Universal Laser Systems (ULS) Guide for PCC MakerLab

The PCC Sylvania MakerLab has Universal Laser Cutters for use by students, staff and faculty. This is **level 3 equipment**, which means extensive training and demonstration of safety proficiency is needed to operate the equipment unsupervised. The main safety concerns with operating a laser cutter are **releasing of toxic fumes, starting a fire or harm to eyes**. This guide will provide you with basic information and guidelines on how to safely operate the laser cutters.

Summary of safety information:

- Users must attend staff led laser training, see calendar at https://www.pcc.edu/maker/ for current training dates

- Release of toxic fumes is prevented and mitigated by:
    - Using only approved materials
    - Turning on ventilation while operating the laser
    - Watching the laser operation
    - Allowing 1 minute of exhaust after the laser finishes operation

- Starting a fire is prevented and mitigated by:
    - Using only approved materials
    - Understanding settings for materials in use
    - Watching the laser operation
    - Pausing laser if flame starts
    - Using welding glove or fire blanket if flame continues

- Harm to eyes is prevented by
    - Keeping the lid closed while using the laser
    - Not tampering with or overriding safety locks and mechanisms
    - Not staring directly at laser
    - Not using highly reflective materials

- Additional safety precautions:
    - Always sign-in and alert a staff member when you will use the laser equipment.
    - If needing to leave laser room, users must pause their job or pass operation to another laser trained individual
    - Fire prevention in order: observance, welding gloves, fire blanket, fire extinguisher, fire alarm

Introduction:

- You will need to use a **CAD (computer aided design)** and **CAM (computer aided manufacturing)** software with the lasers.
    - We train users to use Adobe Illustrator as the CAD with our lasers; other methods may be possible, but maybe not as easily
    - The CAM software is Universal Control Panel and is specific to the brand of lasers. It is admittedly not user friendly and will take a few times to get proficient.
    - The laser machines also have a few control buttons, but just for a few operations; most operation happens through the software.

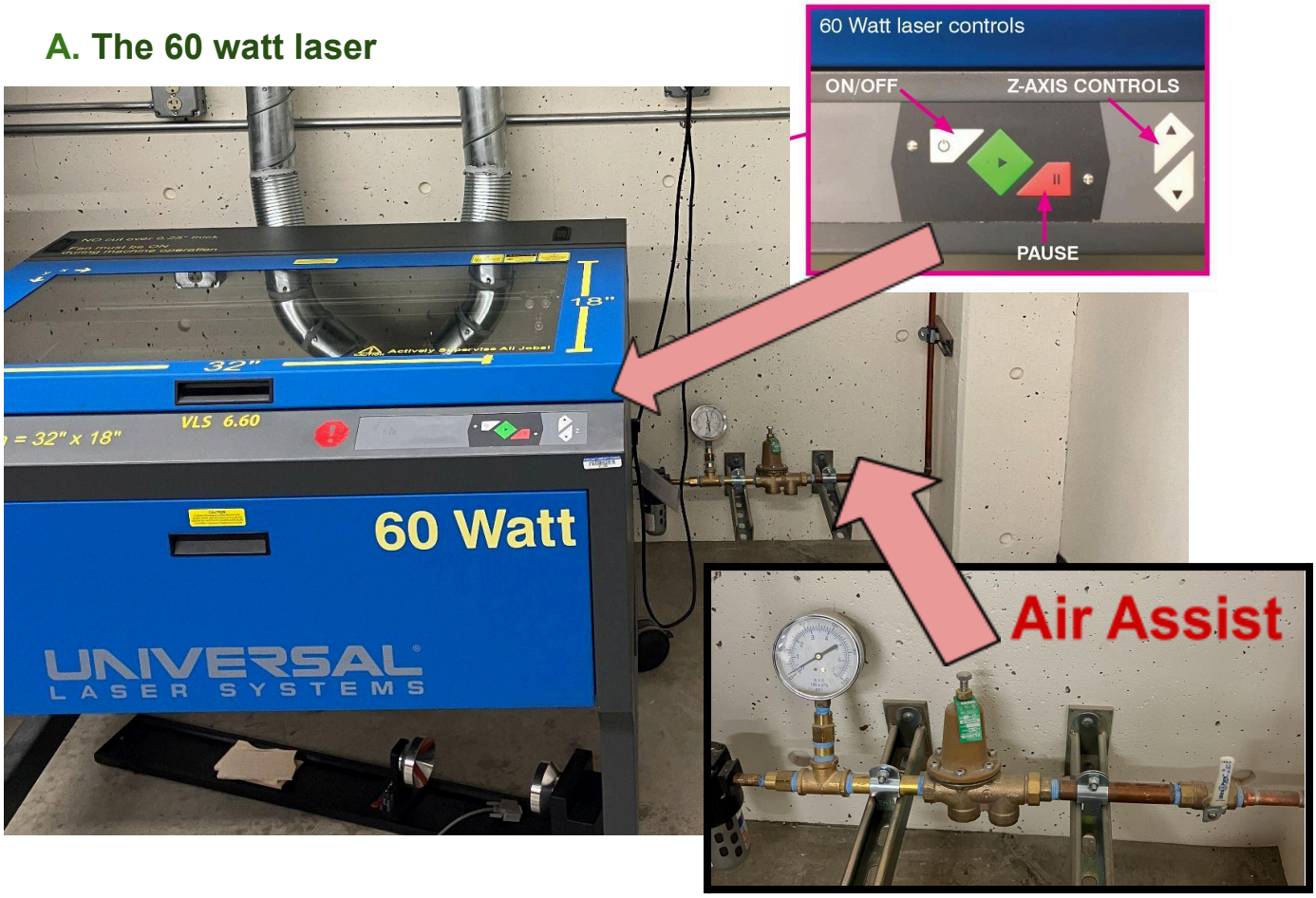
- The laser can perform a few functions:
    - **Cut** – the laser completely burns through the material
    - **Engrave** – the laser burns through the material only partially
    - **Mark** – the laser only discolors the surface but no or hardly any material is burned away

    - There are other terms that you may hear or use, such as etch, score, dark mark, etc. They are also used in industry. We tend to only use the terms cut, mark and engrave for the sake of simplicity and common language and understanding.

- The laser has two movement patterns:
    - **Vector:** The laser moves in a path that is determined by the shape of the design. Depending on the settings, with a vector, a laser can cut (burn through the material completely) or engrave (burn through the material slightly) or mark (discolor the surface)
    - **Raster:** The laser moves back and forth quickly on the x-axis while moving down line by line along the y-axis. While moving, the laser will pulse to create the desired design. Depending on the settings, this will produce a light, dark, shallow, or deep engraving.

Universal Laser Cutters

A. The 60 watt laser



Capacity:

The 60 watt laser has a cutting area of **32" x 18"** and can cut material that is a maximum of a **1/4 inch thick**.

Ventilation:

- This laser is connected to the ventilation system. The switch is behind the 30 Watt laser. The switch must be turned on before you run the laser. The ventilation takes about 2 minutes to really start working.

Air Assist:

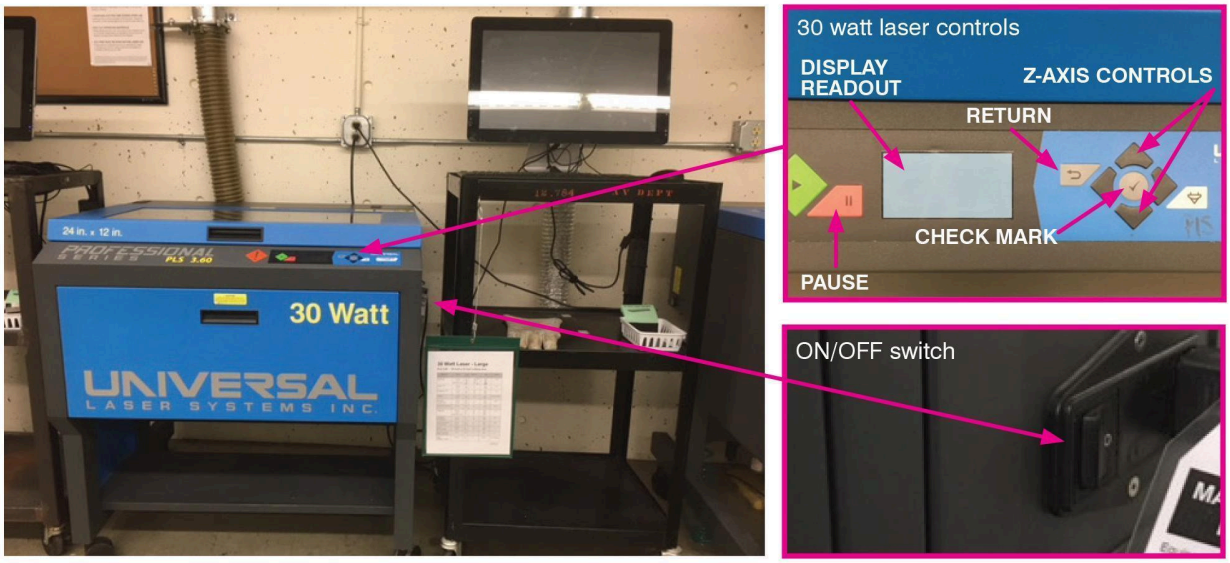
- The 60W laser unit has an air assist feature, it must be turned on before operation of the laser or the lens will become damaged quickly and is costly to replace.
- When the valve is vertical it is off (0 PSI)
- When the valve is horizontal it is on (40-50 psi)
- Air assist blasts air down the cone away from the lens. This keps soot and smoke from clouding the lens thereby giving cleaner and more precise laser function.

Controls:

The 60 watt laser machine controls are on the front of the machine.

- To turn on, press the white on/off button.
- To turn off, press and hold the white on/off button until the machine powers down.
- If you need to stop the laser in the middle of a cut, you can:
    - lift up the lid which will pause the machine OR
    - press the red pause button on the control pad OR
    - press pause on the computer interface in the UCP software
- To adjust the z-axis using the machine, use the up/down arrows on the control panel.
- **However, most focusing happens in the CAM software. To focus the laser, the z-axis is adjusted by raising or lowering the cutting bed. The laser is already calibrated to the honeycomb bed. To adjust for the thickness of the material, use the settings and enable the Z-axis in the CAM software and the machine will move the Z axis to the correct depth.**

B. The large 30 watt laser



Capacity:

- The large 30 watt laser has a cutting area of **24" x 12"** and can cut material that is a maximum of an **1/8 inch thick**.

Ventilation:

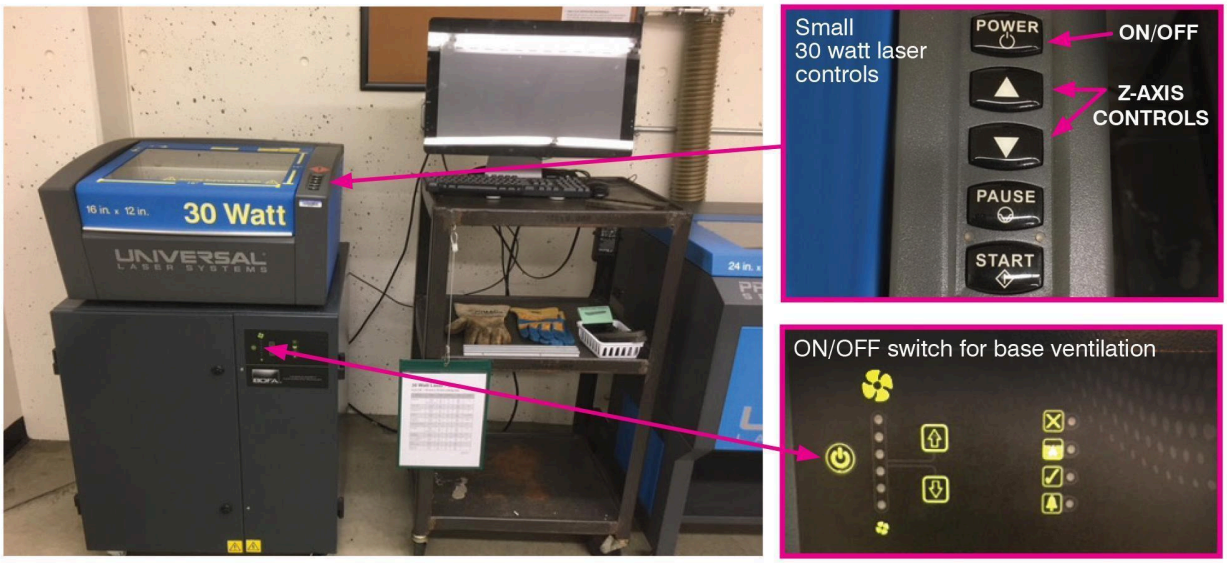
- This laser is connected to the ventilation system. The switch is behind the 30 Watt laser. The switch must be turned on before you run the laser. The ventilation takes about 2 minutes to really start working.

Controls:

- To turn on and off, press the switch on the right side of the laser cutter.
- If you need to stop the laser in the middle of a cut, you can:
    - lift up the lid which will pause the machine OR
    - press the red pause button on the control pad of the machine OR

    - press pause on the computer interface on the UCP software
- To adjust the z-axis using the machine, select Z on the display readout and press the check mark. Then use the up/down arrows on the keypad to adjust the height of the cutting bed.
- **However, most focusing happens in the CAM software. To focus the laser, the z-axis is adjusted by raising or lowering the cutting bed. The laser is already calibrated to the honeycomb bed. To adjust for the thickness of the material, use the settings and enable the Z-axis in the CAM software and the machine will move the Z axis to the correct depth.**

C. The small 30 watt laser



Capacity:

- The small 30 watt laser has a cutting area of **16" x 12"** and can cut material that is a maximum of an **1/8 inch thick**.

Ventilation:

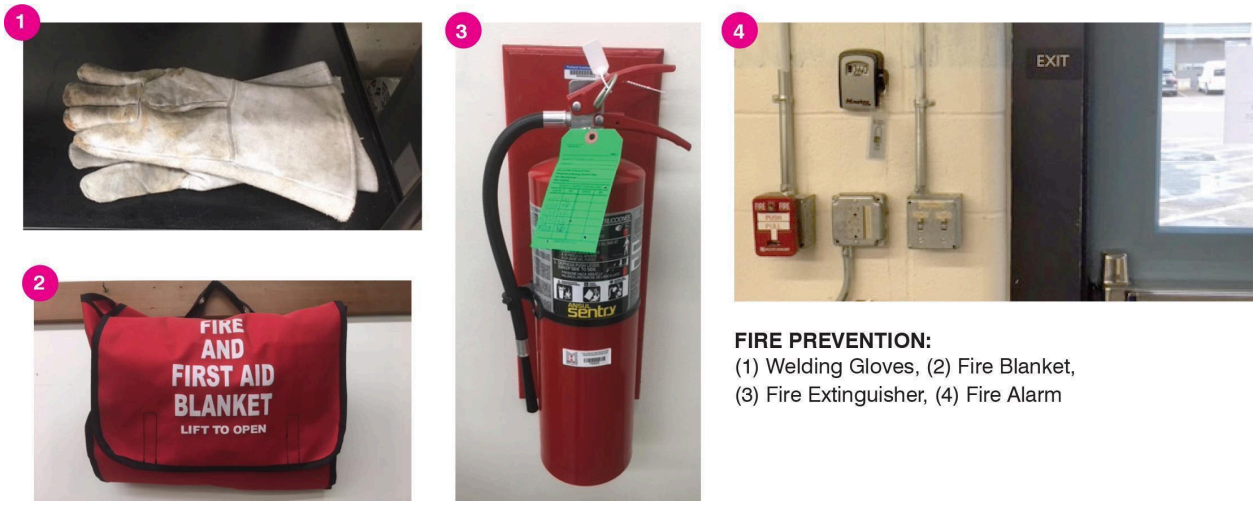
- This laser is **not** connected to the building ventilation system.
- The laser sits on top of a portable ventilation system. **The switch for the exhaust AND the ventilation base must be turned on before using the laser.** The on/off button is located on the front of the ventilation base.

Controls:

- To turn the laser on and off, press the power button on the top of the laser.
- If you need to stop the laser in the middle of a cut, you can:
    - lift up the lid which will pause the machine OR
    - press the pause button on the top of the laser OR
    - press pause on the computer interface.
- To adjust the z-axis, use the up/down buttons on the top of the laser.

- **However, most focusing happens in the CAM software. To focus the laser, the z-axis is adjusted by raising or lowering the cutting bed. The laser is already calibrated to the honeycomb bed. To adjust for the thickness of the material, use the settings and enable the Z-axis in the CAM software and the machine will move the Z axis to the correct depth.**

Fire Prevention



FIRE PREVENTION:
(1) Welding Gloves, (2) Fire Blanket,
(3) Fire Extinguisher, (4) Fire Alarm

The laser room in the Sylvania MakerLab contains safety and fire prevention equipment for your use. **Your responsibility is to watch the laser until the operation is completely finished.** Make sure to check that your laser settings are correctly entered before beginning a cut. Sometimes material will ignite during the lasering process. You need to pay attention and follow these steps in reacting to a fire in the laser cutter:

1. If a flame that is larger than a candle flame develops and begins feeding on the material, you should calmly pause the machine and smother the flame with a welding glove.

2. If the fire is too large to extinguish with a glove, and it is safe to do so, grab the fire blanket, and smother the fire.

3. If the fire is too large to extinguish with a fire blanket, and it is safe to do so, use the fire extinguisher to put out the fire. **ONLY DO THIS AS A LAST RESORT.** The fire extinguisher will damage the laser.

4. **If the fire is out of control:**
    a. Leave the room and close the doors if possible.
    b. Pull the fire alarm at the front door to the MakerLab (AM101).
    c. Evacuate the building.
    d. Call 911.
    e. Call Public Safety (x4444)

NOTES:

- There are welding gloves located at each laser station.
- There is a fire blanket located at the back of the room.
- There is a fire extinguisher located at the back of the room.
- There are two exits, one to the Machine Shop, one to the electronics room
- The fire alarm is located at the front door to the MakerLab (AM101).

Materials

- It's important to be cautious of what materials are being used in the laser cutter. **Certain materials can release toxic fumes when cut with a laser. The MakerLab maintains a list of materials approved for use in our lasers.** This list is available in the MakerLab and we will periodically update it to include new materials.

- If you are interested in trying a new material that is not on our list, **discuss the project with the MakerLab staff and provide a sample of the material and links to research on using the material in a Universal Laser System laser BEFORE you start the project.** We will also research the material and determine if it is safe to cut or etch and will determine optimal settings for material and add it to our database.

- Some materials reflect light differently when being cut or engraved. For example, acrylic reflects more brightly than wood when being cut. **Be cautious when using these materials with the laser; when it is reflecting brightly do not stare directly into it.**

- Materials from various manufacturers may be labeled with a dimension, such as 1/8 inch, but the actual measurement may vary slightly. **Even if 1/8 inch material has previously been used, you should focus the laser to the material you are using using the Z-axis settings in the ULS software.** Use calipers to measure your material.

- **Some materials have sharp corners and splinters or can be hot after cutting. You should be careful when handling material that has just been cut and use gloves and sandpaper when necessary.**

- The MakerLab provides scrap material for use in the lab. If you need to purchase material, please ask the MakerLab staff for approved vendors or purchase from PCC bookstore. **DO NOT** use salvaged material or purchase plywood from the hardware store. We have suppliers that provide material specifically made for lasers. Inspect your material before purchasing to make sure it is not overly warped.

- In some cases, it's necessary to keep material flat on the cutting bed. Steel weights are used for this purpose and are labeled specifically for the laser they are to be used in. **Be cautious of the path of the laser head when using these weights. The laser head will not stop before it hits an object in its path and may cause damage to the machine.** Only use 1/8 inch high weights in the 60 watt laser. 1/2 inch high weights are used in both 30 watt lasers.

Operation

- In order to maintain the lasers in good working order, the laser lens need to be periodically inspected or cleaned before and after cutting to prevent buildup of soot on the lens. **You should not do this. The MakerLab staff are trained in how to do this safely and will be responsible for cleaning and inspecting laser lenses.**

- Your responsibility is to watch the laser from the start to finish of the operation. You may consider working with a trained partner or dividing your project into smaller cuts if you are working on a large project.

- **It is only acceptable to turn your back on or walk away from an operating laser if you have already observed the cutting with the same materials and same settings. Only do so briefly, and keep checking on the operation.**

- **It is NOT acceptable to leave the room, even if your cut or etch will take a long time, or even if you have been doing the same material and settings several times. Small mishaps can happen; you need to be nearby when they do, so they do not become large mishaps.**

- The MakerLab staff can help you optimize your project so you can use your time efficiently. We have a computer dedicated to file setup in the laser room, but other computers throughout the lab can be used as well. Make sure your file is completely ready for cutting before you sign up for time on the laser.

- This is a shared lab. Please be respectful of people waiting to use the lasers after you and **do not** begin a cut or etch that will go over your scheduled time.