Router & Tablesaw Tips & Jigs

31 Shop-tested helpers to improve your accuracy and safety

Table saw sled for precision miters p. 16

Template routing for dead-on duplicates p. 6

Proven projects by the editors of WOOD

A Supplement to WOOD® Magazine
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5 tips to get more from your router table

Whether you go with a floor model or a benchtop version, a router table improves both control and safety when cutting various kinds of parts.

1. Want to super-size those dowels?

Sometimes you need hardwood or big dowels that match the wood of your project, and standard stock doesn’t fill the bill. Here’s a router table technique that we’ve used for projects, such as quilt racks, and for handles on tool caddies and utility carts.

You’ll need a round-over bit with the same radius as the dowel’s radius. For example, use a ⅛” round-over bit to make a 1” dowel. Chuck the bit in the router, and position the fence flush with the pilot bearing. Put two pieces of masking tape on the fence, one on either side of the bit, and mark two points 3” from the bit’s center.

On the tablesaw, rip each dowel blank to a square profile equal in thickness to the desired diameter of the dowel. Making sure the dowel blank is square is essential to achieve the four identical quarter-round cuts you’ll rout later. Cross-cut the blank 6” longer than the length of the finished dowel.

Place your workpiece as shown in the drawing at left. Align the left end with the left-hand start point, as shown in the photo above, hold the end firmly against the fence, and begin routing any edge. Ease the workpiece into the bit, and move the blank across the bit until the right end reaches the right-hand finish point. Repeat the procedure for the three remaining edges. The flat surfaces left at each end not only prevent the blank from rotating, but also keep your fingers at a safe distance from the bit.
2. Sink your teeth into some biscuits

To cut biscuits on your router table, all you need is a slot-cutting bit that matches the standard biscuit thickness of \( \frac{5}{32} \)” and a miter gauge with an auxiliary fence.

Every time you set up to make a joint, center the cutter on the thickness of your stock, and make a test cut to double-check. To further reduce the risk of misalignment, mark the face of each component, then keep that side up.

Plunging a workpiece into a standard slot-cutting bit produces a slot that’s shorter than a standard biscuit. You can lengthen the slot by moving the workpiece and making additional cuts. However, if you’re going to make only a few joints, it’s quicker and easier to shorten the biscuits. Here’s how to cut slots for a rail-and-stile frame.

Use a steel rule to align the face of your router table fence with the front of the bit’s pilot bearing. Place a piece of masking tape on the fence above the bit. Then, use a square and a pencil to mark the center of the bit on the tape. Now, mark the center of a rail. Hold the length of the rail against your miter gauge, equipped with an auxiliary fence that nearly touches the router table fence, as shown in Photo A. Align the two center marks, and clamp a stopblock on the router table fence so it meets the back of the miter-gauge fence. Using the miter-gauge fence as a support, plunge the workpiece squarely into the bit. Cut until it contacts the bearing.

Mark a biscuit at both ends, making it slightly less than the slot length. Slice off the ends with a bandsaw. Test the fit, as shown in Photo B, to make sure that at least half of the biscuit’s width slides into the slot.

To cut a matching slot on a stile, leave the miter gauge and stopblock in place. Carefully push the workpiece into the cutter, as shown in Photo C. You can cut a slot in the other end of the stile with the same setup, but you have to flip the stock over, putting the face side down. If the slots are perfectly centered in the stock thickness, that will work fine. The alternative is to measure the distance from the center of the bit to the miter gauge, and then clamp a stopblock at that same distance to the left of the bit. Remove the miter gauge and right-hand stop, then cut a slot at the opposite end of the stile, still keeping the face side up.

PHOTO A: Your miter gauge, backed by a stopblock, provides a solid, square guide as you push the end of a rail into the spinning slot-cutting bit.

PHOTO B: Trim the biscuit ends, slip it into the slot, and test the fit before gluing. If a gap shows, take just a bit more material off each end of the biscuit.

PHOTO C: Your setup remains the same when you cut a biscuit slot for a stile. This slot will match perfectly the slot in the previously milled rail.
Let’s say you want to make four table legs with matching curves. A table-mounted router and template enable you to produce as many identical legs as you want.

Using 3/4” hardboard or medium-density fiberboard, make a template to the shape you want. Use a bandsaw or scroll-saw to cut close to the line on the template, then sand to it. Attach the template to your stock with cloth-backed, double-faced tape, orienting the grain for best effect. Bandsaw the workpiece within 1/8” of the template.

Turning to your router table, you have two choices for router bits—a flush-trim bit and a pattern-cutting bit. In some situations, you might need both.

A flush-trim bit has a ball-bearing pilot mounted at the tip, as shown at right. To use this type of bit, place your workpiece on the table with the template on top. Adjust the bit height so the pilot runs along the template’s edge.

On pattern-cutting bits, the pilot sits between the shank and the cutter, as shown in the drawings below. Your template rests on the table.

Whichever bit you use, ease the workpiece into the bit until it contacts the pilot, then move the piece from right to left. If you’ve left more than 1/8” of excess material in some spots, trim it to size with a couple of shallow passes. Don’t pause too long in any spot, or you’ll burn the wood. Double-check the surfaces you’ve just routed before you remove the template. Sometimes another pass will smooth out a rough spot. Finally, slide a putty knife blade between workpiece and template, pop them apart, remove the tape, and you’re done.

When you have a workpiece that’s thicker than the cutting length of your bit, use a pattern-cutting bit and a flush-trim bit in the sequence shown in Steps 1, 2, and 3. Make one pass with the pattern-cutting bit, template side down. Remove the template, then make another pass with the pilot bearing riding on the surface you just machined. Finally, flip the workpiece over and use the flush-trim bit, with the pilot bearing riding on the previously milled surface.

### How to handle extra-thick stock

**STEP 1**
- Pattern-cutting bit
- Stock
- Pilot bearing
- Template

**STEP 2**
- Pattern-cutting bit
- Stock
- Template removed

**STEP 3**
- Stock inverted
- Flush-trim bit
4. Make your router think it's a jointer

We added an edge-jointing function to our router-table fence by simply clamping a piece of plastic laminate on the left-hand, outfeed end of the fence. Use sandpaper to ease the edge nearest the router bit, so it won’t catch your workpiece as the board slides past. As seen at right, we used a steel rule to align the laminate with the cutting edge of a straight bit mounted in the router.

Set the bit high enough to trim the entire edge of the board in one pass. Then, turn on the router, and move the board across the table from right to left. You’ll remove $\frac{1}{16}”$ with each pass, and leave a perfectly straight, square edge. Repeat the procedure with a second board, and the two pieces can be glued together without a gap anywhere.

![Image]

Place your laminate piece at the left-hand edge of the bit-clearance notch in the router table fence. The rigid router fence will keep the laminate from flexing.

5. Add custom plates to your table

Router-table work goes smoother and more safely when the hole in your insert plate is only slightly larger than the diameter of the bit. You can buy a plate with removable rings to fit different router-bit diameters, which gets you close enough in most situations—or you can make a custom plate to match a bit exactly. Use Baltic birch plywood for the least expensive plate, or choose polycarbonate for a clear plastic plate. You can buy a 12x12” piece of $\frac{3}{8}”$ polycarbonate from Woodcraft. Call 800-225-1153 to order part number 16L72.

For more routing techniques go to: woodmagazine.com/routertechniques
Fancy flutes simple setup

Add impressive details to your finest work, using a router and these tips.

Traditional detailing on cabinets and furniture often includes the classic look you can create with parallel, round-bottomed grooves called flutes. Because these grooves do not exit at the ends of the workpiece, we call them “stopped” flutes. As a design element, they set your work apart from the ordinary, yet they’re easy to make.

Successful fluting starts with careful planning and layout. For example, for the 2$rac{3}{4}$-wide stile shown here, we used a 1$rac{1}{4}$" core-box bit to make four flutes approximately 1$rac{1}{4}$" wide and 1$rac{1}{16}$" deep, leaving 1$rac{1}{4}$" of flat surface between flutes, and a 1$rac{1}{2}$" border along each edge. Pieces of different dimensions might call for more or fewer, wider or narrower flutes. Whatever the plan, keep the flat intervals equal to or less than the flute width. Draw full-scale samples on paper to arrive at a handsome design.

For best results with stopped flutes, you’ll need a plunge router so you can smoothly lower and raise the bit at the beginning and end of each flute. You’ll also need an adjustable edge guide. Keep each set of stopped flutes aligned at the ends with a startblock and a stopblock.

1 First, set the depth of your cut. To do this, extend the blade of a combination square 1$rac{1}{16}$", and lock it in place. With the router in its plunge mode, hold the blade end on the router base, and adjust the bit to make contact with the square’s head, as shown below. Now, set the router’s depth stop.

2 Mark the ends of your planned flutes on the workpiece. Place a rule on the router base, and measure from the bit to the edge of the base, as shown below. Measuring to the leading edge tells you how far to set your stopblock from the top mark. Measuring to the trailing edge determines the distance from the bottom mark to your startblock. If your router base is round, these measurements will be equal. Place the workpiece at the edge of your workbench, and clamp the blocks and workpiece in place.

3 On a piece of scrap the same width as your workpiece, lay out and mark the locations of your flutes. Now, set your router edge-guide fence to make the first flute. The distance from the fence to the bit center equals the distance from the scrap edge to the nearest mark. Test the setting by routing into the scrap piece, as shown below. When it’s centered on the mark, rout the first flute. (If your router base is round, and block-to-flute distances are equal, flip the workpiece around, and rout the flute nearest the opposite edge.)

4 Cut a wood spacer to match the distance between marks on your scrap template. Clamp the router to your workbench. Loosen the edge-guide fence, and slip the spacer between it and the workbench, as shown below. Tighten the fence, remove the spacer, unclamp the router, and then double-check the setting on your scrap. Rout the second flute on your workpiece. Repeat this step for each flute, using the same spacer. (If your router has a round base, and you cut two flutes in Step 3, flip the workpiece after cutting this third flute, and rout the fourth one.)

5 When you rout a flute (see below), butt the router base against the startblock, plunge to the preset depth, and immediately move the router forward. Rout until the base contacts the stopblock, and immediately allow the plunge mechanism to pop up. Quick entry and exit prevents hard-to-remove burn marks on the wood.
Fast, accurate **template routing**

From machining to bit selection, here are tips to make identical parts.

When you need several copies of curved parts, such as the corbels for a mission furniture project, consider pattern routing. Using a template and a router bit designed to follow it, you’ll speed through the drudgery of making duplicate parts without sacrificing quality. By keeping a battery of templates, you also can save time on projects you decide to build more than once.

**Start the job on paper**

The shape for your template can come from a magazine pattern, woodworking plan, a part from an existing piece of furniture, or a design you draw. If you start from scratch, work out the curve or curves on paper using a lead-core, flexible-curve ruler (available through art supply or woodworking stores); a French curve; an extra-long profile gauge; a compass; or any object that serves as a tracing model for the shape you want to cut.

Of course, pattern-based templates have their limits. A router bit can’t reproduce a sharp inside angle or inside curve with a radius less than the radius of the bit. Either avoid those details in your design or plan to complete them using other tools, such as a scrollsaw or bandsaw, after you’ve routed the rest of the shape.

Begin with a paper pattern. Cut out its straight lines using a knife and straightedge. Use scissors to cut curves roughly \( \frac{1}{2} \)” outside of the marked curved lines.

**Make the template**

Tempered \( \frac{1}{4} \)” hardboard makes an economical template, but we prefer \( \frac{3}{8} \)” Baltic birch plywood. Both materials are free of voids—a vital feature for smooth routing—but the extra thickness of the Baltic birch plywood gives the router’s bearing ample surface to roll along.

Spray-adhere the paper pattern to the rigid template material, matching the straight edges wherever possible to reduce the amount of cutting required.

Bandsaw the pattern curves, as shown in **Photo A**. We used a \( \frac{1}{2} \)” blade, cutting \( \frac{3}{16} \)” outside the cutline. Rely on a scrollsaw if your design includes curves that are too tight for a bandsaw blade.

If you don’t have an oscillating spindle sander, install a sanding drum with 80-grit sandpaper on your drill press. Double-check that you have a 90° angle between the drum and the drill press table. Sand the curved template edges to the paper pattern lines [**Photo B**].

**Get ready to rout**

Trace the shape of the finished template onto your workpiece, aligning straight edges wherever possible. Using a bandsaw, rough-cut your workpiece to \( \frac{5}{16} – \frac{1}{8} \)”
from the edge of its finished form to reduce the amount of material your bit will need to remove.

Using double-faced tape, adhere the template to the workpiece and align straight edges where possible. Whether the pattern will go on the top or bottom of the piece depends on whether you’re routing freehand or on a table, and on your choice of bits.

As seen on the chart below, you have several bit choices for pattern routing. On flush-trim bits, the bearing mounts to the end. On a pattern bit, it’s between the Shank and the cutters. You’ll get the highest quality sand-free edges with spiral- or sheer-cutting bits.

Use your router table when working with small or narrow parts. A flush-trim or pattern bit will work here, but the flush-trim’s top-mounted bearing is best because a pattern bit exposes the spinning cutter above the workpiece. For pieces too large or awkward for the router table, use a handheld router.

**Flush-trim and pattern bit sampler**

<table>
<thead>
<tr>
<th>Bit Type</th>
<th>Size Ranges</th>
<th>Pattern Location on Workpiece</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flush-trim</strong></td>
<td>1/4–1/8” dia.; 1/4–2” cutting length</td>
<td>Table: top Handheld: bottom</td>
<td>Adequate for most work. As with all carbide bits, look for micrograin carbide.</td>
</tr>
<tr>
<td><strong>Spiral flush-trim (upcut)</strong></td>
<td>1/4–1/2” dia.; 1/4–2” cutting length</td>
<td>Table: top Handheld: bottom</td>
<td>Cutters slice at an angle for a smooth cut; upcut bits work best for table-mounted routers.</td>
</tr>
<tr>
<td><strong>Spiral flush-trim (downcut)</strong></td>
<td>1/2–3/4” dia.; 1/2–2” cutting length</td>
<td>Table: top Handheld: bottom</td>
<td>Steep spiral makes smooth slices, especially in laminated materials, such as plywood; downcut versions work best for handheld routing.*</td>
</tr>
<tr>
<td><strong>Downshear flush-trim</strong></td>
<td>1/4” dia.; 1/4–1/2” cutting length</td>
<td>Table: top Handheld: bottom</td>
<td>Cutters slice at an angle for a smooth cut; downshear is best for handheld work while available upshear versions are best for table work.</td>
</tr>
<tr>
<td><strong>Combination upcut/downcut</strong></td>
<td>1/2–1” dia.; 1/2–2” cutting length</td>
<td>Table: either Handheld: either</td>
<td>Slices through thin veneers of plywood with less chipping on both faces.†</td>
</tr>
<tr>
<td><strong>Double bearing flush-trim</strong></td>
<td>1/2–1” dia.; 3/4–2” dia.; 3/4–2” cutting length</td>
<td>Table: bottom Handheld: top</td>
<td>One bit works on both handheld and table-mounted routers for either pattern routing or flush-trim work such as laminates.‡</td>
</tr>
<tr>
<td><strong>Pattern</strong></td>
<td></td>
<td></td>
<td>Top bearing lets template be attached atop a workpiece for handheld routing.</td>
</tr>
</tbody>
</table>

Hard-to-find bits: *from MLCS (800-533-9298, mlcswoodworking.com); † from Woodhaven (800-344-6657, woodhaven.com); ‡ from Eagle America (800-872-2511, eagleamerica.com)
Master the **keyhole bit**

Certain wall hangings, like quilt racks, plaques, and display shelves, look and function better when flush-mounted to a wall. To accomplish that, try this wireless hanging technique. With the right bit, a plunge router, and our simple-to-use template, you'll master keyhole slots in minutes.

As you plunge the bit into your workpiece, it first creates the screw-entry hole. Moving the router with the bit lowered plows an inverted T-shaped slot to capture the screw head.

**Up and down? Side to side?**

Depending upon the type of wall-hanging you're working with, you can cut keyhole slots vertically (with the screw-entry hole at the bottom) or horizontally. Usually a horizontal slot works best for small, flat items that require only one screw for hanging. That allows you to slide the item side to side until it balances and hangs straight. Cut the slot near the top of the workpiece and \(\frac{1}{2}\)–1" on both sides of the center line.

Small weight-bearing pieces, such as the shelf shown below, benefit from a short, vertical slot. Make certain your slot is perfectly centered, though, or the piece may not hang level.

For larger and heavier workpieces, use two or more slots. A picture frame hung from the center of its top rail tends to sag under its own weight, but a vertical keyhole slot in each stile of the frame places the burden on these vertical frame members.

<table>
<thead>
<tr>
<th>Sheet Description</th>
<th>Keyhole Bit Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMALL SHELF</td>
<td>Major diameter: (\frac{3}{8})&quot;</td>
</tr>
<tr>
<td></td>
<td>Minor diameter: (\frac{3}{16})&quot;</td>
</tr>
<tr>
<td></td>
<td>Diameter of guide bushing: (\frac{3}{8})&quot;</td>
</tr>
</tbody>
</table>
|                   | Dust-relief slots: \(\frac{1}{4}\)" x \(\frac{1}{8}\)"
|                   | Slot-index marks: 1" |
|                   | Hardboard template: \(\frac{1}{4}\) x 8 x 18" |

If it's made of wood, and you want to wall-mount it, call on a keyhole bit. Unlike sawtooth hangers or the old wire-over-nail method, keyhole slots capture the head of a screw driven partway into the wall, so you can firmly affix a picture frame, plaque, clock, or bracketed shelf without fear of it falling. And, without eyelets or hangers to get in the way, your workpiece hugs the wall.

A typical keyhole bit has a major diameter (the size of the screw-entry hole) of \(\frac{3}{8}\)", and a minor diameter (the width of the visible slot) of \(\frac{3}{16}\)". For thick stock requiring larger screws, some manufacturers also sell a \(\frac{1}{2}\)" major-diameter bit that leaves a \(\frac{1}{4}\)" visible slot.

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members. In order for the frame to hang straight, both keyhole slots must end the same distance from the top of the frame, and the screws in the wall must be both level and the same distance apart as the frame’s slots.

For long wall hangings, such as a bracketed shelf, where you want to make sure your mounting screws bite into a wall stud, we recommend a pair (or more) of long horizontal slots. Find the mounting location, drive the screws into the wall, then mark the screw locations on the back of the workpiece. Roughly center a long keyhole slot at each screw location, with all slots pointing in the same direction. With 8”-long slots, you can shift the workpiece up to 4” in either direction until it looks right.

**Keep it straight, keep it even**

If a horizontal keyhole slot runs downhill, or if a pair of vertical slots don’t start and stop on the level, your workpiece will be out of kilter. We came up with a simple template, shown on the previous page, to avoid this problem.

Our template requires a 5/8” guide bushing (Porter-Cable part no. 42046), but you can use a different size. Just adjust the slot width accordingly. If your bushing protrudes more than 1/4” beyond the router’s base, you’ll have to file or grind it down to length.

To make the template, first lay out the start and end points (the slot-index marks) of your slots on the hardboard with long, bold lines. You’ll use these index marks for alignment purposes later. With a 5/8” Forstner bit loaded in your drill press, and a fence set 2” from the center of the chuck, bore a hole centered on each of your layout lines. Don’t move the fence when you’re done.

Now remove the waste between the holes. For the short slot, drill a series of overlapping holes with the Forstner bit, then file the edges of the slot smooth; for the long slot, use a 5/8” straight bit in our router table.

Finally, chuck a 3/4” bit in your drill press, then bore and clean out the dust-relief slots. To use the template, follow the photos and instructions at right.

**MASTER KEYHOLE SLOTS IN FOUR EASY STEPS**

1 Mark the slot
Locate the keyhole slot by drawing a long centerline on your workpiece. Measure and mark the bottom end of the keyhole slot, as shown, with a short perpendicular line.

2 Index the template
Align the short line with the slot-index marks on the template, and center the long line in the dust-relief slots. Clamp the template to the workpiece, and set your plunge router’s depth stop so the bit will leave a 1/4–1/2”-thick shoulder above the keyhole slot.

3 Rout the slot
With the guide bushing at the bottom of the slot (as the workpiece will hang) and the router on, plunge the bit into the workpiece. Guide it to the other end, backing out frequently to clear dust.

4 Remove the template
After finishing the cut, turn the router off and back it completely out of the cut. If you’re going to hang the piece from two fasteners, mark the other slot and repeat the process.
Watch out for **loose bits**

Safety advice from a woodworker who has experienced an incident that might happen in your shop.

**The incident**

I was using my table-mounted router to cut mortises in cabinet face-frame stiles when suddenly the \( \frac{1}{4} \)-diameter upcut spiral bit began to chatter loudly. Without shutting off the router, I lifted the stile off the table and immediately felt something tick me on the right cheek. I then shut off the router, and rubbed my cheek to check for what I thought was a splinter.

I didn't find anything but, through my peripheral vision, I saw something sticking out of my forehead between my nose and right eyebrow. Assuming it was a piece of wood, I grabbed it with my handkerchief and pulled it out. I couldn't believe it was the bit! I guess it had glanced off my cheek.

After covering the wound, I drove to a hospital. Although the bit had penetrated \( \frac{5}{8} \)”, an X-ray showed no sign of serious injury, so the opening was sutured.

The next morning, I checked the router and bit and found the nut tight on the collet and no sign of damage on the bit shank. I really don’t know what caused the problem.

The 12-year-old router now resides in a landfill, but I carry the bit with me every day as a lucky charm.

—Clark Mittan, Waldorf, Md.

**The lessons**

A loose router bit can become a dangerous projectile, as Clark learned, and it also can affect the accuracy of your cuts. Although it's not clear what caused Clark’s bit to loosen, here are a number of things you can do to prevent this kind of problem.

- Use only sharp bits. Dull cutting edges increase force and stress on the bit and router collet, which can cause slippage.
- Before you install a bit, make sure the shank and collet are free of sawdust, grease, and other contaminants. Also, check the collet and bit shank for rust and damage, such as scoring, which can create burrs that prevent sufficient collet grip. If you see any corrosion or damage, replace the collet and/or the bit.
- When installing a bit that has a radiused transition area between the cutter and shank, insert the shank into the collet until it bottoms, then pull the bit out enough to clear the radius by about \( \frac{1}{16} \), as shown below. This ensures that the collet clamps tightly around the shank.
- Using the router-supplied wrenches, tighten the collet nut firmly. Never tighten the nut without a bit inserted or you may damage the collet.
- Never exceed the maximum speed specified by the bit and router manufacturers. Use the chart below as a guide for speed based on bit diameter.

<table>
<thead>
<tr>
<th>MAXIMUM ROUTER SPEED</th>
<th>Bit diameter</th>
<th>Max. speed (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1&quot;</td>
<td>Up to 24,000</td>
<td></td>
</tr>
<tr>
<td>1 to 1¼</td>
<td>16,000 to 18,000</td>
<td></td>
</tr>
<tr>
<td>1¼ to 2¼</td>
<td>12,000 to 16,000</td>
<td></td>
</tr>
<tr>
<td>2¼ to 3¼</td>
<td>12,000</td>
<td></td>
</tr>
</tbody>
</table>

Note: Maximum speed of fixed routers is typically 24,000 rpm. When using bits larger than 1" diameter, we recommend using a variable-speed router.

- When you need to remove a lot of material, make multiple shallow passes to minimize stress on the bit and collet.
- Listen to the router. If you hear it straining, you’re probably removing too much material or feeding the workpiece too fast.
- When routing multiple pieces, occasionally shut off the router and measure the cut depth or the bit height to ensure it has not changed.
- Always wear eye protection and, whenever possible, use a bit guard.

**The warning signs**

The chattering that Clark heard signaled that something was loose in the router, requiring immediate shutdown and inspection. Rather than lifting the workpiece, Clark realizes in hindsight that he should have held it in place to safely contain the bit while turning off the router. Also, he was not wearing safety glasses, which might have deflected the bit from his face and prevented a more serious injury if it had hit his eye.

**The woodworker**

With more than 40 years of experience, Clark is a professional woodworker specializing in cabinetry and housing restoration work in the District of Columbia and suburban Maryland.

**CLeARING A BIT-SHANK RADIUS**

![Diagram of clearing a bit-shank radius](image)
14 tips to increase router bit life

Here’s how to get more mileage and better cut quality from your router bits.

1. Clean bits of pitch and resin with lacquer thinner or a good bit cleaner. Lubricate the bearing often.
2. Never overload or abuse a bit. If the job calls for cutting away more than the equivalent of a $\frac{1}{4}$" square area, remove the extra waste by making multiple passes with light cuts.
3. For lots of heavy-duty routing, use $\frac{1}{2}$"-shank bits if your router accepts them. They’re stronger, stiffer, less likely to deflect and cause chatter, and easier to reground.
4. Use bits with the shortest cutting edge and the largest cutting diameter that you have. When possible, select bits with high shear angles, as shown at right, and large-enough gullets to allow fast chip ejection—they will run cooler and stay sharp longer.
5. Use sharp bits. If you’re burning wood, applying more than the usual feed force, or getting chattering while cutting, suspect a dull bit.
6. A router of $1\frac{1}{2}$ hp or more will cut easier and won’t heat up the bit as fast as a router with less power.
7. When mounting a bit, insert the shank into the collet and finger-tighten the lock nut. Twist the bit several turns to let it seat itself. Lock the bit with 80 percent of the shank captured in the collet. Do not insert the shank all the way to the bottom of the collet; allow a $\frac{1}{16}$" gap.
8. Set your router speed to the bit’s optimum rpm. Bits over 1" in diameter should be slowed to cut satisfactorily and not overheat.
9. Consider a two-cutter system. Do most of the rough cutting with one bit, then do the final cut with a new or freshly ground bit with low mileage.
10. Look for uneven cuts caused by extensive wear on a portion of the bit. This defect could produce poorly fitted joints. Sharpen or replace the offending bit.
11. Clean and lightly oil bits after use. Smooth the shanks with fine emery cloth. Clean and check the collet frequently for wear.
12. Lubricate the ball bearings with light oil after each use.
13. Store bits so cutting edges and bearings do not get damaged or strike other bits, as shown above.
14. Buy the highest quality bits you can afford, especially for profiles you’ll use regularly, such as straight bits or round-overs.
Quick-and-easy **height gauge**

Raise your cutting accuracy to new levels.

Set the cutting depth of tablesaw blades easily using this adjustable gauge. To ensure accuracy, we outfitted it with a steel rule. See Source below for the parts.

Start by cutting the body to size from \(\frac{3}{4}\)" maple, as shown on Drawing 1. Plow a \(\frac{13}{16}\)"-deep groove, sized to fit your rule, in one face of the body, where shown.

Next, set your dado blade to \(\frac{1}{4}\)" and cut the combined rabbet and groove in the body for the sliding bar. To do this, place the gauge body on edge (ungrooved face against the fence). Cut the rabbet/groove in three passes, with the last one at \(1\frac{1}{8}\)" where shown on Drawing 1a. Drill and countersink the screw hole. Then, sand and finish the body.

Use a coping saw or scrollsaw to shape the \(\frac{1}{4}\)" acrylic sliding bar to the dimensions shown. Create the adjustment slot by drilling a pair of \(\frac{1}{8}\)" holes where shown and cutting out the material between them. Smooth the edges of the slot and the outer edges of the bar using a fine file. Buff the outer edges if you want to make them supersmooth. Now, scribe a cursor line on the back face, where shown.

Attach the steel rule in the groove using double-faced tape. Place the bottom end of the rule \(\frac{1}{4}\)" from the bottom of the body. Then, install the sliding bar.

To use the gauge, set the cursor line to the desired height. Hold the sliding bar in its groove while adjusting the gauge to keep the bar square with the base. Place the body on the tablesaw top beside the blade, as shown in the photo, then raise the blade to set the height.

**Source**

**Hardware.** Stainless steel rule no. 06K20.06; \(1\frac{1}{2}\)" four-arm plastic knob (\(\frac{1}{4}\)-20 threads) no. 00M55.30. Lee Valley; 800-871-8158, leevalley.com.
Tablesaw **hold-downs**

Boards of a feather work wonders together.

When we designed a tablesaw dust-collection hood for the WOODs magazine shop (see plans at woodmagazine.com/dusthood), we knew we also had to replace the saw’s anti-kickback pawls built into the original blade guard. Whether you build our hood or leave your saw’s guard intact, you’ll appreciate the additional stock control and safety provided by this feather-board system.

Build a pair of feather-board assemblies using the drawing below right as a guide, and attach the mini channel to the mounting rail (which you may need to modify slightly to suit your fence). Align the mounting rail flush with your fence's face, drill pilot holes in the rail where shown, and mark their locations on top of the fence. Drill and tap a hole to accept a #10-32 machine screw at each mark, then attach the rail assembly to the fence.

If your fence locks down at the back of the table, you won’t need to add the anti-lift assembly shown in the drawings. However, a fence that locks only at the front will raise at the rear without this mechanism. To cut the 20° rabbet, rip the dowel 2" down its center. Lay the dowel on your drill-press table, oriented as shown in the **Rabbet Detail**, and bore the hole to accept the threaded rod.

**Source**

**Hardware.** Knobs, square-head channel bolts, and mini channel for a pair of feather boards. Kit no. TS-FB at additional cost for three additional knobs to fit the dust-collection hood. Schlaubach and Sons Woodworking, 720 14th St., Kalona, IA 52247. Call 800-346-9663 to order.

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**FEATHER-BOARD HOLDER DETAIL**

- 2½" dado cut at 30°, centered on block
- ¼" hole ½" deep on bottom
- ½" holes
- ¼" x 2 x 5" hardwood
- ¼" holes
- ¾" screw-head bolt 1½" long
- 6 x ¾" F.H. wood screw
- ½" saw kerfs spaced ½" apart
- F.H. machine screw
- ¼" x 2½ x 8½" hardwood
- ½" carriage bolt 2½" long
- ½" slot
- ½" stop nut
- ½" hole ¾" from end
- ½" rabbet ½" deep
- ½" hole ¾" from end
- ½" dowel 5½" long (¼" chamfers on ends)
- ½" rabbet 2½" deep (cut at a 20° angle)
- ½" hole ¾" from end
- 1" dowel 3½" long (¼" chamfers on ends)

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**ANTI-LIFT MOUNTING DETAIL**

- ¼" stop nuts
- ¾" flat washers
- ¾" threaded rod 8½" long
- ¾" stop nuts
- Saw table
- ¾" stop nut

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**RABBIT DETAIL**

- 2½" x ¼" dado cut at 30°, centered on block
- ¼" hole ½" deep on bottom
- ½" holes
- ¼" x 2 x 5" hardwood
- ½" rabbet 2" deep (cut at a 20° angle)
- ½" stop nut
- ½" hole ¾" from end
- ½" rabbet ½" deep
- ½" hole ¾" from end
- ½" dowel 3½" long (¼" chamfers on ends)
- ½" dowel 5½" long (¼" chamfers on ends)
Easy-lock feather board

Get perfect rip cuts with this quick-to-set tablesaw helper.

When ripping stock on your tablesaw, keep your workpiece firmly and safely against the fence with this handy adjustable locking feather board. Not only does it prevent wavy cuts, it also guards against dangerous kickback.

To build one, use the half-size patterns in Drawing 1 below and Drawing 2 on the next page to cut the handle (A) and feather board (B) to size and shape, noting the location of the angled notch and counterbored hole in the handle. Use a bandsaw to cut the \( \frac{2\frac{1}{2}}{12"} \) parallel kerfs in the feather board and the curved portion of the handle. Cut the 30° angled notch in the bottom edge of the handle edge using a dado blade in your tablesaw along with an auxiliary wooden fence on your miter gauge for support.

**Scale 200% for full-size patterns.**

**PARTS VIEW**

<table>
<thead>
<tr>
<th>HANDLE (Bottom view)</th>
<th>FEATHER BOARD (Top view)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30° Leading (short) finger</td>
<td>30° Leading (short) finger</td>
</tr>
<tr>
<td>( \frac{3}{16}&quot; ) washer, countersunk on bottom side to fit screw head</td>
<td>( \frac{3}{16}&quot; )</td>
</tr>
<tr>
<td>Same thickness as width of your tablesaw slot</td>
<td>( \frac{3}{16}&quot; )</td>
</tr>
</tbody>
</table>

1\(\frac{1}{4}" \) 20 x 3" F.H. machine screw

\( \frac{1}{4}" \) hole, centered inside/\( \frac{1}{4}" \) counterbore \( \frac{1}{4}" \) deep with a \( \frac{1}{4}" \) hole, centered inside
To finalize the feather board, countersink and slide a \( \frac{7}{16} \)" washer onto the head of the machine screw, slide the threaded end through the handle, and fit a washer and four-arm knob onto the end. Fit part B into the angled notch and slide the bottom edge of the handle and the washer into the miter-gauge slot on your tablesaw, as shown on Drawing 2a. If the washer is too wide for your miter-gauge slot, you may need to grind down the outside edges for a good fit.

With the saw off, slide the workpiece between the feather board and fence. Position the trailing edge of the feather board about 1" in front of the leading edge of the saw blade, as shown in the main photo opposite. Put too close to the blade, the feather board can pinch the kerf and cause the workpiece to bind on the blade.

Position the shorter leading finger against the workpiece, as shown in the inset photo opposite so the piece slides forward smoothly yet is held firmly against the fence. If pushing the workpiece between the feather board and rip fence offers too much resistance, back part B off slightly. Once in proper position, tighten the four-arm knob to secure the assembly in place.

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**Project design:** Vernon Lee; Scott Spierling, Sunnyvale, Calif.

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![2a SECTION VIEW](https://www.woodmagazine.com)
Here’s a great way to get on-the-money angled cuts every time.

This miter-cutting sled offers a dual-runner guidance system that rides in the miter-gauge slots of your tablesaw, and adjustable stops that ensure equal-length parts. It also features a safety channel down the middle to keep your hands away from the tablesaw blade.

To build the jig, see the drawing on the next page for the dimensions. We used Baltic birch plywood for the base and hard maple for the other parts. Refer to the photos below for tips that guarantee an exact fit on your saw and a pair of perfectly aligned miter fences.

To mount the runners to your miter sled, place two stacks of two pennies in each miter-gauge slot on your tablesaw to serve as shims [Photo A]. Place a runner in each slot and then apply double-faced tape to the top of each runner. Put two marks on the center of the sled base to define the edges of the blade kerf, and locate the rip fence to bracket those marks over the blade. Press the base against the runners, remove the assembly from the saw and permanently attach the runners with screws.

Place the sled on your tablesaw and cut a kerf about 6” long to serve as a visual guide for placing the fences. Now, cut a right triangle measuring 21½” on its long edge and clamp it firmly to the miter-sled base, as shown [Photo B]. Apply double-faced tape to the bottom of each fence and press them into place. Now, remove the clamps and triangle guide and make test cuts in scrap to check your new sled’s accuracy. When you're sure it's dead-on, permanently attach the fences with screws, making sure the fences sit perpendicular to the sled base.

Affix self-adhesive measuring tapes into the groove atop each fence. (Any ½” tape will work, but a right-to-left reading tape for the left fence and mirror-image left-to-right tape for the right fence will be easier to use.) Make the stop blocks according to the drawing on the next page. Before attaching the acrylic to the blocks, draw or etch a cursor line down the center of each.

To make two workpieces of equal length, start by measuring and marking both ends of the first workpiece. Miter one end using the sled, then transfer the workpiece to the opposite fence. Line up the second mark with the blade, butt the stop against the already mitered end, tighten it, then make the second cut. Leave the stop in place and miter the second workpiece in the same sequence. To avoid weakening the sled base, stop your cut when the highest point of the blade passes through the fence.

Use an 80-tooth crosscut blade for smooth, ready-to-glue surfaces.

Project Design: Brian Hahn, Avoca, Wis.
Magnetic auxiliary fence

“Stick to it” with this fence-protecting accessory.

To avoid drilling into your expensive tablesaw fence to attach jigs, mount them instead to a wooden fence attached to your real fence with rare-earth magnets. Because the magnetic attachment grabs the steel body of the fence, you don’t have to work around clamps. With no clamps or screws, installing and removing the fence takes only seconds.

Adhere the magnets by cutting a filler strip of wood to fit on top of the fence between its faces. Then, bore holes through the filler strip to fit the magnets, glue and screw the strip to the auxiliary fence, and epoxy the magnets in the holes. To prevent the jig from sliding as you feed stock through the saw, attach a steel L-bracket end stop to the jig, where shown.

Project Design: Scott Spencer, Rochester, N.Y.
Tenon cheek-cutting jig

A perfect solution for safe, vertical cuts.

One of the trickiest (and potentially most dangerous) operations on the tablesaw is making cuts into the end of a board stood vertically. The typical tablesaw fence stands too low to provide adequate support when holding the workpiece this way. That’s why many woodworkers bandsaw these delicate cuts and try to sand the cut tenons to perfection, or spend more than $100 to buy a commercial tablesaw tenoning jig. But this tenon-cheek-cutting jig provides absolute accuracy and safety for the cost of two toggle clamps (and free stock from your scrap bin).

The jig rides on both the fence and saw table, as shown at right. It’s absolutely critical that the jig holds the workpiece firmly. Flexing will ruin your tenons, so use only 3/4” cabinet-grade plywood for the jig’s box and fence assembly.

Note: The design shown here is based on a tablesaw fence with parallel sides such as a Biesemeyer-style fence. If your fence does not have this feature, you can secure the basic saddle assembly to a sliding base mounted on runners that ride in the miter slots, or a base that slides along the fence.

CUTTING CLEAN, STRAIGHT FACE AND EDGE CHEEKS

A

When cutting edge cheeks, a spacer placed between the opposite edge and outer clamp helps to achieve a firm hold.

B

On wider stock, the outer clamp secures the workpiece without a spacer when cutting edge cheeks.
Using the drawing above, cut the sides of the saddle to the exact height of your tablesaw fence. Cut the top of the saddle to span both sides when they sit flush against the fence. Glue and screw the top to the sides, ensuring perfect alignment.

Cut this jig’s fence and braces to size and then glue and screw them to the base. (The clearance area makes room for the waste while avoiding binding and kickback problems.) Don’t skimp on screws, as this assembly must be rigid and dead true.

Finally, cut and glue up the parts for the vertical workpiece support. It accommodates boards of varying widths. The first (inside) piece is 3/4" thick, the second 2 1/4". Note that these dimensions may vary, depending on the dimensions of the stock cut. Glue them together, leaving the thicker piece about 4" shorter than the thinner one. Glue and screw this assembly to the fence and add low-silhouette toggle clamps. (Get them from woodworking specialty stores or catalog such as Woodcraft: 800-225-1153, woodcraft.com.)

Now, cut dead-on tenons

Set up the jig by adjusting the saw fence to cut the inside cheek of the workpiece. If your shoulders have equal depth, you can cut all four cheeks without needing to reposition the fence. When cutting the face cheeks, be sure to lay the workpiece flush to the fence and secure it with the lower clamp, as shown in main photo, opposite. When cutting the edge cheeks, add a spacer board for relatively thin stock and clamp it with the outer clamp (Photo A). If the workpiece is wide enough, the upper clamp will hold it in place without a spacer, as shown in Photo B.

When cutting tenons, the first cuts you typically make are the shoulder cuts. Keep in mind that if you set your blade too high on a shoulder cut, you’ll create a shallow kerf in the tenon that will be hidden when the joint is assembled. On the other hand, if you set the blade too high on the cheek cuts, you will cut a kerf into the finished piece that will be visible where the two pieces are joined.

To ensure results the next time you use the jig, it’s always a good idea to keep a mortised mating piece on hand to test-fit the tenon while fine-tuning saw setups. Once you achieve that first snug-fitting mortise-and-tenon joint, you’re ready to cut all of the tenons of that size needed for your project.

Project design: Zane Powel, Indianapolis

Tips for sizing tenons

When figuring tenon size, keep in mind the thickness of your workpiece, the widths of the chisels and drill bits you own, and the purpose for which you’re using a mortise-and-tenon joint. Consider the basics:

- Apply the rule of thirds. For 3/4" stock, that means making a 1/4"-thick tenon with 1/4" shoulders along each side.
- Regarding tenon width, make top and bottom shoulders the same depth as the side shoulders. This lets you cut all four shoulders using the same setup.
- For full strength, make tenon lengths as long as two-thirds the width of the mating mortised workpiece. Err on the side of creating more gluing surface. The longer the tenon, the stronger. Application is your best guide. In a small picture frame, a short “stub” tenon may suffice. Where racking may occur, as in a table leg/apron joint, opt for a deeper tenon.
Texas-size fence

Stable tablesaw support for cutting panels and other unwieldy stock.

Now you can stand workpieces, such as raised panels, upright and cut their edges on your tablesaw. Just use this auxiliary tablesaw fence designed by WOOD® magazine reader Joe Xaver. The jig temporarily bolts to your saw’s existing fence to help you make these cuts safely and accurately, and folding supports make for flat storage.

Before you begin, take a few measurements from your saw to ensure proper fit. First, examine your saw’s existing fence to see if drilling it for the machine screws where shown in the drawing below will interfere with the fence’s operation, and adjust the locations if necessary. For webbed extension wings, measure between the centers of the webs at the front and rear of the extensions. Make the removable spreader this length, and add 1 1/2" to find the length of the cross member. (The dimensions shown are for a table that is 26 1/2" between the centers of the front and rear webs.) For saws with solid extension wings, shorten the dimensions shown for those pieces by 4".

Armed with that information, build the auxiliary fence as shown in the drawing. Drill 5/16" holes in your fence to match the location of the T-nuts, and bolt the tall fence to your saw’s fence as shown in the photo above right. Before using the jig for the first time, adjust the nylon glides so the tall fence is perpendicular to your saw’s tabletop. When you’re finished using the jig, unbol the unit from your fence, pop out the removable spreader (attach it to the top edge of the cross member for storage), fold the legs, and hang the whole thing on a wall.

TABLESAW FENCE

Project Design: Joe Xaver, Auburn, Ill.
Make it square panel-cutting sled

The right sled for cross-cutting one or more pieces.

When you use our panel-cutting sled, you’ll never have to wonder if the corner you just cut is square. For hair-splitting accuracy, the beefy fence is fixed at 90° to the blade and shows exactly where your saw blade will cut. And, the fence-leading design holds wider workpieces more solidly and keeps your work closer than fence-trailing jigs.

Build the jig according to the drawing above right. We made ours from birch-veneer plywood with a solid poplar fence, but you could use any ½" plywood or medium-density fiberboard and a straight scrap of 2×4. Cut both pieces ¼" longer than shown; you’ll trim them to their exact length after you build the jig.

**Note:** A well-tuned tablesaw is essential to complete the assembly. Your saw blade must be parallel to the miter slot. To watch a free video on how to tune up your tablesaw, go to woodmagazine.com/tstuneup.

Before attaching the miter-slot bar, ensure the corner formed by the fence and the right edge of the sled is square. Make a mark 3" from the corner along one edge, and 4" along the perpendicular edge. Measure diagonally between the two marks. If the diagonal measures exactly 5", your corner is square. If it’s more than 5", the angle is greater than 90°; less than 5", and it’s less than 90°.

Next, measure the distance between your tablesaw’s blade and miter slot and add ¼". Using that measurement and a combination square, scribe a line on the sled bottom, measuring from the saw-blade edge. Attach the miter-slot bar along the scribed line.

With the sled’s guide bar in your tablesaw’s miter-gauge slot, crank the saw blade up to full height. Run the sled through the blade, slicing off the extra ¼" from both the base and the fence.

You can now cut with confidence by aligning the cutline on your workpiece with the edge of the fence. For repetitive cuts less than 27°, clamp a stopblock to the fence. When cutting pieces up to 48°, lock in the sled’s built-in stopblock.
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from the editors of WOOD® magazine

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