

Adjusting for Kerf

What is kerf and why should you be concerned about it?

You probably shouldn't be. For most people, the kerf created by the laser is **not** going to be something they will need to worry about. It's an amount of material **equal to the width of a human hair** that is removed by the laser when it cuts.

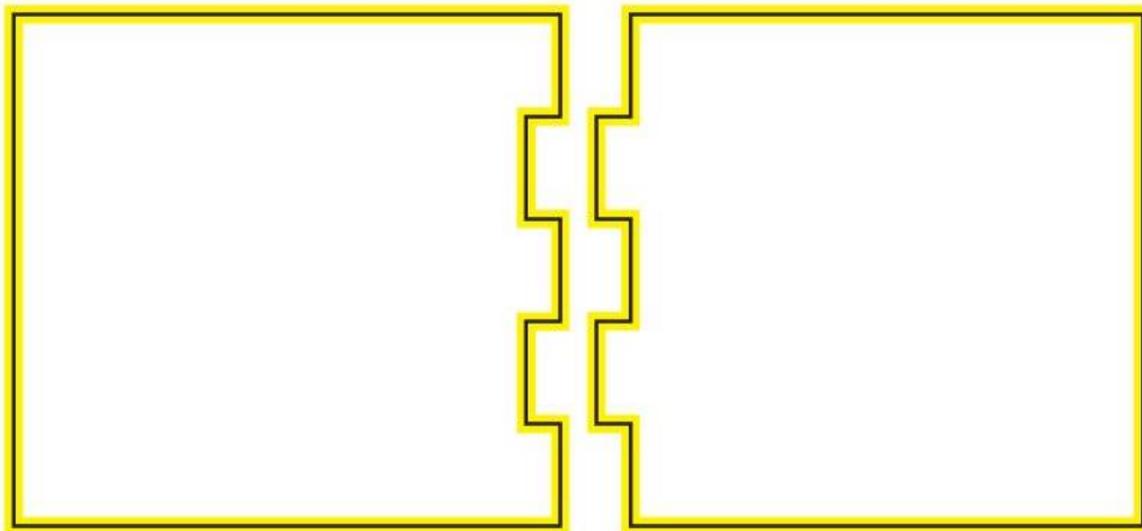
The beam on a laser is very small, generally in the neighborhood of 0.010 inches (0.25 millimeters), but if you are trying to create parts that snap-fit together perfectly without needing glue of any kind to hold the object together, that is enough of a difference to make the fit turn out to be slightly loose instead of snug.

Different materials will have a different kerf size. The thicker the material that you are trying to cut though, the wider the kerf is going to be. Also, some materials will melt unevenly, giving a larger kerf in foams, than in something hard and dense like wood.

There is no "one-size-fits-all" number for kerf. It's going to be different for each material that you cut. You can expect it to be similar for materials of similar density and thickness, but the only way to absolutely lock down kerf is to do TEST CUTS on the material. (I'm a huge believer in test cuts, particularly if you have expensive materials that you don't want to have to buy again.) Once you have a good number for say...birch plywood, make a note of it. The next few times that you do test cuts on birch plywood, start with that number, and fine-tune it. If you try a different supplier for birch plywood, do a test cut. (These are natural materials and they are not going to be consistent.)

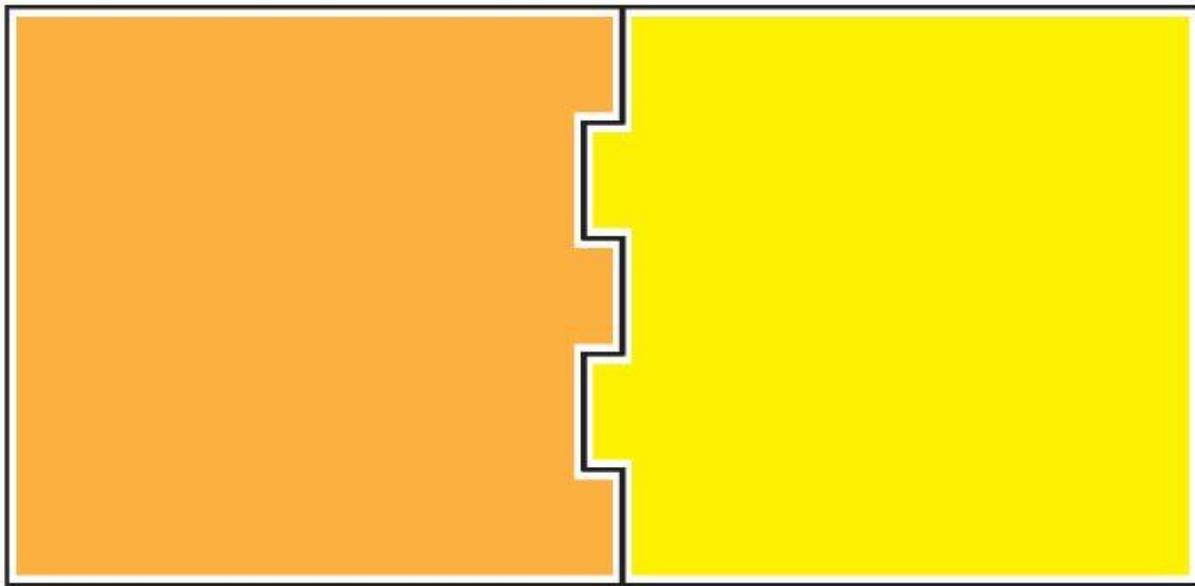
The explanatory diagram below shows what happens as the laser burns along a path. *(Note: It is **NOT** to scale!)*

The **vector path** is the black line in the center, and **that** is what the laser will follow. The yellow line is the fictitious width of the laser beam. As it travels along the path in the center, it nibbles away at the shape inside by an amount equal to **half of the kerf**. The other half of the beam will eat away at the area outside of the shape we created, which we don't care about, unless we left another part sitting flush against the first in our design.

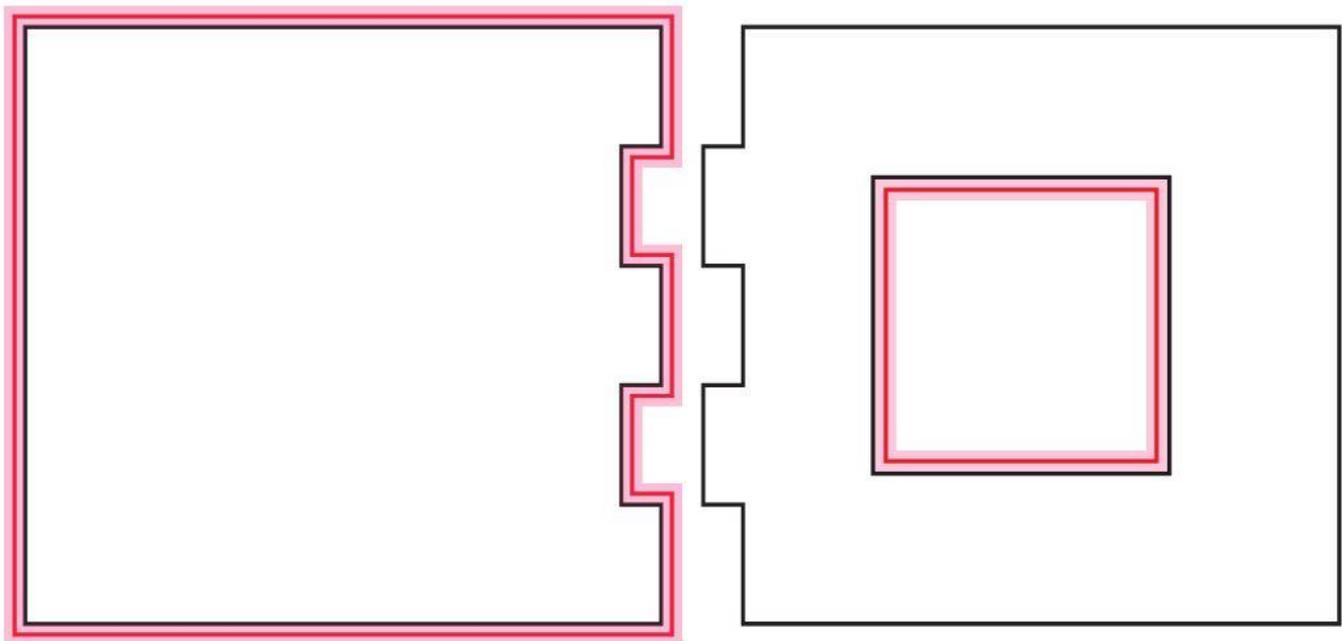


If we designed our parts to be exactly 100 millimeters wide, and they have to be that width in order to fit together properly, we will have to shift the design lines out further by **half the width of the kerf** in order for the end result to wind up at exactly 100 mm. That will cause the edge of the laser beam to just kiss along the originally designed line, instead of the center of the beam. Then the actual part will come out to be the correct size.

With our fake (*really fat*) laser beam scenario, if we cut the shapes out without adjusting for the kerf first, the results (shown colored below) would be what we ended up with. The white areas were eaten by the laser.



This is another illustration of the concept....by shifting the original black line that we wanted to end up with **out** by half a kerf width (the red line), when we cut along the red line, the edge of the laser beam (the pink beam) will just kiss along the original black line, and the size we originally wanted for the part is preserved. For interior cuts in a part, we shift the line to the interior, to make the laser cut in the waste area in the hole.

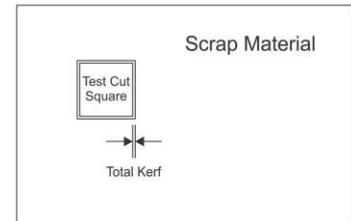


Cases where you might want to consider adjusting for the kerf would be inlay work, parts that need to end up being very specific sizes, miniature work, and anything designed by an engineer. (*Occupational hazard.*)

Adjusting for Kerf in Inkscape

1. Determine the Size of your Kerf

1. You will need a set of **Calipers** for this. If you don't have one, get one.
2. Create a small square (in inches or millimeters or whatever units you want to use) in Inkscape and save that file in **SVG** format with a label of **Test File**. (About an inch should do it. Or 25.4 mm.)
3. Import that file into the Glowforge interface and cut it out of a scrap piece of your material.
4. Take two measurements with the calipers: The size of the square, and the size of the hole.
5. **The difference between the two measurements, divided by 2, is your Kerf number.** You will enter that value into the Stroke size for the paths you create.



6. *(Note: The kerf changes at the top and the bottom of the material, depending on where the laser is focused in the material. The most accurate place to focus the laser for kerf measurements is at the midpoint of the material. Then the kerf at the top and the bottom are closest to being equal.)*

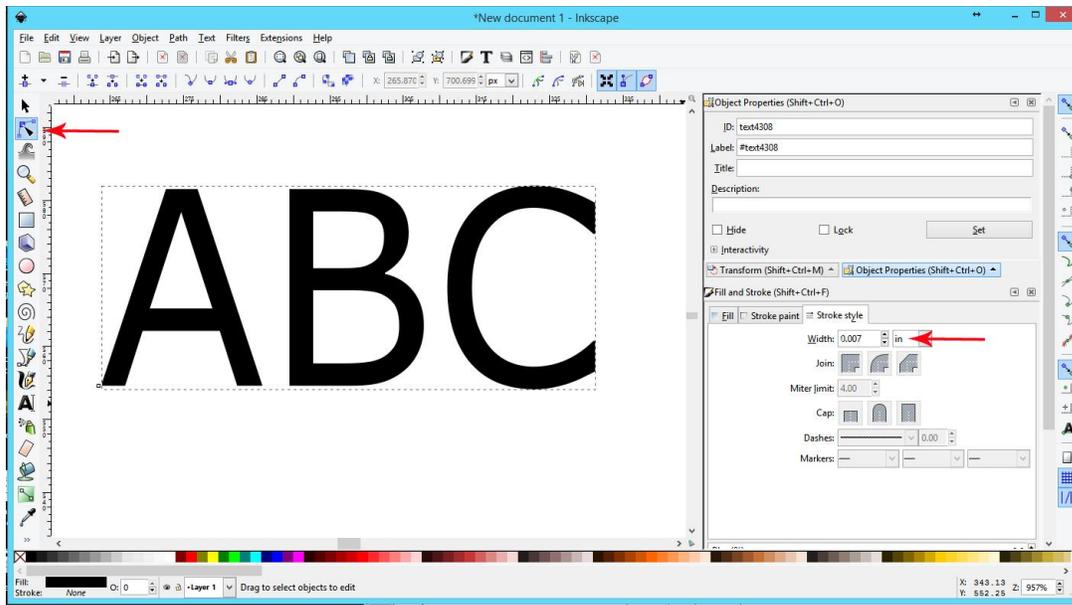
2. Adjust your Design in Inkscape

1. Unfortunately, there is no **easy** way to adjust for kerf in Inkscape, but it can be done. It requires several steps due to the nature of the program. The worst part is that there is no way to get around adjusting for kerf on each of the parts individually.

For this program, we are going to use the stroke size to duplicate the entire width of the laser beam, and then convert that single path into two paths centered around the original path, with the correct distance from the original of half the kerf width.

2. If you are working with text, it is necessary to perform all of the steps in **Edit** mode. *(Fortunately that also works for shapes, so we'll just do it that way for everything.)*

If you are Working With Text:

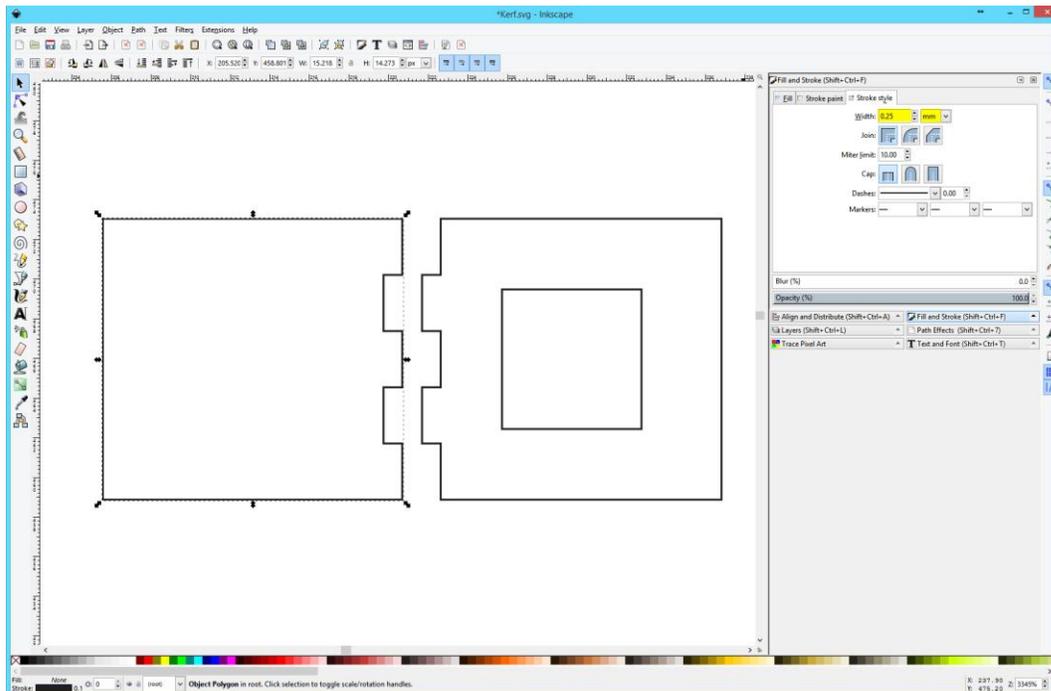


1. Type your letters and make them the size and shape that you want.
 2. Select the text.
 3. Switch to **Edit Mode**.
 4. Click **Path > Object to Path**.
 5. Set the **Stroke width** value (Style tab) for the Text to be **equal to your kerf value**.
Be sure that you **change the units** as well.
 6. Set a Stroke Paint color, and set the Fill for the text to Null.
 7. **While still in Edit mode – Shift + click** on each letter to select them simultaneously.
 8. Click **Path > Stroke to Path**.
 9. **Reset the Stroke width to .002 (or some small number that you will be able to see.)**
Again, set the Fill to null, and choose a Paint Color for the strokes.
 10. **While still in Edit mode – Shift + click** on each letter to select them simultaneously.
 11. Click **Path > Break Apart**.
 12. Now you can zoom in, (while still in Edit mode), and delete either the inside or outside stroke, depending on which way you want to move the laser path to adjust for kerf. Each letter, and hole in the letter, will need to be treated individually.
- For objects that are closed shapes, you will remove the **interior line**.
For **holes** in those enclosed shapes, you will remove the **outer line**.
13. And in case you missed it...you can't do a thing to the text unless you are in Edit mode. So keep that in mind....*chuckle!*

If you are working with Shapes:

Shapes other than text work the same way, but it's less critical that you work from Edit mode. Still for consistency's sake, we'll stick to the same method.

(Note: It is easier to just work from Select mode for shapes, you don't have to Shift+click to select everything, you can just drag a selection rectangle.)



1. Create your objects and make them the size and shape that you want.
2. Select the objects.
3. Switch to **Edit Mode**.
4. Click **Path > Object to Path**.
5. Set the **Stroke width** value (Style tab) for the paths to be **equal to your kerf value**.
Be sure that you **change the units** as well.
6. Set a Stroke Paint color, and set the Fill for the text to Null.
7. **While still in Edit mode – Shift + click** on each shape to select them simultaneously.
(If you switch to normal selection mode – just drag a selection rectangle.)
8. Click **Path > Stroke to Path**.
9. **Reset the Stroke width to .002 (or some small number that you will be able to see.)**
Again, set the Fill to null, and choose a Paint Color for the strokes.
10. Select the paths again.
11. Click **Path > Break Apart**.
12. Now you can **zoom in** and delete either the inside or outside stroke, depending on which way you want to move the laser path to adjust for kerf.
(Each shape, and any holes in the shapes, will need to be treated individually.)
For objects that are closed shapes, you will remove the **interior line**.
For **holes** in those enclosed shapes, you will remove the **outer line**.

You have now adjusted the position of the **center of the strokes** so that they are kerf adjusted. You can save the file as an SVG.

(Frankly, I wouldn't use Inkscape for kerf adjustment on complex designs. It truly borders on the ridiculous.)

