Modifying the focal assembly for the 100mm focal lens

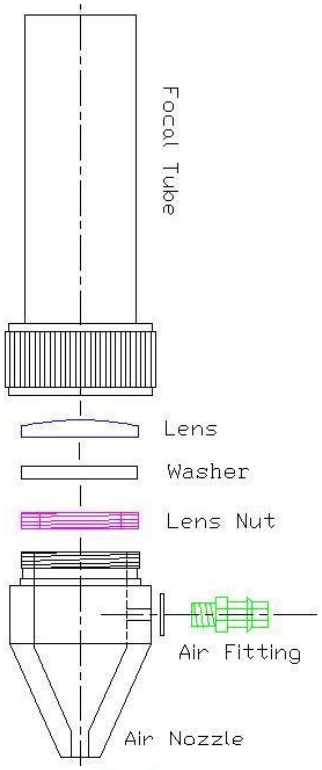
Rabbit Laser - USA
Middletown, OH

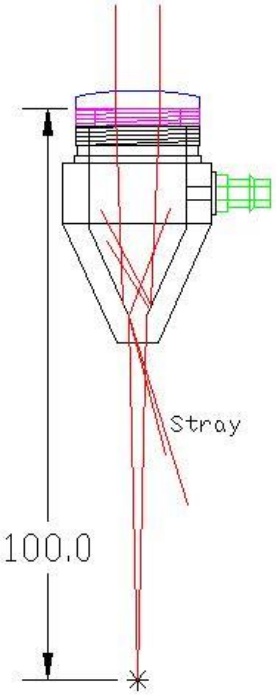
Rabbit Laser USA.com

What is happening and why do you need to modify part of the laser machine?

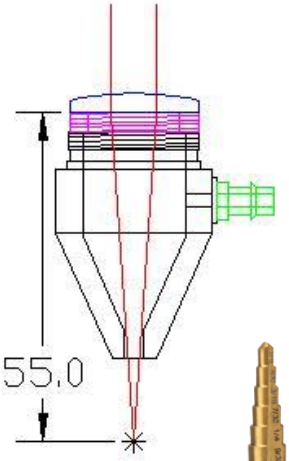
The primary part of the laser machine is the laser tube. The CO2 laser tube produces a laser beam that can be best described as an invisible bundle of light rays. The idea is that all the light points exactly the same direction. The laser tube isn't perfect and so the light rays in the bundle are only 99.99 percent parallel. The rest can become stray light radiation. The laser beam bundle of light is normally about 0.375 inch (9mm) thick. The laser beam is produced at the laser tube and is bounced off of mirrors to get to the final location. With flying optics, the mirrors are mounted on the end of a moving axis such that parallel movements will not affect each axis alignment or final focused position. The final focused position should be on the material to be cut or engraved.

The focusing assembly is the last set of optics prior to the material. The focusing assembly consists of the focal tube, lens, lens nut, air nozzle, and air fitting. Please see the picture to identify the basic parts of the laser focal assembly. The focal tube is mounted to the flying head, just under the last mirror. The last mirror points the laser beam down the center of the focal tube. The focusing lens in mounted into the bottom of the focal tube by using the lens nut. The focal lens can be manufactured with specific curves to focus the laser beam into a tiny spot at a specific distance below the lens. A common lens for laser machines is the 55mm focal lens. This means that the laser beam will be focused into the smallest spot at 55mm from the focal lens. Mounting a 100mm focal lens means that the laser beam will be focused into the smallest spot at 100mm from(below) the focal lens.





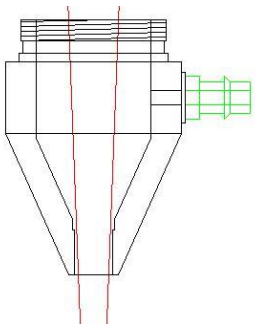
Why is there a problem with mounting the 100mm focal lens in the laser machine? The problem is found at the exit hole of the air nozzle. With a 55mm focal lens, the laser beam(red lines of the picture) is being focused to a distance and the laser beam does not touch the air nozzle. A normal passage of laser light can be seen in the picture (bottom right). The 100mm focal lens must concentrate the laser beam at a further distance and so the laser beam would be expected to touch the air nozzle. The laser beam does not pass through the nozzle material and so will be reflected. Some of the reflected laser light would go up the focal tube, but other parts of the reflected laser light would go out the bottom of the nozzle as stray light. Either case of reflected laser light is uncontrolled and can be dangerous. The picture left shows how the laser beam (red lines) collide with the metal nozzle. The nozzle size only allows 40 percent of the laser beam area to pass through. We know that most of the laser beam power is on the outer rim of the light bundle. This means that surely over 90 percent of the laser power is being lost. The solution to this problem is to modify the nozzle for the exit hole to be larger.



How to modify the nozzle:

You will need tools to remove the focal assembly, a drill, and a step bit. The step bit should have many sizes including 7/32 inch and 1/4 inch. We used the step bit from Harborfreight.com, item number 91616-3VGA.

1) Remove the focal assembly from the laser.
2) Remove the Air Nozzle from the focal tube. This will ensure the lens is safe from the drill bit.
3) Use the step-bit to drill out the small hole to the 7/32 inch diameter. Drill from the outside (tip) of the nozzle. Do not allow the step-bit to cut the hole larger than 7/32 inch.
4) Look into the hole that the step-bit has made. Notice that the 7/32 hole does not go completely into the air nozzle.
5) Use the step-bit to drill from the inside of the air nozzle. Check to make sure the 7/32 diameter is consistent through the air nozzle's exit hole. The next larger section of the step-bit will also cut into the material. See the picture.
6) Remove any burrs from the edges of the drilled hole.
7) Take this opportunity to clean your focal lens.
8) Reassemble your laser components (including the 100mm lens) to the machine.
9) The laser beam should now focus about 2.3 inches (59mm) below the air nozzle tip.



Please take the time to understand the changes. **Notice that different air flow will be required**.