THINGS YOU'LL NEED

- Lathe with a 10" swing
- Two 3" faceplates with hardwood glue blocks attached
  - Glue block should be cross grain hardwood
- Table saw or chop saw equipped with a 60-80 tooth finish cut blade
- 10" to 12" disc sander with a fresh 80-grit disc
  - Alternate make a flat sanding disk for use on the lathe
- Flat glue up surface
  - Waxed heavily
- Small, bright light & straight edge
  - For checking flatness
- Small bottle of Titebond PVA wood glue
- Project wood
  - Two contrasting colors of similar density
  - 2 board feet of one species
  - ¾ board feet of second species
- A selection of hose clamps
  - Be sure to check the brand logo and only buy one brand.
- ⅜" to ½" wood dowel cut into 1" lengths

THINGS TO MAKE

- Sanding stick
  - Use 80 grit sandpaper on a flat hardwood stick

- Segment hold down tool
  - Use an Allen wrench installed in a wood handle and sharpened
- Cutting sled for saw
  - Plan provided for a table saw which can be adapted to a chop saw

THINGS THAT ARE NICE TO HAVE

- Oneway live center
  - Its nose cones will assist in ring alignment and accept useful attachments
    - oneway.ca
- Oneway live center faceplate adapter
  - Screws onto the TS live center from Oneway and allows attachment of your faceplate
    - oneway.ca
- Ring alignment cone
  - Screws onto the Oneway live center to align rings up to 8" internal diameter
    - curttheobald.com
- Segment vessel calculation software
  - Assists in completing all math calculations and vessel drawings
    - woodturnerpro.com
    - segmentedturning.com

BUILDING A TABLE SAW 15-DEGREE SEGMENT CUTTING SLED

- Stock required
  - 24 x 24 sheet of ½" quality plywood
  - Hardwood for miter guides
  - KD hardwood 2" x 4" x 48" for cross supports
  - ¾" x 3" x 24" hardwood for miter fence
- Prepare stock
  - Cut stock to size
    - 1 each 18" x 24" x ½" ply cut dead square
    - 2 each ½" x ¾" x 24" strips for miter groove guides
    - 1 each ¾" x 3" x 24" hardwood segment fence
    - 1 each 2" x 4" x 24" rear cross support brace
    - 1 each 2" x 2" x 24" front cross support fence
  - Collect additional supplies
    - 2 each 1½" bolts with head diameter less than ¾" with washers and nuts
    - Wood screws 1"
    - ¾" Forstner bit
    - Glue
    - Toggle clamp with ¾" mounting screws
    - One each stick on measuring tape (right hand)
    - Fine ink pen
    - Square
    - Vernier calipers
- Assemble sled
  - Sand 18" x 24" base on both side
  - Place miter guides in TS miter slots on top of spacers (to raise them above TS surface)
  - Bring TS fence to 12" setting, lock in place
  - Place glue on miter guides and set 18" x 24" on top aligned with fence
  - Add weight and allow glue to dry
- Add cross supports
  - Carefully align front and back cross support braces
  - Glue and clamp front and back cross support braces

- Add saw kerf
  - Clean up any glue and scrape slides until they are operating smoothly on the saw table
  - Wax the back and miter slides
  - Raise saw blade and cut a kerf through the rear cross support and 12" into the sled
- Mount hardwood segment fence
  - Clamp miter segment fence accurately in place using a protractor to set a 15-degree angle to saw kerf, clamp firmly
  - Flip sled over side-to-side (rear fence is still in the rear) and drill one hole in each miter guide through which to attach the hardwood segment fence. The holes should be large enough to fully bury the head of the attaching bolts.
  - Right-hand hole should be about 4" from front edge of sled and left-hand hole is 7½" from front edge. Drill only through the hardwood miter guides
  - Now drill a smaller hole (the diameter of the bolts) completely through clamped fence
- Complete segment fence assembly
  - Turn sled right side up, remove the segment fence
  - Elongate one of the drilled holes to 1" long
  - Bolt segment fence in place readjusting accurately to 15 degrees
  - Add toggle clamp to the segment fence approximately 6" to the right of the saw kerf
 - Cut a short strip of hardwood with the sled to use as a segment stop

Building a Cutting Sled

- Calibrate the sled
  - Set the TS blade to an accurate 90 degrees vertical with a good straight edge to the bed of the cutting sled (not to the table saw)
  - Rip several strips of hardwood to 1" width
  - Clamp the stop in place with the toggle clamp
  - Carefully cut six segments using sled
  - Snugly assemble the six pieces against a straight edge and check; there should be no gap
    - If there is a gap on the outside of the semicircle of segments, the angle is too big, loosen the bolt attaching the fence at the elongated hole and adjust the segment fence towards the rear of the sled (away from the operator) to increase the angle
    - If the gap on the inside of the semicircle, the angle is too small, adjust the fence rearward (towards the operator) to decrease the angle
  - Repeat by cutting another six segments and retesting

- When the six segment test appears perfect, cut a set of 12 segments
  - Assemble a full ring by clamping the segments together with a hose clamp
  - Check for gaps
  - Readjust fence as needed to decrease the gaps to zero
- When calibration is complete, screw the segment fence firmly in place with several wood screws on both sides of the saw kerf
- Completing the project
  - Recut the stop with the newly calibrated sled
  - With vernier calipers, set the position of the stop at exactly 2" from the right-most tooth of the saw blade, clamp firmly with the toggle clamp
  - At a convenient location on the stop, place a fine line with an ink pen and square
  - Align the stick-on measuring tape's 2" mark with the line drawn on the stop
  - Stick the measuring tape in place

Trigonometry for Segmented Turners

Angle functions are useful in calculating the setup of sleds for specific angles. When accurately determined the calculations can set the segment fence precisely. The longer the measured line the more accurate the setup will be. To calculate the proper angle you need to use the appropriate trig function; here they are:
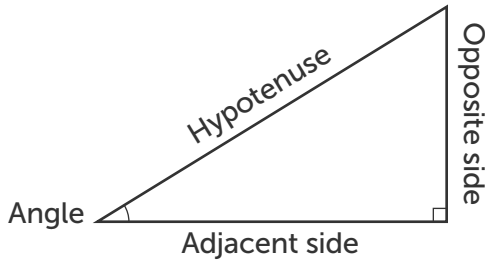
$$\text{Sine} = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\text{Cosine} = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\text{Tangent} = \frac{\text{Opposite}}{\text{Adjacent}}$$

ANGLE	SINE	COSINE	TANGENT
30 degrees (6 sides)	.5000	.8660	.5774
22.5 degrees (8 sides)	.3827	.9239	.4142
18 degrees (10 sides)	.3090	.9511	.3249
15 degrees (12 sides)	.2588	.9659	.2679
11.25 degrees (16 sides)	.1951	.9808	.1989
7.5 degrees (24 sides)	.1305	.9914	.1317

SETTING UP A NEW SEGMENT FENCE

- Draw a horizontal line across the full width of the sled.
- Calculate the distance up the right-hand side of the sled by using the tangent of the desired angle
- Measure up the right-hand side of the sled the exact number of inches from your calculation and mark.
- Draw a line from that mark to the beginning of the horizontal line.
- Align the sled fence to that line for the proper angle.
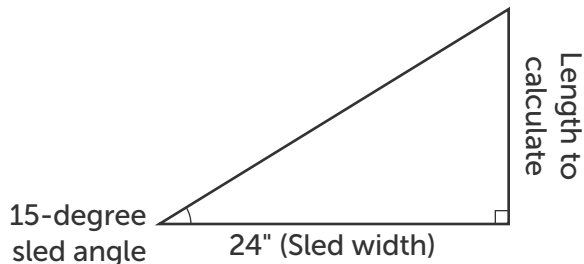
Example

12 segments requires
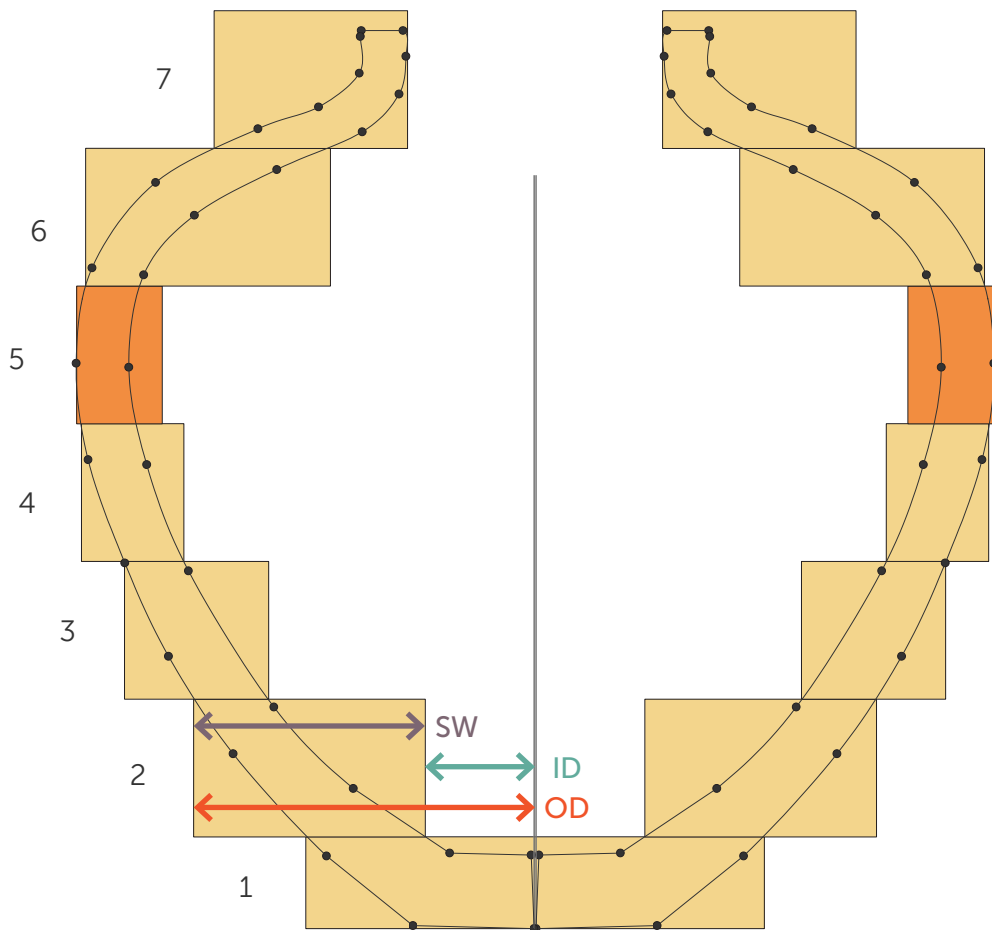a 15-degree segment cutting angle

Sled with is 24"

Tangent 15 degrees x 24" = Right-hand length to calculate

0.2679 x 24" = 6.43"

Outside Diameter (OD) - Internal Diameter (ID) = Segment Width (SW)

Cut List

FOR VESSEL MADE IN CLASS

ROW	WOOD CHOICE	BOARD THICKNESS	BOARD WIDTH	BOARD LENGTH	NUMBER OF SEGMENTS	SEGMENT EDGE LENGTH	OUTSIDE DIAMETER	INSIDE DIAMETER
7	Maple ring	¾" (1.9 cm)	1⁵/₁₆" (3.3 cm)	14¼" (36.2 cm)	12	1¹/₈" (2.9 cm)	4¼" (10.8 cm)	1⁵/₈" (4.1 cm)
6	Maple ring	¾" (1.9 cm)	1½" (3.8 cm)	16½" (41.9 cm)	12	1⁵/₁₆" (3.3 cm)	5" (12.7 cm)	2¼" (5.7 cm)
5	Walnut ring	¾" (1.9 cm)	⁵/₈" (1.6 cm)"	19¼" (48.9 cm)	12	1³/₈" (3.5 cm)	5¹/₈" (13 cm)	4¹/₁₆" (10.3 cm)
4	Maple ring	¾" (1.9 cm)	¹¹/₁₆" (1.7 cm)	19" (48.3 cm)	12	1³/₈" (3.5 cm)	5¹/₈" (13 cm)	3¹³/₁₆" (9.7 cm)
3	Maple ring	¾" (1.9 cm)	1" (2.5 cm)	17" (43.2 cm)	12	1¼" (3.2 cm)	4¾" (12.1 cm)	1⁷/₈" (7.3 cm)
2	Maple ring	¾" (1.9 cm)	1⁷/₁₆" (3.7 cm)	13¼" (33.7 cm)	12	1¹/₁₆" (2.7 cm)	4" (10.2 cm)	1³/₁₆" (3 cm)
1	Maple base	¾" (1.9 cm)	3" (7.6 cm)	3" (7.6 cm)	1			