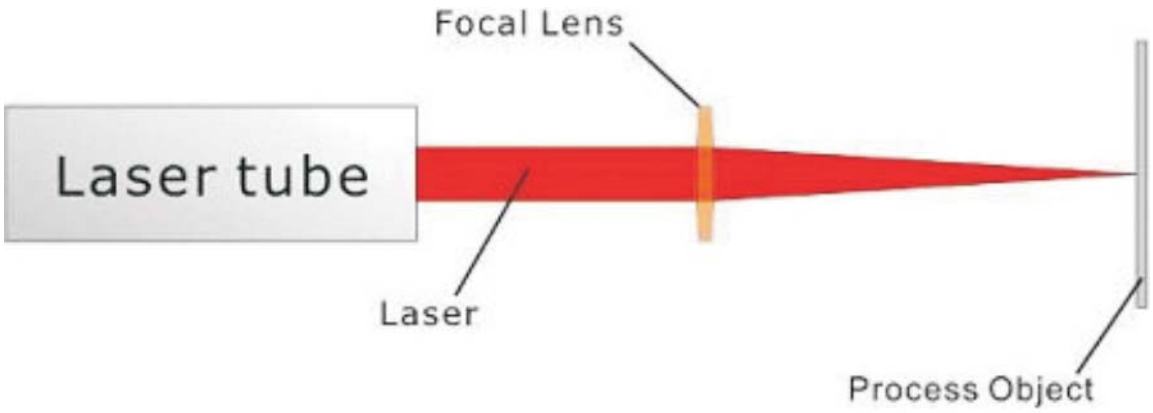
Illustration of the GCC Focus Lens

Remember the Days of Summer as a kid playing with a magnifying glass?

This methodical principle also identically applies to Laser engraving systems - the Laser passes through a focal lens and converges at a single point, using this congregated energy to process and engrave designated working objects.



Laser Process using Focal Lens

For that reason, the focal lens is considered a significant component of the laser. Informatively, there is a wide range of lens sizes to choose from in order to complement and support operations that differ in application requirements, and where different media is used.

LaserPro would also like to remind you that different media will generate different heat affects.

Lens	1.5"	2.0"	2.5"	4.0"
Depending on Focal Distance, its Jorlink's experience these lenses are approx. these spot sizes in red:				
Spot Size	**~.003"** 0.0029" (0.073mm)	**~.006"** 0.039" (0.099mm)	**~.009"** 0.048" (0.121mm)	**~.012"** 0.078" (0.198mm)

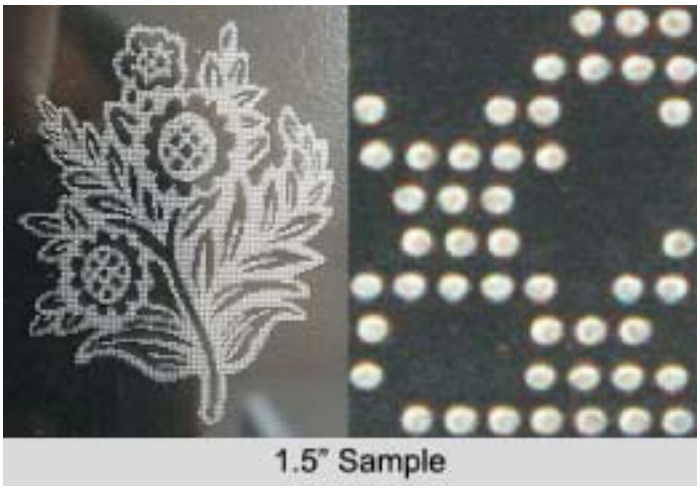
Lens Specifications

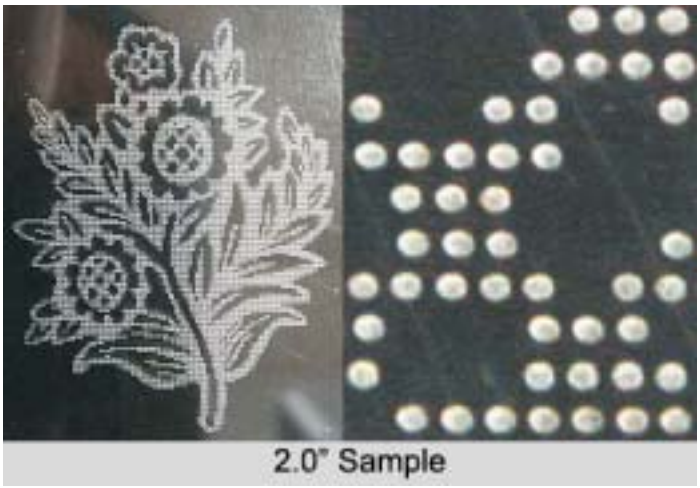
II. Comparison of Engraving Results from a single Job engraved with each of the GCC Lens.

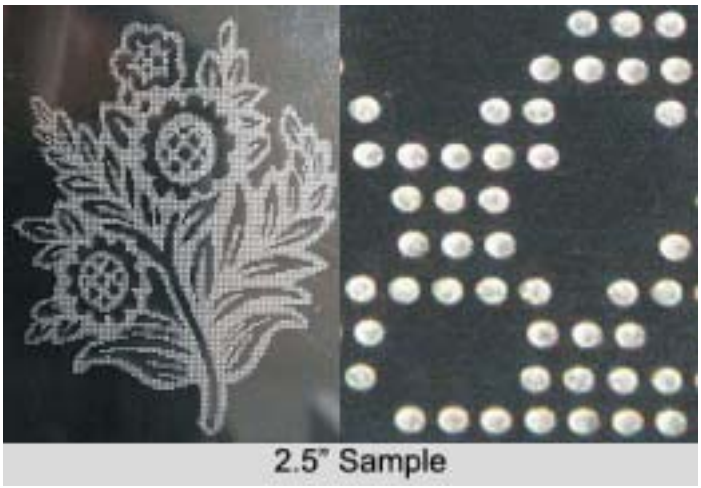
Model: Mercury 30W
Material: Acrylic

LaserPro will showcase 1.5", 2.0" , 2.5" and 4.0" lenses and exhibit with their actual application results.

I. Engraving Results-Graphics


1.5" Sample


2.0" Sample


2.5" Sample


4.0" Sample

From the comparison above we are able to depict an evident enlargement of spots when 4" lens were used, but no considerable changes when 1.5"~2.5" lens are used.

II. Engraving Result - Small Letterings

Engraving 1mm~0.2 mm sized letterings

1.0 mm ----- .039"
.9 mm ----- .035"
.8 mm ----- .031"
.7 mm ----- .027"
.6 mm ----- .023"
.5 mm ----- .019"
.4 mm ----- .015"
.3 mm ----- .011"
.2mm ----- .007"

1.5" lens can engrave letters between 0.4 mm~0.5 mm, letters that are smaller than 0.3mm will be blurred and indistinguishable

1.0 mm ----- .039”
.9 mm ----- .035”
.8 mm ----- .031”
.7 mm ----- .027”
.6 mm ----- .023”
.5 mm ----- .019”
.4 mm ----- .015”
.3 mm ----- .011”
.2mm ----- .007”

Engraving with a 2.0" lens will produce results that are similar to those produced by 1.5" lens; lettering are also sized between 0.4mm~0.5mm

1.0 mm ----- .039”
.9 mm ----- .035”
.8 mm ----- .031”
.7 mm ----- .027”
.6 mm ----- .023”
.5 mm ----- .019”
.4 mm ----- .015”
.3 mm ----- .011”
.2mm ----- .007”

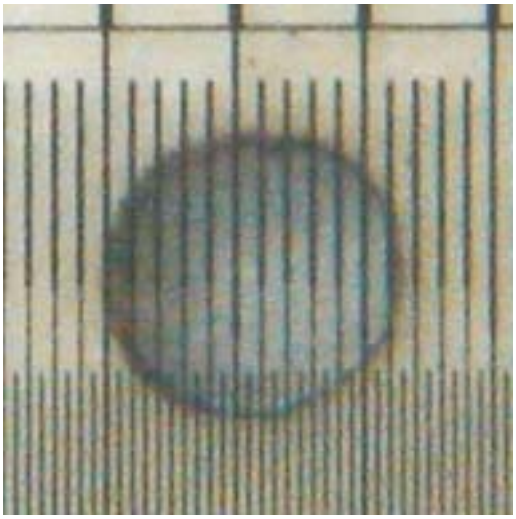
There is no significant difference in engraving results between 2.5” and 2.0” lens. However, when the 0.5mm letter is used, the engraved characters become blurred.

1.0 mm ----- .039”
.9 mm ----- .035”
.8 mm ----- .031”
.7 mm ----- .027”
.6 mm ----- .023”
.5 mm ----- .019”
.4 mm ----- .015”
.3 mm ----- .011”
.2mm ----- .007”

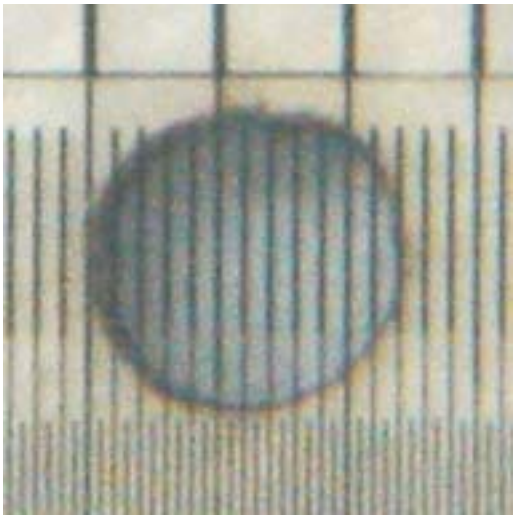
4.0" lens engrave letterings between 0.7 mm~0.8 mm given its bigger spot size; letterings that are smaller than 0.7 mm will be blurred.

III. Heat Affected

LaserPro will now test the actual engraving performance on paper, principally assessing the extent of heating effects using varied lens sizes, and also measure their resultant differences.

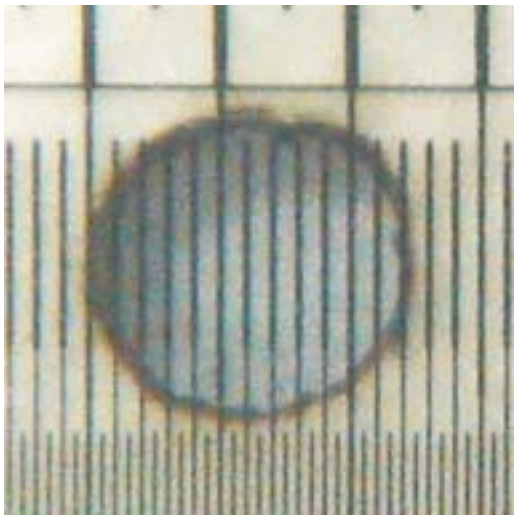


1.5" Lens - engraves a spot size of 0.4 mm (.014”) in diameter, finishing at 11 mm (.433”)

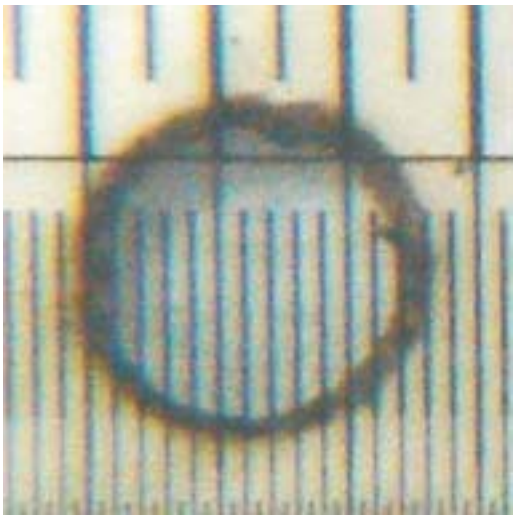


2.0" Lens - engraves a spot size of 0.4 mm (.014”) in diameter, finishing at 12 mm (.472”)

In Short, the larger beam diameter will create a larger spread of heat that will effect the end result to size of a specific material. Here we see a gain of 1 mm (.040”) of effect with the 2.0” Lens



2.5” Lens - engraves a spot of 10 mm (.393”) in diameter, finishing at 12 mm (.472”)



4.0” Lens - engraves a spot of 10 mm (.393”) in diameter, finishing at 13mm (.511”)

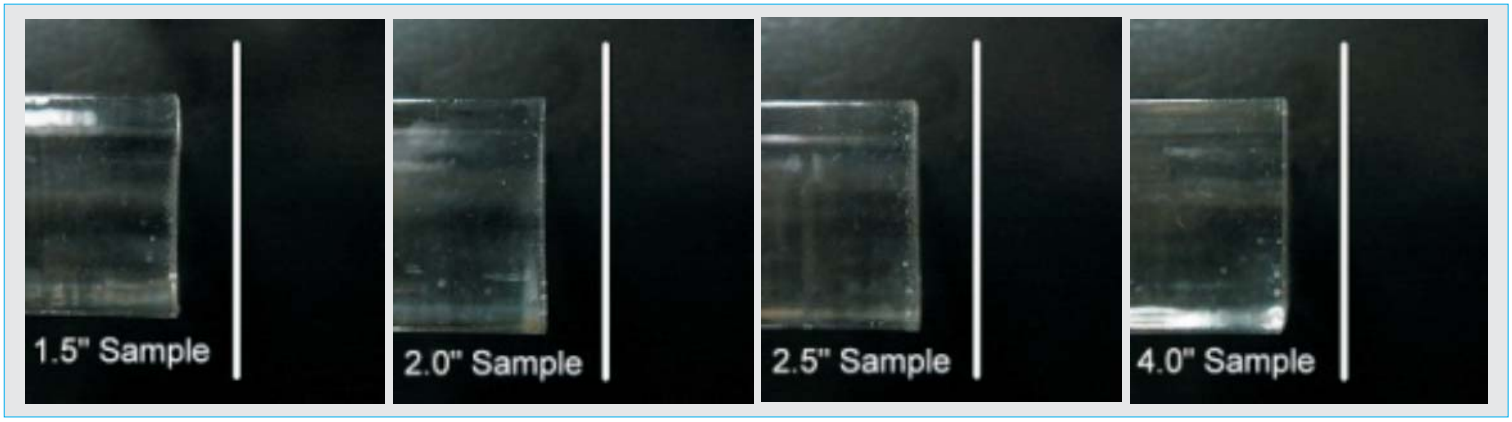
LaserPro would also like to remind you that different media will generate different heat affects.

IV. Vector Cutting

Cutting test conducted using Spirit 100W

For engraving/cutting operations on acrylics with considerable thickness, differences in performance between the lenses would be more evident as they differ in focus.

Comparative testing conducted using Spirit 100W adapting identical parameters.



From the comparative graphs shown above, we are able to depict that the 1.5” lens has a smaller focal Length, and will when cutting thicker acrylics actually produce more curvature in the edges. This can be improved width lenses with longer focal Length are used, as the edges produced will be straighter and smoother as the Laser beam’s effective cutting power is greater.

V. Options

Following the above mentioned comparisons, customers will become more aware of how different sized lenses can be utilized to complement different applications. With continued practice and operation, one can better select the most suitable lens for production and elevate production efficiency. Based on our previous application experiences, here are some recommended lens applications:

1.5” Lens

Small spot sizes are more suitable for small lettering engraving applications, small circular shapes, and for drawing thin lines. It is most applicable for processing micro media, electronic parts and for accomplishing precision cutting.

2.0 – 2.5” Lens

2.0” is currently the most commonly used lens on the market, popularly adapted for engraving images and other general applications. For example, it is generally used for engraving acrylic engravings, souvenirs, and cutting thin objects.

4.0” Lens

Bigger spot sizes are suitable for cutting materials that are thicker, for example, stock wood or thick acrylic sheets.

Additional opportunity for the 2.5” x 4.0” lens are applications where part marking may be at levels that will not allow for focusing with a standard 2.0 lens due to fixtures of component shapes that might come in contact with the lens carnage.

Surface Smoothing or layer removal of material in some industrial process will also benefit from the larger spot size as spreading the laser power across a larger area will provide more of a cleaning (polishing effect) versus a cutting line effect.

Please note; Given the same wattage power, cutting with the assistance of bigger spots essentially gives faster cutting and maintains efficiency, but will also reduce the level of power generated at the material surface so settings may need to be adjusted.

Lens, Laser Lens Comparison - 2nd SOURCE (NOT GCC \ Jorlink PUB.)

The mysteries of focus unraveled here...

Why do you need different lenses?

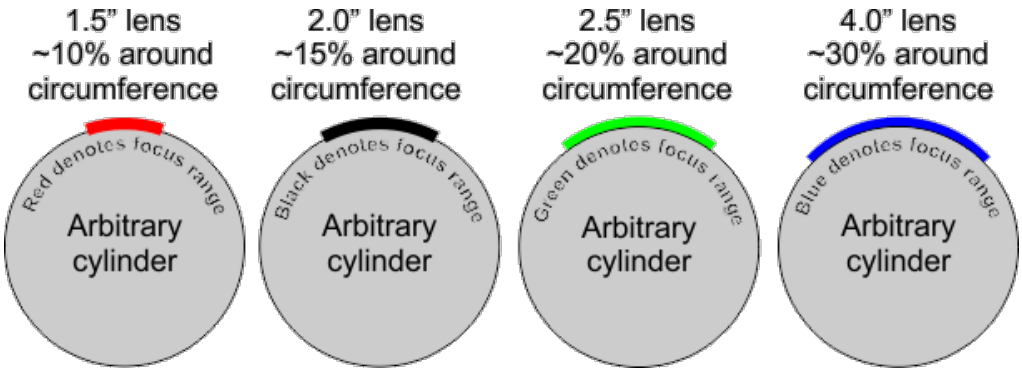
When do you need a rotary indexer?

Learn the differences and understand the trade off's of laser lenses

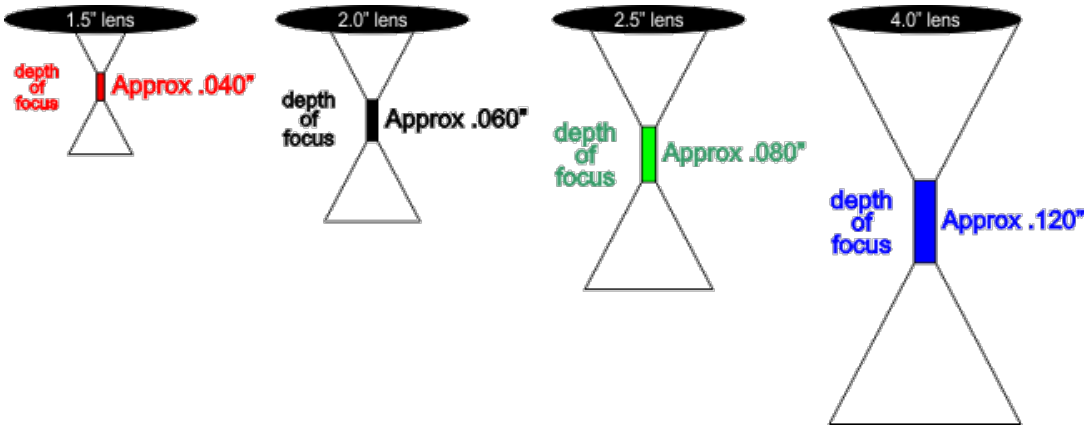
Focus Lenses -

Below are examples of different lenses using typical lenses found in a flatbed laser system.

Below is information about different lenses and how far a laser can mark around an arbitrary round part with each lens:

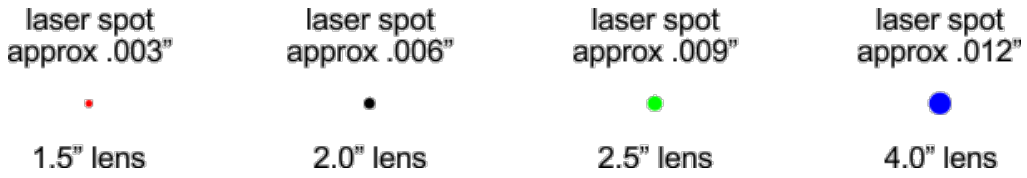


Below you can see lenses have different focal ranges in terms of length and depth. Beam width also changes, effecting resolution and beam energy. Energy is lost in a logarithmic fashion because the circumference of a circle is 3.14 (pi). Spot size times pi is the energy of the spot and is why higher wattage is necessary when using larger lenses, especially using the 4" lens. This is also why a 30 watt CO2 laser using a 2.5" lens has a hard time cutting through even .25" wood or acrylic.



Below is the approximate spot size of each laser lens. The lens acts as a magnifying glass and converges the beam of light. The point at the sharpest convergence is the "spot size" and where laser processing takes place. There are always tradeoffs between lenses. Using a larger lens with larger spot could mean using lower DPI and finishing the job faster;

however, if you are looking for details, either vector cutting or raster engraving, then you may find that the smaller lens with finer resolution is better at the cost of using higher DPI.



1.5” Lens:
Good: Sharpest point and highest resolution best for cutting thin materials and engraving small details
Bad: Out of focus quickest

2” Lens:
Best overall cutting .25" and under and most engraving

2.5” Lens:
Use when cutting .5" material

4.0” Lens:
Good: Largest depth of focus. Use when engraving parts with curvature or cutting thick parts.
Bad: Very large spot and loss of energy. Not good with low power laser