

Are your Laser Cut Edges Straight?

Much like using a magnifying glass and the sun to burn a leaf, a laser cutter uses a focus lens that converges parallel rays from the laser beam and focuses them to a single, intense spot, allowing the beam to cut various material.

With most CO² lasers, the typical beam width before the lens is usually about 6mm-8mm wide and a typical lens is about 18mm-20mm wide, allowing lots of space for the beam to strike the lens more-or-less in the centre.

As you can see from image #1, the lens causes the beam to form almost an hour-glass shape from the lens to the focus point and then out again.

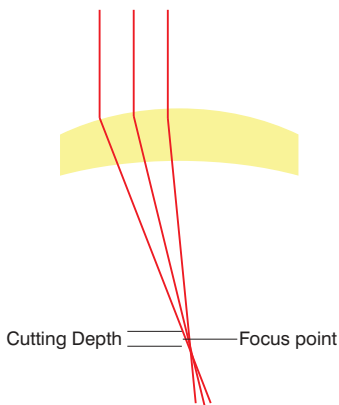
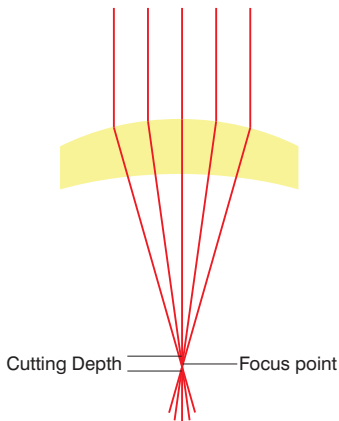
Even assuming that all the elements that make up the optical path in your laser are correctly aligned, this causes a bit of an angle on the cut - (depending on material thickness) typically somewhere around 3-4 degrees - and that is if the beam is striking the lens in the centre.

If the beam is not in the center of the lens, it will be offset in one direction, greatly exaggerating the kerf effect in the other plane, so you will certainly notice it more in one axis than another.

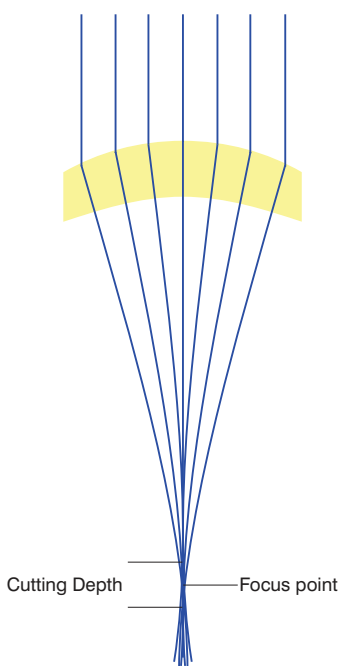
In image #2, if the laser head (and therefore the beam) is moving along the Y-Axis (front to back), the kerf will be really pronounced, but if the beam is moving along the X-Axis (left to right), you might not notice the angle at all, and the cut will seem perpendicular.

So what about a longer focal length lens? Well, this will make quite a difference (See image #3) because the beam will be "in focus" for a longer distance and the sides of the cut will then be straighter (for that distance). This will have the effect of reducing the noticeable kerf significantly.

Remember though that a longer focal length lens creates a larger spot size, which reduces power density of the laser beam. This means that you may then require more power and lower speed to cut through the material - and also depending on your laser machine's head, you may have to change air pressure on the air-assist if the nozzle is further from the workpiece than with the shorter focal length lens.



Exaggerated image showing the kerf if the beam is not in the centre of the lens.



101.6mm lens showing much deeper depth of focus with slightly larger spot area.

