**GUIDELINES FOR WORKING WITH LASER CUTTERS**

Laser cutters are modern computer-controlled tools for making precise and detailed cuts on a variety of materials. To ensure that lasers are used safely, PSU EHS has a few requirements for all laser cutter users.

**REGISTRATION & INSPECTION**

* PRIOR TO PURCHASE, check with the manufacturer to verify that the laser cutter is registered with the FDA, which has regulatory authority over lasers and laser devices under 21 U.S.C. 360. Unregistered lasers shall not be used.
* Laser cutters typically contain a Class IIIB or IV laser and shall be registered with EHS. To register your laser, use this link: [EHS Website](https://ehs.psu.edu/laser-safety/laser-safety-program-forms)
* Each laser should be inspected annually using the Laser Self Inspection Form found on this section of the [EHS Website](https://ehs.psu.edu/laser-safety/laser-safety-program-forms).
* Laser applications should be reviewed with EHS prior to installation.

**TRAINING**

* Laser safety training is required for all laser cutter users. The training is available at: <https://psu.csod.com/samldefault.aspx?returnurl=%252fDeepLink%252fProcessRedirect.aspx%253fmodule%253dlodetails%2526lo%253d51412f6c-c359-4149-abdc-6fe0e6f9fea2>
* Laser cutters are considered Medium-Hazard equipment under the Machine Shop Safety program. Equipment-specific training must be provided to each user of the laser before they can use the laser. A form to document this training is available on this section of the [EHS Website](https://ehs.psu.edu/laser-safety/laser-safety-program-forms)
* A Standard Operating Procedure (SOP) must be developed for the laser cutter, and review of it is part of the equipment-specific training. A form to aid in your SOP creation is available on this section of the [EHS Website](https://ehs.psu.edu/laser-safety/laser-safety-requirements-guidelines)
* Employees who use any cleaning products to clean, lubricate, or for any other purpose in the work area must also complete the Hazard Communication Training. This can be taken as part of the Laboratory Safety training <https://apps.opp.psu.edu/ehs_training/course_list.cfm?page_action=ViewCourses&category=23>, or as a stand-alone training in the LRN (EHS – Hazard Communication) for non-laboratory areas <https://apps.opp.psu.edu/ehs_training/course_list.cfm?page_action=ViewCourses&category=41>.
* Fire extinguisher training is strongly recommended. Contact EHS to arrange a session for your work unit.

**LASER SAFETY**

* The laser itself is most likely infrared and invisible to the human eye. DO NOT LOOK INTO THE LASER!
* Understand what you can adjust on the cutter and how to do so properly for the material you are cutting.
* Eye protection that is laser-opaque may be required for use of laser cutters that do not adequately shield the laser.
* Laser signage is required on work area door if the system is not interlocked or an interlock is defeated, and is available on this section of the [EHS Website](https://ehs.psu.edu/laser-safety/laser-safety-resources)
* DO NOT MODIFY OR DISABLE ANY SAFETY FEATURES OF A LASER CUTTER.
* Some laser cutters are designed with a pass-through for materials that are larger than the cutting bed enclosure. Do not defeat the enclosure of a cutter that does not have this feature.
* DO NOT OPERATE WITHOUT ALL COVERS IN PLACE.
* The FDA has labeling requirements for laser devices. Do not remove these labels, and do not operate a device that lacks these labels.
* If you are the PI of a laser research lab and are using a laboratory-built laser cutter, or need to modify a commercially made laser cutter, please discuss this with EHS prior to disabling or modifying any safety features.
* Keep the unit out of direct sunlight, as this can affect the laser cutter’s internal sensors.

**FIRE SAFETY**

* **NEVER LEAVE AN OPERATING LASER CUTTER UNATTENDED!**
* We recommend having an “air assist” built into the laser cutter. This moves smoke and fumes away from the cutting head and into the unit’s exhaust ventilation system (see below), reducing the likelihood of fires and keeping the laser lens clean. More information on exhaust ventilation is below.
* Keep a fire extinguisher, appropriate for the materials you are cutting, attached to the wall between the laser cutter and the exit door. If you need assistance choosing a fire extinguisher, please contact EHS. Many laser cutter manufacturers recommend carbon dioxide (CO2) or other gas-containing extinguishers instead of dry chemical type extinguishers, so that using the extinguisher inside the laser enclosure does not foul the laser and mechanisms with extinguisher dust.
* Keep your laser cutter clean. Frequent vacuuming of the cutting deck and enclosure will reduce fire risk.
* Keep flammable materials (paper, solvents, etc.) away from the laser cutter.
* Freshly cut materials may be hot enough to ignite other materials. Allow materials to cool before handling. Handle hot materials with heat-proof gloves and set only on heat-proof surfaces until the material has fully cooled.
* Do not attempt to cut materials the laser cutter is not designed to cut.
* Do not stack materials inside the cutting area unless the laser is expressly designed for this function.
* Ensure that any potentially reflective surfaces (glass, metal, some plastics) are properly masked before cutting. This reduces the likelihood of a laser reflecting out of the enclosure and causing eye or other damage. This will also ensure crisper and less singed cut lines. Use only masking material approved by the manufacturer.
* Shut down or unplug a malfunctioning machine immediately!
* Laser cutters shall be plugged directly into a wall outlet, not into an extension cord.
* Keep water and other liquids away from the laser cutter, and do not operate if there is condensation in the unit.
* See the Fire Prevention program: <https://ehs.psu.edu/fire-prevention-and-protection/overview>

**MACHINERY SAFETY**

* Do not defeat the interlocks.
* Do not operate with lid open.
* For combination machines (laser cutters whose CNC heads can also accept conventional mechanical cutters or other devices), there may be additional safety concerns.
* The Lock-out/Tag-out process should be used on machinery that is malfunctioning, being repaired or adjusted, or otherwise not to be used. See the LOTO program: <https://ehs.psu.edu/lockout-tagout/requirements-guidelines>
* See the Machine Shop Safety Program: <https://ehs.psu.edu/machine-shop-safety/requirements-guidelines>

**AIRBORNE HAZARDS & EXHAUST VENTILATION**

* Exhaust from a laser cutter can contain a variety of toxic and unpleasant particulates and gases, including but not limited to carbon monoxide, volatile organic compounds (VOC’s), vaporized metal, etc. Laser cutters MUST be either vented to the outdoors (preferred) or ventilated through a filter system designed for that unit. Any filtration system that does not vent to the outdoors must be reviewed by EHS for approval prior to installation and use.
* EHS may require air testing to ensure that occupants of the workspace and building will not be affected by air contaminants from the laser cutter.
* When possible, get a Safety Data Sheet from the manufacturer of the material you plan to cut, as this can help predict ventilation needs.
* Using a filter requires keeping a logbook that includes preventive maintenance, inspections, and filter replacement schedules; it is also advisable to include in the logbook the materials used, user, and duration of each use.
* Changing filters may require special training and PPE. Using a filter instead of ventilated exhaust outside may also require a carbon monoxide or other gas or particulate detector – please contact EHS for assistance.
* Do not open the lid/hatch/enclosure until the laser has finished working and the automatic fan(s) have stopped.
* Do not use a laser cutter if the exhaust/filtration system is clogged or otherwise malfunctioning.
* See more information on ventilation and maintaining good air quality: <https://ehs.psu.edu/industrial-hygiene-exposure-recognition-control/overview>