



# Laser Cutter Operation Manual

# Safety



**Never leave the laser cutter running unattended!**

Pay attention to your cut. Most materials can set on fire very quickly during laser cutting. Be prepared to stop the machine and to put out the fire. If you must leave the room briefly, pause your work and wait for a minute to make sure there is no chance of fire. Return to finish your work as soon as possible.

## Fire

Read the following guideline and follow it if you cause a fire

### Small fire

If you see a small fire or more than one flash flame in a few seconds, you must:

- Stop the machine using either pause or emergency stop
- Open the lid (This may be enough to put the fire out) If not:
- Blow it out

### Large fire

If you see a large fire contained within the laser but such that opening the lid may burn you, do the following:

- Call for help if someone more experienced is around (use your voice!)
- Pull the fire alarm or use your voice to alert people
- Apply the fire extinguisher to the front grill air intake
- Turn the machine off

### Even larger fires

- Pull the fire alarm or use your voice to alert people
- Evacuate everyone from the laser room and close the doors
- Call 911
- Call makerspace emergency contacts
- Evacuate the building

Some materials such as wood, are burned in order to achieve an etch or cut. Other materials such as acrylic change their chemical structure. In all cases, some light may be visible. This light at the point of lasing may be ok as long as it stays with the motion of the laser. If a flame appears while the laser is in operation, stop your job and try again with lower heat settings or increase cut speed.

## Be Safe

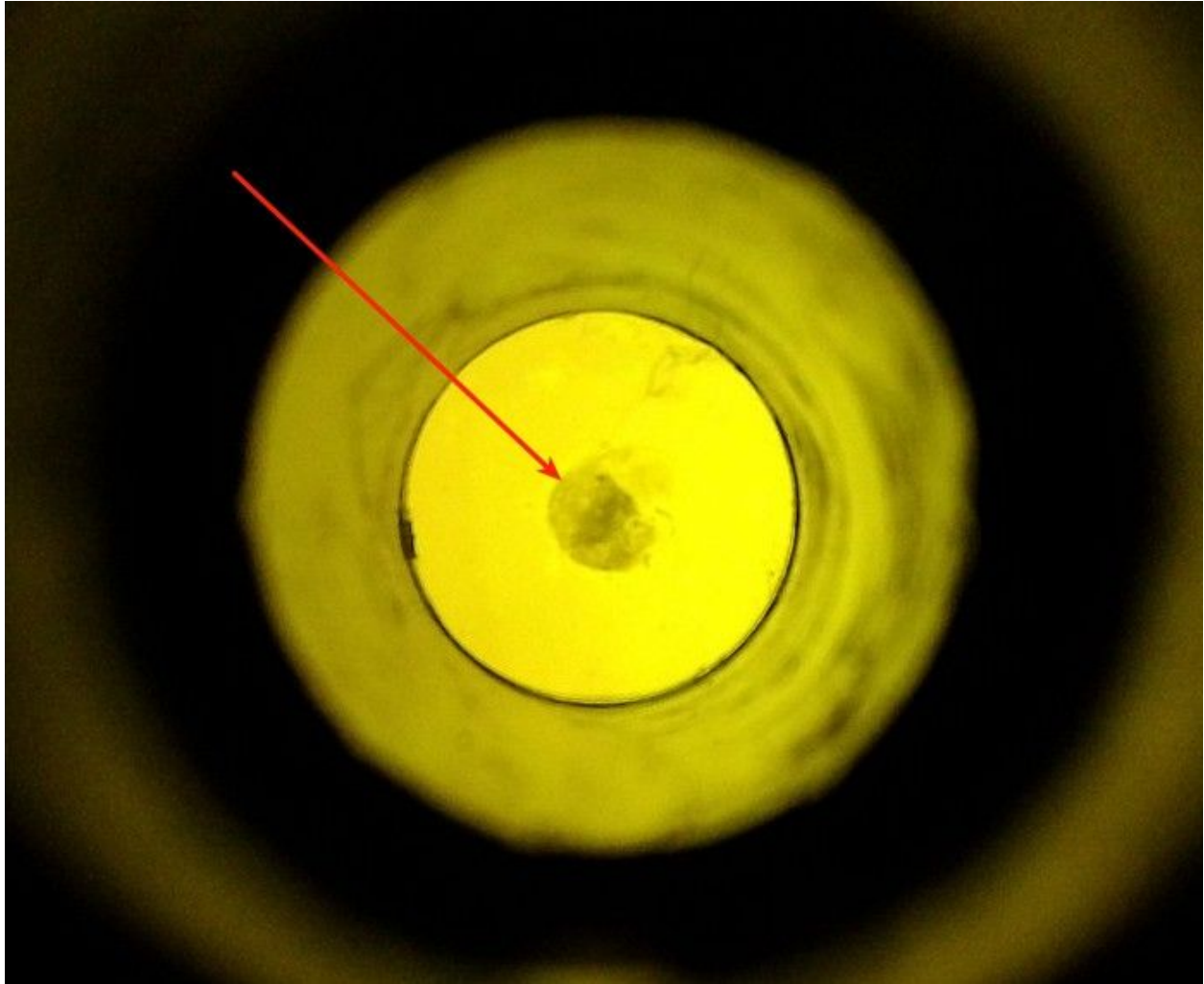
- Do not use unknown or unapproved materials in the laser cutter. If you are not sure talk to a laser support team member
- Never operate the machine with the lid or any of the panels open
- Always check the mirrors and the lense before and after your cut
- Monitor the laser head as well as amp meter during operation

## Makerspace Etiquette

- Do not talk to or distract a person that is operating a sensitive equipment
- Leave the area you are working in cleaner than when you arrived
- Do not leave a machine running unattended. This include any CNC machines, especially laser cutter
- When you learn something interesting about a tool, share your knowledge with others
- Do not do your design work on dedicated computers to run particular equipment such as CNC machines and laser cutter -- unless it is a minimal shape for testing

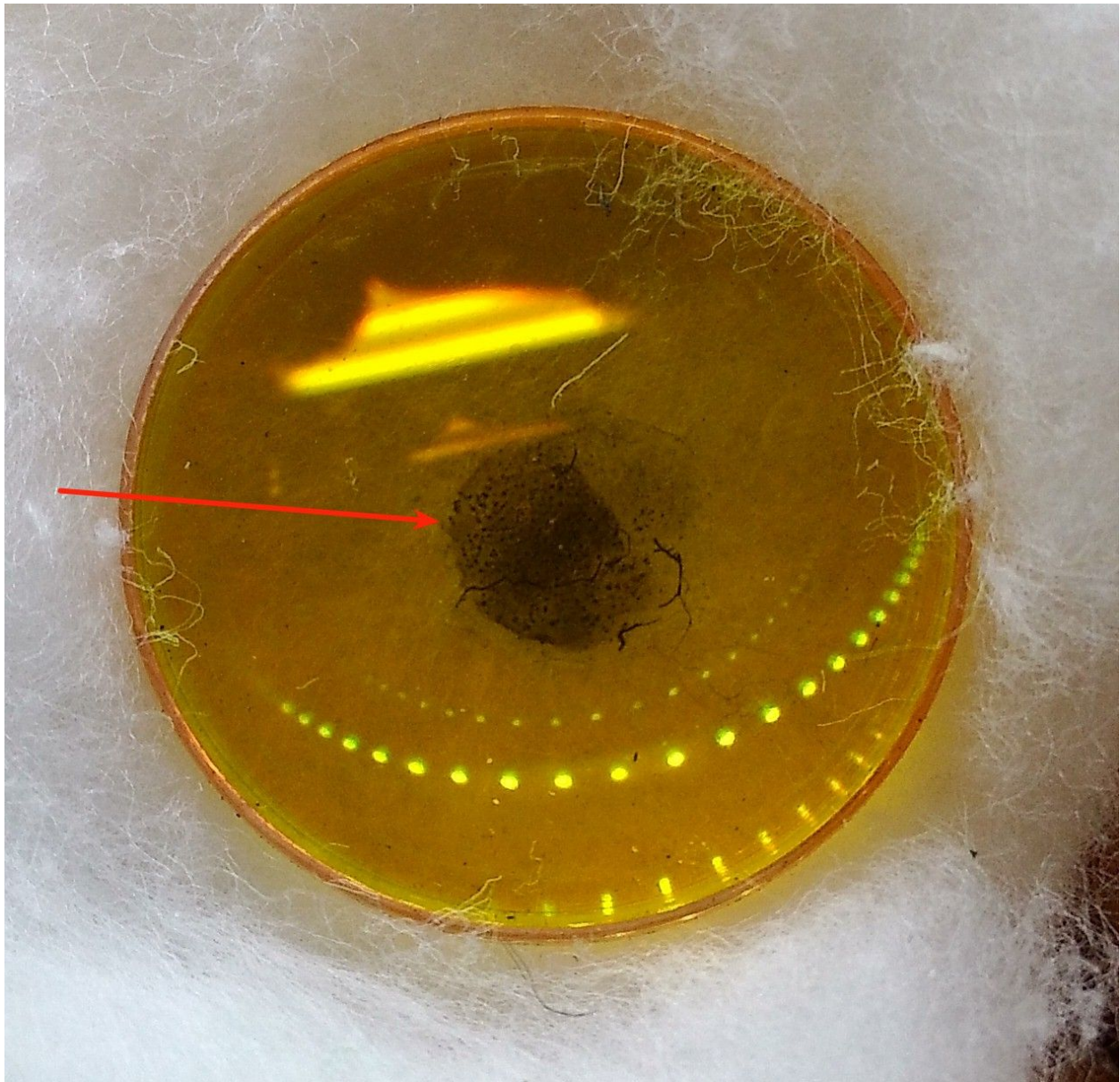
## Checking the Consumables

The mirrors and lense in the laser cutter are relatively expensive consumables. That means that after repeated use a time will come when they will burn. However, we can significantly increase the life of our consumables by keeping them clean. When a burnt spot is formed on a mirror or a lense it will capture the heat from laser which in turn will degrade or destroy the part.



Visually inspect mirrors and lense before and after processing your job

If you notice that the any of the mirrors or the lense has a spot on them, contact someone from the laser support team to help you clean it.



## Approved Materials

Below are a list of materials that can be cut. Any material that can be cut, can also be etched.

- Wood (the more natural the better)
- Leather
- Acrylic
- Pressboard
- Cork

In addition to the above we can also laser etch the following materials

- Anodized aluminium
- Glass
- Ceramic
- Tile
- Marble



**Never laser an unknown or prohibited material**

Many materials produce extremely dangerous vapours that could hurt you or destroy the machine due to their abrasive quality. If you like to work with a materials that is not listed above work with someone from the laser support team to do the research to ensure it is safe. Do not believe everything you read online as there are a lot of misinformation about laser cutting.

## Prohibited Materials Reason

PVC	PVC Contains chlorine, will produce hydrogen chloride gas and can harm your body and the machine's optics!
Vinyl	Contains chlorine, will produce hydrogen chloride gas and can harm your body and the machine's optics!
PVC Foams	Contains chlorine, will produce hydrogen chloride gas and can harm your body and the machine's optics!
Foam Core	Modern foam core is usually made of PVC, so it contains chlorine, will produce hydrogen chloride gas; it also risks a flash fire
Styrofoam	Can flash fire
Polycarbonate or PETG	Does not cut. Read your label. Lexan is a trade name for polycarbonate. Plexiglas is a trade name for acrylic.
ABS	Gives off hydrogen cyanide
Polymer clay	Contains pvc.
Metals	Cannot be etched AND risk reflecting the laser beam back up into the laser



# Software

## CAM

In order to cut a design you need a vector drawing. For etching, a raster image can be used. Any design must be processed in RD Works Laser CAM software. You can obtain this windows only software online or at makerspace.

## CAD and Vector Graphic Design

The RD Works software includes a basic CAD and drawing toolset, however, you do not have to use this feature. There are a number of drawing formats that can be imported into RD Works -- the most common exchange format being DXF. Here is a small sample of some of the programs that can be used to create a vector drawing and export it to pdf.

### 2D Drawing Applications

- Inkscape
- Corel Draw
- Illustrator

### CAD Applications

- QCAD
- Onshape
- Fusion 360 or any other autodesk products

Once your drawing is in RD works you can choose from any of the following operations

#### Cut

This operation will turn on the laser within the power range specified and follows all the paths in your vector drawing. Preference will be given to the elements inside an enclosed contour.

#### Scan

The scan operation is used to etch a raster image or a vector graphic onto wood. If you choose a vector graphic that has two enclosed contours this operation will etch the area between them.



## Dot

This is a useful operation if you want to mark the outline of a shape quickly without cutting or scanning it. You can specify the distance between the dots and the laser will pierce a hole at the location of each dot.

## What to bring

When you come to lasercut something, you should bring

- Your notes
- Your own material to cut (unless using scrap pieces)
- Your design

## Turning On

- Turn on chiller - confirm setting to 24C
- Plug in water pump
- Let cooling system (pump and chiller) run for 2 minutes before laser operation
- Ensure cutting bed is clear of obstructions (do NOT lay your material before turning the machine on)
- Turn on machine key
- Turn on the notebook (password is 4makerl0ops#)



**Do not lay your material or weights on the laser cutting bed before turning on the machine!**

Immediately after turning on the laser cutter the machine will home the laser head and then will attempt to move back to the last known zero coordinate -- which could be anywhere on the table.

## Preparing to Run

- Check mirrors and lens for imperfections - if dirty contact a Laser Support Team Member
- Place material to be cut square on laser cutter bed - material should be flat to surface
- Use control interface arrows on machine to position laser at top right of object cutting area
- Press "Origin" on control interface

- Set focal depth based on material thickness - Press Z on control interface and adjust bed height
- Press escape to go back to main menu
- Turn on ventilation system (switch on top of vent cabinet)
- Ready to cut - confirm laser is in position and “origin” or “zero” has been set there
  - Note: you can press ESC on the main menu to send the laser back to zero
- Always be ready to press pause or emergency stop



**Do NOT use the autofocus!**

The autofocus systems on most lasers including ours are known to fail and can cause significant damage to the laser. Take a few seconds to set your focal distance carefully by manually adjusting the Z height. Feel free to do a few small test cuts until you are satisfied with the cut quality.

## Cutting

- Open RDWorks software
- Draw a simple shape and do a test cut first
- Import your drawing
  - DXF is the most common format for importing your drawing
  - You can import from flash drive or you can email your drawing to [thelaserloops@gmail.com](mailto:thelaserloops@gmail.com)
- Select all objects (CTRL+A) and check the size of object to be cut
  - If you need to resize, first lock proportions and then set the size in **mm**
- Set min and max power (double click command string)
  - Do not use more heat than necessary to cut your material
- **NEVER** set max power above 60% -- our laser tube and power supply will be at its full capacity at 60%
- Set cut speed (see Material Setting Guide, and update it)

## Turning off and Clean Up

- Use the shop vac to clean any debris left on the cutting bed or inside the enclosure to remove fire hazard
- Return the laser to the top right corner and press origin before turning it off
- Turn off the laser by turning the key back to off position
- Turn off the fan, chiller and unplug the pump
- Take a moment to sort off cuts, mark any material that is yours
- Return the key to the laser toolbox

## Workshop Notes

- What is the difference between raster and vector images?
- How can the laser cutter process raster images?
- Make a simple drawing in your favorite vector or CAD program
- Export your drawing to DXF
- Select a material to cut or engrave

## Useful Resources

- [SarbarMultimedia](#) on youtube has some very informative videos. However, do not try everything that he does! Remember this is a shared equipment.
- Sawmill Creek Forum (<http://www.sawmillcreek.org>) is a very supportive community of professionals. There are some very knowledgeable members in their community who are happy to answer questions about laser cutting
- [www.instructables.com](http://www.instructables.com) has many laser cutter projects
- <http://www.thingiverse.com> has a large repository of open source laser cut designs

## Feedback

If you have any questions or feedback feel free to post it on our forum

<https://community.kamloopsmakerspace.com> or email us at [info@kamloopsmakerspace.com](mailto:info@kamloopsmakerspace.com)

Thank you!

## Cut Setting

Material	300dpi raster etching speed/power	600dpi raster etching speed/power	Vector Cutting speed/power

## Cutting Focus Distance

Thickness	1mm	2mm	3mm	4mm	5mm	6mm	7mm	8mm	9mm
Distance									