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PICK GOOD STOCK
AND LAY OUT PARTS

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MILL THE PARTS
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MILL THE PARTS
TO FINAL DIMENSIONS

How to Get Square, Stable Stock

For best results, rough-mill the wood, allow it to stabilize, then finish-mill

BY GARY ROGOWSKI

Take a piece of rough wood, fresh off the woodpile or lumber rack. Now transform that coarse stick into a square, flat piece of stock with parallel sides and ends, suitable for your latest project. It seems to take a sort of magic sometimes to make flat and smooth what starts out twisted and rough. The importance of this feat, however, cannot be overstated. If you lay a foundation of accuracy with your milling, then your joinery and assembly have a much better chance of going together smoothly and sweetly.

I am focusing here on milling rough lumber, as opposed to material already surfaced on two or four sides. When starting with rough lumber, you're not bound by the thicknesses that are commonly available in surfaced stock. Also, rough stock is less expensive. And there is no guarantee that surfaced material is truly flat or straight anyway. That leap of faith has gotten many a woodworker into trouble. So proper milling practices are important in any case.

Start with proper selection and storage

Wood is alive. It moves despite our best efforts to keep it flat and square. How can we mill it straight and flat and then keep it so? Start by learning to read lumber to get a better yield with fewer defects. Learn to recognize end and surface checking, cupping across the width, bowing along the length and twisted sticks. The first step toward having square, flat, stable stock is to leave bad boards at the lumberyard.

Wood movement is dependent on the difference in moisture content from the outside to the inside of the board, so where your lumber is stored along the way also becomes important. Consider the relative humidity of the lumber dealer's facility and your work area. For example, if the stock is kiln-dried but went from outside storage to your shop, you may need to let it acclimate for a few weeks before milling it.

Rough-mill to accommodate movement

As lumber dries in a kiln or elsewhere, different areas can dry at different rates, and internal stresses can develop that cause the board to move. By the time you get it, the board probably has stabilized, with its internal stresses in balance for the moment. However, when you cut the board into pieces or remove material from the outside, the balance of forces can be dis-

Photos: Asa Christiana

LAY OUT THE PARTS

The first step in milling is to decide which parts are coming from which boards. Work from a cut list and measure from an end that is freshly cut and free of defects.

turbed, causing the board to crook, twist, bow, or cup.

In the rough-milling stage, cut the boards a bit oversize and then wait for the stresses to work themselves out again. This may seem like piling more work onto an already big job, but it actually saves time and material. Rough milling won't stop wood from moving, but it leaves enough material to accommodate the movement. If the stock does warp or twist later, you will make it flat and square again when bringing it down to its final dimensions. You'll lose fewer boards this way and end up with flatter, more stable stock.

Using your power tools effectively also affects your millwork. Each of the tools in your shop is designed for a different part of the milling process.

Length, then width, then thickness— Start by crosscutting the stock by ½ in. to 1 in. over in length. Look for end checks and honeycomb checks inside the board after you make your first cut. End checks occur as a board dries out faster near its ends than it does in the middle. The wood cracks, or checks, to relieve this stress. It's very common and no cause for alarm. Plan on losing from 1 in. to 1 ft. of material at each end of a board. Look for checks in the end grain as you cut, but don't trust your eye. Take the offcut and tap it on the saw table or a bench. If the offcut cracks easily,

1 CROSSCUT OVERSIZE

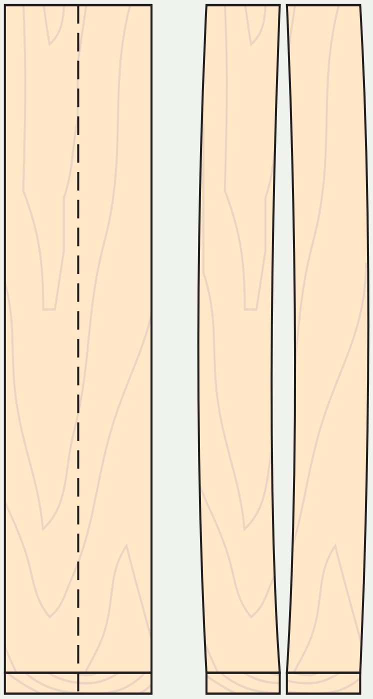
Check for checking. *Take slices off each end of the board until the offcuts are sound. Test for cracks by striking the offcuts against the table. Then crosscut the parts ½ in. to 1 in. over in length.*

2 JOINT ONE EDGE, THEN RIP

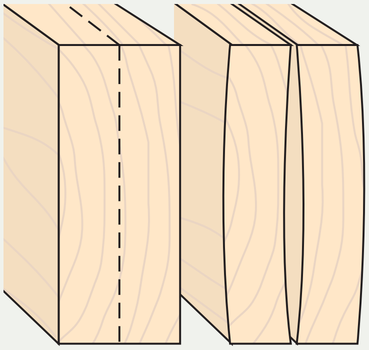
Joint one edge. *It's not important that the edge be square to a face; it just has to be straight and flat. Check grain orientation to get a smooth cut.*

Why rough-mill?

After a kiln-dried board is put into storage, different areas dry and move at different rates, causing internal stresses to develop. When you cut the board into pieces or remove material from the outside, the balance of forces can be disturbed, causing the board to bend or twist. Milling stock a bit oversize in all dimensions leaves enough material to allow you to bring the board back to flat and straight before it is cut to final dimensions. When ripped, lumber tends to go crooked; when resawn, lumber tends to cup or bow.



CROOK WHILE RIPPING
When a board is divided into halves or even thirds, the new pieces tend to bend. Leave at least ⅛ in. extra width to allow for later straightening.



CUP WHILE RESAWING
Resawing also disturbs the balance of internal stresses, causing the new pieces to cup across their width or bow along their length. Leave at least ⅛ in. extra in thickness so that you can flatten it later.

there is still some weakness there. Keep cutting until it doesn't snap easily.

Honeycomb checks are caused by a board drying too quickly on its outer surfaces. This "case-hardening" is often not visible on the surface but can riddle the interior of a board with checks, ruining it for anything but the fire pit. Other times the wood will relieve this stress with one large crack that runs the entire length of the 10-ft. board. Cut away the honeycombing when you find it.

Once the rough crosscutting is done, get your material roughed out to width. If a board is badly cupped across its width or length, running it over a jointer until it's flat can eat up a lot of wood. By ripping pieces to rough width, you work on narrower pieces and can get greater yield. You also can rough out around defects in a board, like knots, sapwood, or checks.

First, joint one edge on the jointer or with a handplane. Just get it flat; don't worry about its being square to any face just yet. When one edge is flat, rip the board ⅛ in. oversize in width on the bandsaw.

Bandsaw vs. tablesaw for ripping rough stock—A bandsaw is much safer than using a tablesaw for this ripcut, for a number of reasons: All of the cutting pressure is down into the table instead of at

Drawings: Michael Pekovich

Rip to ⅛ in. over in width. *The bandsaw is a safer tool for ripping rough lumber than the tablesaw, which is prone to kickback. The bandsaw also wastes less material.*

3 FLATTEN ONE FACE AND RESAW

Mill to rough thickness, if necessary. *If the stock must come down more than ¼ in. in thickness, flatten one face on the jointer (left), then resaw or plane to ⅛ in. over in thickness (right).*

you; there is a smaller kerf and therefore less waste; and if the board closes up on the cut, there is no danger of kickback. (I do not want to recommend that you rough-rip stock on the tablesaw, unless you get a note from your mother.)

Support both ends of the board on a runoff table or adjustable stand. Use a fence on the bandsaw and adjust for blade drift if your saw requires this to make a straight cut. Or just snap a chalkline on the board and make this cut freehand.

If your stock needs to come down more than ¼ in. in thickness, now's the time to do it. Joint one face flat on the jointer and then square an edge to that face before resawing the stock ⅛ in. oversize on the bandsaw. If your stock is close enough in thickness, rough milling is complete.

Now stack the pieces and wait—Next, you must sticker the boards so that air can move around them freely. Don't lay the boards flat on your bench or shop floor and expect them to dry any further. And avoid concrete floors, where boards may in fact absorb moisture and move some. Make ¾-in.-square by 12-in.-long stickers out of straight hardwood. The pile of stickers I made for my shop some 20 years ago still do their intended job very well.

Let the wood sit for a week or so, de-

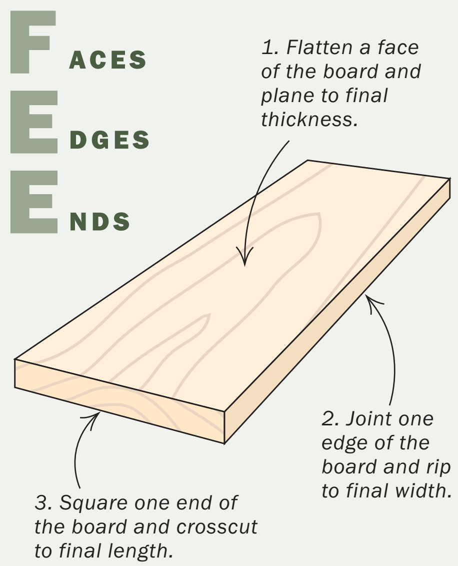
4 STACK THE PARTS ON STICKERS

Stack it and wait. *Layer parts between stickers to let air circulate. Allow a week or more for the parts to move slightly and stabilize.*

MILL TO FINAL DIMENSIONS

THE "FEE" SYSTEM

Follow this sequence for final milling.



1 JOINT AND PLANE THE FACES

Joint the first face. *Start the finish-milling process by jointing one face flat. Use push sticks or pads to hold down the stock, concentrating pressure just past the cutterhead.*

With the jointed side facedown, run the boards through the planer. *Once both faces are flat, alternate faces to take off similar amounts from each side until the finished dimension is reached.*

pending upon how late your project is running, and allow it to finish moving before milling it to final dimensions.

Use the FEE system for final milling

When finish-milling, use the FEE system: Work the Faces, then the Edges, and finally the Ends. This order is exactly the opposite of that for rough-milling.

All of the final milling starts with the jointer. (For a better explanation of how the jointer and planer do their distinctly different jobs, see *FWW* #160, pp. 64-67.) Simply put, you must use the jointer first to flatten one face. Then run this straight, flat side facedown in the planer to create a parallel, flat face on the top side of the board. If you flip over the board and joint the other side, there is no guarantee the faces will be parallel.

If the board is cupped across its face, run the cupped side down on the jointer table because the board will reference off its two outer edges and not rock. Take off small amounts of wood with each pass until you eventually flatten the entire face. Then mark the unjointed face with an X. Bowing along a board is just like cup, only it's along the length of the lumber. Again, it's easier to run the concave side down to the table and the humped side up.

For any of these cuts, check the grain direction of the board before passing it over the jointer. The grain should be running down and away from the front end of the board. This will give you a smooth cut with little or no tearout. Also, slow down the feed rate for the best possible results.

> Ripping to finish width is the first time during the entire milling process that the tablesaw has been turned on, and here only to take a sliver off one edge.

A stumbling block you may encounter here is stock that is too wide for the jointer. There are many ways around this but none of them as convenient as having a wide jointer. You can level the first surface with a handplane, or use a sled or leveling strips to turn your planer into a jointer (see *FWW* #145, pp. 90-91). You may have to rip your boards to the width of the jointer, then reglue them after milling (see *FWW* #163, pp. 96-98, for other solutions to this common problem).

Next, run the boards through the planer, jointed side down. If you get considerable tearout on a face, dampen a rag and lightly wet down the surface of the wood before planing. This will soften the fibers and tone down the tearout. Also, wax your planer tables to help the machine feed the stock. A runoff table also is handy: It will catch boards for you and minimize snipe, which is the tendency of a planer to overcut at the end of a pass.

After the faces are flat and parallel, work on the edges. Check that the jointer fence is square to the outfeed table just beyond the cutterhead. This is the same point where your hand pressure should concentrate once the cut is established. Check for bowing along each board's edge and run the concave edge down on the jointer table. Arrange the grain direction for the best cut, and mark the squared edge and face after cutting.

The last edge needs to be cut parallel to the newly jointed edge. Again, you cannot just flip over this board and joint the second edge; it will not end up parallel to the first. Use the tablesaw to trim this second edge cleanly. Notice that this is the first time during the entire milling process that

2 FLATTEN AN EDGE AND RIP TO FINAL WIDTH

Edges are next. *First, check the jointer fence for squareness (above). Check just past the cutterhead. Joint one edge square, flat, and straight (right), using push sticks or pads when your fingers would pass near the cutterhead.*

Mill the final edge on the tablesaw. *Note that this is the first time the tablesaw has been used during the milling process, and only to remove a small amount of wood.*

3 CROSSCUT TO FINAL LENGTH

Ends are last. *Use a tablesaw sled to cut the ends accurately. Square up one end first (above), then clamp a stop on the sled to cut the other end (right).*

the tablesaw has been turned on, and here only to take a sliver off one edge.

With the faces and edges done, you can finish the ends. Crosscut one end square on all of the boards using your crosscut sled or miter gauge on the tablesaw. Then clamp on a stop to index the final cuts.

The reward for all of this hard work will be square and flat stock that should stay that way as you cut joinery and assemble your project. □

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