מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

יחידת הבטיחות
Safety Unit

ת.ד. 26 רחובות 76100 P.O.B. 26 Rehovot Israel
www.weizmann.ac.il

משרד Office +972-(0)8-934-3844
פקס Fax +972-(0)8-934-4163
safety.unit@weizmann.ac.il

Safety instructions for working with
Universal VLS Laser Cutter

1. Objective

To indicate the risks of working with laser cutter in an embedded/closed system (confocal microscope, FACS devices, etc.) and to prevent damage from exposure to a laser beam in an embedded laser system.

2. Definition

2.1 Laser risk zone: An area in which laser radiation is produced and the expected exposure in routine activity, malfunction, or accident may exceed the Maximum Permissible Exposure.

2.2 Laser product: An apparatus, device, or machine that emits laser radiation, including non-finished products.

2.3 Embedded laser product: A laser product with engineering measures installed that limit the maximum accessible laser radiation emission level. The laser is classified at a lower risk level than that which was assigned to it.

2.4 Hazardous laser product: A laser product classified at risk level 3R that emits laser radiation not in the visible light spectrum, or a laser product with risk level 3B or 4.

2.5 Protective goggles for laser products: Protective goggles according to Israeli Standard 4141, Section 10.

2.6 Laser radiation: Coherent, directional light radiation, concentrated in a narrow range of wavelengths, produced or amplified through a controlled process of forced radiation emissions.

2.7 Risk level: Categorization of a laser product's risk according to its Accessible Emission Limit.

2.8 Risk level 1 (Class 1): A laser product whose radiation level is not dangerous.

2.9 Risk level 3 (Class 3B): A laser product where radiation from a direct beam endangers the eye at any duration of exposure, but is generally not dangerous to the skin.

2.10 Risk level 4 (Class 4): A laser product whose risk to the eyes and skin is dangerous with both a direct beam and a scattered reflected beam. Such a product's beam can ignite flammable materials.

2.11 Device supervisor – a workshop worker who is authorized by the manager of the workshop to operate and maintenance the system.

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3. Background

The Weizmann Institute of Science works with various laser systems. In some systems the laser beam is embedded and protected by number of safety devices that prevent exposure to the laser beam.
The laser cutter system works via two laser beams:
a. Red laser beam to indicate diode 670nm length, 5mW power, risk class 4.
b. an unseen laser beam for laser cutting CO2, 10,640 wave length, 60W power, risk class 4.

3.1 The system has shielding measures installed, such as a door and interlock, which prevent the laser beam from exiting the microscope, so that its risk level drops to Class 1 (an Embedded-1 type system). Therefore, when used normally according to the manufacturer's instructions, there is no danger from the laser, so employees do not need to take special protective measures.

3.2 During servicing (repair, adjustment, etc.), when bypassing the interlock and exposing the beam, the system's risk level is determined according to the risk level of the laser, i.e. level 3B or 4 When servicing, use all appropriate safety requirements for the laser risk level.

4. Authority and responsibility

4.1 It is the responsibility of the device supervisor to ensure that every user of a cutting laser system has done the following:

4.1.1 Read these safety guidelines, read the manufacturer's safety guidelines, performed annual safety training (a new user will be trained upon starting work) about the risks of laser radiation and forms of protection from laser radiation (chemical risks/fire/electricity).

4.1.2 Read the safety instructions from the device's instruction manual.

4.1.3 Signed a commitment form pledging to follow all safety instructions when working with a Laser Cutter.

4.1.4 hang in an accessible place near the device a list of the materials allowed to be cut and process.

4.1.5 Once a month: Visual test of the pumping blower and the suction tube.

4.1.6 Examined, at least once every six months or after any maintenance or

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inspection by a technician, whether the laser source's interlock is intact (opening the door will stop the laser). The details and date of the examination must be recorded in the microscope service log.

4.1.7 Maintenance work of the device such as: mirror cleaning or table cleaning will be done only when device is **turned off**.

4.2 In the event of a malfunction or a need for a change in the system, the head of the laboratory/facility is responsible for the following:

4.2.1 Inviting a service representative or certified technician of the laser cutter system's provider to repair the malfunction or to make changes.

4.2.2 Ensuring that the maintenance of the laser cutter system was performed as necessary, and the safety devices were not impaired.

5. Method

The provider of the laser cutter system must provide the following:

5.1 A sticker on the laser cutter system that defines the laser's risk level according the requirements of Israeli Standard 60825, section 1.

5.2 A fail-safe interlock above the laser compartment connected to the laser cutter system that halts its operation as soon as the door or lid is opened.

6. Safety requirements for users of embedded laser cutter system:

6.1 Before starting working or using the system you must receive guidance by the laboratory or unit head on the structure of the microscope, how it is operated, the risks, including laser risks and safety requirements at work.

6.2 Read (as a new user or for review once a year) the safety tutorials on laser radiation risks and protection from laser radiation, and safety instructions with a confocal microscope.

6.3 Read (as a new user or for review once a year) the safety instructions in the device's instruction manual.

6.4 Sign a commitment form to follow all safety instructions when working with the laser cutter system.

6.5 The following actions must be done before any work with the system:

6.5.1 Turn on external pumping blower.

6.5.2 Open faucet of compressed airflow.

6.5.3 Visual check of the working table, in order to prevent "crashes" of the moving laser head.

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6.6 After any processing work, keep the machine door closed for at least 30
seconds until all emitted gasses will be expelled.
6.7 It is totally forbidden to process materials that are not listed in the allowed list (Appendix B – List of allowed materials for processing and cutting with laser cutter Universal VLS).
6.8 When cutting Teflon remain the machine's door closed for two minutes.
6.9 Maintenance work of the machine, such as cleaning mirrors/table, will be done only by the device supervisor when the machine is off.
6.10 It is forbidden to disassemble or open the system's lids.
6.11 The direct supervisor/responsible technician must be informed about any malfunction or concerns about the system.
6.12 The operator/user must not make any changes to the optical path components of the system.
6.13 When servicing the system, no entrance to the room where the system is located is permitted for Weizmann Institute employees of any status.

7. Procedure for performing maintenance on embedded laser products (Class 1) that have a laser beam with a risk factor of 3B or 4

7.1 Maintenance and service work will be performed only by the manufacturer's representatives, who are authorized to do so and who are well acquainted with the laser system and all the associated risks.
7.2 The service provider must present a valid authorization to work with dangerous lasers.

7.3 The service provider must sign a declaration form (hereinafter: "Appendix A – statement of service provider for laser/laser-inclusive system") in which the provider undertakes to work in accordance with regulations and safety instructions for working with lasers.

7.4 The service provider will use personal protective equipment against laser beams according to Israeli Standard 4141, sections 10 and 11 (EN207, EN208).

7.5 The service provider will use only the service provider's own equipment and not equipment belonging to the Weizmann Institute of Science.

7.6 The fenced-off area must be signposted with the following signs: "Danger! Entrance for authorized personnel only" and a laser radiation warning sign with a caption indicating the laser risk level.

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7.7 While the work is being carried out, no one will be allowed into the room/hall except the mentioned service person/personnel.

7.8 Before carrying out maintenance work, place protective screens between the system and the front doors of the room/hall, or place a laser beam-resistant curtain over the front door. All windows in the room must be draped with a fireproof curtain.

7.9 Ensure that all the room's doors are locked, the warning lights are on and there is no possibility of entering the room.

7.10 If the laser system does not need to be operating during the maintenance work, it must be turned off. If the laser beam is necessary for work, then the operating time and beam intensity should be reduced to the minimum necessary.

7.11 Protective measures must be used, including protective goggles suitable for the laser type.

7.12 The ray will target only controlled areas within the system. Under no circumstances should the laser be operating when aimed at other areas such as the operator's body, the entrance door or windows.

7.13 No flammable or explosive materials will be allowed into the work area.

7.14 Service and maintenance work and the employees who perform such work are subject to the approval of a Laser Safety Officer.

7.15 Only persons who have undergone appropriate safety training and are equipped with appropriate protective measures (protective goggles suitable for the laser type, clothing, etc.) may remain in the laser risk zone.

7.16 When the servicing is completed, the technician must return the system to normal working conditions, including all its safety devices.

7.17 At the end of the work, check to ensure that the interlock and other safety systems, if any, are working properly. This must be recorded in the microscope's service log.

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8. In an emergency

8.1 Follow emergency instructions and report to the Weizmann Service Center 08-934-2999.

8.2 Any laser-related accident or near-accident must be reported immediately:
* Weizmann Service Center 08-934-2999.
* Person who is responsible to the system.
* Laser Safety Officer Yehuda Moshayev tel. 050-9001995, 08-9345155.
* Direct supervisor.

8.3 In case of injury or suspected injury from a laser, the subject must be evacuated immediately to 'Kaplan' Medical Center emergency room for a medical examination.

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Declaration form for service provider for laser/laser-inclusive systems

Name of company providing the service: _____

Job classification: _____

Duration of work: From date: _____ to date: _____

I, the undersigned, hereby declare that I have a valid authorization from the company in which I am employed to engage with laser devices and/or products, including familiarity with laser operation instructions and safety measures from the manufacturer and the company, at the laser risk level at which I provide the service.

I hereby agree to follow the Work Safety Regulations (occupational hygiene and safety when dealing with laser radiation, 5745—2005*) and any law or regulation in Israel, and that these provisions do not detract from my responsibility under any law.

I agree to apply safety measures in accordance with Israeli standards, particularly Standard 60825, section 1 and personal protection measures in accordance with Israeli standards 4141, sections 10 and 11 (EN207 and EN208), and have the equipment to perform the service including personal protective equipment.

I, the undersigned, employed on the grounds of the Weizmann Institute of Science, hereby declare that the accepted provisions and safety procedures of the Weizmann Institute of Science have been brought to my attention, as well as the potential risks in its grounds and facilities.

I hereby agree to comply with all the safety and hygiene requirements, work arrangements, and disciplinary requirements of the Weizmann Institute of Science, and to follow all instructions of the Weizmann Institute of Science Safety Unit personnel issued to me from time to time.

I am aware that if I do not meet the safety requirements, various measures will be taken against me, such as temporarily stopping work until I am removed from the workplace. In such a case, I will not be entitled to any payment or compensation for this.

Signed, the service provider:

Name: _____ ID number: _____

Company name: _____ Address: _____

Signature: _____ Date: _____

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List of materials allowed to be cut and processed in Universal VLS laser cutter

1. Acrylic (plexiglass, PMMA, Lucite)
2. Delrin
3. Paper
4. Cardboard (only non coated)
5. Mylar (thin sheets only)
6. Teflon (thin sheets only)
7. Leather
8. Cloth, Cotton, felt
9. Natural wood (low resin wood only)
10. Plywood (note that glue in plywood tends to catch fire)
11. MDF (leaves a charred edge)

It is absolutely forbidden to cut the following materials:

1. Chlorine containing polymers
2. PVC, Vinyl, artificial leather
3. ABS
4. Polystyrene
5. Polypropylene
6. Fiberglass
7. Coated carbon

Some of these materials emit toxic fumes (Pure Chlorine, Cyanide), others will cause the metallic parts of the cutter to corrode and stop functioning properly. Some simply burn and cannot be cut. If you need to cut another material, please consult your superviser or laser safety officer.