front hinge axis. Use carriage bolts or pieces of threaded rod. The bolts will need a hole drilled through the square section under the round head so they can be turned with a 1/8" hex key wrench. It will help to rub the threads of the bolt with a bar of soap or wax to make them a little easier to turn. The two holes near top and bottom will be used to eliminate the play in the hinge by forcing board 4 to rest on both bolt heads, these two will also be the fine adjustment to square board 4 to the table.
10. Pre-drill another hole in the center of the bottom left edge through board 1 for the left side adjustment bolt. Install the 3rd adjustment bolt the same way as the first two.
11. All 3 adjustment bolts will need a recess for the head in board 4 and the hardwood chuck body. Drill the recesses with a forstner bit where the bolt heads touch approximately ½" deep. This will allow both sides to close to square position without having to drive

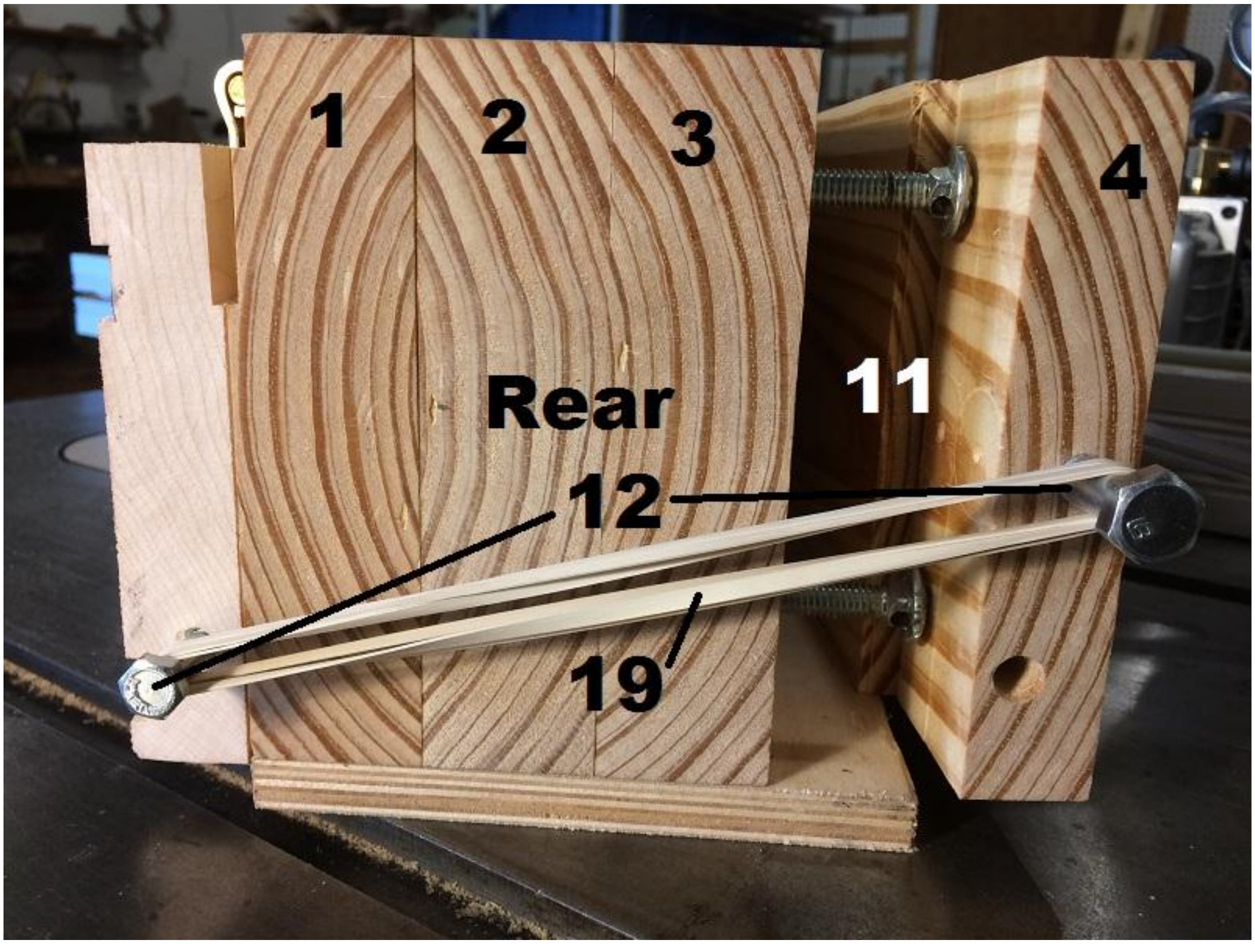
carriage bolts deeper than the square section below the heads. Extend the recess out to the edge because the contact point of the bolt head will move towards the edge as the angle is made larger.

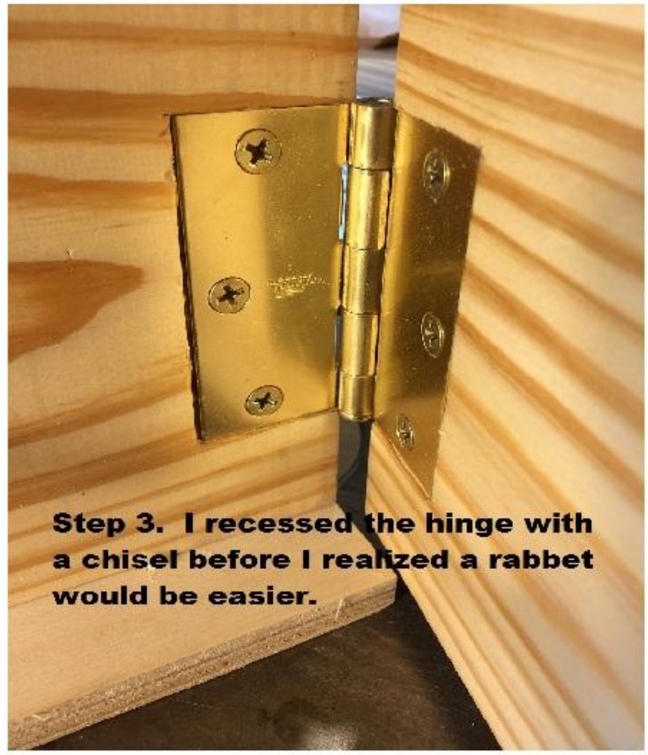
12. Pre-drill holes for 2 short ¼” hex bolts in the rear ends of the hardwood chuck body, and center of board 4 end. These two bolts will hold the rubber bands that keep the sides pulled down against the adjustment bolts.
13. Assemble the two sides to the body of the jig.
14. Drill a ½” hole through the center of the jig through boards 1-4 for the vinyl tube to pass through, it is especially important to locate the center of board 4 so the tube is above the saw fence while jig is on sitting on top or bottom. If your saw has a fence too tall for the tube to come out on the fence side of the jig, you’ll have to re-route the tube to exit the jig at the rear end between boards 3 and 4 to avoid interference.
15. Locate where the tube hole meets the hardwood chuck body. Drill a hole through the chuck body the right size for the brass hose barbs ½” male threaded end. Use a wrench to turn the fitting to form the threads. Finally, enlarge the hole through the body so the fitting will not interfere with the ability for the left side to close fully. The tube should be a loose fit in the hole so it can move easily as needed without kinks.
16. On the outside face of the hardwood chuck body, mill grooves sized to fit the weather-strip tape about half the thickness of the tape. I used a dado blade to do this with the hardwood chuck body removed from the rest of the jig.
17. Apply the weatherstrip tape into the grooves. Avoid any gaps between ends. The tape should stick up slightly above the surface of the wood.
18. Glue down a piece of coarse sandpaper to the center. Make a hole through the sandpaper over the hose barb connector for airflow. Do not get abrasive grains in the tube where they could possibly get sucked into the pump. A filter on the vacuum line would be wise.

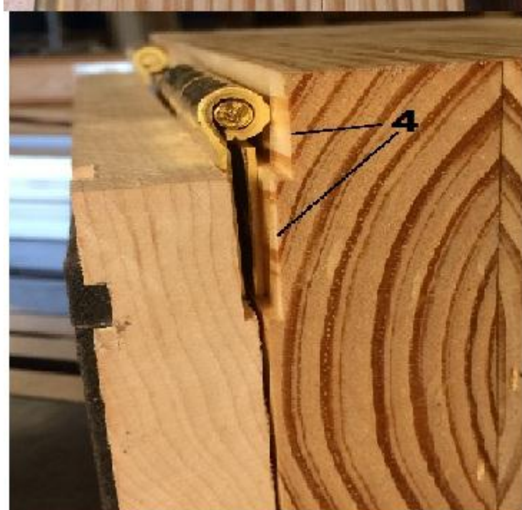
19. Install a few heavy rubber bands on the rear end of the jig. Jig construction is complete!

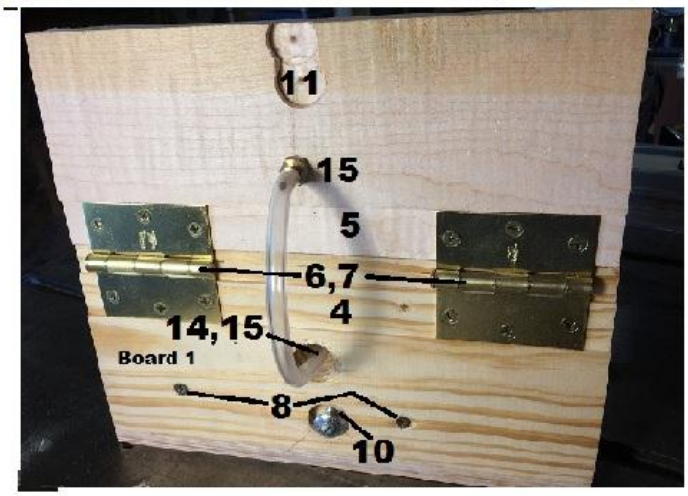
Photos

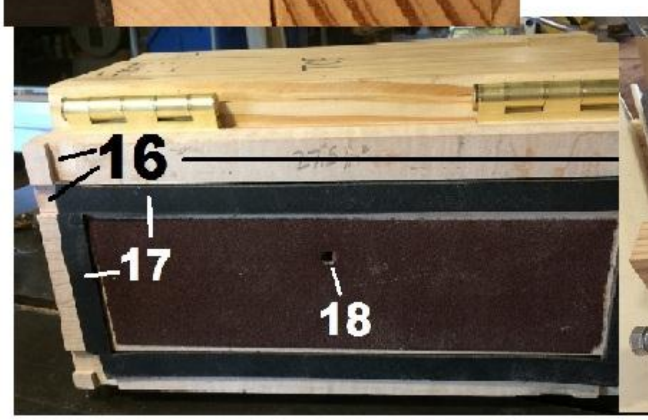
The numbers on the photos refer to the step numbers above.



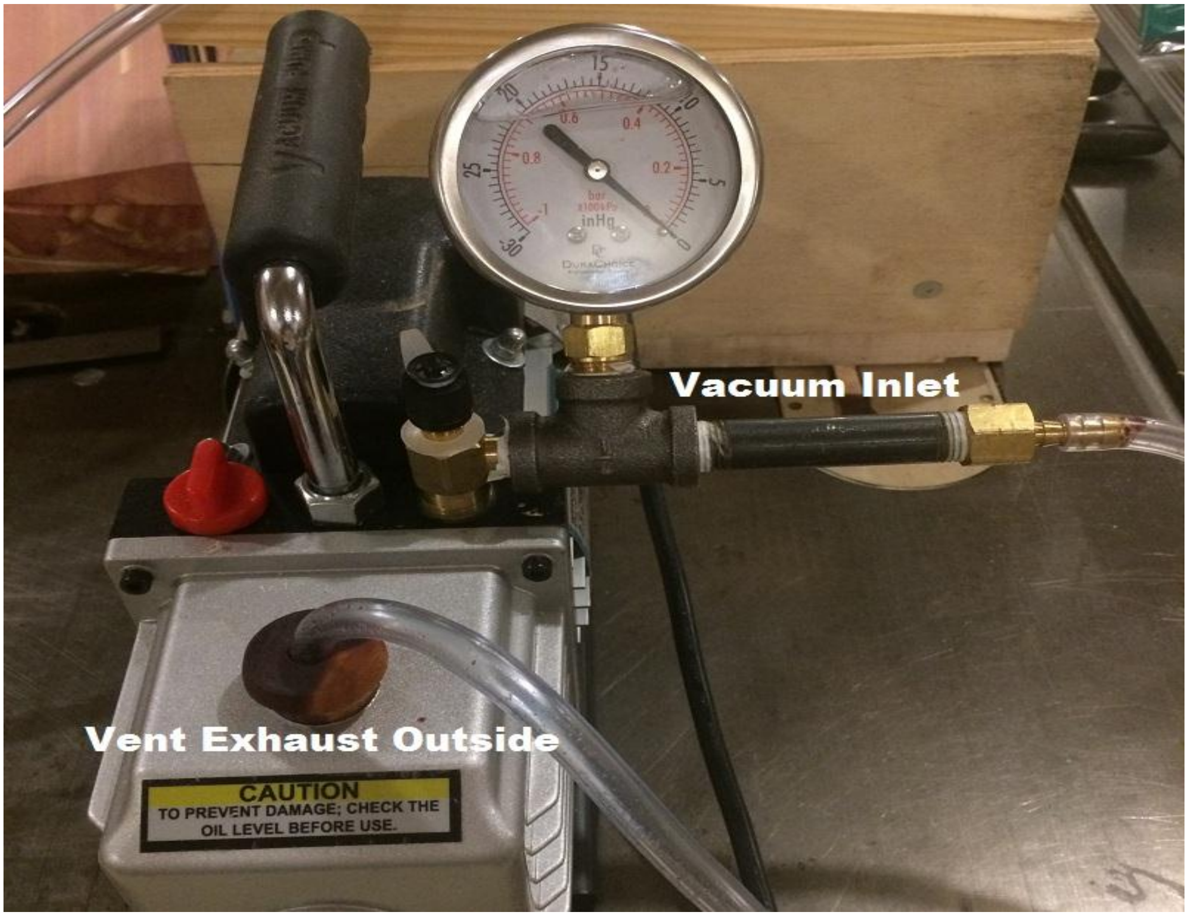

Step 3. I recessed the hinge with a chisel before I realized a rabbet would be easier.







Connecting to vacuum pump

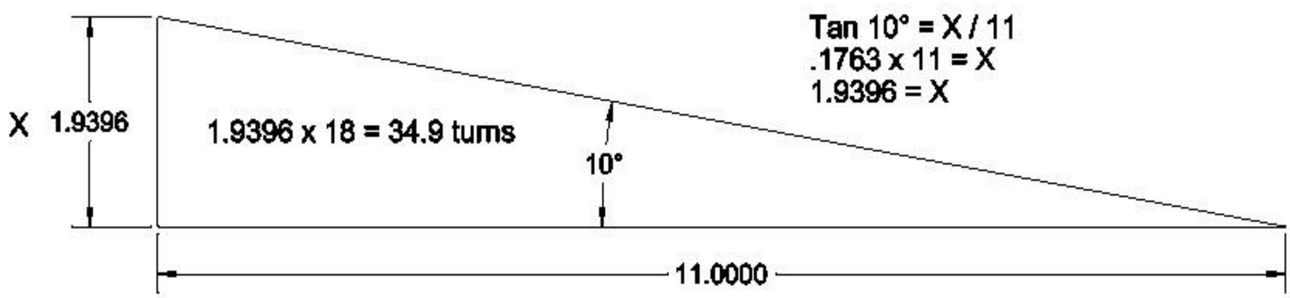


The 2.5 cfm vacuum pump from Harbor Freight works well, but you should modify the exhaust by making a tapered plug to fit the hole and pipe the exhaust outside to avoid breathing the oil mist. The pump will slowly lose oil as the mist condenses inside the tube and makes its way out. Yes, a better solution is needed.

Using the Jig

The jig can be used in 3 different ways – tapered width, tapered length, and no taper for re-sawing short boards. The saw blade should always be square to the table. When cutting a wedge that is tapered along the length, the right side of the jig is opened to the desired angle and the left side stays square to the table. For cutting a wedge that is tapered across the width, the right side is adjusted parallel to the left side and square to the table while the left side is set at the desired angle. To re-saw a board without a taper, then you simply close both sides.

By measuring the distance between the center of the adjusting bolt(s) and the center of the hinge, you can calculate how far to adjust the bolt to get the desired angle. By knowing the thread pitch of the adjusting bolts you can calculate how many turns to change the length of the bolt outside of the body of the jig. For example: If I wanted to cut a wedge tapered along the length with an angle of 10° knowing that the distance from the center of the bolt to center of hinge pin is 11”, and the adjustment bolt has 18 threads per inch, and starting from 0°.



It is very important to square the fence side of the jig to the table so when you flip the jig over to complete a cut you get the minimum step where the two cuts meet down the middle. The front hinge has a little bit of slop in it, so by forcing the right side to rest on top of two adjustment bolts instead of just one with the rubber bands you can fine adjust the squareness to the saw table. The left side has 2 hinges which should drastically reduce the amount of play on the left side so it shouldn’t require 2 adjustment bolts, although that wouldn’t hurt.

After you have made the adjustments you are ready to make a cut. Go through the checklist below.

1. Make sure the fence is parallel to the blade, and the blade is square to the table.

2. If you are making a wedge that's tapered across the width, attach the wood to the jig and then flip the jig over so the sharp edge of the outer wedge is cut first. You don't want the outer wedge to fall at the end of the cut jamming the sharp edge between the blade and throat plate.
3. Turn on the vacuum pump and move jig against fence and adjust fence if needed. Tip the wood parallel to the chuck and move it onto the chuck with bottom edge of wood in contact with table. Make sure the jig itself is not in the path of the blade.
4. When enough contact is made with the gasket, it will suddenly pull the wood onto the chuck. Don't let it pinch you. Make sure the highest point of the work-piece is below the plane of the top surface.
5. Read the gauge. Does it have a strong vacuum? Is the needle stable? Don't make the cut unless there is a strong, steady vacuum holding the work-piece. Make the cut keeping the jig against the fence. Don't force the saw, make the cut in a few passes raising the blade more for each pass.
6. After the blade has reached the height limit, lower it back to starting height and flip the jig over. Do not turn the pump off until both sides are cut all the way through.
7. Complete the cut using several passes. Keep an eye on the gauge in case you cut into a void or something that causes a significant pressure drop.

So you are probably wondering, "how much vacuum pressure is needed?" That will depend on the area inside the weather-strip gasket. There is no regulator to control the vacuum pressure, it just reaches a balance between volume flow rate and leakage. More vacuum pressure is always better since the work-piece rests on a solid surface to prevent distorting. Of course vacuum pressure is limited by the absolute atmospheric pressure at your elevation. Attach the vacuum chuck to a board and try to pull it off at different levels of pressure by opening the other inlet cap on the vacuum pump – get a feel for it by experimenting.

Most of the questions I get about making the scroll saw shells is about making the wedges, I hope that this makes that part easier. Let me remind you that I have several patterns available on my website with more coming soon. Your support is very much appreciated.