

the BASE-ics

Editor's Note. The following article is a collaboration by officers of Segmented Woodturners, a chapter of the AAW. It is an attempt at establishing guidelines and recommendations in this important aspect of segmented woodturning.

The tendency for wood to react to humidity changes and, as a result, change dimension has always challenged segmented woodturners. This is especially true in the vessel base area. Segmenters have been discussing and experimenting for many years with the best method to construct their vessel bases. While there are many ways to establish a base on a segmented vessel, there has never been a consensus on what constitutes the best practices. The most common base constructions are a solid disc of wood, a pie-shaped segmented disc, a pie-shaped segmented disc with a centered plug, and a "floating" base. So what's the best? First, a few questions:

1. What is the effect of the base on the integrity of the piece?
2. Will a solid base disc create a cross-grain glue joint sufficient to create stress at the base area of a vessel over time?
3. How large does the base diameter have to be to cause a problem?
4. What constitutes the best look for the project—a solid base, a segmented disc, or no foot at all?

5. Is a "floating" base worth the construction trouble?

Creating a vessel base that is long-lasting is a challenge, and the answers to these questions are varied, depending upon your point of view and personal experiences. While there have been studies concerning glue types and wood movement, there are no formal studies investigating the best way to construct a segmented vessel base. On the other hand, there have been thousands of segmented woodturnings, and their history helps us to form opinions. Here are a few things that we know:

- When a solid disc is used for the base of a stacked ring construction, there will be only two areas of contact where the grain of the bottom segmented ring and the base are in alignment. The remaining areas of contact will be comprised of some amount of cross-grain joinery.
- Wood fibers expand and contract mostly perpendicular to the direction of the wood grain.
- The wood in cross-grain glue joints will expand and contract in different directions, causing stress in the glue joint.
- The level of stress created

managing the segmented vessel base



Image 1

depends on several factors:

- The wood species' coefficient of expansion.
- The differences between two different woods' coefficient of expansions.
- The environment in which the work resides and its changing conditions (humidity effects).
- We know that end-grain to side-grain joints are weaker than side-grain to side-grain joints.
- And we know that end-grain to end-grain joints are considered a weak type of joinery.

Just because wood moves does not mean that vessel bases will fail, but it forces us to carefully consider our design options.

Let's discuss the various options most commonly being used.

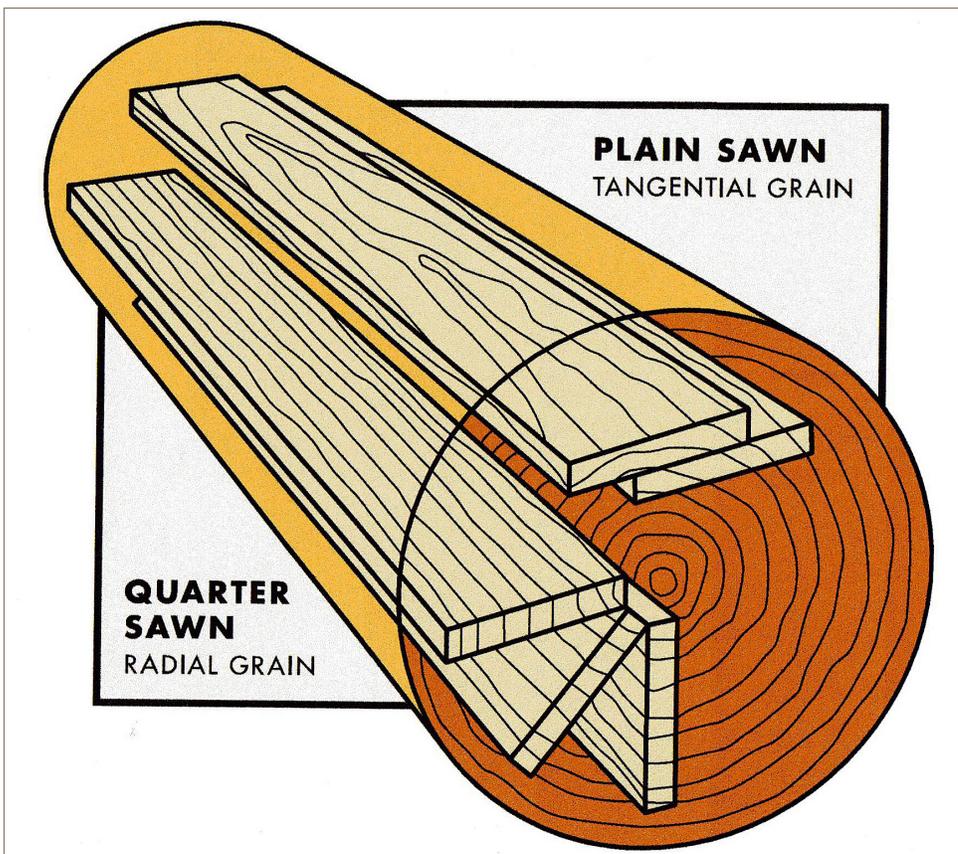
A Solid Disc Style of Base

This probably has been used by all of us at some time and with general success as long as the solid base is relatively small in diameter. A discussion at an AAW event a few years ago tried to establish a maximum diameter that could be used safely without creating too much stress. An arbitrary agreement, among those in attendance, settled on 4" to 6" in diameter, smaller being recognized as better. Even small sizes are affected by the species of the wood being used and its dryness. Using very dry stable wood throughout the turning will definitely improve the stability of the vessel base.

Jim Rodgers says, "I've never experienced a separation in my small transitional vessels (image 1) that are generally less than 6" in diameter. I use stable, dry wood for the base discs, and I make sure that the glue joints are as flat as possible. I use Titebond PVA glue that allows for some tiny amount of movement without letting go."

Another way to reduce movement in solid bases, which we strongly recommend, is to use quarter-sawn stock for the base disc. Quarter-sawn timbers (image 2) have been used in furniture construction for generations, and this grain orientation is well-established to be more stable and less subject to major expansion and contraction issues. Malcolm Tibbetts says, "As much as I prefer the use of a floating base in items such as

Image 2



segmented salad bowls, a floating base is not practical. A solid disc using quarter-sawn boards is the way to go."

Bill Smith used a calculator at woodworkerssource.com/movement.php when providing this statement, "Using quarter-sawn wood for the solid base reduces wood movement by 1/4 to 1/2 depending on wood species. In the Northeast, from summer to winter, a 6" diameter quarter-sawn solid sugar maple base will move about .014". The same base, but with flat-sawn wood, will move about .031" or a little more than twice. Less stable woods will have even greater differences."

Even with quarter-sawn wood, there is still some movement to address. Creating relatively thin vessel walls that can slightly "flex" partially addresses the challenge, and turning the base disc with a slight horizontal "hourglass" profile (thin in the center) also will accommodate some movement. Curt Theobald says, "I always turn a slight depression on both the top and bottom of my base discs."

Because wood moves and because the base disc may move slightly differently from the vessel walls, Bill Smith devised this technique many years ago. He says, "Instead of a flat thin disc, I sometimes use a base disc about 1" thick. Then during the turning, I hollow the inside, creating about a 1/4" (or less) wall. This allows for a little 'flex' at the intersection of base and vessel wall. It's important

that the wall thickness of the base is not much larger than 1/4" or this method will have the same failure rate as using a solid block of wood. I've had good success with the technique." (image 3)

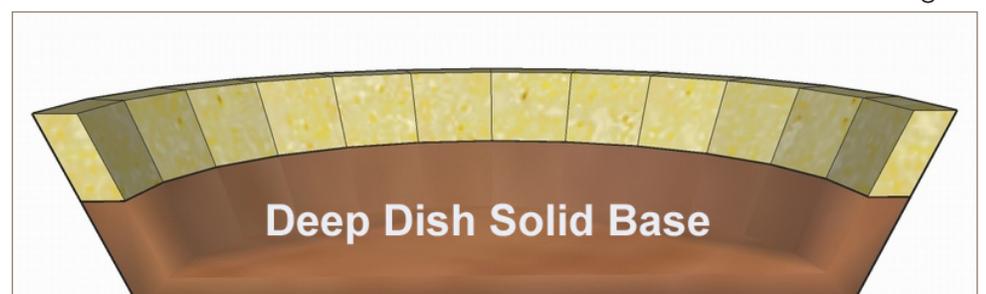
Pie-Shaped Segmented Disc

At the 1st Segmenting Symposium in 2008, the Instant Galley critique was particularly harsh on pie-shaped disc bases. For starters, the segment-to-segment joints are end-grain to end-grain, the weakest type of joint. Perfect alignment of the points also is very difficult. Misaligned points spoil the visual effect. But that's only part of the problem. While the wood movement of the pie-shaped disc generally matches the grain movement direction of the ring above it, the wood is confined and not allowed to move without separating a seam. If the wood expands, it expands perpendicular to the direction of the grain. It is blocked from moving inward so it has to move outward. When it moves outward, the circumference (diameter X 3.14) becomes longer, but the segments do not become longer. Something has to "give."

Image 4



Image 3



It is usually one of the glue joints toward the outside of the ring. Conversely, if the wood shrinks (image 4), it's blocked from moving inward, so the center area has to move outward, and usually a seam near the center opens up.

Pie-Shaped Segmented Disc with a Plug

The use of a plug in the center of a segmented ring is perhaps the most controversial of all our options – opinions vary. Tibbetts says, "In my early days of segmenting, I constructed many bases this way, but as my turnings experienced multiple seasonal humidity changes, I began to realize it simply was not the answer. Too many (not all) bases developed tiny defects as a result of wood movement. Even a few bases less than 3" in diameter began to show stress." Most segmenters have come to accept that a large platter, constructed in this way, likely will experience some serious failures. Because wood moves as a percentage of its total dimension, it's logical to think that the risk of failure will diminish as the overall dimension is reduced, but even wood in tiny dimensions will still move. So what's the verdict? In general, we do not endorse the use of a "plugged" base ring, especially in larger diameters. For those turners who have had good experiences with plugs, our "failure to endorse" may seem extreme. The bottom line is that these types of bases have a poor track

record, while other styles have a better track record. Why take unnecessary risks?

The Floating Base

This is a variation on the floating panels used in door construction. A disc is trapped between rings in a small groove and allowed to move without exerting pressure on the surrounding material (image 5). This eliminates any stress resulting from movement because the disc diameter is cut slightly smaller than the diameter of the recess into which it is housed. This technique has proven to be an especially successful solution when constructing vessels with larger than average bases. (For a detailed explanation, see the "Floating Base" article in this newsletter.)

Stave Construction

In stave construction, vertical grain staves intersect with a horizontal vessel base, presenting a problem. Simply gluing a horizontal disc of wood onto the staves is asking for trouble. A large, vertical grain plug sometimes works (in small sizes), but still there is risk. This is perhaps why many segmenters avoid stave-constructed vessels. Tibbetts says, "The floating

disc is the solution. I've never had a stress defect appear in my stave-constructed vessel bases when using the floating disc technique. It is also a great solution for bases on items such as stave-constructed travel mugs. The floating base is my answer for most all large bases – both stave-constructed and stacked ring constructions."

Using Veneers

The introduction of veneer layers between a solid base disc and a segmented ring can be beneficial. Using several layers of veneer between a solid disc and the first segmented ring actually can create a bit of a shock absorber between the two elements. The multiple layers, using PVA glue can absorb a tiny bit of movement, thus reducing the stress between the base disc and the first main body ring. As a wood, veneers tend to be quite weak, but using plenty of glue to fully penetrate the veneer fibers will help strengthen the

Image 5



joinery. The addition of a few thin contrasting layers can add visual interest. Perhaps more importantly, they can improve long-term vessel stability in the area between the vessel wall and the base.

Recommendations

The officers of the AAW chapter Segmented Woodturners—Malcolm Tibbetts, Curt Theobald, Bill Smith, and Jim Rodgers—would like to suggest the following general guidelines:

- Keep solid bases to a small diameter.
- Keep solid bases short or thin – about 3/8" or less (less mass to move).
- When using a solid disc of wood at the base, try to use quarter-sawn boards.
- Avoid using a "plugged" segmented ring as a base.
- When possible, use a "floating base" on larger projects.
- Try to use only dry, kiln dried, stable woods with low coefficient of expansion. Woods such as mesquite, Gabon ebony, and wenge work well.
- Try to create a thin wall thickness at the junction between the vessel base disc and the stacked rings on the vessel sides.

Remember that wood moves as a percentage of its dimension. Less wood equals less movement.

- Consider creating

a "shock absorber" between the base and vessel side by installing multiple thin veneer layers.

- Always thoroughly seal the vessel with appropriate finish. Wood in a well-sealed vessel will still move, but that movement can be slowed significantly with a good barrier of finish.

As segmenters, we love wood, but we are forever challenged by its movement properties. Properly addressing those movement tendencies will keep glue joints tight for a very long time. No one wants to hear, "What happened here?" (image 6) •

photos of the week



Luna I
Bill Hrnjak, Nipomo CA



Vase with Diamonds
Richard Thomas, Huntingtown MD

Image 6

