8 ways to make end-to-end joints that hold

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Any joint that butts end grain to end grain will be weak because you're gluing wood fibers at their porous ends instead of along their sides. (Picture trying to glue two drinking straws together at their ends instead of along their sides.) Fortunately, you can strengthen end-to-end joints for those rare occasions when they're necessary, such as connecting two pieces of crown molding on a long wall, or making the most of pieces that are too short for your project but too long to scrap.

Boiled down to basics, you must either add reinforcements, such as plates, dowels, or screws, or cut the joint in a way that creates mechanical strength and exposes more face or edge grain for a stronger bond, such as the joint shown *above*, routed with a finger-joint bit. Check out these eight solutions, from basic to beautiful.

Choose the appropriate end-to-end joint

Joint	Pros	Cons	Best Uses
1 Straps	Strong, simple, and quick to install.	Meant to be hidden. Screws may penetrate the surface of thin stock.	Join crown molding and parts that don't rest flat on another surface.
2 Pocket-hole screws	Installs quickly in stock as thin as ½".	A specialized pocket-hole jig is required. Screw holes are visible from the back.	Use for joints that will receive minimal stress and where the workpiece back is concealed.
3 Splines	Strong. Visible and concealed splines can be customized for different workpieces and strength requirements.	Splines must fit tightly to be effective. Visible splines may create appearance problems.	Joints that require added strength. Use concealed splines where appearance is critical.
4 Dowels	Makes a strong connection by creating edge-to-edge glue surfaces around the dowel.	Multiple dowels must be spaced identical distances apart on both workpieces.	Joints where the connector becomes hidden after the joint is assembled.
5 Bevel-cut scarf joint	Simple to cut on a tablesaw, these work on both moldings and dimensional stock.	Gluing surface increases on the bevel, but there's no reinforcement.	Molding profiles where the bevel helps conceal the joint line.
6 Miter-cut scarf joint	Creates a long, edge-grain glue surface. The joint line can be concealed by the grain.	Cutting identical bevels is tricky.	Joining long pieces of lumber where you want a gradual grain transition between pieces.
7 Basic half-lap joint	Face-to-face connection provides a strong glue surface.	Can't be used on molding or profiled workpieces.	Flat workpieces where better-than-average strength is needed.
8 Tabled lap joint	This strong face-to-face connection shows off your craftsmanship.	It's one of the most demanding end-to-end joints to create.	Joints you want to display, not hide.

Plain, practical straps

Use simple metal or plywood straps to reinforce butt joints where they can be hidden or where appearance isn't important, such as on the back side of a wide crown molding where you can't afford any waste. Making your own custom-sized straps from ¼ " plywood saves you money and provides a strong gluing surface.

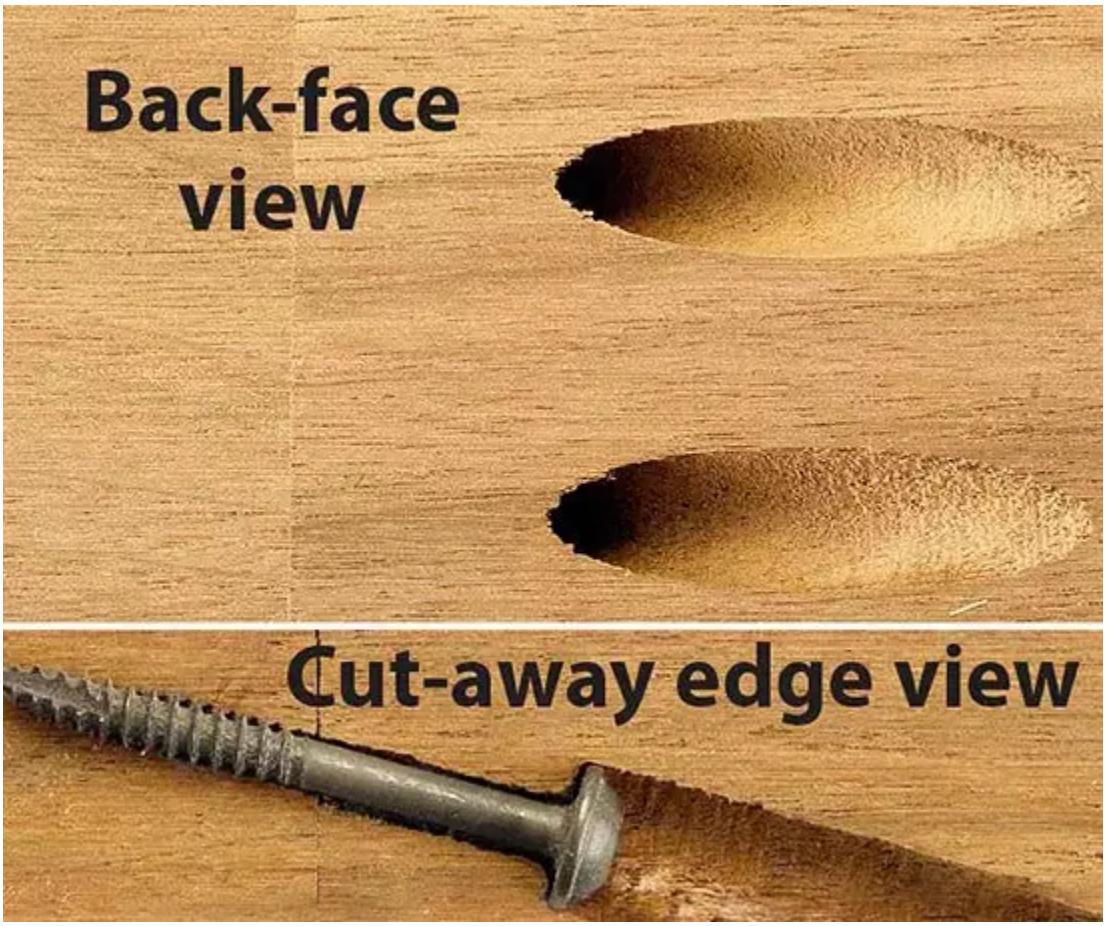
To install a wooden strap, cut it as wide as the workpiece allows. If you're joining pieces with a profile on the opposite face, such as molding, locate the screw holes over the thickest profile points—at the peak of a ridge or curve, for example.

To make the joint, glue and screw one side of the strap to a workpiece. After the glue dries, glue the other half of the strap, and clamp the assembly to a flat surface. For a tight joint, raise the other workpiece about ¼ " at 3' from the end being jointed. Then press the pieces together as you add the mounting screws, as shown *below*. Lay both pieces flat and allow the glue to dry before handling the joint.

Eight #8x1/2" flathead wood screws plus glue hold this end-to-end crown molding joint tightly together.

Pocket-hole screws

Here's another easy method to fasten butt joints in a hurry. To install pocket-hole screws, use a pocket-hole jig to drill an angled hole through one workpiece and into another. A screw inserted into the hole pulls the pieces together, as shown *below*. Workpieces should be at least ½ " thick (using 1" screws), and you can attach parts 1½ " or thicker using 2⅝ " screws. Learn more about making pocket-hole joinery.



Pocket holes drilled into the backface (top) are invisible from the front.The screw then pulls the pieces together (bottom).

Splines provide inner strength

Splines create a face-to-face glue surface that resists flexing. Use through splines for an easy-to-make connection with visible splines. Mark each joint on its top face and set the saw blade ¾ " high?—half the length of the splines. Orient the top faces of each piece against your rip fence for consistent groove positions between pieces. To keep extra-long pieces steady, add an auxiliary fence. Using a backer block to stop tear-out, cut kerfs on the ends to form a groove as wide as one-third the thickness of your stock.

Next, plane and saw the spline blank stock to match the width and combined depth of the grooves. You can make splines from plywood or solid stock. If you choose solid stock, as shown *below*, orient the spline grain *parallel with* the workpiece grain. Insert the spline; then glue and clamp the pieces.


1½"-wide
oak spline

This spline measures a third the thickness of the pieces to be joined, with the grain running perpendicular to the spline length.

For not much more work, create a concealed spline, like the one shown *below*, that disappears after you assemble the joint. We made this joint using a ¼ " straight bit on a table-mounted router. Set the bit height to just more than half the width of your splines. Then adjust your router table fence to center the bit on the thickness of the workpiece ends.

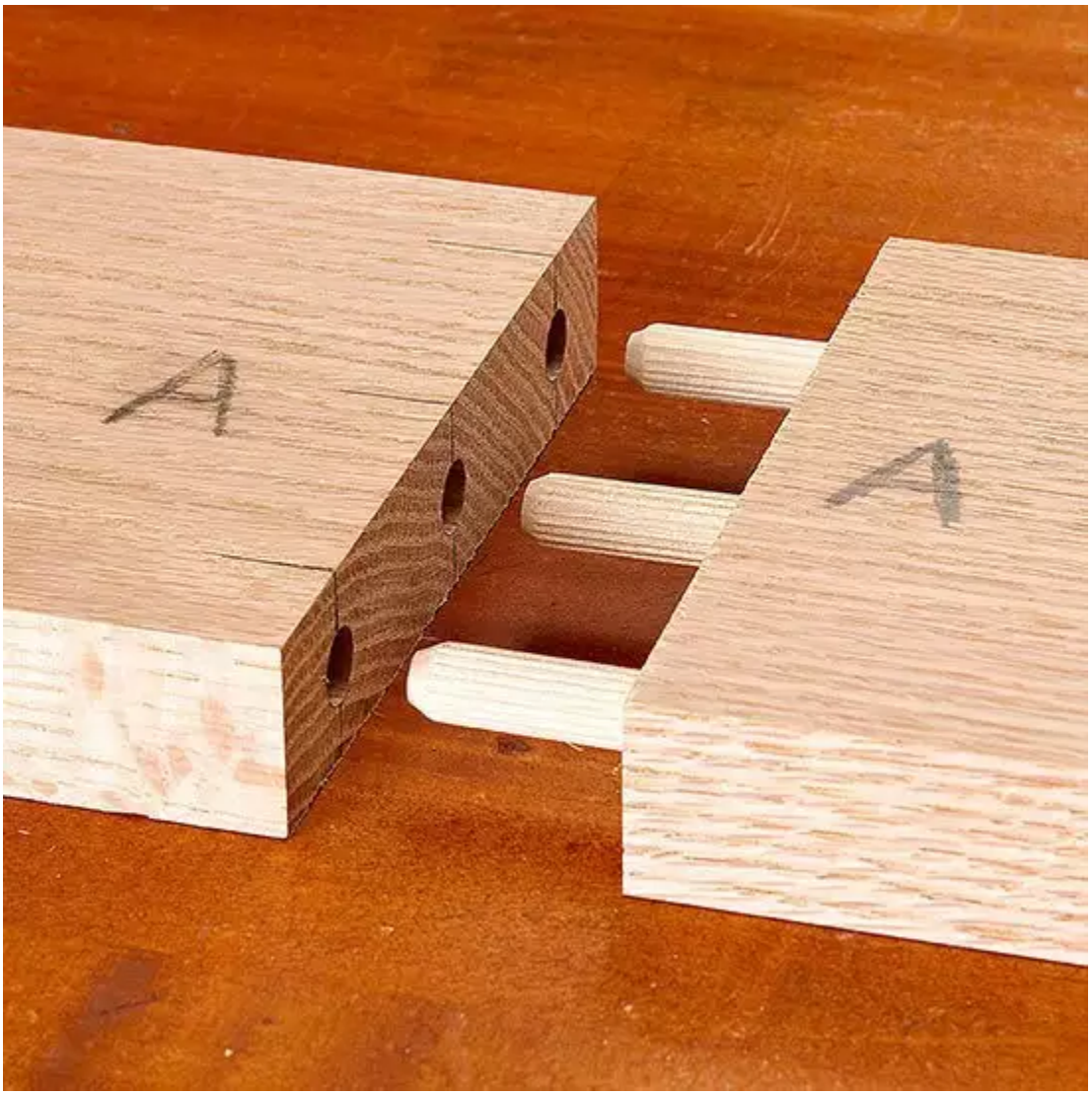
Round over the spline corners for a tight fit in the slot but cut the splines 1/32" narrower than the combined depths of the slots.

Next, build a simple jig to guide your workpieces. From scrap slightly thicker than your workpieces, cut two stopblocks. Space them a distance apart that's twice the width of your workpiece minus mortise insets from both edges. Then attach a crosspiece that's ½ " wider than the bit height for added safety and control. Clamp the connected stopblocks of the finished jig to the router table fence so they're equal distances from the bit, as shown *below*.To keep minor fence adjustment errors from creating an uneven joint, mark the top faces of your workpieces and have them facing you while routing the slots. Using a pushpad, press the workpiece against the router fence and down the edge of the right stop block to the router table. Slide the workpiece to the left stop block, as shown *below*, and raise it clear of the bit.

A push pad holds this test scrap firmly against the router fence. Add a high auxiliary fence to keep long workpieces from tilting.

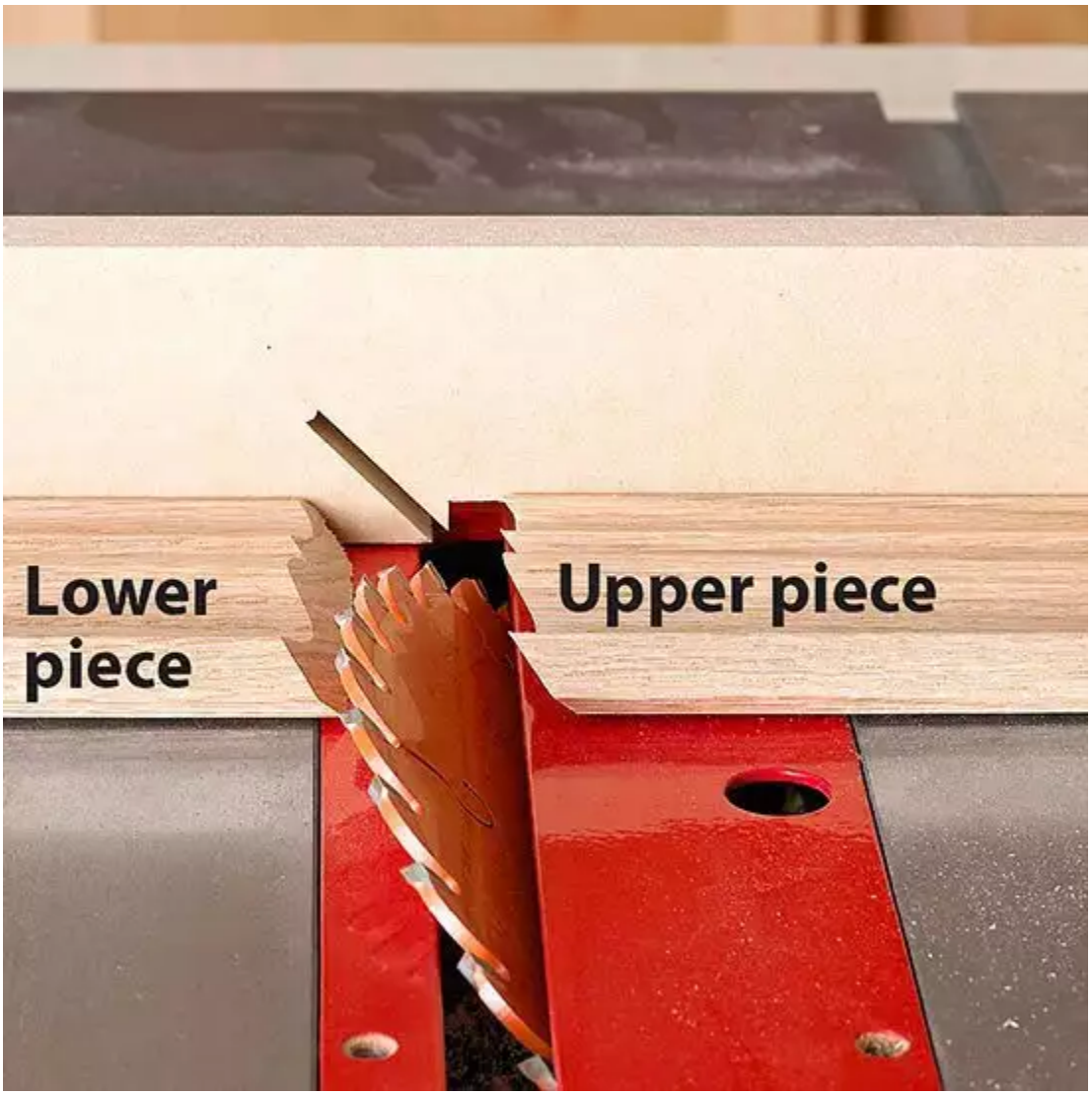
Drill and dowel

A dowel joint, shown *below* provides another invisible connection. Butt the pieces to be joined and mark dowel positions on both faces. Position a doweling jig over the marks, and drill holes $\frac{1}{16}$" deeper than half the dowel length. On one piece, spread glue within the holes, insert the dowels, and clamp it to a flat surface. On the other piece, glue the end grain and holes, force the pieces together, and clamp until dry.



Bevel-cut scarf joints

By cutting ends at an angle before joining them, you expose more long grain for a better bond. The sharper the angle, the larger and better the gluing surface. For example, a 45° bevel increases the gluing surface by about 40 percent and helps conceal the joint line on a profiled surface. To match the angles, cut one end on one side of the saw blade and the mating end on the opposite side, as shown *below*. Even if your blade bevel angle varies slightly from 45°, the pieces will mate.

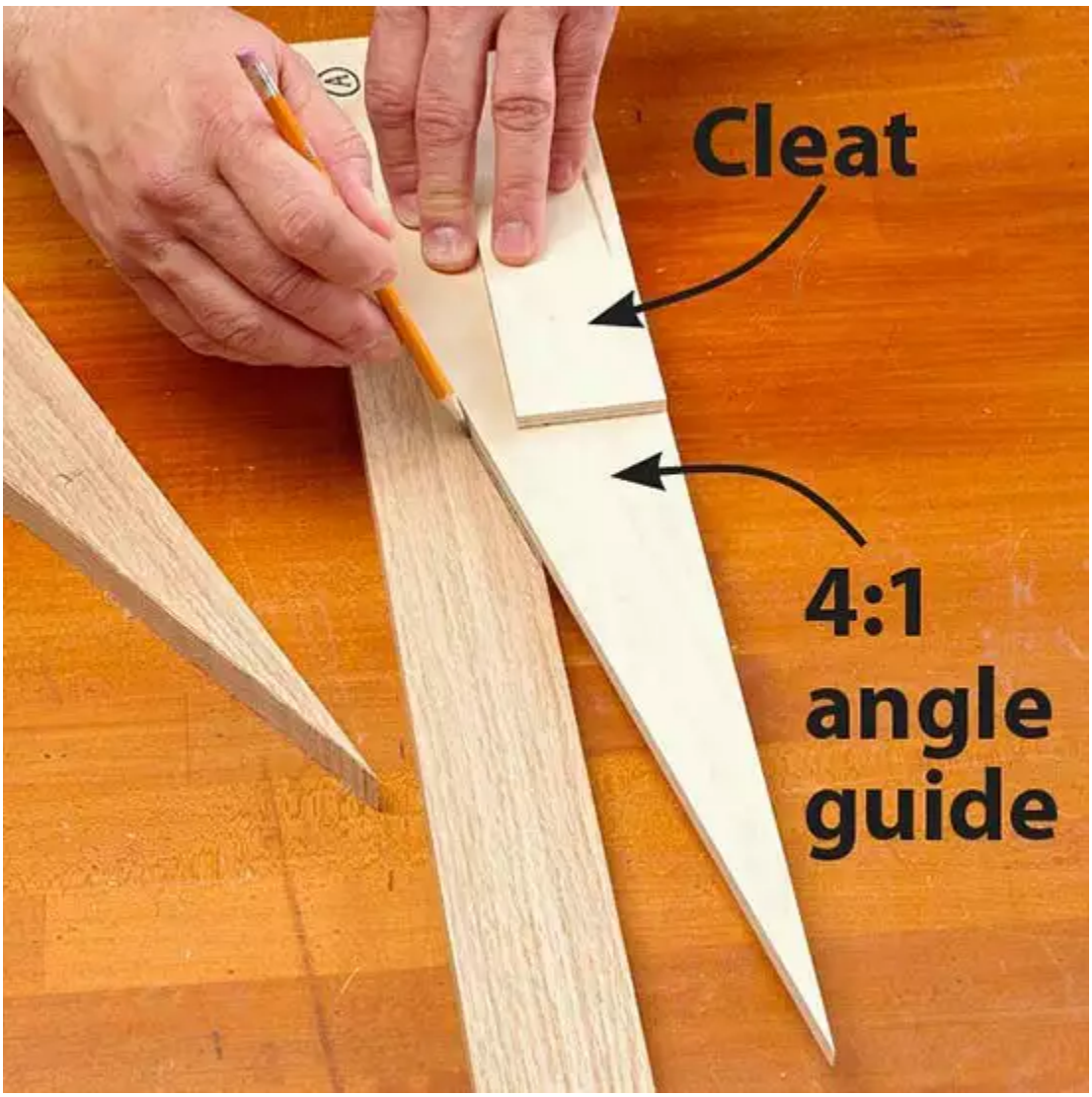

Lower piece
Upper piece

Cut crown-molding ends on opposite sides of the blade for a tight end-to-end joint.

To join the halves, clamp the lower one against a flat surface. Then clamp the upper piece down and against the bevel on the lower piece. Align the pieces with a straightedge, if necessary.

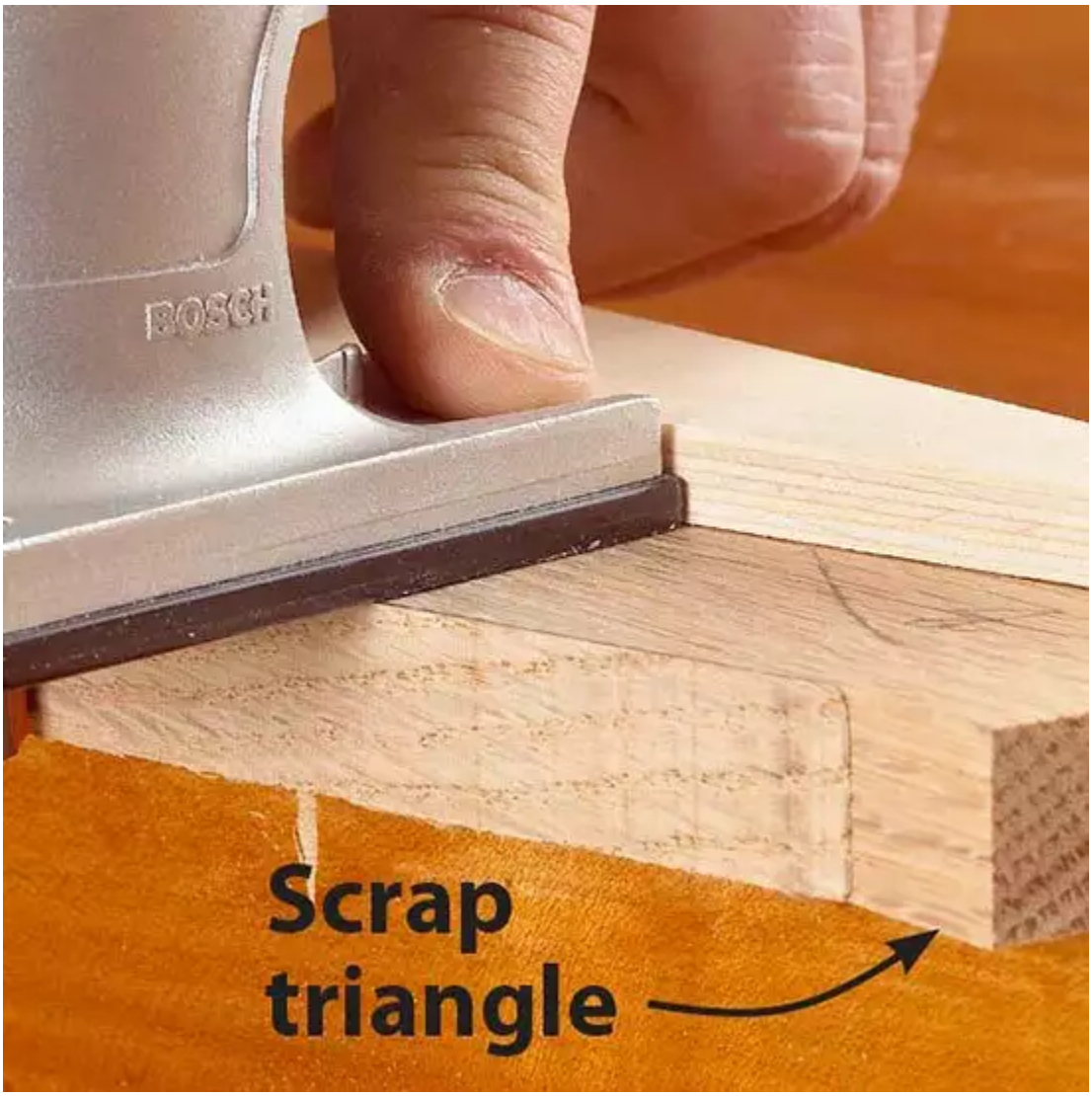
Miter-cut scarf joints

Try this joint for an even larger gluing surface. Begin by making a 4:1 angle guide that's more than double the width of the workpieces. (The guide shown in the photos measures 5x20" for a 2"-wide workpiece.) Identical cleats on both sides of the triangle help position it on the face of both workpieces, as shown *below*. Mark angles on both workpieces, and bandsaw the pieces to within $\frac{1}{32}$" of the lines on the waste sides.



To mark wider moldings, just increase the size of this 4:1 angle guide.

Next, chuck a straight bit in your router. Clamp the guide and workpiece together against the top of a firm surface, such as your workbench, with the workpiece edge overhanging. Place the triangular piece of scrap removed by the bandsaw beneath the angled guide and next to the narrow tip, as shown *below*, to help stabilize the router base and back your cut at the tip. Then trim the remaining waste down to your marked line. Flip the guide upside down and rout the other workpiece.


BOSCH
Scrap
triangle

Ride the edge of the router base along the 4:1 angle guide for a smooth glue edge.

To assemble the joint, glue the mitered edges and hold them loosely together so both edges form straight lines. Then clamp both pieces to a flat surface to prevent them from slipping when you clamp the joint together, as shown *below*.

A 4:1 angle increases this scarf joint's gluing surface more than 450 percent.

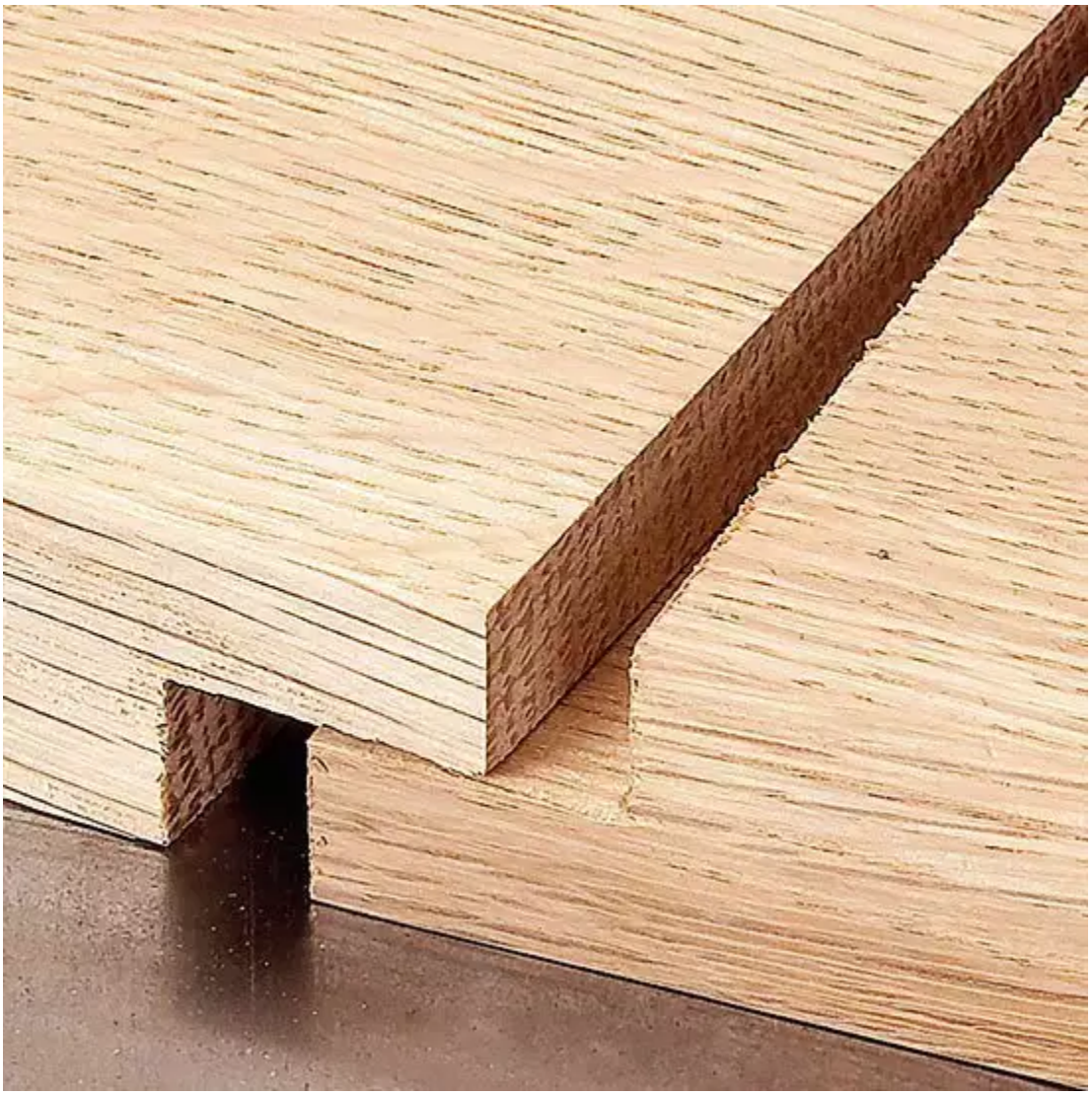
Basic half-lap joints

Attractive, strong, and easy to make on a tablesaw or router table, half-lap joints create face-to-face gluing surfaces. The more the overlap, the better the bond.

To make a simple half-lap joint, begin by marking your cuts. For identical laps, place both workpieces side by side with the ends flush and the appearance side up on one piece and down on the other. Mark an "X" where you'll cut your lap on each piece; then mark a line across both pieces and extend the lines from the faces to the edges on both pieces, as shown *below*.

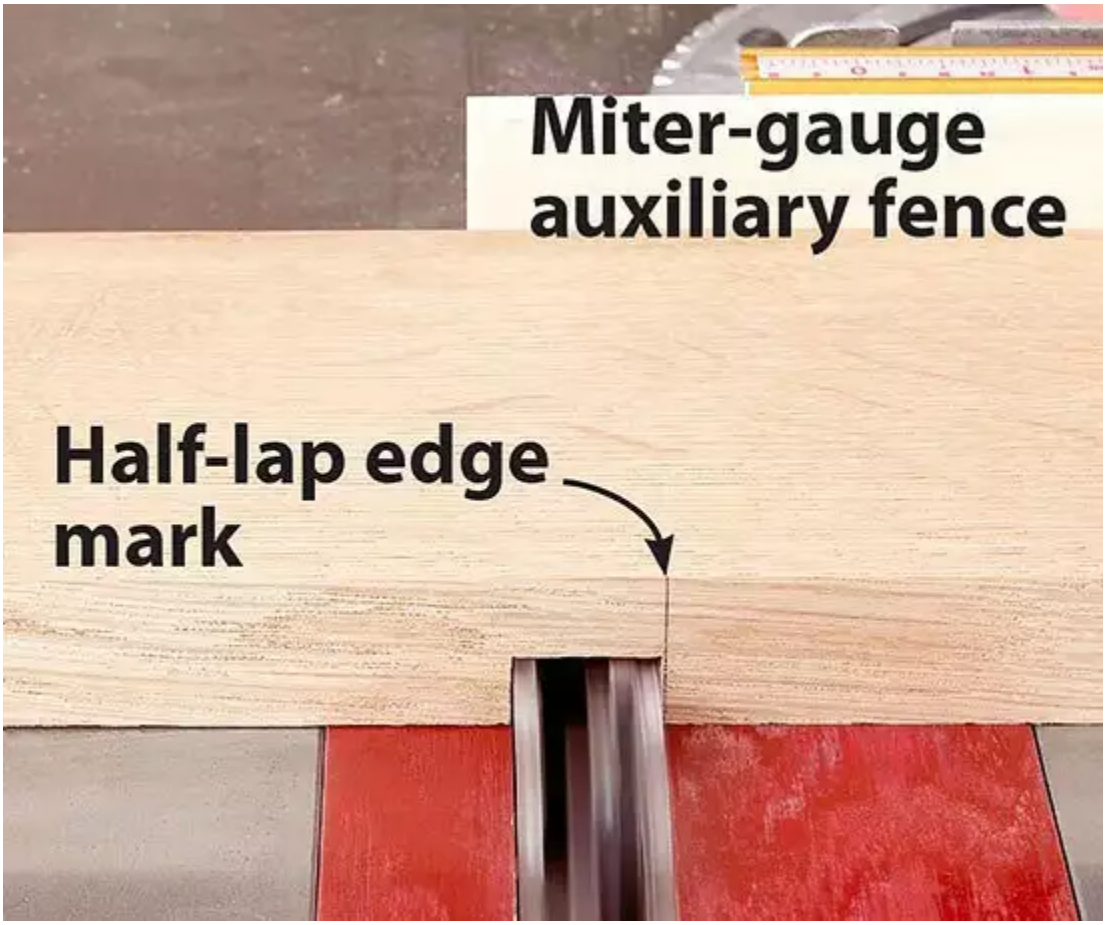
Use the width of your workpieces to mark the length of the overlap.

Next, install a dado set at least 5/8 " wide in your tablesaw and set the blade height to cut half the thickness of your workpieces. Test the fit of the joint using scrap, as shown *below*. Faces of the test scraps should be flush, with solid wood-to-wood contact at the laps.



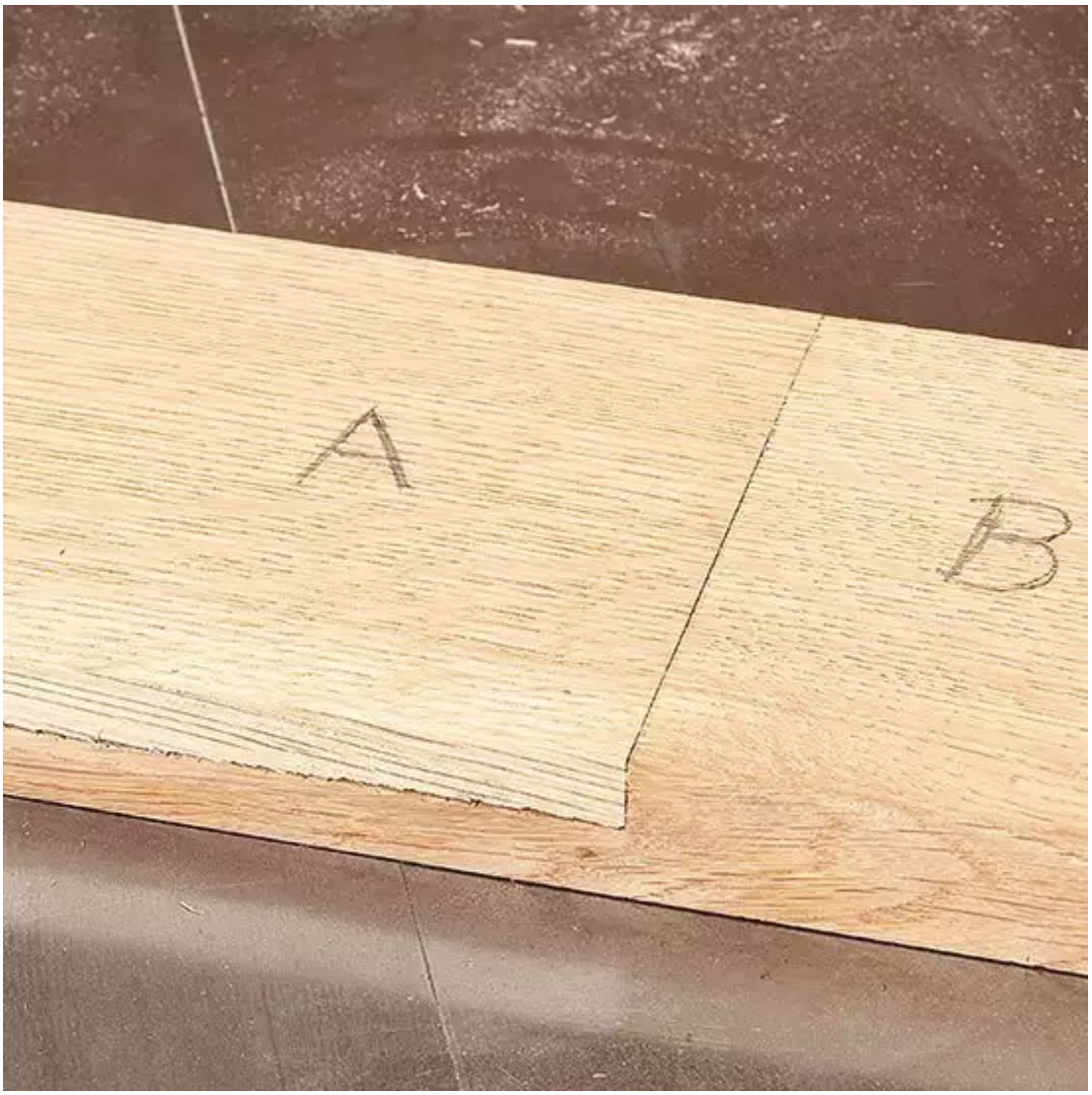
Fine-tune the dado blade height using test cuts on scrap as thick as the workpieces.

Now, cut a dado from the marked joint lines to the ends, as shown *below*. A miter-gauge extension helps position each pass and reduces tear-out. (One piece will be dadoed with the appearance side down.)



Dado the start and end of thehalf-lap on both workpieces together.Then remove the material in between.

Then test-fit the joint, as shown *below*, and check for gaps between the laps or between the bench or saw top and one of the faces. Glue and clamp the laps for a permanent connection.

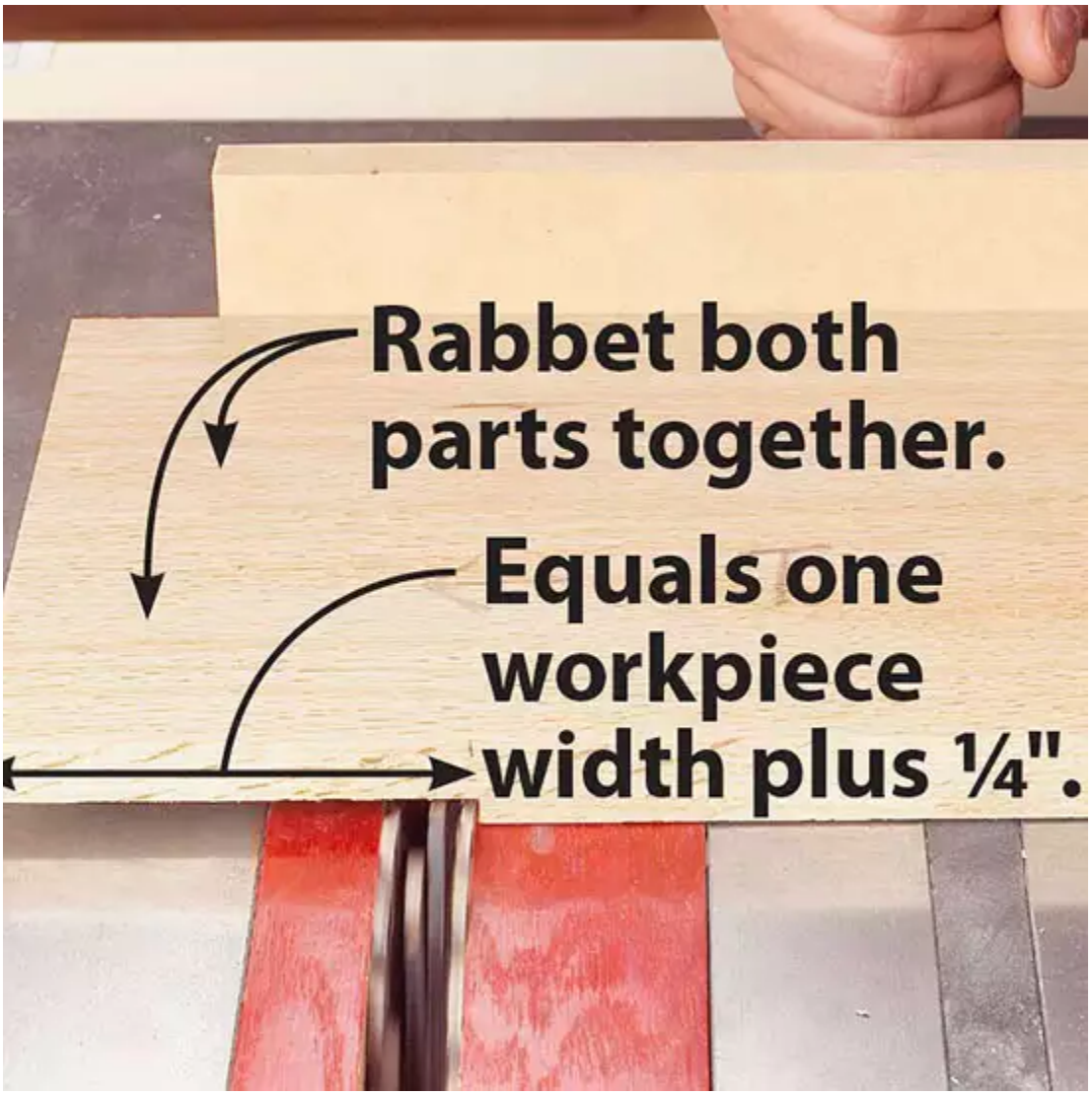

A
B

This half-lap joint creates a durable face-grain connection between the pieces. You can increase or decrease the overlap as needed.

Tabled lap joints

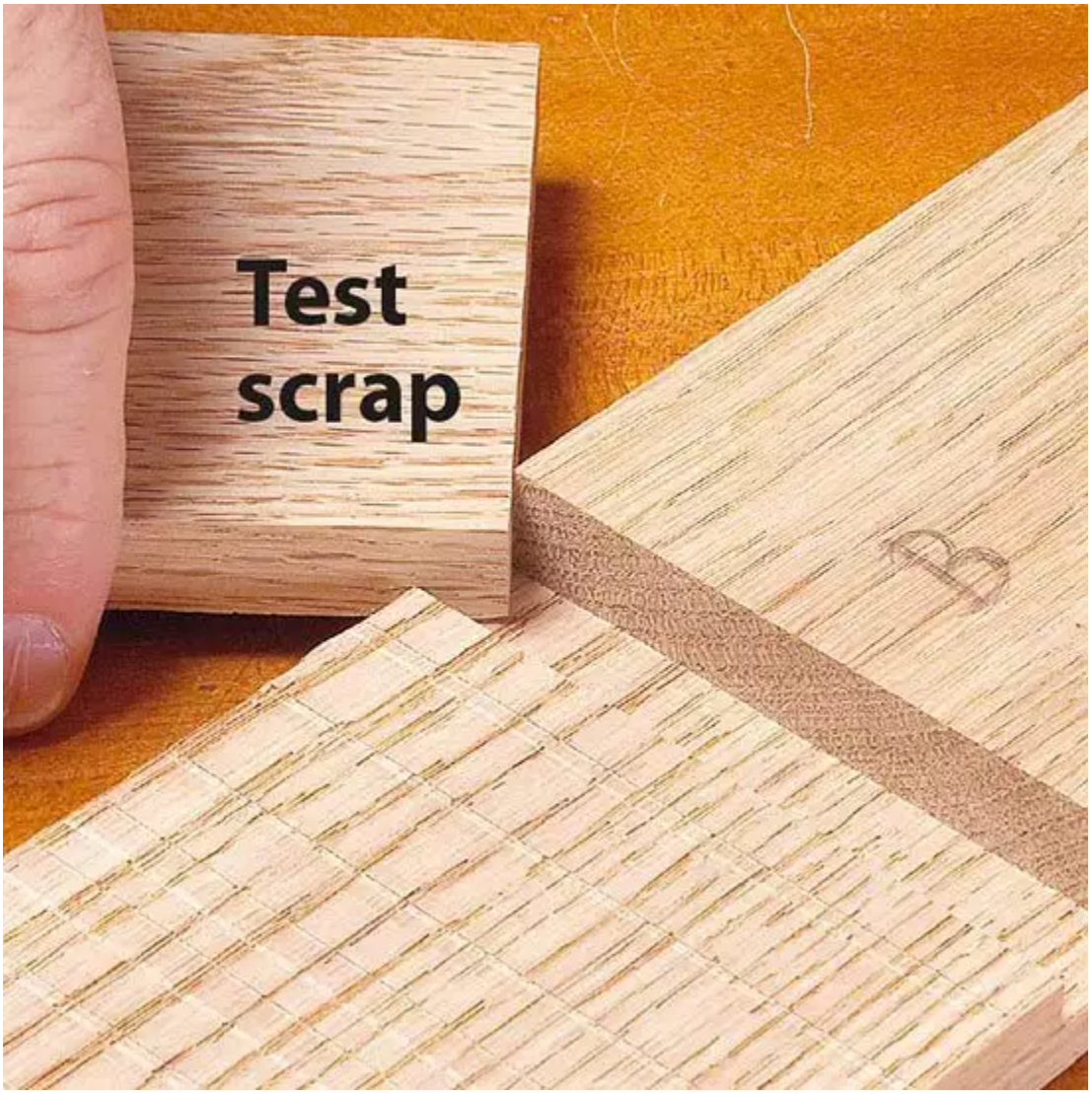
This joint combines the strength of interconnecting parts with the large glue surface of a half-lap joint. To make it, add ¼ " to the workpiece width. (You'll remove it later as you fine-tune the joint.) Then measure that distance from the end of the workpiece. Mark both pieces at the same time as described for a basic half-lap joint. Duplicate these markings on a pair of test pieces the thickness of your final workpieces.

Use the same dado setup as for the basic half-lap, but instead set the blade height to exactly one-third the thickness of your workpieces. Then rabbet both parts and the two test pieces from your edge markings to the ends, as shown *below*.


Rabbet both parts together.
Equals one workpiece width plus ¼".

For perfectly matching half-laps, rabbet both workpieces side-by-side at the same time.

Now reset your dado blade height to exactly two-thirds the thickness of the workpieces. Using your scrap pieces, test and adjust the dado depth until the thicker portion toward the end rests within the thinner section so the faces of both pieces are flush, as shown *below*.



A rabbeted corner of one testpiece should just touch the dado bottom in the other.

Measure from the shoulder of the dado to a distance that equals one-half the width of the workpiece, and place a mark there. With both pieces clamped against the miter gauge, make two passes to define the width of this second pair of dadoes, as shown *below*. Then cut the remaining dadoes.


Rabbeted section
This dado equals half the width of the workpiece.

Cut both pieces edge to edgeat the same time for matchingdado widths.

To ensure a tight joint, gradually trim the ends of each piece separately until both fit the deeper dadoes, as shown *below*. Then glue and clamp the pieces for a joint that shows you can stretch a board with style.

Pieces of a tabled lap jointlock together to form both amechanical connection anda strong glue bond.