Laser Cutter Safety

A laser cutter (left) with regulatory identifying labels (above)

Laser cutters, engravers and scribers are useful tools that utilize laser light to make precision cuts by burning or vaporizing various materials. Laser cutters are designed to cut and separate materials into shapes while laser engravers and laser scribers are designed to remove a surface layer on a material to create permanent markings. Laser cutters/engravers have high risk hazards that are mitigated by following proper use and maintenance protocols.

Laser Radiation

Laser cutters/engravers are equipped with invisible lasers, most commonly a carbon dioxide (CO2) gas laser (wavelength of 10,600 nm) or in some cases a solid-state fibre laser (wavelength of 1064 nm). These lasers are high power and have high risk to cause serious eye damage and skin burns. These lasers are rated as Class 4. However, laser cutters/engravers are engineered to be operated as less hazardous Class 1 or Class 2 lasers thereby lowering the risk of injury when used as designed.

Certain laser cutter models are equipped with a pass-through feature. The pass-through design creates an opening to accommodate oversized materials and when in use, the laser cutter is no longer Class 1 but is instead Class 4. Scattered invisible laser radiation may exit out through the pass-through opening and increase the risk for injury to the skin and/or eyes. Stringent laser safety engineering and administrative controls as well as use of laser eye-protection glasses are required when a laser cutter/engraver is operated with the pass-through feature. Please contact the Laser Safety Officer if a pass-through option on a laser cutter will be used.

Fire hazard

The cutting or engraving process produce high temperature and heat as material is burned away. Fires are a probable hazard. A fire extinguisher must be located within proximity of the laser cutter/engraver and fire extinguisher training is strongly recommended.

Fume exhaust ventilation

Fume exhaust ventilation is an important component of laser cutters. The process of cutting or engraving or scribing generates plumes of particulates, smoke or by-product gases and are referred as laser generated air contaminants (LGACs). LGACs can cause serious acute or chronic health effects when inhaled. Many manufacturers offer a separate ventilation filter system to connect to a laser cutter/engraver. These systems are equipped with HEPA and carbon filters to collect harmful particulates. In some cases connecting laser cutters/engravers to a building exhaust system is necessary if harmful LGAC fumes or gases are produced. It is important to understand the material limitations of laser cutters/engravers. If the material of interest to cut releases flammable, toxic, or corrosive gases a laser cutter/engraver cannot be used to cut the material. Usually manufacturers will provide a list of materials to avoid cutting or engraving because the LGAC gases are dangerous or corrosive. In addition, cutting those materials will damage the laser cutter/engraver and may void a warranty.

Please refer to the OHSE website for a list of common materials and their high risk LGACs produced in the laser cutting/engraving/ scribing process. When in doubt refer to the Safety Data Sheet (SDS) or contact the Laser Safety Officer (ohs@uvic.ca) for more questions about acceptable materials.

Safety guidelines for laser cutters:

- Ensure the laser cutter is installed and maintained as per the manufacturer specifications
- Ensure the laser cutter is connected to a fume exhaust ventilation system and is operating properly
- Ensure a fire extinguisher is available within proximity of the laser cutter
- Develop a safe operating procedure
  Best practices to include:
  - Wait for materials to cool before removing from the laser cutter/engraver
  - Ensure ventilation is not shut off immediately after cutting/engraving to remove any residual LGACs
  - Do not leave a laser cutter/engraver operating unattended
- Ensure all operators are trained on laser safety and (optional) fire extinguisher training
- Ensure all interlocks are working before operation and do not disable during operation.
- Cut/engrave only materials approved by the manufacturer or review the SDS of new materials
- Report all incidents or near misses
- Consult with the OHSE Laser Safety Officer (ohs@uvic.ca) if you have concerns about a laser cutter/engraver.