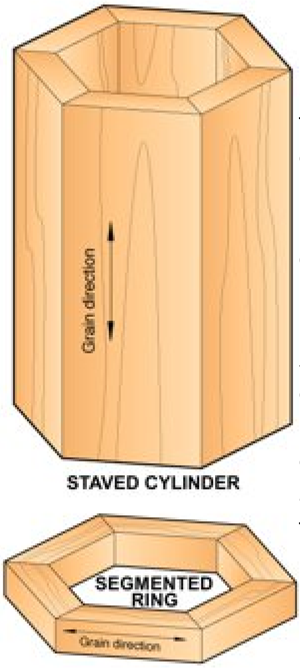
Staves and Segments

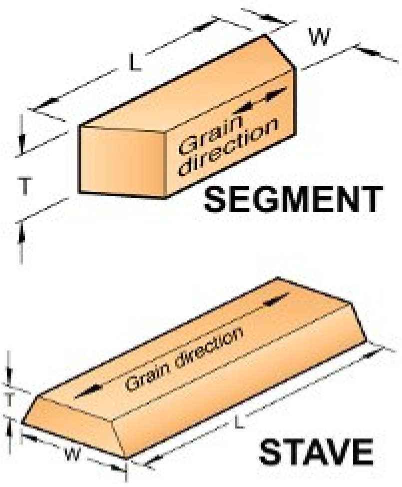


Staved or segmented construction figures in a lot of projects, from ornamental bowl turnings to porch pillars. A question we often hear is: What miter angle (or bevel) do I need? Another recurring question is: How long (or wide) should I make the pieces? Finding those answers is relatively easy. Here's how to do the math.

First, let's get our terminology straight. Staved cylinders and segmented rings may seem alike, but they're two different breeds of cats. As shown in the Staved Cylinder and Segmented Ring illustrations, the individual pieces in a segmented ring are miter-cut (shown in the Segment illustration) and joined at the ends. In a staved cylinder, the component parts are bevel-cut (shown in the Stave illustration) and joined edge-to-edge.

So, things can become confusing when we start talking about the distance between the angles. On a stave that distance is the width, but on a segment, it's the length. For this article, we'll refer always to length. Substitute "width" if you're cutting staves.

Also for simplicity, we'll call the angled cuts miters, even though we know they may be either miters or bevels. Note, too, that this article only covers straight-sided cylinders or flat rings. Tapered cylinders or rings with sloped sides call for compound cuts.



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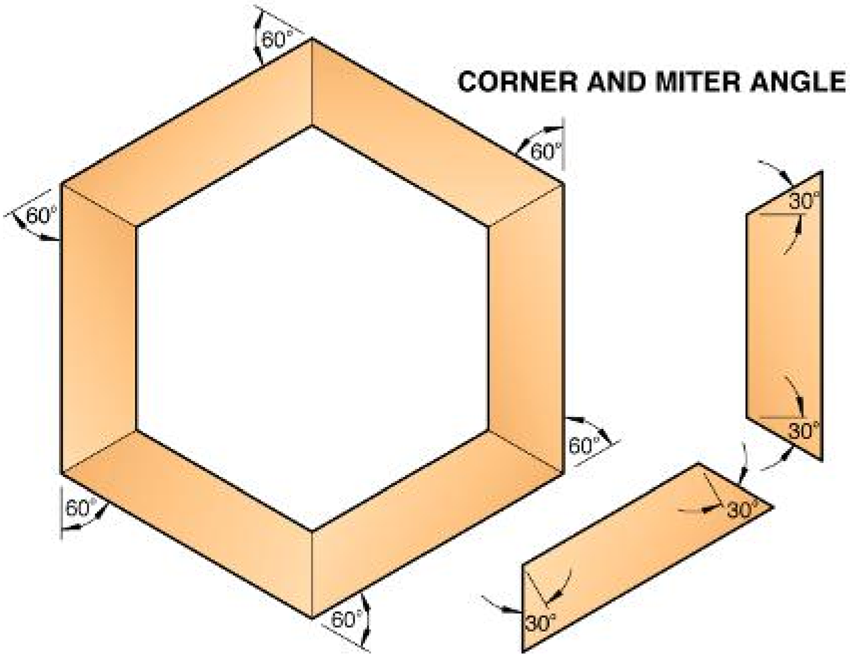
Corner and miter angles for various numbers of sides		
no. of sides	corner	miter
6	60°	30°
8	45°	22-1/2°
10	36°	18°
12	30°	15°
16	22-1/2°	11-1/4°

What's your angle?

A full circle contains 360°. So, to make a closed construction out of straight pieces, the corner angles must add up to 360°. In the simple figure with six equal-length sides shown in the Corner and Miter Angle illustration **below**, the six 60° corners add up to 360°.

But, as shown, 60° is not the angle you need to cut on the ends of each piece. Because two sides come together to make the angle, each side must be miter-cut to exactly half the total corner angle, or 30°.

Here's the rule for finding the angle: To determine the corner angle for a figure with any number of equal-length sides, divide 360° by the number of sides. To find the miter angle, divide the corner angle by two.



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How big will it be?

To figure out the measurement across the assembled construction, shown as D1 in the Assembled Size illustration, multiply the side length (L) times the inside-diameter factor for the appropriate number of sides from the chart **below**. This dimension, which is the diameter of the largest circle that can be drawn inside the outline of the glue-up, also represents the diameter of the largest round piece that could be sawn or turned from the assembled ring.

You can calculate the width across the points, shown as D2, by multiplying the side length times the outside-diameter factor.

FACTOR TO FIND DIAMETER		
no. of sides	Diameter	
		outside (D2)
	1.73205	2
	2.41421	2.61313
10	3.07768	3.23607
	3.73205	3.86370
16	5.02734	5.12583

And if you need to know the diameter of the opening in a ring, shown as D3, just multiply the length of the short edge of the segment (IL) by the appropriate inside-diameter factor.

You can work backwards, too, to find the stave length required to produce a given diameter. In this case, divide the desired diameter by the factor from the chart. To find, for instance, the side length for a hexagon that measures 24" across (D1), divide 24" by the inside-diameter factor (1.73205). Doing this gives us 13.85641", or 13-55/64".