



Penn State Abington MakerSpace  
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**Emergencies**

**Immediately notify local emergency services by dialing 911 for serious incidents (e.g., injuries requiring professional medical attention, fires, explosions, etc.).**

Environmental Health and Safety (EHS) is always available for notification of incidents and/or consultation regarding laboratory safety issues. They can be contacted by dialing 814-865-6391. Their website is located at [www.ehs.psu.edu](http://www.ehs.psu.edu).

**I. Scope, Purpose, and Keywords**

Scope: Operation of MakerSpace Laser Cutter and Engraver by members and staff

Purpose: Safe operation of the tool

Keywords: Laser Cutter and Engraver

**II. Hazard Assessment**

<b>Hazard</b>	<b>Required Engineering Controls and/or PPE</b>
Heat and burning hazards	Fuse, magnetic latch, water flow sensor active
Eye exposure to Class 4 laser	Tinted safety glasses worn when laser is active
Risk of fire by ignition of stock	Never run unattended, note extinguisher access
Airborne dust and smoke	Use clean HEPA filter fume extractor
Overheating	Run clean distilled-water cooling system
Corrosive gas produced if cutting PVC or vinyl	NEVER CUT PVC or VINYL MATERIALS



### III. Procedures

1. Approved Processes
  - a. Removal of material from sheet stock in wood, wood-based, acrylic plastic, styrene plastic, paperboard paper, and other organic/combustible material. Removal includes cutting (slicing all the way through stock) and engraving (surface marking or removal of a portion of material).
2. Personal Protective Equipment (PPE)
  - a. Tinted safety glasses worn when laser is active
  - b. Nitrile gloves if user is sensitive to material being cut
  - c. General shop PPE
3. Environmental Controls
  - a. Ensure equipment is secure so it doesn't move when in use
  - b. Check that fire suppression devices, including fire extinguisher and spray water bottle, are present
4. Required Training
  - a. Review and observe safety practices outlined in General Shop Safety Training
  - b. Supervisor-led observational training and observed practice, and/or task-specific training
  - c. Review of manufacturer's operating manual
5. Inspection before use
  - a. Laser must be disabled and locked out prior to any maintenance
  - b. Supervisor or secondary qualified staff must be present at all times laser is active
  - c. Door magnetic latch, fuse, water flow sensor must all be in place
  - d. Ensure that HEPA filter in fume extraction system is adequately clean and alert staff to evaluate if replacement is needed
  - e. Inspect water in cooling system and alert staff to evaluate if replacement is needed
  - f. Check extruder head to see that it is fully engaged with magnetic connectors
  - g. Check to see that air compressor is operational
  - h. Ensure that cutting grille is present before inserting material. Clean any debris out of grill before use. Material should not exceed size of grille.
  - i. Check Material Safety Data Sheet (MSDS) for any material response to extreme heat. Never cut a material with unknown properties.
  - j. Consult the Laser Cutting Material Settings database at the website to determine speed, power, current, and number of passes settings for a material and thickness. Be aware that this is a starting point reference for testing stock. A test must always be conducted to refine settings to a particular job.
6. Safe operating procedures or precautions
  - a. Turn on all equipment by activating the power strip adjacent to cutter.
  - b. Run test: open test file in design software and open RetinaEngrave driver software.
  - c. From design software, run Print from menu and select Full Spectrum Engineering Driver.



- d. In RetinaEngrave, note design in Raster or Vector tab, and ensure the network address displayed on the laser cutter screen is present in the driver window. If not, hit arrow at lower left.
  - e. Home the laser, then jog using arrows to position at upper left of stock and test the job perimeter to ensure the laser will be positioned correctly over the stock
  - f. Set speed, power, current, and passes according to initial setup in Laser Cutting Material Settings database at website and run a test.
  - g. Repeat process, refining test until desired results are achieved in cutting or engraving.
  - h. Load design file, and repeat homing, jogging and perimeter.
  - i. Run the job by pressing the green START button in RetinaEngrave. Hit PAUSE if you must leave the job and START to resume. STOP will cancel the job.
  - j. NEVER LEAVE A LASER CUTTING JOB UNATTENDED, and NEVER USE A PROHIBITED MATERIAL AS LISTED ON THE WEBSITE. EITHER ACTION WILL BE TREATED AS AN ACT OF VANDALISM AND/OR ENDANGERMENT, WILL RESULT IN IMMEDIATE AND PERMANENT SUSPENSION OF MAKERSPACE PRIVILEGES, AND MAY LEAD TO ADDITIONAL REMEDY IN ACCORDANCE WITH THE PENN STATE CODE OF CONDUCT.
1. Waste Disposal
    - a. Dispose of leftover material in regular trash or recycling as appropriate
    - b. Water from cooling system is safe to dispose of in regular drain system
    - c. HEPA filters are safe to dispose in regular trash
    - d. Spent laser tubes must be disposed of through EHS.

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#### **IV. References**

Full Spectrum H Series CO2 Laser Engraver Manual

[https://sites.psu.edu/abingtonmakerspace/files/2019/02/H\\_Series\\_20x12\\_Manual-1pi6i8r.pdf](https://sites.psu.edu/abingtonmakerspace/files/2019/02/H_Series_20x12_Manual-1pi6i8r.pdf)

RetinaEngrave 3D Software Manual

[https://sites.psu.edu/abingtonmakerspace/files/2019/02/RetinaEngrave3D\\_Manual-1foaiet.pdf](https://sites.psu.edu/abingtonmakerspace/files/2019/02/RetinaEngrave3D_Manual-1foaiet.pdf)

Printed copies available in MakerSpace

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#### **V. Revision History**

Document prepared 25 September 2019 williamCromar, MakerSpace Program Coordinator



**Certification Page**

**My signature below attests that I have read and understand this SOP and agree to fully adhere to its requirements.**

<b>Date</b>	<b>Name</b>	<b>Penn State User ID</b>	<b>Signature</b>