The traditional breadboard end joint is, to my mind, one of woodworking’s slickest solutions for managing wood movement. It’s often used on table tops, blanket chest lids, and other solid wood panels such as the lid for the tool chest on page 20.

The purpose of the joint is to prevent a solid wood panel from cupping, while still allowing it to expand and contract across the grain in response to ambient humidity. The breadboard ends are essentially rails that are mortised to accept tenons on the ends of the panel. They serve the same basic purpose as cleats screwed to the inside face of solid wood panels on rustic furniture, except that breadboard end joints are a lot more elegant and forgiving of wood movement. The time spent making the joint pays off in spades, ensuring projects with strength and beauty to last generations.

There is a variety of approaches to making this classic joint. Over the years, I’ve developed a simple strategy using a modicum of machinery and hand tools, and a jig built from extra stock. My method can be adapted for use with large and small panels.
Designing the joint

As shown in Figure 1, a breadboard end joint consists of multiple mortise-and-tenon joints separated by a haunched section. The tenons reach deeply into the cantilevered rails to give them strength. The space between the tenons allows structural integrity for the rail, which would otherwise be weakened by a deep mating mortise running the entire length. The haunched section keeps the parts aligned between the tenons.

To allow the panel to expand and contract across its width, the rail is glued only at its center section. The outermost sections are anchored in place with dowels that extend through slots, allowing the panel to move while still holding the rail’s outer ends against the tenon shoulders. The outermost mortises are also slightly oversized in length to allow panel movement.

Although there are no hard-and-fast rules on proper tenon width and spacing, I limit the width of my tenons to no more than about 4”. I find that three tenons work nicely on an 18”-wide panel, and four on a 24”-wide panel, but use your own judgment as to the specific spacing. I typically make the tenons one-third the stock thickness, but have bent this rule to accommodate available bits.

Make and mortise the rails

Mill your stock, and cut the rails to final size. For consistency, dress the rails and panel to final thickness at the same time. Also, initially make the rails about 3” oversized in length. You’ll use the excess as spacers for your fences when routing the panel tenons.

Mark the ends of the mortises on the edges of the rails. Lay out the center mortise for a tight fit, but provide extra space on both ends of the outermost mortises. (If needs be, I’ll adjust the tenon width so that the mortises stop about ½” in from the ends of the panel.)

Next, outfit your router with an upcut spiral bit and edge guide. Using the excess from a rail as a test piece, set up the edge guide to rout a mortise that’s perfectly centered across the stock thickness. (I use a dial caliper to check the offset between the face of the stock and the mortise wall.)

Rout the mortises (Photo A) ¼” or so deeper than the tenon length. Now, leaving the edge guide setting as is, adjust the depth of cut for the haunch groove, and rout it out between the mortises.

Photos: Paul Anthony; Illustration: Christopher Mills
Cut the panel tenons

Before cutting the panel tenons, you’ll need to make a pair of double fences to guide the router. Mill four pieces of straight-grained stock to about 2” wide, and a few inches longer than the width of your panel. Most importantly, joint the edges absolutely straight.

Crosscut each excess section of rail into two, and tack each half between the ends of a pair of fences, as shown in Photo B. Afterward, use a square to check the fence edges for parallelism. Run the assembly over a jointer if needed to square the edges and bring them into perfect alignment. (This is important to ensure tight rail contact at the shoulders of the joint.)

Now mark the tenon shoulders fully across one face of the panel using a sharp pencil, and install a wide straight bit in your router. Adjust its depth of cut so that routing in from both faces yields a tenon that’s a hair too fat for its mortise. (Make the cuts on a piece of scrap the same thickness as your panel, and test the fit in a mortise.)

Secure the panel to a couple of risers on your benchtop. Clamp the fences in place, offsetting them from the tenon shoulder line a distance equal to the offset between the edge of your router sub-base and the perimeter of your bit.

Make the cuts as shown in Photo C. The most efficient approach is to use spacers whose

Tip Alert

To prevent exit tearout at the end of the cut, deeply knife the tenon shoulder lines into the edges of the panel before routing.
width equals the diameter of your router bit. For example, here I’m using a ¼"-diameter bit, so I place a ¼"-wide spacer against the fence, and make a complete end-to-end cut. Next, I remove the spacer and make a second ¼"-wide cut to yield my 1"-long tenon. For longer tenons, use more spacers.

After routing, lay the individual tenons out to width, then use a jigsaw to cut out the haunched area between them. Round the edges of the tenons to approximately match the ends of the mortises (Photo D).

Now adjust the tenons to fit. For this I use a shoulder plane (Photo E), but you can also use sandpaper wrapped around a hardwood block. (Remember to remove the same amount from each face to keep the rail centered across the thickness of the panel.)

**Pin it together**

Mark out the dowel hole locations on the undersides of the rails, and clamp them in place. To do this, I crosscut two stout clamping cauls of identical width to a length about 8" longer than my panel width. (The cantilevered ends of the cauls keep the clamps from interfering with the edge guide when routing.)

Set up a router edge guide to align the bit with the dowel hole locations. Then set the plunge depth to bore through the rail and the tenon, stopping short of creating a through hole (unless you want the look of exposed pegs on the top of the panel assembly). Now plunge the holes into the underside of the panel as shown in Photo F.

Remove the rail, adjust your edge guide, and then widen the outermost holes into slots (Photo G). Pare small chamfers at the ends of the joint where shown in Figure 1.

Assemble the parts, gluing only the centermost 6" or so of the joint, and glue short dowels into the holes. After the glue dries, saw and pare the dowels flush to the surface, and then plane or sand both faces of the panel assembly to flush up any discrepancies.

Take a bow. You’ve just created a flat panel that should stay that way forever.

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**Use a router outfitted with an upcut spiral bit and edge guide to bore the dowel holes into the underside of the assembled panel.**

**Reset the edge guide, and elongate the outermost tenon holes to allow seasonal wood movement of the panel.**
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