Planning for seasonal wood movement

Wood expands and contracts with changing humidity. You can't stop it, but you can accommodate it.

In the days before plywood and other man-made sheet goods, when solid-wood construction was the only option, craftsmen had to understand, anticipate, and compensate for wood movement. What they knew then proves just as valuable today.

Why wood moves

Just as they did in a growing tree, wood cells absorb and release moisture. Absorbing moisture causes the wood to expand; as it releases moisture, the wood contracts. Expansion and contraction is most pronounced across a board's width, so the wider the board or panel, the greater the change. Wood moves negligibly along its length and thickness.

Ignoring this basic property of wood can cause joints to pull apart, drawers and doors to stick, panels to split, and gaps to open and close.

8 strategies for dealing with movement

1. Avoid cross-grain construction. As you design a project, keep your eyes open for places where the grain of one piece runs perpendicular to a joined piece. For example, the grain direction of a cabinet top and the side panels should match [**Photo A**]. In the piece shown, because the front-to-back dimension of the side is greater than the top-to-bottom dimension, you might be tempted to orient the grain direction along the longest dimension. Don't—gluing together pieces in that way would inhibit the top from moving across its width, and eventually the top *will* break its glue bond or crack.

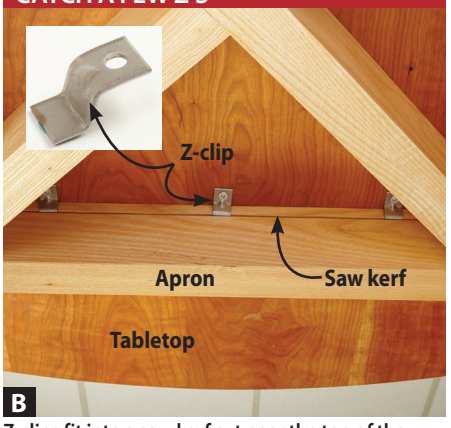
WATCH YOUR GRAIN DIRECTION

A

With the grain direction of the top and side running the same direction, the two panels expand and contract together.

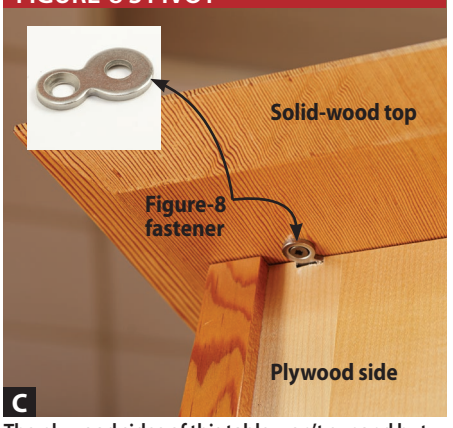
However, you can't avoid cross-grain construction in every instance. Or you may need to join solid wood to sheet goods. The following strategies will help you address these situations.

CATCH A FEW Z'S



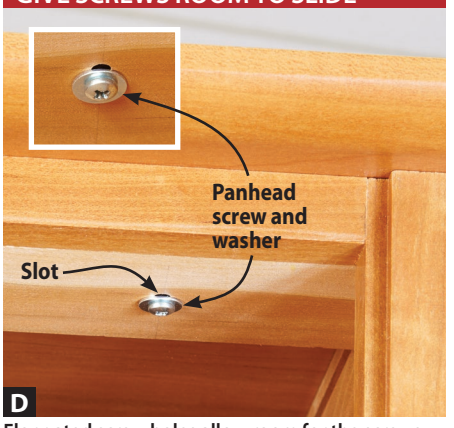
Z-clips fit into a saw kerf cut near the top of the aprons and get screwed to the tabletop. As the top expands or contracts, the clips slide along the kerf.

FIGURE-8'S PIVOT



The plywood sides of this table won't expand but the solid-wood top will. Figure-8 fasteners join the two and pivot slightly as the top moves.

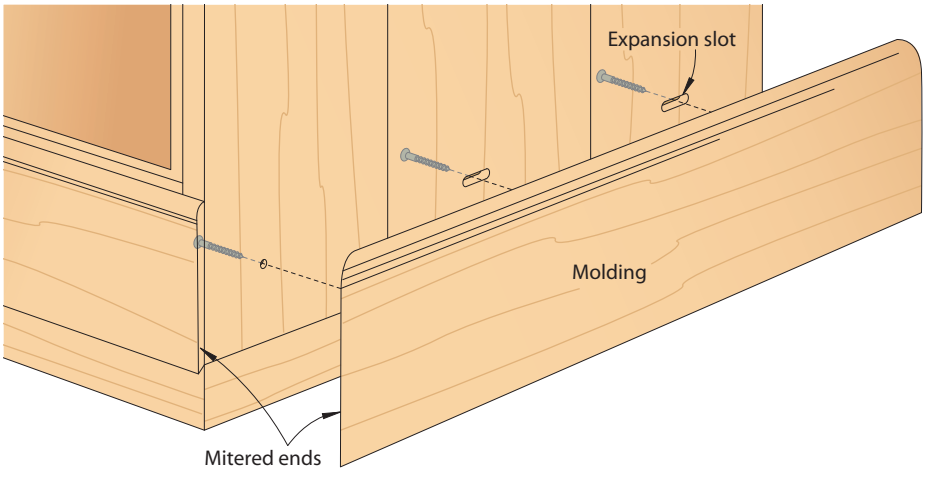
GIVE SCREWS ROOM TO SLIDE



Elongated screw holes allow room for the screws securing the top of this table to slide within the rails as the top expands and contracts.

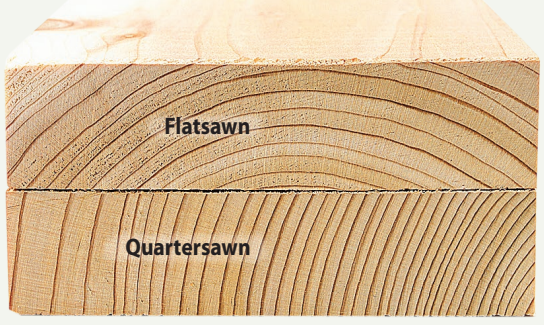
2. Choose fasteners that can move. The wider a tabletop, the more dramatic its change in width with different seasons. Use Z-clips, figure-8 fasteners, or slotted screw holes [**Photos B, C,** and **D**] to hold the top securely while allowing for expansion.

3. Get a hold of moldings. Anchor molding along a solid-wood side panel at the front. This prevents movement of the panel from pulling apart the mitered joint. As shown in the **drawing** at *right*, drill a pilot hole for the front screw, and a slot or slots for additional screws toward the middle and rear.



Know how much your wood will move

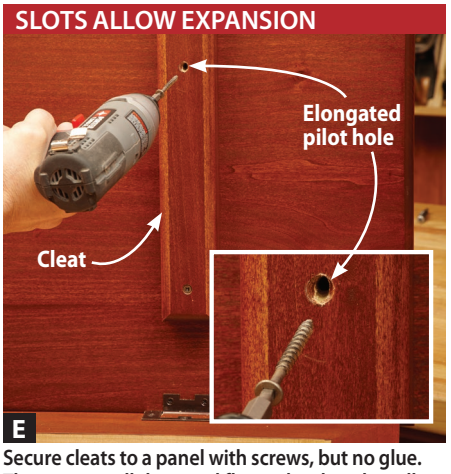
In some climates, lumber moisture content may change from 12–14 percent in the humid summer months to 6–8 percent in drier winter months. Using the values and formula found in the chart at *right,* you can calculate how much expansion and contraction to expect from your lumber. Use that information to determine, for example, how much room to allow around inset doors or drawer fronts, or how long to make a molding so it covers the full width of a cabinet side, no matter the time of year.



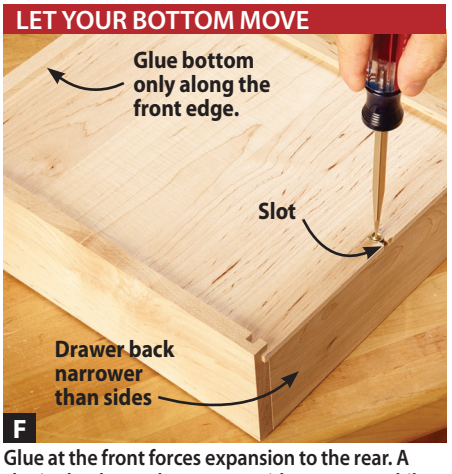
The way in which a board was cut from the log affects how much it will move with changes in humidity. Quartersawn boards move less across their width than do flatsawn boards. Viewed from the end, the growth rings on a flatsawn board curve from edge to edge or edge to face. On a quartersawn board they run vertically, from face to face.

Species	Width in inches at 14-percent moisture content	Width in inches at 6-percent moisture content		Change per inch of width*	
		Flatsawn (See photo at *left.*)	Quartersawn (See photo at *left.*)	Flatsawn	Quartersawn
Ash	12	11.74	11.84	.0027	.0017
Black cherry	12	11.76	11.88	.0025	.0013
Black walnut	12	11.74	11.82	.0027	.0019
Mahogany	12	11.77	11.83	.0024	.0017
Pine	12	11.79	11.87	.0022	.0013
Red oak	12	11.65	11.85	.0037	.0016
Sugar maple	12	11.66	11.84	.0035	.0017
Western red cedar	12	11.77	11.89	.0023	.0011
White oak	12	11.65	11.83	.0037	.0016
Yellow birch	12	11.67	11.75	.0034	.0026

*Multiply width of board in inches by "change per inch of width" to determine how much it will expand or contract per 1 percent change in moisture content.
For example, for a 12"-wide flatsawn ash board:
12" x .0027=.0324"
.0324" x 8 percent change in moisture content = .2592"
12" - .2592" = 11.7408" (round to 11.74")
So, an ash board that started 12" wide at 14-percent moisture content will shrink to about 11¾" wide at 6-percent moisture content.

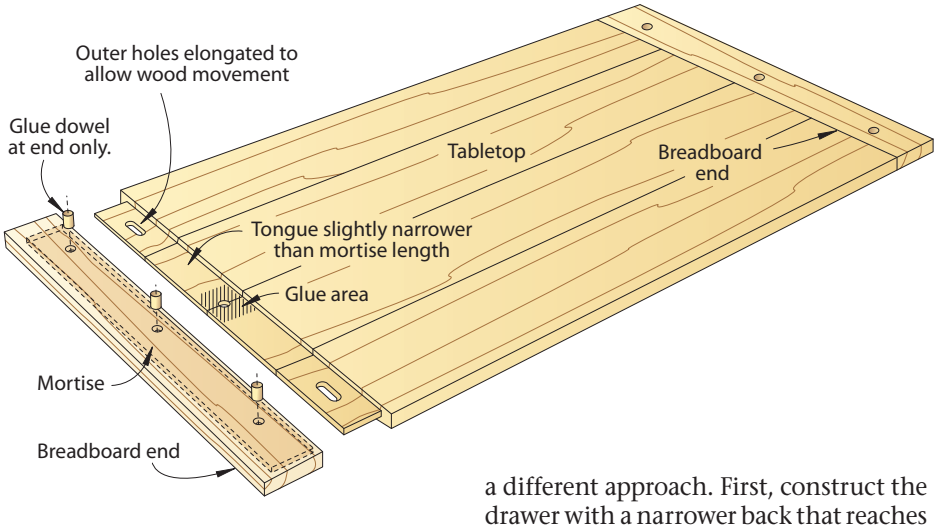


Secure cleats to a panel with screws, but no glue. The screws pull the panel flat to the cleat, but allow the panel to move along the cleat as needed.



Glue at the front forces expansion to the rear. A slot in the drawer bottom provides support while allowing the bottom to move across its width.

As each slat expands or contracts, the rabbets slide over each other, preventing see-through gaps from opening up between slats.



When sizing a solid-wood panel to fit within a frame, allow about ⅛" between the edge of the panel and the groove bottom.

4. Anchor breadboards properly. Running along the ends of a tabletop or panel, breadboard ends hide end grain and help keep the glue-up flat. As shown in the **drawing** *above*, dowel pins hold the breadboards to the tabletop. A small glue area and a pin in the center of the assembly force expansion to each side. Outside pins are glued to only the breadboard. Slots in the tabletop allow it to move freely along the pins. (See **More Resources** to learn how to make breadboard ends.)

5. Let screws slide within cleats. Like breadboard ends, cleats help keep the lid of a chest flat. Secure a cleat with a screw driven through a pilot hole near one end of the cleat. Elongate the other pilot holes by rocking the bit back and forth as you drill [**Photo E**]. This allows the screws to move with the lid.

6. Allow drawer bottoms to slide. Because of its cross-ply construction, plywood moves little, so you can trap it between all four sides of a drawer box. But solid-wood drawer bottoms require a different approach. First, construct the drawer with a narrower back that reaches only to the top of the groove in the drawer sides. This allows the bottom to extend below the drawer back [**Photo F**]. Second, the grain direction of the bottom panel must run from side to side so the bottom can expand and contract freely under the drawer back. To better secure the bottom, cut one or more slots in its rear edge. Apply glue to only the front edge of the bottom and drive a roundhead screw and washer through the slot(s). Snug the screw only enough to prevent the bottom from rattling.

7. Divide and conquer back panels. A wide solid-wood back panel trapped between a cabinet's sides would either split itself or force the sides of the cabinet apart. To prevent that, divide the back into several narrower boards that move independently of each other. On the 56"-wide country sideboard from issue 222 (November 2013), we used twelve 5½"-wide slats with rabbeted edges to span the rear of the cabinet [**Photo G**]. A screw near one edge anchors each slat, trapping the rabbet of the adjacent slat beneath it. A slight gap between slats allows each one to expand freely toward the opposite edge.

8. Use frame-and-panel construction. Confining a solid-wood panel within a frame isolates the panel's expansion and contraction from the rest of the cabinet. However, you must leave room within the frame to allow the panel to move [**Photo H**]. A dab of glue on the center of the top and bottom edges of the panel allows it to expand equally to each side, keeping the raised field centered within the frame.

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Illustrations: **Lorna Johnson**

More Resources

▶ Learn how to make breadboard ends in issue 186 (October 2008). If you don't have that issue, you can watch a free slideshow of the process at **woodmagazine.com/breadboard**.

▶ Purchase *WOOD*'s Complete Guide to Choosing and Using Wood at **woodmagazine.com/allaboutwood**.