

Design considerations for laser cutting Masonite

All tests were done on a 40 watt machine using Masonite purchased from Lowe's. It's nominally 3/16" but is undersized considerably and varies quite a bit in thickness throughout the same sheet. It has a sticker on it that says "Tempered Service". This essentially means both sides are smooth.

Kerf

The laser cuts on the line you specify. However, it does have a thickness. I've measured this and on average it is 0.006" wide (0.003" on either side of the line).

For engraving

Speed	Power	Frequency	Remarks
100	5	500	Very light/surface is breached but not charred
100	25	500	Clearly legible/good for general use
75	50	500	Very dark

For cutting

The following was done on a piece that measured 0.1400" thick...

Speed	Power	Frequency	Remarks
100-30	100	500	Backside of the board is not breached
20	100	500	Start to see an outline on the backside
12	100	500	May cut all the way through
8	100	500	Guaranteed cut

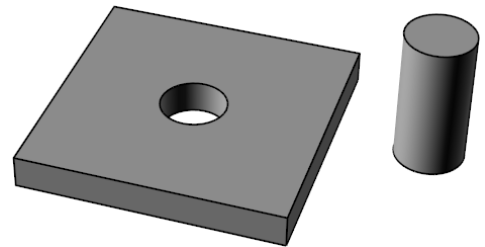
For pin registration

Using 1/4" precision ground steel pins

The pins are exactly 0.25" in diameter.

For a tight fit: make the holes 0.2425"

For a loose fit for rotating: make the holes 0.265"



Using 1/4" cold rolled steel

The stock measures 0.2445” in diameter.

For a tight fit: make the holes 0.2420”

For a loose fit for rotating: make the holes 0.2445”

For ribbing

The thickness of Masonite varies quite a bit. I have sampled the 3/16” Masonite and it varies greatly between 0.1235” and 0.1535”. This poses an issue when ribbing, as ribbing assumes a constant thickness in material.

We need to account for variations in material thickness, and then use an offset value from the measured thickness to determine what our notch thickness will be. The following shows how this is accounted for...

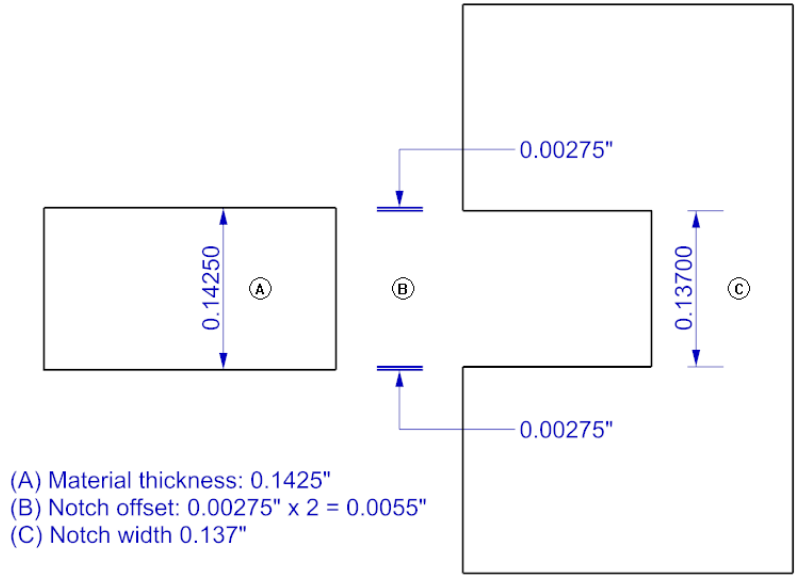
Start by measuring the thickness of the material on all 4 sides with calipers. To take an average, add all thicknesses, and divide the result by the total number of samples.

I.e.

0.1485”		
0.1475”	Masonite board	0.1470”
0.1445”		

Average
0.1485”
+ 0.1475”
+ 0.1470”
+ 0.1445”
<hr/>
0.5875”
0.5875”/4 = 0.1469”

Use this average thickness for our calculations. Our notch thickness is calculated as an offset from the material thickness (what we calculated as an average in the example above). The notch offset is actually undersized from the material thickness, due to the kerf of the laser. In the image below, the notch is 0.00275” smaller than the material on each side (a total offset of 0.0055”). The offset you decide on depends on how tight you want things to fit. Refer to the chart on the next page for a range of values to use...



To figure out our final notch thickness, start with your average material thickness, and then subtract the notch offset you want to use to get your final notch width. I.e.

Average Material Thickness 0.1425"	-	Notch Under Size 0.0055"	=	Notch Width 0.1370"
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All tests done at 100% power, 8% speed, 500 frequency

Average material thickness		Notch offset ...		Notch width	Remarks
0.1469"	-	0.0064"	=	0.1405"	Tight but doable (Ok if sanded)
0.1469"	-	0.0065"	=	0.1404"	Tight but doable (Ok if sanded)
0.1466"	-	0.0063"	=	0.1403"	Tight but doable (Ok if sanded)
0.1466"	-	0.0064"	=	0.1402"	Tight but doable (Ok if sanded)
0.1431"	-	0.0061"	=	0.1370"	Pretty good
0.1431"	-	0.0059"	=	0.1372"	Better
0.1425"	-	0.0057"	=	0.1368"	Better
0.1425"	-	0.0055"	=	0.1370"	Even better
0.1288"	-	0.0053	=	0.1235"	Perfect (not too loose or tight)
0.1288"	-	0.0050	=	0.1238"	Very easy to slide/almost loose
		Smaller values = a looser fit			

In most cases, you will need more than one sheet to complete all the ribs for an object. In these cases, try to use material that is as similar in thickness as possible, and use an average of the thickness for all sheets when determining your average material thickness.

Also, assuming you don't know the average thickness of the material you will be using when designing your ribbed object, you can simply rescale all your ribbed silhouettes in Rhino to their final size just prior to laser cutting.

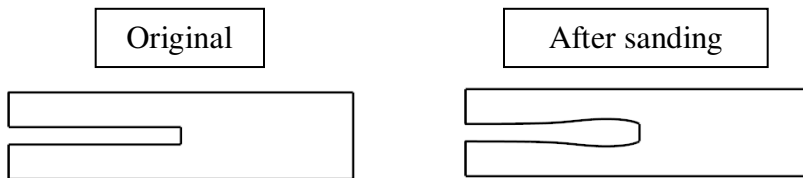
When fitting things together

Keep in mind that as you slide the ribs together, things will get tighter as you reach final position. If they start off tight, they will only get tighter and you may get stuck half way in! If things are tight, avoid committing sliding the pieces in all at once. Work the pieces in and out of their notches a few times first to help remove any remaining charred edges. If you are pretty close to a good fit, you may also want to try chasing the notches with some scrap Masonite first before assembling the pieces. If things are still too tight, resort to sanding.

If sanding is required

Use 200-mesh sandpaper and something rigid, flat and thin to give it support. Simply removing the charred surfaces should be enough to get a good fit.

Although the rib may start off sliding well, it can get tighter as more and more of it is slid into place. For this reason, consider sanding more aggressively on the interior part of the slat as shown below on the right...



As far as chronology, start with a few middle ribs in one direction, and then add a few middle ribs in the opposite direction. Then add from the center outwards. This will minimize tightness...

