

SUPER FMT CHAPTER 4

Mortise & Tenon Routing Procedures

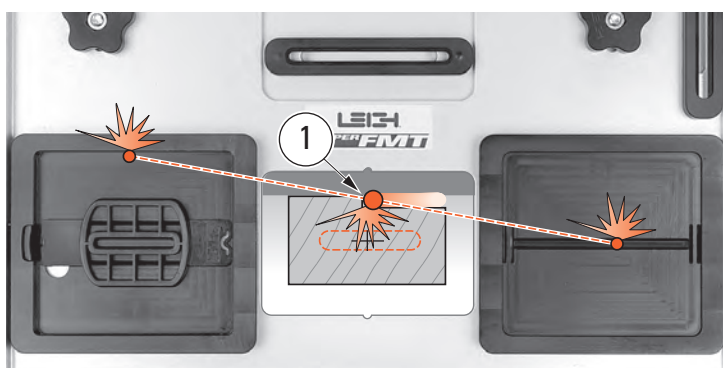
*Single Mortise & Tenon, Test
Production Procedures
Small Joints*

Before using your Leigh Super FMT you must have completed all of the preparatory steps including reading the router safety recommendations on the previous pages. If you haven't done so, it is essential that you do it now.

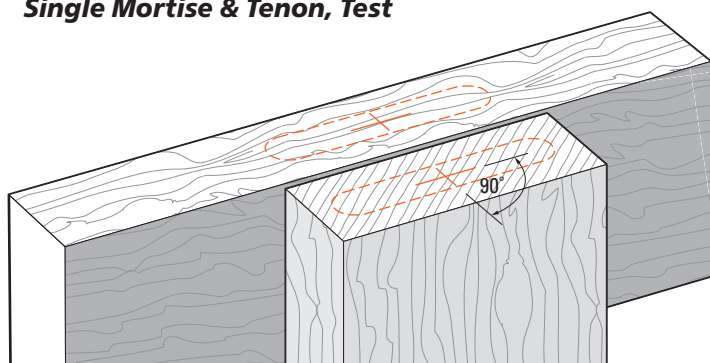
⚠ IMPORTANT SAFETY NOTE

Take great care to not “trap” the bit against the side of tenon rails ①. Do not attempt to rout center tenons in rails thicker than $1\frac{5}{16}$ " [34mm] before referring to 5-39 through 5-44.

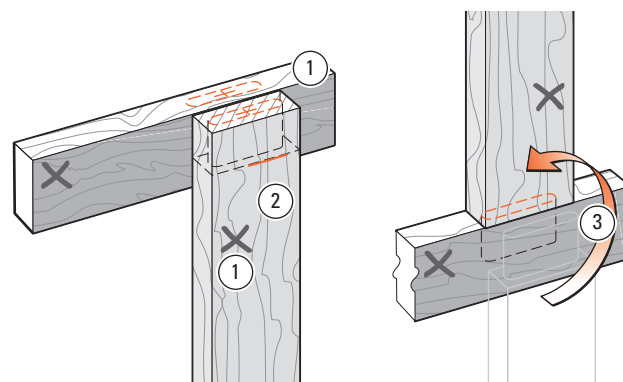
Without using the table movement as prescribed, the bit would have to be plunged into the side of the tenon rail causing the bit to powerfully “drive” the router across the jig. **This could be dangerous and can damage the jig.**



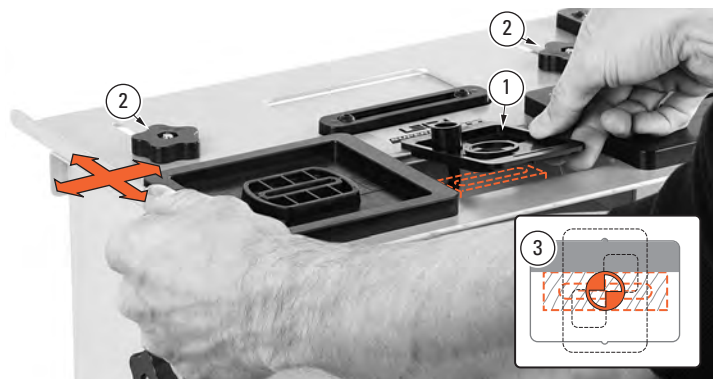
Single Mortise & Tenon, Test



4-1 Let's make a plain single mortise and tenon. Using a fine pencil, mark a cross at the center of the required tenon and mortise positions, the cross lines along and across the axis lines of the joint, at 90° to each other. Mark the mortise several inches [10cm] or so away from the end.



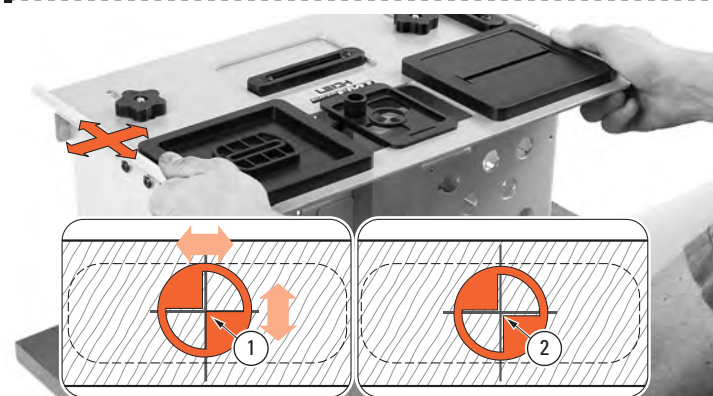
4-2 In almost all cases, it is critical to have the same side of workpieces reference against the clamp plate for each tenon and mortise. So mark one side of each workpiece to reference “this side toward the clamp plate” ①, or “away from” if you prefer. Make a pencil mark ② to the required shoulder depth on the tenon workpiece. When the joint is cut, the tenon piece is rotated 180° to assemble ③.



4-3 If you have not yet mounted the sidestop fence, do so now (see 3-7). Place it off center either side, it doesn't matter which. Fit the table sight in the bit opening ①. Loosen the table knobs ② and move the table to position the sight over the approximate tenon piece position ③. Lock the table knobs. **Always lock the table before positioning workpieces.**



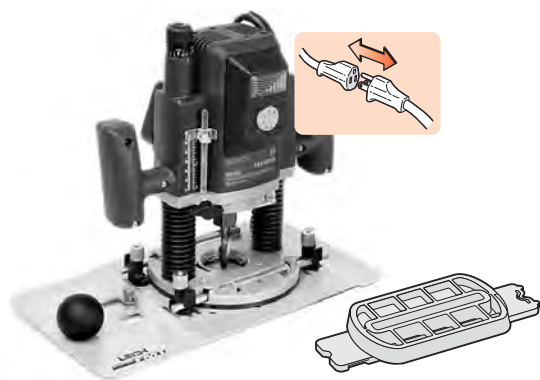
4-4 Clamp the tenon piece with the end **lightly touching the underside of the sight** ①. Its side edge should touch the previously set sidestop fence ②, **with the marked side toward the clamp plate.**



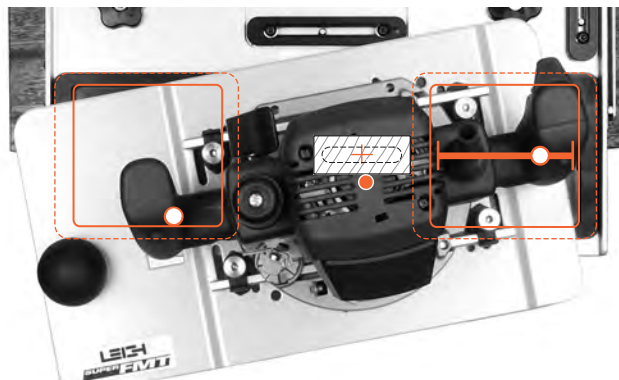
4-5 Loosen the table knobs and move the table until the sight opening is positioned equally around the layout marks on the workpiece. Lock the table. Because the human eye excels at comparisons, differences as small as .004 can be perceived in the space between the edges of the line and the triangles as shown here ①. You can readily center the sight using slight table movements until the spaces appear the same ②.



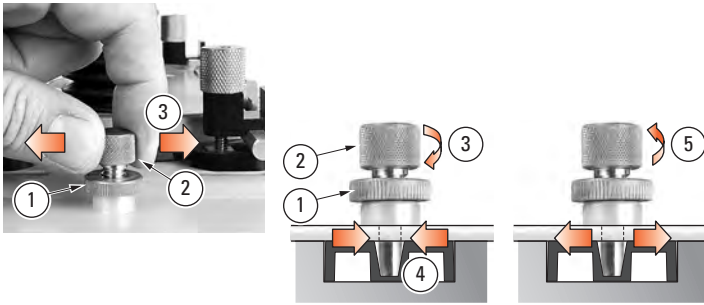
4-6 Unlock the two **FB** front/back limit stops. Move both so they touch the Stop Post, and tighten both stops ①. This prevents front-to-back movement of the table when later sighting the mortise. Remove the sight and store it at the end of the jig.



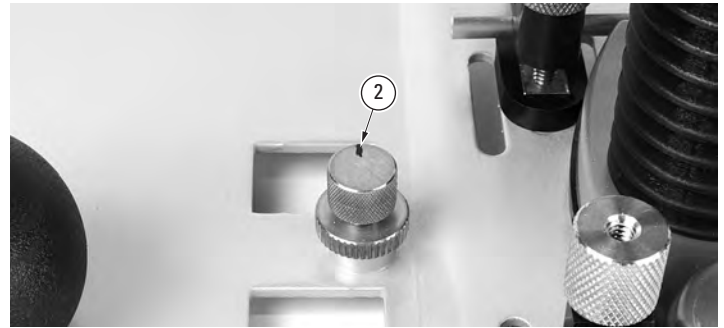
4-7 Unplug the router. Insert the selected guide into the guide recess and matching diameter bit into the router.



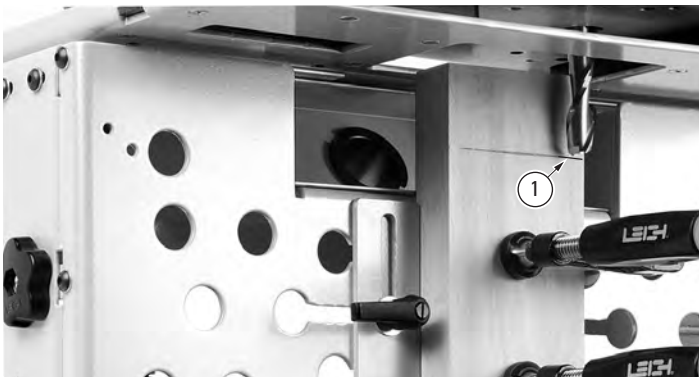
4-8 Make sure the two guide pins are turned up approximately **two-and-a-half turns** from the lowest position to avoid the end of the guide pin contacting the bottom of the guide pin track and guide recess! Place the router on the jig table, the right-hand guide pin in the right side track, the left-hand guide pin in the near side of the guide recess.



4-9 Adjust the right hand guide pin. Turn guide pin lock nut ① up under the guide pin ②. Turn the guide pin down ③ until all front-to-back “play” is eliminated ④, then turn it back up $\frac{1}{8}$ of a turn ⑤. To prevent the guide pin from turning, turn guide pin lock nut down firmly against the threaded boss. The router/sub-base should slide freely left to right. Once set, RH guide pin should require no more adjustment.



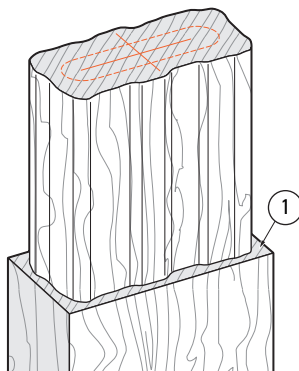
4-10 Repeat this procedure with the left guide pin set in a guide mortise slot. When you have minimal “free play”, use a permanent ink pen to mark a small “dash” at the 12 o’clock position on the guide pin ②. This indexes the guide pin. Before routing your first joint, turn the guide pin up 2 full turns. This is your starting point. Record “number of turns up” or “down” when joint fit is good. Each $\frac{1}{8}$ turn of the LH pin changes the joint glue line fit by approximately 0.0011" [0.03mm].



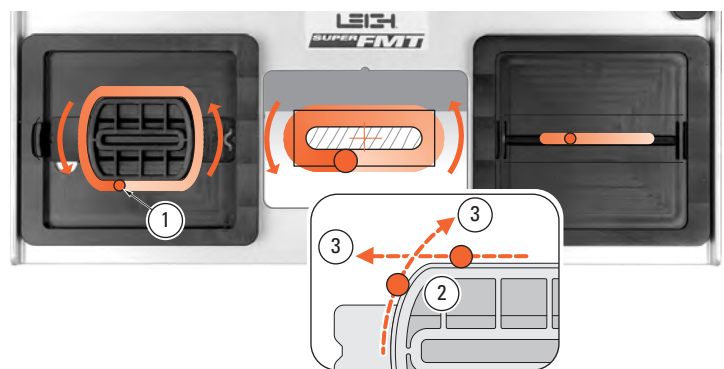
4-11 Plunge the router so the tip of the bit is level with the pencil mark of the tenon shoulder ①, and lock the plunge. Set the plunge depth stop rod to its stop. Tenons are routed in one depth setting; it is not necessary to make multiple passes at different depths of cut.



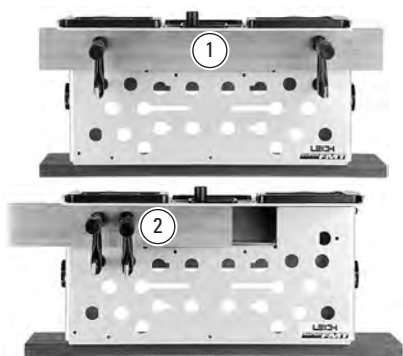
4-12 Read 4-12 through 4-14 before routing. With **guide pin in near side of guide recess**, switch on router power and with firm control, move it in until the bit lightly touches the tenon workpiece. **Very carefully, with the bit very lightly engaging the wood surface, “climb rout” clockwise around the tenon piece ①.** Maintain very light bit contact. **Do not run guide pin on guide yet ②.**



4-13 Control the router firmly, the router is driven clockwise by the bit rotation. This first shallow climb cut will leave a small but clean shoulder ①.



4-14 Routing counterclockwise, run the guide pin around the tenon guide surface. Make sure the pin contacts the entire outer surface ①. In these first test cuts, check the tenon for a completely smooth cut before removing the piece from the jig. Until you are confident with this procedure, as a final cleanup we recommend you run the guide pin “off” of each guide “corner” ② in both directions ③.



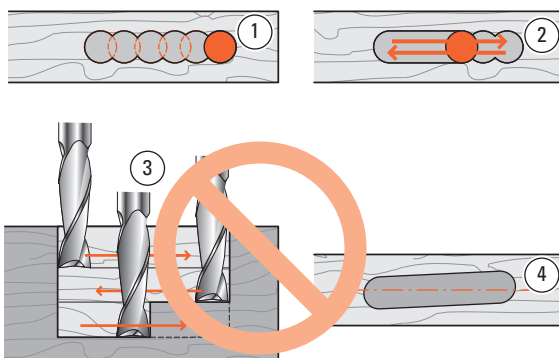
4-15 Remove the router and tenon workpiece from the jig. Position the two clamps so the mortise piece can be positioned for secure holding. Clamp to either both sides of the bit opening ① or to one side ②. Note: Leaving a “horn” on the ends of mortise pieces as in ① not only makes for easy clamping, the horns will be an aid in assembly gluing and clamping later. **Refer to 3-3.**



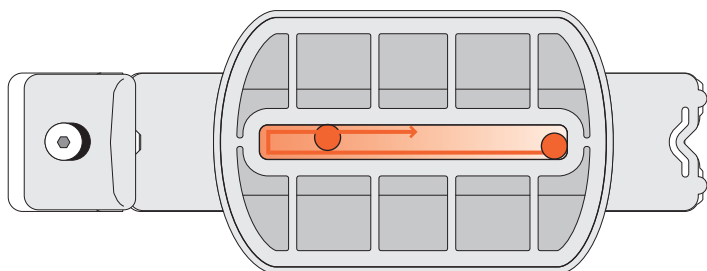
4-16 Fit the sight and remove the sidestop fence if it is in the way. With the marked side of the mortise piece toward the clamp plate, either move the board left and right to align the cross with the sight and clamp in place, or clamp in place first and move the table to align the sight. Remember, you previously set the **FB** limit stops to allow only left/right movement.



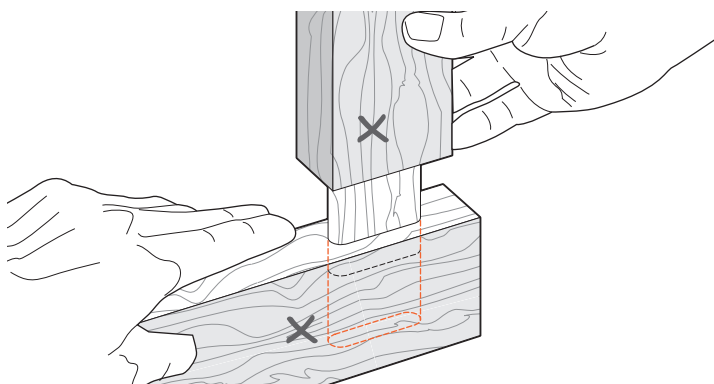
4-17 Remove the sight and place the router/sub-base assembly on the jig, the left hand guide pin in the mortise slot part of the guide. Now raise the plunge stop rod ① slightly, say $\frac{1}{32}$ – $\frac{1}{16}$ " [1–1,5mm] to allow the mortise to be routed slightly deeper than the tenon to ensure perfect tenon shoulder flushness on the finished joint.



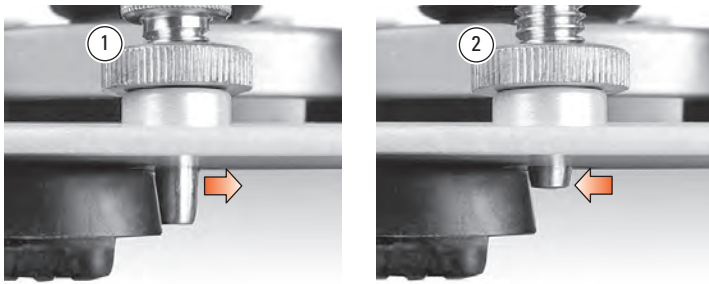
4-18 The best way to rout mortises (parallel to workpiece) is to plunge slightly overlapping holes to full depth ①, and then clean out left-right-left at full depth of cut ②. **Do not rout left-right-left at progressively greater depths without plunging holes ③...** the bit's rotation will pull the bit off the intended mortise line with each pass ④ and the mortise may not be parallel to the workpiece.



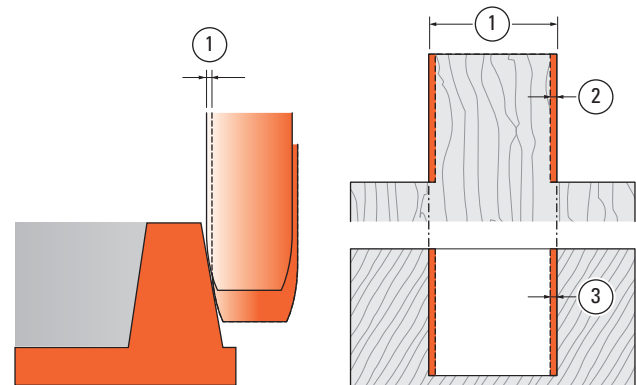
4-19 Make sure the guide pin is run clockwise against both the front and rear of the mortise guide slot on the final passes. The gap between pin and mortise guide slot is greatly exaggerated in this illustration.



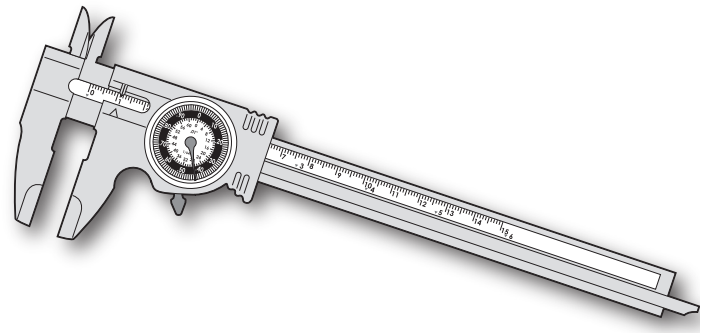
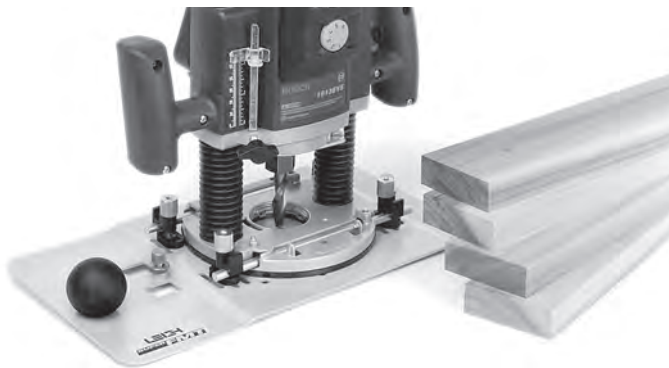
4-20 Remove the mortise piece and keeping the marked faces adjacent, test the tenon for fit and flushness. If the face sides are not flush, check the straightness of the two parts. If they are straight, the clamp plate may not be vertically parallel to the bit. See Appendix II, Jig Adjustments, A2-1 through A2-3.



4-21 Joint fit is adjusted with the left hand guide pin only. If the joint is too loose, turn the guide pin down ①. If the joint is too tight, turn the guide pin up ②. For how much, see 4-22. Guide pin changes affect the mortise and tenon, so rout a complete new joint. **Establish ideal pin height for both mortise and tenon at one pin setting.**

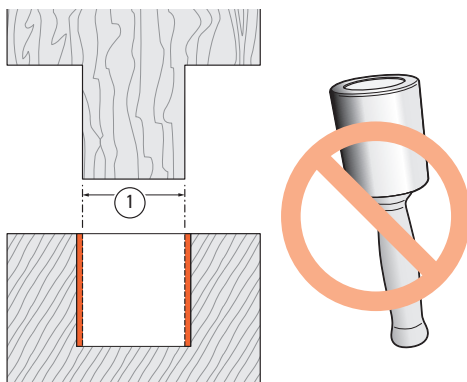


4-22 How much adjustment is required? $\frac{1}{8}$ of a turn of the guide pin knob will change the joint glue-line fit by 0.001" [0,025mm] ①, i.e. turn $\frac{1}{8}$ up; the bit will reduce the tenon thickness by ~0.001" [0,025mm] (half of that per side ②) and increase the mortise width by the same amount ③. Dimensions and angles shown here are exaggerated.



4-23 The Super FMT can provide this accuracy for settings but remember, you're working with wood and a hand-held router, with a lot of movement tolerances; it's not a computer-controlled milling machine. Nevertheless, the Super FMT will allow you to do very precise and consistent work.

4-24 If you have a dial or digital calliper (every shop should have one) you can literally measure the tenon and mortise and adjust accordingly. Every ~0.002" [0,05mm] of difference in mortise to tenon size (say ~.001" [0,025mm] on the glue line) should require $\frac{1}{8}$ of a turn; down to tighten, up to loosen.



4-25 Generally we have found the best fit differential to be 0.005" [0,13mm] "loose". Basically, the dry joint should "push" together fairly easily, but not fall apart under its own weight. If a mallet is needed, it's too tight.



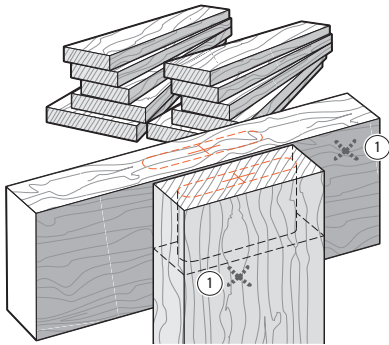
4-26 Once you've established the guide pin setting for a specific bit/guide combination, record the setting on the following page. For example: $\frac{5}{16}$ " x $1\frac{1}{2}$ " [8x35mm] "up $1\frac{3}{4}$ turns". Using the same bit and guide next time, use the recorded setting for a good fit first time. Note: Different wood species may require slightly different settings. ■

Settings Record

[illegible]

Hint: Photocopy or scan this page for future records.

Production Procedures



4-27 When routing frame joints it is only necessary to mark and sight a single tenon and perhaps two mortises. Once the sidestop fence or outriggers are set and the table sighted for one joint, any number of similar joints may be routed without marking. We recommend marking the finished face which goes against the clamp plate (shown here from operator view) ①.



4-28 Mortises Sight ① one mortise and set a stop block ②.



4-29 Set both sets of axis stops to prevent unintentional table movement ①.

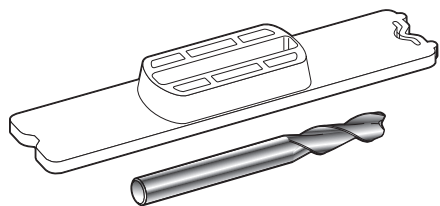


4-30 Sight the second mortise by moving the mortise piece (not the table), and set the second stop block ①. Rout any number of successive (unmarked) mortises without removing the router from the table.

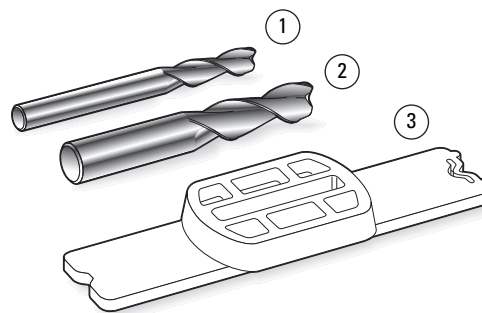


4-31 Multiple mortises in “ladder” type construction are rapidly routed. Mark all mortises on only one piece (only one of the marks needs a front-to-back mark!). Sight the first mortise (cross) to set the table and mark the top of one outrigger in line with workpiece end ①. Table locked, move workpiece, sighting each successive mortise line, marking the outrigger(s) ②. To rout, align unmarked board ends with outrigger marks ②. ■

Small Joints



4-32 The Super FMT is designed so that both mortise and tenon of a particular sized joint may be routed with the same sized bit. So if you are making a single frame with a 1/4" [6mm] guide and bit, this works very effectively. However, if you are in production, it is much more efficient to rout small tenons with a larger bit.

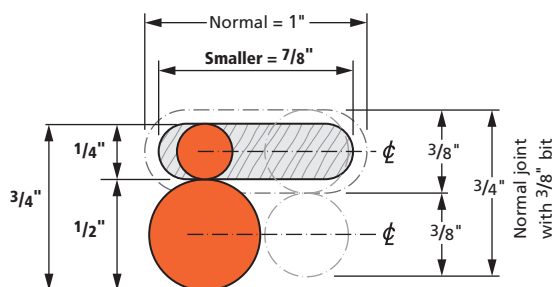


4-33 For example, if you want to rout many 1/4" [6mm] mortises and tenons, the tenons can be much more speedily routed with a 1/2" [10mm] bit. Here's how.

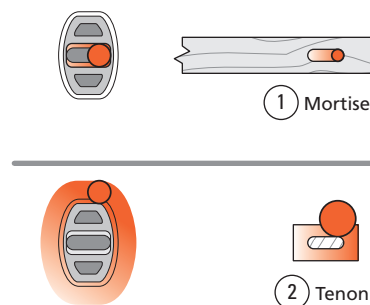
Select 1/4" [6mm] bit for mortises ①.

Select 1/2" [10mm] bit for tenons ②.

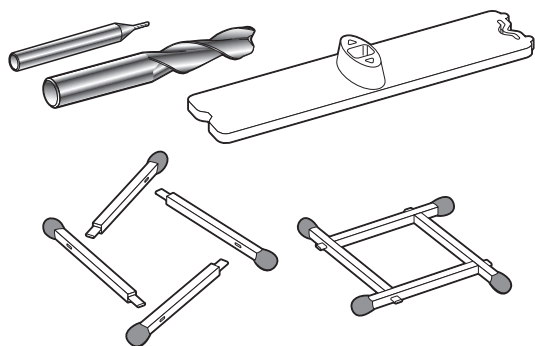
Select 3/8" [8mm] guide ③ for length from the guide/bit selection chart in Appendix I.



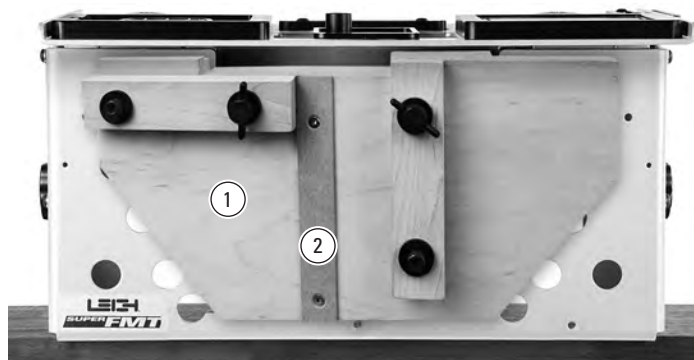
4-34 The diagram illustrates routing the 1/4" joint described above (guide not shown). The result is a perfect 1/4" mortise and tenon, 1/8" smaller both ways than the guide size. Any two bit diameters which add up to two times the nominal guide size will produce a joint the size of the smaller bit. Bear in mind, the maximum usable bit diameter with the Super FMT is 1/2" [12mm].



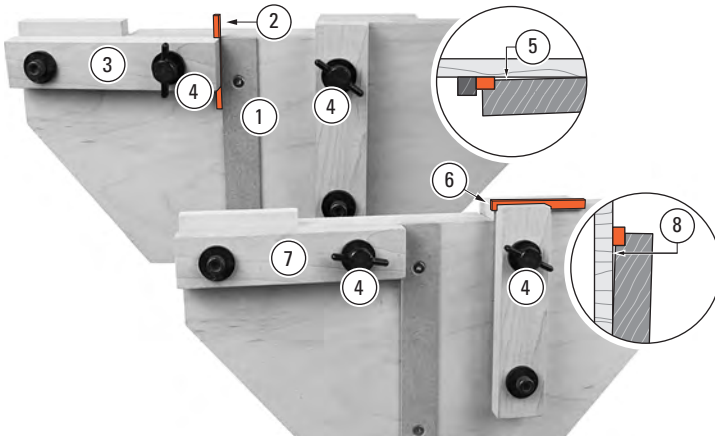
4-35 Using a small guide, combined with an even smaller mortise bit and larger tenon bit gives the Super FMT an additional unique ability to rout joints smaller than the smallest (1/4" [6mm]) guide. For example, take a 1/4" [6mm] guide and **step up** by 1/8" [3mm] to 3/8" [10mm] diameter on the tenon bit...and **step down** the same amount for mortise bit to get 1/8" [3mm] mortise and tenons...**all with adjustable joint tightness.**



4-36 1/32 x 3/32" [0,8 x 2,4mm] mortises and tenons on this "match frame" were formed (with machine tool bits) on a 1/4" x 5/16" guide. The 15/32" tenon bit is 7/32" larger than 1/4". The 1/32" bit is 7/32" smaller than 1/4". A similar metric set: 6mm guide, 1mm mortise bit, and 11mm tenon bit produce 1mm joints. Machine tool bits as small as .010" with 1/4" shanks and similar metric bits are available from machine tool suppliers.



4-37 For very small joints we recommend attaching a rigid piece of ply or MDF ① minimum 3/4" [20mm] to the clamp plate, using the through screw holes in the plate. This should have its own mini sidestop fence attached for tenons ②.



4-38 To hold very small workpieces ②, make up a rabbeted holder ③ with the rabbet slightly shallower than the workpiece thickness, leaving a gap at ⑤ and ⑧. **i.e. For Tenons:** Sidestop ① Tenon Piece ② Holder ③ Clamp ④ Gap ⑤. **For Mortises:** Mortise Piece ⑥, Holder ⑦, Clamp ④, Gap ⑧. ■

