



## router workshop

# MORTISE & LOOSE TENONS

▲ To make a mortise and “loose” tenon joint, cut matching mortises in two pieces. The “loose” tenon is machined separately to fit the mortises.

If you’re planning to build a project with mortise and tenon joinery, you may want to consider this quick and easy variation instead — a mortise and tenon joint with a “loose” tenon. It has all the strength of a traditional mortise and tenon joint *without* the fussing around that’s involved in getting a good fit.

As you can see in the *Photo* at left, a mortise and loose tenon joint differs from its familiar namesake in a couple of ways. First, there are *two* mortises — one in each mating piece. And second, the tenon is

machined as a *separate* part (hence the term “loose”) and then glued into the mortises. This creates a large glue surface, which makes for an exceptionally strong joint.

Besides its strength, though, the real beauty of this joint is it makes aligning the two pieces virtually foolproof. That’s because both mortises are cut using a *single* setup. Specifically, a plunge router with a spiral upcut bit and a simple jig. The jig, which is explained on the next page, ensures identical mortises, and as a result, perfectly aligned pieces.

## build a mortising jig

A plunge router makes quick work of routing mortises. All you need is a stable platform to prevent the router from tipping and an accurate way to guide the router bit.

This T-shaped jig accomplishes both things. The top of the jig provides a solid platform for the router. And an opening in the jig serves as a template for the mortise. In use, a guide bushing that's mounted in the base of the router "follows" this template, ensuring identical mortises every time.

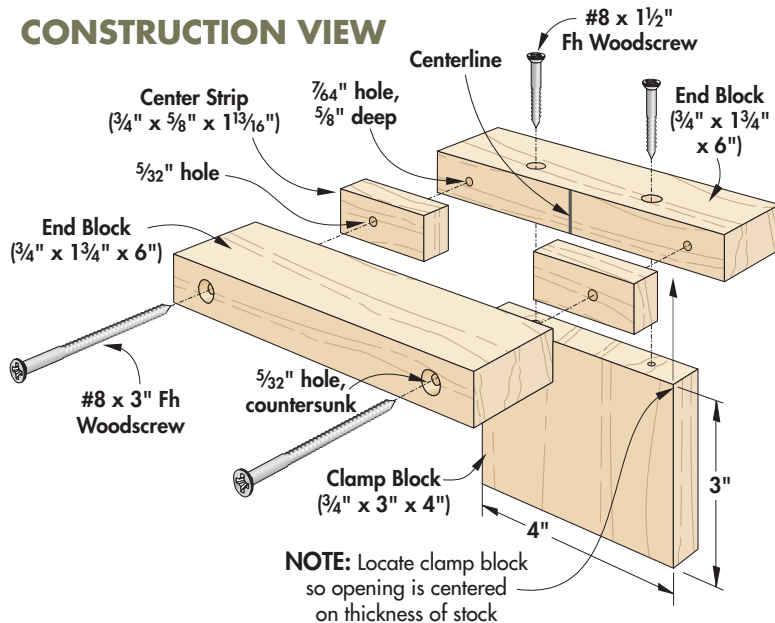
The thing to keep in mind is it's the guide bushing, *not* the router bit, that rides against the sides of the opening. This means the opening must be slightly *larger* than the desired size of the mortise.

There are several factors to consider when sizing the opening: the width and length of the mortise, the size of the bit, and the outside diameter of the guide bushing. Use the formula in the *Jig Opening Detail* below to determine the correct size opening. **Note:** This opening is sized

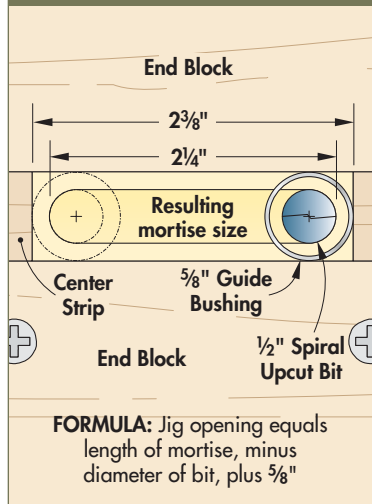
to create a  $1/2" \times 2 1/4"$  mortise when using a  $1/2"$  bit and a  $5/8"$  bushing (the same size as the mortises in the Craftsman table shown on page 52).

**Jig Basics** — The jig itself is quite simple. The top consists of four pieces: two end blocks and two center strips that form the opening (see *Box below* for more on this). A centerline marked on one end block is used to align the workpiece from side to side. And a clamp block screwed to the top positions the workpiece from front to back.

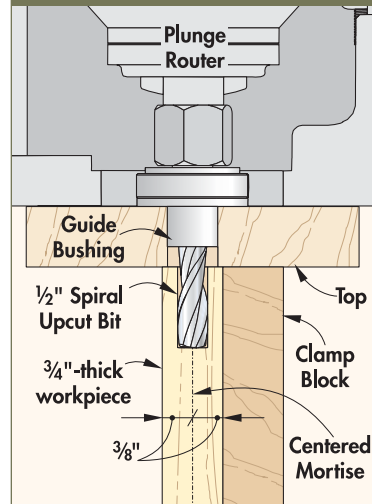
### CONSTRUCTION VIEW



### Jig Opening Detail



### Side Detail

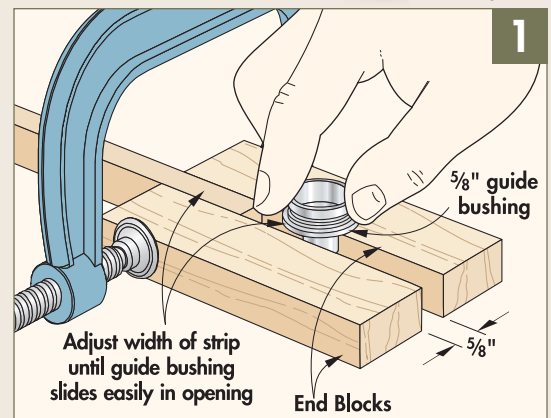


## on bits & bushings

Before routing a mortise, you'll need to equip the router with two things: a  $1/2"$  spiral upcut bit and a  $5/8"$  guide bushing (*Photo, below*).

When building the jig, the goal is to have the guide bushing slide freely in the opening without any play. To do that, I used the guide bushing as a gauge to determine the width of the center strips that form the opening.

Start by clamping a  $5/8"$ -wide, extra-long workpiece between the two end blocks (see *Illustration below*). Then slide the guide bushing back and forth to check the fit. If necessary "thin" the strip until the guide bushing fits just right. Then cut two pieces from the workpiece to form the center strips of the jig.



# lay out, then rout

# MORTISES

Once the jig is assembled, routing the mortises goes like clockwork. You simply tighten the workpiece in a vise, clamp the jig against it, and rout back and forth (*Photo, left*).

Keep in mind that the opening in this jig (*Inset Photo*) is sized to make the mortises in the Craftsman table. If you plan to rout a different-sized mortise, it requires another jig — with a different-sized opening. And as I mentioned earlier, before making the jig, you'll need to determine the size of the mortise. A few guidelines for doing that are explained in the *Illustration* below.

**Lay Out Mortises** — Regardless of their size, though, the procedure for laying out the mortises is the same. The idea is to mark the center of the mortises on the mating pieces (*Figs. 1 and 2*) and then align that mark with the centerline on the jig (*Fig. 3*). Matching up the centerlines like this ensures that the mortises will align with each other.

**Routing the Mortises** — With the layout complete, it's time to rout the mortises. Install the guide bushing in the base of the router and mount the spiral upcut bit. (The *Sidebar* on page 63 shows why this type of bit is specially suited to routing mortises.) Then set the turret on the router to make a series of progressively deeper cuts.

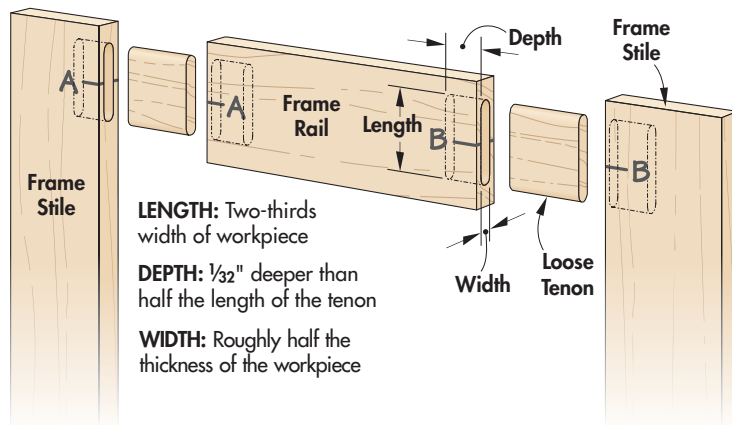
Next, set the router on top of the jig, carefully fitting the guide bushing down into the opening. Now grasp the router, flip the switch, and plunge the bit into the wood until the stop rod contacts the turret. Rout to one side until the guide bushing contacts the end of the opening, and then rout back to the other end. Repeat this process for the remaining depth settings, plunging and routing until the mortise is completed.



▲ With the T-shaped mortising jig clamped to the workpiece, make a series of progressively deeper passes, routing from one end of the opening to the other to cut the mortise (*Inset*).



## SIZING MORTISES



### 1 Mark Centerlines

To lay out the mortises, dry assemble the pieces and mark centerlines across the joint line. Mark mating joints "A-A," "B-B," etc., so you can reassemble the pieces.



### 2 Transfer the Mark

Now use a square to transfer the mark from the face to the end (or edge) of the workpiece. This line will be used to position the jig, as shown in *Fig. 3*.



### 3 Align the Jig

To ensure accuracy, align the centerline on the jig with the centerline on the workpiece. Then clamp the jig onto the workpiece, and you're ready to rout.

# lessons for LOOSE TENONS

Once the mortises are cut, you can turn your attention to the loose tenons. The tenons are cut, one at a time, from a long blank of “tenon stock” (Photo, right). That part is easy enough, and I’ll get back to it in a minute. The trick is making the tenon stock so it fits into the mortises.

**Rip Stock to Width** — To accomplish that, the first step is to rip a piece of hardwood to width. The idea is to rip the piece  $\frac{1}{16}$ " narrower than the length of the mortise. This provides a “fudge factor” that will let you make minor adjustments when it’s time to glue the pieces together.

**Thickness Stock** — The next step is to plane the tenon stock to thickness to match the width of the mortise ( $\frac{1}{2}$ ", in my case). The goal is to have the tenon slip into the mortise with a friction fit. So take some time to “dial in” the planer to get a piece that will fit just right. I use a narrow scrap piece as a test piece, planing it along with the tenon stock and using it to check the fit.

Of course, even if the thickness is dead-on, the square edges of the

tenon stock won’t fit the rounded ends of the mortise.

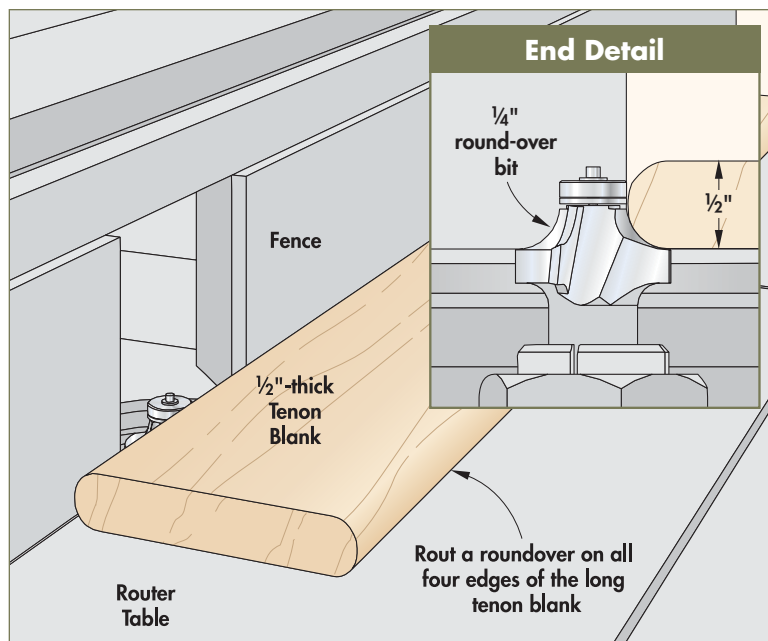
**Round the Edges** — The solution is to round the edges of the tenon stock to match the radius at the ends of the mortise. A roundover bit mounted in a router table makes quick work of that (see Illustration below). Use a bit that’s half the size of the thickness of the tenons. (For example, my tenons were  $\frac{1}{2}$ " thick, so I used a  $\frac{1}{4}$ " round-over bit.)

**Trim Tenons to Length** — Now you’re ready to cut the tenons to length. You’ll want to make them  $\frac{1}{16}$ " shorter than the combined depth of the mortises. This allows for excess glue at the bottom of the mortises.

To ensure identical length tenons, clamp a block to the rip fence several inches in front of the saw blade (Photo, above). Then set the fence so the distance from block to blade matches the desired length of the tenon. Butt the end of the tenon stock against the block, and using a miter gauge, push the workpiece past the blade. Repeat this process to trim each tenon to length.



▲ For identical-length tenons, butt the tenon stock against a block clamped to the rip fence. Then use the miter gauge to guide the stock past the blade.



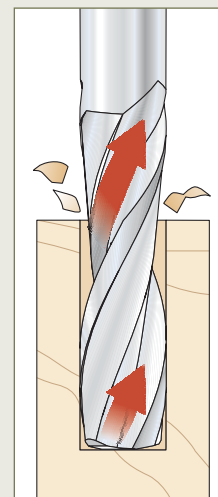
## Spiral Upcut Bits

When it comes to routing mortises, there are three big advantages to using a spiral upcut bit (Photo, below).

**The Tip of the Bit Cuts** — First of all, its cutting edge extends across the tip of the bit, which allows it to “drill” into the workpiece.

**Smooth Clean Cuts** — Another plus is the spiral cutting edges of the bit shear the wood fibers, producing a smooth, clean cut.

**Chip Extraction** — Finally, the flutes of the bit pull chips up out of the cut (toward the router), so they don’t clog the mortise. This reduces heat build-up, which can damage the bit.



$\frac{1}{2}$ " Spiral Upcut Router Bit