MORGAN STATE UNIVERSITY
School of Architecture and Planning

BEARlab
Built Environment Applied Research Laboratory

Laser Cutting Manual

Introduction

The BEARLab has two Universal Laser Systems laser cutters. The laser can be used to cut and engrave a variety of thin, small scale paper and wood products. Files are prepared for laser cutting in Adobe Illustrator and then sent to the laser cutter by printing. The file to be cut can be created in any vector based drawing or CAD program, and imported into Illustrator using the .ai file format

The laser cutter works by focusing an intense beam of light through a series of mirrors and lenses onto a piece of material. The heat generated by the light is powerful enough to burn through many materials. The laser is moved along the path of vector lines to cut the shapes drawn in your software. The power of the laser is increased and decreased to produce different cutting effects. The laser can cut or engrave materials. Laser power is determined by the colors assigned to the lines in your drawing.

Red = Cut   Blue = Engrave

There are a variety of safety and health precautions which must be taken while operating the laser cutter. The burning of material generates smoke and fumes. These need to be extracted to protect users from toxic gases and protect the optics from smoke. Residue built up on the optics will cause the laser to heat and destroy the optical elements.

The invisible infrared light radiation emitted by the laser is harmful to eyes and skin.

- Avoid prolonged direct exposure to the infrared light emitted by the laser.

- Make sure that the exhaust system and room ventilation are on and working properly.

- Monitor the laser for excessive smoke or fire.

Policies

Use: The Laser Lab is self-service, by reservation only. Fees are charged by the minute for the time that the laser cutter and PC are used.

Orientation: Students must attend an orientation workshop, complete the orientation exam with a passing grade and sign the terms of use agreement prior to making reservations.

Reservations: The Laser Lab can be reserved in ½ hour increments for up to 1 hour. Make reservations in person at the counter in the BEARLab. Reservations can be made up to 2 weeks in advance.

Missed Appointments: Reservations will be cancelled if you arrive 10 minutes late or more. The reserved time will become open for walk-in users.

Walk-ins: The laser cutter may be used on a walk-in basis only during non-reserved times.

End of Reservation: All work must be finished by the end of your reserved time. Any job still in process will be aborted at the end of the reserved time.

*Other programs may be used to create files, then prepared in Illustrator.

Vector vs. Raster engraving: Only vector cuts are allowed, no raster engraving is allowed (it is too time-consuming).

rgb vs cmyk: The laser cutters will only cut from rgb documents. Cmyk documents will not cut.

Cost: $0.25 per Minute. (Subject to change) Billing is for entire time the laser room is used. File prep should be done in other Computer labs to avoid cost.

Materials

Acceptable materials: Only materials that have been created in the laser database may be used.

MATERIAL MUST BE FLAT.

Warped materials will not cut properly and will create a fire hazard.

Paper
Up to 1/2" Thickness

Wood
Up to 1/2" Thickness

Acrylic
Up to 1/2" Thickness

**Additional materials may be approved and set up by appointment

Prohibited Materials: Lexan, PVC, styrene, polycarbonate, polypropylene, vinyl, glass, foam core, metal, and any material not listed above. Prohibited materials could melt on the laser bed, or release toxic gas. Plastics can release carcinogens such as benzene.

Preparing files in Adobe Illustrator

To begin, open Adobe Illustrator, a part of the Adobe Creative Suite.

Start >> All Programs >> Adobe Design Standard >> Adobe Illustrator
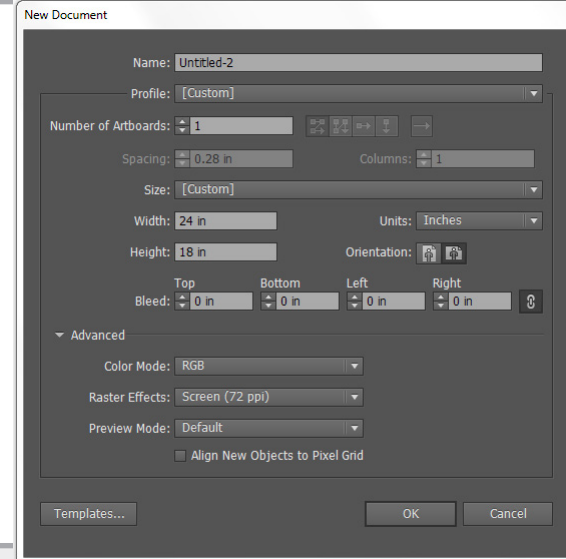

Create a New Document

File >> New

Start with the profile for "Basic RGB", make sure units is set to Inches, and you have the Width and Height set correctly for the laser cutter you will be using. Our red laser cutter has a 36" x 24" bed, the yellow laser cutter has a 24" x 18" bed, and the blue laser cutter has a 24" x 12" bed. Also make sure color mode is set to RGB. CMYK documents cannot be read by our laser cutters.

Artboard

The Artboard is the work area in iIllustrator. The artboard should be set to the size of the bed in the laser cutter you will be using, or to the size of your material if the material is smaller than the laser bed. Only the parts of your drawing that fit on the artboard will be printed to the laser cutter. Any parts that extend outside of the artboard will be trimmed off when you print.

- The ISL9.150D (red) laser cutter has a 36" x 24" bed
- The VLS4.60 (yellow) laser cutter has a 24" x 18" bed
- The VLS3.60 (blue) laser cutter has a 24" x 12" bed
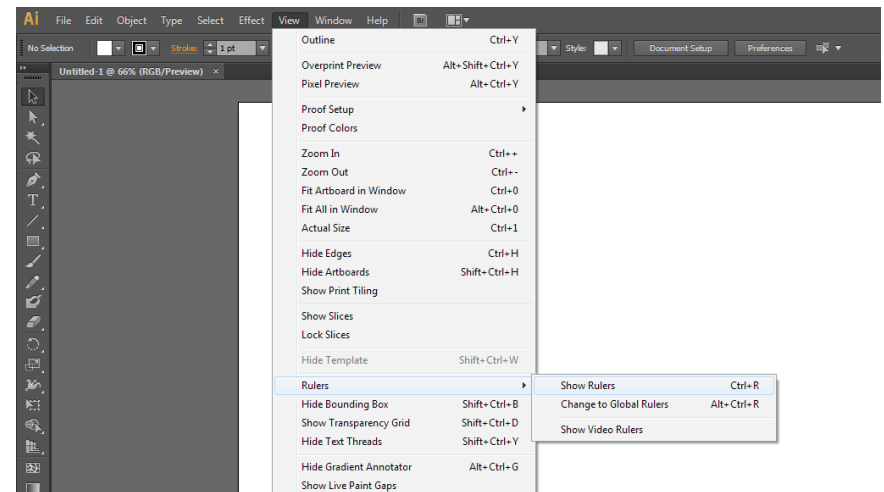
Materials smaller than laser bed can be used.
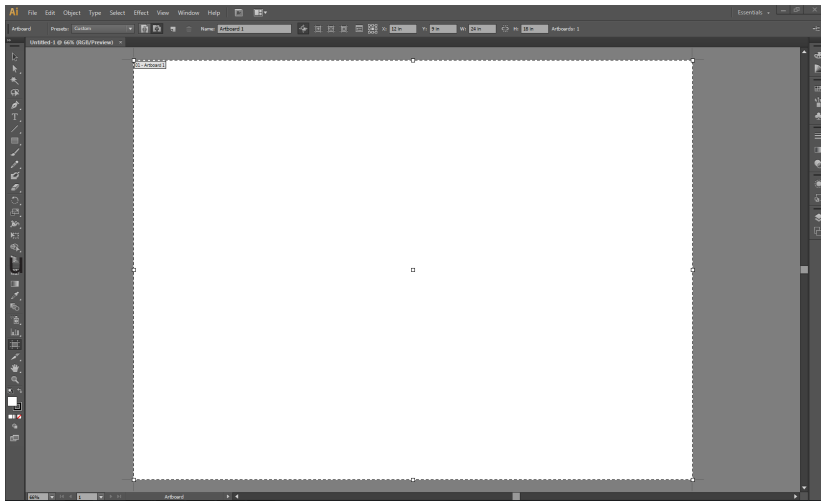
Red = Cut   Blue = Engrave

Rulers

Adobe Illustrator has rulers that will help you draw accurately. As you move the cursor, the position is shown on the rulers.

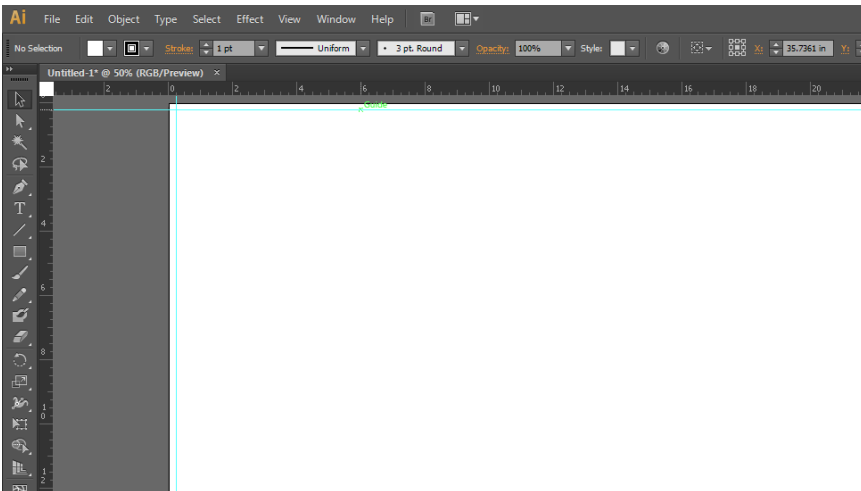*Show rulers with [CTRL + R] or View>>Show Rulers*

You can change the resolution of the rulers by zooming in and out.

[Ctrl +] to zoom in [Ctrl -] to zoom out

Guides

You can use guides to establish measurements and align elements in your drawing. Guides are only visible on the screen and will not print to the laser cutter.

Click and Drag from Rulers to create Guides. Drop to place them.

The size of materials and the alignment of the material to the laser bed are not precise. Use guides to create a 1/8" margin of error along the edges of your Artboard.

Also use guides to describe the material size if you are working with material sheets smaller than the laser bed. Include 1/8" Margin of error for that material.
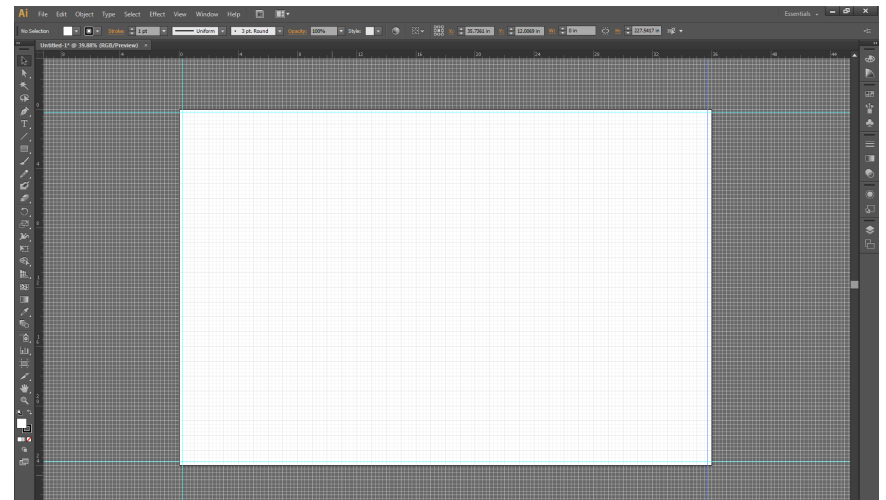
Grid

You can use the grid in Illustrator to help you draw accurately. The grid is only visible on the screen and will not print to the laser cutter.

View>>Show Grid

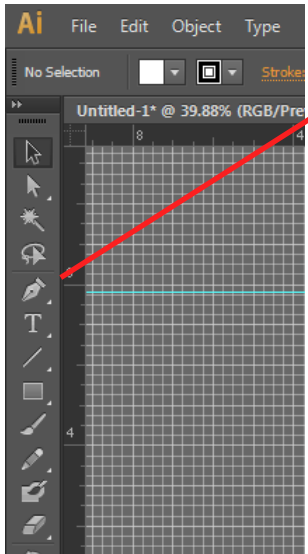The resolution of the grid can be set in the preferences.

Edit>>Preferences>>Grids.

You can set snapping to snap drawings to the grid.
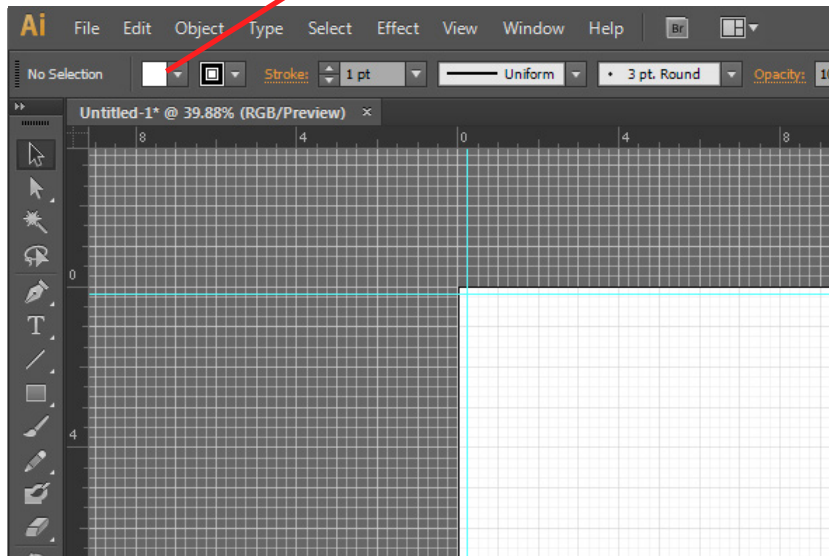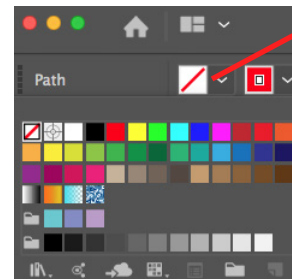
View>>Snap to Grid

Drawing

A variety of drawing tools are available in the tool bar. Click and hold on tools to reveal alternate tools.

Click and Drag or Click in-place and specify parameters to draw lines and shapes.

The properties of the objects you create are displayed in the control bar at the top.
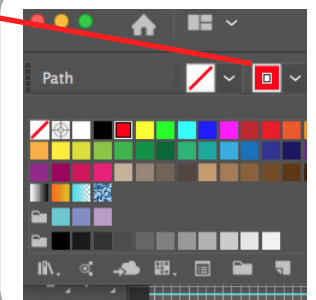
Fill Color

No fill color should be assigned to objects for laser cutting. Set the fill color to None in the control bar. Clicking on the displayed color will open the drop down palette.
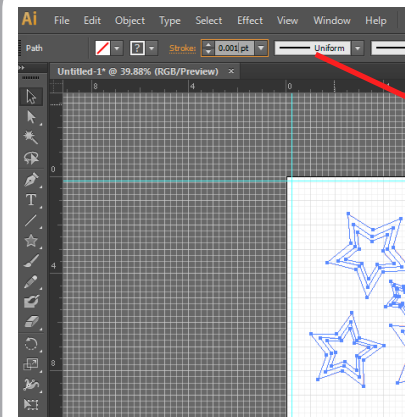
Stroke Color

The Stroke color should be set for the desired cut. Clicking on the displayed color will open the drop down palette.

Red (R:255 / G:0 / B:0) = Cut.
Blue (R:0 / G:0 / B:255) = Engrave.

Stroke Weight

The Stroke Weight must be .001 pt. for all lines to be laser cut. You have to type in .001.

Select all first to apply the change to everything.

Press enter to apply.

Common Problems

There are several common drawing problems you should avoid.

Duplicate Lines

Duplicated lines cause the laser to cut twice on the same line. When those lines are meant to be engraved in your material, the laser may cut through. If those lines are meant to be cuts, the second pass of the laser will cause burning and potentially fire. Carefully inspect your drawings and delete any duplicate lines. Duplicates often look darker in Adobe Illustrator.

Wrong Colors

Using any CMYK colors, or the incorrect RGB values for your red or blue lines will prevent the laser cutter from reading your file. If you use RGB colors but the document is still CMYK the output will be CMYK and will not be read.

Wrong Stroke Weight

Make sure that your lines are all .001pt . You can select all, then set the line weight.

Fill Color

Make sure there is no Fill color assigned to lines and shapes.

Warped Material

Warped materials cause the laser to go out of focus. When this happens, cutting fails and fire may occur. Make sure your material is flat.

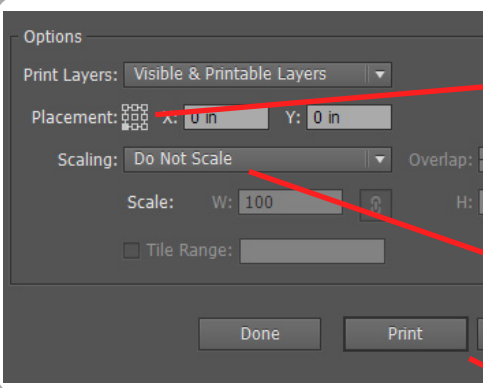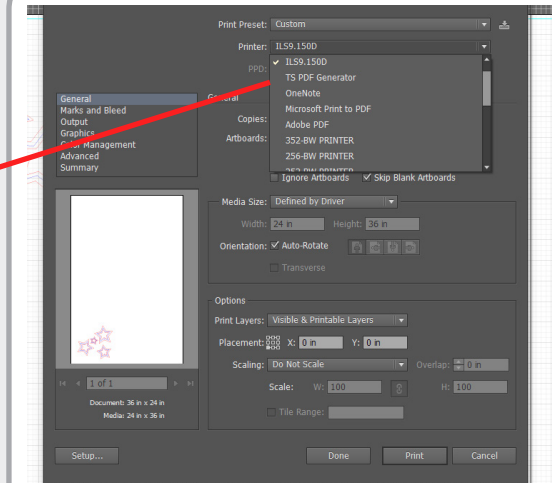## Printing

Print to send your file to the laser cutter.

[Ctrl P] or File>>Print

In the Print dialog, Select the model number the corresponds to the laser cutter you are using.

Red - ISL9.150D
Yellow - VLS4.60
Blue - VLS3.60

Set the placement to the lower left corner by clicking on that corner of the icon.

Make sure "Do Not Scale" is selected.

Click print to send your file to the laser

Part 2. Laser Cutting

Laser Exhaust

Make sure the exhaust system is on before proceeding. If it's not on do not use the laser cutter.

Air Assist

It is crucial that the compressed air be turned on for laser cutter to cut properly. Turn the vale on the wall to point straight out. The pressure regulator should read 40 PSI.

Failure to use the exhaust system or air assist will result in damage to the Laser Cutter.
Repair costs will be charged to you.

Inspect the Laser

Open the lid of the laser.

The Laser Cutter has a bed made of Aluminum "Honeycomb" that supports material and allows the extraction of fumes and particles from below. Make sure that the "Honeycomb"surface is clear of all debris.

Align the Bed

The "Honeycomb" table in the laser cutter is removable and can slide around on the bed. It may come out alignment.
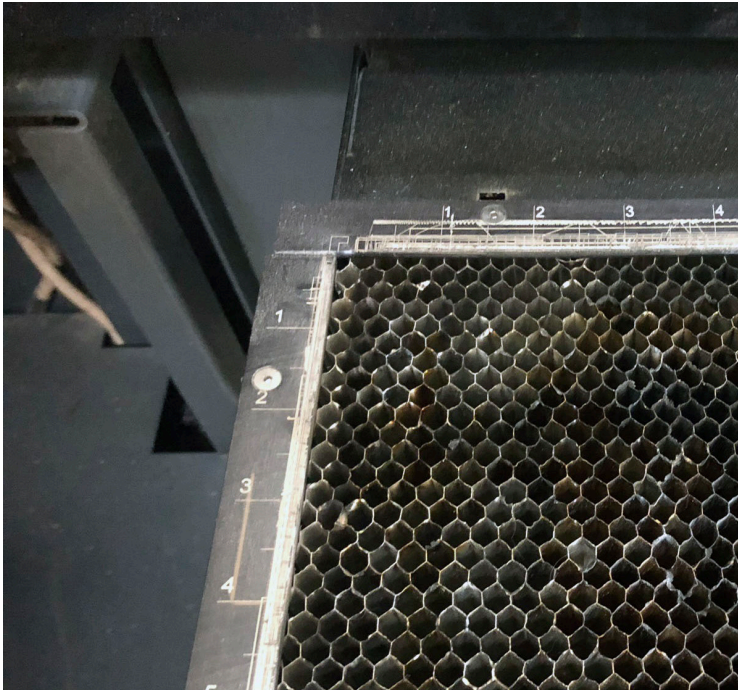
Make sure the table is square to the rulers in the bed of the laser cutter by sliding it back and to the left until it stops.

If the table is not aligned properly, the laser will not be aligned to your material. Inspect for debris and clean if necessary.

Load Material

Material MUST be flat and fit inside of the bed.
Place material flat and in the upper left hand corner of the "Honeycomb" table.

Close the lid.

Open the Laser Control Panel
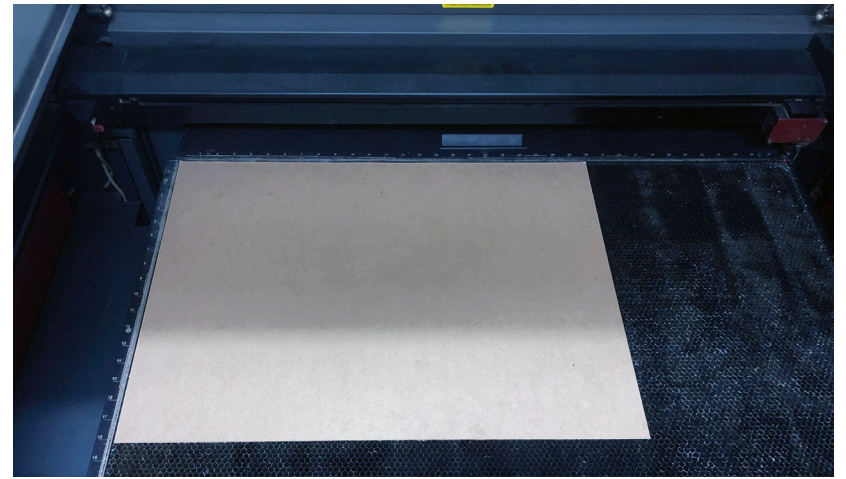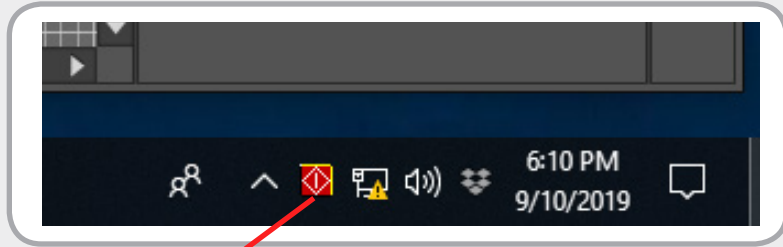

Open the Universal Laser Control Panel by double-clicking the red icon at the bottom of the screen.
There may be a delay.

The Control Panel will look like this...
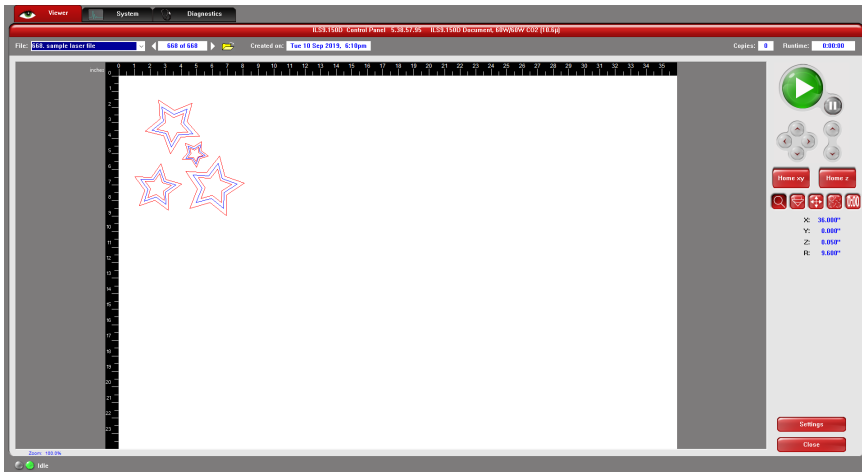
Verify Your File

Verify that the correct file is loaded in the viewer and all the colors are correct. There may be a delay while your file loads.
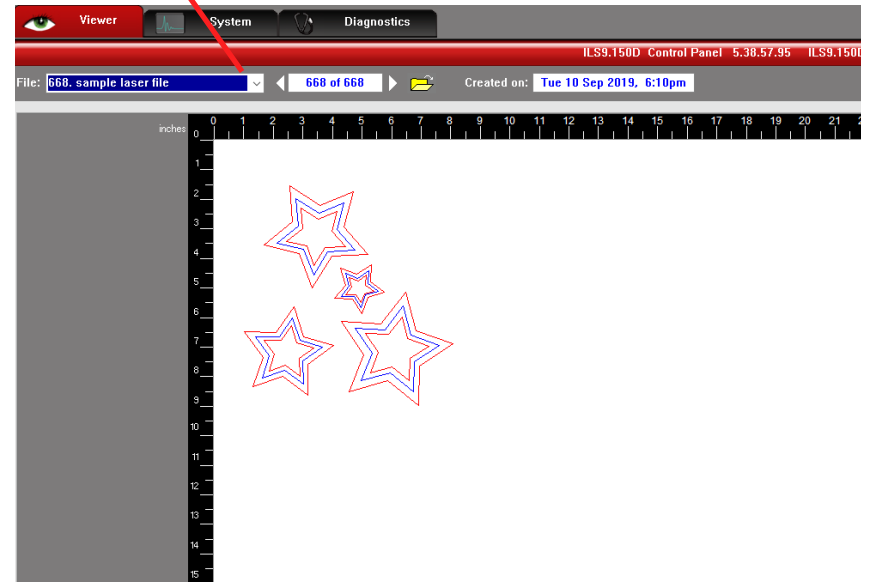
If any lines are black, grey, or missing: Your file was not prepared properly in illustrator. You will need to make changes to the color, fill, and stroke weight, then print again to laser cut.

Cut Settings

Click the Settings button on the bottom right hand corner.

Settings

Close
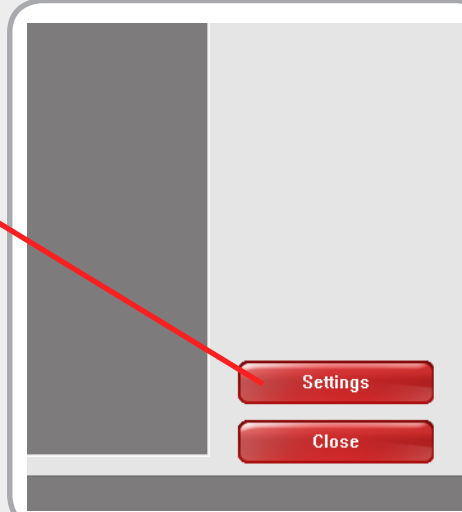
Material Category

Select the appropriate category for your material.
Then locate your specific material.

Viewer | System | Diagnostics

Materials Database | Manual Control

60W CO2 [10.6µ] / 60W CO2 [10.6µ] Laser Settings for ILS9.150D

Selected:

- Materials Database
  - Ceramic
  - Fabric
  - Foam
  - Glass
  - Metal
  - Natural
  - Plastic
  - Rubber

Click to select material, double-click to edit, right-click for other commands.

Intensity Adjustment

Raster ☐ Skip — 0%

Vector Engraving ☐ Skip — 0%

Vector Cutting ☐ Skip — 0%

Which Laser?
☐ Top - 60W ☐ Bottom - 60W

Notes:

Print Special Effects: Normal
☐ Frame Rasters

Print Direction

Vector Performance — Standard

Material Thickness

Units
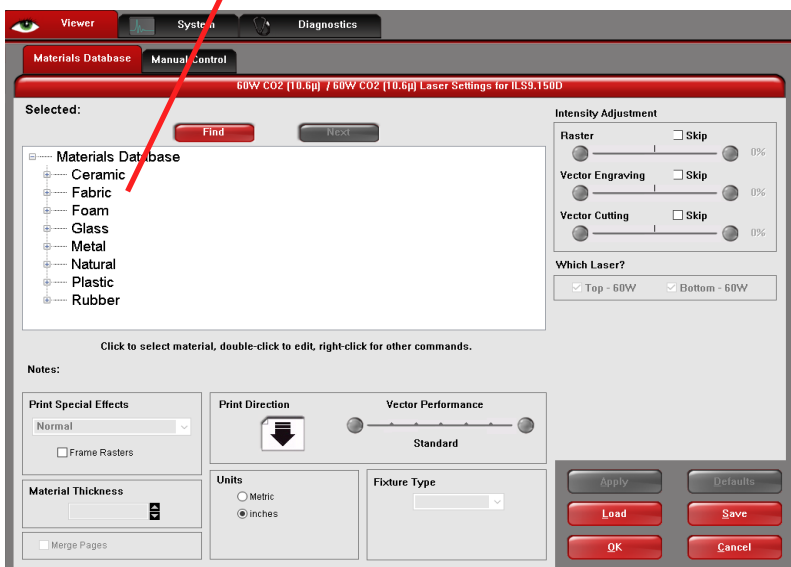○ Metric
● inches

Fixture Type

Apply | Defaults
Load | Save
OK | Cancel

Select Material

Select your material from the Materials List. DOUBLE CLICK!!

Materials Database | Manual Control

60W CO2 [10.6µ] / 60W CO2 [10.6µ] Laser Settings for ILS9.150D

Selected:

Find | Next

- Natural
  - cardstock .05
  - Cork Board
  - Leather
  - **Mat Board**
  - Mother of Pearl
  - Paper
  - Stone
  - Vellum
  - Wood

Click to select material, double-click to edit, right-click for other commands.

Intensity Adjustment

Raster ☐ Skip — 0%

Vector Engraving ☐ Skip — 0%

Vector Cutting ☐ Skip — 0%

Which Laser?
☑ Top - 60W ☑ Bottom - 60W

Notes:

Print Special Effects: Normal
☐ Frame Rasters

Print Direction

Vector Performance — Standard

Material Thickness: 0.03 "

Units
○ Metric
● inches

Fixture Type

☐ Merge Pages

Apply | Defaults
Load | Save
OK | Cancel

Set the material thickness for your material.
Be sure that it's accurate! You can check your material's thickness by using the digital caliper in the laser cutting room.

Make sure the material thickness is correct, then click **OK**

Power on the Laser Cutter

Verify that your settings are right, the drawing is correct and that the laser exhaust & compressed air are on before powering the laser on.

For the Yellow & Blue Laser Cutters, you may have to click the red power button to activate.

Copies: 0   Runtime: 0:00:00

Activate the Engraver.

Click the "Play" button to start your job.
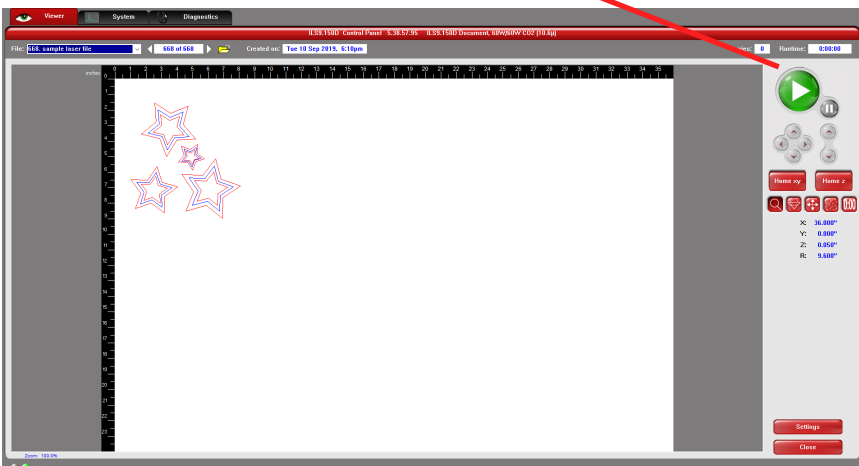
Monitoring Your Cut

You must monitor the laser cutter during cutting. Watch for flame, excessive smoke, or other unusual events. The laser should be visible as a fine point of light on the material. If the spot of light becomes wide or diffuse, the lens has been compromised.

Do not "stare" at the laser. Glance at it periodically to verify that it is working properly. The laser emits dangerous infrared radiation that can damage eyes and skin if exposure is prolonged. (It's like staring at the sun.)

If anything seems out of order, stop the laser immediately by pressing the "Pause" button on the machine.

In Case Of Emergency - Press Pause Immediately

If flame develops, and persists after cutting has stopped, use the fire extinguisher:

Pull the Pin at the top of the extinguisher. The pin releases a locking mechanism and will allow you to discharge the extinguisher.

Aim at the base of the fire, not the flames. This is important in order to put out the fire, you must extinguish the fuel.

Squeeze the lever slowly. This will release the extinguishing agent in the extinguisher. If the handle is released, the discharge will stop.

Sweep from side to side. Using a sweeping motion, move the fire extinguisher back and forth until the fire is completely out. Operate the extinguisher from a safe distance, several feet away, and then move towards the fire once it starts to diminish.

when It's Done

When the laser has completed cutting, the "Head" will return to its home position (The upper-right corner). Do not open the lid before the head returns to home. Wait one minute to allow fumes to clear before opening the lid.

- Remove all material, cut parts and scraps from inside the laser. Do not sweep small scraps down into the table. Carefully remove them.

- The accumulation of scrap in the table will create a fire hazard.

- Caution: Parts may be hot. Allow time to cool.

- Scrap material should be disposed of in recycling or trash.

- Close the lid when you're done.

- Exit all applications on the computer.

- Return to the checkout counter, and let the staff know that you have completed your laser cutting.

- Pay the fee for your time.

- Enjoy!

Lab Info

The Laser Lab is located inside the BEARLab, room #020 in the basement of the CBEIS building.

Hours
The Laser Lab will only be open during normal BEARLab operating hours

Monday:	**10 am - 9 pm**
Tuesday:	**10 am - 9 pm**
Wednesday:	**10 am - 9 pm**
Thursday:	**10 am - 9 pm**
Friday:	**10 am - 5 pm**
Saturday:	**11 am - 4 pm**

If you have any questions about the use of the laser cutters, please drop by the BEARLab, or contact:

BEARLab Manager:
Colleen Sagers
colleen.sagers@morgan.edu
443.885.3513

Resources

Laser Cutting Handbook

...

The Reservation Calendar can be viewed at:

https://www.google.com/calendar/
embed?src=saplaser%40gmail.com&ctz=America/
New_York

Notes