ENVIRONMENTAL HEALTH & SAFETY
UNIVERSITY of WASHINGTON

LASER CUTTERS

Health and Safety Hazards

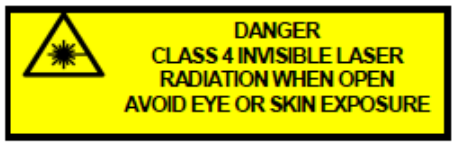
WHAT IS A LASER CUTTER?

A laser cutter is a cutting device which focuses a high energy laser beam onto a material resulting in a high quality and dimensionally accurate cut. These devices can cut, etch, engrave or drill various materials. They have become quite affordable and easy to operate, resulting in significantly expanded use by schools, hobbyists, small businesses, makerspaces and universities.

Laser cutters are normally fully enclosed systems that prevent laser operation unless the safety interlocked doors are fully closed. They typically contain a carbon dioxide (CO_2) laser that produces *invisible laser radiation* at a wavelength of 10600 nm in the infrared spectrum.

LASER CLASSIFICATION

Since they are fully enclosed and interlocked systems, laser cutters are normally low-risk, Class 1 lasers in accordance with *ANSI Z136.1 Safe Use of Lasers.* These devices are safe when used as designed, without manipulating the safety features, and are exempt from UW laser registration and other control measures.



However, the lasers embedded inside the enclosed system are often Class 3B or Class 4 lasers, which emit high energy laser beams capable of causing serious eye and skin injury if the beam is not contained within the device. Therefore, safety interlocks should never be bypassed without permission from EH&S's Radiation Safety team.

HAZARDS AND PRECAUTIONS

- Properly install and maintain the laser cutter according to manufacturer specifications.
- Use the specified filtration system or have a local exhaust system installed prior to use. Change filters according to manufacturer's guidelines.
- Train users in proper use of the equipment, including which materials are permissible to cut, cleaning the equipment, and emergency procedures.
- Always supervise the laser cutting or engraving process to ensure that combustible materials do not ignite.
- Keep the area around the laser cutter free of combustible materials, and have a carbon dioxide fire extinguisher nearby. Users should know how to use the fire extinguisher or get trained by EH&S.

Laser Light

- The invisible high energy laser beam can cause severe eye damage, including blindness and serious skin burns. The doors are interlocked such that the laser beam will be disabled when the doors are opened. This will completely contain the laser beam under normal use.
- Improper use of the controls and modification of the safety features may cause serious eye injury and burns.

- **DO NOT** modify or disable any safety features of the laser system.
- **DO NOT** operate the laser unless all covers are in place and interlocks are working properly.
- **DO NOT** look directly into the laser beam.

Fire

- The high intensity laser beam can produce extremely high temperatures and significant amounts of heat as the substrate material is burned away while cutting.
- Some materials can catch fire during cutting operations creating fumes and smoke inside the device.
- Dirt and debris may cause fire and a poor quality cut or mechanical component failure.
- It is important that users remain with the laser during operation to ensure that any flare-ups or flames are properly contained and extinguished.
- Obtain the safety data sheet (SDS) from the material's manufacturer when handling or processing the materials.

- **DO NOT** use materials that are highly flammable, explosive or produce toxic byproducts.
- **DO NOT** remove material from the cutting bed before it has cooled.
- **DO NOT** leave a laser cutter operating unattended.
- **ALWAYS** clean up clutter, debris and flammable materials in the laser cutter after use.
- **ALWAYS** keep a properly maintained fire extinguisher nearby.

Air contaminants

- Laser cutters will generate fumes, vapors, particulates and metal fumes from substrate that can be highly toxic (plastics and other combustible materials).
- All laser cutter systems must be equipped with a fume exhaust system and filtration system that meets manufacturer specifications.
- These fumes or air contaminants can damage the machine and harm your health. If the air filter or exhaust system is malfunctioning, immediately stop operating the laser cutter and notify your supervisor.
- Filters must be changed regularly according to the frequency of use or as specified by the manufacturer.

- **DO NOT** cut a material that has not been approved by the manufacturer.
- **DO NOT** use a laser cutter with a malfunctioning exhaust system or clogged air filter.

Contact EH&S at ehsdept@uw.edu for more information on exhaust and filtration systems for laser cutters.

TRAINING AND PERSONAL PROTECTIVE EQUIPMENT

- All users must be properly trained on the potential hazards, control measures, lab and manufacturer's operating procedures, use of personal protective equipment (PPE), emergency procedures and safety precautions for operating the laser cutter.
- Other required training includes Fire Extinguisher Training.
- Required PPE: Safety glasses to protect eyes from particles and debris, proper gloves for skin protection to reduce burns, and hearing protection (if necessary).

Resources: Laser Cutter SOP template
Carnegie Mellon University laser cutter fact sheet

For questions about laser cutter safety, contact EH&S at 206.543.7262.