UNIVERSITY OF CALIFORNIA
SANTA CRUZ

UCSC
Laboratory Standard Operating Procedure (SOP)
Baskin 138 Laser Cutter

Department:	CMPE	**Date:**	11/8/2014
Principal Investigator/Supervisor:	Gabriel Elkaim	**Office Phone#:**	831-459-3054
Procedure Author:	Gabriel Elkaim, Soja-Marie Morgens, Max Lichtenstein	**Lab Phone#:**	831-459-2140
Location(s) covered by this SOP/Building/Room#:	Click here to enter text.	**Author Email:**	elkaim@soe.ucsc.edu

Any deviation from this SOP requires approval from the PI.

#1 Brief Experimental Summary: *Provide a general description of the process and/or experimental procedure.*

The MornTech MT-L1290 CNC laser cutting machine is a precision machine that allows use of a CO2 laser to cut 2D shapes from specified flat materials. It is controlled from a computer using Corel Draw and LaserWorks software. Users should always operate it with two trained people in the room with one in the watchbox whenever laser is operating.

Chemical (CAS#)	GHS categories	GHS symbols – *choose the appropriate symbols for each chemical*

#2 Procedure Description:

Approved materials:

Do not use any materials or different thicknesses in the laser cutter unless they are listed in this table. ONLY USE THE SETTING RANGES shown.

ANY deviation from this approved list (including equipment settings) must be approved in writing by the PI and EH&S PRIOR to use NOT ON THE LIST DO NOT USE.

Material:	Maximum thickness:	Use:	Settings:	Hazards
MDF	¼ "	MDF is cheap, sturdy, and easy to cut. MDF edges wear down over time.	Power: 98 Minimum Speed: 5.5 mm/s	
Acrylic	¼ "	Unlike MDF, acrylic keeps its edges, making it useful for precision parts. It is stronger than MDF, but it is also brittle.	Power: 98 Minimum Speed: 5.5 mm/s	Acrylic usually comes covered in thin sheets of protective plastic. the protective plastic wrap will ignite c when cut. Remove plastic wrap before placing in cutter. c
Foamcore	¼ "	Foamcore is extremely cheap and cuts very quickly.	Power: 98 Minimum Speed: 70 mm/s Minimum cut separation: ¼"	Foamcore is combustible (catches on fire) as interior foam absorbs heat and paper wrapping can ignite.Adhere to minimum speed settings. Features should be spaced at least ¼" apart, and cuts sequenced so adjacent parts are cut at separate times.

Laser cutter operation hours: Undergrads should only operate laser cutter when TA, instructor, or staff are available.
Fire alarms: Locate and find the nearest fire alarm pull stations. They are located at the exits to the building. Should the machine have a significant fire, you may need to pull these.
Lab phone: Locate the lab phone. Ensure you can operate it. Know to call 9-1-1 should you have an emergency.
Fire Extinguisher: Locate the fire extinguisher. Ensure it has not already been used and has current inspection tag in place.

Procedure Steps	Work Location / Safety Equipment	Precautions
Sign in: Before using the laser cutter, write an entry in the logbook. It will be located near the laser cutter. Turning on laser cutter: The lid should be closed and the bed should be free of material when turning on the laser cutter. Operating the laser cutter: See appendix A for detailed operating instructions. Removing material: Wait at least ten seconds for the material to cool before removing it from the laser cutter. Sign out: Once cutting is complete and laser cutter is powered down, sign out in the logbook.	**CO2 Fire extinguisher – mounted on wall behind laser cutter** **Fire Resistant lab coats (blue) – Stored on coat rack in BE 138** **Fire Blanket – in red bag hanging on wall near laser cutter** **Heat Resistant Gloves-hanging on wall** **Shop Glasses- in clear case next to door to room**	1. DO NOT under any circumstances attempt to bypass the laser interlock controls. Attempting to do so will result in an immediate and permanent ban from BE138. The laser is very high power and can result in permanent physical damage. It must only operate in a sealed cabinet. 2. There is a black rectangle on the floor around the laser cutter, called the "watchbox." There MUST be at least one person in the watchbox whenever the laser is on. 3. DO NOT use the laser cutter alone. Always have at least 2 people when cutting. 4. DO NOT OPERATE the laser cutter while SLEEPLY or INTOXICATED. This applies to both partners in the team. It is essential to your safety and that of others that you are awake, coherent and alert while operating the system. Operating while sleepy or intoxicated will result in an immediate ban from the fabrication lab. Treat operating the laser cutter as if you were driving a vehicle. 5. DO NOT use the laser cutter without the blower on. The blower reduces the risk of fire. 6. IF anything odd happens during your cut or you collide the head with something, immediately notify the authors of this SOP of the details and PUT A NOTE on the laser cutter, over the power switch. Do not attempt to fix it yourself. 7. DO NOT use any materials other than those documented in this SOP. Do not cut these materials using settings outside of the given ranges.

#3 Personal Protective Equipment (PPE):

PPE is to be worn by those conducting the work and any adjacent personnel.
While the laser is on, fire resistant lab coats are mandatory.
While the laser cutter lid is open, safety glasses are mandatory.

Operators must use closed-toe shoes and long pants.

Eye Protection: ANSI-approved properly fitting impact-resistant safety glasses..

Body Protection: An appropriately-sized lab coat must be worn and buttoned. Laboratory coat sleeves must be of sufficient length to prevent direct skin exposure while wearing gloves. Full length pants (or equivalent) and closed toe/heel shoe attire must be worn at all times by all workers who are occupying or entering a laboratory/technical area. The area of skin between the pants and shoe should not be exposed.

Check box for specialty lab coat: ☒Nomex/Flame Resistant ☐Biological Barrier ☐Other Click here to enter text.

Hand Protection: Use heat resistant gloves when touching any hot parts.

Additional Protection: ☐ Face Shield ☐ Chemical-Proof Apron ☐ Respiratory Protection
☒ Additional Gloves -- Leather gloves ☐ Other Click here to enter text.

#4 Incompatible Conditions and Materials: *List the incompatible conditions, chemicals, and/or materials that should be avoided, along with the safe storage conditions.*

Click here to enter text.

Material:	Incompatibility:	Storage Conditions:
PTFE/Teflon	Does not cut; can release toxic fumes	Do not store in BE138-can be misidentified
Foamcore >.300" Thickness	Ignites easily and fire is sustainable	Do not store in BE138-can be misidentified
Chemically Treated Woods	Releases toxic fumes at high temperature	Do not store in BE138-can be misidentified
PVC	Releases chlorine gas at prolonged high temperature	Do not store in BE138-can be misidentified

#5 Training: *Training required for all personnel conducting this procedure. Include any specific training requirements.*

- Complete EH&S online "Laboratory Safety Fundamentals" class available through the UC Learning Center (http://learningcenter.ucsc.edu/).
- Complete PPE training
- Complete lab hazard assessment tool (LHAT) for Fabrication lab.
- Fully read this SOP
- Go through ~1 hour session of laser cutter training with designated trainers.
- Sign Lab-Specific Training Checklist (http://ehs.ucsc.edu/lab-safety-manual/training.html#lab-specific%20training) with PI, Lab Safety Representative, or other designated person.
- Get sponsorship of a class or PI for authorized use

#6 Clean-Up and Emergency Response Procedures (reference the SDS as needed):

Clean-Up: Remove all debris and materials from laser cutter bed. Throw large scrap pieces in dumpster. If debris falls into the pan, clean the pan with a dust broom. Debris is a fire hazard.

WAIT until material is fully cooled to throw away any material that has smoldered or caught on fire.

If a fire occurs, DO NOT PANIC.

Fire Procedures:

1. If you have a persistent flame that is more than 2 inches tall, or lasts for more than 5 seconds, **STOP THE LASER CUTTER** by pressing **PAUSE**. Immediately use the **UP** arrow key to move the head to the top of the bed. Do not turn the laser cutter off, as this will prevent you from moving the laser cutter head out of the way. Most flames extinguish themselves quickly.
2. If step (1) fails to extinguish the flame, and if the flame is small and unthreatening (it is smoldering, smoking or the

size of a few candle flames), then open the lid. Attempt to blow out the material (like a candle) to extinguish the flame.

3. If step (2) fails to extinguish the flame, use the fire blanket in the red pouch. Remove the blanket, and open it fully. Drape the blanket over the flame and materials to smother the fire. Dp not toss or throw the blanket. Keep blanket on the fire and materials until everything is cool to touch. Do not put the blanket on the fire and immediately remove, the fire can reignite and/or follow the blanket catching you on fire and/or spreading the fire.
4. If step (3) fails to extinguish the fire, use the CO2 fire extinguisher located near the laser cutter. Aim a short blast at the base of the flame and move back and forth, repeat as required to extinguish the fire. Send your partner to pull the fire alarm, located at the exits to the building. Then calmly call 911 from the wall phone in Room 138 and explain the situation.
5. In all cases after extinguishing the flames, close the lid and let the exhaust fan clear the smoke from the chamber. Once the smoke is clear, shut down the laser cutter. Annotate log book and notify TA's and PI.

Once you have extinguished the flame, determine its cause. Most common causes are:

- Improper material or material with a coating.
- Cutting speed is too slow.
- Cuts are too close together.
- Laser cutter is out of focus.
- Blower disabled

Do not proceed with operation of the laser cutter until the cause has been identified and rectified.

Laboratory Emergency Response Equipment: *All research personnel must know location of nearest fire alarm pull station, fire extinguisher, and emergency blanket.. Do not use fire extinguisher unless you are trained to do so. List locations for nearest fire alarm pull and emergency shower/eyewash.*

- Fire extinguisher: Mounted on wall near laser cutter
- Fire blanket: In red pouch on wall near laser cutter
- Leather gloves: Stored near laser cutter
- Fire alarm: At exits of Baskin Engineering building

Emergency Shutdown Procedures:
Press laser cutter power switch. Blower will remain on for ten seconds after main power is cut.

#7 Hazardous Waste(s): *List expected concentrations and amounts of hazardous waste(s) generated during this process. Provide any special/specific waste management. Contact EH&S for specific guidance regarding hazardous waste handling and disposal. General hazardous waste management guidelines: http://ehs.ucsc.edu/programs/waste-management/index.html*

Hazardous waste should not result from proper use of the laser cutter. Debris from your cuts do present a fire hazard. Remove all loose material from the bed and pan after use. Dispose of large pieces of material in dumpster outside. Ensure that all combustible materials (paper, foam coare and other cutting materials) are kept a minimum of 10 ft away and preferable on the other side of the room. Never store materials adjacent to the laser cutter.

Do not attempt to clean or disturb soot or combustion by products from the machine. These items if inhaled in large amounts can be hazardous. Soot that is left behind in the machine must be cleaned out by persons operating under maintenance procedures and with proper PPE. This should be left for persons trained and properly equipped with PPE including breathing masks.

Contact EH&S at x9-3086 or hazwaste@ucsc.edu with any questions.

#8 First Aid / Emergency Procedures: *Describe immediate First Aid or medical treatment required in case of personnel exposure.*

Click here to enter text.

For immediate medical assistance, dial **911**.
UCSC Emergency dispatch will take your call and get you the appropriate immediate assistance.

Report all serious injuries to EH&S as soon as possible.

- For minor cuts & scrapes, a first aid kit has been installed in the lab near the door. There should be first aid cleaning supplies and small bandages and gloves in the kit. Due to possibility of blood borne pathogens, if you are helping someone who is bleeding, use gloves or have the injured party to clean themselves.
- For larger cuts, have injured party apply pressure with large bandage, towel or clean cloth to the wound and a second person should call 9-1-1 on the lab phone.
- For all burns, injured party should seek medical attention. Burns can quickly become infected.
- If smoke is inhaled, stop what you are doing, secure the equipment and move into fresh air outside immediately.

Where to Get Non-Emergency Medical Attention

Students (Non-Emergency)

UCSC Student Health Center
Across the street from College 9 & 10.
Phone: (831) 459-2211
http://healthcenter.ucsc.edu/

Students (Non-Emergency, when Heath Center is closed)

Review After Hours information at their web site, as of 11/1/14, the following locations were listed;

Dominican Hospital Emergency Dept
1555 Soquel Drive, Santa Cruz
Phone: (831) 462-7710
Open 24 hrs

Palo Alto Medical Foundation (PAMF) – Urgent Care
1301 Mission Street, Santa Cruz
Generally open M-F, Sat/Sun 9am-6pm

Faculty & Staff (non-Emergency Medical Care)

UCSC employees with non-emergency work related injuries should seek first aid and medical treatment at

Santa Cruz Occupational Medical Center (SCOMC)
3601 Caldwell Drive, Soquel
Phone: (831) 576-3000
Hours as of 11/1/14; M-F 8:30am to 5pm;

At times when SCOMC is closed;

Dominican Hospital Emergency Dept
1555 Soquel Drive, Santa Cruz

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Open 24 hrs
Tell Emergency Dept Personnel the injured party is a UCSC employee seeking medical care for an industrial injury.

General Procedures in cases of Hazardous Substance Contact.

- In the case of eye or skin contact, flush with water for a minimum of 15 minutes. Ensure that eyelids are held open while rinsing eyes.
- If ingested, flush mouth with water (only if the person is conscious).
- In the case of a needlestick/puncture injury, wash the affected area with soap and warm water for 15 minutes. For employees, follow the instructions at the Risk Services website: http://risk.ucsc.edu/workers-comp/reporting-and-treatment.html
- Seek medical attention immediately.
- Complete incident report form, http://risk.ucsc.edu/all-forms/wc-incident-report-form.pdf, (contact EH&S) and/or follow the instructions at the Risk Services website: http://risk.ucsc.edu/workers-comp/reporting-and-treatment.html

As the Principal Investigator, it is your responsibility to ensure that all individuals conducting this protocol are taught the correct procedures for safe handling of the hazardous materials involved. It is also your responsibility to ensure that your personnel complete Laboratory Safety Training and other applicable safety training courses.

- Prior to conducting any work with, the PI or designee must provide training to his/her laboratory personnel regarding the specific hazards involved in working with this substance, work area decontamination, and emergency procedures.
- The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the SDS provided by the manufacturer.
- The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training within the last year.

I have reviewed and approve this Standard Operating Procedure.

PI Signature _____ DATE 10 / NOV / 2014

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Chemical Information Summary

Provide information for all chemicals included in the SOP. See the SDS for detailed toxicity information. Add more lines as needed.

Physical & Chemical Properties

Chemical	CAS#	Molecular Formula	Structure	Molecular Weight (g/mol)	Density (g/mL)	Form (physical state)	Melting Point (°C)	Boiling point (°C)	Flash point (°C)
Click here to enter text.	Click here to enter text.								

Exposure Limits/Toxicity Data

Chemical	Color	Odor	Cal/OSHA PEL	Toxicity LD_{50}
Click here to enter text.				