

Laboratory Specific Standard Operating Procedures

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*Please complete this form, save and add to the group WIKI, and print a hard copy for the
Laboratory Chemical Hygiene Plan (LCHP) after review by the PI.*

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Room & Building: 296 Linus Pauling Science Center

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Section 1: Brief Title: General use of Universal Laser System VLS3.50 50W CO2 Laser (Check One)

Process

Hazardous Chemical

Hazard Class

Section 2: Describe Process, Hazardous Chemical or Hazard Class.

The Universal Laser System VLS3.50 is a 50W CO2 laser used to cut or engrave a variety of materials including wood, some plastics and paper.

Section 3: Potential Hazards.

Depending upon the material being cut and the power being used, there is a possibility of a fire starting within the machine. Metals should not be used in the laser cutter, as they can spark and deposit debris on the laser optics which will damage them. Vinyl should not be cut/etched/engraved as it releases chlorine gas which is not only toxic, but will also severely damage the instrument. Avoid looking directly at the laser as it cuts, as the light it gives off when etching/cutting/engraving certain materials is very bright and may hurt one's eyes.

Section 4: Personal Protective Equipment.

While operating the instrument, the operator needs to wear mandated personal protective equipment include gloves, a lab coat and eye protection (safety glasses or goggles).

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Section 5: Engineering Controls.

When cutting/etching/engraving materials that may be flammable, ensure that the exhaust is on.
Tape down loose fiber/paper edges with painters tape. The edges of such materials are prone to catching on fire.

Section 6: Special Handling and Storage Requirements.

Before Use:

Check the optics located in the Z-axis cutting arm for debris. Use the provided cleaning solution and Q-Tip to gently, but thoroughly clean the surface. Check the optic located in the back left corner for debris. Gently but thoroughly clean the surface.

NEVER deliver the cleaning solution over the inside of the machine. It contains acetone and will damage the machine.
Ensure that the optic not currently in use is in it's plastic bag and located safety inside the provided padded box.

After Use:

Check both optics for debris and gently but thoroughly clean both.

!!!SEE THE ATTACHED SHEET FOR A LIST OF MATERIALS THAT CAN AND CANNOT BE CUT/ENGRAVED/ETCHED!!!

Section 7: Spill and Accident Procedures.

In case of fire:

- If you notice a small flame on your material, press PAUSE on the machine, allow the head to clear the flame, open the lid and put the flame out.
- There is a fire extinguisher located near the door by the laser cutters. This should be used when the material cannot be safely removed from the machine.

Section 8: Decontamination Procedures.

General Guidelines – Help the contaminated person and evacuate the spill area. Avoid breathing any vapor and eliminate a source of ignition if the chemical is flammable. Confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g. use caution tape and barriers). Report to Supervisor and EH&S for all spills and accidents. Request immediate Oregon State University EH&S response: 737-7000. Report fire or other emergencies: 911.

Section 9: Waste Disposal Procedures.

Consult with the Oregon State University EH&S (Facility Services: 737-2969) for more information about waste disposal procedures.

Section 10: Material Safety Data Sheet Locations.

Online MSDS can be accessed at <http://oregonstate.edu/ehs/sds>

Section 11: Protocol(s):

To Print

1. Select the entire item
2. Change line weight to 00mm, the smallest line weight possible. This enables to the printer to vector cut.
3. Change the color of the lines from white to any other color. Red, blue, ect. Multiple colors can be used on one drawing, which can then be assigned to different power, speed and PPI settings.
4. Select [Print]
5. Change printer settings to "Laser" in the drop down menu.
6. [Properties]
Assign powers, speed, ect per line color. Change thickness of material.
Vector offers smoother line.
Skip will cause the printer to ignore a specific color.
Power/Speed/ect is experimentally determined for different materials. Use of the Materials Database is not recommended.
PPI: Laser shots per inch. Higher PPIs lead to an increase in heat on a material and can damage your substrate. Low PPI will cause perforation, not cutting. 200-300 PPI is the recommended start setting. Use a higher PPI with a smaller optical spot size.
z-axis is the thickness of the material. Be as accurate as possible.
Depth of the image/features is a function of power to speed.
Click [Set] to set changes. You can save settings by clicking the [Save] button.
7. Image Density. Image density defaults to 5. When printing using vectors, a higher DBI means more control. The use of Windows OS limits it, but begin by trying the highest image density, unless you are using a graphic as it was slow down the print. Sometimes, higher image densities can caused images to be distorted or warped.
Click [Apply] to apply settings. You can also [Load] previously saved settings here.
8. Go the lower right hand control panel of the desktop. Click the red box.
Activate the engraver. An LED on the printer means it is on. When the play button on the printing screen goes from grey to green, it is ready to print. To move the start point, open the printer case to view the red dot, showing you where the print will be made, starting on the upper left corner. Click the [Focus] button on the computer screen and click on the image of the printer table to move the red dot where desired. Click on the [Relocate Button] and select [To Pointer] below to move the dot.
9. Close the lid of the printer and press the green play button to print.

Laser Maintenance

A can of air can be used to dry the optics.

Keep focusing tools and additional lenses protected and covered in their padded box at all times.

Inspect the optics every 8 hrs of use and before and after you use the instrument.

To Inspect & Clean

1. Turn off the machine!
2. Remove the lenses carefully using the finger screws. Inspect every lens for a white film.
3. Use canned air to blow debris off the lenses.
4. Using provided cleaning fluid, use 2-3 drops per lens and gently roll the provided Q-tips to clean away the film/dirt. The cleaning solution contains acetone, DO NOT let it drip into the machine.
5. Dry the lens with the lens cloth or with canned air.
6. Remove the mirror & clean it as well.
7. To clean the entry potion (back left of the machine) apply the solution to the Q-tip. DO NOT remove it.
8. Clean bearing race with Q-tip
9. To clean bearings, apply simple green to bearings and clean. NO LUBRICATION NEEDED.

- Below are details of the materials that are commonly cut in Room 36:

| Materials that can be cut and engraved/etched | | | |
|---|--------------------------|-----------------------|--|
| Material Category | Material | Maximum cut thickness | Notes |
| Plastic | Acrylic | 1/4" | Remove any protective paper or plastic layers that came on the material. Apply transfer tape to the BACK of the material to protect from smoke residue when vector cutting. Transfer tape on the front surface provides additional protection to the top surface when raster engraving. Dampening the transfer tape with water before cutting is useful (particularly for thicker materials) to prevent it from burning. |
| | Acrylic (mirrored) | 1/4" | Cut with the mirror facing UP. Apply transfer tape to BOTH sides of the material. Dampening the transfer tape with water before cutting is useful (particularly for thicker materials) to prevent it from burning. |
| | Mylar film | 0.010" | Cuts well, usually needs a little frame to prevent it from curling up and floating away. |
| | PHBV | 1/4" | Bio-polymer material only used by students in Sarah Billington's research lab. Composite of bio-polymer in burlap. Smells weird. |
| | PTFE film | 0.010" | Cuts well, some smoke residue on the back surface. |
| | Styrene | 1/16" | Smokes and results slightly raised edge when cut. Apply transfer tape to both sides of the material to prevent smoke from sticking to the surface. |
| Wood | Basswood | 1/4" | Cuts nicely with light brown edges. Engraves/etches beautifully with a lot of color contrast. Apply transfer tape to both sides of the material to protect from smoke residue when vector cutting, but only to the back side when also raster engraving (tape residue melts into the wood a bit). |
| | Birch ply (high density) | 1/4" | Cuts nicely, cut edge will be dark brown. Apply transfer tape to both sides of the material to protect from smoke residue when vector cutting, but only to the back side when also raster engraving (tape residue melts into the wood a bit). |

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| | Duron/ Masonite | 1/4" | Use the Duron available at Room 36 and the PRL--Home Depot MDF chars significantly and has more outgassing. Duron cuts and etches well though the cut edge will be a bit charcoal-y. The material is sometimes supplied in dark brown, sometimes it is a lighter tan. |
| | Hardwood (walnut, maple, etc) | 1/8" | Cut very nicely. Apply transfer tape to both sides of the material to prevent smoke from sticking to the surface. |
| | Meranti/ Luana plywood (lower density plywoods) | 1/4" | Avoid exterior grade plywood. The adhesives used in these materials are dangerous when burned. Meranti cuts fine, cut edge will be dark brown. Apply transfer tape to both sides of the material to protect from smoke residue when vector cutting, but only to the back side when also raster engraving/etching (tape residue melts into the wood a bit). |
| Paper and Cardboard | Chipboard | 1/8" | Cuts very nicely and quickly. Vector engraved marks tend to be more visible than rastered markings. |
| | Corrugated Cardboard | 1/4" | Cuts nicely, but is flammable—watch carefully. |
| | Foam core | 3/16" | Very flammable material—watch carefully. Space parts from the material edges and each other by approx. 1/4" in your file. Inner foam layer melts away from cut edge of paper. |
| | Mat board | 1/16" | Cuts nicely with slight browning of edges. Apply transfer tape to both sides of the material to prevent smoke from sticking to the surface if finish is important. |
| | Paper | -0.015" (then use Mat Board setting) | Cuts very quickly and cleanly with minimal smoke residue on the back surface. Some art papers will turn a lighter color when engraved for an interesting effect. Can be vector engraved to create a fold line. |
| Fabric | Cotton | -0.030" | Cuts quickly and cleanly with some minor smoke residue that shows on the back of lighter materials. |
| | Ballistic Nylon | 0.020" | Cuts with a clean sealed edge. |

| Materials that can be engraved/etched but NOT cut (Material thickness up to 4" can be engraved on the top surface) | | |
|---|---------------------------|--|
| Material Category | Material | Notes |
| Metal | Anodized/painted aluminum | The laser vaporizes the coated layer to show the bare metal. |
| Glass | Glass | The laser doesn't actually etch the surface, but creates tiny fractures that create a frosted appearance. DAMPENED TAPE??? Consider using the vinyl cutter to create a sticker mask and using the sand blaster at the PRL to create beautifully frosted glass. |
| Stone | Marble, granite, etc. | Turns white when lightly raster etched. Typically filled with paint to highlight the etched area. |

| Materials that CANNOT be cut OR engraved/etched | | |
|---|------------------------------------|--|
| Material Category | Material | Notes |
| Plastic | PVC/Vinyl | Releases poisonous chlorine gas, which is dangerous and very bad for the machine |
| | Delrin/Acetal | Releases poisonous formaldehyde gas, flammable without air assist |
| | Polycarbonate | Releases dangerous fumes and cuts very poorly |
| | High- and low-density polyethylene | Melts into a gooey mess and cuts very poorly |
| | ABS | Melts/burns and does not cut well |
| | Polystyrene foam (pink foam) | VERY flammable, melts a lot |
| Composites | Fiberglass | Releases fumes, doesn't cut |
| | Carbon fiber | Releases fumes, doesn't cut |
| | FR4 (circuit boards) | Releases fumes, doesn't cut |