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Router Bits and Professional Woodworking Products

Technical Manual

Fourteenth Edition, Copyright 2011

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MLCS maintains a complete woodshop staffed with experienced woodworkers to answer all of your questions. All of our bits and products are tested and used in the shop, creating all the projects and samples pictured in the MLCS woodworking products catalog. This Manual is written from hands-on experience, to help you safely and successfully complete your woodworking project. Please read and follow the instructions for each bit, as well as the general guidelines and tips for routing. You can also call us and speak to one of our woodworkers if you need additional help.

Enjoy your woodworking!

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General Guidelines, Tips, and Safety:

- Always use your safety glasses, hearing and dust protection.
- Read and understand the instructions for both the machinery and cutters before starting to work.
- Use safety devices such as pushblocks, featherboards or bit guard/blade guard where appropriate.
- As a general rule of safety, please keep your fingers and hands at least one hand length from any cutting blades.
- When using the router, pay particular attention to the condition of the collet. Frequently, bit breakage and poor performance can be directly attributed to a worn or damaged router collet.
- Always inspect a router bit before use. Remove any wax coating from cutter blades and bearing. Check for chips in the carbide, frozen bearings, worn shaft, and be sure set screws and nuts are tight in bit assemblies.
- Always change bits or make adjustments with the router unplugged.
- Make sure the bit shaft is set at least 3/4" into the collet, but not bottomed out in the collet. The end of the shank should be about 1/16" up from the bottom of the collet.
- Multiple light passes cut more smoothly and easily than one heavy pass. Proper bit RPM is important, especially with larger, heavier bits. In general, burning of the wood or excessive vibration can be corrected with a slower rpm and a lighter cutting pass.
- Use a variable speed router or speed control to reduce the speeds when cutting large diameter bits, as follows: 1/4" to 2" D-- 18,000 RPM; 2-1/8" to 2-1/2" D—16,000 RPM; 2-5/8" to 3-1/2" D—12,000 RPM. Bits with a carbide height greater than 1-1/2" should also be run at 16,000 RPM or less and it is EXTREMELY IMPORTANT to make multiple passes with these router bits.
- Be aware that some cleaning solvents can dissolve the lubricating oil in bit bearings. Either remove the bearing or re-oil it after cleaning a bit.
- Failure to follow all safety instructions and warnings can result in serious bodily injury.
- In no event shall we be liable for death, injuries to persons or property arising from use of our products.
- Defects from misuse, abuse, negligence, or alterations are not covered by the warranty. Our liability is limited to replacement or refund of the product.

All varieties

MLCS is proud to offer an extensive variety of bits to make rail and stile frames for doors. These frames use “cope and stick” joints at the corners, which give a strong tongue and groove joint and a mitered molding look on the inside detail. A groove or rabbet is also created at the same time to hold a raised, flat, or glass panel.

Router: A reliable quality router will cost over \$120 and be worth every penny. MLCS carries bit sets for either 1/4” or 1/2” collets. The 1/2” collet is more versatile, because it accepts a wider variety of bits, including the larger 3 1/2” Raised Panel cutters. 1-1/2 to 2 HP is powerful enough for most work. In all cases, we strongly recommend being able to slow the speed of the router, either with **the MLCS #9400 or #9410 Router Speed Control** or one that is built into your router. This will enable you to better control the work piece and minimize burning on the more resinous woods such as cherry or maple. Speed control is especially important on less expensive routers, as bits can vibrate excessively at full speed. Finally, the router should be table-mounted. A sturdy, flat router table and a solid squared fence are important for producing quality doors. Routing rails and stiles freehand is **NOT** recommended.

Choosing Your Materials

Rails and Stiles: Wood for your rails and stiles should be straight-grained and knot free. Ends and edges should be square to the face of the wood. Consistent thickness throughout will save you hours of sanding later.

Raised Panels: Wood should be selected and glued up to best highlight a “cathedral” or “book-matched” grain pattern. For 3/4” thick stock, you may need to undercut the back of the panel to produce a 1/4” tenon. Choose a material for the panels. Solid wood is traditional, and must float free in the frame to allow for expansion. Solid wood panels must be “raised,” using one of a variety of MLCS Raised Panel bits.

For Painted Doors: MDF (Medium Density Fiberboard) is an excellent alternative to solid wood if you are painting your raised panel doors. It comes in large sheets, machines well, and will be less expensive than solid wood.

Using Flat Panels: 1/4” Plywood Panels in your rail and stile frame look nice in certain applications, and open up the possibility of a veneered panel. (See page 7).



Choosing a Bit or Bit Set

All styles make equally good cuts and joints. There are a variety of profiles and styles from which to choose. The rail and stile bits make a 3/8" wide profile, or a 3/8" deep rabbet in the case of the glass door bits. All the grooves for panels are 1/4" thick x 3/8" deep. (EXCEPTION: French Provincial Bit #8849 is 3/16" thick). The Window Sash (#8893, 8894), Miniature #8848 cut a 1/4" deep profile and joint, and #8845 cuts a 7/16" deep joint.

Reversible Rail & Stile: The slot cutter, profile cutter, and bearing are assembled on a shaft in two different arrangements to produce the end cope and profile/groove cuts.

Matched Rail and Stile: Two separate bits make the required two cuts. No re-assembly needed.

Matched Miniature Rail and Stile: Two separate bits make the required cuts. Again, no re-assembly needed.

Stacked Rail & Stile: Two profile cutters, a slot cutter and a bearing stacked on a single shaft make both cuts by raising and lowering the entire assembly in the router table. (Available in 1/2" shank only)

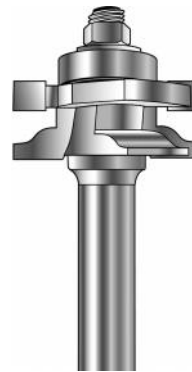
Matched Entry Rail & Stile: A two bit set that cuts the profile detail on both sides of the wood with a slot between them. Use with 1-3/8" Stock for interior doors and 1-3/4" stock for exterior doors. (Available in 1/2" shank only)

Glass Door Reversible Rail & Stile: Same as the Reversible Rail and Stile, but with two slot cutters to produce a rabbet instead of a groove.

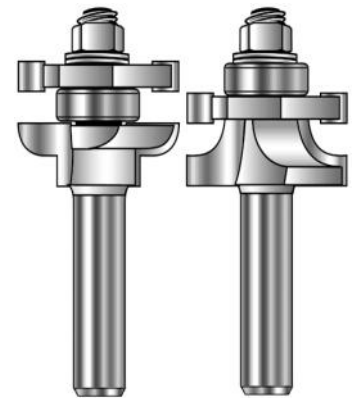
Window Sash/ Miniature Rail & Stile: Both bits work the same as the standard reversible bit, except these cut 1/4" deep instead of 3/8", and leave a rabbet for the glass. These are the best choice to make divided lite doors and mullions as they cut a narrower profile.

Shaper: Shaper versions of the bits work exactly the same as their router bit counterparts, but have three wing cutters and run at a slower speed.

Rails & Stiles



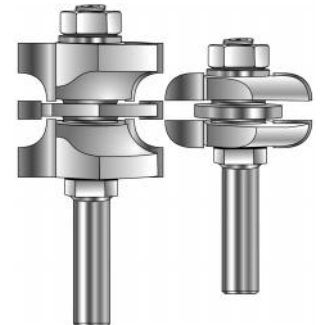
Reversible R & S



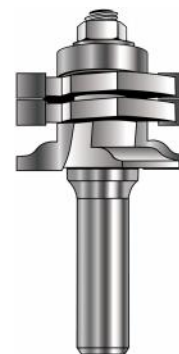
Matched R & S



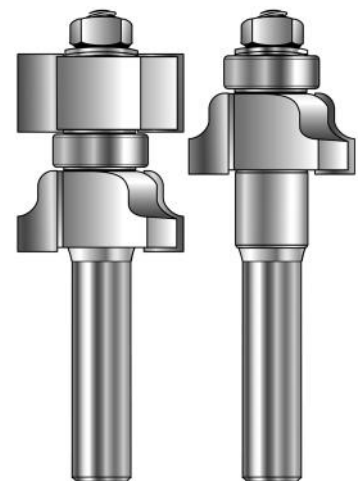
Stacked R & S



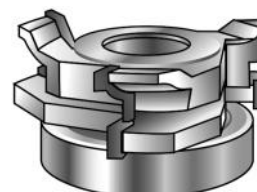
Matched Entry R & S



Glass Door Reversible Rail & Stile



Window Sash Set



Rail and Stile Shaper

Parts Preparation

Prepare enough wood for all of your rails and stiles, plus some test pieces. Decide how the door will sit in the opening: Flush, 3/8" Overlay, or Full Overlay (Fig. 6). The width of the parts depends on the design of the door. About 2 – 2 1/2" is average. **Raised panel Project Calculator (#9101/#9112)** can make your door planning easier to create perfect doors, using computer software.

RAILS: The rails (horizontal pieces) determine the width of the door and should be cut to exact length. Determine the rail width based on the width of the opening, the width of the stiles, and remember to add 3/8" on each side for the joint overlap. The ends of rails are known as tongue or "end cope" cuts.

STILES: The stiles (vertical pieces) can be left a little long to be trimmed after the door is assembled.

PANELS: Select and glue up solid wood panels at this time. Panel pieces should not be cut to exact size until the door frames can be dry-assembled for an exact measurement. The panel should be slightly smaller so it will "float" in the groove.

MAKING YOUR DOORS

If you are using a set-up block, refer to page 9 before continuing.

Reversible Rail & Stile: Start with the bit assembled in the tongue/"end cope" arrangement (Assembly A). You will find thin copper spacers with the bit--put them aside for the moment. Set the bit into the router table and adjust the height so that you get a complete cut on your stock. The exact measurement isn't critical. Set your router fence flush to the bearing. Select a test piece and feed the end through the bit, using your miter gauge or a "push block sled." Keep the piece square and look for a clean even cut.

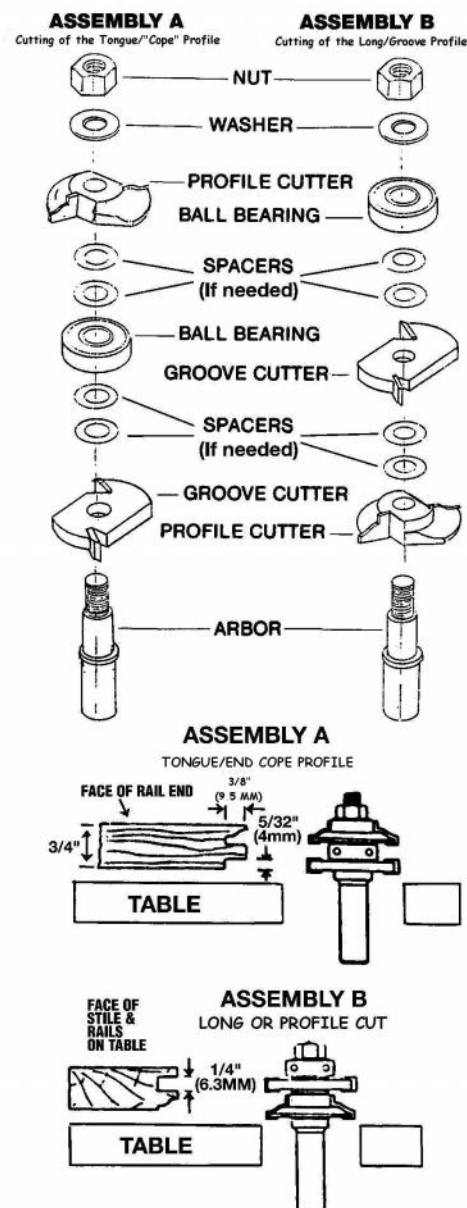
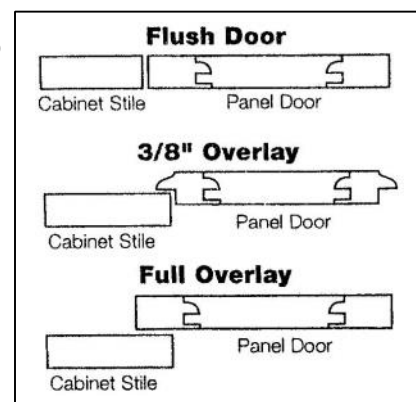
IMPORTANT: When using 1/4" shank bits, always make 2 to 3 passes ending at the bearing.

Now re-arrange the bit into the "long" or profile cut (Assembly B).

Be careful--it is possible to assemble the cutters backwards.

The flat side of the carbide should face into the cut. Do not change the fence; it is already set to the bearing. Adjust the height of the bit to match the previously-cut piece; then run second test piece. **If the fit is good, no shims are needed.** If the fit is too loose, go back to the first cut, add two shims above or below the bearing in the stack, and cut another tongue/"end cope" test piece. The shims can only widen the tongue on this end cope. Determine how many shims are needed (0-4) and note this for future reference. Finally, be careful not to over-tighten the top nut, as this will destroy the shims.

Fig. 6



Rails & Stiles

The bit height adjustment will correct a “step” at the joint (**Figure 7**), assuming that your wood is of equal thickness. Set up and run all of one side of the joint (and maybe an extra or two); then run all of the other side. All of the rails and stiles for an entire kitchen can be cut in an hour or so.

Rail and Stile Pointers and Problem Solvers

Tongue and Groove too tight or loose: On the rail end cope cut, add shims above or below the bearing to make the tenon thicker, thus tightening the joint. Remove shims to loosen.

Misaligned Corners: 1) One wood piece may be thicker than the other. 2) Bit height is not correct. Double-check for accuracy.

Joint Doesn’t “Match” Gaps Top or Bottom: Your wood end may be out of square with face. Check to see if you are cutting full depth of bit to bearing or your router is not square to the table.

Burning: Decrease router speed and feed work faster. Check the rail and stile bits to make sure the cutter is not reversed.

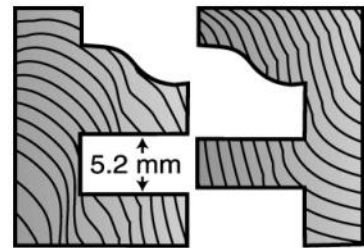
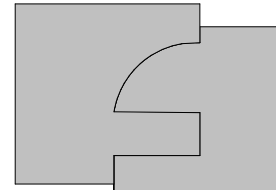
Matched Sets, Stacked, Entry and Shaper bits are all adjusted for fit and height exactly the same way.

PLYWOOD PANEL CONVERSION KIT (#296):

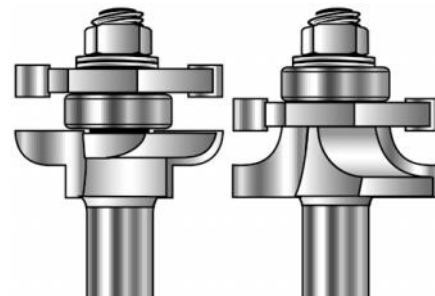
Item #296 comes with two slot cutters allowing the user to quickly convert a matched Rail & Stile set from standard 1/4” joints to 5.2 mm in order to use European plywood for panels.

When changing bits for 5.2 mm use, one slot cutter has 5.2 mm teeth and one has 1/4” teeth. The 1/4” slot cutter **MUST** be installed on the Tongue or “End Cope” cutter. This will produce a 5.2 mm tongue. The 5.2 mm slot cutter is installed on the Rail and Stile bit to produce a 5.2 mm groove allowing the user to fit a 5.2 mm or European plywood panel in place of the standard 1/4” panel.

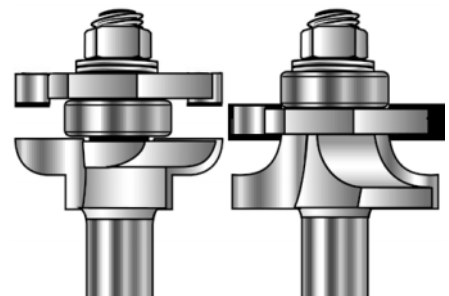
Figure 7



Plywood Panel Conversion Kit #296



**Matched Rail and Stile
(Original Configuration)**



**Matched Rail and Stile Set with
Plywood Conversion Kit #296**

Rails & Stiles

Making Rail and Stiles with Rabbets

There are times when you need a rabbet instead of a groove in your door frame. Always do this for glass doors to allow for replacement. Stained glass, pictures, fabric panels, and many other materials are best installed in a rabbet, from behind, in a door frame. (*Figure 8A*)

Create a rabbet in a normal door frame by assembling the frame empty, running a 3/8" rabbeting bit around the back, then cleaning out the rounded corners with a corner chisel (**MLCS Item #9541**). If you need rabbeted frames regularly, choose one of the MLCS glass door assemblies, or a Window Sash bit. Use these bits just like the reversible styles, except install the spacer provided when making the end cope. (*Figure 8B*)

Panels:

Dry assemble your Rail and Stile frames with clamps. Check the outside dimensions now. All MLCS bits make a 3/8" deep groove, but none of the panels should bottom out in the groove.

Remember! Size the solid wood panels to allow for expansion and contraction with the seasons. A 10" wide panel can move as much as 1/4" over the course of the year! Leaving 1/8" on each side for seasonal expansion is fine. Depending on the style of bit and thickness of wood, you may need to undercut the back of the panel to bring the tongue to 1/4" thick or make the panel flush to the frame. Check your dimensions **twice** and cut the panels to size.

Always run larger raised panel bits in a router table at a reduced speed (*See page 3 for recommended speeds*). Take light cuts by raising the bit or adjusting the fence (**WARNING: When using a raised panel bit with an undercutter, do not attempt to raise the bit. You must adjust the fence back to make multiple passes when using a raised panel bit with an undercutter**). 3 or 4 light passes will give the smoothest results. Some router tables do not have a large enough table opening for these large panel bits. Solve this by using a "false top" with a larger opening fastened down to the original table (*Figure 8C*). This tip works for small fence openings too. **Note: When using the raised panel bit with undercutter, the 3/4" thick panel may be proud (not flush) of the 3/4" thick rail and stiles, depending on the set up.**

For a professional look, sand and finish the panel completely before assembly in the frame. Then, glue up the rail and stile frame, make any final size adjustments, and add the outside edge detail.

Figure 8A

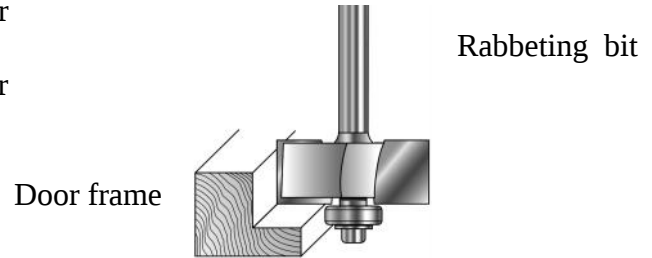


Figure 8B

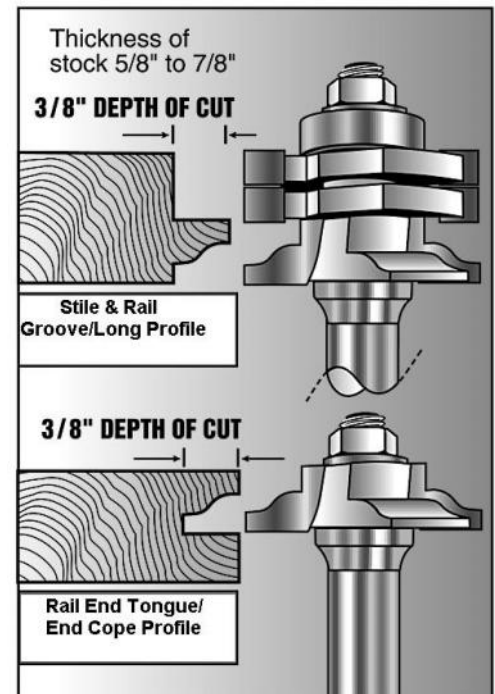
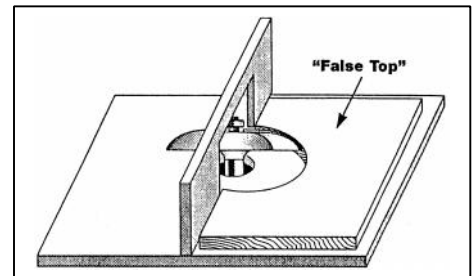


Figure 8C



USING SET-UP BLOCKS ON 3/4" THICK STOCK **(For Rail and Stile Doors)**

Items #9741-9748
#9790-9791

See pages 4-8 for instructions on how to use these router bits/shaper cutters. The stock you are using must be 3/4" uniform thickness for proper set up using the set-up block. We recommend that you start with the cope/rail end (tongue profile) first.

NOTE: the set-up block is not guaranteed to match the profile cut; it is guaranteed to allow the router bit/shaper cutter height to be set quickly and properly.

Install into your router/shaper table, the correct router bit/shaper cutter assembly to create the cope/rail end. Using the set-up block, raise or lower the cutting profile so it corresponds with the proper cut on the set-up block. **NOTE:** If you are using a coping safety sled (MLCS item #9544, #9546 or #9548), you must compensate for the thickness of the sled base when setting the router bit/shaper cutter height.

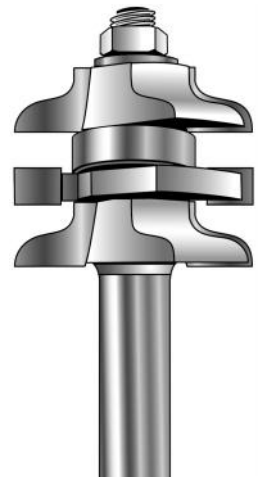


Using a piece of scrap stock, the same thickness as your rail/stile stock, make a test cut. For 1/4" shank router bits, adjust the fence to make the full cut in 3-4 passes; or, for 1/2" shank router bits or shaper cutters, adjust the fence to make the full cut in 1-2 passes. When making the final pass, the fence should be properly aligned with the router bit/shaper cutter by placing a metal straight edge across both the infeed and outfeed fences of the router/shaper table fences. The straight edge must also be in contact with the ball bearing guide/rub collar or smallest diameter of the carbide cutting surface if no ball bearing guide/rub collar is used. When you are satisfied that the cope/rail end cut is correct, proceed to make your actual cope/rail end cuts.

After you have completed the cope/rail end cuts, remove the router bit/shaper cutter assembly and install the correct router bit/shaper cutter assembly to make the stick/stile cut. Using the opposite side of the set-up block raise or lower the cutting profile so it corresponds to the proper profile cut on the set-up block. Now, using one of the rail pieces cut in the previous step, verify that the profile cut on the rail piece mirrors the cutting profile on the router bit/shaper cutter assembly. If the tongue on the rail piece and the slot cutter on the router bit/shaper cutter assembly are not exactly at the same height, adjust the router bit/shaper cutter assembly height accordingly.

Make another test cut, again using a piece of stock the same thickness as your rail/stile stock. Follow the same guidelines as you did when making the test cut in the rail piece. When you have completed this cut, test the fit against one of the cope/rail end pieces you have already cut. If the joint properly fits together and the height of the pieces properly align, proceed to make your actual stick/stile cuts.

NOTE: In order to get a proper joint, it is important to make sure that the router bit/shaper cutter assembly is cut the full depth to the ball bearing guide/rub collar. Also, your stock must be of uniform thickness and your height adjustment must be properly set.

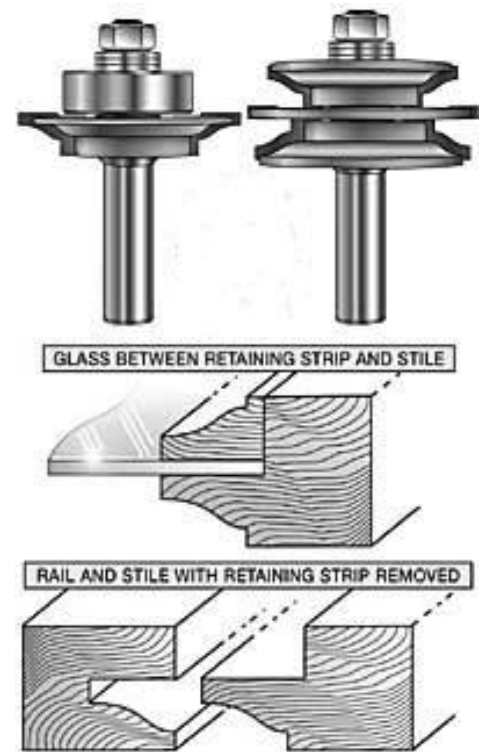


Item #8845

MATCHED RAIL & STILE CUTTERS FOR GLASS DOORS WITH RECOVERABLE BEAD

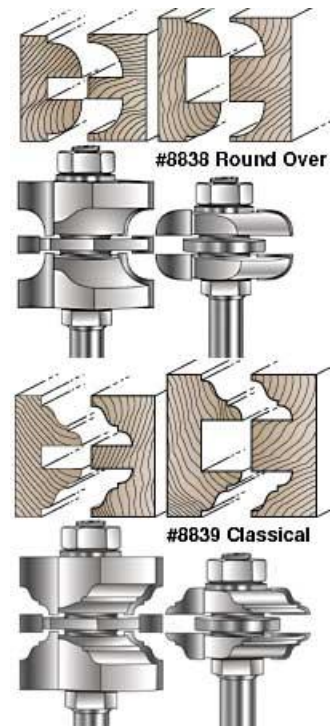
****NOTE:** Crosscut the rails (horizontal pieces) $\frac{7}{8}$ " larger than final length (to allow $\frac{7}{16}$ " at each end for cope into stiles). Rip both the rails and stiles $\frac{1}{8}$ " wider than final width to allow for cutting off the retaining strip. For example, for a $1\frac{1}{2}$ " rail or stile, start with $1\frac{5}{8}$ " piece of stock.

1. Use the router bit with profile cutter and bearing to make the cope cuts on the ends of your rail pieces (horizontal pieces).
2. Change to second router bit and adjust the bit height so that the bottom profile cutter matches the height of the profile cut on the ends of the rails when they are placed face down on the router table top. Because of the amount of material being removed, a better cut result may be achieved by making more than just one pass. Adjust your router fence between cuts until a straight edge touches both fence faces and the carbide at the innermost point between the top (when installed in your router table) profile cutter and slot cutter.
3. After cutting the profiles on the inside of your rail and stile pieces, use a $\frac{1}{8}$ " straight bit, or a $\frac{1}{8}$ " kerf saw blade on your tablesaw, to remove the portion of the wood that protrudes further at the depth and distance of the slot.
4. Assemble and glue the rail and stile. When dry, measure for the glass panel, allowing $\frac{1}{16}$ " on all four sides for any seasonal wood movement. Place the glass panel into the door frame.
5. Measure and miter at 45 degrees the retaining strips removed in step 3 and secure them with brads—Do NOT glue them in place or you will not be able to replace the glass if it should break!! You may want to predrill the brad holes in the retaining strip to avoid splitting them while you are installing them. Be careful not to strike the glass while driving brads in.



IMPORTANT POINTS

- ♦ Always use a router table and fence. These cutters should **NOT** be used freehand.
- ♦ Cutters should **ALWAYS** be run at a **REDUCED SPEED**. Use the **MLCS #9400 or #9410 Speed Control** or a variable speed router.
- ♦ This bit set comes assembled for making a 1/4" tongue and slot. If you are going to make a 1/2" tongue and slot, make sure to replace both the slot cutter and spacer/rub collar or your rails and stiles will not properly match up.
- ♦ Check the top nut when you first receive your cutters and periodically with use. The nut should be very snug, but not over-tightened. This will destroy the adjustment shims.
- ♦ Use Push Blocks (**MLCS #9138, #9139 or #9140**) and a miter gauge or sled to feed your rails and stiles. **NEVER** use fingers to feed narrow stock!
- ♦ A 1-1/2 HP **PROFESSIONAL QUALITY** router will cut the profile in one pass. You can make the cut in 2 passes in difficult wood by adjusting the fence.



DESIGN AND CONSTRUCTION

- ♦ The cope and stick corner created by the bits is not strong enough by itself for a full-sized door. Our favorite method for reinforcing the corners is to assemble the door, then drill through the outside stiles and add screws or dowels into the rails.
- ♦ Glass panels can be made by assembling the door then routing out the profile on one side with a 3/8" Rabbeting Bit. Clean up the corners with a chisel, then make a small piece of molding to hold the glass in place.
- ♦ Panels for the door can be made using any of the MLCS Raised Panel bits. They can be "raised" on one or both sides. Depending on the profile you select, you may have to adjust the thickness of the panel stock so you end up with a 1/4" or 1/2" tongue to fit the frame groove. You can also use 1/4" or 1/2" thick veneer plywood for flat panels.
- ♦ **NOTE:** Veneer plywood will be a true 1/4" or 1/2" while cabinet grade plywood may be up to 1/32" undersized on the thickness, possibly leaving a loose, rattling panel.

3-in-1 Shaper Sets

MLCS Items #1008 & 1009
KATANA Items #11008, #11009

***NOTE: These cutters do not utilize a rub collar to control the depth of cut. Please use these with a fence or optional rub collar #9126 for cathedral doors.*

***Always make the end grain cuts first to avoid tearing out additional material on the long grain cuts.*

MAKING PANELED DOORS

1) Install the Shaper Cutters stacked as shown in **Figure 12A** for the cuts on the ends of the rails (this will create the tongue on the rails).

2) Set the cutter height so that you have at least 1/8" to 3/16" above the tongue. Set your fence so that the carbide protrudes exactly 3/8" from the fence (if it is less than 3/8" you will not get the full cut, and, if it is more than 3/8", you will shorten your rail length). For narrow rails, use a miter gauge or a Coping Safety Sled (MLCS Item #9544, #9546 or #9548). Cut your rails.

3) Leaving the fence at the same position, change the shaper cutter stacked as shown in **Figure 12B** for the long cuts on all pieces (both rails and stiles). Using the rail ends that you have already cut, adjust cutter height so that the 1/4" slot cutter is lined up at exactly the same height as the 1/4" tongue on the rail end. Run a piece of scrap and check for fit. Adjust cutter height as needed to get a flush fit. Cut the stiles and long cuts on the rails.

Figure 12A

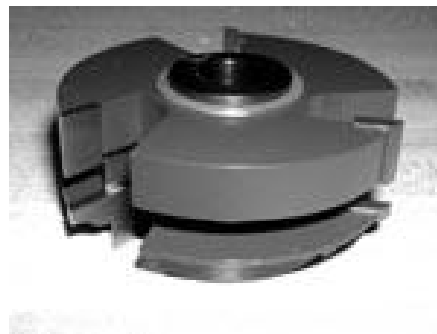
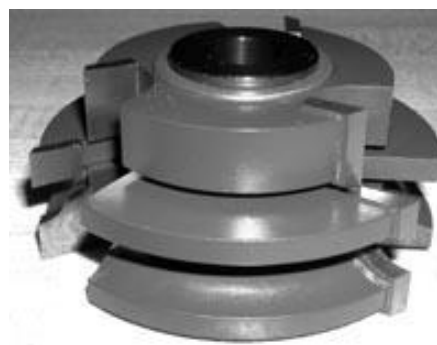


Figure 12B



3-in-1 Shaper Sets

MAKING GLASS DOORS

1) Follow the same directions as making paneled doors above, with the exception of how the shaper cutter will be stacked. Please refer to **Figure 13A** (long cut) and **Figure 13B** (rail/cope cut) for proper stacking order.

MAKING TONGUE and GROOVE JOINTS

- 1) Refer to **Figure 13C** for proper stacking order of the cutters.
- 2) It will be easier to set up if you make the tongue cut first.
- 3) Set the cutter height so that the large 1/4" slot cutter is at the top of your stock. This will center the tongue in 3/4" stock and place the tongue 1/4" from the top of the stock.
- 4) Set the fence so that 3/8" of the carbide protrudes from the fence. Run your first piece of stock. When properly set, just the tongue will touch the outfeed fence.
- 5) To cut the groove, leave the fence set and remove all but the larger diameter 1/4" slot cutter. Use the tongue to set the cutter height, as the slot cutter should be exactly at the same height as the tongue on the piece of stock cut previously. Run a scrap piece and check for fit. Adjust as necessary to get a flush fit and then run the remaining piece.

Figure 13A



Figure 13B



Figure 13C



Cathedral Doors

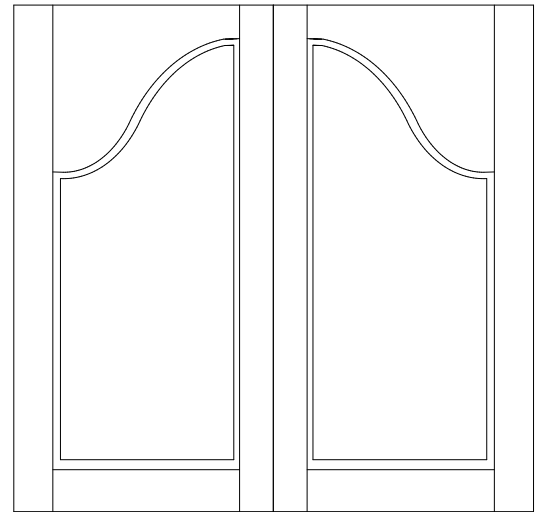
Sets #9377, 9378

It is easy to make your own elegantly curved cabinet doors using **MLCS** router bits and **Cathedral Door Template Guides**. Our set of templates includes seven sizes of curves, allowing you to make doors from about 10" wide to over 22" wide.

Please familiarize yourself with the techniques and procedures for making straight rail and stile doors before trying the cathedral type. Review the **MLCS** instruction sheets for making Rail & Stile Router Bits (*See Pages 4-8*).

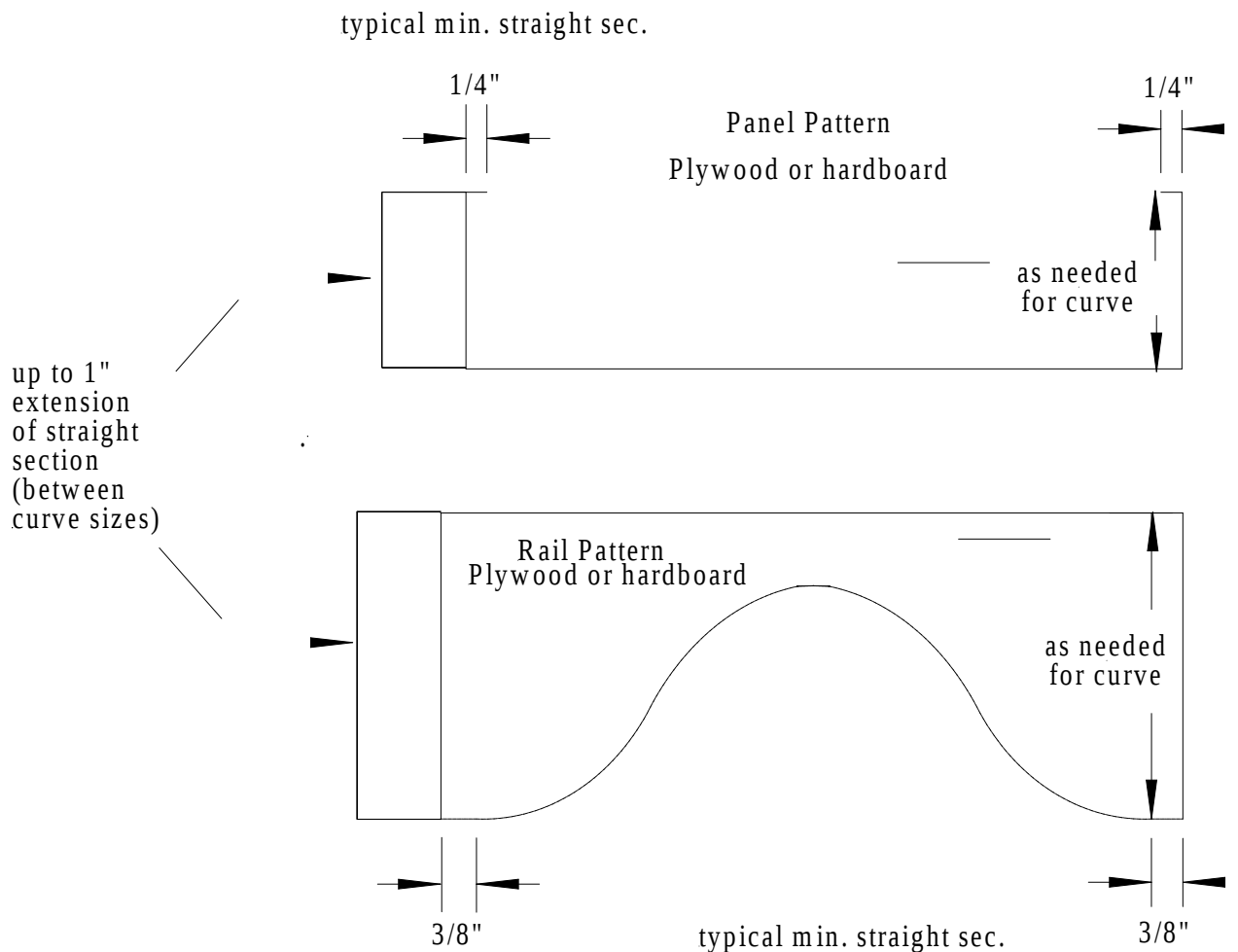
MAKING TEMPLATES FROM PATTERNS. It is possible to transfer the curve shapes from the patterns to plywood or hardboard in several different ways. Use carbon paper to trace the curve onto the template material, and square off as shown on the sheet entitled "Create the Patterns" (*See next page*). Cut out the shape and sand smooth. A small notch at the centerline of the template will help with alignment. Another way to transfer the curves is with a "ponce wheel." This is a wheel with sharp points around its edge and a handle. You roll it around the pattern. Then rub chalk over the holes made in the pattern by the wheel and onto the wood. You can buy a ponce wheel at a sewing supply store. **NOTE:** Even though the curve for the rail and corresponding panel look the same, remember that the panel fits into a groove in the rail, so the two curves are *slightly* different.

DESIGN. When designing a kitchen or series of cabinets with cathedral top doors, try to keep all the doors about the same width if possible. To make doors in sizes between the two-inch increments of the templates, simply add to the length of the straight sections at the ends of the curves or adjust the width of the stiles. Another technique for using the cathedral patterns is to use half of the curve to make one door and the other half for a second door. This layout looks great in an entertainment center or china cabinet.



CREATE THE PATTERNS:

- 1) Select a panel and rail curve for the door size.
- 2) Transfer curve to 1/4" plywood.
- 3) Square the piece to about 3" to 4" long.
- 4) Cut out and sand smooth to lines.
- 5) The 1/4" for the panel and 3/8" for the rail are the panel tongue and the joint overlap. These can be extended to widen the door to a dimension between the curve sizes.

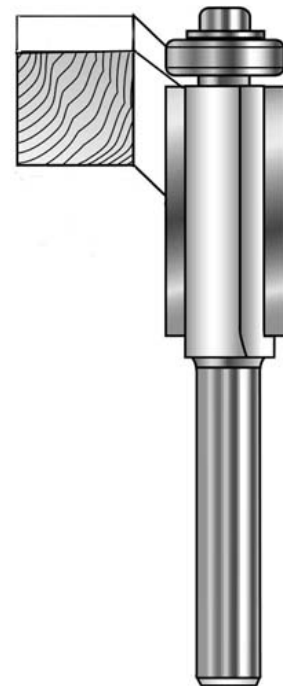
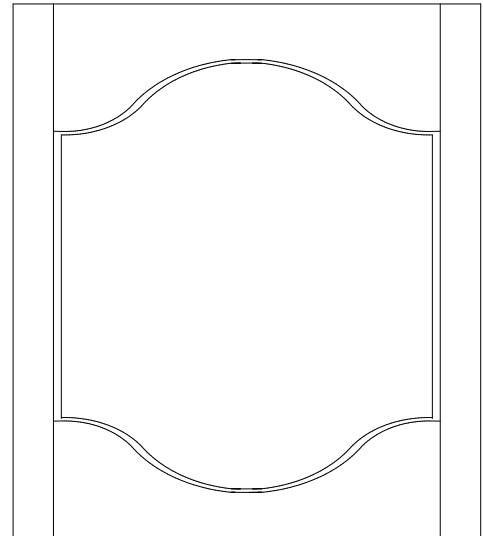


Prepare your stock as you would for straight doors. Be sure that edges and ends are square to each other and to the face, and that all of the rail and stile material is of uniform thickness. Have a few extra pieces for test cuts. For the curved rails, the stock needs to be wide enough to accommodate the curve. This means you may need 4-5 inch width for your rails. Stile material is usually around 2 inches wide. Rails need to be cut to the exact length at this time. This length is determined by the required width of the door. Stiles can be left a little long for now. For more help with the setup and sizing see the **MLCS** video “**Making Your Own Raised Panel Rail and Stile Doors**” (**MLCS Item #9063 VHS or #9068 DVD**).

When making curved rails, the end or “cope” cut must be done first. Set up your bit in the router table, and cope the ends of all your rail stock, including the wide ones for the curved pieces. Also make a few extras for test cuts. Select a curve pattern template from the “Rails” set that is closest to your rail length without being longer. Remember that you can lengthen the 3/8” straight part of the curve to get to the width that you need. Use double-faced tape to attach the template to the rail blank, using the center mark to help you align it. If everything is right, the template ends should be parallel to the coped ends of the rail.

Cut along the curve with a bandsaw, coping saw or jigsaw to within 1/8” or so of the template. Be careful not to cut into the template. If you are afraid you may damage the template, you can trace the line of the curve and cut it out before taping the template down. Trim the rail to the template being careful of the grain direction of the wood.

Set up a flush trim router bit (**MLCS #5503 or #7804 or KATANA #15503 or #17803**) in the router table. This is used to cut the curved shape of the rail to the exact shape of the template. It is best to have a minimum of material to remove with the bit; that’s why you cut to within 1/8” or so in the previous step. This is also a good time to practice with a *starter pin* in your router table. A starter pin is a short pin that is set into the baseplate near the bit opening, which acts as a fulcrum to help you pivot the workpiece into the spinning router bit safely and easily. You will be using the starter pin again later when cutting the profile and groove into the curved rail.



Try to always cut with the grain, even if you need to *climb cut*, that is, cut with the rotation of the bit instead of the usual against the rotation. Feed lightly and *use your push blocks!* The **MLCS** video (**#9063 VHS or #9068 DVD**) shows this technique. **REMINDER:** Be aware that climb cutting tends to pull the work into the bit.

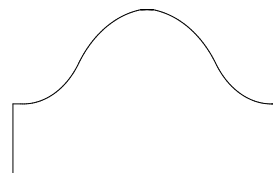
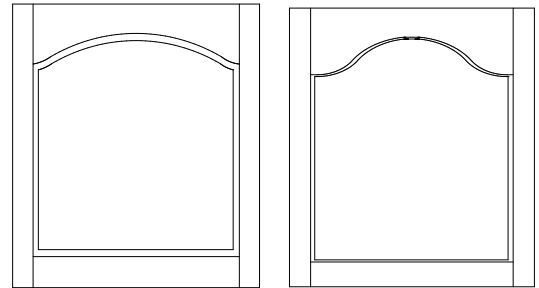
Next, change your router bit setup to cut the profile on the rails and stiles. This is the detail and groove that is around the inside of the doorframe. Make the cuts on the straight pieces of the frame, then set up the starter pin again as you did when shaping the curved rail. Cut the profile and groove on the curve, again using the pin to guide the workpiece into the cut.

At this point you should have four doorframe pieces, including the curved top, which fit together to form the door. Dry-fit the pieces and check your width measurement again. Mark the stiles to locate the rails for the required door height. Measure the inside of the frame at this time to determine the size of the raised panel blank. Make it about 1/4" bigger than the frame inside dimension on all sides (e.g. a 10" wide frame needs a 10-1/2" wide panel). First, cut the panel blank square, then choose the matching template or prepare a pattern for the panel curve as you did for the curved rail.

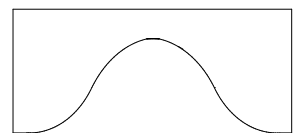
Follow the same procedure that you did for the curved rail, first cutting to shape and flush trimming. Next you will set up your raised panel bit in the router table with the starting pin. Refer to the Video for helpful hints. Start with the bit just above the work surface and take light cuts around the four sides of the panel. All panel bits should also be run at a reduced speed, using either a variable speed router or the **MLCS (#9400 or #9410) Router Speed Control**.

Continue raising the bit and taking light passes until the panel has a 1/4" tongue. **WARNING: Do NOT attempt this if you are using a bit with an undercutter!**

Test fit the panel in your doorframe and, if everything fits, proceed to assembly and finishing. Remember not to glue the panel into the frame groove; it must float freely. Use the rest of the patterns to create the size of doors you will need.



Panel template



Rail template

The MLCS Window Sash and Miniature Rail & Stile Bits will make replacements for the common “double hung sash” windows, unusual size windows, and the “mirror window,” which is a popular interior design element. It is not practical to make the full through mortise and tenon corner joint found on the original windows in the home shop. Instead, a cope and stick is cut with the bits. Then the joint is strengthened with dowels, biscuits, or screws. The bits will also make mullions as true divided lites or as a decorative grill over the glass.

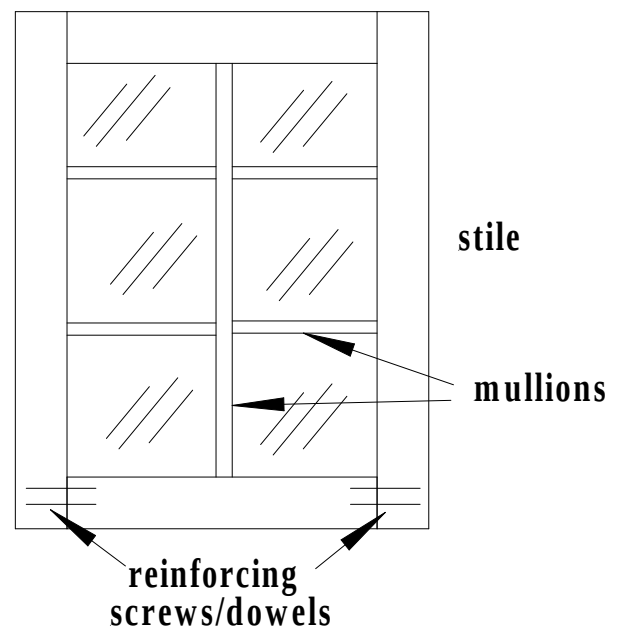
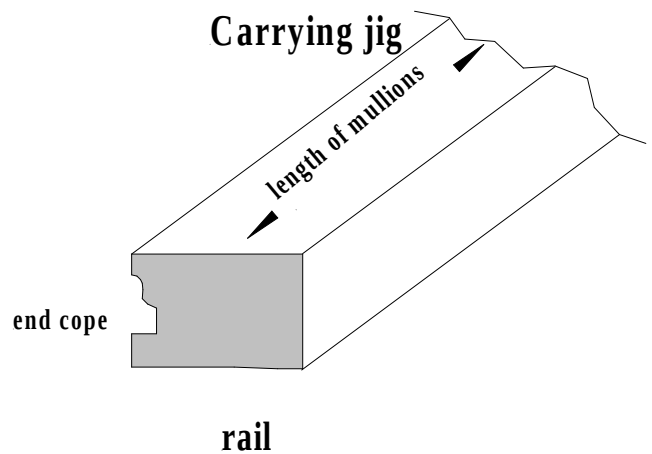
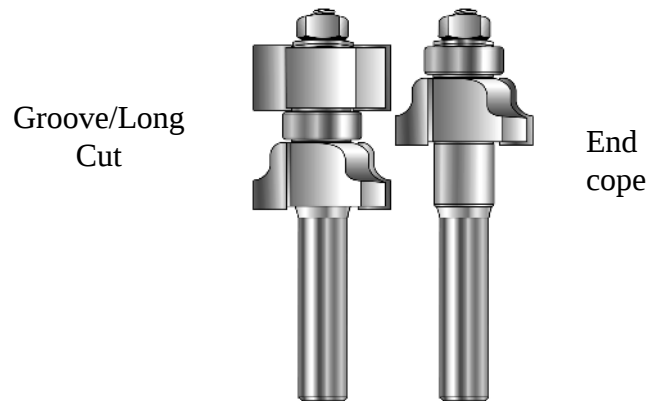
Decide on the thickness of stock for the window. Use #8893 or set #8894 for 1” to 1-1/2” thick stock and #8848 for 1/2” – 3/4” stock. Prepare enough material for all the rails and stiles that you need, plus material for mullions. The mullions are made one at a time from a wide (3” – 5”) board. For best results, all stock should be exactly the same thickness.

Make the outside frame of the window first. Most likely it will need to be a specific size. Cut the rails, or cross pieces, to exact length based on the width of the window. Remember to allow for the width of both of the stiles, and for the joint overlap. See the “Rail & Stile Doors” instructions on pages 4-8. Next set up the bit for the end cope, and cut all of the rail ends. While the bit is still set up, cut this end cope along the long edge of a board 3” wide, as long as your mullions, and the same thickness as the window. This will become a jig for carrying the narrow mullions through the router table. Put this board aside for now.

Change the bit over to the groove/long cut, and run the stiles and rails through. This is the inside edge detail of the door, and interlocks with the “end cope” at the corners, leaving a rabbet on the back of the window for the glass. Dry-clamp the window frame together and check it for size and square. The easiest method for reinforcing the corners is to drill and countersink screws through the outside of the stiles into the rails, then plug the holes. Glue and screw the frame together. Now you are ready to add the mullions.

Windows & Mullions

Items #1024, #8848, #8893, 8894



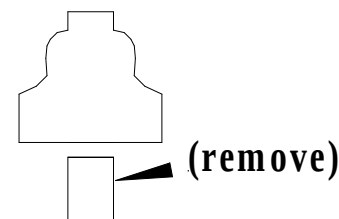
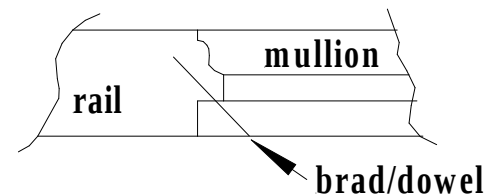
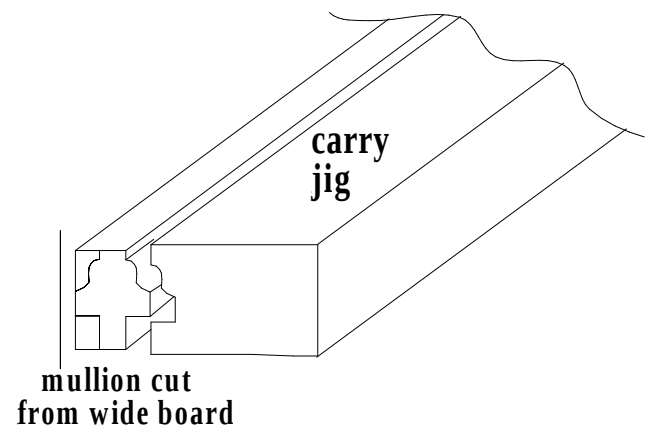
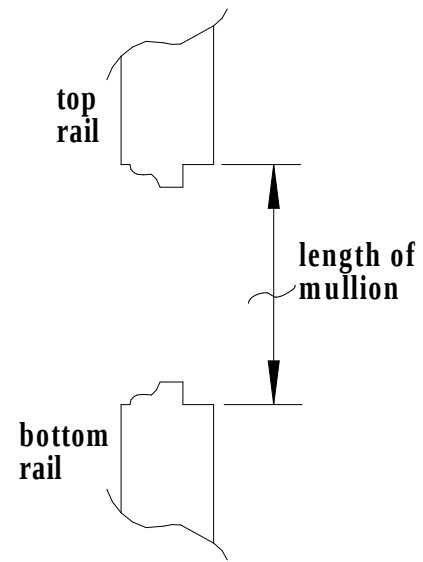
MULLIONS

Make the vertical mullions first. Take the wide board reserved for the mullions and cut it to the exact length needed to fit into the window frame. The easiest way to measure this length is from the back rabbet cut. After the board is cut, set up the sash bit in the end cope configuration, and cut the ends of this board, just like you did on the rail ends in the frame. Re-arrange the bit in the groove/long configuration, and run the mullion board through the bit. You should now have the wide board with the ends coped, and the profile cut along one edge.

Set your table saw to rip the mullion from the wide board. Since this is a narrow cut, be sure to use push sticks and a zero-clearance insert in the saw. The piece should measure about 3/4" wide. That is the depth of the profile detail on both sides (1/4") and some wood (1/8" – 1/4") in the middle. Finally, you must rout the profile cut on the other edge of the mullion. Take the 3" board that you cut earlier, with the cope on the long edge. Fit the profile of the mullion into that edge, and use it to carry the mullion through the cut. It should be a friction-fit, or you can use a little double-faced tape. To make the job even easier, add a couple of handles and a stop on the back of the carry-board. This is a very safe way to cut the profile on this narrow piece.

The mullion should now be a good fit in your window frame between the top and bottom rails. Glue it in place and drill a small hole at an angle into it from the back for a dowel or brad for extra strength. For the rest of the mullions, follow the exact procedure as this one, starting with a wide board cut to the length of the mullion. Use the board to make two mullions at a time, (one off each edge) until it is too narrow to be safe.

If you would like some or all of the mullions to go over the glass instead of dividing it, simply remove the back part with a bandsaw, hand plane and sander.



Dovetail Jig

Items # 6412, 6413, 6414
 # 8712, 8713, 8714

**As seen in and HIGHLY
 RECOMMENDED by Wood
 Magazine.**

**(Jun-July '02, Issue 142, pg. 18)
 (Mar '07, Issue 175, pg. 81)**

NEW Instructions!

The Pins & Tails Traditional Thru Dovetail Jig requires a simple, one-time setup and assembly. After this, boards to be dovetailed are clamped to the jig, router depth is set to match wood thickness, and dovetails are cut. The # 6412 & # 8712 template cuts 3/4" wide tails, 1-1/8" on center, a good size for drawers. The #6413 & #8713 Template cuts 1" wide tails, 2" on center, a good size for chests.

Setup for both templates is identical. In addition to the template and router bits supplied (3/4" x 14 degree dovetail and 3/8" straight) you will need these items to get started:

- A 5/8" O.D. router guide bushing to fit your router. Many router brands offer this as an accessory, or you can purchase **MLCS Item # 9096 Universal Guide Bushing Kit**, which includes this size and fits most any router. **Note:** The bushing must not be thicker than the template to work with this jig.
- A mounting block for each template. It can be of any hard or softwood, and should measure 2-7/8" thick, 18" long, and 4" wide. Note that the templates are attached to the 2-7/8" edge of the block.
- Several test boards, about 6" square x 3/4" thick.

Mounting the Template to the Block:

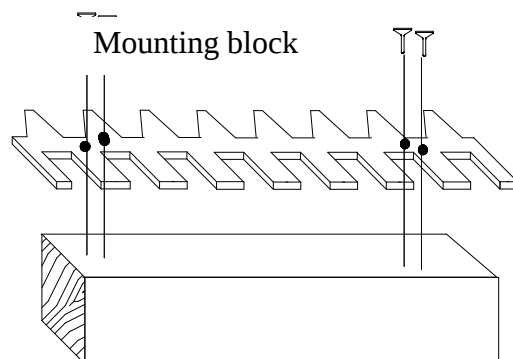
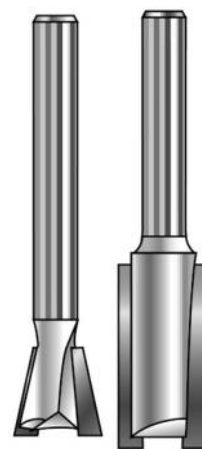
Begin by attaching a template to the 2-7/8" width of the mounting block. Align the template on the mounting block so that the distance from the outside edge of the angled fingers to the surface of the mounting block is 1" on template #6413 or #8713 and 3/4" on template #6412 or #8712. The distance from the outside edge of straight fingers to the surface of the block should be 1-1/8" on template #6413 or #8713 and 1" on template #6412 or #8712. Use the slotted holes and #8 wood screws, centering the screws in the slots, to start. After final adjustment you will drive screws permanently into the round holes in the templates to lock in the setting.

To install a Workbench Clamping Cleat to the Jig:

Cut a piece of stock 2-7/8" wide x 18" long x 3/4" thick. Using (4) 1-1/2" wood screws, attach the cleat to the bottom surface of the mounting block allowing 1-1/2" overhang past each end of the block. Using appropriate sized C clamps attach to any workbench edge, allowing the front surface of the mounting block to slightly overhang the edge of the workbench.

Making the Final Adjustment to the Template Position:

Final adjustment will be made by making a dovetail joint, and checking the fit. Set up your router with the 5/8" guide bushing and the 3/4", 14 degree dovetail bit. Clamp a test board in a vise with the end grain pointing up. Using two C clamps, clamp a test board, so that the end grain of the board is against the bottom of the template and the face grain of the test board is clamped to the mounting block. The straight fingers should be sticking out over the end of the test board, facing you.



To measure for proper router bit depth, lay a second test board up underneath the template and against the first board and draw a pencil line indicating the board thickness. Set the router on top of the template and adjust the router bit to this line. Make a test cut on the board, creating dovetails along the end of the board by feeding the router into the finger slots. Don't worry about the left-right adjustment at this point; it's easy to do this later.

Put the dovetailed board aside for the moment, and install the 3/8" diameter straight bit in your router (The same 5/8" guide bushing will be used). Clamp a second test board under the angled fingers of the template, same as you did before. Set the depth of the straight bit exactly like you did with the dovetail bit.

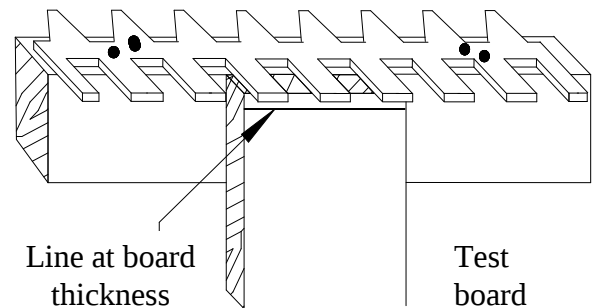
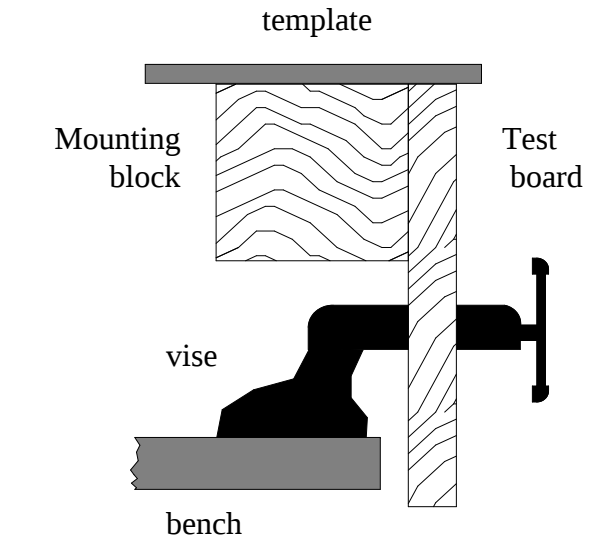
Cut the pins now by feeding the straight bit through the angled fingers. Remove this piece from the jig and try the fit with the first test board. By sliding the template forward and back in its slots, you loosen and tighten the fit of the joint (see the diagram below, right). The dovetail/pins cut (first cut) does not change; only the sockets (second cut) are affected by moving the template.

In order to get equal spaced dovetails from the top and bottom edge, you should space the stock's corners equally between the fingers of the template. For example, if your stock is 1/2" wider than the finger spacing, then set the stock 1/4" past each end finger. Marking registration lines on the block will help in setting up your stock. The registration lines should be in the exact center of the dovetail/pins and sockets. Draw these lines on each side of the block for each pin or socket.

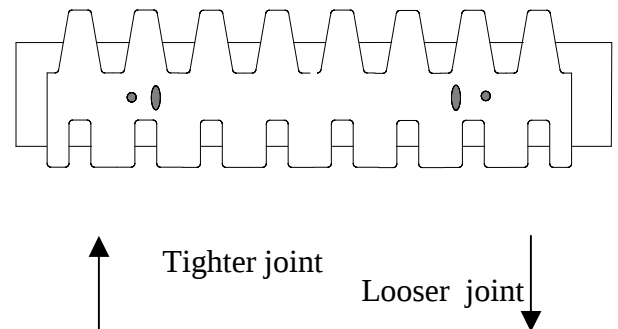
The dovetails/pins and sockets are cut basically the same. First clamp your stock to the side with the straight fingers centering it between two registration lines. Mount the 3/4", 14 degree dovetail bit and 5/8" guide bushing in your router. Cut out the dovetails in the stock. Next, mount your second piece of stock on the other side of the jig, again centering it between two registration lines. Change to a 3/8" diameter straight bit and make your cuts. Remove the stock and test fit. Make any adjustments and when satisfied, make permanent by driving screws into round holes.

You can cut joints longer than the templates by simply shifting them along the boards. With practice, you can also vary the dovetail spacing with the same technique.

Dovetail Jig



Move template with reference to mounting block



Biscuit joinery has become a standard woodworking operation, replacing many traditional techniques such as doweling and mortise and tenon. Originally, an expensive (\$300 - \$500) machine was needed to make this easy and convenient joint. Now MLCS has a system for less than \$35.

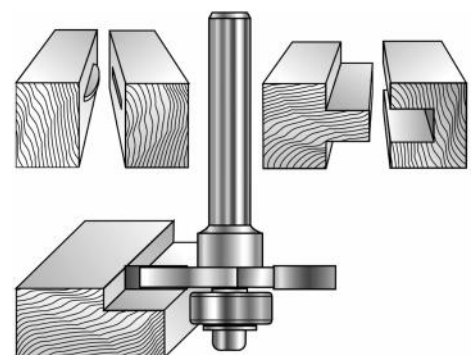
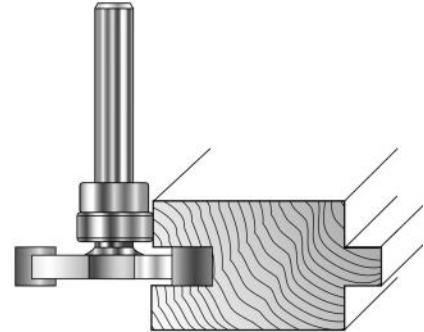
The heart of our system is a bearing guided slot cutter, sized to the standard biscuit thickness of 5/32" or 1/8" thickness for the H-9 biscuit. The biscuits are industry- standard, made of a compressed beech that swells and locks the joint upon contact with common water-based woodworker's glue. (Elmer's, Titebond, etc.) You can use the biscuit cutter either freehand or in a table-mounted router.

The basic edge-to-edge joint is easy to setup and do. Install the bit in your router and set bit height to approximately the center of the wood thickness. It doesn't have to be exact; the beauty of this joint is that both pieces to be joined register against the router base and cut the slot the same distance from the face of the wood. This makes the joint perfect every time. Also, you do not need to make the slots any particular length or location. Just run several 5" to 6" slots and put biscuits all along the joint. This eliminates tedious marking for centerlines. Spread glue in the slots, place the biscuits, and clamp tight.

Biscuits can also be used on miter joints. These can be done with caution on the router table. Set up your bit as before. Then clamp a guide to the table for the workpiece to ride against as you feed it into the bit. The round (#11) style of biscuits works best for this application, as they are deeper and shorter than the #20 size. For particularly tiny frames, the #H-9 size biscuit is only 1-1/2" long and thinner (1/8") than standard. With thicker wood, you can use a double biscuit for a super strong joint.

Biscuit Joinery

Kits # 6065, 8365, 6064, 8364, 6063, 8363
Katana Kits #16065, 18365



Router Collet Extension

Items #9464, #9468

Includes: 1/2" collet for #9464 or 1/4" collet for #9468, collet nut, collet base on 1/2" extension shank

Make sure the router collet extension is properly assembled. Please note the extension shank should be secured tightly, but the collet nut should be tightened only with the same pressure as any router collet.

WARNING! Do NOT bottom bit in router collet extension. Fully seat bit in the collet then pull up 1/16" to 1/8" to prevent bottoming out bit.

Keep in mind that by extending your 1/4" or 1/2" shank router bit, you are increasing the strain on all parts. It is very important that you decrease the size of the cuts taken. Plan on making the full cut in several passes and make very small cuts per pass. This is especially important when using larger bits, or any 1/4" shank bits.



The Solid Brass Router Inlay Set #9177 will create a perfectly matched recess and inlay piece. It can be used for decorative accents, butterfly keys, and repair work. The set fits into a 1-3/16" thru hole with a 1-3/8" rim in the router base. This is standard on Porter Cable and Black & Decker routers. If needed, MLCS sells replacement bases for many other brands. An 1/8" spiral downcut bit also comes with the set.

All inlay work requires a pattern. MLCS carries a selection of shapes such as hearts, bowties, geometrics, and animals, or you can make your own pattern from 1/4" thick material. The actual inlay is 3/16" smaller than the pattern. Also notice that the bushing cannot get into tight corners. Cut the patterns into a square of plastic or plywood with a scroll saw, coping saw, and drill bits. Sand and file all edges smooth, as any irregularities will show up in the finished pattern.

Cut the recess (female cut):

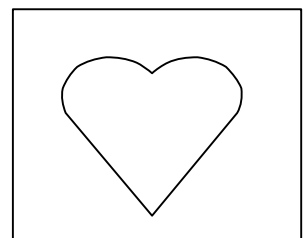
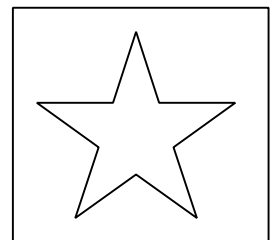
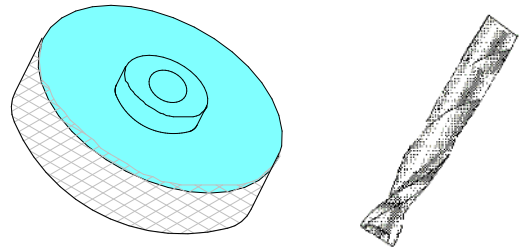
Locate and attach a pattern to the background stock securely with double-face tape (**MLCS Item #9489, or #9493**). The 9/16" diameter bushing sleeve should be in place on the guide. Set the spiral bit to cut to a depth of approximately 3/16" by making two passes of 3/32" each. Cut around the pattern and waste away all of the material within the pattern.

Cut the inlay (male piece):

Prepare your inlay material slightly thicker than the recess depth (3/16"). Fasten the inlay stock down to a scrap board and fasten the pattern to the stock, again using double-face tape. You will cut through the stock this time, again making the cut in two passes of 3/32" each. Pull the outer sleeve off of the guide and set the to a 3/32" depth. Carefully plunge the bit and cut around the pattern edge. Repeat after setting the bit to the full 3/16" depth. The inside is the good part.

REMEMBER: You **MUST** keep the guide tight against the pattern or the inlay will not fit properly.

Assembly: Fit the inlay piece into the recess. Some sanding may be required on the corners. Sand flush to the background and finish.



MLCS Spiral Upcut and Downcut Bits provide a smooth shearing action, keeping steady contact with the workpiece and leaving work almost fray and splinter-free.

While most MLCS bits are carbide-tipped, spiral bits are **SOLID CARBIDE**. Though harder than steel, carbide is also more brittle. Thus, extra care must be taken with these bits. Never force your work. Don't make sudden plunges or starts. **Important:** When the diameter of the bit is less than the depth of your groove, **take the cut in multiple passes, going deeper each time**. For smaller diameter bits (1/4" or less), we recommend cutting depths of half the bit diameter per pass. **Do NOT try to take the full depth in one pass.**

CHOOSING AND USING THE RIGHT BIT

UPCUT Bits remove sawdust and wood chips from a plunge cut with upward shearing. They work well for making deep mortises. In this application, any tearout caused by the upcut will be hidden by the tenoned workpiece. Upcut bits can also be used for any edge treatment performed with the work facing upward. Upcut bits are also useful when cutting dadoes in a router table.

DOWNCUT Bits (naturally) cut downward (away from the router base). This motion gives grooves, dadoes, rabbets, shallow mortises and plunge cuts a smooth clean edge.

REMEMBER: Downcut bits push sawdust into the cut. Making multiple passes reduces the buildup of sawdust in the groove.

COMPRESSION UP/DOWN SPIRAL Bits (**MLCS #7425**) cut upward and downward simultaneously. This unusual design makes them perfect for smoothing and tidying the edges of hardwood plywood or melamine-coated particleboard (MCP). **NOTE:** When working with easily chipped materials, you may want to precut your pieces oversized using a tablesaw.

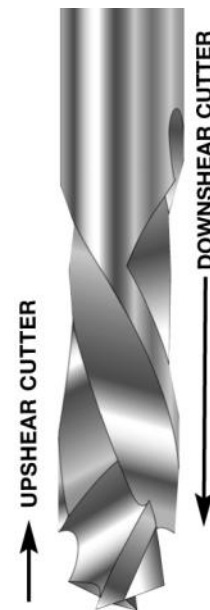
Spiral Up/Downcut Bits



Spiral Upcut Bit



Spiral Downcut Bit



Compression Up-Down Spiral Bit
 (#7425)

Lock Miter

Bits #5547, 5548, 7847, 7849, 7850
 KATANA Bits #17849, 17850

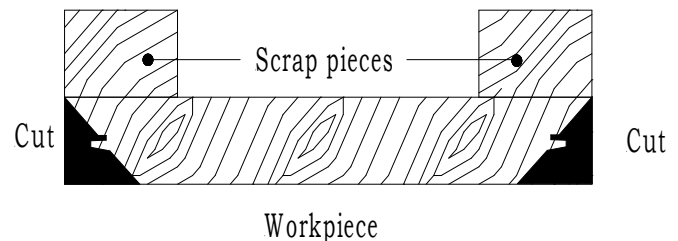
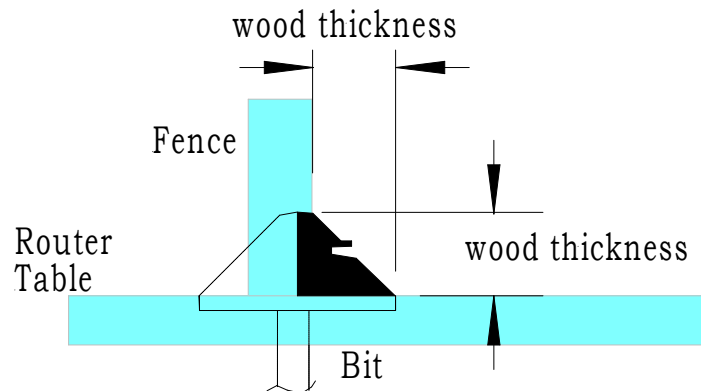
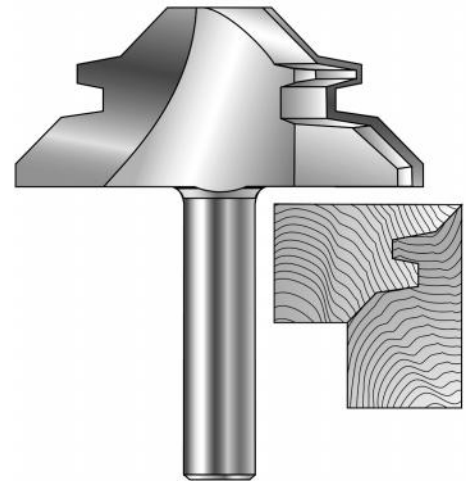
The Lock Miter bit makes clean, self-aligning mitered corners in hardwood, softwood, and plywood. Choose your bit based on the thickness of the material you plan to use, following the catalog specs. The bit must be used in a router table with a straight, squared fence. Best results are obtained with minimum clearance around the bit both in the table and fence. A variable speed router or **Router Speed Control (MLCS Item #9400 or #9410)** will make the job easier.

The Lock Miter bit uses only one set-up for both sides of the cut. **The most important thing to remember when adjusting the bit is this:** The bit should be centered on the stock and be an equal distance from the top to the bottom, and only the diagonal of the bit should show.

If you are using a set-up block, refer to pages 28-29 before continuing.

Prepare some test wood the same thickness as your project, about 6" wide and cut square and true. Do not pre-miter the ends of the work. The bit does this. At the ends of the test pieces to be cut, attach a scrap of wood, as shown below, along the cut to act as a guide against the fence and table. Once the actual workpiece clears the bit, there is only a point of the piece left to ride the fence or table. The scrap piece keeps the work running straight and true. Run one side of the joint down on the table, then run the other side upright against the fence. Remove the scrap pieces and check the fit. Make a minute adjustment in the height of the bit or the depth of cut to align the corner, then run all of your corner pieces.

TIPS: Use double-faced tape (**MLCS Item #9489 or #9493**) to fasten the scrap pieces to all of the ends of the workpieces at once. Make them about an inch longer at each end for good stability. The **Merle Adjustable Corner Clamp (MLCS Item #9012)** is the best choice for gluing up a lock-mitered box.





Lock Miter

If you experience excessive tear-out due to grain orientation or when using some plywoods, follow these steps in an attempt to eliminate this situation.

After following the set-up and testing instructions, and when you are satisfied with the fit of your Lock Miter joints proceed by:

1. Clamp a long stop block (preferably close to length of your fence) securely and snugly behind the back of your fence assembly. (You will be moving the router table fence and this will allow to return the fence to it's proper position for your final pass).
2. Slide the fence forward exposing only $\frac{1}{4}$ to $\frac{1}{3}$ of the router bit. Secure in place.
3. Make the cuts on your stock with the fence secured in this forward position. When completed loosen the fence.
4. Slide the fence backward toward the stop block, exposing more of the router bit. Again make the cuts on your stock with the fence secured at this new position. (Repeat as needed until the fence is once again positioned against the stop block. Multiple shallow cuts will yield a cleaner cut with less chance of tear-out).

Setup Block for Lock Miter Bit

USING SET-UP BLOCKS ON 1/2", 11/16" and 3/4" THICK STOCK * (For Lock Miter Joints)

Items #9751, #9753, #9754, #9755

See pages 26-27 for instructions on how to use these bits. The stock must have 1/2" or 3/4" for #9751, #9753 and #9754 or 11/16" for #9755 uniform thickness. Use the miter end of the set-up block with the flat edge for 1/2" stock and the full 45-degree miter end of the set-up block for 3/4" stock.

Using the set-up block, raise or lower the bit until the block aligns with the tongue and groove of the bit. (Note: the set-up block is not intended to match the profile cut; its purpose is to allow the bit height to be set quickly and properly). Move your router fence in until the setup block contacts both sides of your router fence.

Make sure the speed of the router is about 12,000-14,000 rpm. Test cut a piece of stock using extra or scrap wood.

Fit together and check for surface and joint match. You may have to fine tune the joint after testing your first cut to get a perfect fit, by either adjusting the fence in or out, or adjusting the bit height up or down. Remember any adjustment will be doubled on the cut. (for example, if you adjust the bit up or down by 1/32", then the joint will be different by 2/32" or 1/16")

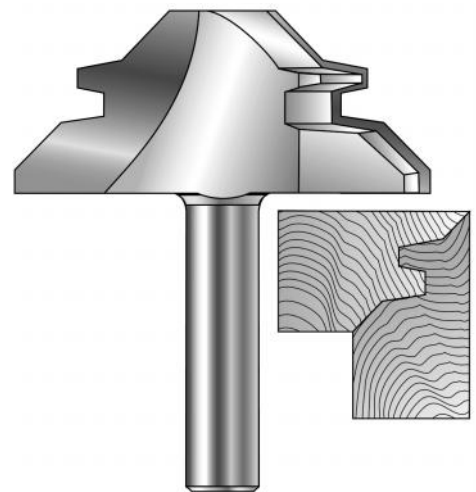
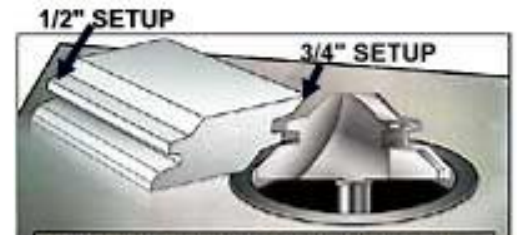
Once you have a perfect fit with your extra or scrap wood, you are ready to make the lock miter joint with your good stock.

NOTE 1: If the joint is good, but the surfaces are not even or the miter portion has a square edge, you must adjust the height of the bit upward or downward.

NOTE 2: If you have a split fence, close the opening as much as safe operations, permits.

* The set-up block is approximately 3/4". If your wood does not match the set-up block size:

- Plane the wood to match the set-up block, if possible.
- If the wood is thicker than the set-up block, raise the bit and push the fence back slightly, until a good fit is obtained.
- If the wood is thinner than the set-up block, lower the bit and move the fence forward slightly, until a good fit is obtained.



Setup Block for Lock Miter Bit

Items #9750

USING SET-UP BLOCKS ON 3/8" and 1/2" THICK STOCK * (For Lock Miter Joints)

See pages 26-27 for instructions on how to use this bit. The stock must have 3/8" or 1/2" uniform thickness. Use the miter end of the set-up block with the flat edge for 3/8" stock and the full 45-degree miter end of the set-up block for 1/2" stock.

Using the set-up block, raise or lower the bit until the block aligns with the tongue and groove of the bit. (Note: the set-up block is not intended to match the profile cut; its purpose is to allow the bit height to be set quickly and properly). Move your router fence in until the setup block contacts both sides of your router fence.

Make sure the speed of the router is about 18,000 rpm. Test cut a piece of stock using extra or scrap wood.

Fit together and check for surface and joint match. You may have to fine tune the joint after testing your first cut to get a perfect fit, by either adjusting the fence in or out, or adjusting the bit height up or down. Remember any adjustment will be doubled on the cut. (for example, if you adjust the bit up or down by 1/32", then the joint will be different by 2/32" or 1/16")

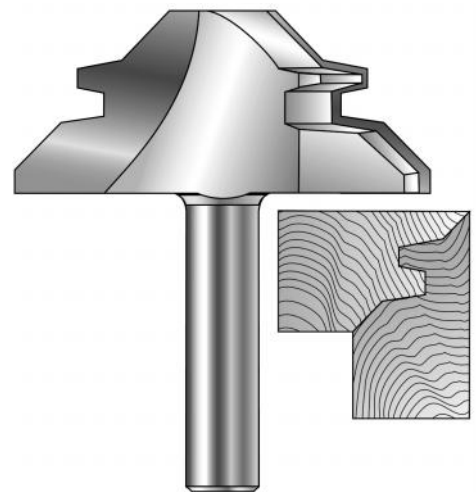
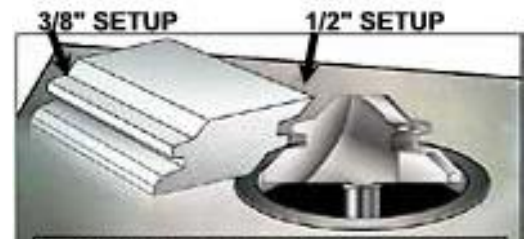
Once you have a perfect fit with your extra or scrap wood, you are ready to make the lock miter joint with your good stock.

NOTE 1: If the joint is good, but the surfaces are not even or the miter portion has a square edge, you must adjust the height of the bit upward or downward.

NOTE 2: If you have a split fence, close the opening as much as safe operations, permits.

* The set-up block is approximately 1/2". If your wood does not match the set-up block size:

- Plane the wood to match the set-up block, if possible.
- If the wood is thicker than the set-up block, raise the bit and push the fence back slightly, until a good fit is obtained.
- If the wood is thinner than the set-up block, lower the bit and move the fence forward slightly, until a good fit is obtained.



Mitered Door Frame

Items #8781, #8782, #8783, #8784, #8785

The MLCS Mitered Door Frame Bit allows you to create dramatic rail and stile doors, picture or mirror frames, chair rails, crown moldings or other decorative trim. Combine this bit with any raised panel bit to create highly decorative raised panel doors.

(Before starting these instructions, check your stock for uniform thickness. If it is not of uniform thickness, machine it as needed to make it of uniform thickness.)

Preparing your Rails and Stiles

1. Rip your stock to a final width of 2- 1/2".
2. Cut your stock to length, allowing a few extra inches to the length of each piece. (You may choose to leave the stock in longer lengths and cut them to final size after routing if you have the need for any short lengths.)
3. Rout the profile on the top face of your stock using the (# 8781) Mitered Molding router bit. (**Figure 30A**) Because you will be removing a large amount of wood, complete this step by making the cut in multiple passes by adjusting the router bit cutting depth between each pass. The final pass should leave the ball bearing guide on the bottom of the router bit flush with your router table fence.
4. Change to a 1/4" wide (5.2mm wide for flat undersized 1/4" plywood panel) by 3/8" deep slot cutting router bit. On the inside edge of the rails and stiles, rout the slot the full length of the rail and stile to create the slot for the panel to fit into, leaving at least 1/8" of thickness behind the panel slot. (**Figure 30B**) (The inside is the thicker edge with the cove profile cut at the top of the stock.) You may choose to make this cut in multiple passes to avoid tear out. Be sure to rout this slot on the inside of all (4) pieces of stock.

(The next step will be very crucial to the fit and appearance of your finished assembly)

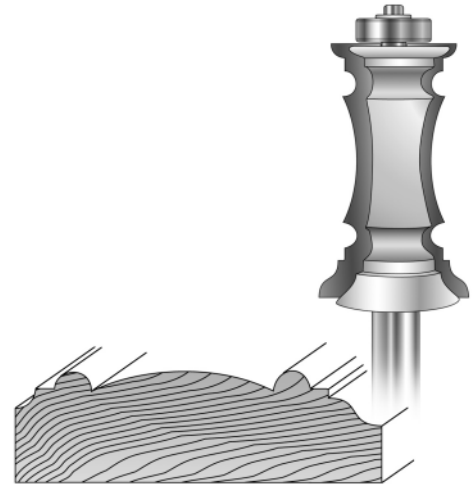


Figure 30A

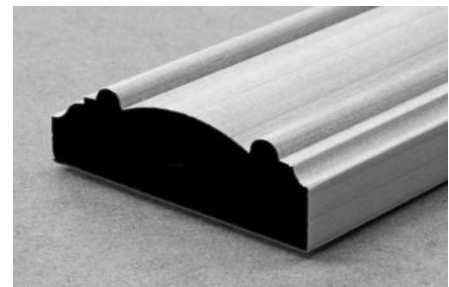
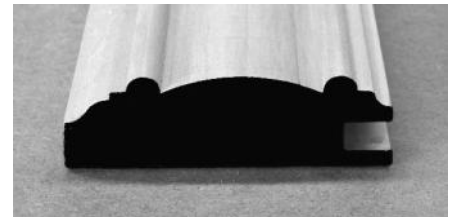


Figure 30B



Mitered Door Frame

5. Use a precision miter gauge; miter sled or chop saw to cut the 45-degree miter joints. Any deviation from a perfect 45-degree angle can mean gaps in your miter joints and an assembly that is not square. Make sure you orientate your stock properly so that the short length has the panel slot cut into it. (**Figure 31A**)

Making the Center Panel

6. Now it is time to cut the raised panel to size and rout the profile on it. Make sure to size it properly by allowing for the panel slot depth in the rail and stile when calculating the overall panel dimension. Also be sure to allow space for any seasonal panel movement due to changes in humidity. Complete the panel by routing the profile until you have an appropriate 1/4" thick tongue on the panel edge to fit into the slot on your rails and stiles.

Assembly of the Frame and Panel

7. Install (#5365/#7665) 5/32" wide slot cutting router bit to cut the proper depth slots for the biscuit joint. We are using a #11 round face frame biscuit to align the joint and provide a stronger joint than just a basic edge-to-edge glue joint. Place the two edges to be joined and place a registration mark across the center of the mitered edges. (**Figure 31B**)

8. Adjust your router table fence so that it is flush with the ball bearing guide on the biscuit slot cutting router bit. Adjust your router table fence faces to close up the gap around the router bit. If your router table fence faces do not move, you may make a zero clearance sub face and attach it to your existing fence with clamps or double-sided tape.

9. Place the long edge of the rail or stile against the router table fence and slowly pivot the mitered edge of the rail or stile into the spinning router bit so that the registration line is aligned with the ball bearing on the router bit. Repeat this operation until both ends of all four pieces are completed. (**Figure 31C**)

Figure 31A

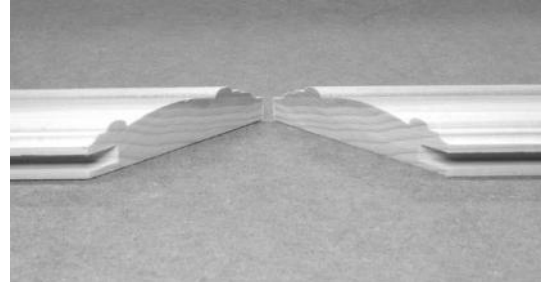


Figure 31B

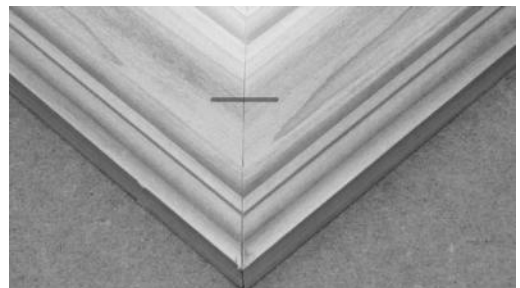
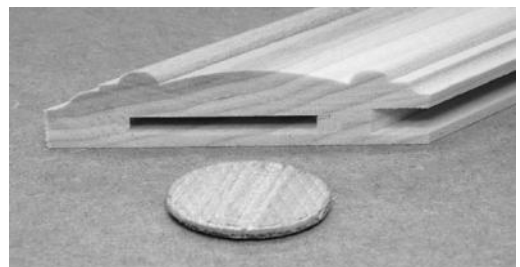


Figure 31C



Mitered Door Frame

10. Apply glue to the miter ends of one of the rails and the corresponding edge of each stile. Apply glue into the biscuit slots in each of these same pieces. Place (1) #11 biscuit into each end of the rail and align these (3) pieces. **(Figure 32)** Tape may be used to temporarily hold these assembled joints together. Slide the panel into the slot in the stiles and rail that are now assembled. **(Do not glue the panel into these slots. It must be allowed to float to avoid cracking from seasonal wood movement.)**

11. Apply glue to the mitered ends of the remaining rail and exposed stile ends. Apply glue into the remaining biscuit slots. Insert (1) #11 biscuit into each stile and slide the rail into place closing up the frame assembly. Measure diagonally from corner to corner to check if the assembly is square. Use appropriate clamps such as #9012 Merle Multi Corner Band Clamp to hold the assembly until the glue is dry.

Finish by sanding then applying a stain or finish to complete your project.

Figure 32



Tongue & Groove & Glue Joint Bits

All tongue and groove bits are used to create a mechanical joint for the wood pieces to be glued. This adds tremendous strength and insures accurate alignment. In general, the bits can have a straight or wedged joint and are either one- or two-piece sets. The V-notch set adds a common decorative element to the joint.

All the bits except the Tongue and Groove Assembly (with bearing) require a router table and fence. The more straight and square your table, the better the joints will be. Also, featherboards will greatly increase your ability to feed the work smoothly and evenly. Be sure that for all the bits your router fence is set so that you are taking a complete depth of cut on the bit.

Please note: In order to use the bearing on these bits to guide the depth of cut, an additional piece of stock must be fastened or clamped to the bottom of the Tongue & Groove stock.

The one-piece tongue and groove bits (**#5546, #7846**), both straight and wedge, can be set once for both halves of the joint, as can the Glue Joint bits (**#5553** and **#7853**). The height of the bit is adjusted so that the center of the joint on the cutter is centered on the thickness of the wood. Both pieces are run; then one is flipped over and fitted to the other. This only works if the all the wood pieces are of even thickness and if they were run evenly through the router table. Use of featherboards is encouraged! Sometimes it is easier to run all the pieces for one half of the joint; then reset the bit height to match and run all of the other half of the joint.

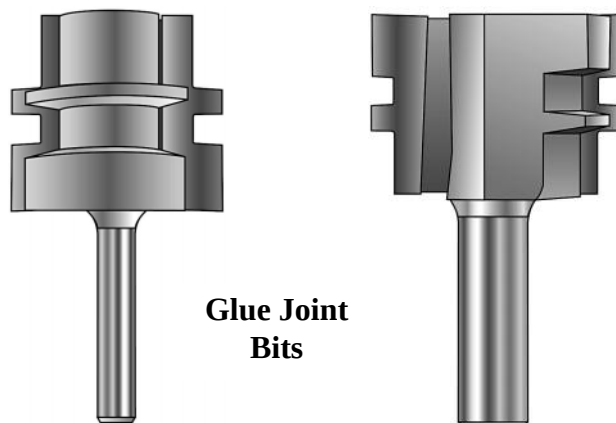
TIP: If you are unsure about the straightness of your wood or if you are making a particularly long joint, choose a wedged version of the bit. It will be easier to fit the joint together.

T&G Bits **#5544, #5546, #7842, #7843, #7844, #7846**

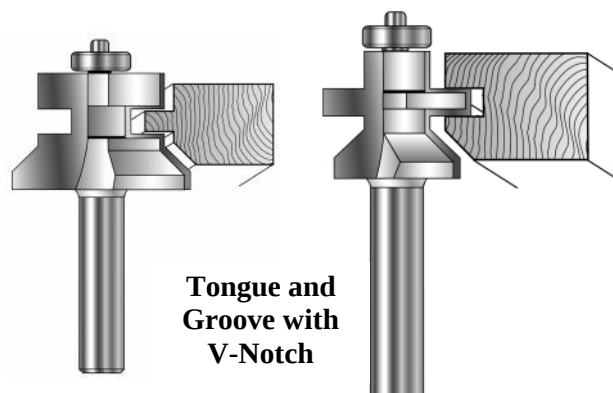
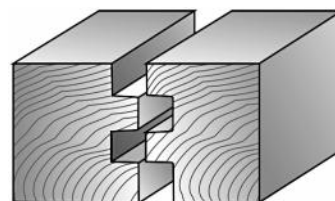
Glue Joint Bit **#5553, #7853**

KATANA T&G Bits **#15541, #17840**

KATANA Glue Joint Bit **#18846**

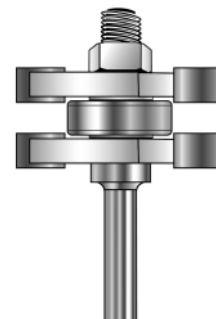


Glue Joint Bits



Tongue and Groove with V-Notch

Tongue and Groove Assembly



Finger Joint

Items #7861, 7862

Finger joints are primarily intended for end-grain-to-end-grain joining, as in lengthening a board. It is frequently seen in moldings that are to be painted. The joint can be used in longer edge-to-edge joining, provided that the wood is very straight and flat.

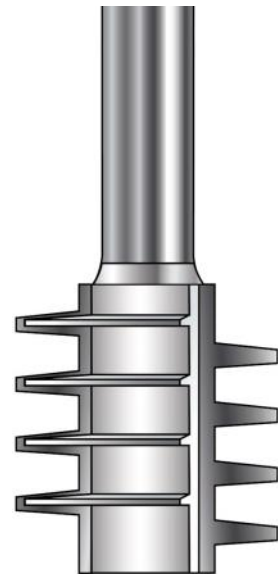
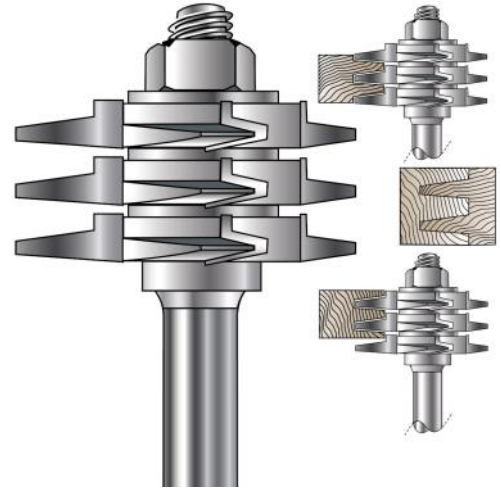
For #7862, place the cutters on the arbor or spindle so that the carbide on the upper cutter fits into the flat area on the lower cutter. When properly assembled, the carbide cutting surfaces will be staggered to the front from bottom to top of the stack. The cutters will rotate about an eighth of a turn and stop when properly set.

All of the finger joint bits must be used in a router table with a fence. Set the fence so that you are cutting the full bit profile. The inside edge of the bit should actually shave some length off the wood piece.

Set the height of the bit based on the thickness of the wood that you are using. Ideally, there should be a solid finger on the top and bottom of the joint. Avoid a thin shaving here that could break out or stick up when gluing.

Run all of the pieces you need for one side of the joint. Then adjust the height of the bit to match the cut pieces. Align by matching the fingers that were cut on the first board with the fingers on the bit. Then cut the other side of the joint. Use a push block or miter gauge to feed the pieces.

Glue, clamp, and sand for a perfect joint.



Drawer Lock

Bits #5552, #7851, #7852
SHAPER Cutter #1082
KATANA Bit #18850

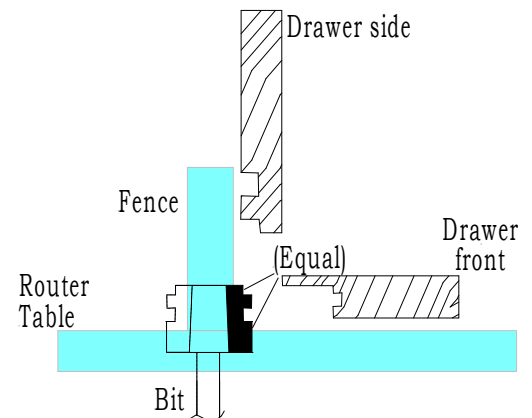
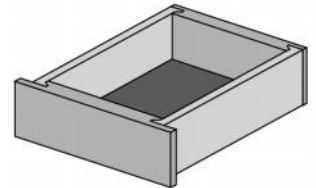
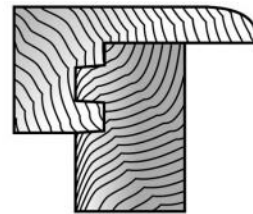
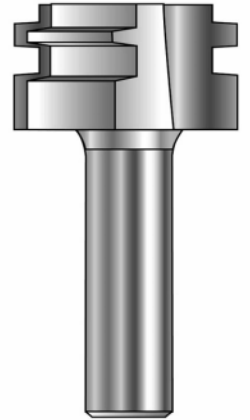
The Drawer Lock bit creates a production-style joint suitable for most common furniture and kitchen drawers. The bit should be used in a router table with a straight, squared fence. Accurate alignment and setup of the router is important for a solid, tight-fitted joint.

Cut the drawer-side joint first. Set the bit height so that the end notch on the drawer side (about 1/8" for Bit #7851) is the same as the end notch on the bit. **NOTE:** For Bit #5552 and #7852 and **KATANA Bit #18850**, the end notch on the side should be about 3/16". Set the fence so that the entire cutting edge of the bit cuts wood. It can be a bit deep but it cannot be shallow or the joint won't work. The sides are run through the router table vertically with the inside against the fence. A featherboard (**MLCS Item #9478**) helps give a clean smooth feed. Run all of the side joints at this time.

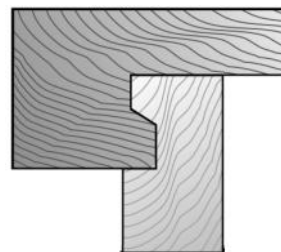
REMEMBER: Do not cut until the sides are matched with the front. Make a sample cut first!!

The drawer front is cut down on the table inside face down. Leave the bit height as before, and make a first cut into the edge against the fence. Expose more of the bit and cut again, until the proper lip overlap extends past the side piece.

Note: Wood thickness and variations can create a need for slight adjustments. Always use test pieces to determine your final settings.



Katana #18850



Rule Joint

Sets #6100, 8400, 8401
 Katana Sets #16100, #18400, #18401

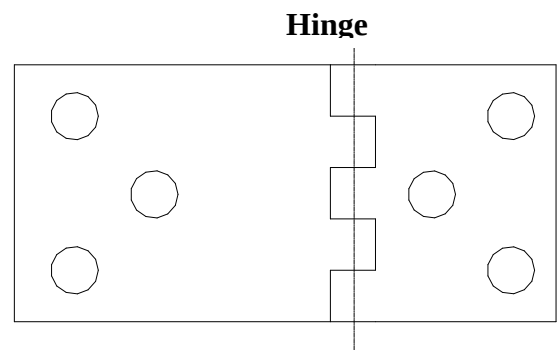
The rule joint is used to join a dropleaf extension to a tabletop. In the up position, this joint makes a tight, well-supported connection. In the down (dropped) position, this joint appears to be a nicely moulded edge.

Both 5/8" and 1/2" radius roundover and cove bits are used to make the rule joint. It depends on the wood thickness and hinge type you are using. Rule joint hinges are designed with one leaf longer than the other.

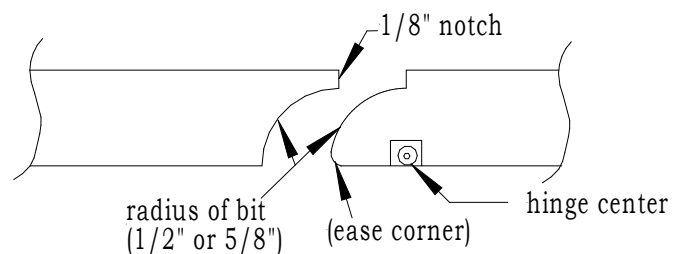
The hinge knuckle is recessed into the bottom of the main table at the center point of the edge radius. Usually, there is a 1/8" notch at the top. With 3/4" thick wood, 1/2" radius cutters are used. This puts the hinge pivot point at the bottom surface of the table, so that the leaves of the hinge can be surface mounted. If the wood is thicker, say 7/8", the hinge point must then be recessed further into the bottom by recessing the hinge leaves as well. Use 5/8" radius cutters to avoid recessing the hinge leaves in this case. As always, have the hardware on hand before starting.

Ease the bottom edge of the main table to smooth the hinge action. Also, shift the hinge pivot point slightly toward the edge of the main table so the joint doesn't rub and wear.

Because the location of the hinge pivot point is so important to a properly working joint, you should practice on some test pieces of the same thickness as your final project.



Drop Leaf Hinge



Crown/Architectural Molding, Chair Rail, Casing/Base Molding

**Bits #7864-70, 7886, 7891-99, 7900-03
 KATANA #17868, 18065, 18075, 18079**

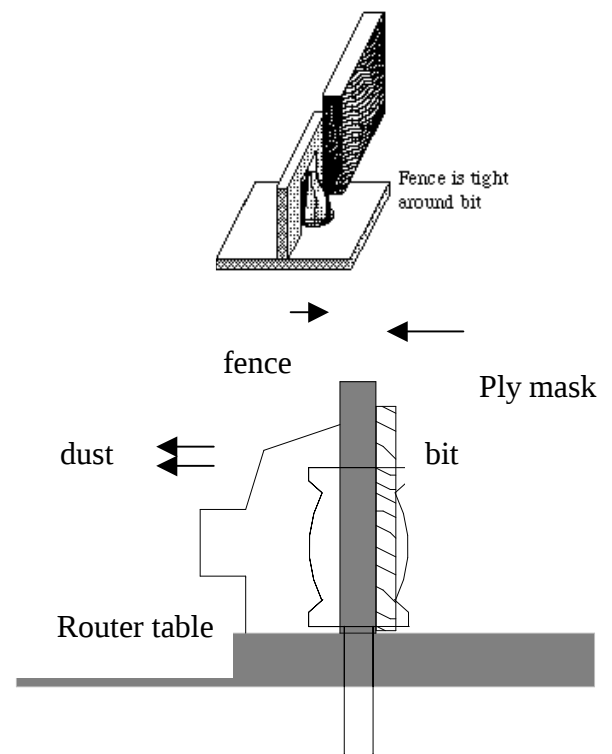
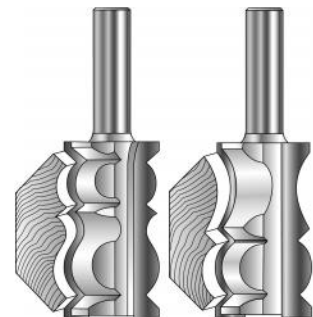
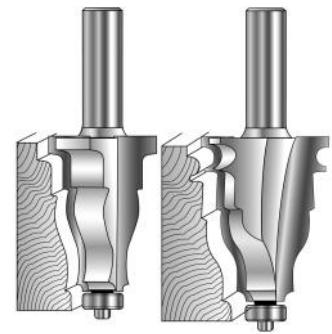
The Crown and Architectural Molding bits will make custom trim for projects and home at a fraction of the cost of store-bought molding and allow you to use any species of wood. The following tips will help you run these larger bits safely and produce great results.

These bits should always be run in a router table with a fence. Bits should be run at a reduced speed to control burning and tearout. Be sure to support your work well both on the infeed and outfeed side of the table, especially with longer moldings.

Because you are cutting into the face grain of the wood with these bits, create a zero-clearance opening in your fence to reduce tearout. This can be an extra piece of plywood fastened to the original fence that you cut through with the bit to create the zero-clearance opening.

Attach featherboards to the table and fence of the router table to hold the work firmly against the bit. This will minimize chatter marks that are difficult to sand out. Most of the time the cut can be made in one pass with a good quality 1 1/2hp or larger router. With hardwoods a two-pass operation is easy to do. Set the fence for the full cut. Then temporarily fasten a piece of 1/4" plywood on to the fence, cut out to clear the bit. This effectively spaces the work away from the bit for a light first pass. Run all the molding, remove the 1/4" plywood "mask" and run the molding again at the full bit depth.

Since the bits cut across almost the entire face of the molding, you can experience difficulty on the outfeed side because there is little wood left to ride against the fence. The solution is to start with a board wide enough for the molding profile and some flat section. Set your featherboard to push against this flat. Then rip the board to final width after the profile is run. If the board is wide enough, you can run the profile on both edges, leave the flat in the middle, and get two runs of molding from one board.



Gooseneck Molding

Bits # 8567, 8565 (or others)

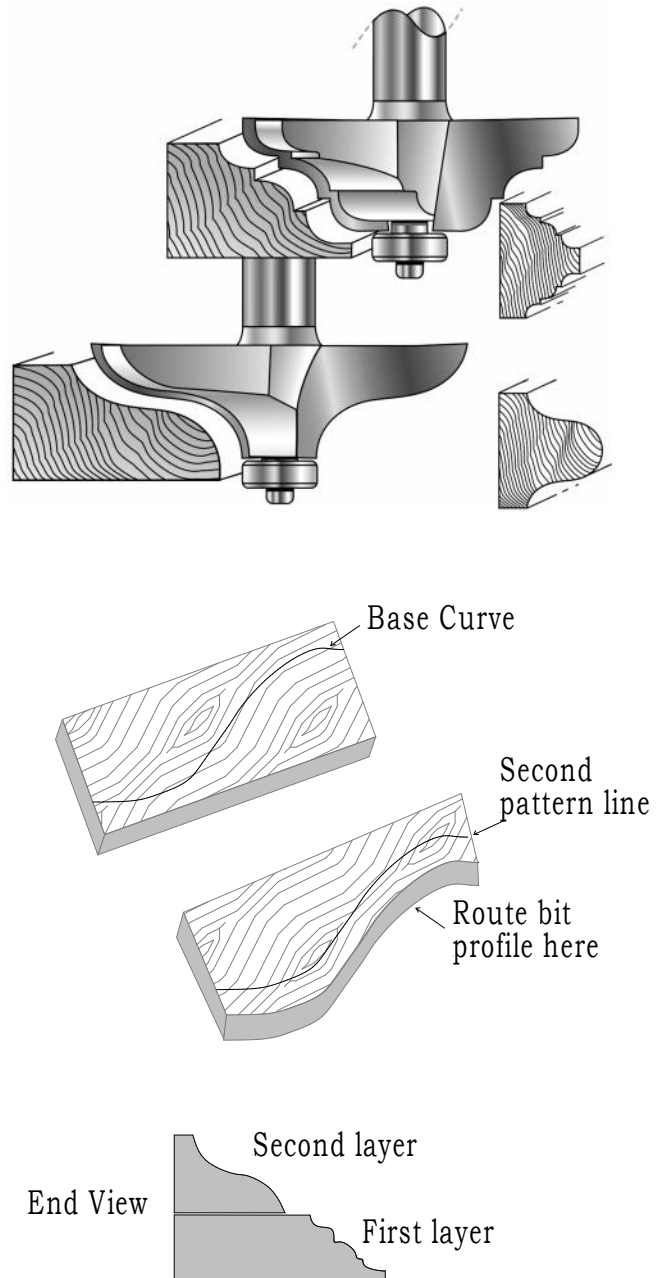
Gooseneck or Swan's neck molding is traditionally found at the top of grandfather clocks, highboys, and other Queen Anne style furniture. It has usually been hand carved or made with a combination of custom-made router bits. Our method uses stock MLCS table edge bits and some imagination to produce moldings with great depth and detail.

Determine the width and height of the molding needed. It is usually two mirror-image pieces with a gap between them, or *broken pediment*. Create a pattern for the base curve of the molding, an S-curve that flattens out at the outside edge to horizontal. This is to allow a miter for the side moldings.

Cut a piece of wood wide and long enough to make the curve and cover the entire height of the gooseneck. Run the grain along the curve, angling upward toward the center gap. Draw and bandsaw the base curve along one edge of the wood and sand smooth. (Make two pieces, left and right). Set up one of the table edge bits in a router table with a starter pin. The pin allows you to cut the bit detail along the curved edge of the wood. Make the cut in 3 passes, raising the bit higher on each pass. Use a reduced speed on the router and be careful with the grain direction. When finished, you should have a board with the molded curve along one edge. Make a left and right version.

Now make a second pattern. Trace along the *inside* of the molded detail on the first board. Prepare a second board, similar to the first and cut this second pattern shape along one edge. After routing, the second board is layered onto the first, creating a deeper molding with a different routed detail.

Finally, shape the top of the molding sandwich, cutting through both pieces to create the top profile, which is usually parallel to the original S-curve. Cut the "gap" shape on the bandsaw; then cut the corner miter by fastening the molding to a plywood board and tilting your tablesaw blade to 45 degrees. Create straight sections of the same profile for the sides of the project.



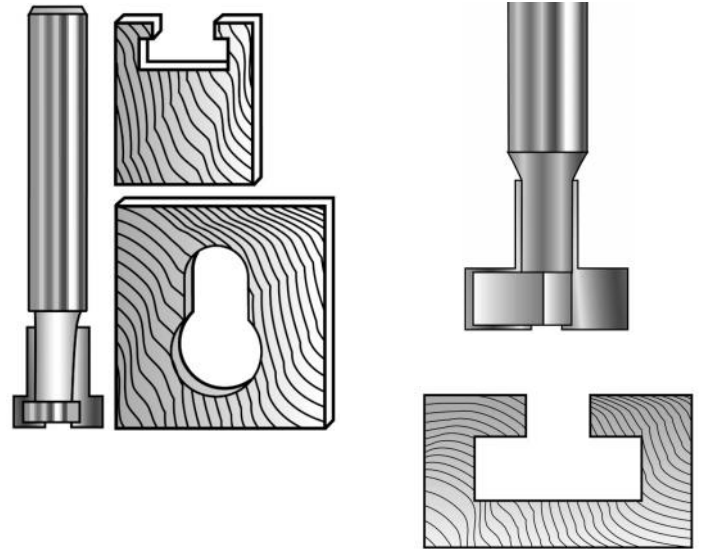
T-Slot & Keyhole Cutters

T-Slot Bits # 6333, 6334, 8637
Keyhole Bits #5438, 5439, 7738, 7739

T-Slot cutter bits are similar to keyhole cutters, except that they are larger and cut more wood in a “blind” hole. Follow these instructions for a safe and successful cut.

Use a slower speed on your router. Depending on your feed rate and type of wood, vary the speed until you get a comfortable cut. If you do not have a variable speed router, the **MLCS #9400 or #9410 Speed Control** works well with all standard routers (except soft start models).

It is best to work with a router table against a fence and use featherboards and stop blocks to control the cut. But, if you work with a hand-held router, use guides clamped in place. Because of the shape of the bit, you must make the cut in one pass. In difficult wood or with the largest of the bits you can make a preliminary cut with a plain straight bit first to clean out a majority of the wood. Also, drilling the entry hole with a forstner bit helps, even though all the T-slot cutters will plunge cut.



Traditional Foot Bit

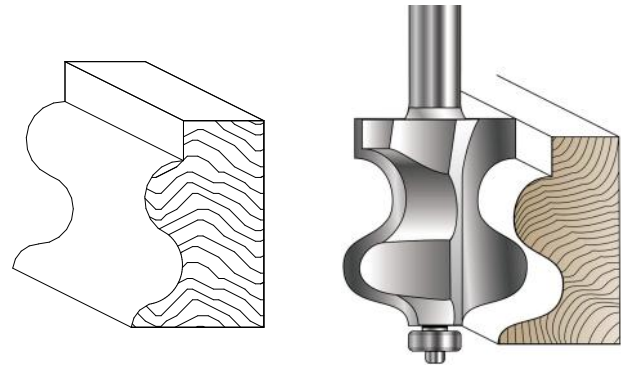
Bit #6289, 8590

Using the MLCS Traditional Foot Bit you can add classic, elegant styling and detail to any basic box. Set up the bit in your router table and prepare some stock for the feet. It should be planed to equal thickness and the long edges should be parallel and smooth.

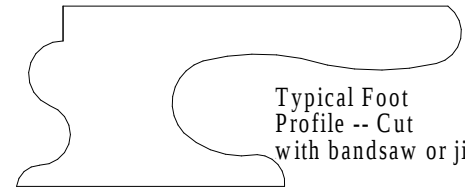
Run sufficient lengths of the stock material, taking 2 – 3 passes to complete the cut. Run the router at a reduced speed. If you have wide stock you can make the cut on two edges, then rip them to width on the table saw.

Make a pattern of the ogee profile for your foot. Miter one end of your molded stock and cut it to the approximate length for a foot. Use your pattern to draw the profile on the back of the stock. Then cut the shape with your scroll saw or band saw. Sand smooth. Continue making the feet until you have enough to complete a box (usually 8). Remember to make right and left miters.

The foot pieces can now be rabbeted along the top edge to receive the box. Glue together corner pairs and clamp with masking tape. When dry, sand the corners and glue to the box bottom.



Bit Profile



Typical Foot
Profile -- Cut
with bandsaw or jigsaw

READ CAREFULLY BEFORE INSTALLING ROUTER TABLE BASEPLATE!!

The Router Table Plate Installation Kit, Item #9331, creates an opening that is slightly larger than the base plate itself. This is an intentional design feature for the following reasons:

- Allows easy removal of the base plate even when the table top has expanded due to heat and humidity changes.
- Compensates for smaller hole cut by router bits that have been re-sharpened repeatedly.
- Allow for minor variations in the dimensions of the base plate itself.

To make certain that your base plate is positioned correctly, align the **INSIDE** of the template opening with the routing area before placing the template onto the table surface.

Please review all instructions thoroughly before beginning Step 1.

1. Decide where on your router table to position your All-In-One Router base plate. Remove the backing paper from your double-sided tape and affix the template to the table top.
2. Use the locking nut to install the combination guide and bushing on the router plate. Follow the template with a 1/2" diameter straight bit, cutting through the top completely in a clockwise direction. Note: Removing excess sawdust will provide for a smoother cut.
3. Loosen the set screw in order to take out the larger bushing from the template guide. Reduce bit depth to less than 1/4" before your first cut, again following the template. Next, adjust depth of cut as needed to ensure a true flush fit.
4. Insert the router plate into the opening to verify that the rabbet depth is sufficient for the plate to be flush. Verify the fit **BEFORE** taking out the template.
5. Finally, take away the template and clean the adhesive residue from the top.

MOUNTING THE ROUTER BASE PLATE IN YOUR ROUTER TABLE

Item #9338

For the MLCS 9334 aluminum plate see page 43.

When mounting a larger router, the handles should fit in the same direction as the long opening. Your current router base plate will function as the drilling jig. However, you should determine the optimum router positioning **PRIOR TO** removing the base plate. Be sure to take into account depth adjustment knobs, depth lock levers/knobs, and, of course, the location of your switch. Place your router in the inverted position and turned properly under the table. Then mark with tape on the front edge of the router's base plate to verify the position. Next, remove the screws from the base plate.

Locate the top/front of your base plate by observing the position of the starting pinholes. The holes will be to the **RIGHT** of the bit opening. Again mark with tape front and center on the plate to serve as a reminder.

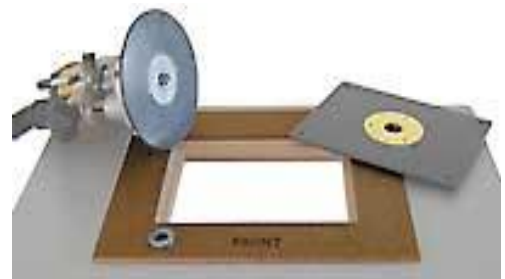
Center the router base plate on the nearest concentric ridge. Then position the mounting holes along the radial lines. Keep the base plate in place with double sided tape (3 to 4 pieces arranged around the ring should be adequate).

Drill through the new base plate using a drill bit that matches the size of the holes in your router's base plate. **NOTE:** If available, perform this operation on a drill press to keep the holes perpendicular. **IMPORTANT:** A piece of wood should be clamped to the front of the router plate while drilling to avoid splintering of the plate.

After removing the router base plate, countersink the mounting holes in the 9338 router plate, similar to the router's own base plate. For best results, we recommend a single flute countersink at a slow speed and a drill press if available.

Drill a 5/16" diameter hole and inset the magnets into your router table top underneath where the allen head adjustment screws are located.

Finally, mount the 9338 router plate to the router. If the screws that came with your router are not long enough, longer screws can be purchased at a hardware store or home center in your area.



MOUNTING THE ROUTER BASE PLATE IN YOUR ROUTER TABLE

For the MLCS 9338 all-in-one router plate see page 42.

When mounting a larger router, the handles should fit in the same direction as the long opening. Your current router base plate will function as the drilling jig. However, you should determine the optimum router positioning PRIOR TO removing the base plate. Be sure to take into account depth adjustment knobs, depth lock levers/knobs, and, of course, the location of your switch. Place your router in the inverted position and turned properly under the table. Then mark with tape on the front edge of the router's base plate to verify the position. Next, remove the screws from the base plate.

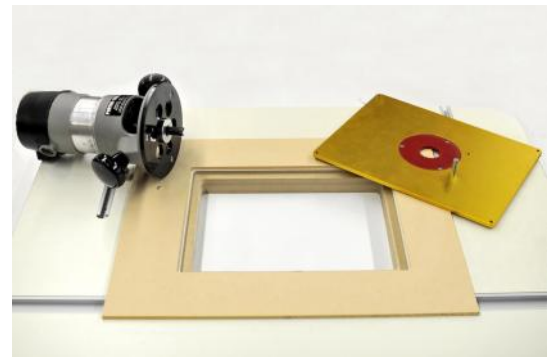
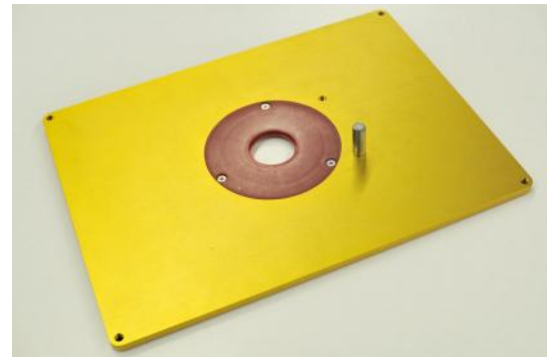
Locate the top/front of your base plate by observing the position of the starting pinholes. The holes will be to the RIGHT of the bit opening. Again mark with tape front and center on the plate to serve as a reminder.

There are pre-marked mounting hole locations for the most popular routers. Refer to the instruction sheet/legend to see if your router is included. If it is, then drill the appropriate size hole through the insert plate for mounting screw at the pre-marked locations. If your router is not included in the instruction legend, then install an insert ring into the insert plate with an opening close to the same size as the opening in your router sub base. You will then have to align the router sub base, so that it is centered on the insert ring. Mark the mounting hole locations on the aluminum insert plate and drill the appropriate size hole through the insert plate. The use of a drill press, if possible, will assure a perpendicular through hole. You may also choose to temporarily attach the sub base to the insert plate, using double sided tape, while you are drilling the mounting holes through the insert plate.

After removing the router base plate, countersink the mounting holes in the top side of the 9334 router plate, similar to the router's own base plate. For best results, we recommend a single flute countersink at a slow speed and a drill press if available.

Drill a 5/16" diameter hole and inset the magnets into your router table top underneath where the allen head adjustment screws are located.

Finally, mount the 9334 router plate to the router. If the screws that came with your router are not long enough, longer screws can be purchased at a hardware store or home center in your area.



Router Plate Kit

Item #9334

INSTALLATION

Porter Cable	A	690 series	
	A	7529	
	A	8529	
Bosch	A	1617	
	A	1618	
Sears	C	315 275 000	D 315 175 070
	D	315 175 040	
	D	315 175 050	
	E	315 175 060	
Fein	B	FT 1800	
Milwaukee	A	5615	
	A	5616	
	A	5619	
Elu	B	177	
Dewalt	B	621	
	B	625	
	A	616 series	
	A	618 series	

Gate Leg Drop Leaf Table Plans



Preparing the table top blanks:

Cut and glue enough 3/4" stock to make three panels 40" long by 24" wide (they will be cut to final size at a later time). While the glue dries we will work on the legs.

Preparing the table legs:

After squaring the stock for the legs to 1-3/4", cut the legs to a finished length of 29". Using a taper jig (MLCS #9008), set the angle to 2 degrees to cut the taper on the faces of the legs that will be on the inside of the table frame (*Figure 45A*). Start the taper 14" from the top of the leg.



Figure 45A

Mark each leg at the top to indicate which corner will be facing into the center of the completed table frame (this is to indicate which faces of the legs will be mortised to accept the tenon on the apron). Using a 3/8" diameter forstner bit (MLCS #9203), cut overlapping holes 1/2" deep to remove the bulk of the mortise in each leg. The mortise starts 1/2" from the top and stops 3" from the top of the leg (*Figure 45B*).



Figure 45B

The four table legs that will make up the base will get two faces mortised, while the two gate legs will only have one face mortised (place the gate legs in the position they will be mounted to determine which face to mortise). After the drilling has been done it is now time to finish the mortises using a router and either a 1/2" diameter spiral up-cut bit or straight cutting bit. (It may be easier to mark the starting and stopping points on the opposite side faces of the legs to the faces being mortised as they will not be visible when routing). Rout the remaining material from the mortises in each leg (*Figure 45C*).



Figure 45C

Preparing the aprons:

Cut the aprons to the finished dimensions given in the parts list. The gate leg apron will still be left at the 19-1/4" length and be cut to final length at a later step. Using a 1/2" deep rabbeting bit (MLCS #5393, 7693 or Katana #17691) to cut the tenons on each end of the table frame aprons. The gate leg apron will only have a tenon cut on one end (*Figure 46D*). Use a piece of scrap stock the same thickness as your aprons to adjust the bit height. The rabbeting bit should be 1/8" above the router table as the starting point. Make a test cut on the scrap piece and check the width of the tenon for a snug fit. Adjust the bit as needed until you achieve an acceptable fit.



Figure 46D

After cutting the rabbet, the shoulder of the tenon must be made to allow the tenon to fit into the mortise. This is easiest to do on a table saw using the miter gauge (*Figure 46E*). Set the table saw blade to 3/4" and remove the shoulders up to the rabbeted cut. Dry fit the table base to make sure the mortise and tenon fit together properly.



Figure 46E

Then using a 1/4" diameter edge beading bit (MLCS #5531, 7831 or Katana #17831), rout the full length of the bottom edge of each apron (*Figure 46F*). Also, rout the end grain of the gate leg apron that does not have the tenon cut on it. Before cutting the profile on the gate leg apron, make sure that it is properly orientated so the bead ends up on the bottom edge of the apron.



Figure 46F

Apply glue to the mortise and tenon on each leg and table apron. Fit these together and clamp up this assembly, checking to make sure that it is square. While this assembly is clamped up, glue the table mounting cleats in their position between the long table aprons. As the glue in this assembly dries, it is time to complete the tabletop panels.

Completing the top panels:

Cut the panel that will be the center panel of the tabletop to a finished size of 38" long by 22" wide. The next steps will be done with the table leaf panels face down on a sacrificial backer board.

Completing the table leaves:

The table leaves are rounded on the end and should be cut with a circle cutting jig (MLCS #9308 Curv Pro Circle and Ellipse cutting jig) to ensure a consistent radius. The first step is to layout a line 2" from the edge of the leaf panel that will mate up to the table top. Make that line across the entire 40" length. Next make a perpendicular line at the center of the width of the panel across the 24" length. Using the Curv Pro set the center of the base at the intersection of both lines just made in the previous step. Secure the base in place using the three available mounting holes. Follow the set up instructions provided with the Curv Pro to make a half circle with an inside radius of 19" (*Figure 47G*). Cut the radius making sure to stop at the 2" line previously made (*Figure 47H*). Complete the cut by making straight cuts on the last two inches on each side of the leaf (a large panel used on a table saw can make this step easier) (*Figure 47I*). Repeat these steps for the second table leaf.

Routing the drop leaf profiles or rule joint profiles:

Because the hinges will be recessed, 1/2" radius round-over and 1/2" radius cove bits will be used to create the drop leaf or rule joint. Start by routing the round-over profile on all four edges of the tabletop and the outside of the table leaves (***do not rout the long straight edge of the table leaves with the round-over bit***). Set the round-over bit to a cutting depth where it will produce a 1/8" fillet above the start of the round-over profile (*Figure 47J*).

After completing the round-over cuts, change to the cove bit. Using a piece of scrap wood the same thickness as your table top, adjust the bit height to leave a 1/8" fillet below the cove profile. When you have the bit height adjusted so that the cove profile overlaps the round-over profile, and both pieces of stock are aligned at the same height, proceed to rout the cove profile along the long straight edge of the table leaves. This will complete the steps necessary to make the drop leaf or rule joint (*Figure 47K*).

Figure 47G



Figure 47H

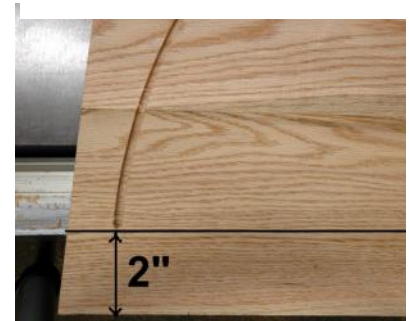


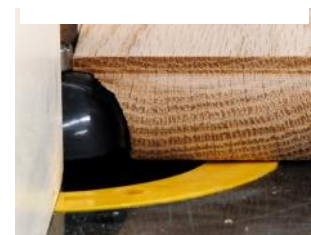
Figure 47I



Figure 47J



Figure 47K



Gate Leg Drop Leaf Table Plans

Laying out the position for the drop leaf hinges:

Place the two table leaves and tabletop face down on a clean, flat surface. Position the pieces so that they are aligned along the joints and even at the edges. Three hinges will be used on each leaf to add proper support and stability. Mark the two outer hinge locations 2-1/2" from the outside edges of the table. The center hinge will be positioned in the exact center of the table. Position the hinges so the longer hinge leaf lays on the table leaf and the hinge barrel is 1/2" from the edge of the center panel (*Figure 48L*). Trace the outline of the hinge to mark the location of the mortise.



Figure 48L

Making and using hinge mortising jig:

Make a jig to mortise the hinges into the table bottom by following these steps. Using a piece of 1/4" thick plywood or hardboard, draw the outline of the hinge onto it, also marking the position of the hinge barrel. Use a drill bit to make a starter hole in the jig inside the outline of the hinge. Use a scroll saw or jig saw to cut out the hinge opening in the template (*Figure 48M*).

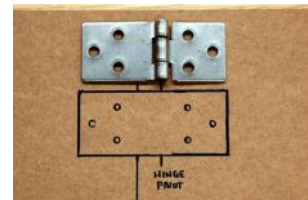


Figure 48M

Cut each side of the mortise separately. Align the jig to match the traced outline on the tabletop and leaves. Use double sided tape to secure the jig in position while routing. Using a 1/2" diameter dado clean out bit (MLCS #5382), adjust the depth of the bit to cut 1/8" deep into the tabletop and leaf. Allow the guide bearing on the shaft of the bit to follow the recess in the mortising jig. Clear out all of the material in the area the hinge will be mortised (*Figure 48N*). Repeat these routing steps until all six hinge mortises are completed. A corner chisel (MLCS #9540, 9541) or hand chisel will need to be used to square up the radiuses of the corners of the mortise. Next, an additional jig will be made to mortise for the hinge barrel.



Figure 48N

Using another piece of 1/4" thick plywood or hardboard, mark a 3/8" wide slot 1/4" wider than the width of the hinge barrel you are using. Again cut out this rectangular recess using a scroll saw or jig saw. The center of the hinge barrel will be 1/2" from the edge of the tabletop. So, therefore mark a line 1/2" from the centerline of the 3/8" wide dimension. Mount a 3/4" wide piece of scrap wood to the outside of this line (this block is to register against the edge of the tabletop) (*Figure 48O*). Install a 3/8" template guide bushing (MLCS #9047) into the base of your router. Install a 1/4" diameter straight cutting bit into your router. Adjust the bit to cut to a depth that is 1/8" deeper than the hinge mortise that has already been cut. Using double sided tape, position the jig so that the jig is centered over the hinge mortise already cut into the tabletop. Allow the template guide bushing to follow the template to cut the mortise for the hinge barrel.



Figure 48O

Mounting the hinges to the tabletop and table leaves:

Place the hinges into the mortises cut in the tabletop and table leaves. Pre-drill the screw holes to mount the hinges (MLCS #9371 Flash bit will provide a perfectly centered hole) (*Figure 49P*). Install the screws to secure the hinges being careful not to over-tighten and strip the threads. Test the leaves for proper folding action. If they bind on the bottom of the table edge, relief sand the corners of the table bottom to allow for clearance (*Figure 49Q*).



Figure 49P

Preparing the gate leg:

Cut the gate leg apron to a length of 15-1/4" (measure from the tenon). The short piece that is left will be used to mount the gate leg. Apply glue to the mortise and tenon on each gate leg and clamp these assemblies. (**Remember to keep the routed bead at the bottom edge of the apron**). After the glue dries, surface mount the hinge to the gate leg apron and gate leg apron mounting block (*Figure 49R*).



Figure 49Q

Installing the table base to the tabletop:

Drill three mounting holes through each of the mounting cleats in the table base. The two outer holes should be elongated to allow the tabletop to move seasonally. With the tabletop/leaf assembly still sitting on a clean, protective surface face down, position the table base on this assembly. Center the table base over the top and secure the top to the base using 1-1/4" wood screws.



Figure 49R

Installing the gate leg:

To install the gate leg in the proper position, place the gate leg along the previously drawn centerline. Place the gate leg apron on a 45 degree angle to the table base and mark the position of the table leg apron mounting base. Pre-drill the mounting screw holes from the inside of the table aprons. Reposition the gate leg apron mount and secure using 1-1/4" wood screws. Stop block cleats will be installed next. With the gate legs still in a 45 degree position, place the 8" cleats in position along the outside of the apron and secure in place with 1-1/4" wood screws (this will stop the gate legs and support the table leaf at the proper position when the table leaf is folded up) (*Figure 49S*).



Figure 49S

Have a helper assist you in the next step. Fold in the gate legs, lift up the table leaves to closed position, and carefully turn the table over to an upright position (**be very careful to take precaution that the table leaves do not swing open and cause injury during this step**).

Finish by sanding and applying a stain, dye or other type of finish.

Parts List for Drop Leaf Gate Leg Table

Part Description	Length	Width	Thickness	Quantity	Notes
Legs	29"	1-3/4"	1-3/4"	6	
Long Aprons	33-1/4"	3-1/2"	3/4"	2	
Short Aprons	15-3/4"	3-1/2"	3/4"	2	
Gate Leg Aprons	19-1/4"	3-1/2"	3/4"	2	This will be cut shorter later
Gate Leg Cleats	8"	3/4"	3/4"	2	
Table Top	40"	24"	3/4"	1	
Table Leaf	40"	24"	3/4"	2	Rough Size
Table Cleats	15-3/4"	2-1/2"	3/4"	3	Rough Size
Drop Leaf Hinges				3 pair	
Gate Leg Hinge				1 pair	
Wood Screws	1/2"			36	
Wood Screws	1-1/4"			19	

Multi-Molding Crown Molding

MLCS Item #7871+#7872

Set-up Instructions

1. Rip wood to a width of 4-7/8”.
2. Set bit height to 2-7/16” above table surface.
3. First make the cut on one edge of board. Then flip over the board and cut the opposite edge of board. To cut the full depth of the bit use 5 to 6 passes per edge.

For best results, bit speed should be reduced to 12,000 to 15,000 rpm. (If your router doesn't have variable speed, MLCS Speed Control, item #9400 or #9410, can be used with non-soft start routers to allow slowing your router bit down to recommended speed).

Note: You may need to sand the middle of the cove area to remove any remaining ridge from the milling process. First use 100-grit sandpaper to remove any ridge. Then using finer grits (120, 150, 180, 220) sand to final finish. Now apply your stain or paint.



How To Make Beaded Panels

You Will Need the Following Items:

1/8" Point Cutting Round Over Bit (#6431)

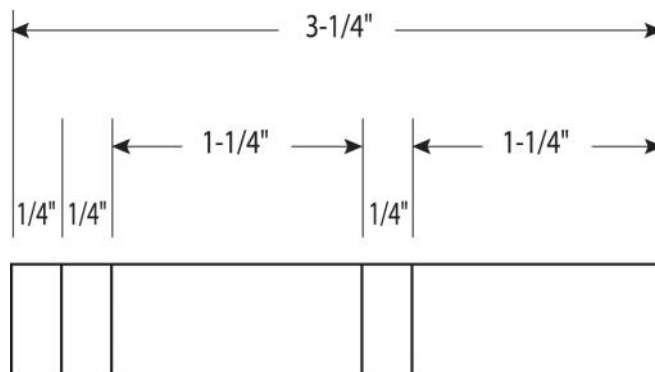
1/4" Straight Cutting Bit (#5470, #5468, or #7770)

1/2" Straight Cutting Bit (#5474, #5477, #7774, #7777, or #7775)

Router Table

Ruler

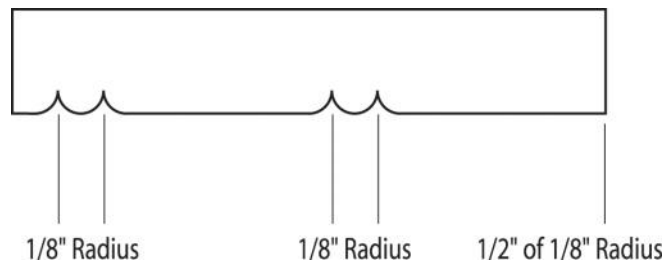
From a piece of scrap wood, make a set up block to set the fence for all of the cuts necessary to make the beads. Lay out the first line 1/4" from the end of the set up board. This end will be the edge that the tongue will cut from. Make a second line 1/4" from the first line. Measure 1-1/4" and draw a line at this point. Make your fourth line a 1/4" from this line. Again, measure 1-1/4" and make a final line at this point. This is the edge that the groove will be milled into. This also gives you the final width of the panel.



Rip all of your boards to their final width (3-1/4"). You may find it to be easier to make your panels out of longer stock and cut into final length after all routing has been done. This is recommended when your panels aren't very long.

Set up your Router with the Point Cutting Round Over bit and adjust your bit to a height of no more than 1/8".

Using the set up block made in step (1), set your Router Table Fence so that the bit is centered on the first line. Rout all of your boards at this fence location. When you have finished all of your boards, reposition the fence so that the bit is centered over the next line. Again rout all of your boards at this location. Repeat until you have routed at all of the lines from the set up block. Finally, adjust your fence so that the bit is centered over the edge of the board.



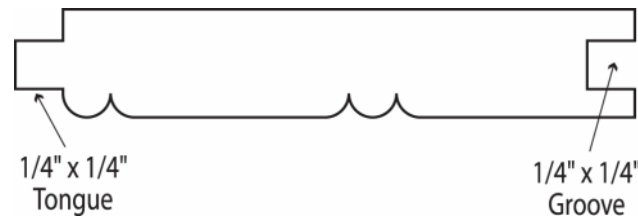
How To Make Beaded Panels

It is now time to create the groove. Set up your Router with the 1/4" Straight bit and adjust the bit height to 1/4"(*) . Set the Router Table Fence so that the bit is centered on the edge of the board. The board will be routed vertically against the Router Table Fence and you will be routing the edge of the board that has one half of the radius routed on it.

*(You can rout the groove in one pass if you are using softwood, but two passes are recommended for hardwoods.)

Next it is time to make the 1/4" tongue. Set up your Router by switching to the 1/2" Straight bit. Set one of the boards that has the groove in it on the Router Table surface and adjust bit height to the of the groove. Set the fence so that 1/4" of the Straight bit is exposed from the fence. Keeping the boards oriented the same way as you had the board for the set up (either beads up or beads down), rout all the boards creating one side of the tongue. Repeat set up to adjust for the other side of the tongue and rout one board to complete the tongue. Check the tongue for fit. It should be snug but not overly tight. Adjust bit height to fine tune fit, then rout all remaining boards to complete your beaded panels.

If you made your panels long, cut them to final length and install them in your project.



Box Joint Bit

Item #7860

Making A Safety Sled

To aid in the use of Box Joint Bit #7860, a simple safety sled will help prevent tear-out and will also speed bit height adjustment. To make the sled you will need the following:

- A small piece of 1/4" plywood, masonite, or phenolic plastic (approximately 6" wide by 14" long).
- Some scrap wood, preferably hardwood, to make the backer blocks (3/4" x 2" x 13").
- Four (4) #6 x 3/4" wood screws

Cut your base to 6" wide by 14" long. Mark lines 90 degrees from the edge at 2" from each end of the base to use as a mounting guide for the backer blocks. Drill mounting holes approximately 2-3/8" in from the ends of the base and approximately 1-1/4" in from the edge of the base. Countersink the holes on the bottom side of the base to accept the heads of the mounting screws. Cut two backer blocks to approx 6" in length and secure, with 3/4" dimension against base, using #6 wood screws, making sure backer blocks do not overhang base. Make sure head screws are recessed so that they do not scratch your tabletop.

To Use The Sled

The sled has two ends on it so that there will be support after the bit has cut through to prevent tear-out. Use one end always at the first bit height set-up and then reposition the bit height and use the opposite end of the sled for that second cut position.

Making the Box Joint

To make the first cut, adjust the bit height so that the bottom one of the 5/32" slot cutters is at the height of the sled top. Set your fence so that the cutters are protruding the same amount as the thickness of your stock. Mark the top edges of all 4 pieces to keep them oriented properly. Run the first piece of stock through the bit. Turn your stock to the other end and run it through, keeping orientation mark the same. If your stock wants to slide along the backorder block, apply adhesive backed sandpaper to the face of the block to help hold the stock in place. After running both ends of the first piece, run the piece that will be across from it on the assembly. To run the other two pieces, first turn the sled around and, using one of the pieces already cut as a guide, adjust the bit height so that the slot cutters are at the same height as the fingers on the cut piece (measure with cut piece positioned on the sled). Cut both pieces the same as above at the new bit height. When you are done, the 4 pieces should form a box with interlocking corners and all pieces should line up at the same height. The next time you go to use the bit, adjust the bit height to match the profile cut on the backer blocks.



Rosette Cutters

Rosette Cutters Item # 948, 949,
963-968, 9350

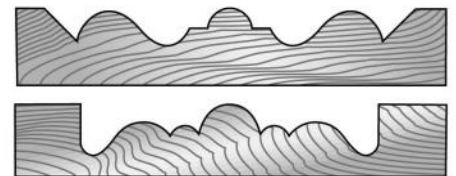
Rosette Cutters generally cut across the face grain of the wood. Follow these tips and suggestions for a safe and successful cut.

Always use Rosette cutters in a stationary machine, never in a hand held drill. The drill press, milling machine or lathe will work well. The controlled feed of a mill or lathe tailstock gives the best results.

Choice of material can affect the quality of the cut. Pine is the least desirable of wood choices. Tight-grained hardwoods, such as Maple, Mahogany, Birch, and Cherry work best. Red Oak is good but a little tearout is possible. For painted molding, MDF (medium density fiberboard) cuts well.

All cutters should be run at slow speeds, 300-600 rpm.

SPECIAL NOTE: 350 RPM is the MAXIMUM for Rosette Cutter Head #9350. Be sure everything is clamped tight and that the cutter is square to the workpiece. Cut rosettes in a long board; then separate into squares. If you are feeding the quill manually, go easy and gently, letting the cutter do the work. Aggressive feeding will cause the cutter to jam into the wood.



Plug/Tenon Cutters

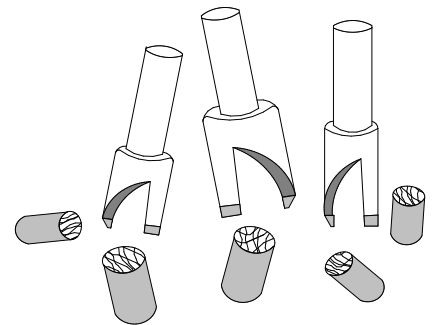
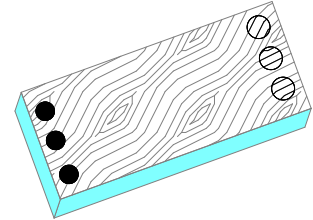
**Plug Cutter Set #9160,
Tenon Cutters #9281-9**

Plug cutters are designed to cut the face grain of wood to give nearly invisible filler for screw holes. You can also use a contrasting color wood to accent joinery and add detail.

Sizes range from 1/4" to 1". There are also several types of tool. In all cases the most consistent and accurate results are obtained using the plug cutters in the drill press. Always clamp the wood securely.

Holes to be plugged should be at least 1/4" deep to allow for flush sanding and good gluing. Cut the plugs about 1/16" deeper than the hole from scrap wood to be filled. Plugs can be removed by prying them out with a screwdriver. You can also cut them free with a bandsaw.

Carefully match grain and glue in place. Sand flush and finish.



Merle Clamp

Merle Clamp Item #9012
Corners and Jaws #9013

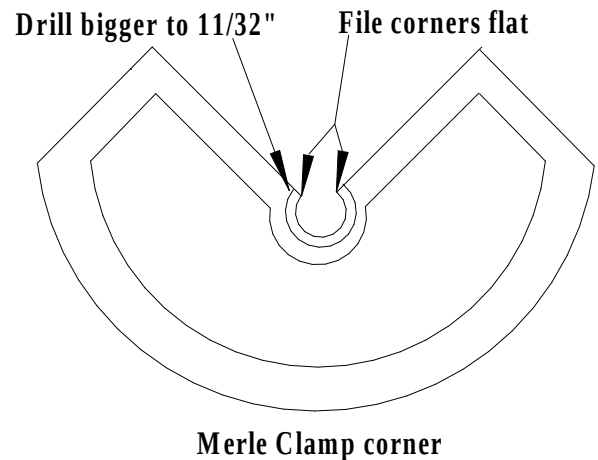
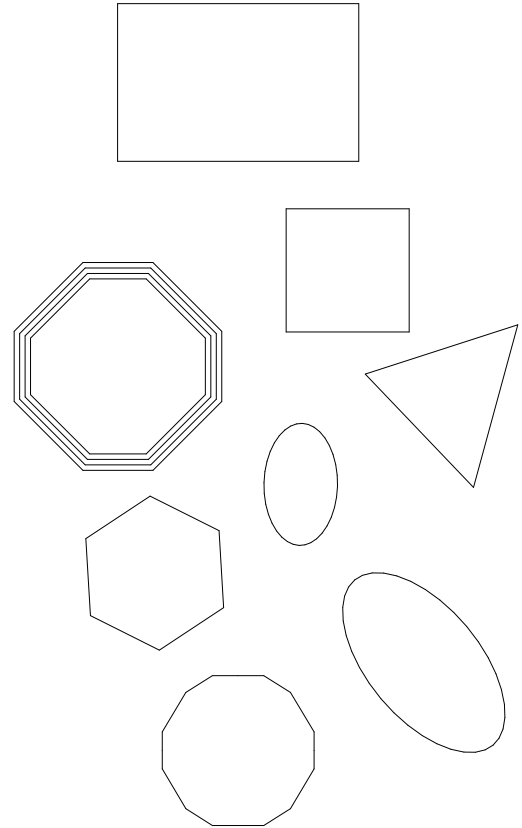
The Award Winning Merle Adjustable Corner Clamp is now even better, with our exclusive MLCS Pivoting Jaws! These self-adjusting jaws will align to any angle or shape.

The Merle Clamp has been a standard in the workshop for clamping almost any size square or rectangular frame. It is ideal for picture frames, boxes, drawers, cabinets, and we even used it to clamp the leg frames up on our shop workbench! The standard capacity is from 2 5/8" x 2 5/8" to 69" x 69", (or 23 feet around). Added banding (purchased separately) increases capacity to 40 feet around! The only drawback was that for odd shapes, such as triangles, hexagons, octagons, rounds, or ovals, you needed to make wooden inserts for the aluminum corners to match the shape you were clamping.

Now with the MLCS Pivoting Jaws you get all the original features of the clamp, plus the ability to clamp any shape built right in. Hold boxes or frames with 3,4,5,6,7, or 8 sides. Round and oval shapes are no problem. An added feature of the Pivoting Jaws is the plastic jaws will not mar your work, so there is no need for additional clamping pads. The jaws are also easily removed when not needed.

Additional Merle Clamp aluminum corners are now available with Pivoting Jaws, 4 to a pack for \$14.95 (**Item #9013**). Pivoting Jaws are available by themselves 10 to a pack for just \$5.00! (**Item #9014**) It's easy to retrofit an original Merle Clamp for Pivoting Jaws, just follow the simple instructions below:

1. Mount an 11/32" drill bit in your drill press, and clamp one of your original Merle Clamp aluminum corners firmly to the drill press table.
2. Carefully drill out the original hole of the corner.
3. Use a mill file to flatten the corners at the open side of the hole.
4. Tap a Pivoting Jaw in place.



Multi-Sided Glue Joint Bits

Items #7838-7840

Figure 58

1) Adjust Bit Point Height to the proper setting using **Table 57A** below as a guide.

2) Adjust your router table fence so that the top edge of your stock (on bits #7838 for 6 sided object and #7839) is level with the height that the router bit intersects the fence face. This is easiest done by looking down the side of the fence and holding a straightedge along the top of your stock (**see Figure 58**). The bottom edge of your stock will contact the fence (on bits #7838 for 12 sided objects and bit #7840).

NOTE: By varying the bit point height, you can create objects that have a ribbed appearance vs. an aligned joint.

How Determine the Width of the Sides of Your Cylinder

After deciding upon the desired number of sides and diameter of your finished project, apply the appropriate formula below to determine the required **WIDTH** of each side.

6 Sided Object: Width = Outside Diameter / 1.7
 8 Sided Object: Width = Outside Diameter / 2.4
 12 Sided Object: Width = Outside Diameter / 3.7
 16 Sided Object: Width = Outside Diameter / 5.0

You should cut each side a little bigger than needed (1/16" or so). This provides a margin of error and allows for finishing.

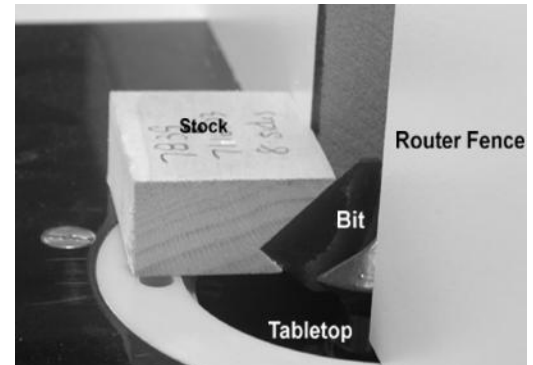
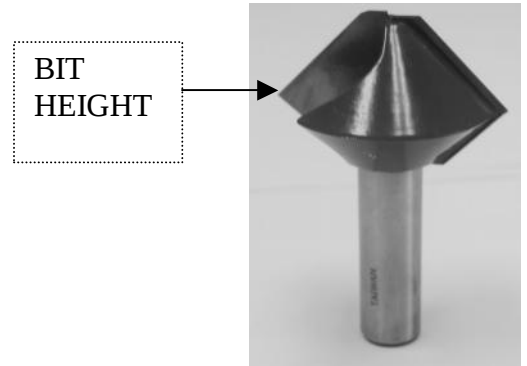


Table 58A

		1/2" Stock Thickness	3/4" Stock Thickness	Orientation
Bit #		Bit Point Height Settings	Bit Point Height Settings	
7838	6 sided object	15/64"	3/8"	Run Outer Face Up
7838	12 sided object	13/32"	11/16"	Run Inner Face Up
7839	8 sided object	1/8"	7/32"	Run Outer Face Up
7840	16 sided object	29/64"	23/32"	Run Inner Face Up

Multi-Sided Glue Joint Set

Item #8357

Figure 59

1) Adjust Bit Point Height to the proper setting using **Table 59A** below as a guide.

2) Adjust your router table fence so that the top edge of your stock (for 6 and 8-sided objects) is level with the height that the router bit intersects the fence face. This is most easily done looking down the side of the fence and holding a straightedge along the top of your stock (see **Figure 59**). The bottom edge of your stock will contact the fence (for 12 and 16 sided objects).

NOTE: By varying the bit point height, you can create objects that have a ribbed appearance vs. an aligned joint.

How Determine the Width of the Sides of Your Cylinder

After deciding upon the desired number of sides and diameter of your finished project, apply the appropriate formula below to determine the required **WIDTH** of each side.

6 Sided Object: Width = Outside Diameter / 1.7
 8 Sided Object: Width = Outside Diameter / 2.4
 12 Sided Object: Width = Outside Diameter / 3.7
 16 Sided Object: Width = Outside Diameter / 5.0

You should cut each side a little bigger than needed (1/16" or so). This provides a margin of error and allows for finishing.

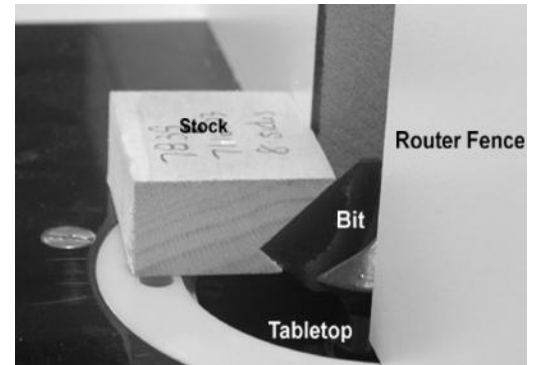
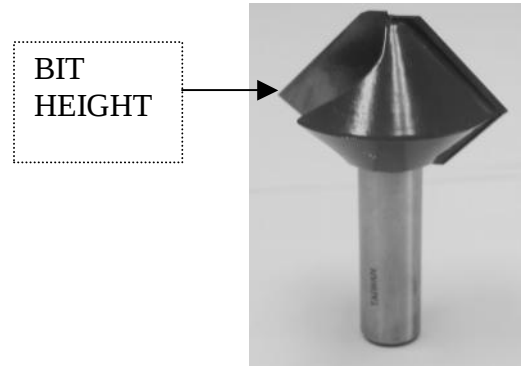


Table 59A

		1/2" Stock Thickness	3/4" Stock Thickness	Orientation
Bit #		Bit Point Height Settings	Bit Point Height Settings	
(Same Bit Does Both)	6 sided object	15/64"	3/8"	Run Outer Face Up
	12 sided object	13/32"	11/16"	Run Inner Face Up
	8 sided object	1/8"	7/32"	Run Outer Face Up
	16 sided object	29/64"	23/32"	Run Inner Face Up

MILLING THE CENTER POST

1. To begin, square your stock to make the setup and milling much easier.
2. Next, find the center of your stock by making intersecting lines from corner to corner.
3. Use a circle template or protractor to draw the diameter of the center post if you plan to turn it on a lathe. This will help to ensure the proper bit height adjustment as described in step 10 below.
4. Mark the center of one of the post faces. (This will be used to adjust the router table fence). You should only need to mark one face if you have properly squared your stock.
5. Since the Candle Stand bit removes a large amount of material, it is recommended that you use a 1/2" straight bit or 1/2" spiral upcut bit to clear out some of the material first.
6. Insert the 1/2" bit into your router table and adjust the fence so that the centerline on your stock is set with the centerline on your router bit.
7. Make sure you mount a stop block on your router table or fence to control the length of the cut. Adjust this cut according to the height of your table legs where they meet the center post.
8. Adjust the bit height and make enough passes to remove material up to 3/8" cut height for #7687 or 5/8" for #7688. (Candle Stand bit will cut up a 3/8" high dovetail for #7687 or 5/8" for #7688 and up to 3/8" depth straight cut for #7687 or 1/4" for #7688.)
9. Carefully, rout all four sides of the center post.



10. Switch to the Candle Stand bit, but leave the fence and stop blocks in the same position. Adjust the bit height so that you cut the dovetail and enough of the straight cutter to mortise the leg into the center post by at least 1/16".

11. Once again rout all four sides of your center post.

12. You may choose to use a 3/8" Roundover bit to radius the legs to fit the radius cut by the Candle Stand bit. If you choose not to do so and want to leave a square edge on your legs, you must use a chisel to square the corners in the center post.

13. If you desire a turned center post, you may now turn the center post on a lathe.

MILLING THE LEGS

1. To create a very tight and secure joint, a dovetail must be cut into the legs to mate with the center post.

2. Lower the Candle Stand bit so just the 3/8" dovetail is exposed for #7687 or 5/8" dovetail for #7688.

3. Move your fence forward exposing just the angled portion of the dovetail section of the Candle Stand bit.

4. Run a test piece on both sides and check the fit. Adjust the fence as needed to acquire a proper fit.

5. Run all four legs on both sides.

6. Cut approximately 1/2" of **just the dovetail** off the top and legs.

7. Assemble legs and center post using wood glue. Install the legs into the center post by sliding the dovetails on the legs into the dovetail sockets on the center post.

Train Track Bits

Items #7309-7314

Before You Leave the Station

- 1) Have a thorough understanding of how to operate your router and follow all safety procedures appropriate to the use of such machinery. These instructions only cover procedures specific to the making of the train track pieces.
- 2) Remember—**DO NOT** use the bits freehand. They are designed for router table use **ONLY**.
- 3) Keep joints fairly loose so young hands can easily assemble and disassemble the track.
- 4) If you are attempting to match already existing track, do not follow the measurements provided—make your own measurements from your existing track.
- 5) A right angle fixture, either handmade or store-bought, is needed to hold a work piece stable in a vertical position.
- 6) For best results, we suggest European Beech Stock. This project is not recommended for hard woods, such as cherry and oak, etc., due to the danger of burning.



Making Straight Track

- 1) First, determine your track length. Many sizes will do, but common sizes found in stores are 4-1/4", 5-3/4" and 1-1/8". Remember: The overall length will be longer than the "track length" when you consider the male connector. So, add 11/16" to the length for the male connector.

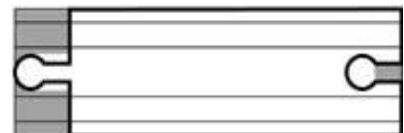
HINT: Cut several track pieces at a time to avoid the difficulty of repeating exact router setup.

- 2) Use 7/16" thick, 1-9/16" wide wood blanks for your straight track components. If duplicating store-bought track, use stock with identical measurements.

THE FEMALE CONNECTOR CUT (MLCS Item #7310)

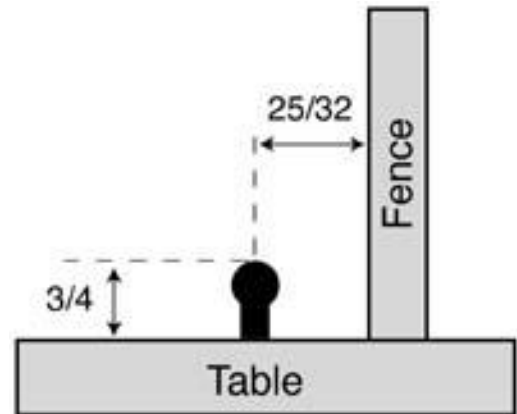
HINT: Precutting material around the joints allows you to work more effectively. (Precut the shaded areas as shown in **Figure 62**)

Figure 62



Train Track Bits

Figure 63A



1) Place the Female Connector Bit (MLCS Item #7310) into your router at a height of $3/4$ ". The center of the bit should lie $25/32$ " from the router fence. (See **Figure 63A**)

HINT: Cutting a small opening at one end of your work piece will reduce pressure and allow cleaner cutting. To avoid chip-out, we recommend using a backing board behind the pieces to be cut.

2) Using the right angle jig against the router fence, place your work piece perpendicular to your router table and flush against the fence and clamp in place.

3) Holding the right angle fixture firmly against the fence, push the fixture through the bit at a steady, moderate pace in **ONE PASS** only! **Remember:** You'll be using this cut as a guide for the male cut later on. Also, make all your female cuts first before moving on to the male cut.

THE MALE CONNECTOR CUT (MLCS Item #7309)

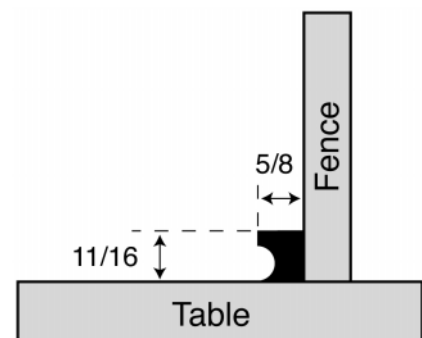
1) After precutting the opposite end, place the Male Connector Bit (MLCS Item #7309) in your router at a height setting of $11/16$ ". The upper outside edge of the bit should lie $5/8$ " from your fence. (See **Figure 63B**).

2) Again position the work piece in the right angle fixture perpendicular to the table, flush with the fence. Clamp in place and pass through the bit steadily to make your cut.

3) Flip stock and repeat the cutting process so the cut is centered on the work piece.

HINT: Make fine adjustments at this time by repositioning your fence in or out. Test with the female connector, remembering that you want a loose fit for easy disassembly.

Figure 63B



Train Track Bits

CUTTING THE TRACK GROOVE (USING THE SINGLE GROOVE BIT #7311)

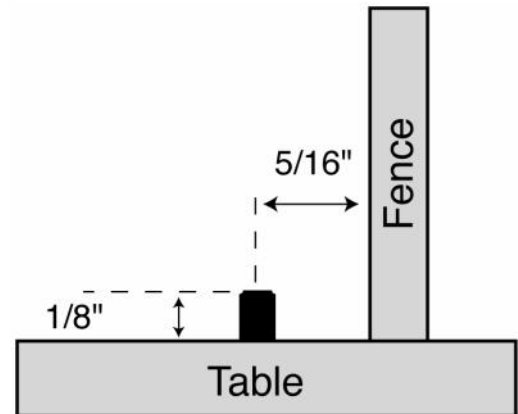
- 1) Grooves measure 1/4" wide, 1/8" deep, and 1" on center.
- 2) Use our custom Train track bit (**MLCS Item #7311**) set at 1/8" height and 5/16" distance from bit center to your router fence (when using single groove bit). (**See Figure 64**)
- 3) With a push block, push the track piece **HORIZONTALLY** (flat on the table) over the bit, holding tight and flush against the fence.
- 4) Flip stock end for end and repeat for second cut.
- 5) Smooth sharp inner edges by hand-sanding to avoid derailments. You can also soften the outer edges by sanding or chamfering with a small chamfer bit (1/16").

CUTTING THE TRACK GROOVE (USING THE DOUBLE GROOVE BIT #7312)

This bit will cut both track grooves in a single pass. NOTE: This bit can only be used for cutting STRAIGHT track.

- 1) Mount the bit in the router table and set the height to 1-9/16" and set the fence so that 1/8 of an inch of the bit is exposed.
- 2) Using a Push Stick, push the track blank against the fence and into the bit on its edge (**vertically**). This will produce both track grooves at the same time.
- 3) Smooth sharp inner edges by hand-sanding to avoid derailments.

Figure 64



Making the Curved Track

1) **Preparation:** You'll need a circle template. Construct one from scrap plywood about 11" x 13". Identify and label a lengthwise center line on the jig. About 2" from the edge on the center line, drill a 3/16" hole. This will be your pivot point. To identify the position of the wood blank on your template, mark a 90-degree guide line 6-11/16" from the center of the pivot hole. (See Figure 65)

2) Prepare wood blanks 7/16" thick, 3" wide, and 8" in length. (See Figure 65)

3) Set your wood blank on the jig at the guide line. Glue support blocks in place around the perimeter. Add another block the same thickness as the track near the pivot hole for support so the jig stays flat to the table.

4) Next, you must drill the centers of the arcs into your router table. Position the center of the first hole 8-1/4" from the center of the bit. Position the second hole 9-1/4" from the center of the bit. It is **extremely important** that these holes be accurately positioned!! A 3/16" drill bit can make the center holes AND serve as the pivot point of the jig.

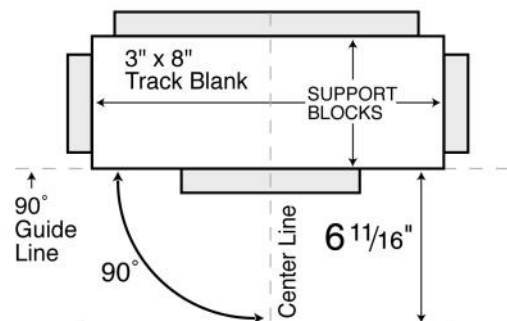
HINT: You may need to use a "false" table top if you can't drill directly into your router table. 3/4" plywood works well as a false top. Also, you can use a 3/16" drill bit to drill the center holes and then use the same bit as a pivot pin.

5) Place our Single Track Groove bit #7311 in your router at 1/8" above the table top and put your track blank into the jig. Place the jig on the table, aligning the pivot point through the jig and the first center hole. Turn on your router and slowly move the jig through the bit clockwise.

6) Move the pivot point to the second center hole and repeat the process.

7) Flip the track blank over and repeat step 5 and 6 to create track on both sides of your blank, so the curves can be used for either right or left-hand turns.

Figure 65



Train Track Bits

ANGLING THE GROOVE TRACK BLANK

Using a table saw and miter guide, cut the grooved blanks at an angle according to the dimensions shown in **Figure 66A**. NOTE: The male cut will be made on the right side of the track and the female cut on the left. Mark your blank accordingly.

CUTTING THE TRACK EDGES

Mark a guide line for the inner and outer edges of the track piece $\frac{3}{16}$ " from the track grooves. Cut on a band saw and sand. **HINT:** Exact width is essential at the ends to match the straight track at $1\frac{9}{16}$ " wide, in order to allow for smooth fitting track assembly.

USING THE RIGHT ANGLE FIXTURE

1) PREPARATION: Adjust the right angle jig to support the curved track for machining of the male and female connectors. Copy the inside radius of the curved track on 2 plywood scraps and cut the plywood along the lines. Attach the cut plywood pieces to your right angle jig $1\frac{9}{16}$ " apart. See **Figure 66B**. **HINT:** You may want to use a curved track piece to position the plywood.

2) Precutting the ends to be routed is a good idea.

3) The procedure for cutting the connectors is similar to that for straight track and the bit height doesn't change. However, the distance from the fence to the bit depends on where you placed your curved support plywood on your right angle fixture. **This is a trial and error process!!** The key is that the ball end cutter is centered on the track. The male cutter sits closer to the fence and the cut is made in 2 passes, flipping the stock. Adjust the male cutter by moving the fence in and out until the cut fits the connecting track piece. (See **Figure 66C**)

Figure 66A

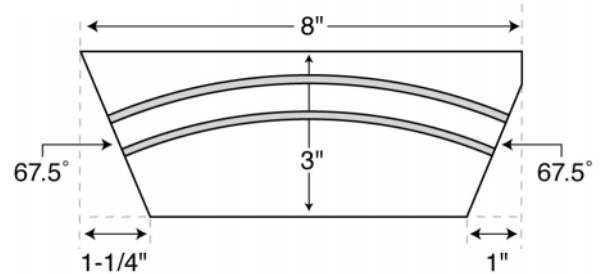


Figure 66B

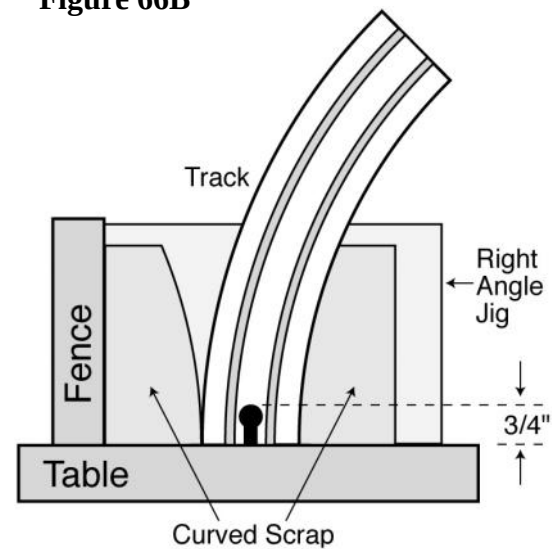
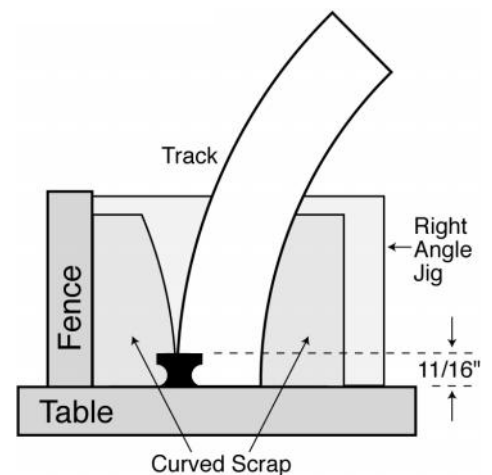


Figure 66C



On-Point Universal Laser Guided Router Plate General Instructions

- 1) Remove the sub base from your router.
- 2) Put a V Groove, or any pointed/small diameter router bit into your router.
- 3) Place your router on top of the Laser Plate and line up the point/center of the router bit with the exact center of the "X" of the laser guides.
- 4) Be sure the mounting screw holes in your router base do not overlap the laser guides or wiring in the Laser Plate. If it does simply rotate your router until the holes are clear of the laser guides and wiring.
- 5) Very carefully mark the mounting screw hole pattern on the Laser Plate.
- 6) Drill the proper size hole for your mounting screws completely through the Laser Plate.
- 7) From the bottom side of the Laser Plate counter sink each hole so that the screw head is below the surface of the Laser Plate. This will ensure that the screw heads will not mar your work or interfere in any way.
- 8) Mount your router to the Laser Plate.
- 9) Turn off Laser Plate when not in use. This will extend the life of the batteries and lasers.



Tips-

Use heavy-duty double face tape to mount your router to the Laser Plate as a temporary solution.
 Holes can be counter bored up to 3/8" for shorter screws.
 The router's sub base can be used as a pattern for marking mounting holes.

Warning:

Always wear proper safety protection and follow the safety instructions of your router properly.

Danger - Avoid direct eye exposure from the lasers.
 Class 111A Laser Product
 Max output <5 mW

Using the On-Point Universal Laser Guide Router Plate to make perfectly spaced cuts:

Easily set up your straight edge guide using the On-Point's laser as your reference point. Perfect for cutting dado slots in furniture construction or making general decorative cuts in any project.

Set-up and Use:

1. On your work piece, mark the centerline of your slot or groove with a pen, pencil or marking gauge.
2. Position the On-Point router base over the centerline drawn in step 1 at either end of the line. Turn on the laser and center the laser's cross hair directly over the point at the end of the line. Place your straight edge guide so that it is flush against the On-Point router base. (see *figure 68A* & Additional tip below).
3. Move the On-Point router base to the opposite end of the line. Keeping the router base oriented the same way as it was in step 2, again place your straight edge guide so that it is flush against the On-Point router base. (see *figure 68B* & Additional tip below).
4. Lock your straight edge guide in place and rout your groove.

Additional tip:

If you are routing stopped grooves instead of through grooves, when you have the router set on the ends of your lines, clamp a stop block at the edge of the router base. Then when the On-Point router base contacts the stop block(s), you have cut the full length of your stopped groove. (see *figure 68C*). The stop block is clamped to Work Piece.

Figure 68A

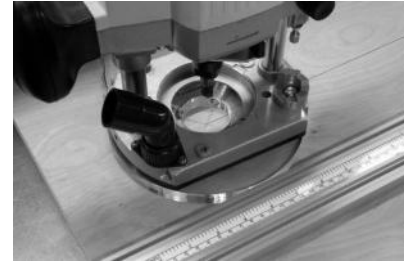


Figure 68B

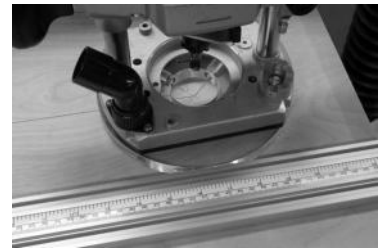


Figure 68C



Pin Router

INSTALLATION:

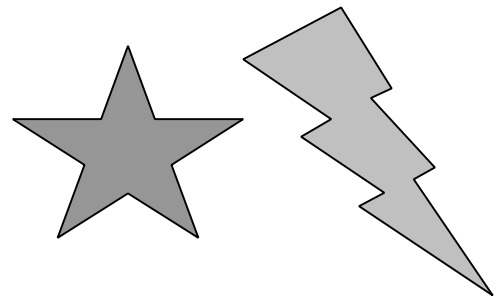
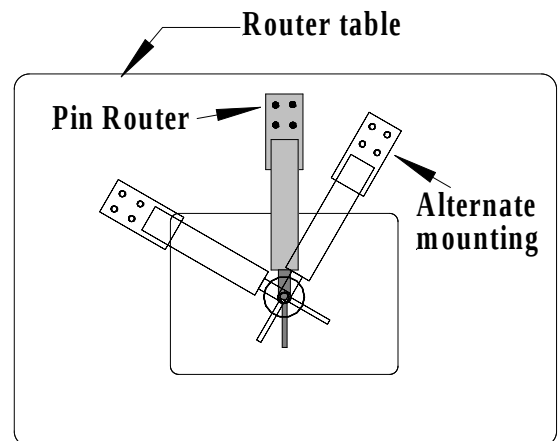
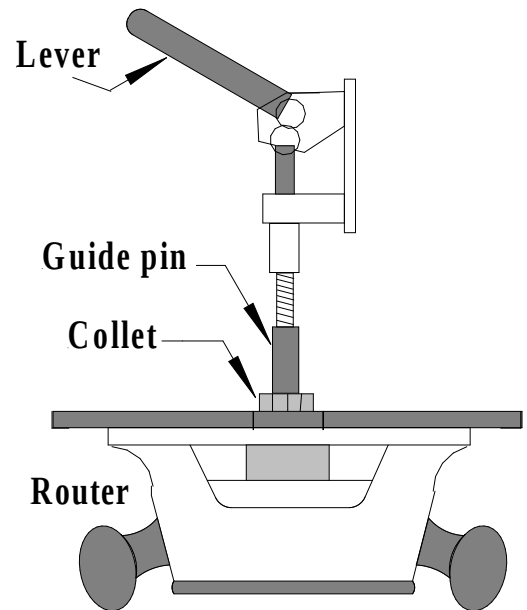
The Pin Router installs easily on virtually any router table. Raise your router all the way up in the table, with no bit in the collet. The router itself will help you align the Pin Router Arm. The pin should end up precisely centered above the router collet. Choose the 1/4" or 1/2" guide pin (depending on the collet size) and screw it into the pin router, and tighten the nut to hold it in place. Lower the pin, and place it into the router collet. Hand tighten the router collet. The mounting plate of the pin router should be sitting flat on the router table. If not, adjust the router height or pin. Now decide where on the table you would like the arm mounted. It can be straight back, or off at an angle from center. Note that the mounting holes will go through the table, so be sure that you won't run into any obstructions.

Mark the four mounting holes on your router table. Drill these holes carefully with a 3/8" bit. Install and tighten the four bolts, washers and nuts provided. Loosen the router collet and raise the pin. Your Pin router is now ready for use!

PATTERNS:

The Pin Router can use either inside, or outside patterns, depending on the finished piece. To cut out shapes, such as hearts, diamonds, or irregularly shaped parts, an outside pattern is used. This is the most common use of the Pin Router. To cut a shaped hole or recess into a workpiece, an inside pattern is needed.

An outside pattern consists of the desired shape cut out of 1/2" or 1/4" plywood or hardboard, mounted to a backer board. The backer board should be big enough to hold and feed through the router bit. Make the pattern shape by cutting it out on with a bandsaw or jig saw, then sanding or filing the edges perfectly smooth. Any bumps or roughness on the pattern will be transferred to the workpiece, so take your time on this step.



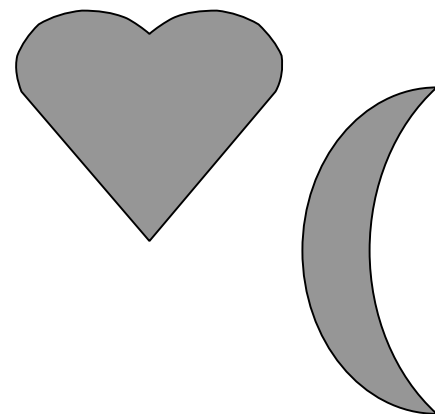
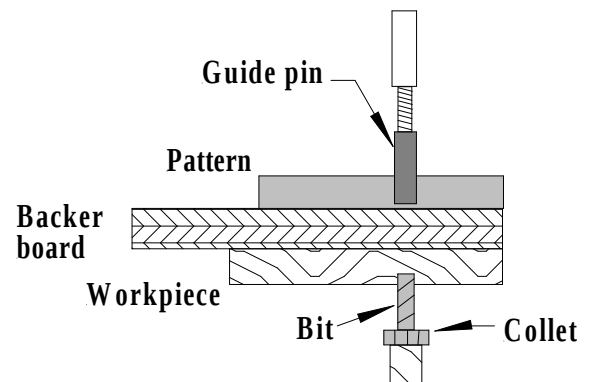
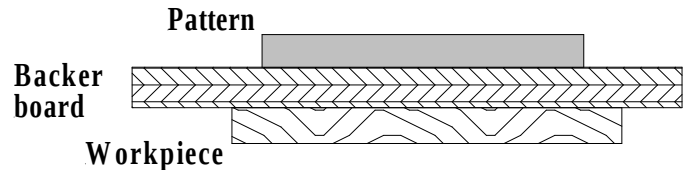
Pin Router

The backer board can be plywood, at least 1/2" thick, because the router bit will cut into it slightly when cutting out the workpiece.

The pattern shape and the backer board are fastened permanently together. Now take your workpiece, and fasten it to the opposite side of the backer board, using double faced tape or small brads. Keep the brads out of the path of the router bit, and make sure you fasten both the area of the finished shape, and portions of the waste wood to the backer board. You want everything to stay in place when you finish cutting out the part.

Choose a pin size (1/4", 5/16", 3/8", 1/2"), and a matching diameter of straight bit, and install them in the Pin Router and router collet. Usually the smaller sizes are used for outside work, and the larger sizes are used for inside work because they remove more material as they cut. A spiral bit does the best job of clearing out the chips, but a standard straight bit works just fine. To get the feel of the cutting action, set the router bit no more than 1/8" above the table for a first pass. Adjust the Pin height with the lever until it is down next to the pattern shape, but not touching the backer board. Lock it in place with the knob. You are now ready to route!

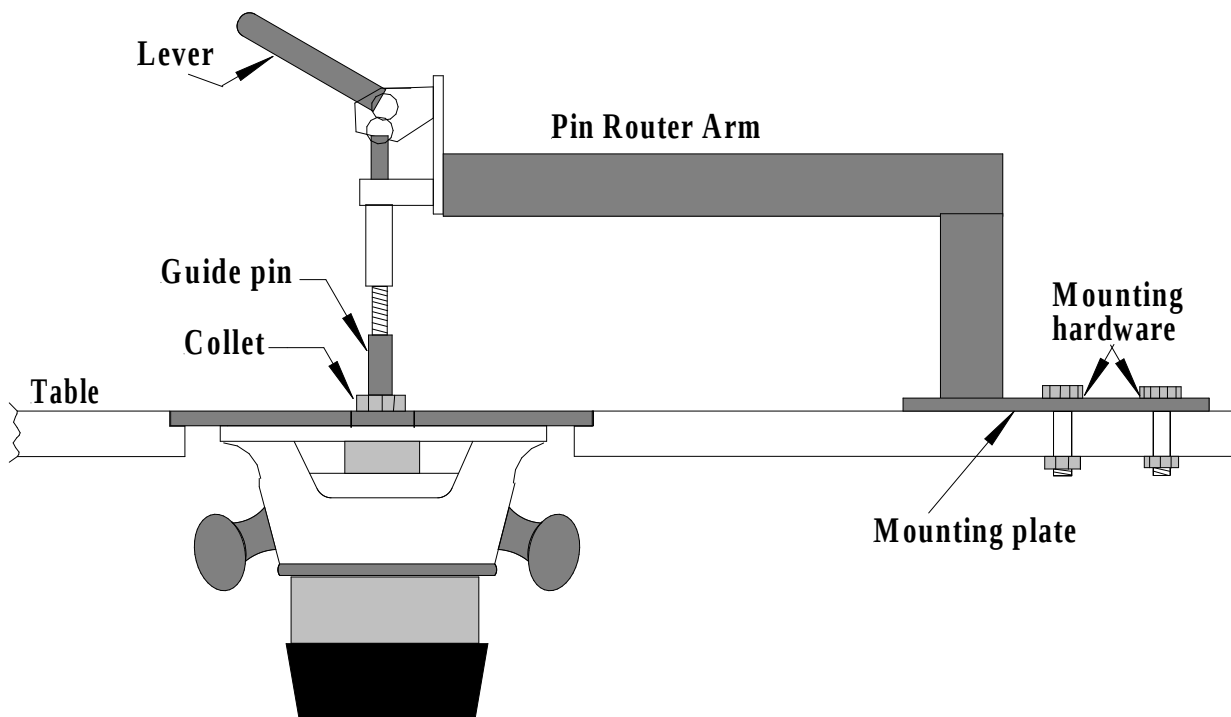
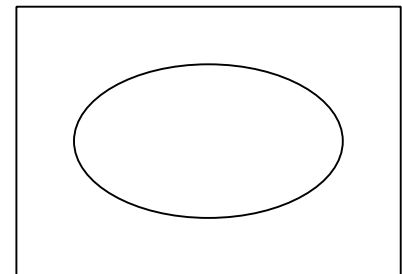
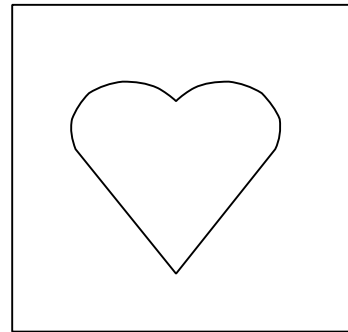
Start the router, and carefully feed the bit into the workpiece until the pin touches the pattern. Now carefully feed the work against the pin and around the pattern. Don't worry if you run off the pattern, that is the waste. The pattern covers the good part of the work. After going around once, raise the router up a bit and go around the pattern again. You will develop a feel, after a bit of practice, for moving around the pattern. Depending on the wood, and the thickness, two or three passes may be needed to cut all the way through. Remove the finished piece from the backer board. Install a new piece of wood, and make as many more exact copies as you need!



Router Table

For an inside pattern, you can use one of the MLCS Inlay Patterns, or make your own. To make an inside pattern use drill bits, scrollsaw, or coping saw to make the shape in the middle of a pattern board. This type of pattern “traps” the Pin Router pin. Attach to a backer board as above, and mount the workpiece same as before. In cutting you will need to plunge the workpiece/pattern assembly onto the router bit, then lower the guide pin into the pattern recess. Take light passes, and proceed as above.

Slight variations in size from any of the patterns can be made by combining different size guide pins and router bits. You can also use groove-forming and point-cutting bits for other effects. Repetitive straight lines as in dados for shelves, can also be done easily on the Pin Router.



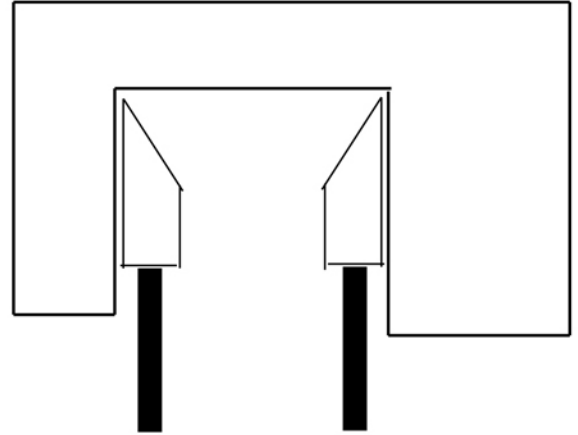
Stack Dado Blade Set

Item #9106

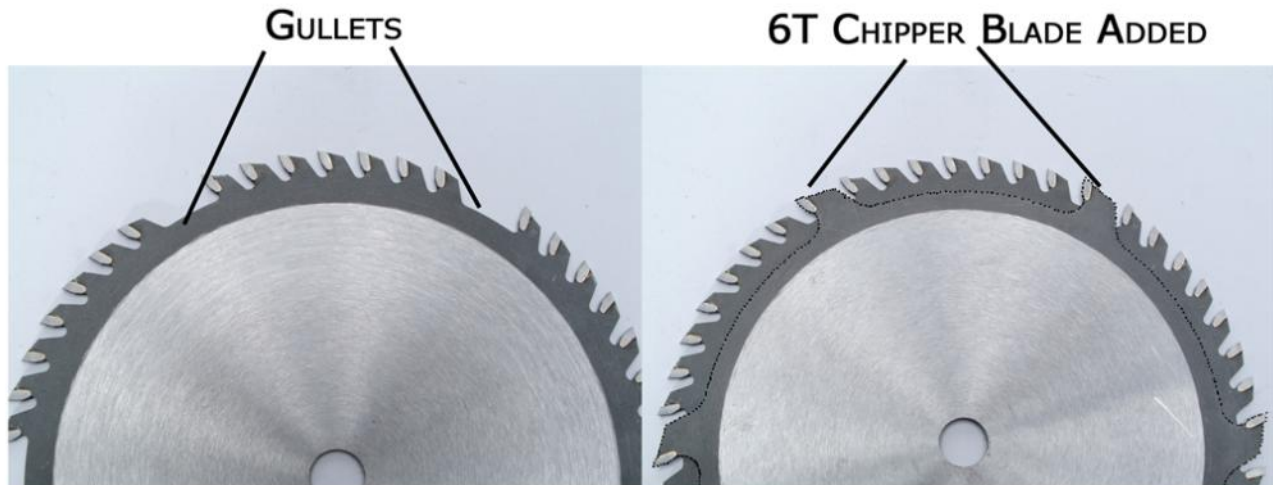
MLCS #9106 Super Stack Dado Blade Set Mounting Instructions

Set up the Super Stack Dado Blade Set with the 42T Blades on the outside of the chipper blades. 42T blades should be on both the right and left sides of the 6T chipper blades. The points of the 42 Teeth should always be orientated on the outside of the set up.

When Stacking the set of blades make sure the 6T chipper blades are aligned in the gullets of the 42T blades and the carbide does not make contact with the steel body and shoulder of the 42T blades.



PROPER BLADE PLACEMENT WITH TOOTH POINTS TO THE OUTSIDE



Warning:

Always use proper safety protection and follow OSHA regulations. Wear a dusk mask, goggles, and keep hands away from the saw blade. Use at your own risk.

Note: For deep dados or when cutting dados with a low power table saw, cut 1/2 of the dado depth, then raise the blade to full depth and finish cut.

Stack Dado Blade Set

Item #9106

MLCS #9106 Super Stack Dado Blade Combination Chart

Width of Dado	Outside Blades	1/16" Chipper	3/32" Chipper	1/8" Chipper
1/4"	2	-	-	-
5/16"	2	1	-	-
11/32"	2	-	1	-
3/8"	2	-	-	1
13/32"	2	1	1	-
7/16"	2	1	-	1
15/32"	2	-	1	1
1/2"	2	-	-	2
17/32"	2	1	1	1
9/16"	2	1	-	2
19/32"	2	-	1	2
5/8"	2	-	-	3
21/32"	2	1	1	2
11/16"	2	1	-	3
23/32"	2	-	1	3
3/4"	2	-	-	4
25/32"	2	1	1	3
13/16"	2	1	-	4
27/32"	2	-	1	4
29/32"	2	1	1	4

Shims are supplied to allow for fine adjustments to the width of the dado.

Miter T-Fence

Item #9467

Miter T-Fence Mounting Instructions

Make more accurate miter cuts and decrease tear-out with our precision extruded aluminum Miter T-Fence. Easily bolts to existing miter gauge for increased size (2-5/16" high by 22" long). Extension bar allows Maximum 36" length.

Mounting Methods

Note: Installing the Miter T-Fence onto MLCS Gauges (items #9456 or #9458) will not require a mounting block as shown below because these Miter Gauges have a "U" shaped channel to accept the mounting hardware. Other manufacturer's Miter Gauges may also have these "U" shaped channels or may even have through holes to correspond to the mounting hardware slot height on the MLCS #9467 Miter T-Fence. If your gauge differs, then use one of the other two mounting methods described below.

Slide the two hex head bolts into the T-Slots located in the back of the Miter T-Fence. Position the Miter T-Fence so that it will not contact the cutting blade when the Miter Gauge is pushed through its slot. The bolt should be seated into the "U" shaped slot in the Miter Gauge body. Secure the Miter T-Fence in place using a lock washer and star knob on each bolt.

Method 1: (See Figure 74A)

1. Make a mounting block of wood as follows: 2-1/4" high, 3/4" thick, 4" longer than your miter gauge face.
2. The block will require 2 (two) 1/4" holes positioned as follows: 1-1/2" from the bottom of the board and 1" from each end.
3. Draw a centerline on both the miter gauge face and your mounting block. Line up the lines and mount the block to the miter gauge using wood screws.
4. Insert the 1/4" hex bolts into the T-Slots located in the back of the Miter T-Fence and through the holes previously drilled in the mounting block. Secure with knobs.

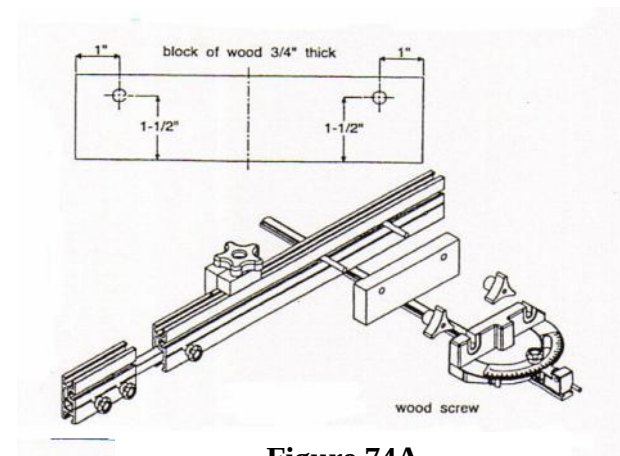


Figure 74A

Miter T-Fence

Item #9467

Method 2: (See Figure 75A)

1. Determine the center point of the miter gauge face and mark it.
2. Make a mark one inch to each side of the center line, 1-1/2" from the bottom of the miter gauge face, and drill 1/4" holes at these points.
3. Insert the 1/4" Hex Bolts into the T-Slots located in the back of the Miter T-Fence and through the holes previously drilled in the miter gauge face. Secure with knobs.

Installing the Miter T-Fence on a Miter Saw

- 1 Mark your Miter Saw Fence 2" and 6" from the outer edge and 1-1/2" above the miter saw table and drill 2 (two) 1/4" holes at the marks.
 2. Insert the 1/4" hex bolts into the T-Slots located in the back of the Miter Fence and through the holes you just drilled. Secure with knobs.
- Reposition the Miter Fence as needed. You will want your saw blade about 1/8" from the fence edge.

Constructing Table Support

1. Cut a 1/2" thick board to the width of your miter table.
2. Determine how far the Miter T-Fence goes beyond the end of the Miter Saw Table. Cut your board to that length.
3. On the back side of your board, drill 2 (two) 3/8" holes with a spacing of about 3".
4. Insert the two 3/8" Hex Bolts (not supplied) into the T-Slots located in the bottom of the Miter Fence and through the holes you just drilled. Secure with knobs.
5. Cut another board for the 4" extension and repeat steps 1-4.

NOTE: Since Miter Saws vary in size, the mounting hole placement may need to be adjusted accordingly.

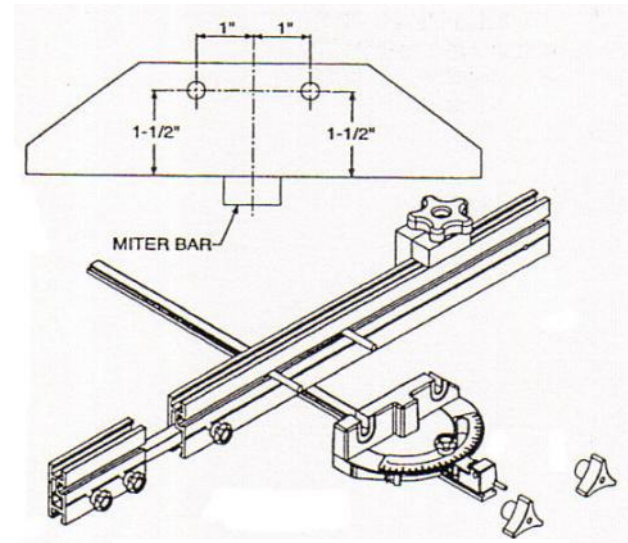


Figure 75A

22.5° Lock Miter Set

Bits #7740

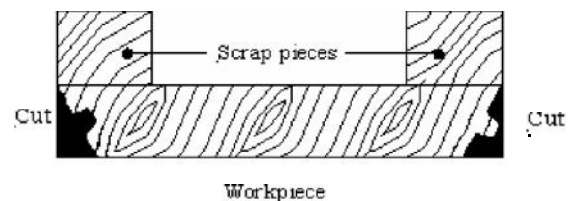
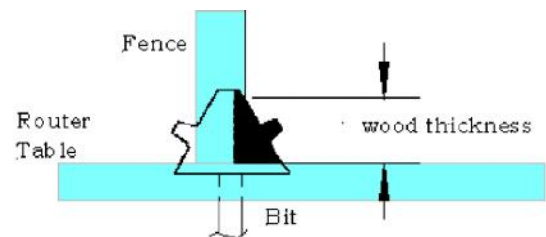
The Lock Miter bit set makes a clean, self-aligning mitered 45° corners in hardwood, softwood, and plywood. The bits must be used in a router table with a straight, squared fence. Best results are obtained with minimum clearance around the bit both in the table and fence. A variable speed router or **Router Speed Control (MLCS Item #9400 or #9410)** will make the job easier.

The most important thing to remember when adjusting the bit is this: The bit should be centered on the stock and be an equal distance from the top to the bottom, and only the diagonal of the bit should show.

If you are using a set-up block, refer to pages 28-29 before continuing.

Prepare some test wood the same thickness as your project, about 6" wide and cut square and true. Do not pre-miter the ends of the work. The bit does this. At the ends of the test pieces to be cut, attach a scrap of wood, as shown below, along the cut to act as a guide against the fence and table. Once the actual workpiece clears the bit, there is only a point of the piece left to ride the fence or table. The scrap piece keeps the work running straight and true. Run one side of the joint down on the table, then run the other side upright against the fence. Remove the scrap pieces and check the fit. Make a minute adjustment in the height of the bit or the depth of cut to align the corner, then run all of your corner pieces.

TIPS: Use double-faced tape (**MLCS Item #9489 or #9493**) to fasten the scrap pieces to all of the ends of the workpieces at once. Make them about an inch longer at each end for good stability. The **Merle Adjustable Corner Clamp (MLCS Item #9012)** is the best choice for gluing up a lock-mitered box.



If you experience excessive tear-out due to grain orientation or when using some plywoods, follow these steps in an attempt to eliminate this situation.

After following the set-up and testing instructions, and when you are satisfied with the fit of your Lock Miter joints proceed by:

1. Clamp a long stop block (preferably close to length of your fence) securely and snugly behind the back of your fence assembly. (You will be moving the router table fence and this will allow to return the fence to it's proper position for your final pass).
2. Slide the fence forward exposing only 1/4 to 1/3 of the router bit. Secure in place.
3. Make the cuts on your stock with the fence secured in this forward position. When completed loosen the fence.
4. Slide the fence backward toward the stop block, exposing more of the router bit. Again make the cuts on your stock with the fence secured at this new position. (Repeat as needed until the fence is once again positioned against the stop block. Multiple shallow cuts will yield a cleaner cut with less chance of tear-out).

Setup Block for 45° Lock Miter Bits

Item #9756

USING SET-UP BLOCKS ON 3/4" THICK STOCK * (For 45° Lock Miter Joints)

The stock must have 3/4" for #9756.

Using the set-up block, raise or lower the bit until the block aligns with either the tongue or groove of the bit, depending on which bit you use first. Move your router fence in until the setup block contacts both sides of your router fence.

Make sure the speed of the router is about 16,000-18,000 rpm. Test cut a piece of stock using extra or scrap wood to see if the profile is cut correctly. It should make a perfect 45° joint when mated to the setup block. Repeat this procedure for the second bit to make the complimentary cut on the mating piece of stock.

Fit together and check for surface and joint match. You may have to fine tune the joint after testing your first cut to get a perfect fit, by either adjusting the fence in or out, or adjusting the bit height up or down.

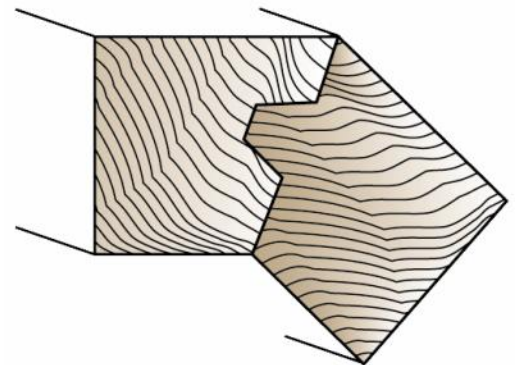
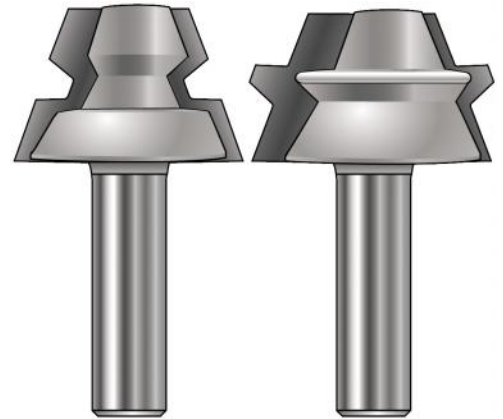
Once you have a perfect fit with your extra or scrap wood, you are ready to make the lock miter joint with your good stock.

NOTE 1: If the joint is good, but the surfaces are not even or the miter portion has a square edge, you must adjust the height of the bit upward or downward.

NOTE 2: If you have a split fence, close the opening as much as safe operations, permits.

** The set-up block is approximately 3/4". If your wood does not match the set-up block size:*

- Plane the wood to match the set-up block, if possible.
- If the wood is thicker than the set-up block, raise the bit and push the fence back slightly, until a good fit is obtained.
- If the wood is thinner than the set-up block, lower the bit and move the fence forward slightly, until a good fit is obtained.



Concealed Euro Hinge Marking Guide

Item #9552

Make a horizontal line on back of cabinet door at the desired hinge height.

Place Marking Guide against the edge of the back of the door with the centerline of the Marking Guide on the horizontal line.

Mark center of hinge cup hole and mounting tab screws at hole "A".

Remove Marking Guide and drill a 1-3/8" hole, 1/2" deep at hinge cup center mark.

Drill two 7/64" pilot holes approximately 3/8" deep at hinge mounting tab locations.

Set hinge cup in hole and secure with oval head mounting screws.

Mark center of hinges at desired height on the inside of the cabinet frame.

Make a horizontal line at this location.

Make a vertical line 1-1/2" in from the edge of the cabinet frame.

Place hinge mounting plates over the intersection of these lines and mark screw opening at center of oblong openings.

Drill 7/64" pilot holes approximately 3/8" deep at these locations.

Install hinge-mounting plates using the oval head mounting screws.

Slide tabs on hinges under the edge of the hinge mounting plates and push back of hinge toward cabinet side until it locks into place.



Dust Catcher for Table Saw & Router Tables

Item #9027

Included Parts:

- 1 Dust Catcher Bag (with 12 snap heads attached)
- 12 pieces Phillips head snap receptors

Assembly:

Line up snaps on the Dust Catcher Bag with the base of your stand. Place a mark on stand above snap head. Do this for all snaps. You may measure the distance between snaps and layout accordingly.

Use a 5/32" drill bit to drill 12 holes for receptors.

Screw the 12 Phillips head snap receptors into the base of the stand with the snap end facing outward.

Always snap the bag on by hand. Any other method may break snaps.

Operation:

Check that all snaps are secured in place.

Begin use of machine.

Never fill bag more than 2/3 full. Too much weight will cause bag to fail. Check often.

Wear dust mask and safety goggles to empty bag.

Maintenance:

Inspect that snaps & receptors remain firmly in place.

Check for tears. A torn bag should not be used.



Raised Panel Calculator

Item #9102

General Use Instructions:

When inputting your size specifications into the input fields, do not use “ for inches or mm after the values as this will give you an error during the calculate and report phase of the program. You can either use fractions or decimal equivalents when inputting SAE sizes. For example: for 3/4”, enter 3/4, and for .75”, enter .75 .

Glossary of Terms:

Rail and Stile Door Information

Selection of Door Style: Using the door option drawings on the left side of the input screen, click on the appropriate style door that you wish to make. You have the option of a single panel, two panels with an intermediate rail, two panels with an intermediate stile, three panels with both an intermediate rail and stile, four panels divided door or an arched top cathedral door.

Panel Width Clearance: This is amount you would like to leave to allow for seasonal expansion and contraction across the width of your raised panel. The value will generally be between 0” - 1/8” (0” - .125”) depending on the wood species and climate.

Panel Height Clearance: This is the amount you would like to leave to allow for seasonal expansion and contraction along the height of your raised panel. The value will generally be between 0” - 1/16” (0” - .0625”) depending on the wood species and climate.

Slot Depth: This is the amount of the depth of the slot cut by your rail and stile set. Our MLCS rail and stile sets are designed to cut a standard 3/8” (.375”) depth except for French Provincial set #8849, which cuts a 1/4” (.250”) deep slot.

Top Rail Width: This is the width of the top rail of your door.

Bottom Rail Width: This is the width of the bottom rail of your door.

Left Stile Width: This is the width of the left stile of your door.

Right Stile Width: This is the width of the right stile of your door.

Opening Information

Width: This is the dimension of the full width of the opening that the door(s) will be designated for.

Height: This is the dimension of the full height of the opening that the door(s) will be designated for.

Single Door / Double Door: Select the option you wish to use. This gives you the opportunity to use the door input data to calculate the size for a single door or two doors to fit the opening dimensions. Choosing the double door option will add 2 extra stiles, break the rail lengths into 4 smaller rails and your raised panels will be narrower. The double door option works well on opening sizes that are wider than 28", reducing the door widths. The benefit of using the double door option on a wide opening means less swing clearance needed and the door will be lighter and more rigid.

Clearance Between Doors: This input screen will only be active if you have selected to make double doors. This is the amount of clearance you want to allow between the two doors where they meet in the center of your opening. The typical value is usually 1/32" – 1/16" (.0312" - .0625").

Inset / Overlay: This option allows you to choose if you are installing your doors so that they inset (fit inside of the opening size) or overlay (sit on top of your face frame, covering and overhanging the opening size).

Left, Right, Top & Bottom: This is the amount you want to allow for the finished door to fit to your cabinet. For an inset door, this value will usually be 1/32" – 3/32" (.0312" - .0938"). For an overlay door, this value is decided by your choice of hinge you will be using. Most European style hinges require a certain overlay dimension and you should refer to the manufacturers specification for this measurement. If using standard surface mount hinge, this dimension is usually between 1/4" - 5/8" (.250" - .625").

Door / Opening Name: This option is helpful when you are making a project that will have several openings and you will be making several doors. It will allow you to name each door and opening to help keep you organized.

Measurement Units: This option allows you to input your measurements in either standard SAE (inch increments) or metric (millimeters) values.

Report: When all of your input fields have had the values entered into them, clicking on this button will provide you with the report for your door.

Cancel All: This button exits the input screen and returns you to the home screen. You will lose all of the information you have entered when you click on this button.