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American Association of Woodturners

# Critical Dimensions

By Alan Lacer

## Conquering the challenges of the lidded box



**B**oxes hold a complexity and a bit of mystery that are uncommon to most woodturnings. A successful box incorporates a complexity of design considerations—including dimensions, type of fit, and planning—to overcome wood's inherent movement.

The mystery comes from the enclosed area sealed away by a lid—which generates a desire to open the box to see what's inside.

### Tools and turning stock

Before you begin, you must decide on a number of issues related to the wood. My suggestion: Learn with end-grain boxes about 2½"-to 3"-diameter and under 4" in finished height. Here's why.

When you turn a face-grain box, you must account for normal wood movement and allow for a loose-fitting lid. However, end-

grain stock allows you to design a tighter-fitting lid—or even a suction or threaded lid.

For an enduring and pleasing fit, I recommend keeping the diameter to less than 4". Also, the hollowing challenges increase when you hollow deeper boxes.

But perhaps the greatest challenge in fitting pieces together is dealing with wood movement, which is critically important when you expect tight fits over time. Several factors challenge the boxmaker: wood movement when

transitioning from green to drier, seasonal and humidity cycles, and changes from removing large amounts of material (hollowing the base and lid).

There are several strategies to reduce variables. First, select turning stock with low moisture content. Next, pick a species that is relatively stable such as cherry, mahogany, catalpa, mesquite, or walnut. Many burls—once properly seasoned—are stable for boxes as the movement is often more uniform than regular timber.

You can also minimize wood movement—even if properly seasoned—by roughing out the lid and base and setting both aside to “relax” for a couple of days.

For tools, you will need a roughing gouge, skew chisel, parting tool, 1/2" roundnose scraper, diamond-profiled scraper, and 3/8" detailed gouge. A ring or hook tool is optional. You'll also need a vernier caliper with a depth gauge and a 6" metal ruler.

### Prepare for chucking

Because you will turn much of your box while it's supported at one end only, accurate mounting is important. For the end-grain box, mount it in either a wooden jam chuck or a scroll chuck. To prepare the piece for either chuck, mount your turning stock between centers and cut a properly sized tenon at both ends.

For either chucking method, make the shoulder above the tenon slightly concave for good support. Allow at least 1 1/2" of waste material for the chucking process, the box tenon, and the wood lost by separation. Thus, a 4"-tall finished box requires a minimum of 5 1/2" of turning stock.



Allow the roughed-out pieces to rest a few days, which will reduce the amount of wood movement due to hollowing.

### Separate the lid from the base

First, determine how much height to assign to the lid. In the example of a 4"-tall finished box, allow about 1 3/4" at this step for the lid. Part off the lid.

If your goal is to have good grain alignment, you need to minimize the wood lost in cutting the lid from the base. Avoid a regular parting tool, which will easily remove at least double its width (steel width, clearance, torn grain).

A thin-kerf parting tool is a better option, but go slowly and take breaks to allow the wood and the tool to cool. I normally use a hacksaw (heavy frame, 18 to 24 tpi, lower speeds on the lathe, tool rest removed) to reduce the wood loss and minimize overheating. (To make your own parting tool, see the Fall 2004 issue of the journal.)

### Work inside the lid

It may seem strange, but the inside of the lid holds the key to the entire box: whether the lid will include a tenon or mortise, a pleasing height and diameter, and even the quality of the fit.

Before you begin turning the lid, you must address several

design considerations:

- How deep will you hollow?
- What diameter will the lid be?
- What length of mortise or tenon will be required?

For most boxes, design the tenon in the base unless the lid is a low or flat feature (and therefore requires the tenon in the lid). Designing the tenon in the base often looks more interesting, and it adds to the volume of the box. A 3/8" to 1/2" tenon is about right.

For a box this size, aim for a 1/4"-thick wall. A thinner wall reacts more to humidity changes, and a thicker wall feels heavy when handled.

The process of hollowing end grain presents some challenges. If you apply the same techniques used when turning a face-grain bowl—working from larger to smaller diameter for hollowing—you will soon be cutting against the grain. And if you turn with a regular gouge to work from the center out and up the sides, you will find it results in a scraping action and usually not very clean.

Here are better options: Use a roundnose scraper to work from

*Continued*



Use a hacksaw (teeth pointing away) in a heavy frame to minimize wood loss in separating the lid from the base. This will improve grain flow between the two parts.

the center across the bottom and a little up the sides—regular scraping at first, then finish with shear-scraping.

I've had best results with a ring or hook tool that cuts (not scrapes) *and* works with the grain direction. In practice, this tool is nothing

more than a right-angled gouge that allows these two aspects to occur. (See the AAW website for details about making your own hook tool.)

After turning the bottom of the lid, sand through 150, 220, and 320 grits for most hardwoods.

Cutting the side of the mortise is critical to your success. Because you must secure the lid to the base for turning, you must turn this area cleanly and straightly. A flat scraper ground in the fashion shown at *left* is ideal.

Because the side must be left unsanded—sanding changes the circularity of the lid—shear-scrape this step. To check for straightness, use your 6" ruler aligned with the ways of the lathe. When held along the sides of the mortise, the ruler should appear parallel to the wood or the wood cants back slightly to the outside of the lid. Either case will produce a secure fit over the tenon.

Note: This method only works if the centers of your lathe are aligned.

### Mount the lid on the base

Fit the base material into your chuck. Slowly reduce the tenon diameter to accept the lid. Remember that every fitting cut removes double what you think—so go slowly. (Apply your high-school geometry: A 1/16"-deep cut removes 1/8" from the diameter.)

Be certain at this point that you have made critical measurements. Use your calipers with depth gauge to determine the depth of hollowing on the lid. Also, note the lid's wall thickness at this time.

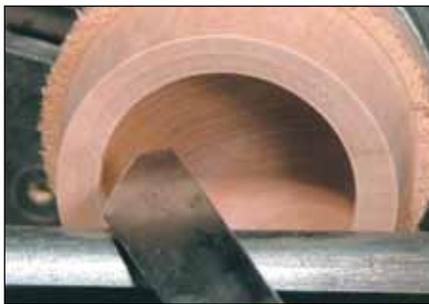
I normally get close to the diameter, make a small taper at the end of the tenon, and then creep up to the fit. Aim for a fit that is tight enough to hold the lid on the base while turning the outside of the box but loose enough to remove when the outside is complete.



If you don't have a hook or ring tool, use a 1/2" roundnose scraper in a shear-scraping action to finish the end-grain. Tilt it to the left to about 45 degrees.



Inside the lid, the hook tool performs two actions: working with the grain and cutting the wood.



Cut the mortise shoulder with an offset diamond scraper and a shear-scraping action. Be sure not to sand this area.



With a 6" ruler, line up the mortise shoulder with the ways. Your goal: a parallel cut or slight outside cant.



Complete the outer side of the box with a roughing gouge. Add fine detailing at the joint or the top of the lid with a skew chisel or detail gouge.

## Shape the outside

With the lid securely on the base, design questions take over. I normally complete the lid first. This determines the length and shape of the base. Wall thicknesses and desired lid shapes will guide your choices.

After you're satisfied with the lid, determine the base height. I've found that about one-third lid and two-thirds base or 40 percent lid and 60 percent base make appealing proportions.

Work the outside of the box with three basic tools. A roughing gouge or skew chisel performs well for the sides. I prefer a detailing gouge for the top of the lid. When you're satisfied with the shape and quality of the surface, sand through 150, 220, and 320 grits for most hardwoods.

## Hollow the base

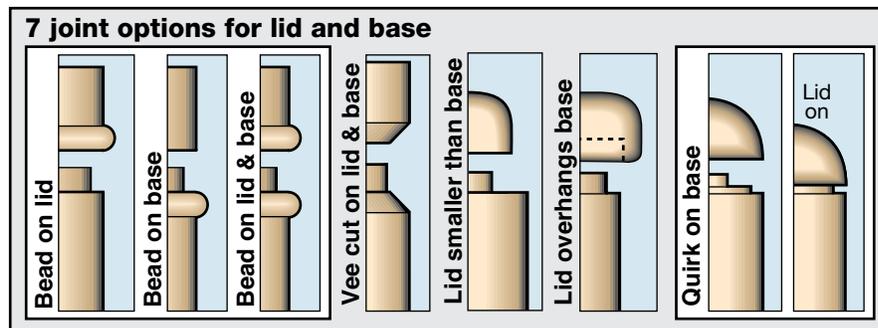
Now that you've determined the diameter and shape of the base, it's time to hollow. First, drill just short of the final depth with a 1/2" to 3/4" bit in a Jacobs-style chuck fit in your tailstock. This step also opens up the center to work the tool in an easier fashion.

Hollow with a scraper and either finish by shear scraping or with a ring or hook tool. Then, sand the inside as described earlier.

## Almost complete

Two operations remain before you reverse-chuck to finish off the bottom of the box: Detail the joint where the lid meets the base and determine the final fit.

Detailing the joint is critical, as the two pieces will not look as nice in the days and weeks ahead as



they do right now—the perfect circularity you now have may disappear because of wood movement. If you decorate the joint, this problem goes away—and you improve the appearance.

There are many options to accent the joint. Shown *above* are some of the options to accent the joint. (A quirk is a small square detail.)

If you haven't already incorporated joint details, it's not too late to do so now. For example, the V-cut with a skew and the small quirk on the base are design steps left to this stage.

The final fit is one of personal preference. If you intend for the box to be picked up to remove the lid, a soft suction or a fairly tight fit may be in order. To remove the lid without picking up the entire box, aim for a slightly loose fit.

For this final fitting, use a skew chisel for a light scrape with a peeling action. Cut the surface of the tenon cleanly to eliminate sanding. Again, sanding affects circularity.

## Complete the bottom

Part off the box, allowing some extra wood for cleaning up the bottom. If there is sufficient waste material in the chuck, use this to make a tenon for jam-chucking the base. If too little material remains, turn a jam chuck from the same or a softer wood species.

Fit slowly until the inside of the box slips over the tenon of the waste material. I like to use the hook or ring tool to cut a concave base, leaving a narrow rim near the outside of the box. Sand and detail the bottom until it equals the rest of your box in quality.

## Finish notes

I avoid quick finishes on boxes, as most are shellac-based and won't hold up to excessive handling.

For a film finish, try melamine (pre-catalyzed lacquer), a high-quality spray lacquer, or a varnish-based finish (gel or wiping forms work well). For dark woods and a flatter appearance, apply pure tung oil or a wipe-on finish like Deftoil or Watco.

For an oil finish with more luster, try the Maloof mix of equal thirds of pure tung oil, boiled linseed oil, and solvent-based varnish. After applying, immediately wipe off the excess. Allow to dry for several days, lightly abrade with fine synthetic steel wool, and apply a second coat. After repeating these steps for three or four coats, your finish will develop a shine.

If you've chosen a dense exotic wood (cocobolo, blackwood, or ebony), a coat of buffed wax is adequate.

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